Supporting Information

Gold(III)-Catalyzed Formal [3+2] Annulations of *N*-Acyl Sulfilimines with Ynamides for the Synthesis of 4-Aminooxazoles

Xianhai Tian, Lina Song, Chunyu Han, Cheng Zhang, Yufeng Wu, Matthias Rudolph, Frank Rominger and A. Stephen K. Hashmi*

E-mail: hashmi@hashmi.de

Content

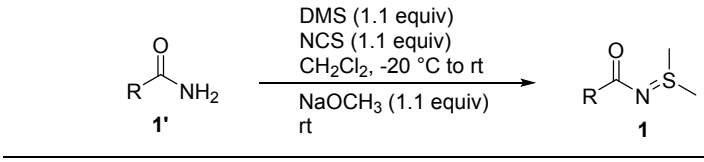
1. General Methods

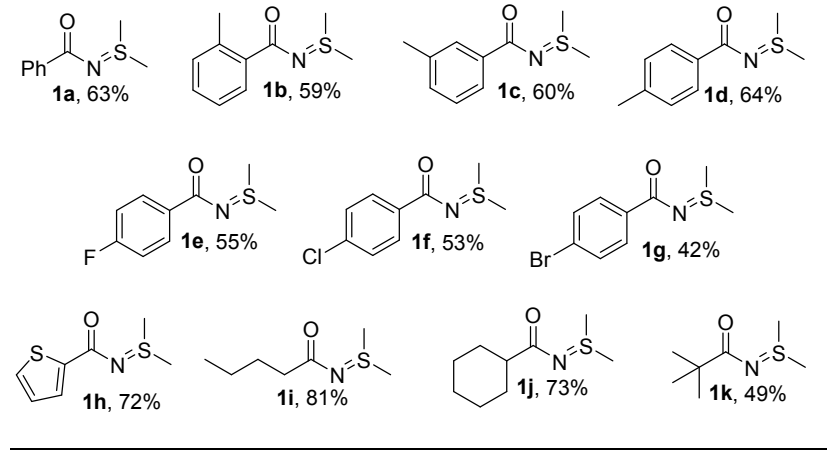
Chemicals were purchased from commercial suppliers (Sigma-Aldrich, Alfa Aesar and TCI) and used as delivered. The reagents **1**,[1] **2**[2] have been prepared according to the literature. Dry solvents were dispensed from the solvent purification system MB SPS-800. Deuterated solvents were bought from Euriso-Top. NMR spectra were, if not mentioned otherwise, recorded at room temperature on the following spectrometers: Bruker Avance-III-300, Bruker Avance III 400, and Bruker Avance-III-500. Chemical shifts are given in ppm and coupling constants in Hz. The following abbreviations were used for ^{1}H NMR spectra to indicate the signal multiplicity: s (singlet), brs (broad singlet), d (doublet), t (triplet), q (quartet), quint (quintet), sext (sextet), sept (septet) and m (multiplet) as well as combinations of them. When combinations of multiplicities are given the first character noted refers to the biggest coupling constant. All ^{13}C NMR spectra were measured with ^{1}H-decoupling. The multiplicities mentioned in these spectra [s (singlet, quaternary carbon), d (doublet, CH-group), t (triplet, CH_2-group), q (quartet, CH_3-group)] were determined by DEPT135 spectra. Mass spectra (MS and HRMS) were determined at the chemistry department of the University of Heidelberg under the direction of Dr. J. Gross. EI^+-spectra were measured on a JOEL JMS-700 spectrometer. For ESI^+-spectra a Bruker ApexQu FT-ICR-MS spectrometer was applied. Infrared Spectroscopy (IR) was processed on an FT-IR Bruker (IF528), IR Perkin Elmer (283) or FT-IR Bruker Vector 22. The solvent or matrix is denoted in brackets. For the most significant bands the wave number ν (cm^{-1}) is given. X-ray crystal structure analyses were measured at the chemistry department of the University of Heidelberg under the direction of Dr. F. Rominger on a Bruker Smart CCD or Bruker APEX-II CCD instrument using Mo-Kα-radiation. Diffraction intensities were corrected for Lorentz and polarization effects. An empirical absorption correction was applied using SADABS based on the Laue symmetry of reciprocal space. Hydrogen atoms were either isotropically refined or calculated. The structures were solved and refined by Dr. F. Rominger using the SHELXTL software package. Gas Chromatography / Mass Spectrometry (GC/MS) spectra were measured on two different hardware systems: 1. HP 5972 Mass Selective Detector, coupled with a HP 5890 SERIES II plus gas chromatograph. 2. Agilent 5975C Mass Selective Detector, coupled with an Agilent 7890A gas chromatograph. In both cases, as a capillary column, an OPTIMA 5 cross-linked Methyl Silicone column (30 m x 0.32 mm, 0.25 μm) was employed and helium was used as the carrier gas. Gas Chromatography (GC) was carried out on a HP 5890 SERIES II plus gas chromatograph. As a capillary column, an OPTIMA 5 cross-linked Methyl Silicone column (30 m x 0.32 mm, 0.25 μm) was employed and nitrogen was used as the carrier gas. Melting Points were measured in open glass capillaries in a Büchi melting point apparatus (according to Dr. Tottoli) and were not calibrated. Flash Column Chromatography was accomplished using Silica gel 60 (0.04 - 0.063 mm / 230 - 400 mesh ASTM) purchased from Macherey-Nagel or Aluminium oxide (neutral or basic) purchased from Macherey-Nagel. As eluents, mixtures of petroleum ether (PE), ethyl acetate (EA) were used. Analytical Thin Layer Chromatography (TLC) was carried out on precoated Macherey-Nagel POLYGRAM® SIL G/UV254 or POLYGRAM® ALOX N/UV254 plastic sheets. Detection was accomplished using UV-light (254 nm), $KMnO_4$ (in 1.5 M Na_2CO_3 (aq.)), molybdatophosphoric acid (5 % in ethanol), vanillin/H_2SO_4 (in ethanol) or anisaldehyde/HOAc (in ethanol). IUPAC names of the compounds described in the experimental section were determined with the program ACDLabs 12.0®.

2. Experiment Procedures

Procedure A: Synthesis of *S*,*S*-dimethyl-*N*-acylsulfilimines **1a-k**[1]

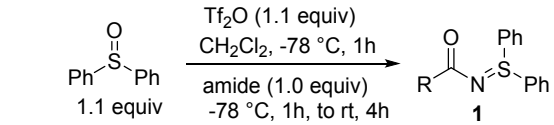
At -20 °C, to a solution of amides **1'** (10.0 mmol, 1.0 equiv) and DMS (11.0 mmol, 1.1 equiv) in 20 mL DCM was added NCS (1.46 g, 1.1 equiv). The reaction was stirred at -20 °C for 1 h and then for an additional hour at room temperature. NaOMe (25% w/w in MeOH, 4.5 mL) was added, and the resulting mixture was stirred for 10 min. After the addition of 20 mL H_2O, stirring continued for 5 min. The organic layer was separated, and the aqueous layer was extracted with DCM (2 × 20 mL). The combined organic layer was dried over anhydrous $MgSO_4$, and evaporated to give crude products. Purification via column chromatography can give *S*,*S*-dimethyl-*N*-acylsulfilimines **1a-k** (42-81% yields).

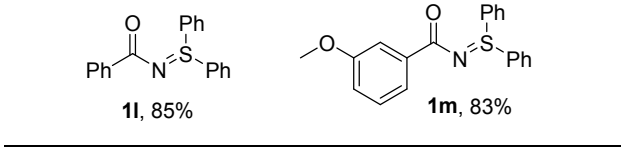




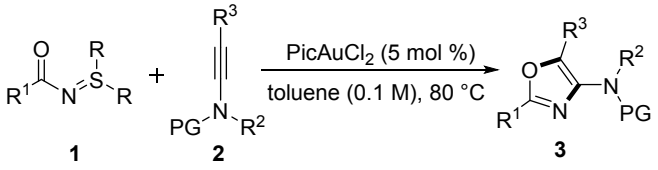
Procedure B: Synthesis of *S,S*-diphenyl-*N*-acylsulfilimine **1l-m**

Under N_2, to a solution of diphenyl sulfoxide (2.0 g, 1.1 equiv) in CH_2Cl_2 (40 mL) was added trifluoromethanesulfonic anhydride (1.85 mL, 1.1 equiv) dropwise at −78 °C. After being stirred at −78 °C for 1 h, the mixture was slowly treated with amides (10 mmol, 1.0 equiv) followed by a one-hour stir at −78 °C and a further four-hour stir at room temperature. 30 mL saturated $NaHCO_3$ aqueous solution was added, separated. The organic layer was washed with brine, dried over anhydrous Na_2SO_4, and concentrated in vacuum. The residue was purified by column chromatography using EtOAc and petroleum ether as eluent to give *S,S*-diphenyl-*N*-acylsulfilimine **1l-m** in 83-85% yields (based on amides).



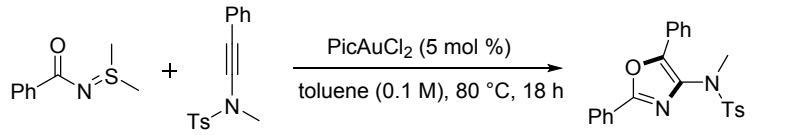


Procedure C: Synthesis of 4-aminooxazoles **3** from sulfilimines **1** and ynamides **2**



In a small vial (3.0 mL in volume), a mixture of sulfilimine **1** (0.3 mmol) and ynamide **2** (0.2 mmol) in 2.0 mL anhydrous toluene was treated with $PicAuCl_2$ (3.8 mg, 5 mol %) and then heated to 80 °C for 4 h. The solvent was reduced in vacuo, and the residue was purified through column chromatography using EtOAc and petroleum ether as eluent to give the corresponding 4-aminooxazoles **3.**

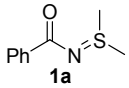
Procedure D: Gram-Scale Synthesis of 4-aminooxazoles **3aa**



1a (4.5 mmol) **2a** (3.0 mmol) **3aa** (1.03 g, 85% yield)

A sealed tube (50 mL in volume) was charged with sulfilimine **1a** (815 mg, 4.5 mmol), ynamide **2a** (855 mg, 3.0 mmol) and 30 mL anhydrous toluene. Then $PicAuCl_2$ (57 mg, 5 mol %) was added and the resulting mixture was heated to 80 °C for 18 h. The solvent was reduced in vacuo, and the residue was purified through column chromatography using EtOAc and petroleum ether as eluent to give 4-aminooxazoles **3aa** (1.03 g, 85% yield).

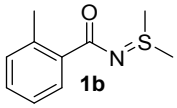
3. Characterization Data



1a

***N*-(dimethyl-λ⁴-sulfanylidene)benzamide (1a)**[3]

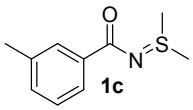
Yield: 1140 mg, 63%; white solid, mp 98-99 °C; R_f = 0.30 (EA/MeOH = 10/1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.06 (d, J = 7.5 Hz, 2H), 7.41 (t, J = 7.5 Hz, 1H), 7.35 (t, J = 7.5 Hz, 2H), 2.77 (s, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ = 177.2 (s), 136.3 (s), 130.8 (d), 128.5 (d, 2C), 127.9 (d, 2C), 32.0 (q, 2C) ppm; IR (reflection) $\tilde{\nu}$ = 3064, 3013, 2923, 1788, 1675, 1593, 1547, 1450, 1425, 1332, 1302, 1164, 1133, 1069, 1036, 990, 959, 917, 810, 716, 694, 658, 618 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_9H_{12}NOS$ calcd for 182.0634, found 182.0634.



1b

***N*-(dimethyl-λ⁴-sulfanylidene)-2-methylbenzamide (1b)**

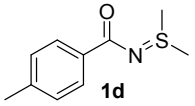
Yield: 1150 mg, 59%; white solid, mp 52-53 °C; R_f = 0.29 (EA/MeOH = 10/1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.61 (d, J = 7.0 Hz, 1H), 7.19-7.14 (m, 1H), 7.08 (t, J = 6.5 Hz, 2H), 2.70 (s, 6H), 2.46 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 180.4 (s), 137.3 (s), 136.7 (s), 130.8 (d), 129.2 (d), 128.8 (d), 125.4 (d), 31.9 (q, 2C), 20.8 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3444, 3015, 2925, 1787, 1672, 1604, 1551, 1491, 1435, 1346, 1294, 1154, 1103, 1030, 989, 959, 873, 813, 800, 749, 656, 630, 612 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{10}H_{14}NOS$ calcd for 196.0791, found 196.0783.



1c

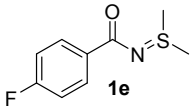
***N*-(dimethyl-λ⁴-sulfanylidene)-3-methylbenzamide (1c)**

Yield: 1171 mg, 60%; white solid, mp 62-63 °C; R_f = 0.60 (EA/MeOH = 10/1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.80 (s, 1H), 7.77 (d, J = 7.5 Hz, 1H), 7.17-7.11 (m, 2H), 2.60 (s, 6H), 2.27 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 176.9 (s), 137.4 (s), 136.2 (s), 131.4 (d), 129.0 (d), 127.8 (d), 125.5 (d), 31.7 (q, 2C), 21.3 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3024, 3004, 2917, 1591, 1541, 1432, 1420, 1410, 1310, 1216, 1154, 1114, 1083, 1043, 990, 968, 932, 910, 831, 812, 781, 751, 689, 659 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{10}H_{14}NOS$ calcd for 196.0791, found 196.0792.



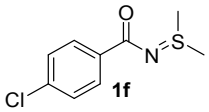
_N_-(dimethyl-λ⁴-sulfanylidene)-4-methylbenzamide (1d)

Yield: 1250 mg, 64%; white solid, mp 138-140 °C; R_f = 0.20 (EA/MeOH = 10/1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.89 (d, J = 8.0 Hz, 2H), 7.10 (d, J = 8.0 Hz, 2H), 2.69 (s, 6H), 2.30 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 177.1 (s), 140.9 (s), 133.5 (s), 128.6 (d, 2C), 128.5 (d, 2C), 32.0 (q, 2C), 21.5 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3002, 2920, 1944, 1603, 1584, 1536, 1434, 1419, 1321, 1288, 1165, 1128, 1097, 1038, 1013, 989, 946, 918, 868, 846, 810, 785, 760, 693 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{10}H_{14}NOS$ calcd for 196.0791, found 196.0789.



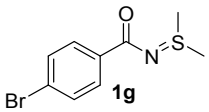
_N_-(dimethyl-λ⁴-sulfanylidene)-4-fluorobenzamide (1e)[4]

Yield: 1103 mg, 55%; white solid, mp 130-131 °C; R_f = 0.27 (EA/MeOH = 10/1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.01 (dd, J = 9.0, 6.0 Hz, 2H), 6.96 (t, J = 8.5 Hz, 2H), 2.70 (s, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 175.9 (s), 164.5 (d, $J_{C\text{-}F}$ = 248.1 Hz), 132.5 (d, $J_{C\text{-}F}$ = 3.0 Hz), 130.7 (d, $J_{C\text{-}F}$ = 8.8 Hz, 2C), 114.7 (d, $J_{C\text{-}F}$ = 21.4 Hz), 32.0 (q, 2C) ppm; IR (reflection) $\tilde{\nu}$ = 3077, 3005, 2925, 1936, 1605, 1540, 1503, 1423, 1327, 1298, 1219, 1144, 1084, 1043, 998, 952, 921, 873, 856, 829, 795, 771, 736, 689 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_9H_{11}FNOS$ calcd for 200.0540, found 200.0536.



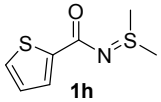
4-chloro-_N_-(dimethyl-λ⁴-sulfanylidene)benzamide (1f)[5]

Yield: 1138 mg, 53%; white solid, mp 99-100 °C; R_f = 0.31 (EA/MeOH = 10/1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.94 (d, J = 8.5 Hz, 2H), 7.26 (d, J = 8.5 Hz, 2H), 2.71 (s, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 175.9 (s), 136.9 (s), 134.7 (s), 129.9 (d, 2C), 128.0 (d, 2C), 32.0 (q, 2C) ppm; IR (reflection) $\tilde{\nu}$ = 3065, 3000, 2920, 1793, 1580, 1525, 1486, 1432, 1417, 1403, 1333, 1294, 1280, 1170, 1135, 1087, 1034, 1016, 993, 957, 913, 863, 834, 802, 763, 717, 687 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_9H_{11}{}^{35}ClNOS$ calcd for 216.0244, found 216.0247.



4-bromo-_N_-(dimethyl-λ⁴-sulfanylidene)benzamide (1g)

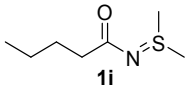
Yield: 1092 mg, 42%; white solid, mp 153-154 °C; R_f = 0.26 (EA/MeOH = 10/1); ^{1}H NMR (500 MHz, DMSO-d_6) δ 7.88-7.84 (m, 2H), 7.80-7.74 (m, 2H), 3.10 (s, 6H) ppm; ^{13}C NMR (125 MHz, DMSO-d_6) δ 168.6 (s), 132.5 (d, 2C), 131.5 (s), 131.1 (d, 2C), 127.9 (s), 31.6 (q, 2C) ppm; IR (reflection) $\tilde{\nu}$ = 3104, 3027, 2936, 1706, 1676, 1589, 1490, 1448, 1423, 1253, 1225, 1179, 1157, 1083, 1025, 996, 976, 932, 876, 844, 820, 748, 707, 638 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_9H_{11}{}^{79}BrNOS$ calcd for 259.9739, found 259.9733.



1h

***N*-(dimethyl-λ⁴-sulfanylidene)thiophene-2-carboxamide (1h)**

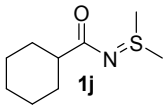
Yield: 1350 mg, 72%; white solid, mp 128-130 °C; R_f = 0.45 (EA/MeOH = 10/1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.59 (dd, *J* = 3.5, 1.0 Hz, 1H), 7.29 (dd, *J* = 5.0, 1.0 Hz, 1H), 6.96 (dd, *J* = 5.0, 3.5 Hz, 1H), 2.72 (s, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.3 (s), 141.2 (s), 129.8 (d), 129.3 (d), 127.3 (d), 32.1 (q, 2C) ppm; IR (reflection) $\tilde{\nu}$ = 3095, 3002, 2920, 1552, 1524, 1420, 1363, 1337, 1296, 1220, 1116, 1099, 1031, 989, 956, 857, 826, 808, 753, 724 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_7H_{10}NOS_2$ calcd for 188.0198, found 188.0198.



1i

***N*-(dimethyl-λ⁴-sulfanylidene)pentanamide (1i)**

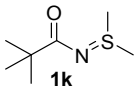
Yield: 1310 mg, 81%; colorless oil; R_f = 0.15 (EA/MeOH = 10/1); ^{1}H NMR (300 MHz, $CDCl_3$) δ 2.57 (s, 6H), 2.20-2.08 (m, 2H), 1.54-1.44 (m, 2H), 1.30-1.18 (m, 2H), 0.86-0.72 (m, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ 184.9 (s), 37.2 (t), 31.7 (q, 2C), 28.8 (t), 22.5 (t), 13.8 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3399, 3008, 2956, 2927, 2871, 1672, 1547, 1433, 1367, 1272, 1228, 1196, 1089, 1033, 967, 792, 733 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_7H_{16}NOS$ calcd for 162.0947, found 162.0948.



1j

***N*-(dimethyl-λ⁴-sulfanylidene)cyclohexanecarboxamide (1j)**

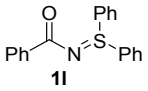
Yield: 1371 mg, 73%; colorless oil; R_f = 0.15 (EA/MeOH = 10/1); ^{1}H NMR (300 MHz, $CDCl_3$) δ 2.54 (s, 6H), 2.20-2.08 (m, 1H), 1.76-1.70 (m, 2H), 1.65-1.56 (m, 2H), 1.53-1.45 (m, 1H), 1.35-1.22 (m, 2H), 1.19-1.06 (m, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ 187.7 (s), 46.0 (d), 31.6 (q, 2C), 30.4 (t, 2C), 25.9 (t, 3C) ppm; IR (reflection) $\tilde{\nu}$ = 3425, 3007, 2930, 2853, 2657, 1710, 1671, 1561, 1449, 1377, 1337, 1264, 1210, 1179, 1135, 1032, 990, 919, 893, 817, 779, 754, 647 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_9H_{18}NOS$ calcd for 188.1104, found 188.1096.



1k

***N*-(dimethyl-λ⁴-sulfanylidene)cyclohexanecarboxamide (1k)**

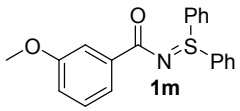
Yield: 796 mg, 49%; white solid, mp 49-50 °C; R_f = 0.18 (EA/MeOH = 10/1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 2.58 (s, 6H), 1.12 (s, 9H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 190.8 (s), 39.5 (s), 31.7 (q, 2C), 28.6 (q, 3C) ppm; IR (reflection) $\tilde{\nu}$ = 3427, 2954, 2927, 2867, 1667, 1532, 1478, 1459, 1433, 1391, 1360, 1324, 1203, 1030, 990, 964, 902, 821, 787, 772 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_7H_{16}NOS$ calcd for 162.0947, found 162.0947.



1l

***N*-(diphenyl-λ⁴-sulfanylidene)benzamide (1l)**

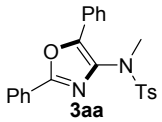
Yield: 2596 mg, 85%; white solid, mp 135-137 °C; R_f = 0.33 (EA/PE = 1/1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.22-8.16 (m, 2H), 7.81-7.72 (m, 4H), 7.46-7.36 (m, 7H), 7.33 (t, J = 7.5 Hz, 2H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 176.6 (s), 136.5 (s), 136.4 (s, 2C), 131.9 (d, 2C), 130.9 (d), 129.8 (d, 4C), 129.0 (d, 2C), 127.9 (d, 4C), 127.8 (d, 2C) ppm; IR (reflection) $\tilde{\nu}$ = 3054, 1593, 1552, 1478, 1446, 1322, 1292, 1168, 1129, 1085, 1068, 1023, 997, 932, 875, 805, 748, 710, 685, 616 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{19}H_{16}NOS$ calcd for 306.0947, found 306.0935.



1m

***N*-(diphenyl-λ^4-sulfanylidene)-3-methoxybenzamide (1m)**

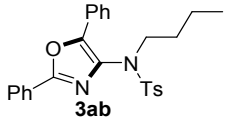
Yield: 2784 mg, 83%; white solid, mp 138-140 °C; R_f = 0.28 (EA/PE = 1/1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.82 (d, J = 7.5 Hz, 1H), 7.78-7.73 (m, 4H), 7.73-7.70 (m, 1H), 7.46-7.37 (m, 6H), 7.24 (t, J = 8.0 Hz, 1H), 6.96-6.91 (m, 1H), 3.78 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 176.4 (s), 159.3 (s), 137.9 (s), 136.3 (s, 2C), 131.9 (d, 2C), 129.8 (d, 4C), 128.8 (d), 127.9 (d, 4C), 121.6 (d), 117.4 (d), 113.5 (d), 55.4 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3080, 3062, 3052, 3004, 2958, 2937, 2834, 1738, 1605, 1589, 1548, 1478, 1443, 1318, 1276, 1217, 1161, 1101, 1079, 1042, 1020, 997, 921, 886, 828, 809, 782, 755, 743, 685 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{20}H_{18}NO_2S$ calcd for 336.1053, found 336.1057.



3aa

***N*-(2,5-diphenyloxazol-4-yl)-*N*,4-dimethylbenzenesulfonamide (3aa)**[6]

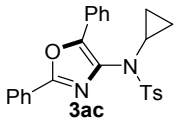
Yield: 74 mg, 92%; white solid, mp 178-179 °C; R_f = 0.16 (EA/PE = 1/10); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.12-8.05 (m, 2H), 8.02-7.94 (m, 2H), 7.84 (d, J = 8.1 Hz, 2H), 7.53-7.44 (m, 5H), 7.43-7.37 (m, 1H), 7.35 (d, J = 8.1 Hz, 2H), 3.18 (s, 3H), 2.48 (s, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ 158.0 (s), 145.6 (s), 144.0 (s), 135.1 (s), 134.5 (s), 130.7 (d), 129.4 (d, 2C), 128.94 (d, 2C), 128.90 (d), 128.8 (d, 4C), 127.17 (s), 127.15 (s), 126.3 (d, 2C), 125.4 (d, 2C), 37.4 (q), 21.7 (d) ppm; IR (reflection) $\tilde{\nu}$ = 1618, 1597, 1556, 1488, 1463, 1448, 1370, 1350, 1244, 1193, 1165, 1121, 1088, 1065, 1034, 1004, 994, 916, 859, 812, 775, 766, 712, 701, 684, 666, 609 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{23}H_{21}N_2O_3S$ calcd for 405.1267, found 405.1261.



3ab

***N*-butyl-*N*-(2,5-diphenyloxazol-4-yl)-4-methylbenzenesulfonamide (3ab)**

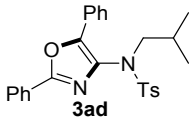
Yield: 77 mg, 87%; white solid, mp 136-137 °C; R_f = 0.27 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.04 (d, J = 8.0 Hz, 2H), 7.92-7.87 (m, 2H), 7.72 (d, J = 8.0 Hz, 2H), 7.42-7.37 (m, 5H), 7.32-7.27 (m, 1H), 7.25 (d, J = 8.0 Hz, 2H), 3.39 (t, J = 7.5 Hz, 2H), 2.38 (s, 3H), 1.40-1.30 (m, 2H), 1.23-1.14 (m, 2H), 0.69 (t, J = 7.5 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 158.0 (s), 147.3 (s), 143.8 (s), 135.5 (s), 133.3 (s), 130.6 (d), 129.3 (d, 2C), 128.9 (d), 128.83 (d, 2C), 128.76 (d, 2C), 128.7 (d, 2C), 127.21 (s), 127.16 (s), 126.3 (d, 2C), 125.5 (d, 2C), 50.0 (t), 30.0 (t), 21.7 (q), 19.9 (t), 13.6 (q) ppm; IR (reflection) $\tilde{\nu}$ = 2953, 2932, 2871, 1677, 1619, 1597, 1557, 1493, 1469, 1450, 1344, 1247, 1223, 1165, 1089, 1069, 994, 907, 877, 808, 778, 768, 737, 704, 685, 662, 631 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{26}H_{27}N_2O_3S$ calcd for 447.1737, found 447.1739.



3ac

***N*-cyclopropyl-*N*-(2,5-diphenyloxazol-4-yl)-4-methylbenzenesulfonamide (3ac)**

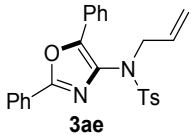
Yield: 82 mg, 95%; white solid, mp 240-241 °C; R_f = 0.27 (EA/PE = 1/1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.05-7.98 (m, 4H), 7.94 (d, J = 8.0 Hz, 2H), 7.51-7.44 (m, 5H), 7.41-7.34 (m, 3H), 2.73-2.67 (m, 1H), 2.49 (s, 3H), 1.15-0.80 (m, 2H), 0.71 (s, 2H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 157.0 (s), 145.0 (s), 143.0 (s), 134.0 (s), 133.9 (s), 129.5 (d), 128.3 (d, 2C), 128.1 (d, 2C), 127.76 (d, 2C), 127.75 (d, 2C), 127.74 (d), 126.2 (s), 126.1 (s), 125.2 (d, 2C), 124.1 (d, 2C), 30.8 (d), 20.6 (q), 6.5 (t, 2C) ppm; IR (reflection) $\tilde{\nu}$ = 3334, 2932, 1738, 1597, 1559, 1504, 1470, 1443, 1412, 1378, 1353, 1324, 1294, 1225, 1175, 1159, 1134, 1117, 1090, 1064, 1016, 997, 976, 945, 887, 846, 813, 772, 725, 706, 672, 649, 618 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{25}H_{23}N_2O_3S$ calcd for 431.1424, found 431.1424.



3ad

***N*-(2,5-diphenyloxazol-4-yl)-*N*-isobutyl-4-methylbenzenesulfonamide (3ad)**

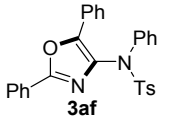
Yield: 79 mg, 89%; white solid, mp 120-121 °C; R_f = 0.31 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.07 (d, J = 8.0 Hz, 2H), 7.91-7.86 (m, 2H), 7.69 (d, J = 8.0 Hz, 2H), 7.43-7.37 (m, 5H), 7.33-7.28 (m, 1H), 7.25 (d, J = 8.0 Hz, 2H), 3.19 (d, J = 7.0 Hz, 2H), 2.39 (s, 3H), 1.60-1.49 (m, 1H), 0.78 (d, J = 6.5 Hz, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 157.9 (s), 147.1 (s), 143.8 (s), 135.2 (s), 133.8 (s), 130.6 (d), 129.3 (d, 2C), 128.9 (d), 128.84 (d, 2C), 128.82 (d, 2C), 128.7 (d, 2C), 127.2 (s), 127.1 (s), 126.3 (d, 2C), 125.8 (d, 2C), 57.8 (t), 27.2 (d), 21.7 (q), 20.4 (q, 2C) ppm; IR (reflection) $\tilde{\nu}$ = 2966, 2921, 2873, 2851, 1735, 1616, 1597, 1556, 1487, 1469, 1448, 1380, 1343, 1286, 1229, 1164, 1089, 1068, 1035, 1011, 995, 935, 850, 808, 778, 768, 703, 688, 664, 639 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{26}H_{27}N_2O_3S$ calcd for 447.1737, found 447.1741.



3ae

***N*-allyl-*N*-(2,5-diphenyloxazol-4-yl)-4-methylbenzenesulfonamide (3ae)**[6]

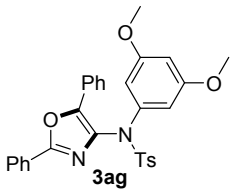
Yield: 50 mg, 58%; white solid, mp 130-132 °C; R_f = 0.53 (EA/PE = 1/5); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.05-7.98 (m, 2H), 7.92-7.85 (m, 2H), 7.76-7.70 (m, 2H), 7.43-7.36 (m, 5H), 7.32-7.27 (m, 1H), 7.26 (d, J = 8.0 Hz, 2H), 5.71-7.60 (m, 1H), 4.97 (dd, J = 14.0, 1.0 Hz, 1H), 4.88 (dd, J = 10.0, 1.0 Hz, 1H), 4.04 (d, J = 7.0 Hz, 2H), 2.39 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 157.9 (s), 147.3 (s), 144.0 (s), 135.4 (s), 133.1 (s), 131.7 (d), 130.6 (d), 129.4 (d, 2C), 128.9 (d), 128.83 (d, 4C), 128.75 (d, 2C), 127.2 (s), 127.1 (s), 126.3 (d, 2C), 125.5 (d, 2C), 119.8 (d), 53.1 (q), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3061, 2901, 2859, 1618, 1597, 1560, 1489, 1450, 1352, 1285, 1220, 1166, 1089, 1062, 1025, 999, 979, 926, 851, 814, 775, 748, 718, 701, 686, 663 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{25}H_{23}N_2O_3S$ calcd for 431.1424, found 431.1431.



3af

***N*-(2,5-diphenyloxazol-4-yl)-4-methyl-*N*-phenylbenzenesulfonamide (3af)**[6]

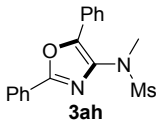
Yield: 77 mg, 83%; white solid, mp 202-203 °C; R_f = 0.24 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.04-7.99 (m, 2H), 7.98-7.92 (m, 2H), 7.64 (d, *J* = 8.5 Hz, 2H), 7.46-7.33 (m, 7H), 7.29 (t, *J* = 7.5 Hz, 1H), 7.20-7.11 (m, 5H), 2.37 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 157.9 (s), 146.5 (s), 143.9 (s), 139.9 (s), 135.4 (s), 134.4 (s), 130.7 (d), 129.2 (d, 2C), 129.02 (d, 2C), 128.98 (d, 2C), 128.85 (d, 2C), 128.84 (d, 2C), 127.6 (d), 127.5 (d, 2C), 127.3 (s), 127.0 (s), 126.3 (d, 2C), 125.5 (d, 2C), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3055, 1596, 1552, 1484, 1447, 1371, 1342, 1248, 1211, 1186, 1160, 1091, 1069, 1016, 954, 848, 812, 776, 756, 726, 701, 686, 666, 650 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{28}H_{23}N_2O_3S$ calcd for 467.1424, found 467.1422.



3ag

***N*-(3,5-dimethoxyphenyl)-*N*-(2,5-diphenyloxazol-4-yl)-4-methylbenzenesulfonamide (3ag)**

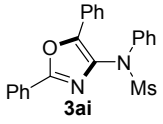
Yield: 88 mg, 84%; white solid, mp 184-186 °C; R_f = 0.35 (EA/PE = 1/5); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.02-7.93 (m, 4H), 7.74 (d, *J* = 8.0 Hz, 2H), 7.43-7.37 (m, 5H), 7.29 (t, *J* = 7.5 Hz, 1H), 7.20 (t, *J* = 8.0 Hz, 2H), 6.61 (d, *J* = 1.5 Hz, 2H), 6.22 (t, *J* = 2.0 Hz, 1H), 3.59 (s, 3H), 2.37 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 160.6 (s, 2C), 157.9 (s), 146.6 (s), 144.0 (s), 141.5 (s), 135.5 (s), 134.2 (s), 130.6 (d), 129.2 (d, 2C), 129.1 (d, 2C), 129.0 (d), 128.84 (d, 2C), 128.82 (d, 2C), 127.3 (s), 127.0 (s), 126.3 (d, 2C), 125.5 (d, 2C), 105.2 (d, 2C), 99.3 (d), 55.4 (q, 2C), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3071, 3007, 2942, 2840, 1592, 1488, 1451, 1358, 1292, 1228, 1207, 1164, 1133, 1087, 1057, 1018, 995, 914, 851, 811, 775, 759, 705, 694, 685, 668, 612 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{30}H_{27}N_2O_5S$ calcd for 527.1635, found 527.1636.



3ah

***N*-(2,5-diphenyloxazol-4-yl)-4-methyl-*N*-phenylbenzenesulfonamide (3ah)**[7]

Yield: 51 mg, 78%; white solid, mp 183-184 °C; R_f = 0.25 (EA/PE = 1/5); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.09-8.05 (m, 2H), 8.04-7.99 (m, 2H), 7.51-7.45 (m, 5H), 7.41-7.36 (m, 1H), 3.34 (s, 3H), 3.21 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 158.4 (s), 145.4 (s), 134.8 (s), 130.9 (d), 129.1 (d), 128.9 (d, 2C), 128.87 (d, 2C), 127.0 (s), 126.9 (s), 126.3 (d, 2C), 125.4 (d, 2C), 38.0 (q), 37.0 (q) ppm; IR (reflection) $\tilde{\nu}$ = 1683, 1614, 1553, 1494, 1452, 1365, 1348, 1336, 1239, 1201, 1151, 1098, 1058, 1034, 1004, 993, 975, 960, 913, 853, 779, 764, 731, 697, 685, 628 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{17}H_{17}N_2O_3S$ calcd for 329.0954, found 329.0951.

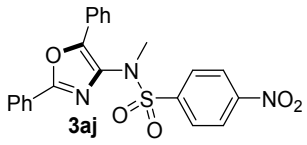


3ai

***N*-(2,5-diphenyloxazol-4-yl)-*N*-phenylmethanesulfonamide (3ai)**[7]

Yield: 70 mg, 90%; white solid, mp 201-203 °C; R_f = 0.45 (EA/PE = 1/5); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.10-8.00 (m, 2H), 7.74 (d, *J* = 7.5 Hz, 2H), 7.65 (d, *J* = 8.0 Hz, 2H), 7.46-7.39 (m, 3H), 7.36 (d, *J* = 7.5 Hz, 2H), 7.32-7.24 (m, 3H), 7.20 (T, *J* = 7.5 Hz, 1H), 3.25 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 158.3, 146.0, 140.1, 134.2, 130.9, 129.4, 129.1, 128.91, 128.85,

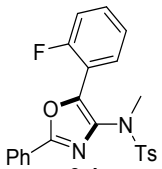
127.8, 127.0, 127.0, 126.7, 126.4, 125.4, 38.7 ppm; IR (reflection) $\tilde{\nu}$ = 3029, 3017, 2933, 1596, 1555, 1487, 1448, 1404, 1366, 1349, 1241, 1205, 1152, 1142, 1069, 1016, 964, 928, 784, 761, 710, 690, 647 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{22}H_{19}N_2O_3S$ calcd for 391.1111, found 391.1111.



