Supporting Information

Electrochemical Synthesis of 1,1'-Binaphthalene-2,2'-diamines *via* Transition-metal-free Oxidative Homocoupling

Duona Fan, Md. Imrul Khalid, Ganesh Tatya Kamble, Hiroaki Sasai, and Shinobu Takizawa*

SANKEN, Osaka University, Mihogaoka, Ibaraki-shi, Osaka 567-0047, Japan.

E-mail: taki@sanken.osaka-u.ac.jp

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1. General information

^{1}H- and ^{13}C-NMR spectra were recorded at 25 °C using a JEOL JMN ECS400 FT NMR instrument (^{1}H-NMR 400 MHz; ^{13}C-NMR 100 MHz). The ^{1}H-NMR spectra are reported as follows: chemical shift in ppm downfield of tetramethylsilane and referenced to a residual solvent peak ($CHCl_3$) at 7.26 ppm, integration, multiplicities (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet), and coupling constants (Hz). The ^{13}C-NMR spectra are reported in ppm relative to the central line of the triplet for $CDCl_3$ at 77.16 ppm. ESI-MS spectra were obtained using a JMS-T100LC instrument (JEOL). FT-IR spectra were recorded using a JASCO FT-IR system (FT/IR4100). Thin-layer chromatography (TLC) analysis of the reaction mixture was performed on Merck silica gel 60 F254 TLC plates and visualized under UV light. Column chromatography on SiO_2 was performed using Kanto Silica Gel 60 (63–210 μm). Substrate **1a** is commercially available purchased from Tokyo Chemical Industries (TCI). Other commercially available organic and inorganic compounds were directly used without further purification. All electrochemical oxidative coupling reactions were carried out by using ElectraSyn 2.0 (IKA®) setup (**Figure 1**). With advantages of standard electrodes and accessories, ElectraSyn device avoids deviation and allows better reproducibility.

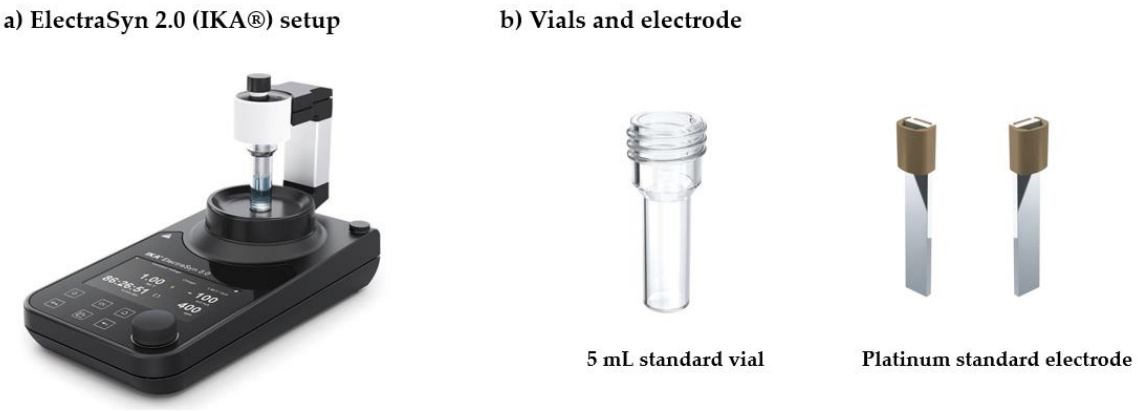


Figure S1. IKA device ElectraSyn 2.0 standard setup

2. Optimization of the reaction conditions

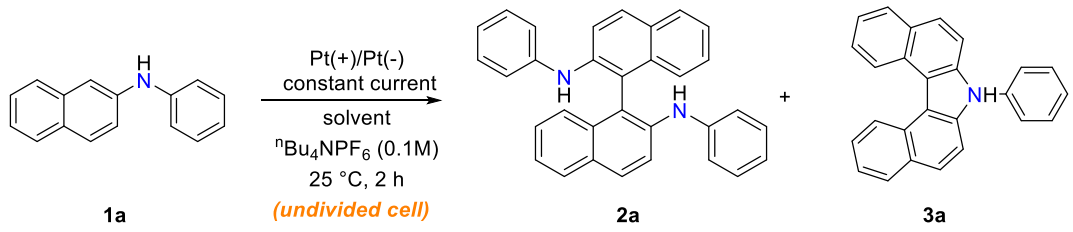


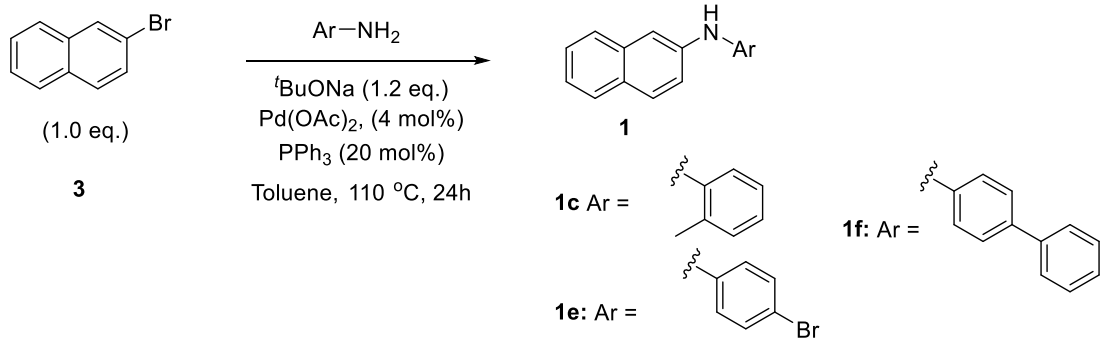
Table S1. Screening solvent of constant current for optimizing reaction conditions.

Entry	Solvent	Constant current (mA)	% Yield[a] (% Current efficiency)	
			2a	3a
1	MeOH	4	10 (7)	5
2	MeCN	4	*No reaction*	
3	Toluene	4	*No Reaction*	
4	HFIP/EtOH 1:1(*v*/*v*)	4	30 (20)	6
5	HFIP	4	98 (66)	-
6	EtOH	4	6 (4)	5
7	HFIP	1	35 (24)	-
8	HFIP	2	60 (40)	-
9	HFIP	3	82 (55)	-
10	HFIP	5	65 (44)	-
11	HFIP	6	49 (22)	-
12	HFIP	8	*Complex mixture*	

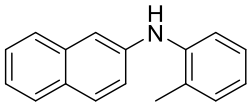
[a] NMR yield using 1,3,5- trimethoxybenzene as internal standard.

3. Experimental procedures

3.1. Synthesis of substrates 1c, 1e, and 1f



N-2-Tolyl-2-naphthylamine (**1c**)



N-2-Tolyl-2-naphthylamine (**1c**) was prepared followed by literature procedure [1]. 2-bromonaphthalene (2.0 g, 10.0 mmol), 2-toluidine (1.0 mL, 12.0 mmol), PPh_3 (0.4 g, 2.0 mmol), and $Pd(OAc)_2$ (0.09 g, 0.04 mmol), and sodium *tert*-butoxide (1.0 g, 10.0 mmol) were added to dry toluene solution (70.0 mL) under N_2 atmosphere. The mixture was stirred for 24 h at 110 °C

until reaction completed. Then the reaction mixture was quenched by water, and was extracted with ethyl acetate (3 times), dried over anhydrous Na_2SO_4, and concentrated under reduced pressure. The residue was purified by column chromatography on silica-gel (hexane/ethyl acetate = 20/1) to give the product **1c** as brown liquid in 95% yield.

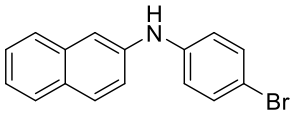
^{1}H-, ^{13}C-NMR, HRMS are in accordance with the reported literature [2].

^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.69 (dd, J = 8.5, 3.4 Hz, 2H), 7.57 (d, J = 8.2 Hz, 1H), 7.37-7.33 (m, 1H), 7.31-7.20 (m, 3H), 7.17-7.12 (m, 3H), 7.00-6.94 (m, 1H), 5.48 (s, 1H), 2.25 (s, 3H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 142.0, 141.2, 134.9, 131.2, 129.3, 129.2, 129.1, 127.8, 127.0, 126.6, 126.6, 123.4, 122.7, 120.0, 119.8, 111.2, 18.1.

HRMS (APCI): calcd for $C_{17}H_{15}N$: *m/z* $[M + H]^+$ 234.1278, found 234.1277.

N-4-Bromophenyl-2-naphthylamine (**1e**)



N-4-Bromophenyl 2-naphthylamine (**1e**) was prepared followed by literature procedure [1]. 2-bromonaphthalene (2.0 g, 10.0 mmol), 4-bromoaniline (2.1 g, 12.0 mmol), PPh_3 (0.4 g, 2.0 mmol), and $Pd(OAc)_2$ (0.09 g, 0.04 mmol), and sodium tert-butoxide (1.0 g, 10.0 mmol) were added to dry toluene solution (70.0 mL) under N_2 atmosphere. The mixture was stirred for 24 h at 110 °C until reaction completed. The reaction mixture was quenched by water, and the product was extracted with ethyl acetate (3 times), dried over anhydrous Na_2SO_4, and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (hexane/ethyl acetate = 20/1) to give the product **1e** as pale white solid in 95% yield.

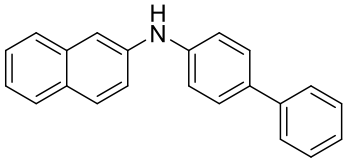
^{1}H-, ^{13}C-NMR, HRMS are in accordance with the reported literature [3].

^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.77-7.75 (m, 2H), 7.66 (d, *J* = 8.5 Hz, 1H), 7.45-7.38 (m, 4H), 7.33 (td, *J* = 7.4, 1.2 Hz, 1H), 7.21 (dd, *J* = 8.5, 2.5 Hz, 1H), 7.03 (dt, *J* = 9.6, 2.5 Hz, 2H), 5.90 (s, 1H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 142.3, 140.2, 134.6, 132.4, 129.5, 129.4, 127.8, 126.7, 126.6, 124.0, 120.2, 119.6, 113.2, 112.5.

HRMS (ESI): calcd for $C_{16}H_{13}BrN$: *m/z* $[M + H]^+$ 298.0226, found 298.0222.

N-([1,1'-Biphenyl]-4-yl)-2-naphthylamine (**1f**)



N-([1,1'-Biphenyl]-4-yl)-2-naphthylamine (**1f**) was prepared according to literature procedure [4] and could afford in quantitative yield as pale yellow solid. A suspension of 2-bromonaphthalene (941 mg, 4.54 mmol), [1,1'-biphenyl]-4-amine (1.0 g, 5.91 mmol), $Pd(OAc)_2$ (30.6 mg, 3.0 mol%), *rac*-BINAP (126.1 mg, 4.5 mol%) and Cs_2CO_3 (2.2 g, 1.5 eq.) in 25 mL dry toluene was refluxed under N_2 atmosphere for 12 h. After cooling, the reaction mixture was then filtered through a short pad of silica gel and the organic solvent was evaporated under reduced pressure. The crude product was then purified by silica column chromatography (hexane/dichloromethane = 3/2) to afford the desired product **1f** as colorless solid in 82% yield.

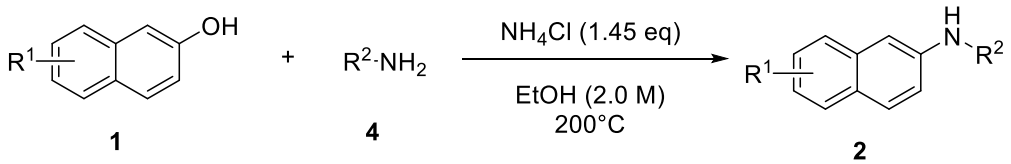
^{1}H-, ^{13}C-NMR, HRMS are in accordance with the reported patent [5].

^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.78-7.75 (m, 2H), 7.68 (d, *J* = 8.2 Hz, 1H), 7.61-7.54 (m, 4H), 7.50 (d, *J* = 2.3 Hz, 1H), 7.45-7.40 (m, 3H), 7.34-7.30 (m, 2H), 7.28 (d, *J* = 2.3 Hz, 1H), 7.25-7.22 (m, 2H), 5.96 (s, 1H)

^{13}C-NMR (100 MHz, $CDCl_3$): δ 142.4, 140.9, 140.6, 134.7, 134.2, 129.3, 128.9, 128.2, 127.8, 126.8, 126.7, 126.6, 126.6, 123.7, 120.2, 118.3, 112.1.

HRMS (APCI) calcd for $C_{22}H_{18}N$: *m/z* $[M+H]^+$ 296.1434, found 296.1429.

3.2. Synthesis of substrate 1d, 1g-1k, and 1p

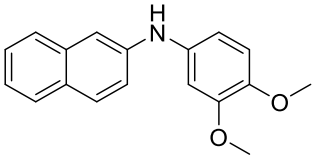


1 **4** **2**

1d: R^1 = H, R^2 = 3,4- OMe- Ph
1g: R^1 = H, R^2 = Me
1h: R^1 = H, R^2 = Et
1i: R^1 = H, R^2 = ^{i}Pr
1j: R^1 = H, R^2 = ^{t}-Bu
1k: R^1 = 7-OMe, R^2 = Ph

2d: R^1 = H, R^2 = 3,4- OMe- Ph
2g: R^1 = H, R^2 = Me
2h: R^1 = H, R^2 = Et
2i: R^1 = H, R^2 = ^{i}Pr
2j: R^1 = H, R^2 = ^{t}-Bu
2k: R^1 = 7-OMe, R^2 = Ph

N-(3,4-Dimethoxyphenyl)-2-naphthylamine (**1d**)



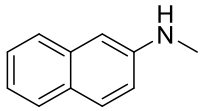
N-(3,4-Dimethoxyphenyl)-2-naphthylamine (**1d**) was prepared according to the literature procedure [1]. In a dry 100 mL steel bomb, 2-naphthol (1.0 g, 6.9 mmol), NH_4Cl (535 mg, 10.0 mmol), and 3,4-dimethoxyaniline (2.1 g, 13.8 mmol) were added, then dissolved in 3.5 mL EtOH, the resulting mixture was heated up to 200 °C and stirred for 16 h. The reaction mixture was quenched with 6N NaOH after reaction completed. Then the mixture was extracted with ethyl acetate, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by silica column chromatography (hexane/ethyl acetate = 6/1) to afford the product **1d** in 39% yield as pale red liquid.

^{1}H-NMR (400 MHz, DMSO-D6): δ 8.10 (s, 1H), 7.67 (t, *J* = 8.6 Hz, 2H), 7.58 (d, *J* = 8.2 Hz, 1H), 7.31-7.26 (m, 2H), 7.17-7.14 (m, 2H), 6.88 (d, *J* = 8.2 Hz, 1H), 6.77 (d, *J* = 2.3 Hz, 1H), 6.72 (dd, *J* = 8.6, 2.3 Hz, 1H), 3.70 (s, 3H), 3.69 (s, 3H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 149.8, 145.1, 142.7, 136.2, 134.9, 129.3, 128.7, 127.7, 126.5, 126.4, 123.1, 119.2, 112.7, 112.3, 109.5, 105.8, 56.4, 56.0.

HRMS (APCI) calcd for $C_{18}H_{17}NO_2$: *m/z* $[M+H]^+$ 280.1332, found 280.1328.

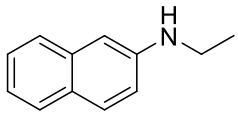
N-methylnaphthalen-2-amine (**1g**)



Compound **1g** was prepared according to the literature procedure [1]. In a dry 100 mL steel bomb, added 2-naphthol (500 mg, 3.47 mmol), ammonium chloride (408.5 mg, 7.6 mmol), methylamine (40% in methanol, 3.) and ethanol (2.0M, 1.8 mL). The reaction mixture was heated up to 200 °C, for 12 h. The reaction was quenched by 6N NaOH after completion. Then filter the residue and extracted with EtOAc, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by silica column chromatography (*n*-Hexane/EtOAc = 20/1) to afford the desired product *N*-methylnaphthalen-2-amine (**1g**) in 80% yield as yellow oil. Analytic data is in accordance with the reported literature [1].

^{1}H NMR (400 MHz, CHLOROFORM-D) *δ* 7.72-7.57 (m, 3H), 7.42-7.36 (m, 1H), 7.21 (td, *J* = 7.4, 1.2 Hz, 1H), 6.89 (dd, *J* = 8.7, 2.3 Hz, 1H), 6.81 (d, *J* = 2.3 Hz, 1H), 3.88 (s, 1H), 2.95 (s, 3H).

N-Ethyl-2-naphthylamine (**1h**)



N-Ethyl-2-naphthylamine (**1h**) was prepared according to the literature procedure [1]. In a dry 100 mL steel bomb, added 2-naphthol (500 mg, 3.47 mmol), ammonium chloride (408.5 mg, 7.6 mmol), ethylamine (2.0 M in methanol, 11.2 mL) and ethanol (2.0M, 1.8 mL). The reaction mixture was heated up to 200 °C, for 16 h. The reaction was quenched by 6N NaOH after the completion. Then

filter the residue and extracted with ethyl acetate, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by silica column chromatography (hexane/ethyl acetate = 20/1) to afford the product **1h** in 80% yield as brown oil.

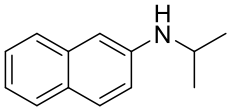
^{1}H-, ^{13}C-NMR, HRMS are in accordance with the reported literature [5].

^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.67 (d, *J* = 8.4 Hz, 1H), 7.62 (d, *J* = 8.4 Hz, 2H), 7.38-7.34 (m, 1H), 7.21-7.17 (m, 1H), 6.86 (m, 1H), 6.80 (d, *J* = 1.8 Hz, 1H), 3.26 (q, *J* = 7.2 Hz, 2H), 1.32 (t, *J* = 7.2 Hz, 3H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 146.2, 135.4, 129.0, 127.8, 127.6, 126.4, 126.0, 122.0, 118.1, 104.4, 38.6, 14.9.

HRMS (APCI): calcd for $C_{12}H_{13}N$: *m/z* $[M + H]^+$ 172.1121, found 172.1118.

N-Isopropyl-2-naphthylamine (**1i**)



N-Isopropyl-2-naphthylamine (**1i**) was prepared according to the literature procedure [1]. In a dry 100 mL steel bomb, 2-naphthol (1.0 g, 6.9 mmol), NH_4Cl (505 mg, 10 mmol), and isopropyl amine (17.8 mL) were dissolved in EtOH (2.0 M, 3.5 mL), the resulting mixture was heated up to 200 °C, for 16 h. The reaction mixture was evaporated under reduced pressure to remove excess isopropyl amine, then wash with 6N NaOH, and extracted with ethyl acetate, dried over Na_2SO_4, and concentrated the organic layer under reduced pressure. The residue was purified by silica column chromatography (hexane/ethyl acetate = 10/1) to afford the product **1i** in 90% yield as light brown liquid.

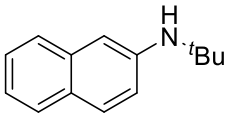
^{1}H-, ^{13}C-NMR, HRMS are in accordance with the reported literature [1].

^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.77 (d, *J* = 8.1 Hz, 1H), 7.73-7.71 (m, 2H), 7.47 (dd, *J* = 8.1, 7.8 Hz, 1H), 7.30 (dd, *J* = 8.1, 7.8 Hz, 1H), 6.93-6.90 (m, 2H), 3.85 (sept, *J* = 6.3 Hz, 1H), 3.70 (brs, 1H), 1.36 (d, *J* = 6.3 Hz, 6H)

^{13}C-NMR (100 MHz, $CDCl_3$): δ 144.9, 135.3, 129.1, 127.7, 127.5, 126.4, 126.0, 122.0, 118.5, 105.4, 44.6, 22.9

HRMS (APCI): calcd for $C_{13}H_{16}N$: *m/z* $[M + H]^+$ 186.1277, found 186.1276.

N-(tert-butyl)naphthalen-2-amine (**1j**)

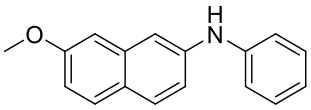


N-(tert-butyl)naphthalen-2-amine (**1j**) was prepared followed by literature procedure [1]. 2-bromonaphthalene (2.0 g, 10.0 mmol), *tert*-butylamine (1.3 mL, 12.0 mmol), PPh_3 (0.4 g, 2.0 mmol), and $Pd(OAc)_2$ (0.09 g, 0.04 mmol), and sodium *tert*-butoxide (1.0 g, 10.0 mmol) were added to dry toluene solution (70.0 mL) under N_2 atmosphere. The mixture was stirred for 24 h at 110 °C until reaction completed. Then the reaction mixture was quenched by water and was extracted with ethyl acetate (3 times), dried over anhydrous Na_2SO_4, and concentrated under reduced pressure. The residue was purified by column chromatography on silica-gel (hexane/ethyl acetate = 20/1) to give the product **1j** as brown liquid in 75% yield.

^{1}H NMR (400 MHz, CHLOROFORM-D) *δ* 7.66 (d, *J* = 8.2 Hz, 1H), 7.61 (d, *J* = 8.7 Hz, 2H), 7.35 (t, *J* = 7.6 Hz, 1H), 7.20 (t, *J* = 7.6 Hz, 1H), 7.04 (d, *J* = 1.8 Hz, 1H), 6.90 (dd, *J* = 8.7, 2.3 Hz, 1H), 1.42 (s, 9H).

N-Phenyl-7-methoxy-2-naphthylamine (**1k**)

N-Phenyl-7-methoxy-2-naphthylamine (**1k**) was prepared followed by literature procedure [1]. In a dry 100 mL steel bomb, 7-methoxynaphthalen-2-ol (174 mg, 1.0 mmol), NH_4Cl (77.8 mg, 1.45 mmol), and aniline (2.8 mL, 31.5 mmol) were added, then dissolved in 2 mL EtOH, the resulting mixture was heated up to 200 °C and stirred for 16 h. The reaction mixture was quenched with 6N NaOH after reaction completed. Then the mixture was extracted with ethyl acetate, dried over Na_2SO_4,



and concentrated under reduced pressure. The residue was purified by silica column chromatography (*n*-hexane/ethyl acetate = 10/1) to afford the product **1k** in 60% yield as pale white solid.

^{1}H-, ^{13}C-NMR, HRMS are in accordance with the reported literature [6]

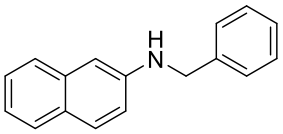
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.63 (dd, *J* = 12.8, 9.2 Hz, 2H), 7.34-7.28 (m, 3H), 7.17-7.15 (m, 2H), 7.06 (dd, *J* = 8.7, 2.3 Hz, 1H), 6.99-6.94 (m, 3H), 5.85 (s, 1H), 3.88 (s, 3H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 158.3, 142.9, 141.6, 136.0, 129.5, 129.2, 129.1, 124.6, 121.5, 118.6, 117.6, 116.2, 110.7, 104.8, 55.3.

HRMS (APCI) calcd for $C_{17}H_{16}NO$: *m/z* $[M+H]^+$ 250.1227, found 250.1226.

IR (KBr): 3393, 2995, 2969, 1631, 1505, 1463, 1308, 1219, 1028, 843, 748 cm^{-1}

N-Benzyl-2-naphthylamine (**1p**)



N-Benzyl-2-naphthylamine (**1p**) was prepared followed by literature procedure [1]. In a dry 100 mL steel bomb, 2-naphthol (2.88 g, 20.0 mmol), NH_4Cl (2.4 g, 22.0 mmol), and benzylamine (40 mL) were dissolved in EtOH (2.0 M, 5.0 mL), the resulting mixture was heated up to 200 °C, for 16 h. The reaction mixture was quenched with 6N NaOH after the reaction completed. Then the mixture was extracted with ethyl acetate, dried over Na_2SO_4, and concentrated under reduced pressure. The residue was purified by silica column chromatography (hexane/ethyl acetate = 10/1) to afford the product **1p** in 30% yield as pale yellow solid.

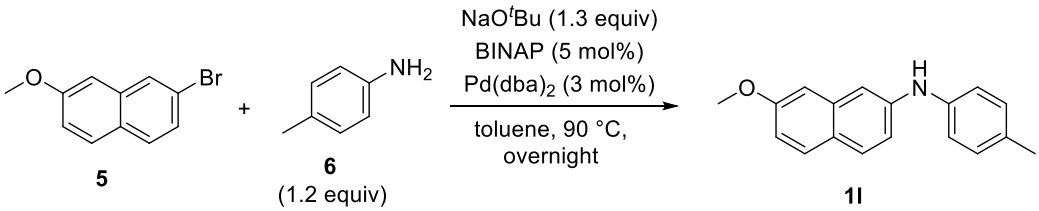
^{1}H-, ^{13}C-NMR, HRMS are in accordance with the reported literature [7].

^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.68-7.58 (m, 3H), 7.42 (d, *J* = 7.4 Hz, 2H), 7.38-7.28 (m, 4H), 7.20 (td, *J* = 7.4, 1.2 Hz, 1H), 6.93 (dd, *J* = 8.7, 2.5 Hz, 1H), 6.84 (d, *J* = 2.5 Hz, 1H), 4.45 (s, 2H), 4.20 (s, 1H).

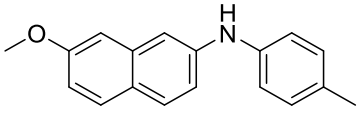
^{13}C-NMR (100 MHz, $CDCl_3$): δ 145.6, 139.1, 135.2, 129.1, 128.8, 128.8, 127.8, 127.7, 127.5, 126.4, 126.1, 122.2, 118.0, 105.0, 48.6.

HRMS (APCI) calcd for $C_{17}H_{16}N$: *m/z* $[M+H]^+$ 234.1277, found 234.1276.

3.3. Synthesis of substrates 1l-n



N-4-Tolyl-7-methoxy-2-naphthylamine (**1l**)



A toluene solution (30 mL) of 2-bromo-7-methoxynaphthalene (**5**) (30 mmol), 4-toluidine (**6**) (3.8 g, 36 mmol), $Pd(dba)_2$ (3 mol%), *rac*-BINAP (5 mol%), and NaO^{t}Bu (4.5 g, 40 mmol) was stirred at 90 °C under N_2 atmosphere. After stirring for 12 h, the reaction mixture was filtered. Then the filtrate was directly purified on silica gel (*n*-hexane/ethyl acetate = 10/1) to give **1l** (70% yield) as a white solid.

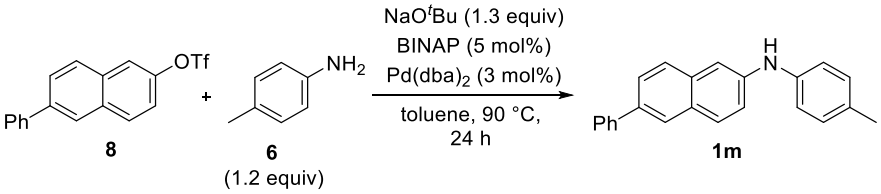
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.60-7.65 (m, 2H), 7.26 (d, *J* = 2.3 Hz, 1H), 7.14 (d, *J* = 8.5 Hz, 2H), 7.10 (d, *J* = 8.5 Hz,

2H), 7.02 (dd, *J* = 8.5, 2.3 Hz, 1H), 6.93-6.96 (m, 2H), 5.75 (s, 1H), 3.89 (s, 3H), 2.34 (s, 3H).

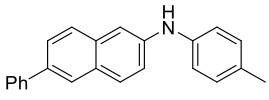
^{13}C-NMR (100 MHz, $CDCl_3$): δ 158.4, 142.5, 140.2, 136.1, 131.6, 130.1, 129.3, 129.1, 124.4, 119.7, 117.2, 115.9, 109.5, 104.8, 55.4, 20.9.

HRMS (APCI): calcd for $C_{18}H_{18}NO$: *m/z* 264.1383 $[M + H]^+$, found 264.1378.

IR (KBr): 3387, 3027, 2998, 2922, 2861, 1631, 1514, 1214, 1030, 817 cm^{-1}.



6-Phenyl-*N*-(*p*-tolyl)naphthalen-2-amine (**1m**)



A coupling of **1m** was performed following the same procedures used as that of **1l**.

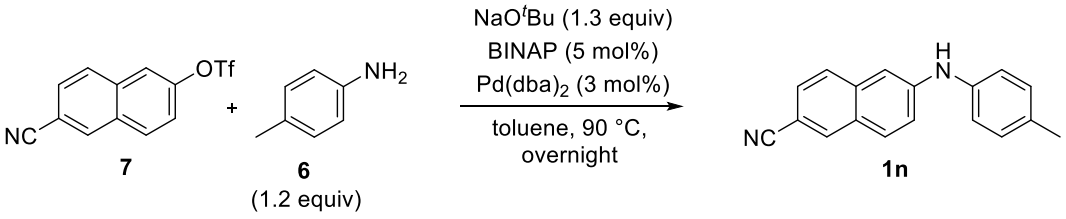
1m (51% yield): a white solid.

^{1}H NMR (400 MHz, $CDCl_3$): *δ* 7.93 (s, 1H), 7.78 (d, *J* = 9.2 Hz, 1H), 7.67-7.71 (m, 4H), 7.47 (ddd, *J* = 7.8, 7.3, 1.4 Hz, 2H), 7.38 (d, *J* = 2.3 Hz, 1H), 7.35 (tt, *J* = 7.3, 1.5 Hz, 1H), 7.20 (dd, *J* = 8.7, 2.3 Hz, 1H), 7.10-7.16 (m, 4H), 5.82 (s, 1H), 2.34 (s, 3H).

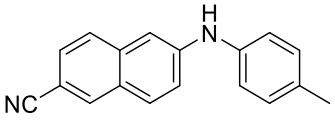
^{13}C NMR (100 MHz, $CDCl_3$): *δ* 142.02, 141.43, 140.10, 135.98, 134.07, 131.63, 130.11, 129.60, 129.17, 128.93, 127.26, 127.07, 126.99, 126.20, 125.70, 120.06, 119.61, 110.02, 20.90.

HRMS (APCI): calcd for $C_{23}H_{20}N$: *m/z* 310.1590 $[M + H]^+$, found 310.1586.

IR (KBr): 3421, 3060, 3021, 2922, 2857, 1605, 1523, 1445, 1307, 816 cm^{-1}.



N-4-Toly-6-cyano-2-naphthylamine (**1n**)



N-4-Toly-6-cyano-2-naphthylamine (**1n**) was prepared with the same procedures as that of **1l**.

1n (72% yield): a yellow solid.

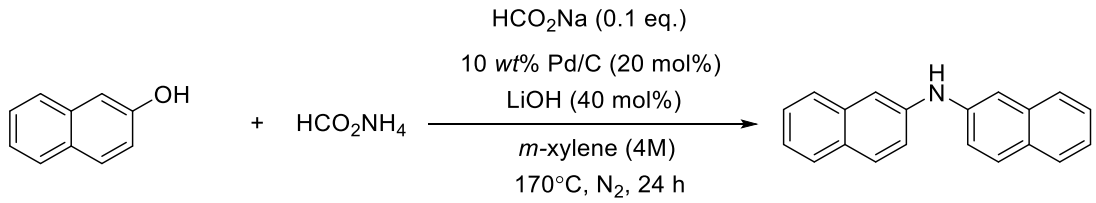
^{1}H-NMR (600 MHz, $CDCl_3$): δ 8.05 (s, 1H), 7.73 (d, *J* = 9.0 Hz, 1H), 7.60 (d, *J* = 8.4 Hz, 1H), 7.47 (dd, *J* = 8.4, 1.7 Hz, 1H), 7.28 (d, *J* = 9.0 Hz, 1H), 7.18-7.22 (m, 3H), 7.13-7.16 (m, 2H), 5.99 (s, 1H), 2.37 (s, 3H).

^{13}C-NMR (150 MHz, $CDCl_3$): δ 145.3, 138.3, 136.7, 133.9, 133.4, 130.3, 130.0, 127.2, 127.22, 127.16, 121.4, 120.3, 120.1, 107.8, 105.5, 21.0.

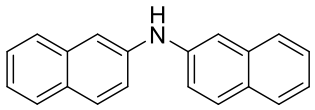
HRMS (APCI): calcd for $C_{18}H_{15}N_2$: *m/z* $[M+H]^+$ 259.1230, found 259.1230.

IR (KBr): 3357, 3060, 3026, 2914, 2857, 2217, 1533, 1407, 1314, 816 cm^{-1}.

3.4. Synthesis of substrates 1o



2,2'-Dinaphthylamine (**1o**)



2,2'-Dinaphthylamine (**1o**) was prepared followed by literature procedure [8]. To a 10.0 mL flame-dried Schlenk flask, the naphthol (2.0 mmol, 10 equiv), ammonium formate (2;0.20 mmol, 1equiv), lithium hydroxide (0.08 mmol, 0.4 equiv), and activated 10 wt% Pd/C (0.20 mmol, 20 mol%) were added. Under N_2 protection, the anhydrous m-xylene (0.5 mL) was added. The reaction mixture was heated with stirring to 160℃. After 24 h, the reaction mixture was diluted with EtOAc (10 mL) and filtered through silica gel and the organic solvent was removed by evaporation under reduced pressure. 2N aqueous NaOH solution to quench the reaction. The aqueous layer was extracted with EtOAc and the combined organic phase was washed with brine and dried over sodium sulfate. The solvent was removed under reduced pressure and the residue was purified by column chromatography (eluent:hexane/ethyl acetate, 5:1 v/v). The product was obtained in 40% yield as yellow solid and analytic data are in accordance with the reported paper [8].

^{1}H NMR (400 MHz, DMSO-D_6) δ 9.71 (s, 1H), 7.71 (dd, J = 8.2, 5.0 Hz, 4H), 7.62 (d, J = 7.8 Hz, 2H), 7.35-7.31 (m, 2H), 7.22-7.18 (m, 2H), 7.04 (td, J = 8.9, 2.4 Hz, 4H).

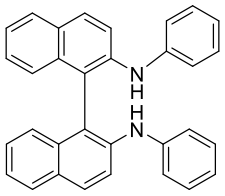
^{13}C-NMR (100 MHz, DMSO-D_6): δ 155.8, 135.1, 129.8, 128.3, 128.1, 126.6, 126.5, 123.2, 119.1, 109.2.

HRMS (APCI): calcd for $C_{20}H_{15}N$: *m/z* $[M + H]^+$ 270.1277, found 270.1274.

3.5 General procedure for the preparation of homocoupling of 2-naphthylamine

ElectraSyn 2.0 and platinum were utilized as the reaction device and electrode, respectively. A suspension of 2-naphthylamines **1** (0.1 mmol) and ^{n}Bu$_4$NPF$_6$ (0.1 M, 193.7 mg, 0.5 mmol) in HFIP (5 mL) was added to an undivided vessel and stirred under a constant current of 4 mA at 25 ℃. After stirring for 2 h, the electrolyte was removed using short silica gel column chromatography (*n*-hexane/ethyl acetate = 1/1). The fraction was dried, and the crude product was purified by silica-gel column chromatography (*n*-hexane/ethyl acetate = 20/1) to afford the pure homocoupling product **2**.

N^2,*N*$^{2'}$-di-p-tolyl-[1,1'-binaphthalene]-2,2'-diamine (**2a**)



2a (98% yield): a white solid.

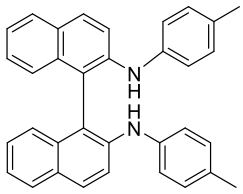
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.94 (dd, J = 14.0, 8.5 Hz, 4H), 7.76 (d, J = 9.2 Hz, 2H), 7.37-7.41 (m, 2H), 7.30-7.34 (m, 2H), 7.23-7.28 (m, 6H), 7.02 (q, J = 8.1 Hz, 6H), 5.68 (s, 2H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 142.6, 140.5, 134.1, 129.6, 129.5, 129.4, 128.3, 127.2, 124.6, 123.6, 122.3, 120.1, 118.0, 116.5.

HRMS (APCI): calcd for $C_{32}H_{25}N$: *m/z* $[M + H]^+$ 437.2012, found 437.2007.

IR (KBr): 3381, 1619, 1496, 1473, 1415, 1338, 1292, 812 cm^{-1}

N^2,*N*$^{2'}$-di-p-tolyl-[1,1'-binaphthalene]-2,2'-diamine (**2b**)



2b (92% yield): a white solid.

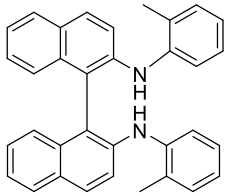
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.83 (t, *J* = 9.4 Hz, 4H), 7.60 (d, *J* = 9.2 Hz, 2H), 7.30-7.27 (m, 2H), 7.25-7.21 (m, 2H), 7.15 (d, *J* = 8.2 Hz, 2H), 7.01 (d, *J* = 8.2 Hz, 4H), 6.89 (dd, *J* = 11.0, 2.3 Hz, 4H), 5.53 (s, 2H), 2.27 (s, 6H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 141.3, 134.2, 134.0, 132.3, 129.9, 129.5, 129.3, 128.3, 127.1, 124.5, 123.3, 121.2, 117.5, 115.5, 20.9.

HRMS (APCI): calcd for $C_{34}H_{29}NO_2$: *m/z* $[M + H]^+$ 465.2325, found 465.2314.

IR (KBr): 3381, 2915, 2849, 1616, 1509, 1412, 1342, 1293, 858, 815 cm^{-1}

N^2, *N*$^{2'}$-di-o-tolyl-[1,1'-binaphthalene]-2,2'-diamine (**2c**)



2c (83% yield): a white solid.

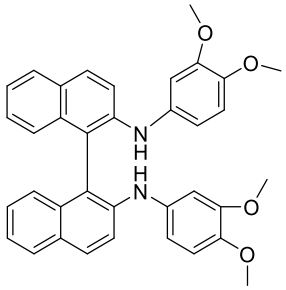
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.82-7.85 (m, 4H), 7.43 (d, *J* = 2.1 Hz, 1H), 7.41 (d, *J* = 2.1 Hz, 1H), 7.25-7.31 (m, 6H), 7.20-7.22 (m, 2H), 7.11 (t, *J* = 6.6 Hz, 4H), 6.94 (t, *J* = 7.6 Hz, 2H), 5.41 (s, 2H), 1.89 (s, 6H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 141.4, 140.4, 134.0, 131.0, 129.5, 129.0, 128.4, 127.2, 126.8, 124.3, 123.4, 123.2, 121.6, 117.0, 115.0, 17.8.

HRMS (APCI): calcd for $C_{34}H_{29}N$: *m/z* 465.2325 $[M + H]^+$, found 465.2311.

IR (KBr): 3386, 2913, 2317, 1613, 1494, 1412, 1341, 1293, 814, 742 cm^{-1}

N^2,*N*$^{2'}$-bis(3,4-dimethoxyphenyl)-[1,1'-binaphthalene]-2,2'-diamine (**2d**)



2d (89% yield): a red liquid.

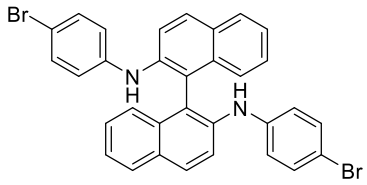
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.72 (d, *J* = 8.6 Hz, 4H), 7.60 (d, *J* = 8.2 Hz, 2H), 7.36-7.40 (m, 2H), 7.27-7.29 (m, 2H), 7.14 (dd, *J* = 8.6, 2.6 Hz, 2H), 6.86 (d, *J* = 8.2 Hz, 2H), 6.80 (d, *J* = 2.6 Hz, 2H), 6.77 (dd, *J* = 8.6, 2.6 Hz, 2H), 5.69 (s, 2H), 3.90 (s, 6H), 3.85 (s, 6H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 149.8, 145.1, 142.8, 136.2, 134.9, 129.3, 128.78, 127.76, 126.6, 126.4, 123.2, 119.2, 112.8, 112.3, 109.5, 105.8, 56.4, 56.0.

HRMS (APCI): calcd for $C_{36}H_{33}N_2O_4$: *m/z* 557.2435 $[M + H]^+$, found 557.2438.

IR (KBr): 3365, 2933, 2833, 1601, 1511, 1465, 1228, 1024, 838, 811 cm^{-1}

N^2, *N*$^{2'}$-bis(4-bromophenyl)-[1,1'-binaphthalene]-2,2'-diamine (**2e**)



2e (76% yield): a white solid.

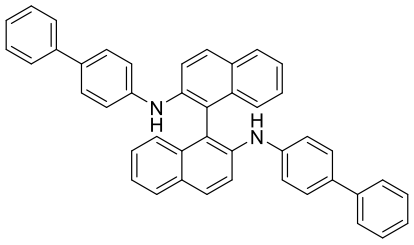
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.90 (d, *J* = 9.2 Hz, 2H), 7.86 (d, *J* = 7.8 Hz, 2H), 7.60 (d, *J* = 9.2 Hz, 2H), 7.32-7.36 (m, 2H), 7.23-7.25 (m, 6H), 7.11 (d, *J* = 8.7 Hz, 2H), 6.77 (d, *J* = 2.1 Hz, 2H), 6.75 (d, *J* = 2.1 Hz, 2H), 5.44 (s, 2H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 141.9, 139.7, 134.0, 132.3, 129.9, 129.8, 128.5, 127.4, 124.6, 124.1, 121.0, 118.4, 117.5, 114.2.

HRMS (APCI) calcd for $C_{32}H_{23}Br_2N_2$: *m/z* 595.0203 $[M+H]^+$, found 595.0203.

IR (KBr): 3411, 3380, 2924, 2858, 1616, 1494, 1340,1258, 817, 748 cm^{-1}

N^2,*N*$^{2'}$-di([1,1'-biphenyl]-4-yl)-[1,1'-binaphthalene]-2,2'-diamine (**2f**)



2f (66% yield): a white solid.

