

Electronic Supporting Information

Copper oxide nanoparticle mediated ‘click chemistry’ for the synthesis of mono-, bis- and tris-triazole derivatives using 10,10-dipropargyl-9-anthrone as a key building block

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I. General Information and Methods.

IR spectra were recorded on IR spectrophotometer. ^1H and ^{13}C NMR spectra were recorded on 400 MHz spectrometer TMS as internal reference; chemical shifts (δ scale) are reported in parts per million (ppm). ^1H NMR Spectra are reported in the order: multiplicity, coupling constant (J value) in hertz (Hz) and no of protons; signals were characterized as s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet) and bs (broad). Elemental analyses were carried out using CHNS/O analyzer. The X-ray crystal structures were determined with a diffractometer. Complete crystallographic data of **8b** (CCDC no. 942856) and **9b** (CCDC no. 921613) for the structural analysis have been deposited with the Cambridge Crystallographic Data Centre, Copies of this information may be obtained free of charge from the Director, Cambridge Crystallographic Data Centre, 12 Union Road, Cambridge CB2 1EZ, UK, (fax: +44-1223-336033, e-mail: deposit@ccdc.cam.ac.uk or via: www.ccdc.cam.ac.uk). The copper oxide nanoparticle were purchased from Sigma-Aldrich.

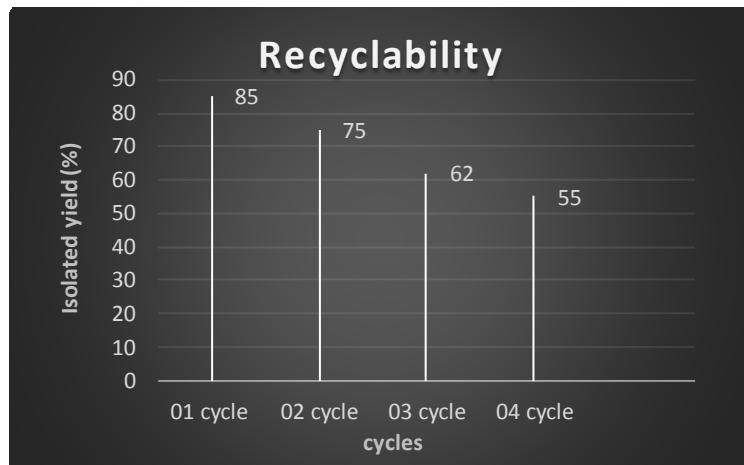


Fig. 1 Recyclability of copper oxide nanoparticle of **9b**

Recyclability of the catalyst^a in **9b**

Entry	mmol scale	Amount of catalyst	Recovered catalyst	Time (h)	Yield (%)
01	04	32	28	1.5	85
02	3.5	28	24	2	75
03	3	24	20	2.5	62
04	2.5	20	15	3	55

^aThe copper oxide nanoparticle was reused as follows: it was filtered off, washed with dichloromethane and finally dried before use for next cycle.

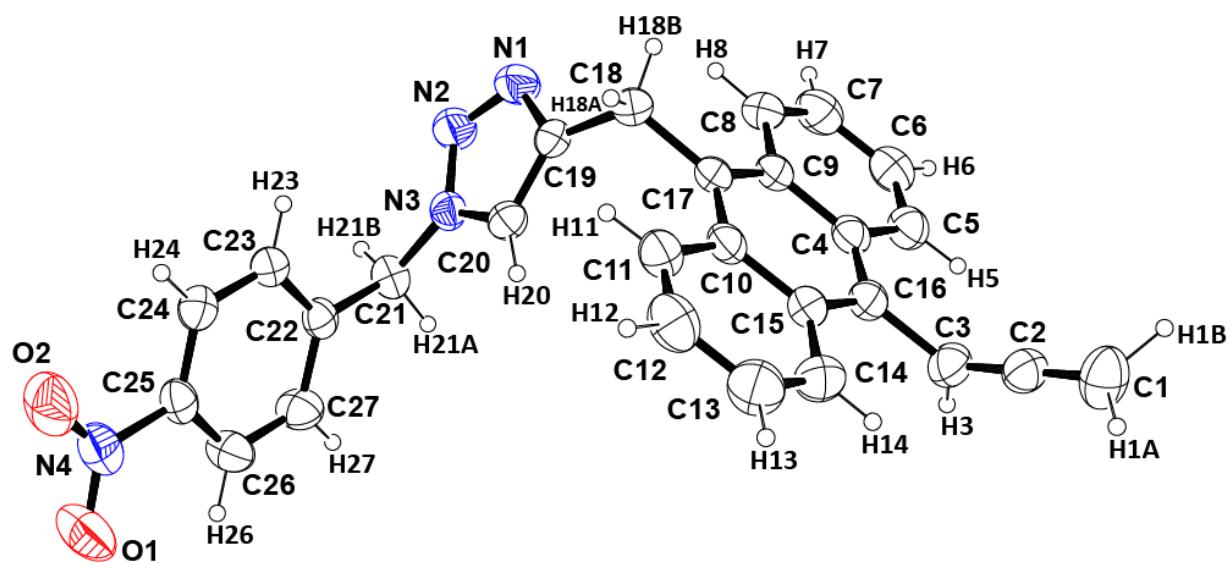


Fig. 2 30% probability of ORTEP ellipsoids of **8b**

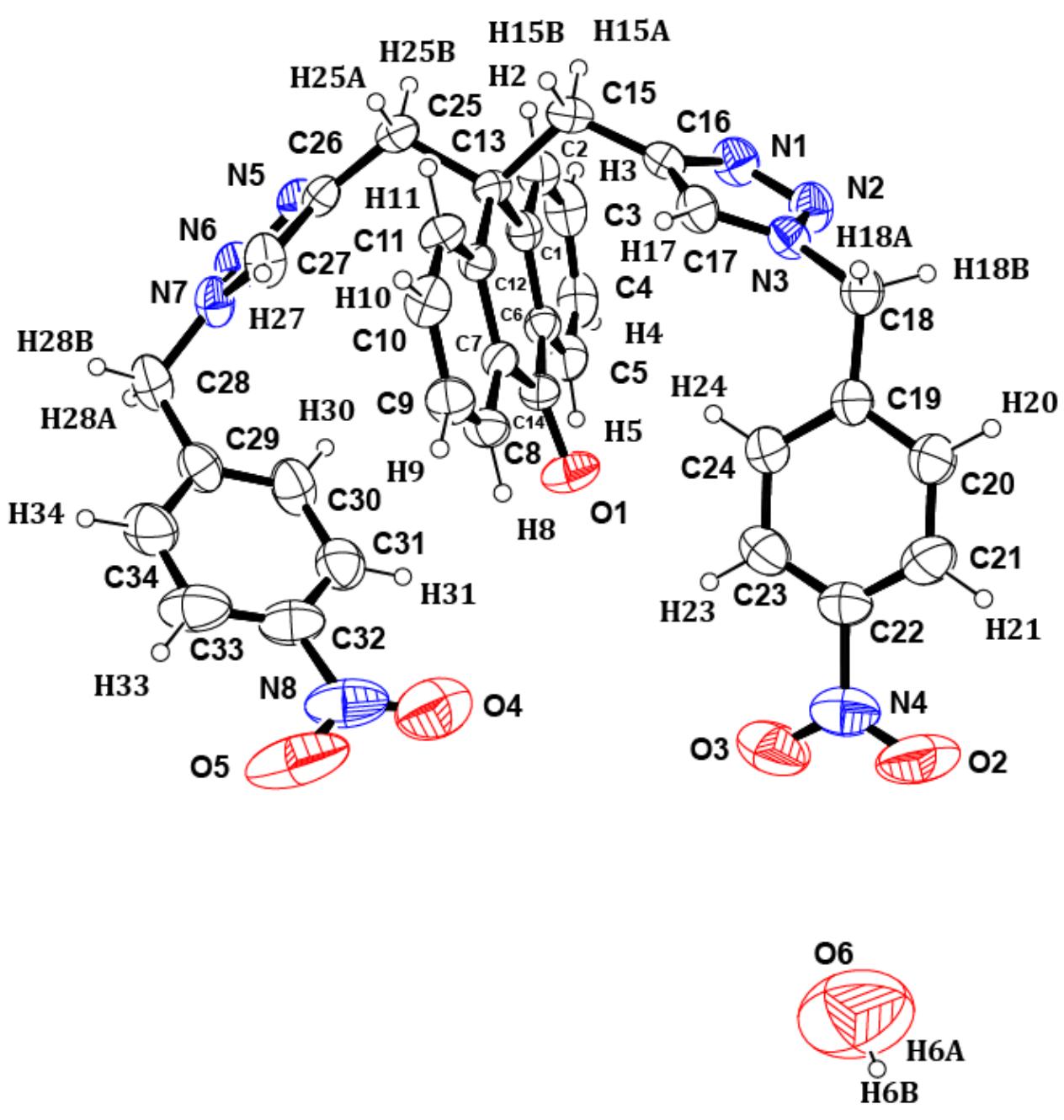


Fig. 3 30% probability of ORTEP ellipsoids of **9b**

Table 6 Crystal Data and Structure Refinement for Compound **8b** and **9b**

Entry	Identification code	Compound 8b	Compound 9b
01	Empirical formula	C27 H20 N4 O2	C34 H27.05 N8 O5.53
02	Formula weight	432.47	636.09
03	Temperature	296(2) K	296(2) K
04	Wavelength	0.71073	0.71073
05	Radiation type	Mo K\alpha	Mo K\alpha
06	Radiation source	'fine-focus sealed tube'	fine-focus sealed tube
07	Crystal system	monoclinic	monoclinic
08	Space group	P 21/n	P 21/c
09	Cell length	a 12.4688(7) b 10.2492(6) c 16.9379(9)	a 17.5453(9) b 9.9306(6) c 18.5780(10)
10	Cell Angle	α 90.0 β 97.094(5) δ 90.0	α 90.0 β 108.562(2) δ 90.0
11	Cell Volume	2148.0 (2)	3068.6(3)
12	Density	1.337	1.395
13	Completeness to theta	25.00° / 99.8%	25.25° / 96.9%
14	Absorption correction	multi-scan	multi-scan
15	Refinement method	Full-matrix least-squares on F2	Full-matrix least-squares on F2
16	Index ranges	-14<=h<=14, -12<=k<=6, -12<=l<=20	-20<=h<=19, -11<=k<=11, -22<=l<=22
17	Reflection number	3780	5375
18	Theta range	2.94-25.00	1.22-25.25
19	Cell formula units Z	4	4
20	CCDC no	942856	921613

10,10-dipropargyl-9-anthrone (2): Yield = 0.256 g, 95%, white solid, mp 210-211 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.42-8.39 (m, 2H), 7.73-7.67 (m, 4H), 7.54-7.48 (m, 2H), 3.09 (d, *J* = 2.4 Hz, 4H), 1.66 (t, *J* = 2.4 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃): δ 183.8, 144.6, 133.7, 132.6, 127.8, 127.7, 126.0, 79.5, 71.7, 45.2, 33.5; IR (KBr)v_{max} 3286, 3255, 3073, 2914, 2116, 1649, 1600, 1585, 1459, 1440, 1324, 1178 cm⁻¹; Anal. calcd for C₂₀H₁₄O: C, 88.86; H, 5.22. found C, 88.75; H, 5.15.

9-allenyl-10-prop-2-ynyl-anthracene (4): Yield = 0.227 g, 90%, yellow solid, mp 168-169 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.45 (d, *J* = 8.8 Hz, 2H), 8.33 (d, *J* = 8.8 Hz, 2H), 7.59-7.50 (m, 4H), 6.95 (t, *J* = 7.2 Hz, 1H), 5.05 (d, *J* = 7.2 Hz, 2H), 4.44 (d, *J* = 2.4 Hz, 2H), 2.07 (t, *J* = 2.8 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃): δ 211.2, 129.7, 129.6, 128.2, 127.8, 126.8, 126.2, 125.4, 124.6, 88.1, 82.4, 75.6, 69.8, 17.9; IR (KBr)v_{max} 3284, 3043, 2972, 2109, 1945, 1622, 1442, 1374, 1314, 1180 cm⁻¹; Anal. calcd for C₂₀H₁₄: C, 94.45; H, 5.55. found C, 94.34; H, 5.49.

10,10-diprop-2-ynyl-9-(prop-2-yn-1-oxy)-9,10-dihydroanthracene (5): Yield = 0.263 g, 85%, pale yellow solid, mp 96-97 °C, ¹H NMR (400 MHz, CDCl₃): δ 7.62 (d, *J* = 8.0 Hz, 2H), 7.53 (d, *J* = 7.2 Hz, 2H), 7.39 (t, *J* = 7.2 Hz, 2H), 7.33 (t, *J* = 7.2 Hz, 2H), 5.61 (s, 1H), 4.03 (d, *J* = 2.4 Hz, 2H), 3.34 (t, *J* = 2.8 Hz, 2H), 2.85 (d, *J* = 2.4 Hz, 2H), 2.49 (t, *J* = 2.4 Hz, 1H), 1.92 (t, *J* = 2.4 Hz, 1H), 1.59 (t, *J* = 2.4 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃): δ 141.3, 134.8, 130.0, 128.6, 127.2, 126.7, 126.0, 81.3, 81.0, 80.0, 75.7, 75.1, 71.9, 70.7, 54.3, 46.1, 35.9, 26.6; IR (KBr)v_{max} 3286, 3066, 3028, 2923, 2853, 2116, 1649, 1599, 1484, 1446, 1323 cm⁻¹; Anal. calcd for C₂₃H₁₈O: C, 89.00; H, 5.85. found C, 88.88; H, 5.78.

1-benzyl-4-((9-(propa-1,2-dienyl)anthracen-10-yl)methyl)-1H-1,2,3-triazole (8a): Yield = 0.348 g, 90%, yellow solid, mp 177-178 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.38 (d, *J* = 9.6 Hz, 2H), 8.21 (d, *J* = 9.2 Hz, 2H), 7.44-7.41 (m, 4H), 7.18-7.16 (m, 3H), 7.01 (brs, 2H), 6.88 (t, *J* = 7.6 Hz, 1H), 6.66 (s, 1H), 5.22 (s, 2H), 4.99 (s, 2H), 4.98 (s, 2H); ¹³C NMR (100 MHz, CDCl₃): δ 211.2, 134.9, 130.6, 129.9, 129.7, 129.1, 128.6, 127.9, 127.5, 126.7, 126.1, 125.9, 125.0, 121.9, 88.1, 75.7, 54.1, 25.3; IR (KBr)v_{max} 3120, 3064, 2953, 1946, 1662, 1550, 1444, 1318, 1215 cm⁻¹; Anal. calcd for C₂₇H₂₁N₃: C, 83.69; H, 5.46; N, 10.84. found C, 83.56; H, 5.39; N, 10.78.

1-(4-nitrobenzyl)-4-((9-(propa-1,2-dienyl)anthracen-10-yl)methyl)-1H-1,2,3-triazole (8b): Yield = 0.376 g, 87%, yellow solid, mp 153-154 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.44 (d, *J* = 8.8 Hz, 2H), 8.25 (d, *J* = 8.8 Hz, 2H), 8.06 (d, *J* = 8.4 Hz, 2H), 7.50-7.48 (m, 4H), 7.18 (d, *J* = 8.4 Hz, 2H), 6.93 (t, *J* = 7.6 Hz, 1H), 6.74 (s, 1H), 5.35 (s, 2H), 5.06 (s, 2H), 5.03 (s, 2H); ¹³C NMR (100 MHz, CDCl₃): δ 211.1,

148.5, 147.8, 141.7, 130.2, 129.7, 129.5, 128.3, 127.4, 126.6, 126.1, 125.4, 124.7, 124.0, 122.1, 87.9, 75.6, 52.8, 25.0; IR (KBr) ν_{max} 3135, 3075, 3051, 2963, 1946, 1605, 1520, 1443, 1344, 1261, 1209 cm⁻¹; Anal. calcd for C₂₇H₂₀N₄O₂: C, 74.98; H, 4.66; N, 12.95. found C, 74.89; H, 4.59; N, 12.85.

1-(4-methoxybenzyl)-4-((9-(propa-1,2-dienyl)anthracen-10-yl)methyl)-1H-1,2,3-triazole (8c): Yield = 0.354 g, 85%, yellow solid, mp 161-162°C, ¹H NMR (400 MHz, CDCl₃): δ 8.45-8.42 (m, 2H), 8.28-8.26 (m, 2H), 7.51-7.45 (m, 4H), 7.02 (d, *J* = 8.4 Hz, 2H), 6.94 (t, *J* = 7.6 Hz, 1H), 6.74 (d, *J* = 7.6 Hz, 2H), 6.68 (s, 1H), 5.21 (s, 2H), 5.05 (s, 2H), 5.04 (d, *J* = 7.6 Hz, 2H), 3.72 (s, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 211.1, 159.7, 147.9, 130.6, 129.8, 129.5, 129.3, 126.7, 126.5, 125.9, 125.3, 124.9, 121.5, 114.3, 87.9, 75.6, 55.2, 53.5, 25.2; IR (KBr) ν_{max} 3127, 3068, 2962, 2932, 2836, 1946, 1611, 1513, 1441, 1302, 1249, 1209 cm⁻¹; Anal. calcd for C₂₈H₂₃N₃O: C, 80.55; H, 5.55; N, 10.06. found C, 80.46; H, 5.46; N, 9.98.

4-((9-(propa-1,2-dienyl)anthracen-10-yl)methyl)-1-propyl-1H-1,2,3-triazole (8d): Yield = 0.258 g, 76%, yellow solid, mp: 117-118°C, ¹H NMR (400 MHz, CDCl₃): δ 8.46-8.44 (m, 2H), 8.29-8.27 (m, 2H), 7.52-7.47 (m, 4H), 6.95 (t, *J* = 7.2 Hz, 1H), 6.68 (s, 1H), 5.06-5.04 (m, 4H), 4.04 (t, *J* = 7.6 Hz, 2H), 1.74-1.68 (m, 2H), 0.78 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 211.2, 147.7, 130.8, 129.9, 129.7, 127.4, 126.7, 126.1, 125.4, 125.0, 121.8, 88.1, 75.7, 51.9, 25.3, 23.7, 11.1; IR (KBr) ν_{max} 3119, 3068, 2966, 2931, 2875, 1950, 1620, 1550, 1443, 1383, 1262, 1218 cm⁻¹; Anal. calcd for C₂₃H₂₁N₃: C, 81.38; H, 6.24; N, 12.38. found C, 81.29; H, 6.15; N, 12.29.

1-butyl-4-((10-(propa-1,2-dien-1-yl)anthracen-9-yl)methyl)-1H-1,2,3-triazole (8e): Yield = 0.268 g, 76%, yellow solid, mp 120-121 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.47-8.44 (m, 2H), 8.31-8.28 (m, 2H), 7.52-7.48 (m, 4H), 6.66 (t, *J* = 7.2 Hz, 1H), 6.68 (s, 1H), 5.06-5.05 (m, 4H), 4.08 (t, *J* = 7.2 Hz, 2H), 1.69-1.64 (m, 2H), 1.23-1.14 (m, 2H), 0.81 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 211.2, 147.6, 130.7, 129.9, 129.6, 127.4, 126.6, 126.1, 125.4, 124.9, 121.7, 88.1, 75.6, 50.1, 32.2, 25.3, 19.8, 13.5; IR (KBr) ν_{max} 3120, 3070, 2962, 2929, 2871, 1951, 1599, 1460, 1385, 1261, 1217 cm⁻¹; Anal. calcd for C₂₄H₂₃N₃: C, 81.55; H, 6.56; N, 11.89. found C, 81.44; H, 6.45; N, 11.79.

1-(sec-butyl)-4-((10-(propa-1,2-dien-1-yl)anthracen-9-yl)methyl)-1H-1,2,3-triazole (8f): Yield = 0.282 g, 80%, yellow solid, mp 129-130 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.46-8.44 (m, 2H), 8.30-8.28 (m, 2H), 7.51-7.48 (m, 4H), 6.96 (t, *J* = 6.8 Hz, 1H), 6.68 (s, 1H), 5.08-5.05 (m, 4H), 4.33 (q, *J* = 7.2 Hz, 1H), 1.73-1.62 (m, 2H), 1.32 (d, *J* = 6.8 Hz, 3H), 0.68 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃): δ

211.2, 147.4, 130.9, 130.1, 129.7, 127.3, 126.6, 126.1, 125.4, 125.1, 119.7, 88.2, 75.7, 58.9, 30.3, 25.5, 20.8, 10.5; IR (KBr) ν_{max} 3123, 3066, 2964, 2933, 2876, 1949, 1619, 1547, 1443, 1384, 1368, 1260, 1225 cm⁻¹; Anal. calcd for C₂₄H₂₃N₃: C, 81.55; H, 6.56; N, 11.89. found C, 81.45; H, 6.46; N, 11.80.

1-hexyl-4-((10-(propa-1,2-dien-1-yl)anthracen-9-yl)methyl)-1H-1,2,3-triazole (8g): Yield = 0.289 g, 76%, yellow solid, mp 141-142 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.47-8.44 (m, 2H), 8.29-8.27 (m, 2H), 7.52-7.47 (m, 4H), 6.96 (t, J = 7.2 Hz, 1H), 6.67 (s, 1H), 5.06-5.04 (m, 4H), 4.07 (t, J = 7.2 Hz, 2H), 1.68-1.65 (m, 2H), 1.15-1.12 (m, 6H), 0.77 (t, J = 7.2 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 211.2, 147.7, 130.8, 129.9, 129.7, 127.4, 126.7, 126.1, 125.4, 125.0, 121.8, 88.1, 75.6, 50.3, 31.1, 30.2, 26.2, 25.3, 22.4, 13.9; IR (KBr) ν_{max} 3121, 3073, 2953, 2929, 2856, 1945, 1619, 1554, 1443, 1314, 1219 cm⁻¹; Anal. calcd for C₂₆H₂₇N₃: C, 81.85; H, 7.13; N, 11.01. found C, 81.74; H, 7.05; N, 10.94.

1-allyl-4-((10-(propa-1,2-dien-1-yl)anthracen-9-yl)methyl)-1H-1,2,3-triazole (8h): Yield = 0.276 g, 82%, yellow solid, mp 164-165 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.46-8.44 (m, 2H), 8.30-8.27 (m, 2H), 7.51-7.44 (m, 4H), 6.95 (t, J = 7.2 Hz, 1H), 6.71 (s, 1H), 5.83-5.74 (m, 1H), 5.14 (d, J = 10.4 Hz, 2H), 5.06-5.02 (m, 4H), 4.72 (d, J = 6.0 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃): δ 211.2, 148.0, 131.3, 130.7, 129.9, 129.6, 127.4, 126.7, 126.1, 125.4, 124.9, 121.7, 120.1, 88.1, 75.6, 52.8, 25.3; IR (KBr) ν_{max} 3122, 3069, 2926, 2853, 1952, 1618, 1443, 1383, 1220, 1137 cm⁻¹; Anal. calcd for C₂₃H₁₉N₃: C, 81.87; H, 5.68; N, 12.45. found C, 81.76; H, 5.60; N, 12.36. Chemical Formula: C₂₃H₁₉N₃

Ethyl 2-(4-((10-(propa-1,2-dien-1-yl)anthracen-9-yl)methyl)-1H-1,2,3-triazol-1-yl)acetate (8i): Yield = 0.299 g, 78%, yellow solid, mp 159-160 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.45-8.43 (m, 2H), 8.31-8.28 (m, 2H), 7.52-7.47 (m, 4H), 6.95 (t, J = 7.2 Hz, 1H), 6.85 (s, 1H), 5.09 (s, 2H), 5.05 (d, J = 6.8 Hz, 2H), 4.88 (s, 2H), 4.11 (q, J = 8.0 Hz, 2H), 1.14 (t, J = 7.2 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 211.2, 166.2, 148.1, 130.5, 129.9, 129.6, 127.4, 126.7, 126.1, 125.4, 124.9, 123.3, 88.1, 75.6, 62.3, 50.8, 25.1, 14.0; IR (KBr) ν_{max} 3132, 3080, 2990, 2961, 1938, 1756, 1620, 1546, 1445, 1375, 1217 cm⁻¹; Anal. calcd for C₂₄H₂₁N₃O₂: C, 75.18; H, 5.52; N, 10.96. found C, 75.05; H, 5.44; N, 10.87.

1-phenyl-2-(4-((10-(propa-1,2-dien-1-yl)anthracen-9-yl)methyl)-1H-1,2,3-triazol-1-yl)ethanone (8j): Yield = 0.324 g, 78%, yellow solid, mp 181-182 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.38 (d, J = 8.8 Hz, 2H), 8.28 (d, J = 8.4 Hz, 2H), 7.76 (d, J = 8.0 Hz, 2H), 7.52 (t, J = 7.6 Hz, 2H), 7.48-7.40 (m, 3H), 7.37 (t, J = 7.2 Hz, 2H), 6.89-6.85 (m, 2H), 5.49 (s, 2H), 5.04 (s, 2H), 4.98 (d, J = 6.8 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃): δ 211.2, 190.4, 134.5, 133.9, 130.6, 129.9, 129.6, 129.2, 128.1, 127.4, 126.6, 126.2, 125.4,

124.9, 123.8, 88.1, 75.6, 55.4, 25.2; IR (KBr) ν_{max} 3134, 3067, 2963, 2923, 2853, 1948, 1705, 1597, 1448, 1412, 1349, 1261, 1226 cm⁻¹; Anal. calcd for C₂₈H₂₁N₃O: C, 80.94; H, 5.09; N, 10.11. found C, 80.82; H, 4.98; N, 10.04.

10,10-bis((1-benzyl-1H-1,2,3-triazol-4-yl)methyl)anthracen-9(10H)-one (9a): Yield = 0.472 g, 88%, white solid, mp 195-196 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.05 (d, *J* = 7.6 Hz, 2H), 7.88 (d, *J* = 8.0 Hz, 2H), 7.65 (d, *J* = 8.0 Hz, 2H), 7.34-7.25 (m, 8H), 6.76 (d, *J* = 6.0 Hz, 4H), 5.79 (s, 2H), 5.12 (s, 4H), 3.84 (s, 4H); ¹³C NMR (100 MHz, CDCl₃): δ 182.6, 144.9, 143.2, 134.5, 133.9, 132.3, 129.0, 128.5, 127.4, 127.3, 127.2, 121.5, 53.6, 47.1, 40.8; IR (KBr) ν_{max} 3164, 3133, 3062, 3032, 2961, 1664, 1602, 1545, 1496, 1455, 1323, 1216 cm⁻¹; Anal. calcd for C₃₄H₂₈N₆O: C, 76.10; H, 5.26; N, 15.66. found C, 75.98; H, 5.18; N, 15.56.

10,10-bis((1-(4-nitrobenzyl)-1H-1,2,3-triazol-4-yl)methyl)anthracen-9(10H)-one (9b): Yield = 0.533 g, 85%, white solid, mp 181-182 °C, ¹H NMR (400 MHz, CDCl₃): δ 7.98 (d, *J* = 8.8 Hz, 4H), 7.90 (d, *J* = 8.0 Hz, 2H), 7.84 (d, *J* = 8.0 Hz, 2H), 7.62-7.58 (m, 2H), 7.26-7.22 (m, 2H), 6.71 (d, *J* = 8.8 Hz, 4H), 5.84 (s, 2H), 5.13 (s, 4H), 3.77 (s, 4H); ¹³C NMR (100 MHz, CDCl₃): δ 181.3, 146.3, 144.1, 142.2, 141.7, 132.9, 130.9, 126.7, 126.2, 125.5, 122.7, 121.3, 50.9, 46.1, 39.4; IR (KBr) ν_{max} 3136, 3070, 2956, 2931, 2857, 1661, 1601, 1523, 1493, 1455, 1419, 1357, 1324, 1216 cm⁻¹.

10,10-bis((1-(4-methoxybenzyl)-1H-1,2,3-triazol-4-yl)methyl)anthracen-9(10H)-one (9c): Yield = 0.489 g, 82%, white solid, mp 167-168 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.01 (d, *J* = 7.6 Hz, 2H), 7.84 (d, *J* = 8.0 Hz, 2H), 7.61 (t, *J* = 8.0 Hz, 2H), 7.29 (t, *J* = 7.6 Hz, 2H), 6.77-6.69 (m, 8H), 5.70 (s, 2H), 5.01 (s, 4H), 3.80 (s, 6H), 3.78 (s, 4H); ¹³C NMR (100 MHz, CDCl₃): δ 182.6, 159.8, 145.0, 143.1, 133.9, 132.4, 129.0, 127.4, 127.3, 126.6, 121.3, 114.4, 55.5, 53.3, 47.1, 40.9; IR (KBr) ν_{max} 3129, 3066, 2960, 2933, 2833, 1663, 1602, 1515, 1324, 1255, 1217 cm⁻¹; Anal. calcd for C₃₆H₃₂N₆O₃: C, 72.47; H, 5.41; N, 14.08. found C, 72.35; H, 5.30; N, 13.98.

10,10-bis((1-(4-methylbenzyl)-1H-1,2,3-triazol-4-yl)methyl)anthracen-9(10H)-one (9d): Yield = 0.485 g, 88%, white solid, mp 215-216 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.06 (d, *J* = 8.0 Hz, 2H), 7.87 (d, *J* = 8.0 Hz, 2H), 7.64 (t, *J* = 7.6 Hz, 2H), 7.32 (t, *J* = 7.6 Hz, 2H), 7.07 (d, *J* = 7.6 Hz, 4H), 6.68 (d, *J* = 7.6 Hz, 4H), 5.78 (s, 2H), 5.07 (s, 4H), 3.83 (s, 4H), 2.35 (s, 6H); ¹³C NMR (100 MHz, CDCl₃): δ 182.6, 144.9, 143.1, 138.3, 133.9, 132.2, 131.5, 129.6, 127.4, 127.2, 121.4, 53.4, 47.0, 40.8, 21.2; IR (KBr) ν_{max} 3132,

3062, 3025, 2959, 2922, 1666, 1602, 1516, 1458, 1323, 1217 cm^{-1} ; Anal. calcd for $\text{C}_{36}\text{H}_{32}\text{N}_6\text{O}$: C, 76.57; H, 5.71; N, 14.88. found C, 76.45; H, 5.60; N, 14.77.

10,10-bis((1-(4-bromobenzyl)-1H-1,2,3-triazol-4-yl)methyl)anthracen-9(10H)-one (9e): Yield = 0.588 g, 85%, white solid, mp 205-206 °C, ^1H NMR (400 MHz, CDCl_3): δ 8.05 (d, J = 8.0 Hz, 2H), 7.92 (d, J = 8.0 Hz, 2H), 7.67 (t, J = 7.2 Hz, 2H), 7.41 (d, J = 8.4 Hz, 4H), 7.34 (t, J = 7.6 Hz, 2H), 6.63 (d, J = 8.4 Hz, 4H), 5.78 (s, 2H), 5.07 (s, 4H), 3.87 (s, 4H); ^{13}C NMR (100 MHz, CDCl_3): δ 182.6, 144.8, 134.1, 133.5, 132.2, 129.7, 128.9, 127.5, 127.3, 127.2, 122.6, 121.6, 52.9, 47.1, 40.7; IR (KBr) ν_{max} 3123, 3065, 2954, 2929, 1651, 1598, 1489, 1458, 1408, 1325, 1176 cm^{-1} ; Anal. calcd for $\text{C}_{34}\text{H}_{26}\text{Br}_2\text{N}_6\text{O}$: C, 58.81; H, 3.77; N, 12.10. found C, 58.70; H, 3.69; N, 11.98.

10,10-bis((1-(4-fluorobenzyl)-1H-1,2,3-triazol-4-yl)methyl)anthracen-9(10H)-one (9f): Yield = 0.492 g, 86%, white solid, mp 194-195 °C, ^1H NMR (400 MHz, CDCl_3): δ 8.05 (d, J = 7.6 Hz, 2H), 7.89 (d, J = 8.0 Hz, 2H), 7.67 (t, J = 8.0 Hz, 2H), 7.34 (t, J = 7.2 Hz, 2H), 6.98-6.94 (m, 4H), 6.76-6.73 (m, 4H), 5.77 (s, 2H), 5.09 (s, 4H), 3.84 (s, 4H); ^{13}C NMR (100 MHz, CDCl_3): δ 182.5, 163.9, 144.9, 134.0, 132.2, 130.4, 129.2, 129.1, 127.5, 127.2, 127.1, 121.3, 116.1, 115.8, 52.8, 47.1, 40.8; IR (KBr) ν_{max} 3133, 3067, 2965, 1665, 1603, 1514, 1457, 1323, 1237, 1161 cm^{-1} ; Anal. calcd for $\text{C}_{34}\text{H}_{26}\text{F}_2\text{N}_6\text{O}$: C, 71.32; H, 4.58; N, 14.68. found C, 71.22; H, 4.50; N, 14.59.

10,10-bis((1-propyl-1H-1,2,3-triazol-4-yl)methyl)anthracen-9(10H)-one (9g): Yield = 0.330 g, 75%, white solid, mp 188-189 °C, ^1H NMR (400 MHz, CDCl_3): δ 8.14 (d, J = 8.0 Hz, 2H), 7.93 (d, J = 8.0 Hz, 2H), 7.72 (t, J = 7.6 Hz, 2H), 7.41 (t, J = 7.6 Hz, 2H), 5.86 (s, 2H), 3.91-3.82 (m, 8H), 1.53-1.46 (m, 4H), 0.57 (t, J = 7.2 Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3): δ 182.9, 145.2, 142.8, 134.1, 132.5, 127.6, 127.3, 127.2, 121.1, 51.6, 46.9, 40.9, 23.5, 10.7; IR (KBr) ν_{max} 3133, 3063, 2965, 2934, 2876, 1666, 1602, 1457, 1385, 1352, 1323, 1215 cm^{-1} ; Anal. calcd for $\text{C}_{26}\text{H}_{28}\text{N}_6\text{O}$: C, 70.89; H, 4.41; N, 19.08. found C, 70.77; H, 4.35; N, 18.97.

10,10-bis((1-butyl-1H-1,2,3-triazol-4-yl)methyl)anthracen-9(10H)-one (9h): Yield = 0.351 g, 75%, white solid, mp 176-177 °C, ^1H NMR (400 MHz, CDCl_3): δ 8.18 (d, J = 8.0 Hz, 2H), 7.96 (d, J = 8.4 Hz, 2H), 7.76 (t, J = 8.4 Hz, 2H), 7.44 (t, J = 7.2 Hz, 2H), 5.89 (s, 2H), 3.94 (t, J = 7.2 Hz, 4H), 3.88 (s, 4H), 1.52-1.45 (m, 4H), 0.98-0.88 (m, 4H), 0.77 (t, J = 7.6 Hz, 6H); ^{13}C NMR (100 MHz, CDCl_3): δ 182.9, 145.2, 142.8, 134.1, 132.5, 127.6, 127.3, 127.2, 121.1, 49.7, 46.9, 40.9, 32.0, 19.4, 13.4; IR (KBr) ν_{max}

3129, 3071, 2957, 2928, 2856, 1666, 1603, 1461, 1324, 1215 cm⁻¹; Anal. calcd for C₂₈H₃₂N₆O: C, 71.77; H, 6.88; N, 17.93. found C, 71.65; H, 6.79; N, 17.83.

10,10-bis((1-(sec-butyl)-1H-1,2,3-triazol-4-yl)methyl)anthracen-9(10H)-one (9i): Yield = 0.365 g, 78%, white solid, mp 149-150 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.11 (d, *J* = 7.6 Hz, 2H), 7.92 (d, *J* = 8.4 Hz, 2H), 7.70 (t, *J* = 7.2 Hz, 2H), 7.38 (t, *J* = 7.6 Hz, 2H), 5.83 (s, 2H), 4.11 (q, *J* = 7.6 Hz, 2H), 3.84 (s, 4H), 1.49-1.36 (m, 4H), 1.14 (d, *J* = 6.8 Hz, 6H), 0.40 (t, *J* = 7.2 Hz, 6H); ¹³C NMR (100 MHz, CDCl₃): δ 182.8, 145.3, 142.6, 134.0, 132.5, 127.5, 127.4, 127.1, 119.1, 58.4, 47.1, 40.8, 30.1, 20.6, 10.0; IR (KBr)v_{max} 3137, 3067, 3036, 2963, 2935, 2875, 1666, 1603, 1479, 1459, 1351, 1326, 1217 cm⁻¹; Anal. calcd for C₂₈H₃₂N₆O: C, 71.77; H, 6.88; N, 17.93. found C, 71.64; H, 6.78; N, 17.82.

10,10-bis((1-hexyl-1H-1,2,3-triazol-4-yl)methyl)anthracen-9(10H)-one (9j): Yield = 0.330 g, 75%, white solid, mp 162-163 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.15 (d, *J* = 8.0 Hz, 2H), 7.92 (d, *J* = 7.6 Hz, 2H), 7.71 (t, *J* = 8.0 Hz, 2H), 7.41 (t, *J* = 8.0 Hz, 2H), 5.86 (s, 2H), 3.90 (t, *J* = 7.2 Hz, 4H), 3.85 (s, 4H), 1.50-1.43 (m, 4H), 1.19-1.06 (m, 8H), 0.94-0.86 (m, 4H), 0.81 (t, *J* = 7.2 Hz, 6H); ¹³C NMR (100 MHz, CDCl₃): δ 182.9, 145.3, 142.8, 134.1, 132.6, 127.6, 127.3, 121.1, 50.0, 46.9, 41.1, 31.1, 30.1, 25.9, 22.5, 14.1; IR (KBr)v_{max} 3132, 3061, 2953, 2931, 2860, 1668, 1603, 1459, 1383, 1323, 1213 cm⁻¹; Anal. calcd for C₃₂H₄₀N₆O: C, 70.25; H, 7.68; N, 16.02. found C, 70.11; H, 7.59; N, 15.91.

