Supporting Information

for

A novel 4-aminoantipyrine-Pd(II) complex catalyzes Suzuki–Miyaura cross-coupling reactions of aryl halides

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Full experimental details and copies of all NMR spectra (^{1}H and ^{13}C spectra) of all compounds isolated

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General methods and materials: All reagents and solvents used were obtained commercially and used without further purification unless indicated otherwise. All products were characterized by ^{1}H NMR and ^{13}C NMR. ^{1}H NMR spectra were recorded on 400 MHz in $CDCl_3$, and ^{13}C NMR spectra were recorded on 101 MHz in $CDCl_3$ using TMS as internal standard. Multiplicities are indicated as s (singlet), d (doublet), t (triplet), q (quartet), and m (multiplet), and coupling constants (J) are reported in hertz.

Synthesis of 4-aminoantipyrine–palladium (II) complex, 4-AAP–Pd(II): [1] To a stirred solution 0.5 M of Li_2PdCl_4 (1.13 mL, 0.56 mmol) in methanol at room temperature was added a solution of 4-AAP (0.115 g, 0.56 mmol) in methanol (2mL) and AcONa (0.046 g, 0.56 mmol). Stirring was continued for 3 days and then the mixture was diluted with H_2O (2 mL). The precipitated compound was filtered, washed with H_2O (2 X 2 mL) and ethyl ether (2 x 2 mL). After recrystalization ($CHCl_3$:Hex) provided the 4-AAP-Pd(II) complex as orange solid. Yield 74%; mp 210°C; IR (neat): 3478, 2926, 1616, 1586 cm^{-1}; UV: λ^{max} 465 nm; ^{1}H-NMR (400 MHz, $CDCl_3$) δ ppm: 7.55 – 7.44 (m, 2H), 7.42 – 7.33 (m, 3H), 3.07 (s, 3H), 2.29 (s, 3H), 1.84 (q, 1H); ^{13}C-NMR ($CDCl_3$) δ ppm: 161.4, 143.7, 133.2, 129.3, 129.0, 127.8, 124,7, 123.3, 112.3, 35.4, 10.3; Anal. Calcd. for $C_{22}H_{24}Cl_2N_6O_2Pd_2$ C 38.39, H 3.51, N 12.21; found C 38.52, H 3.54, N 12.35.

General Procedure for the Suzuki–Miyaura cross-coupling reaction: In a 10 mL glass tube containing a Teflon-coated stir bar was placed p-bromobenzaldehyde **2e** (0.05 g, 0.27 mmol, 1 equiv), phenylboronic acid **1a** (0.05 g, 0.40 mmol, 1.5 equiv), 2M K_2CO_3 (0.33 mL, 0.67 mmol, 2.5 equiv), 4-AAP-Pd(II) (0.28 mg, 0.3 mol % Pd) and EtOH (2 mL). The mixture was stirred at reflux for 4 h. After cooling, the mixture was diluted with ether Et_2O (5 mL), washed with sat. aq. $NaHCO_3$ (3 mL), brine (3 mL) and dried over Na_2SO_4. Evaporation of the solvent and purification of the residue over a silica gel column (Hex: AcOEt 90:10), furnished the biphenyl **3q**.

Characterization of the products

1,1'-Biphenyl (**3a**): [2]

White solid; m.p. = 69-70°C; ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 7.59 (dd, J = 8.2, 1.1Hz, 4H), 7.43 (m, 4H), 7.34 (m, 2H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 141.2, 128.7, 127.2, 127.1

4-Methoxy-1,1'-biphenyl (**3b**): [3]

White solid, m.p. = 88-89°C; ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 7.58-7.54 (m, 4H), 7.45-7.41 (m, 2H), 7.34-7.30 (m, 1H), 7.01-6.98 (m, 2H), 3.86 (m, 3H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 159.9, 140.6, 133.6, 128.5, 128.0, 126.5, 126.5, 114.0, 55.2

4-(Trifluoromethyl)-1,1'-biphenyl (**3c**): [4]

White solid, m.p. = 66-67°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 7.69 (s, 4H), 7.60 (m, 2H), 7.48 (m, 2H), 7.41 (m, 1H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 144.7, 139.7, 129.0, 128.2, 127.6, 127.4, 127.3, 125.73, 125.69, 125.65, 125.60

3-Nitro-1,1'-biphenyl (**3d**): [5]

Light yellow solid, m.p. 57-58°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 8.46 (t, J = 2Hz, 1H), 8.20 (ddd, J = 8.2, 2.3, 1.0Hz, 1H), 7.92 (dd, J=7.7, 1.8, 1.1Hz, 1H), 7.63 (m, 3H), 7.58 (m, 2H), 7.44 (m, 1H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 148.5, 142.7, 138.5, 132.9, 129.5, 129.0, 128.4, 127.0, 121.8, 121.8

[1,1'-Biphenyl]-2-ylmethanol (**3e**): [6]

Colorless oil; ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 7.54-7.53 (m, 1H), 7.43-7.34 (m, 7H), 7.28-7.26 (m, 1H), 4.59 (s, 2H), 1.78 (b, 1H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 141.3, 140.6, 139.1, 138.0, 130.0, 129.1, 128.3, 127.7, 127.6, 127.2, 63.1

(4'-Methoxy-[1,1'-biphenyl]-2-yl)methanol (3**f**): [7]

White solid, m.p. = 79-80°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 7.52 (dd, J = 6.9, 1.8Hz, 1H), 7.36-7.20 (m, 5H), 6.96-6.94 (m, 2H), 4.60 (s, 2H), 3.84 (s, 3H), 1.71

(s, 1H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 158.7, 140.8, 132.8, 130.0, 130.0, 128.3, 127.5, 127.2, 113.5, 63.1, 55.1

(4'-(Trifluoromethyl)-[1,1'-biphenyl]-2-yl)methanol (**3g**): [8]

Light yellow oil, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 7.68 (d, J = 8Hz, 2H), 7.56 (dd, J = 7.5, 1.1Hz, 1H), 7.50 (d, J = 8Hz, 2H), 7.40 (dtd, 2H, J = 18.3, 7.4, 1.5Hz), 7.27 (dd, J = 7.4, 1.4Hz, 1H), 4.56 (s, 2H), 1.82 (s, 1H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 144.3, 140.0, 137.7, 133.6, 129.9, 129.5, 128.7, 128.4, 127.9, 125.5, 125.2, 125.1, 125.1, 125.1, 62.9

(3'-Nitro-[1,1'-biphenyl]-2-yl)methanol (**3h**):

Yellow oil, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 8.28 (d, J = 1.7Hz, 1H), 8.23 (dd, J = 8.2, 1.1Hz, 1H), 7.76 (d, J = 7.6Hz, 1H), 7.59 (m, 2H), 7.44 (tdd, J = 15, 10.4, 4.3Hz, 2H), 7.30 (dd, J = 7.4, 1.2Hz, 1H), 4.58 (s, 2H), 1.94 (s, 1H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 147.9, 142.1, 138.8, 137.5, 135.2, 132.9, 130.1, 129.8, 129.0, 128.9, 128.6, 128.0, 123.8, 123.1, 122.0, 121.9, 62.7

4-Nitro-1,1'-biphenyl (**3i**): [9]

Light yellow solid; m.p. 109-111°C; ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 8.30 (m, 2H), 7.74 (m, 2H), 7.62 (m, 2H), 7.53 (m, 3H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 147.6, 138.7, 129.1, 128.9, 127.8, 127.3, 124.1

4-Methoxy-4'-nitro-1,1'-biphenyl (**3j**): [7]

Light yellow solid, m.p. = 105-106°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 8.26 (d, J = 8.8Hz, 2H), 7.69 (d, J = 8.8Hz, 2H), 7.58 (d, J = 8.8Hz, 2H), 7.02 (d, J = 8.8Hz, 2H), 3.87 (s, 3H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 160.2, 147.0, 146.3, 130.9, 128.4, 126.9, 124.0, 114.4, 55.2

4-Nitro-4'-(trifluoromethyl)-1,1'-biphenyl (**3k**): [10]

White solid, m.p.108-109°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 8.34 (d, J =8.8Hz, 2H), 7.75 (m, 6H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 147.6, 146.0, 128.1, 127.8, 126.13, 126.09, 126.06, 126.02, 124.2

3,4'-Dinitro-1,1'-biphenyl (**3l**): [11]

Yellow solid, m.p. 184-187°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 8.50 (t, J = 1.8Hz, 1H), 8.37 (m, 2H), 8.31 (dd, J = 8.2, 2.1Hz, 1H), 7.96 (dd, J = 6.5, 1.3Hz, 1H), 7.80 (m, 2H), 7.71 (t, J = 8Hz, 1H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 133.1, 130.1, 127.9, 124.3, 123.4, 122.1

[1,1'-Biphenyl]-2-ol (**3m**): [12]

White solid; m.p. 56-57°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 7.47 (m, 4H), 7.39 (m, 1H), 7.26 (m, 2H), 6.99 (td, J = 7.4, 1.0, 2H), 5.22 (s, 1H); ^{13}C-NMR (101 MHz,

$CDCl_3$): δ (ppm) 152.4, 137.1, 130.2, 129.2, 129.1, 128.7, 128.1, 127.8, 127.2, 127.1, 120.8, 115.8

4'-Methoxy-[1,1'-biphenyl]-2-ol (**3n**): [7]

Light yellow oil, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 7.40-7.38 (m, 2H), 7.25-7.20 (m, 2H), 7.02-6.95 (m, 4H), 5.25 (s, 1H), 3.45 (s, 3H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 159.1, 152.3, 130.1, 129.0, 128.6, 127.6, 120.6, 115.5, 114.5, 55.2

4'-(Trifluoromethyl)-[1,1'-biphenyl]-2-ol (**3o**): [13]

White solid, m.p. 105-106°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 7.73 (d, J =8.2Hz, 2H), 7.63 (d, J =8.1Hz, 2H), 7.29 (m, 2H), 7.03 (t, J = 7.5Hz, 1H), 6.96 (d, J = 8.1Hz, 1H), 5.04 (s, 1H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 152.3, 148.0, 141.1, 130.4, 129.8, 129.5, 126.9, 125.88, 125.84, 125.81, 125.77, 121.2, 116.2

3'-Nitro-[1,1'-biphenyl]-2-ol (**3p**):

^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 8.46 – 8.42 (m, 1H), 8.22 (ddd, J = 8.2, 2.3, 1.1 Hz, 1H), 7.89 (ddd, J = 7.7, 1.7, 1.1 Hz, 1H), 7.65 – 7.59 (m, 1H), 7.36 – 7.28 (m, 2H), 7.06 (td, J = 7.5, 1.1 Hz, 1H), 6.95 (dd, J = 8.0, 1.1 Hz, 1H), 5.07 (s, 1H) ; ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 152.20, 139.40, 135.29, 133.03, 131.99, 129.96, 129.41, 129.15, 124.25, 123.27, 121.79, 116.10

[1,1'-Biphenyl]-4-carboxaldehyde (**3q**): [4]

White solid, m.p. = 58–60 °C; ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 10.06 (s, 1H), 7.96 (m, 2H), 7.76 (m, 2H), 7.64 (m, 2H), 7.50 (dd, J = 11.5, 4.4Hz, 2H), 7.43 (d, J =7.3Hz, 1H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 192.0, 147.0, 140.0, 135.0, 130.1, 128.9, 128.3, 127.5, 127.2

4'-Methoxy-[1,1'-biphenyl]-4-carboxaldehyde (**3r**): [14]

White solid, m.p. = 100-102°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 10.03 (s, 1H), 7.92 (d, J = 8.3Hz, 2H), 7.71 (d, J = 8.3Hz, 2H), 7.59 (d, J = 8.8Hz, 2H), 7.01 (d, J = 8.8Hz, 2H), 3.86 (s, 3H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 191.7, 159.9, 146.6, 134.4, 131.8, 130.1, 128.3, 126.8, 114.3, 55.2

4'-(Trifluoromethyl)-[1,1'-biphenyl]-4-carboxaldehyde (**3s**): [15]

Colorless oil, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 10.08 (s, 1H), 7.99 (m, 2H), 7.76 (m, 6H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 191.6, 145.4, 143.0, 135.6, 130.2, 127.8, 127.5, 125.8, 125.79, 125.76, 125.72

3'-Nitro-[1,1'-biphenyl]-4-carboxaldehyde (**3t**): [16]

Light yellow solid, m.p. 112-115°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 10.09 (s, 1H), 8.50 (t, J = 1.8Hz, 1H), 8.27 (dd, J =8.2, 1.2, 1H), 8.02 (d, J = 8.3Hz, 2H), 7.97 (d, J = 7.7Hz, 1H), 7.80 (d, J = 8.2Hz, 2H), 7.68 (t, J = 8Hz, 1H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 191.6, 148.7, 144.3, 141.4, 133.2, 130.0, 127.8, 123.1, 122.2

[1,1'-Biphenyl]-4-amine (**3u**): [3]

Brown solid, m.p. = 49-51°C; ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 7.53 (dd, J= 8.2, 1.3Hz, 2H), 7.29 (m, 4H), 7.26 (m, 1H), 6.74 (m, 2H), 3.70 (b, 2H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 145.8, 141.0, 131.4, 128.5, 127.8, 126.2, 126.1, 115.2

4'-Methoxy-[1,1'-biphenyl]-4-amine (**3v**): [17]

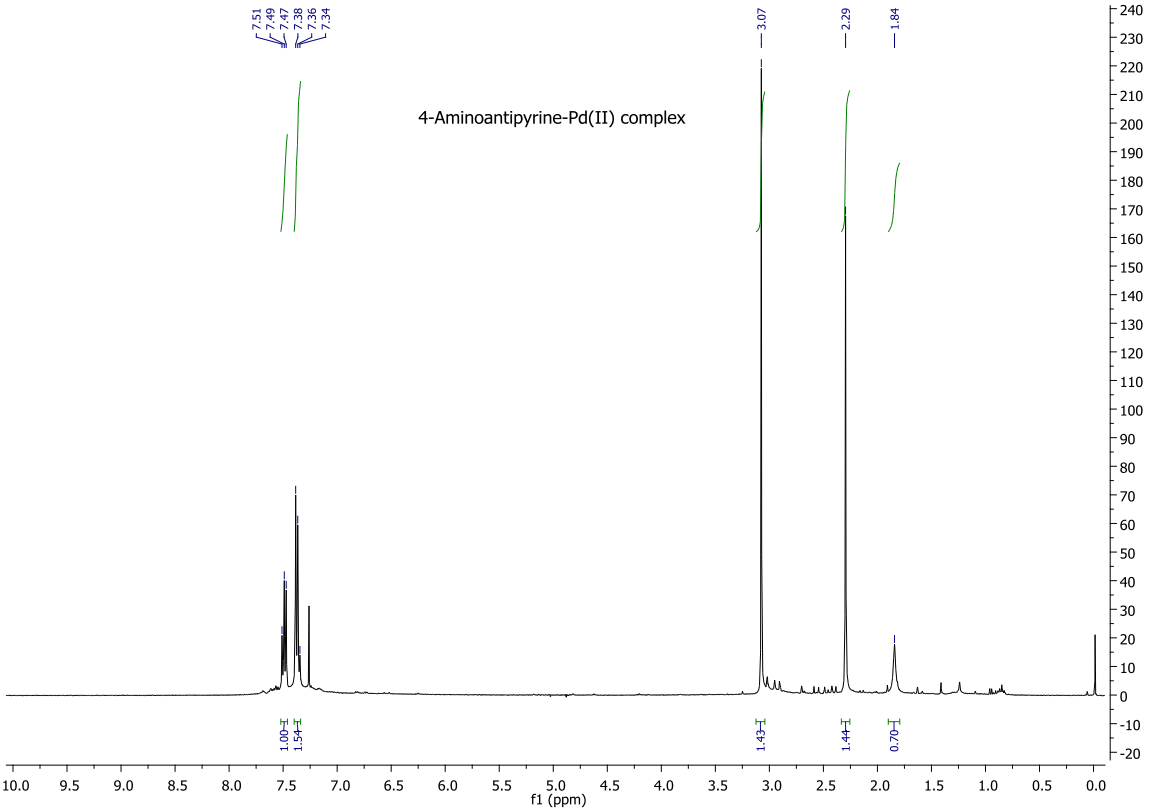
Light yellow solid, m.p. = 143-145°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 7.48 (d, J = 8.9Hz, 2H), 7.38 (d, J = 8.6Hz, 2H), 6.96 (d, J = 8.9Hz, 2H), 6.75 (d, J = 8.6Hz, 2H), 3.85 (s, 3H), 3.70 (b, 2H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 158.2, 145.1, 133.7, 131.1, 127.4, 127.2, 115.2, 113.9, 55.1

4'-(Trifluoromethyl)-[1,1'-biphenyl]-4-amine (**3w**): [18]

Yellow solid, m.p.140-144°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 7.62 (s, 4H), 7.42 (m, 2H), 6.75 (m, 2H), 3.79 (s, 2H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 146.65, 144.57, 132.0, 129.7, 128.1, 126.4, 125.60, 125.57, 125.53, 125.49, 116.7, 115.3

3'-Nitro-[1,1'-biphenyl]-4-yl-amine (**3x**): [18]

