Ruthenium-catalyzed Synthesis of Poly-substituted furans via Intermolecular Oxidative Annulation of 3-(phenyl ethynyl) oxazolidine-2-ones.

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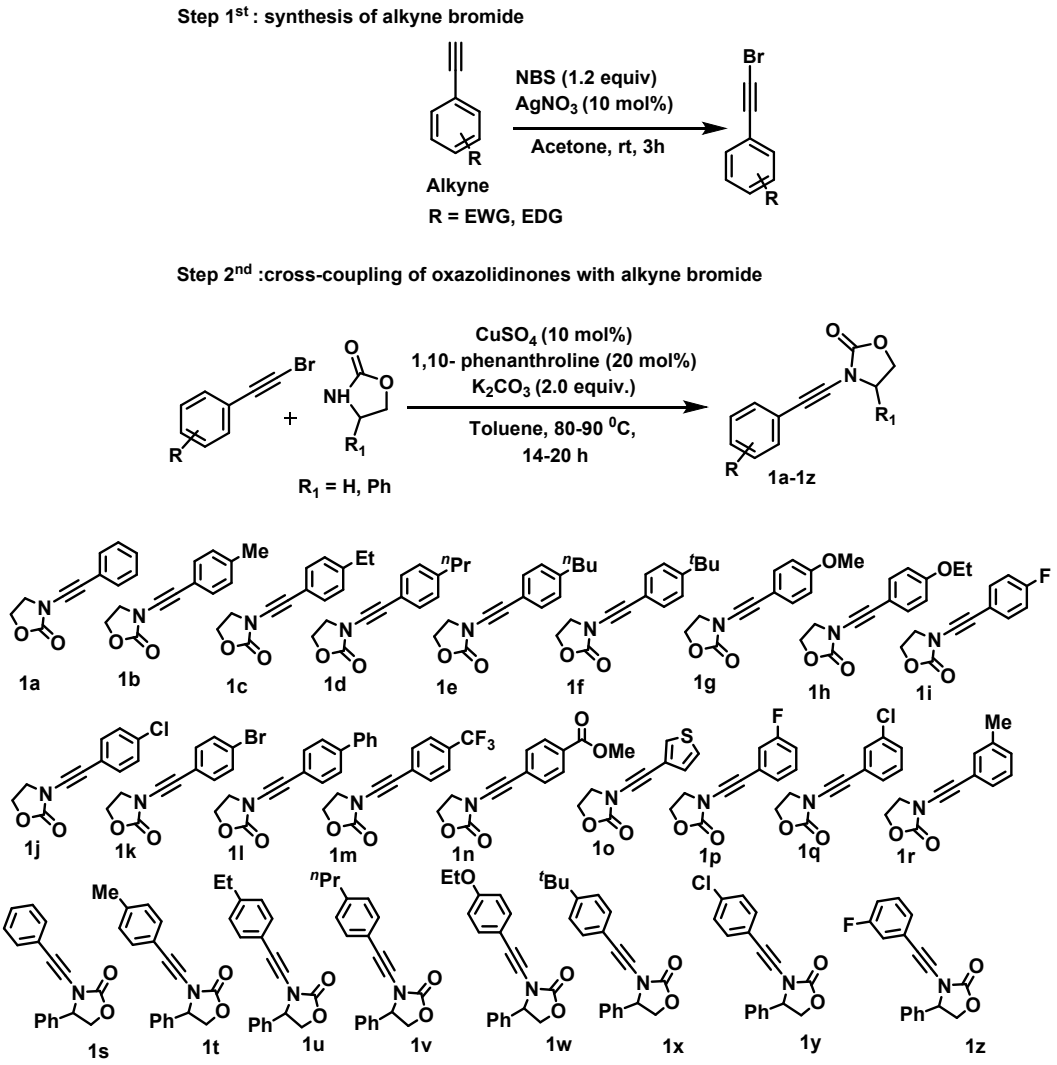
1. General procedure

Most of the metals, reagents, and starting materials were purchased from commercial sources and used as such. The progress of the reaction was monitored by analytical TLC on silica gel G/GF 254 plates. The column chromatography was performed with silica gel 100-200 mesh using EtOAc/hexane as an eluent. Proton and carbon nuclear magnetic resonance spectra (^{1}H, 400 MHz; and ^{13}C, 100 MHz) spectra were recorded either Bruker Avance on a 400 MHz using TMS as an internal standard (^{1}H NMR, $CDCl_3$ at 7.26 ppm; ^{13}C NMR, $CDCl_3$ at 77.0 ppm) and chemical shifts (δ ppm) (multiplicity, coupling constant (Hz), integration). The abbreviations for multiplicity are as follows: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, dd = doublet of doublets. Melting points are uncorrected were determined in capillary tubes on a hot stage melting point apparatus containing silicon oil. High resolution mass spectra were taken with a 3000-mass spectrometer and Q-TOF Analyzer. IR spectra were recorded using a FTIR spectrophotometer.

2. General procedure for the synthesis of starting Ynamides 1a-1z, 1a'-1b';



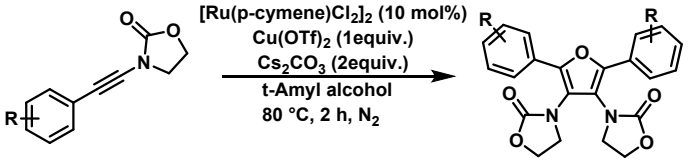
Step 1st: synthesis of alkyne bromide;

A solution of alkyne (1.0 eq.), N-bromosuccinimide (1.2 eq.), and silver nitrate (5 mol%) in acetone (0.3 M) was stirred at room temperature for 3 h. After the completion of the reaction, it was filtered and washed with hexane. After that, acetone was then removed on a rotary evaporator. The resulting product was dissolved in hexane, and the solution was passed through a short silica gel column to give alkyne bromide upon concentrating the fractions under reduced pressure.[1-5]

Step 2nd: cross-coupling of oxazolidinones with alkyne bromide;

Alkyne bromide (1.0 eq.) obtained from step a, oxazolidinones (1.2 eq.), K_2CO_3 (2.0 eq.), $CuSO_4 \cdot 5H_2O$ (10 mol%), 1,10-phenanthroline (20 mol%) in toluene (0.5 M) was heated at 80 °C for 12 h. After cooling to room temperature, the reaction mixture was concentrated under reduced pressure, and the residue was purified by flash chromatography on silica gel.[1-5]

3. General procedure for the synthesis of tetrasubstituted furans (2a-2z);



We synthesized tetrasubstituted furan derivatives by reacting with ynamide (1.06 mmol), $Cu(OTf)_2$ (1 equiv.) as an oxidant and $CsCO_3$ (2 equiv.) as a base in the presence of catalyst $[Ru(p\text{-cymene})Cl_2]_2$ (10 mol%) in *t*-amyl alcohol under N_2 condition. The reaction mixture was stirred at 80˚C for 2hr. After completion of the reaction water (20 ml) was added and then reaction mixture was extracted with EtOAc (3×50ml), dried over anhydrous Na_2SO_4. The solvent was evaporated under reduced pressure to obtain crude product which was further purified by column chromatography on a silica gel (100-200 mesh) using EtOAc/hexane as solvent system. All the products (**2a-2z**) were prepared by same procedure.

4. Single Crystal X-rays of compound 2c;

Crystallization: Crystals of compound **2c** were grown from the solvent Chloroform and Methanol (9:1) by a slow evaporation method.

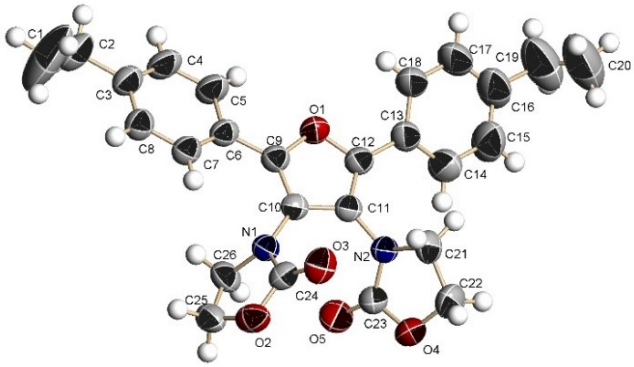


Figure 1 ORTEP diagram drawn with 50% ellipsoid probability for non-H atoms of the crystal structure of compound **2c** determined at 295K.

X-Ray Data Collection and Structure Refinement Details:

A good quality single crystal of size 0.10 x 0.09 x 0.04mm, was selected under a polarizing microscope and was mounted on a glass fiber for data collection. Single crystal X-ray data for compound 2c were collected on the Rigaku XtaLAB Synergy-S single crystal X-ray diffractometer equipped with a HyPix-6000HE Hybrid Photon Counting (HPC) detector and dual Mo and Cu microfocus sealed X-ray source with kappa goiniometer at 295 (2) K. Data collection cell determination, and data reduction was performed using the CrysAlisPro[6] software. Structure solution and refinement were performed by using SHELX-97.[7] Refinement of coordinates and anisotropic thermal parameters of non-hydrogen atoms were carried out by the full-matrix least-squares method. The hydrogen atoms attached to carbon atoms were generated with idealized geometries and isotropically refined using a riding model.

Table 1 Crystal data and structure refinement details for **2c**.

Compound	**2c**
Empirical formula	$C_{26}H_{26}N_2O_5$
Formula weight	446.18
Crystal System	Monoclinic
Space group	$P2_1/n$
a (Å)	9.5806(2)
b (Å)	9.2512(2)
c (Å)	25.9330(5)
α (°)	90.00
β (°)	91.395(2)
γ (°)	90.00
V (Å^3)	2297.81(8)
Z	4
D_c (g/cm^3)	1.291
F_{000}	944
μ (mm^{-1})	0.735
θ_{max} (°)	77.94

Total reflections	14941
Unique reflections	4575
Reflections [$I > 2\sigma(I)$]	3596
Parameters	301
R_{int}	0.0308
Goodness-of-fit	1.090
R [$F^2 > 2\sigma(F^2)$]	0.0641
wR (F^2, all data)	0.1989
CCDC No.	2408896

References

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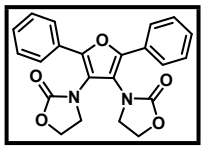
3. Y. Yamaguchi, T. Ochi, T. Wakamiya, Y. Matsubara, and Z. Yoshida, New Fluorophores with Rod-Shaped Polycyano π-Conjugated Structures: Synthesis and Photophysical Properties. *Org. Lett.* 2006, **8**, 717–720.
4. B. Zhou, W. Chen, Y. Yang, G. Deng, and Y. Liang, A radical cyclization cascade of 2-alkynylbenzonitriles with sodium arylsulfinates. *Org. Biomol. Chem*. 2018, **16**, 7959–7963.
5. Y. He, X. Zhang, and X. Fan, Synthesis of naphthalene amino esters and arylnaphthalene lactone lignans through tandem reactions of 2-alkynylbenzonitriles. *Chem. Commun*. 2014, **50**, 5641-5643.
6. Crys Alis Pro, Oxford Diffraction /Agilent Technologies UK Ltd, Yarnton, England.
7. Sheldrick, G. M. Acta Crystallogr. Sect. A 2008, 64, 112–122.

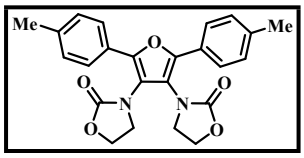
6. Spectral data of obtained compound;

3,3'-(2,5-diphenylfuran-3,4-diyl)bis(oxazolidin-2-one) (2a)



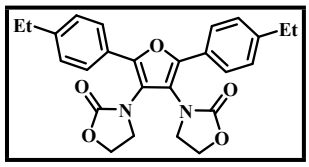
Yield: 75% (310 mg); mp 251-253 °C; FT-IR (cm^{-1}): 3921.64, 3219.01, 2920.73, 2379.92, 1743.90, 1030.29, 759.35; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.730 (d, J = 7.72 Hz, 4H), 7.472 (t, J = 7.84 Hz, 4H), 7.379 (t, J = 7.40 Hz, 2H), 4.539 (t, J = 8.24 Hz, 4H), 3.940 (t, J = 8.25 Hz 4H), ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.75, 146.96, 129.07, 128.89, 125.05, 118.85, 63.50, 45.32; HRMS; Calculated for $C_{22}H_{18}N_2O_5$ $[M+K]^+$, *m/z* 429.0853 found 429.0847

3,3'-(2,5-di-p-tolylfuran-3,4-diyl)bis(oxazolidin-2-one) (2b)



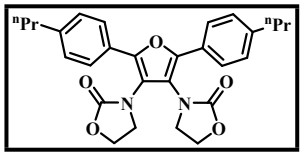
Yield: 74% (328 mg); mp 226-228 °C; FT-IR (cm^{-1}): 3772.13, 2919.59, 1751.68, 1084.36, 755.79, 499.65; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.524 (d, J = 7.29 Hz, 4H), 7.183 (d, J = 7.17 Hz, 4H), 4.440 (t, J = 7.65 Hz, 4H), 3.842 (t, J = 7.65 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.81, 146.92, 138.85, 129.73, 126.23, 124.98, 118.12, 63.46, 45.30, 21.41; HRMS; Calculated for $C_{24}H_{22}N_2O_5$ $[M+Na]^+$, *m/z* 418.1529 found 419.4.

3,3'-(2,5-bis(4-ethylphenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2c)



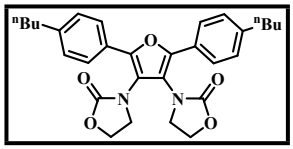
Yield: 72% (340 mg); mp 201-203 °C; FT-IR (cm^{-1}): 3837.92, 3740.78, 2963.59, 1894.03, 1033.26, 754.87; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.627 (d, J = 8.25 Hz, 4H), 7.288 (d, J = 8.25 Hz, 4H), 4.527 (t, J = 8.40 Hz, 4H), 3.931 (t, J = 8.27 Hz 4H), 2.696 (q, J = 7.60Hz 4H), 1.274 (t, J =7.60 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.81, 146.94, 145.12, 128.53, 126.45, 125.06, 118.13, 63.46, 45.33, 28.74, 15.31; HRMS; Calculated for $C_{26}H_{26}N_2O_5$ $[M+Na]^+$, *m/z* 469.1729 found 469.1734.

3,3'-(2,5-bis(4-propylphenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2d)



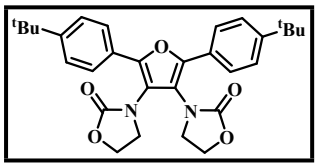
Yield: 70% (351 mg); mp 183-185 °C; FT-IR (cm^{-1}): 3922.46, 3775.85, 2922.54, 1687.31, 1034.91, 761.93; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.621 (d, J = 8.23 Hz, 4H), 7.265 (d, J = 8.01 Hz, 4H), 4.526 (t, J = 8.34 Hz, 4H), 3.932 (t, J = 8.28Hz 4H), 2.627 (t, J = 7.72 Hz, 4H), 1.721 – 1.629 (m, 4H), 0.965 (t, J = 7.40 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.81, 146.93, 143.62, 129.12, 126.46, 124.94, 118.12, 63.46, 45.34, 37.88, 29.69, 24.34, 13.80; HRMS; Calculated for $C_{28}H_{30}N_2O_5$ $[M+Na]^+$, *m/z* 497.2052, found 497.2047.

3,3'-(2,5-bis(4-butylphenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2e)



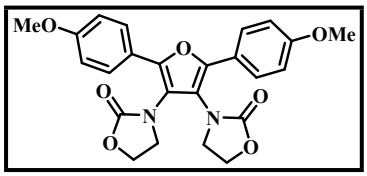
Yield: 69% (367 mg); mp 173-175 °C; FT-IR (cm^{-1}): 3921.16, 3775.29, 2855.35, 1754.62, 1078.66, 761.15; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.612 (d, J = 8.19 Hz, 4H), 7.270 (d, J = 7.95 Hz, 4H), 4.530 (t, J = 8.40 Hz, 4H), 3.936 (t, J = 8.28 Hz 4H), 2.654 (t, J = 7.75 Hz, 4H), 1.672 - 1.596 (m, 4H), 1.431 - 1.339 (m, 4H), 0.951 (t, J = 7.34 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.80, 146.93, 143.84, 129.07, 126.42, 124.95, 118.13, 63.46, 45.34, 35.52, 33.40, 22.36, 13.94; HRMS; Calculated for $C_{30}H_{34}N_2O_5$, $[M+Na]^+$ *m/z* 525.2365, found 525.2360.

3,3'-(2,5-bis(4-(tert-butyl)phenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2f)



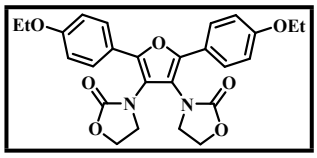
Yield: 67% (356 mg); mp 272-274 °C; FT-IR (cm^{-1}): 3917.43, 3776.33, 2957.62, 1758.07, 1032.86, 757.44; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.643 (d, J = 8.64 Hz, 4H), 7.476 (d, J = 8.68 Hz, 4H), 4.534 (t, J = 8.38 Hz, 4H), 3.944 (t, J = 8.24 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.76, 151.96, 146.89, 126.20, 125.96, 124.78, 118.24, 63.44, 45.40, 34.81, 31.20; MS(ESI); Calculated for $C_{30}H_{34}N_2O_5$ $[M+H]^+$, *m/z* 502.2468 found 503.6.

3,3'-(2,5-bis(4-methoxyphenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2g)



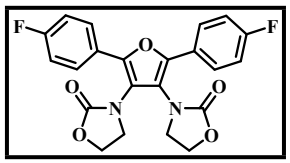
Yield: 69% (329 mg); mp 213-215 °C; FT-IR (cm^{-1}): 3912.23, 3775.22, 2345.19, 1603.23, 1303.85, 1030.93, 755.44; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.638 (d, J = 8.93 Hz, 4H), 6.985 (d, J = 8.93 Hz, 4H), 4.519 (t, J = 8.28 Hz, 4H), 3.912 (t, J = 8.26 Hz 4H), 3.862 (s, 6H, OMe); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 159.90, 157.90, 146.62, 126.56, 121.80, 117.25, 114.50, 63.43, 55.37, 45.37; HRMS; Calculated for $C_{24}H_{22}N_2O_7$ $[M+Na]^+$, *m/z* 489.1064 found 489.1059.

3,3'-(2,5-bis(4-ethoxyphenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2h)



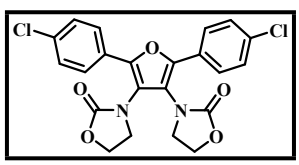
Yield: 66% (334 mg); mp 214-216 °C; FT-IR (cm^{-1}): 3922.32, 3776.08, 2920.29, 1757.23, 1115.82, 762.28; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.612 (d, J = 8.21 Hz, 4H), 6.965 (d, J = 8.25 Hz, 4H), 4.514 (t, J = 7.86 Hz, 4H), 4.082 (q, J = 6.73 Hz 4H), 3.910 (t, J = 7.53 Hz, 4H), 1.444 (t, J = 6.67 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 159.27, 157.92, 146.63, 126.53, 121.63, 117.13, 114.97, 63.60, 63.44, 45.37, 14.79; HRMS; Calculated for $C_{26}H_{26}N_2O_5$ $[M+Na]^+$, *m/z* 501.1638, found 501.1632.

3,3'-(2,5-bis(4-fluorophenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2i)



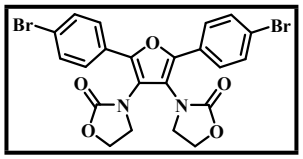
Yield: 81% (366 mg); mp 277-279 °C; FT-IR (cm^{-1}): 3833.34, 3738.11, 2918.56, 1636.17, 1391.26, 1229.66, 833.93, 766.17; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.716 – 7.682 (m, 4H), 7.195 – 7.153 (m, 4H), 4.538 (t, J = 8.14 Hz, 4H), 3.909 (t, J = 8.16 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 164.12, 161.60, 157.76, 146.20, 127.11, 127.03, 125.04, 118.61, 116.44, 116.22, 63.50, 45.36; HRMS; Calculated for $C_{22}H_{16}F_2N_2O_5$ $[M+Na]^+$, *m/z* 449.0925, found 449.0919.

3,3'-(2,5-bis(4-chlorophenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2j)



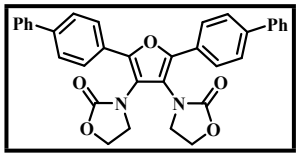
Yield: 80% (388 mg); mp 253-255 °C; FT-IR (cm^{-1}): 3920.71, 3776.53, 2921.74, 1688.39, 1032.90, 496.72; ^{1}H NMR (400MHz, $CDCl_3$) δ (ppm): 7.651 (d, J = 8.70 Hz, 4H), 7.451 (d, J = 8.74 Hz, 4H), 4.543 (t, J = 8.34 Hz, 4H), 3.912 (t, J = 8.23 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.67, 146.27, 134.95, 129.44, 127.12, 126.28, 119.39, 63.54, 45.29, 29.69; HRMS; Calculated for $C_{22}H_{16}Cl_2N_2O_5$ $[M+Na]^+$, *m/z* 481.0334, found 481.0328.

3,3'-(2,5-bis(4-bromophenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2k)



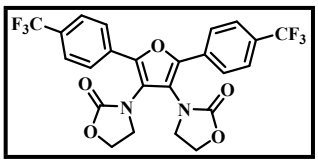
Yield: 78% (451 mg); mp 274-276 °C; FT-IR (cm^{-1}): 3922.43, 3775.24, 2919.26, 1753.04, 1078.84, 764.45; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.612 (d, J = 8.79 Hz, 4H), 7.578 (d, J = 8.66 Hz, 4H), 4.541 (t, J = 8.36 Hz, 4H), 3.910 (t, J = 8.30 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.68, 146.34, 132.39, 127.53, 126.49, 123.19, 119.52, 63.55, 45.27; HRMS; Calculated for $C_{22}H_{16}Br_2N_2O_5$, *m/z* $[M+K]^+$, 584.9063, found 584.9058.

3,3'-(2,5-di([1,1'-biphenyl]-4-yl)furan-3,4-diyl)bis(oxazolidin-2-one) (2l)



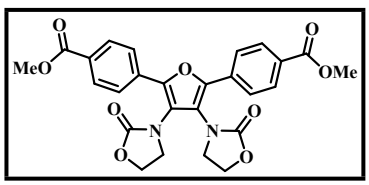
Yield: 78% (448 mg); mp 259-261 °C; FT-IR (cm^{-1}): 3923.04 3774.58, 2919.93, 1633.88, 1034.82, 759.68, 498.62; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.822 (d, J = 8.40 Hz, 4H), 7.718 (d, J = 8.43 Hz, 4H), 7.649 (dd, J = 8.40Hz, J = 1.32 Hz, 4H), 7.483 (d, J = 7.80 Hz, 4H), 7.391 (d, J = 7.35 Hz, 2H), 4.576 (t, J = 8.41 Hz, 4H), 3.999 (t, J = 8.32 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.79, 146.88, 141.51, 140.09, 128.96, 127.83, 127.73, 127.70, 127.01, 125.44, 119.08, 63.55, 45.38; HRMS; Calculated for $C_{34}H_{26}N_2O_5$ $[M+Na]^+$, *m/z* 565.1739, found 565.1734.

3,3'-(2,5-bis(4-(trifluoromethyl)phenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2m)



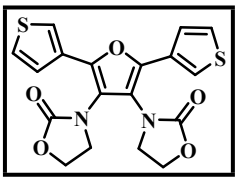
Yield: 76% (423 mg); mp 249-251 °C; FT-IR (cm^{-1}): 3920.20, 3776.50, 2922.04, 1764.55, 1245.51, 763.04, 466.42; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.856 (d, J = 8.23 Hz, 4H), 7.751 (d, J = 8.34 Hz, 4H), 4.573 (t, J = 8.36 Hz, 4H), 3.941 (t, J = 8.23 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 156.54, 145.31, 130.68, 129.98, 129.62, 125.20, 125.17, 124.25, 124.07, 121.37, 119.89, 62.59, 44.28; HRMS; Calculated for $C_{24}H_{16}F_6N_2O_5$ $[M+K]^+$, *m/z* 565.0600 found 565.0595.

dimethyl 4,4'-(3,4-bis(2-oxooxazolidin-3-yl)furan-2,5-diyl)dibenzoate (2n)



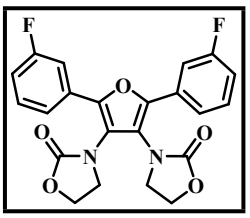
Yield: 83% (445 mg); mp 289-291 °C; FT-IR (cm^{-1}): 3922.21, 3773.09, 1627.61, 1079.32, 827.62, 498.22; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.152 (d, J = 8.53 Hz, 4H), 7.819 (d, J = 8.52 Hz, 4H), 4.573 (t, J = 8.30 Hz, 4H), 3.957 (s, 6H), 3.951 (t, J = 8.09 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 166.32, 157.57, 146.62, 132.42, 130.41, 130.24, 124.78, 120.97, 63.63, 52.37, 45.23; HRMS; Calculated for $C_{26}H_{22}N_2O_9$ $[M+Na]^+$, *m/z* 529.1223, found 529.1218.

3,3'-(2,5-di(thiophen-3-yl)furan-3,4-diyl)bis(oxazolidin-2-one) (2o)



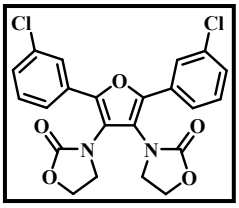
Yield: 53% (225 mg); mp 113-115 °C; FT-IR (cm^{-1}): 3922.11, 3773.68, 2857.18, 1645.05, 1079.04, 827.43, 760.41; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.599 (dd, J = 2.93 Hz, J = 1.29 Hz, 2H), 7.438 (dd, J = 5.07 Hz, J = 2.95 Hz, 2H), 7.407 (dd, J = 5.07 Hz, J = 1.29 Hz, 2H), 4.542 (t, J = 8.18 Hz, 4H), 3.954 (t, J = 8.36 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.78, 144.31, 129.71, 127.00, 124.47, 121.91, 117.50, 63.45, 45.56; HRMS; Calculated for $C_{18}H_{14}N_2O_5S_2$ $[M+Na]^+$, *m/z* 425.0242, found 425.0236.

3,3'-(2,5-bis(3-fluorophenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2p)



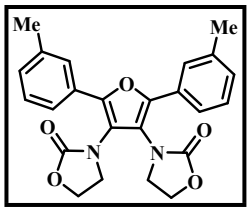
Yield: 78% (352 mg); mp 283-285 °C; FT-IR (cm^{-1}): 3410.04, 2918.58, 1751.87, 830.88, 768.98; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.517 (d, J = 7.86 Hz, 2H), 7.507 – 7.426 (m, 4H), 7.119 – 7.074 (m, 2H), 4.563 (t, J = 8.33 Hz, 4H), 3.950 (t, J = 8.26 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 164.14, 162.17, 157.62, 146.06, 130.92, 130.85, 130.53, 120.65, 119.95, 116.08, 115.92, 112.08, 111.89, 63.58, 45.26; HRMS; Calculated for $C_{22}H_{16}F_2N_2O_5$ $[M+Na]^+$, *m/z* 449.0925, found 449.0929.

3,3'-(2,5-bis(3-chlorophenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2q)



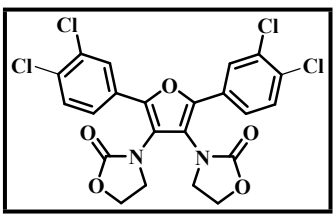
Yield: 76% (368 mg); mp 211-213 °C; FT-IR (cm^{-1}): 3838.30, 3744.65, 2919.85, 1756.06, 1031.80, 762.41, 497.61; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.717 (t, J = 1.81 Hz, 2H), 7.624 - 7.598 (m, 2H), 7.421 (t, J = 7.95 Hz, 2H), 7.382 - 7.354 (m, 2H), 4.560 (t, J = 8.34 Hz, 4H), 3.939 (t, J = 8.23 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.61, 145.90, 135.29, 130.46, 130.20, 129.05, 125.01, 123.03, 120.01, 63.62, 45.26; HRMS; Calculated for $C_{22}H_{16}Cl_2N_2O_5$, *m/z* 481.0334, found $[M+Na]^+$ 481.0328.

3,3'-(2,5-di-m-tolylfuran-3,4-diyl)bis(oxazolidin-2-one) (2r)



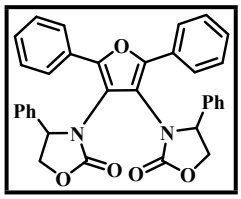
Yield: 65% (288 mg); mp 193-195 °C; FT-IR (cm^{-1}): 3410.99, 2920.72, 1759.81, 1081.86, 826.87, 763.16; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.534 (d, J = 2.33 Hz, 2H), 7.517 (d, J = 8.33 Hz, 2H), 7.351 (d, J = 7.67 Hz, 2H), 7.191 (d, J = 7.58 Hz, 2H), 4.528 (t, J = 8.36 Hz, 4H), 3.933 (t, J = 8.25 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.78, 146.99, 138.77, 129.64, 128.94, 128.86, 125.64, 122.24, 118.65, 63.52, 45.29, 21.62; HRMS; Calculated for $C_{24}H_{22}N_2O_5$, *m/z* 441.1426, found $[M+Na]^+$ 441.1421.

3,3'-(2,5-bis(3,4-dichlorophenyl)furan-3,4-diyl)bis(oxazolidin-2-one) (2s)



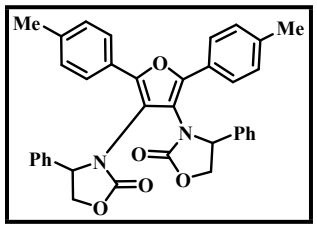
Yield: 79% (440 mg); mp 304-306 °C; FT-IR (cm^{-1}): 3772.16, 3142.94, 1765.47, 1398.04, 1033.66, 760.13; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.806 (s, 2H), 7.558 (s, 4H), 4.562 (t, J = 8.00 Hz, 4H), 3.923 (t, J = 8.02 Hz 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.55, 145.32, 133.74, 133.31, 131.28, 128.23, 126.73, 126.04, 120.40, 63.65, 45.26; ESIMS; Calculated for $C_{22}H_{14}Cl_4N_2O_5$ $[M+Na]^+$, *m/z* 525.96, found 527.0.

3,3'-(2,5-diphenylfuran-3,4-diyl)bis(4-phenyloxazolidin-2-one) (2t)



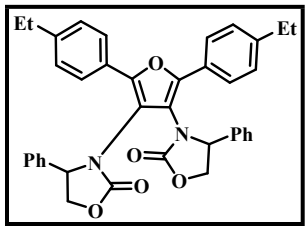
Yield: 62% (356 mg); mp 129-131 °C; FT-IR (cm^{-1}): 3773.47, 2921.38, 1632.39, 1037.64, 766.62; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.328- 7.266 (m, 10H), 7.074 (dd, *J* = 8.29 Hz, *J* = 1.21 Hz 4H), 7.024 (d, *J* = 7.41 Hz, 2H), 6.907 (d, *J* = 7.74 Hz, 4H), 5.188 (t, *J* = 8.61 Hz, 2H), 4.857 (t, *J* = 9.00 Hz, 2H), 4.542 (t, *J* = 8.83 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 156.48, 149.93, 133.87, 127.92, 127.73, 127.46, 127.21, 125.90, 125.74, 124.00, 115.41, 68.99, 61.80; HRMS; Calculated for $C_{34}H_{26}N_2O_5$ $[M+K]^+$, *m/z* 581.1479 found 581.1473.

3,3'-(2,5-di-p-tolylfuran-3,4-diyl)bis(4-phenyloxazolidin-2-one) (2u)



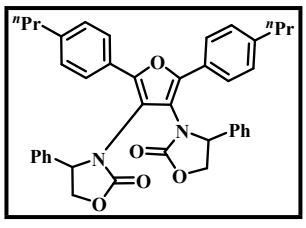
Yield: 60% (362 mg); mp 93-95 °C; FT-IR (cm^{-1}): 3901.69, 3731.13, 2924.37, 1754.31, 1089.33, 772.32; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.193 (d, *J* = 8.15 Hz, 4H), 7.073 (d, *J* = 6.70 Hz, 4H), 7.071 (d, *J* = 7.27 Hz, 4H), 7.028 (d, *J* = 7.41 Hz, 2H), 6.913 (t, *J* = 7.73 Hz, 4H), 5.167 (t, *J* = 8.66 Hz, 2H), 4.837 (t, *J* = 8.93 Hz, 2H), 4.511 (t, *J* = 8.81 Hz 2H), 2.359 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.52, 150.83, 138.68, 135.05, 128.91, 128.87, 128.25, 128.21, 126.67, 125.84, 115.79, 70.05, 62.86, 21.39; HRMS; Calculated for $C_{36}H_{30}N_2O_5$ $[M+Na]^+$, *m/z* 593.2052 found 593.2047.

3,3'-(2,5-bis(4-ethylphenyl)furan-3,4-diyl)bis(4-phenyloxazolidin-2-one) (2v)



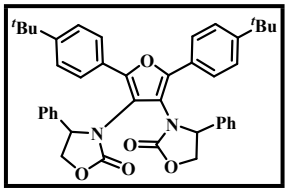
Yield: 58% (367 mg); mp 88-90 °C; FT-IR (cm^{-1}): 3918.91, 3776.48, 2858.63, 1759.66, 1039.32, 706.90, 497.18; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.217 (d, *J* = 8.19 Hz, 4H), 7.089 (d, *J* = 7.50 Hz, 4H), 7.069 (d, *J* = 6.60 Hz, 4H), 7.016 (t, *J* = 7.39 Hz, 2H), 6.894 (t, *J* = 7.76 Hz, 4H), 5.170 (t, *J* = 8.66 Hz, 2H), 4.839 (t, *J* = 8.93 Hz, 2H), 4.524 (t, *J* = 8.76 Hz, 2H), 2.647 (q, *J* = 7.58 Hz, 4H), 1.252 (t, *J* =7.66 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.55, 150.91, 145.14, 130.06, 128.86, 128.27, 128.16, 127.74, 126.05, 115.83, 69.99, 62.82, 28.82, 15.77; HRMS; Calculated for $C_{38}H_{34}N_2O_5$ $[M+Na]^+$, *m/z* 621.2365 found 621.2360.

3,3'-(2,5-bis(4-propylphenyl)furan-3,4-diyl)bis(4-phenyloxazolidin-2-one) (2w)



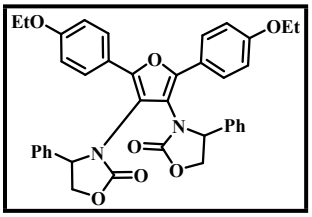
Yield: 56% (317 mg); mp 98-100 °C; FT-IR (cm^{-1}): 3900.42, 3826.58, 2857.69, 2308.93, 1846.06, 1385.05, 764.58; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.213 (d, *J* = 8.24 Hz, 4H), 7.074 (d, *J* = 8.04 Hz, 4H), 7.072 (d, *J* = 7.86 Hz, 4H), 7.017 (t, *J* = 7.43 Hz, 2H), 6.987 (t, *J* = 7.77 Hz, 4H), 5.174 (t, *J* = 8.64 Hz, 2H), 4.840 (t, *J* = 8.97Hz, 2H), 4.525 (t, *J* = 8.77 Hz, 4H), 2.588 (t, *J* = 7.73 Hz, 4H), 1.702 – 1.610 (m, 4H), 0.964 (t, *J* = 7.37 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.54, 150.90, 143.50, 135.04, 128.8, 128.36, 128.27, 128.18, 126.65, 126.05, 115.80, 69.99, 62.85, 37.86, 24.58, 13.71; MS (ESI); Calculated for $C_{40}H_{38}N_2O_5$ $[M+Na]^+$, *m/z* 649.2678, found 649.2673.

3,3'-(2,5-bis(4-(tert-butyl)phenyl)furan-3,4-diyl)bis(4-phenyloxazolidin-2-one) (2x)



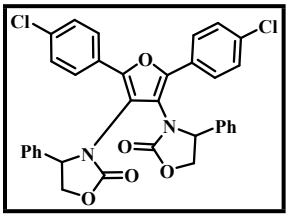
Yield: 53% (354 mg); mp 115-117 °C; FT-IR (cm^{-1}): 3911.00, 3776.27, 2958.09, 1760.07, 1037.81, 761.02, 554.47; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.275 (d, J = 8.58 Hz, 4H), 7.207 (d, J = 8.59 Hz, 4H), 7.067 (dd, J = 8.33 Hz, J = 1.21 Hz 4H), 6.999 (t, J = 7.44 Hz, 2H), 6.866 (t, J = 7.75 Hz, 4H), 5.171 (t, J = 8.58 Hz, 2H), 4.841 (t, J = 8.98 Hz 2H), 4.543 (t, J = 8.48 Hz 2H), 1.336 (s,18H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.55, 151.90, 150.89, 135.10, 128.83, 128.29, 128.10, 126.51, 125.77, 125.09, 115.93, 69.90, 62.76, 34.73, 31.27; HRMS; Calculated for $C_{42}H_{42}N_2O_5$ $[M+Na]^+$, *m/z* 677.2991 found 677.2986.

3,3'-(2,5-bis(4-ethoxyphenyl)furan-3,4-diyl)bis(4-phenyloxazolidin-2-one) (2y)



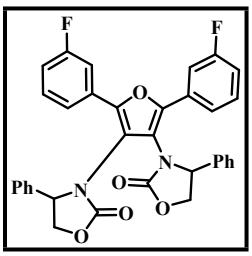
Yield: 52% (360 mg); mp 107-109 °C; FT-IR (cm^{-1}): 3835.79, 3609.29, 2922.73, 1756.31, 1180.94, 828.90; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.220 (d, J = 8.88 Hz, 4H), 7.079 (dd, J = 8.36 Hz, J = 1.28 Hz, 4H), 7.040 (d, J = 7.43 Hz, 2H), 6.947 (t, J = 7.69 Hz, 4H), 6.787 (d, J = 8.88 Hz, 4H), 5.159 (t, J = 8.64 Hz, 2H), 4.836 (t, J = 8.97 Hz, 2H), 4.507 (t, J = 8.80 Hz, 2H), 4.057 (q, J = 6.99 Hz, 4H), 1.445 (t, J =7.02Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 159.33, 157.60, 150.48, 135.17, 128.89, 128.21, 121.33, 115.05, 114.28, 70.01, 63.55, 62.82, 14.76; HRMS; Calculated for $C_{38}H_{34}N_2O_7$ $[M+Na]^+$, *m/z* 653.2264 found 653.2258.

3,3'-(2,5-bis(4-chlorophenyl)furan-3,4-diyl)bis(4-phenyloxazolidin-2-one) (2z)



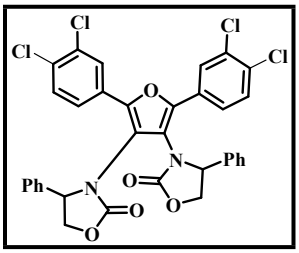
Yield: 64% (413 mg); mp 223-225 °C; FT-IR (cm^{-1}): 3923.04, 3774.58, 2919.93, 1633.88, 1386.46, 1034.82, 830.37, 498.62; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.244 (d, J = 9.10 Hz, 4H), 7.212 (d, J = 8.86 Hz, 4H), 7.098 – 7.065 (m, 6H), 6.968 (d, J = 7.76 Hz, 4H), 5.154 (t, J = 8.44 Hz, 2H), 4.869 (t, J = 8.98 Hz 2H), 4.577 (t, 7.244 (d, J = 8.80 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.40, 150.13, 134.92, 129.17, 128.56, 128.39, 128.18, 128.01, 126.73, 117.08, 69.96, 62.75; ESMS; Calculated for $C_{34}H_{24}Cl_2N_2O_5$ $[M+H]^+$, *m/z* 610.10, found 611.1.

3,3'-(2,5-bis(3-fluorophenyl)furan-3,4-diyl)bis(4-phenyloxazolidin-2-one) (2a')



Yield: 67% (410 mg); mp 228-230 °C; FT-IR (cm^{-1}): 3921.94, 3776.16, 2856.94, 2379.58, 1385.64, 1106.49, 759.56; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.273 – 7.219 (m, 2H), 7.118 (t, J = 7.47 Hz, 6H), 7.059 (d, J = 7.40 Hz, 2H), 6.997 (d, J = 6.67 Hz, 4H), 6.995 (t, J = 8.02 Hz, 4H), 5.173 (t, J = 8.48 Hz, 2H), 4.879 (t, J = 9.04 Hz, 2H), 4.615 (t, J = 8.88 Hz 2H);^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 163.68, 161.23, 157.32, 149.89, 134.80, 130.08, 129.99, 129.00, 129.18, 128.36, 128.22, 122.47, 117.48, 115.96, 115.75, 113.65, 113.41, 69.91, 62.70; HRMS; Calculated for $C_{34}H_{24}F_2N_2O_5$ $[M+Na]^+$, *m/z* 601.1551 found $[M+Na]^+$ 601.1545.

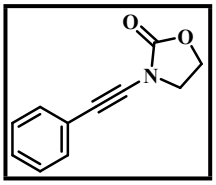
3,3'-(2,5-bis(3,4-dichlorophenyl)furan-3,4-diyl)bis(4-phenyloxazolidin-2-one) (2b')



Yield: 66% (474 mg); mp 218 -220 °C; FT-IR (cm^{-1}): 3914.40, 3772.51, 2925.02, 2342.35, 1761.14, 1397.22, 1078.33, 767.60; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.319 (d, *J* = 8.13 Hz, 2H), 7.139 – 7.097 (m, 8H), 7.009 (t, *J* = 6.99 Hz, 4H), 5.151 (t, *J* = 7.99 Hz, 2H), 4.888 (t, J = 8.88 Hz, 2H), 4.666 (t, *J* = 8.36 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 157.36, 149.14, 134.85, 133.20, 132.67, 130.28, 129.30, 128.44, 128.37, 128.21, 127.75, 125.83, 118.13, 69.77, 62.57; ESIMS; Calculated for $C_{34}H_{22}Cl_4N_2O_5$ $[M+Na]^+$, *m/z* 678.02 found $[M+H]^+$ 679.1.

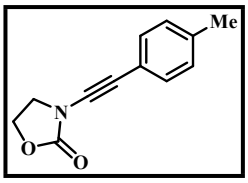
8. Spectral data of Ynamides;

3-(phenylethynyl)oxazolidin-2-one (1a)



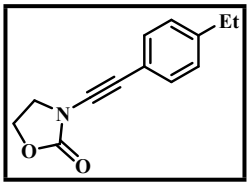
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.453 - 7.428 (m, 2H), 7.316 – 7.291 (m, 3H), 4.505 - 4.465 (dd, *J* = 8.14 Hz, *J* = 7.81 Hz, 2H), 4.028 – 3.988 (dd, *J* = 8.14 Hz, *J* = 7.81 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.96, 131.85, 131.56, 128.33, 128.21, 122.18, 79.05, 71.16, 63.12, 47.05.