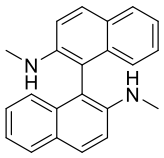
^{1}H-NMR (400 MHz, $CDCl_3$) δ 7.92 (d, *J* = 9.0 Hz, 2H), 7.87 (d, *J* = 8.0 Hz, 2H), 7.74 (d, *J* = 9.0 Hz, 2H), 7.47-7.49 (m, 4H), 7.32-7.40 (m, 10H), 7.27-7.25 (m, 4H), 7.18 (d, *J* = 8.0 Hz, 2H), 6.98-7.00 (m, 4H), 5.63 (s, 2H).

^{13}C-NMR (100 MHz, $CDCl_3$) δ 142.1, 140.8, 140.1, 134.9, 134.1, 129.7, 129.6, 128.8, 128.4, 127.9, 127.2, 126.8, 126.7, 124.6, 123.8, 119.7, 118.5, 117.1.

HRMS (APCI): calcd for $C_{44}H_{33}N_2$: *m/z* 589.2638 $[M + H]^+$, found 589.2631.

IR (KBr): 3394, 1596, 1510, 1488, 1302, 907, 822, 760 cm^{-1}

N^2,*N*$^{2'}$-dimethyl-[1,1'-binaphthalene]-2,2'-diamine(**2g**)



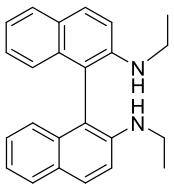
2g (30% yield): a pale yellow solid.

Analytic data is in accordance with the reported literature [9].

^{1}H-NMR (400 MHz, $CDCl_3$): *δ* 9.22 (d, *J* = 8.2 Hz, 2H), 8.05 (dd, *J* = 8.0, 1.1 Hz, 2H), 7.94-7.92 (m, 2H), 7.75-7.66 (m, 4H), 7.53-7.50 (m, 2H), 4.12 (s, 2H), 1.57 (s, 6H).

^{13}C-NMR (100 MHz, $CDCl_3$): *δ* 137.8, 129.8, 129.3, 126.7, 125.5, 125.2, 123.3, 117.3, 110.8, 29.7.

N^2,*N*$^{2'}$-diethyl-[1,1'-binaphthalene]-2,2'-diamine (**2h**)



2h (87% yield): a yellow liquid.

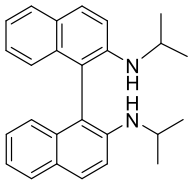
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.89 (d, *J* = 9.2 Hz, 2H), 7.78-7.80 (m, 2H), 7.13-7.28 (m, 6H), 6.95-6.97 (m, 2H), 3.62 (s, 2H), 3.23 (d, *J* = 6.8 Hz, 4H), 1.03 (t, *J* = 6.8 Hz, 6H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 144.7, 134.0, 129.7, 128.2, 127.8, 126.8, 124.0, 122.0, 114.3, 112.3, 38.7, 15.4.

HRMS (APCI): calcd for $C_{24}H_{25}N$: *m/z* 341.2012 $[M + H]^+$, found 341.2003.

IR (KBr): 3387, 2967, 2866, 1613, 1510, 1426,1306, 1279, 813, 745 cm^{-1}

N^2,*N*$^{2'}$-diisopropyl-[1,1'-binaphthalene]-2,2'-diamine (**2i**)



2i (87% yield): a white solid.

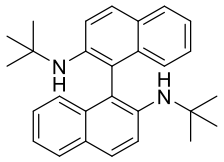
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.85 (d, *J* = 9.2 Hz, 2H), 7.74-7.76 (m, 2H), 7.23-7.26 (m, 2H), 7.09-7.18 (m, 4H), 6.90 (d, *J* = 8.2 Hz, 2H), 3.77 (s, 2H), 3.39 (s, 2H), 1.04 (d, *J* = 6.2 Hz, 6H), 0.96 (d, *J* = 6.2 Hz, 6H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 144.2, 134.2, 129.6, 128.0, 127.7, 126.6, 124.1, 121.9, 115.1, 112.5, 44.6, 23.4.

HRMS (APCI): calcd for $C_{26}H_{29}N_2$: *m/z* 369.2325 $[M + H]^+$, found 369.2325.

IR (KBr): 3393, 2972, 2924, 2866, 1617, 1508, 1491, 1299, 1176, 809, 745 cm^{-1}

N^2,*N*$^{2'}$-di-tert-butyl-[1,1'-binaphthalene]-2,2'-diamine (**2j**)



2j (72% yield): a white solid.

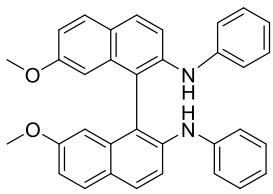
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.82 (q, *J* = 4.6 Hz, 2H), 7.76 (t, *J* = 6.4 Hz, 2H), 7.49 (dd, *J* = 8.7, 5.5 Hz, 2H), 7.10-7.20 (m, 4H), 6.92 (t, *J* = 6.6 Hz, 2H), 3.63 (s, 2H), 1.20 (d, *J* = 5.5 Hz, 18H)

^{13}C-NMR (100 MHz, $CDCl_3$): δ 144.44, 134.09, 128.76, 127.95, 127.76, 126.49, 124.47, 122.11, 117.74, 114.84, 51.44, 30.76

HRMS (APCI): calcd for $C_{28}H_{32}N_2$: *m/z* $[M + H]^+$ 397.2639, found 397.2639.

IR (KBr): 3393, 2967, 2919, 2866, 1621, 1491, 1336, 815 cm^{-1}.

7,7'-dimethoxy-N^2,$N^{2'}$-diphenyl-[1,1'-binaphthalene]-2,2'-diamine (**2k**)



2k (95% yield): a white solid.

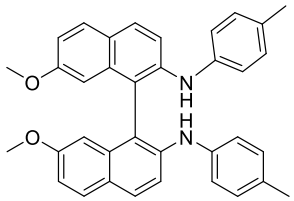
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.79 (d, *J* = 9.0 Hz, 2H), 7.73 (d, *J* = 9.0 Hz, 2H), 7.54 (d, *J* = 9.0 Hz, 2H), 7.17-7.21 (m, 4H), 6.91-6.99 (m, 8H), 6.52 (d, *J* = 2.3 Hz, 2H), 5.60 (s, 2H), 3.55 (s, 6H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 158.8, 142.7, 141.0, 135.2, 129.9, 129.4, 129.3, 124.0, 122.2, 120.0, 115.7, 115.5, 115.4, 103.4, 55.2.

HRMS (APCI): calcd for $C_{34}H_{29}N_2O_2$: *m/z* $[M + H]^+$ 497.2224, found 497.2212.

IR (KBr): 3360, 2924, 2849, 2370, 1620, 1509, 1458, 1275, 1028, 830, 750 cm^{-1}

7,7'-dimethoxy-N^2,$N^{2'}$-di-*p*-tolyl-[1,1'-binaphthalene]-2,2'-diamine (**2l**)



2l (87% yield): a white solid.

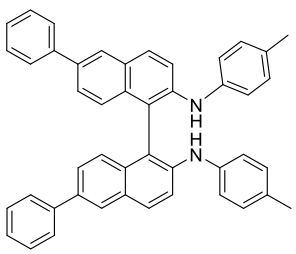
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.75 (d, *J* = 9.0 Hz, 2H), 7.71 (d, *J* = 9.0 Hz, 2H), 7.46 (d, *J* = 9.0 Hz, 2H), 7.02 (d, *J* = 7.8 Hz, 4H), 6.90-6.95 (m, 6H), 6.51 (d, *J* = 2.3 Hz, 2H), 5.53 (s, 2H), 3.55 (s, 6H), 2.27 (s, 6H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 158.8, 141.8, 140.0, 135.2, 132.2, 129.9, 129.9, 129.2, 124.7, 121.1, 115.3, 114.9, 114.5, 103.2, 55.2, 20.9.

HRMS (APCI): calcd for $C_{36}H_{33}N_2O_2$: *m/z* $[M + H]^+$ 525.2537, found 525.2543.

IR (KBr): 3388, 3360, 2957, 2922, 2361, 2350, 1622, 1510, 1336, 1217, 1031, 882, 844, 824 cm^{-1}

6,6'-diphenyl-N^2,$N^{2'}$-di-p-tolyl-[1,1'-binaphthalene]-2,2'-diamine (**2m**)



2m (65% yield): a red solid.

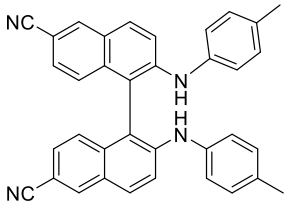
^{1}H-NMR (400 MHz, $CDCl_3$): δ 8.04 (d, *J* = 1.8 Hz, 2H), 7.92 (d, *J* = 9.2 Hz, 2H), 7.63-7.68 (m, 6H), 7.51-7.54 (m, 2H), 7.45 (t, *J* = 7.8 Hz, 4H), 7.33 (t, *J* = 7.3 Hz, 2H), 7.27 (s, 1H), 7.25 (s, 1H), 7.03 (d, *J* = 8.2 Hz, 4H), 6.93 (d, *J* = 8.2 Hz, 4H), 5.60 (s, 2H), 2.28 (s, 6H)

^{13}C-NMR (100 MHz, $CDCl_3$): δ 141.49, 139.80, 135.96, 133.35, 132.45, 129.95, 129.49, 128.93, 127.25, 127.11, 126.79, 126.30, 124.99, 121.34, 117.83, 20.90

HRMS (APCI): calcd for $C_{46}H_{36}N_2$: *m/z* $[M + H]^+$ 617.2951, found 617.2947.

IR (KBr): 3404, 2961, 2852, 1598, 1512, 1491, 1266, 809 cm^{-1}.

2,2'-bis(p-tolylamino)-[1,1'-binaphthalene]-6,6'-dicarbonitrile (**2n**)



2n (87% yield): a yellow solid.

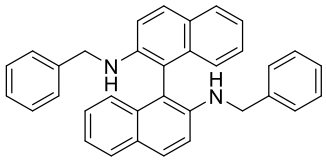
^{1}H-NMR (400 MHz, $CDCl_3$): δ 8.05 (s, 2H), 7.73 (d, *J* = 8.7 Hz, 2H), 7.60 (d, *J* = 8.7 Hz, 2H), 7.47 (dd, *J* = 8.7, 2.0 Hz, 2H), 7.18-7.22 (m, 6H), 7.14 (dd, *J* = 6.2, 2.0 Hz, 4H), 5.98 (s, 2H), 2.37 (s, 6H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 145.3, 138.4, 136.7, 133.9, 133.4, 130.3, 130.0, 127.2, 127.2, 127.2, 121.4, 120.3, 120.1, 107.8, 105.5, 21.0.

HRMS (APCI): calcd for $C_{36}H_{27}N_4$: *m/z* $[M + H]^+$ 515.2230, found 515.2230.

IR (KBr): 3357, 2919, 2855, 2318, 2214, 1606, 1591, 1509, 1313, 903, 814 cm^{-1}

N^2, $N^{2'}$-dibenzyl-[1,1'-binaphthalene]-2,2'-diamine (**2p**)



2p (85% yield): a white solid.

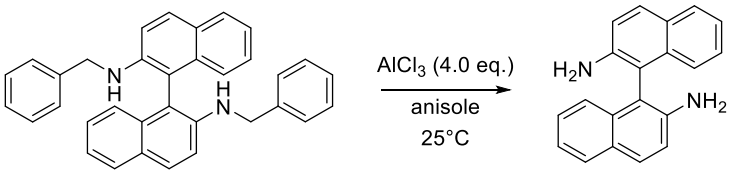
^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.86 (d, *J* = 9.2 Hz, 2H), 7.80-7.83 (m, 2H), 7.31-7.26 (m, 6H), 7.25-7.20 (m, 10H), 7.10 (dt, *J* = 7.3, 3.1 Hz, 2H), 4.46 (d, *J* = 5.5 Hz, 4H), 4.37 (d, *J* = 5.5 Hz, 2H).

^{13}C-NMR (100 MHz, $CDCl_3$): δ 144.3, 140.0, 134.0, 129.8, 128.6, 128.3, 127.9, 127.0, 126.90, 126.86, 124.0, 122.2, 114.3, 112.1, 47.7.

HRMS (APCI): calcd for $C_{34}H_{29}N_2$: *m/z* $[M + H]^+$ 465.2325, found 456.2321.

IR (KBr): 3417, 3059, 2924, 2854, 1616, 1508, 1426, 1298, 907, 809 cm^{-1}

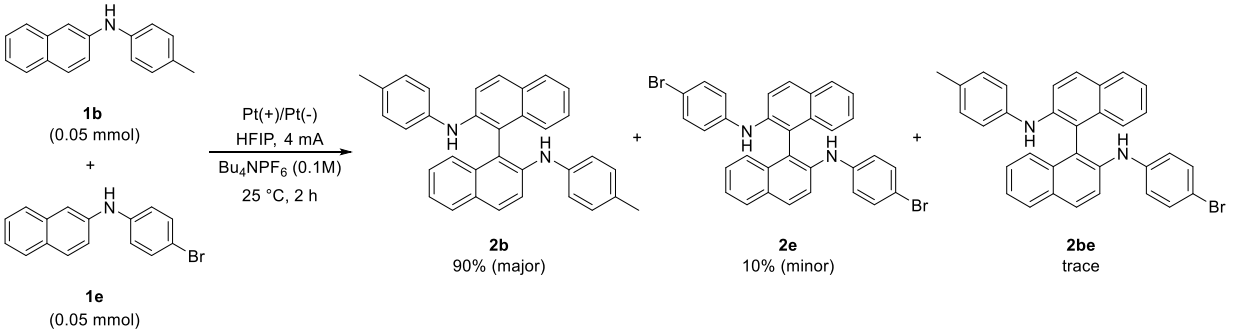
3.6. Synthesis of BINAM



2l **7**

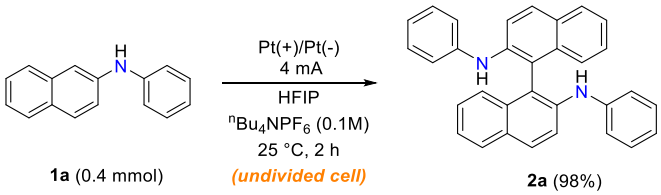
The synthesis of compound **7** was followed by the reported procedure [10]. A solution of **2l** (0.01 mmol) in anisole (0.1 mL) was added to a suspension of 4 equiv. $AlCl_3$ in anisole (0.1 mL). The mixture was stirred under 25 ℃ for 48 h. The reaction was quenched by water and extracted with ethyl acetate. The organic layer was dried over $MgSO_4$ and concentrated under reduced pressure. The residue was purified by silica column chromatography (hexane/ethyl acetate = 3/1) to afford the **7** in 32% yield. The ^{1}H-NMR data of **7** are in accordance with the reported literature [11].

3.7 Electrochemical heterocoupling of substrate 1b and 1e



ElectraSyn 2.0 with platinum electrode were utilized for the electrochemical hetero-coupling of **1b** and **1e**. A mixture of **1b** (14.9 mg, 0.05 mmol), **1e** (11.7 mg, 0.05 mmol) and $^{n}Bu_4NPF_6$ (0.1 M, 193.7 mg, 0.5 mmol) in HFIP (5 mL) was added to an undivided vessel and stirred under a constant current of 4 mA at 25 °C. After stirring for 2 h, the electrolyte was removed by short silica gel column chromatography (*n*-hexane/ethyl acetate = 1/1). The fraction was dried, and the residue was analyzed by using ^{1}H-NMR with 1,3,5-trimetoxybenzene as a standard. The determination of the each ration of products by using the NMR and HPLC analysis was difficult because of overlapping of each peak, finally, the crude product was purified by silica-gel column chromatography (*n*-hexane/ethyl acetate = 20/1) to afford **2b** in 90%, **2e** in 10%, trace amount of **2be**, along with recovery of **1b** and **1e**.

3.8 Scale up reaction of 1a



1a (0.4 mmol)

2a (98%)

ElectraSyn 2.0 and platinum were utilized as the reaction device and electrode, respectively. A mixture of 2-naphthylamines **1** (87.7 mg, 0.4 mmol) and $^{n}Bu_4NPF_6$ (0.1 M, 774.8 mg, 2.0 mmol) in HFIP (20 mL) was added to an undivided vessel and stirred under a constant current of 4 mA at 25 °C. After stirring for 2 h, the electrolyte was removed using short silica gel column chromatography (*n*-hexane/ethyl acetate = 1/1). The fraction was dried, and the crude product was purified by silica-gel column chromatography (*n*-hexane/ethyl acetate = 20/1) to afford the pure homocoupling product **2** with 98% yield.

4. References

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5. CV chart

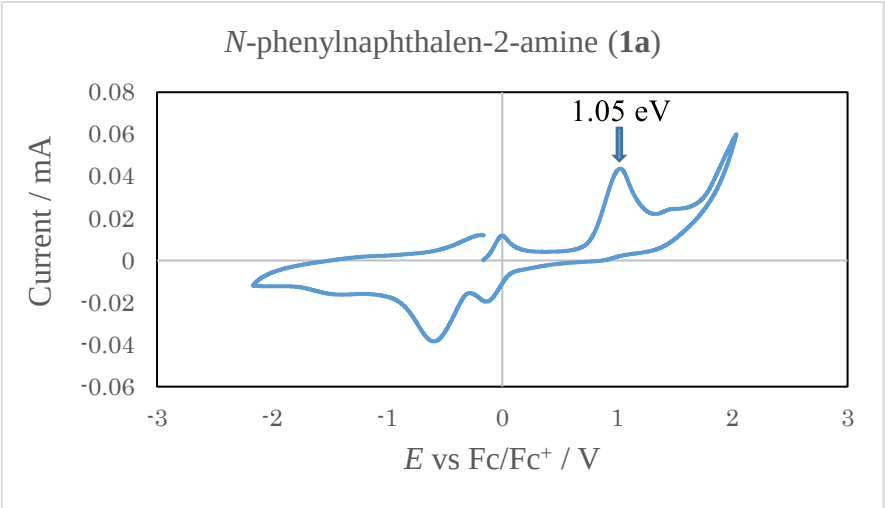
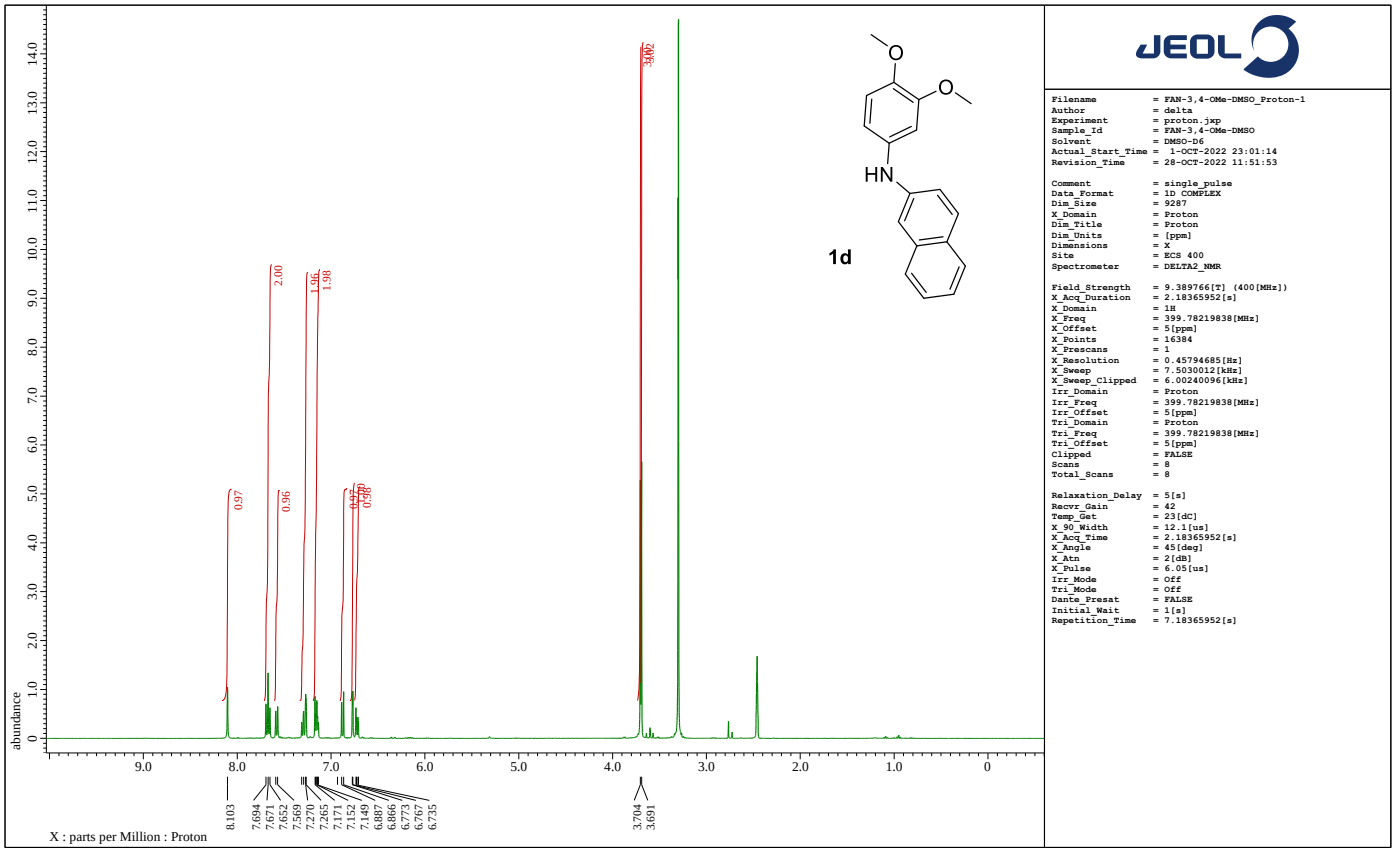
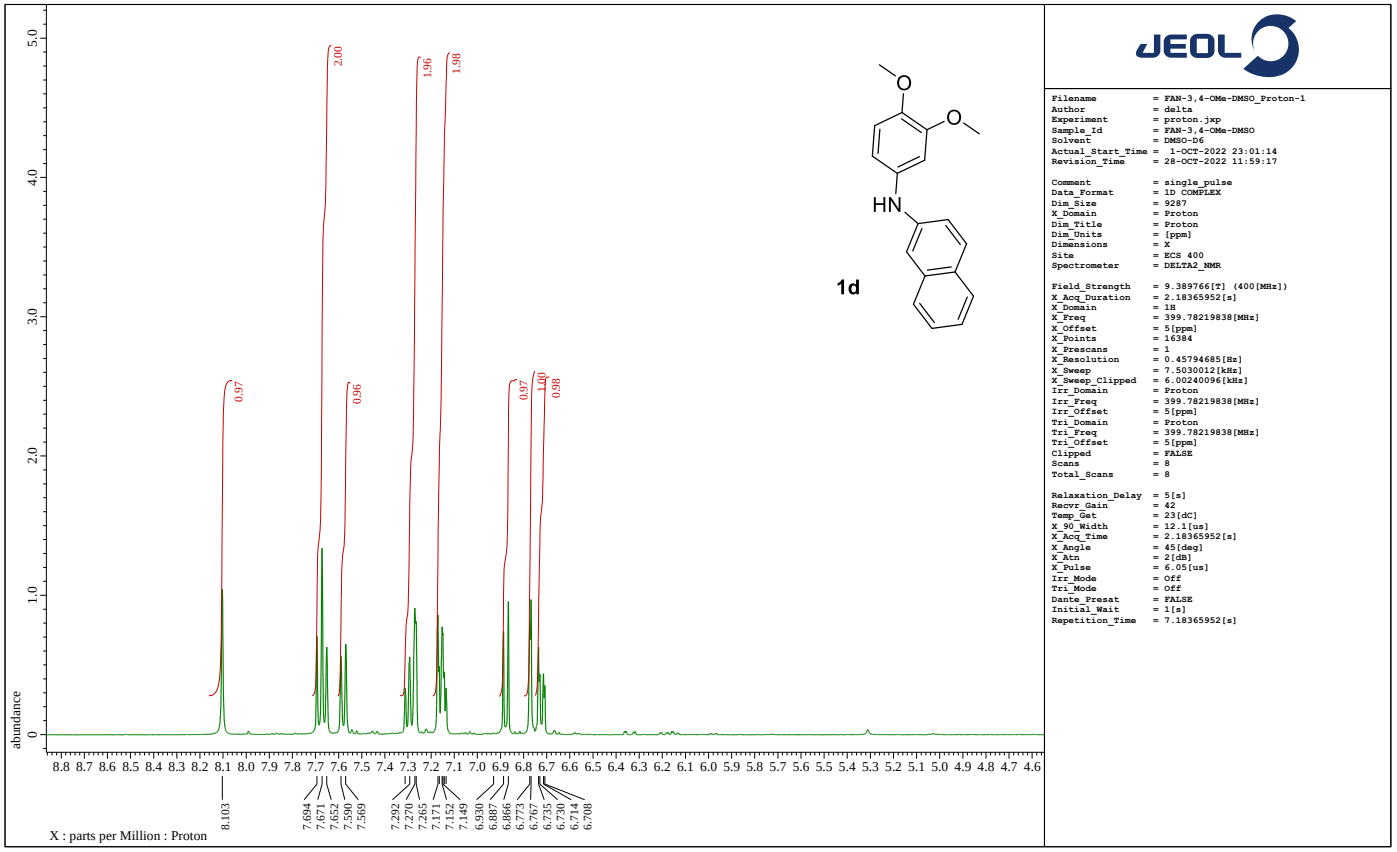


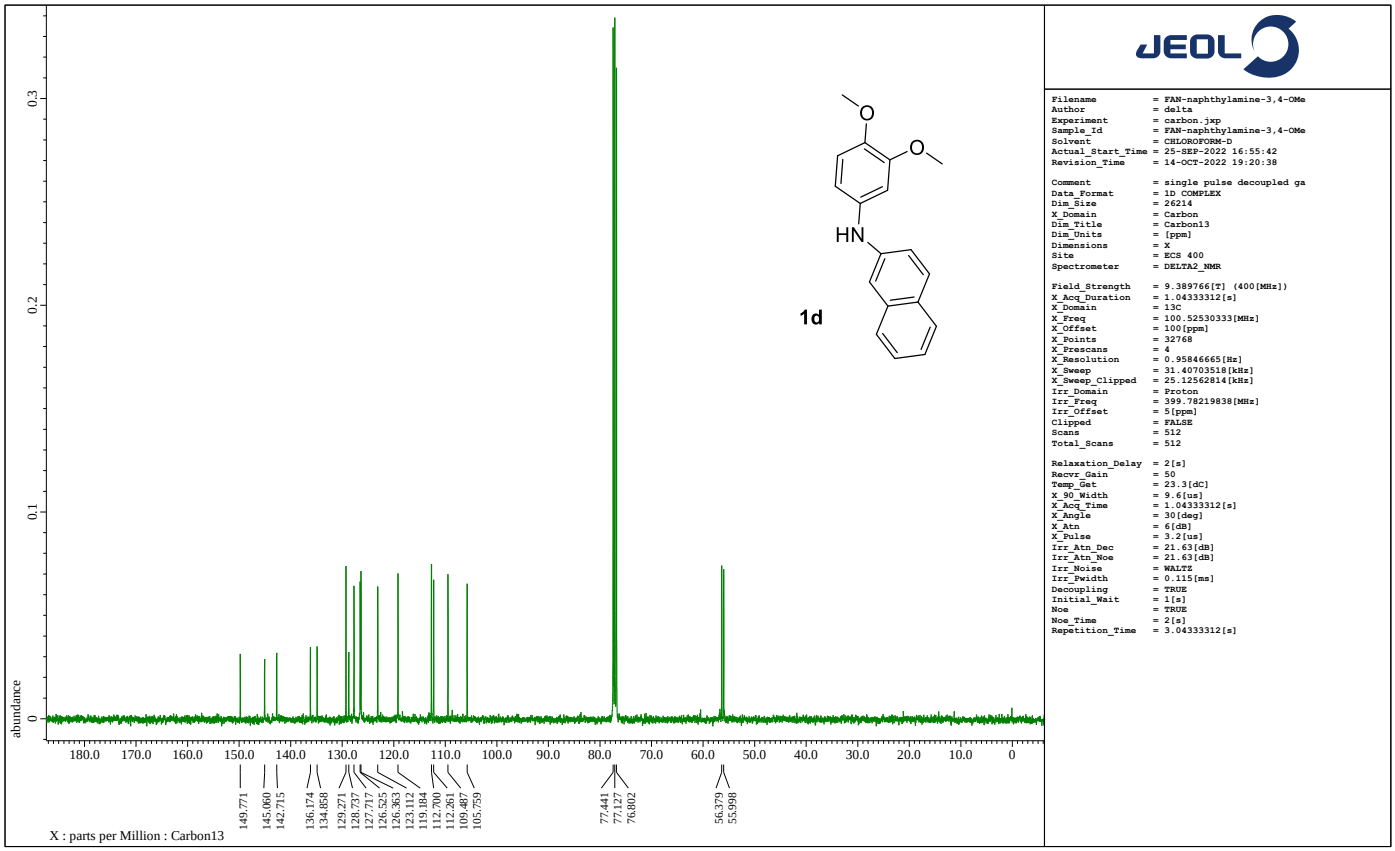
Figure S2. CV experiments (MeCN) as a solvent with Bu_4NPF_6 (0.1 M) as electrolyte.

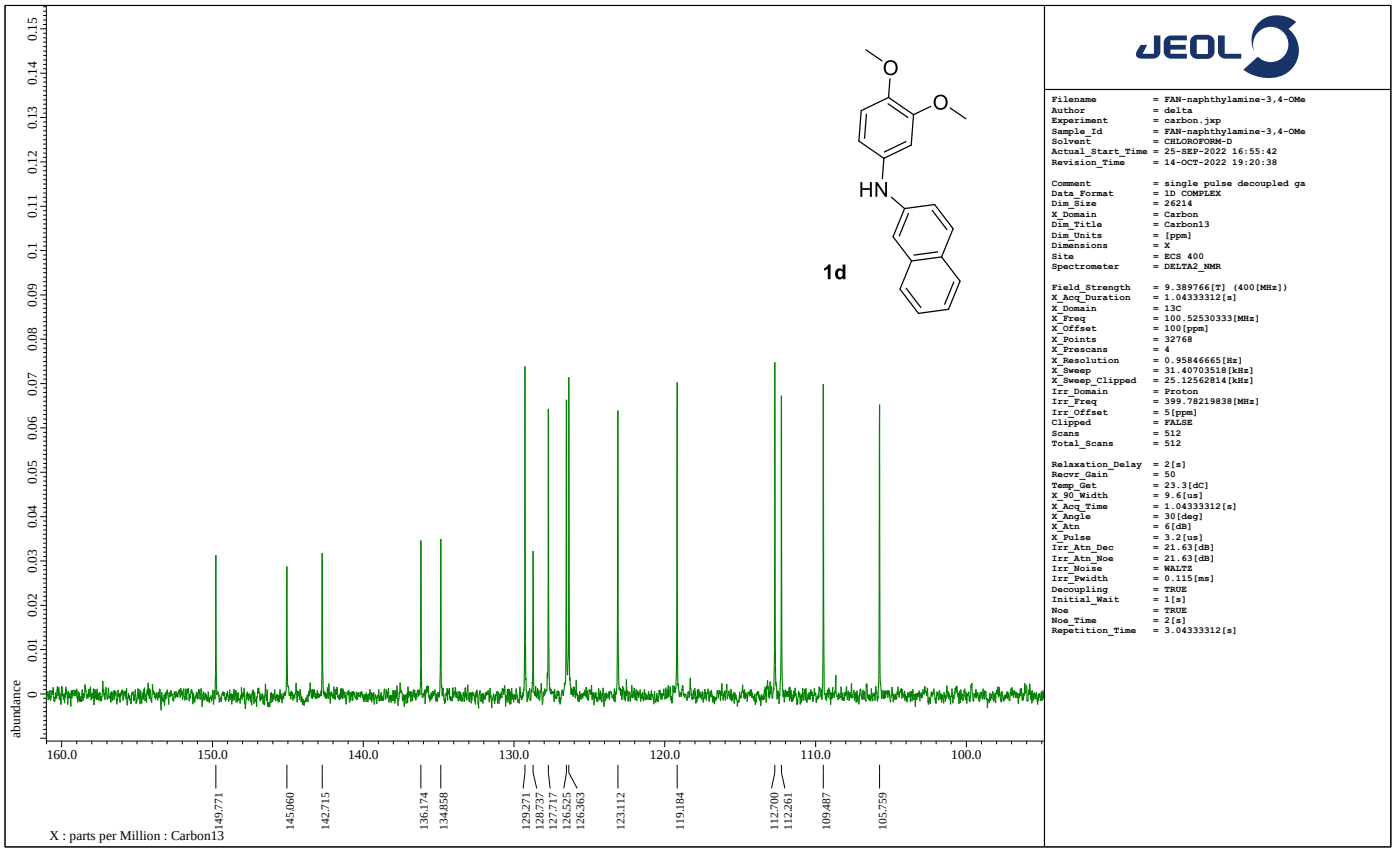
6. NMR Spectra



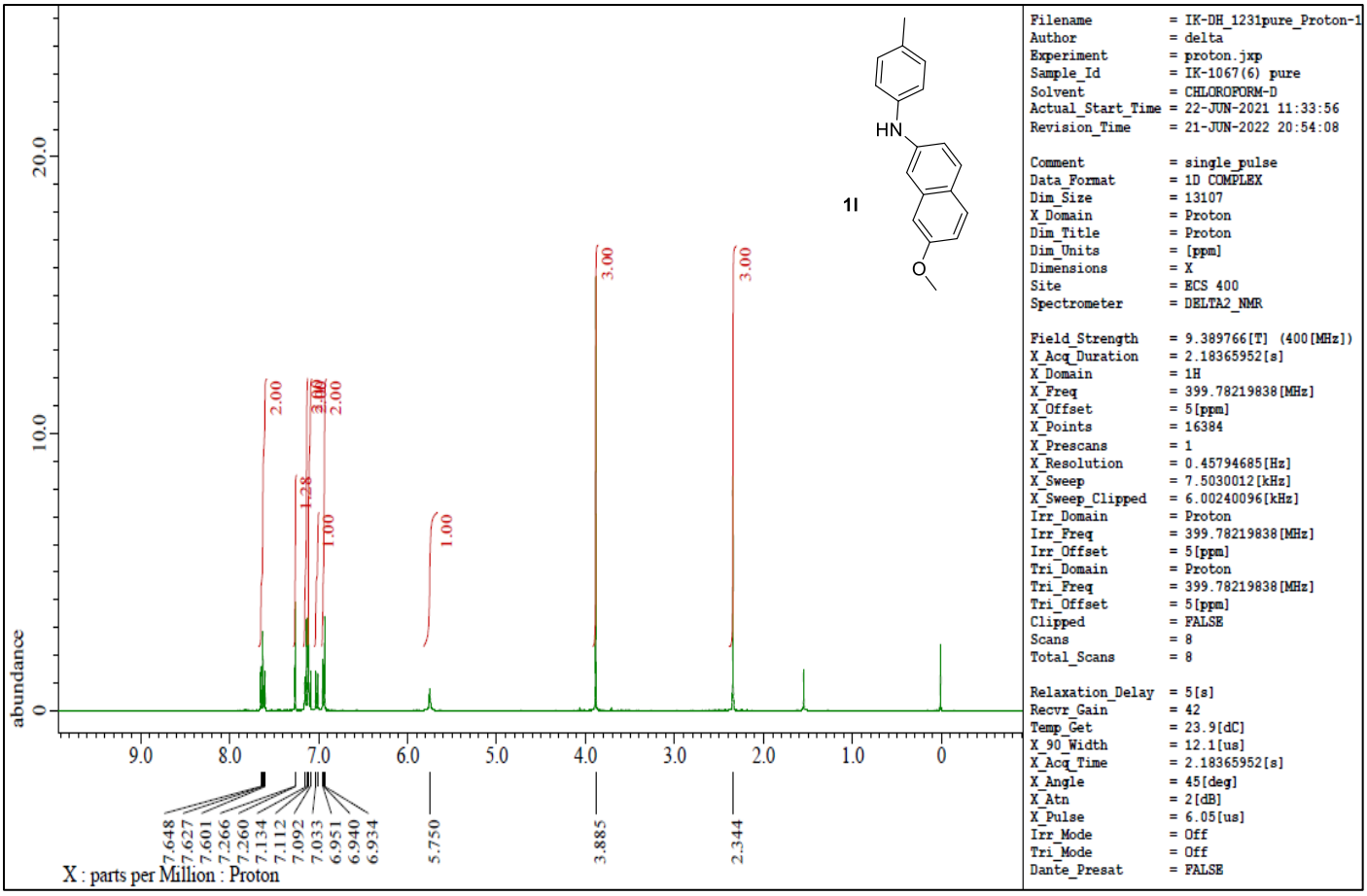


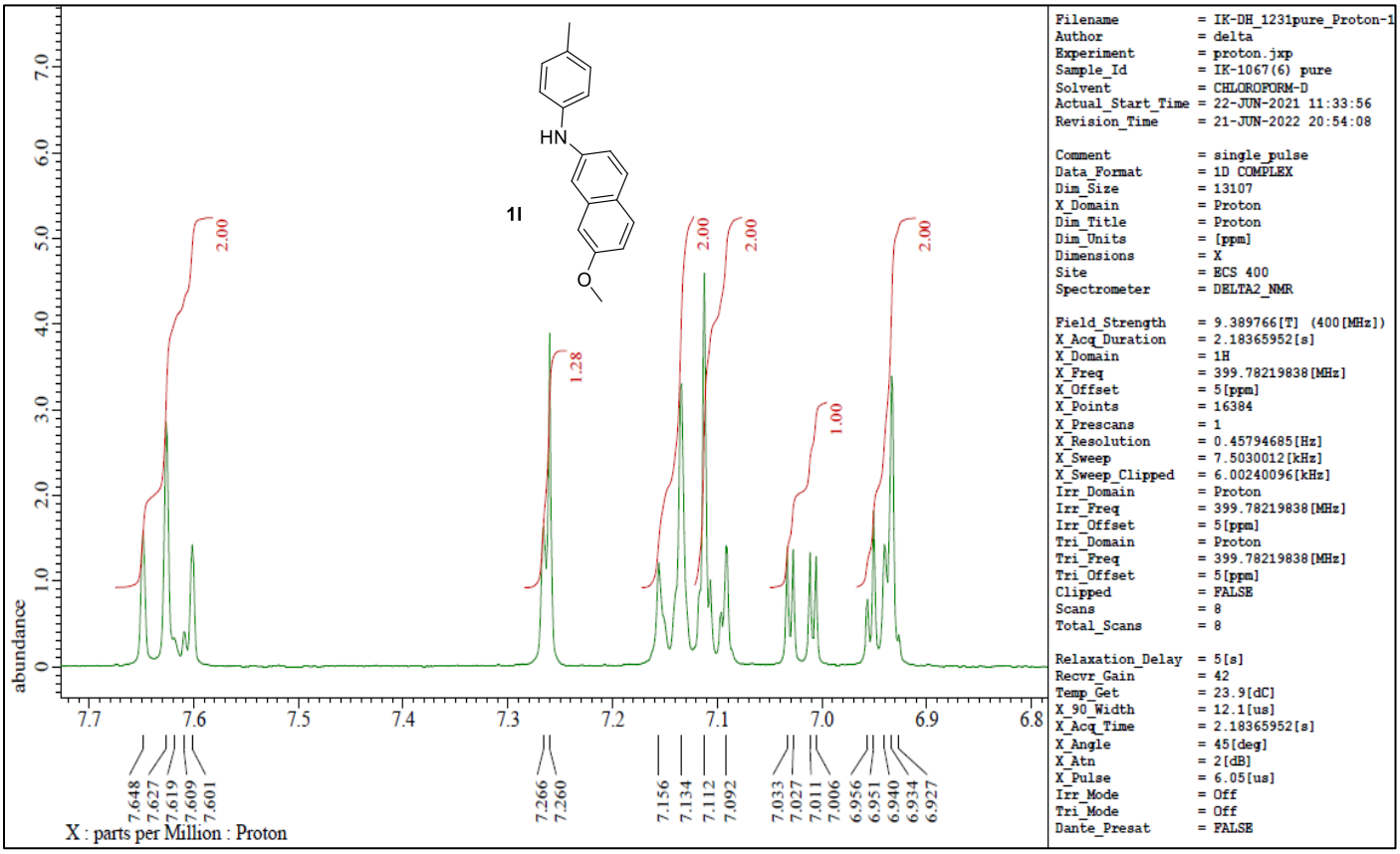
Compound **1d** (^{1}H NMR, 400 MHz, DMSO).