3aj

***N*-(2,5-diphenyloxazol-4-yl)-*N*-methyl-4-nitrobenzenesulfonamide (3aj)**

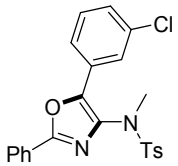
Yield: 72 mg, 80%; white solid, mp 161-162 °C; R_f = 0.38 (EA/PE = 1/5); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.34-8.28 (m, 2H), 8.09-8.04 (m, 2H), 7.97-7.93 (m, 2H), 7.88-7.82 (m, 2H), 7.45-7.37 (m, 5H), 7.35-7.30 (m, 1H), 3.15 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 158.3 (s), 150.5 (s), 145.9 (s), 143.3 (s), 134.1 (s), 131.0 (d), 130.2 (d, 2C), 129.3 (d), 129.0 (d, 4C), 126.74 (s), 126.72 (s), 126.2 (d, 2C), 125.4 (d, 2C), 124.0 (d, 2C), 37.8 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3118, 3100, 3079, 1738, 1633, 1607, 1555, 1528, 1485, 1448, 1400, 1371, 1348, 1326, 1309, 1246, 1206, 1162, 1107, 1084, 1065, 1024, 1005, 994, 947, 927, 868, 853, 778, 768, 738, 711, 691, 679, 630, 612 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{22}H_{18}N_3O_5S$ calcd for 436.0962, found 436.0947.



3ak

***N*-(5-(2-fluorophenyl)-2-phenyloxazol-4-yl)-*N*,4-dimethylbenzenesulfonamide (3ak)**

Yield: 66 mg, 78%; white solid, mp 127-128 °C; R_f = 0.16 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.92-7.86 (m, 3H), 7.67 (d, J = 8.5 Hz, 2H), 7.40-7.35 (m, 3H), 7.34-7.28 (m, 1H), 7.21 (d, J = 8.0 Hz, 2H), 7.20-7.16 (m, 1H), 7.12-7.06 (m, 1H), 3.10 (d, J = 7.0 Hz, 2H), 2.36 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 159.22 (s), 159.17 (d, $J_{C\text{-}F}$ = 252.3 Hz), 143.8 (s), 141.6 (d, $J_{C\text{-}F}$ = 2.6 Hz), 136.9 (s), 134.7 (s), 130.9 (d, $J_{C\text{-}F}$ = 8.3 Hz), 130.8 (d), 129.4 (d, $J_{C\text{-}F}$ = 2.4 Hz), 129.4 (d, 2C), 128.8 (d, 2C), 128.6 (d, 2C), 127.1 (s), 126.4 (d, 2C), 124.4 (d, $J_{C\text{-}F}$ = 3.6 Hz), 116.4 (d, $J_{C\text{-}F}$ = 21.4 Hz), 115.6 (d, $J_{C\text{-}F}$ = 12.9 Hz), 37.3 (q), 21.6 (q) ppm; IR (reflection) $\tilde{\nu}$ = 2930, 1738, 1599, 1576, 1556, 1488, 1449, 1371, 1341, 1287, 1217, 1160, 1113, 1088, 1072, 1023, 1002, 947, 883, 864, 813, 778, 759, 723, 701, 688, 666, 607 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{23}H_{20}FN_2O_3S$ calcd for 423.1173, found 423.1162.

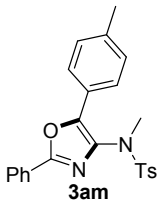


3al

***N*-(5-(3-chlorophenyl)-2-phenyloxazol-4-yl)-*N*,4-dimethylbenzenesulfonamide (3al)**

Yield: 71 mg, 81%; white solid, mp 175-176 °C; R_f = 0.17 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.96-7.92 (m, 1H), 7.91-7.86 (m, 3H), 7.71 (d, J = 8.5 Hz, 2H), 7.42-7.37 (m, 3H), 7.33 (t, J = 8.0 Hz, 1H), 7.28-7.24 (m, 3H), 3.08 (s, 3H), 2.39 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 158.5 (s), 144.2 (s), 144.1 (s), 136.0 (s), 134.8 (s), 134.3 (s), 130.9 (d), 130.2 (d), 129.4 (d, 2C), 128.89 (d, 2C), 128.88 (d, 2C), 128.83 (s), 128.81 (d), 126.9 (s), 126.4 (d, 2C), 125.2 (d), 123.6 (d), 37.3 (q), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3068, 2944, 1737, 1624,

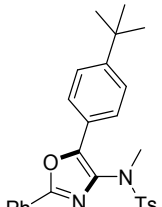
1595, 1556, 1474, 1449, 1353, 1302, 1291, 1244, 1167, 1156, 1087, 1063, 1009, 949, 870, 837, 808, 780, 765, 739, 708,, 692, 680, 667, 610 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{23}H_{20}{}^{35}ClN_2O_3S$ calcd for 439.0878, found 439.0877.



3am

***N*,4-dimethyl-*N*-(2-phenyl-5-(*p*-tolyl)oxazol-4-yl)benzenesulfonamide (3am)**

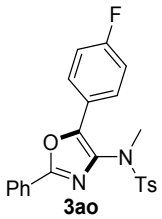
Yield: 70 mg, 83%; white solid, mp 169-170 °C; R_f = 0.61 (EA/PE = 1/5); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.88 (d, *J* = 7.5 Hz, 4H), 7.75 (d, *J* = 7.5 Hz, 2H), 7.42-7.35 (m, 3H), 7.26 (d, *J* = 8.0 Hz, 2H), 7.21 (d, *J* = 8.0 Hz, 2H), 3.08 (s, 3H), 2.39 (s, 3H), 2.33 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 157.6 (s), 145.9 (s), 143.9 (s), 139.0 (s), 134.6 (s), 134.4 (s), 130.5 (d), 129.5 (d, 2C), 129.4 (d 2C), 128.9 (d 2C), 128.8 (d 2C), 127.2 (s), 126.2 (d 2C), 125.4 (d 2C), 124.4 (s), 37.4 (q), 21.7 (q), 21.5 (q) ppm; IR (reflection) $\tilde{\nu}$ = 2923, 1738, 1665, 1604, 1555, 1510, 1491, 1450, 1366, 1345, 1304, 1235, 1181, 1161, 1120, 1088, 1067, 1021, 999, 945, 914, 857, 835, 817, 778, 731, 714, 705, 695, 667, 618 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{24}H_{23}N_2O_3S$ calcd for 419.1424, found 419.1419.



3an

***N*-(5-(4-(tert-butyl)phenyl)-2-phenyloxazol-4-yl)-*N*,4-dimethylbenzenesulfonamide (3an)**

Yield: 80 mg, 87%; white solid, mp 191-192 °C; R_f = 0.44 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.90-7.85 (m, 2H), 7.75 (d, *J* = 8.5 Hz, 2H), 7.45-7.41 (m, 2H), 7.40-7.35 (m, 3H), 7.26 (d, *J* = 8.0 Hz, 2H), 3.08 (s, 3H), 2.40 (s, 3H), 1.29 (s, 9H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 157.7 (s), 152.1 (s), 145.9 (s), 143.9 (s), 134.6 (s), 134.5 (s), 130.5 (d), 129.4 (d, 2C), 128.9 (d, 2C), 128.8 (d, 2C), 127.3 (s), 126.2 (d, 2C), 125.8 (d, 2C), 125.2 (d, 2C), 124.3 (s), 37.4 (q), 34.8 (s), 31.2 (q, 3C), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 2965, 2951, 2902, 2868, 1622, 1596, 1557, 1509, 1487, 1449, 1372, 1351, 1269, 1164, 1113, 1087, 1067, 1002, 949, 864, 842, 812, 777, 740, 706, 695, 668, 613 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{27}H_{29}N_2O_3S$ calcd for 461.1893, found 461.1889.

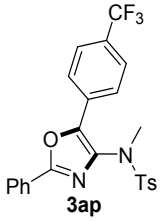


3ao

***N*-(5-(4-fluorophenyl)-2-phenyloxazol-4-yl)-*N*,4-dimethylbenzenesulfonamide (3ao)**

Yield: 65 mg, 77%; white solid, mp 197-198 °C; R_f = 0.34 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.02-7.96 (m, 2H), 7.90-7.84 (m, 2H), 7.72 (d, *J* = 8.5 Hz, 2H), 7.42-7.36 (m, 3H), 7.27 (d, *J* = 8.0 Hz, 2H), 7.10 (t, *J* = 8.5 Hz, 2H), 3.08 (s, 3H), 2.40 (s, 3H) ppm; ^{13}C NMR (125

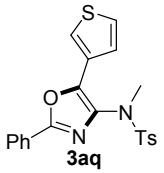
MHz, $CDCl_3$) δ 162.9 (d, J_{C-F} = 248.4 Hz), 157.9 (s), 144.9 (s), 144.1 (s), 134.7 (s), 134.3 (s), 130.7 (d), 129.4 (d, 2C), 128.9 (d, 2C), 128.8 (d, 2C), 127.5 (d, J_{C-F} = 8.3 Hz, 2C), 127.0 (s), 126.2 (d, 2C), 123.5 (d, J_{C-F} = 3.4 Hz), 116.0 (d, J_{C-F} = 21.9 Hz, 2C), 37.4 (q), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 1590, 1552, 1508, 1448, 1372, 1341, 1305, 1231, 1162, 1087, 1075, 1003, 966, 945, 872, 839, 814, 777, 717, 707, 696, 665, 618 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{23}H_{20}FN_2O_3S$ calcd for 423.1173, found 423.1170.



3ap

***N*,4-dimethyl-*N*-(2-phenyl-5-(4-(trifluoromethyl)phenyl)oxazol-4-yl)benzenesulfonamide (3ap)**

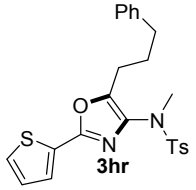
Yield: 81 mg, 86%; white solid, mp 162-163 °C; R_f = 0.36 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.22 (d, *J* = 8.5 Hz, 2H), 8.03-7.97 (m, 2H), 7.82 (d, *J* = 8.0 Hz, 2H), 7.76 (d, *J* = 8.5 Hz, 2H), 7.55-7.48 (m, 3H), 7.38 (d, *J* = 8.0 Hz, 2H), 3.21 (s, 3H), 2.51 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 158.8 (s), 144.2 (s), 136.7 (s), 134.1 (s), 131.1 (d), 130.4 (s), 130.3 (q, J_{C-F} = 32.4 Hz), 129.5 (d, 2C), 128.92 (d, 2C), 128.89 (d, 2C), 126.8 (s), 126.4 (d, 2C), 125.8 (q, J_{C-F} = 3.8 Hz), 125.5 (d, 2C), 124.0 (q, J_{C-F} = 270.5 Hz), 37.3 (q), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 2938, 1620, 1599, 1556, 1490, 1450, 1415, 1371, 1356, 1321, 1251, 1159, 1105, 1091, 1066, 1015, 999, 925, 859, 845, 807, 775, 729, 702, 667, 608 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{24}H_{20}F_3N_2O_3S$ calcd for 473.1141, found 473.1129.



3aq

***N*,4-dimethyl-*N*-(2-phenyl-5-(thiophen-3-yl)oxazol-4-yl)benzenesulfonamide (3aq)**

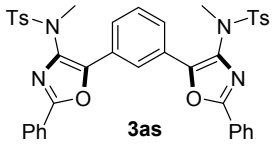
Yield: 74 mg, 90%; white solid, mp 194-196 °C; R_f = 0.38 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.00-7.95 (m, 2H), 7.84 (d, *J* = 8.0 Hz, 2H), 7.76 (d, *J* = 5.0 Hz, 1H), 7.51-7.47 (m, 3H), 7.46 (dd, *J* = 5.0, 3.0 Hz, 1H), 7.37 (d, *J* = 8.0 Hz, 2H), 3.18 (s, 3H), 2.50 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 157.6 (s), 144.0 (s), 143.6 (s), 134.4 (s), 133.8 (s), 130.6 (d), 129.4 (d, 2C), 128.83 (d, 2C), 128.82 (d, 2C), 127.8 (s), 127.2 (s), 126.5 (d), 126.2 (d, 2C), 125.4 (d), 123.0 (d), 37.3 (q), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3099, 2935, 1738, 1628, 1596, 1552, 1486, 1448, 1402, 1378, 1346, 1287, 1219, 1161, 1088, 1069, 1018, 896, 867, 851, 806, 780, 707, 694, 664, 624 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{21}H_{19}N_2O_3S_2$ calcd for 411.0832, found 411.0816.



3hr

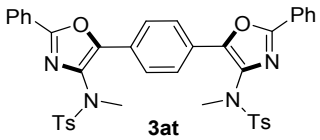
***N*,4-dimethyl-*N*-(5-(3-phenylpropyl)-2-(thiophen-2-yl)oxazol-4-yl)benzenesulfonamide (3hr)**

Yield: 87 mg, 96%; light yellow oil; R_f = 0.44 (EA/PE = 1/10); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.58 (d, *J* = 8.1 Hz, 2H), 7.46 (d, *J* = 2.7 Hz, 1H), 7.29 (d, *J* = 4.5 Hz, 1H), 7.26-7.09 (m, 7H), 6.99 (t, *J* = 4.5 Hz, 1H), 3.01 (s, 3H), 2.80 (d, *J* = 7.5 Hz, 2H), 2.67 (d, *J* = 7.5 Hz, 2H), 2.35 (s, 3H), 2.09-1.93 (m, 2H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ 154.3 (s), 148.4 (s), 143.8 (s), 141.6 (s), 134.9 (s), 134.3 (s), 130.0 (s), 129.4 (d, 2C), 128.5 (d, 2C), 128.4 (d, 4C), 128.1 (d), 127.9 (d), 127.4 (d), 126.0 (d), 37.2 (q), 35.5 (m), 29.1 (m), 24.3 (m), 21.6 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3025, 2937, 2863, 1637, 1597, 1423, 1307, 1290, 1155, 1087, 1050, 1019, 848, 812, 782, 699, 607, 534, 515, 512, 494 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{24}H_{25}N_2O_3S_2$ calcd for 453.1301, found 4531300.



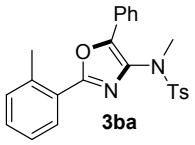
***N*,*N*′-(1,3-phenylenebis(2-phenyloxazole-5,4-diyl))bis(*N*,4-dimethylbenzenesulfonamide) (3as)**

Yield: 63 mg, 43%; white solid, mp 242-244 °C; R_f = 0.31 (EA/PE = 1/3); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.80 (s, 1H), 8.04-7.93 (m, 6H), 7.76 (d, *J* = 8.0 Hz, 4H), 7.53 (t, *J* = 8.0 Hz, 1H), 7.44-7.39 (m, 6H), 7.28 (d, *J* = 8.0 Hz, 4H), 3.18 (s, 3H), 2.40 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 158.3 (s, 2C), 145.1 (s, 2C), 144.0 (s, 2C), 135.6 (s, 2C), 134.4 (s, 2C), 130.7 (d, 2C), 129.39 (d, 4C), 129.36 (d), 128.95 (d, 4C), 128.87 (d, 4C), 127.8 (s, 2C), 127.1 (s, 2C), 126.5 (d, 4C), 125.5 (d, 2C), 122.3 (d), 37.6 (q, 2C), 21.7 (q, 2C) ppm; IR (reflection) $\tilde{\nu}$ = 2924, 1703, 1597, 1557, 1488, 1449, 1362, 1305, 1228, 1160, 1087, 1067, 1023, 1001, 949, 912, 864, 809, 778, 760, 733, 705, 689, 665, 606 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{40}H_{35}N_4O_6S_2$ calcd for 731.1993, found 731.1991.



***N*,*N*′-(1,4-phenylenebis(2-phenyloxazole-5,4-diyl))bis(*N*,4-dimethylbenzenesulfonamide) (3at)**

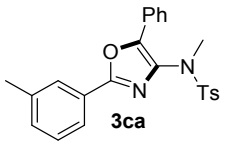
Yield: 73 mg, 50%; white solid, mp 270-272 °C; R_f = 0.28 (EA/PE = 1/3); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.11 (s, 4H), 7.94-7.88 (m, 4H), 7.76 (d, *J* = 8.0 Hz, 4H), 7.44-7.38 (m, 6H), 7.29 (d, *J* = 8.0 Hz, 4H), 7.28 (d, *J* = 8.0 Hz, 4H), 3.13 (s, 3H), 2.41 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 158.3 (s, 2C), 145.2 (s, 2C), 144.1 (s, 2C), 135.7 (s, 2C), 134.4 (s, 2C), 130.8 (d, 2C), 129.4 (d, 4C), 128.95 (d, 4C), 128.89 (d, 4C), 127.2 (s, 2C), 127.0 (s, 2C), 126.3 (d, 4C), 125.7 (d, 4C), 37.4 (q, 2C), 21.7 (q, 2C) ppm; IR (reflection) $\tilde{\nu}$ = 3061, 2901, 2859, 1618, 1597, 1560, 1489, 1450, 1352, 1285, 1220, 1166, 1089, 1062, 1025, 999, 979, 926, 851, 814, 775, 748, 718, 701, 686, 663 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{40}H_{35}N_4O_6S_2$ calcd for 731.1993, found 731.1997.



***N*,4-dimethyl-*N*-(5-phenyl-2-(*o*-tolyl)oxazol-4-yl)benzenesulfonamide (3ba)**

Yield: 66 mg, 79%; white solid, mp 192-193 °C; R_f = 0.38 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.01 (d, *J* = 7.5 Hz, 2H), 7.90 (d, *J* = 8.0 Hz, 1H), 7.75 (d, *J* = 8.5 Hz, 2H), 7.41 (t, *J*

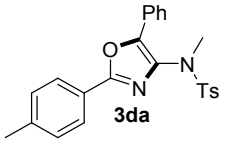
= 8.0 Hz, 2H), 7.30 (d, *J* = 7.5 Hz, 1H), 7.27-7.23 (m, 3H), 7.22-7.16 (m, 2H), 3.09 (s, 3H), 2.48 (s, 3H), 2.38 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 158.2 (s), 145.1 (s), 143.9 (s), 137.6 (s), 134.7 (s), 134.5 (s), 131.8 (d), 130.3 (d), 129.4 (d, 2C), 128.89 (d), 128.86 (d, 4C), 128.5 (d), 127.2 (s), 126.1 (d), 125.9 (s), 125.4 (d, 2C), 37.6 (q), 22.0 (q), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 2926, 1615, 1597, 1550, 1492, 1447, 1367, 1346, 1242, 1196, 1157, 1085, 1060, 1005, 993, 917, 862, 816, 770, 719, 707, 692, 665, 627, 612 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{24}H_{23}N_2O_3S$ calcd for 419.1424, found 419.1421.



3ca

***N*,4-dimethyl-*N*-(5-phenyl-2-(*m*-tolyl)oxazol-4-yl)benzenesulfonamide (3ca)**

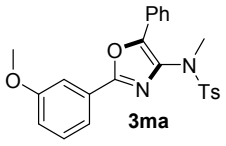
Yield: 63 mg, 75%; white solid, mp 149-150 °C; R_f = 0.38 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.99 (d, *J* = 7.0 Hz, 2H), 7.90 (d, *J* = 8.0 Hz, 2H), 7.71-7.65 (m, 2H), 7.41 (t, *J* = 7.5 Hz, 2H), 7.32-7.29 (m, 1H), 7.28-7.24 (m, 3H), 7.20 (d, *J* = 7.5 Hz, 1H), 3.09 (s, 3H), 2.40 (s, 3H), 2.35 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 158.2 (s), 145.5 (s), 143.9 (s), 138.6 (s), 135.0 (s), 134.5 (s), 131.5 (d), 129.4 (d, 2C), 128.94 (d, 2C), 128.86 (d), 128.82 (d, 2C), 128.75 (d), 127.2 (s), 127.0 (s), 126.8 (d), 125.4 (d, 2C), 123.5 (d), 37.4 (q), 21.7 (q), 21.4 (q) ppm; IR (reflection) $\tilde{\nu}$ = 1619, 1596, 1554, 1496, 1472, 1450, 1368, 1345, 1307, 1255, 1187, 1160, 1089, 1077, 1037, 1006, 875, 839, 818, 802, 765, 711, 690, 665 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{24}H_{23}N_2O_3S$ calcd for 419.1424, found 419.1424.



3da

***N*,4-dimethyl-*N*-(5-phenyl-2-(*p*-tolyl)oxazol-4-yl)benzenesulfonamide (3da)**

Yield: 78 mg, 93%; white solid, mp 196-198 °C; R_f = 0.50 (EA/PE = 1/5); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.98 (d, *J* = 7.5 Hz, 2H), 7.76 (d, *J* = 8.0 Hz, 2H), 7.75 (d, *J* = 8.0 Hz, 2H), 7.40 (t, *J* = 8.0 Hz, 2H), 7.29 (d, *J* = 7.5 Hz, 1H), 7.26 (d, *J* = 8.0 Hz, 2H), 7.18 (d, *J* = 8.0 Hz, 2H), 3.08 (s, 3H), 2.39 (s, 3H), 2.33 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 158.2 (s), 145.3 (s), 143.9 (s), 141.0 (s), 135.0 (s), 134.5 (s), 129.6 (d), 129.4 (d), 129.0 (d), 128.81 (d), 128.78 (d), 127.2 (s), 126.2 (d), 125.3 (d), 124.5 (s), 37.4 (q), 21.7 (q), 21.6 (q) ppm; IR (reflection) $\tilde{\nu}$ = 3067, 2928, 1618, 1597, 1496, 1450, 1371, 1349, 1251, 1162, 1087, 1062, 1004, 993, 856, 813, 767, 718, 705, 689, 665, 629 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{24}H_{23}N_2O_3S$ calcd for 419.1424, found 419.1427.

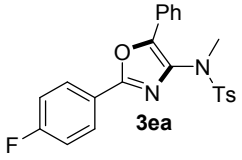


3ma

***N*-(2-(3-methoxyphenyl)-5-phenyloxazol-4-yl)-*N*,4-dimethylbenzenesulfonamide (3ma)**

Yield: 56 mg, 64%; white solid, mp 175-177 °C; R_f = 0.42 (EA/PE = 1/5); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.01-7.96 (m, 2H), 7.70 (d, *J* = 8.0 Hz, 2H), 7.48 (d, *J* = 7.5 Hz, 1H), 7.43-7.37 (m, 3H), 7.33-7.28 (m, 2H), 7.26 (d, *J* = 8.0 Hz, 2H), 6.93 (dd, *J* = 8.0, 2.0 Hz, 1H), 3.80 (s, 3H), 3.09 (s, 3H), 2.39 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 158.2, 145.5, 144.0, 138.6, 135.0, 134.5, 131.5, 129.4, 128.94, 128.86, 128.82, 128.76, 127.2, 127.0, 126.8, 125.4, 123.5, 37.4, 21.7, 21.4 ppm; IR (reflection) $\tilde{\nu}$ = 3055, 2932, 2840, 1604, 1552, 1492, 1461, 1447, 1374,

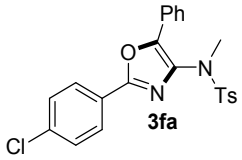
1344, 1318, 1282, 1256, 1231, 1185, 1161, 1081, 1065, 1032, 1006, 966, 877, 865, 841, 810, 795, 764, 740, 711, 693, 683, 664, 629, 605 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{24}H_{23}N_2O_4S$ calcd for 435.1373, found 435.1371.



3ea

***N*-(2-(4-fluorophenyl)-5-phenyloxazol-4-yl)-*N*,4-dimethylbenzenesulfonamide (3ea)**

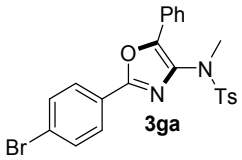
Yield: 61 mg, 73%; white solid, mp 199-200 °C; R_f = 0.38 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.00-7.94 (m, 2H), 7.91-7.85 (m, 2H), 7.74 (d, *J* = 8.5 Hz, 2H), 7.40 (d, *J* = 7.5 Hz, 2H), 7.30 (t, *J* = 7.5 Hz, 1H), 7.08 (d, *J* = 8.5 Hz, 2H), 3.08 (s, 3H), 2.40 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 164.2 (d, J_{C-F} = 250.1 Hz), 157.2 (s), 145.7 (s), 144.0 (s), 134.7 (s), 135.0 (s), 129.4 (d, 2C), 129.0 (d), 128.91 (d, 2C), 128.85 (d, 2C), 128.4 (d, J_{C-F} = 8.6 Hz, 2C), 127.0 (s), 125.4 (d, 2C), 123.5 (d, J_{C-F} = 3.3 Hz), 116.2 (d, J_{C-F} = 22.0 Hz, 2C), 37.4 (q), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 1615, 1600, 1498, 1459, 1417, 1371, 1345, 1294, 1238, 1200, 1160, 1088, 1061, 1036, 1004, 995, 863, 840, 815, 766, 742, 722, 705, 686, 665, 630 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{23}H_{20}FN_2O_3S$ calcd for 423.1173, found 423.1167.



3fa

***N*,4-dimethyl-*N*-(2-phenyl-5-(*p*-tolyl)oxazol-4-yl)benzenesulfonamide (3fa)**

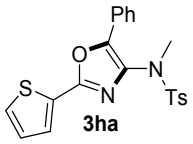
Yield: 64 mg, 73%; white solid, mp 169-171 °C; R_f = 0.41 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.99-7.96 (m, 2H), 7.84-7.80 (m, 2H), 7.73 (d, *J* = 8.5 Hz, 2H), 7.41 (t, *J* = 8.0 Hz, 2H), 7.38-7.35 (m, 2H), 7.31 (d, *J* = 7.5 Hz, 1H), 7.27 (d, *J* = 8.0 Hz, 2H), 3.08 (s, 3H), 2.40 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 157.0 (s), 145.9 (s), 144.0 (s), 136.8 (s), 135.1 (s), 134.5 (s), 129.4 (d, 2C), 129.2 (d, 2C), 129.1 (d), 128.89 (d, 2C), 128.86 (d, 2C), 127.5 (d, 2C), 126.9 (s), 125.6 (s), 125.4 (d, 2C), 37.4 (q), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 2926, 1734, 1598, 1483, 1454, 1405, 1364, 1345, 1294, 1157, 1087, 1062, 1033, 1013, 993, 845, 834, 808, 775, 745, 718, 702, 690, 667, 626, 607 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{23}H_{20}{}^{35}ClN_2O_3S$ calcd for 439.0878, found 439.0887.



3ga

***N*-(2-(4-bromophenyl)-5-phenyloxazol-4-yl)-*N*,4-dimethylbenzenesulfonamide (3ga)**

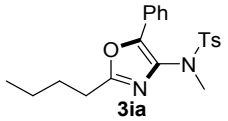
Yield: 65 mg, 67%; white solid, mp 185-187 °C; R_f = 0.38 (EA/PE = 1/10); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.97 (d, *J* = 7.5 Hz, 2H), 7.74 (d, *J* = 8.5 Hz, 2H), 7.72 (d, *J* = 8.0 Hz, 2H), 7.52 (d, *J* = 8.5 Hz, 2H), 7.40 (d, *J* = 7.5 Hz, 2H), 7.31 (t, *J* = 7.5 Hz, 1H), 7.26 (d, *J* = 8.0 Hz, 2H), 3.07 (s, 3H), 2.40 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 157.1 (s), 146.0 (s), 144.0 (s), 135.1 (s), 134.4 (s), 132.1 (d, 2C), 129.4 (d, 2C), 129.1 (d), 128.89 (d, 2C), 128.86 (d, 2C), 127.7 (d, 2C), 126.9 (s), 126.0 (s), 125.4 (d, 2C), 125.1 (s), 37.4 (q), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 1598, 1493, 1477, 1447, 1400, 1369, 1348, 1163, 1089, 1078, 1005, 920,, 859, 825, 812, 765, 739, 728, 714, 687, 666, 623, 607 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{23}H_{20}{}^{79}BrN_2O_3S$ calcd for 483.0373, found 483.0371.



3ha

***N*,4-dimethyl-*N*-(5-phenyl-2-(thiophen-2-yl)oxazol-4-yl)benzenesulfonamide (3ha)**

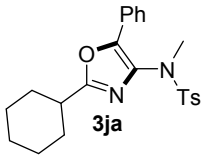
Yield: 81 mg, 98%; white solid, mp 168-170 °C; R_f = 0.40 (EA/PE = 1/5); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.0 Hz, 2H), 7.73 (d, *J* = 8.0 Hz, 2H), 7.58 (d, *J* = 3.5 Hz, 1H), 7.40 (t, *J* = 8.0 Hz, 2H), 7.37 (d, *J* = 4.5 Hz, 1H), 7.30 (t, *J* = 7.5 Hz, 1H), 7.26 (d, *J* = 8.0 Hz, 2H), 7.05 (t, *J* = 4.5 Hz, 1H), 3.07 (s, 3H), 2.39 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 154.3 (s), 145.1 (s), 144.0 (s), 134.8 (s), 134.3 (s), 129.7 (s), 129.4 (d), 129.0 (d), 128.9 (d), 128.83 (d), 128.75 (d), 128.1 (d), 128.0 (d), 126.9 (s), 125.4 (d), 37.4 (q), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 2931, 1701, 1620, 1593, 1577, 1494, 1449, 1422, 1345, 1245, 1160, 1088, 1023, 991, 855, 813, 765, 706, 688, 666, 613 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{21}H_{19}N_2O_3S_2$ calcd for 411.0832, found 411.0837.



3ia

***N*-(2-butyl-5-phenyloxazol-4-yl)-*N*,4-dimethylbenzenesulfonamide (3ia)**

Yield: 69 mg, 90%; white solid, mp 91-92 °C; R_f = 0.43 (EA/PE = 1/5); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.88 (d, *J* = 7.5 Hz, 2H), 7.67 (d, *J* = 8.0 Hz, 2H), 7.37 (t, *J* = 8.0 Hz, 2H), 7.27 (d, *J* = 7.0 Hz, 1H), 7.23 (d, *J* = 8.0 Hz, 2H), 3.04 (s, 3H), 2.65 (t, *J* = 7.5 Hz, 2H), 2.37 (s, 3H), 1.67-1.61 (m, 2H), 1.37-1.28 (m, 2H), 0.89 (t, *J* = 7.5 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 161.9 (s), 145.2 (s), 143.9 (s), 134.4 (s), 133.2 (s), 129.4 (d, 2C), 128.7 (d, 4C), 128.6 (d), 127.3 (s), 125.2 (d, 2C), 37.2 (q), 29.1 (t), 28.0 (t), 22.2 (t), 21.7 (q), 13.8 (q) ppm; IR (reflection) $\tilde{\nu}$ = 2966, 2941, 2876, 1583, 1496, 1451, 1346, 1248, 1187, 1158, 1078, 1036, 1010, 864, 816, 773, 755, 726, 692, 667, 615 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{21}H_{25}N_2O_3S$ calcd for 385.1580, found 385.1577.



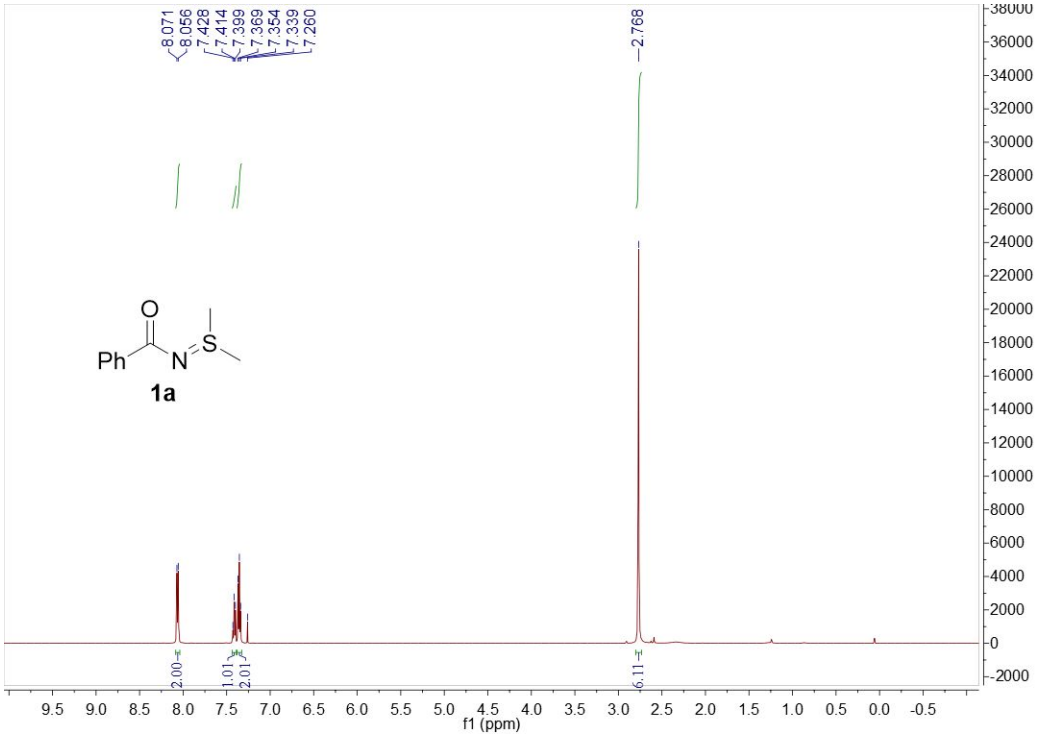
3ja

***N*-(2-cyclohexyl-5-phenyloxazol-4-yl)-*N*,4-dimethylbenzenesulfonamide (3ja)**

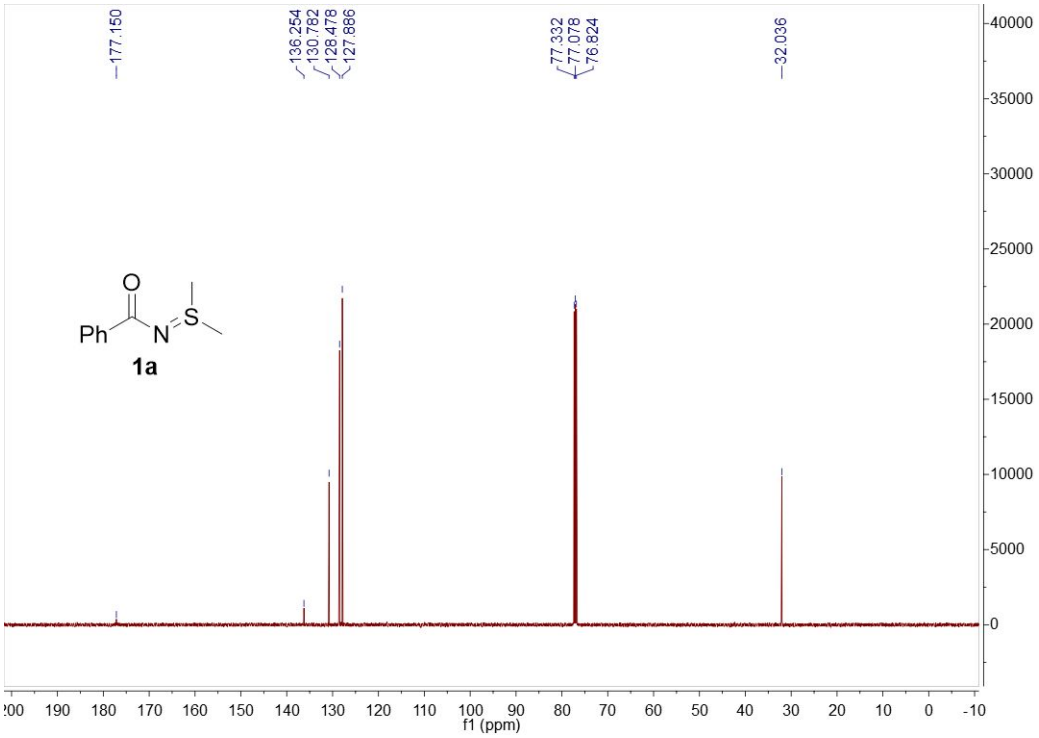
Yield: 78 mg, 95%; white solid, mp 125-127 °C; R_f = 0.53 (EA/PE = 1/5); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.88 (d, *J* = 7.5 Hz, 2H), 7.68 (d, *J* = 8.0 Hz, 2H), 7.29-7.22 (m, 3H), 3.03 (s, 3H), 2.72-2.62 (m, 1H), 2.37 (s, 3H), 2.01-1.87 (m, 2H), 1.80-1.66 (m, 2H), 1.66-1.58 (m, 1H), 1.53-1.48 (m, 2H), 1.35-1.17 (m, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 164.8 (s), 144.7 (s), 143.9 (s), 134.5 (s), 133.2 (s), 129.4 (d, 2C), 128.8 (d, 2C), 128.7 (d, 2C), 128.5 (d), 127.4 (s), 125.2 (d, 2C), 37.6 (d), 37.2 (q), 30.4 (t, 2C), 25.7 (t, 2C), 25.5 (t, 2C), 21.7 (q) ppm; IR (reflection) $\tilde{\nu}$ = 2928, 2858, 1597, 1571, 1495, 1449, 1349, 1243, 1157, 1088, 1068, 1034, 846, 812, 768, 731, 687, 667, 615 cm^{-1}; HRMS (ESI) (M+H) (*m/z*) $C_{23}H_{27}N_2O_3S$ calcd for 411.1737, found 411.1737.

