

Supplementary Information

Efficient Access to 1,3,4-Trisubstituted Pyrroles via Gold-Catalysed Cycloisomerization of 1,5-Diynes

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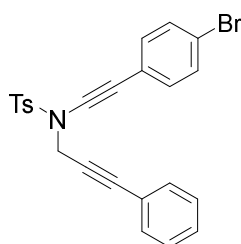
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General information

Unless otherwise indicated, all reagents were used as received from commercial suppliers without further purification. Reaction progress was monitored by thin layer chromatography (TLC). Visualization was achieved by ultraviolet light (254 nm). Flash column chromatography was performed using silica gel 60 (200-300 mesh, Merck and co.). All ^1H NMR, ^{13}C NMR spectra were recorded on Bruker AV-III 400 in CDCl_3 . Chemical shifts were given in parts per million (ppm, δ), referenced to the peak of tetramethylsilane, defined at $\delta = 0.00$ (^1H NMR), or the solvent peak of CDCl_3 , defined at $\delta = 77.16$ (^{13}C NMR). Coupling constants were quoted in Hz (J). ^1H NMR Spectroscopy splitting patterns were designated as singlet (s), doublet (d), triplet (t), quartet (q), pentet (p), septet (se), octet (o). Splitting patterns that could not be interpreted or easily visualized were designated as multiplet (m). Mass spectra were recorded on a high resolution mass spectrometer ESI-QTOF.

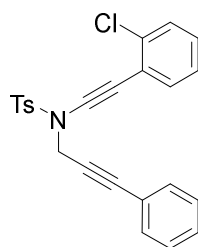
General Procedure for the Synthesis of diynes

Compounds diynes (**1a**, **1c**, **1d**, **1e**, **1f**, **1n**) were prepared according to the known procedure. The data of new compounds are described below.¹⁻⁹



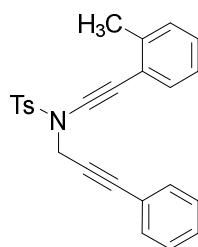
N-((4-bromophenyl)ethynyl)-4-methyl-N-(3-phenylprop-2-yn-1-yl)benzenesulfonamide (**1b**)

Compound **1b** was obtained as white solid; $R_f = 0.6$ (petroleum ether : ethyl acetate = 5 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.90 (d, $J = 8.4$ Hz, 2H), 7.43-7.40 (m, 2H), 7.32-7.23 (m, 7H), 7.17-7.15 (m, 2H), 4.56 (s, 2H), 2.36 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 145.2, 134.4, 133.1, 131.8, 131.7, 129.8, 128.8, 128.4, 128.3, 122.2, 122.1, 121.8, 86.7, 83.2, 81.1, 70.5, 43.0, 21.7; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{18}\text{BrNO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 486.0134, found 486.0139.



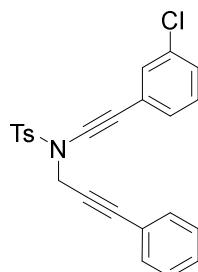
N-((2-chlorophenyl)ethynyl)-4-methyl-N-(3-phenylprop-2-yn-1-yl)benzenesulfonamide (**1g**)

Compound **1g** was obtained as white solid; $R_f = 0.55$ (petroleum ether : ethyl acetate = 5 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.96 (d, $J = 8.4$ Hz, 2H), 7.43-7.41 (m, 1H), 7.37-7.34 (m, 1H), 7.28-7.22 (m, 5H), 7.20 -7.15 (m, 4H), 4.59 (s, 2H), 2.33 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 145.1, 135.7, 134.4, 133.0, 131.8, 129.8, 129.3, 128.9, 128.7, 128.4, 128.2, 126.5, 122.8, 122.1, 87.1, 86.7, 81.1, 68.6, 43.1, 21.7; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{18}\text{ClNO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 442.0639, found 442.0639.



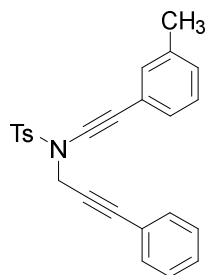
4-methyl-N-(3-phenylprop-2-yn-1-yl)-N-(o-tolyethynyl)benzenesulfonamide (**1h**)

Compound **1h** was obtained as white solid; $R_f = 0.57$ (petroleum ether : ethyl acetate = 5 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.91 (d, $J = 8.0$ Hz, 2H), 7.37 (d, $J = 7.6$ Hz, 1H), 7.27-7.22 (m, 5H), 7.18-7.10 (m, 5H), 4.57 (s, 2H), 2.35 (s, 3H), 2.33 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 145.0, 140.2, 134.4, 131.8, 131.7, 129.7, 129.4, 128.7, 128.4, 128.2, 128.1, 125.6, 122.5, 122.1, 86.5, 85.8, 81.3, 70.1, 43.1, 21.7, 20.8; HRMS (ESI) m/z calcd for $\text{C}_{25}\text{H}_{21}\text{NO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 422.1185, found 422.1187.



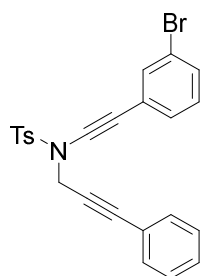
N-((3-chlorophenyl)ethynyl)-4-methyl-N-(3-phenylprop-2-yn-1-yl)benzenesulfonamide (**1i**)

Compound **1i** was obtained as white solid; $R_f = 0.6$ (petroleum ether : ethyl acetate = 5 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.90 (d, $J = 8.0$ Hz, 2H), 7.357-7.353 (m, 1H), 7.31-7.21 (m, 8H), 7.19-7.16 (m, 2H), 4.56 (s, 2H), 2.37 (s, 3H).; ^{13}C NMR (101 MHz, CDCl_3) δ 145.2, 134.4, 134.2, 131.8, 131.3, 129.8, 129.64, 129.62, 128.8, 128.4, 128.33, 128.26, 124.6, 122.1, 86.8, 83.4, 81.1, 70.3, 43.0, 21.7. HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{18}\text{ClNO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 442.0639, found 442.0641.



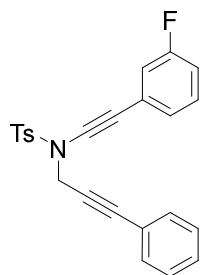
4-methyl-N-(3-phenylprop-2-yn-1-yl)-N-(m-tolylethynyl)benzenesulfonamide (1j)

Compound **1j** was obtained as white solid; $R_f = 0.6$ (petroleum ether : ethyl acetate = 5 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.91 (d, $J = 8.0$ Hz, 2H), 7.29-7.21 (m, 6H), 7.19-7.16 (m, 4H), 7.10-7.08 (m, 1H), 4.55 (s, 2H), 2.34 (s, 3H), 2.30 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 145.0, 138.1, 134.4, 132.3, 131.8, 129.7, 129.0, 128.73, 128.72, 128.4, 128.29, 128.27, 122.6, 122.2, 86.6, 81.8, 81.3, 71.4, 43.1, 21.7, 21.3; HRMS (ESI) m/z calcd for $\text{C}_{25}\text{H}_{21}\text{NO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 422.1185, found 422.1187.



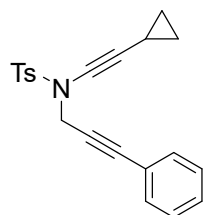
N-((3-bromophenyl)ethynyl)-4-methyl-N-(3-phenylprop-2-yn-1-yl)benzenesulfonamide (1k)

Compound **1k** was obtained as pale yellow solid; $R_f = 0.6$ (petroleum ether : ethyl acetate = 5 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.90 (d, $J = 8.0$ Hz, 2H), 7.52-7.51 (m, 1H), 7.42-7.39 (m, 1H), 7.31-7.24 (m, 6H), 7.19-7.13 (m, 3H), 4.56 (s, 2H), 2.36 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 145.2, 134.3, 134.2, 131.8, 131.1, 130.0, 129.8, 128.8, 128.33, 128.32, 124.8, 122.2, 122.0, 86.8, 83.5, 81.1, 70.1, 43.0, 21.7; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{18}\text{BrNO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 486.0134, found 486.0139.



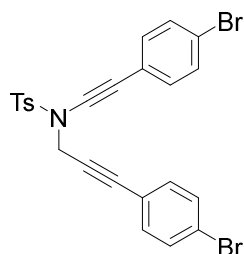
N-((3-fluorophenyl)ethynyl)-4-methyl-N-(3-phenylprop-2-yn-1-yl)benzenesulfonamide (1l)

Compound **1l** was obtained as white solid; $R_f = 0.6$ (petroleum ether : ethyl acetate = 5 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.90 (d, $J = 7.6$ Hz, 2H), 7.30-7.22 (m, 6H), 7.17-7.16 (m, 3H), 7.07 (d, $J = 9.2$ Hz, 1H), 6.98 (t, $J = 8.0$ Hz, 1H), 4.56 (s, 2H), 2.35 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 162.4 (d, $J = 247.2$ Hz), 145.2, 134.3, 131.7, 130.0 (d, $J = 8.8$ Hz), 129.8, 128.8, 128.32, 128.29, 127.4 (d, $J = 2.9$ Hz), 124.6 (d, $J = 9.8$ Hz), 122.0, 118.2 (d, $J = 22.8$ Hz), 115.3 (d, $J = 21.2$ Hz), 86.7, 83.1, 81.1, 70.4, 42.9, 21.7; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -113.09; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{18}\text{FNO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 426.0935, found 426.0935.



N-(cyclopropylethynyl)-4-methyl-N-(3-phenylprop-2-yn-1-yl)benzenesulfonamide (1m)

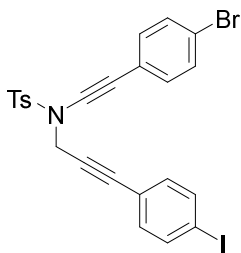
Compound **1m** was obtained as yellow solid; $R_f = 0.6$ (petroleum ether : ethyl acetate = 5 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.85 (d, $J = 8.0$ Hz, 2H), 7.31-7.23 (m, 5H), 7.15-7.13 (m, 2H), 4.41 (s, 2H), 2.35 (s, 3H), 1.35-1.29 (m, 1H), 0.81-0.76 (m, 2H), 0.67-0.63 (m, 2H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 144.7, 134.3, 131.7, 129.5, 128.6, 128.3, 128.2, 122.2, 86.2, 81.5, 75.5, 68.4, 42.9, 21.7, 9.0, -0.6; HRMS (ESI) m/z calcd for $\text{C}_{21}\text{H}_{19}\text{NO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 372.1029, found 372.1029.



N-((4-bromophenyl)ethynyl)-N-(3-(4-bromophenyl)prop-2-yn-1-yl)-4-methylbenzenesulfonamide (1o)

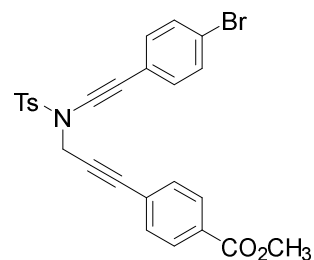
Compound **1o** was obtained as pale yellow solid; $R_f = 0.6$ (petroleum ether : ethyl acetate = 5 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.89 (d, $J = 8.0$ Hz, 2H), 7.42 (d, $J = 8.8$ Hz, 2H), 7.39 (d, $J = 8.8$ Hz, 2H), 7.30 (d, $J = 8.0$ Hz, 2H), 7.23 (d, $J = 8.8$ Hz, 2H), 7.02 (d, $J = 8.8$ Hz, 2H), 4.53 (s, 2H), 2.38 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 145.2, 134.3, 133.2, 133.0, 131.7, 131.6, 129.8,

128.4, 123.2, 122.3, 121.7, 121.0, 85.6, 83.1, 82.4, 70.5, 42.9, 21.8; HRMS (ESI) m/z calcd for $C_{24}H_{17}Br_2NO_2SNa^+$ ($M+Na$) $^+$ 565.9219, found 565.9222.



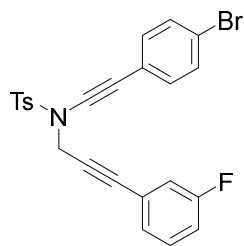
N-((4-bromophenyl)ethynyl)-N-(3-(4-iodophenyl)prop-2-yn-1-yl)-4-methylbenzenesulfonamide (1p)

Compound **1p** was obtained as white solid; $R_f = 0.57$ (petroleum ether : ethyl acetate = 5 : 1); 1H NMR (400 MHz, $CDCl_3$, TMS) δ 7.88 (d, $J = 8.0$ Hz, 2H), 7.59 (d, $J = 8.0$ Hz, 2H), 7.42 (d, $J = 8.0$ Hz, 2H), 7.30-7.22 (m, 4H), 6.88 (d, $J = 8.0$ Hz, 2H), 4.53 (s, 2H), 2.38 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.2, 137.5, 134.3, 133.2, 133.0, 131.7, 129.8, 128.3, 122.3, 121.6, 121.5, 94.9, 85.8, 83.1, 82.7, 70.5, 42.9, 21.8; HRMS (ESI) m/z calcd for $C_{24}H_{17}BrINO_2SNa^+$ ($M+Na$) $^+$ 611.9100, found 611.9101.



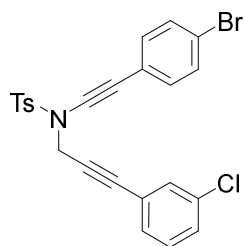
methyl 4-(3-((N-((4-bromophenyl)ethynyl)-4-methylphenyl)sulfonamido)prop-1-yn-1-yl)benzoate (1q)

Compound **1q** was obtained as pale yellow solid; $R_f = 0.55$ (petroleum ether : ethyl acetate = 5 : 1); 1H NMR (400 MHz, $CDCl_3$, TMS) δ 7.94-7.89 (m, 4H), 7.42 (d, $J = 8.0$ Hz, 2H), 7.30 (d, $J = 8.0$ Hz, 2H), 7.26-7.20 (m, 4H), 4.57 (s, 2H), 3.91 (s, 3H), 2.36 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 166.4, 145.3, 134.2, 133.0, 131.7, 131.6, 130.1, 129.8, 129.4, 128.3, 126.6, 122.3, 121.6, 85.8, 84.2, 83.1, 70.5, 52.4, 42.8, 21.7; HRMS (ESI) m/z calcd for $C_{26}H_{20}BrNO_4SNa^+$ ($M+Na$) $^+$ 544.0189, found 544.0190.



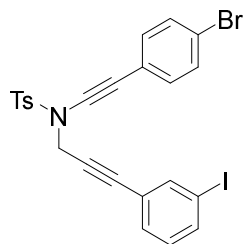
N-((4-bromophenyl)ethynyl)-N-(3-(3-fluorophenyl)prop-2-yn-1-yl)-4-methylbenzenesulfonamide (1r)

Compound **1r** was obtained as yellow solid; $R_f = 0.6$ (petroleum ether : ethyl acetate = 5 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.90 (d, $J = 8.4$ Hz, 2H), 7.42 (d, $J = 8.4$ Hz, 2H), 7.31 (d, $J = 8.0$ Hz, 2H), 7.25-7.19 (m, 3H), 7.00 (td, $J_1 = 8.4$, $J_2 = 2.4$ Hz, 1H), 6.95 (d, $J = 8.0$ Hz, 1H), 6.78 (d, $J = 8.8$ Hz, 1H), 4.55 (s, 2H), 2.38 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 162.2 (d, $J = 247.7$ Hz), 145.3, 134.3, 133.0, 131.6, 129.9 (d, $J = 8.6$ Hz), 129.8, 128.3, 127.6 (d, $J = 3.1$ Hz), 123.8 (d, $J = 9.5$ Hz), 122.3, 121.6, 118.6 (d, $J = 23.1$ Hz), 116.2 (d, $J = 21.2$ Hz), 85.4 (d, $J = 3.4$ Hz), 83.1, 82.1, 70.4, 42.8, 21.6; ^{19}F NMR (376 MHz, CDCl_3) δ -112.70; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{BrFNO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 504.00340, found 504.0045.



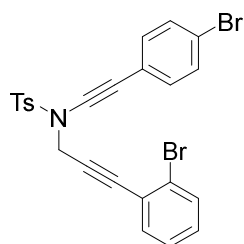
N-((4-bromophenyl)ethynyl)-N-(3-(2-chlorophenyl)prop-2-yn-1-yl)-4-methylbenzenesulfonamide (1s)

Compound **1s** was obtained as yellow solid; $R_f = 0.6$ (petroleum ether : ethyl acetate = 5 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.90 (d, $J = 7.6$ Hz, 2H), 7.38 (d, $J = 8.0$ Hz, 2H), 7.29 (d, $J = 7.6$ Hz, 2H), 7.24-7.22 (m, 3H), 7.16 (t, $J = 7.6$ Hz, 1H), 7.05-7.02 (m, 2H), 4.55 (s, 2H), 2.36 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 145.2, 134.1, 133.8, 132.9, 131.5, 131.4, 129.68, 129.65, 129.5, 128.9, 128.1, 123.5, 122.1, 121.4, 85.0, 83.1, 82.4, 70.3, 42.6, 21.6. HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{BrClNO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 519.9744, found 519.9747.



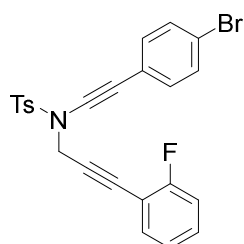
N-((4-bromophenyl)ethynyl)-N-(3-(3-iodophenyl)prop-2-yn-1-yl)-4-methylbenzenesulfonamide (1t)

Compound **1t** was obtained as yellow solid; $R_f = 0.57$ (petroleum ether : ethyl acetate = 5 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.89 (d, $J = 8.4$ Hz, 2H), 7.62 (d, $J = 8.0$ Hz, 1H), 7.45-7.41 (m, 3H), 7.32 (d, $J = 8.4$ Hz, 2H), 7.24 (d, $J = 8.4$ Hz, 2H), 7.14 (d, $J = 7.6$ Hz, 1H), 6.98 (t, $J = 7.6$ Hz, 1H), 4.55 (s, 2H), 2.41 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 145.3, 140.3, 137.8, 134.3, 133.1, 131.7, 130.8, 129.84, 129.79, 128.3, 124.0, 122.3, 121.6, 93.5, 84.9, 83.1, 82.6, 70.5, 42.8, 21.9; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{BrINO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 611.9100, found 611.9103.



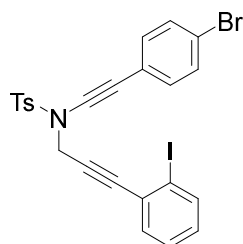
N-((4-bromophenyl)ethynyl)-N-(3-(2-bromophenyl)prop-2-yn-1-yl)-4-methylbenzenesulfonamide (1u)

Compound **1u** was obtained as yellow solid; $R_f = 0.61$ (petroleum ether : ethyl acetate = 5 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.89 (d, $J = 8.0$ Hz, 2H), 7.52 (d, $J = 7.6$ Hz, 1H), 7.42 (d, $J = 8.4$ Hz, 2H), 7.27-7.24 (m, 4H), 7.22 -7.13 (m, 3H), 4.61 (s, 2H), 2.31 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 145.2, 134.2, 133.7, 133.1, 132.5, 131.7, 130.0, 129.8, 128.4, 127.0, 125.5, 124.3, 122.3, 121.8, 85.8, 85.1, 83.2, 70.6, 42.9, 21.7; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{Br}_2\text{NO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 565.9219, found 565.9222.



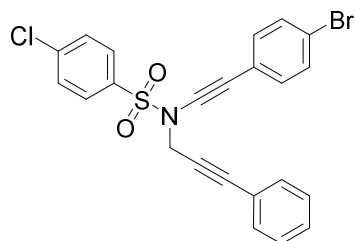
N-((4-bromophenyl)ethynyl)-N-(3-(2-fluorophenyl)prop-2-yn-1-yl)-4-methylbenzenesulfonamide (1v)

Compound **1v** was obtained as yellow solid; $R_f = 0.61$ (petroleum ether : ethyl acetate = 5 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.89 (d, $J = 8.4$ Hz, 2H), 7.42 (d, $J = 8.4$ Hz, 2H), 7.32-7.24 (m, 5H), 7.17-7.13 (m, 1H), 7.06-7.01 (m, 2H), 4.59 (s, 2H), 2.33 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 162.9 (d, $J = 253.5$ Hz), 145.2, 134.2, 133.7 (d, $J = 1.0$ Hz), 133.1, 131.6, 130.7 (d, $J = 8.0$ Hz), 129.8, 128.3, 124.0 (d, $J = 3.7$ Hz), 122.3, 121.7, 115.6 (d, $J = 20.8$ Hz), 110.7 (d, $J = 15.8$ Hz), 86.3 (d, $J = 3.2$ Hz), 83.1, 80.2, 70.6, 42.9, 21.7; ^{19}F NMR (376 MHz, CDCl_3) δ -109.63; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{BrFNO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 504.0040, found 504.0045.



N-((4-bromophenyl)ethynyl)-N-(3-(2-iodophenyl)prop-2-yn-1-yl)-4-methylbenzenesulfonamide (1w)

Compound **1w** was obtained as yellow solid; $R_f = 0.62$ (petroleum ether : ethyl acetate = 5 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.89 (d, $J = 8.0$ Hz, 2H), 7.72 (d, $J = 8.0$ Hz, 1H), 7.37 (d, $J = 8.0$ Hz, 2H), 7.25-7.18 (m, 5H), 7.11 (d, $J = 7.6$ Hz, 1H), 6.93 (t, $J = 7.6$ Hz, 1H), 4.61 (s, 2H), 2.25 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 145.2, 138.7, 134.1, 133.0, 132.9, 131.5, 129.9, 129.7, 128.6, 128.2, 127.7, 122.1, 121.7, 100.4, 88.3, 84.9, 83.3, 70.6, 42.8, 21.6; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{BrINO}_2\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 611.9100, found 611.9105.



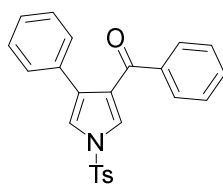
N-((4-bromophenyl)ethynyl)-4-chloro-N-(3-phenylprop-2-yn-1-yl)benzenesulfonamide (1x)

Compound **1x** was obtained as yellow solid; $R_f = 0.62$ (petroleum ether : ethyl acetate = 5 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.95 (d, $J = 8.8$ Hz, 2H), 7.47-7.41 (m, 4H), 7.34-7.23 (m, 5H), 7.15 (d, $J = 7.2$ Hz, 2H), 4.58 (s, 2H); ^{13}C NMR (101 MHz, CDCl_3) δ 140.8, 135.7, 133.1, 131.71,

131.68, 129.7, 129.5, 129.0, 128.5, 122.5, 121.7, 121.4, 87.1, 82.7, 80.8, 70.7, 43.2; HRMS (ESI) m/z calcd for $C_{23}H_{15}BrClNO_2SNa^+$ ($M+Na$) $^+$ 505.9588, found 505.9594.

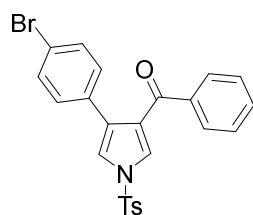
General procedure for the synthesis of pyrrol

To a sealed Schlenk tube was added diyne (0.2 mmol), $Cy_3PAuNTf_2$ (7.6mg, 0.01 mmol), H_2O (0.6 mmol, 10.8 mg) and this mixture was treated with dry CH_3NO_2 (2 mL) under air. The solution was heated at 50 °C for 1h. The resulting solution was cooled to room temperature, and filtered through Celite with ethyl acetate as the eluent. The solvents were evaporated under reduced pressure and the residue was purified by column chromatography on silica gel to afford the products.



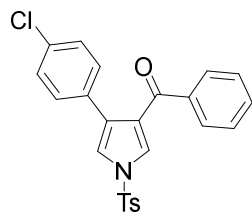
phenyl(4-phenyl-1-tosyl-1H-pyrrol-3-yl)methanone (2a)

Compound **2a** was obtained as yellow solid, 44.3 mg, in 55% yield; $R_f = 0.4$ (petroleum ether : dichloromethane = 1 : 1); 1H NMR (400 MHz, $CDCl_3$, TMS) δ 7.83-7.79 (m, 4H), 7.55 (d, $J = 2.0$ Hz, 1H), 7.51 (t, $J = 7.6$ Hz, 1H), 7.38 (t, $J = 7.6$ Hz, 2H), 7.34-7.21 (m, 8H), 2.42 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.8, 146.2, 138.4, 135.2, 132.9, 132.7, 130.55, 130.52, 129.8, 128.6, 128.5, 128.3, 127.52, 127.46, 126.7, 126.0, 119.3, 21.9.; HRMS (ESI) m/z calcd for $C_{24}H_{19}NO_3SNa^+$ ($M+Na$) $^+$ 424.0978, found 424.0978.



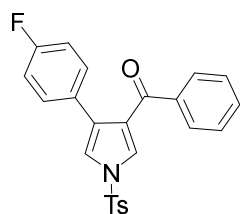
(4-(4-bromophenyl)-1-tosyl-1H-pyrrol-3-yl)(phenyl)methanone (2b)

Compound **2b** was obtained as pale yellow solid, 68.6 mg, in 71% yield; $R_f = 0.41$ (petroleum ether : dichloromethane = 1 : 1); 1H NMR (400 MHz, $CDCl_3$, TMS) δ 7.83-7.79 (m, 4H), 7.57-7.54 (m, 2H), 7.44-7.33 (m, 6H), 7.27-7.26 (m, 1H), 7.19 (d, $J = 8.0$ Hz, 2H), 2.42 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.5, 146.3, 138.3, 134.9, 133.0, 131.6, 131.4, 130.5, 130.2, 129.7, 129.3, 128.5, 127.4, 127.0, 125.5, 121.6, 119.4, 21.8; HRMS (ESI) m/z calcd for $C_{24}H_{18}BrNO_3SNa^+$ ($M+Na$) $^+$ 502.0083, found 502.0086.



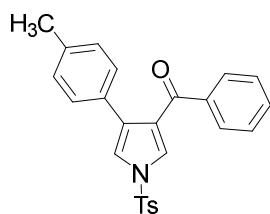
(4-(4-chlorophenyl)-1-tosyl-1H-pyrrol-3-yl)(phenyl)methanone (2c)

Compound **2c** was obtained as pale yellow solid, 53.8 mg, in 62% yield; $R_f = 0.41$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.83-7.79 (m, 4H), 7.57-7.54 (m, 2H), 7.42 (t, $J = 7.6$ Hz, 2H), 7.34 (d, $J = 8.0$ Hz, 2H), 7.26-7.21 (m, 5H), 2.43 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 190.6, 146.3, 138.3, 135.0, 133.4, 133.0, 131.2, 130.5, 129.9, 129.7, 129.3, 128.55, 128.47, 127.4, 127.0, 125.6, 119.5, 21.8; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{18}\text{ClNO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 458.0588, found 458.0589.



(4-(4-fluorophenyl)-1-tosyl-1H-pyrrol-3-yl)(phenyl)methanone (2d)

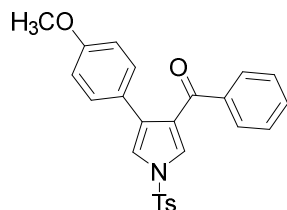
Compound **2d** was obtained as pale yellow solid, 54.5 mg, in 65% yield; $R_f = 0.4$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.83-7.78 (m, 4H), 7.56-7.53 (m, 2H), 7.41 (t, $J = 7.6$ Hz, 2H), 7.35 (d, $J = 8.0$ Hz, 2H), 7.30-7.27 (m, 2H), 7.24 (d, $J = 2.4$ Hz, 1H), 6.97-6.93 (m, 2H), 2.43 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 190.7, 162.3 (d, $J = 247.6$ Hz), 146.3, 138.4, 135.0, 132.9, 130.5, 130.3 (d, $J = 8.2$ Hz), 129.7, 129.5, 128.7 (d, $J = 3.4$ Hz), 128.5, 127.4, 126.9, 125.7, 119.3, 115.2 (d, $J = 21.6$ Hz), 21.8; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -114.8; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{18}\text{FNO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 442.0884, found 442.0884.



phenyl(4-(p-tolyl)-1-tosyl-1H-pyrrol-3-yl)methanone (2e)

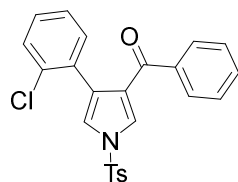
Compound **2e** was obtained as yellow solid, 44.0 mg, in 53% yield; $R_f = 0.3$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.82-7.80 (m, 4H), 7.55-7.51 (m,

2H), 7.41 (t, $J = 7.6$ Hz, 2H), 7.33 (d, $J = 8.4$ Hz, 2H), 7.25-7.24 (m, 1H), 7.20 (d, $J = 8.0$ Hz, 2H), 7.07 (d, $J = 8.0$ Hz, 2H), 2.43 (s, 3H), 2.30 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 190.8, 146.1, 138.5, 137.3, 135.2, 132.8, 130.6, 130.5, 129.8, 129.7, 129.1, 128.5, 127.4, 126.7, 126.0, 119.1, 21.8, 21.3. HRMS (ESI) m/z calcd for $\text{C}_{25}\text{H}_{21}\text{NO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 438.1134, found 438.1136.



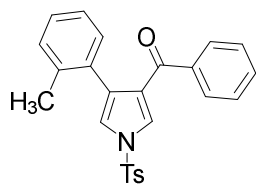
(4-(4-methoxyphenyl)-1-tosyl-1H-pyrrol-3-yl)(phenyl)methanone (2f)

Compound **2f** was obtained as yellow solid, 45.1 mg, in 52% yield; $R_f = 0.25$ (petroleum ether : dichloromethane = 1 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.82-7.79 (m, 4H), 7.55-7.52 (m, 2H), 7.40 (t, $J = 7.6$ Hz, 2H), 7.33 (d, $J = 8.4$ Hz, 2H), 7.26-7.21 (m, 3H), 6.80 (d, $J = 8.4$ Hz, 2H), 3.76 (s, 3H), 2.42 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 190.9, 159.1, 146.1, 138.5, 135.1, 132.8, 130.5, 130.2, 129.8, 129.7, 128.4, 127.4, 126.7, 125.8, 125.0, 118.8, 113.8, 55.3, 21.8; HRMS (ESI) m/z calcd for $\text{C}_{25}\text{H}_{21}\text{NO}_4\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 454.1084, found 454.1085.



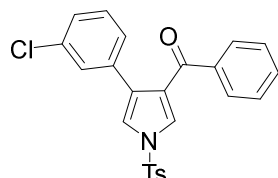
(4-(2-chlorophenyl)-1-tosyl-1H-pyrrol-3-yl)(phenyl)methanone (2g)

Compound **2g** was obtained as yellow solid, 49.4 mg, in 57% yield; $R_f = 0.4$ (petroleum ether : dichloromethane = 1 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.83-7.78 (m, 4H), 7.56-7.50 (m, 2H), 7.40 (t, $J = 7.6$ Hz, 2H), 7.35 (d, $J = 8.4$ Hz, 2H), 7.32-7.30 (m, 1H), 7.28-7.25 (m, 2H), 7.22-7.19 (m, 2H), 2.43 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 190.2, 146.2, 138.0, 135.1, 133.4, 132.7, 132.2, 131.4, 130.5, 129.64, 129.62, 129.0, 128.4, 127.4, 127.3, 127.1, 126.7, 125.9, 120.7, 21.8; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{18}\text{ClNO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 458.0588, found 458.0590.



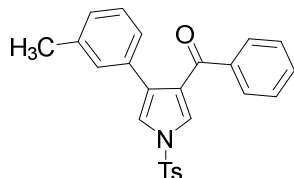
phenyl(4-(o-tolyl)-1-tosyl-1H-pyrrol-3-yl)methanone (2h)

Compound **2h** was obtained as pale yellow solid, 49.3 mg, in 59% yield; $R_f = 0.4$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.81 (d, $J = 8.4$ Hz, 2H), 7.76 (d, $J = 7.6$ Hz, 2H), 7.58 (d, $J = 2.0$ Hz, 1H), 7.52 (t, $J = 7.6$ Hz, 1H), 7.41-7.34 (m, 4H), 7.20-7.11 (m, 5H), 2.44 (s, 3H), 2.10 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 190.4, 146.1, 138.3, 136.5, 135.3, 132.7, 132.6, 130.5, 130.2, 130.0, 129.7, 129.5, 128.4, 127.9, 127.4, 127.1, 126.3, 125.6, 120.1, 21.9, 20.4; HRMS (ESI) m/z calcd for $\text{C}_{25}\text{H}_{21}\text{NO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 438.1134, found 438.1134.



