Electronic Supplementary Information

Iterative addition of carbon nucleophiles to *N*,*N*-dialkyl carboxamides for synthesis of α-tertiary amines

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1. General

1.1. Nuclear magnetic resonance (NMR) spectroscopy

^{1}H NMR spectra (400 MHz) were recorded on a Bruker Avance 400 MHz NMR, QNP probe or Bruker Avance III 400 MHz NMR, BBFO probe in $CDCl_3$ [using TMS (for ^{1}H, δ = 0.00) as internal standard], THF-*d*$_8$ [using THF (δ = 3.58) as internal standard], or benzene-*d*$_6$ [using C_6H_6 (δ = 7.16) as internal standard]. ^{13}C NMR spectra (100 MHz) were recorded on a Bruker Avance 400 MHz NMR, QNP probe or Bruker Avance III 400 MHz NMR, BBFO probe in $CDCl_3$ [using $CDCl_3$ (for ^{13}C, δ = 77.00) as internal standard], THF-*d*$_8$ [using THF (δ = 67.58) as internal standard], or acetone-*d*$_6$ [using acetone (δ = 29.92) as internal standard]. Proton decoupled ^{19}F NMR spectra [^{19}F{^{1}H}] (376 MHz) were recorded on a Bruker Avance III 400 MHz NMR, BBFO probe. The following abbreviations were used to explain the multiplicities: s = singlet, brs = broad singlet, d = doublet, t = triplet, q = quartet, sept = septet, m = multiplet.

1.2. Mass spectroscopy

Mass spectra (ESI) were obtained with a Thermo Finnigan LCQ Fleet mass spectrometer. High-resolution mass spectra (ESI) were obtained with a Waters Q-Tof Premier mass spectrometer.

1.3. Melting point

Melting points (uncorrected) were recorded on an MPA 100 OptiMelt Automated Melting Point System.

1.4. IR

IR spectra were recorded on a Shimadzu IR Prestige-21 FT-IR spectrometer. The absorption data only for the key functional groups were recorded in the characterization of the respective substrates.

1.5. Single-crystal X-ray diffraction

X-ray data collection and structural refinement, intensity data for **2** were collected on a Bruker D8 Quest diffractometer. The structures were solved by intrinsic phasing method with SHELXTL XT (SHELXTL XT, Program for crystal structure solution, Bruker AXS Inc.) and refined for all data by full-matrix least squares method on F^2. All non-hydrogen atoms were subjected to anisotropic refinement. The hydrogen atoms were generated geometrically and allowed to ride in their respective parent atoms; they were assigned appropriate isotropic thermal parameters and included in the structure-factor calculations.

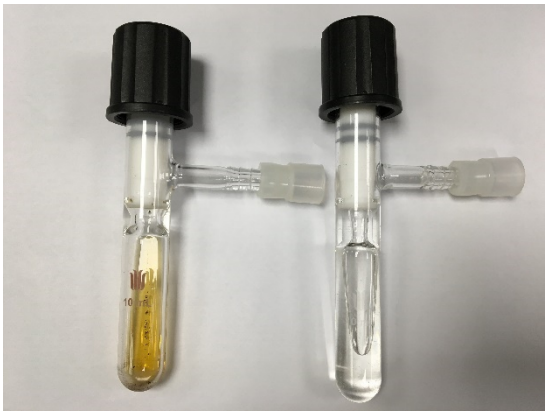
1.6. Purification methods

Flash column chromatography was performed using Merck silica gel 60 with distilled solvents. Thin layer chromatography (TLC) analyses were performed on silica gel glass plates (Merck silica gel 60), and the spots were visualized with UV light (254 nm), phosphomolybdic acid stain, or iodine in silica gel. Preparative thin layer chromatography (PTLC) plates were prepared using Merck silica gel 60 PF_{254} (Merck 1.07747.2500).

1.7. Reagents and solvents

All anaerobic and moisture-sensitive manipulations were carried out with standard Schlenk techniques under argon gas. All glassware was oven dried for at least 24 h at 120 °C before use. Tetrahydrofuran (THF) and diethyl ether (Et_2O) were distilled over sodium benzophenone ketyl and stored over 4Å molecular sieves. Dichloromethane (CH_2Cl_2) and

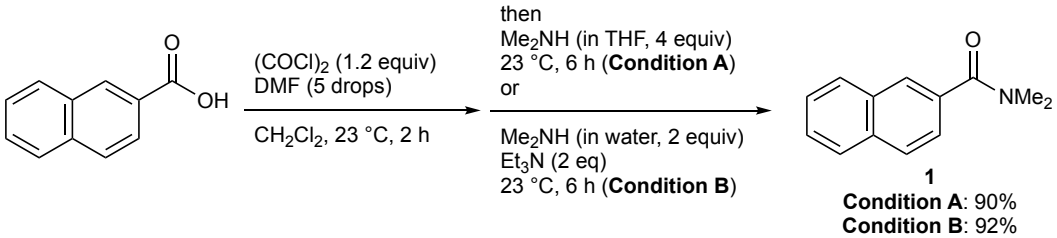
toluene were taken from a solvent purification system (PS-400-5, innovative technology Inc.). Methylmagnesium bromide solution (MeMgBr, 3.0 M in Et_2O, Sigma-Aldrich 189898), allylmagnesium chloride solution (allylMgCl, 2.0 M in THF, Sigma-Aldrich 225908), benzylmagnesium chloride solution ($PhCH_2MgCl$, 1.0 M in THF, TCI B1933), ethynylmagnesium bromide solution (0.5 M in THF, Sigma-Aldrich 346152), (trimethylsilyl)methylmagnesium chloride solution (Me_3SiCH_2MgCl, 1.0 M in Et_2O, Sigma-Aldrich 256021), lithium phenylacetylide solution (1.0 M in THF, Sigma-Aldrich 340677), methyllithium solution (MeLi, 3.1 M in diethoxymethane, Sigma-Aldrich 514330), *n*-butyllithium solution (*n*-BuLi, 2.6 M in hexane, Kanto Chemical 04935), *i*-propyllithium solution (*i*-PrLi, 0.7 M in pentane, Sigma-Aldrich 529745), and *t*-butyllithium solution (*t*-BuLi 1.7 M in pentane, Sigma-Aldrich 186198) were purchased and they were titrated before use (see section 4 for details). Other solvents and reagents, unless otherwise noted, were commercially available and used as received. Tetrabutylammonium cyanide (Sigma-Aldrich 358665) was purchased from Sigma-Aldrich, Inc. and it is handled under an argon atmosphere in a glovebox or with Schlenk techniques under an argon atmosphere due to its moisture sensitivity. Bromotrimethylsilane (Me_3SiBr, Sigma-Aldrich 194409) was purchased from Sigma-Aldrich, Inc. and distilled before use. Due to the instability of Me_3SiBr, it should be distilled regularly and stored in dark.



Scheme S1. Bromotrimethylsilane. Freshly distilled one (right); the one after two weeks (left).

2. Synthesis and characterization of starting materials

2.1. *N*,*N*-Dimethyl-2-naphthamide (1)[1]



1
Condition A: 90%
Condition B: 92%

Condition A *(with Me_2NH solution in THF):*

To a suspension of 2-naphthoic acid (8.61 g, 50.0 mmol, 1.0 equiv) (Sigma-Aldrich 180246) in anhydrous CH_2Cl_2 (100 mL) was added $(COCl)_2$ (5.2 mL, 60.6 mmol, 1.2 equiv) (Sigma-Aldrich O8801) and *N*,*N*-dimethylformamide (DMF, 5 drops) at 23 °C. The reaction mixture was stirred at 23 °C for 2 h and then the volatile materials were removed *in vacuo*. The crude mixture was redissolved in anhydrous CH_2Cl_2 (20 mL) and cooled to 0 °C. A solution of Me_2NH in THF (2 M, 100 mL, 200 mmol, 4 equiv) (TCI D3948) was added dropwise, and the reaction mixture was stirred continuously at 23 °C for 6 h. The reaction was quenched with saturated aqueous NH_4Cl solution and extracted three times with CH_2Cl_2.

The combined organic layers were dried over $MgSO_4$ and filtered. The solvents were removed *in vacuo* and the resulting residue was purified by flash column chromatography on silica gel (hexane/ethyl acetate = 2:1→1:4) to give **1** as light yellow solid (9.76 g). The product was further purified by recrystallization from hexane to give **1** as colorless crystal (9.05 g, 45.4 mmol) in 90% yield.

Condition B *(with Me_2NH solution in water):*

To a suspension of 2-naphthoic acid (5.17 g, 30.1 mmol, 1.0 equiv) in anhydrous CH_2Cl_2 (60 mL) was added $(COCl)_2$ (3.1 mL, 36.9 mmol, 1.2 equiv) and DMF (5 drops) at 23 °C. The reaction mixture was stirred at 23 °C for 2 h and then the volatile materials were removed *in vacuo*. The crude mixture was redissolved in anhydrous CH_2Cl_2 (20 mL) and cooled to 0 °C. An aqueous solution of Me_2NH (40% *wt*, 7.6 mL, 60.0 mmol, 2.0 equiv) (Acros 163670025) was added dropwise. Triethylamine (8.4 mL, 60.3 mmol, 2.0 equiv) was then added dropwise to the resulting mixture at 0 °C, and the mixture was stirred continuously at 23 °C for 6 h. The same work-up and purification procedures as above were conducted to give **1** as colorless crystal (5.49 g, 27.6 mmol) in 92% yield after recrystallization from hexane.

M.p. 86.4 – 88.0 °C. (lit 82 – 83 °C)[2]

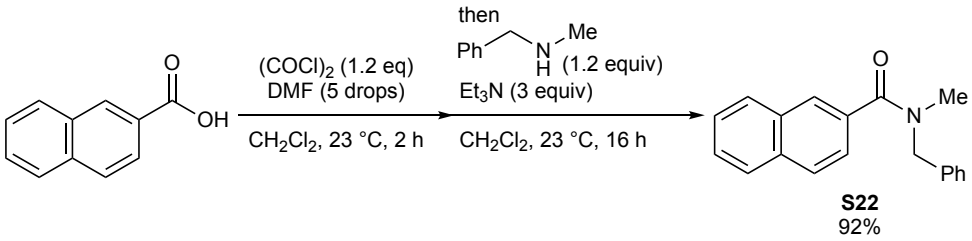
R_f = 0.18 (eluent: hexane/ethyl acetate = 2:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (s, 1H), 7.88 − 7.84 (m, 4H), 7.55 − 7.50 (m, 3H), 3.16 (brs), 3.03 (brs).

^{13}C NMR (100 MHz, $CDCl_3$) δ 171.5, 133.6, 133.5, 132.6, 128.3, 128.1, 127.7, 126.9, 126.8, 126.5, 124.4, 39.6, 35.3.

MS (ESI) *m/z* 200.09 [$(M+H)^+$].

2.2. *N*-Benzyl-*N*-methyl-2-naphthamide (S22)[3]



S22
92%

Prepared from 2-naphthoic acid (1.72 g, 10.0 mmol, 1.0 equiv), $(COCl)_2$ (1.0 mL, 11.7 mmol, 1.2 equiv), *N*-methylbenzylamine (1.46 g, 12.1 mmol, 1.2 equiv) (Sigma-Aldrich B25606), and triethylamine (4.2 mL, 30.1 mmol, 3.0 equiv) according to the condition **B** described in section 2.1. The NMR spectra data are well matched with those reported.

Purification silica gel, hexane/ethyl acetate = 4:1→1:1.

Yield 92% yield (2.53 g, 9.20 mmol) as white solid.

M.p. 75.6 – 77.0 °C.

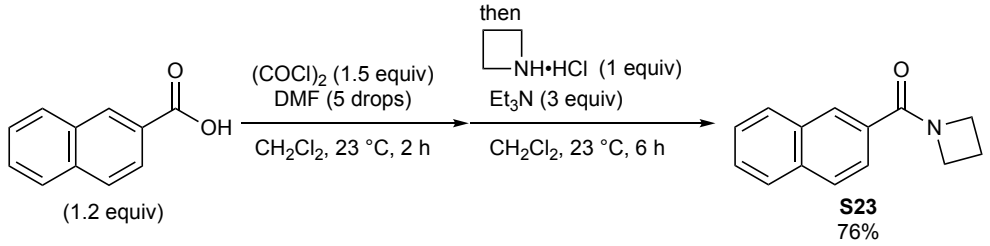
R_f = 0.37 (eluent: hexane/ethyl acetate = 4:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) (1:1 mixture of rotamers) δ 7.95 (s, 2H), 7.85 (m, 6H), 7.55 (dd, *J* = 8.4, 1.6 Hz, 2H), 7.52 (m, 4H), 7.38 – 7.32 (m, 8H), 7.19 (m, 2H), 4.81 (brs, 2H), 4.57 (brs, 2H), 3.08 (brs, 3H), 2.92 (brs, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) (1:1 mixture of rotamers) δ 172.2, 171.5, 137.0, 136.5, 133.5*, 133.4*, 132.6*, 128.7*, 128.3*, 128.2*, 127.7*, 127.5*, 126.9*, 126.63*, 126.56*, 124.2**, 55.2, 50.8, 37.2, 33.2 (*2C overlapped; **4C overlapped).

MS (ESI) *m/z* 276.23 [$(M+H)^+$].

2.3. Azetidin-1-yl(naphthalen-2-yl)methanone (S23)



Prepared from 2-naphthoic acid (1.66 g, 9.66 mmol, 1.2 equiv), $(COCl)_2$ (1.0 mL, 11.7 mmol, 1.5 equiv), azetidine hydrochloride (749 mg, 8.00 mmol, 1.0 equiv) (Sigma-Aldrich 471283), and triethylamine (3.3 mL, 23.7 mmol, 3.0 equiv) according to the condition **B** described in section 2.1.

Purification silica gel, hexane/ethyl acetate = 2:1→1:4.

Yield 76% yield (1.28 g, 6.07 mmol) as white solid.

M.p. 115.0 – 116.1 °C.

R_f = 0.14 (eluent: hexane/ethyl acetate = 2:1, visualized by UV).

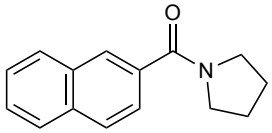
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.12 (s, 1H), 7.90 – 7.84 (m, 3H), 7.72 (dd, *J* = 8.5, 1.6 Hz, 1H), 7.57 – 7.50 (m, 2H), 4.37 (t, *J* = 7.7 Hz, 2H), 4.28 (t, *J* = 7.7 Hz, 2H), 2.36 (tt, *J* = 7.7, 7.7 Hz, 2H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 170.3, 134.3, 132.5, 130.6, 128.7, 128.14, 128.08, 127.7, 127.4, 126.5, 124.5, 53.5, 49.0, 16.1.

IR (KBr, neat) ν_{max} 2970, 2881, 1633, 1614 [*v* (C=O)], 1409, 839, 759 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{14}H_{14}NO$ $[(M+H)^+]$: 212.1075, found: 212.1073.

2.4. Naphthalen-2-yl(pyrrolidin-1-yl)methanone (S24)[1]



S24

Prepared from 2-naphthoic acid, pyrrolidine (Sigma-Aldrich P73803), and triethylamine according to the condition **B** described in section 2.1. The NMR spectra data are well matched with those reported.

White solid.

M.p. 76.4 – 77.6 °C. (lit. 76 – 77 °C)[4]

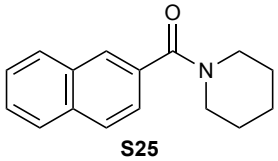
R_f = 0.18 (eluent: hexane/ethyl acetate = 2:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (s, 1H), 7.88 – 7.84 (m, 3H), 7.62 (dd, *J* = 8.5, 1.5 Hz, 1H), 7.55 – 7.49 (m, 2H), 3.71 (t, *J* = 6.7 Hz, 2H), 3.50 (t, *J* = 6.7 Hz, 2H), 2.00 (tt, *J* = 6.7, 6.7 Hz, 2H), 1.88 (tt, *J* = 6.7, 6.7 Hz, 2H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 169.6, 134.5, 133.7, 132.5, 128.4, 128.0, 127.7, 126.93, 126.87, 126.4, 124.4, 49.6, 46.2, 26.4, 24.4.

MS (ESI) *m/z* 226.15 $[(M+H)^+]$.

2.5. Naphthalen-2-yl(piperidin-1-yl)methanone (S25)[1]



S25

Prepared from 2-naphthoic acid, piperidine (Sigma-Aldrich 104094), and triethylamine according to the condition **B** described in section 2.1. The NMR spectra data are well matched with those reported.

White solid.

M.p. 101.6 – 102.6 °C. (lit. 97 – 98 °C)[4]

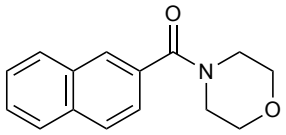
R_f = 0.30 (eluent: hexane/ethyl acetate = 4:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 – 7.84 (m, 4H), 7.54 – 7.51 (m, 2H), 7.48 (dd, *J* = 8.5, 1.6 Hz, 1H), 3.76 (brs, 2H), 3.40 (brs, 2H), 1.69 (brs, 4H), 1.54 (brs, 2H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 170.3, 133.8, 133.5, 132.7, 128.3, 128.1, 127.7, 126.8, 126.5, 126.4, 124.2, 48.8, 43.2, 26.5, 25.6, 24.6.

MS (ESI) *m/z* 240.17 [$(M+H)^+$].

2.6. Morpholino(naphthalen-2-yl)methanone (S26)[1]



S26

Prepared from 2-naphthoic acid, morpholine (Alfa Aesar A10355), and triethylamine according to the condition **B** described in section 2.1. The NMR spectra data are well matched with those reported.

White solid.

M.p. 97.1 – 98.5 °C. (lit. 101.3 − 102.2 °C)[5]

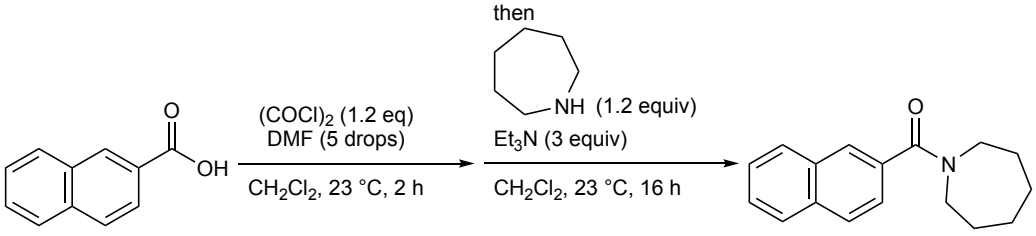
R_f = 0.27 (eluent: hexane/ethyl acetate = 2:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (s, 1H), 7.89 – 7.85 (m, 3H), 7.56 – 7.51 (m, 2H), 7.49 (dd, *J* = 8.4, 1.6 Hz, 1H), 3.72 – 3.55(m, 8H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 170.4, 133.7, 132.6, 132.5, 128.4, 128.3, 127.7, 127.1, 127.0, 126.7, 124.2, 69.9 (2C overlapped), 48.3, 42.6.

MS (ESI) *m/z* 242.16 [$(M+H)^+$].

2.7. Azepan-1-yl(naphthalen-2-yl)methanone (S27)



S27
85%

Prepared from 2-naphthoic acid (1.72 g, 10.0 mmol, 1.0 equiv), $(COCl)_2$ (1.0 mL, 11.7 mmol, 1.2 equiv), azepane (1.4 mL, 12.4 mmol, 1.2 equiv) (Sigma-Aldrich, H10401), and triethylamine (4.2 mL, 30.1 mmol, 3.0 equiv) according to the condition **B** described in section 2.1.

Purification silica gel, hexane/ethyl acetate = 2:1→1:4

Yield 85% yield (2.15 g, 8.50 mmol) as light yellow oil.

R_f = 0.36 (eluent: hexane/ethyl acetate = 2:1, visualized by UV).

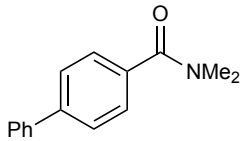
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 – 7.84 (m, 4H), 7.54 – 7.50 (m, 2H), 7.48 (dd, *J* = 8.5, 1.4 Hz, 1H), 3.75 – 3.72 (m, 2H), 3.43 – 3.41 (m, 2H), 1.91 – 1.86 (m, 2H), 1.71 – 1.61 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 171.5, 134.6, 133.3, 132.7, 128.2, 128.1, 127.7, 126.7, 126.5, 125.9, 124.0, 49.8, 46.3, 29.5, 27.8, 27.2, 26.4.

IR (KBr, neat) ν_{max} 2926, 2854, 1614 [*v* (C=O)] 1423, 758 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{17}H_{20}NO$ [$(M+H)^+$]: 254.1545, found: 254.1547.

2.8. *N*,*N*-Dimethyl-[1,1'-biphenyl]-4-carboxamide (S28)[6]



S28

Prepared from biphenyl-4-carboxylic acid (Sigma-Aldrich B34729) and Me_2NH (2 M in THF) according to the condition **A** described in section 2.1. The NMR spectra data are well matched with those reported.

White solid.

R_f = 0.18 (eluent: hexane/ethyl acetate = 2:1, visualized by UV).

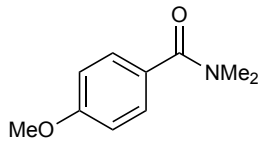
M.p. 106.4 – 107.7 °C. (lit. 104 – 105 °C)[7]

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.62 (d, *J* = 8.3 Hz, 2H), 7.60 (d, *J* = 7.4 Hz, 2H), 7.50 (d, *J* = 8.3 Hz, 2H), 7.45 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.37 (t, *J* = 7.4 Hz, 1H), 3.13 (brs, 3H), 3.04 (brs, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 171.4, 142.4, 140.3, 135.1, 128.8, 127.7, 127.6, 127.1, 127.0, 39.6, 35.4.

MS (ESI) *m/z* 226.15 [$(M+H)^+$].

2.9. 4-Methoxy-*N*,*N*-dimethylbenzamide (S29)[1]



S29

Prepared from 4-methoxybenzoic acid (Sigma-Aldrich 8.05971) and Me_2NH (2 M in THF) according to the condition **A** described in section 2.1. The NMR spectra data are well matched with those reported.

Colorless oil.

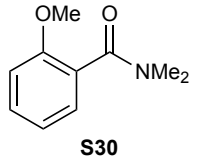
R_f = 0.24 (eluent: hexane/ethyl acetate = 1:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (d, *J* = 8.8 Hz, 2H), 6.90 (d, *J* = 8.8 Hz, 2H), 3.83 (s, 3H), 3.05 (brs, 6H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 171.5, 160.5, 129.0, 128.3, 113.5, 55.3, 39.7, 35.6.

MS (ESI) *m/z* 180.05 [$(M+H)^+$].

2.10. 2-Methoxy-*N*,*N*-dimethylbenzamide (S30)[1]



S30

Prepared from 2-methoxybenzoic acid (Sigma-Aldrich 169978) and Me_2NH (2 M in THF) according to the condition **A** described in section 2.1. The NMR spectra data are well matched with those reported.

Colorless oil.

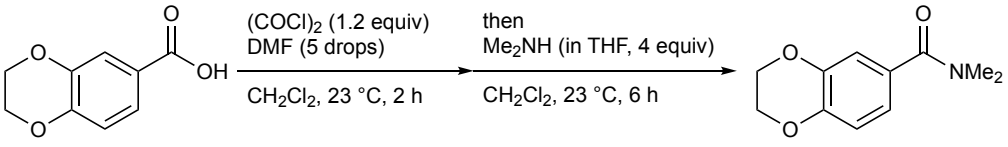
R_f = 0.21 (eluent: hexane/ethyl acetate = 1:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 (ddd, *J* = 8.3, 7.4, 1.7 Hz, 1H), 7.23 (dd, *J* = 7.4, 1.7 Hz, 1H), 6.98 (dd, *J* = 7.4, 7.4 Hz, 1H), 6.91 (d, *J* = 8.3 Hz, 1H), 3.83 (s, 3H), 3.12 (s, 3H), 2.85 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 169.4, 155.2, 130.2, 127.8, 126.3, 120.8, 110.9, 55.5, 38.1, 34.7.

MS (ESI) *m/z* 180.06 [$(M+H)^+$].

2.11. *N*,*N*-Dimethyl-2,3-dihydrobenzo[*b*][1,4]dioxine-6-carboxamide (S31)



S31
93%

The titled compound was synthesized using 1,4-benzodioxane-6-carboxylic acid (1.80 g, 10.0 mmol, 1.0 equiv) (Sigma-Aldrich 658375), $(COCl)_2$ (1.0 mL, 11.7 mmol, 1.2 equiv), and Me_2NH in THF (2 M, 20 mL, 40 mmol, 4.0 equiv) by following the condition **A** described in section 2.1.

Purification silica gel, hexane/ethyl acetate = 2:1→1:4.

Yield 93% yield (1.93 g, 9.32 mmol) as light yellow solid.

M.p. 89.5 – 90.7 °C.

R_f = 0.17 (eluent: hexane/ethyl acetate = 2:1, visualized by UV).

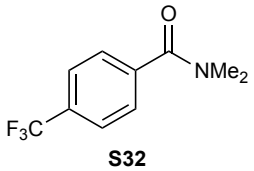
^{1}H NMR (400 MHz, $CDCl_3$) δ 6.97 (d, *J* = 1.9 Hz, 1H), 6.85 (dd, *J* = 8.3, 1.9 Hz, 1H), 6.92 (d, *J* = 8.3 Hz, 1H), 4.29 – 4.25 (m, 4H), 3.04 (brs, 6H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 170.9, 144.7, 143.1, 129.3, 120.7, 117.0, 116.7, 64.4, 64.2, 39.6, 35.4.

IR (KBr, neat) ν_{max} 2933, 2881, 1608 [*v* (C=O)], 1575, 1489, 840 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{11}H_{14}NO_3$ [$(M+H)^+$]: 208.0974, found: 208.0974.

2.12. *N*,*N*-Dimethyl-4-(trifluoromethyl)benzamide (S32)[1]



S32

Prepared from 4-(trifluoromethyl)benzoic acid (Sigma-Aldrich 196894) and Me_2NH (2 M in THF) according to the condition **A** described in section 2.1. The NMR spectra data are well matched with those reported.

White solid.

M.p. 96.0 – 97.1 °C. (95 – 96 °C)[7]

R_f = 0.37 (eluent: hexane/ethyl acetate = 2:1, visualized by UV).

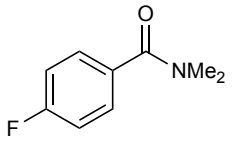
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68 (d, *J* = 8.0 Hz, 2H), 7.53 (d, *J* = 8.0 Hz, 2H), 3.13 (brs, 3H), 2.97 (brs, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 170.0, 139.9, 131.4 (q, $^2J_{C-F}$ = 32.5 Hz), 127.3, 125.4 (q, $^3J_{C-F}$ = 3.7 Hz), 123.7 ($^1J_{C-F}$ = 270.7 Hz), 39.3, 35.2.

^{19}F NMR (376 MHz, $CDCl_3$) δ −62.9.

MS (ESI) *m*/*z* 218.06 [$(M+H)^+$].

2.13. 4-Fluoro-*N*,*N*-dimethylbenzamide (S33)[6]



S33

Prepared from 4-fluorobenzoic acid (Sigma-Aldrich 128384) and Me_2NH (40% *wt* in H_2O) according to the condition **B** described in section 2.1. The NMR spectra data are well matched with those reported.

White solid.

M.p. 64.1 – 65.2 °C. (lit. 65 °C)[8]

R_f = 0.28 (eluent: hexane/ethyl acetate = 1:1, visualized by UV).

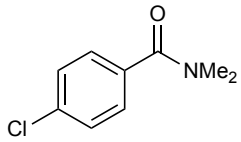
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 – 7.41 (m, 2H), 7.11 – 7.06 (m ,2H), 3.10 (brs, 3H), 2.99 (brs, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 170.6, 163.2 (d, $^1J_{C-F}$ = 249.3 Hz), 132.3 (d, $^4J_{C-F}$ = 3.5 Hz), 129.3 (d, $^3J_{C-F}$ = 8.5 Hz), 115.3 (d, $^2J_{C-F}$ = 21.8 Hz), 39.6, 35.4.

^{19}F NMR (376 MHz, $CDCl_3$) δ −110.7.

MS (ESI) *m*/*z* 168.01 [$(M+H)^+$].

2.14. 4-Chloro-*N*,*N*-dimethylbenzamide (S34)[9]



S34

Prepared from 4-chlorobenzoic acid (Sigma-Aldrich 135585) and Me_2NH (40% *wt* in H_2O) according to the condition **B** described in section 2.1. The NMR spectra data are well matched with those reported.

White solid.

M.p. 58.8 – 59.9 °C. (lit. 56 – 57 °C)[10]

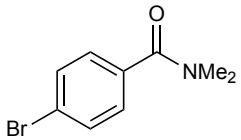
R_f = 0.31 (eluent: hexane/ethyl acetate = 1:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 – 7.35 (m, 4H), 3.10 (brs, 3H), 2.98 (brs, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 170.4, 135.5, 134.6, 128.5, 39.5, 35.3.

MS (ESI) *m*/*z* 184.05 [$(M+H)^+$].

2.15. 4-Bromo-*N*,*N*-dimethylbenzamide (S35)[1]



S35

Prepared from 4-bromobenzoic acid (Sigma-Aldrich 108510) and Me_2NH (40% *wt* in H_2O) according to the condition **B** described in section 2.1. The NMR spectra data are well matched with those reported.

White solid.

M.p. 72.0 – 73.6 °C. (lit. 76 – 77 °C)[7]

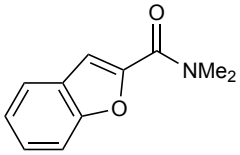
R_f = 0.31 (eluent: hexane/ethyl acetate = 1:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54 (d, *J* = 8.5 Hz, 2H), 7.30 (d, *J* = 8.5 Hz, 2H), 3.10 (brs, 3H), 2.97 (brs, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 170.4, 135.0, 131.5, 128.7, 123.7, 39.4, 35.3.

MS (ESI) *m*/*z* 218.06 [$(M+H)^+$].

2.16. *N*,*N*-Dimethylbenzofuran-2-carboxamide (S36)[6]



S36

Prepared from benzofuran-2-carboxylic acid (Sigma-Aldrich 307270), Me_2NH (40% *wt* in H_2O), and triethylamine according to the condition **B** described in section 2.1. The NMR spectra data are well matched with those reported.

White solid.

M.p. 73.7 – 75.1 °C. (lit. 71 – 73 °C)[11]

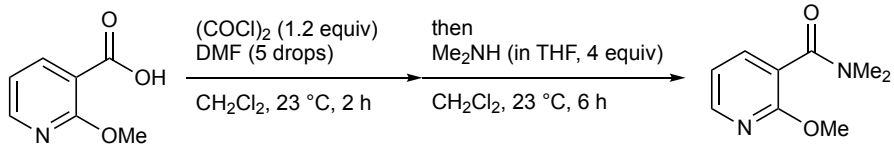
R_f = 0.33 (eluent: hexane/ethyl acetate = 1:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 (d, *J* = 7.8 Hz, 1H), 7.53 (d, *J* = 8.3 Hz, 1H), 7.39 (dd, *J* = 7.8, 7.8 Hz, 1H), 7.31 – 7.26 (m, 2H), 3.35 (brs, 2H), 3.15 (brs, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 160.9, 154.6, 149.2, 127.0, 126.3, 123.4, 122.2, 111.8, 111.6, 38.4, 36.4.

MS (ESI) *m*/*z* 190.08 [$(M+H)^+$].

2.17. 2-Methoxy-*N*,*N*-dimethylnicotinamide (S37)



S37
84%

The titled compound was synthesized using 2-methoxynicotinic acid (1.53 g, 10.0 mmol, 1.0 equiv) (TCI M2041), $(COCl)_2$ (1.0 mL, 11.7 mmol, 1.2 equiv), and Me_2NH in THF (2 M, 20 mL, 40 mmol, 4.0 equiv) by following the condition **A** described in section 2.1.

Purification silica gel, hexane/ethyl acetate = 2:1→1:4.

Yield 84% yield (1.51 g, 8.39 mmol) as white solid.

M.p. 95.0 – 96.8 °C.

R_f = 0.20 (eluent: hexane/ethyl acetate = 2:1, visualized by UV).

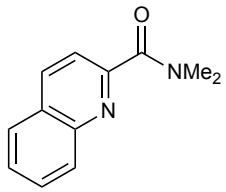
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.20 (dd, *J* = 5.0, 1.9 Hz, 1H), 7.58 (dd, *J* = 7.2, 1.9 Hz, 1H), 6.94 (dd, *J* = 7.2, 5.0 Hz, 1H), 3.98 (s, 3H), 3.12 (s, 3H), 2.87(s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 167.7, 159.4, 147.7, 137.1, 120.4, 116.8, 53.6, 38.1, 34.9.

IR (KBr, neat) ν_{max} 2954, 2933, 1625 [*v* (C=O)], 1402, 1012, 777 cm^{-1}.

HRMS (ESI) *m*/*z* calcd for $C_9H_{13}N_2O_2$ [$(M+H)^+$]: 181.0977, found: 181.0979.

2.18. *N*,*N*-Dimethylquinoline-2-carboxamide (S38)[12]



S38

Prepared from 2-quinolinecarboxylic acid (Sigma-Aldrich 160660) and Me_2NH (2 M in THF) according to the condition **A** described in section 2.1. The NMR spectra data are well matched with those reported.

Light yellow oil.

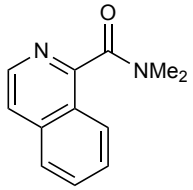
R_f = 0.20 (eluent: hexane/ethyl acetate = 1:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.26 (d, *J* = 8.4 Hz, 1H), 8.11 (d, *J* = 8.4 Hz, 1H), 7.85 (d, *J* = 8.1 Hz, 1H), 7.76 (ddd, *J* = 8.4, 7.0, 1.4 Hz, 1H), 7.71 (d, *J* = 8.4 Hz, 1H), 7.60 (ddd, *J* = 8.1, 7.0, 1.0 Hz, 1H), 3.20 (s, 3H), 3.17 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.9, 154.0, 146.4, 137.0, 129.9, 129.4, 127.8, 127.5, 127.3, 120.4, 38.9, 35.6.

MS (ESI) *m*/*z* 201.08 [$(M+H)^+$].

2.19. *N*,*N*-Dimethylisoquinoline-1-carboxamide (S39)[9]



S39

Prepared from isoquinoline-1-carboxylic acid (TCI I0671) and Me_2NH (2 M in THF) according to the condition **A** described in section 2.1. The NMR spectra data are well matched with those reported.

Light yellow solid.

M.p. 135.8 – 137.8 °C. (lit. 139 – 141 °C)[13]

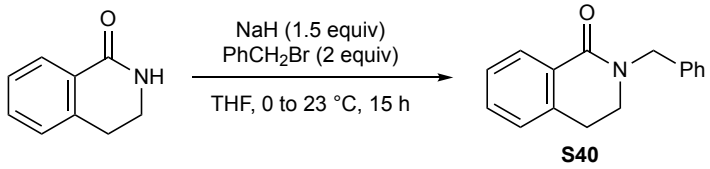
R_f = 0.14 (eluent: hexane/ethyl acetate = 1:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.52 (d, *J* = 5.7 Hz, 1H), 8.02 (d, *J* = 8.2 Hz, 1H), 7.86 (d, *J* = 8.2 Hz, 1H), 7.72 (dd, *J* = 8.2, 7.5 Hz, 1H), 7.68 (d, *J* = 5.7 Hz, 1H), 7.62 (dd, *J* = 8.2, 7.5 Hz, 1H), 3.27 (s, 3H), 2.87 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.2, 155.6, 141.6, 136.4, 130.7, 128.0, 126.9, 125.9, 125.3, 121.2, 38.3, 34.8.

MS (ESI) *m*/*z* 201.08 [$(M+H)^+$].

2.20. 2-Benzyl-3,4-dihydroisoquinolin-1(2*H*)-one (S40)[1]



S40

Prepared by treating 3,4-dihydroisoquinolin-1(2*H*)-one (Fluorochem 076493) with sodium hydride (Sigma-Aldrich 452912) and benzyl bromide (Sigma-Aldrich B17905) in THF according to the reported procedure. The NMR spectra data are well matched with those reported.

Light yellow oil.

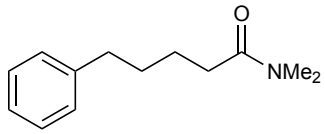
R_f = 0.30 (eluent: hexane/ethyl acetate = 10:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.15 (dd, *J* = 7.7, 1.1 Hz, 1H), 7.41 (ddd, *J* = 7.4, 7.4, 1.4 Hz, 1H), 7.36 (d, *J* = 7.5 Hz, 1H), 7.33 – 7.25 (m, 5H), 7.15 (d, *J* = 7.4 Hz, 1H), 4.80 (s, 2H), 3.48 (t, *J* = 6.6 Hz, 2H), 2.93 (t, *J* = 6.6 Hz, 2H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 164.5, 138.0, 137.4, 131.7, 129.4, 128.6, 128.4, 128.0, 127.4, 127.0, 126.9, 50.4, 45.3, 28.1.

MS (ESI) *m/z* 238.17 [$(M+H)^+$].

2.21. *N*,*N*-Dimethyl-5-phenylpentanamide (S41)[9]



S41

Prepared from 5-phenylvaleric acid (Sigma-Aldrich P37602) and Me_2NH (2 M in THF) according to the condition **A** described in section 2.1. The NMR spectra data are well matched with those reported.

Light yellow oil.

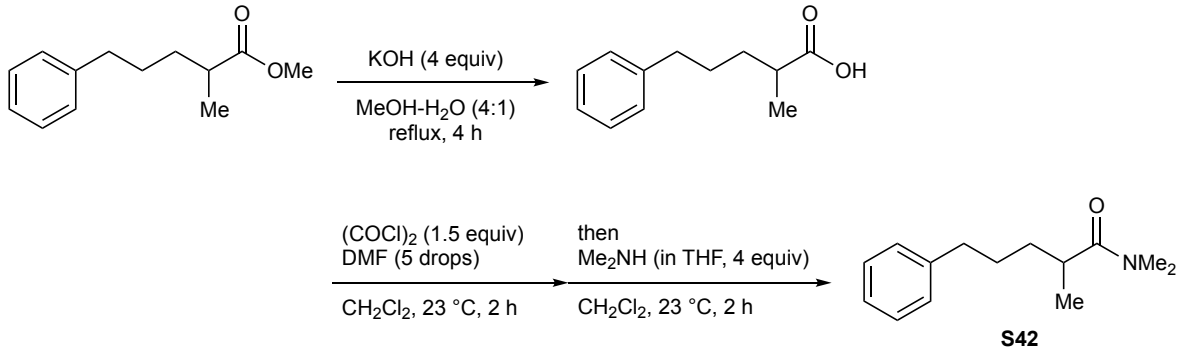
R_f = 0.33 (eluent: hexane/ethyl acetate = 1:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28 – 7.24 (m, 2H), 7.18 – 7.15 (m, 3H), 2.97 (s, 3H), 2.93 (s, 3H), 2.64 (t, *J* = 6.8 Hz, 2H), 2.32 (t, *J* = 6.8 Hz, 2H), 1.69 – 1.67 (m, 4H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 172.8, 142.2, 128.3, 128.1, 125.6, 37.1, 35.7, 35.2, 33.1, 31.1, 24.7.

MS (ESI) *m/z* 206.14 [$(M+H)^+$].

2.22. *N*,*N*,2-Trimethyl-5-phenylpentanamide (S42)[9]



S42

Prepared from 2-methyl-5-phenylpentanoate via its alkaline hydrolysis followed by amidation of the resulting carboxylic acid according to the reported procedure. The NMR spectra data are well matched with those reported.

Light yellow oil.

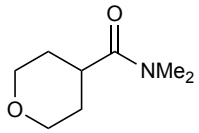
R_f = 0.31 (eluent: hexane/ethyl acetate = 2:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28 – 7.25 (m, 2H), 7.18 – 7.16 (m, 3H), 3.00 (s, 3H), 2.94 (s, 3H), 2.76 – 2.53 (m, 3H), 1.79 – 1.70 (m, 1H), 1.67 – 1.52 (m, 2H), 1.46 – 1.37 (m, 1H), 1.09 (d, *J* = 6.8 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 176.5, 142.3, 128.3, 128.2, 125.6, 37.1, 36.0, 35.55, 35.47, 33.7, 29.4, 17.4.

MS (ESI) *m*/*z* 220.16 [$(M+H)^+$].

2.23. *N*,*N*-Dimethyltetrahydro-2*H*-pyran-4-carboxamide (S43)[1]



S43

Prepared from tetrahydropyran-4-carboxylic acid (Fluorochem 043853) and Me_2NH (40% *wt* in H_2O) according to the condition **B** described in section 2.1. The NMR spectra data are well matched with those reported.

White solid.

M.p. 70.6 – 72.0 °C. (lit. 65 – 67 °C)[14]

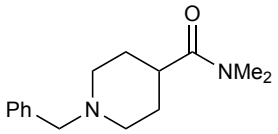
R_f = 0.30 (eluent: hexane/ethyl acetate = 1:1, visualized by phosphomolybdic acid stain).

^{1}H NMR (400 MHz, $CDCl_3$) δ 4.02 (ddd, *J* = 11.8, 4.1, 2.1 Hz, 2H), 3.45 (ddd, *J* = 11.8, 11.8, 2.1 Hz, 2H), 3.06 (s, 3H), 2.95 (s, 3H), 2.75 (tt, *J* = 11.3, 3.8 Hz, 1H), 1.91 (dddd, *J* = 13.5, 11.8, 11.8, 4.4 Hz, 2H), 1.61 (dddd, *J* = 13.5, 5.6, 2.1, 2.1 Hz, 2H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 174.2, 67.2, 37.7, 36.9, 35.6, 28.8.

MS (ESI) *m*/*z* 157.21 [$(M+H)^+$].

2.24. 1-Benzyl-*N*,*N*-dimethylpiperidine-4-carboxamide (S44)[1]



S44

Prepared from 1-benzylpiperidine-4-carboxylic acid and Me_2NH (2 M in THF) according to the condition **A** described in section 2.1. The NMR spectra data are well matched with those reported.

Light yellow solid.

M.p. 84.6 – 85.4 °C. (lit. 83.5 – 84.5 °C)[14]

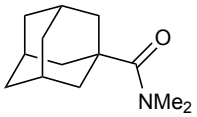
R_f = 0.24 (eluent: ethyl acetate, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32 – 7.22 (m, 5H), 3.51 (s, 2H), 3.03 (s, 3H), 2.96 – 2.93 (m, 2H), 2.93 (s, 3H), 2.47 (tt, *J* = 11.3, 3.8 Hz, 1H), 2.00 (ddd, *J* = 11.7, 11.7, 2.1 Hz, 2H), 1.87 (dddd, *J* = 12.7, 12.0, 12.0, 3.5 Hz, 1H), 1.67 – 1.64 (m, 2H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 175.0, 138.4, 129.0, 128.1, 126.9, 63.2, 53.1, 38.9, 36.9, 35.5, 28.5.

MS (ESI) *m*/*z* 247.16 [$(M+H)^+$].

2.25. *N*,*N*-Dimethyladamantane-1-carboxamide (45)[1]



45

Prepared from 1-adamantanecarboxylic acid (Sigma-Aldrich 106399), Me_2NH (2 M in THF) according to the condition **A** described in section 2.1. The NMR spectra data are well matched with those reported.

White solid.

M.p. 80.3 – 81.1 °C. (lit. 79 – 80 °C)[15]

R_f = 0.34 (eluent: hexane/ethyl acetate = 2:1, visualized by phosphomolybdic acid stain).

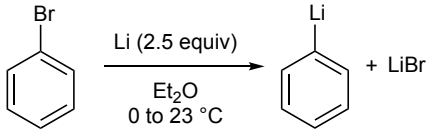
^{1}H NMR (400 MHz, $CDCl_3$) δ 3.06 (s, 6H), 2.05 – 1.99 (m, 9H), 1.76 – 1.70 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 176.9, 41.6, 38.7, 38.5, 36.6, 28.5.

MS (ESI) *m*/*z* 208.15 [$(M+H)^+$].

3. Preparation of organometallic reagents

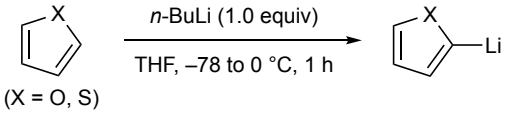
3.1. Preparation of phenyllithium[16]



In a 250 mL three-necked flask fitted with a dropping funnel, a reflux condenser, and a PTFE coated stir bar was added lithium metal granular (3.48 g, 501 mmol, 2.5 equiv) (Sigma-Aldrich, 499811) under an argon atmosphere. It was stirred vigorously for 10 min to scrape the lithium surface, and anhydrous Et_2O (20 mL) was added. A solution of bromobenzene (21 mL, 201 mmol, 1.0 equiv) (TCI B0439) in anhydrous Et_2O (80 mL) was added to the dropping funnel, and 10 mL of the solution was added to the lithium suspension at 0 °C. Vigorous reaction should take place within 5 min and a silvery surface on lithium was observed. The rest of the bromobenzene solution was then added dropwise (about 1 drop/sec) over 2 h at 0 °C and the mixture was stirred for another 30 min before warming up to 23 °C. At this moment, most of the lithium metal should have disappeared, and the mixture was heated at 40 °C for 1 h. After cooling down to 23 °C, the stirring was stopped, and the mixture was stand for 1 h to settle the precipitate. (Occasionally, crystals of PhLi might be formed upon cooling. In this case, minimum amounts of Et_2O (5 – 10 mL) was added and the mixture was stirred until the crystals were fully dissolved before transferred to the Schlenk filter.) The mixture was cannulated to a Schlenk filter, and it was filtered under an argon atmosphere to obtain a brown solution. The solid residue was washed with another 15 mL of Et_2O. The concentration was determined by the titration against *N*-benzylbenzamide. The final concentration of PhLi should be 1.00 – 1.30 M.

4-Methoxyphenyllithium was prepared by the same method using 4-bromoanisole (6.4 mL, 50.1 mmol, 1.0 equiv) (Fluorochem BR1023) and lithium metal (868 mg, 125 mmol, 2.5 equiv) in anhydrous Et_2O.

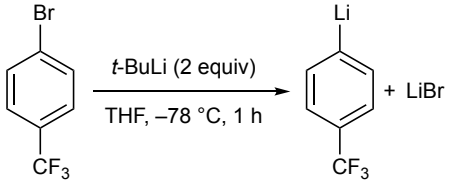
3.2. Preparation of 2-thienyllithium[17]



In a 25 mL sealed tube equipped with a PTFE coated stir bar was added distilled thiophene (1.6 mL, 20.0 mmol, 1.0 equiv) and anhydrous THF (10 mL). The mixture was cooled to –78 °C (acetone-dry ice bath). *n*-BuLi (7.8 mL, 20.0 mmol, 1.0 equiv) (2.56 M in hexane, Kanto Chemical 04935) was added dropwise over 10 min and the mixture was slowly warm up to 23 °C over 1 h. The resulting light yellow solution was titrated against 2-propanol/1,10-phenanthroline.

2-Furyllithium[18] was prepared by the same method as above using distilled furan (1.5 mL, 20.6 mmol, 1.0 equiv) and *n*-BuLi (7.8 mL, 20.0 mmol, 1.0 equiv) in anhydrous THF (10 mL).

3.3. Preparation of aryllithium with *t*-BuLi[19]



In a 25 mL sealed tube equipped with a PTFE coated stir bar was added 4-bromobenzotrifluoride (115 μL, 0.82 mmol) and anhydrous THF (3 mL). The mixture was cooled to –78 °C (acetone-dry ice bath), and *t*-BuLi (1.2 mL, 1.58 mmol, 2.0 equiv) (1.32 M in pentane, Sigma-Aldrich 186198) was added dropwise over 5 min. The mixture was stirred at –78 °C for 1 h and used directly.

2-Pyridyllithium and (1-methyl-1*H*-indol-5-yl)lithium was prepared by the same method as above.

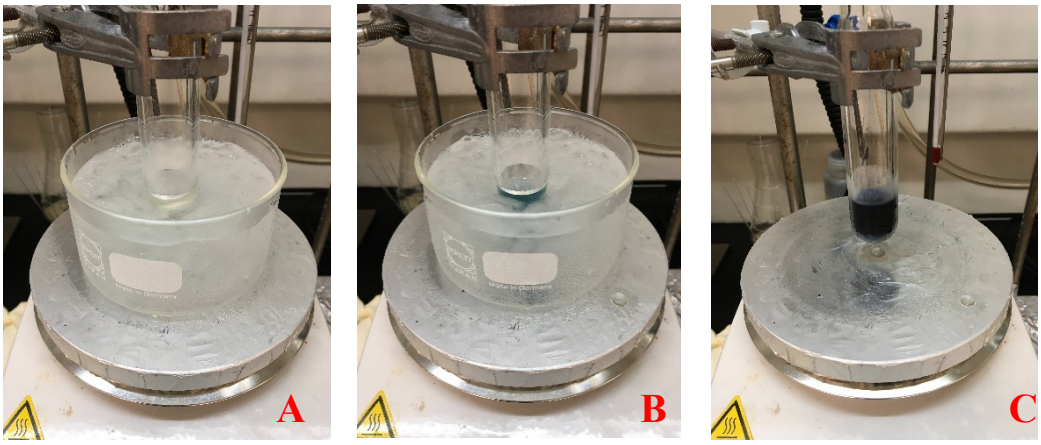
4. Titration of organometallic reagents

To ensure the quality of the organometallic reagents, all the organolithium reagents and Grignard reagents except for those prepared by Br-Li exchange with *t*-BuLi (section 3.3) were titrated before use. Frequently used organometallic reagents (PhLi, MeMgBr and Me_3SiCH_2MgCl) were titrated on a weekly basis. The titration methods are described below:

4.1. Titration against *N*-benzylbenzamide[20]

In a sealed tube equipped with a PTFE coated stir bar was added accurately weighted *N*-benzylbenzamide (recrystallized before use), and it was dissolved in anhydrous THF (5 mL). The solution was cooled to 0 °C, and PhLi solution in Et_2O was added dropwise *via* syringe until a light blue color persisted for 30 seconds. For example, 0.61 mL of PhLi solution was used against 145 mg (0.687 mmol) of *N*-benzylbenzamide: concentration of PhLi = 1.13 M.

MeLi (Sigma-Aldrich, 514330), *n*-BuLi (Kanto, 04935-25), *i*-PrLi (Sigma-Aldrich, 446904), and *t*-BuLi (Sigma-Aldrich, 186198) were titrated with this method (titration for *t*-BuLi was performed at –78 °C).



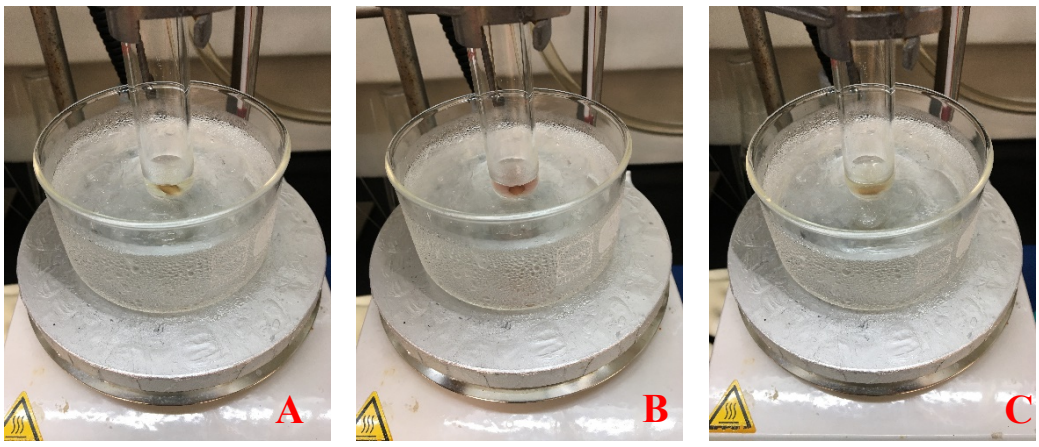
Scheme S2. Titration of PhLi against *N*-benzylbenzamide. (A) before endpoint; (B) at the endpoint; (C) over the endpoint.

4.2. Titration against 2-propanol/1,10-phenanthroline[21]

The 2-propanol solution in toluene with 0.2% *wt* 1,10-phenanthroline (phen) was prepared by adding freshly distilled 2-propanol (2.5 mL, 32.7 mmol), 1,10-phenanthroline (78 mg, Sigma-Aldrich 131377) and anhydrous toluene in a 25 mL volumetric flask (1.31 M).

In a sealed tube equipped with a PTFE coated stir bar was added accurately measured MeMgBr solution in Et_2O (Sigma-Aldrich, 189898), and it was diluted with anhydrous THF (2.5 mL). The solution was cooled to 0 °C and a stock solution of 2-propanol in toluene (1.31 M, with 0.2% *wt* phen) was added dropwise. A red/purple color appeared upon the addition of 2 to 3 drops of 2-propanol solution, and it was added until the purple color disappeared. For example, 0.56 mL of 2-propanol solution (0.734 mmol) was used for 0.25 mL of MeMgBr solution: concentration of MeMgBr = 2.93 M.

$PhCH_2MgCl$ (TCI B1933), allylMgCl (Sigma-Aldrich 225908), and ethynylmagnesium bromide (Sigma-Aldrich 346152) were titrated with this method.

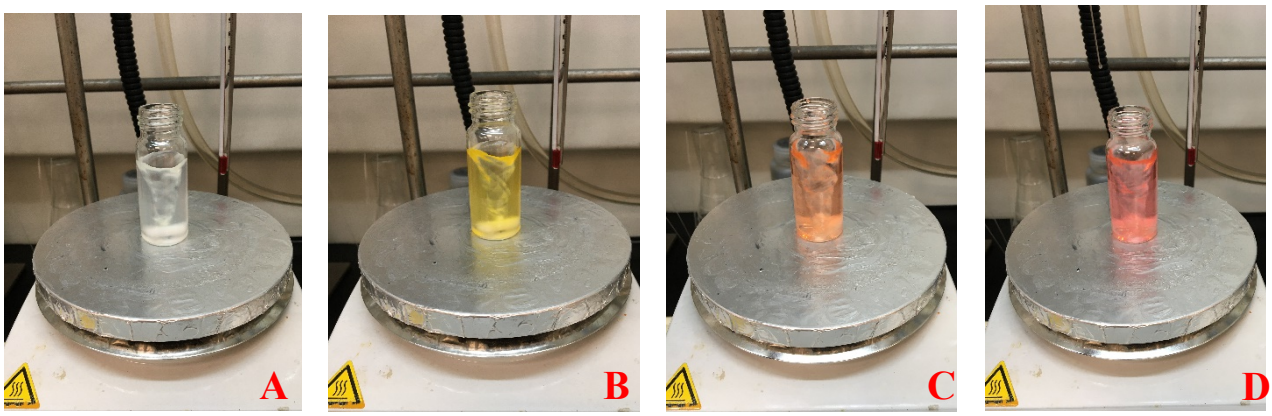


Scheme S3. Titration of MeMgBr against 2-propanol solution in toluene with 0.2% *wt* phen. (A) before adding 2-propanol solution; (B) after 5 drops of 2-propanol solution added; (C) at the end point.

4.3. Titration against a standardized HCl solution

A solution of Me_3SiCH_2MgCl in THF (Sigma-Aldrich, 256021) was carefully added to deionized water (15 mL) with vigorous stirring. Two drops of 0.1% methyl orange solution were added, and it was titrated with a standardized HCl solution (1.04 M, TCI H1202) until an orange color persisted for 30 seconds. For example, 0.47 mL of HCl solution (0.489 mmol) was used for 0.50 mL of Me_3SiCH_2MgCl solution: concentration of Me_3SiCH_2MgCl = 0.98 M.

Lithium phenylacetylide (Sigma-Aldrich 340677) was titrated with this method.



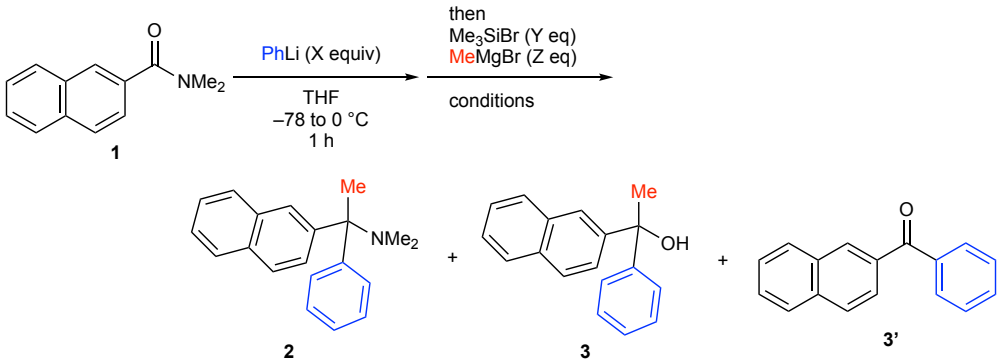
Scheme S4. Titration of Me_3SiCH_2MgCl against standardized HCl solution: (A) Grignard added to water; (B) addition of methyl orange solution; (C) at the end point; (D) over the end point.

5. Synthesis of α-tertiary amines by iterative addition of carbon nucleophiles

5.1. Optimization of the reaction conditions

The optimization of the reaction conditions was conducted using carboxamide **1** (**Table S1**). PhLi (2.0 equiv) was added to carboxamide **1** at –78 °C (dry ice-acetone bath). Dry ice was taken out from the bath, and the mixture was slowly warmed up to 0 °C for 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for 10 min). Subsequently, Me_3SiBr (2.5 equiv) and MeMgBr (3.0 equiv) was added at 0 °C and the mixture was stirred at 23 °C for 3 h to provide α-tertiary amine **2** in 71% yield, with alcohol **3** in 12% yield and ketone **3'** in 5% yield (entry 1). The reaction in Et_2O or in toluene gave ketone **3'** as the major product (79% and 67% yield, respectively) (entries 2 and 3). Heating at 60 °C for 2 h after the addition of MeMgBr was found to give higher yield of **2** and minimized the formation of ketone **3'** (entry 4). The change of the initial concentration of carboxamide **1** (from 0.1 M to 0.2 M) did not affect the process efficiency (entry 5), whereas addition of PhLi at 0 °C (instead of –78 to 0 °C) gave lower yield of **2** (entry 6). Reduction of the amounts of PhLi (from 2 equiv to 1.5 equiv), Me_3SiBr (from 2.5 equiv to 2 equiv) and MeMgBr (from 3 equiv to 2.5 equiv) improved the yield of **2** to 89% (84% isolated yield) (entry 7). It should also be noted that use of more reactive silylation reagents, Me_3SiI (generate *in situ* from Me_3SiCl and NaI) and $Me_3SiOSO_2CF_3$ (Me_3SiOTf), did not improve the process efficiency (entries 8 and 9).

Table S1 Optimization of the reaction condition[a]

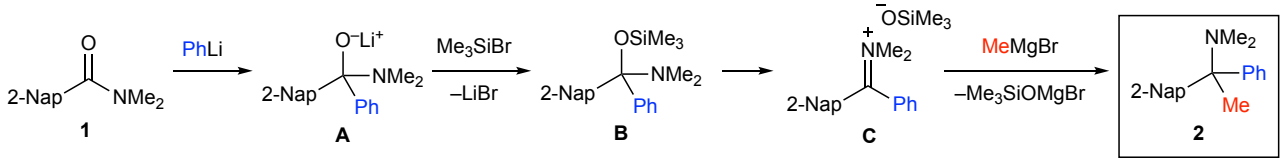


Entry	solvent	PhLi (X eq)	Me_3SiBr (Y eq)	MeMgBr (Z eq)	Conditions	**2** (%)[b]	**3** (%)[b]	**3'** (%)[b]
1	THF	2	2.5	3	0 °C to rt, 3 h	71	12	5
2	Et_2O	2	2.5	3	0 °C to rt, 3 h	9	7	79
3	toluene	2	2.5	3	0 °C to rt, 3 h	12	23	67
4	THF	2	2.5	3	0 to 60 °C, 2 h	84	6	<2
5[d]	THF	2	2.5	3	0 to 60 °C, 2 h	84	11	<2
6[d,e]	THF	2	2.5	3	0 to 60 °C, 2 h	77	11	<2
7[d]	THF	1.5	2	2.5	0 to 60 °C, 2 h	89 (84)[c]	8	<2
8[f]	THF	1.5	2	2.5	0 to 60 °C, 2 h	78	20	<2
9[g]	THF	1.5	2	2.5	0 to 60 °C, 2 h	45	43	11

[a] The reactions were conducted by using 0.5 mmol of **1** in THF (5 mL, 0.1 M). [b] Crude ^{1}H NMR yield with 1,1,2,2-tetrachloroethane as internal standard. [c] Isolated yield in parenthesis. [d] Reaction with 2.5 mL THF (0.2 M). [e] Addition of PhLi was conducted at 0 °C for 1 h. [f] Me_3SiI (generated *in situ* using Me_3SiCl and NaI) was used instead of Me_3SiBr. [g] Me_3SiOTf was used instead of Me_3SiBr.

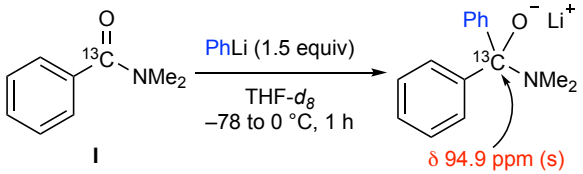
5.2. NMR studies of anionic hemiaminal intermediate A

The proposed mechanism for the formation of a-tertiary amine **2** was depicted in **Scheme S5**. Addition of PhLi to carboxamide **1** forms anionic hemiaminal intermediate **A**, which is silylated with Me_3SiBr to give **B**. Subsequent elimination of trimethylsiloxide generates the iminium ion **C**, which is attacked by MeMgBr to generate α-tertiary amine **2**. To detect and characterize the anionic hemiaminal intermediate like **A**, ^{13}C-labelled benzamide **I** was used for the NMR studies.



Scheme S5. Proposed mechanistic pathways for the formation of **2**.

Experimental procedure:



In a 25 mL sealed tube equipped with a PTFE coated stir bar was added a solution of ^{13}C-labelled amide **I** (75.2 mg, 0.500 mmol, 1.0 equiv) in THF-d_8 (2.5 mL), and the mixture was cooled to –78 °C (dry ice-acetone bath). PhLi (0.65 mL, 0.754 mmol, 1.5 equiv) (1.16 M in Et_2O) was added dropwise over 30 seconds, and the mixture was slowly warm up to 0 °C over 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for 10 min). After stirring at 23 °C for 15 min, an aliquot was taken to an argon flushed J. Young NMR tube to conduct ^{1}H, ^{13}C and HMBC spectroscopic analyses (**Scheme S6** and **Scheme S7**).

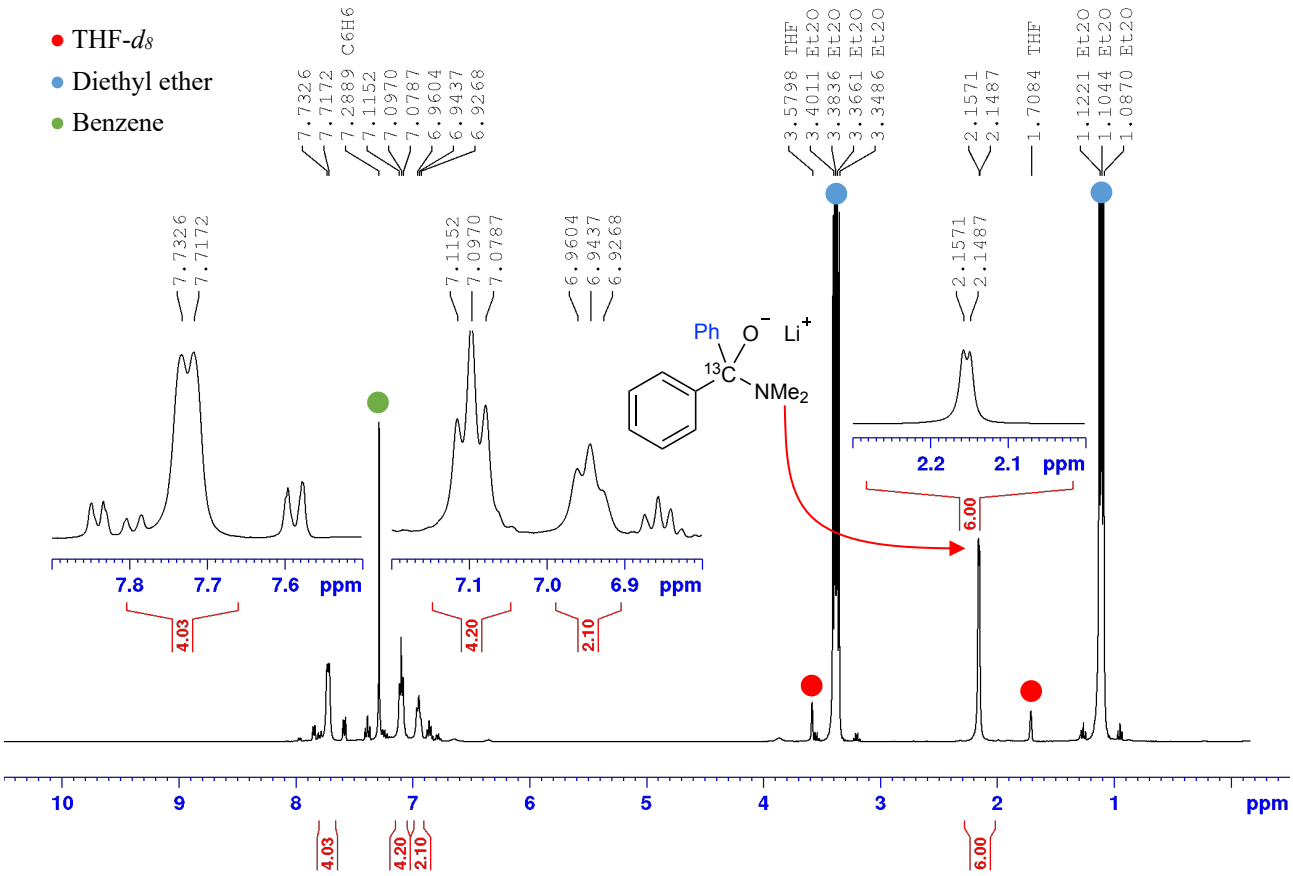
NMR data for the resulting anionic hemiaminal intermediate:

^{1}H NMR (400 MHz, THF-d_8) δ 7.72 (d, J = 7.2 Hz, 4H), 7.10 (dd, J = 7.2, 6.8 Hz, 4H), 6.94 (t, J = 6.8 Hz, 2H), 2.15 (d, J = 3.4 Hz, 6H).

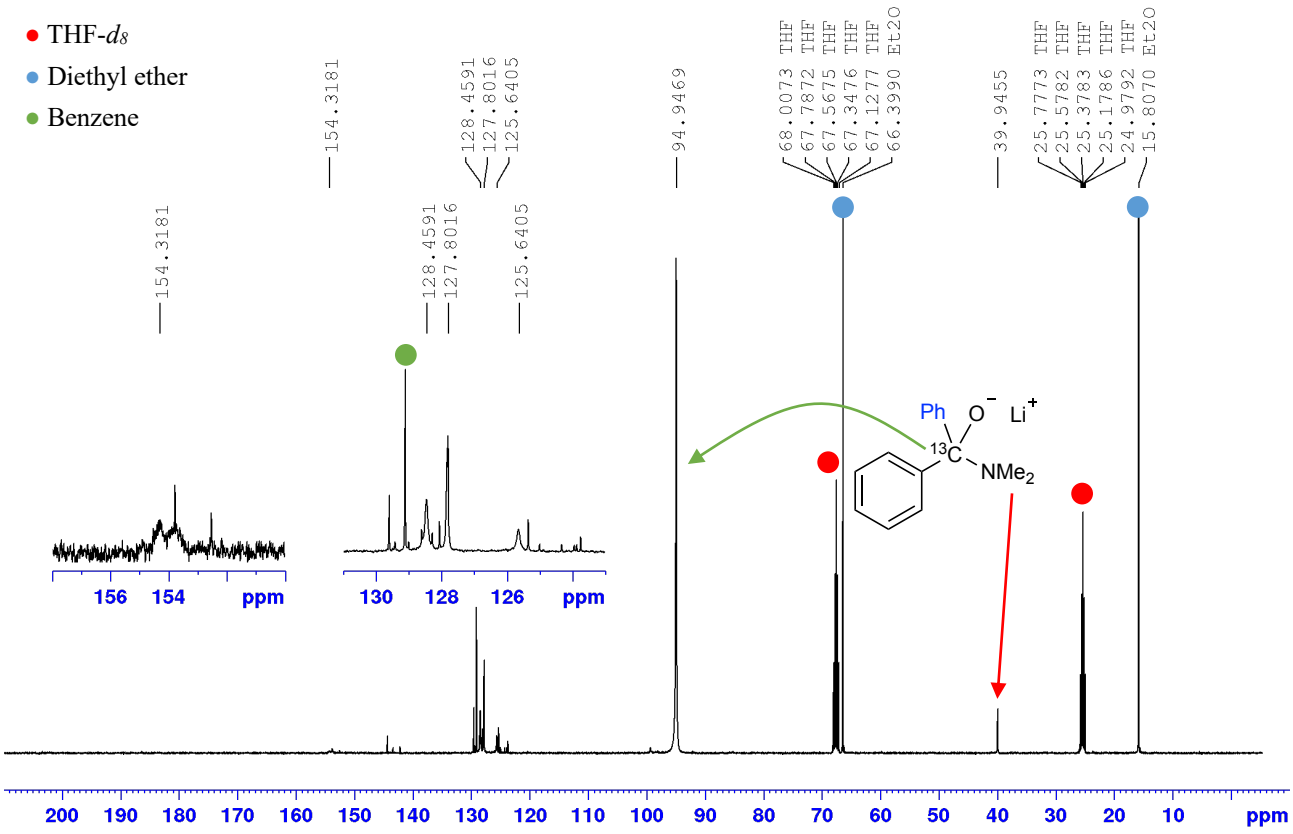
^{13}C NMR (100 MHz, THF-d_8) δ 154.3, 128.5, 127.8, 125.6, 94.9, 39.9.

In the ^{1}H NMR spectrum, the doublet at 2.15 ppm represents the protons of NMe_2, which shows a $^3J_{^1H\text{-}^{13}C}$ coupling of 3.4 Hz with the tetrahedral carbon (^{13}C). The HMBC spectrum of the crude mixture showed the correlation of 2.15 ppm (NMe_2) in the ^{1}H NMR and 94.9 ppm (^{13}C) in the ^{13}C NMR (**Scheme S8**).

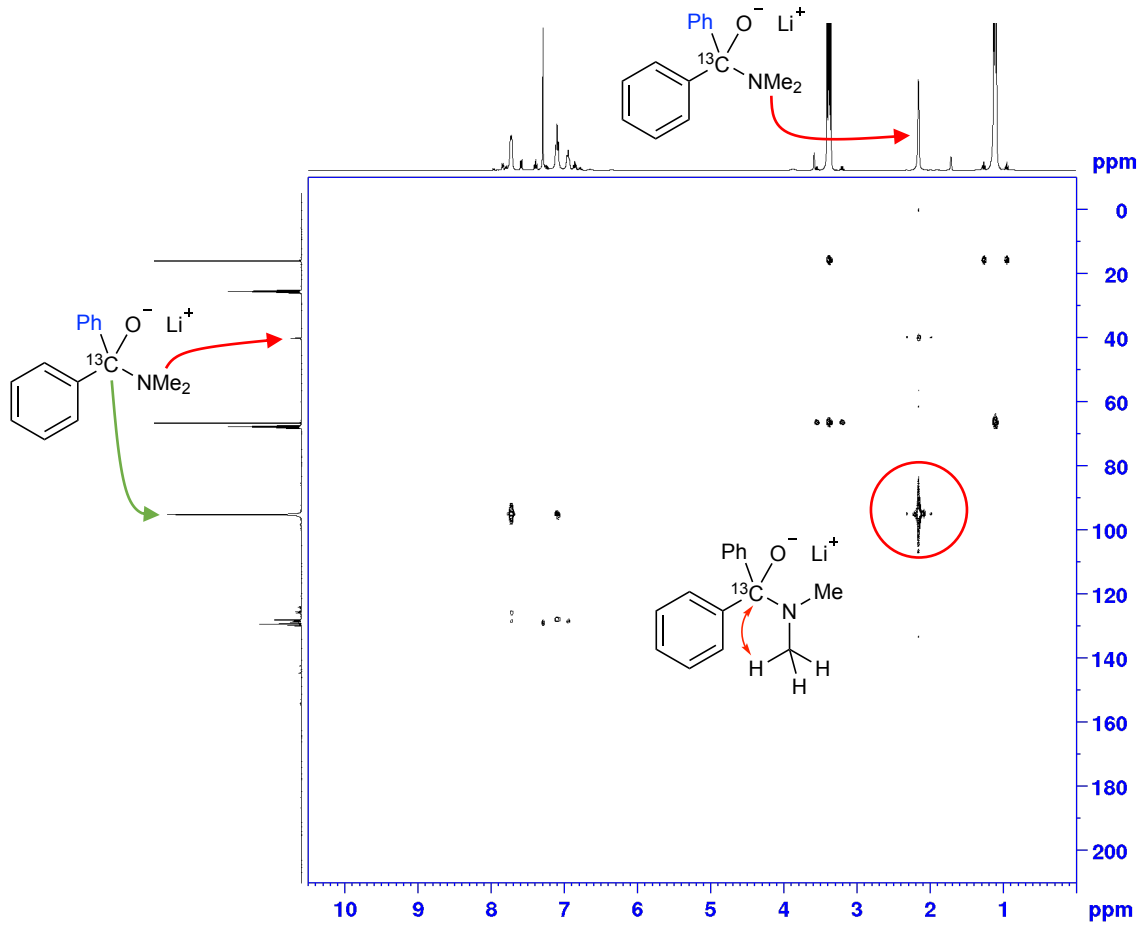
The anionic hemiaminal intermediate was found to be stable under an argon atmosphere. No significant decomposition was observed after 21 days as judged by ^{1}H NMR (**Scheme S9**).



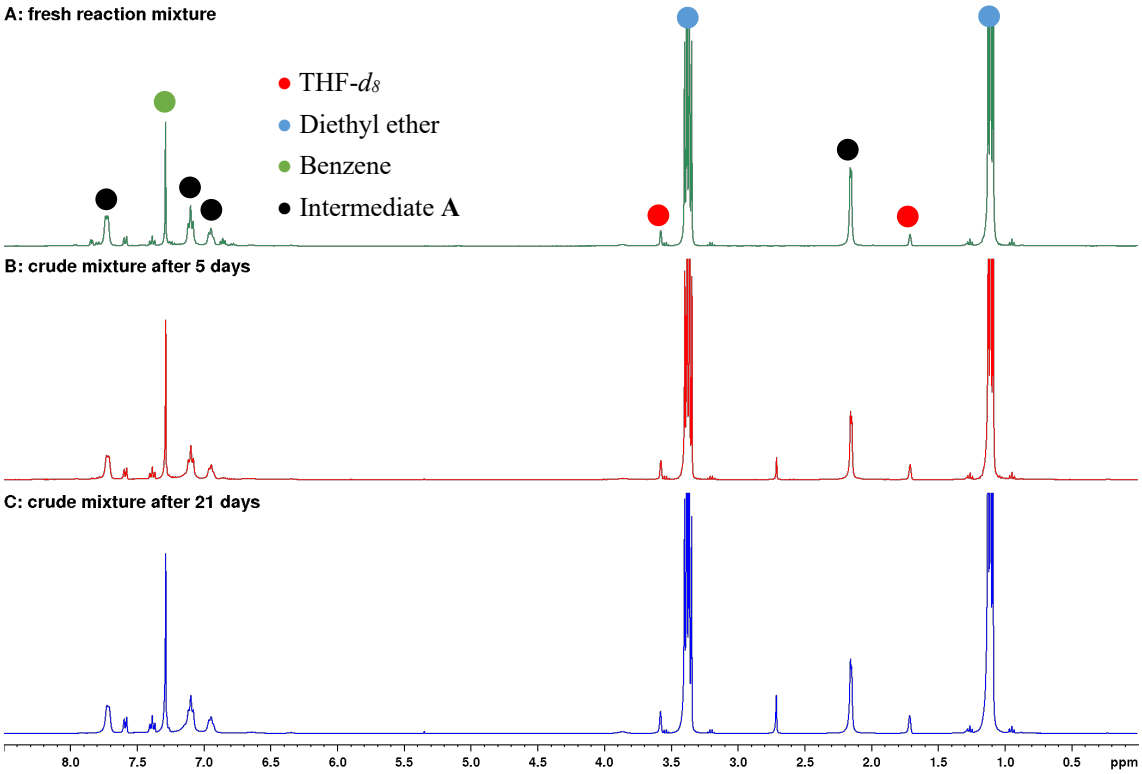
Scheme S6. ^{1}H NMR of the reaction of ^{13}C-labelled benzamide **I** and PhLi in THF-d_8.



Scheme S7. ^{13}C NMR of the reaction of ^{13}C-labelled benzamide **I** and PhLi in THF-d_8.



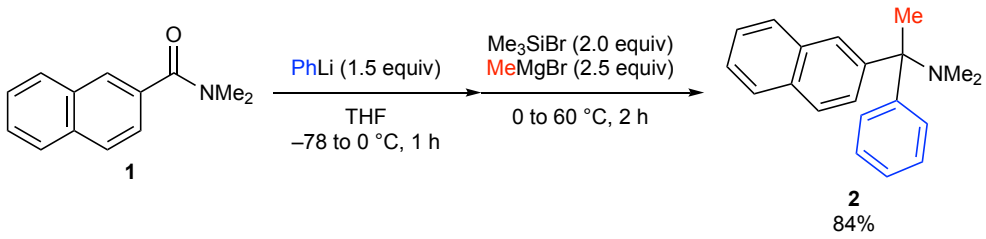
Scheme S8. HMBC spectrum of the reaction of ^{13}C-labelled benzamide **I** and PhLi in THF-d_8.



Scheme S9. Stability test on the anionic hemiaminal intermediate. (A) ^{1}H NMR taken after the reaction; (B) after 5 days; (C) after 21 days.

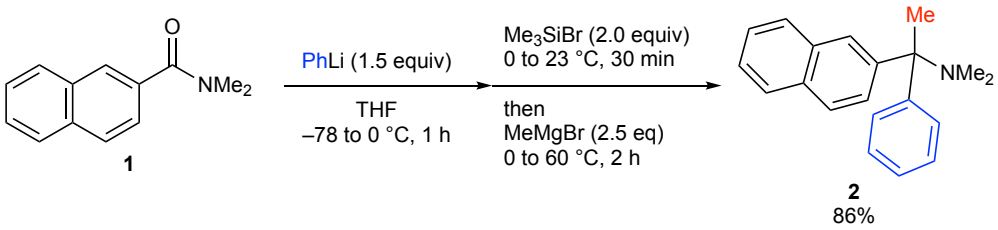
5.3. General procedures for reductive functionalization of amides with Grignard reagents

5.3.1. General Procedure A: in 0.5 mmol scale

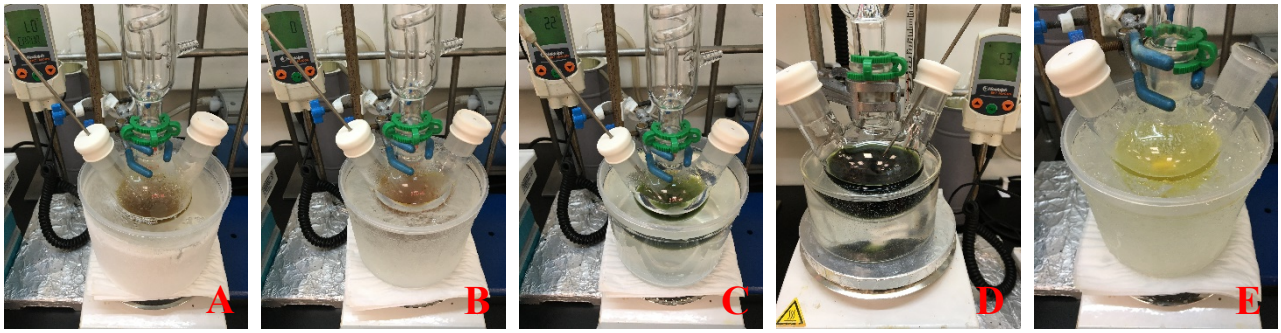


Under an argon atmosphere, in a 25 mL sealed tube equipped with a PTFE coated stir bar was added a solution of carboxamide **1** (99.7 mg, 0.500 mmol, 1.0 equiv) in anhydrous THF (2.5 mL) and the mixture was cooled to –78 °C (dry ice-acetone bath). PhLi (0.67 mL, 0.757 mmol, 1.5 equiv) (1.13 M in Et_2O) was added dropwise over 30 seconds, and the mixture was slowly warmed up to 0 °C over 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for 10 min). Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was then added in one portion, and the mixture was stirred for 5 min at 0 °C. MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O) was added and the mixture was heated at 60 °C (oil bath) for 2 h. The mixture was carefully quenched with pH 10 NH_4Cl-NH_3 buffer (10 mL) at 0 °C (ice-water bath) and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. The volatile materials were removed and the resulting residue was purified by flash column chromatography on silica gel (hexane/ethyl acetate = 100:4) to give a-tertiary amine **2** as light yellow solid (115 mg, 0.418 mmol) in 84% yield.

5.3.2. In 15 mmol scale for the synthesis of 2



Under an argon atmosphere, in a 250 mL three-necked flask fitted with a reflux condenser, a thermo sensor, and a PTFE coated stir bar was added a solution of carboxamide **1** (2.99 g, 15.0 mmol, 1.0 equiv) in anhydrous THF (75 mL) and it was cooled to –78 °C (dry ice-acetone bath). PhLi (16.8 mL, 22.5 mmol, 1.5 equiv) (1.34 M in Et_2O) was added dropwise over 10 minutes. After the addition of PhLi, dry ice was taken out from the bath, and the mixture was slowly warmed up to 0 °C for 1.5 h. (After 1 h, the internal temperature reached –10 °C, and the bath was replaced to an ice-water bath and stirred for 30 min). Me_3SiBr (4.0 mL, 30.3 mmol, 2.0 equiv) was added in one portion, observing that the internal temperature reached 18 °C rapidly. The ice-water bath was removed, and the mixture was stirred at 23 °C for another 30 min. The mixture was again cooled in an ice-water bath for 10 min (until the internal temperature reached 1 °C), MeMgBr (12.4 mL, 37.7 mmol, 2.5 equiv) (3.04 M in Et_2O) was added dropwise over 10 min and the mixture was then heated at 60 °C (oil bath) for 2 h (the internal temperature reached 53 °C). The mixture was carefully quenched with pH 10 NH_4Cl-NH_3 buffer (100 mL) at 0 °C (ice-water bath) and the organic materials were extracted with CH_2Cl_2 (50 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. The volatile materials were removed *in vacuo* and the residue was purified by flash column chromatography on silica gel (hexane/ethyl acetate = 100:4) to give amine **2** as light yellow solid (3.54 g, 12.9 mmol) in 86% yield.



Scheme S10. On 15 mmol scale for synthesis of **2a**. (A) addition of PhLi at –78 °C; (B) mixture warmed up to 0 °C; (C) addition of Me_3SiBr; (D) addition of MeMgBr; (E) mixture quenched with buffer.

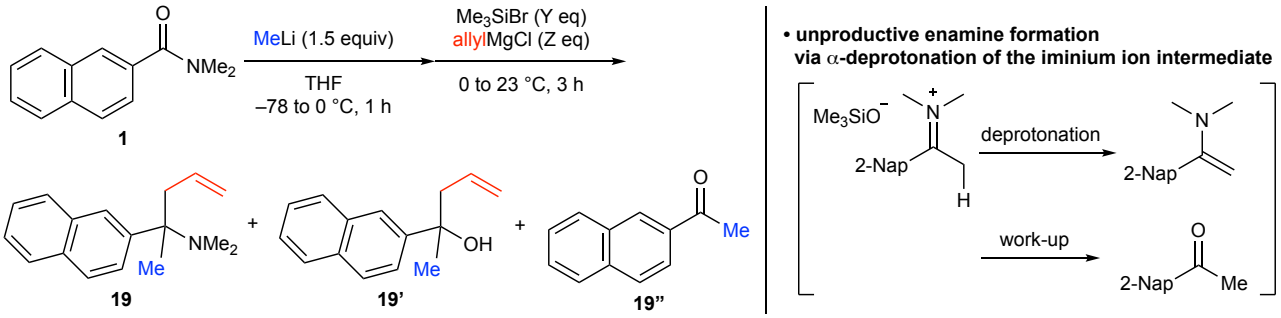
5.4. Functionalization of carboxamides with alkyllithium reagents and functionalization of aliphatic amides

5.4.1. Optimization of the reaction condition

The modification of the reaction conditions was conducted in the reactions of carboxamide **1** with MeLi and allylMgCl (**Table S2**). Under the optimized reaction protocol (section 5.3.1), the reaction afforded α-tertiary amine **19** in 42% yield along with generation of alcohol **19'** and ketone **19"** in 15% and 43% yields, respectively (entry 1). Formation of substantial amounts of ketone **19"** was assumed due to unproductive α-deprotonation of the iminium ion intermediate formed after addition of Me_3SiBr, generating inert enamine which was converted into ketone **19"** upon aqueous workup. It was found that quick addition of allylMgCl immediately after Me_3SiBr could suppress the formation of alcohol **19'** and ketone **19"** to some extent (the interval between addition of Me_3SiBr and allylMgCl should be less than 30 s) (entry 2).

Use of 3 equivalents of allylMgCl slightly improved the yield of **19** in 64% yield (60% isolated yield) (entry 3). On the other hand, the use of PhMgBr instead of allylMgCl resulted in the formation of ketone **19"** in 80% yield but the corresponding α-tertiary amine was not observed at all (entry 4).

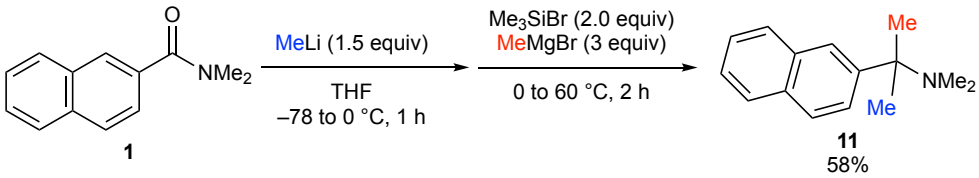
Table S2 Optimization of the reaction conditions[a]



Entry	Me_3SiBr (X eq)	allylMgCl (Y eq)	**19** (%)[b]	**19'** (%)[b]	**19"** (%)[b]
1[d]	2.0	2.5	42	15	43
2[e]	2.0	2.5	59	27	14
3[e]	2.0	3.0	64 (60)[c]	11	25
4[f]	2.0	3.0	0	0	80

[a] The reactions were conducted in 0.5 mmol scale with 2.5 mL THF. [b] Crude ^1H NMR yield with 1,1,2,2-tetrachloroethane as internal standard. [c] Isolated yield in parenthesis. [d] After the addition of Me_3SiBr, the mixture was stirred for 5 min at 0 °C before addition of allylMgCl. [e] Soon after the addition of Me_3SiBr, allylMgCl was added (less than 30 sec interval). [f] PhMgBr was used as the 2nd nucleophile instead of allylMgCl.

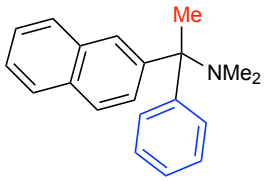
5.4.2. General procedure B



Under an argon atmosphere, in a 25 mL sealed tube equipped with a PTFE coated stir bar was added a solution of carboxamide **1** (99.7 mg, 0.500 mmol) in anhydrous THF (2.5 mL) and the mixture was cooled to –78 °C (dry ice-acetone bath). MeLi (0.27 mL, 0.753 mmol, 1.5 equiv) (2.79 M in diethoxymethane) was added dropwise over 30 seconds, and the mixture was slowly warmed up to 0 °C over 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for 10 min). Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was added in one portion, and then MeMgBr was **immediately** added (0.52 mL, 1.52 mmol, 3.0 equiv) (2.92 M in Et_2O). The mixture was heated at 60 °C (oil bath) for 2 h. The mixture was carefully quenched with pH 10 NH_4Cl-NH_3 buffer (10 mL) at 0 °C and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. The volatile materials were removed *in vacuo* and the resulting residue was purified by flash column chromatography on silica gel (hexane/ethyl acetate/trimethylamine = 100:5:1) to give amine **11** as colorless oil (61.9 mg, 0.290 mmol) in 58% yield.

5.5. Characterization of the products

5.5.1. *N*,*N*-Dimethyl-1-(naphthalen-2-yl)-1-phenylethan-1-amine (2)



2

M.p. 100.8 – 102.1 °C.

R_f = 0.21 (eluent: hexane/DCM/Et_2O = 10:1:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93 (s, 1H), 7.82 – 7.80 (m, 1H), 7.77 – 7.75 (m, 1H), 7.71 (d, *J* = 8.7 Hz, 1H), 7.58 (dd, *J* = 8.7, 1.8 Hz, 1H), 7.52 – 7.50 (m, 2H), 7.46 – 7.39 (m, 2H), 7.27 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.16 (t, *J* = 7.4 Hz, 1H), 2.20 (s, 6H), 1.85 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 145.5, 143.8, 133.1, 132.0, 128.1, 127.8, 127.7, 127.28, 127.26, 126.8, 126.1, 125.7, 125.6, 125.4, 67.0, 39.9, 19.1.

IR (KBr, neat) ν_{max} 3055, 2983, 2821, 2779, 1597, 1490, 744, 704 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{20}H_{22}N$ $[(M+H)^+]$: 276.1752, found: 276.1750.

Crystals of **2** suitable for X-ray crystallographic analysis were obtained by recrystallization from hexane. The ORTEP drawing of **2** is shown in Figure **S1** (CCDC 2105303).

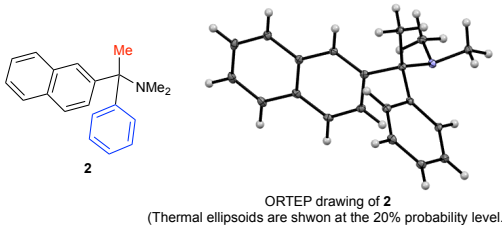


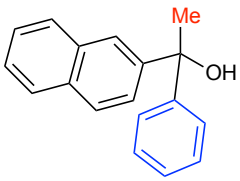
Figure S1 ORTEP illustration of compound **2**.

Table S3. Sample and crystal data for 2.

Chemical formula	$C_{20}H_{21}N$	
Formula weight	275.38 g/mol	
Temperature	100(2) K	
Wavelength	1.54178 Å	
Crystal size	0.160 x 0.200 x 0.220 mm	
Crystal habit	colorless block	
Crystal system	orthorhombic	
Space group	P n a 21	
Unit cell dimensions	a = 23.603(2) Å	α = 90°
	b = 6.0263(7) Å Å	β = 90°
	c = 10.4104(12) Å	γ = 90°
Volume	1480.8(3) $Å^3$	
Z	4	
Density (calculated)	1.235 g/cm^3	
Absorption coefficient	0.536 mm^{-1}	
F (000)	592	

Table S4. Data collection and structure refinement for 2.		
Theta range for data collection	5.67 to 68.21°	
Index ranges	-27<=h<=28, -6<=k<=7, -12<=l<=12	
Reflections collected	5414	
Independent reflections	2169 [R(int) = 0.0534]	
Coverage of independent reflections	98.1%	
Absorption correction	Multi-Scan	
Max. and min. transmission	0.9190 and 0.8910	
Refinement method	Full-matrix least-squares on F^2	
Refinement program	SHELXL-2018/3 (Sheldrick, 2018)	
Function minimized	Σ w $(F_o^2 - F_c^2)^2$	
Data / restraints / parameters	2169 / 1 / 194	
Goodness-of-fit on F^2	1.043	
Final R indices	2080 data; I>2σ (I)	R1 = 0.0453, wR2 = 0.1222
	all data	R1 = 0.0465, wR2 = 0.1237
Weighting scheme	w=1/[σ^2 (F_o^2)+ $(0.0750P)^2$+0.1116P] where P= $(F_o^2+2F_c^2)/3$	
Absolute structure parameter	-1.1(7)	
Extinction coefficient	0.0074(16)	
Largest diff. peak and hole	0.259 and -0.184 eÅ^{-3}	
R.M.S. deviation from mean	0.045 eÅ^{-3}	

5.5.2. 1-(Naphthalen-2-yl)-1-phenylethan-1-ol (3)[22]



3

Light yellow oil.

Purification silica gel, hexane/ethyl acetate = 100:10.

R_f = 0.29 (eluent: hexane/ethyl acetate = 20:1, visualized by UV).

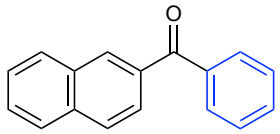
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 1.4 Hz, 2H), 7.84 – 7.82 (m, 1H), 7.80 – 7.78 (m, 1H), 7.75 (d, *J* = 8.7 Hz, 1H), 7.49 – 7.43 (m, 4H), 7.40 (dd, *J* = 8.7, 1.9 Hz, 1H), 7.31 (dd, *J* = 7.3, 7.3 Hz, 2H), 7.24 (t, *J* = 7.3 Hz, 1H), 2.28 (s, 1H), 2.04 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 147.7, 145.2, 133.0, 132.4, 128.22, 128.19, 127.9, 127.5, 127.0, 126.1, 125.9 (2C overlapped), 124.9, 123.7, 76.3, 30.7.

HRMS (ESI) *m/z* calcd for $C_{18}H_{17}O$ $[(M+H)^+]$: 249.1279, found: 249.1281.