Orange solid, m.p. 124-126°C, ^{1}H-NMR (400 MHz, $CDCl_3$): δ (ppm) 8.39 (t, J = 2Hz, 1H), 8.10 (ddd, J = 8.2, 2.3, 1.0Hz), 7.85 (ddd, J = 7.8, 1,8, 1.0Hz), 7.54 (t, J = 8Hz, 1H), 7.45 (m, 2H), 679 (m, 2H), 3.84 (s, 2H); ^{13}C-NMR (101 MHz, $CDCl_3$): δ (ppm) 146.8, 142.6, 131.9, 129.3, 128.5, 127.9, 115.3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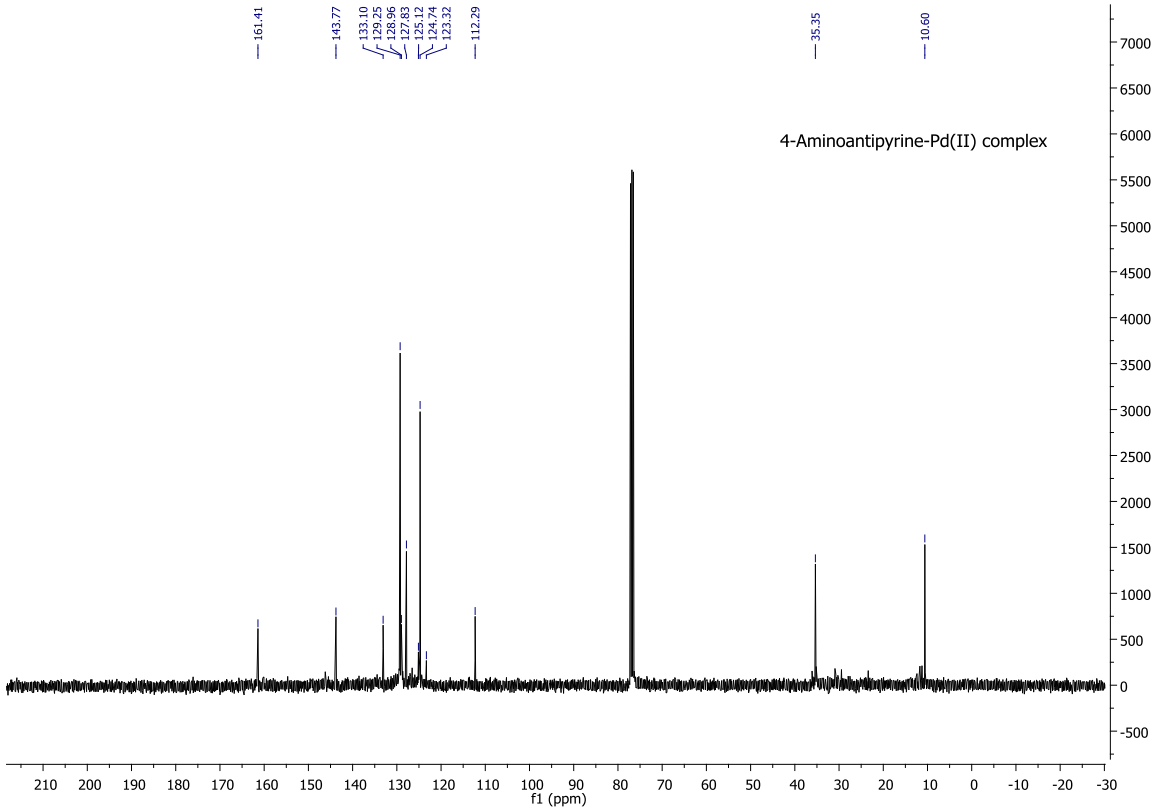
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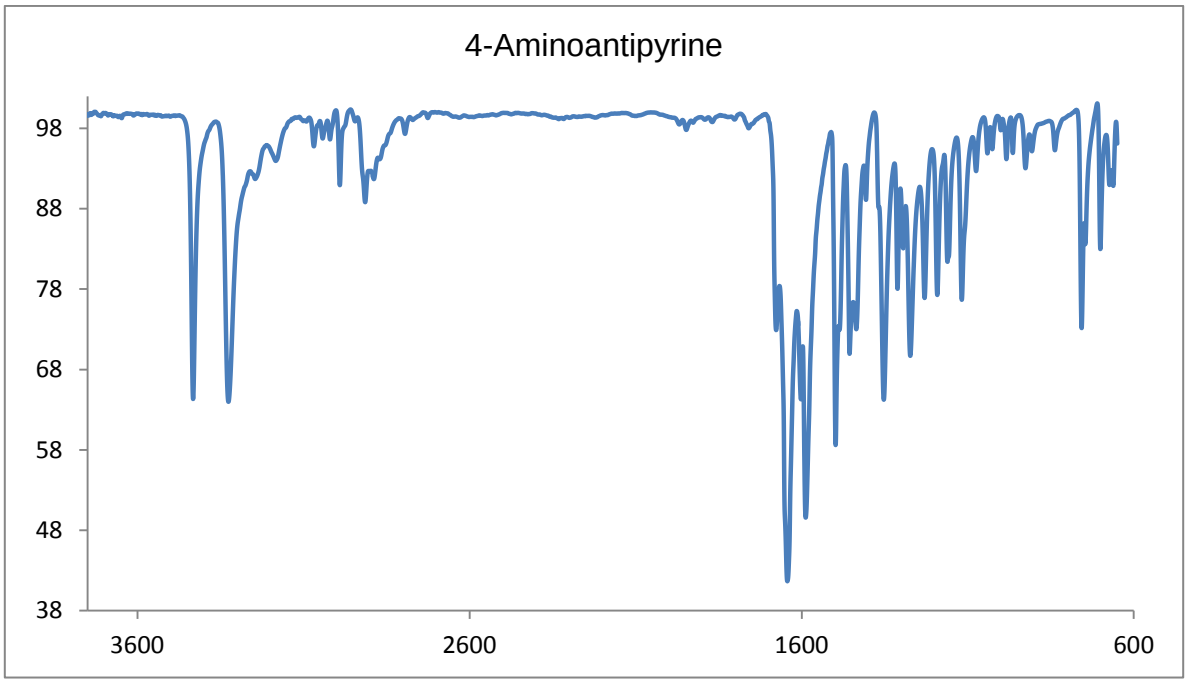
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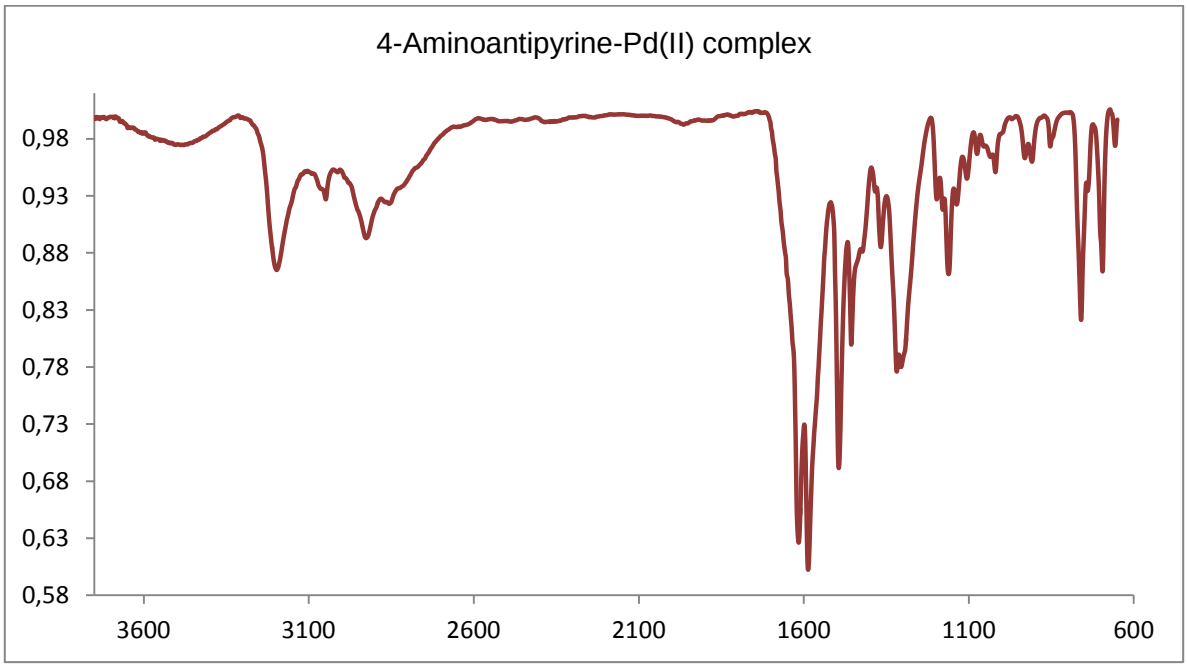
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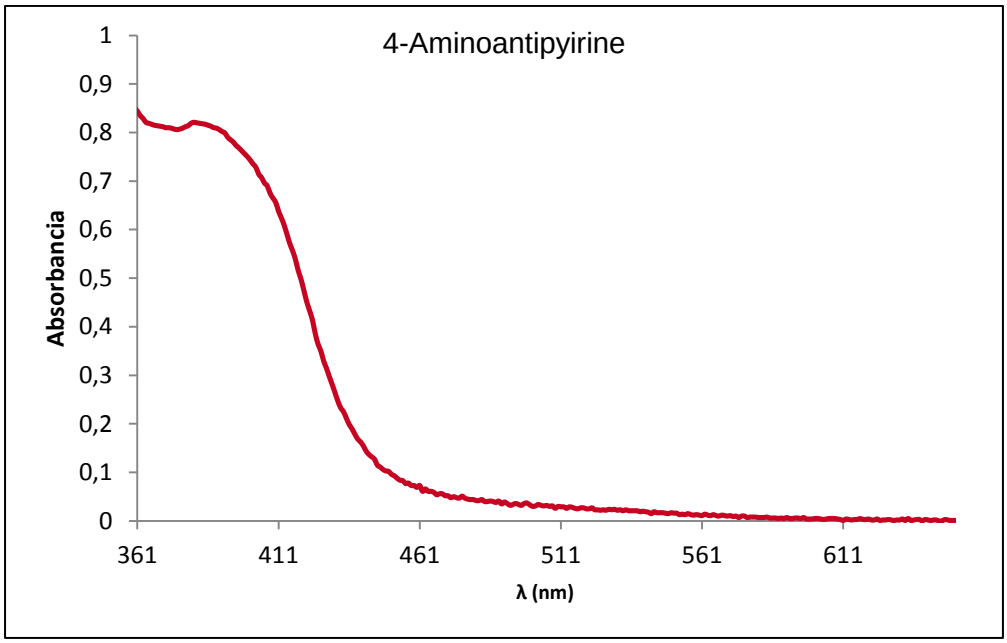
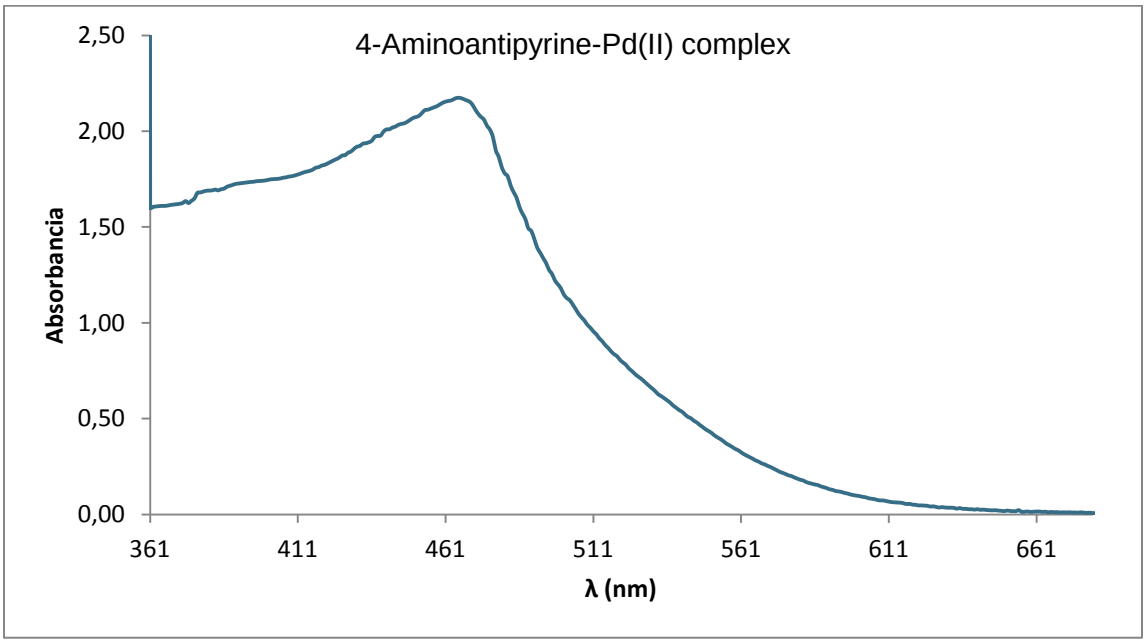
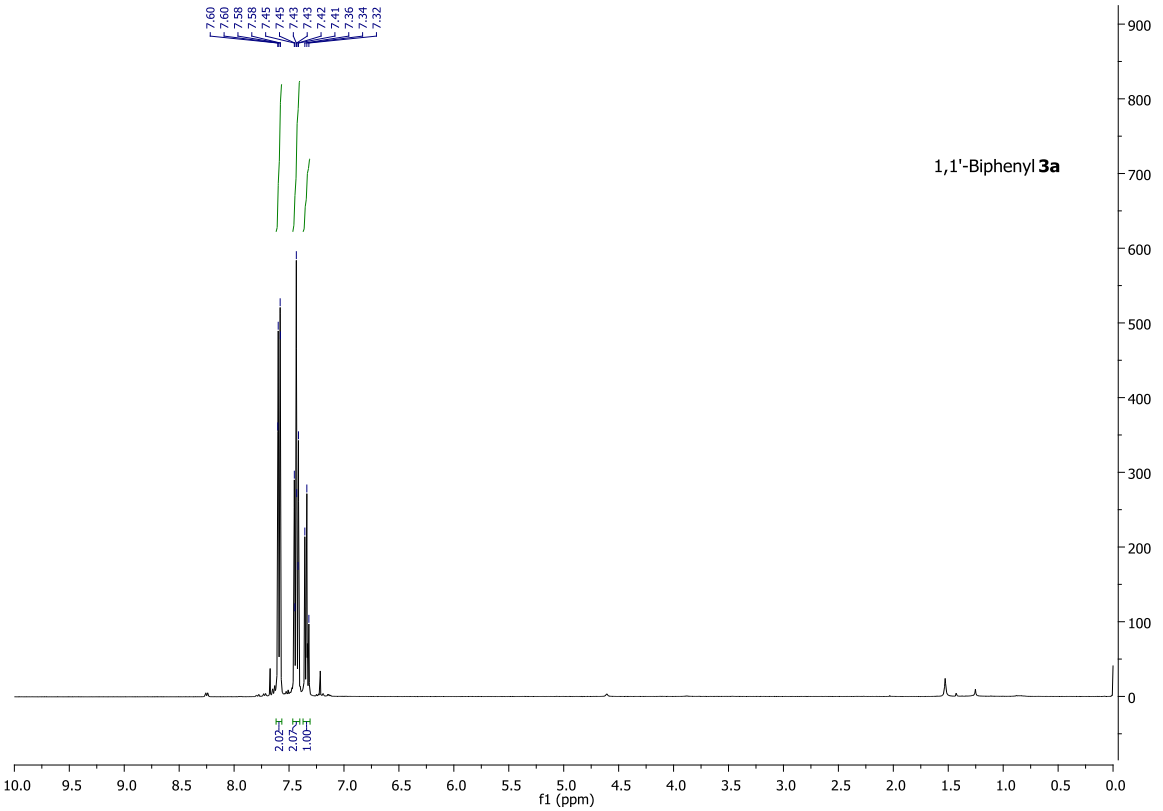




