

Supporting information

Convenient Synthesis of Benzo[4,5]thiazolo [2,3-*c*][1,2,4]triazoles with 1 mol% CuCl₂•2H₂O as Catalyst in Water

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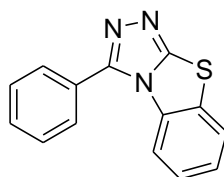
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Characterization Data

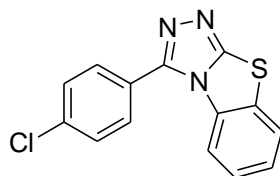
3-Phenylbenzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4a)¹



4a

Yellow powder; Mp 145-146 °C; **IR** (KBr) *v*: 3074, 1636, 1579, 1483, 773, 755, 704 cm^{-1} ; **¹H NMR** (DMSO-*d*₆, 500 MHz): δ = 8.09 (dd, *J* = 1.2, 8.0 Hz, 1H, ArH), 7.85–7.83 (m, 2H, ArH), 7.67–7.66 (m, 3H, ArH), 7.48–7.41 (m, 3H, ArH); **¹³C NMR** (DMSO-*d*₆, 125 MHz): δ = 132.3, 131.2, 130.2, 129.7, 129.6, 127.3, 126.9, 126.3, 114.4; **HRMS** (ESI-TOF⁺): *m/z* calcd for C₁₄H₁₀N₃S [(M + H)⁺], 252.0595; found, 252.0592.

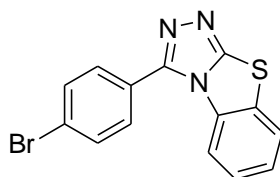
3-(4-Chlorophenyl)benzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4b)



4b

Cyan powder; Mp 198-199 °C; **IR** (KBr) *v*: 3092, 3074, 1632, 1603, 1484, 843, 762 cm^{-1} ; **¹H NMR** (DMSO-*d*₆, 500 MHz): δ = 8.09 (d, *J* = 7.5 Hz, 1H, ArH), 7.89 (d, *J* = 8.4 Hz, 2H, ArH), 7.74 (d, *J* = 8.5 Hz, 2H, ArH), 7.51–7.42 (m, 3H, ArH); **¹³C NMR** (DMSO-*d*₆, 125 MHz): δ = 136.0, 132.2, 131.6, 130.2, 129.7, 127.4, 126.9, 126.2, 114.6; **HRMS** (ESI-TOF⁺): *m/z* calcd for C₁₄H₉ClN₃S [(M + H)⁺], 286.0206; found, 286.0210.

3-(4-Bromophenyl)benzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4c)

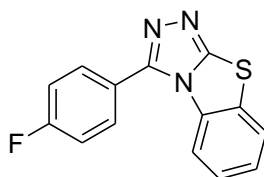


4c

Yellow powder; Mp 198-200 °C; **IR** (KBr) *v*: 3089, 3072, 1629, 1599, 1483, 830, 762

cm⁻¹; **¹H NMR** (DMSO-*d*₆, 500 MHz): δ = 8.09 (d, *J* = 7.3 Hz, 1H, ArH), 7.87 (d, *J* = 8.4 Hz, 2H, ArH), 7.80 (d, *J* = 8.4 Hz, 2H, ArH), 7.51–7.42 (m, 3H, ArH); **¹³C NMR** (DMSO-*d*₆, 125 MHz): δ = 132.6, 132.2, 131.7, 130.2, 127.4, 126.9, 126.6, 126.2, 124.8, 114.6; **HRMS** (ESI-TOF⁺): *m/z* calcd for C₁₄H₉BrN₃S [(M + H)⁺], 329.9701; found, 329.9709.

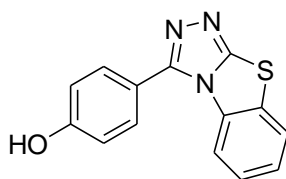
3-(4-Fluorophenyl)benzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4d)



4d

Gray powder; Mp 168-169 °C; **IR** (KBr) *v*: 3069, 1609, 1486, 840, 765 cm⁻¹; **¹H NMR** (CDCl₃, 500 MHz): δ = 7.80–7.78 (m, 2H, ArH), 7.71 (d, *J* = 8.0 Hz, 1H, ArH), 7.48 (d, *J* = 8.1 Hz, 1H, ArH), 7.41 (t, *J* = 7.5 Hz, 1H, ArH), 7.36–7.29 (m, 3H, ArH); **¹³C NMR** (CDCl₃, 125 MHz): δ = 164.2 (¹*J*_{C-F} = 247.6 Hz), 132.6, 131.3 (³*J*_{C-F} = 6.6 Hz), 129.9, 126.4, 124.9, 123.1, 116.4 (²*J*_{C-F} = 21.7 Hz), 114.1; **HRMS** (ESI-TOF⁺): *m/z* calcd for C₁₄H₉N₃OSF [(M + H)⁺], 270.0501; found, 270.0512.

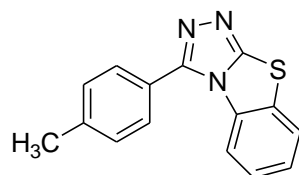
4-(Benzo[4,5]thiazolo[2,3-*c*][1,2,4]triazol-3-yl)phenol (4e)



4e

Gray powder; Mp 275-276 °C; **IR** (KBr) *v*: 3056, 3013, 1613, 1589, 1494, 840, 750 cm⁻¹; **¹H NMR** (DMSO-*d*₆, 500 MHz): δ = 10.15 (s, 1H, OH), 8.06 (t, *J* = 4.5 Hz, 1H, ArH), 7.62 (d, *J* = 8.2 Hz, 2H, ArH), 7.46–7.43 (m, 3H, ArH), 7.02–7.00 (d, *J* = 8.3 Hz, 2H, ArH); **¹³C NMR** (DMSO-*d*₆, 125 MHz): δ = 160.1, 131.3, 130.3, 127.3, 126.8, 126.2, 116.3, 114.4, 102.7; **HRMS** (ESI-TOF⁺): *m/z* calcd for C₁₄H₁₀N₃OS [(M + H)⁺], 268.0545; found, 268.0549.

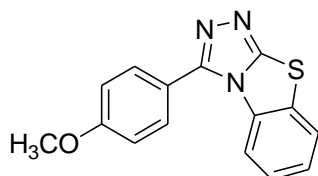
3-(*p*-Tolyl)benzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4f)¹



4f

Brown powder; Mp 155-156 °C; **IR** (KBr) ν : 3066, 3031, 2919, 2850, 1609, 1579, 1486, 820, 748 cm^{-1} ; **$^1\text{H NMR}$** (DMSO- d_6 , 500 MHz): δ = 8.07 (d, J = 7.9 Hz, 1H, ArH), 7.72 (d, J = 7.7 Hz, 2H, ArH), 7.47 (d, J = 7.7 Hz, 3H, ArH), 7.45–7.41 (m, 2H, ArH), 2.46 (s, 3H, CH₃); **$^{13}\text{C NMR}$** (DMSO- d_6 , 125 MHz): δ = 141.0, 132.3, 130.1, 129.6, 127.3, 126.9, 126.3, 124.5, 114.5, 21.6; **HRMS** (ESI-TOF⁺): m/z calcd for C₁₅H₁₂N₃S [(M + H)⁺], 266.0752; found, 266.0759.

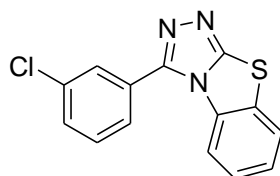
3-(4-Methoxyphenyl)benzo[4,5]thiazolo[2,3-c][1,2,4]triazole (4g)¹



4g

Cyan powder; Mp 141-142 °C; **IR** (KBr) ν : 3088, 3056, 2999, 2922, 2841, 1614, 1575, 1483, 846, 747 cm^{-1} ; **$^1\text{H NMR}$** (CDCl₃, 500 MHz): δ = 7.72–7.69 (m, 3H, ArH), 7.54 (d, J = 8.1 Hz, 1H, ArH), 7.39 (t, J = 7.5 Hz, 1H, ArH), 7.33 (t, J = 7.7 Hz, 1H, ArH), 7.11 (d, J = 8.5 Hz, 2H, ArH), 3.93 (s, 3H, OCH₃); **$^{13}\text{C NMR}$** (CDCl₃, 125 MHz): δ = 161.5, 132.7, 130.7, 130.3, 126.2, 124.8, 119.1, 114.5, 114.3, 55.5; **HRMS** (ESI-TOF⁺): m/z calcd for C₁₅H₁₂ON₃S [(M + H)⁺], 282.0701; found, 282.0709.

3-(3-Chlorophenyl)benzo[4,5]thiazolo[2,3-c][1,2,4]triazole (4h)

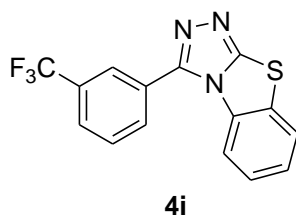


4h

Pink powder; Mp 168-169 °C; **IR** (KBr) ν : 3053, 3009, 1626, 1569, 1482, 775, 755, 708 cm^{-1} ; **$^1\text{H NMR}$** (CDCl₃, 500 MHz): δ = 7.83 (s, 1H, ArH), 7.74–7.69 (m, 2H, ArH),

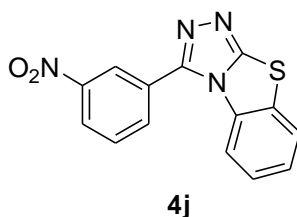
7.62–7.59 (m, 1H, ArH), 7.57 (d, $J = 7.7$, Hz, 1H, ArH), 7.54 (d, $J = 7.9$, Hz, 1H, ArH), 7.45–7.36 (m, 2H, ArH); $^{13}\text{C NMR}$ (CDCl_3 , 125 MHz): $\delta = 156.6, 148.0, 135.2, 132.6, 130.9, 130.3, 129.8, 129.2, 128.6, 127.2, 126.6, 124.9, 114.2$; **HRMS** (ESI-TOF⁺): m/z calcd for $\text{C}_{14}\text{H}_9\text{N}_3\text{SCl}$ [(M + H)⁺], 286.0206; found, 286.0213.

3-(3-(Trifluoromethyl)phenyl)benzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4i)



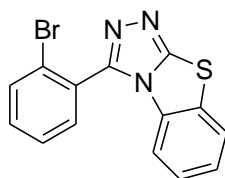
Gray powder; Mp 174–175 °C; **IR** (KBr) ν : 3083, 3046, 1622, 1581, 1482, 808, 747, 704 cm^{-1} ; $^1\text{H NMR}$ (CDCl_3 , 500 MHz): $\delta = 8.11$ (s, 1H, ArH), 8.03 (d, $J = 7.5$ Hz, 1H, ArH), 7.89 (d, $J = 7.8$ Hz, 1H, ArH), 7.79–7.74 (m, 2H, ArH), 7.48–7.43 (m, 2H, ArH), 7.39 (t, $J = 7.7$ Hz, 1H, ArH); $^{13}\text{C NMR}$ (CDCl_3 , 125 MHz): $\delta = 132.8, 132.3, 131.7$ ($^2J_{\text{C-F}} = 33.2$ Hz), 130.0, 129.7, 128.2, 127.4, 126.6, 126.5, 126.1, 125.0, 123.5 ($^1J_{\text{C-F}} = 271.3$ Hz), 114.1; **HRMS** (ESI-TOF⁺): m/z calcd for $\text{C}_{15}\text{H}_9\text{N}_3\text{SF}_3$ [(M + H)⁺], 320.0469; found, 320.0473.

3-(3-Nitrophenyl)benzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4j)



Gray powder; Mp 237–238 °C; **IR** (KBr) ν : 3097, 1624, 1579, 1483, 813, 754, 681 cm^{-1} ; $^1\text{H NMR}$ (CDCl_3 , 500 MHz): $\delta = 8.72$ (s, 1H, ArH), 8.49 (d, $J = 7.5$ Hz, 1H, ArH), 8.20 (d, $J = 7.0$ Hz, 1H, ArH), 7.85 (t, $J = 7.6$ Hz, 1H, ArH), 7.77 (d, $J = 7.6$ Hz, 1H, ArH), 7.51–7.40 (m, 3H, ArH); $^{13}\text{C NMR}$ (CDCl_3 , 125 MHz): $\delta = 148.5, 134.8, 132.7, 130.4, 129.7, 128.9, 126.8, 126.7, 125.3, 125.2, 123.9, 113.9$; **HRMS** (ESI-TOF⁺): m/z calcd for $\text{C}_{14}\text{H}_9\text{N}_4\text{O}_2\text{S}$ [(M + H)⁺], 297.0446; found, 297.0459.

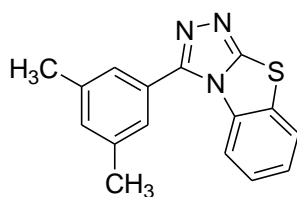
3-(2-Bromophenyl)benzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4k)



4k

Brown powder; Mp 145-146 °C; **IR** (KBr) ν : 3059, 1636, 1600, 1483, 770, 761, 682 cm^{-1} ; **^1H NMR** (CDCl_3 , 500 MHz): δ = 7.82 (d, J = 7.7 Hz, 1H, ArH), 7.71 (d, J = 8.0 Hz, 1H, ArH), 7.66 (d, J = 2.8 Hz, 1H, ArH), 7.57–7.51 (m, 2H, ArH), 7.39 (t, J = 7.6 Hz, 1H, ArH), 7.31 (t, J = 7.7 Hz, 1H, ArH), 7.03 (d, J = 8.2 Hz, 1H, ArH); **^{13}C NMR** (CDCl_3 , 125 MHz): δ = 133.3, 132.8, 132.5, 129.7, 128.8, 127.9, 126.5, 126.4, 124.6, 124.3, 114.4; **HRMS** (ESI-TOF⁺): m/z calcd for $\text{C}_{14}\text{H}_9\text{N}_3\text{BrS}$ [(M + H)⁺], 329.9701; found, 329.9710.

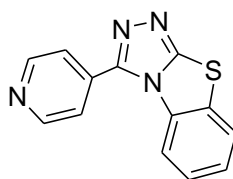
3-(3,5-Dimethylphenyl)benzo[4,5]thiazolo[2,3-c][1,2,4]triazole (4l)



4l

White powder; Mp 186-187 °C; **IR** (KBr) ν : 3052, 3006, 2917, 2850, 1602, 1483, 752, 720, 683 cm^{-1} ; **^1H NMR** (CDCl_3 , 500 MHz): δ = 7.70 (d, J = 7.9 Hz, 1H, ArH), 7.56 (d, J = 8.0 Hz, 1H, ArH), 7.41–7.32 (m, 4H, ArH), 7.24 (s, 1H, ArH), 2.44 (s, 6H, CH_3); **^{13}C NMR** (CDCl_3 , 125 MHz): δ = 156.1, 149.7, 138.8, 132.7, 130.1, 126.8, 126.6, 126.3, 126.2, 124.7, 114.3, 40.9, 21.3; **HRMS** (ESI-TOF⁺): m/z calcd for $\text{C}_{16}\text{H}_{14}\text{N}_3\text{S}$ [(M + H)⁺], 280.0908; found, 280.0913.

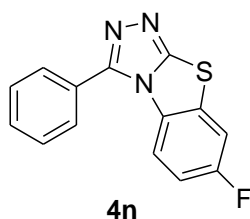
3-Benzylbenzo[4,5]thiazolo[2,3-c][1,2,4]triazole (4m)



4m

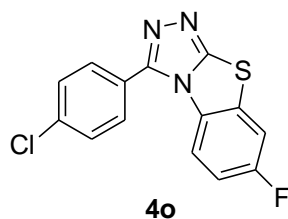
Brown powder; Mp 145-147 °C; **IR** (KBr) ν : 3059, 1632, 1600, 1489, 748, 727, 681 cm^{-1} ; **$^1\text{H NMR}$** (CDCl_3 , 500 MHz): δ = 8.90 (d, J = 4.3 Hz, 2H, ArH), 7.76–7.74 (m, 3H, ArH), 7.61 (d, J = 8.1 Hz, 1H, ArH), 7.46 (t, J = 7.7 Hz, 1H, ArH), 7.41 (t, J = 7.7 Hz, 1H, ArH); **$^{13}\text{C NMR}$** (CDCl_3 , 125 MHz): δ = 150.7, 134.7, 132.6, 129.6, 126.9, 126.7, 125.2, 123.4, 122.9, 114.3; **HRMS** (ESI-TOF⁺): m/z calcd for $\text{C}_{13}\text{H}_8\text{N}_4\text{S}$ [(M + H)⁺], 253.0571; found, 253.0562.

7-Fluoro-3-phenylbenzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4n)



White powder; Mp 181-182 °C; **IR** (KBr) ν : 3076, 1626, 1589, 1490, 799, 767, 699 cm^{-1} ; **$^1\text{H NMR}$** (CDCl_3 , 500 MHz): δ = 7.79–7.76 (m, 2H, ArH), 7.65–7.59 (m, 3H, ArH), 7.50 (dd, J = 4.4, 9.1 Hz, 1H, ArH), 7.44 (dd, J = 2.6, 7.7 Hz, 1H, ArH), 7.07–7.03 (m, 1H, ArH); **$^{13}\text{C NMR}$** (CDCl_3 , 125 MHz): δ = 160.3 ($^1J_{\text{C-F}}$ = 248.6 Hz), 159.3, 134.3 ($^3J_{\text{C-F}}$ = 10.0 Hz), 129.2, 129.1, 127.9, 127.8, 127.6, 126.6, 115.3 ($^3J_{\text{C-F}}$ = 8.9 Hz), 114.1 ($^2J_{\text{C-F}}$ = 24.3 Hz), 111.9 ($^2J_{\text{C-F}}$ = 27.1 Hz); **HRMS** (ESI-TOF⁺): m/z calcd for $\text{C}_{14}\text{H}_9\text{N}_3\text{SF}$ [(M + H)⁺], 270.0501; found, 270.0512.

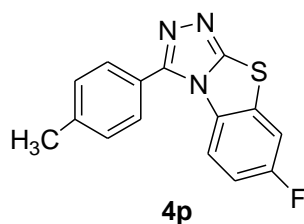
3-(4-Chlorophenyl)-7-fluorobenzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4o)



Gray powder; Mp 264-265 °C; **IR** (KBr) ν : 3099, 3075, 1636, 1601, 1487, 853, 824, 719 cm^{-1} ; **$^1\text{H NMR}$** (CDCl_3 , 500 MHz): δ = 7.73 (d, J = 8.2 Hz, 2H, ArH), 7.60 (d, J = 8.2 Hz, 2H, ArH), 7.49–7.44 (m, 2H, ArH), 7.10–7.07 (m, 1H, ArH); **$^{13}\text{C NMR}$** (CDCl_3 , 125 MHz): δ = 160.3 ($^1J_{\text{C-F}}$ = 248.6 Hz), 137.2, 134.3 ($^3J_{\text{C-F}}$ = 10.0 Hz), 130.3, 129.6, 126.4, 125.1, 115.1 ($^3J_{\text{C-F}}$ = 8.9 Hz), 114.2 ($^2J_{\text{C-F}}$ = 24.5 Hz), 112.1 ($^2J_{\text{C-F}}$ = 27.0 Hz), 111.9; **HRMS** (ESI-TOF⁺): m/z calcd for $\text{C}_{14}\text{H}_8\text{N}_3\text{ClFS}$ [(M + H)⁺], 304.0112;

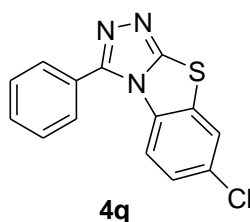
found, 304.0119.

7-Fluoro-3-(*p*-tolyl)benzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4p)



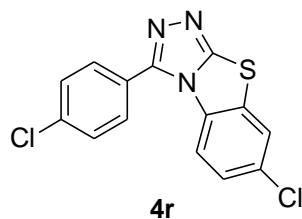
Pink powder; Mp 216-217 °C; **IR** (KBr) ν : 3073, 3029, 2920, 2851, 1636, 1585, 1491, 842, 825, 720 cm^{-1} ; **$^1\text{H NMR}$** (CDCl_3 , 500 MHz): δ = 7.67 (d, J = 8.0 Hz, 2H, ArH), 7.51 (dd, J = 4.4, 9.1 Hz, 1H, ArH), 7.44–7.41 (m, 3H, ArH), 7.07–7.03 (m, 1H, ArH), 2.50 (s, 3H, CH_3); **$^{13}\text{C NMR}$** (CDCl_3 , 125 MHz): δ = 160.2 ($^1J_{\text{C-F}}$ = 248.2 Hz), 156.0, 149.4, 141.2, 134.3 ($^3J_{\text{C-F}}$ = 10.0 Hz), 129.9, 128.9, 126.6, 123.6, 115.3 ($^3J_{\text{C-F}}$ = 8.7 Hz), 114.0 ($^2J_{\text{C-F}}$ = 24.0 Hz), 111.9 ($^2J_{\text{C-F}}$ = 27.2 Hz); **HRMS** (ESI-TOF⁺): m/z calcd for $\text{C}_{15}\text{H}_{11}\text{N}_3\text{FS}$ [(M + H)⁺], 284.0658; found, 284.0649.

7-Chloro-3-phenylbenzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4q)



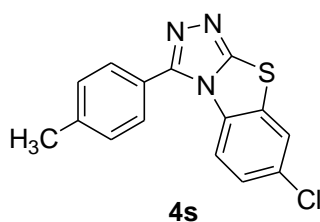
White powder; Mp 209-211 °C; **IR** (KBr) ν : 3083, 3072, 2992, 2851, 1716, 1528, 1481, 1466, 1447, 854, 792, 769, 717, 698, 623 cm^{-1} ; **$^1\text{H NMR}$** (CDCl_3 , 500 MHz): δ = 7.79-7.77 (m, 2H, ArH), 7.70 (d, J = 2.0 Hz, 1H, ArH), 7.64-7.59 (m, 3H, ArH), 7.47 (d, J = 8.9 Hz, 1H, ArH), 7.30 (dd, J = 2.0, 8.8 Hz, 1H, ArH); **$^{13}\text{C NMR}$** (CDCl_3 , 125 MHz): δ = 134.2, 132.1, 131.0, 129.1, 128.6, 126.8, 126.6, 115.0; **HRMS** (ESI-TOF⁺): m/z calcd for $\text{C}_{14}\text{H}_9\text{N}_3\text{SCl}$ [(M + H)⁺], 286.0206; found, 286.0215.

7-Chloro-3-(4-chlorophenyl)benzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4r)



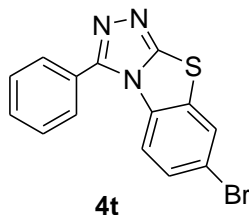
Brown powder; Mp 270-271 °C; **IR** (KBr) ν : 3092, 3069, 1735, 1519, 1484, 845, 824, 799, 743 cm^{-1} ; **¹H NMR** (DMSO-*d*₆, 500 MHz): δ = 8.25 (s, 1H, ArH), 7.85 (d, J = 8.2 Hz, 2H, ArH), 7.72 (d, J = 8.3 Hz, 2H, ArH), 7.49 (d, J = 8.8 Hz, 1H, ArH), 7.38 (d, J = 8.8 Hz, 1H, ArH); **¹³C NMR** (CDCl₃, 125 MHz): δ = 137.3, 134.2, 132.3, 130.3, 129.6, 128.4, 126.9, 125.1, 124.7, 114.8; **HRMS** (ESI-TOF⁺): m/z calcd for C₁₄H₈N₃SCl₂ [(M + H)⁺], 319.9816; found, 319.9812.

7-Chloro-3-(p-tolyl)benzo[4,5]thiazolo[2,3-c][1,2,4]triazole (4s)



Gray powder; Mp 230-231 °C; **IR** (KBr) ν : 3093, 3054, 2923, 2853, 1540, 1486, 856, 829, 816, 794 cm^{-1} ; **¹H NMR** (CDCl₃, 500 MHz): δ = 7.68 (d, J = 1.8 Hz, 1H, ArH), 7.65 (d, J = 8.0 Hz, 2H, ArH), 7.46 (d, J = 8.9 Hz, 1H, ArH), 7.40 (d, J = 7.8 Hz, 2H, ArH), 7.28 (dd, J = 1.9, 8.7 Hz, 1H, ArH), 2.49 (s, 3H, CH₃); **¹³C NMR** (CDCl₃, 125 MHz): δ = 149.7, 141.3, 134.2, 131.9, 129.8, 128.9, 128.7, 126.7, 124.5, 123.6, 115.0, 21.5; **HRMS** (ESI-TOF⁺): m/z calcd for C₁₅H₁₁N₃SCl [(M + H)⁺], 300.0362; found, 300.0356.

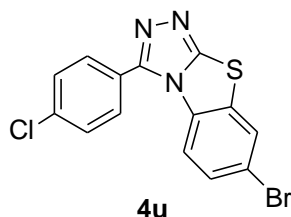
7-Bromo-3-phenylbenzo[4,5]thiazolo[2,3-c][1,2,4]triazole (4t)



White powder; Mp 224-225 °C; **IR** (KBr) ν : 3090, 1526, 1480, 828, 765, 716, 698, 622

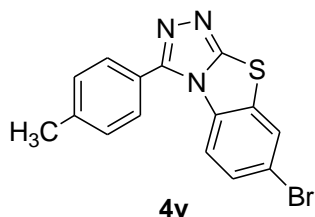
cm⁻¹; **¹H NMR** (CDCl₃, 500 MHz): δ = 7.85 (d, J = 8.0 Hz, 2H, ArH), 7.78-7.76 (m, 2H, ArH), 7.62-7.60 (m, 3H, ArH), 7.45 (dd, J = 1.4, 8.8 Hz, 1H, ArH), 7.39 (d, J = 8.8 Hz, 1H, ArH); **¹³C NMR** (CDCl₃, 125 MHz): δ = 134.7, 131.0, 129.7, 129.2, 127.3, 126.9, 119.3, 115.5; **HRMS** (ESI-TOF⁺): m/z calcd for C₁₄H₉N₃SBr [(M + H)⁺], 329.9701; found, 329.9715.

7-Bromo-3-(4-chlorophenyl)benzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4u)



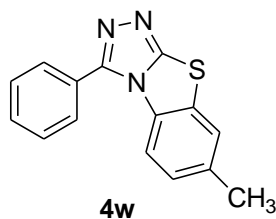
Brown powder; Mp 297-298 °C; **IR** (KBr) ν : 3064, 1726, 1602, 1485, 862, 842, 775, 669 cm⁻¹; **¹H NMR** (DMSO-*d*₆, 500 MHz): δ = 8.38 (s, 1H, ArH), 7.85 (d, J = 8.0 Hz, 2H, ArH), 7.72 (d, J = 8.0 Hz, 2H, ArH), 7.61 (d, J = 8.6 Hz, 1H, ArH), 7.32 (d, J = 8.7 Hz, 1H, ArH); **¹³C NMR** (CDCl₃, 125 MHz): δ = 137.4, 134.6, 130.3, 129.8, 129.6, 128.9, 127.6, 125.1, 119.5, 115.3; **HRMS** (ESI-TOF⁺): m/z calcd for C₁₄H₉N₃SBr [(M + H)⁺], 363.9311; found, 363.9320.