10,10-bis((1-allyl-1H-1,2,3-triazol-4-yl)methyl)anthracen-9(10H)-one (9k): Yield = 0.348 g, 80%, white solid, mp 179-180 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.17 (d, *J* = 8.0 Hz, 2H), 7.95 (d, *J* = 8.0 Hz, 2H), 7.75 (t, *J* = 8.0 Hz, 2H), 7.44 (t, *J* = 8.0 Hz, 2H), 5.92 (s, 2H), 5.69-5.62 (m, 2H), 5.11 (d, *J* = 10.4 Hz, 2H), 4.77 (d, *J* = 17.2 Hz, 2H), 4.57 (d, *J* = 6.0 Hz, 4H), 3.88 (s, 4H); ¹³C NMR (100 MHz, CDCl₃): δ 182.9, 144.9, 142.9, 134.0, 132.4, 131.1, 127.5, 127.2, 121.3, 119.1, 52.1, 46.9, 40.8; IR (KBr)v_{max} 3135, 3066, 2959, 2916, 2823, 1665, 1601, 1458, 1323, 1217 cm⁻¹; Anal. calcd for C₂₆H₂₄N₆O: C, 71.54; H, 5.54; N, 19.25. found C, 71.43; H, 5.45; N, 19.13.

diethyl 2,2'-(4,4'-(10-oxo-9,10-dihydroanthracene-9,9-diyl)bis(methylene))bis(1H-1,2,3-triazole-4,1-diyl)diacetate (9l): Yield = 0.423 g, 80%, white solid, mp 153-154 °C, ¹H NMR (400 MHz, CDCl₃): δ 8.14 (d, *J* = 8.0 Hz, 2H), 7.94 (t, *J* = 8.0 Hz, 2H), 7.73 (t, *J* = 8.0 Hz, 2H), 7.40 (t, *J* = 7.6 Hz, 2H), 6.06 (s, 2H), 4.72 (s, 4H), 4.07 (q, *J* = 6.8 Hz, 4H), 3.88 (s, 4H), 1.13 (t, *J* = 7.2 Hz, 6H); ¹³C NMR (100 MHz, CDCl₃): δ 182.8, 165.9, 144.9, 143.1, 133.9, 132.3, 127.5, 127.3, 122.7, 62.2, 50.6, 46.7, 40.7, 13.9; IR

(KBr) ν_{max} 3170, 3138, 2987, 2939, 2845, 2861, 1755, 1666, 1603, 1459, 1354, 1324, 1263, 1231 cm^{-1} ; Anal. calcd for $\text{C}_{28}\text{H}_{28}\text{N}_6\text{O}_5$ C, 63.63; H, 5.34; N, 15.90. found C, 63.50; H, 5.25; N, 15.78.

10-((1-(4-nitrobenzyl)-1H-1,2,3-triazol-4-yl)methyl)-10-(prop-2-yn-1-yl)anthracen-9(10H)-one (10):

Yield = 0.340 g, 76%, white solid, mp 183-184 °C, ^1H NMR (400 MHz, CDCl_3): δ 8.23 (d, J = 8.4 Hz, 2H), 8.12 (d, J = 8.8 Hz, 2H), 7.79 (d, J = 8.0 Hz, 2H), 7.68 (t, J = 8.0 Hz, 2H), 7.43 (t, J = 8.0 Hz, 2H), 6.85 (d, J = 8.8 Hz, 2H), 5.87 (s, 1H), 5.23 (s, 2H), 3.73 (s, 2H), 3.21 (d, J = 2.4 Hz, 2H), 1.63 (t, J = 2.4 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 183.2, 148.0, 144.8, 143.9, 141.8, 134.0, 132.5, 127.9, 127.8, 127.5, 126.7, 124.3, 121.8, 79.4, 71.8, 52.7, 46.1, 39.9, 34.6; IR (KBr) ν_{max} 3287, 3139, 3073, 2926, 2852, 2301, 1657, 1602, 1517, 1460, 1348, 1324, 1224 cm^{-1} ; Anal. calcd for $\text{C}_{27}\text{H}_{20}\text{N}_4\text{O}_3$: C, 72.31; H, 4.49; N, 12.49. found C, 72.18; H, 4.39; N, 12.37.

10-((1-(3-bromopropyl)-1H-1,2,3-triazol-4-yl)methyl)-10-(prop-2-yn-1-yl)anthracen-9(10H)-one (11):

Yield = 0.282 g, 65%, semi-solid, ^1H NMR (400 MHz, CDCl_3): δ 8.31 (d, J = 7.6 Hz, 2H), 7.82 (d, J = 8.0 Hz, 2H), 7.73 (t, J = 8.0 Hz, 2H), 7.49 (t, J = 7.6 Hz, 2H), 5.94 (s, 1H), 4.04 (t, J = 6.8 Hz, 2H), 3.73 (s, 2H), 3.23 (d, J = 2.8 Hz, 2H), 2.96 (t, J = 6.4 Hz, 2H), 1.84-1.77 (m, 2H), 1.65 (t, J = 2.4 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 183.3, 144.8, 142.9, 133.9, 132.5, 127.7, 127.5, 127.4, 126.5, 122.1, 121.7, 79.5, 71.6, 47.6, 46.7, 46.1, 39.7, 34.5, 32.3; IR (KBr) ν_{max} 3294, 3068, 2925, 2853, 2101, 1654, 1599, 1458, 1324, 1218, 1176 cm^{-1} ; Anal. calcd for $\text{C}_{23}\text{H}_{20}\text{BrN}_3\text{O}$: C, 63.60; H, 4.64; N, 9.67. found C, 63.48; H, 4.55; N, 9.56.

10,10-bis((1-benzyl-1H-1,2,3-triazol-4-yl)methyl)-9,10-dihydroanthracen-9-ol (12a): Yield = 0.452 g, 84%, white solid, mp 159-160 °C, ^1H NMR (400 MHz, CDCl_3): δ 7.56 (d, J = 7.6 Hz, 2H), 7.34 (d, J = 7.6 Hz, 2H), 7.31-7.23 (m, 8H), 7.22-7.18 (m, 2H), 6.89 (d, J = 8.4 Hz, 2H), 6.79 (d, J = 6.8 Hz, 2H), 6.31 (s, 1H), 5.67 (s, 1H), 5.18 (s, 2H), 5.13 (s, 2H), 5.00 (s, 1H), 4.98 (s, 1H), 3.69 (s, 2H), 3.67 (s, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 144.6, 144.3, 138.4, 137.9, 135.0, 134.8, 129.0, 128.9, 128.8, 128.4, 127.7, 127.5, 127.1, 126.6, 122.6, 121.7, 67.8, 53.7, 53.6, 46.5, 40.4, 40.3; IR (KBr) ν_{max} 3532, 3146, 3061, 3035, 2924, 2825, 1601, 1543, 1490, 1415, 1352, 1325, 1220 cm^{-1} ; Anal. calcd for $\text{C}_{34}\text{H}_{30}\text{N}_6\text{O}$: C, 75.81; H, 5.61; N, 15.60. found C, 75.65; H, 5.53; N, 15.48.

10,10-bis((1-(4-nitrobenzyl)-1H-1,2,3-triazol-4-yl)methyl)-9,10-dihydroanthracen-9-ol (12b): Yield = 0.502 g, 80%, white solid, mp 226-227 °C, ^1H NMR (400 MHz, CD_2Cl_2): δ 8.10 (d, J = 8.4 Hz, 4H), 7.62 (d, J = 8.0 Hz, 2H), 7.42 (d, J = 7.6 Hz, 2H), 7.34 (t, J = 7.2 Hz, 2H), 7.27 (t, J = 7.2 Hz, 2H), 7.01 (d, J =

8.4 Hz, 2H), 6.89 (d, J = 8.4 Hz, 2H), 6.56 (s, 1H), 5.89 (s, 1H), 5.33 (s, 2H), 5.25 (s, 2H), 5.13 (s, 1H), 5.12 (s, 1H), 3.73 (s, 4H); ^{13}C NMR (100 MHz, CDCl_3): δ 145.8, 145.6, 141.8, 137.7, 136.6, 126.7, 126.6, 126.1, 125.6, 124.9, 124.8, 122.2, 122.1, 121.5, 64.3, 50.3, 44.9, 36.5; IR (KBr) ν_{max} 3543, 3132, 2962, 2927, 2855, 1603, 1517, 1487, 1421, 1754, 1261, 1218 cm^{-1} ; Anal. calcd for $\text{C}_{34}\text{H}_{28}\text{N}_8\text{O}_5$: C, 63.96; H, 4.49; N, 17.82. found C, 63.83; H, 4.38; N, 18.70.

10,10-bis((1-propyl-1H-1,2,3-triazol-4-yl)methyl)-9,10-dihydroanthracen-9-ol (12c): Yield = 0.318 g, 72%, white solid, mp 141-142 °C, ^1H NMR (400 MHz, CDCl_3): δ 7.57 (d, J = 7.6 Hz, 2H), 7.51 (d, J = 7.6 Hz, 2H), 7.35-7.31 (m, 2H), 7.28-7.26 (m, 2H), 6.40 (s, 1H), 5.79 (s, 1H), 5.32 (s, 1H), 3.96 (t, J = 7.2 Hz, 2H), 3.90-3.85 (m, 3H), 3.69-3.68 (m, 4H), 1.61 (q, J = 7.2 Hz, 2H), 1.53 (q, J = 7.2 Hz, 2H), 0.69 (t, J = 7.2 Hz, 3H), 0.59 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3): δ 144.1, 143.9, 138.9, 138.0, 129.0, 128.6, 127.3, 126.8, 122.5, 121.5, 111.9, 68.4, 51.7, 51.5, 46.6, 40.6, 39.8, 23.7; IR (KBr) ν_{max} 3537, 3132, 2964, 2927, 2875, 1602, 1542, 1490, 1457, 1328, 1261 cm^{-1} ; Anal. calcd for $\text{C}_{26}\text{H}_{30}\text{N}_6\text{O}$: C, 70.56; H, 6.83; N, 18.99. found C, 70.45; H, 6.72; N, 18.88.

diethyl 2,2'-(4,4'-(10-hydroxy-9,10-dihydroanthracene-9,9-diyl)bis(methylene))bis(1H-1,2,3-triazole-4,1-diyl)diacetate (12d): Yield = 0.413 g, 78%, white solid, mp: 145-146 °C, ^1H NMR (400 MHz, CDCl_3): δ 7.65 (d, J = 8.0 Hz, 2H), 7.50 (d, J = 8.0 Hz, 2H), 7.33 (t, J = 7.6 Hz, 2H), 7.21 (t, J = 7.2 Hz, 2H), 6.17 (s, 1H), 5.95 (s, 1H), 5.20 (s, 1H), 4.72 (s, 2H), 4.70 (s, 2H), 4.68 (s, 1H), 4.08-4.02 (m, 4H), 3.74 (s, 2H), 3.66 (s, 2H), 1.15-1.11 (m, 6H); ^{13}C NMR (100 MHz, CDCl_3): δ 166.7, 166.1, 144.1, 138.3, 137.7, 128.7, 128.3, 127.6, 127.1, 126.5, 123.4, 122.9, 66.8, 62.4, 62.2, 50.6, 50.4, 46.6, 40.6, 40.3, 14.0, 13.9; IR (KBr) ν_{max} 3537, 3143, 2986, 2943, 1746, 1603, 1547, 1489, 1463, 1383, 1221 cm^{-1} ; Anal. calcd for $\text{C}_{28}\text{H}_{30}\text{N}_6\text{O}_5$: C, 63.38; H, 5.70; N, 15.84. found C, 63.25; H, 5.59; N, 15.72.

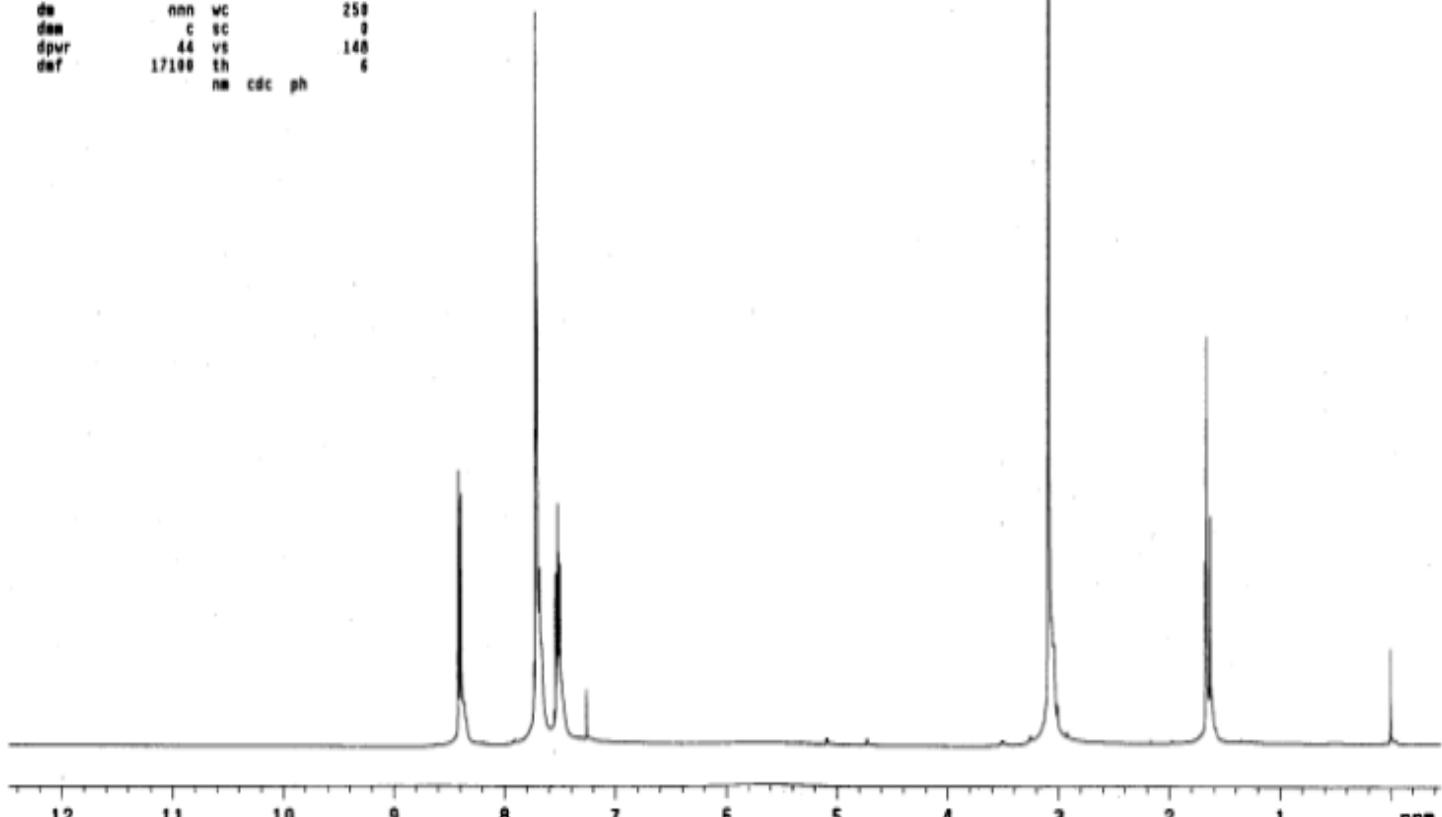
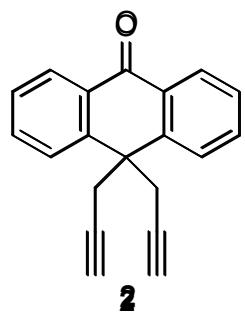
4,4'-(10-((1-benzyl-1H-1,2,3-triazol-4-yl)methoxy)-9,10-dihydroanthracene-9,9-diyl)bis(methylene))bis(1-benzyl-1H-1,2,3-triazole) (13): Yield = 0.510 g, 72%, Semi-solid, ^1H NMR (400 MHz, CDCl_3): δ 7.50 (d, J = 8.0 Hz, 2H), 7.34-7.32 (m, 5H), 7.27-7.15 (m, 12H), 6.97-6.95 (m, 2H), 6.75 (d, J = 7.2 Hz, 2H), 6.28 (s, 1H), 5.71 (s, 1H), 5.42 (s, 2H), 5.11-5.09 (m, 4H), 5.07 (s, 2H), 3.81 (s, 2H), 3.71 (s, 2H), 3.64 (s, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 145.7, 144.4, 144.2, 140.2, 134.9, 134.7, 134.6, 129.0, 128.8, 128.7, 128.4, 128.3, 128.2, 128.1, 127.8, 127.2, 127.1, 126.8, 122.7, 122.5, 121.8, 74.5, 58.3, 53.9, 53.5, 53.3, 47.1, 40.7, 38.4; IR (KBr) ν_{max} 3135, 3061, 3031, 2925, 2847, 1603, 1544,

1496, 1453, 1325, 1217 cm⁻¹; Anal. calcd for C₄₄H₃₉N₉O: C, 74.45; H, 5.54; N, 17.76. found C, 74.32; H, 5.46; N, 17.64.

¹H NMR spectra of **2**

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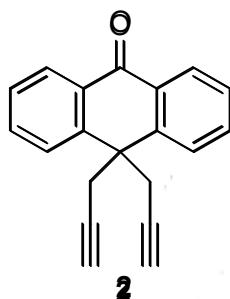


¹³C NMR spectra of **2**

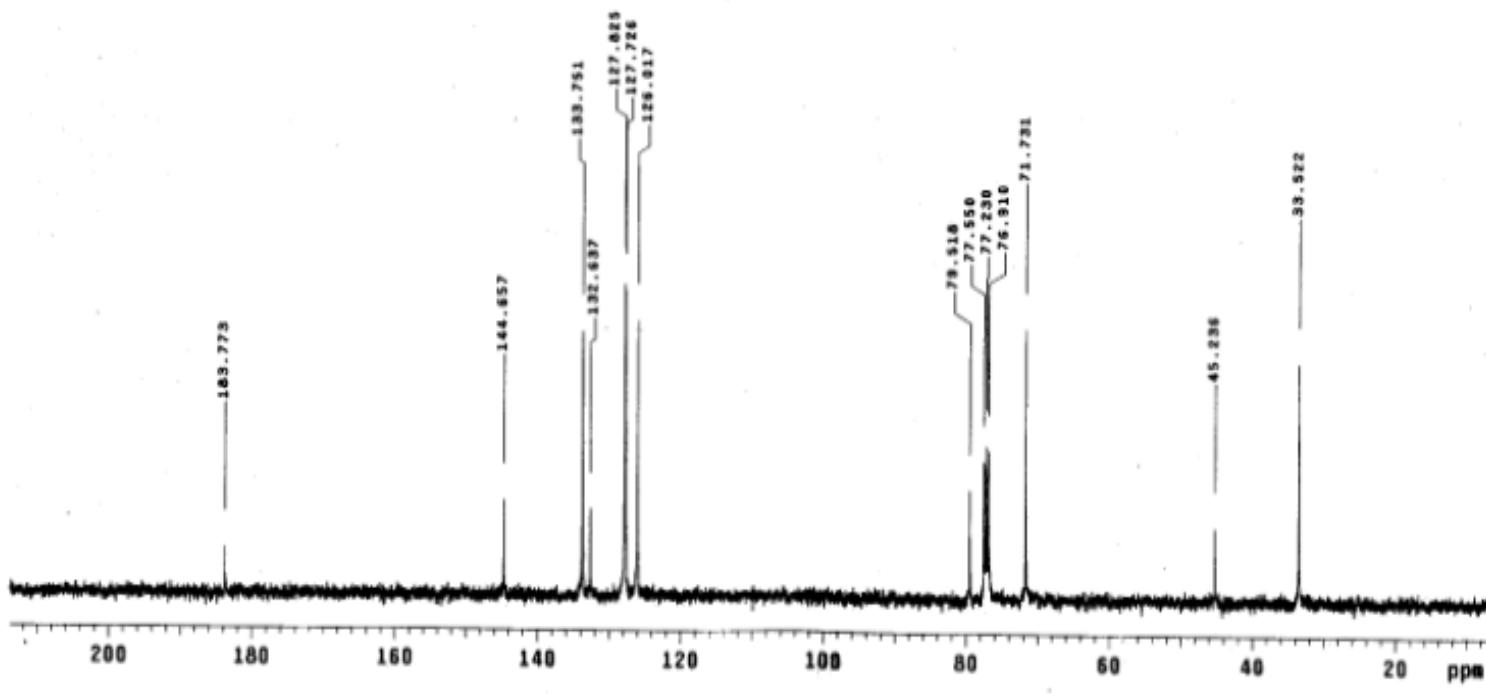
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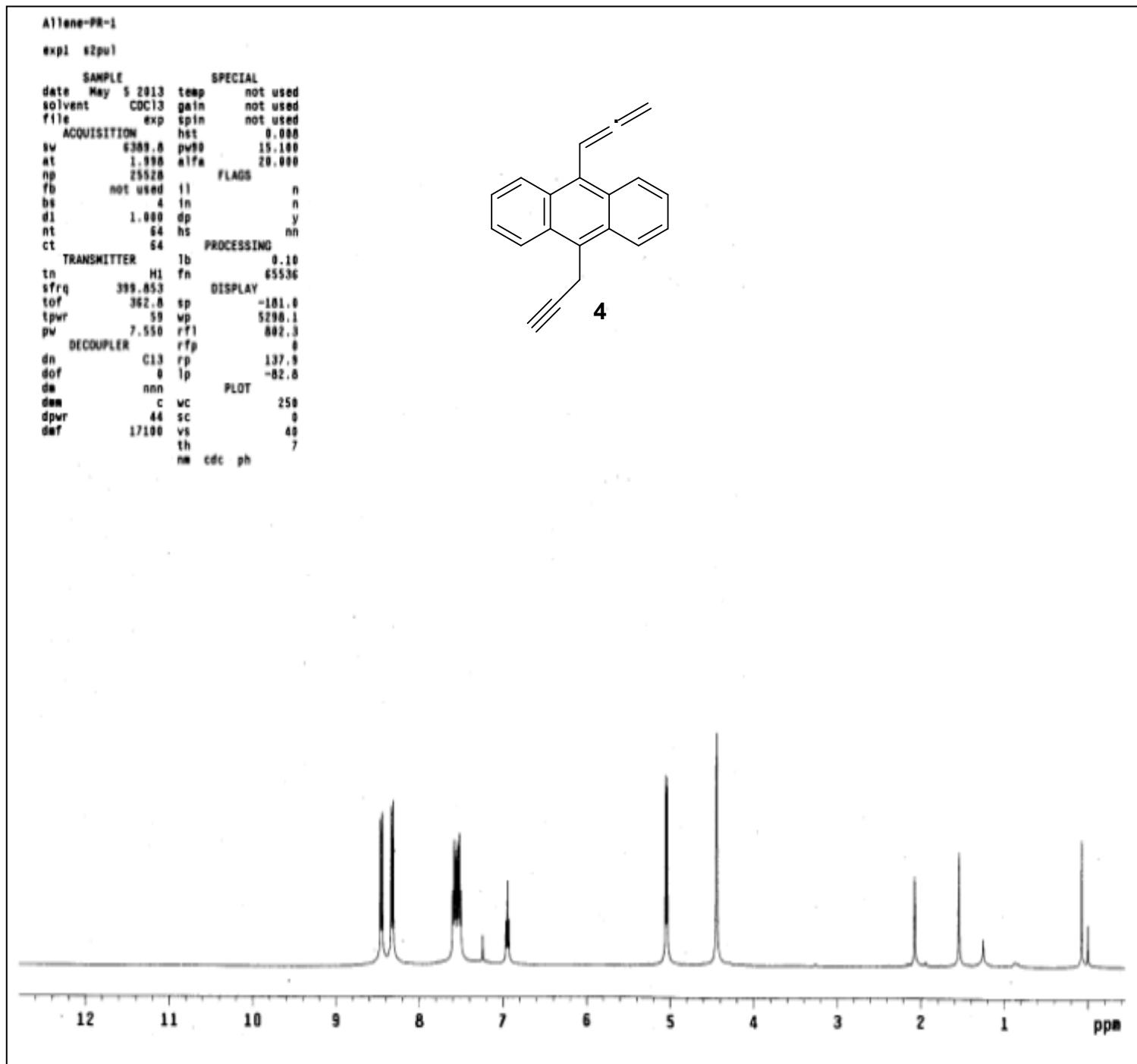
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sw 25125.6 FLAGS
at 1.159 11 n
np 68270 tn n
rb 13800 dp y
bs 10 hs nn
d1 1.000 PROCESSING
nt 2800 tb 2.00
ct 510 fn 65536
TRANSMITTER DISPLAY
tn C13 tp 666.7
sfreq 108.554 wp 28833.1
tof 1536.3 rf1 9276.7
tpwr 61 rfp 7764.8
pw 4.788 rp -55.2
DECOUPLER lp -388.5
dn H1 PLOT
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de yyy sc 8
dme w vs 43
dpgr 42 th 6
daf 8500 nm no ph



2



¹H NMR spectra of 4

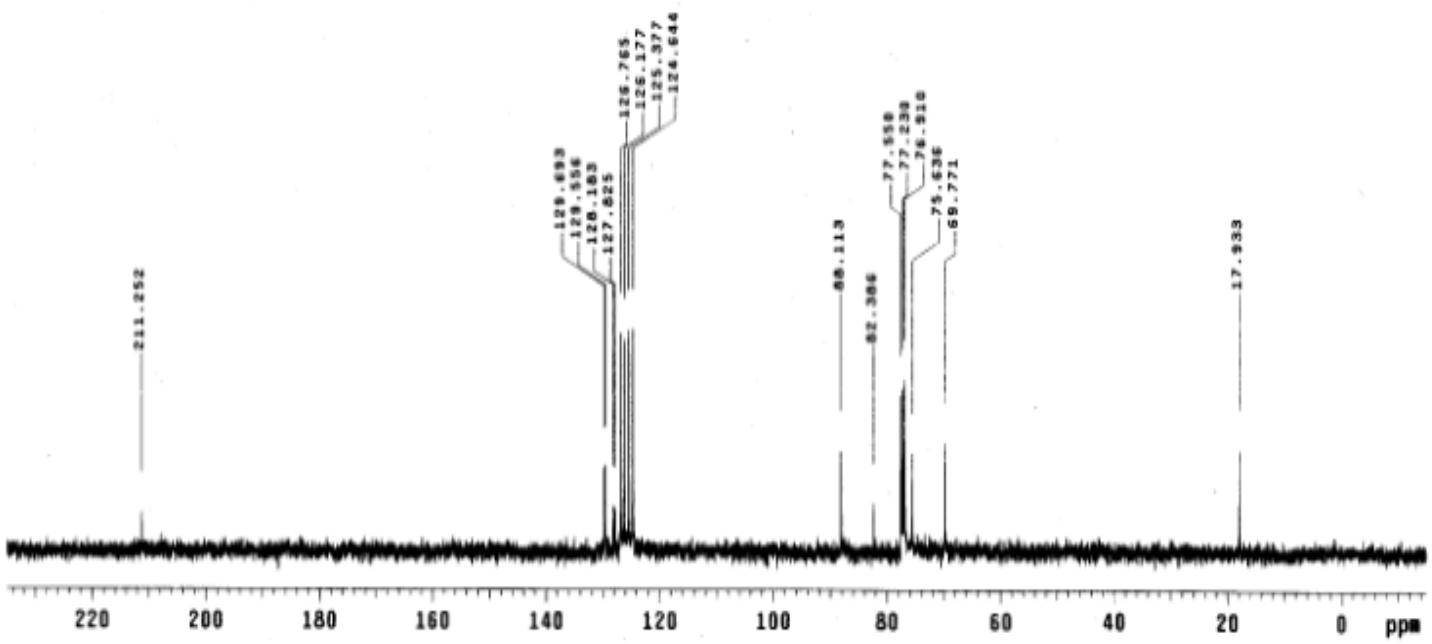
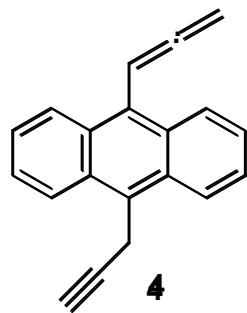


¹³C NMR spectra of 4

Allene-Pk-1-13C

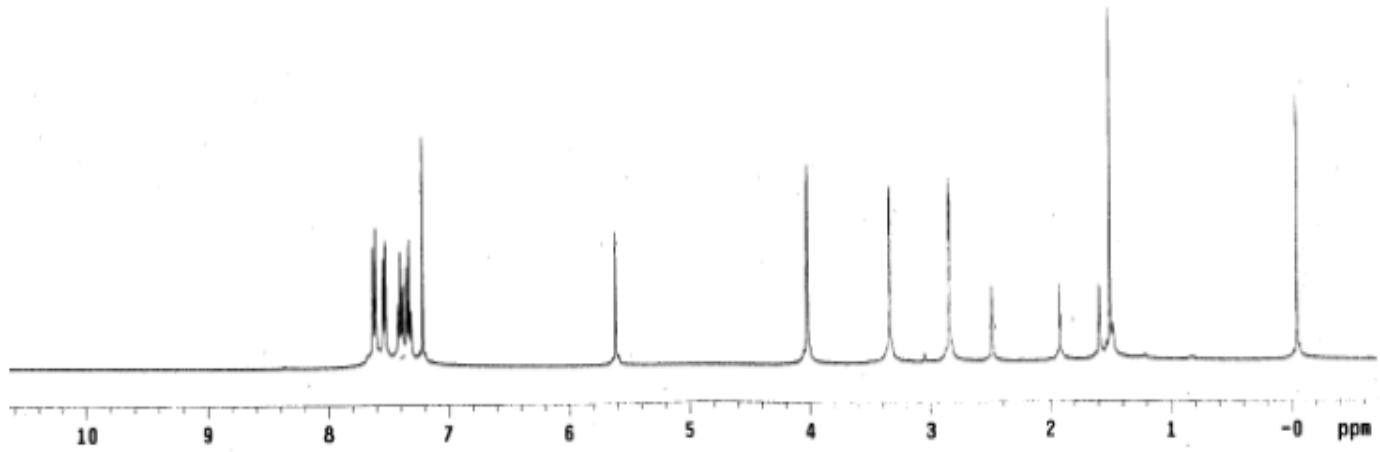
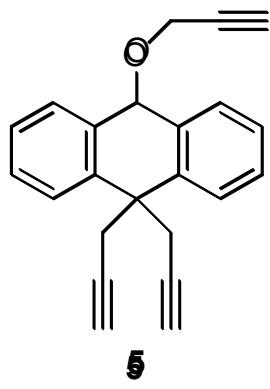
expt1 s2pu1

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solvent CDCl ₃	gain not used
file	exp spin not used
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et 1.199	alpha 20.000
np 60270	FLAGS
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bs 10	in n
di 1.000	dp y
nt 5000	hs nm
ct 400	PROCESSING
TRANSMITTER	lb 2.00
tn C13	fn 55536
sfrq 100.554	DISPLAY
tof 1536.3	sp -1511.8
tpwr 61	wp 25125.6
pw 4.700	rfl 9275.9
DECOUPLER	rfp 7764.9
dn H1	rp -82.8
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dm yyy	PLOT
dme v	wc 250
dpwr 42	sc 0
df 8500	vs 28
	th 4
nm no ph	



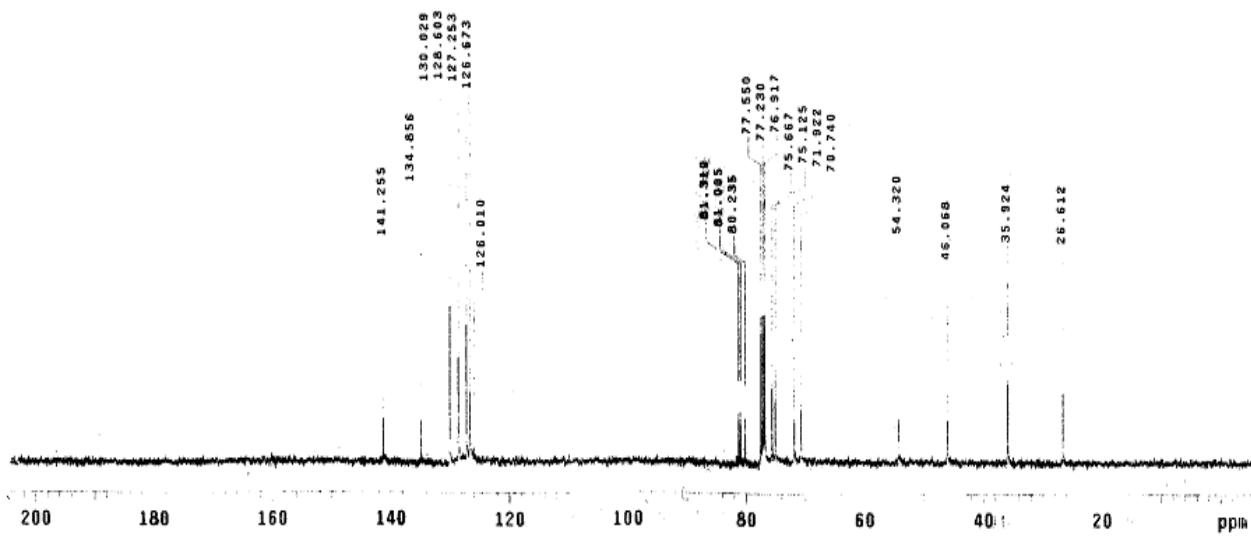
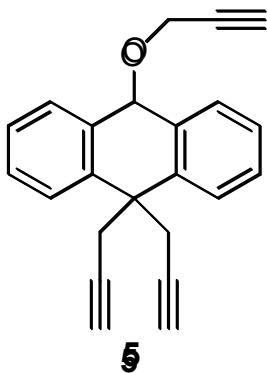
¹H NMR spectra of **5**

TRI-AKL-PR
expt s2pul
SAMPLE SPECIAL
date Sep 12 2012 temp not used
solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION hst 8.008
sw 8389.8 pw00 19.790
at 1.998 alfa 20.000
np 25528 FLAGS
tb not used tl n
bs 4 in n
di 1.000 dp y
nt 32 hs nn
et 32 PROCESSING
TRANSMITTER 1b 0.10
tn H1 fn 65536
sfrq 399.853 DISPLAY
t0f 362.8 sp -283.9
tpwr 57 wp 4550.9
pw 9.850 rfl 812.8
DECOUPLER rfp 0
dn C13 rp 101.2
dof 0 lp -79.4
dm nnn PLOT
dmn c wc 250
dpwr 50 sc 0
def 15900 vs 51
th 10
nm cdc ph



¹³C NMR spectra of 5

AKL-PR-11-13C
expi \$2pu1
SAMPLE SPECIAL
date Apr 14 2013 temp not used
solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION hst 0.008
sw 25125.6 pw88 9.400
at 1.199 alfa 20.000
np 60270 FLAGS
fb 13800 t1 n
bs 10 in n
d1 1.000 dp y
nt 5000 hs nn
ct 750 PROCESSING
TRANSMITTER 1b 2.00
tn C13 fn 65536
sfrq 100.554 DISPLAY
tof 1536.3 sp -555.6
tpwr 61 wp 21096.9
pw 4.700 rfp 9277.5
DECOUPLER rfp 7764.9
dn H1 rp -70.1
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dm yyy PLOT
dss w wc 250
dpwr 42 SC 0
dmr 8500 vs 30
th 2
nm no ph

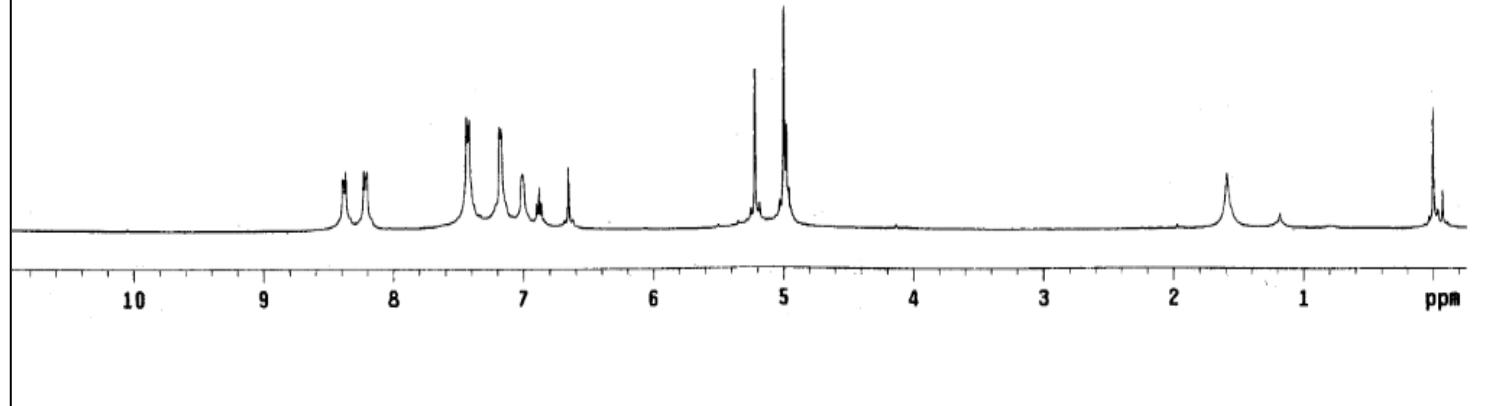
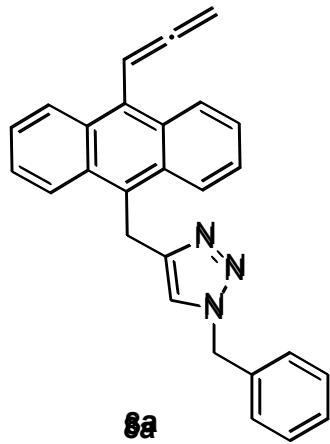


