Supporting Information

Stereoselective Geminal Difunctionalization of Vinyl Arenes Mediated by Bromonium Ion

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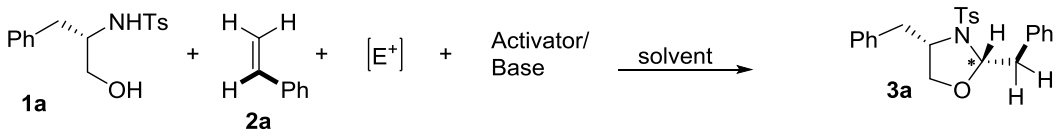
Contents **Page No**

General Experimental Methods

All reactions were carried out in oven-dried apparatus using dry solvents under anhydrous conditions, unless otherwise noted. Reaction mixtures were stirred magnetically unless otherwise stated. Analytical grade solvents were distilled and dried according to literature procedures (D. D. Perrin and W. L. F. Armarego, *Purification of laboratory chemicals*, Academic press, oxford, 3rd edn., 1988). Analytical TLC was performed on commercial plates coated with silica gel GF_{254} (0.25 mm). Visualization of TLC was accomplished using UV light or PMA stain. Silica gel (230 - 400 mesh) was used for column chromatography. NMR spectra were recorded on 400 MHz spectrometer. The chemical shifts (δ, ppm) are reported with reference to either internal standard $SiMe_4$ (for ^1H) or the central line (77.0 ppm) of $CDCl_3$ (for ^{13}C). The following abbreviations explain the multiplicity s = singlet, d = doublet, t = triplet, q = quartet, dd = doublet of a doublet, m = multiplet, and br = broad. IR spectra were recorded as thin films on NaCl plates on a FT-IR spectrometer. High-resolution mass spectra (HRMS) were recorded on a Micromass Q-TOF mass spectrometer. Isolated yields refer to chromatographically and spectroscopically (^1H NMR) homogeneous materials, unless otherwise stated.

All commercially available reagent grade styrenes **2a-2p**, free amino alcohol precursor for 1c-1g, **NBS**, and **AgOTf** were used as received, without further purification. The free amino alcohols phenylalaninol and alaninol were synthesized by the reduction of the corresponding L-amino acid according to the reported literature procedure.[1]

Table 1. Representative optimization. [a]



Entry	E^+(Electrophile source)	Activator/ Base	Solvent	Temp	Time	Yield (%)[b]
1)	NBS	—	CH_2Cl_2	rt	24h	N.R.
2)	NBS	—	Dioxane	rt	24 h	N.R.
3)	NBS	—	CH_3CN	rt	24 h	N.R.
4)	NBS	—	$PhCH_3$	rt	24 h	N.R.
5)	NBS	—	DCE	rt	24 h	N.R.
6)	NBS	—	CH_2Cl_2	reflux	5 h	N.R.
7)	NBS	—	CH_2Cl_2	0 °C	24 h	N.R.
8)	PTAB	—	CH_2Cl_2	rt	24 h	N.R.
9)	NIS	—	CH_2Cl_2	rt	24 h	N.R.
10)	I_2	—	CH_2Cl_2	rt	24 h	N.R.
11)	NIS	K_2CO_3 (5.0)[c]	CH_2Cl_2	rt	24 h	N.R.
12)	NBS	K_2CO_3 (5.0)[c]	CH_2Cl_2	rt	24 h	N.R.
13)	NBS	AgOTf (1.4)[c]	CH_2Cl_2	rt	1 h	**88**
14)	NBS	AgOTf (**0.2**)[c]	CH_2Cl_2	rt	3 h	11
15)	NBS (**0.2**)[c]	AgOTf	CH_2Cl_2	rt	3 h	14

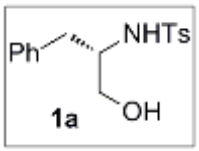
[a]Reaction conditions: 1 equiv (0.2 mmol) of **1a**; 1.2 equiv of **2a**; 1.2 equiv of $[E]^+$. [b]Isolated yields. [c]equiv in parenthesis.

Synthesis of *N*-Ts-aminoalcohols:

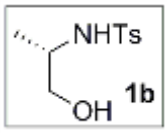
The *N*-Ts-aminoalcohols **1a-1g** were synthesized from the corresponding amino alcohols by a (modified) reported method.[2]

General procedure:

To a well stirred solution of amino alcohol (10 mmol) and Na_2CO_3 (20 mmol) in 120 ml of THF and H_2O (3:1) was added the solution of TsCl (10 mmol) in 5 mL of THF at 0 °C. It was allowed to warm up to room temperature and stirred for 3h. Then the reaction mixture was poured in to 100 mL of H_2O and extracted with CH_2Cl_2. The combined organic layers were dried (anhyd. Na_2SO_4), filtered and concentrated *in vacuo.* The residue obtained was purified by flash chromatography (Pet. Ether: EtOAc, 1:1) to afford *N*-Ts-aminoalcohol in pure form.

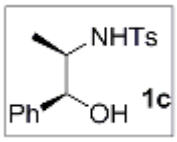


(2*S*)-*N*-(4-methylbenzenesulfonyl)-2-Amino-3-phenyl-1-propanol (1a): white solid (1.85 g, 92%); mp 68-69 °C (lit.,[3] 73-74 °C); $[\alpha]_D^{21}$ -28.9 (*c* 1.1 in $CHCl_3$) [lit.,[4] $[\alpha]_D^{20}$ -27.3 (*c* 1.3 in $CHCl_3$)]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 (d, *J* = 8.0 Hz, 2H), 7.21-7.17 (m, 5H), 6.97 (dd, *J* = 5.6, 3.1 Hz, 2H), 4.90 (d, *J* = 16.8 Hz, 1H), 3.65-3.44 (m, 3H), 2.78 (dd, *J* = 13.8, 7.0 Hz, 1H), 2.68 (dd, *J* = 13.8, 7.3 Hz, 1H), 2.41 (s, 3H), 2.23 (br d, *J* = 16.7 Hz, 1H).



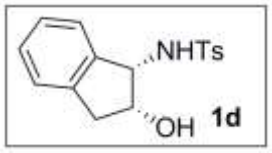
(2*S*)-*N*-(4-methylbenzenesulfonyl)-2-Amino-1-propanol (1b): white solid (2.62 g, 86%); mp 57-59 °C (lit.,[5] 63-64 °C); $[\alpha]_D^{21}$ -4.6 (*c* 1.0 in $CHCl_3$, l = 0.5 dm) [lit.,[6] $[\alpha]_D^{20}$ -6.6 (*c* 1.0 in $CHCl_3$)]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79 (d, *J* = 8.2 Hz, 2H), 7.31 (d, *J* = 8.1 Hz, 2H), 5.31 (br s, 1H), 3.57 (dd, *J* = 10.8, 2.9 Hz, 1H), 3.45-3.37 (m, 2H), 2.64 (br s, 1H), 2.43 (s, 3H), 1.01 (d, *J* = 6.5 Hz, 3H).

(1*S*,2*R*)-*N*-(4-methylbenzenesulfonyl)-2-Amino-1-phenyl-propanol (1c):



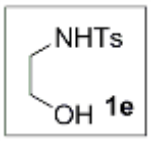
As per the general procedure using D-(+)-Norephedrine hydrochloride (1.0 g, 5.3 mmol) and Na_2CO_3 (2.25g, 21.2 mmol) gave the title compound as a colorless crystals (1.52 g, 93%); mp 89-90 °C (*ent*-lit.,[7] 86-88 °C); $[\alpha]_D^{21}$ +16.4 (*c* 1.0 in $CHCl_3$) [*ent*-lit.,[7] $[\alpha]_D^{20}$ -14.2 (*c* 1.0 in $CHCl_3$)]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77 (d, *J* = 8.1 Hz, 2H), 7.33-7.24 (m, 7H), 4.92 (d, *J* = 8.6 Hz, 1H), 4.78 (dd, *J* = 3.8 Hz, 1H), 3.62-3.54 (m, 1H), 2.67 (d, *J* = 4.7 Hz, 1H), 2.42 (s, 3H), 0.84 (d, *J* = 6.8 Hz, 3H).

(1*S*,2*R*)-*cis*-*N*-(4-methylbenzenesulfonyl)-1-Amino-2-indanol (1d):

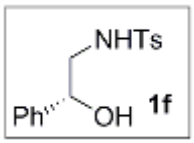


white solid (0.20 g, 98%); mp 141-143 °C (lit.,[8] 135-136 °C); $[\alpha]_D^{21}$ +41.1 (*c* 1.0 in $CHCl_3$) [lit.,[8] $[\alpha]_D^{23}$ +38.4 (*c* 1.12 in $CHCl_3$)]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (d, *J* = 8.2 Hz, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 7.23-7.12 (m, 3H), 7.04 (d, *J* = 7.4 Hz, 1H), 5.49 (d, *J* = 9.1 Hz, 1H), 4.65 (dd, *J* = 9.1, 4.8 Hz, 1H), 4.27 (d, *J* = 4.7 Hz, 1H), 3.01 (dd, *J* = 16.7, 4.9 Hz, 1H), 2.85 (d, *J* = 16.6 Hz, 1H), 2.44 (s, 3H), 2.38 (d, *J* = 5.0 Hz, 1H).

***N*-(4-methylbenzenesulfonyl)-2-Aminoethanol (1e):** colorless crystals (3.14 g, 89%); mp 54-56 °C (lit.,[9] 53-55 °C); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (d, *J* = 8.1 Hz, 2H), 7.31(d, *J* = 8.0Hz, 2H), 5.36 (br s, 1H), 3.69 (dd, *J* = 10.0, 5.1 Hz, 2H), 3.08 (dd, *J* = 10.5, 5.6 Hz, 2H), 2.54 (br s, 1H), 2.43 (s, 3H).

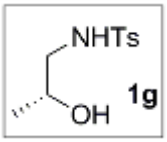


(1*R*)-*N*-(4-methylbenzenesulfonyl)-2-Amino-1-phenylethanol (1f): white solid (0.20 g, 97%); mp 98-100 °C (lit.,[10] 107-108 °C); $[\alpha]_D^{21}$ -69.4 (*c* 1.0 in

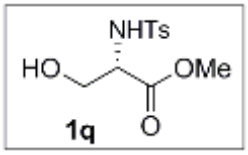


$CHCl_3$) [lit.,[11] $[\alpha]_D^{20}$ -70.5 (*c* 1.0 in $CHCl_3$)]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (d, *J* = 8.2 Hz, 2H), 7.33-7.26 (m, 7H), 5.29-5.21 (br m, 1H), 4.80-4.76 (m, 1H), 3.25-3.19 (m, 1H), 3.04-2.98 (m, 1H), 2.88-2.81 (br m, 1H), 2.41 (s, 3H).

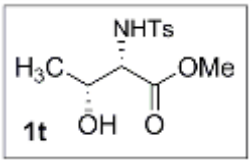
(2*R*)-*N*-(4-methylbenzenesulfonyl)-1-Amino-2-propanol (1g): white solid (0.29 g, 94%); mp 60-62 °C; $[\alpha]_D^{21}$ -20.7 (*c* 2.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3500, 3290, 2975, 2928, 2878, 1923, 1630, 1600, 1451, 1428, 1324, 1151, 1092, 1019, 943, 841, 816, 706, 666; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (d, *J* = 8.1 Hz, 2H), 7.30 (d, *J* = 8.0 Hz, 2H), 5.47 (dd, *J* = 6.2 Hz, 1H), 3.90 (br d, *J* = 2.9 Hz, 1H), 3.04-2.98 (m, 1H), 2.80-2.73 (m, 2H), 2.42 (s, 3H), 1.13 (d, *J* = 6.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.5, 136.6, 129.7, 127.0, 66.5, 50.0, 21.5, 20.5; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{10}H_{15}NO_3SNa$, 252.0670; found, 252.0669.



(2*S*)-methyl-*N*-(4-methylphenylsulfonyl)-3-hydroxy-2-Amino-propanoate (1q): white solid (0.23 g, 84%); mp 90-92 °C (lit.,[12] 83-84 °C); $[\alpha]_D^{21}$ +8.1 (*c* 1.0 in $CHCl_3$, l = 0.50 dm) [lit.,[13] $[\alpha]_D^{20}$ +12.2 (*c* 0.83 in $CHCl_3$)]; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (d, *J* = 8.0 Hz, 2H), 7.30 (d, *J* = 8.0 Hz, 2H), 5.88 (d, *J* = 7.9 Hz, 1H), 4.02-3.94 (m, 1H), 3.89 (br d, *J* = 3.0 Hz, 2H), 3.60 (s, 3H), 2.79 (dd, *J* = 6.4 Hz, 1H), 2.42 (s, 3H).



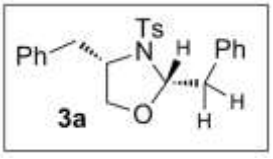
(2*S*,3*R*)-methyl-*N*-(4-methylphenylsulfonyl)-3-hydroxy-2-Amino-butanoate (1t): white solid (0.25 g, 88%); mp 102-103 °C (lit.,[14] 102 °C); $[\alpha]_D^{21}$ -4.6 (*c* 2.0 in $CHCl_3$) [lit.,[14] $[\alpha]_D^{20}$ -4.66 (*c* 2.13 in $CHCl_3$)];



^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (d, J = 8.1 Hz, 2H), 7.29 (d, J = 8.4 Hz, 2H), 5.75 (br d, J = 9.6 Hz, 1H), 4.19-4.13 (m, 1H), 3.83 (dd, J = 9.7, 3.0 Hz, 1H), 3.51 (s, 3H), 2.59 (d, J = 5.5 Hz, 1H), 2.41 (s, 3H), 1.26 (d, J = 6.2 Hz, 3H).