3-(p-tolylethynyl)oxazolidin-2-one (1b)



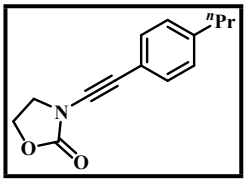
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.332 (d, *J* = 8.10 Hz, 2H), 7.017 (d, *J* = 7.90 Hz, 2H), 4.488 - 4.448 (dd, *J* = 8.18 Hz, *J* = 7.79 Hz, 2H), 4.008 – 3.968 (dd, *J* = 8.19 Hz, *J* = 7.78 Hz, 2H), 2.339 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.99, 138.41, 131.62, 129.08, 119.01, 78.29, 71.20, 63.03, 47.10, 21.45.

3-((4-ethylphenyl)ethynyl)oxazolidin-2-one (1c)



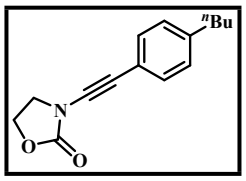
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.361 (d, *J* = 8.30 Hz, 2H), 7.137 (d, *J* = 8.45 Hz, 2H), 4.501 - 4.461 (dd, *J* = 8.15 Hz, *J* = 7.82 Hz, 2H), 4.022 – 3.982 (dd, *J* = 8.14 Hz, *J* = 7.84 Hz, 2H), 2.639 (q, *J* = 7.61 Hz, 2H), 1.223 (t, *J* = 7.62 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.98, 144.70, 131.69, 127.87, 119.24, 78.28. 71.25, 63.02, 47.12, 28.77, 15.30.

3-((4-propylphenyl)ethynyl)oxazolidin-2-one (1d)



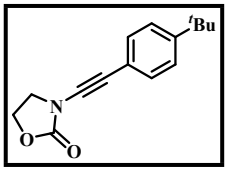
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.353 (d, *J* = 8.19 Hz, 2H), 7.113 (d, *J* = 8.24 Hz, 2H), 4.496 - 4.456 (dd, *J* = 8.17 Hz, *J* = 7.79 Hz, 2H), 4.015 – 3.975 (dd, *J* = 8.15 Hz, *J* = 7.81 Hz, 2H), 2.572 (t, *J* = 7.78 Hz, 2H), 1.653 – 1.597 (m, 2H), 0.923 (t, *J* = 7.37 Hz, 3H) ; ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 156.00, 143.19, 131.62, 128.48, 119.24, 78.29, 71.27, 63.02, 47.11, 37.90, 24.29, 13.73.

3-((4-butylphenyl)ethynyl)oxazolidin-2-one (1e)



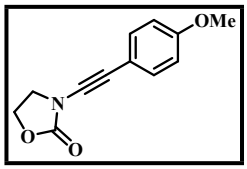
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.350 (d, J = 8.19 Hz, 2H), 7.113 (d, J = 8.21 Hz, 2H), 4.491 - 4.451 (dd, J = 8.22 Hz, J = 7.78 Hz, 2H), 4.011 – 3.971 (dd, J = 8.15 Hz, J = 7.78 Hz, 2H), 2.593 (t, J = 7.85 Hz, 2H), 1.598 – 1.540 (m, 2H), 1.383 – 1.291 (m, 2H), 0.917 (t, J = 7.33 Hz, 3H) ; ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.00, 142.37, 130.57, 127.40, 118.18, 77.34, 70.17, 62.05, 46.08, 34.50, 32.32, 21.25, 12.88.

3-((4-(tert-butyl)phenyl)ethynyl)oxazolidin-2-one (1f)



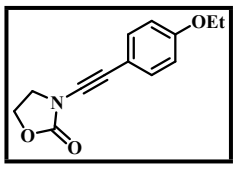
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.376 (d, J = 8.65 Hz, 2H), 7.321 (d, J = 8.64 Hz, 2H), 4.492 - 4.452 (dd, J = 8.19 Hz, J = 7.78 Hz, 2H), 4.015 – 3.975 (dd, J = 8.16 Hz, J = 7.80 Hz, 2H), 1.303 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 159.74, 156.05, 133.49, 114.77, 113.95, 77.59, 70.94, 62.97, 55.29, 47.14, 29.69.

3-((4-methoxyphenyl)ethynyl)oxazolidin-2-one (1g)



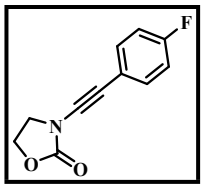
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.387 (d, J = 8.81 Hz, 2H), 6.835 (d, J = 8.83 Hz, 2H), 4.495 - 4.455 (dd, J = 8.17 Hz, J = 7.78 Hz, 2H), 4.010 – 3.970 (dd, J = 8.19 Hz, J = 7.76 Hz, 2H), 3.809 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 159.73, 156.05, 133.49, 114.07, 113.95, 77.59, 70.93, 62.97, 55.29, 47.14, 29.69.

3-((4-ethoxyphenyl)ethynyl)oxazolidin-2-one (1h)



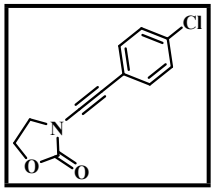
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.370 (d, J = 8.86 Hz, 2H), 6.816 (d, J = 8.85 Hz, 2H), 4.490 - 4.450 (dd, J = 8.18 Hz, J = 7.79 Hz, 2H), 4.026 (q, J = 7.03 Hz, 2H), 4.003 – 3.964 (dd, J = 8.14 Hz, J = 7.82 Hz, 2H), 1.407 (t, J = 6.99 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 159.13, 156.07, 133.49, 114.45, 113.85, 77.53, 70.98, 63.50, 62.98, 47.14, 14.73.

3-((4-fluorophenyl)ethynyl)oxazolidin-2-one (1i)



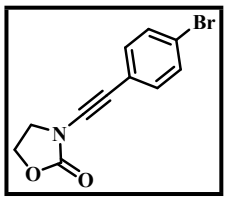
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.449 – 7.399 (m, 2H), 7.032 – 6.975 (m, 2H), 4.512 - 4.473 (dd, J = 8.15 Hz, J = 7.81 Hz, 2H), 4.023 – 3.983 (dd, J = 8.91 Hz, J = 7.84 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 163.51, 161.53, 155.94, 133.71, 133.64, 118.21, 118.19, 115.70, 115.53, 78.61, 70.16, 63.09, 47.01.

3-((4-chlorophenyl)ethynyl)oxazolidin-2-one (1j)



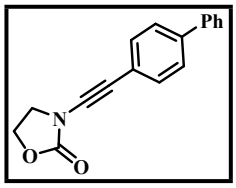
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.364 (d, J = 8.72 Hz, 2H), 7.280 (d, J = 8.72 Hz, 2H), 4.516 - 4.476 (dd, J = 8.13 Hz, J = 7.82 Hz, 2H), 4.028 – 3.988 (dd, J = 8.12 Hz, J = 7.82 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.81, 138.22, 132.77, 128.67, 120.71, 79.83, 70.27, 63.10, 46.97.

3-((4-chlorophenyl)ethynyl)oxazolidin-2-one (1k)



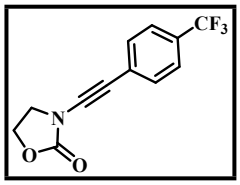
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.439 (d, J = 8.55 Hz, 2H), 7.293 (d, J = 8.47 Hz, 2H), 4.512 - 4.480 (dd, J = 8.16 Hz, J = 7.79 Hz, 2H), 4.024 – 3.992 (dd, J = 8.14 Hz, J = 7.83 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.76, 132.94, 131.59, 122.40, 121.19, 79.99, 70.39, 63.09, 46.96.

3-([1,1'-biphenyl]-4-ylethynyl)oxazolidin-2-one (1l)



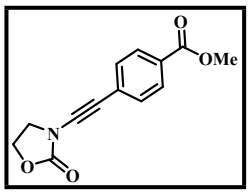
^{1}H NMR (400MHz, $CDCl_3$) δ (ppm): 7.583 (d, J = 7.58 Hz, 2H), 7.548 (d, J = 8.84 Hz, 2H), 7.507 (d, J = 8.21 Hz, 2H), 7.439 (t, J = 7.44 Hz, 2H), 7.351 (d, J = 7.31 Hz, 2H), 4.495 (t, J = 8.87 Hz, 2H), 4.025 (t, J = 8.50 Hz, 2H); ^{13}C NMR (101MHz, $CDCl_3$) δ (ppm): 155.89, 140.92, 140.27, 131.98, 128.86, 127.64, 126.99, 121.98, 121.08, 79.57, 71.16, 63.06, 47.09.

3-((4-(trifluoromethyl)phenyl)ethynyl)oxazolidin-2-one (1m)



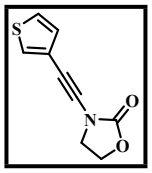
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.563 (d, J = 8.50 Hz, 2H), 7.522 (d, J = 8.44 Hz, 2H), 4.536 - 4.496 (dd, J = 8.16 Hz, J = 7.75 Hz, 2H), 4.058 – 4.018 (dd, J = 8.17 Hz, J = 7.76 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.63, 131.36, 129.88, 129.56, 126.20, 125.30, 125.27, 125.23, 125.19, 122.56, 81.35, 70.45, 63.15, 46.90.

methyl 4-((2-oxooxazolidin-3-yl)ethynyl)benzoate (1n)



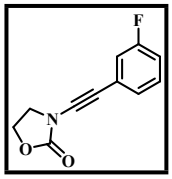
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.977 (d, J = 8.57 Hz, 2H), 7.481 (d, J = 8.61 Hz, 2H), 4.534 - 4.494 (dd, J = 8.15 Hz, J = 7.77 Hz, 2H), 4.056 – 4.017 (dd, J = 8.16 Hz, J = 7.76 Hz, 2H), 3.915 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 166.53, 155.63, 131.00, 129.48, 129.27, 127.09, 81.92, 71.07, 63.14, 52.20, 46.93.

3-(thiophen-3-ylethynyl)oxazolidin-2-one (1o)



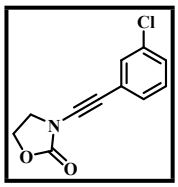
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.459 (dd, J = 2.98 Hz, J = 1.10 Hz, 1H), 7.263 (dd, J = 4.35 Hz, J = 1.28 Hz, 1H), 7.115 (dd, J = 4.98 Hz, J = 1.08 Hz, 1H), 4.504 – 4.464 (dd, J = 8.19 Hz, J = 7.77 Hz, 2H), 4.015 - 3.975 (dd, J = 8.20 Hz, J = 7.75 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 156.02, 130.08, 129.18, 125.33, 120.90, 78.37, 66.40, 63.10, 47.03.

3-((3-fluorophenyl)ethynyl)oxazolidin-2-one (1p)



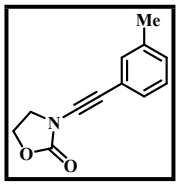
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.296 – 7.256 (m, 1H), 7.226 – 7.200 (m, 1H), 7.145 – 7.110 (m, 1H), 7.033 – 6.982 (m, 1H), 4.520 – 4.481 (dd, J = 8.17 Hz, J = 7.75 Hz, 2H), 4.036 - 3.996 (dd, J = 8.16 Hz, J = 7.77 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 163.55, 161.10, 155.78, 129.95, 129.86, 127.32, 127.29, 124.14, 124.04, 118.28, 118.06, 115.56, 115.35, 79.88, 70.29, 70.26, 63.15, 46.94.

3-((3-chlorophenyl)ethynyl)oxazolidin-2-one (1q)



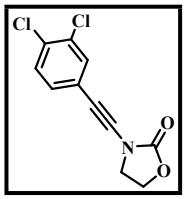
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.428 – 7.419 (m, 1H), 7.327 – 7.301 (m, 1H), 7.293 – 7.268 (m, 1H), 7.251 – 7.212 (m, 1H), 4.520 – 4.480 (dd, *J* = 8.13 Hz, *J* = 7.80 Hz, 2H), 4.032 - 3.992 (dd, *J* = 8.13 Hz, *J* = 7.81 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.75, 134.12, 131.20, 129.57, 129.52, 128.38, 123.98, 80.15, 70.13, 63.16, 46.94.

3-(m-tolylethynyl)oxazolidin-2-one (1r)



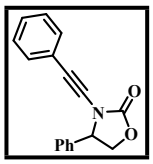
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.271 – 7.233 (m, 2H), 7.190 (t, *J* = 7.61 Hz, 1H), 7.114 (d, *J* = 7.57 Hz, 1H), 4.013 – 3.981 (dd, *J* = 8.19 Hz, *J* = 7.76 Hz, 2H), 4.036 - 3.996 (dd, *J* = 8.12 Hz, *J* = 7.83 Hz, 2H), 2.318 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 163.55, 161.10, 155.93, 138.00, 132.15, 129.09, 128.58, 128.20, 121.94, 118.28, 118.06, 78.62, 71.38, 63.02, 47.07, 21.19.

3-((3,4-dichlorophenyl)ethynyl)oxazolidin-2-one (1r)



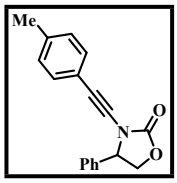
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.516 (d, *J* = 1.38 Hz, 1H), 7.375 (d, *J* = 8.28 Hz, 1H), 7.250 (d, *J* = 8.58 Hz, *J* = 1.50 Hz, 1H), 4.507 (t, *J* = 8.19 Hz, 1H), 4.012 (t, *J* = 8.18 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.67, 132.92, 132.50, 132.45, 130.51, 130.37, 122.27, 80.83, 69.38, 63.20, 46.88.

3-((4-ethylphenyl)ethynyl)-4-phenyloxazolidin-2-one (1t)



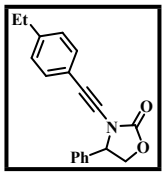
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.483 – 7.382 (m, 5H), 7.265 - 7.206 (m, 5H), 5.143 (dd, *J* = 8.62 Hz, *J* = 1.47 Hz, 1H), 4.776 (t, *J* = 8.87 Hz, 1H), 4.306 (dd, *J* = 8.96 Hz, *J* = 1.84 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.58, 136.05, 131.48, 129.56, 129.35, 128.16, 128.07, 126.91, 122.12, 78.02, 70.78, 62.24.

4-phenyl-3-(p-tolylethynyl)oxazolidin-2-one (1u)



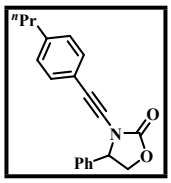
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.475 – 7.380 (m, 5H), 7.153 (d, *J* = 8.10 Hz, 2H), 7.025 (d, *J* = 7.93 Hz, 2H), 5.146 – 5.106 (dd, *J* = 8.57 Hz, *J* = 7.15 Hz, 1H), 4.773 (t, *J* = 8.85 Hz, 1H), 4.324 – 4.284 (dd, *J* = 8.93 Hz, *J* = 7.09 Hz, 1H), 2.292 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.63, 138.25, 136.13, 131.52, 129.49, 129.31, 128.90, 126.89, 118.97, 77.22, 72.87, 70.71, 62.26, 21.41.

3-((4-ethylphenyl)ethynyl)-4-phenyloxazolidin-2-one (1v)



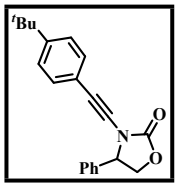
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.480 – 7.380 (m, 5H), 7.180 (d, *J* = 8.25 Hz, 2H), 7.051 (d, *J* = 8.42 Hz, 2H), 5.128 (dd, *J* = 8.67 Hz, *J* = 1.53 Hz, 1H), 4.773 (t, *J* = 8.87 Hz, 1H), 4.305 (dd, *J* = 8.94 Hz, *J* = 1.85 Hz, 1H), 2.587 (t, *J* = 7.60 Hz, 2H), 1.177 (t, *J* = 7.60 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.63, 144.57, 136.14, 131.60, 129.30, 127.72, 126.90, 119.22, 77.25, 72.90, 70.72, 62.26, 28.74, 15.32.

3-((4-chlorophenyl)ethynyl)-4-phenyloxazolidin-2-one (1w)



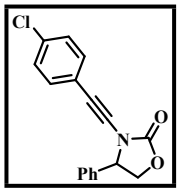
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.473 – 7.379 (m, 5H), 7.173 (d, *J* = 8.24 Hz, 2H), 7.027 (d, *J* = 8.31 Hz, 2H), 5.145 – 5.106 (dd, *J* = 8.60 Hz, *J* = 7.12 Hz, 1H), 4.771 (t, *J* = 8.87 Hz, 1H), 4.321 – 4.281 (dd, *J* = 8.91 Hz, *J* = 7.11 Hz, 1H), 2.521 (t, *J* = 7.83 Hz, 2H), 1.623 (m, 2H), 0.888 (t, *J* = 7.35 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.64, 143.03, 136.15, 131.52, 129.48, 129.30, 128.32, 126.90, 119.22, 72.90, 70.72, 62.26, 37.87, 24.29, 13.69.

3-((4-(tert-butyl)phenyl)ethynyl)-4-phenyloxazolidin-2-one (1y)



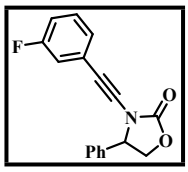
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.454 – 7.381 (m, 5H), 7.244 (d, *J* = 8.67 Hz, 2H), 7.192 (d, *J* = 8.67 Hz, 2H), 5.128 (dd, *J* = 8.60 Hz, *J* = 1.40 Hz, 1H), 4.772 (t, *J* = 8.84 Hz, 1H), 4.305 (dd, *J* = 8.96 Hz, *J* = 1.81 Hz, 1H), 1.259 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.60, 151.40, 136.15, 131.32, 129.48, 129.29, 126.92, 125.16, 119.07, 77.42, 72.88, 70.71, 62.29, 34.70, 31.13.

3-((4-chlorophenyl)ethynyl)-4-phenyloxazolidin-2-one (1z)



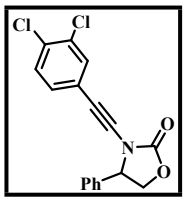
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.492 – 7.378 (m, 5H), 7.196 (d, *J* = 8.91 Hz, 2H), 7.165 (d, *J* = 8.98 Hz, 2H), 5.158 – 5.118 (dd, *J* = 8.51 Hz, *J* = 7.21 Hz, 1H), 4.789 (t, *J* = 8.90 Hz, 1H), 4.338 – 4.297 (dd, *J* = 8.92 Hz, *J* = 7.14 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 135.92, 134.07, 132.65, 129.63, 129.38, 128.50, 126.87, 120.64, 78.91, 71.90, 70.81, 62.19, 29.70.

3-((3-fluorophenyl)ethynyl)-4-phenyloxazolidin-2-one (1a')



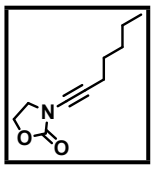
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.498 – 7.383 (m, 5H), 7.041 - 7.016 (m, 1H), 6.963 - 6.913 (m, 2H), 5.143 (dd, *J* = 8.57 Hz, *J* = 1.35 Hz, 1H), 4.792 (t, *J* = 8.81 Hz, 1H), 4.327 (dd, *J* = 8.96 Hz, *J* = 1.83 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 163.43, 160.99, 155.39, 135.87, 129.78, 129.70, 129.66, 129.40, 127.21, 127.18, 126.89, 124.07, 123.97, 118.19, 117.96, 115.42, 115.21, 78.97, 71.94, 71.90, 70.84, 62.18.

3-((3,4-dichlorophenyl)ethynyl)-4-phenyloxazolidin-2-one (1b')



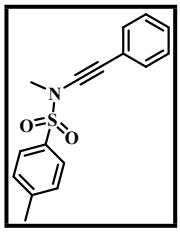
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.491 – 7.444 (m, 3H), 7.387 (d, *J* = 6.65 Hz, 2H), 7.311 (d, *J* = 1.61 Hz, 1H), 7.277 (t, *J* = 8.61 Hz, 1H), 7.078 – 7.058 (dd, *J* = 8.36 Hz, *J* = 1.72 Hz, 1H), 5.141 (t, *J* = 8.15 Hz, 1H), 4.798 (t, *J* = 8.86 Hz, 1H), 4.343 – 4.311 (dd, *J* = 8.85 Hz, *J* = 1.58 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 154.27, 134.71, 131.79, 131.30, 129. 41, 129.16, 128.70, 128.41, 125.82, 121.13, 78.88, 69.92, 69.86, 61.09.

3-(hept-1-yn-1-yl)oxazolidin-2-one (3a)



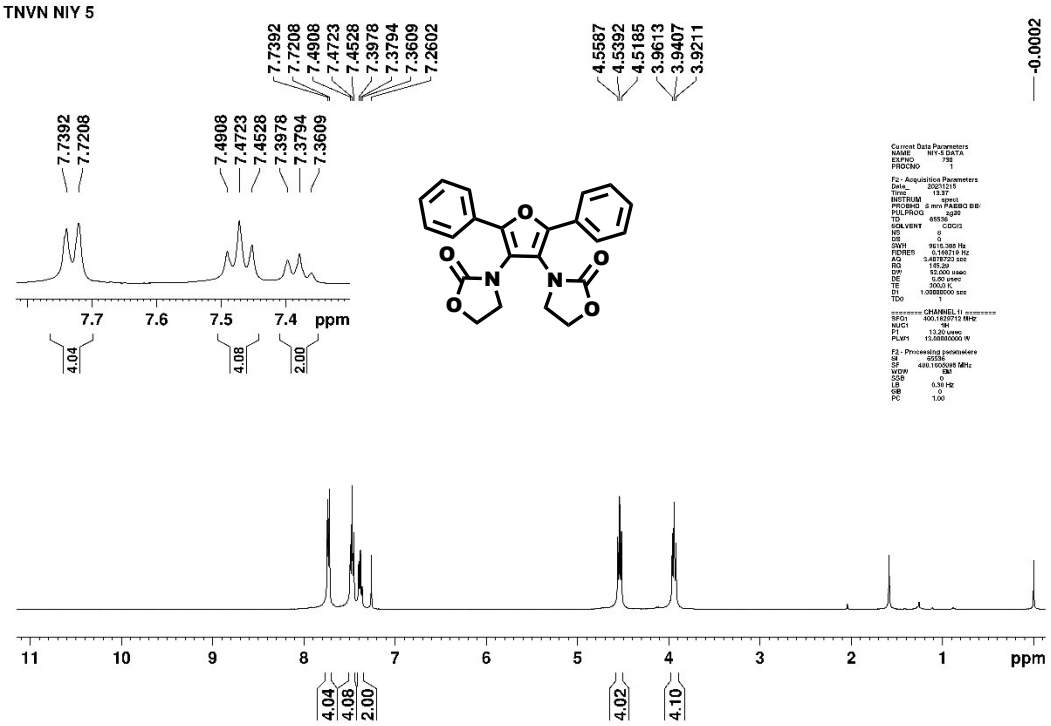
^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 4.429 – 2.389 (dd, J = 8.17 Hz, J = 7.83 Hz, 2H), 3.891 - 3.851 (dd, J = 8.16 Hz, J = 7.85 Hz, 2H), 2.297 (t, J = 7.20 Hz, 2H), 1.568 – 1.496 (m, 2H), 1.403 - 1.292 (m, 4H), 0.900 (t, J = 7.23 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 156.65, 72.66, 70.00, 62.77, 47.06, 31.03, 28.49, 22.17, 18.3, 13.94.

N,4-dimethyl-N-(phenylethynyl)benzenesulfonamide (5c)

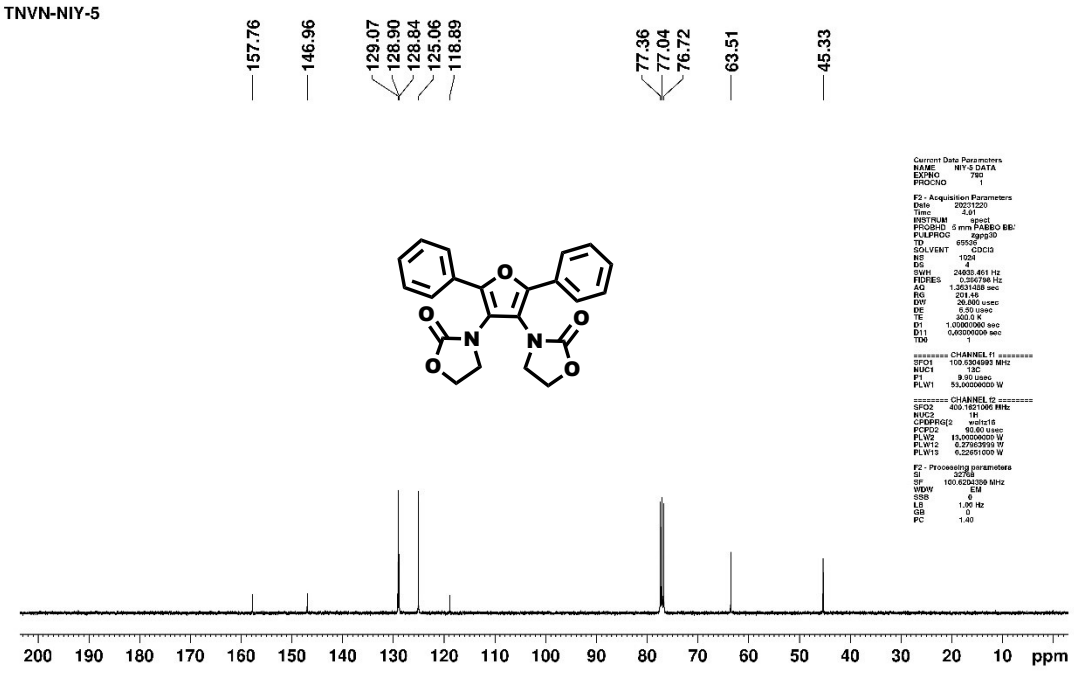


^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.839 (d, J = 8.16 Hz, 2H), 7.378 – 7.347 (m, 4H), 7.305 – 7.255 (m, 3H), 3.150 (s, 3H), 2.457 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 144.83, 133.24, 131.42, 129.83, 128.29, 127.88, 122.71, 83.96, 69.04, 39.33, 21.68.

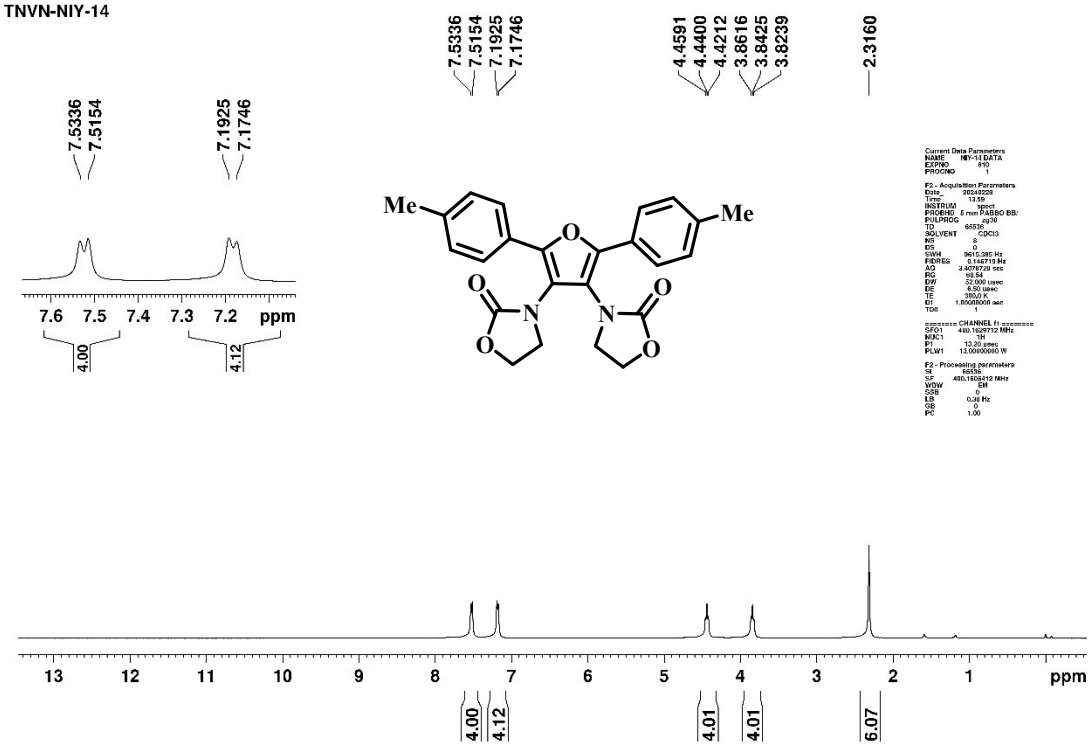
18. Copies of NMR Spectra:



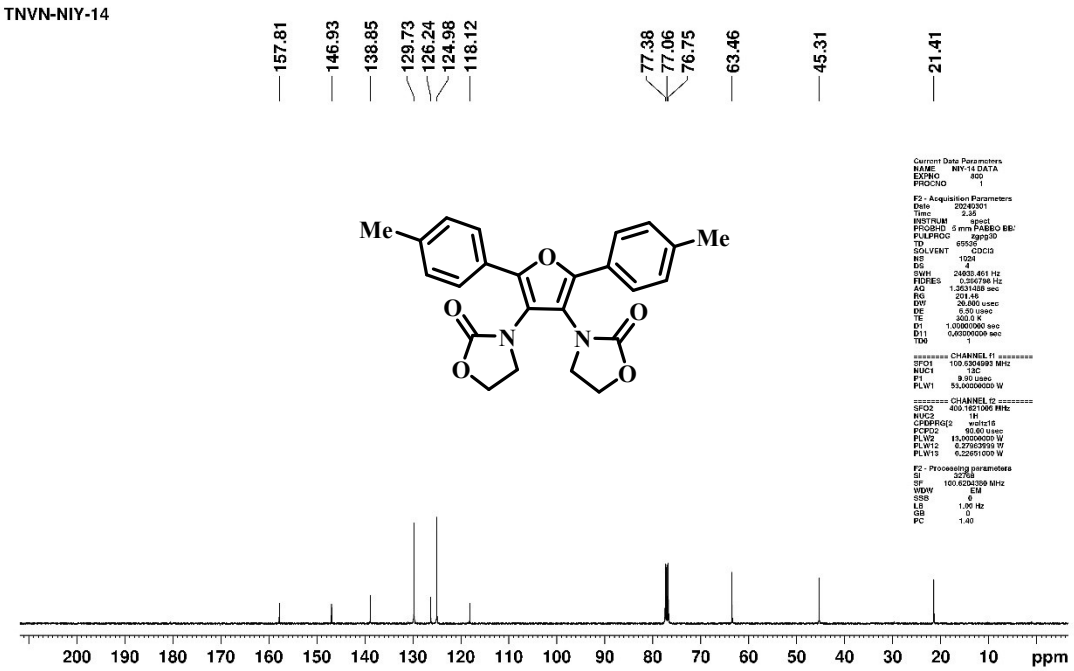
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2a**



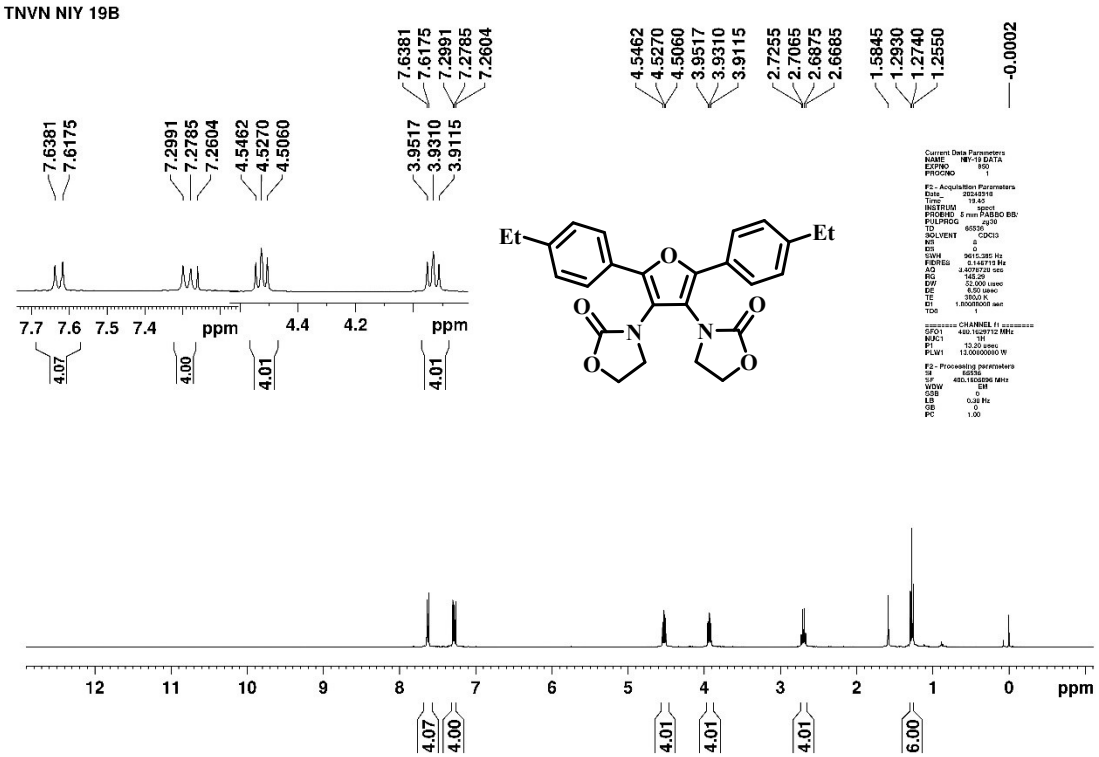
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2a**



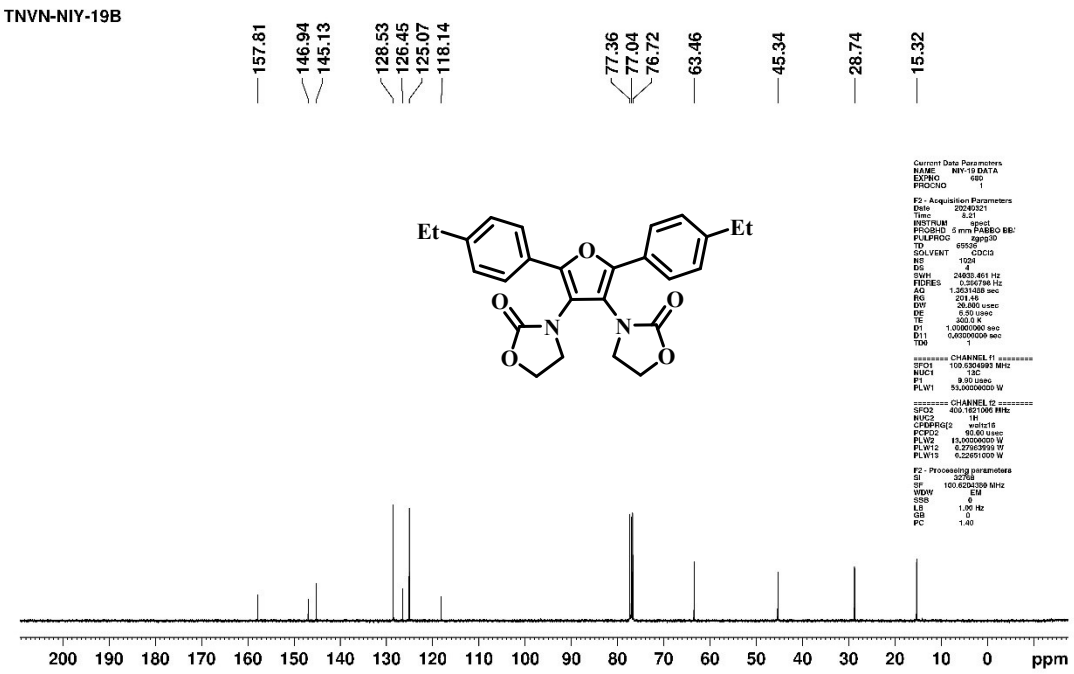
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2b**



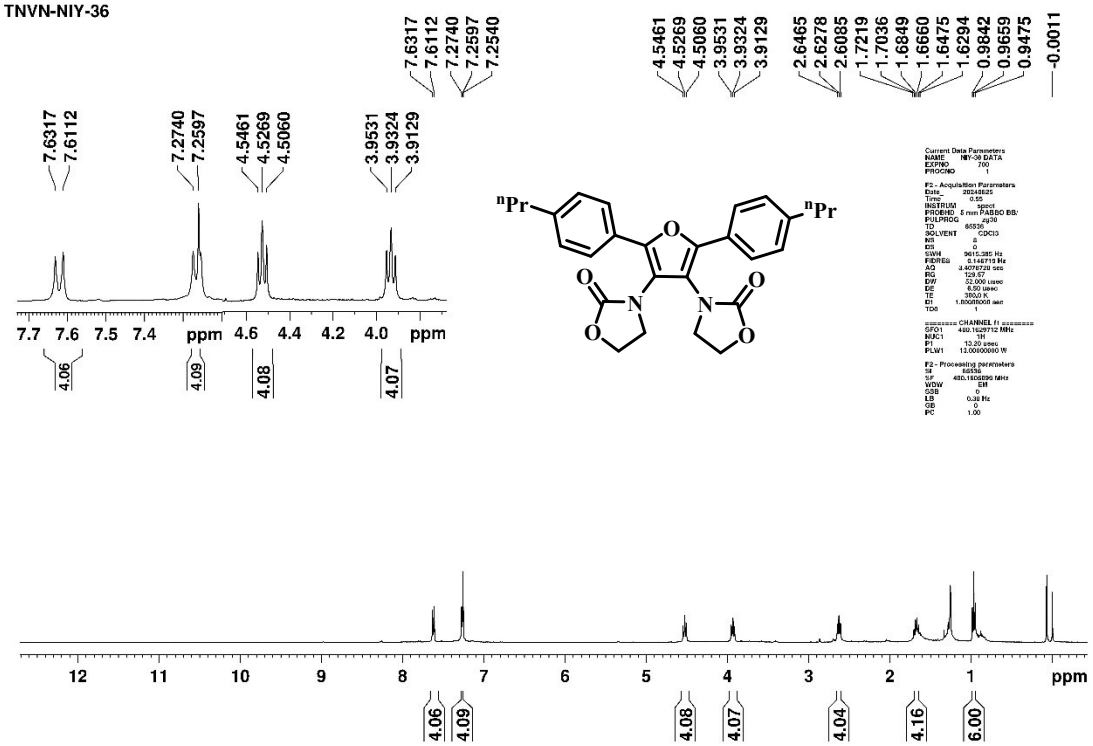
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2b**



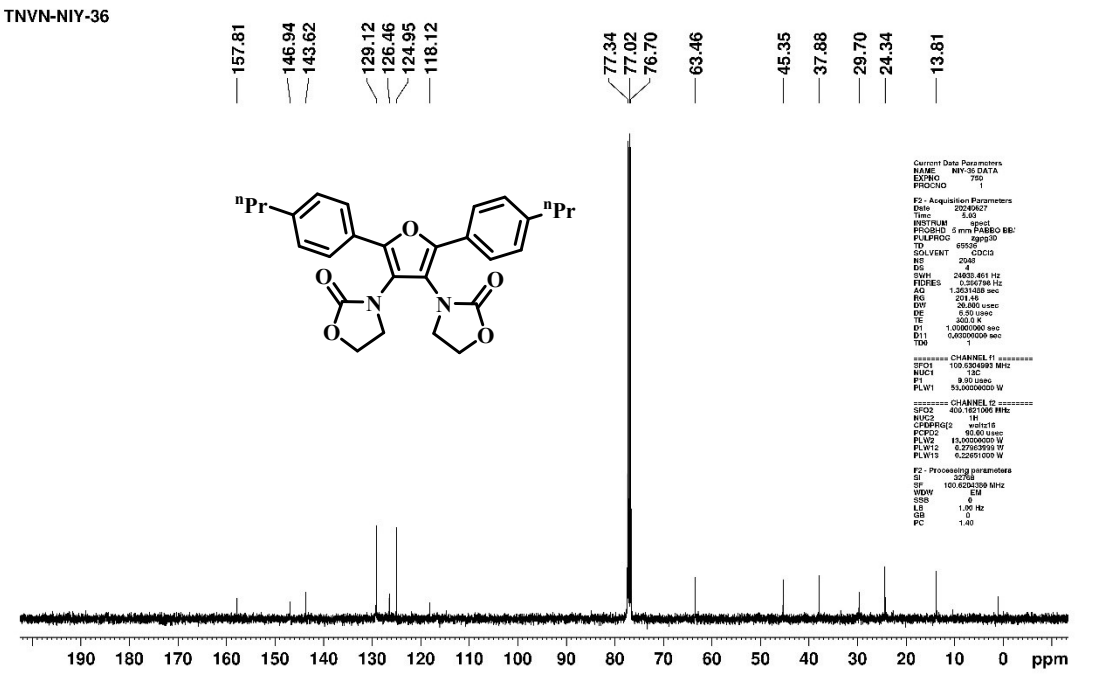
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2c**



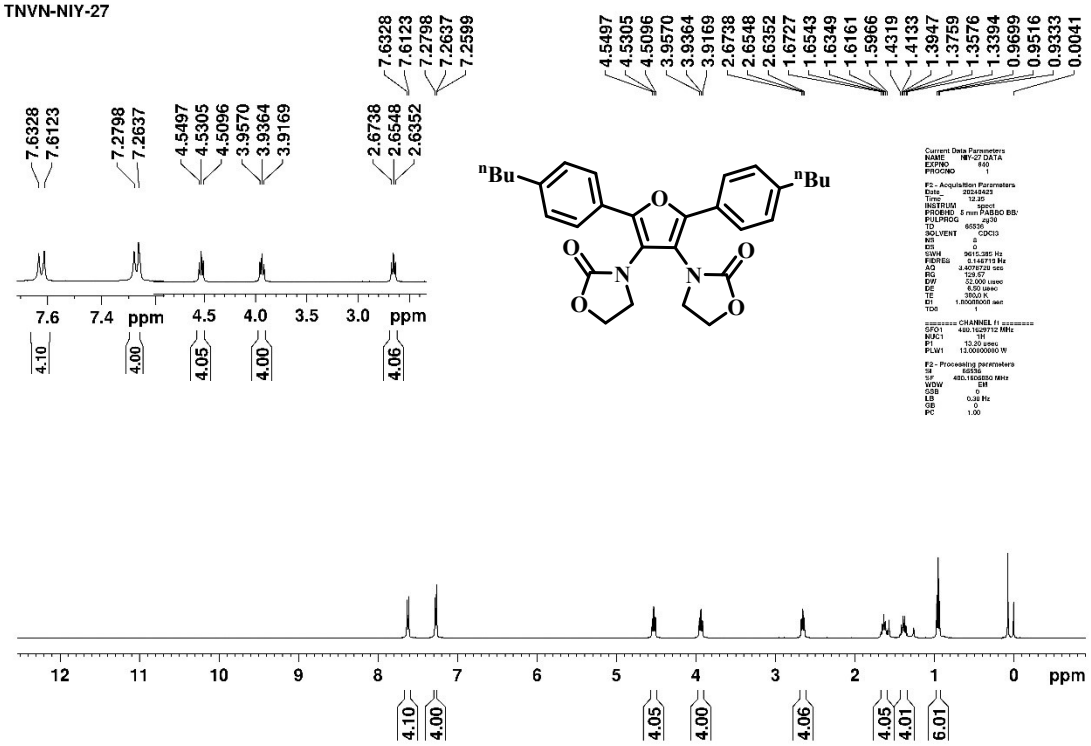
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2c**