IR (KBr, neat) ν_{max} 3417 [*v* (O–H)], 3055, 2978, 2929, 1598, 1446, 746, 700 cm^{-1}.

5.5.3. Naphthalen-2-yl(phenyl)methanone (3')[23]



3'

White solid.

Purification hexane/ethyl acetate = 100:1.

M.p. 71.2 − 73.0 °C. (lit. 72 – 73 °C)[24]

R_f = 0.27 (eluent: hexane/ethyl acetate = 30:1, visualized by UV).

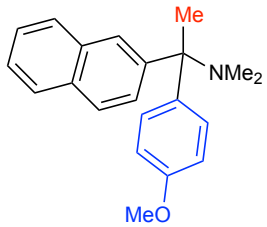
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.27 (s, 2H), 7.95 (d, *J* = 1.1 Hz, 2H), 7.93 – 7.90 (m, 2H), 7.88 – 7.85 (m, 2H), 7.64 – 7.59 (m, 2H), 7.57 – 7.50 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 196.7, 137.8, 135.2, 134.8, 132.3, 132.2, 131.8, 130.0, 129.3, 128.28, 128.27, 128.24, 127.8, 126.7, 125.7.

IR (KBr, neat) ν_{max} 3057, 1651 (C=O), 1597, 1467, 1288, 750, 698 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{17}H_{13}O$ [$(M+H)^+$]: 233.0966, found: 233.0963.

5.5.4. 1-(4-Methoxyphenyl)-*N*,*N*-dimethyl-1-(naphthalen-2-yl)ethan-1-amine (4)



4

This compound was prepared according to general procedure **A** from amide **1** (99.6 mg, 0.500 mmol) through addition of 4-methoxyphenyllithium (0.46 mL, 0.750 mmol, 1.5 equiv) (1.63 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.41 mL, 1.25 mmol, 2.5 equiv) (3.05 M in Et_2O).

Purification silica gel, hexane/ethyl acetate = 100:4.

Yield 47% yield (71.3 mg, 0.233 mmol) as light yellow oil.

R_f = 0.19 (eluent: hexane/ethyl acetate = 40:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93 (s, 1H), 7.80 (d, *J* = 7.3 Hz, 1H), 7.76 (d, *J* = 7.3 Hz, 1H), 7.71 (d, *J* = 8.7 Hz, 1H), 7.58 (d, *J* = 8.7 Hz, 1H), 7.45 – 7.39 (m, 4H), 6.81 (d, *J* = 8.7 Hz, 2H), 3.77 (s, 3H), 2.20 (s, 6H), 1.83 (s, 3H).

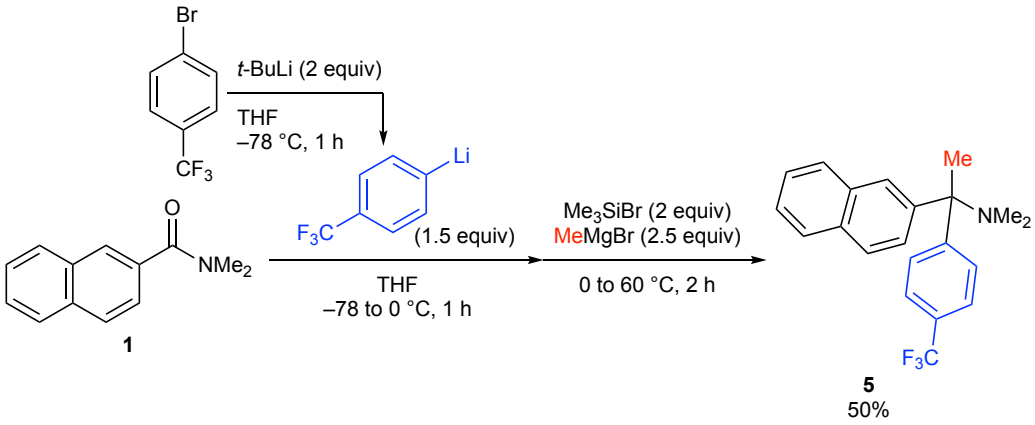
^{13}C NMR (100 MHz, $CDCl_3$) δ 157.8, 144.3, 137.5, 133.1, 132.0, 128.9, 128.1, 127.28, 127.25, 126.7, 125.7, 125.5, 125.2, 113.0, 66.5, 55.1, 39.9, 19.3.

IR (KBr, neat) ν_{max} 3055, 2821, 2779, 1606, 1502, 1180, 1249 [*v* (C–O)], 1031 [*v* (C–O)], 746 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{21}H_{24}NO$ [$(M+H)^+$]: 306.1858, found: 306.1860.

It should be noted that ^{1}H NMR spectrum of **4** showed a trace of contaminations, which are most likely the materials non-related with the reactions themselves (i.e. purification solvent, silicon grease). Thus, we consider that they do not impact to the chemical yields of the products. Unfortunately, these could not be removed in the purification process.

5.5.5. *N*,*N*-Dimethyl-1-(naphthalen-2-yl)-1-(4-(trifluoromethyl)phenyl)ethan-1-amine (5)



In a 25 mL sealed tube equipped with a PTFE coated stir bar was added 4-bromobenzotrifluoride (185 mg, 0.82 mmol) and anhydrous THF (3 mL). The mixture was cooled to –78 °C (dry ice- acetone bath), and *t*-BuLi (1.2 mL, 1.58 mmol, 2.0 equiv) (1.32 M in pentane, Sigma-Aldrich 186198) was added dropwise over 5 min. The mixture was stirred at –78 °C for 1 h. A solution of carboxamide **1** (99.6 mg, 0.500 mmol) in THF (3.0 mL) was added at –78 °C and slowly warmed up to 0 °C over 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for 10 min). Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was added in one portion, and the mixture was stirred for 5 min at 0 °C. MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O) was added and then the mixture was heated at 60 °C (oil bath) for 2 h. The mixture was carefully quenched with pH 10 NH_4Cl-NH_3 buffer (10 mL) at 0 °C and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. The volatile materials were removed and the residue was purified by flash column chromatography on silica gel (hexane/Et_2O = 100:4) to give **5** as colorless oil (84.9 mg, 0.248 mmol) in 50% yield.

R_f = 0.38 (eluent: hexane/ethyl acetate = 50:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (s, 1H), 7.82 – 7.80 (m, 1H), 7.78 – 7.76 (m, 1H), 7.72 (d, *J* = 8.7 Hz, 1H), 7.66 (d, *J* = 8.2 Hz, 2H), 7.55 – 7.52 (m, 3H), 7.47 – 7.41 (m, 2H), 2.20 (s, 6H), 1.87 (s, 3H).

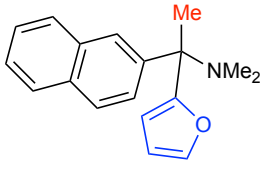
^{13}C NMR (100 MHz, $CDCl_3$) δ 150.2, 142.5, 133.1, 132.1, 128.3 (q, $^2J_{C\text{-}F}$ = 32.3 Hz), 128.2, 127.9, 127.5, 127.3, 126.5, 126.0, 125.9, 125.5, 124.8 (q, $^3J_{C\text{-}F}$ = 3.7 Hz), 124.3 (q, $^1J_{C\text{-}F}$ = 270.7 Hz), 67.0, 39.8, 18.7.

^{19}F NMR (376 MHz, $CDCl_3$) δ −62.4.

IR (KBr, neat) ν_{max} 3059, 2825, 2785, 1616, 1504, 1120, 746 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{21}H_{21}NF_3$ [$(M+H)^+$]: 344.1626, found: 344.1629.

5.5.6. 1-(Furan-2-yl)-*N*,*N*-dimethyl-1-(naphthalen-2-yl)ethan-1-amine (6)



6

This compound was prepared according to general procedure **A** from amide **1** (99.6 mg, 0.500 mmol) through addition of 2-furyllithium (0.67 mL, 0.750 mmol, 1.5 equiv) (1.12 M in THF), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.41 mL, 1.25 mmol, 2.5 equiv) (3.05 M in Et_2O).

Purification silica gel, hexane/Et_2O = 100:4.

Yield 91% yield (120 mg, 0.452 mmol) as colorless oil.

R_f = 0.21 (eluent: hexane/ethyl acetate = 40:1, visualized by UV).

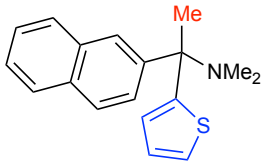
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 – 7.77 (m, 4H), 7.70 (d, *J* = 8.6 Hz, 1H), 7.44 – 7.41 (m, 3H), 6.36 – 6.35 (m, 1H), 6.30 – 6.29 (m, 1H), 2.25 (s, 3H), 1.78 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 157.2, 143.3, 141.7, 133.2, 132.4, 128.2, 127.5, 127.3, 125.9, 125.7, 125.6, 125.4, 109.6, 108.3, 64.6, 40.0, 22.1.

IR (KBr, neat) ν_{max} 3055, 2825, 2781, 1597, 1504, 1012, 734 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{18}H_{20}NO$ [(M+H)$^+$]: 266.1545, found: 266.1542.

5.5.7. *N,N*-Dimethyl-1-(naphthalen-2-yl)-1-(thiophen-2-yl)ethan-1-amine (7)



7

This compound was prepared according to general procedure **A** from amide **1** (99.6 mg, 0.500 mmol) through addition of 2-furyllithium (0.77 mL, 0.755 mmol, 1.5 equiv) (0.98 M in THF), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.41 mL, 1.25 mmol, 2.5 equiv) (3.05 M in Et_2O).

Purification silica gel, hexane/Et_2O = 100:4.

Yield 55% yield (77.5 mg, 0.276 mmol) as light yellow oil.

R_f = 0.30 (eluent: hexane/ethyl acetate = 40:1, visualized by UV).

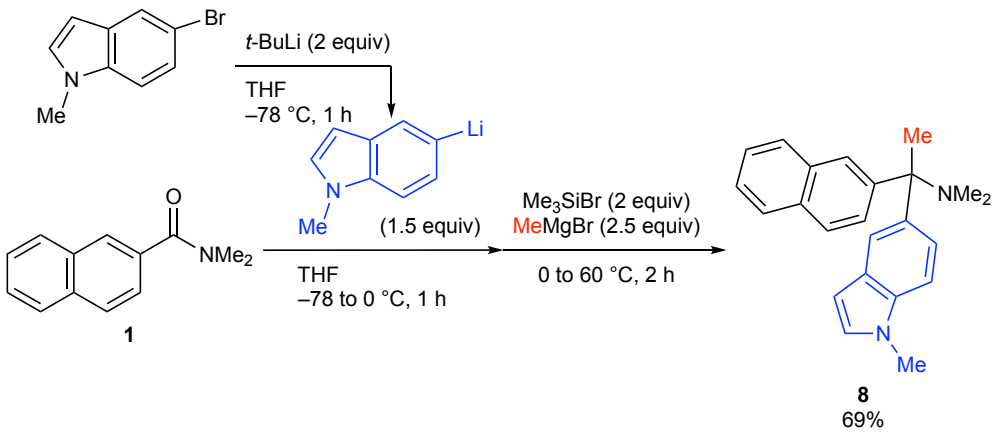
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (s, 1H), 7.84 – 7.75 (m, 4H), 7.44 – 7.42 (m, 2H), 7.20 (dd, *J* = 2.9, 2.9 Hz, 1H), 6.92 – 6.92 (m, 2H), 2.25 (s, 6H), 1.92 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 150.4, 144.4, 133.1, 132.3, 128.2, 127.5, 127.3, 126.0, 125.9, 125.8, 125.7, 125.2, 125.0, 124.3, 65.8, 39.9, 21.7.

IR (KBr, neat) ν_{max} 3055, 2823, 2781, 1597, 1504, 1458, 947, 746, 698 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{18}H_{20}NS$ [(M+H)$^+$]: 282.1316, found: 282.1316.

5.5.8. *N,N*-Dimethyl-1-(1-methyl-1*H*-indol-5-yl)-1-(naphthalen-2-yl)ethan-1-amine (8)



1

8
69%

In a 25 mL sealed tube equipped with a PTFE coated stir bar was added 5-bromo-1-methylindole (168 mg, 0.80 mmol) (Sigma-Aldrich 718300) and anhydrous THF (3 mL). The mixture was cooled to –78 °C (dry ice-acetone bath), and *t*-BuLi (1.2 mL, 1.61 mmol, 2.0 equiv) (1.34 M in pentane, Sigma-Aldrich 186198) was added dropwise over 5 min. The mixture was stirred at –78 °C for 1 h. A solution of carboxamide **1** (99.6 mg, 0.500 mmol) in THF (3.0 mL) was added at –78 °C and slowly warmed up to 0 °C over 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for 10 min). Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was added in one portion, and the mixture was stirred for 5 min at 0 °C (ice-water bath). MeMgBr (0.42 mL, 1.28 mmol, 2.5 equiv) (3.04 M in Et_2O) was added and then the mixture was heated at 60 °C (oil bath) for 2 h. The mixture was carefully quenched with pH 10 NH_4Cl-NH_3 buffer (10 mL) at 0 °C and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. The volatile materials were removed and the residue was purified by flash column chromatography on silica gel (hexane/Et_2O/triethylamine = 100:5:1) to give **8** as yellow oil (114 mg, 0.347 mmol) in 69% yield.

R_f = 0.33 (eluent: hexane/ethyl acetate = 10:1, visualized by UV).

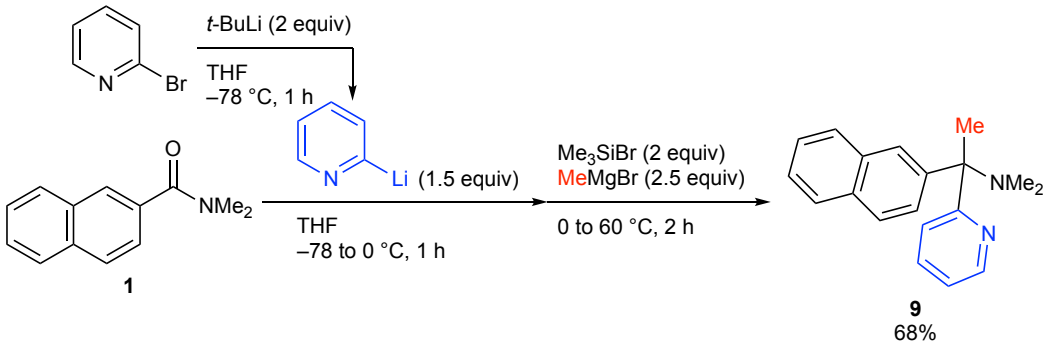
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (s, 1H), 7.81 (d, *J* = 7.6 Hz, 1H), 7.77 (d, *J* = 1.1 Hz, 1H), 7.75 (d, *J* = 7.6 Hz, 1H), 7.69 (d, *J* = 8.7 Hz, 1H), 7.62 (dd, *J* = 8.7, 1.5 Hz, 1H), 7.44 – 7.38 (m, 2H), 7.35 (dd, *J* = 8.7, 1.5 Hz, 1H), 7.19 (d, *J* = 8.7 Hz, 1H), 7.00 (d, *J* = 2.9 Hz, 1H), 6.43 (d, *J* = 2.9 Hz, 1H), 3.74 (s, 3H), 2.24 (s, 6H), 1.92 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 144.8, 136.4, 135.3, 133.1, 131.9, 128.8, 128.2, 127.9, 127.2, 127.1, 127.0, 125.6, 125.4, 125.3, 122.5, 119.6, 108.4, 101.2, 67.1, 40.1, 32.8, 19.7.

IR (KBr, neat) ν_{max} 3055, 2981, 2819, 2779, 1599, 1487, 1460, 748, 723 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{23}H_{25}N_2$ $[(M+H)^+]$: 329.2018, found: 329.2018.

5.5.9. *N*,*N*-Dimethyl-1-(naphthalen-2-yl)-1-(pyridin-2-yl)ethan-1-amine (9)



In a 25 mL sealed tube equipped with a PTFE coated stir bar was added 2-bromopyridine (127 mg, 0.80 mmol) (Sigma-Aldrich B80100) and anhydrous THF (3 mL). The mixture was cooled to –78 °C (dry ice-acetone bath), and *t*-BuLi (1.2 mL, 1.61 mmol, 2.0 equiv) (1.34 M in pentane, Sigma-Aldrich 186198) was added dropwise over 5 min. The mixture was stirred at –78 °C for 1 h. A solution of carboxamide **1** (99.6 mg, 0.500 mmol) in THF (3.0 mL) was added at –78 °C and slowly warmed up to 0 °C over 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for 10 min). Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was added in one portion, and the mixture was stirred for 5 min at 0 °C (ice-water bath). MeMgBr (0.41 mL, 1.25 mmol, 2.5 equiv) (3.05 M in Et_2O) was added and then the mixture was heated at 60 °C (oil bath) for 2 h. The mixture was carefully quenched with pH 10 NH_4Cl-NH_3 buffer (10 mL) at 0°C and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$

and filtered. The volatile materials were removed *in vacuo* and the resulting residue was purified by flash column chromatography on silica gel (hexane/ethyl acetate/triethylamine = 100:6:1) to give **9** as light brown solid (93.6 mg, 0.339 mmol) in 68% yield.

M.p. 103.4 – 105.0 °C.

R_f = 0.31 (eluent: hexane/ethyl acetate = 5:1, visualized by UV).

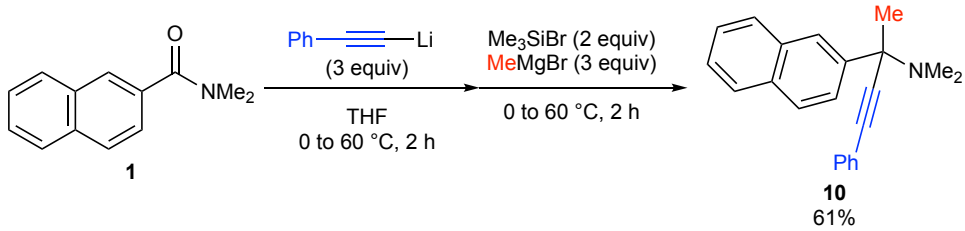
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.51 (d, *J* = 4.0 Hz, 1H), 7.98 (s, 1H), 7.81 – 7.80 (m, 1H), 7.75 – 7.68 (m, 4H), 7.58 (dd, *J* = 7.4, 7.4 Hz, 1H), 7.44 – 7.38 (m, 2H), 7.04 (dd, *J* = 5.8, 5.8 Hz, 1H), 2.25 (s, 6H), 1.96 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 164.7, 148.3, 143.4, 135.9, 133.2, 133.1, 128.2, 127.4, 127.2, 126.2, 125.7, 125.63, 125.60, 122.6, 121.1, 69.2, 39.9, 15.4.

IR (KBr, neat) ν_{max} 3055, 2823, 2783, 1585, 1504, 1460, 746 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{19}H_{21}N_2$ [$(M+H)^+$]: 277.1705, found: 277.1704.

5.5.10. *N*,*N*-Dimethyl-2-(naphthalen-2-yl)-4-phenylbut-3-yn-2-amine (10)



The titled compound was synthesized with a modified protocol from general procedure **A**: Under an argon atmosphere, in a 25 mL sealed tube equipped with a PTFE coated stir bar was added a solution of carboxamide **1** (99.7 mg, 0.500 mmol) in anhydrous THF (2.5 mL) and it was cooled to 0 °C. Lithium phenylacetylide (1.7 mL, 1.56 mmol, 3.1 equiv) (0.915 M in THF) was added dropwise over 30 seconds, and then the mixture was heated at 60 °C (oil bath) for 2 h. After the mixture was cooled to 0 °C (ice-water bath), Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was added in one portion, and the mixture was stirred for 5 min at 0 °C. MeMgBr (0.50 mL, 1.53 mmol, 3.1 equiv) (3.05 M in Et_2O) was added and then the mixture was heated at 60 °C (oil bath) for 2 h. The mixture was carefully quenched with pH 10 NH_4Cl-NH_3 buffer (10 mL) at 0 °C and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. The volatile materials were removed and the residue was purified by flash column chromatography on silica gel (hexane/Et_2O = 50:1) to give **10** as yellow oil (91.8 mg, 0.418 mmol) in 61% yield.

R_f = 0.26 (eluent: hexane/ethyl acetate = 40:1, visualized by UV).

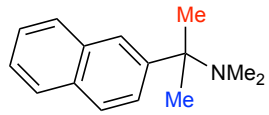
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.24 (s, 2H), 7.88 – 7.82 (m, 4H), 7.61 – 7.59 (m, 2H), 7.51 – 7.43 (m, 2H), 7.40 – 7.33 (m, 3H), 2.33 (s, 6H), 1.79 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 142.6, 133.1, 132.8, 131.9, 128.4, 128.21, 128.15, 128.0, 127.5, 125.9, 125.8, 125.4, 124.5, 123.3, 88.4, 87.8, 64.4, 40.6, 31.0.

IR (KBr, neat) ν_{max} 3057, 2821, 2779, 2222 [v(C≡C)], 1633, 1598, 754 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{22}H_{22}N$ [$(M+H)^+$]: 300.1752, found: 300.1751.

5.5.11. *N*,*N*-Dimethyl-2-(naphthalen-2-yl)propan-2-amine (11)



11

This compound was prepared according to general procedure **B** (section 5.4.2) from amide **1** (99.6 mg, 0.500 mmol) through addition of MeLi (0.27 mL, 0.753 mmol, 1.5 equiv) (2.79 M in diethoxymethane), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.52 mL, 1.52 mmol, 3.0 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/Et_2O/triethylamine = 100:5:1.

Yield 58% yield (61.9 mg, 0.290 mmol) as colorless oil.

$\mathbf{R_f}$ = 0.24 (eluent: hexane/DCM/ ethyl acetate = 10:1:1, visualized by UV).

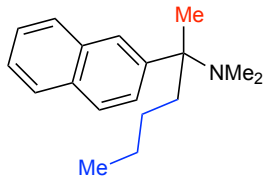
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 – 7.79 (m, 4H), 7.75 (dd, *J* = 8.7, 1.7 Hz, 1H), 7.47 – 7.40 (m, 2H), 2.20 (s, 6H), 1.45 (s, 6H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 146.6, 133.2, 132.2, 128.0, 127.5, 127.3, 125.7, 125.39, 125.37, 124.0, 59.6, 39.1, 23.1.

IR (KBr, neat) ν_{max} 3057, 1598, 1502, 744 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{15}H_{20}N$ [$(M+H)^+$]: 214.1596, found: 214.1599.

5.5.12. *N*,*N*-Dimethyl-2-(naphthalen-2-yl)hexan-2-amine (12)



12

This compound was prepared according to general procedure **B** (section 5.4.2) from amide **1** (99.6 mg, 0.500 mmol) through addition of *n*-BuLi (0.30 mL, 0.768 mmol, 1.5 equiv) (2.56 M in diethoxymethane), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.50 mL, 1.53 mmol, 3.0 equiv) (3.05 M in Et_2O).

Purification silica gel, hexane/Et_2O/triethylamine = 100:5:1.

Yield 66% yield (83.8 mg, 0.329 mmol) as light yellow oil.

$\mathbf{R_f}$ = 0.36 (eluent: hexane/ethyl acetate = 10:1, visualized by UV).

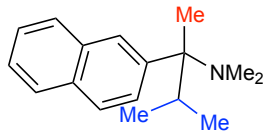
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 – 7.76 (m, 4H), 7.69 (dd, *J* = 8.6, 1.8 Hz, 2H), 7.47 – 7.41 (m, 2H), 2.19 (s, 6H), 1.84 (ddd, *J* = 12.7, 12.7, 4.5 Hz, 1H), 1.70 (ddd, *J* = 12.7, 12.7, 4.5 Hz, 1H), 1.40 (s, 3H), 1.16 (tq, *J* = 7.3, 7.3 Hz, 2H), 1.04 – 0.93 (m, 1H), 0.87 – 0.79 (m, 1H), 0.75 (t, *J* = 7.3 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 144.3, 133.0, 132.2, 128.0, 127.32, 127.28, 125.9, 125.6, 125.4, 125.3, 62.6, 41.5, 38.9, 27.0, 23.3, 14.0, 13.9.

IR (KBr, neat) ν_{max} 3057, 2935, 2819, 2777, 1634, 1598, 1504, 1463, 744 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{18}H_{26}N$ [$(M+H)^+$]: 256.2065, found: 256.2065.

5.5.13. *N*,*N*,3-Trimethyl-2-(naphthalen-2-yl)butan-2-amine (13)



13

This compound was prepared according to general procedure **B** (section 5.4.2) from amide **1** (99.6 mg, 0.500 mmol) through addition of *i*-PrLi (1.6 mL, 0.770 mmol, 1.5 equiv) (0.481 M in pentane), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.50 mL, 1.53 mmol, 3.0 equiv) (3.05 M in Et_2O).

Purification silica gel, hexane/Et_2O/triethylamine = 100:5:1.

Yield 31% yield (37.7 mg, 0.156 mmol) as colorless oil.

$\mathbf{R_f}$ = 0.36 (eluent: hexane/ethyl acetate = 10:1, visualized by UV).

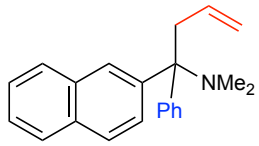
^{1}H NMR (400 MHz, C_6D_6) δ 7.84 (s, 1H), 7.78 (dd, *J* = 8.7, 1.4 Hz, 1H), 7.76 – 7.73 (m, 1H), 7.69 – 7.65 (m, 2H), 7.31 – 7.26 (m, 2H), 2.10 (s, 6H), 1.95 (sept, *J* = 6.7 Hz, 1H), 1.26 (s, 3H), 0.95 (d, *J* = 6.7 Hz, 3H), 0.65 (d, *J* = 6.7 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 140.2, 132.8, 132.1, 128.1, 127.25, 127.22, 127.0, 126.1, 125.5, 125.4, 65.7, 39.0, 34.4, 18.7, 17.2, 12.8.

IR (KBr, neat) ν_{max} 3057, 2976, 2821, 2779, 1631, 1598, 1502, 1463, 744 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{17}H_{24}N$ [$(M+H)^+$]: 242.1909, found: 242.1906.

5.5.14. *N*,*N*-Dimethyl-1-(naphthalen-2-yl)-1-phenyl-2-(trimethylsilyl)ethan-1-amine (14)



14

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **1** (99.6 mg, 0.500 mmol) through addition of PhLi (0.65 mL, 0.748 mmol, 1.5 equiv) (1.15 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and allylMgCl (0.68 mL, 1.26 mmol, 2.5 equiv) (1.86 M in THF).

Purification silica gel, hexane/Et_2O = 100:2.

Yield 92% yield (137 mg, 0.461 mmol) as colorless oil.

$\mathbf{R_f}$ = 0.38 (eluent: hexane/ethyl acetate = 50:1, visualized by UV).

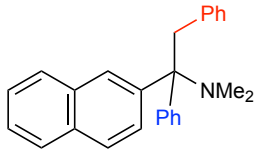
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (s, 1H), 7.85 – 7.81 (m, 2H), 7.74 (d, *J* = 8.6 Hz, 1H), 7.48 – 7.46 (m, 2H), 7.38 – 7.25 (m, 6H), 5.57 (dddd, *J* = 17.0, 10.1, 6.9, 6.9, 1H), 4.91 – 4.86 (m, 2H), 3.09 (dd, *J* = 14.3, 6.9 Hz, 1H), 3.04 (dd, *J* = 14.3, 6.9 Hz, 1H), 2.15 (s, 6H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 140.0, 138.7, 134.5, 132.6, 132.2, 129.6 (2C overlapped), 128.3 (2C overlapped), 128.0, 127.3, 127.1, 126.5, 126.3, 125.7, 117.0, 71.0, 43.5, 39.7.

IR (KBr, neat) ν_{max} 3055, 2937, 2823, 2781, 1637 [*v* (C=C)], 1597, 1444, 912 [*v* (C=C)], 746, 705 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{22}H_{24}N$ [$(M+H)^+$]: 302.1909, found: 302.1907.

5.5.15. *N*,*N*-Dimethyl-1-(naphthalen-2-yl)-1,2-diphenylethan-1-amine (15)



15

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **1** (99.6 mg, 0.500 mmol) through addition of PhLi (0.65 mL, 0.748 mmol, 1.5 equiv) (1.15 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and $PhCH_2MgCl$ (1.4 mL, 1.30 mmol, 2.6 equiv) (0.931 M in THF).

Purification silica gel, hexane/ethyl acetate = 100:2.

Yield 91% yield (160 mg, 0.455 mmol) as light yellow oil.

R_f = 0.28 (eluent: hexane/ethyl acetate = 40:1, visualized by UV).

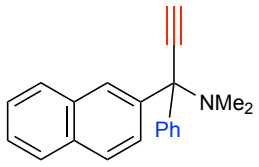
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.80 – 7.79 (m, 1H), 7.75 – 7.73 (m, 2H), 7.65 (d, *J* = 8.7 Hz, 1H), 7.47 – 7.41 (m, 2H), 7.29 (dd, *J* = 8.7, 1.7 Hz, 1H), 7.26 – 7.22 (m, 5H), 6.98 (t, *J* = 7.4 Hz, 1H), 6.90 (dd, *J* = 7.4, 7.4 Hz, 2H), 6.61 (d, *J* = 7.4 Hz, 2H), 3.60 (d, *J* = 13.8 Hz, 1H), 3.58 (d, *J* = 13.8 Hz, 1H), 2.20 (s, 6H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 139.7, 137.9, 137.5, 132.5, 132.1, 130.5, 129.9, 128.5 (2C overlapped), 128.2, 127.2, 127.1, 126.8, 126.3, 125.8, 125.63, 125.59, 125.5, 72.7, 44.8, 40.0.

IR (KBr, neat) ν_{max} 3055, 2937, 2823, 2781, 1597, 1494, 746, 698 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{26}H_{26}N$ [$(M+H)^+$]: 352.2065, found: 352.2066.

5.5.16. *N*,*N*-Dimethyl-1-(naphthalen-2-yl)-1-phenylprop-2-yn-1-amine (16)



16

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **1** (99.6 mg, 0.500 mmol) through addition of PhLi (0.65 mL, 0.748 mmol, 1.5 equiv) (1.15 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and ethynylmagnesium bromide (2.5 mL, 1.28 mmol, 2.6 equiv) (0.51 M in THF).

Purification silica gel, hexane/Et_2O = 100:2.

Yield 86% yield (122 mg, 0.428 mmol) as light yellow solid.

M.p. 103.2 – 106.3 °C.

R_f = 0.36 (eluent: hexane/ethyl acetate = 40:1, visualized by UV).

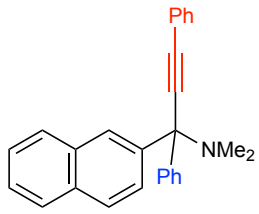
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.30 (s, 1H), 7.86 – 7.82 (m, 4H), 7.74 – 7.70 (m, 2H), 7.45 – 7.38 (m, 2H), 7.25 (dd, *J* = 7.5, 7.5 Hz, 2H), 7.12 (t, *J* = 7.5 Hz, 1H), 2.91 (s, 1H), 2.27 (s, 6H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 143.8, 141.5, 133.2, 132.5, 128.23, 128.20, 128.0, 127.4, 127.0, 126.9, 125.9, 125.8, 125.4, 124.9, 80.7, 77.4, 72.6, 40.9.

IR (KBr, neat) ν_{max} 3290 [*v* (C≡C)], 3055, 2987, 2864, 2783, 2099 [*v* (C≡C)], 1597, 1489, 742, 700, 678 [*v* (≡C–H)] cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{21}H_{20}N$ [$(M+H)^+$]: 286.1596, found: 286.1596.

5.5.17. *N*,*N*-Dimethyl-1-(naphthalen-2-yl)-1,3-diphenylprop-2-yn-1-amine (17)



17

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **1** (99.7 mg, 0.500 mmol) through addition of PhLi (0.65 mL, 0.748 mmol, 1.5 equiv) (1.15 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and lithium phenylacetylide (1.4 mL, 1.29 mmol, 2.6 equiv) (0.92 M in THF).

Purification silica gel, hexane/Et_2O = 100:1.

Yield 83% yield (150 mg, 0.416 mmol) as light yellow solid.

M.p. 117.8 – 119.5 °C.

R_f = 0.36 (eluent: hexane/ethyl acetate = 40:1, visualized by UV).

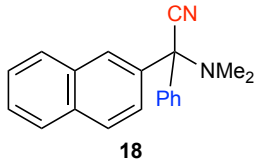
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.35 (s, 1H), 7.92 – 7.89 (m, 3H), 7.85 – 7.83 (m, 1H), 7.75 – 7.72 (m, 2H), 7.69 – 7.66 (m, 2H), 7.45 – 7.37 (m, 5H), 7.27 (dd, *J* = 7.5, 7.5 Hz, 2H), 7.14 (t, *J* = 7.5 Hz, 1H), 2.35 (s, 6H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 144.3, 142.1, 133.2, 132.5, 132.0, 128.4, 128.30, 128.27, 128.2, 128.0, 127.4, 127.03, 126.96, 125.9, 125.8, 125.5, 125.1, 123.3, 89.9, 87.0, 73.1, 41.1.

IR (KBr, neat) ν_{max} 3057, 2987, 2862, 2781, 2214 [*v* (C≡C)], 1597, 1489, 750, 700 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{27}H_{24}N$ [$(M+H)^+$]: 362.1909, found: 362.1908.

5.5.18. 2-(Dimethylamino)-2-(naphthalen-2-yl)-2-phenylacetonitrile (18)



18

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **1** (99.6 mg, 0.500 mmol) through addition of PhLi (0.66 mL, 0.752 mmol, 1.5 equiv) (1.14 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and tetrabutylammonium cyanide (337 mg, 1.25 mmol, 2.5 equiv) (Sigma-Aldrich 358665).

Purification neutral alumina, hexane/CH_2Cl_2 = 100:15.

Yield 66% yield (95.2 mg, 0.332 mmol) as white solid.

M.p. 108.6 – 110.5 °C.

R_f = 0.29 (eluent: hexane/ethyl acetate = 50:1, visualized by UV).

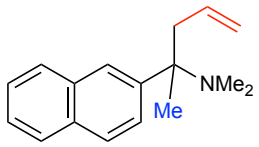
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (s, 1H), 7.86 (d, *J* = 7.4 Hz, 1H), 7.79 – 7.71 (m, 5H), 7.50 – 7.44 (m, 2H), 7.32 (dd, *J* = 7.3, 7.3 Hz, 2H), 7.22 (t, *J* = 7.3 Hz, 1H), 2.36 (s, 6H).

^{13}C NMR (100 MHz, acetone-d_6) δ 141.3, 138.9, 134.1, 134.0, 129.94, 129.91, 129.3, 129.2, 128.5, 127.7, 127.6, 127.1, 125.9, 124.4, 117.2, 78.1, 41.7.

IR (KBr, neat) ν_{max} 3059, 2997, 2956, 2870, 2789, 2222 [*v* (C≡N)], 1597, 1448, 744, 700 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{20}H_{19}N_2$ [$(M+H)^+$]: 287.1548, found: 287.1548.

5.5.19. *N*,*N*-Dimethyl-2-(naphthalen-2-yl)pent-4-en-2-amine (19)



19

This compound was prepared according to general procedure **B** (section 5.4.2) from amide **1** (99.6 mg, 0.500 mmol) through addition of MeLi (0.27 mL, 0.753 mmol, 2.5 equiv) (2.79 M in diethoxymethane), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and allylMgCl (0.81 mL, 1.51 mmol, 3.0 equiv) (1.86 M in THF).

Purification silica gel, hexane/ethyl acetate/triethylamine = 100:5:1.

Yield 60% yield (72.4 mg, 0.302 mmol) as colorless oil.

R_f = 0.22 (eluent: hexane/ethyl acetate = 10:1, visualized by UV).

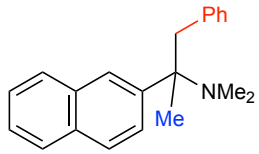
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 – 7.78 (m, 3H), 7.75 (s, 1H), 7.71 (dd, *J* = 8.6, 1.8 Hz, 1H), 7.47 – 7.41 (m, 2H), 5.34 (dddd, *J* = 17.0, 10.0, 8.1, 6.0 Hz, 1H), 4.92 (dd, *J* = 17.0, 1.6 Hz, 1H), 4.83 (dd, *J* = 10.0, 1.6 Hz, 1H), 2.68 (dd, *J* = 13.6, 6.0 Hz, 1H), 2.50 (dd, *J* = 13.6, 8.1 Hz, 1H), 2.22 (s, 6H), 1.41 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 143.7, 135.3, 133.0, 132.3, 128.1, 127.4, 127.3, 125.9, 125.6, 125.54, 125.47, 117.0, 62.5, 46.0, 39.0, 14.1.

IR (KBr, neat) ν_{max} 3057, 2976, 2819, 2777, 1637 [*v* (C=C)], 1599, 1504, 1369, 966, 912 [*v* (C=C)], 740, 690 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{17}H_{22}N$ [$(M+H)^+$]: 240.1752, found: 240.1750.

5.5.20. *N*,*N*-Dimethyl-2-(naphthalen-2-yl)-1-phenylpropan-2-amine (20)



20

This compound was prepared according to general procedure **B** (section 5.4.2) from amide **1** (99.6 mg, 0.500 mmol) through addition of MeLi (0.27 mL, 0.753 mmol, 1.5 equiv) (2.79 M in diethoxymethane), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and $PhCH_2MgCl$ (1.7 mL, 1.56 mmol, 3.1 equiv) (0.92 M in THF).

Purification silica gel, hexane/Et_2O/triethylamine = 100:5:1.

Yield 49% yield (71.5 mg, 0.247 mmol) as white solid.

M.p. 91.0 – 92.7 °C.

R_f = 0.19 (eluent: hexane/ethyl acetate = 5:1, visualized by UV).

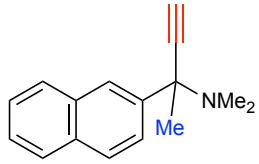
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 – 7.76 (m, 3H), 7.71 (dd, *J* = 8.7, 1.2 Hz, 1H), 7.67 – 7.65 (m, 1H), 7.44 – 7.37 (m, 3H), 6.99 (t, *J* = 7.3 Hz, 1H), 6.91 (dd, *J* = 7.3, 7.3 Hz, 2H), 6.54 (d, *J* = 7.3 Hz, 2H), 3.14 (d, *J* = 12.7 Hz, 1H), 3.12 (d, *J* = 12.7 Hz, 1H), 2.29 (s, 6H), 1.36 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 143.1, 138.1, 132.9, 132.3, 130.6, 128.1, 127.3, 127.2, 127.1, 126.3, 126.2, 125.7, 125.5, 125.4, 64.0, 47.9, 39.2, 12.3.

IR (KBr, neat) ν_{max} 3057, 2978, 2819, 2777, 1598, 1506, 742, 704 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{21}H_{24}N$ [$(M+H)^+$]: 290.1909, found: 290.1909.

5.5.21. *N*,*N*-Dimethyl-2-(naphthalen-2-yl)but-3-yn-2-amine (21)



21

This compound was prepared according to general procedure **B** (section 5.4.2) from amide **1** (99.6 mg, 0.500 mmol) through addition of MeLi (0.27 mL, 0.753 mmol, 1.5 equiv) (2.79 M in diethoxymethane), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and ethynylmagnesium bromide (3.0 mL, 1.56 mmol, 3.1 equiv) (0.52 M in THF).

Purification silica gel, hexane/Et_2O = 100:5, then PTLC, hexane/acetone = 10:1.

Yield 42% yield (47.0 mg, 0.210 mmol) as light yellow solid.

M.p. 103.2 – 106.3 °C.

R_f = 0.32 (eluent: hexane/ethyl acetate = 15:1, visualized by UV).

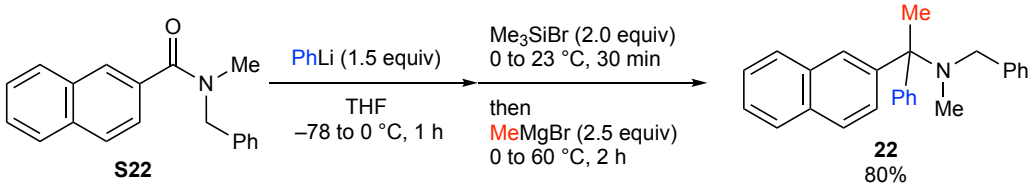
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.19 (s, 1H), 7.87 – 7.81 (m, 3H), 7.78 (dd, *J* = 8.7, 1.7 Hz, 1H), 7.49 – 7.43 (m, 2H), 2.69 (s, 1H), 2.24 (s, 6H), 1.70 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 142.4, 133.1, 132.8, 128.2, 128.0, 127.4, 125.9, 125.8, 125.2, 124.3, 81.9, 75.6, 63.7, 40.4, 31.2.

IR (KBr, neat) ν_{max} 3296 [*v* (C≡C)], 2086 [*v* (C≡C)], 3059, 2987, 2860, 2783, 1595, 1558, 1508, 819, 740, 639 [*v* (≡C–H)] cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{16}H_{18}N$ [$(M+H)^+$]: 224.1439, found: 224.1441.

5.5.22. *N*-Benzyl-*N*-methyl-1-(naphthalen-2-yl)-1-phenylethan-1-amine (22)



S22 **22** 80%

The titled compound was synthesized with a modified protocol from the general procedure **A** (section 5.3.1): Under an argon atmosphere, in a 25 mL sealed tube equipped with a PTFE coated stir bar was added a solution of amide **S22** (138 mg, 0.502 mmol) in anhydrous THF (2.5 mL) and the mixture was cooled to –78 °C (dry ice-acetone bath). PhLi (0.65 mL, 0.748 mmol, 1.5 equiv) (1.15 M in Et_2O) was added dropwise over 30 seconds, and the mixture was slowly warmed up to 0 °C over 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for 10 min). Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was added in one portion, and the mixture was warmed up to 23 °C and stirred for 30 min. The mixture was cooled to 0 °C (ice-water bath). MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O) was added and then the mixture was heated at 60 °C (oil bath) for 2 h. The mixture was carefully quenched with pH 10 NH_4Cl-NH_3 buffer (10 mL) at 0 °C and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. The volatile materials were removed and the residue was purified by flash column chromatography on silica gel (hexane/Et_2O = 100:1) to give **22** as colorless oil (142 mg, 0.405 mmol) in 81% yield.

R_f = 0.38 (eluent: hexane/ethyl acetate = 50:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.98 (s, 1H), 7.83 – 7.79 (m, 2H), 7.76 – 7.72 (m, 2H), 7.67 (d, *J* = 7.8 Hz, 2H), 7.48 (d, *J* = 7.4 Hz, 2H), 7.45 – 7.38 (m, 2H), 7.35 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.30 – 7.22 (m, 3H), 7.15 (t, *J* = 7.4 Hz, 1H), 3.57 (d, *J* = 14.3 Hz, 1H), 3.55 (d, *J* = 14.3 Hz, 1H), 2.13 (s, 3H), 2.01 (s, 3H).

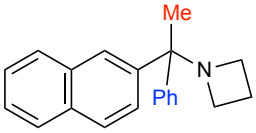
^{13}C NMR (100 MHz, $CDCl_3$) δ 146.3, 144.2, 140.7, 133.2, 132.0, 128.2, 128.12, 128.08, 128.0, 127.6, 127.4, 127.3, 126.52, 126.46, 126.2, 125.8, 125.6, 125.2, 67.6, 56.2, 36.3, 18.6.

IR (KBr, neat) ν_{max} 3057, 2985, 2845, 2796, 1599, 1492, 740, 698 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{26}H_{26}N$ [$(M+H)^+$]: 352.2065, found: 352.2063.

It should be noted that ^{1}H NMR spectrum of **22** showed a trace of contaminations, which are most likely the materials non-related with the reactions themselves (i.e. purification solvent, silicon grease). Thus, we consider that they do not impact to the chemical yields of the products. Unfortunately, these could not be removed in the purification process.

5.5.23. 1-(1-(Naphthalen-2-yl)-1-phenylethyl)azetidine (23)



23

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **S23** (106 mg, 0.502 mmol) through addition of PhLi (0.63 mL, 0.750 mmol, 1.5 equiv) (1.19 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/ethyl acetate/triethylamine = 100:4:1.

Yield 88% yield (126 mg, 0.439 mmol) as white solid.

M.p. 101.4 – 102.9 °C.

R_f = 0.16 (eluent: hexane/ethyl acetate = 15:1, visualized by UV).

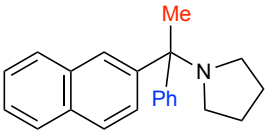
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (s, 1H), 7.86 – 7.84 (m, 1H), 7.80 – 7.77 (m, 1H) ,7.70 (d, *J* = 8.7 Hz, 1H), 7.49 – 7.42 (m, 2H), 7.36 – 7.26 (m, 5H), 7.22 (t, *J* = 7.0 Hz, 1H), 3.22 – 3.14 (m, 4H), 1.90 (tt, *J* = 7.0, 7.0 Hz, 2H), 1.77 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 144.3, 142.6, 133.0, 132.1, 128.2, 128.1, 127.7, 127.4, 127.2, 127.0, 126.4, 125.8, 125.62, 125.59, 65.4, 48.0, 23.2, 16.7.

IR (KBr, neat) ν_{max} 3053, 2956, 2912, 2848, 1597, 1489, 746, 702 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{21}H_{22}N$ [$(M+H)^+$]: 288.1752, found: 288.1751.

5.5.24. 1-(1-(Naphthalen-2-yl)-1-phenylethyl)pyrrolidine (24)



24

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **S24** (113 mg, 0.500 mmol) through addition of PhLi (0.63 mL, 0.750 mmol, 1.5 equiv) (1.19 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/ethyl acetate/triethylamine = 100:4:1.

Yield 88% yield (133 mg, 0.442 mmol) as light yellow oil.

R_f = 0.26 (eluent: hexane/ethyl acetate = 100:1, visualized by UV).

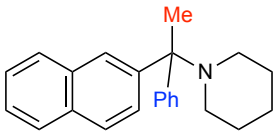
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (d, *J* = 0.9 Hz, 1H), 7.82 – 7.80 (m, 1H), 7.78 – 7.76 (m, 1H), 7.70 (d, *J* = 8.7 Hz, 1H), 7.50 (dd, *J* = 8.7, 1.8 Hz, 1H), 7.46 – 7.39 (m, 4H), 7.28 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.19 (t, *J* = 7.4 Hz, 1H), 2.56 – 2.47 (m, 4H), 1.89 (s, 3H), 1.73 – 1.66 (m, 4H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 145.5, 143.5, 133.0, 132.0, 128.2, 128.0, 127.6, 127.3, 127.2, 126.9, 126.1, 125.7, 125.6, 125.5, 65.1, 46.7, 23.5, 23.4.

IR (KBr, neat) ν_{max} 3059, 2966, 2872, 2810, 1632, 1504, 744, 703 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{22}H_{24}N$ [$(M+H)^+$]: 302.1909, found: 302.1910.

5.5.25. 1-(1-(Naphthalen-2-yl)-1-phenylethyl)piperidine (25)



25

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **S25** (120 mg, 0.502 mmol) through addition of PhLi (0.63 mL, 0.750 mmol, 1.5 equiv) (1.19 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/ethyl acetate = 200:1.

Yield 89% yield (140 mg, 0.444 mmol) as light yellow solid.

M.p. 112.1 – 113.9 °C.

R_f = 0.29 (eluent: hexane/ethyl acetate = 100:1, visualized by UV).

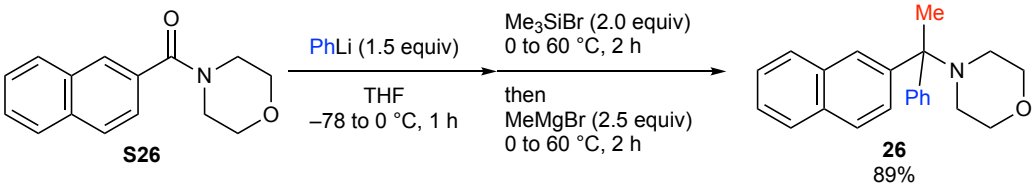
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 (s, 1H), 7.79 – 7.77 (m, 1H), 7.75 – 7.72 (m, 1H), 7.69 (s, 1H), 7.55 (d, *J* = 7.3 Hz, 2H), 7.44 – 7.37 (m, 2H), 7.25 (dd, *J* = 7.3, 7.3 Hz, 2H), 7.12 (t, *J* = 7.3 Hz, 1H), 2.41 – 2.38 (m, 4H), 1.86 (s, 3H), 1.64 – 1.58 (m ,4H), 1.48 – 1.42 (m, 2H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 146.6, 144.5, 133.2, 131.9, 128.1, 127.8, 127.4, 127.31, 127.26, 126.5, 125.9, 125.6, 125.5, 125.0, 67.3, 48.6, 26.9, 25.2, 18.3.

IR (KBr, neat) ν_{max} 3055, 2929, 2846, 2804, 1596, 742, 702 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{23}H_{26}N$ [$(M+H)^+$]: 316.2065, found: 316.2067.

5.5.26. 4-(1-(Naphthalen-2-yl)-1-phenylethyl)morpholine (26)



S26 **26** 89%

The titled compound was synthesized with a slightly modified protocol from the general procedure **A** (section 5.3.1): Under argon atmosphere, in a 25 mL sealed tube equipped with a PTFE coated stir bar was added a solution of carboxamide **S26** (127 mg, 0.502 mmol) in anhydrous THF (2.5 mL) and the mixture was cooled to –78 °C (acetone-dry

ice bath). PhLi (0.63 mL, 0.750 mmol, 1.5 equiv) (1.19 M in Et_2O) was added dropwise over 30 seconds, and the mixture was slowly warmed up to 0 °C over 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for 10 min). Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was added in one portion, and the mixture was heated at 60 °C (oil bath) for 2 h. After the mixture was cooled to 0 °C (ice-water bath), MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O) was added and then the mixture was heated at 60 °C 2 h. The mixture was carefully quenched with pH 10 NH_4Cl-NH_3 buffer (10 mL) at 0°C and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. The volatile materials were removed and the residue was purified by flash column chromatography on silica gel (hexane/Et_2O = 100:5) to give **26** as colorless oil (142 mg, 0.446 mmol) in 89% yield.

M.p. 96.5 – 98.7 °C.

R_f = 0.30 (eluent: hexane/ethyl acetate = 15:1, visualized by UV).

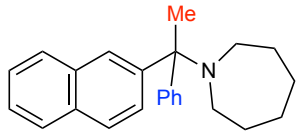
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (s, 1H), 7.81 – 7.79 (m, 1H), 7.76 – 7.74 (m, 1H), 7.71 (d, *J* = 8.7 Hz, 1H), 7.65 (dd, *J* = 8.7, 1.8 Hz, 1H), 7.55 (d, *J* = 7.4 Hz, 2H), 7.46 – 7.40 (m, 2H), 7.28 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.16 (t, *J* = 7.4 Hz, 1H), 3.77 (dd, *J* = 4.5, 4.5 Hz, 4H), 2.51 (ddd, *J* = 11.6, 4.5, 4.5 Hz, 2H), 2.46 (ddd, *J* = 11.6, 4.5, 4.5 Hz, 2H), 1.90 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 145.3, 143.2, 133.1, 132.0, 128.1, 128.0, 127.6, 127.5, 127.3, 126.4, 126.3, 125.8, 125.7, 125.4, 67.8, 66.8, 47.8, 18.6.

IR (KBr, neat) ν_{max} 3055, 2958, 2848, 1597, 1504, 1444, 1114 [*v* (C=O)], 862, 744, 704 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{22}H_{24}NO$ $[(M+H)^+]$: 318.1858, found: 318.1856.

5.5.27. 1-(1-(Naphthalen-2-yl)-1-phenylethyl)azepane (27)



27

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **S27** (127 mg, 0.502 mmol) through addition of PhLi (0.63 mL, 0.750 mmol, 1.5 equiv) (1.19 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/Et_2O = 100:1.

Yield 76% yield (125 mg, 0.380 mmol) as yellow solid.

M.p. 98.0 – 99.9 °C.

R_f = 0.31 (eluent: hexane/ethyl acetate = 100:1, visualized by UV).

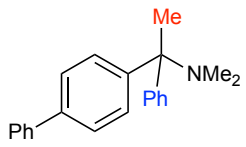
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (s, 1H), 7.82 (dd, *J* = 8.7, 1.9 Hz, 1H), 7.78 – 7.76 (m, 1H), 7.73 – 7.71 (m, 1H), 7.69 (d, *J* = 8.7 Hz, 1H), 7.62 (d, *J* = 7.5 Hz, 2H), 7.43 – 7.36 (m, 2H), 7.24 (dd, *J* = 7.5, 7.5 Hz, 2H), 7.09 (t, *J* = 7.5 Hz, 1H), 2.67 – 2.57 (m, 4H), 1.91 (s, 3H), 1.75 – 1.70 (m, 4H), 1.62 – 1.56 (m, 4H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 148.1, 146.0, 133.2, 131.9, 128.1, 127.9, 127.4, 127.3, 126.9, 126.2, 125.8, 125.6, 125.4, 124.5, 69.0, 52.7, 30.0, 26.5, 17.5.

IR (KBr, neat) ν_{max} 3055, 2980, 2920, 2850, 1597, 1504, 1444, 740, 700 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{24}H_{28}N$ $[(M+H)^+]$: 330.2222, found: 330.2224.

5.5.28. 1-([1,1'-Biphenyl]-4-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (28)



28

This compound was prepared according to general procedure **A** (section 5.3.1) from carboxamide **S28** (113 mg, 0.502 mmol) through addition of PhLi (0.65 mL, 0.748 mmol, 1.5 equiv) (1.15 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/Et_2O = 100:5.

Yield 85% yield (129 mg, 0.429 mmol) as white solid.

M.p. 79.2 – 81.8 °C.

R_f = 0.19 (eluent: hexane/ethyl acetate = 20:1, visualized by UV).

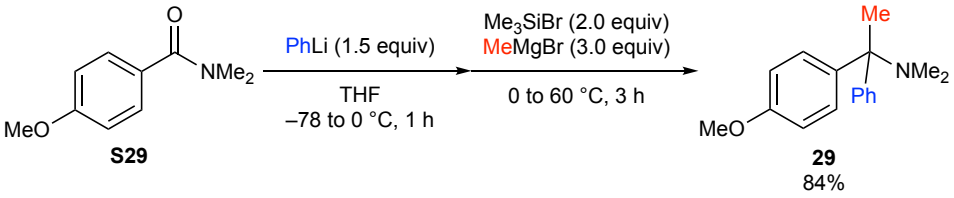
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 (d, *J* = 7.4 Hz, 2H), 7.54 – 7.49 (m, 6H), 7.40 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.32 – 7.27 (m, 3H), 7.18 (t, *J* = 7.4 Hz, 1H), 2.18 (s, 6H), 1.78 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 145.7, 145.0, 140.8, 138.8, 128.7, 128.1, 127.8, 127.7, 127.0, 126.9, 126.4, 126.1, 66.8, 39.9, 19.6.

IR (KBr, neat) ν_{max} 3055, 2983, 2939, 2821, 2779, 1598, 1485, 761, 698 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{22}H_{24}N$ [$(M+H)^+$]: 302.1909, found: 302.1908.

5.5.29. 1-(4-Methoxyphenyl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (29)



S29 **29** 84%

The titled compound was synthesized with a slightly modified protocol with general procedure **A** (section 5.3.1): Under an argon atmosphere, in a 25 mL sealed tube equipped with a PTFE coated stir bar was added a solution of carboxamide **S29** (89.6 mg, 0.500 mmol) in anhydrous THF (2.5 mL) and the mixture was cooled to –78 °C (dry ice-acetone bath). PhLi (0.66 mL, 0.752 mmol, 1.5 equiv) (1.14 M in Et_2O) was added dropwise over 30 seconds, and the mixture was slowly warmed up to 0 °C over 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for 10 min). Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was added in one portion, and the mixture was stirred for 5 min at 0 °C (ice-water bath). MeMgBr (0.50 mL, 1.53 mmol, 3.1 equiv) (3.05 M in Et_2O) was added and then the mixture was heated at 60 °C (oil bath) for 3 h. The mixture was carefully quenched with pH 10 NH_4Cl-NH_3 buffer (10 mL) at 0 °C and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. The volatile materials were removed and the residue was purified by flash column chromatography on silica gel (hexane/ethyl acetate/triethylamine = 100:5:1) to give **29** as colorless oil (107 mg, 0.420 mmol) in 84% yield.

R_f = 0.35 (eluent: hexane/ethyl acetate = 20:1, visualized by UV).

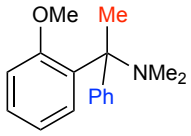
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (d, *J* = 7.5 Hz, 2H), 7.35 (d, *J* = 8.8 Hz, 2H), 7.27 (dd, *J* = 7.5, 7.5 Hz, 2H), 7.16 (t, *J* = 7.5 Hz, 1H), 6.80 (d, *J* = 8.8 Hz, 2H), 3.77 (s, 3H), 2.13 (s, 6H), 1.72 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 157.7, 146.3, 137.8, 128.8, 127.7, 127.6, 125.9, 112.9, 66.4, 55.1, 39.8, 19.9.

IR (KBr, neat) ν_{max} 3057, 2985, 2935, 2821, 2779, 1608, 1508, 1249 [ν (C–O)], 1182, 1043 [ν (C–O)], 848, 704 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{17}H_{22}NO$ [$(M+H)^+$]: 256.1701, found: 256.1702.

5.5.30. 1-(2-Methoxyphenyl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (30)



30

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **S30** (89.6 mg, 0.500 mmol) through addition of PhLi (0.63 mL, 0.750 mmol, 1.5 equiv) (1.19 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/Et_2O/triethylamine = 100:5:1

Yield 86% yield (110 mg, 0.431 mmol) as light yellow solid.

M.p. 53.7 – 56.0 °C.

R_f = 0.17 (eluent: hexane/ethyl acetate = 10:1, visualized by UV).

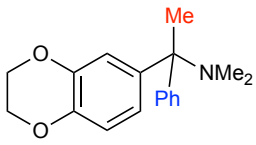
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.24 – 7.20 (m, 4H), 7.17 – 7.11 (m, 1H), 7.01 (ddd, *J* = 7.8, 7.4, 1.1 Hz, 1H), 6.79 (dd, *J* = 8.1, 1.1 Hz, 1H), 3.37 (s, 3H), 2.13 (s, 6H), 1.80 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 157.6, 143.6, 135.3, 129.0, 127.6, 127.3, 126.9, 125.5, 120.1, 112.8, 65.7, 55.2, 40.0, 19.2.

IR (KBr, neat) ν_{max} 3055, 2987, 2935, 2823, 2781, 1597, 1483, 1240 [ν (C–O)], 1028 [ν (C–O)], 756, 700 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{17}H_{22}NO$ [$(M+H)^+$]: 256.1701, found: 256.1698.

5.5.31. 1-(2,3-Dihydrobenzo[*b*][1,4]dioxin-6-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (31)



31

This compound was prepared according to general procedure **A** (section 5.3.1) from carboxamide **S31** (104 mg, 0.502 mmol) through addition of PhLi (0.63 mL, 0.750 mmol, 1.5 equiv) (1.19 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/ethyl acetate = 100:10.

Yield 88% yield (125 mg, 0.441 mmol) as white solid.

M.p. 86.4 – 87.4 °C.

R_f = 0.25 (eluent: hexane/ethyl acetate = 10:1, visualized by UV).

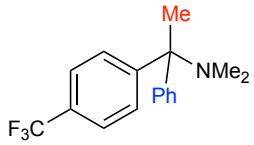
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (d, *J* = 7.4 Hz, 2H), 7.26 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.15 (t, *J* = 7.4 Hz, 1H), 6.98 (d, *J* = 2.2 Hz, 1H), 6.90 (dd, *J* = 8.5, 2.2 Hz, 1H), 6.74 (d, *J* = 8.5 Hz, 1H), 4.22 (brs, 4H), 2.14 (s, 6H), 1.69 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 146.2, 142.6, 141.7, 139.3, 127.7, 127.5, 126.0, 120.9, 116.7, 116.2, 66.3, 64.3 (2C overlapped), 39.8, 19.2.

IR (KBr, neat) ν_{max} 3057, 2981, 2870, 2820, 2781, 1587, 1502, 1286, 1066 [ν (C–O)], 880 [ν (C–O)], 746, 702 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{18}H_{22}NO_2$ [$(M+H)^+$]: 284.1651, found: 284.1651.

5.5.32. *N*,*N*-Dimethyl-1-phenyl-1-(4-(trifluoromethyl)phenyl)ethan-1-amine (32)



32

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **S32** (109 mg, 0.502 mmol) through addition of PhLi (0.65 mL, 0.748 mmol, 1.5 equiv) (1.15 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/Et_2O = 100:2.

Yield 76% yield (111 mg, 0.378 mmol) as a colorless oil.

$\mathbf{R_f}$ = 0.33 (eluent: hexane/ethyl acetate = 40:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61 (d, *J* = 8.3 Hz, 2H), 7.52 (d, *J* = 8.3 Hz, 2H), 7.42 (d, *J* = 7.3 Hz, 2H), 7.29 (dd, *J* = 7.3, 7.3 Hz, 2H), 7.19 (t, *J* = 7.3 Hz, 1H), 2.14 (s, 6H), 1.76 (s, 3H).

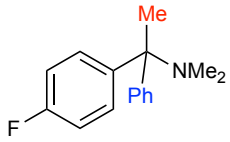
^{13}C NMR (100 MHz, $CDCl_3$) δ 150.5, 144.5, 128.3 (q, $^2J_{C\text{-}F}$ = 32.2 Hz), 127.91, 127.89, 127.6, 126.5, 124.7 (q, $^3J_{C\text{-}F}$ = 3.7 Hz), 124.3 (q, $^1J_{C\text{-}F}$ = 271.8 Hz), 67.0, 39.8, 19.4.

^{19}F NMR (376 MHz, $CDCl_3$) δ −62.9.

IR (KBr, neat) ν_{max} 3059, 2987, 2827, 2785, 1618, 1446, 1409, 1327, 1122, 1008, 860, 704 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{17}H_{19}NF_3$ [$(M+H)^+$]: 294.1470, found: 294.1469.

5.5.33. 1-(4-Fluorophenyl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (33)



33

This compound was prepared according to general procedure **A** (section 5.3.1) from carboxamide **S33** (104 mg, 0.502 mmol) through addition of PhLi (0.66 mL, 0.752 mmol, 14.5 equiv) (1.14 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.41 mL, 1.25 mmol, 2.5 equiv) (3.05 M in Et_2O).

Purification silica gel, hexane/Et_2O = 100:10.

Yield 86% yield (105 mg, 0.432 mmol) as colorless oil.

$\mathbf{R_f}$ = 0.22 (eluent: hexane/ethyl acetate = 40:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 – 7.40 (m, 4H), 7.27 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.17 (t, *J* = 7.4 Hz, 1H), 6.94 (dd, *J* = 8.7, 8.7 Hz, 2H), 2.13 (s, 6H), 1.73 (s, 3H).

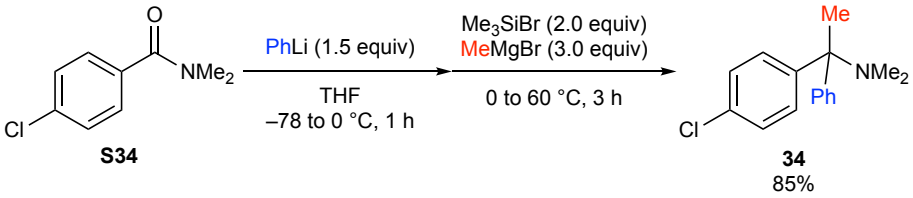
^{13}C NMR (100 MHz, $CDCl_3$) δ 161.2 (d, $^1J_{C\text{-}F}$ = 245.0 Hz), 145.6, 141.6 (d, $^4J_{C\text{-}F}$ = 3.2 Hz), 129.2 (d, $^3J_{C\text{-}F}$ = 7.7 Hz), 127.8, 127.6, 126.2, 114.4 (d, $^2J_{C\text{-}F}$ = 20.9 Hz), 66.5, 39.8, 19.8.

^{19}F NMR (376 MHz, $CDCl_3$) δ −117.4.

IR (KBr, neat) ν_{max} 3059, 2985, 2823, 2783, 1600, 1504, 1222 [*v* (C–F)], 802, 700 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{16}H_{19}NF$ [$(M+H)^+$]: 244.1502, found: 244.1500.

5.5.34. 1-(4-Chlorophenyl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (34)



The titled compound was synthesized with a slightly modified protocol with general procedure **A** (section 5.3.1): Under an argon atmosphere, in a 25 mL sealed tube equipped with a PTFE coated stir bar was added a solution of carboxamide **S34** (91.8 mg, 0.502 mmol) in anhydrous THF (2.5 mL) and the mixture was cooled to –78 °C (dry ice-acetone bath). PhLi (0.64 mL, 0.756 mmol, 1.5 equiv) (1.18 M in Et_2O) was added dropwise over 30 seconds, and the mixture was slowly warmed up to 0 °C over 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for 10 min). Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was added in one portion, and the mixture was stirred for 5 min at 0 °C (ice-water bath). MeMgBr (0.50 mL, 1.53 mmol, 3.1 equiv) (3.05 M in Et_2O) was added and then the mixture was heated at 60 °C (oil bath) for 3 h. The mixture was carefully quenched with pH 10 NH_4Cl-NH_3 buffer (10 mL) at 0 °C and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. Volatiles were removed and the residue was purified by flash column chromatography on silica gel (hexane/Et_2O = 100:10) to give **34** as colorless oil (111 mg, 0.429 mmol) in 85% yield.

R_f = 0.33 (eluent: hexane/ethyl acetate = 40:1, visualized by UV).

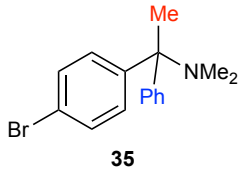
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 – 7.39 (m, 4H), 7.29 – 7.22 (m, 4H), 7.18 (t, *J* = 7.2 Hz, 1H), 2.13 (s, 6H), 1.72 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 145.2, 144.6, 131.8, 129.1, 127.85, 127.83, 127.6, 126.3, 66.6, 39.8, 19.5.

IR (KBr, neat) ν_{max} 3084, 2985, 2823, 2783, 1598, 1487, 1222, 1093 [*v* (C–Cl)], 1012, 759, 704 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{16}H_{19}NCl$ [$(M+H)^+$]: 260.1206, found: 260.1208.

5.5.35. 1-(4-Bromophenyl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (35)



35

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **S35** (114 mg, 0.500 mmol) through addition of PhLi (0.66 mL, 0.752 mmol, 14.5 equiv) (1.14 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.41 mL, 1.25 mmol, 2.5 equiv) (3.05 M in Et_2O).

Purification silica gel, hexane/Et_2O = 100:2.

Yield 71% yield (107 mg, 0.353 mmol) as light yellow oil.

R_f = 0.30 (eluent: hexane/ethyl acetate = 40:1, visualized by UV).

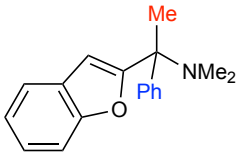
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 – 7.33 (m, 6H), 7.27 (dd, *J* = 7.3, 7.3 Hz, 2H), 7.18 (t, *J* = 7.3 Hz, 1H), 2.13 (s, 6H), 1.72 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 145.2, 145.0, 130.8, 129.5, 127.8, 127.6, 126.3, 120.0, 66.7, 39.8, 19.5.

IR (KBr, neat) ν_{max} 3057, 2985, 2823, 2781, 1485, 1008 [*v* (C–Br)], 758, 704 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{16}H_{19}NBr$ [$(M+H)^+$]: 304.0701, found: 304.0703.

5.5.36. 1-(Benzofuran-2-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (36)



36

This compound was prepared according to general procedure **A** (section 5.3.1) from carboxamide **S36** (94.6 mg, 0.501 mmol) through addition of PhLi (0.63 mL, 0.750 mmol, 1.5 equiv) (1.19 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/ethyl acetate = 100:5.

Yield 78% yield (104 mg, 0.392 mmol) as light brown solid.

M.p. 59.5 – 60.7 °C.

$\mathbf{R_f}$ = 0.22 (eluent: hexane/ethyl acetate = 20:1, visualized by UV).

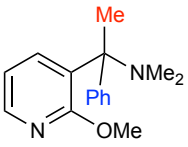
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 – 7.52 (m, 3H), 7.45 (d, *J* = 7.9 Hz, 1H), 7.30 (dd, *J* = 7.5, 7.5 Hz, 2H), 7.24 – 7.17 (m, 3H), 6.65 (d, *J* = 0.6 Hz, 1H), 2.28 (s, 6H), 1.80 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 160.4, 154.7, 144.8, 128.05, 128.01, 127.2, 126.8, 123.7, 122.5, 120.7, 111.3, 105.0, 64.9, 40.0, 21.9.

IR (KBr, neat) ν_{max} 3082, 2985, 2825, 2783, 1600, 1454, 1253 [*v* (C–O)], 935, 750, 702 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{18}H_{20}NO$ [$(M+H)^+$]: 266.1545, found: 266.1546.

5.5.37. 1-(2-Methoxypyridin-3-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (37)



37

This compound was prepared according to general procedure **A** (section 5.3.1) from amide **S37** (90.1 mg, 0.501 mmol) through addition of PhLi (0.63 mL, 0.750 mmol, 1.5 equiv) (1.19 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/ethyl acetate/triethylamine = 100:20:1.

Yield 86% yield (110 mg, 0.430 mmol) as light yellow oil.

$\mathbf{R_f}$ = 0.26 (eluent: hexane/ethyl acetate = 20:1, visualized by UV).

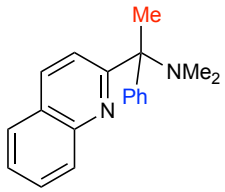
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.14 (dd, *J* = 7.5, 1.9 Hz, 1H), 8.04 (dd, *J* = 4.9, 1.9 Hz, 1H), 7.26 – 7.14 (m, 5H), 6.94 (dd, *J* = 7.5, 4.9 Hz, 1H), 3.63 (s, 3H), 2.11 (s, 6H), 1.79 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 161.4, 144.6, 142.5, 137.5, 129.3, 127.4, 127.2, 125.9, 116.4, 65.0, 52.6, 39.8, 17.9.

IR (KBr, neat) ν_{max} 3055, 2985, 2825, 1783, 1577, 1454, 1398, 1242 [*v* (C–O)], 1018 [*v* (C–O)], 750, 700 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{16}H_{21}N_2O$ [$(M+H)^+$]: 257.1654, found: 257.1650.

5.5.38. *N*,*N*-Dimethyl-1-phenyl-1-(quinolin-2-yl)ethan-1-amine (38)



38

This compound was prepared according to general procedure **A** (section 5.3.1) from carboxamide **S38** (100 mg, 0.501 mmol) through addition of PhLi (0.63 mL, 0.750 mmol, 1.5 equiv) (1.19 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/ethyl acetate/triethylamine = 100:10:1.

Yield 87% yield (121 mg, 0.438 mmol) as white solid.

M.p. 110.9 – 112.2 °C.

R_f = 0.25 (eluent: hexane/ethyl acetate = 5:1, visualized by UV).

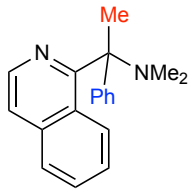
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (d, *J* = 8.4 Hz, 1H), 7.96 (d, *J* = 8.7 Hz, 1H), 7.79 (d, *J* = 8.7 Hz, 1H), 7.69 (d, *J* = 8.0 Hz, 1H), 7.66 – 7.61 (m, 3H), 7.45 (ddd, *J* = 8.2, 6.8, 1.1 Hz, 1H), 7.26 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.13 (t, *J* = 7.4 Hz, 1H), 2.25 (s, 6H), 1.98 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 165.1, 147.0, 146.1, 135.4, 129.6, 128.7, 128.0, 127.4, 127.1, 126.6, 126.2, 126.0, 121.0, 69.7, 39.9, 14.1.

IR (KBr, neat) ν_{max} 3059, 2981, 2825, 2783, 1597, 1498, 958, 852, 756, 704 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{19}H_{21}N_2$ $[(M+H)^+]$: 277.1705, found: 277.1706.

5.5.39. 1-(Isoquinolin-1-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (39)



39

This compound was prepared according to general procedure **A** (section 5.3.1) from carboxamide **S39** (100 mg, 0.501 mmol) through addition of PhLi (0.63 mL, 0.750 mmol, 1.5 equiv) (1.19 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/ethyl acetate/triethylamine = 100:30:1.

Yield 78% yield (108 mg, 0.391 mmol) as yellow solid.

M.p. 124.0 – 125.4 °C.

R_f = 0.14 (eluent: hexane/ethyl acetate = 5:1, visualized by UV).

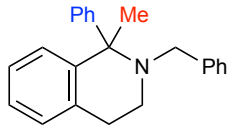
^{1}H NMR (400 MHz, $CDCl_3$) δ 9.20 (d, *J* = 8.8 Hz, 1H), 8.48 (d, *J* = 5.6 Hz, 1H), 7.66 (d, *J* = 8.1 Hz, 1H), 7.52 (d, *J* = 7.7 Hz, 2H), 7.50 – 7.45 (m, 2H), 7.38 – 7.33 (m, 1H), 7.20 (dd, *J* = 7.5, 7.5 Hz, 2H), 7.06 (t, *J* = 7.5 Hz, 1H), 2.34 (s, 6H), 1.99 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 163.0, 145.0, 140.4, 136.9, 129.0, 128.3, 127.7, 127.6, 127.2, 127.1, 126.0, 125.7, 120.5, 72.3, 40.5, 18.3.

IR (KBr, neat) ν_{max} 3053, 2985, 2829, 2787, 1556, 952, 819, 752, 705 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{19}H_{21}N_2$ $[(M+H)^+]$: 277.1705, found: 277.1703.

5.5.40. 2-Benzyl-1-methyl-1-phenyl-1,2,3,4-tetrahydroisoquinoline (40)[25]



40

This compound was prepared according to general procedure **A** (section 5.3.1) from carboxamide **S40** (119 mg, 0.502 mmol) through addition of PhLi (0.63 mL, 0.750 mmol, 1.5 equiv) (1.19 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.43 mL, 1.26 mmol, 2.5 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/Et_2O = 100:2.

Yield 80% yield (125 mg, 0.399 mmol) as white solid.

M.p. 105.0 – 105.9 °C. (lit. 102 – 103 °C)[25]

R_f = 0.55 (eluent: hexane, visualized by UV).

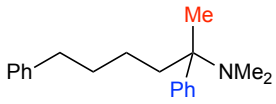
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 (d, *J* = 7.4 Hz, 2H), 7.30 – 7.23 (m, 6H), 7.18 (dd, *J* = 7.1, 7.1 Hz, 2H), 7.07 – 7.02 (m, 2H), 6.96 (t, *J* = 7.1 Hz, 1H), 6.68 (d, *J* = 7.8 Hz, 1H), 3.56 (d, *J* = 13.8 Hz, 1H), 3.29 (d, *J* = 13.8 Hz, 1H), 3.09 (ddd, *J* = 15.9, 8.3, 8.3 Hz, 1H), 2.85 (dd, *J* = 8.3, 2.9 Hz, 2H), 2.70 (ddd, *J* = 15.9, 2.9, 2.9 Hz, 1H), 1.80 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 148.6, 144.8, 140.7, 134.0, 129.1, 128.4, 128.3, 128.2, 128.0, 127.7, 126.6, 126.5, 125.6, 125.4, 64.1, 54.1, 42.3, 30.2, 19.7.

IR (KBr, neat) ν_{max} 3059, 2974, 2804, 1600, 1491, 752, 698 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{23}H_{24}N$ $[(M+H)^+]$: 314.1909, found: 314.1912.

5.5.41. *N*,*N*-Dimethyl-2,6-diphenylhexan-2-amine (41)



41

This compound was prepared according to general procedure **B** (section 5.4.2) from carboxamide **S41** (103 mg, 0.502 mmol) through addition of PhLi (0.64 mL, 0.755 mmol, 1.5 equiv) (1.18 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.52 mL, 1.52 mmol, 3.0 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/ethyl acetate/triethylamine = 100:5:1.

Yield 56% yield (79.0 mg, 0.281 mmol) as colorless oil.

R_f = 0.14 (eluent: hexane/ethyl acetate = 10:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 (d, *J* = 7.3 Hz, 2H), 7.30 (dd, *J* = 7.3, 7.3 Hz, 2H), 7.24 – 7.18 (m, 3H), 7.13 (t, *J* = 7.3 Hz, 1H), 7.04 (d, *J* = 7.0 Hz, 2H), 2.49 (ddd, *J* = 13.7, 7.6, 7.6 Hz, 1H), 2.45 (ddd, *J* = 13.7, 7.6, 7.6 Hz, 1H), 2.15 (s, 6H), 1.79 (ddd, *J* = 12.6, 12.6, 4.4 Hz, 1H), 1.65 (ddd, *J* = 12.6, 12.6, 4.4 Hz, 1H), 1.47 (tt, *J* = 7.7, 7.7 Hz, 2H), 1.29 (s, 3H), 1.14 – 1.02 (m, 1H), 1.02 – 0.91 (m, 1H).

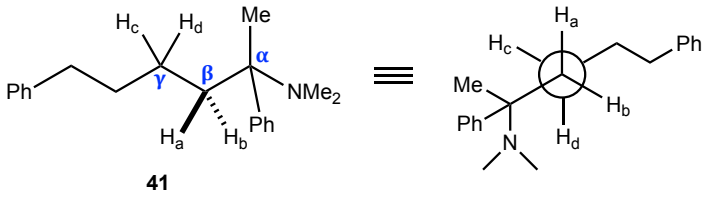
^{13}C NMR (100 MHz, $CDCl_3$) δ 146.2, 142.7, 128.2, 128.1, 127.7, 127.0, 126.0, 125.5, 62.4, 41.5, 38.8, 35.7, 32.1, 24.4, 14.5.

IR (KBr, neat) ν_{max} 3024, 2937, 2858, 2770, 1602, 1494, 746, 698 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{20}H_{28}N$ $[(M+H)^+]$: 282.2222, found: 282.2226.

Interpretation of ^{1}H NMR couplings on the methylene protons β to the amine moiety

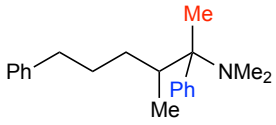
The ^{1}H signals found at 1.79 ppm (ddd, J = 12.6, 12.6, 4.4 Hz, 1H) and 1.65 ppm (ddd, J = 12.6, 12.6, 4.4 Hz, 1H) are assigned as H_a and H_b on the methylene carbon β to the amine moiety (Figure S2). Due to the chiral center constructed α to the amine moiety to the carbon, H_a and H_b become non-equivalent and thus split as doublet with larger coupling constant (12.6 Hz). These protons are also coupled with the next γ-methylene protons H_c and H_d, where one causes larger doublet coupling (12.6 Hz) and another does smaller coupling (4.4 Hz). Typically, it could be assumed that the C_β-C_γ single bond could be free rotating, and thus, the coupling of H_a to H_c and H_d (also H_b to H_c and H_d) could be averaged out to give around 6 to 8 Hz. However, the C_β-C_γ bond rotation might be somewhat restricted due to the sterically bulky α-tertiary amine moiety. Therefore, we reasoned that H_a and H_d with dihedral angle of about 180º would have larger coupling constant (12.6 Hz) and H_a and H_c with dihedral angle of 60º would have smaller coupling constant (4.4 Hz). The same interpretation of ^{1}H NMR couplings could be applied for the compound **12** [its methylene proton β- to the amine moiety at 1.84 (ddd, J = 12.7, 12.7, 4.5 Hz, 1H), 1.70 (ddd, J = 12.7, 12.7, 4.5 Hz, 1H)].



41

Figure S2. The configuration of **41**

5.5.42. *N*,*N*,3-Trimethyl-2,6-diphenylhexan-2-amine (42)



42

This compound was prepared according to general procedure **B** (section 5.4.2) from carboxamide **S42** (110 mg, 0.502 mmol) through addition of PhLi (0.64 mL, 0.755 mmol, 1.5 equiv) (1.18 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.52 mL, 1.52 mmol, 3.0 equiv) (2.92 M in Et_2O). It was isolated as a pair of an inseparable mixture of diastereomers. The dr ratio (1.6:1) was assigned by ^{1}H NMR of the reaction crude mixture using the ratio of the methyl protons on the tertiary carbon (see below).

Purification silica gel, hexane/ethyl acetate/triethylamine = 100:5:1

Yield 49% yield (72.2 mg, 0.245 mmol) as colorless oil (dr 1.6:1).

R_f = 0.15 (eluent: hexane/ethyl acetate = 10:1, visualized by UV)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 – 7.37 (m, 2H, both isomers), 7.30 – 7.13 (m, 8H, both isomers), 2.65 – 2.58 (m, 1H, both isomers), 2.55 – 2.46(m, 1H, both isomers), 2.10 (s, 6H, both isomers), 1.95 – 1.83 (m, 2H, both isomers), 1.74 – 1.59 (m, 2H, both isomers), 1.52 – 1.37 (m, 1H, both isomers), 1.30 (s, 3H, minor isomer), 1.29 (s, 3H, major isomer), 0.87 – 0.68 (m, 4H, both isomers), 0.59 – 0.51 (m, 0.4H, minor isomer).

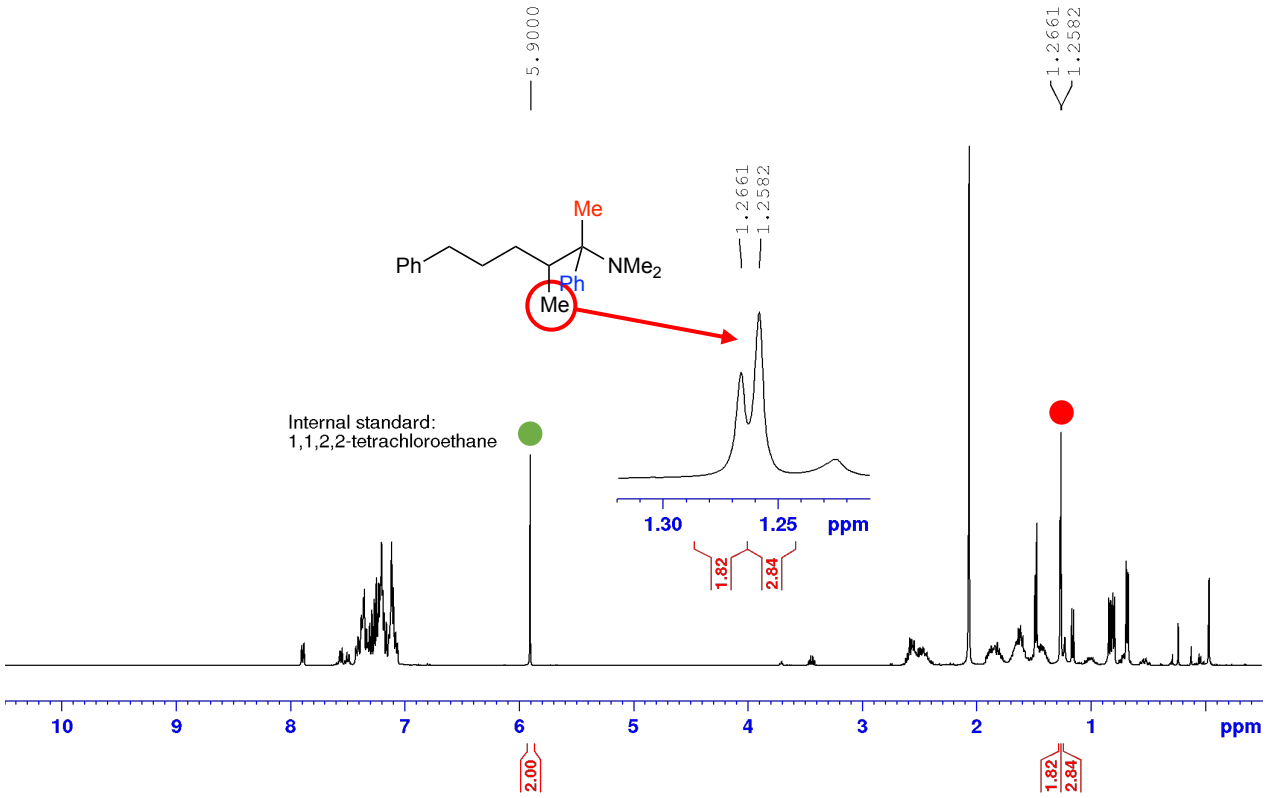
Major isomer ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.9, 142.3, 128.3, 128.21, 128.17, 127.0, 126.0, 125.51, 65.4, 39.7, 38.8, 36.5, 30.7, 30.6, 15.3, 13.1.

Minor isomer ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.8, 142.2, 128.3, 128.17 (2C overlapped), 127.0, 126.0, 125.54, 65.1, 39.3, 38.8, 36.3, 32.4, 30.5, 14.1, 13.2.

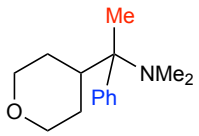
IR (KBr, neat) ν_{max} 3059, 2970, 2935, 2858, 1602, 1494, 1446, 763, 700 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{21}H_{30}N$ [$(M+H)^+$]: 296.2378, found: 296.2376.

Determination of dr ratio in crude NMR:



5.5.43. *N,N*-Dimethyl-1-phenyl-1-(tetrahydro-2*H*-pyran-4-yl)ethan-1-amine (43)



43

This compound was prepared according to general procedure **B** (section 5.4.2) from carboxamide **S43** (78.5 mg, 0.500 mmol) through addition of PhLi (0.64 mL, 0.755 mmol, 1.5 equiv) (1.18 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.52 mL, 1.52 mmol, 3.0 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/ethyl acetate/triethylamine = 100:5:1.

Yield 40% yield (46.1 mg, 0.198 mmol) as white solid.

M.p. 60.3 – 62.7 °C.

R_f = 0.17 (eluent: hexane/ethyl acetate = 5:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 – 7.38 (m, 2H), 7.29 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.20 (t, *J* = 7.4 Hz, 1H), 3.90 (ddd, *J* = 11.7, 11.7, 3.6 Hz, 2H), 3.35 (ddd, *J* = 11.7, 11.7, 1.8 Hz, 1H), 3.32 (ddd, *J* = 11.7, 11.7, 1.8 Hz, 1H), 2.15 (s, 6H), 1.90

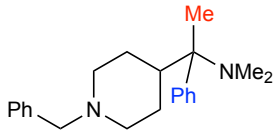
(dddd, J = 11.8, 11.8, 3.0, 3.0 Hz, 1H), 1.74 (dddd, J = 13.5, 4.3, 2.2, 2.2 Hz, 1H), 1.52 (dddd, J = 13.5, 4.3, 2.2, 2.2 Hz, 1H), 1.31 (s, 3H), 1.24 (dddd, J = 13.5, 12.3, 12.3, 4.3 Hz, 1H), 0.88 (dddd, J = 12.3, 12.3, 12.3, 4.3 Hz, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 142.3, 128.2, 127.2, 126.2, 68.6 (2C overlapped), 64.6, 43.1, 38.7, 29.2, 27.3, 12.2.

IR (KBr, neat) ν_{max} 3055, 2949, 2825, 2781, 1492, 1097 [ν (C–O)], 833[ν (C–O)], 771, 702 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{15}H_{24}NO$ $[(M+H)^+]$: 234.1858, found: 234.1859.

5.5.44. 1-(1-Benzylpiperidin-4-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (44)



44

This compound was prepared according to general procedure **B** (section 5.4.2) from carboxamide **S44** (123 mg, 0.500 mmol) through addition of PhLi (0.64 mL, 0.755 mmol, 1.5 equiv) (1.18 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and MeMgBr (0.52 mL, 1.52 mmol, 3.0 equiv) (2.92 M in Et_2O).

Purification silica gel, hexane/acetone = 100:10.

Yield 45% yield (73.0 mg, 0.227 mmol) as yellow oil.

R_f = 0.34 (eluent: hexane/ethyl acetate = 5:1, visualized by UV).

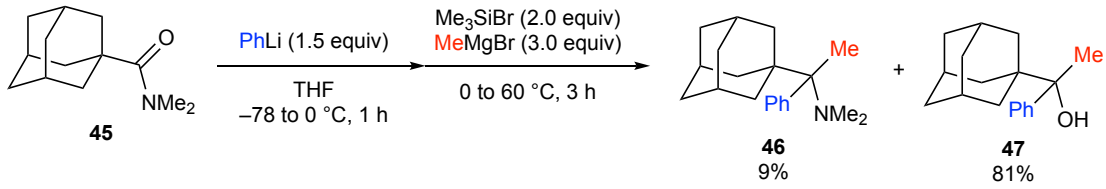
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 (d, J = 7.6 Hz, 2H), 7.28 – 7.15 (m, 8H), 3.41 (m, 2H), 2.88 – 2.57 (m, 2H), 2.12 (s, 6H), 1.93 – 1.78 (m, 3H), 1.66 – 1.60 (m, 2H), 1.30 (s, 3H), 1.16 (dddd, J =12.4, 12.4, 12.4, 2.7 Hz, 1H), 0.85 (dddd, J =12.4, 12.4, 12.4, 2.7 Hz, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 142.6, 138.2, 129.2, 128.2, 128.0, 127.1, 126.8, 126.0, 64.6, 63.4, 54.6, 54.4, 44.1, 38.7, 28.3, 26.4, 12.6.

IR (KBr, neat) ν_{max} 3059, 2941, 2821, 2781, 1494, 771, 736, 698 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{22}H_{31}N_2$ $[(M+H)^+]$: 323.2487, found: 323.2485.

5.5.45. The reaction of amide 45

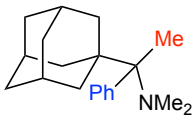


45 | **46** 9% | **47** 81%

The titled compound was synthesized with a modified protocol of general procedure **A** (section 5.3.1): Under an argon atmosphere, in a 25 mL sealed tube equipped with a PTFE coated stir bar was added a solution of carboxamide **45** (104 mg, 0.502 mmol) in anhydrous THF (2.5 mL) and it was cooled to –78 °C (dry ice-acetone bath). PhLi (0.64 mL, 0.755 mmol, 1.5 equiv) (1.18 M in Et_2O) was added dropwise over 30 seconds, and the mixture was slowly warmed up to 0 °C over 1 h. Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was added in one portion, and the mixture was stirred for 5 min at 0 °C (ice-water bath). MeMgBr (0.52 mL, 1.52 mmol, 3.0 equiv) (2.92 M in Et_2O) was added and then the mixture was heated at 60 °C (oil bath) for 3 h. The mixture was carefully quenched with pH 10 NH_4Cl-NH_3 buffer (10 mL) at 0 °C and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. The volatile materials were removed and the residue was purified by flash column chromatography on

silica gel to give **46** (hexane/Et_2O = 100:10) as white solid (12.5 mg, 0.0442 mmol) in 9% yield and **47** (hexane/Et_2O = 100:20) as white solid (104 mg, 0.406 mmol) in 81% yield.

1-(Adamantan-1-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (46)



46

M.p. 120.8 – 123.1 °C.

R_f = 0.24 (eluent: hexane/ethyl acetate = 15:1, visualized by iodine in silica gel).

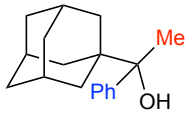
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (d, *J* = 7.4 Hz, 2H), 7.25 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.17 (t, *J* = 7.4 Hz, 1H), 2.22 (s, 6H), 1.88 (m, 3H), 1.78 (m, 3H), 1.58 – 1.55 (m, 3H), 1.51 – 1.48 (m, 3H), 1.39 (m, 3H), 1.25 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 146.8, 128.5, 126.8, 125.7, 68.2, 42.3, 39.3, 37.9, 36.9, 29.2, 9.7.

IR (KBr, neat) ν_{max} 2945, 2908, 2848, 2775, 1442, 736, 705 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{20}H_{30}N$ [$(M+H)^+$]: 284.2378, found: 284.2379.

1-(Adamantan-1-yl)-1-phenylethan-1-ol (47)[26]



47

M.p. 69.8 – 71.4 °C.

R_f = 0.35 (eluent: hexane/ethyl acetate = 15:1, visualized by phosphomolybdic acid stain).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 (d, *J* = 7.4 Hz, 2H), 7.30 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.22 (t, *J* = 7.4 Hz, 1H), 1.95 (m, 3H), 1.67 – 1.60 (m, 6H), 1.55 – 1.52 (m, 9H).

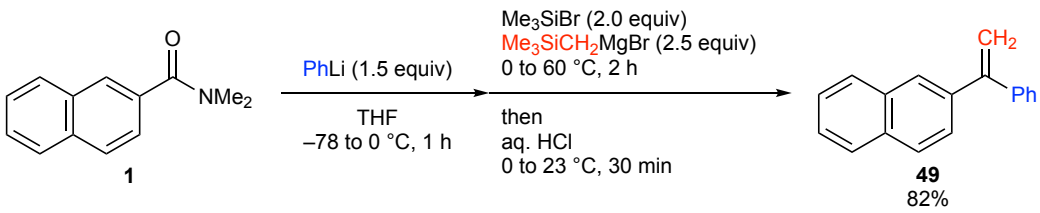
^{13}C NMR (100 MHz, $CDCl_3$) δ 145.5, 127.2, 126.9, 126.2, 78.6, 39.0, 36.9, 36.5, 28.6, 24.0.

IR (KBr, neat) ν_{max} 3460 [*v* (O–H)], 2902, 2946, 1439, 746, 704 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{18}H_{25}O$ [$(M+H)^+$]: 257.1905, found: 257.1903.