General procedure for the synthesis of oxazolidines 3a-3t.

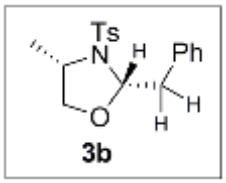
To a colorless solution of *N*-Ts aminoalcohol (0.16 mmol) and styrene (0.19 mmol) in 2 mL of CH_2Cl_2 in a well dried Schlenk flask under argon atmosphere was added NBS (0.19 mmol) and AgOTf (0.22 mmol) at room temperature [25 °C]. The reaction mixture turned from a colorless solution to a white cloudy solution then to a colorless solution with a pale yellow suspension and finally to a colorless solution with pale grey precipitate in 60 min. The progress of the reaction was monitored by TLC. After stirring the reaction mixture for 60 min at room temperature 3 mL of H_2O, 2 mL of sat. soln. of aq.$NaHCO_3$ and 2 mL of sat. soln. of aq.$Na_2S_2O_3$ were added in succession and extracted with CH_2Cl_2. The combined organic layers were dried (anhyd. Na_2SO_4), filtered and concentrated *in vacuo*. The crude product obtained was purified by flash chromatography (Pet. Ether: Et_2O, 16:1) to furnish oxazolidines in pure form.



(2*S*,4*S*)-2,4-dibenzyl-3-tosyloxazolidine (3a): white solid (59 mg, 88%); mp 76-79 °C; $[\alpha]_D^{21}$ +23.5 (*c* 1.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3384, 3030, 2926, 2867, 1598, 1496, 1455, 1345, 1164, 1090, 816, 745, 700, 666; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (d, J = 8.1 Hz, 2H), 7.39-7.18 (m, 10 H), 7.09 (d, J = 7.3 Hz, 2H), 5.09 (dd, J = 7.8, 6.8 Hz, 1H), 3.78-3.73 (m, 1H), 3.61 (dd, J = 9.1, 2.4 Hz, 1H), 3.28 (dd, J = 14.1, 1.8 Hz, 1H), 3.08-2.99 (m, 2H), 2.92 (dd, J = 13.6, 3.6 Hz, 1H), 2.41 (s, 3H), 2.25 (dd, J = 13.4, 10.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.2, 137.5, 135.9, 134.0,

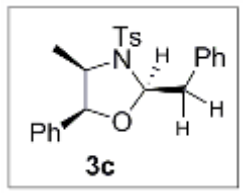
130.5, 129.9, 129.4, 128.6, 128.1, 127.8, 126.8, 126.6, 92.6, 68.8, 60.6, 42.2, 40.4, 21.5; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{24}H_{25}NO_3SNa$, 430.1453; found, 430.1450.

(2*S*,4*S*)-2-benzyl-4-methyl-3-tosyloxazolidine (3b): colorless crystals (54 mg, 75%); mp 151-152 °C; $[\alpha]_D^{21}$ -60.5 (*c* 1.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3854, 3750, 3031, 2985, 2930, 2871, 1348, 1164, 1102, 1087, 1049, 993, 819, 760, 748, 701, 669, 646; ^1H NMR (400 MHz, $CDCl_3$) δ 7.73 (d, *J* = 8.2 Hz, 2H), 7.33-7.23 (m, 7H), 5.10 (dd, *J* = 7.2, 2.2 Hz, 1H), 3.73-3.65 (m, 1H), 3.45 (dd, *J* = 8.4, 3.7 Hz, 1H), 3.34 (dd, *J* = 8.5, 6.3 Hz, 1H), 3.27 (dd, *J* = 14.0, 2.3 Hz, 1H), 3.07 (dd, *J* = 14.1, 7.2 Hz, 1H), 2.42 (s, 3H), 1.08 (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.1, 136.1, 134.0, 130.3, 129.9, 128.1, 127.8, 126.7, 92.6, 71.6, 55.1, 42.6, 21.5, 20.4; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{18}H_{21}NO_3SNa$, 354.1140; found, 354.1142.



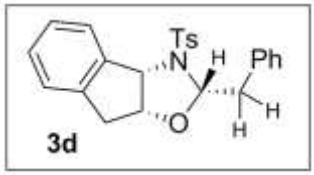
3b

(2*R*,4*R*,5*S*)-2-benzyl-4-methyl-5-phenyl-3-tosyloxazolidine (3c): colorless solid (58mg, 72%); mp 111-112 °C; $[\alpha]_D^{21}$ +2.8 (*c* 2.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3064, 3031, 2981, 2931, 2869, 1598, 1496, 1455, 1350, 1165, 1022, 1002, 816, 754, 702, 671, 653; ^1H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, *J* = 7.9 Hz, 2H), 7.45-7.20 (m, 10H), 7.07 (d, *J* = 7.3 Hz, 2H), 5.20 (d, *J* = 5.8 Hz, 1H), 4.18 (d, *J* = 5.4 Hz, 1H), 3.92-3.86 (m, 1H), 3.40 (d, *J* = 14.0 Hz, 1H), 3.25 (dd, *J* = 14.0, 6.0 Hz, 1H), 2.46 (s, 3H), 0.40 (d, *J* = 6.7 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.2, 135.8, 135.3, 134.5, 130.9, 130.0, 128.2, 128.0, 127.83, 127.80, 126.7, 125.9, 90.9, 81.1, 58.4, 42.5, 21.6, 16.9; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{24}H_{25}NO_3SNa$, 430.1453; found, 430.1451.



3c

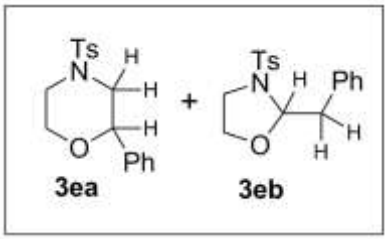
(2*S*,3a*S*,8a*R*)-2-benzyl-3-tosyl-indanooxazolidine (3d): white solid (42 mg, 79%); mp 123-124 °C; $[\alpha]_D^{21}$ -38.8 (*c* 1.0 in $CHCl_3$);



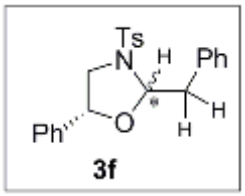
3d

IR (Neat): ν_{max}/cm^{-1} 3064, 3030, 2925, 2865, 1598 ,1495, 1479, 1455, 1351, 1164, 1091, 1054, 816, 753, 700, 665; ^1H NMR (400 MHz, $CDCl_3$) δ 7.79 (d, J = 7.6 Hz, 2H), 7.49 (d, J = 7.2 Hz, 1H), 7.35-7.03 (m, 10H), 5.33 (dd, J = 7.6, 2.7 Hz, 1H), 5.23 (d, J = 5.4 Hz, 1H), 4.17 (dd, J = 5.2 Hz, 1H), 3.07 (d, J = 17.4 Hz, 1H), 3.0-2.91 (m, 2H), 2.49 (dd, J =14.0, 7.9 Hz, 1H), 2.44 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.3, 140.0, 139.8, 136.1, 134.6, 130.0, 129.7, 128.7, 128.0, 127.8, 127.6, 126.5, 126.0, 125.1, 93.6, 81.1, 67.6, 43.5, 37.7, 21.6; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{24}H_{23}NO_3SNa$, 428.1296; found, 428.1294.

Mixture of 2-phenyl-4-tosylmorpholine (3ea[15]) and 2-benzyl-3-tosyloxazolidine (3eb[16]): Mixture of oxazolidine ***A*** and morpholine ***B*** (**1**:**2**)**:** pale yellow oil (62 mg, 65%); ^1H NMR (400 MHz, $CDCl_3$) δ 7.73 (d, J = 8.2 Hz, 0.70H, *2A*), 7.61 (d, J = 8.2 Hz, 1.30H, *2B*), 7.36-7.22 (m, 7H, *7A+7B*), 5.27 (dd, J = 6.8, 2.9 Hz, 0.33H, *1A*), 4.60 (dd, J = 10.3, 2.4 Hz, 0.67H, *1B*), 4.07 (dd, J = 11.6, 2.2 Hz, 0.67 H, *1B*), 3.85 (ddd, J = 11.6, 2.6, Hz, 0.67H, *1B*), 3.78-3.71 (m, 1H, *1A+1B*), 3.63 (d, J = 11.2 Hz, 0.67H, *1B*), 3.45-3.37 (m, 0.33H, *1A*), 3.28-3.22 (m, 0.33H, *1A*), 3.19-3.13 (m, 0.67H, *2A*), 3.01 (dd, J = 14.0, 6.8 Hz, 0.39H, *1A*), 2.50 (ddd, J = 11.5, 3.3 Hz, 0.67H, *1B*), 2.43- 2.40 (2s, 3H, *3A+3B*), 2.24 (dd, J = 0.9 Hz, 0.67 H, *1B*).

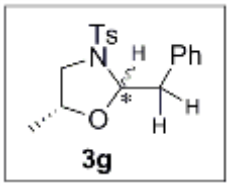


(5*R*)-2-benzyl-5-phenyl-3-tosyloxazolidine (3f): mixture of diastereomers ***A*** and ***B*** (*2:3*): white solid (61 mg, 74%); mp 82-85 °C; $[\alpha]_D^{21}$ -6.4 (*c* 1.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3854, 3751, 3063, 3032, 2924, 2888, 1598, 1495, 1456, 1350, 1165, 1093, 994, 967, 816, 758, 700, 668; ^1H NMR (400 MHz, $CDCl_3$) δ 7.79 (d, J = 8.1 Hz, 1.2H, *2B*), 7.66 (dd, J = 8.1 Hz, 0.8H, *2A*), 7.39-7.13 (m, 10H, *10A+10B*), 7.02-7.00 (m, 1.2H, *2B*), 6.85 (d, J = 7.4 Hz, 0.8H, *2A*), 5.50 (dd, J = 4.9



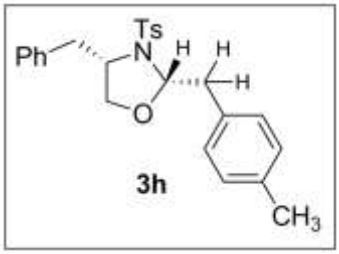
Hz, 0.4H, *1A*), 5.43 (dd, *J* = 5.4, 3.0 Hz, 0.6H, *1B*), 4.94 (dd, *J* = 7.1 Hz, 0.4H, *1A*), 4.06 (dd, *J* = 10.2, 5.4 Hz, 0.6H, *1B*), 3.79 (dd, *J* = 11.9, 5.4 Hz, 0.6H, *1B*), 3.71 (dd, *J* = 13.2, 6.9 Hz, 0.4H, *1A*), 3.30-3.17 (m, 1.6H, *1A*+*2B*), 3.08 (dd, *J* = 8.8 Hz, 0.4H, *1A*), 2.84 (dd, *J* = 11.0 Hz, 0.6H, *1B*), 2.45-2.38 (m, 3.4H, 3A+3B+1B); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.3, 144.1, 137.9, 136.4, 136.1, 135.5, 134.8, 133.1, 130.6, 130.2, 130.0, 129.8, 128.5, 128.43, 128.39, 128.33, 128.25, 128.11, 128.07, 127.9, 127.7, 126.7, 126.3, 125.6, 92.2, 91.6, 78.9, 77.9, 53.8, 53.7, 42.36, 42.33, 21.58, 21.52; HRMS (ESI-QTOF) *m/z*: [M+ Na]$^+$ calcd for $C_{23}H_{23}NO_3SNa$, 416.1296; found, 416.1295.

(5*R*)-2-benzyl-5-methyl-3-tosyloxazolidine (3g): mixture of diastereomers ***A*** and ***B*** (*3:2*): pale yellow solid (52 mg, 65%); mp 54-58 °C; $[\alpha]_D^{21}$ -24.2 (*c* 1.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3448, 3031, 2978, 2930, 2889, 1598, 1496, 1455, 1349, 1166, 1091, 1020, 1000, 817, 764, 748, 701, 668; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (d, *J* = 8.1 Hz, 2H), 7.33-7.22 (m, 7H), 5.28 (dd, *J* = 6.8, 2.7 Hz, 0.4H, *1B*), 5.24 (dd, *J* = 5.9, 2.0 Hz, 0.6H, *1A*), 4.17-4.09 (m, 0.4H, *1B*), 3.51 (dd, *J* = 11.5, 5.9 Hz, 0.6H, *1A*), 3.45 (dd, *J* = 9.2, 5.7 Hz, 0.4H, *1B*), 3.24-2.98 (m, 2.6H, *3A*+*2B*), 2.75 (dd, *J* = 8.5 Hz, 0.4H, *1B*), 2.50-2.40 (m, 3.6H, *3A*+*3B*+*1A*), 1.02 (d, *J* = 5.9 Hz, 1.8H, *3A*), 0.92 (d, *J* = 6.1 Hz, 1.2 H, *3B*); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.1, 136.3, 135.8, 134.9, 133.4, 130.5, 130.0, 129.9, 129.8, 128.5, 128.3, 128.0, 127.9, 127.6, 126.64, 126.59, 91.59, 91.46, 73.37, 72.57, 53.1, 52.9, 42.6, 42.2, 21.5, 21.4, 18.1, 17.3; HRMS (ESI-QTOF) *m/z*: [M+ Na]$^+$ calcd for $C_{18}H_{21}NO_3SNa$, 354.1140; found, 354.1142.