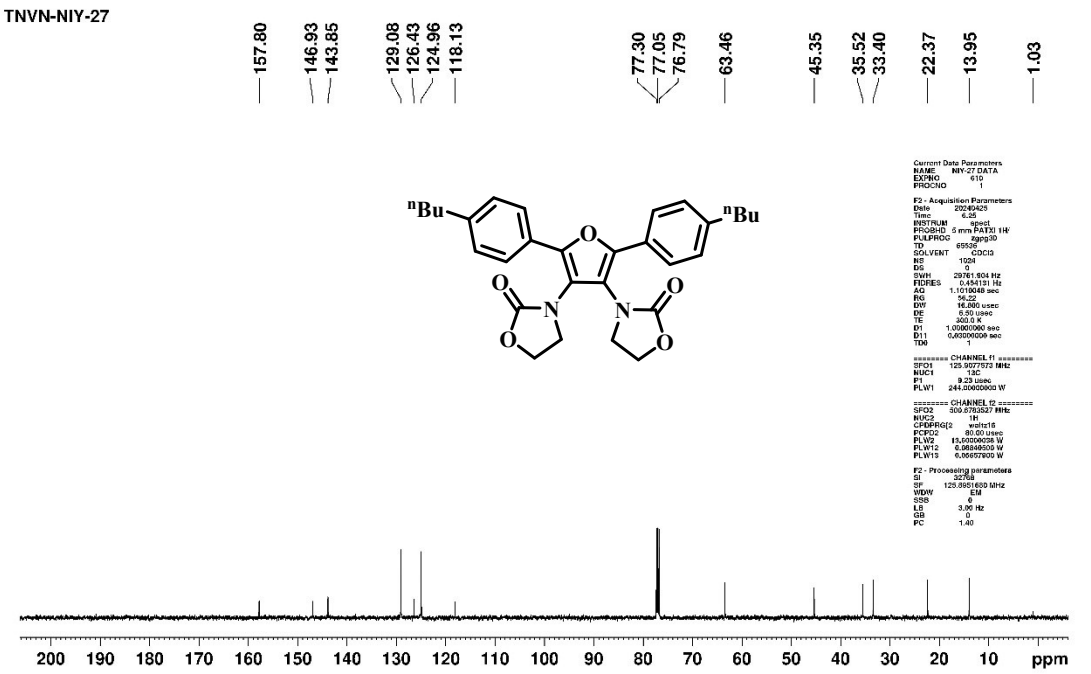
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2d**



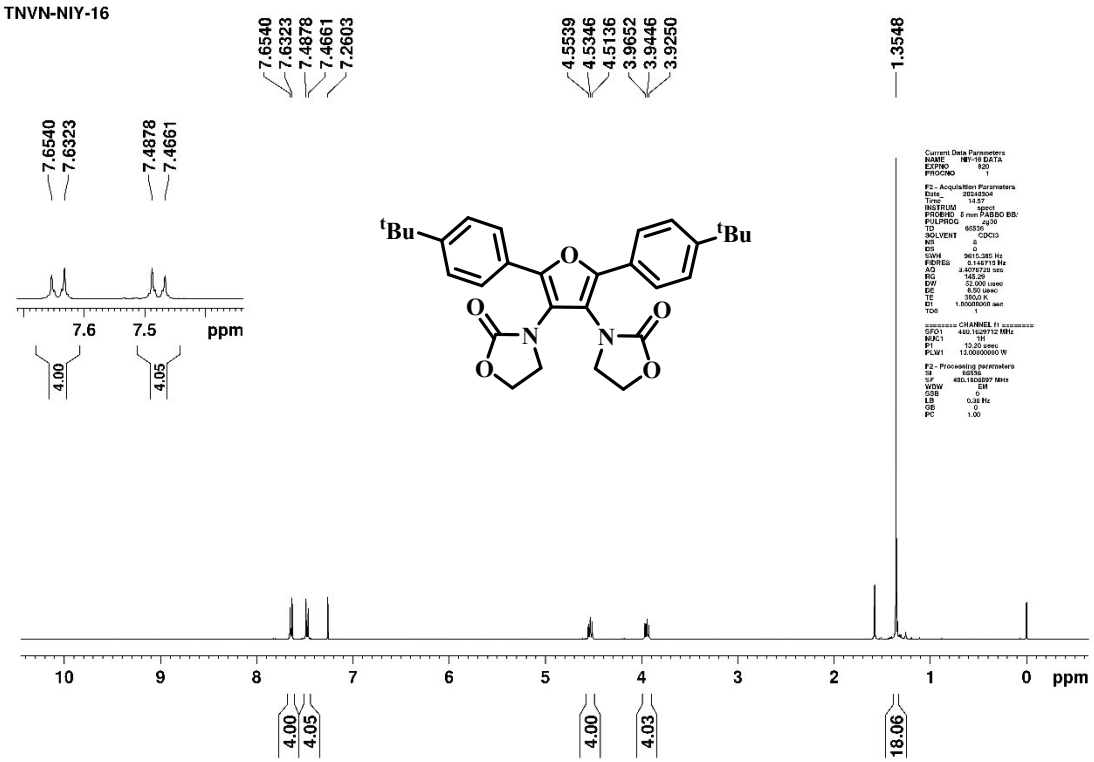
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2d**



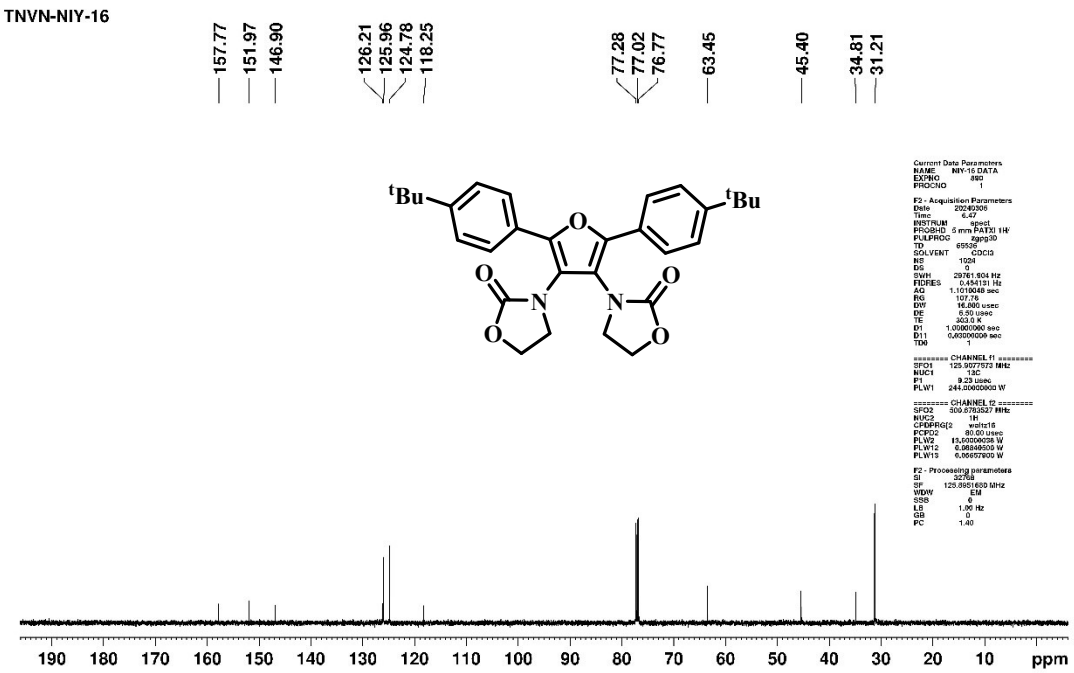
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2e**



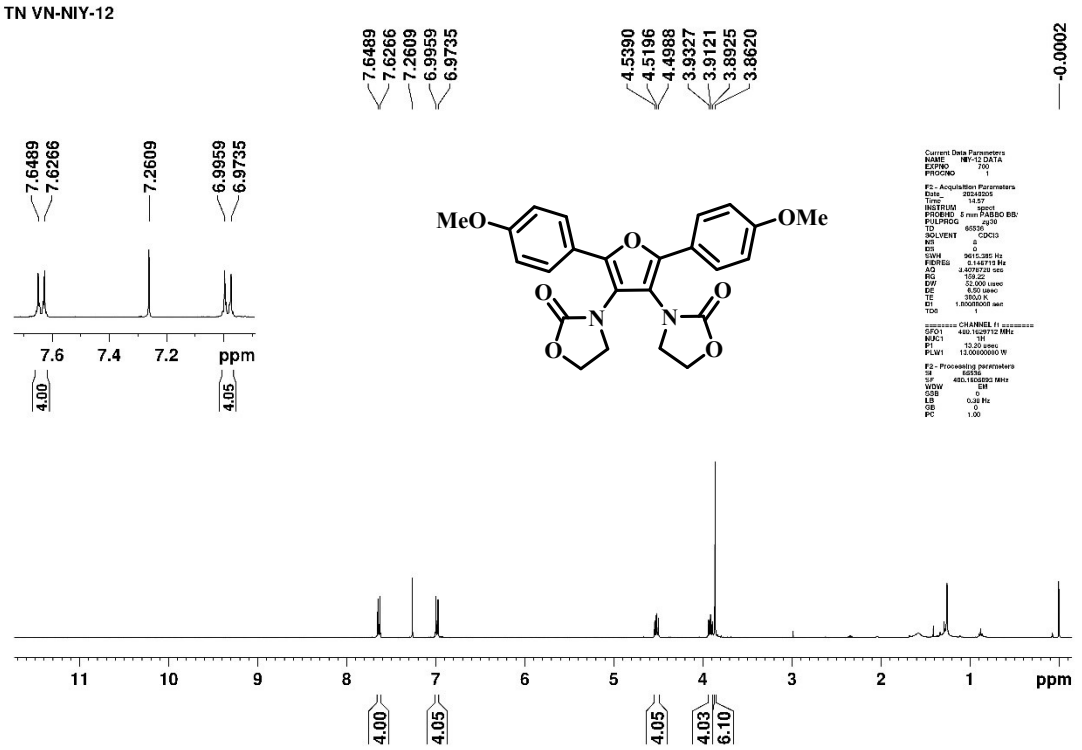
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2e**



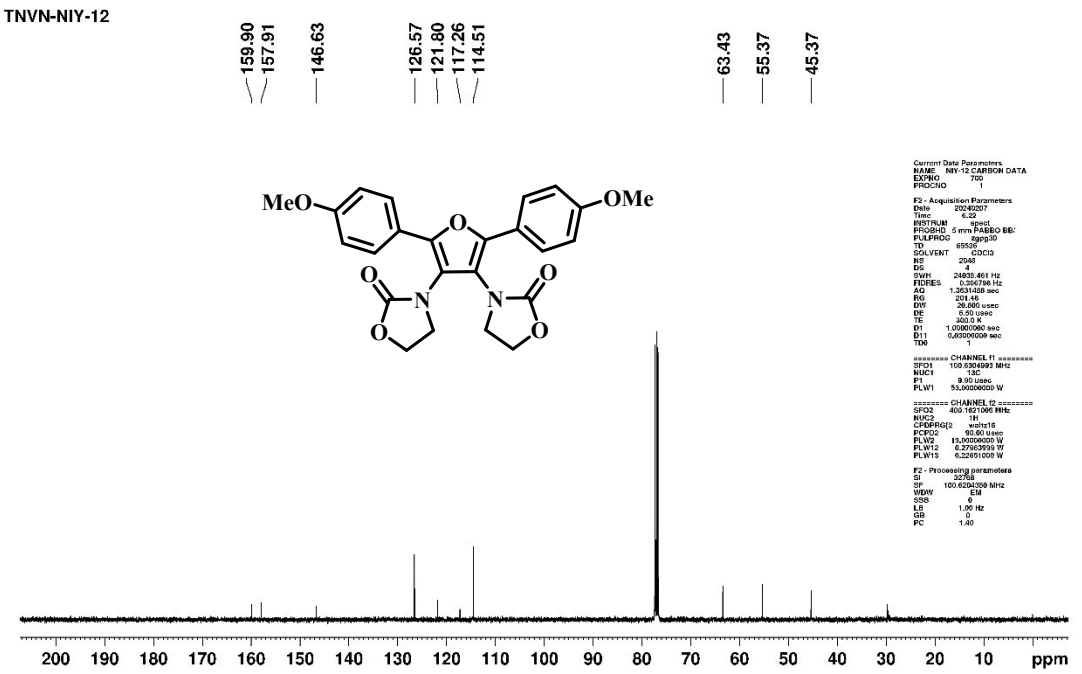
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2f**



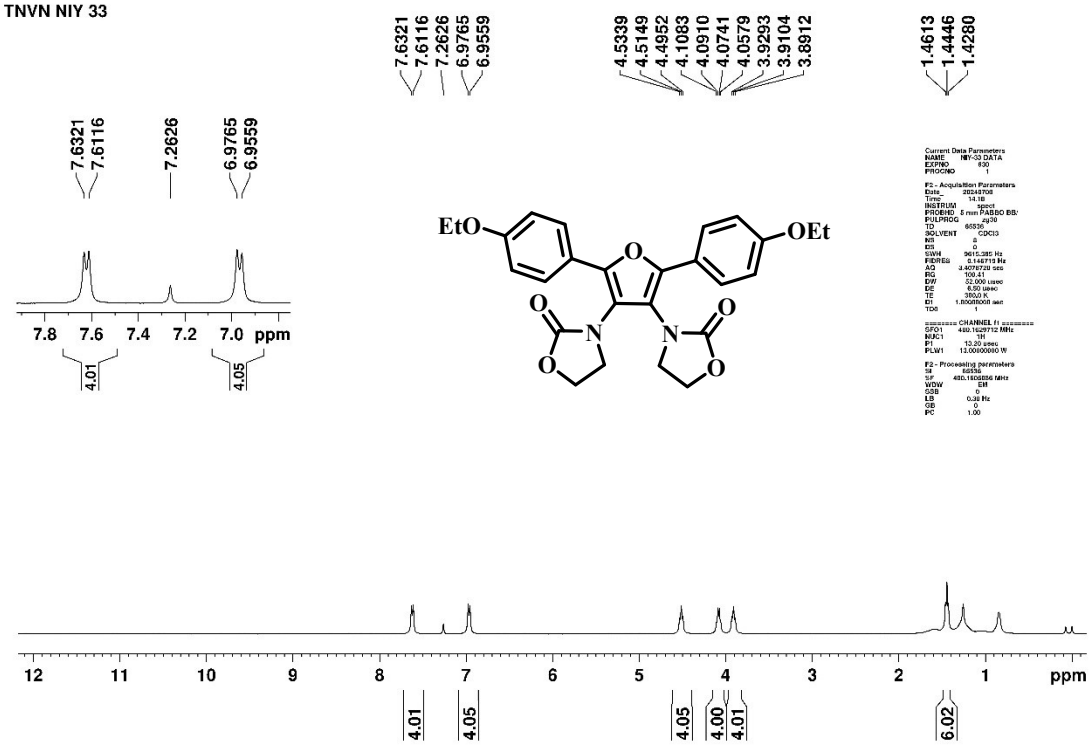
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2f**



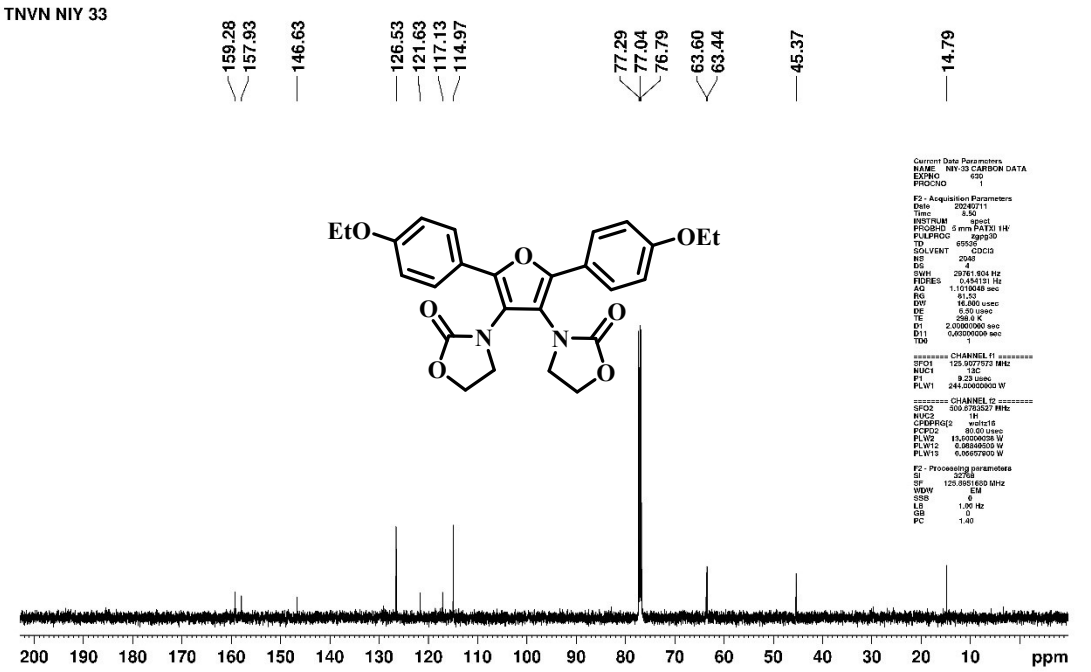
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2g**



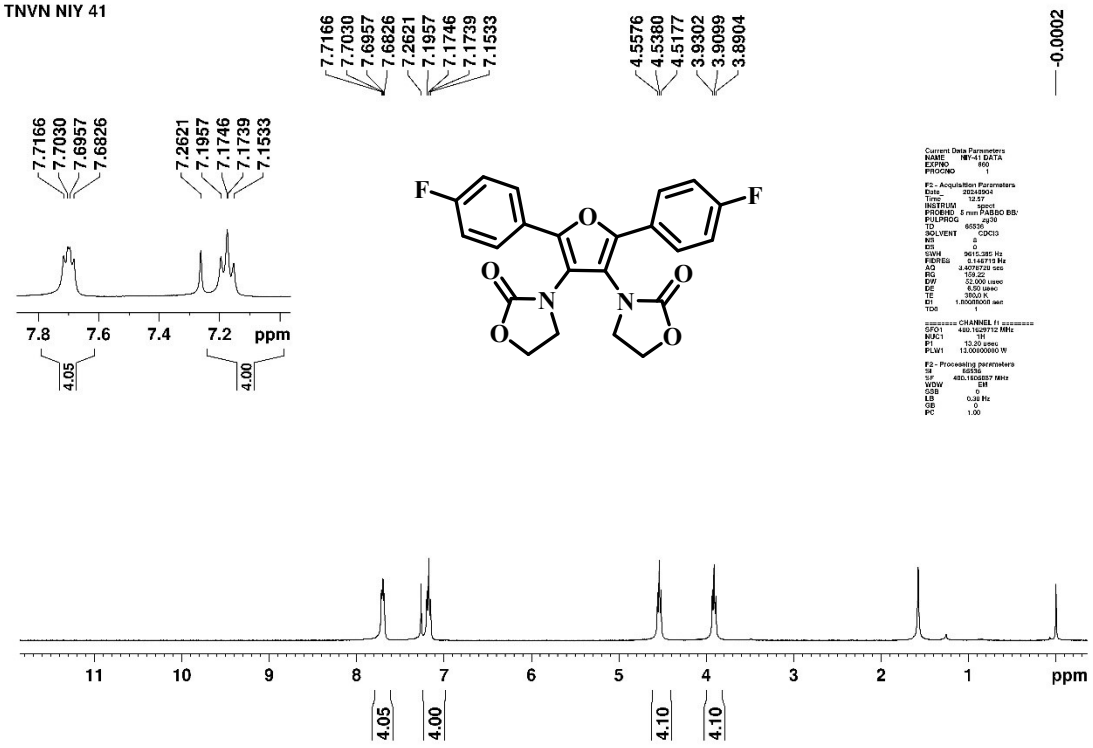
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2g**



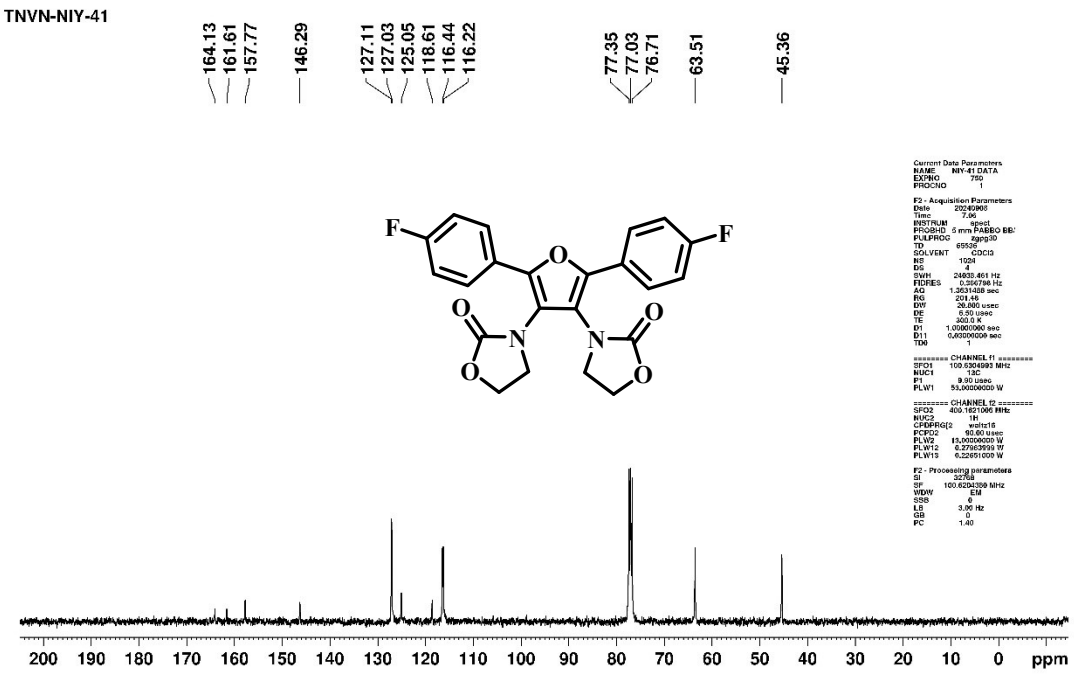
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2h**



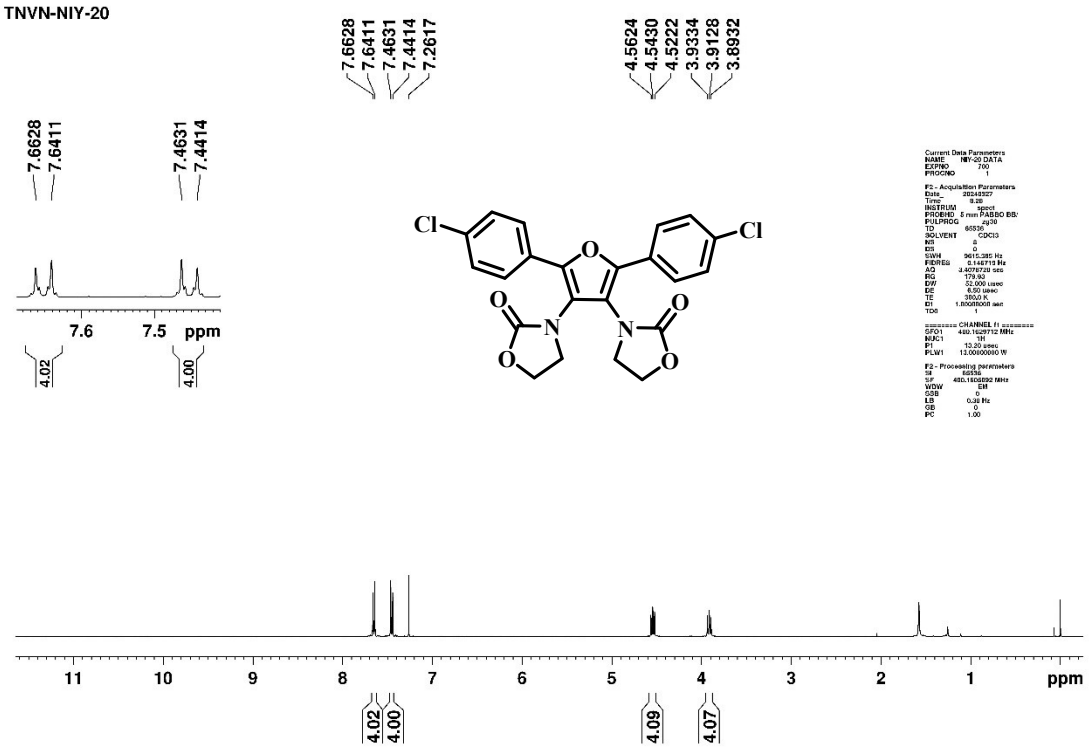
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2h**



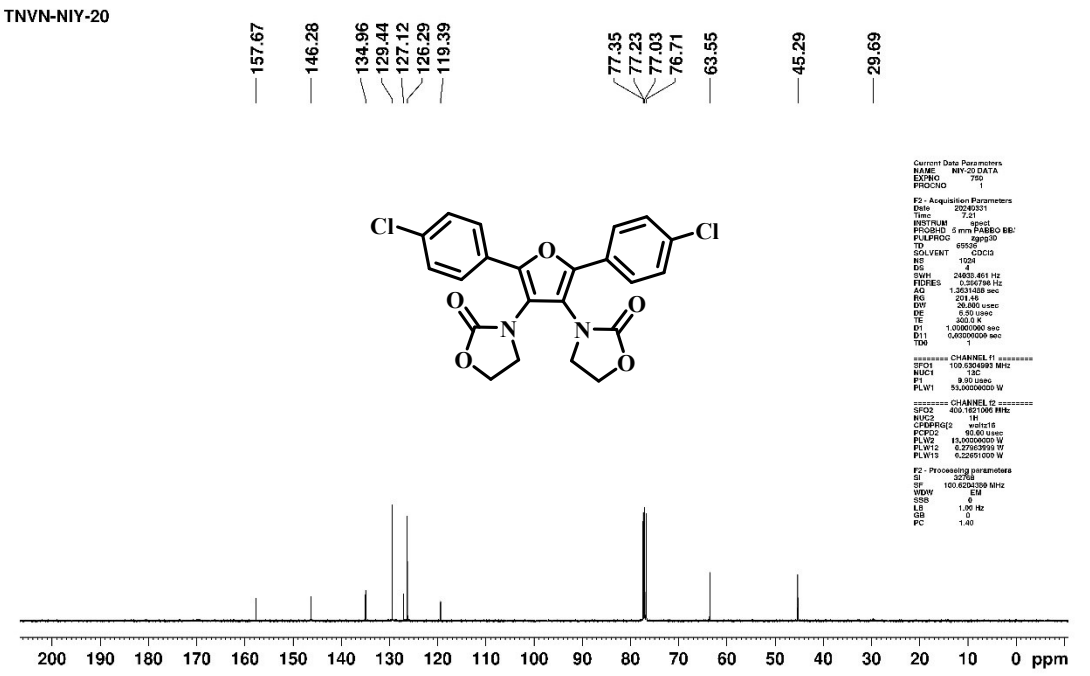
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2i**



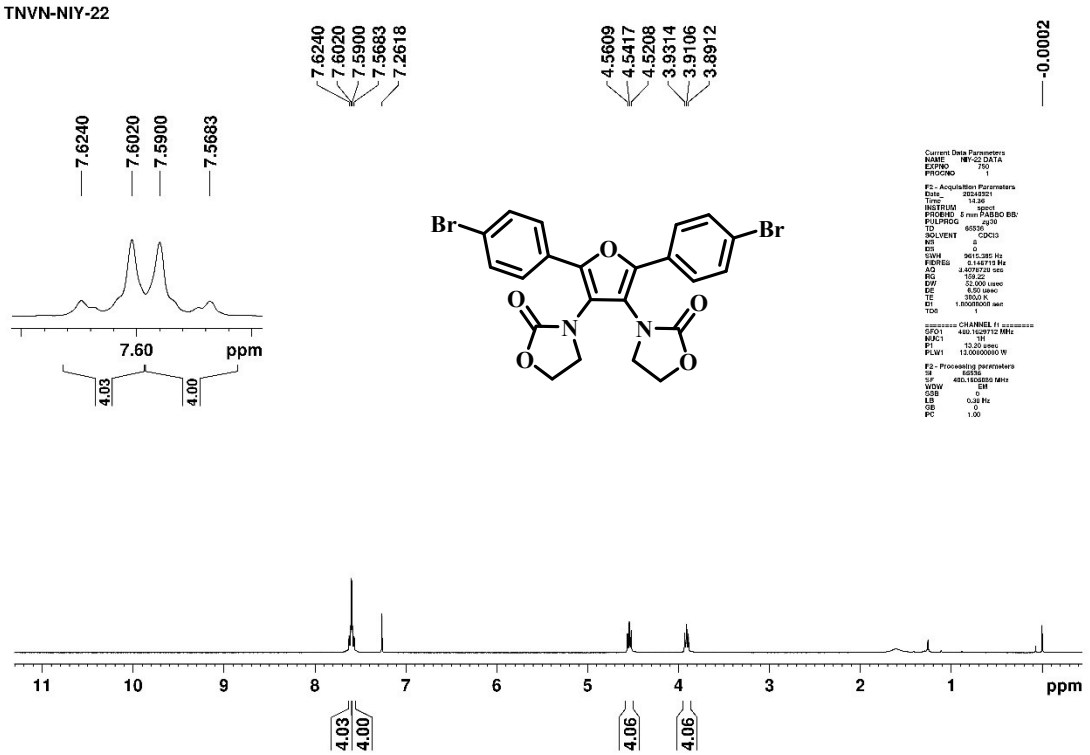
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2i**



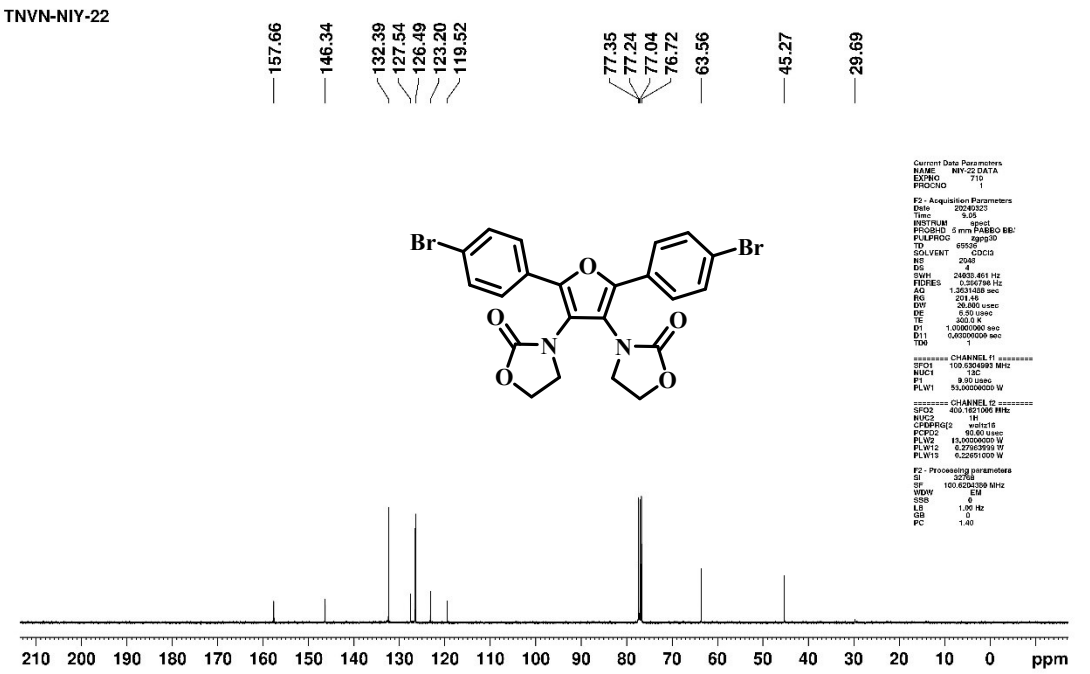
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2j**



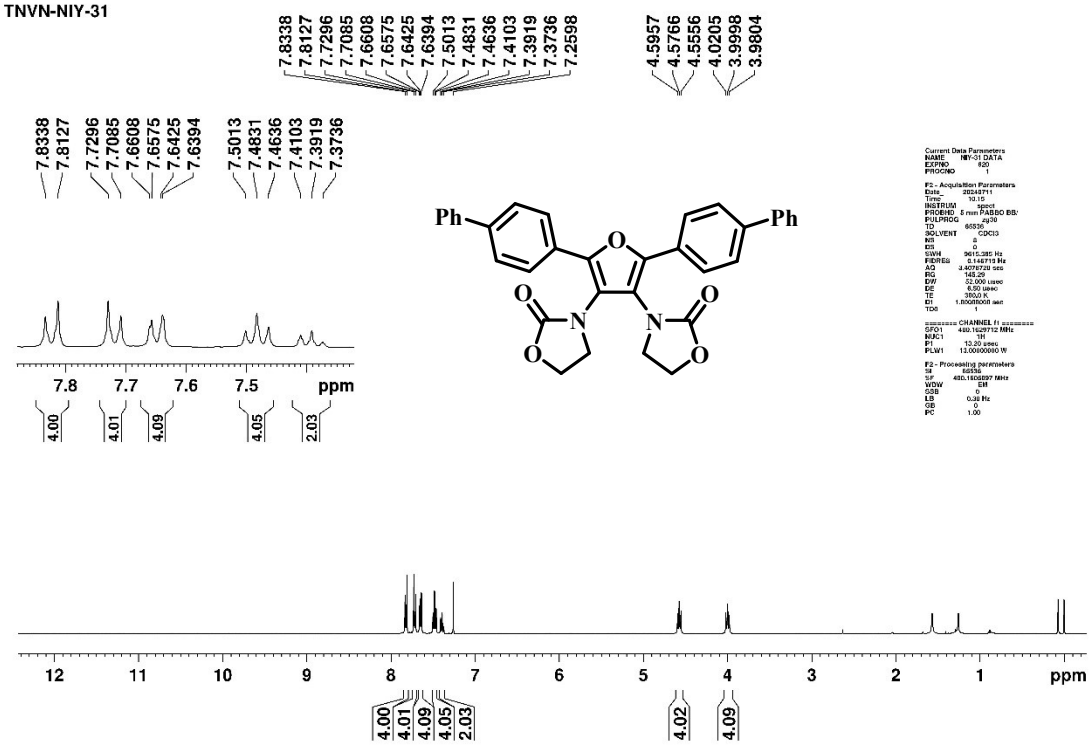
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2j**



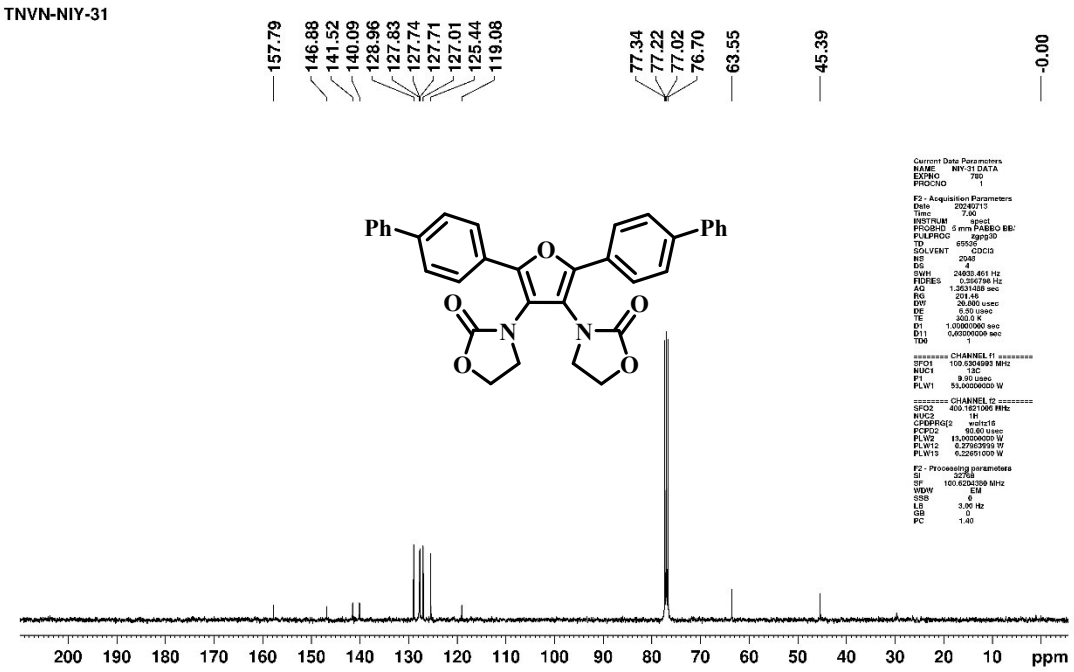
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2k**



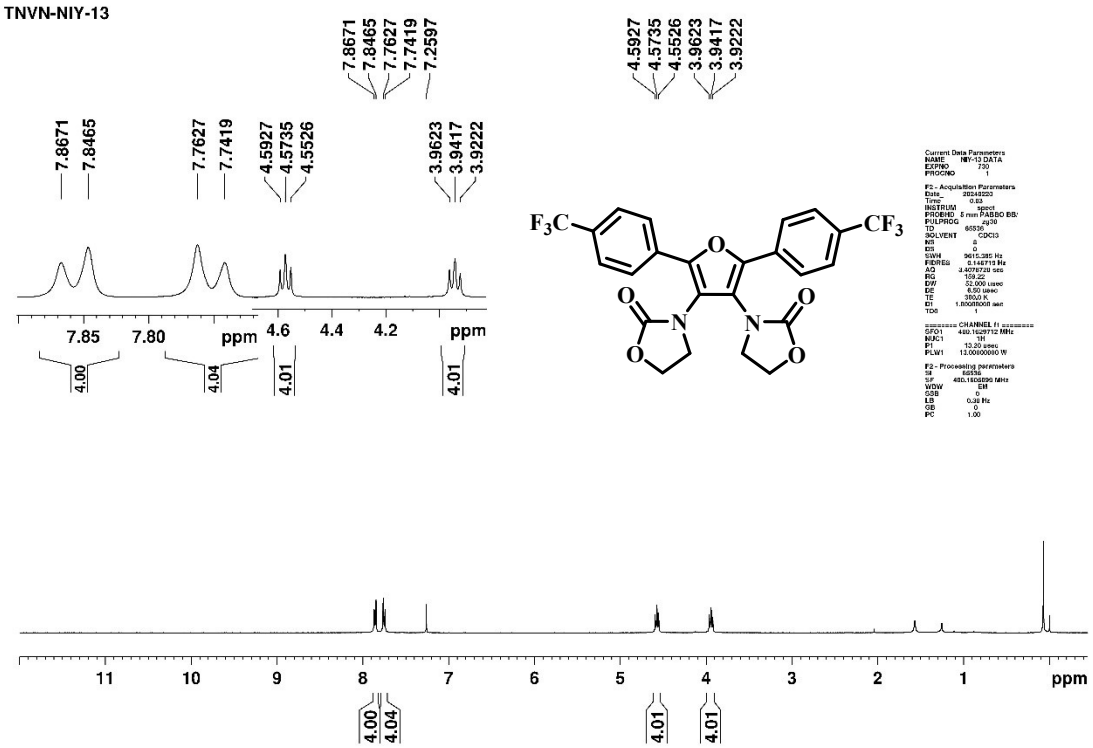
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2k**



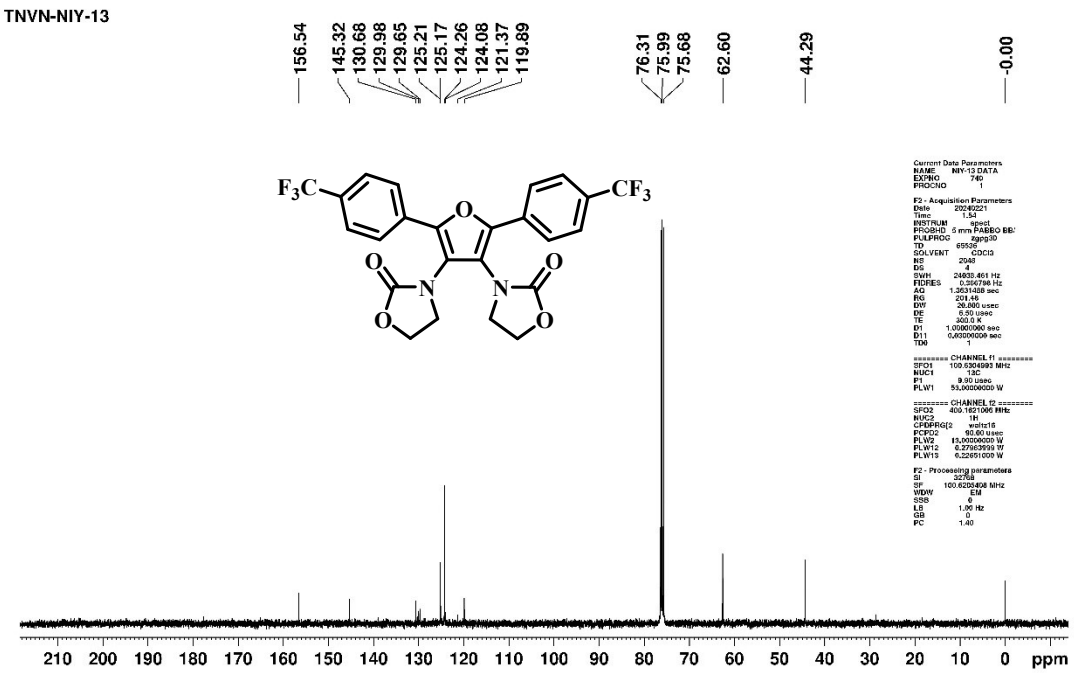
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2l**