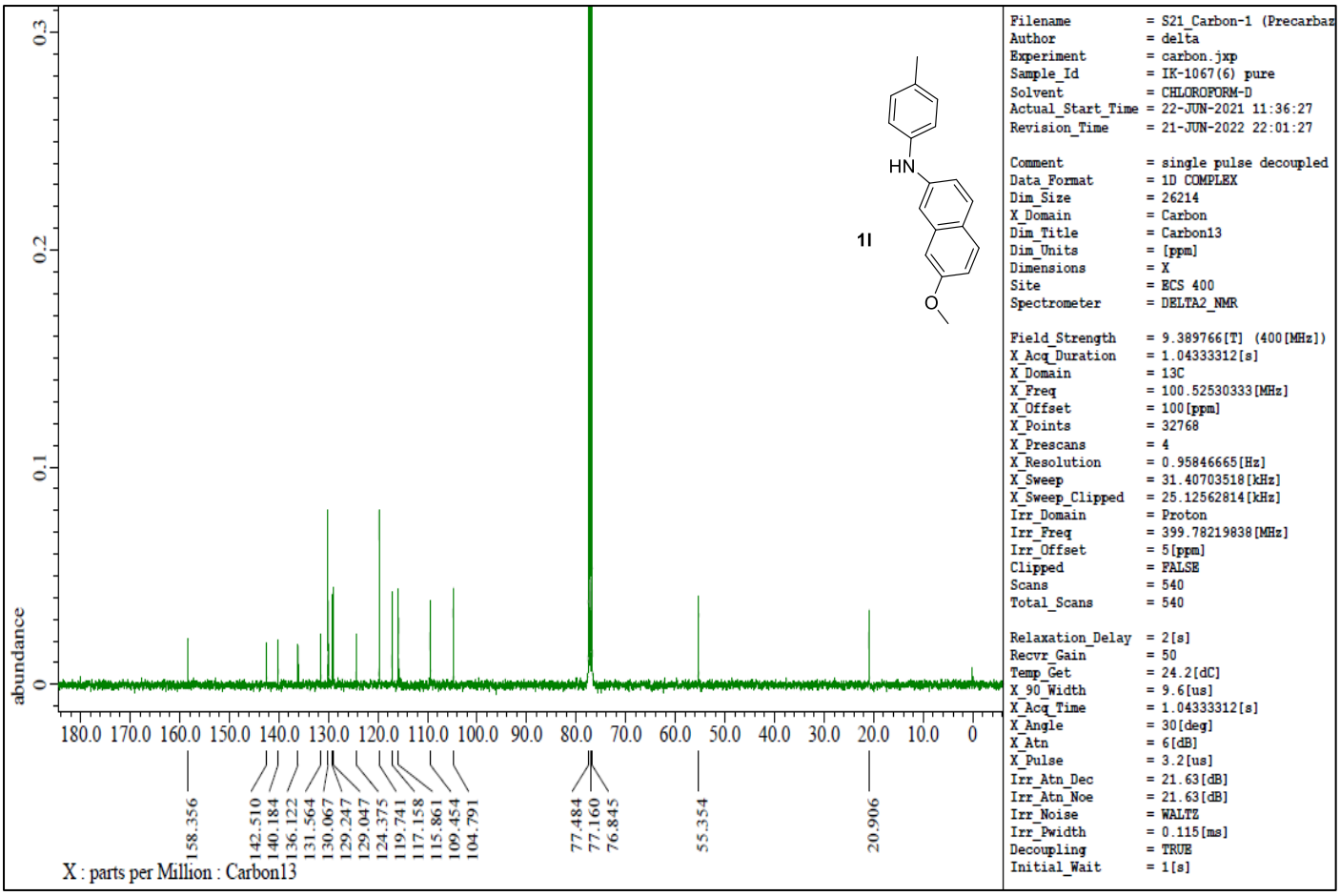


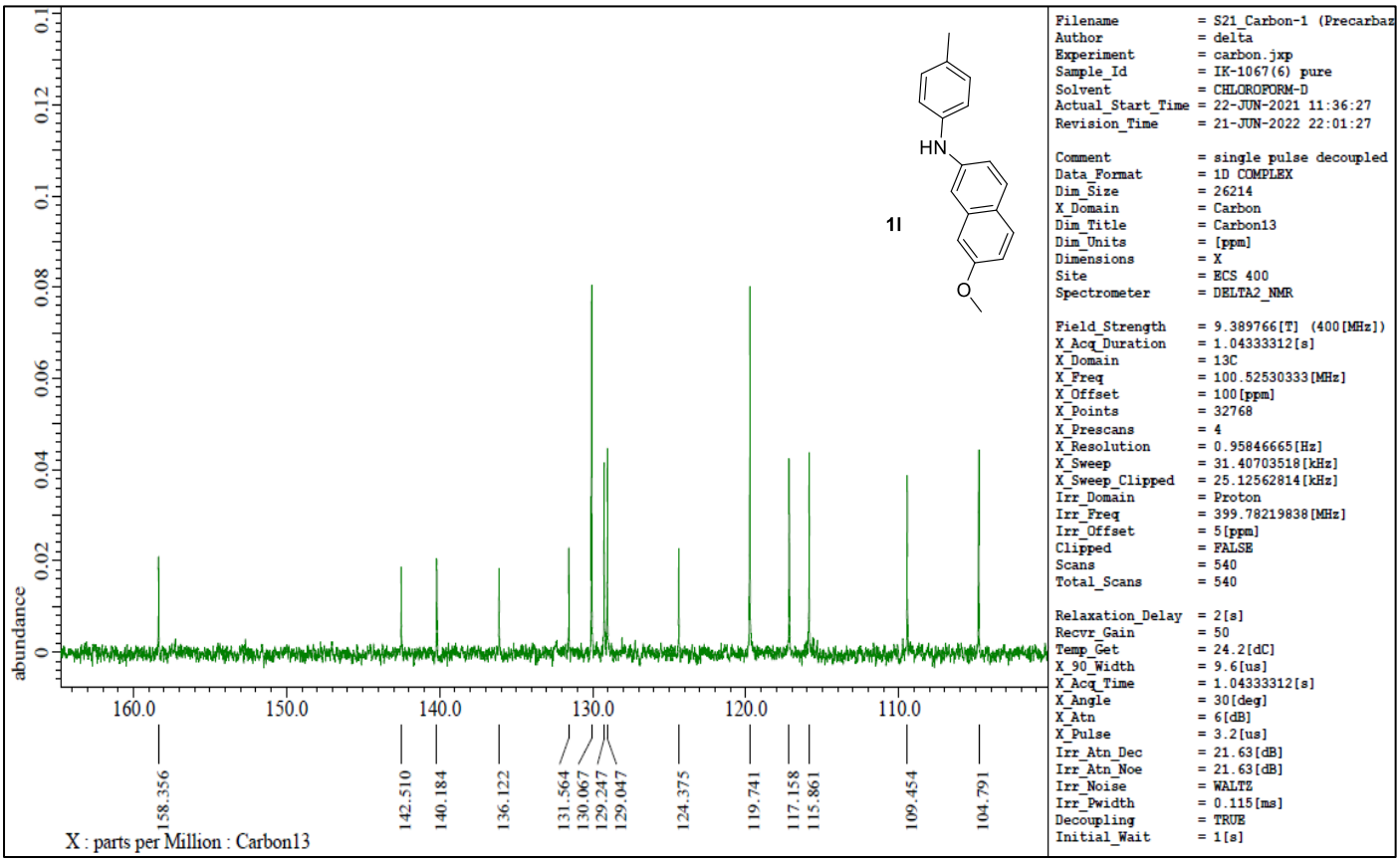
Compound **1d** (^{13}C NMR, 100 MHz, $CDCl_3$).



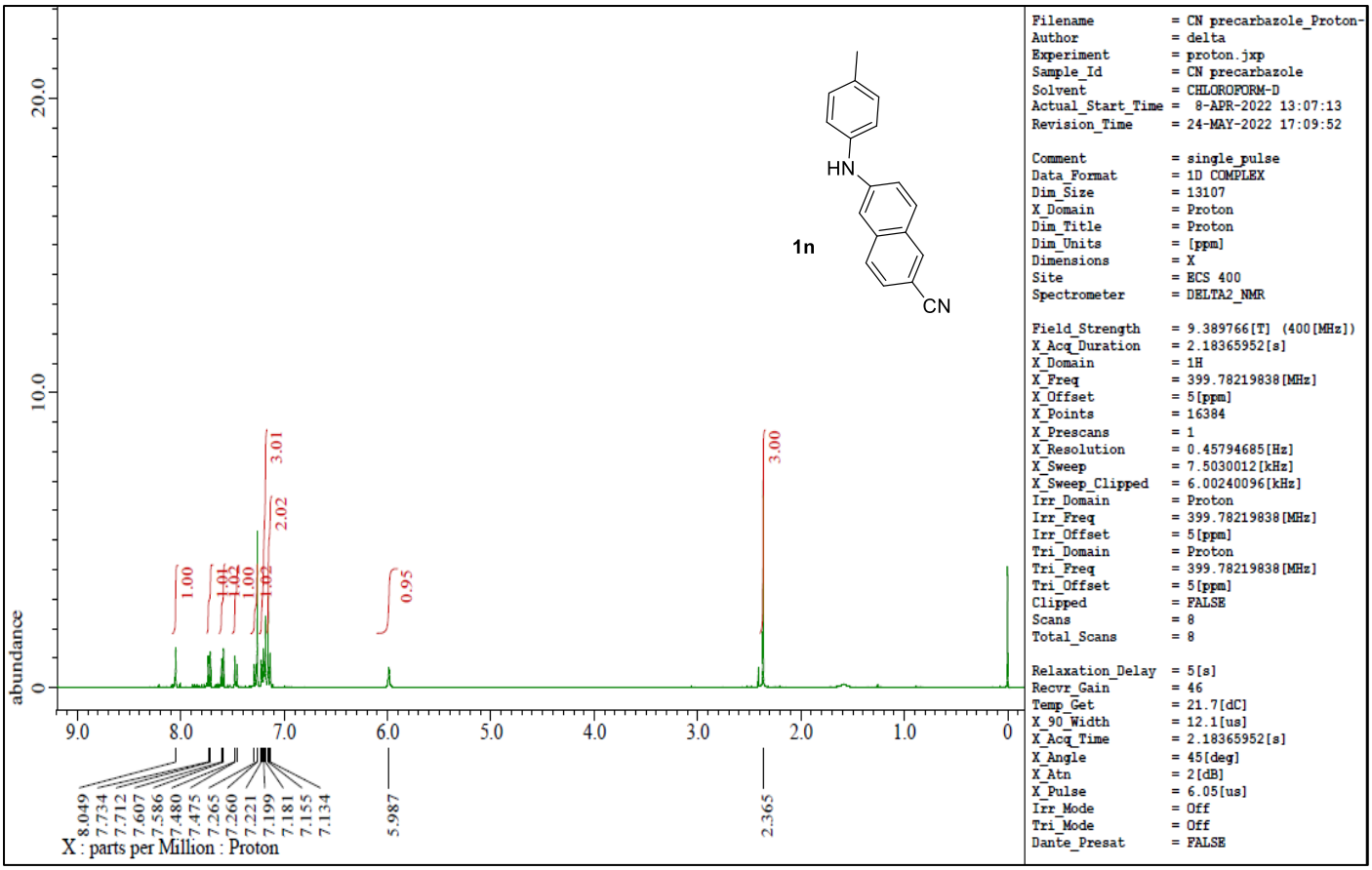


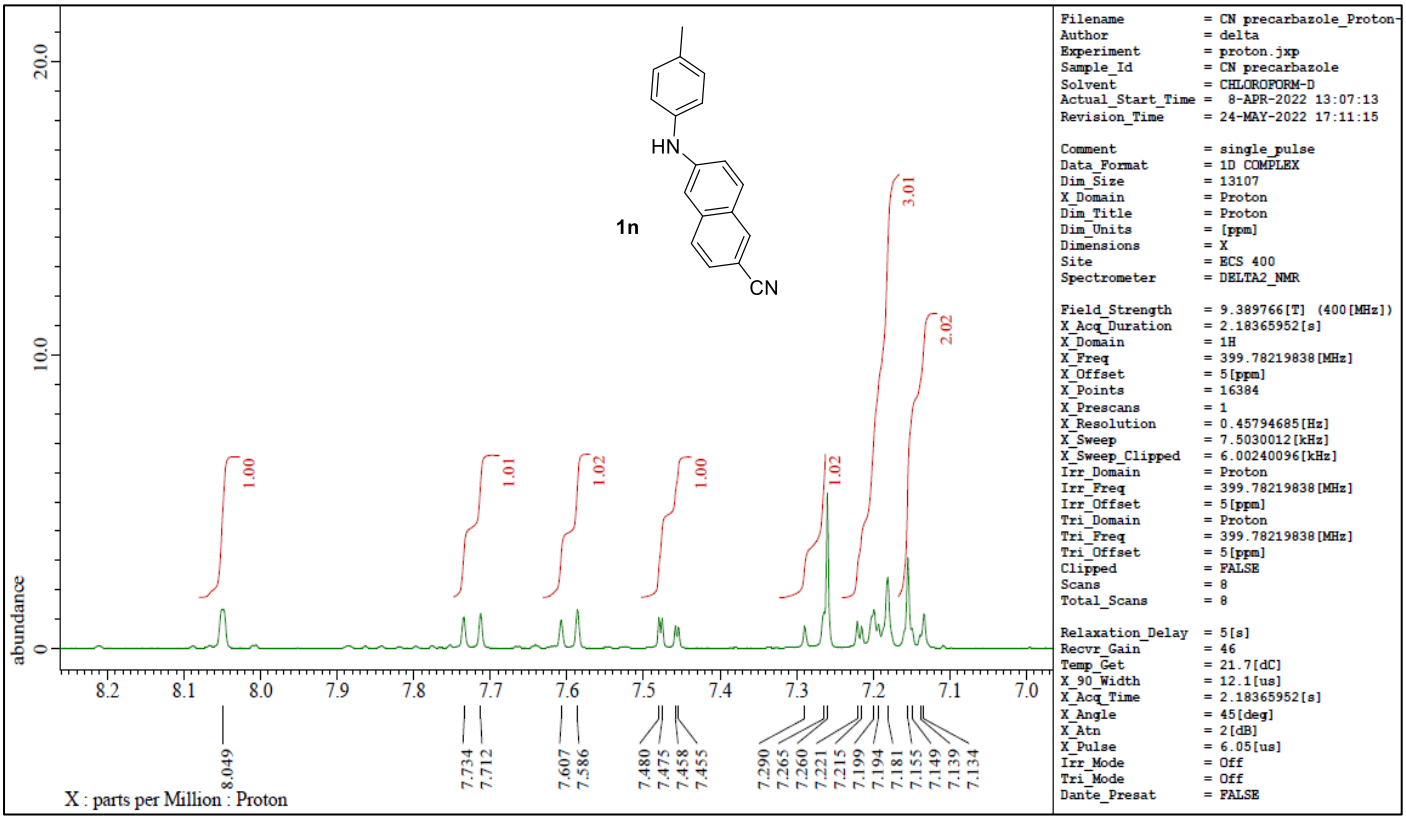
Compound **1l** (^{1}H NMR, 400 MHz, $CDCl_3$).



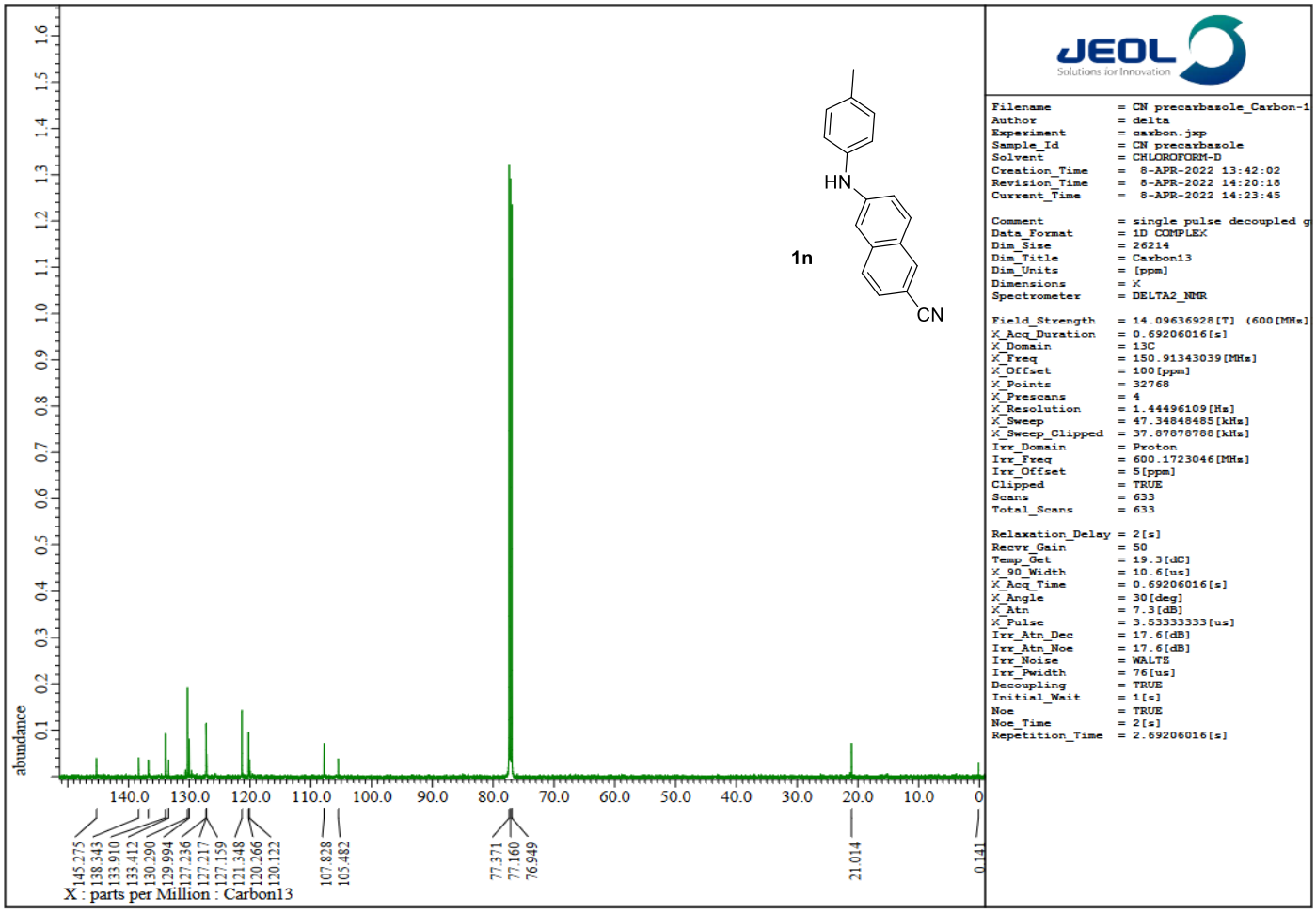


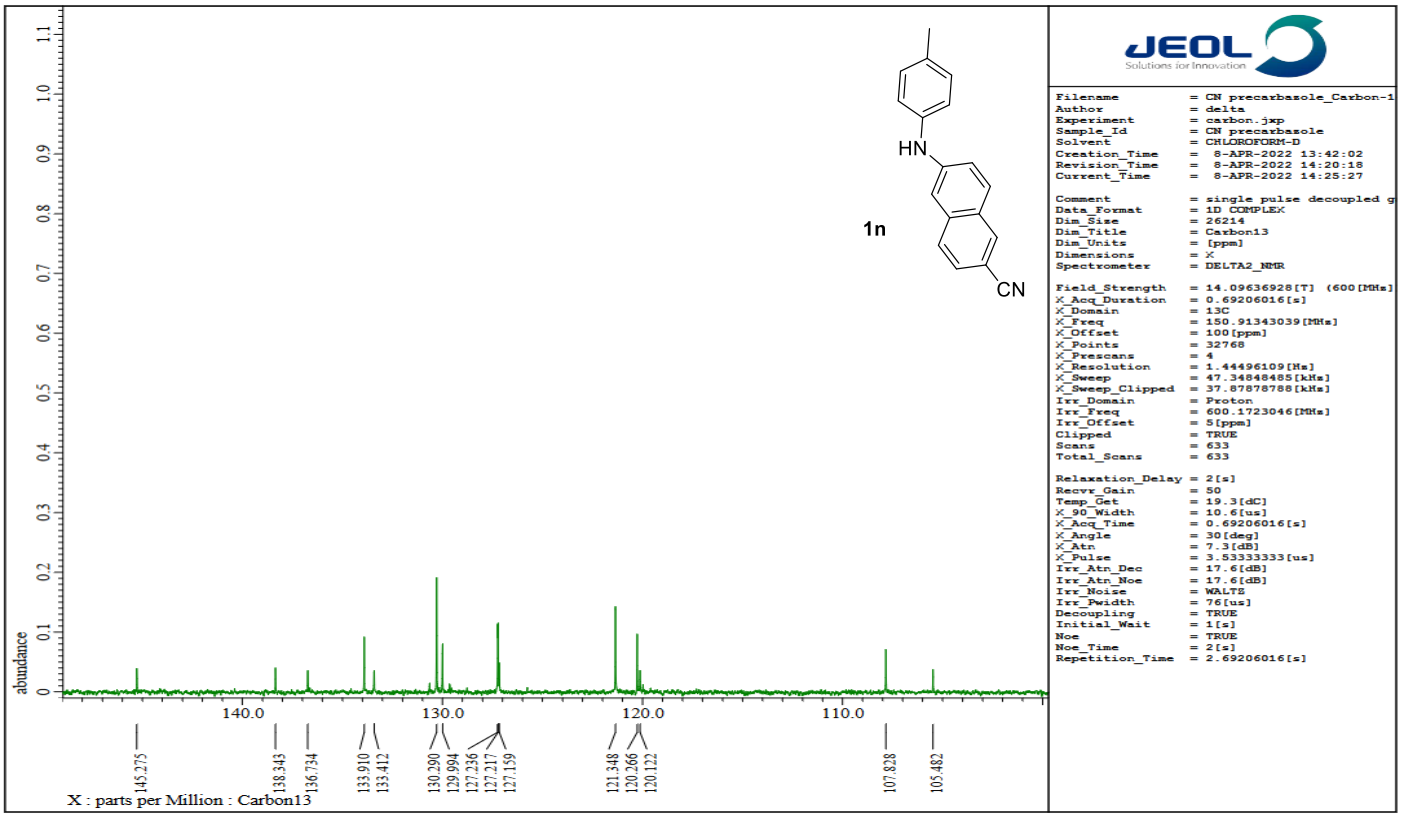
Compound **1l** (^{13}C NMR, 100 MHz, $CDCl_3$).



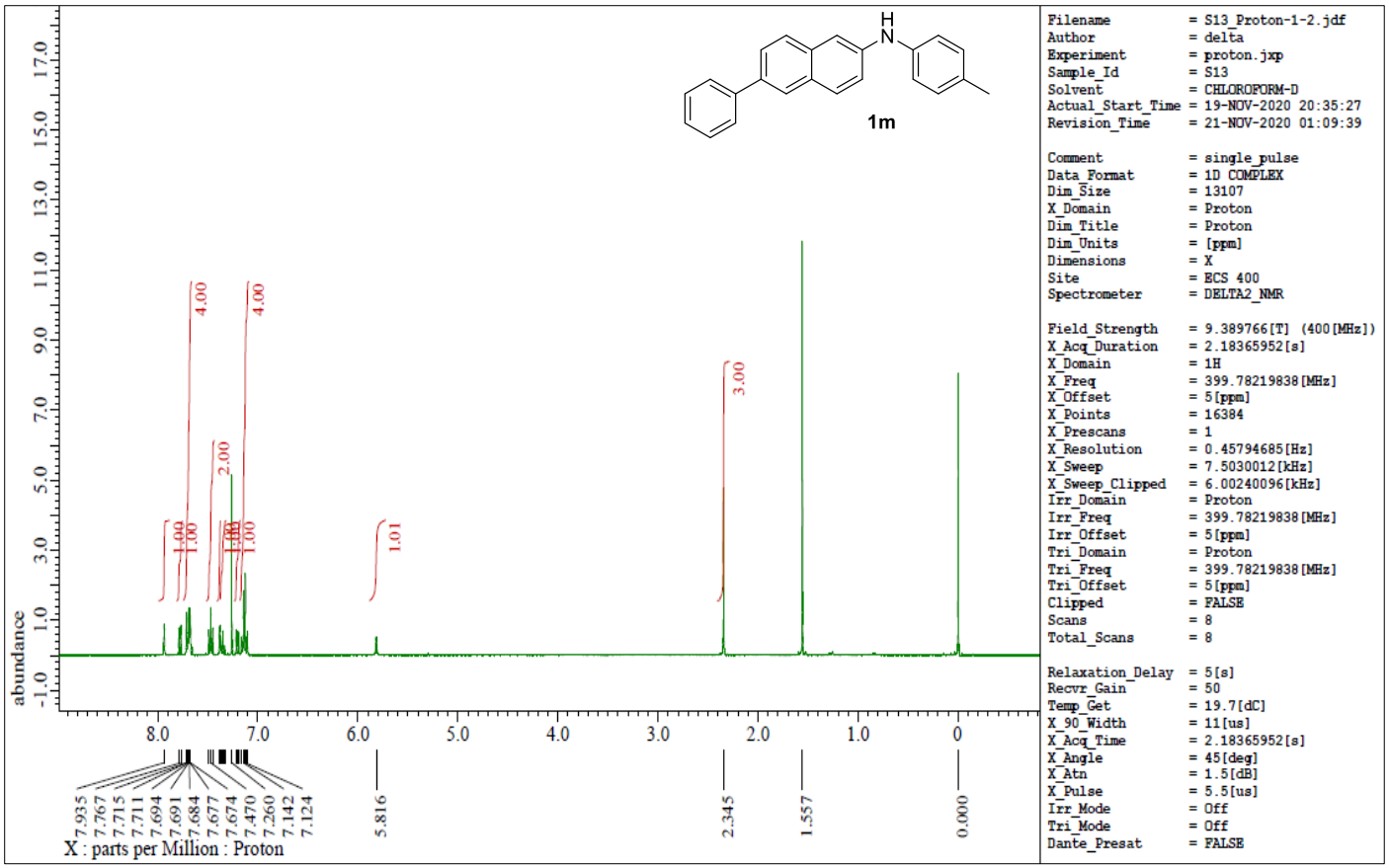


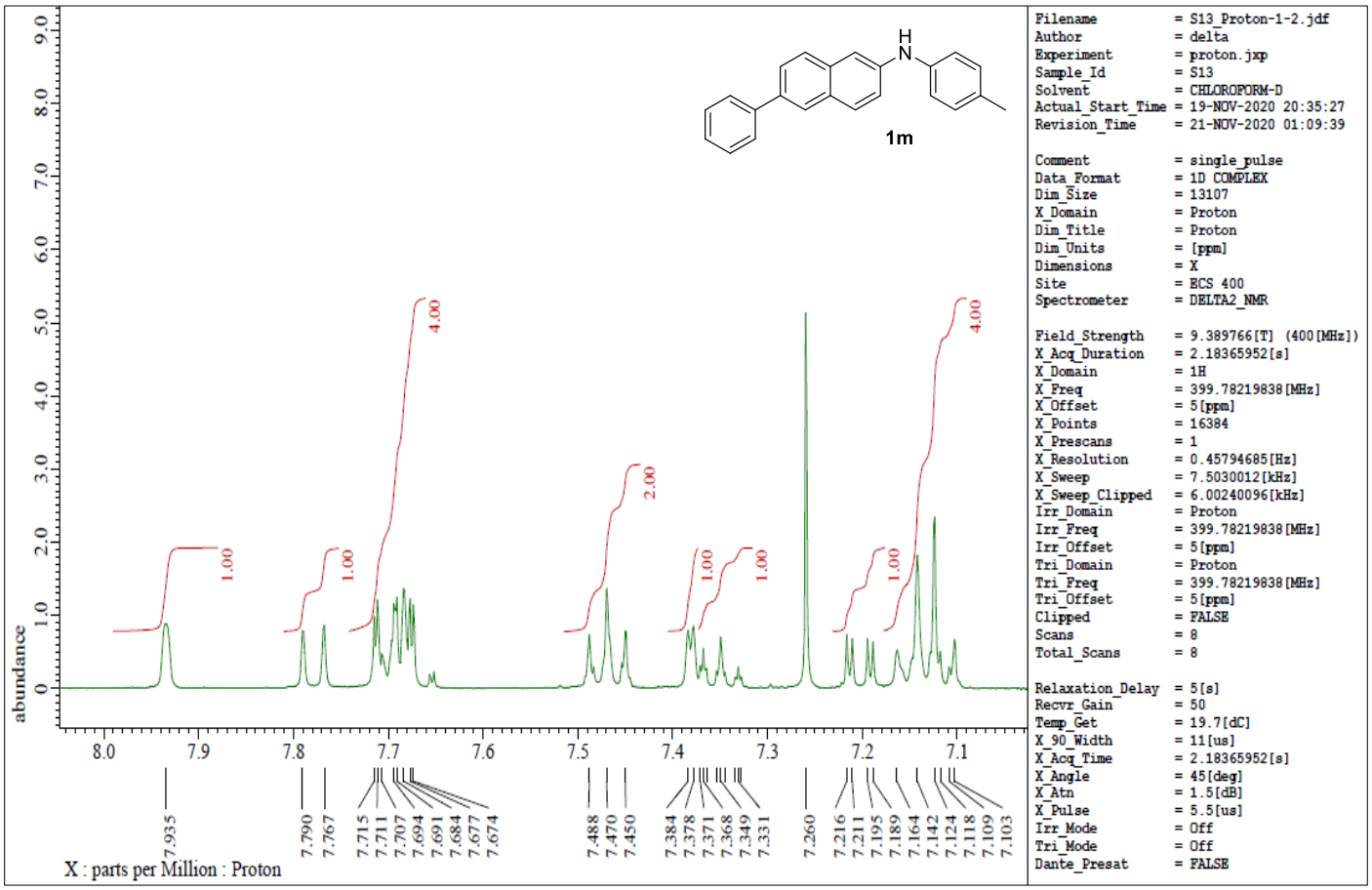
Compound **1n** (^{1}H NMR, 400 MHz, $CDCl_3$).



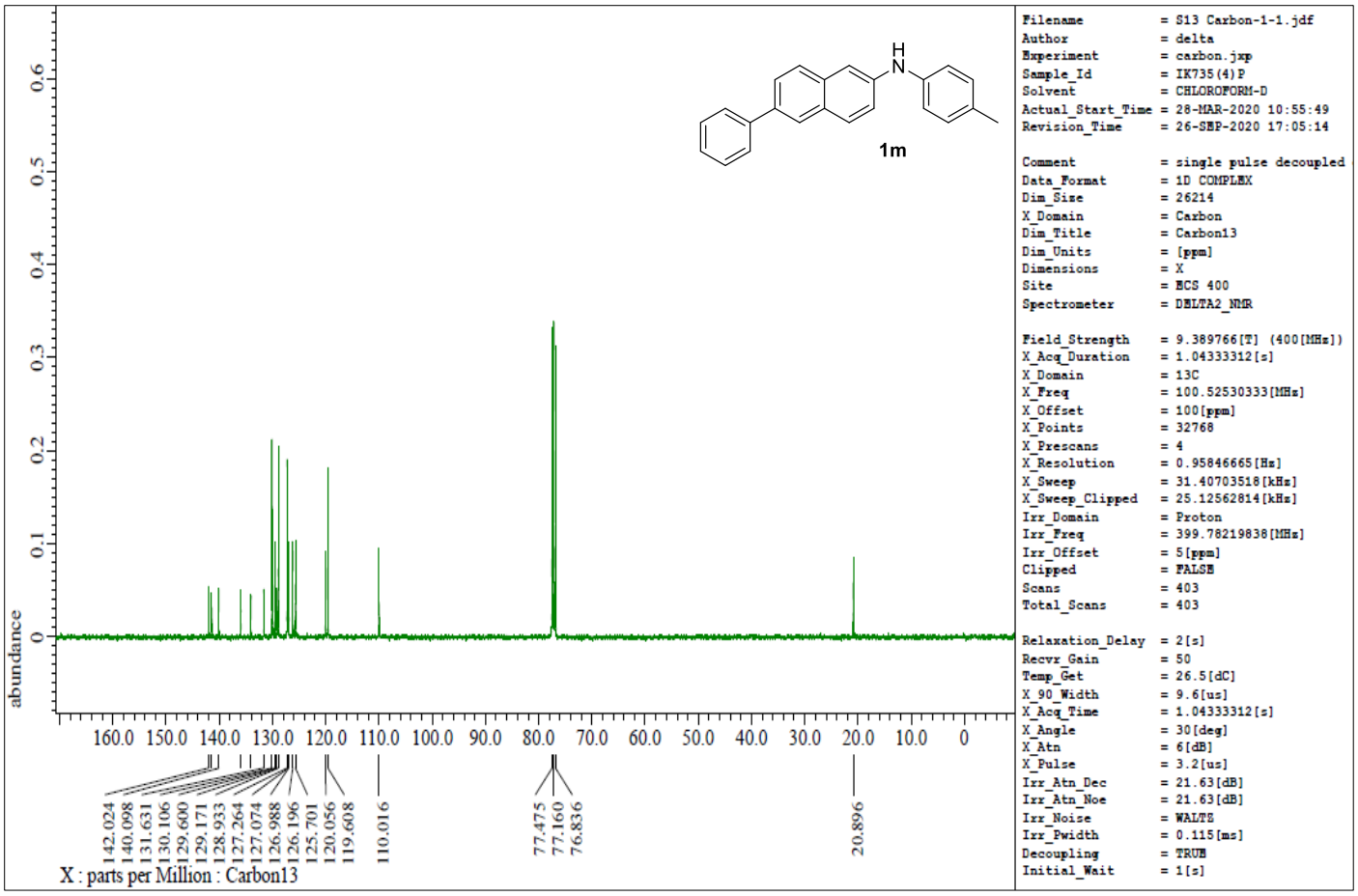


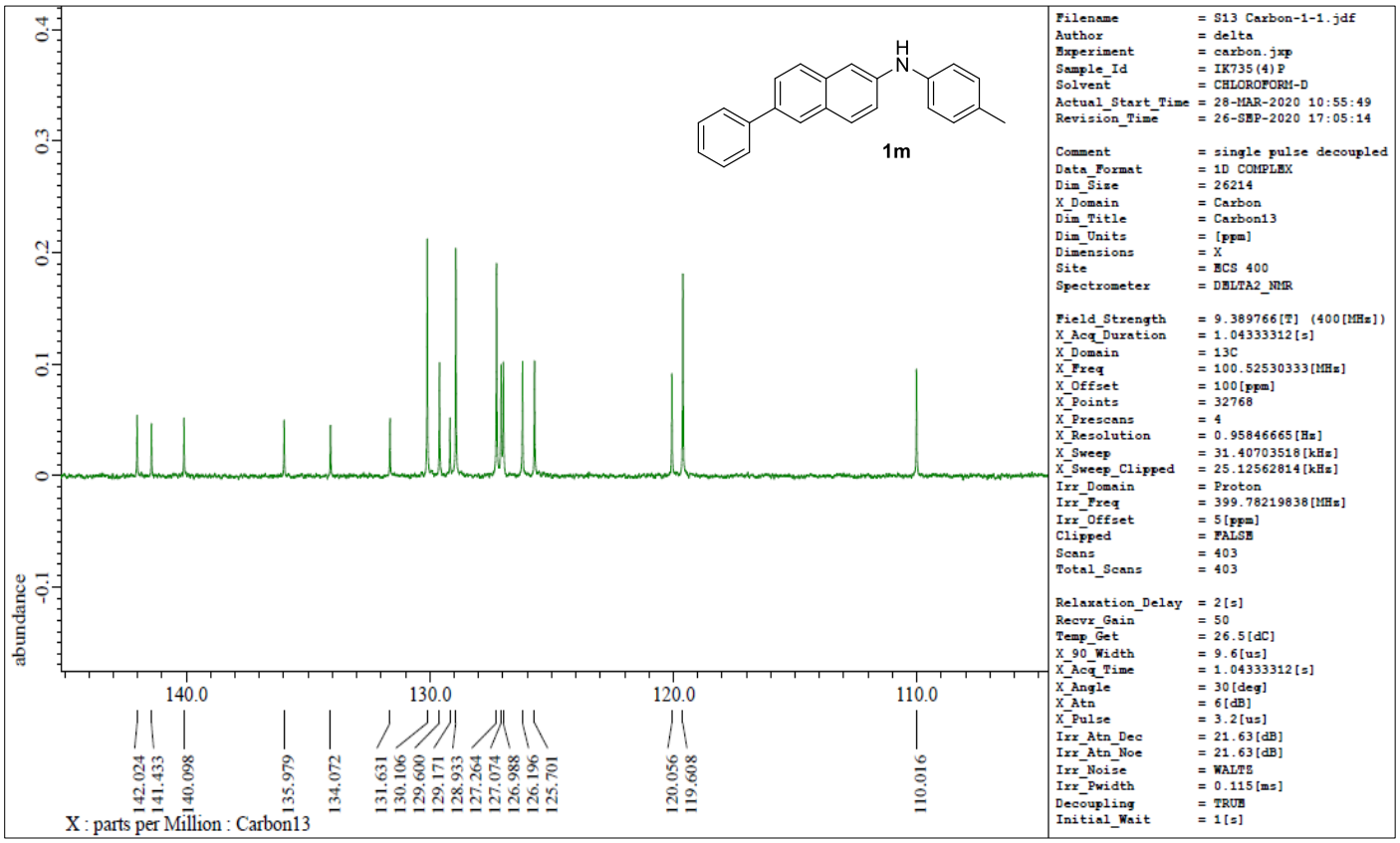
Compound **1n** (^{13}C NMR, 100 MHz, $CDCl_3$).



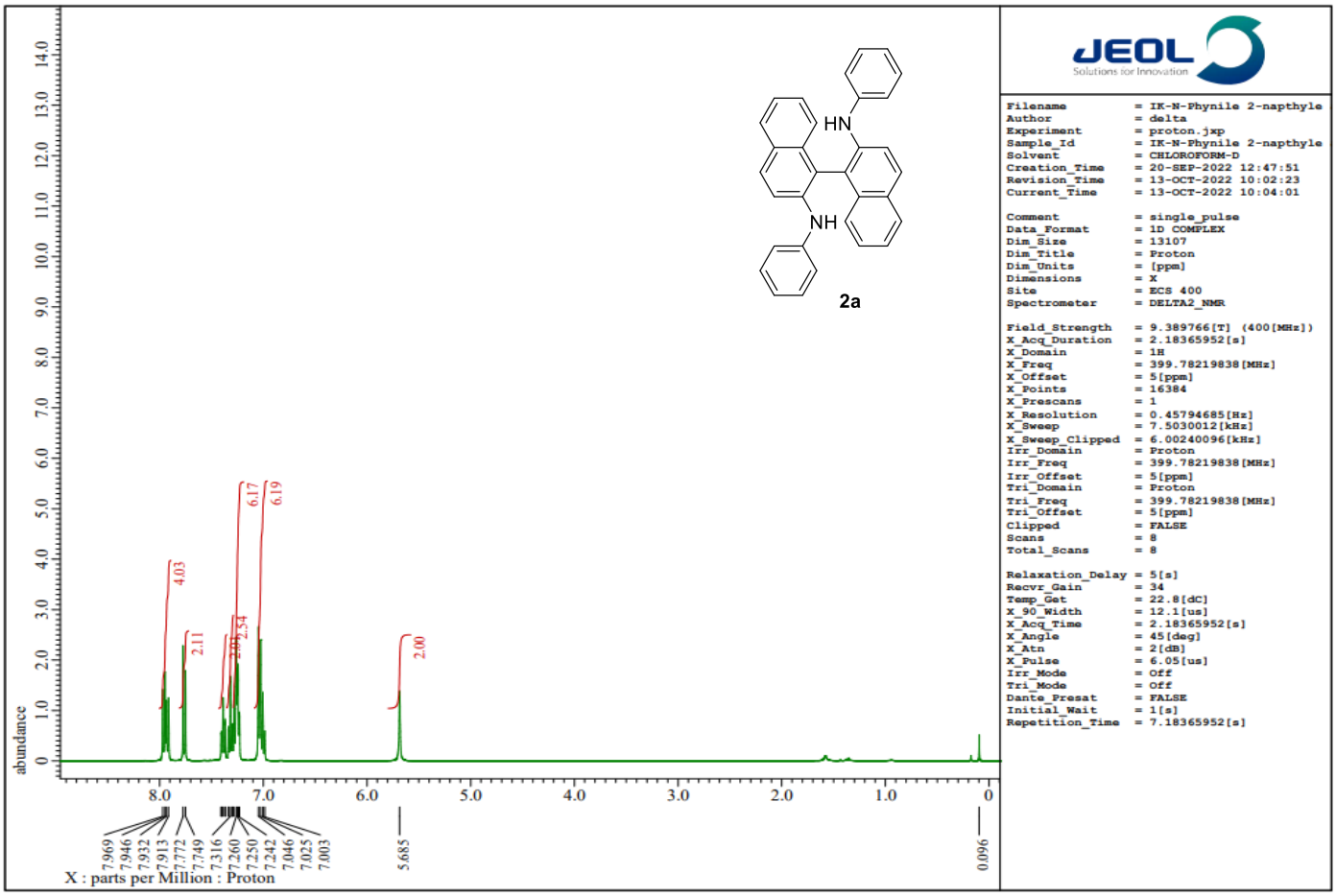


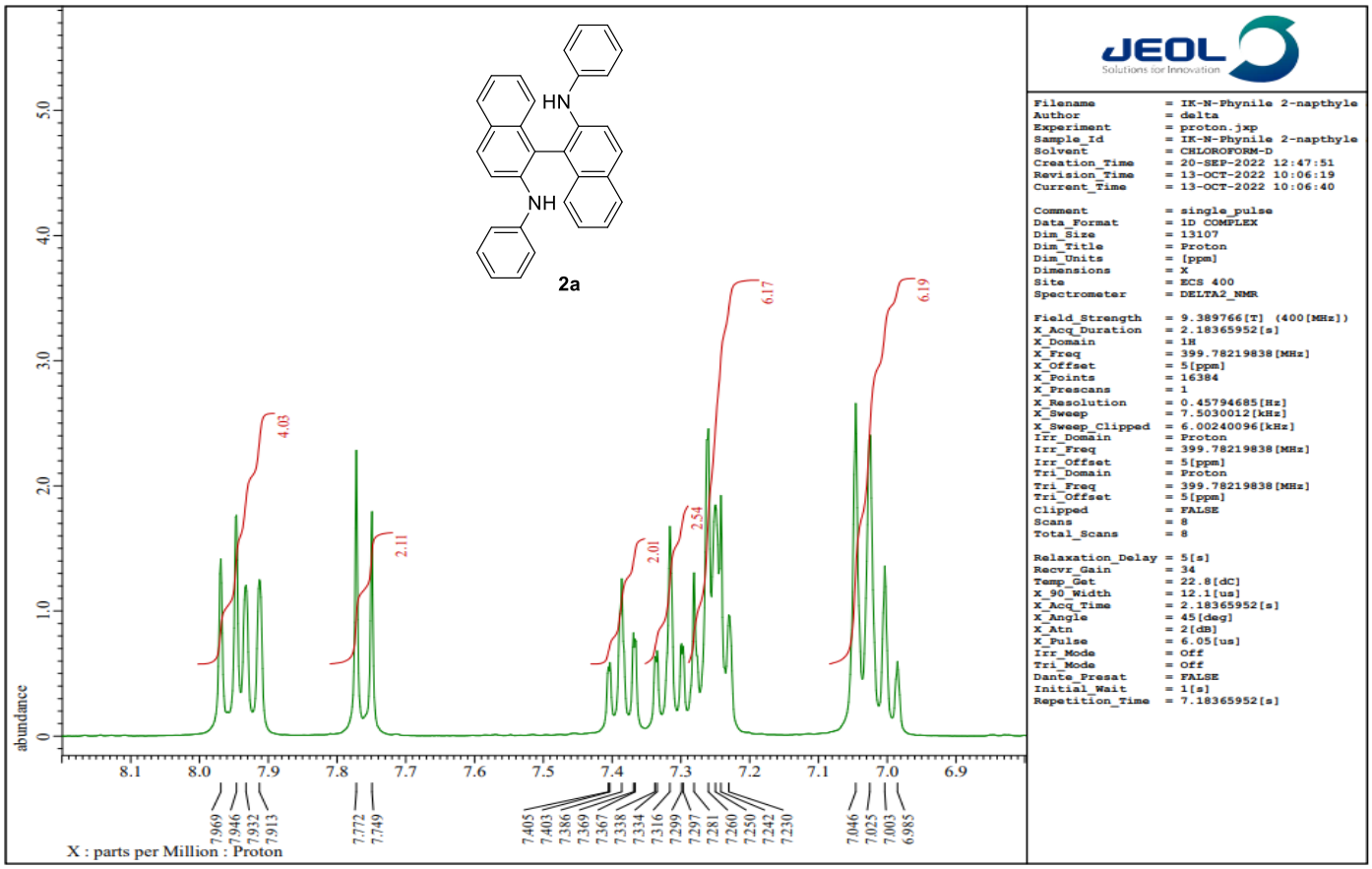
Compound **1m** (^{1}H NMR, 400 MHz, $CDCl_3$).