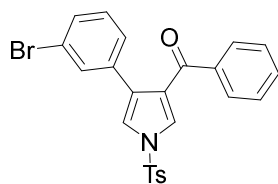
(4-(3-chlorophenyl)-1-tosyl-1H-pyrrol-3-yl)(phenyl)methanone (**2i**)

Compound **2i** was obtained as yellow solid, 50.0 mg, in 57% yield; $R_f = 0.4$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.83-7.79 (m, 4H), 7.56-7.52 (m, 2H), 7.42 (t, $J = 7.6$ Hz, 2H), 7.36-7.32 (m, 3H), 7.27 (d, $J = 2.4$ Hz, 1H), 7.21-7.18 (m, 3H), 2.42 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 190.5, 146.3, 138.3, 134.9, 134.5, 134.1, 132.9, 130.5, 129.6, 129.5, 129.1, 128.53, 128.51, 127.5, 127.4, 126.99, 126.98, 125.6, 119.7, 21.8; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{18}\text{ClNO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 458.0588, found 458.0590.



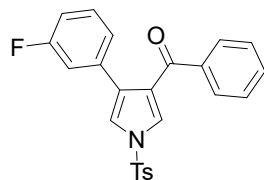
phenyl(4-(m-tolyl)-1-tosyl-1H-pyrrol-3-yl)methanone (**2j**)

Compound **2j** was obtained as yellow solid, 42.7 mg, in 51% yield; $R_f = 0.4$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.83-7.78 (m, 4H), 7.54-7.51 (m, 2H), 7.40 (t, $J = 7.6$ Hz, 2H), 7.34 (d, $J = 8.0$ Hz, 2H), 7.25 (d, $J = 2.8$ Hz, 1H), 7.16-7.13 (m, 1H), 7.10-7.08 (m, 2H), 7.03 (d, $J = 7.2$ Hz, 1H), 2.44 (s, 3H), 2.27 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 190.9, 146.2, 138.5, 137.9, 135.2, 132.8, 132.5, 130.7, 130.5, 129.8, 129.3, 128.4, 128.29, 128.25, 127.4, 126.7, 126.1, 125.8, 119.3, 21.9, 21.5; HRMS (ESI) m/z calcd for $\text{C}_{25}\text{H}_{21}\text{NO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 438.1134, found 438.1134.



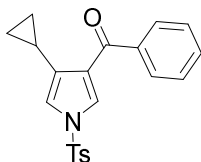
(4-(3-bromophenyl)-1-tosyl-1H-pyrrol-3-yl)(phenyl)methanone (2k)

Compound **2k** was obtained as yellow solid, 60.7 mg, in 63% yield; $R_f = 0.41$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.83-7.78 (m, 4H), 7.56-7.53 (m, 2H), 7.47 (s, 1H), 7.42 (t, $J = 7.6$ Hz, 2H), 7.35 (d, $J = 8.0$ Hz, 3H), 7.27-7.22 (m, 2H), 7.12 (t, $J = 8.0$ Hz, 1H), 2.43 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 190.5, 146.4, 138.3, 134.9, 134.8, 133.0, 131.4, 130.6, 130.4, 129.74, 129.66, 129.0, 128.53, 127.48, 127.45, 127.0, 125.6, 122.3, 119.7, 21.8; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{18}\text{BrNO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 502.0083, found 502.0087.



(4-(3-fluorophenyl)-1-tosyl-1H-pyrrol-3-yl)(phenyl)methanone (2l)

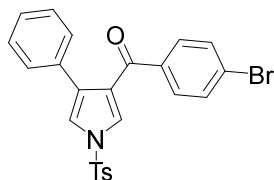
Compound **2l** was obtained as yellow solid, 47.5 mg, in 57% yield; $R_f = 0.41$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.83-7.79 (m, 4H), 7.57-7.53 (m, 2H), 7.42 (t, $J = 7.6$ Hz, 2H), 7.35 (d, $J = 8.0$ Hz, 2H), 7.28 (d, $J = 2.4$ Hz, 1H), 7.25-7.18 (m, 1H), 7.08-7.03 (m, 2H), 6.94-6.90 (m, 1H), 2.43 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 190.5, 162.6 (d, $J = 246.3$ Hz), 146.3, 138.3, 135.0, 134.9 (d, $J = 8.4$ Hz), 133.0, 130.5, 129.8, 129.7, 129.3 (d, $J = 2.3$ Hz), 128.5, 127.5, 126.9, 125.7, 124.4 (d, $J = 2.8$ Hz), 119.7, 115.6 (d, $J = 22.4$ Hz), 114.3 (d, $J = 21.1$ Hz), 21.8; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -113.5; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{18}\text{FNO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 442.0884, found 442.0882.



(4-cyclopropyl-1-tosyl-1H-pyrrol-3-yl)(phenyl)methanone (2m)

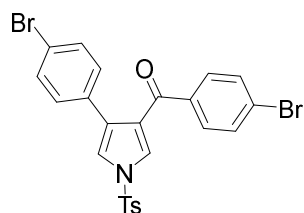
Compound **2m** was obtained as yellow oil 46.5 mg, in 64% yield; $R_f = 0.55$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.81-7.79 (m, 2H), 7.73 (d, $J = 8.4$ Hz, 2H), 7.58 (t, $J = 7.6$ Hz, 1H), 7.50-7.46 (m, 2H), 7.41 (d, $J = 2.4$ Hz, 1H), 7.31 (d, $J = 8.4$ Hz,

2H), 6.79 (d, $J = 1.6$ Hz, 1H), 2.41 (s, 3H), 2.23-2.16 (m, 1H), 0.90-0.85 (m, 2H), 0.54- 0.50 (m, 2H); ^{13}C NMR (101 MHz, CDCl_3) δ 191.3, 145.9, 139.3, 135.2, 133.6, 132.4, 130.4, 129.4, 128.5, 127.2, 127.1, 116.6, 21.8, 8.5, 7.2. HRMS (ESI) m/z calcd for $\text{C}_{21}\text{H}_{19}\text{NO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 388.0978, found 388.0978.



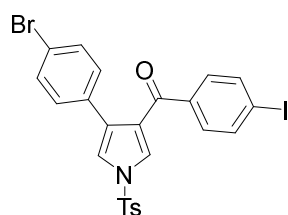
(4-bromophenyl)(4-phenyl-1-tosyl-1H-pyrrol-3-yl)methanone (2n)

Compound **2n** was obtained as yellow solid, 34.0mg, in 35% yield; $R_f = 0.4$ (petroleum ether : dichloromethane = 1 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.82 (d, $J = 8.0$ Hz, 2H), 7.65 (d, $J = 8.0$ Hz, 2H), 7.54-7.51 (m, 3H), 7.35 (d, $J = 8.0$ Hz, 2H), 7.27-7.22 (m, 6H), 2.43 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 189.7, 146.3, 137.1, 135.0, 132.5, 131.7, 131.2, 130.5, 130.3, 128.6, 128.4, 127.9, 127.6, 127.5, 126.5, 125.6, 119.4, 21.8; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{18}\text{BrNO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 502.0083, found 502.0085.



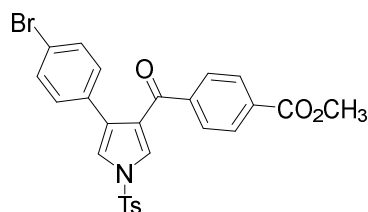
(4-bromophenyl)(4-(4-bromophenyl)-1-tosyl-1H-pyrrol-3-yl)methanone (2o)

Compound **2o** was obtained as yellow solid, 66.8 mg, in 60% yield; $R_f = 0.4$ (petroleum ether : dichloromethane = 1 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.82 (d, $J = 8.0$ Hz, 2H), 7.66 (d, $J = 8.4$ Hz, 2H), 7.56 (d, $J = 8.4$ Hz, 2H), 7.52 (d, $J = 2.0$ Hz, 1H), 7.39 (d, $J = 8.4$ Hz, 2H), 7.35 (d, $J = 8.0$ Hz, 2H), 7.26 (d, $J = 2.4$ Hz, 1H), 7.17 (d, $J = 8.0$ Hz, 2H), 2.43 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 189.5, 146.5, 137.1, 134.9, 131.9, 131.55, 131.51, 131.2, 130.6, 130.2, 129.3, 128.2, 127.5, 126.9, 125.3, 121.8, 119.6, 21.9; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{Br}_2\text{NO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 581.9168, found 581.9168.



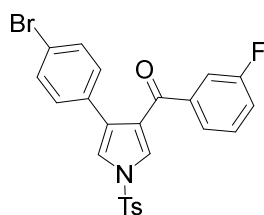
(4-(4-bromophenyl)-1-tosyl-1H-pyrrol-3-yl)(4-iodophenyl)methanone (2p)

Compound **2p** was obtained as yellow solid, 81.0 mg, in 67% yield; $R_f = 0.40$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.82 (d, $J = 8.0$ Hz, 2H), 7.78 (d, $J = 8.0$ Hz, 2H), 7.50 (d, $J = 8.4$ Hz, 3H), 7.39 (d, $J = 8.0$ Hz, 2H), 7.35 (d, $J = 8.4$ Hz, 2H), 7.26 (s, 1H), 7.17 (d, $J = 8.0$ Hz, 2H), 2.43 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 189.7, 146.4, 137.9, 137.6, 134.9, 131.52, 131.49, 131.1, 130.6, 130.2, 129.3, 127.5, 127.0, 125.2, 121.8, 119.6, 100.8, 21.9; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{BrINO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 627.9049, found 627.9050.



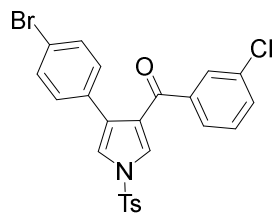
methyl 4-(4-(4-bromophenyl)-1-tosyl-1H-pyrrole-3-carbonyl)benzoate (2q)

Compound **2q** was obtained as yellow solid, 58.6 mg, in 54% yield; $R_f = 0.38$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 8.08 (d, $J = 8.0$ Hz, 2H), 7.83 (d, $J = 2.0$ Hz, 2H), 7.81 (d, $J = 2.0$ Hz, 2H), 7.54 (d, $J = 2.4$ Hz, 1H), 7.39 (d, $J = 8.4$ Hz, 2H), 7.36 (d, $J = 8.4$ Hz, 2H), 7.27 (d, $J = 2.4$ Hz, 1H), 7.19 (d, $J = 8.0$ Hz, 2H), 3.95 (s, 3H), 2.44 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 189.9, 166.3, 146.5, 141.9, 134.8, 133.7, 131.5, 130.6, 130.3, 129.7, 129.4, 129.2, 127.5, 127.4, 125.2, 121.8, 119.7, 52.6, 21.9; HRMS (ESI) m/z calcd for $\text{C}_{26}\text{H}_{20}\text{BrNO}_5\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 560.0138, found 560.0140.



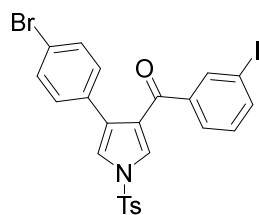
(4-(4-bromophenyl)-1-tosyl-1H-pyrrol-3-yl)(3-fluorophenyl)methanone (2r)

Compound **2r** was obtained as yellow solid, 53.8 mg, in 55% yield; $R_f = 0.41$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.83 (d, $J = 8.4$ Hz, 2H), 7.58-7.56 (m, 2H), 7.47 (d, $J = 9.2$ Hz, 1H), 7.42-7.35 (m, 5H), 7.27- 7.23 (m, 2H), 7.17 (d, $J = 8.4$ Hz, 2H), 2.44 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 189.1, 162.6 (d, $J = 249.4\text{Hz}$), 146.5, 140.4 (d, $J = 6.3$ Hz), 134.8, 131.49, 131.46, 130.6, 130.25 (d, $J = 7.6$ Hz), 130.24, 129.3, 127.5, 127.1, 125.5 (d, $J = 2.9$ Hz), 125.1, 121.8, 120.0 (d, $J = 21.4$ Hz), 119.6, 116.3 (d, $J = 22.5$ Hz), 21.8; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -111.7; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{BrFNO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 519.9990, found 519.9992.



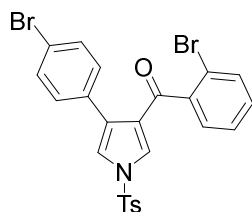
(4-(4-bromophenyl)-1-tosyl-1H-pyrrol-3-yl)(3-chlorophenyl)methanone (2s)

Compound **2s** was obtained as yellow solid, 47.6mg, in 46% yield; $R_f = 0.42$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.83 (d, $J = 8.4$ Hz, 2H), 7.72 (s, 1H), 7.65 (d, $J = 7.6$ Hz, 1H), 7.55 (d, $J = 2.4$ Hz, 1H), 7.52 (d, $J = 8.0$ Hz, 1H), 7.41-7.34 (m, 5H), 7.26 (d, $J = 2.4$ Hz, 1H), 7.17 (d, $J = 8.4$ Hz, 2H), 2.44 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 189.1, 146.5, 139.9, 134.9, 134.8, 132.9, 131.51, 131.48, 130.6, 130.3, 129.9, 129.6, 129.3, 127.8, 127.5, 127.2, 125.2, 121.8, 119.6, 21.9; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{BrClNO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 535.9693, found 535.9697.



(4-(4-bromophenyl)-1-tosyl-1H-pyrrol-3-yl)(3-iodophenyl)methanone (2t)

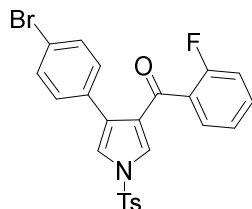
Compound **2t** was obtained as yellow solid, 59.4 mg, in 50% yield; $R_f = 0.45$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 8.05 (s, 1H), 7.86-7.82 (m, 3H), 7.73 (d, $J = 7.6$ Hz, 1H), 7.55 (d, $J = 2.0$ Hz, 1H), 7.40-7.36 (m, 4H), 7.26 (d, $J = 2.0$ Hz, 1H), 7.17-7.14 (m, 3H), 2.44 (s, 3H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 188.9, 146.4, 141.6, 140.1, 138.5, 134.8, 131.5, 131.4, 130.6, 130.25, 130.22, 129.2, 128.7, 127.5, 127.2, 125.1, 121.8, 119.6, 94.2, 21.9; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{BrINO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 627.9049, found 627.9051.



(2-bromophenyl)(4-(4-bromophenyl)-1-tosyl-1H-pyrrol-3-yl)methanone (2u)

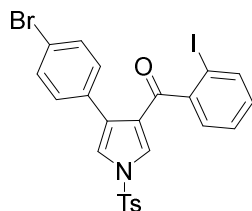
Compound **2u** was obtained as yellow solid, 54.6 mg, in 49% yield; $R_f = 0.38$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.79 (d, $J = 8.4$ Hz, 2H), 7.57 (d, J

= 7.2 Hz, 1H), 7.42-7.40 (m, 3H), 7.36-7.32 (m, 4H), 7.31-7.26 (m, 3H), 7.17 (d, $J = 2.4$ Hz, 1H), 2.43 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 190.0, 146.5, 141.1, 134.8, 133.5, 131.6, 131.3, 131.2, 130.61, 130.58, 129.39, 129.37, 129.0, 127.5, 127.4, 125.7, 121.8, 120.1, 119.9, 21.9; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{Br}_2\text{NO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 581.9168, found 581.9169.



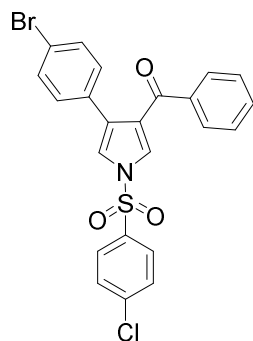
(4-(4-bromophenyl)-1-tosyl-1H-pyrrol-3-yl)(2-fluorophenyl)methanone (2v)

Compound **2v** was obtained as pale yellow solid, 49.8 mg, in 50% yield; $R_f = 0.43$ (petroleum ether : dichloromethane = 1 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.80 (d, $J = 8.4$ Hz, 2H), 7.567-7.565 (m, 1H), 7.52-7.43 (m, 2H), 7.39-7.34 (m, 4H), 7.22-7.16 (m, 4H), 7.04 (t, $J = 9.2$ Hz, 1H), 2.43 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 187.1, 161.1 (d, $J = 254.3$ Hz), 146.4, 134.8, 133.5 (d, $J = 8.5$ Hz), 131.5, 131.2, 130.7 (d, $J = 2.3$ Hz), 130.59, 130.57, 129.0, 128.4 (d, $J = 2.6$ Hz), 127.9 (d, $J = 13.8$ Hz), 127.5, 126.5, 124.3 (d, $J = 3.6$ Hz), 121.7, 119.7, 116.5 (d, $J = 21.9$ Hz), 21.8; ^{19}F NMR (376 MHz, CDCl_3) δ -112.0; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{BrFNO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 519.9990, found 519.9993.



(4-(4-bromophenyl)-1-tosyl-1H-pyrrol-3-yl)(2-iodophenyl)methanone (2w)

Compound **2w** was obtained as yellow solid, 51.0 mg, in 42% yield; $R_f = 0.45$ (petroleum ether : dichloromethane = 1 : 1); ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.86 (d, $J = 7.6$ Hz, 1H), 7.80 (d, $J = 8.4$ Hz, 2H), 7.43-7.41 (m, 2H), 7.39-7.34 (m, 4H), 7.32-7.26 (m, 3H), 7.18 (d, $J = 2.4$ Hz, 1H), 7.14 (td, $J_1 = 8.0$ Hz, $J_2 = 2.0$ Hz, 1H), 2.43 (s, 3H); ^{13}C NMR (101 MHz, CDCl_3) δ 191.5, 146.5, 144.5, 140.1, 134.8, 131.7, 131.4, 131.3, 130.59, 130.57, 129.5, 129.1, 129.0, 128.0, 127.5, 125.1, 121.8, 120.2, 92.9, 21.9; HRMS (ESI) m/z calcd for $\text{C}_{24}\text{H}_{17}\text{BrINO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 627.9049, found 627.9050.



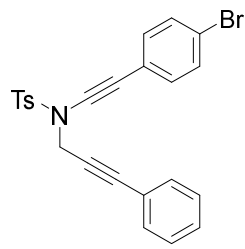
(4-(4-bromophenyl)-1-((4-chlorophenyl)sulfonyl)-1H-pyrrol-3-yl)(phenyl)methanone (2x)

Compound **2x** was obtained as yellow solid, 71.3 mg, in 71% yield; $R_f = 0.42$ (petroleum ether : dichloromethane = 1 : 1); $^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.87 (d, $J = 8.4$ Hz, 2H), 7.79 (d, $J = 7.2$ Hz, 2H), 7.57-7.51 (m, 4H), 7.44-7.37 (m, 4H), 7.26 (d, $J = 2.0$ Hz, 1H), 7.18 (d, $J = 8.0$ Hz, 2H); $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 190.4, 141.8, 138.1, 136.3, 133.1, 131.5, 131.4, 130.3, 130.2, 129.8, 129.7, 128.8, 128.6, 126.7, 126.1, 121.8, 119.3; HRMS (ESI) m/z calcd for $\text{C}_{23}\text{H}_{15}\text{BrClNO}_3\text{SNa}^+$ ($\text{M}+\text{Na}$) $^+$ 521.9537, found 521.9540.

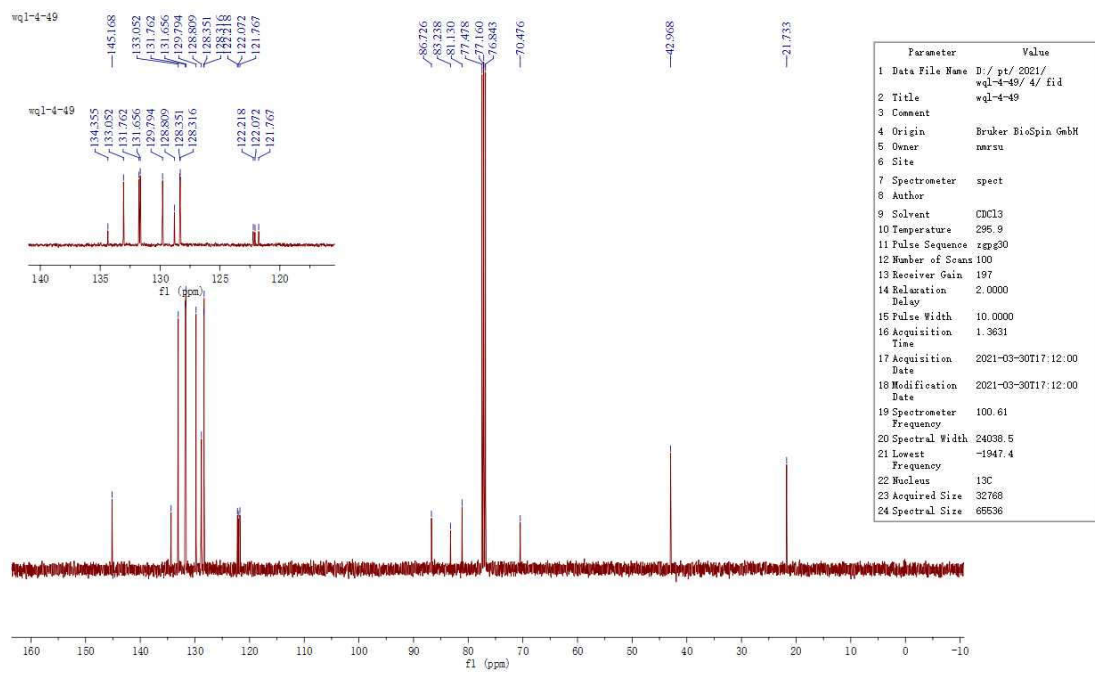
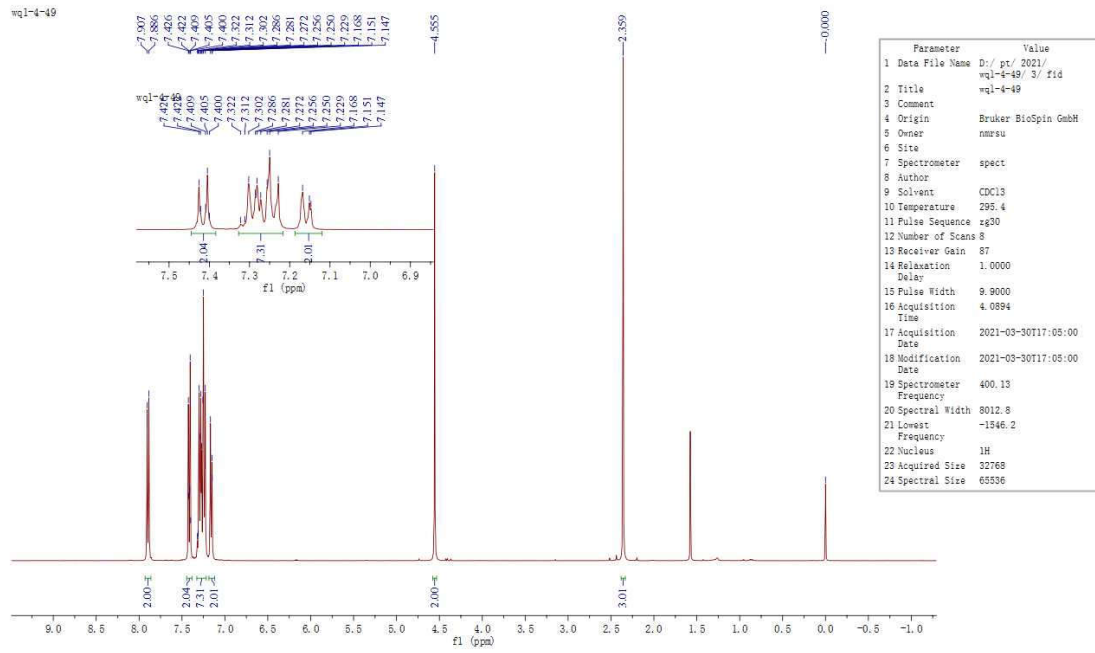
References

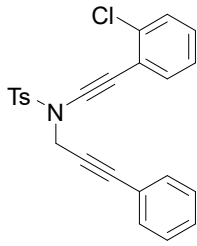
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NMR Spectra

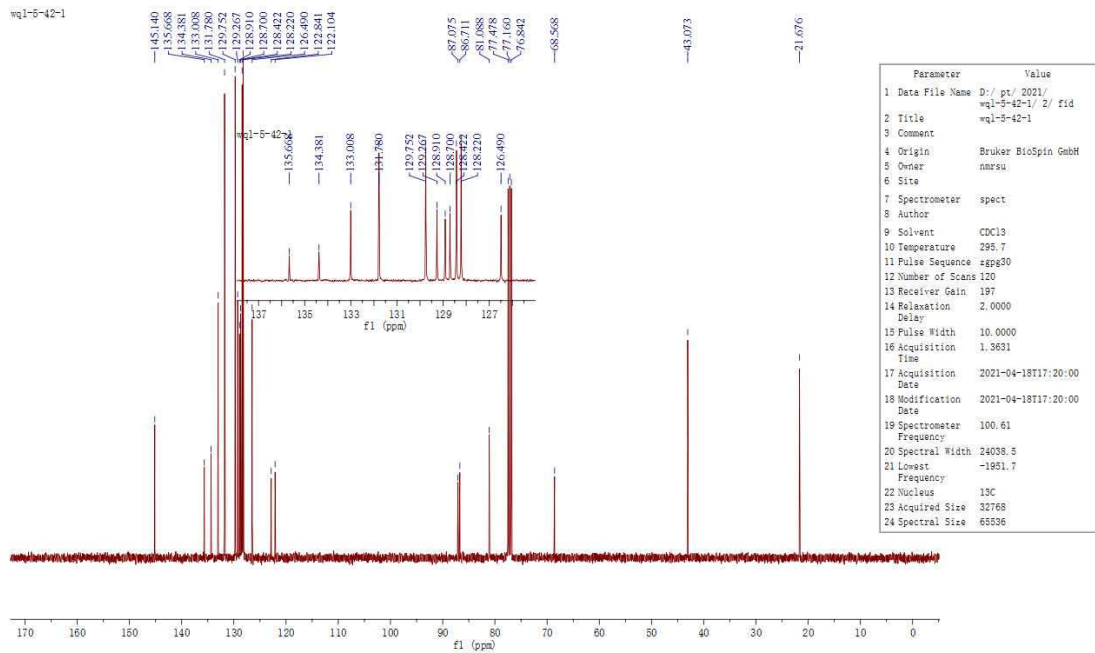
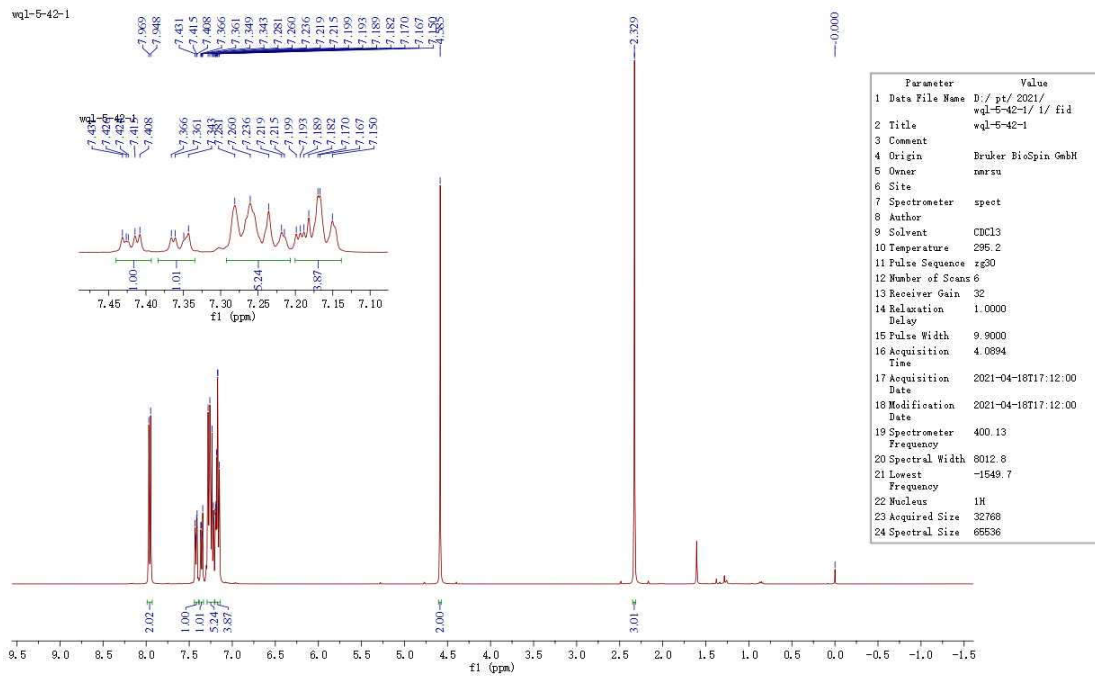


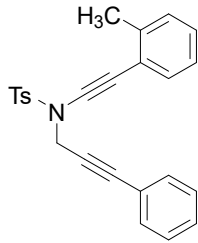
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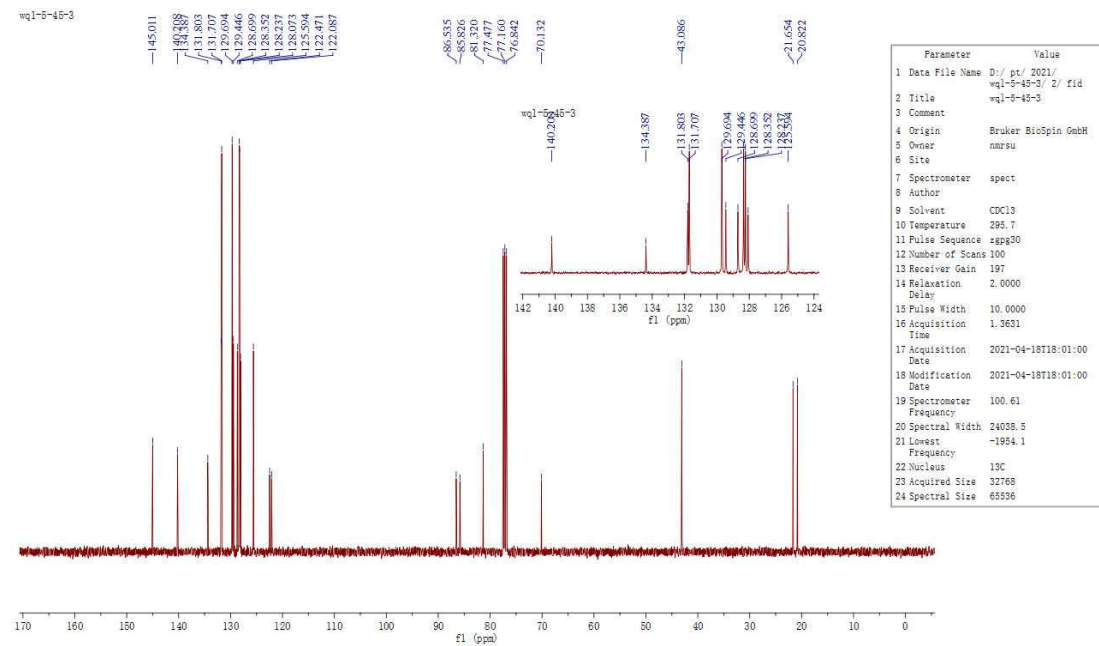
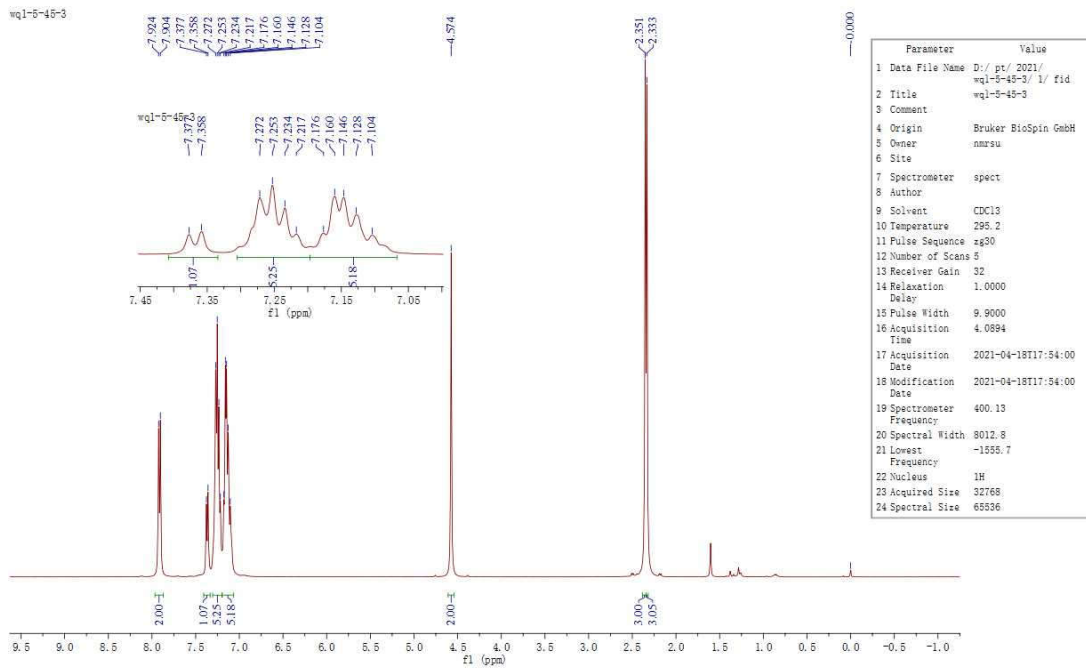