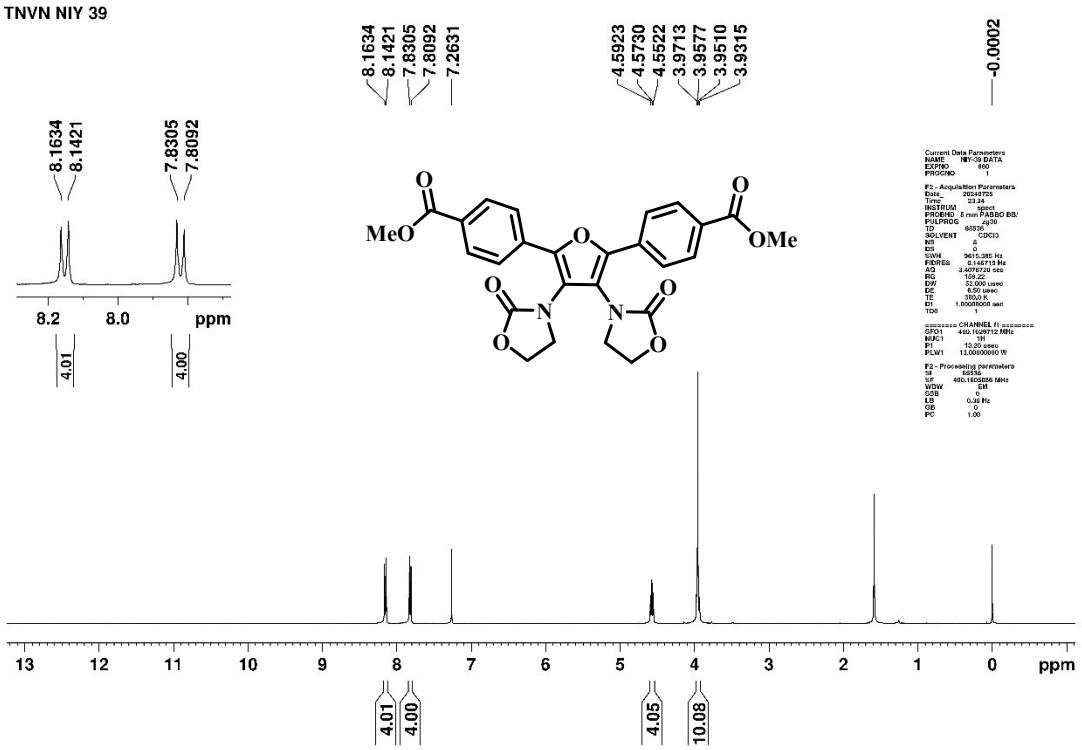
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2l**



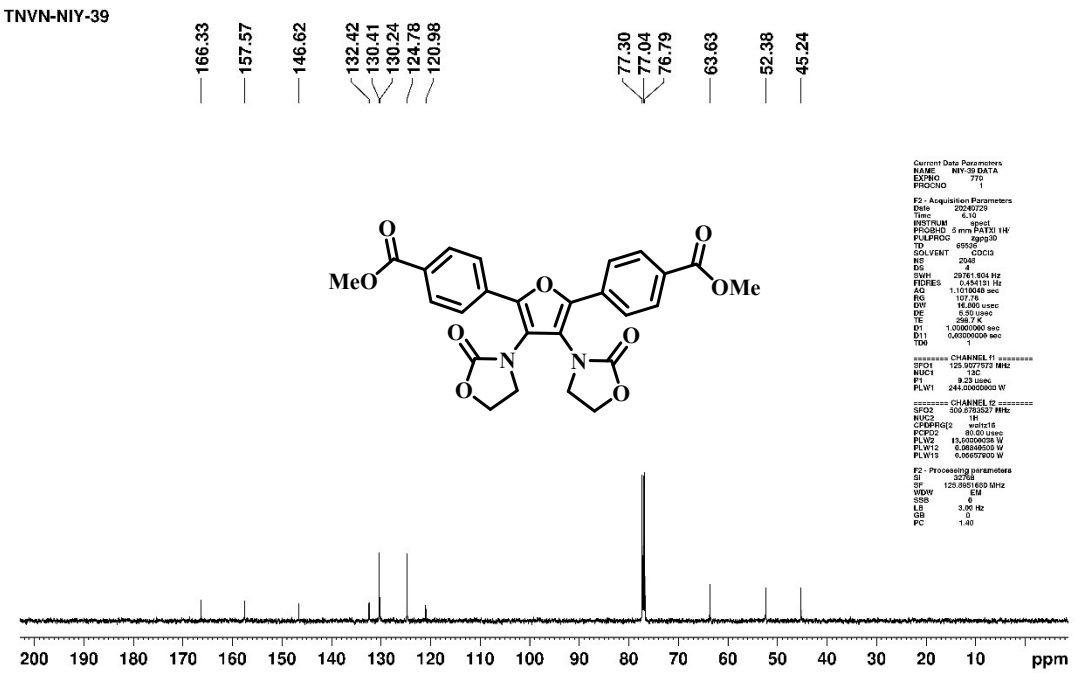
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2m**



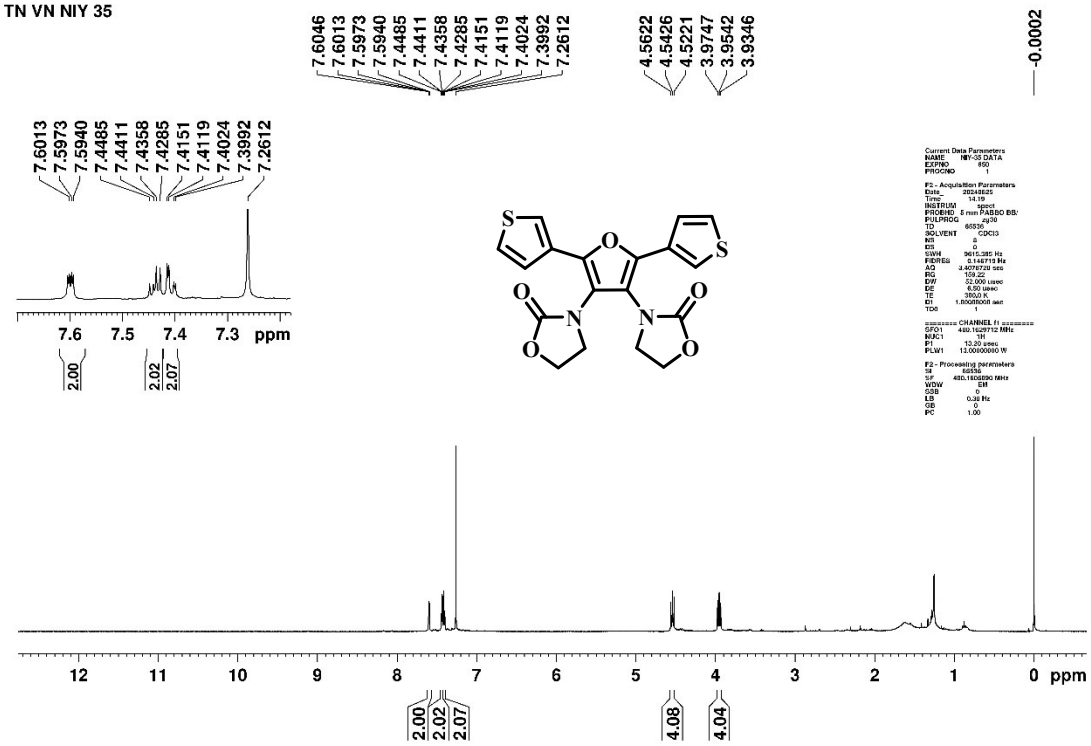
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2m**



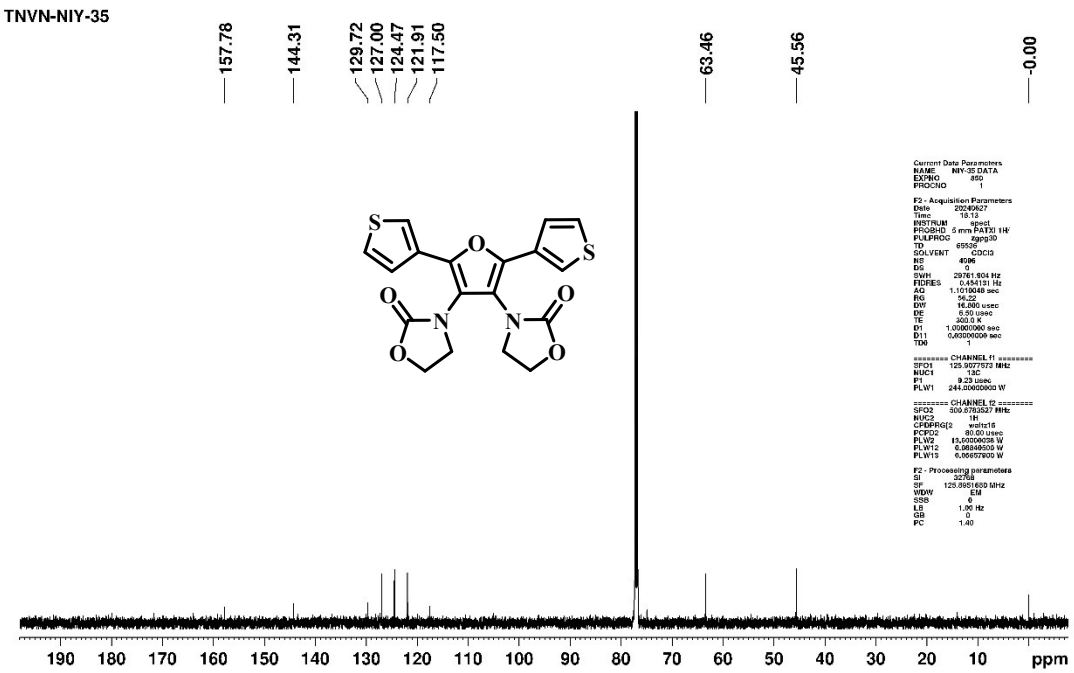
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2n**



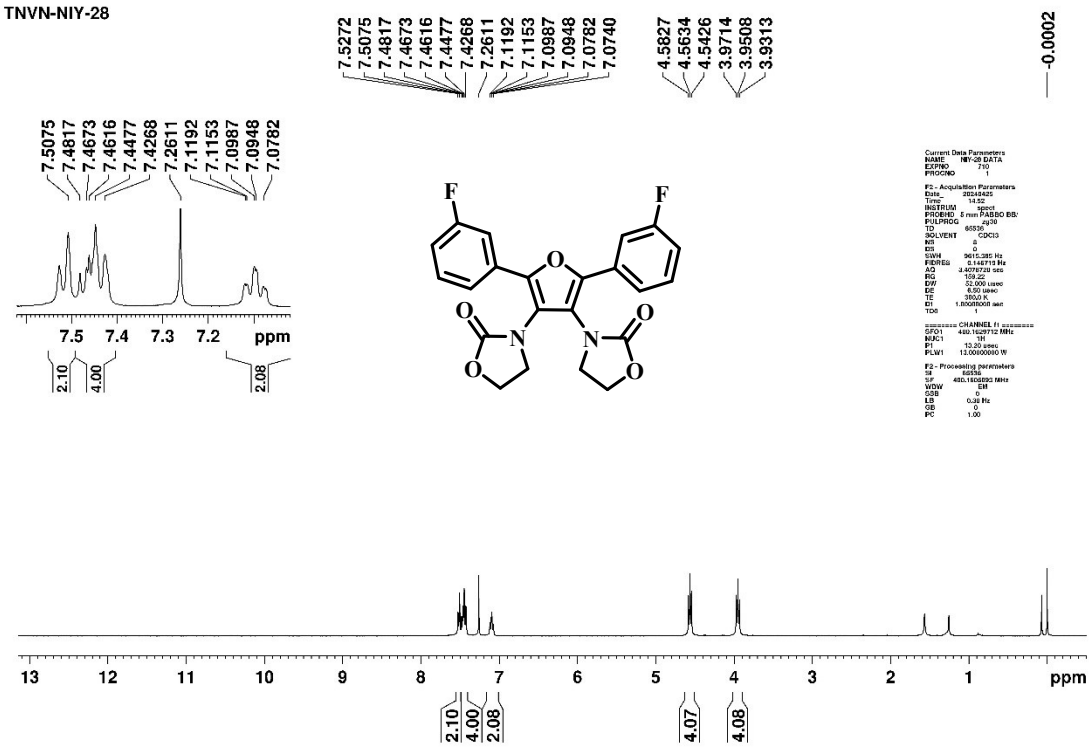
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2n**



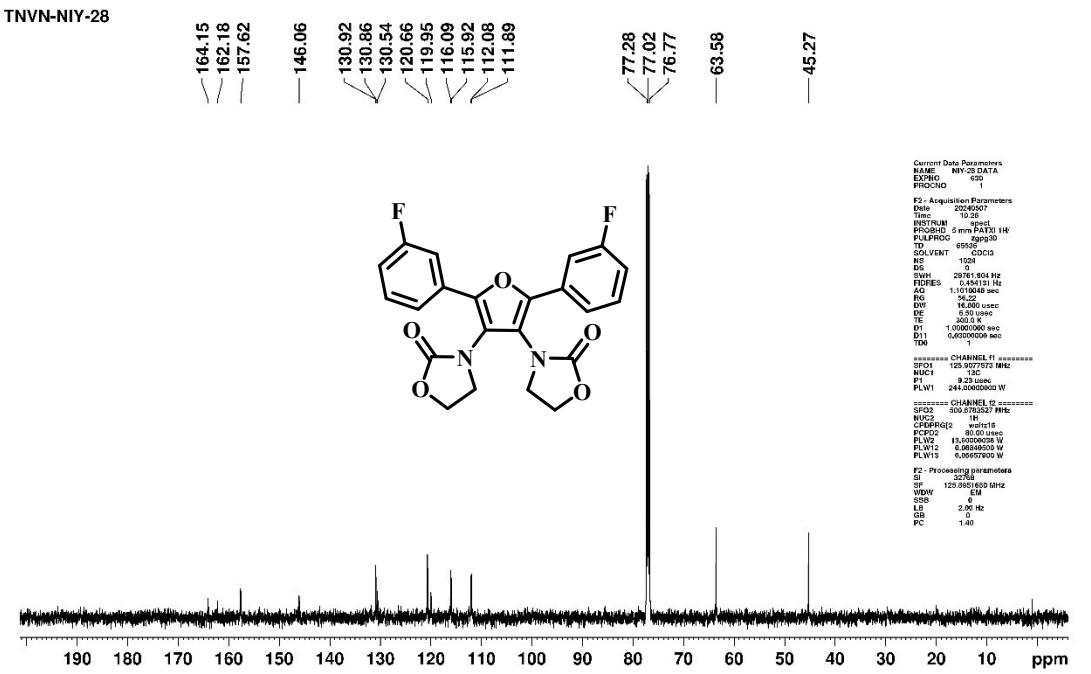
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2o**



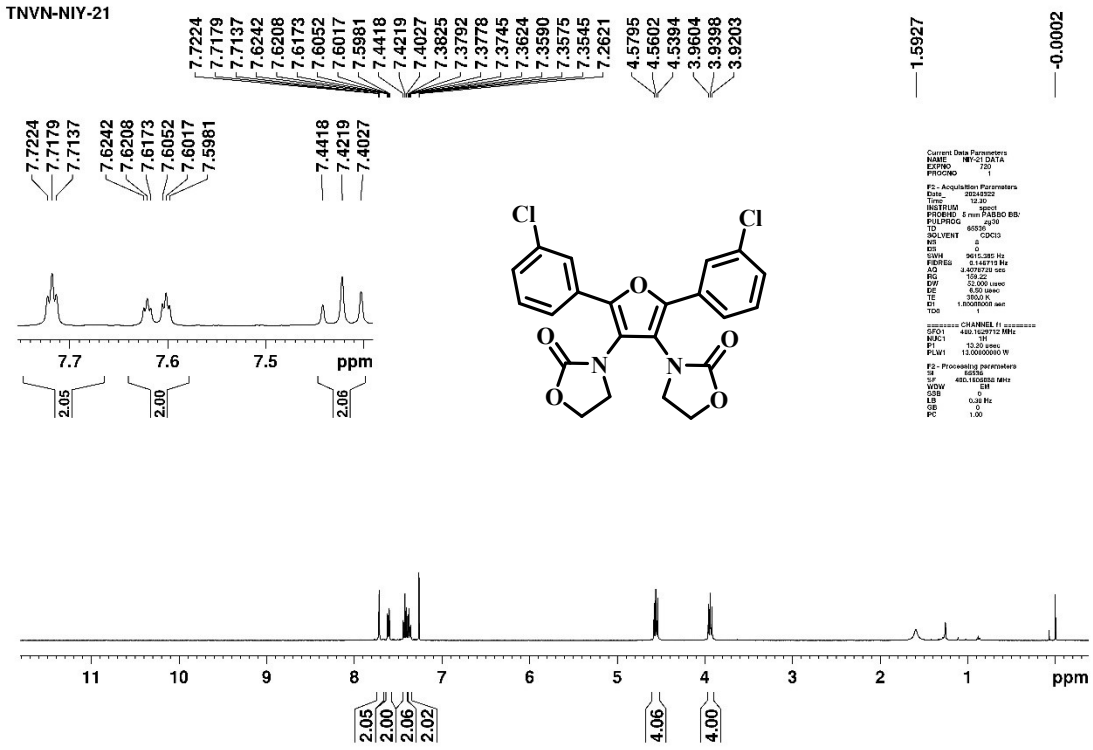
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2o**



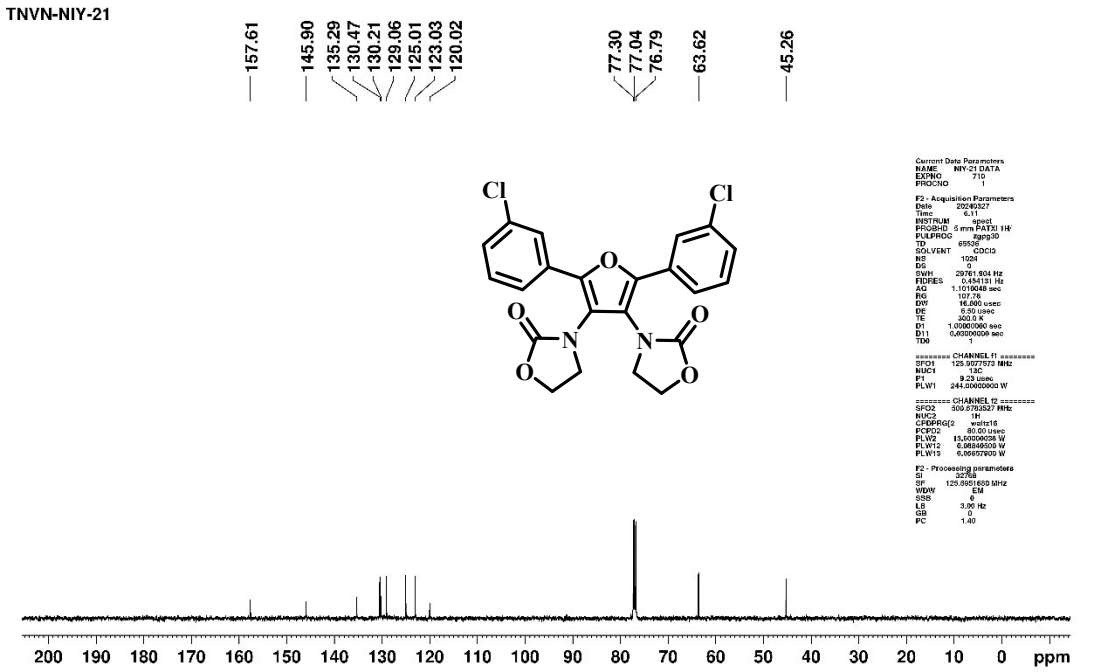
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2p**



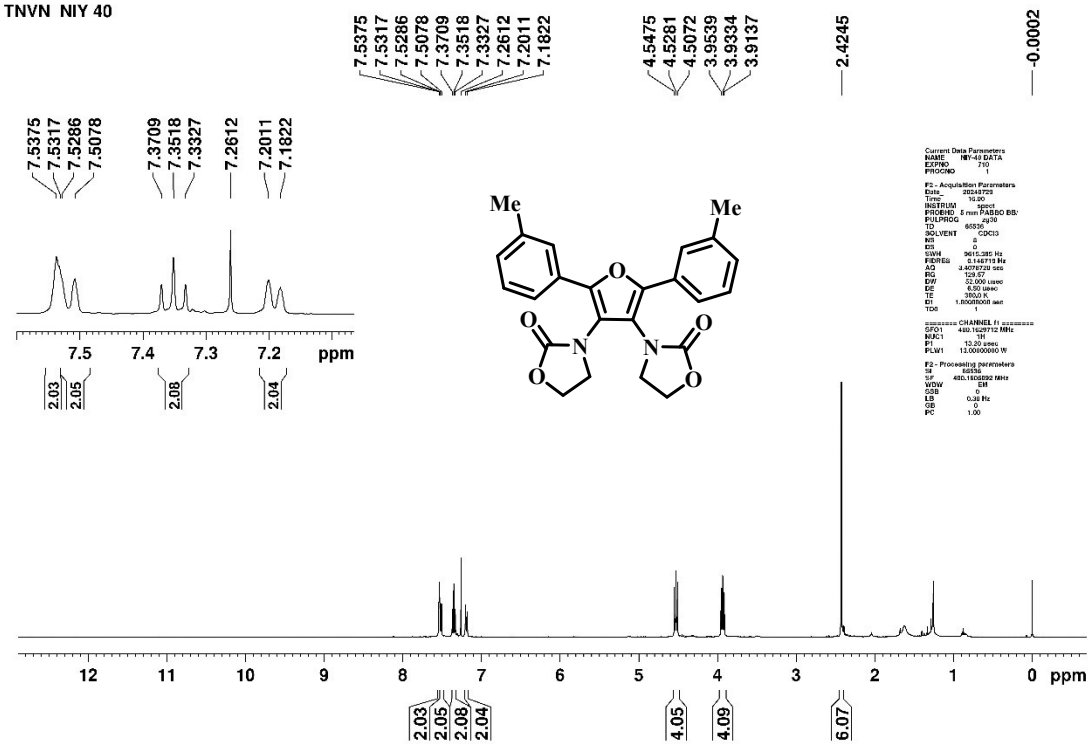
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2p**



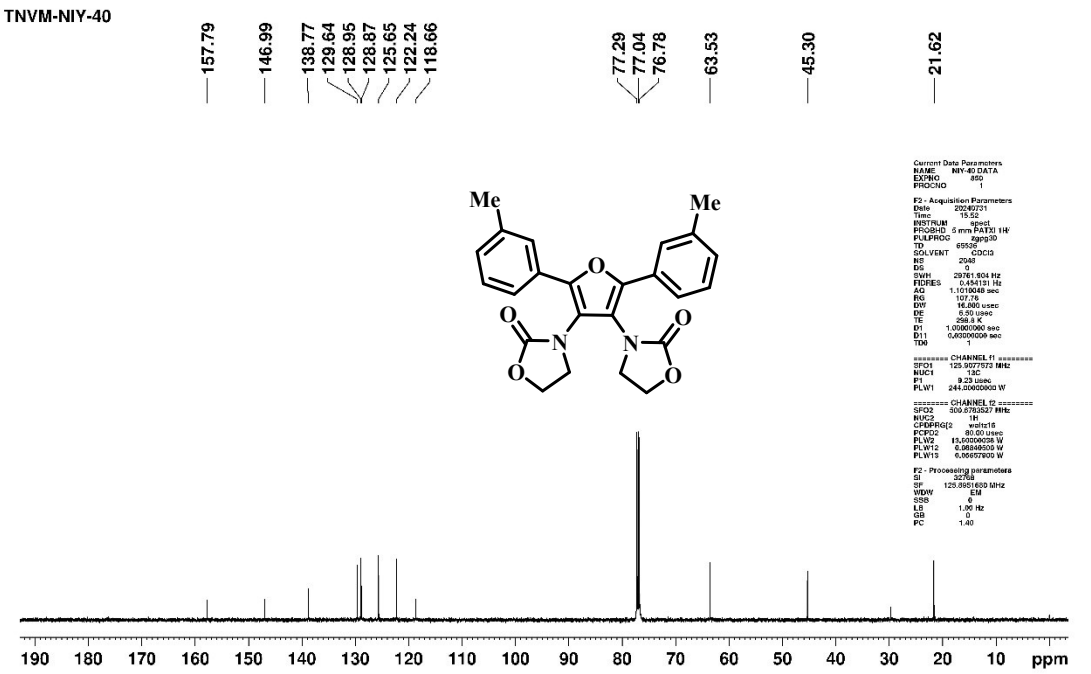
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2q**



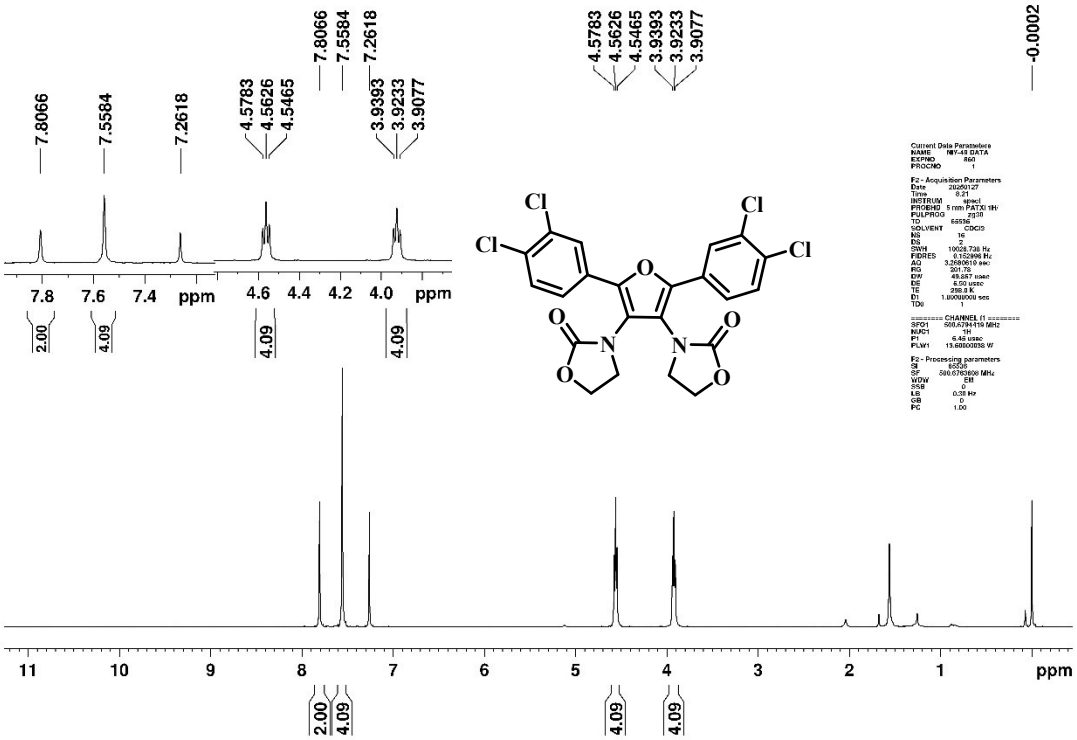
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2q**



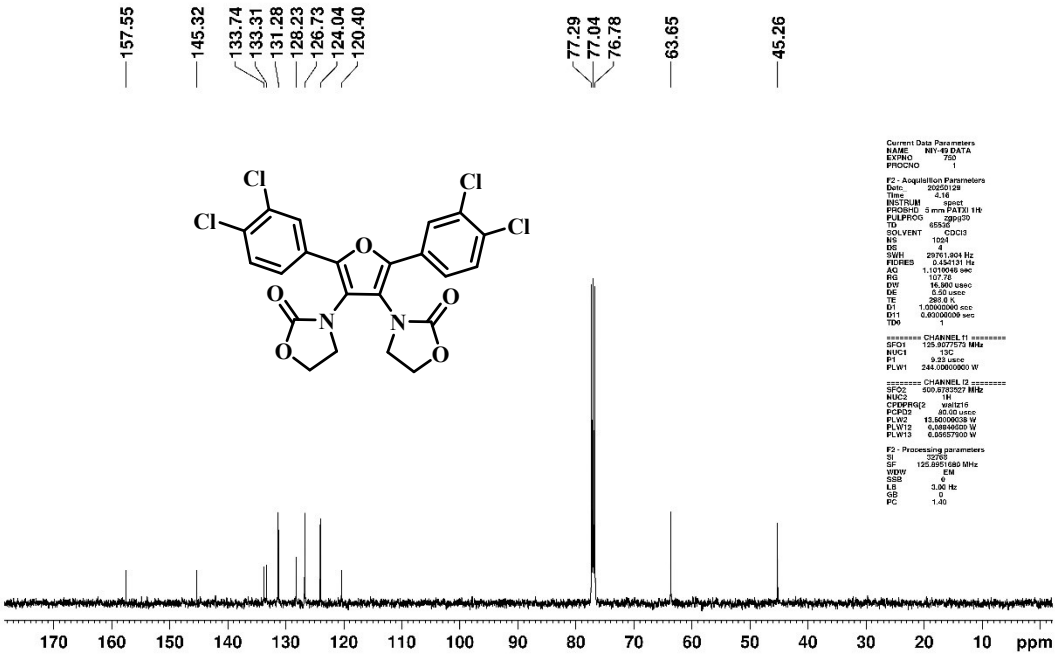
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2r**



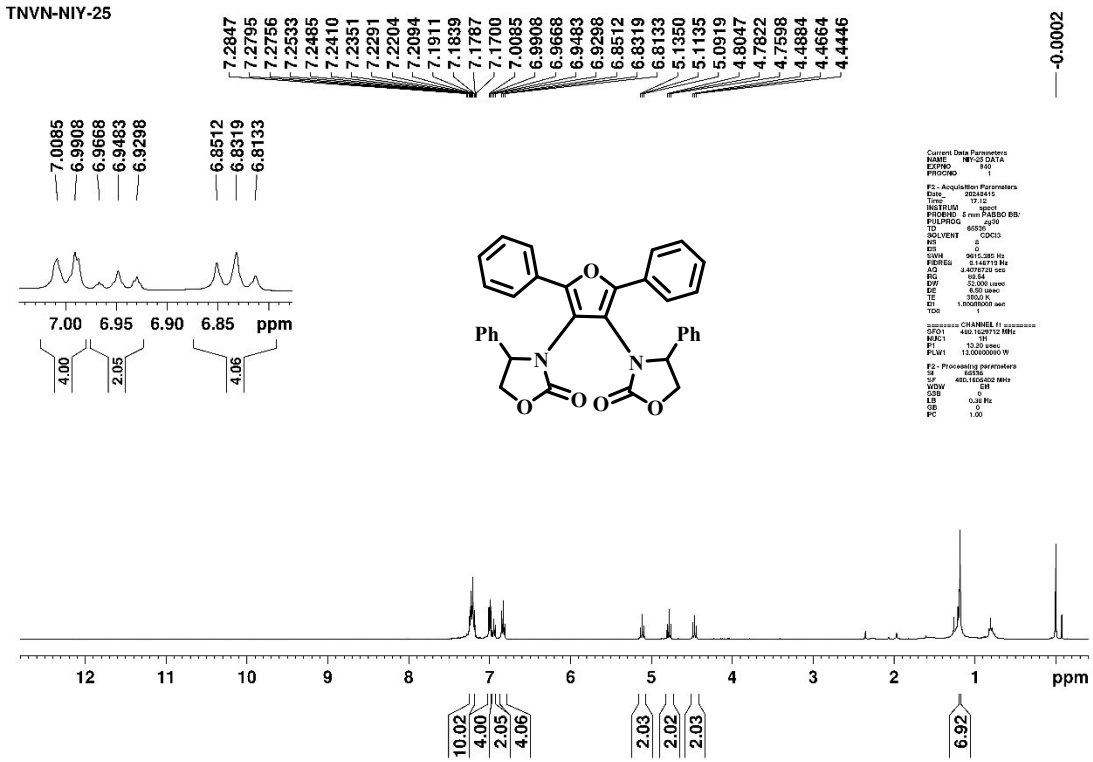
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2r**



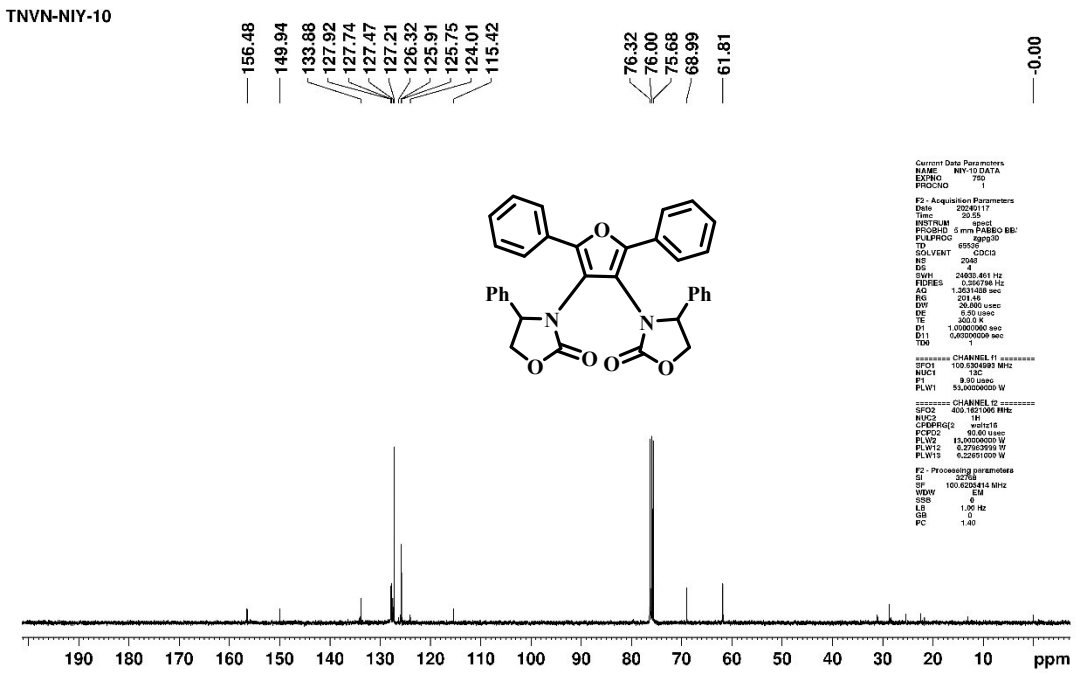
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2s**



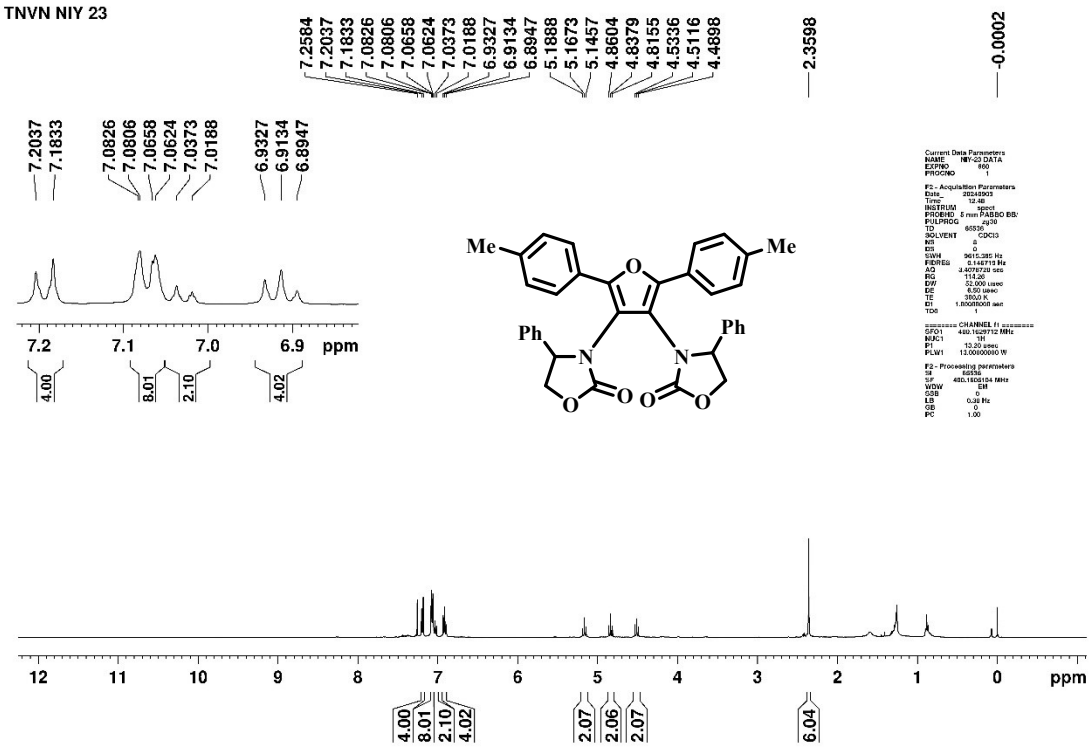
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2s**



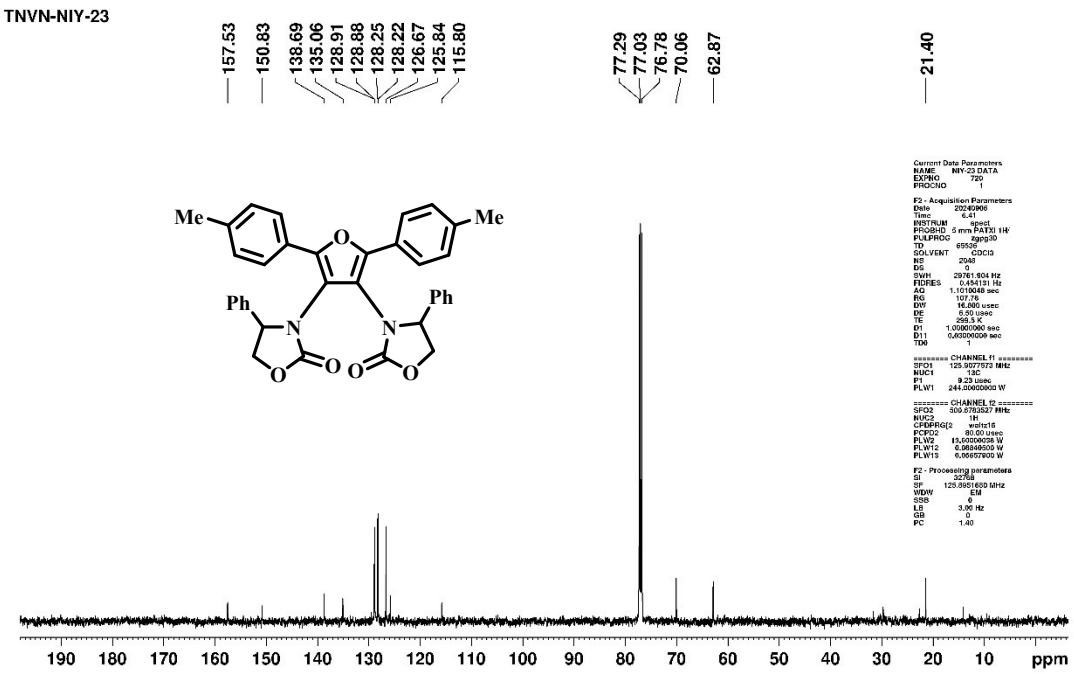
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2t**



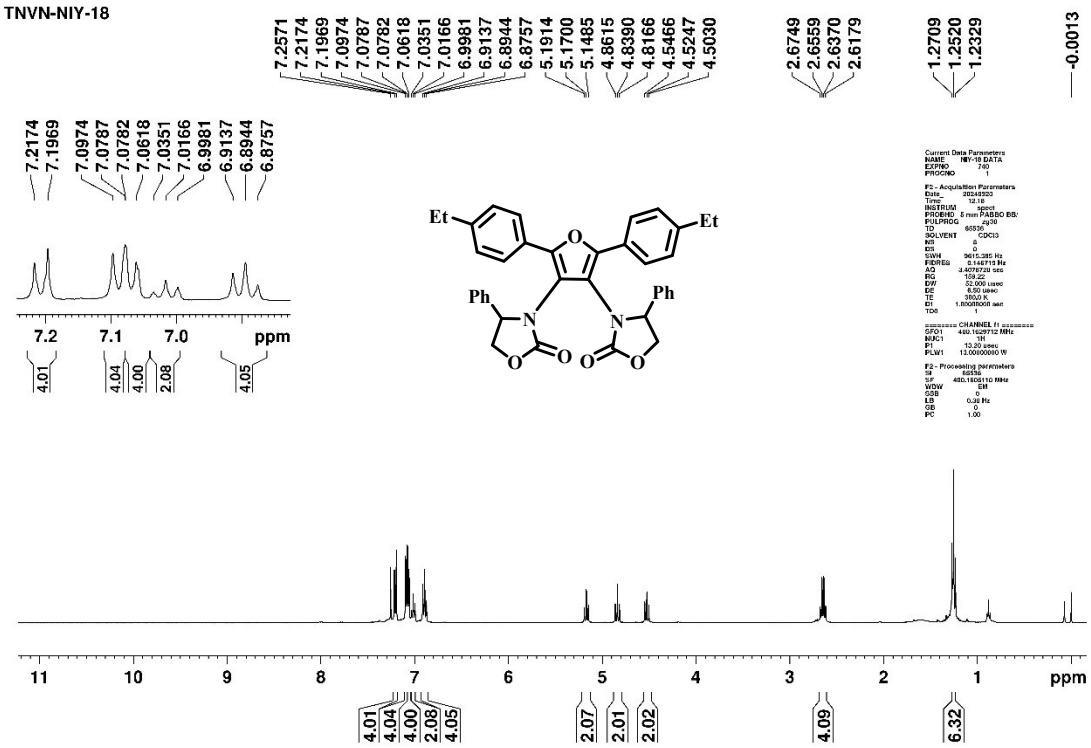
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2t**



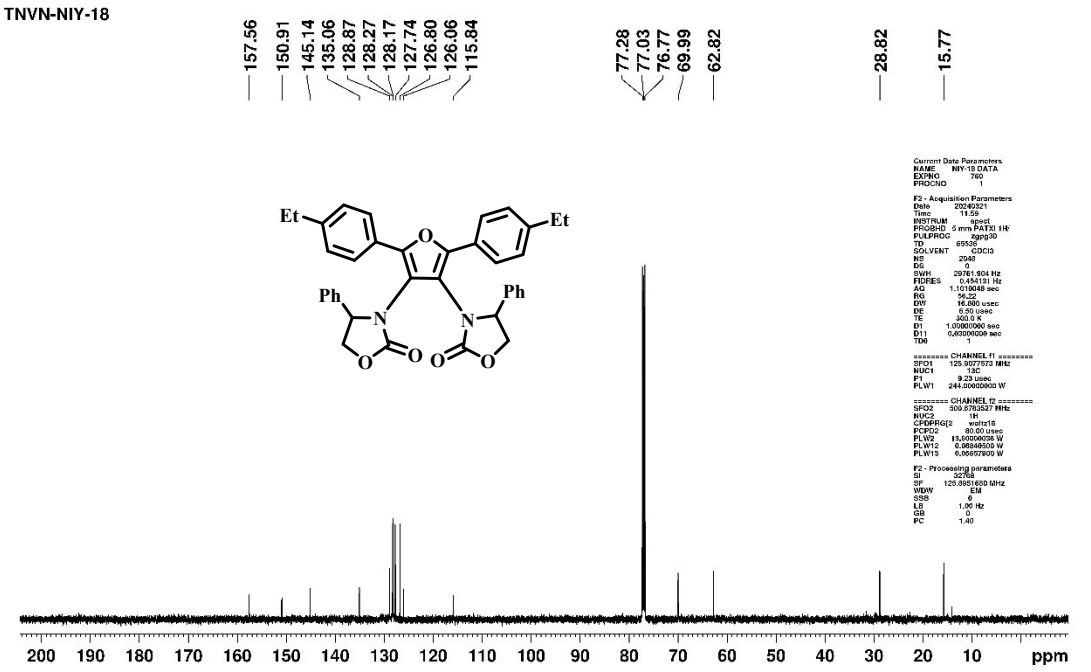
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2u**