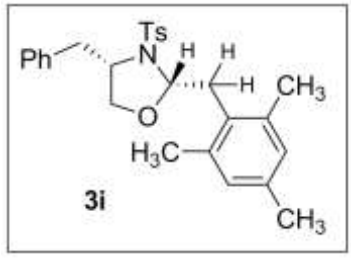


(2*S*,4*S*)-4-benzyl-2-(4-methylbenzyl)-3-tosyloxazolidine (3h): colorless oil (61mg, 88%); $[\alpha]_D^{21}$ +22.7 (*c* 1.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3027, 2924, 2868, 1598, 1516, 1495, 1454, 1349, 1164, 1091, 1054, 815, 754, 703, 665; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (d, *J* = 8.1 Hz,

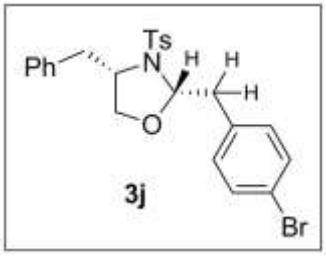
2H), 7.32-7.10 (m, 11H), 5.06 (dd, *J* = 7.3, 1.9 Hz, 1H), 3.80-3.74 (m, 1H), 3.62 (dd, *J* = 9.0, 2.7 Hz, 1H), 3.24 (d, *J* = 14.1 Hz, 1H), 3.07 (dd, *J* = 8.9, 6.0 Hz, 1H), 3.0-2.92 (m, 2H), 2.41 (s, 3H), 2.41-2.32 (m, 1H), 2.32 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.1, 137.5, 136.3, 134.1, 132.9, 130.2, 129.9, 129.4, 128.9, 128.6, 127.8, 126.7, 92.9, 68.8, 60.6, 41.9, 40.6, 21.5, 21.1; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{25}H_{27}NO_3SNa$, 444.1609; found, 444.1609.



(2*S*,4*S*)-4-benzyl-3-tosyl-2-(2,4,6-trimethylbenzyl)oxazolidine (3i): pale yellow oil (58 mg, 70%); $[\alpha]_D^{21}$ -17.6 (*c* 1.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3462, 2923, 2862, 1601, 1350, 1163, 1026, 772, 704, 664; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (d, *J* = 8.1 Hz, 2H), 7.36-7.23 (m, 7H), 6.88 (s, 2H), 5.12 (dd, *J* = 9.2, 1.7 Hz, 1H), 3.90-3.86 (m, 1H), 3.70 (dd, *J* = 9.0, 3.2 Hz, 1H), 3.33 (d, *J* = 13.0 Hz, 1H), 3.21 (dd, *J* = 13.5 , 3.7 Hz, 1H), 3.11 (dd, *J* = 8.9, 6.1 Hz, 1H), 2.97 (dd, *J* = 14.2, 9.4 Hz, 1H), 2.86 (dd, *J* = 13.4, 10.1 Hz, 1H), 2.43 (s, 3H), 2.41 (s, 3H), 2.38 (s, 3H), 2.27 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.2, 137.4, 137.2, 136.1, 134.1, 130.4, 129.9, 129.6, 129.0, 128.7, 127.8, 126.8, 92.5, 68.7, 60.5, 40.9, 36.5, 21.5, 20.8, 20.6; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{27}H_{31}NO_3SNa$, 472.1922; found, 472.1925.

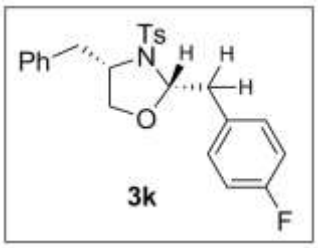


(2*S*,4*S*)-4-benzyl-2-(4-bromobenzyl)-3-tosyloxazolidine (3j): colorless oil (68 mg, 85%); $[\alpha]_D^{21}$ +22.2 (*c* 1.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3426, 3028, 2928, 2870, 1597, 1490, 1453, 1349, 1306, 1163, 1091, 1071, 1013, 814, 765, 704, 665; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (d, *J* = 8.1 Hz, 2H), 7.45 (d, *J* = 8.2 Hz, 2H), 7.34-7.19 (m, 7H),



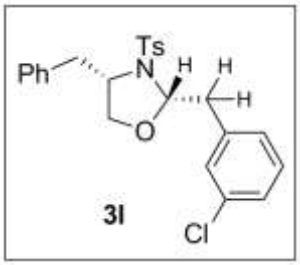
7.10 (d, *J* = 7.4 Hz, 2H), 5.03 (dd, *J* = 6.6, 1.9 Hz, 1H), 3.78-3.75 (m, 1H), 3.61 (dd, *J* = 9.1, 2.3 Hz, 1H), 3.22 (d, *J* = 14.1 Hz, 1H), 3.06 (dd, *J* = 8.9, 6.1 Hz, 1H), 2.98 (dd, *J* = 14.1, 6.8 Hz, 1H), 2.92 (dd, *J* = 13.6, 3.6 Hz, 1H), 2.42 (s, 3H), 2.26 (dd, *J* = 13.4, 10.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.3, 137.3, 134.9, 133.9, 132.2, 131.2, 130.0, 129.4, 128.6, 127.8, 126.7, 120.8, 92.3, 68.8, 60.6, 41.5, 40.5, 21.5; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{24}H_{24}BrNO_3SNa$, 508.0558; found, 508.0556.

(2*S*,4*S*)-4-benzyl-2-(4-fluorobenzyl)-3-tosyloxazolidine (3k):



colorless solid (67 mg, 86%); mp 71-73 °C; $[\alpha]_D^{21}$ +30.6 (*c* 1.1 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3029, 2928, 2870, 1600, 1510, 1349, 1222, 1164, 1144, 1091, 1054, 994, 839, 816, 754, 704, 664; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (d, *J* = 8.0 Hz, 2H), 7.34-7.19 (m, 7H), 7.09-7.00 (m, 4H), 5.04 (d, *J* = 5.2 Hz, 1H), 3.77-3.74 (m, 1H), 3.60 (d, *J* = 9.1 Hz, 1H), 3.23 (d, *J* = 13.9 Hz, 1H), 3.07-3.00 (m, 2H), 2.89 (dd, *J* = 13.5, 3.4 Hz, 1H), 2.41 (s, 3H), 2.19 (dd, *J* = 13.2, 11.0 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.0 (d, $^1J_{C-F}$ = 243.3 Hz), 144.3, 137.3, 133.9, 132.06 (d, $^3J_{C-F}$ = 7.8 Hz), 131.51 (d, $^4J_{C-F}$ = 3 Hz), 130.0, 129.4, 128.6, 127.8, 126.7, 114.88 (d, $^2J_{C-F}$ = 21 Hz), 92.4, 68.7, 60.6, 41.1, 40.5, 21.5; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{24}H_{24}FNO_3SNa$, 448.1359; found, 448.1355.

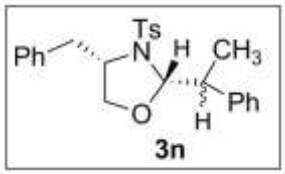
(2*S*,4*S*)-4-benzyl-2-(3-chlorobenzyl)-3-tosyloxazolidine (3l):



white solid (32 mg, 50%); mp 92-96 °C; $[\alpha]_D^{21}$ +10.8 (*c* 1.2 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3512, 3028, 2928, 2871, 1599, 1574, 1476, 1432, 1350, 1163, 1091, 1056, 997, 753, 700, 679, 666; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (d, *J* = 8.2 Hz, 2H), 7.40-7.19 (m, 10H), 7.09 (d, *J* = 7.2 Hz, 2H), 5.07 (dd, *J* = 6.7, 2.1 Hz, 1H), 3.76-3.72 (m, 1H), 3.62 (dd, *J* = 9.0, 2.3 Hz, 1H), 3.24 (dd, *J*

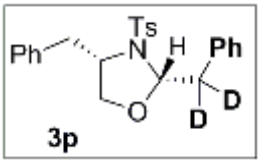
= 14.1, 2.0 Hz, 1H), 3.07 (dd, *J* = 9.0, 6.0 Hz, 1H), 3.0 (dd, *J* = 14.1, 6.7 Hz, 1H), 2.88 (dd, *J* = 13.5, 3.7 Hz, 1H), 2.42 (s, 3H), 2.22 (dd, *J* = 13.5, 10.7 Hz, 1H) ; ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.3, 137.9, 137.3, 133.9, 133.8, 130.5, 130.0, 129.4, 129.3, 128.8, 128.6, 127.8, 127.0, 126.7, 92.2, 68.8, 60.6, 41.6, 40.4, 21.5; HRMS (ESI-QTOF) *m/z* : $[M+ Na]^+$ calcd for $C_{24}H_{24}ClNO_3SNa$, 464.1063; found, 464.1061.

(2*S*,4*S*)-4-benzyl-2-(1-phenylethyl)-3-tosyloxazolidine (3n):



mixture. of diastereomers ***A*** and ***B*** (*3:2*): white solid (56 mg, 98%); mp 79-81 °C; $[\alpha]_D^{21}$ +36.3 (*c* 1.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3432, 3028, 2979, 2934, 2873, 1599, 1496, 1454, 1351, 1165, 1091, 1030, 751, 701, 664; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (dd, *J* = 14.3, 8.1 Hz, 2H), 7.40-7.13 (m, 1H), 6.93 (d, *J* = 7.2 Hz, 1H), 5.05 (d, *J* = 2.4 Hz, 0.6H, *1A*), 4.92 (d, *J* = 2.4 Hz, 0.4 H, *1B*), 3.84 (br t, *J* = 5.6 Hz, 0.4H, *1B*), 3.71-3.56 (m, 1.4H, *1A*+*2B*), 3.44 (dd, *J* = 8.9, 3.1 Hz, 0.6 H, *1A*), 3.32-3.25 (m, 0.6 H, *1A*) , 3.17 (dd, *J* = 13.3, 3.2 Hz, 0.4 H, *1B*), 3.05-2.97 (m, 1H, *1A*+*1B*), 2.78 (dd, *J* = 12.9, 11.7 Hz, 0.4 H, *1B*), 2.61 (dd, *J* = 13.6, 3.8 Hz, 0.6H, *1A*), 2.41 (s, 1.8 H, *3A*), 2.39 (s, 1.2H, *3B*), 1.59 (dd, *J* = 13.5, 11.0 Hz, 0.6 H, *1A*), 1.46 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.2, 144.1, 142.4, 140.4, 137.7, 137.6, 134.1, 134.0, 129.9, 129.8, 129.3, 129.2, 128.8, 128.5, 128.40, 128.36, 127.9, 127.85, 127.8, 126.9, 126.8, 126.7, 126.5, 95.85, 95.78, 68.9, 68.7, 61.1, 60.5, 43.99, 43.60, 41.3, 39.7, 21.51, 21.50, 17.0, 12.9; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{25}H_{27}NO_3SNa$, 444.1609; found, 444.1610.

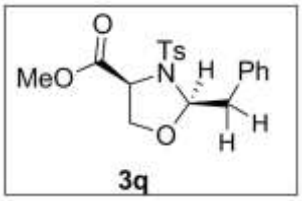
(2*S*,4*S*)-2-(dideuteromethylphenyl)-4-benzyl-3-tosyloxazolidine



(3p): colorless oil (30 mg, 68%); $[\alpha]_D^{21}$ +23.3 (*c* 1.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3846, 3744, 3614, 2974, 2927, 2872, 1700, 1518, 1456, 1382, 1139, 1081, 1036, 1006, 830, 751, 702; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (d, *J* =

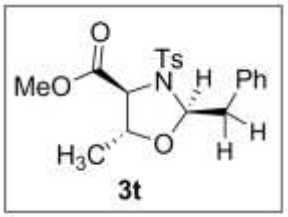
8.0 Hz, 2H), 7.33-7.18 (m, 10H), 7.09 (d, *J* = 7.4 Hz, 2H), 5.08 (s, 1H, C*H*CD_2), 3.77-3.75 (m, 1H), 3.61 (dd, *J* = 9.0, 1.9 Hz, 1H), 3.06 (dd, *J* = 8.6, 6.3 Hz, 1H), 2.91 (dd, *J* = 13.6, 3.3 Hz, 1H), 2.41 (s, 3H), 2.25 (dd, *J* = 13.1, 11.0 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.2, 137.5, 135.9, 134.1, 130.5, 129.9, 129.4, 128.6, 128.1, 127.8, 126.8, 126.7, 92.6, 68.8, 60.6, 41.5 (br t, $^1J_{C\text{-}D}$ = 19.45 Hz), 40.5, 21.5; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{24}H_{23}D_2NO_3SNa$, 432.1578; found, 432.1579.

(2*R*,4*S*)-methyl-2-benzyl-3-tosyloxazolidine-4-carboxylate (3q): colorless oil (67 mg, 83%); $[\alpha]_D^{21}$ +11.1 (*c* 1.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3783, 3462, 1757, 1596, 1440, 1352, 1212, 1162, 1093, 1013, 816, 770, 701, 670; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (d, *J* = 8.1 Hz, 2H), 7.36-7.21 (m, 7H), 5.25 (dd, *J* = 8.3, 2.9 Hz, 1H), 4.38 (dd, *J* = 6.9, 3.3 Hz, 1H), 4.15 (dd, *J* = 9.0, 3.3 Hz, 1H), 3.72 (s, 3H), 3.62-3.54 (m, 1H), 3.27 (dd, *J* = 14.1, 2.8 Hz, 1H), 3.05 (dd, *J* = 14.1, 8.3 Hz, 1H), 2.42 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.0, 144.5, 136.0, 134.3, 129.9, 129.7, 128.3, 127.8, 126.7, 93.5, 68.8, 59.6, 52.8, 41.8, 21.5; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{19}H_{21}NO_5SNa$, 398.1038; found, 398.1035.