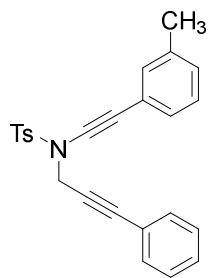
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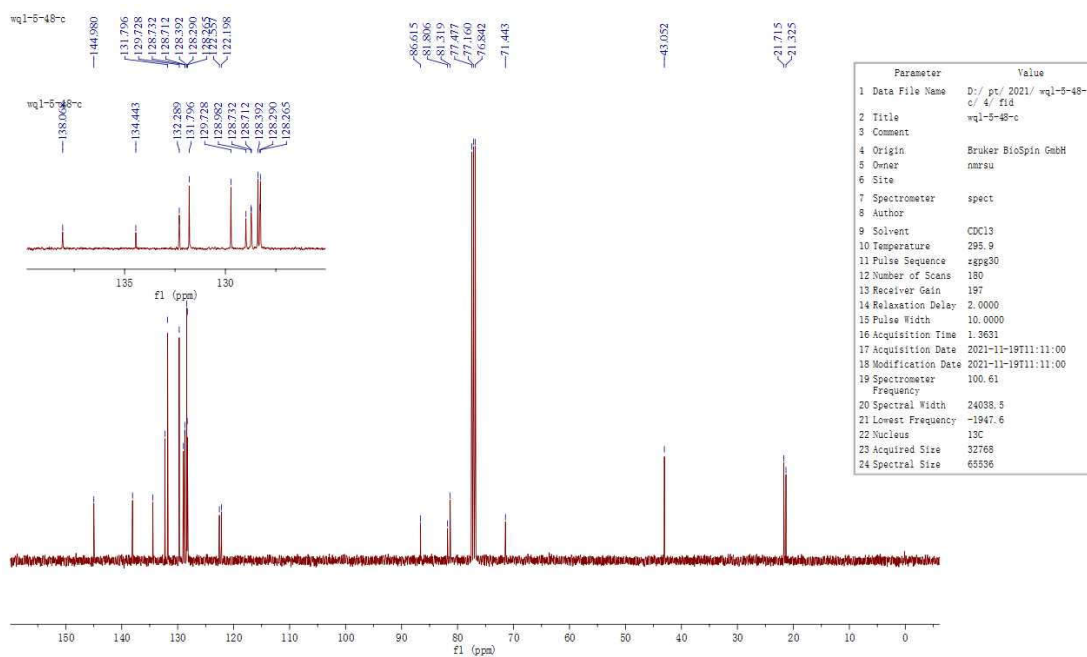
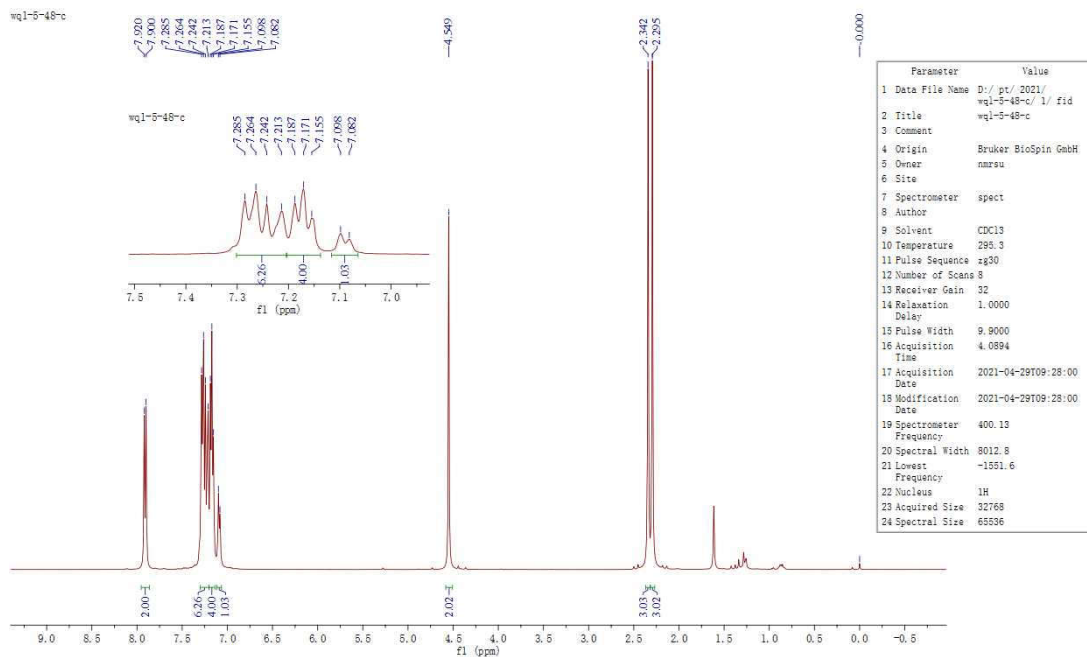


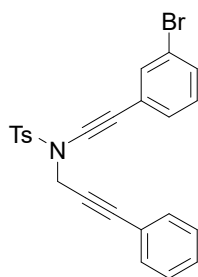
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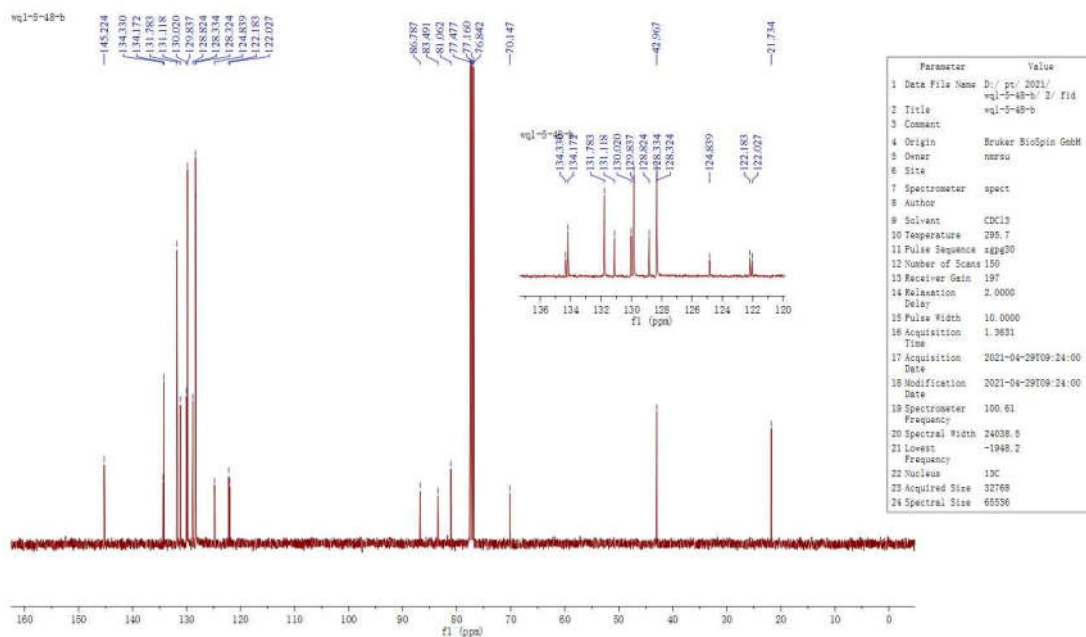
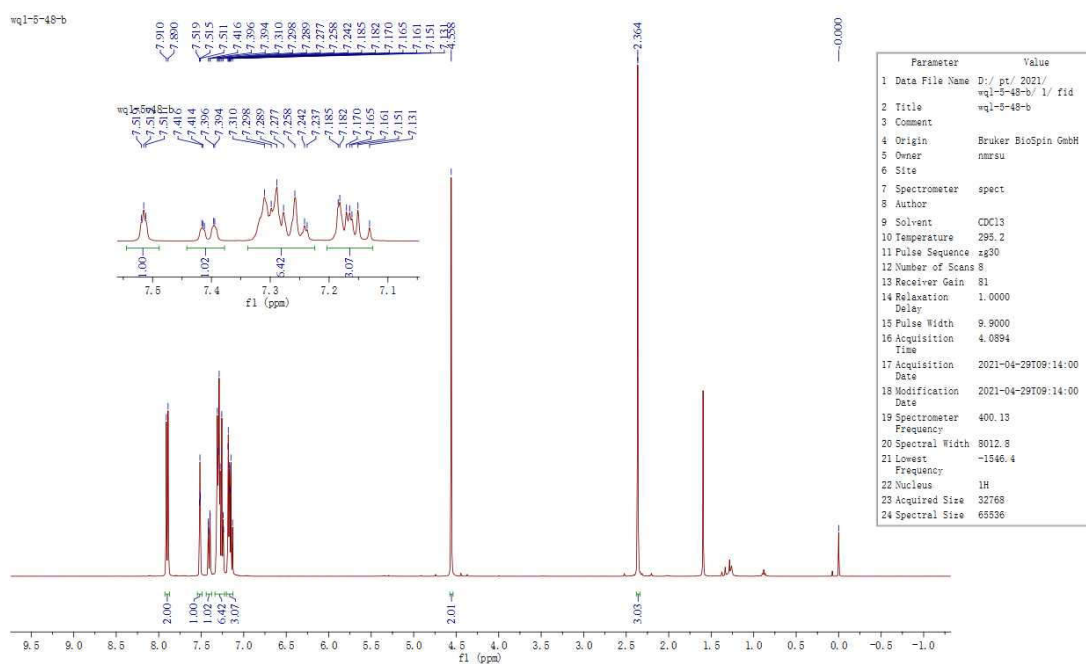


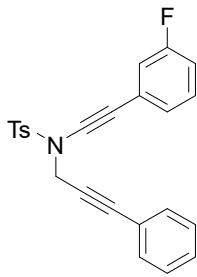
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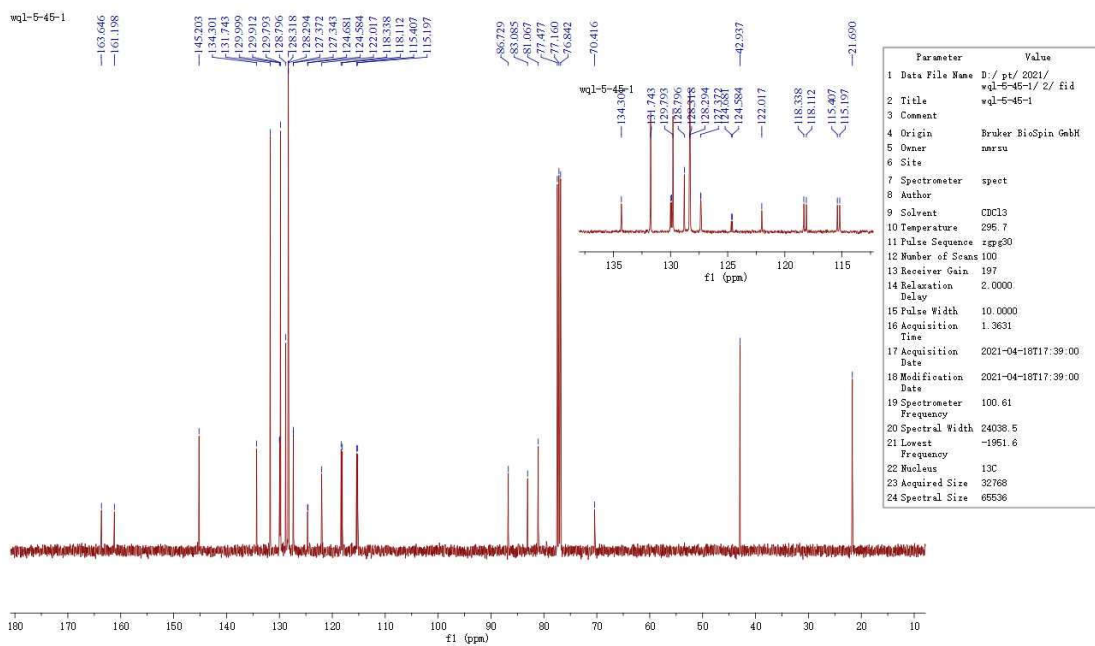
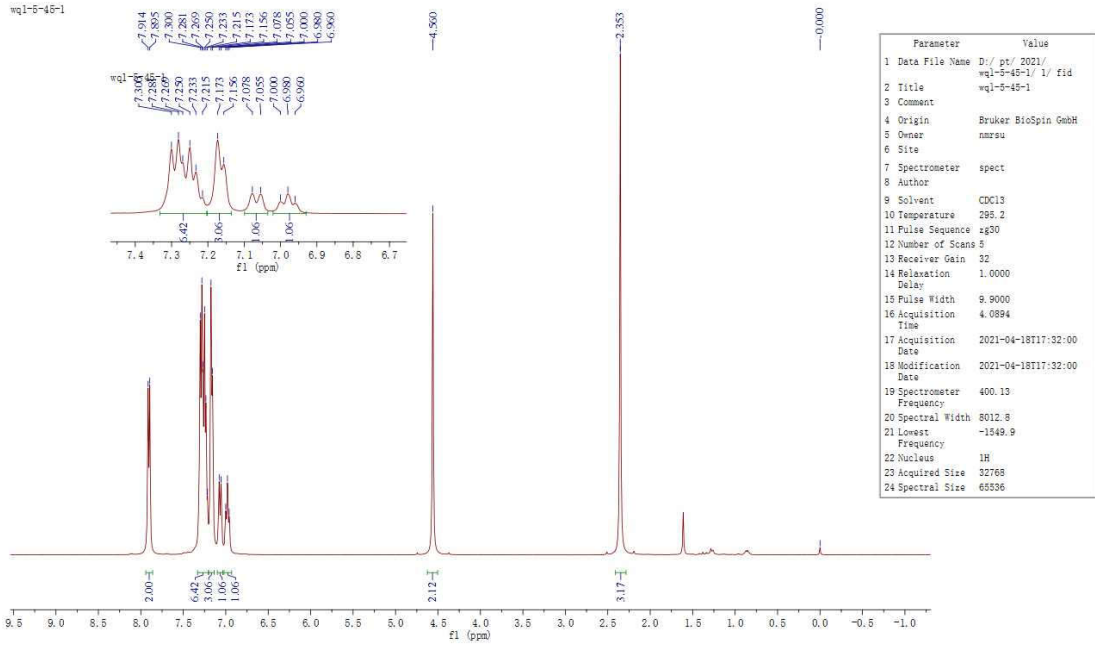


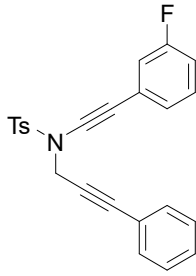
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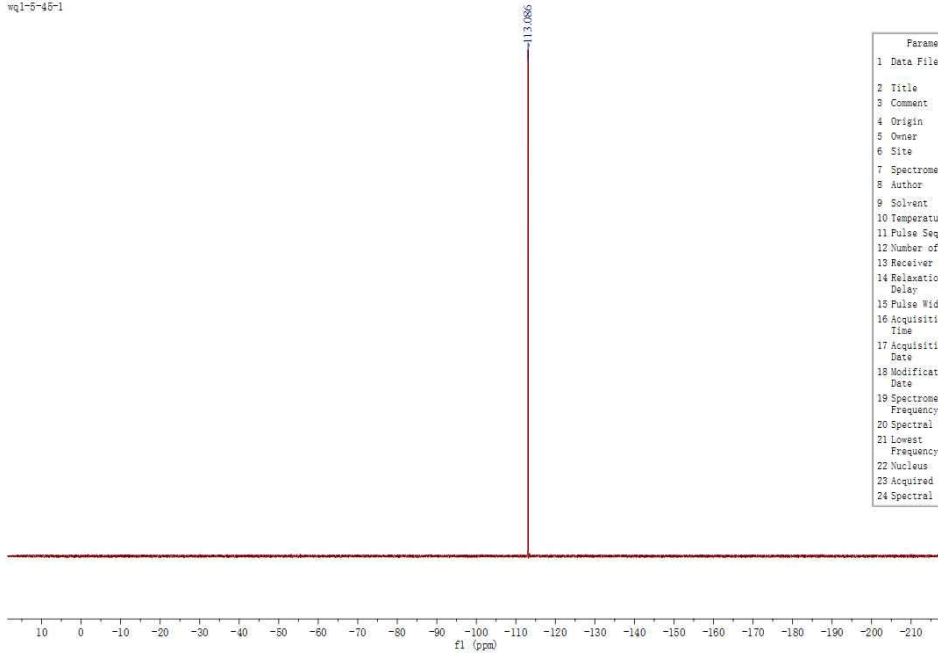
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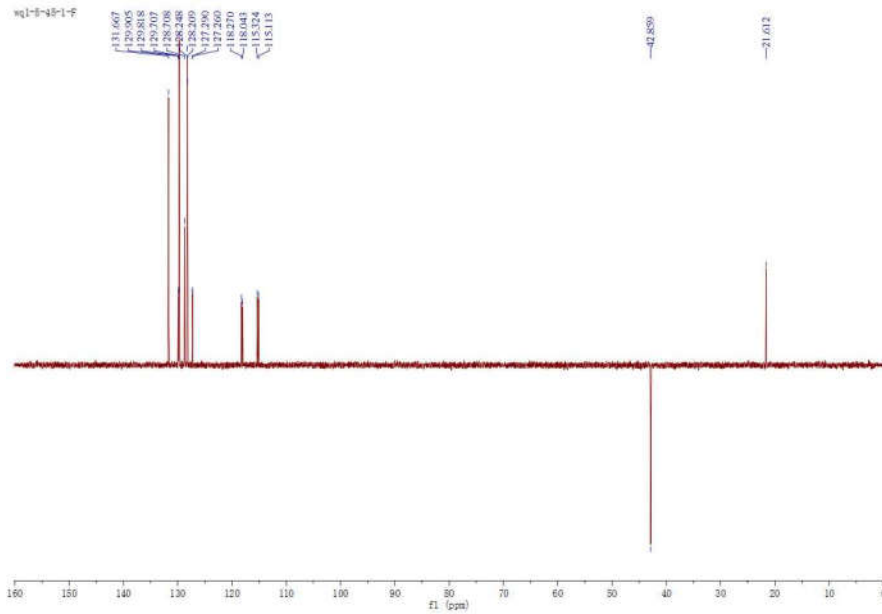
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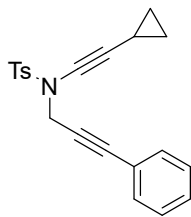


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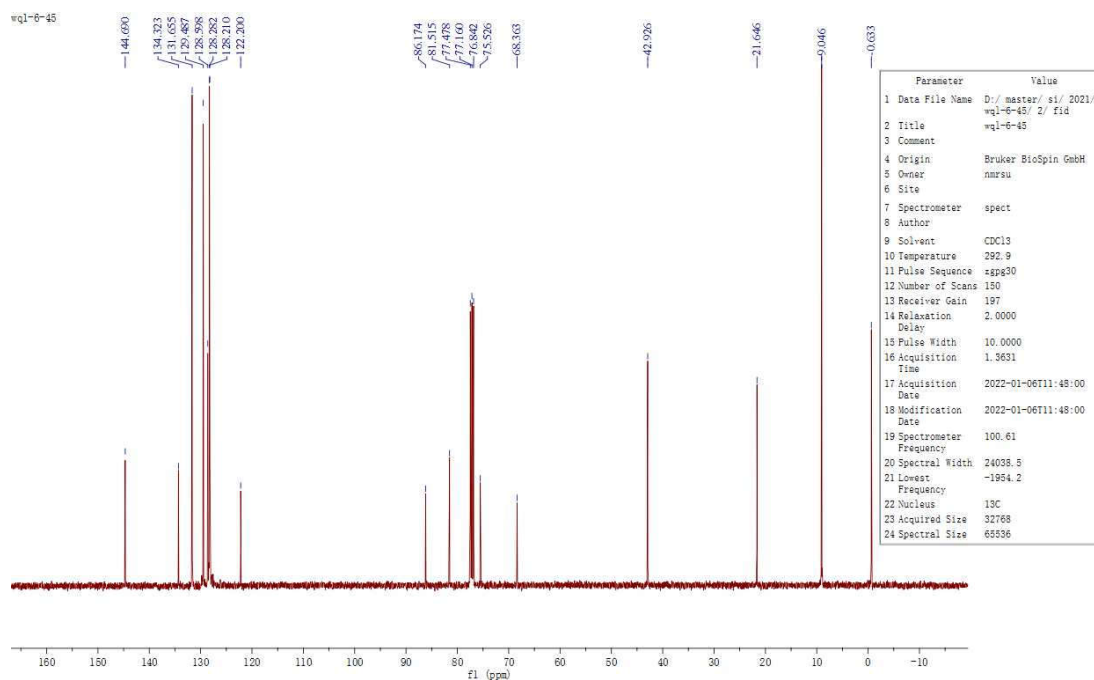
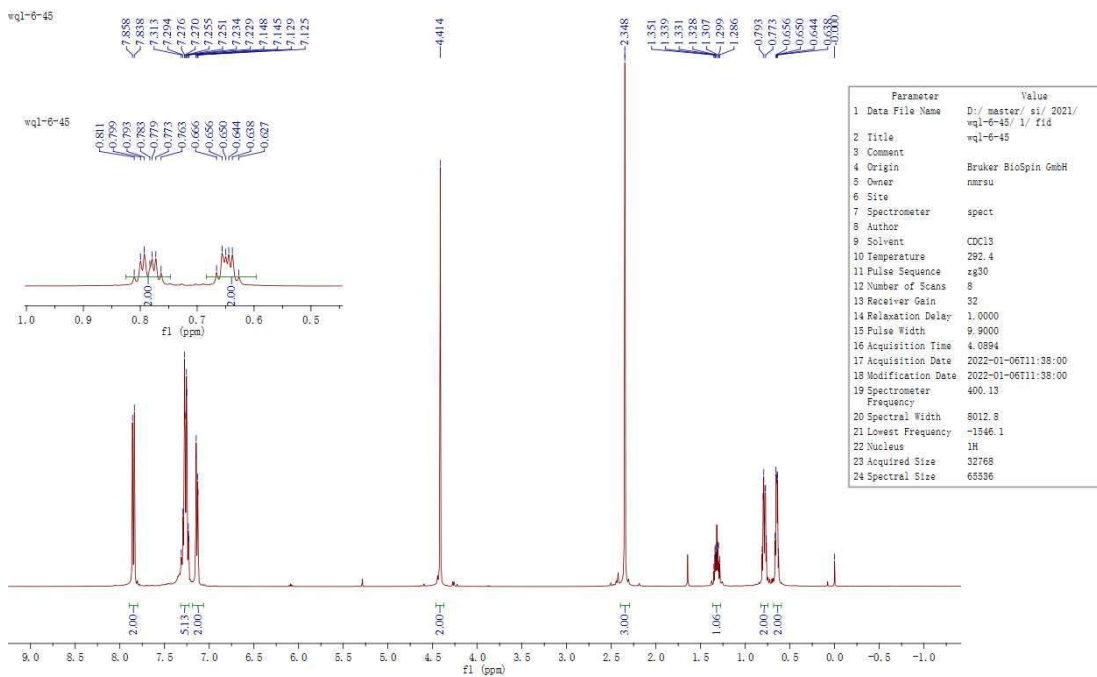
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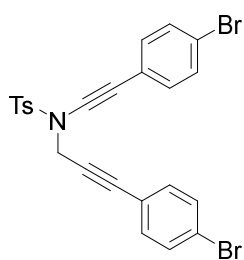


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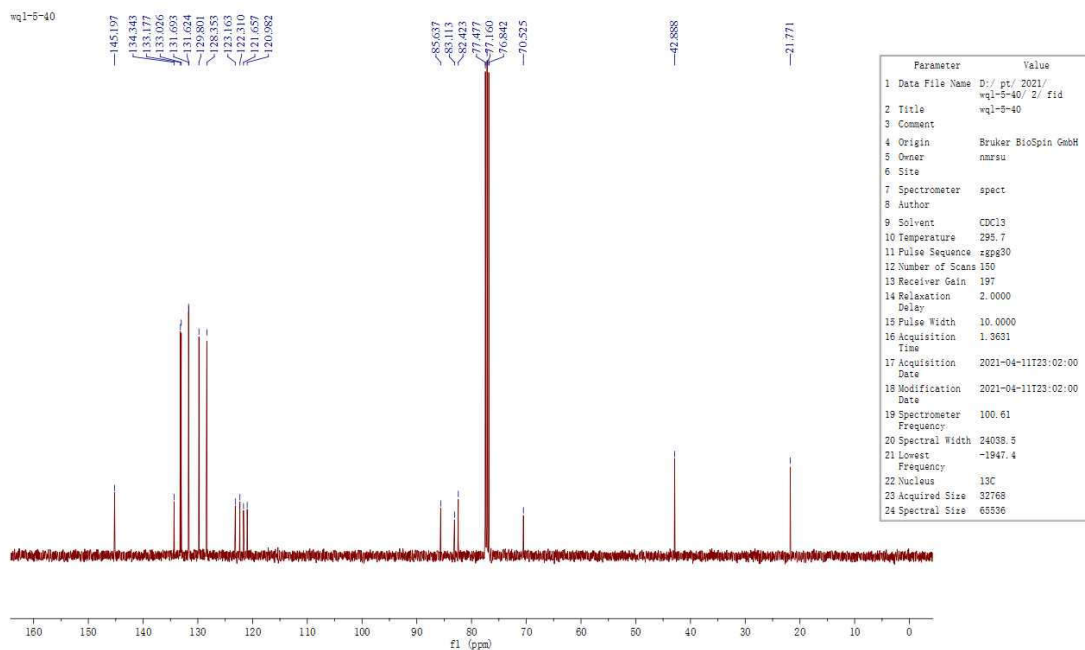
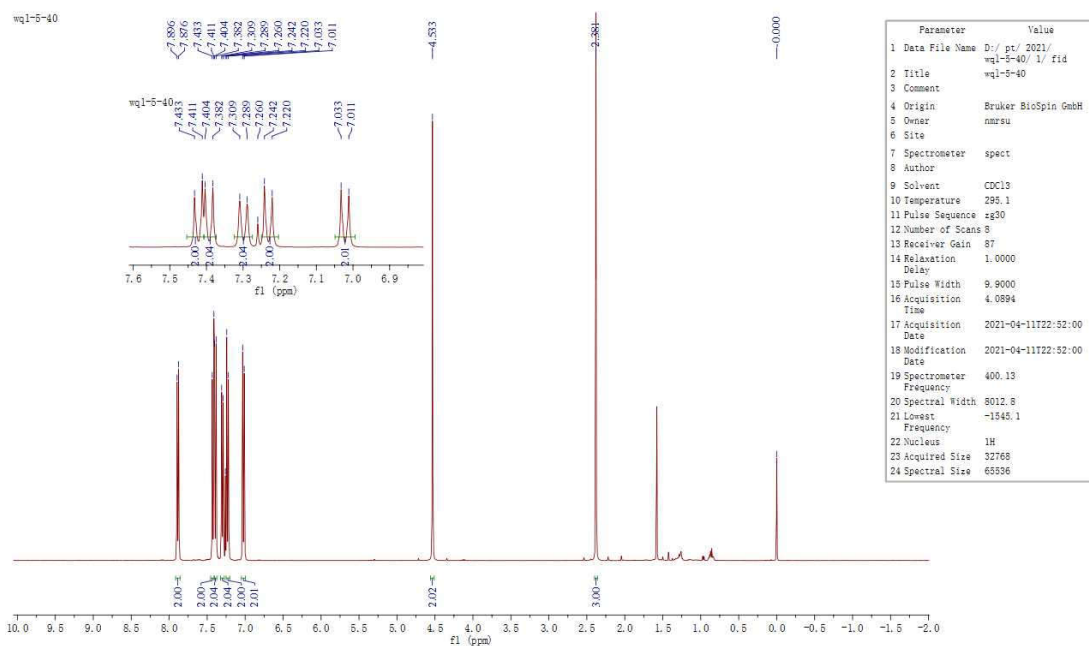


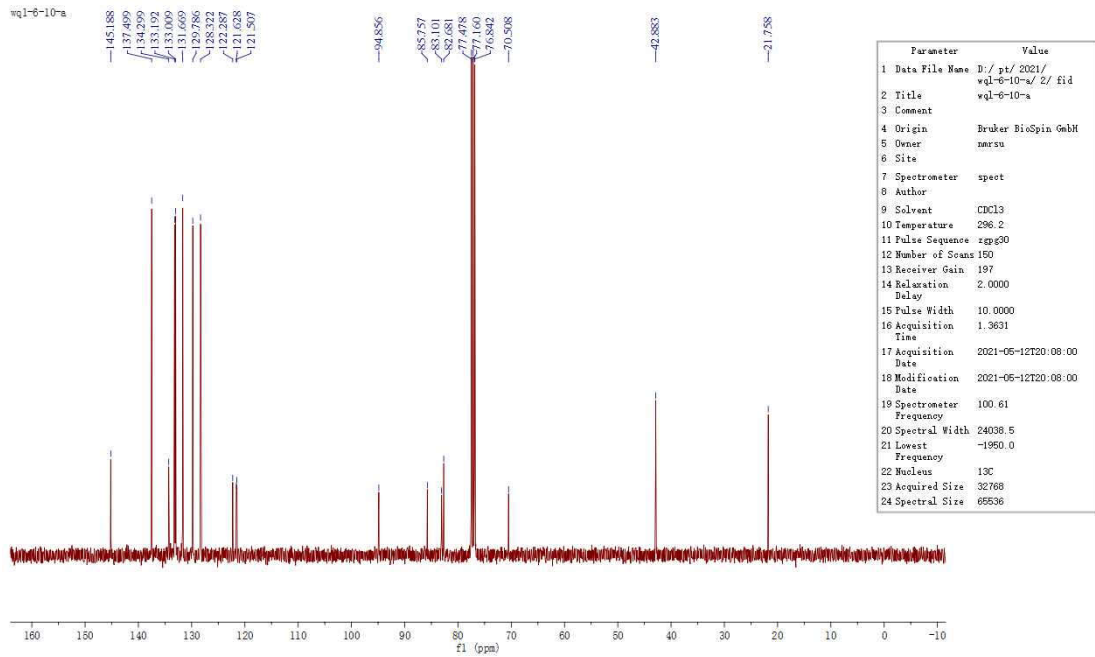
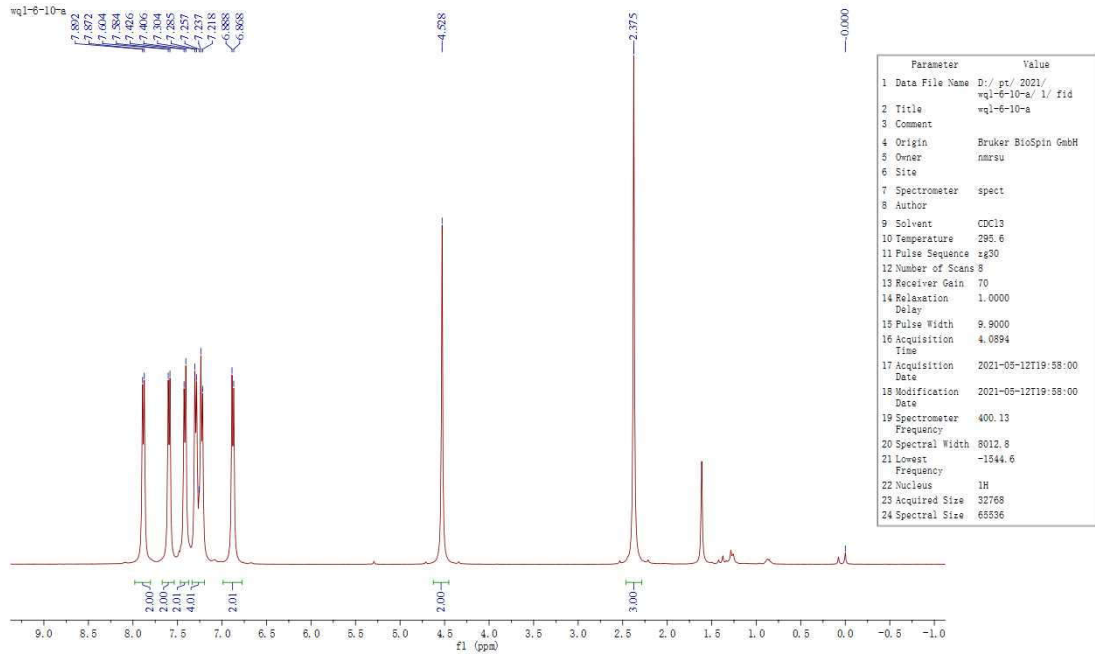
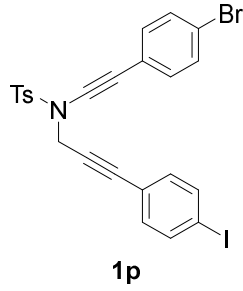
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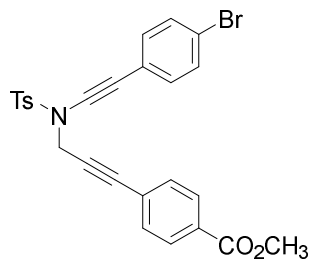