4. NMR spectra

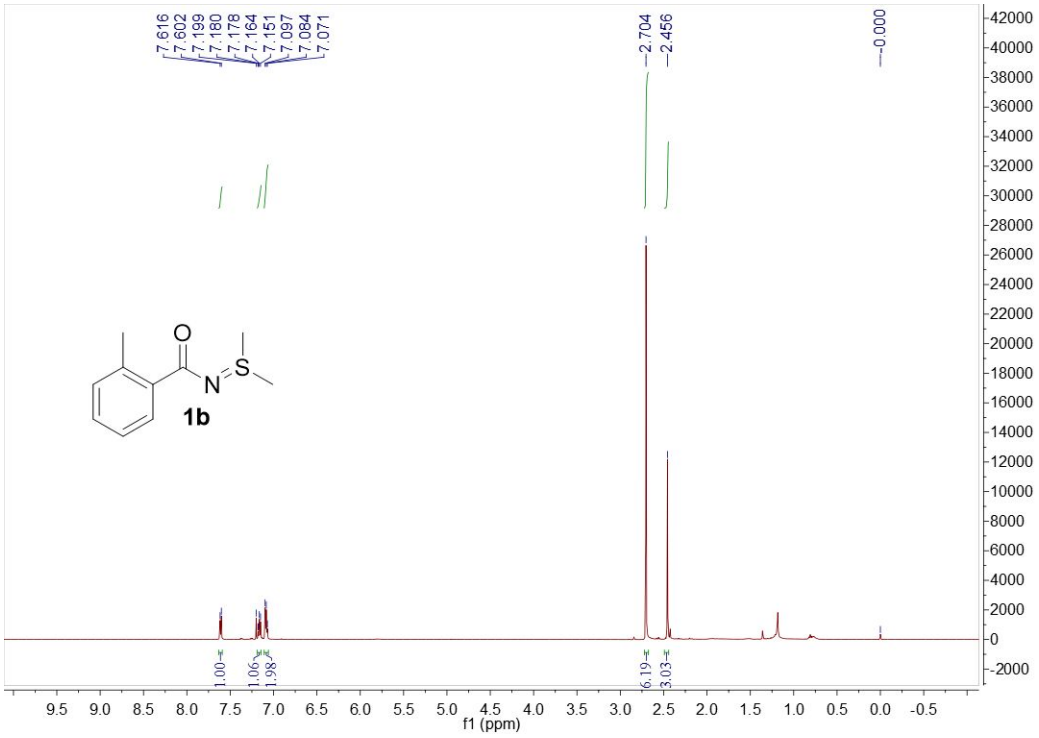
^{1}H NMR of compound **1a** in $CDCl_3$



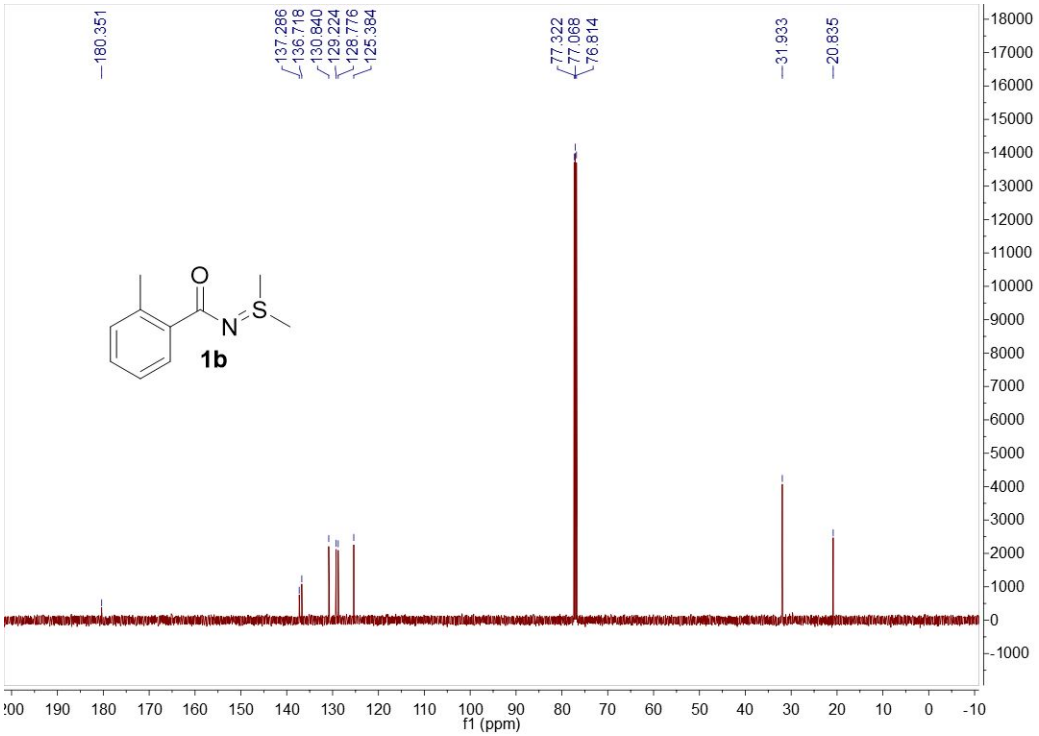
^{13}C NMR of compound **1a** in $CDCl_3$



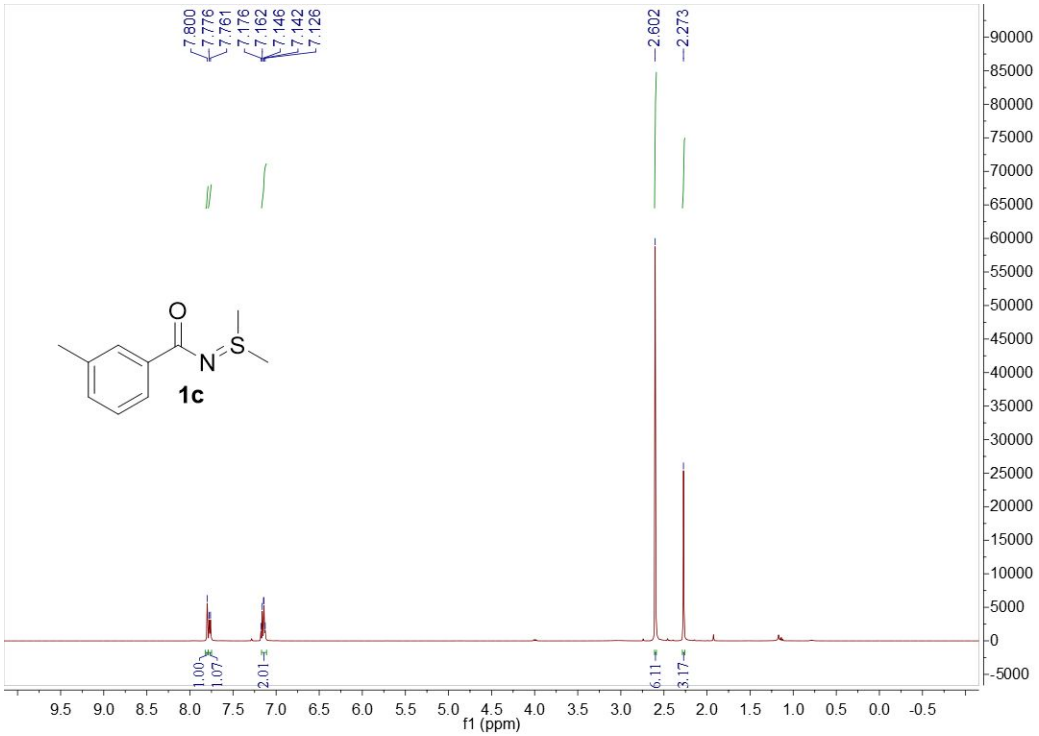
^{1}H NMR of compound **1b** in $CDCl_3$



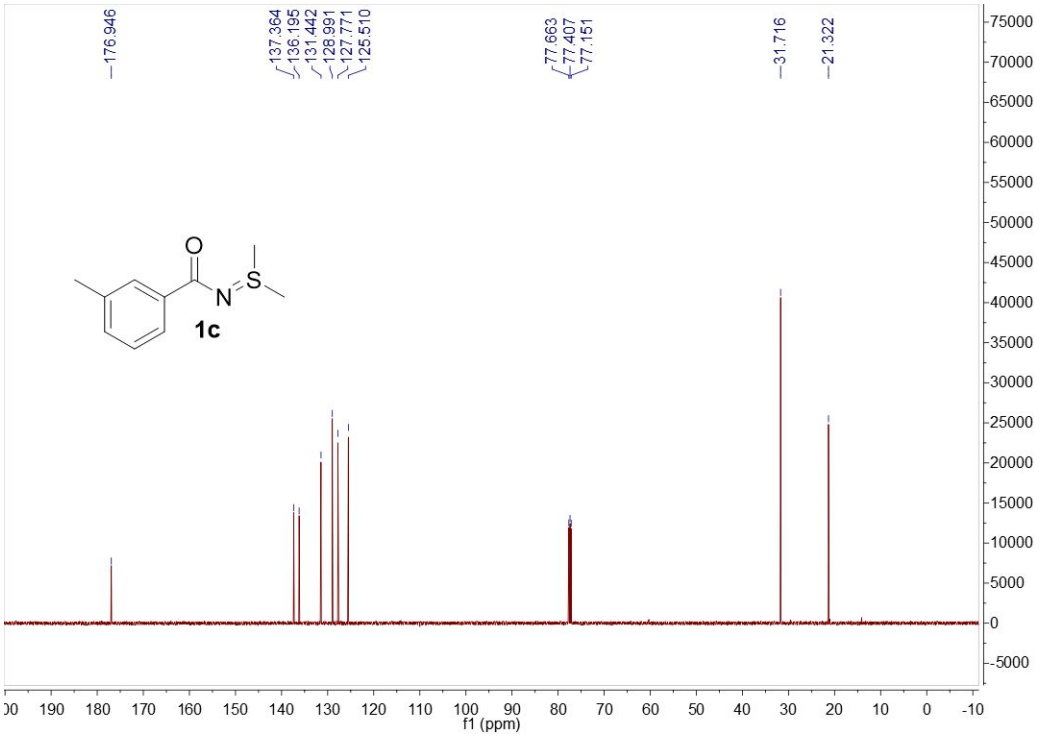
^{13}C NMR of compound **1b** in $CDCl_3$



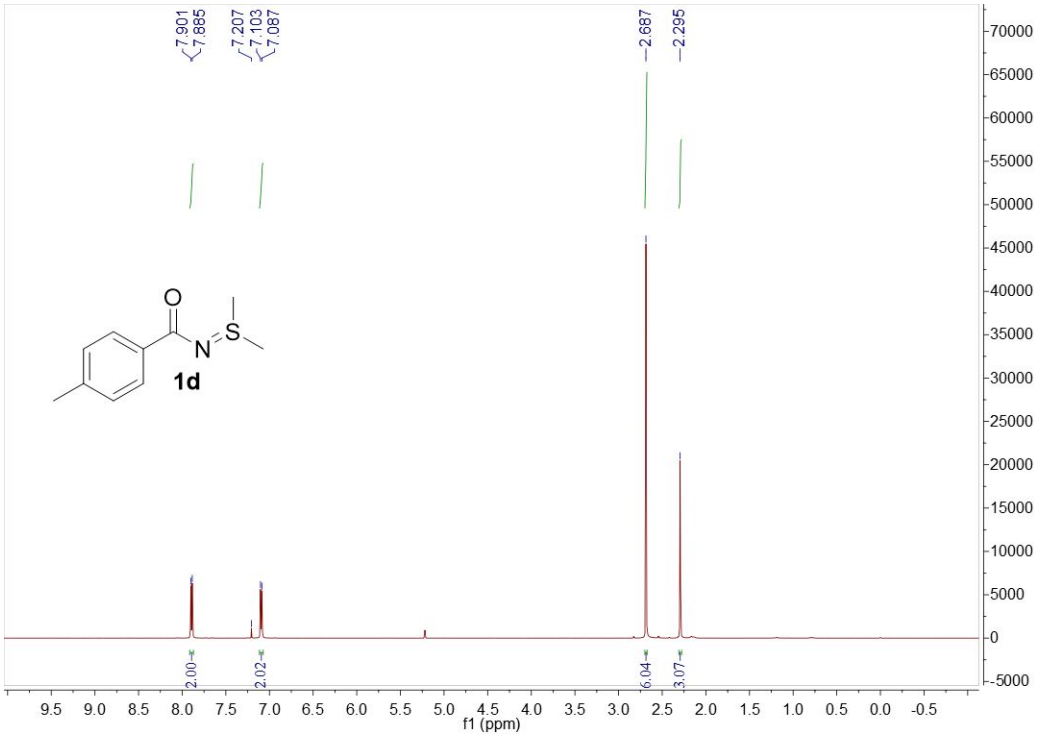
^{1}H NMR of compound **1c** in $CDCl_3$



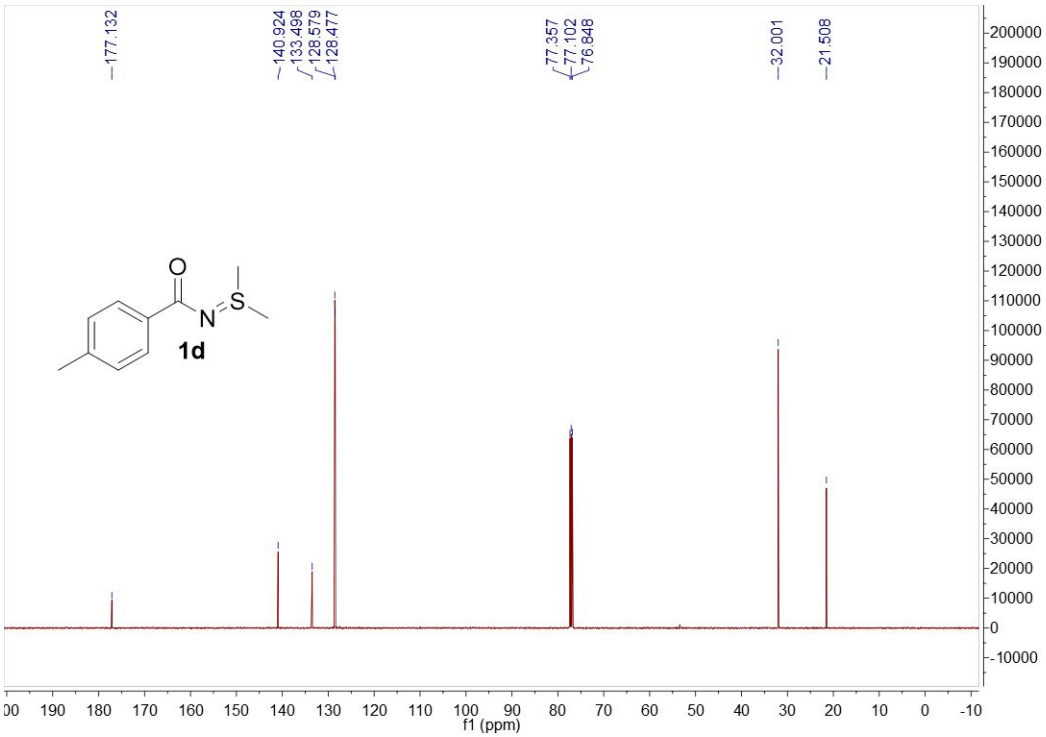
^{13}C NMR of compound **1c** in $CDCl_3$



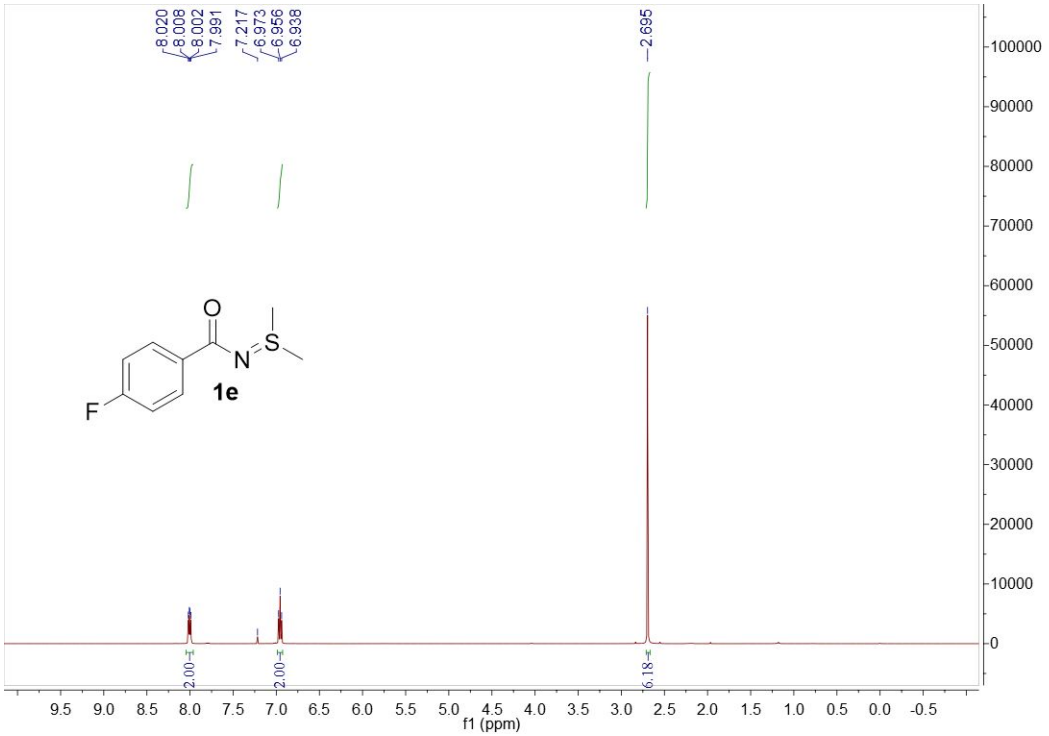
^{1}H NMR of compound **1d** in $CDCl_3$



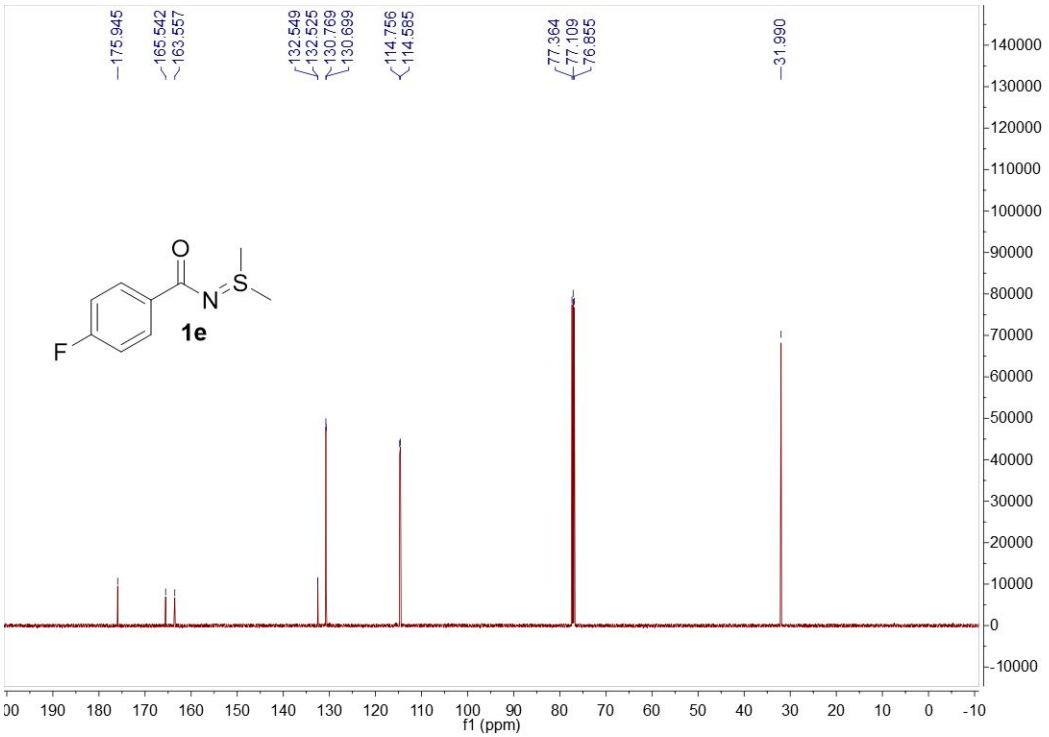
^{13}C NMR of compound **1d** in $CDCl_3$



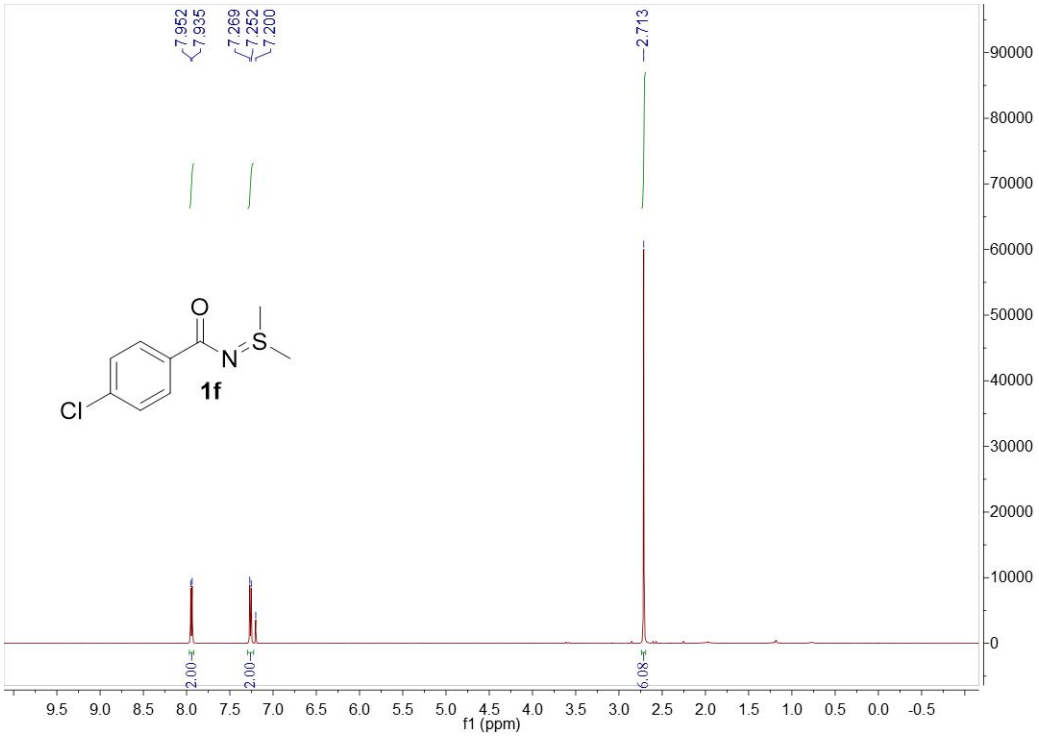
^{1}H NMR of compound **1e** in $CDCl_3$



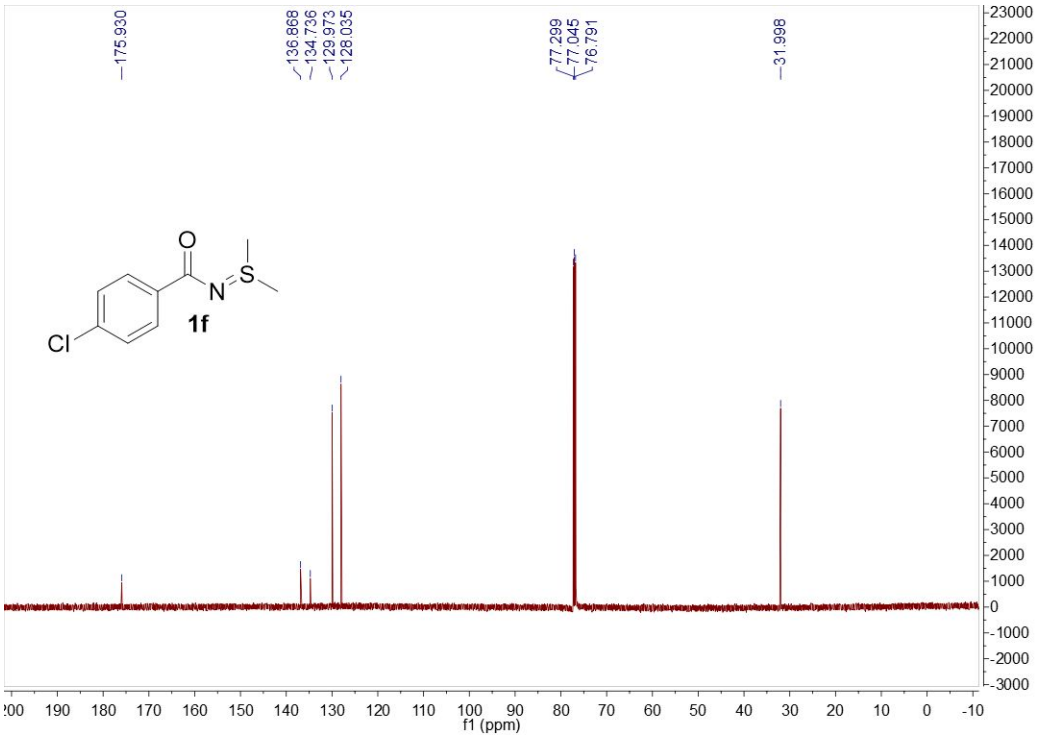
^{13}C NMR of compound **1e** in $CDCl_3$



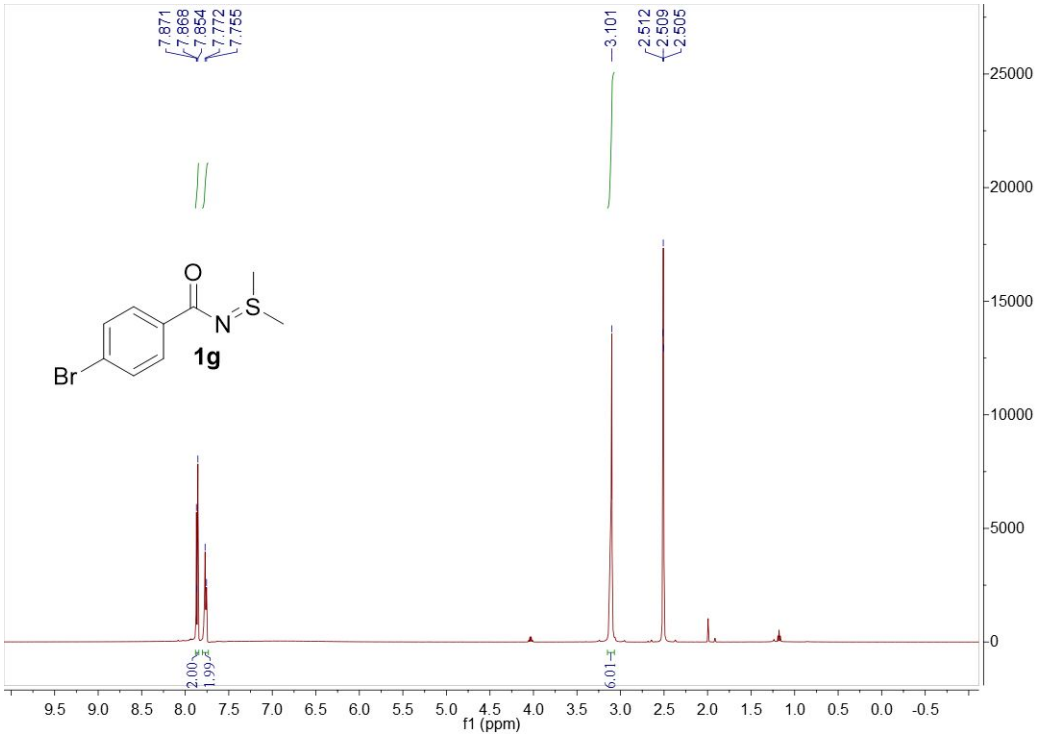
^{1}H NMR of compound **1f** in $CDCl_3$



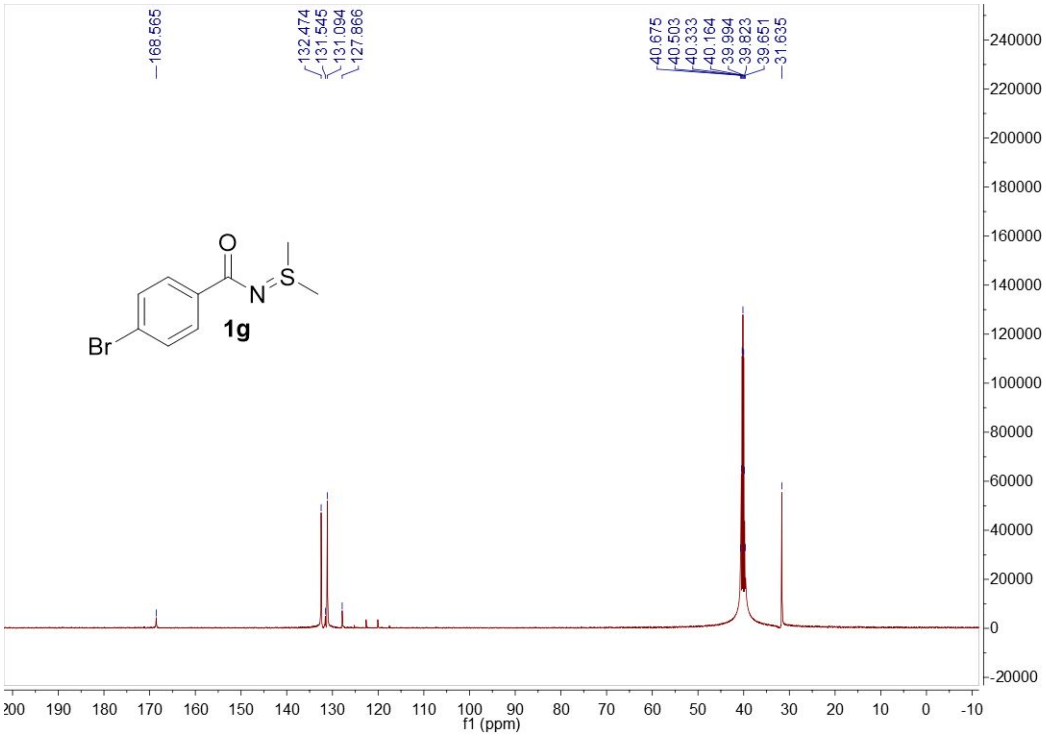
^{13}C NMR of compound **1f** in $CDCl_3$



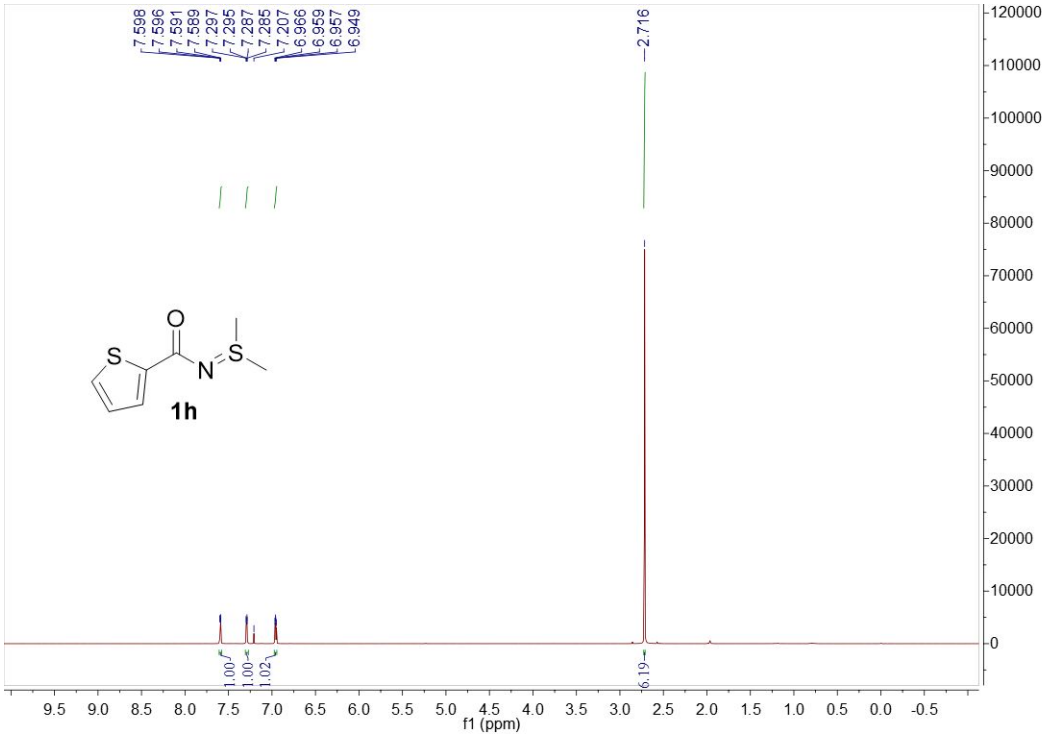
^{1}H NMR of compound **1g** in $CDCl_3$



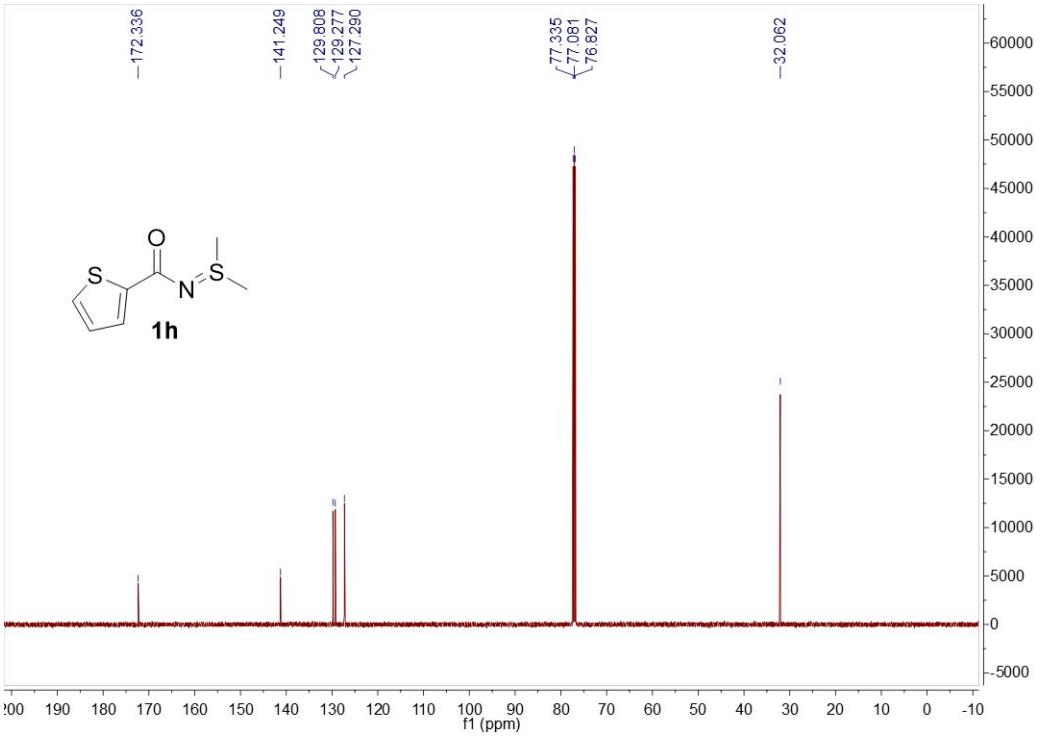
^{13}C NMR of compound **1g** in $CDCl_3$