UV-Vis spectra, 1.5 mM in CH_3CN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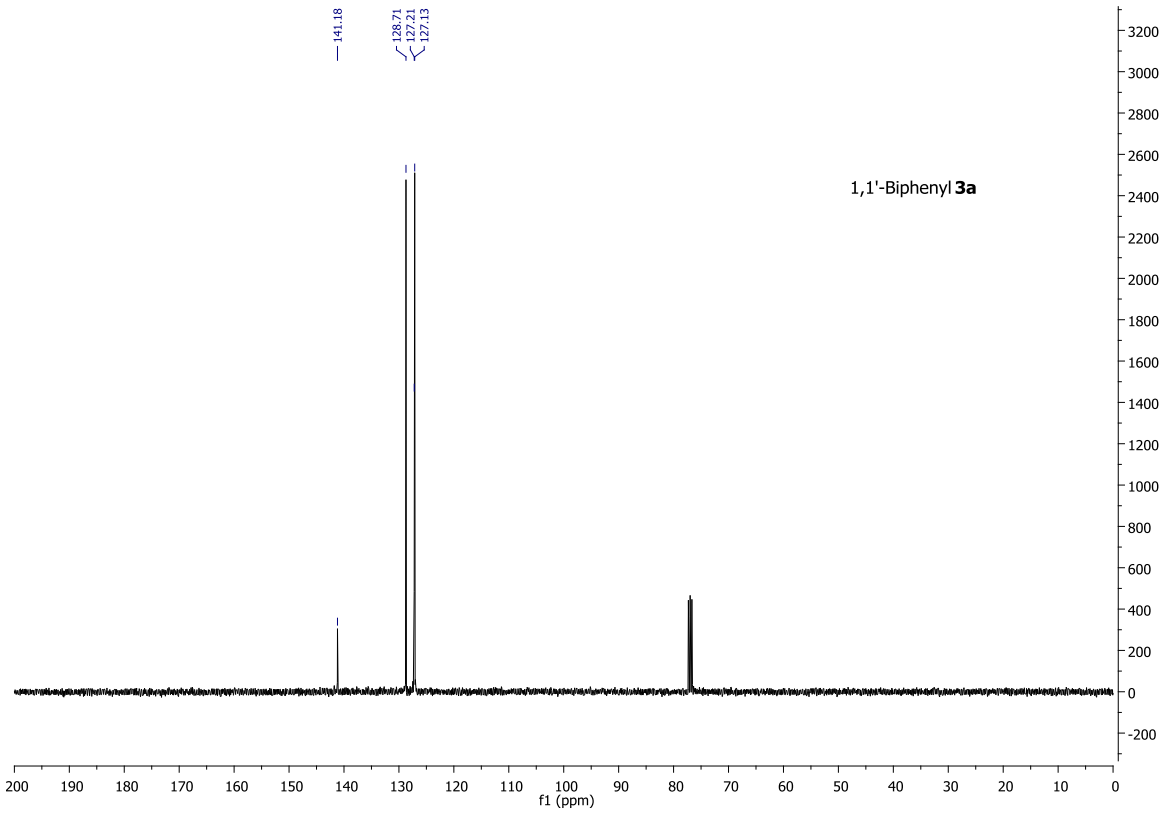
f1 (ppm)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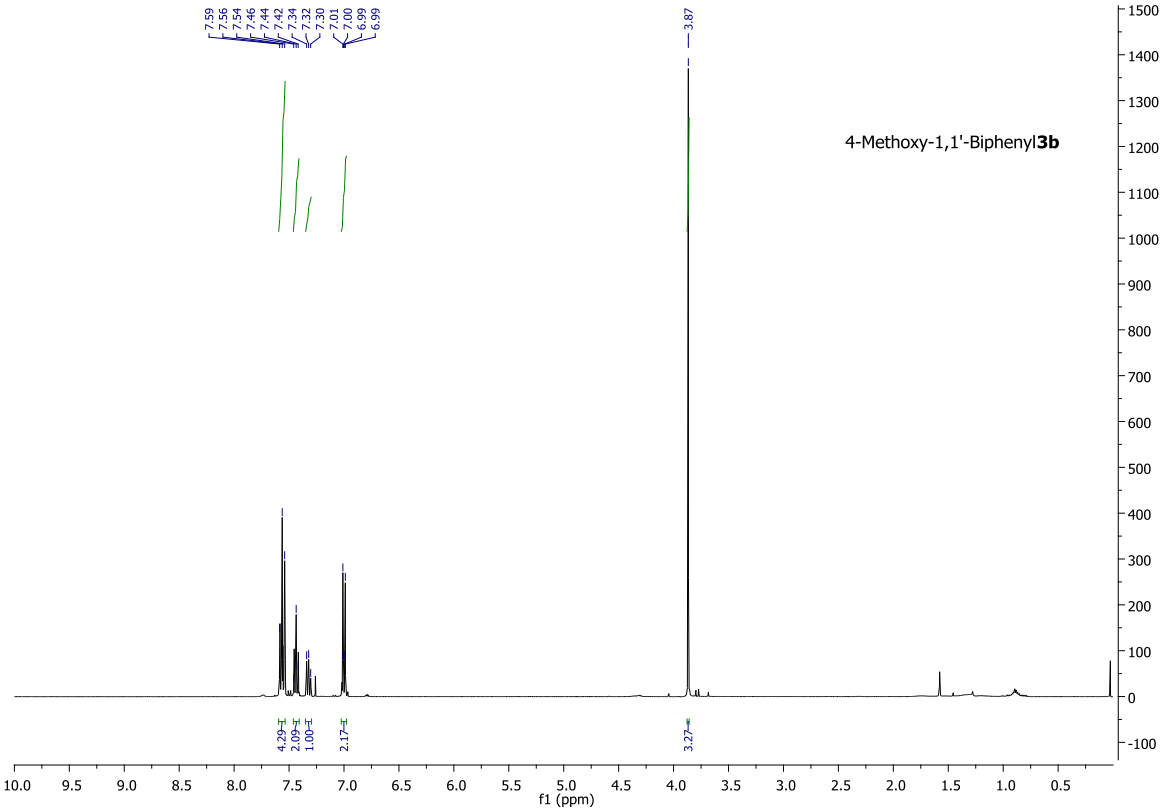
1,1'-Biphenyl **3a**
f1 (ppm)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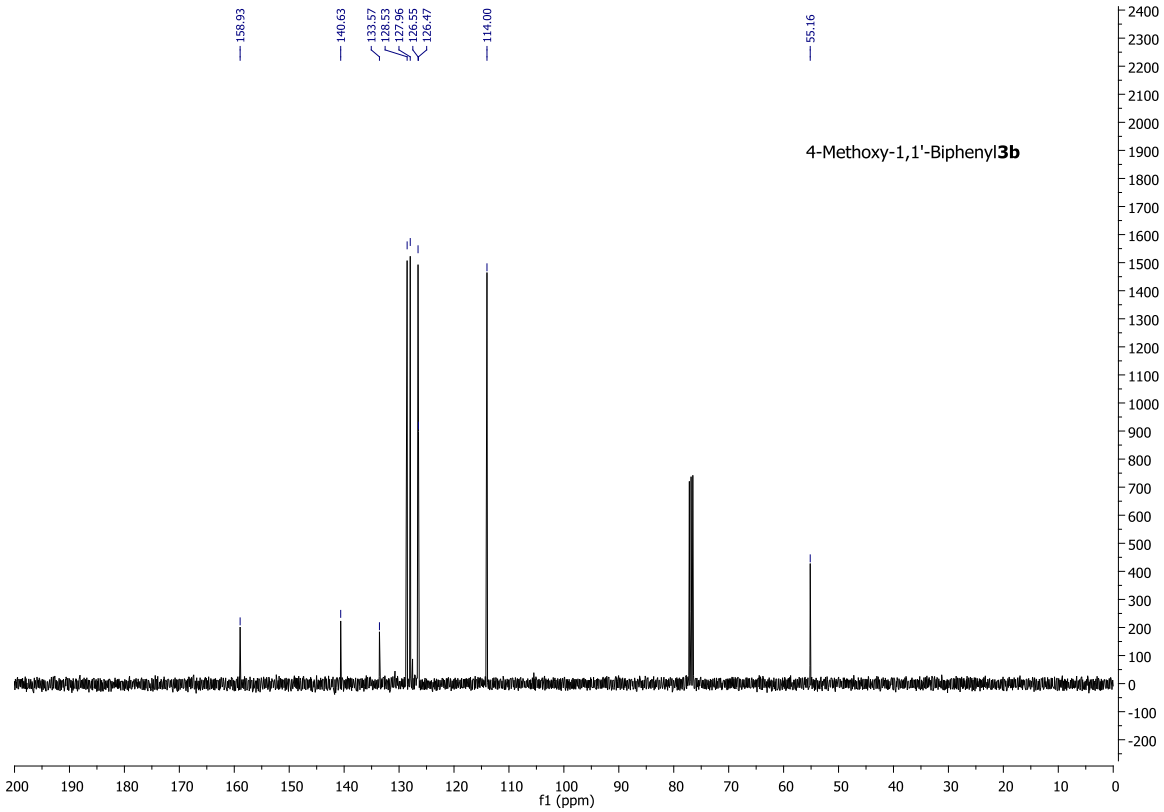
f1 (ppm)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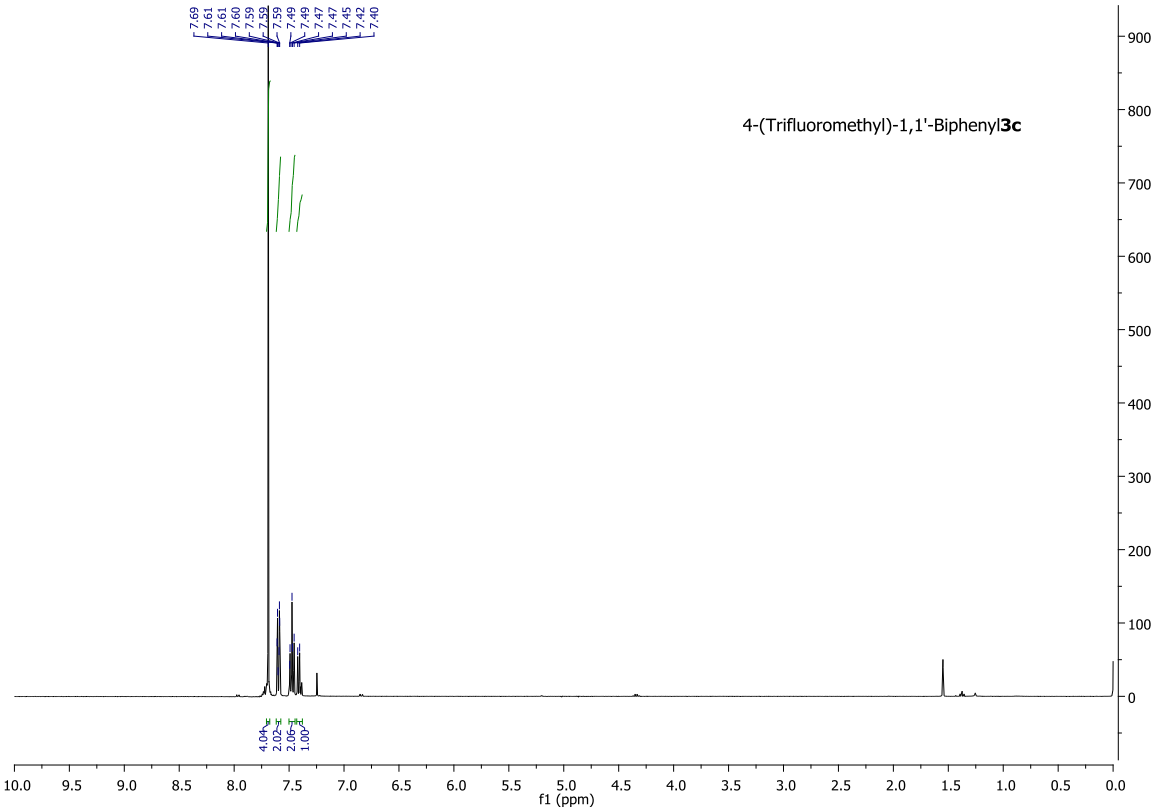
f1 (ppm)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4-(Trifluoromethyl)-1,1'-Biphenyl**3c**
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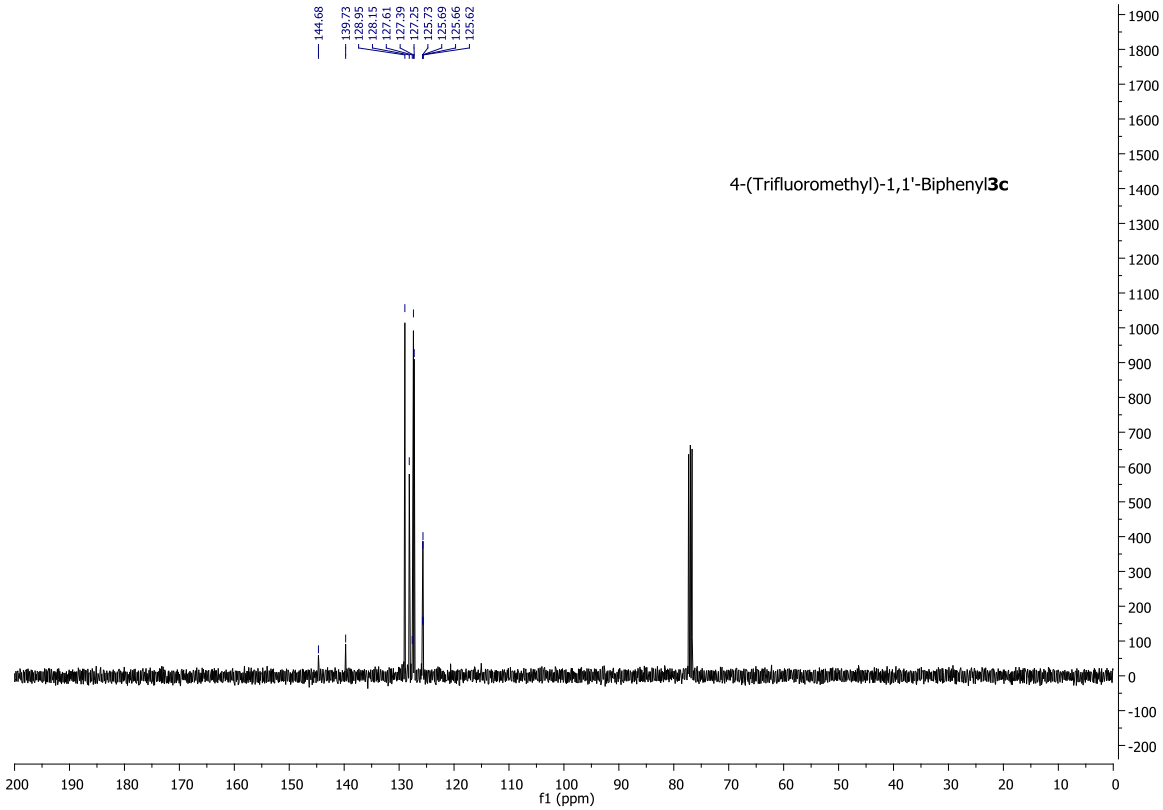
2.02
2.06
1.00
f1 (ppm)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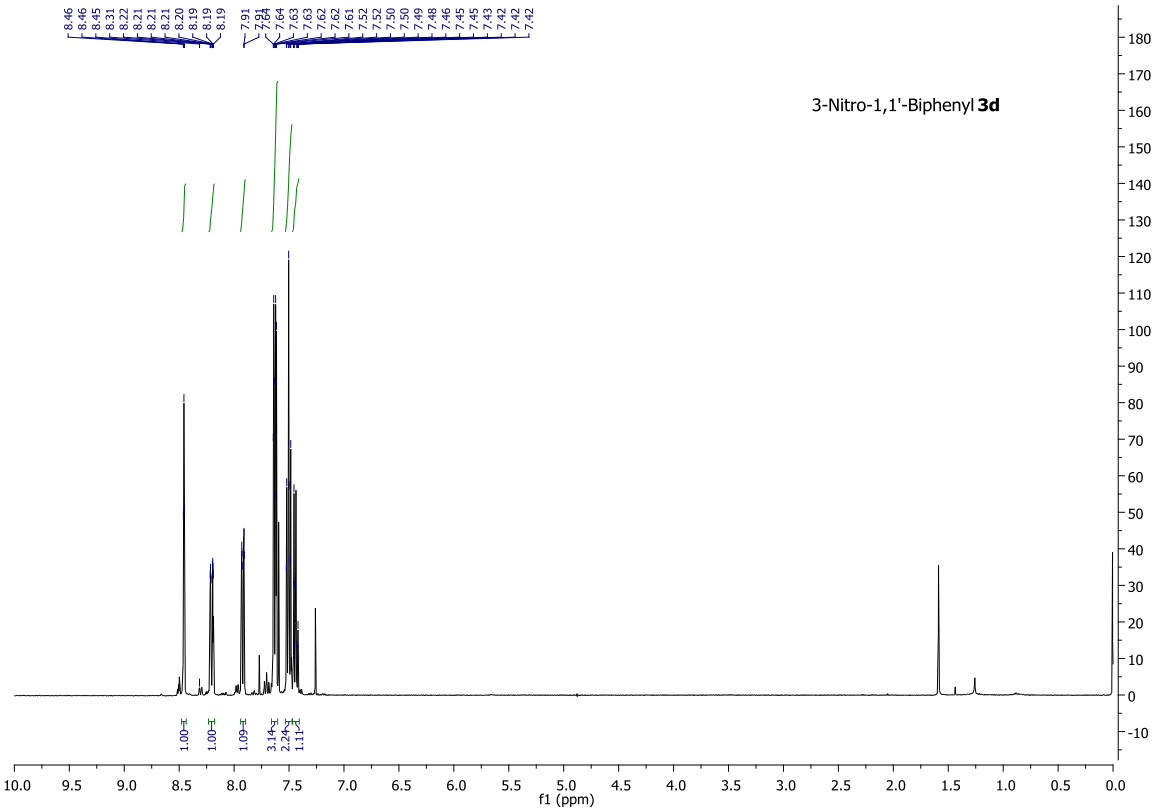
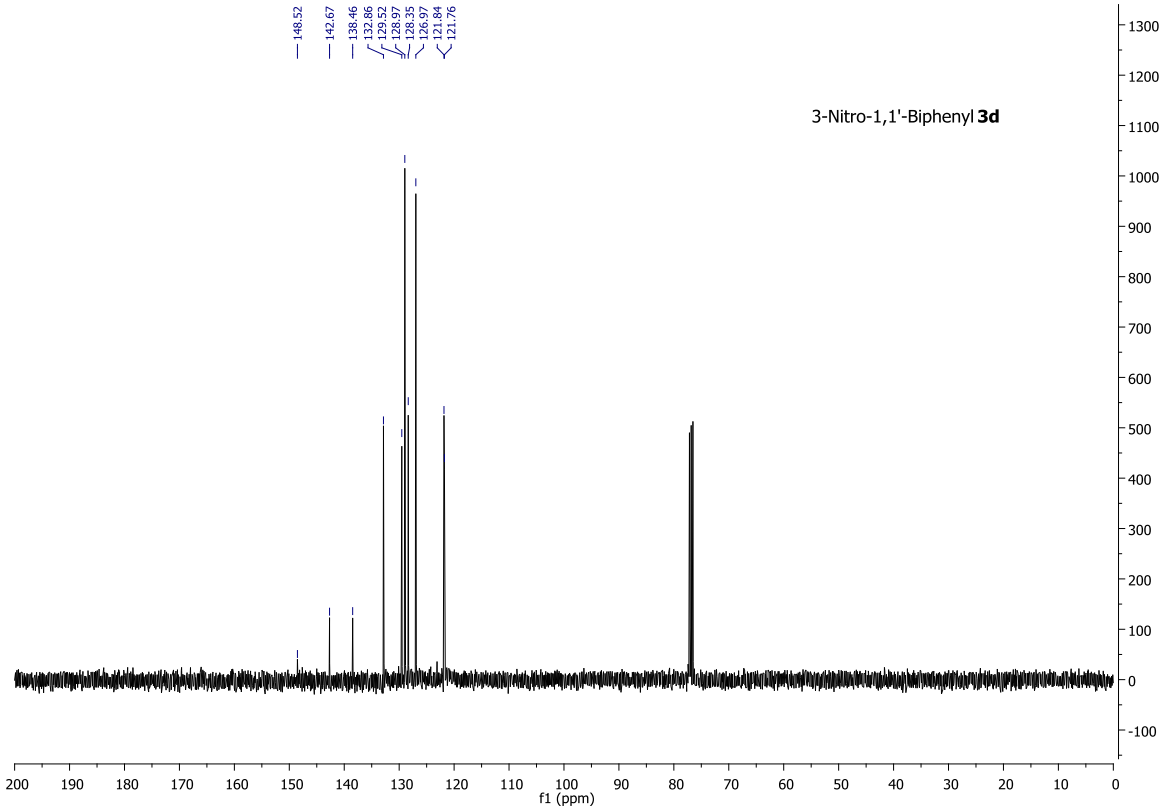
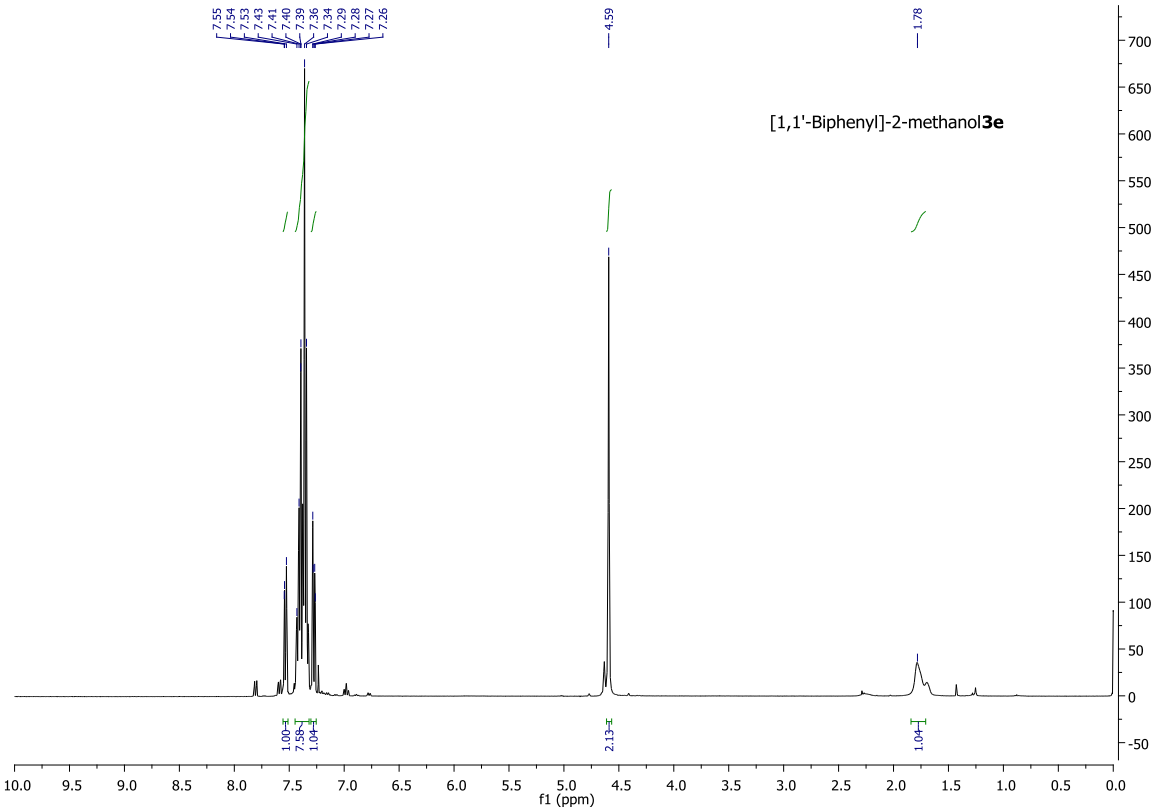
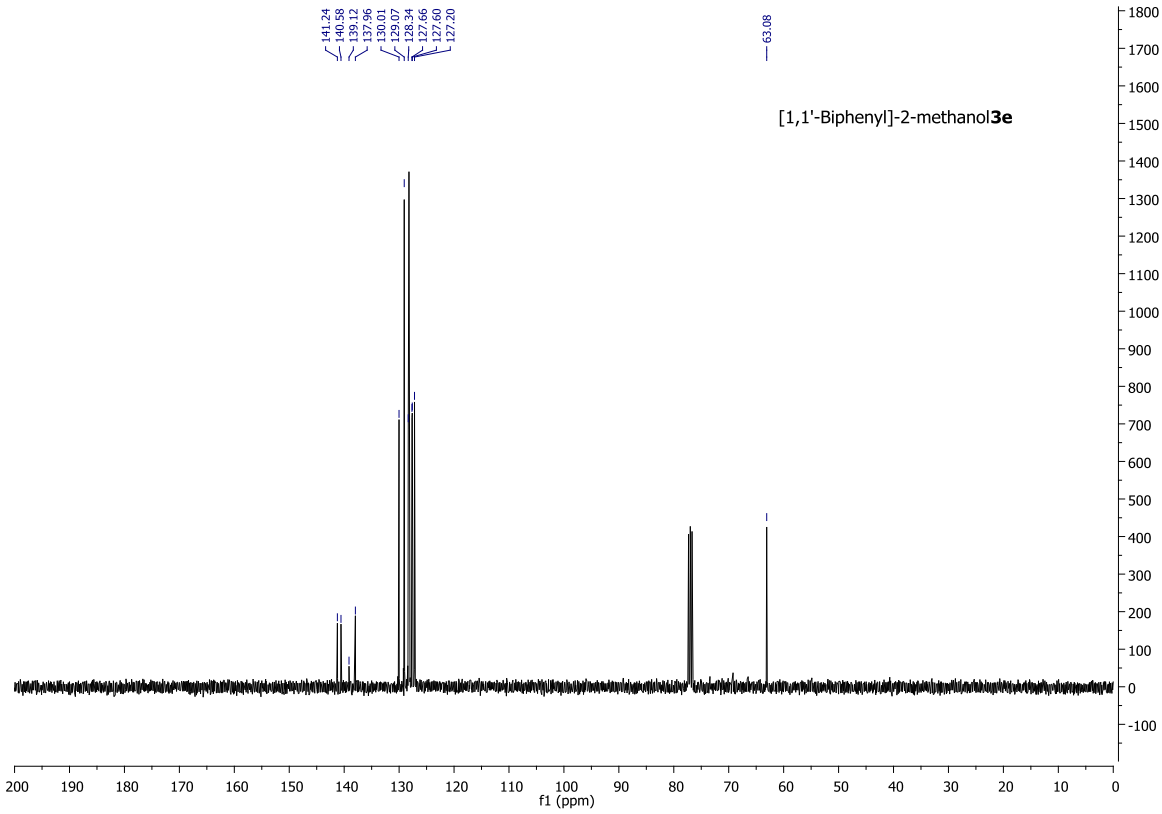
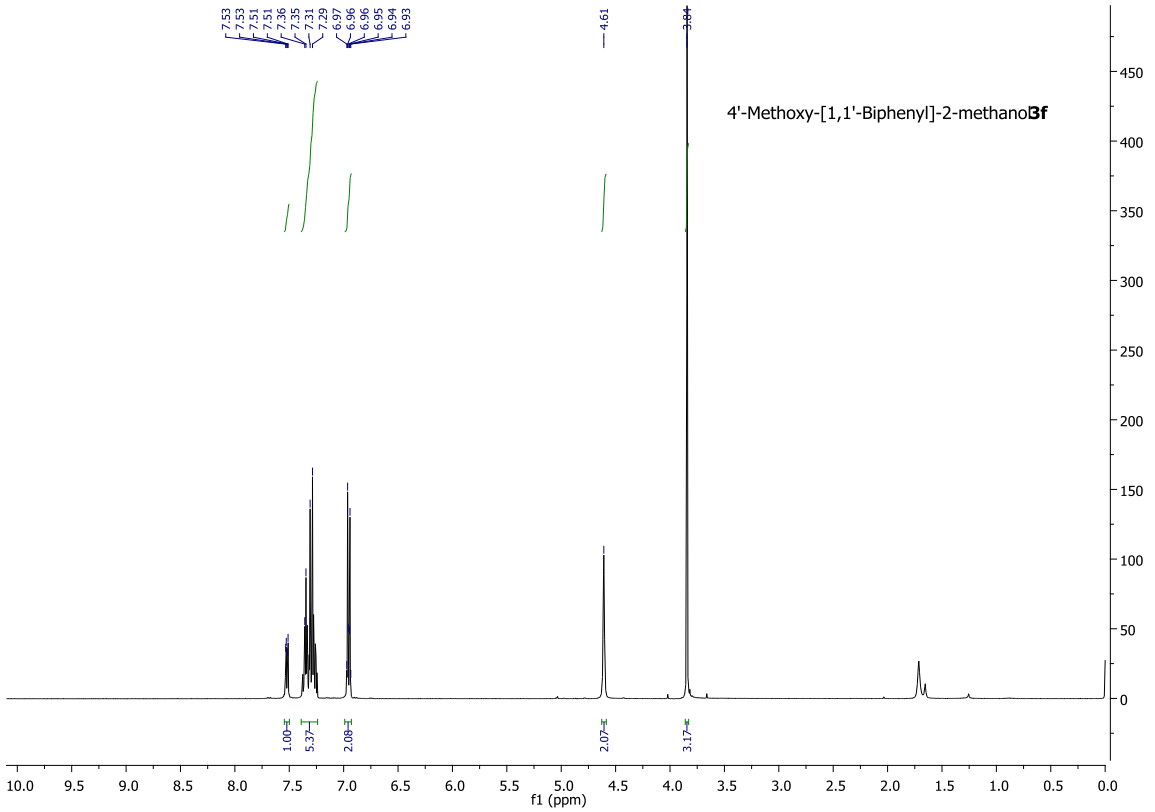
128.15
127.61
127.39
127.25
125.73
125.69
125.66
125.62
4-(Trifluoromethyl)-1,1'-Biphenyl**3c**
f1 (ppm)

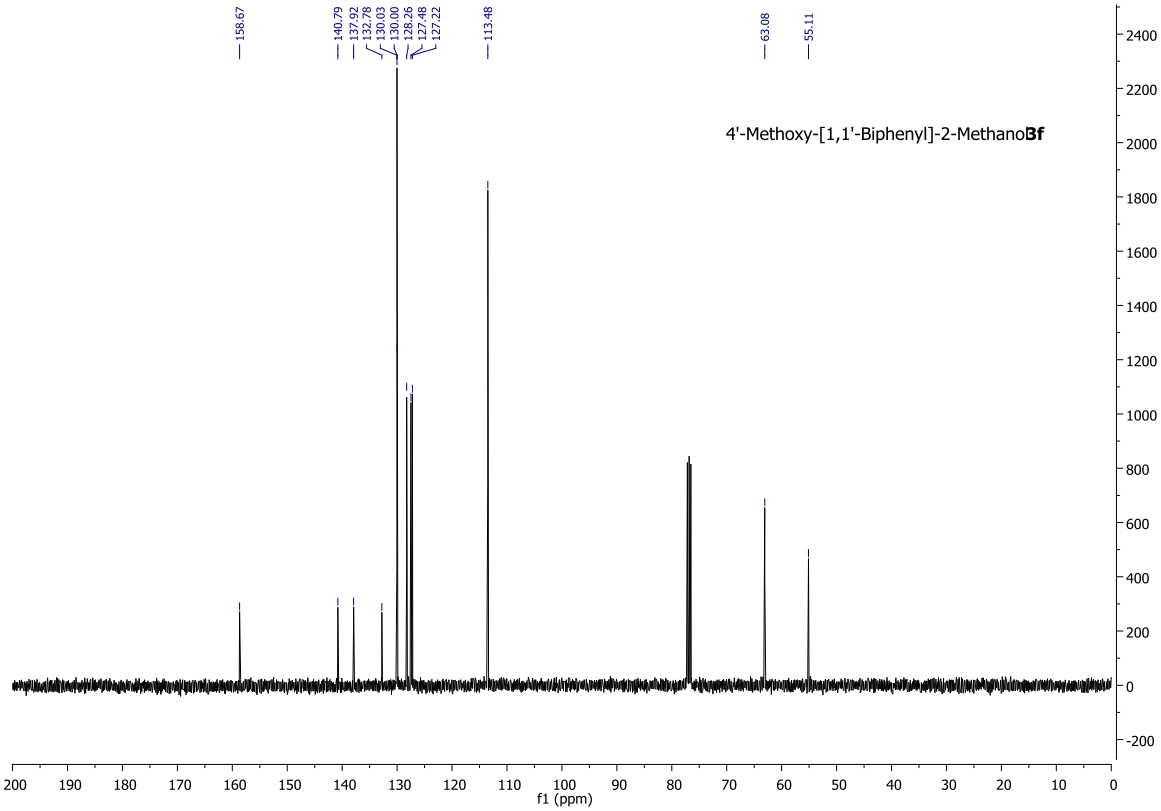

3-Nitro-1,1'-Biphenyl **3d**
f1 (ppm)

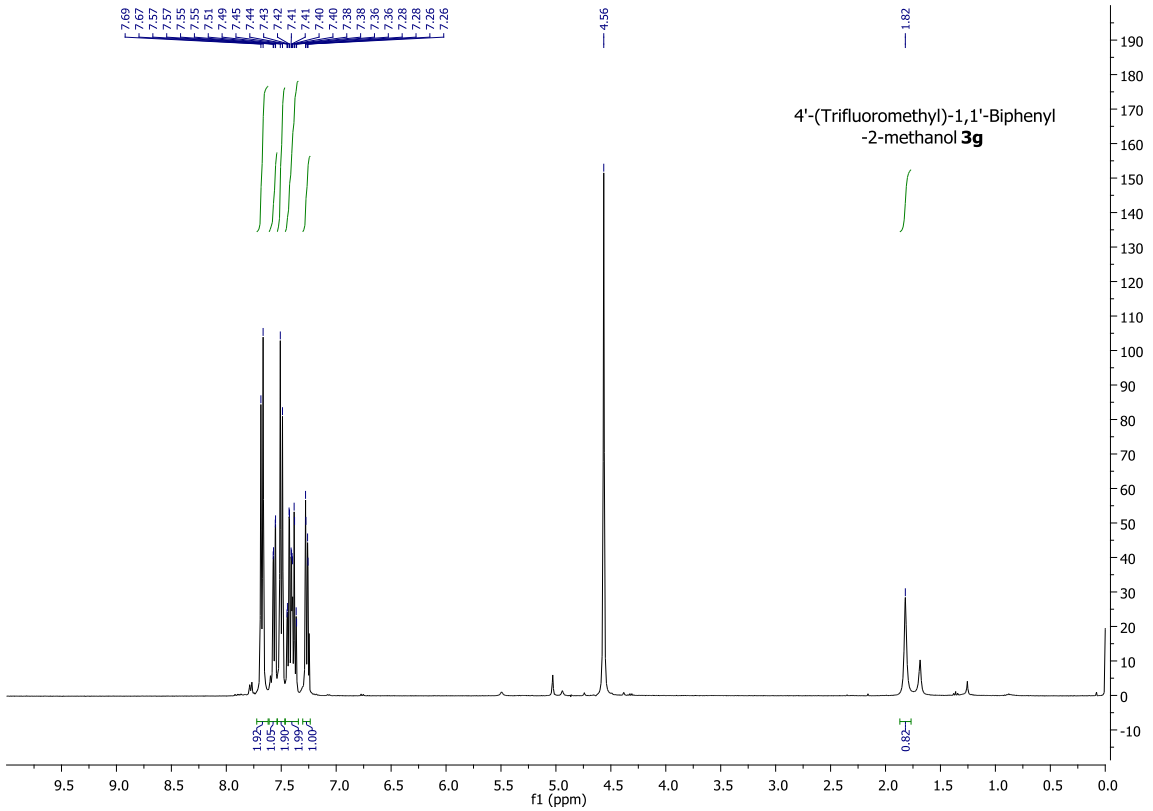

3-Nitro-1,1'-Biphenyl **3d**
f1 (ppm)