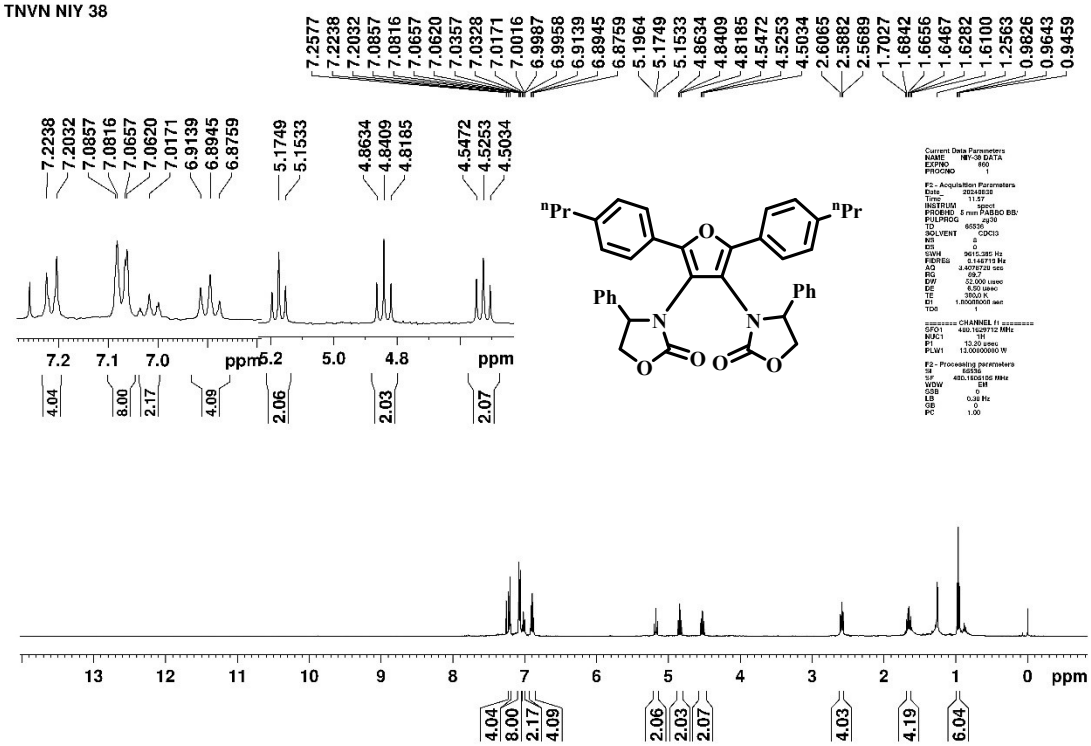
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2u**



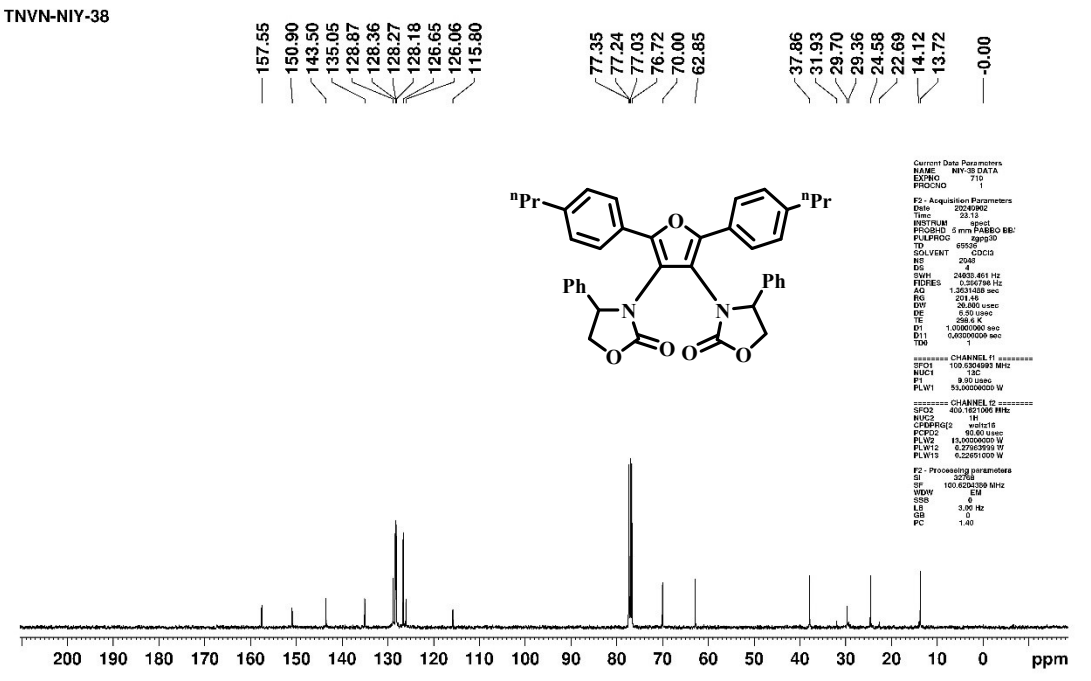
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2v**



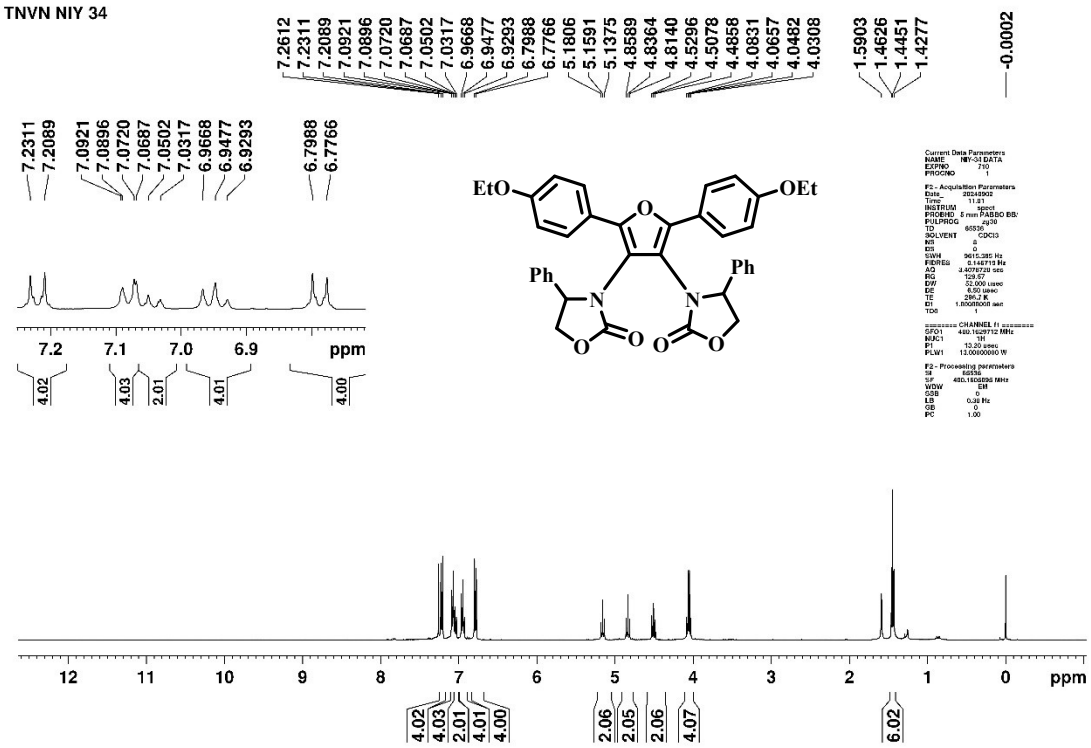
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of A **2v**



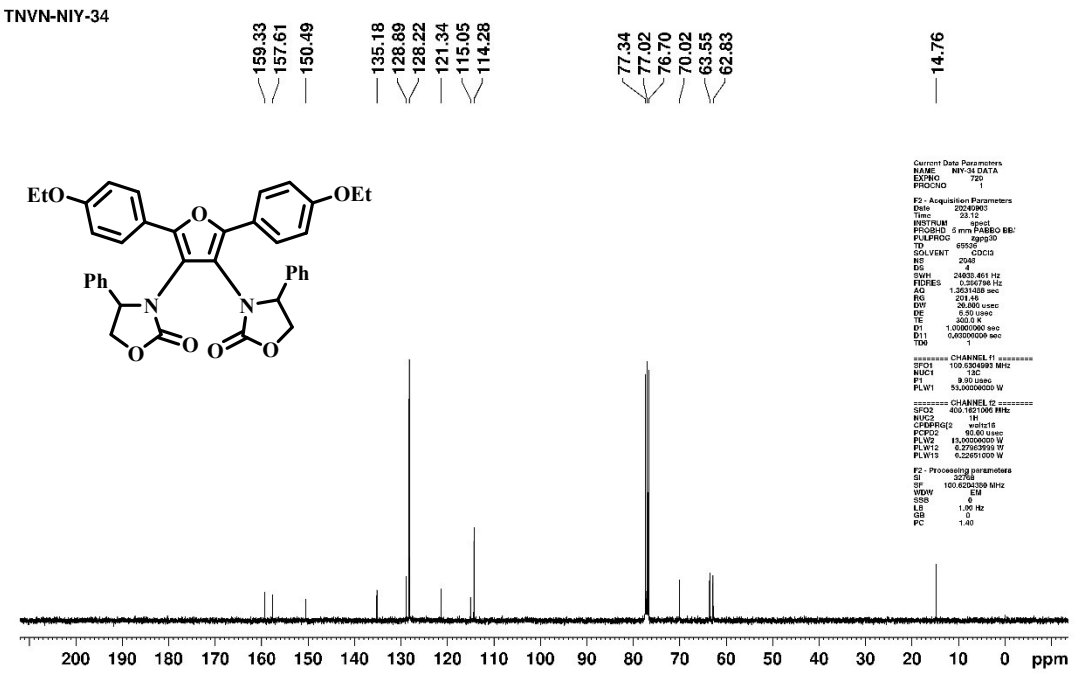
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2w**



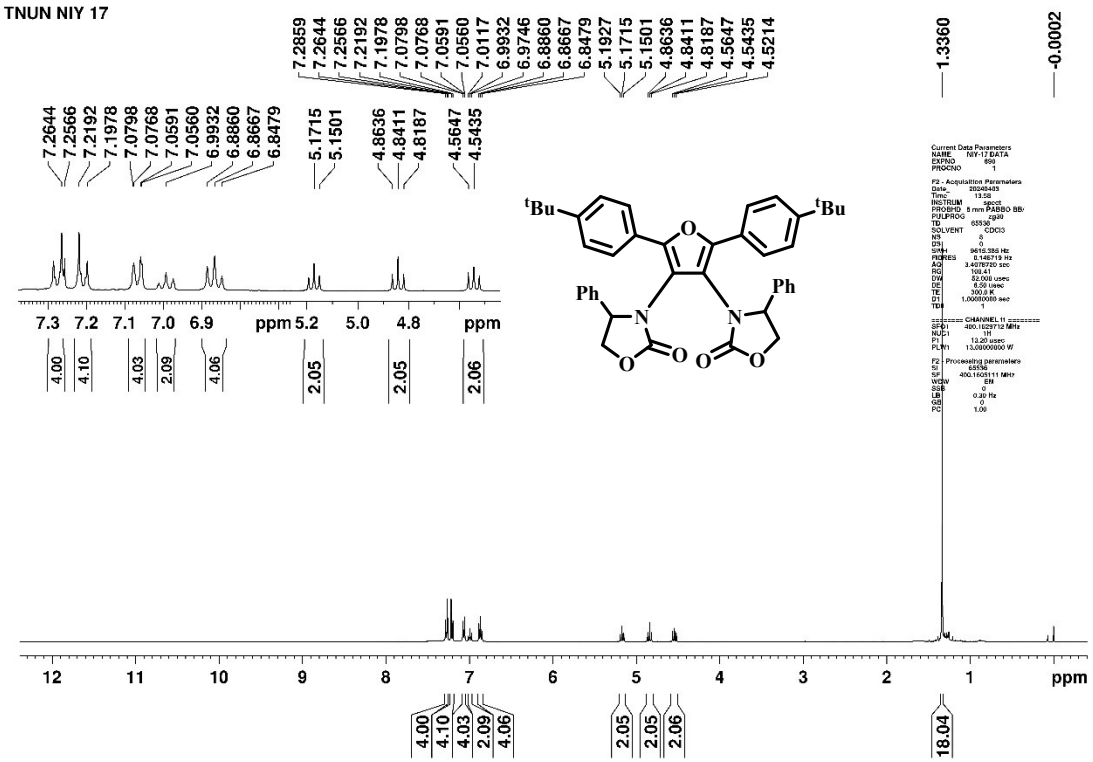
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2w**



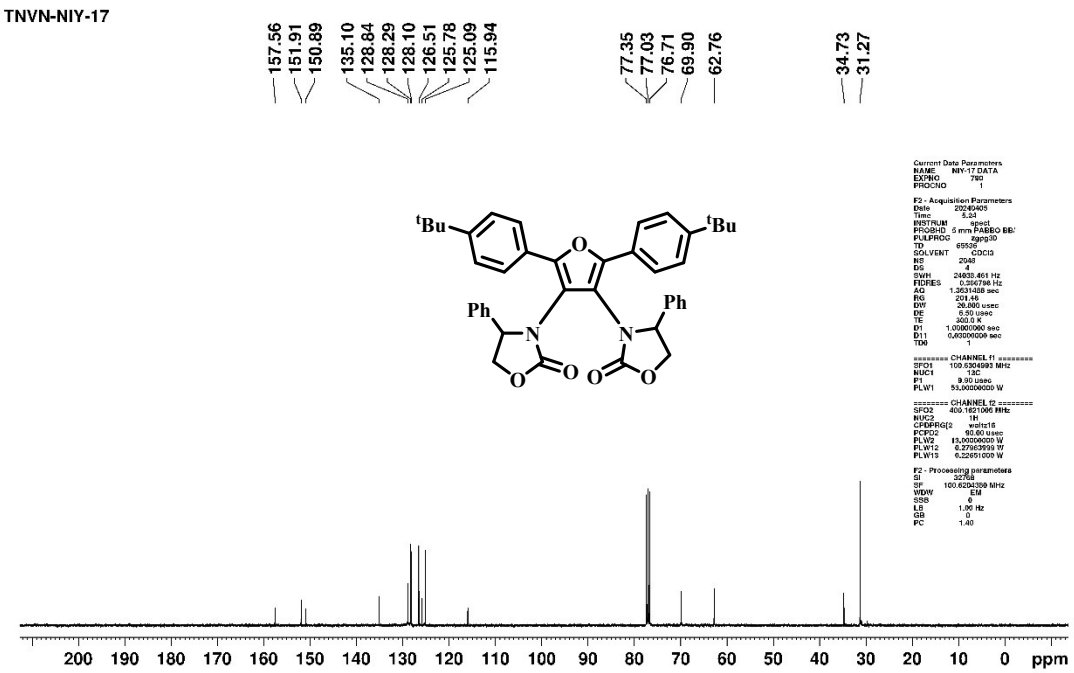
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2x**



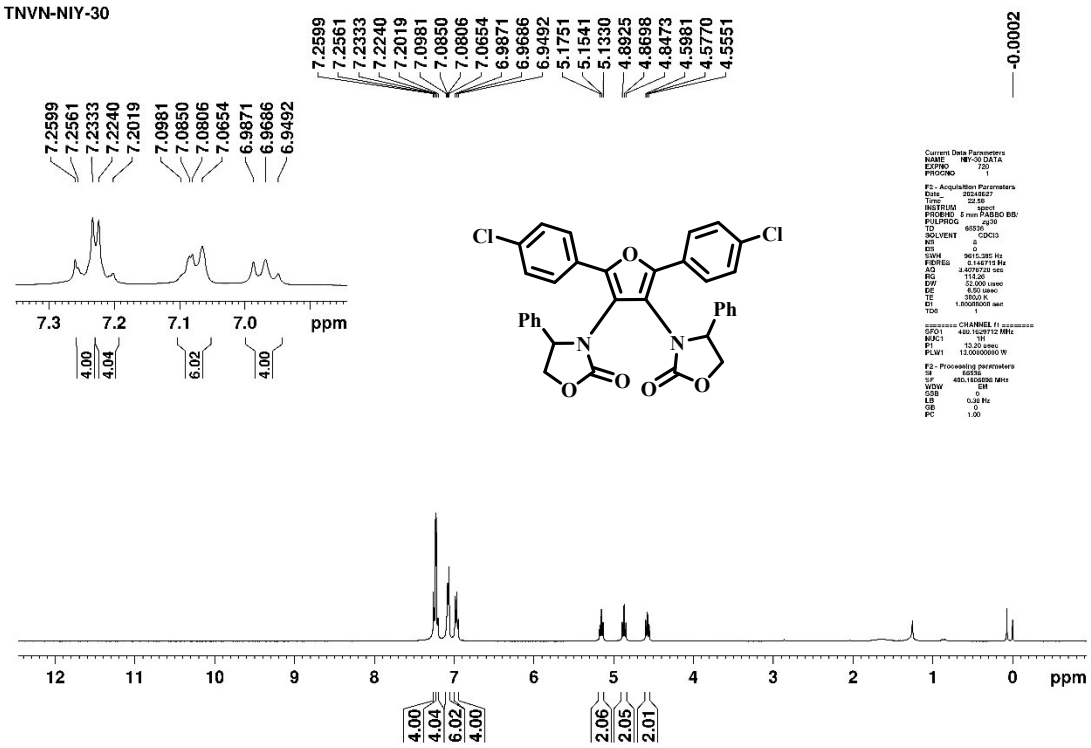
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2x**



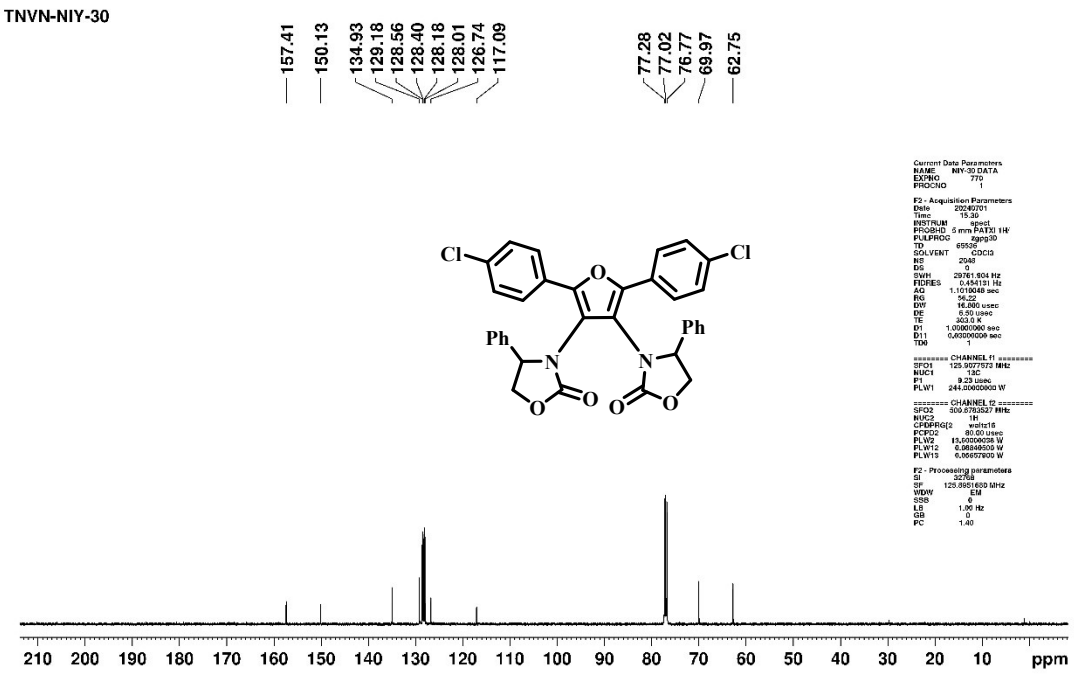
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2y**



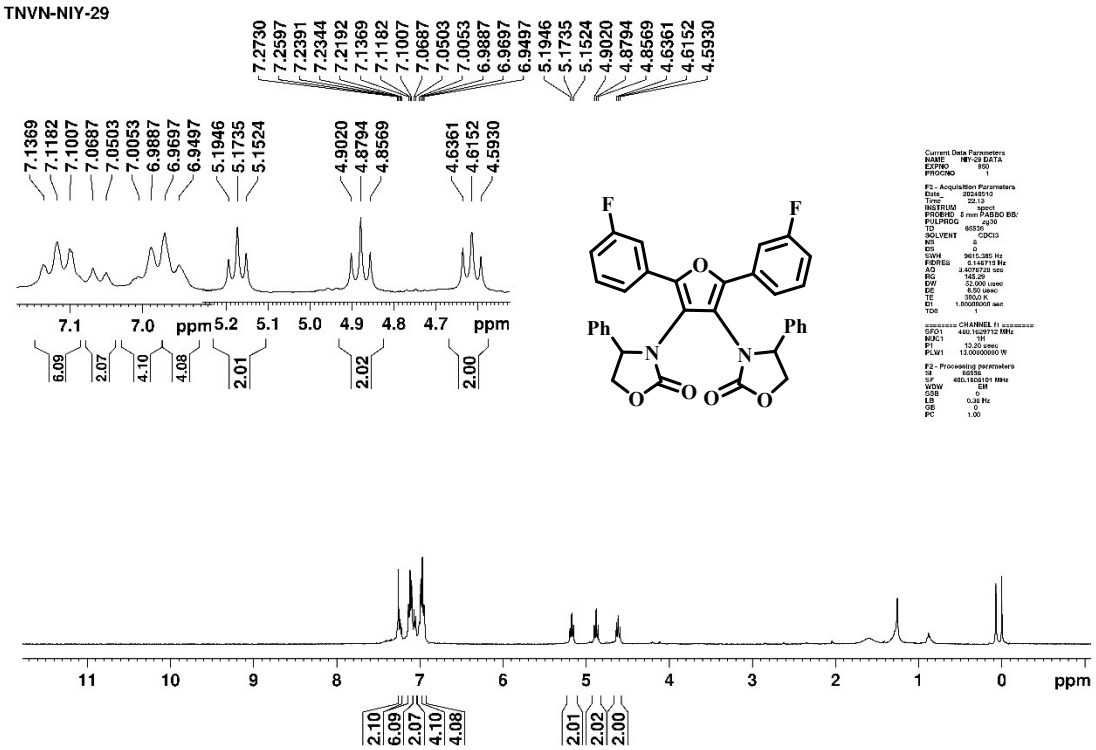
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2y**



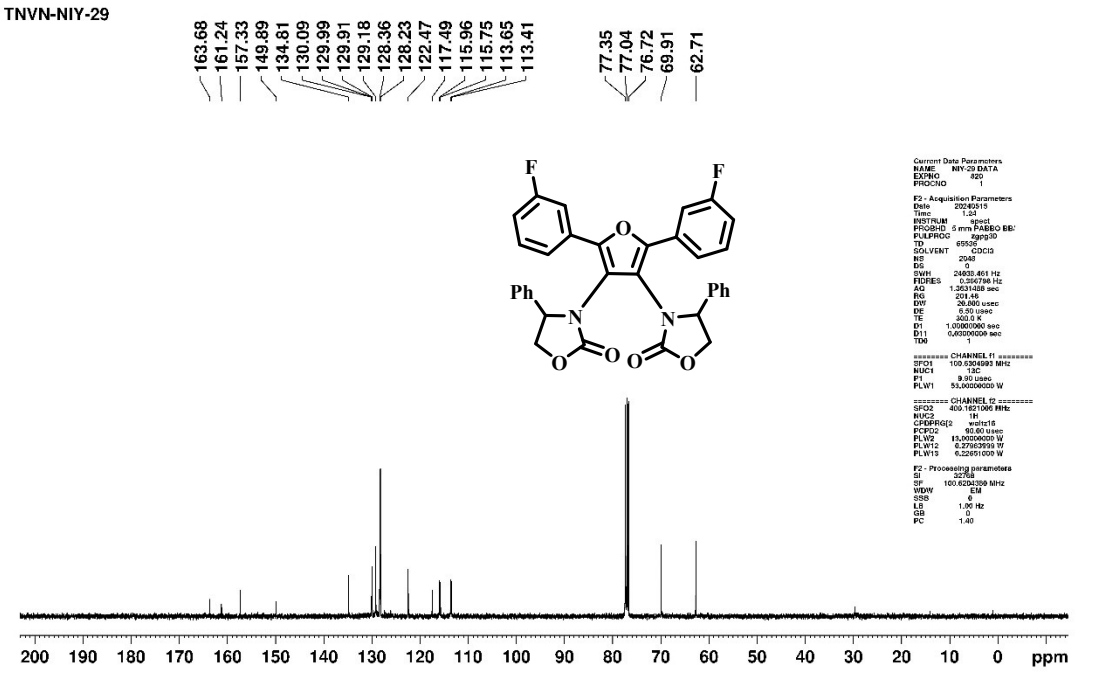
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2z**



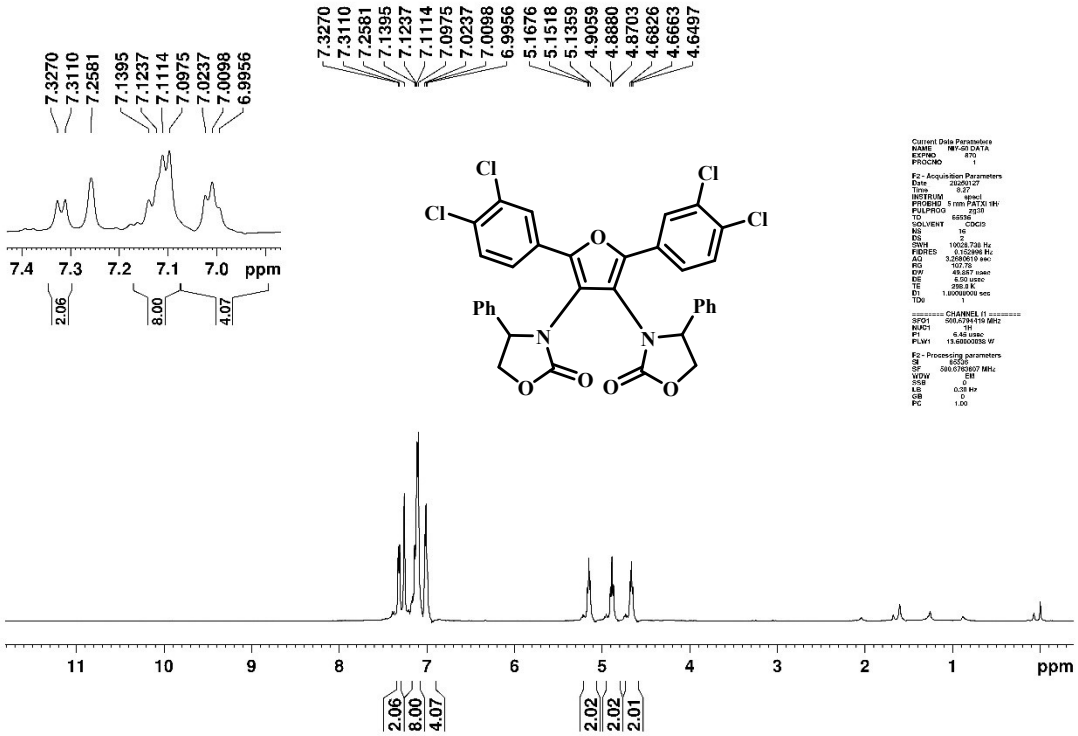
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2z**



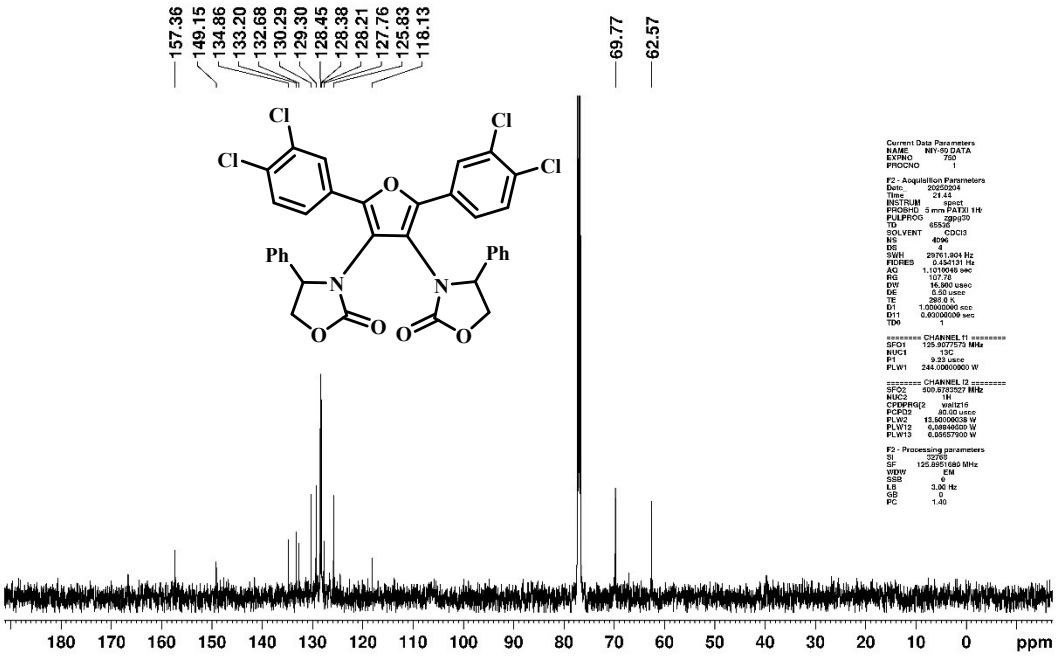
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2a'**



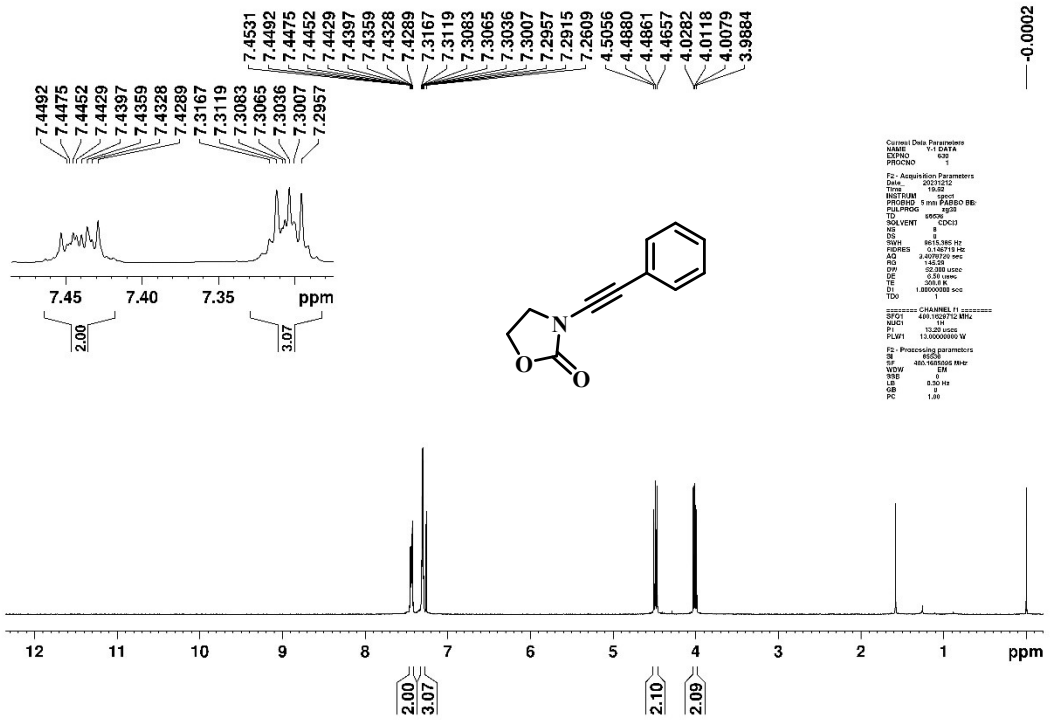
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2a'**



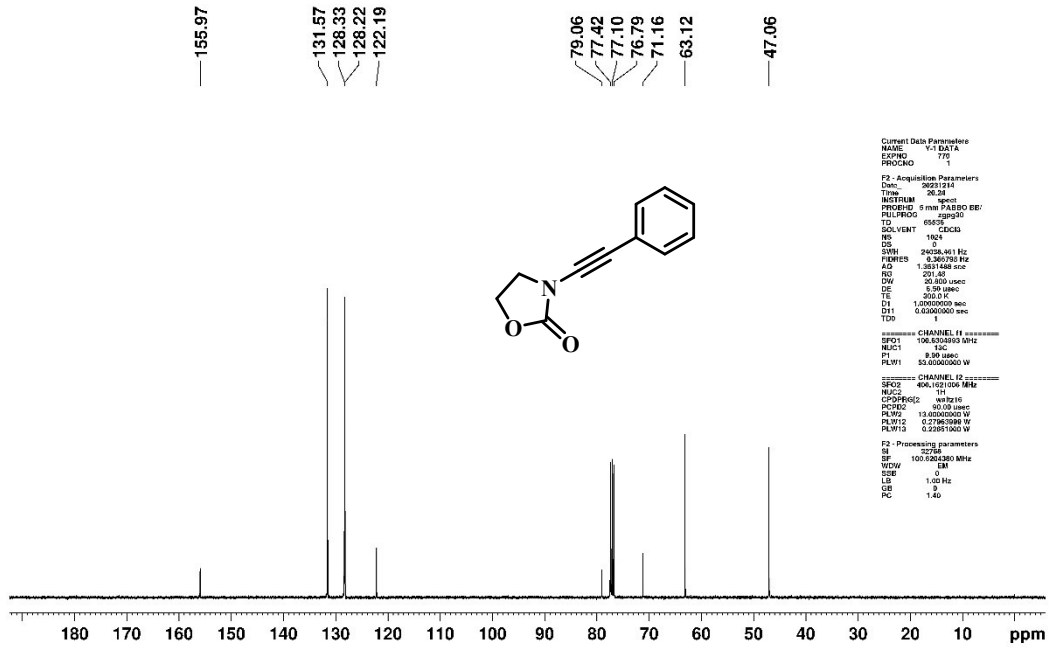
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **2b'**



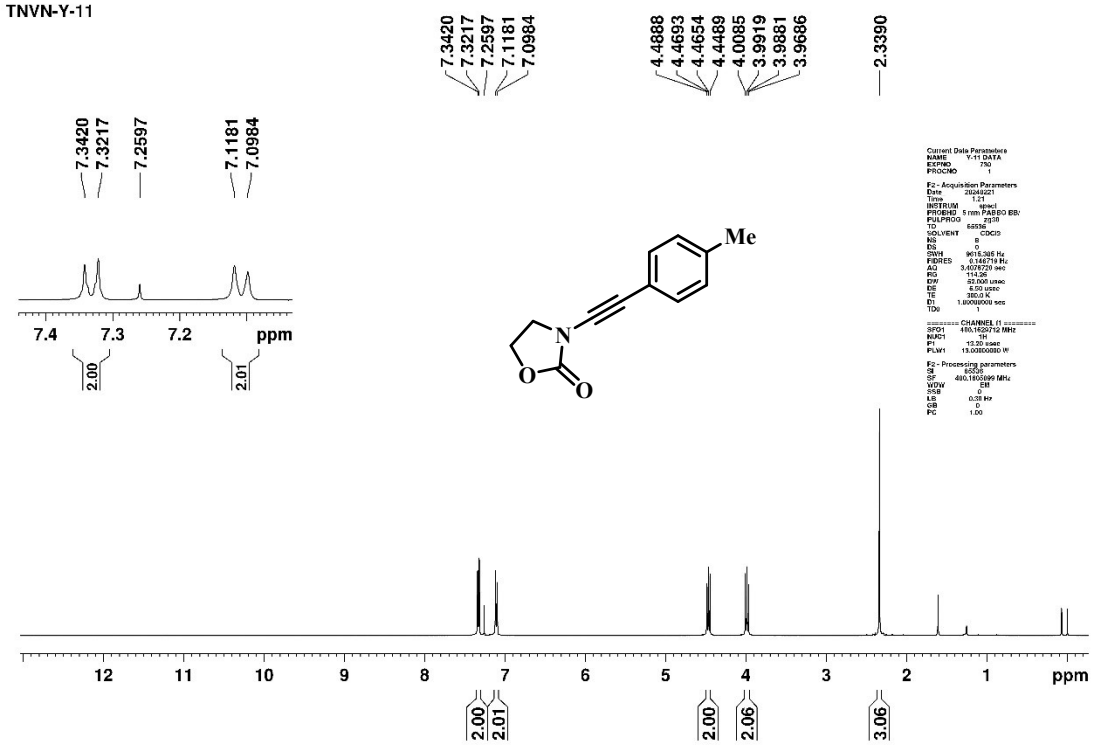
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **2b'**



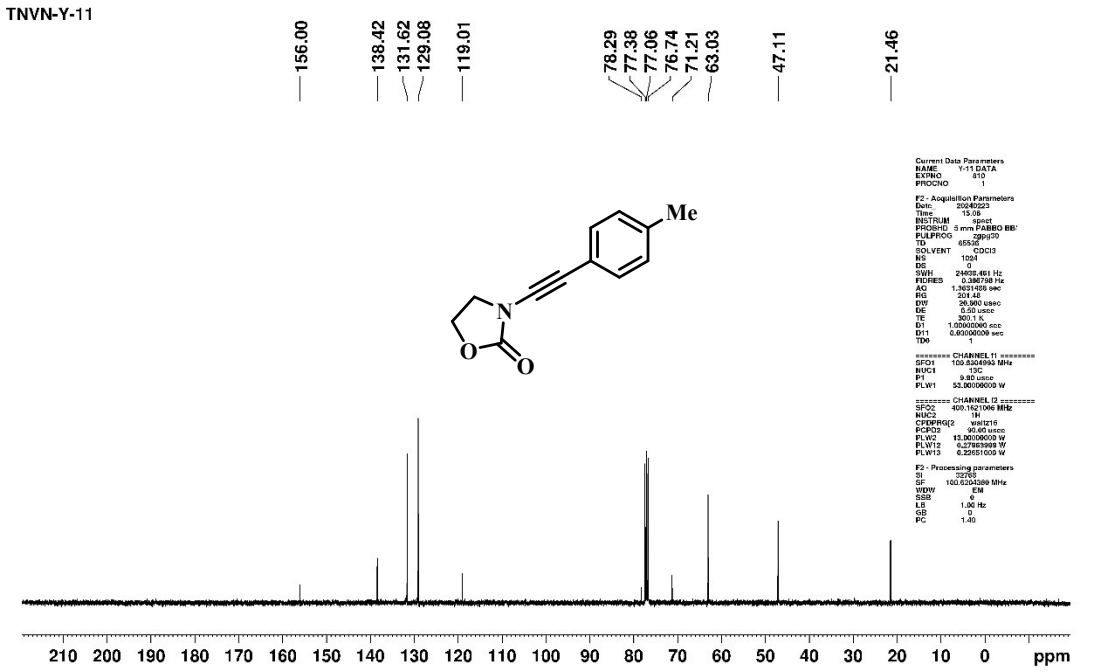
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1a**



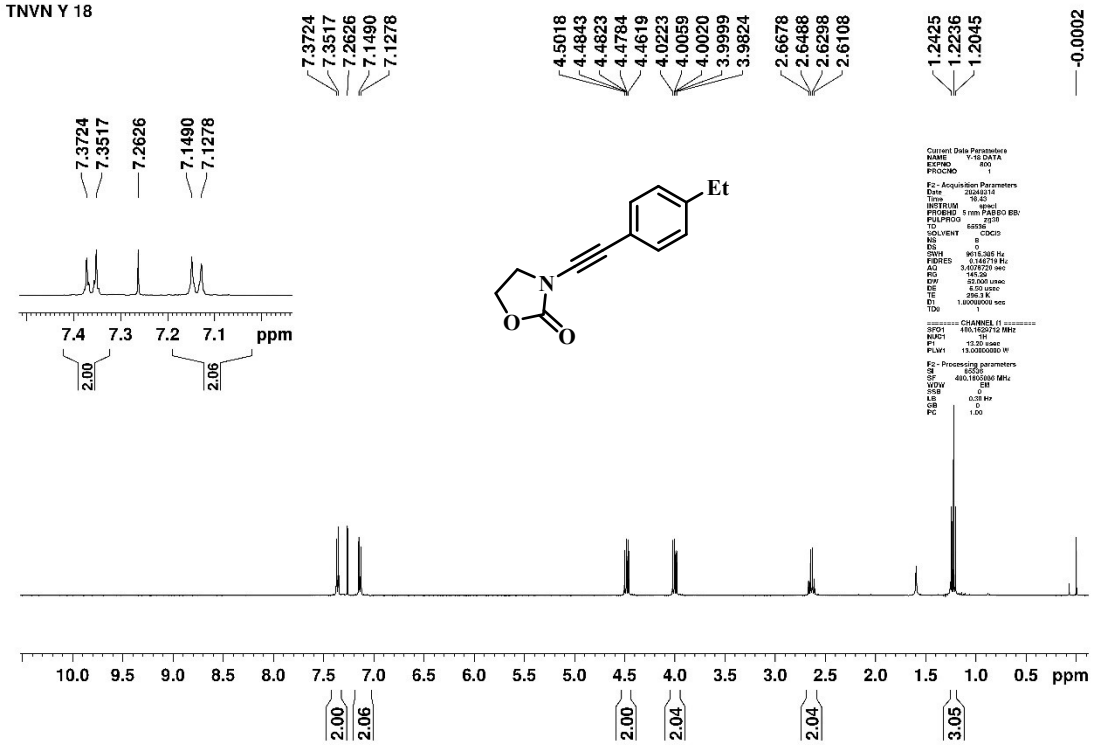
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1a**