6. Synthesis of 1,1-diarylethylenes via arylative Peterson olefination of carboxamides

6.1. General procedure (General Procedure C)

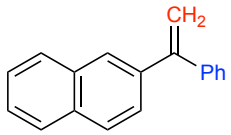


Under an argon atmosphere, in a 25 mL sealed tube equipped with a PTFE coated stir bar was added a solution of carboxamide **1** (99.7 mg, 0.500 mmol) in anhydrous THF (2.5 mL) and the mixture was cooled to –78 °C (dry ice-acetone bath). PhLi (0.64 mL, 0.755 mmol, 1.5 equiv) (1.18 M in Et_2O) was added dropwise over 30 seconds, and the mixture was slowly warmed up to 0 °C over 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for

10 min). Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was added in one portion, and the mixture was stirred for 5 min at 0 °C (water-ice bath). (Trimethylsilyl)methylmagnesium chloride (Me_3SiCH_2MgCl, 1.3 mL, 1.27 mmol, 2.5 equiv) (0.98 M in Et_2O) was added and then the mixture was heated at 60 °C (oil bath) for 2 h. The mixture was carefully quenched with water (1.0 mL) at 0 °C, and 3 M aqueous HCl (5 mL) was added with vigorous stirring. The mixture was stirred at 23 °C for 30 min, and 3 M aqueous NaOH (5 mL) was added at 0 °C to neutralize the excess HCl. A solution of pH 10 NH_4Cl-NH_3 buffer (10 mL) was added, and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. The volatile materials were removed and the residue was purified by flash column chromatography on silica gel (hexane/Et_2O = 100:1) to give **49** as white solid (94.3 mg, 0.410 mmol) in 82% yield.

6.2. Characterization of the products

6.2.1. 2-(1-Phenylvinyl)naphthalene (49)[27]



49

This compound was prepared according to general procedure **C** from carboxamide **1** (99.6 mg, 0.500 mmol) through addition of PhLi (0.64 mL, 0.755 mmol, 1.5 equiv) (1.18 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and Me_3SiCH_2MgCl (1.3 mL, 1.27 mmol, 2.5 equiv) (0.98 M in Et_2O). The crude was subsequently treated with 3 M aqueous HCl (5 mL).

M.p. 55.2 – 56.7 °C. (lit. 53 – 55 °C)[28]

R_f = 0.35 (eluent: hexane, visualized by UV).

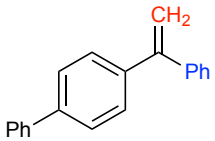
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 – 7.78 (m, 4H), 7.49 – 7.44 (m, 3H), 7.40 – 7.34 (m, 5H), 5.59 (d, *J* = 1.0 Hz, 1H), 5.54 (d, *J* = 1.0 Hz, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 150.0, 141.5, 138.9, 133.3, 132.9, 128.4, 128.21, 128.16, 127.8, 127.7, 127.6, 127.3, 126.4, 126.1, 126.0, 114.8.

IR (KBr, neat) ν_{max} 3053, 1610, 1504, 896, 860, 777, 750, 696 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{18}H_{15}$ [$(M+H)^+$]: 231.1174, found: 231.1172.

6.2.2. 4-(1-Phenylvinyl)-1,1'-biphenyl (50)[29]



50

This compound was prepared according to general procedure **C** from carboxamide **S28** (113 mg, 0.502 mmol) through addition of PhLi (0.64 mL, 0.755 mmol, 1.5 equiv) (1.18 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and Me_3SiCH_2MgCl (1.3 mL, 1.27 mmol, 2.5 equiv) (0.98 M in Et_2O). The crude was subsequently treated with 3 M aqueous HCl (5 mL).

Purification silica gel, hexane/Et_2O = 100:2.

Yield 84% yield (108 mg, 0.422 mmol) as white solid.

M.p. 93.9 – 95.2 °C. (lit. 96 – 98 °C)[30]

R_f = 0.57 (eluent: hexane, visualized by UV).

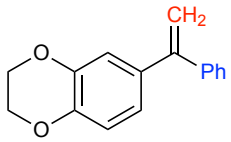
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.62 (d, *J* = 7.2 Hz, 2H), 7.57 (d, *J* = 8.2 Hz, 2H), 7.46 – 7.33 (m, 10H), 5.53 (s, 1H), 5.48 (s, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 149.6, 141.4, 140.7, 140.5, 140.4, 128.8, 128.6, 128.3, 128.2, 127.7, 127.3, 127.0, 126.9, 114.3.

IR (KBr, neat) ν_{max} 3051, 3030, 1602, 1485, 902, 850, 770, 740, 704 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{20}H_{17}$ [$(M+H)^+$]: 257.1330, found: 257.1329.

6.2.3. 6-(1-Phenylvinyl)-2,3-dihydrobenzo[*b*][1,4]dioxine (51)



51

This compound was prepared according to general procedure **C** from carboxamide **S31** (104 mg, 0.502 mmol) through addition of PhLi (0.64 mL, 0.755 mmol, 1.5 equiv) (1.18 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and Me_3SiCH_2MgCl (1.3 mL, 1.27 mmol, 2.5 equiv) (0.98 M in Et_2O). The crude was subsequently treated with 3 M aqueous HCl (5 mL).

Purification silica gel, hexane/Et_2O = 100:5.

Yield 84% yield (100 mg, 0.420 mmol) as light yellow oil.

R_f = 0.28 (eluent: hexane/ethyl acetate = 50:1, visualized by UV).

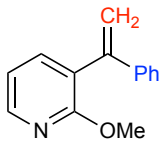
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 – 7.30 (m, 5H), 6.87 – 6.86 (m, 1H), 6.82 – 6.81 (m, 2H), 5.39 (d, *J* = 1.0 Hz, 1H), 5.33 (d, *J* = 1.0 Hz, 1H), 4.29 – 4.24 (m, 4H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 149.3, 143.3, 143.1, 141.5, 135.0, 128.3, 128.1, 127.6, 121.4, 117.1, 116.8, 113.2, 64.4, 64.3.

IR (KBr, neat) ν_{max} 3078, 3053, 1612, 1577, 1504, 1066 [*v* (C–O)], 885 [*v* (C–O)], 704 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{16}H_{15}O_2$ [$(M+H)^+$]: 239.1072, found: 239.1070.

6.2.4. 2-Methoxy-3-(1-phenylvinyl)pyridine (52)



52

This compound was prepared according to general procedure **C** from carboxamide **S37** (90.0 mg, 0.500 mmol) through addition of PhLi (0.64 mL, 0.755 mmol, 1.5 equiv) (1.18 M in Et_2O), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and Me_3SiCH_2MgCl (1.3 mL, 1.27 mmol, 2.5 equiv) (0.98 M in Et_2O). The crude was subsequently treated with 3 M aqueous HCl (5 mL).

Purification silica gel, hexane/ethyl acetate = 100:10.

Yield 60% yield (63.5 mg, 0.301 mmol) as yellow oil.

R_f = 0.26 (eluent: hexane/ethyl acetate = 50:1, visualized by UV).

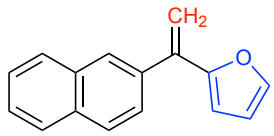
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.16 (dd, *J* = 5.0, 1.4 Hz, 1H), 7.50 (dd, *J* = 7.0, 1.4 Hz, 1H), 7.28 – 7.26 (m, 5H), 6.91 (dd, *J* = 7.0, 5.0 Hz, 1H), 5.74 (s, 1H), 5.39 (s, 1H), 3.81 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 161.4, 146.2, 145.4, 140.3, 139.3, 128.1, 127.6, 126.5, 124.8, 116.6, 116.5, 53.4.

IR (KBr, neat) ν_{max} 3054, 3024, 2847 [*v* (C–O)], 1575, 1465, 1255 [*v* (C–O)], 1018, 778, 708 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{14}H_{14}NO$ $[(M+H)^+]$: 212.1075, found: 212.1073.

6.2.5. 2-(1-(Naphthalen-2-yl)vinyl)furan (53)[31]



53

This compound was prepared according to general procedure **C** from carboxamide **1** (99.6 mg, 0.500 mmol) through addition of 2-furyllithium (0.67 mL, 0.750 mmol, 1.5 equiv) (1.12 M in THF), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and Me_3SiCH_2MgCl (1.3 mL, 1.27 mmol, 2.5 equiv) (0.98 M in Et_2O). The crude was subsequently treated with 3 M aqueous HCl (5 mL).

Purification silica gel, hexane/Et_2O = 100:1

Yield 56% yield (60.8 mg, 0.281 mmol) as orange oil.

R_f = 0.60 (eluent: hexane, visualized by UV).

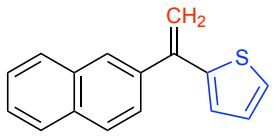
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (s, 1H), 7.87 – 7.83 (m, 3H), 7.56 (d, *J* = 8.4 Hz, 1H), 7.50 – 7.47 (m, 3H), 6.41 (dd, *J* = 3.0, 2.0 Hz, 1H), 6.23 (d, *J* = 3.0 Hz, 1H), 5.83 (s, 1H), 5.35 (s, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 154.1, 142.5, 139.3, 137.0, 133.2, 133.1, 128.1, 127.7, 127.6, 127.2, 126.5, 126.2, 126.1, 112.5, 111.3, 109.3.

IR (KBr, neat) ν_{max} 3053, 3008, 1598, 1539, 1504, 1432, 889, 749, 689 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{16}H_{13}O$ $[(M+H)^+]$: 221.0966, found: 221.0968.

6.2.6. 2-(1-(Naphthalen-2-yl)vinyl)thiophene (54)



54

This compound was prepared according to general procedure **C** from carboxamide **1** (99.6 mg, 0.500 mmol) through addition of 2-thienyllithium (0.77 mL, 0.755 mmol, 1.5 equiv) (0.98 M in THF), followed by addition of Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) and Me_3SiCH_2MgCl (1.3 mL, 1.27 mmol, 2.5 equiv) (0.98 M in Et_2O). The crude was subsequently treated with 3 M aqueous HCl (5 mL).

Purification silica gel, hexane/Et_2O = 100:1.

Yield 60% yield (71.3 mg, 0.302 mmol) as colorless oil.

R_f = 0.67 (eluent: hexane, visualized by UV).

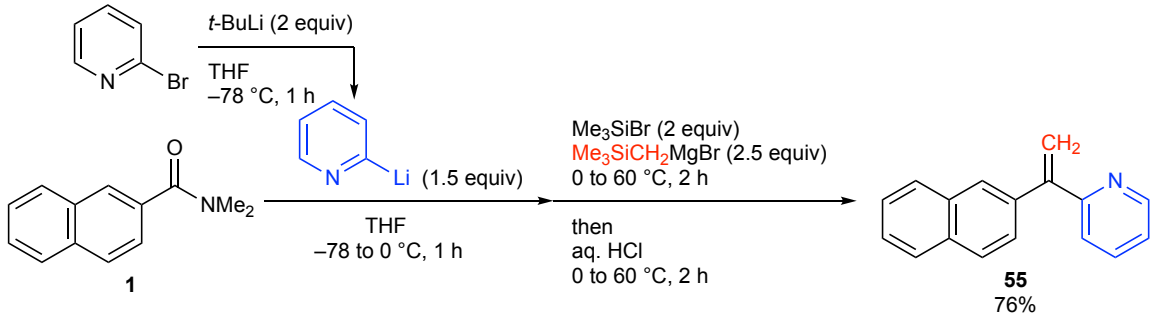
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (s, 1H), 7.86 – 7.81 (m, 3H), 7.55 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.50 – 7.46 (m, 3H), 7.25 (dd, *J* = 5.1, 1.1 Hz, 1H), 6.99 (dd, *J* = 5.1, 3.6 Hz, 1H), 6.94 (dd, *J* = 3.6, 1.1 Hz, 1H), 5.66 (s, 1H), 5.37 (s, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 144.8, 143.3, 138.4, 133.2, 133.1, 128.2, 127.7, 127.6, 127.3, 127.2, 126.6, 126.5, 126.2, 126.1, 125.1, 114.2.

IR (KBr, neat) ν_{max} 3093, 3057, 1598, 1506, 1432, 890, 752, 704 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{16}H_{13}S$ $[(M+H)^+]$: 237.0738, found: 237.0738.

6.2.7. 2-(1-(Naphthalen-2-yl)vinyl)pyridine (55)[32]



The titled compound was synthesized with a modified protocol with general procedure **C**: In a 25 mL sealed tube equipped with a PTFE coated stir bar was added 2-bromopyridine (127 mg, 0.80 mmol) (Sigma-Aldrich B80100) and anhydrous THF (3 mL). The mixture was cooled to –78 °C (dry ice-acetone bath), and *t*-BuLi (1.2 mL, 1.58 mmol, 2.0 equiv to 2-bromopyridine) (1.32 M in pentane, Sigma-Aldrich 186198) was added dropwise over 5 min. The mixture was stirred at –78 °C for 1 h (after 50 min, the cooling bath was replaced to an ice-water bath and stirred for 10 min). A solution of amide **1** (99.6 mg, 0.500 mmol) in THF (3.0 mL) was added at –78 °C and the mixture was slowly warmed up to 0 °C over 1 h. Me_3SiBr (0.13 mL, 0.985 mmol, 2.0 equiv) was added in one portion, and the mixture was stirred for 5 min at 0 °C (ice-water bath). Me_3SiCH_2MgCl (1.3 mL, 1.27 mmol, 2.5 equiv) (0.98 M in Et_2O) was added and then the mixture was heated at 60 °C (oil bath) for 2 h. The mixture was carefully quenched with water (1.0 mL) at 0 °C, and 6 M aqueous HCl (5 mL) was added with vigorous stirring. The mixture was stirred at 60 °C (oil bath) for 2 h, and 6 M aqueous NaOH (5 mL) was added at 0 °C (ice-water bath) to neutralize the excess HCl. A solution of pH 10 NH_4Cl-NH_3 buffer (10 mL) was added, and the organic materials were extracted with CH_2Cl_2 (20 mL × 3). The combined organic layers were dried over $MgSO_4$ and filtered. The volatile materials were removed and the residue was purified by flash column chromatography on silica gel (hexane/ethyl acetate = 100:10) to give **55** as light yellow oil (87.8 mg, 0.380 mmol) in 76% yield.

R_f = 0.28 (eluent: hexane/ethyl acetate = 20:1, visualized by UV).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.67 (d, *J* = 4.2 Hz, 1H), 7.85 – 7.80 (m, 4H), 7.65 (dd, *J* = 7.9, 7.9 Hz, 1H), 7.48 – 7.46 (m, 3H), 7.31 (d, *J* = 7.9 Hz, 1H), 7.23 – 7.22 (m, 1H), 6.08 (s, 1H), 5.73 (s, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 158.5, 149.4, 149.2, 137.8, 136.3, 133.3, 133.0, 128.1, 127.8, 127.6, 127.4, 126.5, 126.1, 126.0, 122.9, 122.5, 118.1.

IR (KBr, neat) ν_{max} 3053, 3010, 1583, 896, 748 cm^{-1}.

HRMS (ESI) *m/z* calcd for $C_{17}H_{14}N$ $[(M+H)^+]$: 232.1126, found: 232.1128.

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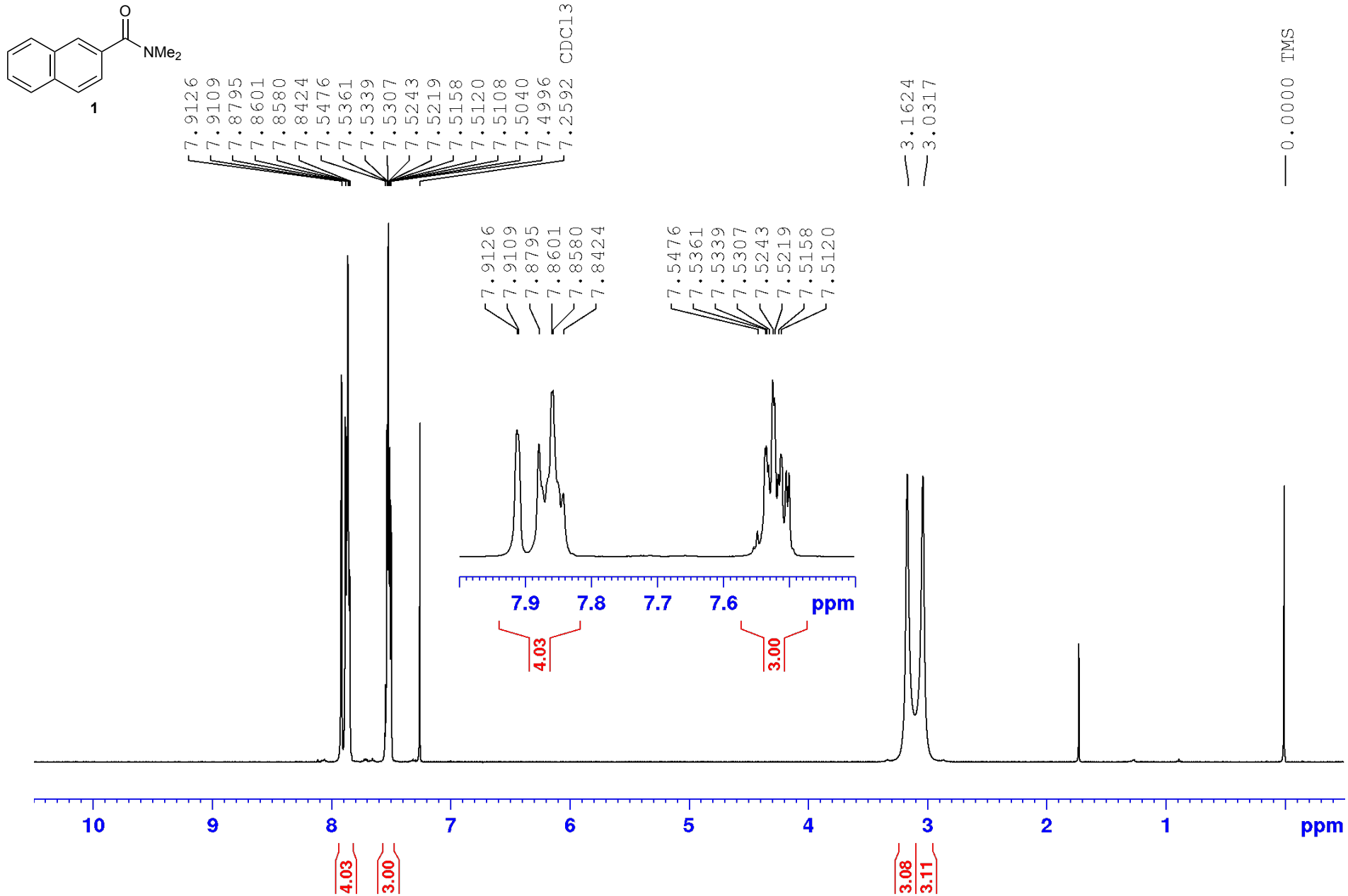
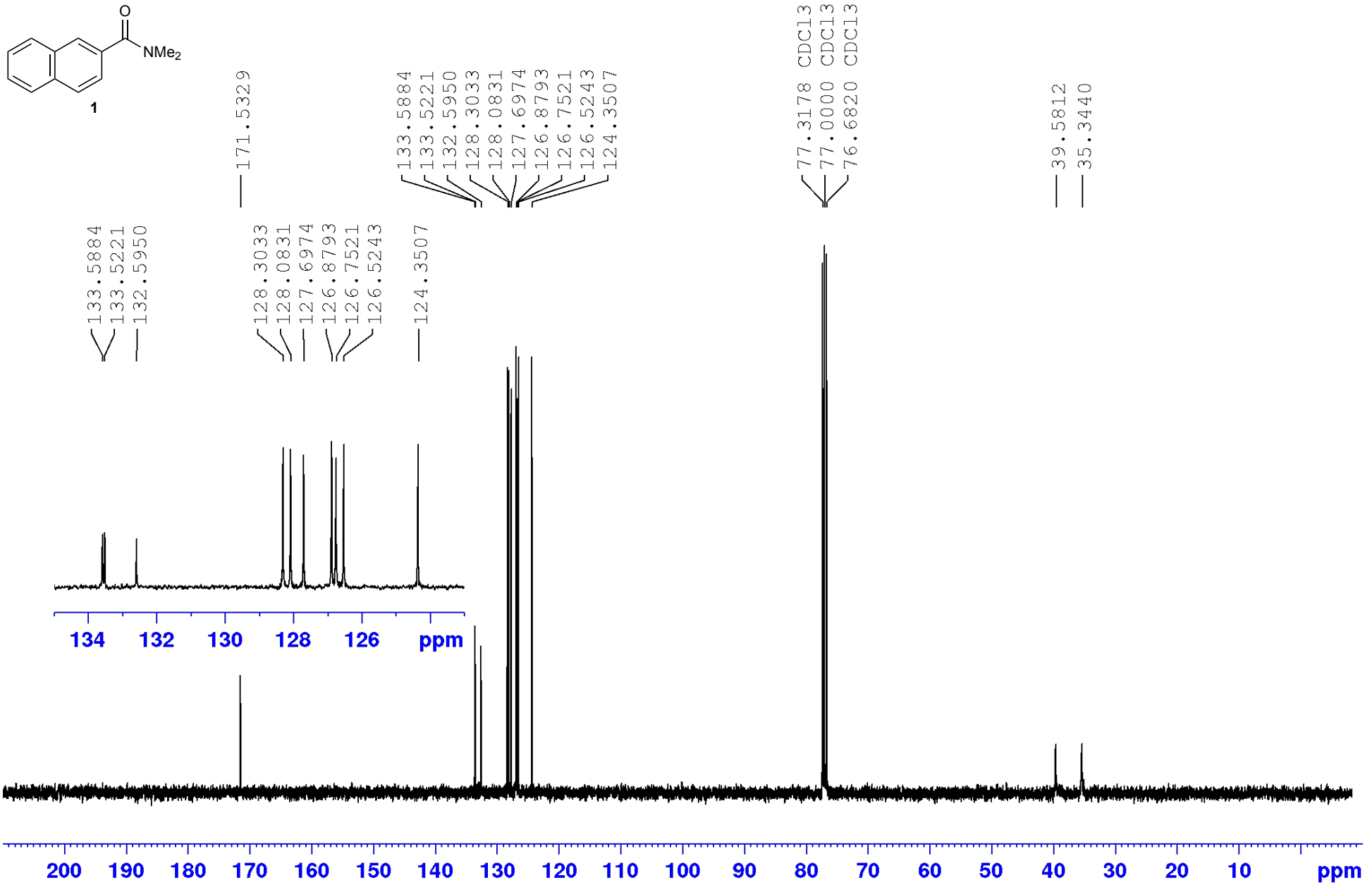
8.1 *N,N*-Dimethyl-2-naphthamide (1)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

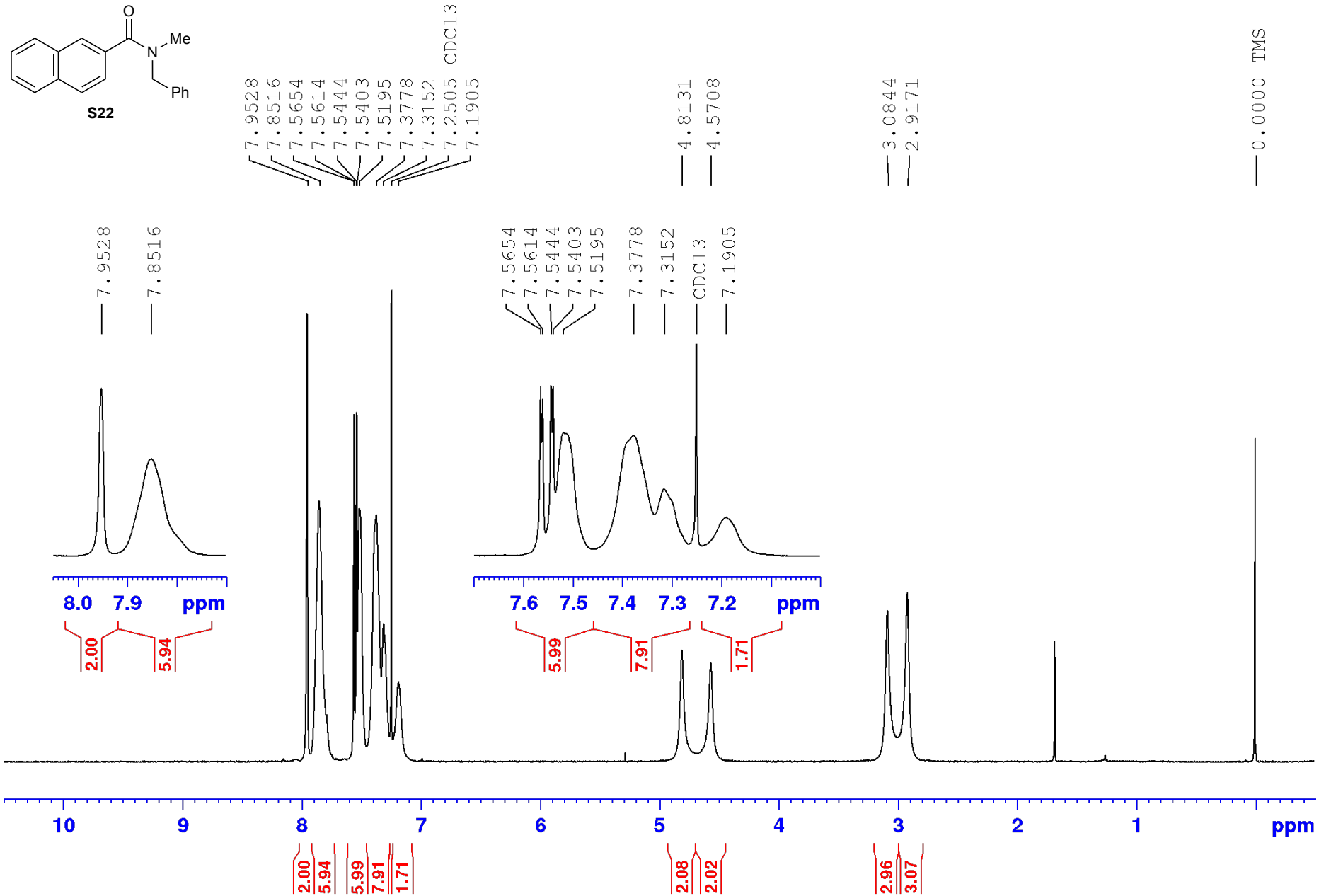


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

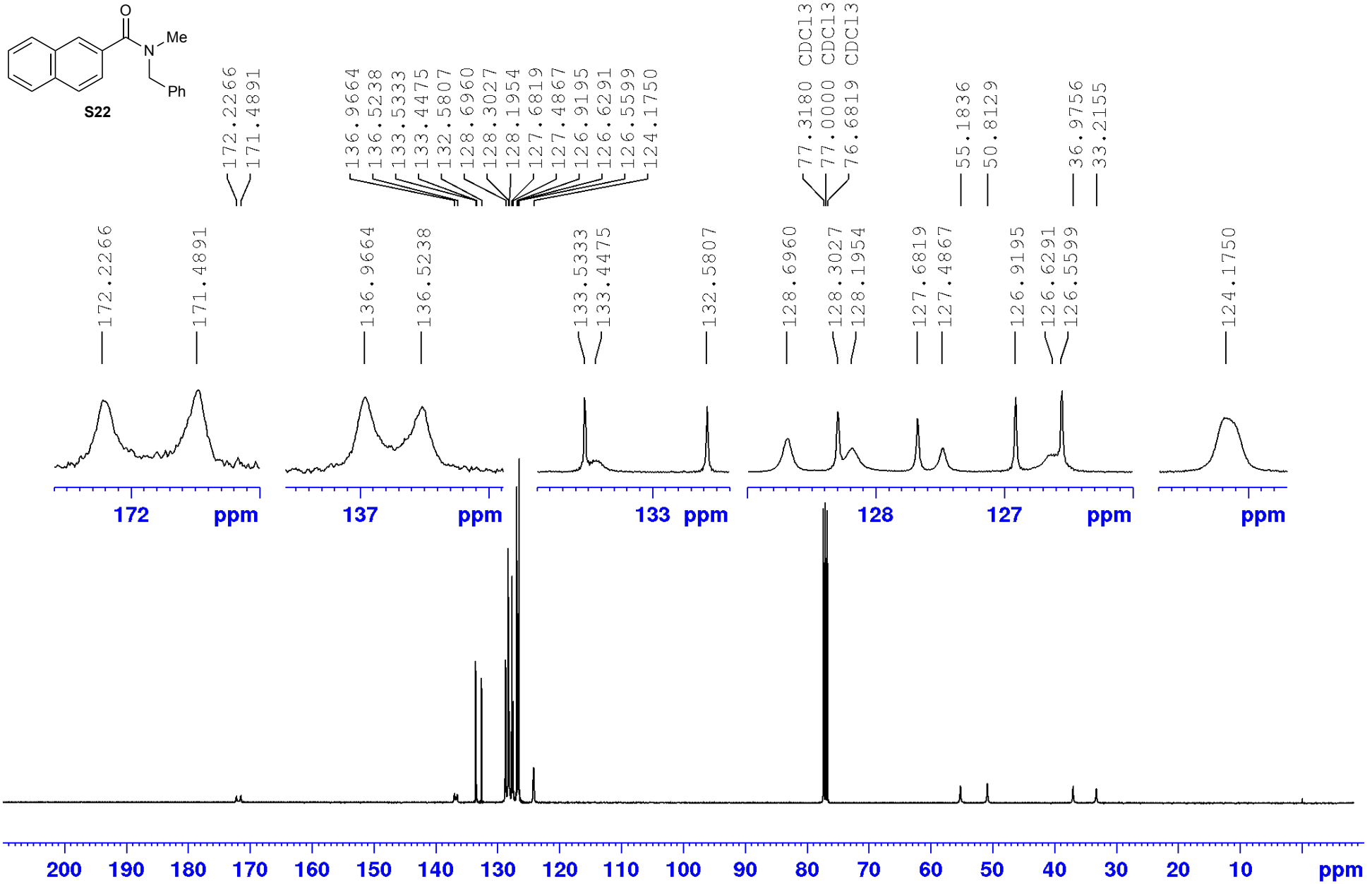


8.2 *N*-Benzyl-*N*-methyl-2-naphthamide (S22)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

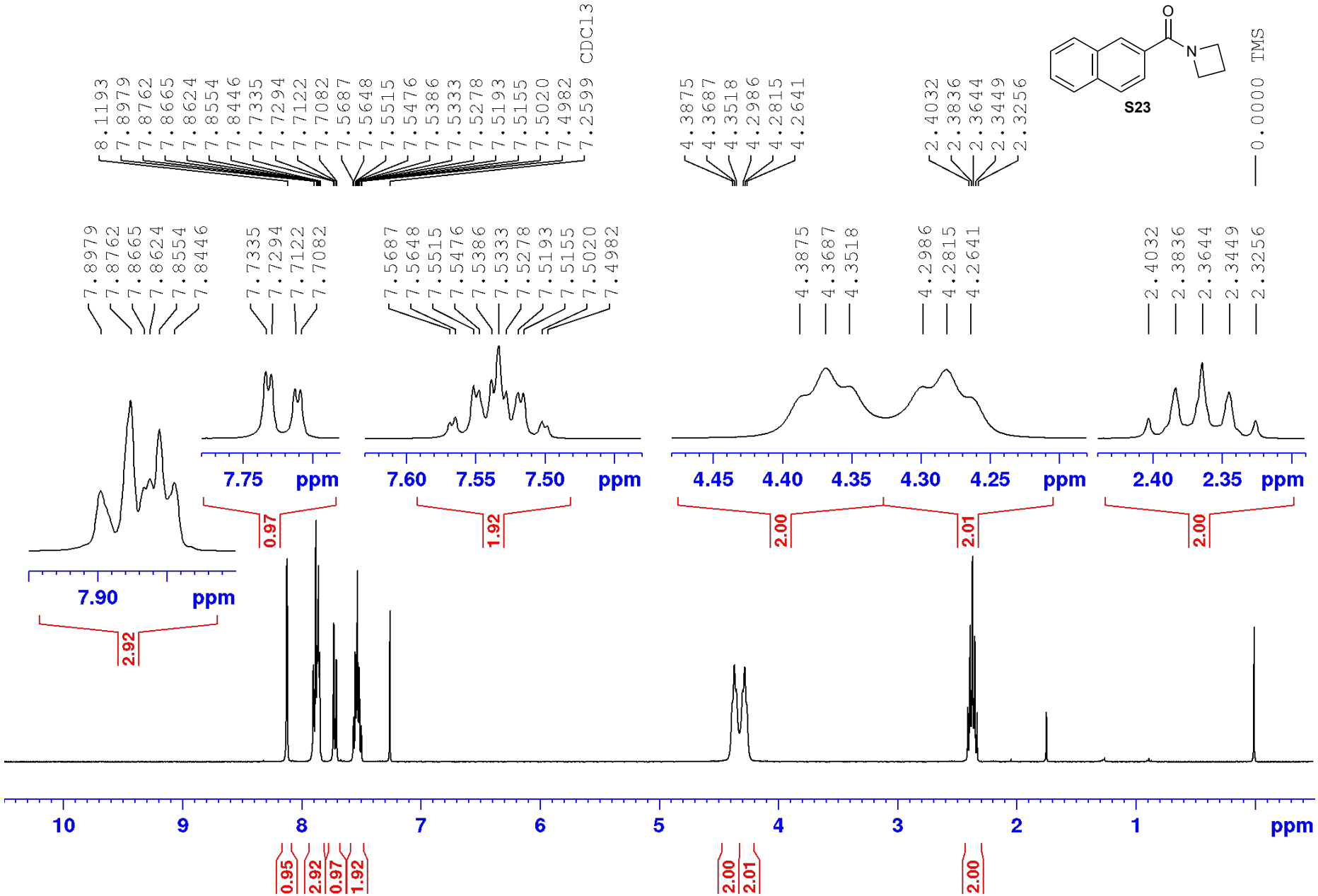


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

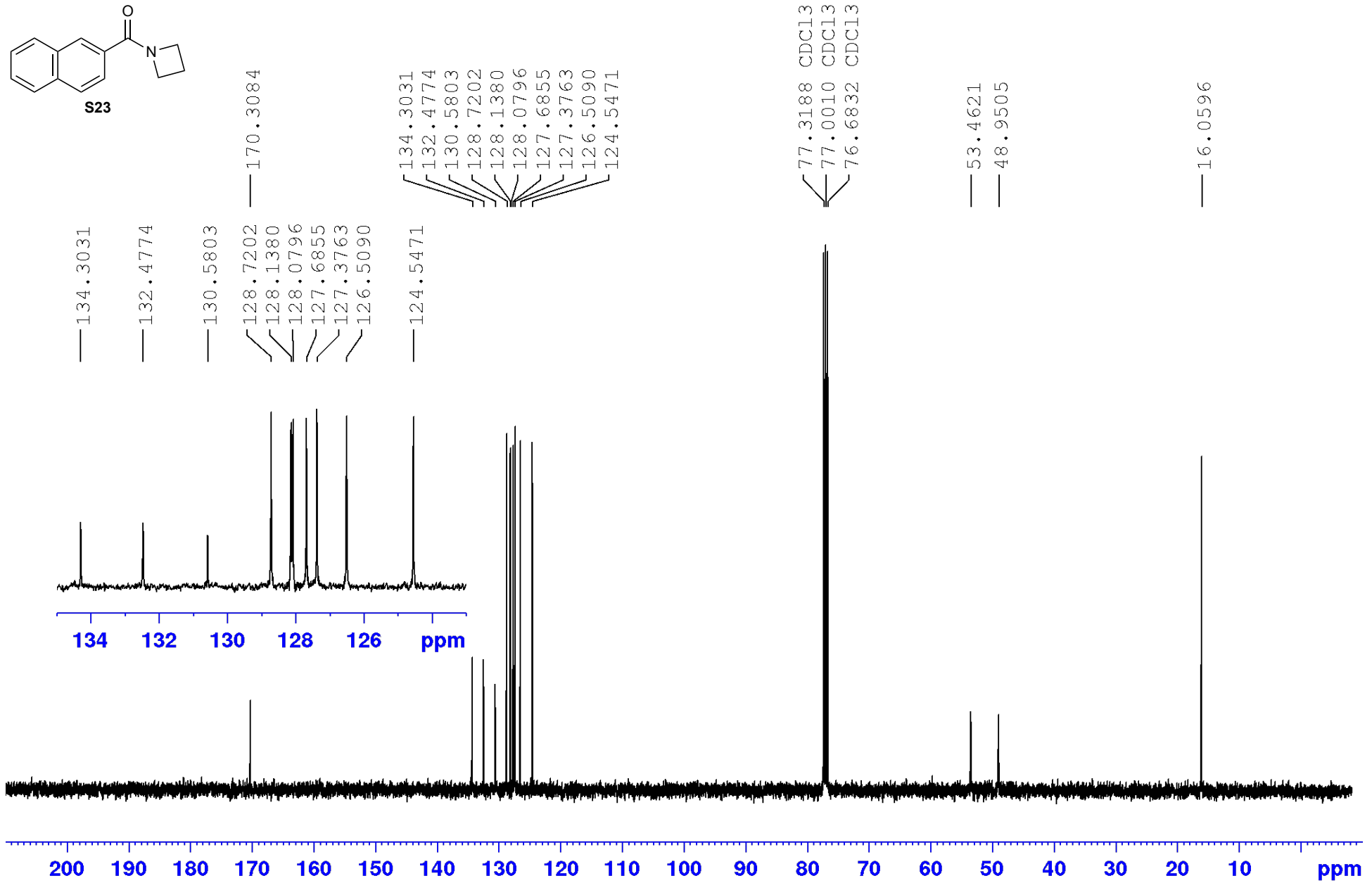


8.3 Azetidin-1-yl(naphthalen-2-yl)methanone (S23)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

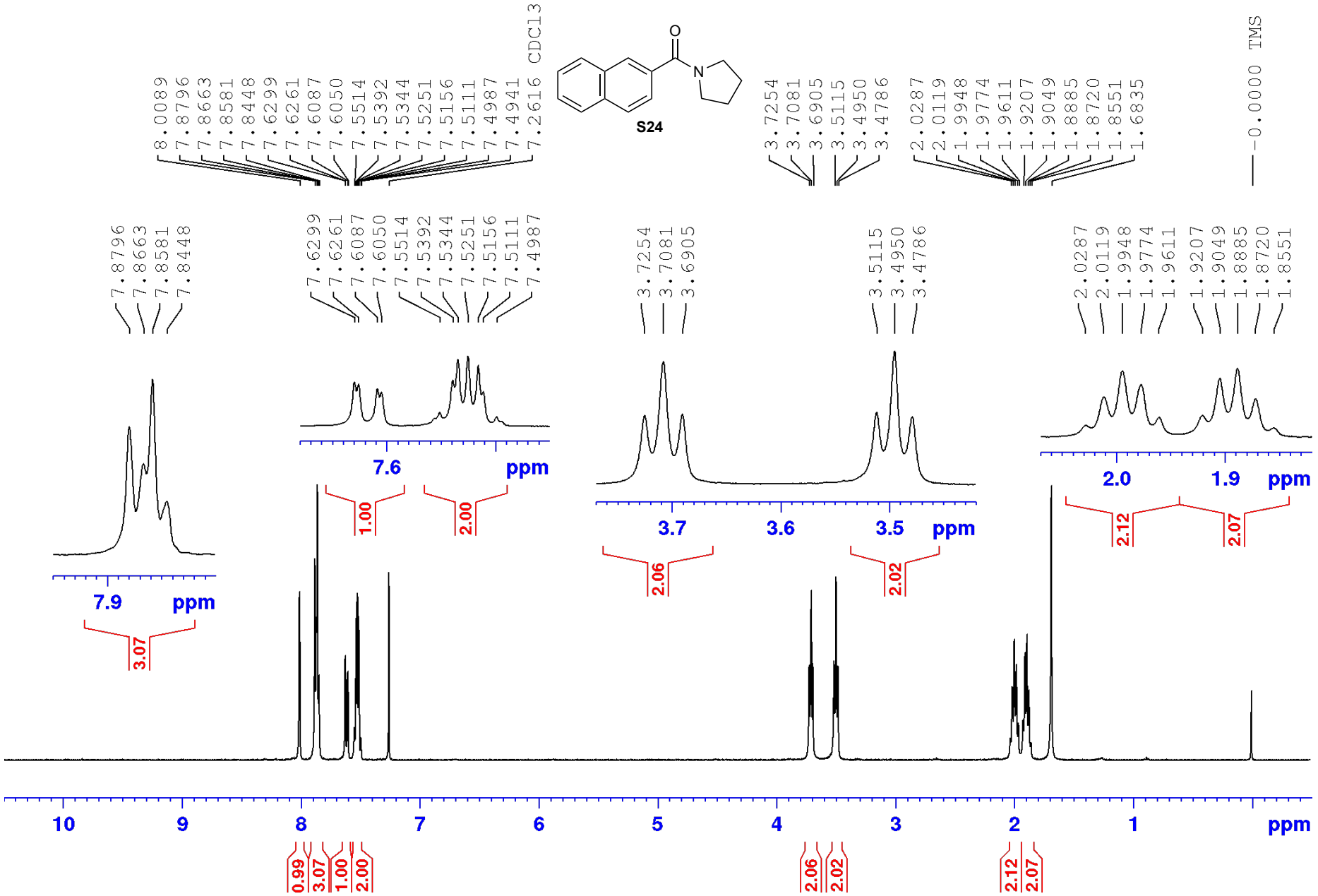


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

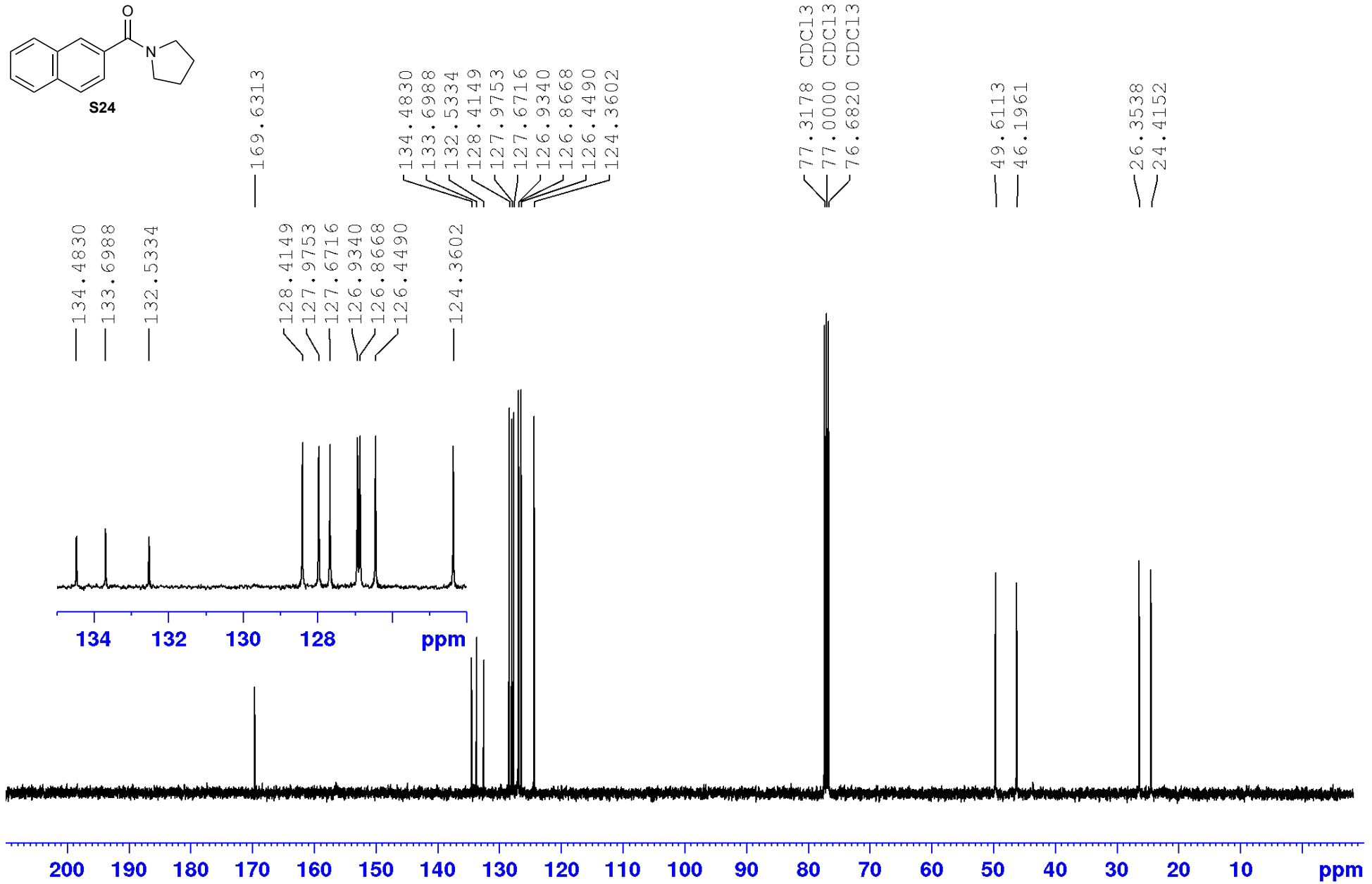


8.4 Naphthalen-2-yl(pyrrolidin-1-yl)methanone (S24)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

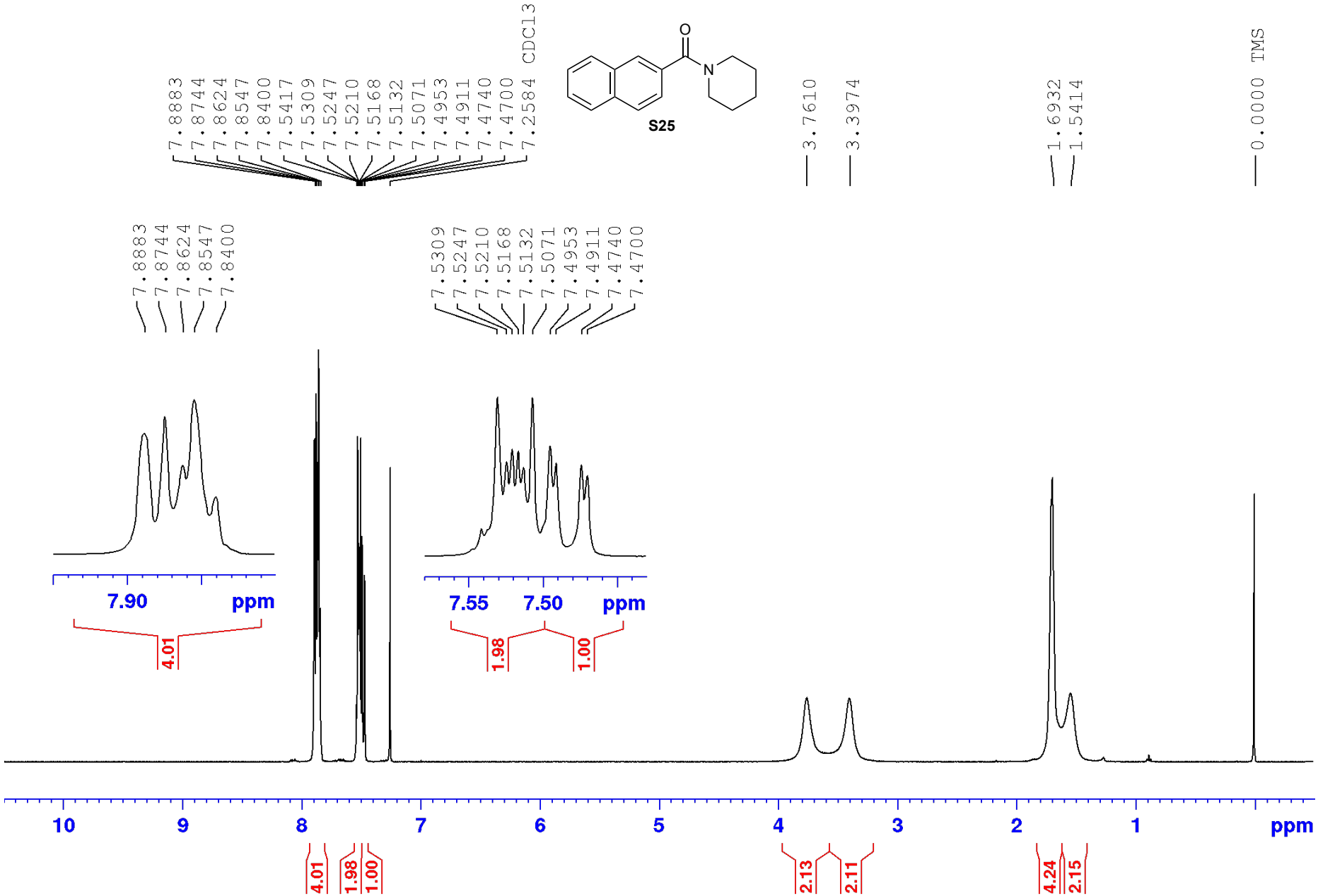


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

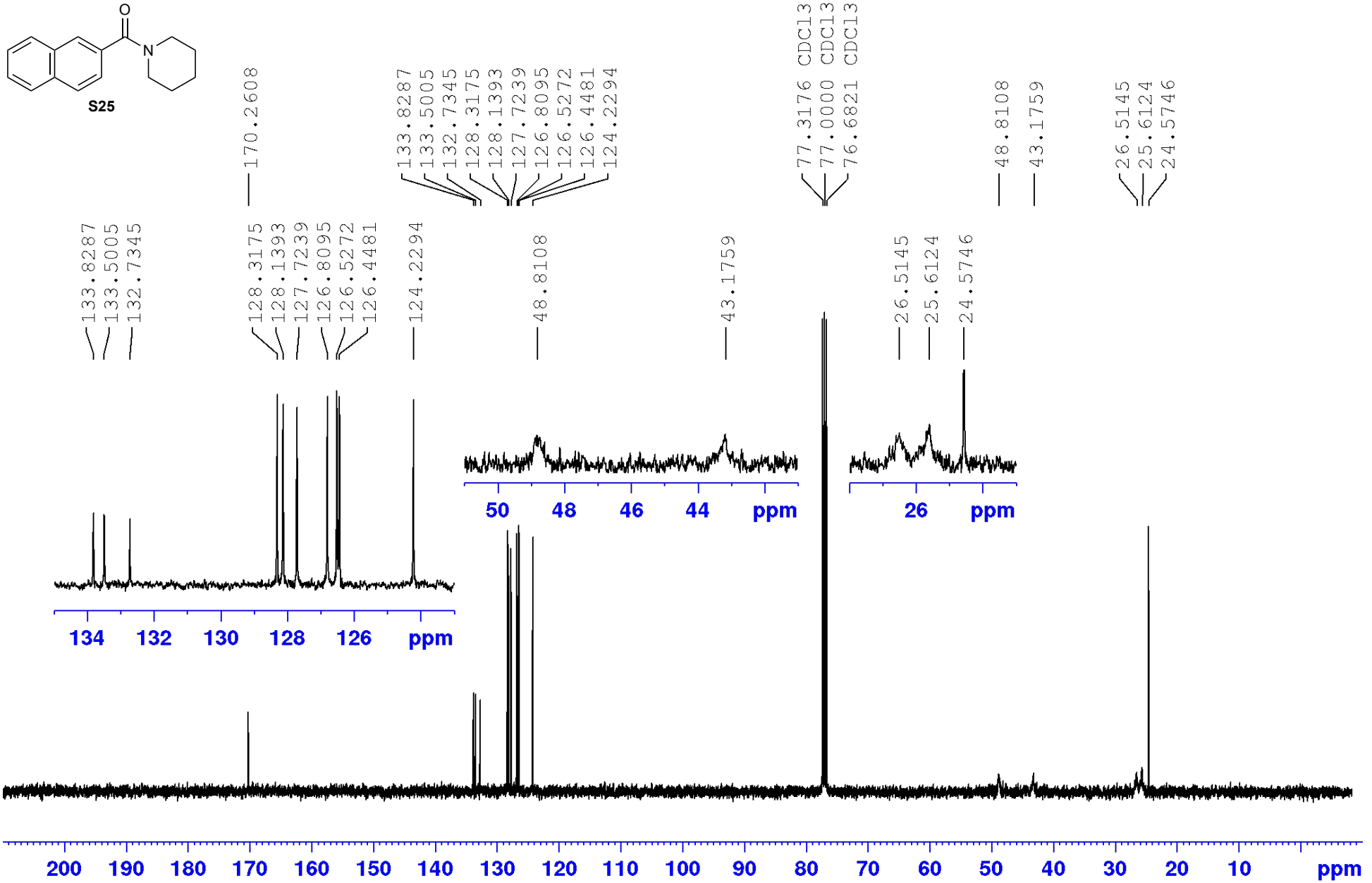


8.5 Naphthalen-2-yl(piperidin-1-yl)methanone (S25)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

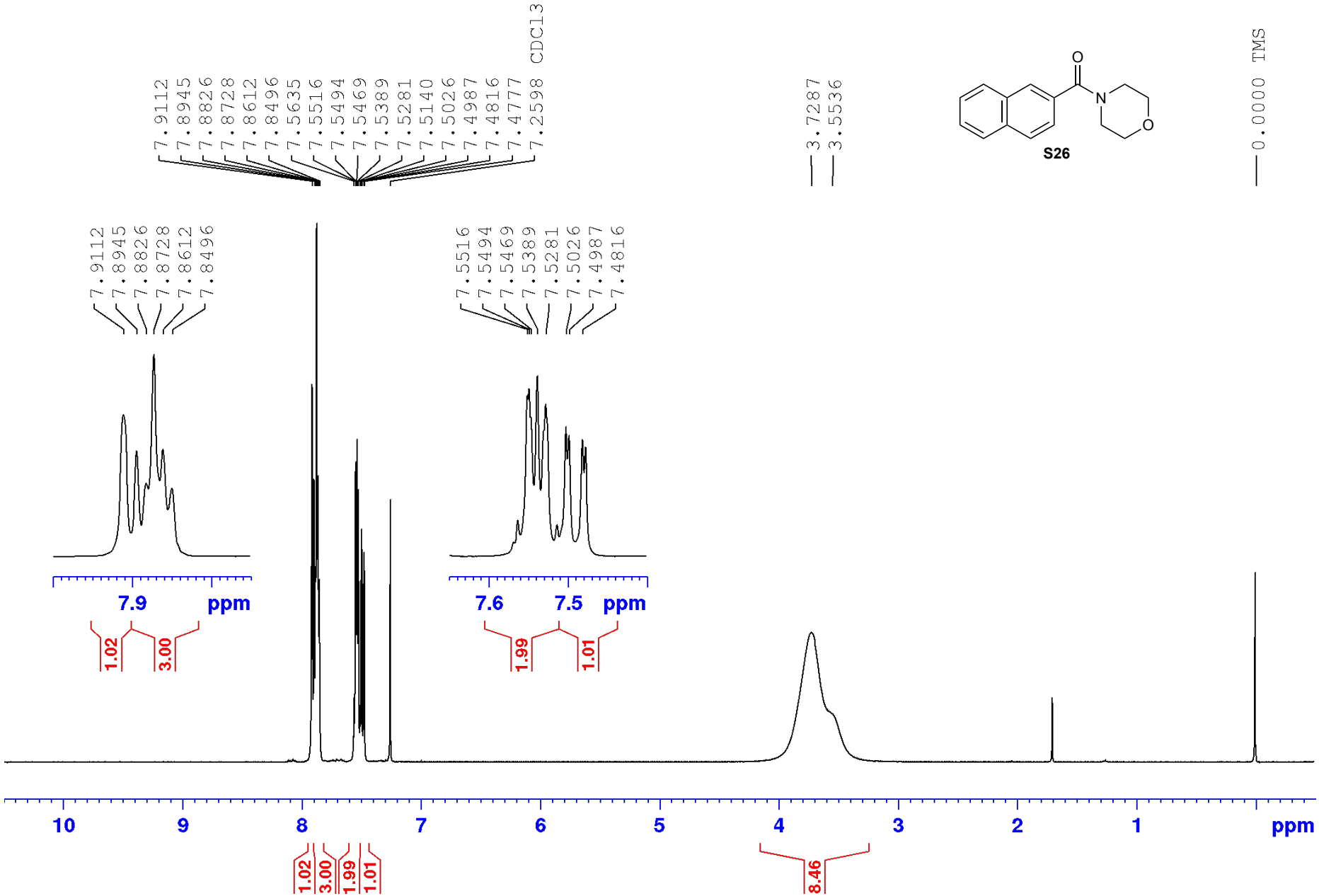


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

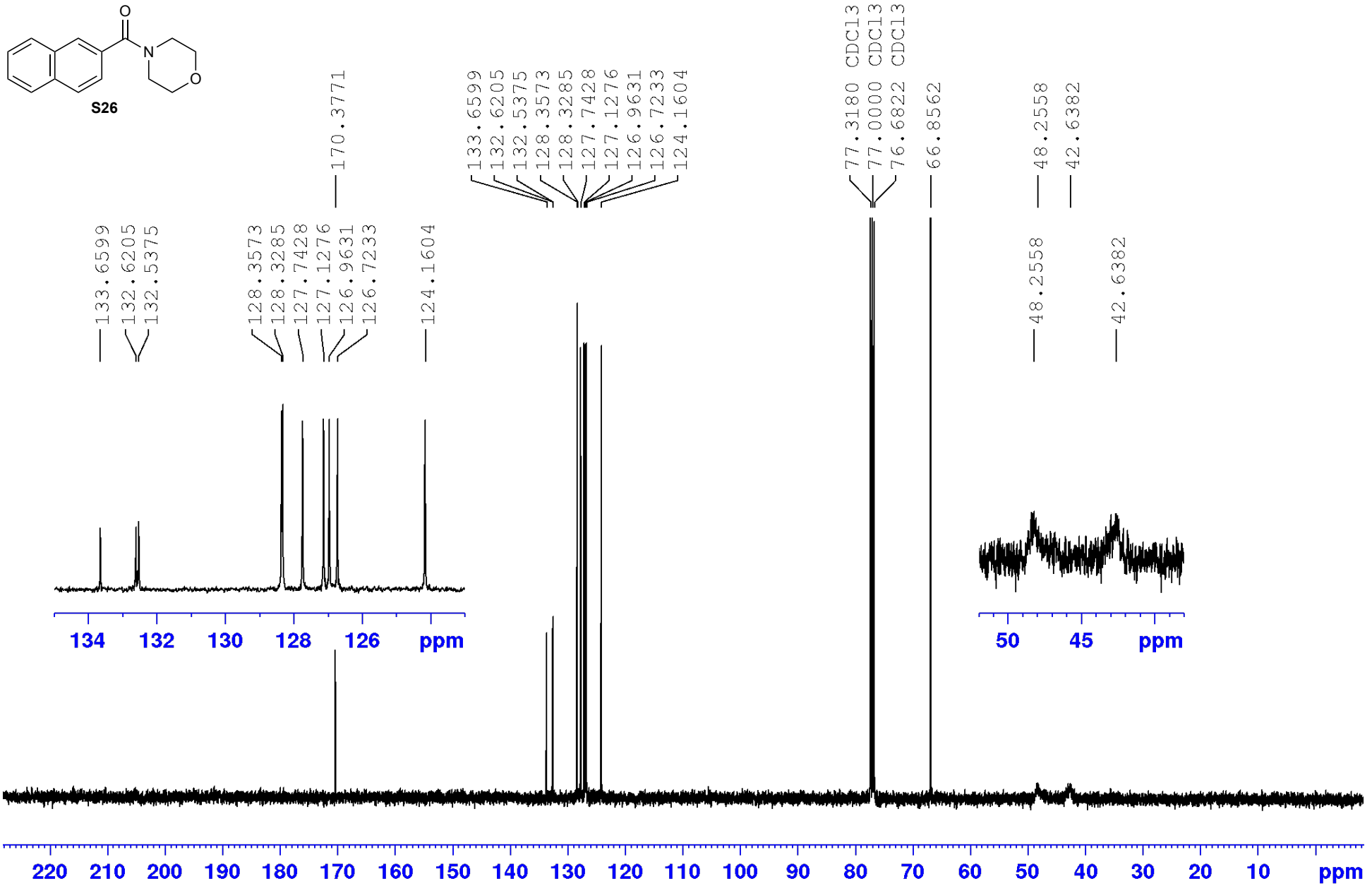


8.6 Morpholino(naphthalen-2-yl)methanone (S26)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

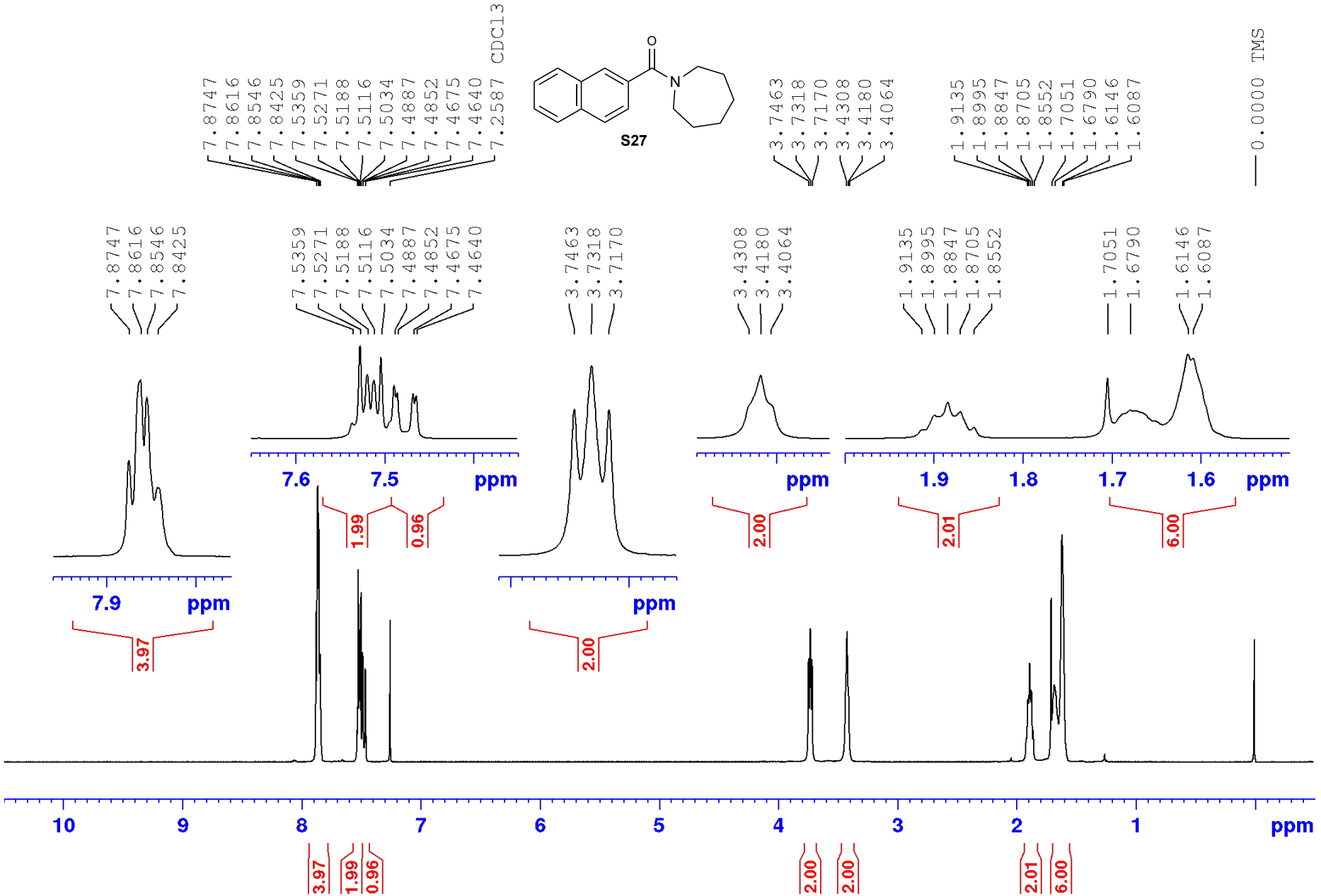


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

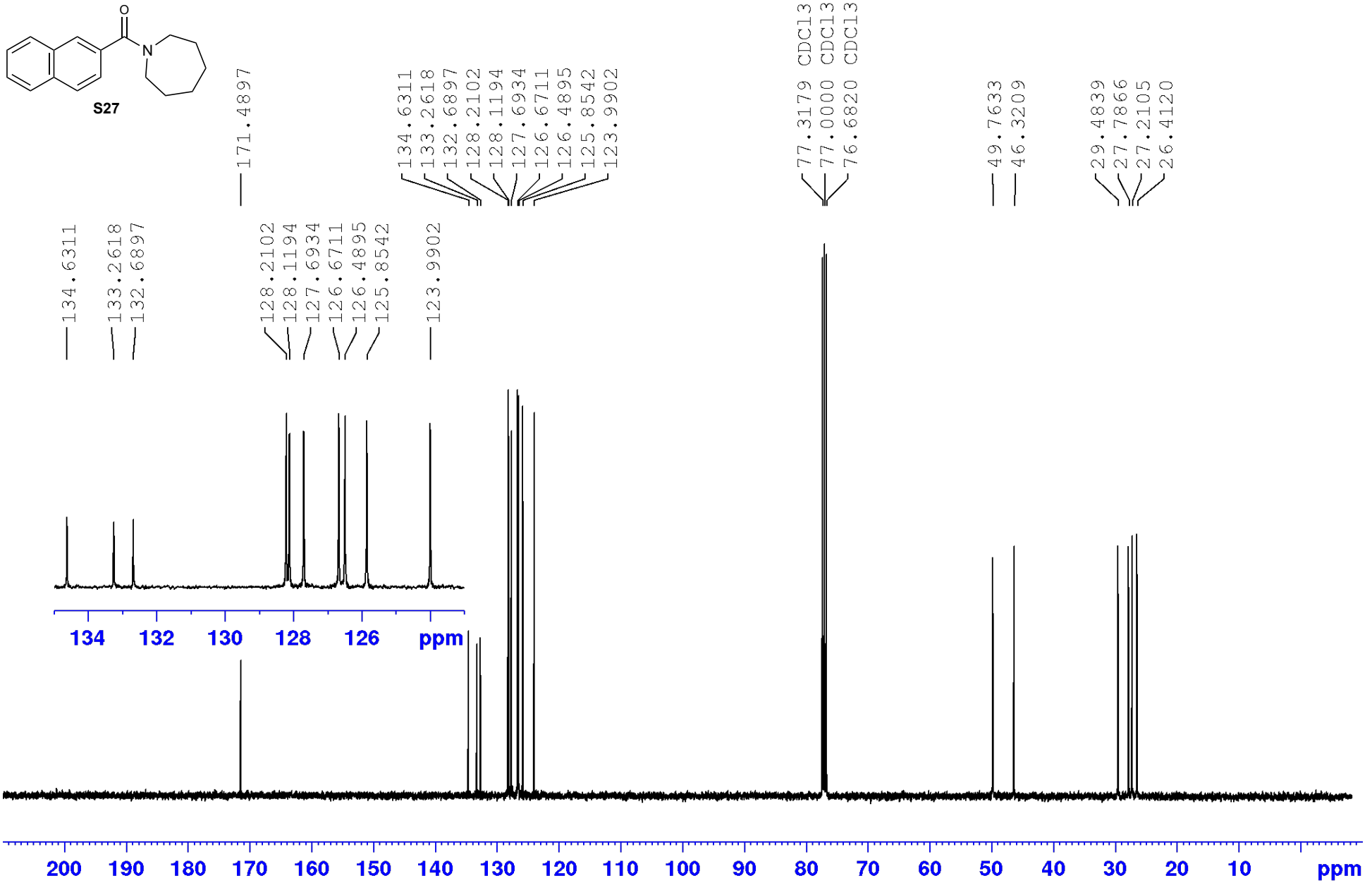


8.7 Azepan-1-yl(naphthalen-2-yl)methanone (S27)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

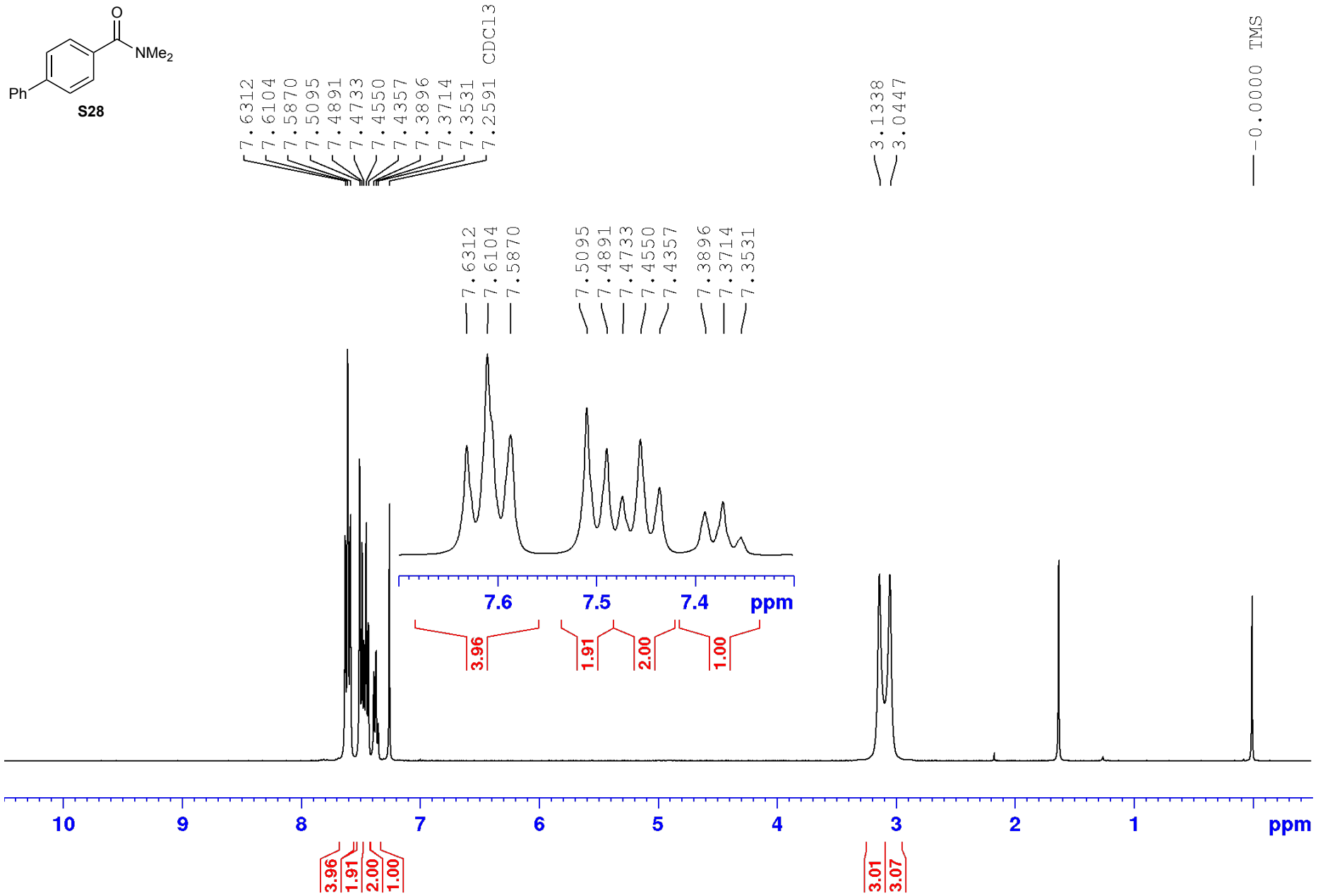


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

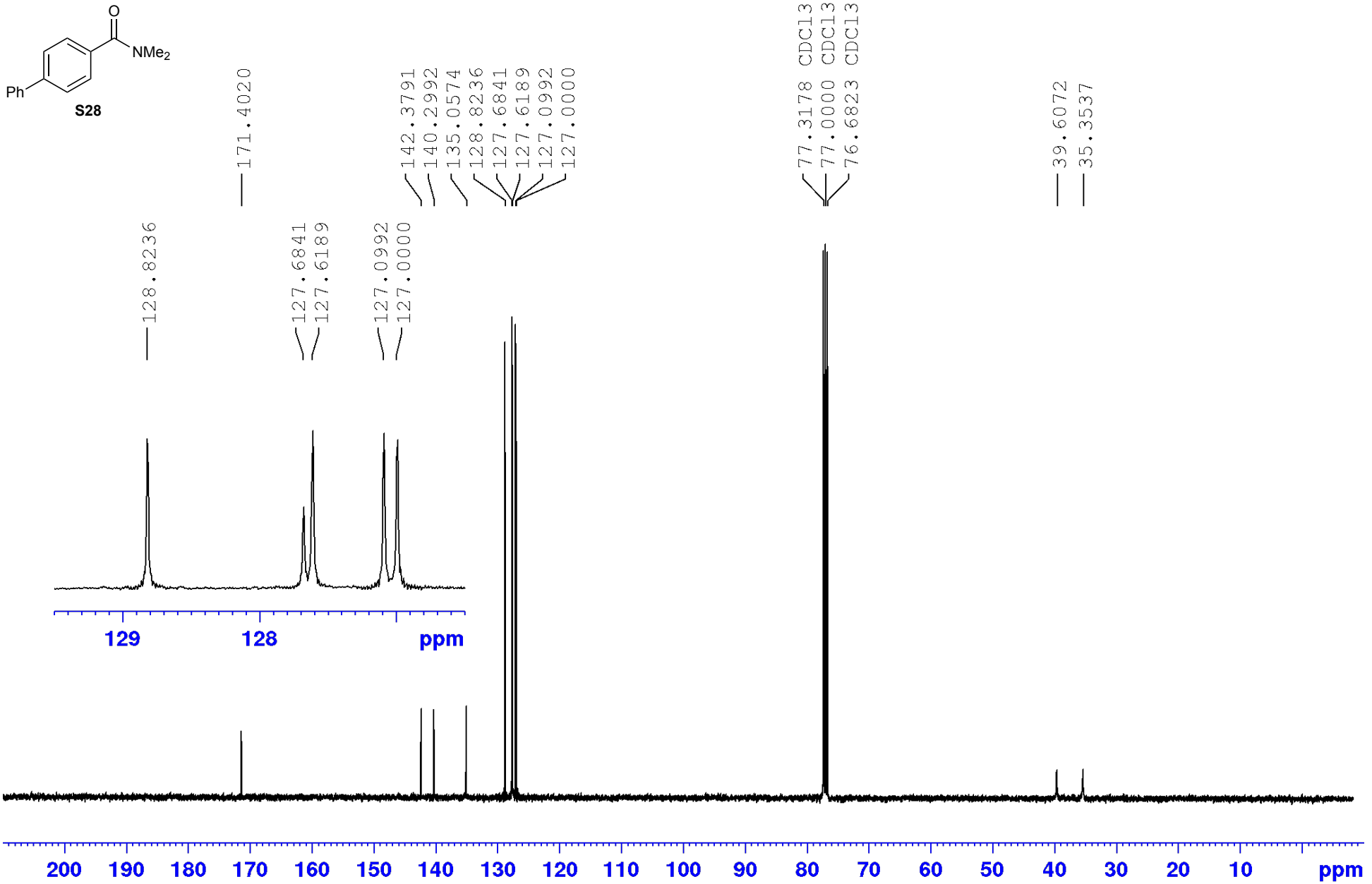


8.8 *N,N*-Dimethyl-[1,1'-biphenyl]-4-carboxamide (S28)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

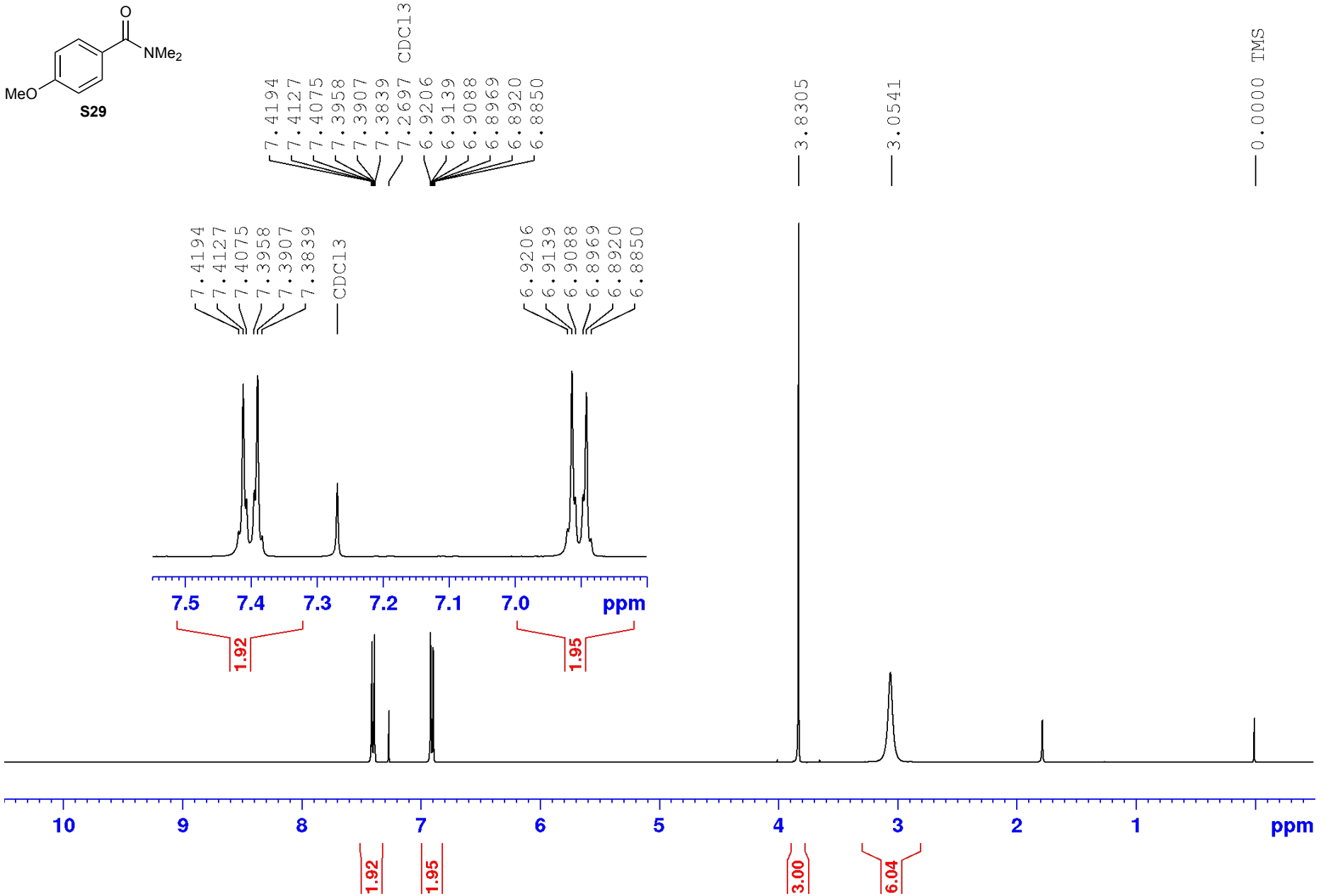


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

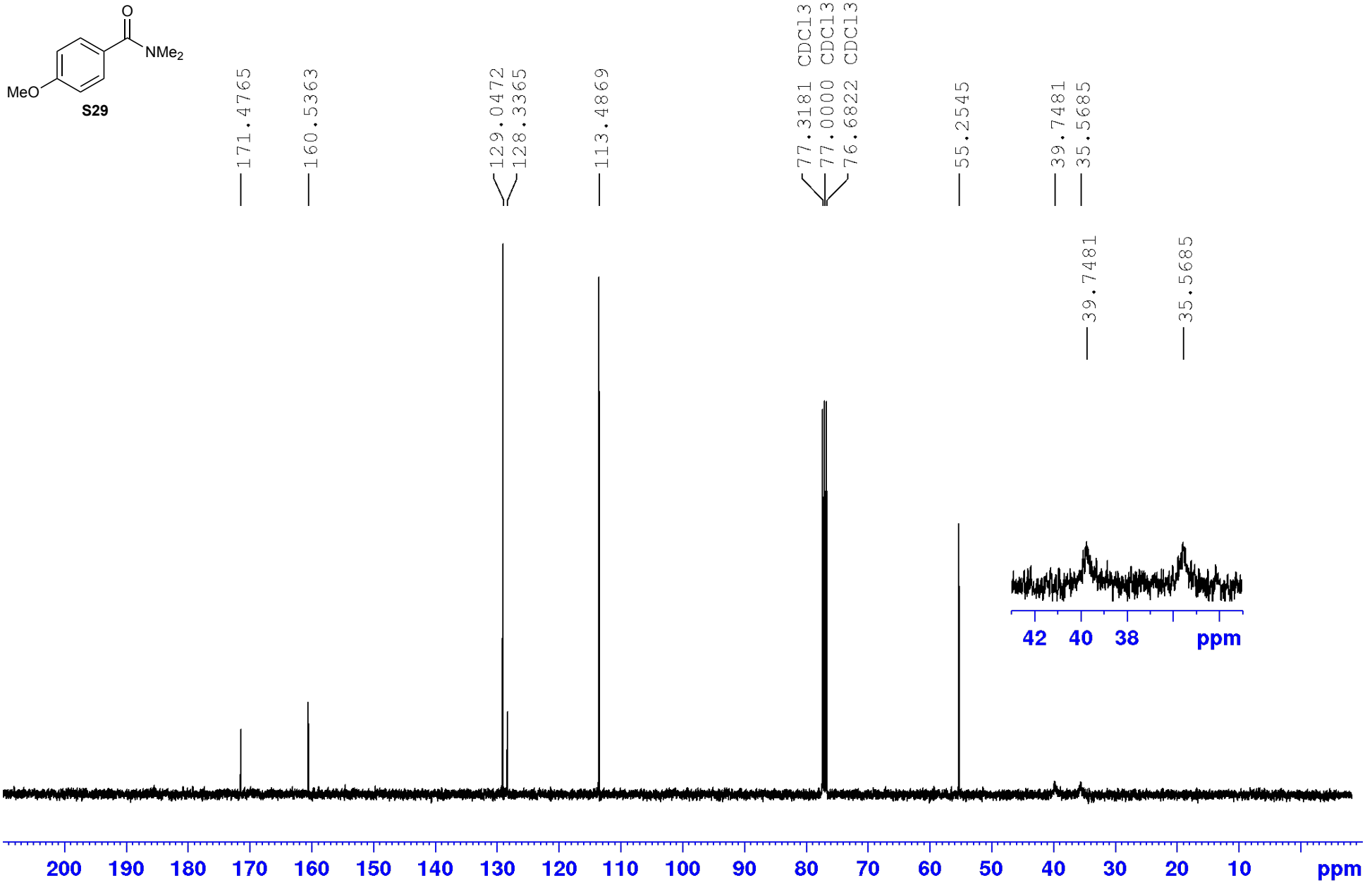


8.9 4-Methoxy-*N*,*N*-dimethylbenzamide (S29)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

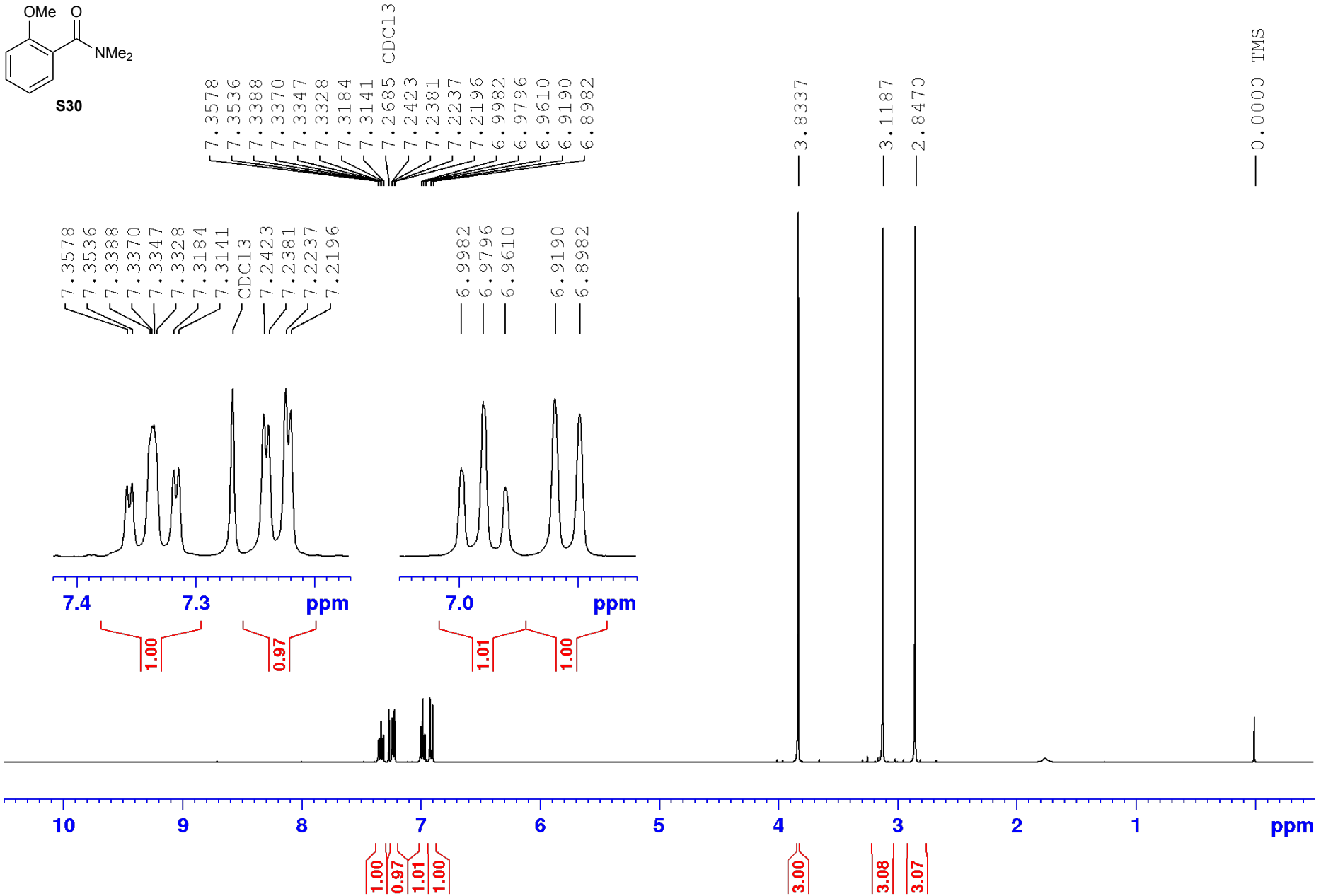


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

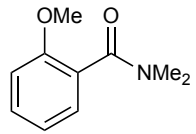


8.10 2-Methoxy-*N*,*N*-dimethylbenzamide (S30)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



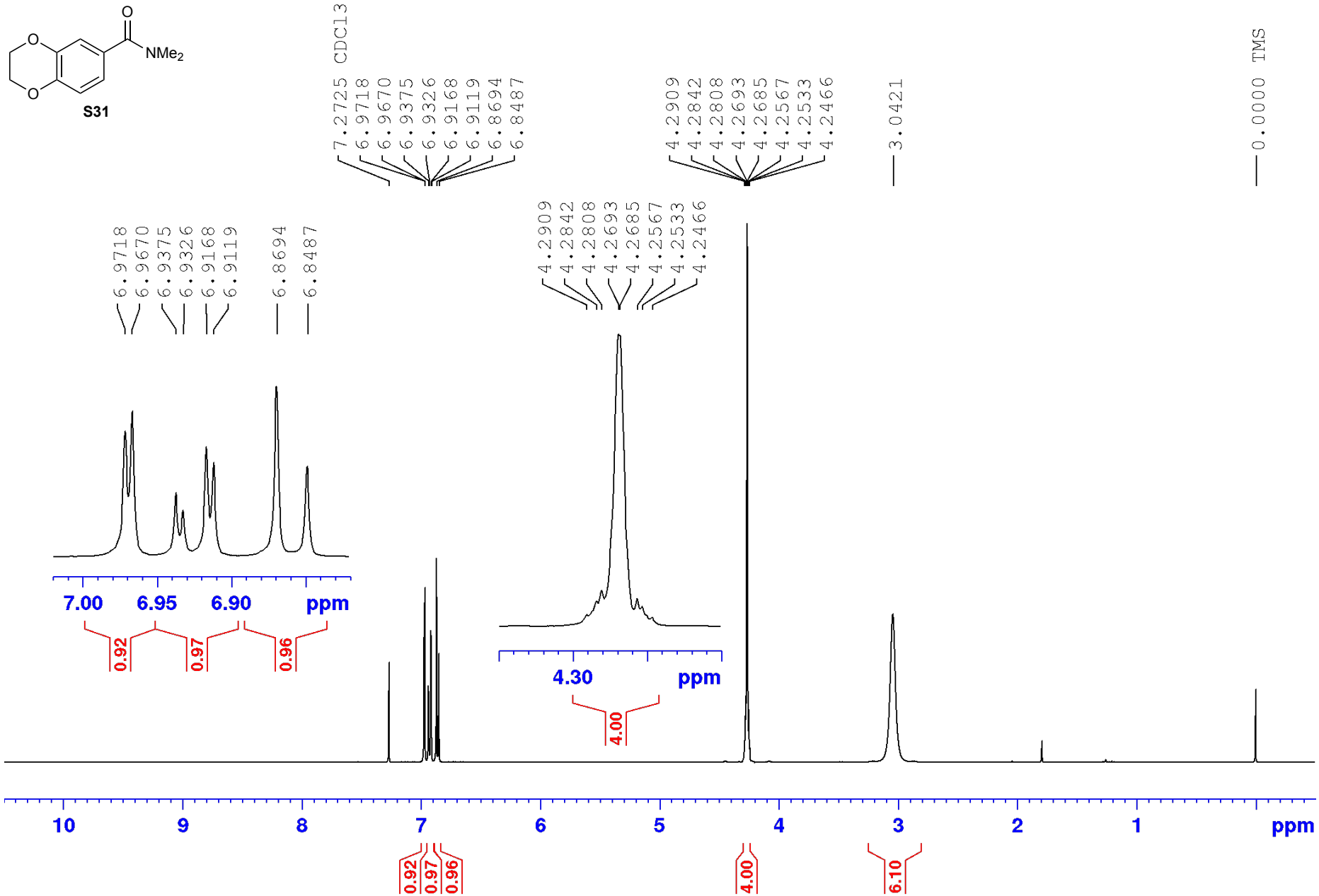
^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



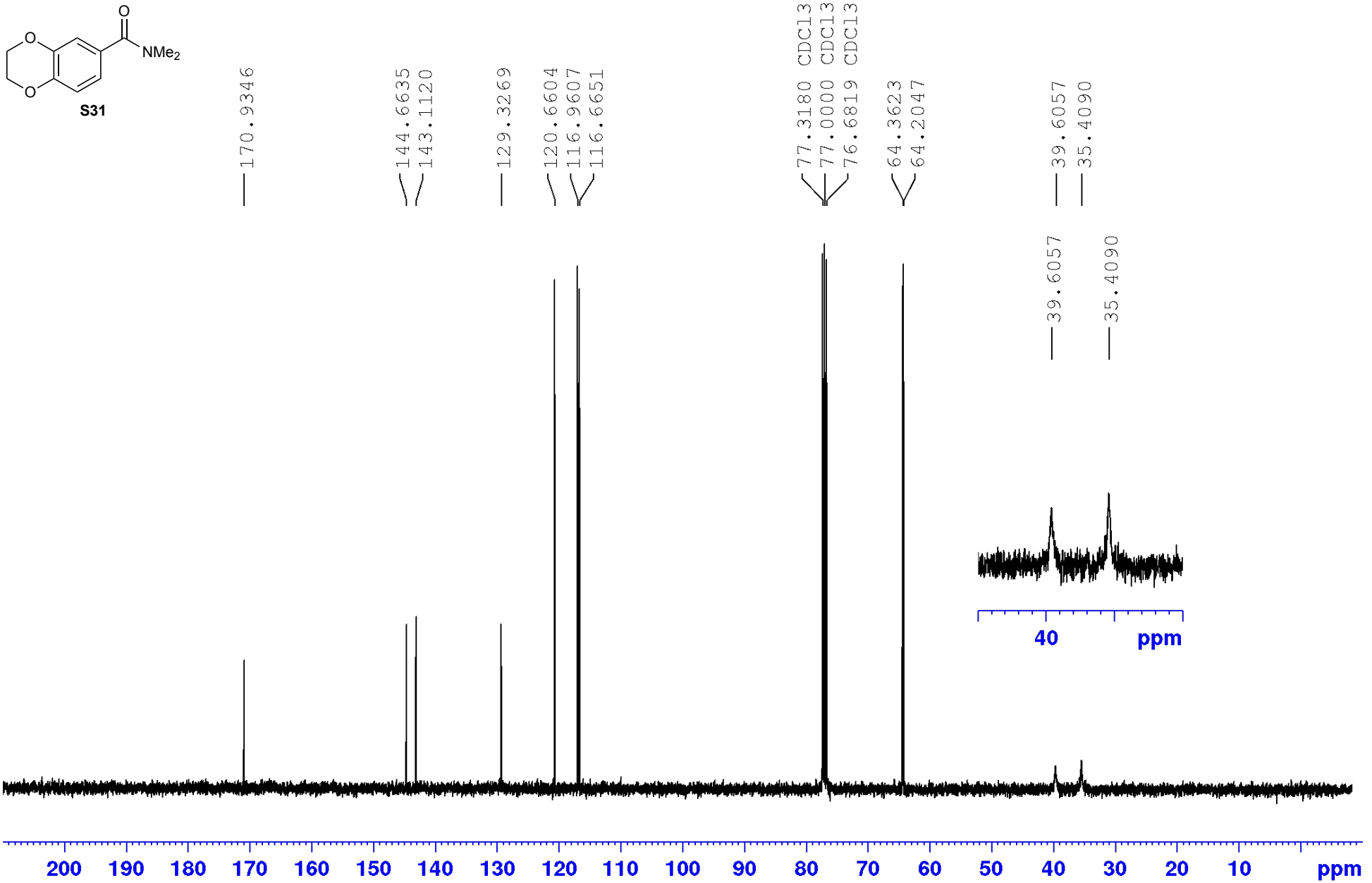
S30

8.11 *N,N*-dimethyl-2,3-dihydrobenzo[*b*][1,4]dioxine-6-carboxamide (S31)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