¹H NMR spectra of 8a

ALL-PR-3

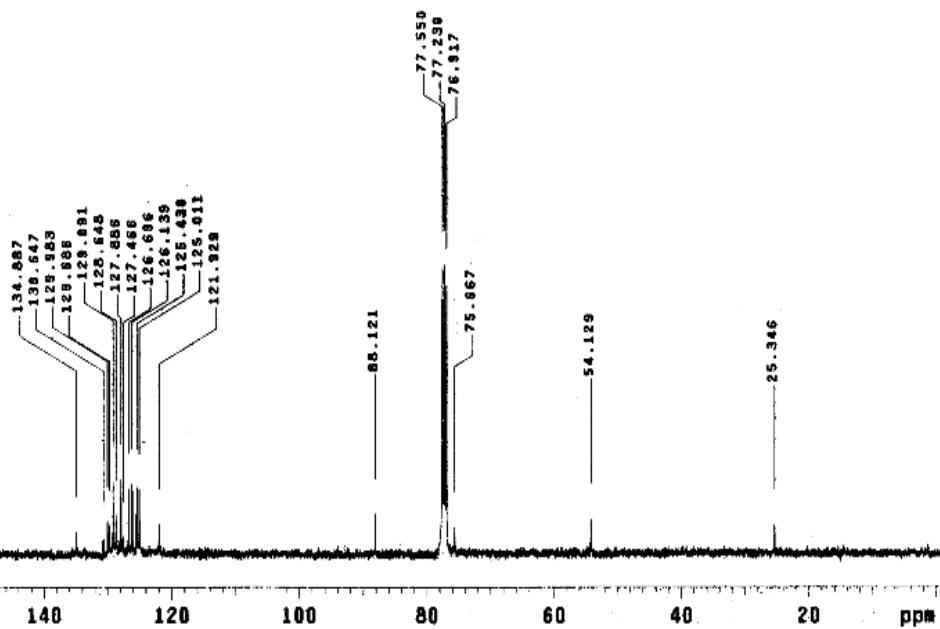
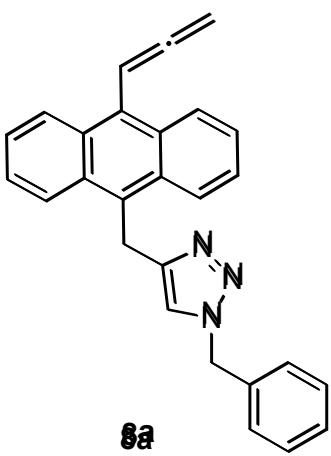
exp1 s2pul

SAMPLE SPECIAL
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solvent CDCl₃ gain not used
file exp spin not used
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sw 6389.8 pw0 19.700
at 1.998 alfa 20.000
np 25528 FLAGS
fb not used 11 n
bs 4 in n
d1 1.000 dp y
nt 32 hs nn
ct 32 PROCESSING
TRANSMITTER 1b 0.10
tn H1 fn 65536
sfrq 399.853 DISPLAY
tof 362.8 sp -103.7
tpwr 57 wp 4500.6
pw 9.850 rfl 825.7
DECOUPLER C13 rp 0
dn C13 rp 101.9
dof 0 1p -78.1
dm nnn PLOT
dmm c wc 250
dpwr 58 sc 0
def 15900 vs 30
th 17
nm cdc ph



¹³C NMR spectra of **8a**

ALL-PR-3-13C
expi 92pul
SAMPLE SPECIAL
date May 5 2012 temp not used
solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION hst 0.808
sw 25125.6 pw90 18.608
at 1.199 alfa 20.808
np 60270 FLAGS
fb 13800 i1 n
bs 18 in n
di 1.008 dp y
nt 10000 hs nn
ct 4548 PROCESSING
TRANSMITTER 1b 2.00
tn C13 fn 65536
sfreq 100.554 DISPLAY
tof 1536.3 sp -87.5
tpwr 61 wp 22714.8
pw 9.380 rfp 9272.1
DECOUPLER rfp 7764.5
dn H1 rfp -24.2
dof 0 1p -420.0
dm VVY PLOT
dmm v wc 250
dpwr 42 sc 0
dmr 8980 vs 41
th 2
nm no ph

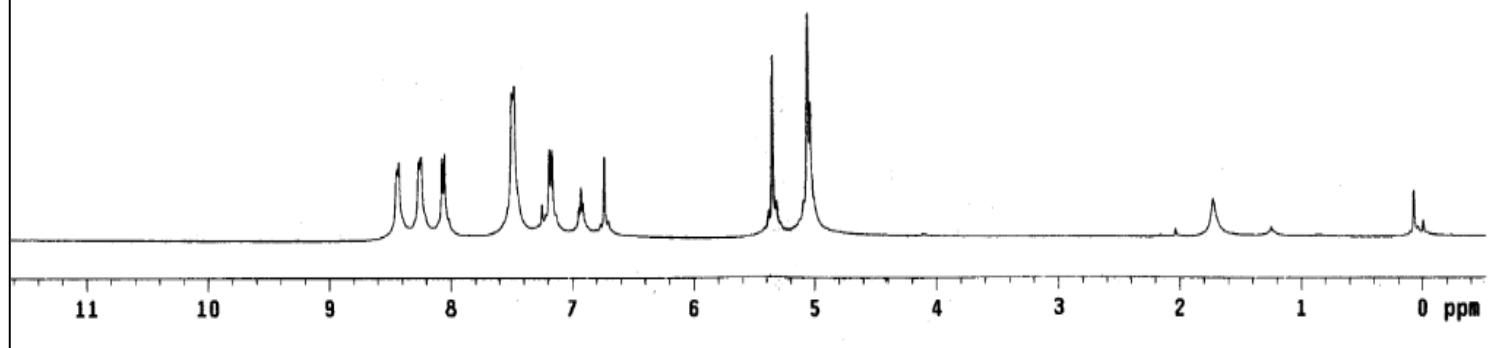
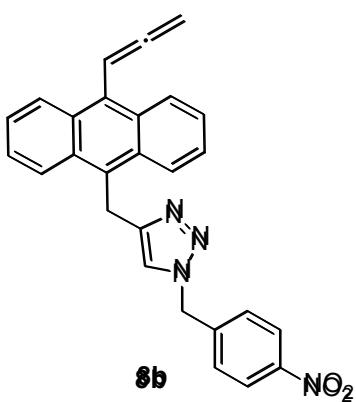


¹H NMR spectra of **8b**

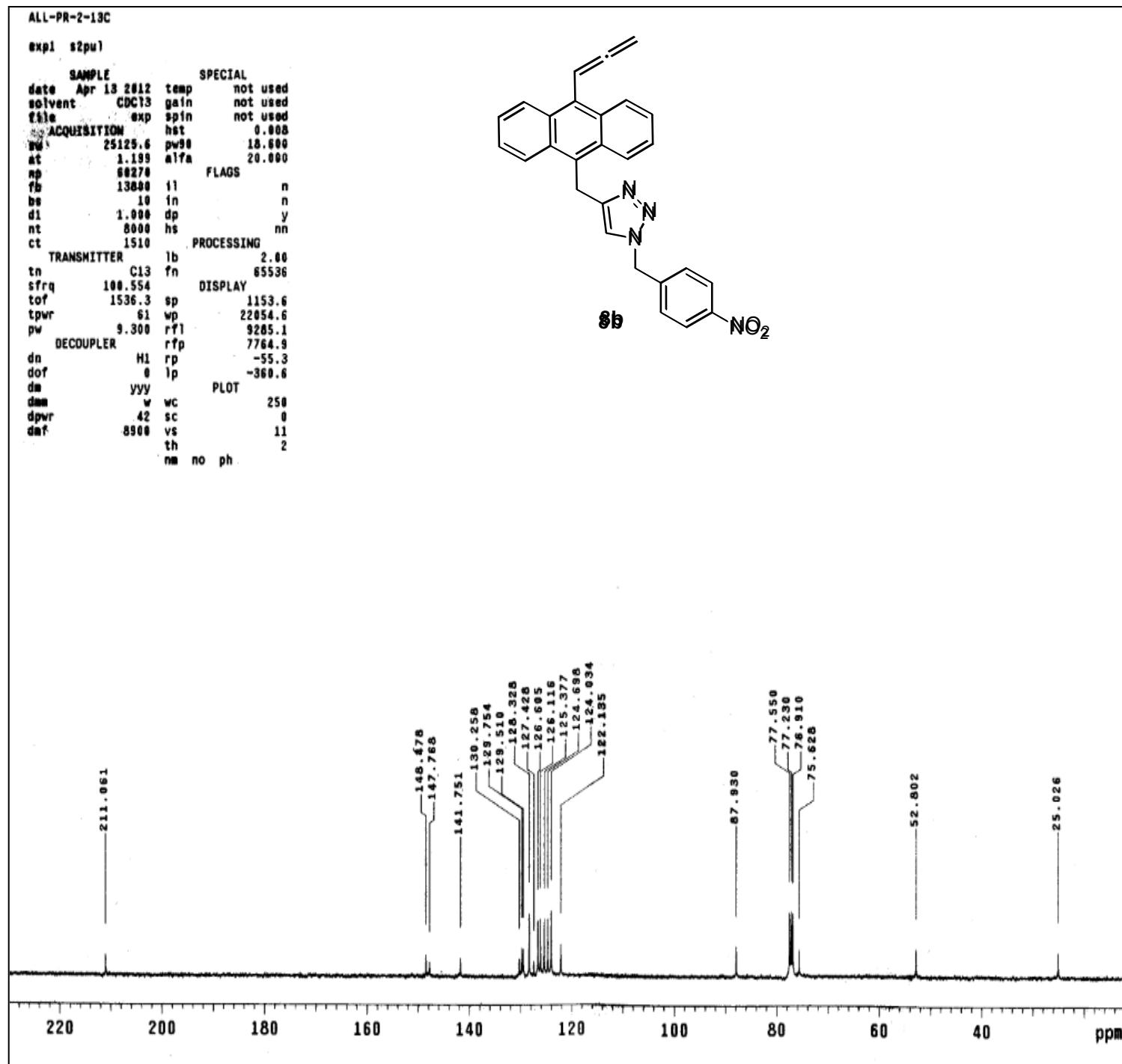
ALL-PR-2

exp1 s2pu1

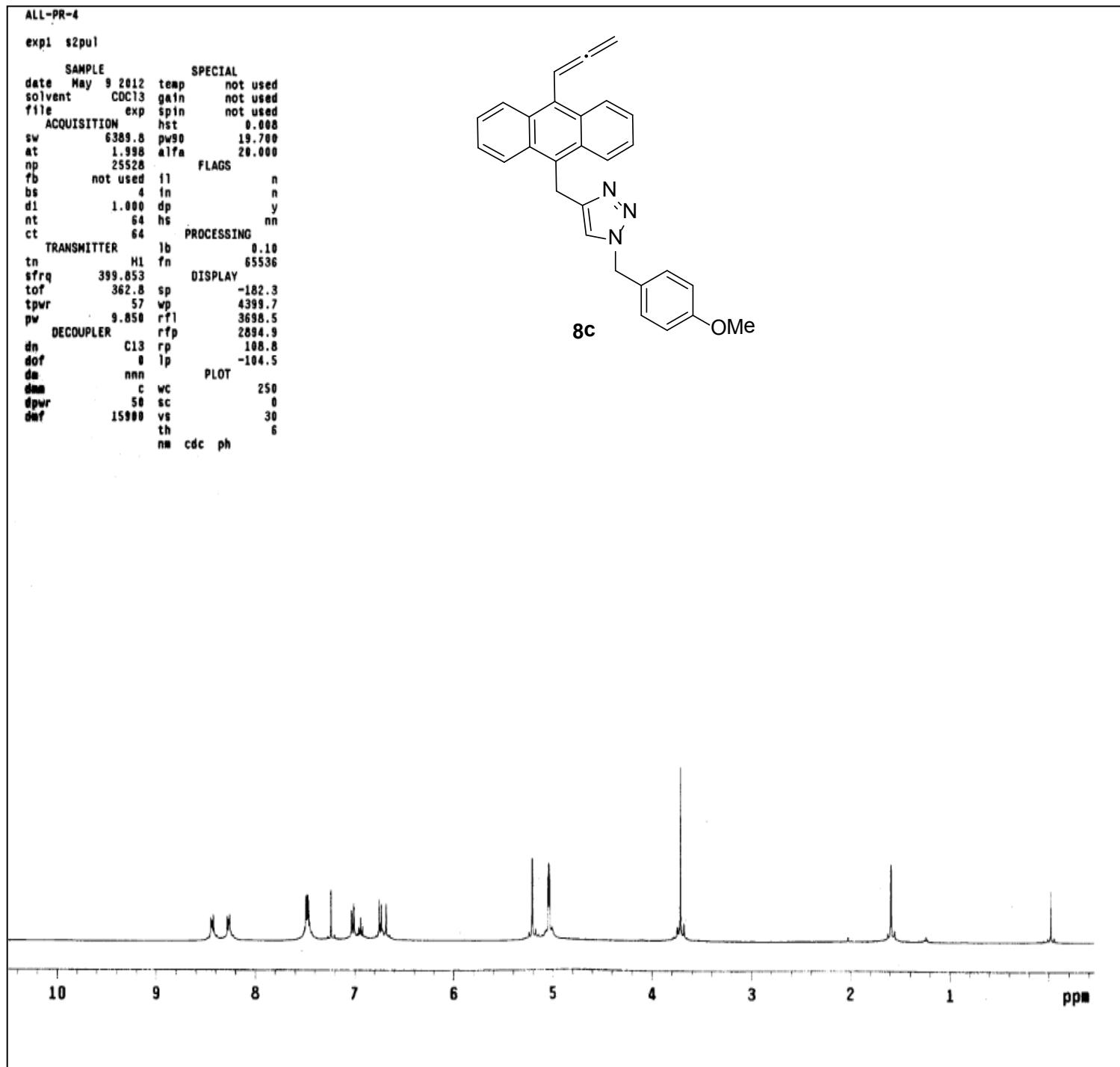
SAMPLE SPECIAL
date Apr 13 2012 temp not used
solvent CDCl₃ gain not used
file exp spin not used
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sw 6389.8 pw90 19.700
at 1.998 alfa 20.000
np 25528 FLAGS
fb not used f1 n
bs 4 in
d1 1.000 dp y
nt 64 hs nn
ct 64 PROCESSING
TRANSMITTER 1b 0.10
tn M1 fn 65536
sfrq 399.853 DISPLAY
tof 362.8 sp -210.8
tpwr 57 wp 4869.9
pw 9.850 rfp 3697.5
DECOUPLER C13 rp 2898.9
dn C13 rp 94.8
dof 0 lp -76.7
da nnn PLOT
dme c wc 250
dpwr 50 sc 0
def 15800 vs 30
th 23
nm cdc ph



¹³C NMR spectra of **8b**

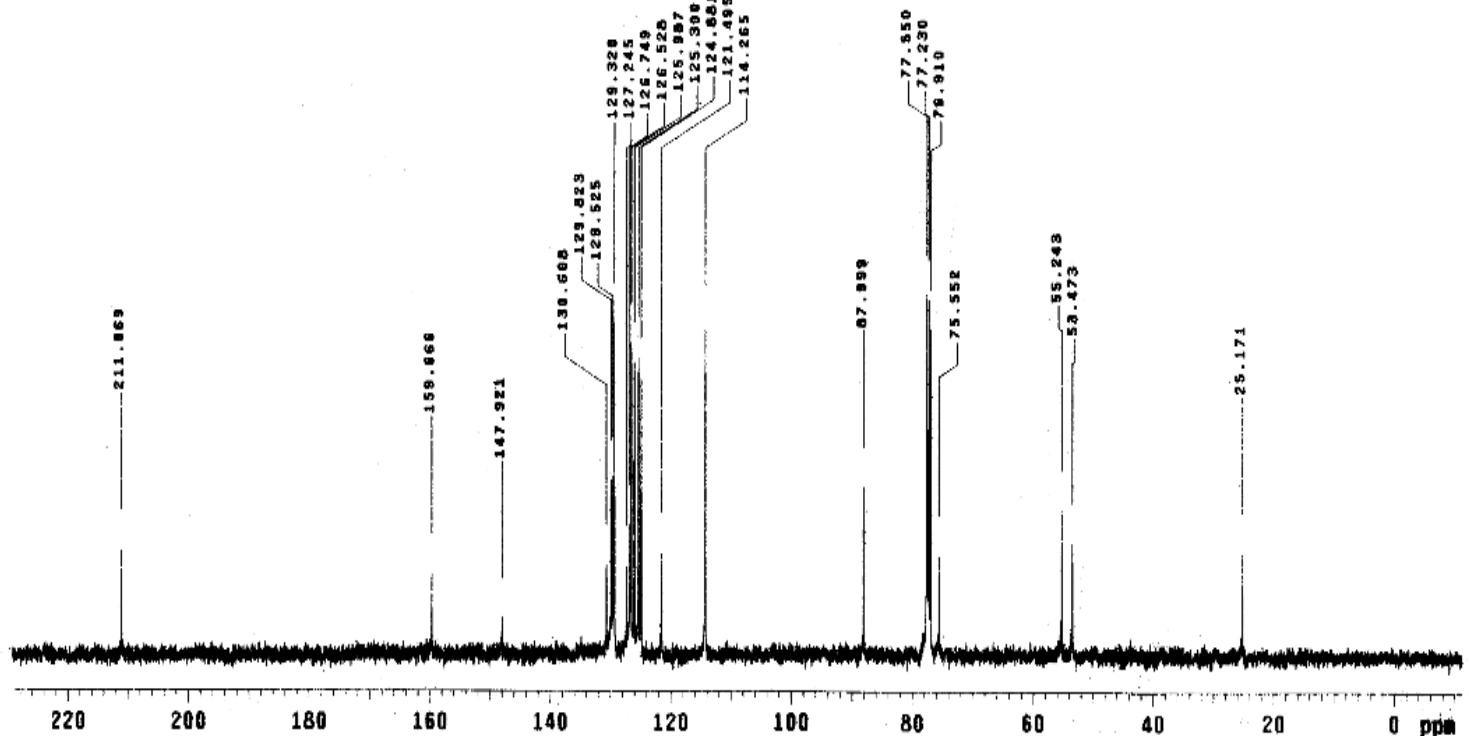
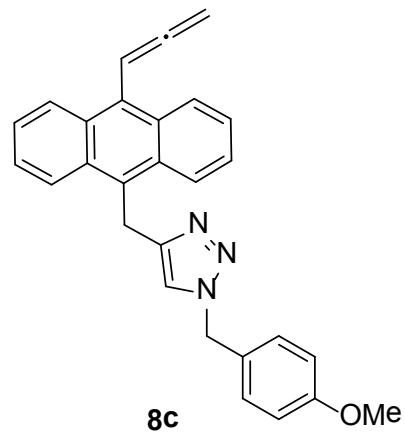


¹H NMR spectra of 8c



¹³C NMR spectra of 8c

ALL-PR4-13C
expi t2pul
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solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION hst 0.008
sw 25125.6 pw0 18.600
at 1.195 alfa 20.000
np 60276 FLAGS
fb 13800 f1 n
bs 4 in n
d1 1.000 dp y
nt 5000 hs nn
ct 1218 PROCESSING
TRANSMITTER 1b 2.00
tn C13 fn 65536
sfrq 100.554 DISPLAY
t0f 1536.3 sp -1126.9
tpwr 61 wp 24167.9
pw 9.300 rfp 9267.4
DECOUPLER H1 rfp 7764.9
dn 1H rp -41.4
dor 0 lp 002.6
dm yyy PLOT %
dme w vc 250
dpwr 42 sc 0
dmf 8900 vs 46
th 4
nm no ph

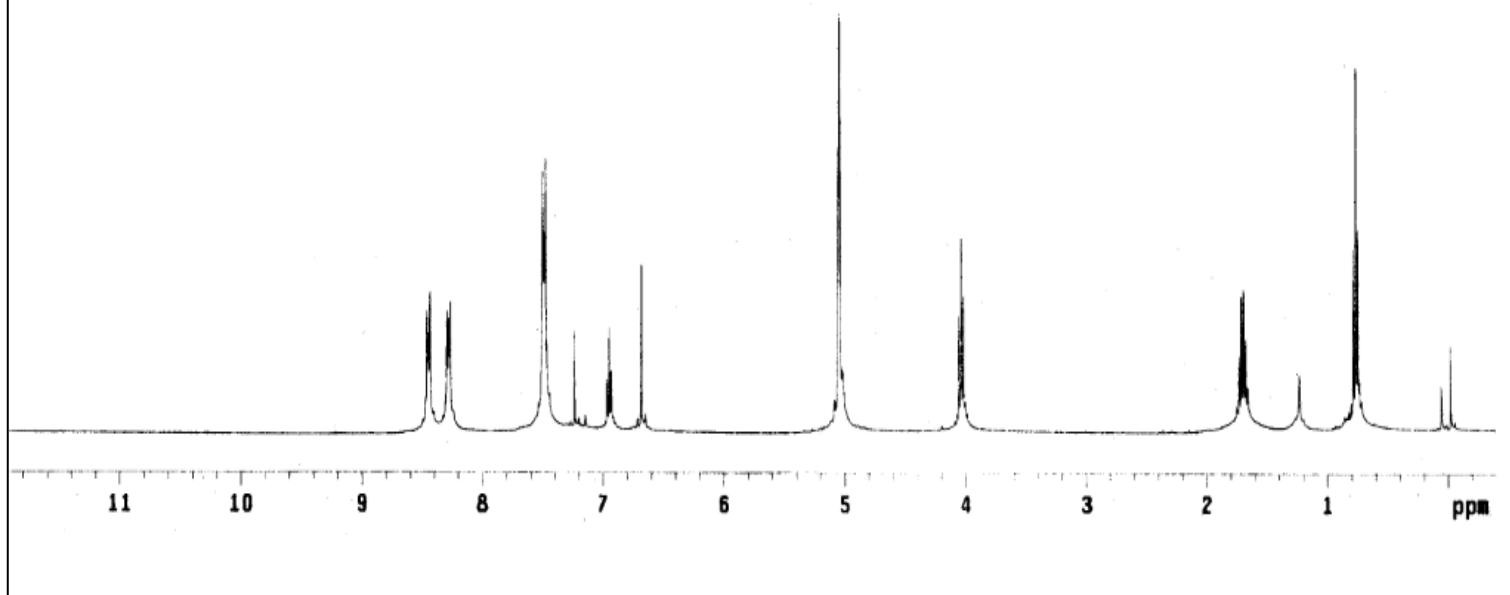
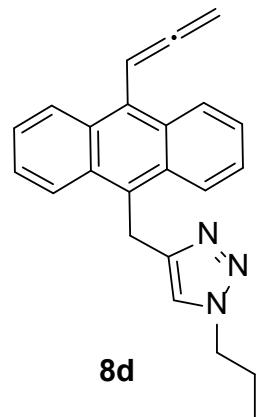


¹H NMR spectra of **8d**

ALL-PR-9

exp1 s2pul

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solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION hst 0.008
sw 6389.8 pw0 19.700
at 1.998 alfa 20.000
np 25528 FIDQ9S
fb not used t1 n
bs 4 in n
di 1.000 dp y
nt 64 hs nn
ct 64 PROCESSING
TRANSMITTER lb 0.10
tn H1 fn 65536
sfrq 399.853 DISPLAY
tof 362.8 sp -156.9
tpwr 57 wp 4979.1
pw 9.850 rfl 3698.3
DECOUPLER rfp 2884.9
dn C13 rp 104.1
dof 0 lp -76.3
dm nnn PLOT
dmm c wc 250
dpwr 50 sc 0
dmf 15900 vs 55
th 26
nm cdc ph

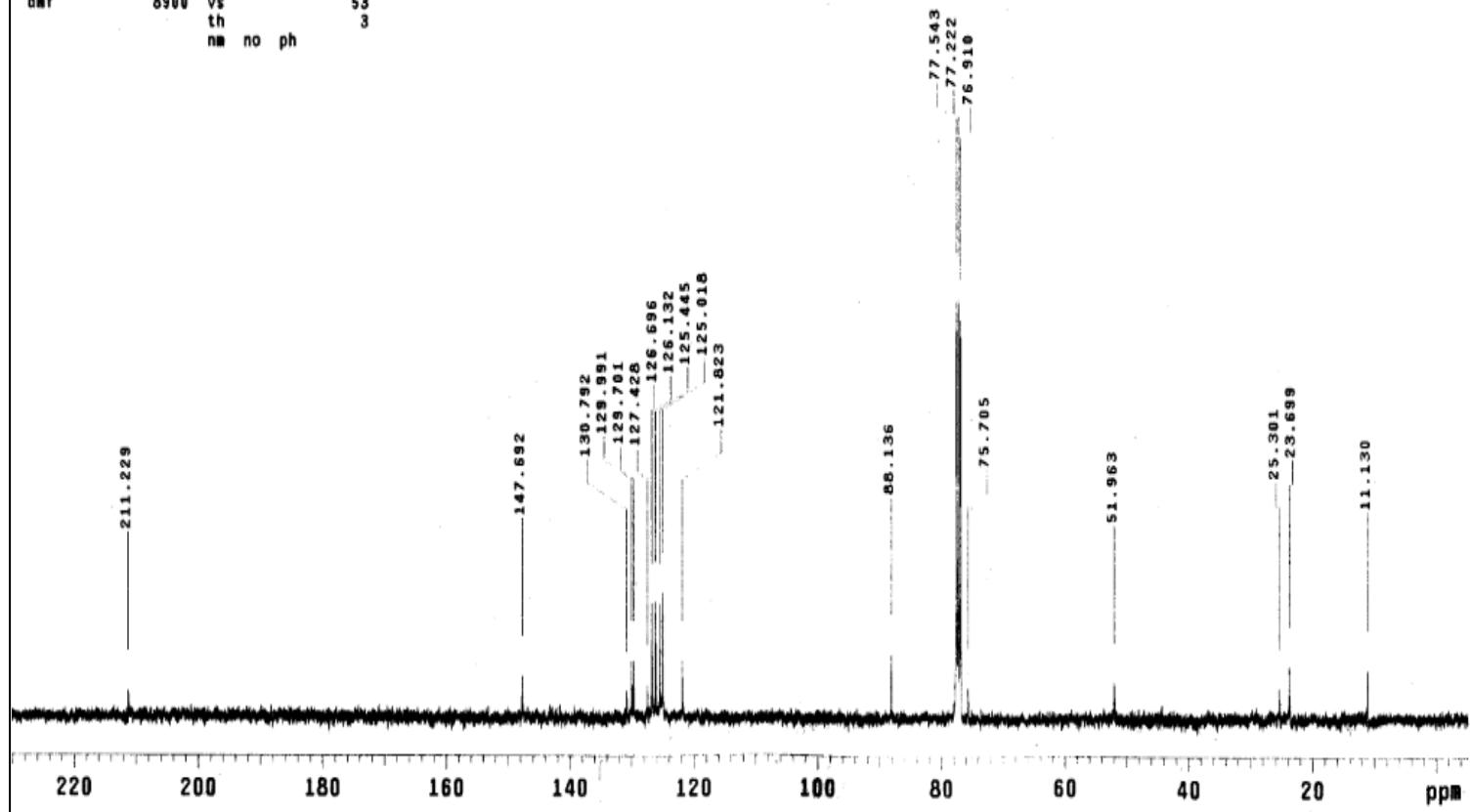
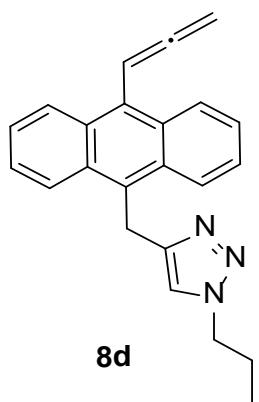


¹³C NMR spectra of **8d**

ALL-PR-9-13C

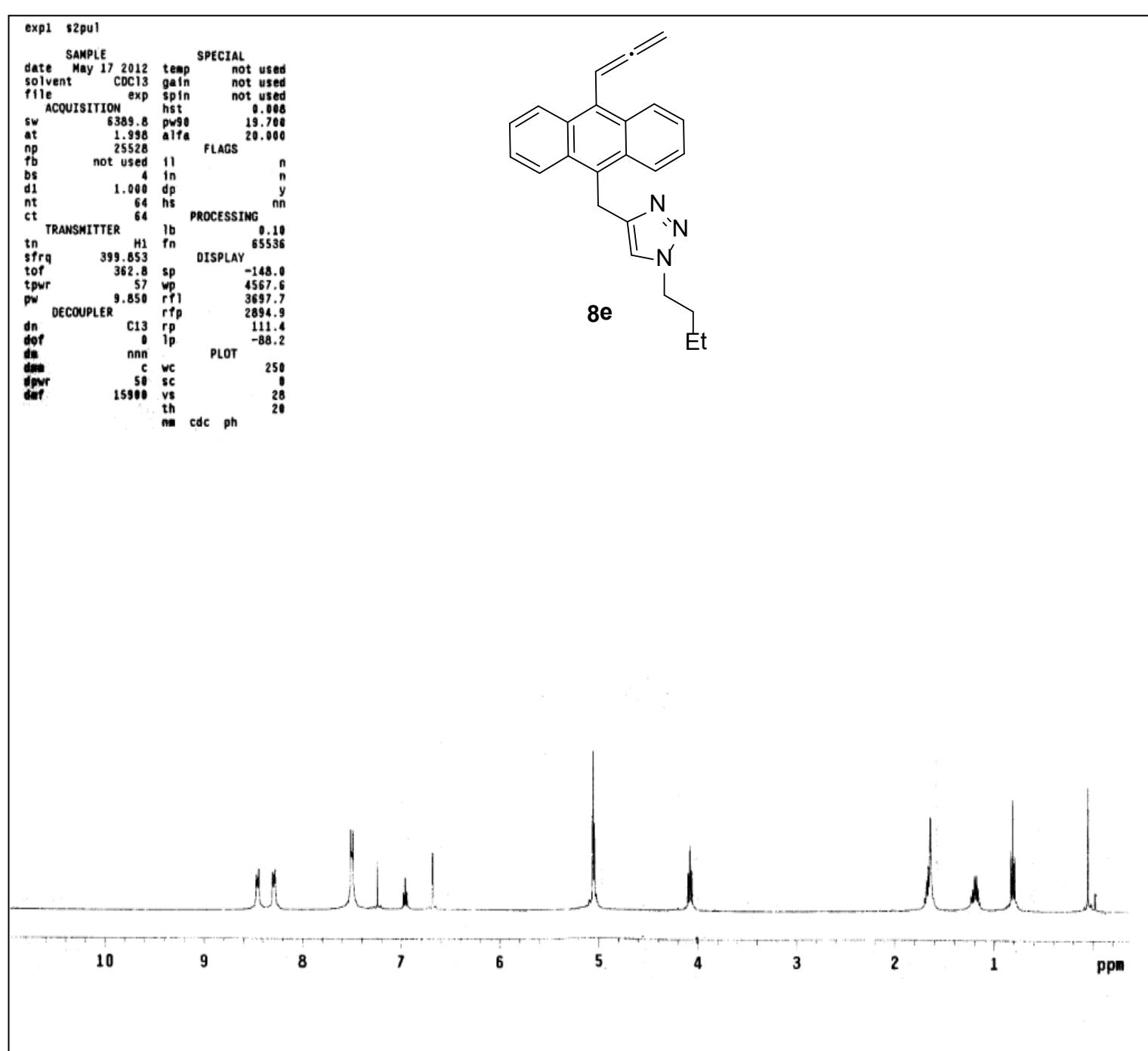
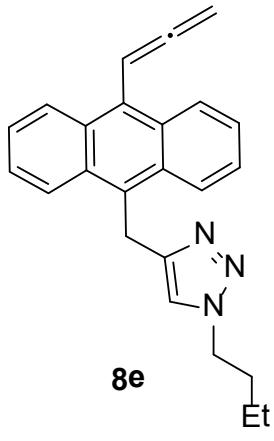
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solvent CDCl₃ gain not used
file exp spin not used
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at 1,199 alfa 20.000
np 60270 FLQOS
fb 13800 ll n
bs 10 in n
d1 1,000 dp y
nt 5000 hs nn
ct 2390 PROCESSING
TRANSMITTER lb 2.00
tn C13 fn 65536
sfrq 100.554 DISPLAY
tof 1536.3 sp -518.0
tpwr 61 wp 23870.4
pw 9.300 rfl 9272.9
DECOUPLER rfp 7764.9
dn H1 rp -16.0
dof 0 1p -412.5
dm yyy PLOT
dmm w wc 258
dpwr 42 sc 0
dmf 8900 vs 53
th 3
nm no ph