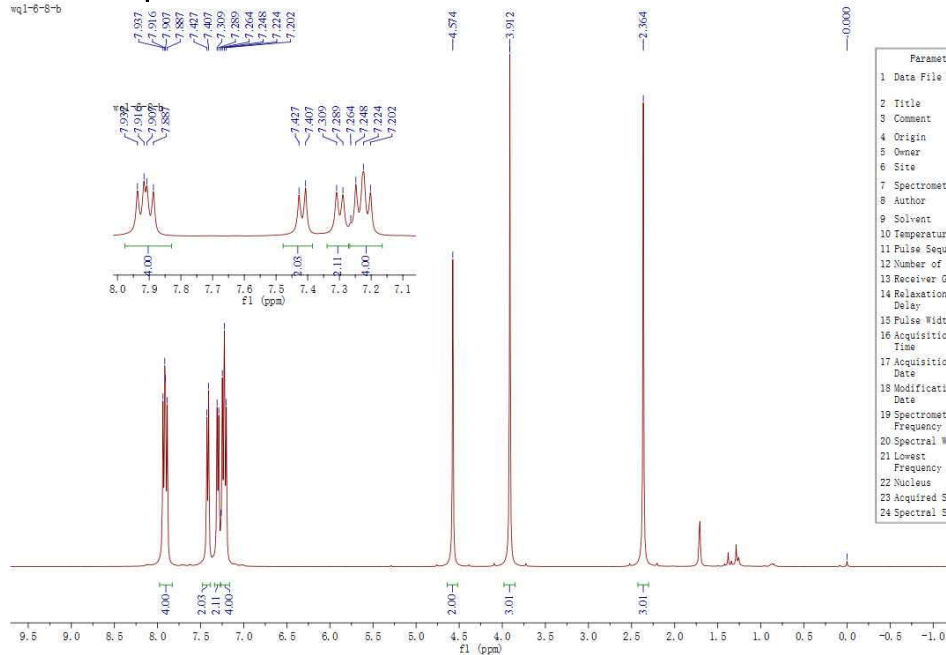
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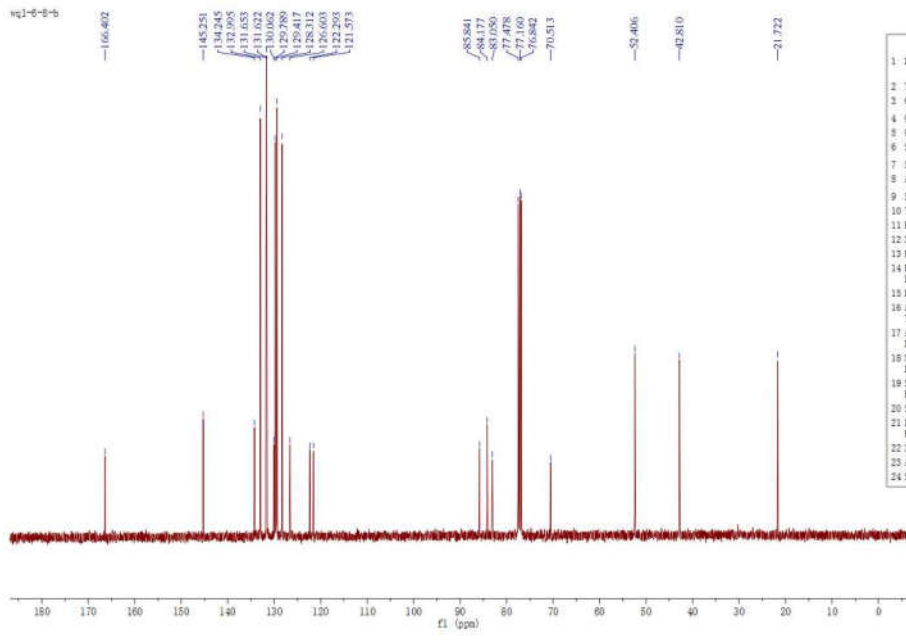


wq1-6-8-b

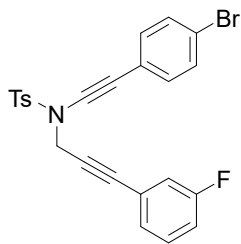


Parameter	Value
1 Data File Name	D:/pr/2021/wq1-6-8-b/1/ fid
2 Title	wq1-6-8-b
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	mrsu
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	296.0
11 Pulse Sequence	zg30
12 Number of Scans	8
13 Receiver Gain	32
14 Relaxation Delay	1.0000
15 Pulse Width	9.9000
16 Acquisition Time	4.0894
17 Acquisition Date	2021-05-12T10:45:00
18 Modification Date	2021-05-12T10:45:00
19 Spectrometer Frequency	400.13
20 Spectral Width	8012.8
21 Lowest Frequency	-1942.4
22 Nucleus	1H
23 Acquired Size	32768
24 Spectral Size	65936

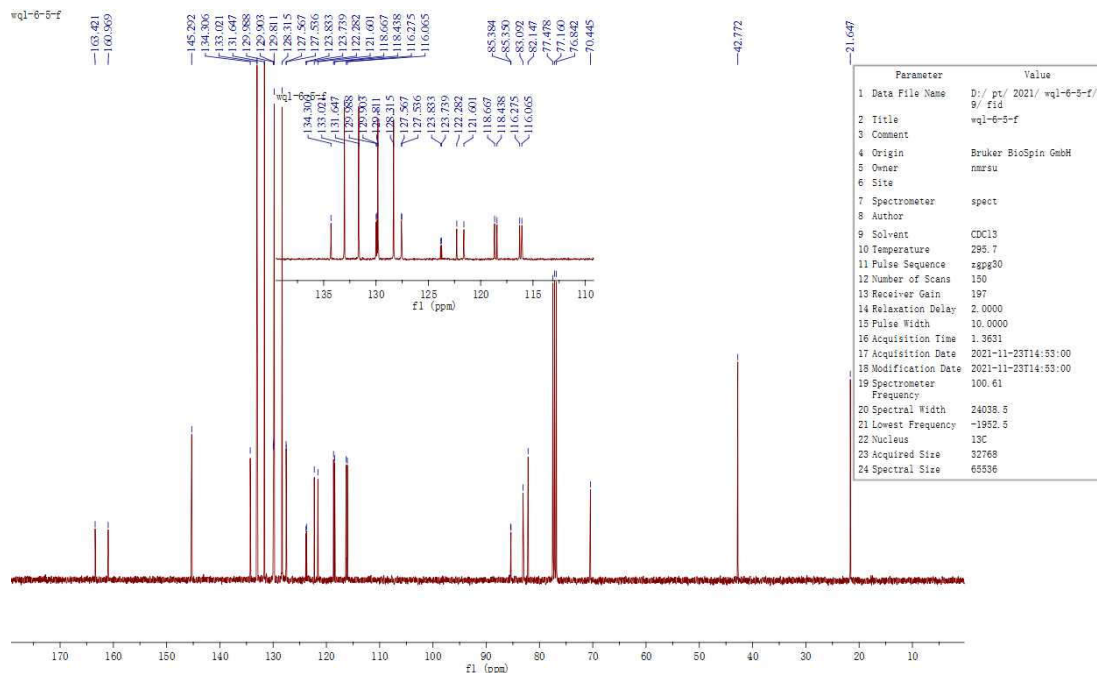
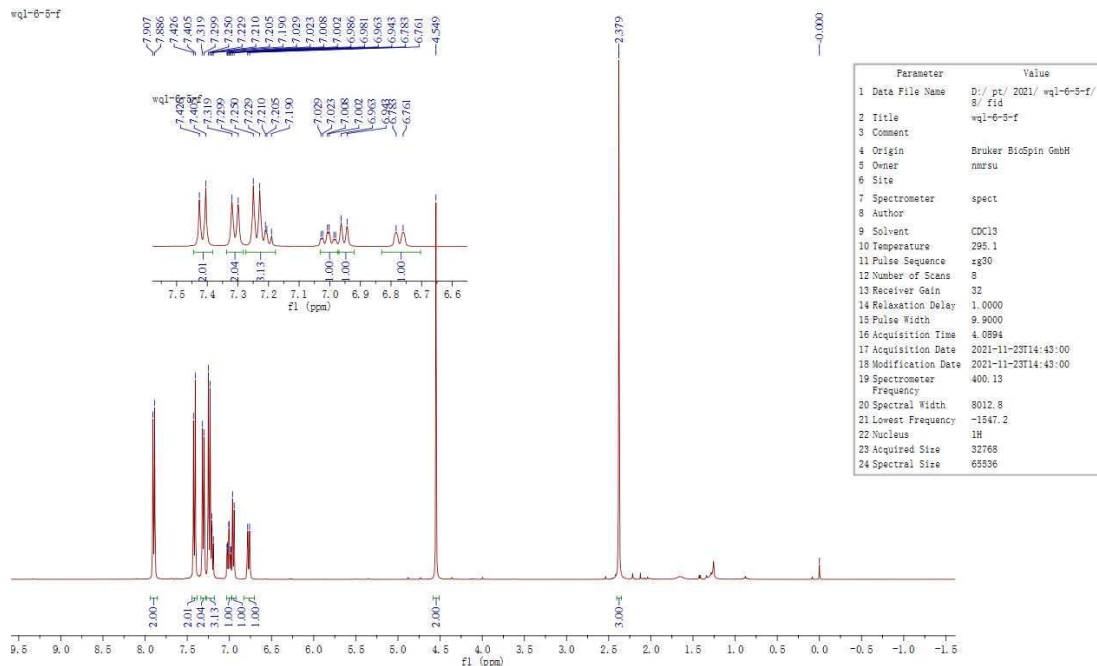
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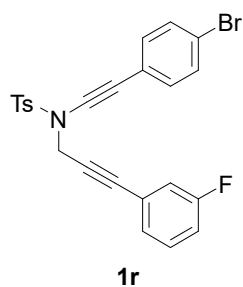


Parameter	Value
1 Data File Name	D:/pr/2021/wq1-6-8-b/2/ fid
2 Title	wq1-6-8-b
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	mrsu
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	296.3
11 Pulse Sequence	zgpg30
12 Number of Scans	150
13 Receiver Gain	197
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	1.9631
17 Acquisition Date	2021-05-12T10:55:00
18 Modification Date	2021-05-12T10:55:00
19 Spectrometer Frequency	100.61
20 Spectral Width	24038.3
21 Lowest Frequency	-1951.9
22 Nucleus	13C
23 Acquired Size	32768
24 Spectral Size	65936

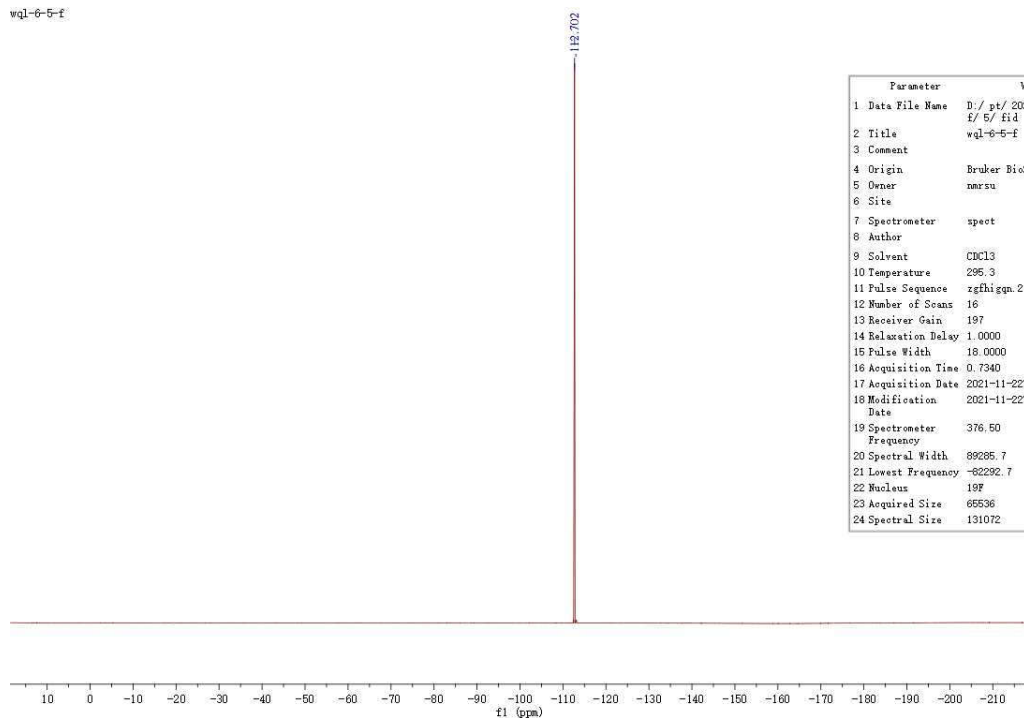


1r



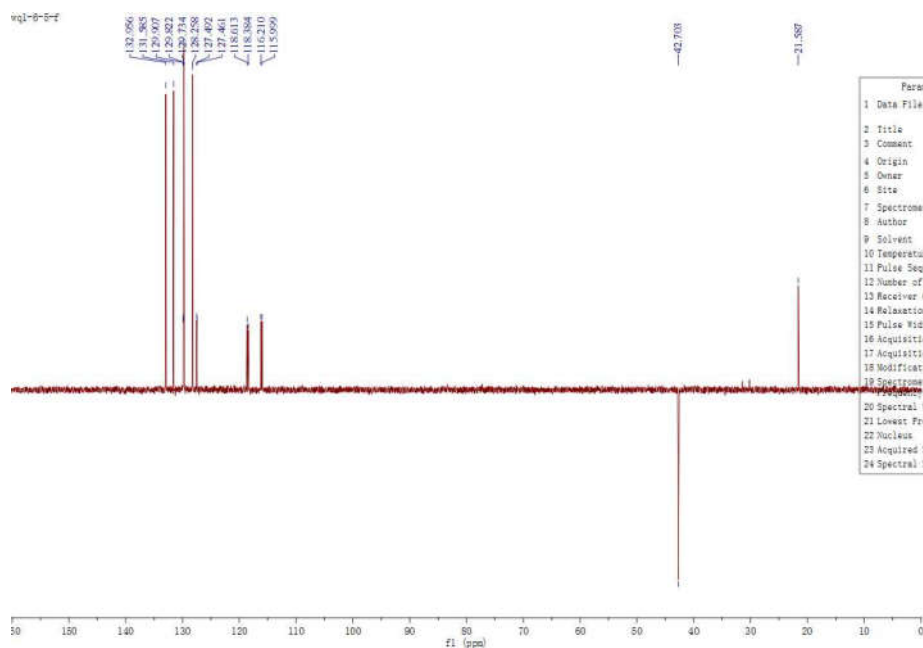


wq1-6-5-f

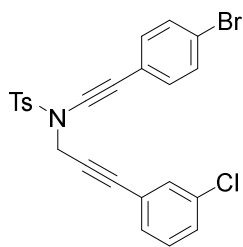


Parameter	Value
1 Data File Name	D:/_pt/ 2021/ wq1-6-5-f/ 5/ fid
2 Title	wq1-6-5-f
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	nmsru
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	296.3
11 Pulse Sequence	zgfhggm.2
12 Number of Scans	16
13 Receiver Gain	197
14 Relaxation Delay	1.0000
15 Pulse Width	18.0000
16 Acquisition Time	0.7340
17 Acquisition Date	2021-11-22T10:54:00
18 Modification Date	2021-11-22T10:54:00
19 Spectrometer Frequency	376.50
20 Spectral Width	89285.7
21 Lowest Frequency	-82292.7
22 Nucleus	13C
23 Acquired Size	65536
24 Spectral Size	131072

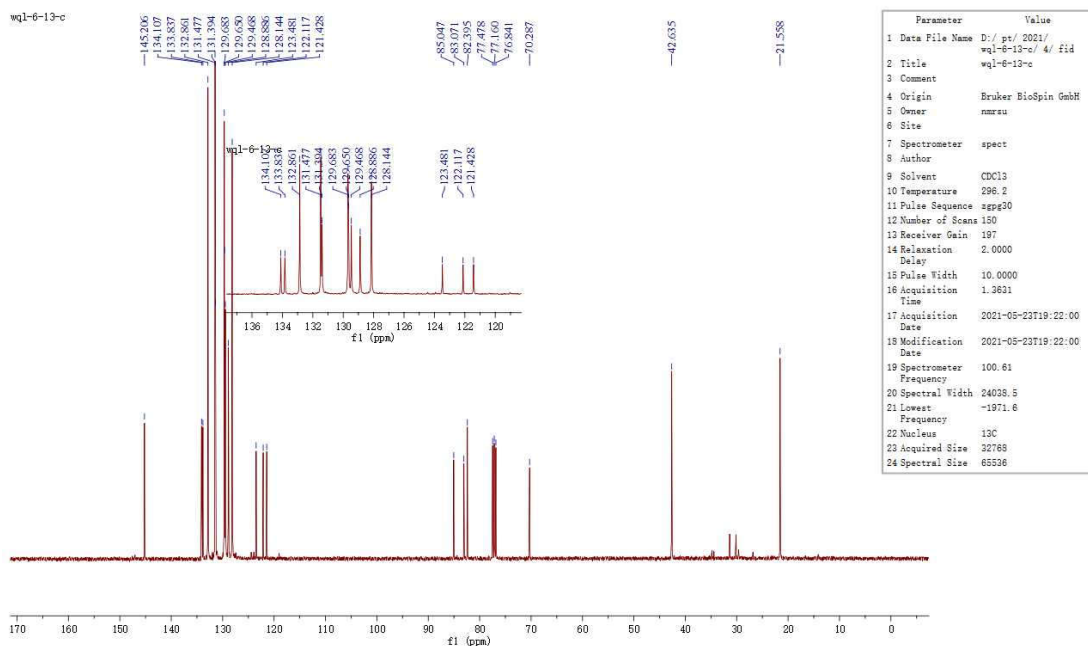
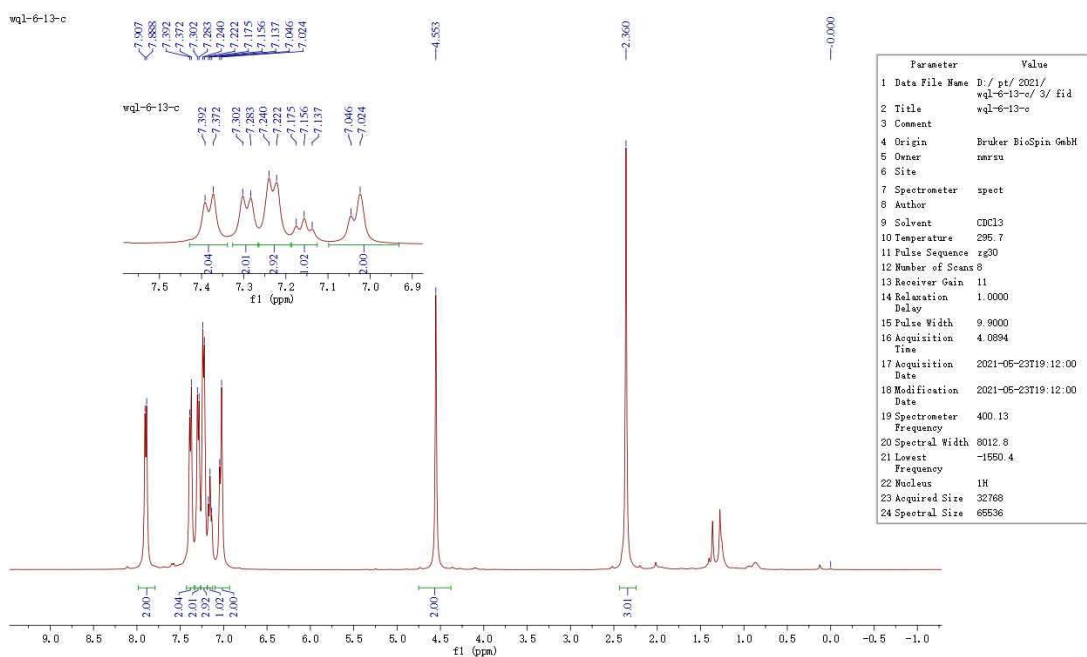
wq1-6-5-f

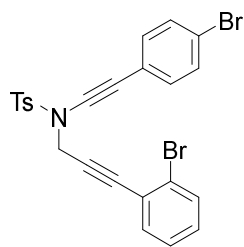


Parameter	Value
1 Data File Name	D:/_pt/ 2021/ wq1-6-5-f/ 3/ fid
2 Title	wq1-6-5-f
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	nmsru
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	295.7
11 Pulse Sequence	deptspl35
12 Number of Scans	138
13 Receiver Gain	197
14 Relaxation Delay	2.0000
15 Pulse Width	18.0000
16 Acquisition Time	2.0316
17 Acquisition Date	2021-11-21T16:34:00
18 Modification Date	2021-11-21T16:34:00
19 Spectrometer Frequency	100.61
20 Spectral Width	16129.0
21 Lowest Frequency	-16.0
22 Nucleus	13C
23 Acquired Size	32768
24 Spectral Size	65536

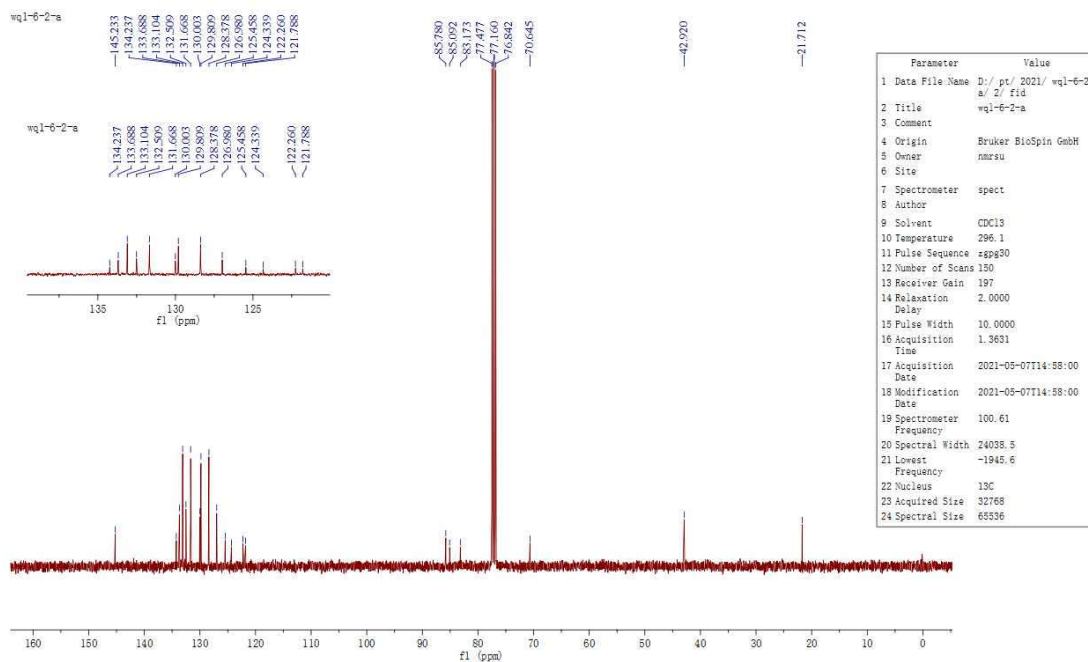
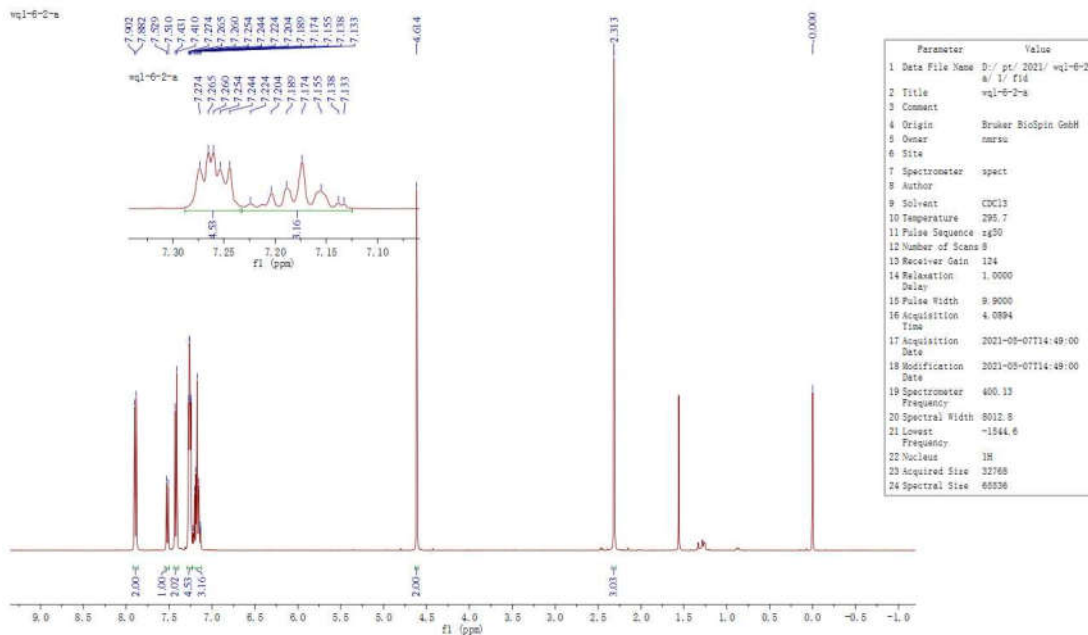


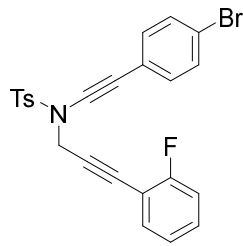
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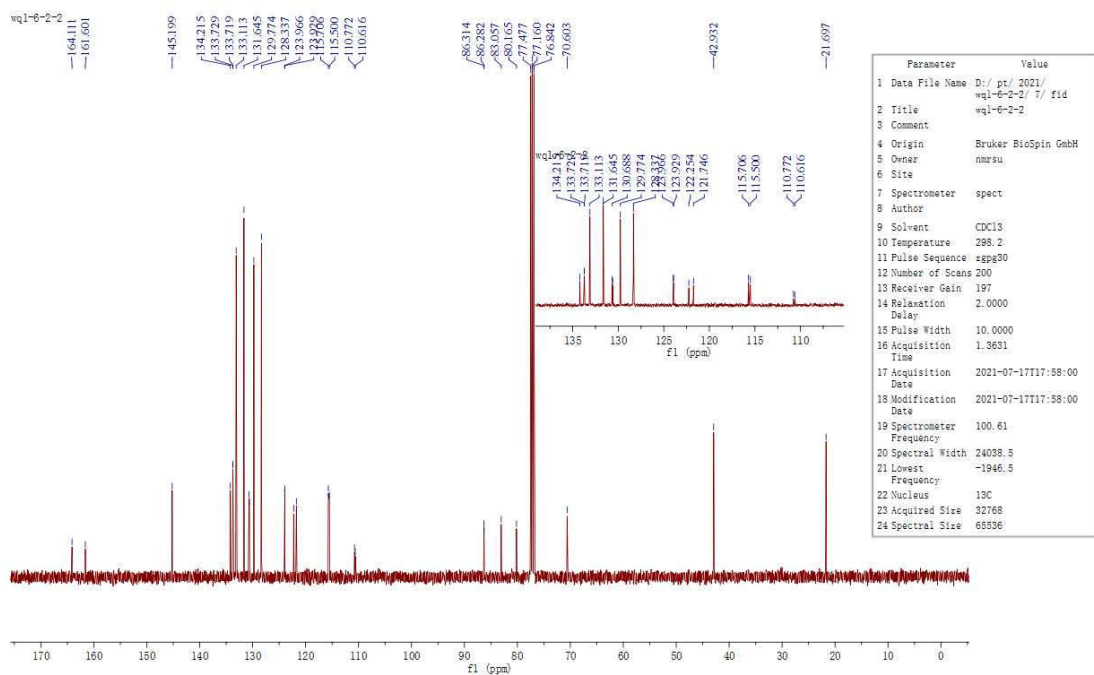
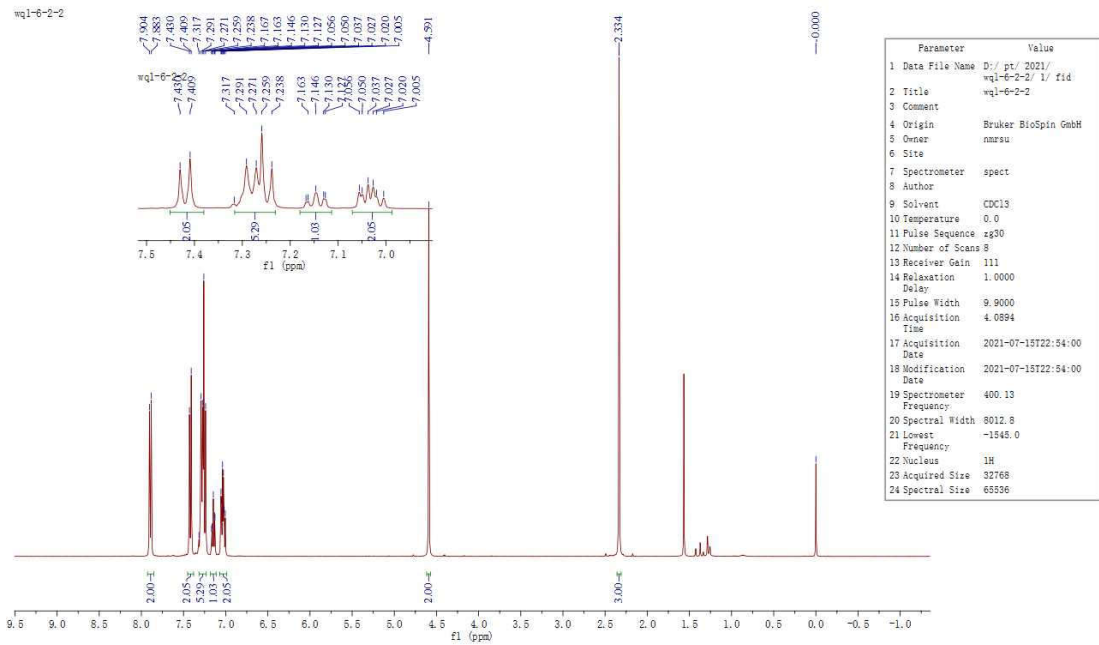