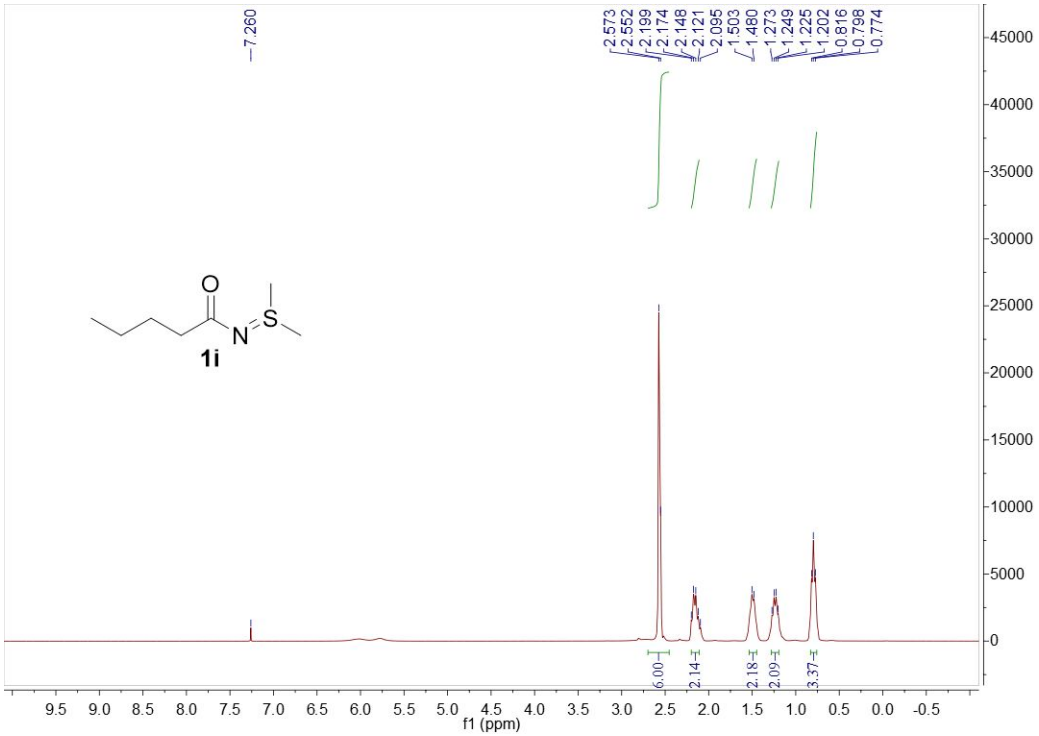
^{1}H NMR of compound **1h** in $CDCl_3$



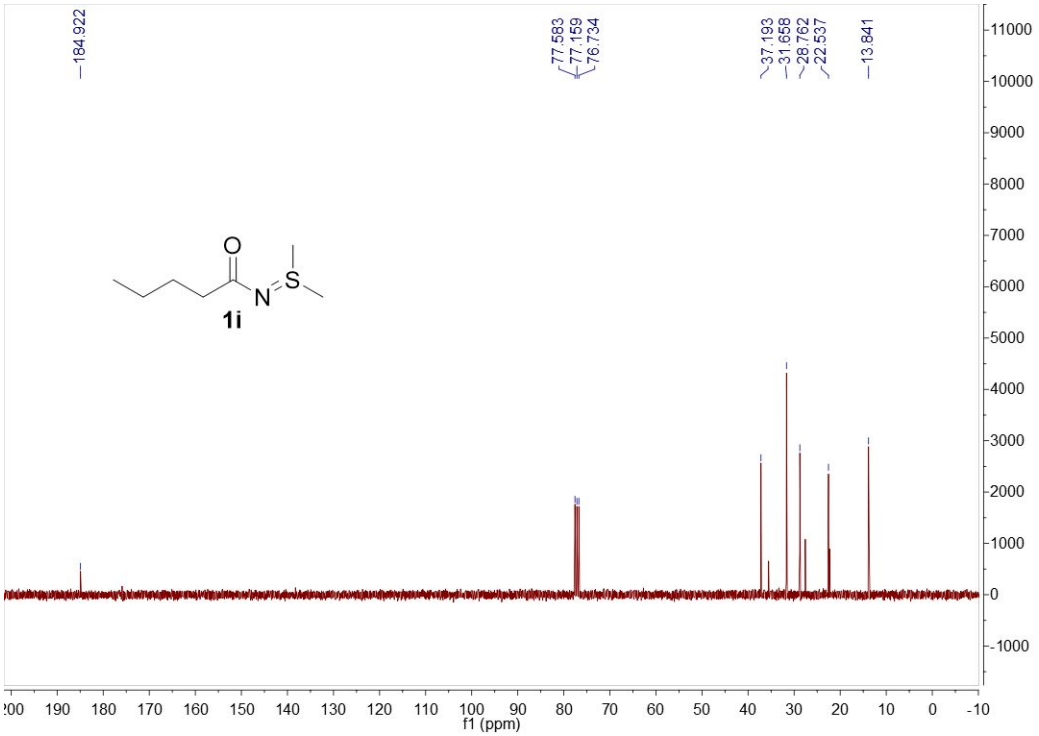
^{13}C NMR of compound **1h** in $CDCl_3$



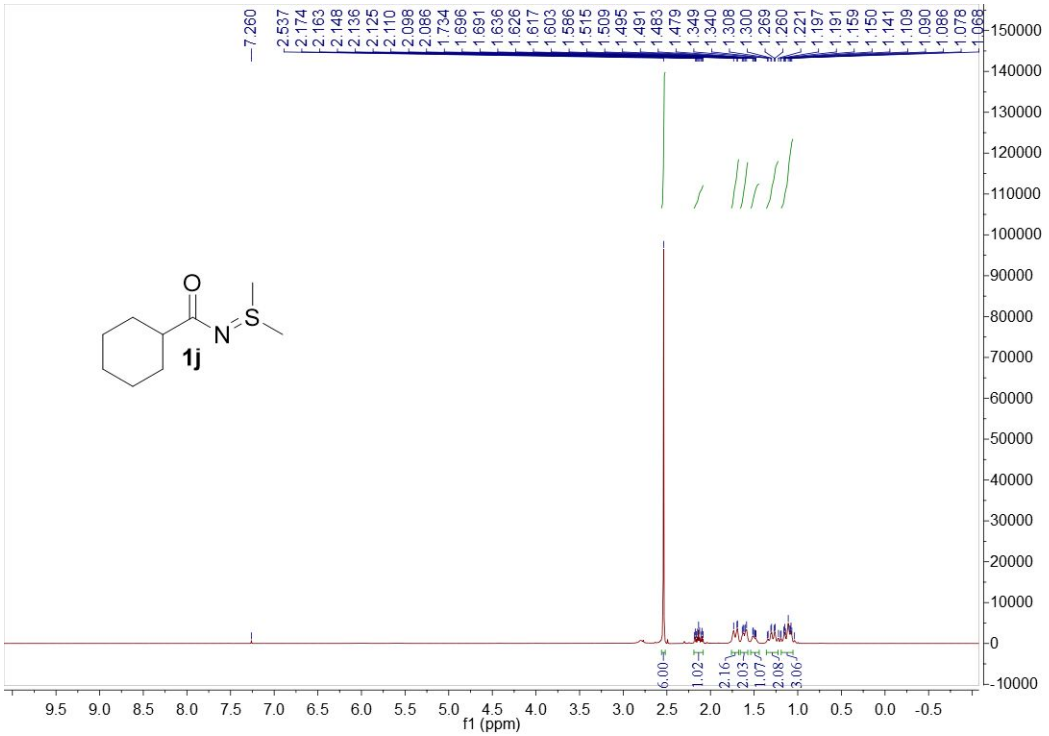
^{1}H NMR of compound **1i** in $CDCl_3$



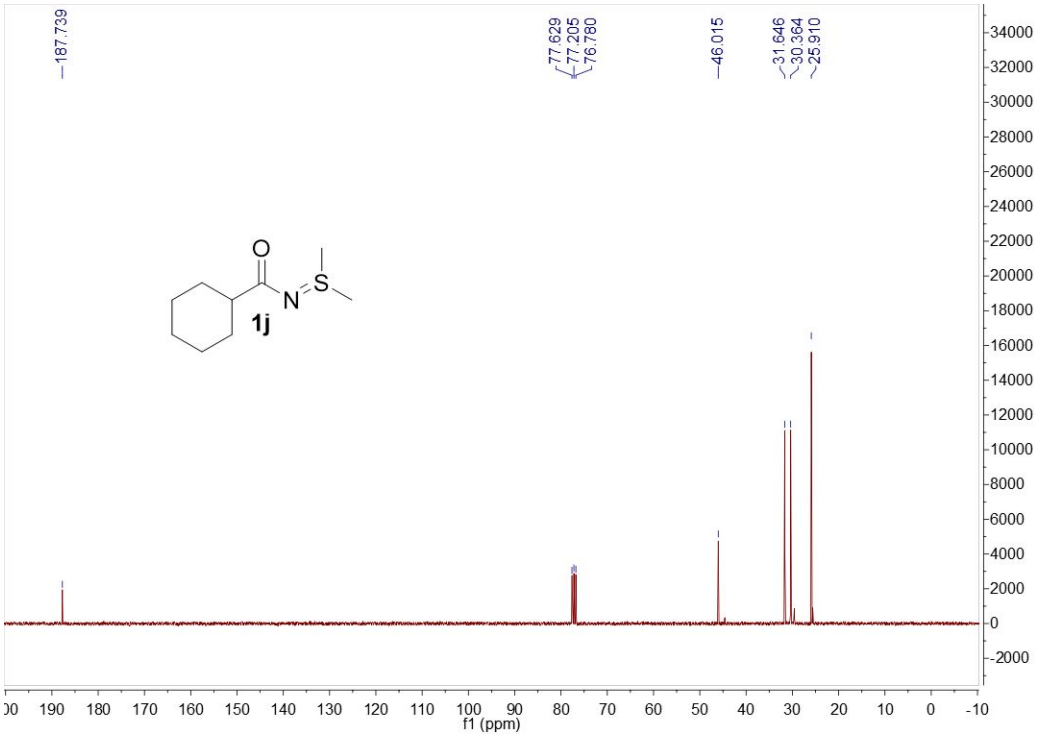
^{13}C NMR of compound **1i** in $CDCl_3$



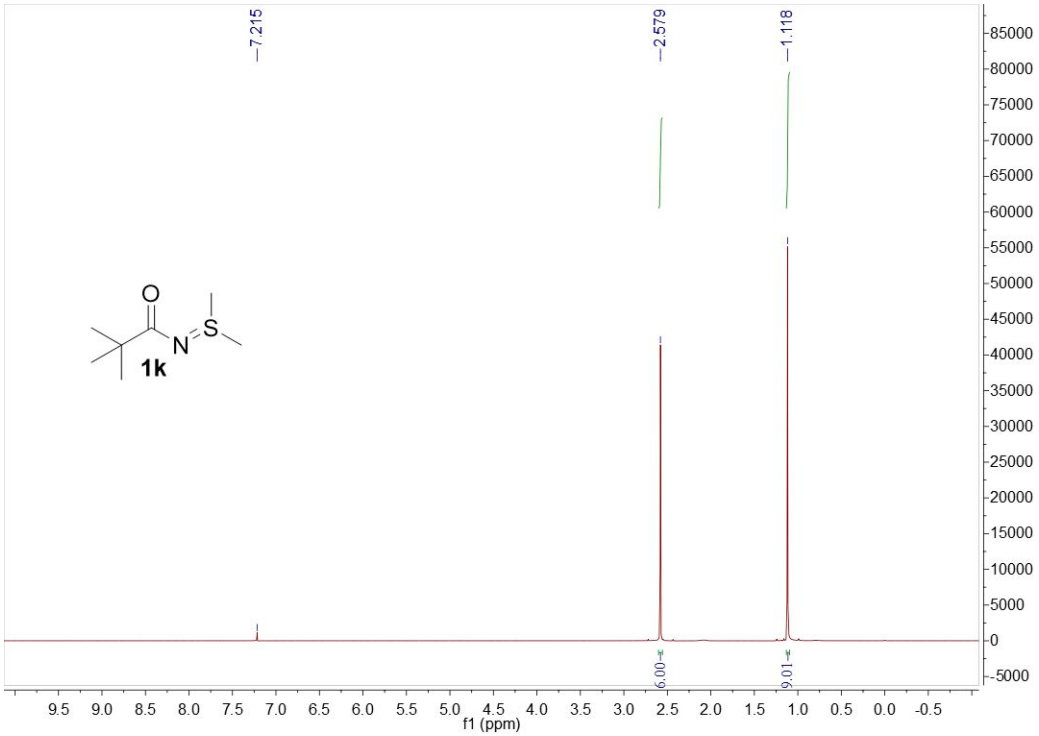
^{1}H NMR of compound **1j** in $CDCl_3$



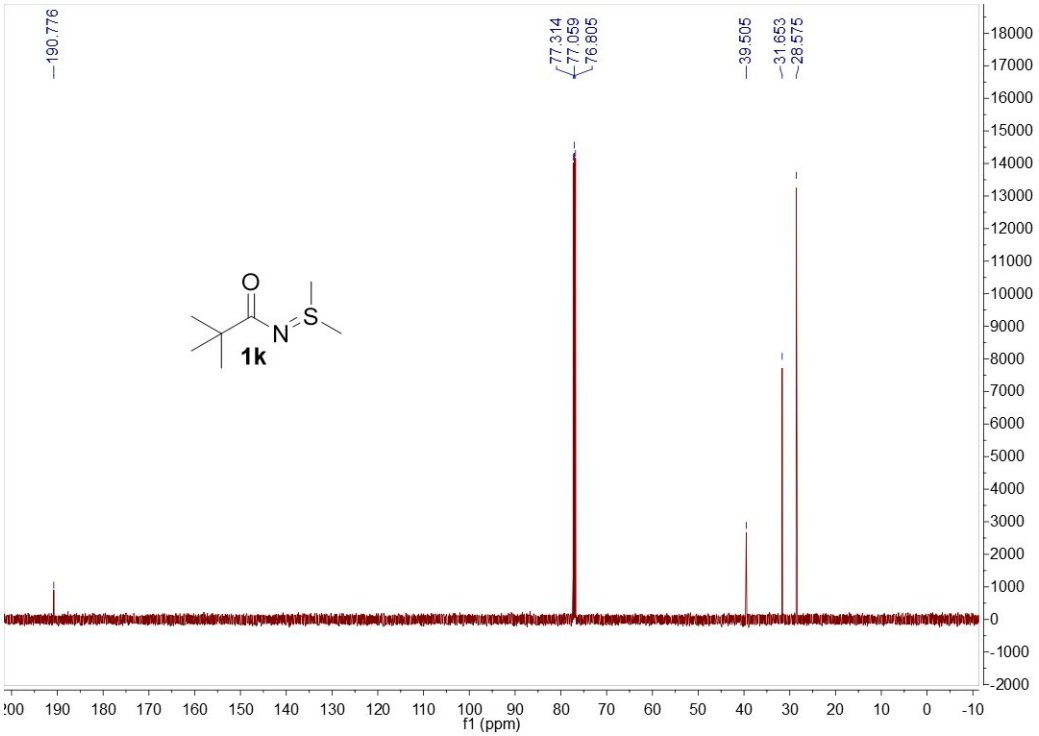
^{13}C NMR of compound **1j** in $CDCl_3$



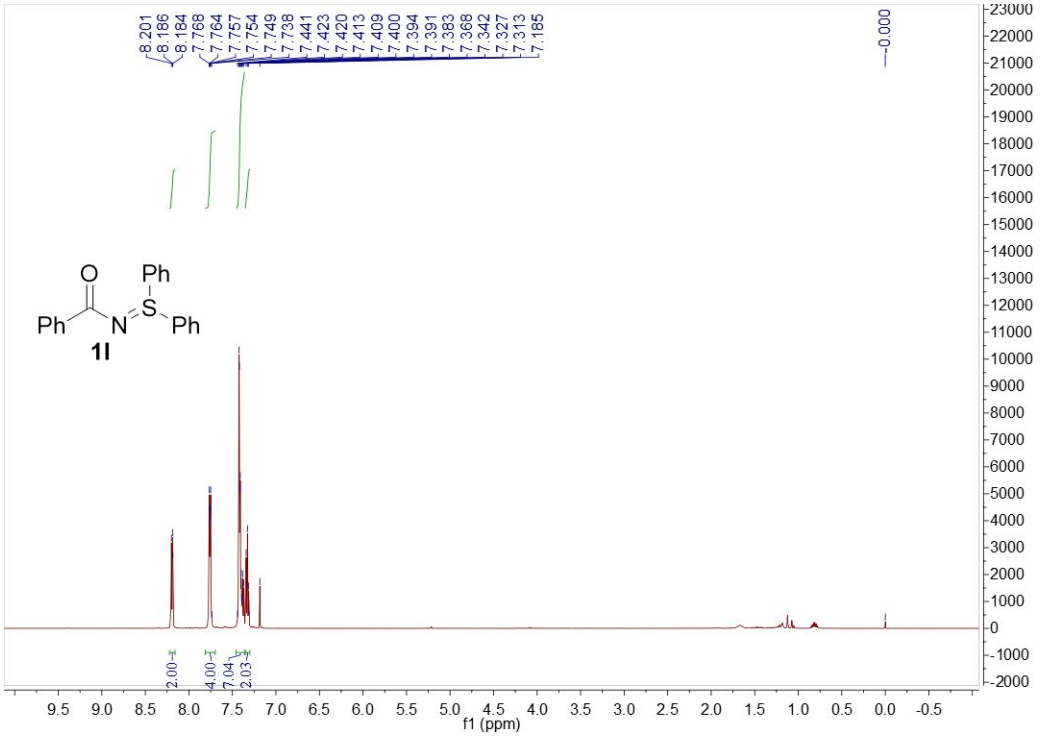
^{1}H NMR of compound **1k** in $CDCl_3$



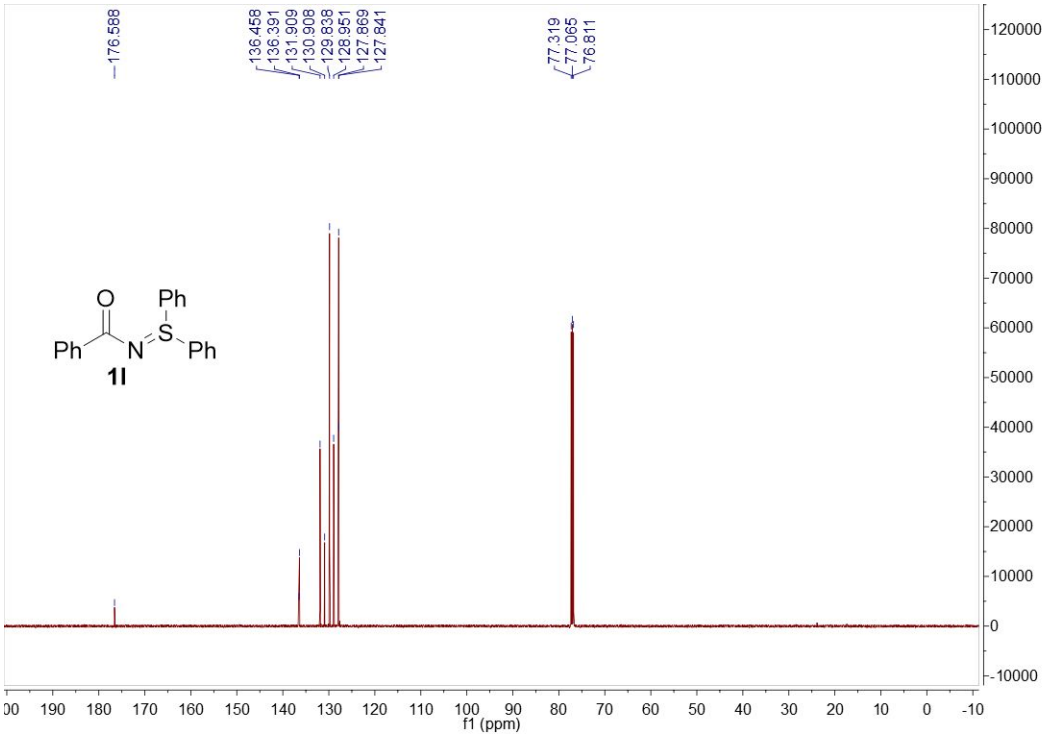
^{13}C NMR of compound **1k** in $CDCl_3$



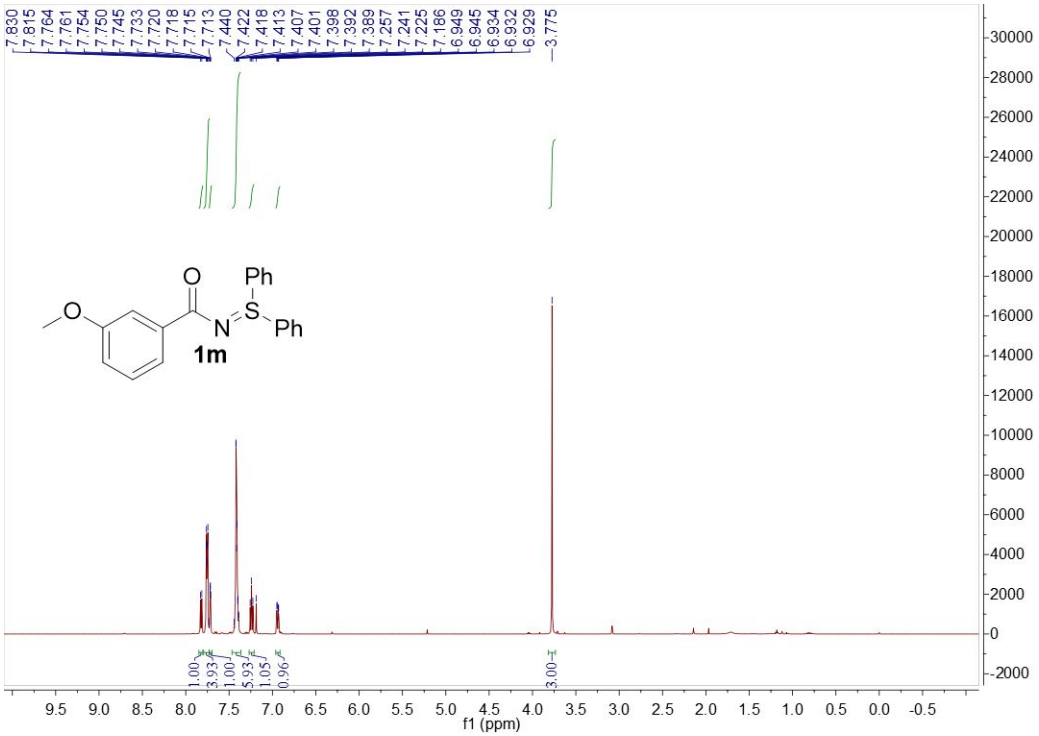
^{1}H NMR of compound **1l** in $CDCl_3$



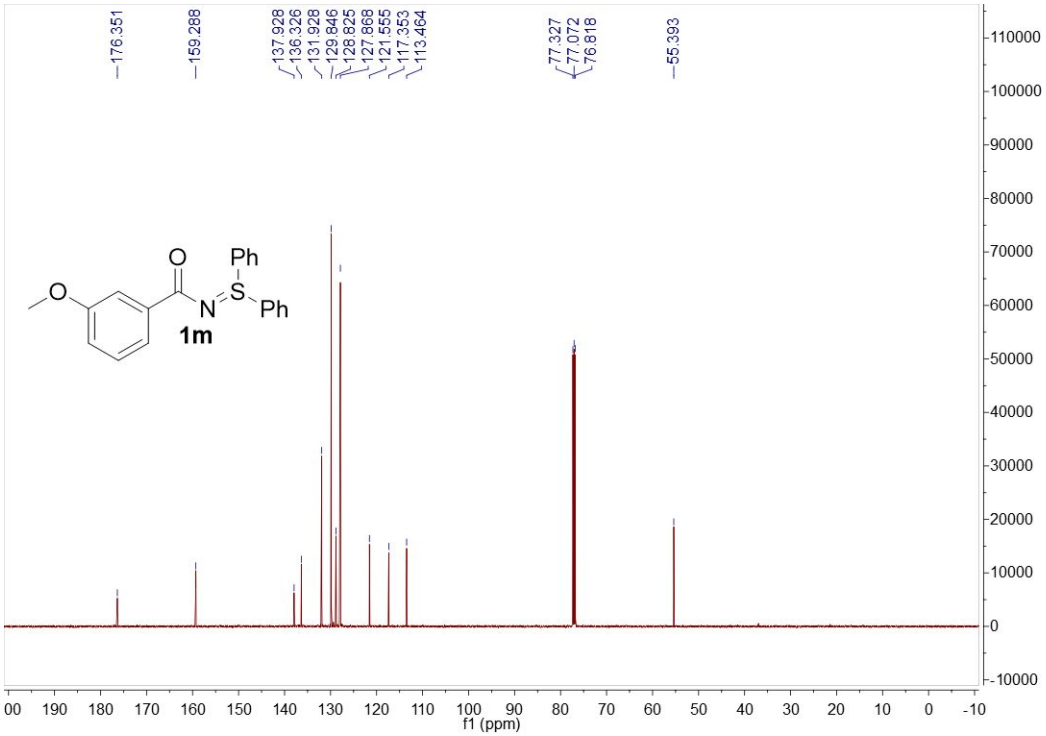
^{13}C NMR of compound **1l** in $CDCl_3$



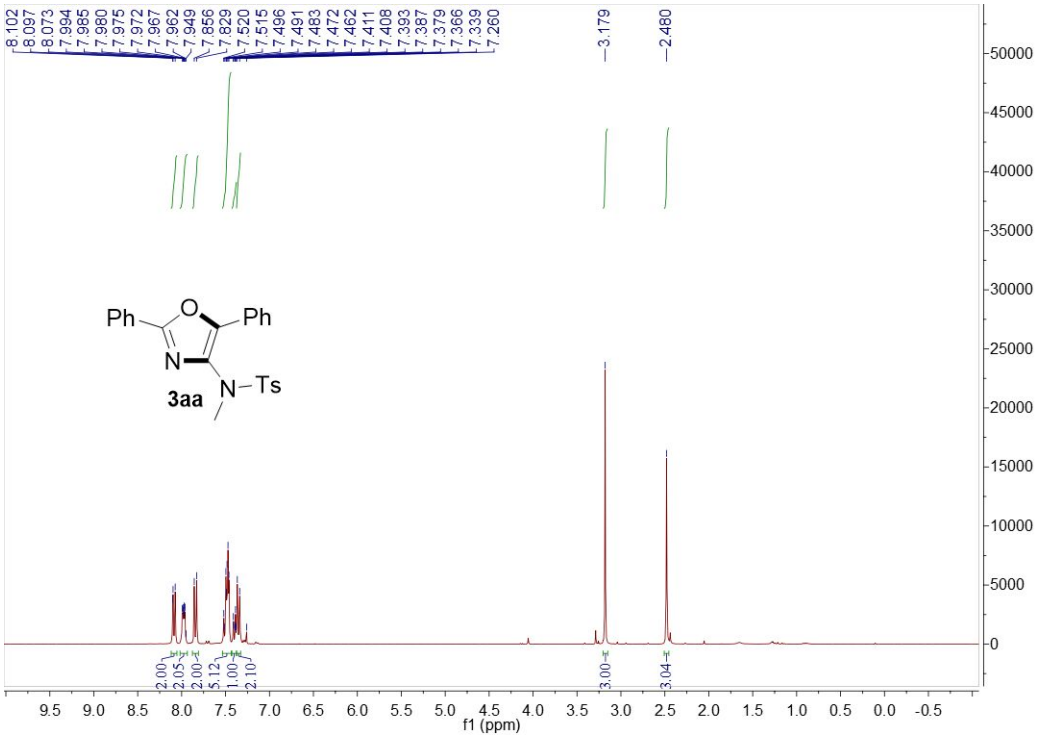
^{1}H NMR of compound **1m** in $CDCl_3$



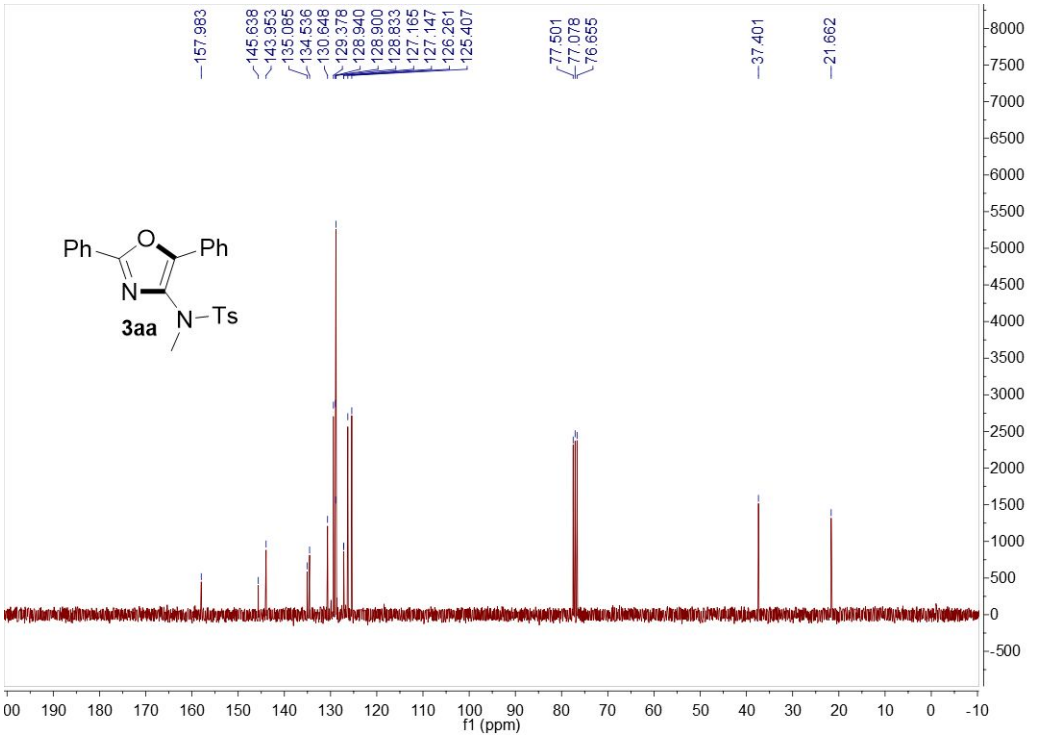
^{13}C NMR of compound **1m** in $CDCl_3$



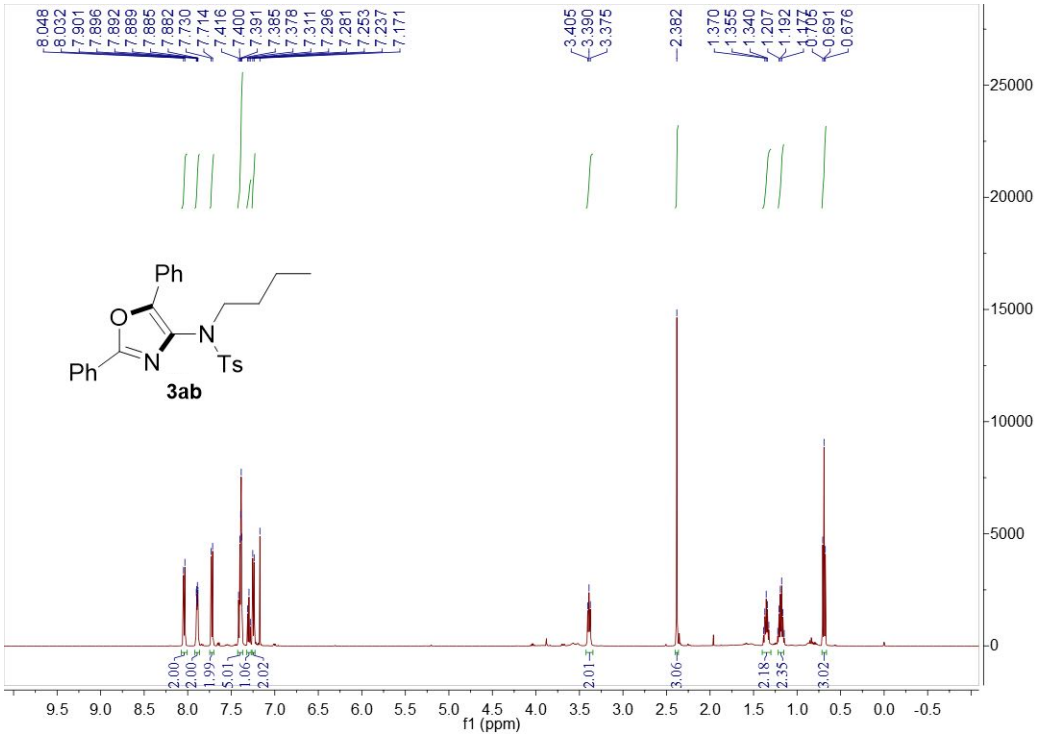
^{1}H NMR of compound **3aa** in $CDCl_3$



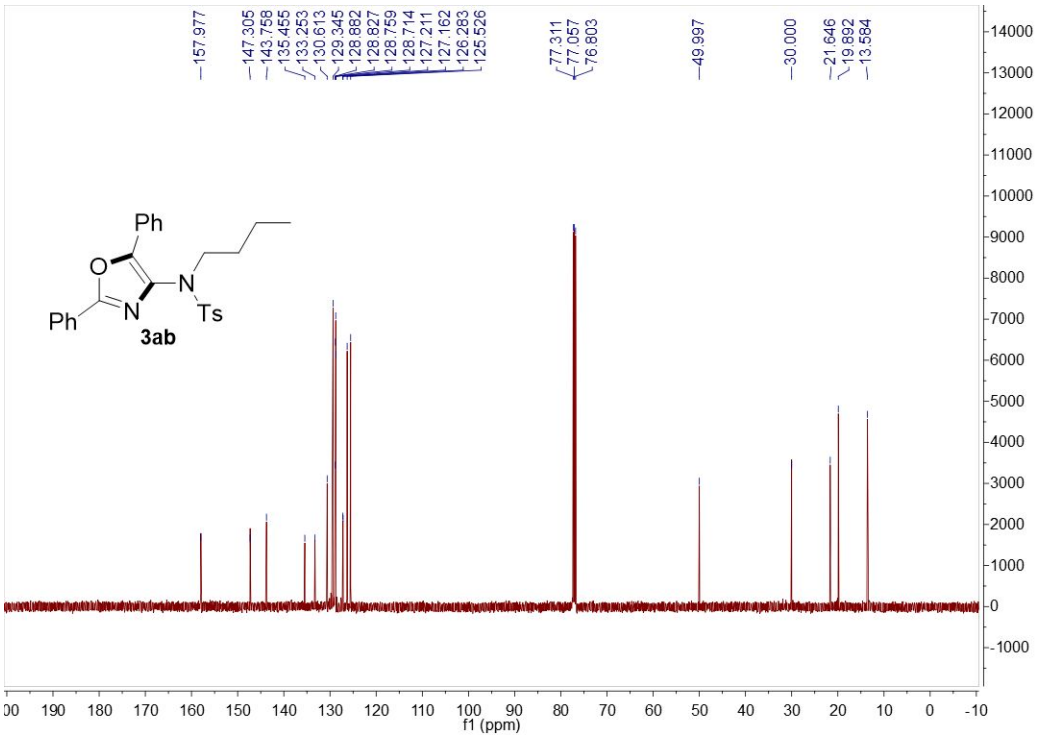
^{13}C NMR of compound **3aa** in $CDCl_3$