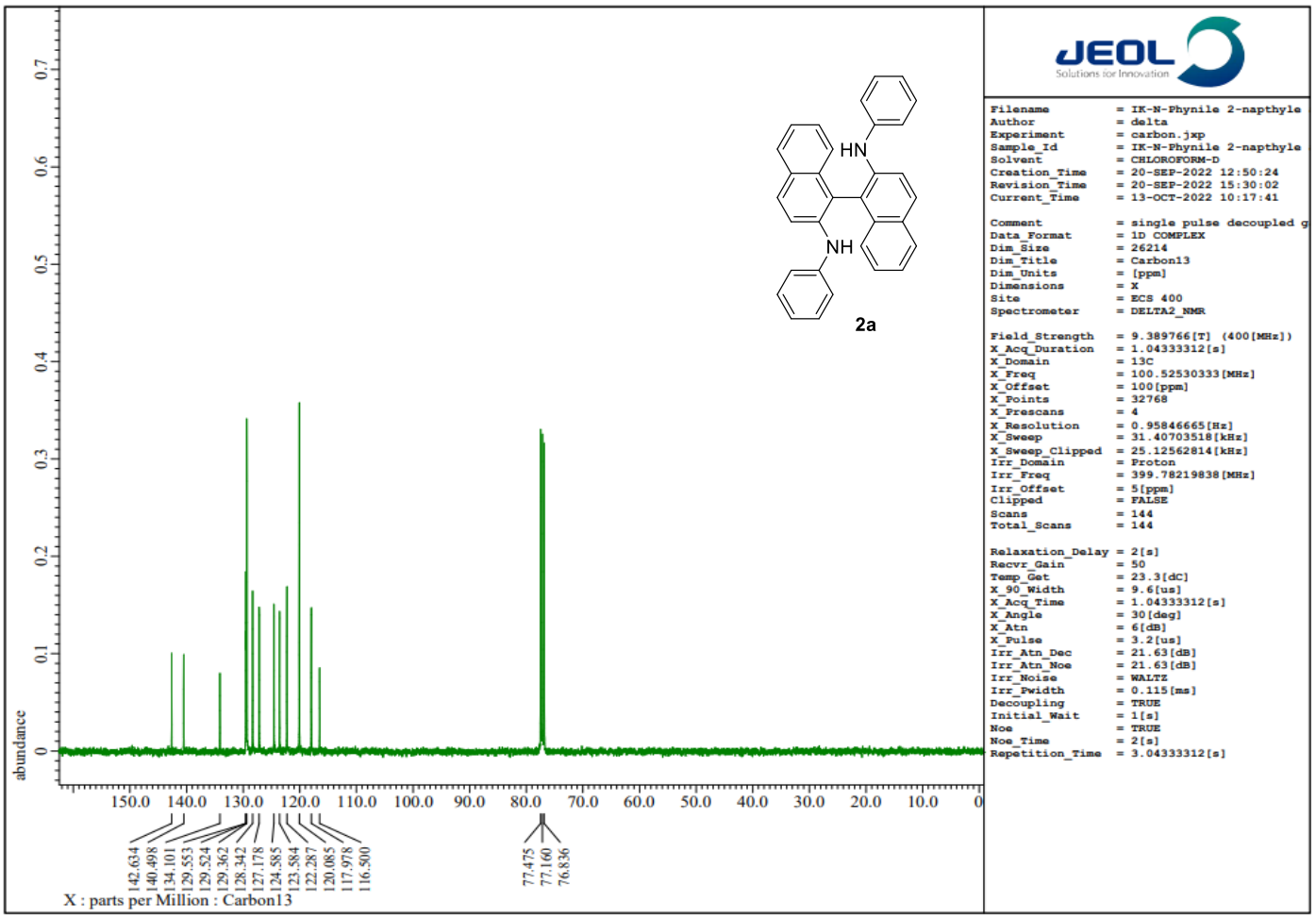


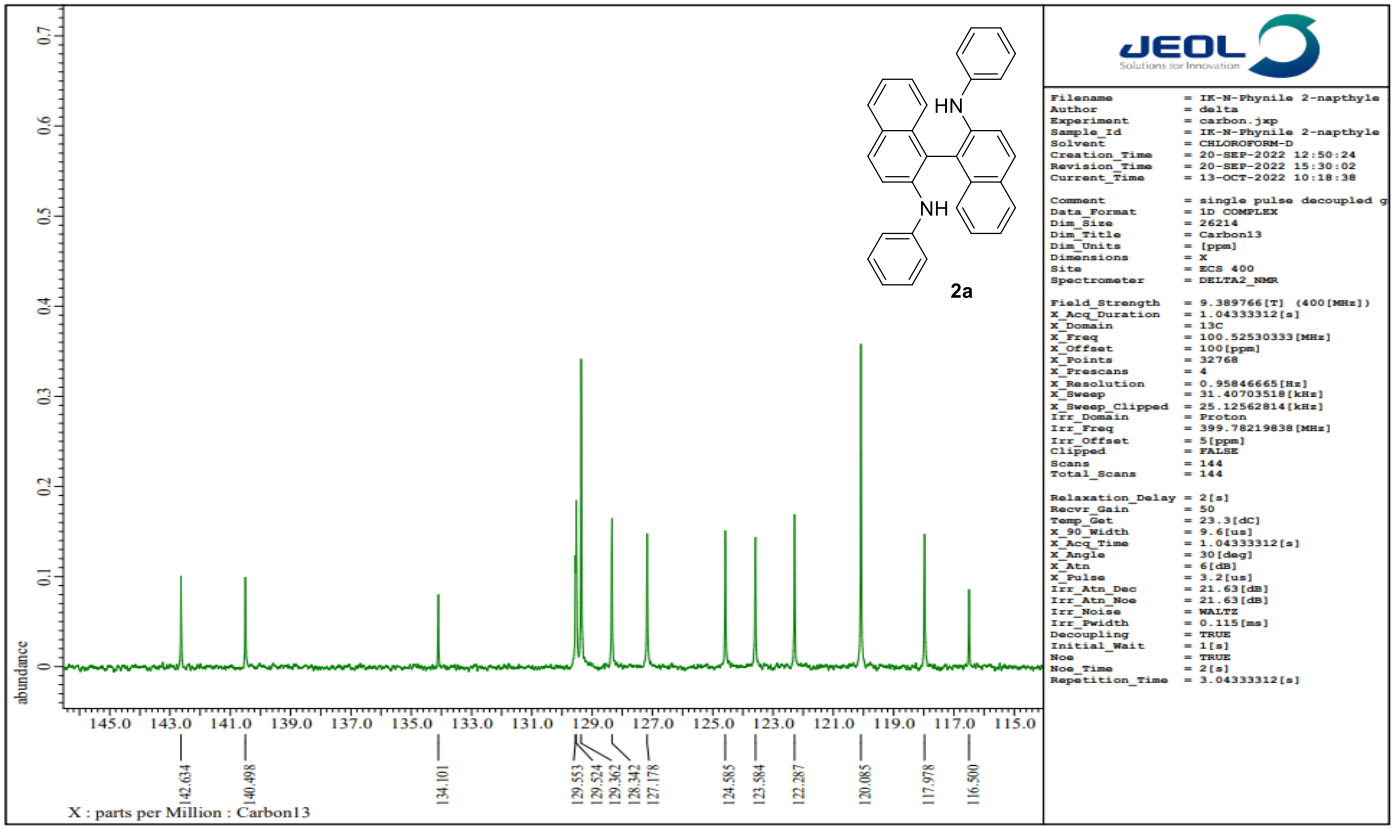
Compound **1m** (^{13}C NMR, 100 MHz, $CDCl_3$).



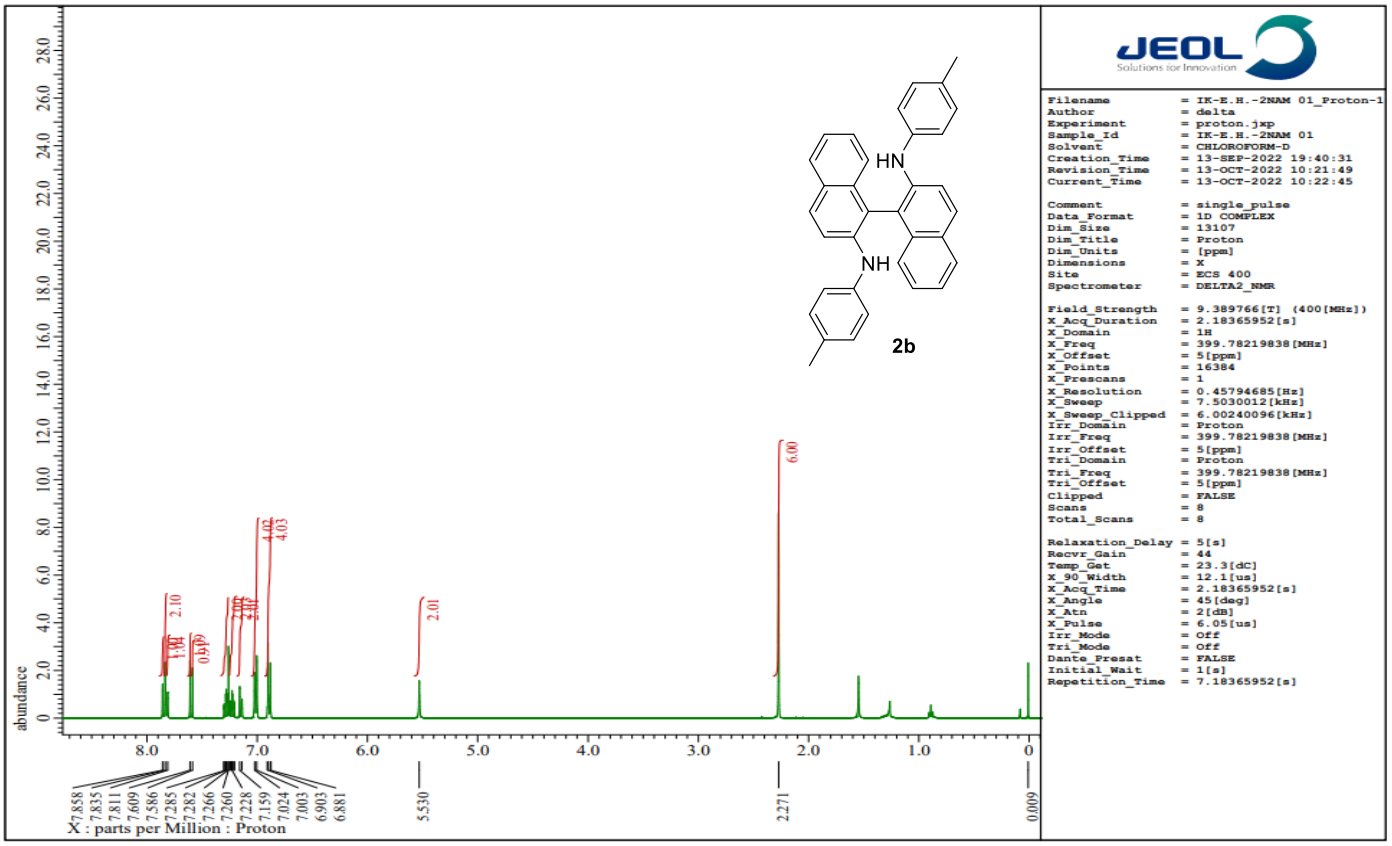


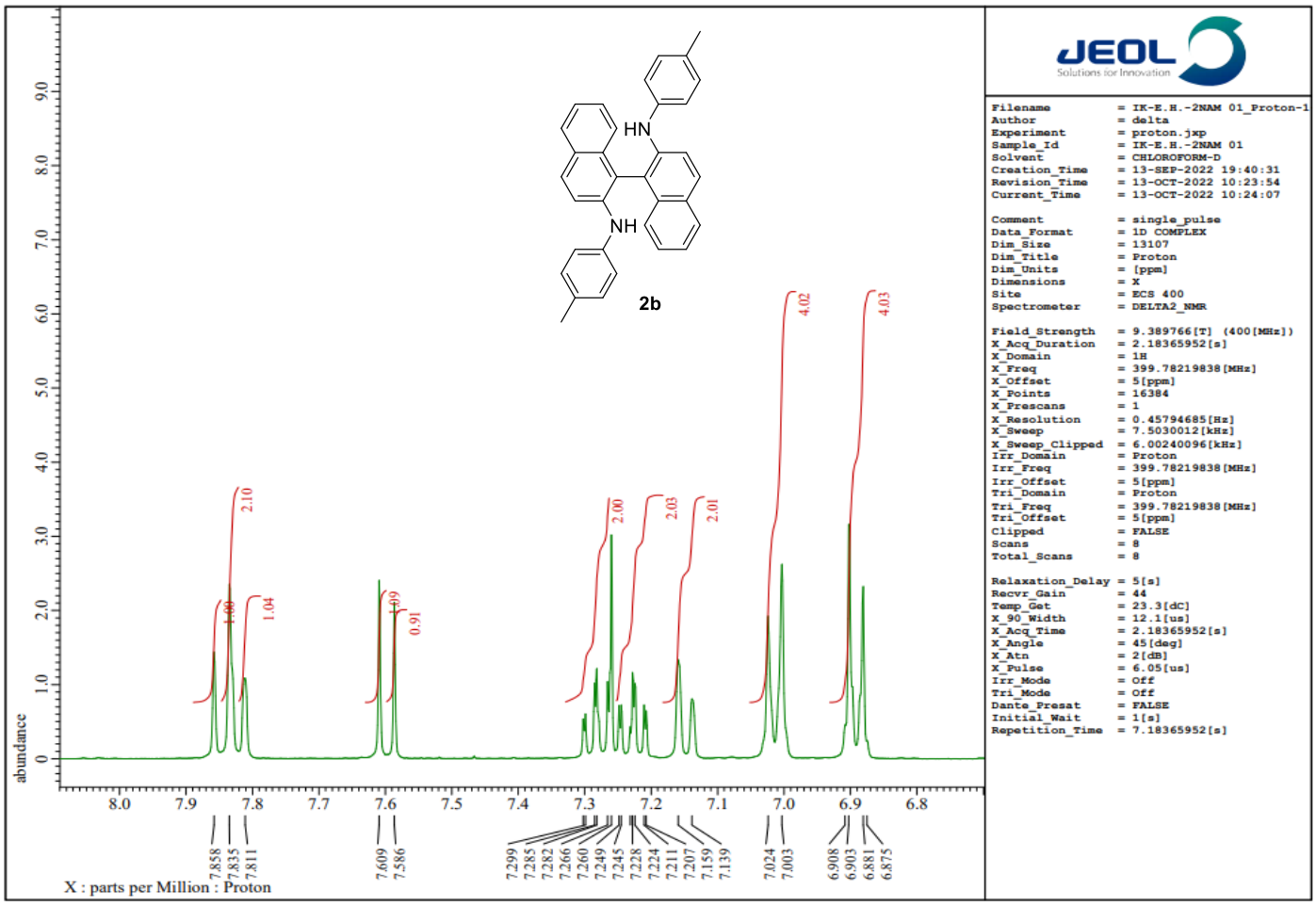
Compound **2a** (^{1}H NMR, 400 MHz, $CDCl_3$).



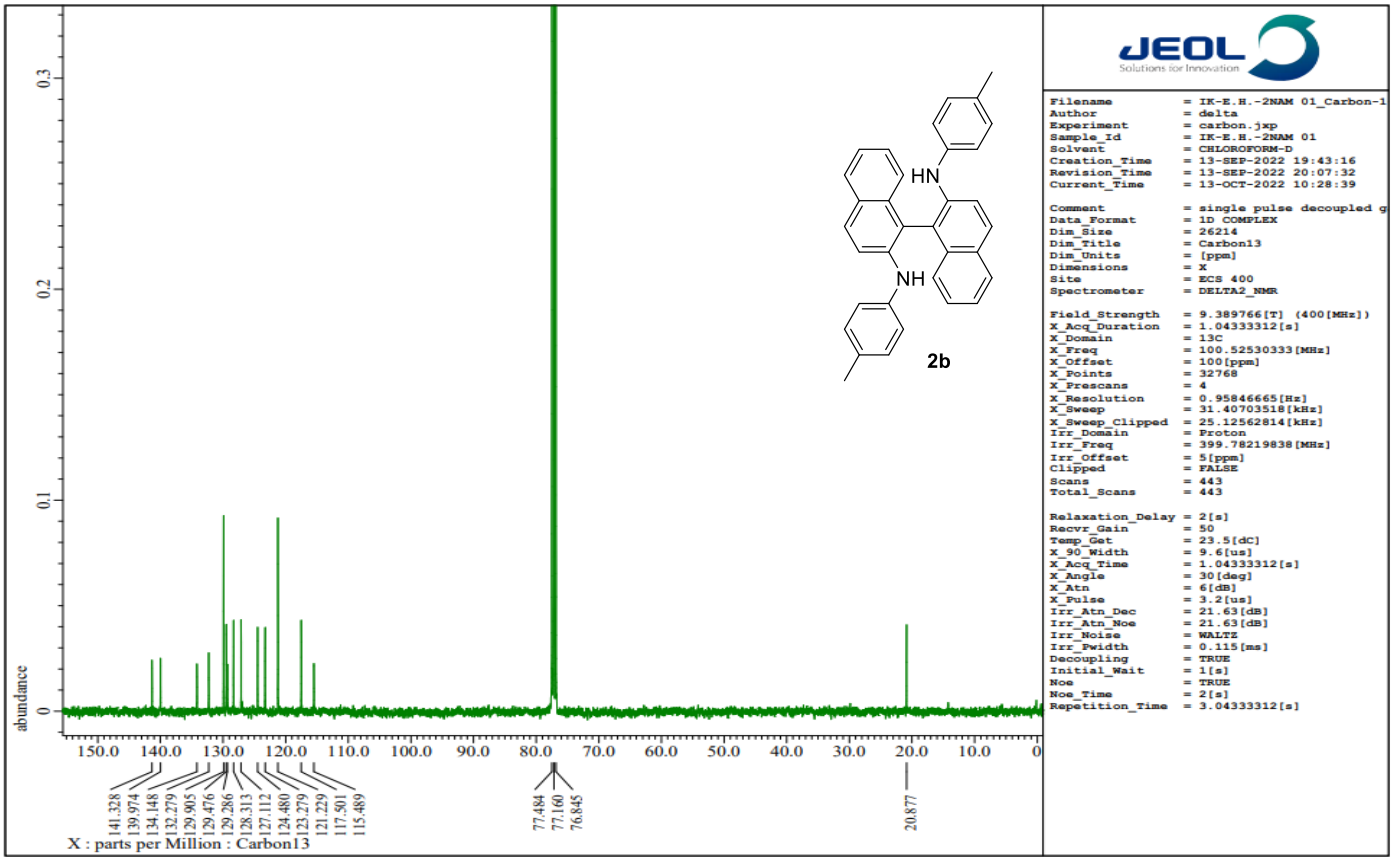


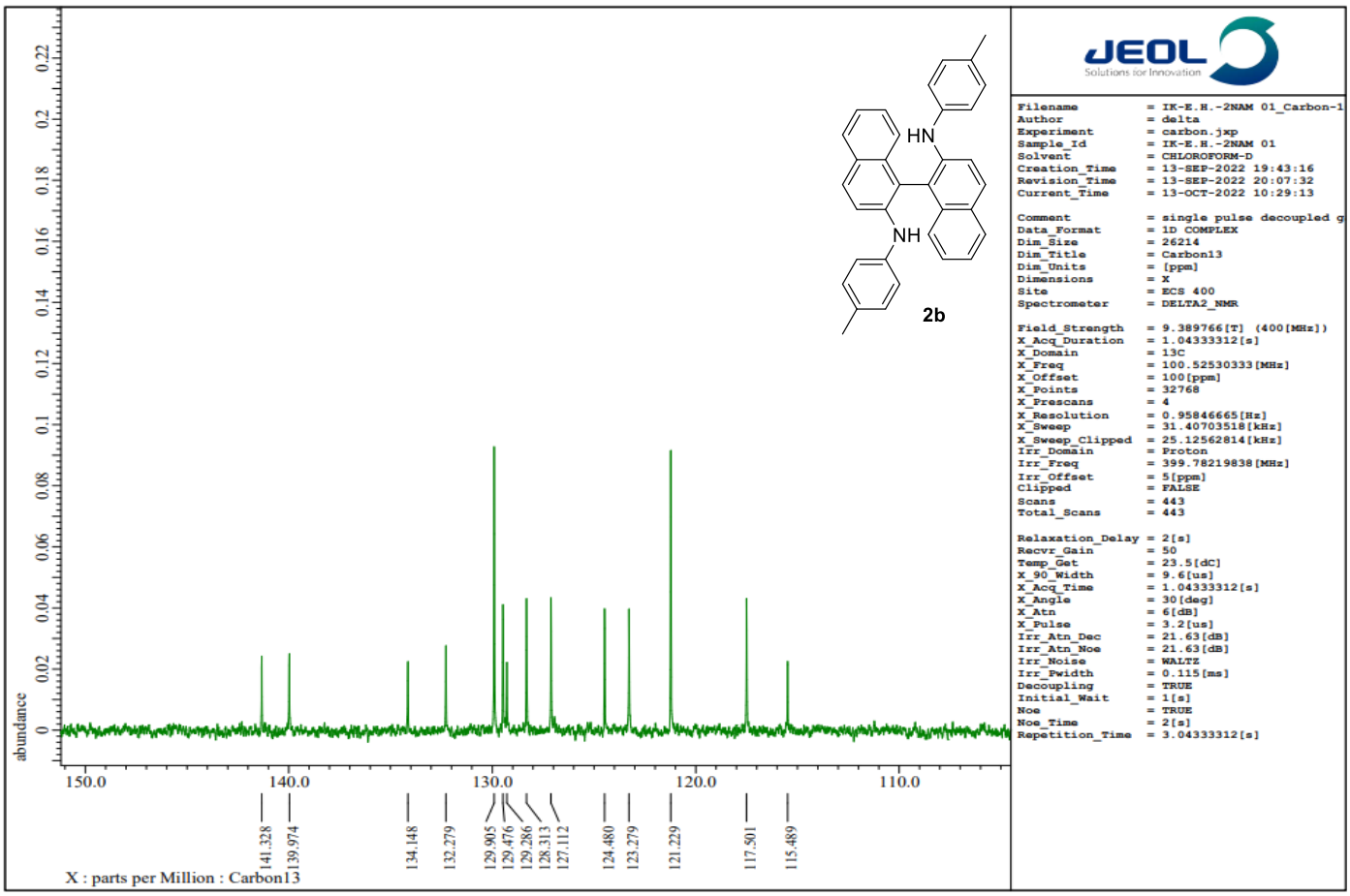
Compound **2a** (^{13}C NMR, 100 MHz, $CDCl_3$).



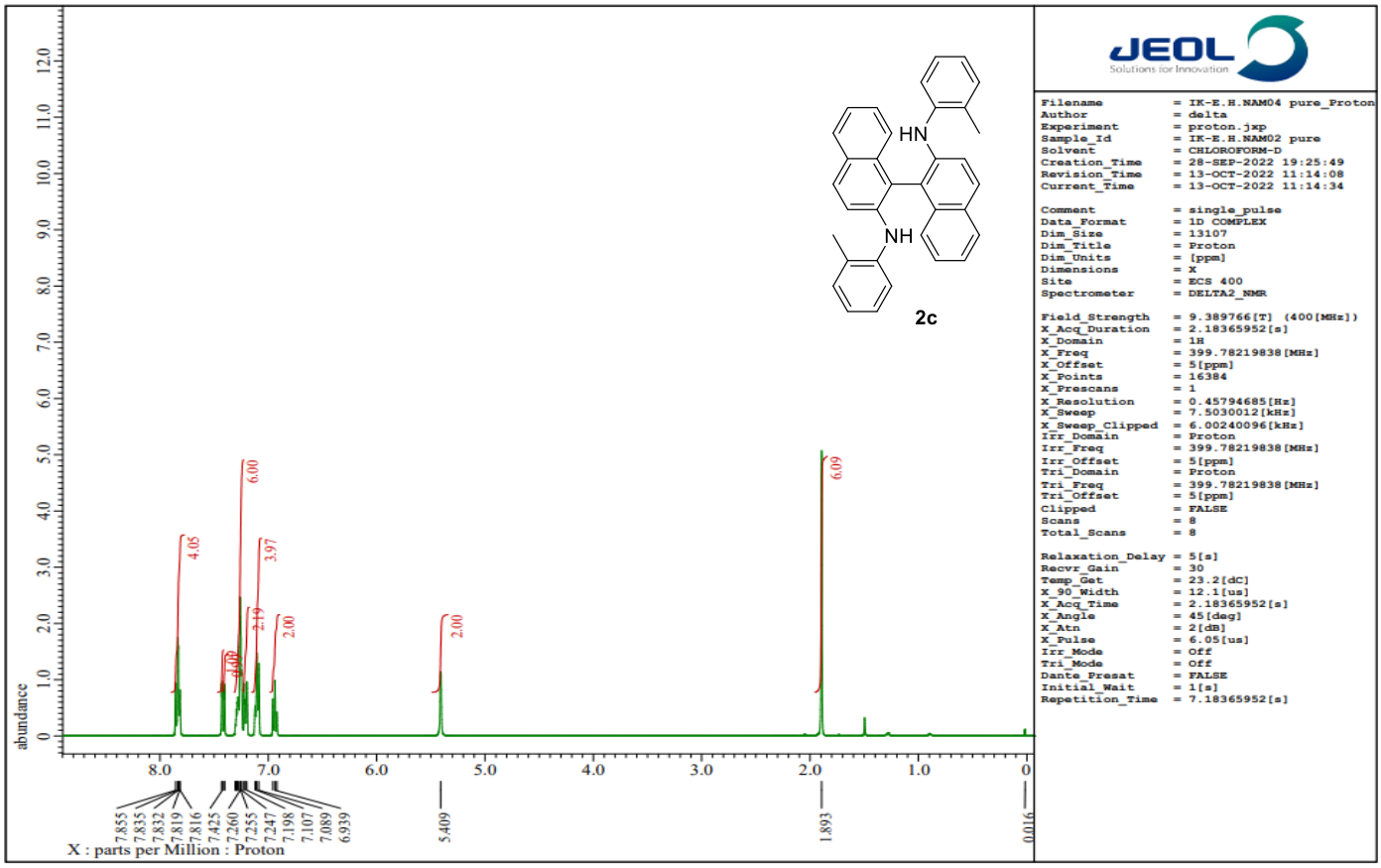


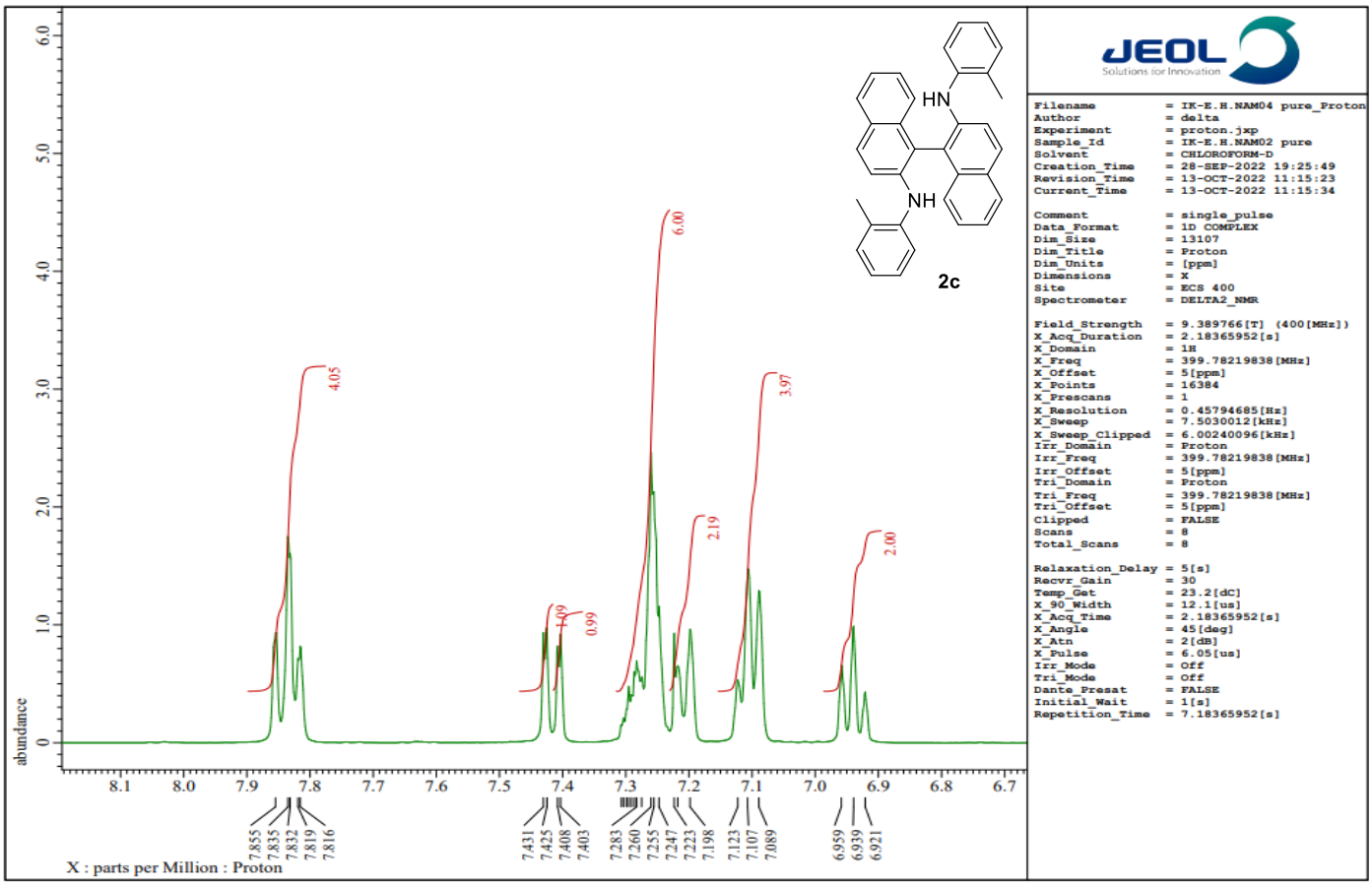
Compound **2b** (^{1}H NMR, 400 MHz, $CDCl_3$).



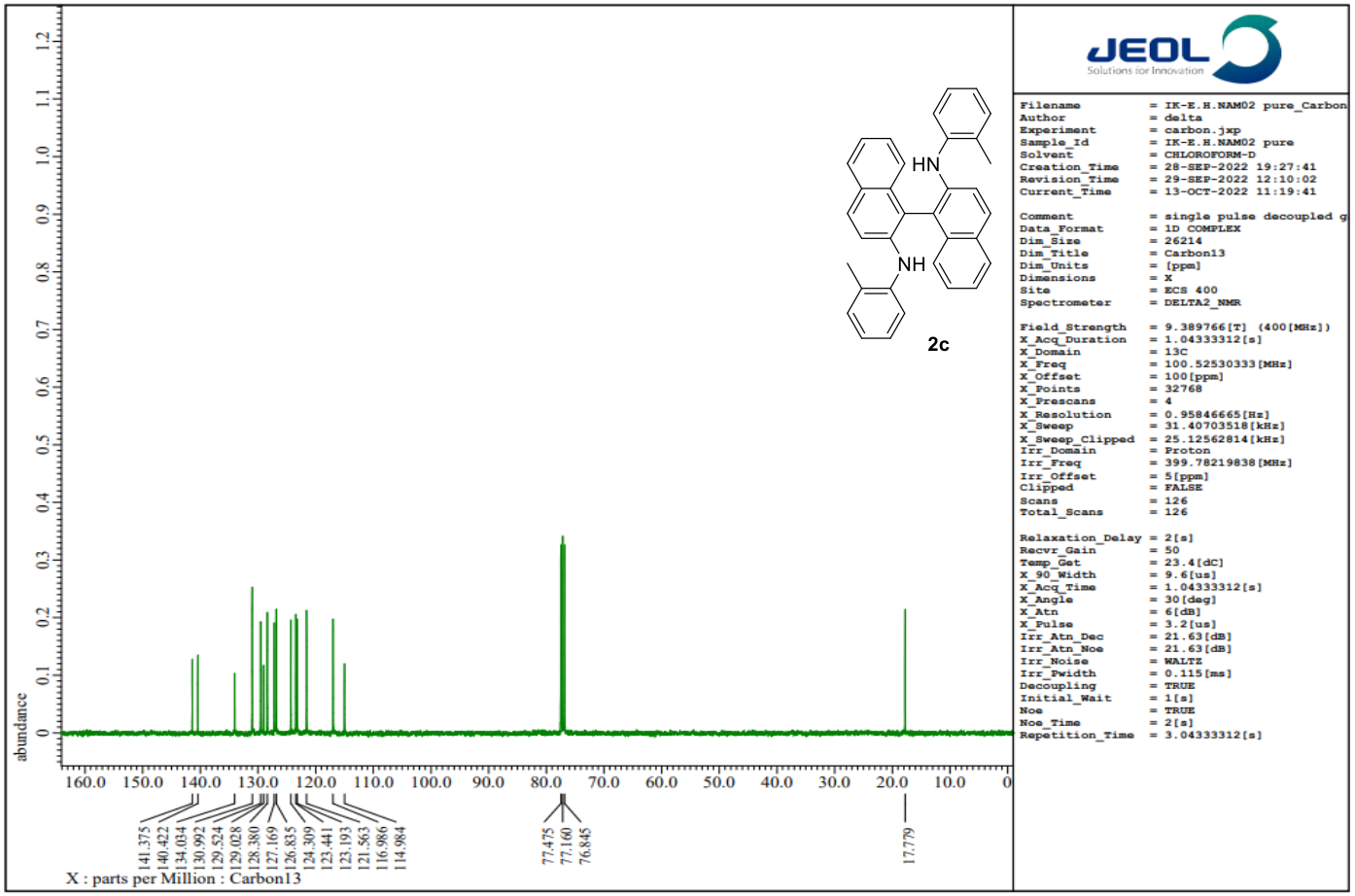


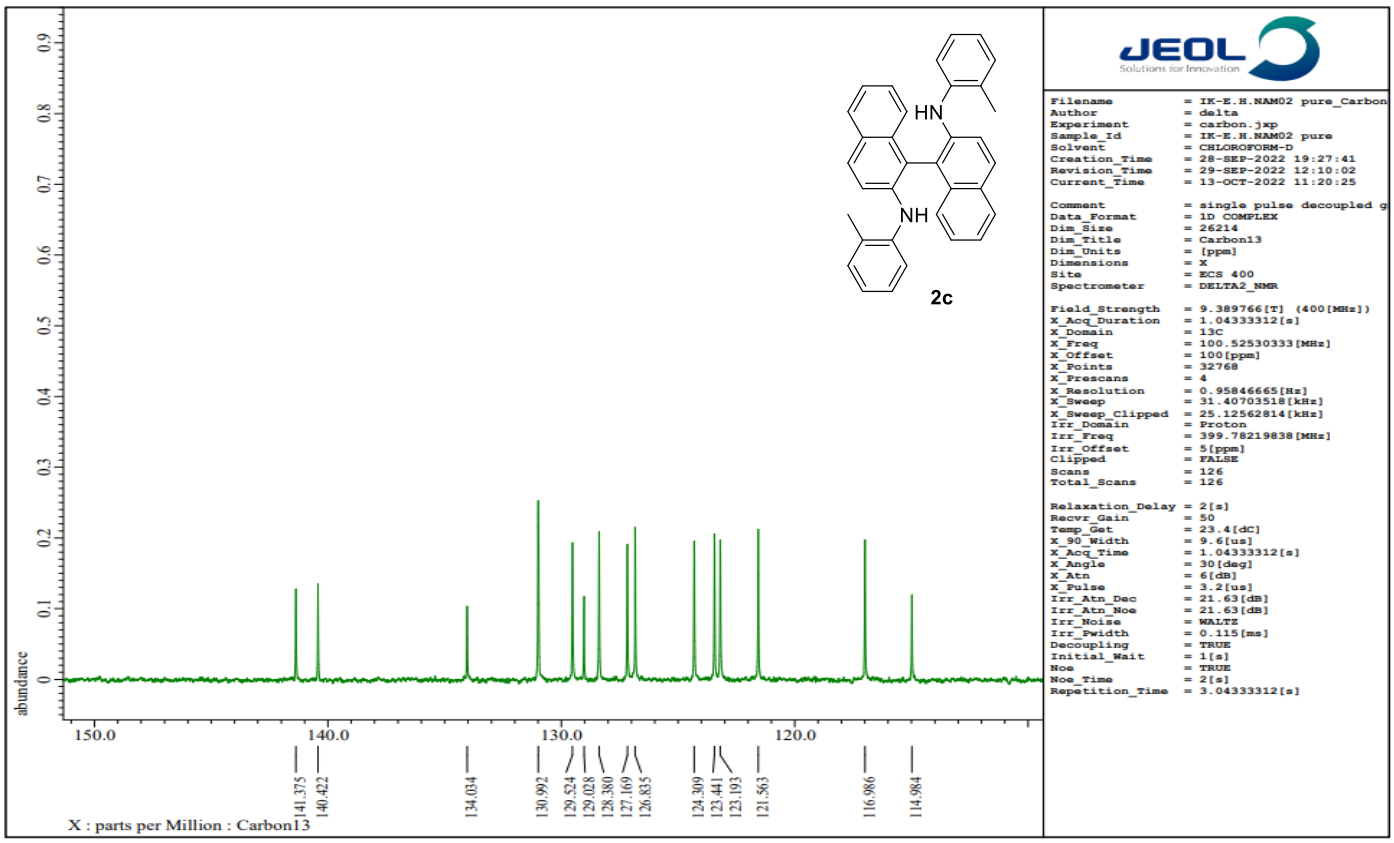
Compound **2b** (^{13}C NMR, 100 MHz, $CDCl_3$).