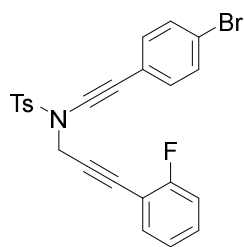
1u





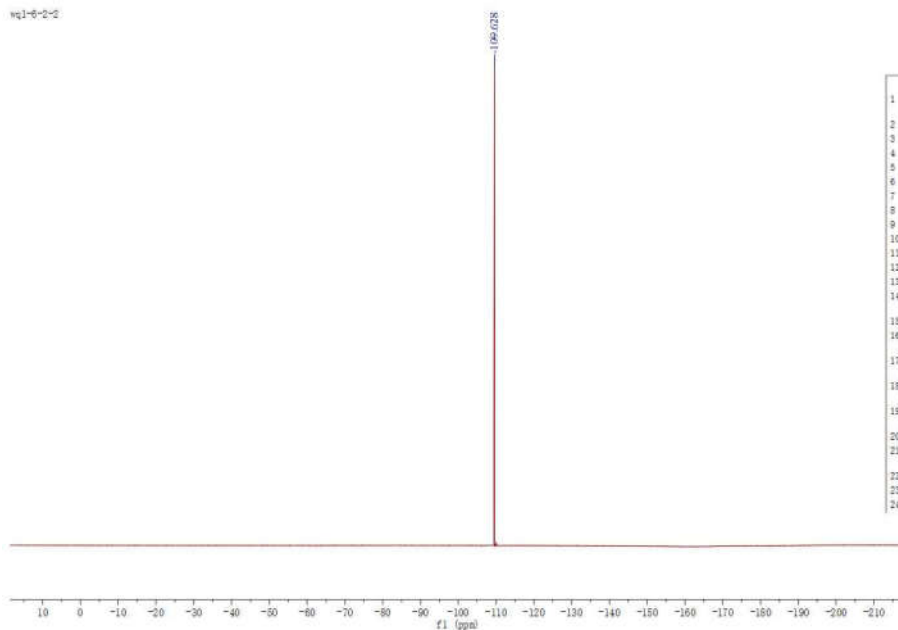
1v





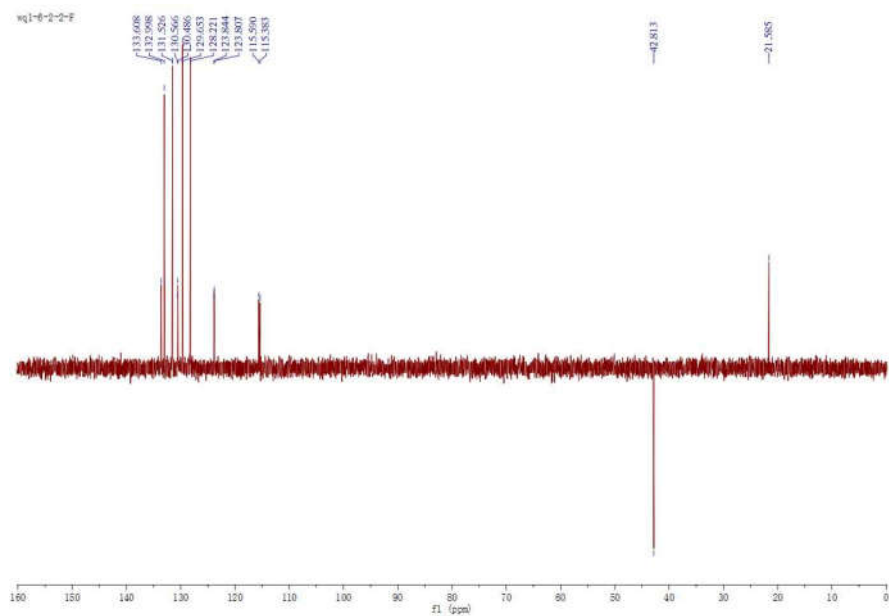
1v

wq1-6-2-2-C

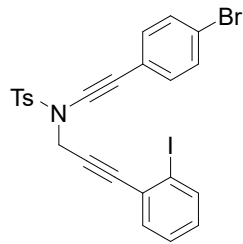


Parameter	Value
1 Data File Name	D:/pr/2021/wq1-6-2-2/6/ f1d
2 Title	wq1-6-2-2
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	nmrsu
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	297.7
11 Pulse Sequence	zgpg30qz
12 Number of Scans	16
13 Receiver Gain	197
14 Relaxation Delay	3.0000
15 Pulse Width	18.0000
16 Acquisition Time	0.7340
17 Acquisition Date	2021-07-17T11:45:00
18 Modification Date	2021-07-17T11:45:00
19 Spectrometer Frequency	376.50
20 Spectral Width	89285.7
21 Lowest Frequency	-82282.7
22 Nucleus	13C
23 Acquired Size	65536
24 Spectral Size	131072

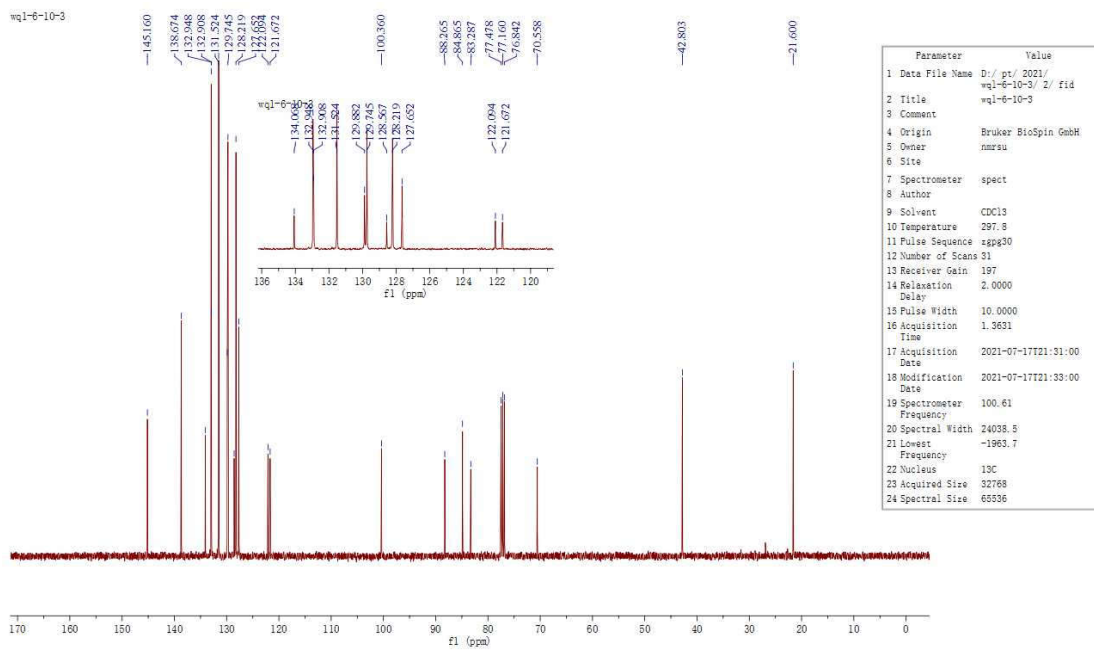
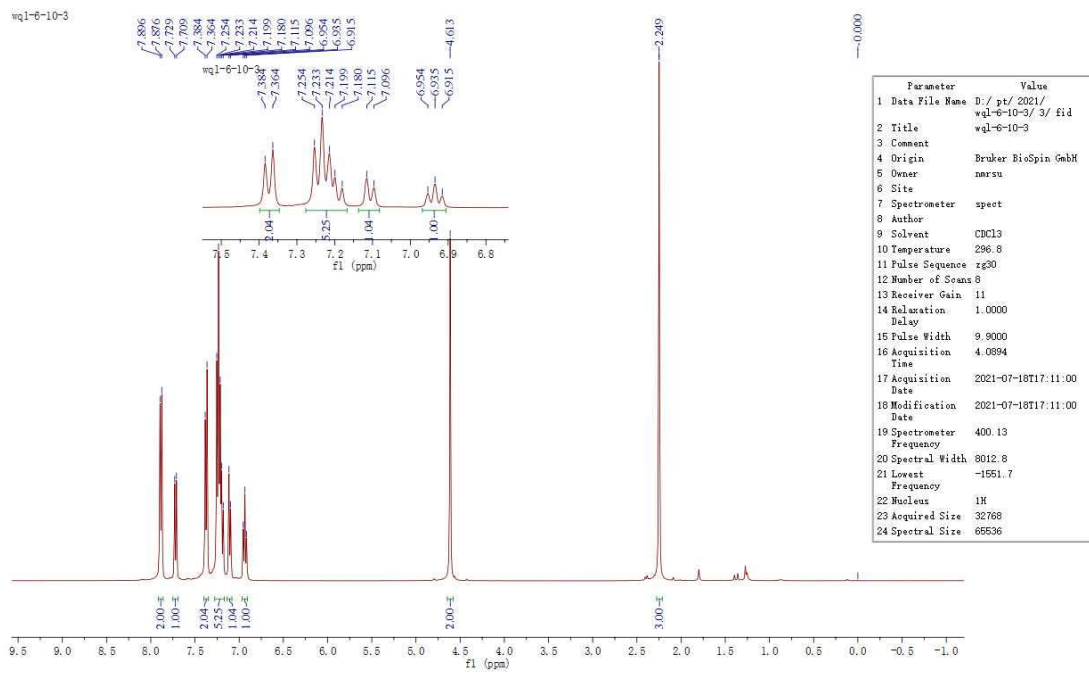
wq1-6-2-2-F

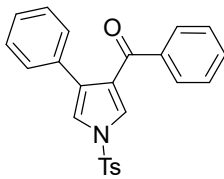


Parameter	Value
1 Data File Name	D:/pr/2021/wq1-6-2-2-F/1/ f1d
2 Title	wq1-6-2-2-F
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	nmrsu
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	296.4
11 Pulse Sequence	deptsq135
12 Number of Scans	125
13 Receiver Gain	197
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	2.0516
17 Acquisition Date	2021-08-12T15:47:00
18 Modification Date	2021-08-12T15:56:00
19 Spectrometer Frequency	100.61
20 Spectral Width	16129.0
21 Lowest Frequency	-16.0
22 Nucleus	13C
23 Acquired Size	32768
24 Spectral Size	65536

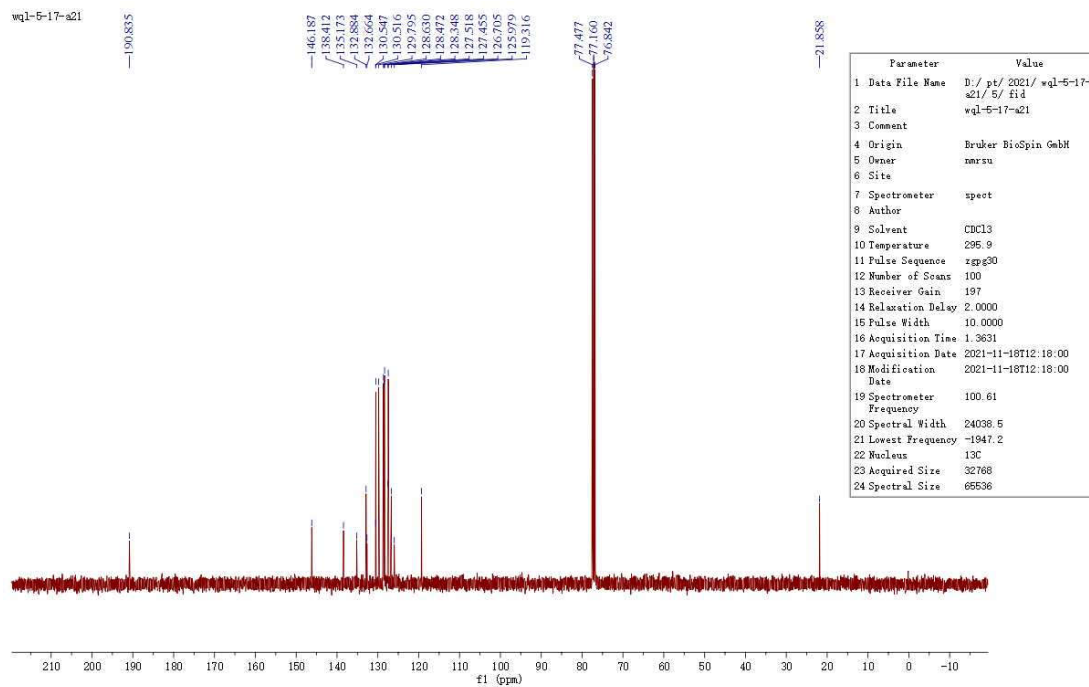
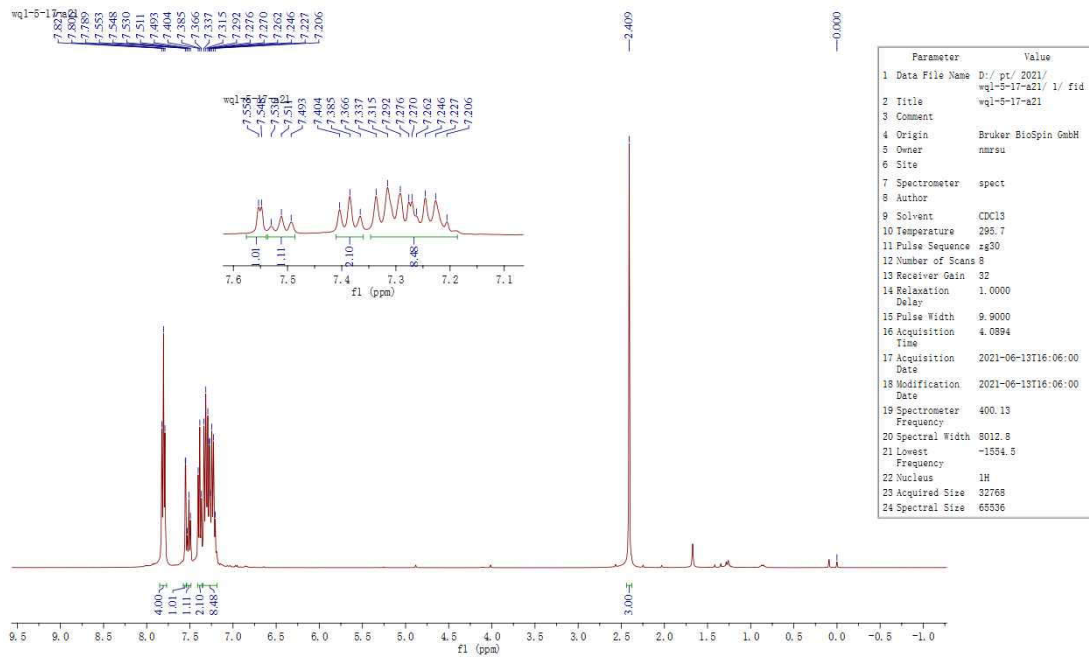


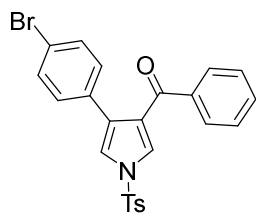
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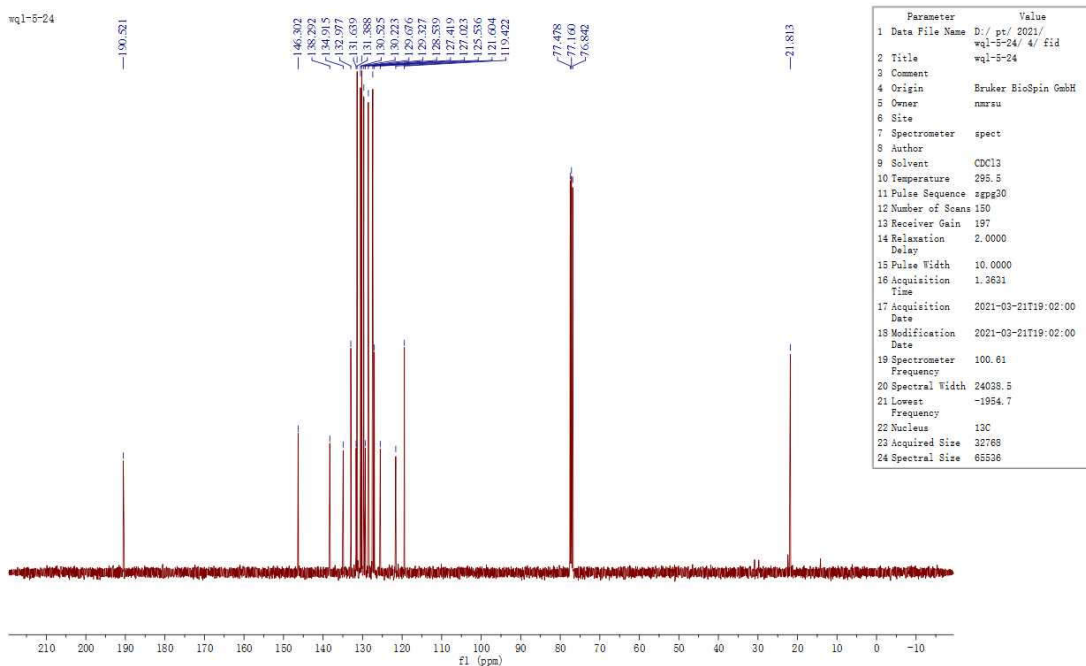
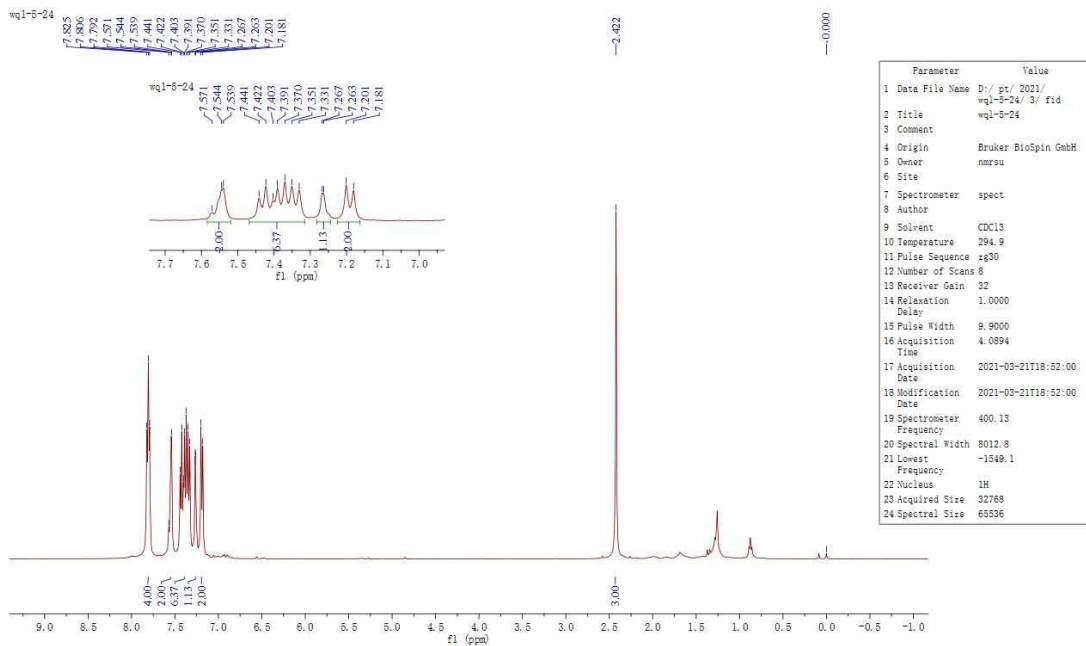


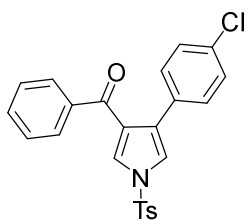
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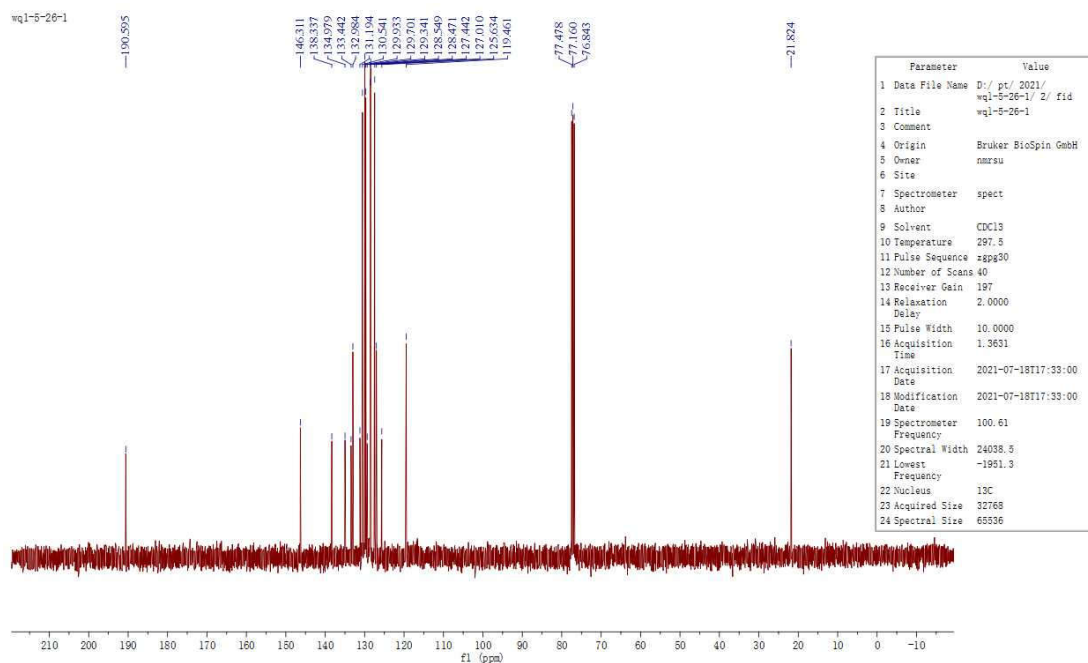
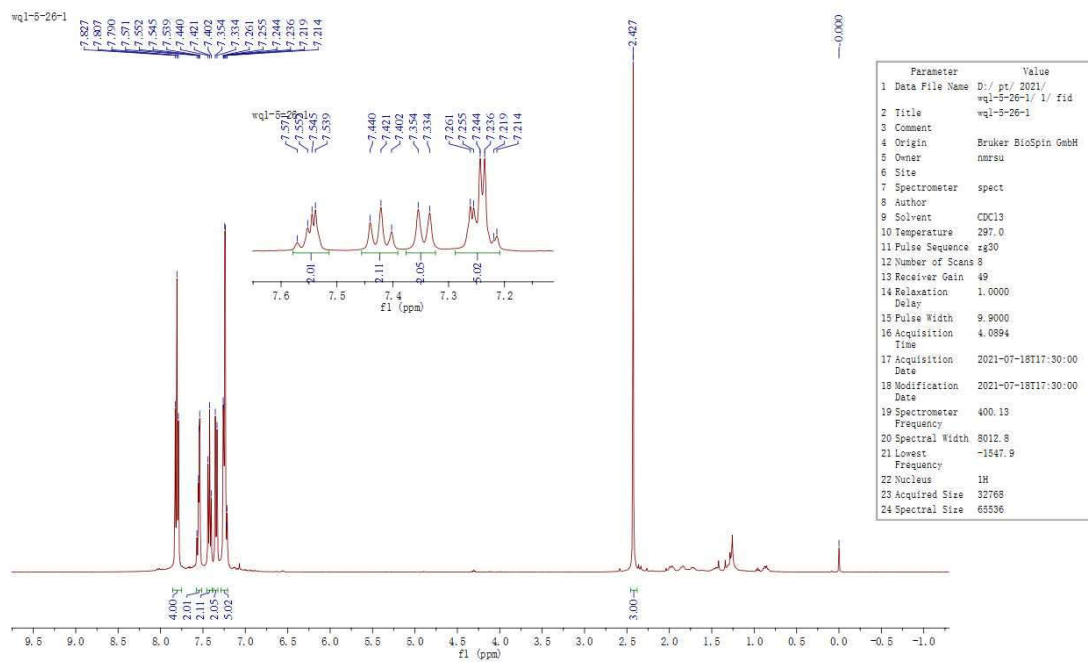


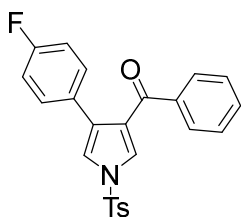
2b



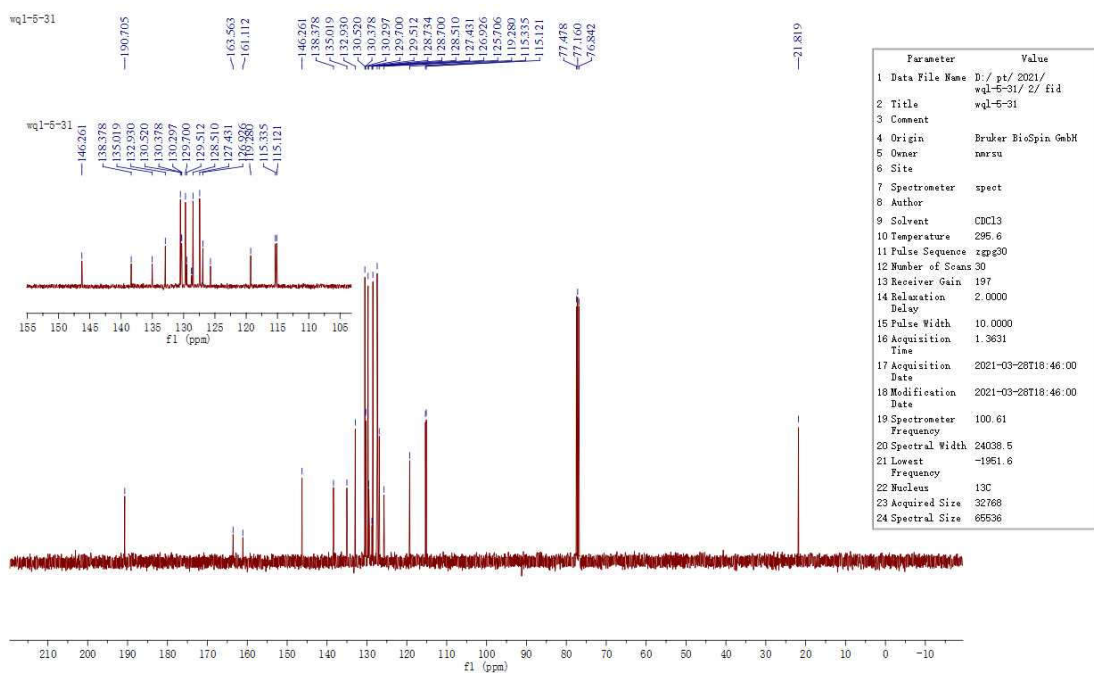
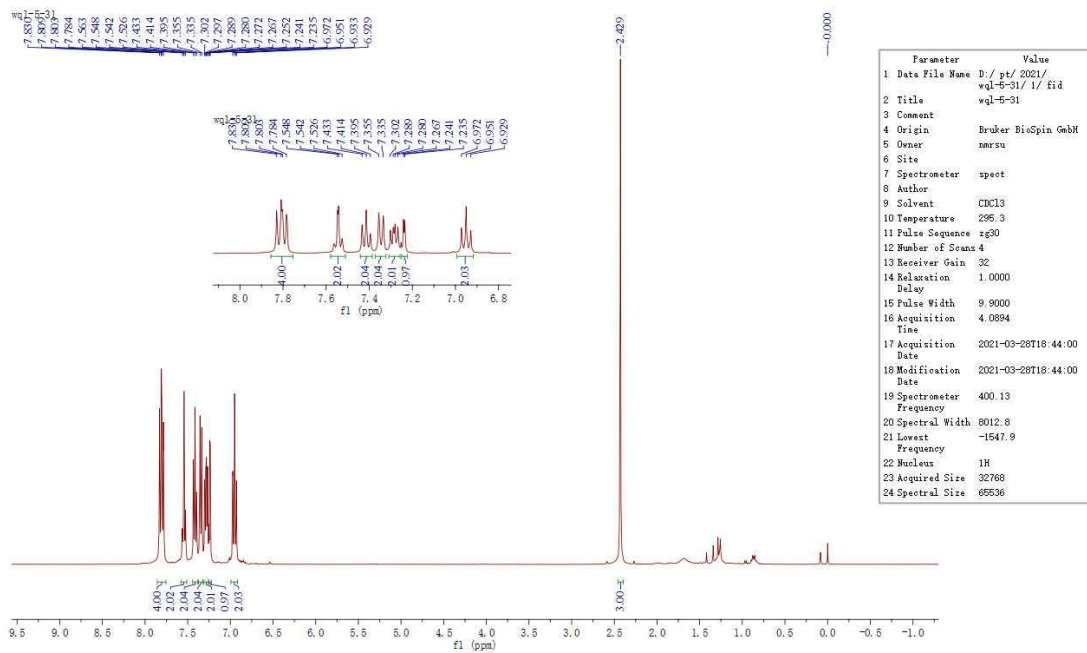


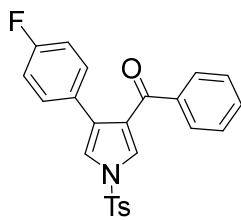
2c





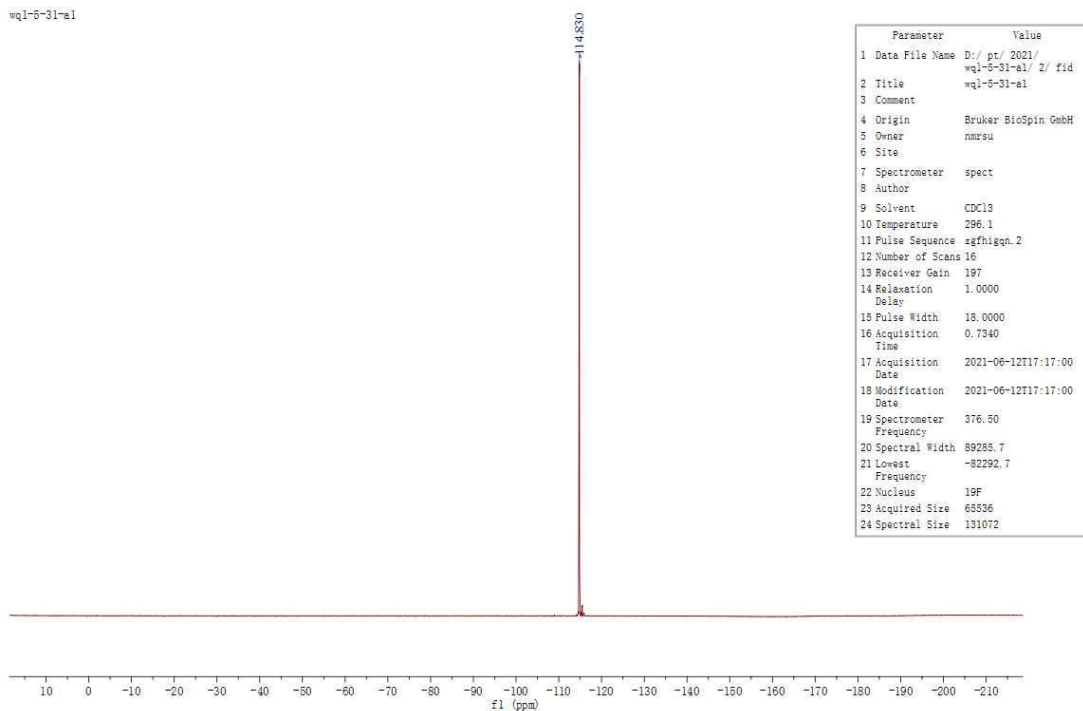
2d



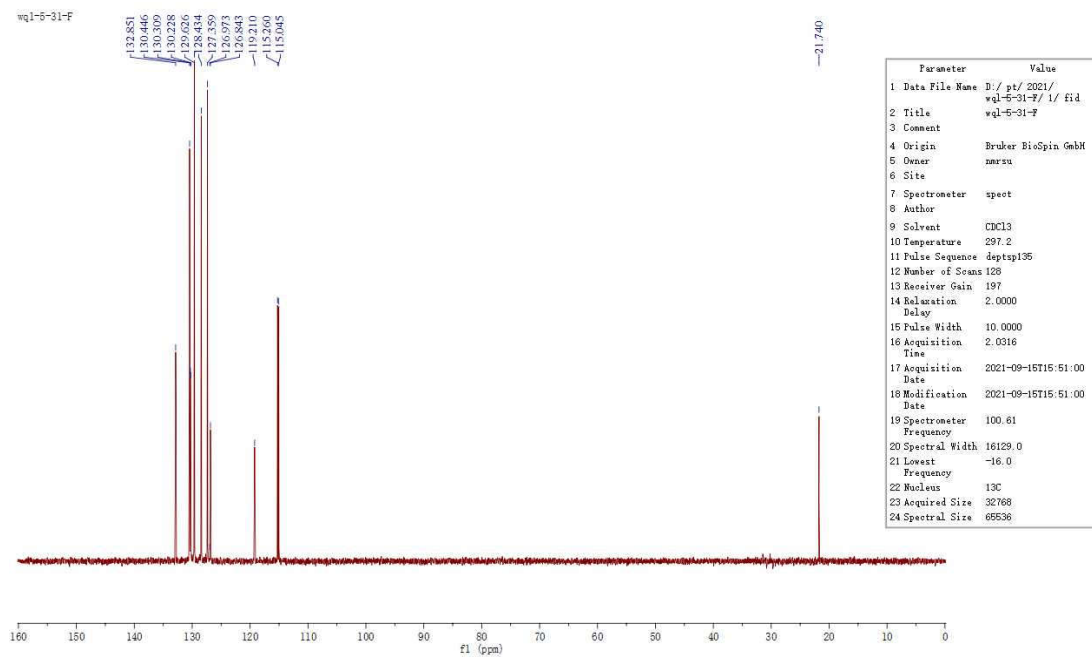


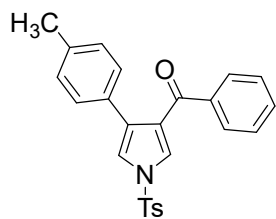
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wq1-5-31-a1