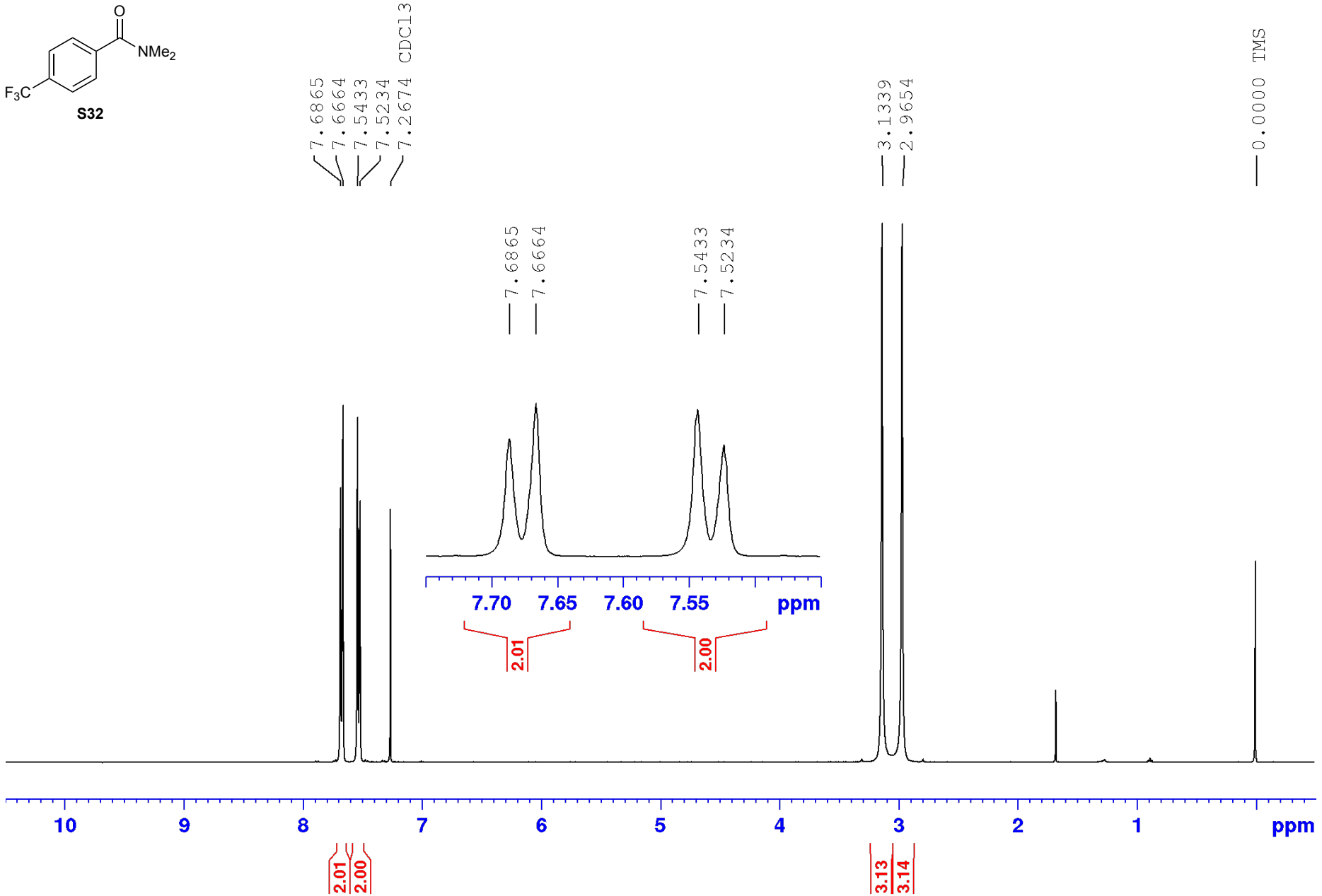


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

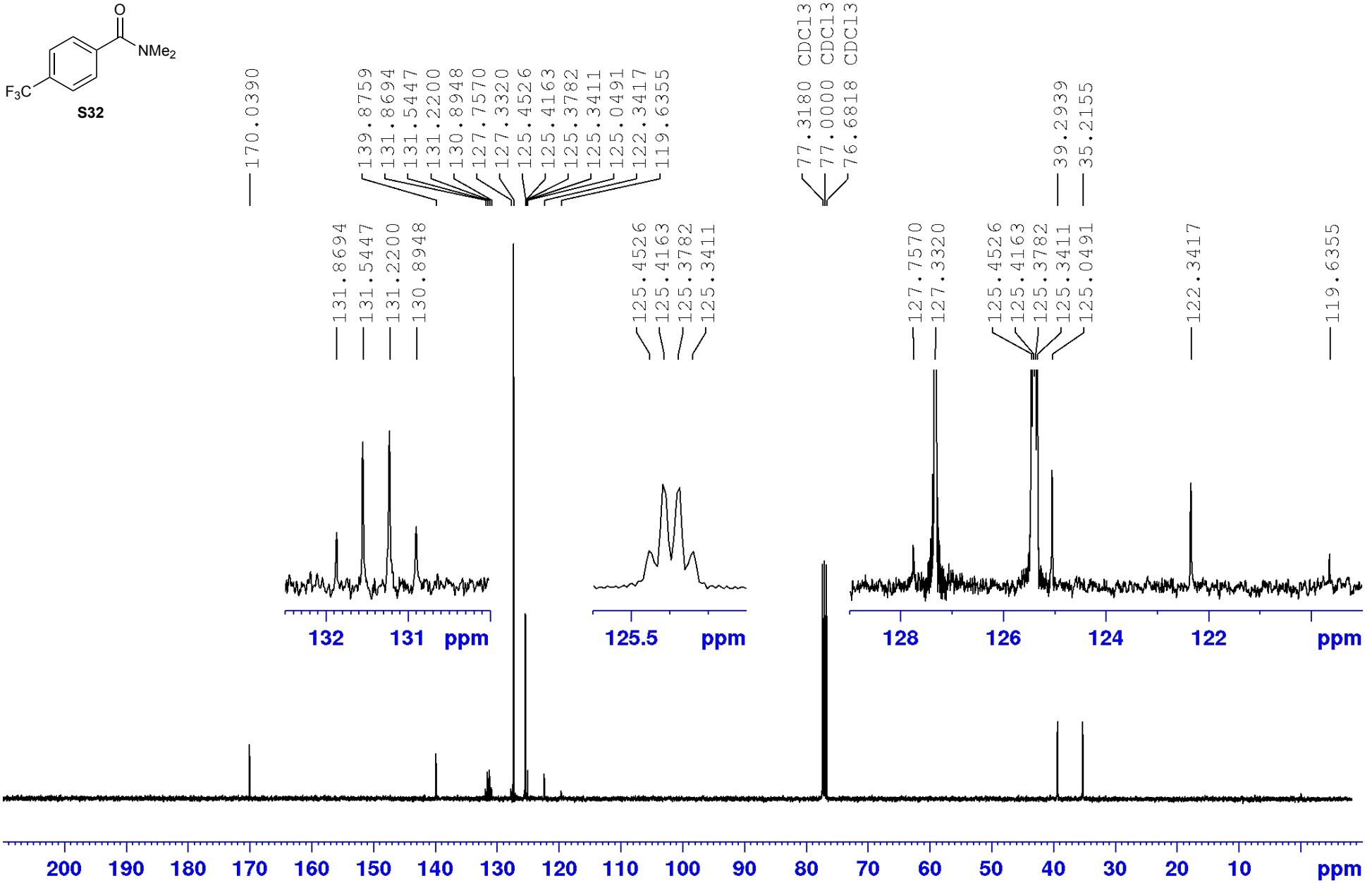


8.12 *N,N*-Dimethyl-4-(trifluoromethyl)benzamide (S32)

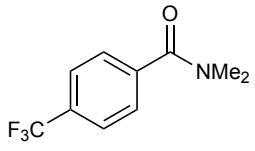
^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



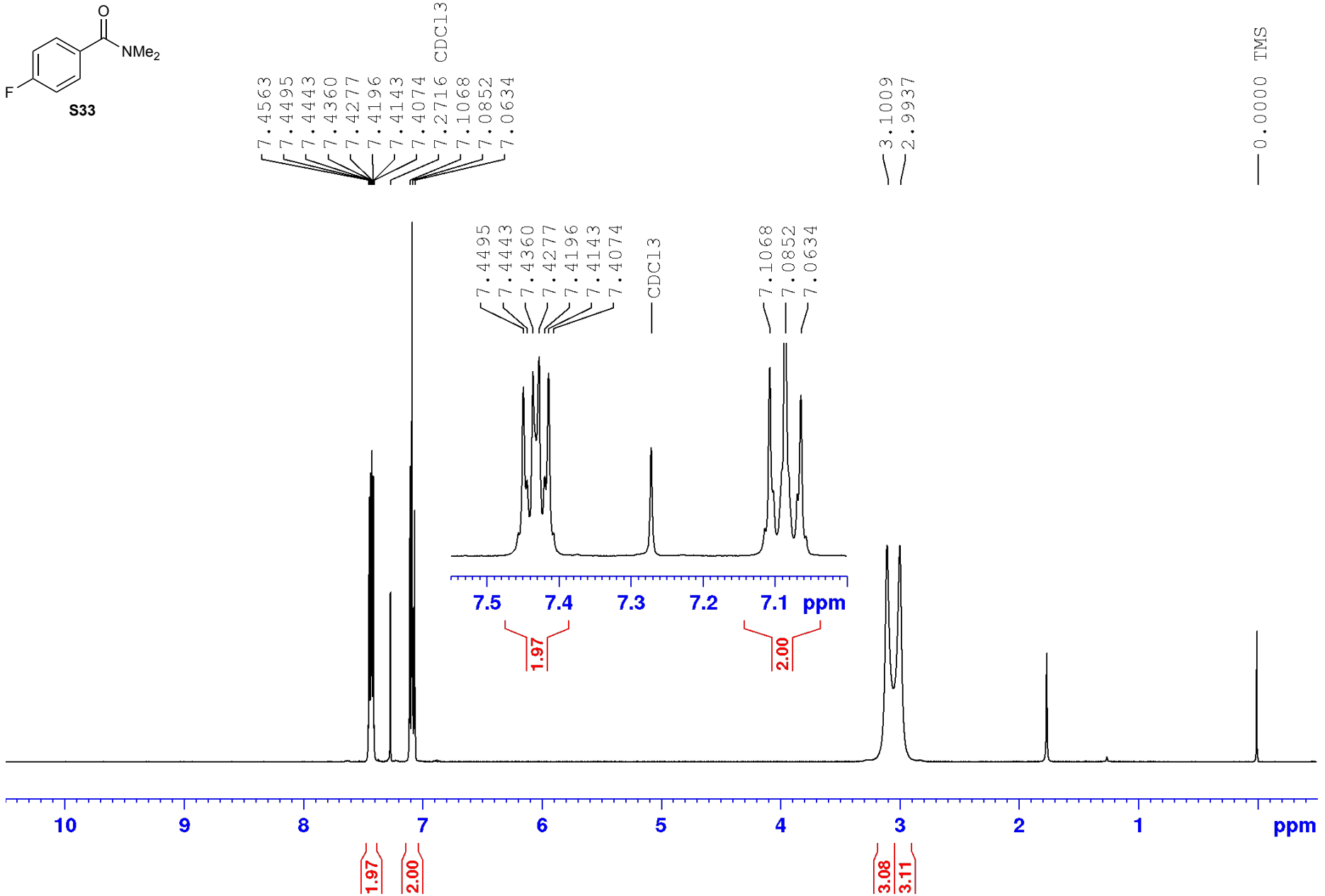
^{19}F NMR Spectrum (376 MHz on Bruker BBFO 400) in $CDCl_3$



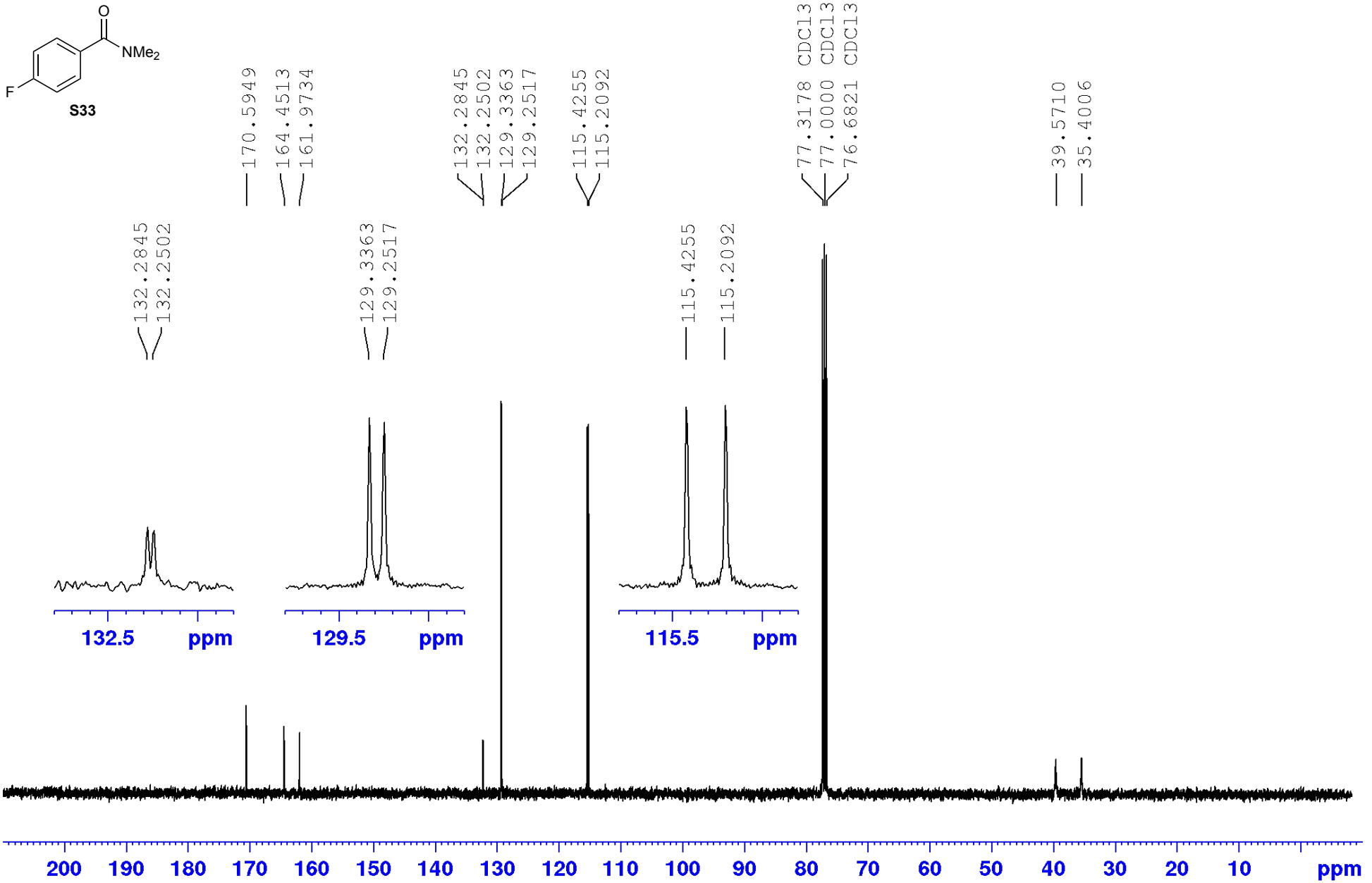
S32

8.13 4-Fluoro-*N*,*N*-dimethylbenzamide (S33)

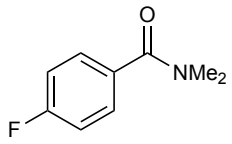
^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



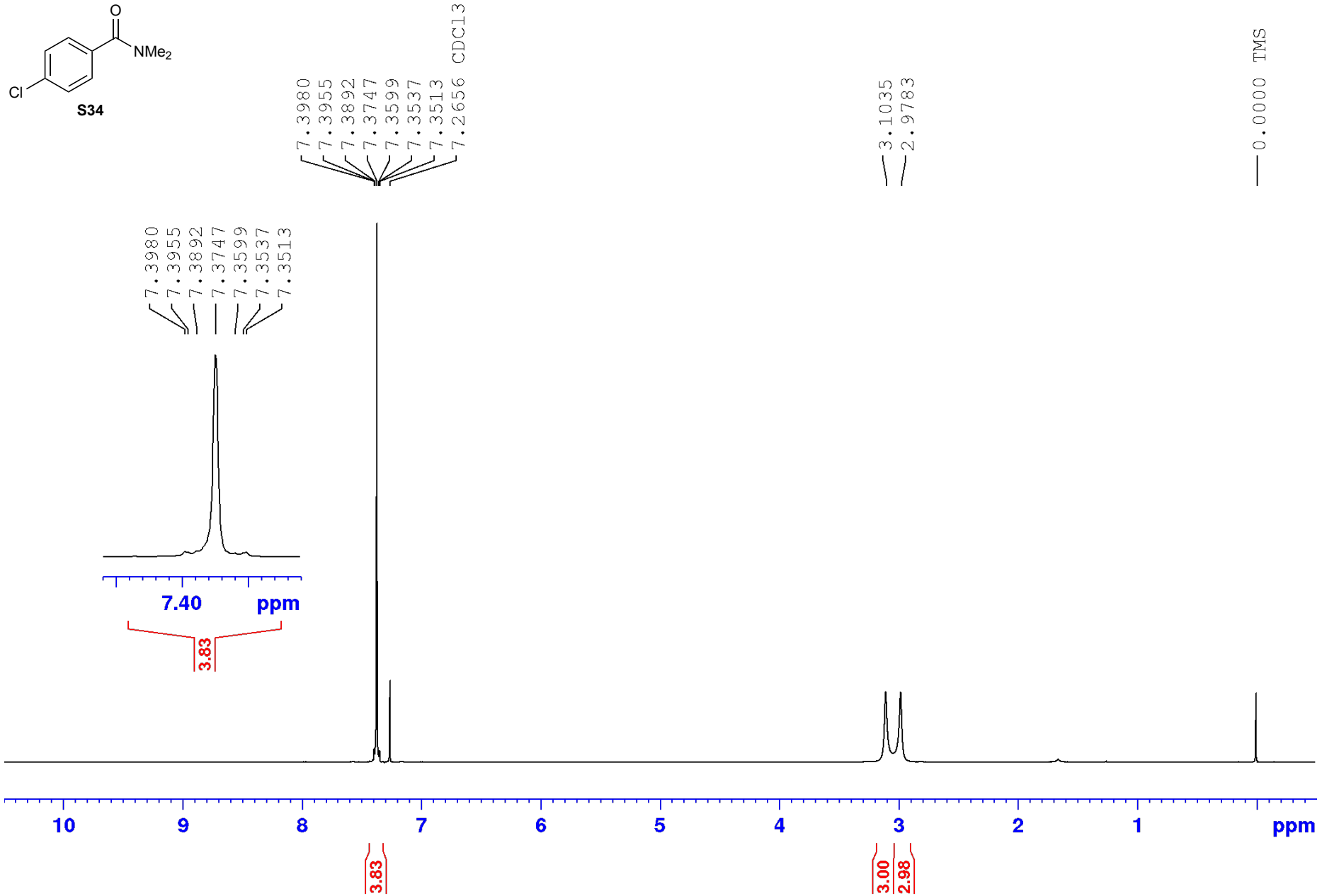
^{19}F NMR Spectrum (376 MHz on Bruker BBFO 400) in $CDCl_3$



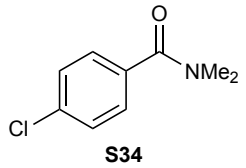
S33

8.14 4-Chloro-*N*,*N*-dimethylbenzamide (S34)

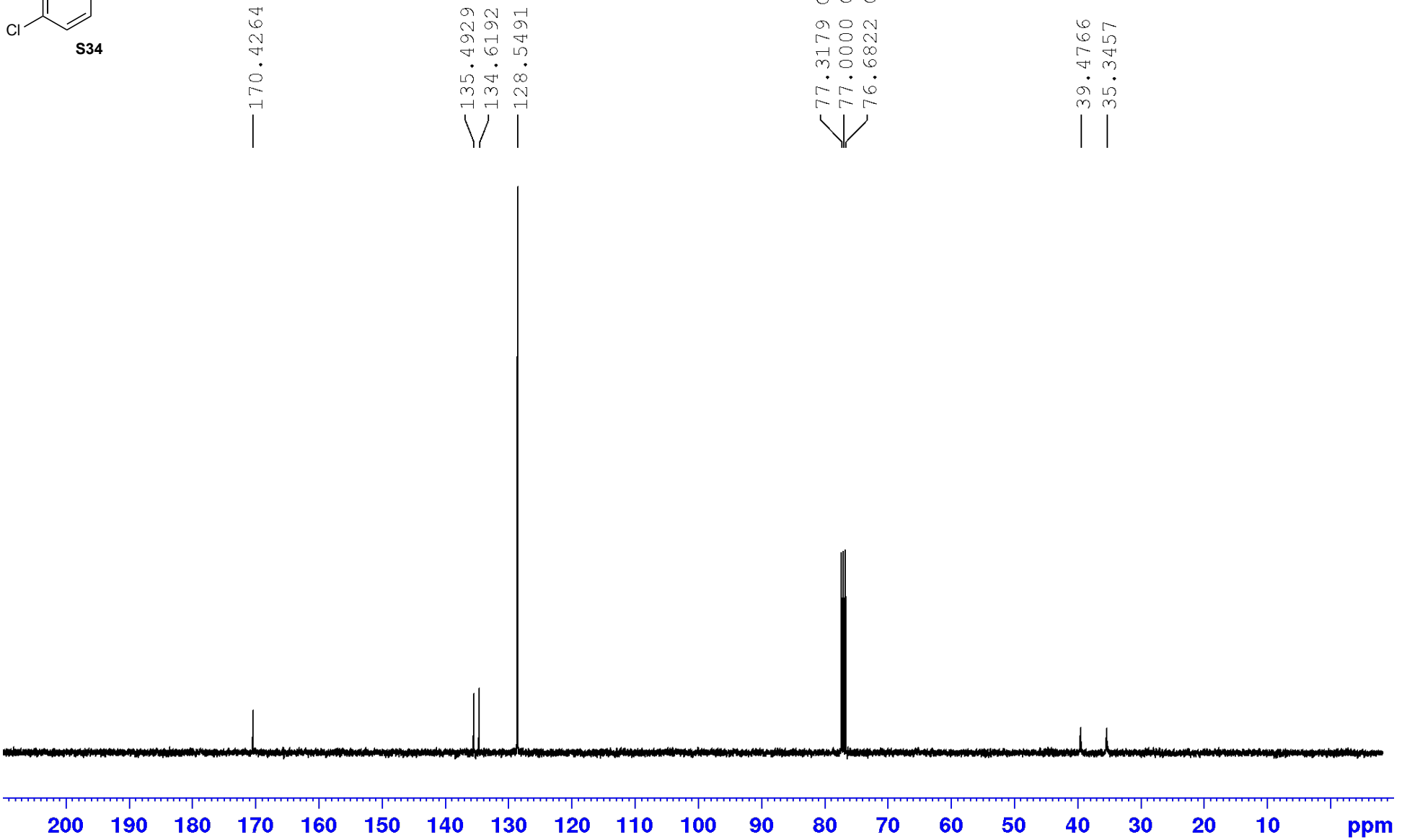
^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

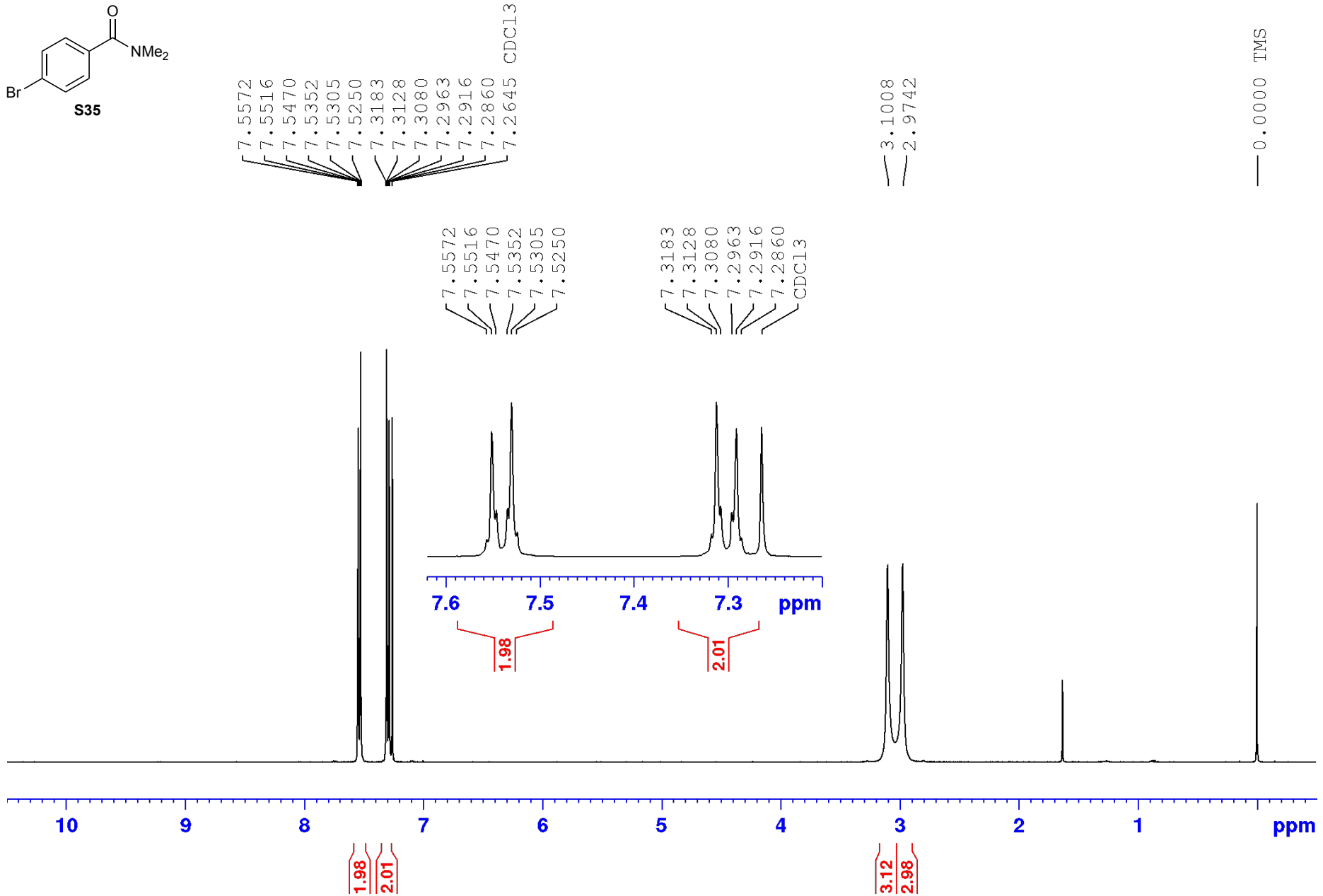


S34

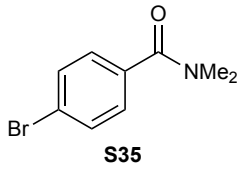


8.15 4-Bromo-*N*,*N*-dimethylbenzamide (S35)

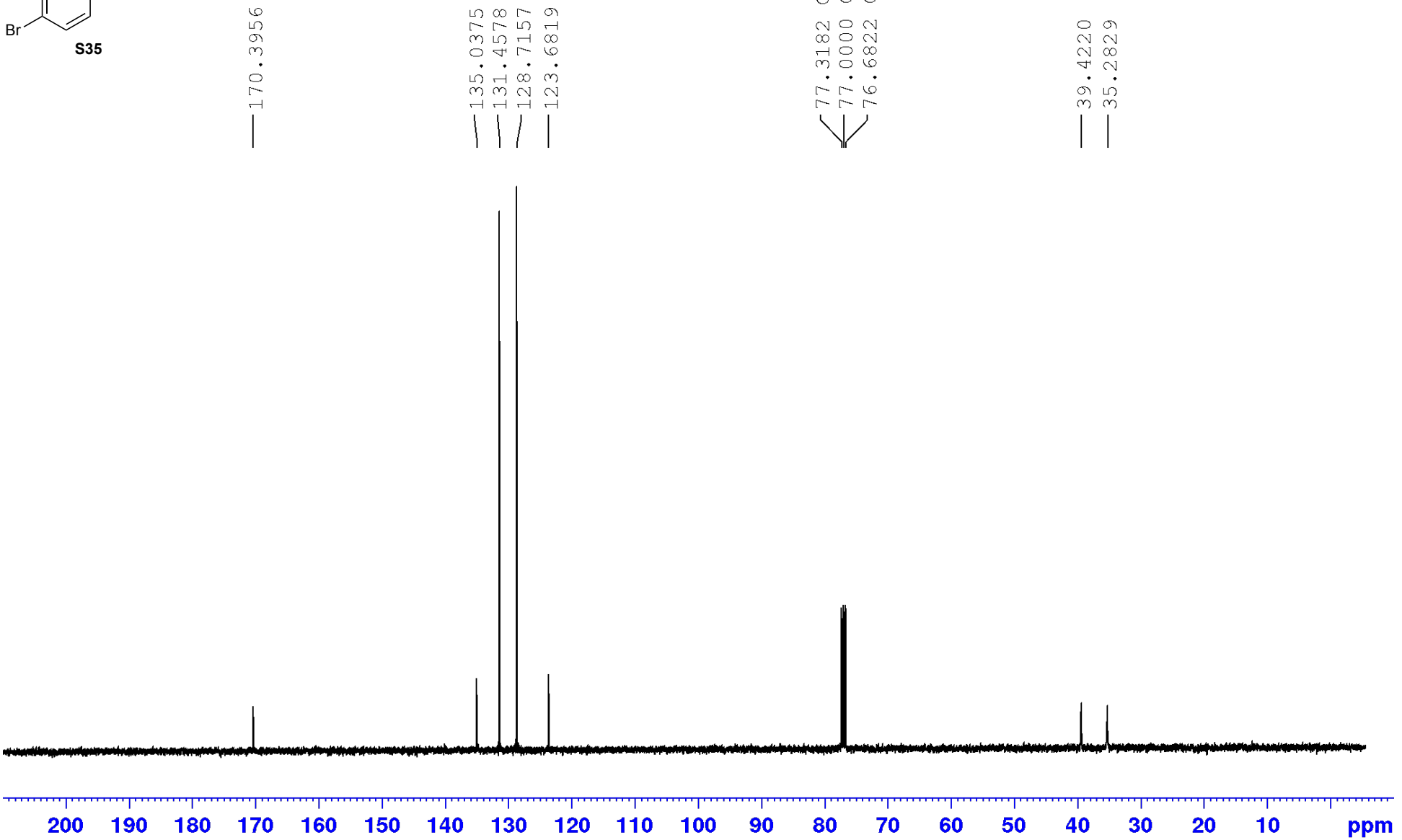
^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

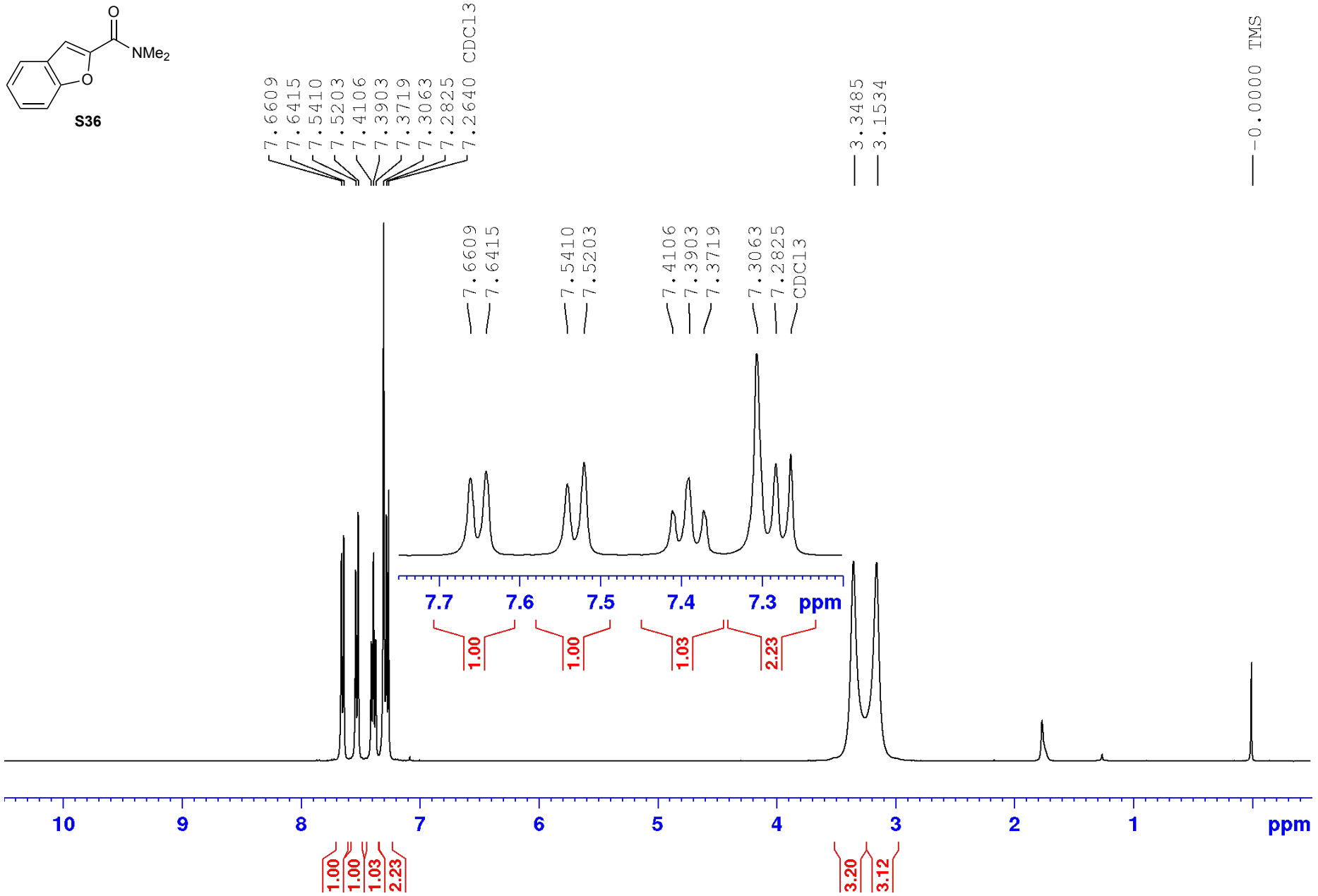


S35

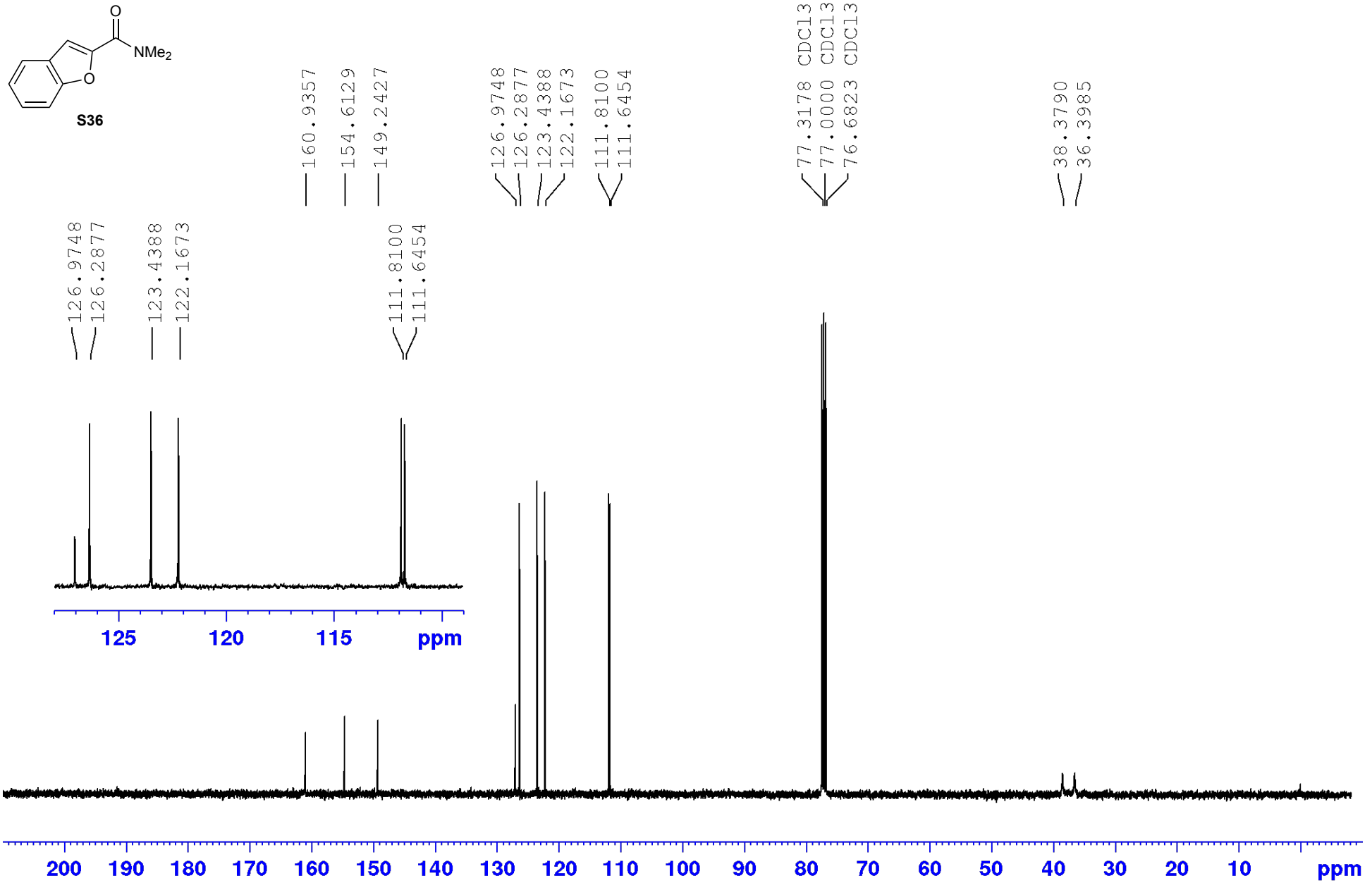


8.16 *N,N*-Dimethylbenzofuran-2-carboxamide (S36)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

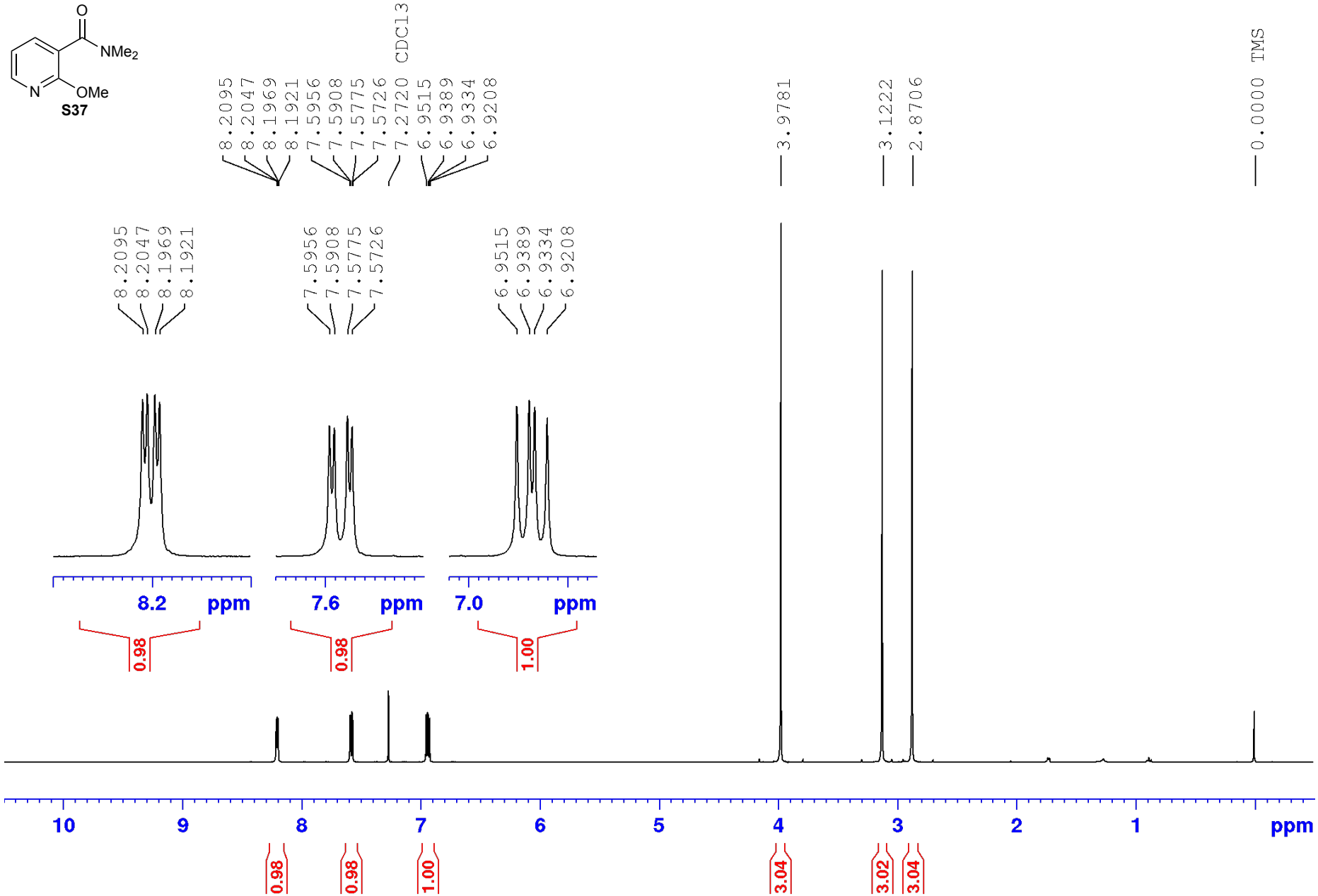


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

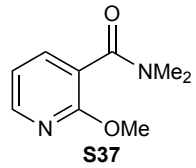


8.17 2-Methoxy-*N*,*N*-dimethylnicotinamide (S37)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



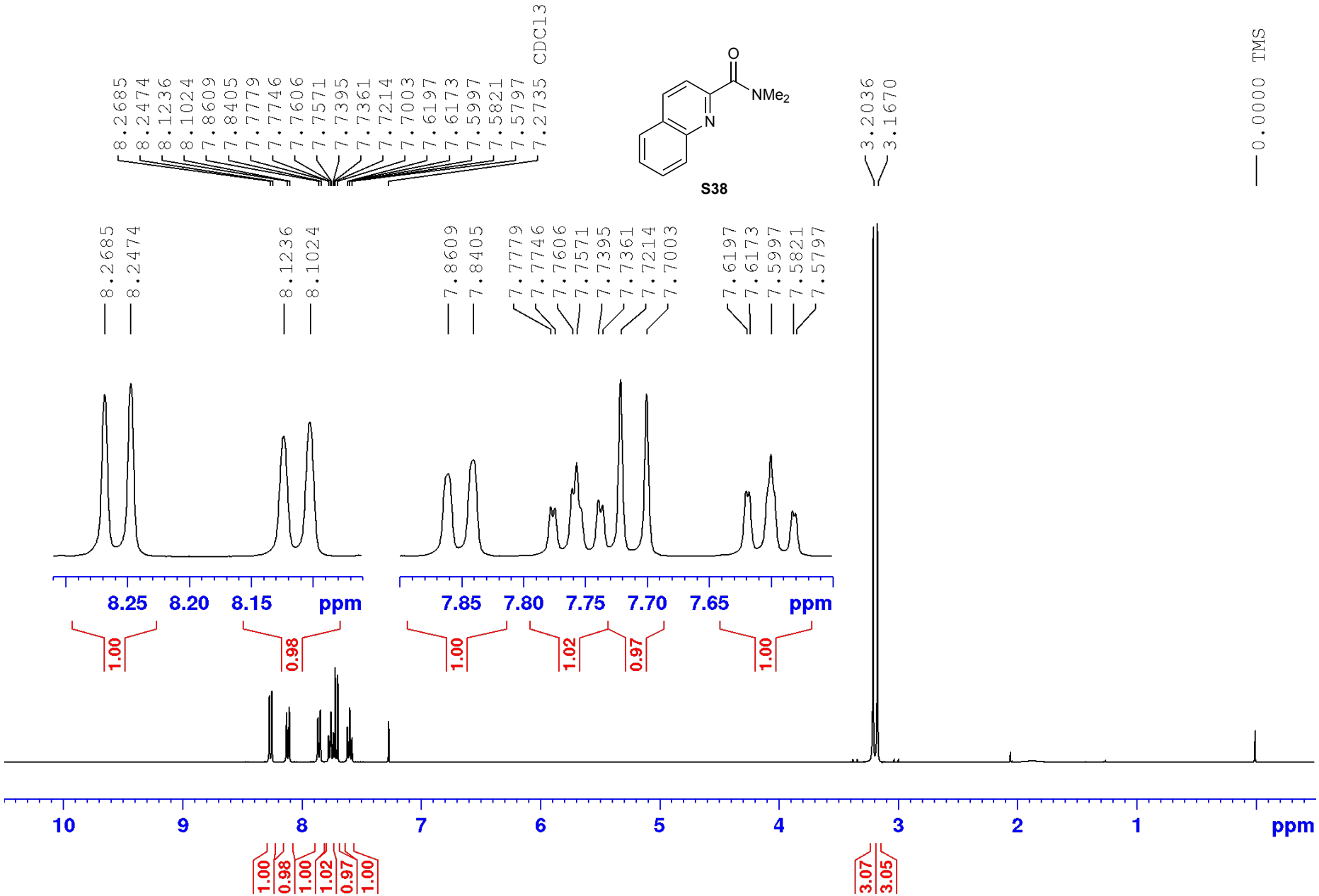
^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



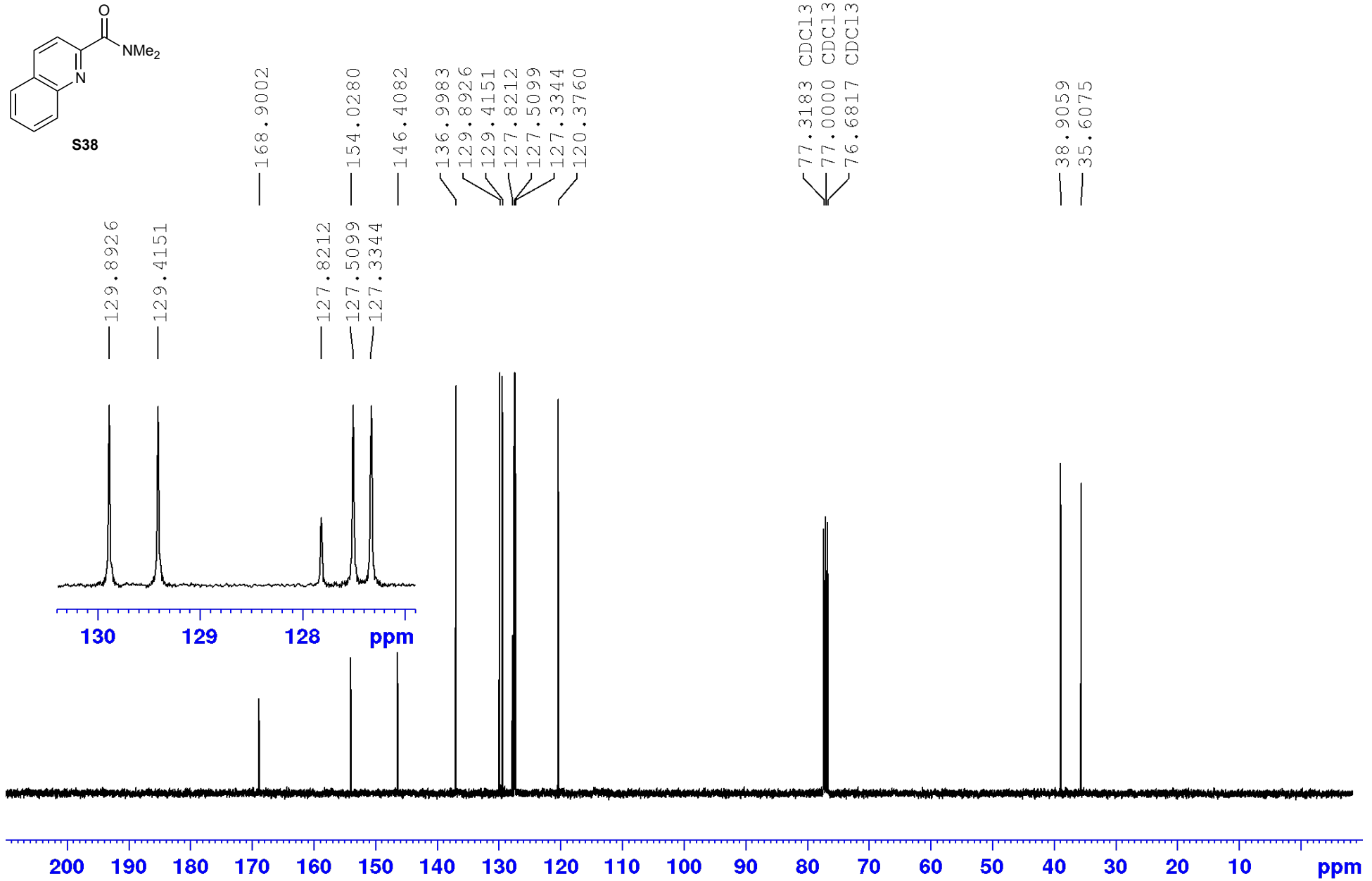
S37

8.18 *N,N*-Dimethylquinoline-2-carboxamide (S38)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

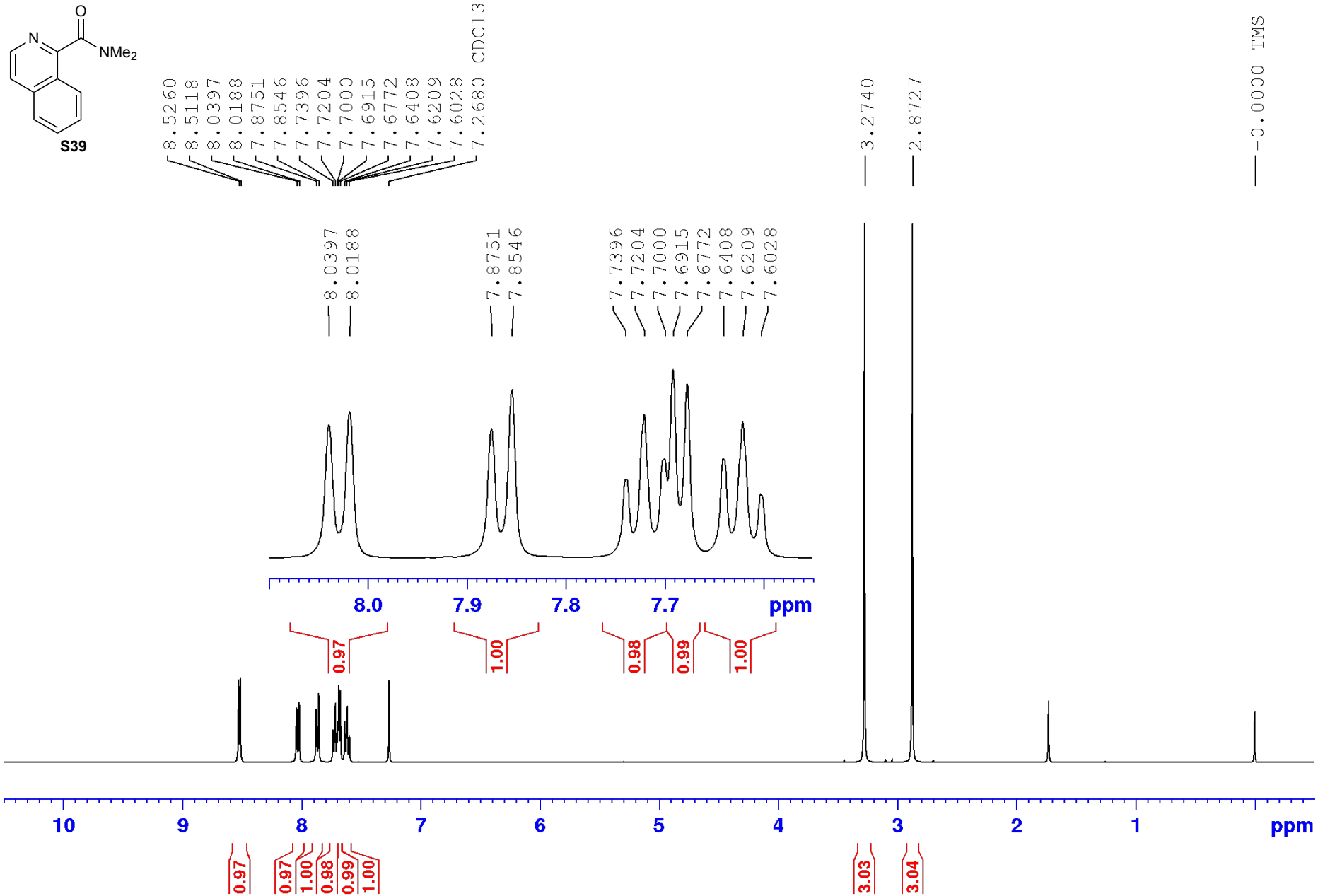


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

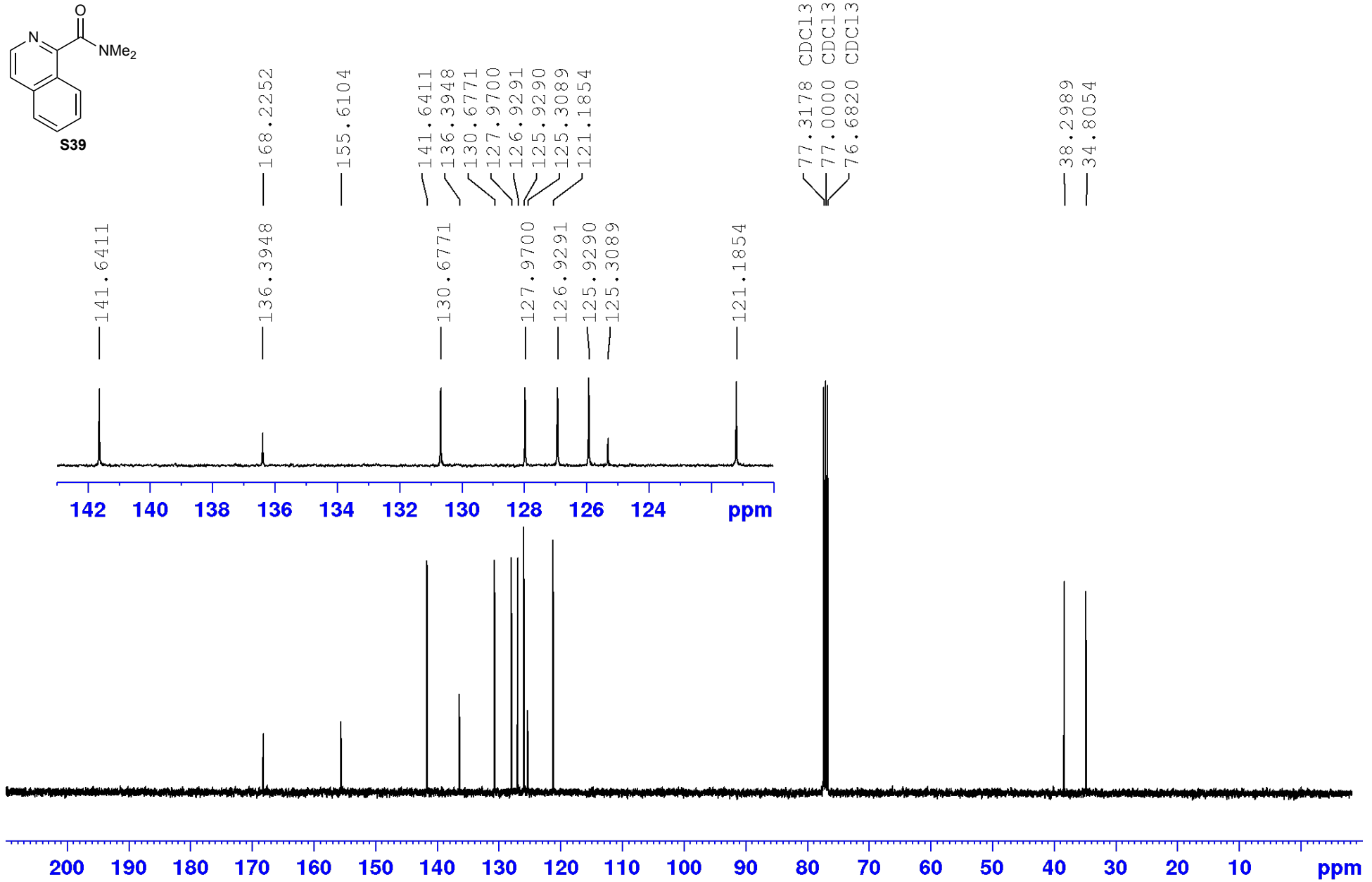


8.19 *N,N*-Dimethylisoquinoline-1-carboxamide (S39)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

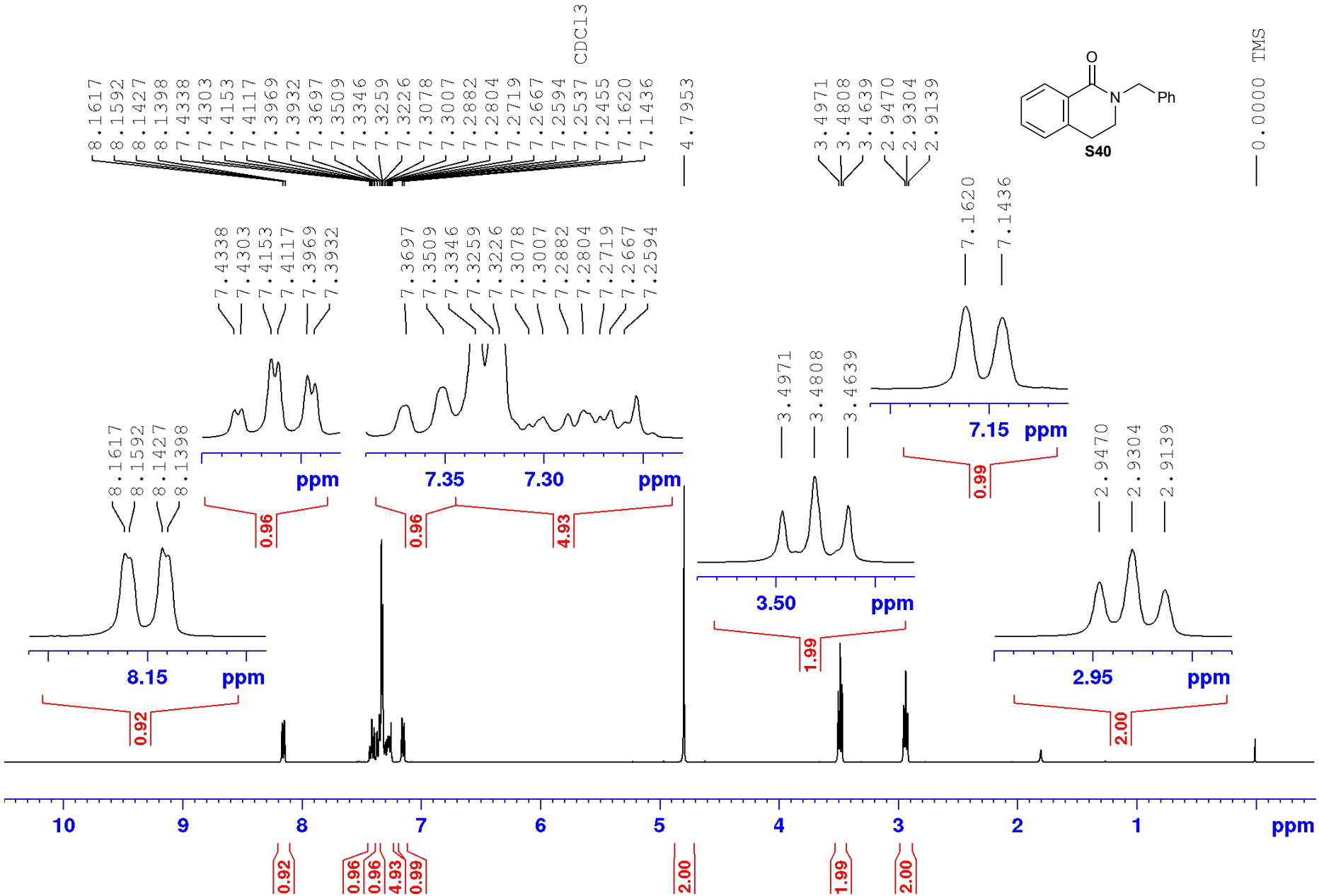


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

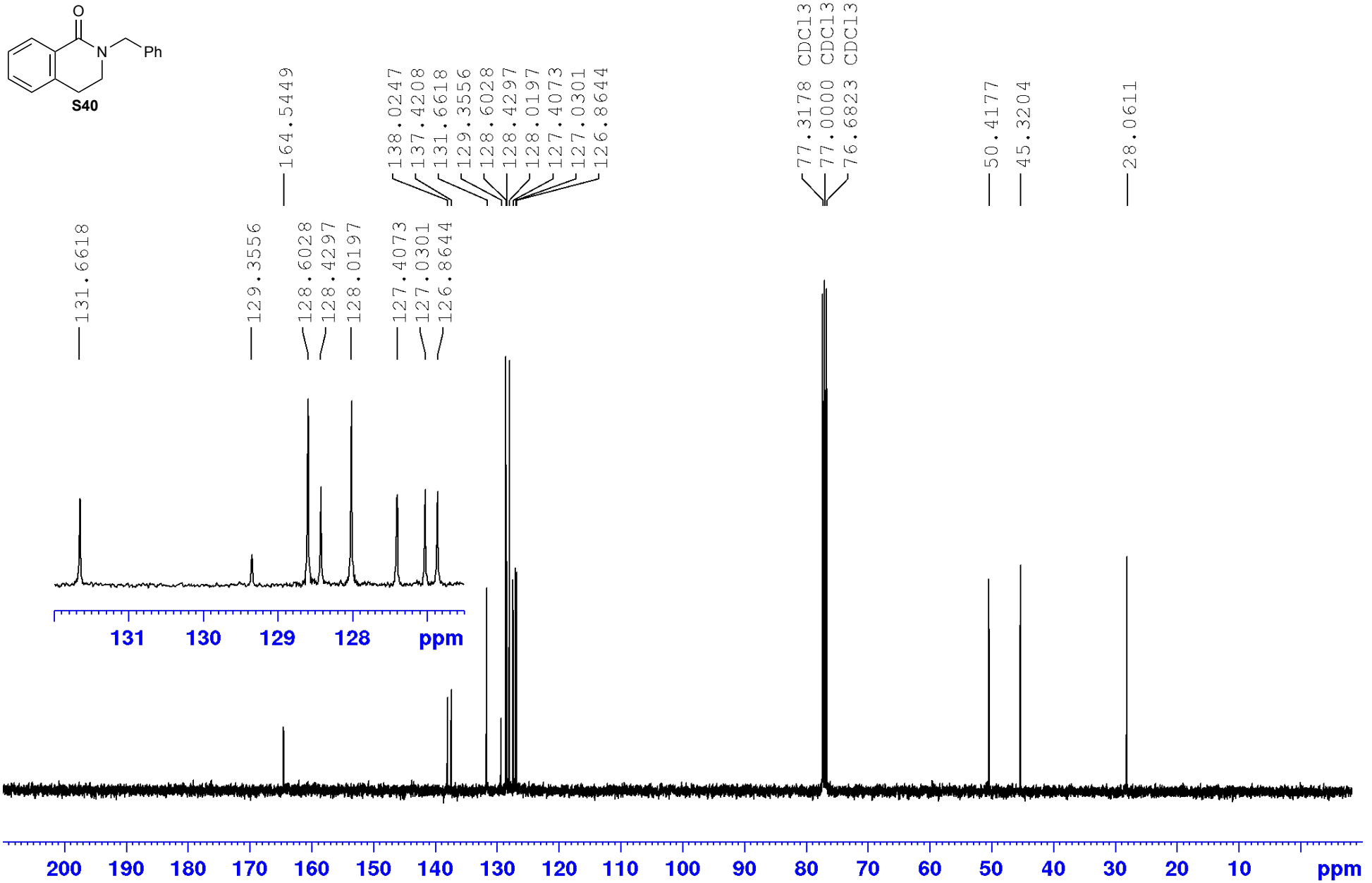


8.20 2-Benzyl-3,4-dihydroisoquinolin-1(2*H*)-one (S40)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

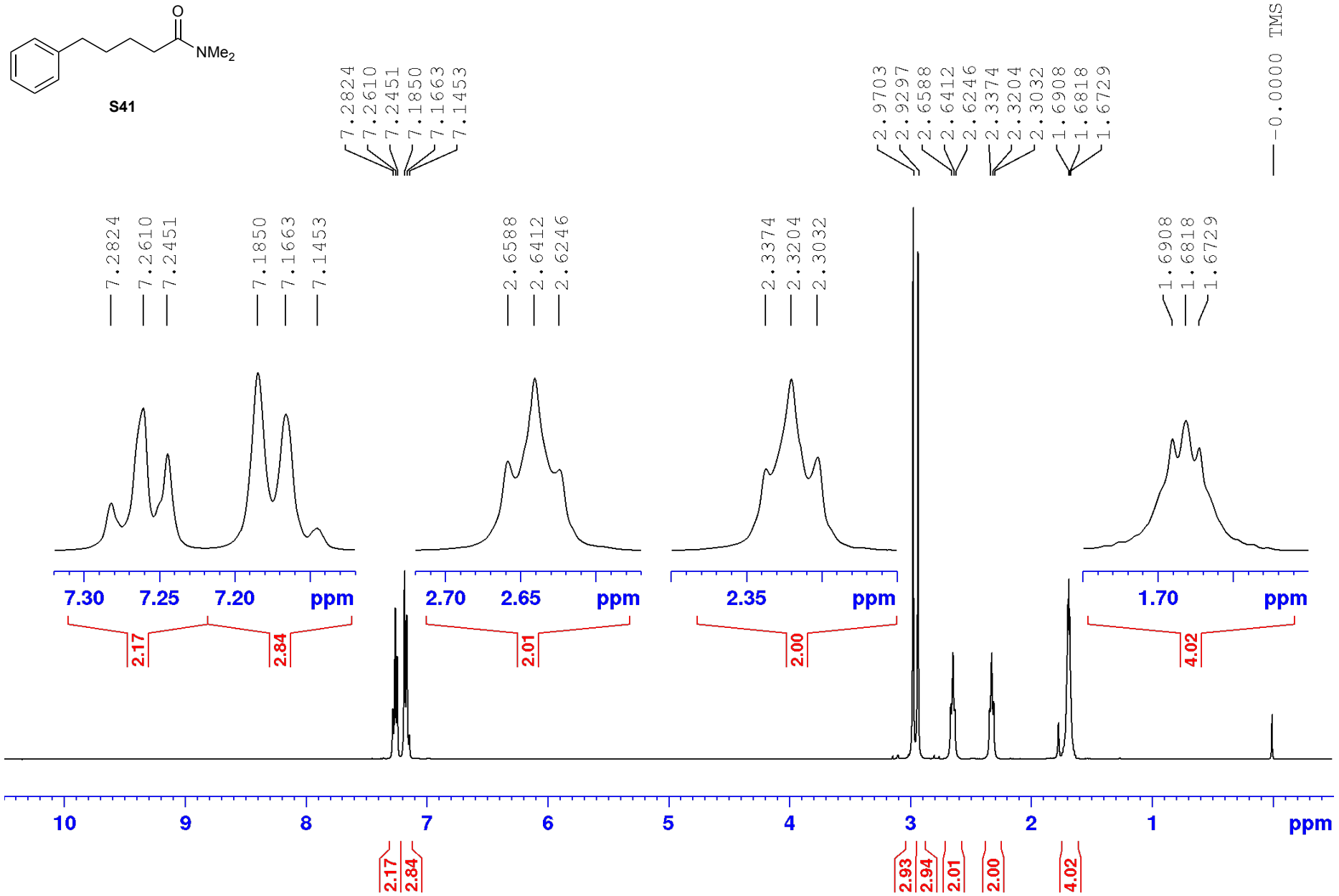


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

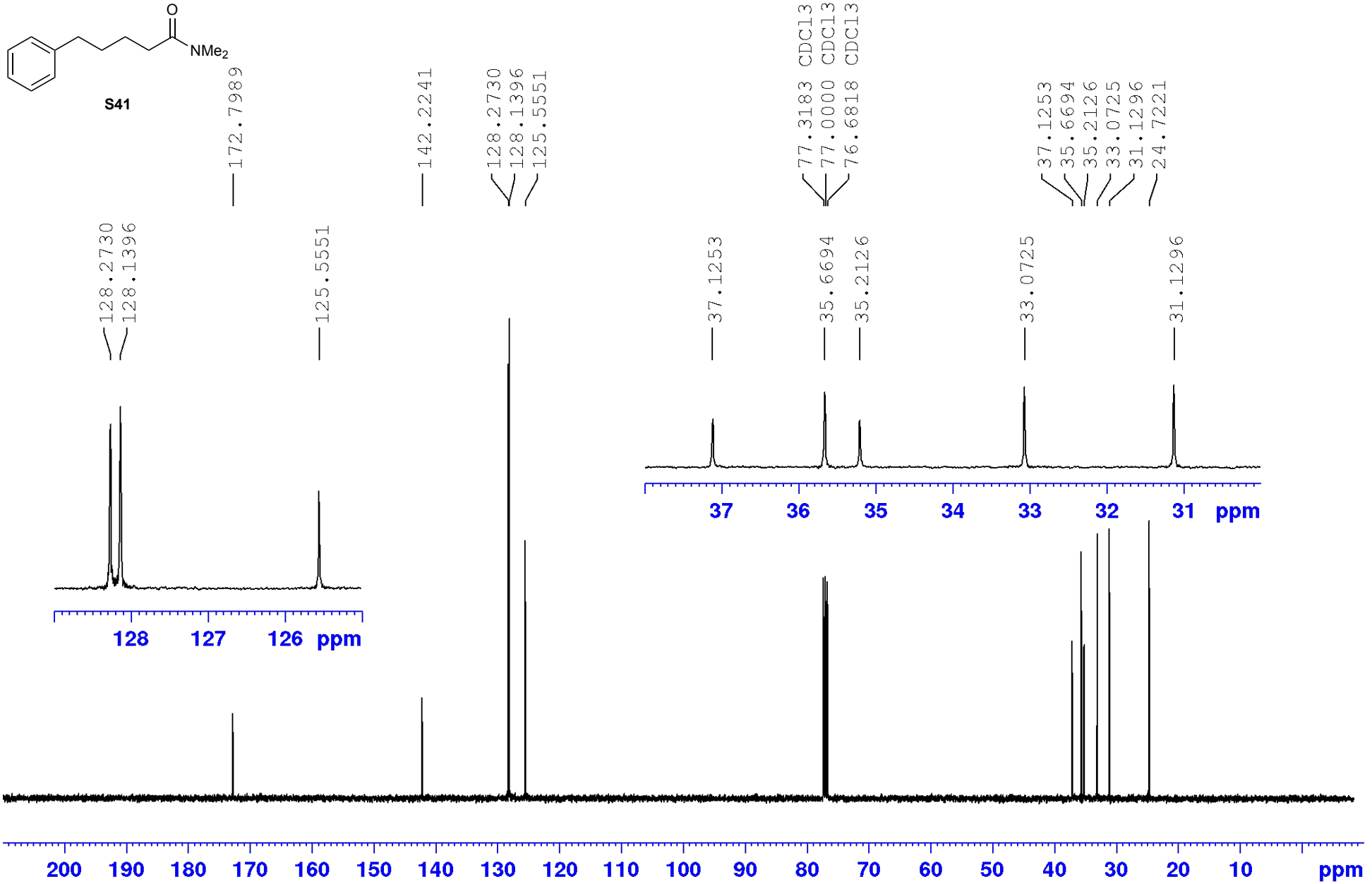


8.21 *N,N*-Dimethyl-5-phenylpentanamide (S41)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

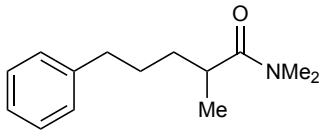


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

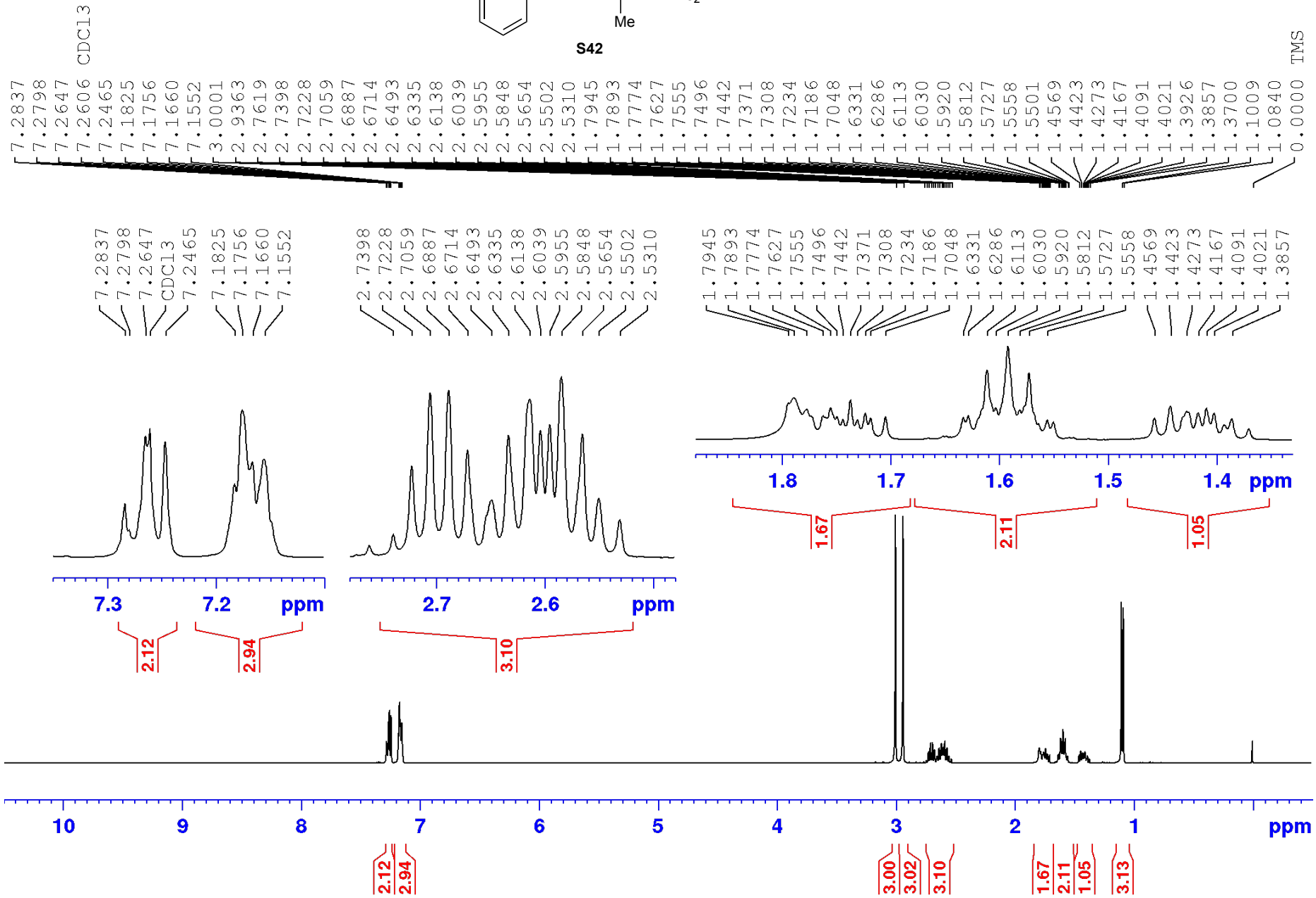


8.22 *N,N*,2-trimethyl-5-phenylpentanamide (S42)

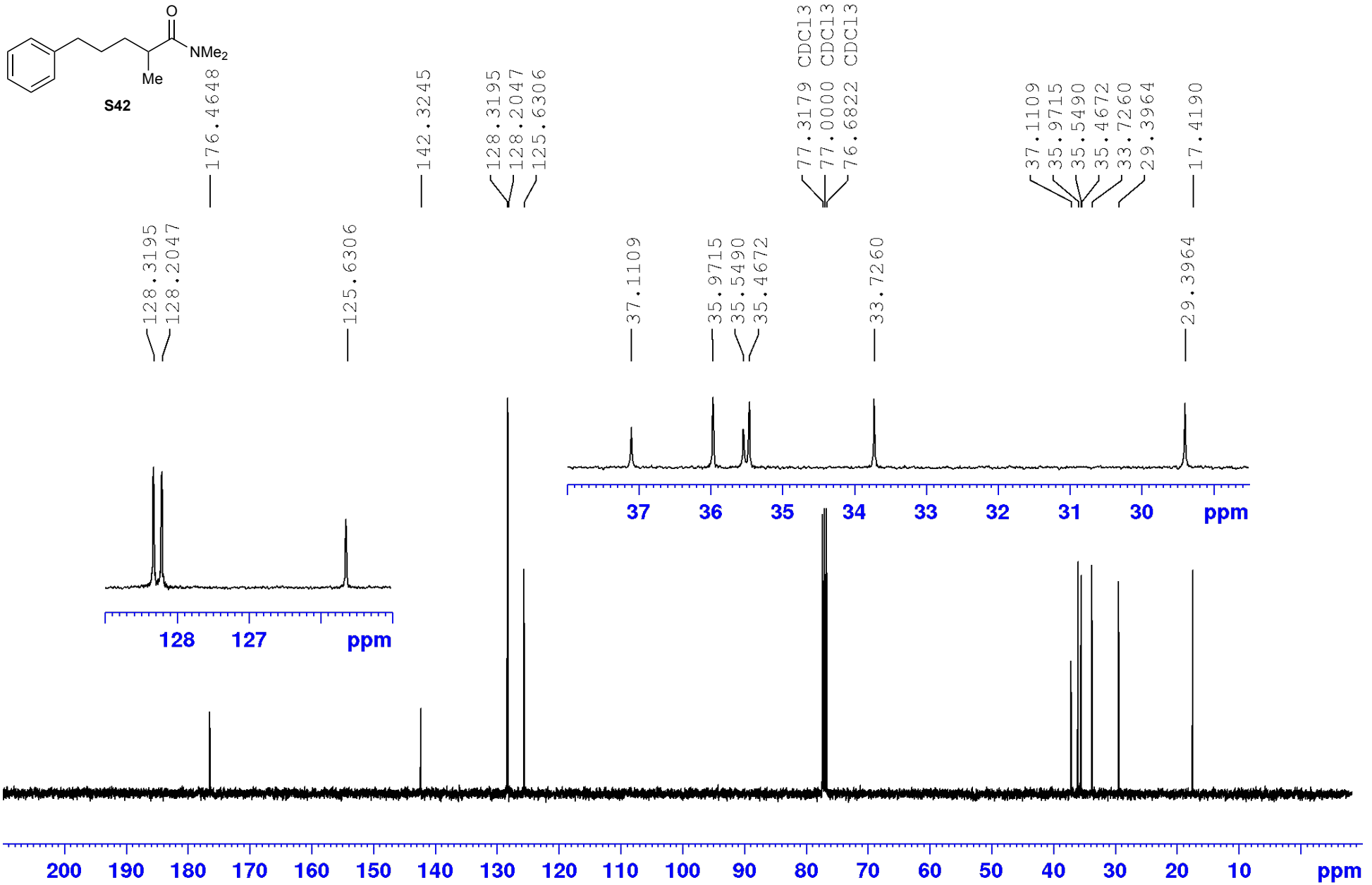
^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



S42

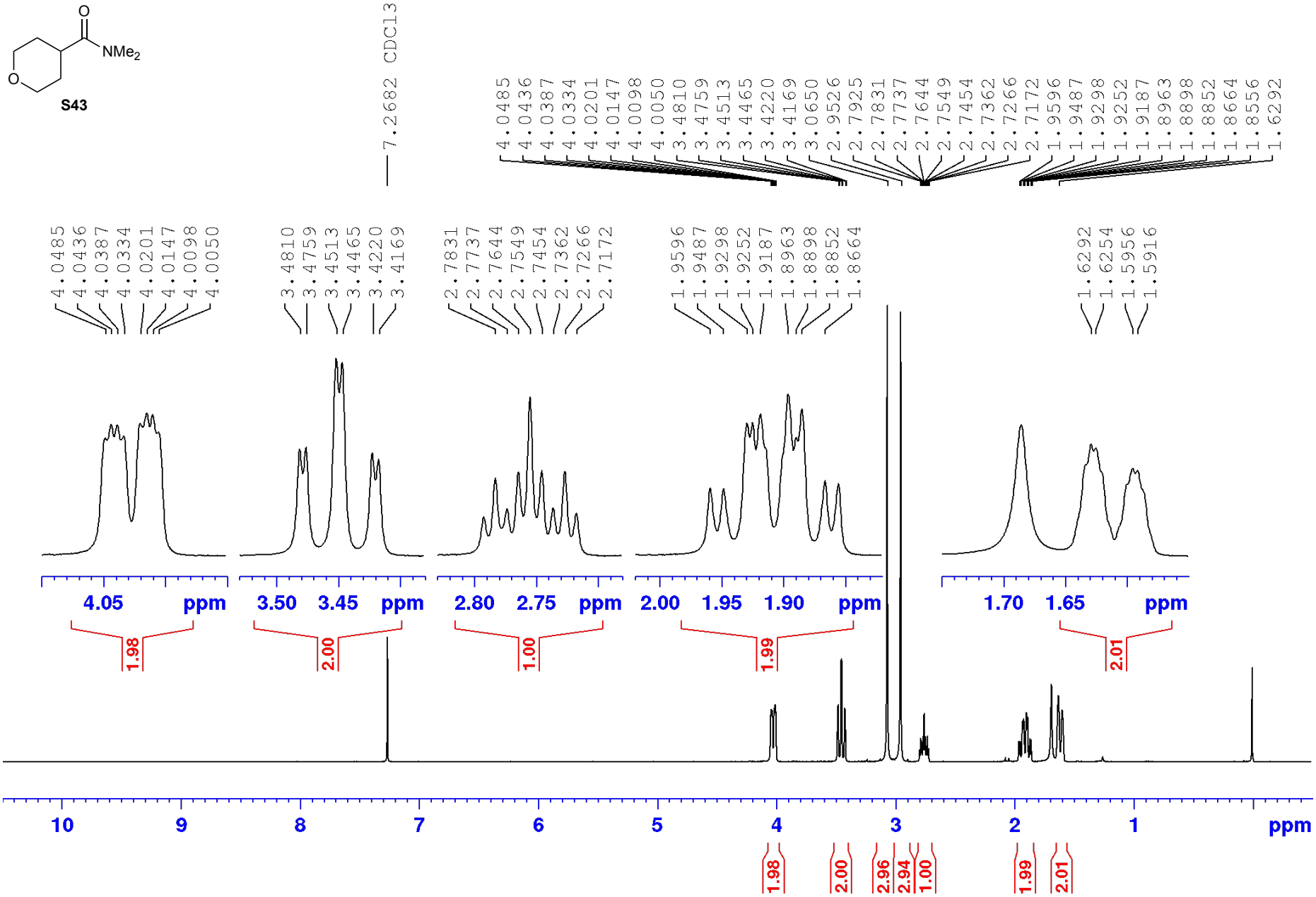


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

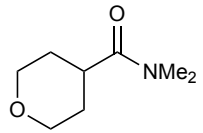


8.23 *N,N*-dimethyltetrahydro-2H-pyran-4-carboxamide (S43)

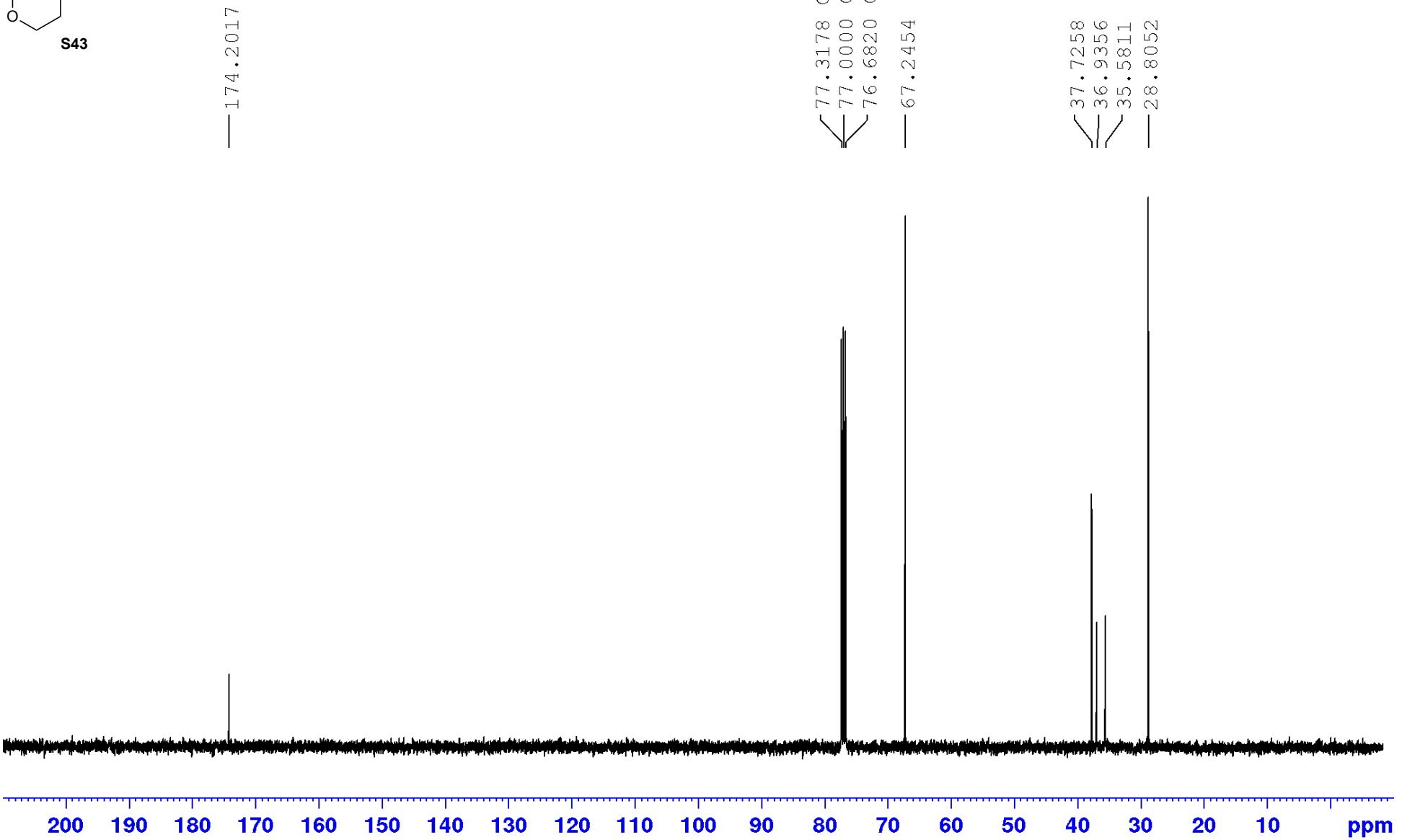
^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

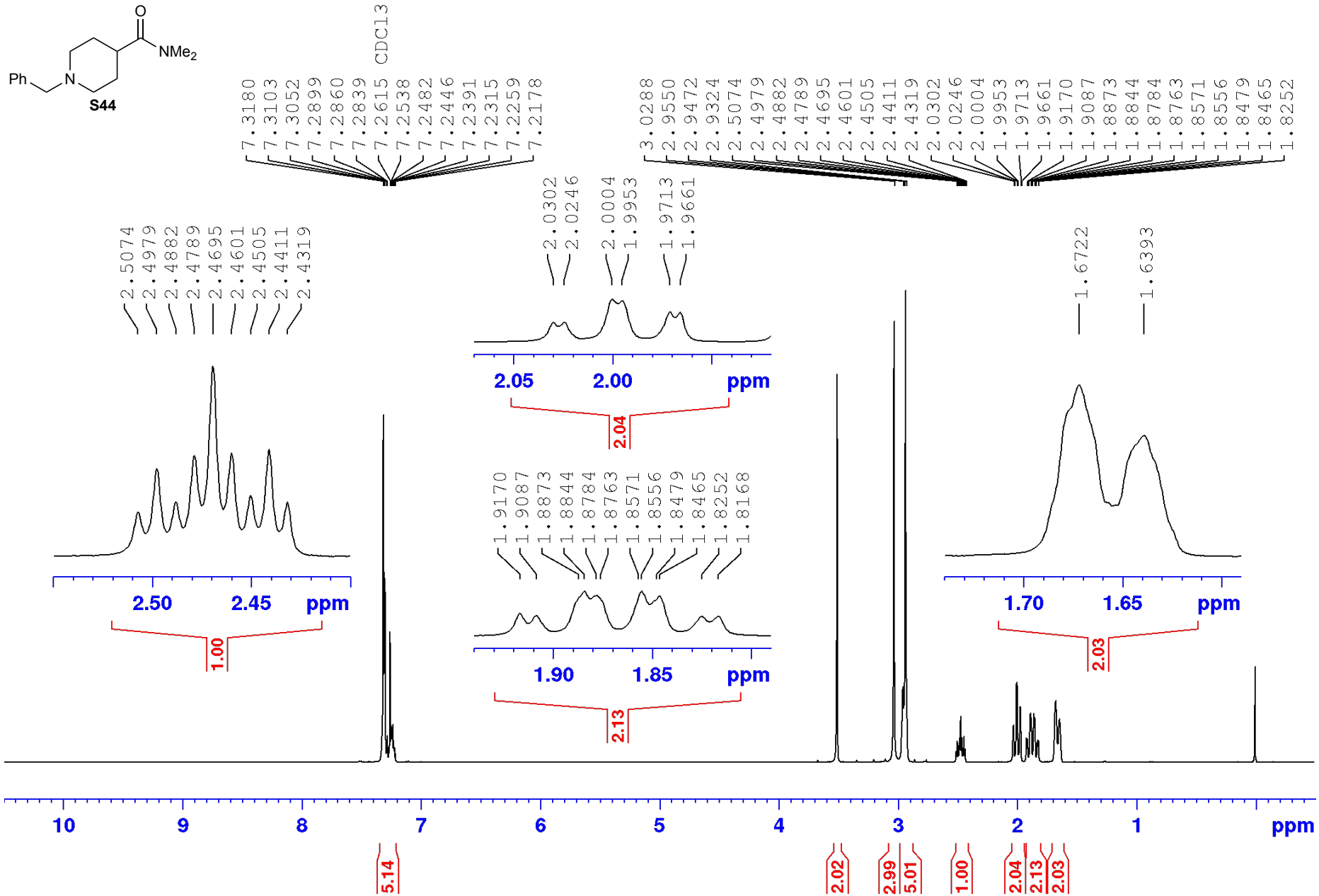


S43

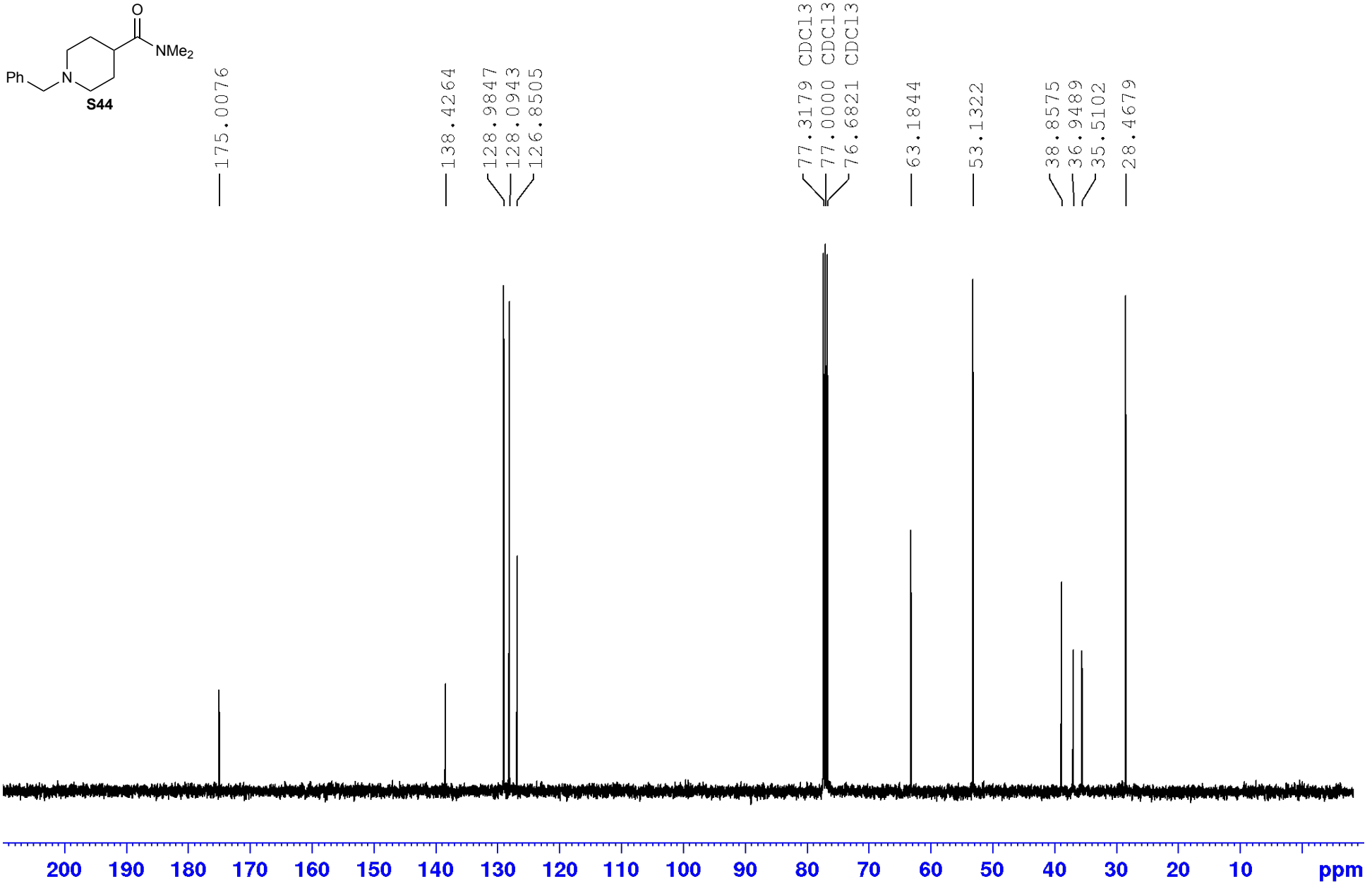


8.24 1-Benzyl-*N*,*N*-dimethylpiperidine-4-carboxamide (S44)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