3q

(2*R*,4*S*,5*R*)-methyl-2-benzyl-5-methyl-3-tosyloxazolidine-4-carboxylate (3t): colorless oil (55mg, 81%); $[\alpha]_D^{21}$ -4.4 (*c* 1.0 in $CHCl_3$); IR (Neat): ν_{max}/cm^{-1} 3783, 3432, 2930, 1759, 1597, 1440, 1357, 1163, 1020, 771, 671; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (d, *J* = 8.0 Hz, 2H), 7.32-7.21 (m, 7H), 5.41 (dd, *J* = 12.0, 4.3 Hz, 1H), 4.43-4.37 (m, 1H), 3.84 (d, *J* = 6.2 Hz, 1H), 3.78 (s, 3H), 3.18-3.06 (m, 2H), 2.43 (s, 3H), 1.09 (d, *J* = 6.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.1, 144.4, 136.1, 134.0, 129.8, 129.7, 128.3, 127.9, 126.7, 93.0, 76.6, 65.8, 52.8, 41.5, 21.5 18.3; HRMS (ESI-QTOF) *m/z*: $[M+ Na]^+$ calcd for $C_{20}H_{23}NO_5SNa$, 412.1195; found, 412.1190.



3t

References

1 M. J. McKennon and A. I. Meyers, *J. Org. Chem.* 1993, **58**, 3568.

2 Y. Qin, C. Wang, Z. Huang, X. Xiao and Y. Jiang, *J. Org. Chem.* 2004, **69**, 8533.

3 S. G. Pyne, M. J. Hensel and P. L. Fuchs, *J. Am. Chem. Soc.* 1982, **104**, 5719.

4 T. Izuhara, W. Yokota, M. Inoue and T. Katoh, *Heterocycles* 2002, **56**, 553.

5 L. A. Gandon, A. G. Russell, T. Güveli, A. E. Brodwolf, B. M. Kariuki, N. Spencer and J. S. Snaith, *J. Org. Chem.* 2006, **71**, 5198.

6 J. Jurczak, D. Gryko, E. Kobrzycka, H. Gruza and P. Prokopowicz, *Tetrahedron* 1998, **54**, 6051.

7 I. Hoppe, H. Hoffmann, I. Gärtner, T. Krettek and D. Hoppe, *Synthesis*, 1991, 1157.

8 A. K. Ghosh and S. Fidanze, *J. Org. Chem.* 1998, **63**, 6146.

9 T. Izumi and K. Fukaya, *Bull. Chem. Soc. Jpn.* 1993, **66**, 1216.

10 K. B. Sharpless, A. O. Chong and K. Oshima, *J. Org. Chem.* 1976, **41**, 177.

11 M. Penso, V. Lupi, D. Albanese, F. Foschi, D. Landini and A. Tagliabue, *Synlett*, 2008, 2451.

12 M. Yar, E. M. McGarrigle and V. K. Aggarwal, *Angew. Chem. Int. Ed.* 2008, **47**, 3784.

13 J. E. Baldwin, A. C. Spivey, C. J. Schofield and J. B. Sweeney, *Tetrahedron*, 1993, **49**, 6309.

14 S. Itsuno, K. Watanabe, T. Matsumoto, S. Kuroda, A.Yokoi and A. El-Shehawy, *J. Chem. Soc., Perkin Trans. 1*, 1999, 2011.

15 M. K. Ghorai, D. Shukla and K. Das, *J. Org. Chem.* 2009, **74**, 7013.

16 L. D. Elliott, J. W. Wrigglesworth, B. Cox, G. C. Lloyd-Jones and K. I. Booker-Milburn, *Org. Lett.*, 2011, **13**, 728.

X-Ray Crystal Structure Information

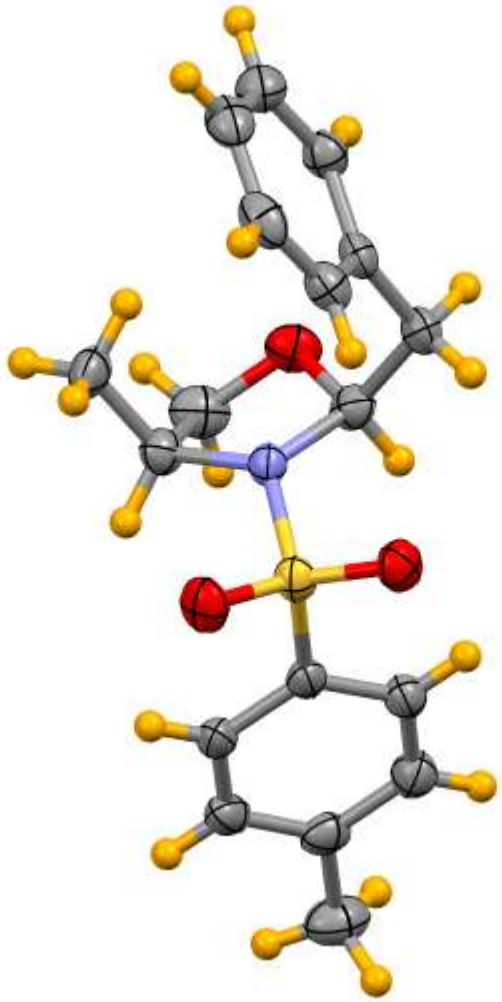


Figure 1. X-ray molecular structure (ORTEP diagram with 30 % probability ellipsoids) of **3b**

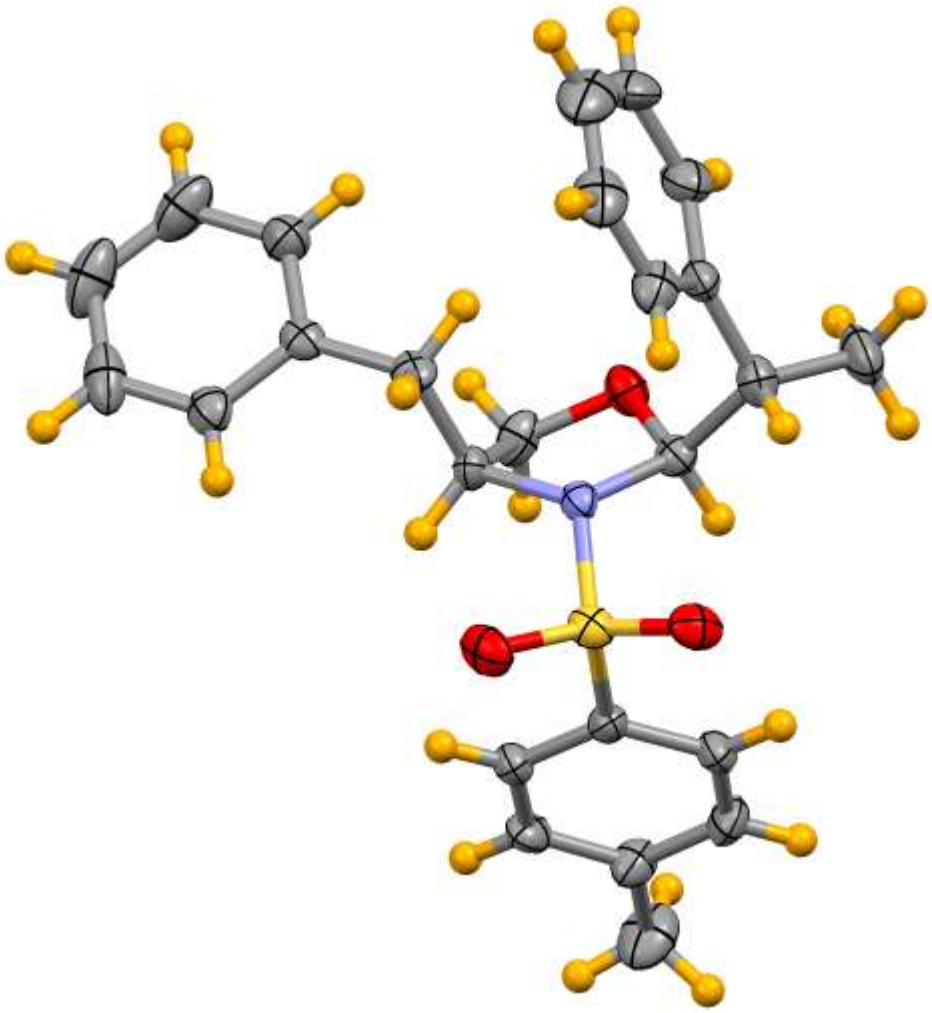
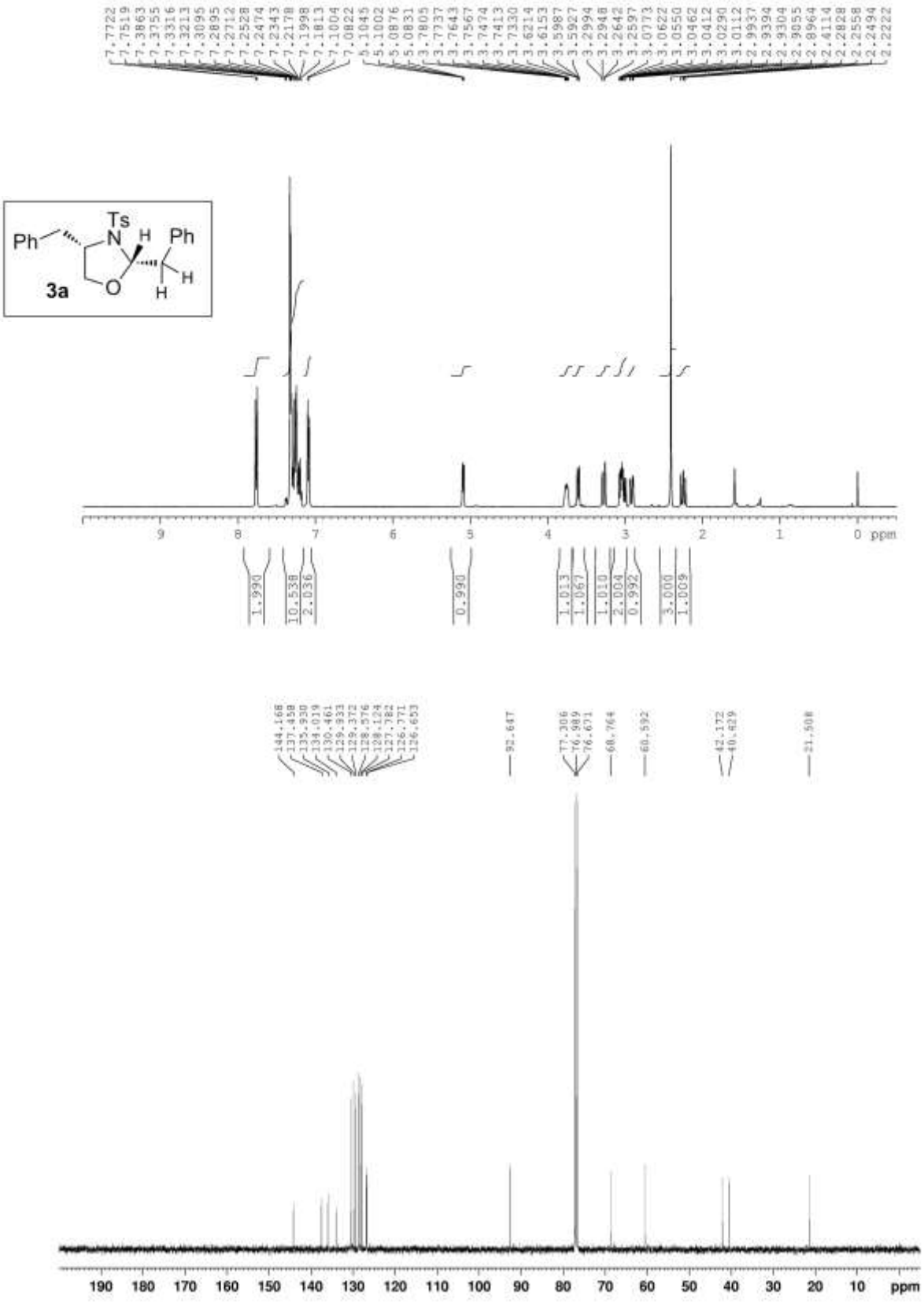


Figure 2. X-ray molecular structure (ORTEP diagram with 30 % probability ellipsoids) of **3n** (solvent of crystallization, $CDCl_3$ has been omitted for clarity).