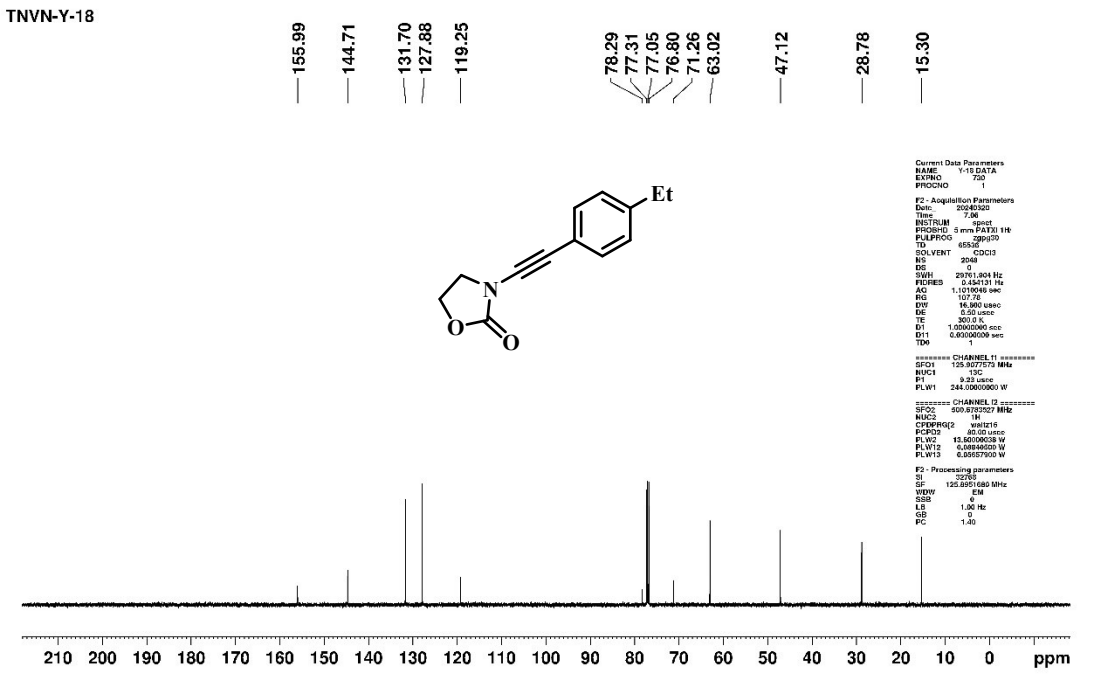
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1b**



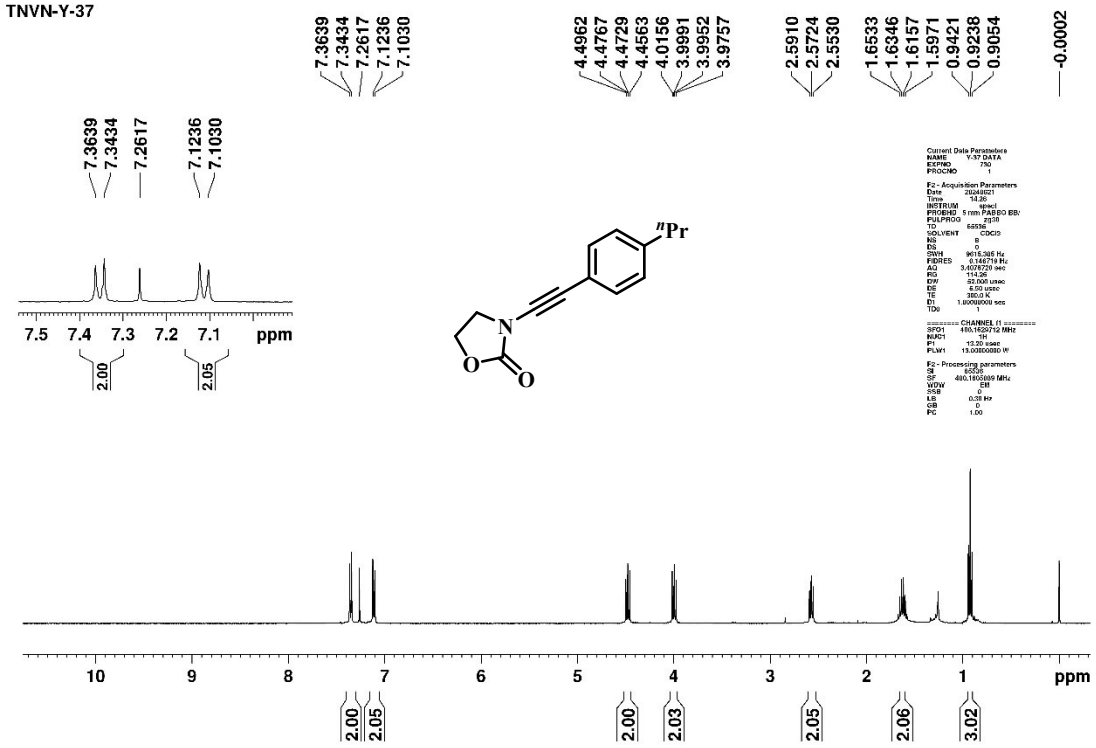
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1b**



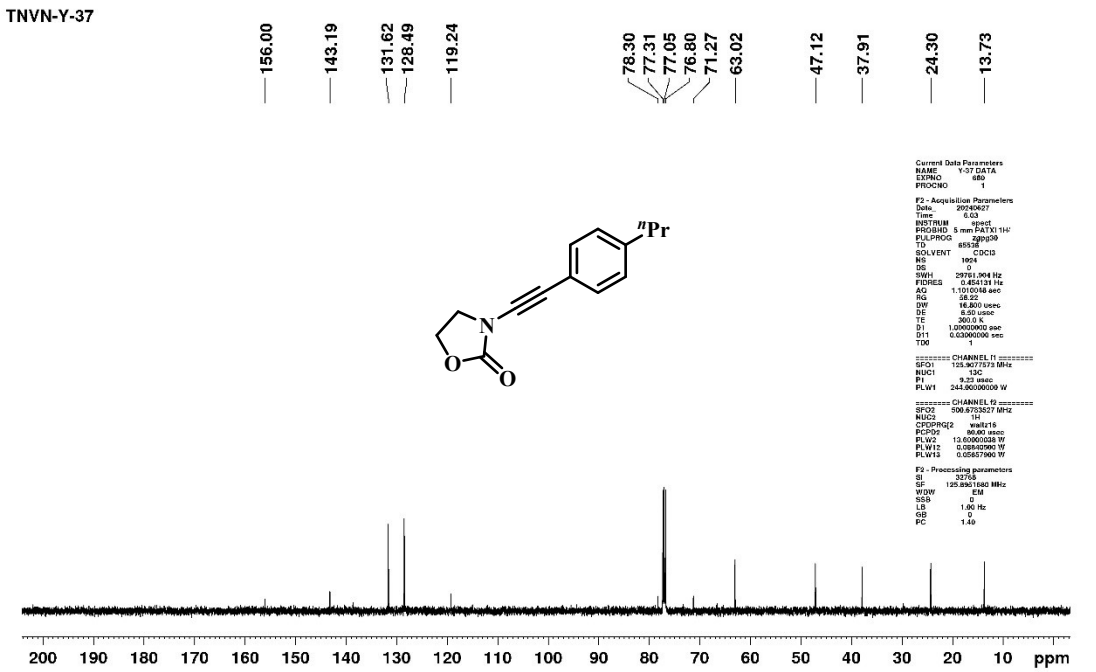
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1c**



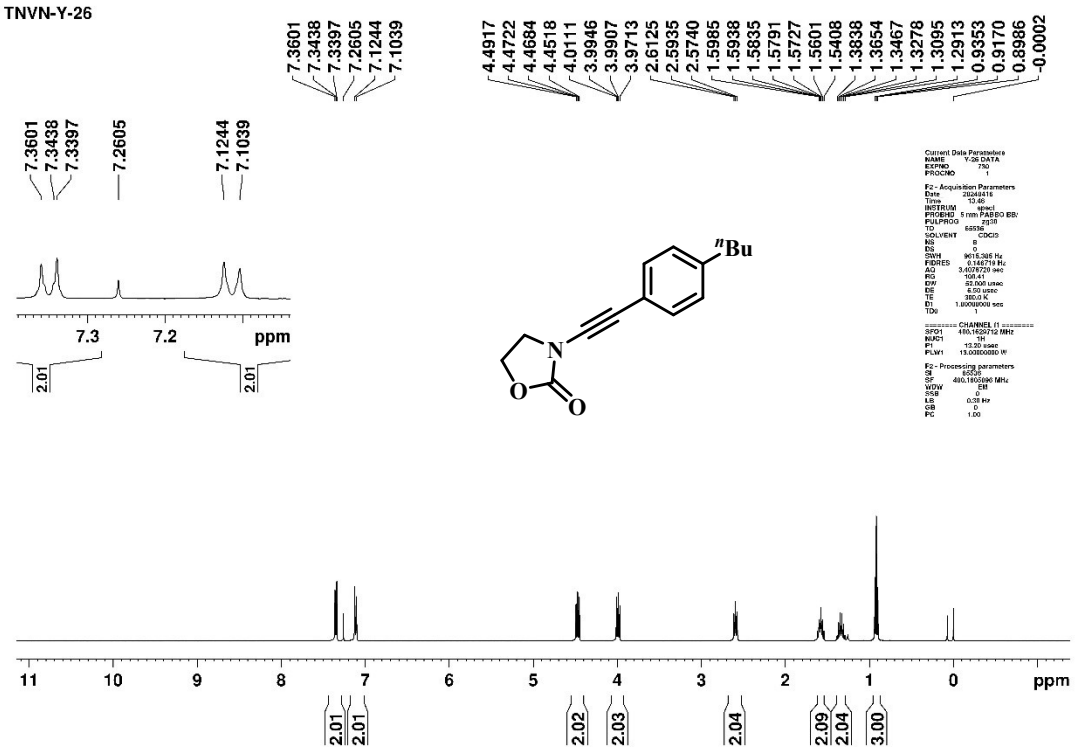
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1c**



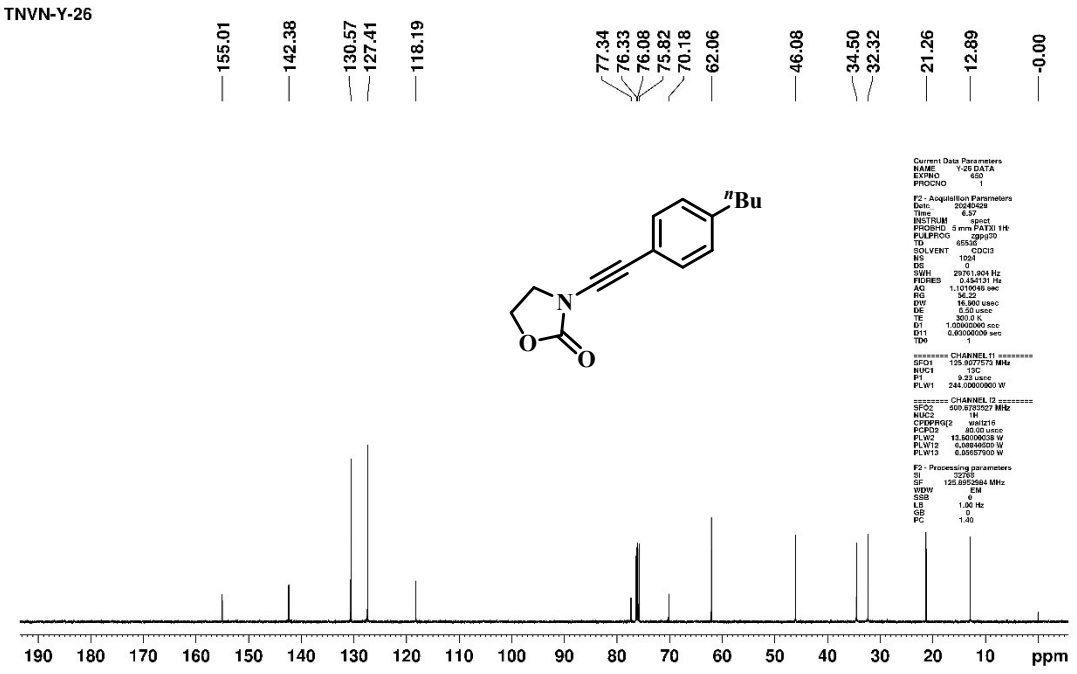
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1d**



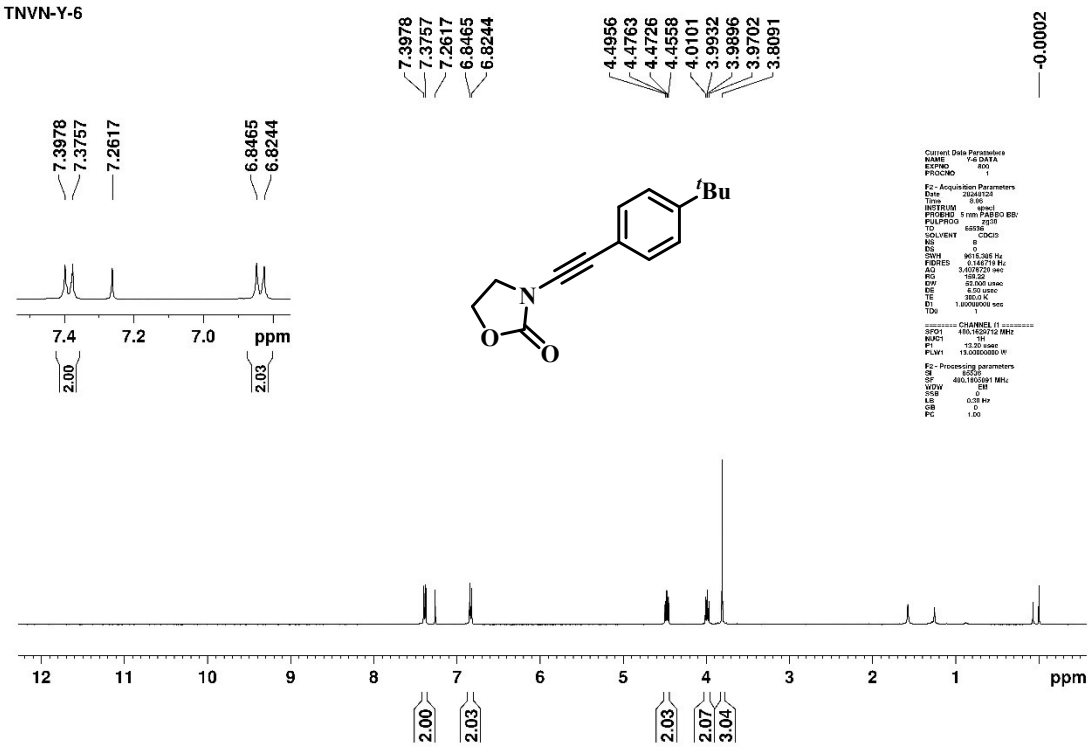
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1d**



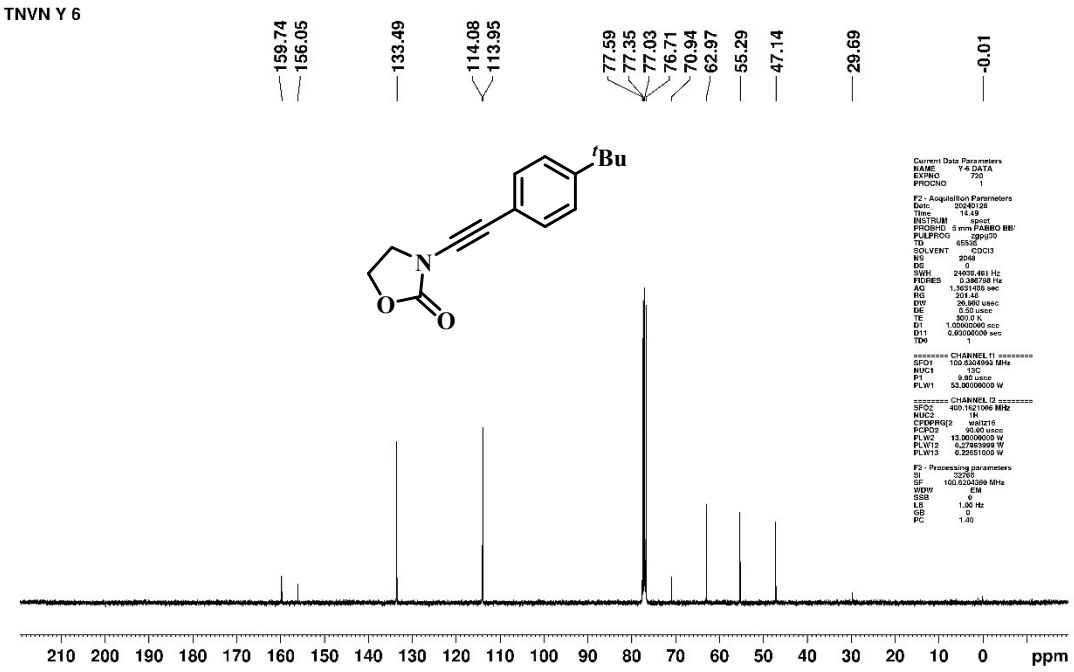
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1e**



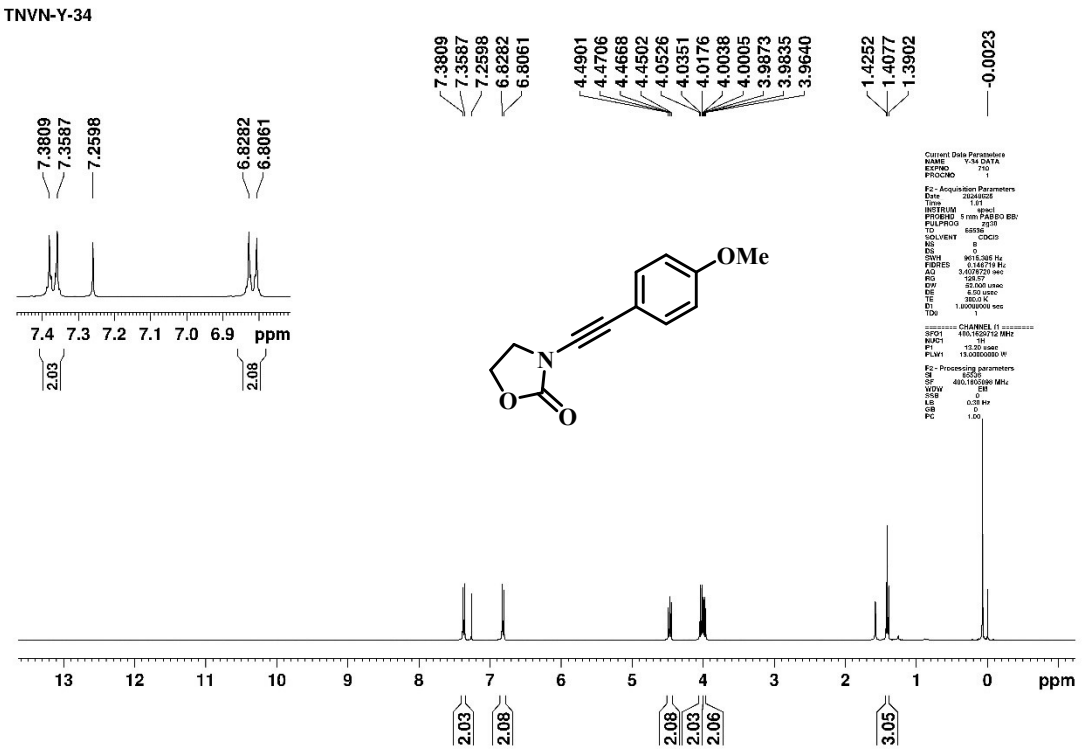
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1e**



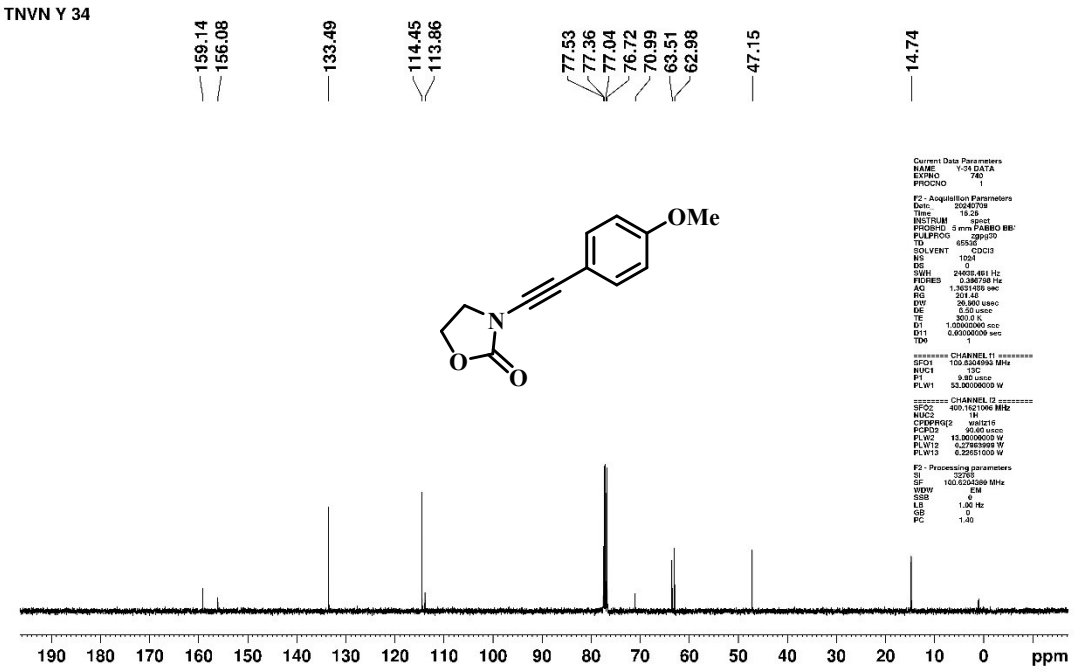
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1f**



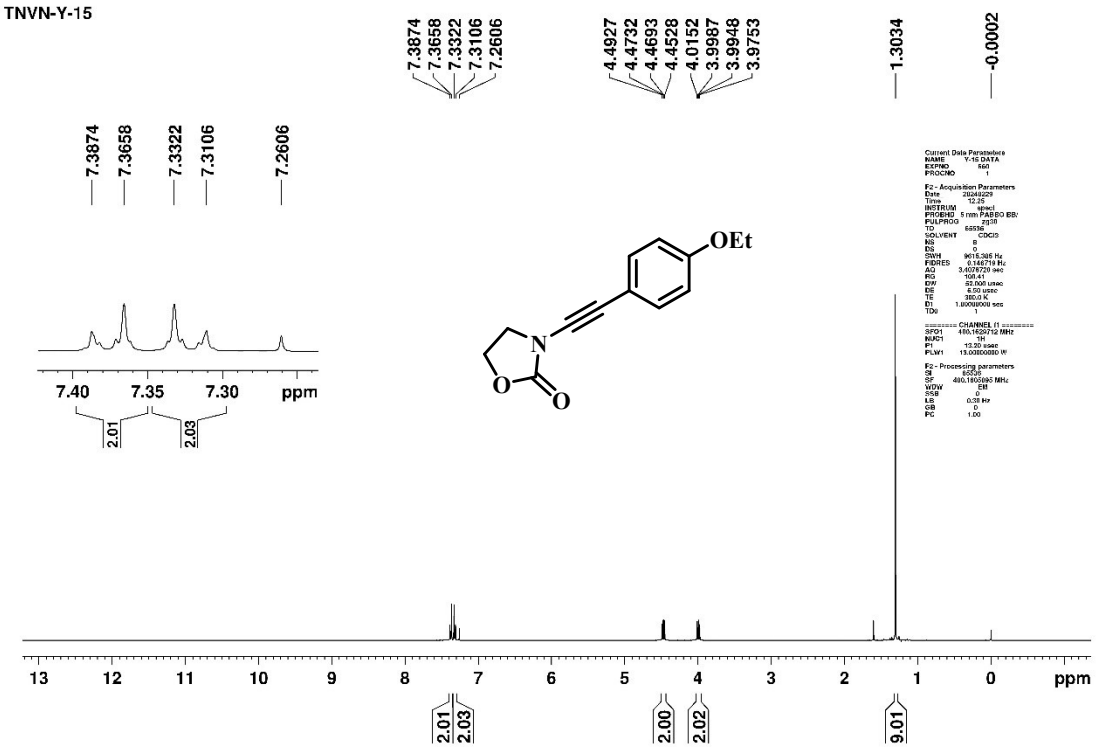
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1f**



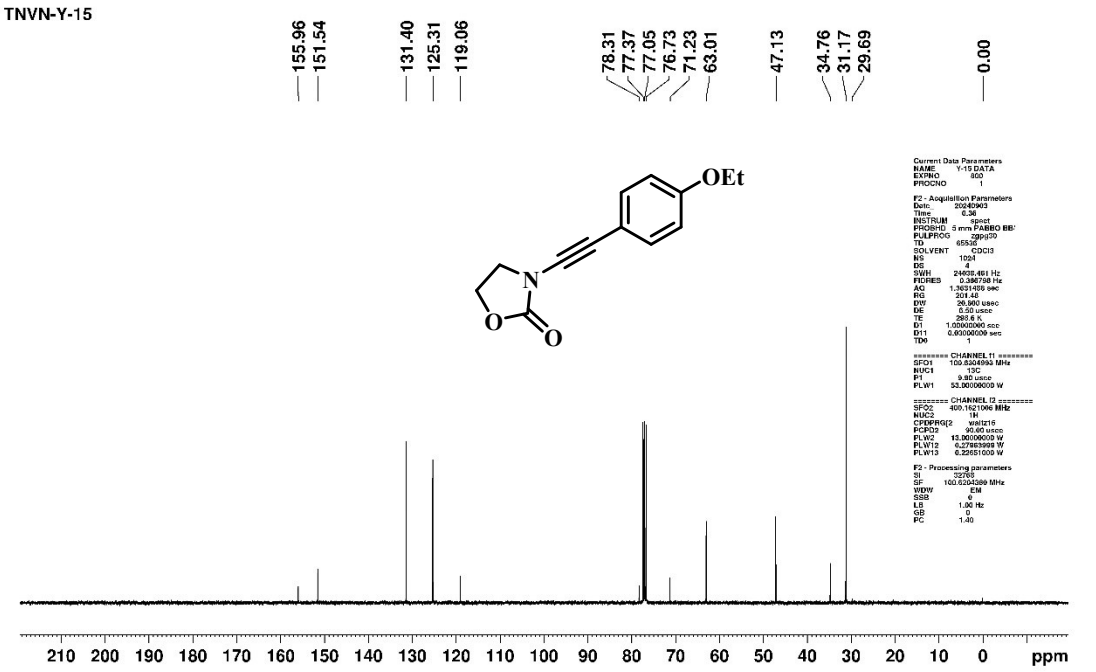
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1g**



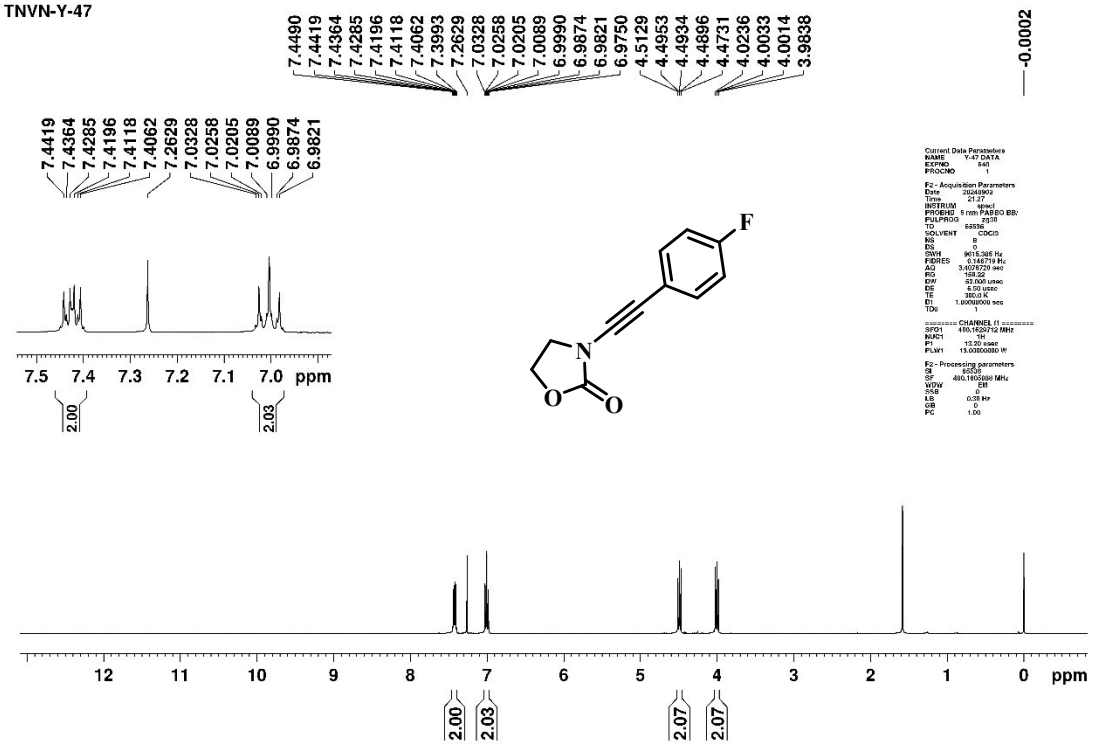
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1g**



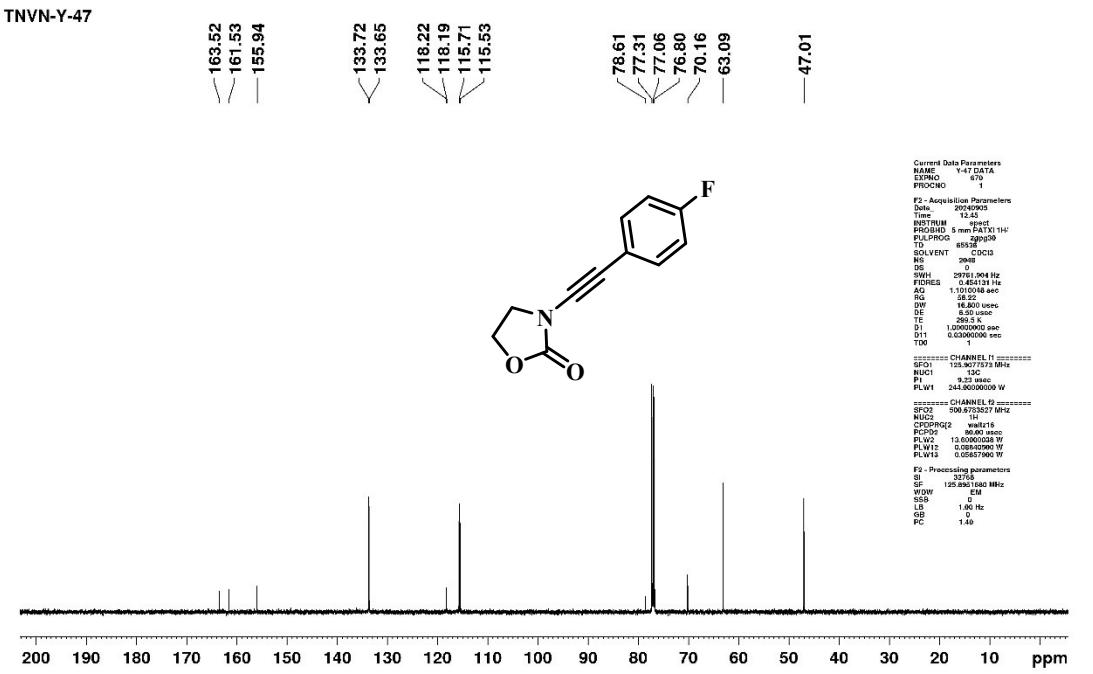
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1h**



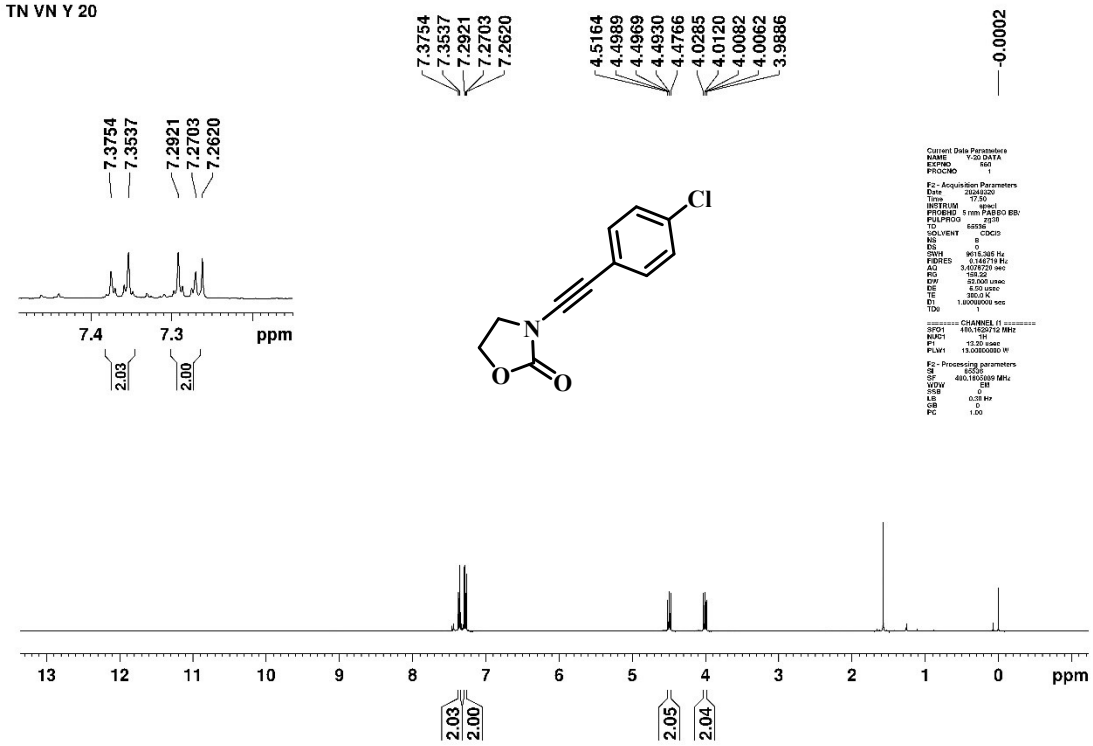
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1h**



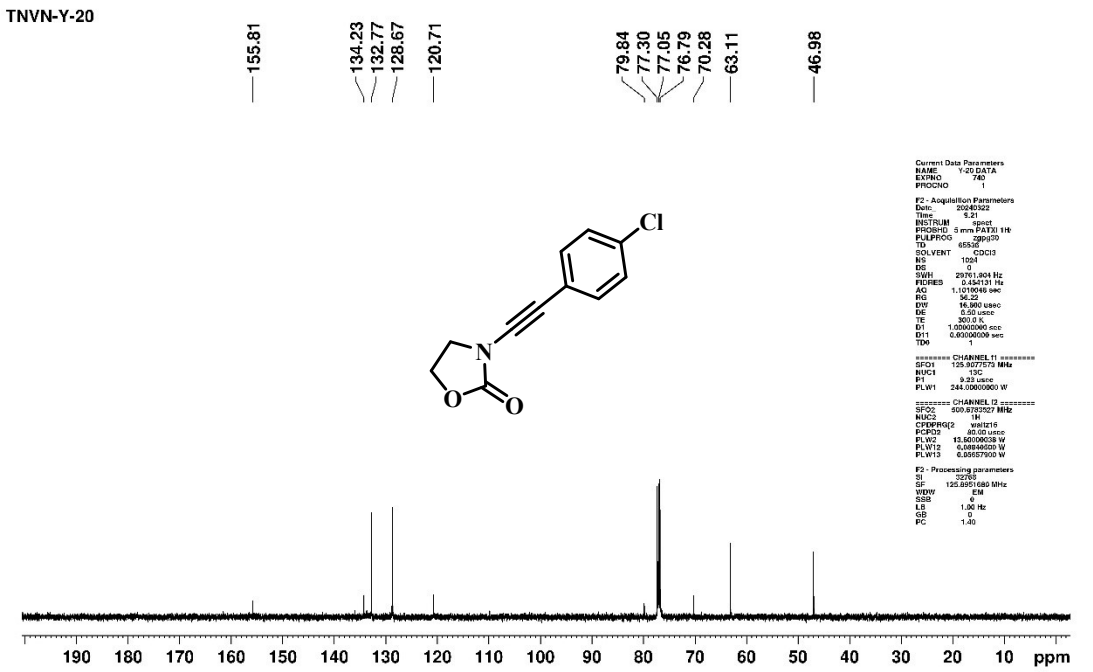
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1i**



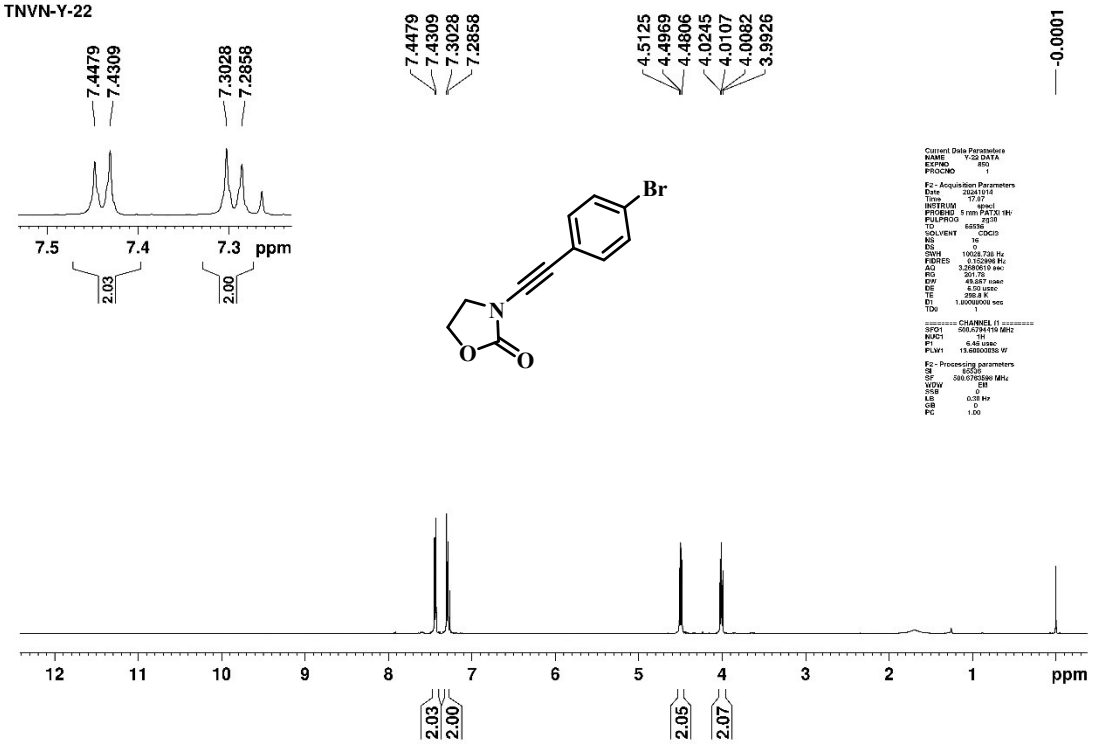
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1i**



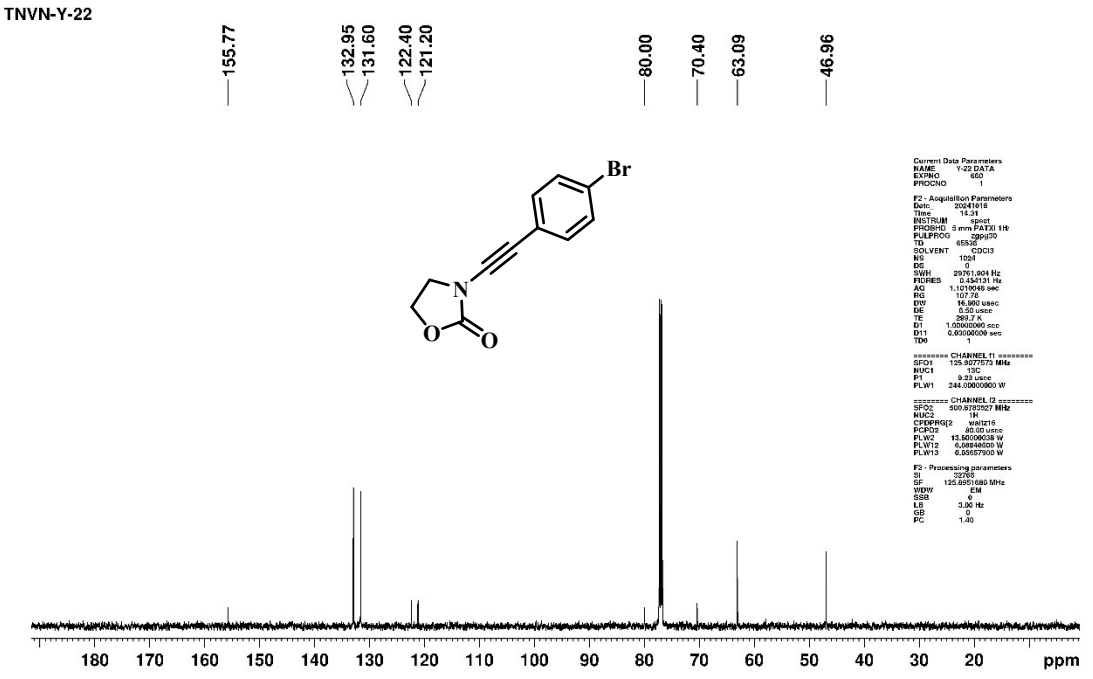
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1j**



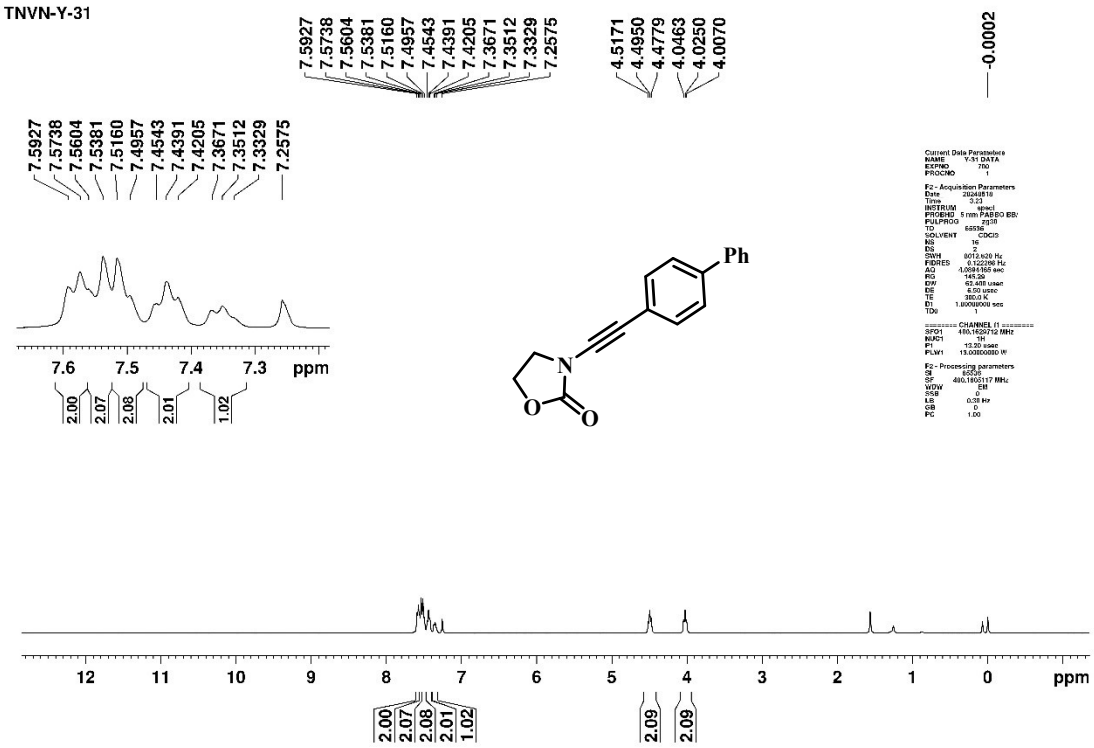
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1j**