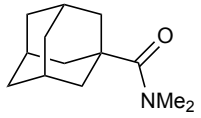


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



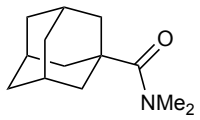
8.25 (3*r*,5*r*,7*r*)-*N*,*N*-Dimethyladamantane-1-carboxamide (45)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



45

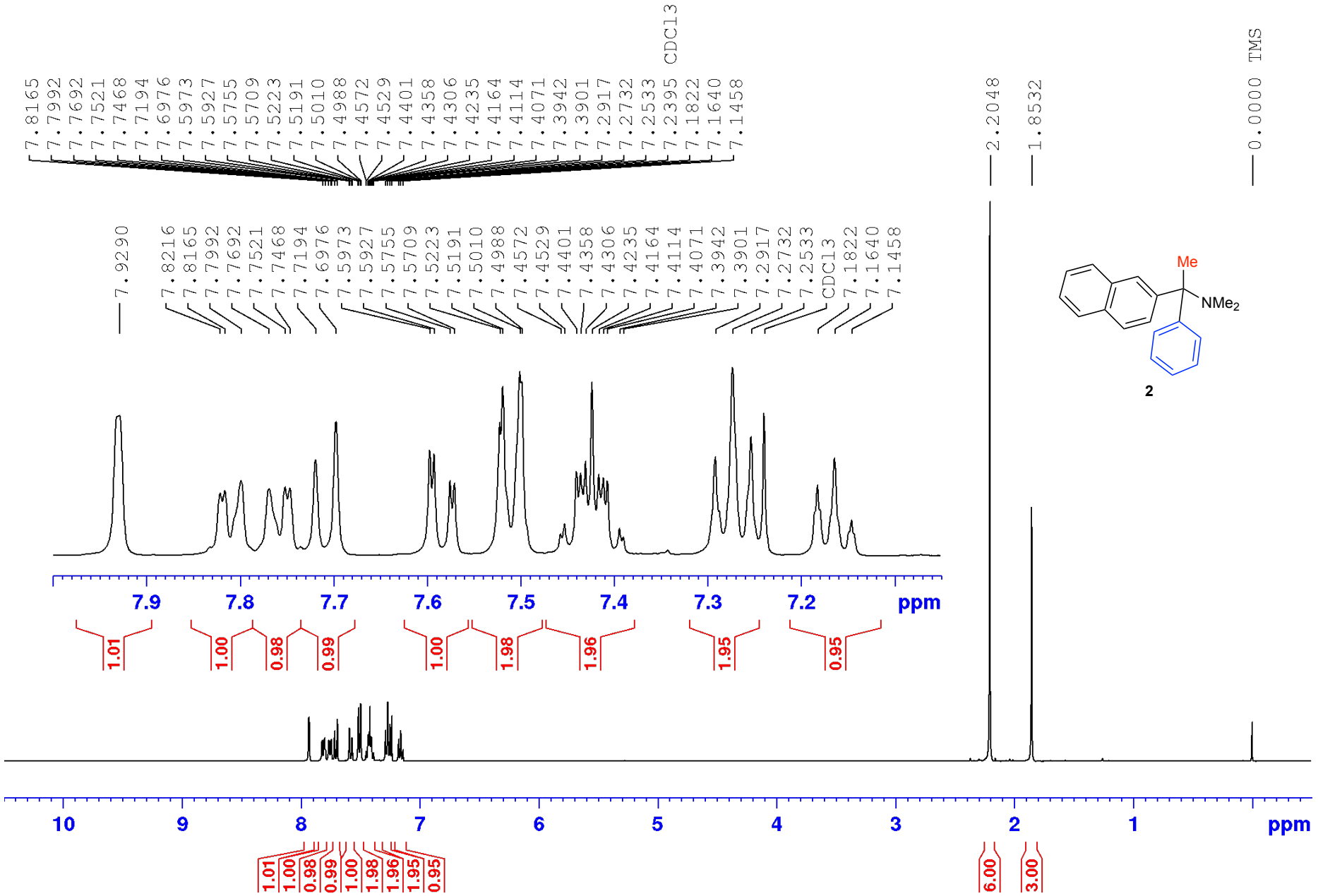
^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



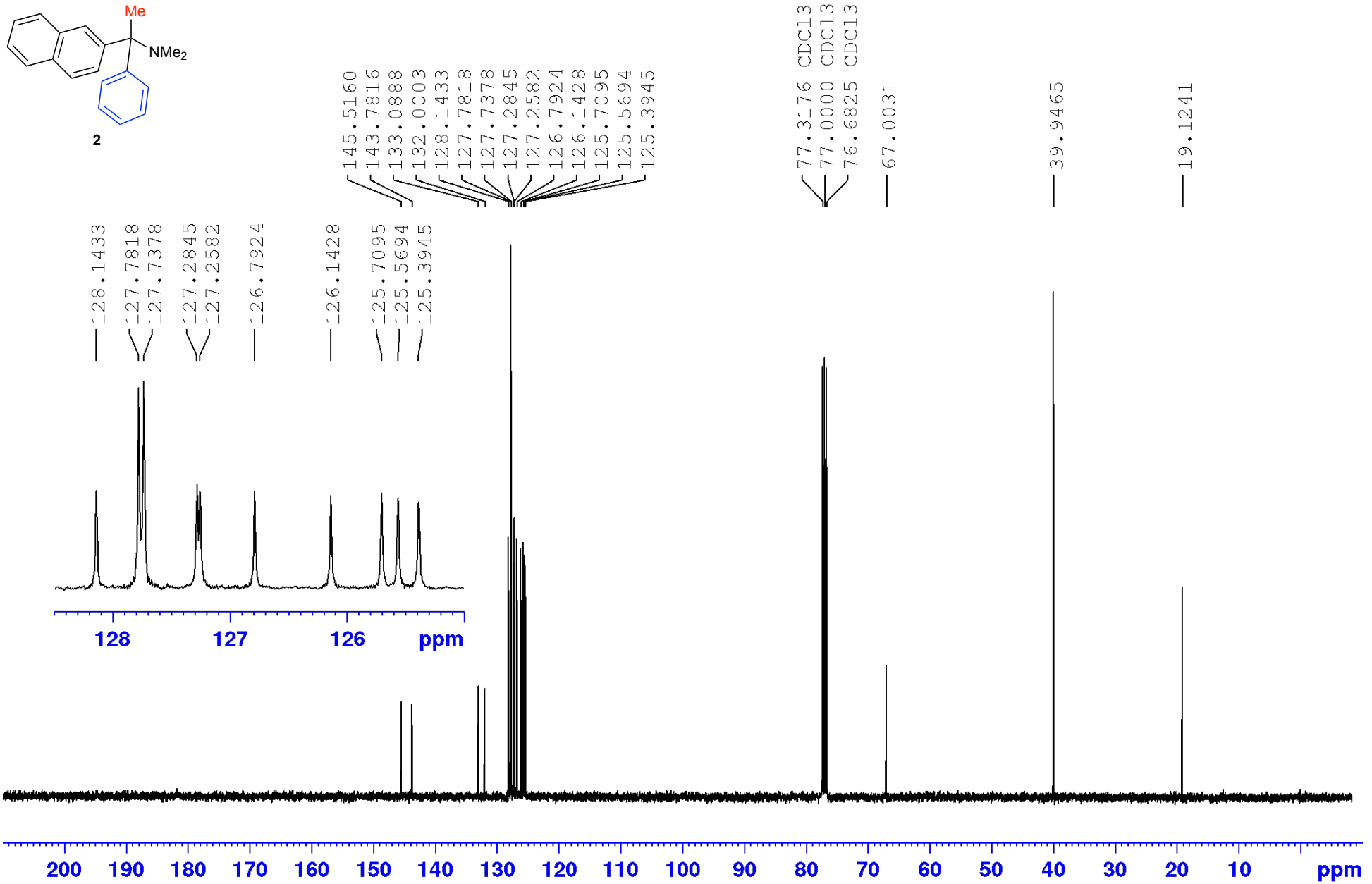
45

8.26 *N,N*-Dimethyl-1-(naphthalen-2-yl)-1-phenylethan-1-amine (2)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

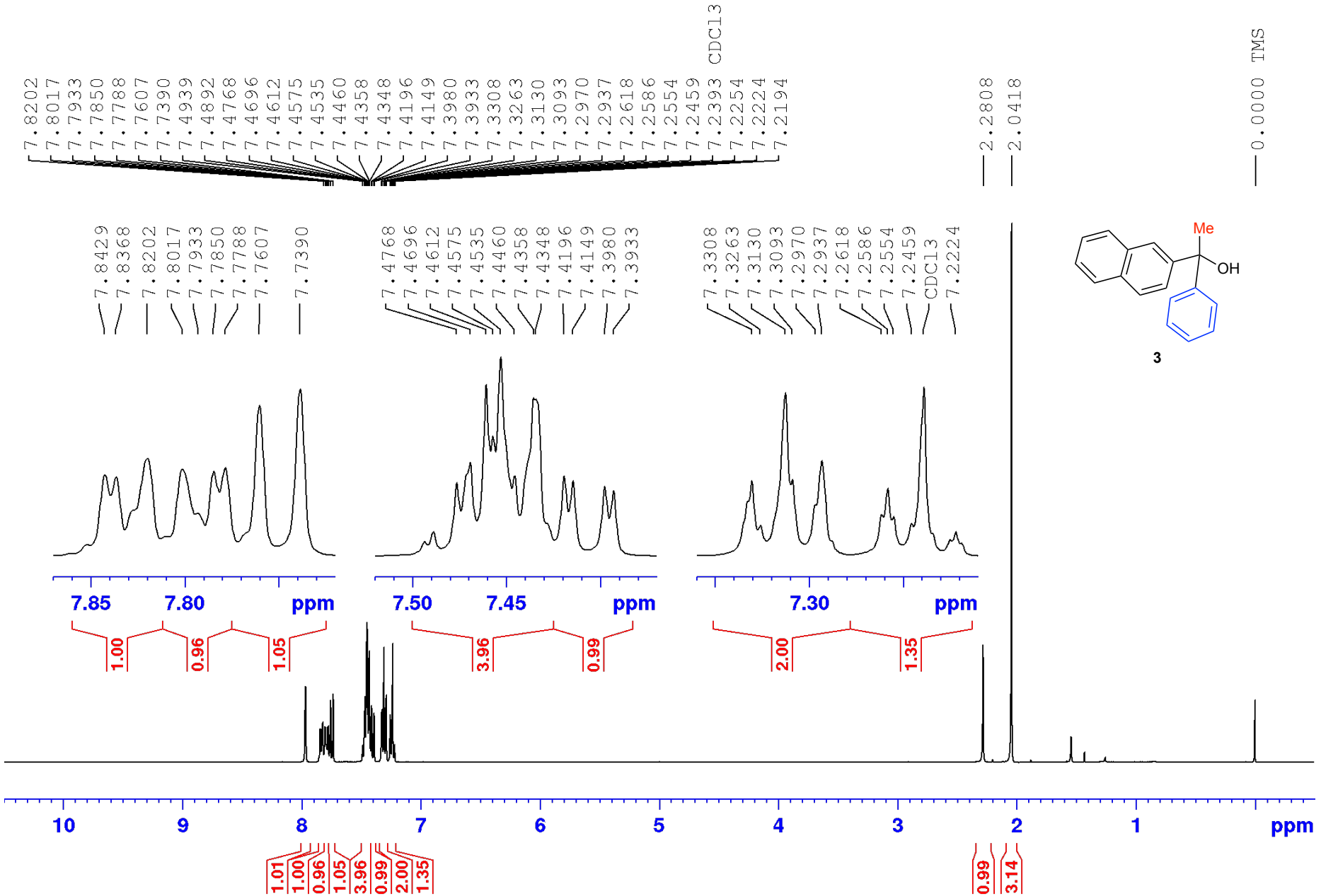


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

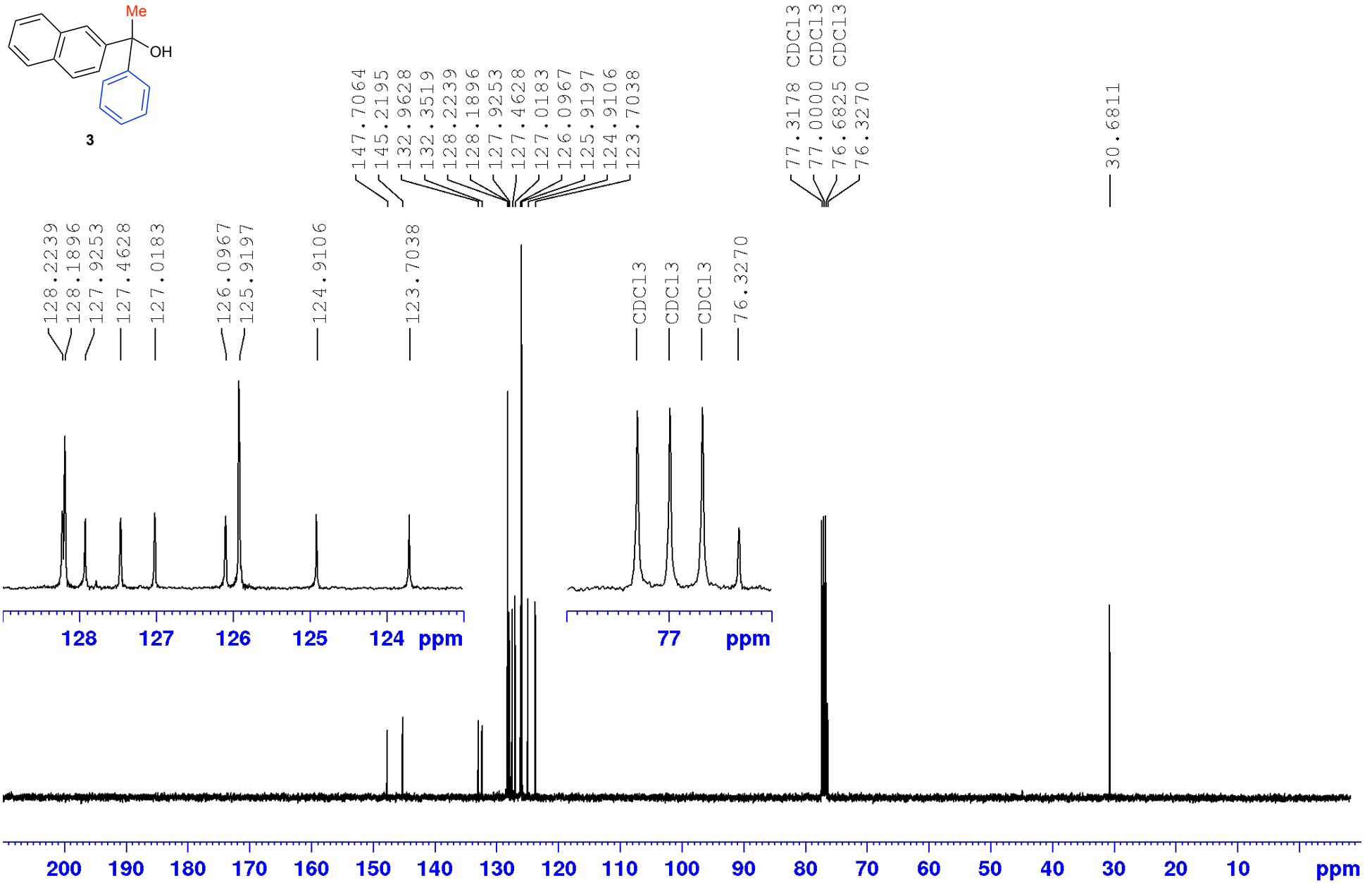


8.27 1-(Naphthalen-2-yl)-1-phenylethan-1-ol (3)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

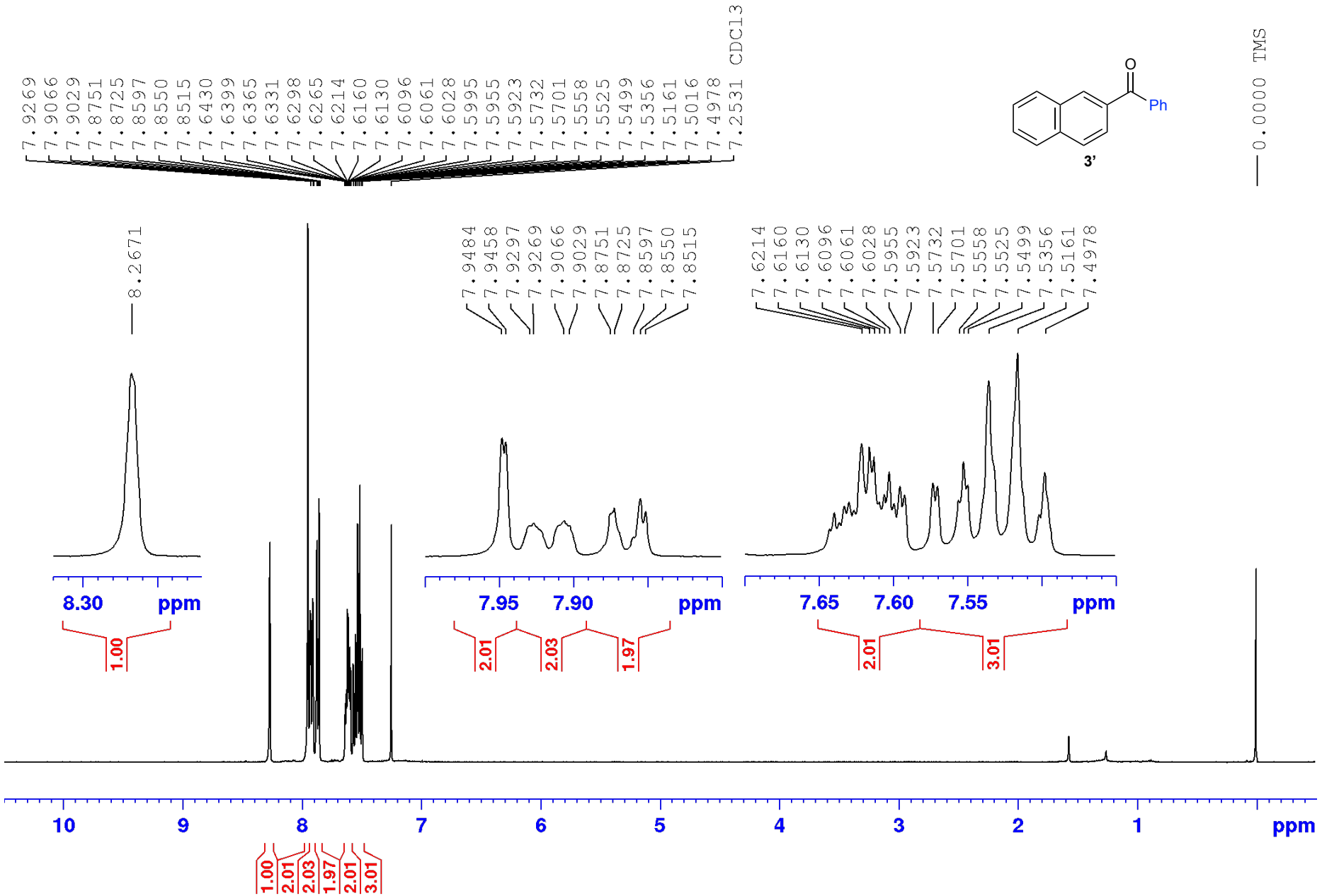


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

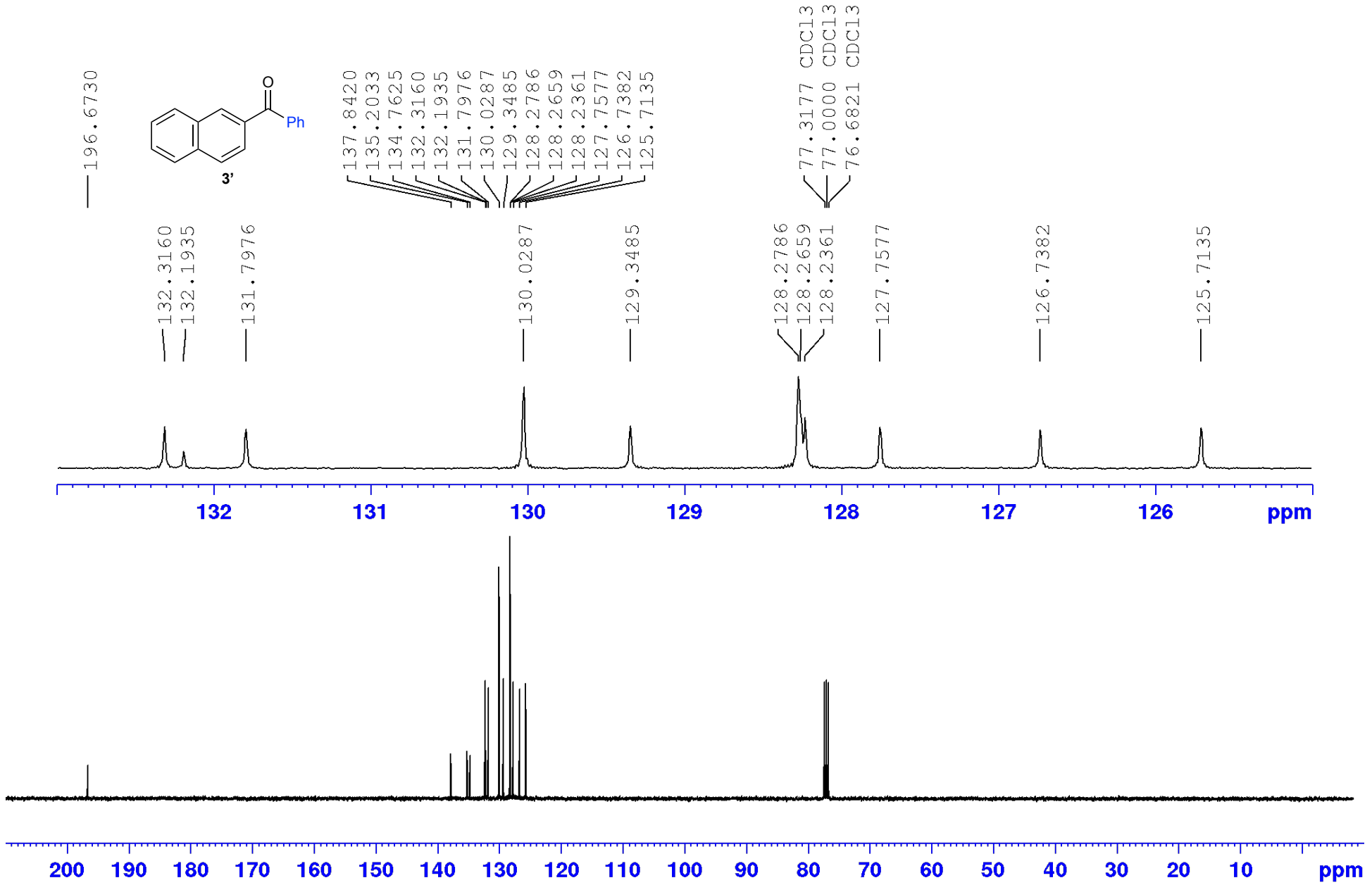


8.28 Naphthalen-2-yl(phenyl)methanone (3')

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

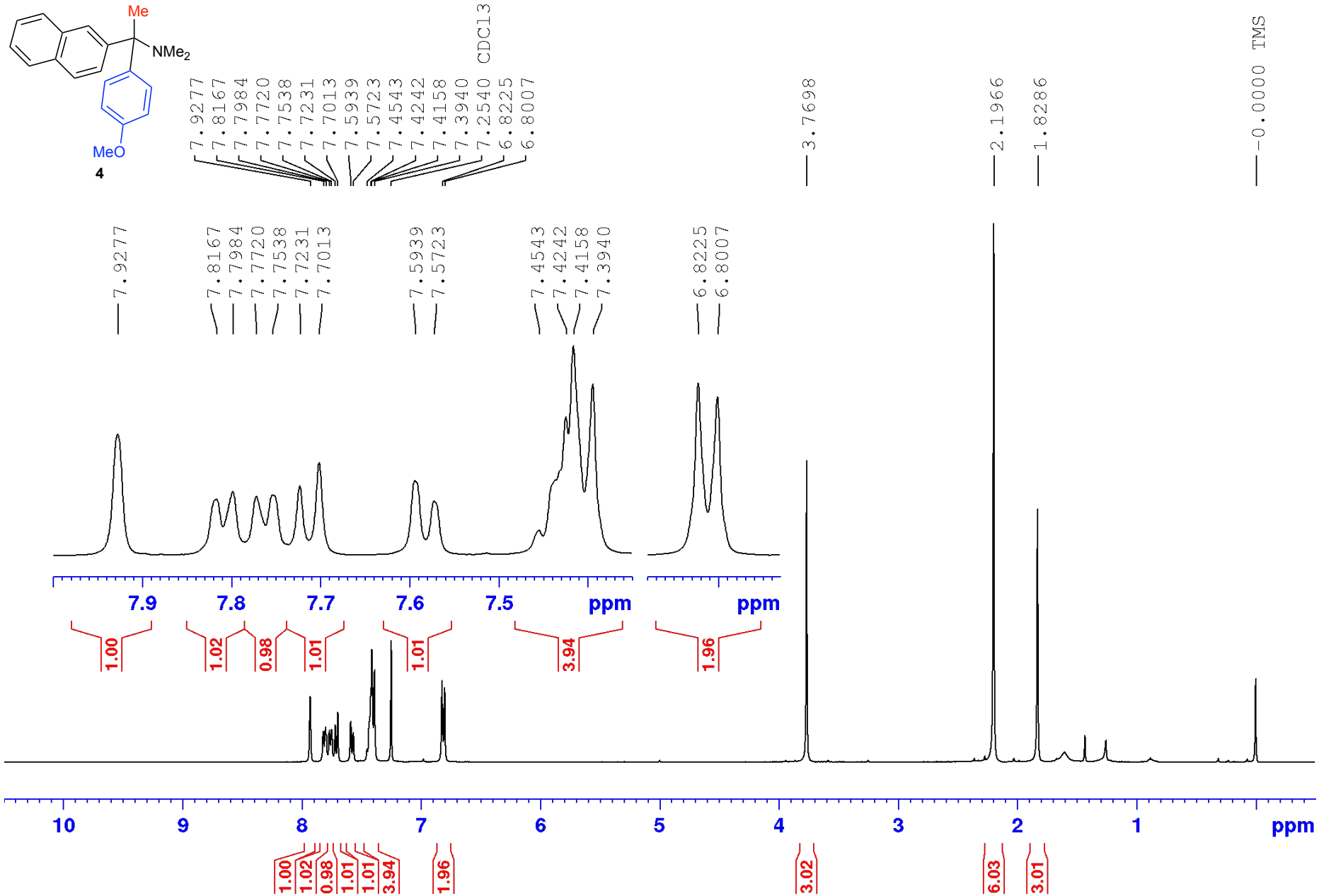


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

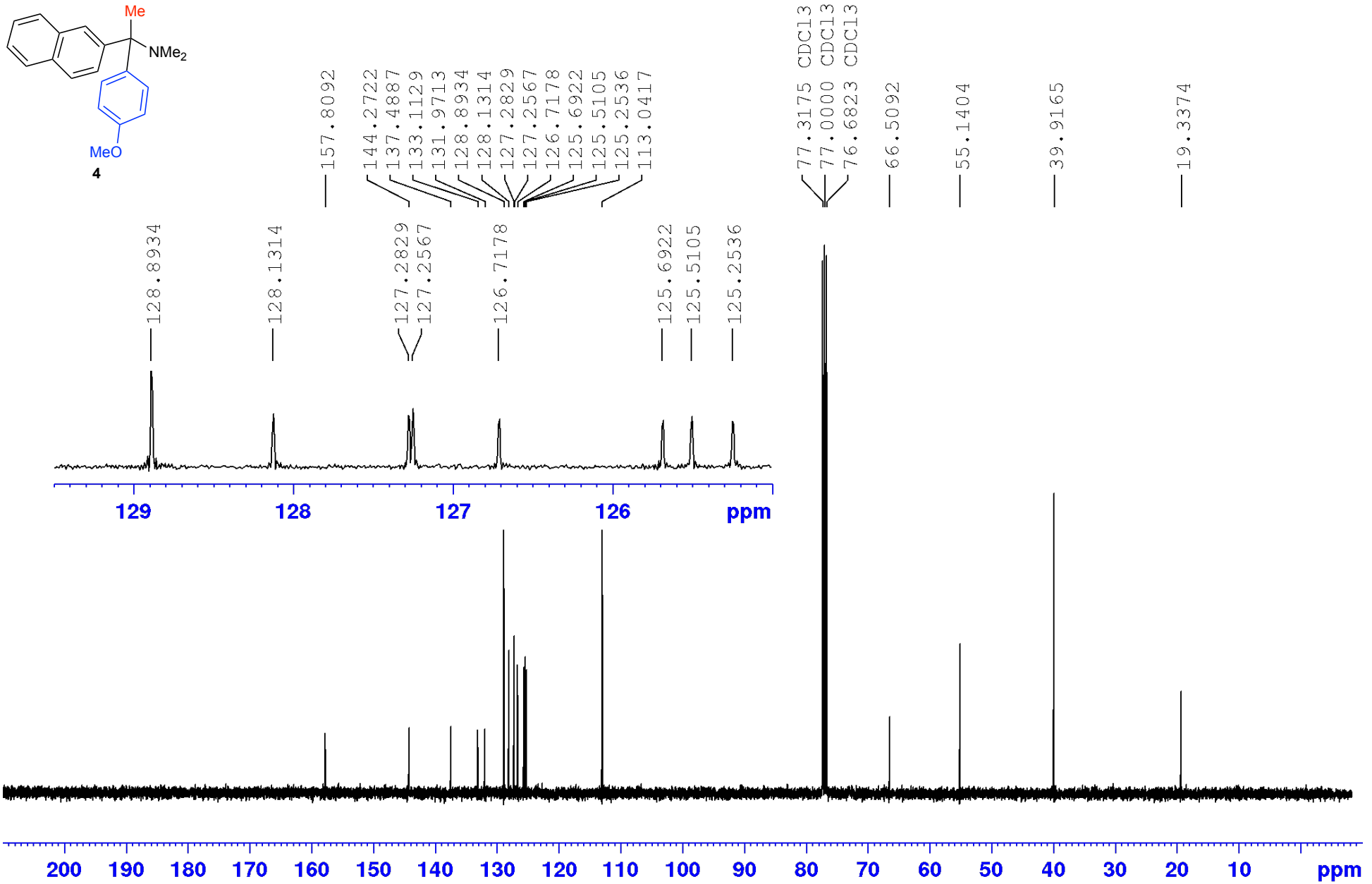


8.29 1-(4-Methoxyphenyl)-*N*,*N*-dimethyl-1-(naphthalen-2-yl)ethan-1-amine (4)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

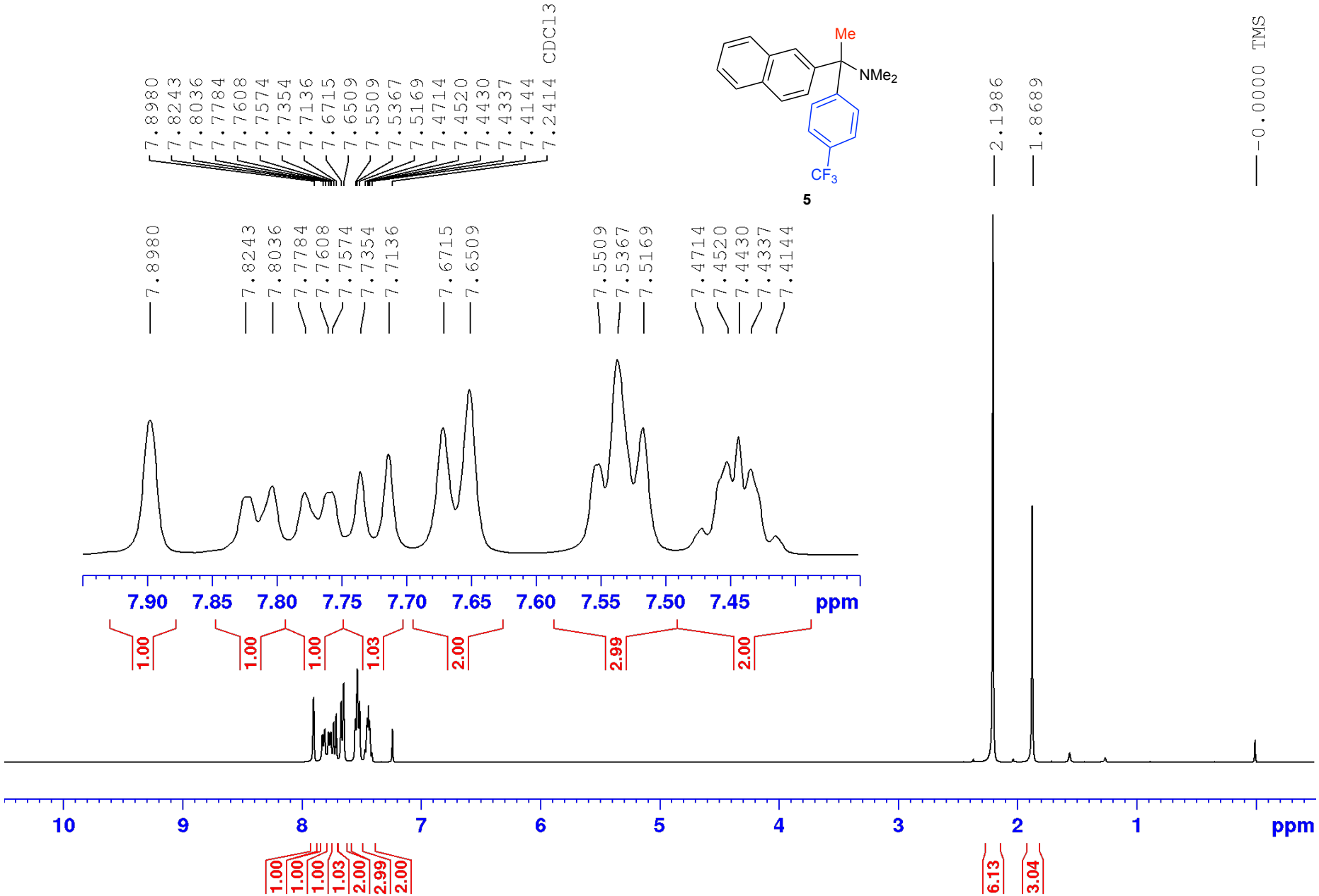


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

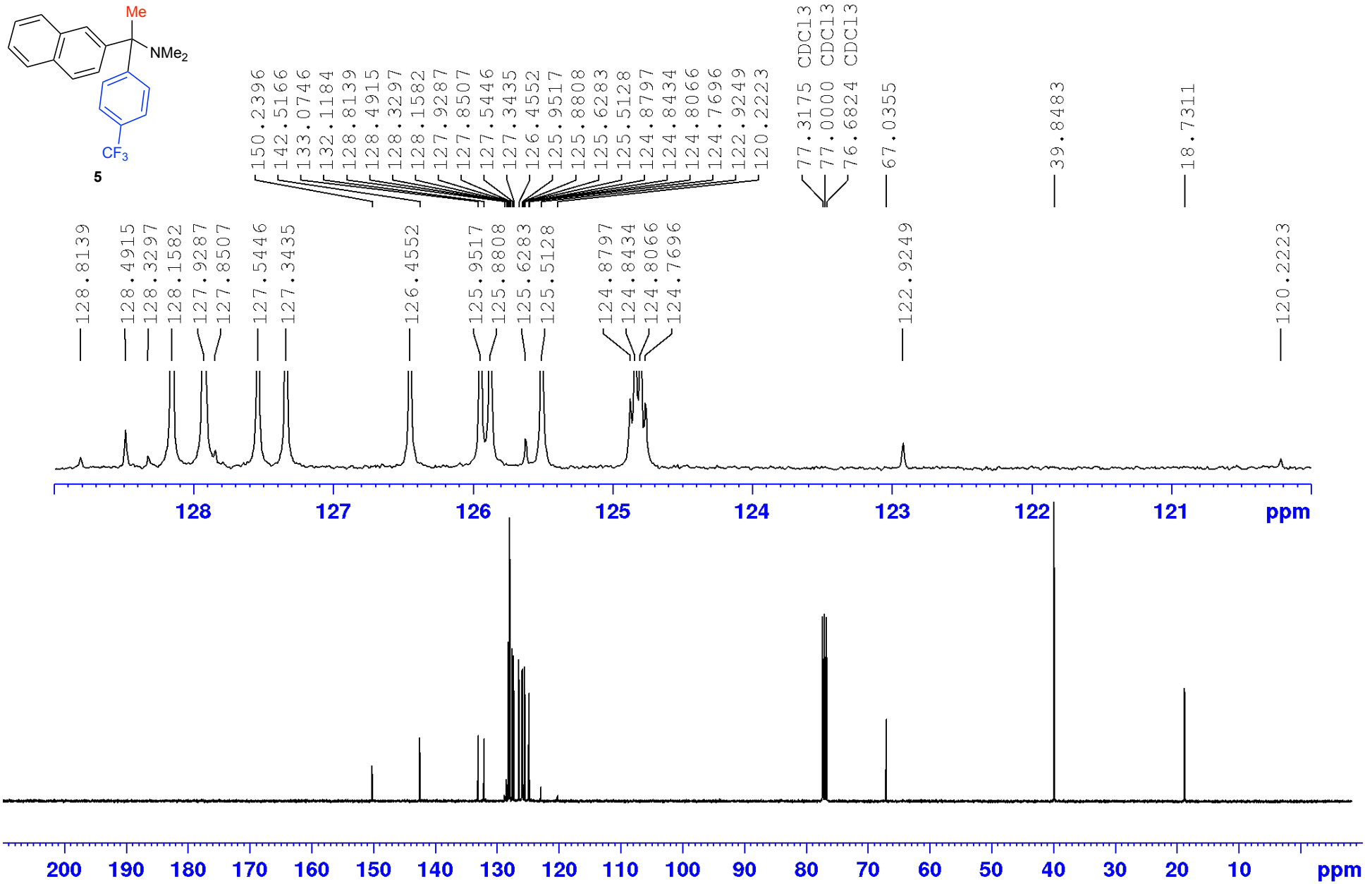


8.30 *N,N*-Dimethyl-1-(naphthalen-2-yl)-1-(4-(trifluoromethyl)phenyl)ethan-1-amine (5)

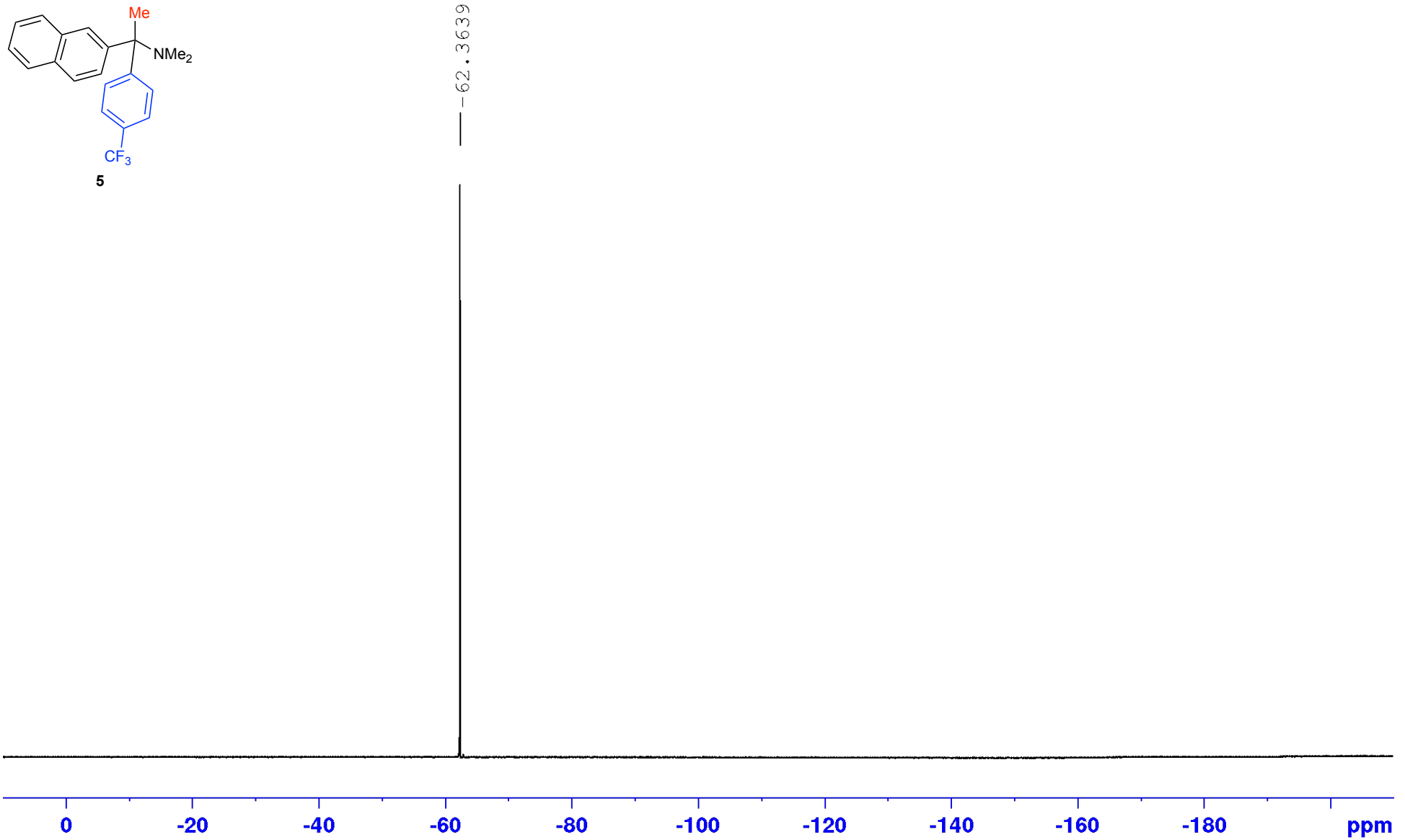
^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



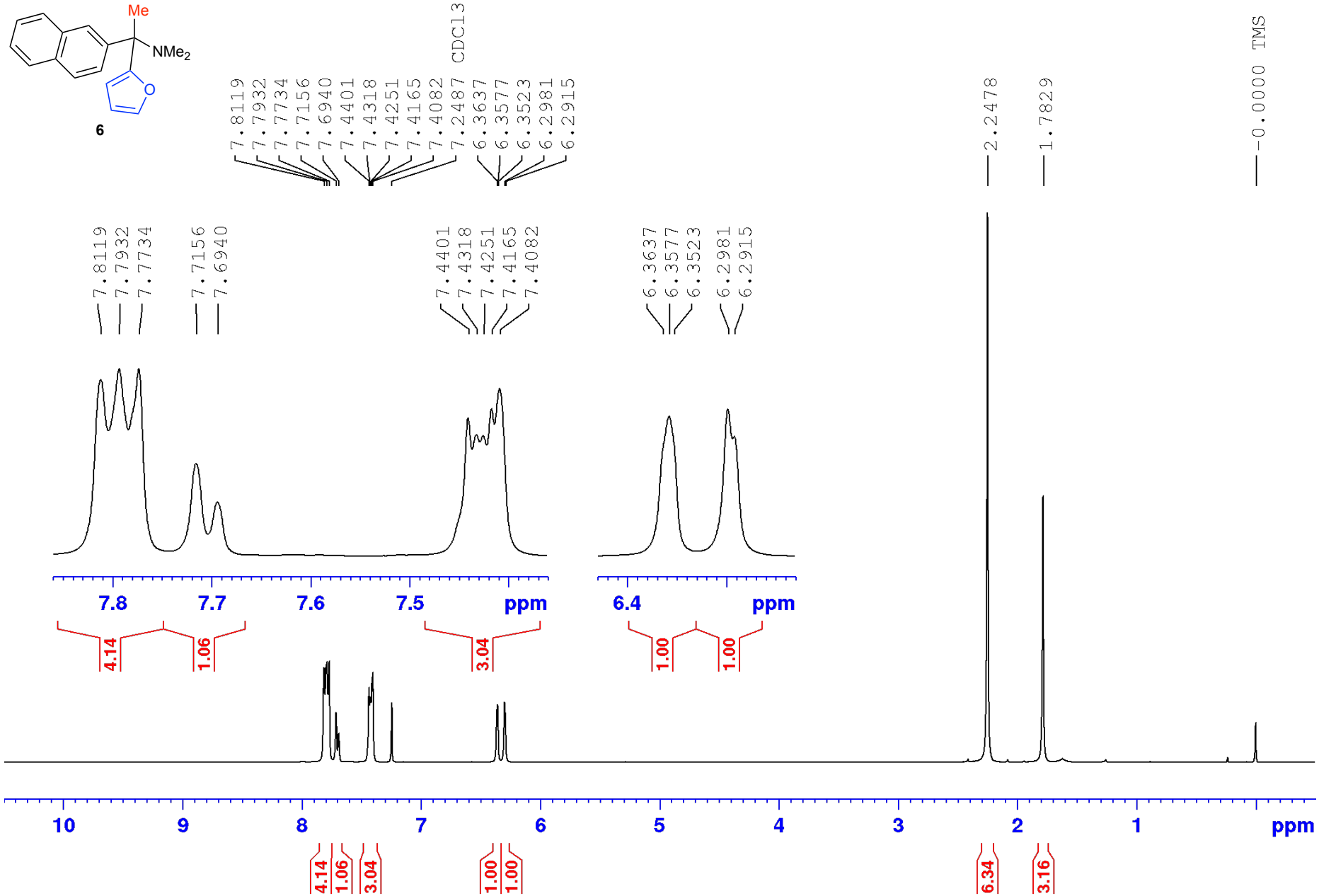
^{19}F NMR Spectrum (376 MHz on Bruker BBFO 400) in $CDCl_3$



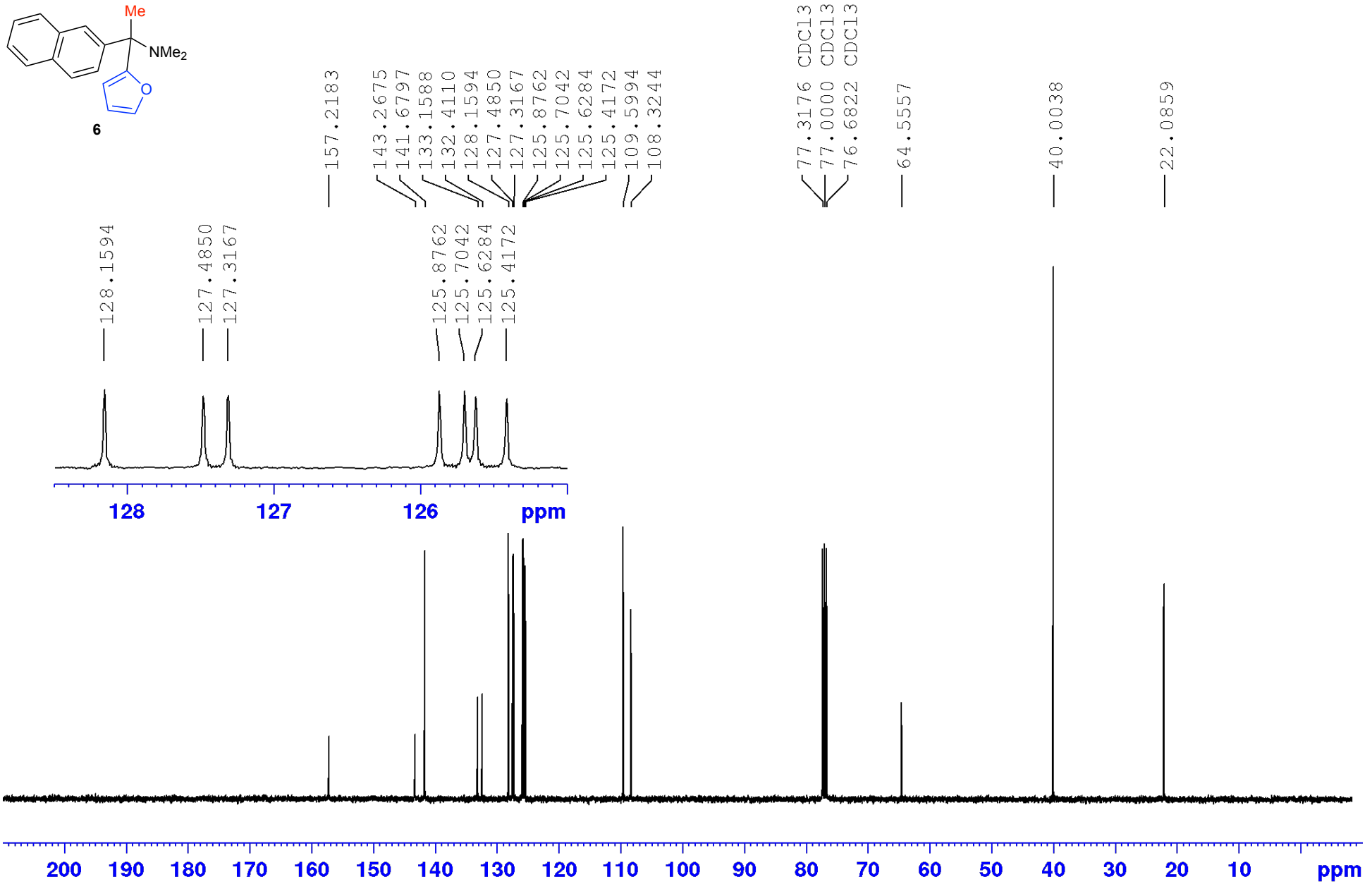
5

8.31 1-(Furan-2-yl)-*N*,*N*-dimethyl-1-(naphthalen-2-yl)ethan-1-amine (6)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

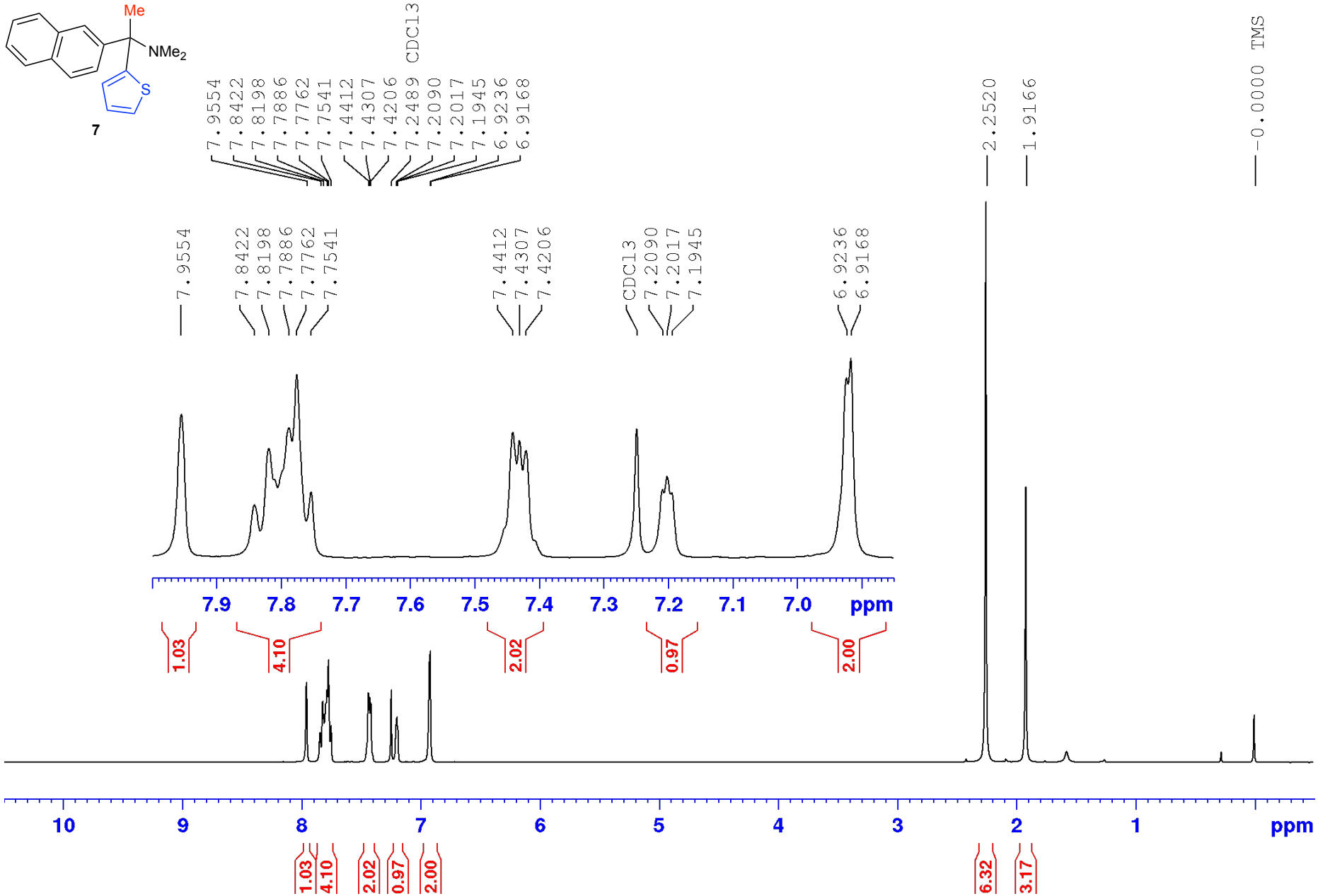


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

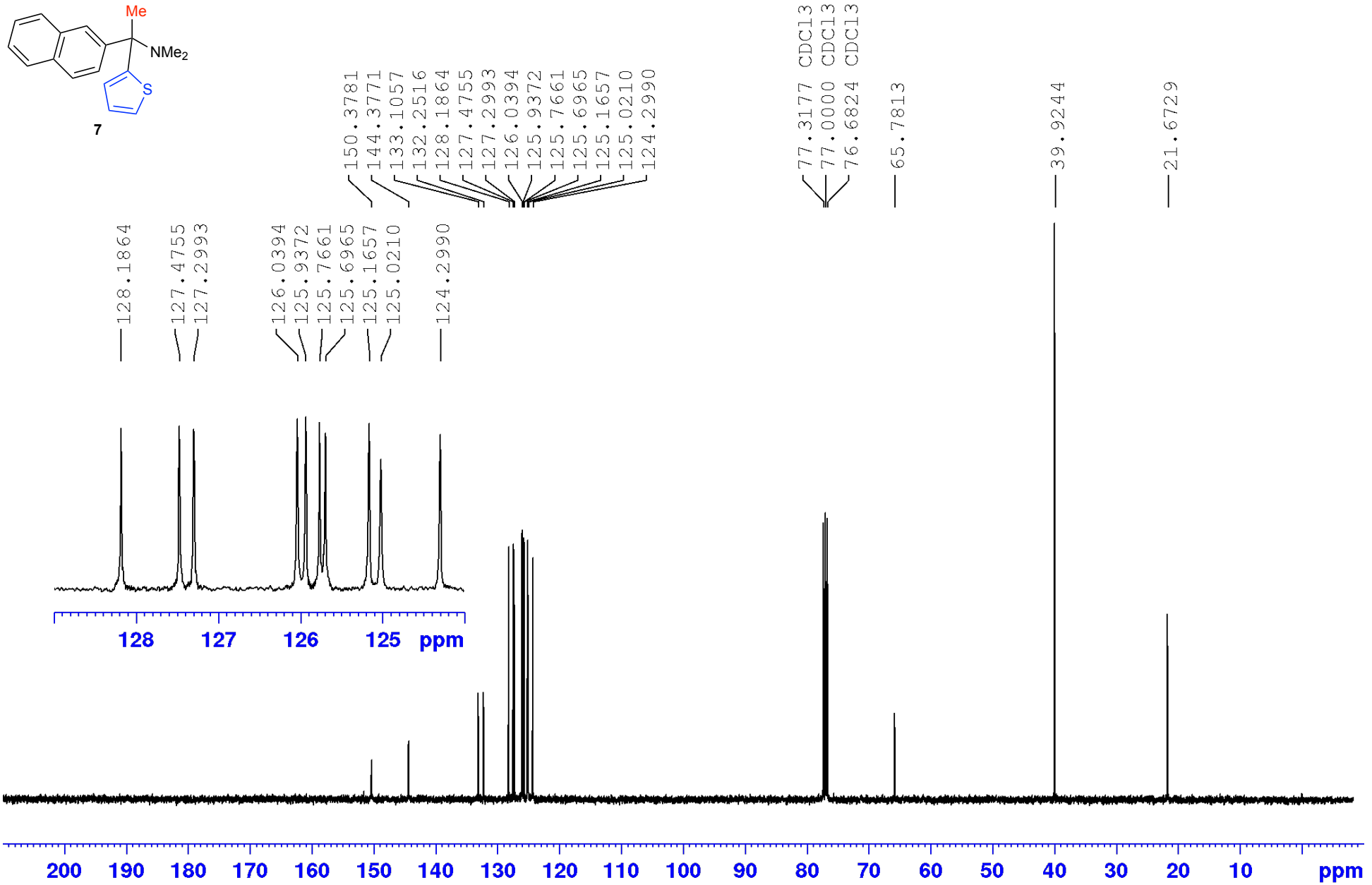


8.32 *N,N*-Dimethyl-1-(naphthalen-2-yl)-1-(thiophen-2-yl)ethan-1-amine (7)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

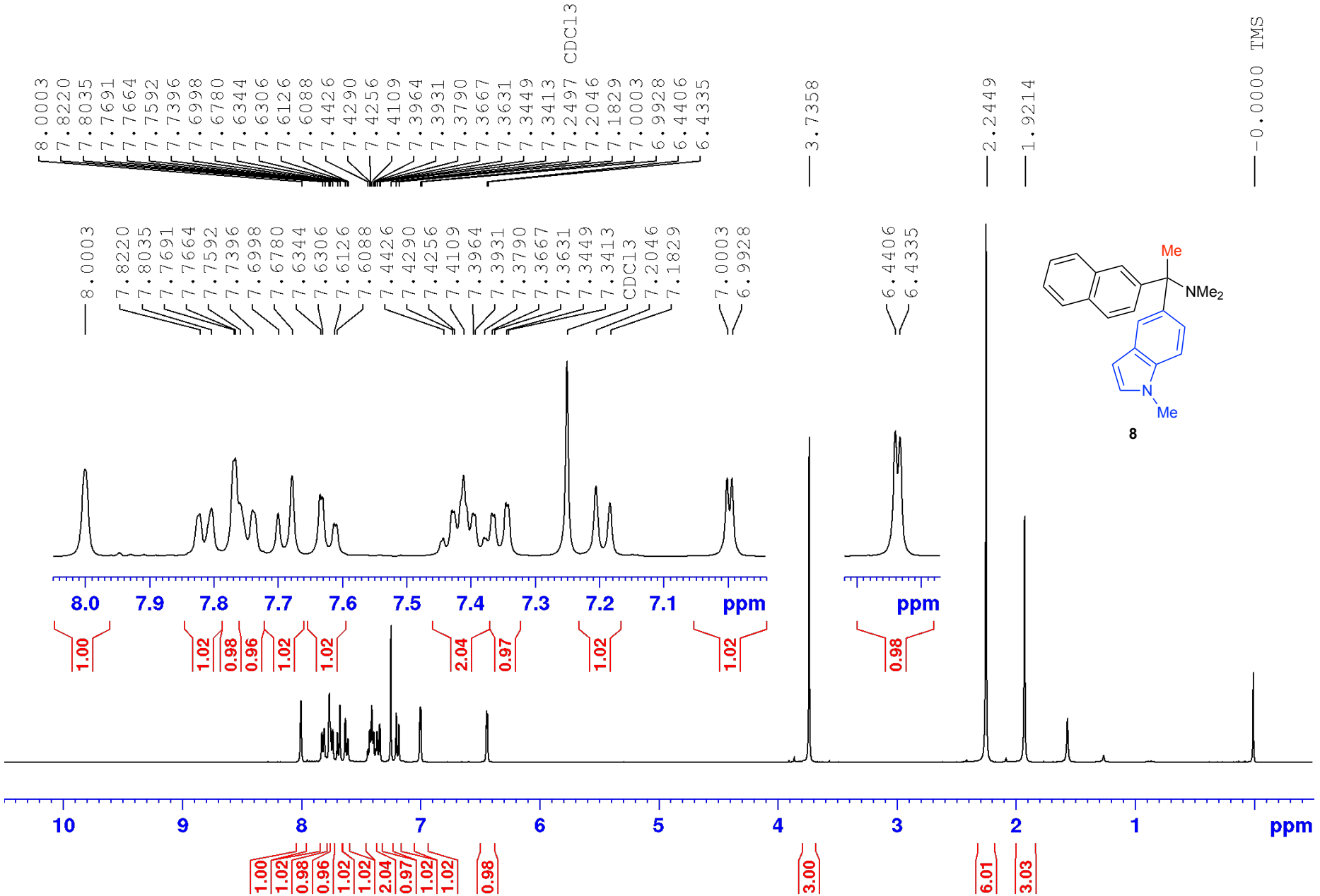


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

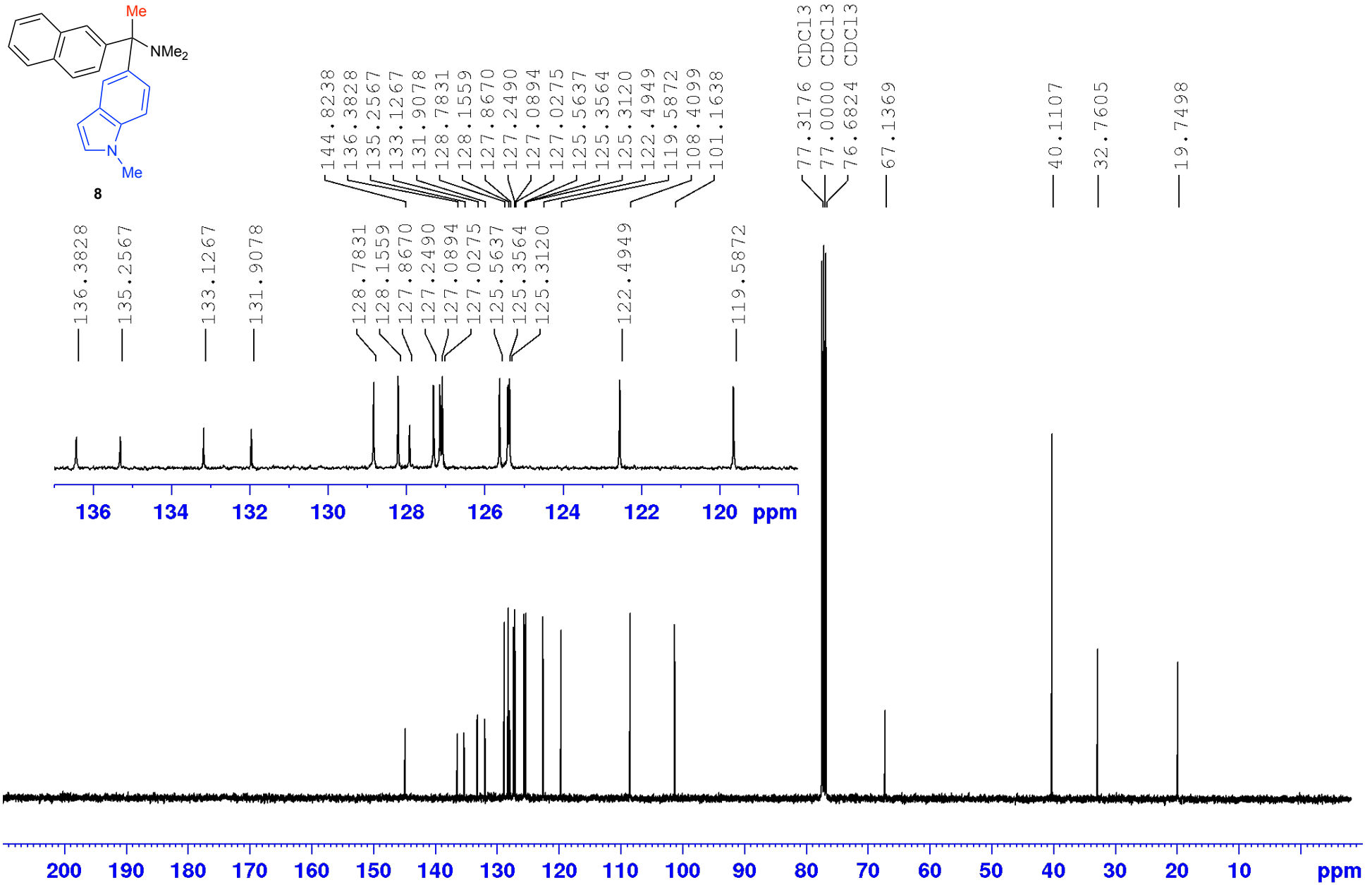


8.33 *N,N*-Dimethyl-1-(1-methyl-1*H*-indol-5-yl)-1-(naphthalen-2-yl)ethan-1-amine (8)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

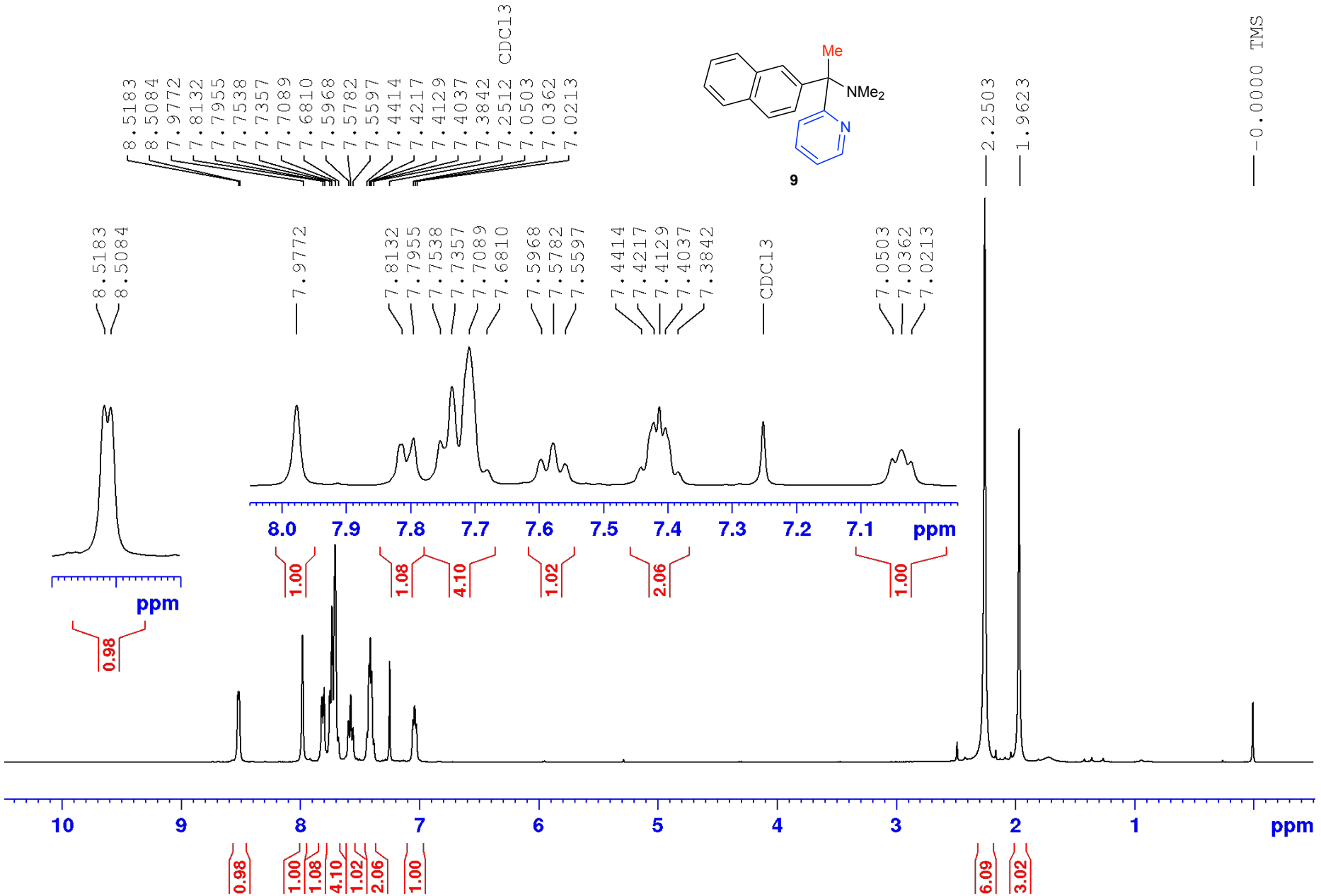


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

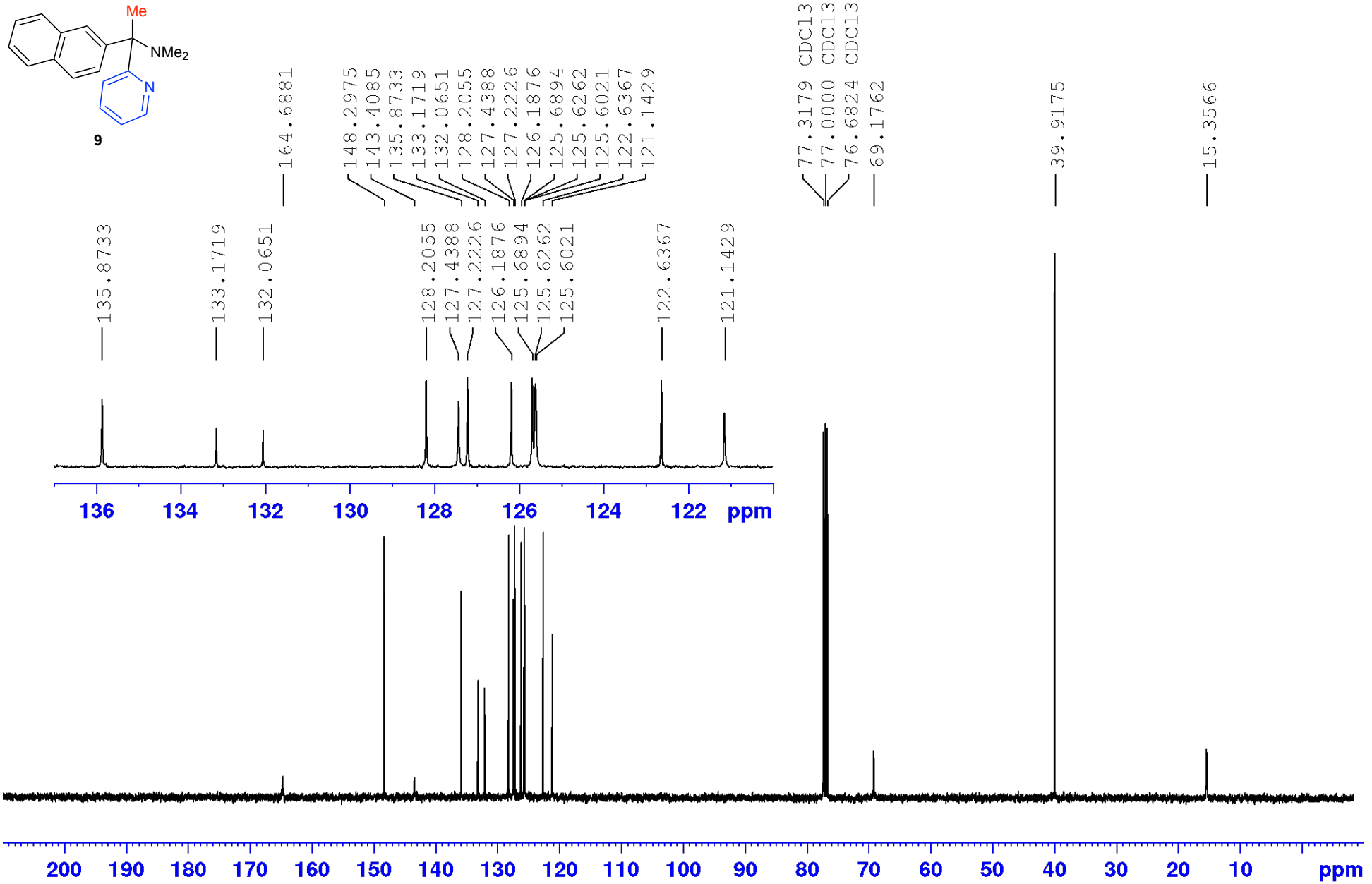


8.34 *N,N*-Dimethyl-1-(naphthalen-2-yl)-1-(pyridin-2-yl)ethan-1-amine (9)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

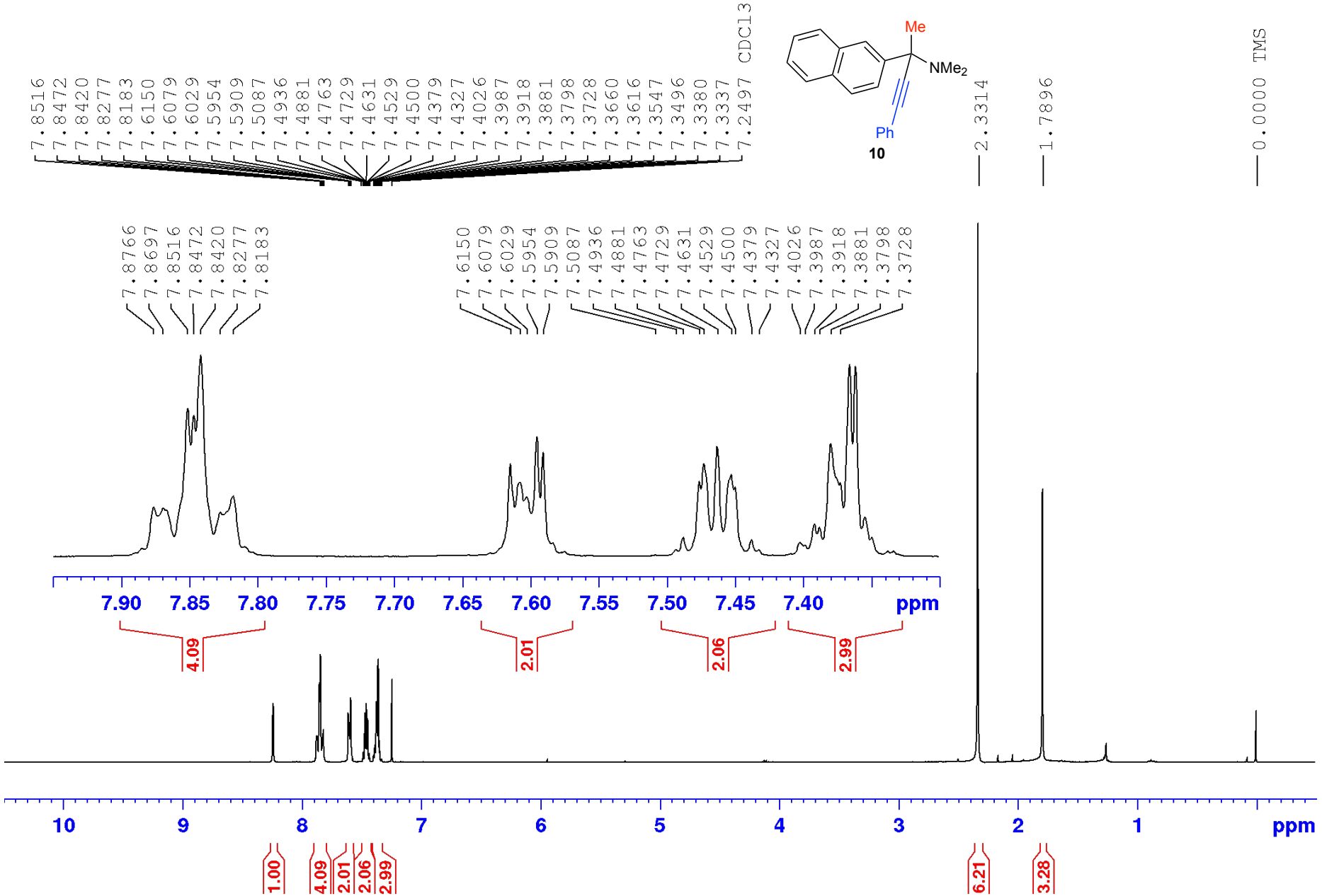


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

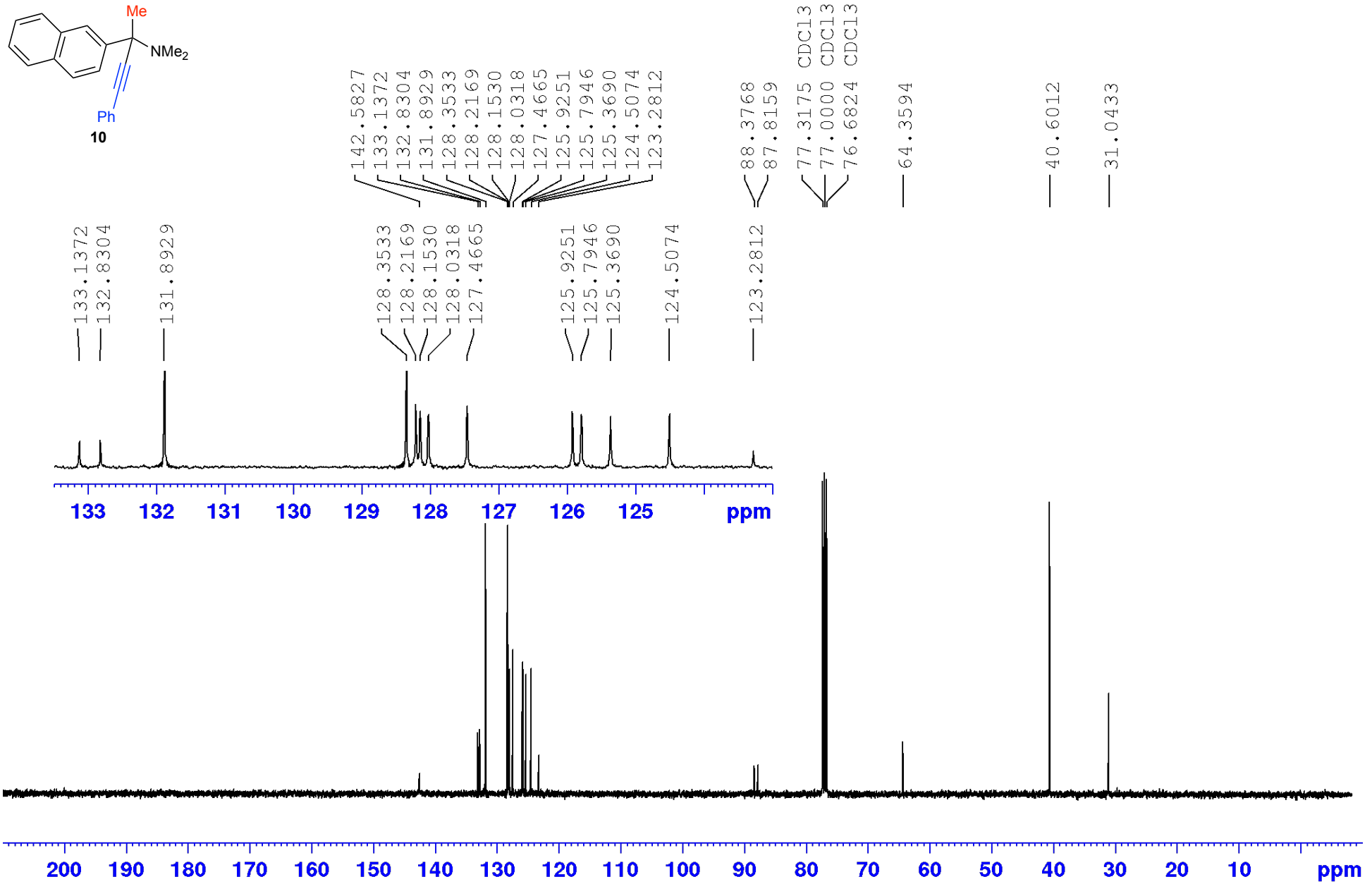


8.35 *N,N*-Dimethyl-2-(naphthalen-2-yl)-4-phenylbut-3-yn-2-amine (10)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

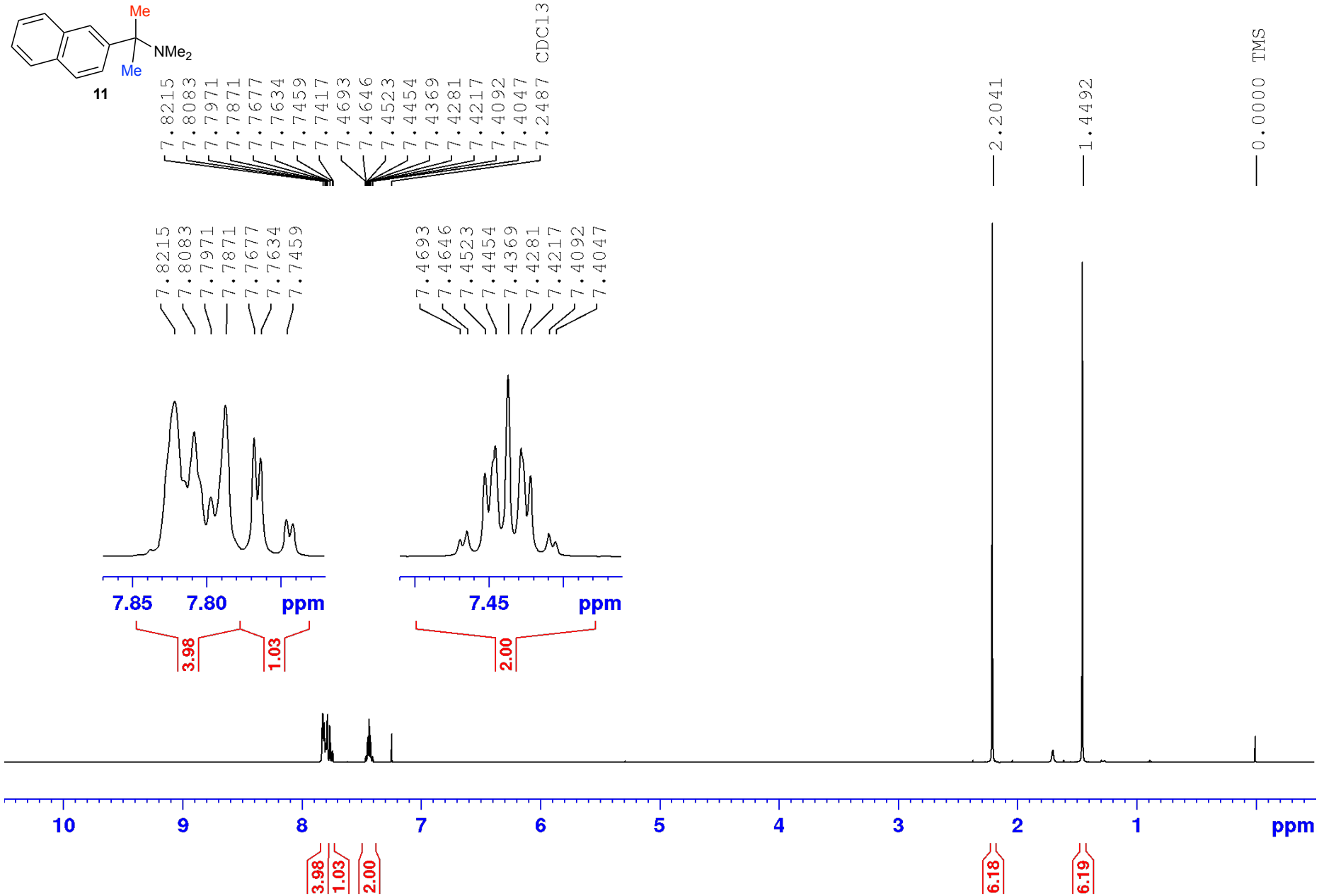


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

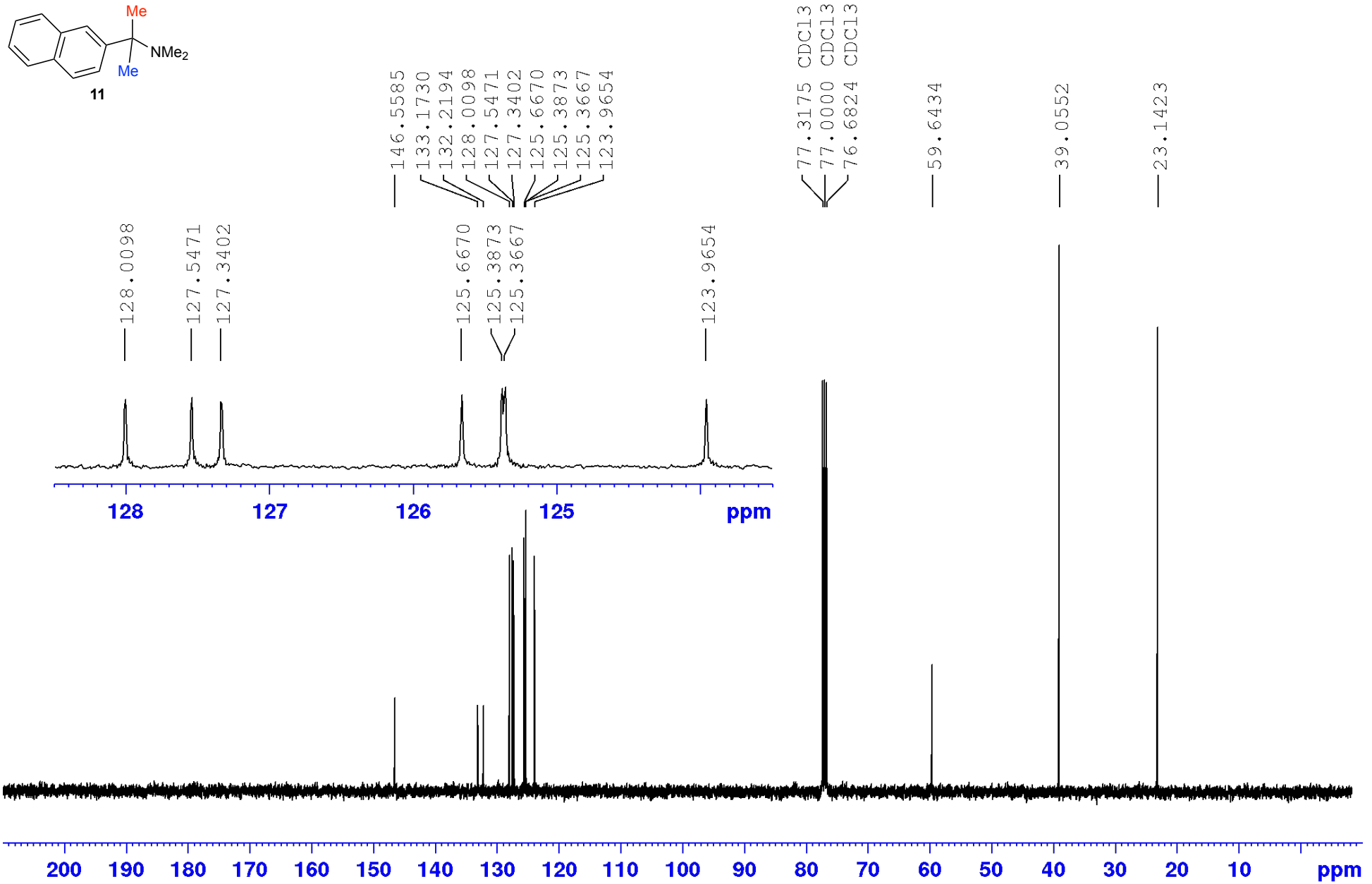


8.36 *N,N*-Dimethyl-2-(naphthalen-2-yl)propan-2-amine (11)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

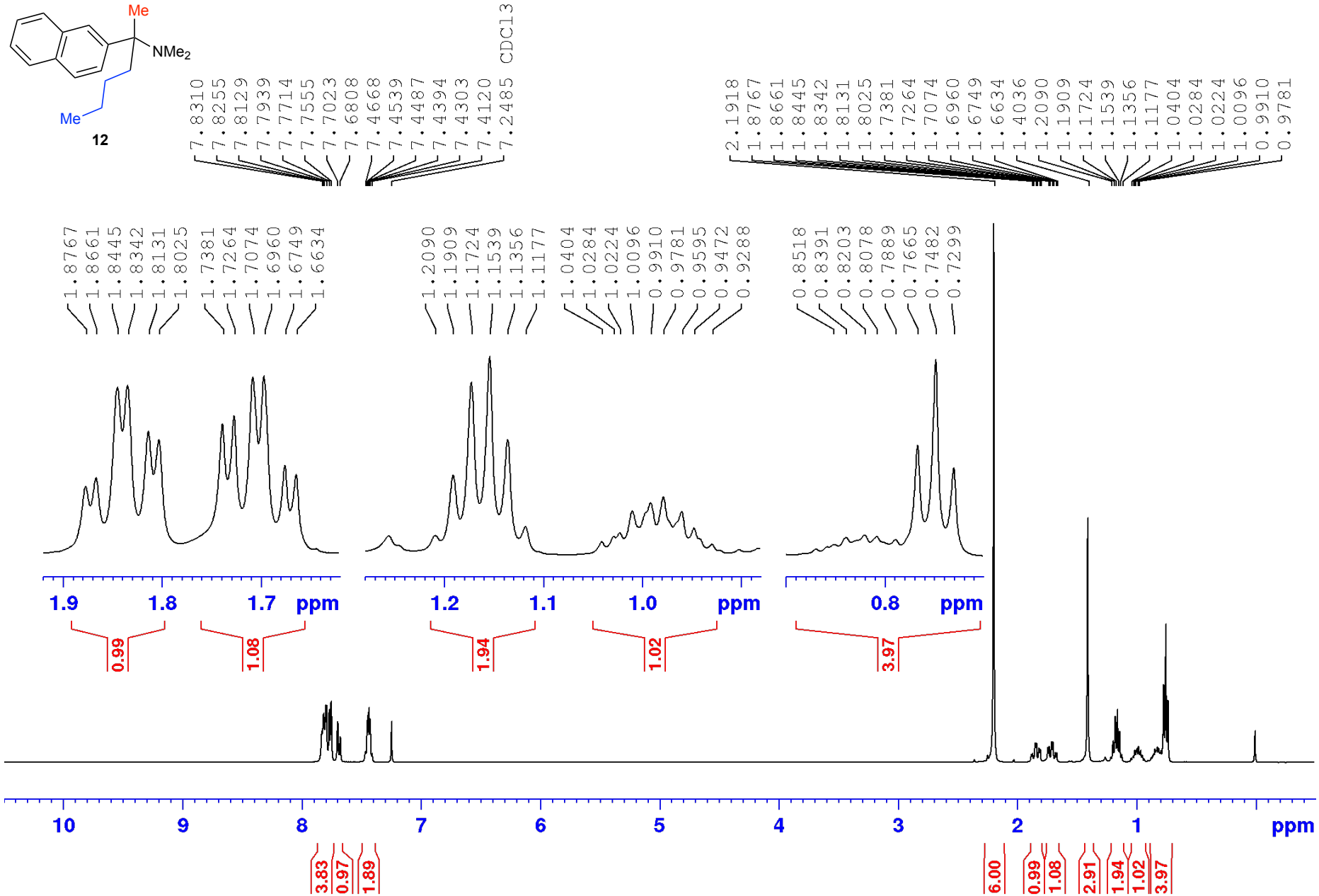


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

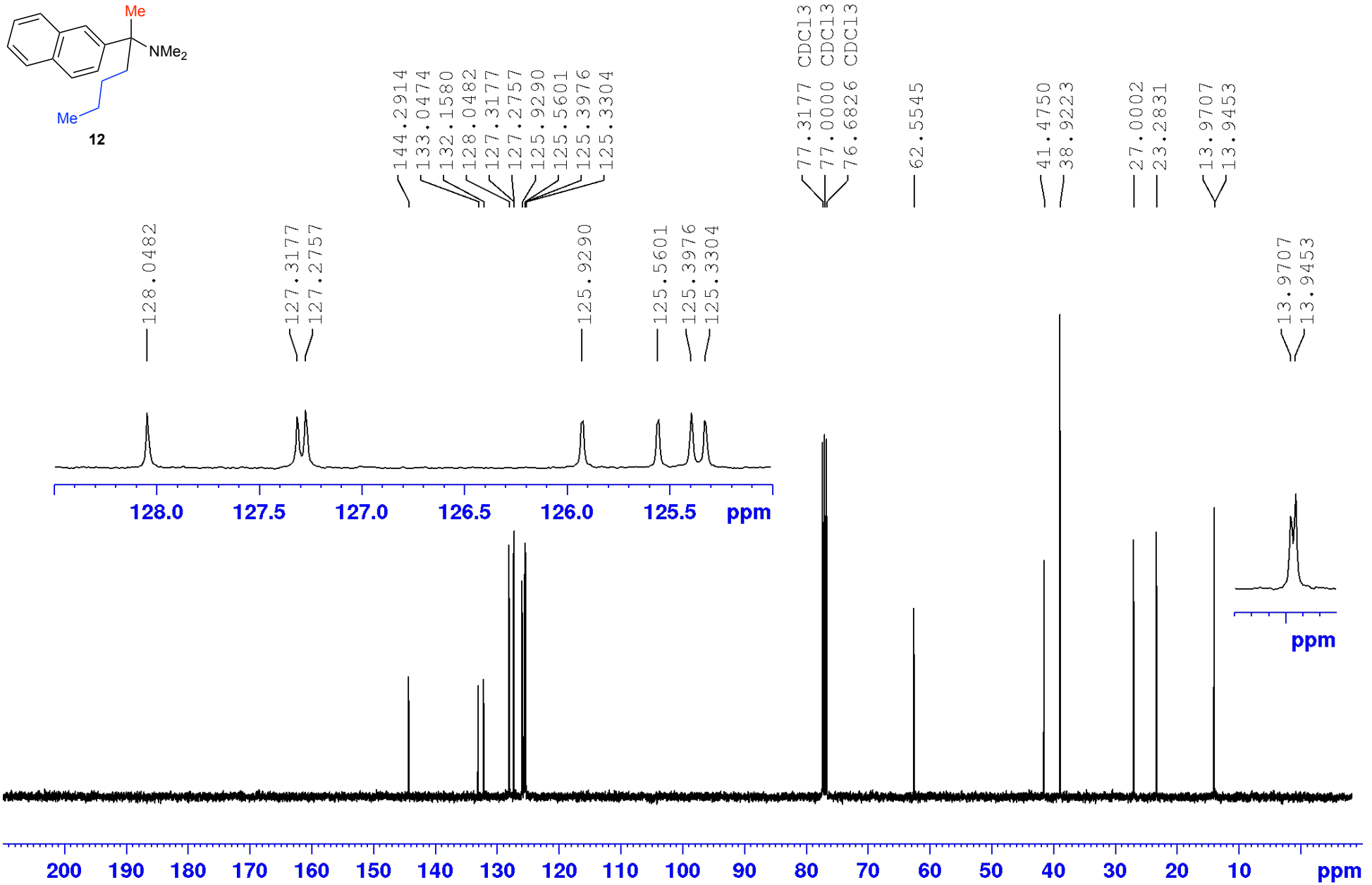


8.37 *N,N*-Dimethyl-2-(naphthalen-2-yl)hexan-2-amine (12)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