7-Bromo-3-(*p*-tolyl)benzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4v)



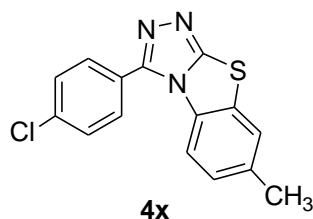
Brown powder; Mp 254-255 °C; **IR** (KBr) ν : 3098, 2921, 2852, 1724, 1484, 848, 829, 816, 771 cm⁻¹; **¹H NMR** (CDCl₃, 500 MHz): δ = 7.83 (d, J = 1.6 Hz, 1H, ArH), 7.65 (d, J = 8.0 Hz, 2H, ArH), 7.45-7.43 (m, 1H, ArH), 7.42-7.41 (m, 2H, ArH), 7.40-7.39 (m, 1H, ArH), 2.50 (s, 3H, CH₃); **¹³C NMR** (CDCl₃, 125 MHz): δ = 141.3, 134.5, 129.9, 129.5, 129.0, 128.9, 127.3, 123.5, 119.2, 115.3, 21.6; **HRMS** (ESI-TOF⁺): m/z calcd for C₁₅H₁₁N₃SBr [(M + H)⁺], 343.9857; found, 343.9846.

7-Methyl-3-phenylbenzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4w)



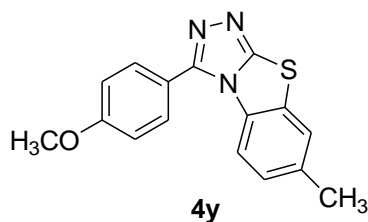
White powder; Mp 180-181 °C; **IR** (KBr) *v*: 3025, 2920, 2851, 1636, 1584, 1493, 1385, 813, 762, 694 cm⁻¹; **¹H NMR** (CDCl₃, 500 MHz): δ = 7.80–7.79 (m, 2H, ArH), 7.61-7.59 (m, 3H, ArH), 7.50 (s, 1H, ArH), 7.42 (d, *J* = 8.5 Hz, 1H, ArH), 7.12 (d, *J* = 8.5 Hz, 1H, ArH), 2.45 (s, 3H, CH₃); **¹³C NMR** (CDCl₃, 125 MHz): δ = 136.7, 132.6, 130.6, 129.1, 128.9, 127.9, 127.2, 126.9, 124.8, 113.9, 21.3; **HRMS** (ESI-TOF⁺): *m/z* calcd for C₁₅H₁₂N₃S [(M + H)⁺], 266.0752; found, 266.0763.

3-(4-Chlorophenyl)-7-methylbenzo[4,5]thiazolo[2,3-c][1,2,4]triazole (4x)



Gray powder; Mp 222-223 °C; **IR** (KBr) *v*: 3098, 3078, 2920, 2853, 1604, 1493, 1383, 827, 723, 698 cm⁻¹; **¹H NMR** (CDCl₃, 500 MHz): δ = 7.75 (d, *J* = 8.4 Hz, 2H, ArH), 7.58 (d, *J* = 8.5 Hz, 2H, ArH), 7.51 (s, 1H, ArH), 7.39 (d, *J* = 8.4 Hz, 1H, ArH), 7.14 (d, *J* = 8.3 Hz, 1H, ArH), 2.46 (s, 3H, CH₃); **¹³C NMR** (CDCl₃, 125 MHz): δ = 136.9 (*J* = 8.3 Hz), 136.8, 132.7, 130.4, 129.4, 127.8, 127.3, 125.6, 124.9, 113.8, 21.3; **HRMS** (ESI-TOF⁺): *m/z* calcd for C₁₅H₁₁N₃SCl [(M + H)⁺], 300.0362; found, 300.0375.

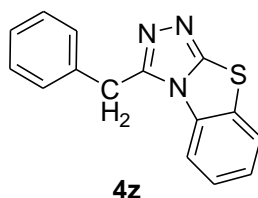
3-(4-Methoxyphenyl)-7-methylbenzo[4,5]thiazolo[2,3-c][1,2,4]triazole (4y)



White powder; Mp 161-162 °C; **IR** (KBr) *v*: 3055, 2921, 2850, 1615, 1494, 1383, 840, 805, 731 cm⁻¹; **¹H NMR** (CDCl₃, 500 MHz): δ = 7.72 (d, *J* = 7.5 Hz, 2H, ArH), 7.48 (s,

1H, ArH), 7.42 (d, $J = 8.0$ Hz, 1H, ArH), 7.12 (d, $J = 6.7$ Hz, 3H, ArH), 3.90 (s, 3H, OCH₃), 2.45 (s, 3H, CH₃); ¹³C NMR (CDCl₃, 125 MHz): $\delta = 161.4, 136.5, 132.7, 130.6, 128.0, 127.2, 124.8, 119.2, 114.4, 113.9, 55.5, 21.3$; HRMS (ESI-TOF⁺): m/z calcd for C₁₆H₁₄N₃OS [(M + H)⁺], 296.0858; found, 298.0849.

3-Benzylbenzo[4,5]thiazolo[2,3-*c*][1,2,4]triazole (4z)

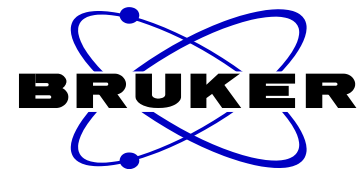
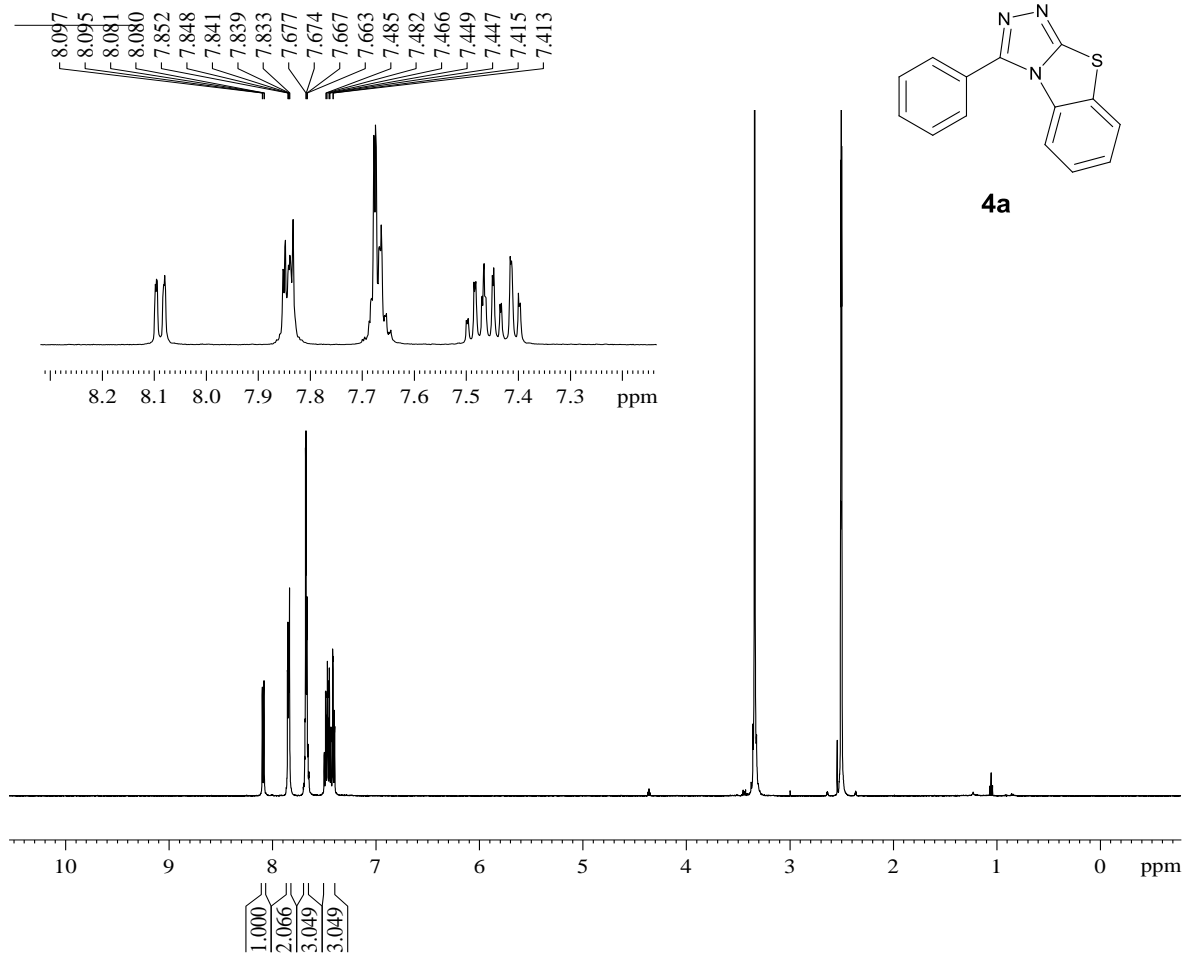


Cyan powder; Mp 170-171 °C; IR (KBr) ν : 3059, 2925, 1632, 1600, 1489, 748, 727, 681 cm⁻¹; ¹H NMR (CDCl₃, 500 MHz): $\delta = 7.64$ (d, $J = 6.4$ Hz, 1H, ArH), 7.42 (d, $J = 6.3$ Hz, 1H, ArH), 7.34-7.31 (m, 4H, ArH), 7.28-7.26 (m, 3H, ArH), 4.65 (s, 2H, CH₂); ¹³C NMR (CDCl₃, 125 MHz): $\delta = 134.5, 132.4, 129.1, 128.1, 127.4, 126.6, 126.0, 124.6, 114.1, 32.5$; HRMS (ESI-TOF⁺): m/z calcd for C₁₅H₁₂N₃S [(M + H)⁺], 266.0752; found, 266.0741.

References

1. G. Jayanthi, S. Muthusamy, R. Paramasivam, V. T. Ramakrishnan, N. Ramasamy, P. Ramamurthy, *J. Org. Chem.*, 1997, **62**, 5766-5770.

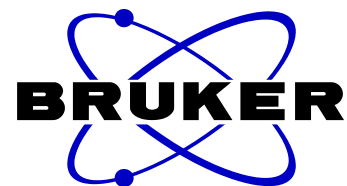
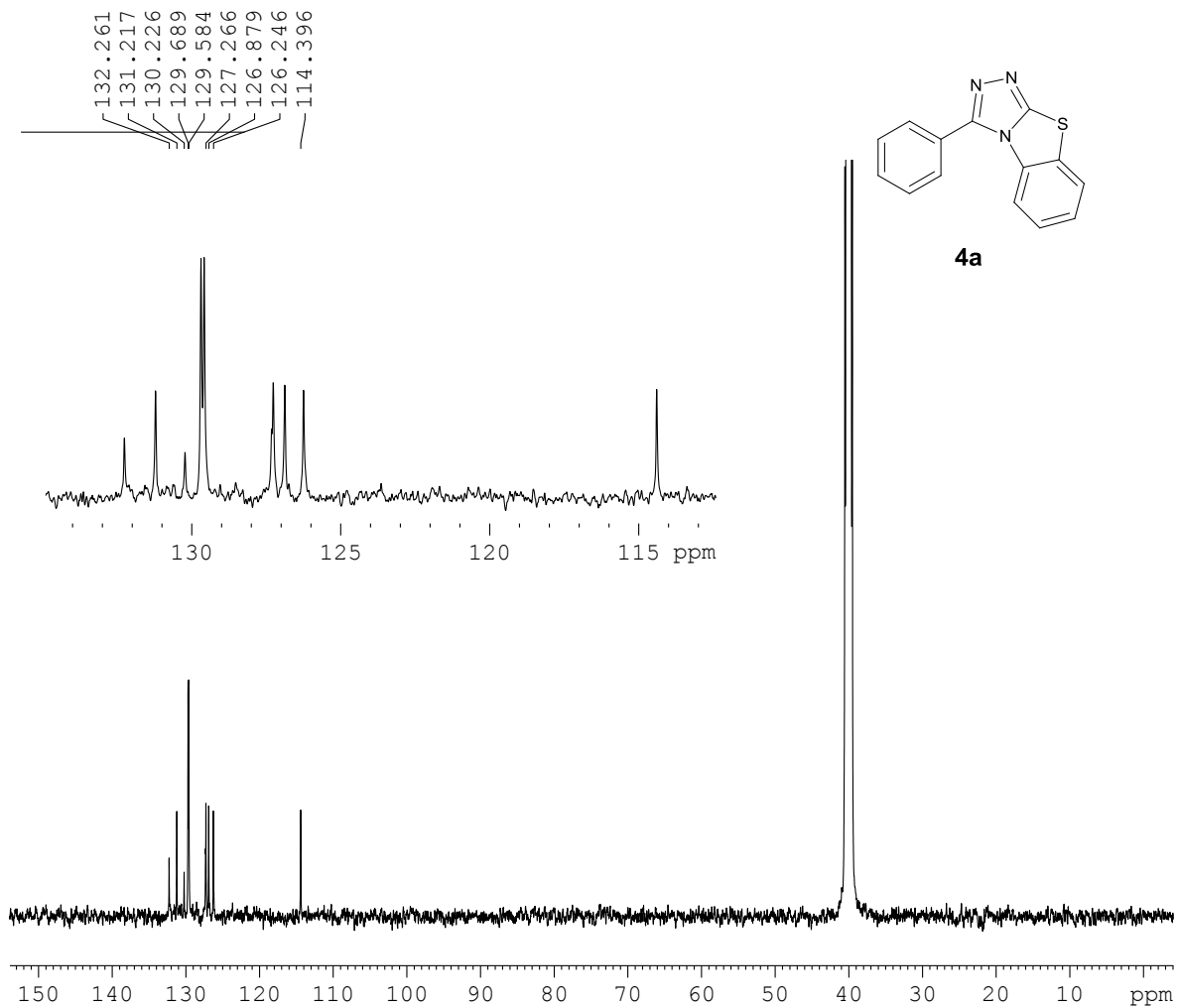
¹H and ¹³C NMR spectra of compound 4



NAME Lm-2-1b
 EXPNO 1
 PROCNO 1
 Date_ 20111027
 Time 19.39
 INSTRUM av500
 PROBHD 5 mm PABBO BB-
 PULPROG zg30
 TD 32768
 SOLVENT DMSO
 NS 8
 DS 1
 SWH 10000.000 Hz
 FIDRES 0.305176 Hz
 AQ 1.6385000 sec
 RG 575
 DW 50.000 usec
 DE 6.00 usec
 TE 296.1 K
 D1 2.00000000 sec
 TD0 1

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 P1 13.50 usec
 PL1 2.20 dB
 SFO1 500.0335010 MHz
 SI 16384
 SF 500.0300015 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 2.00

LM-2-1B 13C 1D 2011 11 03

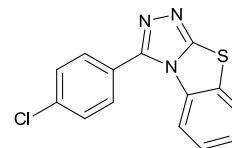


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PROCNO 1
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TD 65536
SOLVENT DMSO
NS 2096
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 3640
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DE 6.00 usec
TE 298.3 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

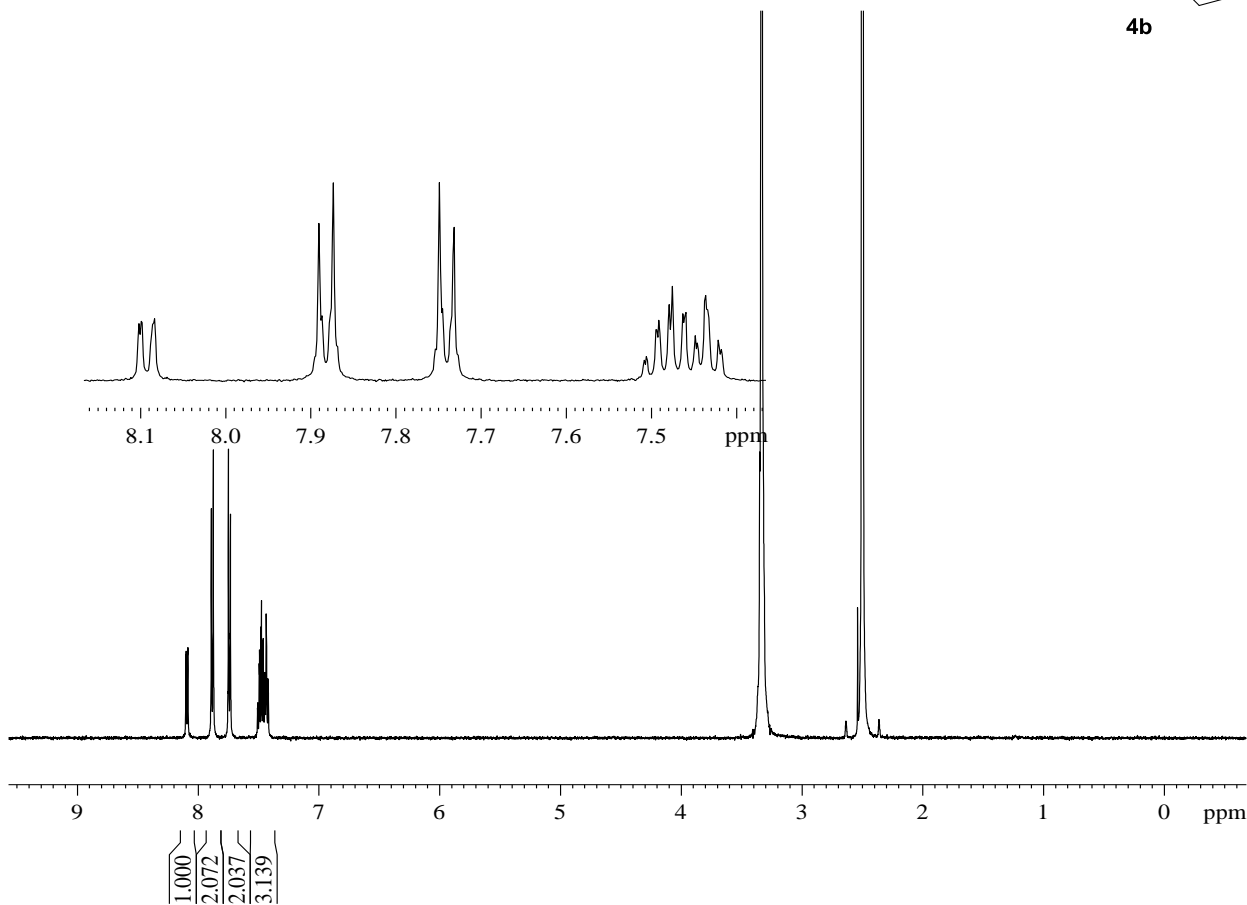
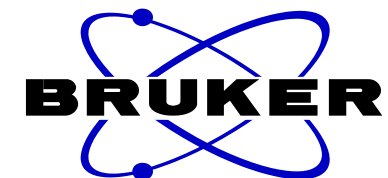
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PL1 2.00 dB
SFO1 125.7464750 MHz

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NUC2 1H
PCPD2 80.00 usec
PL2 2.20 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326387 MHz
WDW EM
SSB 0
LB 6.00 Hz
GB 0
PC 2.00

8.084
7.890
7.873
7.749
7.732
7.508
7.506
7.494
7.491
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7.463
7.460
7.448
7.446
7.436
7.421
7.418



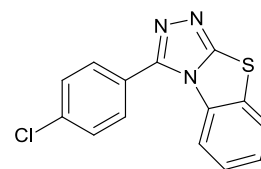
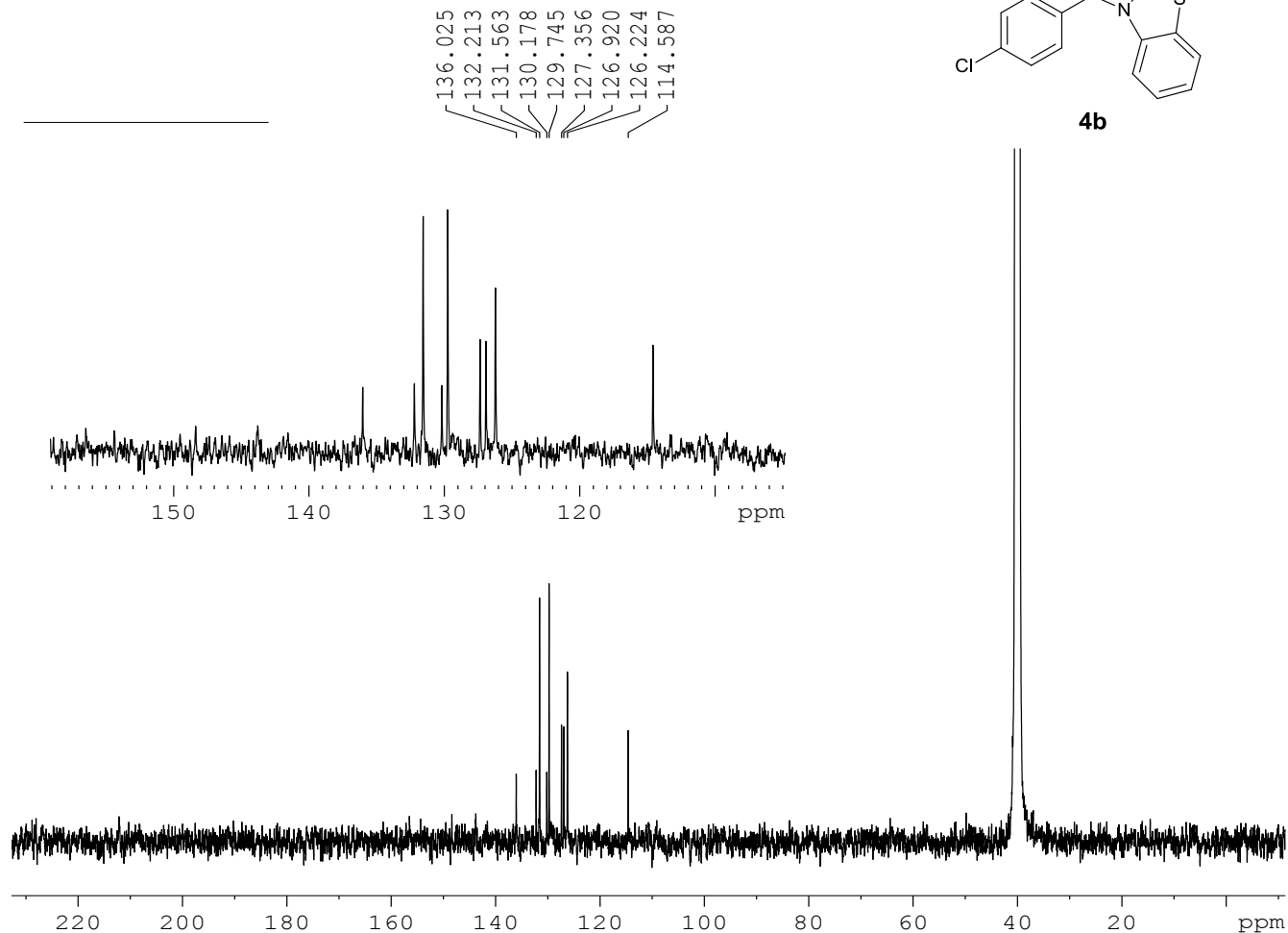
4b



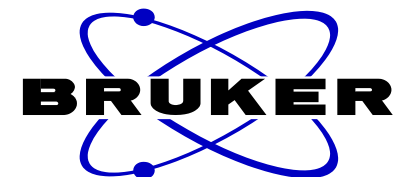
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PROCNO 1
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Time 19.59
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PULPROG zg30
TD 32768
SOLVENT DMSO
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 575
DW 50.000 usec
DE 6.00 usec
TE 296.0 K
D1 2.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
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WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 2.00

LM-2-2B 13C 1D 2011 11 21



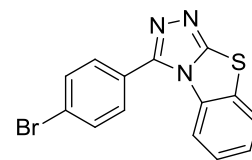
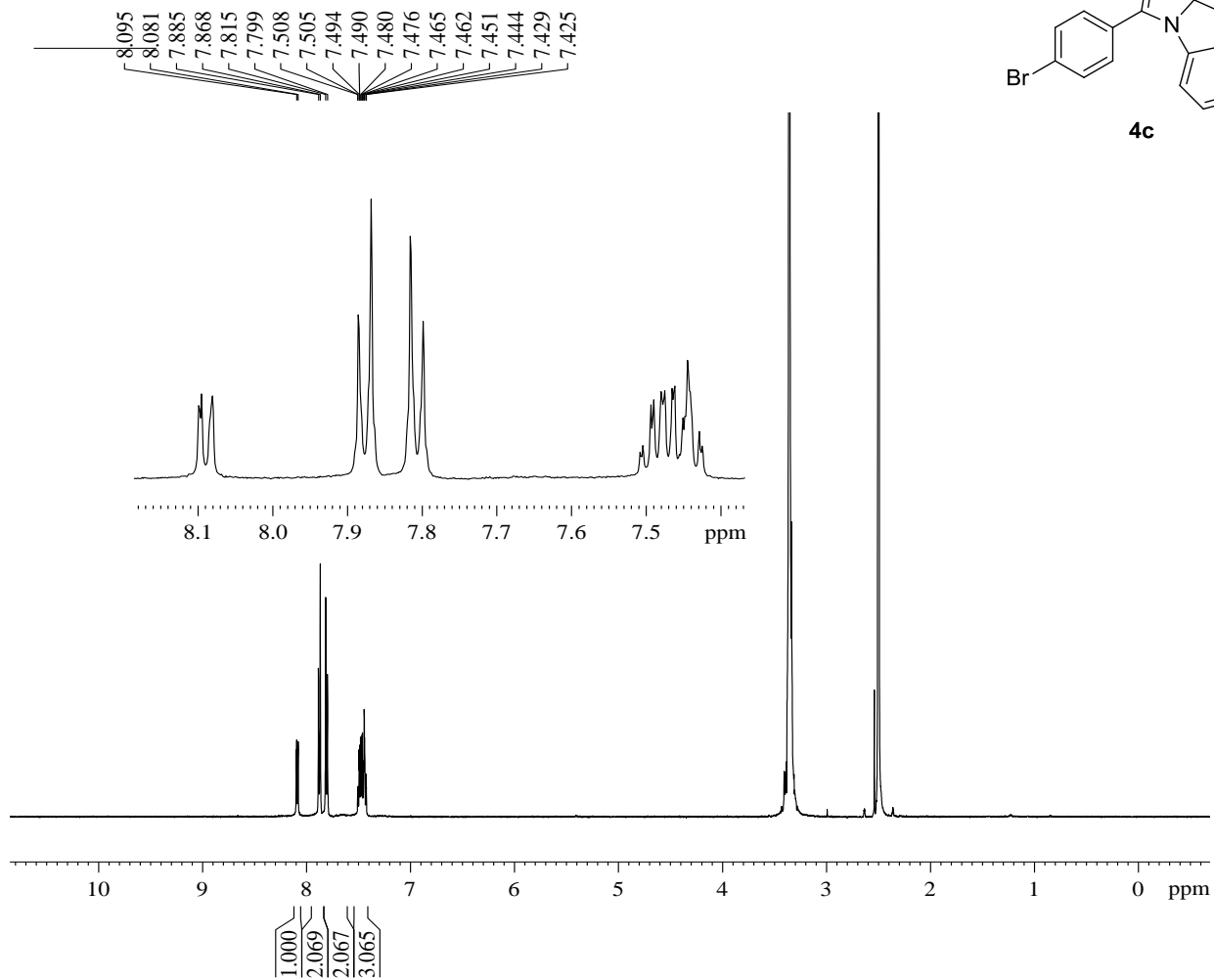
4b



NAME Lm-2-2b
EXPNO 21
PROCNO 1
Date_ 20111121
Time_ 18.09
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PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT DMSO
NS 2167
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 14600
DW 15.300 usec
DE 6.00 usec
TE 295.3 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

==== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

==== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.20 dB
PL12 17.66 dB
PL13 17.66 dB
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SI 32768
SF 125.7326387 MHz
WDW EM
SSB 0
LB 6.00 Hz
GB 0
PC 2.00



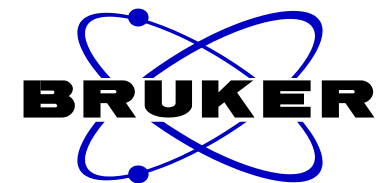
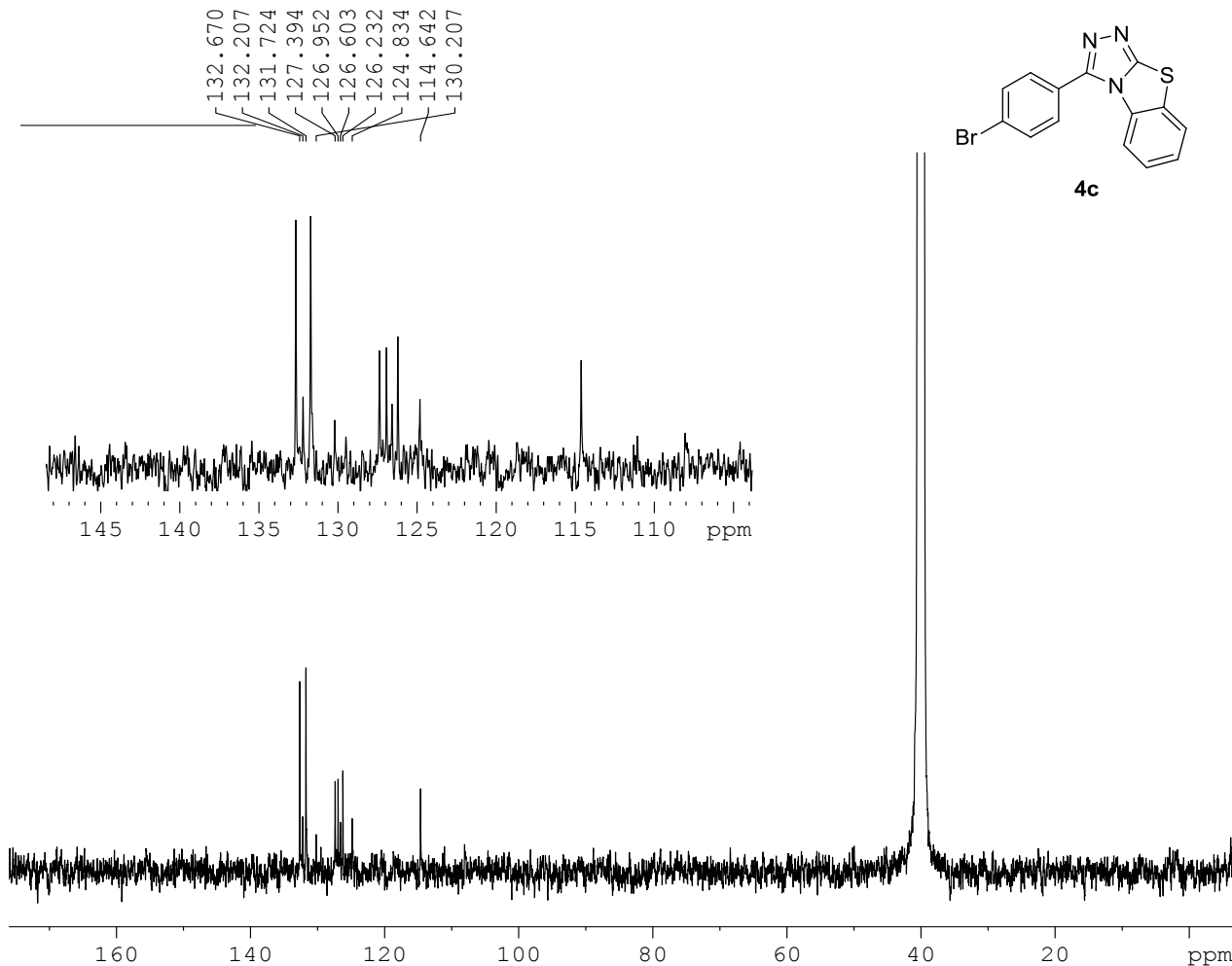
4c



NAME Lm-3B
 EXPNO 1
 PROCNO 1
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 Time 16.01
 INSTRUM av500
 PROBHD 5 mm PABBO BB-
 PULPROG zg30
 TD 32768
 SOLVENT DMSO
 NS 8
 DS 1
 SWH 10000.000 Hz
 FIDRES 0.305176 Hz
 AQ 1.6385000 sec
 RG 322
 DW 50.000 usec
 DE 6.00 usec
 TE 294.8 K
 D1 2.0000000 sec
 TD0 1

===== CHANNEL f1 =====
 NUC1 1H
 P1 13.50 usec
 PL1 2.20 dB
 SFO1 500.0335010 MHz
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 LB 0.30 Hz
 GB 0
 PC 2.00

LM-2-3B 13C 1D 2011 11 29

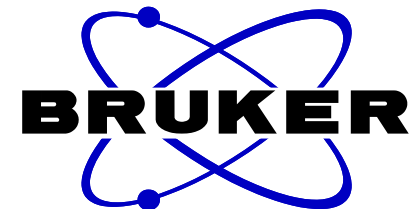
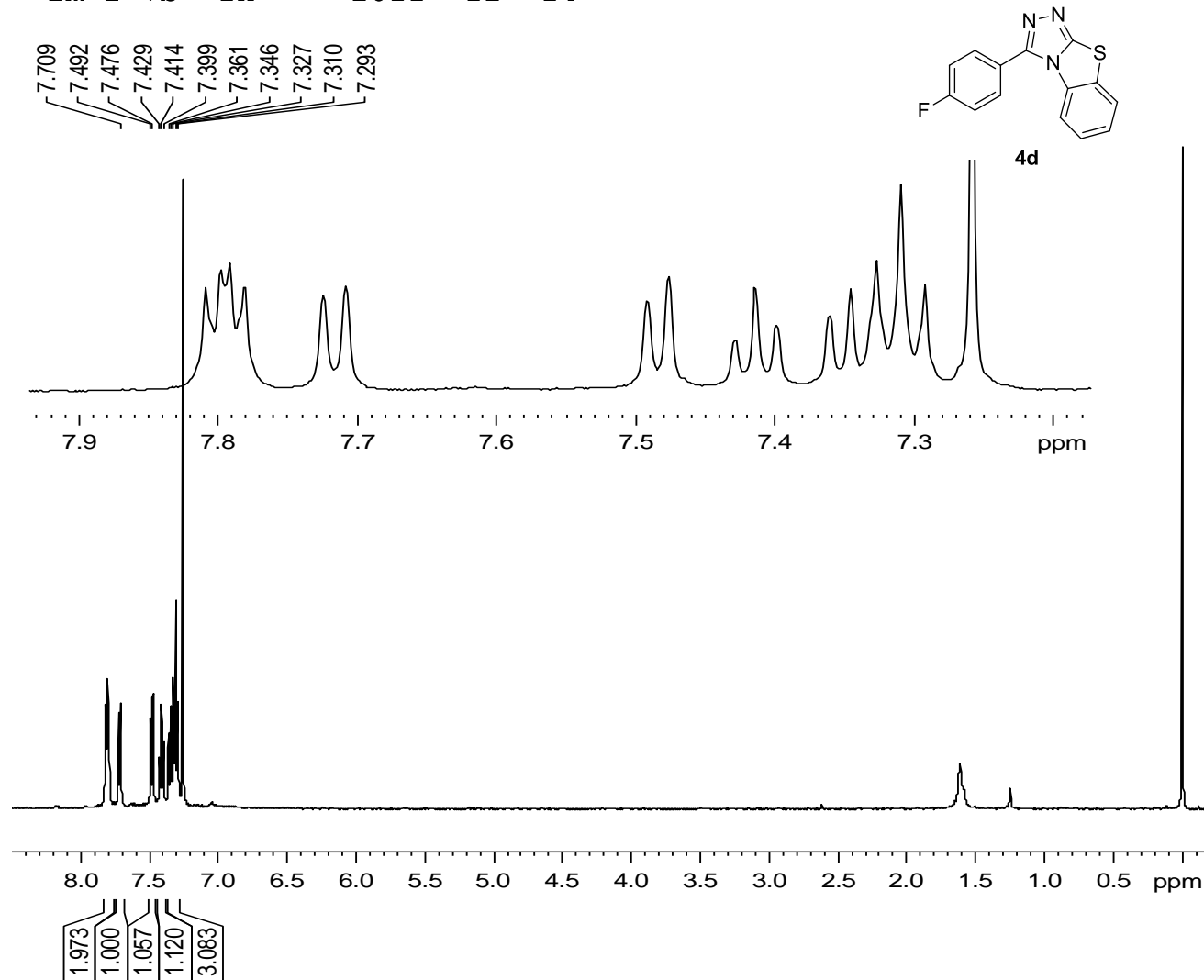


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PROCNO 1
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PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT DMSO
NS 2080
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 5790
DW 15.300 usec
DE 6.00 usec
TE 298.1 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

==== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

==== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.20 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
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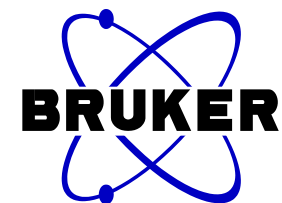
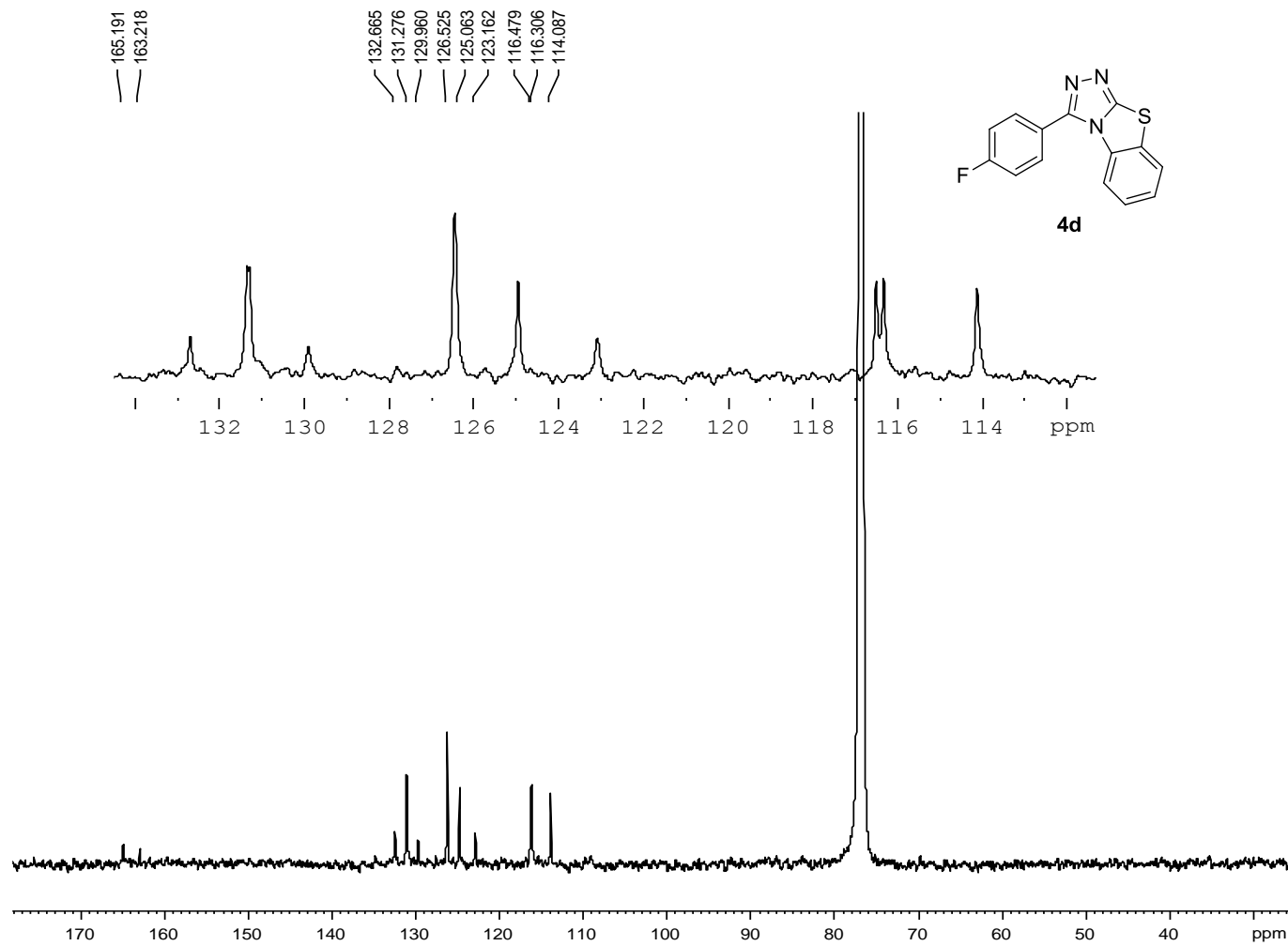
—lm-2-7b 1H 2011 12 14



NAME lm-2-7b
EXPNO 11
PROCNO 1
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PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 4
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 812
DW 50.000 usec
DE 6.00 usec
TE 294.0 K
D1 2.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
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— Im-2-7b 13C 1D 2011 12 19

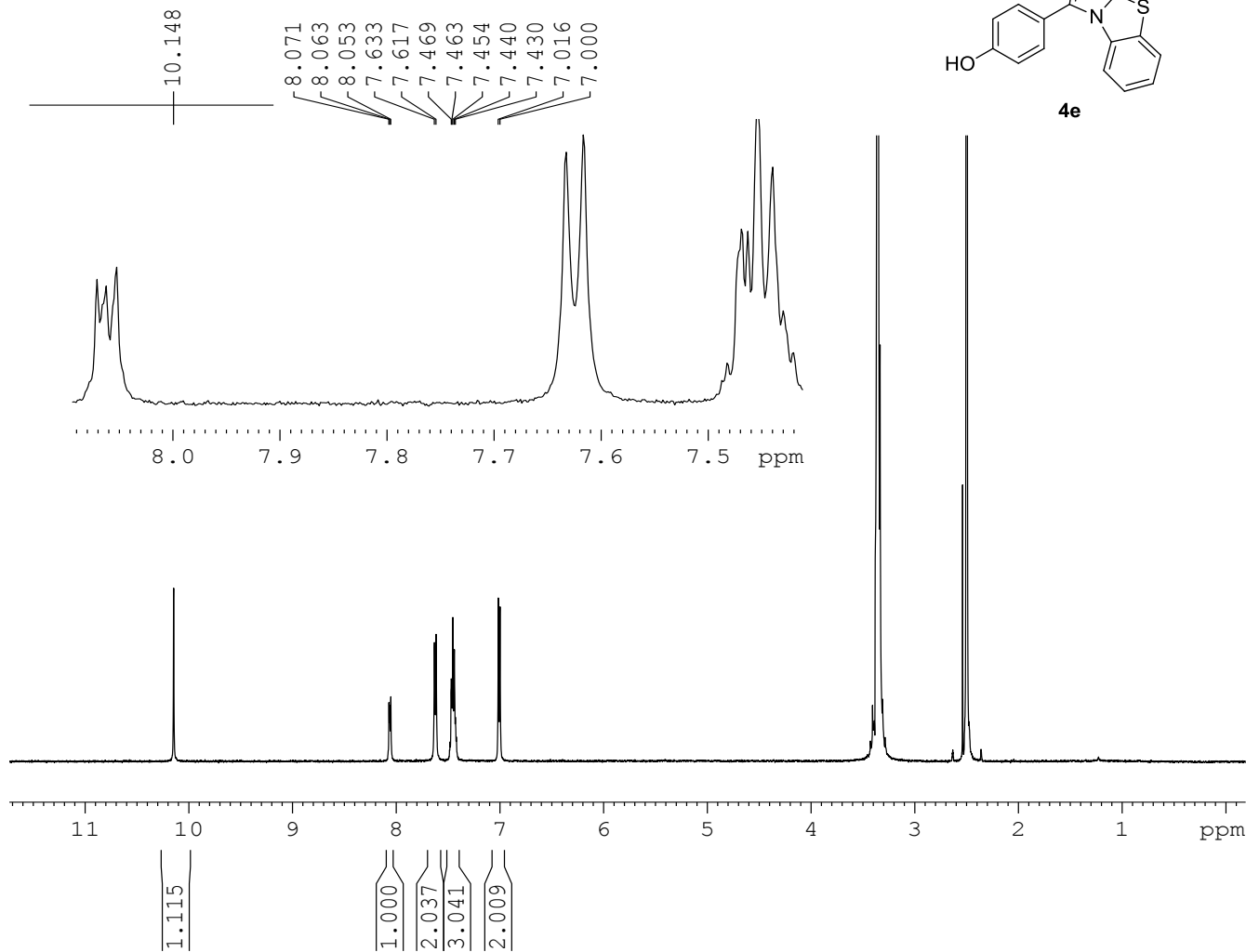
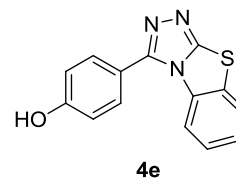


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TD 65536
SOLVENT CDCl3
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SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 18400
DW 15.300 usec
DE 6.00 usec
TE 294.5 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

==== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

==== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.20 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
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SF 125.7326472 MHz
WDW EM
SSB 0
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GB 0
PC 2.00

Lm-5B 1H 2011 11 23



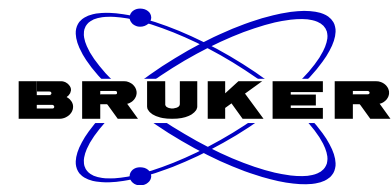
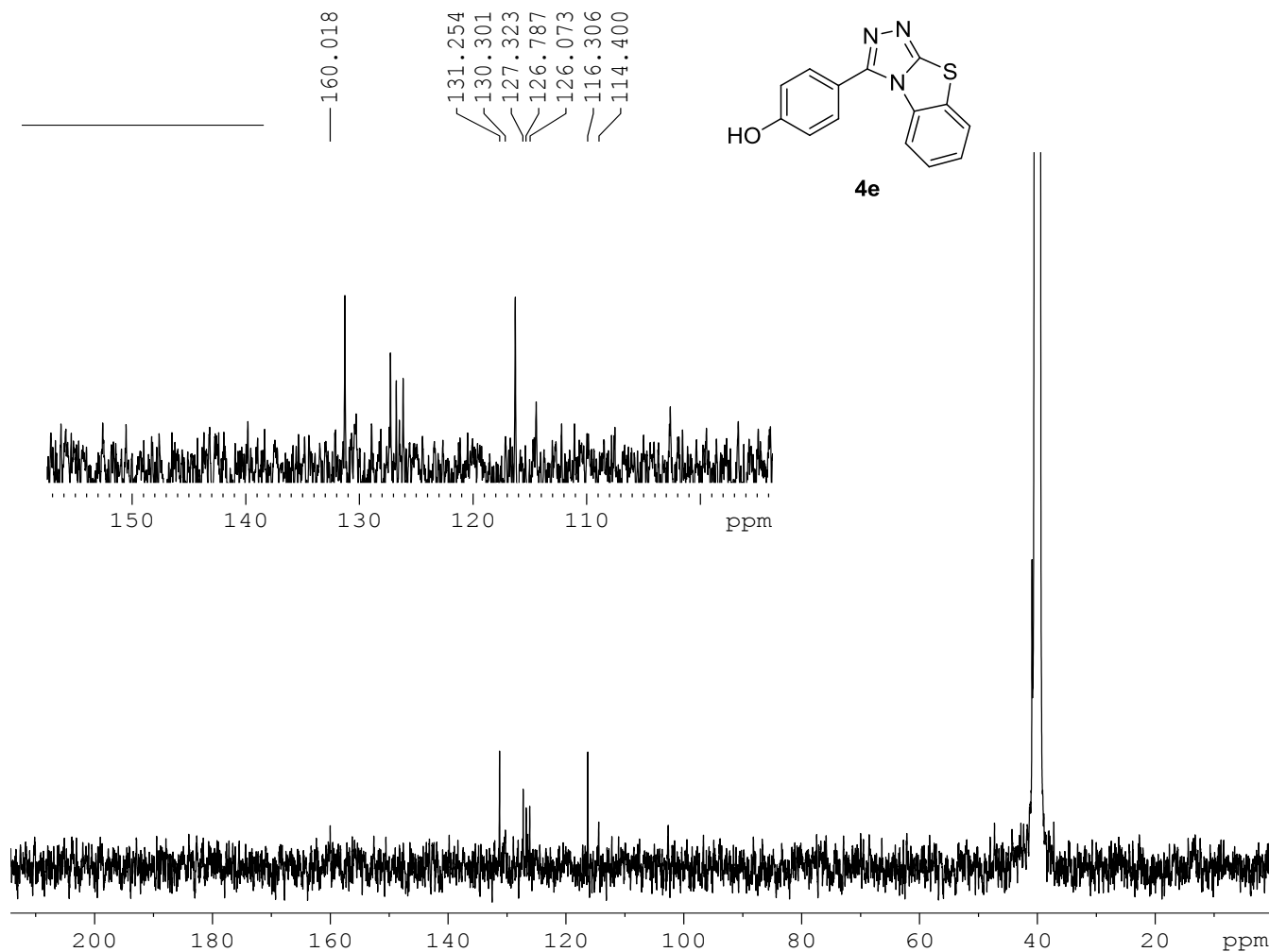
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PULPROG             zg30
TD                  32768
SOLVENT             DMSO
NS                  8
DS                  1
SWH                 10000.000 Hz
FIDRES              0.305176 Hz
AQ                  1.6385000 sec
RG                  322
DW                  50.000 usec
DE                  6.00 usec
TE                  294.8 K
D1                  2.00000000 sec
TD0                 1
  
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===== CHANNEL f1 =====
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PL1                  2.20 dB
SFO1                 500.0335010 MHz
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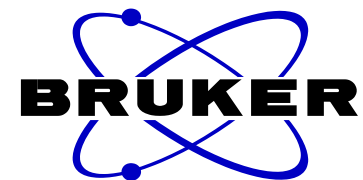
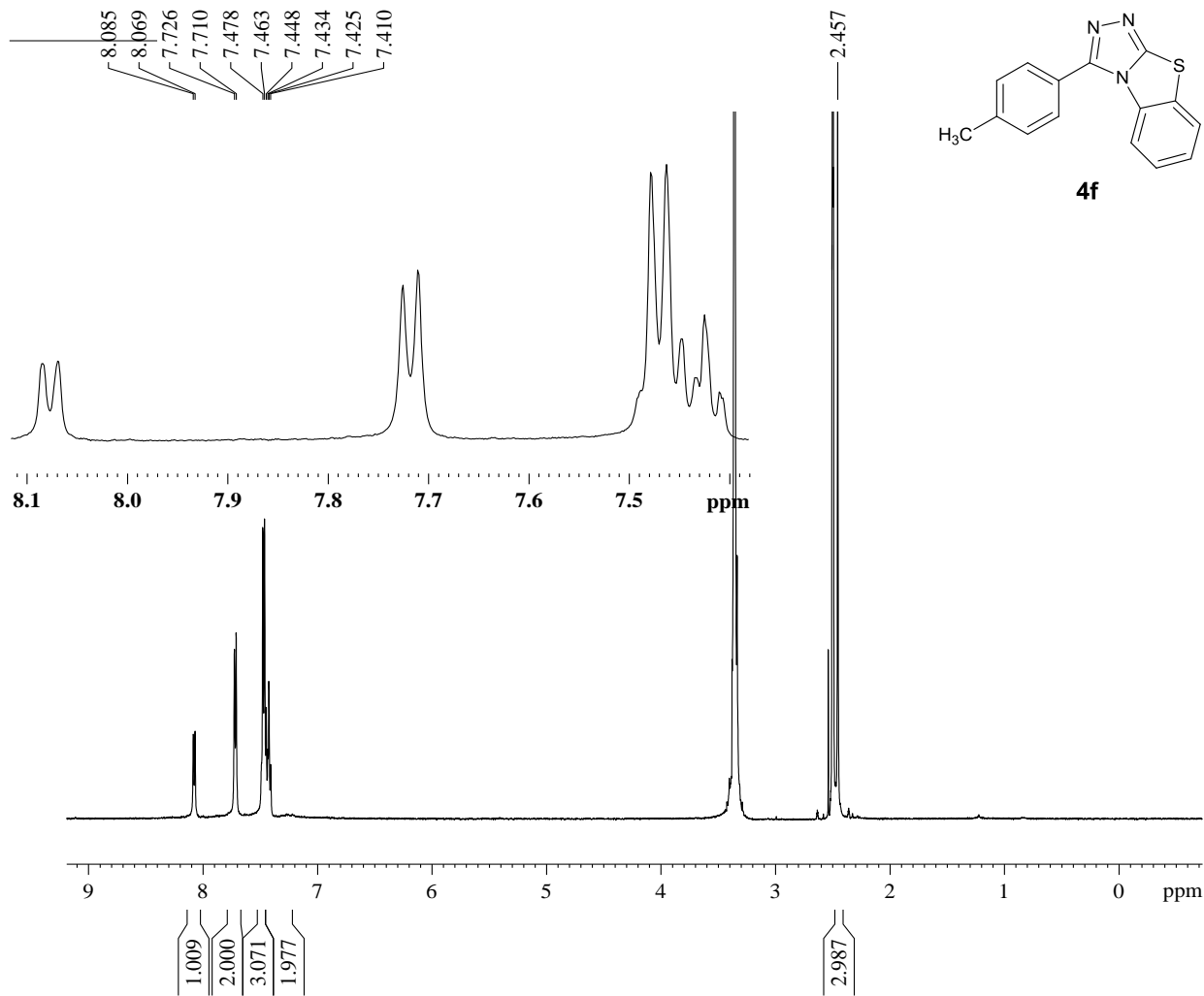
LM-2-5B 13C 1D 2011 12 07



NAME LM-2-5B
EXPNO 2
PROCNO 1
Date_ 20111207
Time_ 13.58
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT DMSO
NS 932
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 18400
DW 15.300 usec
DE 6.00 usec
TE 296.8 K
D1 2.0000000 sec
d11 0.0300000 sec
DELTA 1.89999999 sec
TD0 1

==== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

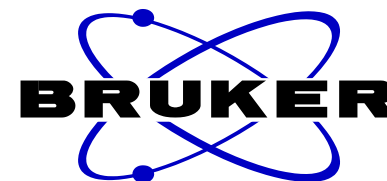
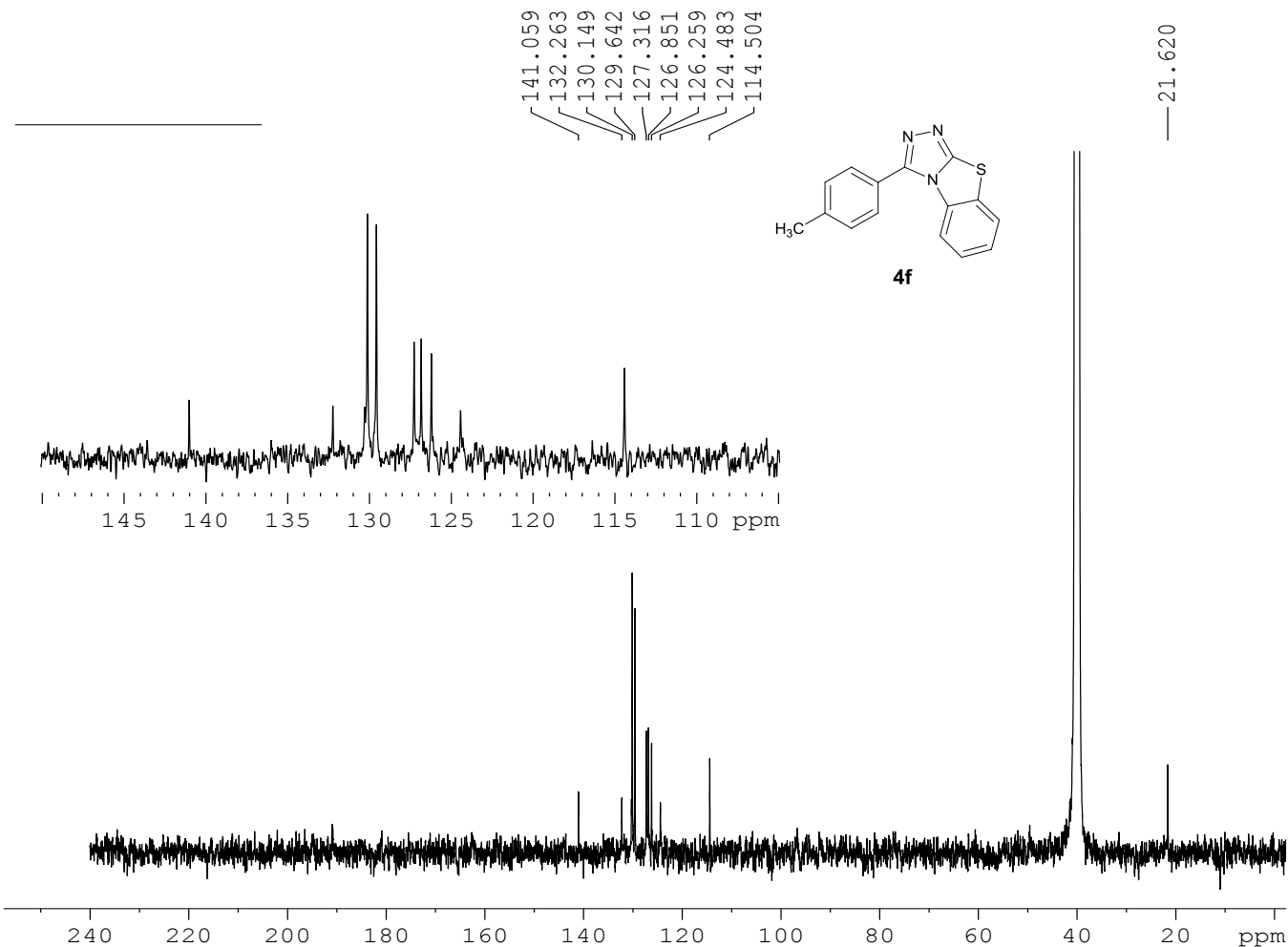
==== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.20 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326387 MHz
WDW EM
SSB 0
LB 6.00 Hz
GB 0
PC 2.00



NAME Lm-4B
 EXPNO 1
 PROCNO 1
 Date_ 20111122
 Time 16.06
 INSTRUM av500
 PROBHD 5 mm PABBO BB-
 PULPROG zg30
 TD 32768
 SOLVENT DMSO
 NS 8
 DS 1
 SWH 10000.000 Hz
 FIDRES 0.305176 Hz
 AQ 1.6385000 sec
 RG 322
 DW 50.000 usec
 DE 6.00 usec
 TE 294.8 K
 D1 2.00000000 sec
 TD0 1

===== CHANNEL f1 =====
 NUC1 1H
 P1 13.50 usec
 PL1 2.20 dB
 SFO1 500.0335010 MHz
 SI 16384
 SF 500.0300015 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 2.00

Lm-2-4B 13C 1D 2011 11 29

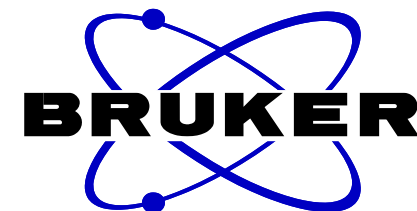
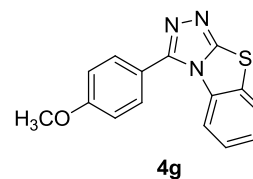
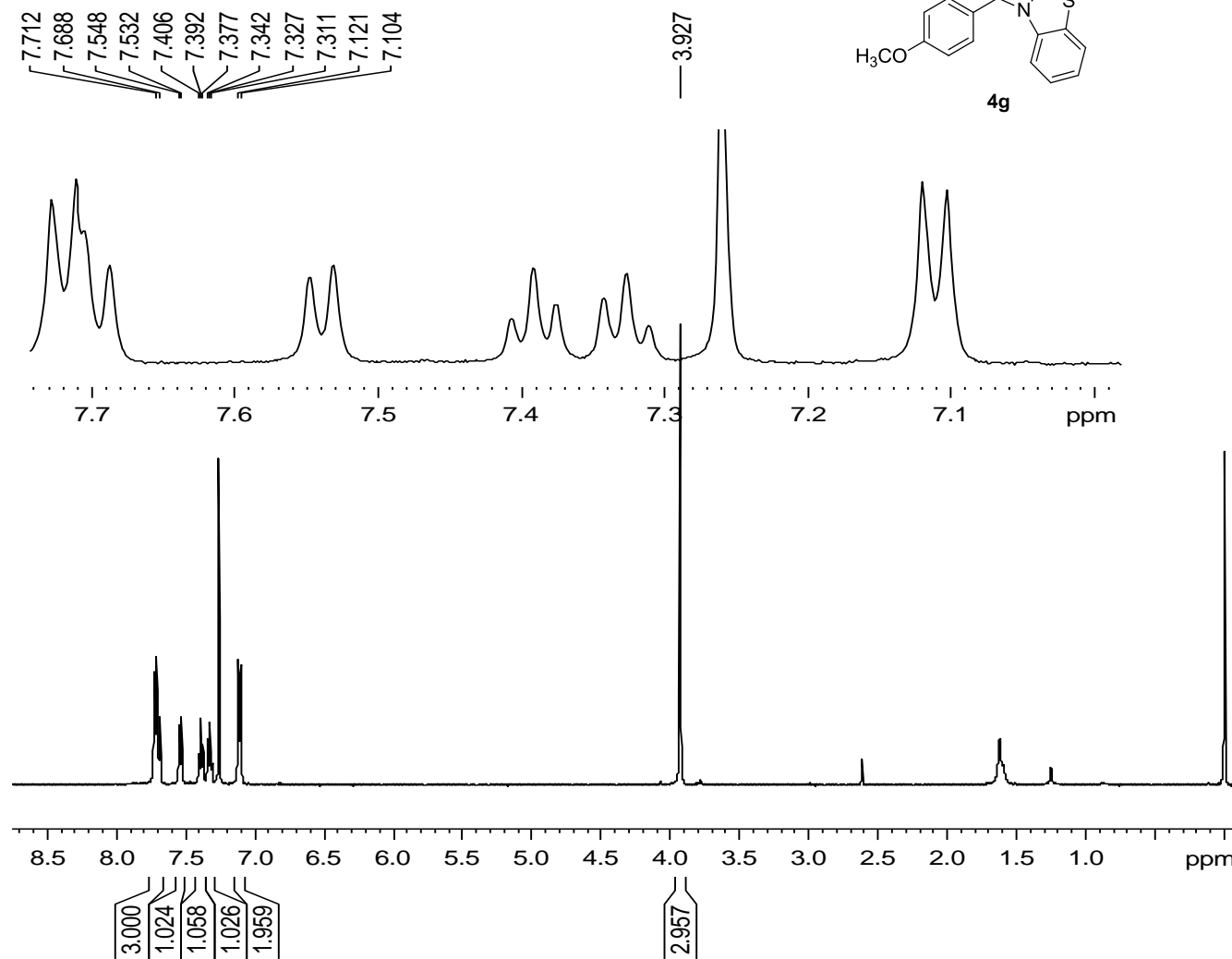


NAME Lm-2-4B
EXPNO 2
PROCNO 1
Date_ 20111129
Time_ 18.15
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT DMSO
NS 1883
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 512
DW 15.300 usec
DE 6.00 usec
TE 297.8 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

==== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

==== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.20 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326387 MHz
WDW EM
SSB 0
LB 6.00 Hz
GB 0
PC 2.00

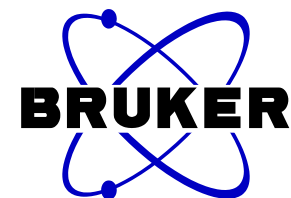
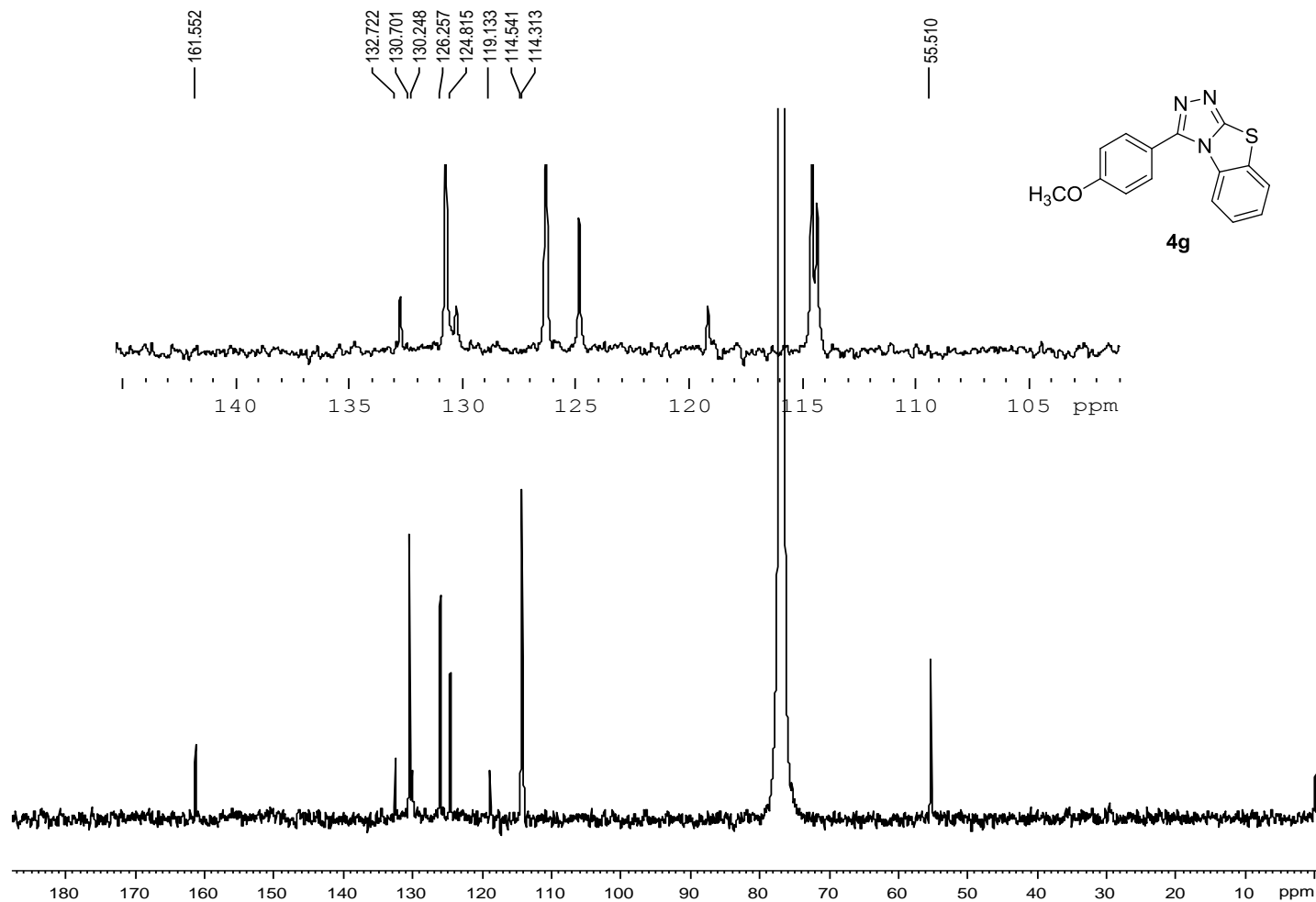
LM-2-6B 1H 2011 12 12



NAME LM-2-6B
EXPNO 1
PROCNO 1
Date_ 20111212
Time_ 20.03
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 4
DS 2
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 724
DW 50.000 usec
DE 6.00 usec
TE 293.7 K
D1 2.00000000 sec
TD0 1

==== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
SI 16384
SF 500.0300102 MHz
WDW EM
SSB 0
LB 0.10 Hz
GB 0
PC 4.00

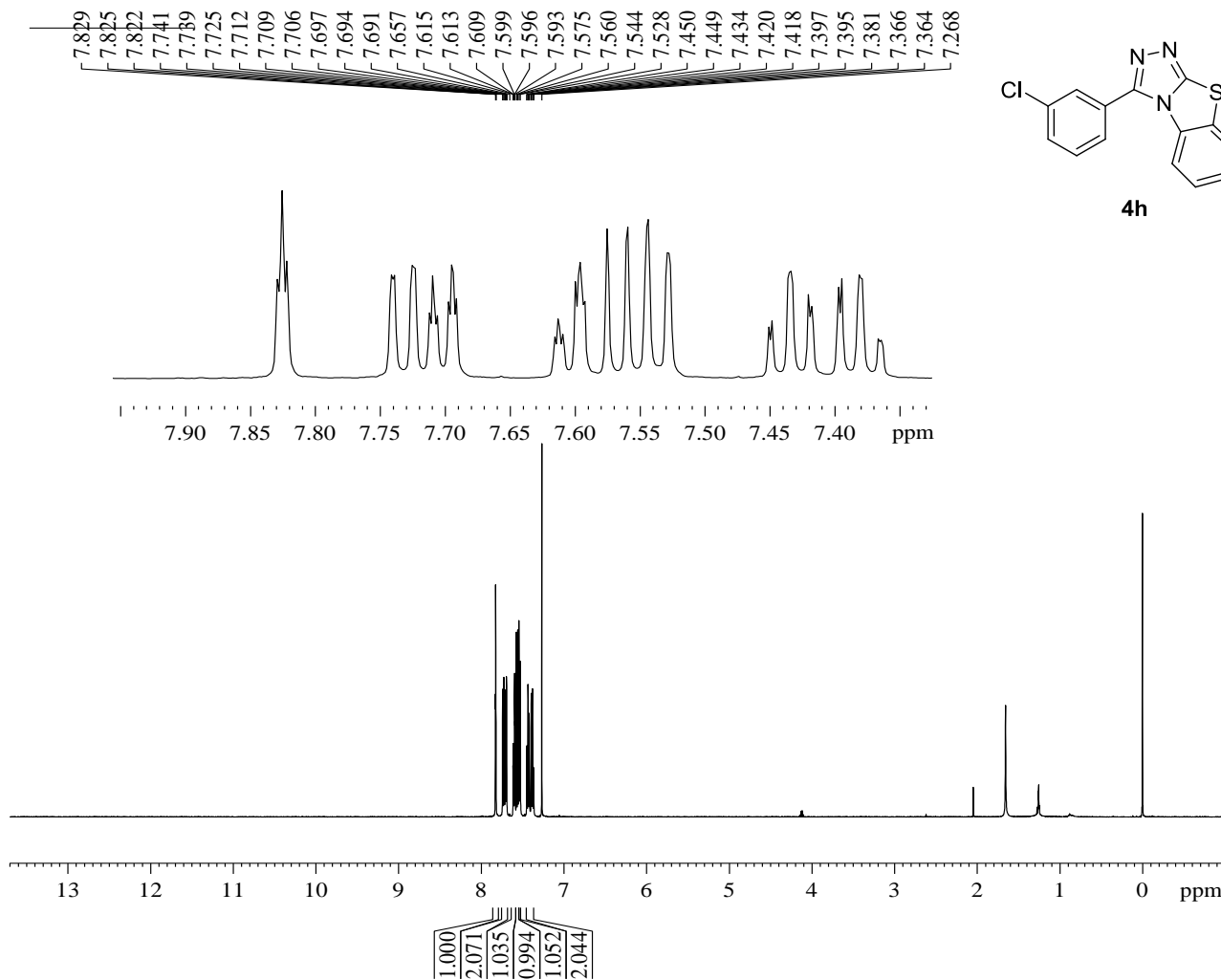
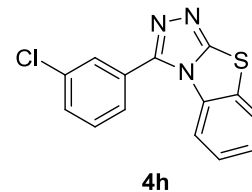
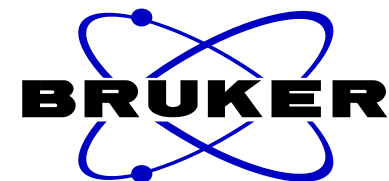
— Lm-2-BB 13C 1D 2011 12 14



NAME Lm-2-BB
EXPNO 2
PROCNO 1
Date_ 20111214
Time 21.57
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 11361
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 2050
DW 15.300 usec
DE 6.00 usec
TE 295.6 K
D1 2.0000000 sec
d11 0.0300000 sec
DELTA 1.89999998 sec
TD0 1

===== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

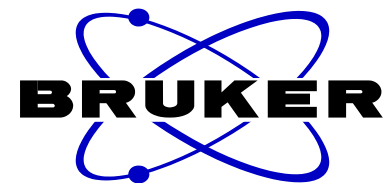
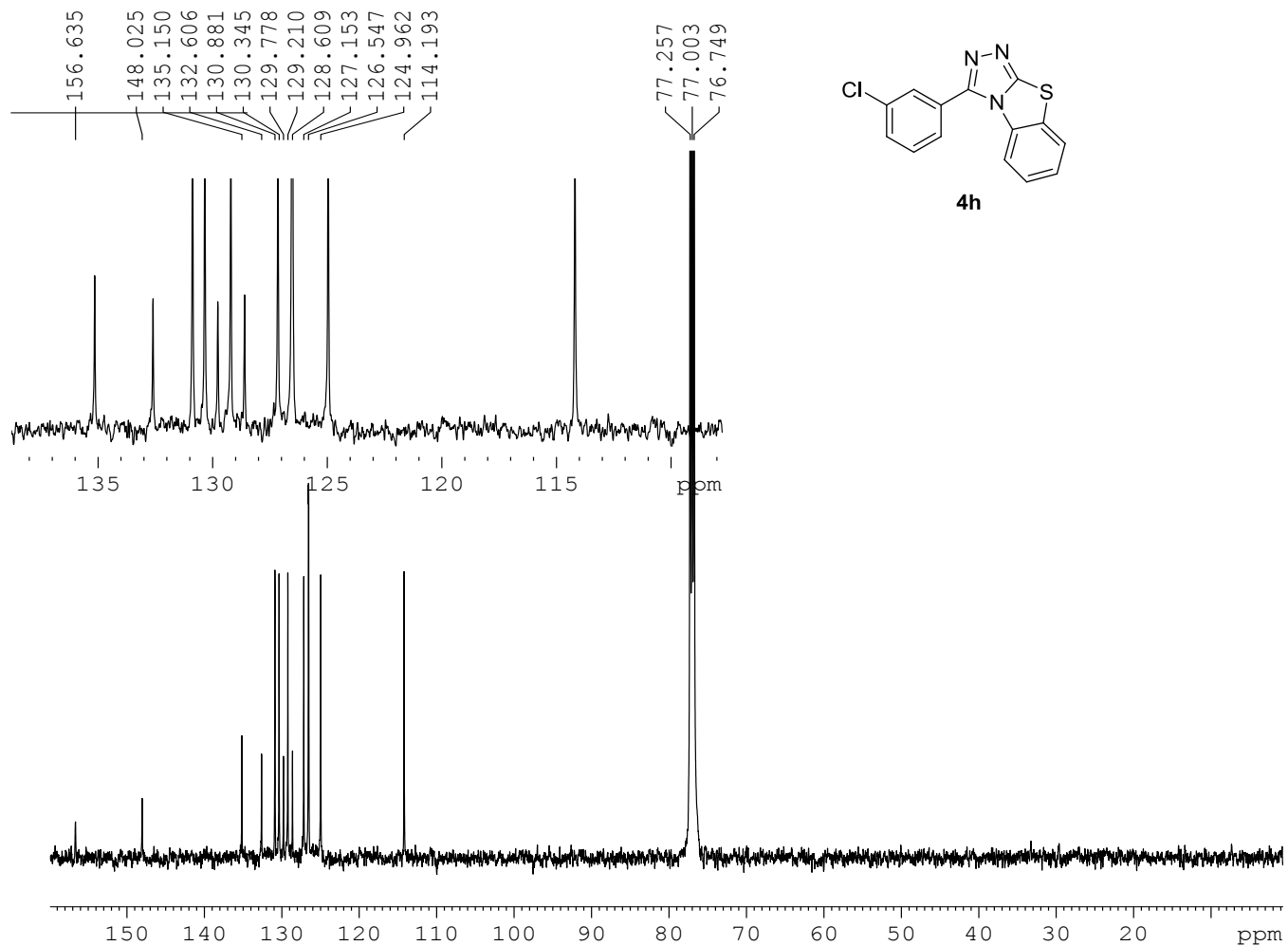
===== CHANNEL f2 =====
CPDPRG2 w altz 16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326395 MHz
WDW EM
SSB 0
LB 10.00 Hz
GB 0
PC 2.00



NAME LM-2-13B
EXPNO 1
PROCNO 1
Date_ 20120411
Time 21.56
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 645
DW 50.000 usec
DE 6.00 usec
TE 297.8 K
D1 2.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
SI 16384
SF 500.0300064 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 2.00

LM-2-13B 13C 1D 2012 04 12

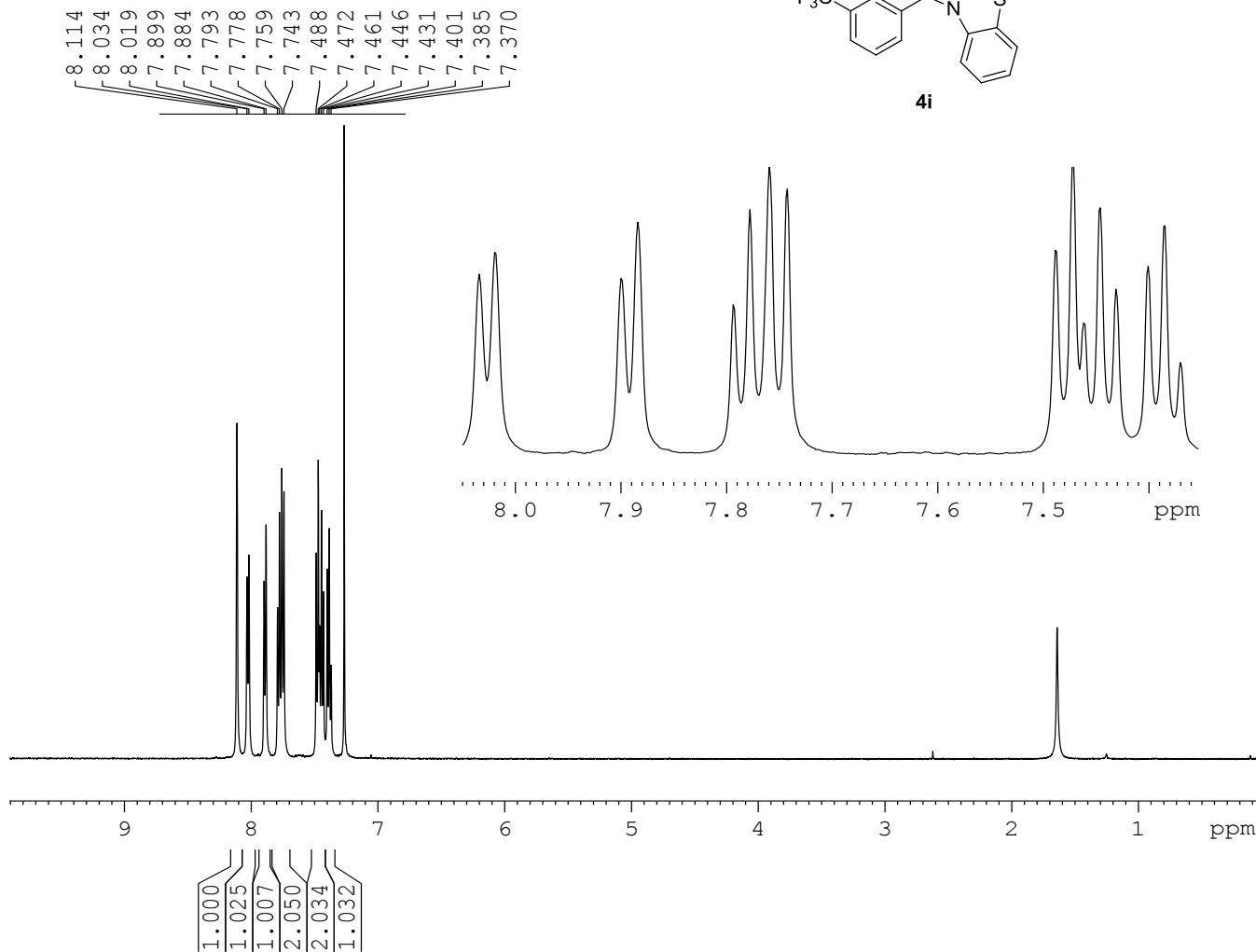
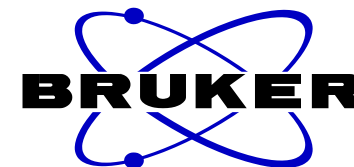
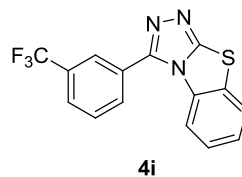


NAME LM-2-13B
EXPNO 2
PROCNO 1
Date_ 20120414
Time_ 13.31
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 1214
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 812
DW 15.300 usec
DE 6.00 usec
TE 296.1 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

=====
CHANNEL f1
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

=====
CHANNEL f2
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326482 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 2.00