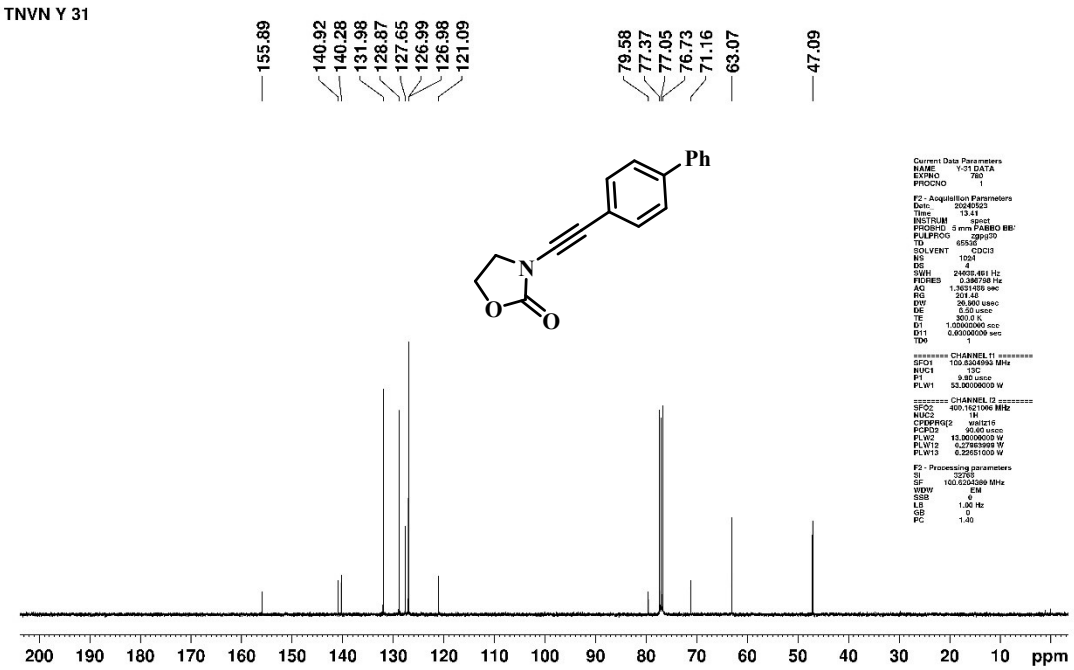
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1k**



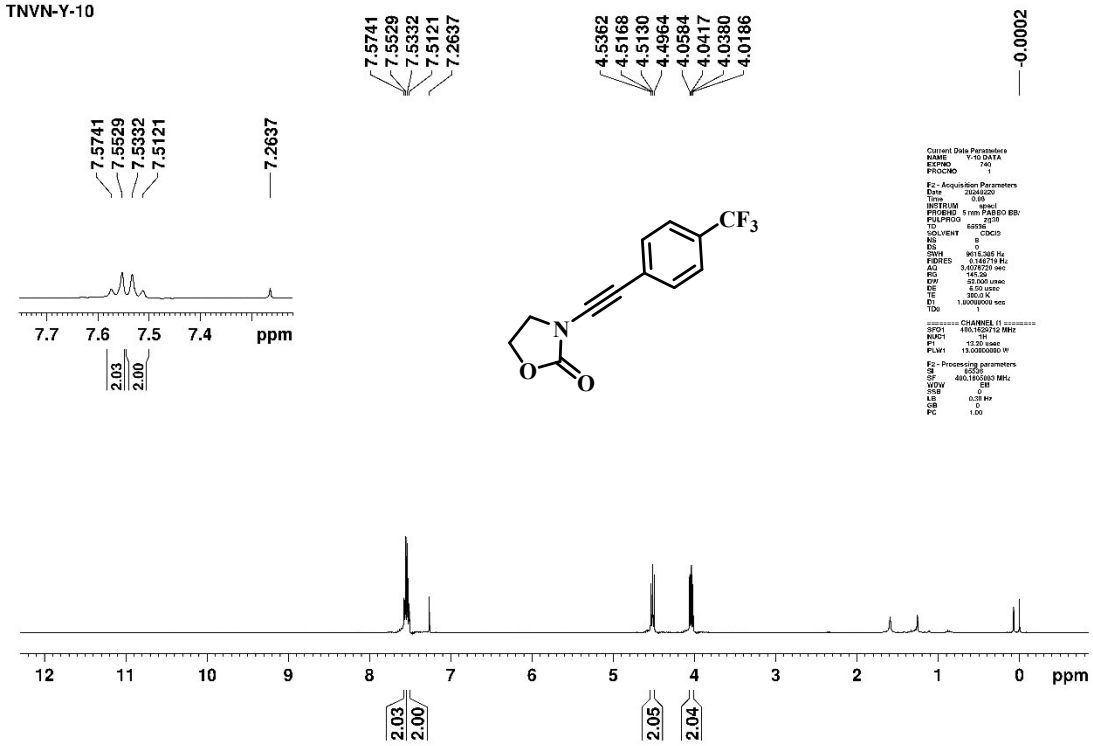
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1k**



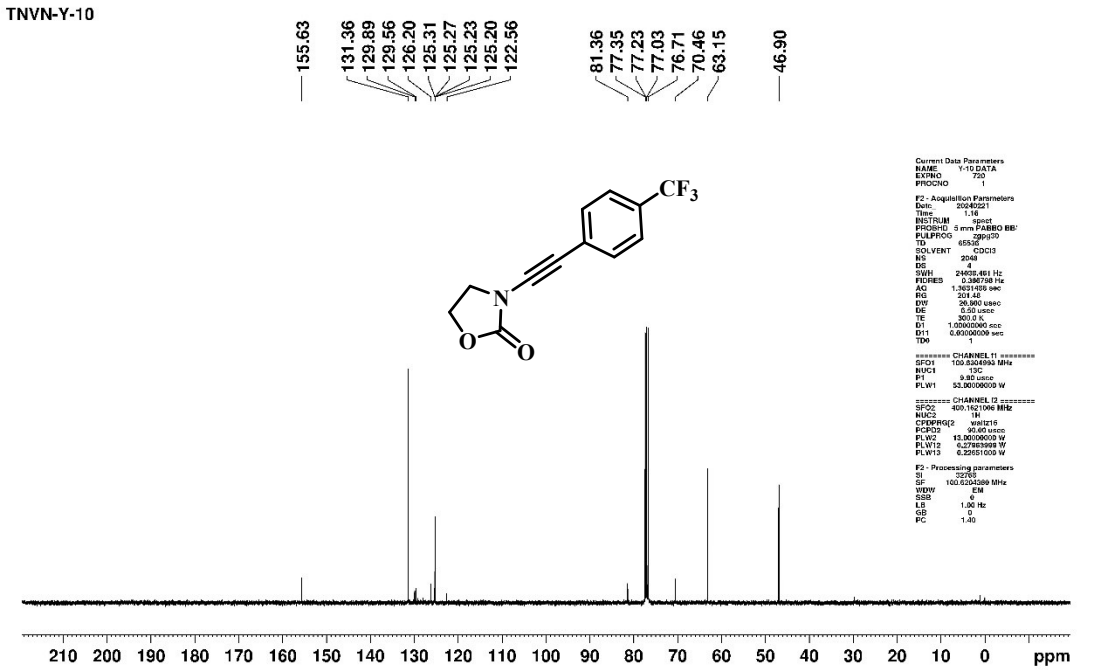
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1l**



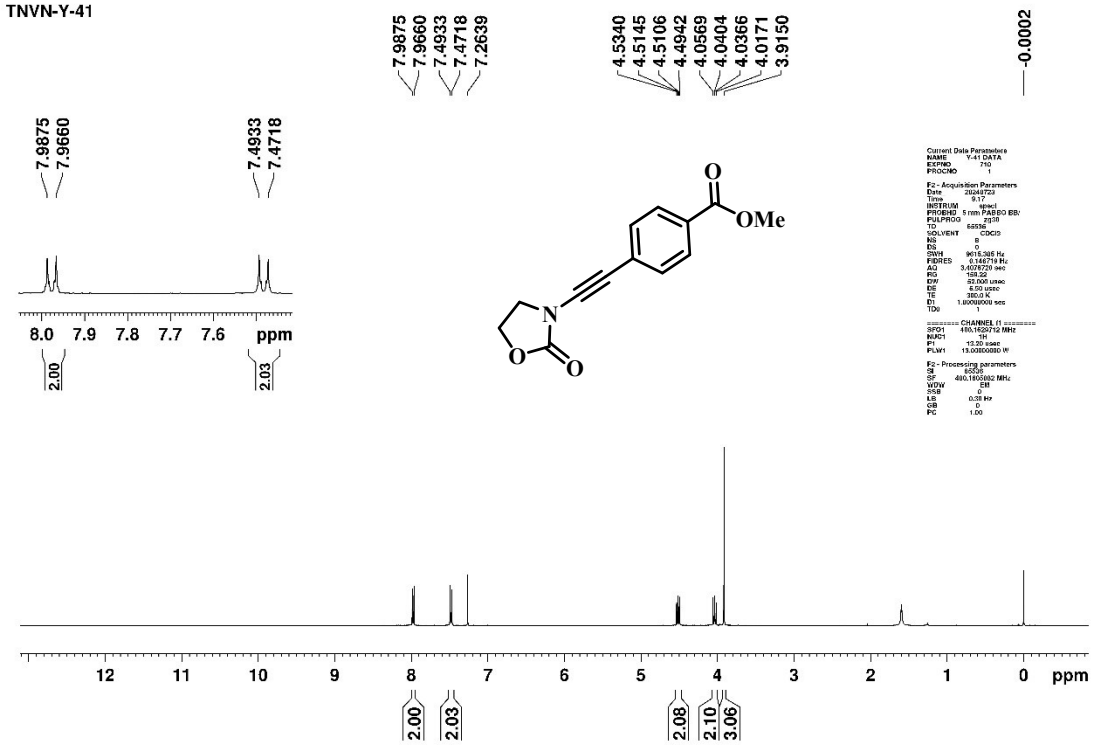
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1l**



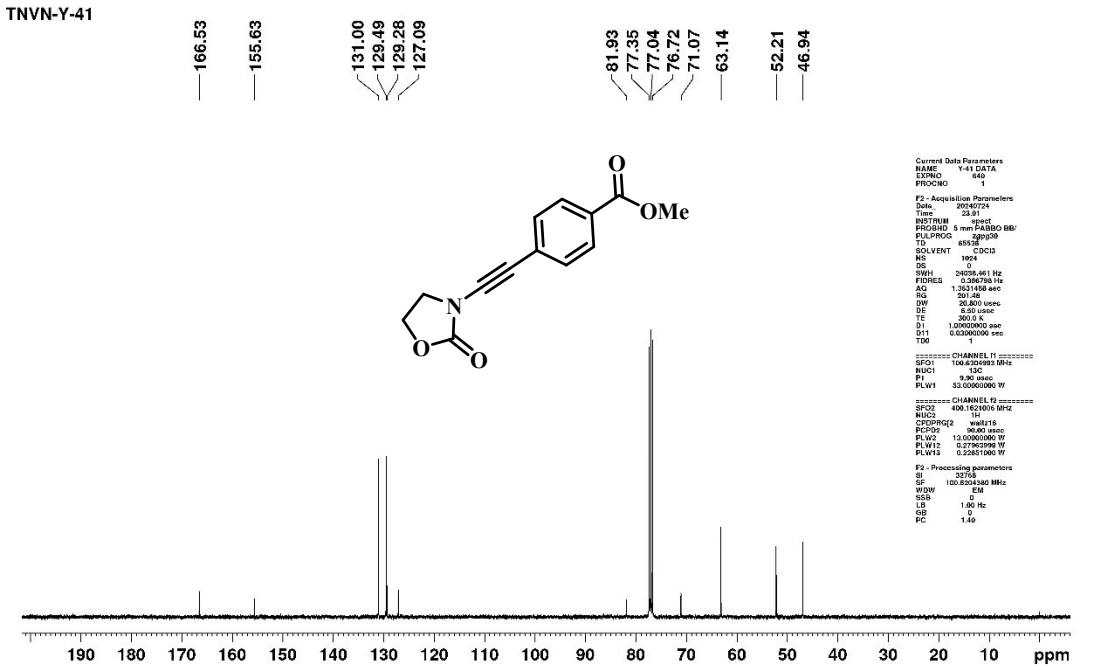
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1m**



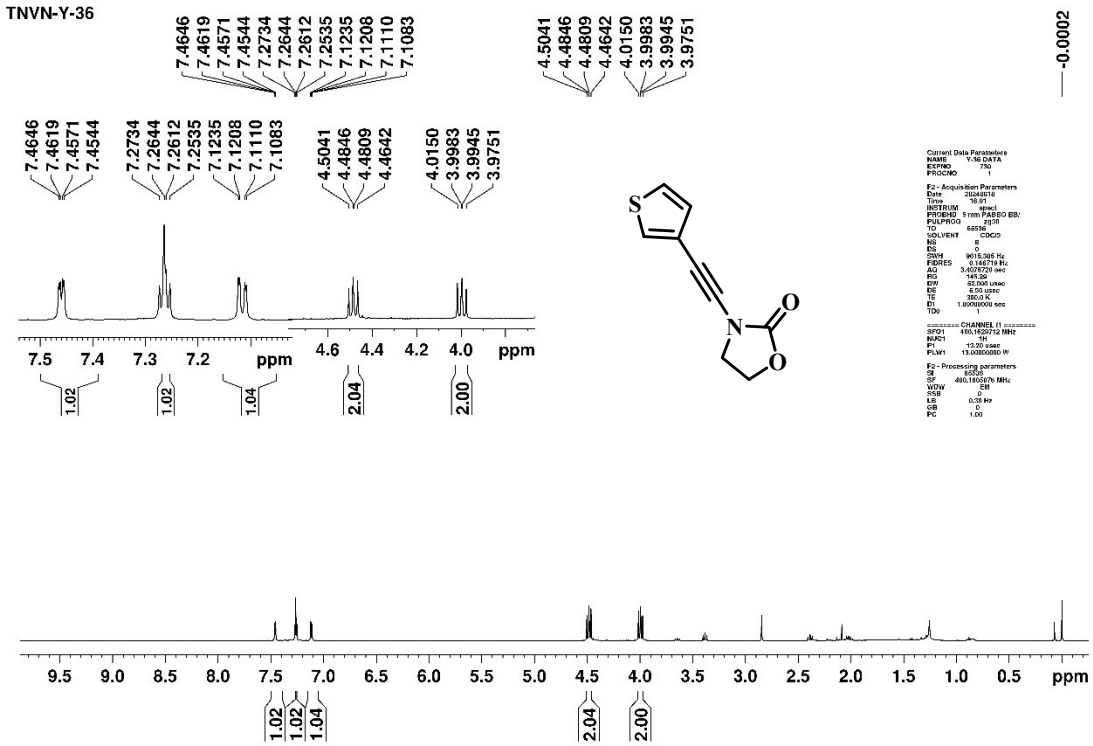
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1m**



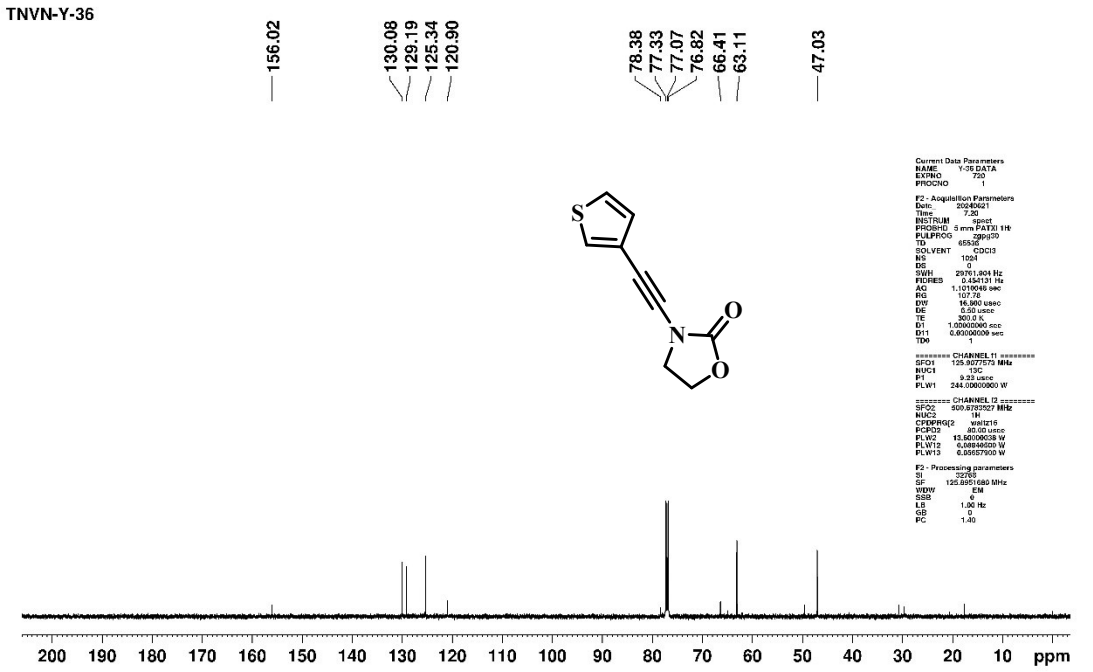
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1n**



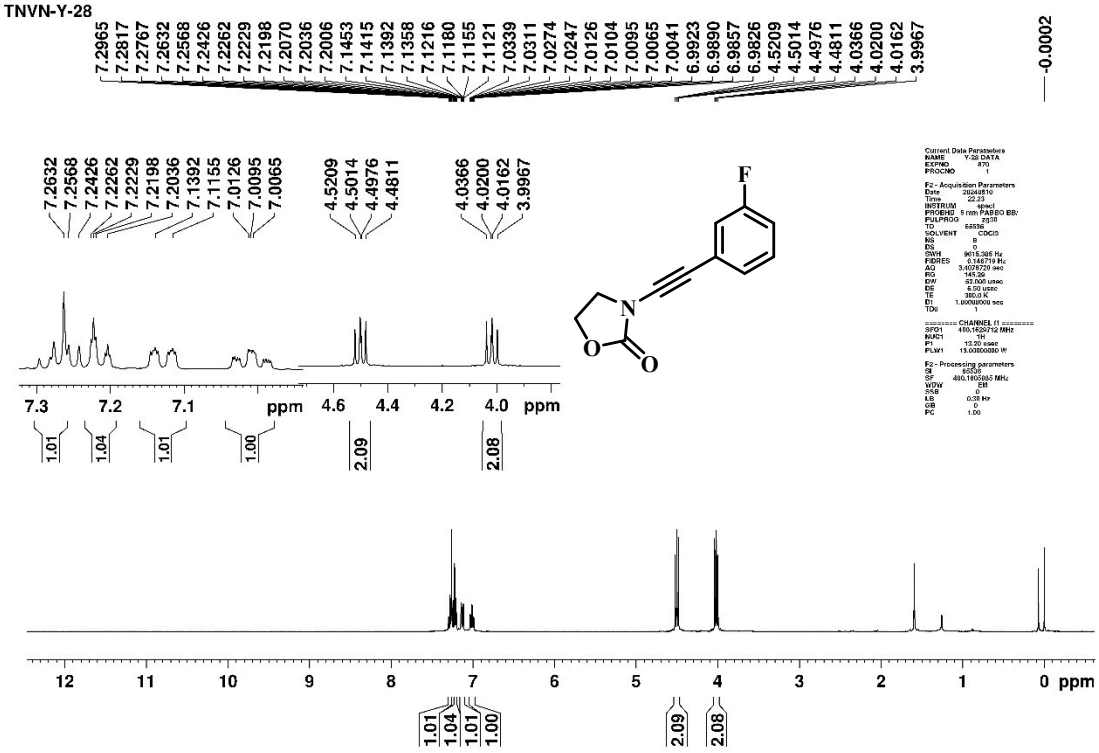
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1n**



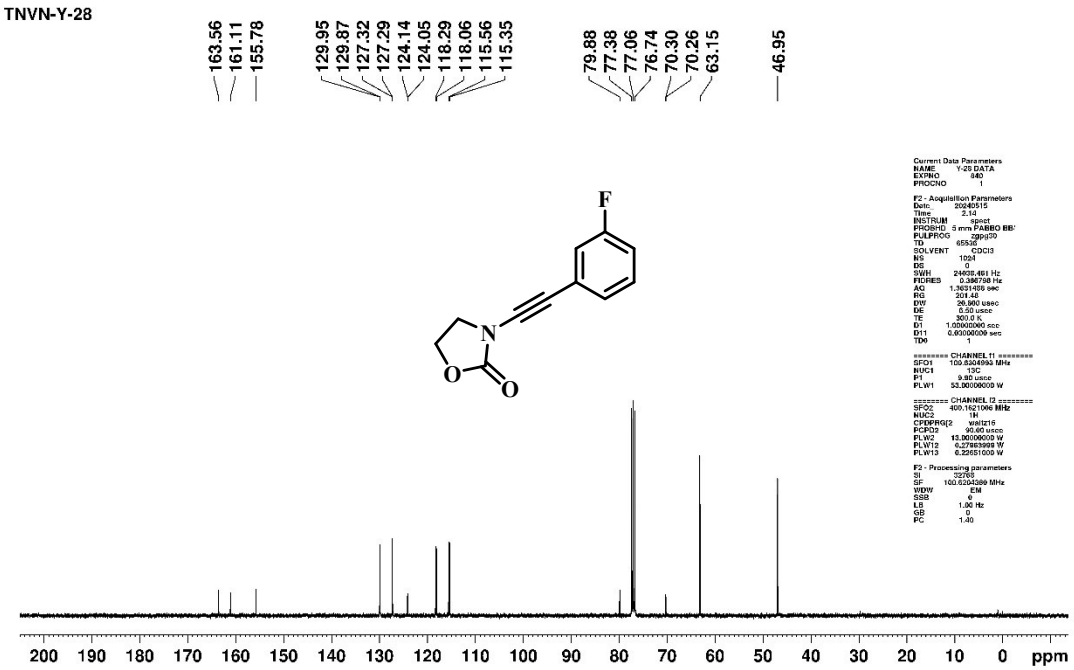
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1o**



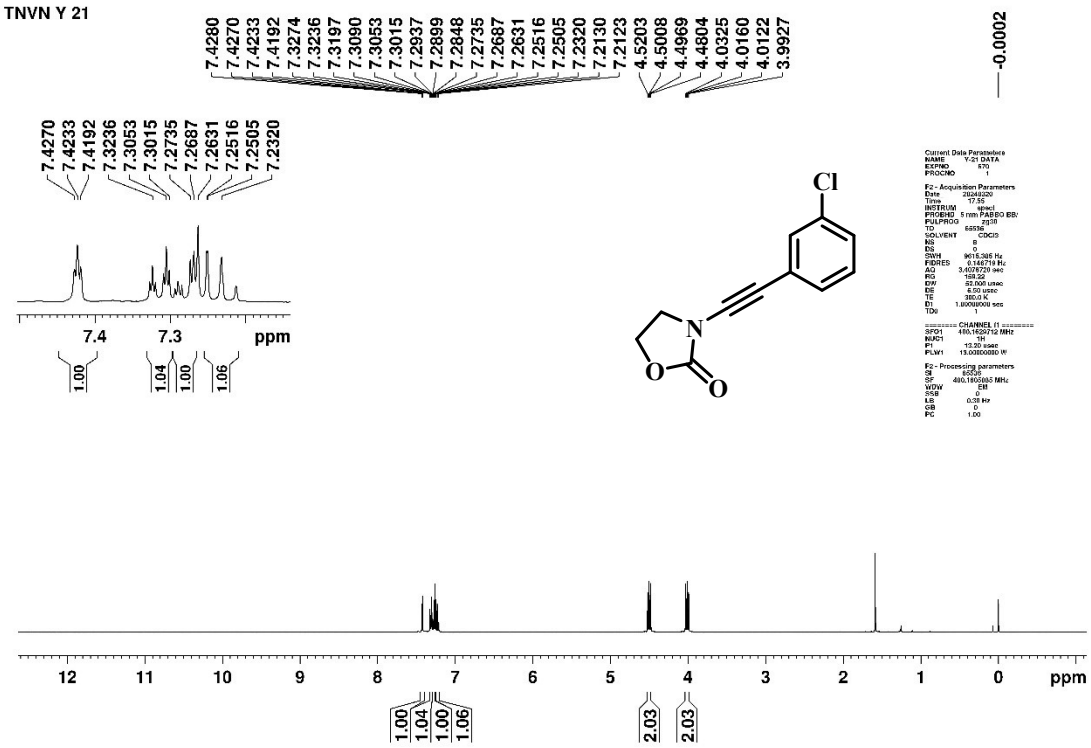
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1o**



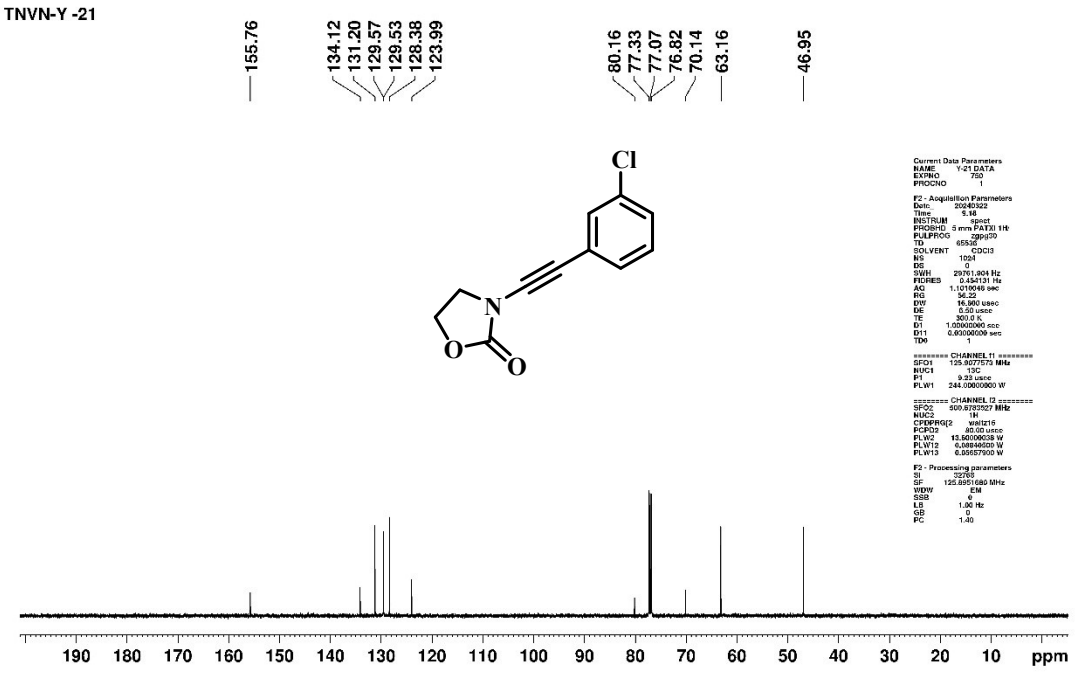
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1p**



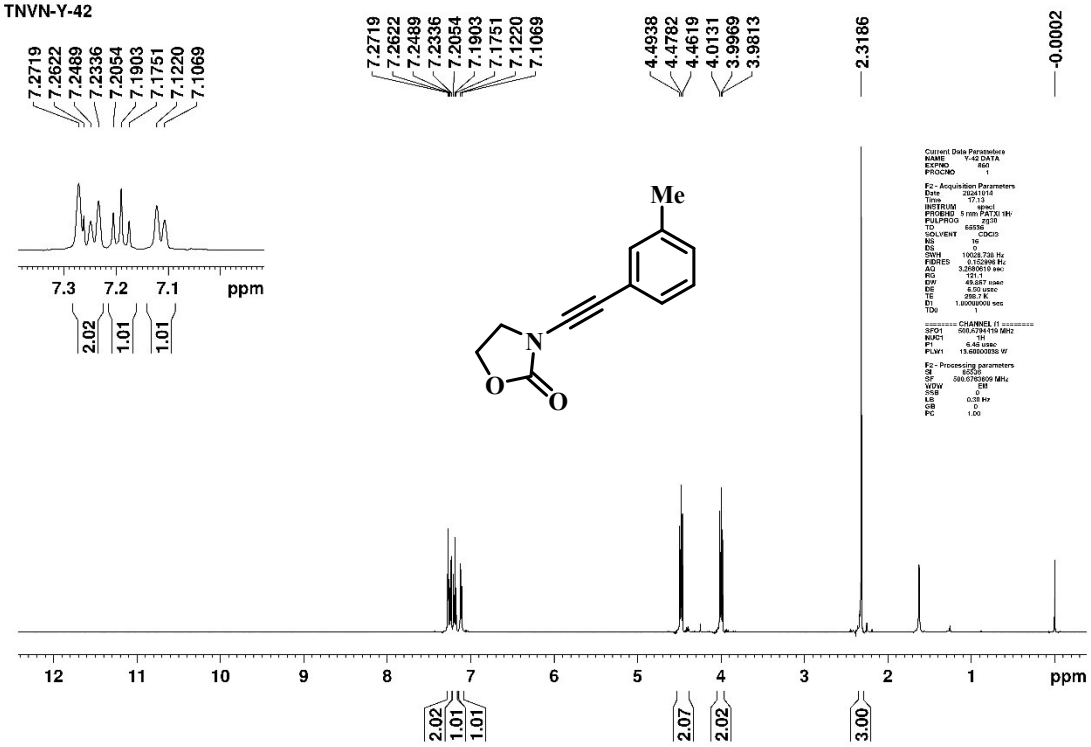
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1p**



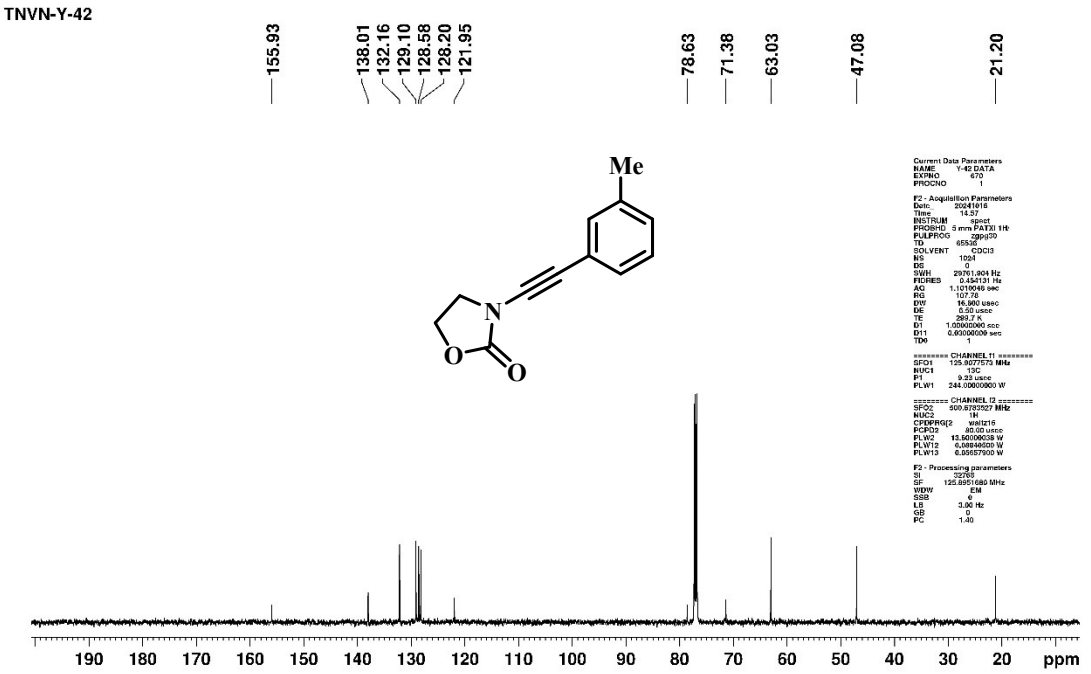
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1q**



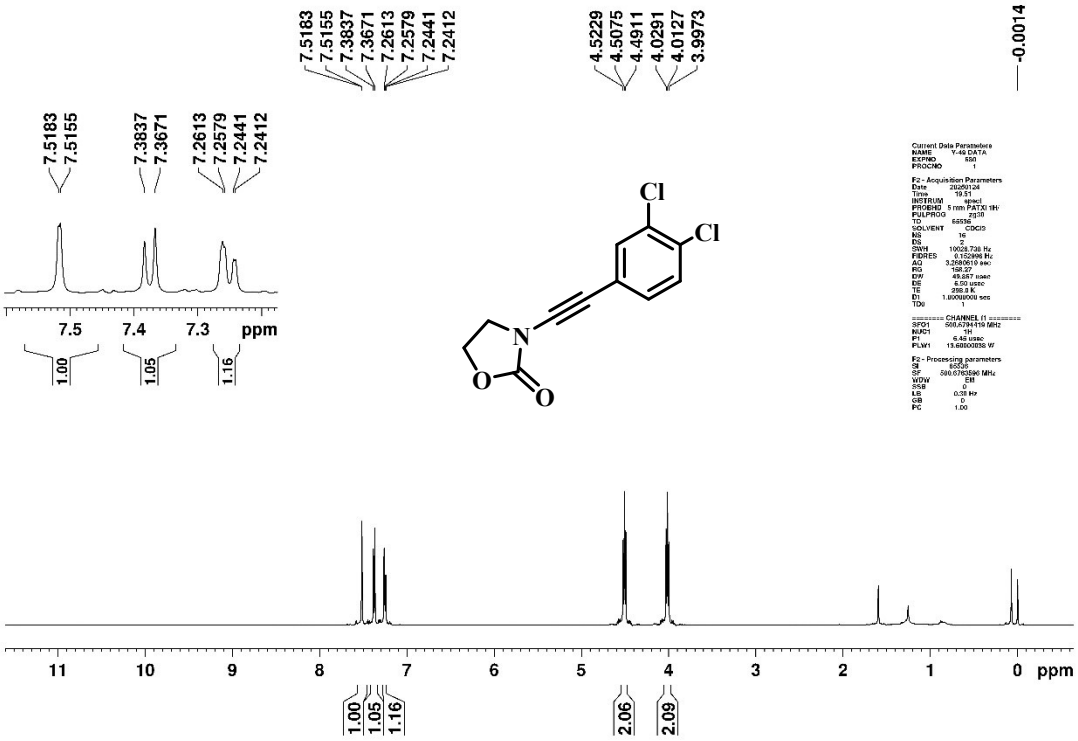
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1q**



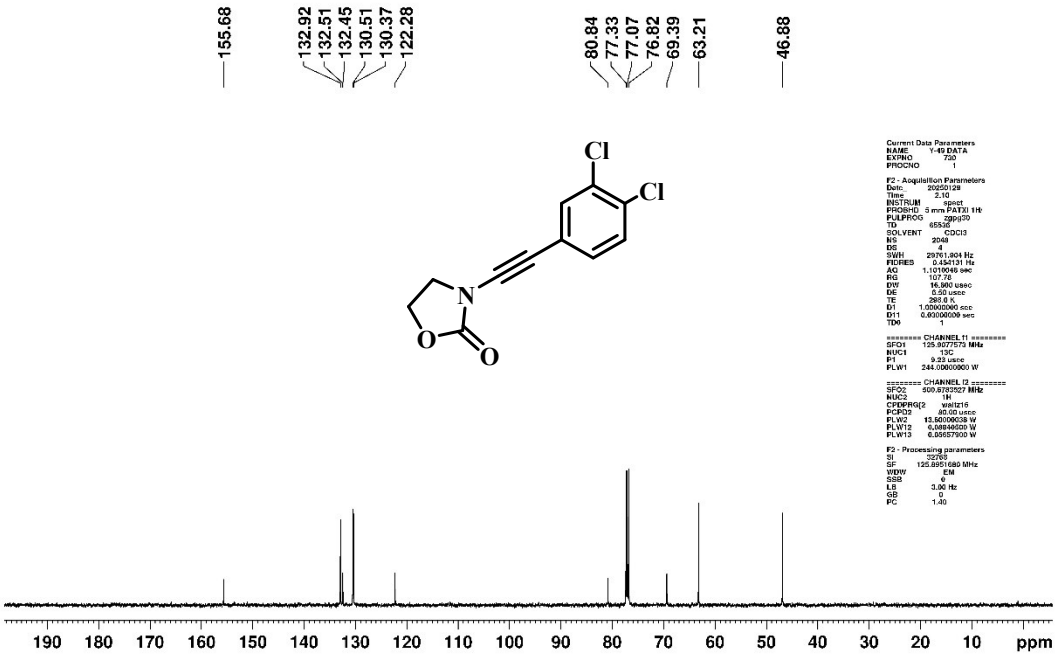
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1r**



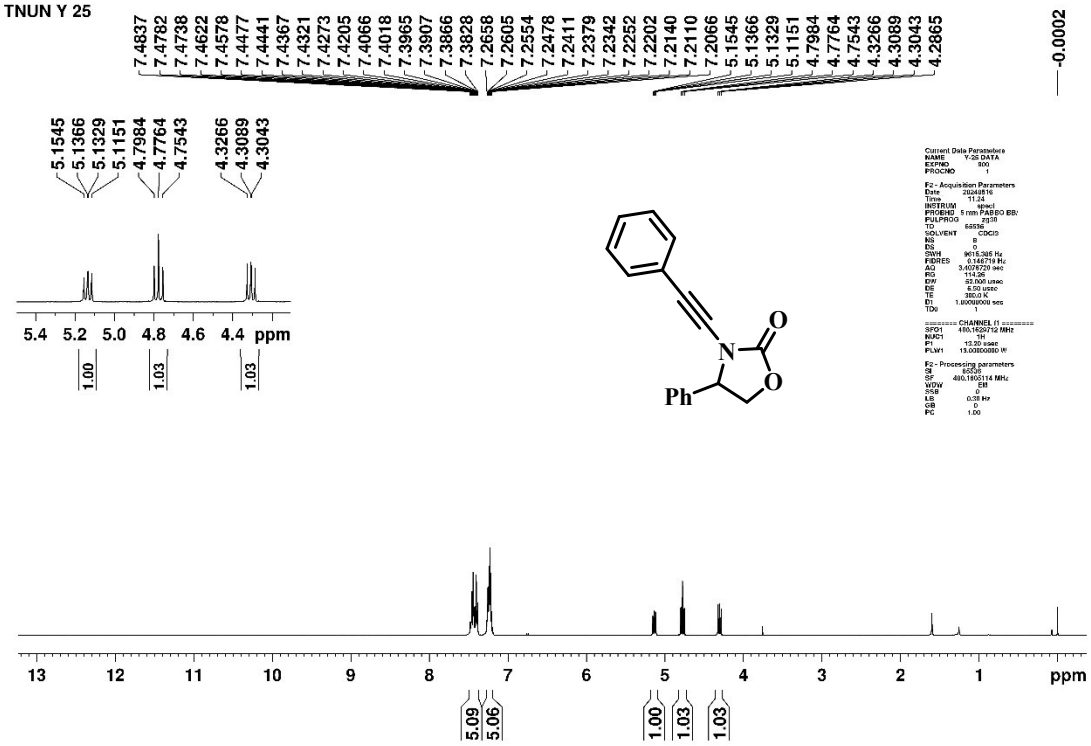
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1r**



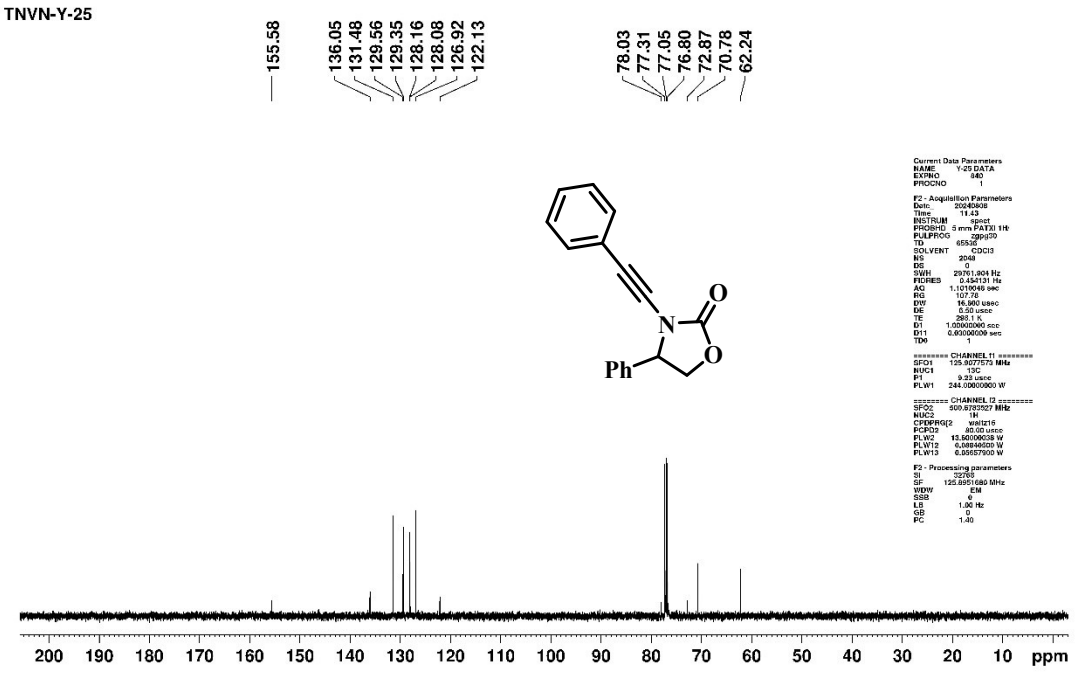
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1s**