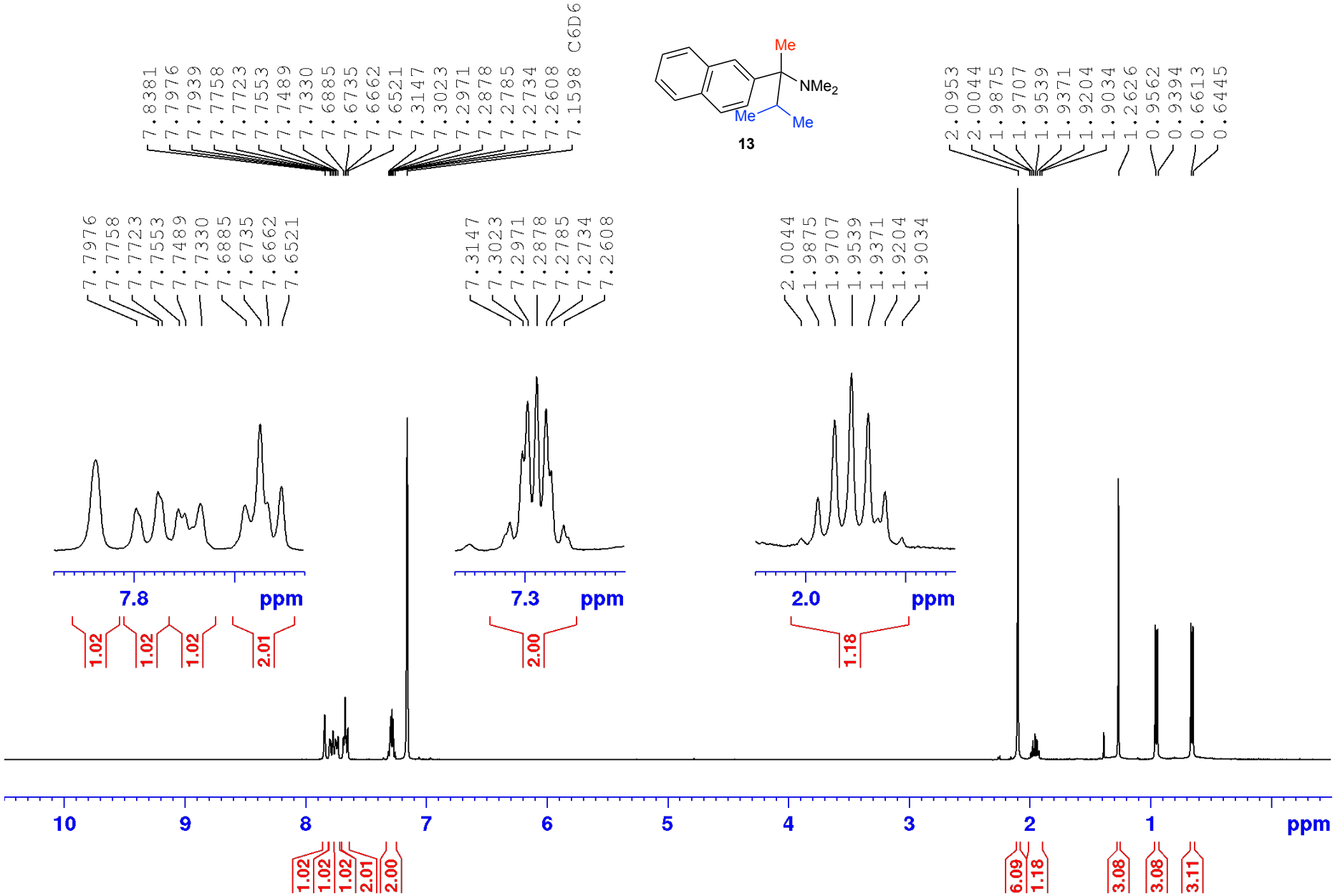


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

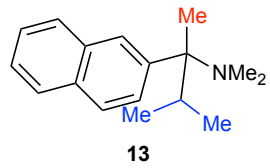


8.38 *N,N*,3-Trimethyl-2-(naphthalen-2-yl)butan-2-amine (13)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in C_6D_6



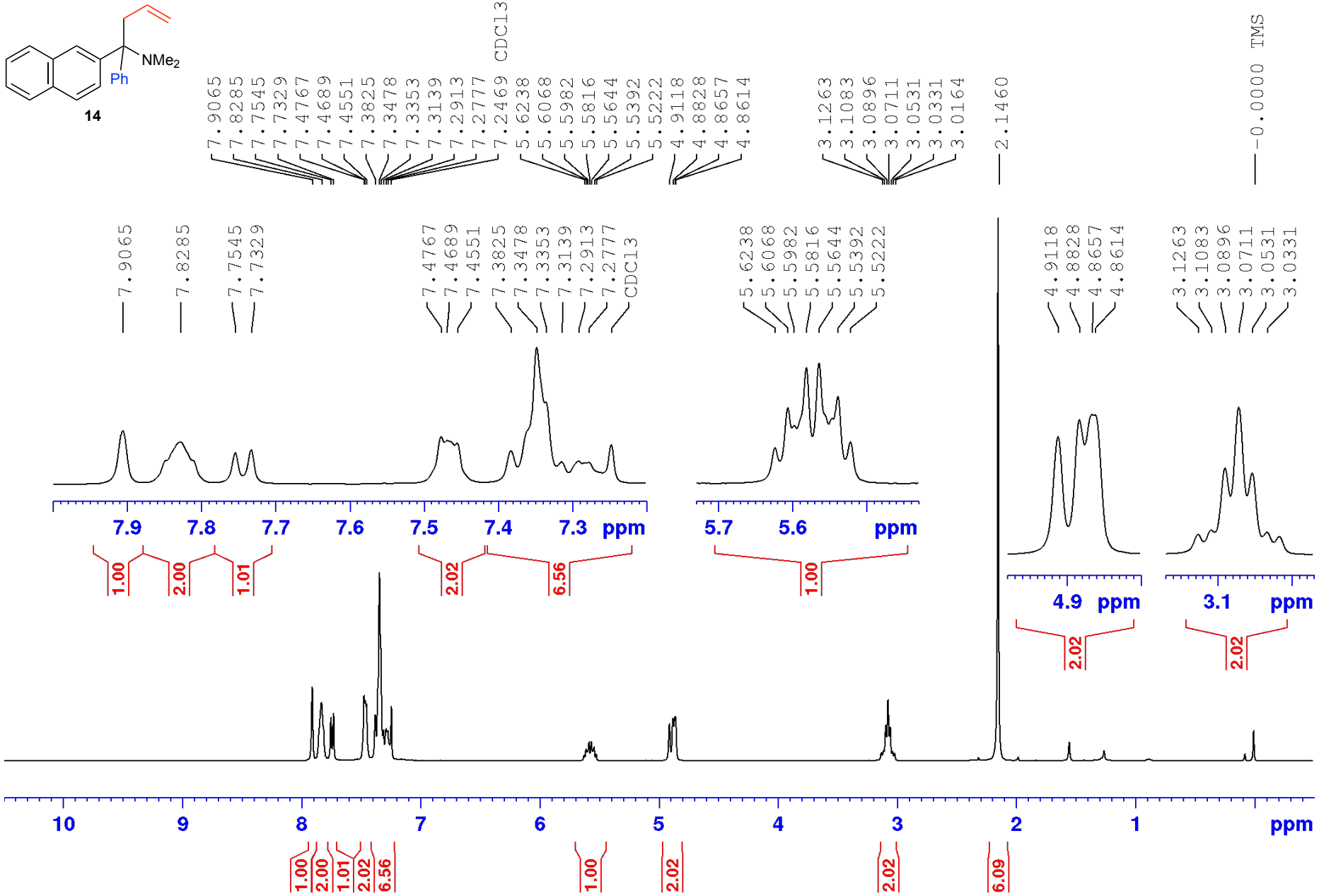
^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



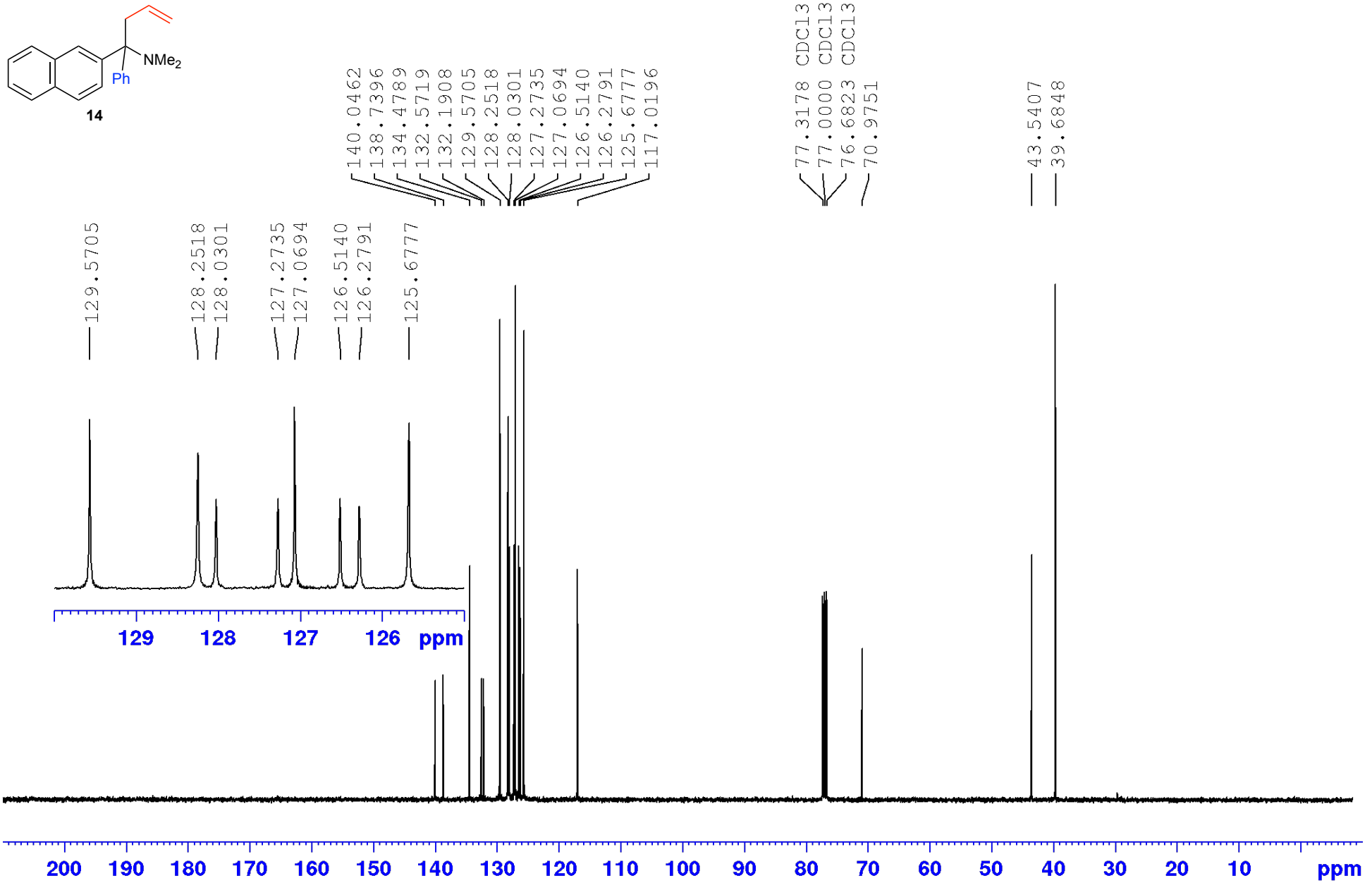
13

8.39 *N,N*-Dimethyl-1-(naphthalen-2-yl)-1-phenyl-2-(trimethylsilyl)ethan-1-amine (14)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

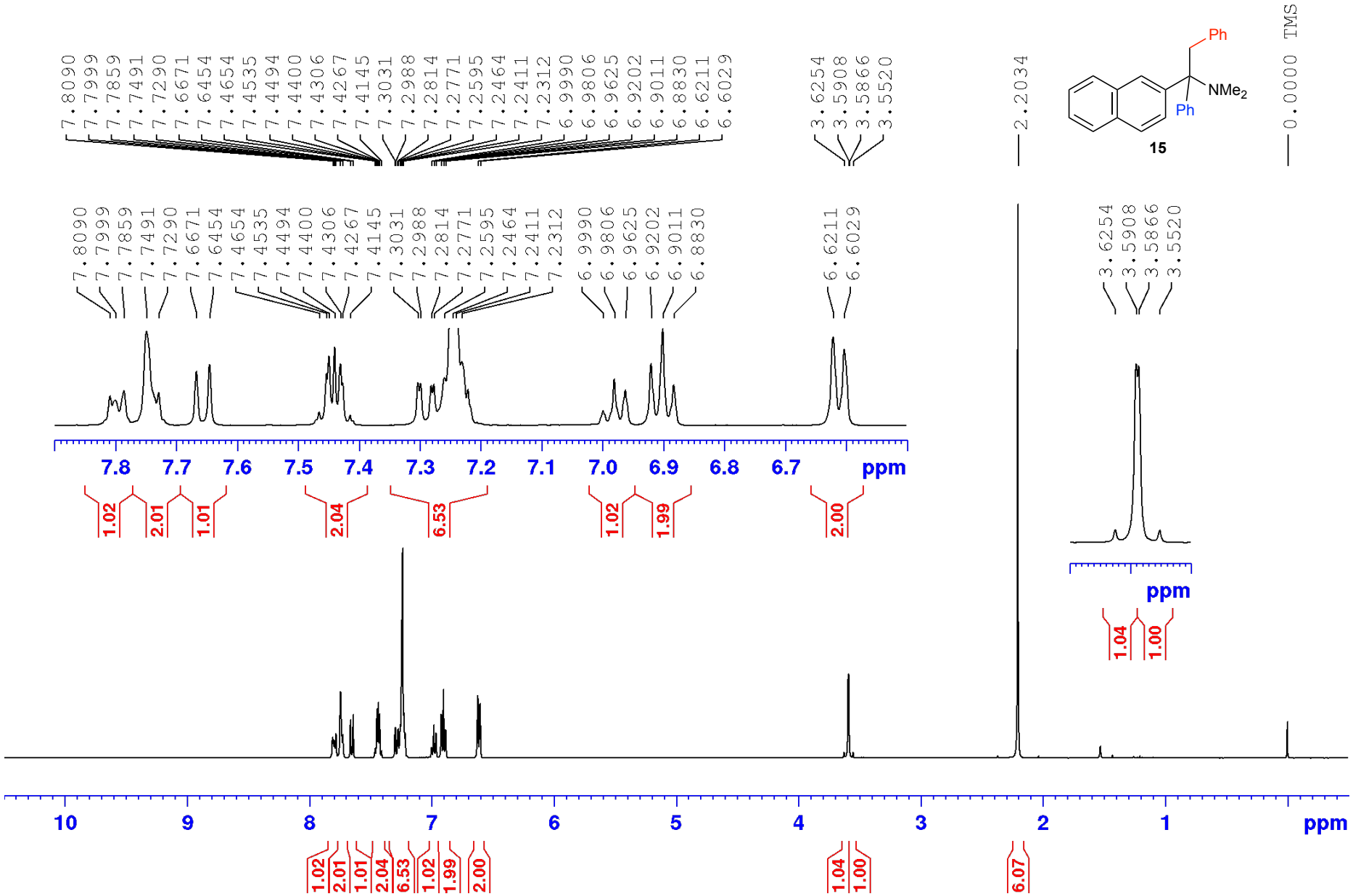


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

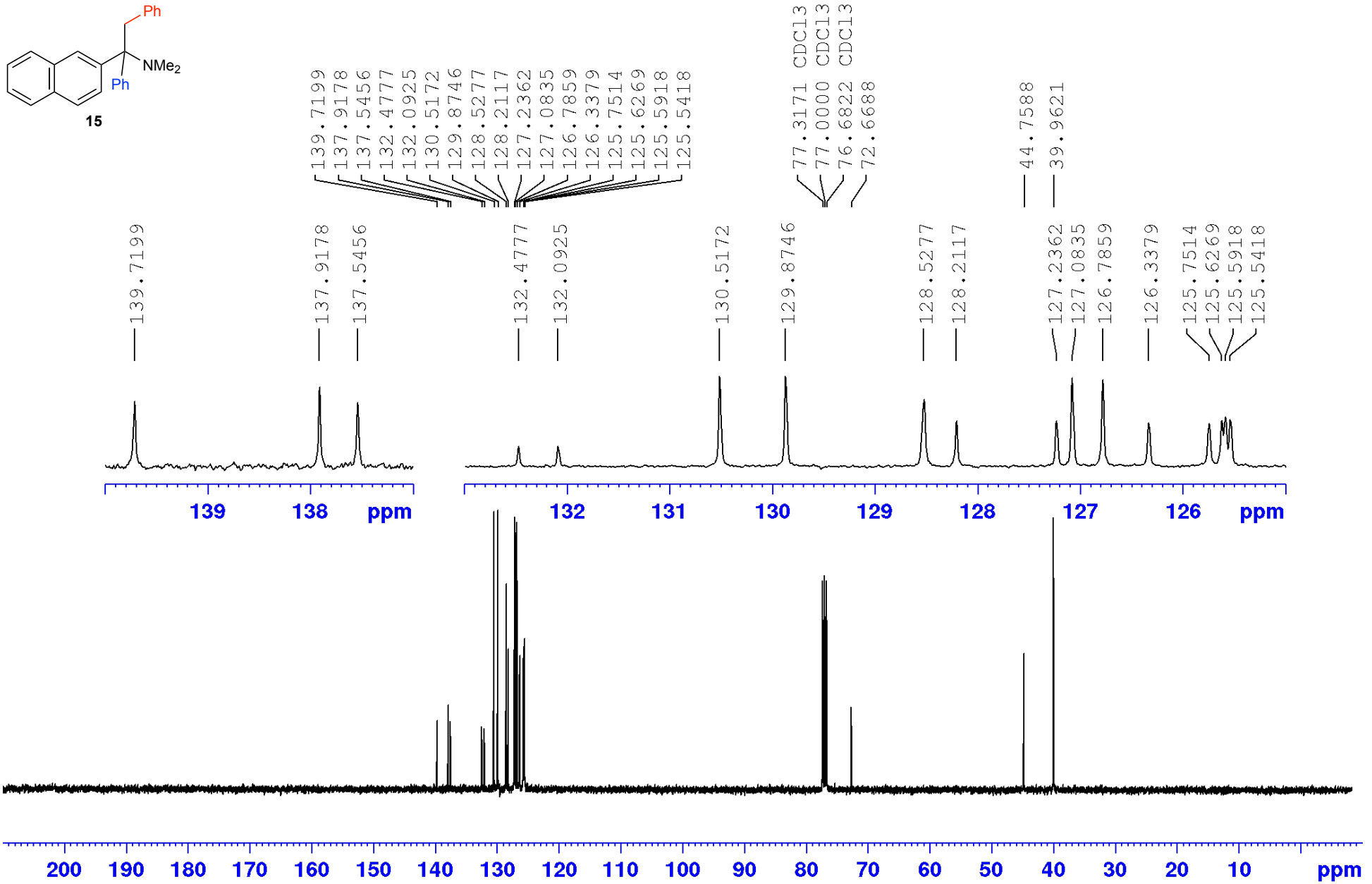


8.40 *N,N*-Dimethyl-1-(naphthalen-2-yl)-1,2-diphenylethan-1-amine (15)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

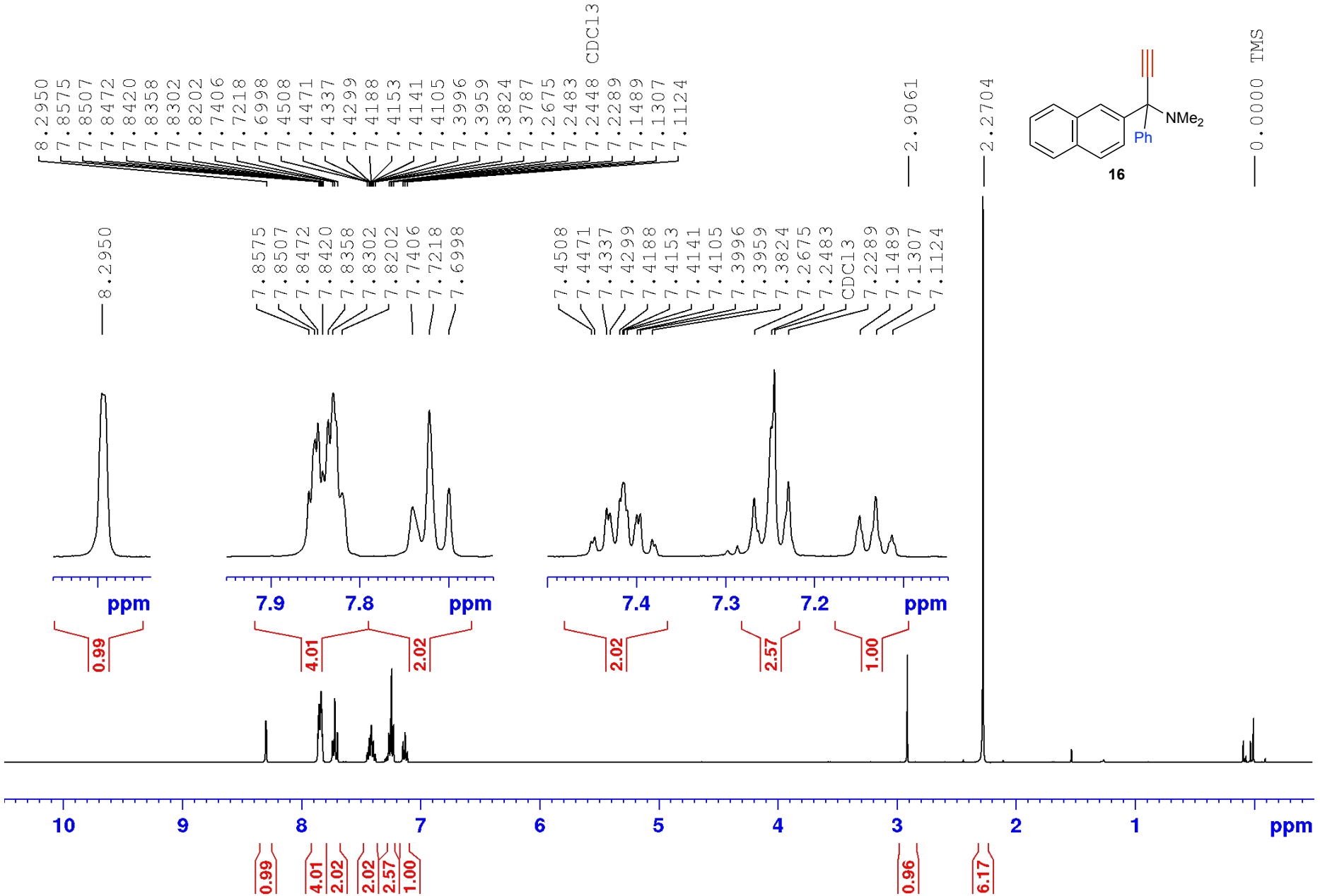


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

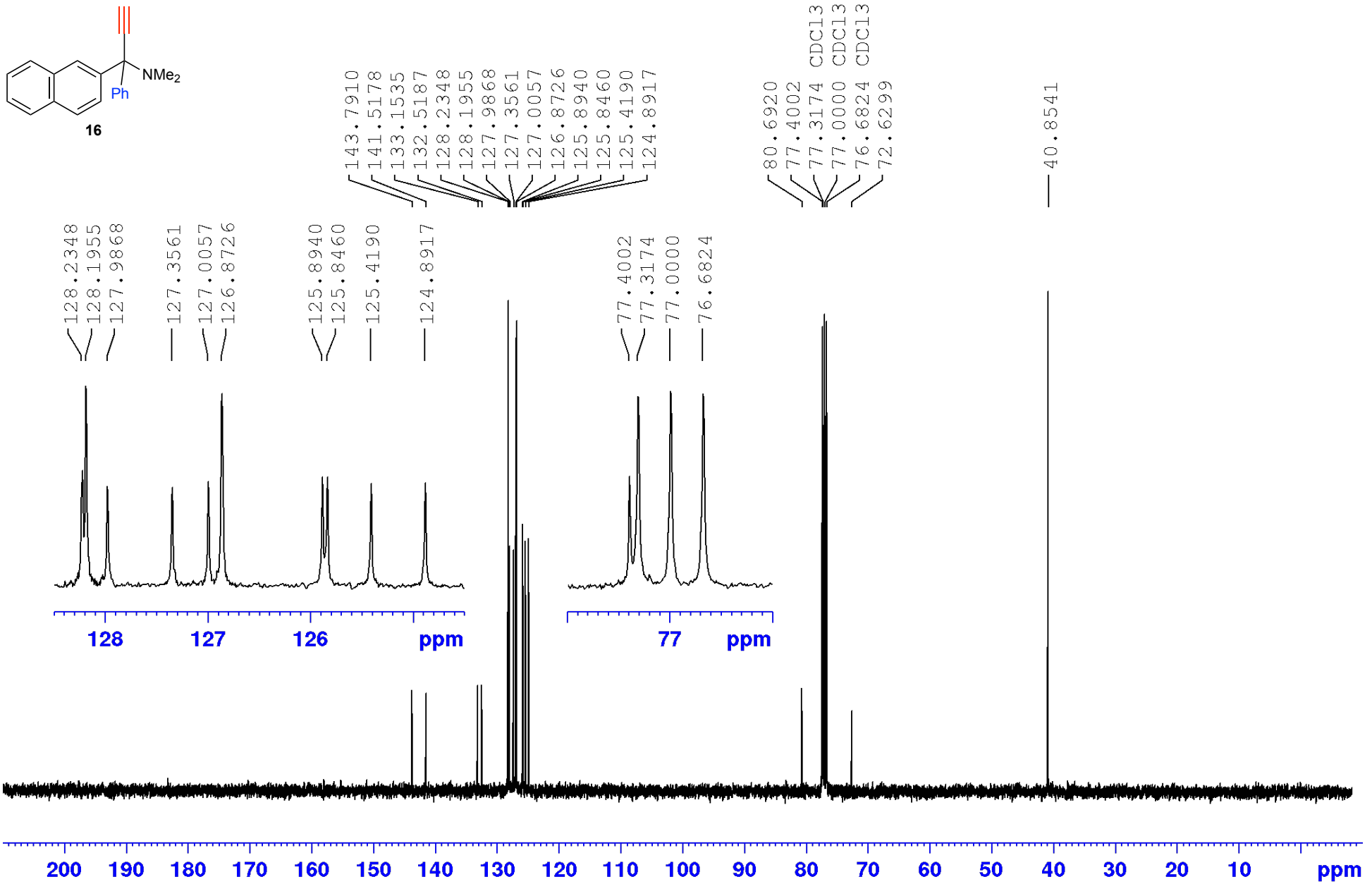


8.41 *N,N*-Dimethyl-1-(naphthalen-2-yl)-1-phenylprop-2-yn-1-amine (16)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

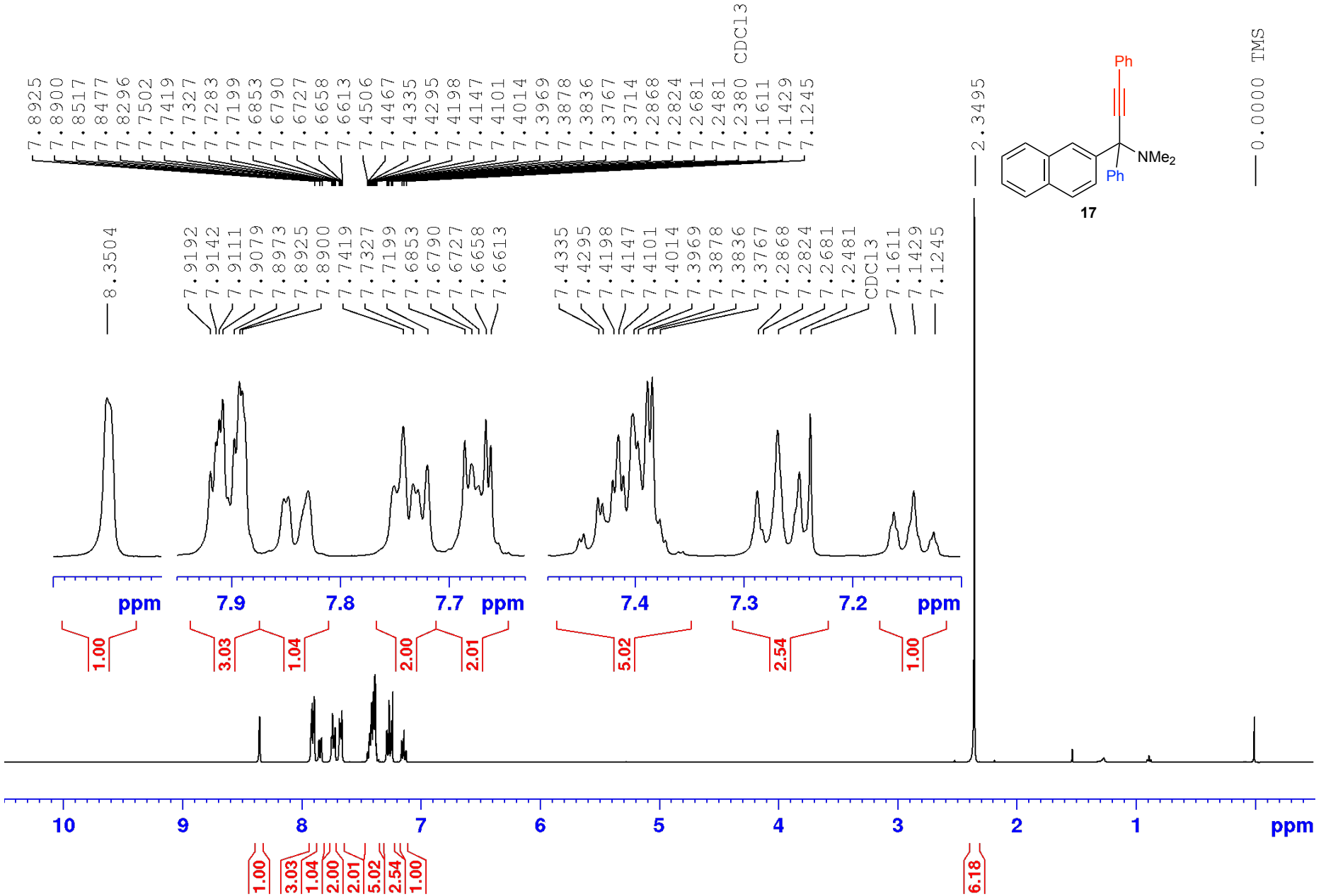


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

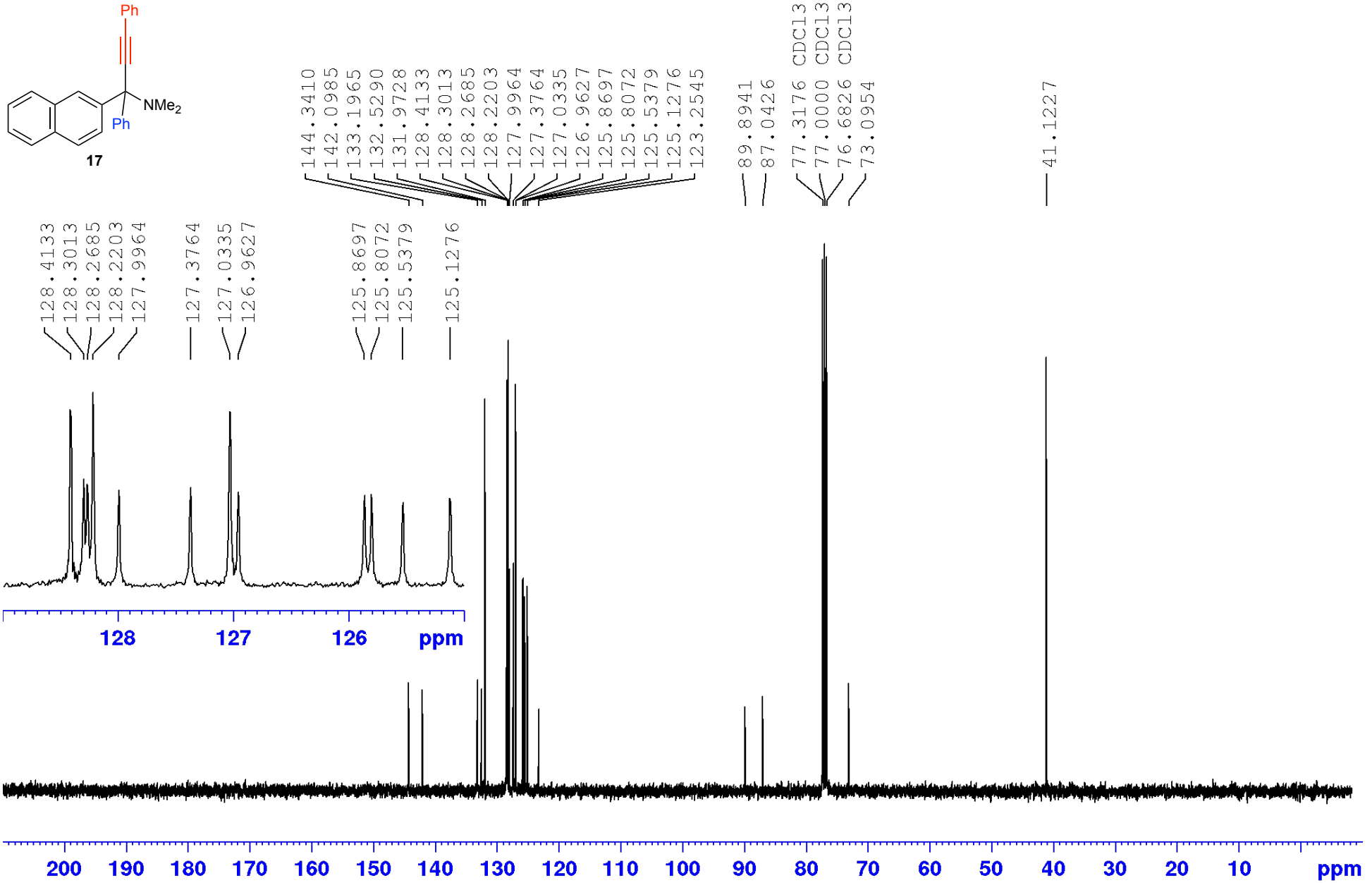


8.42 *N,N*-Dimethyl-1-(naphthalen-2-yl)-1,3-diphenylprop-2-yn-1-amine (17)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

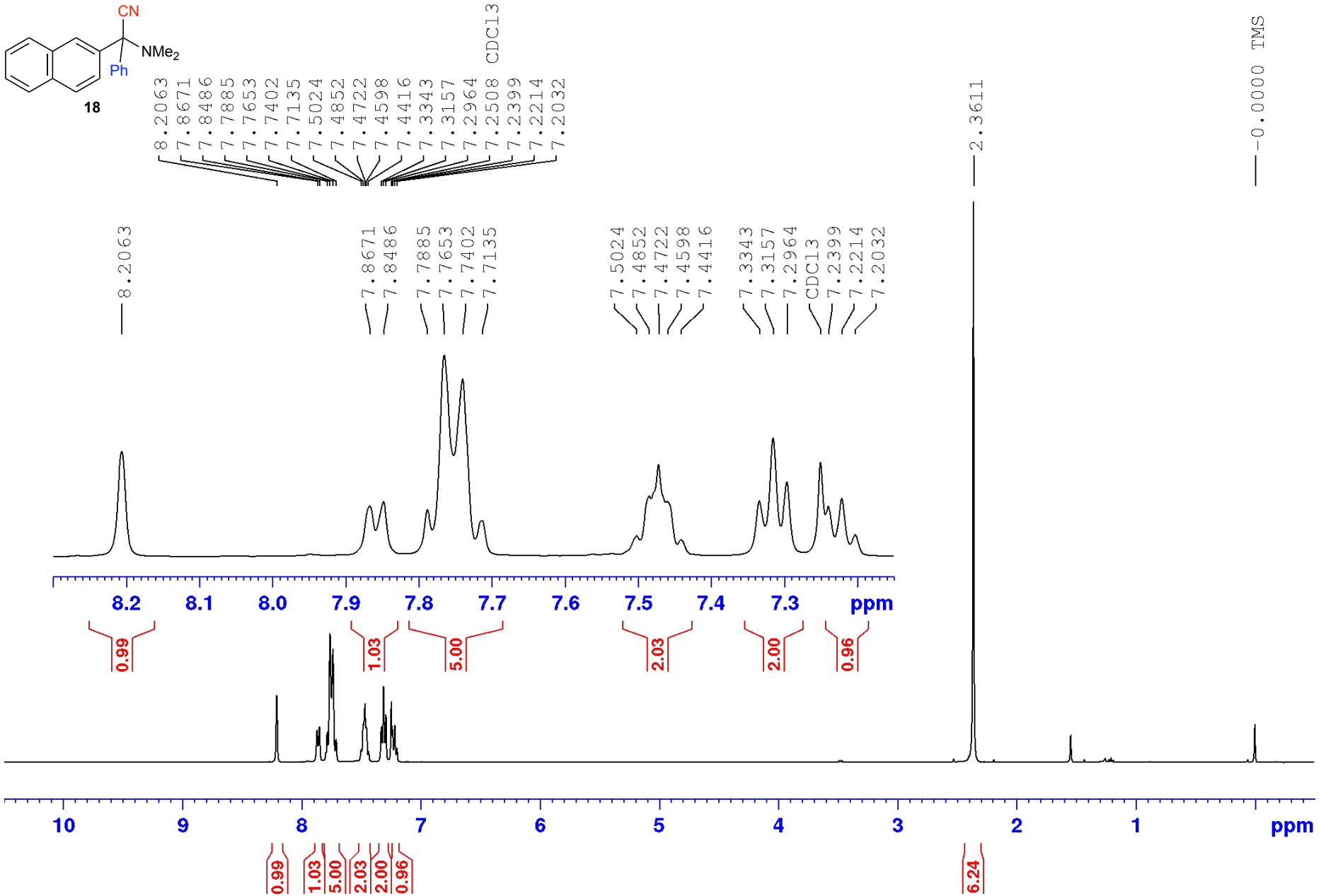


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

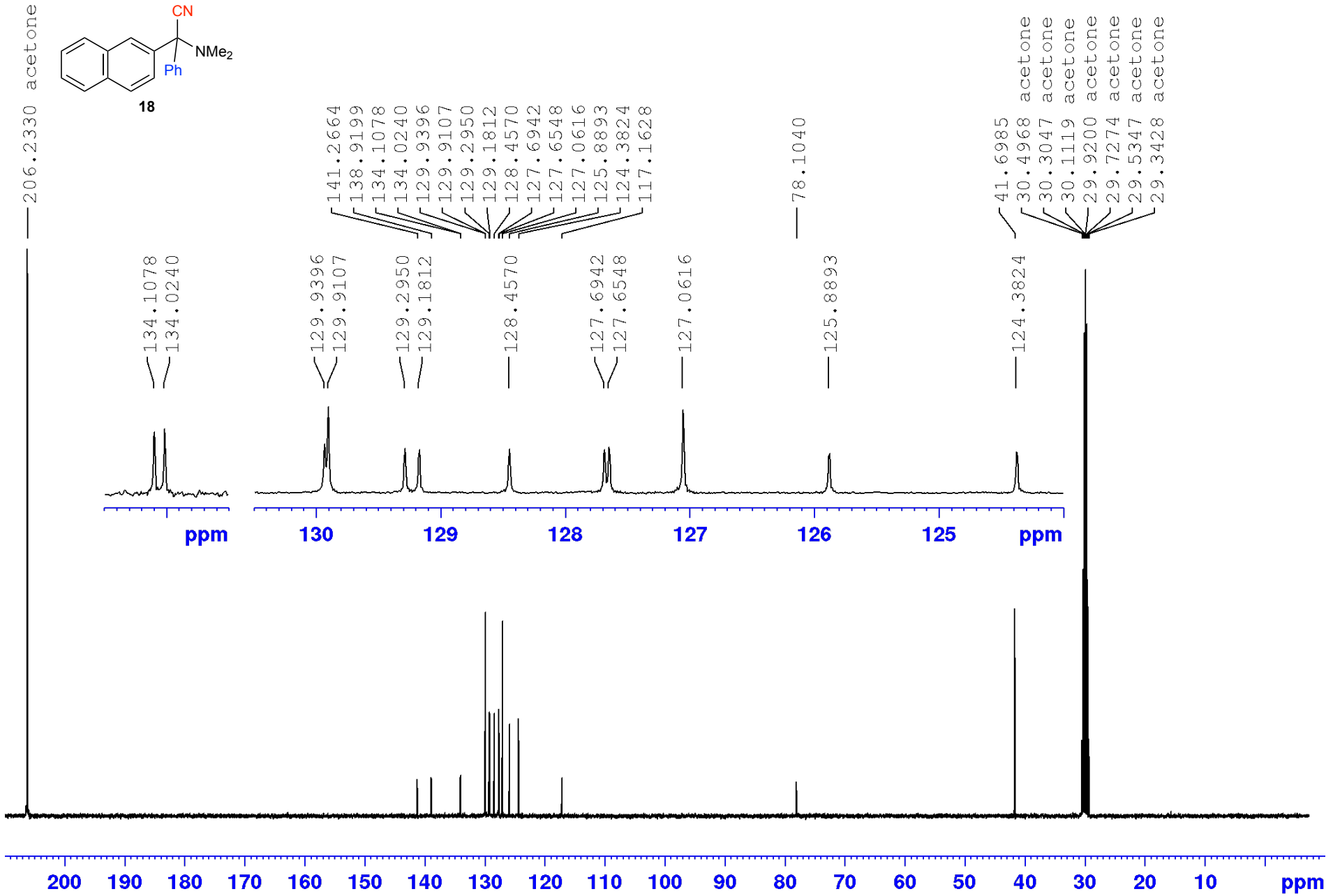


8.43 2-(Dimethylamino)-2-(naphthalen-2-yl)-2-phenylacetonitrile (18)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

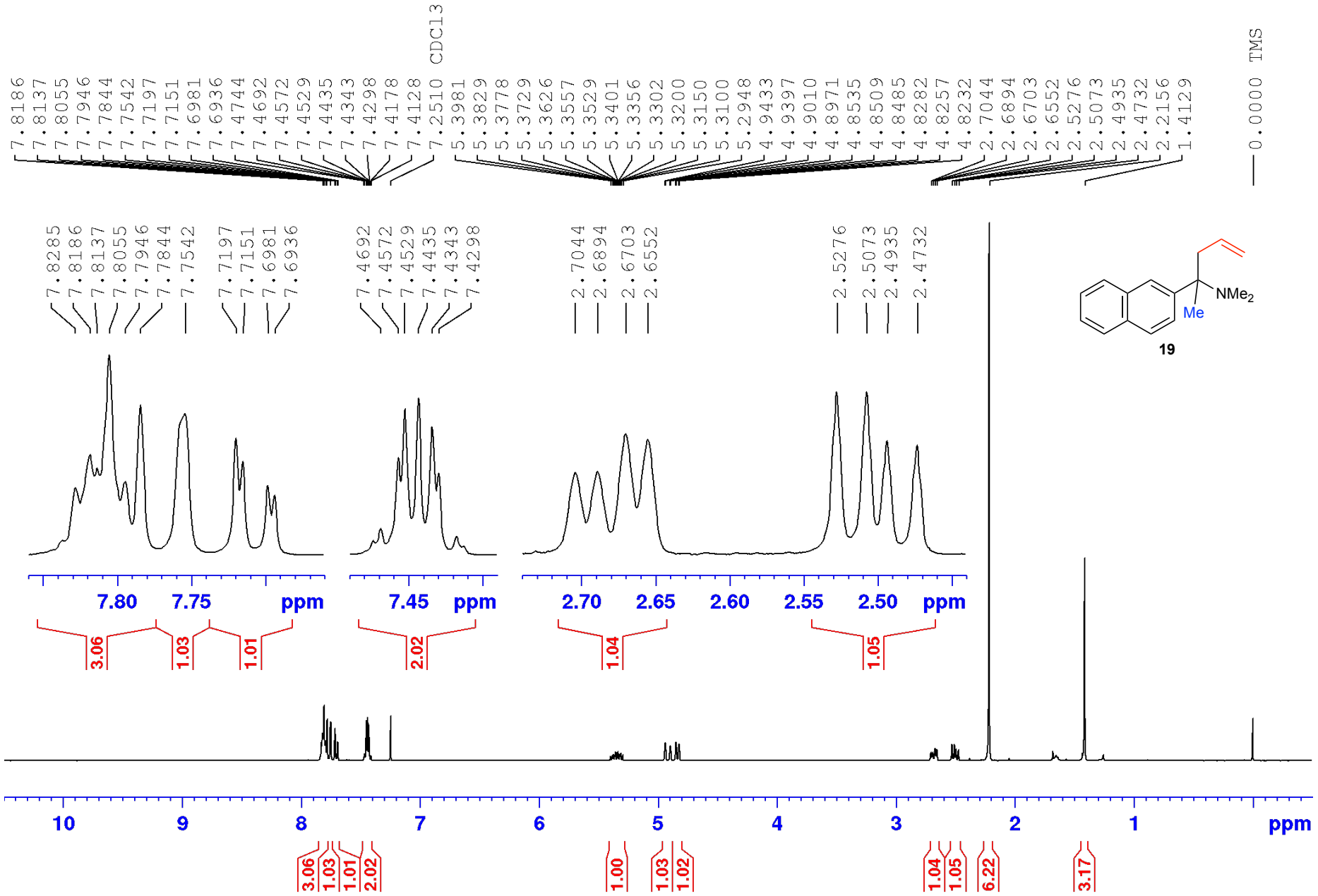


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in acetone-d_6

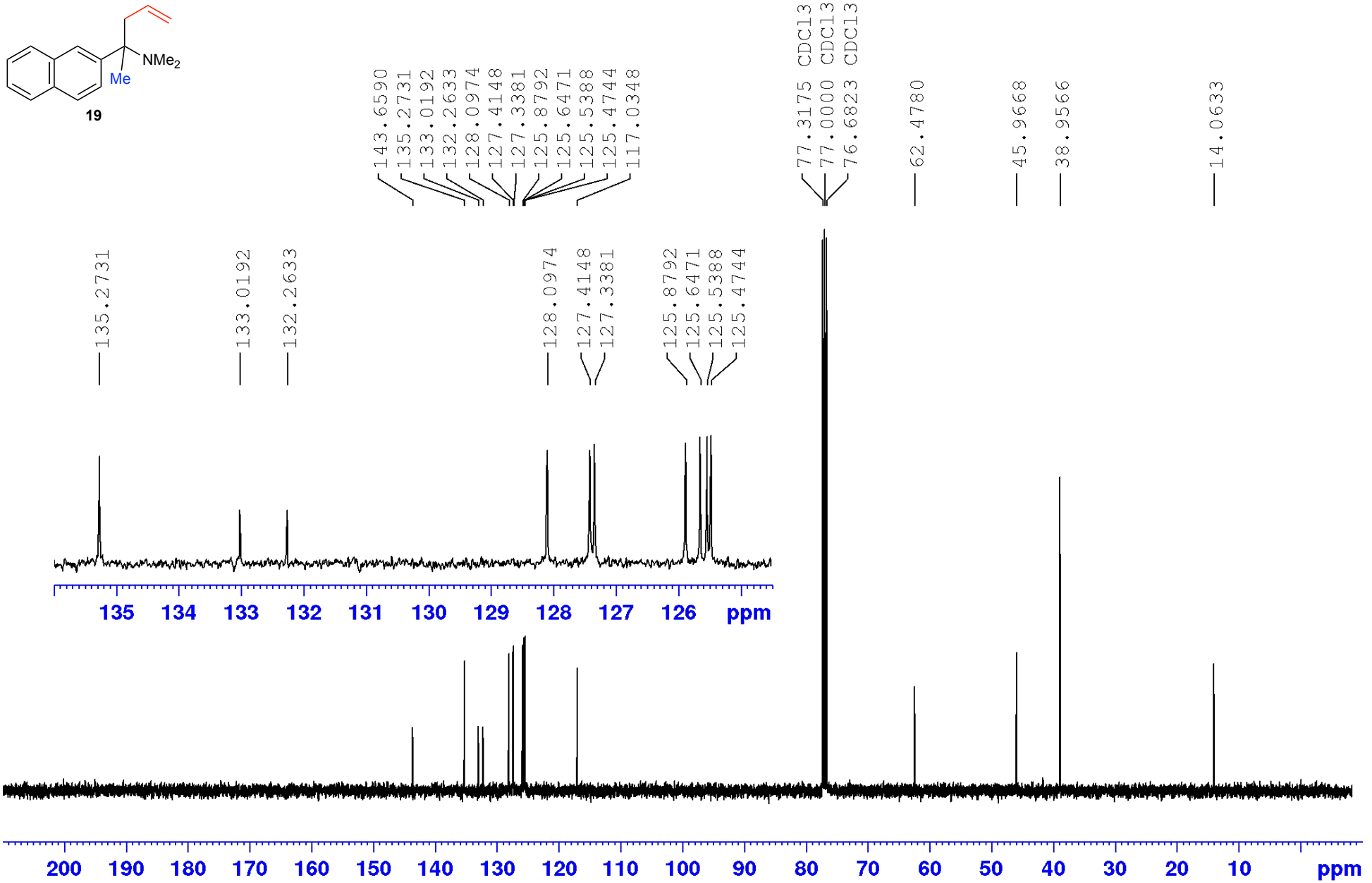


8.44 *N,N*-Dimethyl-2-(naphthalen-2-yl)pent-4-en-2-amine (19)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

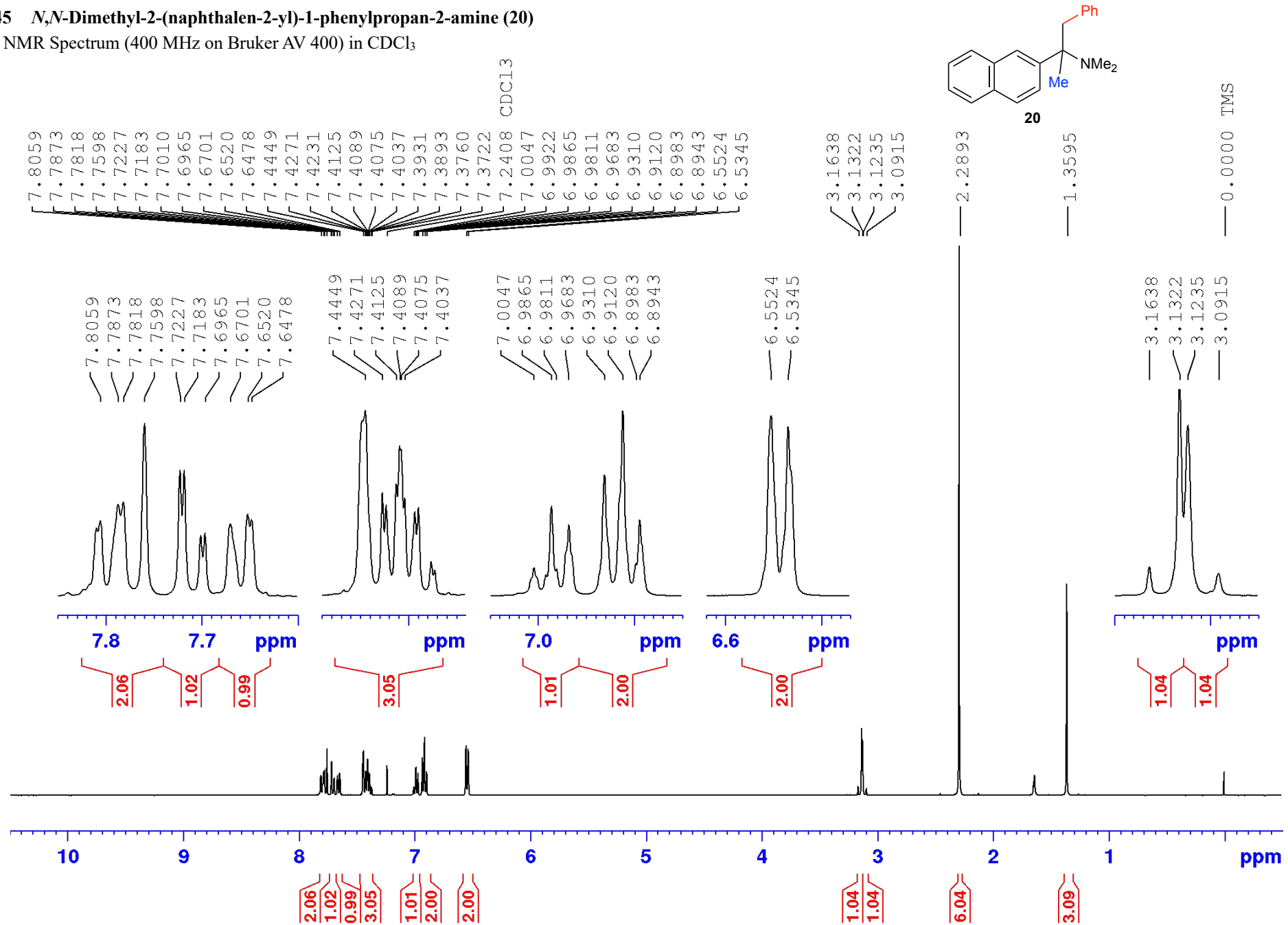


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

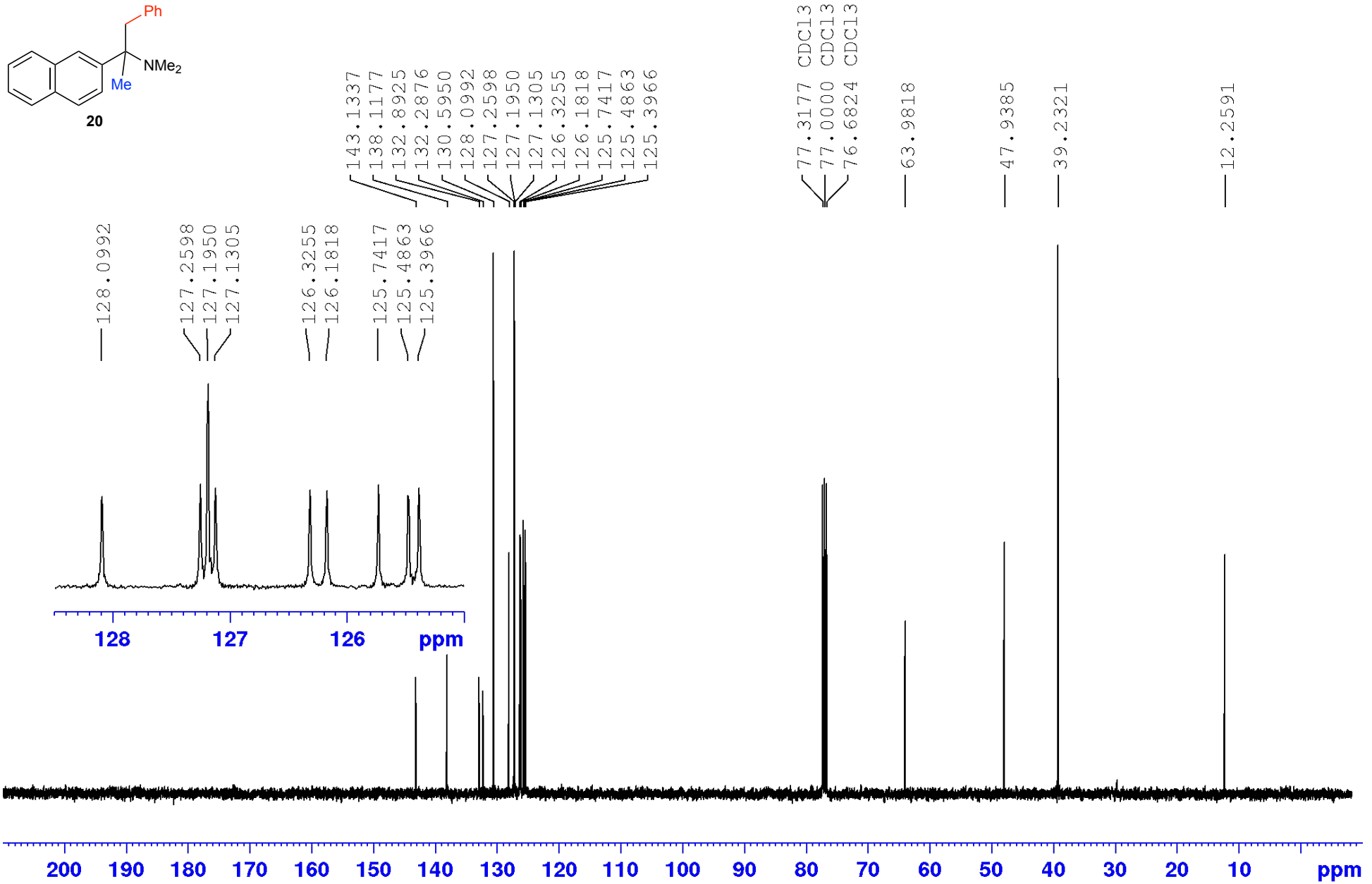


8.45 *N,N*-Dimethyl-2-(naphthalen-2-yl)-1-phenylpropan-2-amine (20)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

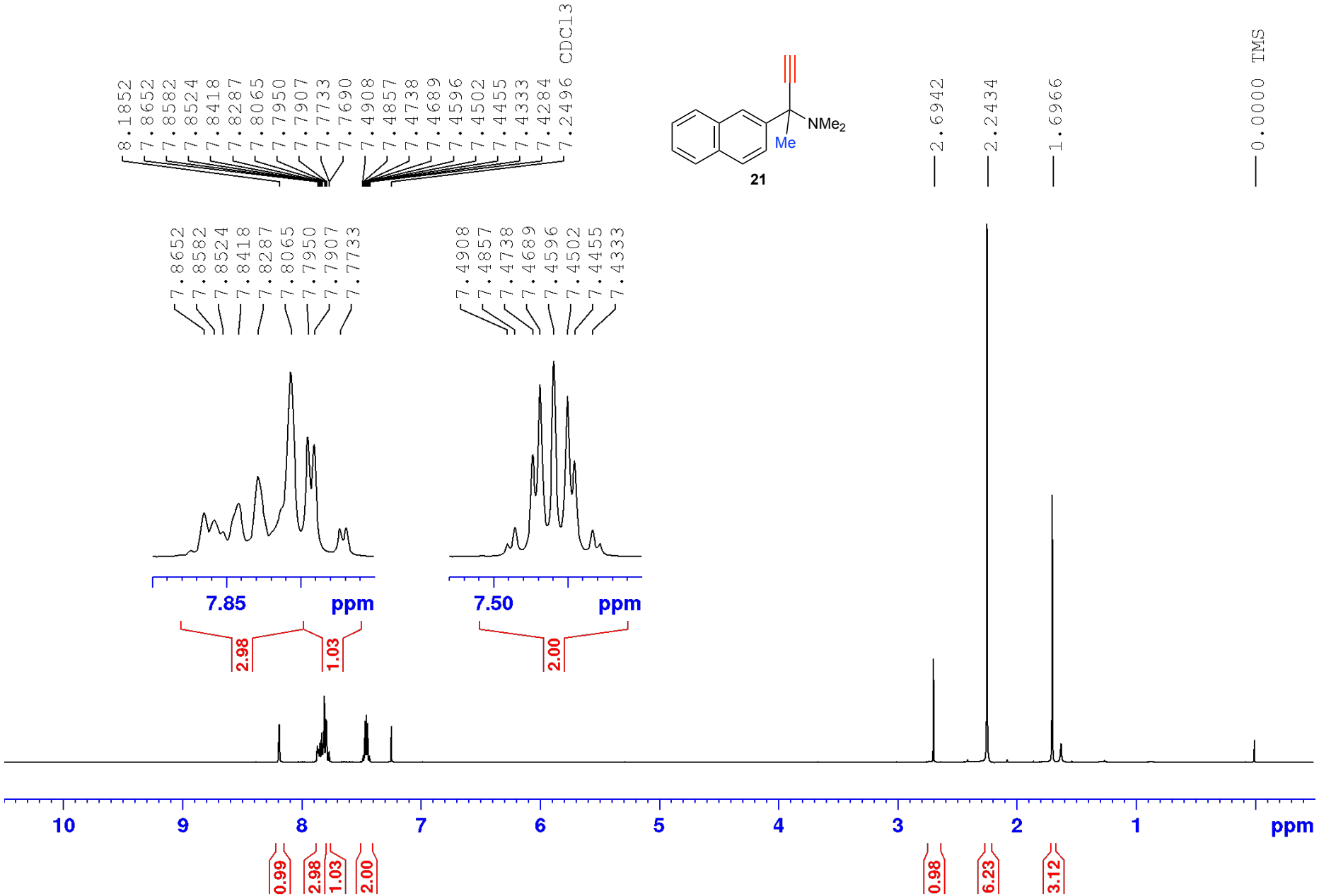


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

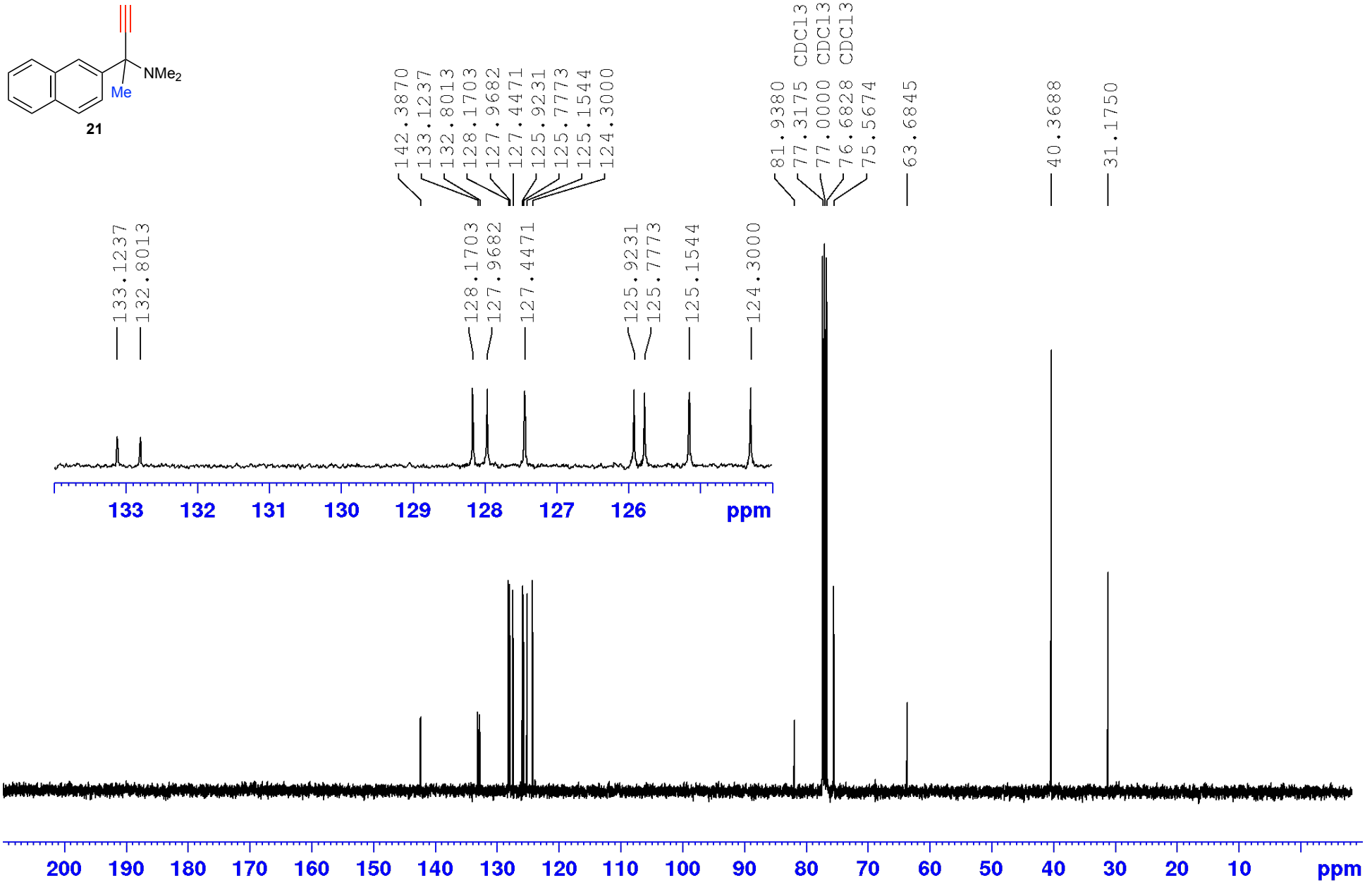


8.46 *N,N*-Dimethyl-2-(naphthalen-2-yl)but-3-yn-2-amine (21)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

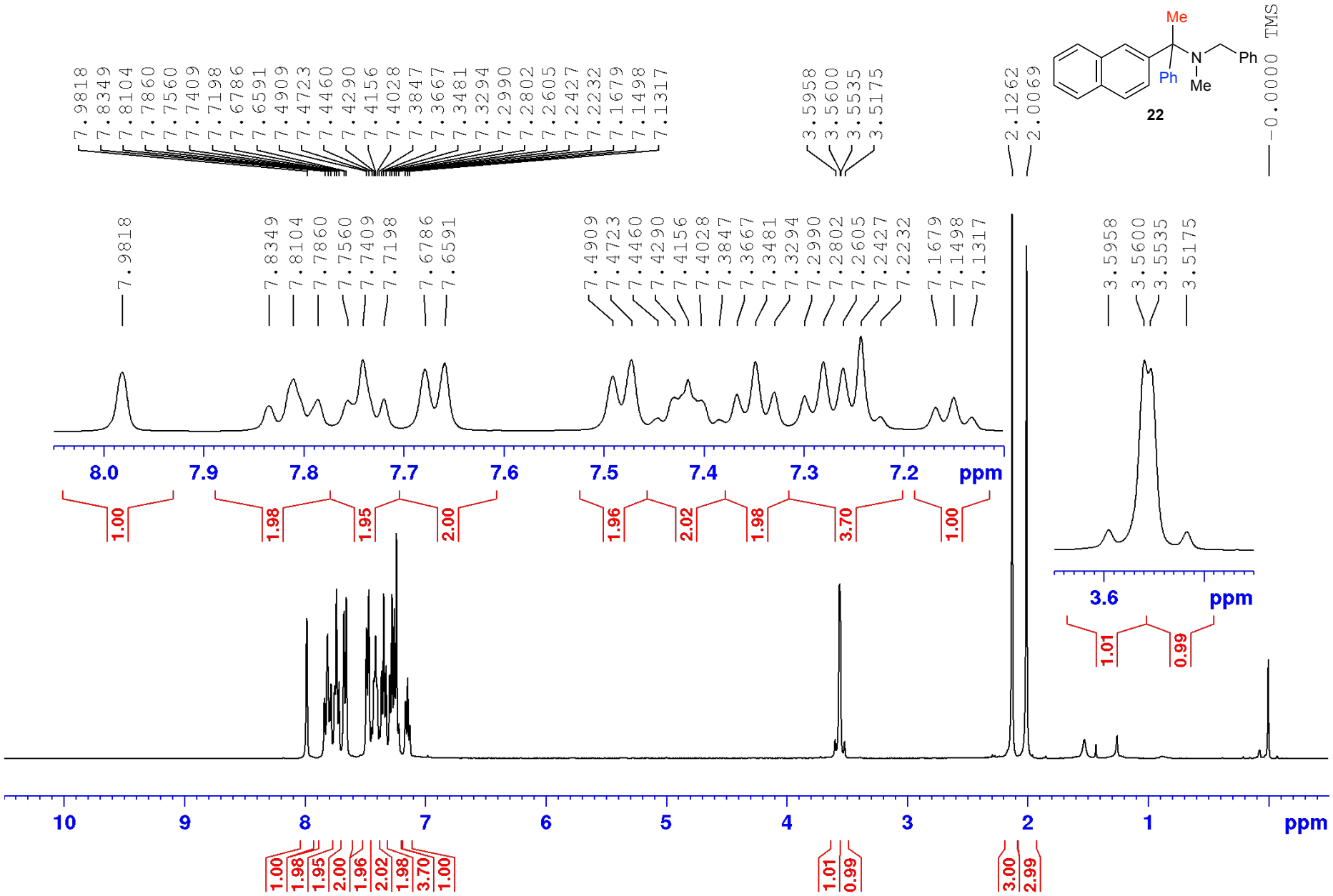


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

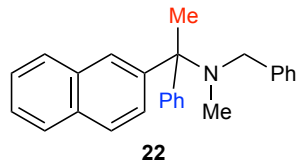


8.47 *N*-Benzyl-*N*-methyl-1-(naphthalen-2-yl)-1-phenylethan-1-amine (22)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



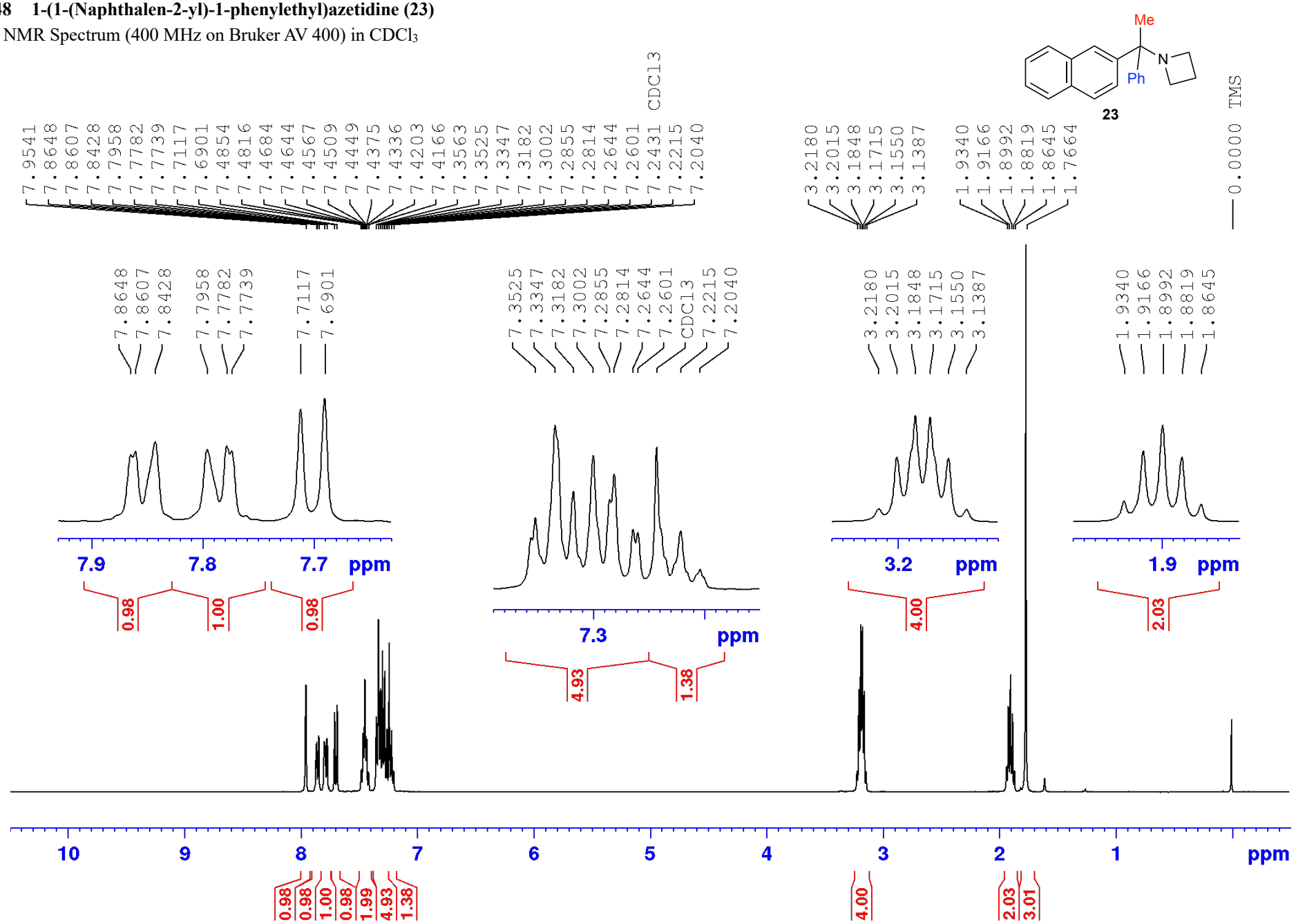
^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



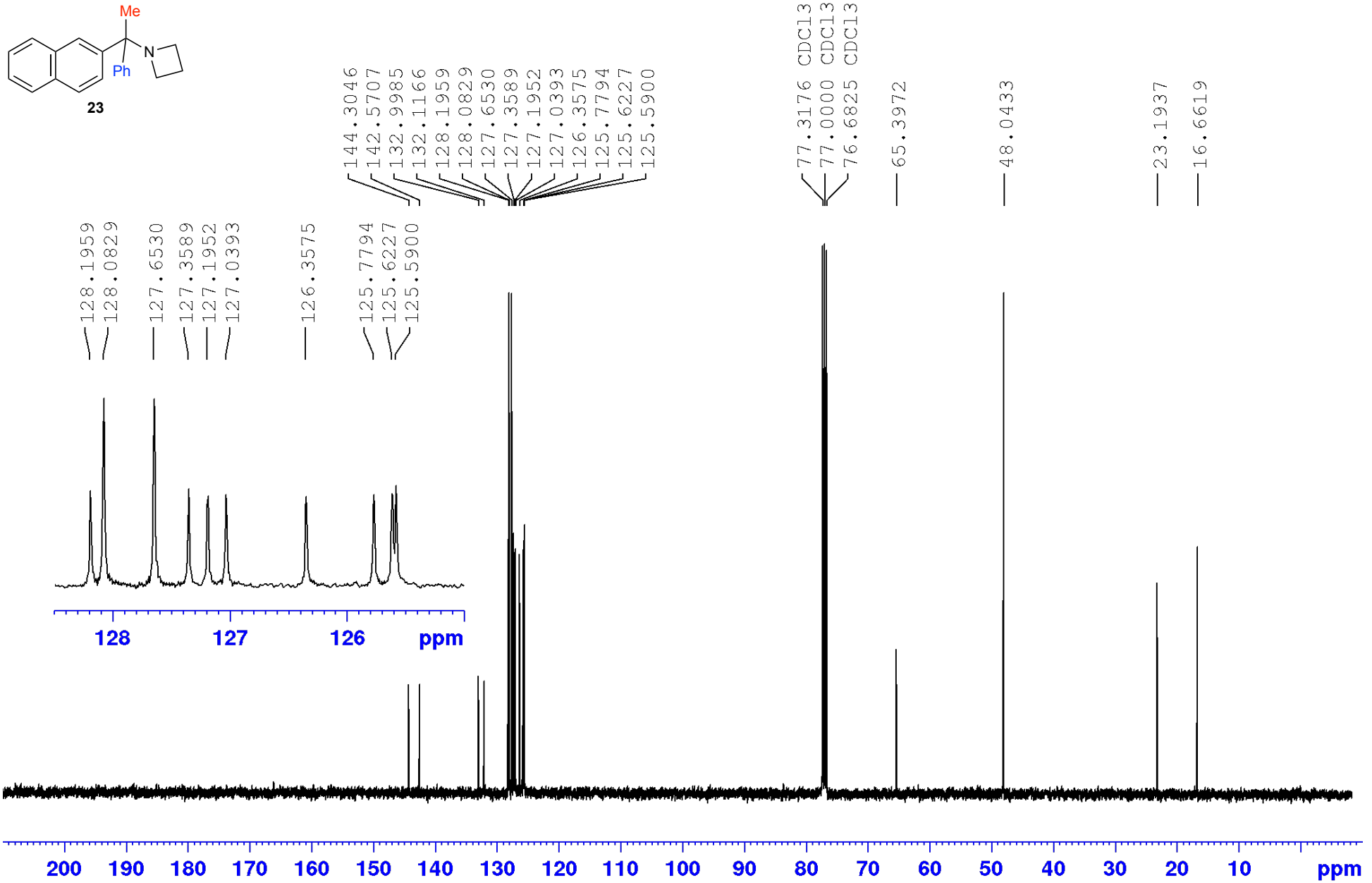
22

8.48 1-(1-(Naphthalen-2-yl)-1-phenylethyl)azetidine (23)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

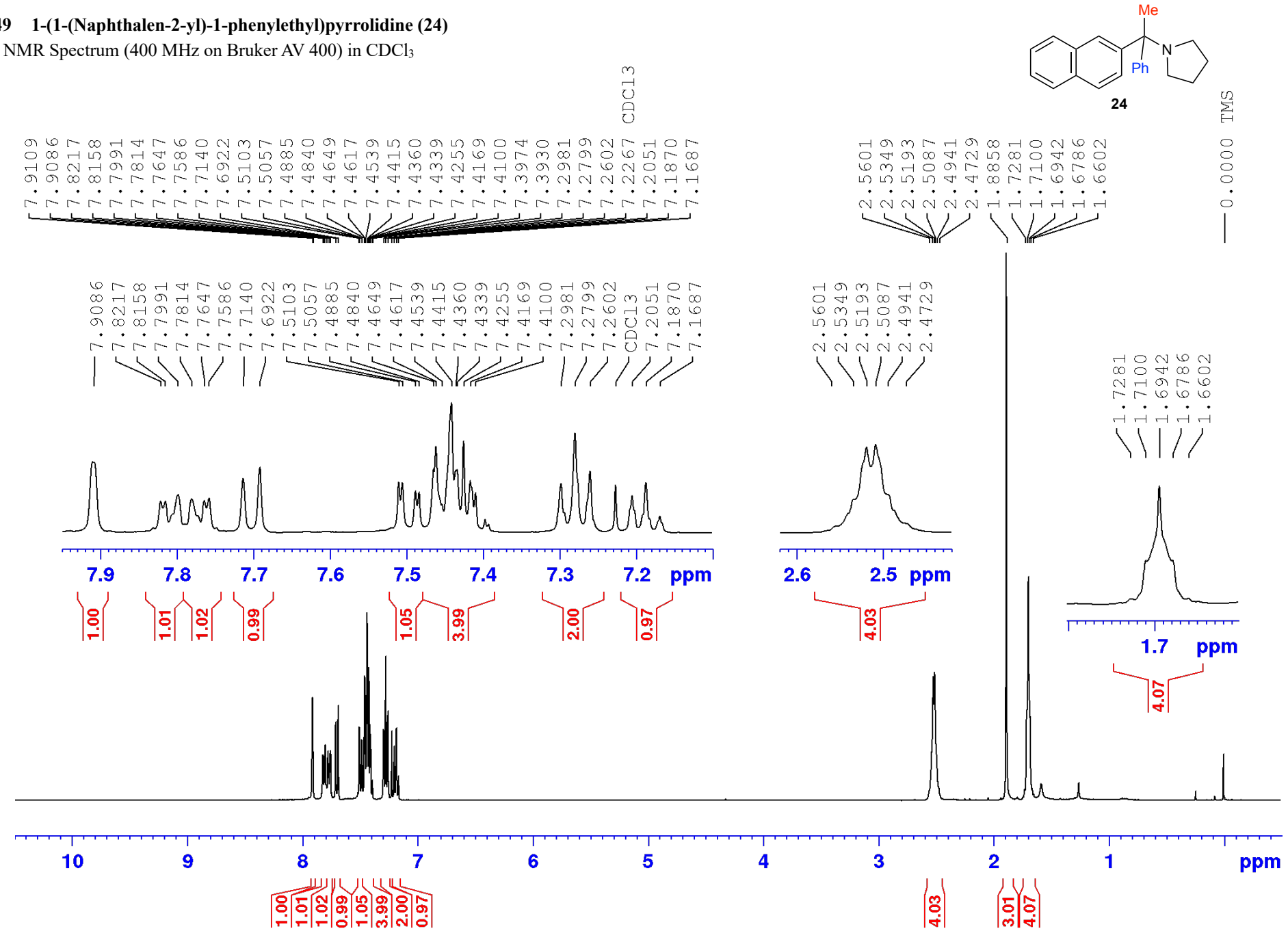


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

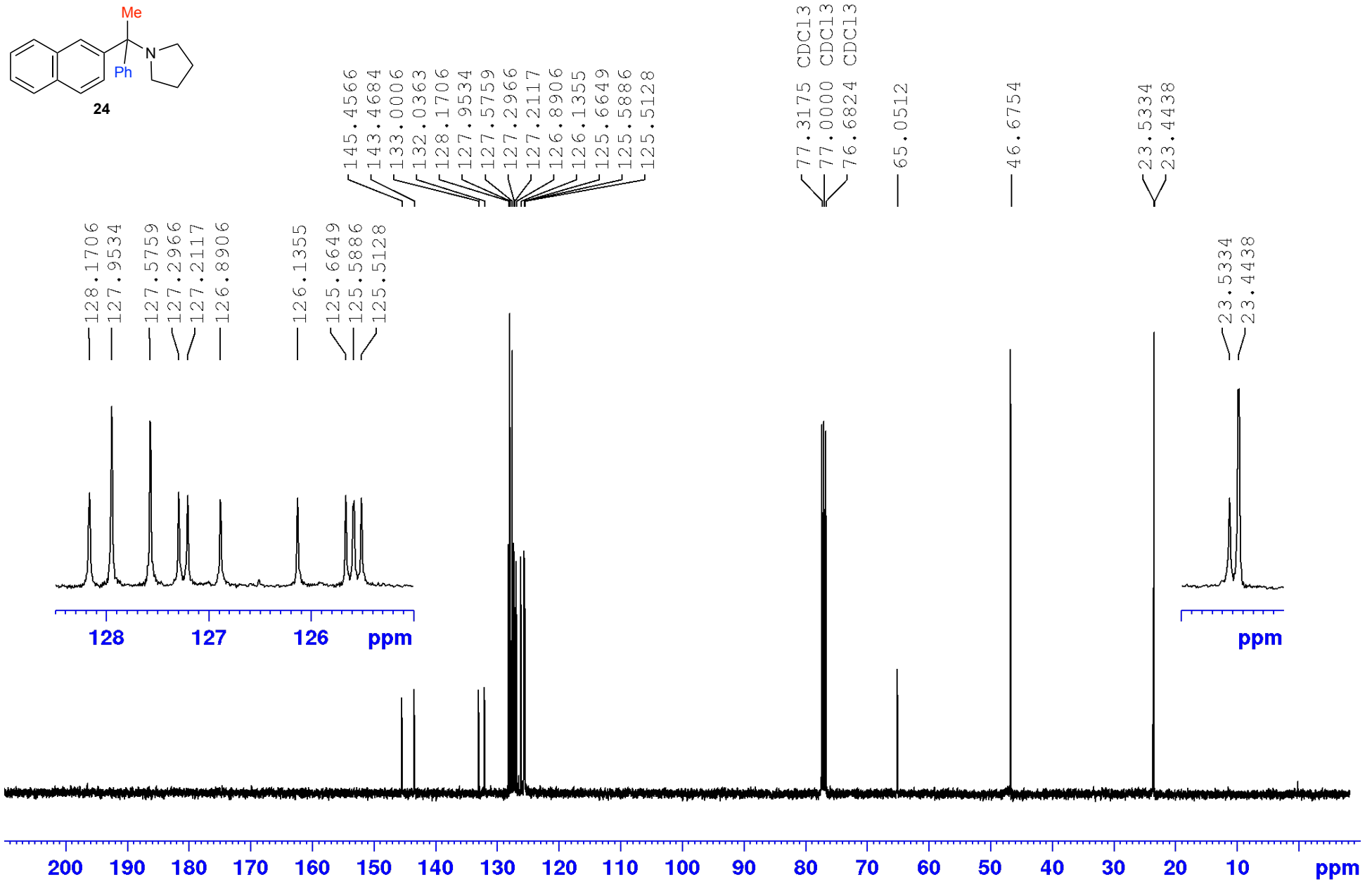


8.49 1-(1-(Naphthalen-2-yl)-1-phenylethyl)pyrrolidine (24)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

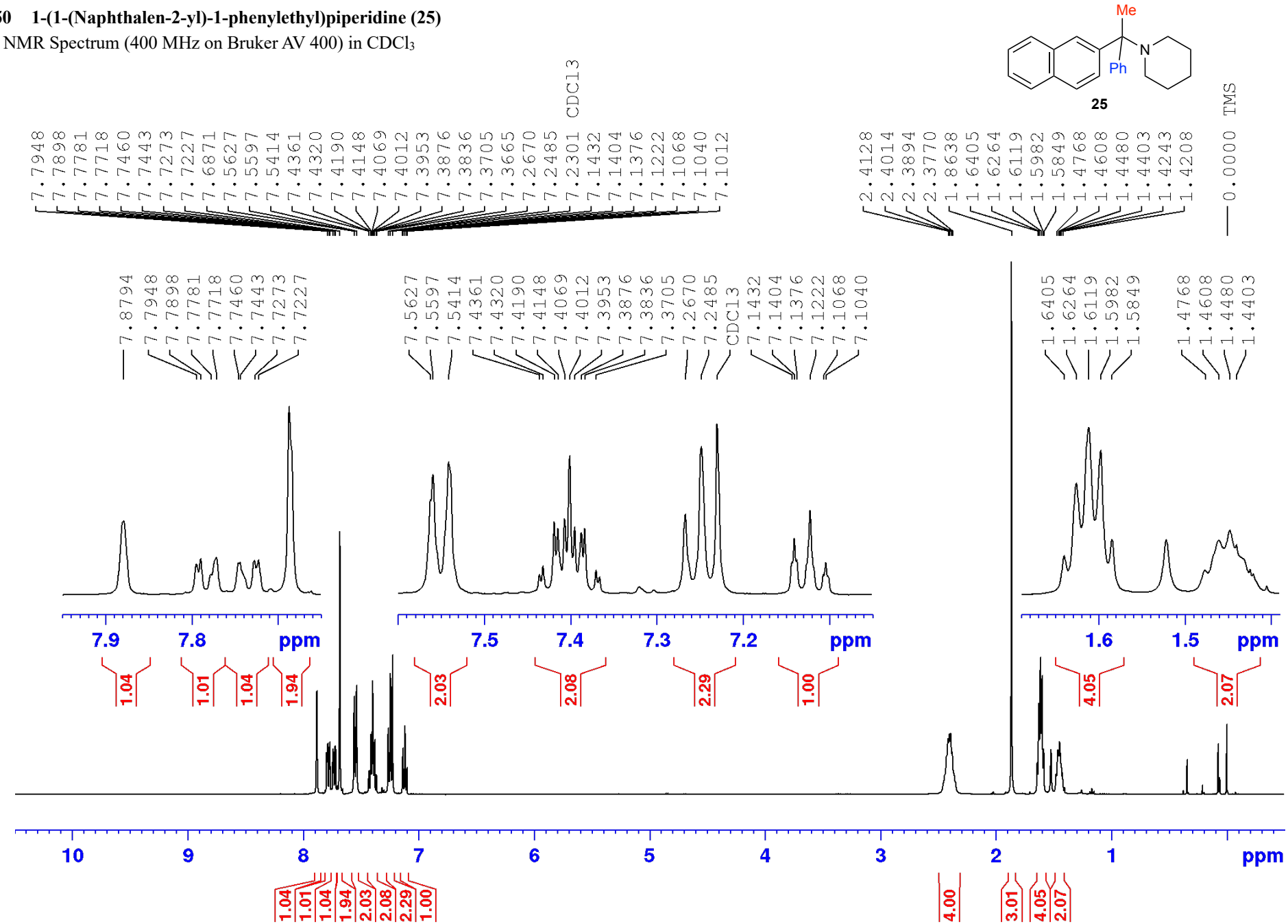


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

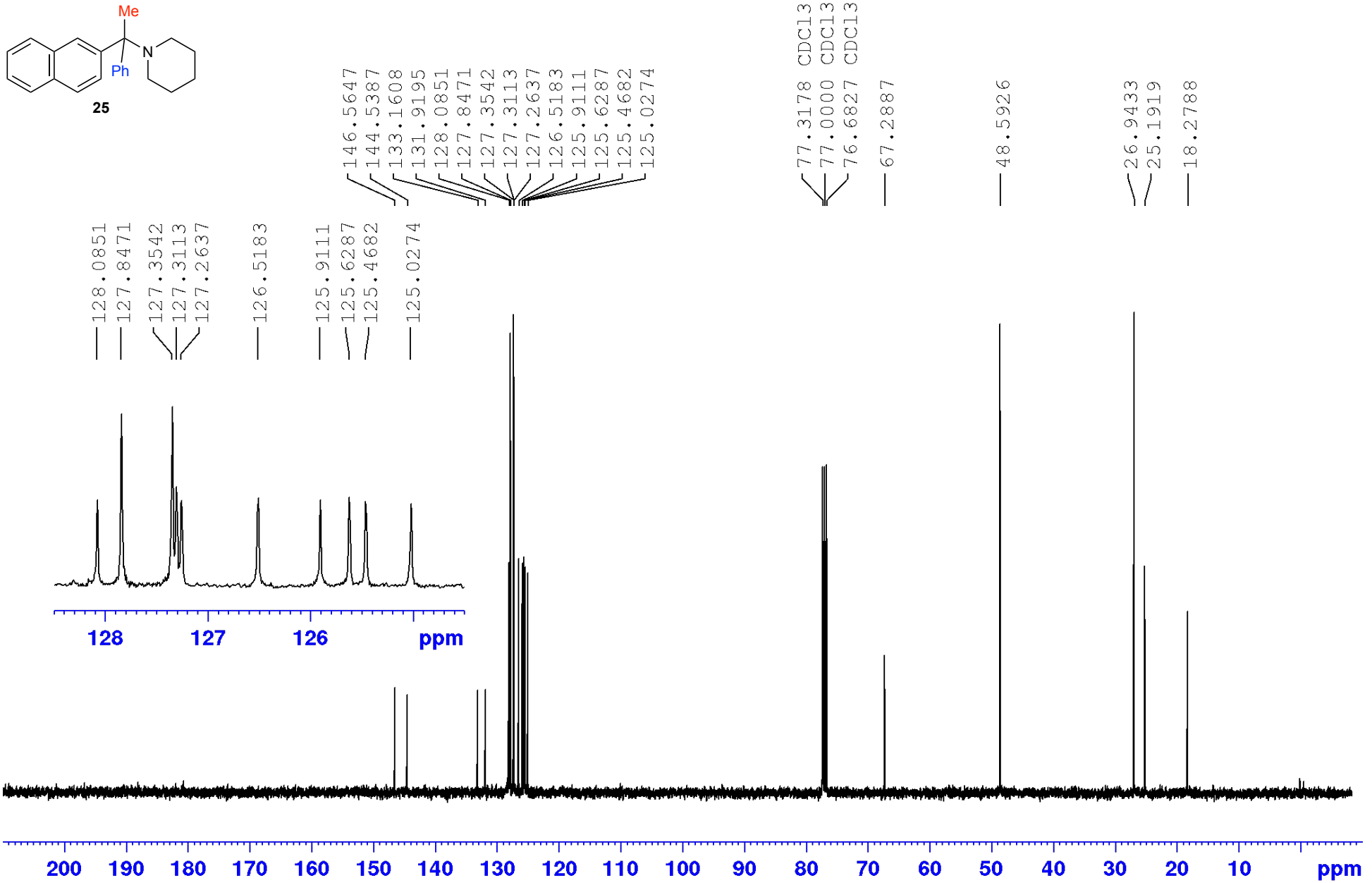


8.50 1-(1-(Naphthalen-2-yl)-1-phenylethyl)piperidine (25)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