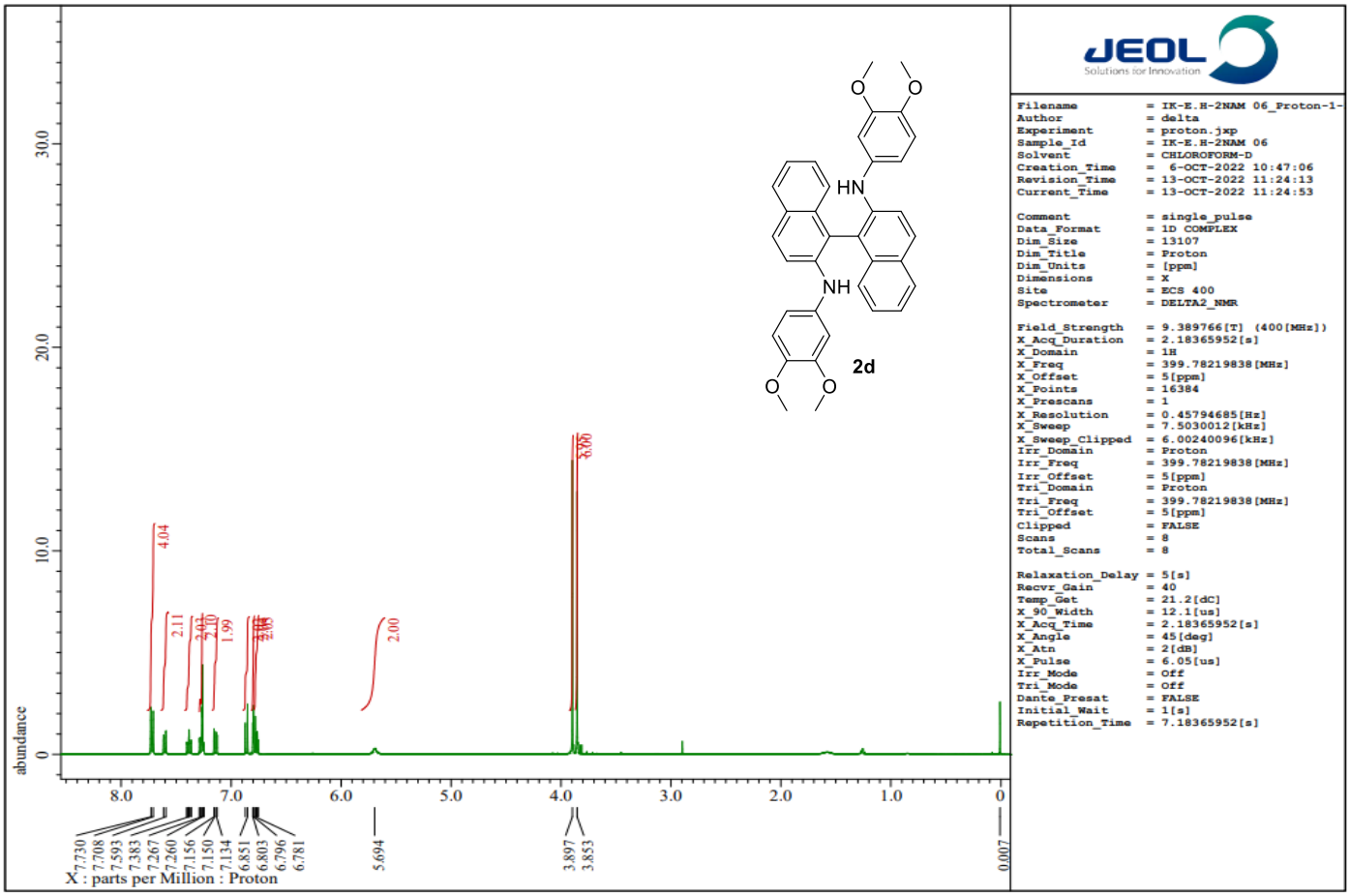


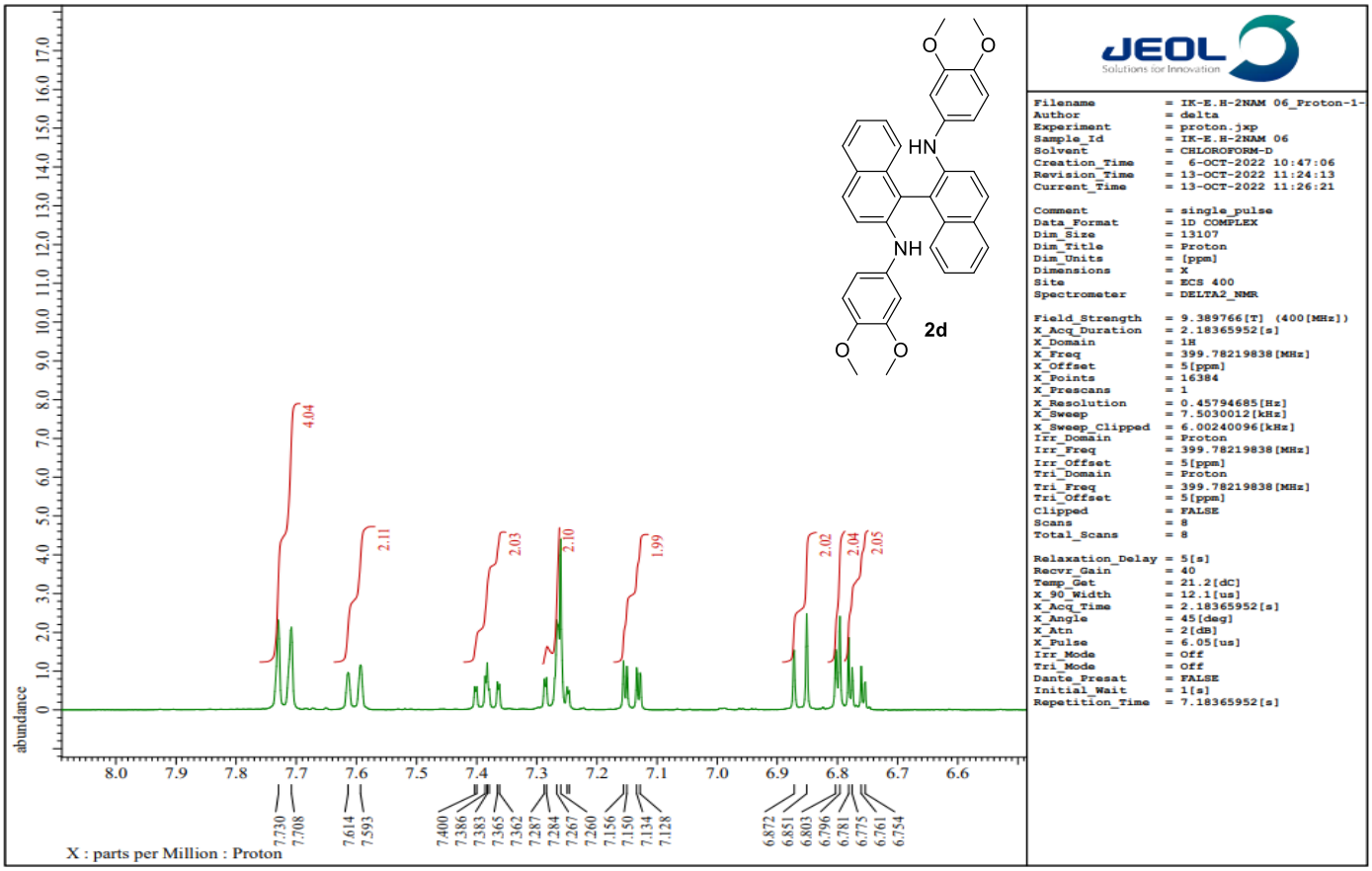
Compound **2c** (^{1}H NMR, 400 MHz, $CDCl_3$).



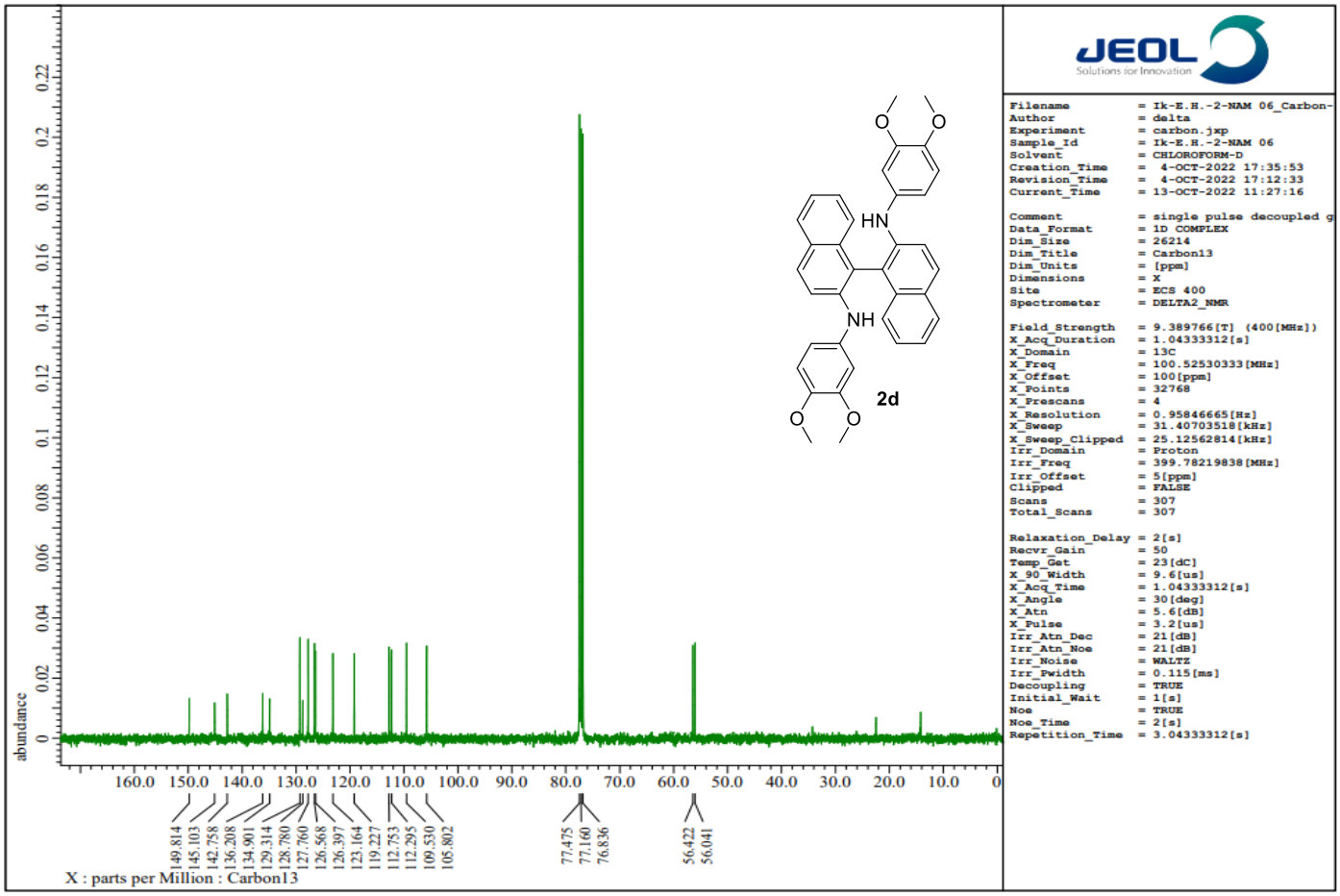


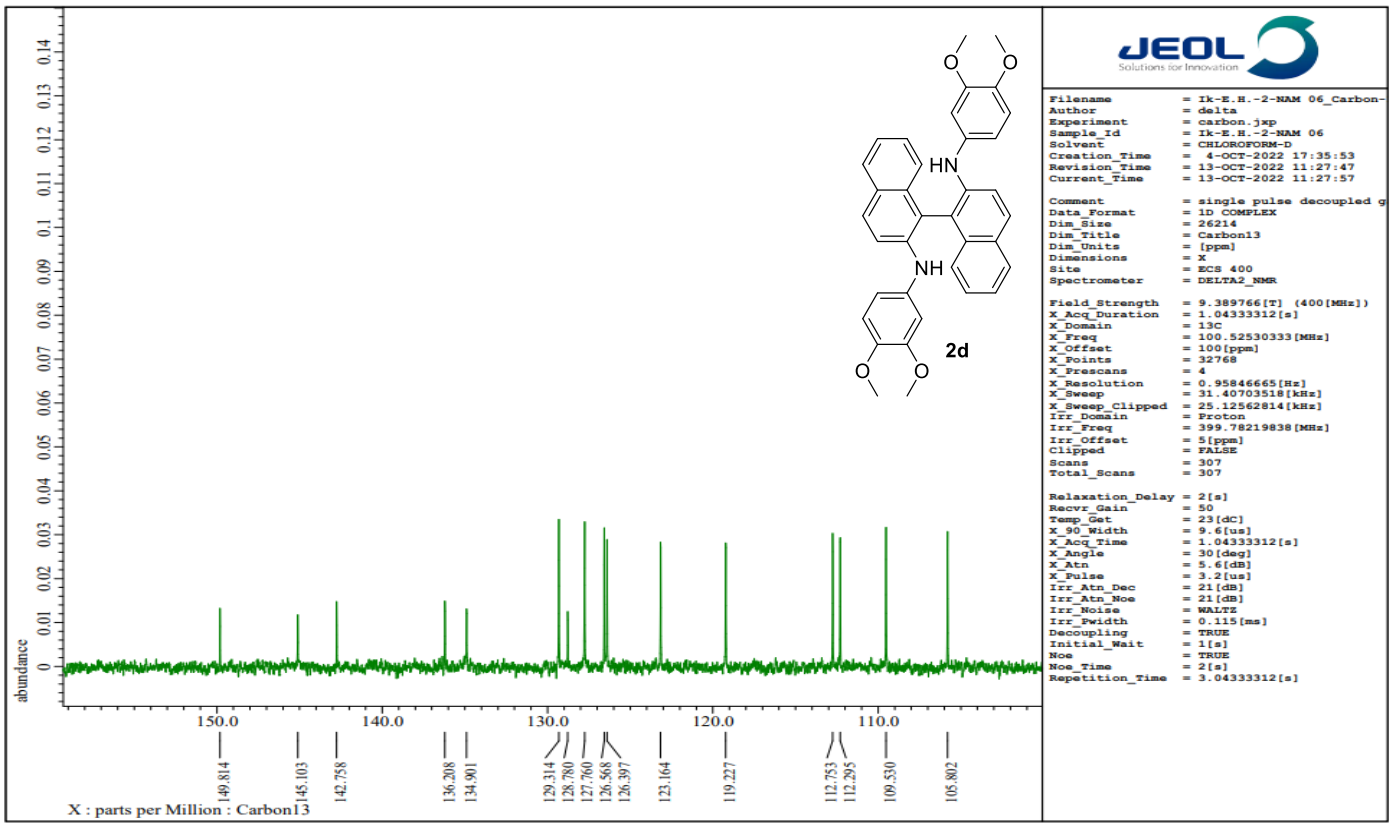
Compound **2c** (^{13}C NMR, 100 MHz, $CDCl_3$).



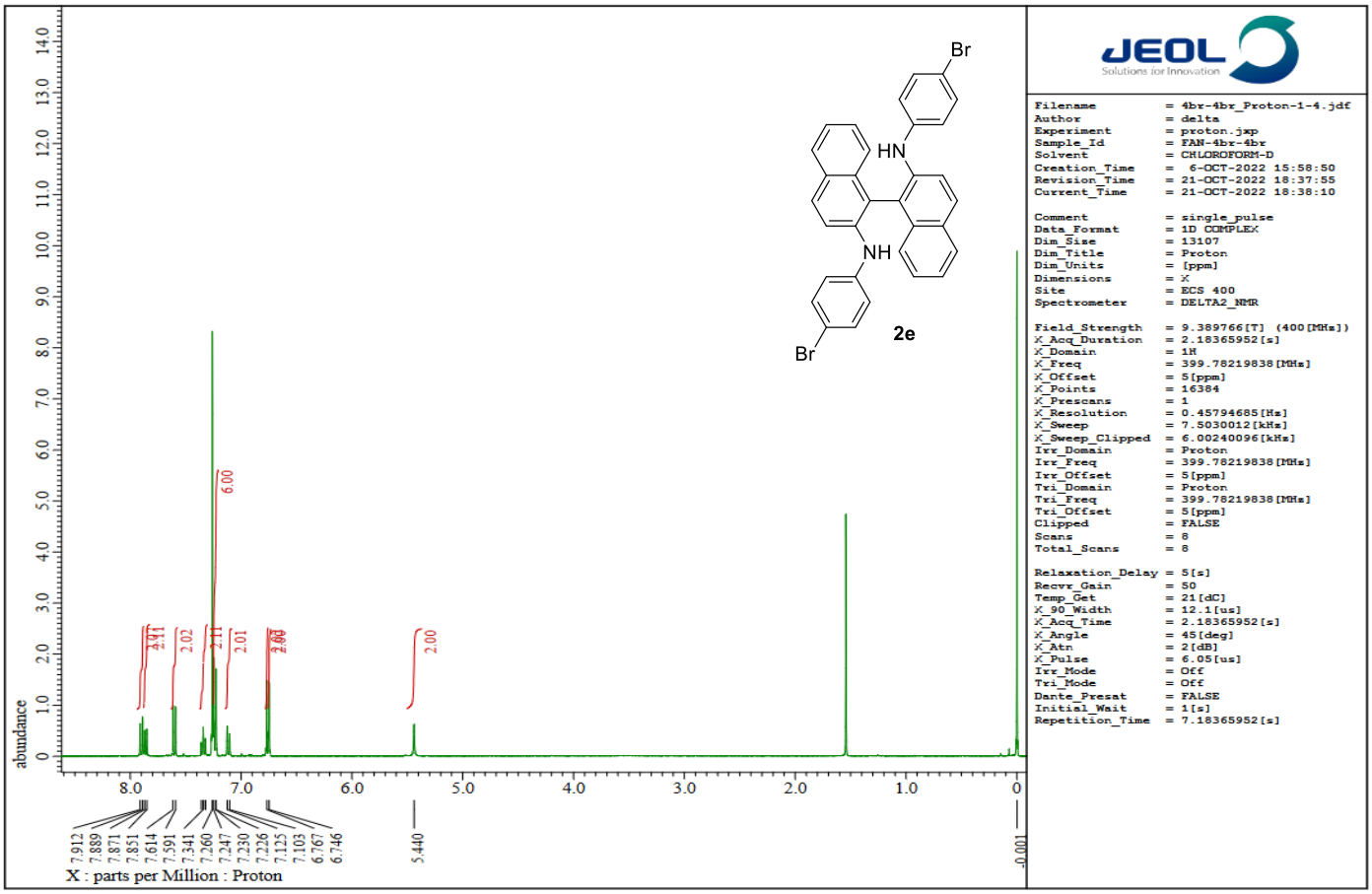


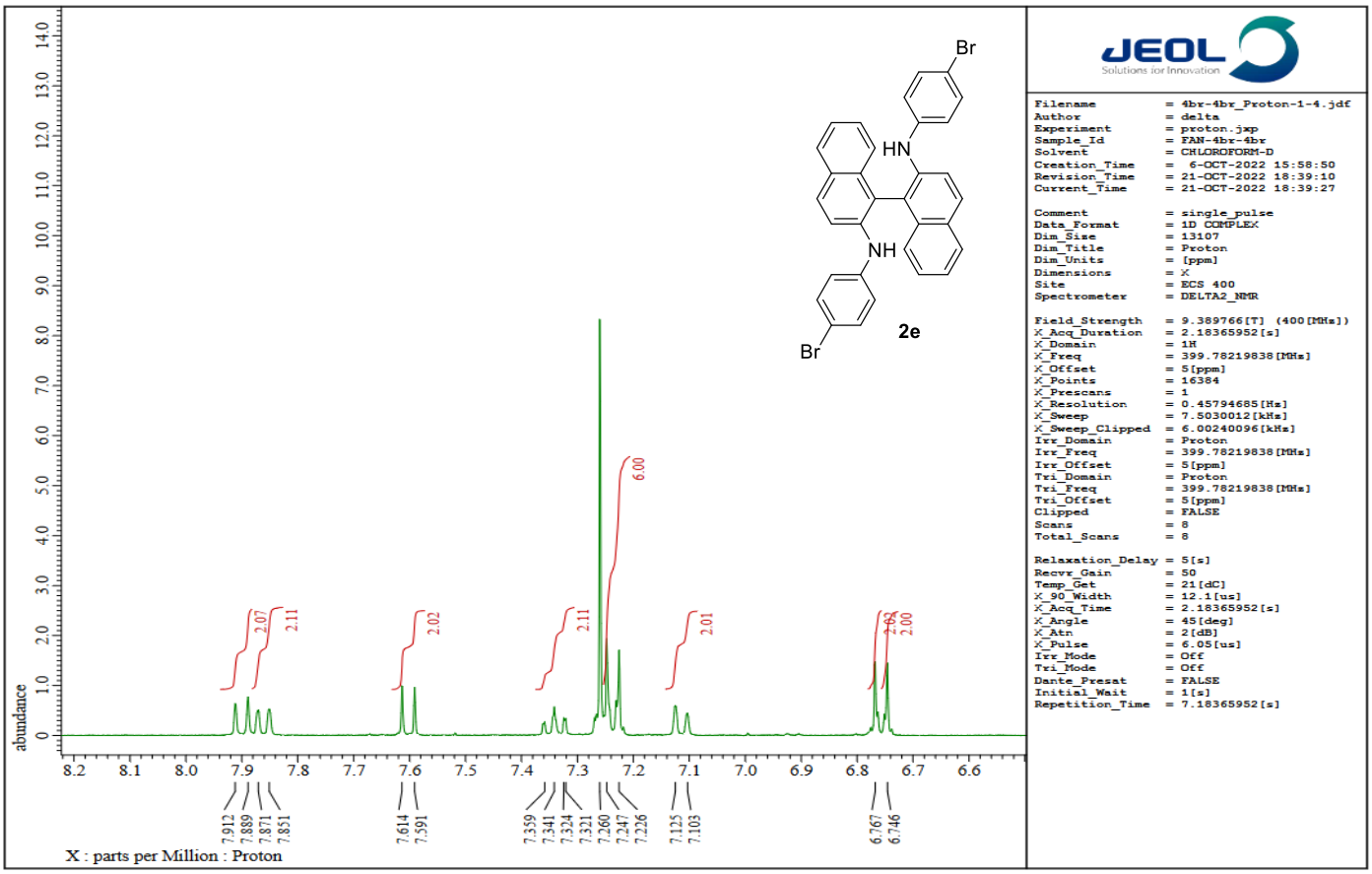
Compound **2d** (^{1}H NMR, 400 MHz, $CDCl_3$).



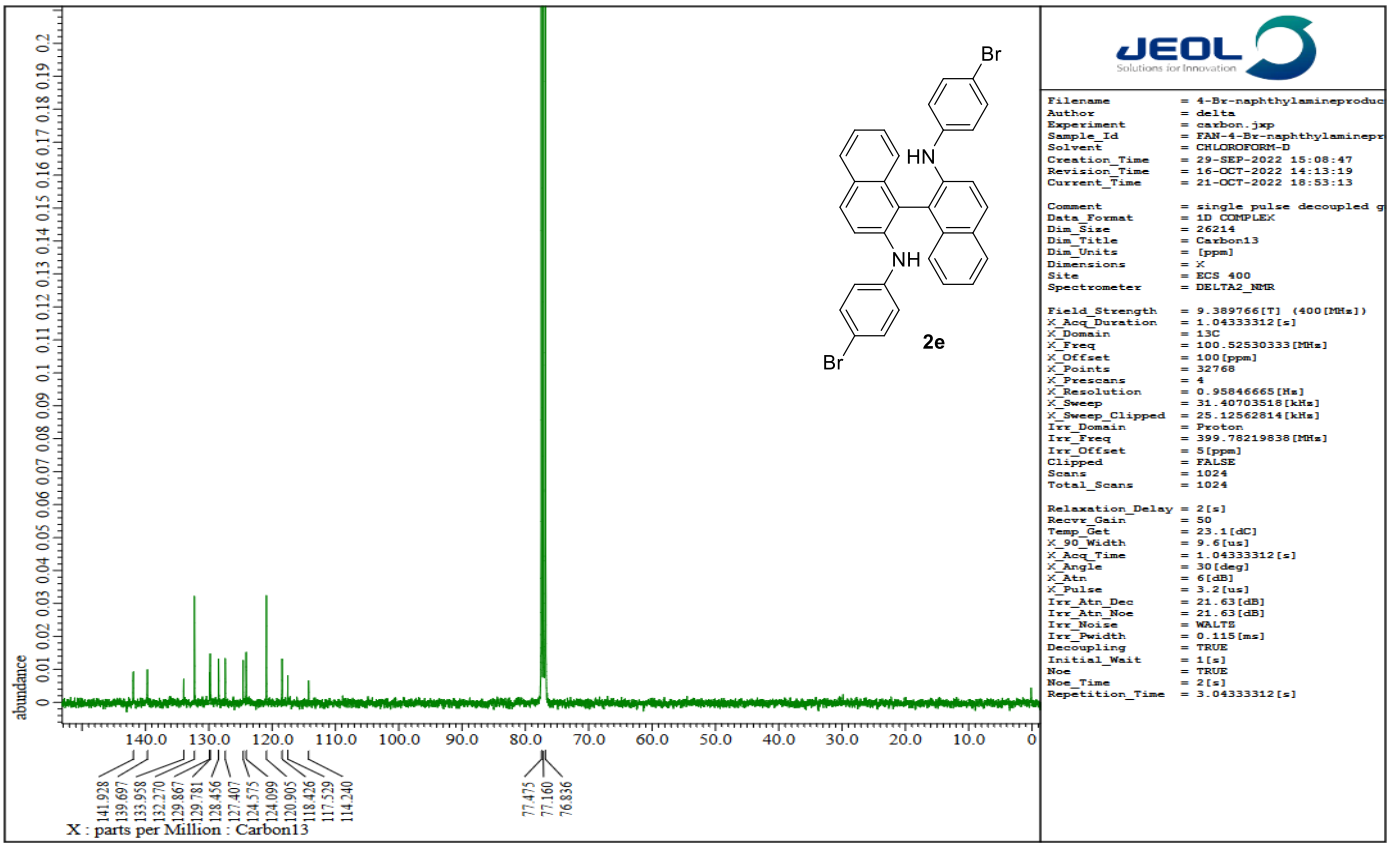


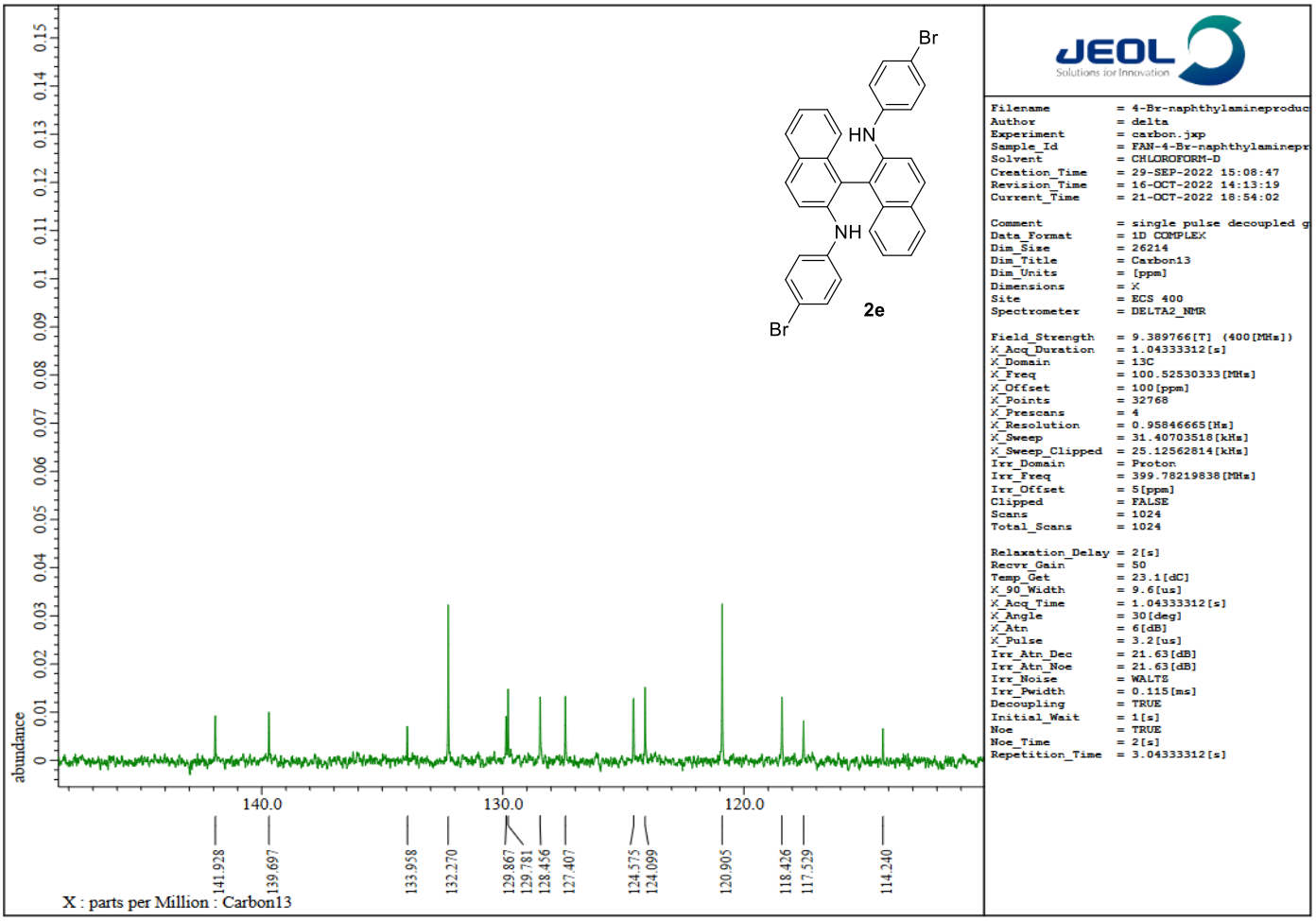
Compound **2d** (^{13}C NMR, 100 MHz, $CDCl_3$).



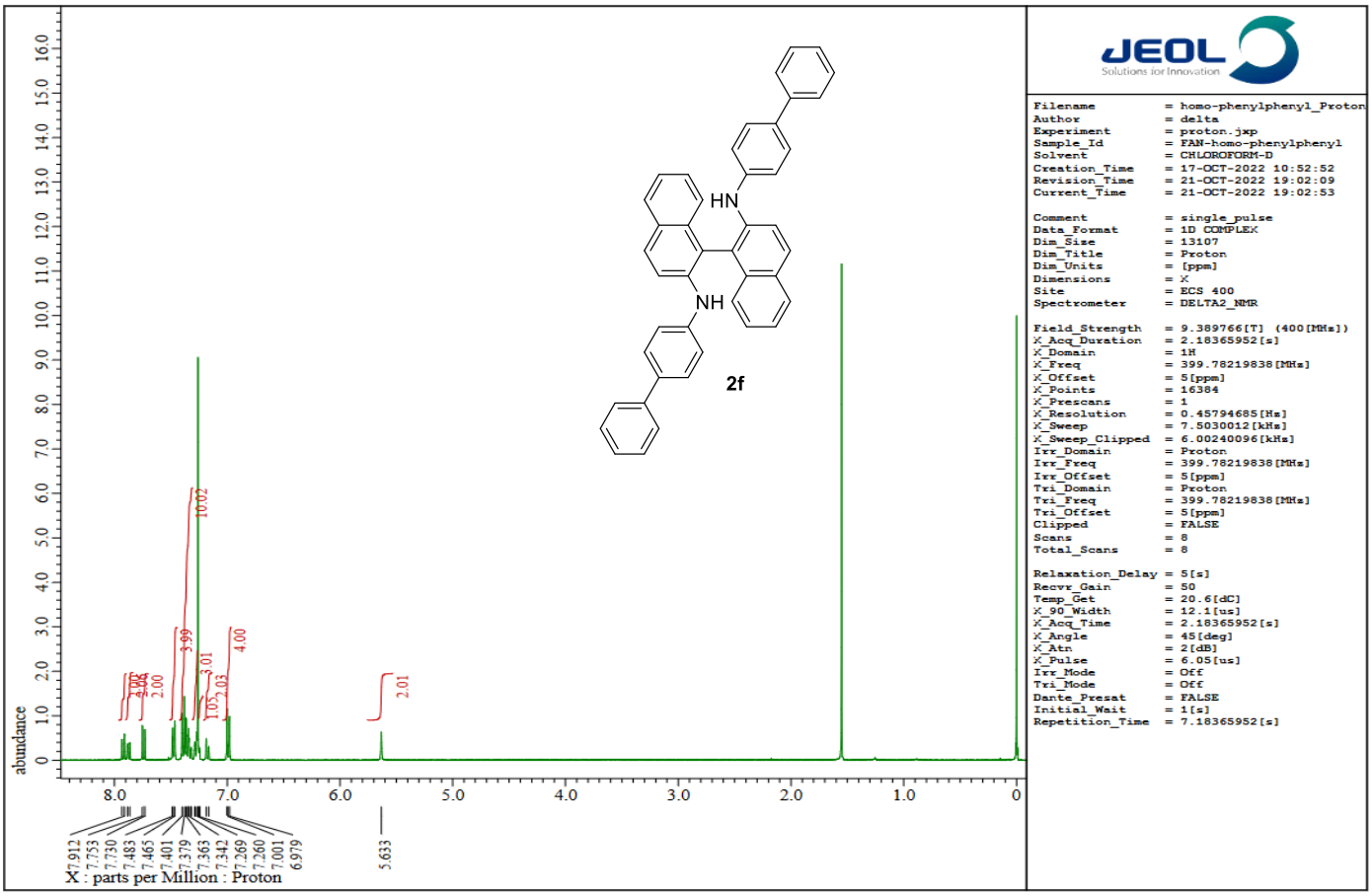


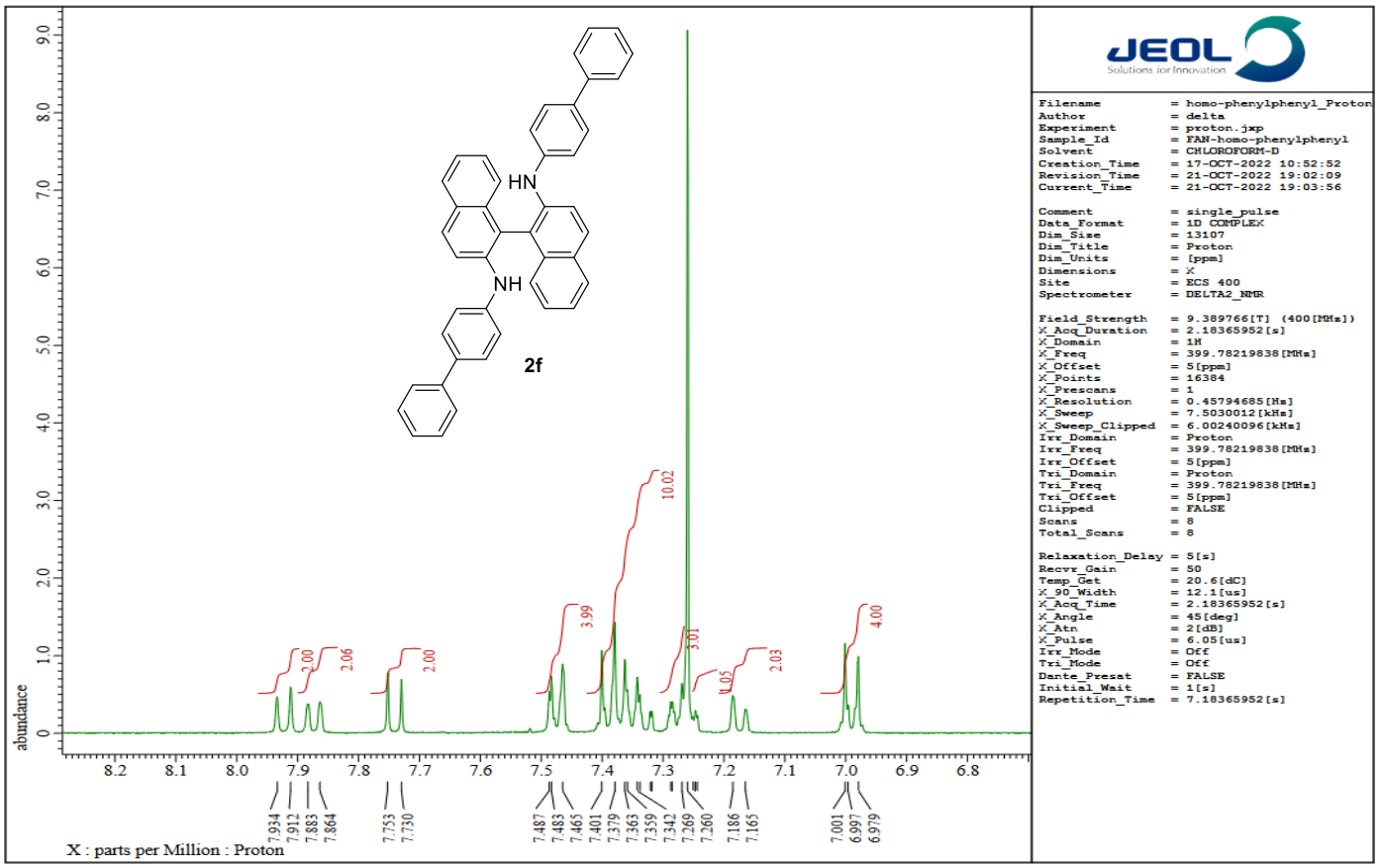
Compound **2e** (^{1}H NMR, 400 MHz, $CDCl_3$).



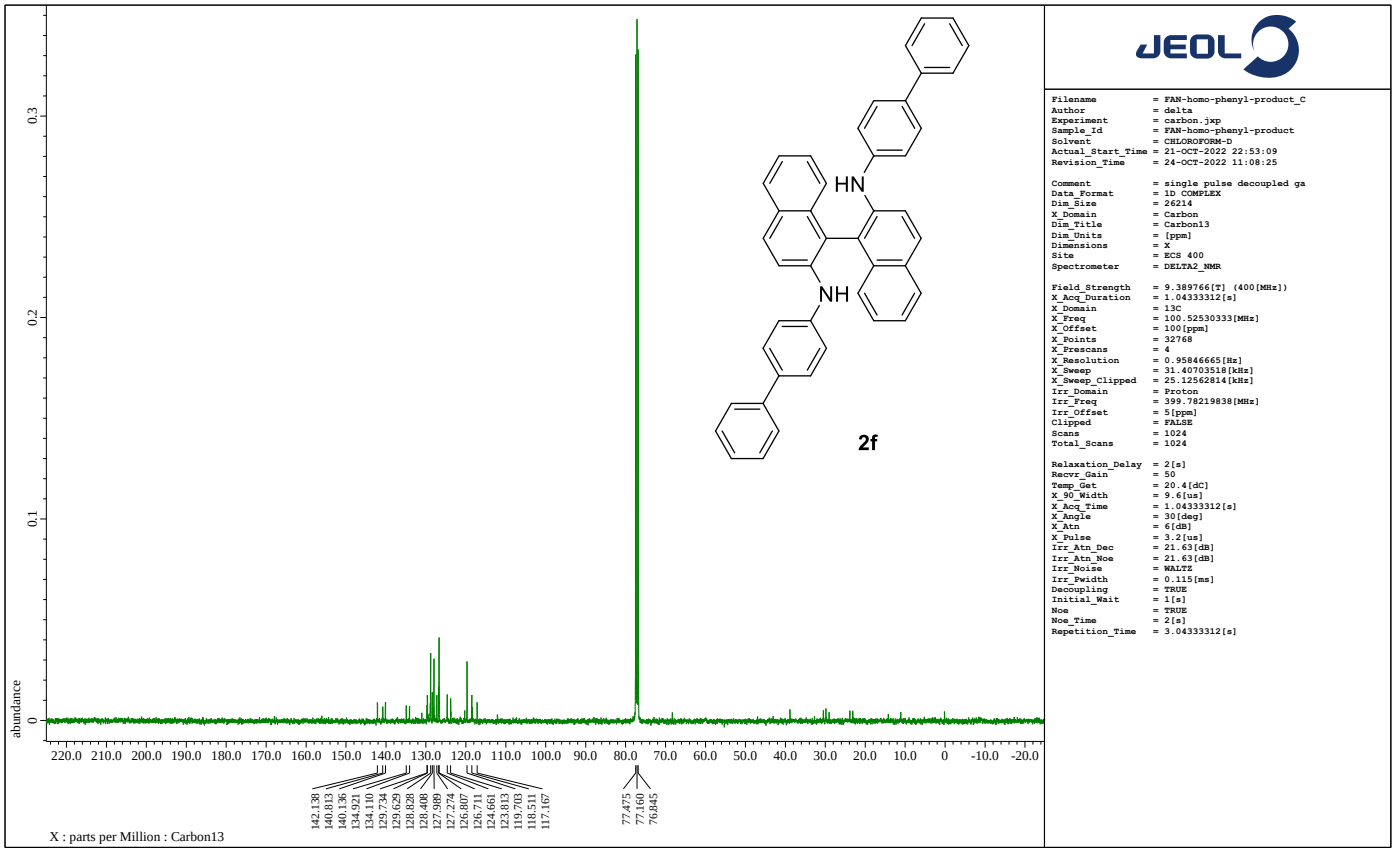


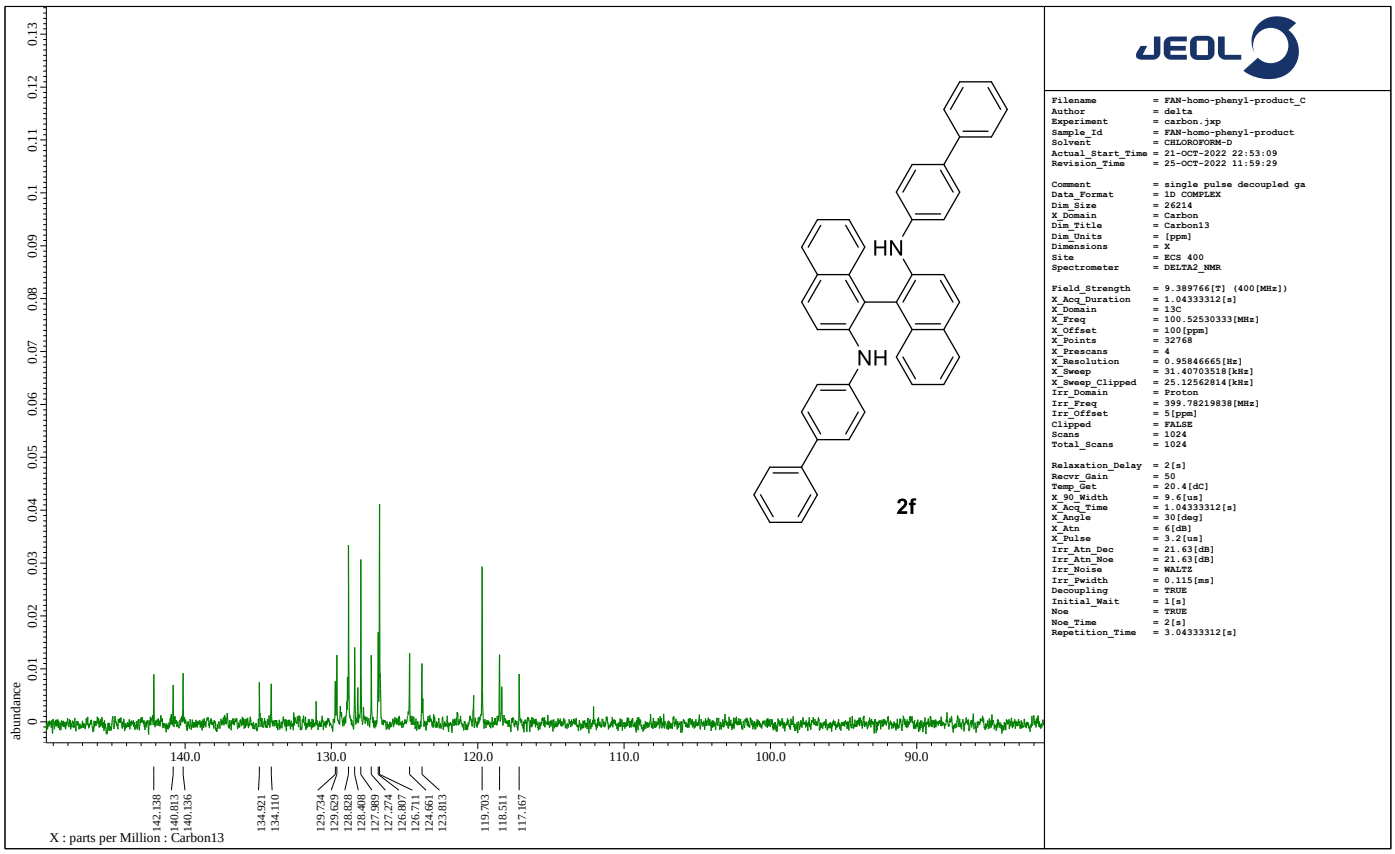
Compound **2e** (^{13}C NMR, 100 MHz, $CDCl_3$).