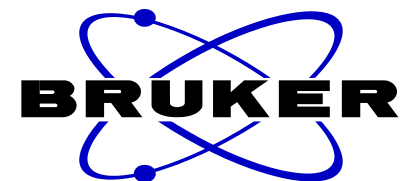
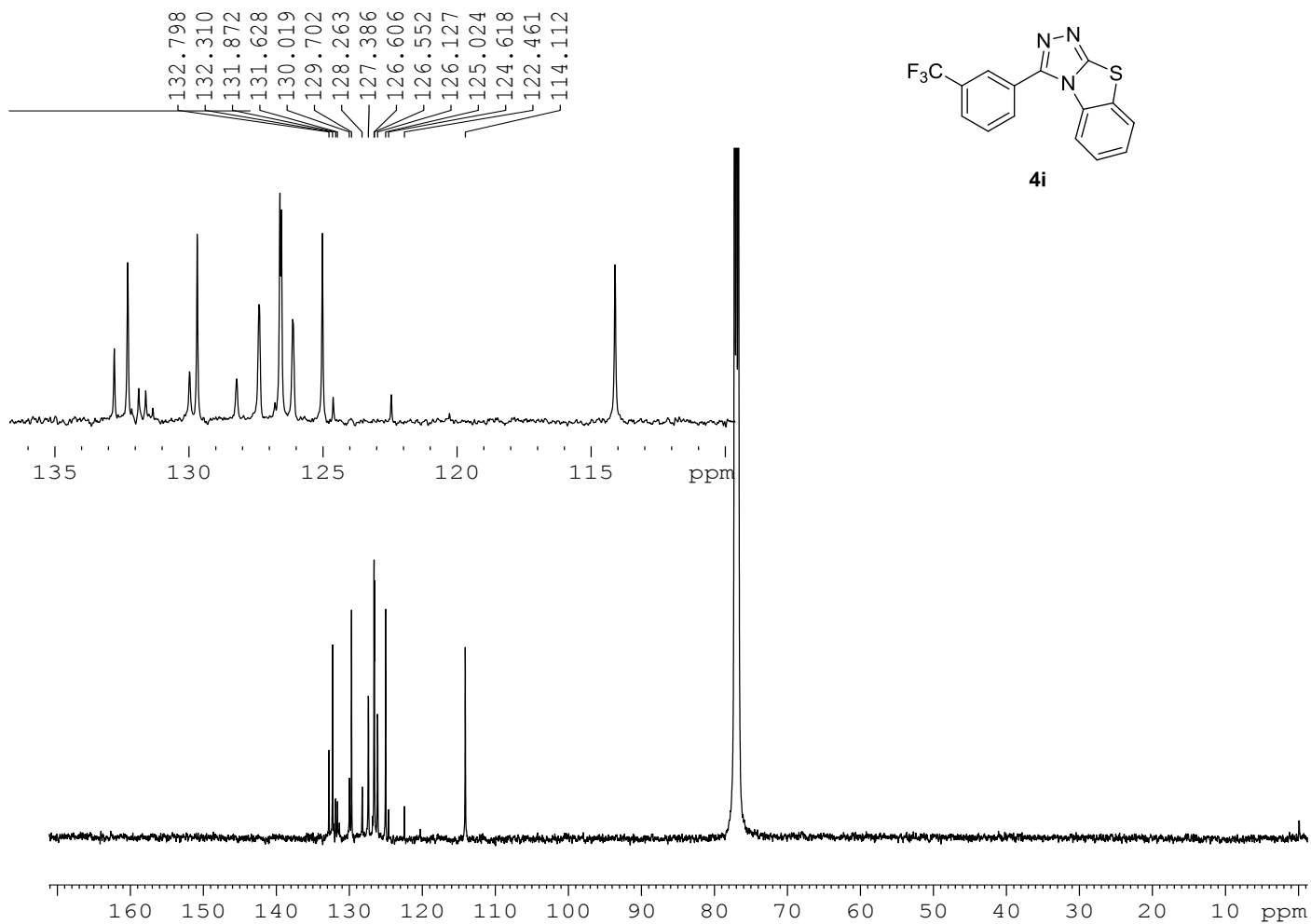
LM-2-15B 1H 2012 04 12



NAME LM-2-15B
EXPNO 1
PROCNO 1
Date_ 20120412
Time_ 10.14
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 645
DW 50.000 usec
DE 6.00 usec
TE 293.1 K
D1 2.00000000 sec
TD0 1

==== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
SI 16384
SF 500.0300064 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 2.00

LM-2-15B 13C 1D 2012 04 14

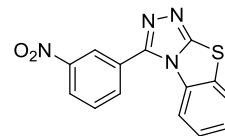


```
NAME LM-2-15B
EXPNO 2
PROCNO 1
Date_ 20120415
Time_ 6.58
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 10716
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 812
DW 15.300 usec
DE 6.00 usec
TE 298.1 K
D1 2.0000000 sec
d11 0.0300000 sec
DELTA 1.89999998 sec
TD0 1

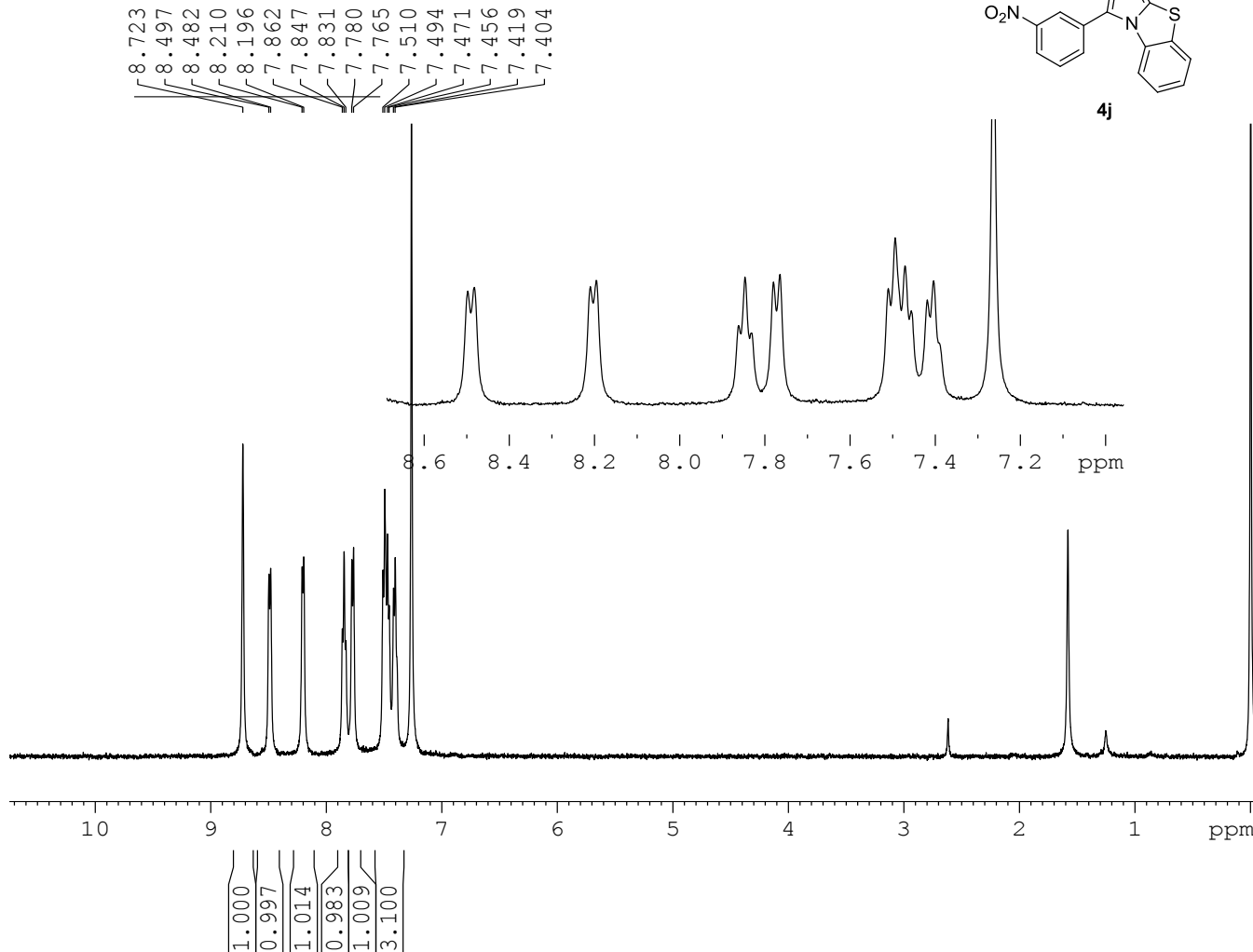
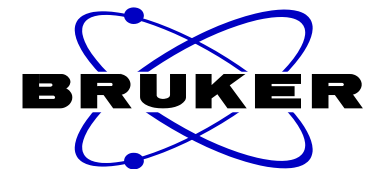
===== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

===== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326482 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 2.00
```

LM-2-16B 1H 2012 04 17



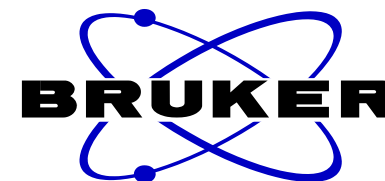
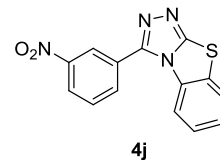
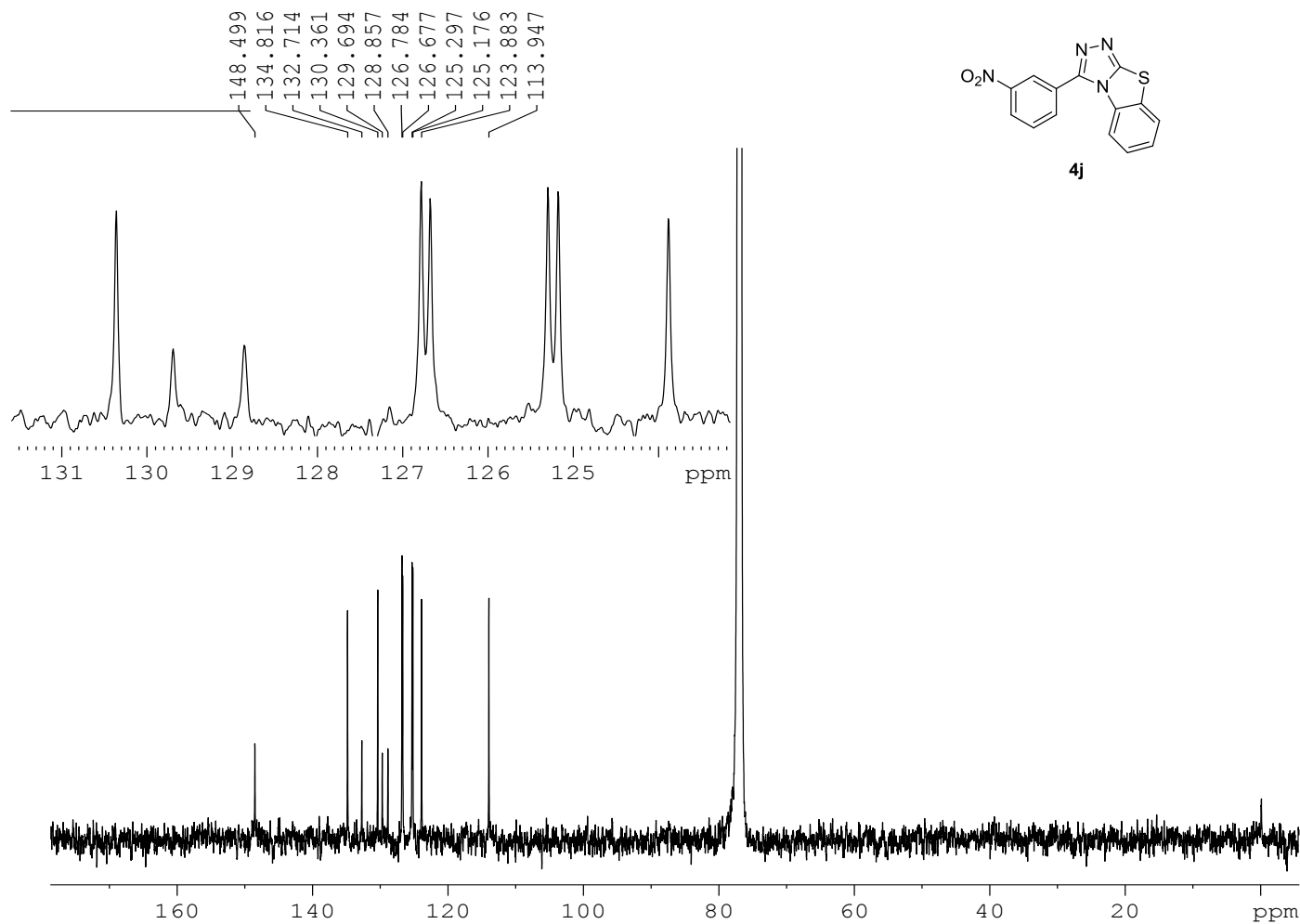
4j



NAME LM-2-16B
EXPNO 1
PROCNO 1
Date_ 20120417
Time_ 16.53
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 645
DW 50.000 usec
DE 6.00 usec
TE 294.6 K
D1 2.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
SI 16384
SF 500.0300072 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 2.00

LM-2-16B 13C 1D 2012 04 19



NAME LM-2-16B
EXPNO 2
PROCNO 1
Date_ 20120419
Time_ 11.24
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 4298
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 812
DW 15.300 usec
DE 6.00 usec
TE 298.2 K
D1 2.0000000 sec
d11 0.0300000 sec
DELTA 1.89999998 sec
TD0 1

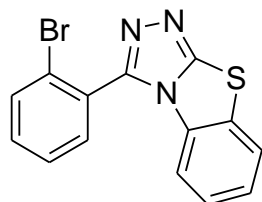
==== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

==== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326482 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 2.00

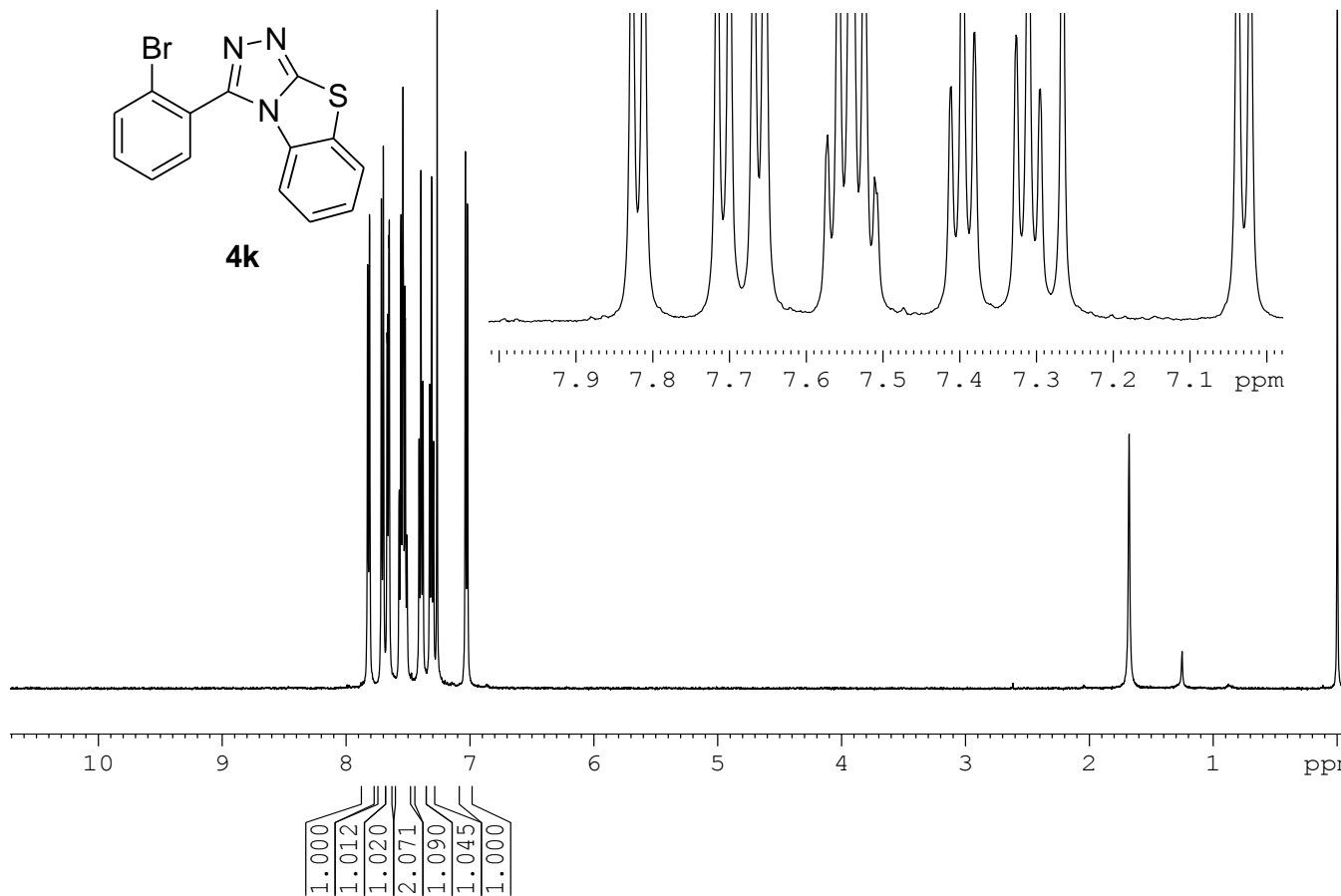
LM-2-8B 1H 2012 05 07



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7.716
7.700
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7.667
7.655
7.653
7.572
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7.542
7.526
7.511
7.411
7.396
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7.326
7.311
7.295
7.038
7.021



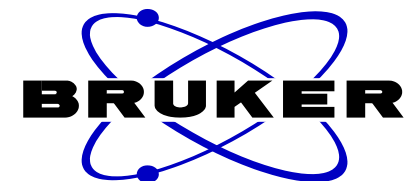
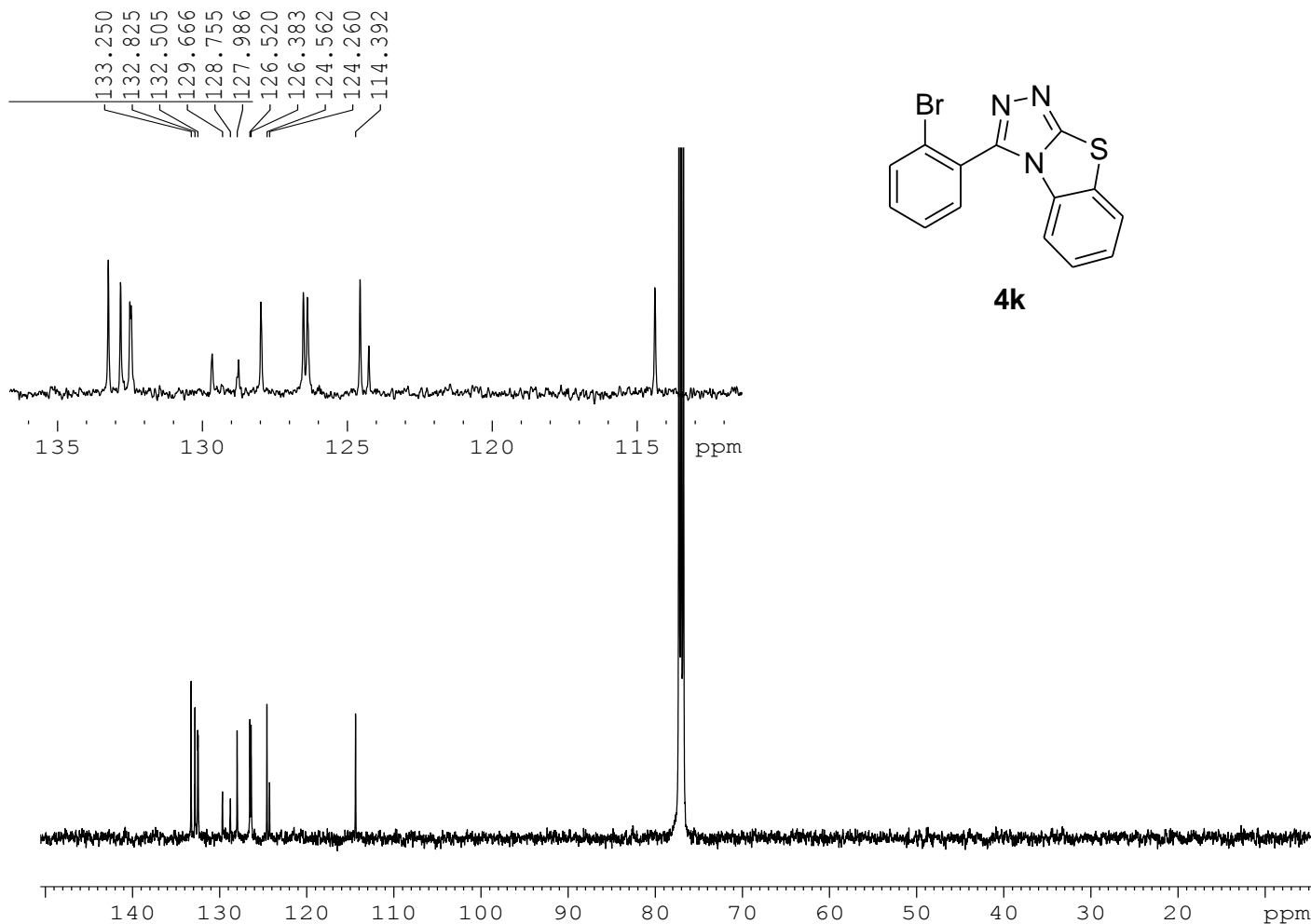
4k



NAME LM-2-8B
EXPNO 1
PROCNO 1
Date_ 20120507
Time_ 21.54
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 645
DW 50.000 usec
DE 6.00 usec
TE 295.5 K
D1 2.00000000 sec
TDO 1

==== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
SI 16384
SF 500.0300081 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 2.00

LM-2-8B 13C 1D 2012 05 09

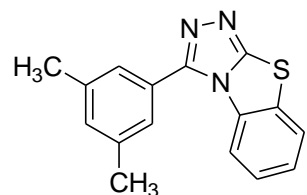
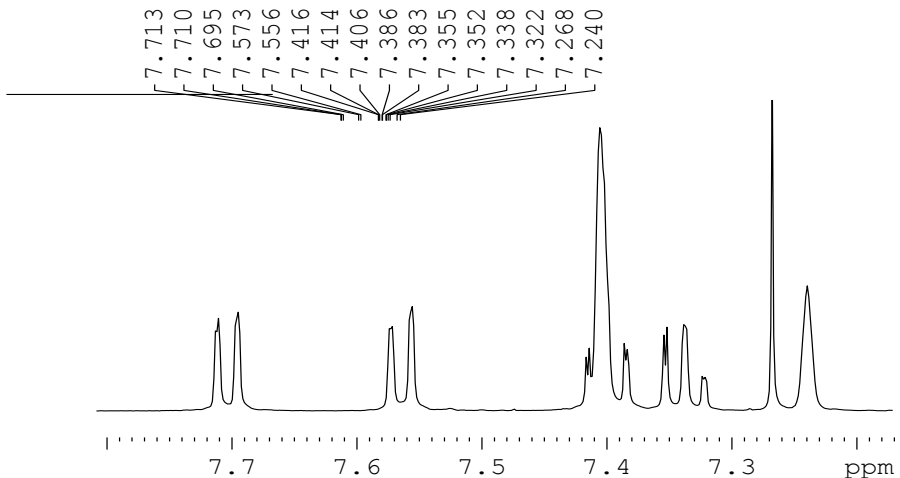
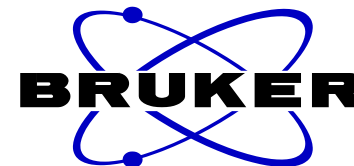


```
NAME LM-2-8B
EXPNO 2
PROCNO 1
Date_ 20120509
Time_ 18.45
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 612
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 11500
DW 15.300 usec
DE 6.00 usec
TE 301.7 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

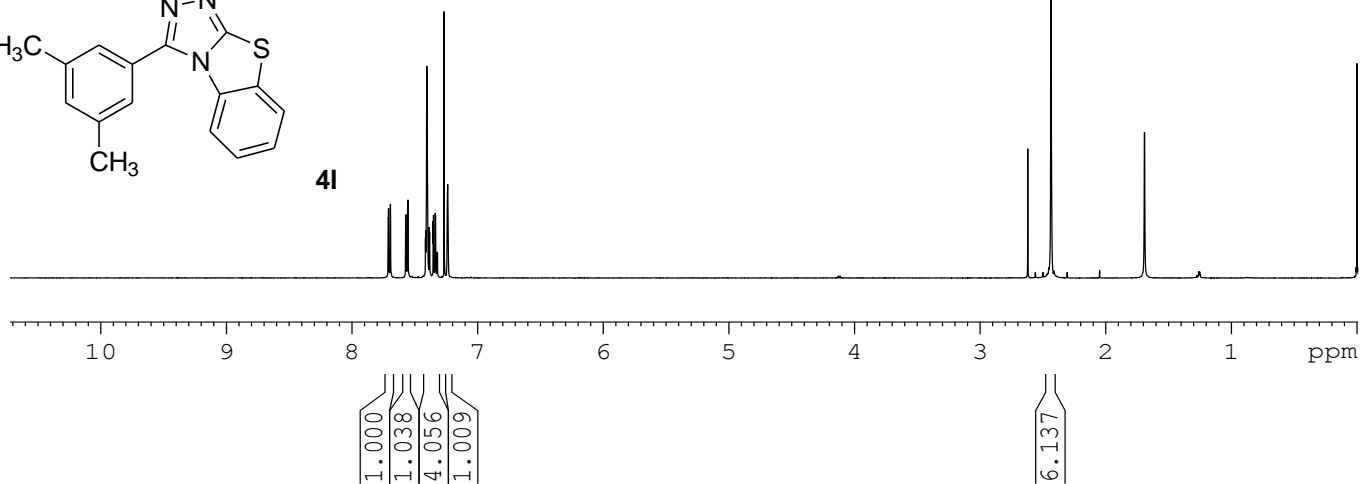
===== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

===== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326440 MHz
WDW EM
SSB 0
LB 4.00 Hz
GB 0
PC 2.00
```

LM-2-17B 1H 2012 04 12



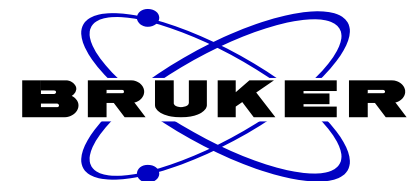
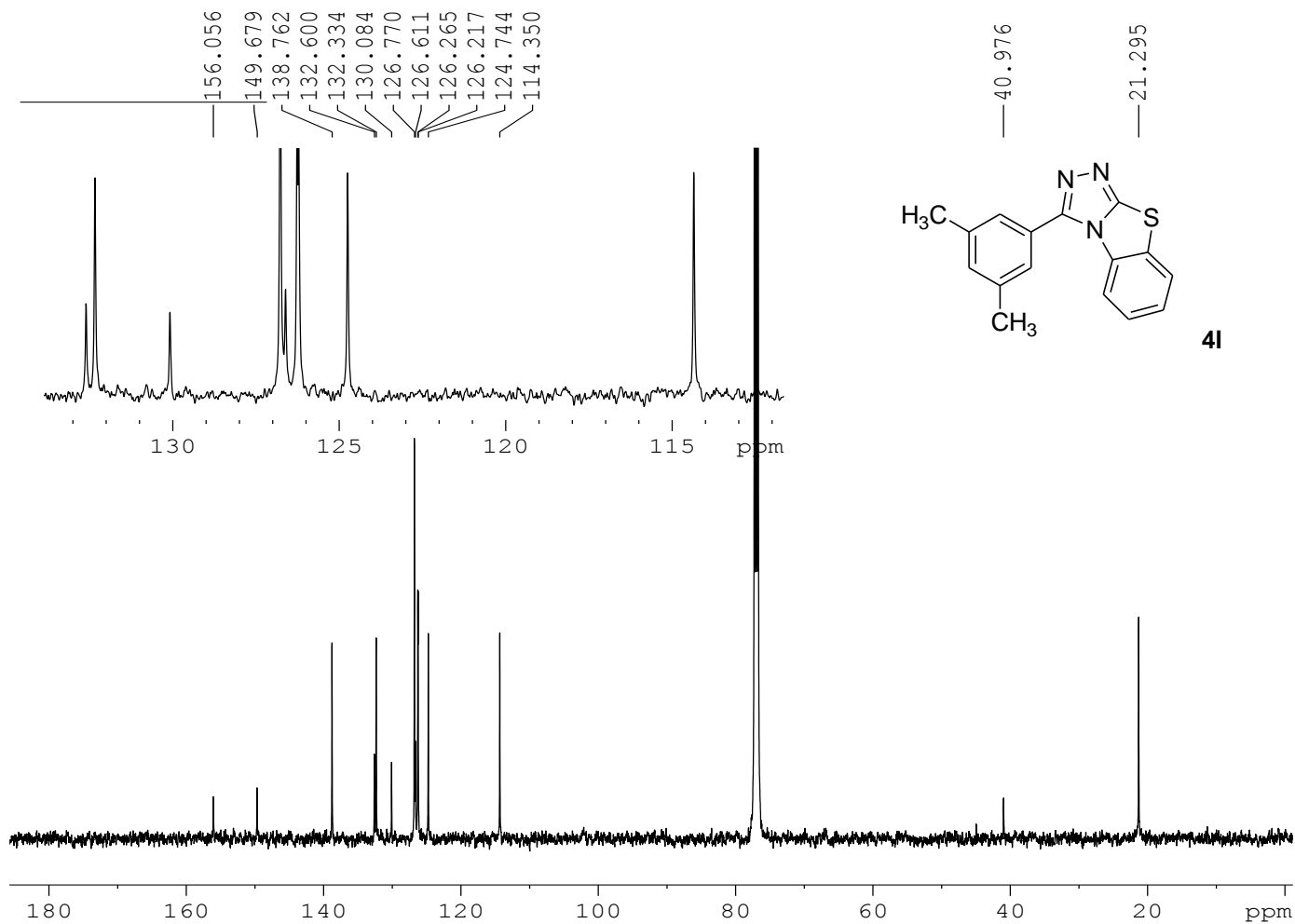
4I