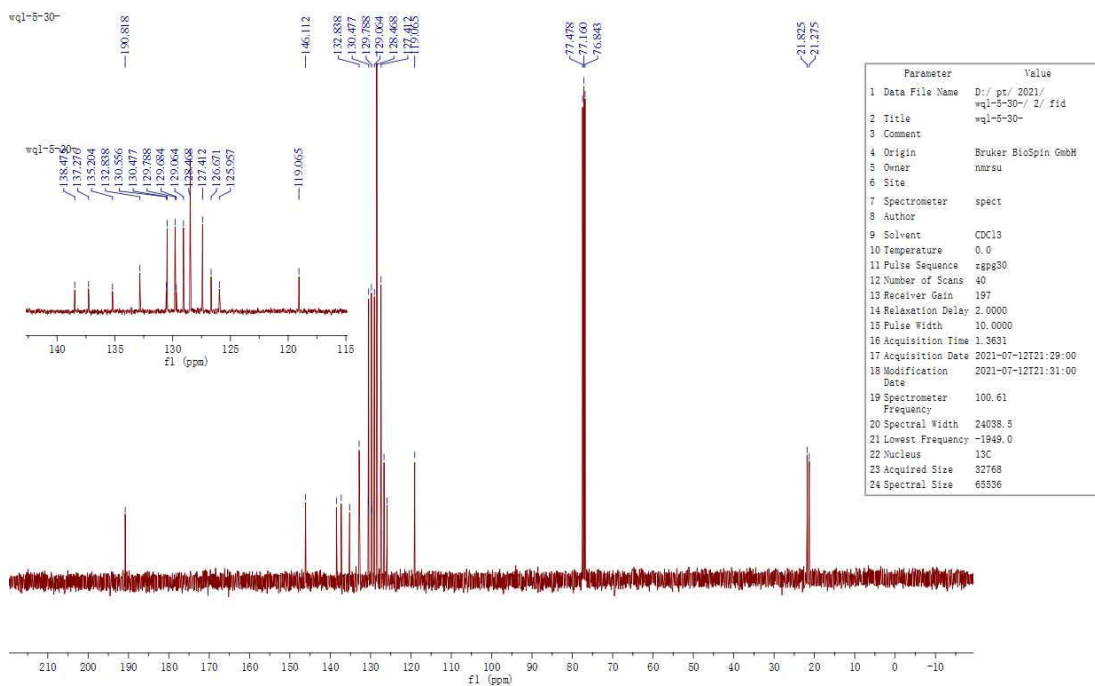
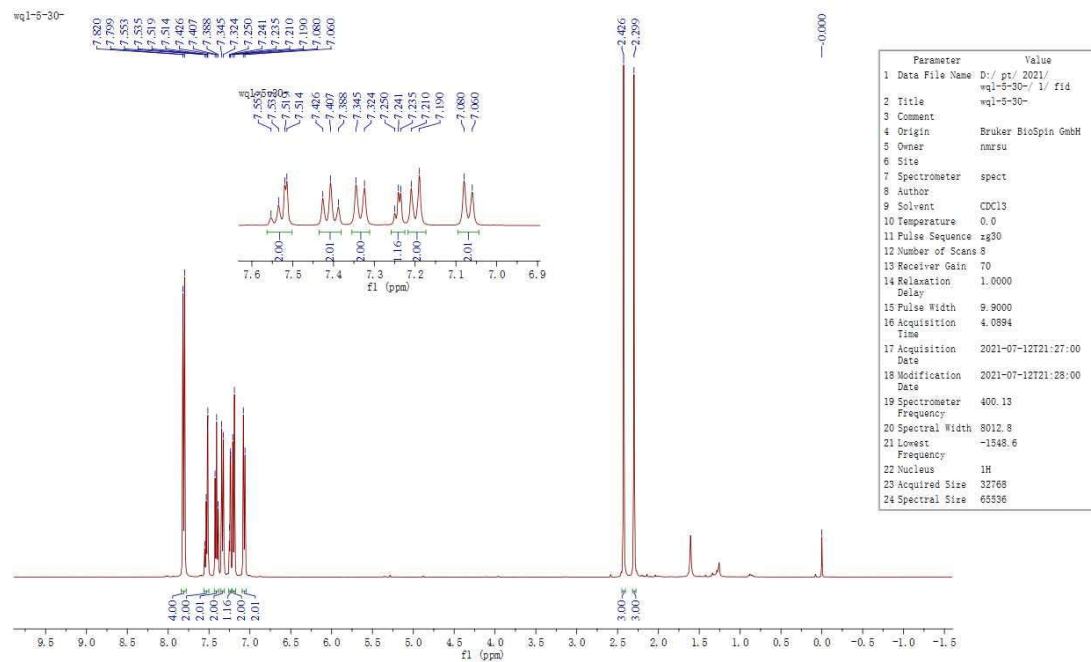


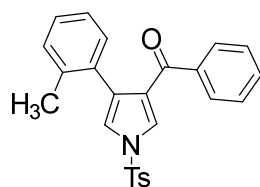
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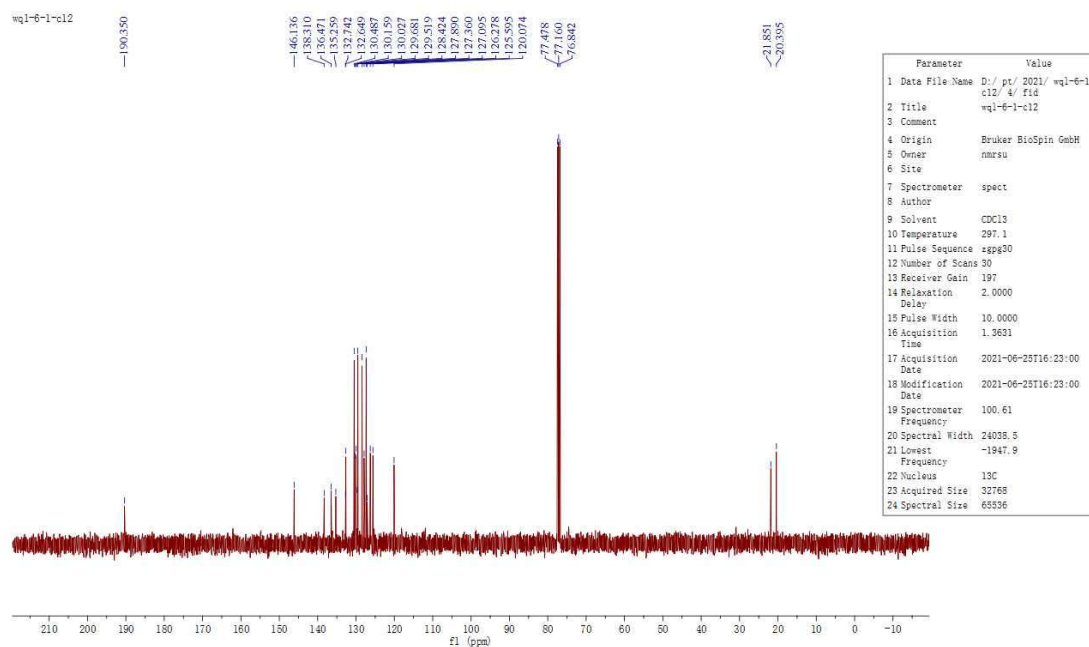
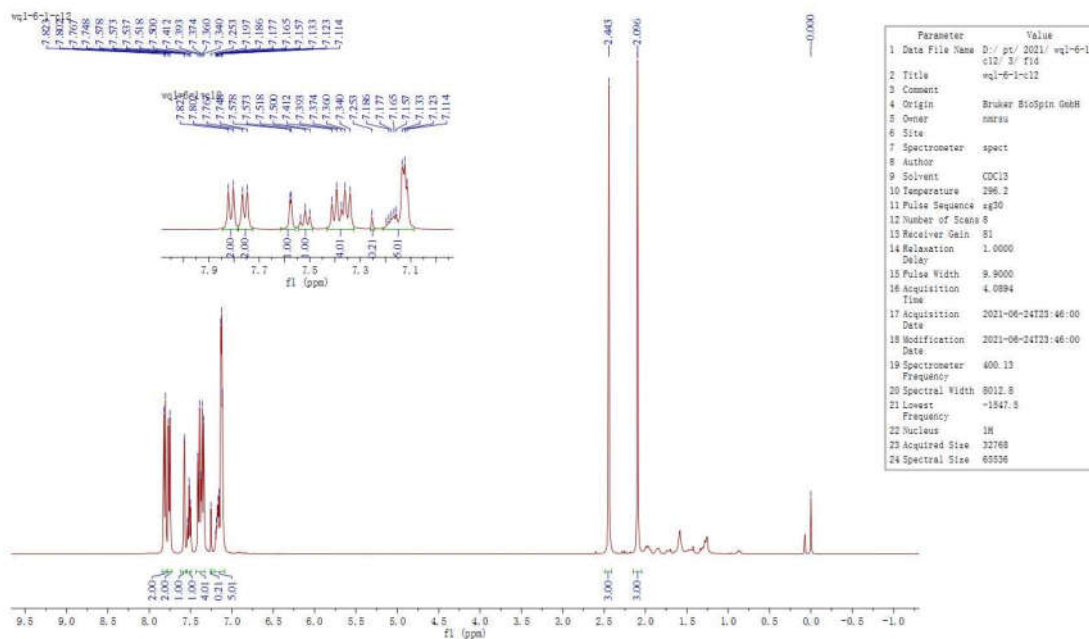


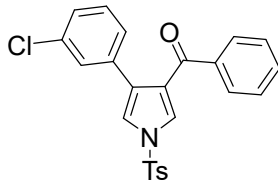
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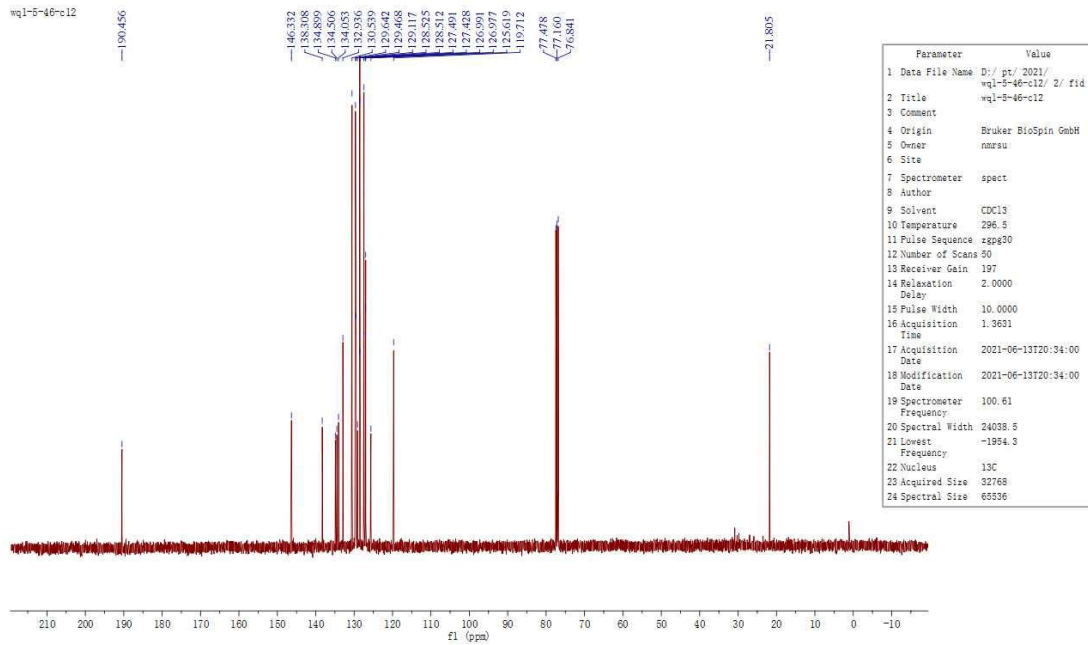
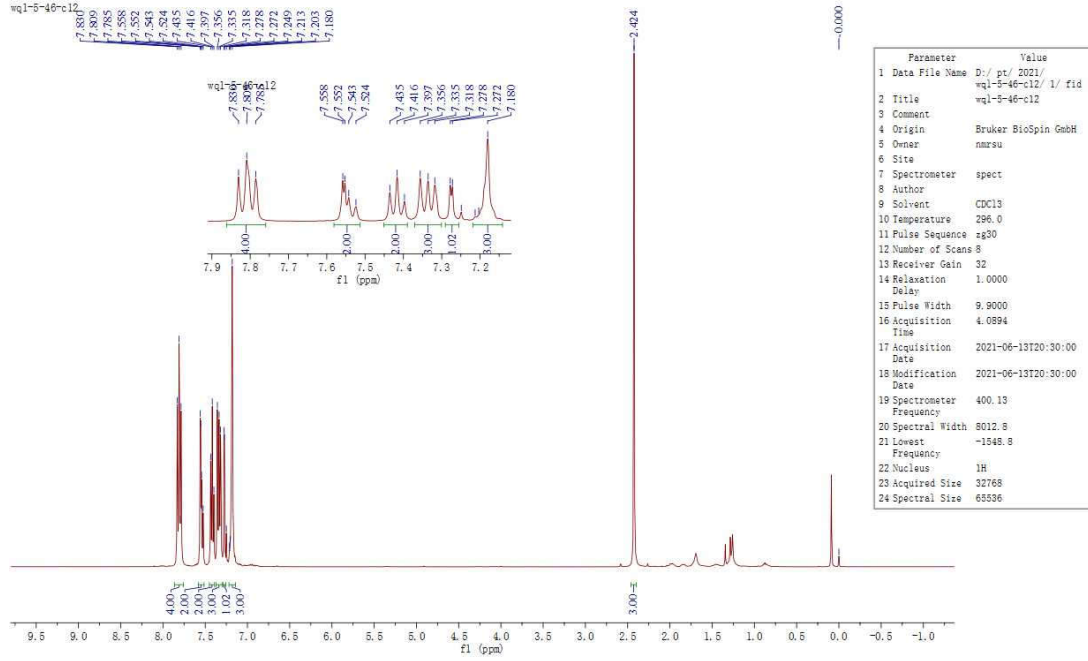


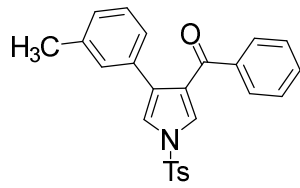
2h



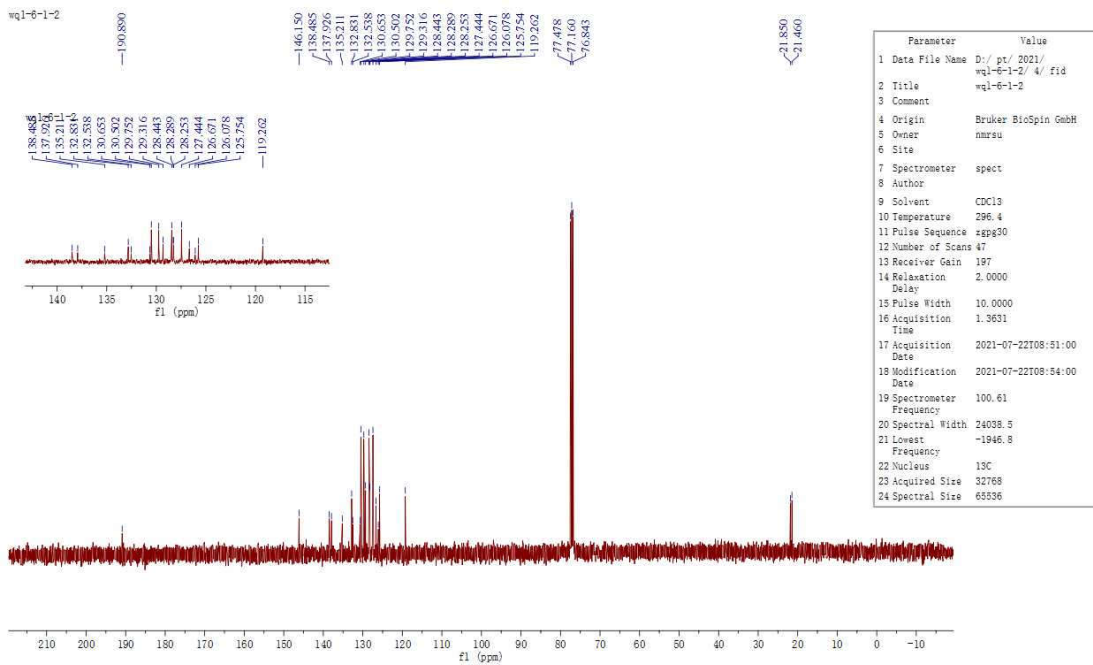
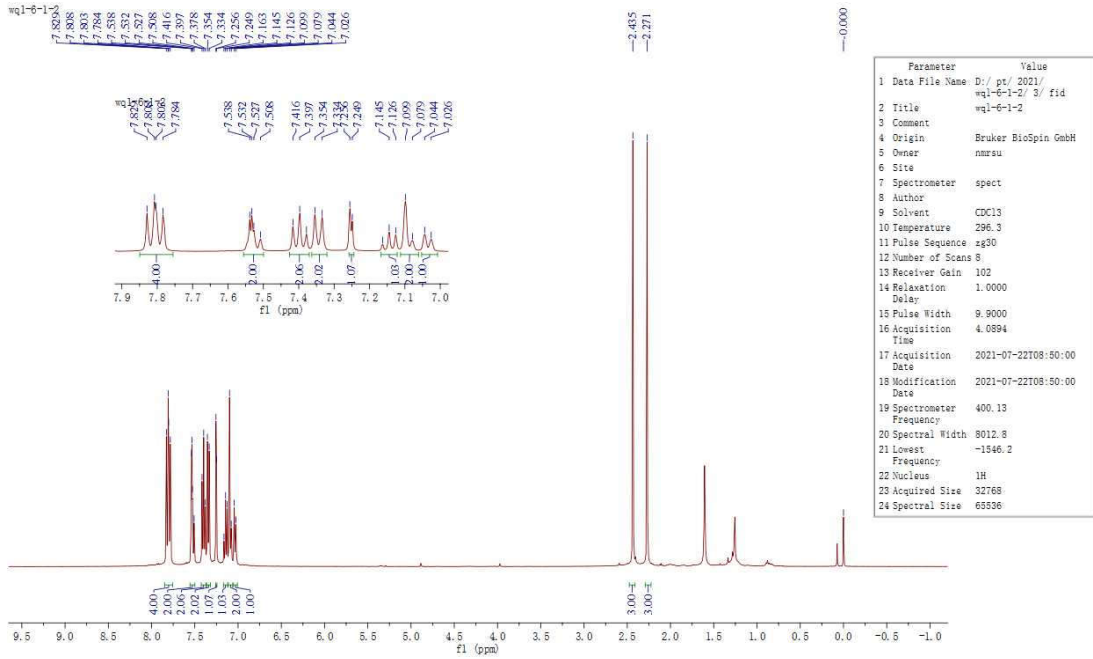


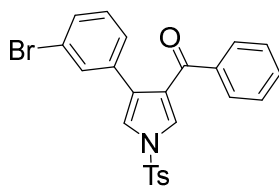
2i



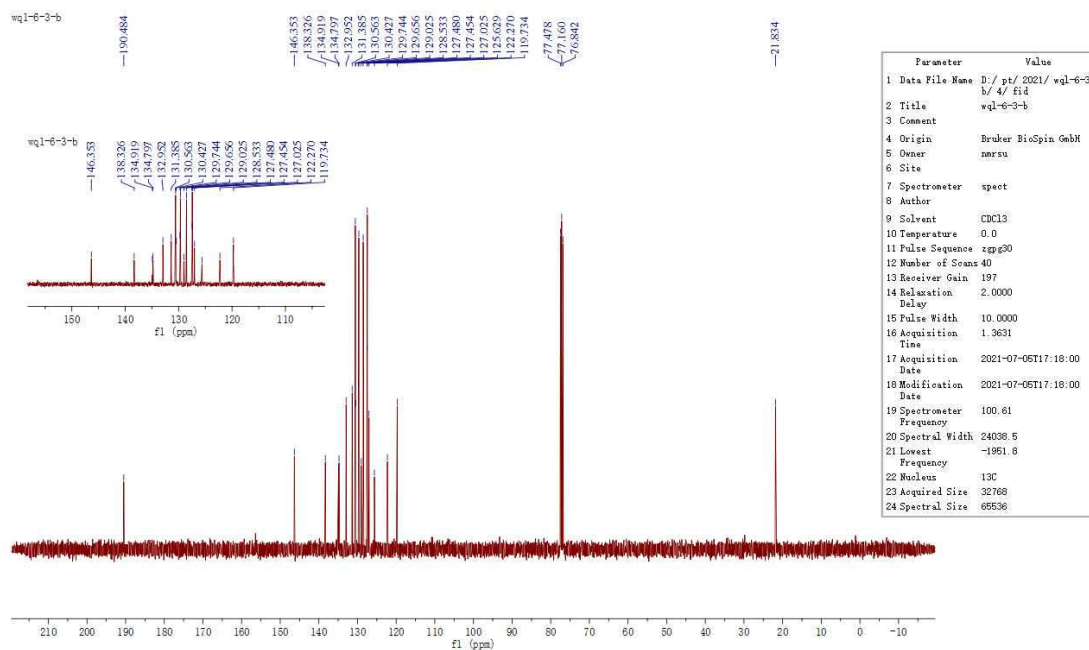
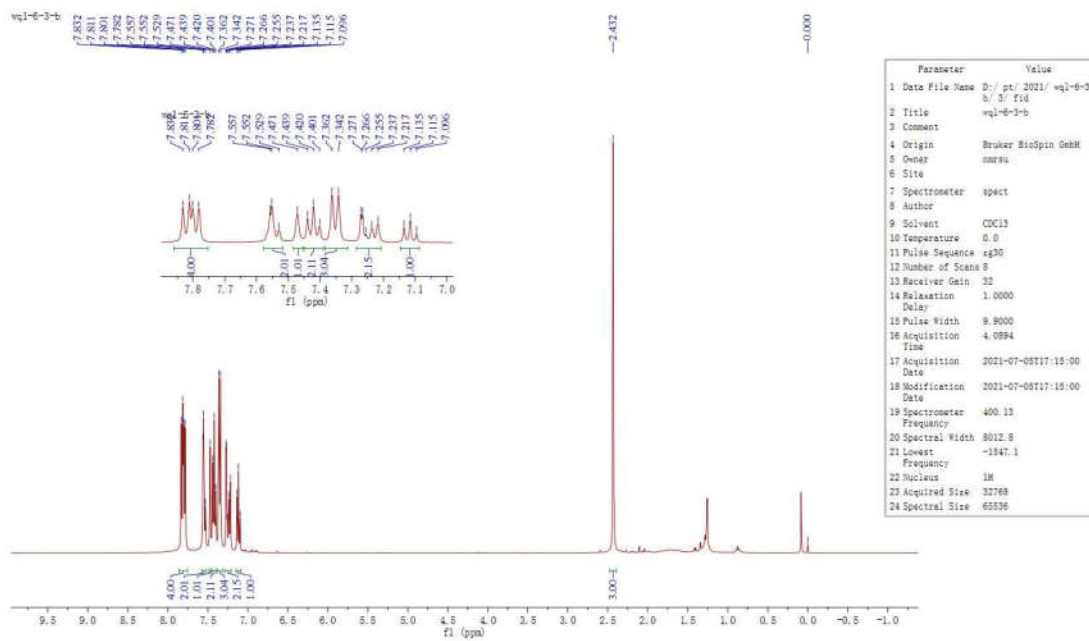


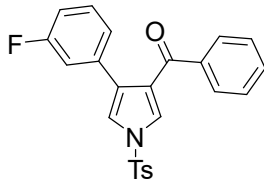
2j





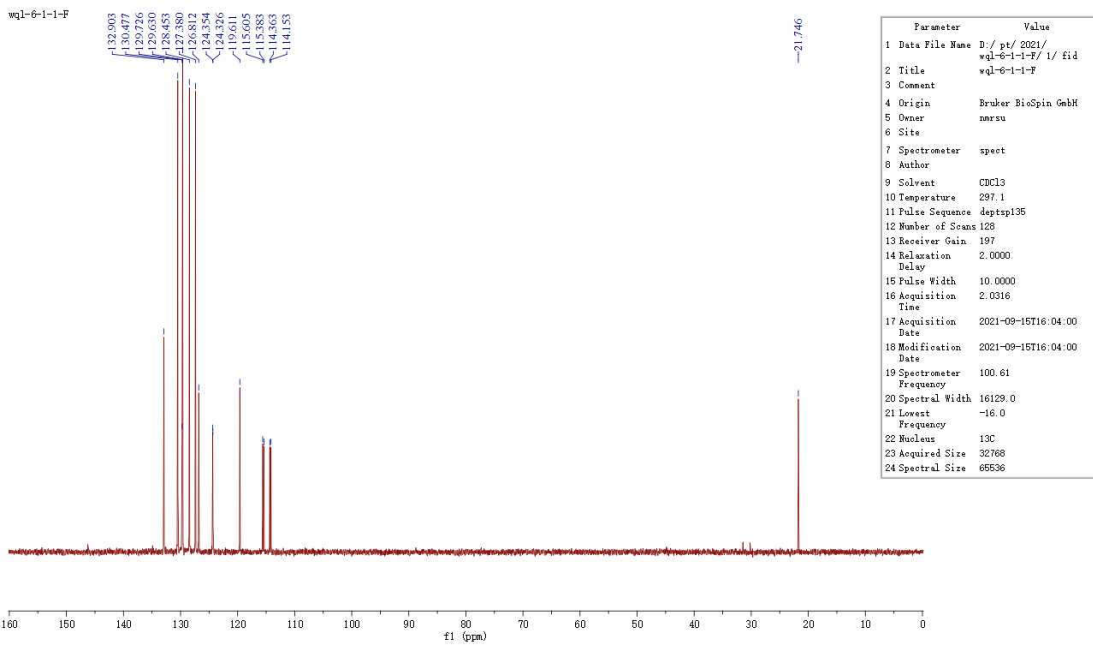
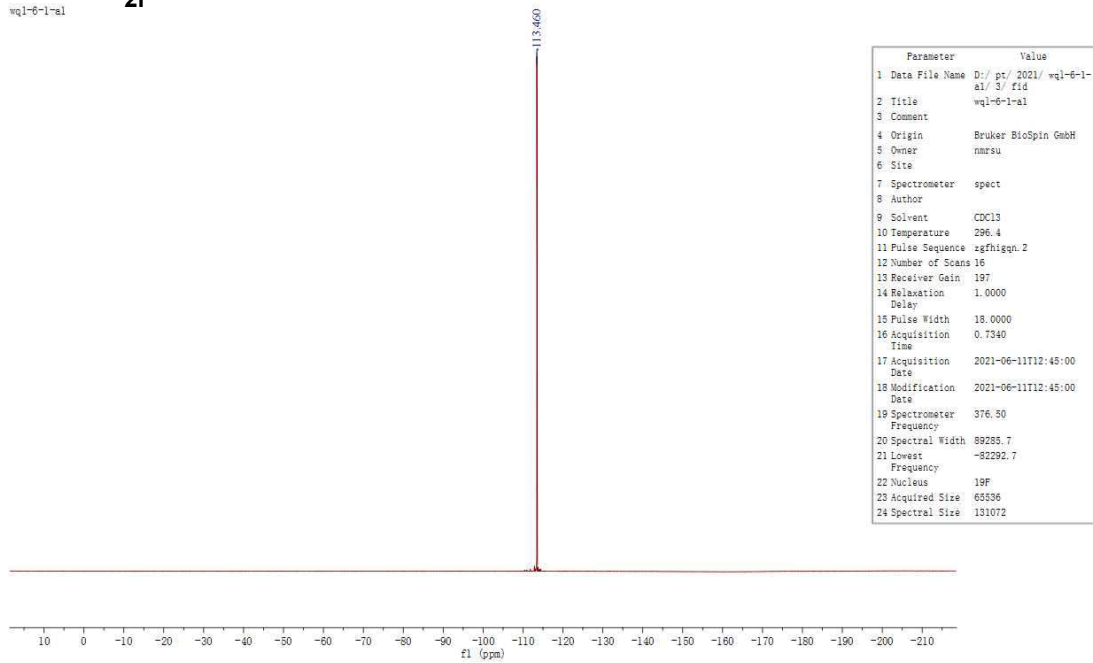
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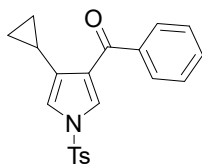




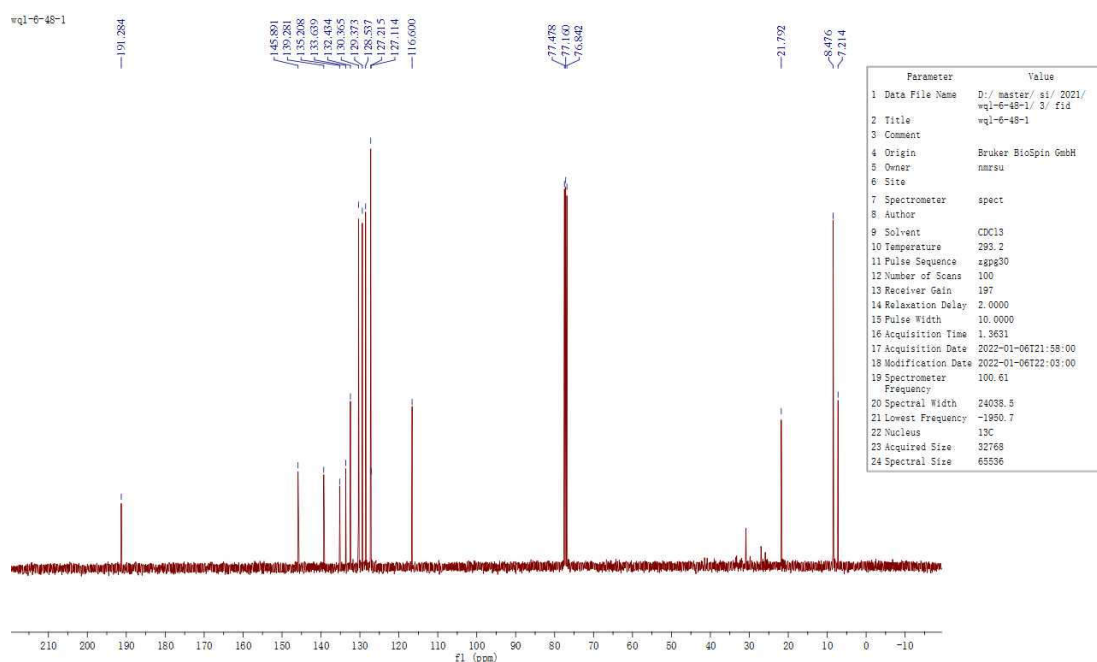
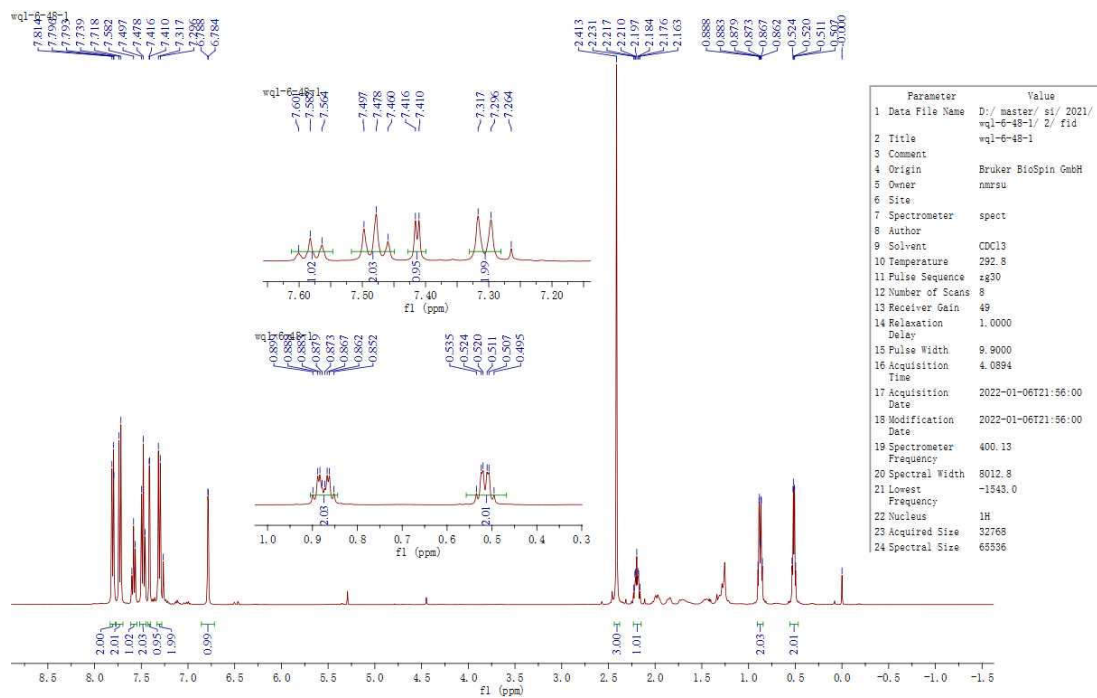
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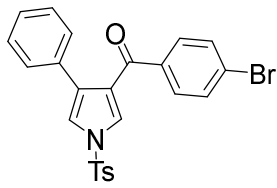
wq1-6-1-a1