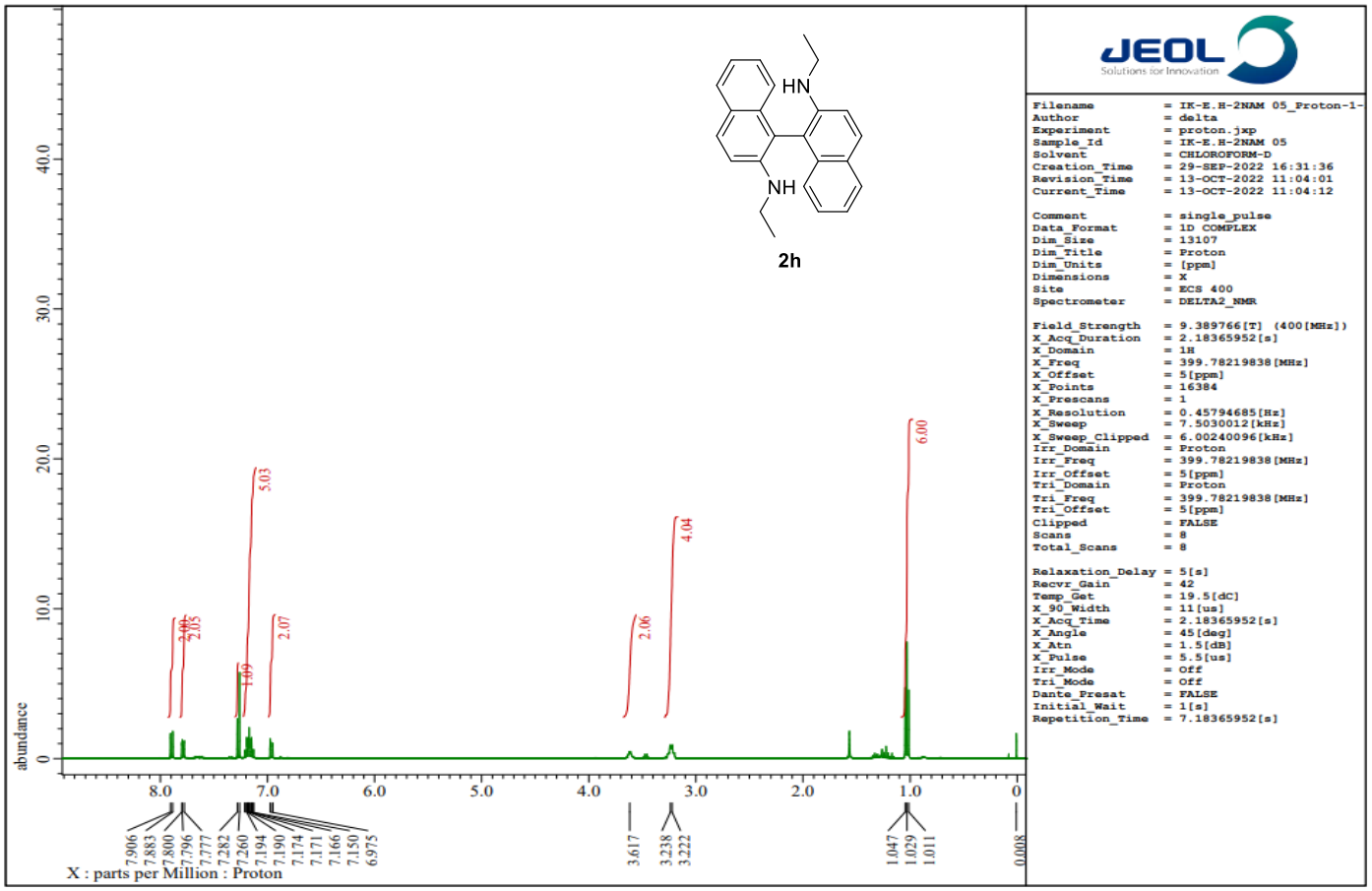


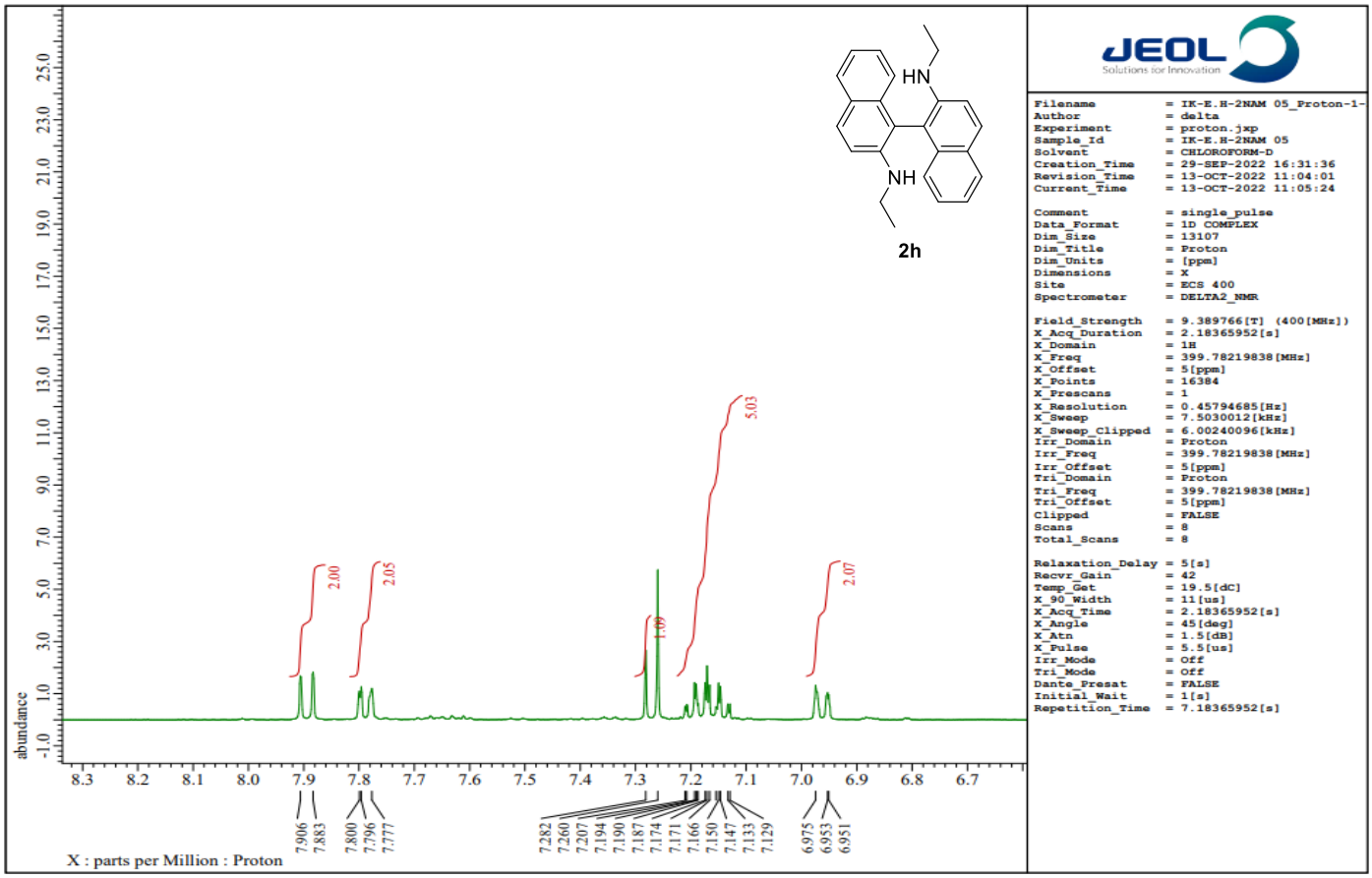
Compound **2f** (^{1}H NMR, 400 MHz, $CDCl_3$).



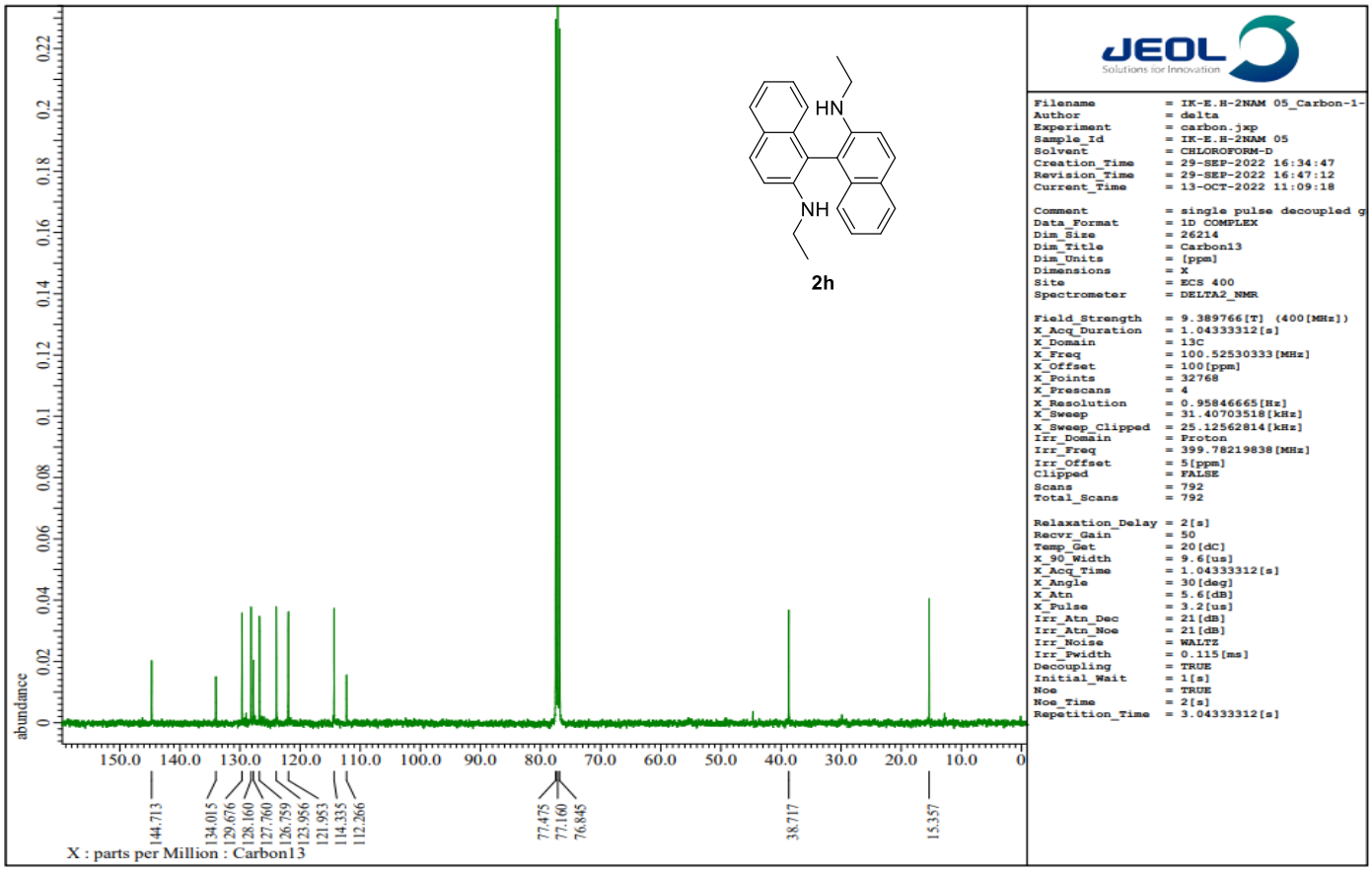


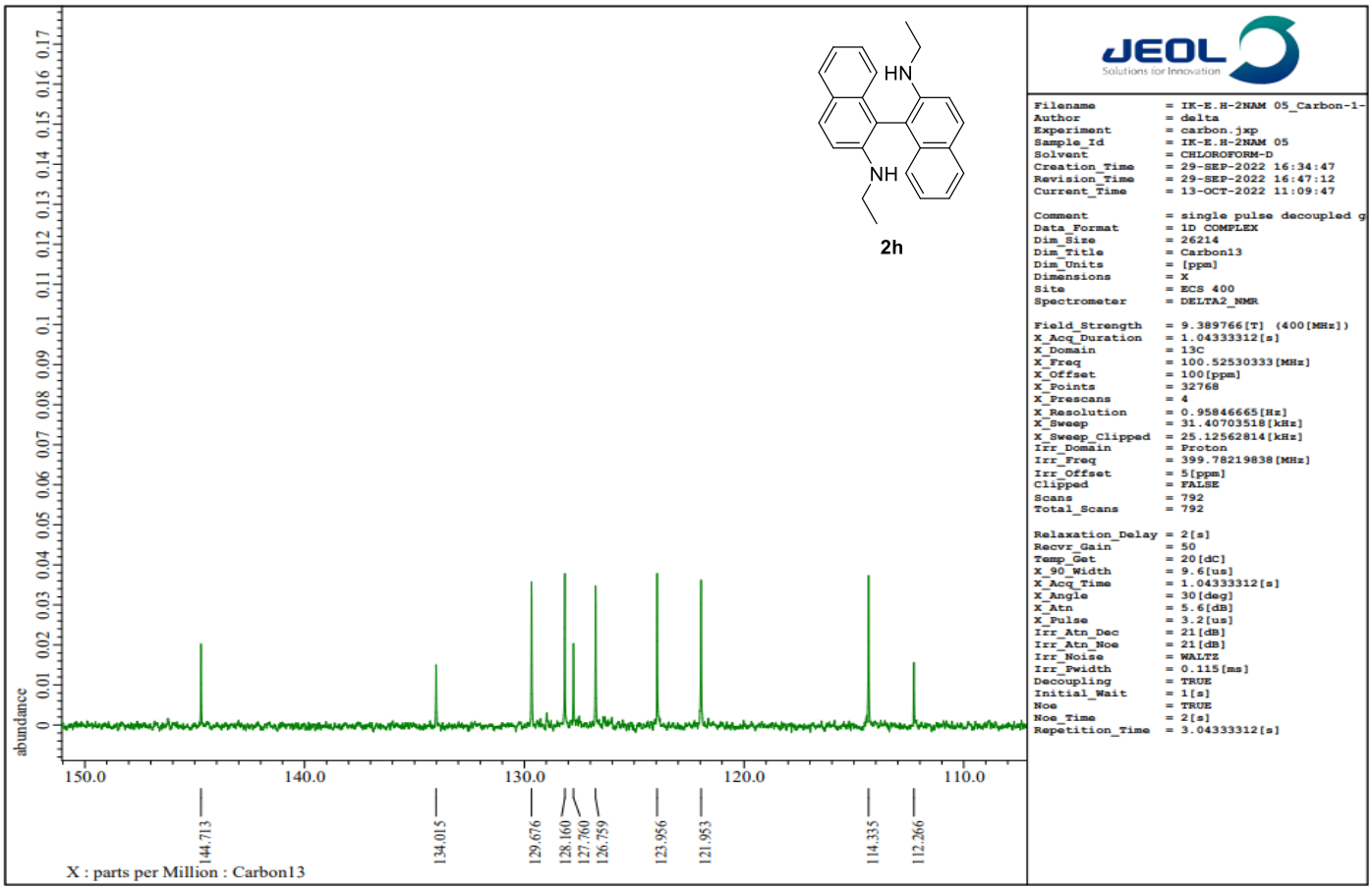
Compound **2f** (^{1}C NMR, 100 MHz, $CDCl_3$).



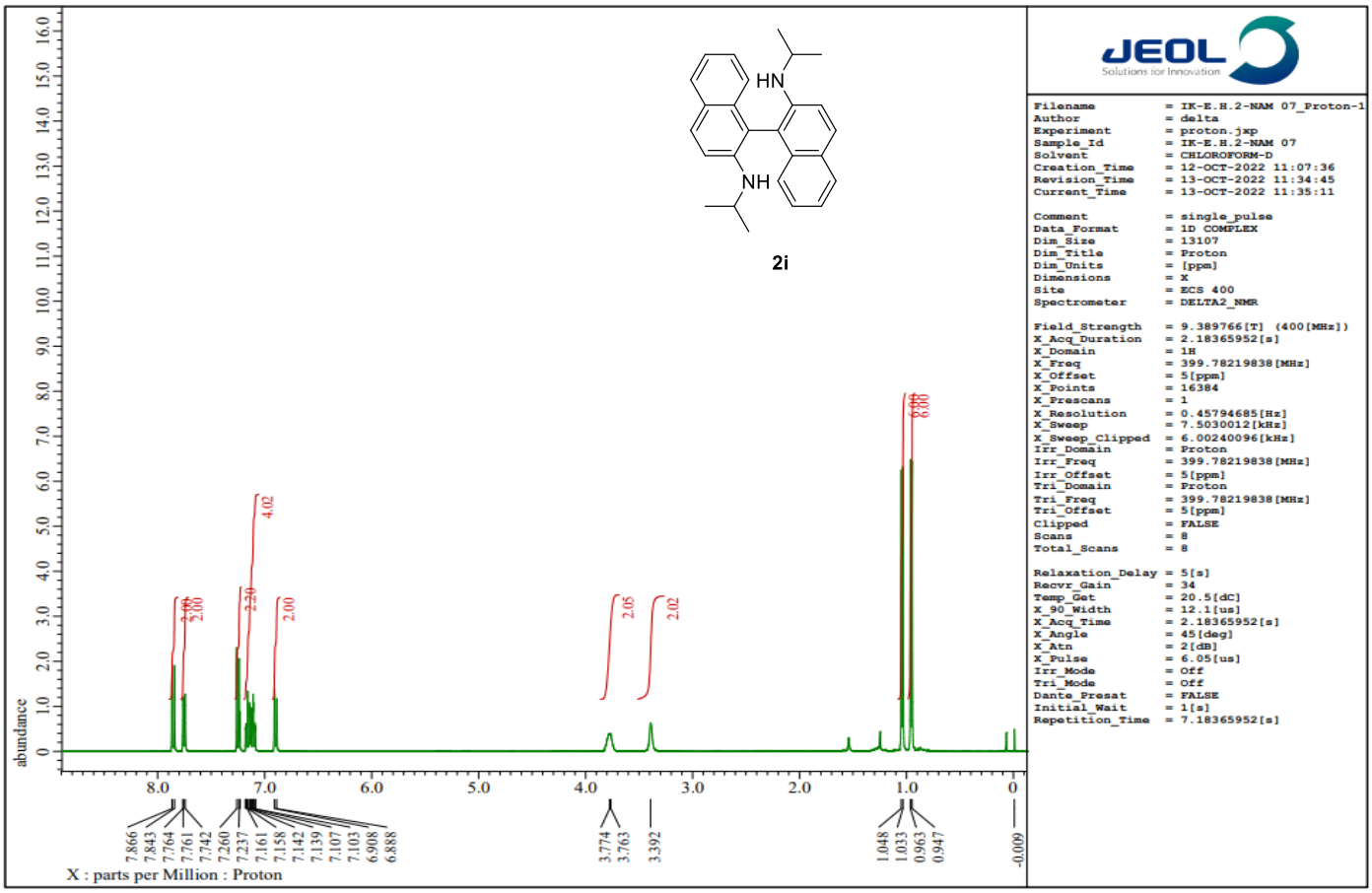


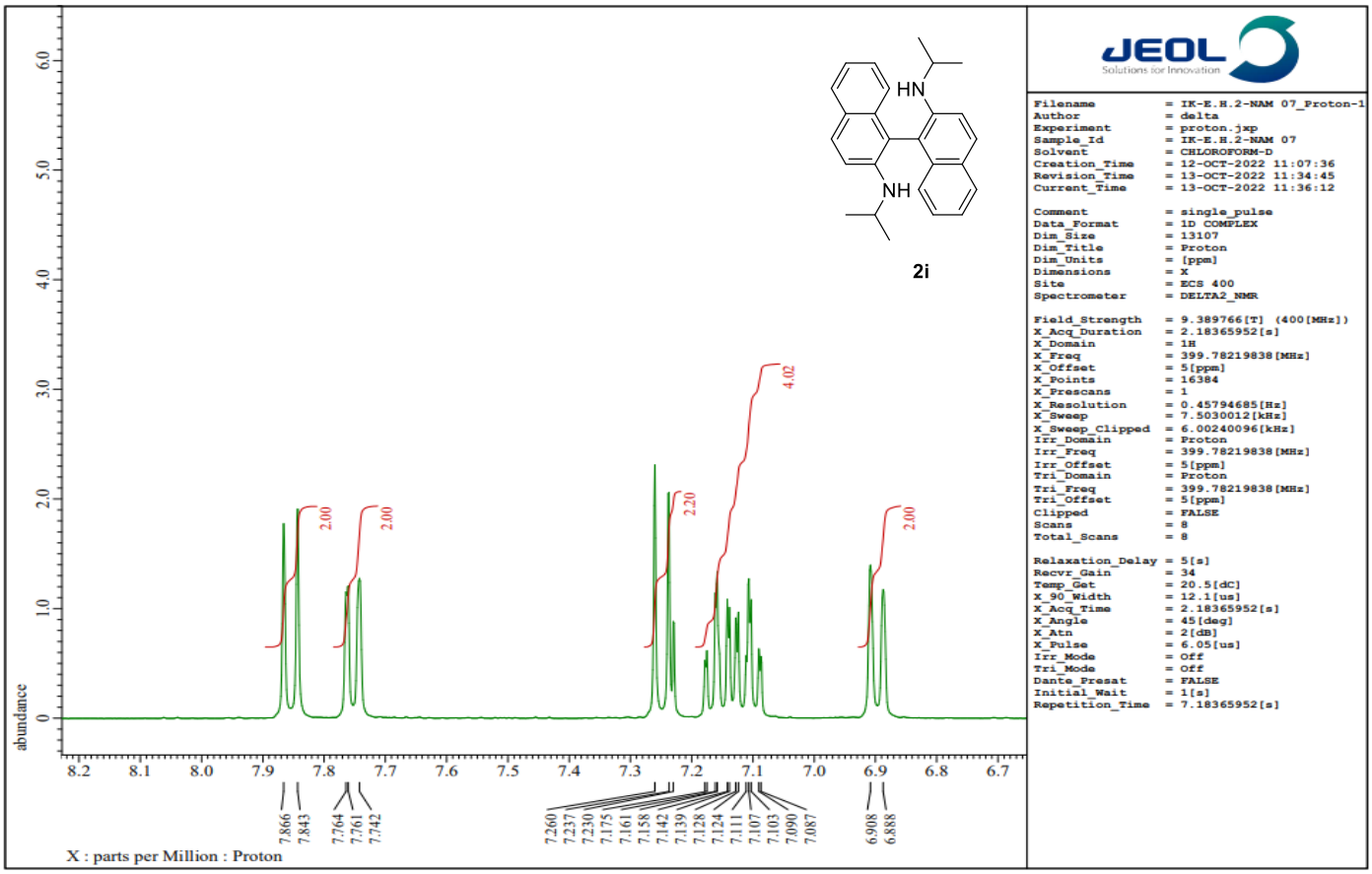
Compound **2h** (^{1}H NMR, 400 MHz, $CDCl_3$).



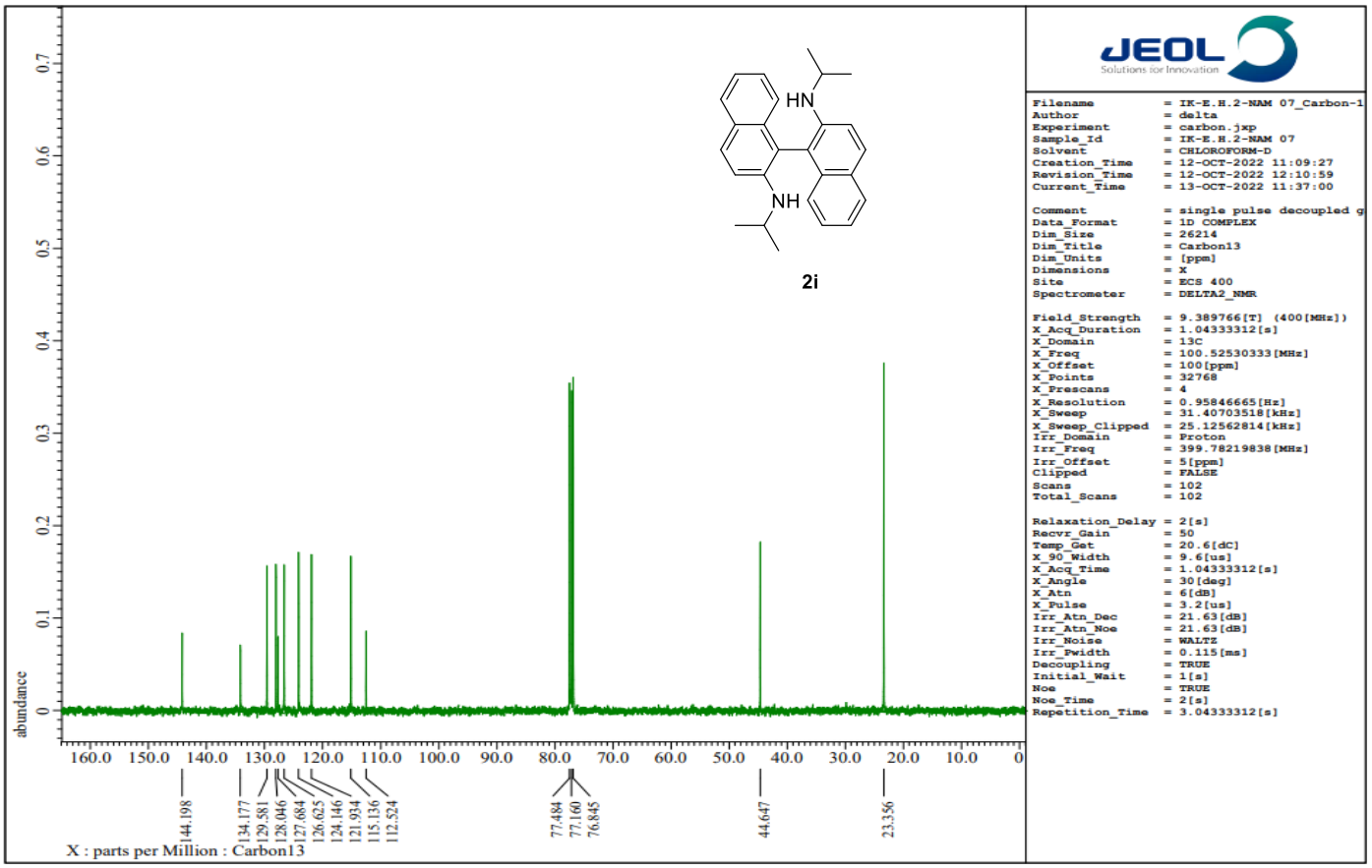


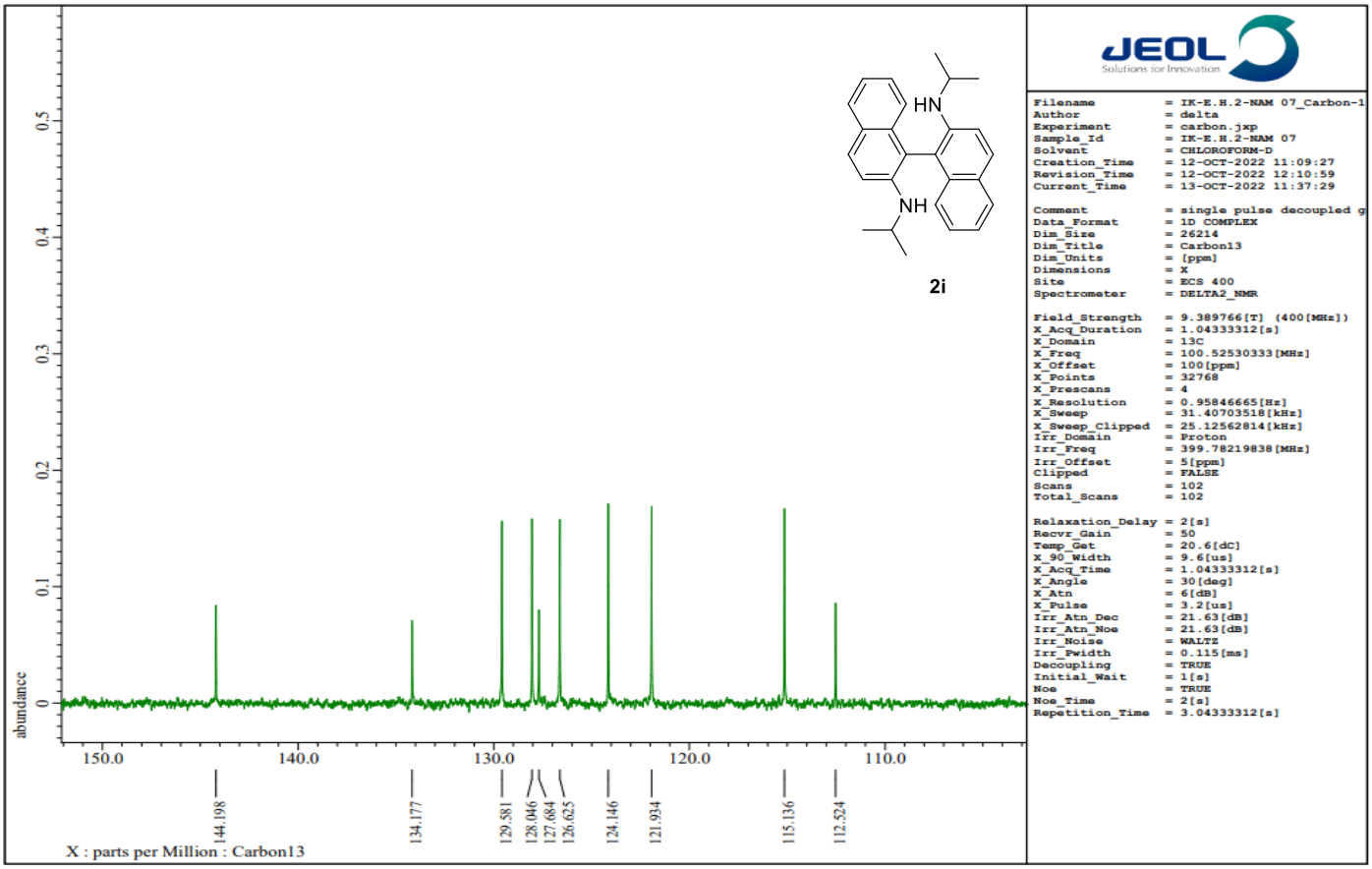
Compound **2h** (^{13}C NMR, 100 MHz, $CDCl_3$).



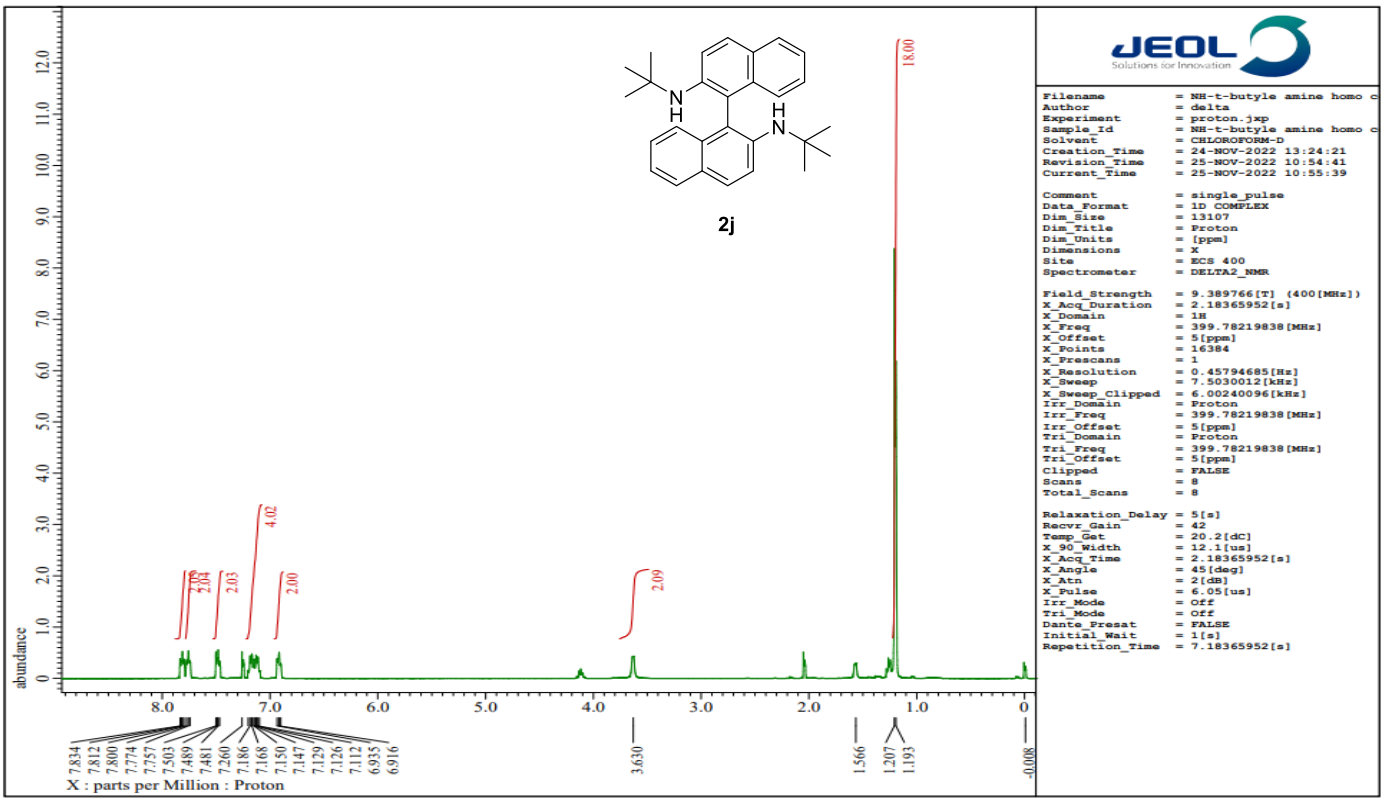


Compound **2i** (^{1}H NMR, 400 MHz, $CDCl_3$).