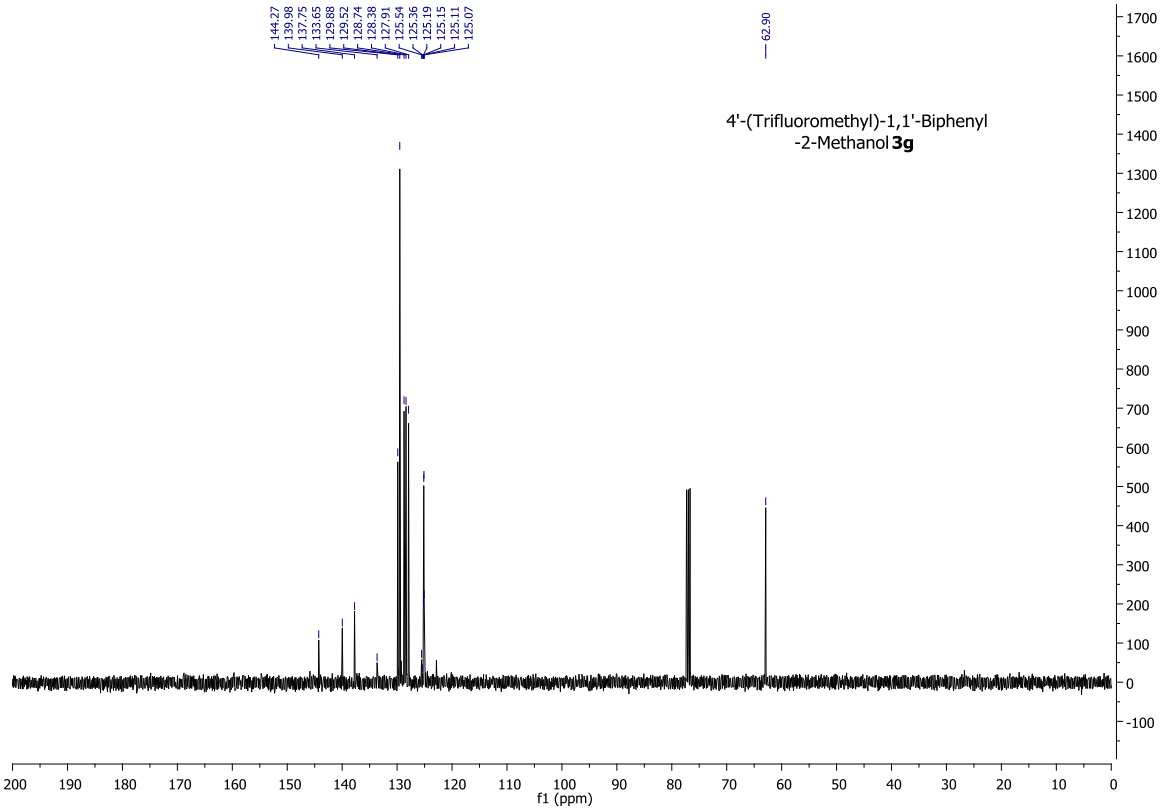

7.55
7.54
7.53
7.43
7.41
7.40
7.39
7.36
7.34
7.29
7.28
7.27
7.26
4.59
1.78
[1,1'-Biphenyl]-2-methanol**3e**
1.00
7.58
1.04
2.13
1.04
f1 (ppm)

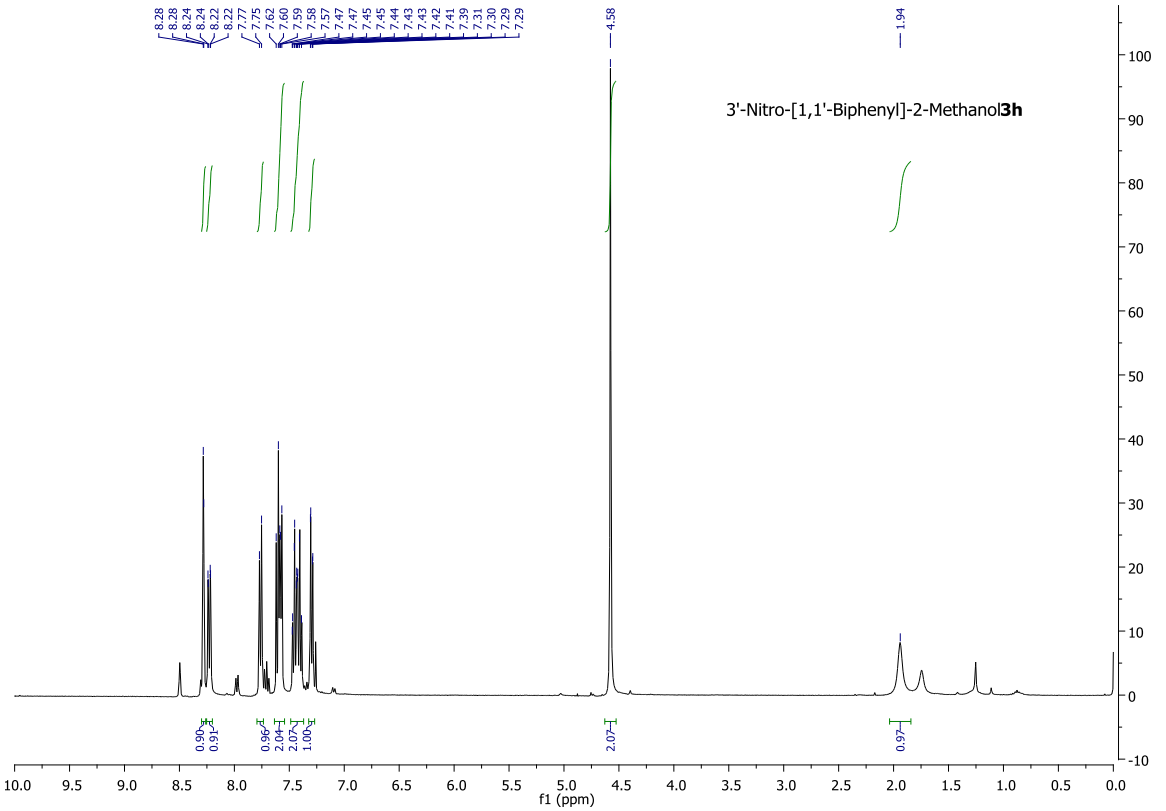

141.24
140.58
139.12
137.96
130.01
129.07
128.34
127.66
127.60
127.20
63.08
[1,1'-Biphenyl]-2-methanol**3e**
f1 (ppm)

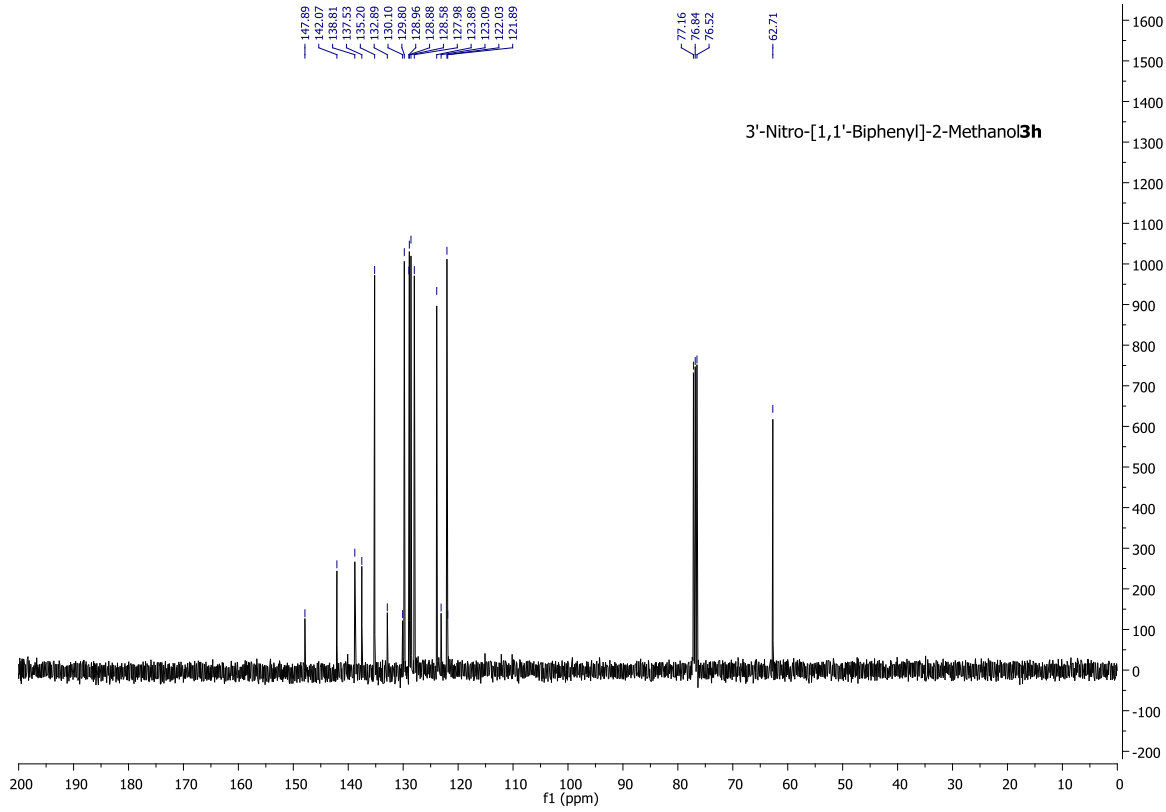

7.53
7.53
7.51
7.51
7.36
7.35
7.31
7.29
6.97
6.96
6.96
6.95
6.94
6.93
4.61
3.84
4'-Methoxy-[1,1'-Biphenyl]-2-methanol
1.00
5.37
2.08
2.07
3.17
f1 (ppm)

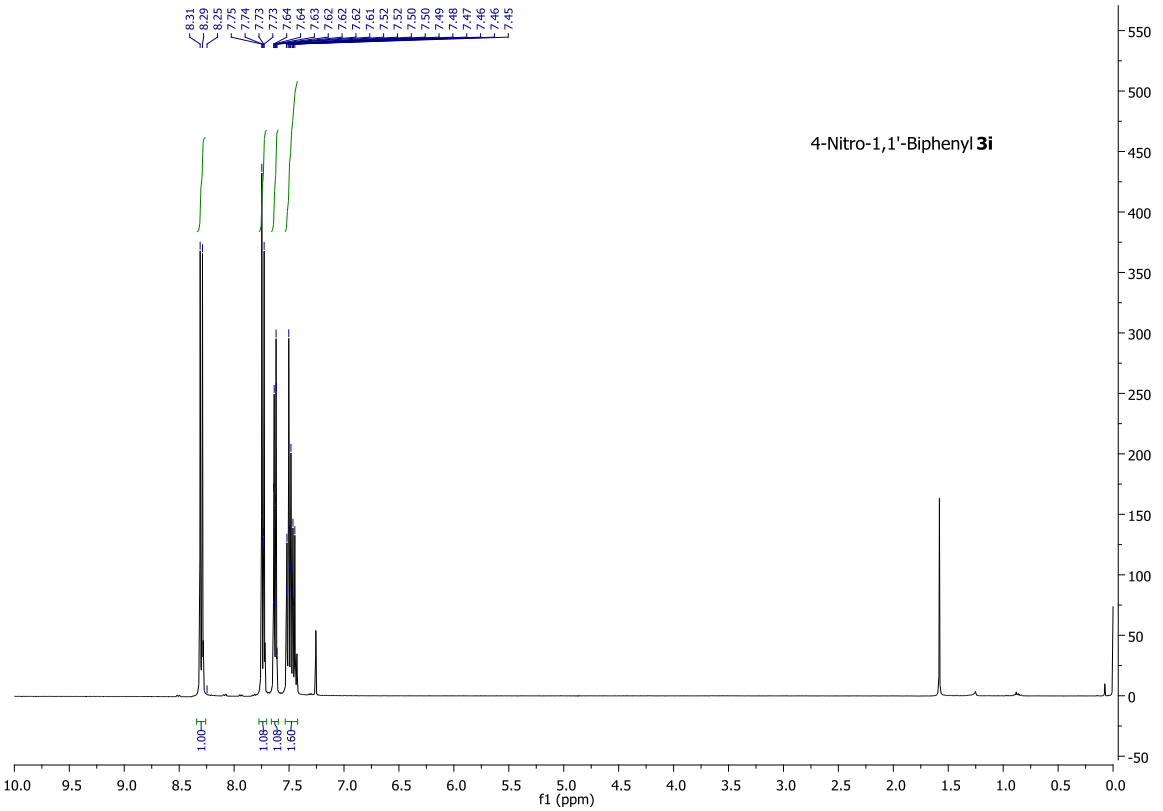

158.67
140.79
137.92
132.78
130.03
130.00
128.26
127.48
127.22
113.48
63.08
55.11
4'-Methoxy-[1,1'-Biphenyl]-2-Methanol
f1 (ppm)

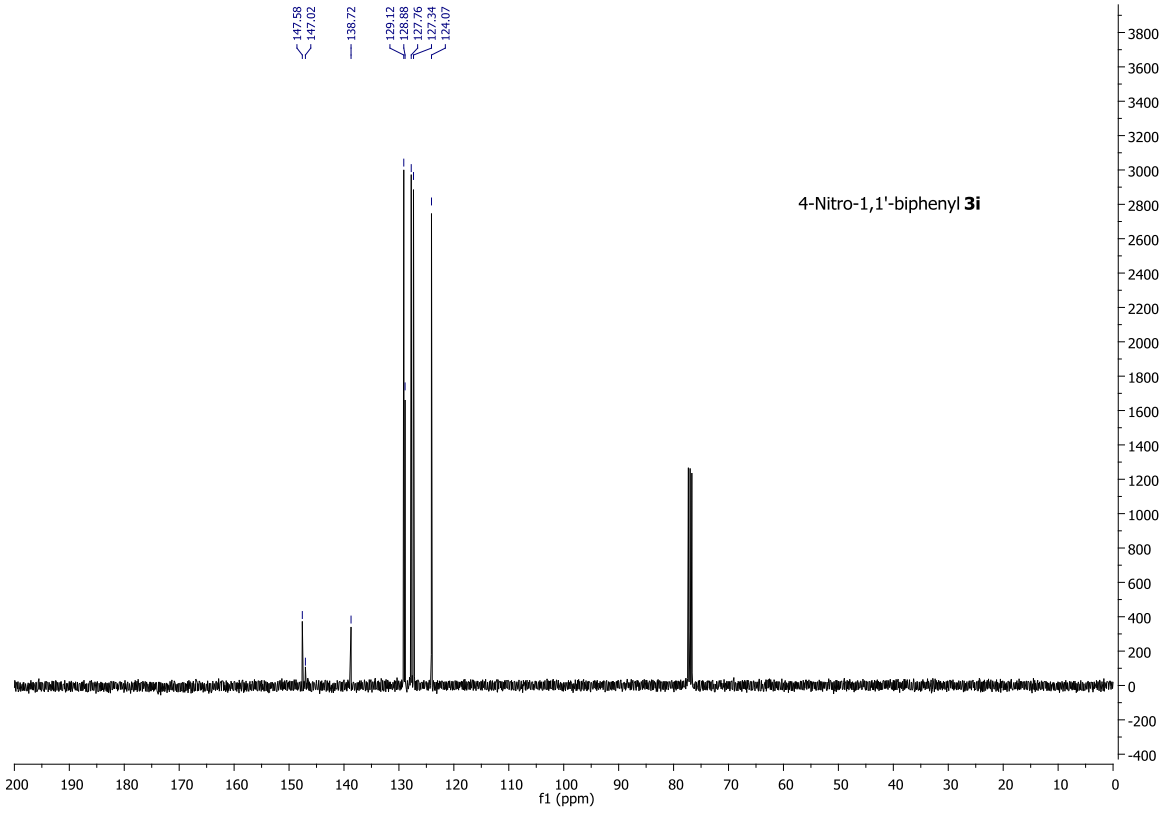

4'-(Trifluoromethyl)-1,1'-Biphenyl
-2-methanol **3g**
f1 (ppm)

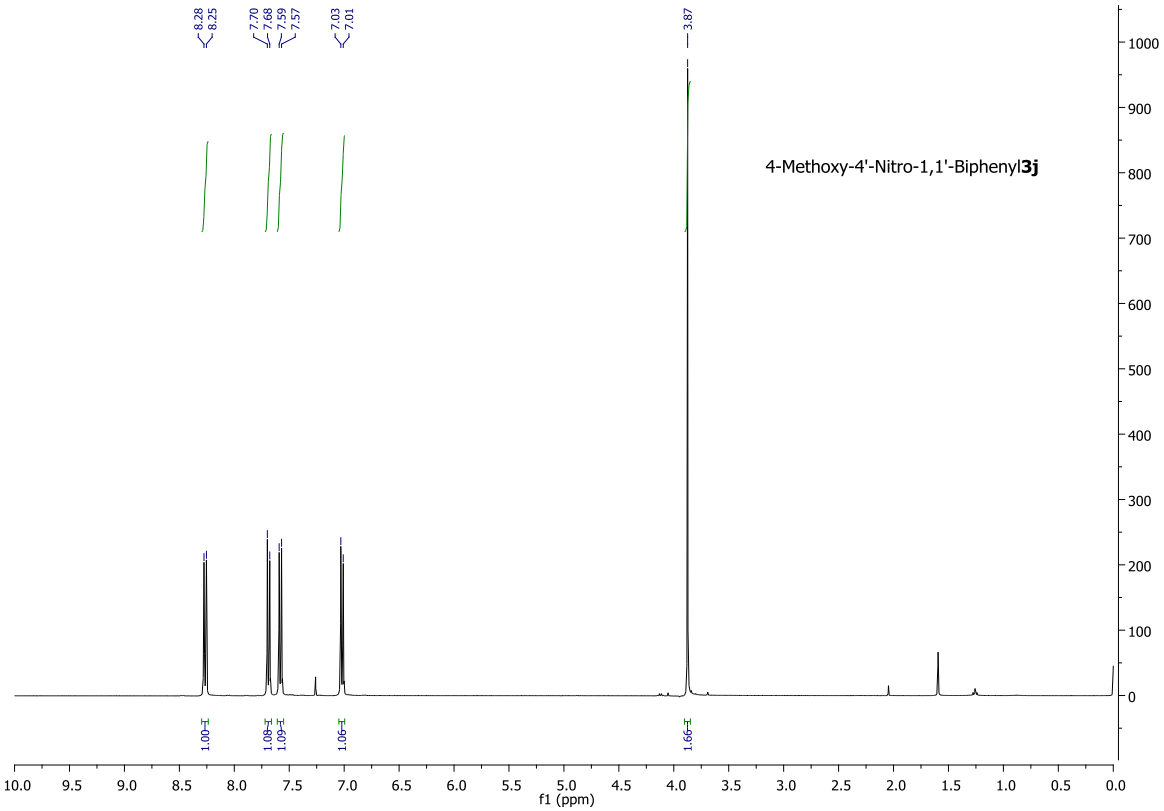

4'-(Trifluoromethyl)-1,1'-Biphenyl
-2-Methanol **3g**
f1 (ppm)

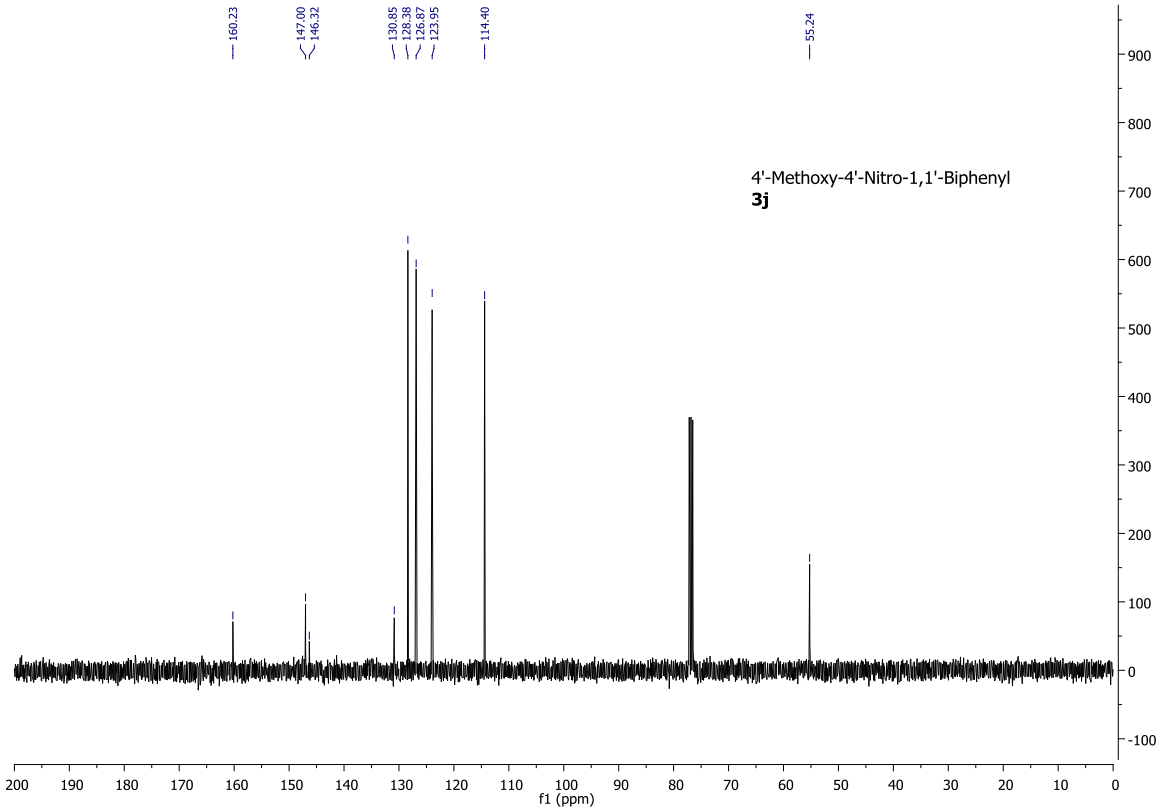

8.28
8.28
8.24
8.24
8.22
8.22
7.77
7.75
7.62
7.60
7.59
7.58
7.57
7.47
7.47
7.45
7.45
7.44
7.43
7.43
7.42
7.41
7.39
7.31
7.30
7.29
7.29
4.58
1.94
3'-Nitro-[1,1'-Biphenyl]-2-Methanol3h
0.90
0.91
0.96
2.04
2.07
1.00
2.07
0.97
f1 (ppm)