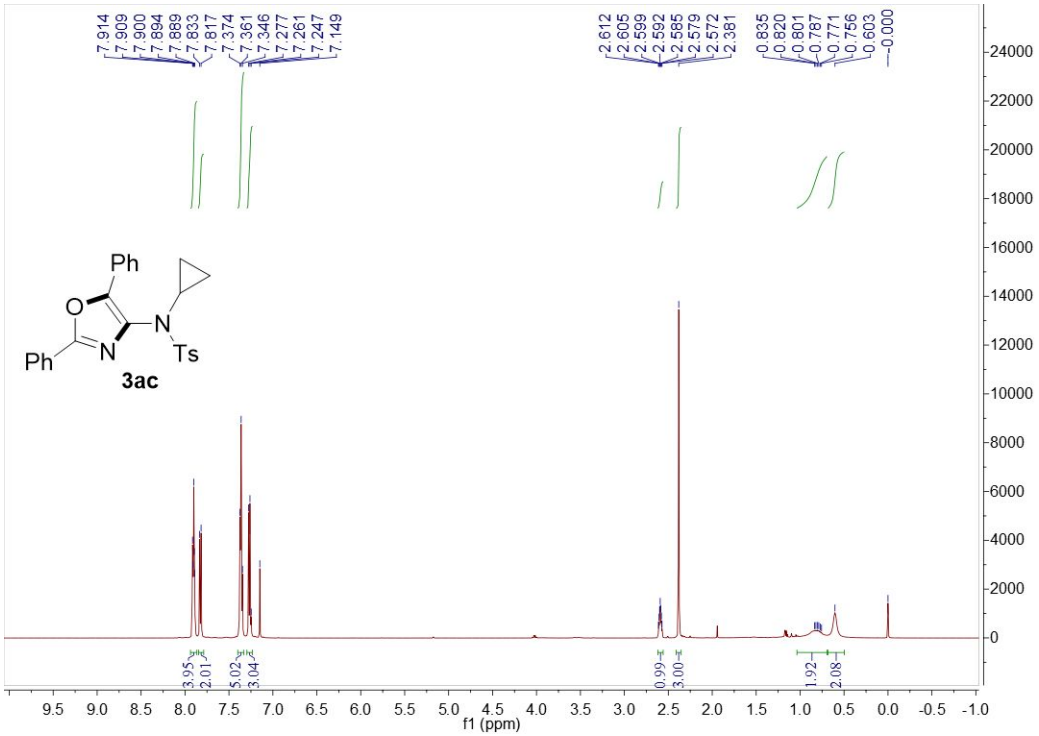
^{1}H NMR of compound **3ab** in $CDCl_3$



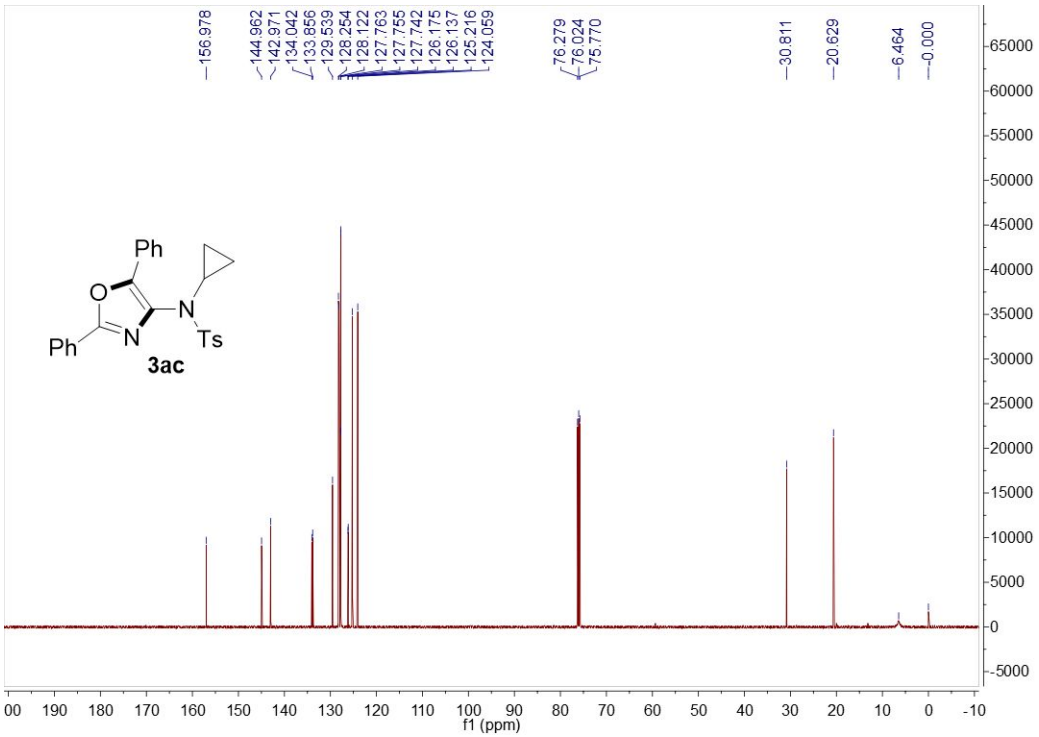
^{13}C NMR of compound **3ab** in $CDCl_3$



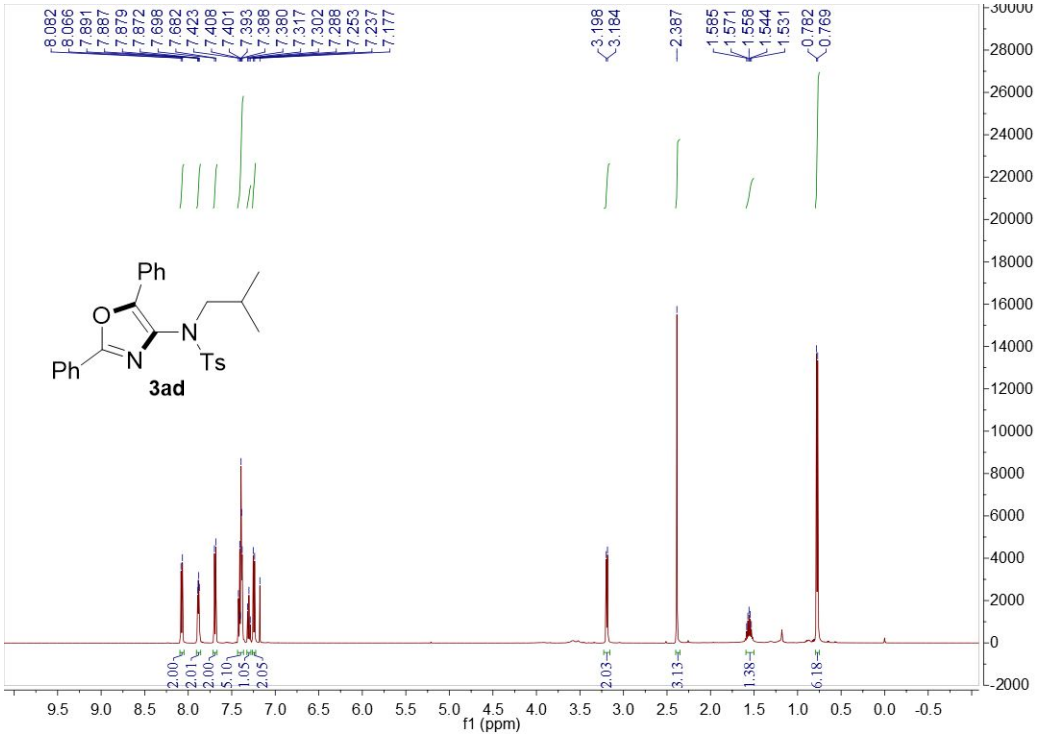
^{1}H NMR of compound **3ac** in $CDCl_3$



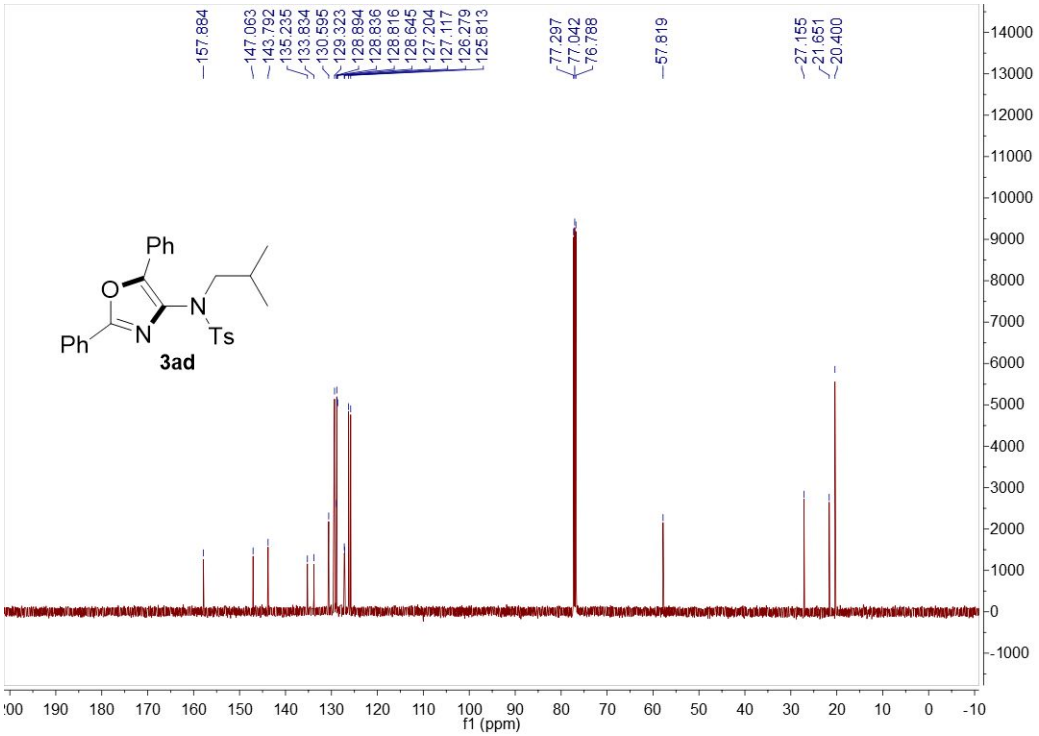
^{13}C NMR of compound **3ac** in $CDCl_3$



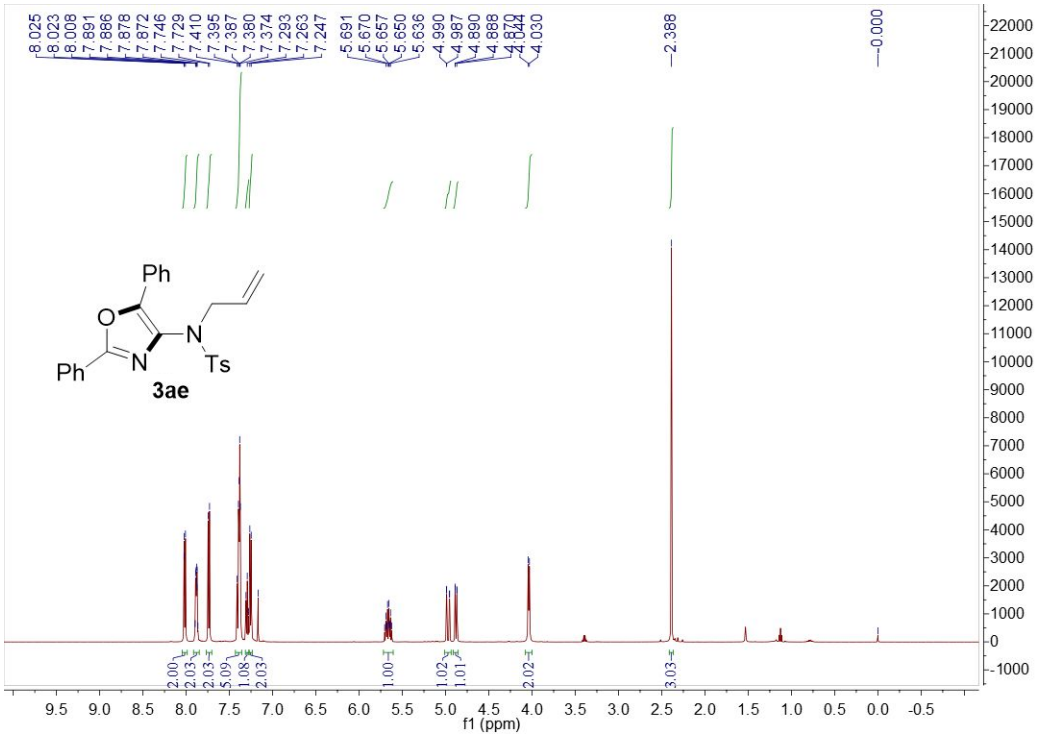
^{1}H NMR of compound **3ad** in $CDCl_3$



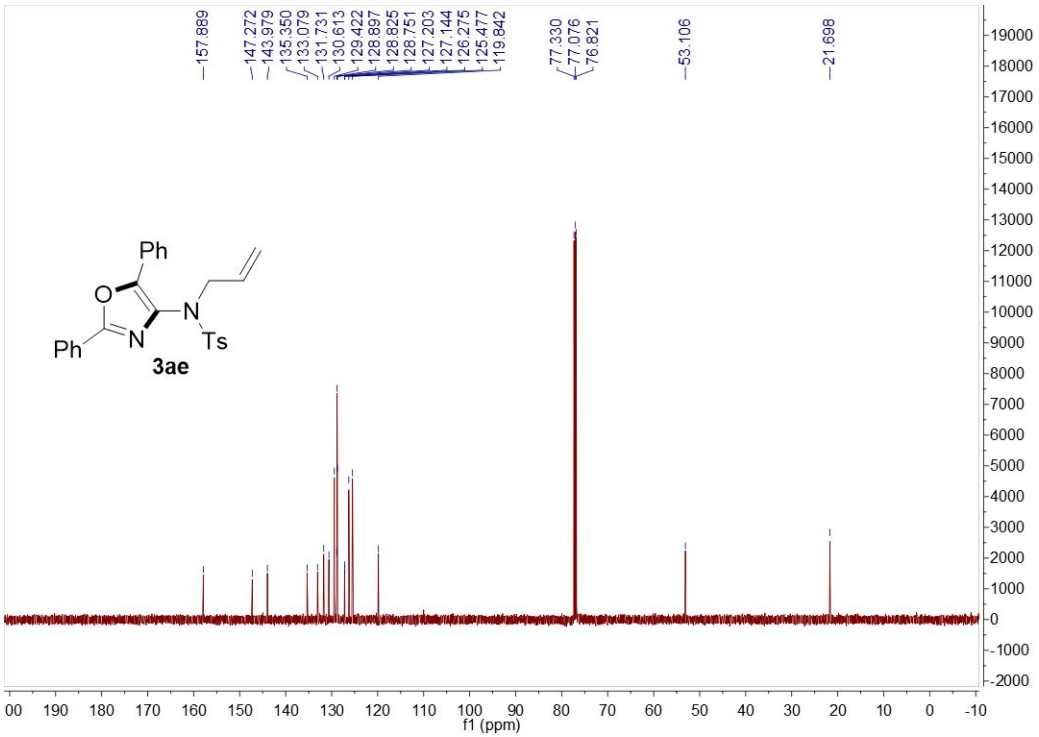
^{13}C NMR of compound **3ad** in $CDCl_3$



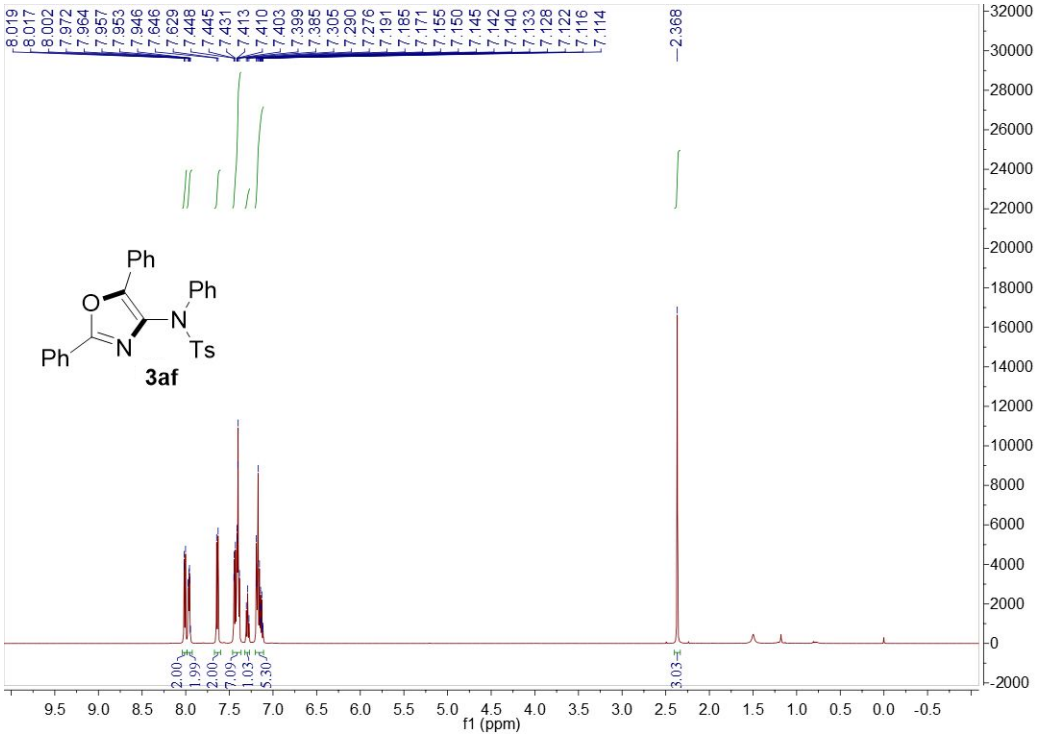
^{1}H NMR of compound **3ae** in $CDCl_3$



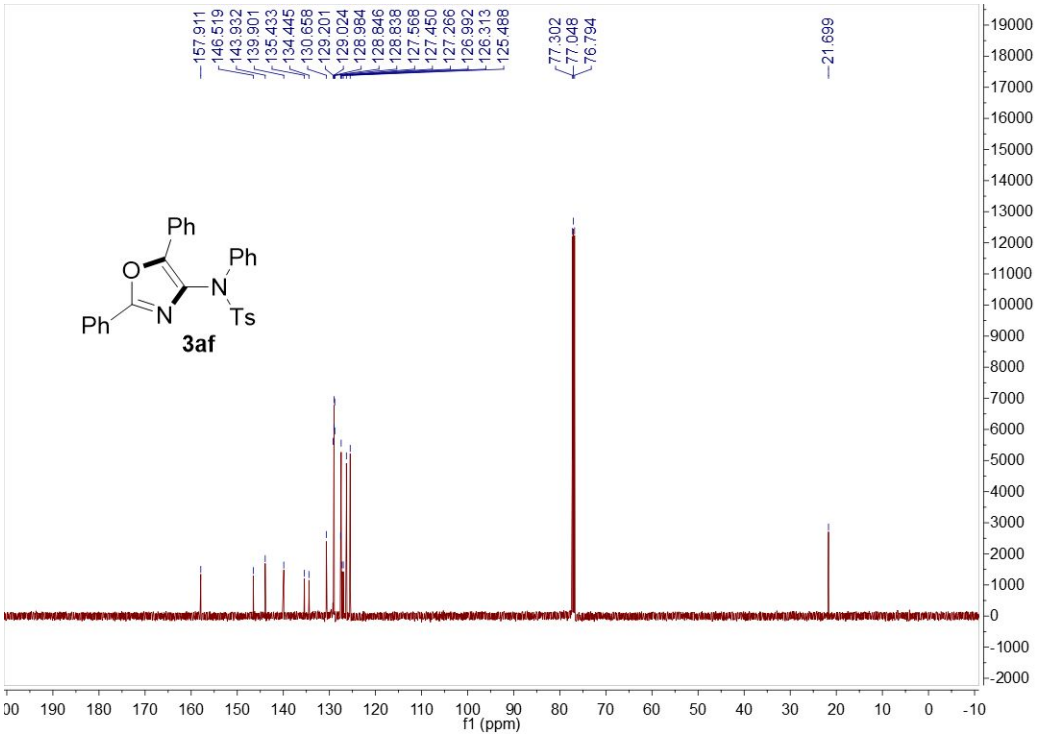
^{13}C NMR of compound **3ae** in $CDCl_3$



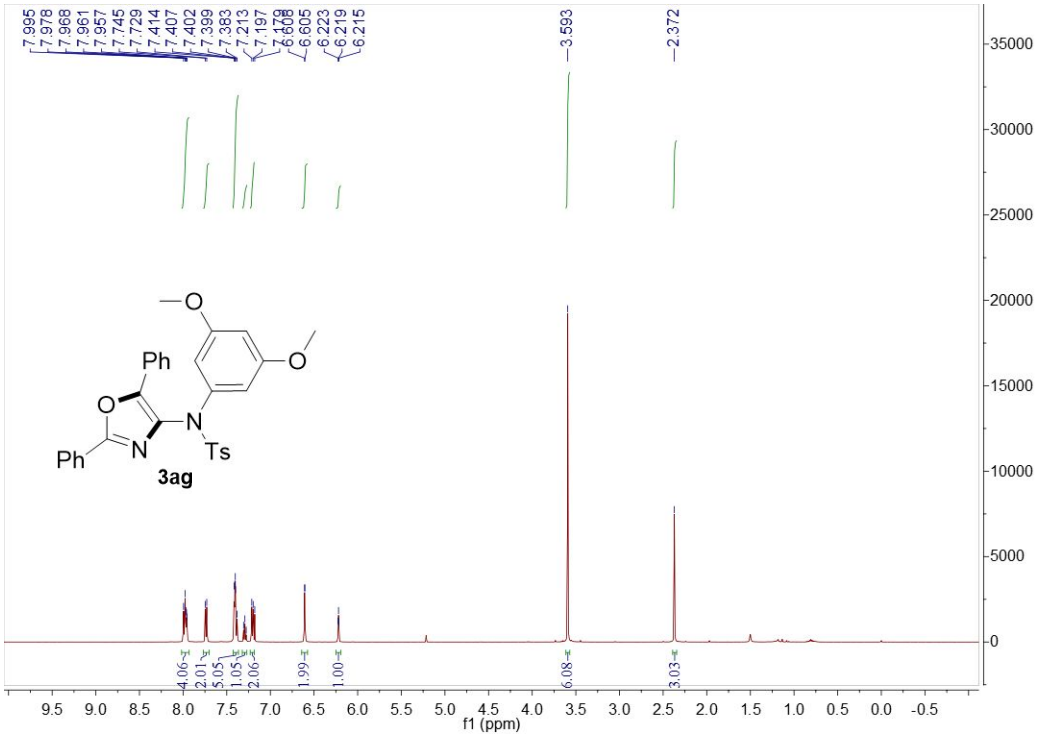
^{1}H NMR of compound **3af** in $CDCl_3$



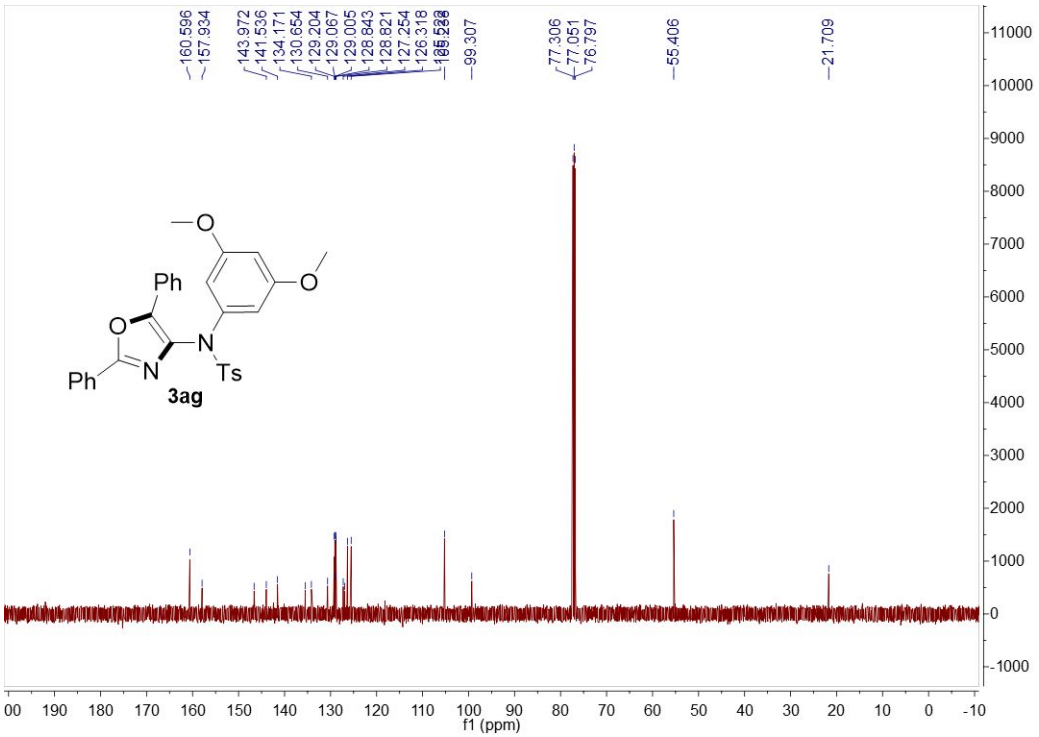
^{13}C NMR of compound **3af** in $CDCl_3$



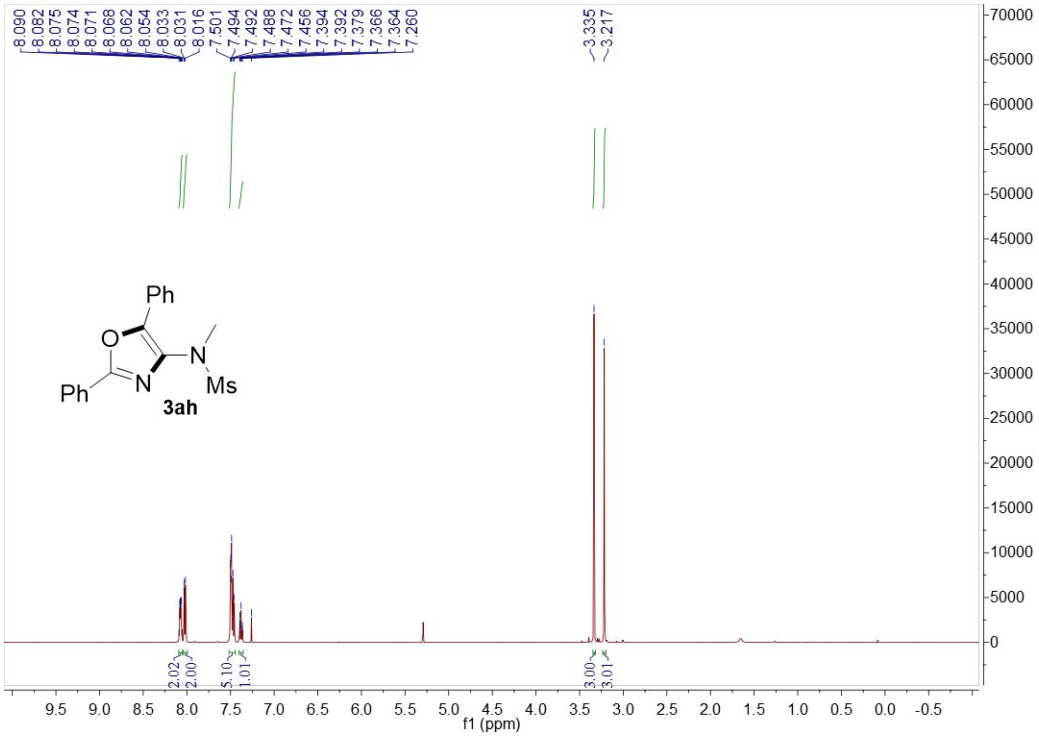
^{1}H NMR of compound **3ag** in $CDCl_3$



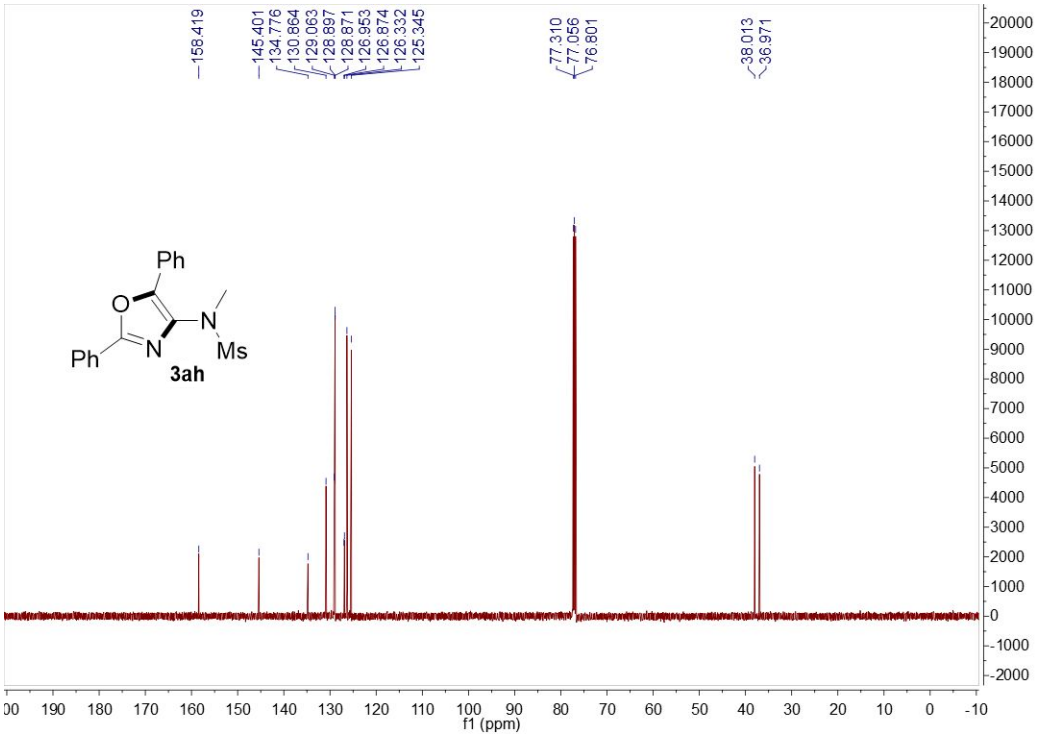
^{13}C NMR of compound **3ag** in $CDCl_3$



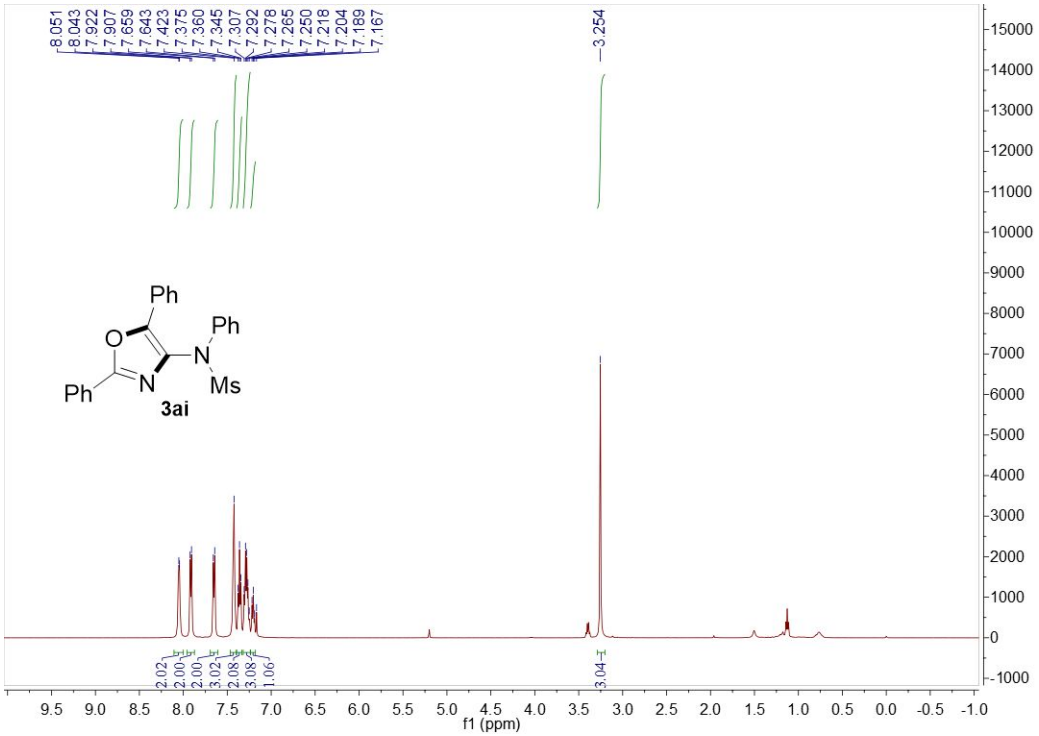
^{1}H NMR of compound **3ah** in $CDCl_3$



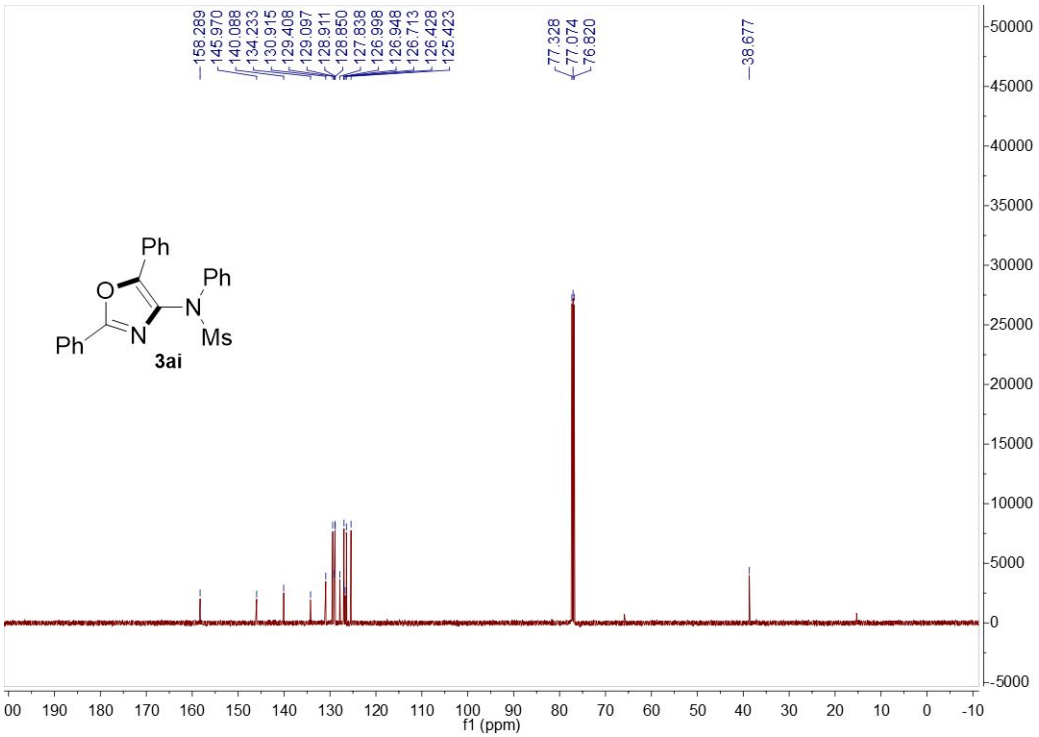
^{13}C NMR of compound **3ah** in $CDCl_3$