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



JEOL Solutions for Innovation

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Author            = delta
Experiment        = proton.jxp
Sample_Id         = NH-t-butyle amine homo c
Solvent           = CHLOROFORM-D
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Revision_Time     = 25-NOV-2022 10:54:41
Current_Time      = 25-NOV-2022 10:55:39

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Dim_Units         = [ppm]
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Spectrometer      = DELTA2_NMR

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X_Offset          = 5[ppm]
X_Points          = 16384
X_Prescans        = 1
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X_Sweep           = 7.5030012[kHz]
X_Sweep_Clipped   = 6.00240096[kHz]
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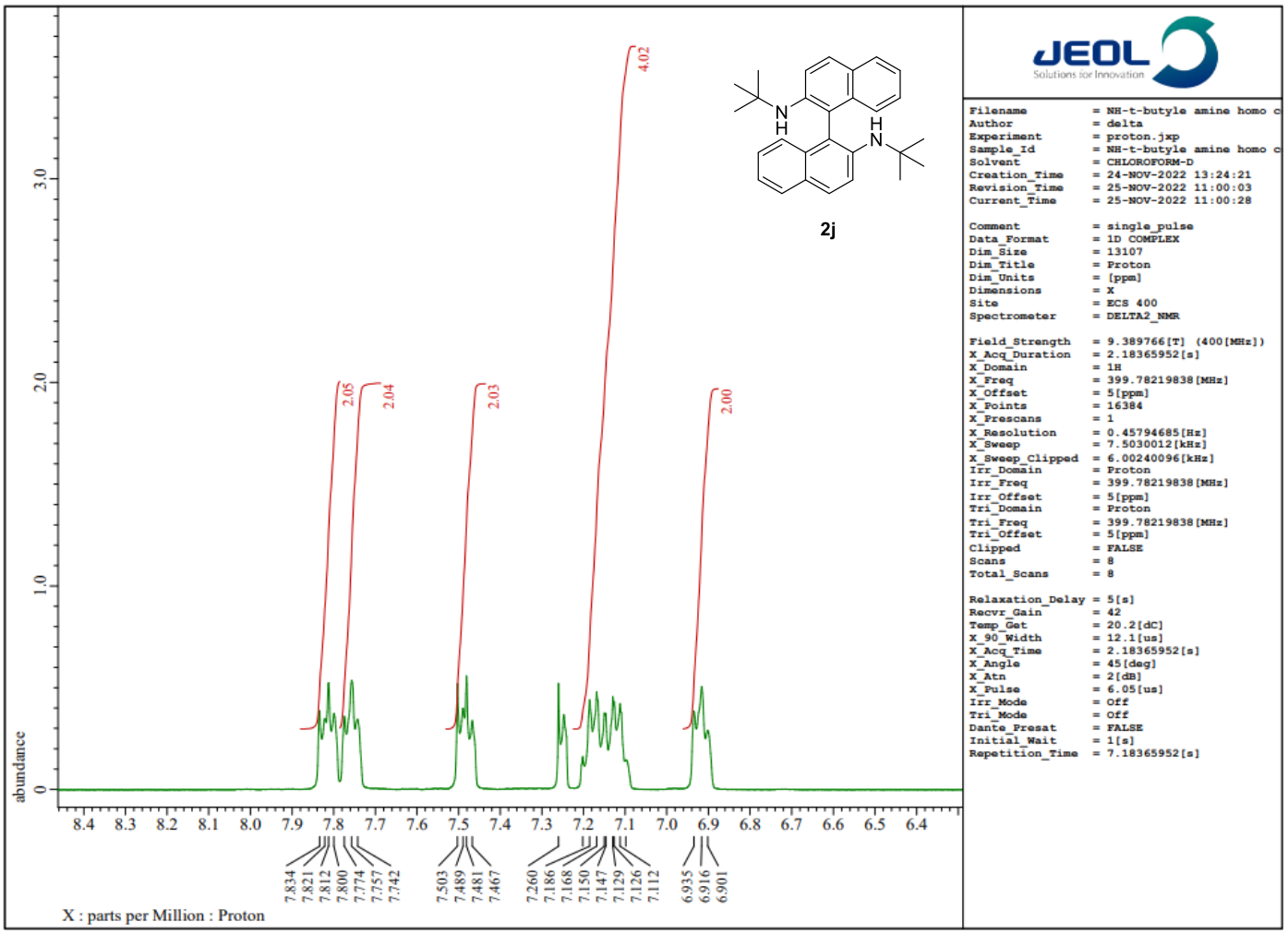

JEOL Solutions for Innovation

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Filename          = NH-t-butyle amine homo c
Author            = delta
Experiment        = proton.jxp
Sample_Id         = NH-t-butyle amine homo c
Solvent           = CHLOROFORM-D
Creation_Time     = 24-NOV-2022 13:24:21
Revision_Time     = 25-NOV-2022 11:00:03
Current_Time      = 25-NOV-2022 11:00:28

Comment           = single_pulse
Data_Format       = 1D COMPLEX
Dim_Size          = 13107
Dim_Title         = Proton
Dim_Units         = [ppm]
Dimensions        = X
Site              = ECS 400
Spectrometer      = DELTA2_NMR

Field_Strength    = 9.389766[T] (400[MHz])
X_Acq_Duration    = 2.18365952[s]
X_Domain          = 1H
X_Freq            = 399.78219838[MHz]
X_Offset          = 5[ppm]
X_Points          = 16384
X_Prescans        = 1
X_Resolution      = 0.45794685[Hz]
X_Sweep           = 7.5030012[kHz]
X_Sweep_Clipped   = 6.00240096[kHz]
Irr_Domain        = Proton
Irr_Freq          = 399.78219838[MHz]
Irr_Offset        = 5[ppm]
Tri_Domain        = Proton
Tri_Freq          = 399.78219838[MHz]
Tri_Offset        = 5[ppm]
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Scans             = 8
Total_Scans       = 8

Relaxation_Delay  = 5[s]
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Temp_Get          = 20.2[dC]
X_90_Width        = 12.1[us]
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X_Atn             = 2[dB]
X_Pulse           = 6.05[us]
Irr_Mode          = Off
Tri_Mode          = Off
Dante_Presat      = FALSE
Initial_Wait      = 1[s]
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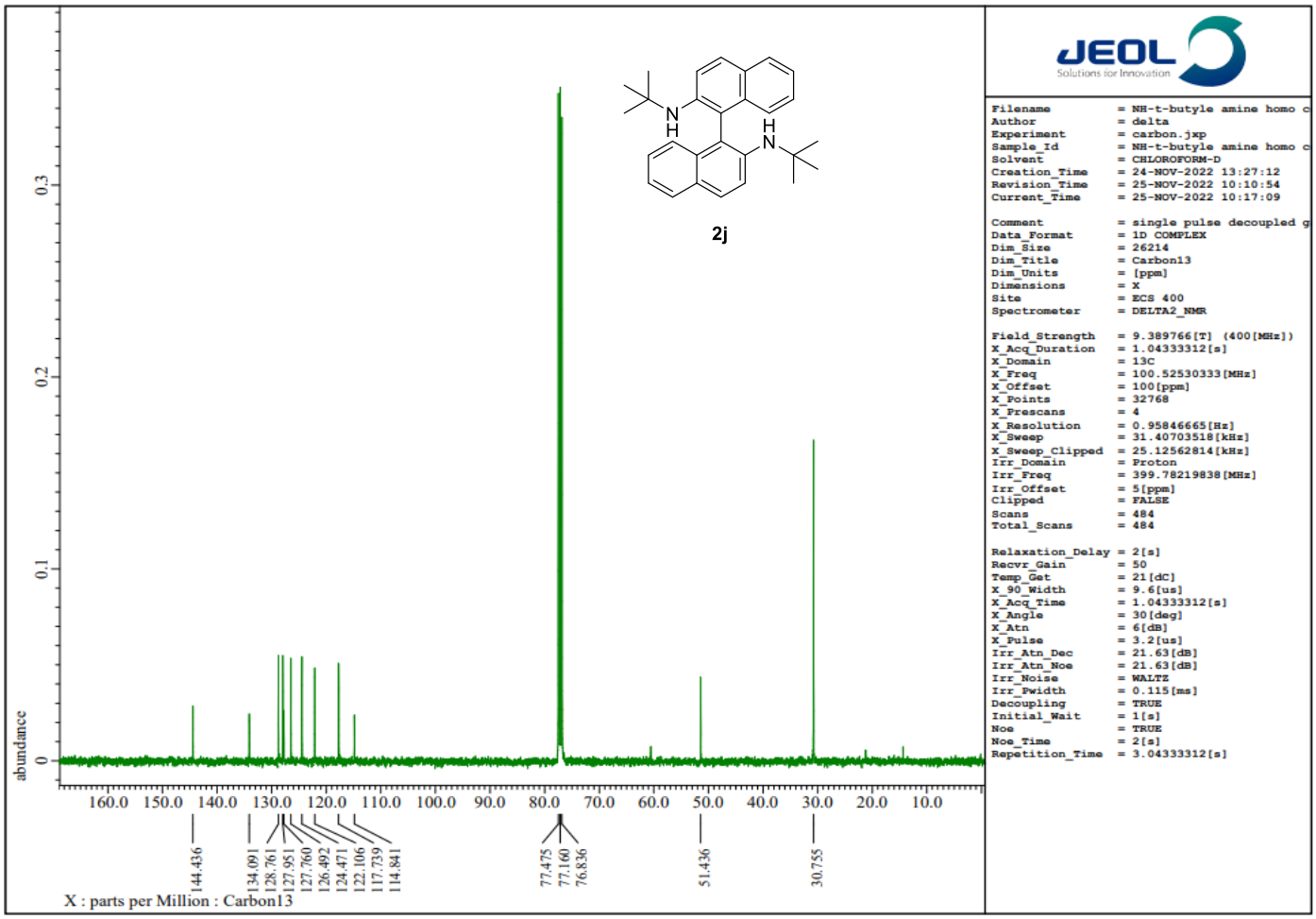
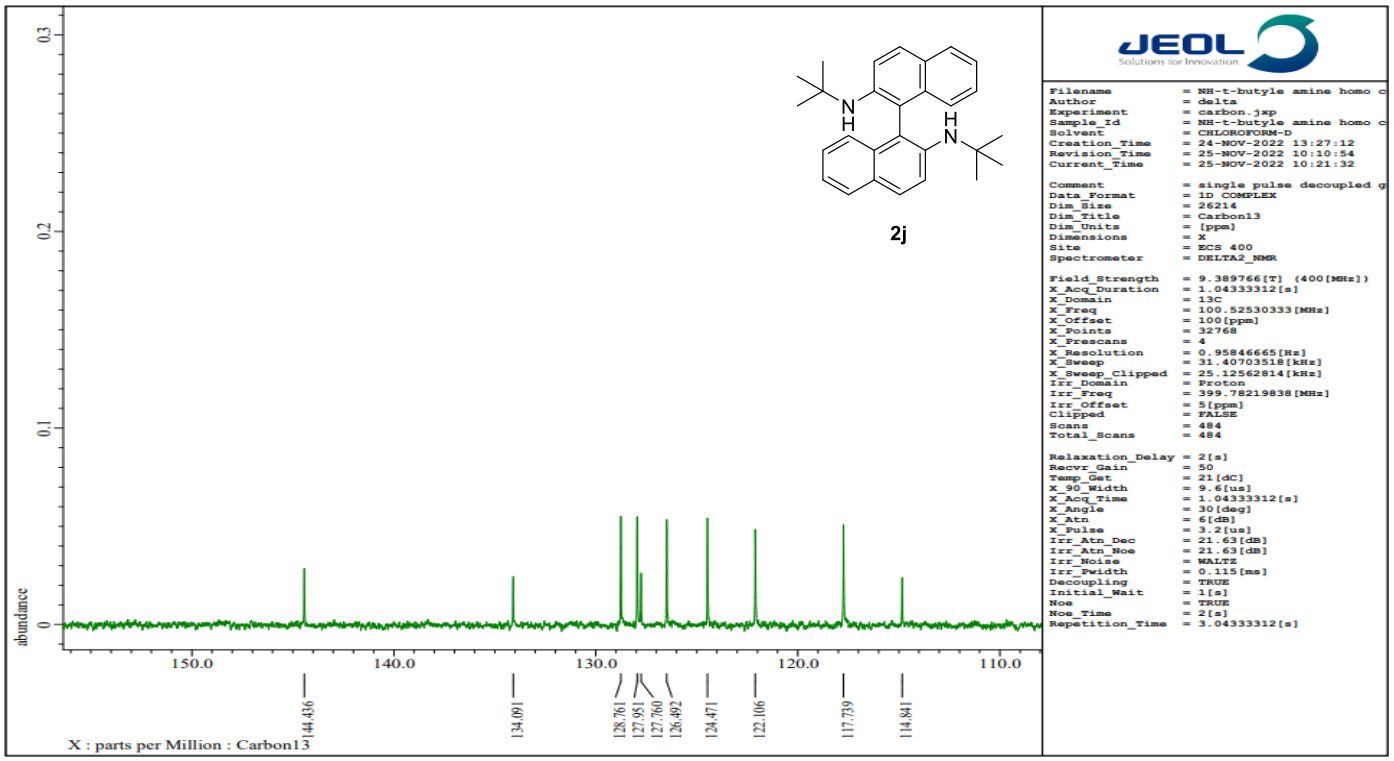
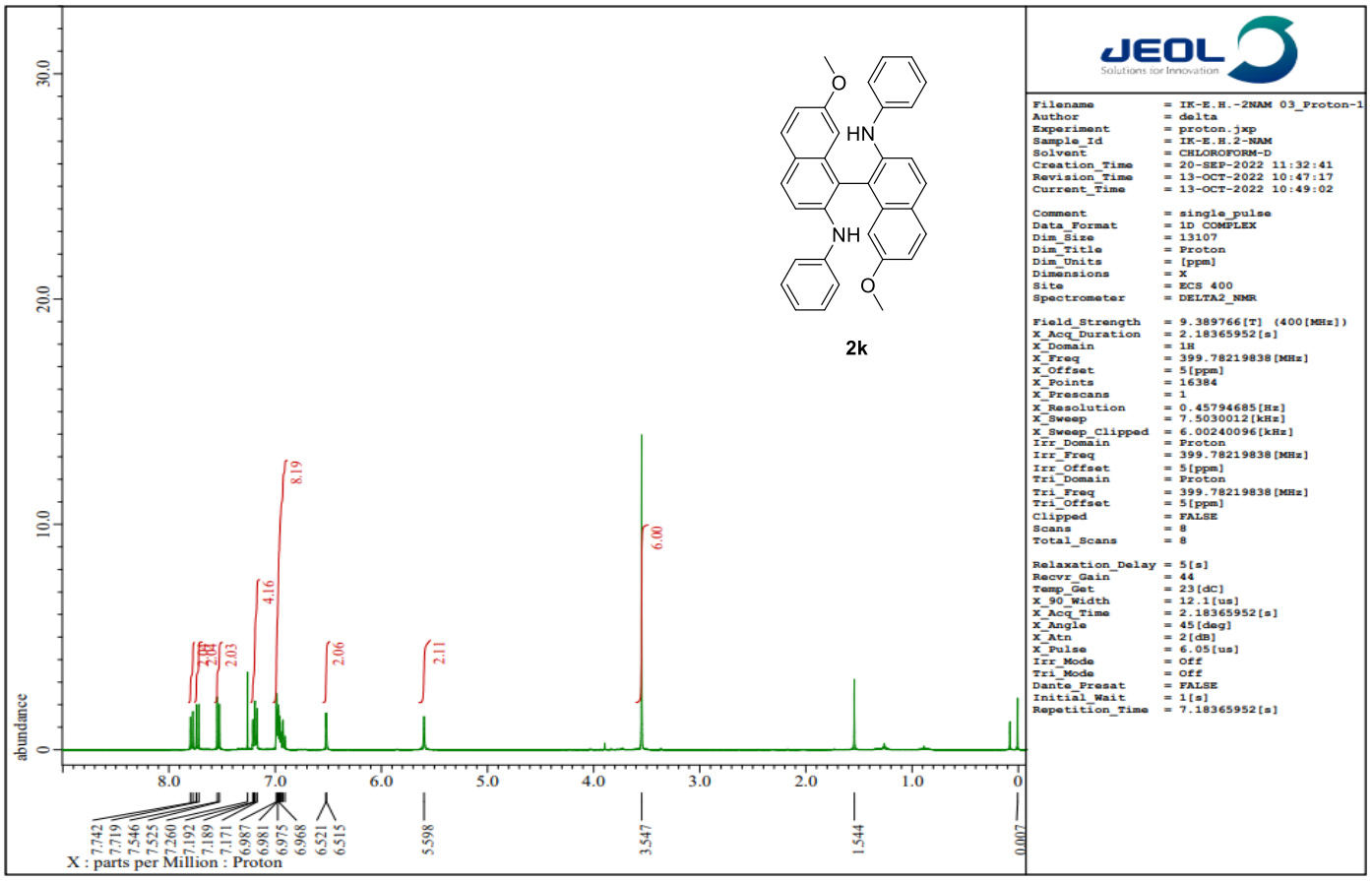
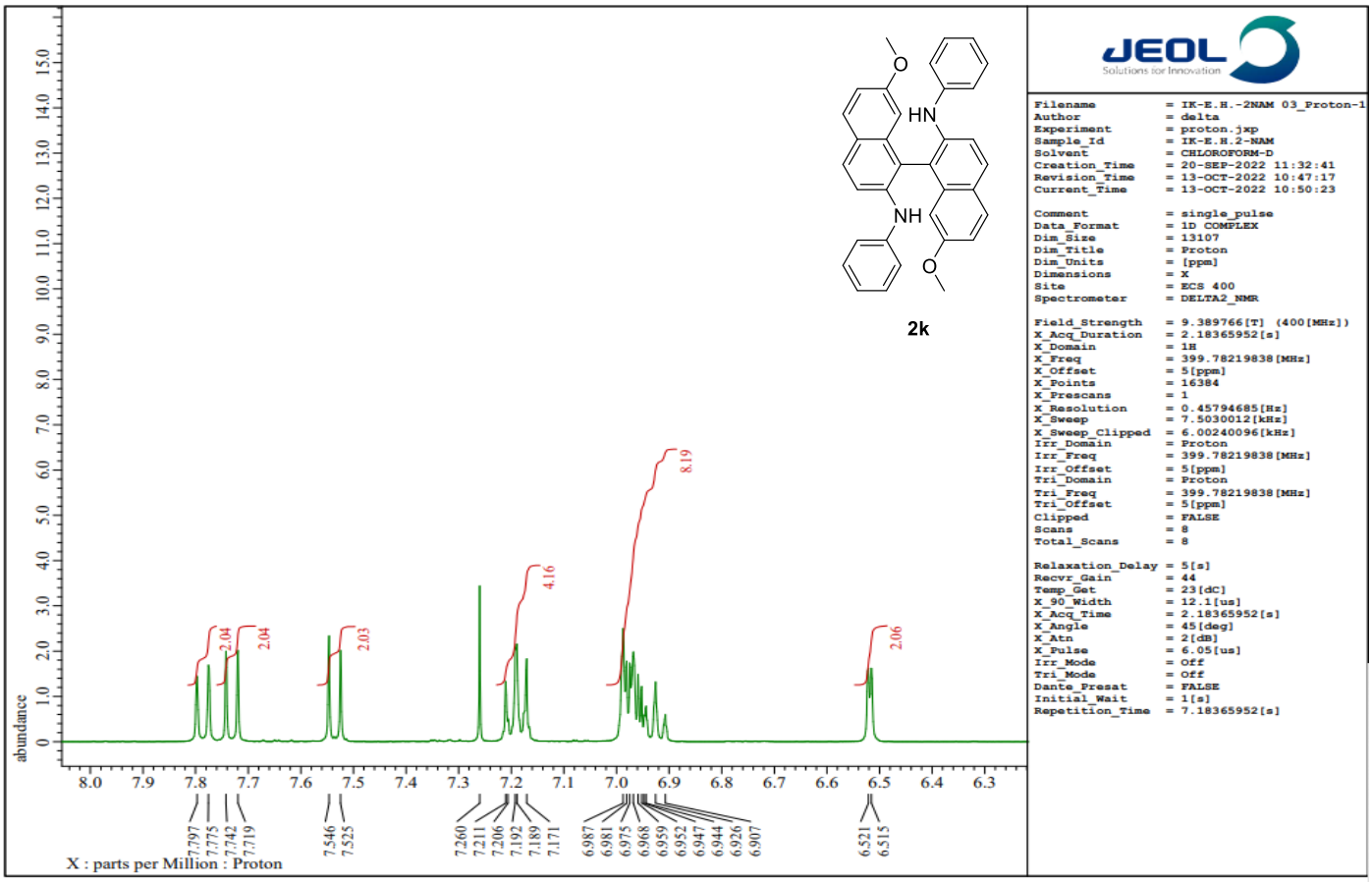
Compound **2j** (^{1}H NMR, 400 MHz, $CDCl_3$).



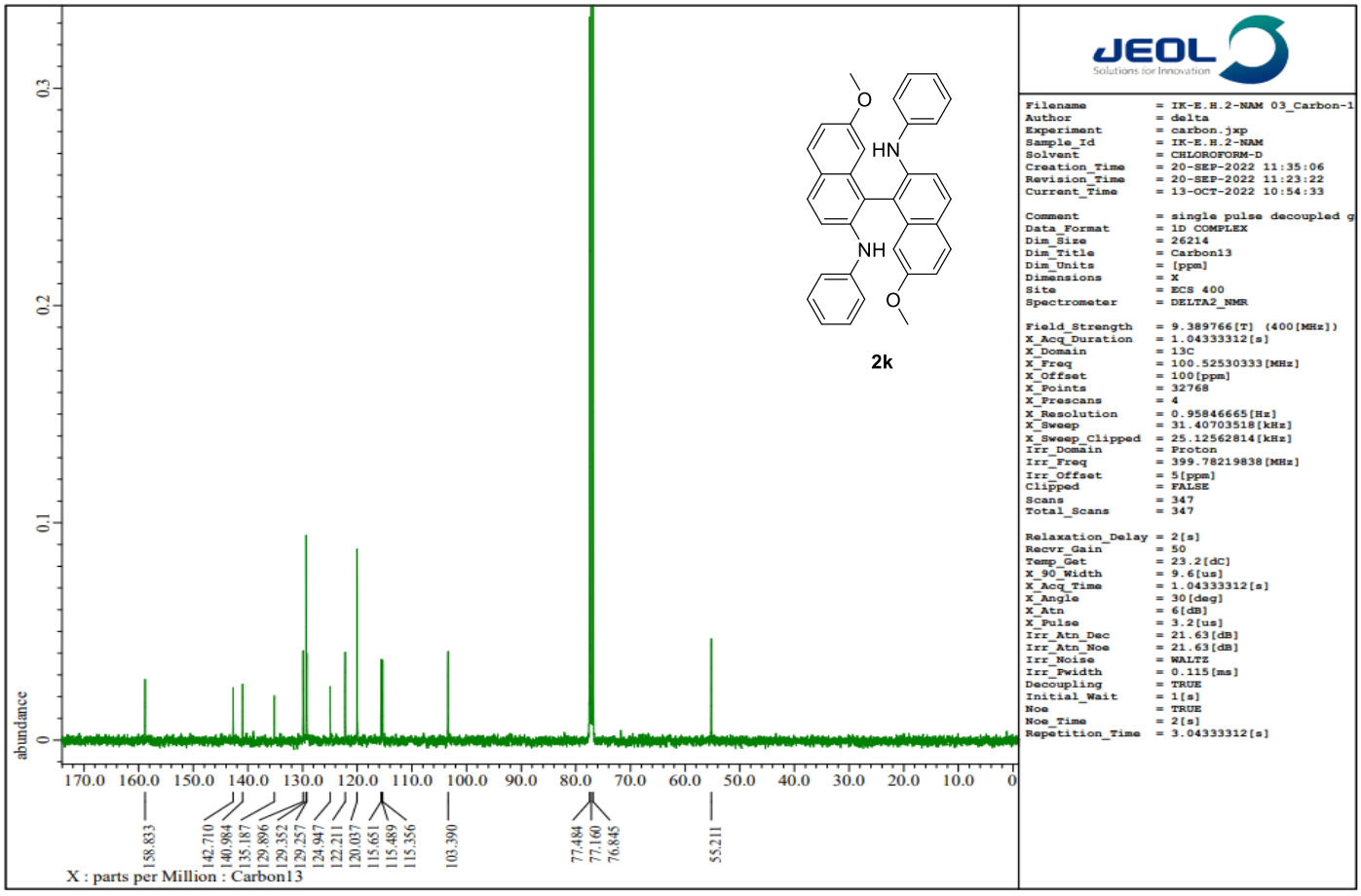


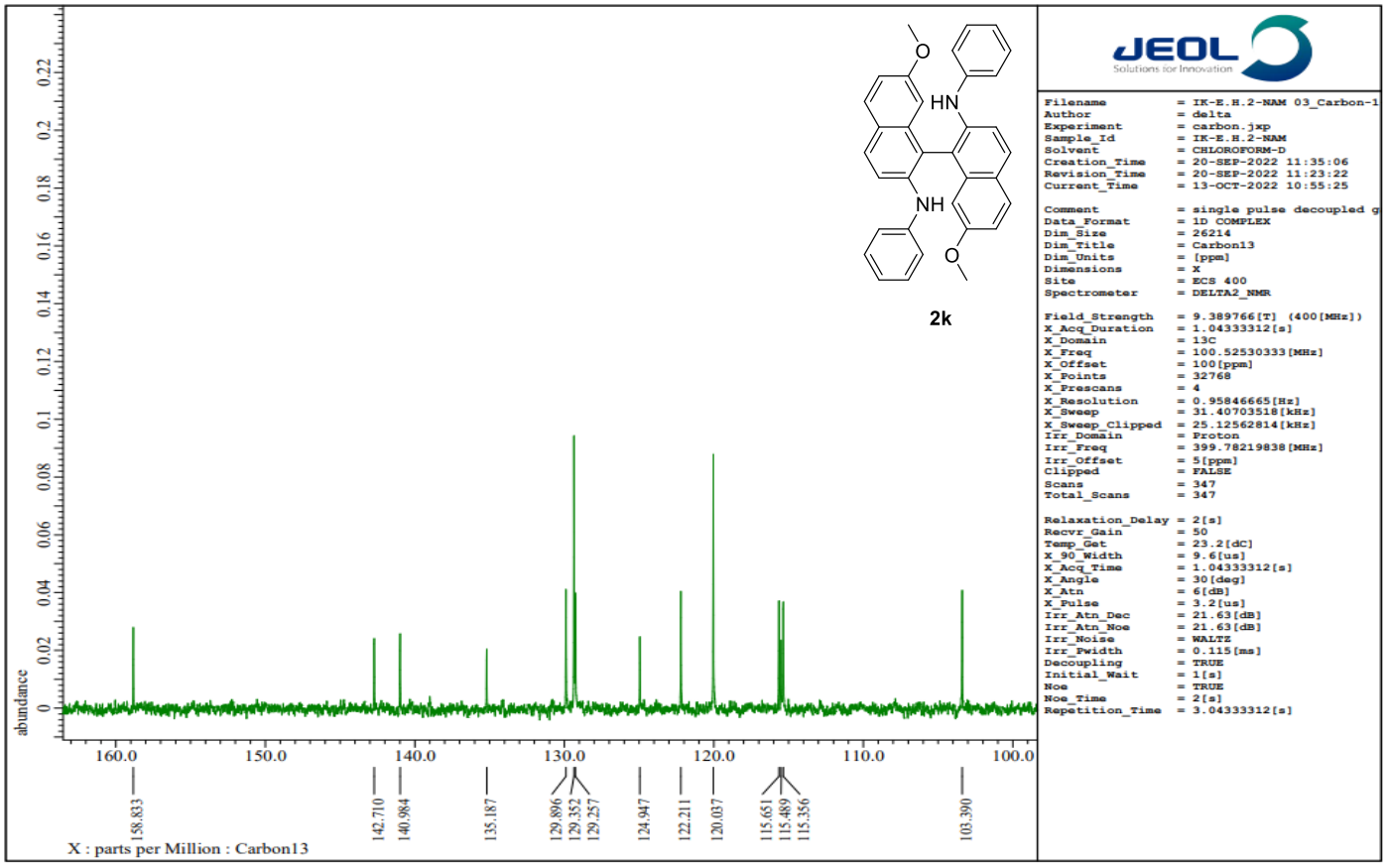
Compound **2j** (^{13}C NMR, 100 MHz, $CDCl_3$).



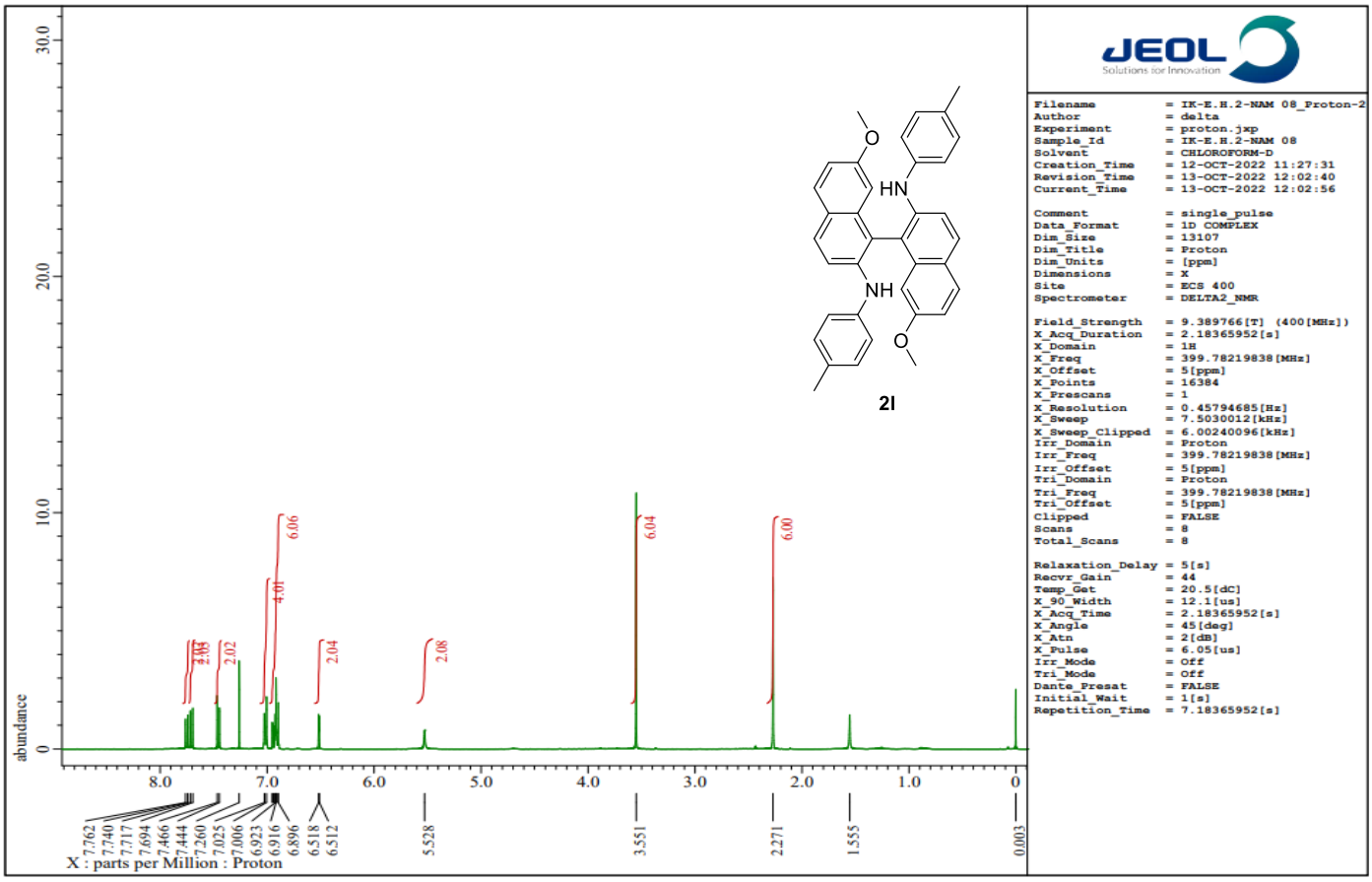


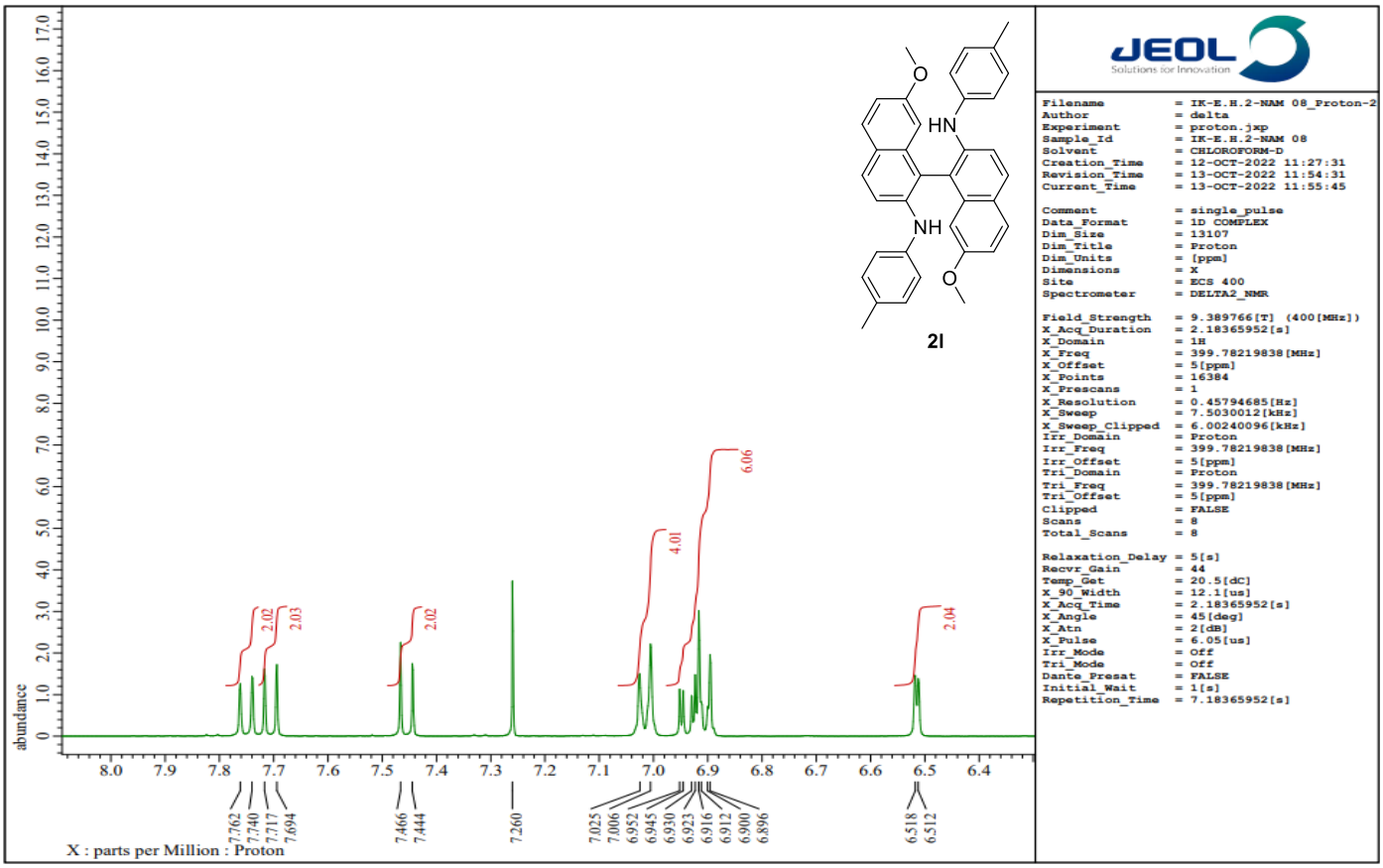
Compound **2k** (^{1}H NMR, 400 MHz, $CDCl_3$).



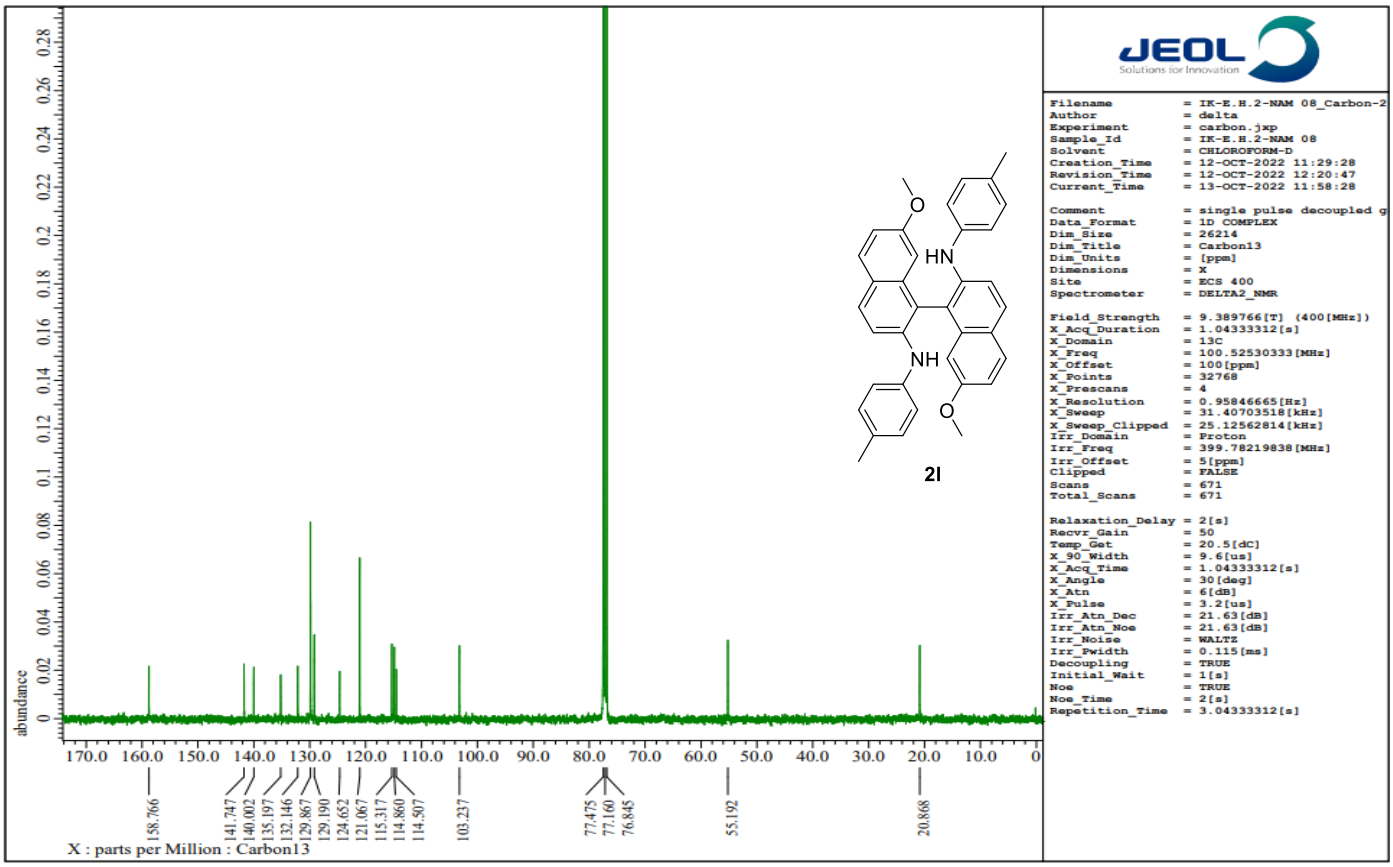


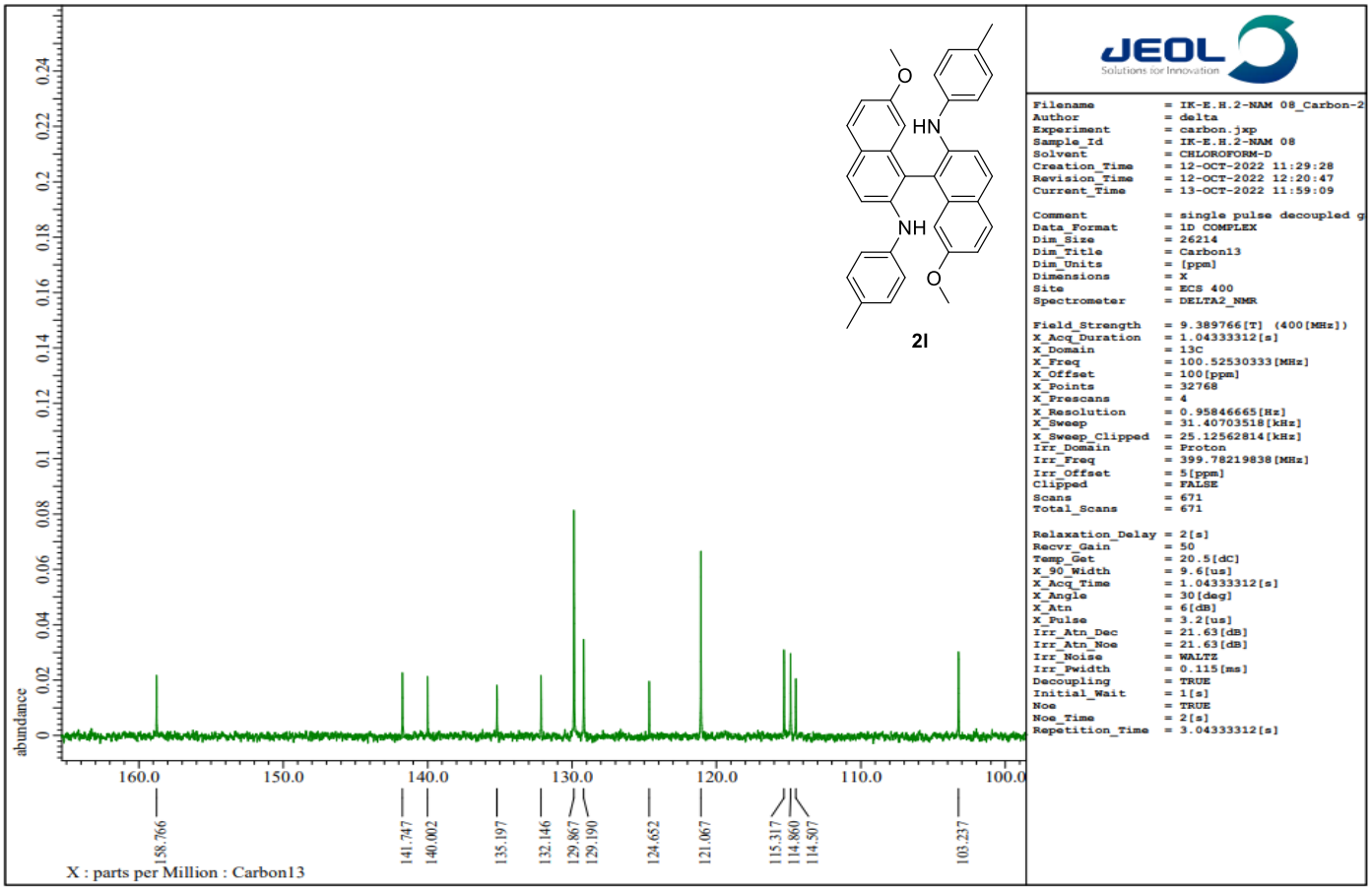
Compound **2k** (^{13}C NMR, 100 MHz, $CDCl_3$).