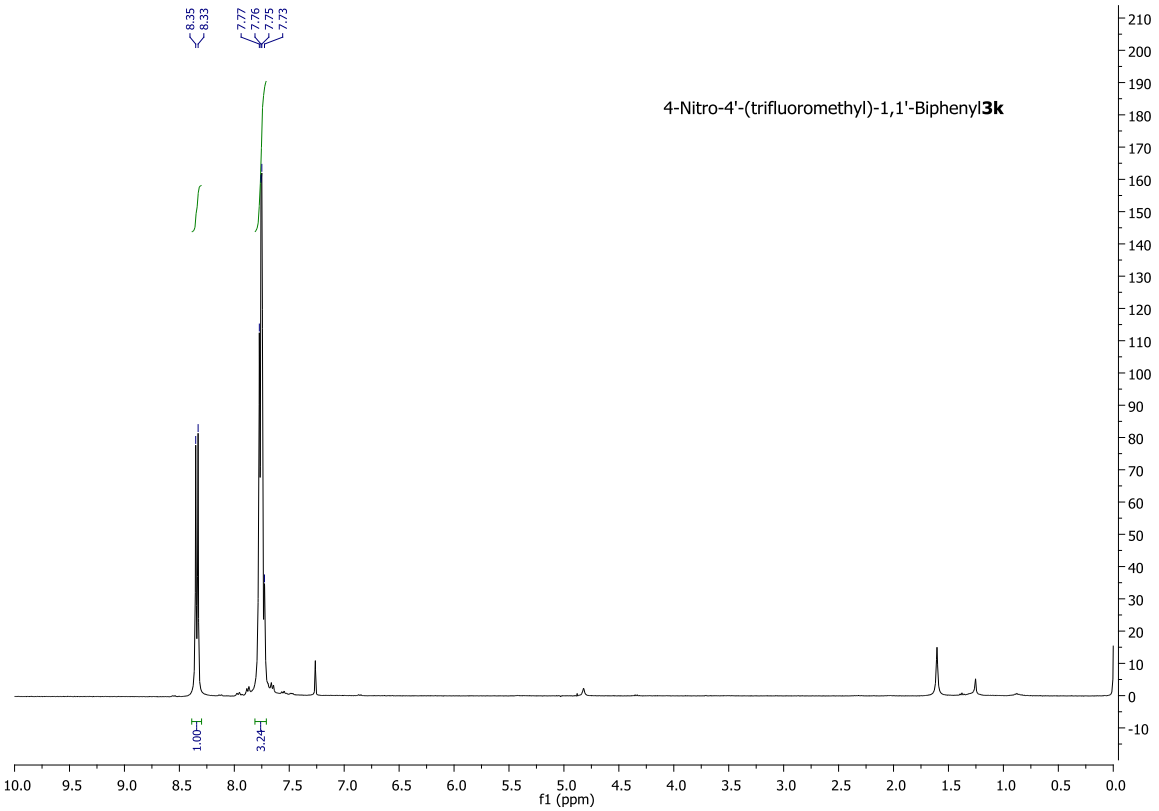

147.89
142.07
138.81
137.53
135.20
132.89
130.10
129.80
128.96
128.88
128.58
127.98
123.89
123.09
122.03
121.89
77.16
76.84
76.52
62.71
3'-Nitro-[1,1'-Biphenyl]-2-Methanol3h
f1 (ppm)

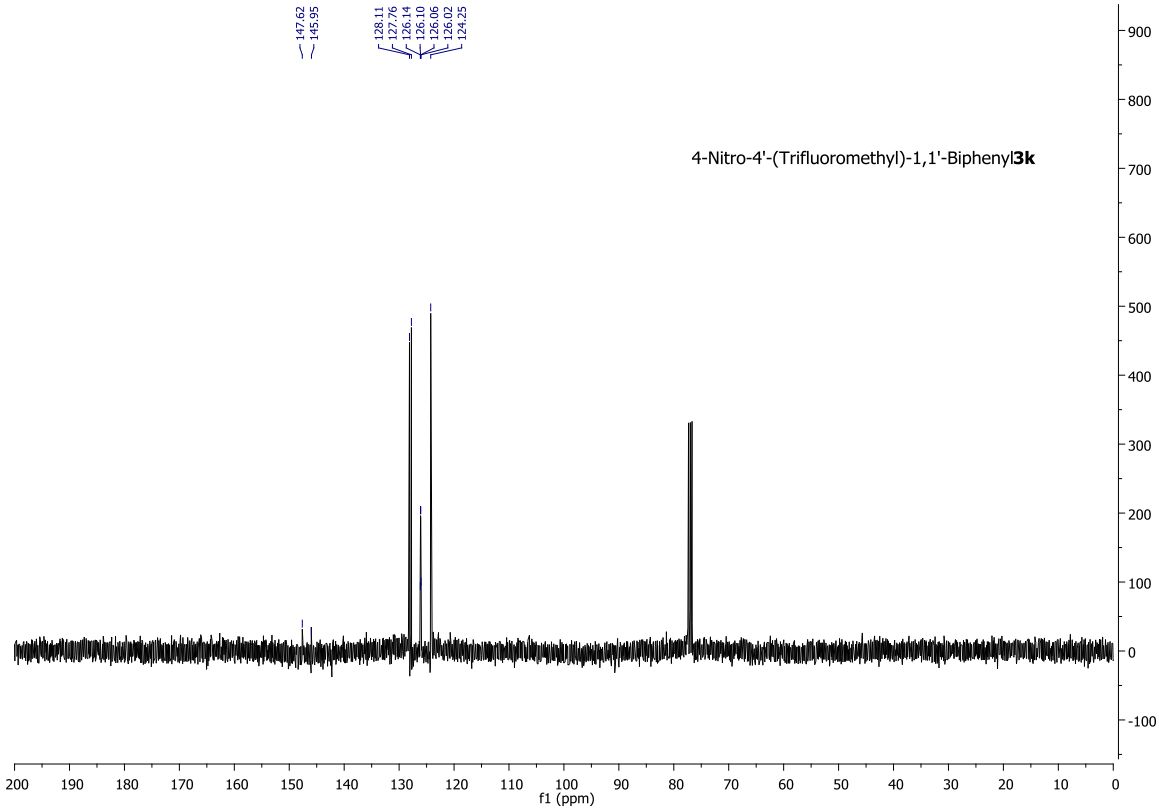

8.31
8.29
8.25
7.75
7.74
7.73
7.73
7.64
7.64
7.63
7.62
7.62
7.62
7.61
7.52
7.52
7.50
7.50
7.49
7.48
7.47
7.46
7.46
7.45
4-Nitro-1,1'-Biphenyl **3i**
1.00
1.09
1.08
1.60
f1 (ppm)

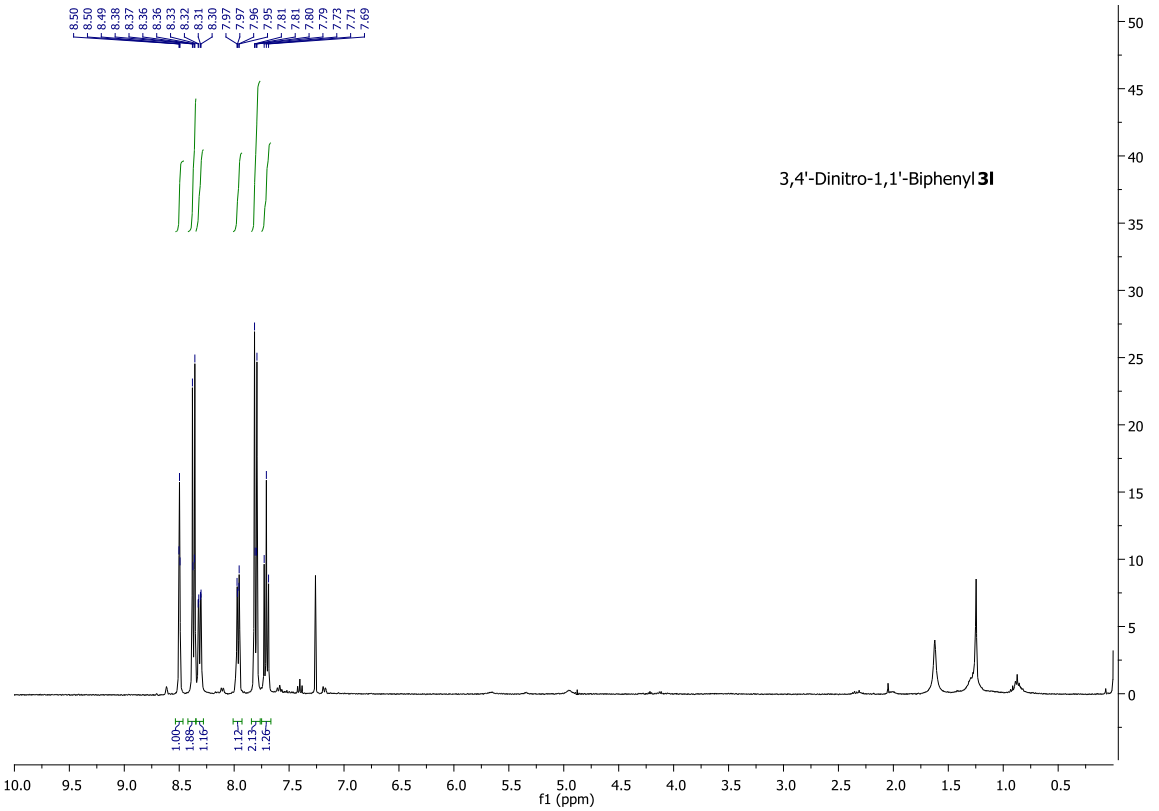

147.58
147.02
138.72
129.12
128.88
127.76
127.34
124.07
4-Nitro-1,1'-biphenyl **3i**
f1 (ppm)

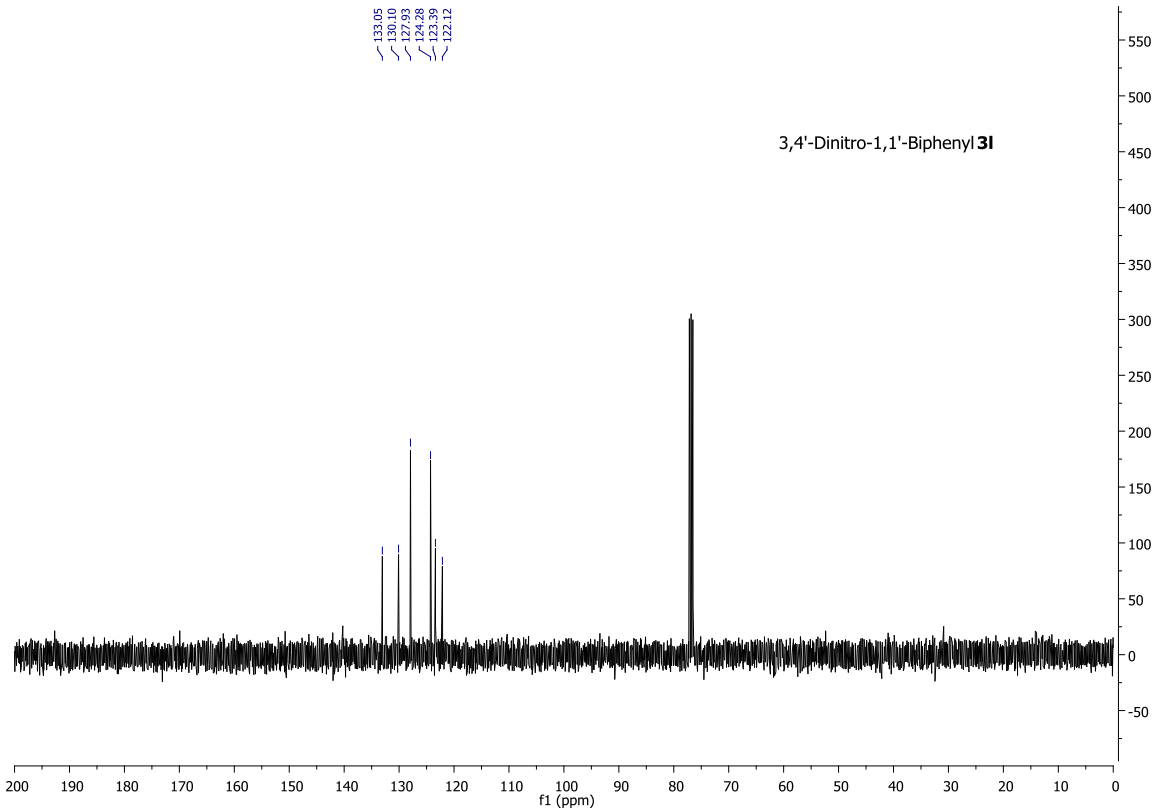

8.28
8.25
7.70
7.68
7.59
7.57
7.03
7.01
3.87
4-Methoxy-4'-Nitro-1,1'-Biphenyl**3j**
1.00
1.08
1.09
1.06
1.66
f1 (ppm)

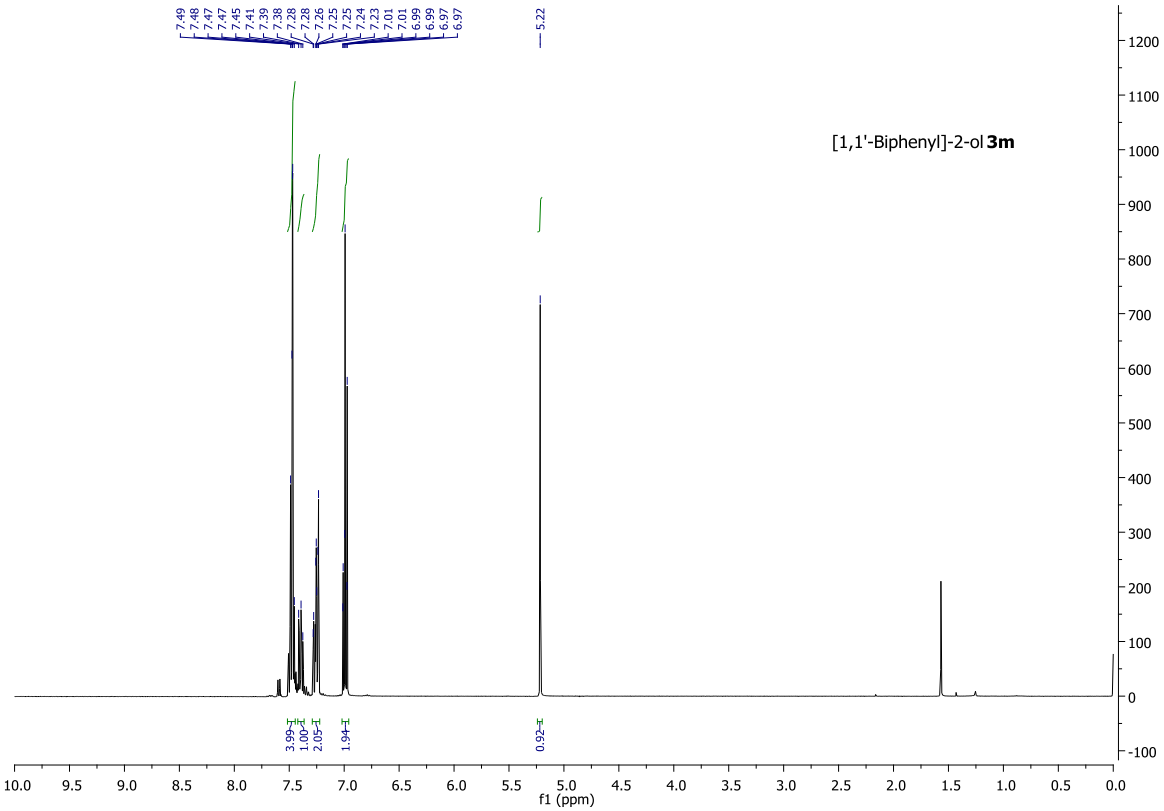

160.23
147.00
146.32
130.85
128.38
126.87
123.95
114.40
55.24
4'-Methoxy-4'-Nitro-1,1'-Biphenyl
3j
f1 (ppm)

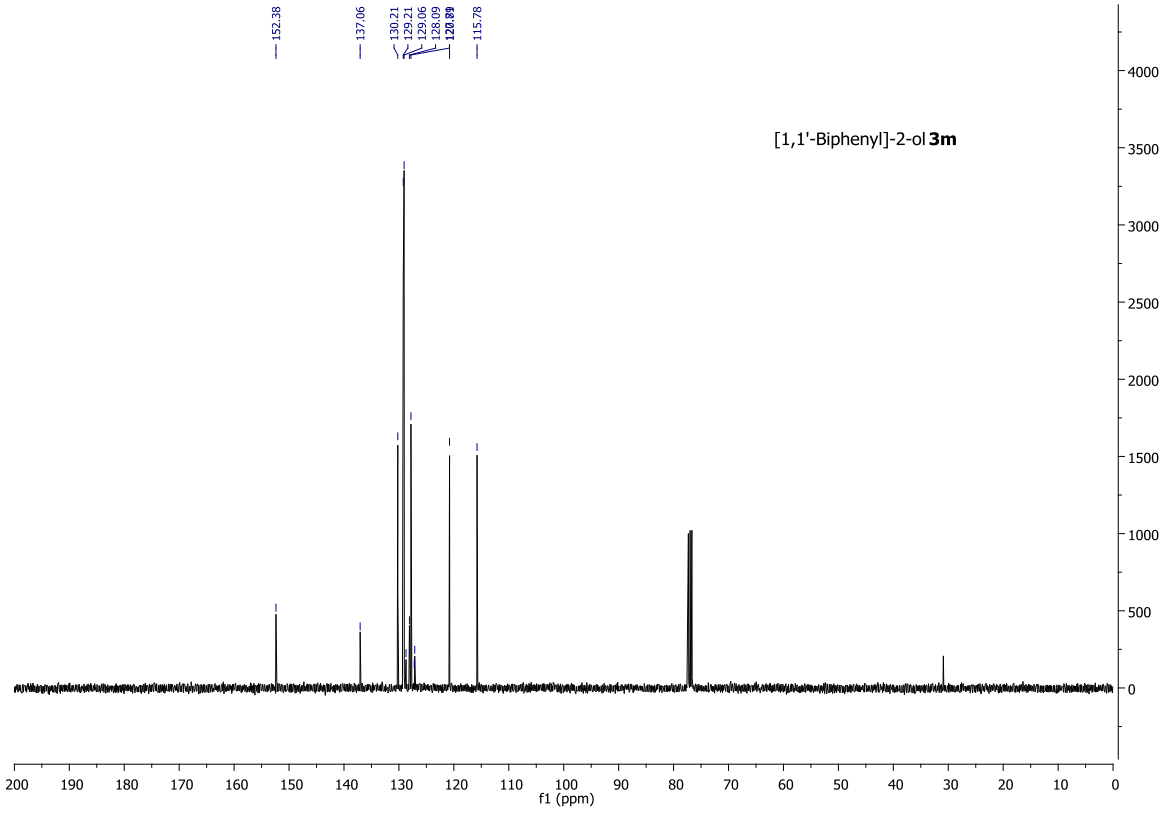

8.35
8.33
7.77
7.76
7.75
7.73
4-Nitro-4'-(trifluoromethyl)-1,1'-Biphenyl**3k**
1.00
3.24
f1 (ppm)

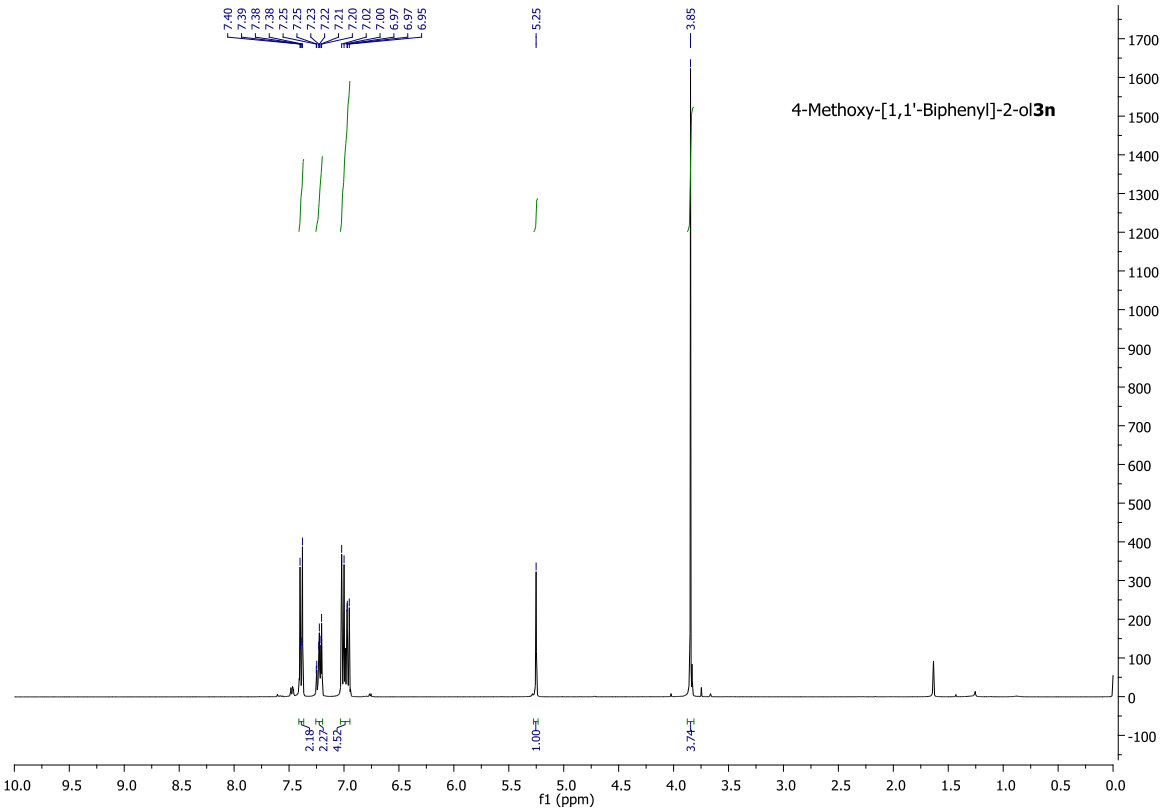

147.62
145.95
128.11
127.76
126.14
126.10
126.06
126.02
124.25
4-Nitro-4'-(Trifluoromethyl)-1,1'-Biphenyl**3k**
f1 (ppm)