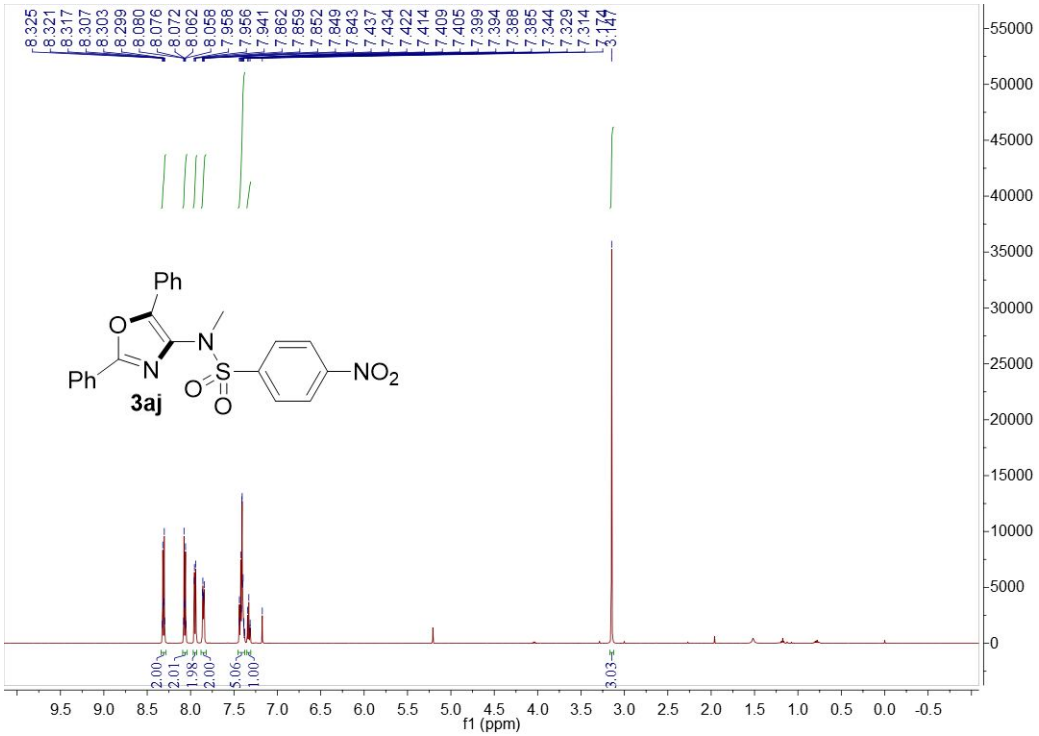
^{1}H NMR of compound **3ai** in $CDCl_3$



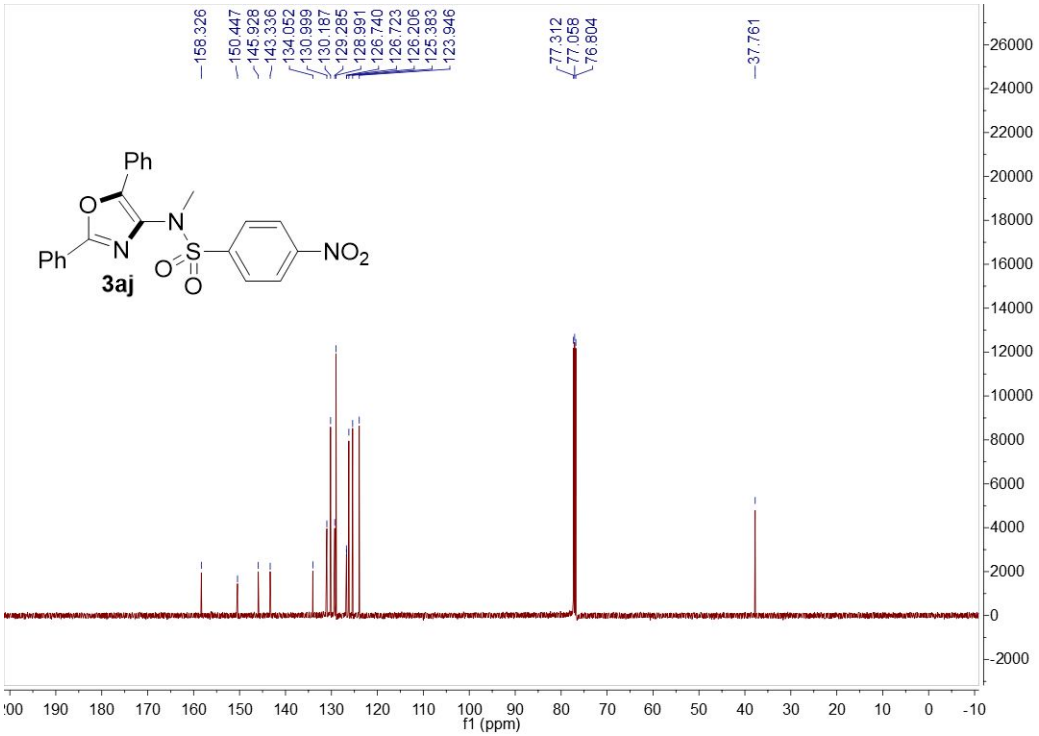
^{13}C NMR of compound **3ai** in $CDCl_3$



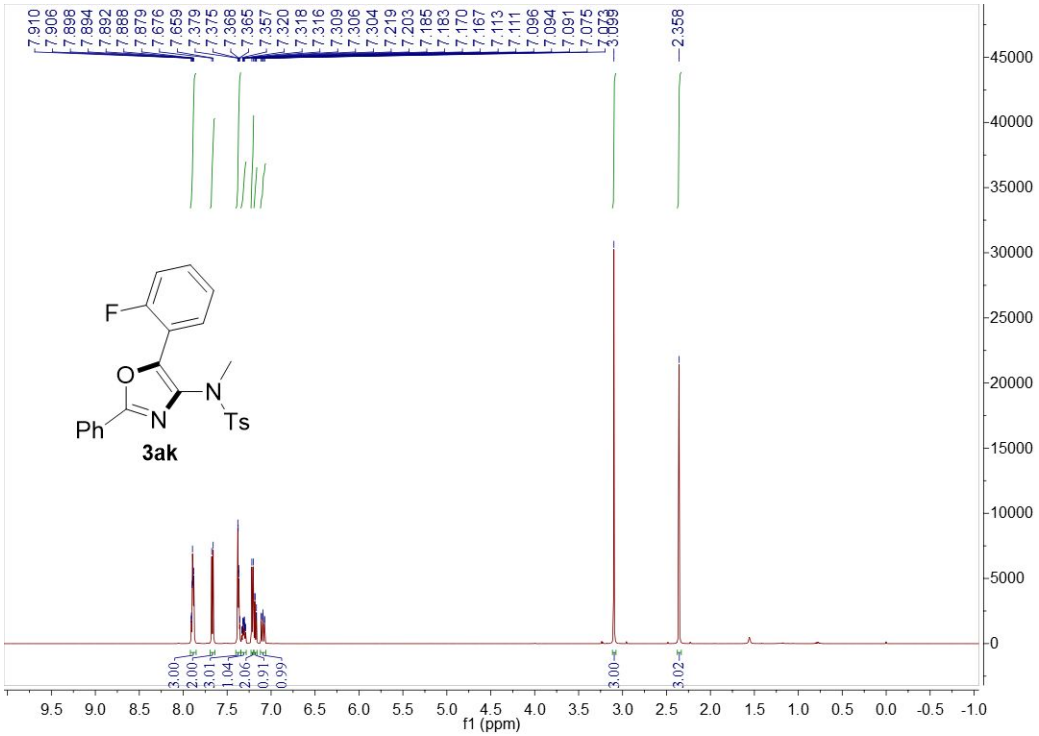
^{1}H NMR of compound **3aj** in $CDCl_3$



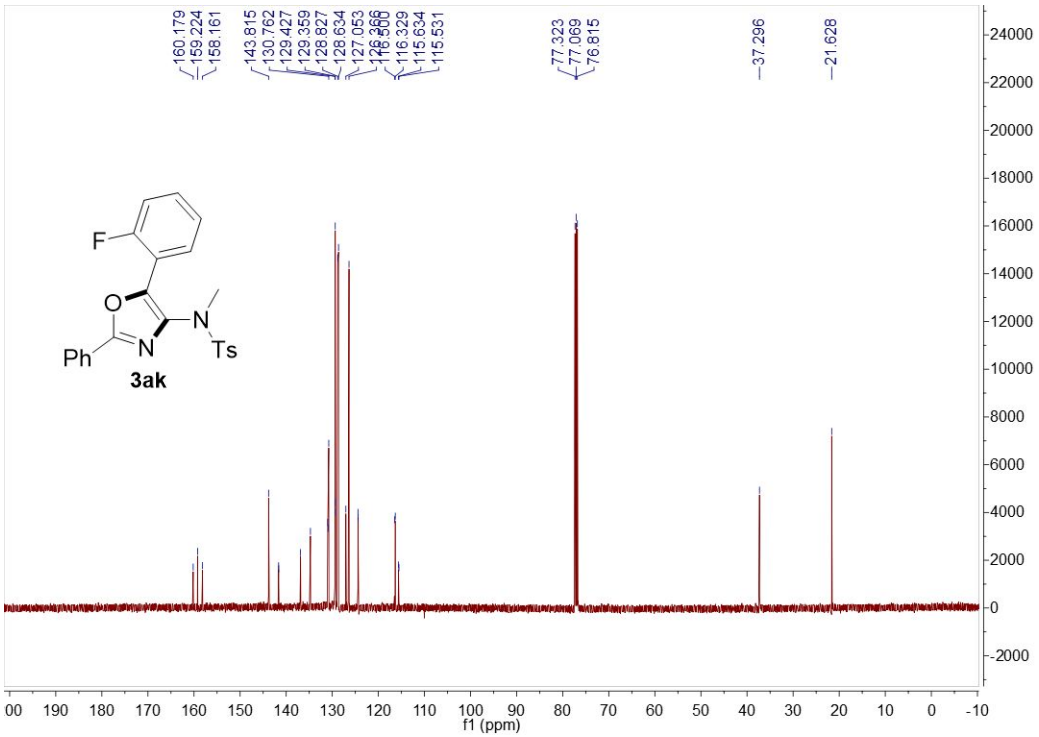
^{13}C NMR of compound **3aj** in $CDCl_3$



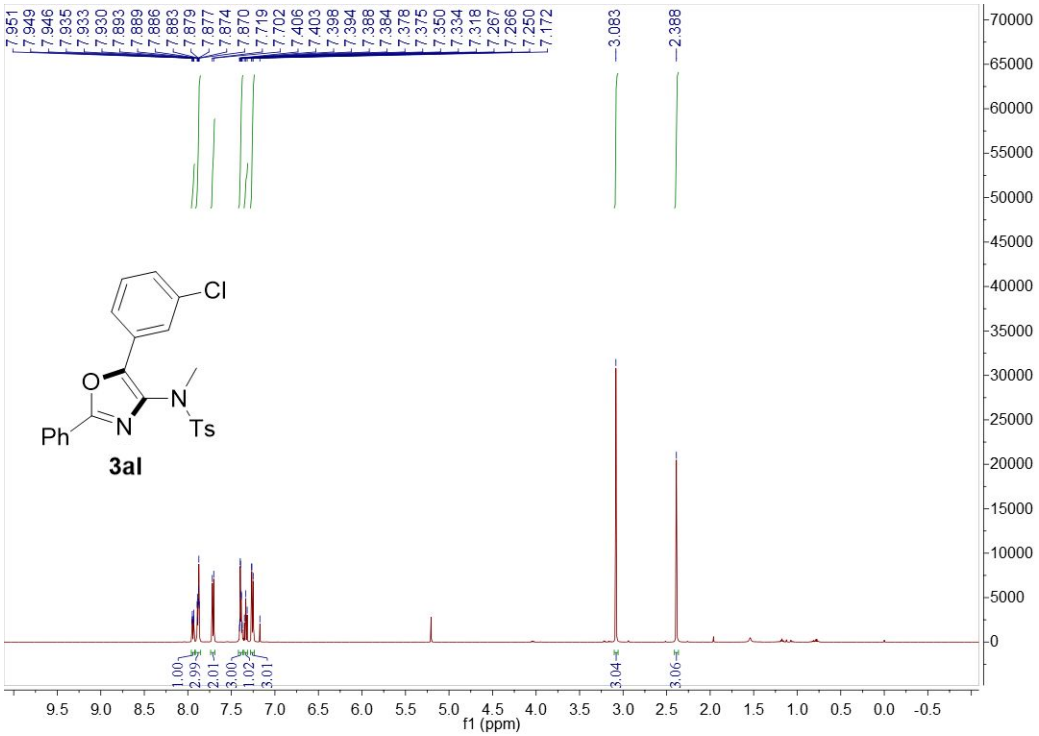
^{1}H NMR of compound **3ak** in $CDCl_3$



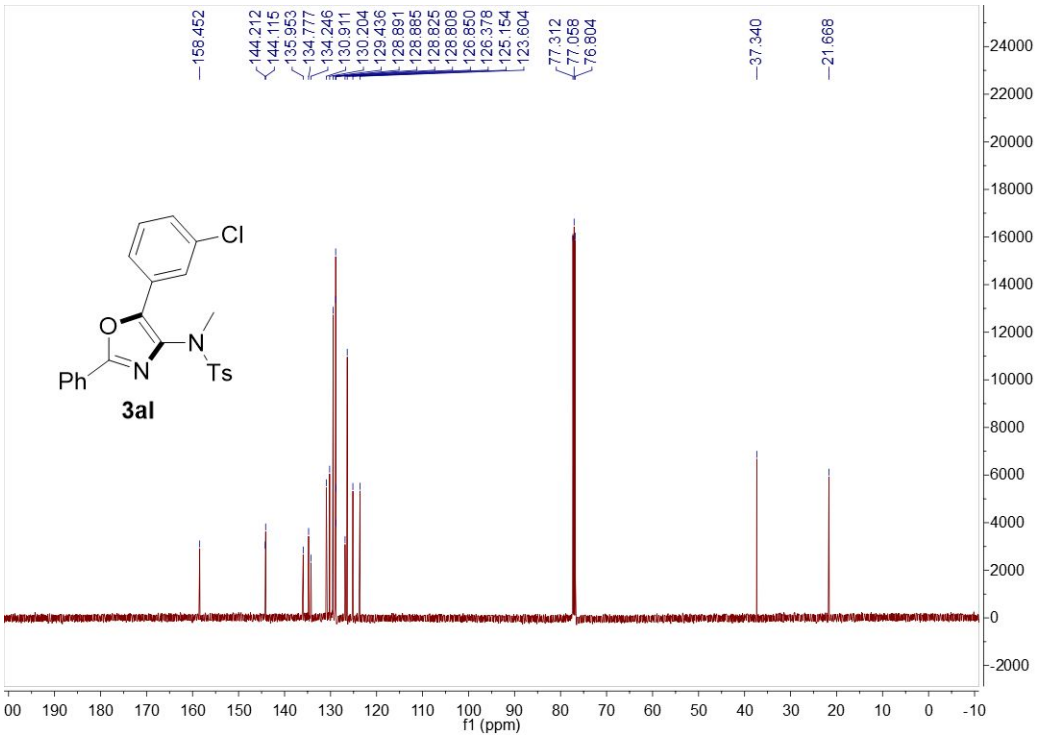
^{13}C NMR of compound **3ak** in $CDCl_3$



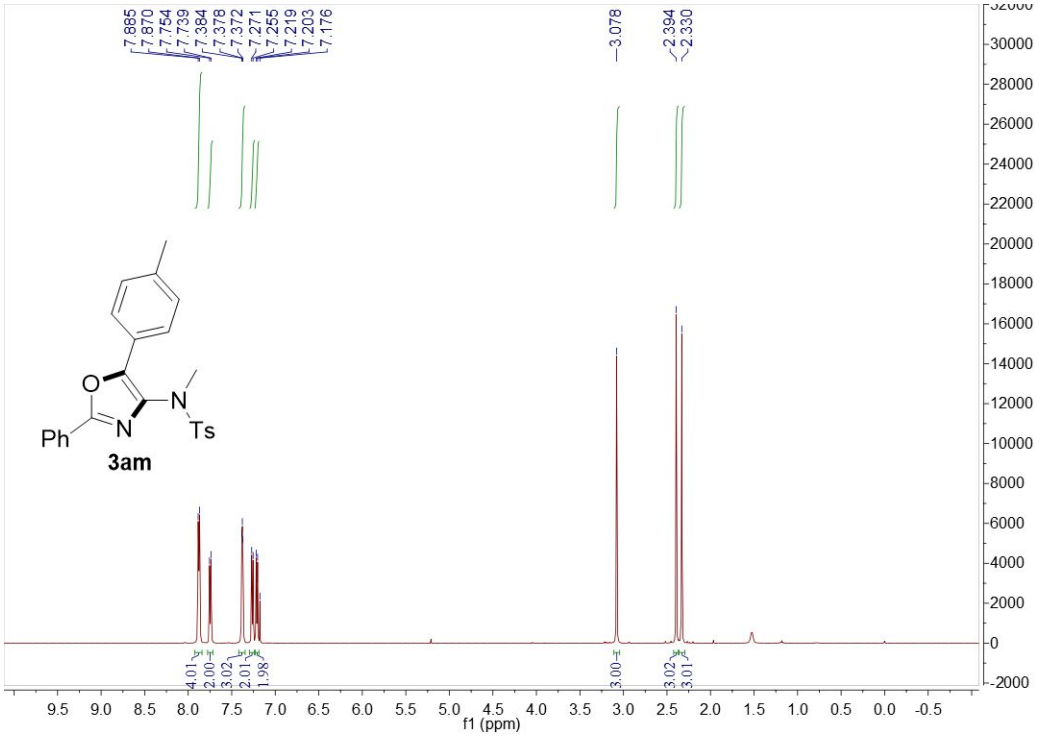
^{1}H NMR of compound **3al** in $CDCl_3$



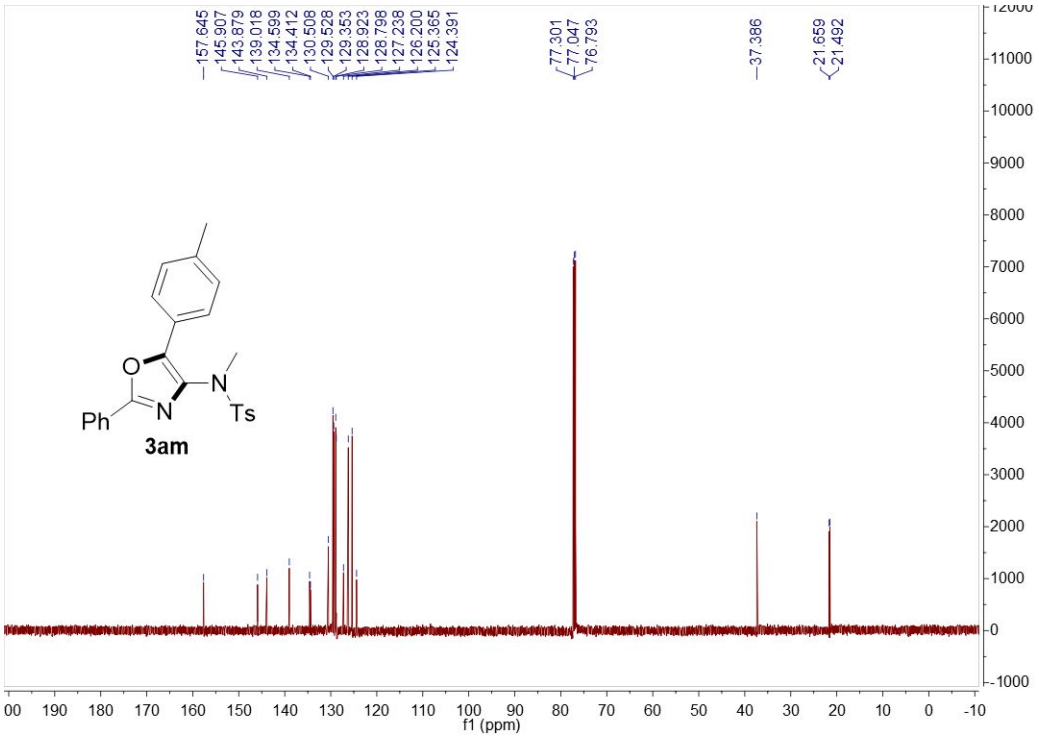
^{13}C NMR of compound **3al** in $CDCl_3$



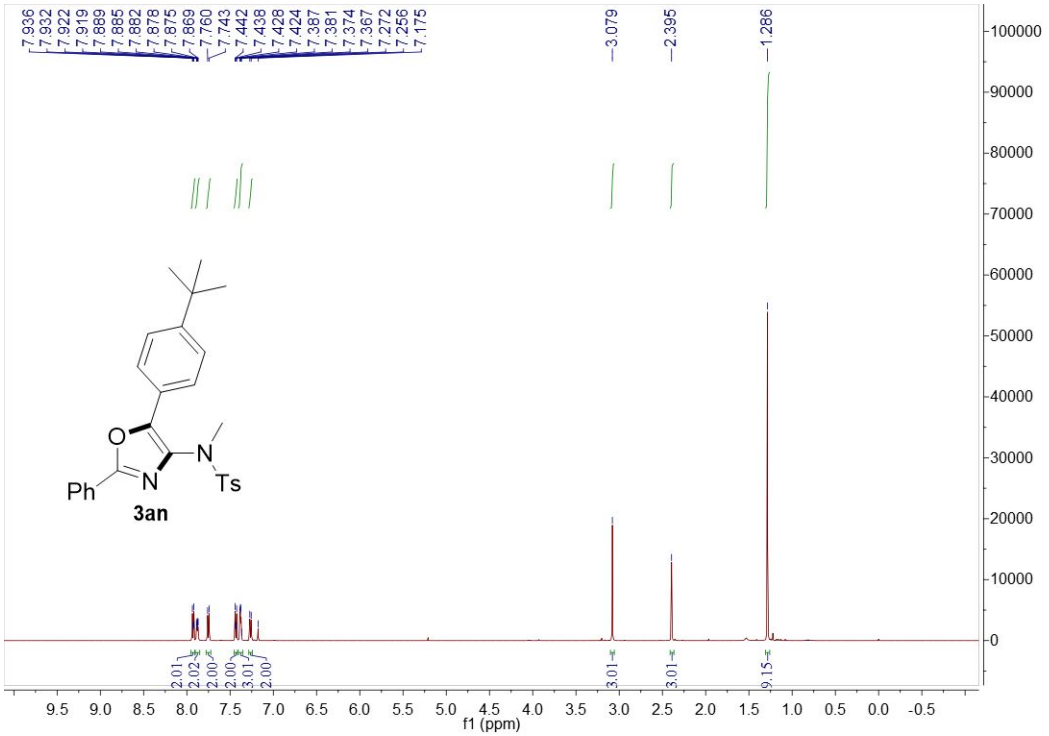
^{1}H NMR of compound **3am** in $CDCl_3$



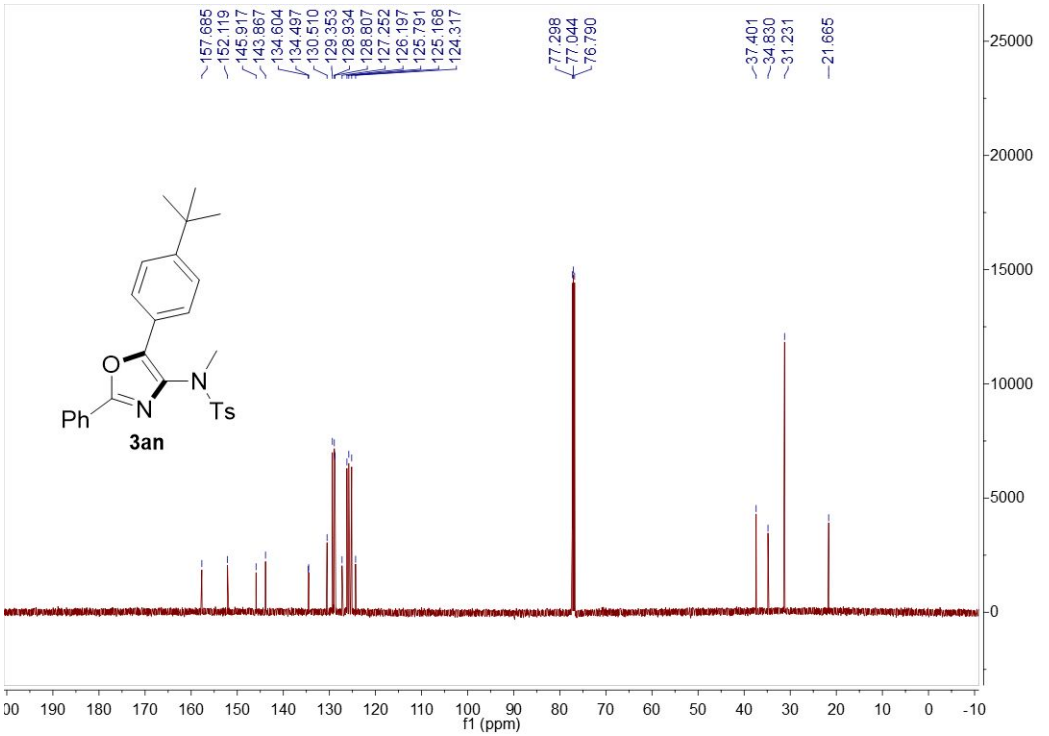
^{13}C NMR of compound **3am** in $CDCl_3$



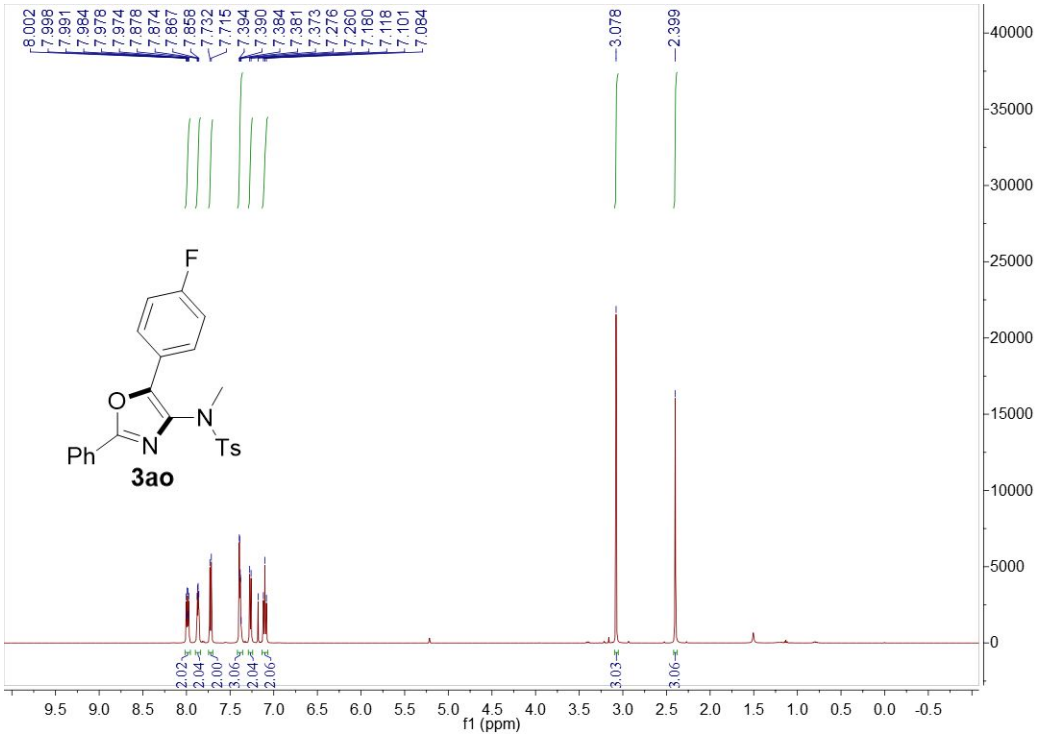
^{1}H NMR of compound **3an** in $CDCl_3$



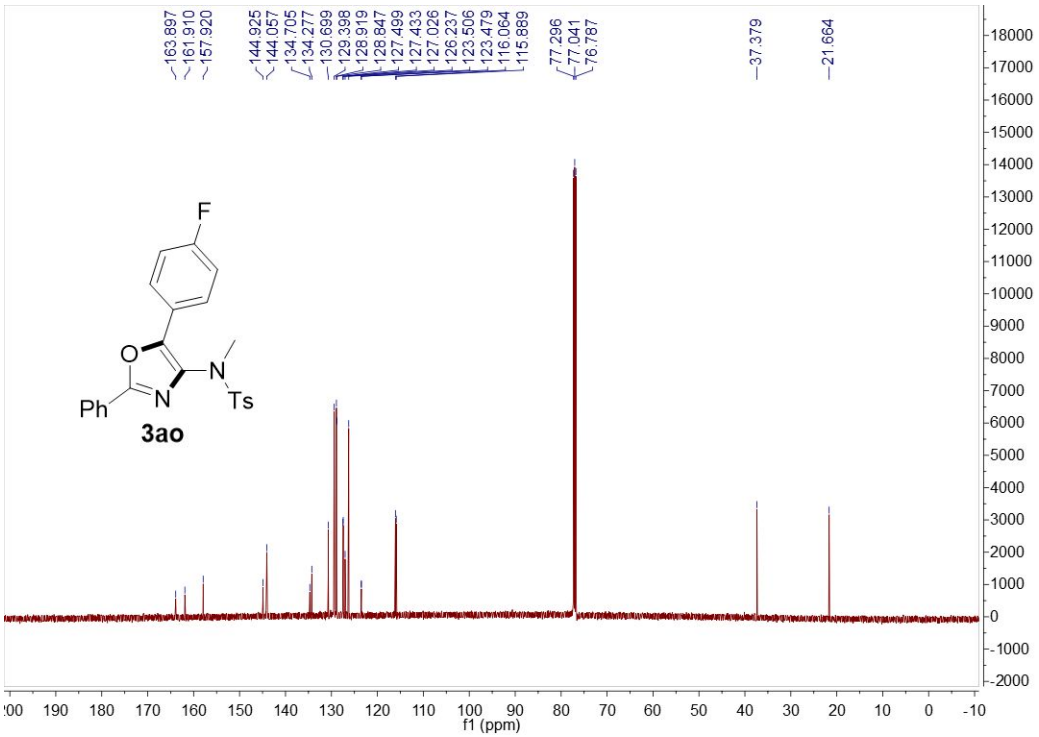
^{13}C NMR of compound **3an** in $CDCl_3$



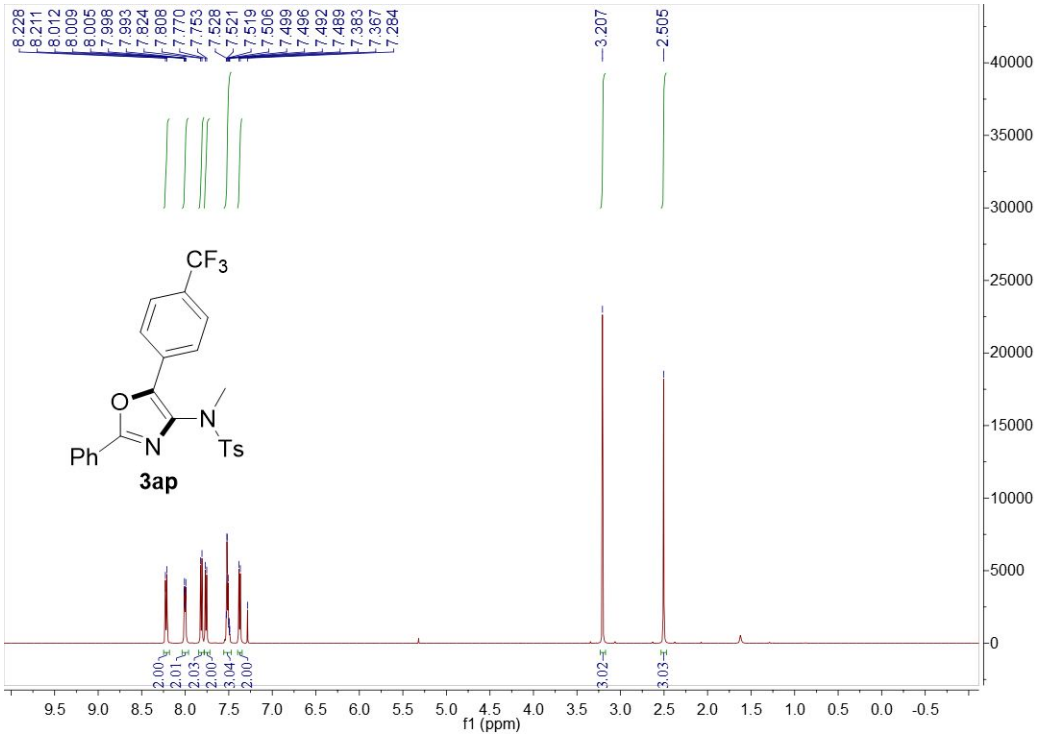
^{1}H NMR of compound **3ao** in $CDCl_3$



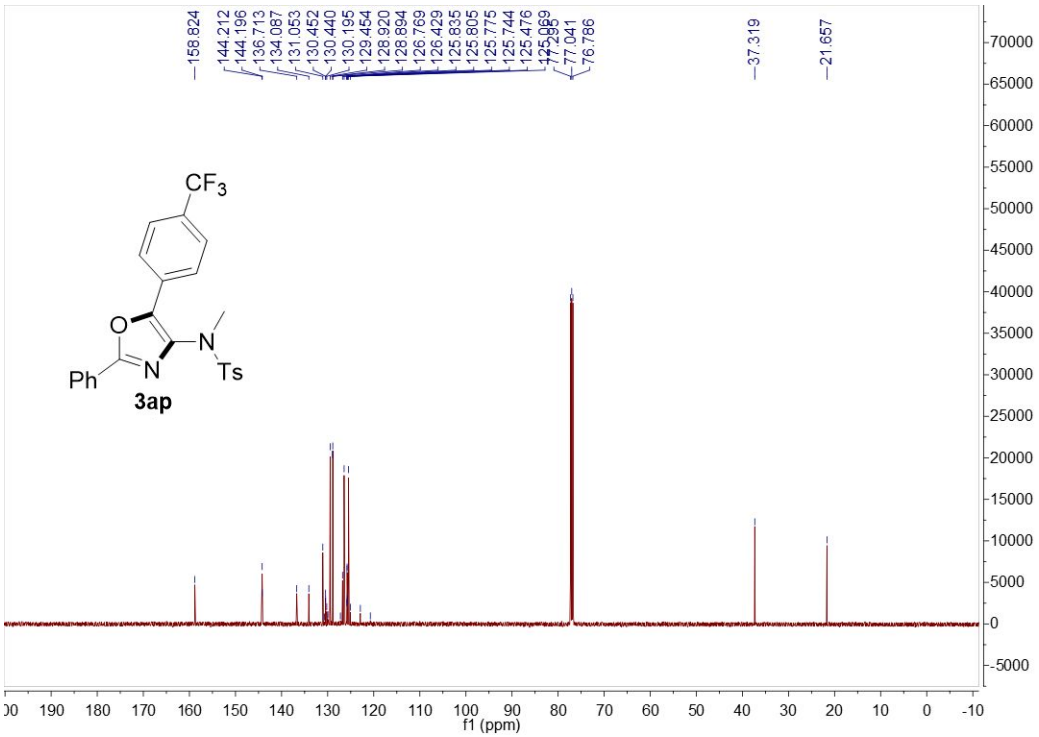
^{13}C NMR of compound **3ao** in $CDCl_3$



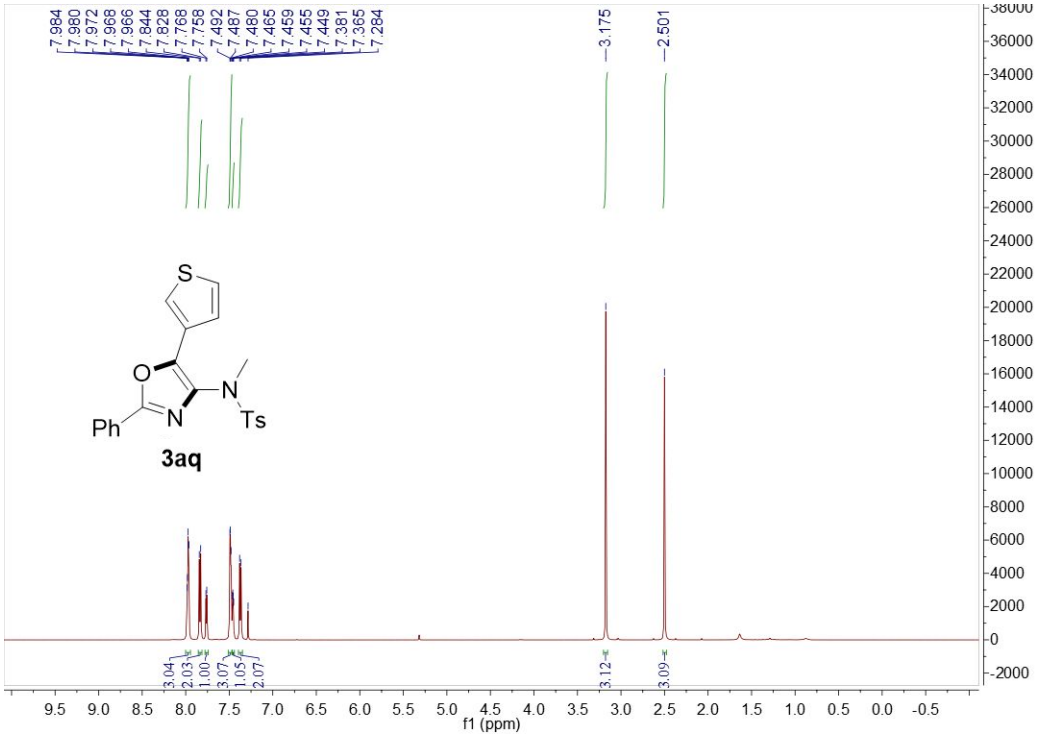
^{1}H NMR of compound **3ap** in $CDCl_3$