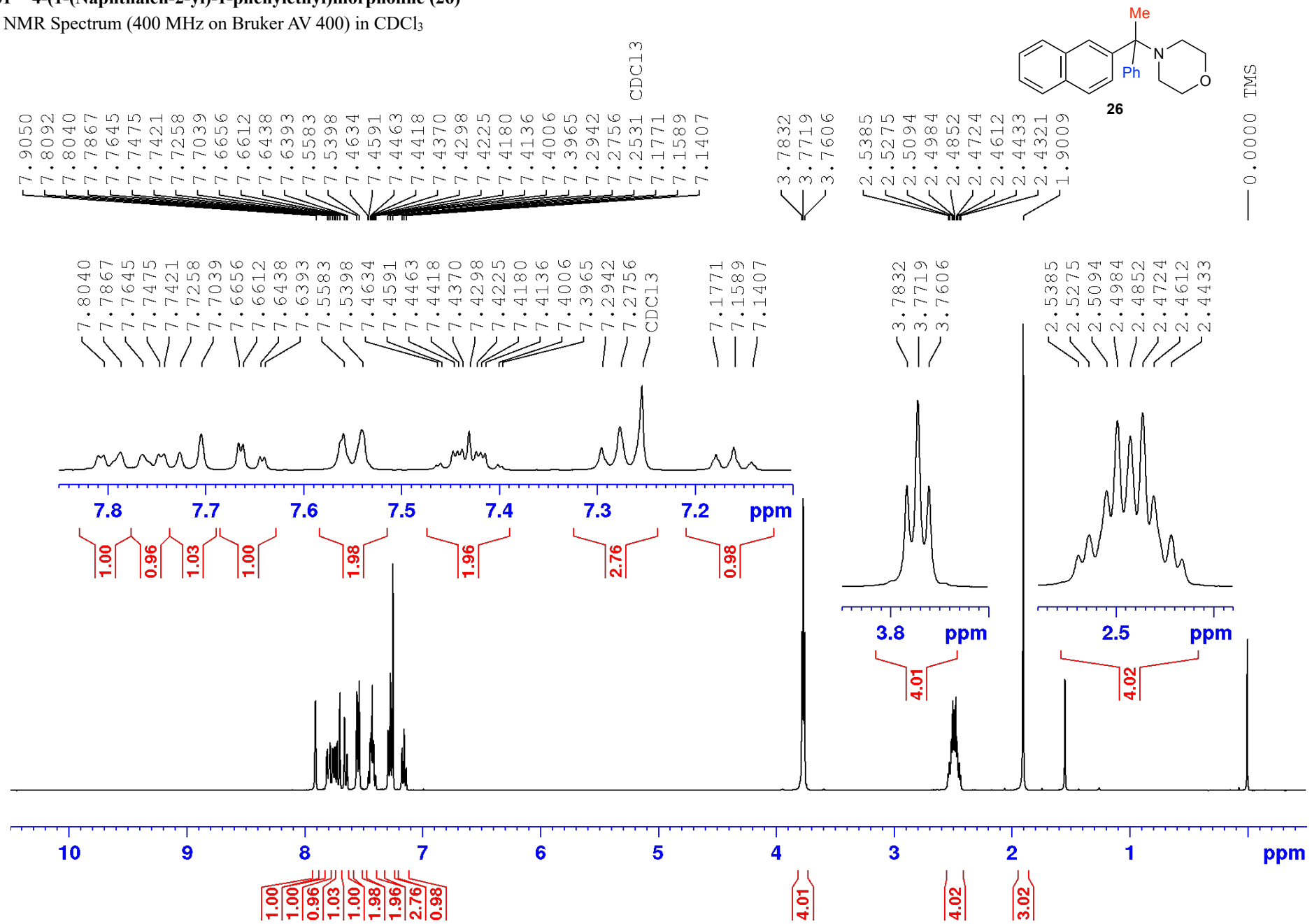


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

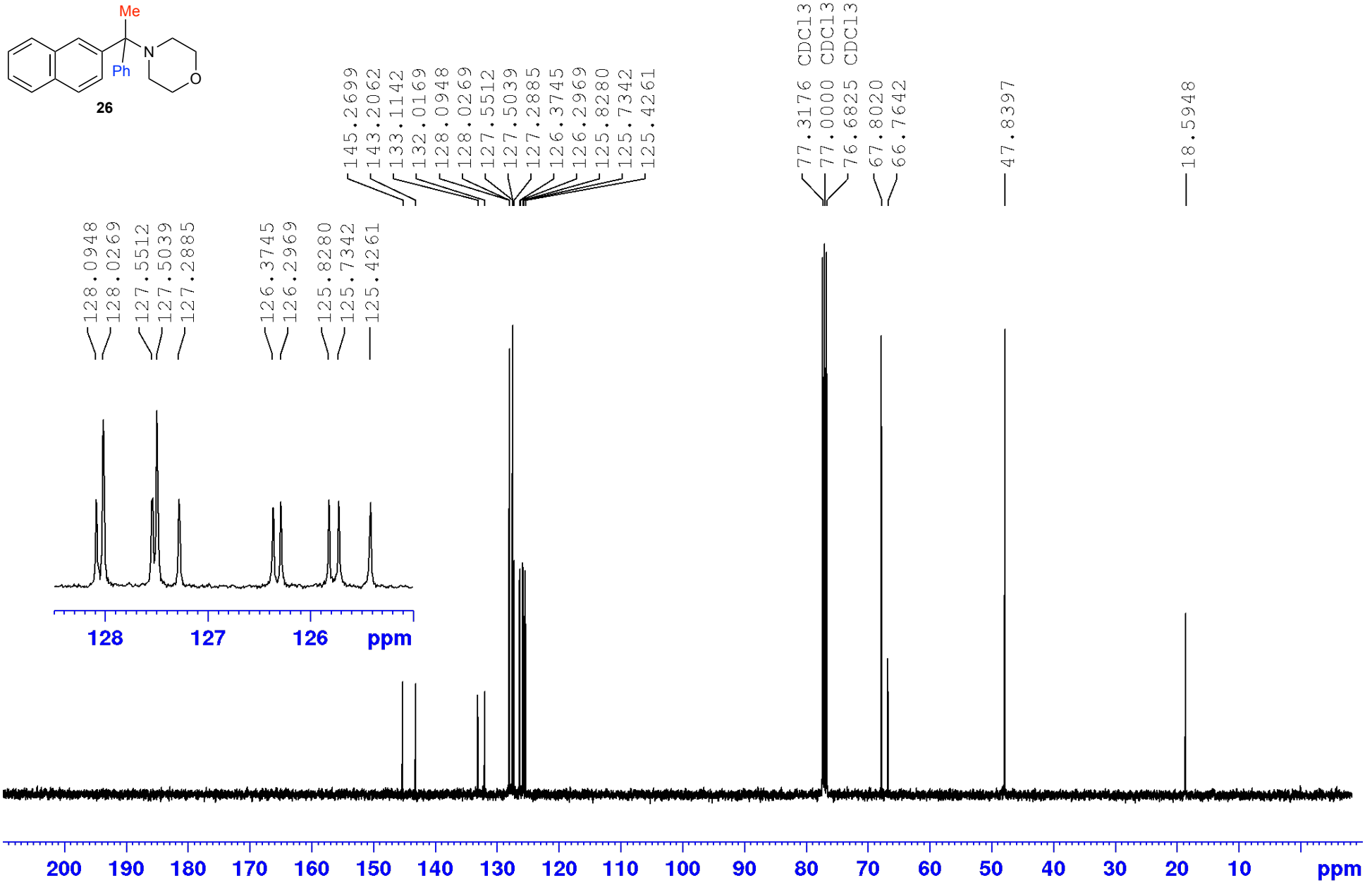


8.51 4-(1-(Naphthalen-2-yl)-1-phenylethyl)morpholine (26)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

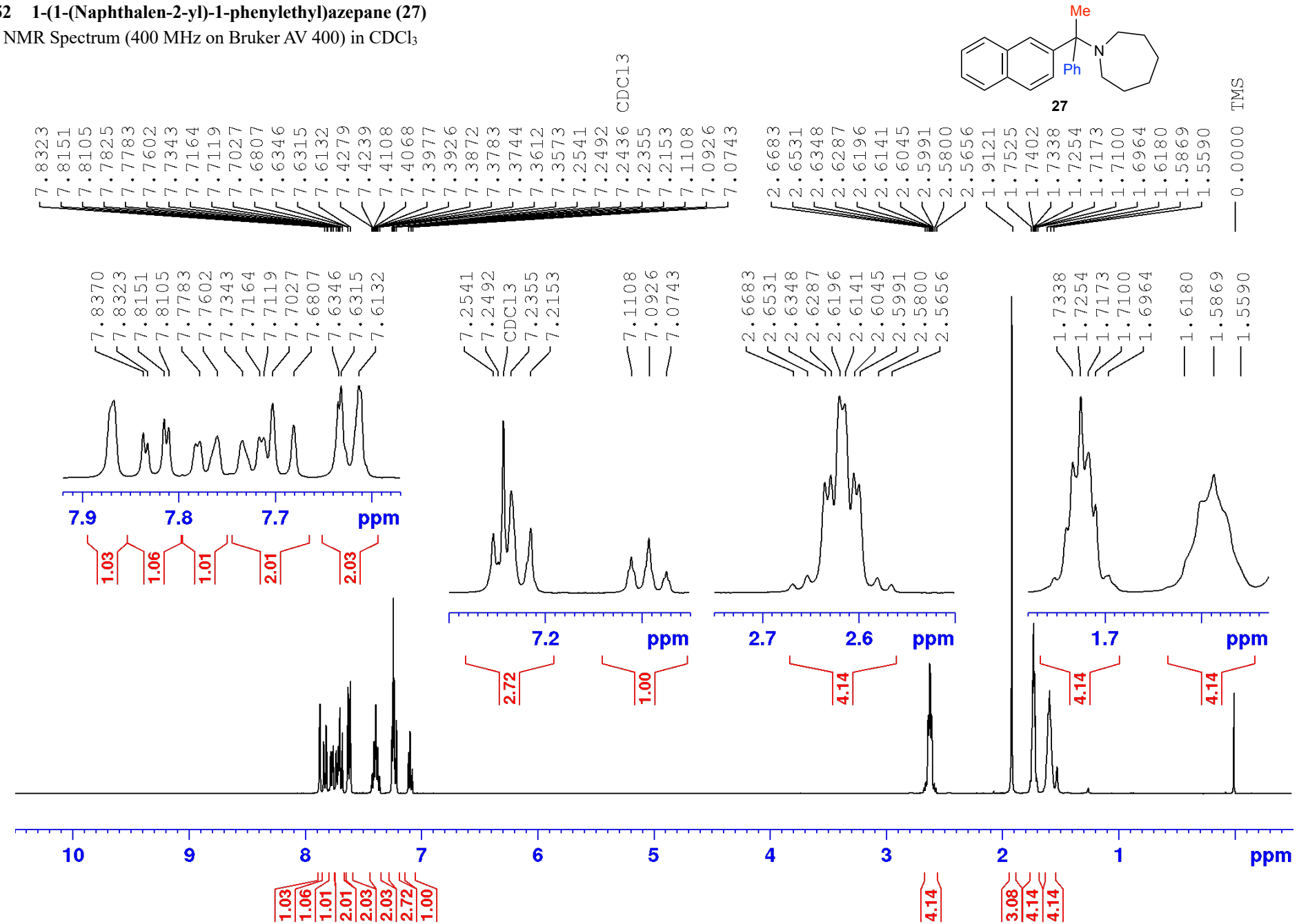


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

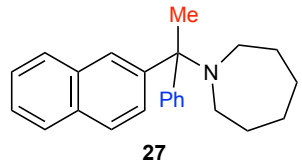


8.52 1-(1-(Naphthalen-2-yl)-1-phenylethyl)azepane (27)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



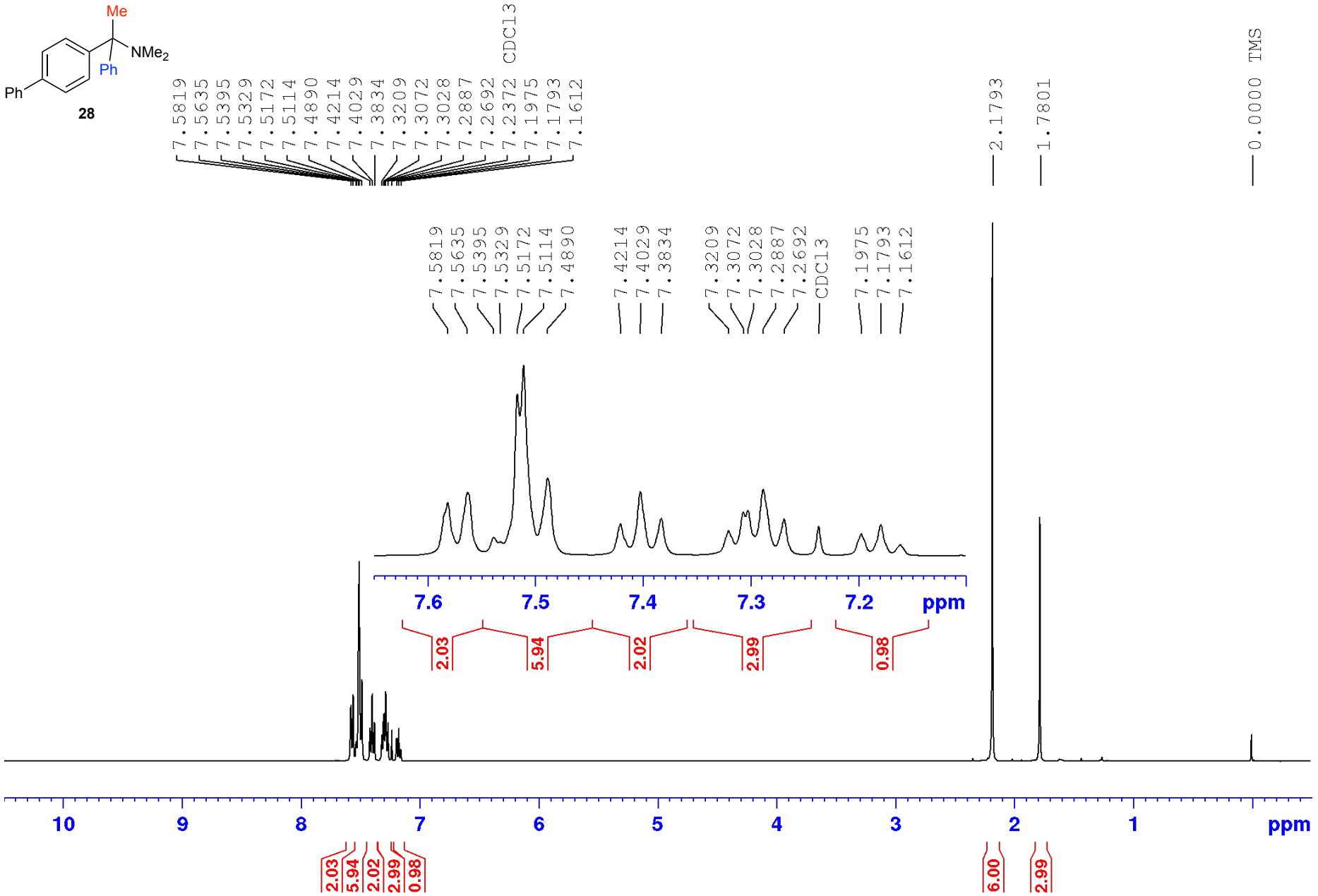
^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



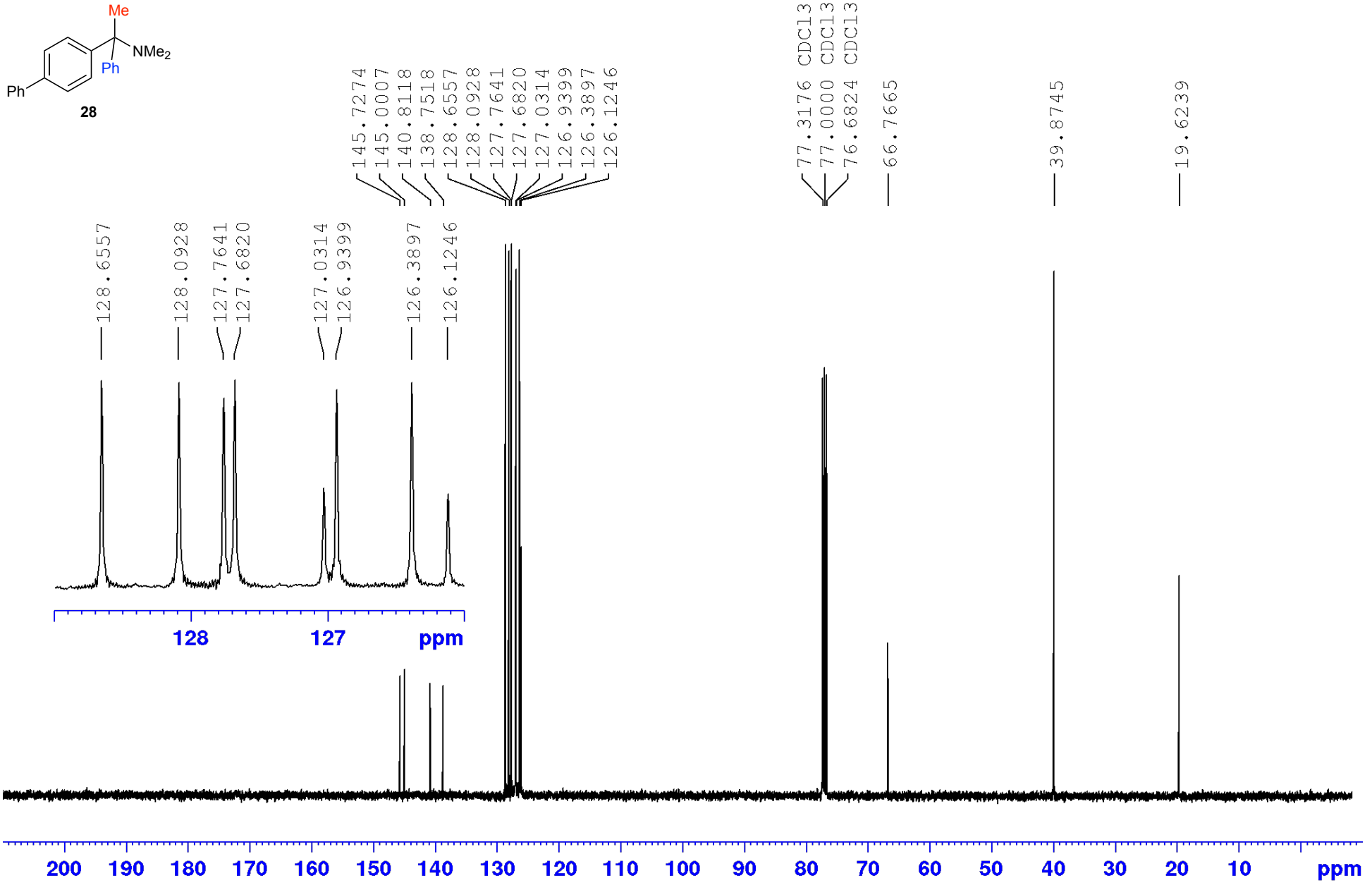
27

8.53 1-([1,1'-biphenyl]-4-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (28)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

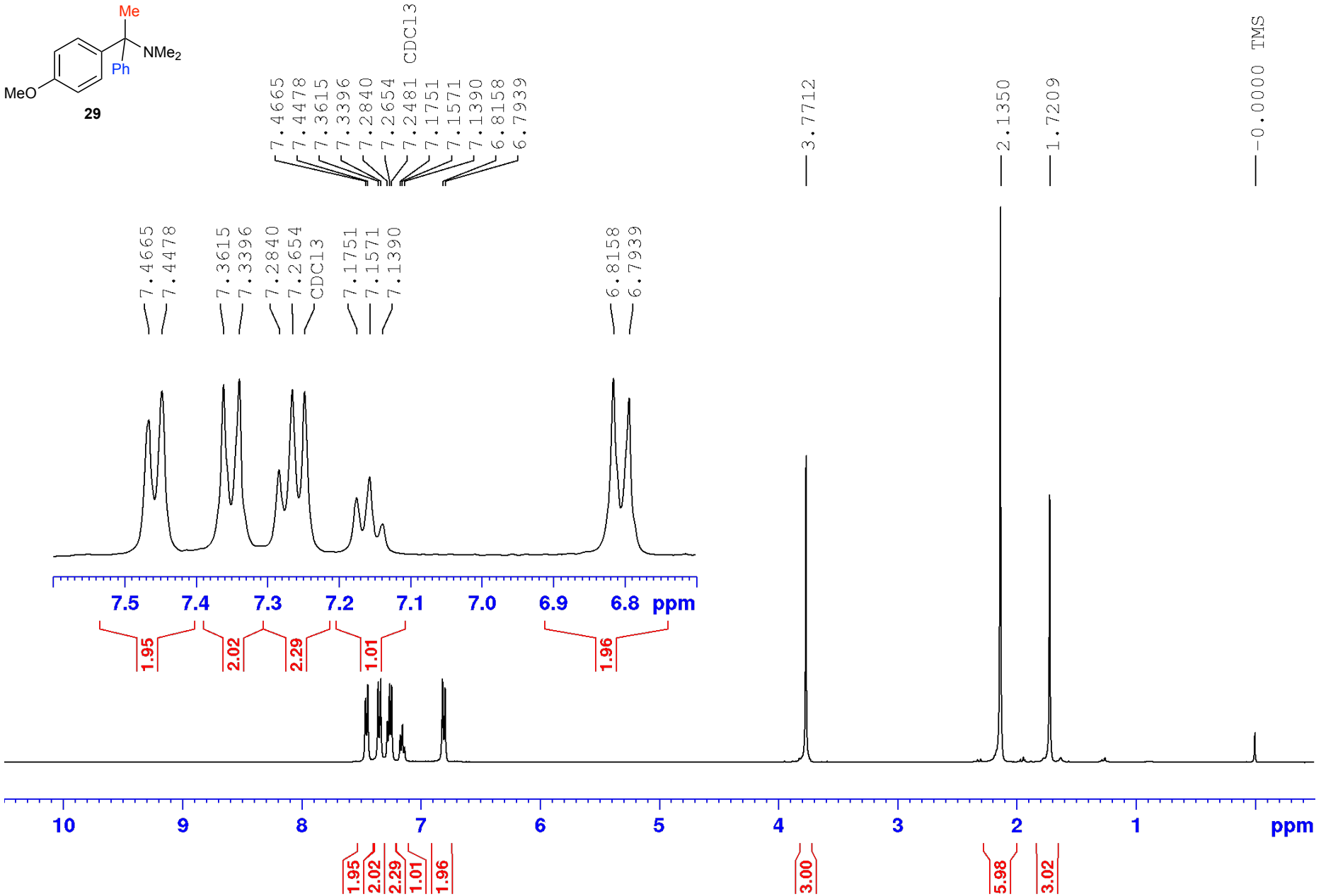


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

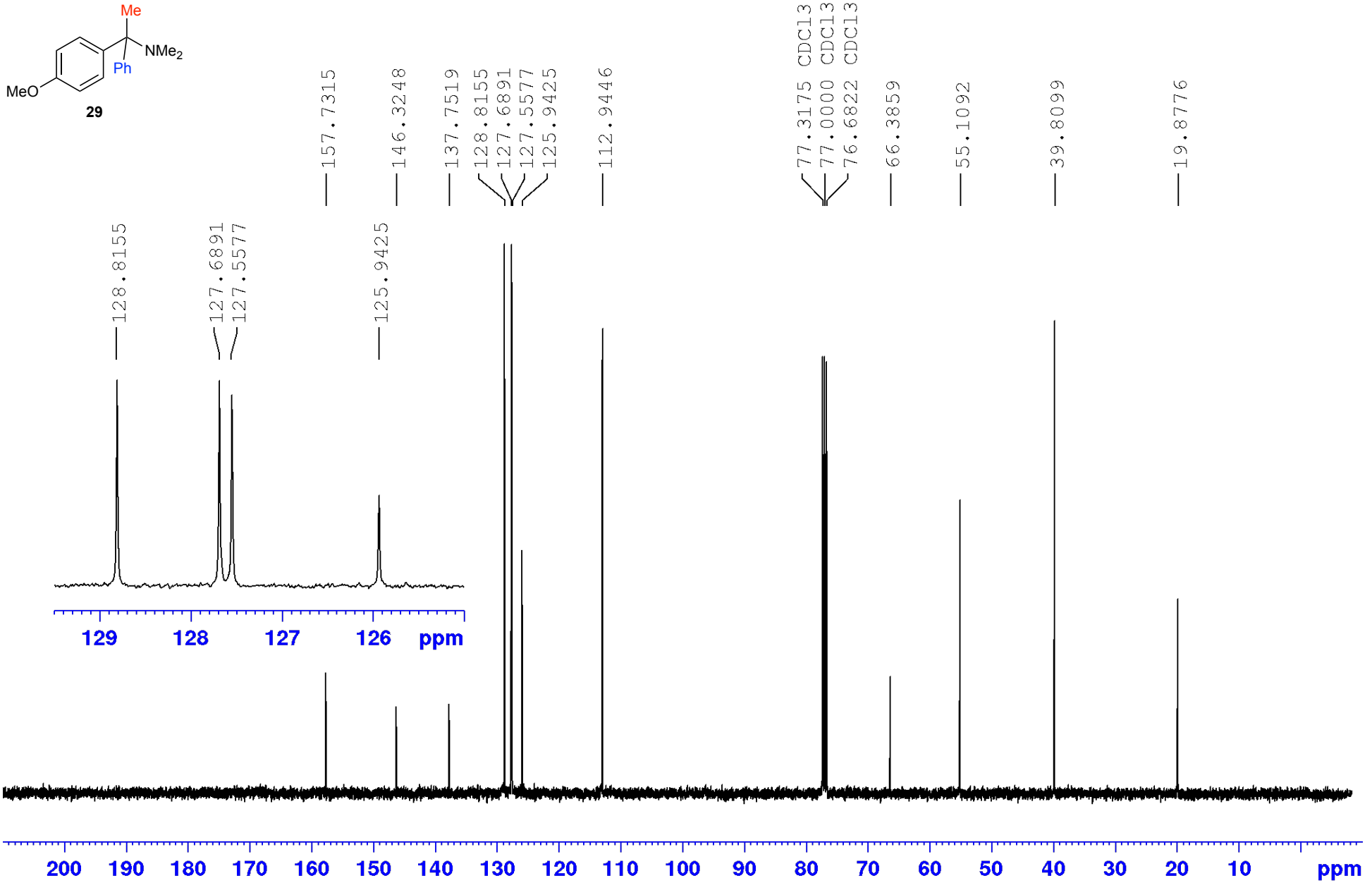


8.54 1-(4-Methoxyphenyl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (29)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

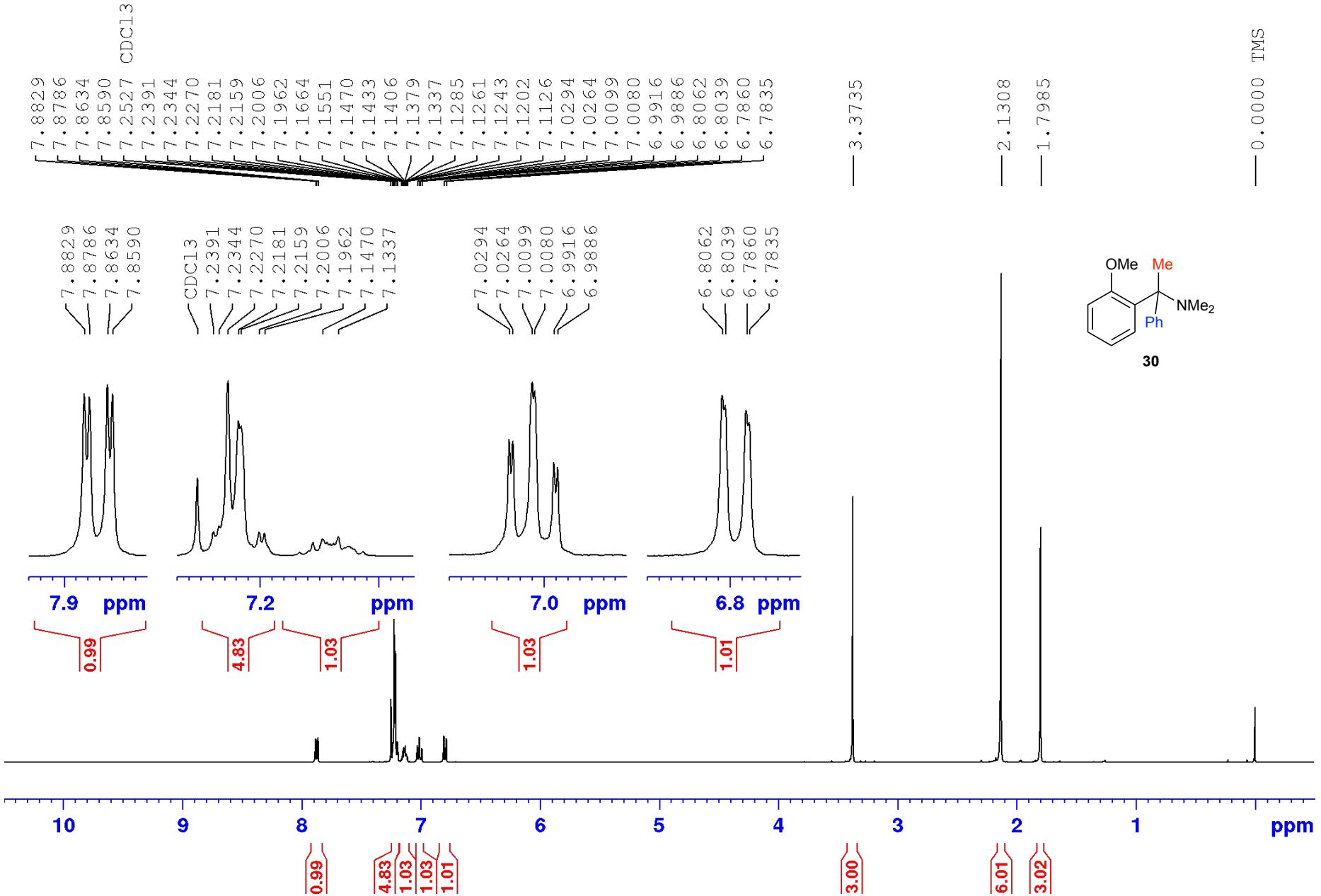


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

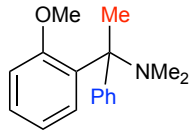


8.55 1-(2-Methoxyphenyl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (30)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



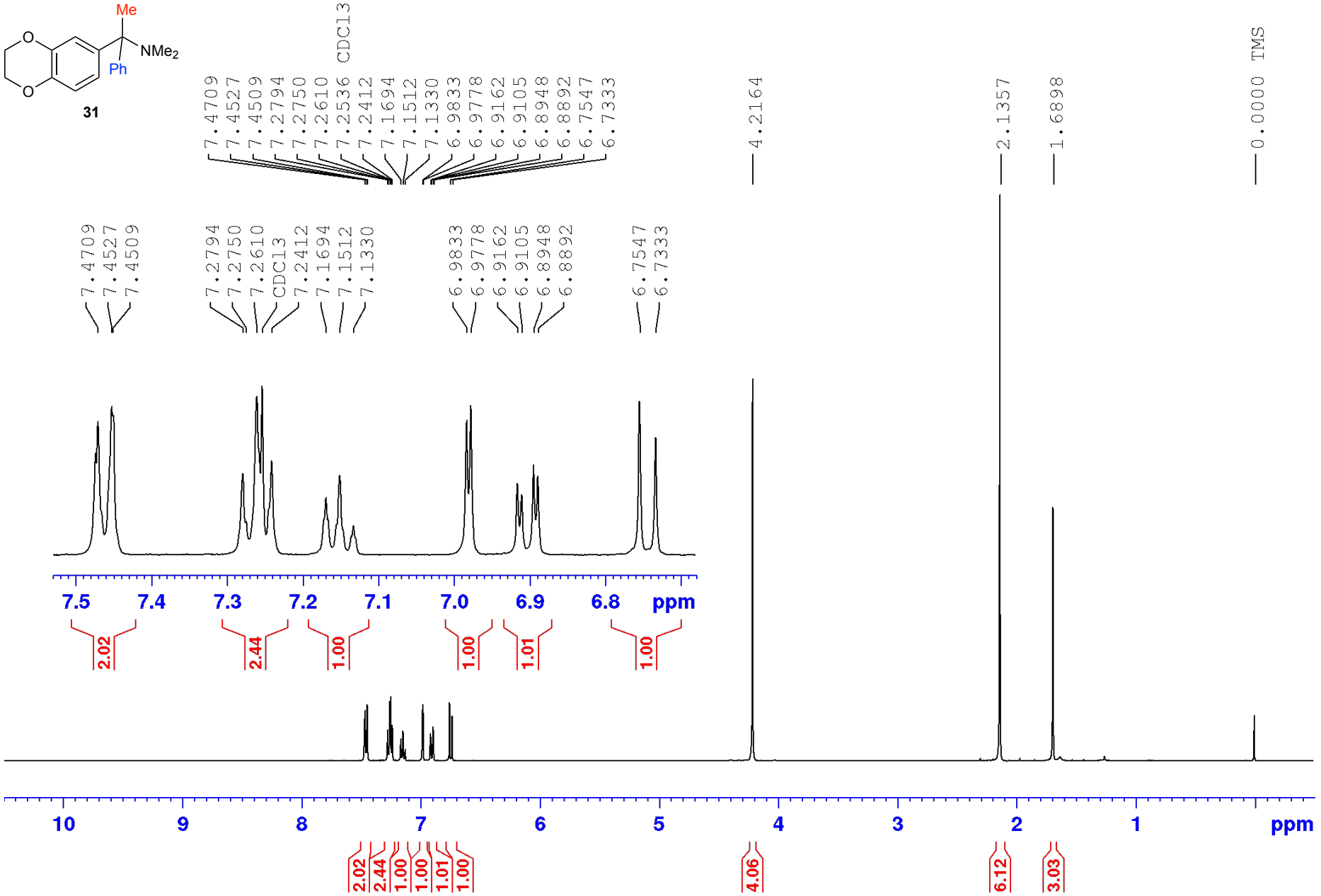
^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



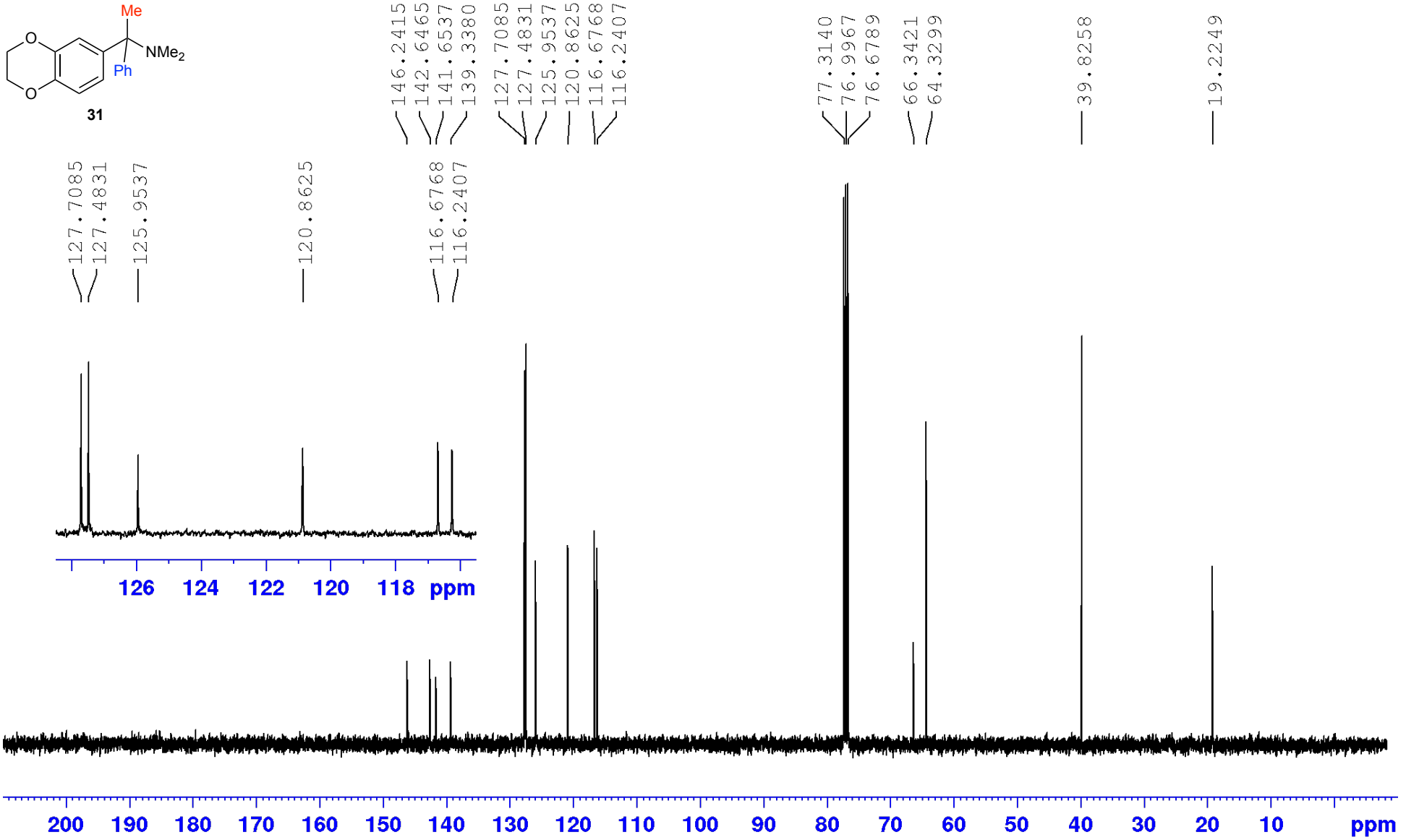
30

8.56 1-(2,3-Dihydrobenzo[*b*][1,4]dioxin-6-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (31)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

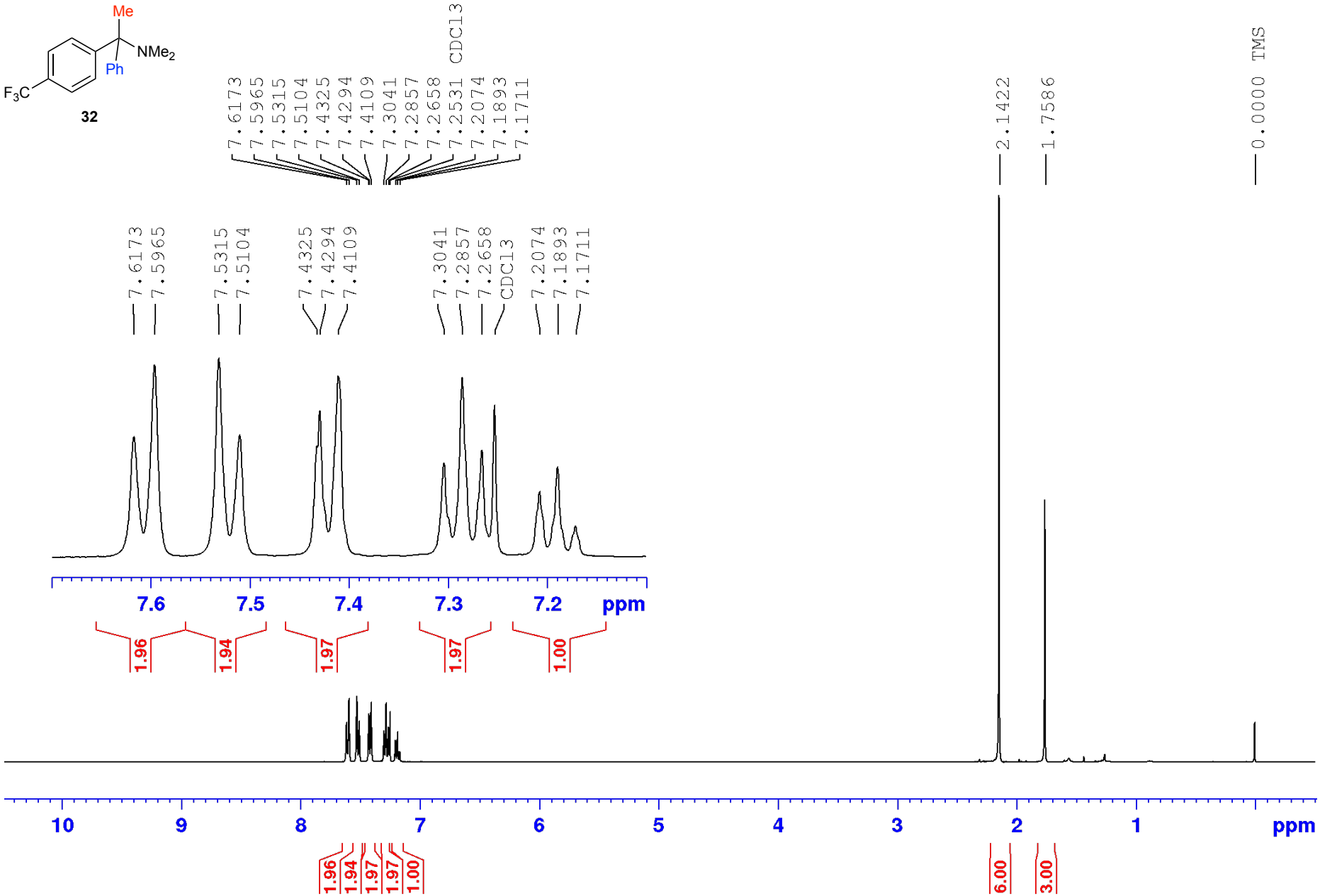


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

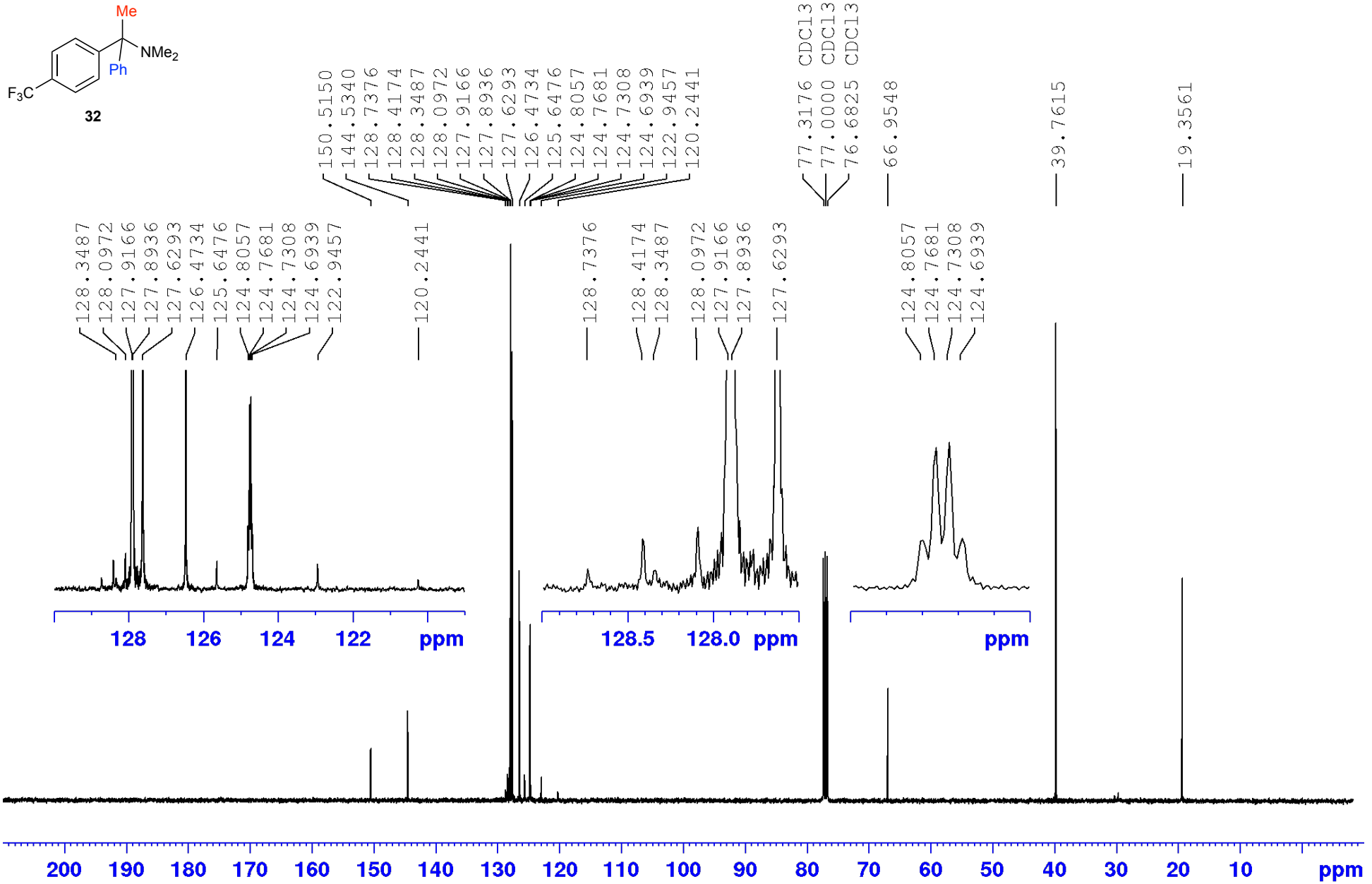


8.57 *N,N*-Dimethyl-1-phenyl-1-(4-(trifluoromethyl)phenyl)ethan-1-amine (32)

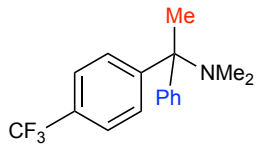
^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



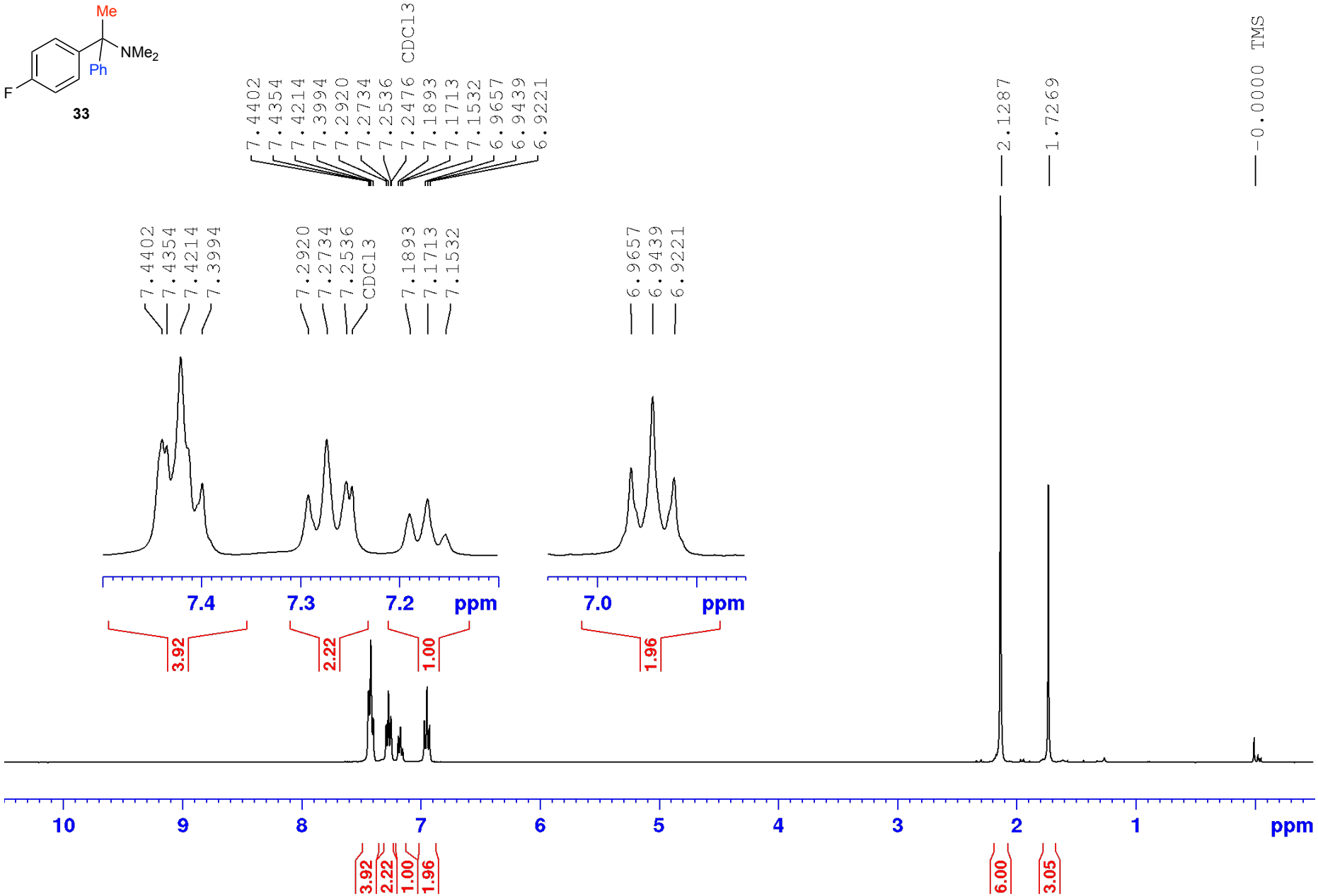
^{19}F NMR Spectrum (376 MHz on Bruker BBFO 400) in $CDCl_3$



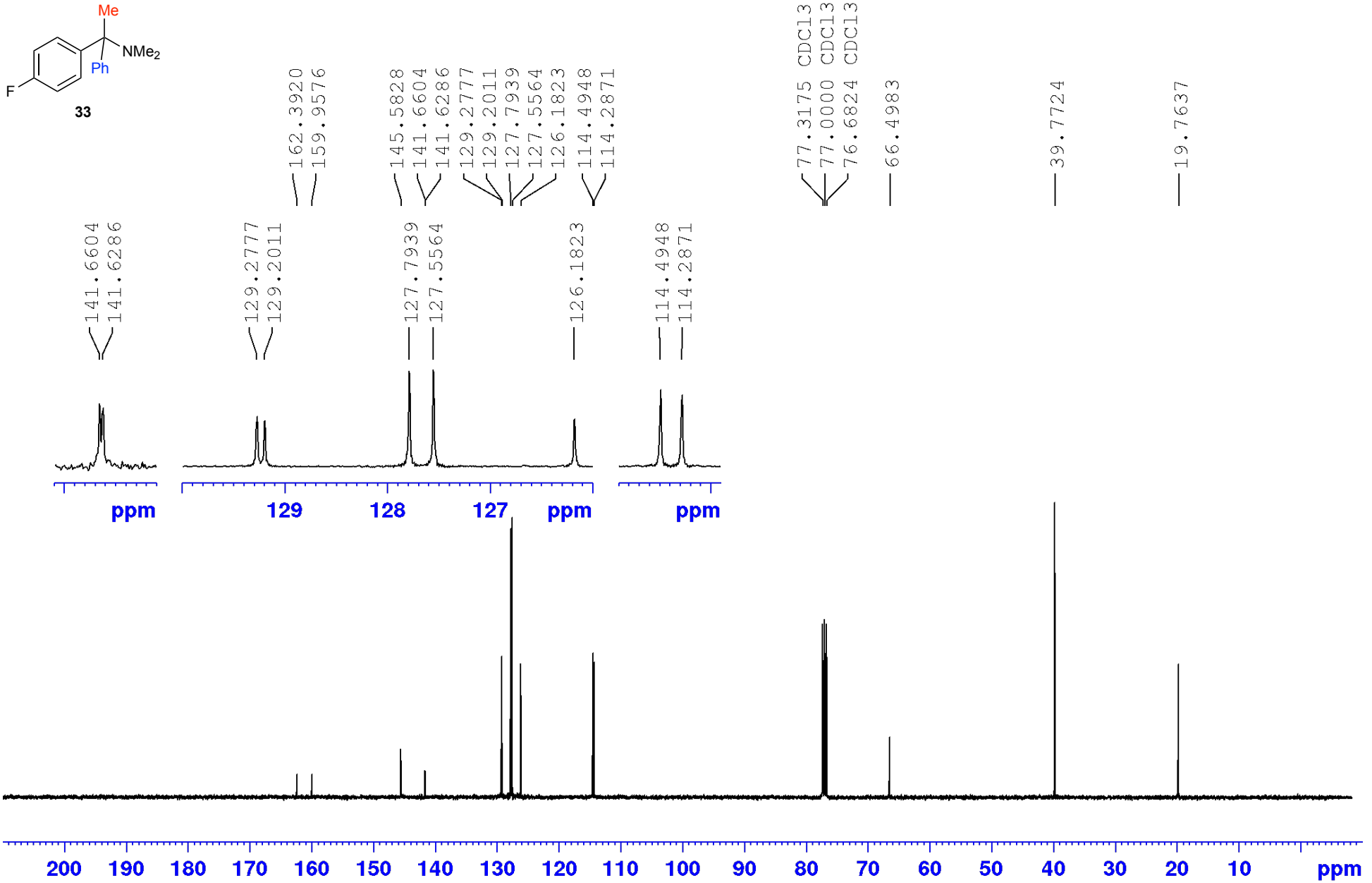
32

8.58 1-(4-Fluorophenyl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (33)

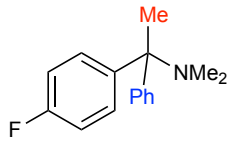
^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



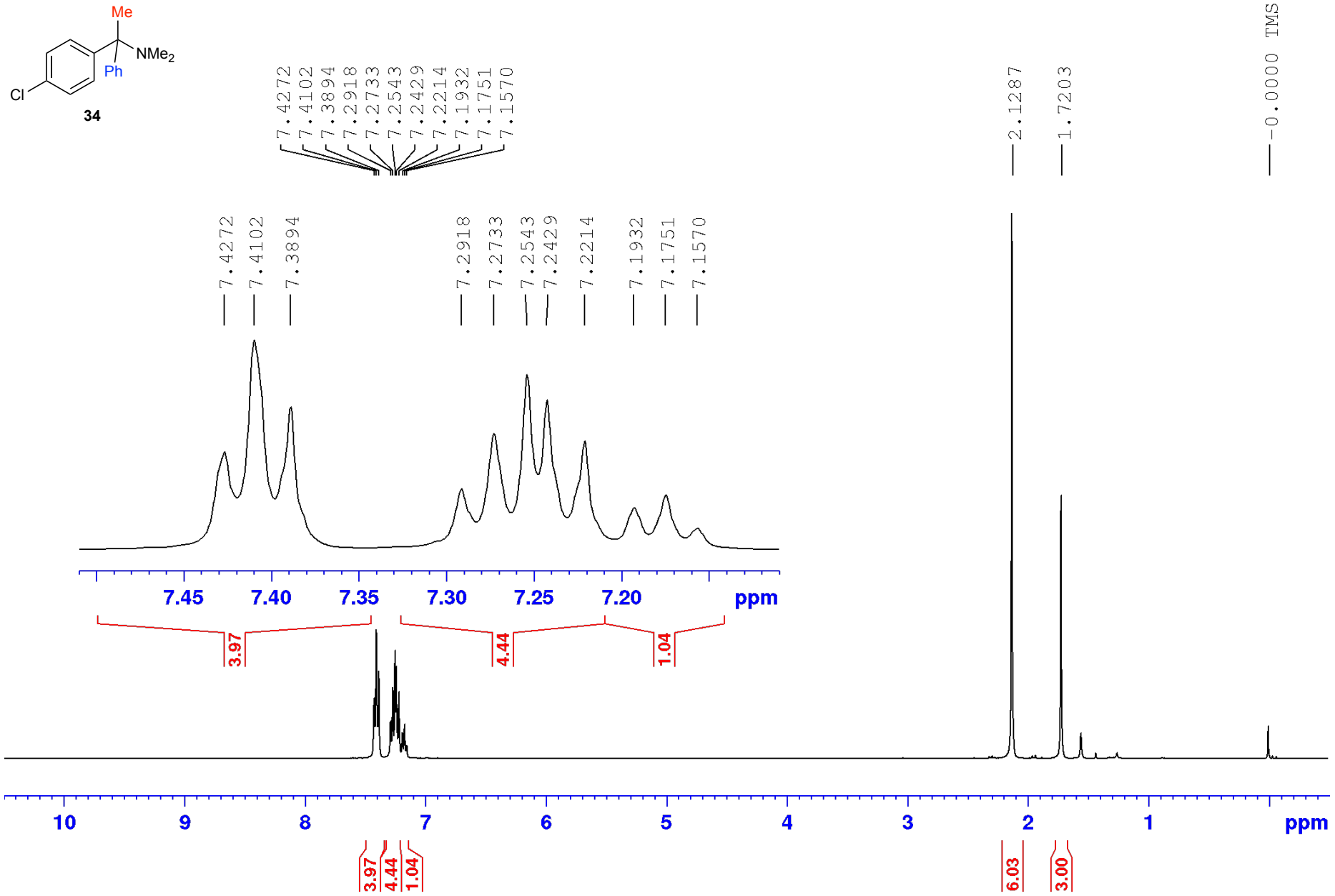
^{19}F NMR Spectrum (376 MHz on Bruker BBFO 400) in $CDCl_3$



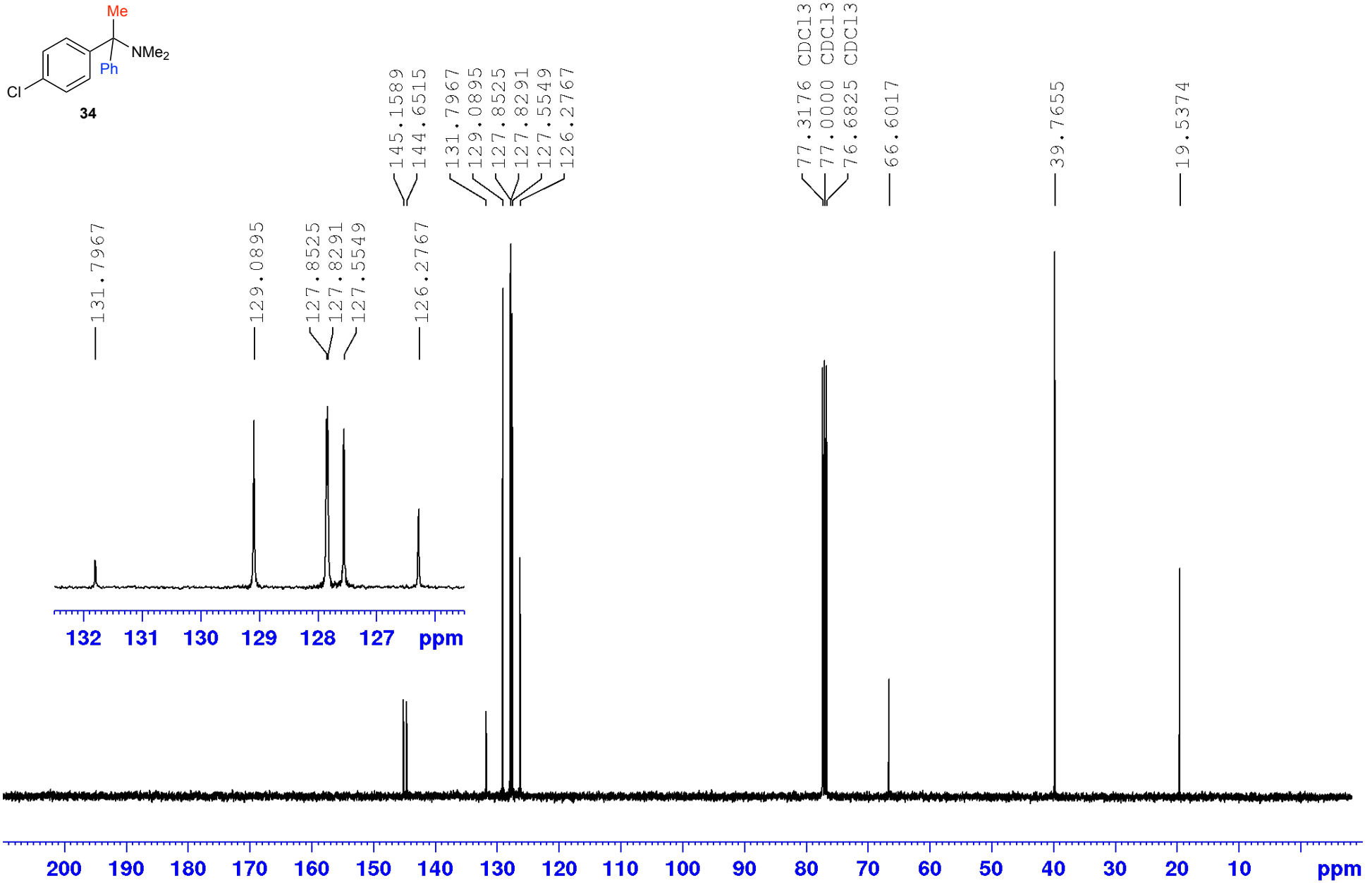
33

8.59 1-(4-Chlorophenyl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (34)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

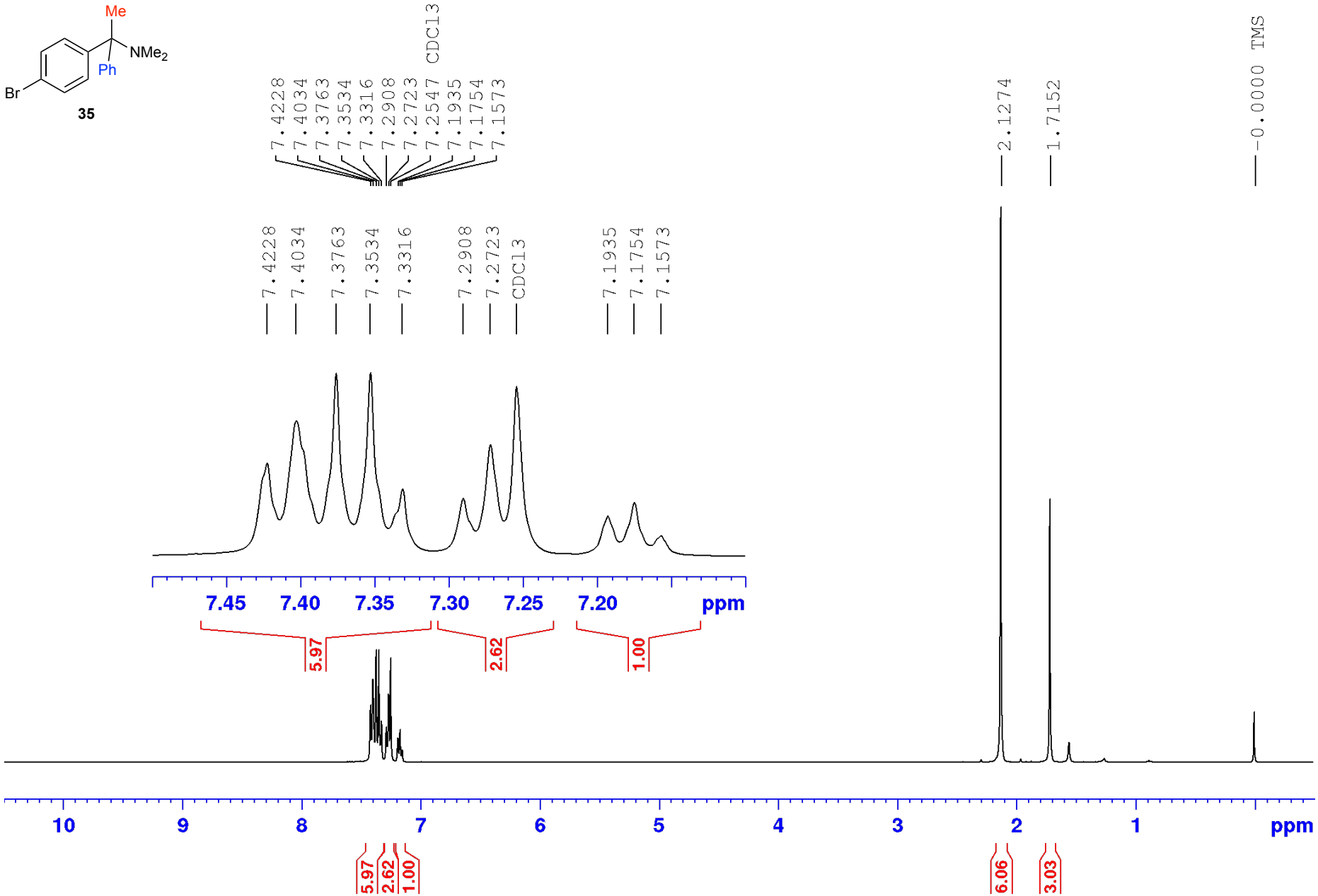


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

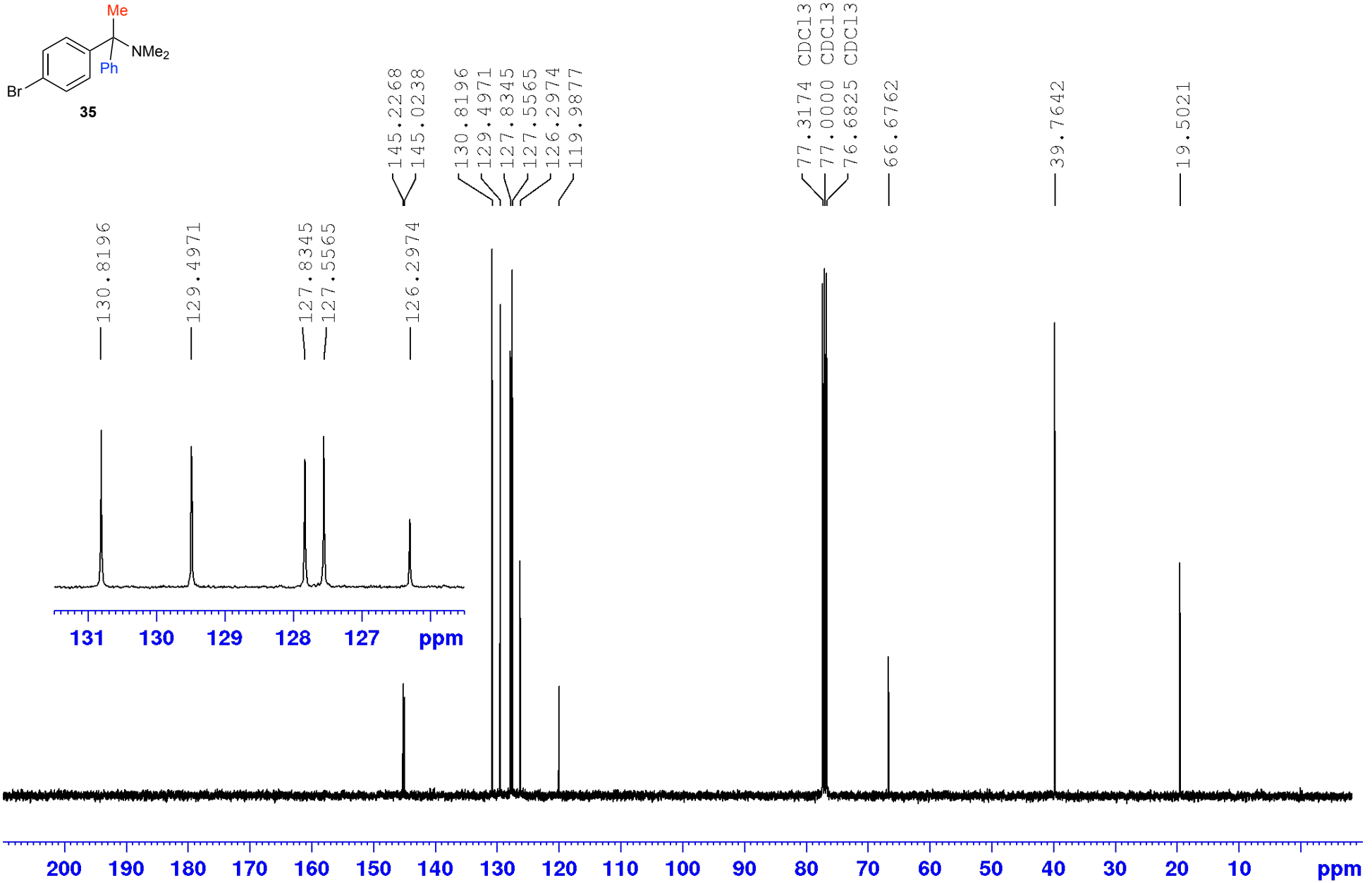


8.60 1-(4-Bromophenyl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (35)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

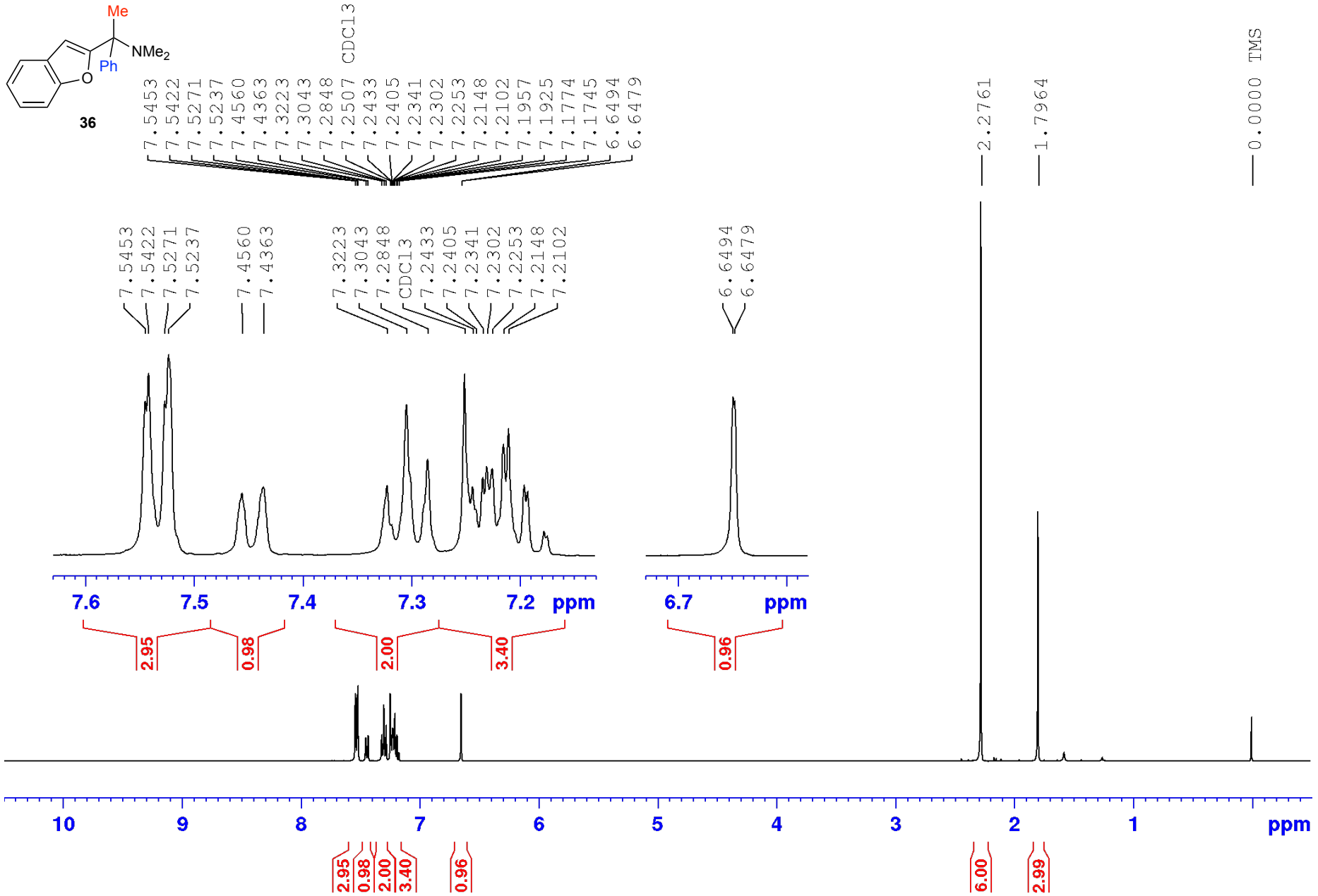


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

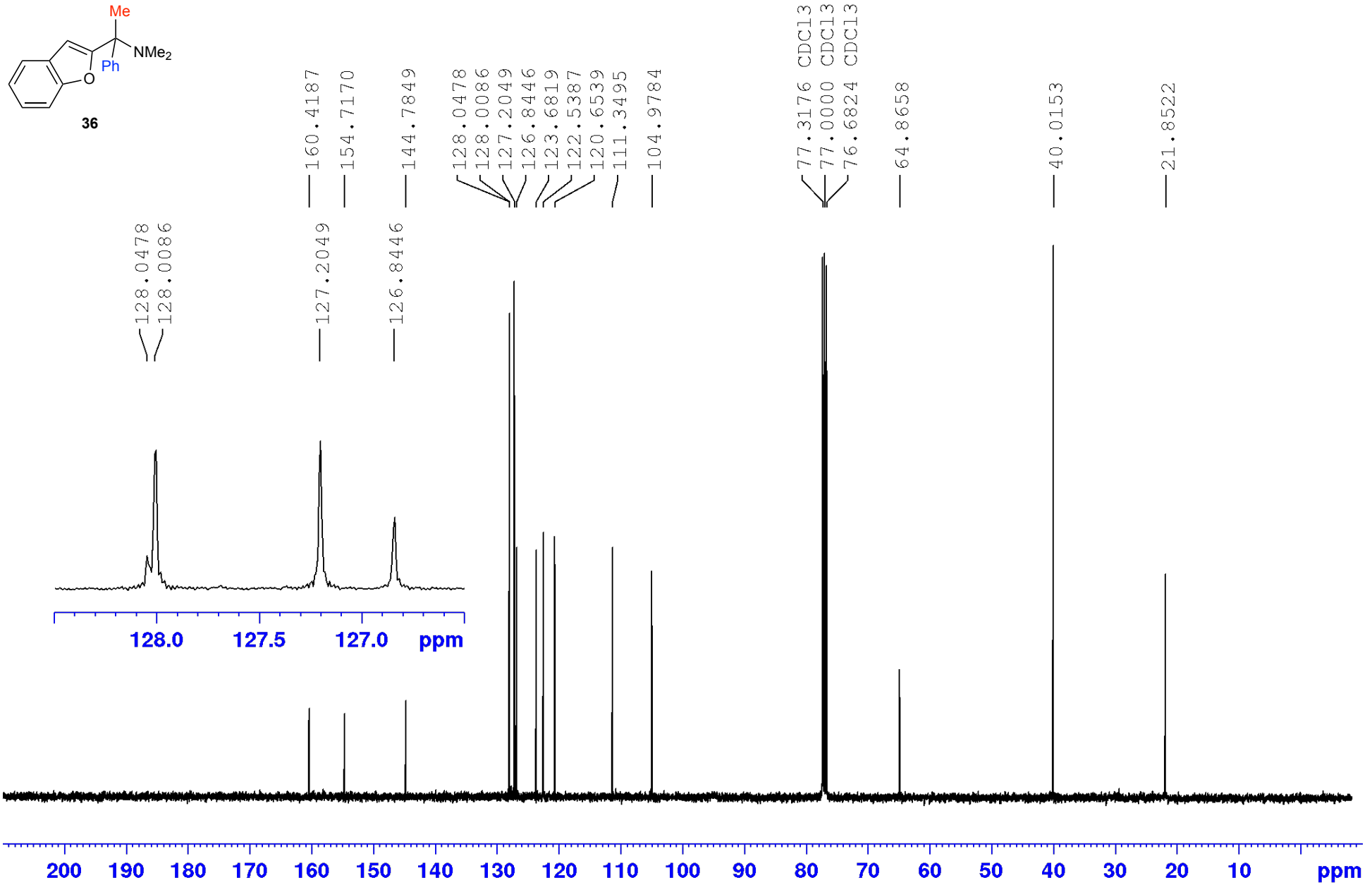


8.61 1-(Benzofuran-2-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (36)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

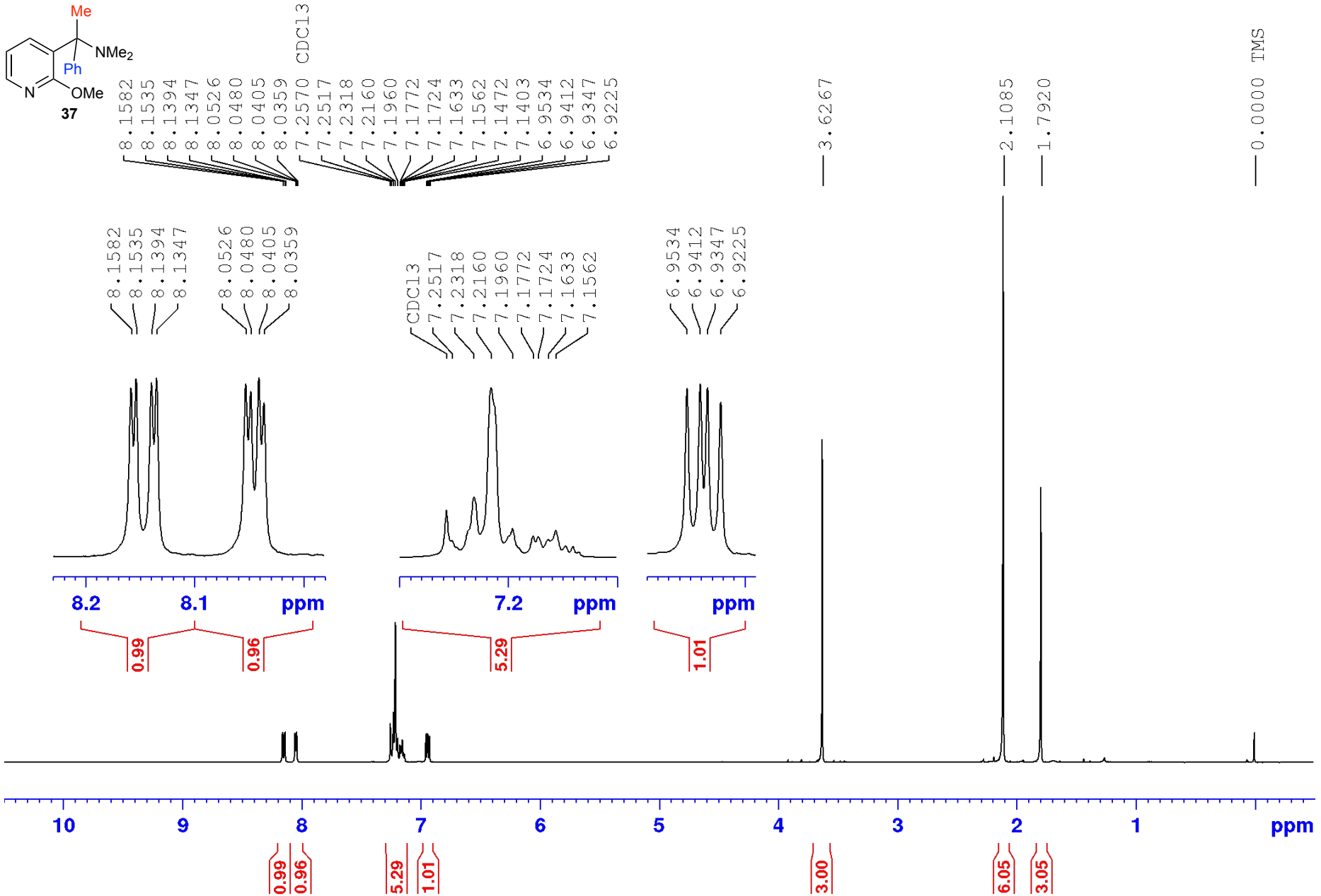


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

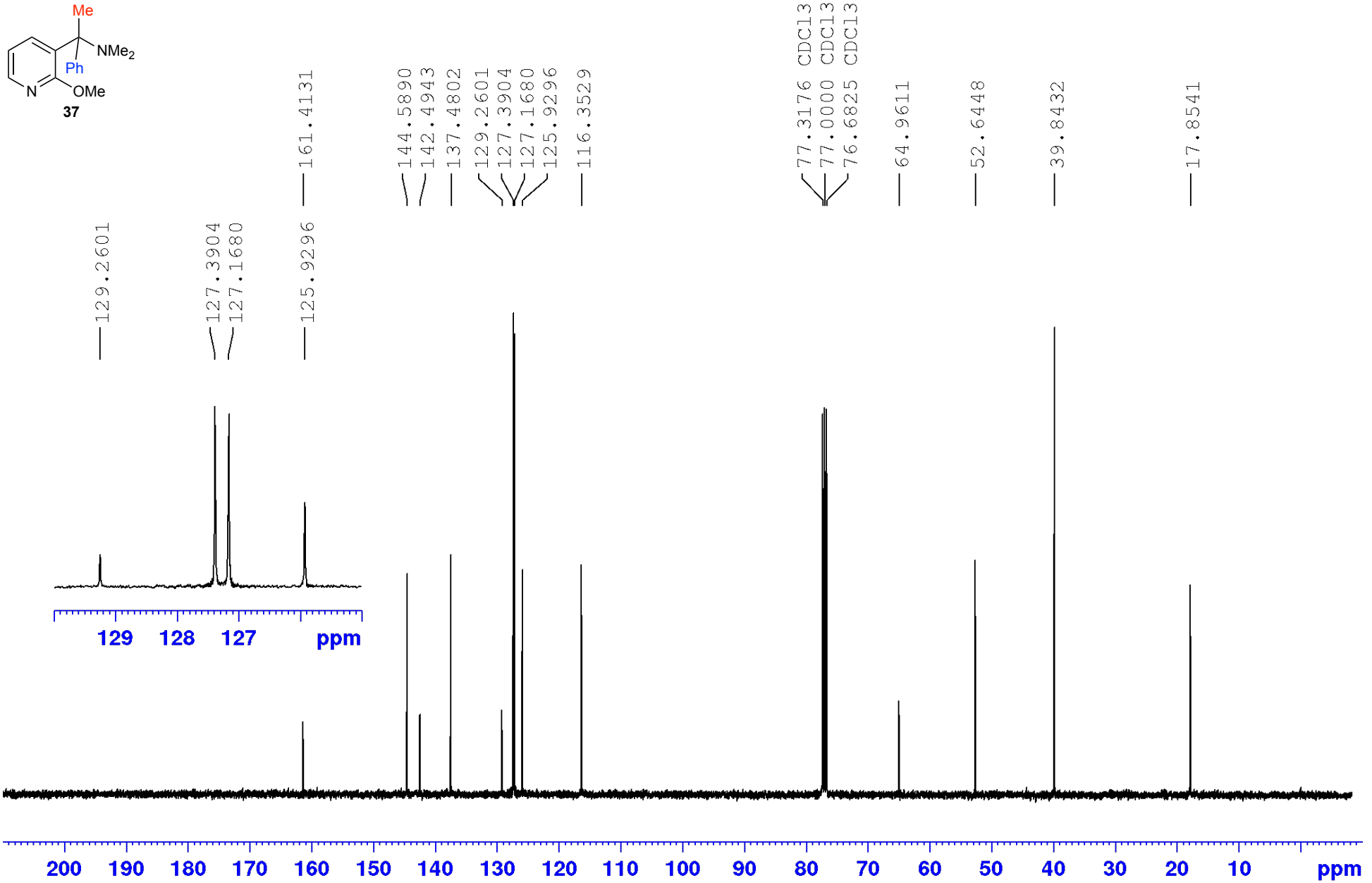


8.62 1-(2-Methoxypyridin-3-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (37)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

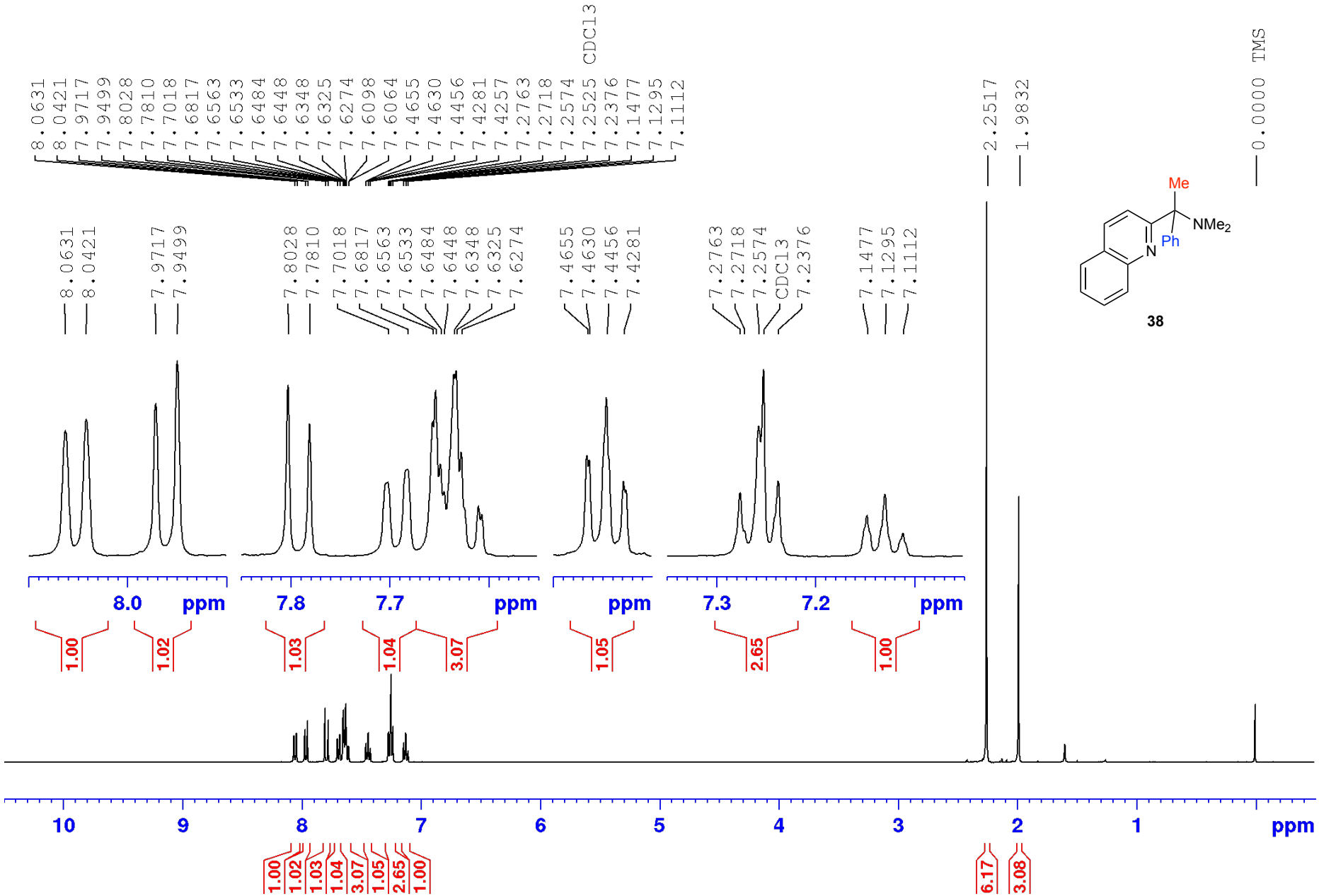


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

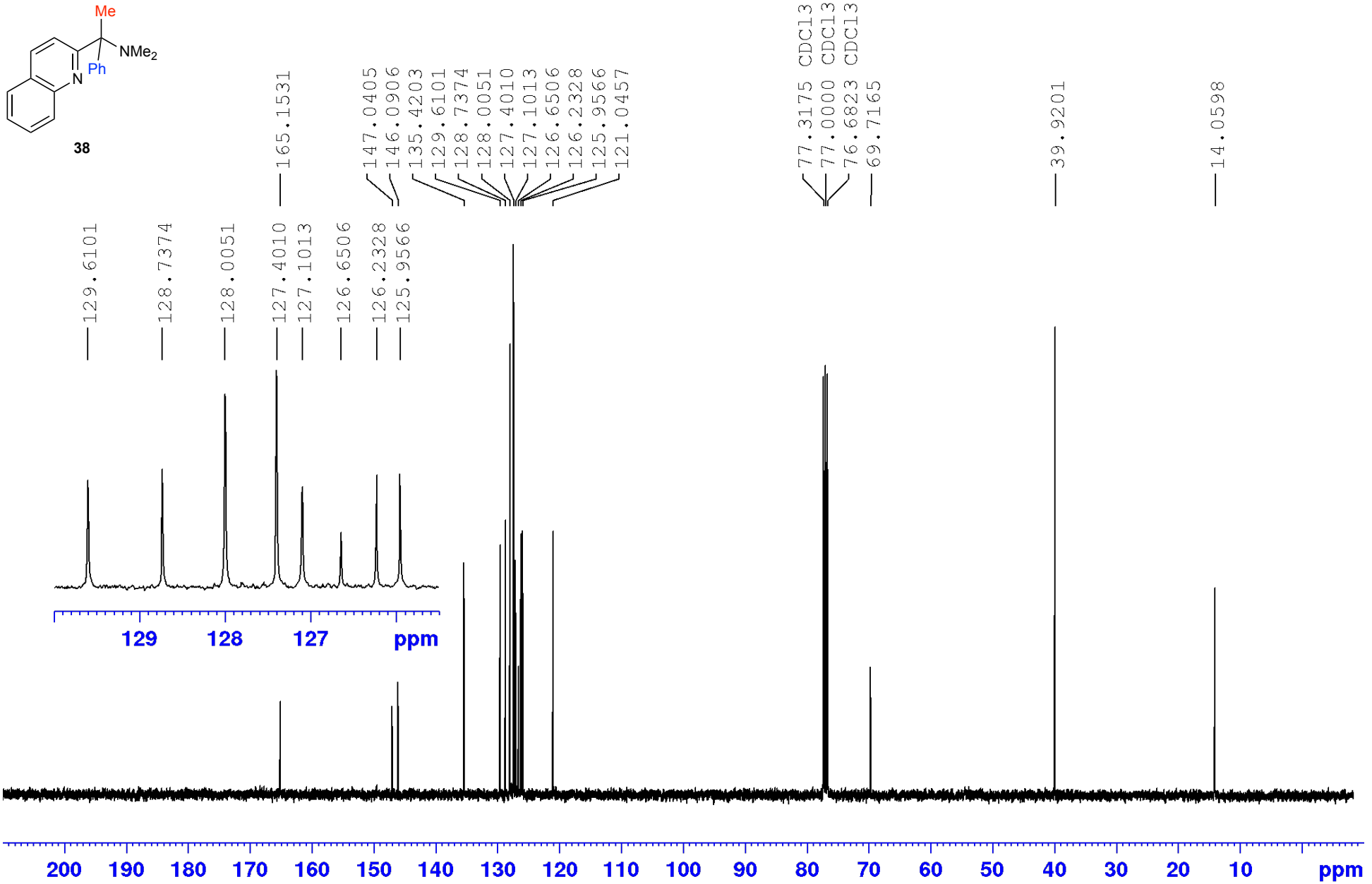


8.63 *N,N*-Dimethyl-1-phenyl-1-(quinolin-2-yl)ethan-1-amine (38)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