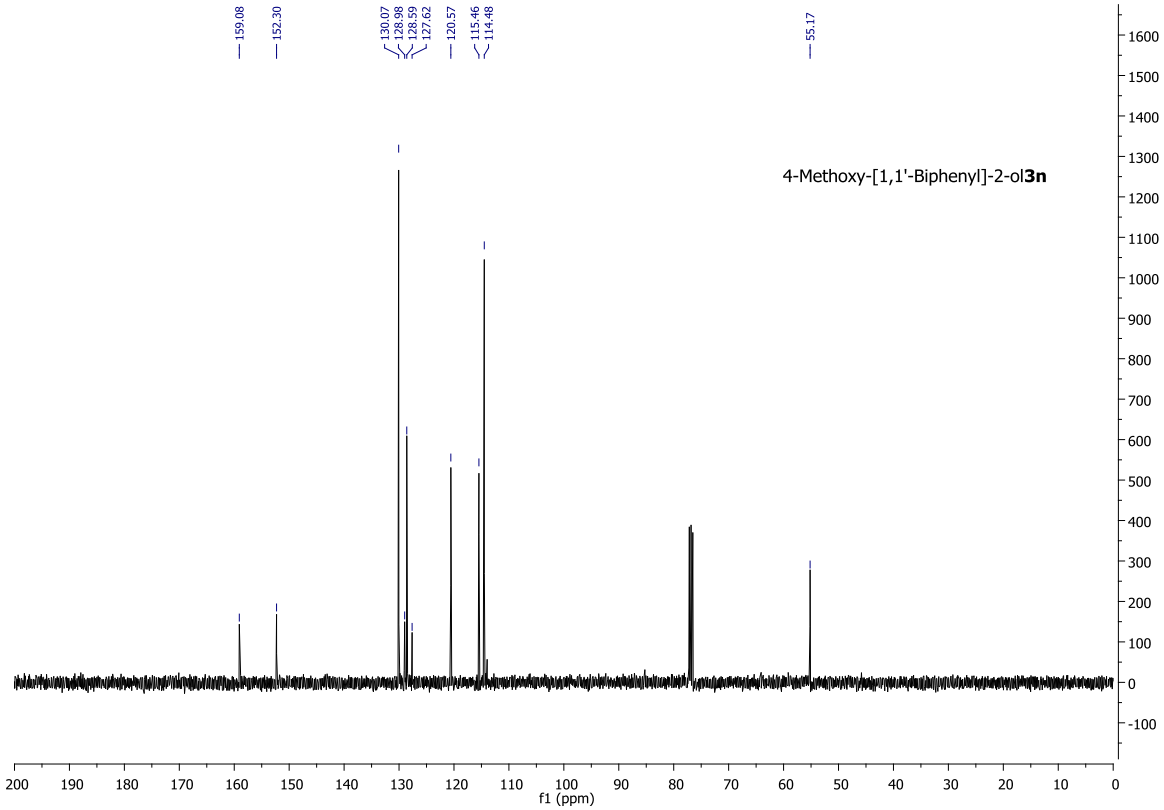

8.50
8.50
8.49
8.38
8.37
8.36
8.36
8.33
8.32
8.31
8.30
7.97
7.97
7.96
7.95
7.81
7.81
7.80
7.79
7.73
7.71
7.69
3,4'-Dinitro-1,1'-Biphenyl 3l
1.00
1.88
1.16
1.12
2.13
1.26
f1 (ppm)

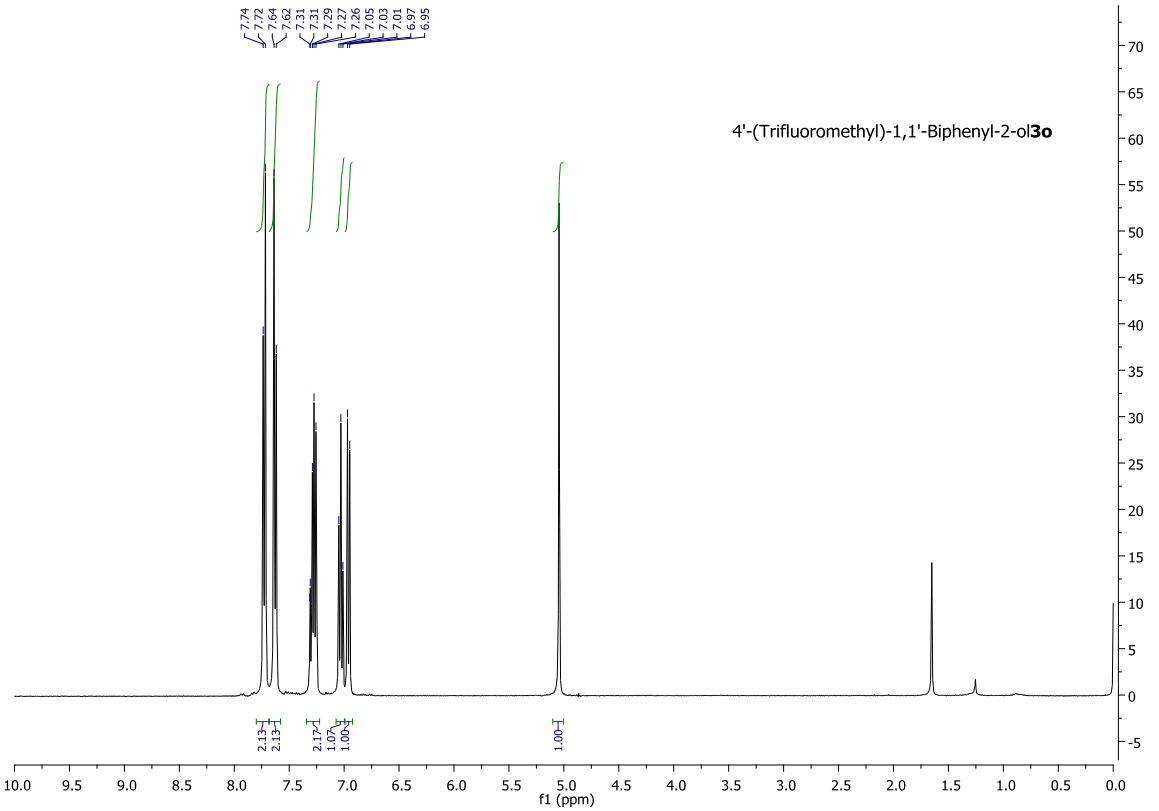

133.05
130.10
127.93
124.28
123.39
122.12
3,4'-Dinitro-1,1'-Biphenyl 3l
f1 (ppm)

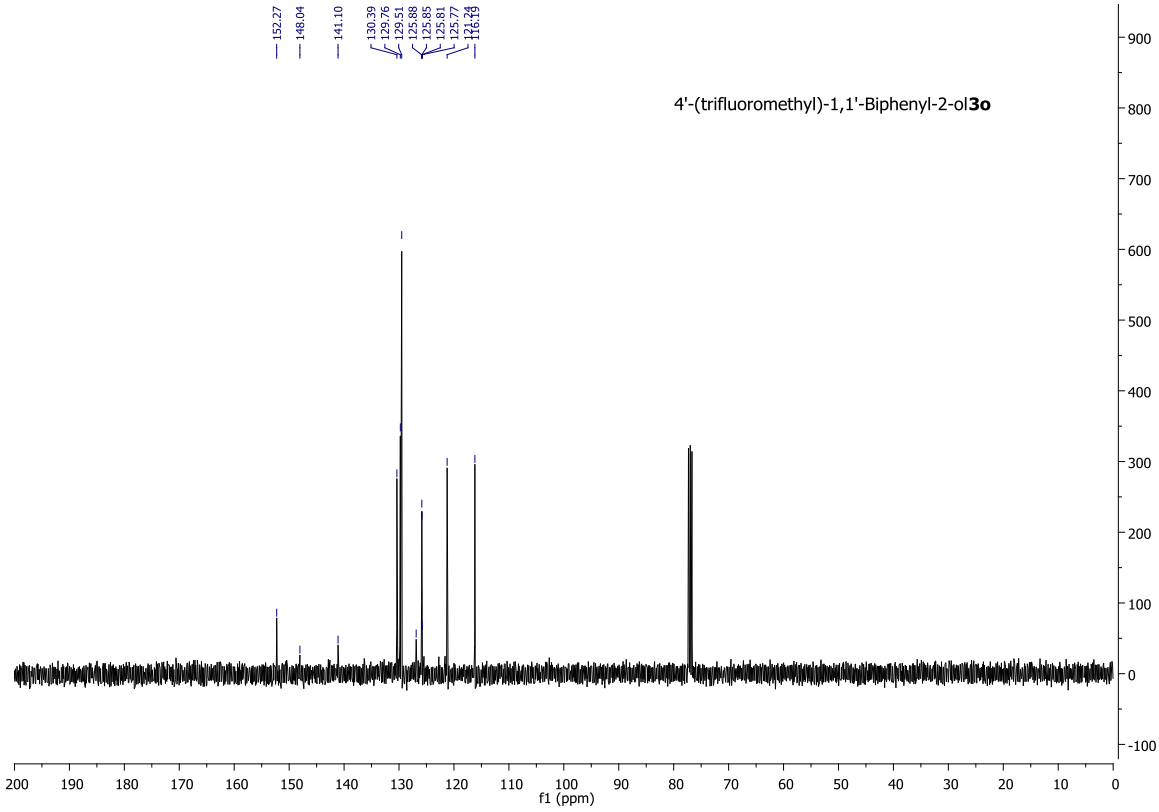

7.49
7.48
7.47
7.47
7.47
7.45
7.41
7.39
7.38
7.28
7.28
7.26
7.25
7.25
7.24
7.23
7.01
7.01
6.99
6.97
6.97
5.22
[1,1'-Biphenyl]-2-ol 3m
3.99
1.00
2.05
1.94
0.92
f1 (ppm)

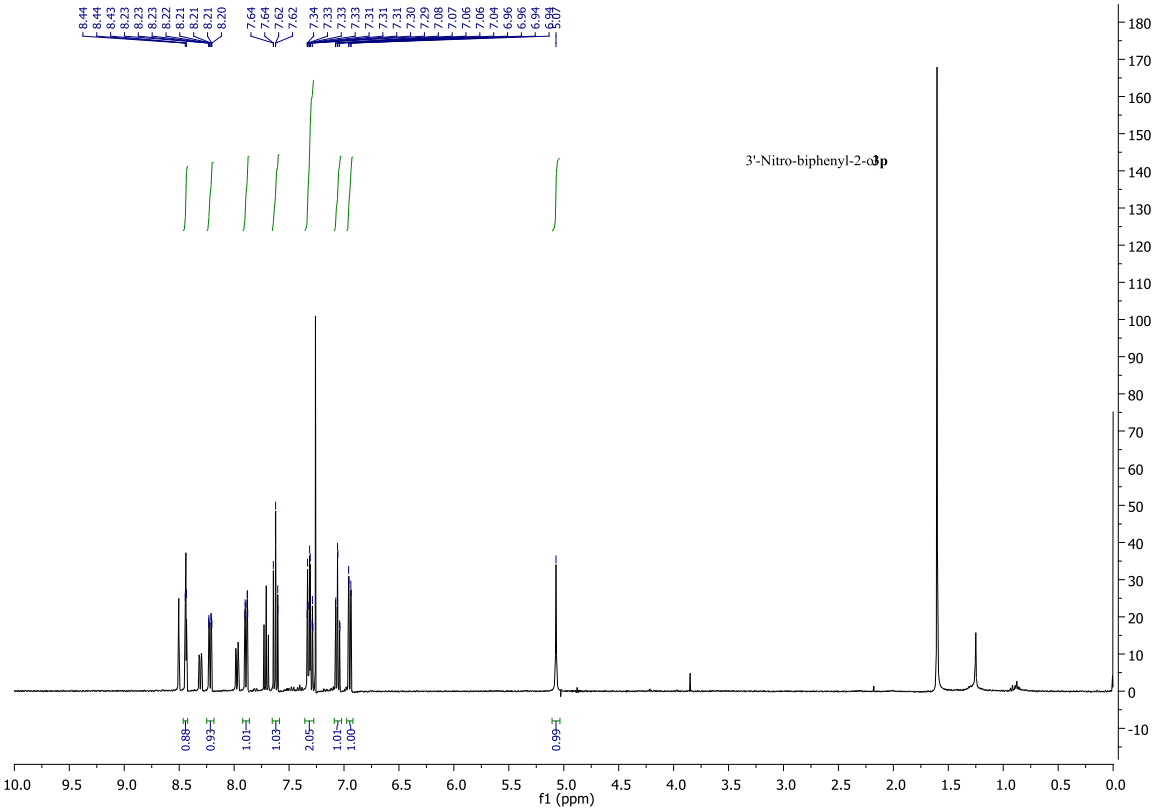

152.38
137.06
130.21
129.21
129.06
128.09
120.89
115.78
[1,1'-Biphenyl]-2-ol 3m
f1 (ppm)

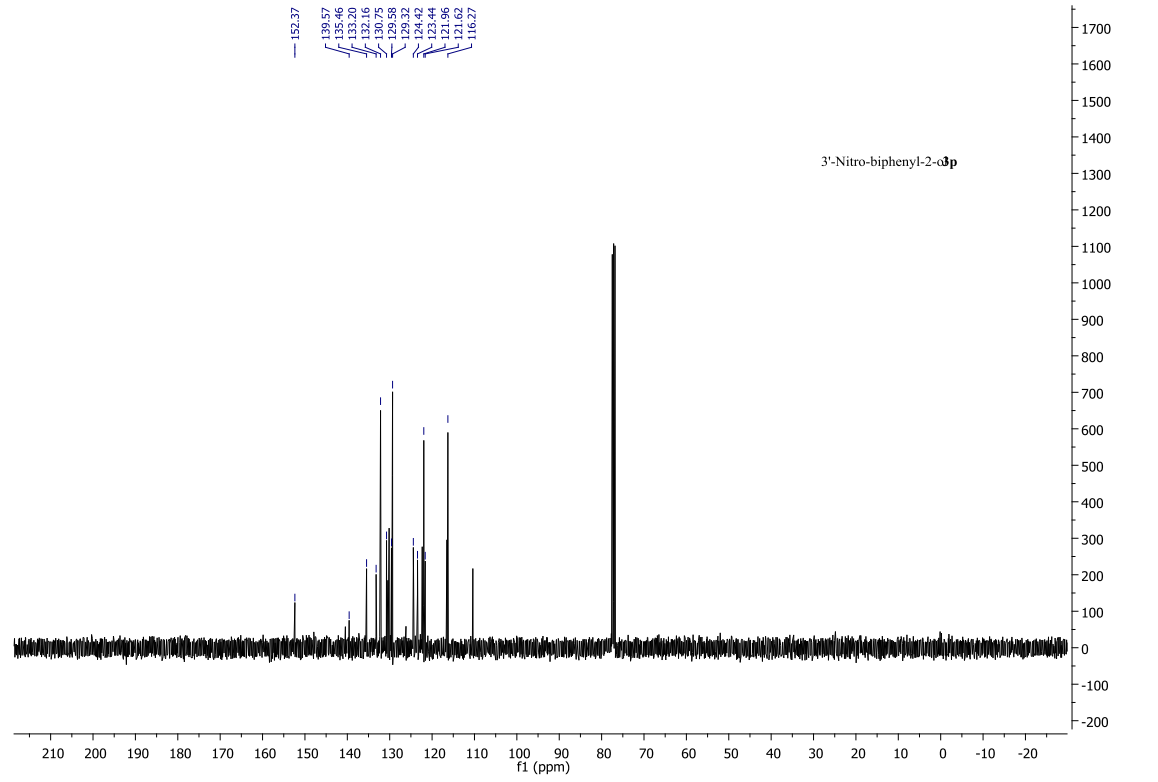

7.40
7.39
7.38
7.38
7.25
7.25
7.23
7.22
7.21
7.20
7.02
7.00
6.97
6.97
6.95
5.25
3.85
4-Methoxy-[1,1'-Biphenyl]-2-ol**3n**
2.19
2.27
4.52
1.00
3.74
f1 (ppm)

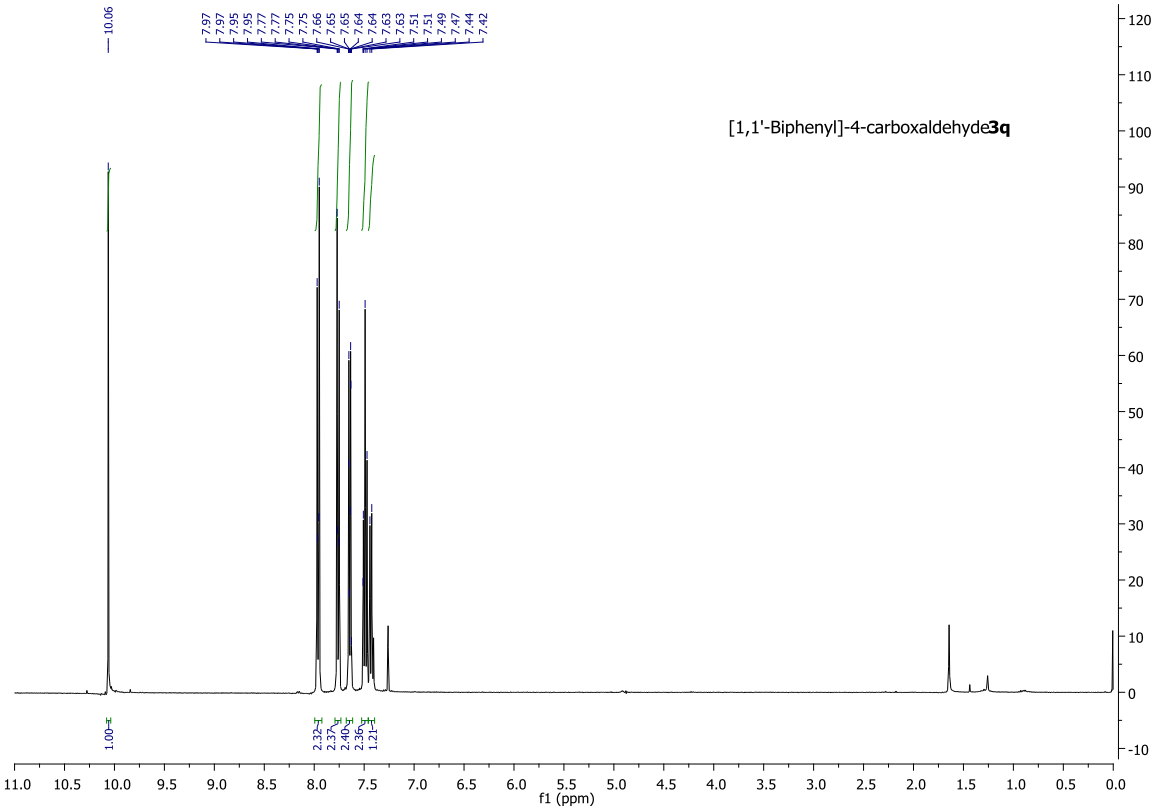

159.08
152.30
130.07
128.98
128.59
127.62
120.57
115.46
114.48
55.17
4-Methoxy-[1,1'-Biphenyl]-2-ol**3n**
f1 (ppm)

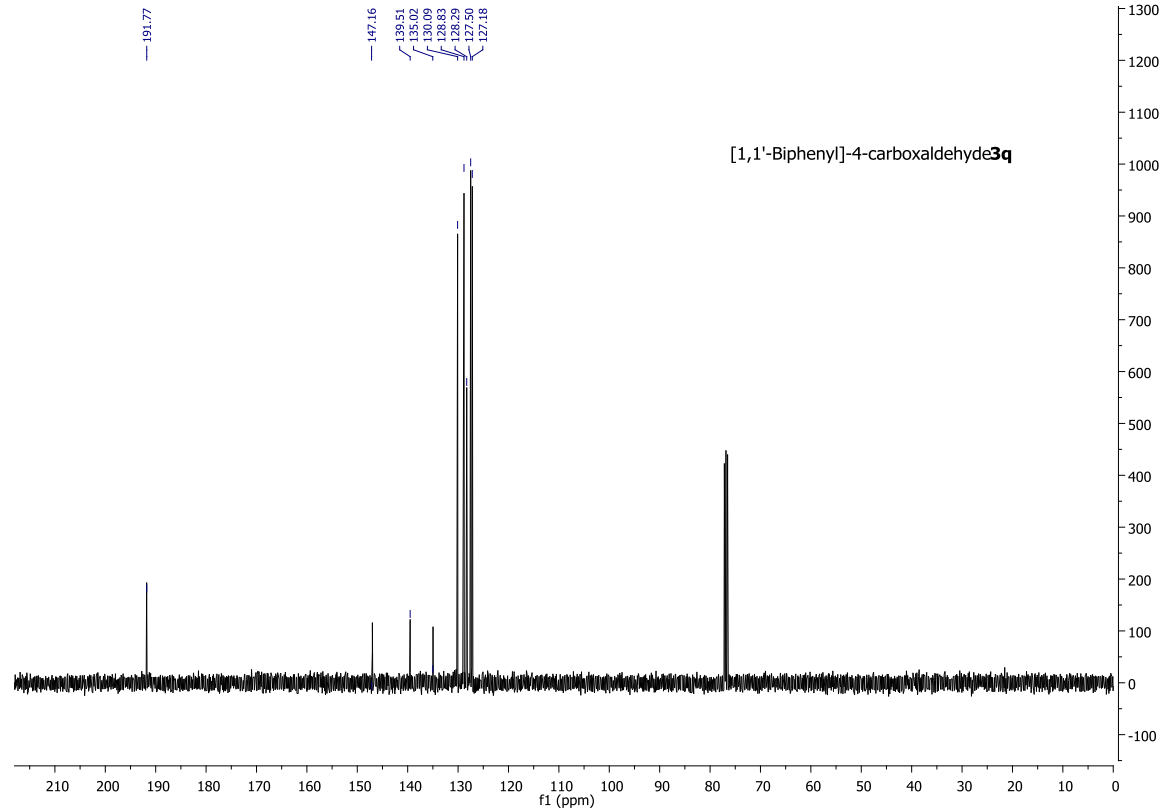

7.74
7.72
7.64
7.62
7.31
7.29
7.27
7.26
7.05
7.03
7.01
6.97
6.95
4'-(Trifluoromethyl)-1,1'-Biphenyl-2-ol**3o**
2.13
2.13
2.17
1.07
1.00
1.00
f1 (ppm)