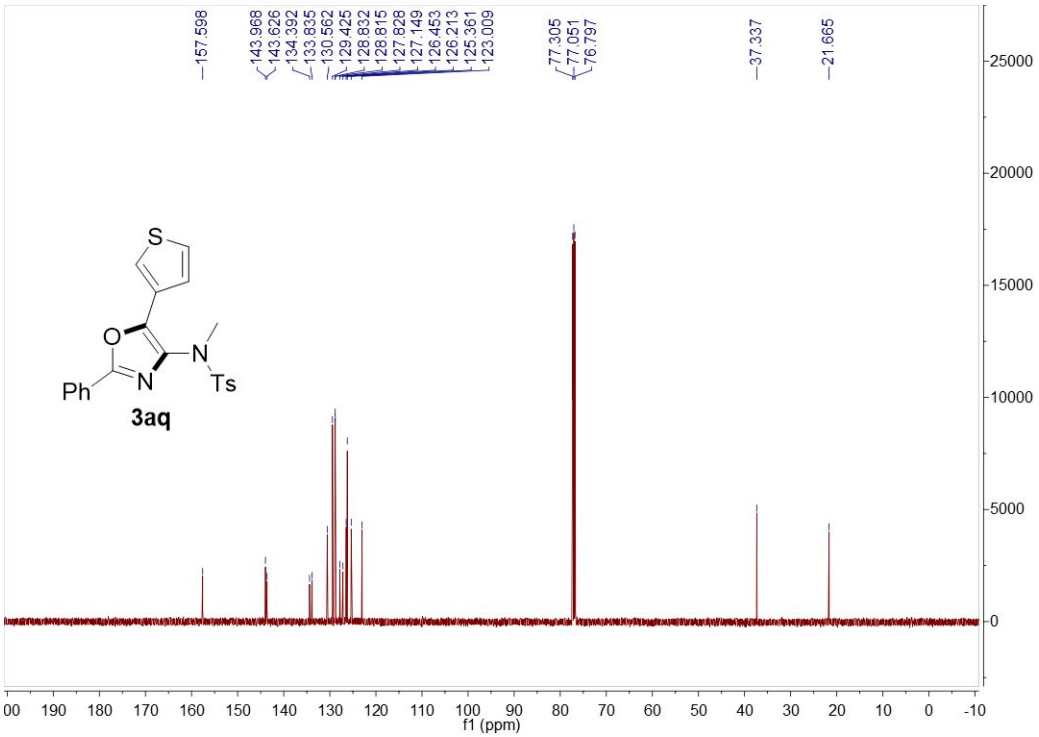
^{13}C NMR of compound **3ap** in $CDCl_3$



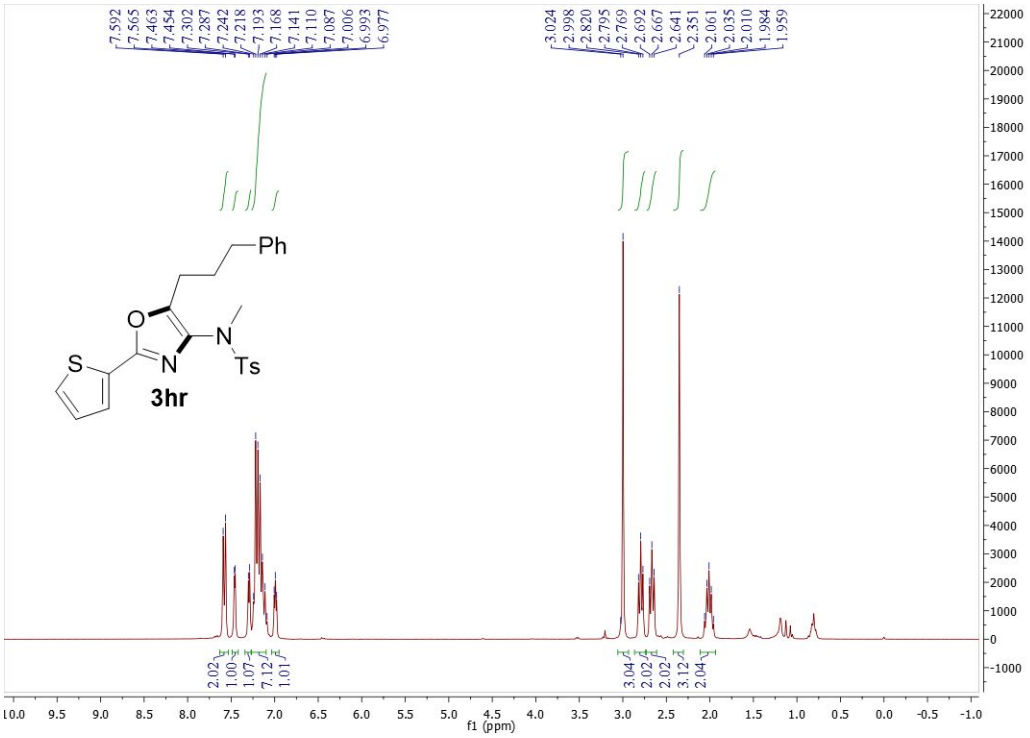
^{1}H NMR of compound **3aq** in $CDCl_3$



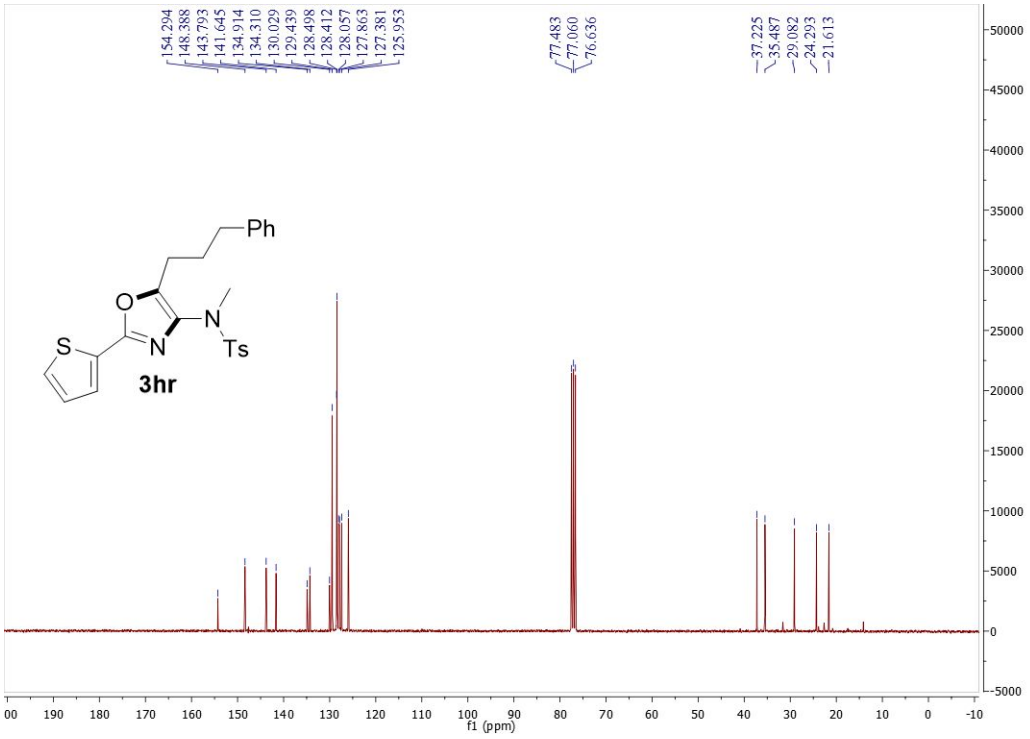
^{13}C NMR of compound **3aq** in $CDCl_3$



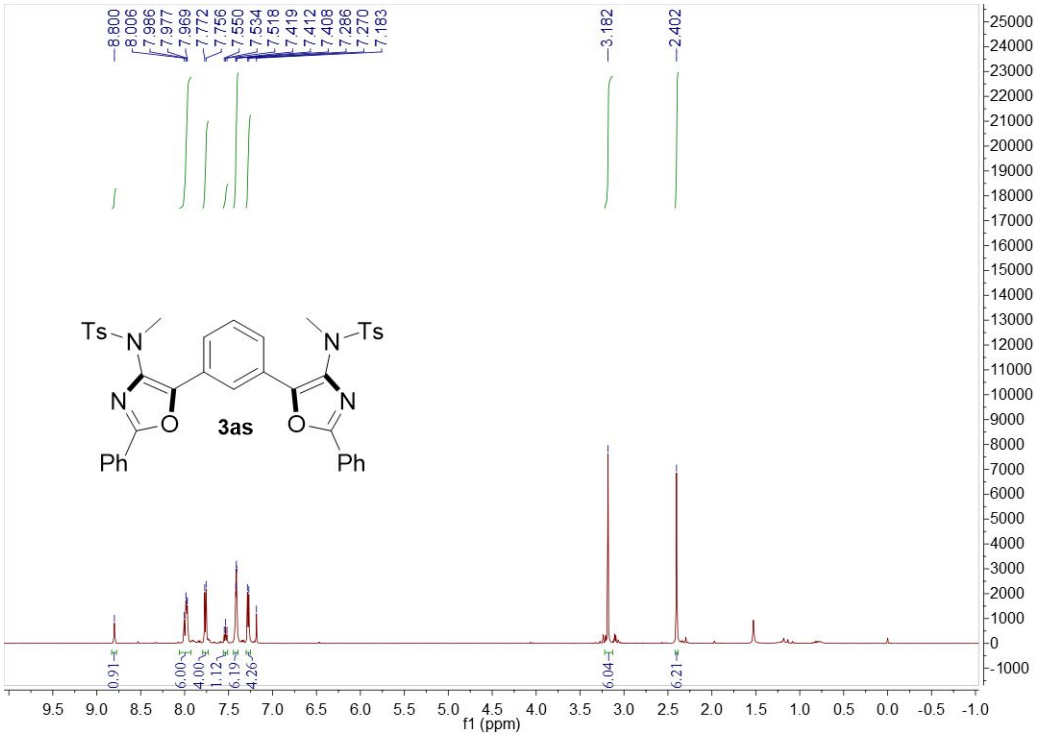
^{1}H NMR of compound **3hr** in $CDCl_3$



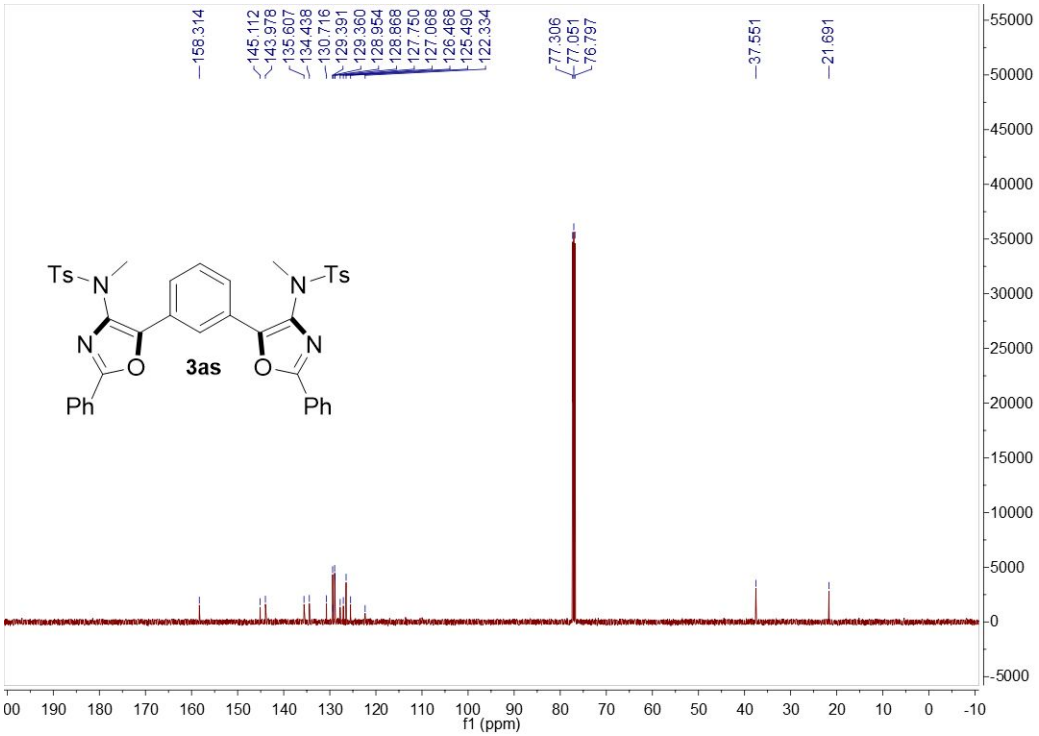
^{13}C NMR of compound **3hr** in $CDCl_3$



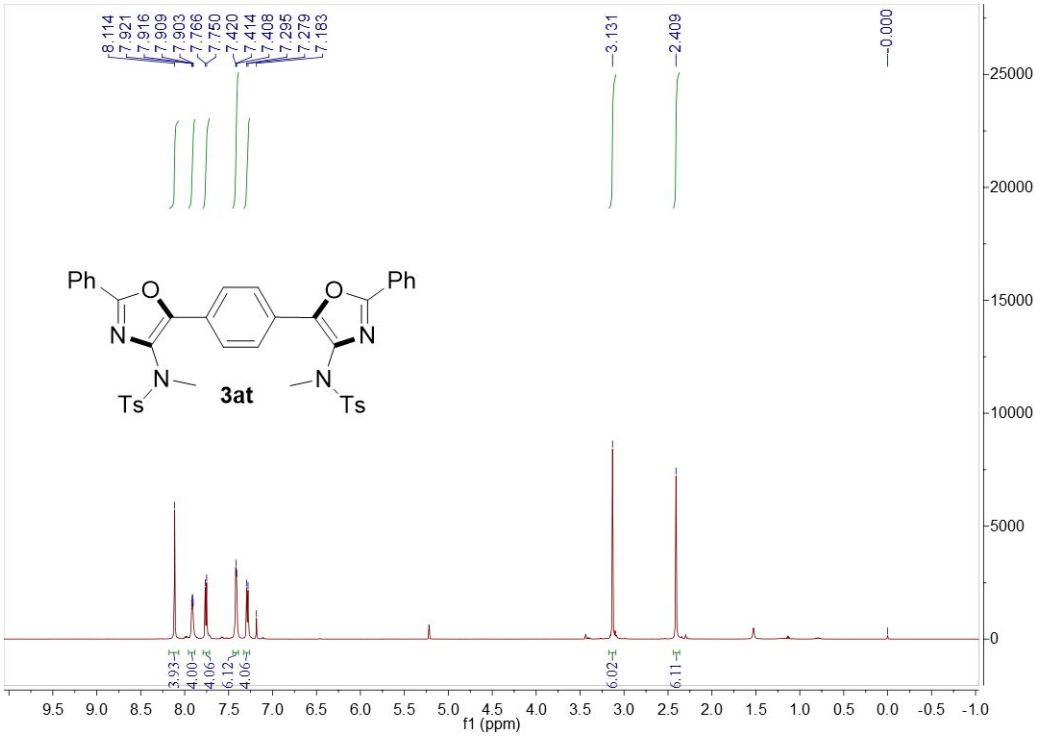
^{1}H NMR of compound **3as** in $CDCl_3$



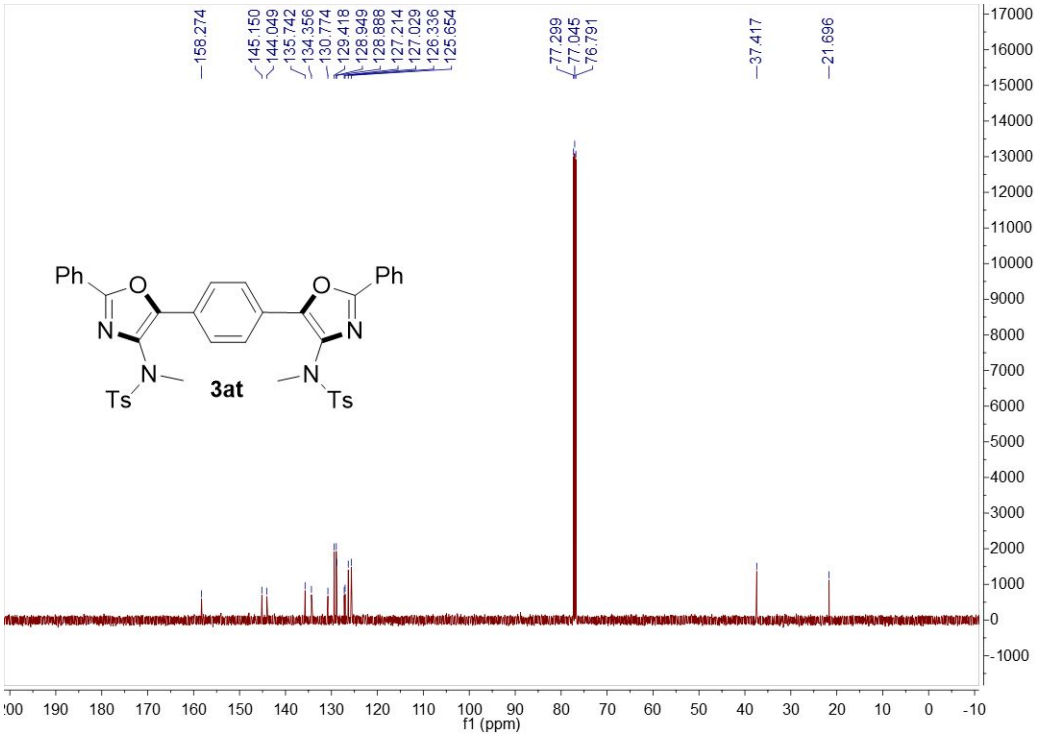
^{13}C NMR of compound **3as** in $CDCl_3$



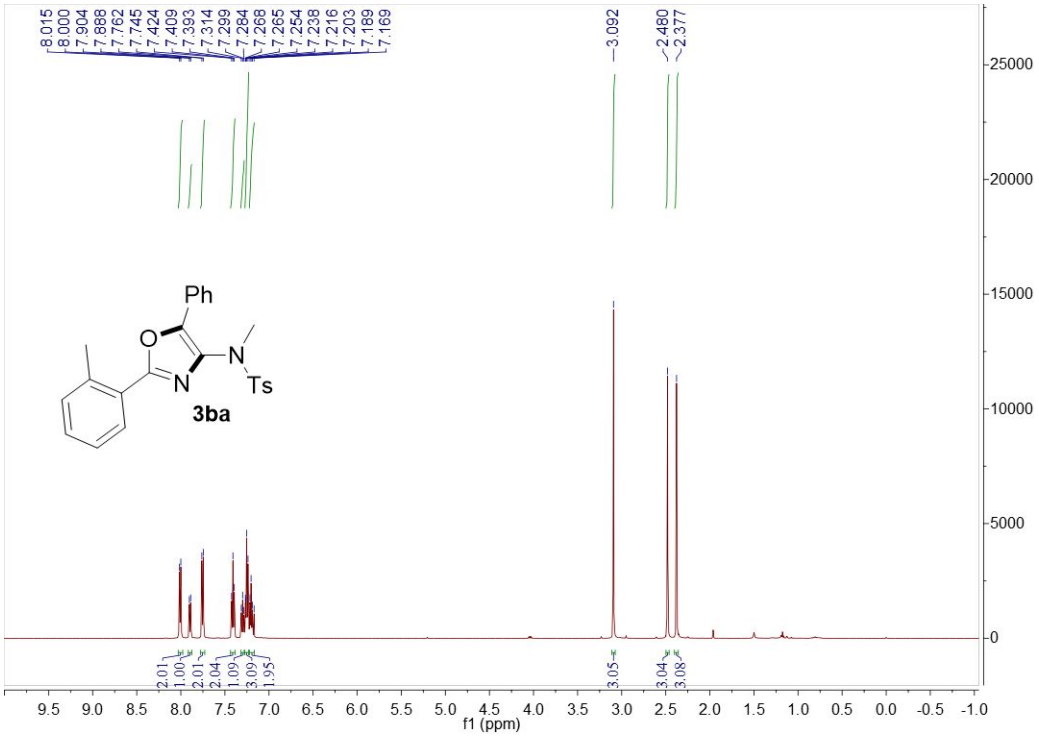
^{1}H NMR of compound **3at** in $CDCl_3$



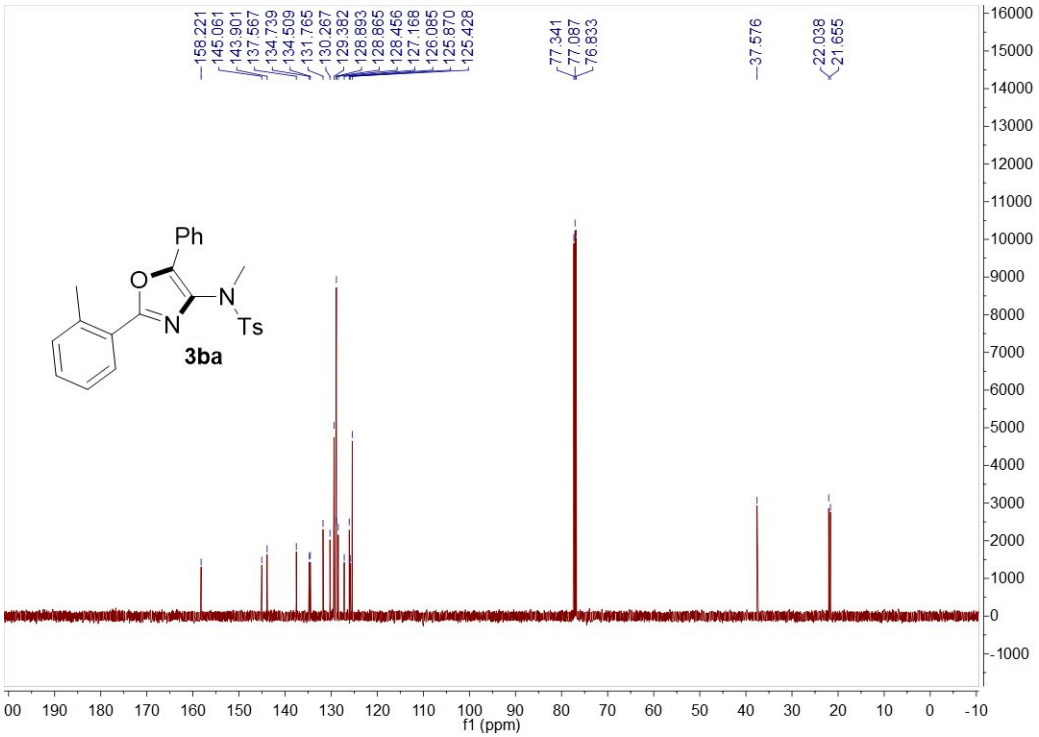
^{13}C NMR of compound **3at** in $CDCl_3$



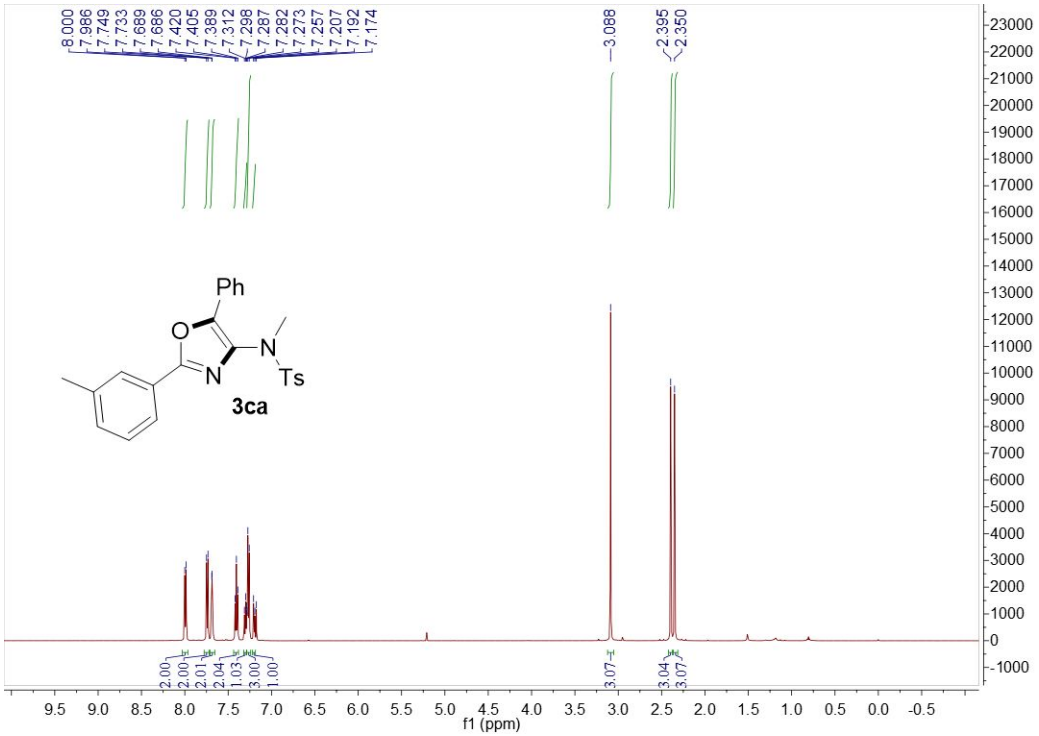
^{1}H NMR of compound **3ba** in $CDCl_3$



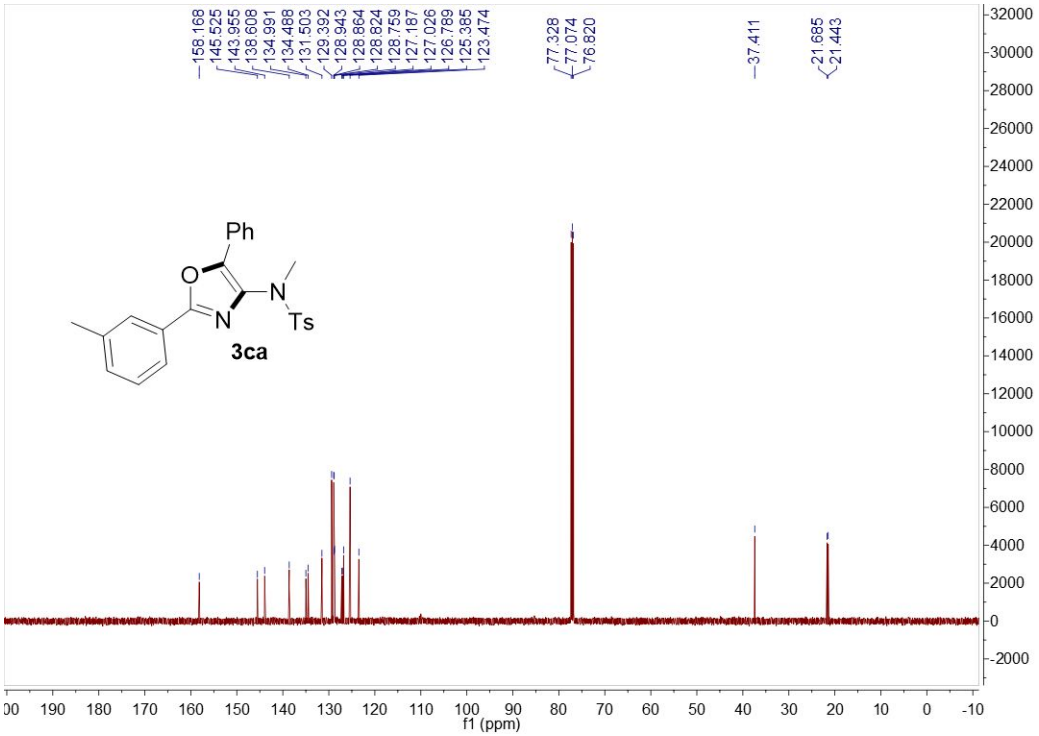
^{13}C NMR of compound **3ba** in $CDCl_3$



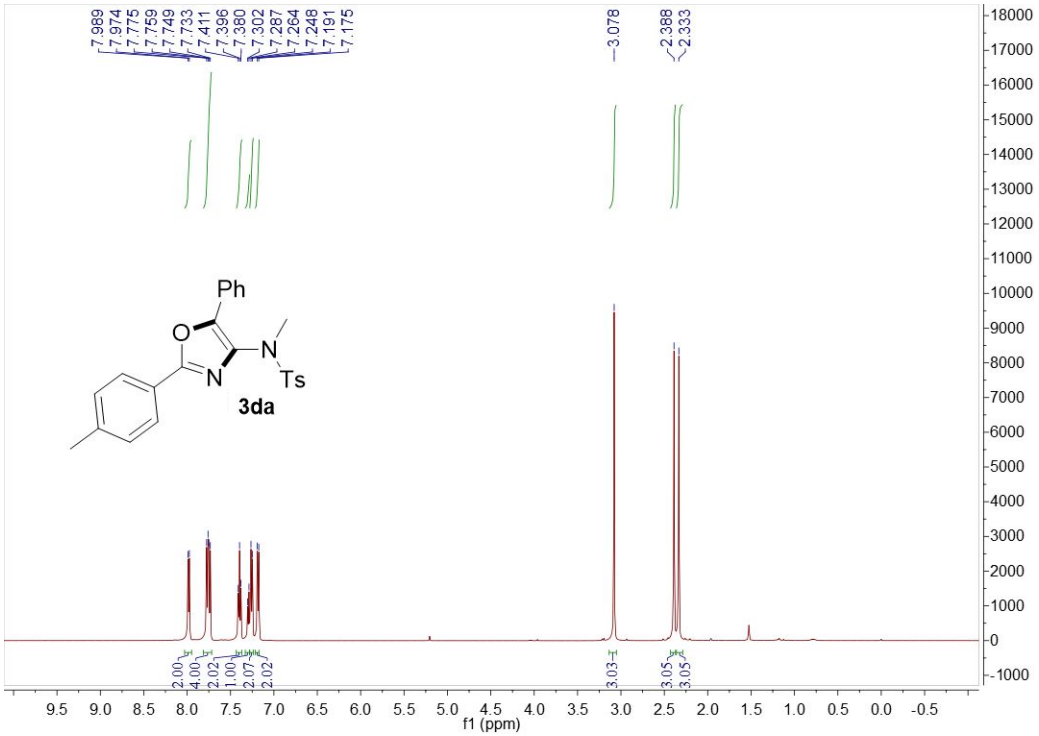
^{1}H NMR of compound **3ca** in $CDCl_3$



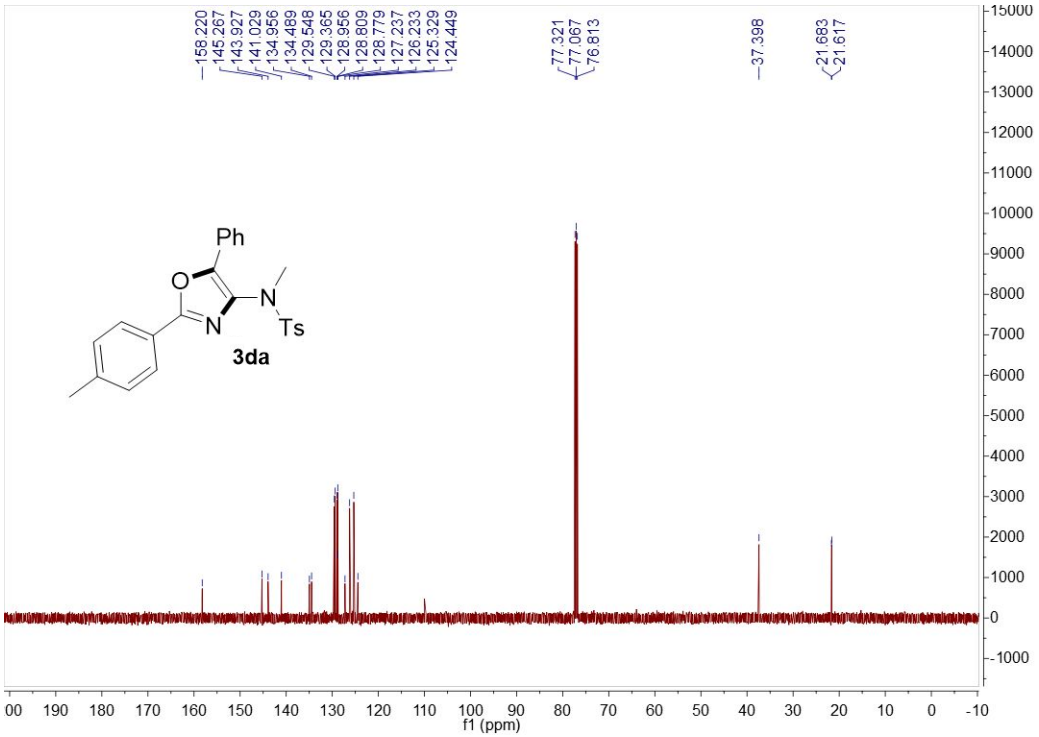
^{13}C NMR of compound **3ca** in $CDCl_3$



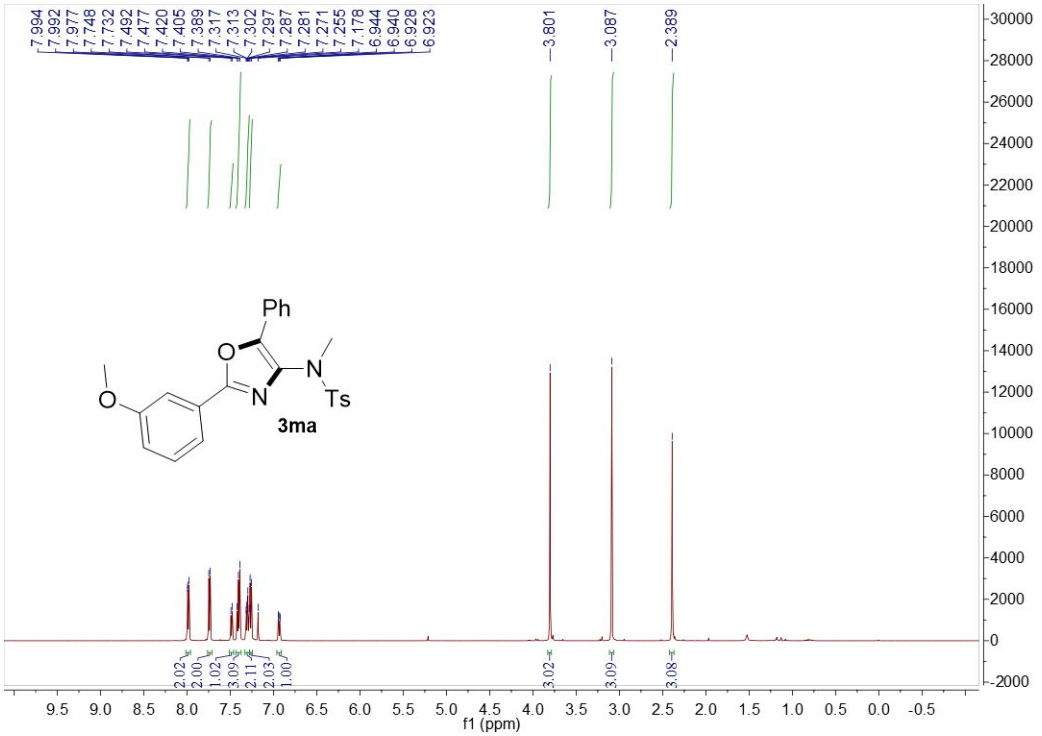
^{1}H NMR of compound **3da** in $CDCl_3$