¹H NMR spectra of 8e

```
exp1 s2pul
SAMPLE          SPECIAL
date  May 17 2012 temp    not used
solvent   CDCl3 gain     not used
file      exp  spin    not used
ACQUISITION hst      0.008
sw       6389.8 pw90    19.700
at       1.998 alfa   20.000
np       25528  FLAGS
fb      not used 11      n
bs        4 in      n
dl      1.000 dp      y
nt       64 hs      nn
ct       64 PROCESSING
TRANSMITTER 1b      0.10
tn      H1 fn      65536
sfrq    399.853 DISPLAY
tof      362.8 sp      -148.0
tpwr    57 wp      4567.6
pw      9.850 rfl     3697.7
DECOUPLER rfp     2894.9
dn      C13 rp      111.4
def      0 lp      -88.2
dm      nnn PLOT
dme      c wc      250
dpwr    50 sc      0
dref    15900 vs      28
th      20
nm cdc ph
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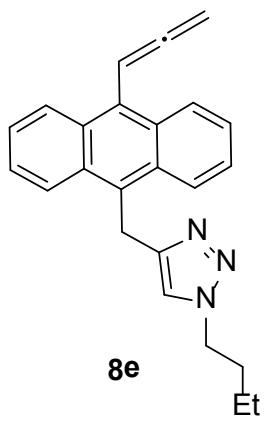


¹³C NMR spectra of 8e

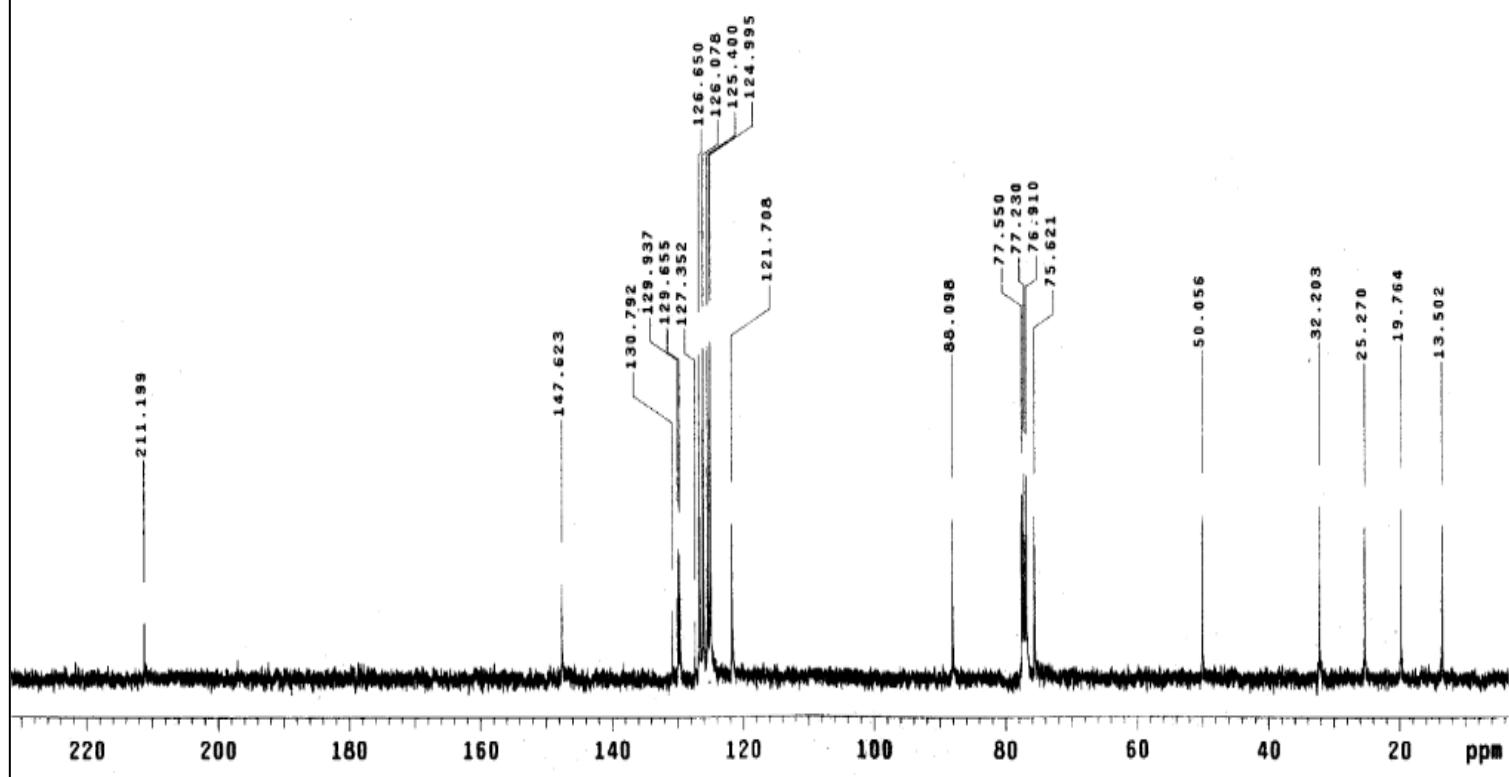
ALL-PR-7R-13C

expt s2pu1

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solvent CDCl₃ gain not used
file exp spin not used
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at 1.199 alfa 20.000
np 60270 FLAGS
fb 13800 t1 n
bs 10 in n
di 1.000 dp y
nt 5000 hs nn
ct 590 PROCESSING
TRANSMITTER 1b 2.00
tn C13 fn 65536
sfrq 100.554 DISPLAY
tof 1536.3 sp 336.9
tpwr 61 wp 22946.4
pw 4.700 rf1 9276.7
DECOUPLER rfp 7764.9
dn H1 rp -38.1
dof 0 lp -339.7
de yyy PLOT
dss w wc 250
dpw 42 sc 0
def 8500 vs 41
th 4
nm no ph



8e



¹H NMR spectra of **8f**

ALL-PR-8

exp1 s2pu1

SAMPLE SPECIAL

date Jun 5 2012 temp not used

solvent CDCl₃ gain not used

file exp spin not used

ACQUISITION hst 0.008

sw 6389.8 pw90 19.700

at 1.998 alfa 20.000

np 25528 FLAGS

fb not used 11 n

bs 4 in n

di 1.000 dp y

nt 64 hs nn

ct 64 PROCESSING

TRANSMITTER lb 0.10

tn H1 fn 65536

sfrq 399.853 DISPLAY

tof 362.8 sp -80.7

tpwr 57 wp 4702.0

pw 9.850 rfp 3697.5

DECOUPLER rfp 2894.9

dn C13 rp 114.5

dof 0 lp -84.3

dm nnn PLOT

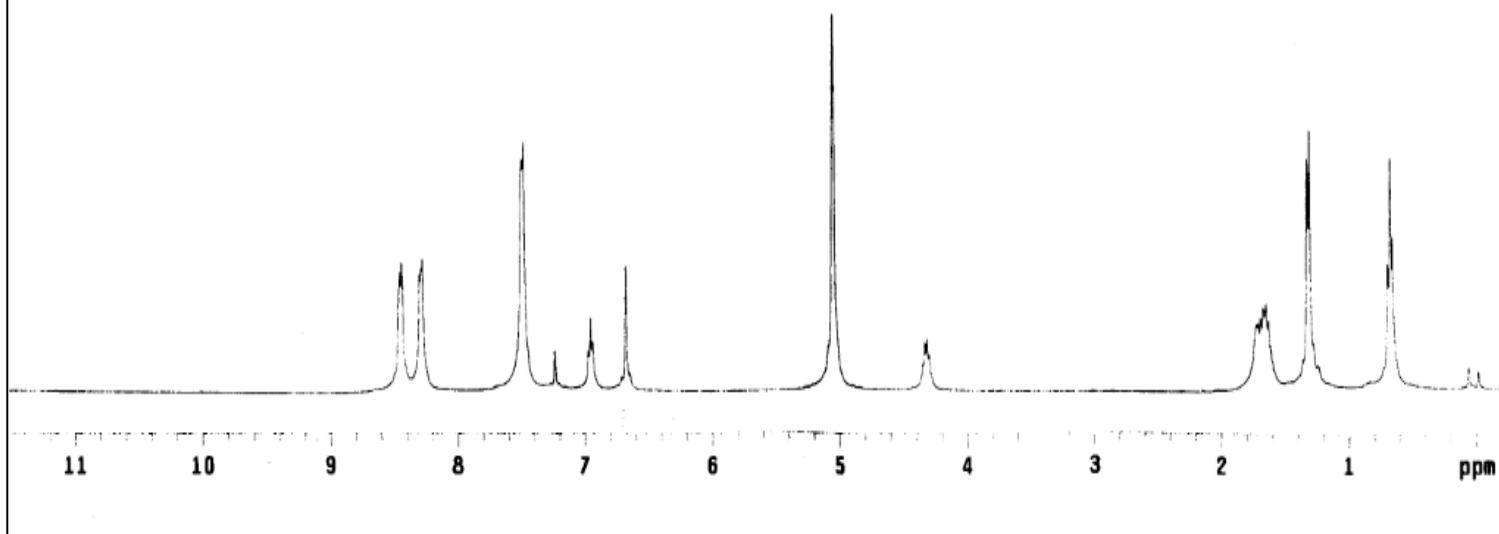
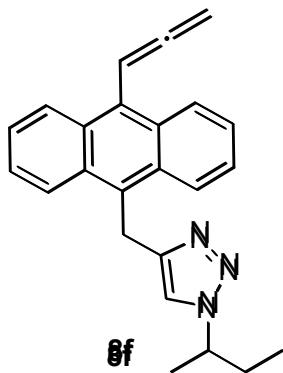
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dppr 50 sc 0

dat 15900 vs 48

th 6

nm cdc ph

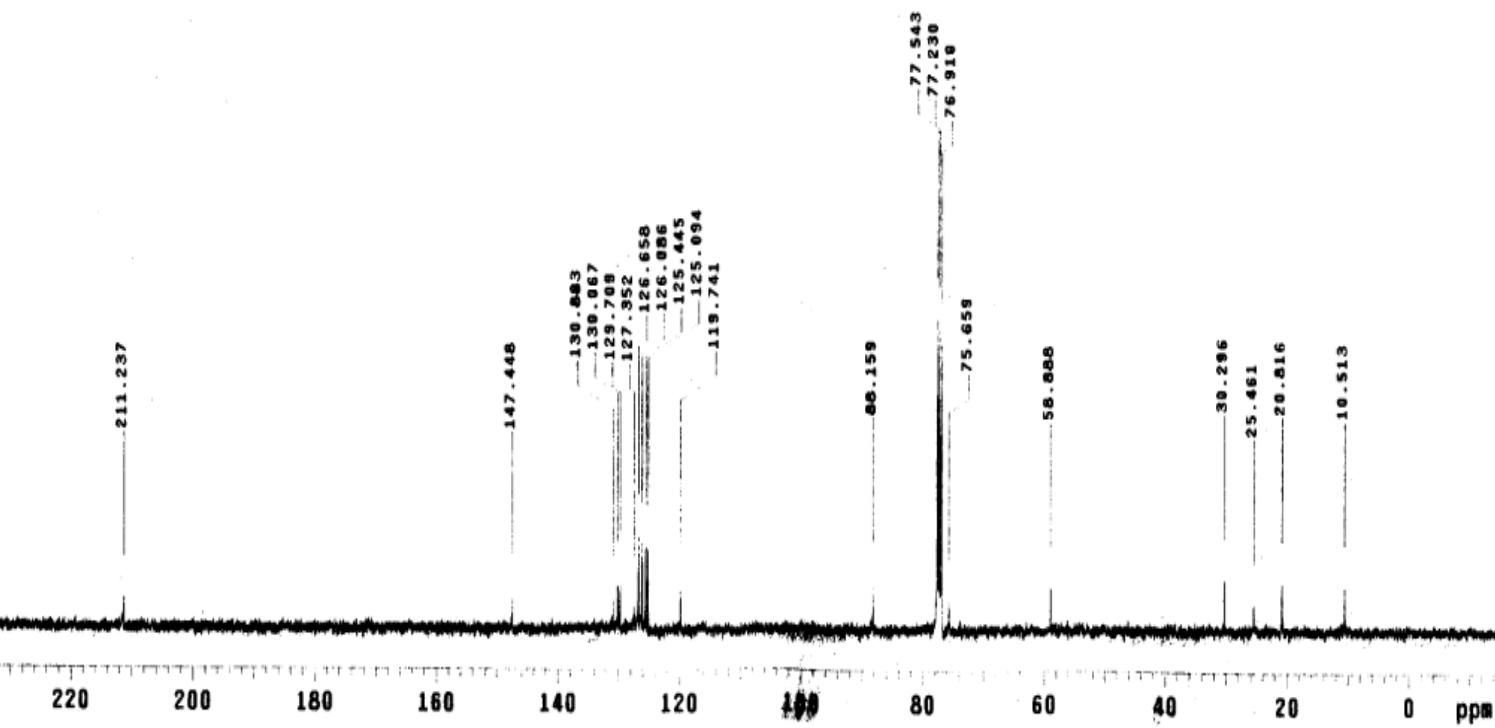
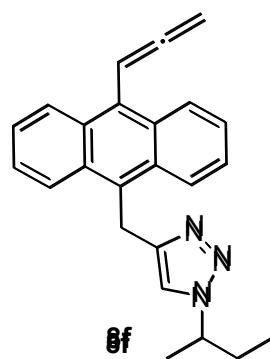


¹³C NMR spectra of **8f**

ALL-PR-8-13C

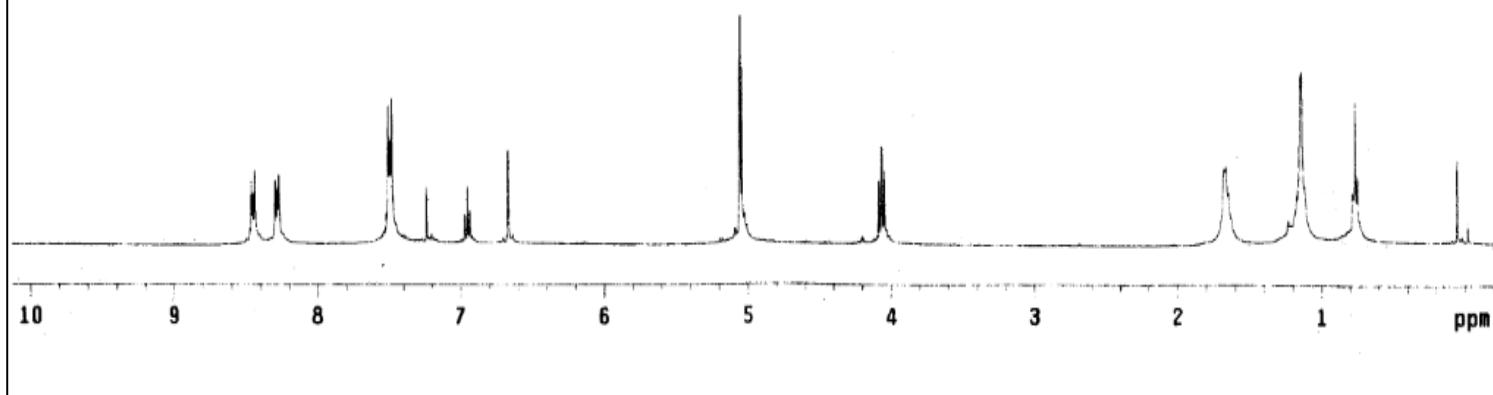
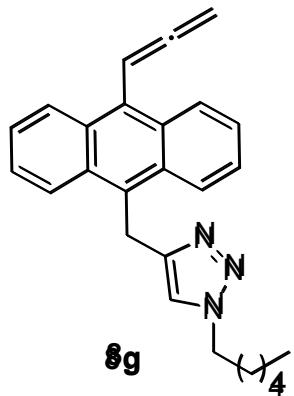
expi t2pul

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solvent CDCl₃ gain not used
file exp spin not used
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at 1.199 alfa 20.000
np 60270 FLAGS
fb 13800 11 n
bs 10 in n
d1 1.000 dp y
nt 15000 hs nn
ct 1530 PROCESSING
TRANSMITTER lb 2.00
tn C13 fn 65536
sfrq 100.554 DISPLAY
tof 1536.3 sp -1508.0
tpwr 61 wp 25125.6
pw 9.388 rfp 9272.9
DECOUPLER rfp 7764.9
dn H1 rp -68.5
dof 0 lp -271.4
dp vyy PLOT
dme w vc 250
dpvr 42 sc 0
def 8900 vs 37
th 2
nm no ph



¹H NMR spectra of 8g

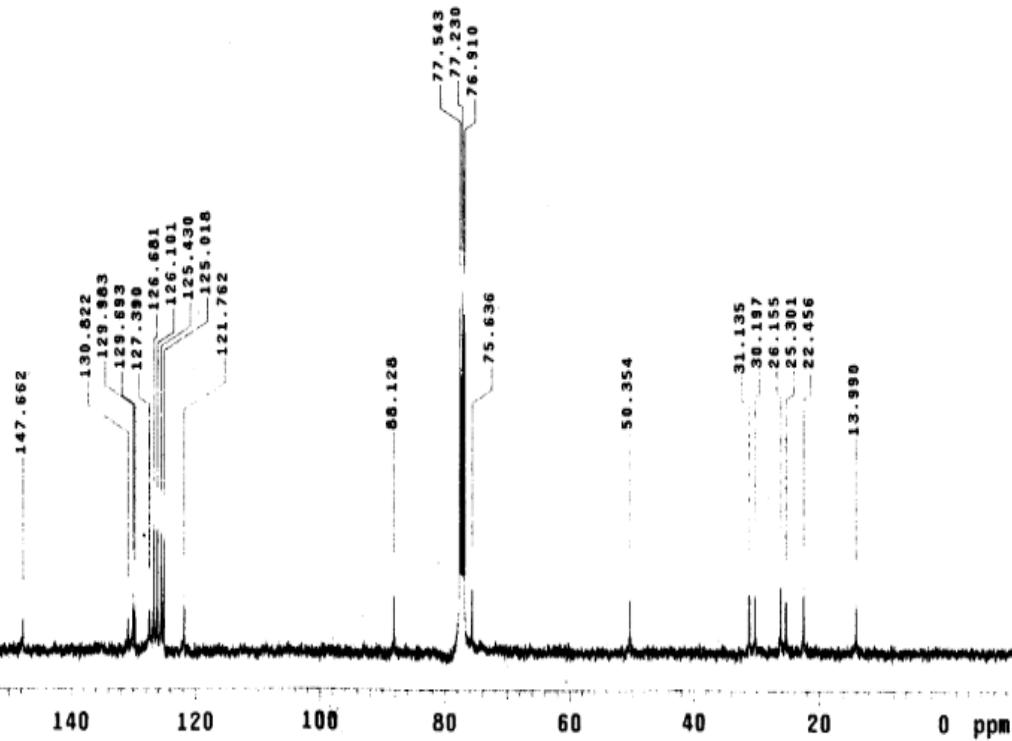
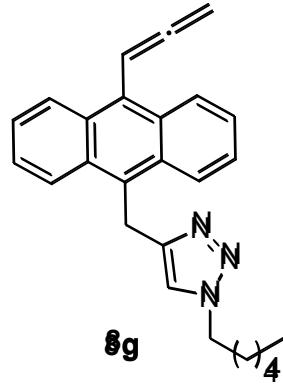
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solvent   CDCl3 gain  not used
file      exp spin  not used
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sw       6389.8 pw90  19.700
at        1.998 alfa  20.000
np       25528   FLAGS
fb      not used 1l      n
bs        4   fn      n
di      1.000 dp      y
nt        64   hs      nn
ct        64   PROCESSING
TRANSMITTER 1b      0.10
tn      H1 fn    65536
sfrq   399.853   DISPLAY
t0f     362.8 sp    -88.7
tpwr    57 wp    4139.4
pw      9.858 rfp   3697.1
DECOUPLER   rfp   2894.9
dn      C13 rp    103.9
dof      0 lp    -88.8
dm      nnn PLOT
dmm      c wc    250
dpwr    50 sc      0
dmf    15900 vs      29
th      th      20
nm cdc ph
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¹³C NMR spectra of 8g

ALL-PR-6-13C
expt s2pul

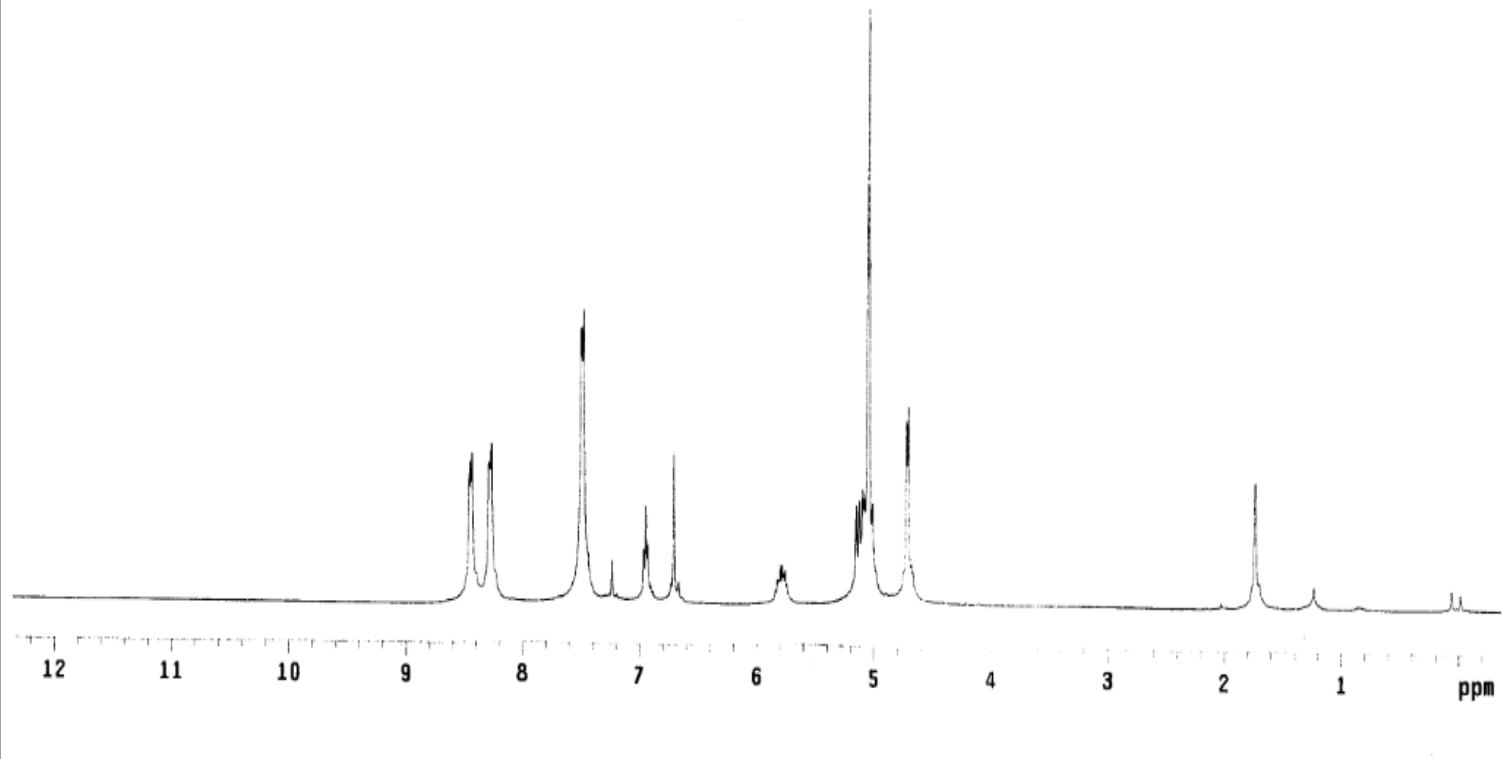
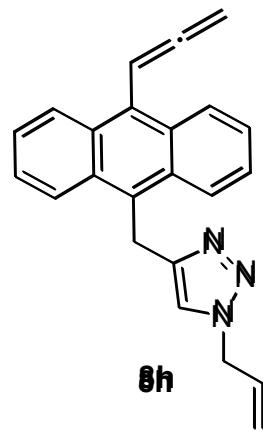
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date May 19 2012 temp not used
solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION hst 0.008
sw 25125.6 pw8 18.600
at 1.199 alfa 20.000
np 68270 FLAGS
fb 13800 t1 n
bs 10 in
di 1.000 dp y
nt 10000 hs nn
ct 5740 PROCESSING
TRANSMITTER lb 2.00
tn C13 fn 65536
sfrq 100.554 DISPLAY
t0f 1536.3 sp -1179.8
tpwr 61 wp 24365.7
pw 9.300 r1 9274.4
DECOUPLER rfp 7764.9
dn H1 rp -89.7
dof 0 lp -271.4
dm vvy PLOT
dss w wc 250
dpwr 42 sc 0
dmf 8900 vs 44
th 3
nm no ph



¹H NMR spectra of **8h**

```
ALL-PR-10
expi s2pu1

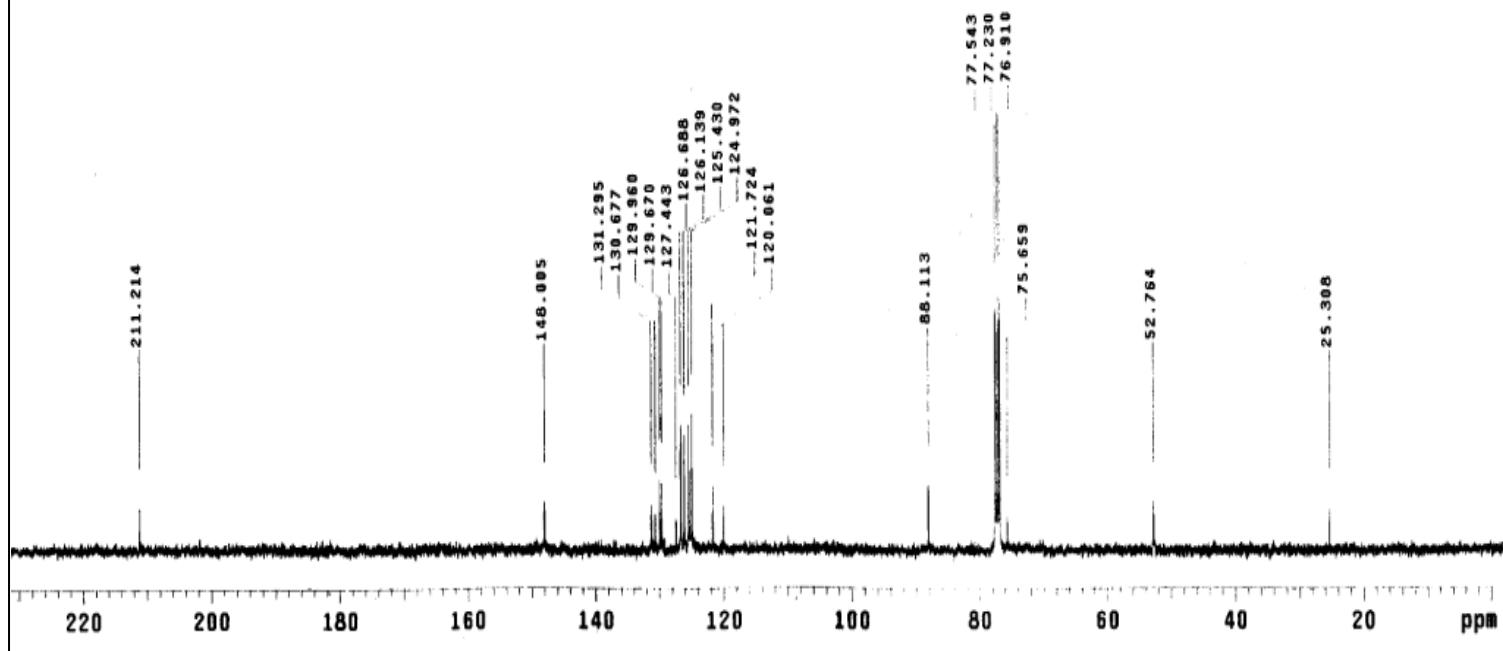
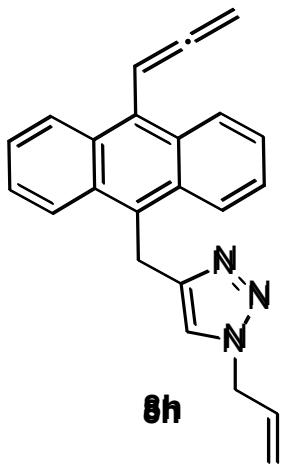
SAMPLE          SPECIAL
date Jun 9 2012 temp not used
solvent CDCl3 gain not used
file exp spin not used
ACQUISITION hst 0.008
sw 6389.8 pw90 19.700
at 1.998 alfa 20.000
np 25528 FLAGS
fb not used t1 n
bs 4 tn n
d1 1.000 dp y
nt 32 hs nn
ct 32 PROCESSING
TRANSMITTER lb 0.10
tn H1 fn 65536
sfrq 399.853 DISPLAY
t0f 362.8 sp -147.2
tpwr 57 wp 5088.3
pw 9.850 rf1 3696.9
DECOUPLER rfp 2894.9
dn C13 rp 115.4
dof 0 lp -87.7
dm nnn PLOT
dmm c wc 250
dpwr 50 sc 0
dmf 15900 vs 77
th 20
nm cdc ph
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¹³C NMR spectra of **8h**

ALL-PR-10-13C
expi s2pul

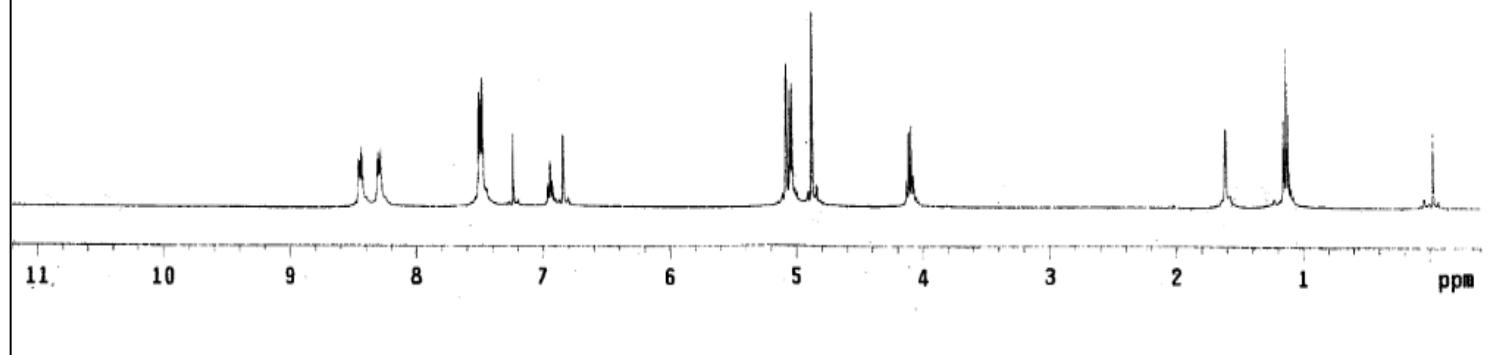
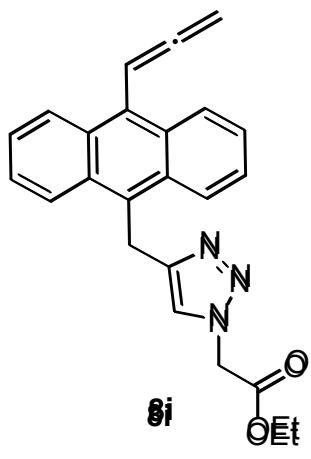
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solvent CDCl₃ gain not used
file exp spin not used
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sw 25125.6 pw80 18.680
at 1.199 alfa 20.000
np 60270 FLAGS
fb 13800 i1 n
bs 10 in n
di 1.000 dp y
nt 5000 hs nn
ct 990 PROCESSING
TRANSMITTER lb 2.00
tn C13 fn 65536
sfreq 100.554 DISPLAY
tof 1536.3 sp -189.1
tpwr 61 wp 23474.7
pw 9.300 rfp 9274.4
DECOUPLER rfp 7764.9
dn H1 rp -39.9
dof 0 lp -364.0
dm yyy PLOT
dmm w wc 250
dpwr 42 sc 0
dmf 8900 vs 32
th 2
nm no ph



¹H NMR spectra of **8i**

ALL-PR-5
expi stdih

SAMPLE SPECIAL
date May 12 2012 temp not used
solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION hst 0.008
sw 6006.0 pw90 19.700
at 1.995 alfa 20.000
np 23964 FLAGS
fb not used fl n
bs 4 ln n
d1 1.000 dp y
nt 64 hs nn
ct 64 PROCESSING
TRANSMITTER fn not used
tn HI DISPLAY
sfrq 399.853 sp -160.3
tof 0 wp 4695.8
tpwr 57 rfl 3868.0
pw 7.000 rfp 2894.9
DECOUPLER rp 107.0
dn C13 lp -90.0
dof 0 PLOT
dm mnn wc 250
dma c sc 0
dpwr 50 vs 25
dmf 15900 th 6
nm cdc ph

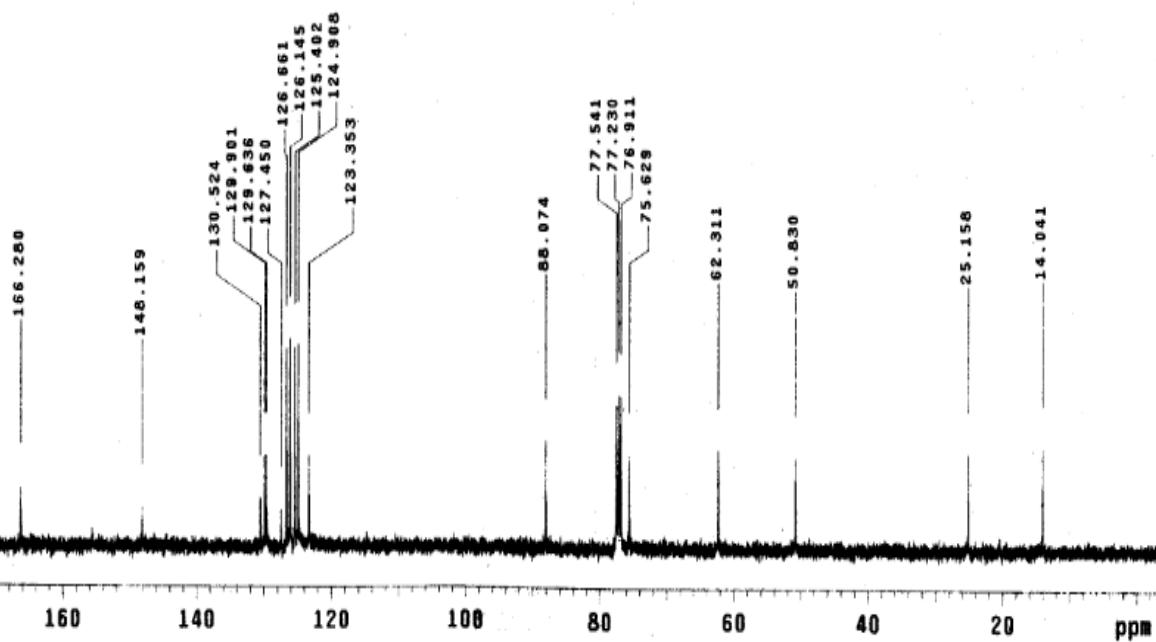
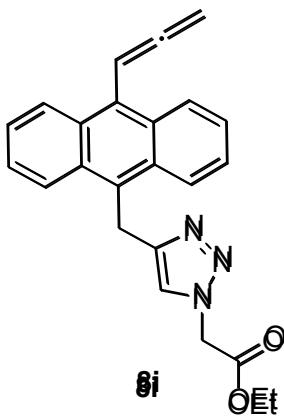


¹³C NMR spectra of **8i**

ALL-PM-5-13C

expi std13c

SAMPLE SPECIAL
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solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION hst 0.008
sw 25000.0 pw0 18.600
at 1.199 alfa 20.000
np 59988 FLAGS
fb 13800 ll n
bs 10 ln n
d1 0 dp y
nt 5000 hs nn
ct 2180 PROCESSING
TRANSMITTER 1b 1.00
tn C13 fn not used
sfrq 100.552 DISPLAY
tof 0 sp -324.8
tpwr 61 wp 22338.8
pw 8.667 rfl 10750.1
DECOUPLER rfp 7764.9
dn H1 rp -34.7
dof 0 lp -387.3
dm vvv PLOT
dmm w wc 250
dpwr 42 sc 0
dmf 8900 vs 25
th 3
nm no ph

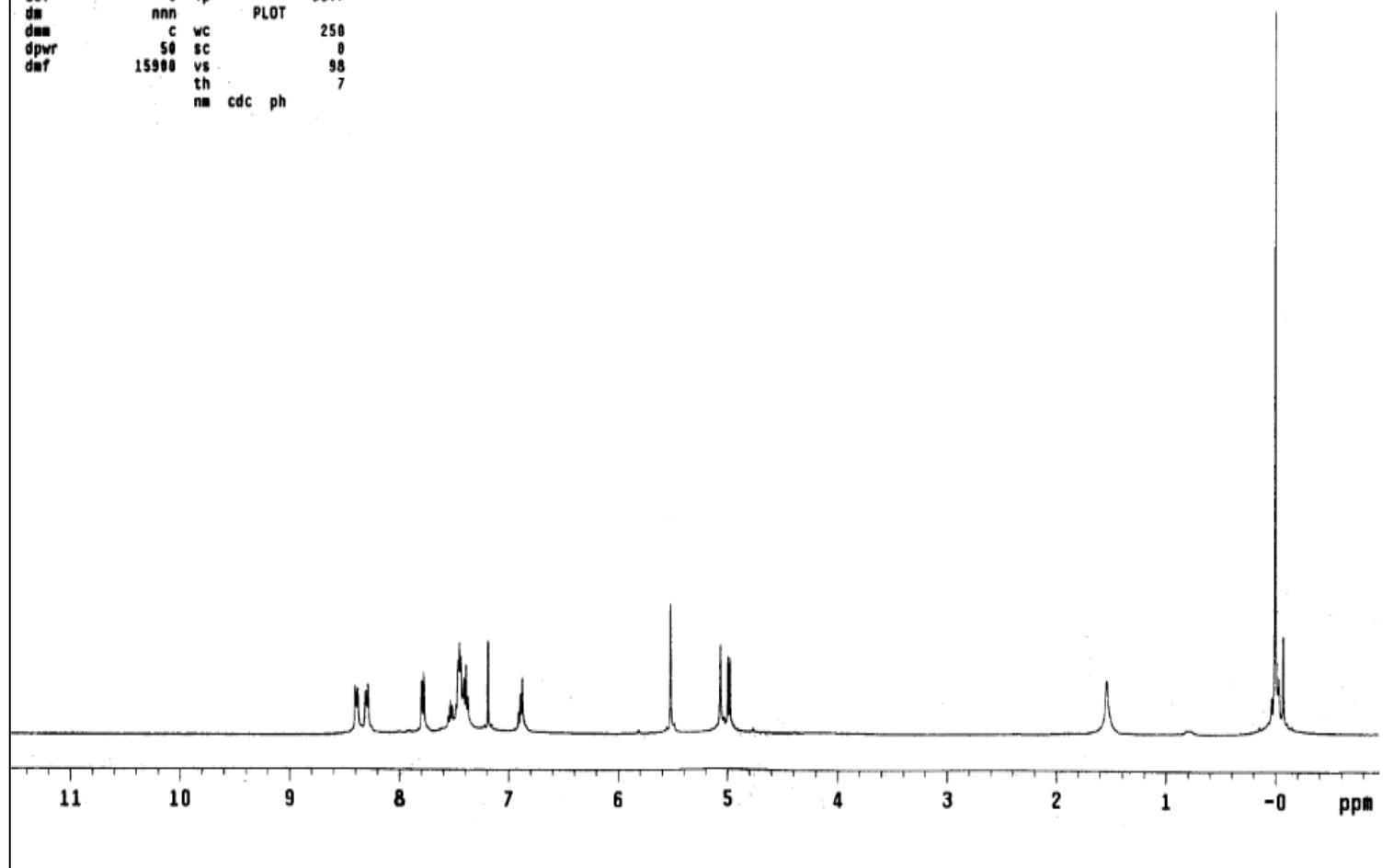
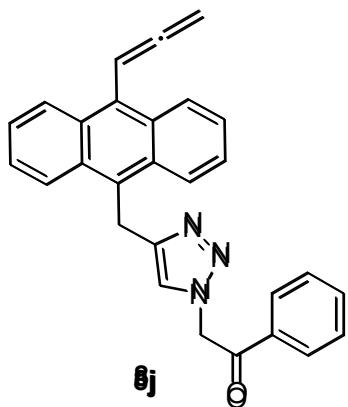


¹H NMR spectra of **8j**

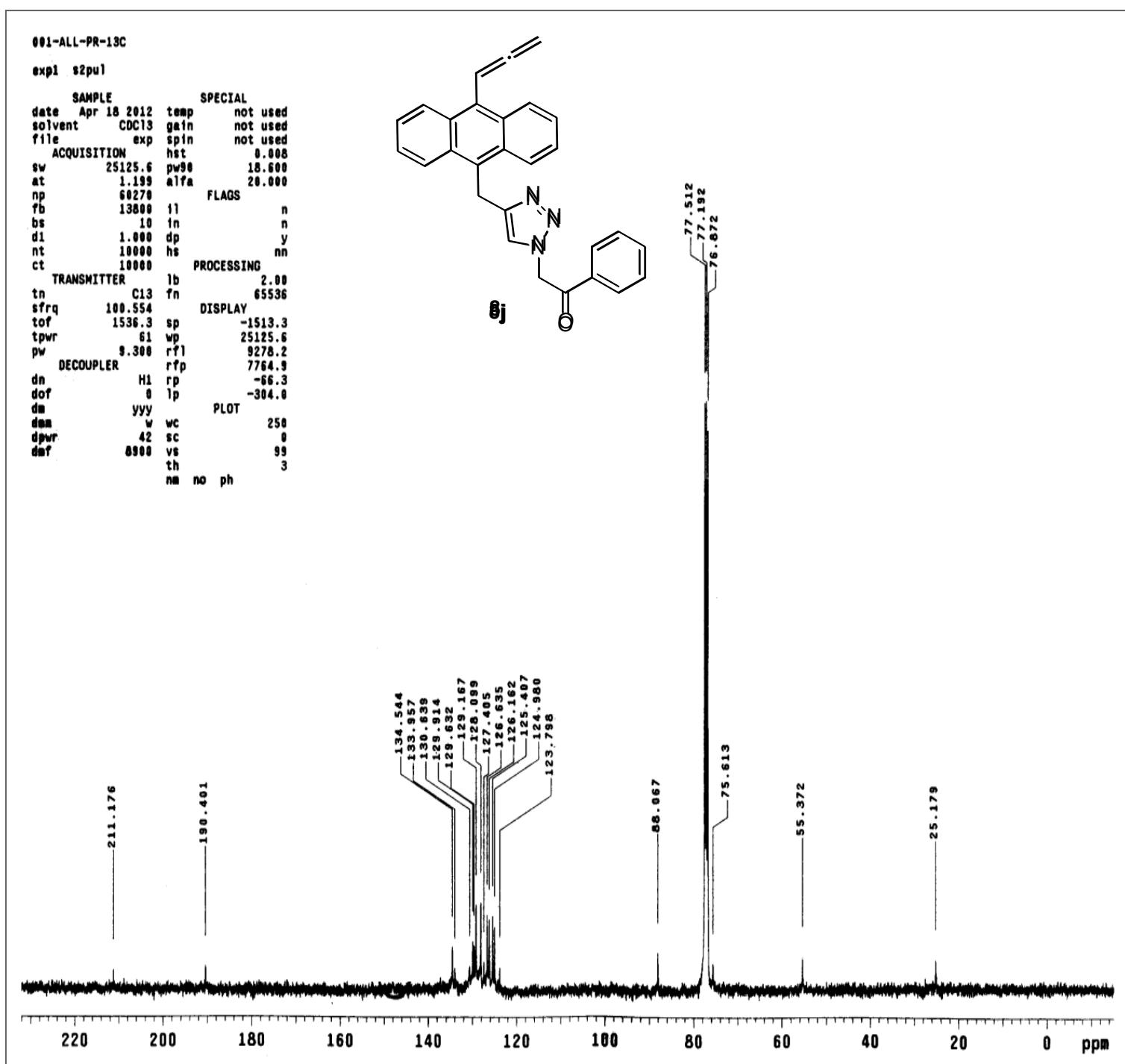
ALL_PR_1

exp1 s2pu1

SAMPLE SPECIAL
date Mar 30 2012 temp not used
solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION hst 0.008
sw 6389.8 pw0 19.700
at 1.998 alfa 20.000
np 25528 FLAGS
fb not used 11 n
bs 4 in n
di 1.000 dp y
nt 64 hs nn
ct 64 PROCESSING
TRANSMITTER 1b 0.10
tn H1 fn 65536
sfrq 399.853 DISPLAY
tof 362.8 sp -378.1
tpwr 57 wp 5046.2
pw 9.850 rfp 823.1
DECOUPLER rfp 0
dn C13 rp 109.9
dof 8 lp -93.7
dm nnn PLOT
dmm c wc 250
dpwr 50 sc 0
dmf 15990 vs 98
th 7
nm cdc ph