NAME LM-2-17B
EXPNO 1
PROCNO 1
Date_ 20120412
Time_ 10.18
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 512
DW 50.000 usec
DE 6.00 usec
TE 293.1 K
D1 2.00000000 sec
TDO 1

==== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
SI 16384
SF 500.0300064 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 2.00

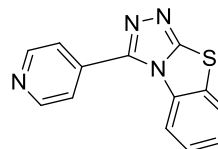
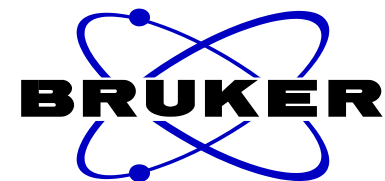
LM-2-17B 13C 1D 2012 04 15



NAME LM-2-17B
EXPNO 2
PROCNO 1
Date_ 20120415
Time_ 18.47
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 1713
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 812
DW 15.300 usec
DE 6.00 usec
TE 296.5 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

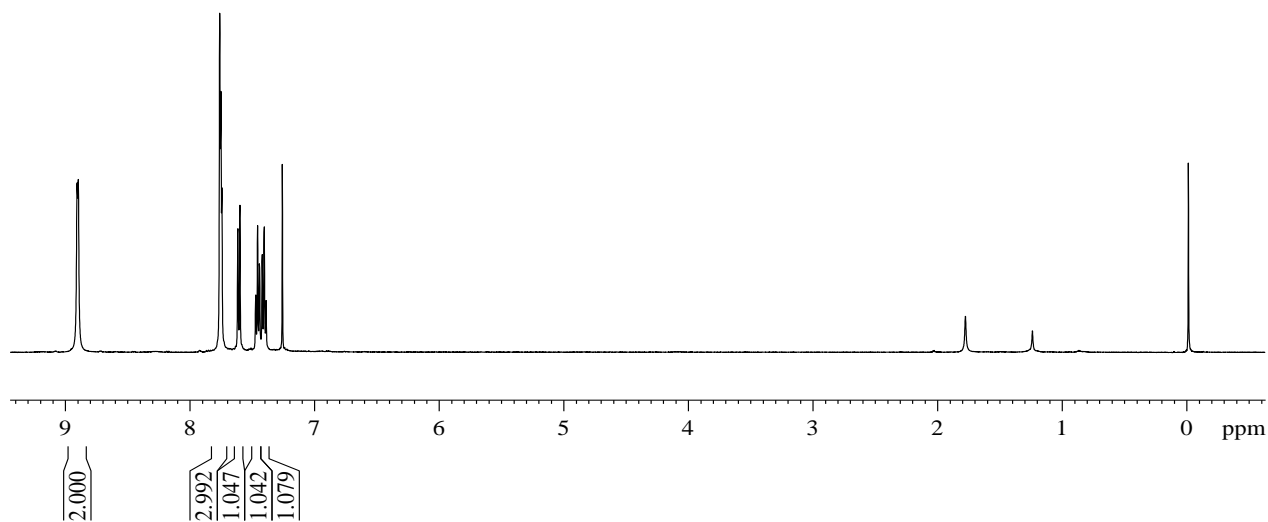
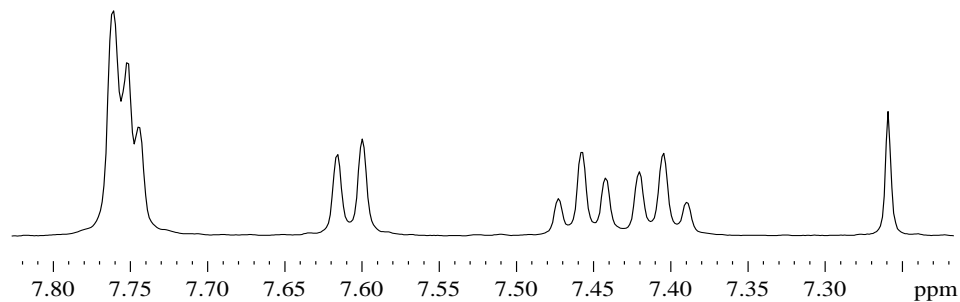
==== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

==== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326482 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 2.00



4m

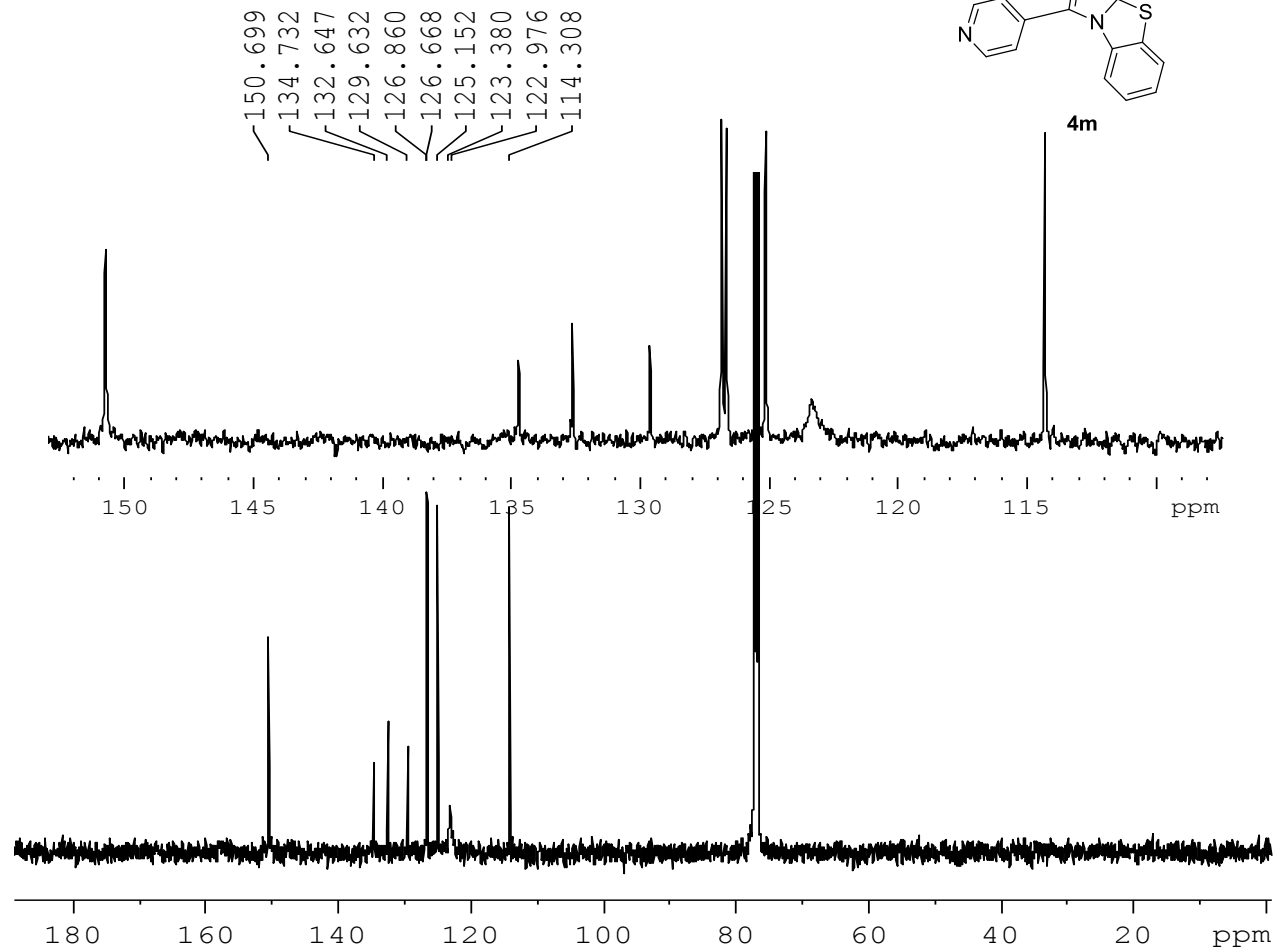
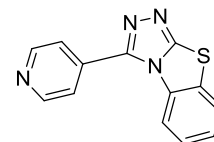
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7.616
7.600
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7.442
7.420
7.405
7.390
7.259



NAME LM-2-18B-2
EXPNO 1
PROCNO 1
Date_ 20121207
Time 19.13
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 16384
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.610352 Hz
AQ 0.8193000 sec
RG 645
DW 50.000 usec
DE 8.00 usec
TE 292.4 K
D1 1.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.00 usec
PL1 2.00 dB
SFO1 500.0338500 MHz
SI 16384
SF 500.0300092 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 5.00

LM-2-18B-2 13C 1D 2012 12 12

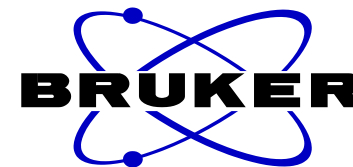


NAME LM-2-18B-2
EXPNO 2
PROCNO 1
Date_ 20121212
Time_ 12.15
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDC13
NS 556
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 1150
DW 15.300 usec
DE 6.00 usec
TE 292.4 K
D1 2.0000000 sec
d11 0.0300000 sec
DELTA 1.89999998 sec
TD0 10

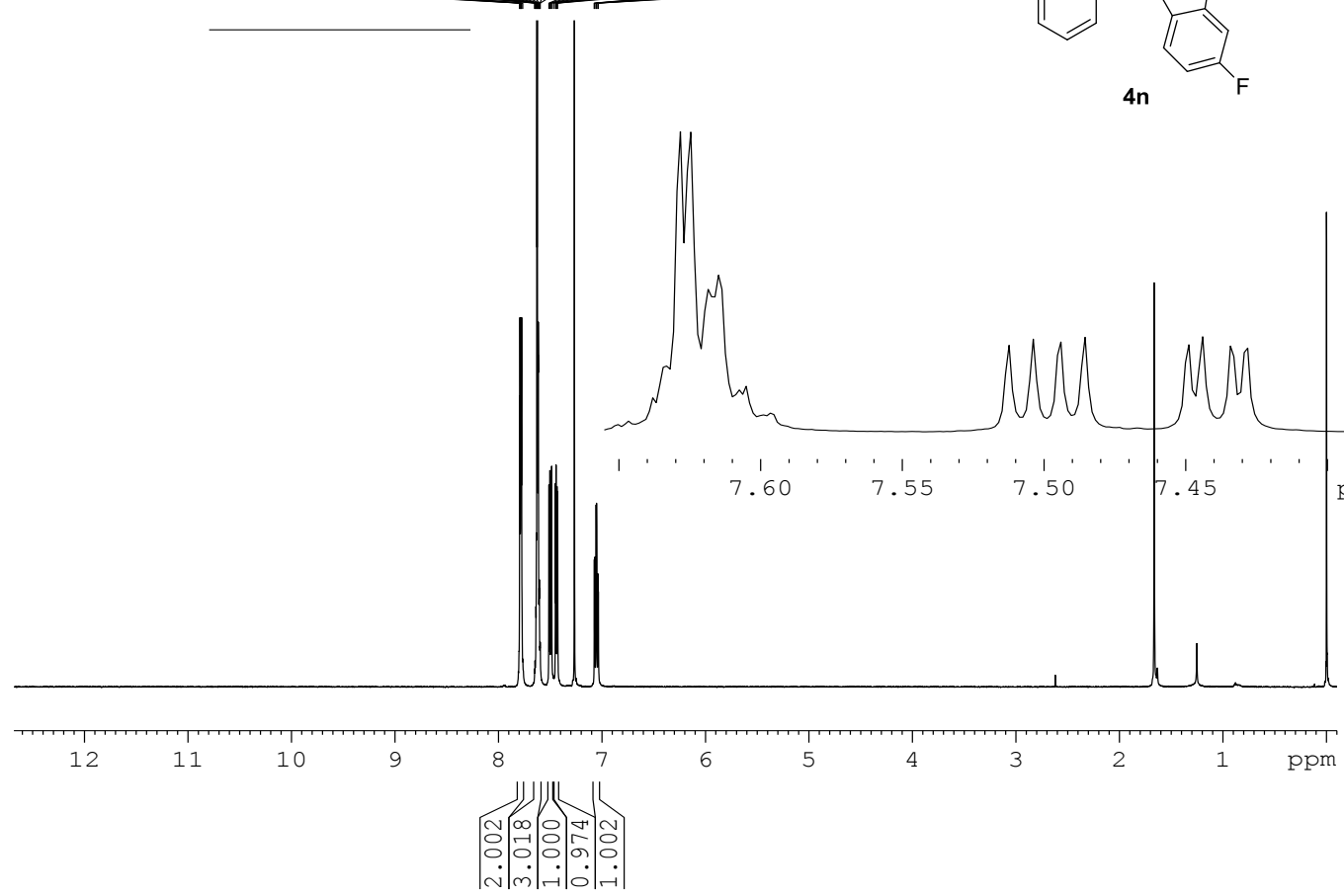
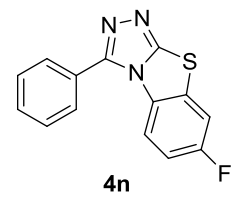
=====
CHANNEL f1
NUC1 13C
P1 12.20 usec
PL1 3.00 dB
SFO1 125.7464750 MHz

=====
CHANNEL f2
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.00 dB
PL12 17.70 dB
PL13 17.70 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326455 MHz
WDW EM
SSB 0
--

LM-2-10B 1H 2012 03 29



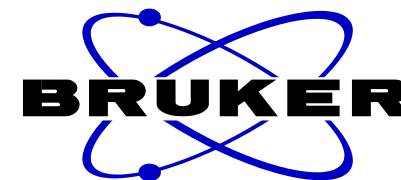
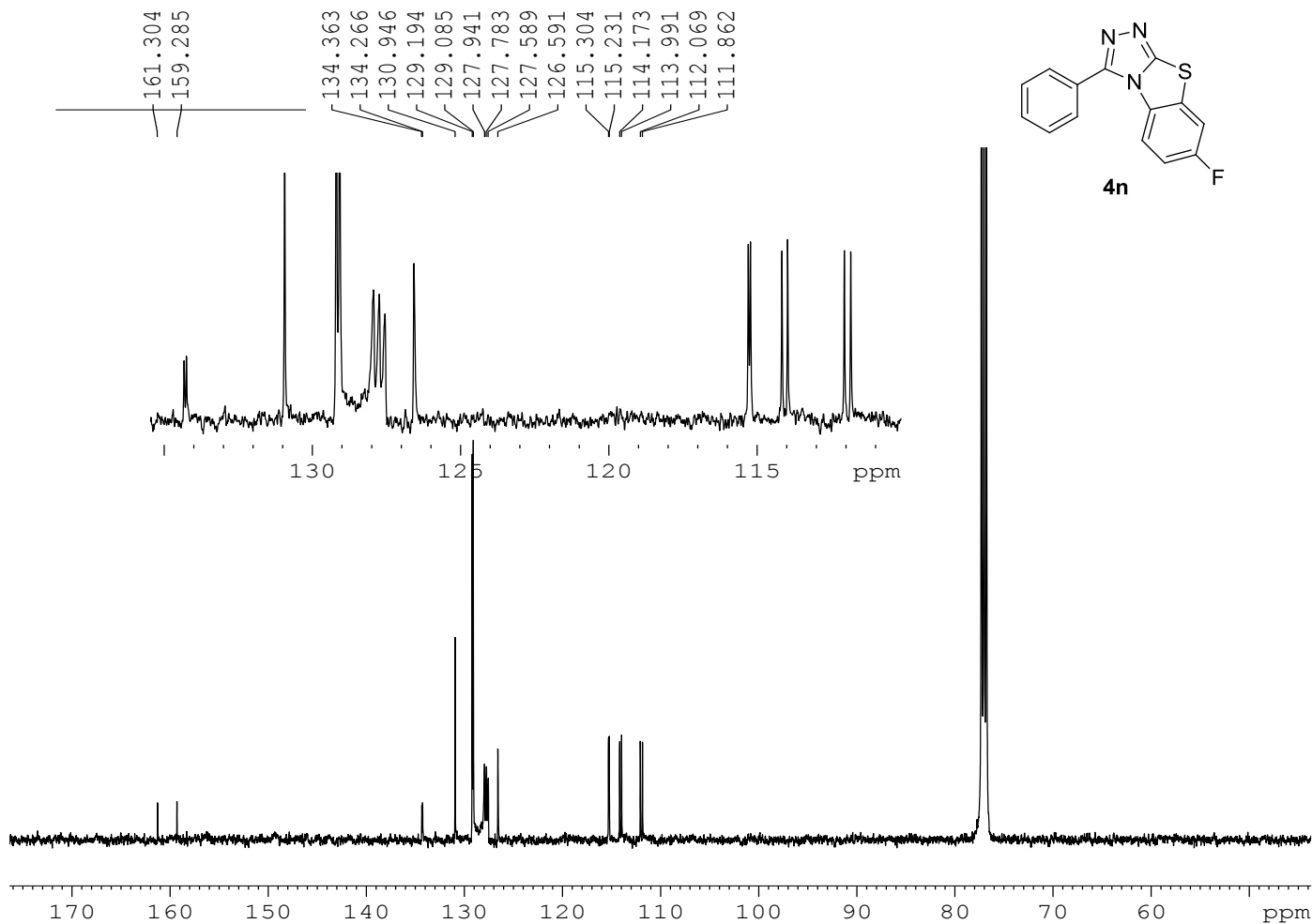
7.795
7.792
7.785
7.782
7.776
7.765
7.650
7.647
7.638
7.633
7.628
7.625
7.618
7.615
7.607
7.605
7.599
7.596
7.513
7.504
7.494
7.486
7.467
7.449
7.444
7.434
7.429
7.074
7.069
7.057
7.052
7.040
7.035



NAME LM-2-10B
EXPNO 1
PROCNO 1
Date_ 20120329
Time_ 19.18
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 645
DW 50.000 usec
DE 6.00 usec
TE 292.7 K
D1 2.00000000 sec
TD0 1

==== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
SI 16384
SF 500.0300068 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 2.00

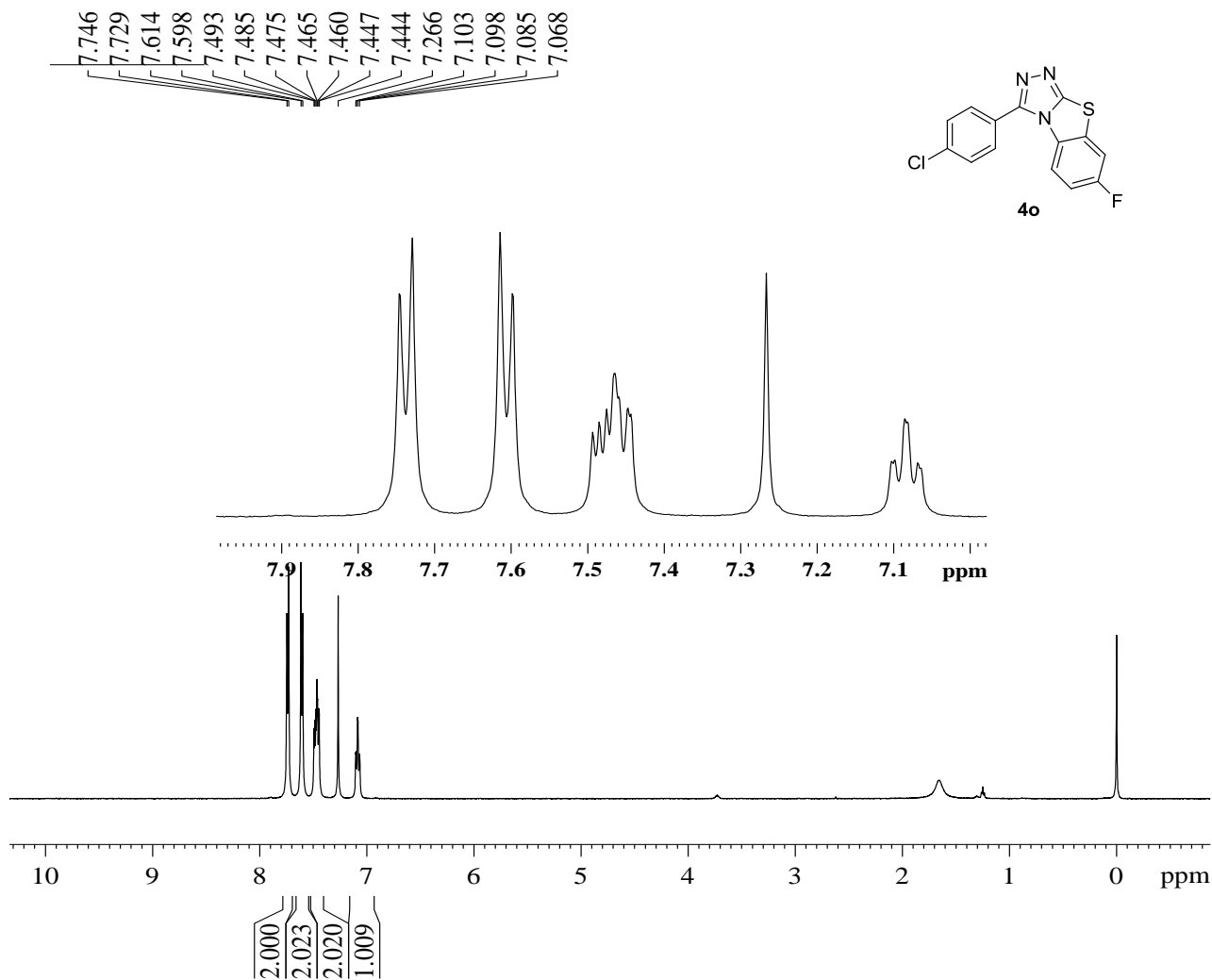
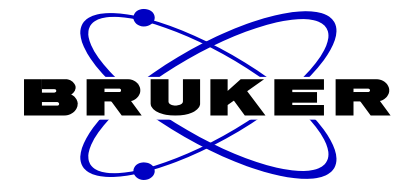
LM-2-10B 13C 1D 2012 04 05



NAME LM-2-10B
EXPNO 2
PROCNO 11
Date_ 20120405
Time_ 10.43
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDC13
NS 2203
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 3250
DW 15.300 usec
DE 6.00 usec
TE 294.1 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.899999998 sec
TDO 1

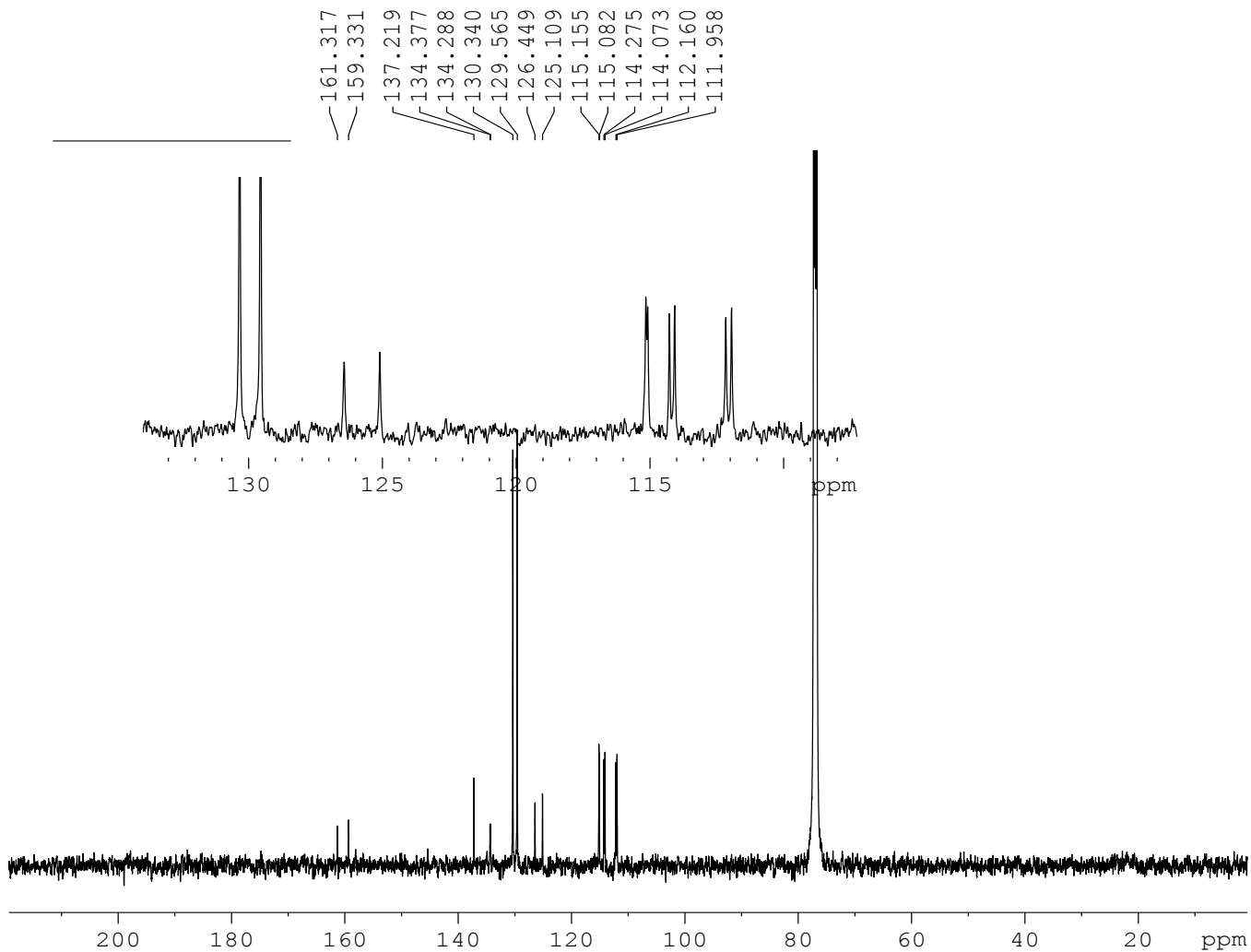
==== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

==== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.20 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326435 MHz
WDW EM
SSB 0
LB 3.00 Hz
GB 0
PC 2.00



NAME LM-2-11B
EXPNO 1
PROCNO 1
Date_ 20120329
Time 19.22
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 645
DW 50.000 usec
DE 6.00 usec
TE 292.7 K
D1 2.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
SI 16384
SF 500.0300064 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 2.00

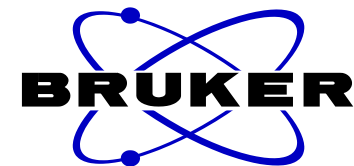
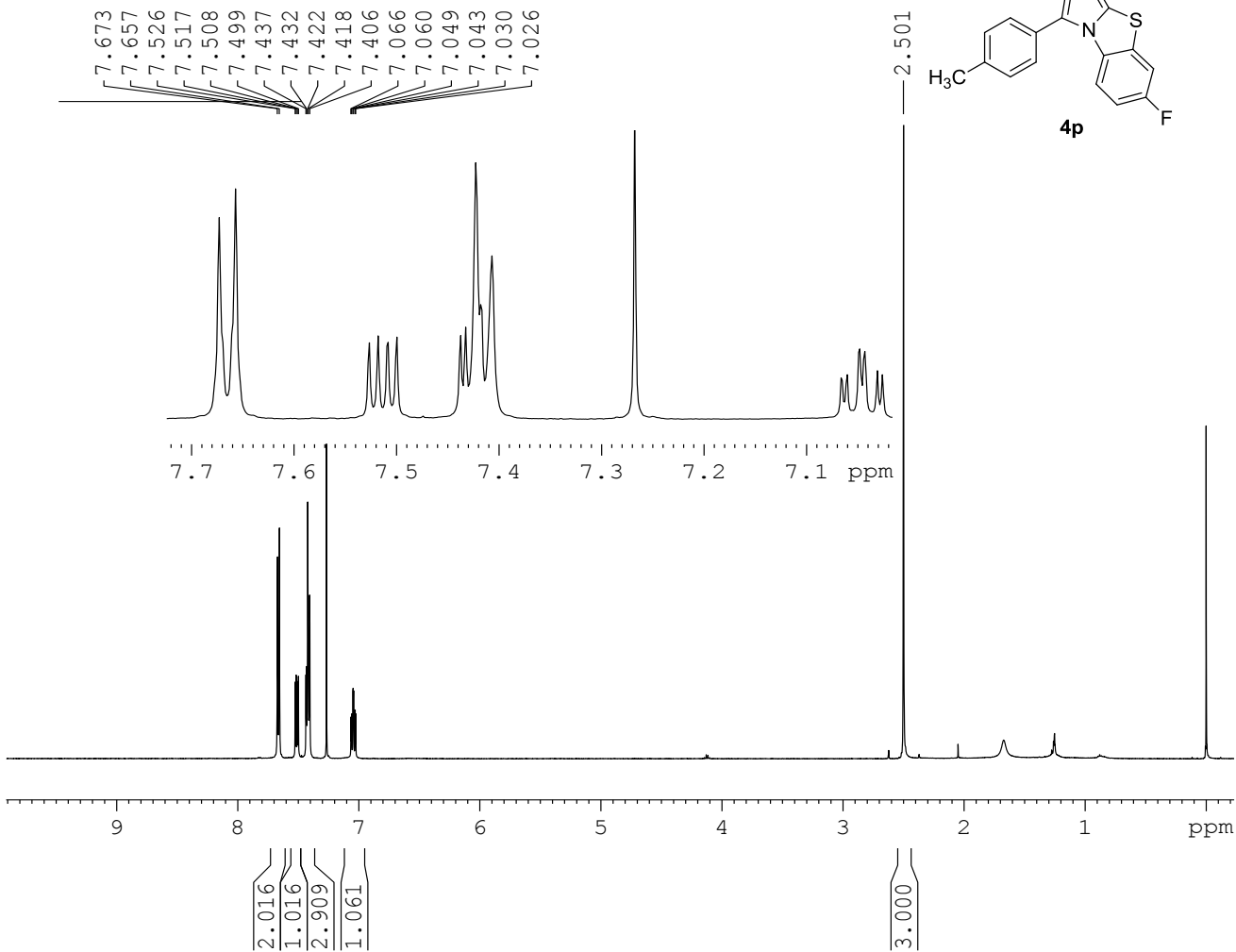


```
NAME          LM-2-11B
EXPNO         2
PROCNO       1
Date_        20120405
Time_        11.42
INSTRUM      av500
PROBHD       5 mm PABBO BB-
PULPROG      zgpg30
TD           65536
SOLVENT      CDC13
NS           3024
DS           2
SWH          32679.738 Hz
FIDRES       0.498653 Hz
AQ           1.0027661 sec
RG           3250
DW           15.300 usec
DE           6.00 usec
TE           293.4 K
D1           2.00000000 sec
d11          0.03000000 sec
DELTA        1.899999998 sec
TD0          1
```

```
===== CHANNEL f1 =====
NUC1          13C
P1            9.60 usec
PL1           2.00 dB
SFO1         125.7464750 MHz
```

```
===== CHANNEL f2 =====
CPDPRG2      waltz16
NUC2          1H
PCPD2        80.00 usec
PL2           2.60 dB
PL12         17.66 dB
PL13         17.66 dB
SFO2         500.0355000 MHz
SI           32768
SF           125.7326482 MHz
WDW          EM
SSB          0
LB           5.00 Hz
GB           0
PC           2.00
```

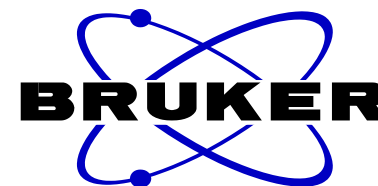
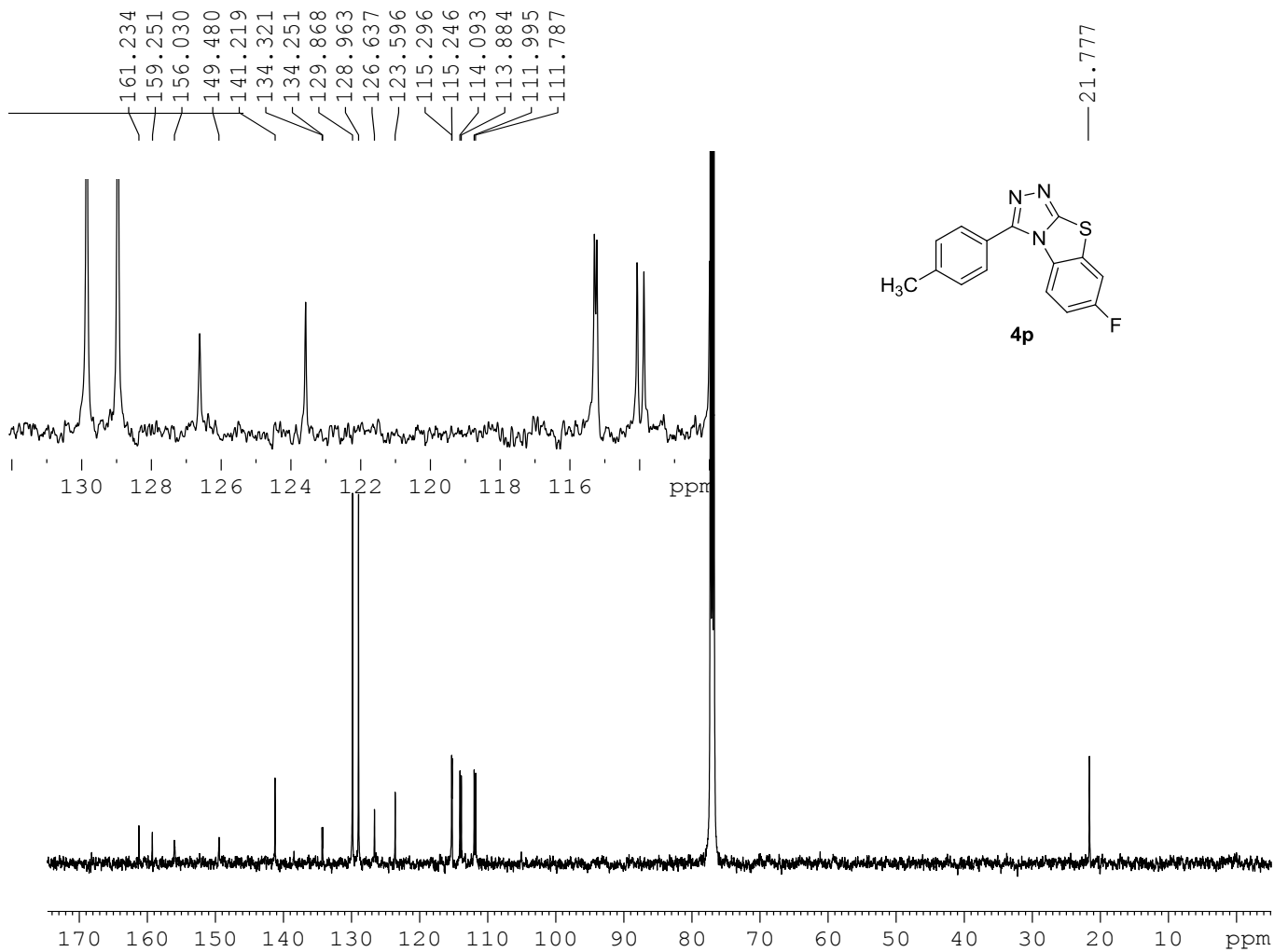
LM-2-14B 1H 2012 04 12



NAME LM-2-14B
EXPNO 1
PROCNO 1
Date_ 20120412
Time_ 10.09
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 645
DW 50.000 usec
DE 6.00 usec
TE 293.1 K
D1 2.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
SI 16384
SF 500.0300064 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 2.00

LM-2-14B 13C 1D 2012 04 15

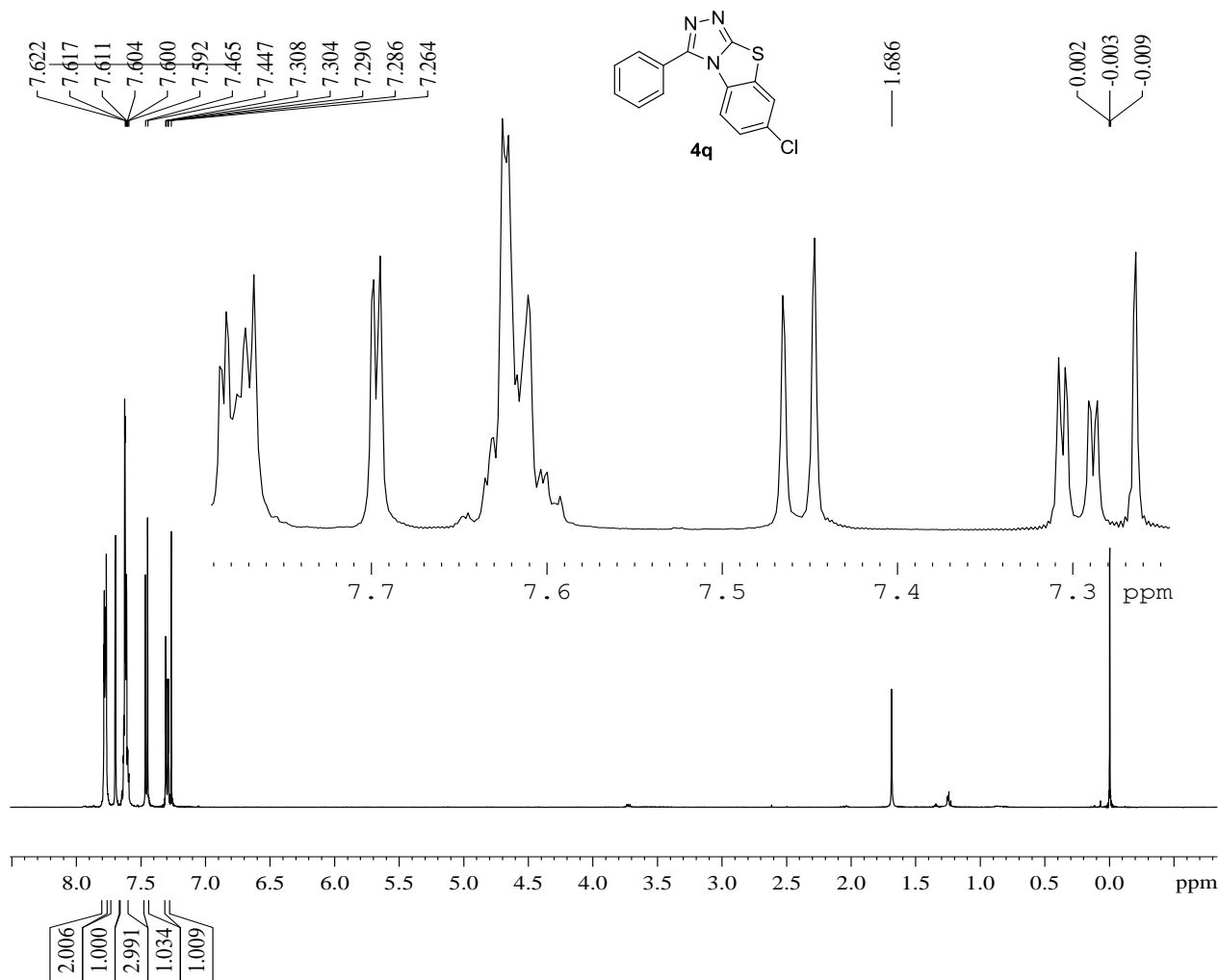


NAME LM-2-14B
EXPNO 21
PROCNO 1
Date_ 20120415
Time 13.31
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 1727
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 812
DW 15.300 usec
DE 6.00 usec
TE 296.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

==== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

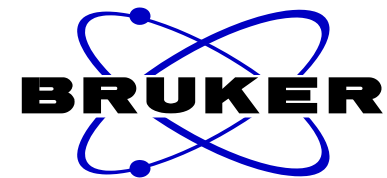
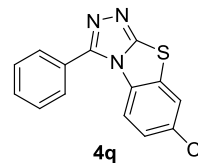
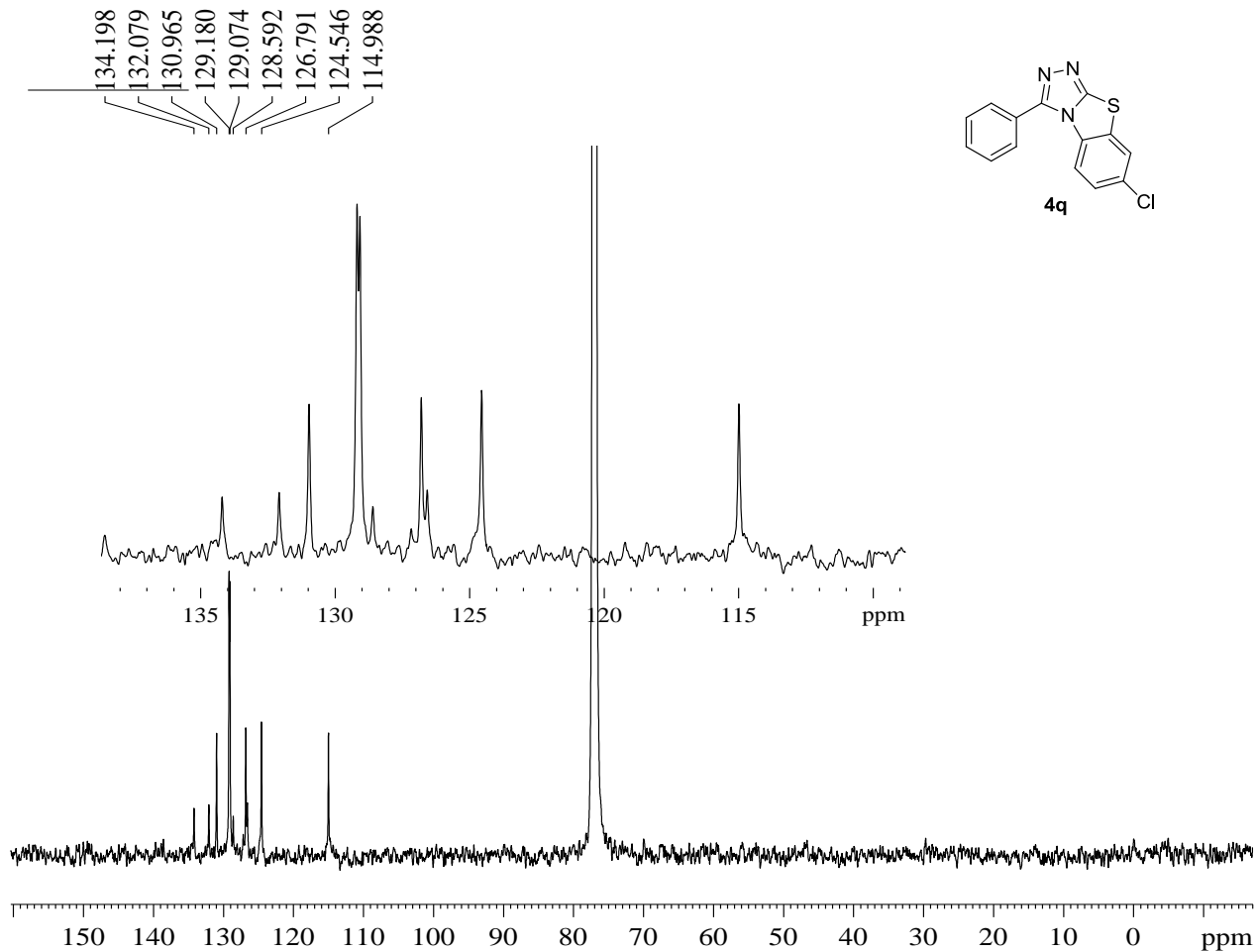
==== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326440 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 2.00

LSL-2-22b 1H 1D 2013 12 27



NAME LSL-2-22b
EXPNO 1
PROCNO 1
Date_ 20131227
Time 16.14
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 16384
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.610352 Hz
AQ 0.8193000 sec
RG 512
DW 50.000 usec
DE 8.00 usec
TE 293.6 K
D1 1.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.00 usec
PL1 2.00 dB
SFO1 500.0338500 MHz
SI 16384
SF 500.0300087 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00

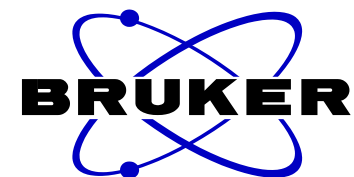
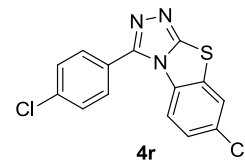
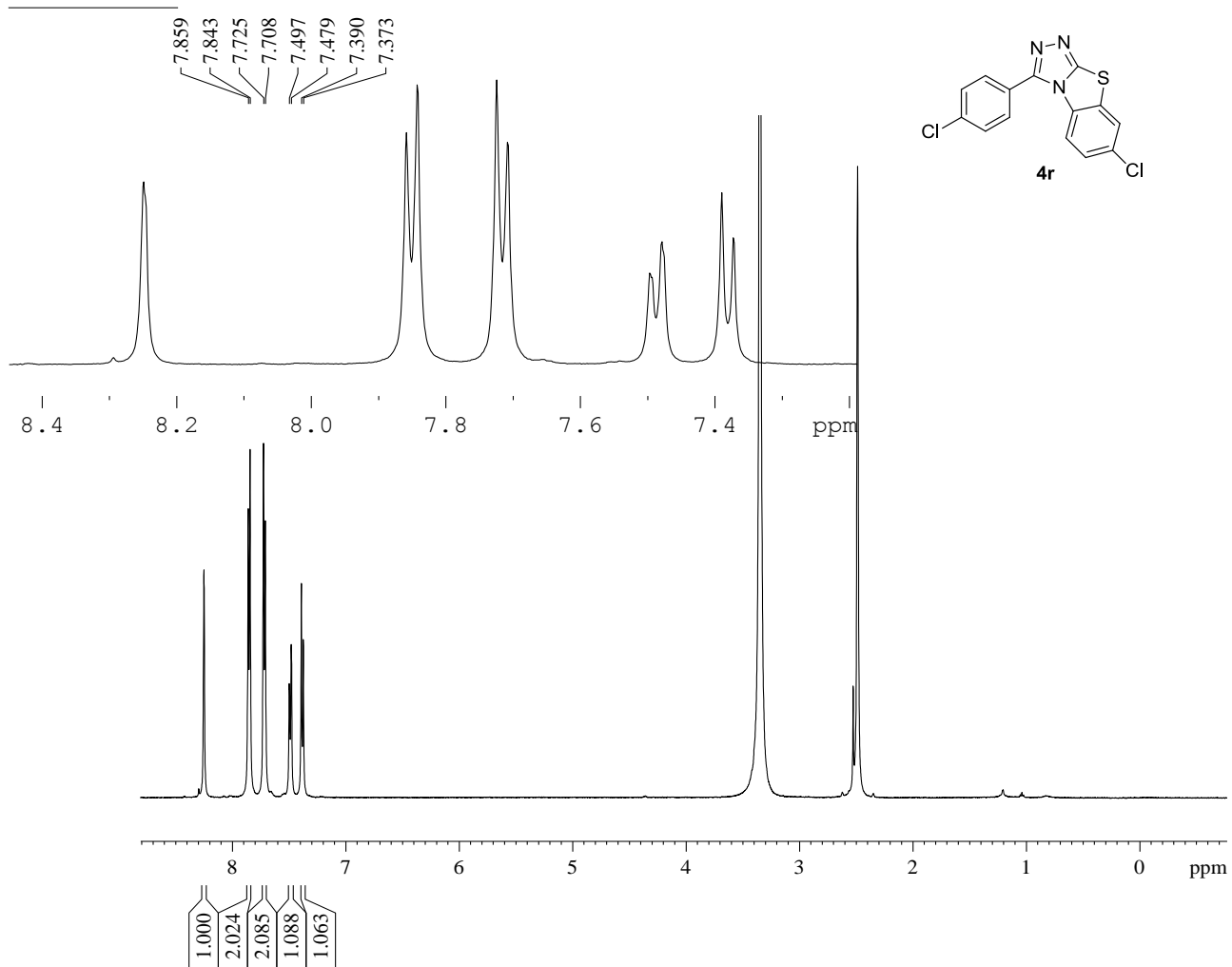


NAME lm-2-22b
EXPNO 2
PROCNO 1
Date_ 20130620
Time 15.21
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 2111
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 5160
DW 15.300 usec
DE 6.00 usec
TE 301.6 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 20

===== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

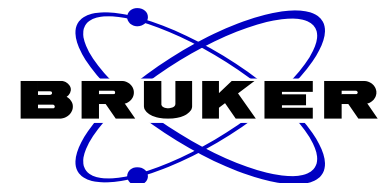
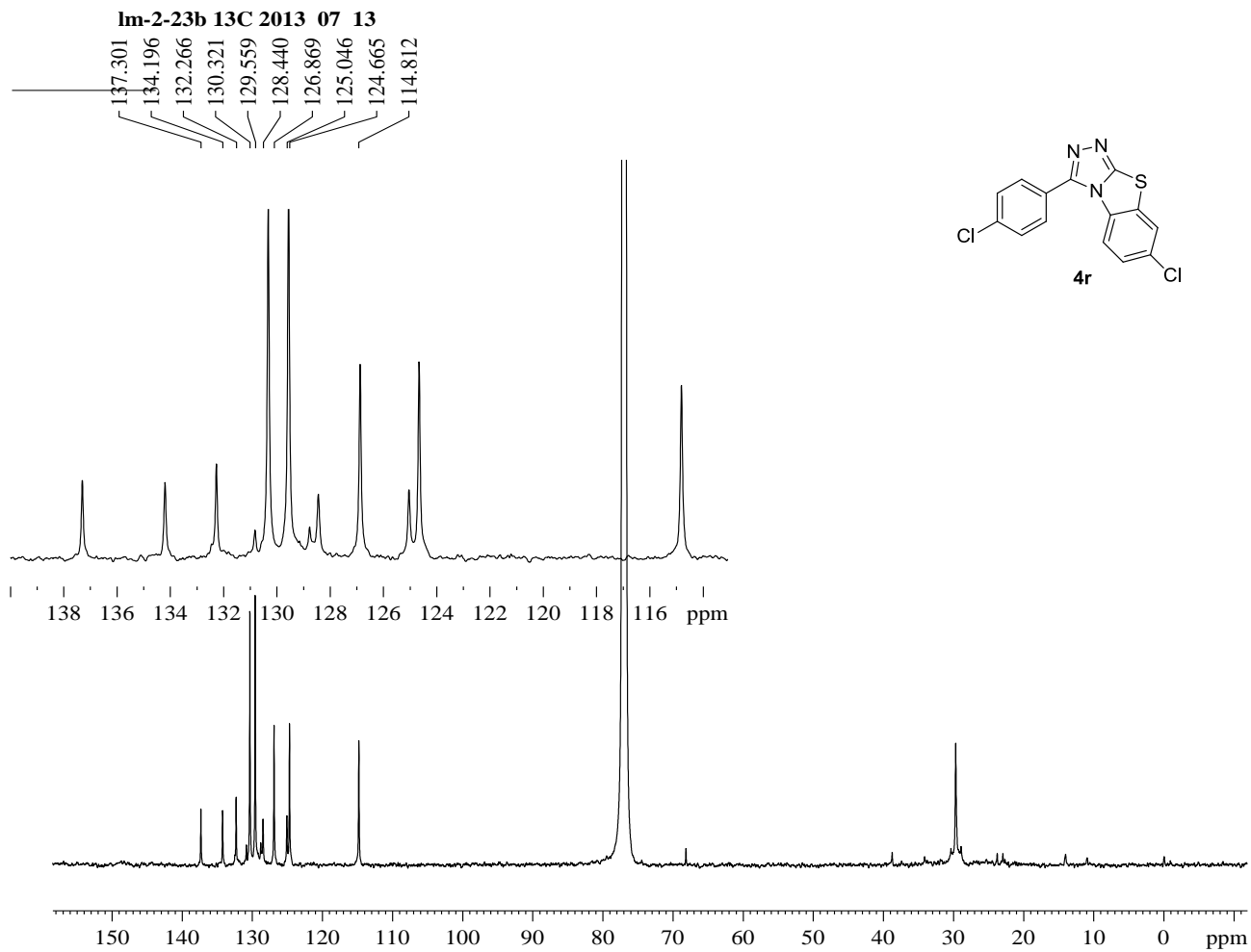
===== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326440 MHz
WDW EM

lm-2-23b-1 1H 1D 2013 12 31



NAME lm-2-23b-1
EXPNO 1
PROCNO 1
Date_ 20131231
Time 16.43
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 16384
SOLVENT DMSO
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.610352 Hz
AQ 0.8193000 sec
RG 322
DW 50.000 usec
DE 8.00 usec
TE 293.4 K
D1 1.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.00 usec
PL1 2.00 dB
SFO1 500.0338500 MHz
SI 16384
SF 500.0300085 MHz
WDW EM
SSB 0
LB 0.60 Hz
GB 0
PC 4.00