^{13}C NMR of compound **3da** in $CDCl_3$



^{1}H NMR of compound **3ma** in $CDCl_3$



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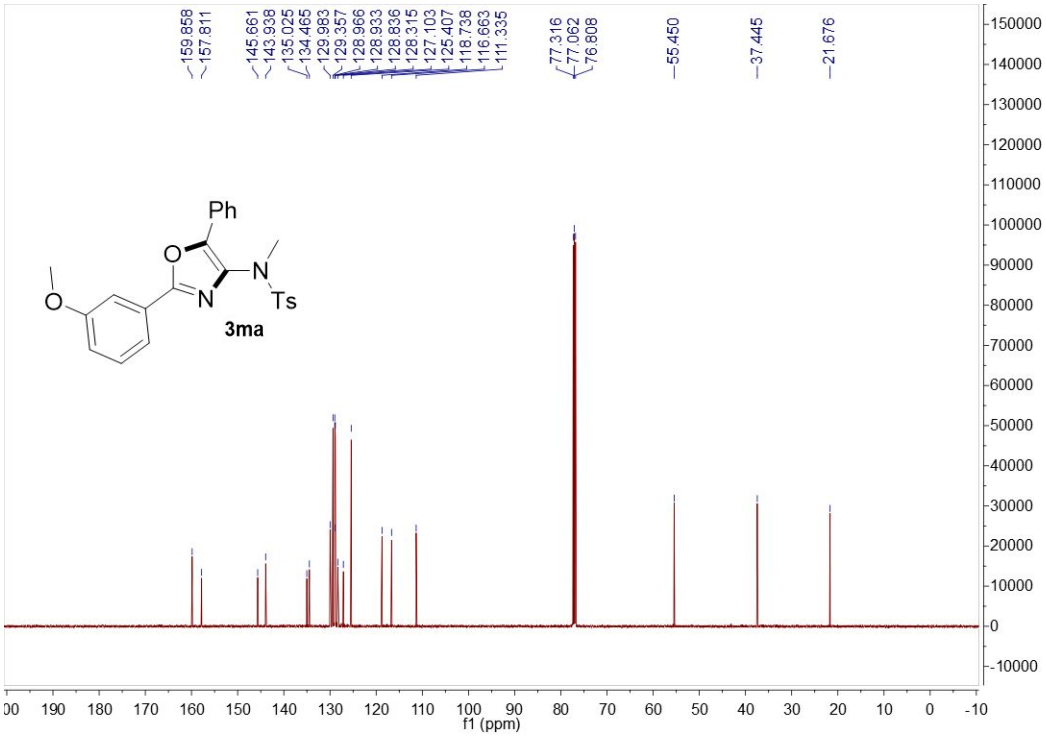

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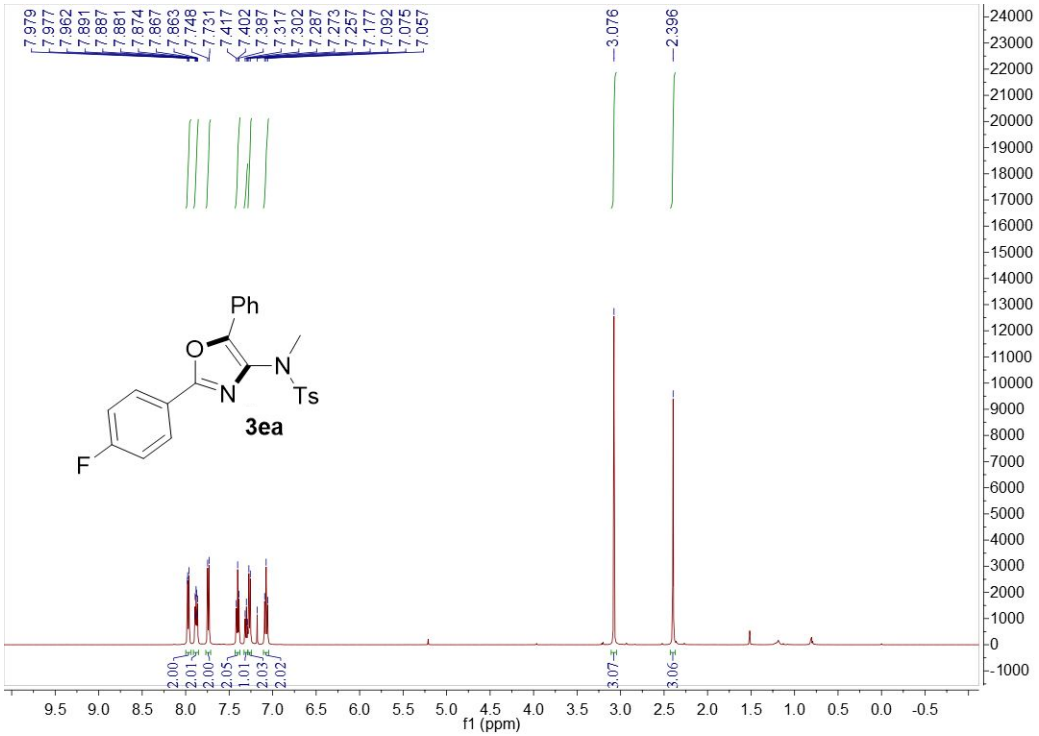
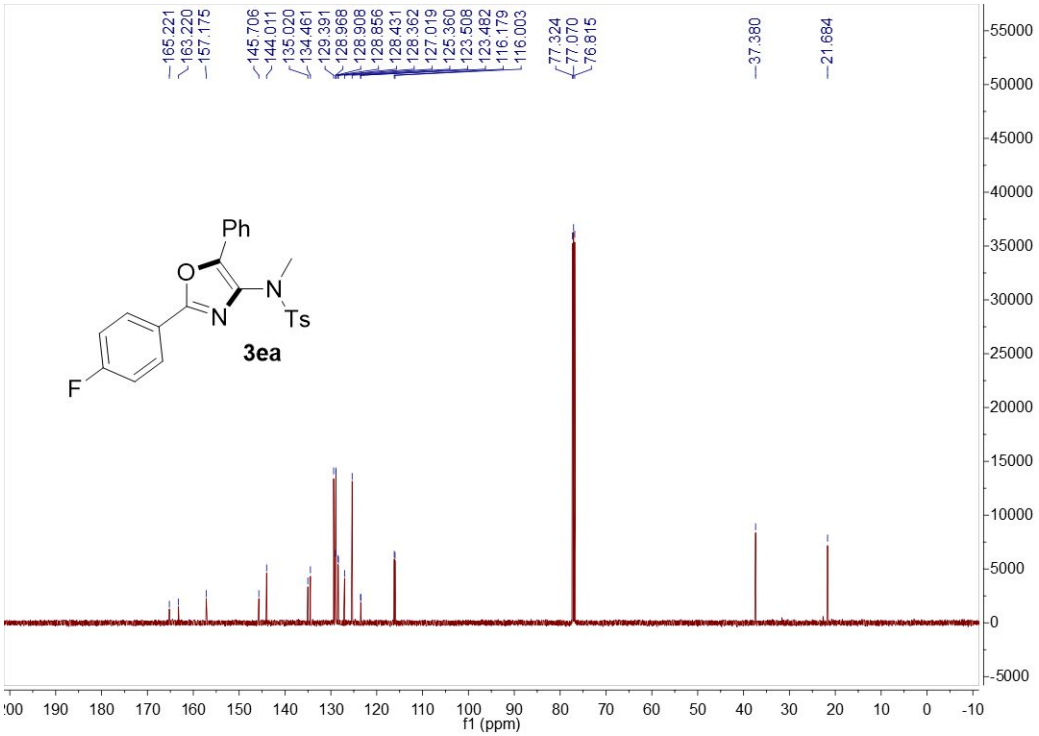
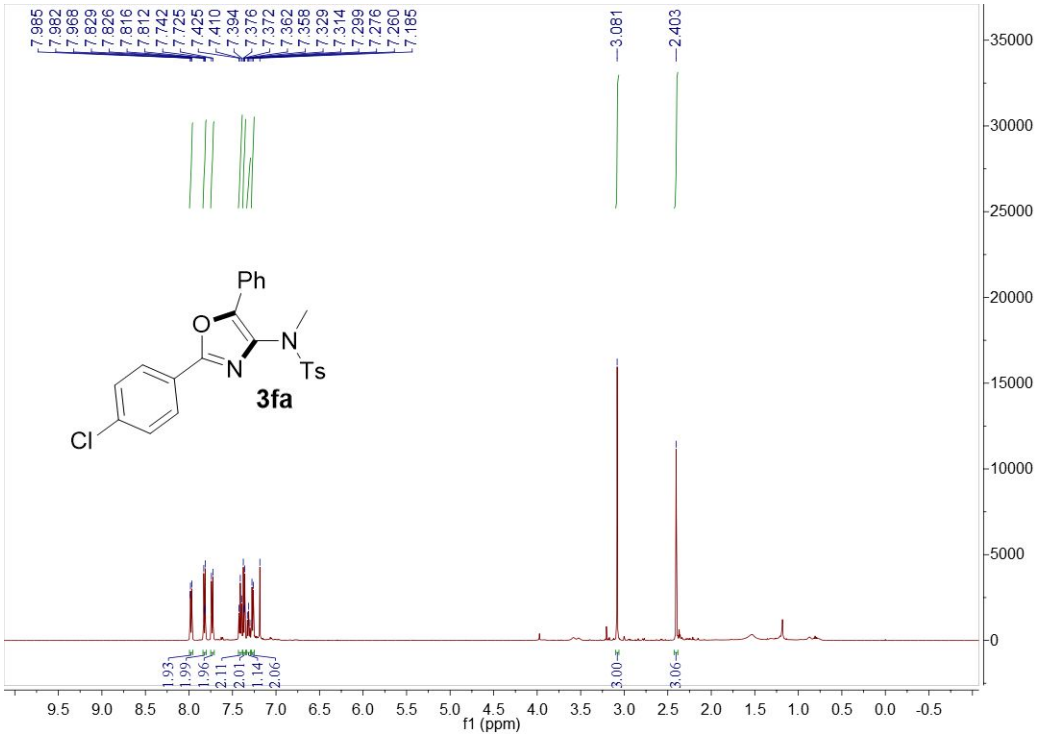


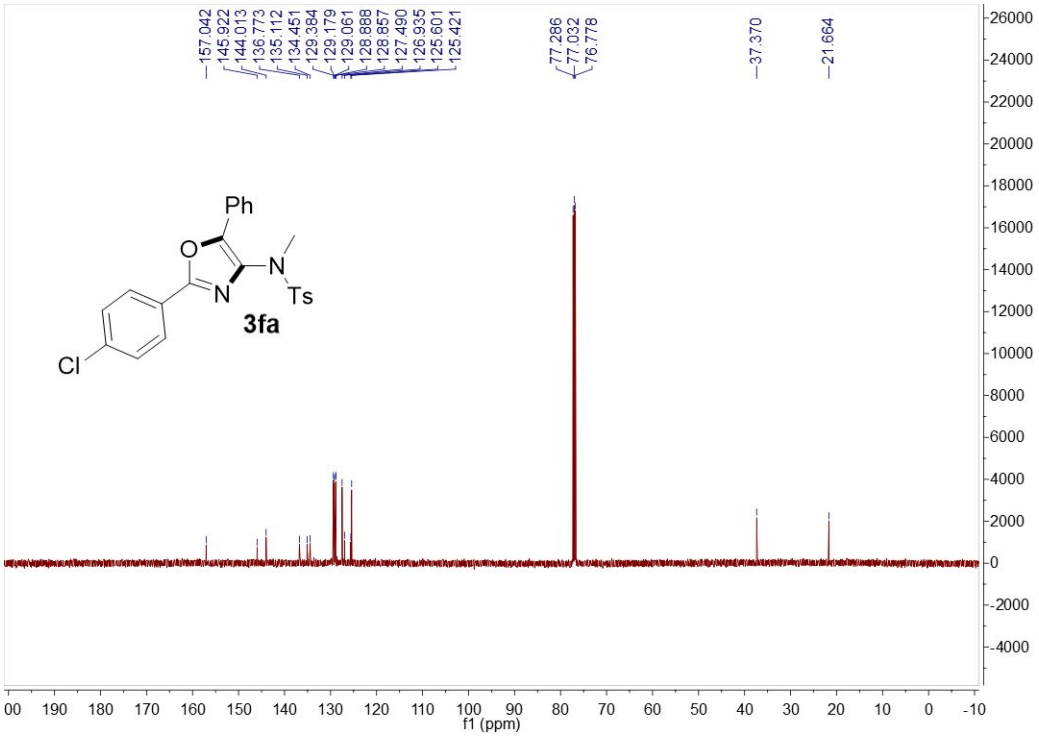
^{13}C NMR of compound **3ea** in $CDCl_3$



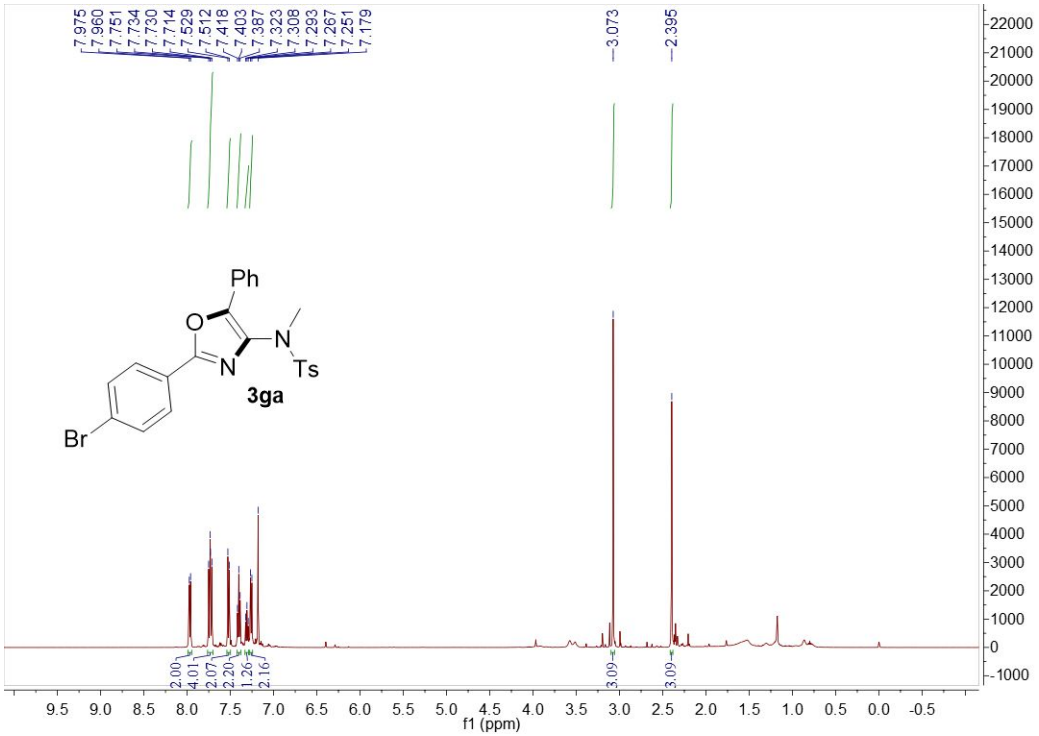
^{1}H NMR of compound **3fa** in $CDCl_3$



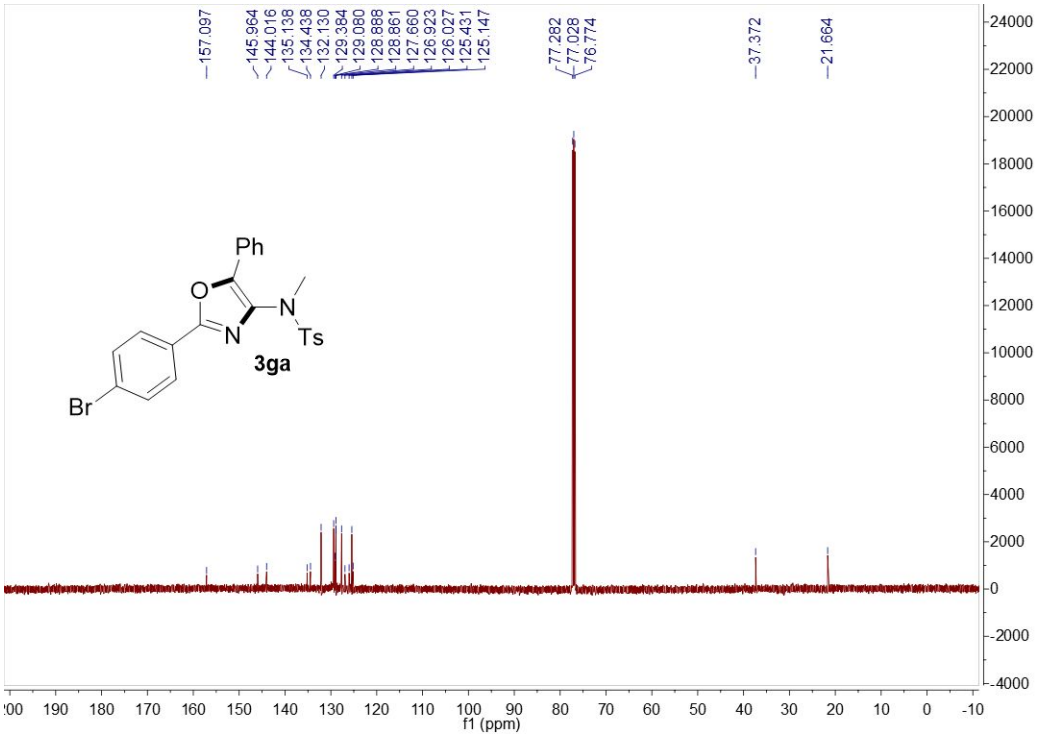
^{13}C NMR of compound **3fa** in $CDCl_3$



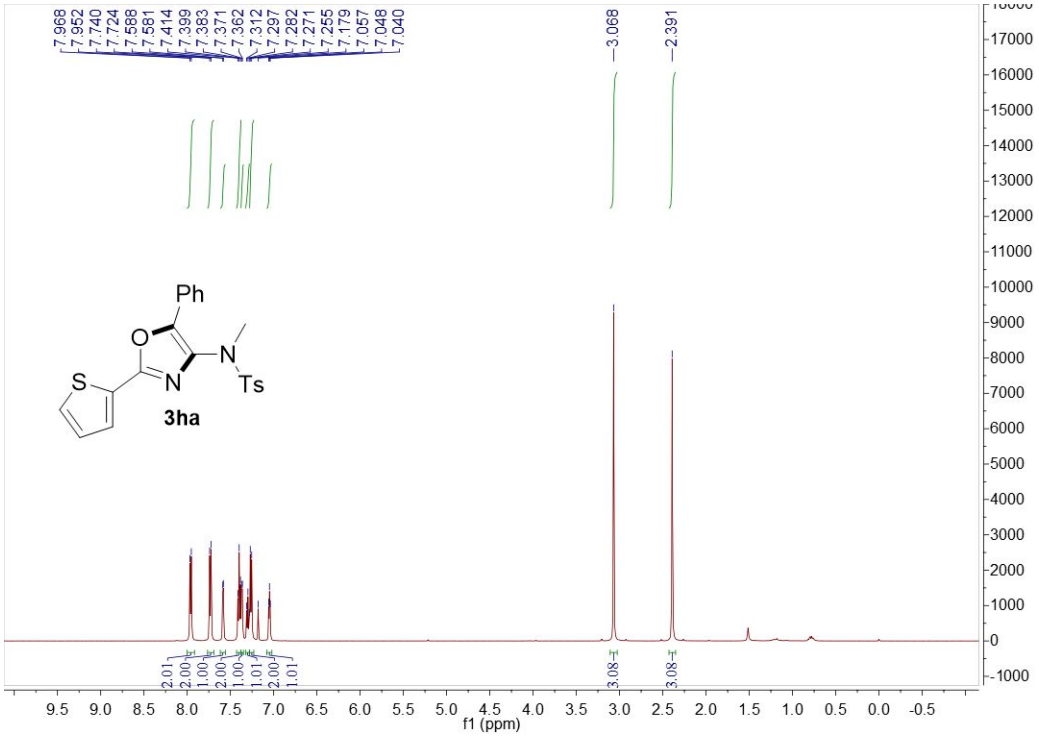
^{1}H NMR of compound **3ga** in $CDCl_3$



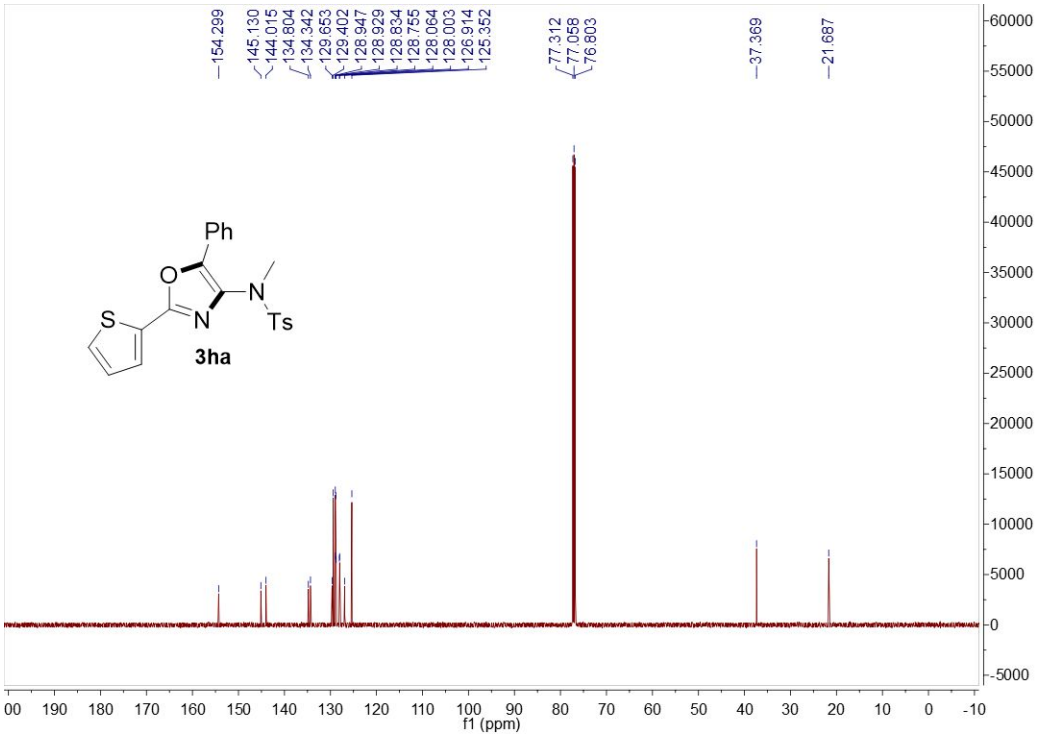
^{13}C NMR of compound **3ga** in $CDCl_3$



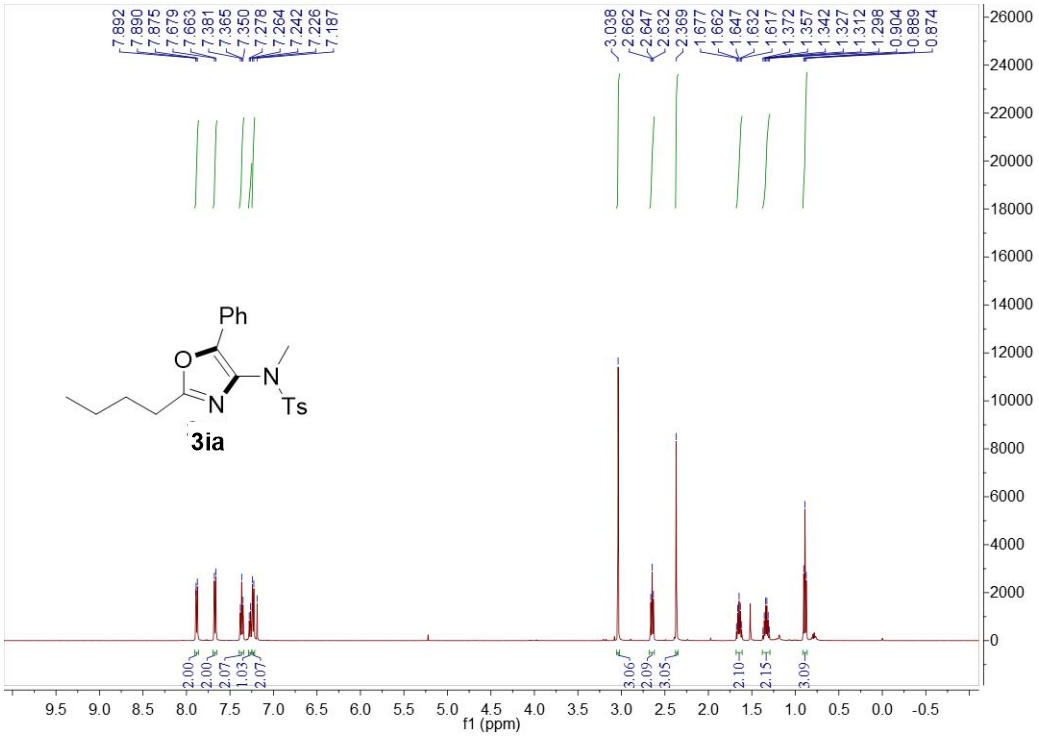
^{1}H NMR of compound **3ha** in $CDCl_3$



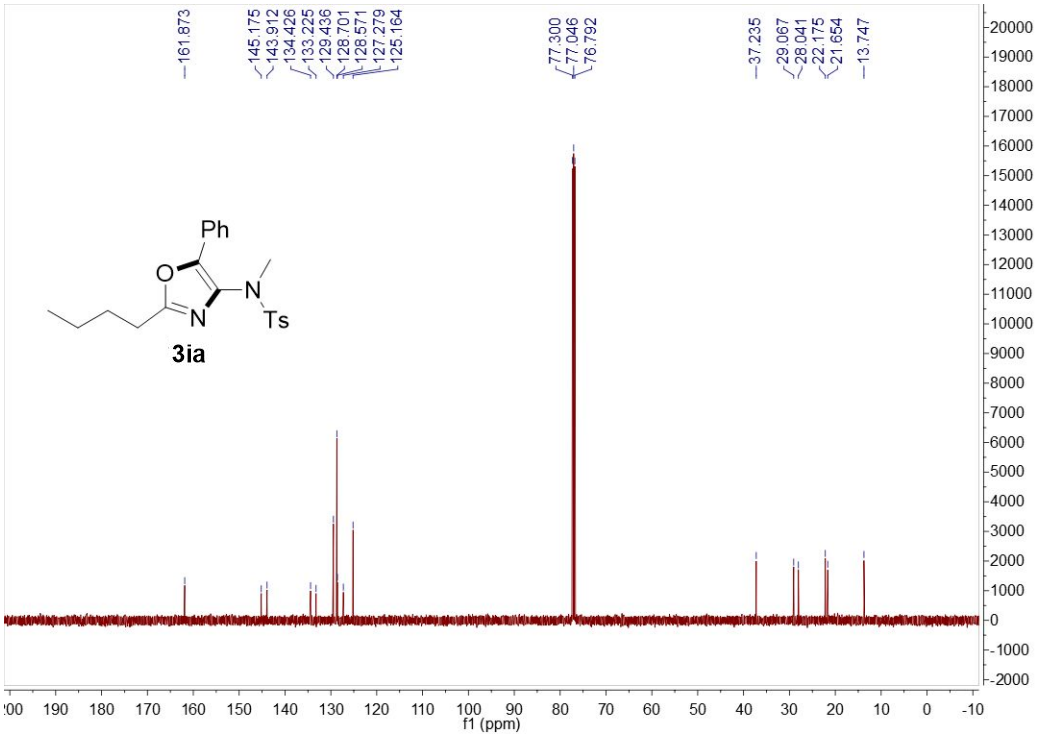
^{13}C NMR of compound **3ha** in $CDCl_3$



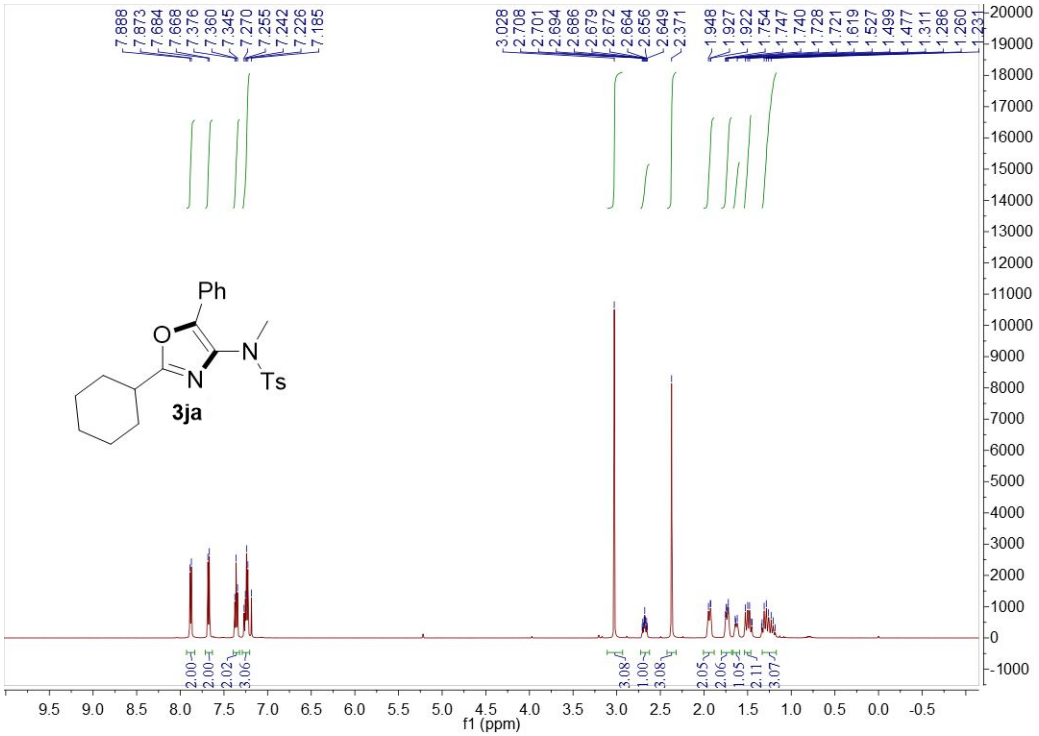
^{1}H NMR of compound **3ia** in $CDCl_3$



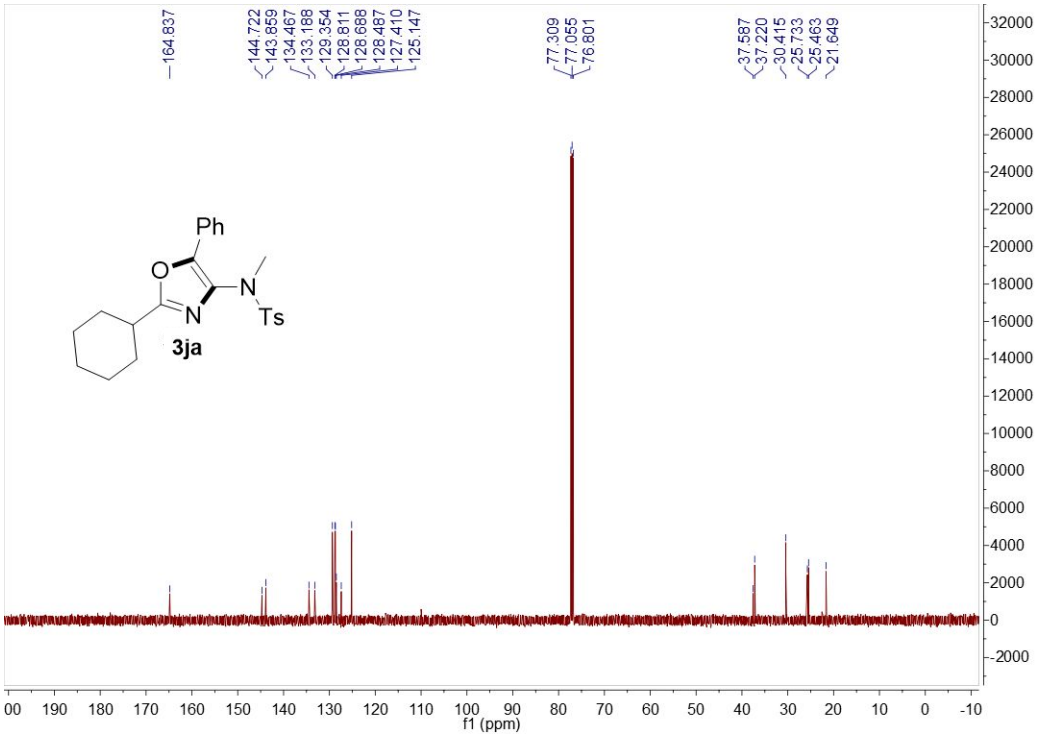
^{13}C NMR of compound **3ia** in $CDCl_3$



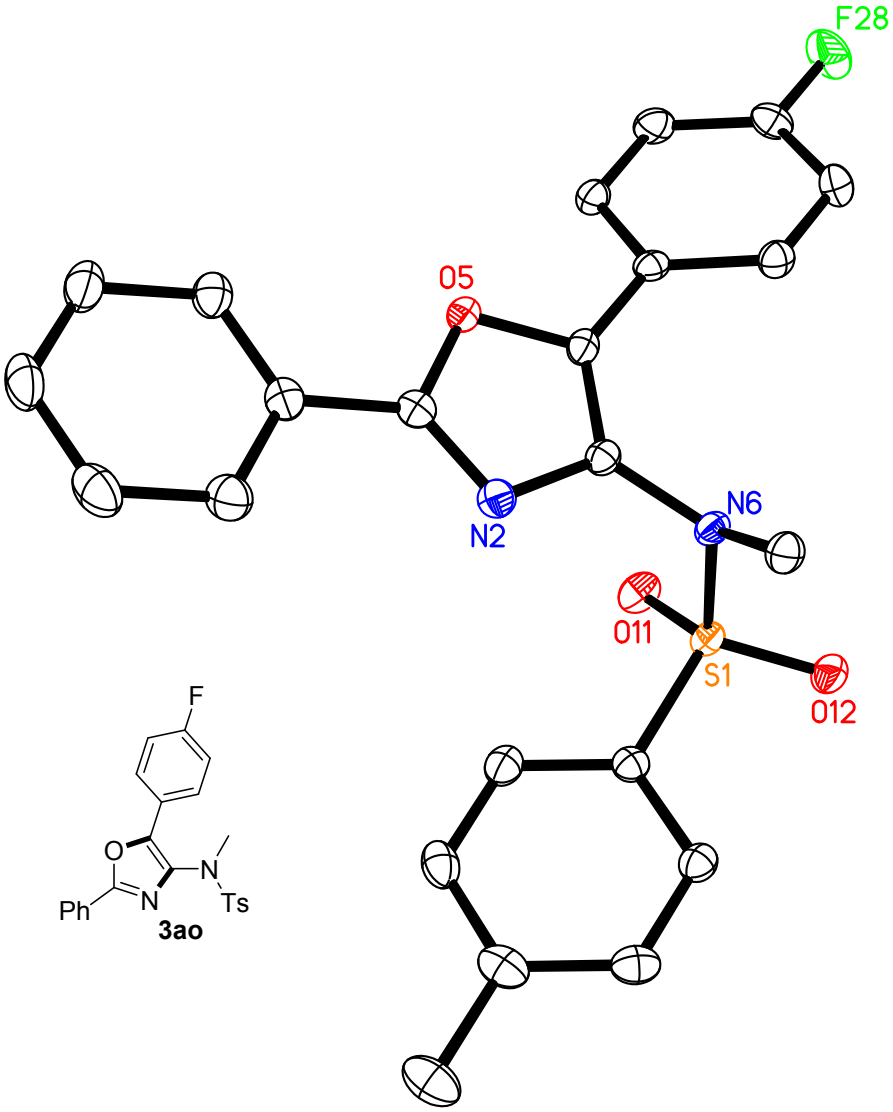
^{1}H NMR of compound **3ja** in $CDCl_3$



^{13}C NMR of compound **3ja** in $CDCl_3$



5. Solid state molecular structure of 3ao



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