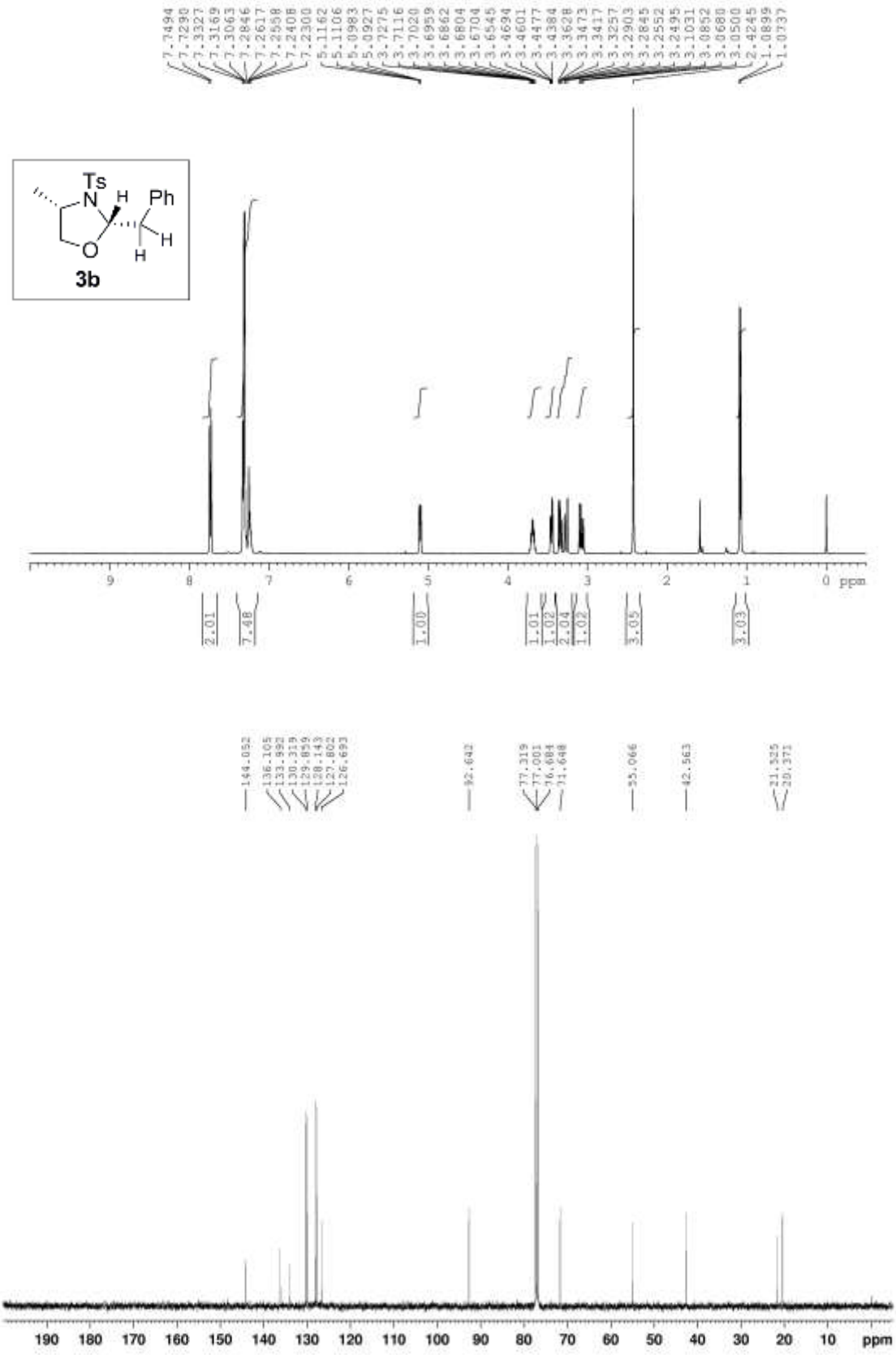
Table 1. Crystal data and structure refinement details for compounds **3b** and **3n.**

DATA	**3b**	**3n**
CCDC number	942034	942035
Formula	$C_{18}H_{21}N_1O_3S_1$	$C_{25}H_{27}N_1O_3S_1$. $CHCl_3$
Formula weight	331.43	540.91
Color	colourless	Colourless
Crystal morphology	Block	Block
Crystal size (mm)	0.30 0.25 0.20	0.30 0.25 0.20
Temperature/K	295(1)	295(1)
Radiation	Mo Kα	Mo Kα
Wavelength/Å	0.71073	0.71073
Crystal system	Monoclinic	Orthorhombic
Space group	*P*21	$P2_12_12_1$
a (Å)	7.4739(8)	8.413(1)
b (Å)	9.911(1)	14.850(2)
c (Å)	11.8150(12)	21.756(2)
α (°)	90	90
β (°)	102.072(2)	90
γ (°)	90	90
Volume ($Å^3$)	855.83(15)	2718.1(5)
Z	2	4
Density (g/ml)	1.29	1.32
μ (1/mm)	0.203	0.441
F (000)	352.0	1128
θ (min, max)	1.7, 25.0	2.6, 25.0
No. Unique Reflns	2950	4718
No. of parameters	210	309
$h_{min,max}$	–8, 8	–9, 10
$k_{min,max}$	–11, 11	–17, 17
$l_{min,max}$	–14, 13	–25, 25
$R_{\_all}$, wR_{2_all}	0.046, 0.098	0.164, 0.139
$R_{\_obs}$, wR_{2_obs}	0.038, 0.093	0.077, 0.108
$\Delta\rho_{min}$, $\Delta\rho_{max}$ ($eÅ^{-3}$)	–0.168, 0.147	-0.248, 0.283
GooF	1.15	0.97

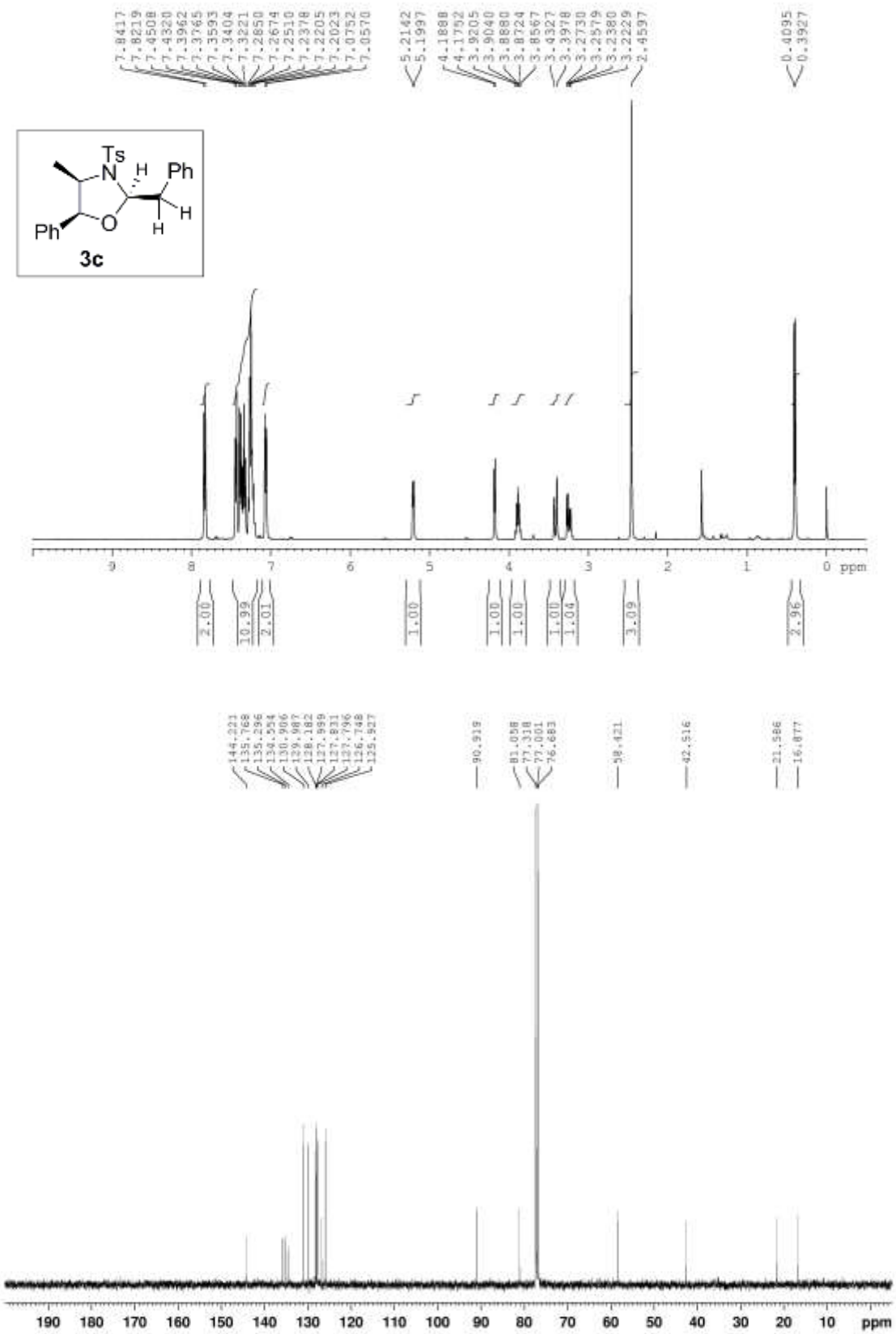
^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3a**



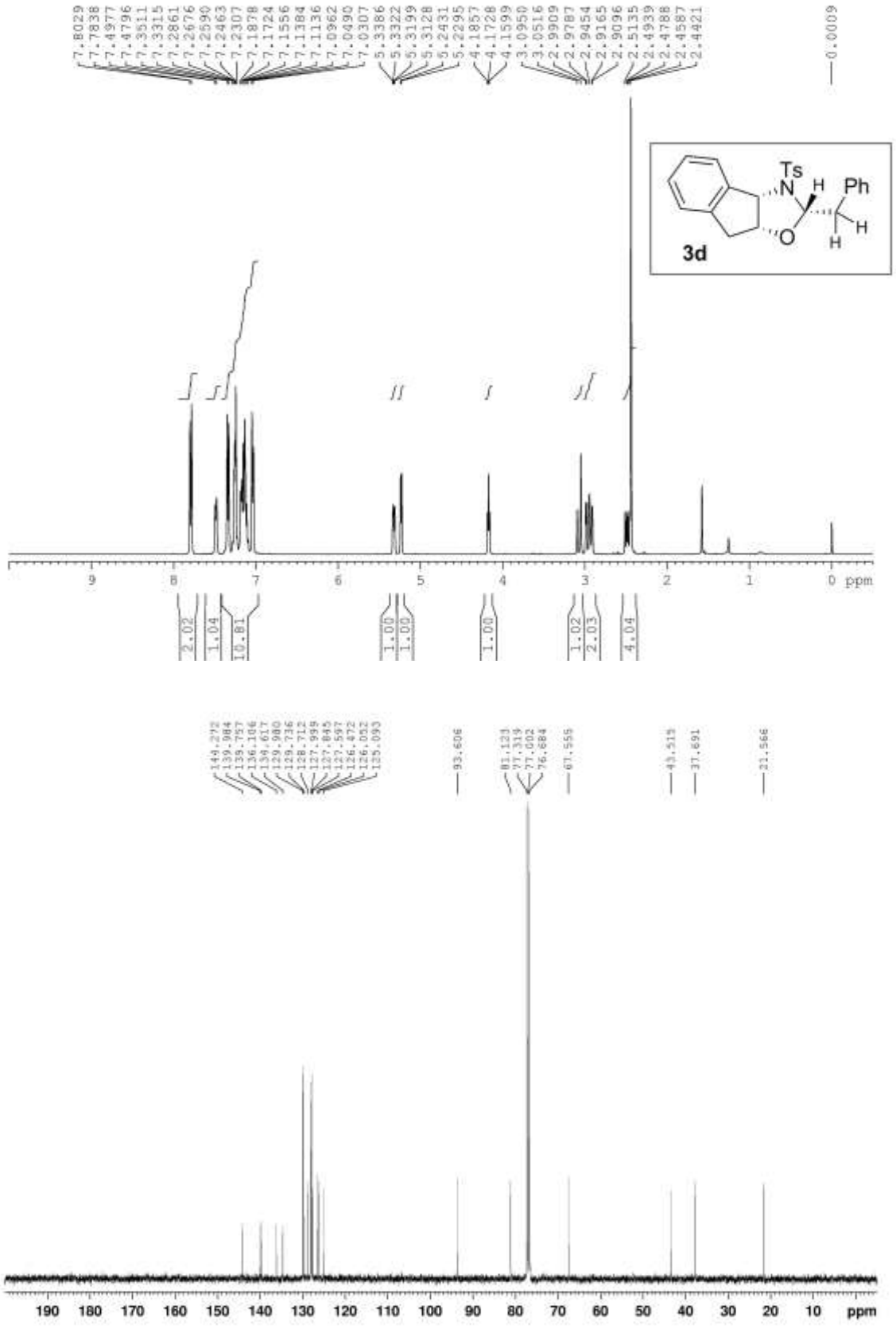
^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3b**