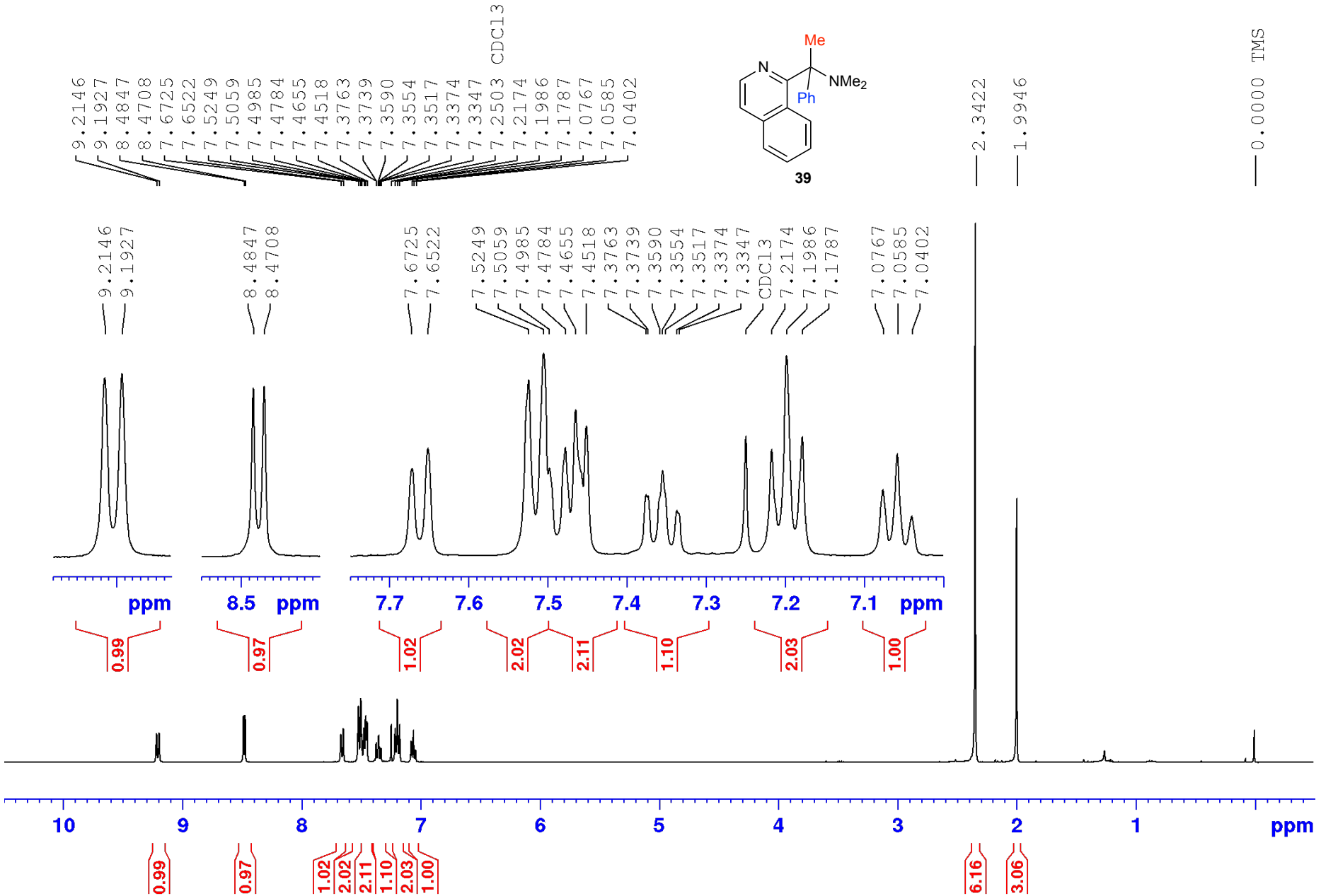


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

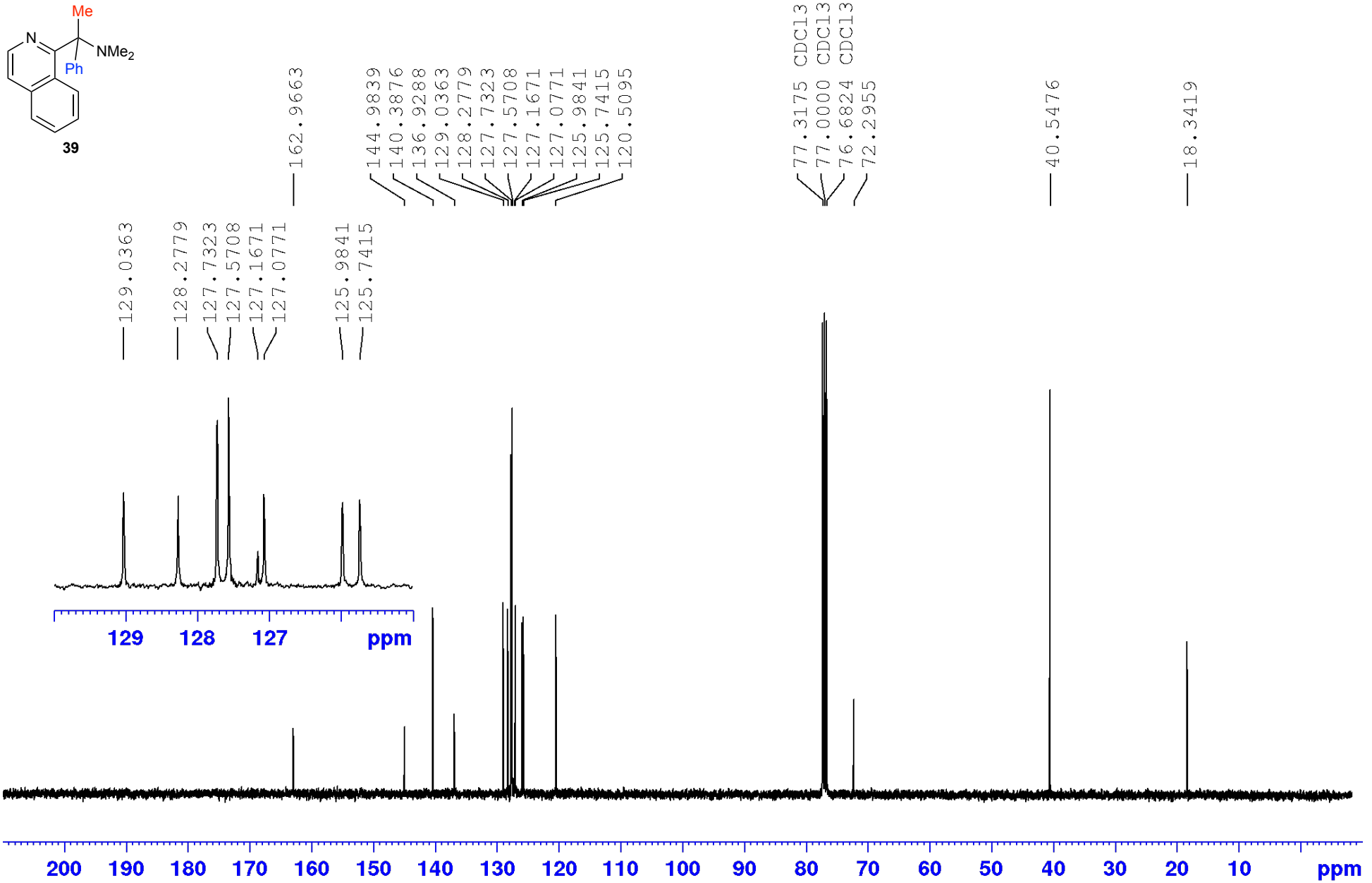


8.64 1-(Isoquinolin-1-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (39)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

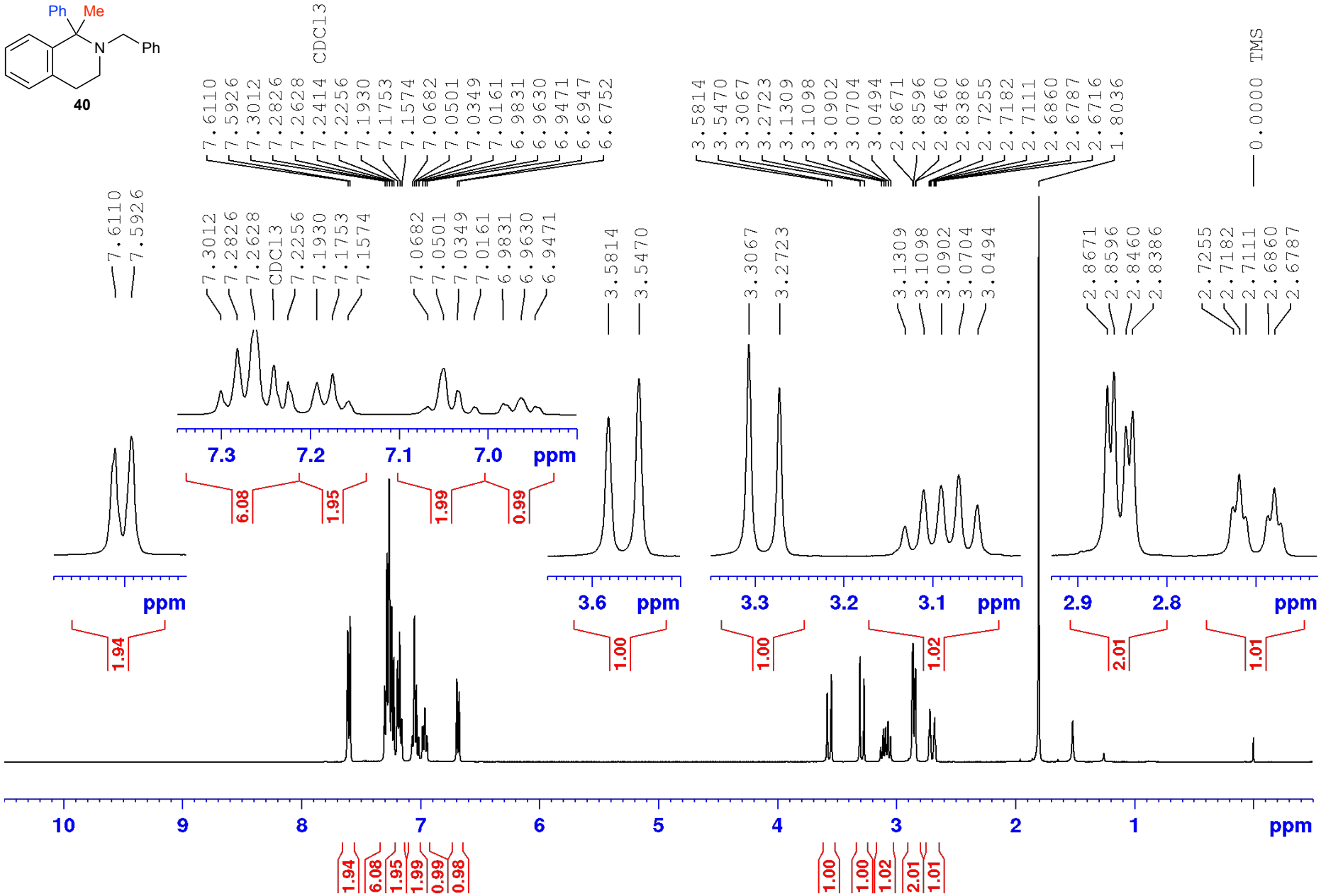


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

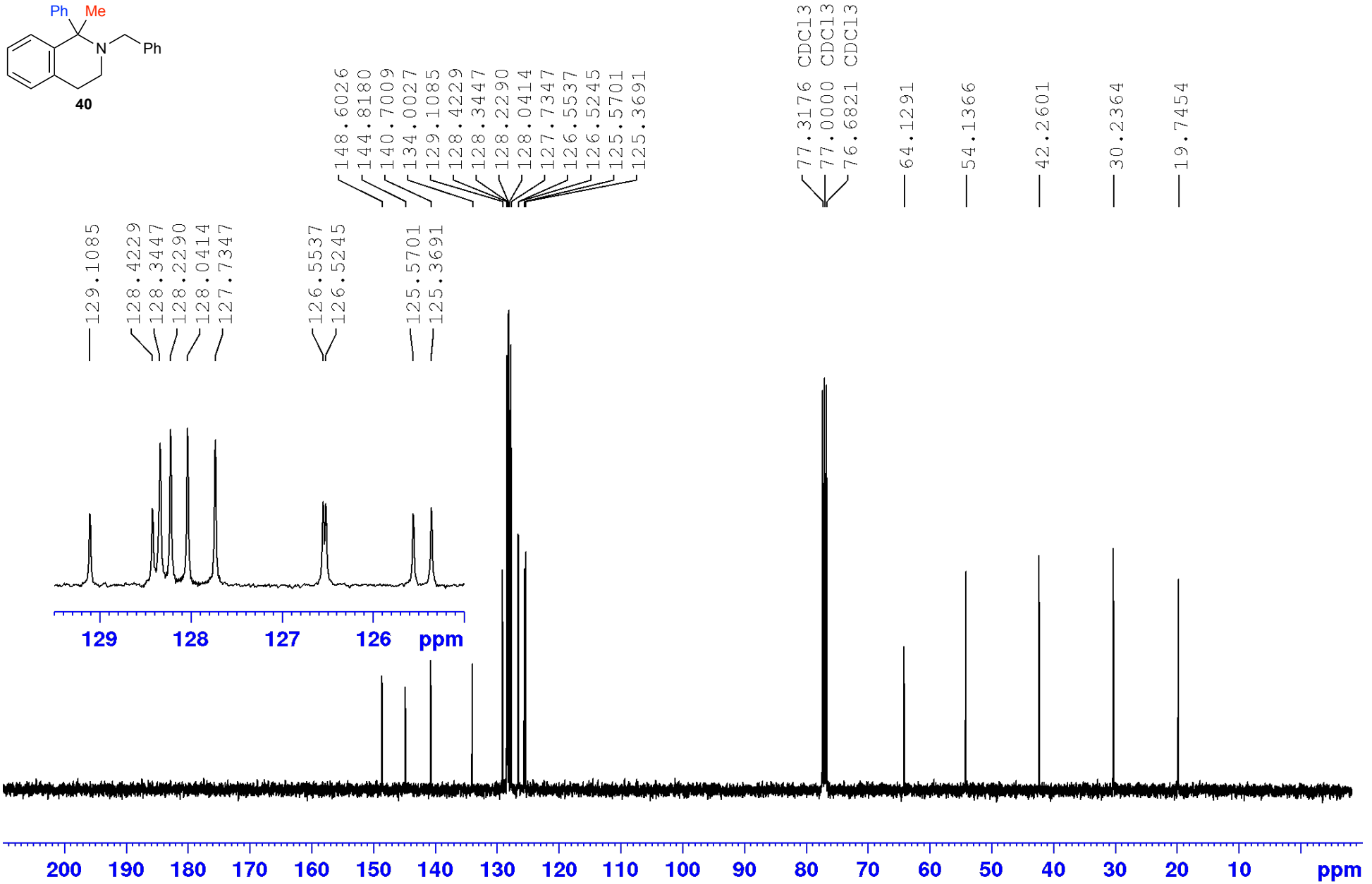


8.65 2-Benzyl-1-methyl-1-phenyl-1,2,3,4-tetrahydroisoquinoline (40)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

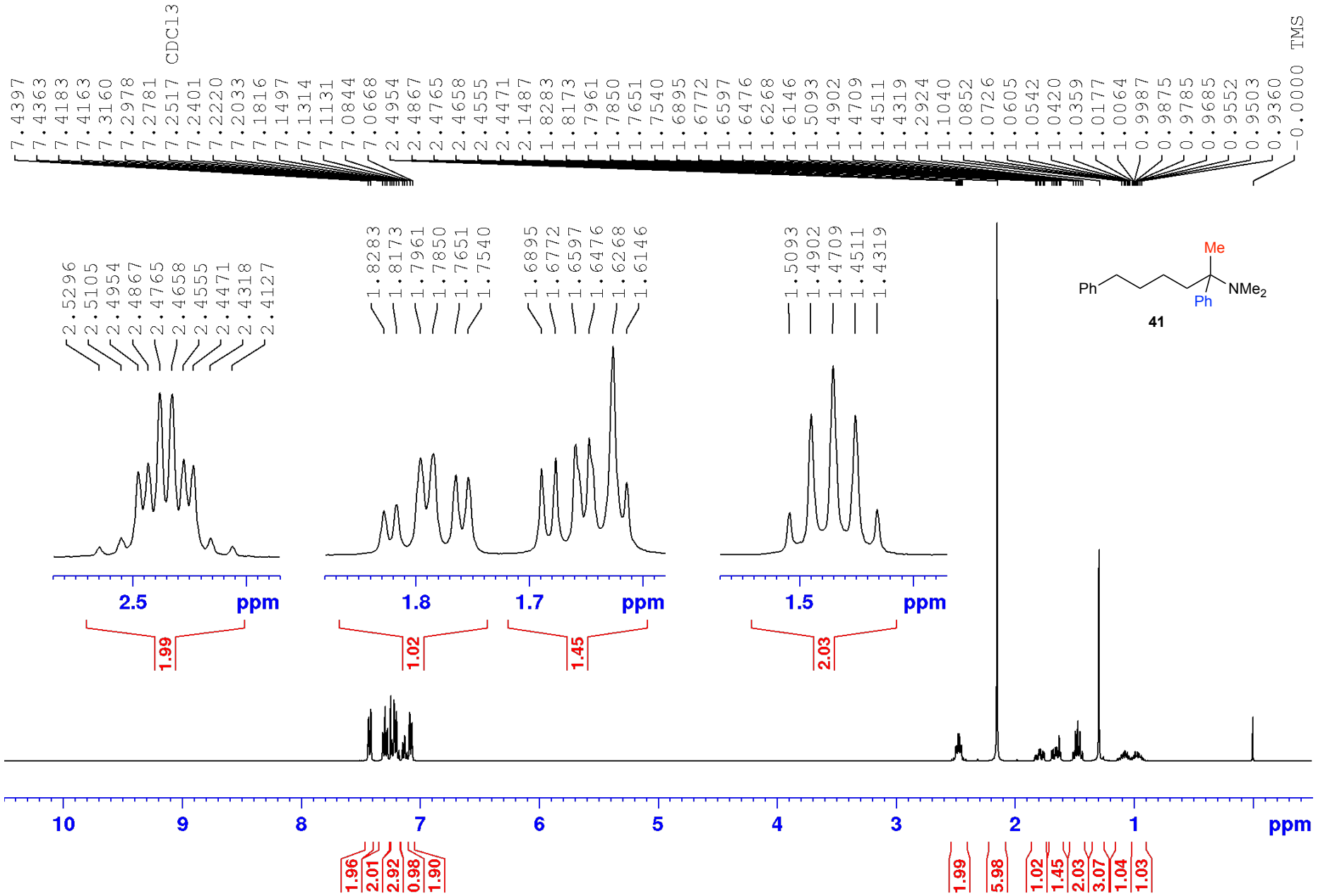


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

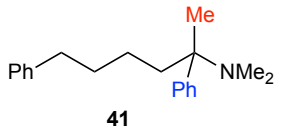


8.66 *N,N*-Dimethyl-2,6-diphenylhexan-2-amine (41)

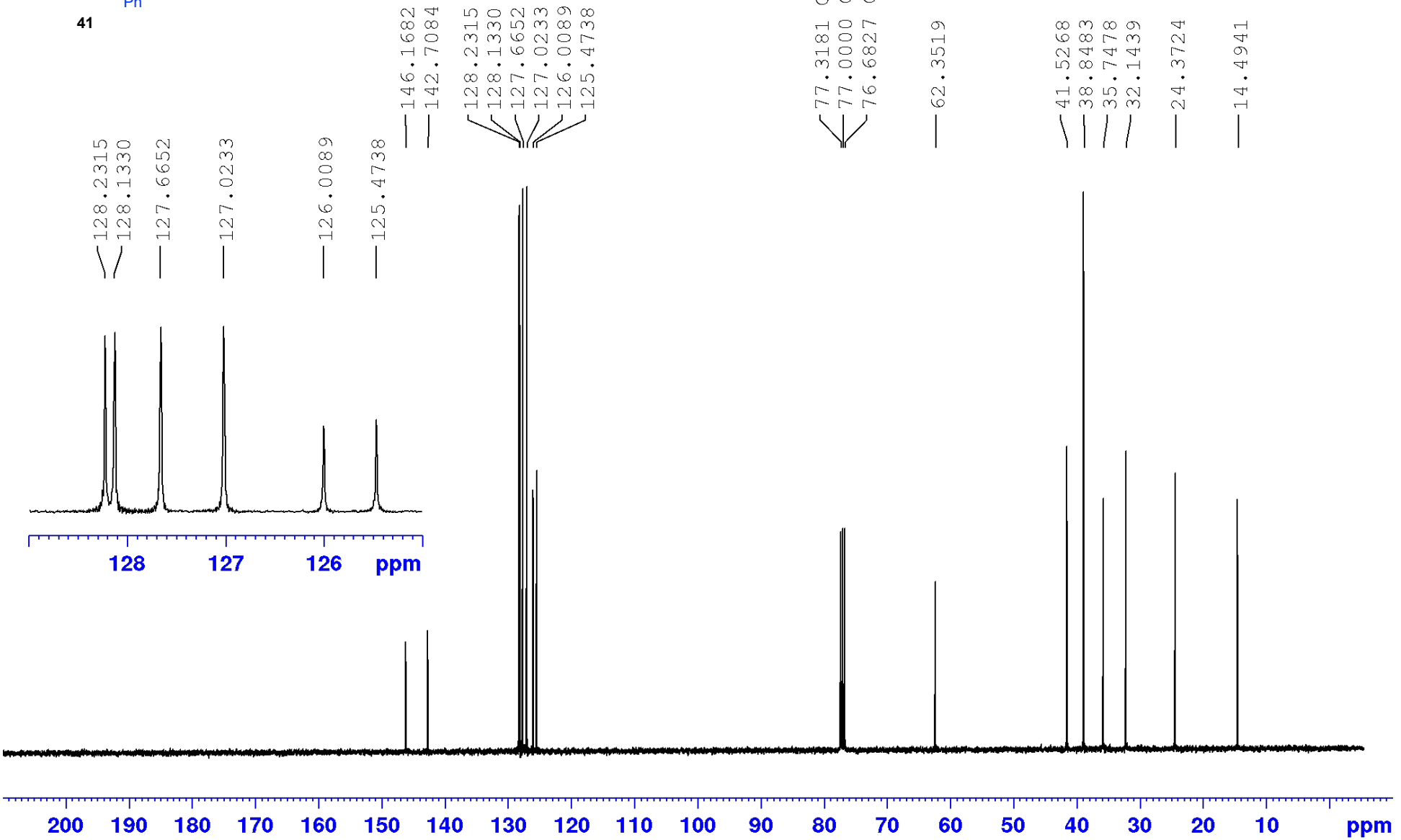
^{1}H NMR Spectrum (400 MHz on Bruker BBFO 400) in $CDCl_3$



^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

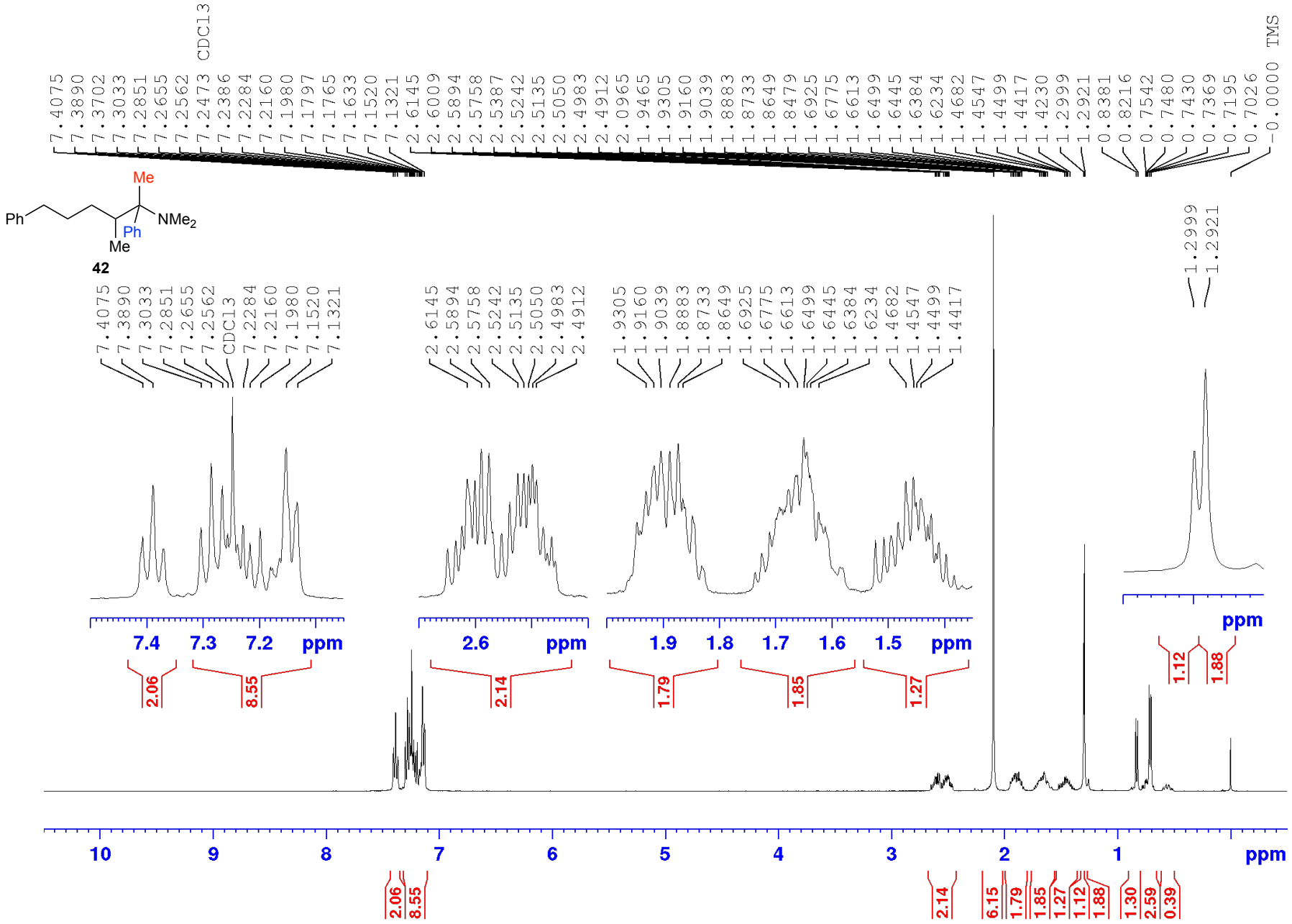


41

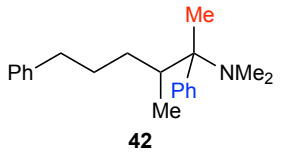


8.67 *N,N*,3-trimethyl-2,6-diphenylhexan-2-amine (42)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



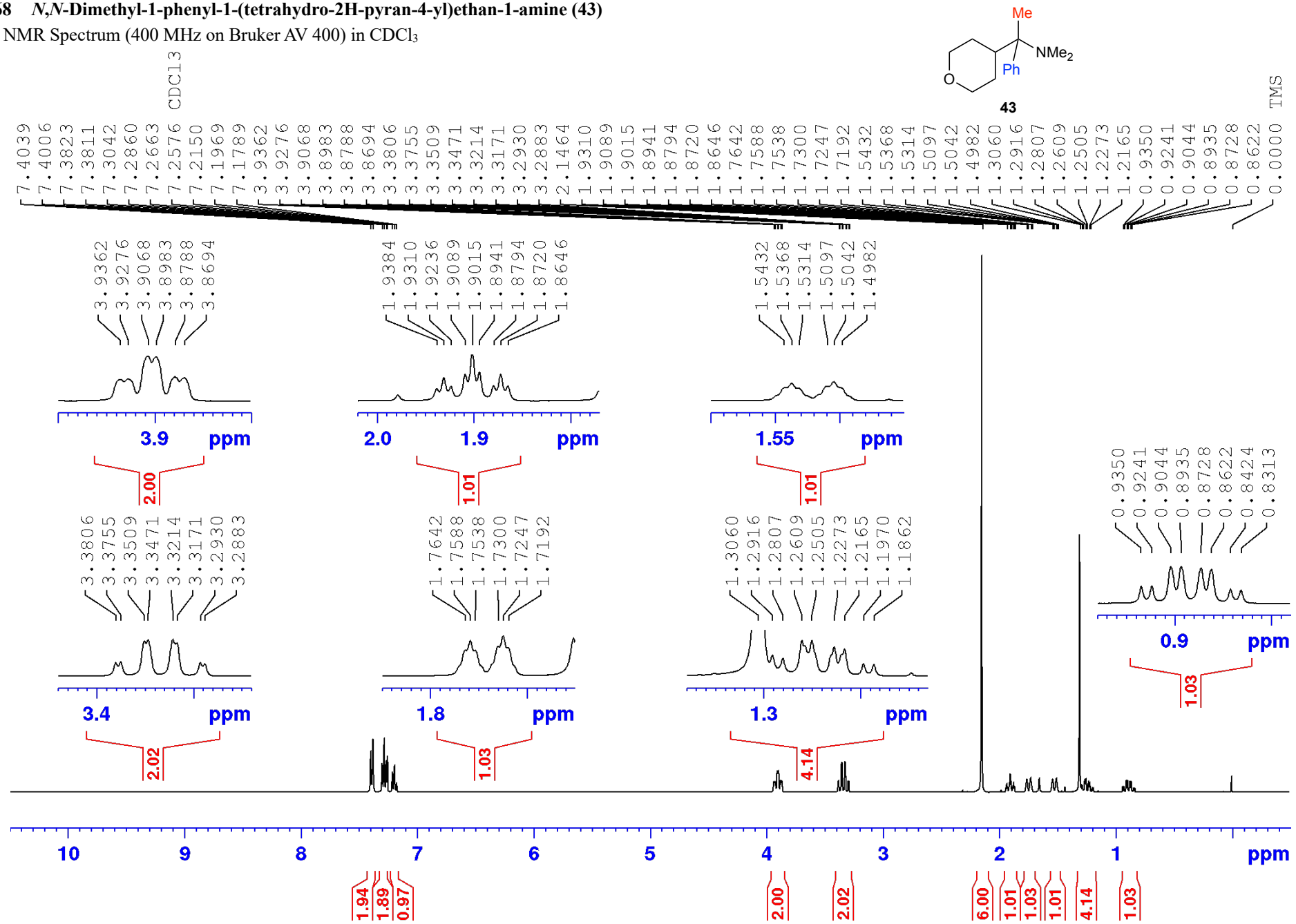
^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



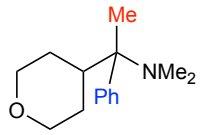
42

8.68 *N,N*-Dimethyl-1-phenyl-1-(tetrahydro-2H-pyran-4-yl)ethan-1-amine (43)

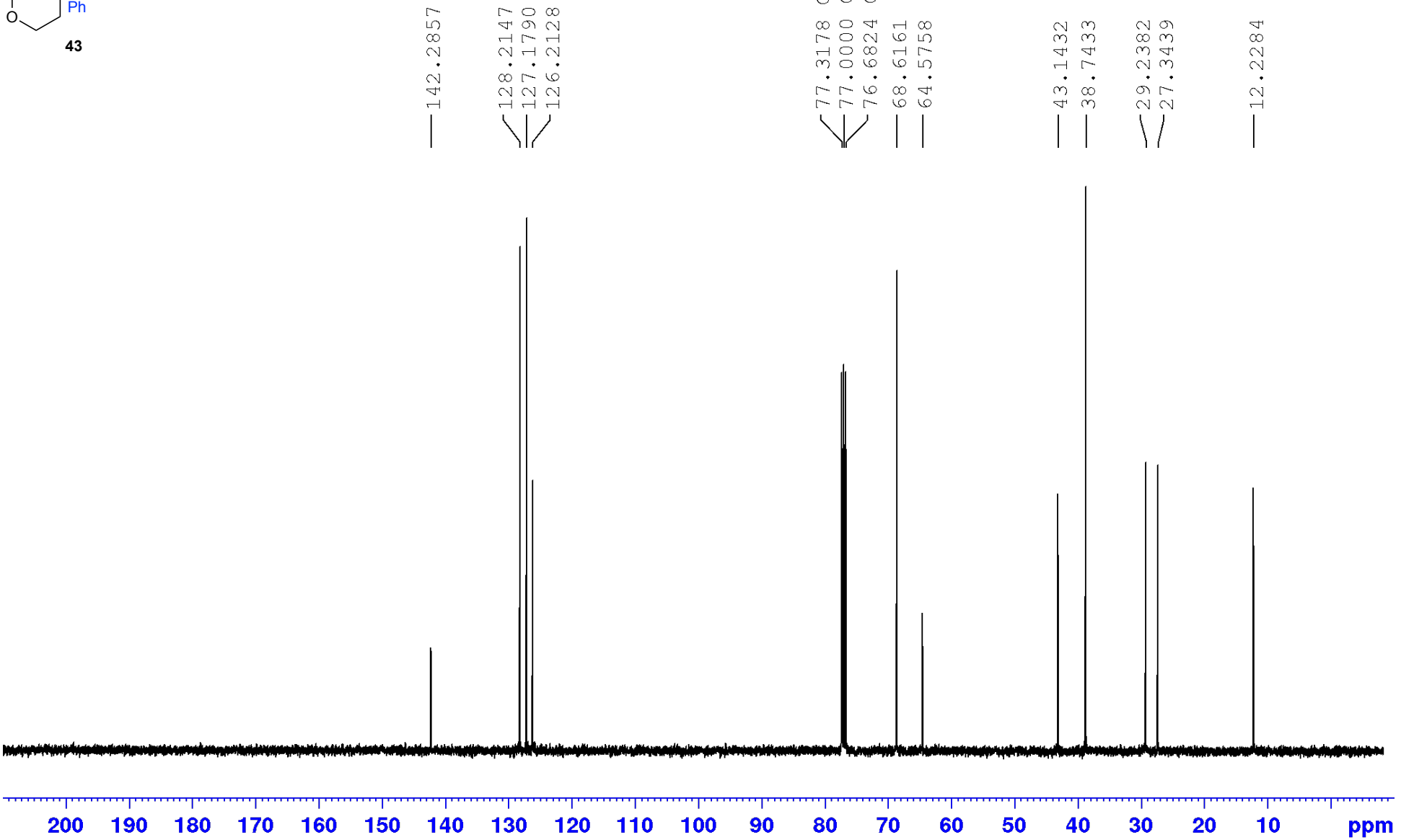
^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

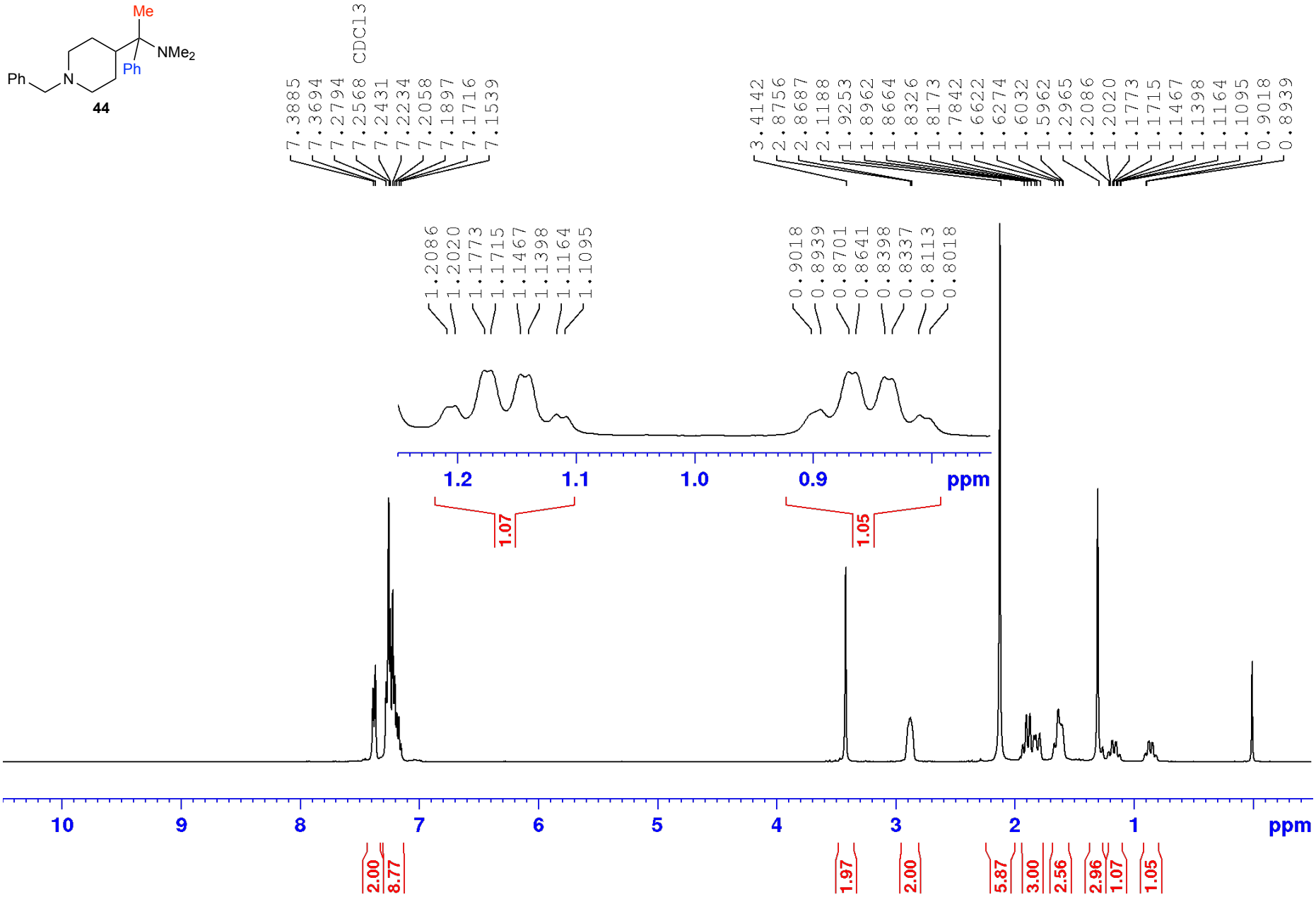


43

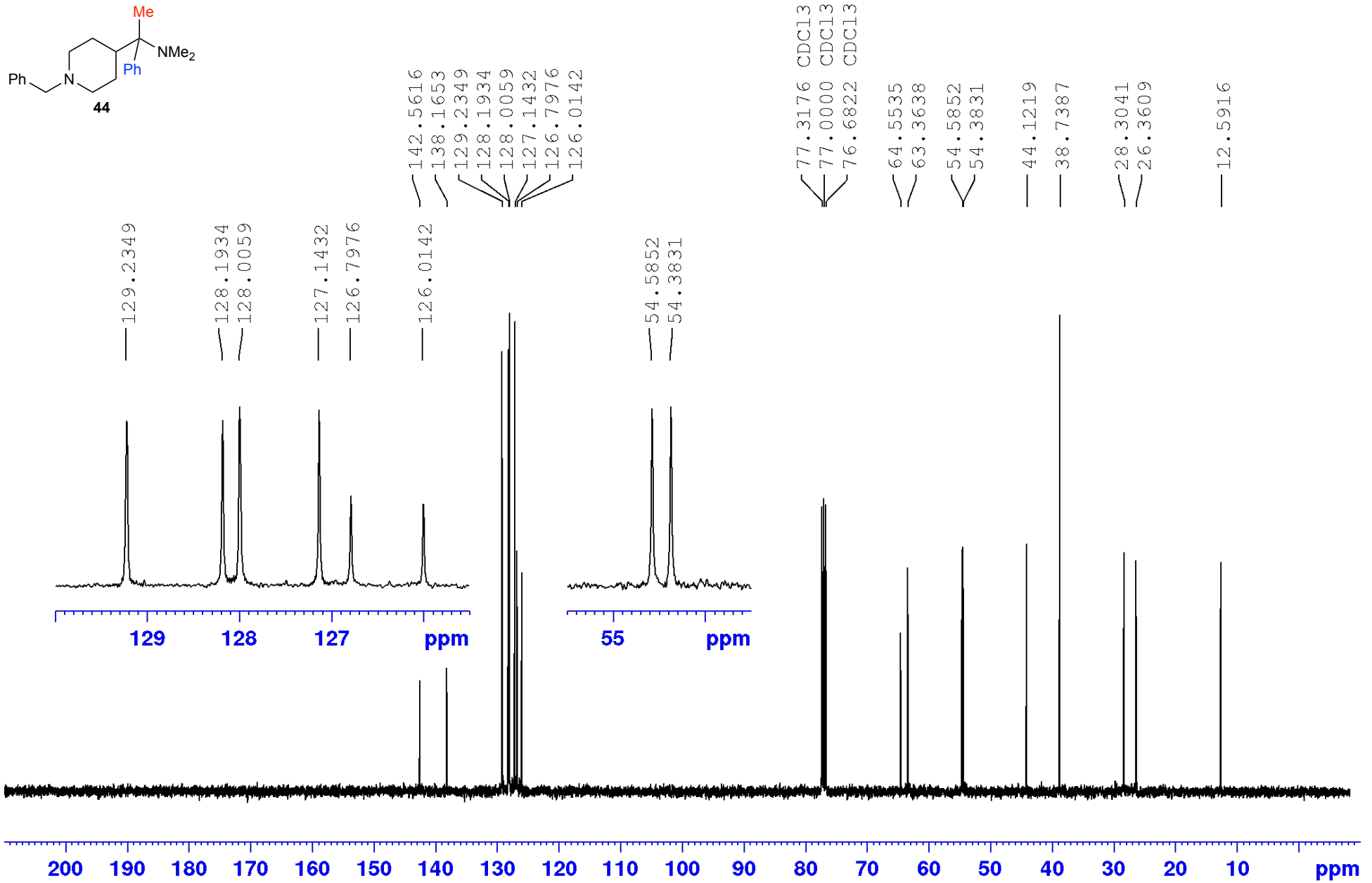


8.69 1-(1-Benzylpiperidin-4-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (44)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

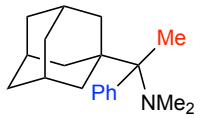


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



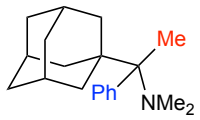
8.70 1-((3*r*,5*r*,7*r*)-Adamantan-1-yl)-*N*,*N*-dimethyl-1-phenylethan-1-amine (46)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



46

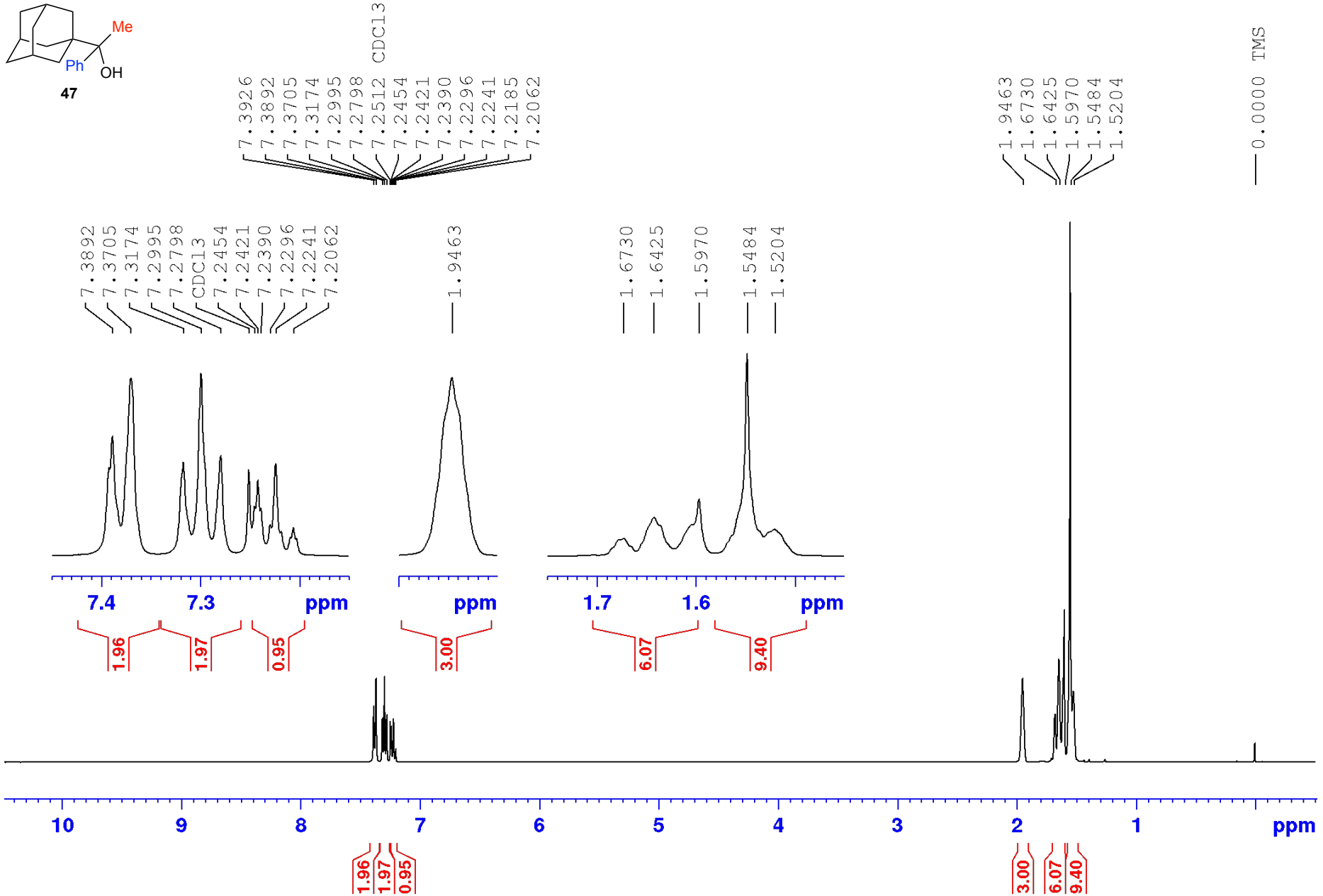
^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



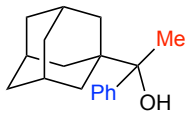
46

8.71 1-((3*r*,5*r*,7*r*)-Adamantan-1-yl)-1-phenylethan-1-ol (47)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



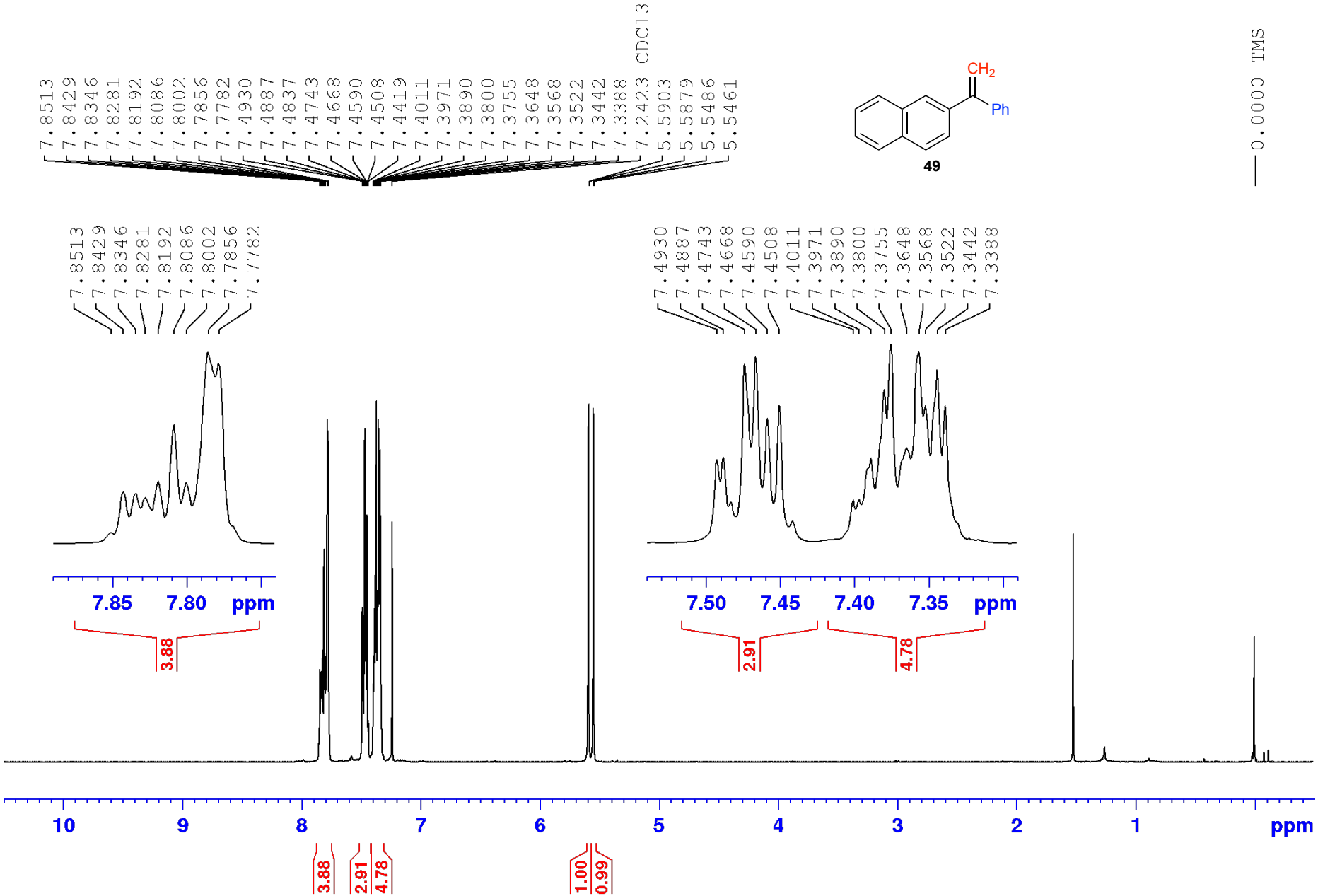
^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



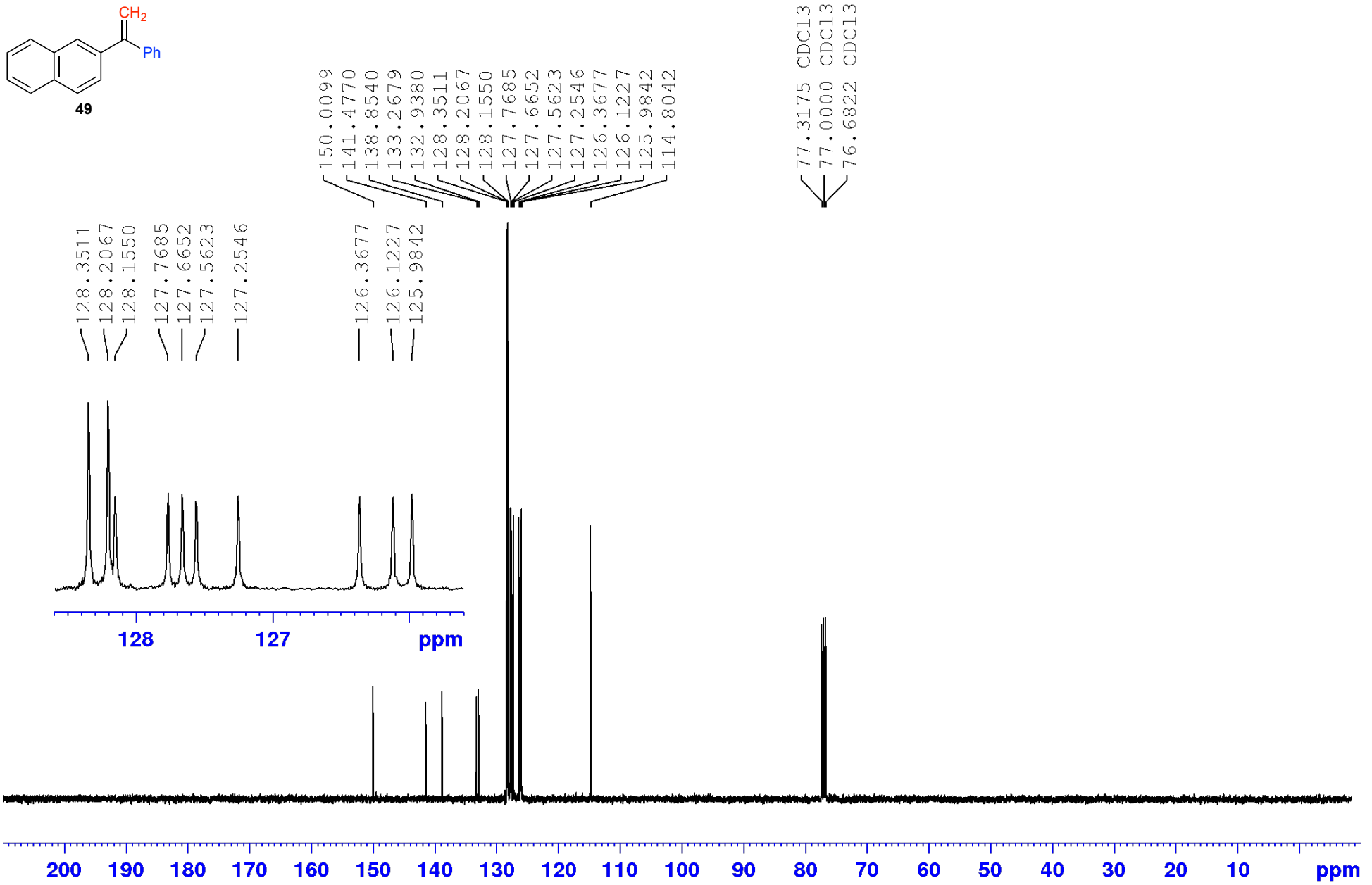
47

8.72 2-(1-Phenylvinyl)naphthalene (49)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

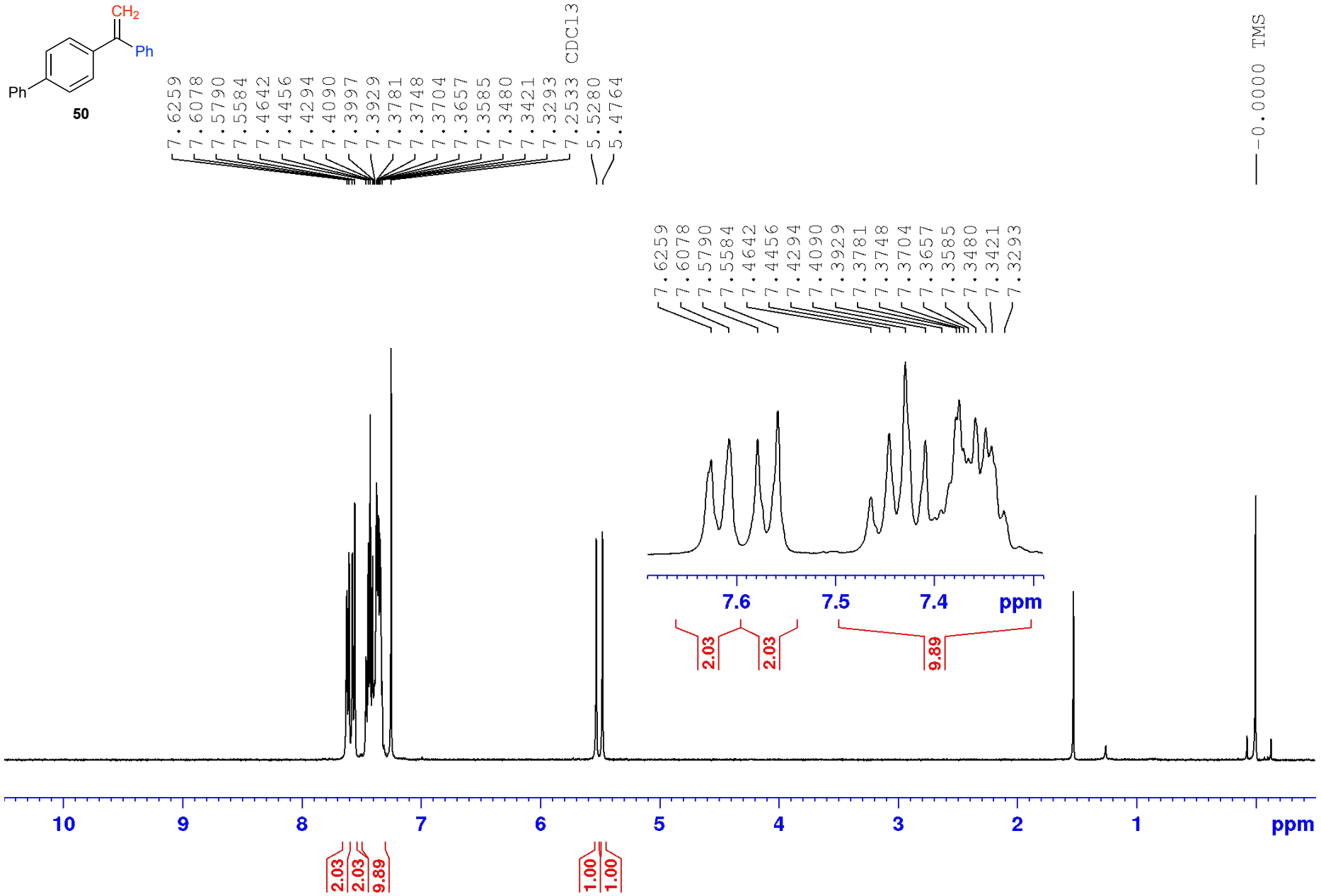


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

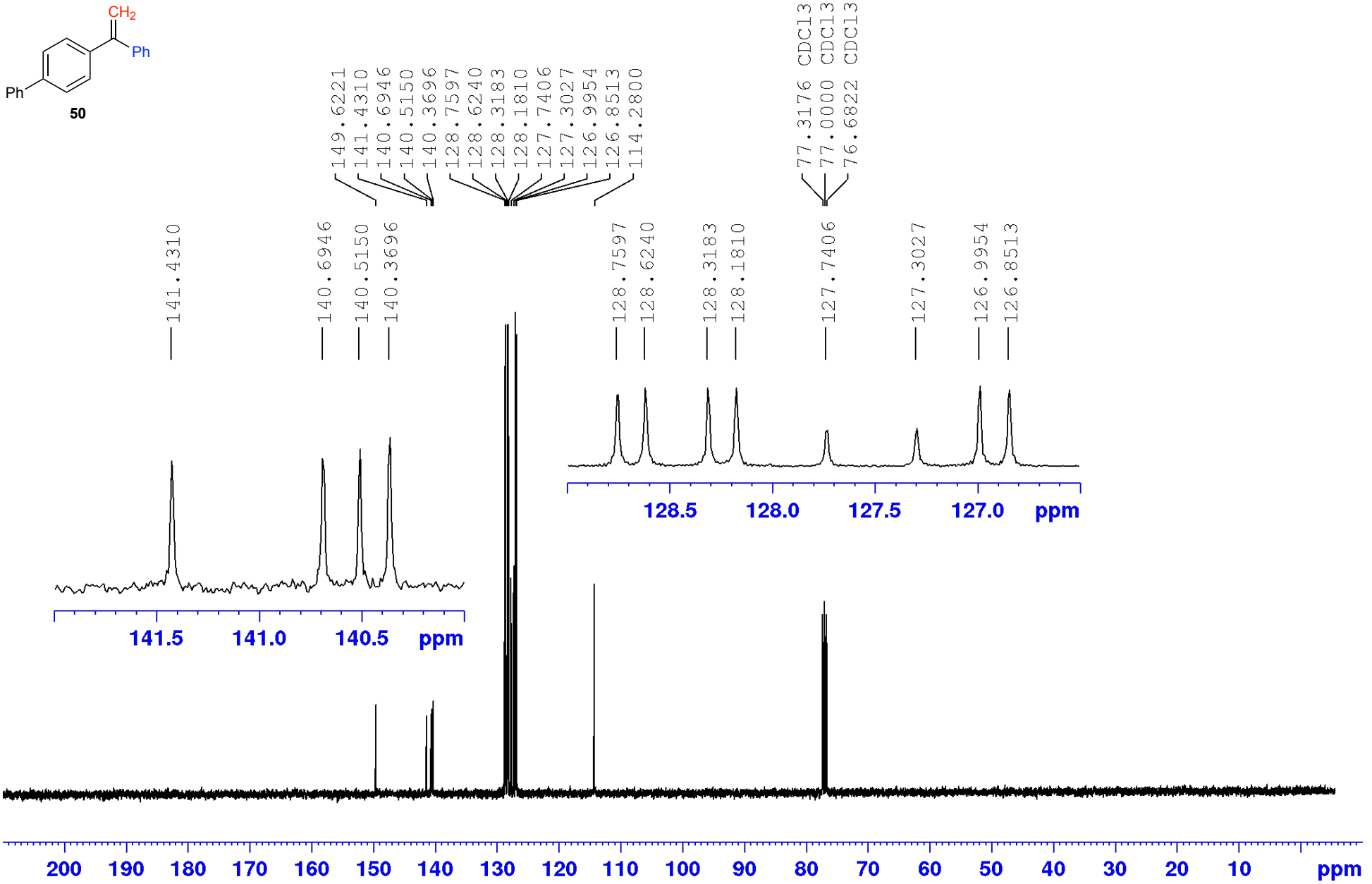


8.73 4-(1-Phenylvinyl)-1,1'-biphenyl (50)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

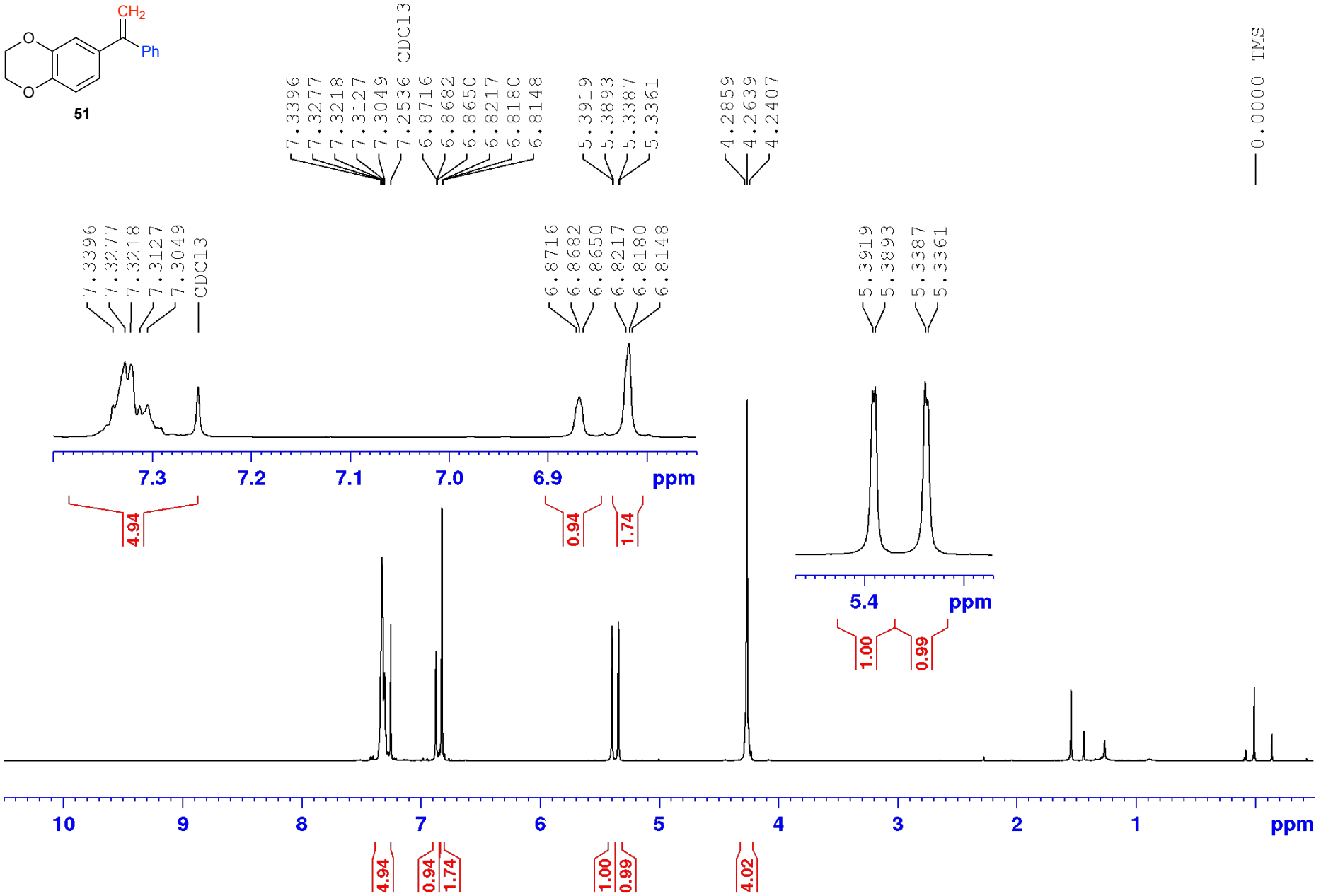


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

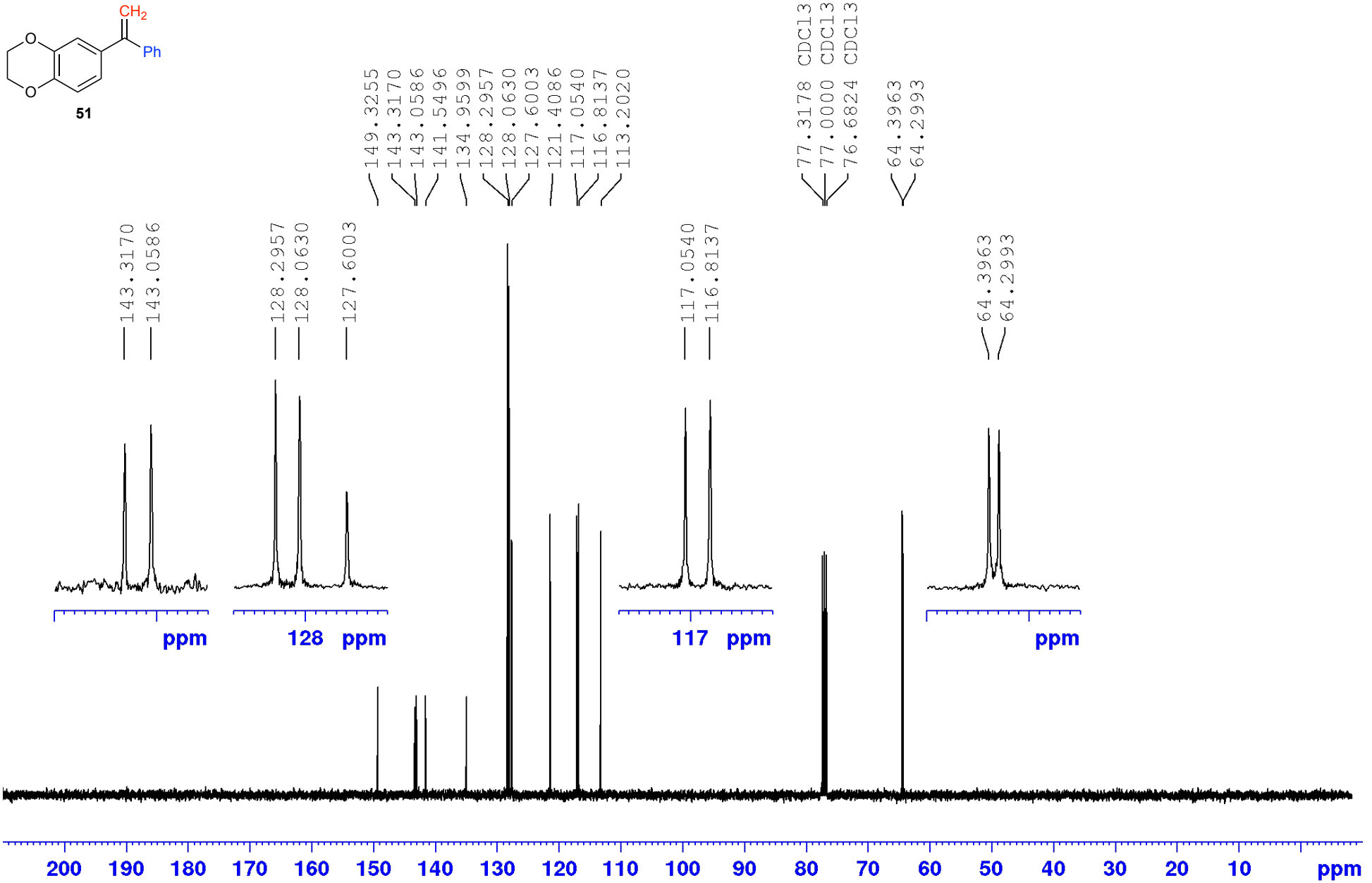


8.74 6-(1-Phenylvinyl)-2,3-dihydrobenzo[*b*][1,4]dioxine (51)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

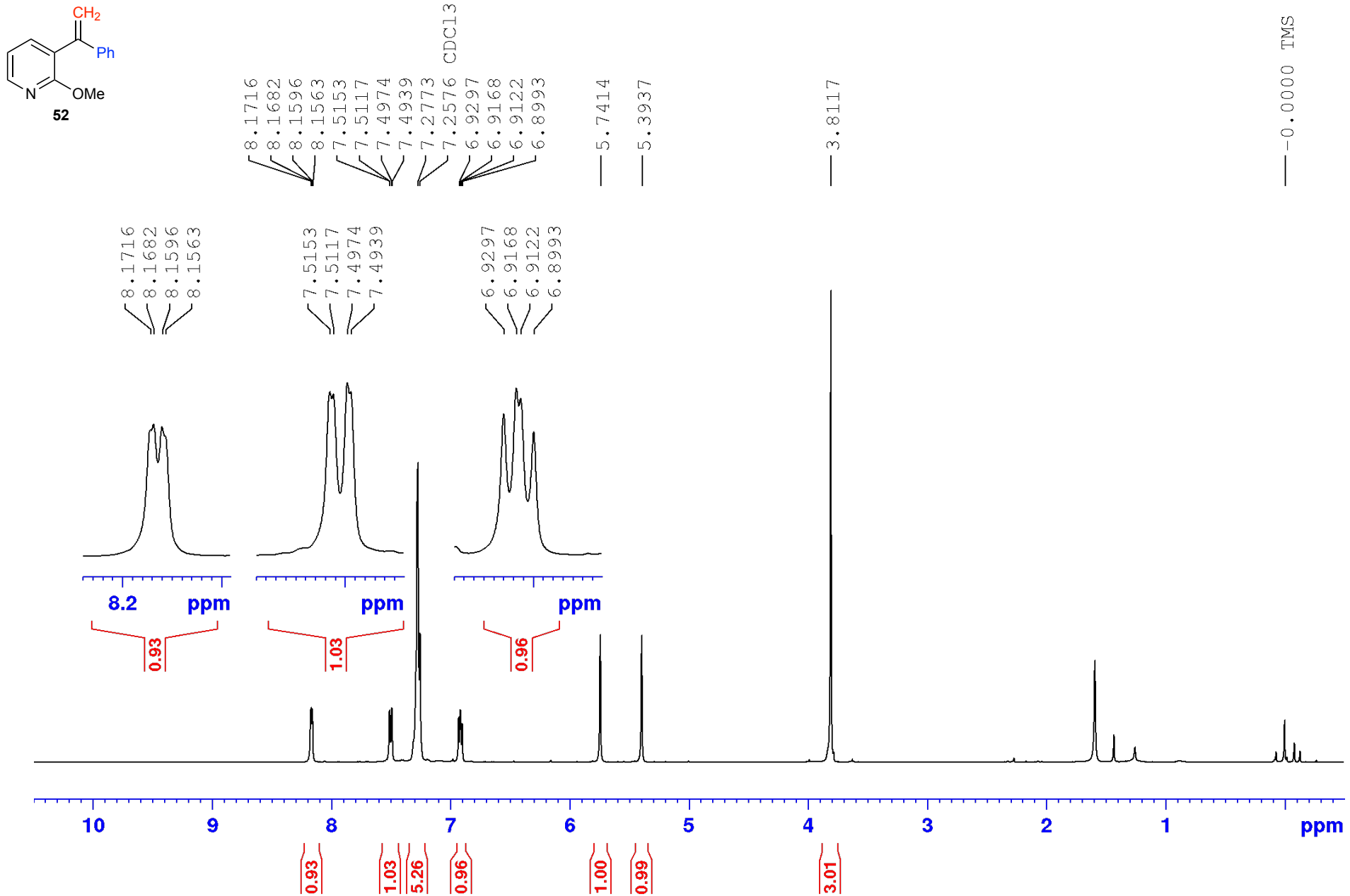


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

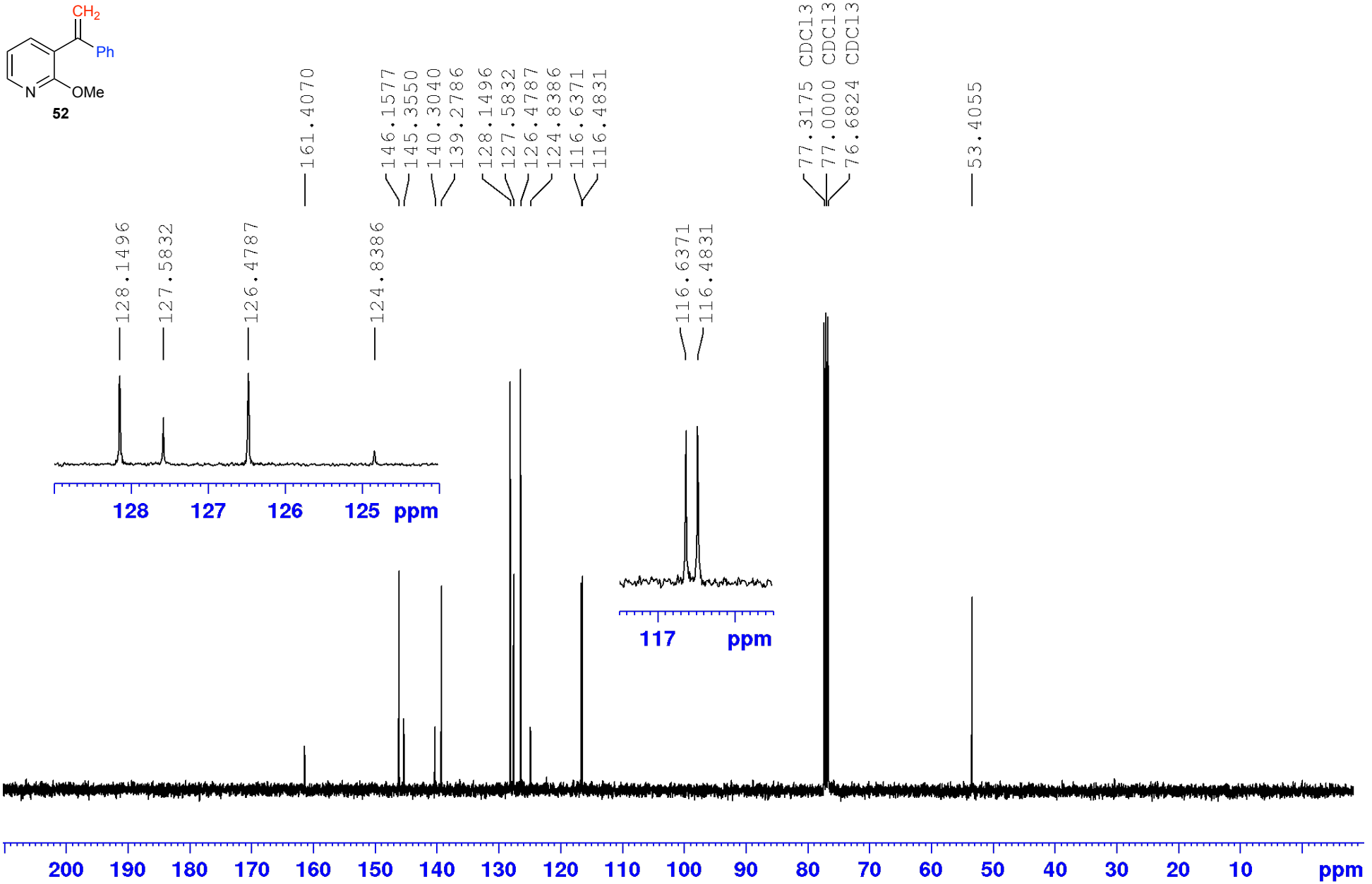


8.75 2-Methoxy-3-(1-phenylvinyl)pyridine (52)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

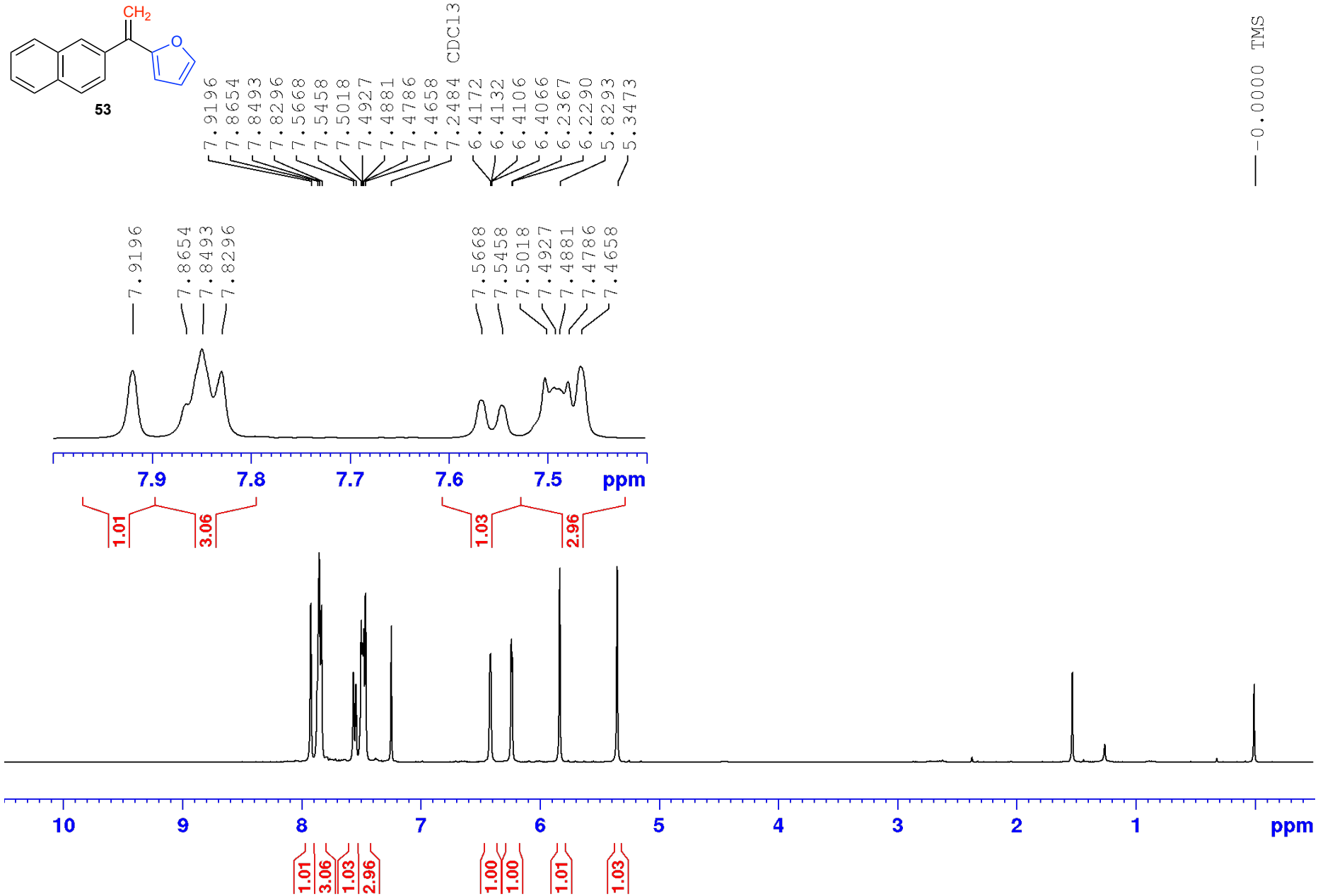


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

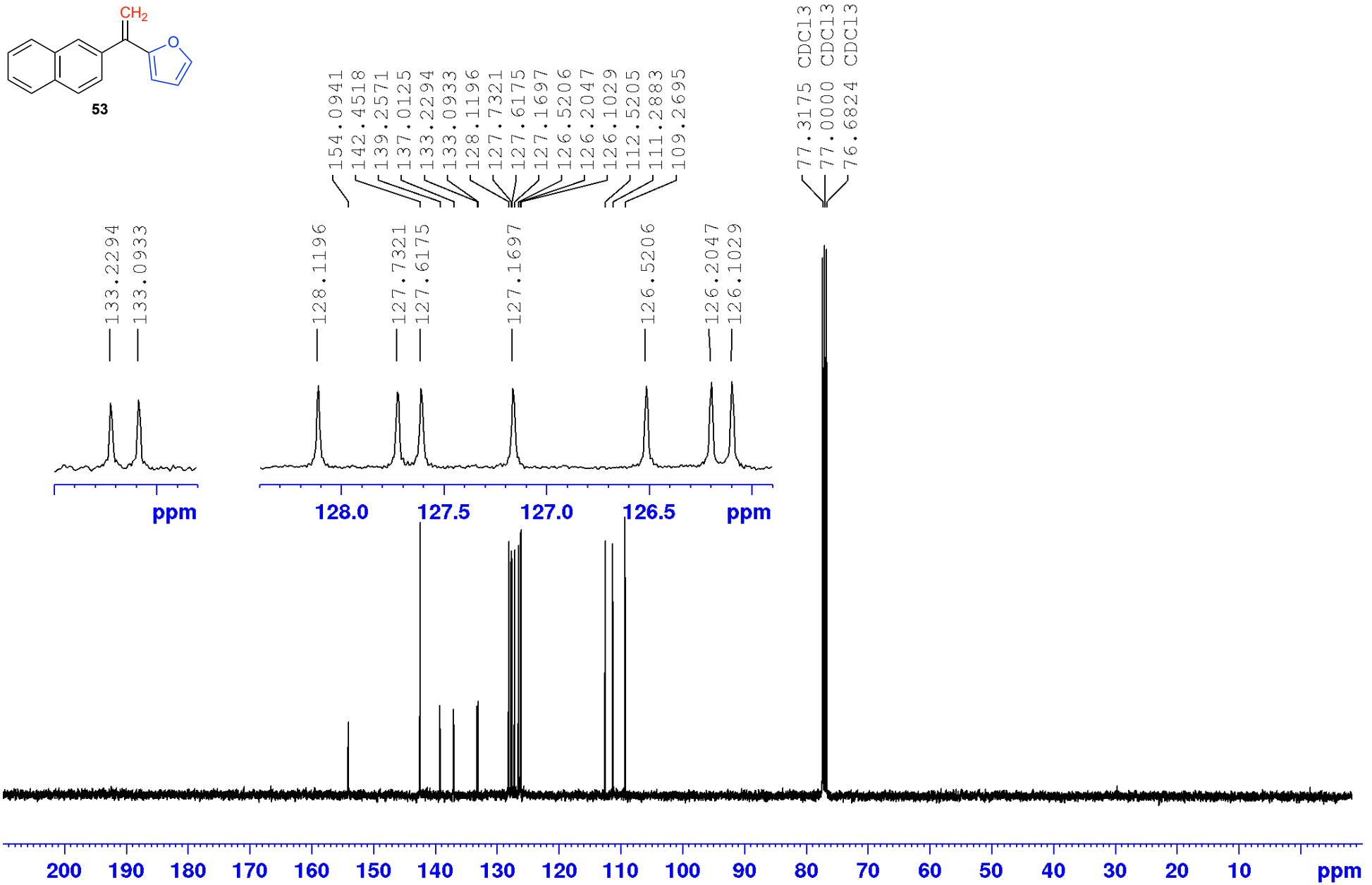


8.76 2-(1-(Naphthalen-2-yl)vinyl)furan (53)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

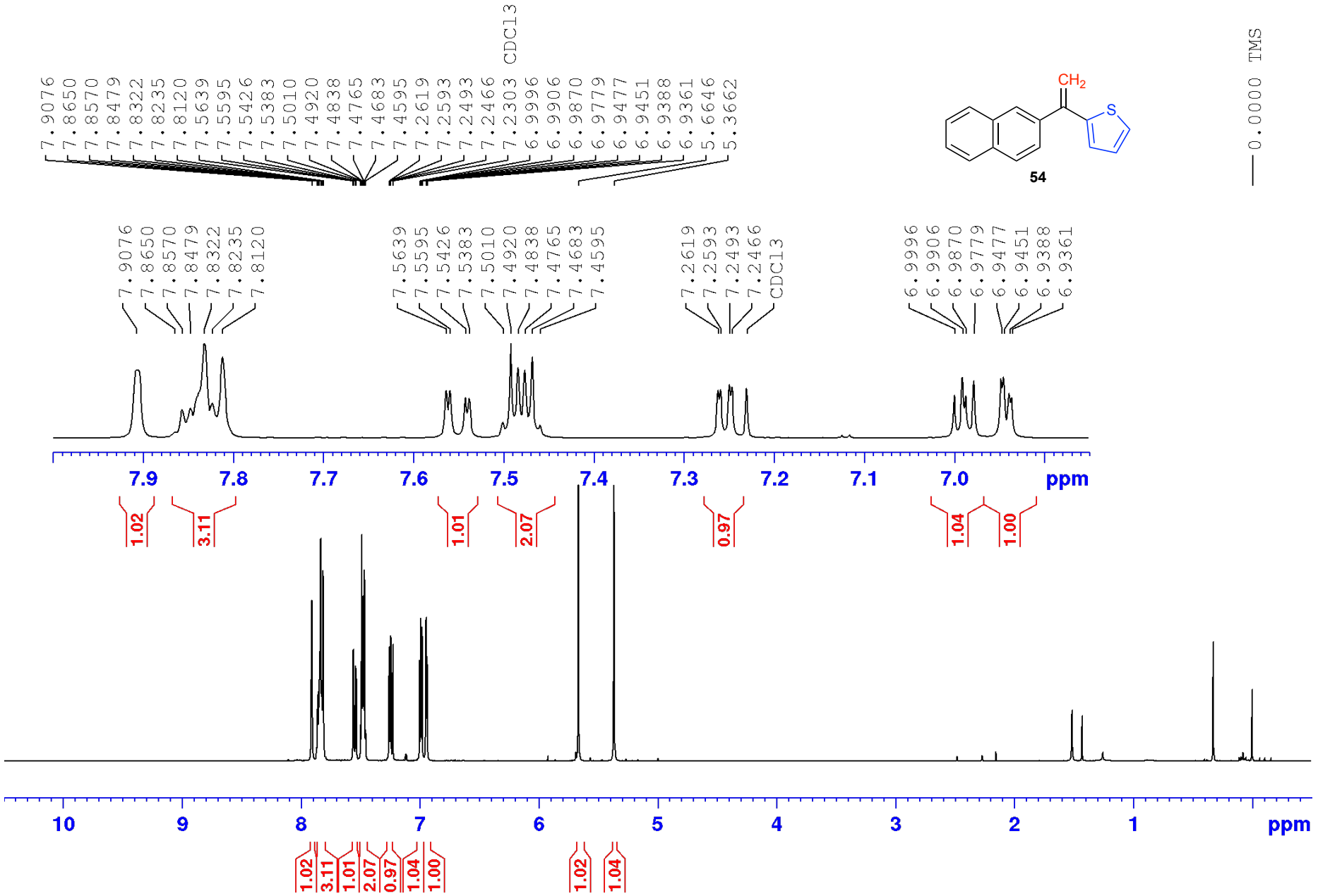


^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

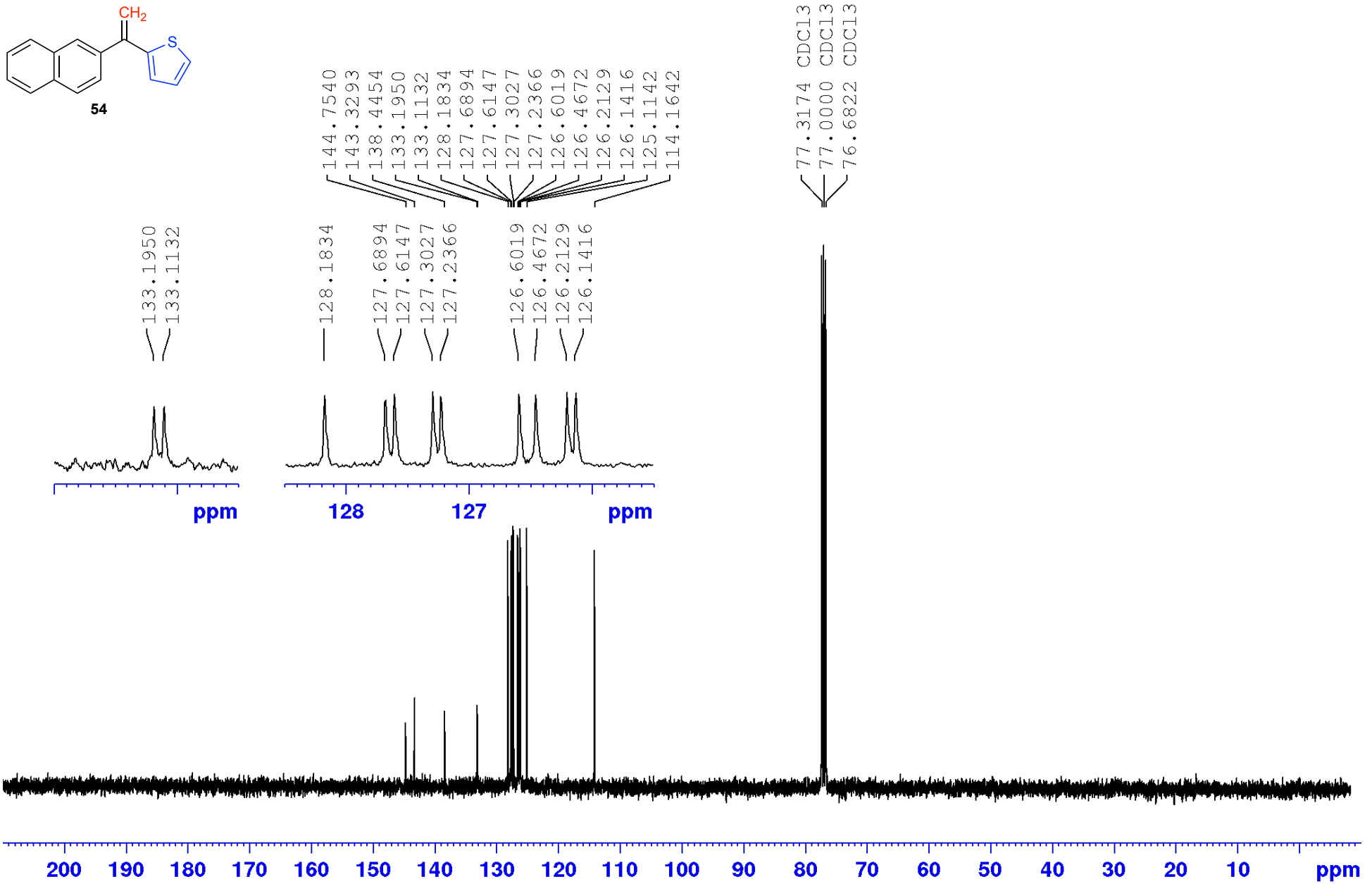


8.77 2-(1-(Naphthalen-2-yl)vinyl)thiophene (54)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$

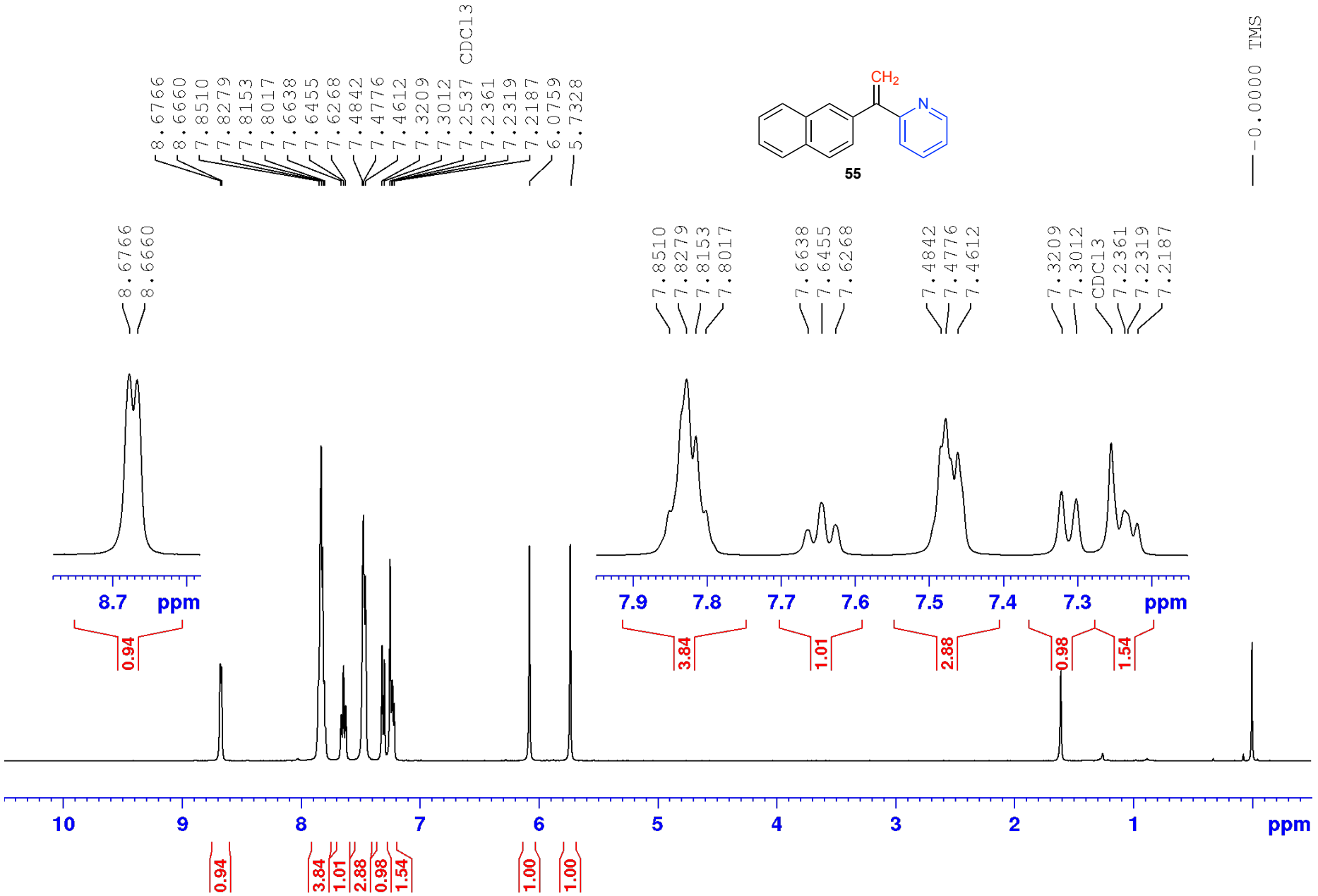


^{13}C NMR Spectrum (400 MHz on Bruker BBFO 400) in $CDCl_3$



8.78 2-(1-(Naphthalen-2-yl)vinyl)pyridine (55)

^{1}H NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$



^{13}C NMR Spectrum (400 MHz on Bruker AV 400) in $CDCl_3$