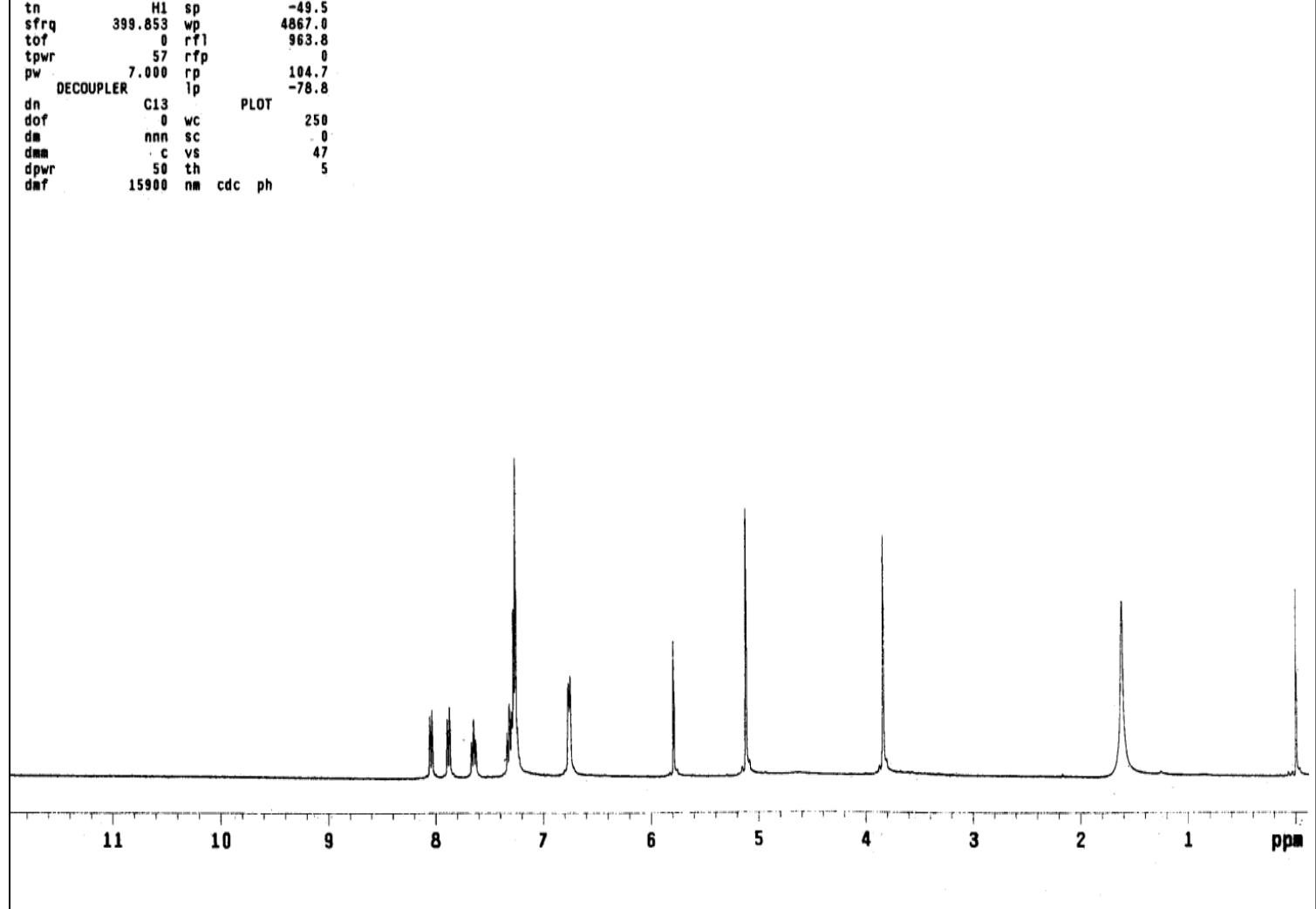
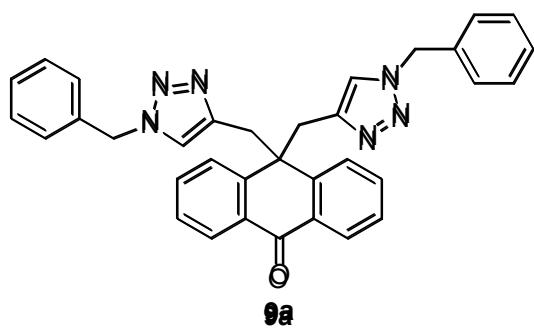


¹³C NMR spectra of **8j**



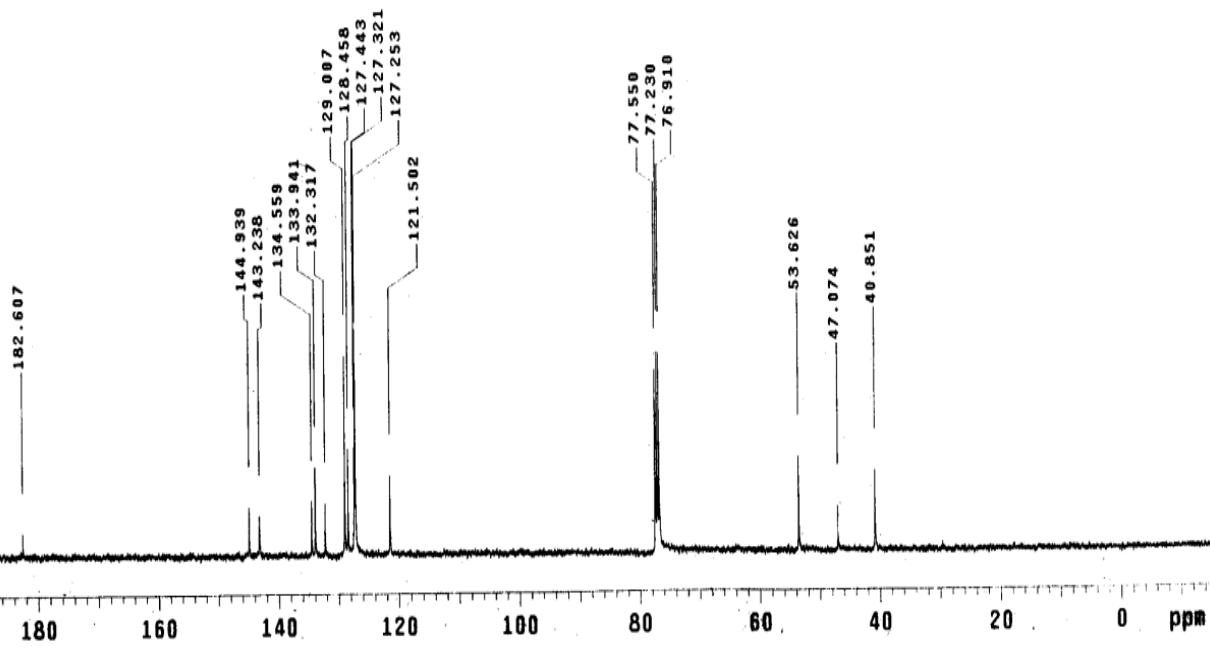
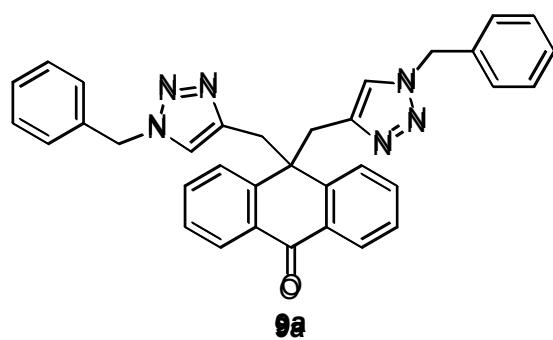
¹H NMR spectra of 9a

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expt1 std1h
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solvent   CDCl3 gain     not used
file /export/home/- spin    not used
ciftemp/ANTH-PR-2 hst    0.008
ACQUISITION pw90    19.700
sw      6006.0 alfa   20.000
at      1.995   FLAGS
np      23964   t1      n
fb      not used in      n
bs      4      dp      y
di      1.000   hs      nn
nt      32      PROCESSING
ct      32   fn      not used
TRANSMITTER          DISPLAY
tn      H1 sp      -49.5
sfrq   399.853 wp      4867.0
tof      0 rrf1    963.8
tpwr   57 rfp     0
pw      7.000 rp      104.7
DECOUPLER          PLOT
dn      C13      PLOT
dof      0 wc      250
dm      nnn sc      0
dmm      c vs      47
dpwr   50 th      5
dmf    15900 nm cdc ph
```



¹³C NMR spectra of 9a

```
exp1 s2pu1
SAMPLE          SPECIAL
date Aug 2 2012 temp    not used
solvent   CDCl3 gain     not used
file      exp spin    not used
ACQUISITION hst      0.008
sw       25125.6 pw90    18.600
at        1.199 alfa   20.000
np       60270   FLAGS
fb        13800 11      n
bs         10 in      n
d1        1.000 dp      y
nt        5000 hs     nn
ct        2690   PROCESSING
TRANSMITTER 1b      2.00
tn      C13 fn      65536
sfrq    100.554   DISPLAY
tof     1536.3 sp     -1514.1
tpwr    61 wp      25125.6
pw      9.300 rfl    9279.0
DECOUPLER rfp      7764.9
dn      H1 rp      -64.0
dof      0 1p      -328.7
da      yyy PLOT
dmm      w wc      250
dpwr    42 sc      0
dmf     8900 vs      28
          th      2
          nm no ph
```



¹H NMR spectra of **9b**

expt s2pul

SAMPLE SPECIAL

date Jun 29 2012 temp not used

solvent CDCl₃ gain not used

file exp spin not used

ACQUISITION hst 0.008

sw 6389.8 pw90 19.700

at 1.998 alfa 20.000

np 25528 FLAGS

fb not used 11 n

bs 4 in n

di 1.000 dp y

nt 32 hs nn

ct 32 PROCESSING

TRANSMITTER lb 0.10

tn HI fn 65536

sfreq 399.853 DISPLAY

tof 362.8 sp -223.8

tpwr 57 wp 4423.9

pw 9.850 rfp 1798.2

DECOUPLER rfp 999.6

dn C13 rp 118.6

dof 0 lp -96.3

ds nnn PLOT

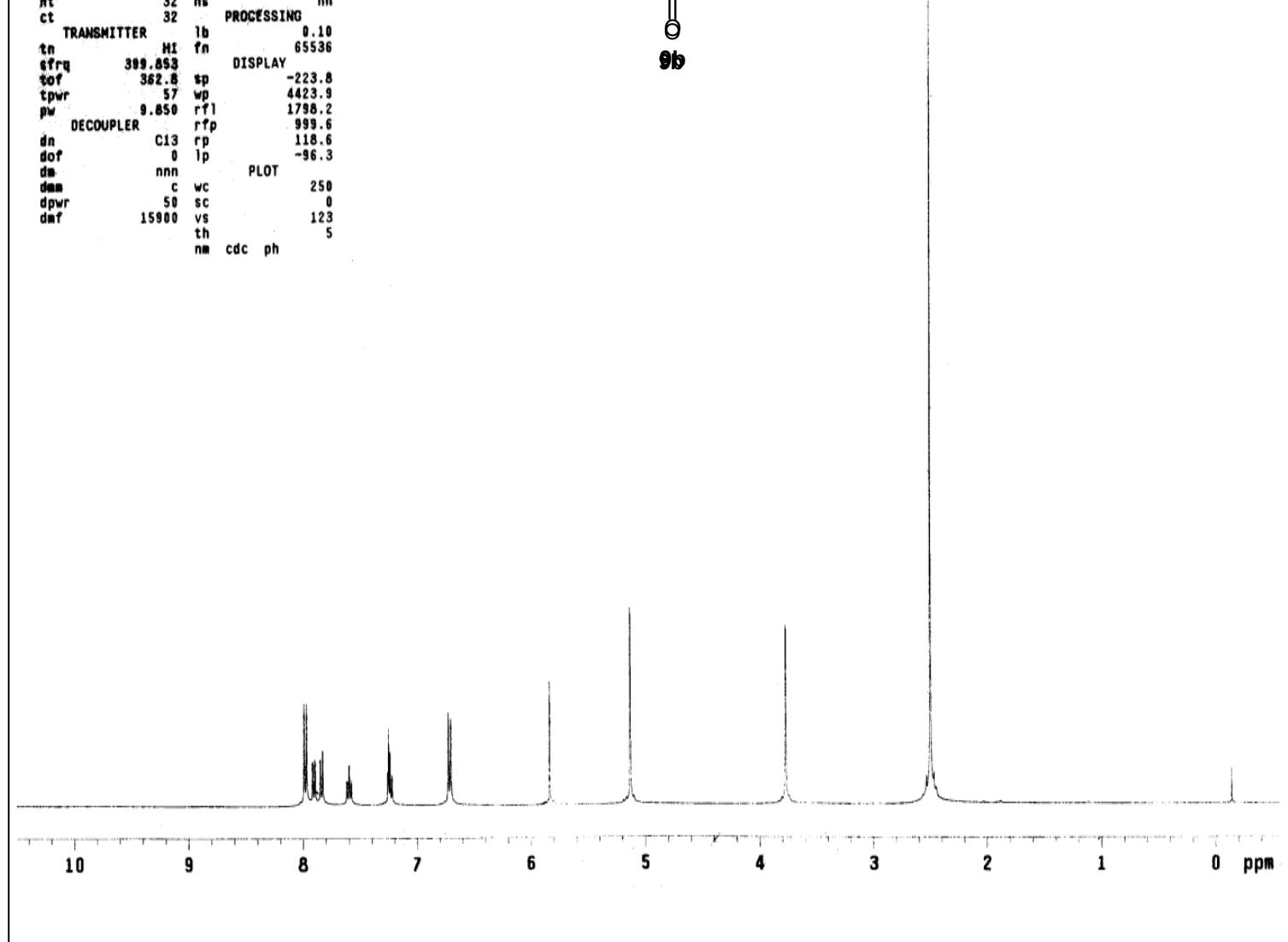
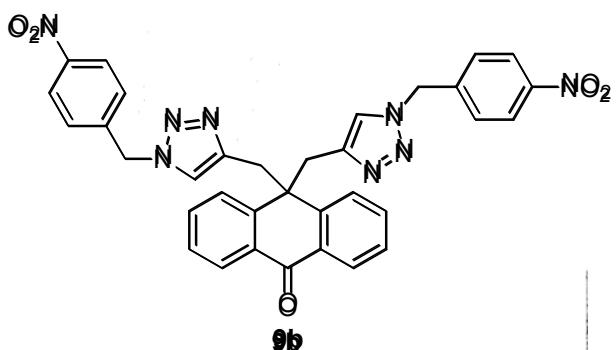
dmm c wc 250

dpwr 50 sc 0

dmf 15900 vs 123

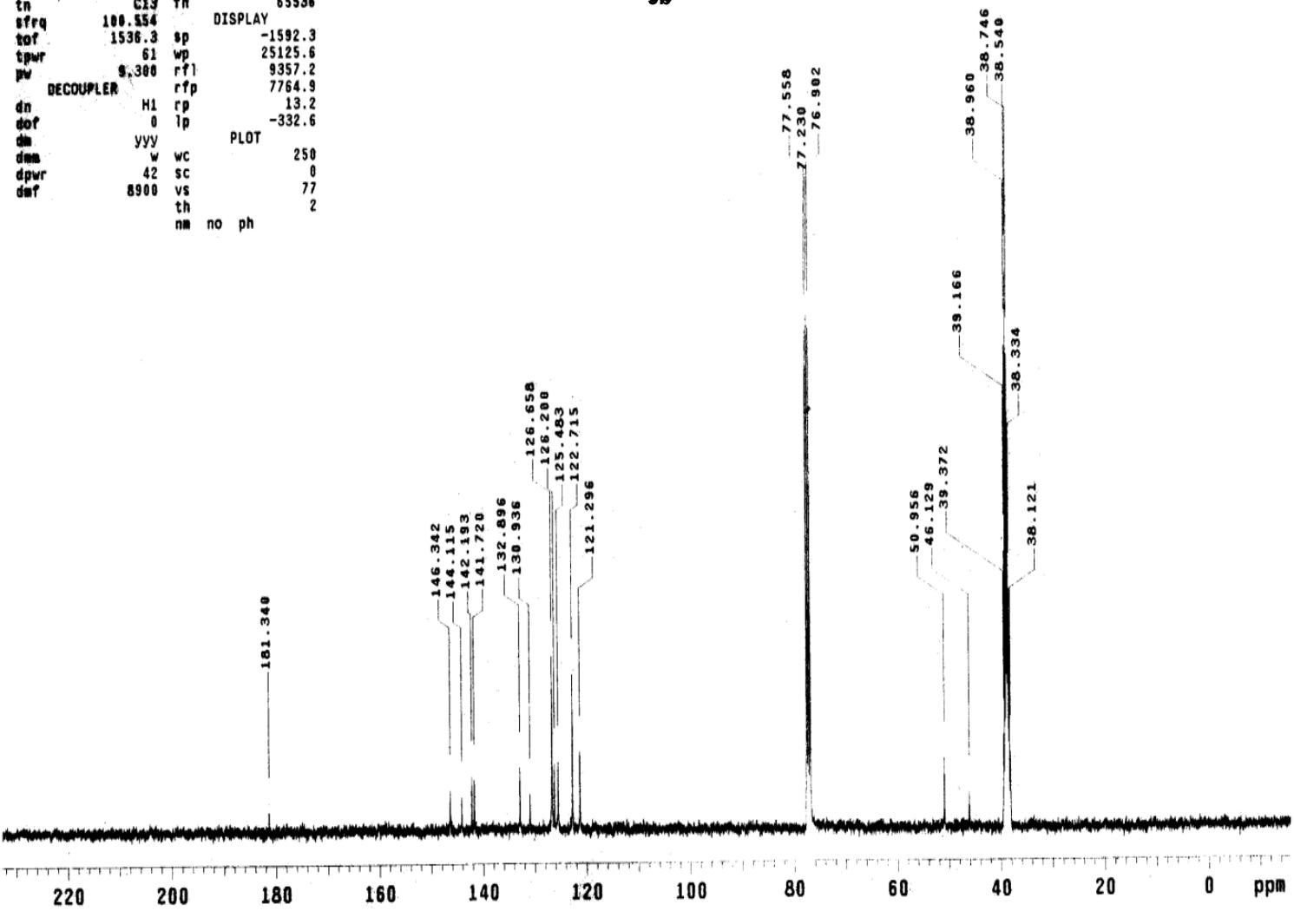
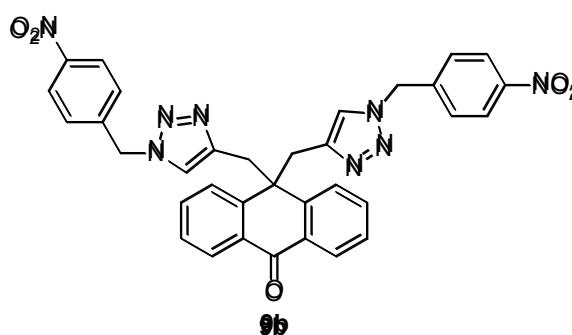
th 5

nm cdc ph



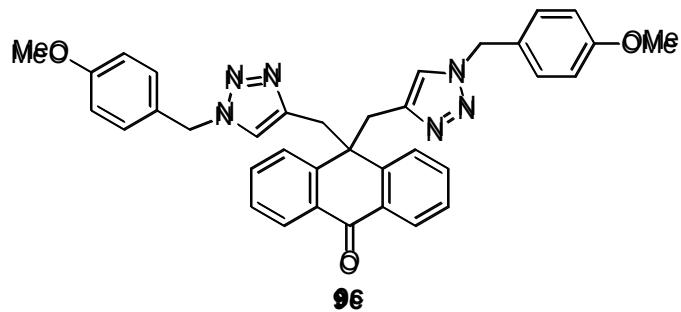
¹³C NMR spectra of 9b

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expt s2pul
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date   Aug 4 2012 temp    not used
solvent   CDCl3 gain    not used
file      exp spin   not used
ACQUISITION hst      0.008
sw      25125.6 pw90    18.600
at      1.199 alfa   20.000
np      60270   FLAG8
fb      13800   11      n
bs       10      tn      n
di      1.000   dp      y
nt      5000    hs      nn
ct      5000    PROCESSING
TRANSMITTER 1b      2.00
tn      C13    fn      65536
sfreq  100.554  DISPLAY
t0f     1536.3  sp      -1592.3
tpwr   61      wp      25125.6
pw     9.300   rfp     9357.2
DECOUPLER H1      rfp     7764.9
dn      H1      rp      13.2
dof     0       lp      -332.6
dm      yyy     PLOT
dme     w       wc      250
dpwr   42      sc      0
def     8900   vs      77
th      nm      no      ph
```