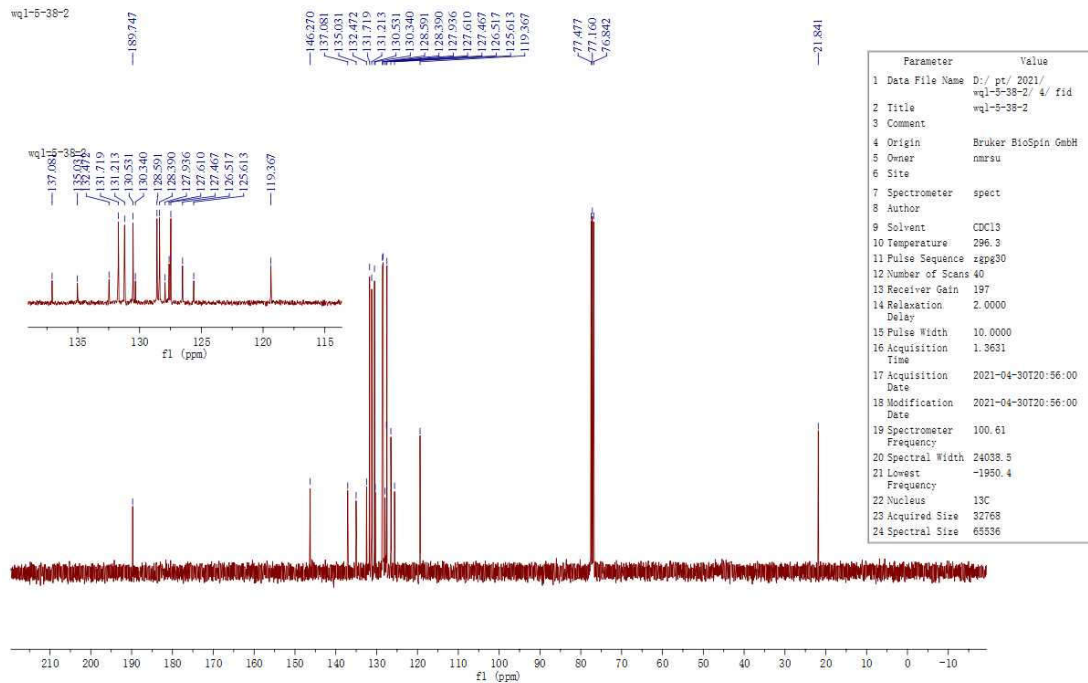
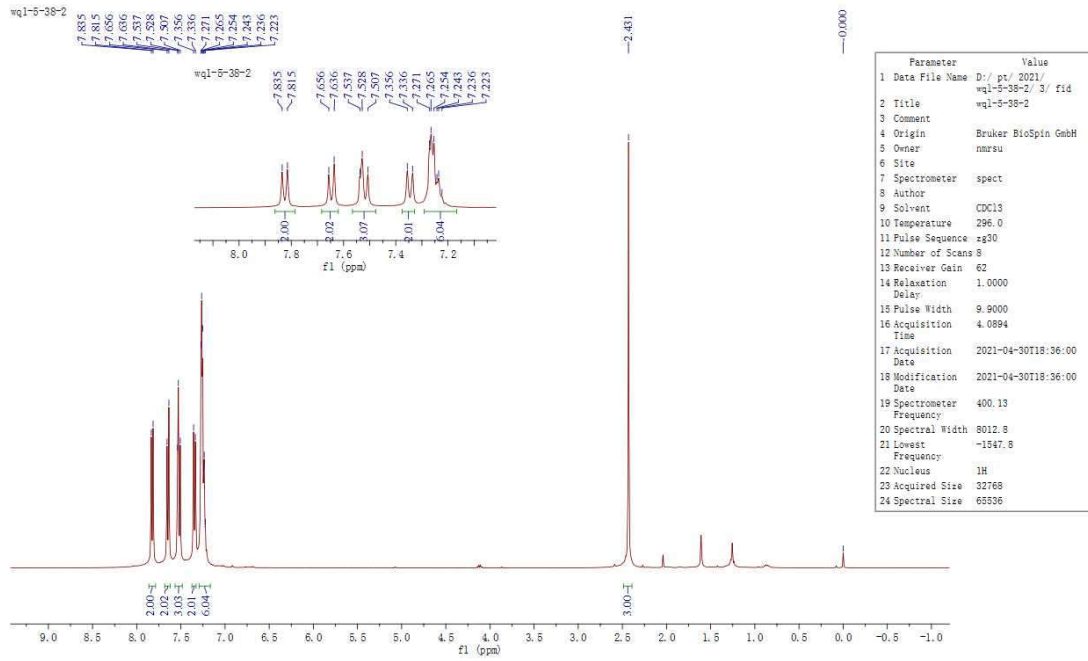


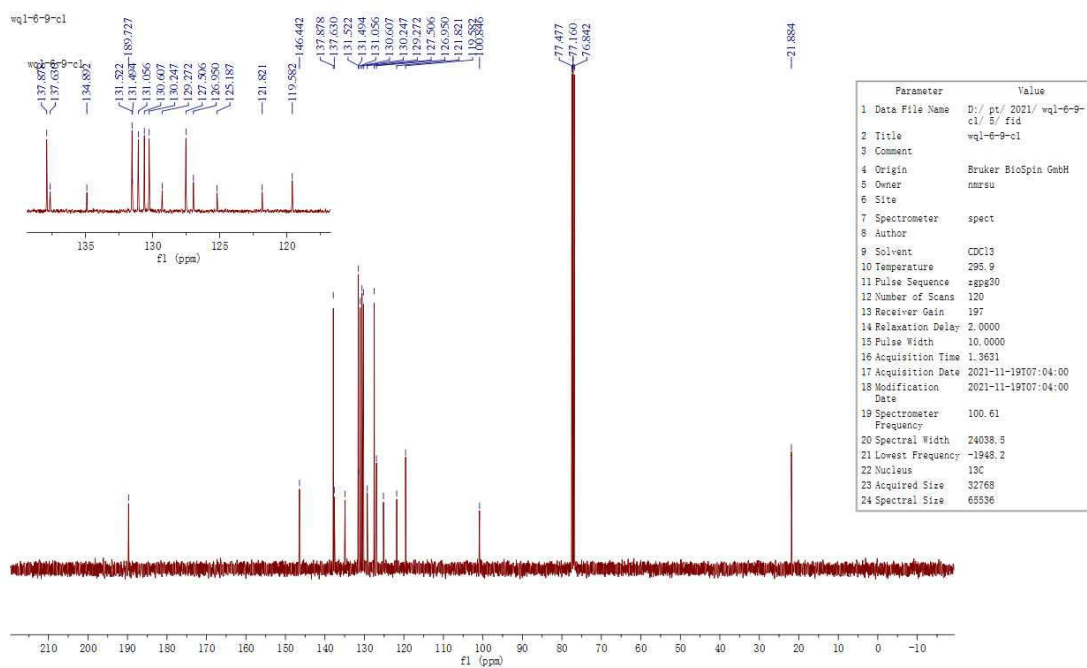
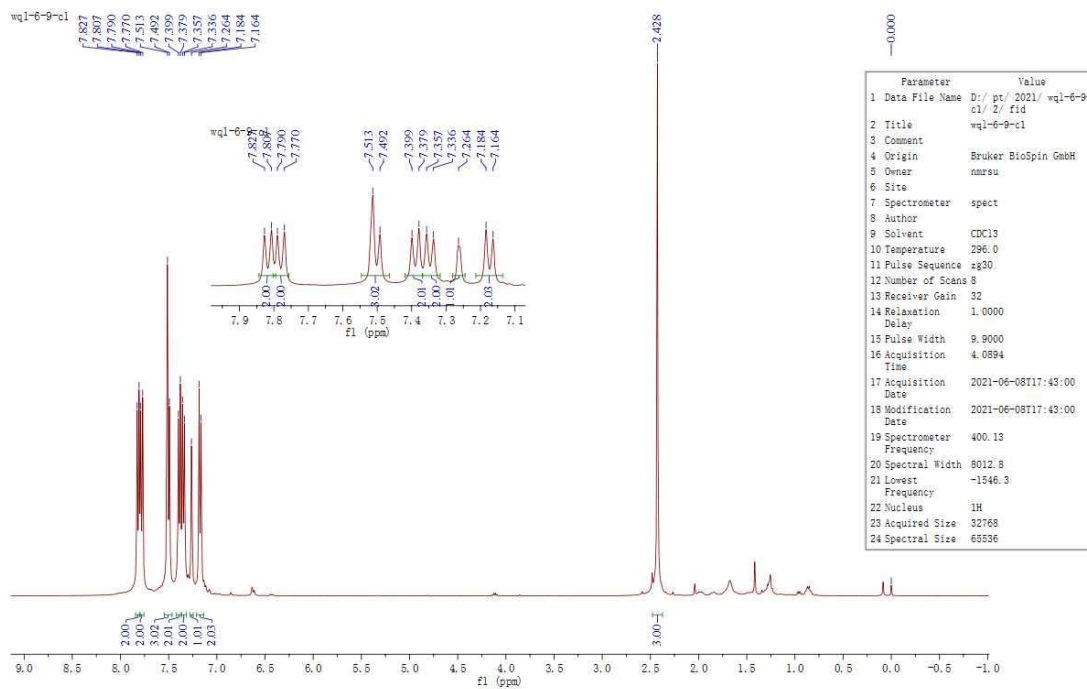
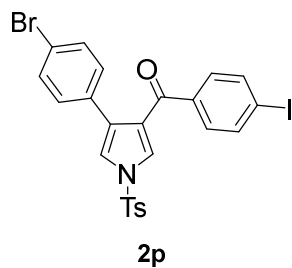
2m

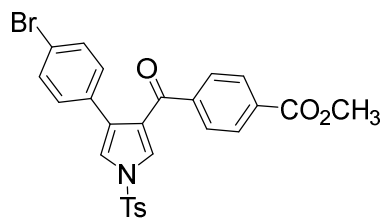




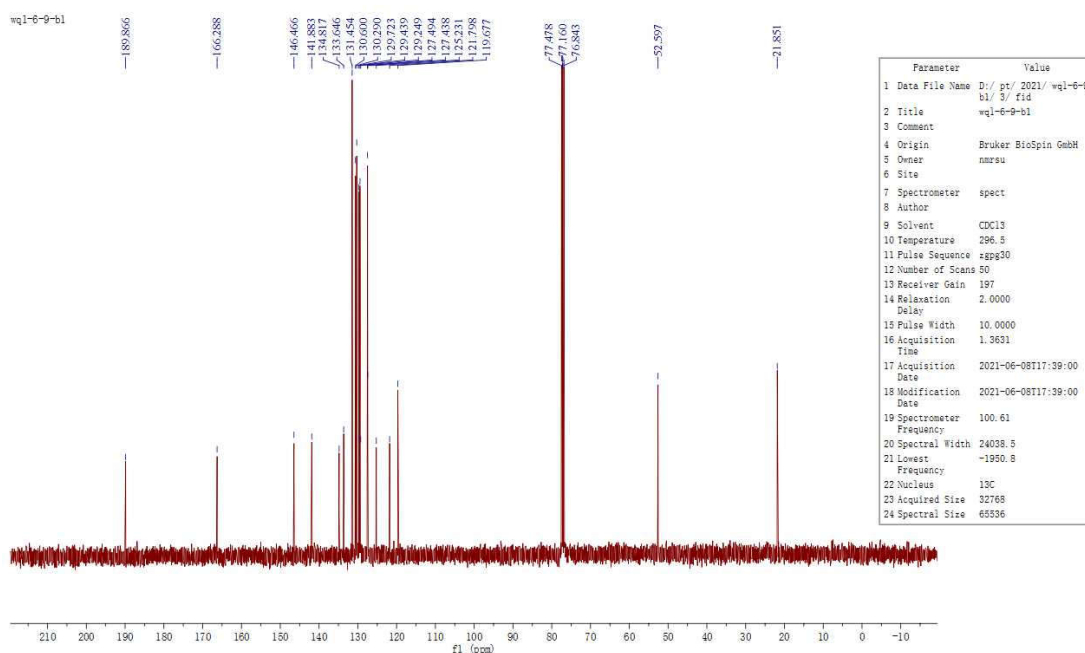
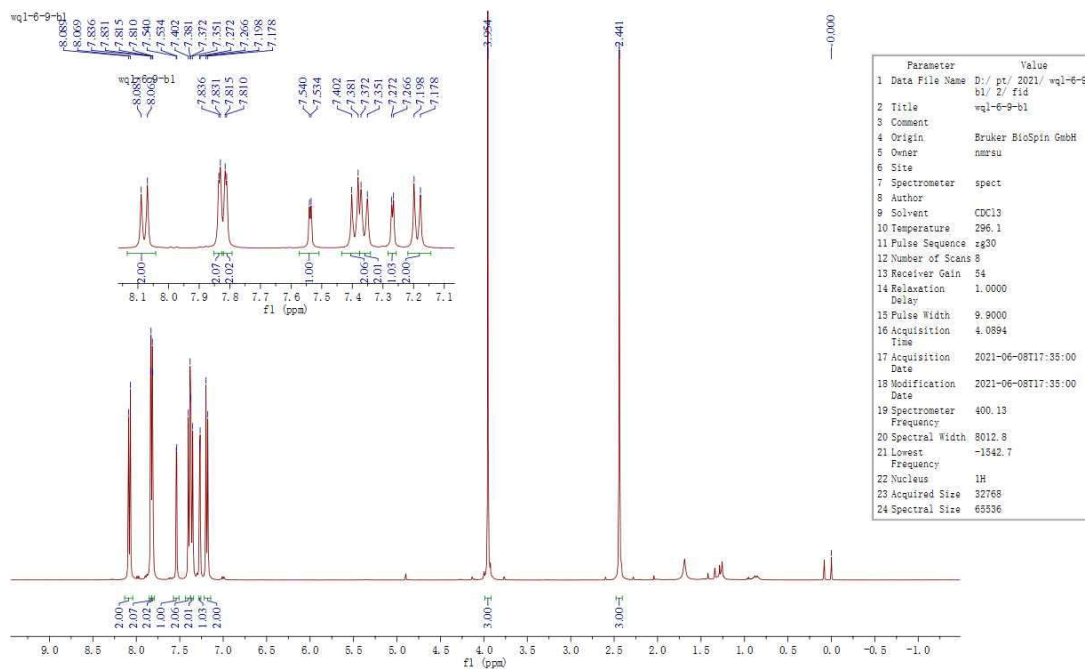
2n

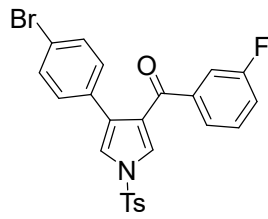




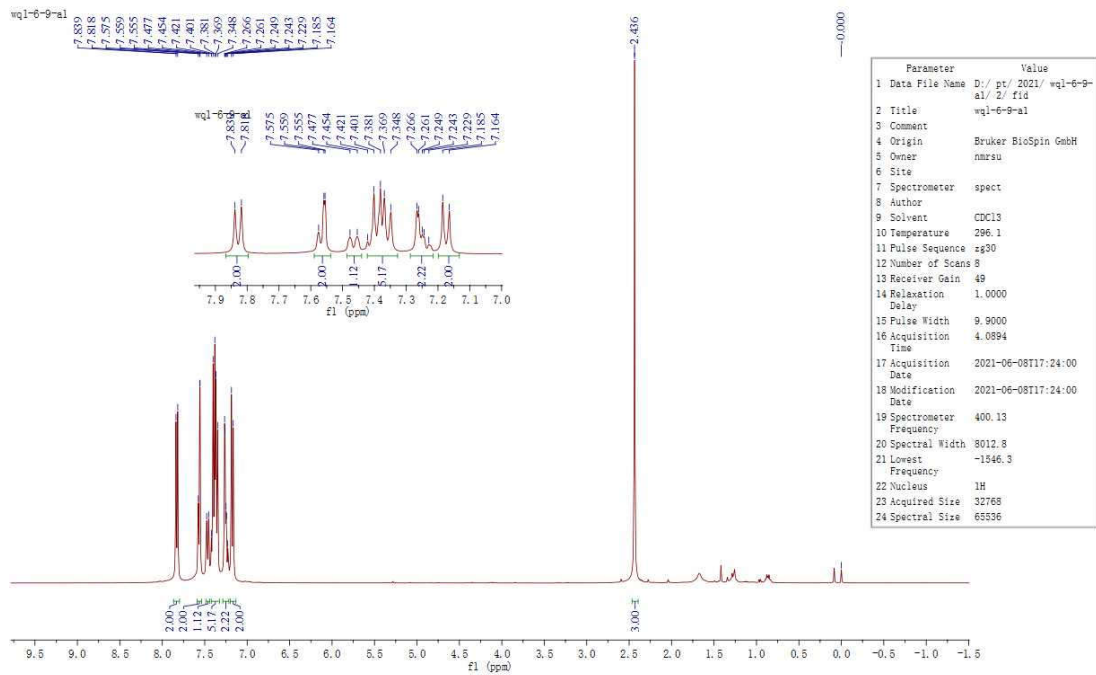


2q

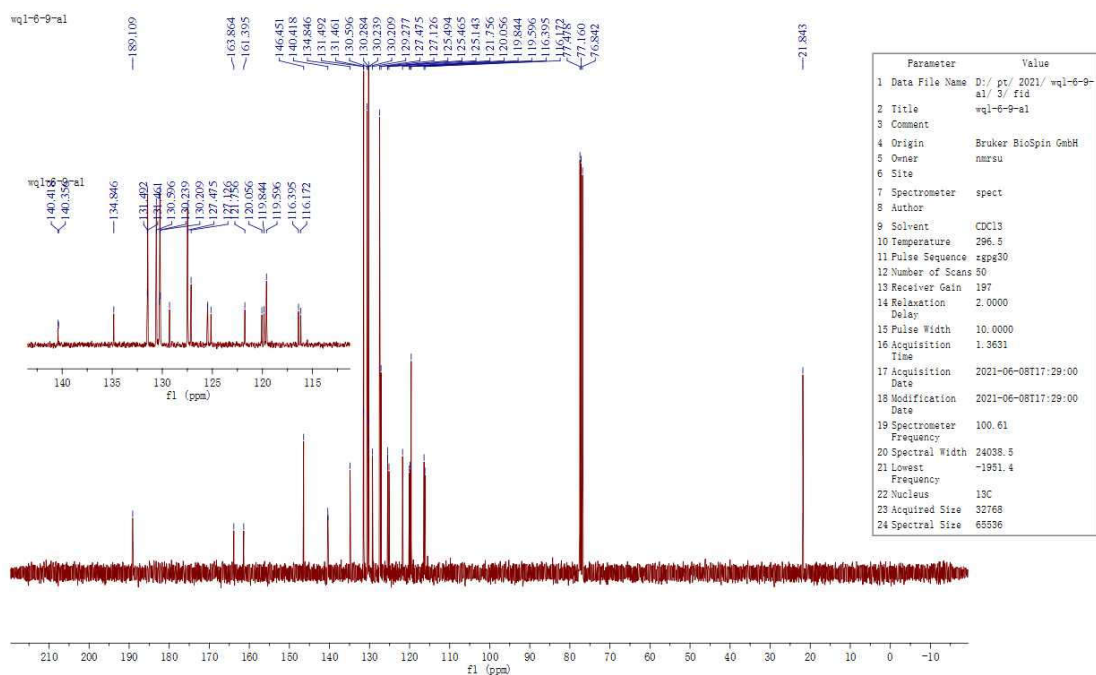




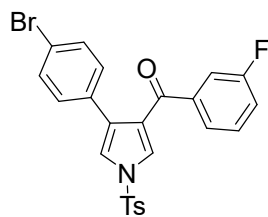
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Parameter	Value
1 Data File Name	D:/pt/2021/wq1-6-9-a1/2/fid
2 Title	wq1-6-9-a1
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	nmsru
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	296.1
11 Pulse Sequence	zg30
12 Number of Scans	8
13 Receiver Gain	49
14 Relaxation Delay	1.0000
15 Pulse Width	9.9000
16 Acquisition Time	4.0894
17 Acquisition Date	2021-06-08T17:24:00
18 Modification Date	2021-06-08T17:24:00
19 Spectrometer Frequency	400.13
20 Spectral Width	8012.8
21 Lowest Frequency	-1546.3
22 Nucleus	1H
23 Acquired Size	32768
24 Spectral Size	65536

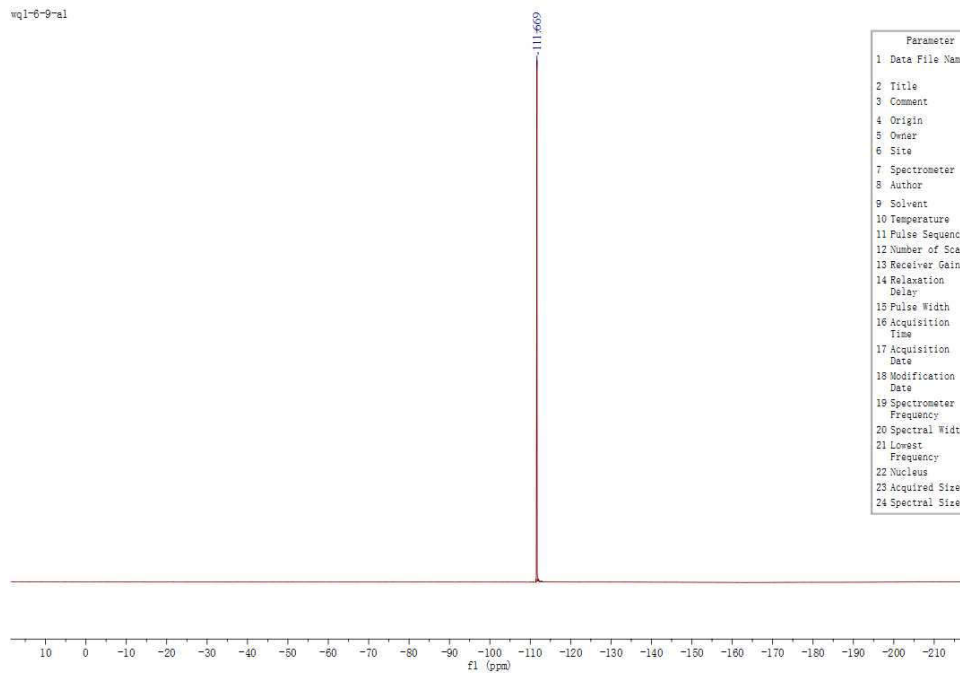


Parameter	Value
1 Data File Name	D:/pt/2021/wq1-6-9-a1/3/fid
2 Title	wq1-6-9-a1
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	nmsru
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	296.5
11 Pulse Sequence	zgpg30
12 Number of Scans	50
13 Receiver Gain	197
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	1.3631
17 Acquisition Date	2021-06-08T17:29:00
18 Modification Date	2021-06-08T17:29:00
19 Spectrometer Frequency	100.61
20 Spectral Width	24038.5
21 Lowest Frequency	-1991.4
22 Nucleus	13C
23 Acquired Size	32768
24 Spectral Size	65536



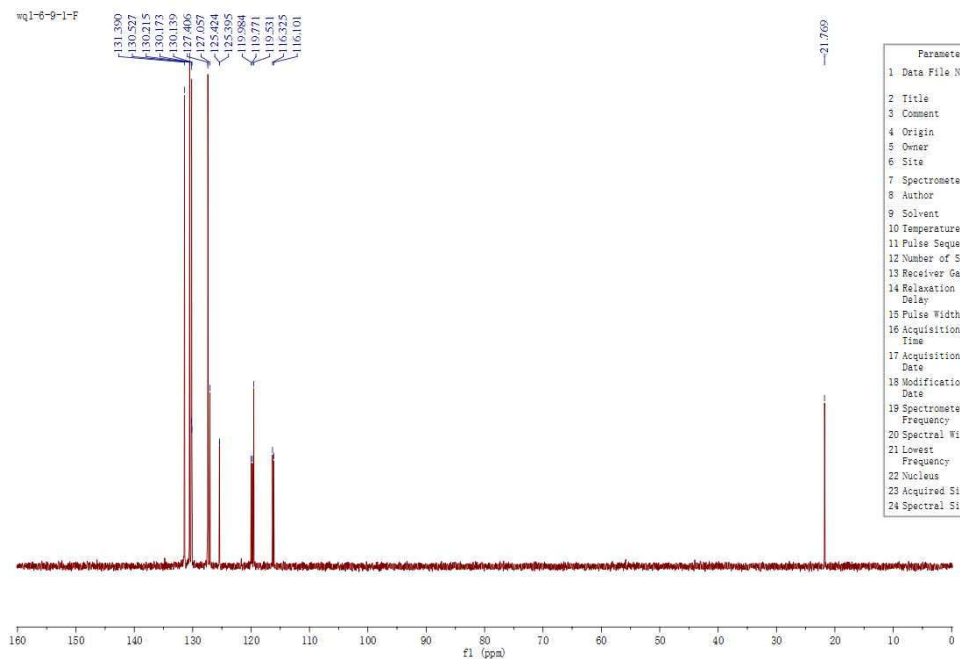
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wq1-6-9-a1

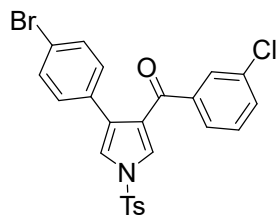


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2 Title	wq1-6-9-a1
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	nmsu
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	296.3
11 Pulse Sequence	zgpg30m.2
12 Number of Scans	16
13 Receiver Gain	197
14 Relaxation Delay	1.0000
15 Pulse Width	18.0000
16 Acquisition Time	0.7340
17 Acquisition Date	2021-06-08T23:55:41
18 Modification Date	2021-06-08T23:55:00
19 Spectrometer Frequency	376.46
20 Spectral Width	89295.7
21 Lowest Frequency	-82292.7
22 Nucleus	1H
23 Acquired Size	65536
24 Spectral Size	131072

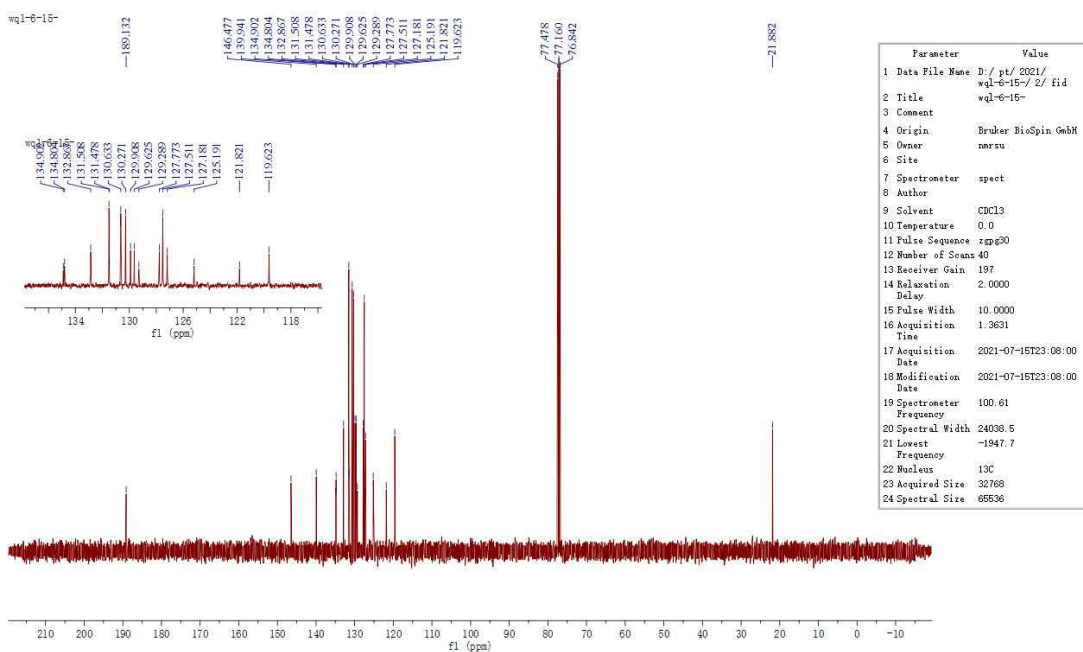
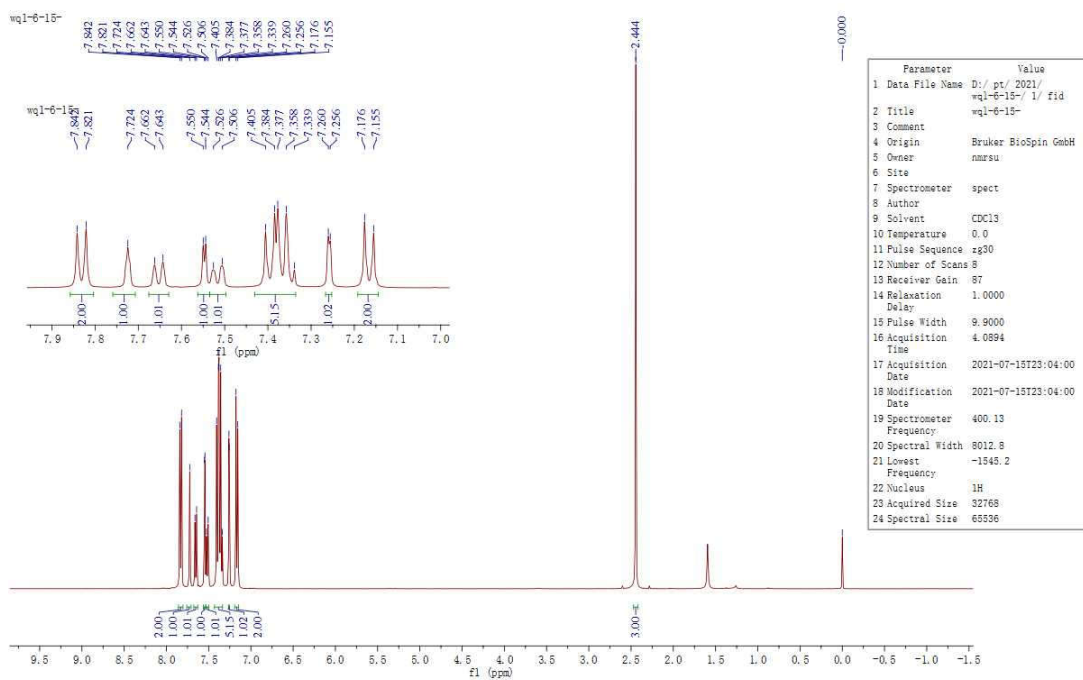
wq1-6-9-1-F

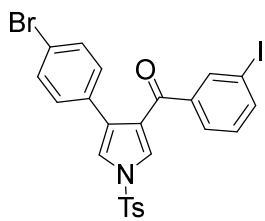


Parameter	Value
1 Data File Name	D:/pt/2021/wq1-6-9-1-F/1/fid
2 Title	wq1-6-9-1-F
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	nmsu
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	297.4
11 Pulse Sequence	deptsq135
12 Number of Scans	81
13 Receiver Gain	197
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	2.0316
17 Acquisition Date	2021-09-15T16:29:00
18 Modification Date	2021-09-15T16:30:00
19 Spectrometer Frequency	100.61
20 Spectral Width	16129.0
21 Lowest Frequency	-16.0
22 Nucleus	13C
23 Acquired Size	32768
24 Spectral Size	65536