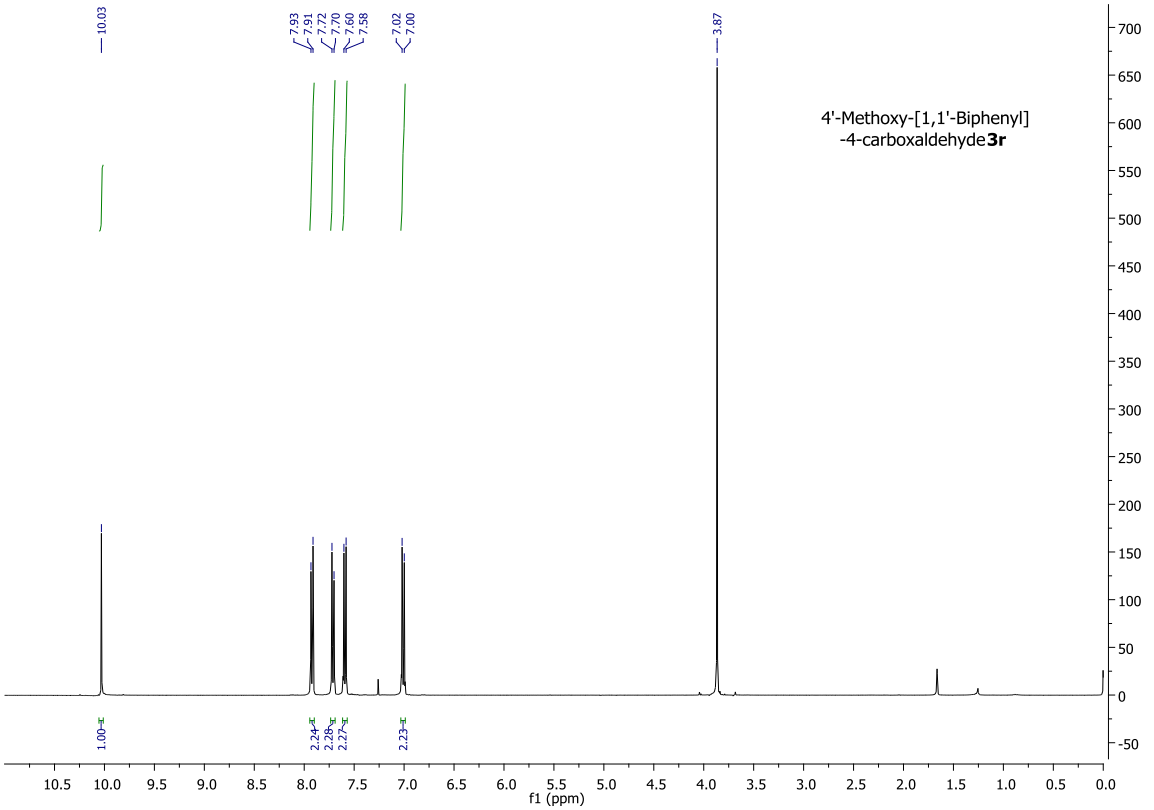

152.27
148.04
141.10
130.39
129.76
129.51
125.88
125.85
125.81
125.77
121.24
116.19
4'-(trifluoromethyl)-1,1'-Biphenyl-2-ol**3o**
f1 (ppm)

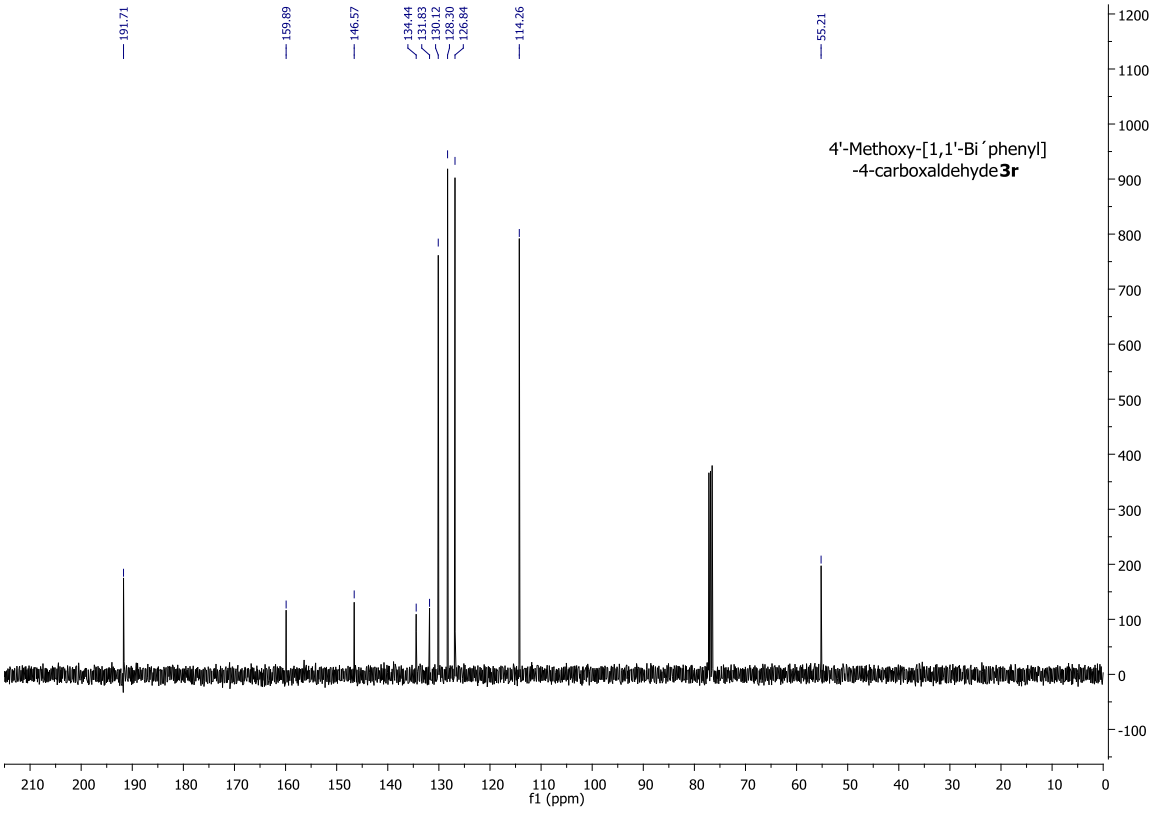

8.44
8.44
8.43
8.23
8.23
8.23
8.22
8.21
8.21
8.21
8.20
7.64
7.64
7.62
7.62
7.34
7.33
7.33
7.33
7.31
7.31
7.31
7.30
7.29
7.08
7.07
7.06
7.06
7.04
6.96
6.96
6.94
5.04
5.03
3'-Nitro-biphenyl-2-ol, 3p
0.88
0.93
1.01
1.03
2.05
1.01
1.00
0.99
f1 (ppm)

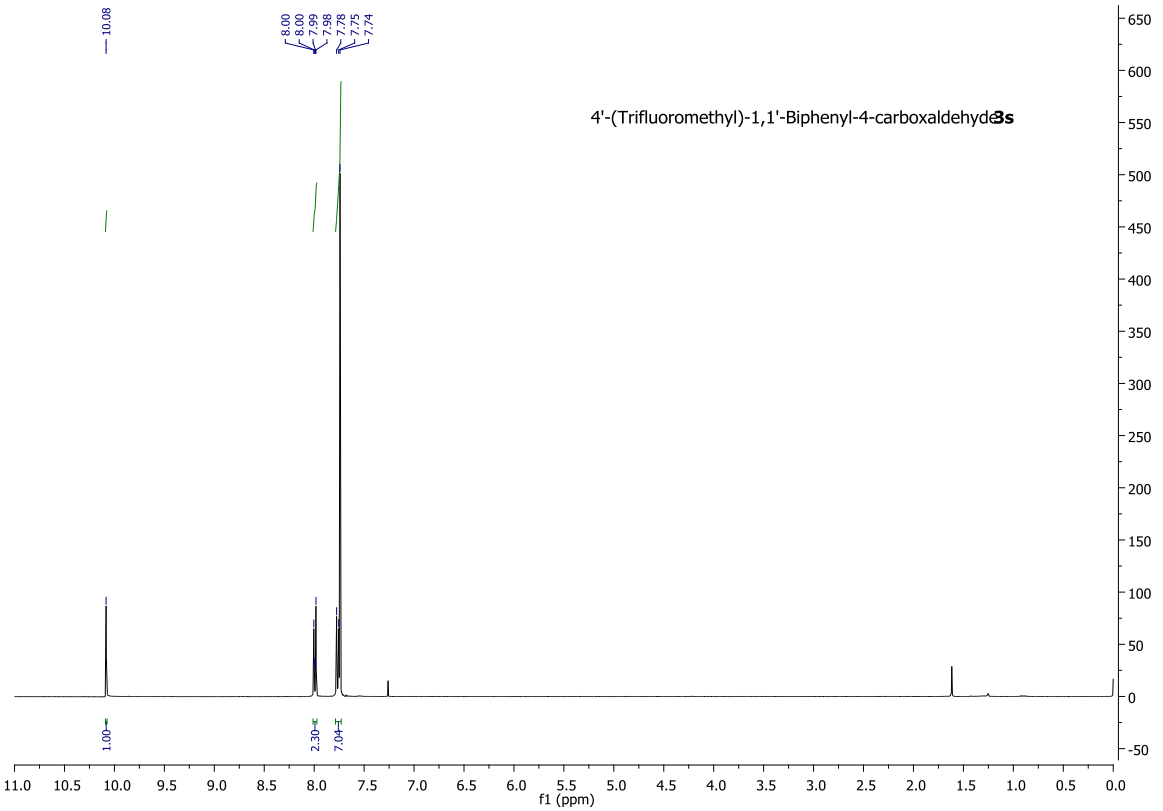

152.37
139.57
135.46
133.20
132.16
130.75
129.58
129.32
124.42
123.44
121.96
121.62
116.27
3'-Nitro-biphenyl-2-ol, 3p
f1 (ppm)

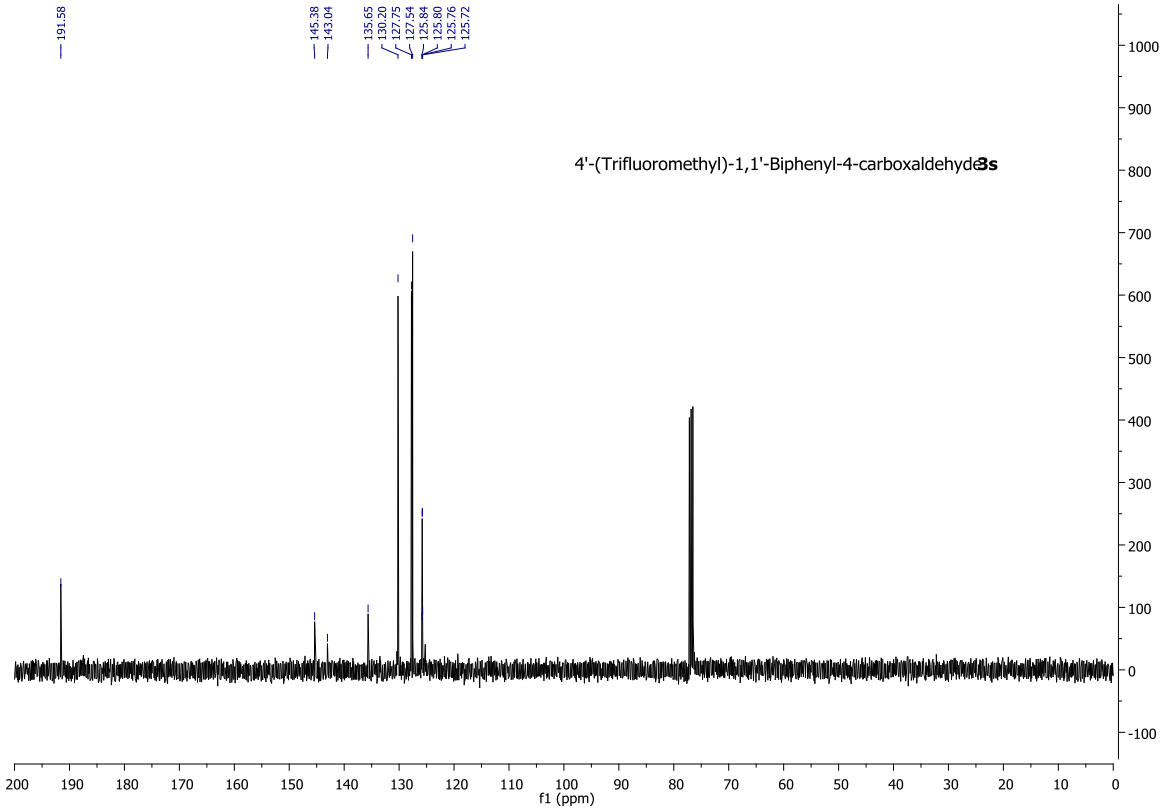

[1,1'-Biphenyl]-4-carboxaldehyde3q
10.06
7.97
7.97
7.95
7.95
7.77
7.77
7.75
7.75
7.66
7.65
7.65
7.64
7.64
7.63
7.63
7.51
7.51
7.49
7.47
7.44
7.42
1.00
2.32
2.37
2.40
2.36
1.21
f1 (ppm)

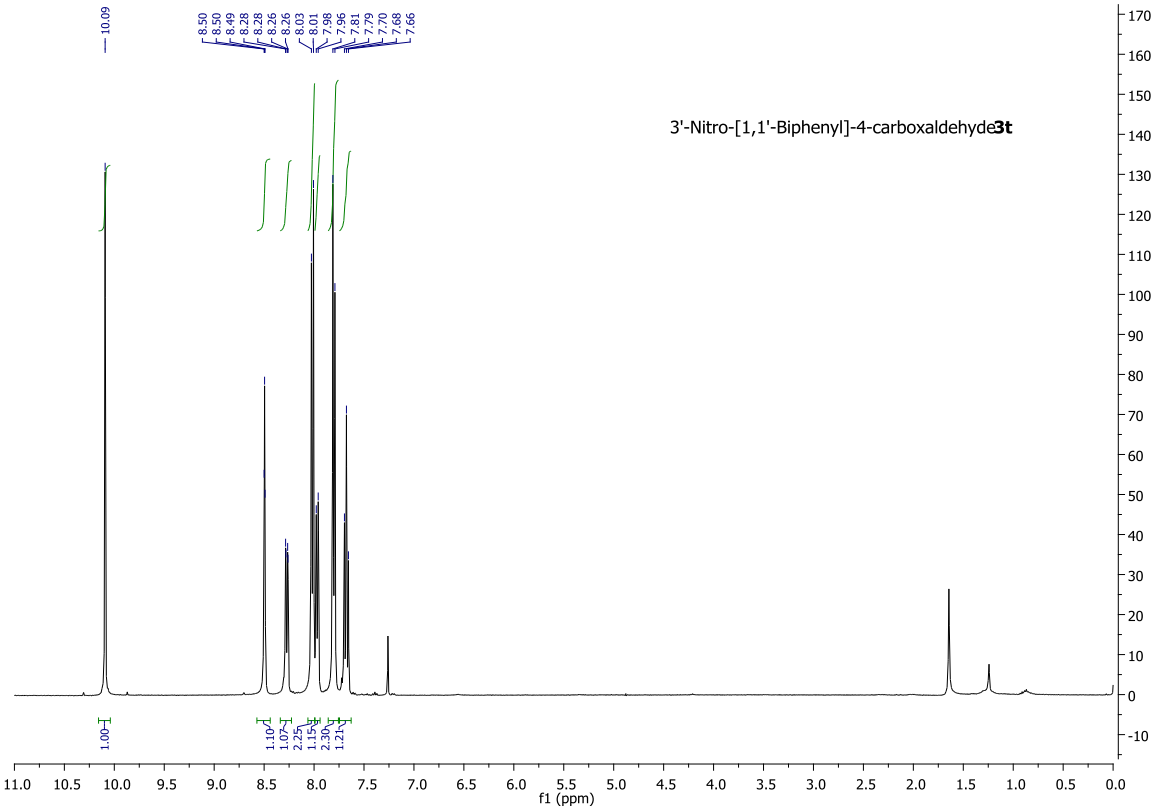

[1,1'-Biphenyl]-4-carboxaldehyde3q
191.77
147.16
139.51
135.02
130.09
128.83
128.29
127.50
127.18
f1 (ppm)

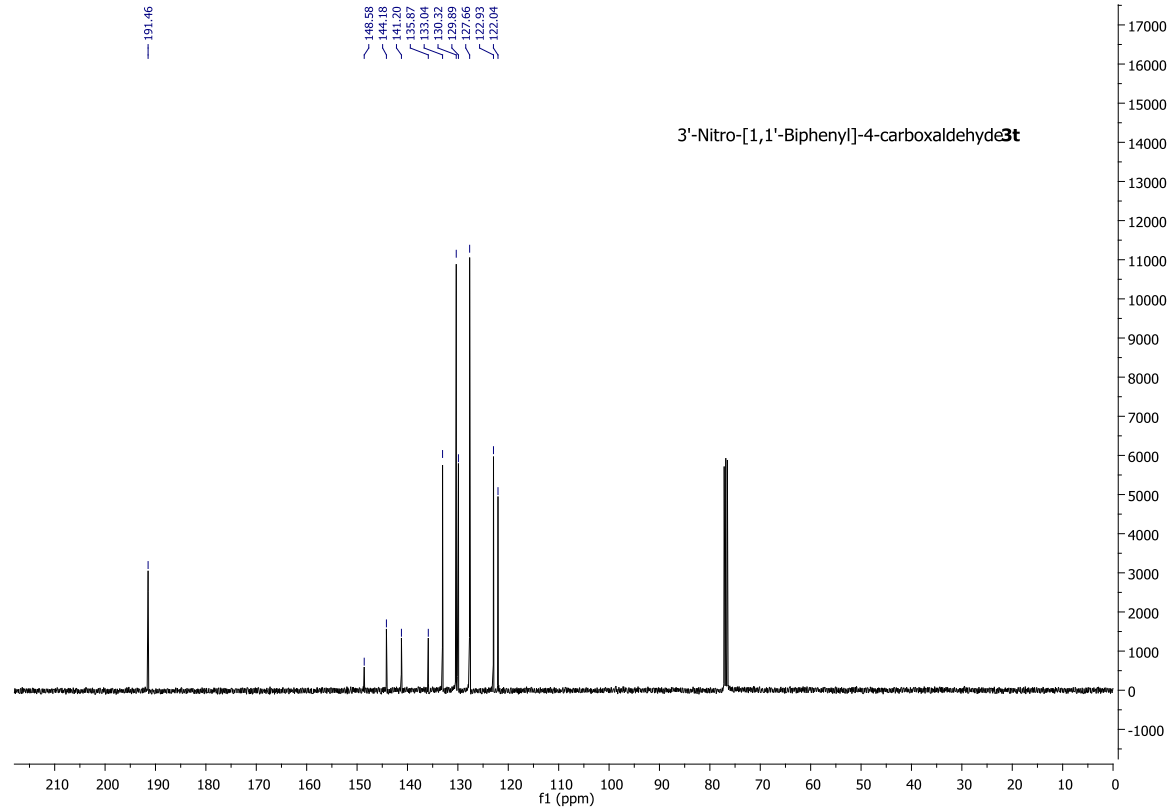

10.03
7.93
7.91
7.72
7.70
7.60
7.58
7.02
7.00
3.87
4'-Methoxy-[1,1'-Biphenyl]
-4-carboxaldehyde**3r**
1.00
2.24
2.28
2.27
2.23
f1 (ppm)

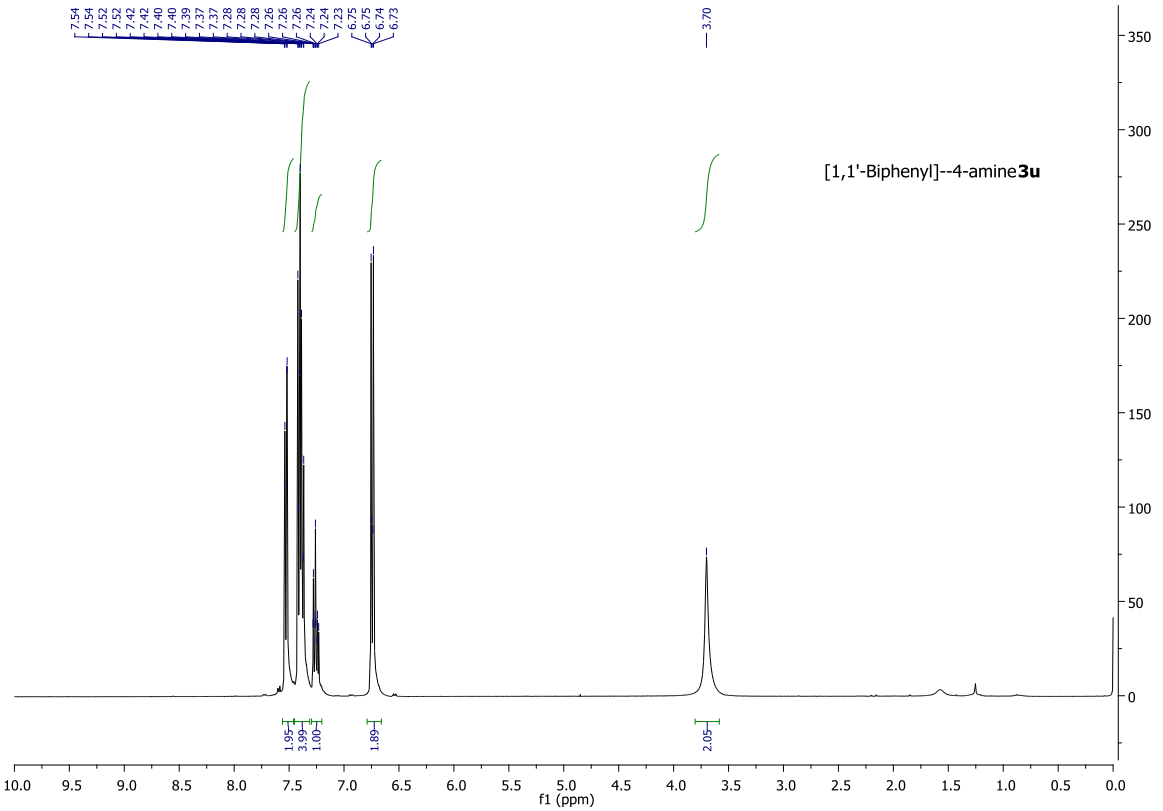

191.71
159.89
146.57
134.44
131.83
130.12
128.30
126.84
114.26
55.21
4'-Methoxy-[1,1'-Bi´phenyl]
-4-carboxaldehyde**3r**
f1 (ppm)