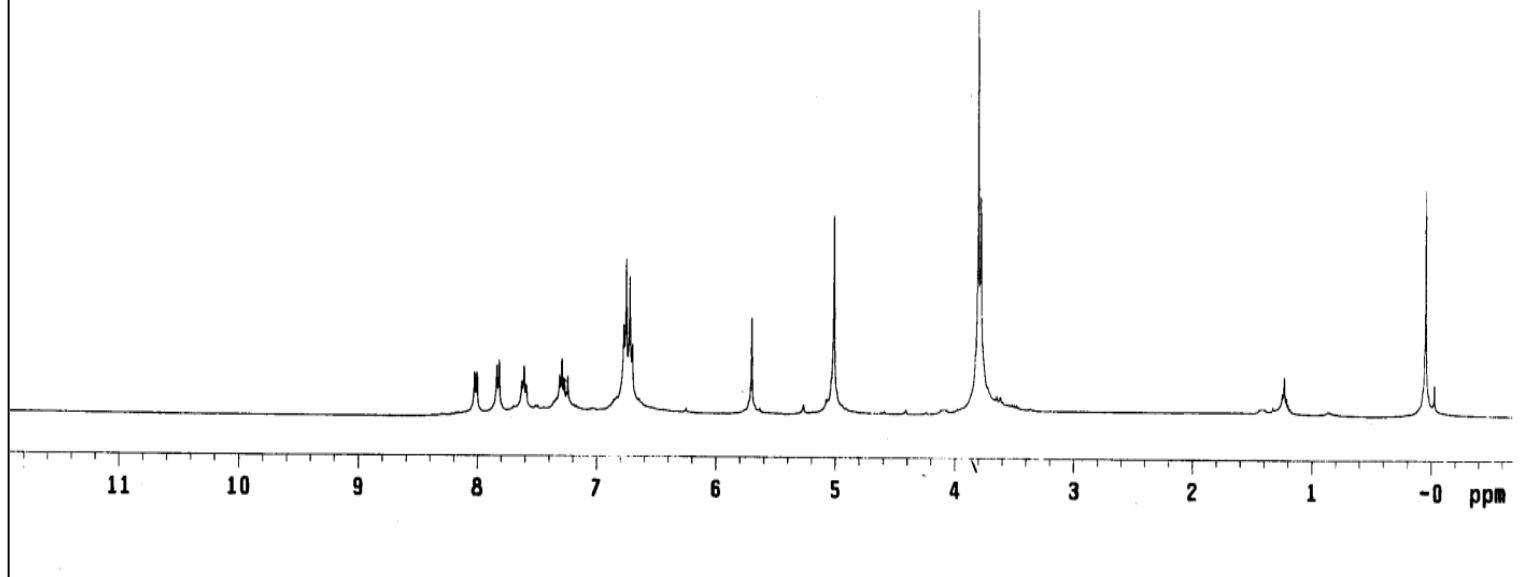


¹H NMR spectra of 9c

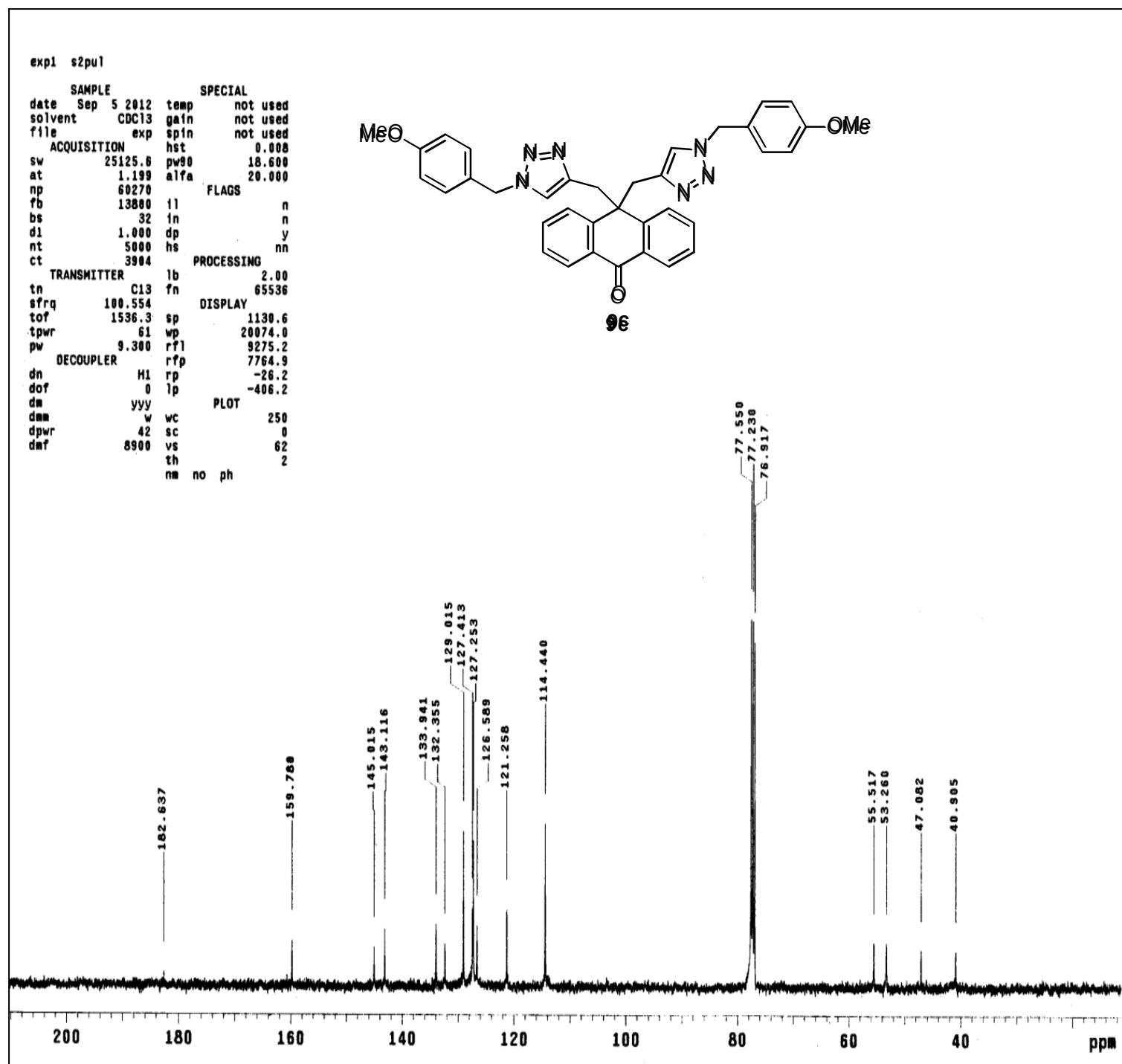
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expi s2pul
SAMPLE          SPECIAL
date Sep 4 2012 temp    not used
solvent   CDCl3 gain     not used
file      exp spin    not used
ACQUISITION hst      0.008
sw       6389.8 pw90    19.700
at       1.998 alfa   20.000
np       25528   FLAGS
fb       not used f1      n
bs        4 in      n
di       1.000 dp      y
nt       32 hs      nn
ct       32 PROCESSING
TRANSMITTER 1b      0.10
tn       H1 fn     65536
sfrq    399.853   DISPLAY
tof      362.8 sp     -274.7
tpwr    57 wp     5063.0
pw      9.850 rfl    3698.5
DECOUPLER rfp     2894.9
dn       C13 rp     100.2
dof      0 1p     -88.7
dm      nnn PLOT
dmm      c wc     250
dpwr    50 sc      0
dmf     15900 vs     51
            th     20
nm cdc ph
```



9c

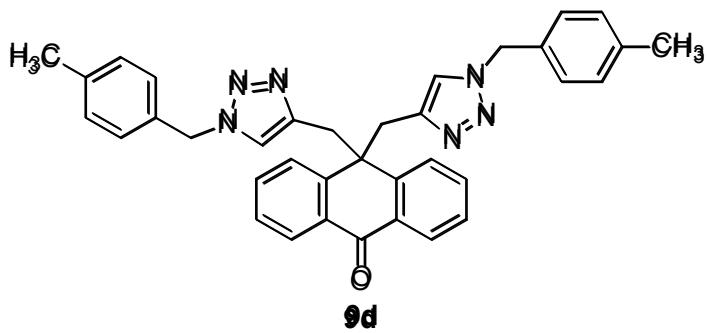


¹³C NMR spectra of 9c

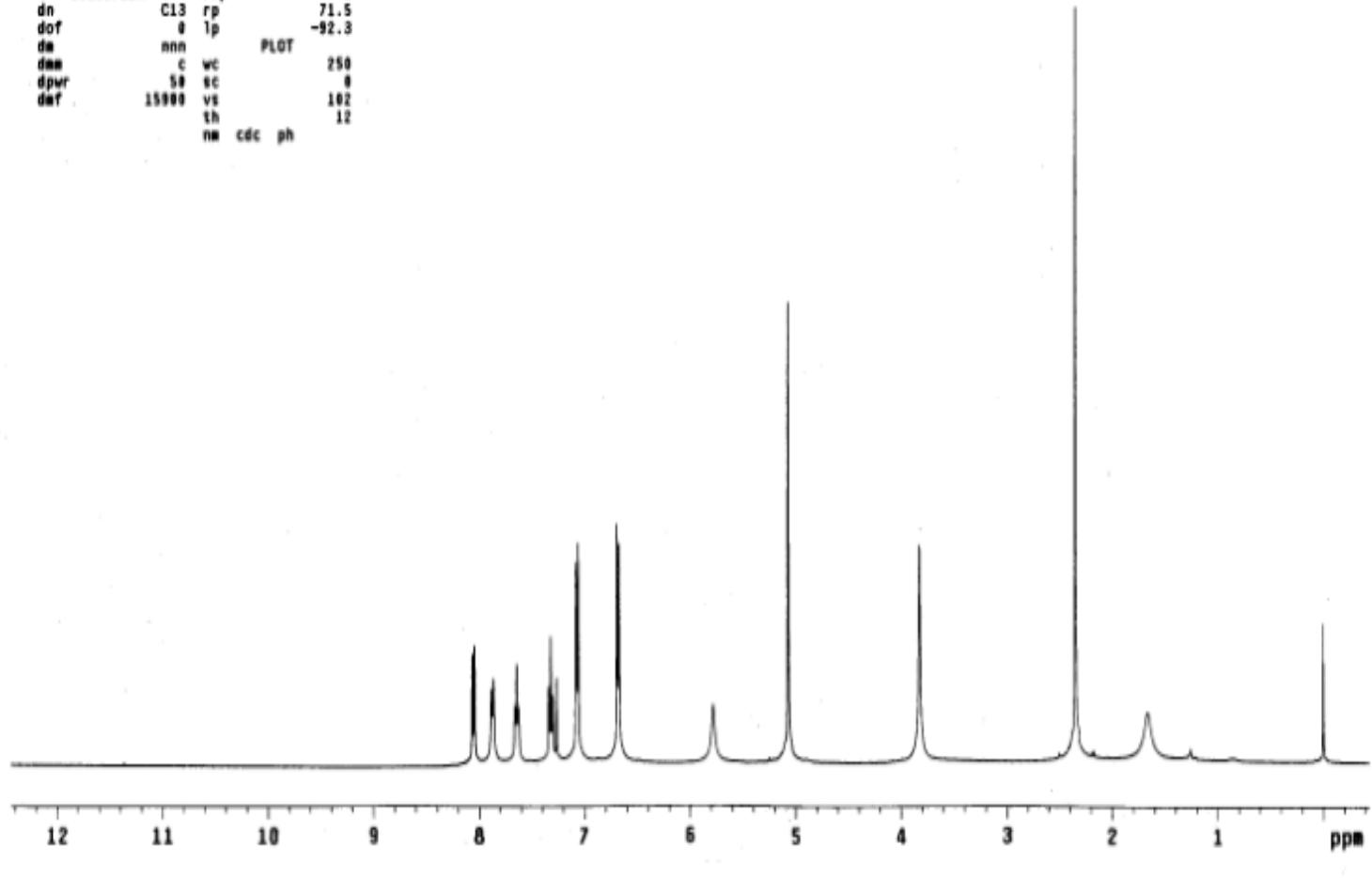


¹H NMR spectra of 9d

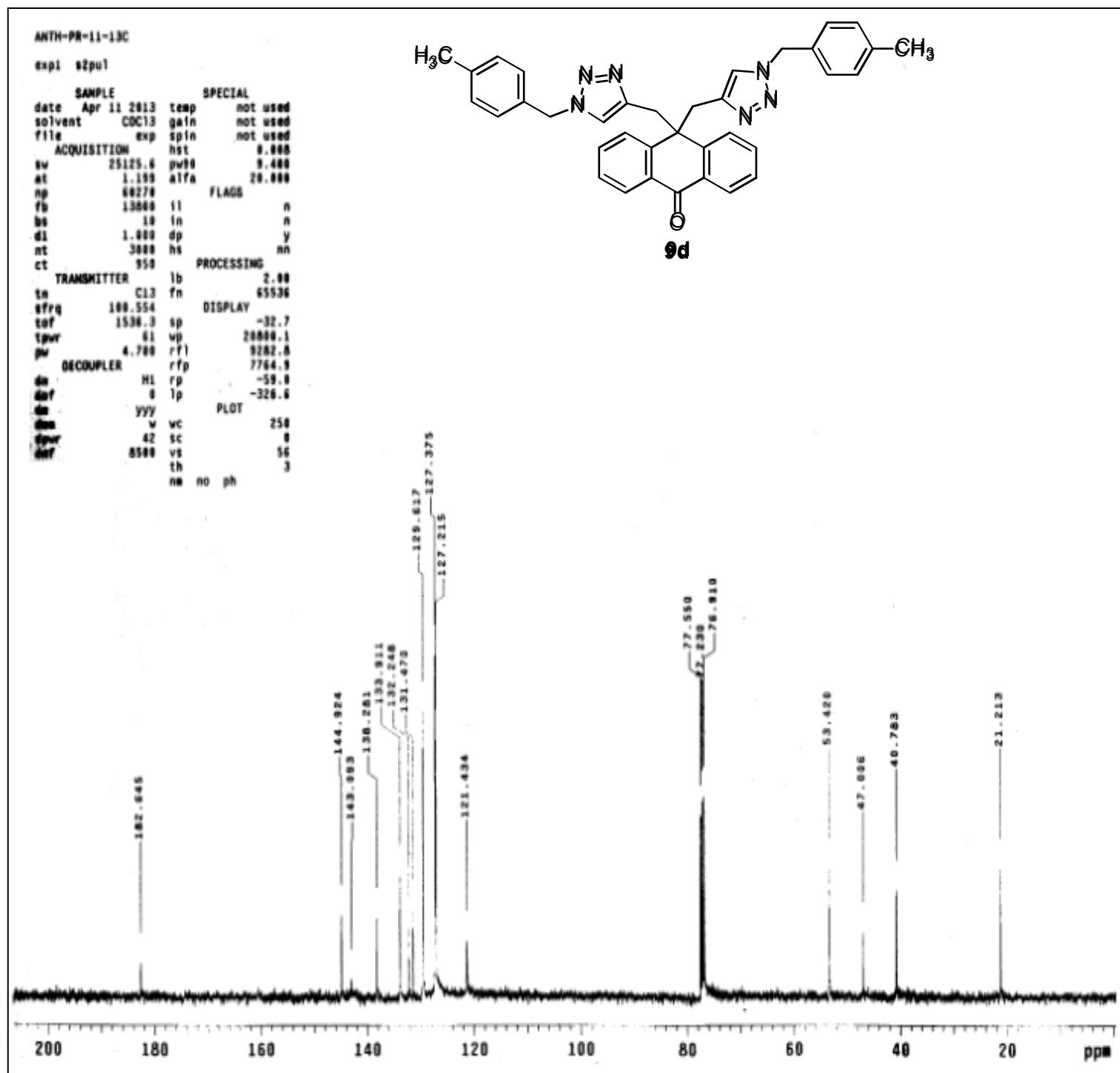
ANTH-PR-11
expt s2pul
SAMPLE SPECIAL
date Mar 11 2013 temp not used
solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION het 8.000
sw 6389.8 pw8 14.100
at 1.998 alfa 20.000
np 25528 FLAGS
fb not used t1 n
bs 4 in n
d1 1.000 dp y
nt 32 hs nn
ct 32 PROCESSING
TRANSMITTER 1b 0.10
tn H1 fn 65536
sfrq 399.853 DISPLAY
tof 362.8 sp -173.8
tpwr 62 wp 5147.0
pw 7.450 rfl 785.0
DECOUPLER rfp 0
dn C13 rp 71.5
dof d 1p -92.3
da mnn PLOT
dme c wc 250
dpwr 50 sc 0
def 15000 vs 102
th 12
nm cdc ph



9d



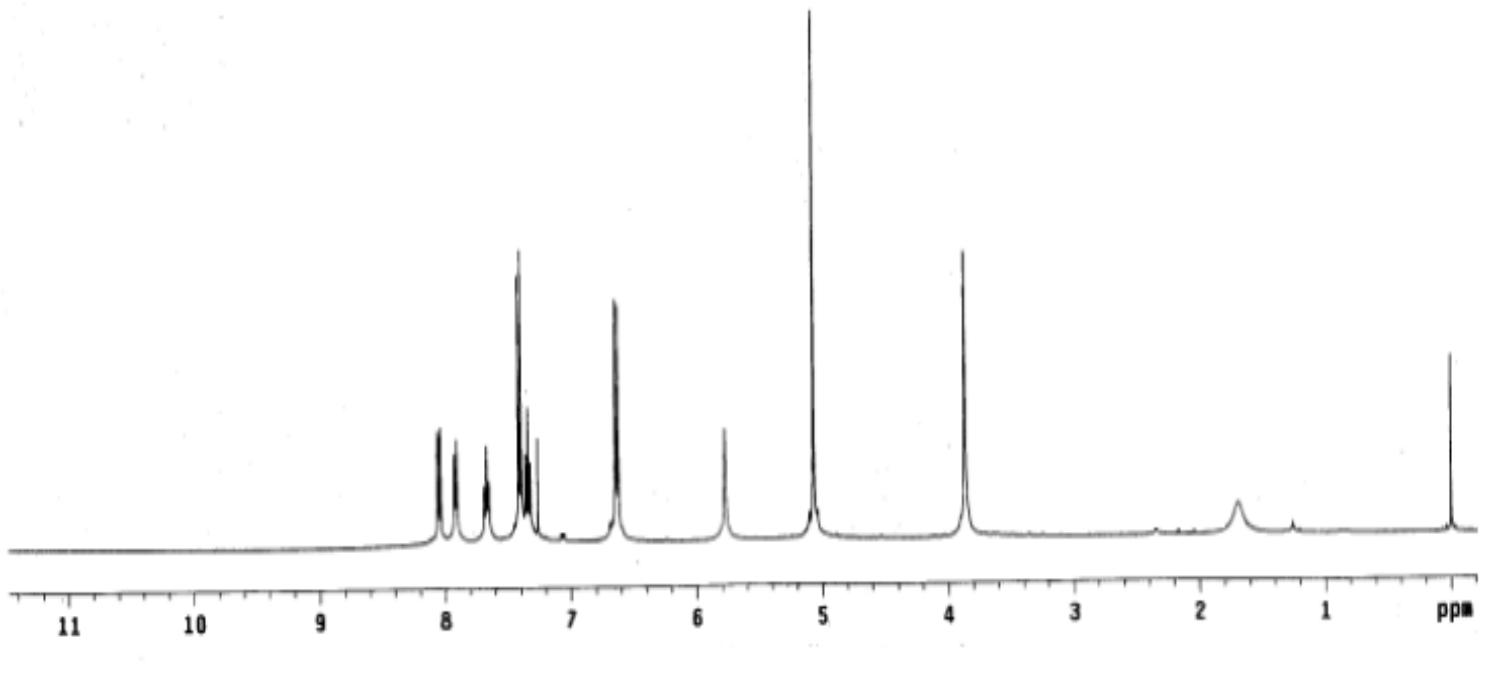
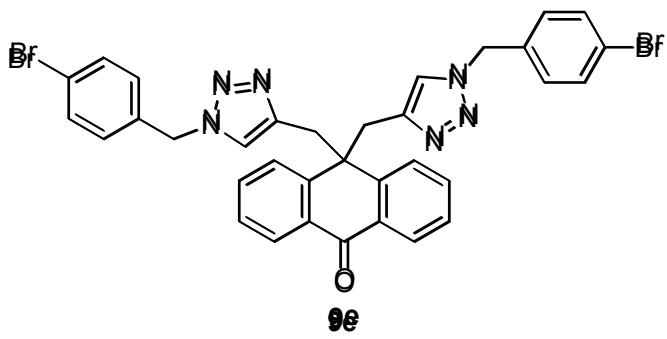
¹³C NMR spectra of 9d



¹H NMR spectra of 9e

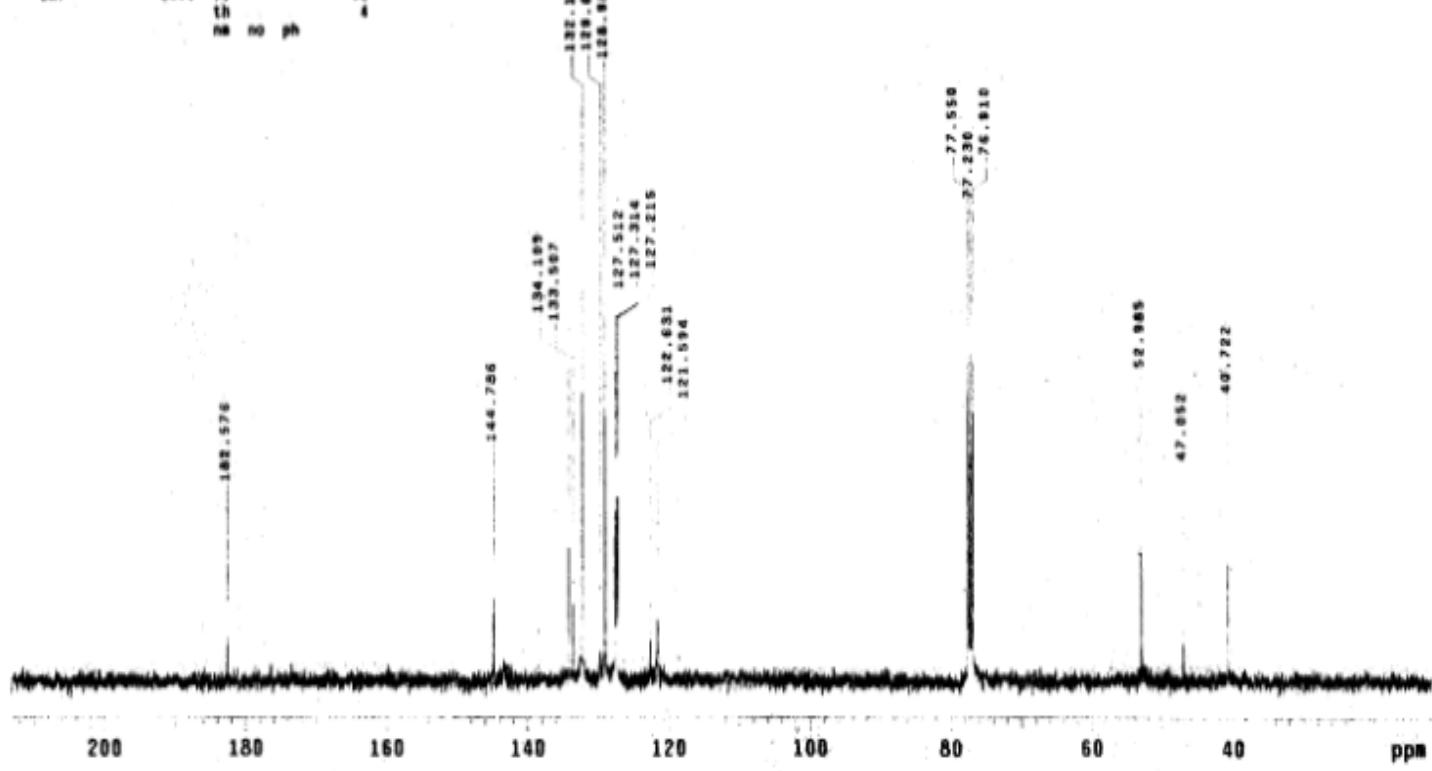
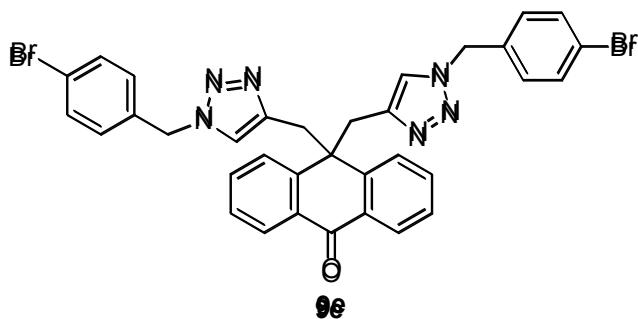
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expt s2pul

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solvent CDCl₃ gain not used
file exp spin not used
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sw 6389.8 pw08 14.100
at 1.998 alfa 29.000
np 25528 FLAGS
fb not used tl n
bs 4 in n
dl 1.000 dp y
nt 32 hs nn
ct 32 PROCESSING
TRANSMITTER 1b 0.10
tn H1 fn 65536
sfrq 399.853 DISPLAY
tof 362.8 sp -87.8
tpwr 62 wp 4676.8
pw 7.058 rfl 792.9
DECOUPLER rfp 0
dn C13 rp 68.9
dof 6 tp -85.2
de nnn PLOT
dm c wc 250
dpwr 50 sc 0
dmt 15000 vs 67
dtf th 6
ns cdc ph

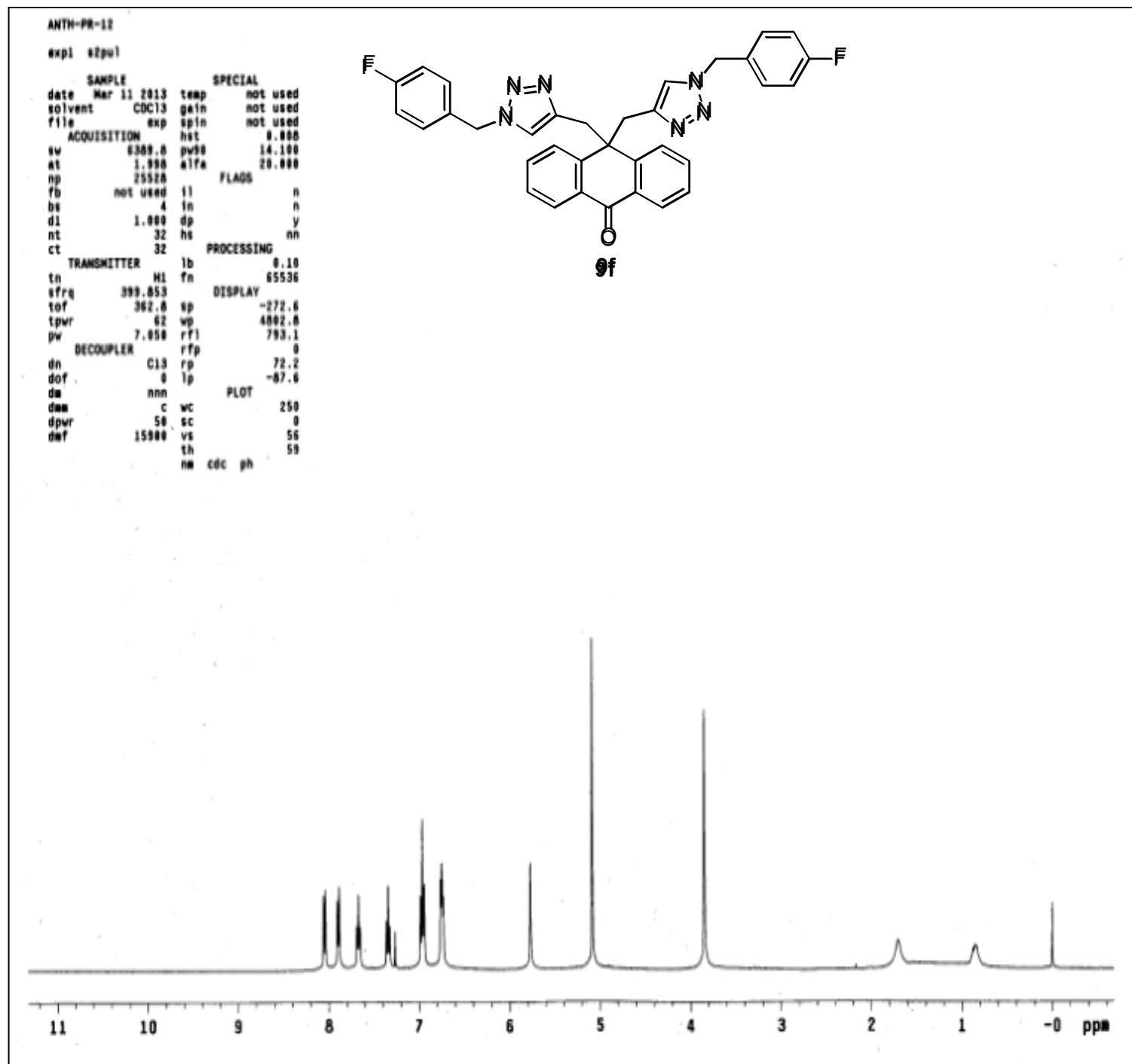


¹³C NMR spectra of 9e

ANTH-PR-13-13C
expi szpu!
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solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION hst 0.000
ev 23125.6 pw90 9.488
et 1.198 alfa 20.000
np 68278 FLAGS
fb 13888 ll n
bs 18 in n
d1 1.000 dp y
nt 24000 hs nm
ct 720 PROCESSING
TRANSMITTER lb 2.00
tn C13 fn 65536
sfrq 100.554 DISPLAY
t0f 1535.3 sp 1198.4
tpwr 61 wp 29230.8
pv 4.788 rfp 9281.3
DECOUPLER rfp 7764.5
dn H1 rp -44.3
dcf 0 lp -304.8
dm VVY PLOT
dss w wc 250
dpwr 42 sc 0
def 8500 vs 55
th 4
ns no ph

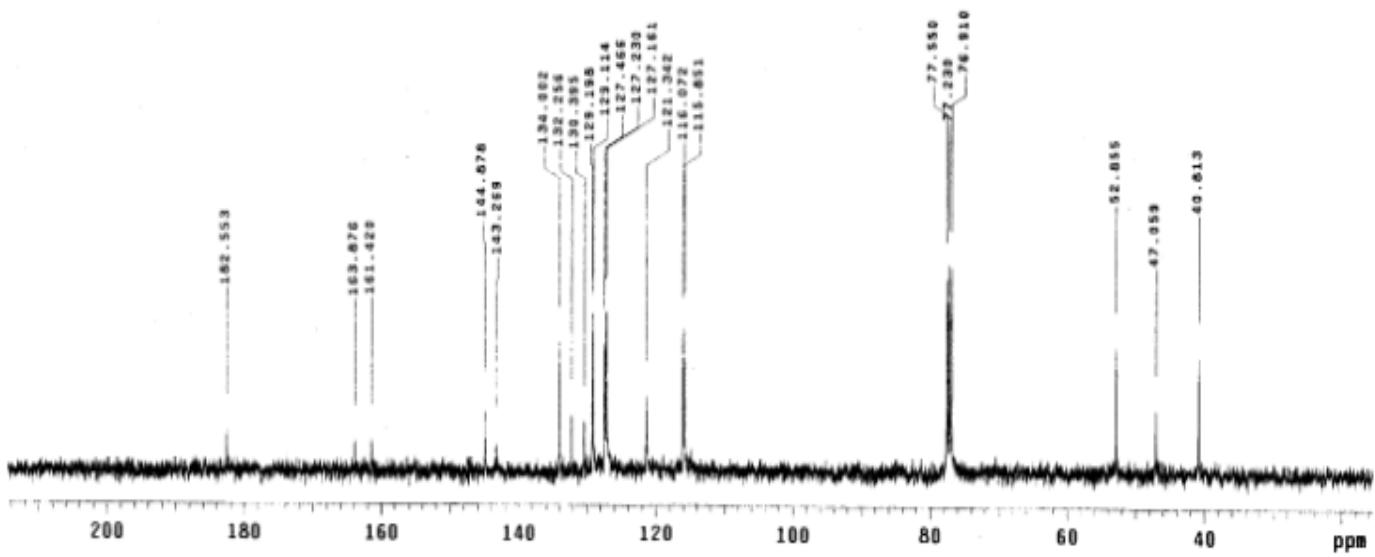
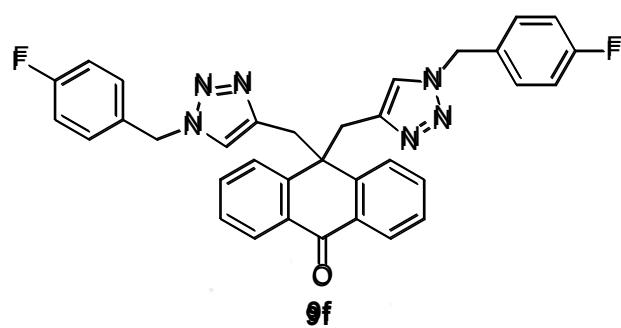


¹H NMR spectra of 9f



¹³C NMR spectra of 9f

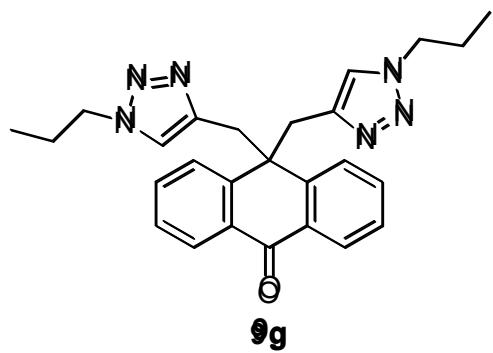
AMTH-PR-j2-13C
expt 82pu1
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date Apr 13 2013 temp not used
solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION hst 0.008
sw 25125.6 pw90 9.400
at 1.199 alfa 20.000
np 60270 FLAGS
fb 13800 t1 n
bs 10 ln n
di 1.000 dp y
nt 2000 hs mn
ct 600 PROCESSING
TRANSMITTER lb 2.00
tn C13 fn 65536
sfrq 100.554 DISPLAY
tof 1536.3 sp 1553.9
tpwr 61 wp 20000.0
pw 4.700 rrf1 9281.3
DECOUPLER rfp 7764.9
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dss w wc 256
dpwr 42 sc 8
def 8500 vs 25
th 4
nm no ph



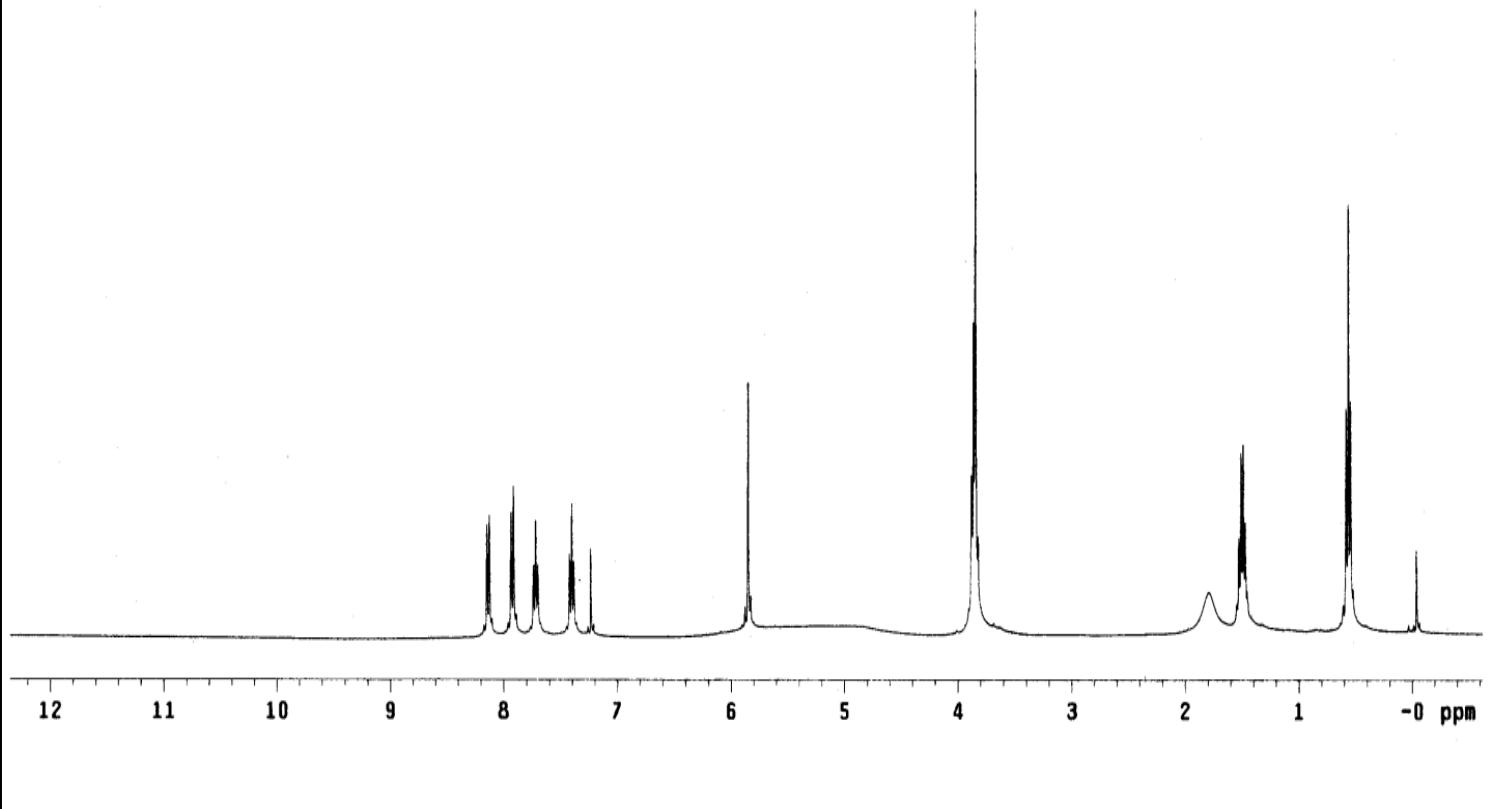
¹H NMR spectra of 9g

expt1 s7pu1

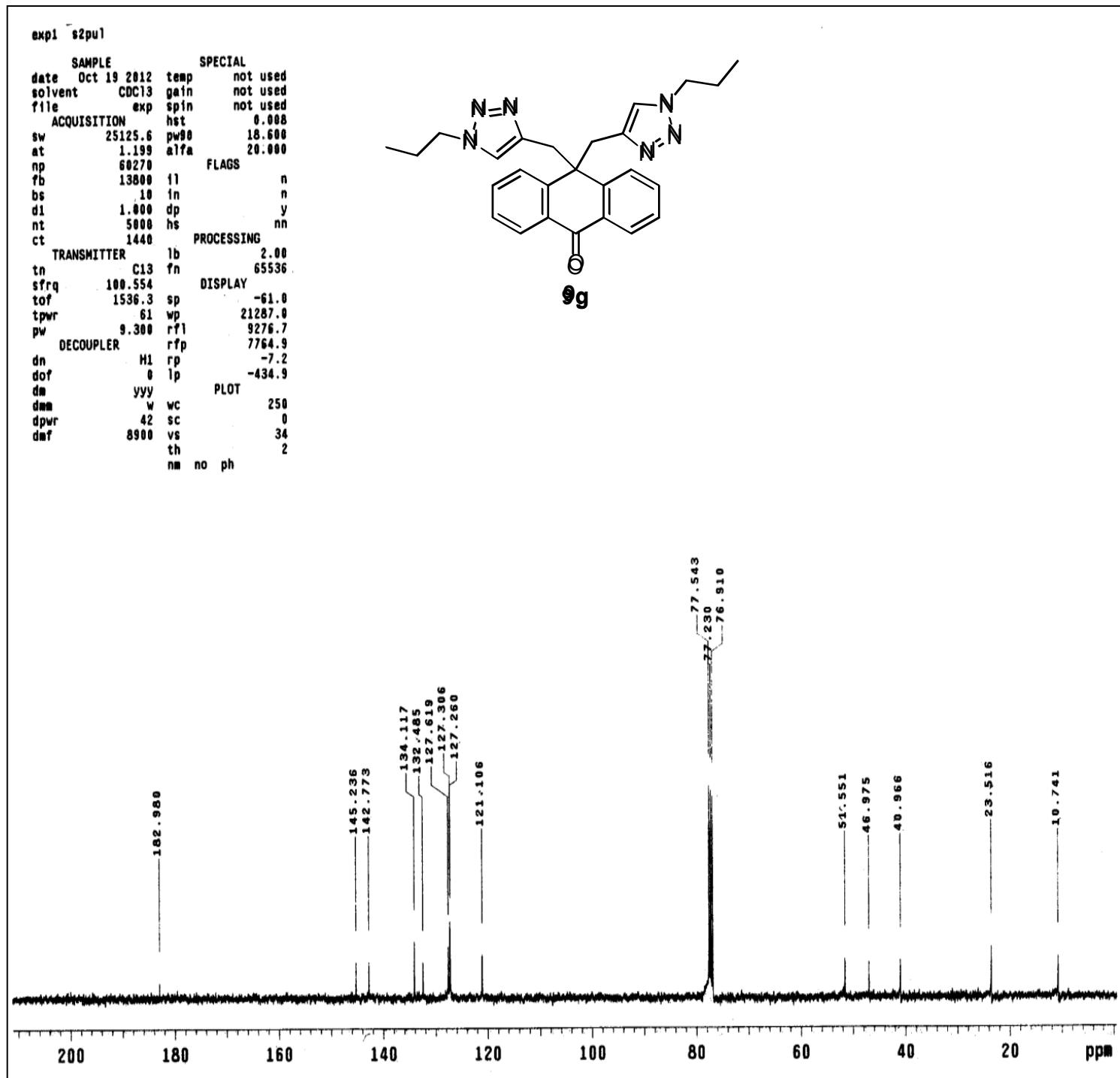
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date Oct 20 2012 temp not used
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file exp spin not used
ACQUISITION hst 0.008
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at 1.998 alfa 20.000
np 25528 FLAGS
fb not used 11 n
bs 4 in n
dl 1.000 dp y
nt 32 hs nn
ct 32 PROCESSING
TRANSMITTER 1b 0.10
tn H1 fn 65536
sfrq 399.853 DISPLAY
tof 362.8 sp -249.4
tpwr 57 wp 5188.9
pw 9.850 rfl 3698.3
DECOUPLER rfp 2894.9
dn C13 rp 105.4
dof 0 lp -90.5
dm nnn PLOT
dmm c wc 250
dpwr 50 sc 0
dmf 15900 vs 81
th 20
nm cdc ph



9g

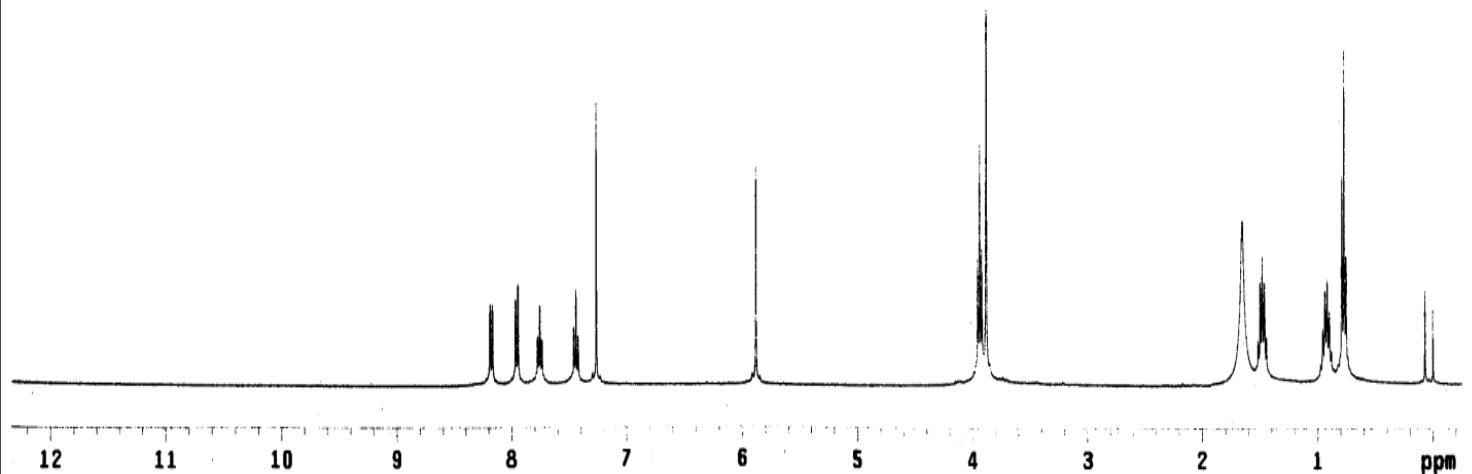
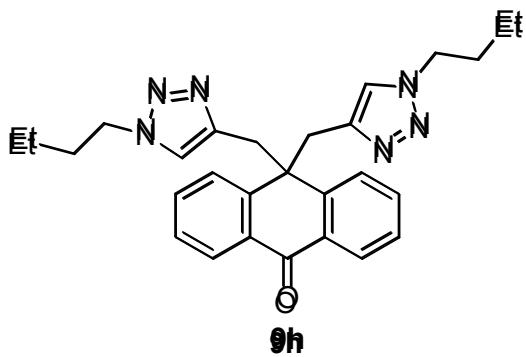


¹³C NMR spectra of 9g

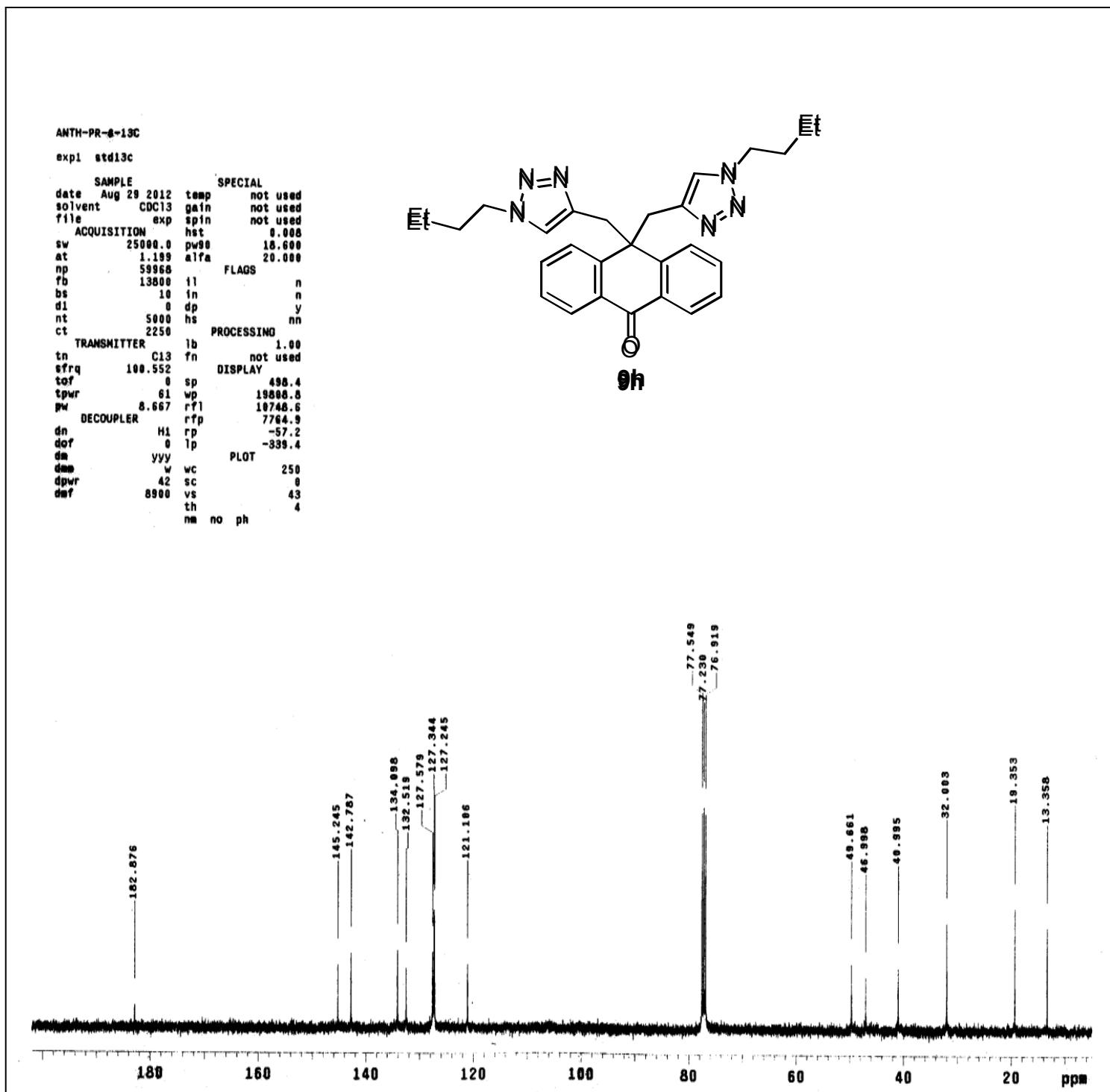


¹H NMR spectra of 9h