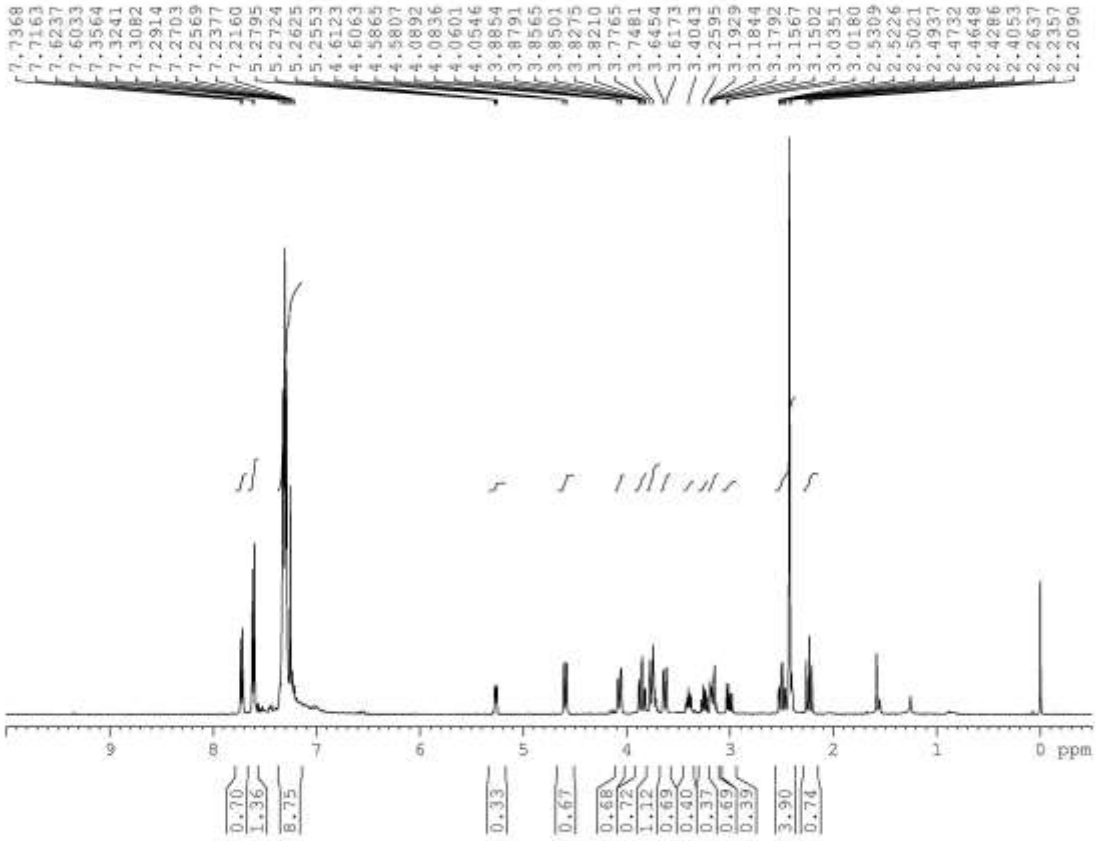
^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3c**

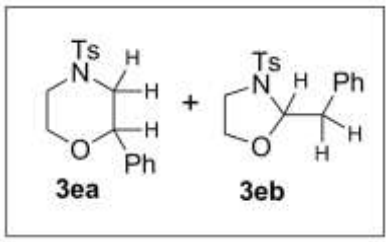


^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3d**

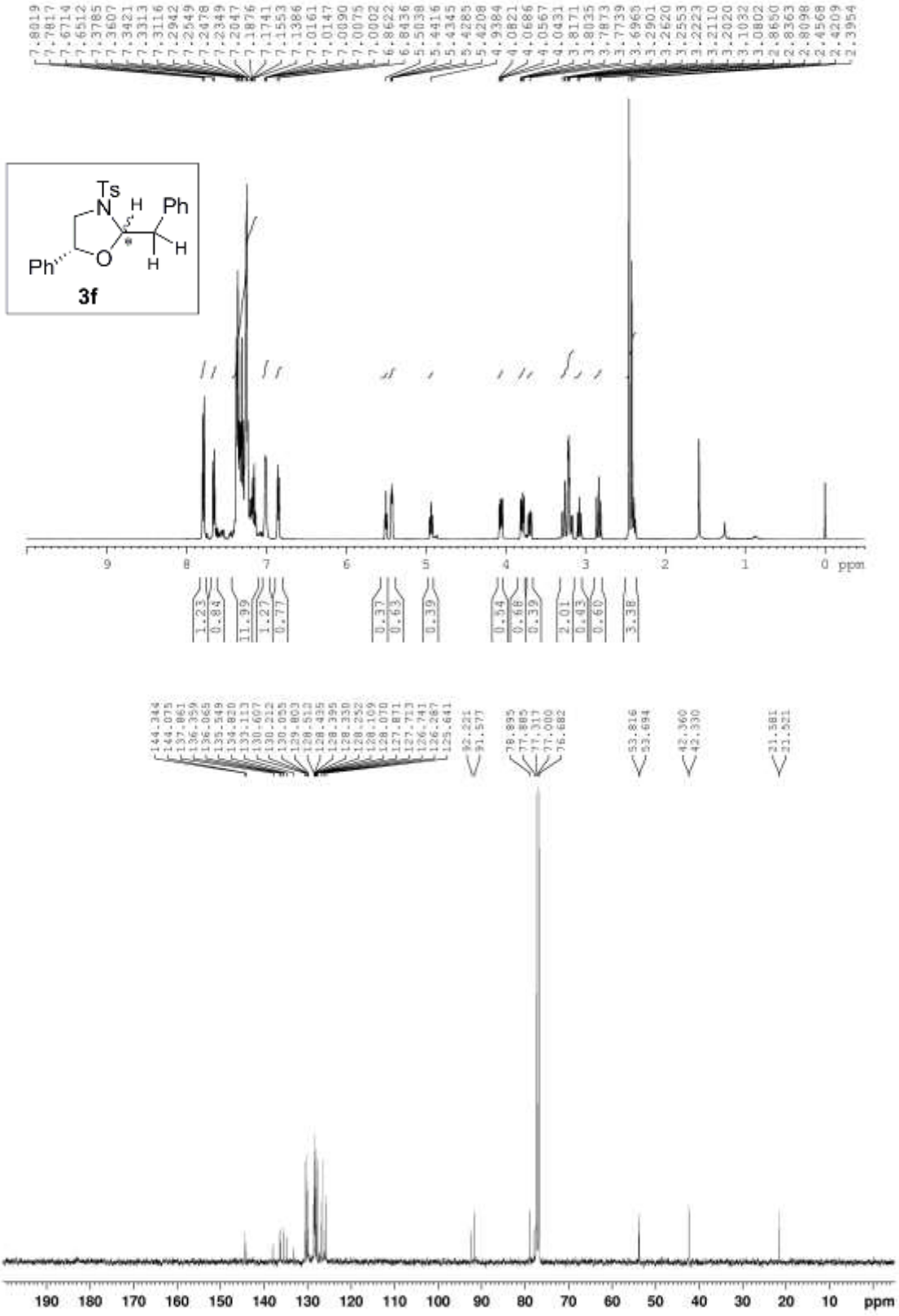


^{1}H spectrum (400 MHz, $CDCl_3$) of compound **3ea+3eb**

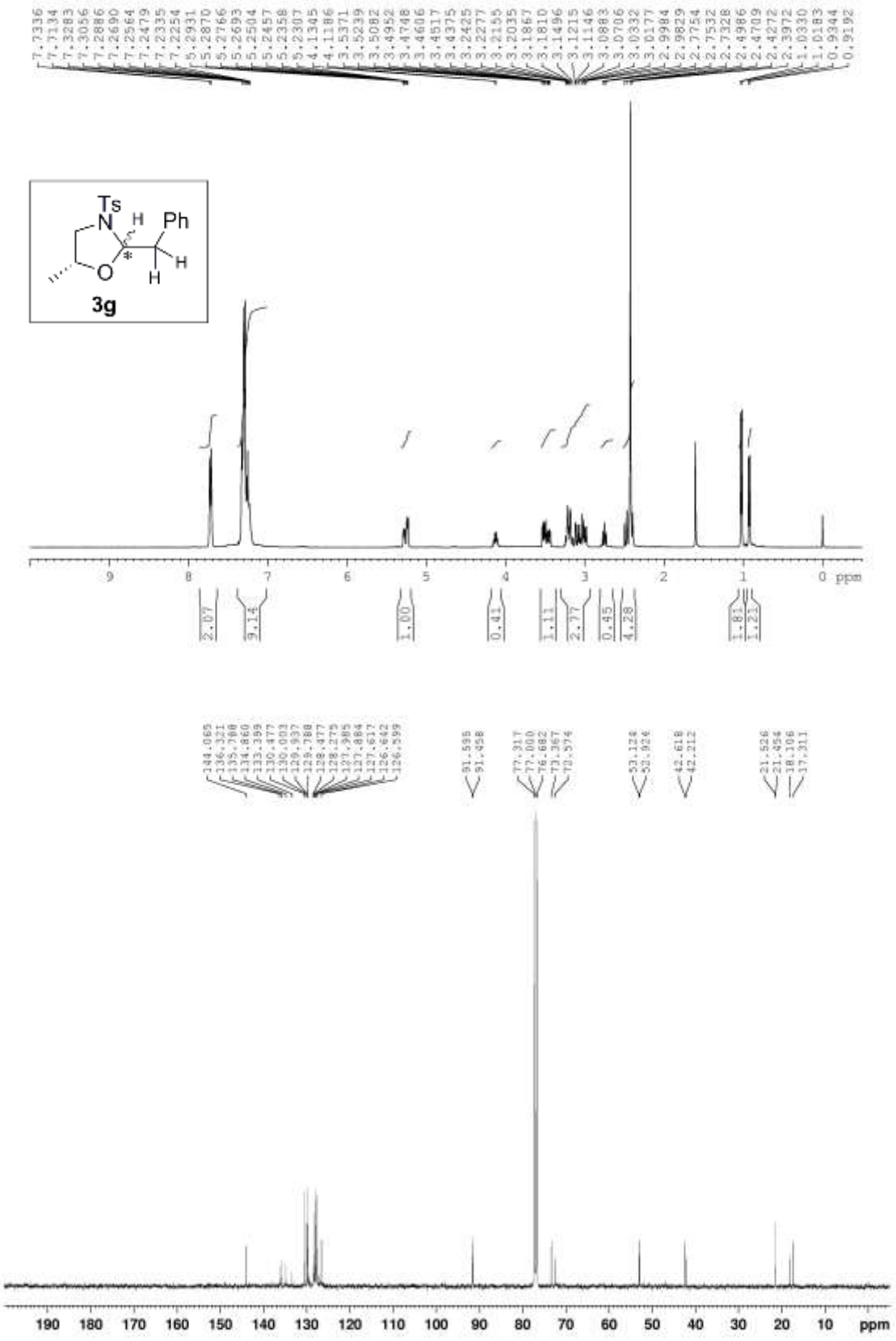




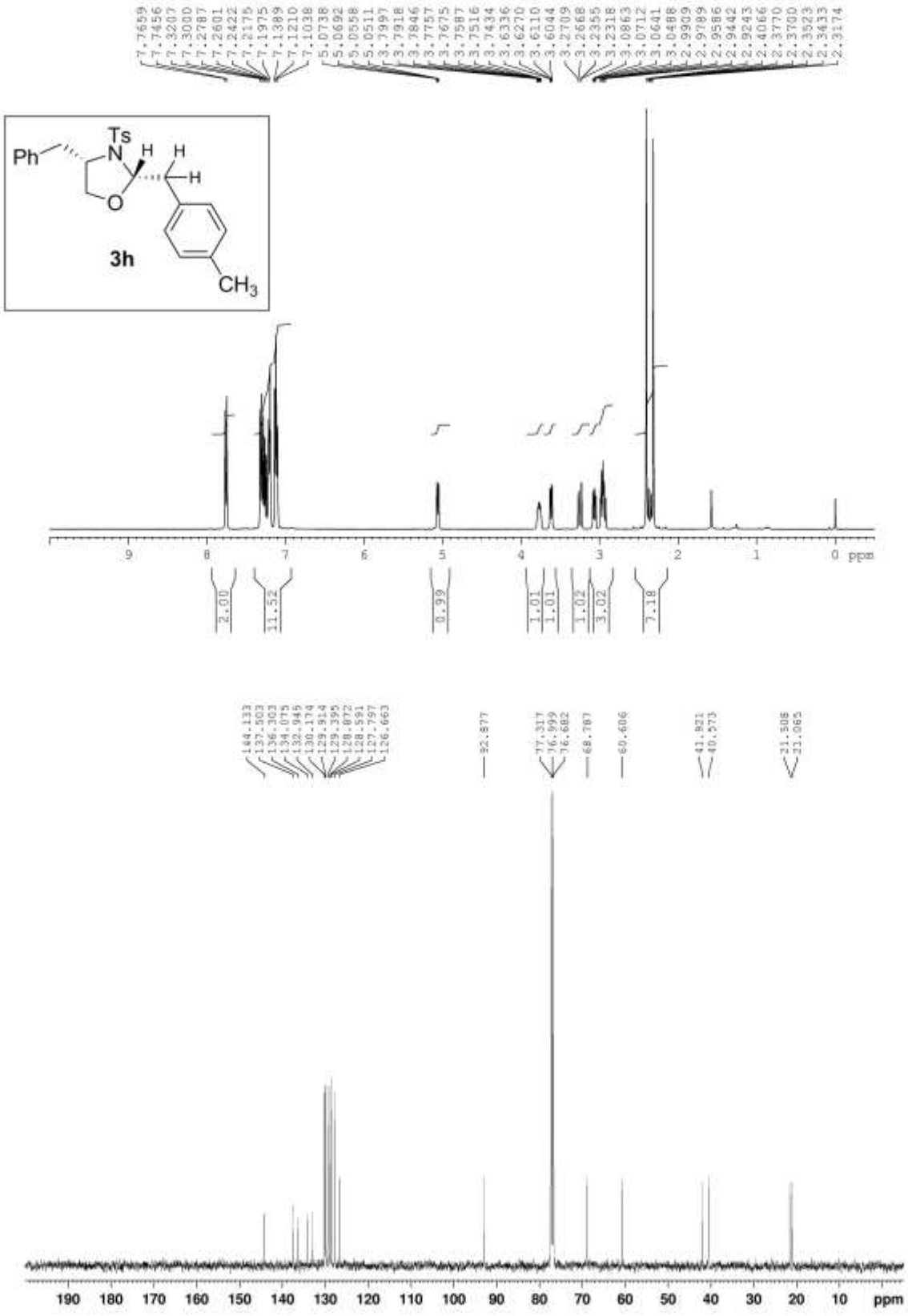
^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3f**