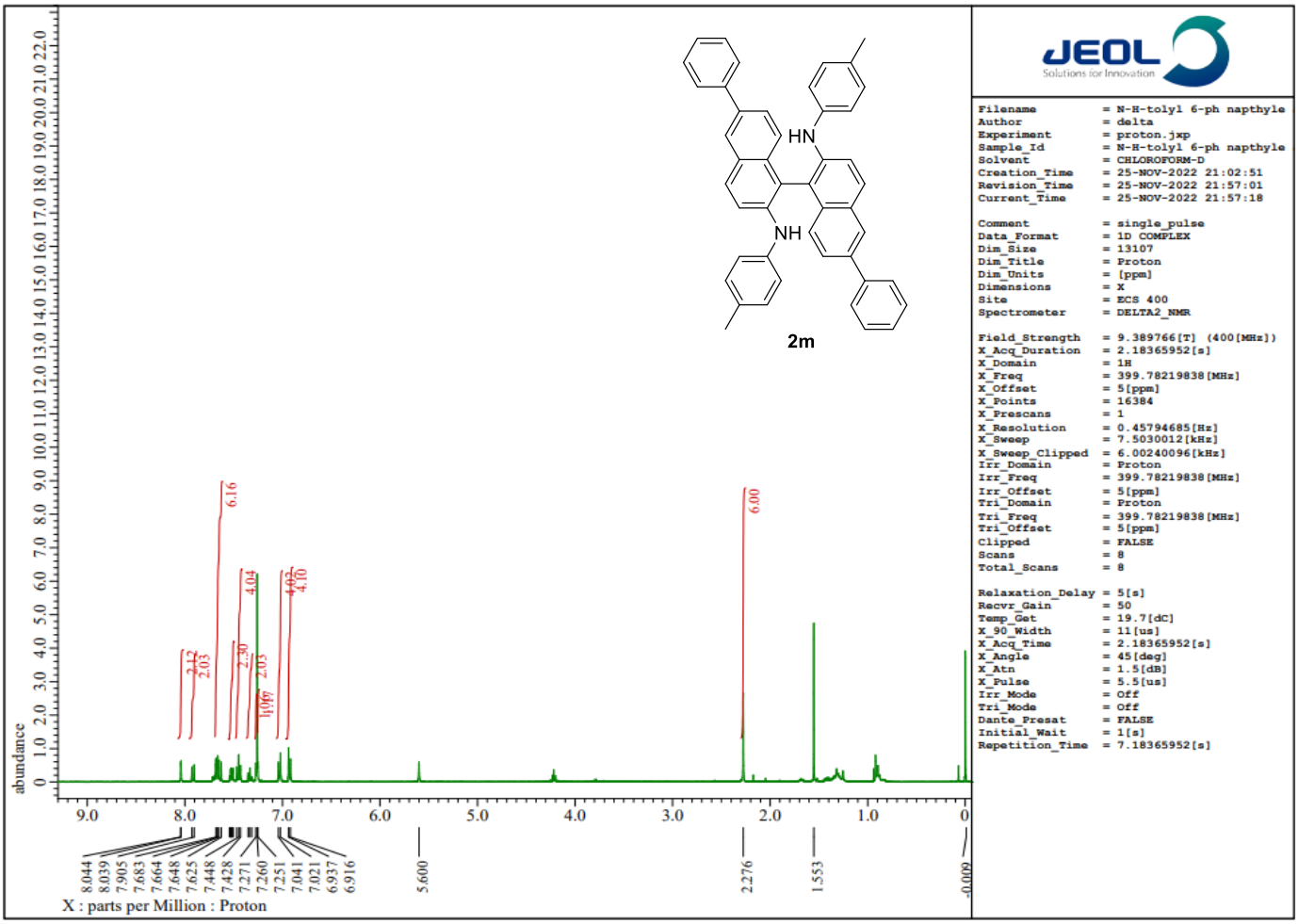


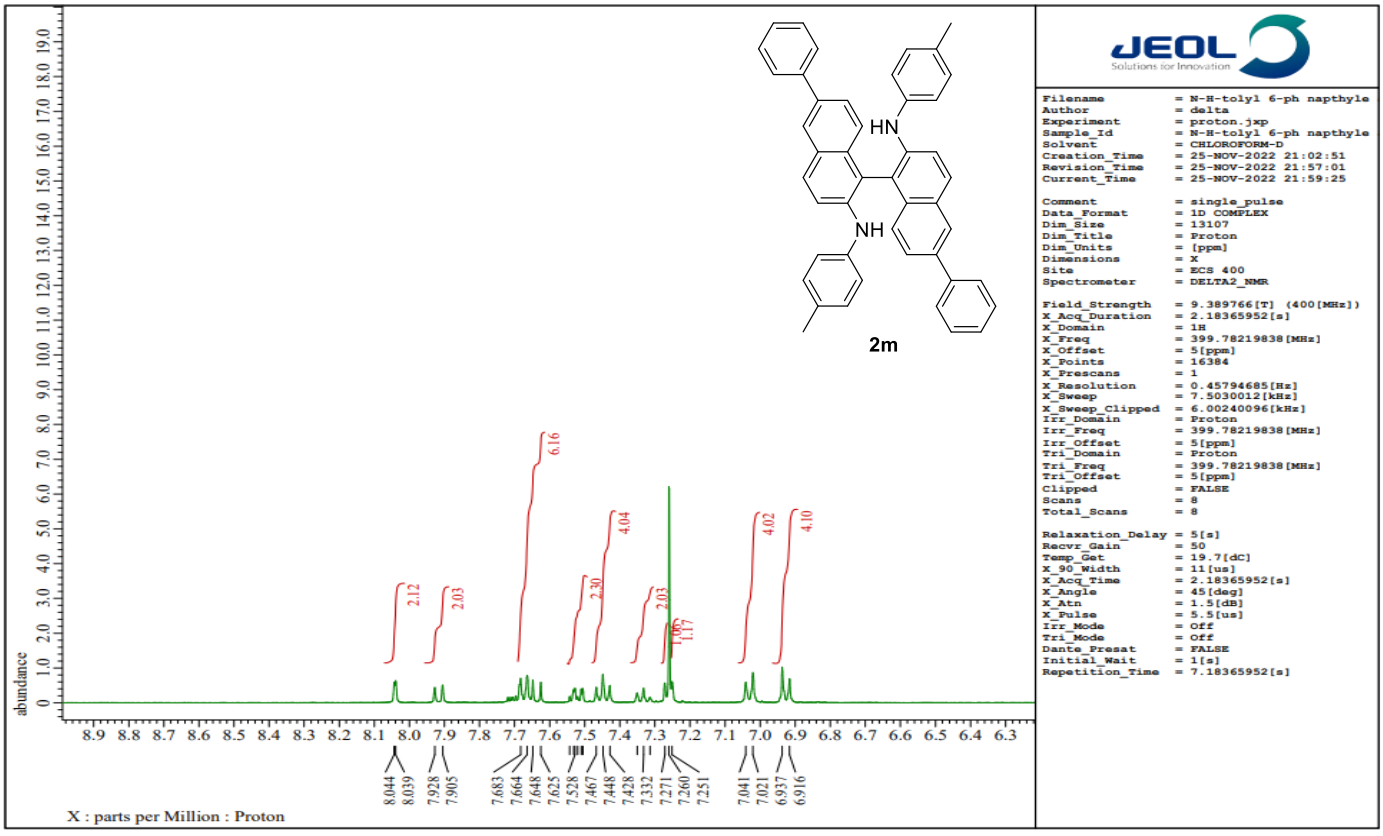
Compound **2l** (^{1}H NMR, 400 MHz, $CDCl_3$).



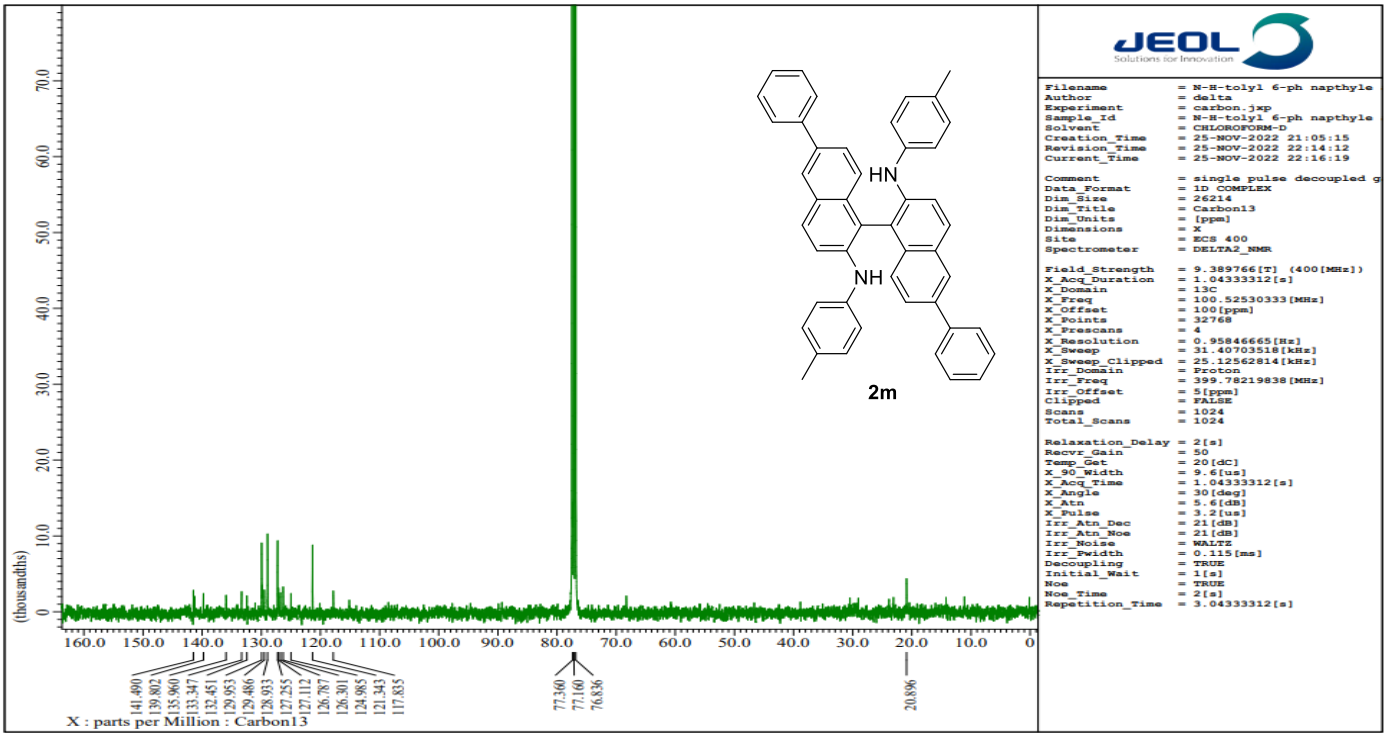


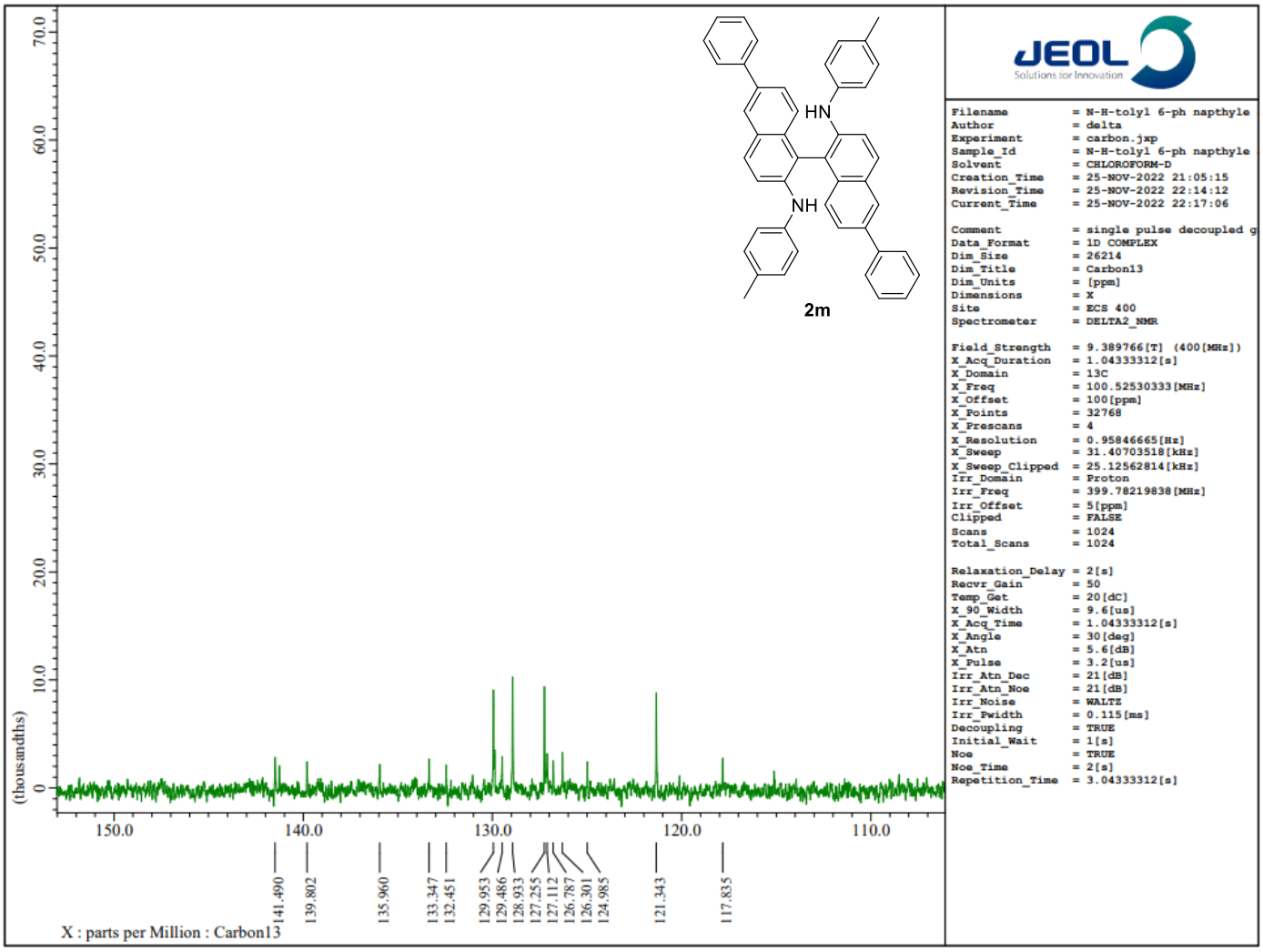
Compound **2l** (^{13}C NMR, 100 MHz, $CDCl_3$).



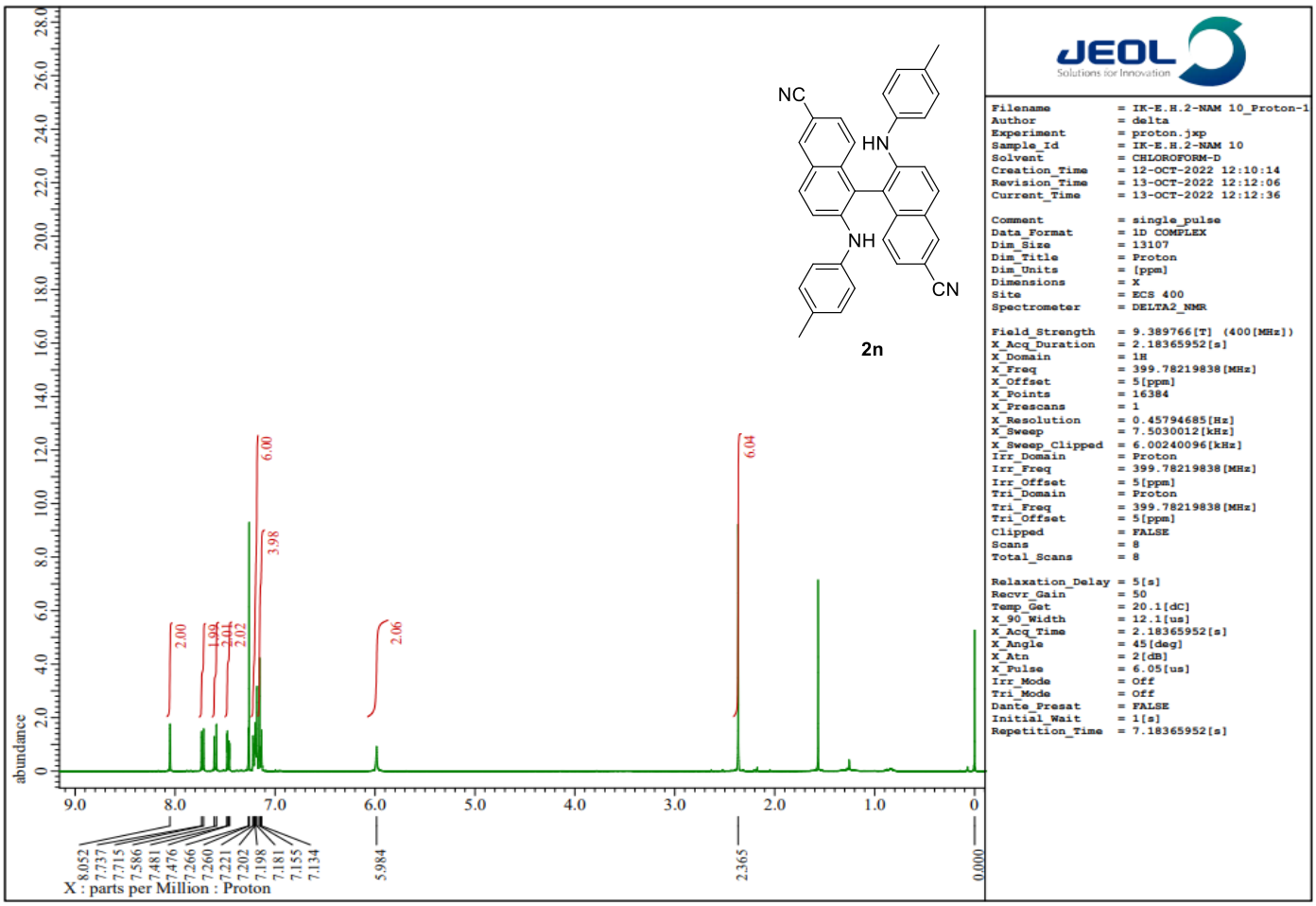


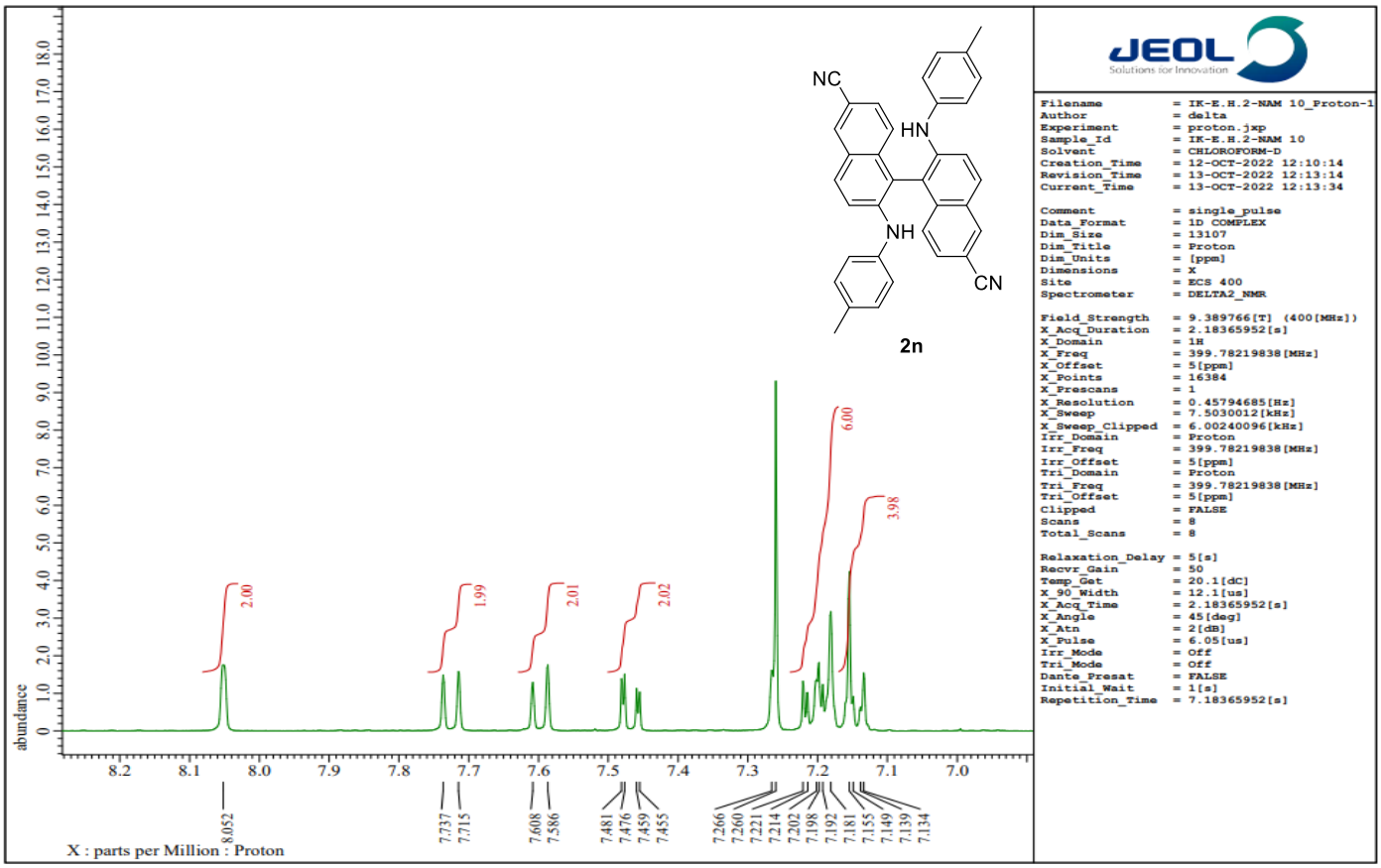
Compound **2m** (^{1}H NMR, 400 MHz, $CDCl_3$).



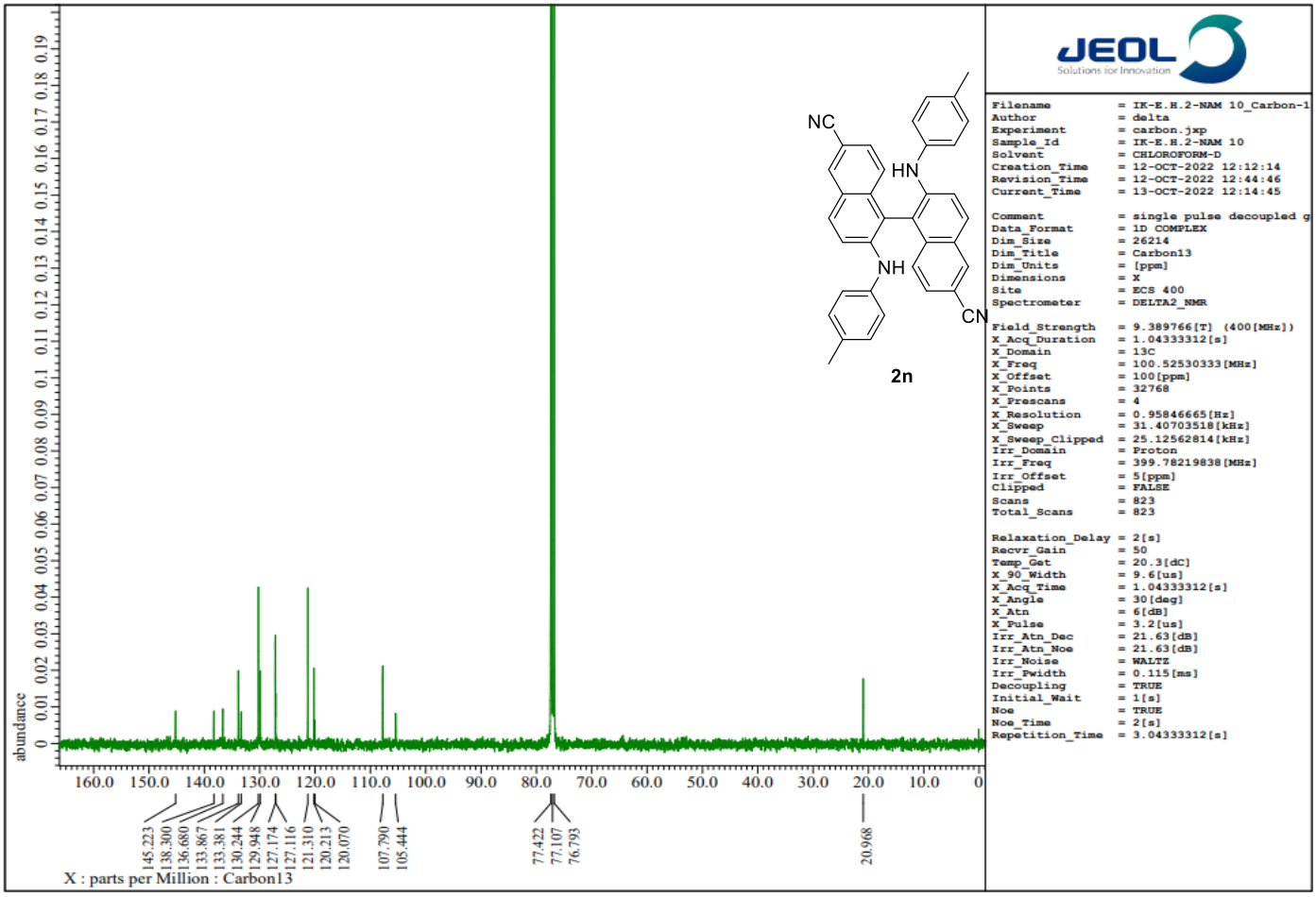


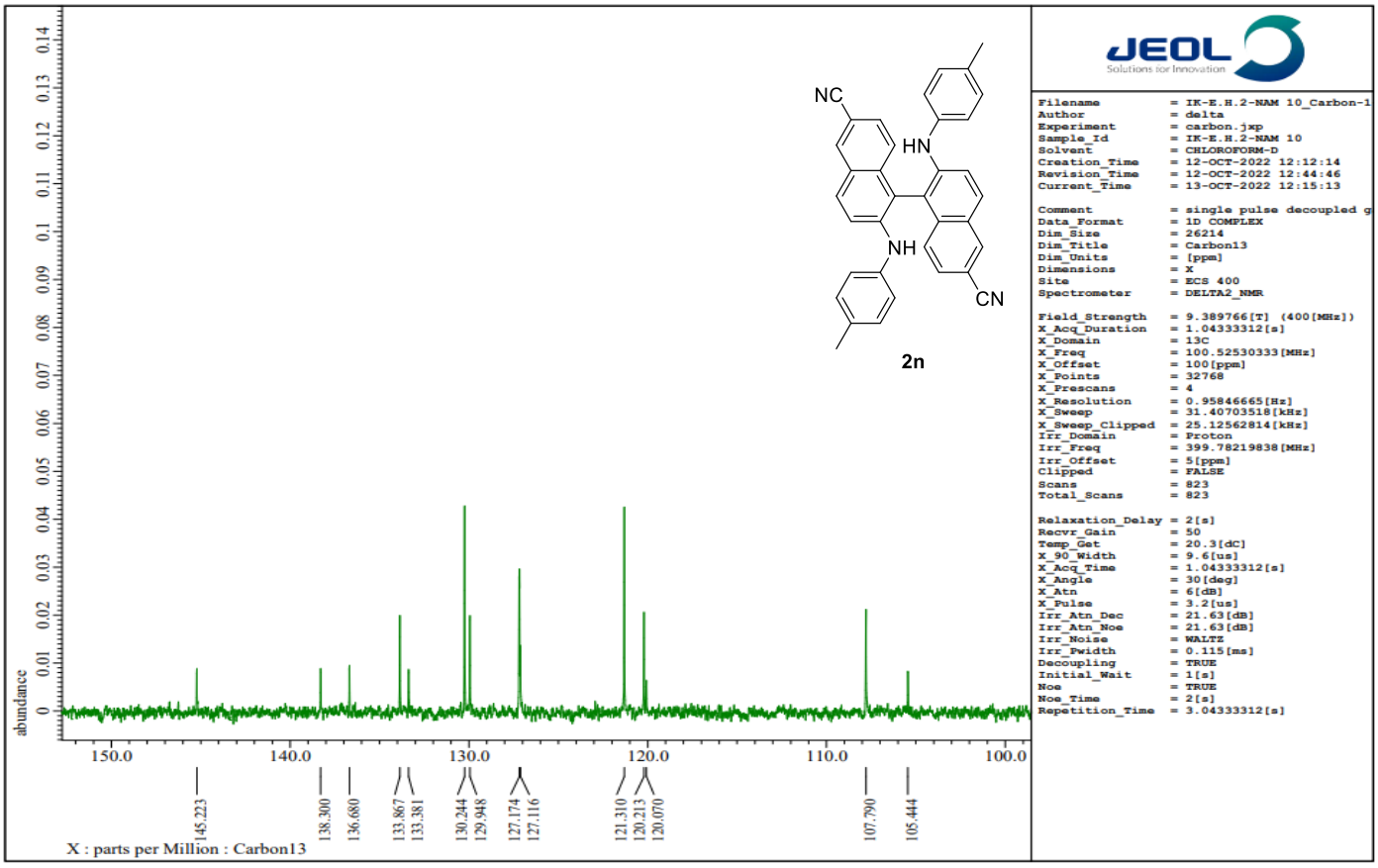
Compound **2m** (^{13}C NMR, 100 MHz, $CDCl_3$).



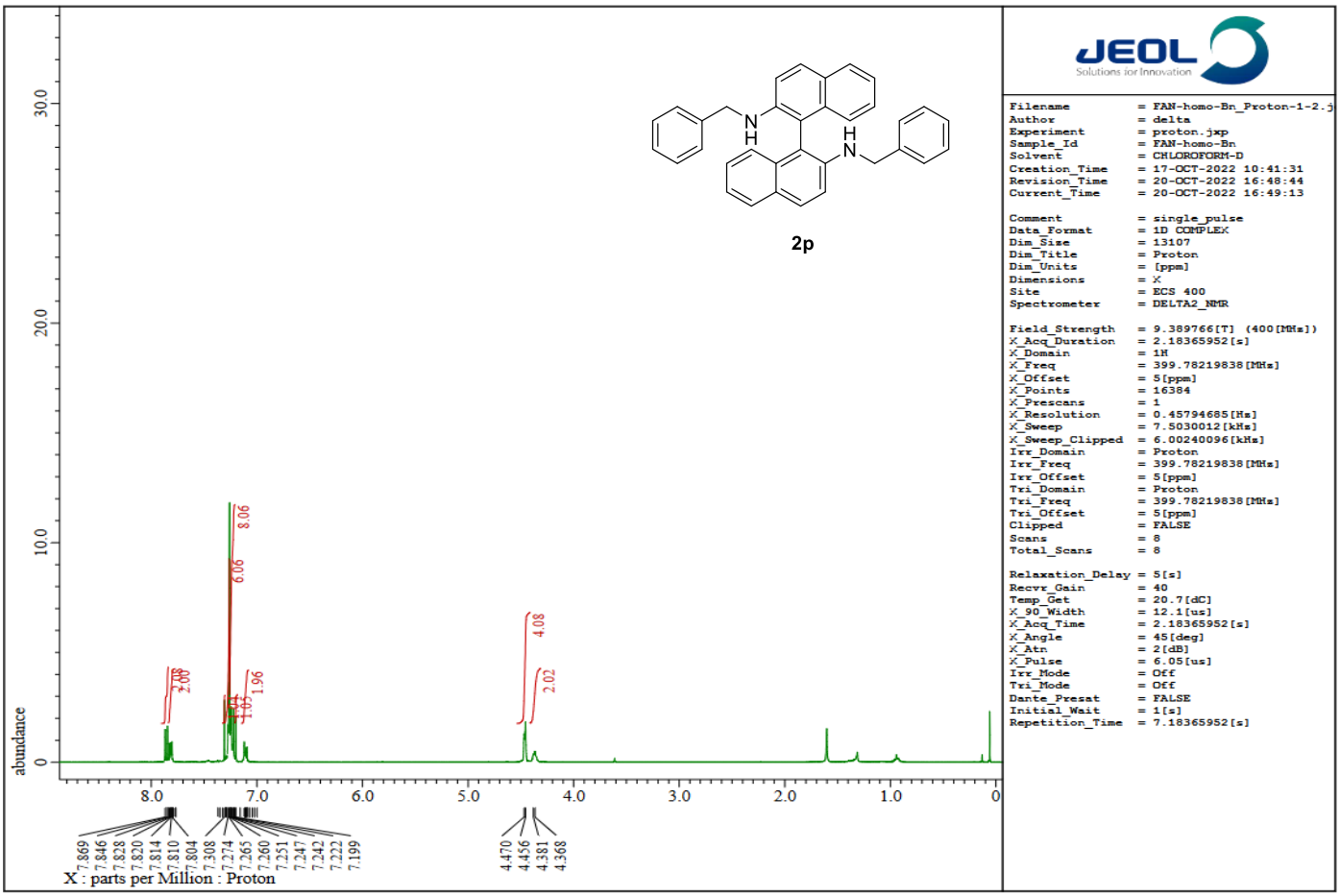


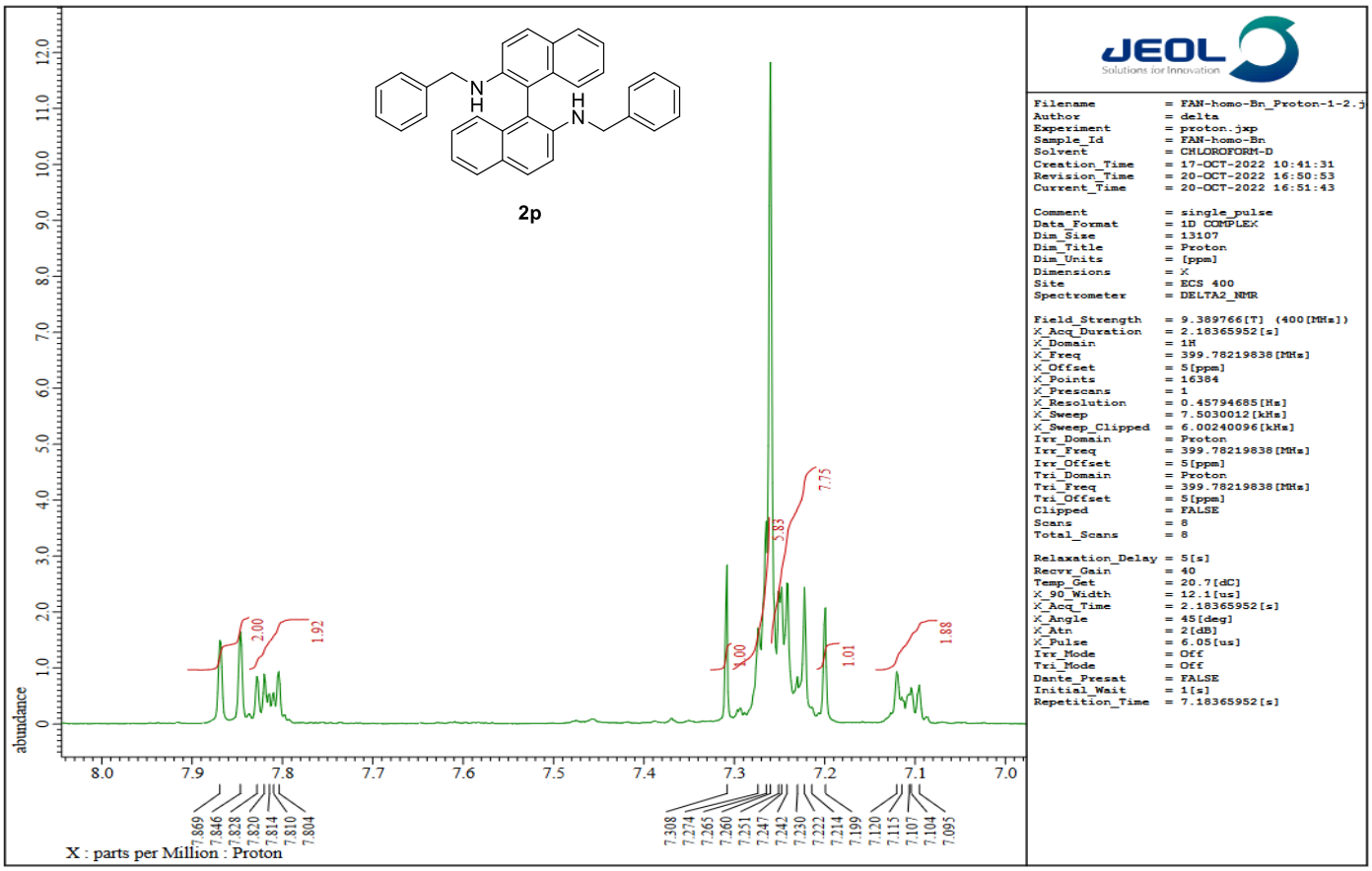
Compound **2n** (^{1}H NMR, 400 MHz, $CDCl_3$).



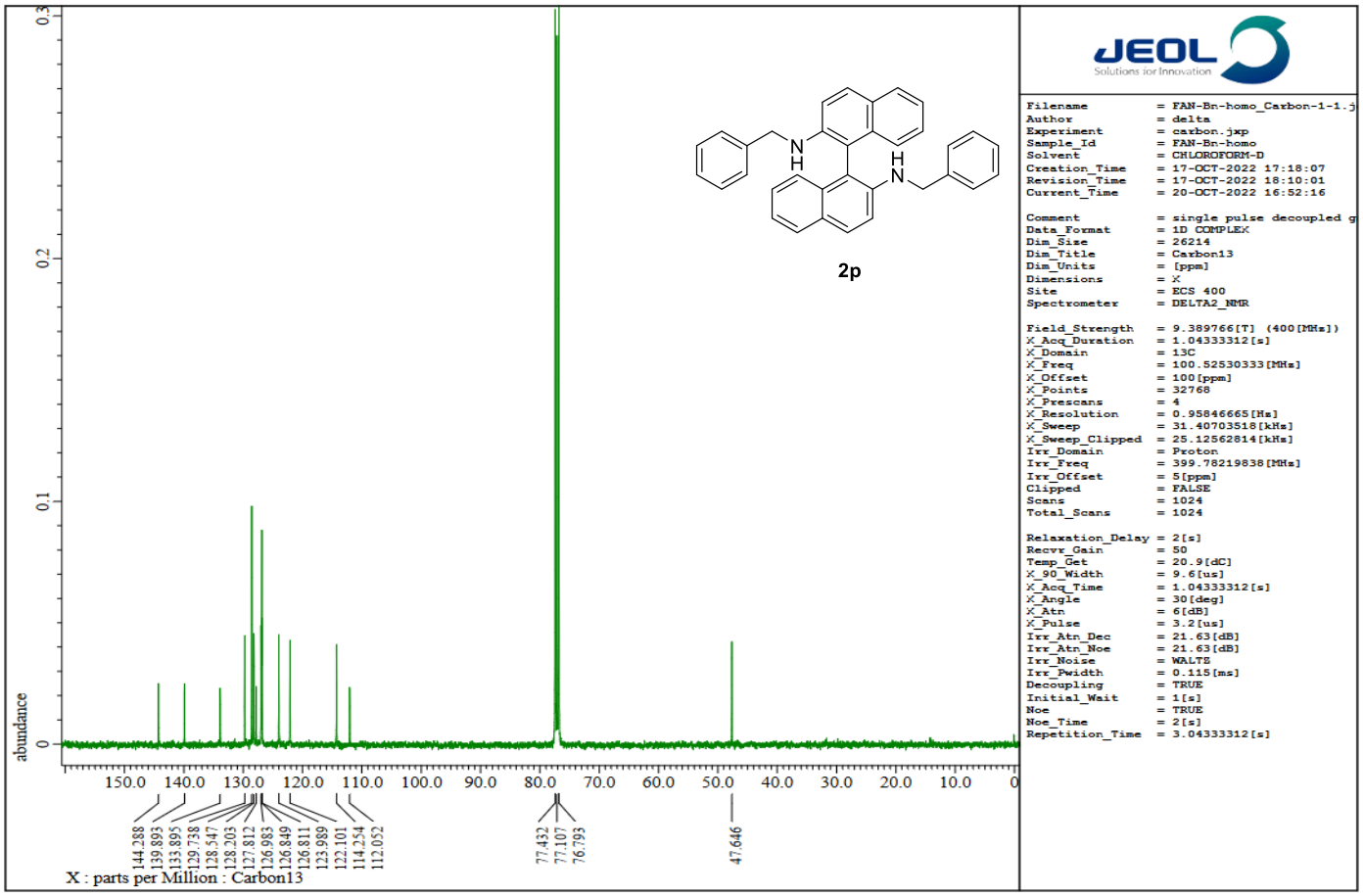


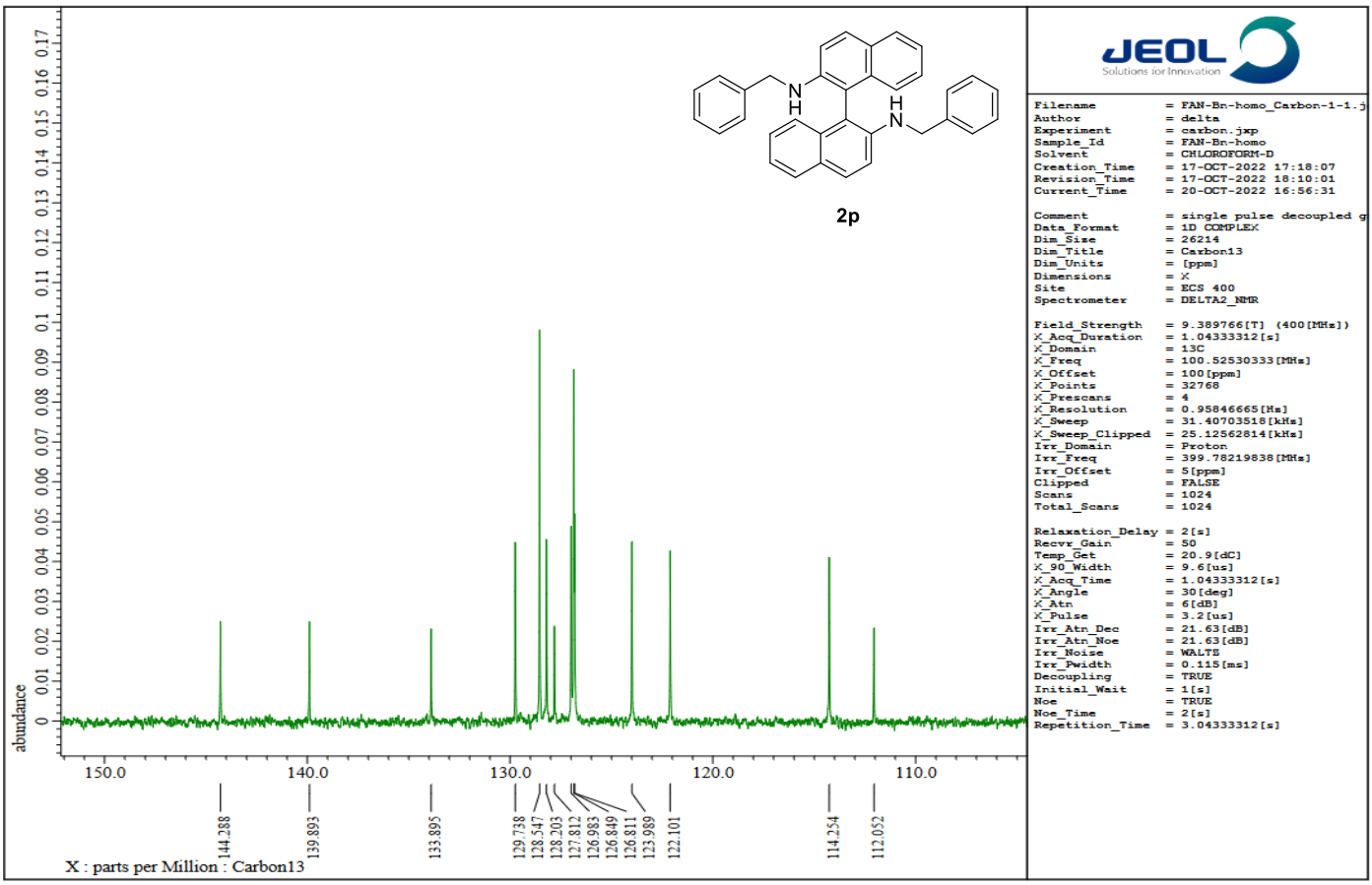
Compound **2n** (^{13}C NMR, 100 MHz, $CDCl_3$).





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





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