```
exptl stdih
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date   Aug 29 2012 temp    not used
solvent   CDCl3 gain    not used
file     exp spin    not used
      ACQUISITION hst    0.008
sw       6006.0 pw90    19.700
at        1.995 alfa   20.000
np      23964 FLAGS
fb      not used il    n
bs         4 in     n
di      1.000 dp     y
nt       32 hs    nn
ct       32 PROCESSING
      TRANSMITTER fn    not used
tn        H1          DISPLAY
sfrq    399.853 sp    -103.0
tof      0 wp     5035.2
tpwr    57 rf1    963.1
pw      7.000 rfp    0
      DECOUPLER rp    101.9
dn       C13 1p    -77.5
dof       0          PLOT
dm      nnn wc    250
dma      c sc     0
dpwr    50 vs     49
dmf    15900 th    20
      nm cdc ph
```



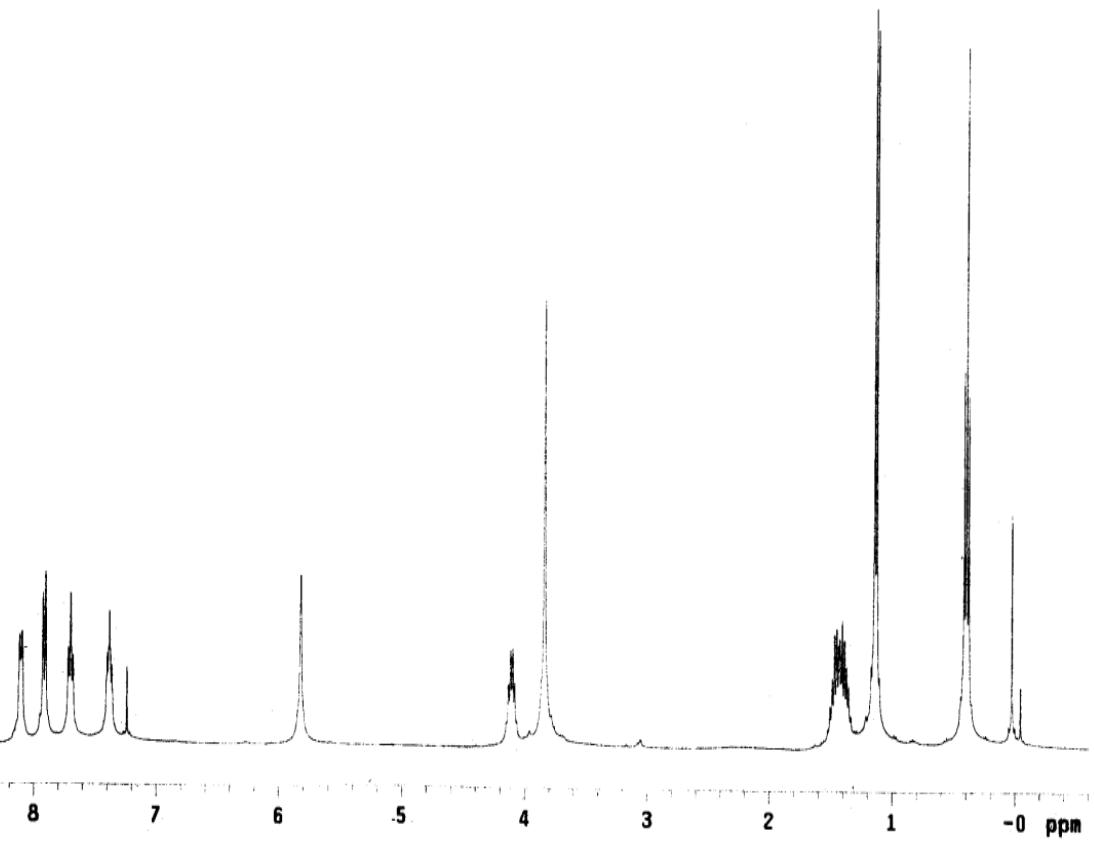
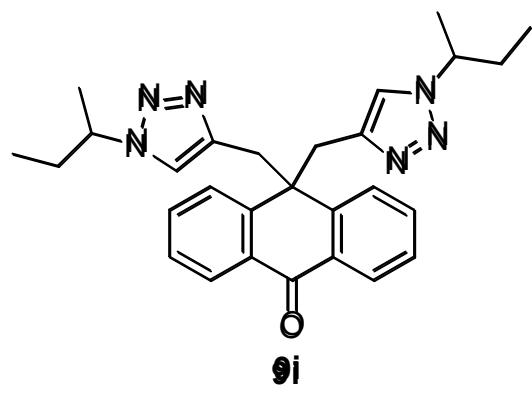
¹³C NMR spectra of 9h



¹H NMR spectra of **9i**

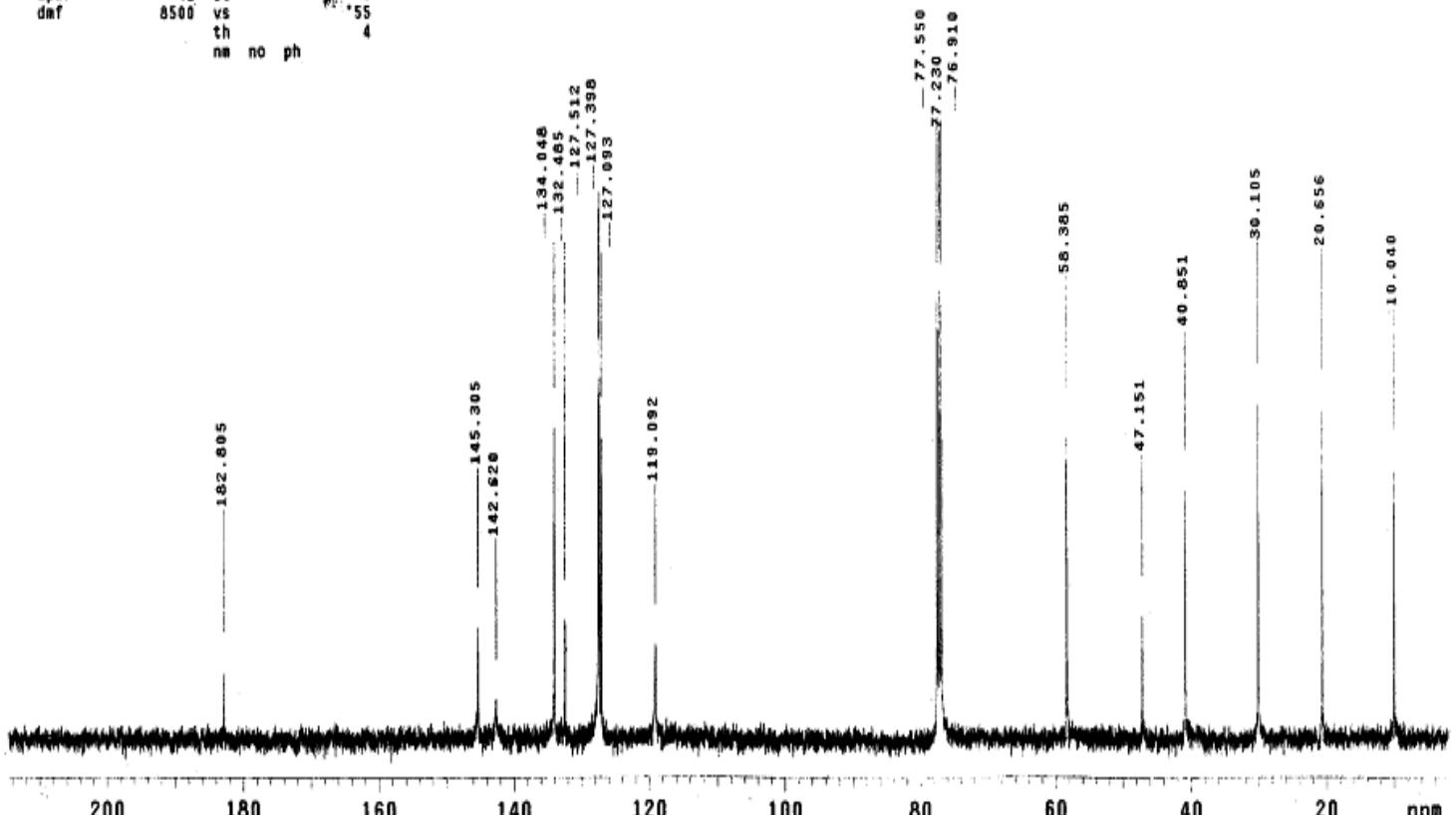
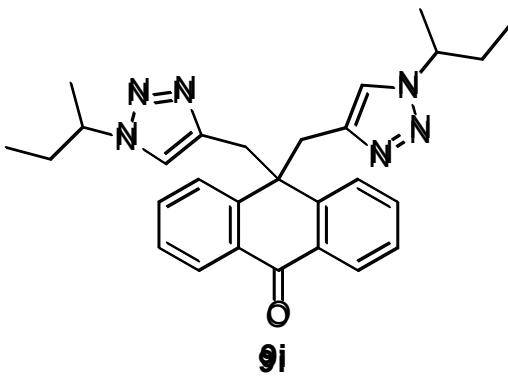
expt s2pul

SAMPLE SPECIAL
date Sep 7 2012 temp not used
solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION hst 0.008
sw 6389.8 pw90 19.700
at 1.998 alfa 20.000
np 25528 FLAGS
fb not used 11 n
bs 4 in
di 1.000 dp y
nt 32 hs nn
ct 32 PROCESSING
TRANSMITTER 1b 0.10
tn H1 fn 65536
sfrq 399.853 DISPLAY
tof 362.8 sp -240.8
tpwr 57 wp 4785.8
pw 9.850 rfl 3698.1
DECOUPLER rfp 2884.9
dn C13 rp 110.1
dof 0 lp -94.2
dm nnn PLOT
dem c wc 250
dpwr 50 sc 0
dft 15900 vs 99
th 7
nm cdc ph



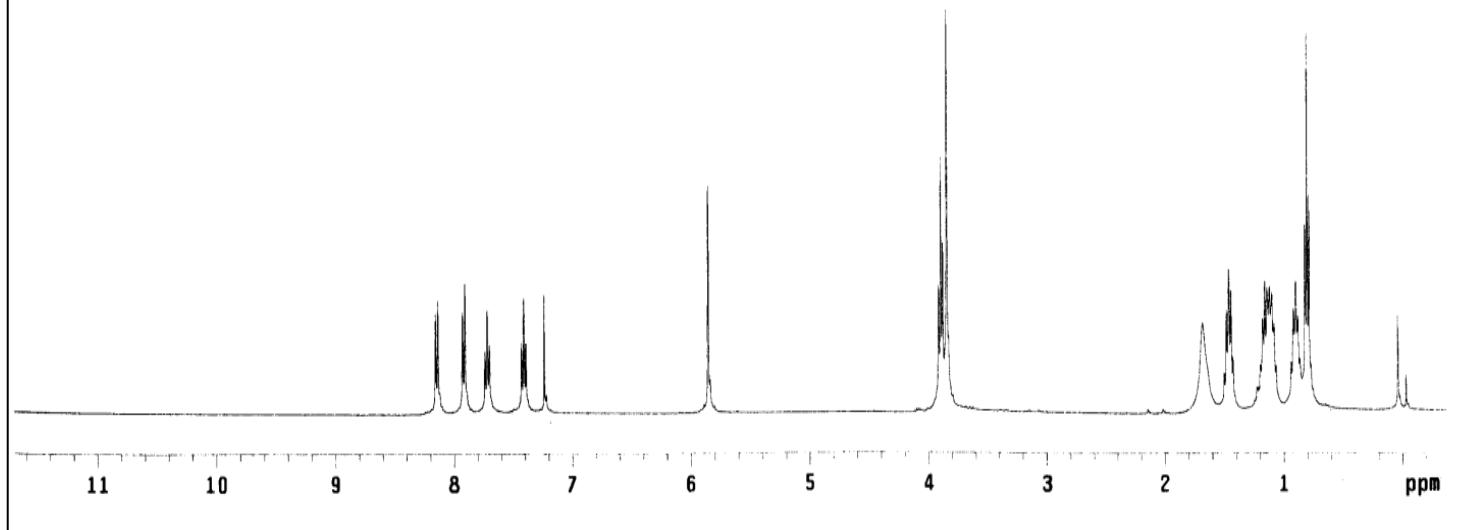
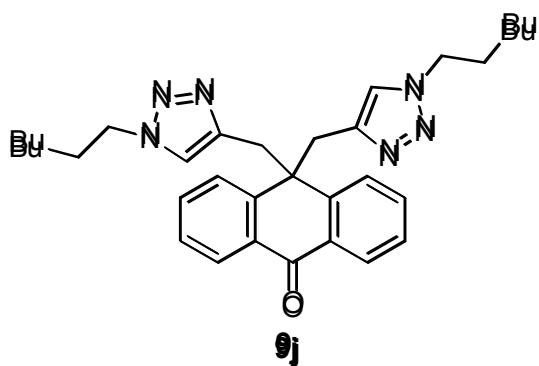
¹³C NMR spectra of **9i**

```
exp1 s2pul
SAMPLE          SPECIAL
date Jul 12 2013 temp    not used
solvent   CDCl3 gain     not used
file      exp spin    not used
ACQUISITION hst      0.008
sw       25125.6 pw90    9.400
at        1.199 alfa   20.000
np       60270   FLAGS
fb       13800   f1      n
bs        10    tn      n
di       1.000 dp      y
nt       5000   hs      nn
ct       1040   PROCESSING
TRANSMITTER lb      2.00
tn       C13   fn      65536
sfrq    100.554   DISPLAY
tof      1536.3   sp      203.5
tpwr    61    wp      21361.4
pw       4.700   r11     9278.2
DECOUPLER rfp     7764.8
dn       H1    rp      -69.7
dof      0    lp      -277.8
dm      yyy   PLOT
dmm      w    wc      256
dpwr    42    sc      0
dmr     8500   vs      55
dmf      4
nm no ph
```

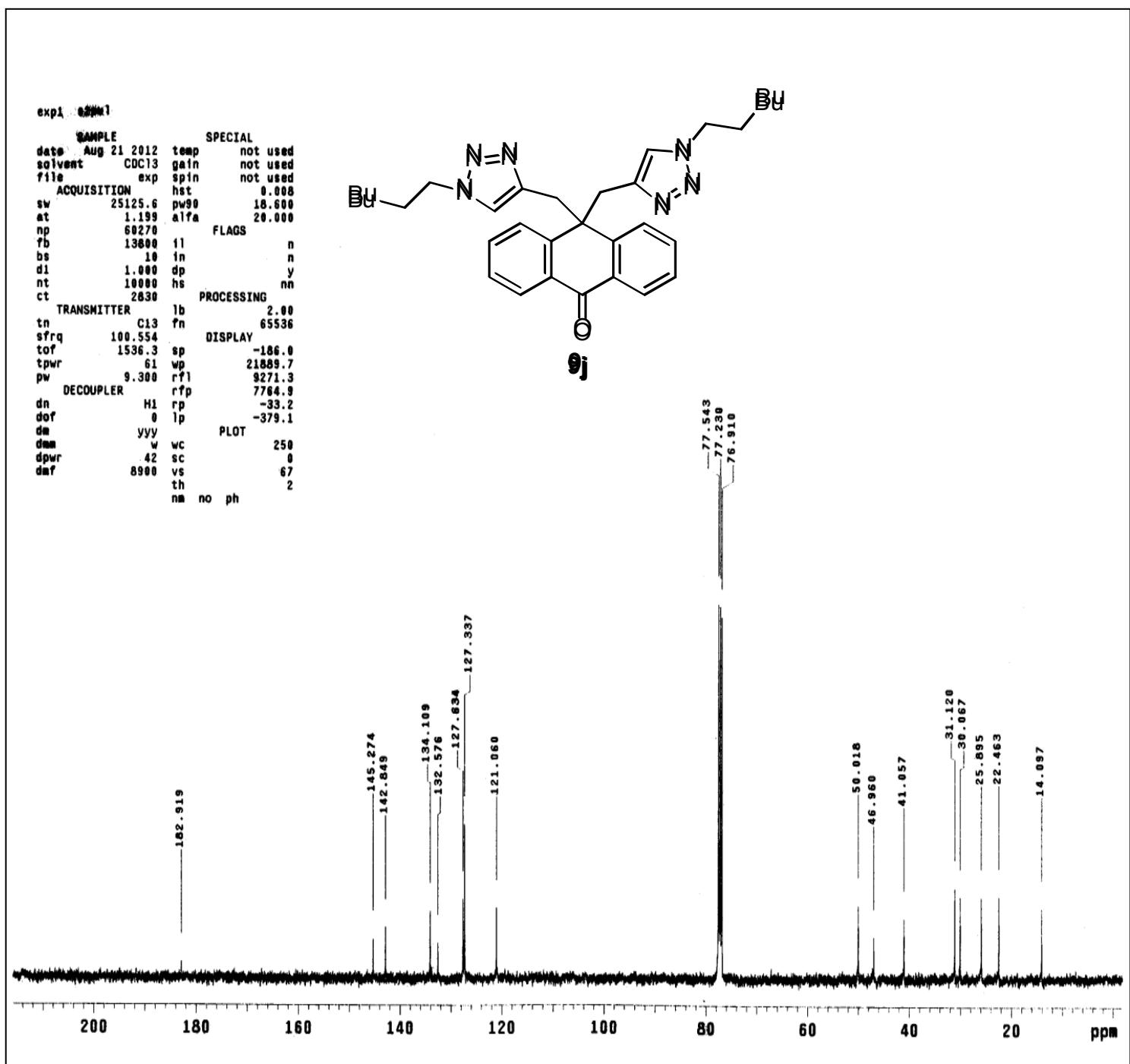


¹H NMR spectra of **9j**

```
exptl s2pul
SAMPLE          SPECIAL
date   Aug 21 2012 temp    not used
solvent   CDCl3 gain    not used
file      exp spin   not used
ACQUISITION    hst     0.008
sw       6389.8 pw90   19.700
at        1.998 alfa   20.000
np       25528  FLAGS
fb      not used tl     n
bs         4 fn     n
di       1.000 dp     y
nt        32 hs     nn
ct        32
TRANSMITTER    1b     0.10
tn        H1 fn    not used
sfrq    399.853  DISPLAY
tof      362.8 sp    -147.7
tpwr     57 wp    4827.7
pw       9.850 rfl   3697.4
DECOUPLER     rfp   2894.9
dn        C13 rp    115.0
dof       0 lp    -92.2
dm      nnn PLOT
dmm      c wc    250
dpwr     50 sc     0
dmf     15900 vs    54
            th    26
nm  cdc ph
```

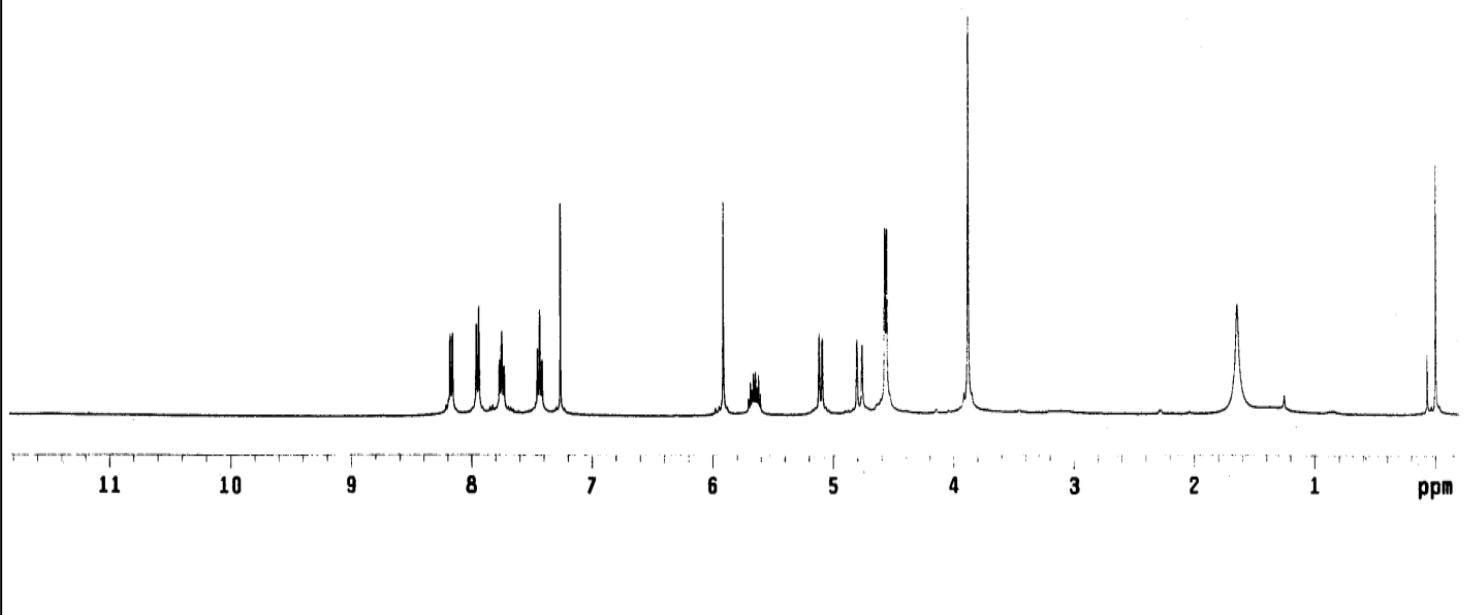
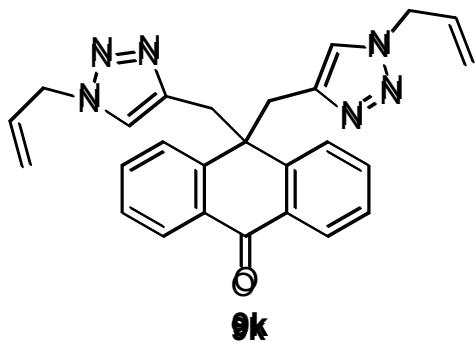


¹³C NMR spectra of 9j



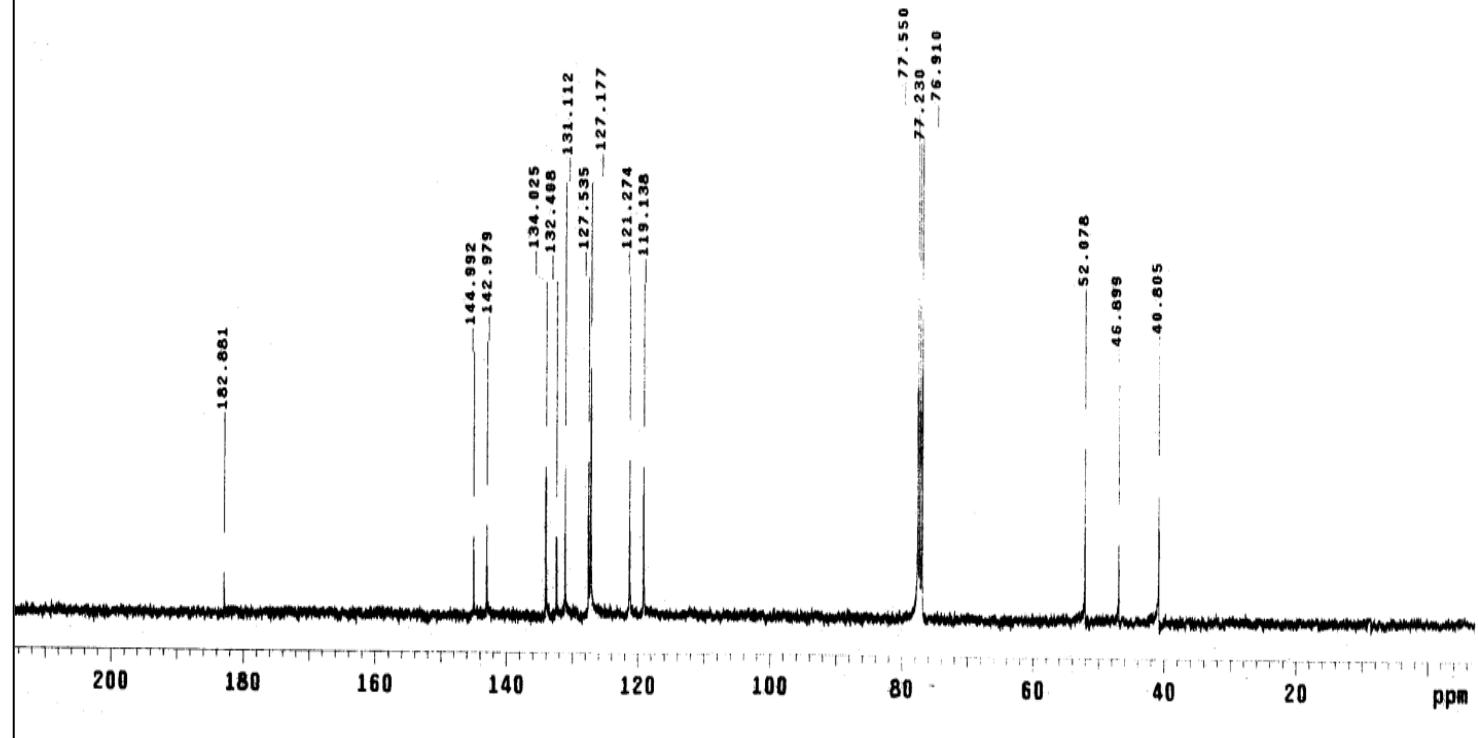
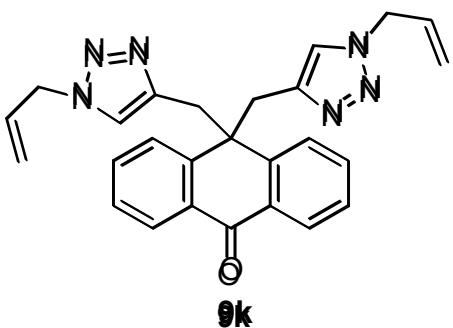
¹H NMR spectra of **9k**

```
expt s2pul
SAMPLE          SPECIAL
date Sep 3 2012 temp    not used
solvent   CDCl3 gain     not used
file      exp spin    not used
ACQUISITION hst      0.008
sw       6389.8 pw90    19.700
at        1.998 alfa    20.000
np        25528 FLAGS
fb       not used 11      n
bs         4 in
di        1.000 dp      y
nt        32 hs      nn
ct        32 PROCESSING
TRANSMITTER 1b      0.10
tn        H1 fn      65536
sfrq     399.853 DISPLAY
tof       362.8 sp      -80.0
tpwr      57 wp      4811.2
pw       9.850 rfl     793.5
DECOUPLER C13 rfp     0
dn        C13 rp      104.8
dof       0 lp      -81.4
dm        nnn PLOT
dmr      c wc      250
dpwr      50 sc      0
dmf      15900 vs      54
      th      14
nm      cdc ph
```

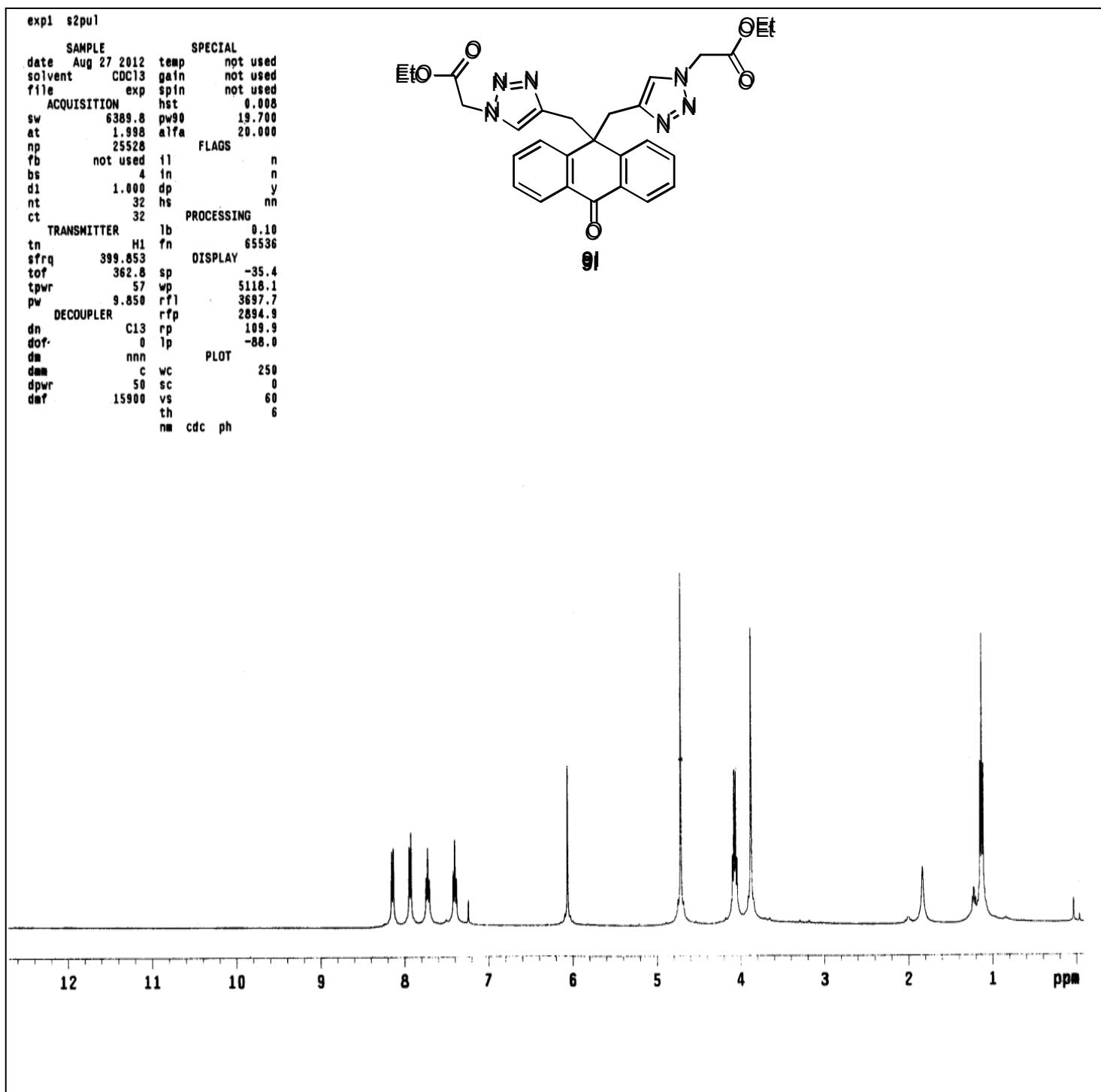


¹³C NMR spectra of 9k

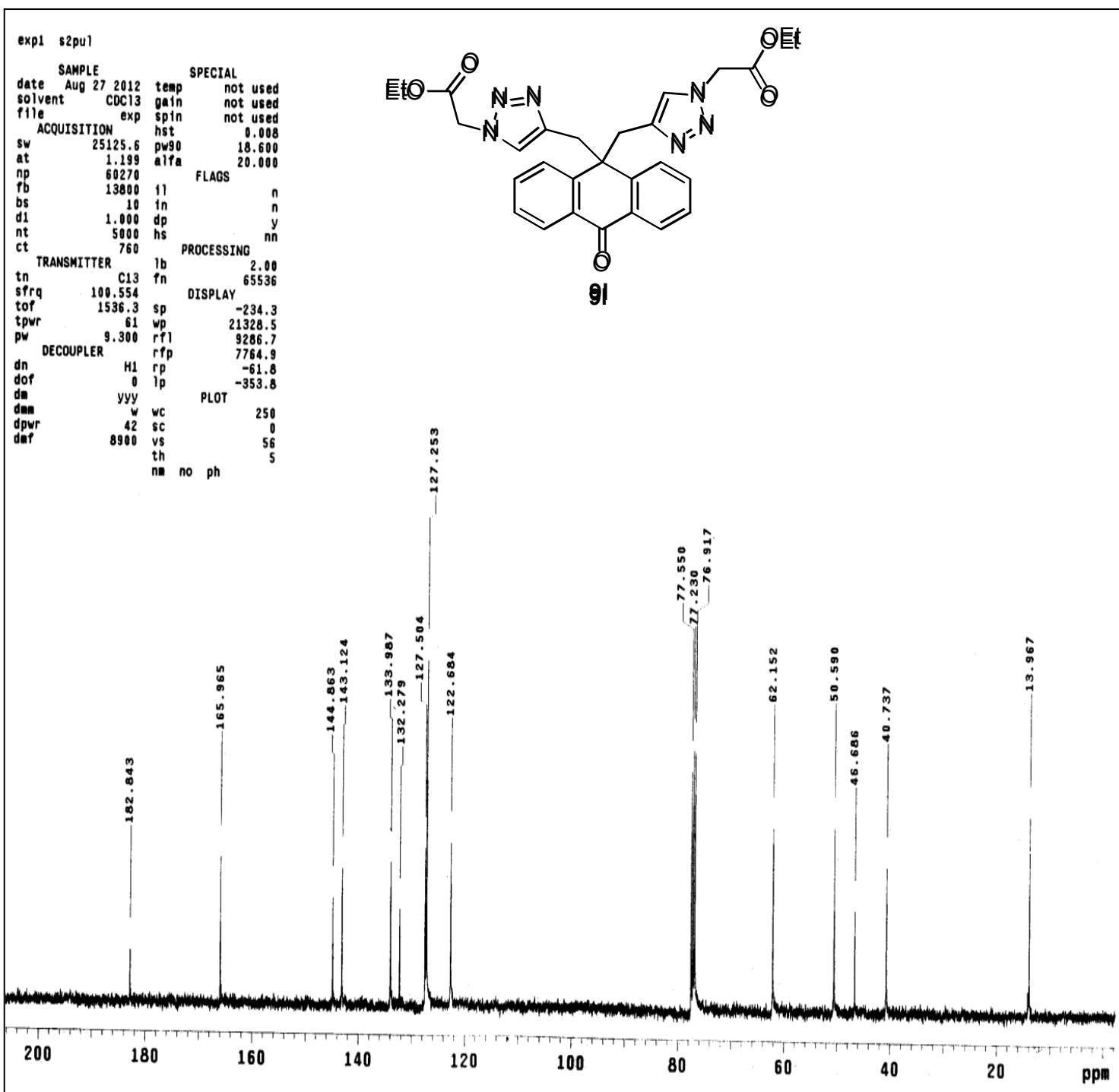
```
expt1 s2pul
SAMPLE          SPECIAL
date  Sep 3 2012 temp  not used
solvent   CDCl3 gain  not used
file      exp spin  not used
ACQUISITION hst    0.008
sw      25125.6 pw90  18.600
at       1.199 alfa  20.000
np      60270   FLAGS
fb      13800   11     n
bs        10   in     n
di      1.000 dp     y
nt      5000 hs     nn
ct      1250   PROCESSING
TRANSMITTER 1b    2.00
tn      C13 fn    65536
sfrq    100.554  DISPLAY
t0f     1536.3 sp   -726.6
tpwrr   61 wp    22352.1
pw      8.300 rfp   8283.6
DECOUPLER   rfp   7764.9
sh      H1 rp    4.2
dof      0 1p   -466.6
sh      VVY PLOT
sh      V  WC   250
sh      42 SC    0
sh      8900 VS   40
sh      th    3
nm no ph
```



¹H NMR spectra of 9l

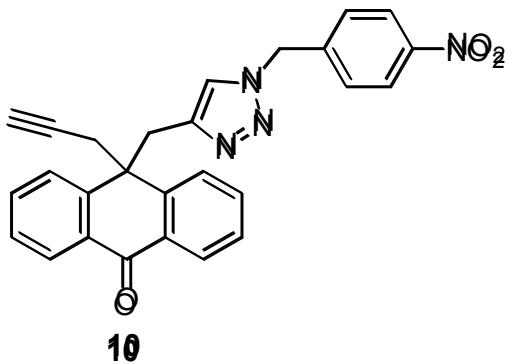


¹³C NMR spectra of 9l

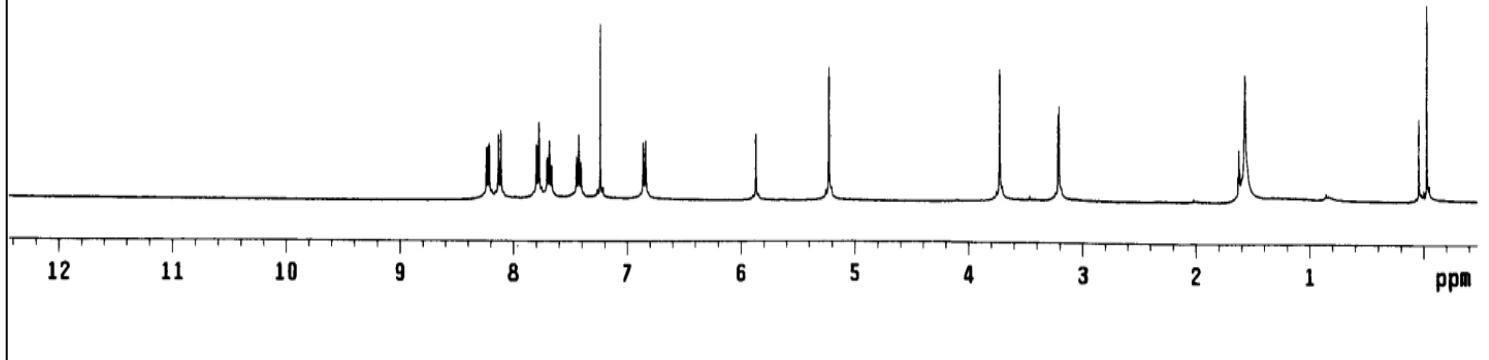


¹H NMR spectra of **10**

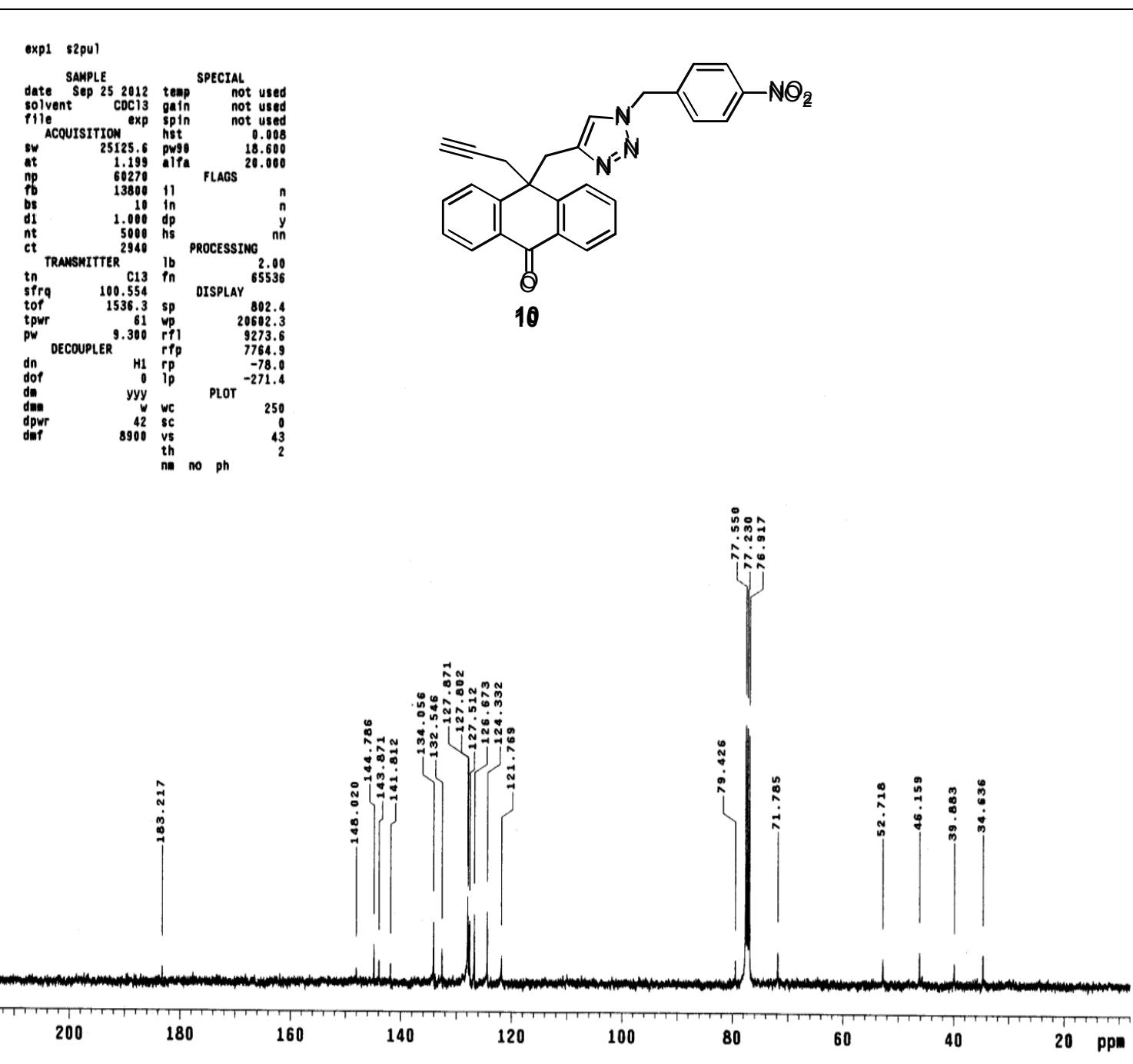
```
expt s2pul
SAMPLE          SPECIAL
date Sep 23 2012 temp not used
solvent   CDCl3 gain not used
file      exp spin not used
ACQUISITION    hst 0.008
sw       6389.8 pw90 19.700
at        1.998 alfa 20.000
np       25528 FLAGS
fb      not used fl n
bs         4 in n
di       1.000 dp y
nt        32 hs nn
ct        32 PROCESSING
TRANSMITTER    1b 0.10
tn        H1 fn 65536
sfrq     399.853 DISPLAY
t0f      362.8 sp -190.5
tpwr     57 wp 5163.8
pw       9.850 rfp 3698.3
DECOUPLER    rfp 2894.9
dn        C13 rp 95.7
dof       0 lp -70.8
dm       nnn PLOT
dmm      c wc 250
dpwr     50 sc 0
dmf      15900 vs 25
th      nm cdc ph 7
nm cdc ph
```



10

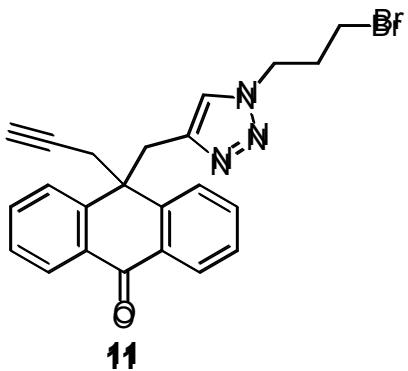


¹³C NMR spectra of **10**

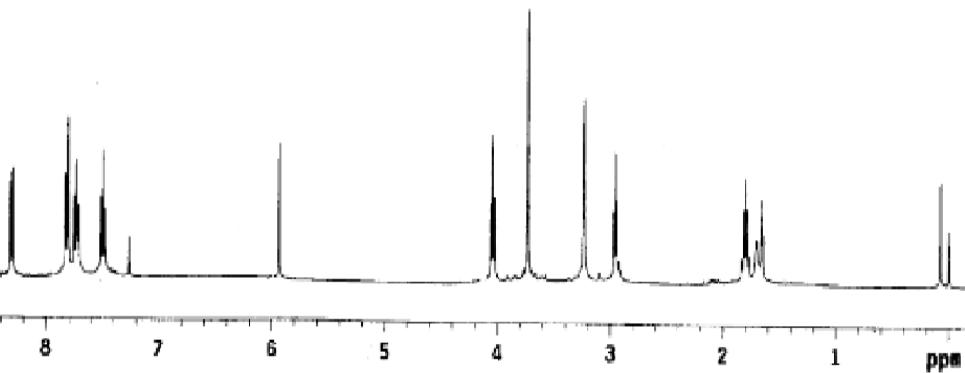


¹H NMR spectra of **11**

ANTH-PR-14
exp1 t2put
SAMPLE SPECIAL
date Mar 18 2013 temp not used
solvent CDCl₃ gain not used
file exp spin not used
ACQUISITION het 0.008
SW 6389.8 pw90 14.100
AT 1.996 alfa 20.000
NP 25528 FLAGS
FB not used t1 n
BS 4 in n
DI 1.000 DP y
NT 32 HS nn
ET 32
TRANSMITTER 1b 0.10
TN HI fn 65536
SFRQ 399.853 DISPLAY
TOF 362.8 SP -70.4
TPWR 62 WP 5121.8
PW 7.050 RF1 792.3
DECOUPLER RFP 0
DN C13 RP 70.8
D0F 0 LP -90.6
DN MNN PLOT
DSS C WC 250
DPWR 50 SC 0
DMF 15900 VS 37
TH 9
MM C6C PH

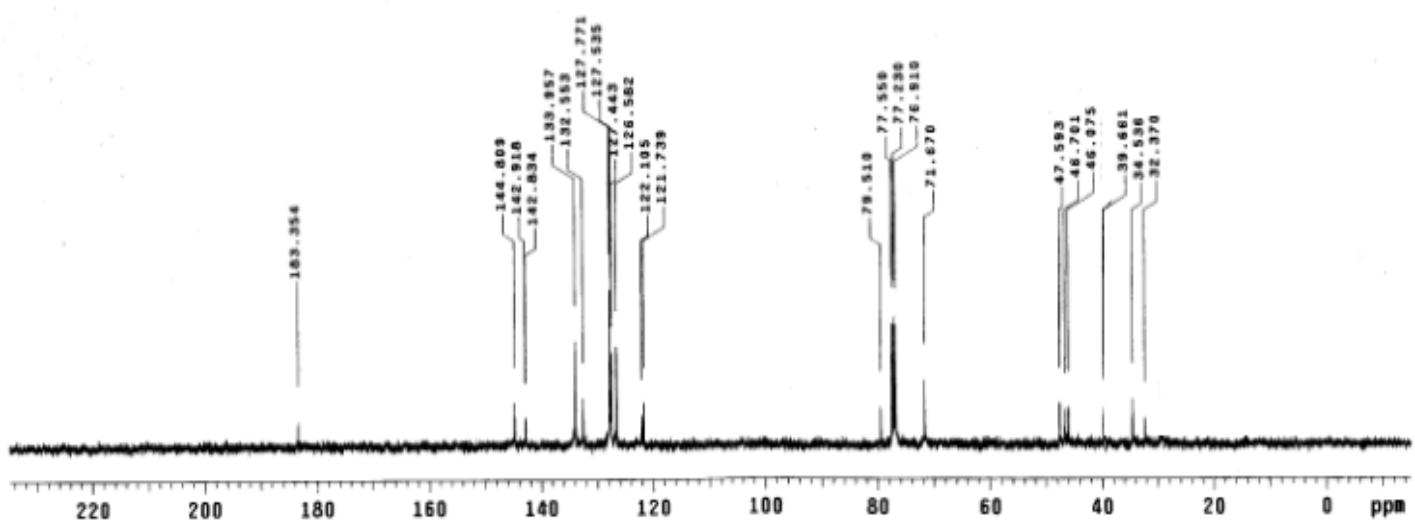
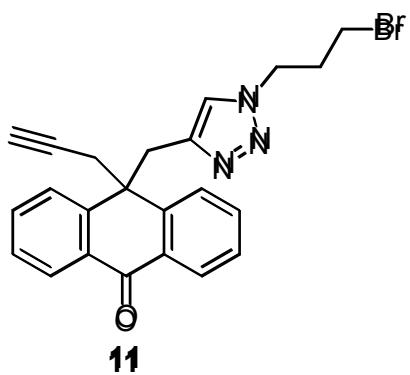


11



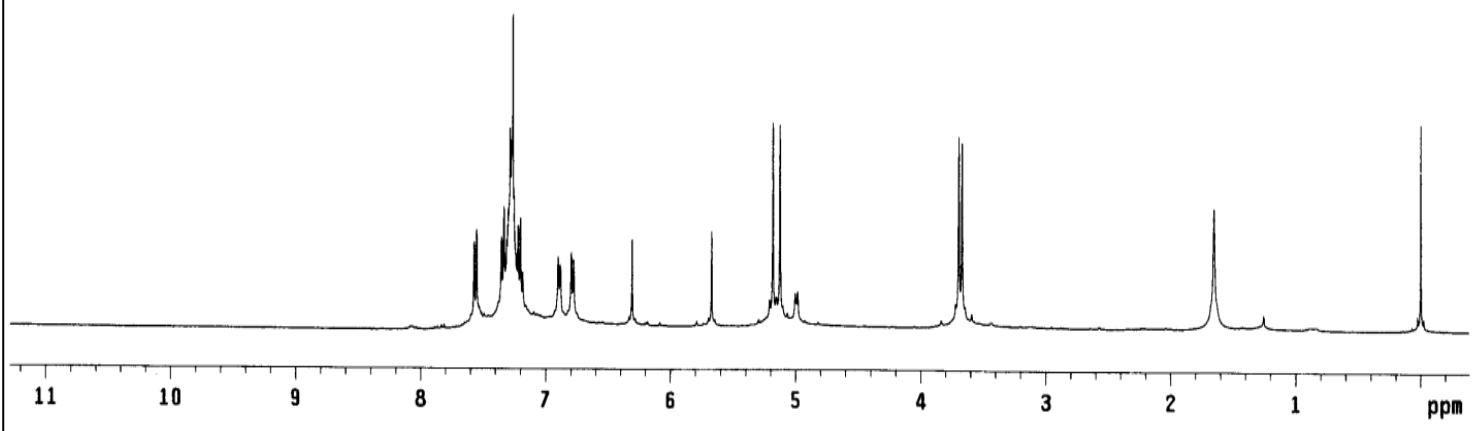
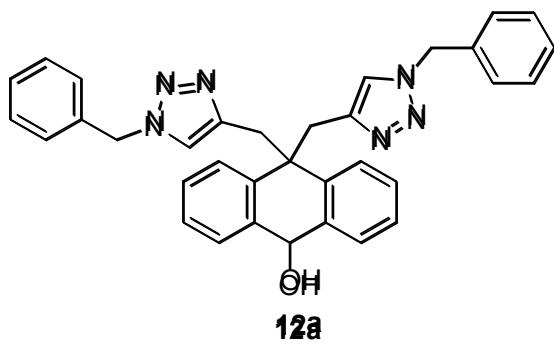
¹³C NMR spectra of **11**