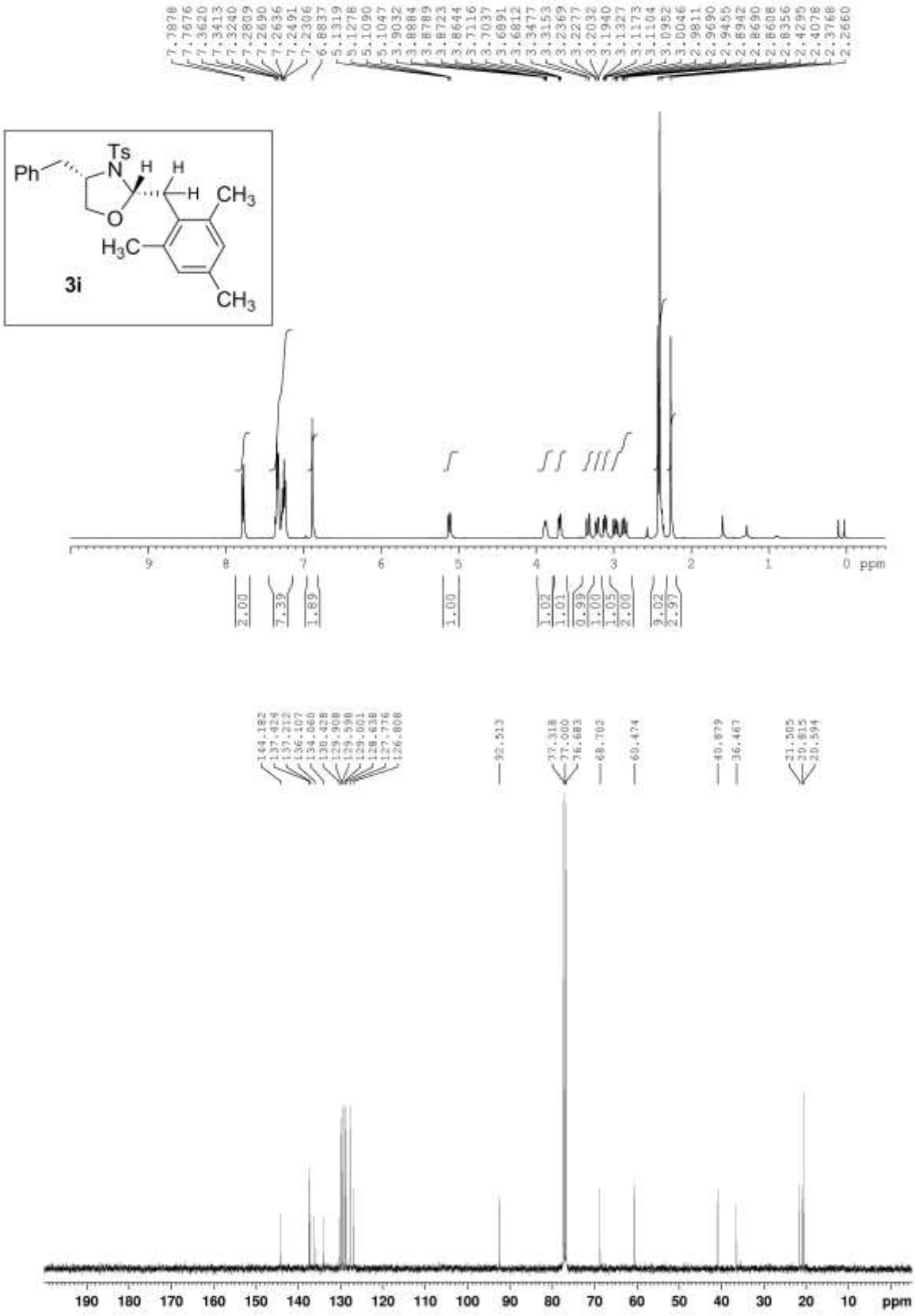
^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3g**



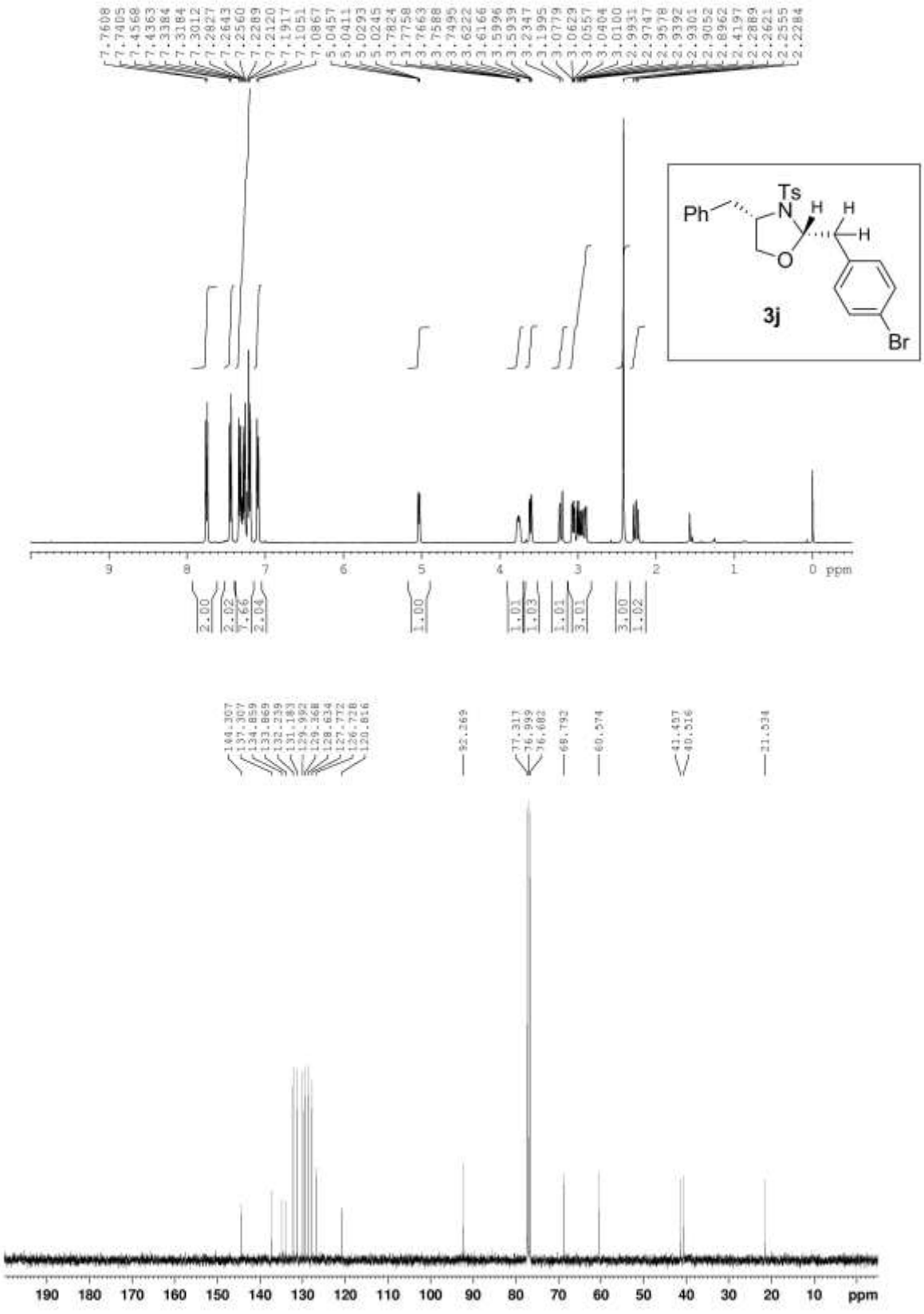
^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3h**



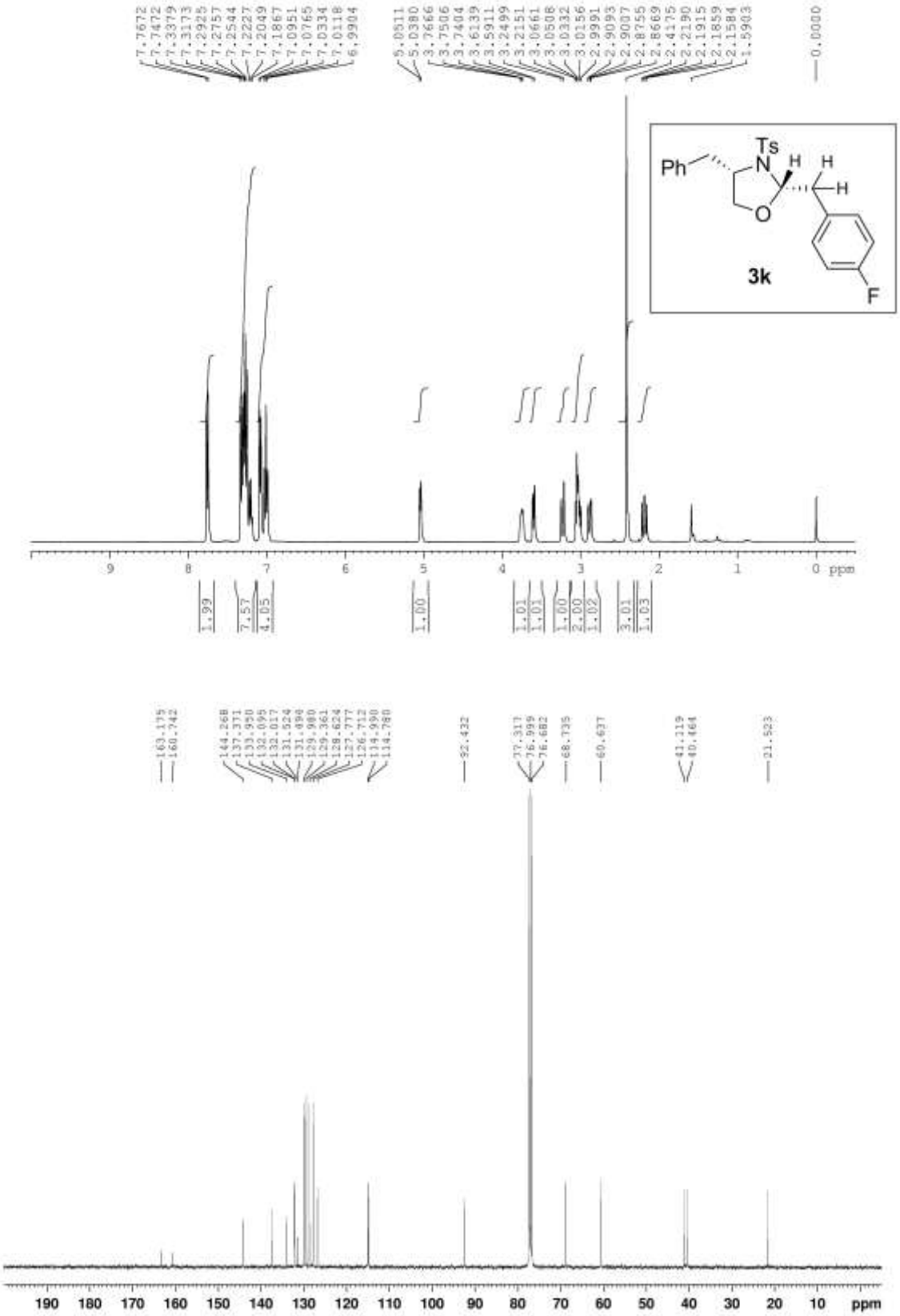
^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3i**