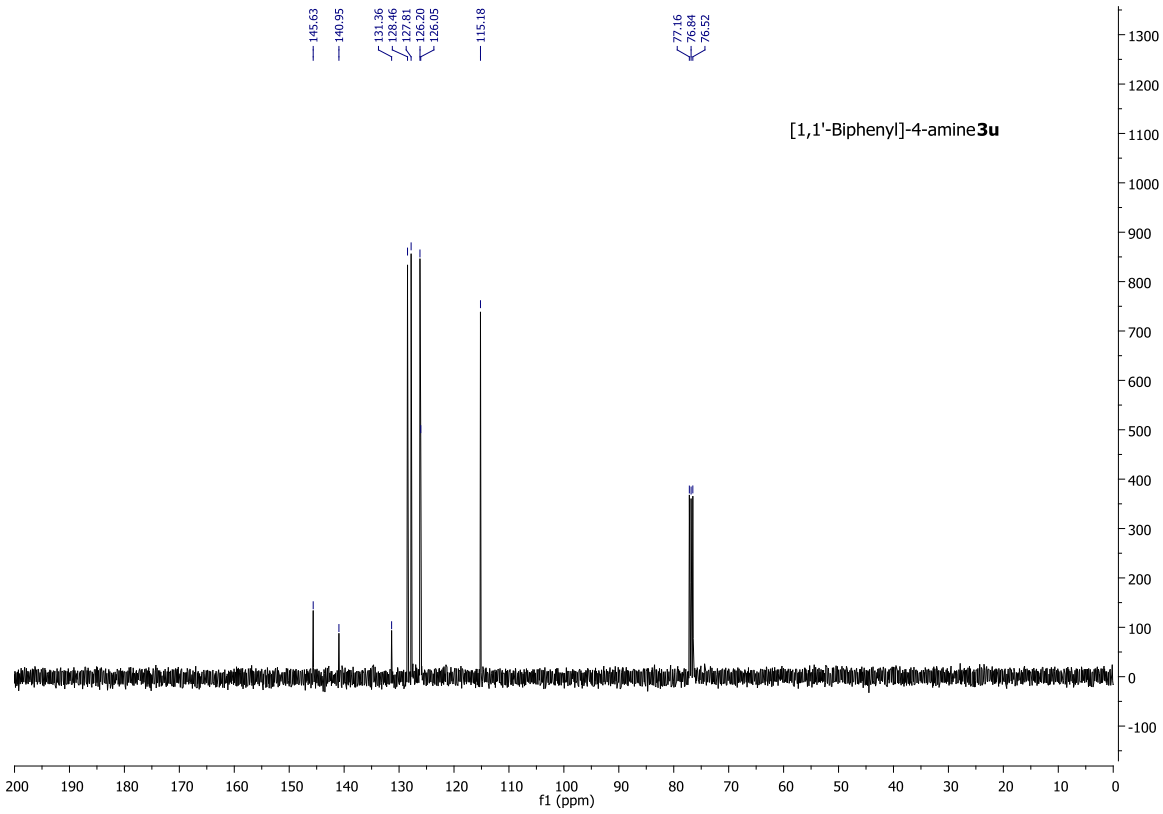

10.08
8.00
8.00
7.99
7.98
7.78
7.75
7.74
4'-(Trifluoromethyl)-1,1'-Biphenyl-4-carboxaldehyde 3s
1.00
2.30
7.04
f1 (ppm)

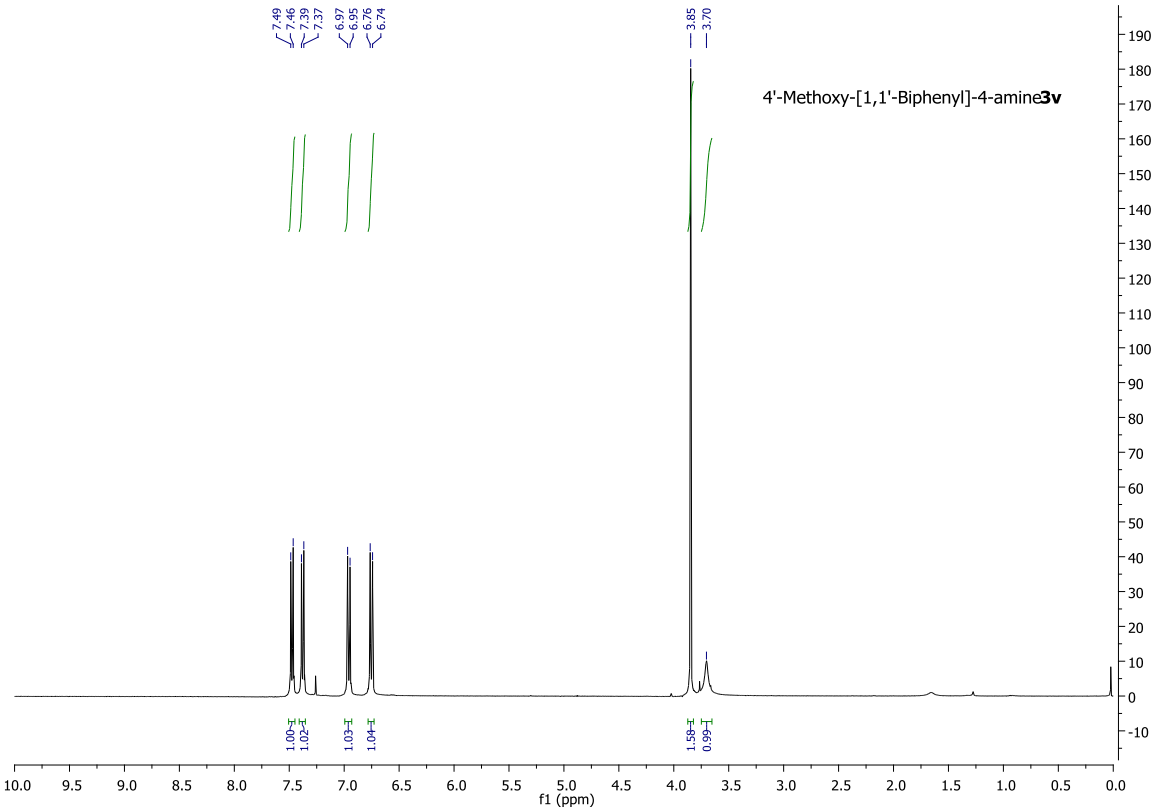

191.58
145.38
143.04
135.65
130.20
127.75
127.54
125.84
125.80
125.76
125.72
4'-(Trifluoromethyl)-1,1'-Biphenyl-4-carboxaldehyde 3s
f1 (ppm)

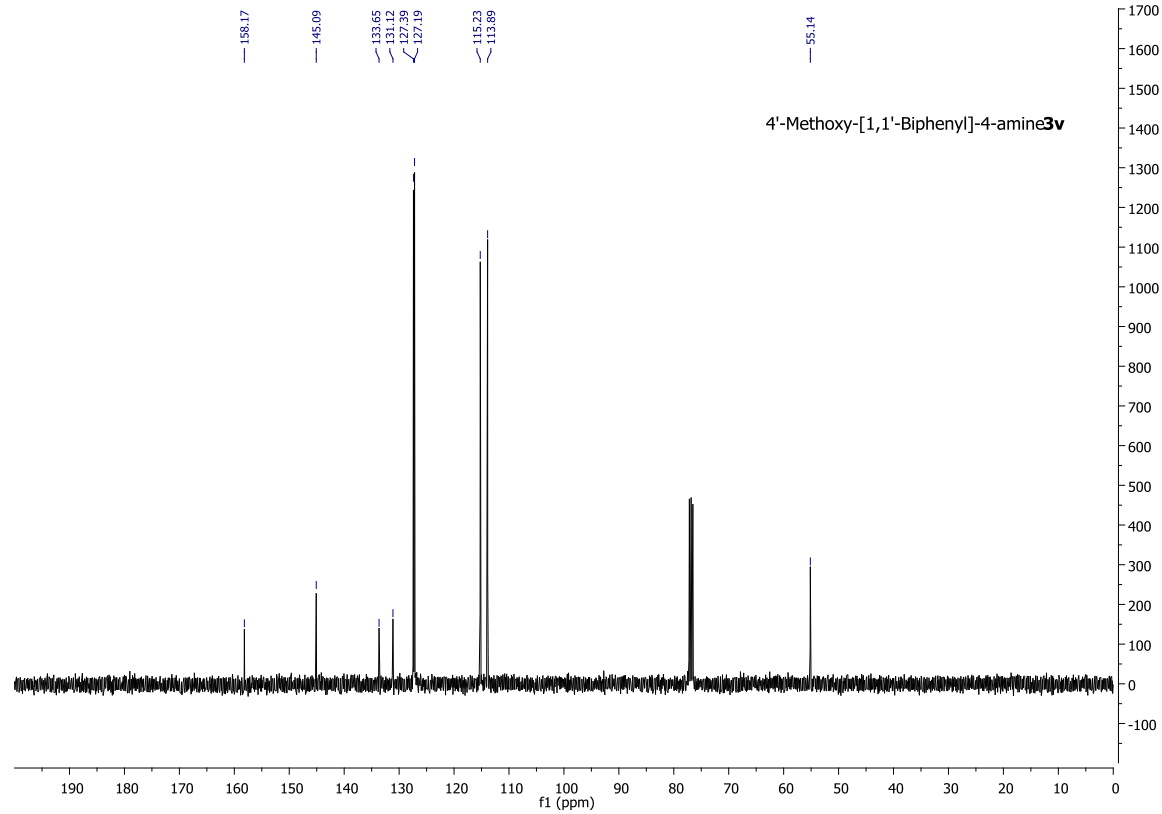

10.09
8.50
8.50
8.49
8.28
8.28
8.26
8.26
8.03
8.01
7.98
7.96
7.81
7.79
7.70
7.68
7.66
3'-Nitro-[1,1'-Biphenyl]-4-carboxaldehyde3t
1.00
1.10
1.07
2.25
1.15
2.30
1.21
f1 (ppm)

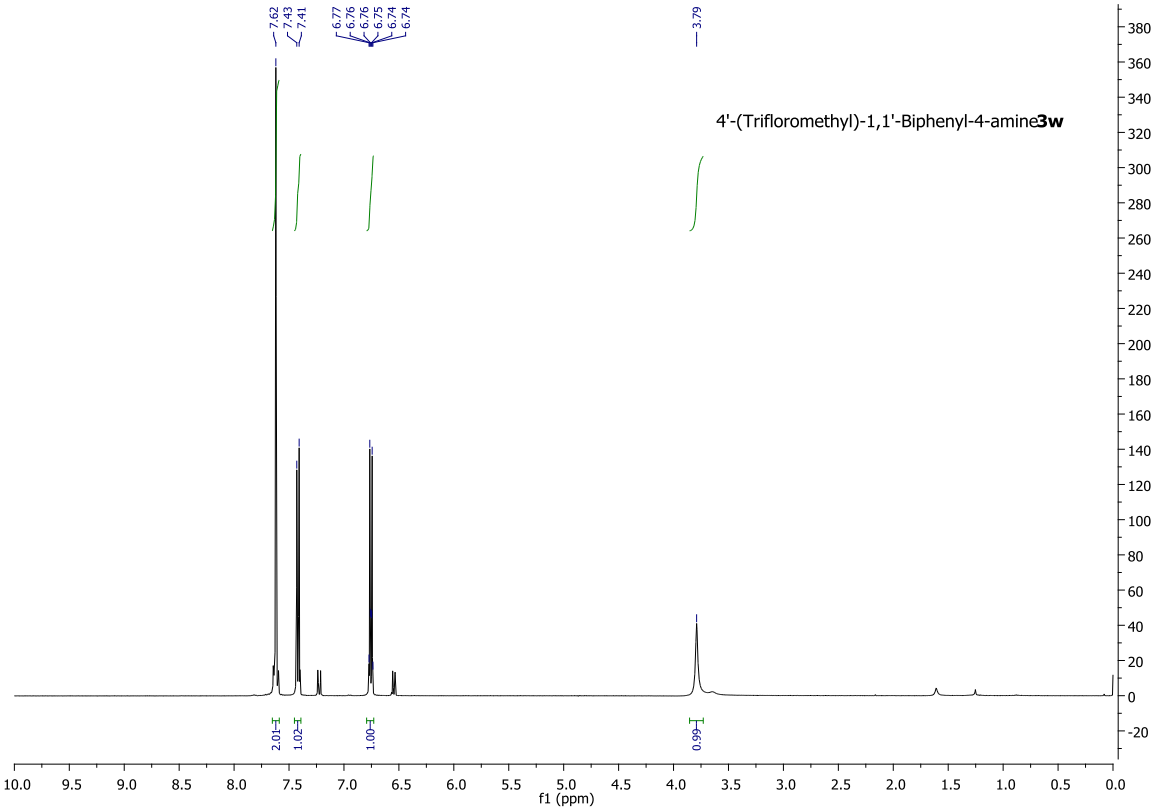

191.46
148.58
144.18
141.20
135.87
133.04
130.32
129.89
127.66
122.93
122.04
3'-Nitro-[1,1'-Biphenyl]-4-carboxaldehyde3t
f1 (ppm)

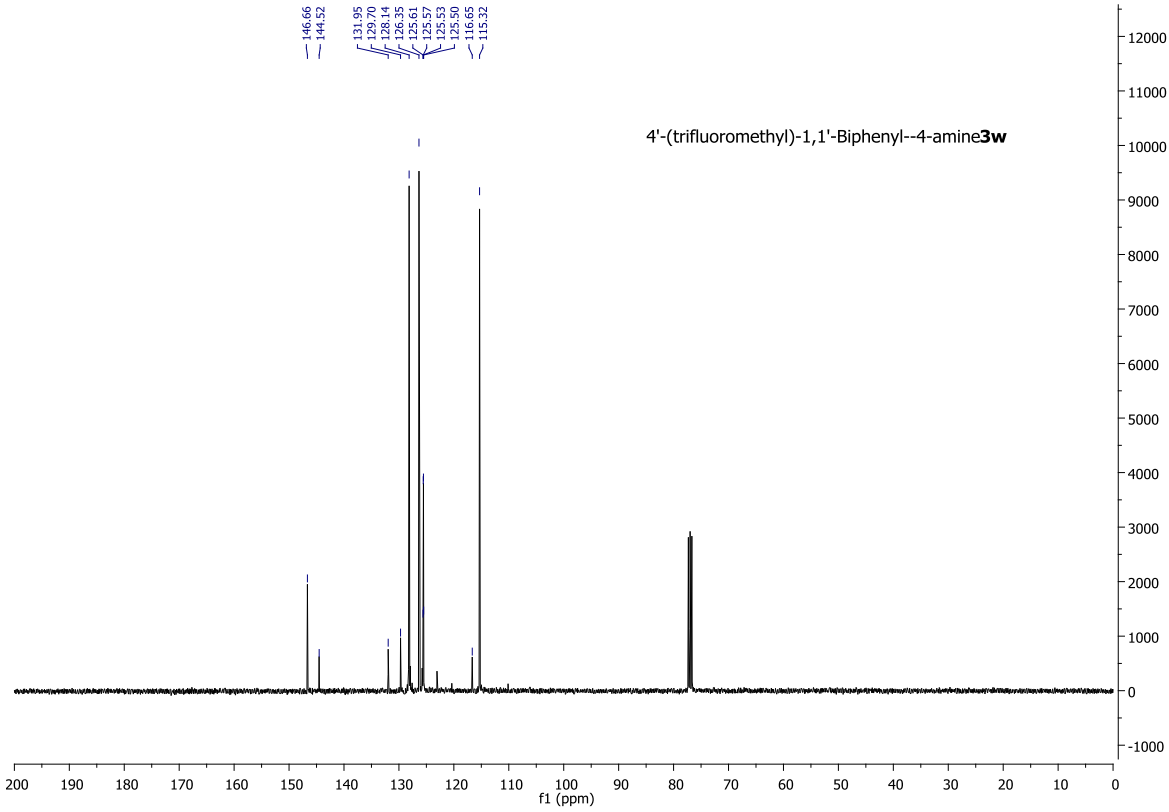

7.54
7.54
7.52
7.52
7.42
7.42
7.40
7.40
7.39
7.37
7.37
7.28
7.28
7.26
7.26
7.26
7.24
7.24
7.23
6.75
6.75
6.74
6.73
3.70
[1,1'-Biphenyl]--4-amine3u
1.95
3.99
1.00
1.89
2.05
f1 (ppm)

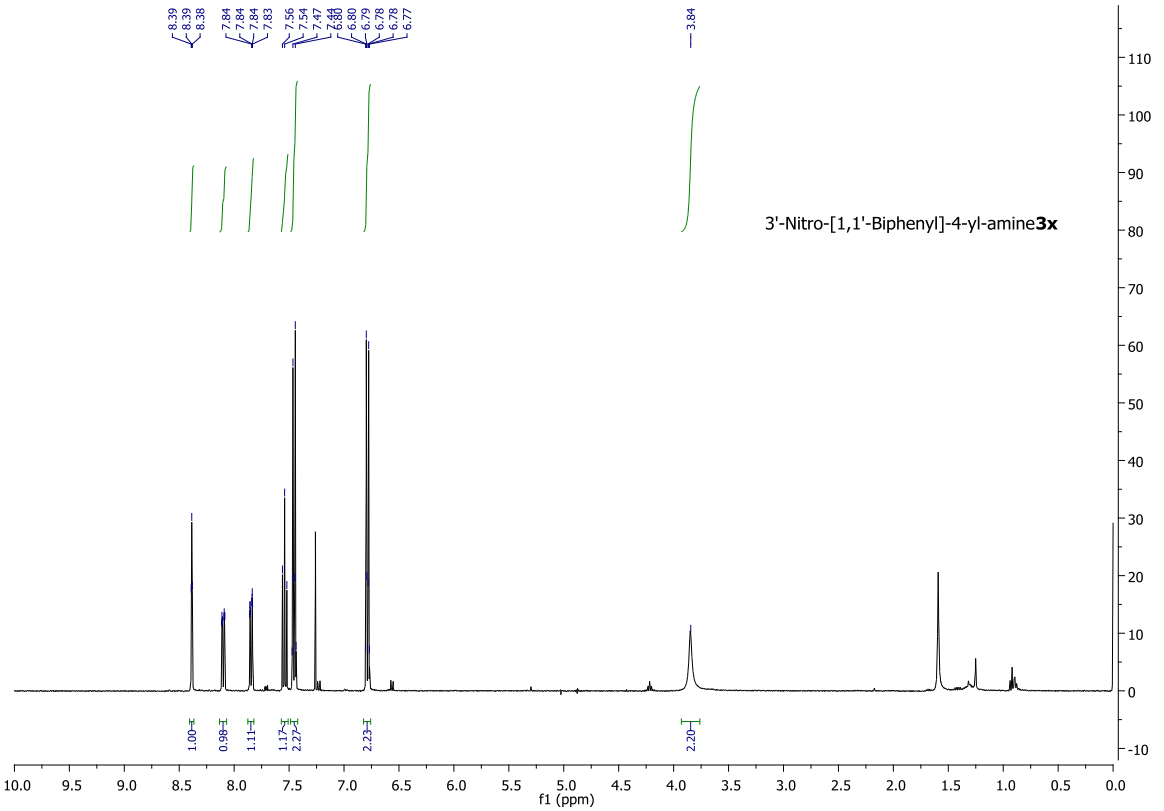

145.63
140.95
131.36
128.46
127.81
126.20
126.05
115.18
77.16
76.84
76.52
[1,1'-Biphenyl]-4-amine3u
f1 (ppm)

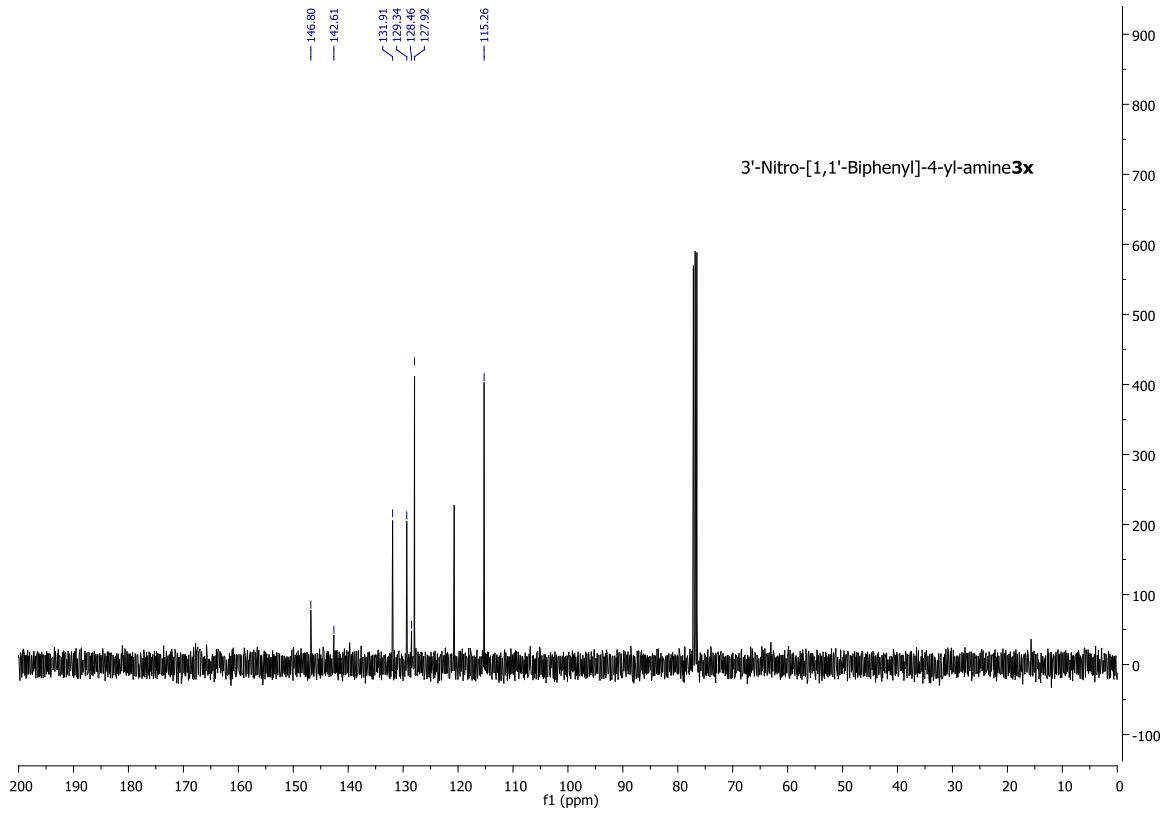

7.49
7.46
7.39
7.37
6.97
6.95
6.76
6.74
3.85
3.70
4'-Methoxy-[1,1'-Biphenyl]-4-amine3v
1.00
1.02
1.03
1.04
1.58
0.99
f1 (ppm)


158.17
145.09
133.65
131.12
127.39
127.19
115.23
113.89
55.14
4'-Methoxy-[1,1'-Biphenyl]-4-amine3v
f1 (ppm)


7.62
7.43
7.41
6.77
6.76
6.76
6.75
6.74
6.74
3.79
4'-(Trifloromethyl)-1,1'-Biphenyl-4-amine3w
2.01
1.02
1.00
0.99
f1 (ppm)


146.66
144.52
131.95
129.70
128.14
126.35
125.61
125.57
125.53
125.50
116.65
115.32
4'-(trifluoromethyl)-1,1'-Biphenyl--4-amine3w
f1 (ppm)


8.39
8.39
8.38
7.84
7.84
7.84
7.83
7.56
7.54
7.47
7.44
6.80
6.79
6.78
6.78
6.77
3.84
3'-Nitro-[1,1'-Biphenyl]-4-yl-amine3x
1.00
0.98
1.11
1.17
2.27
2.23
2.20
f1 (ppm)


146.80
142.61
131.91
129.34
128.46
127.92
115.26
3'-Nitro-[1,1'-Biphenyl]-4-yl-amine3x
f1 (ppm)

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