```
ANTH-PR=14R=13C
exptl s2pul
SAMPLE          SPECIAL
date  Apr 27 2013 temp    not used
solvent   CDCl3 gain    not used
file     exp spin    not used
ACQUISITION hst      0.008
sw      25125.6 pw06   9.400
at      1.199 alfa   20.000
np      60270   FLAGS
fb      138800 11      n
bs      10      in
di      1.000 dp      y
nt      3000  hs      nn
ct      600  PROCESSING
TRANSMITTER 1b      2.00
tn      C13 fn      65536
sfrq  100.554  DISPLAY
t0f    1536.3 sp      -1514.1
tpwr  61  wp      25125.6
pw    4.700 rrf1   9279.0
DECOUPLER   rfp      7764.9
dn      H1 rp      -78.3
dof     8  lp      -273.2
ds     yyy  PLOT
dss    v  wc      258
dpvr  42  sc      8
def    8500 vs      22
th      3
nm no ph
```



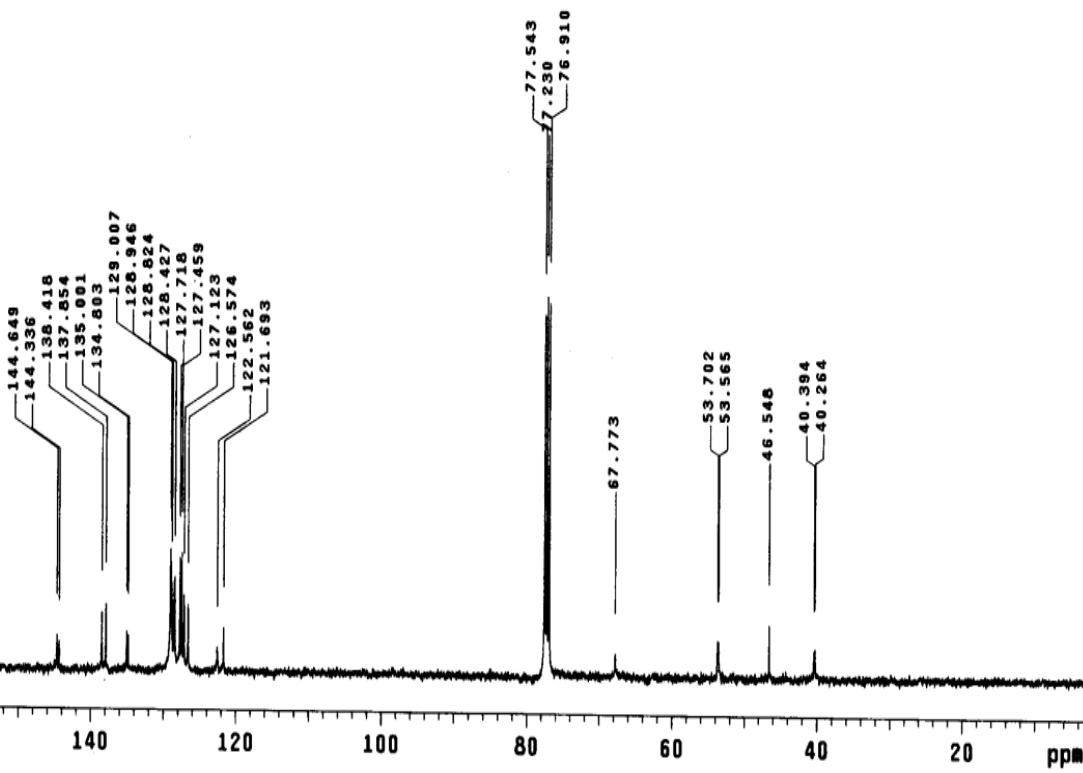
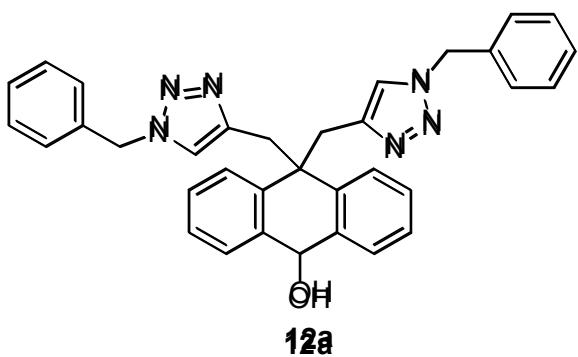
¹H NMR spectra of 12a

```
exp1 s2pu1
SAMPLE          SPECIAL
date  Sep 14 2012 temp  not used
solvent   CDCl3 gain  not used
file      exp spin  not used
ACQUISITION hst    0.008
sw       6389.8 pw90  19.700
at        1.998 aifa  20.000
np      25528  FLAGS
fb      not used 11    n
bs         4 in     n
d1      1.000 dp     y
nt        64 hs     nn
ct        64 PROCESSING
TRANSMITTER 1b    0.10
tn        H1 fn    65536
sfrq     399.853  DISPLAY
tof      362.8 sp    -156.6
tpwr     57 wp    4668.5
pw       9.850 rf1   794.7
DECOUPLER rfp   0
dn        C13 rp   107.6
dof      0 lp    -90.4
dm      nnn PLOT
dm      c wc    250
dpwr     50 sc    0
daf     15900 vs    41
th      th     8
nm cdc ph
```

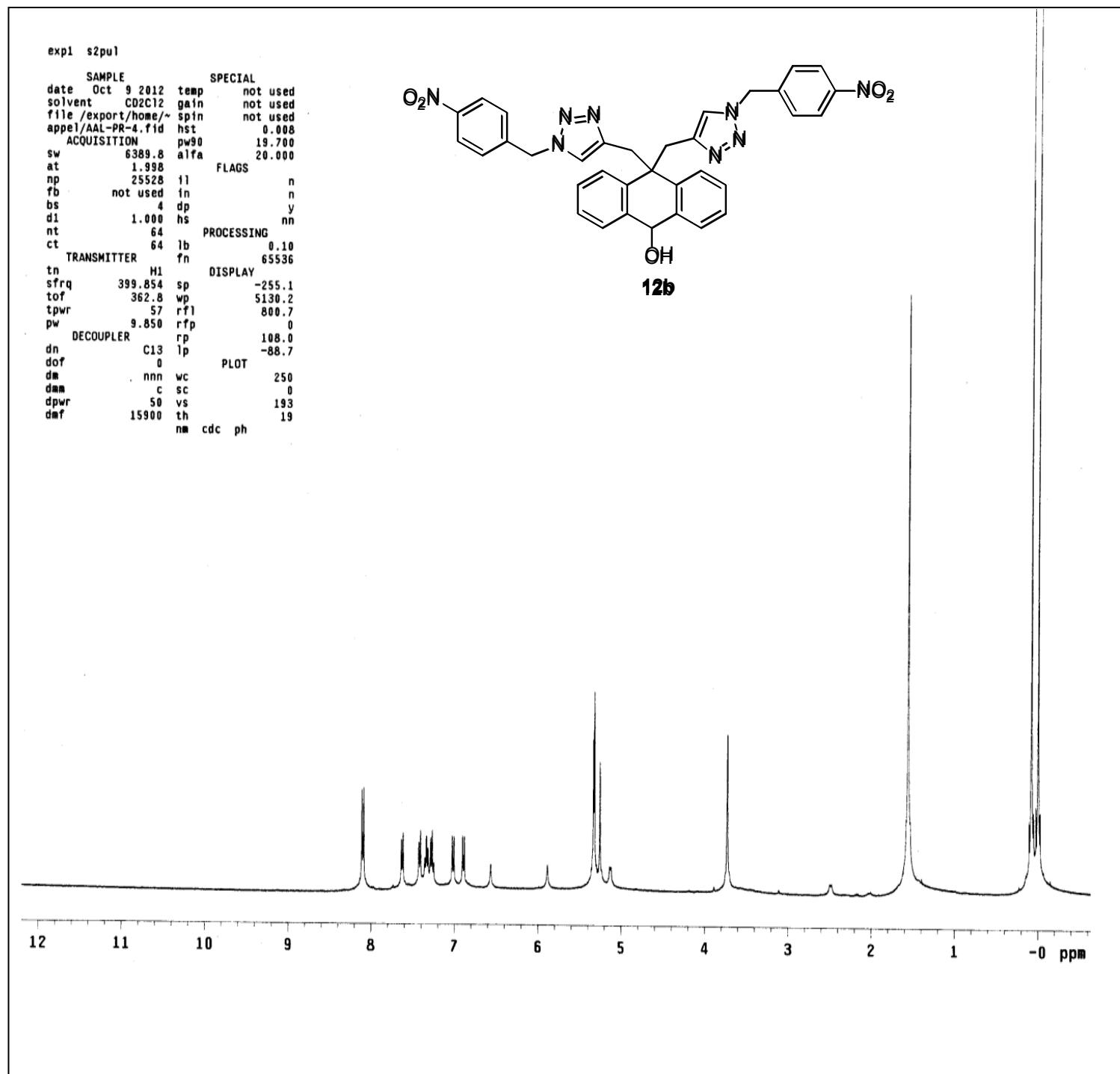


¹³C NMR spectra of 12a

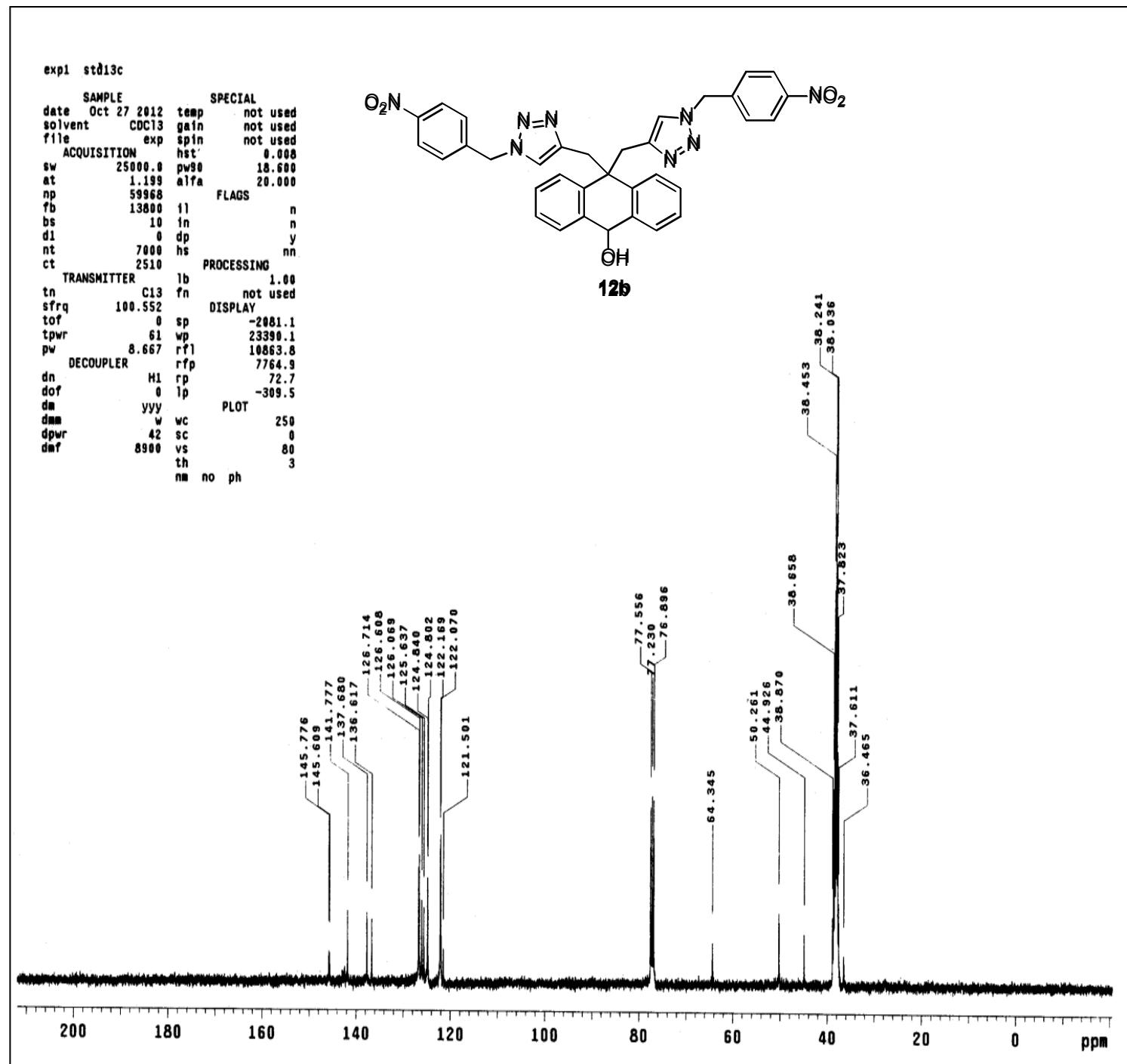
```
exptl s2pul
SAMPLE          SPECIAL
date   Sep 14 2012 temp    not used
solvent   CDCl3 gain    not used
file     exp spin   not used
ACQUISITION hst      0.008
sw      25125.6 pw90    18.000
at      1.199 alfa   20.000
np      60278  FLAGS
fb      13800  11      n
bs      10     in      n
d1      1.000 dp      y
nt      5000  hs      nn
ct      3680  PROCESSING
TRANSMITTER 1b      2.00
tn      C13  fn      65536
sfrq   100.554 DISPLAY
t0f    1536.3 sp      236.5
tpwr   61    wp      20469.6
pw      9.300 rfl     9278.2
DECOUPLER   rfp     7764.9
dn      H1    rp      -62.8
dof     0    1p      -318.2
dm      yyy   PLOT
dme    w    wc      250
dpwr   42    sc      0
dmf    8900 vs      47
th      2
nm no ph
```



¹H NMR spectra of 12b



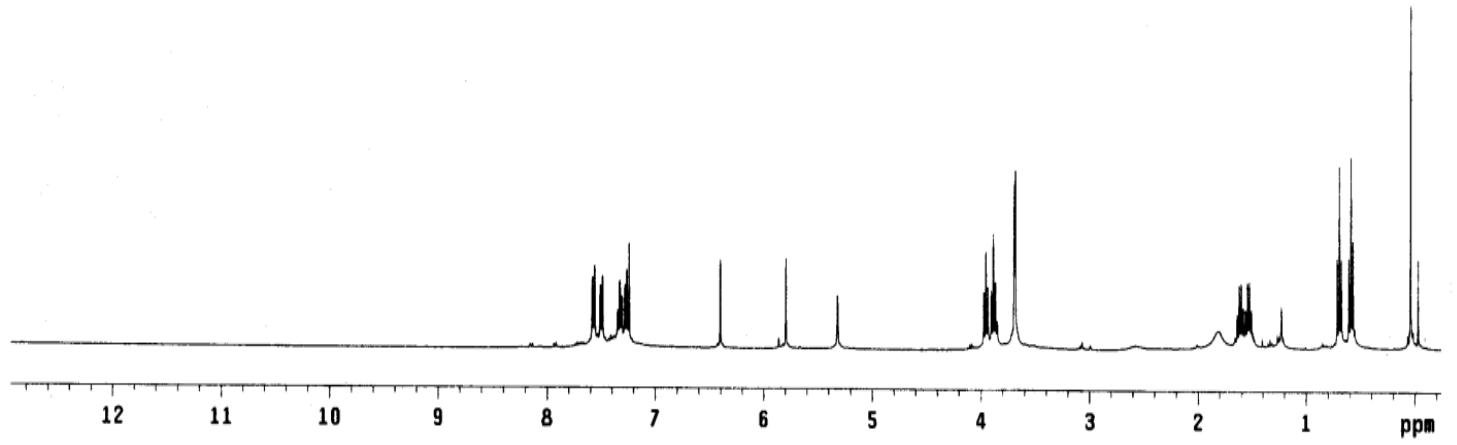
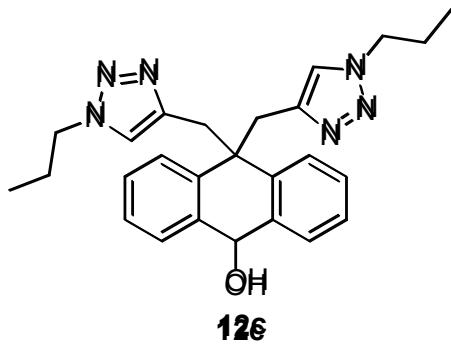
¹³C NMR spectra of 12b



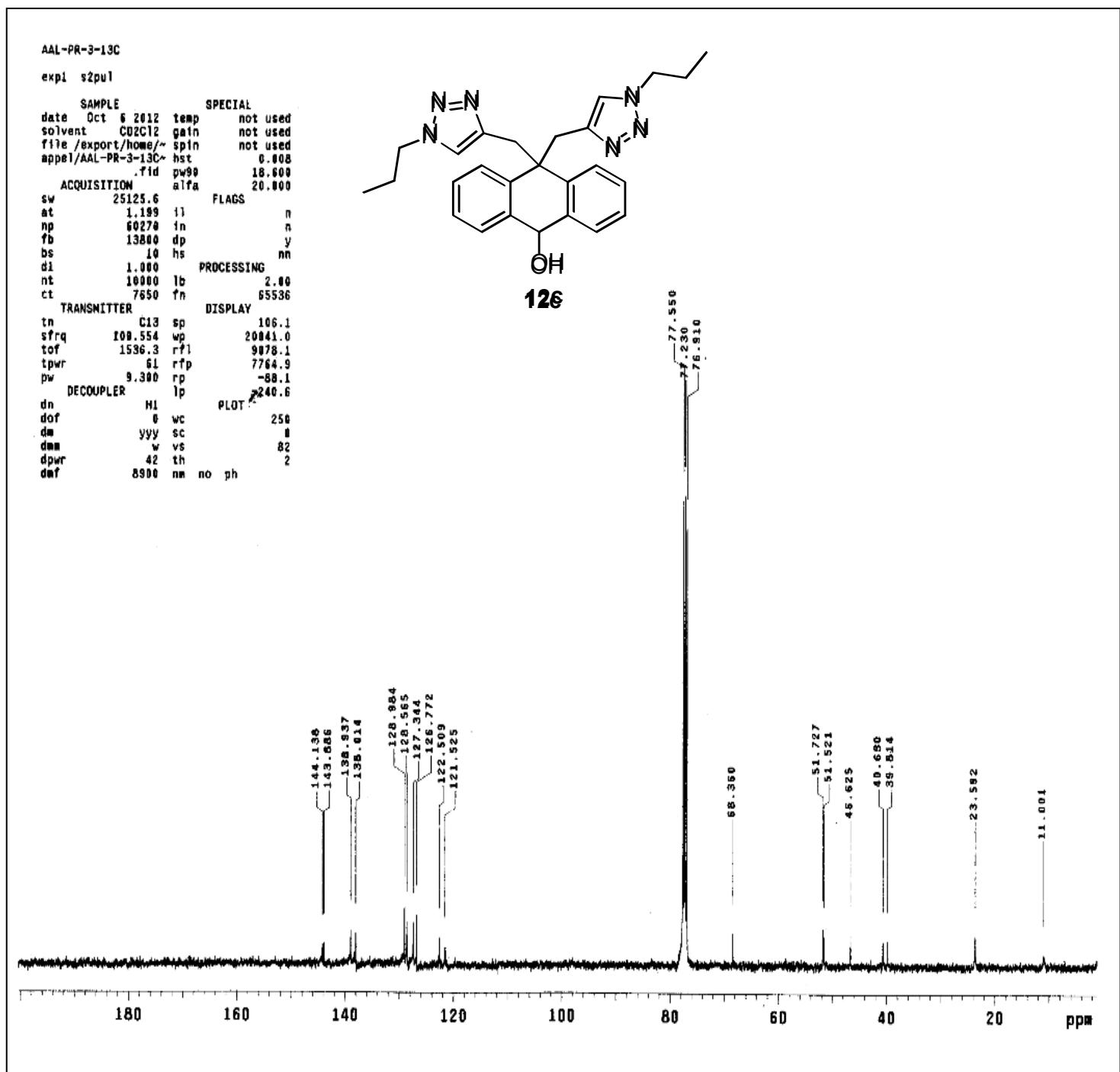
¹H NMR spectra of 12c

exp1 s2pul

SAMPLE SPECIAL
date Oct 9 2012 temp not used
solvent CDCl₃ gain not used
tfile exp spin not used
ACQUISITION hst 0.008
sw 6389.8 pw0 19.700
at 1.998 alfa 20.000
np 25528 FLAGS
fb not used 11 n
bs 4 in n
di 1.000 dp y
nt 32 hs nn
ct 32 PROCESSING
TRANSMITTER 1b 0.10
tn H1 fn 65536
sfrq 399.853 DISPLAY
tof 362.8 sp -98.2
tpwr 57 wp 5273.0
pw 9.850 rfp 3698.3
DECOUPLER C13 rp 2894.9
dn C13 rp 104.0
dof 0 lp -79.2
dm nnn PLOT
dmm c wc 250
dpwr 50 sc 0
dmf 15900 vs 45
th 27
nm cdc ph

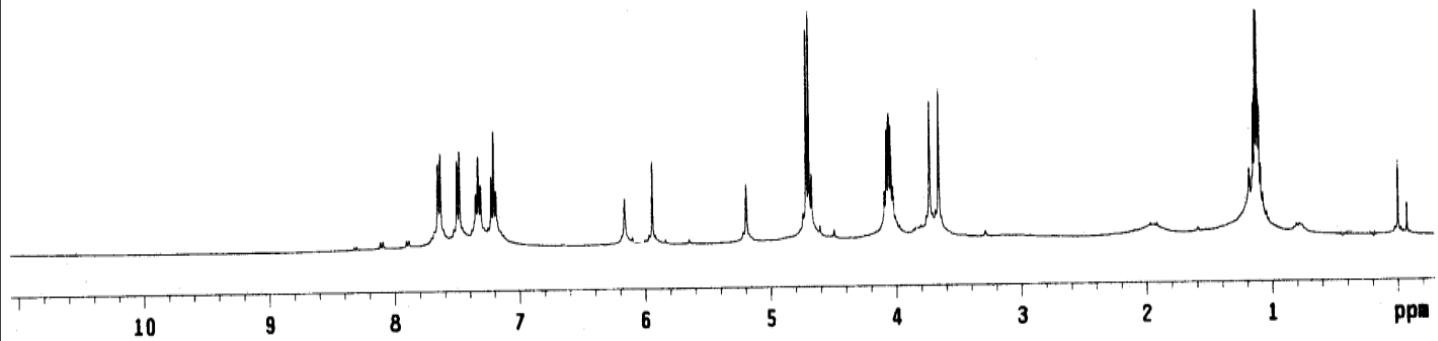
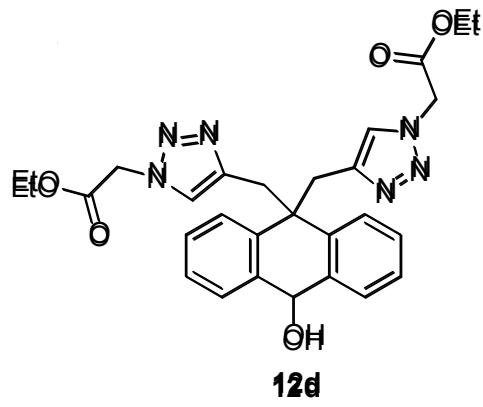


¹³C NMR spectra of 12c



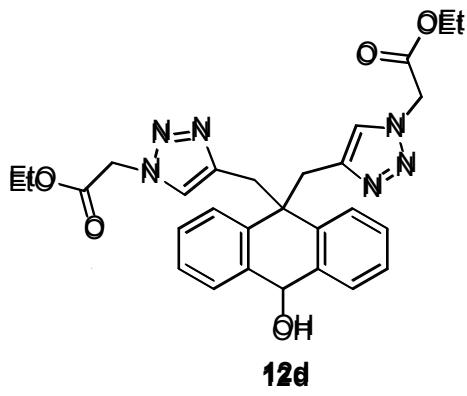
¹H NMR spectra of 12d

```
exp1 s2pu1
SAMPLE          SPECIAL
date Nov 7 2012 temp    not used
solvent   CDCl3 gain     not used
file      exp spin    not used
ACQUISITION hst      0.008
sw       6389.8 pw90    19.700
at        1.998 alfa   20.000
np       25528  FLAGS
fb      not used 11      n
bs        4 in      n
di       1.000 dp      y
nt        32 hs      nn
ct        32 PROCESSING
TRANSMITTER 1b      0.10
tn       H1 fn     65536
sfrq    399.853  DISPLAY
t0f     362.8 sp     -117.0
tpwr    57 wp     4542.5
pw      9.850 rf1    815.1
DECOUPLER rfp     0
dn       C13 rp     109.9
dof      0 lp     -100.0
dm      nnn PLOT
dme     c wc     250
dpwr    50 sc      0
dmf    15900 vs     30
th      th      13
nm cdc ph
```

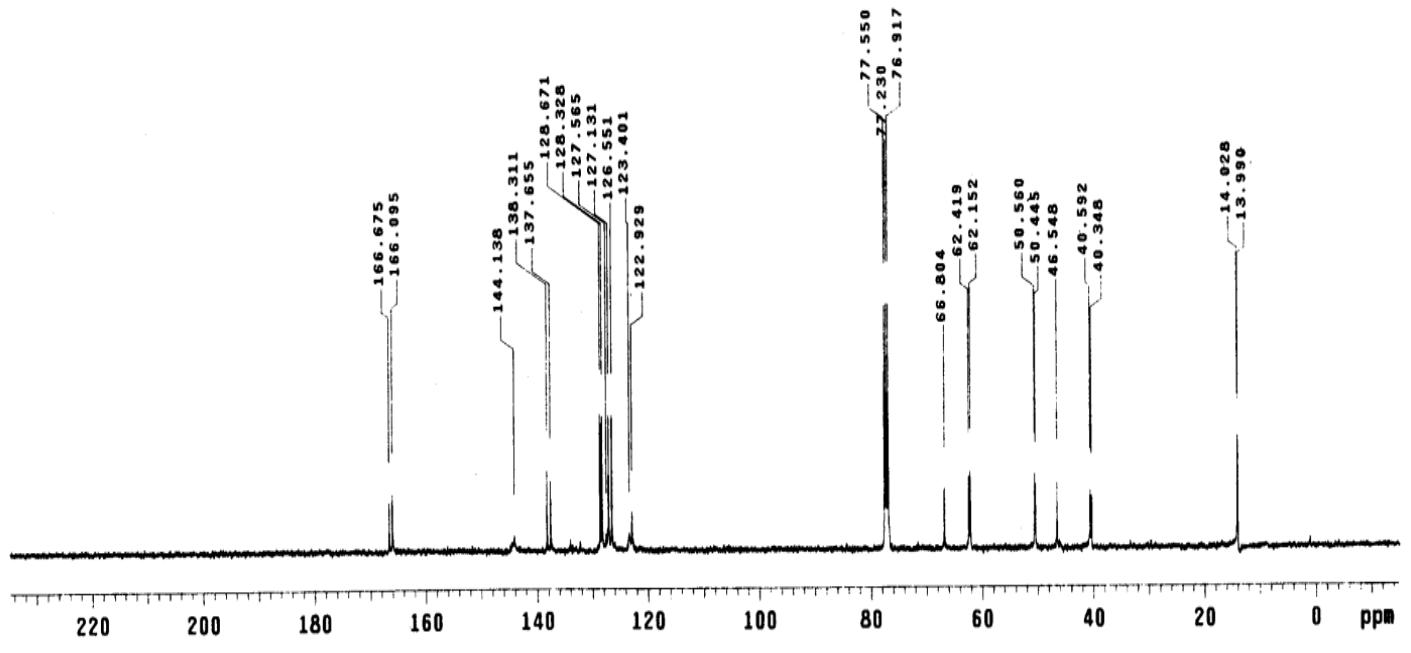


¹³C NMR spectra of 12d

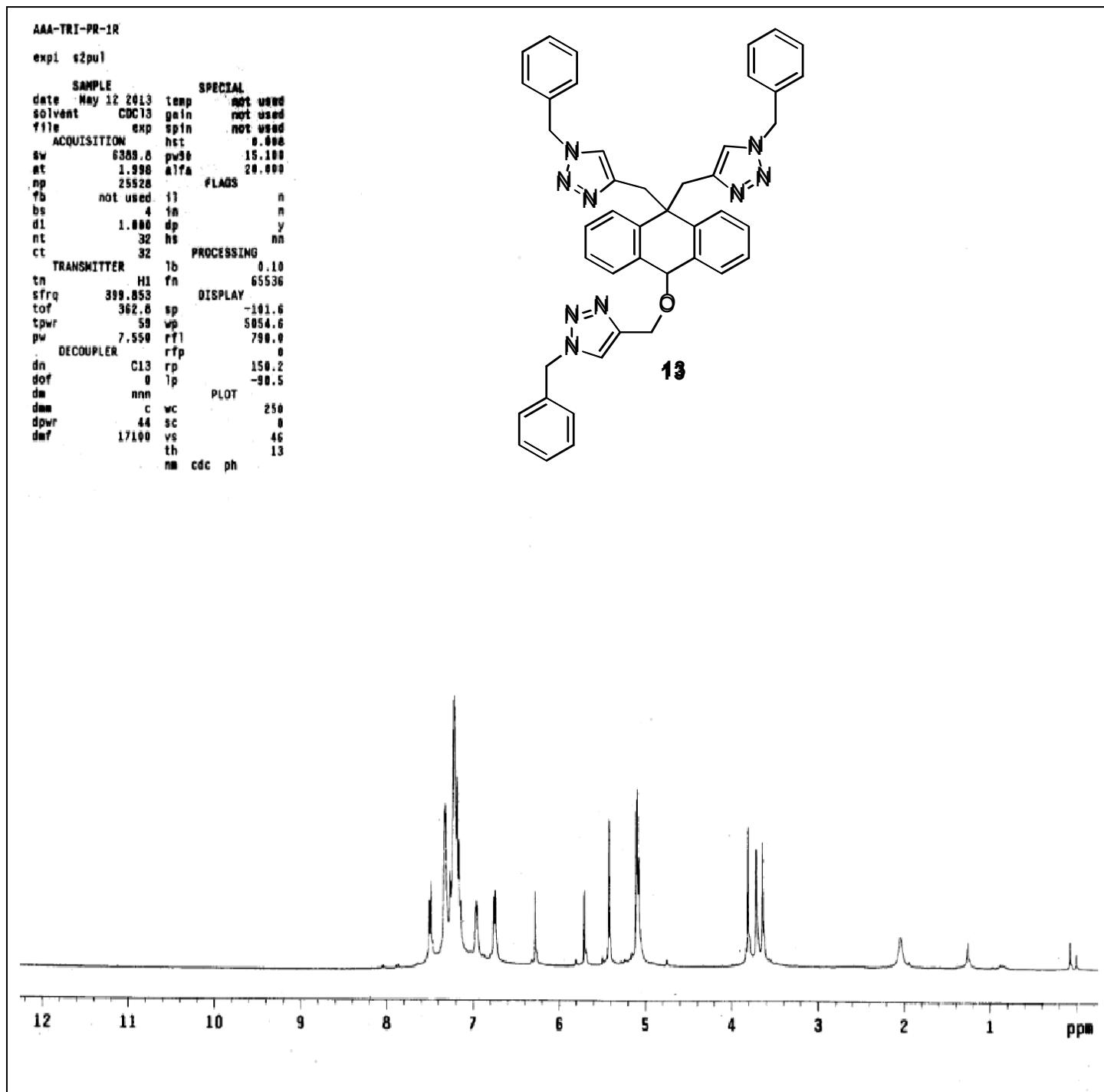
```
exp1 s2pul
SAMPLE          SPECIAL
date  Oct 19 2012 temp  not used
solvent   CDCl3 gain  not used
file      exp spin  not used
ACQUISITION    hst      0.008
sw       25125.6 pw90   18.600
at       1.199 alfa   20.000
np       60270   FLAGS
fb       13800   f1      n
bs        10     in      n
d1       1.000   dp      y
nt       8000    hs      nn
ct       2050    PROCESSING
TRANSMITTER    1b      2.00
tn       C13   fn      65536
sfrq    100.554  DISPLAY
t0f     1536.3   sp      -1520.2
tpwr    61     wp      25125.6
pw       9.300   rf1     9285.1
DECOUPLER     rfp     7764.9
dn       H1     rp      0.1
dof      0     lp      -398.0
dm       yyy    PLOT
dmm      w     wc      250
dpwr    42     sc      0
dmf     8900   vs      30
      th      1
nm no ph
```



12d



¹H NMR spectra of **13**



¹³C NMR spectra of **13**