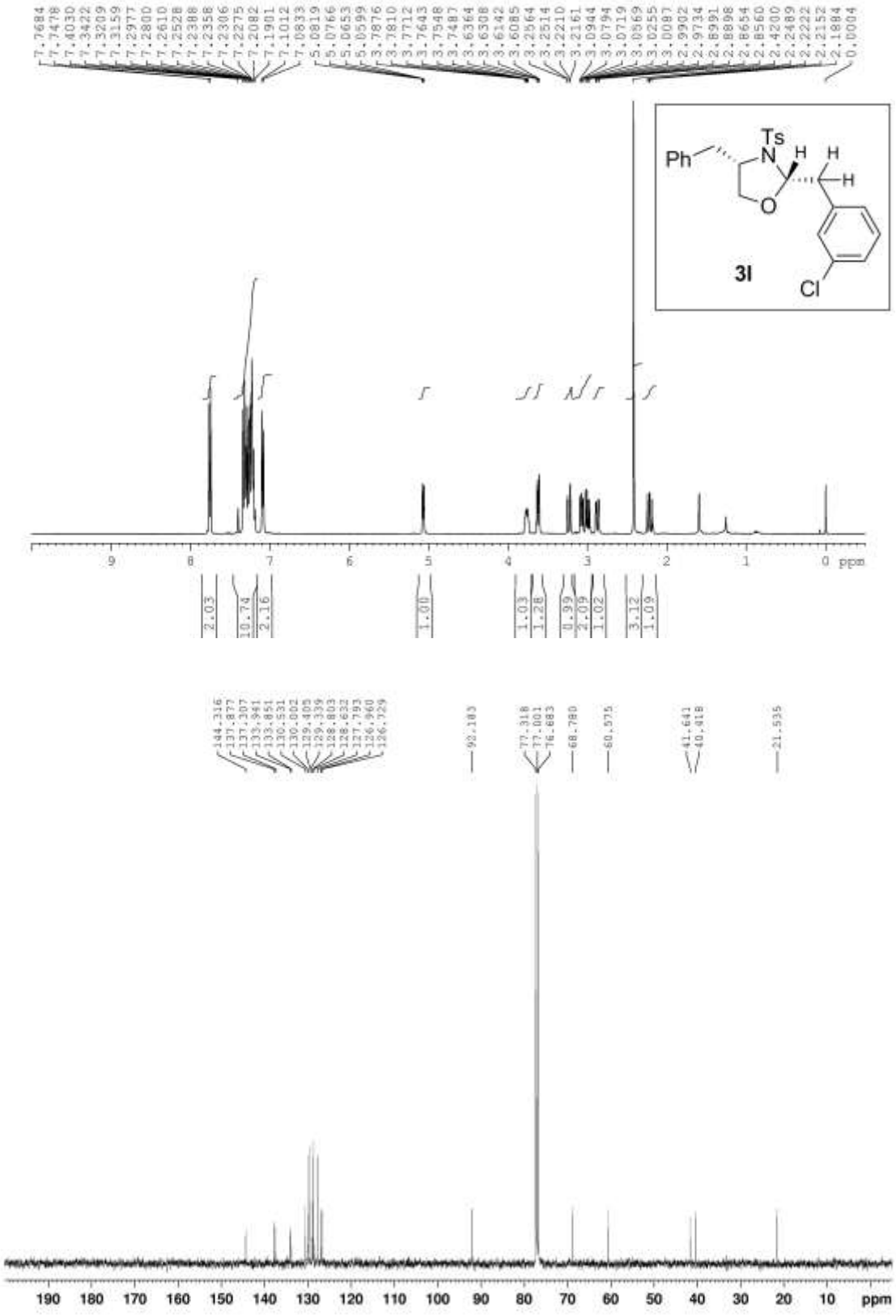
^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3j**



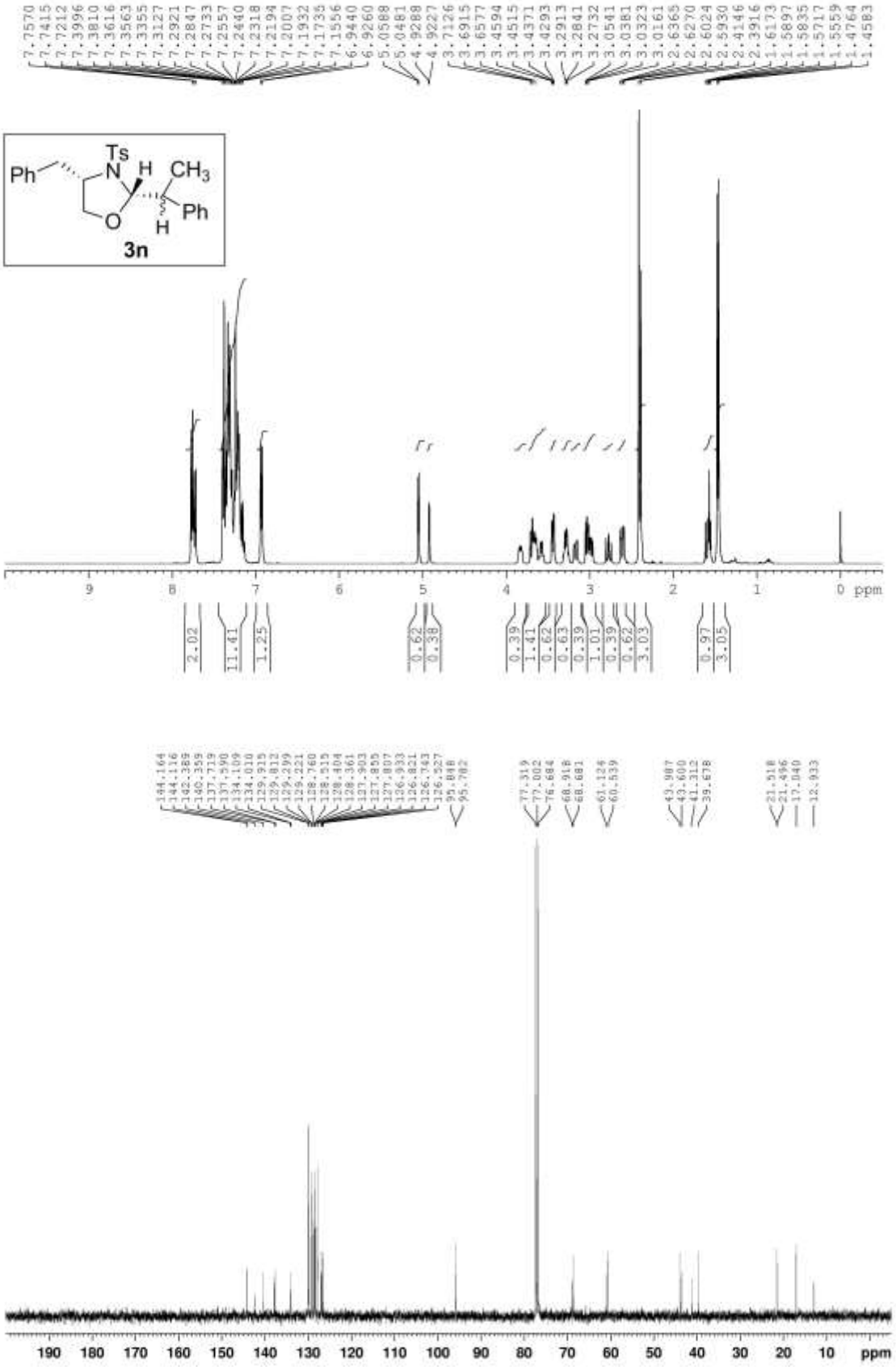
^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3k**



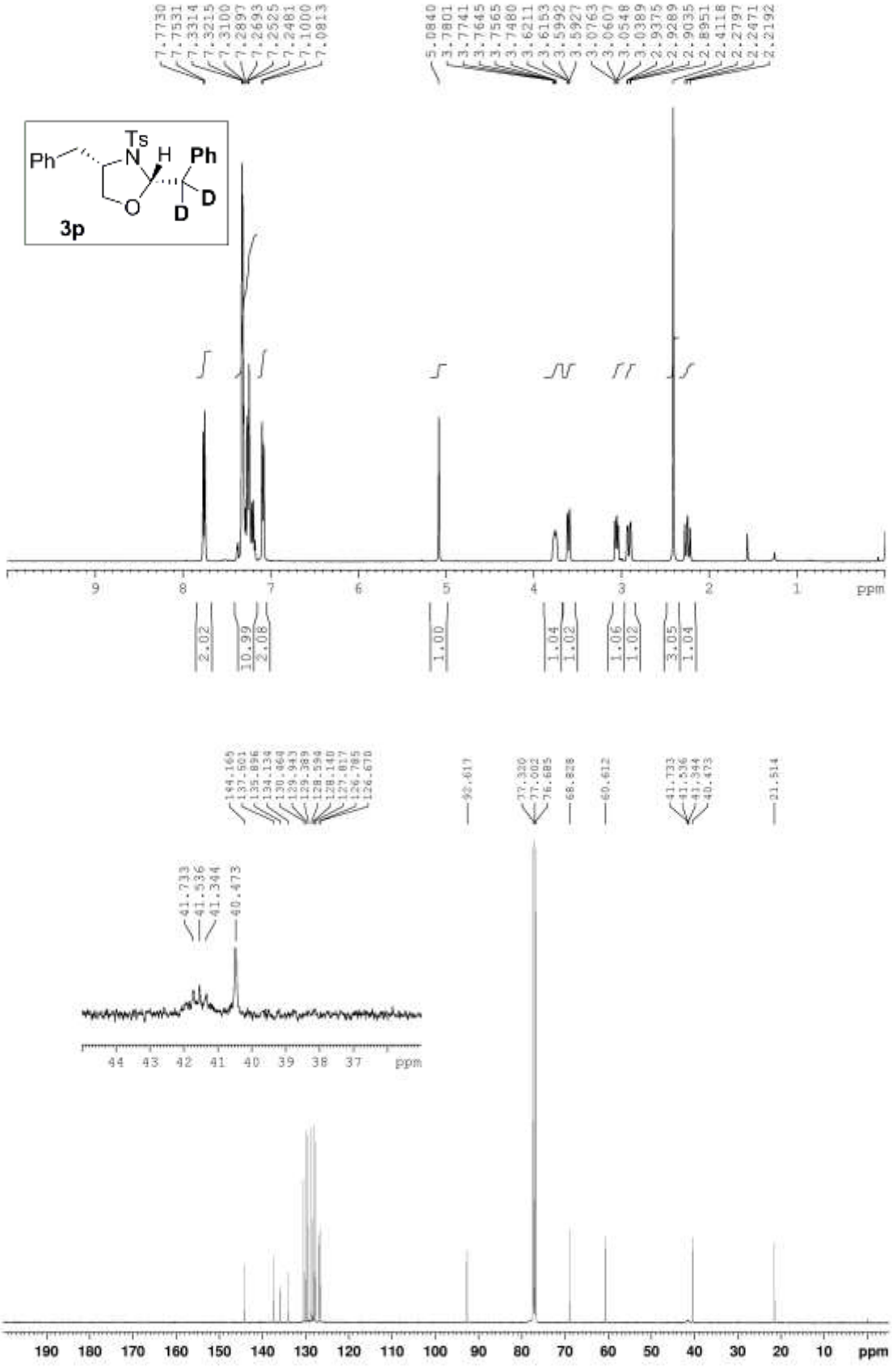
^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3l**



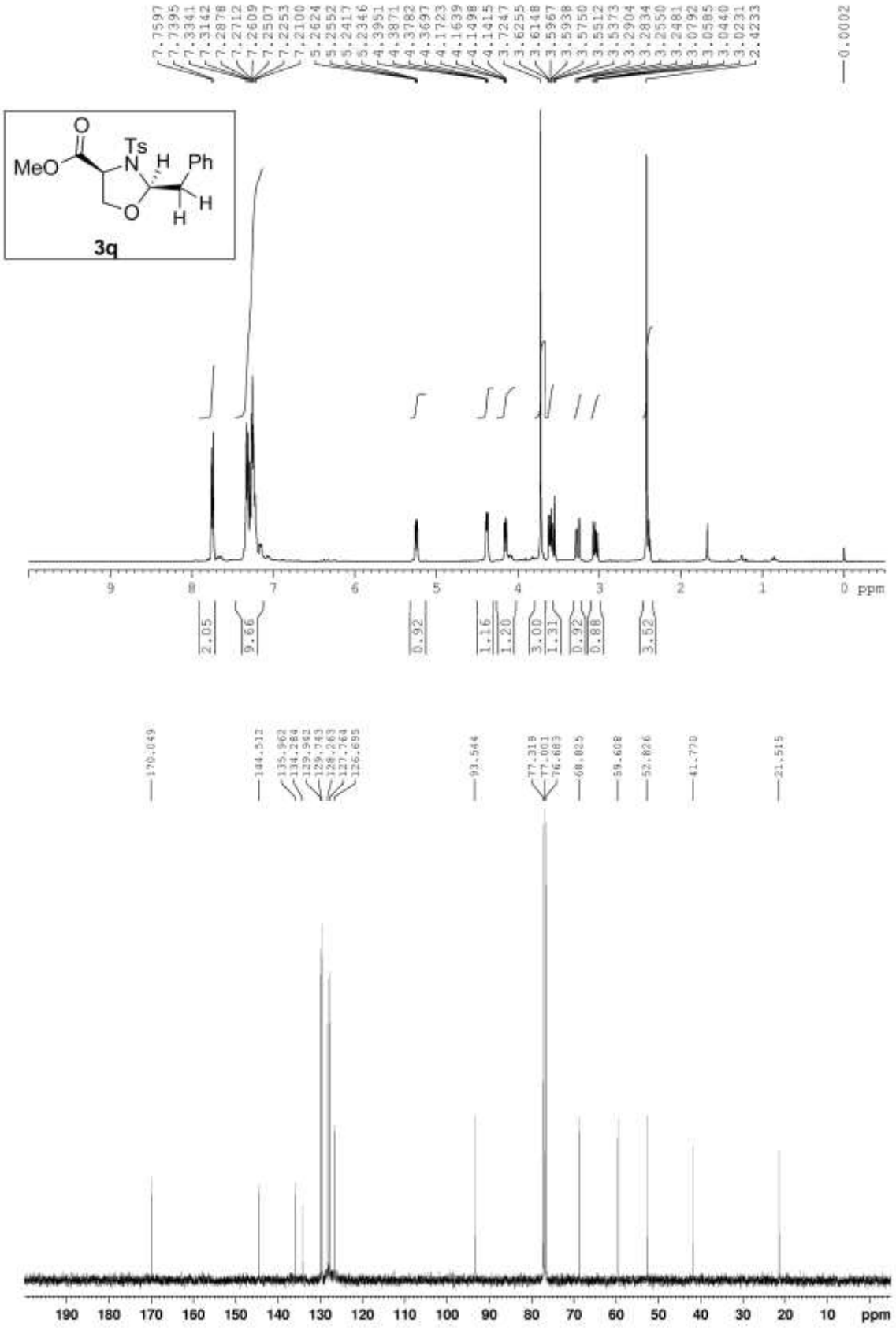
^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3n**



^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3p**



^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3q**



^{1}H and ^{13}C NMR spectrum (400; 100 MHz, $CDCl_3$) of compound **3t**