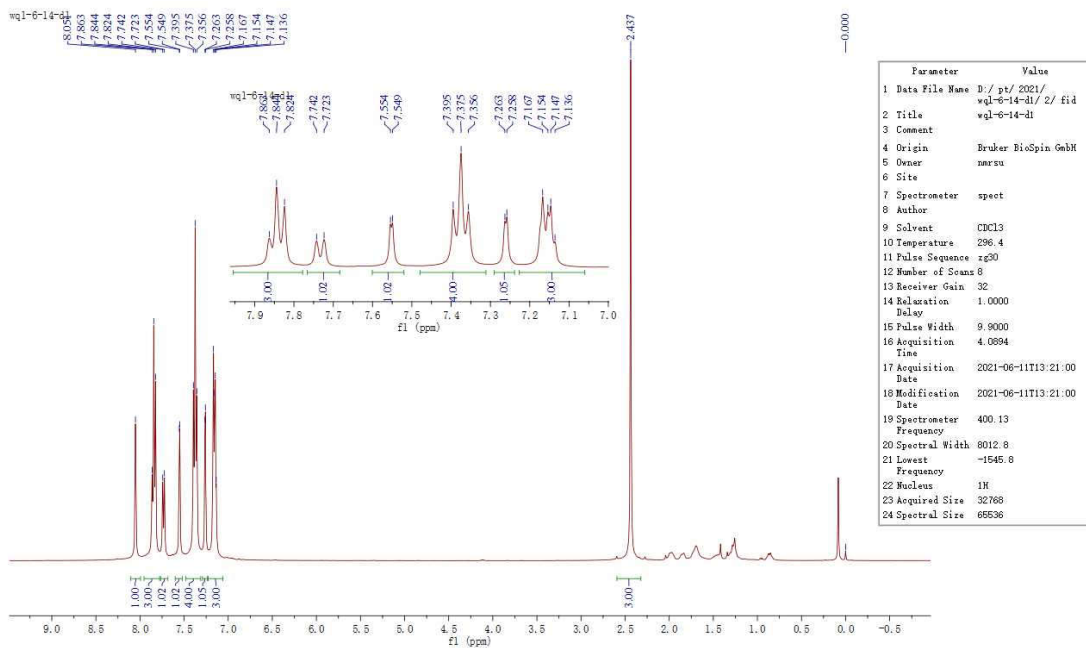


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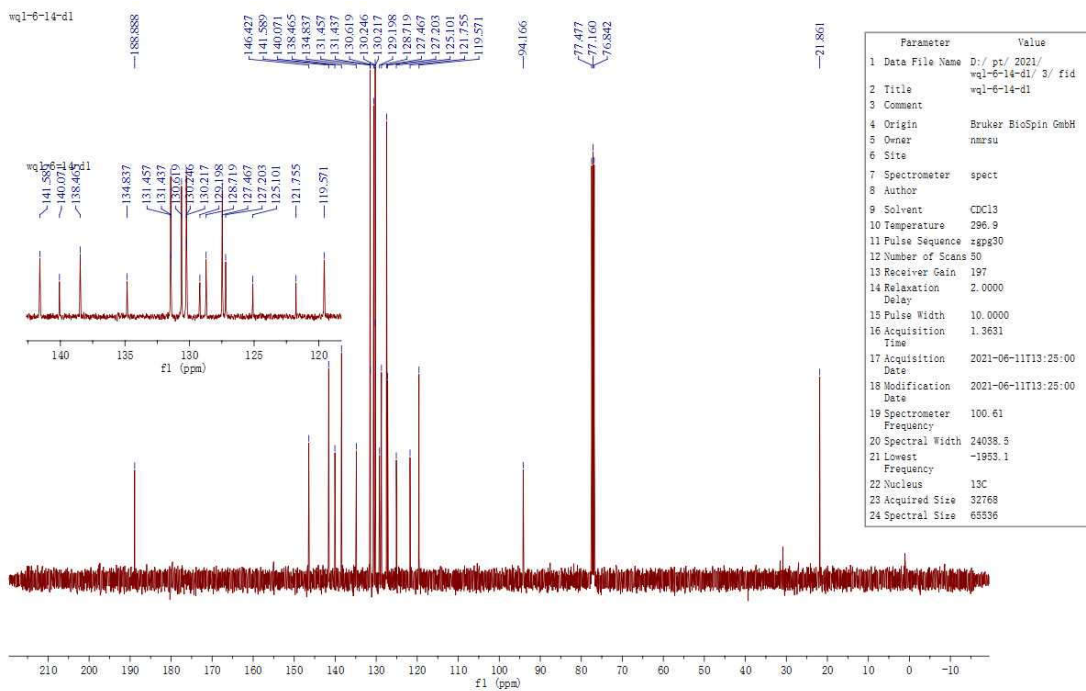




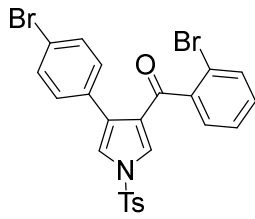
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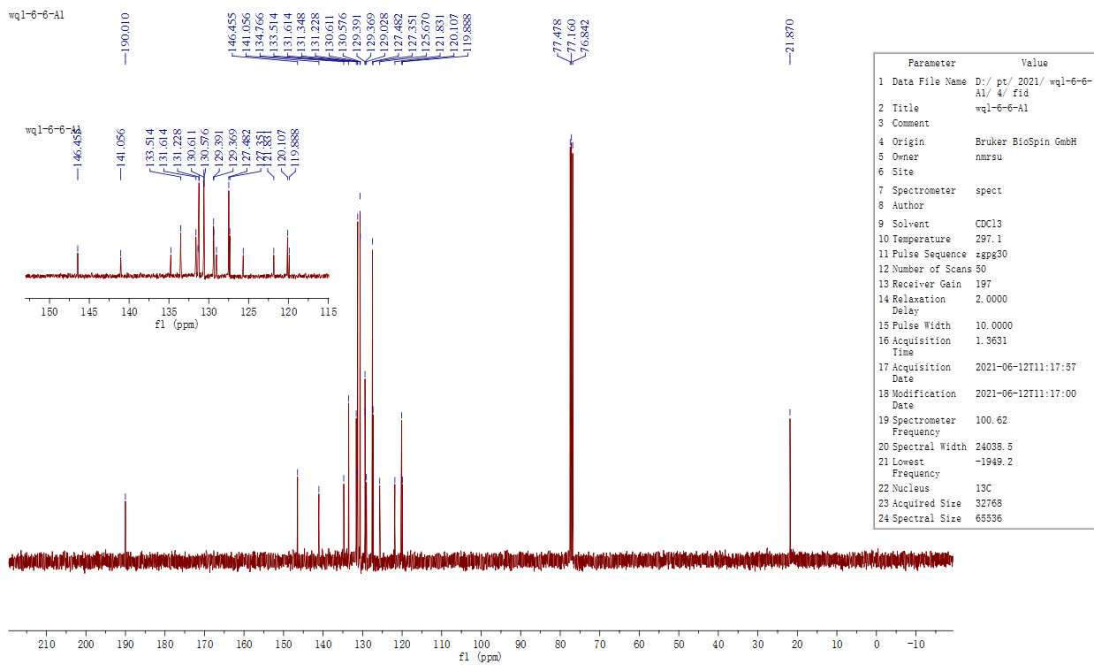
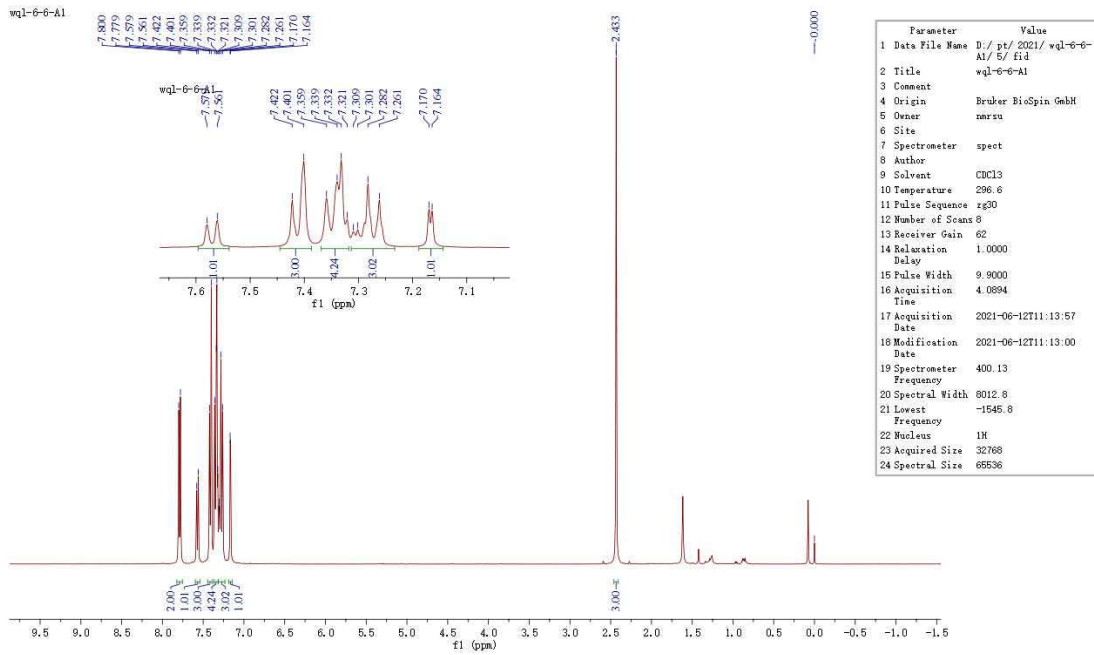
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1 Data File Name	D:/pt/2021/wq1-6-14-d1/2/ f1d
2 Title	wq1-6-14-d1
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	nrsu
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	296.4
11 Pulse Sequence	zg30
12 Number of Scans	8
13 Receiver Gain	32
14 Relaxation	1.0000
15 Delay	
16 Pulse Width	9.9000
17 Acquisition	4.0894
18 Time	
19 Acquisition	2021-06-11T13:21:00
20 Date	
21 Modification	2021-06-11T13:21:00
22 Date	
23 Spectrometer	400.13
24 Frequency	
25 Spectral Width	8012.0
26 Lowest	-1545.0
27 Frequency	
28 Nucleus	1H
29 Acquired Size	32768
30 Spectral Size	65536

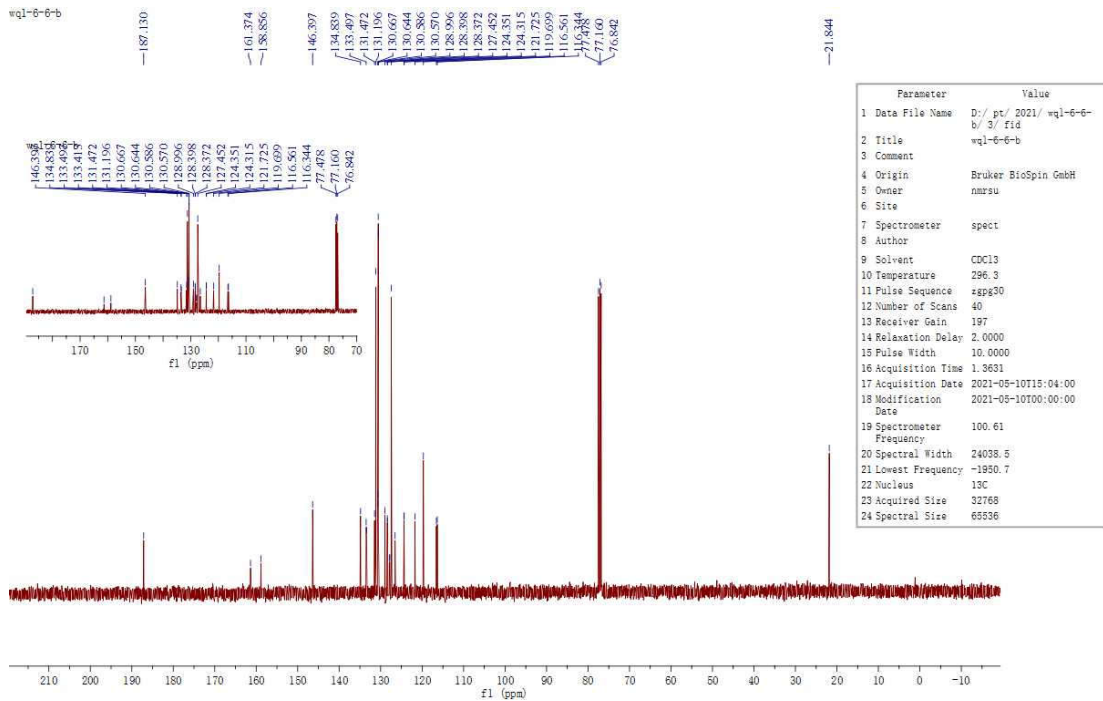
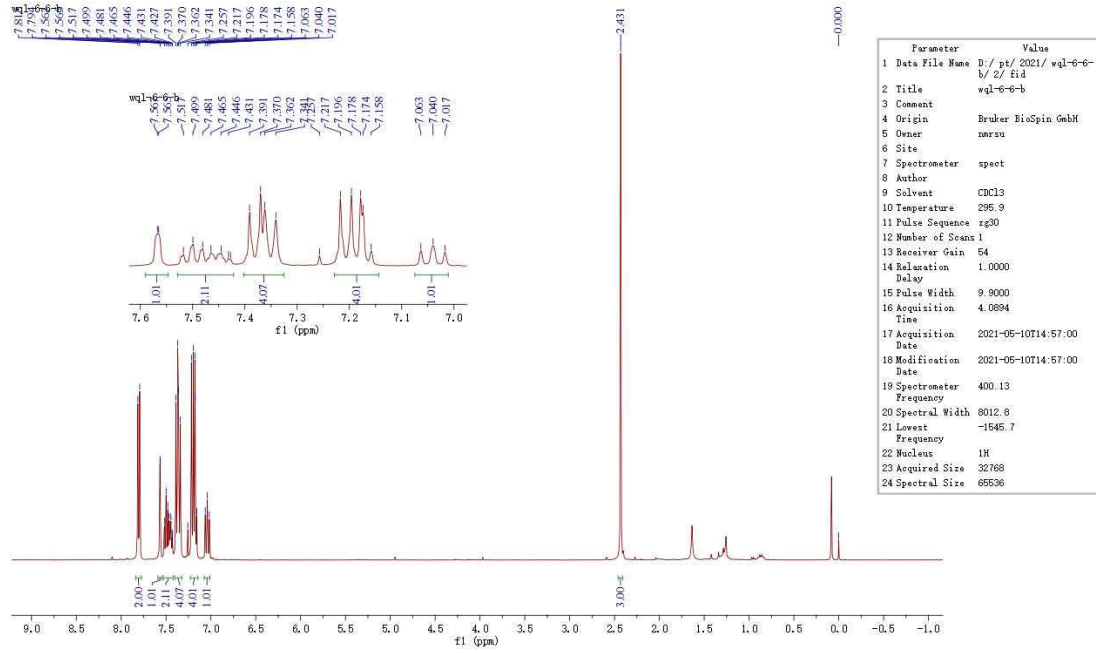
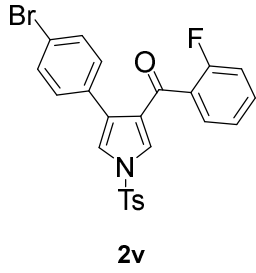


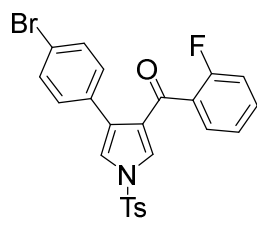
Parameter	Value
1 Data File Name	D:/pt/2021/wq1-6-14-d1/3/ f1d
2 Title	wq1-6-14-d1
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	nrsu
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	296.9
11 Pulse Sequence	zgpg30
12 Number of Scans	80
13 Receiver Gain	197
14 Relaxation	2.0000
15 Delay	
16 Pulse Width	10.0000
17 Acquisition	1.3631
18 Time	
19 Acquisition	2021-06-11T13:25:00
20 Date	
21 Modification	2021-06-11T13:25:00
22 Date	
23 Spectrometer	100.61
24 Frequency	
25 Spectral Width	24038.5
26 Lowest	-1953.1
27 Frequency	
28 Nucleus	13C
29 Acquired Size	32768
30 Spectral Size	65536



2u

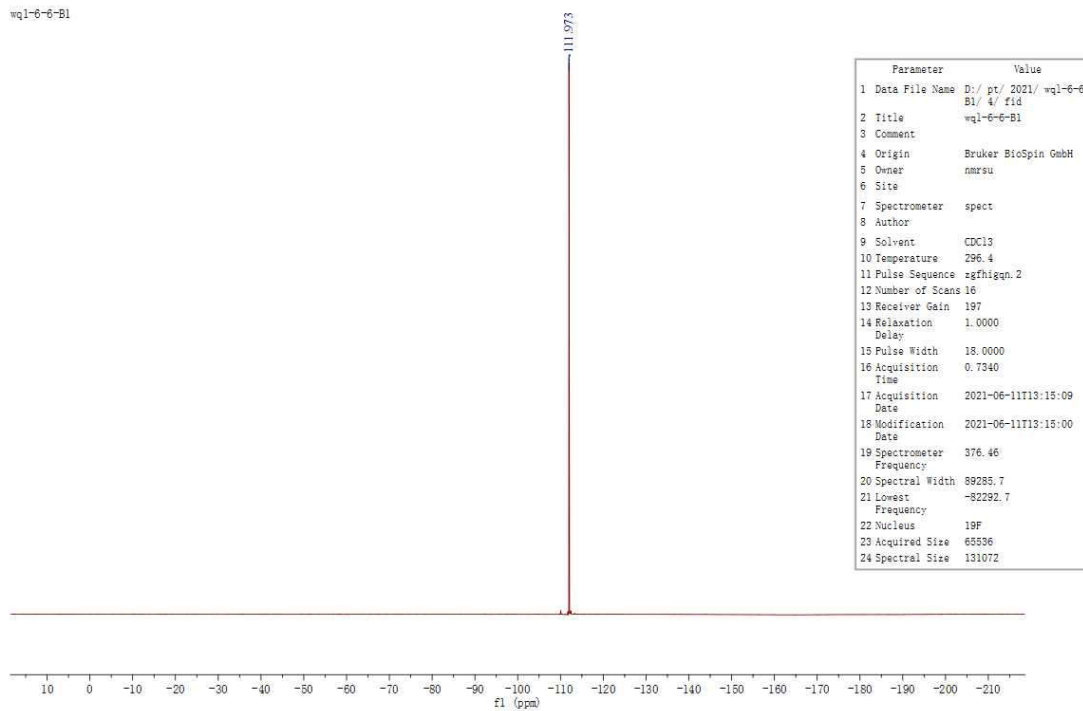




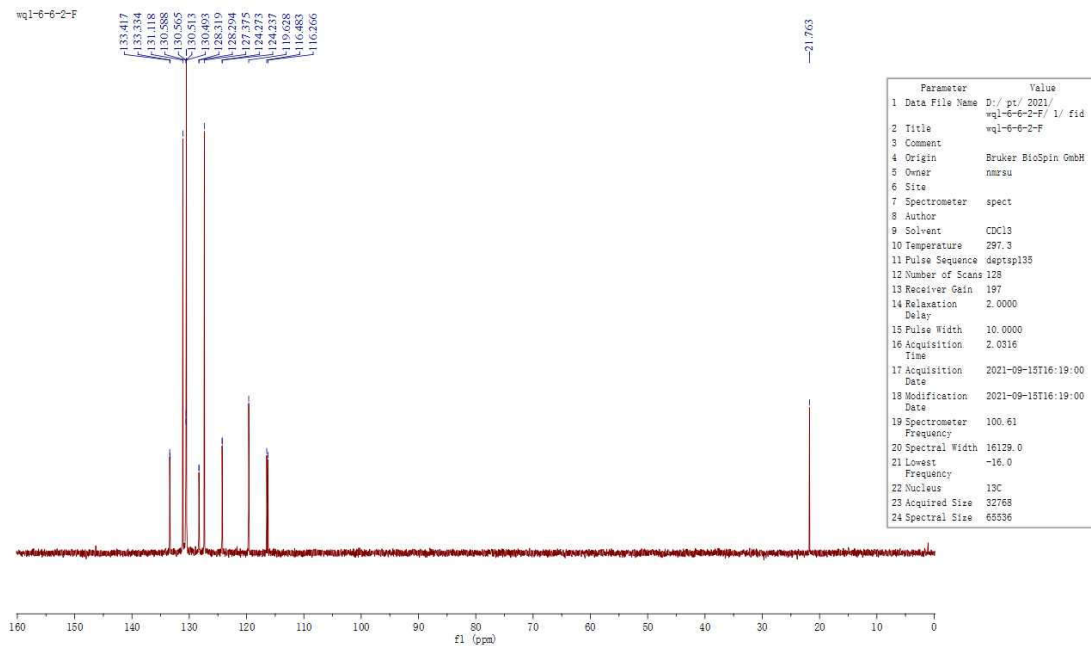


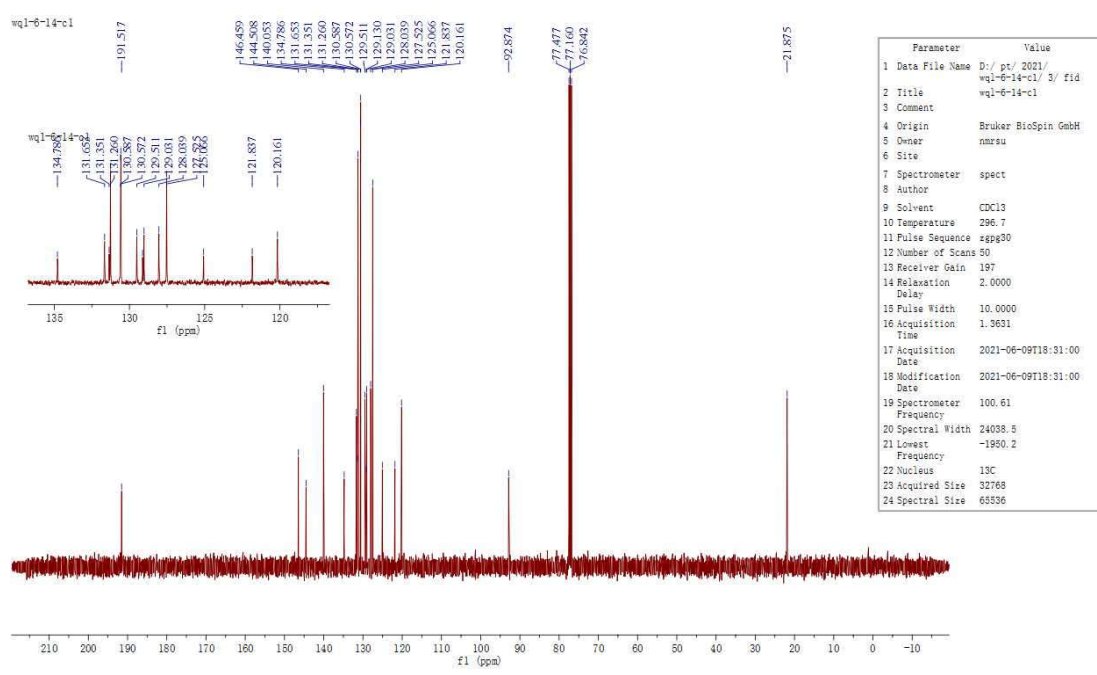
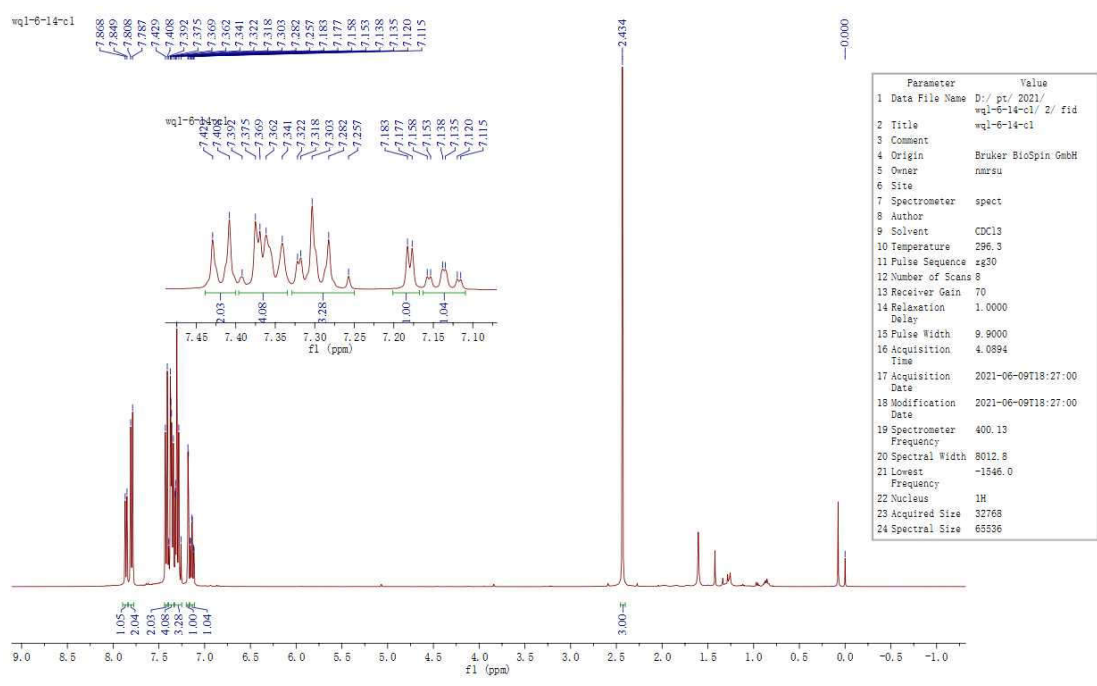
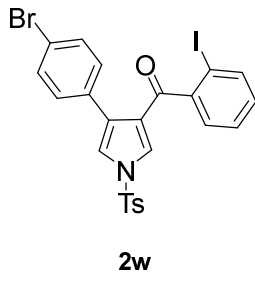
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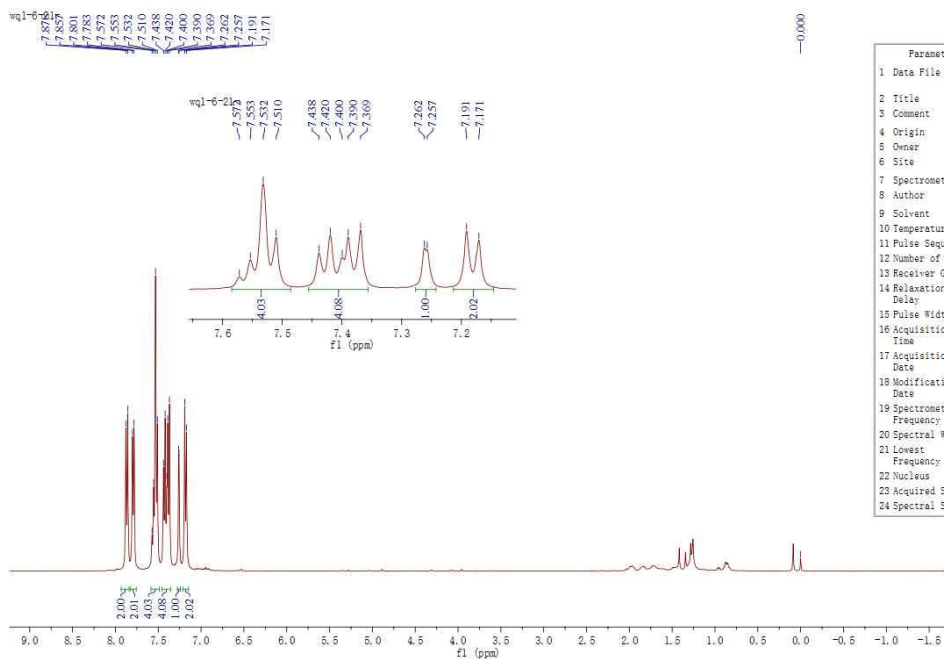
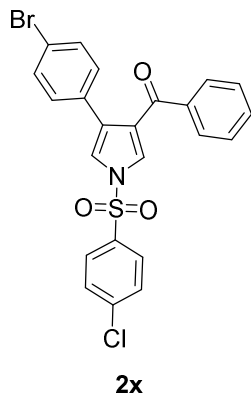
wq1-6-6-B1



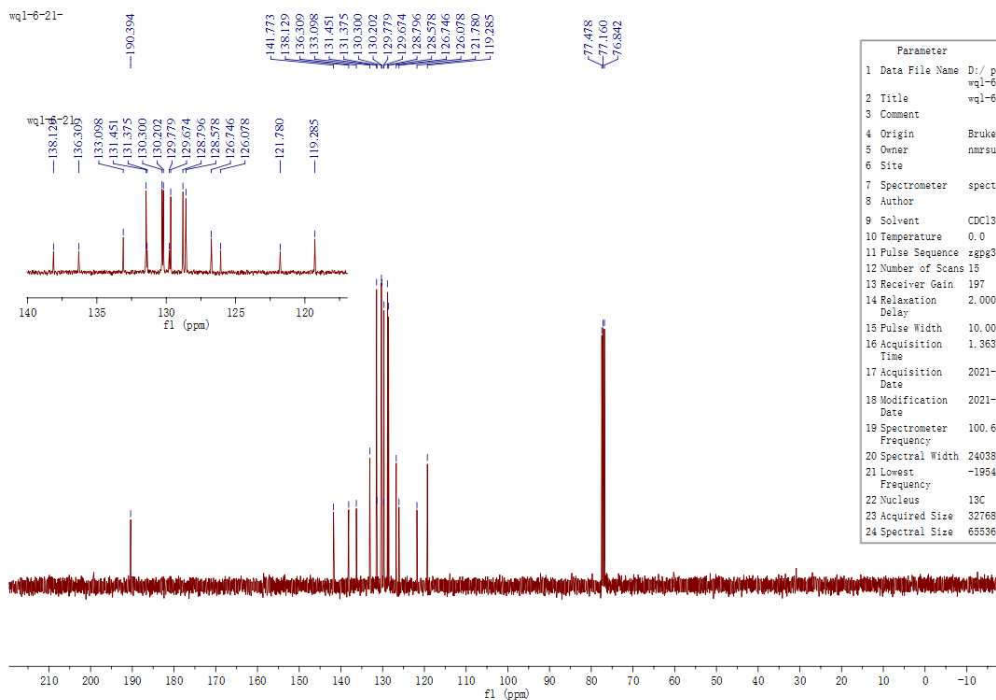
wq1-6-6-2-F







Parameter	Value
1 Data File Name	D:/ pt/ 2021/ wq1-6-21-/ 1/ fid
2 Title	wq1-6-21-
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	nmsu
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	0.0
11 Pulse Sequence	zg30
12 Number of Scans	8
13 Receiver Gain	32
14 Relaxation Delay	1.0000
15 Pulse Width	9.9000
16 Acquisition Time	4.0894
17 Acquisition Date	2021-07-12T21:36:00
18 Modification Date	2021-07-12T21:36:00
19 Spectrometer Frequency	400.13
20 Spectral Width	8012.8
21 Lowest Frequency	-1847.9
22 Nucleus	1H
23 Acquired Size	32768
24 Spectral Size	65536



Parameter	Value
1 Data File Name	D:/ pt/ 2021/ wq1-6-21-/ 2/ fid
2 Title	wq1-6-21-
3 Comment	
4 Origin	Bruker BioSpin GmbH
5 Owner	nmsu
6 Site	
7 Spectrometer	spect
8 Author	
9 Solvent	CDCl3
10 Temperature	0.0
11 Pulse Sequence	zgpg30
12 Number of Scans	15
13 Receiver Gain	197
14 Relaxation Delay	2.0000
15 Pulse Width	10.0000
16 Acquisition Time	1.9631
17 Acquisition Date	2021-07-12T21:37:00
18 Modification Date	2021-07-12T21:38:00
19 Spectrometer Frequency	100.61
20 Spectral Width	24038.5
21 Lowest Frequency	-1954.0
22 Nucleus	13C
23 Acquired Size	32768
24 Spectral Size	65536