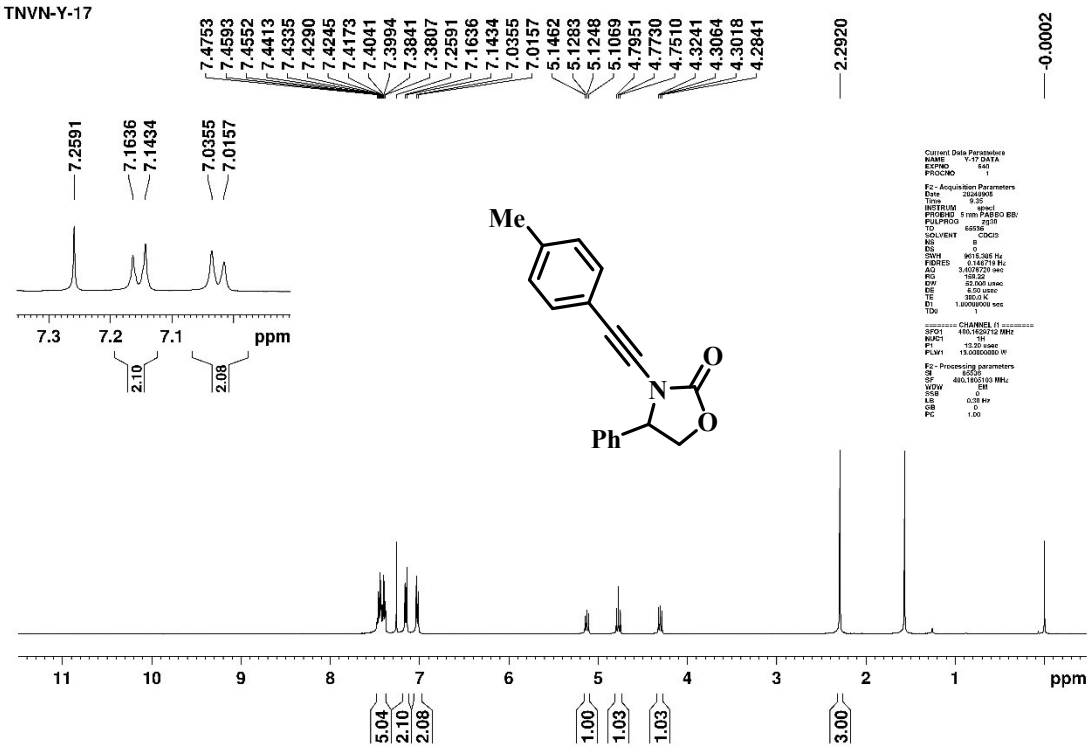
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1s**



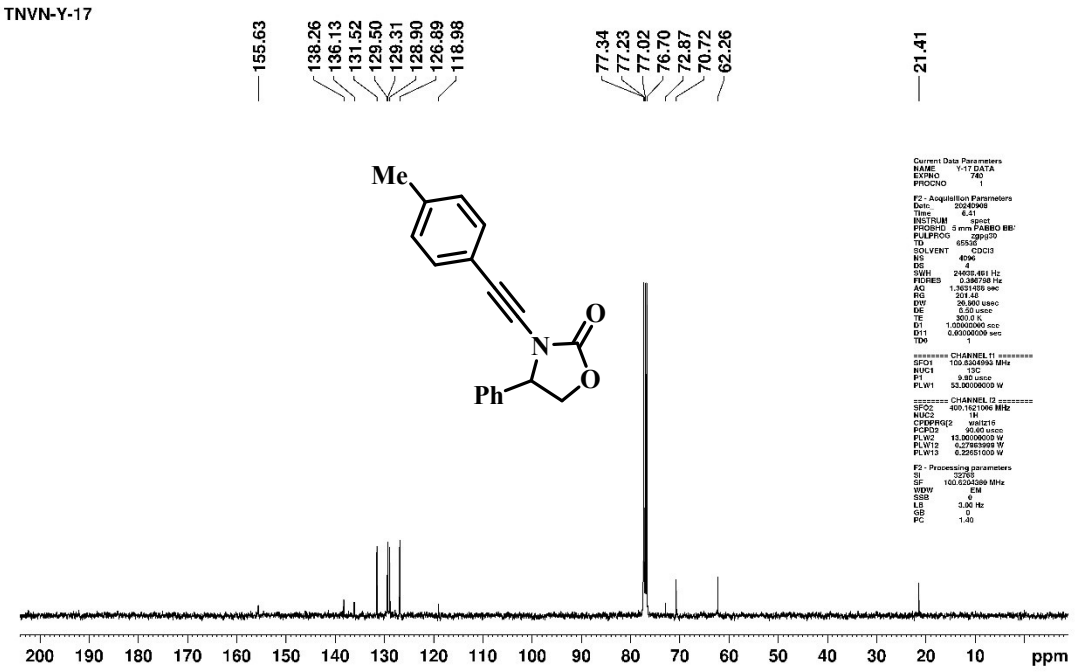
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1t**



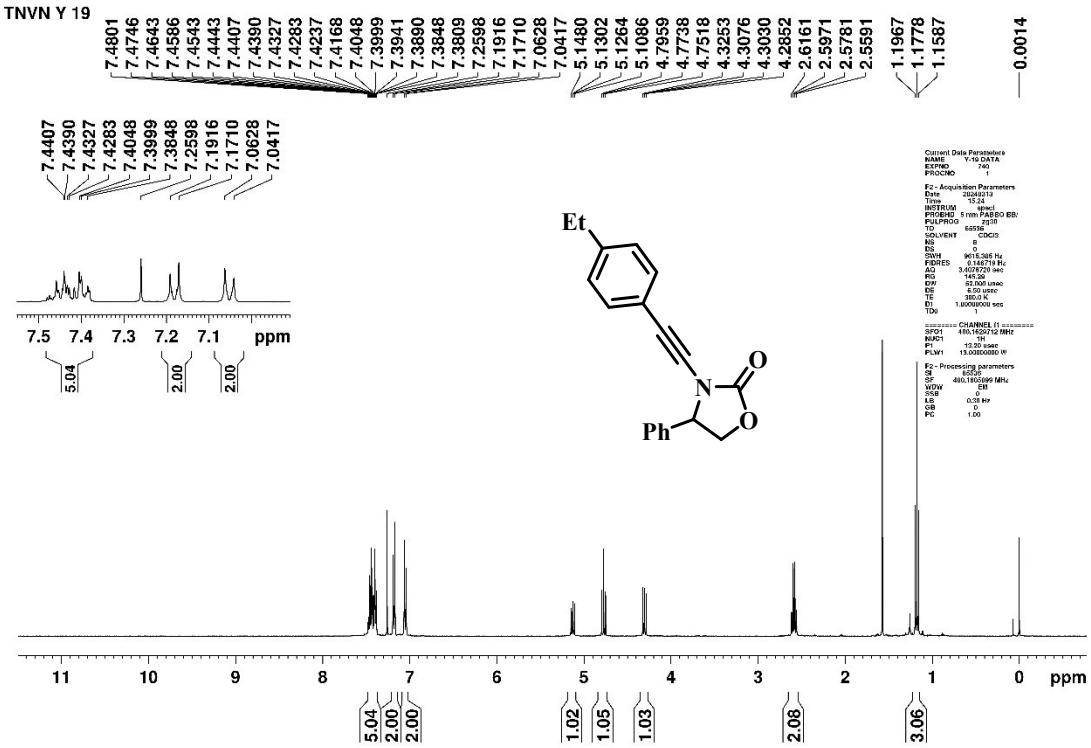
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1t**



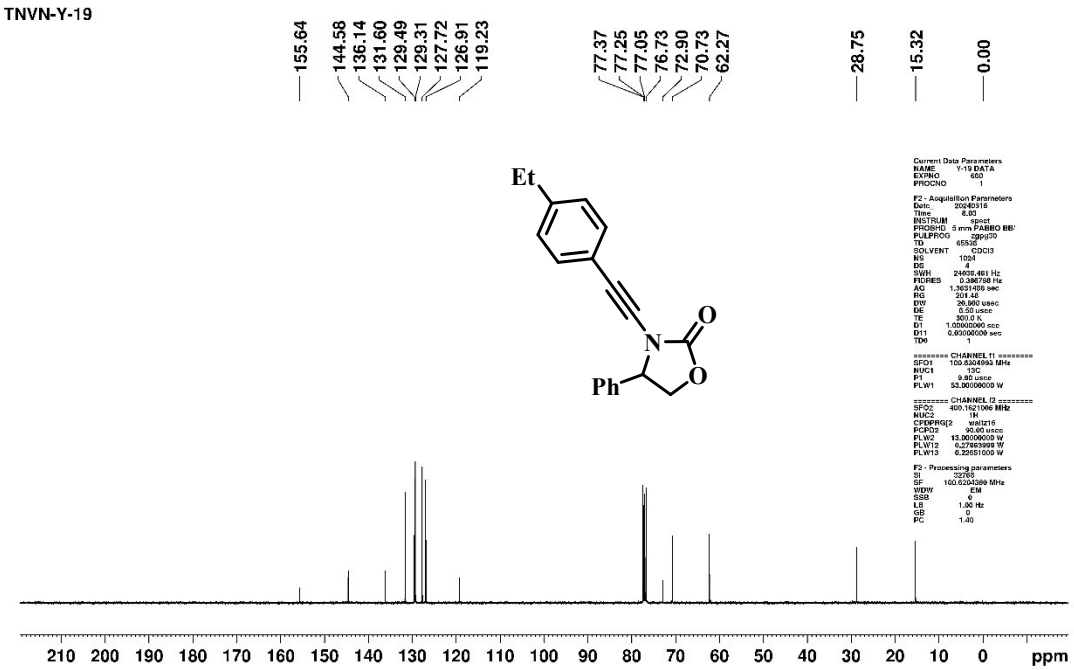
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1u**



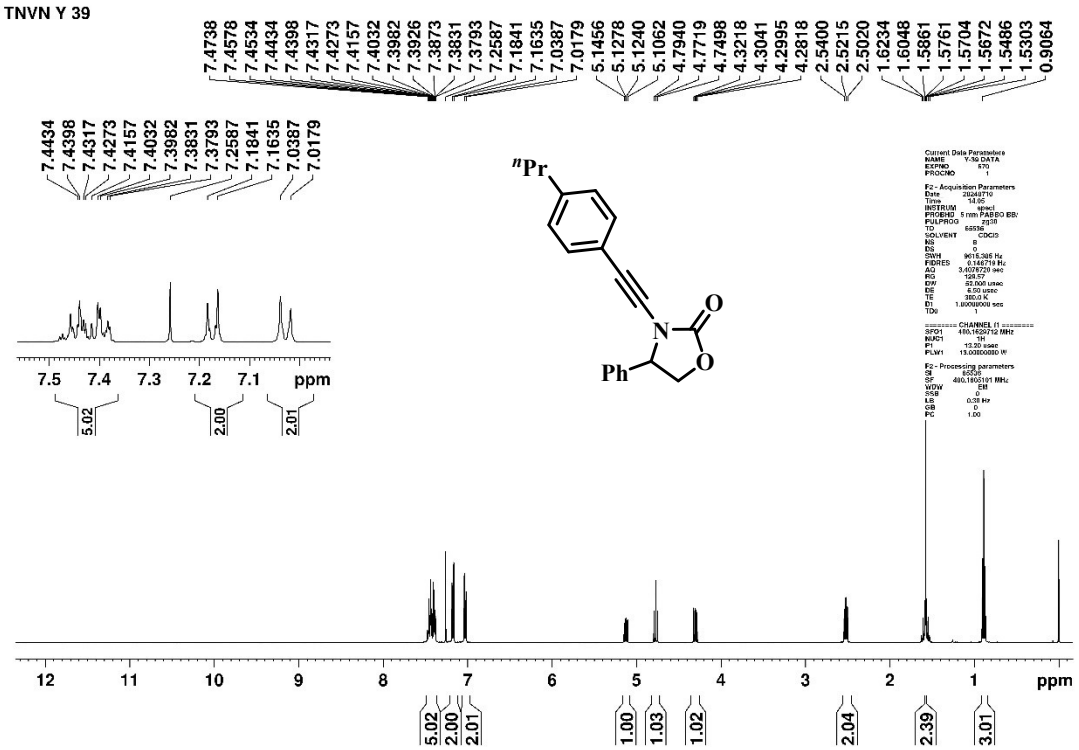
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1u**



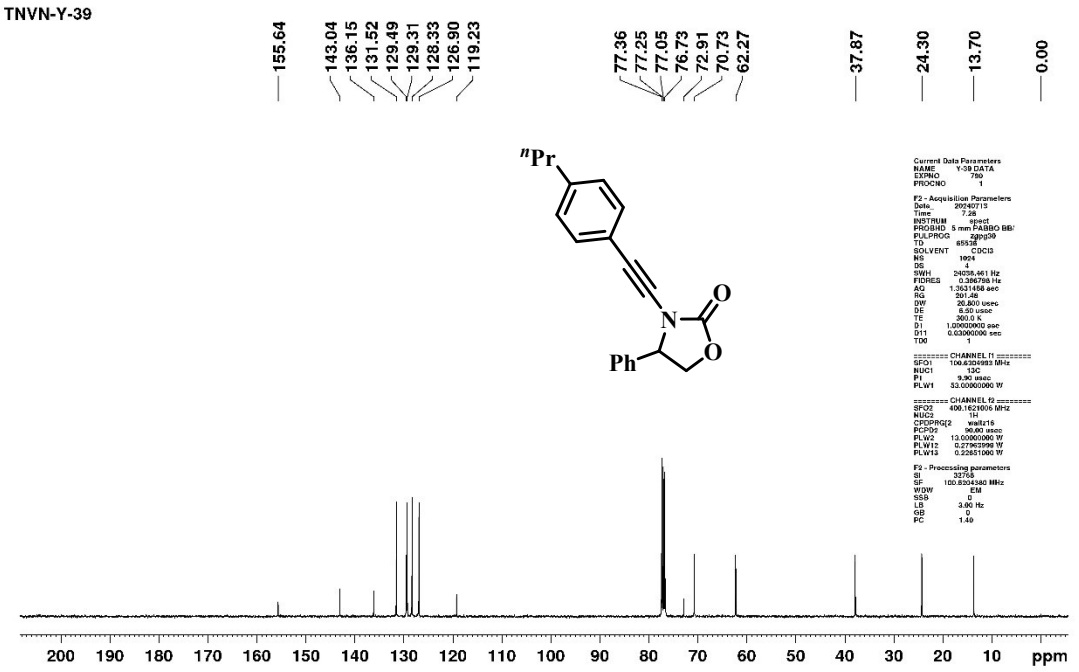
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1v**



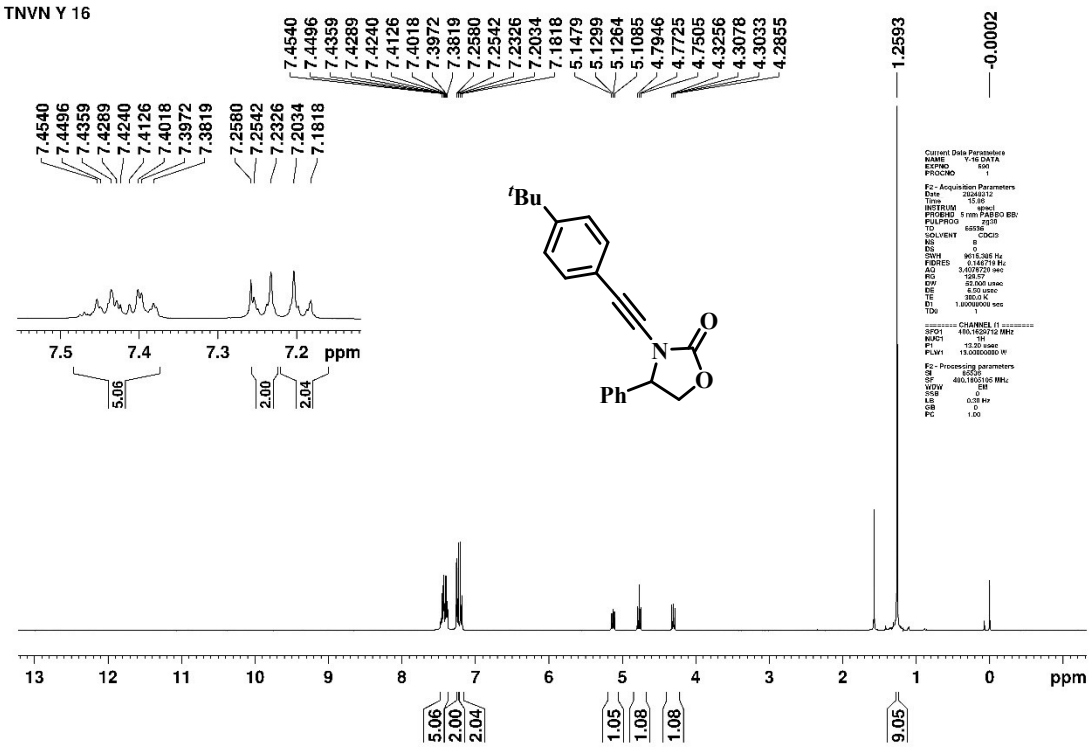
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1v**



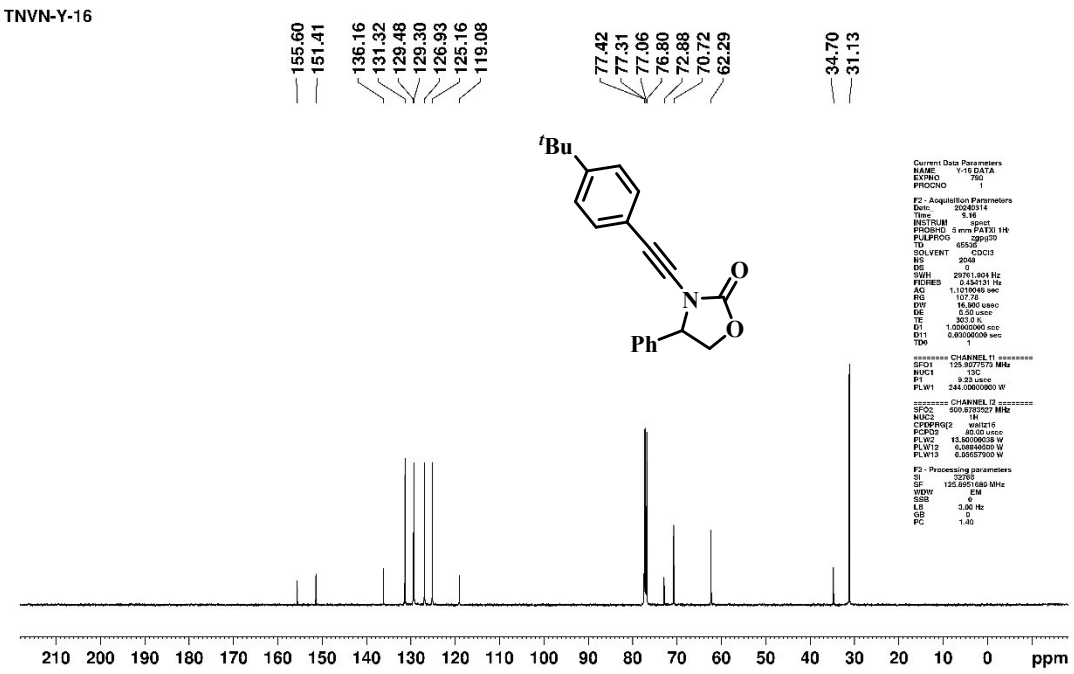
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1w**



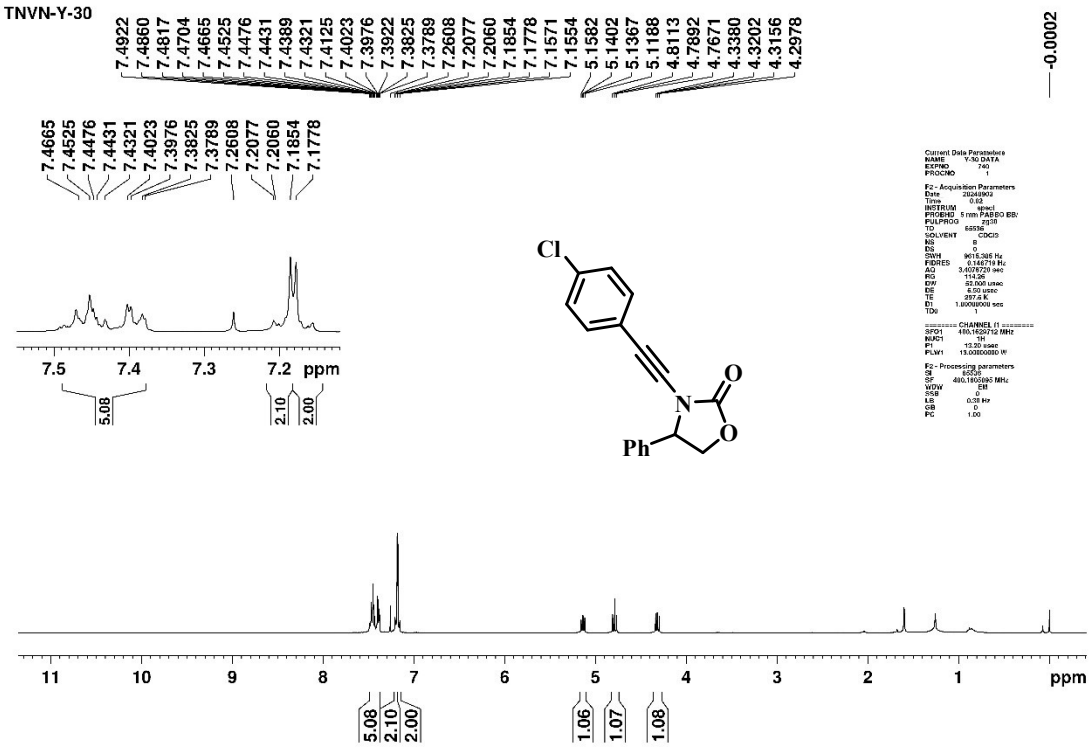
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1w**



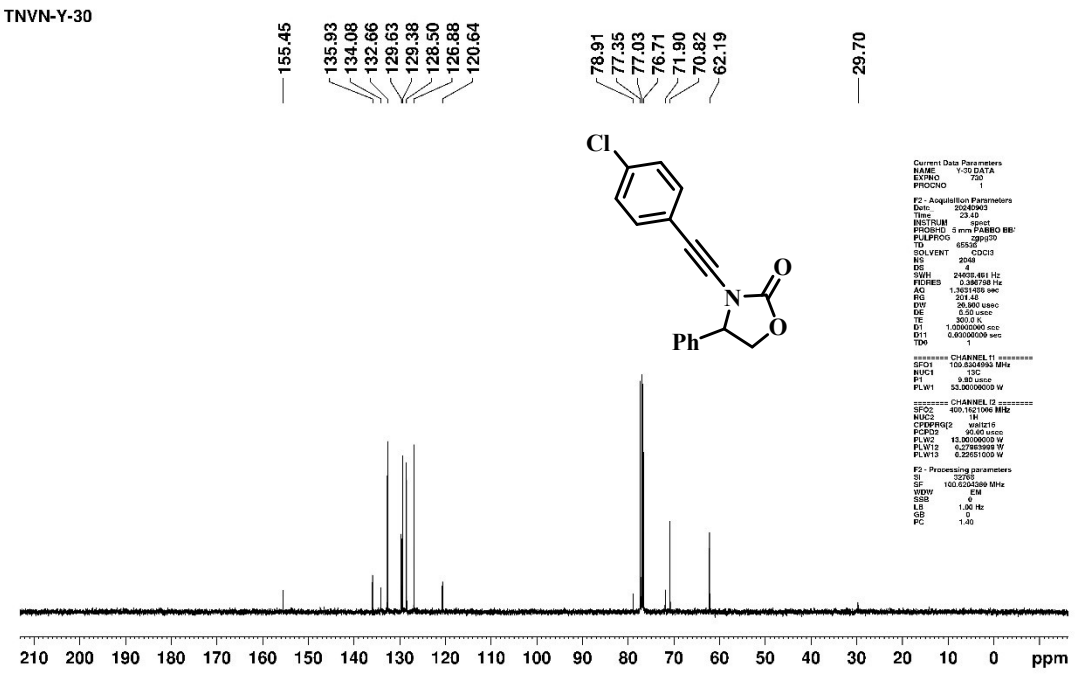
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1y**



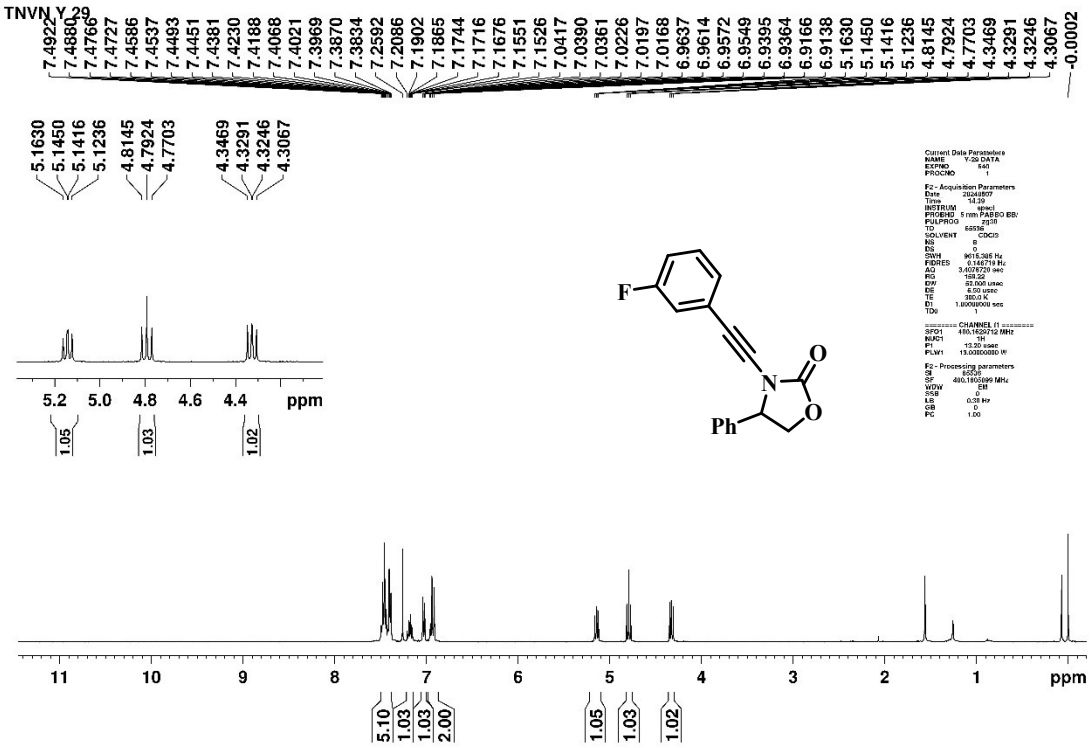
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1y**



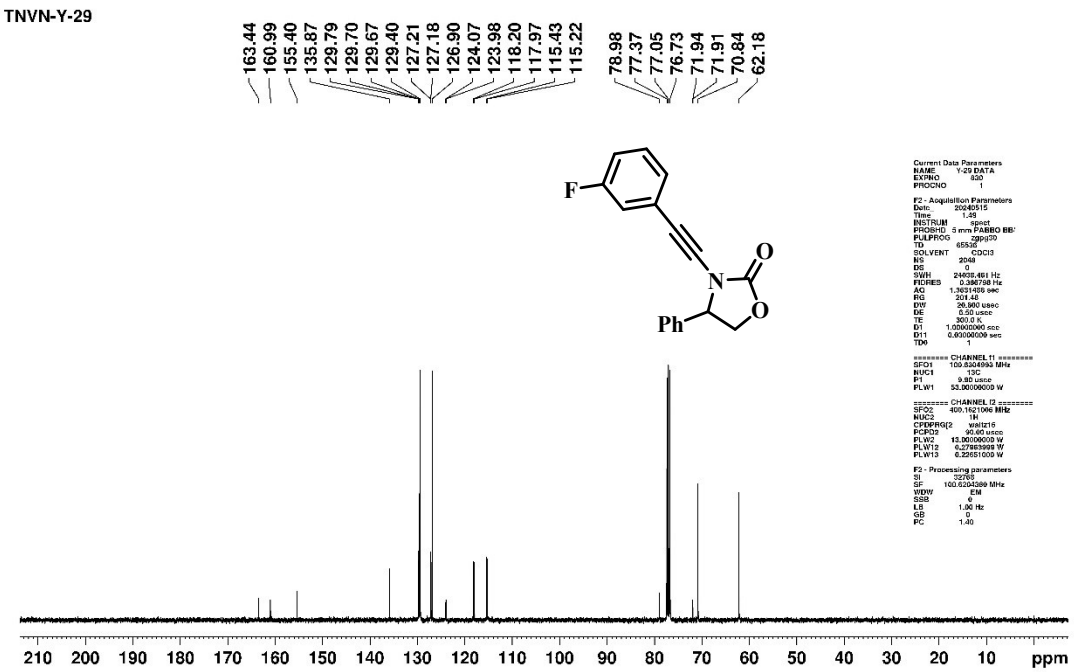
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1z**



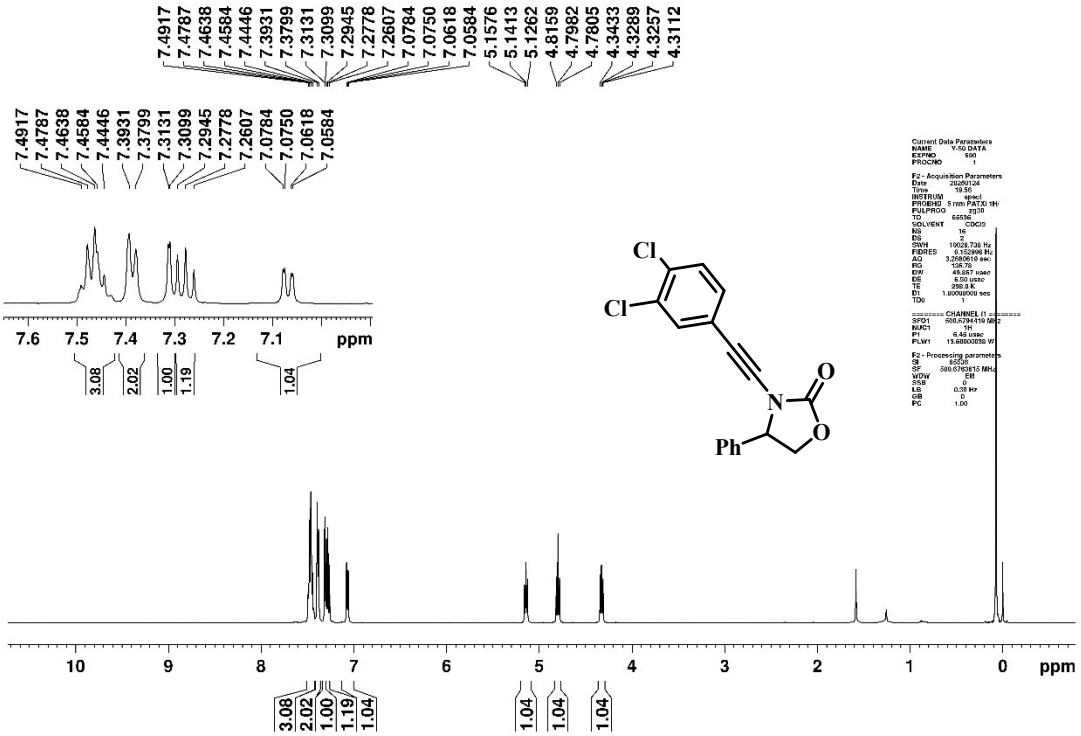
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1z**



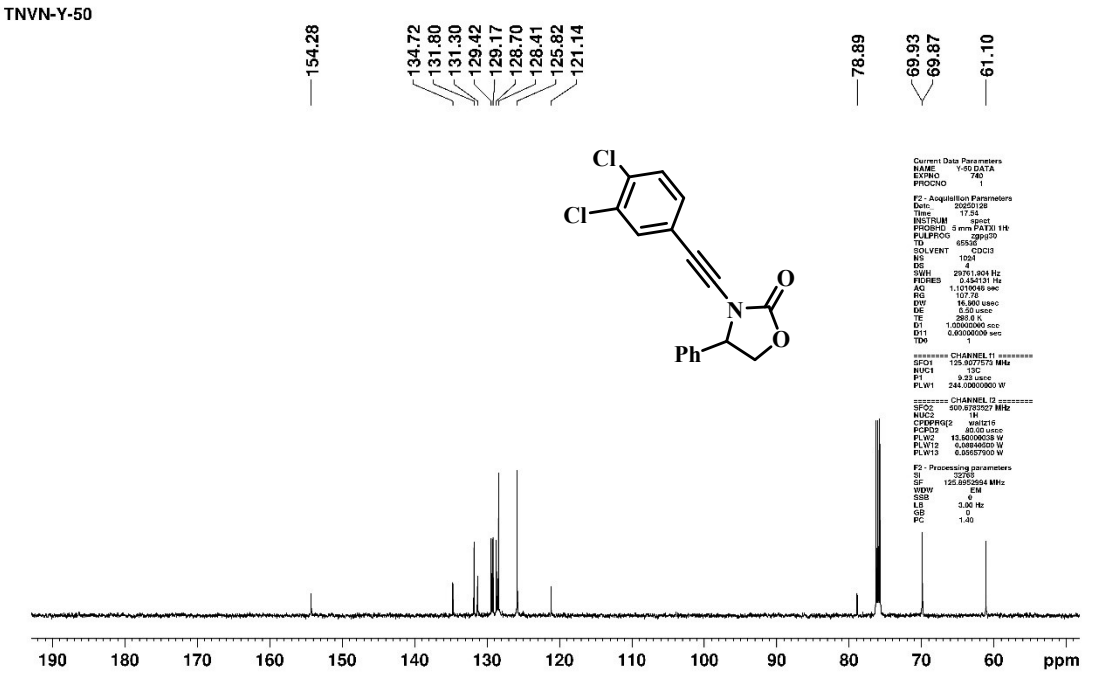
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1a'**



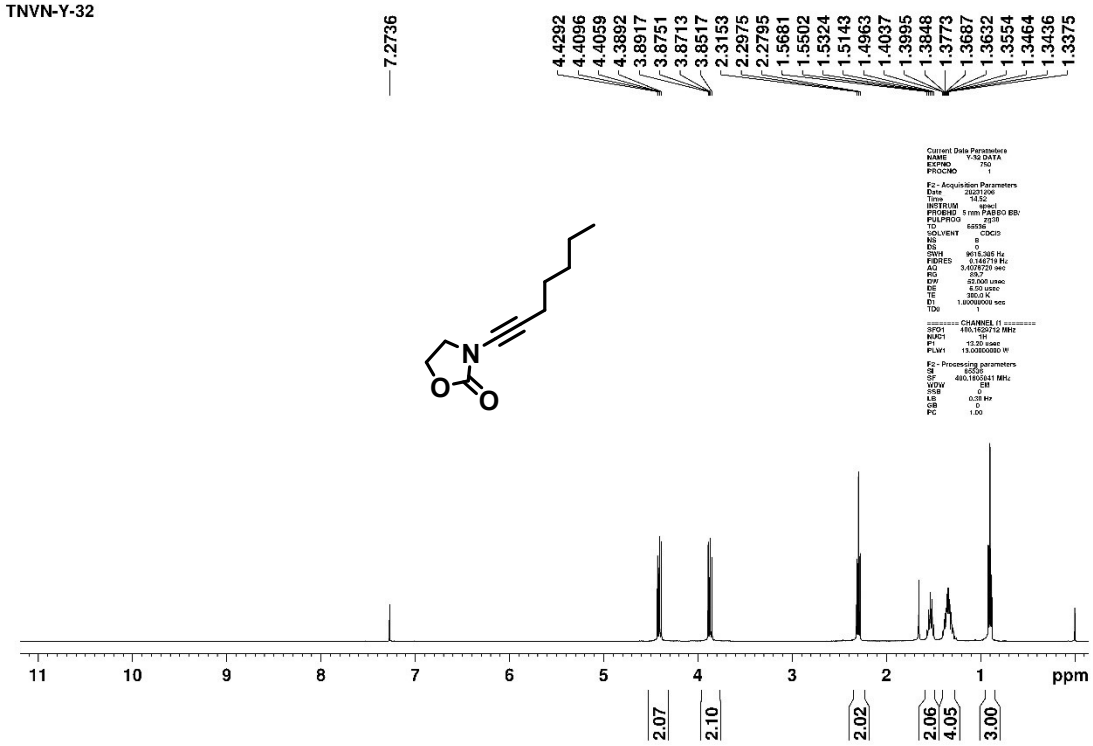
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1a'**



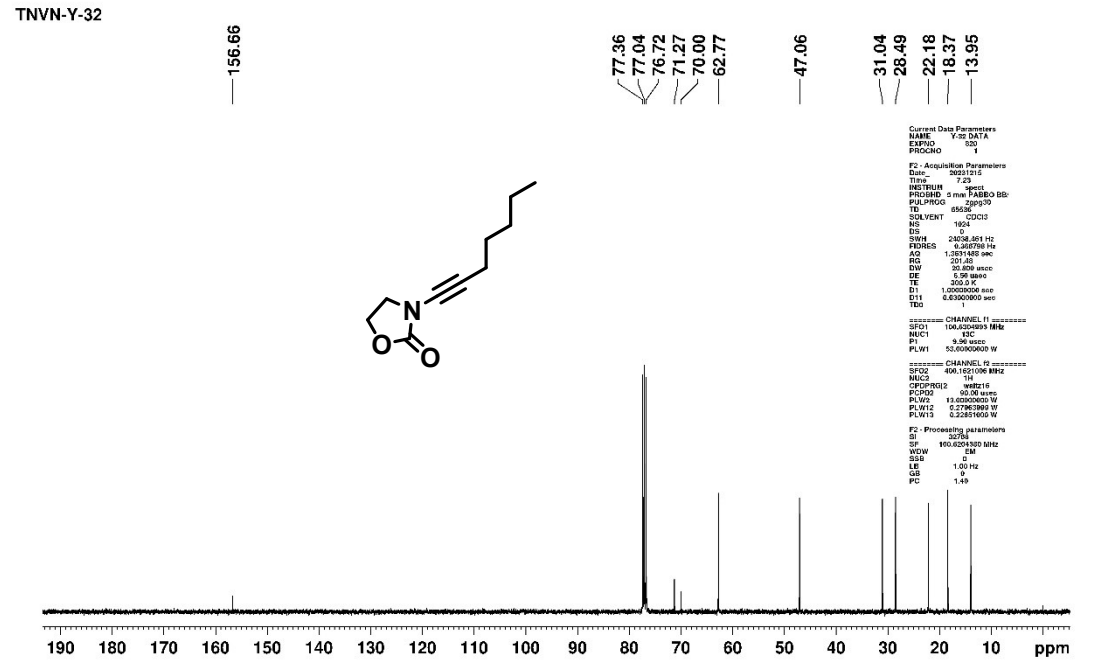
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **1b'**



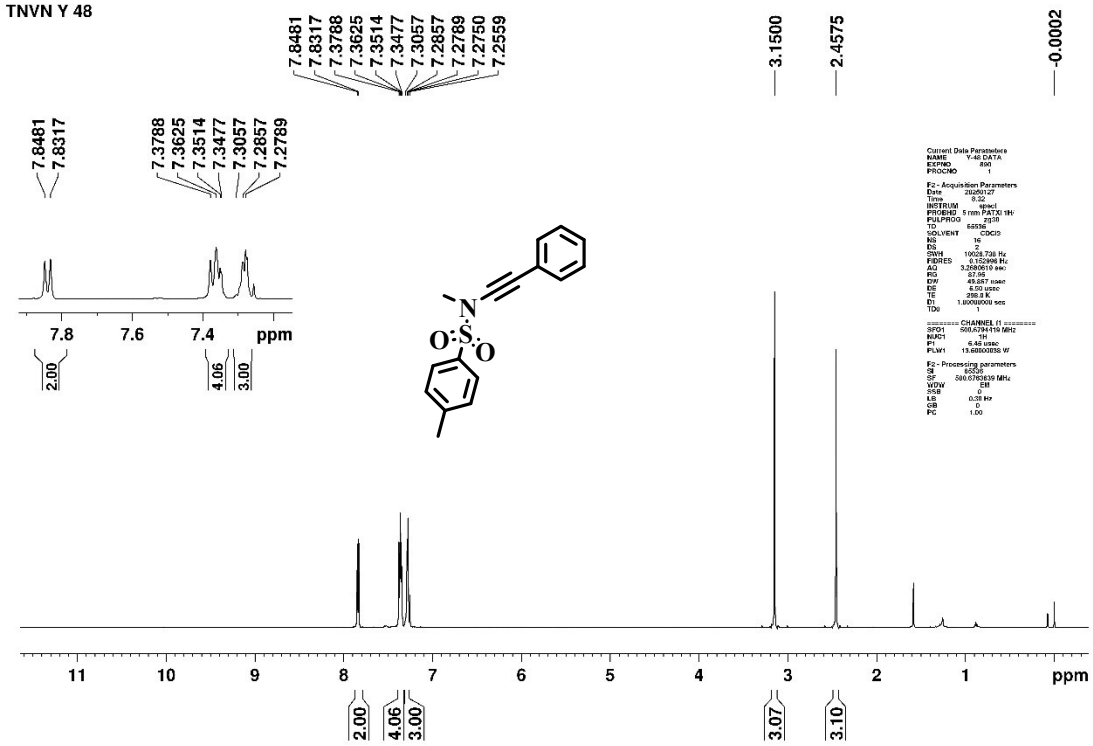
^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **1b'**



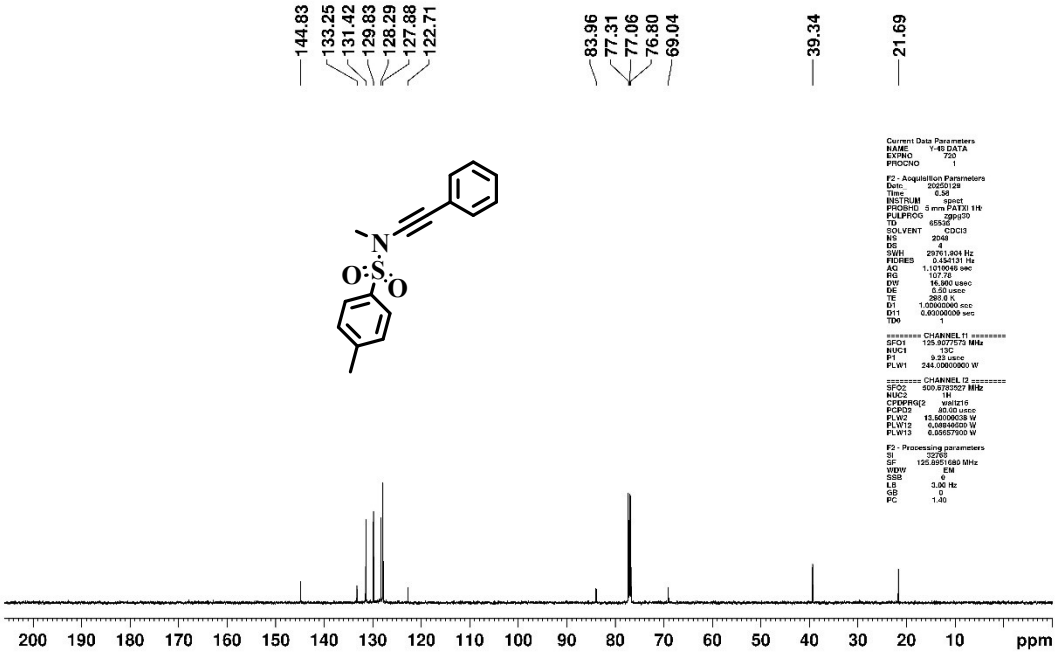
^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **5a**



^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **5a**



^{1}H NMR (400 MHz, $CDCl_3$) spectrum of **5c**



^{13}C NMR (100 MHz, $CDCl_3$) spectrum of **5c**