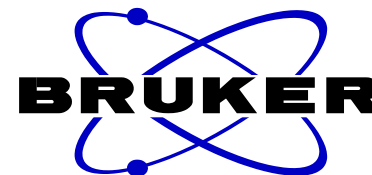
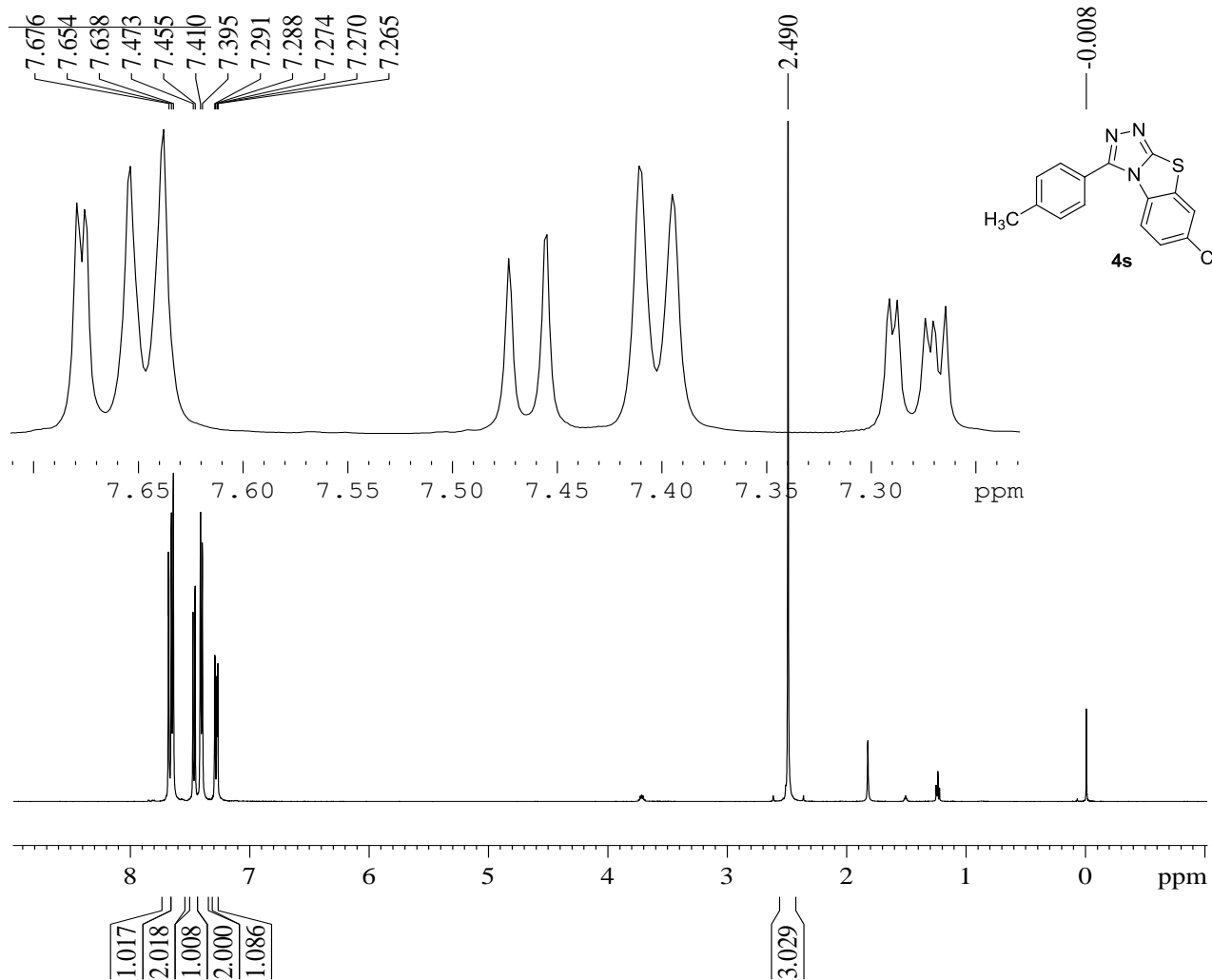


NAME 1m-2-23b
EXPNO 21
PROCNO 1
Date_ 20130713
Time 21.06
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 17784
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 1820
DW 15.300 usec
DE 6.00 usec
TE 673.2 K
D1 2.0000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 40

===== CHANNEL f1 =====
NUC1 13C
P1 12.20 usec
PL1 3.00 dB
SFO1 125.7464750 MHz

===== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.00 dB
PL12 17.70 dB
PL13 17.70 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326466 MHz
WDW EM

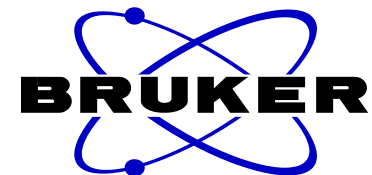
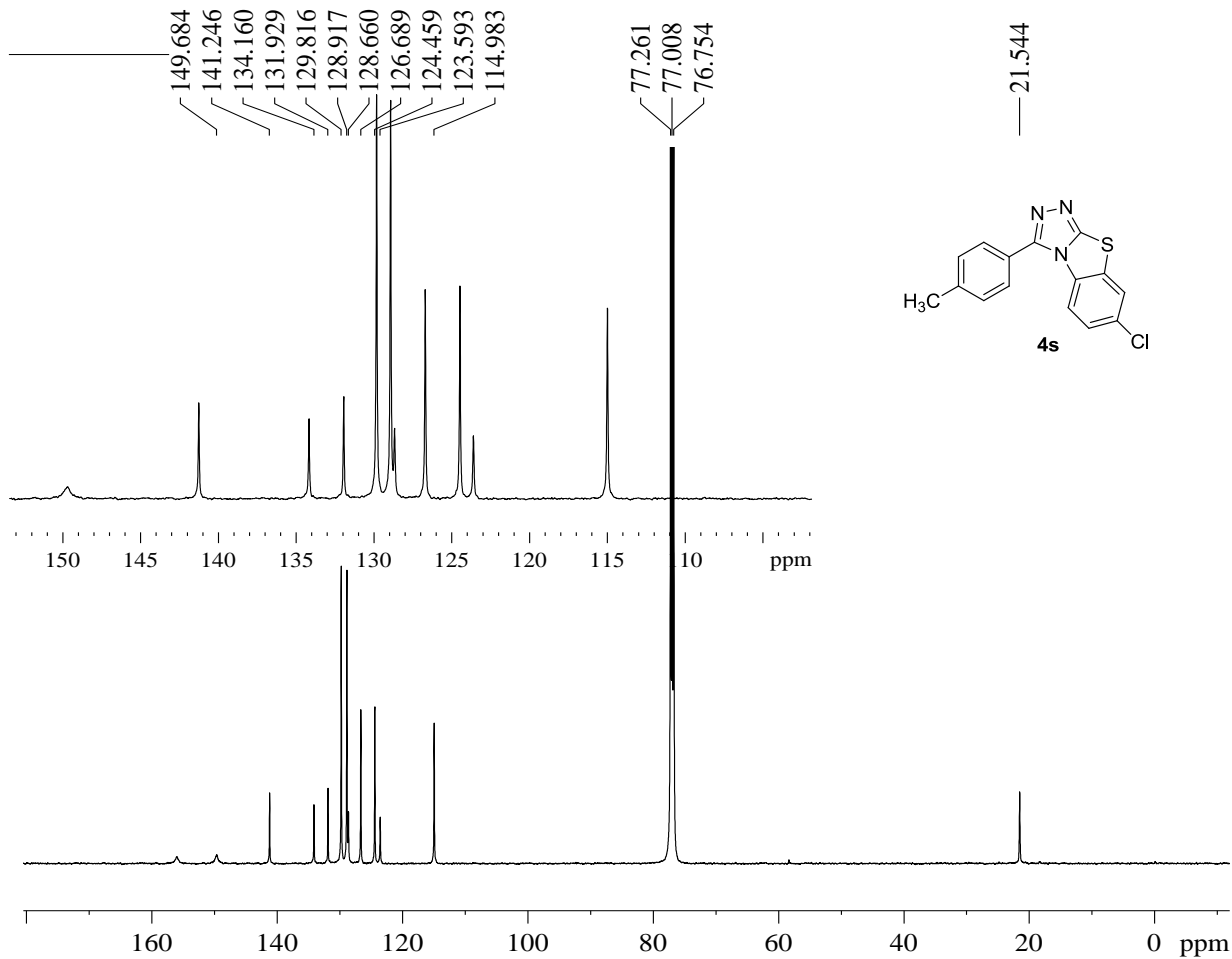
lm-2-24b-1 1H 1D 2013 12 31



NAME lm-2-24b-1
EXPNO 1
PROCNO 1
Date_ 20131231
Time 17.12
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 16384
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.610352 Hz
AQ 0.8193000 sec
RG 322
DW 50.000 usec
DE 8.00 usec
TE 293.5 K
D1 1.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.00 usec
PL1 2.00 dB
SFO1 500.0338500 MHz
SI 16384
SF 500.0300085 MHz
WDW EM
SSB 0
LB 0.60 Hz
GB 0
PC 4.00

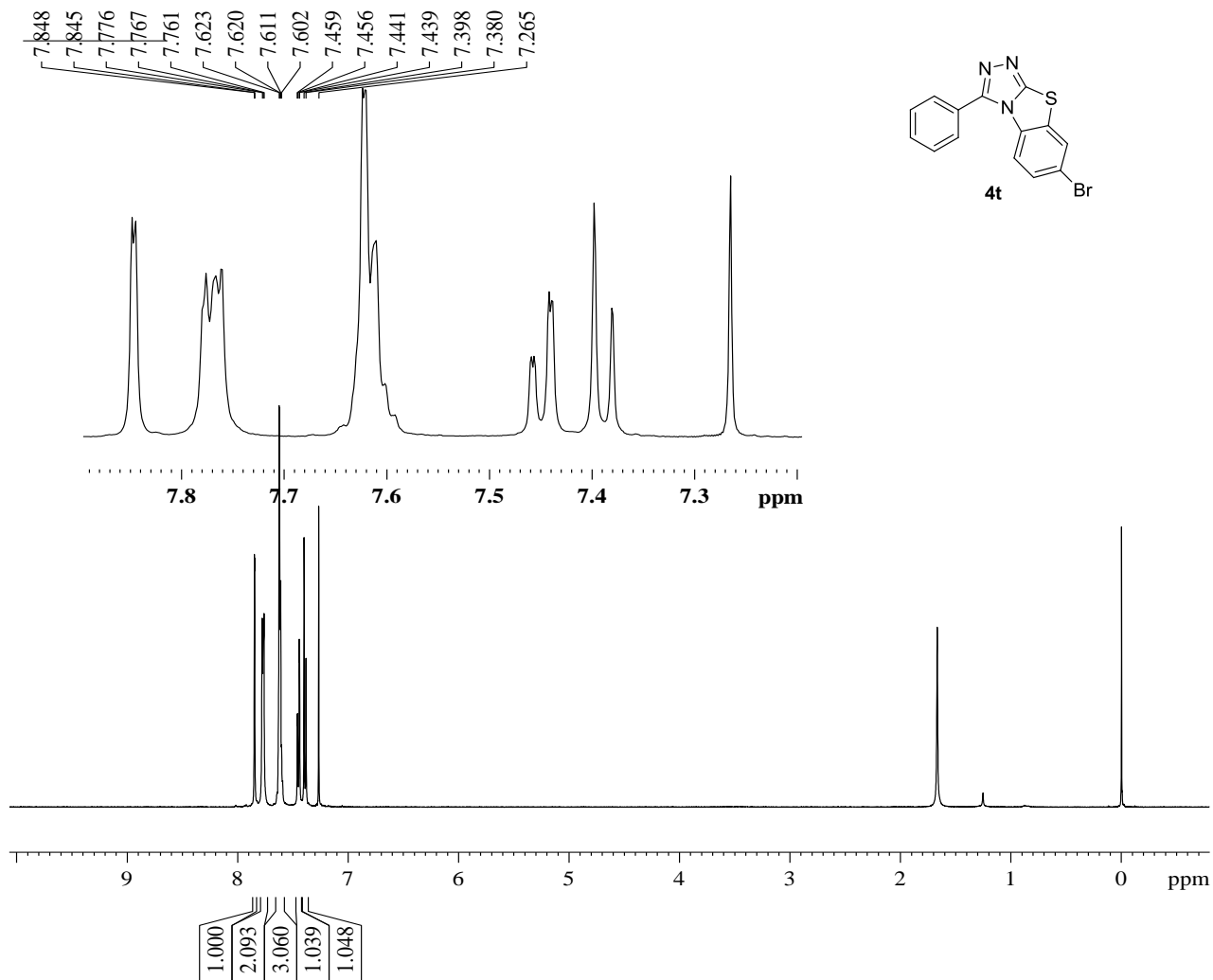
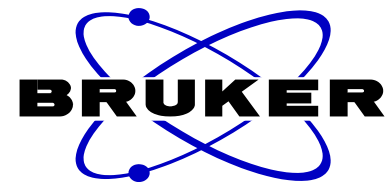
lm-2-24B-2 13C 2013 12 31



NAME lm-2-24b-2
 EXPNO 2
 PROCNO 1
 Date_ 20131231
 Time 18.20
 INSTRUM spect
 PROBHD 5 mm PABBO BB-
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 16164
 DS 2
 SWH 32679.738 Hz
 FIDRES 0.498653 Hz
 AQ 1.0027661 sec
 RG 1820
 DW 15.300 usec
 DE 6.00 usec
 TE 296.6 K
 D1 2.00000000 sec
 d11 0.03000000 sec
 DELTA 1.89999998 sec
 TD0 40

===== CHANNEL f1 =====
 NUC1 13C
 P1 12.20 usec
 PL1 3.00 dB
 SFO1 125.7464750 MHz

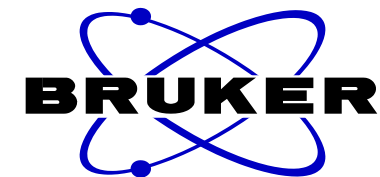
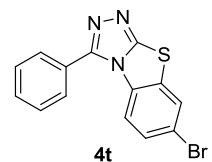
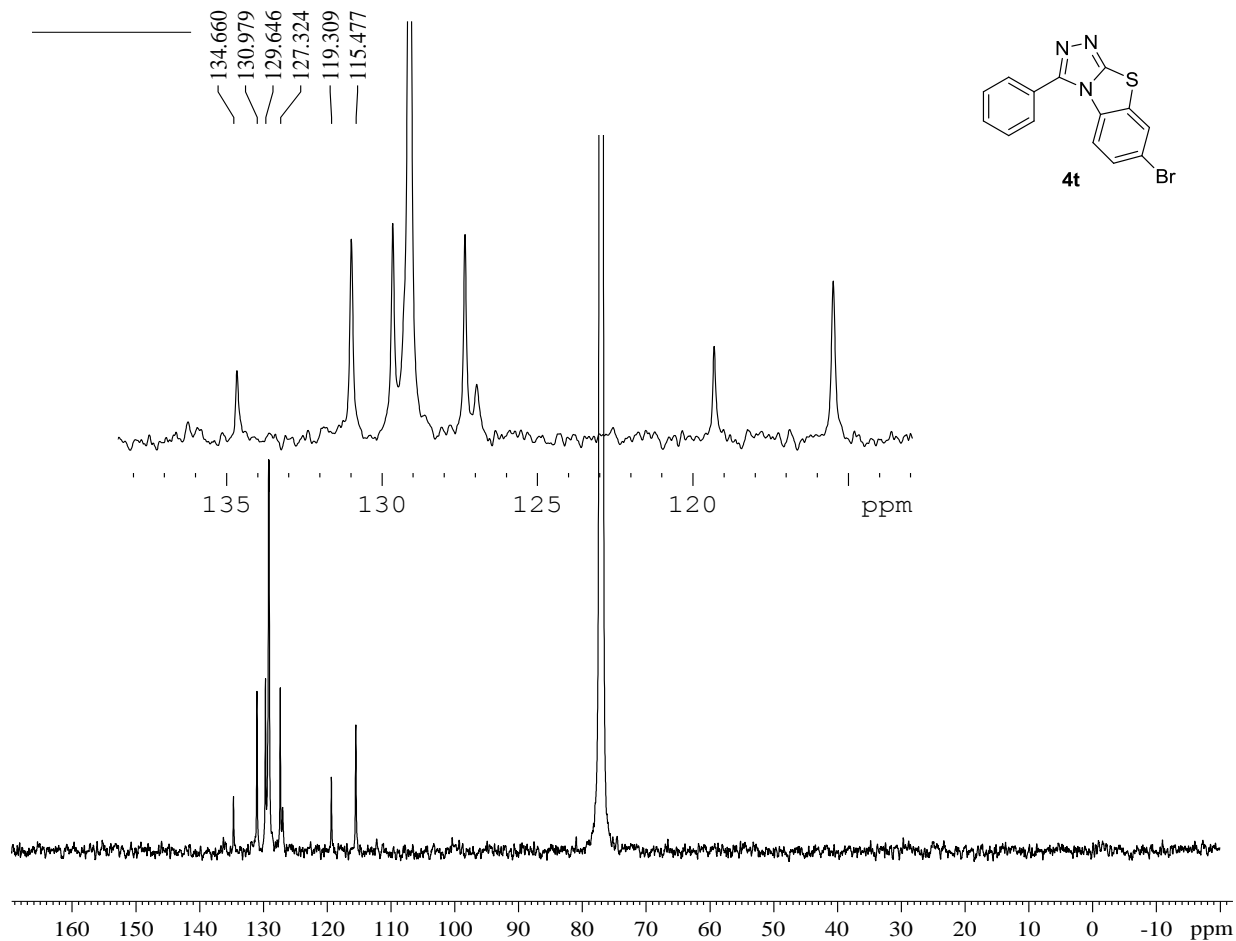
===== CHANNEL f2 =====
 CPDPRG2 waltz16
 NUC2 1H
 PCPD2 80.00 usec
 PL2 2.00 dB
 PL12 17.70 dB
 PL13 17.70 dB
 SFO2 500.0355000 MHz
 SI 32768
 SF 125.7326472 MHz
 WDW EM



NAME lm-2-25b
EXPNO 1
PROCNO 1
Date_ 20130618
Time 15.51
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 16384
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.610352 Hz
AQ 0.8193000 sec
RG 724
DW 50.000 usec
DE 8.00 usec
TE 297.8 K
D1 1.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.00 usec
PL1 2.00 dB
SFO1 500.0338500 MHz
SI 16384
SF 500.0300072 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 4.00

lm-2-25b 13C 2013 06 20



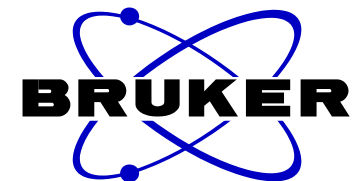
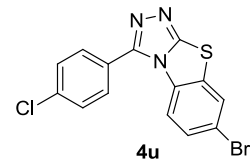
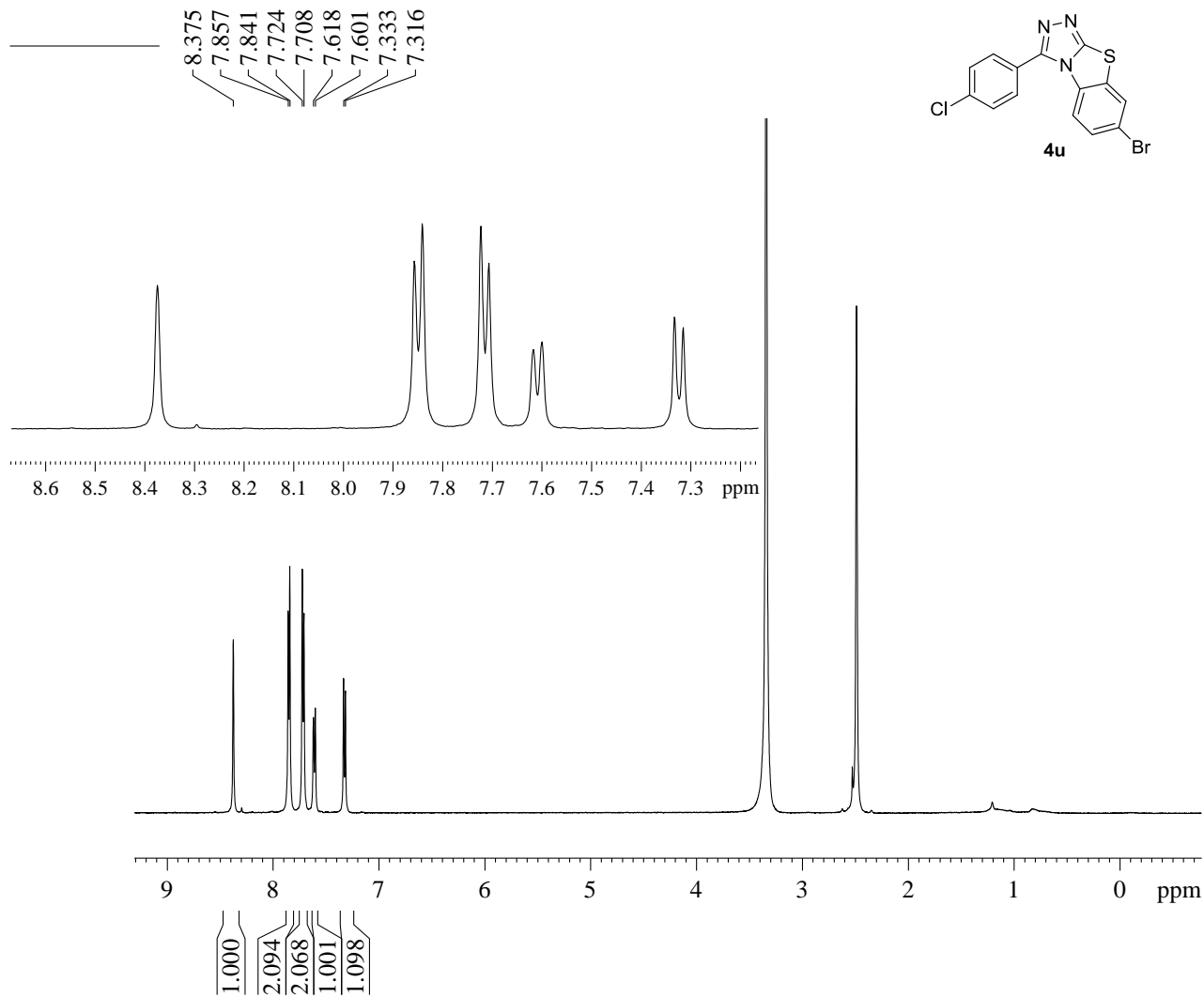
NAME lm-2-25b
EXPNO 2
PROCNO 1
Date_ 20130620
Time 17.53
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 1493
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 5160
DW 15.300 usec
DE 6.00 usec
TE 299.4 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 40

===== CHANNEL f1 =====

NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

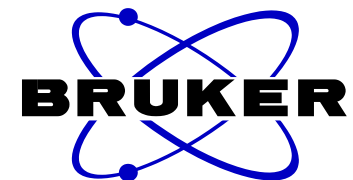
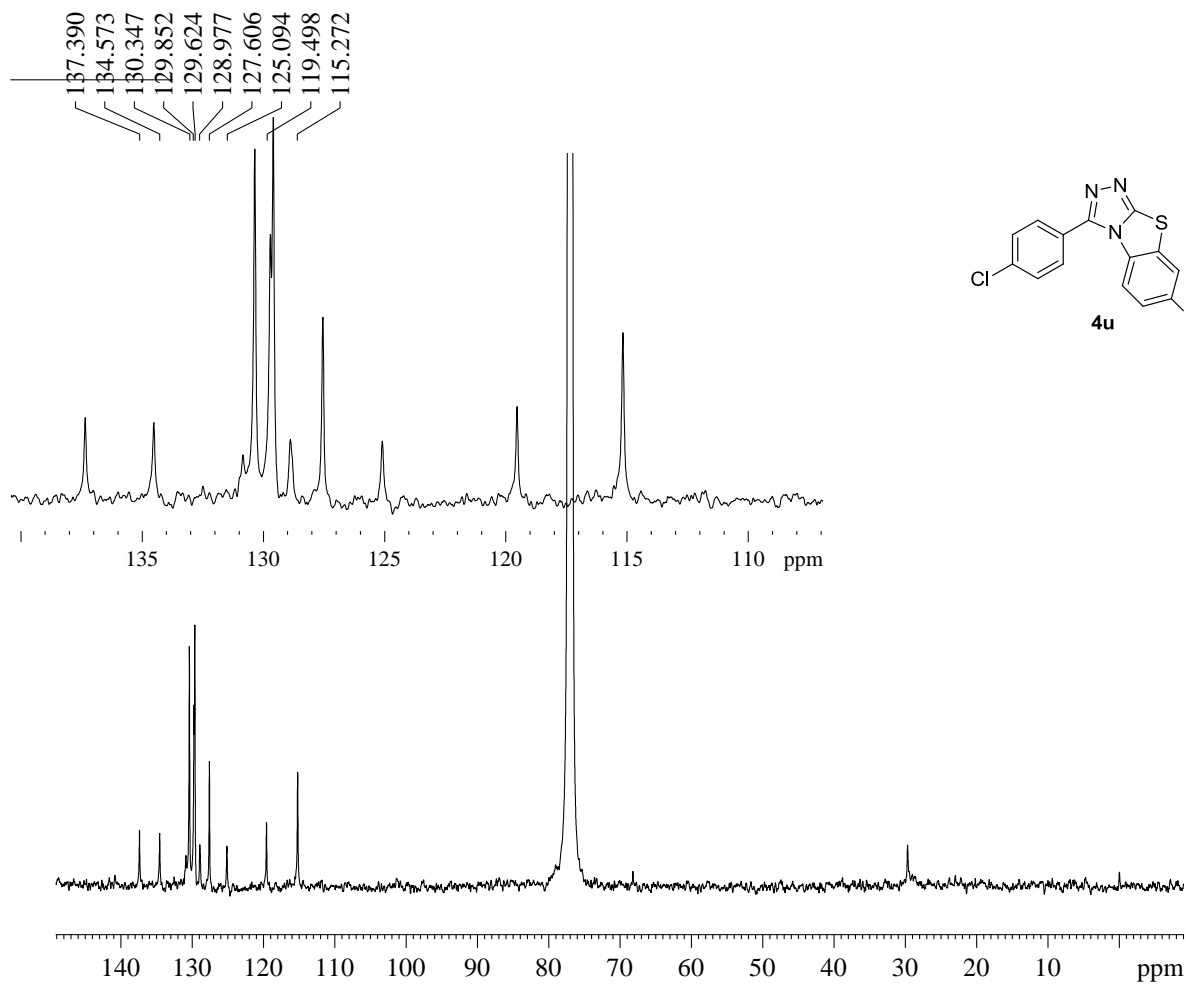
===== CHANNEL f2 =====

CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326472 MHz
WDW EM



NAME lm-2-26b-1
 EXPNO 1
 PROCNO 1
 Date_ 20131231
 Time 17.00
 INSTRUM spect
 PROBHD 5 mm PABBO BB-
 PULPROG zg30
 TD 16384
 SOLVENT DMSO
 NS 8
 DS 1
 SWH 10000.000 Hz
 FIDRES 0.610352 Hz
 AQ 0.8193000 sec
 RG 322
 DW 50.000 usec
 DE 8.00 usec
 TE 293.5 K
 D1 1.00000000 sec
 TD0 1

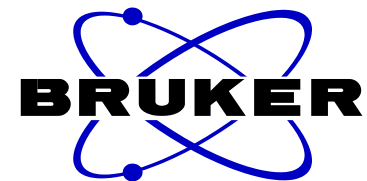
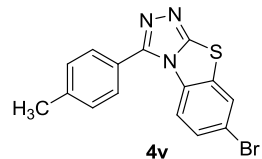
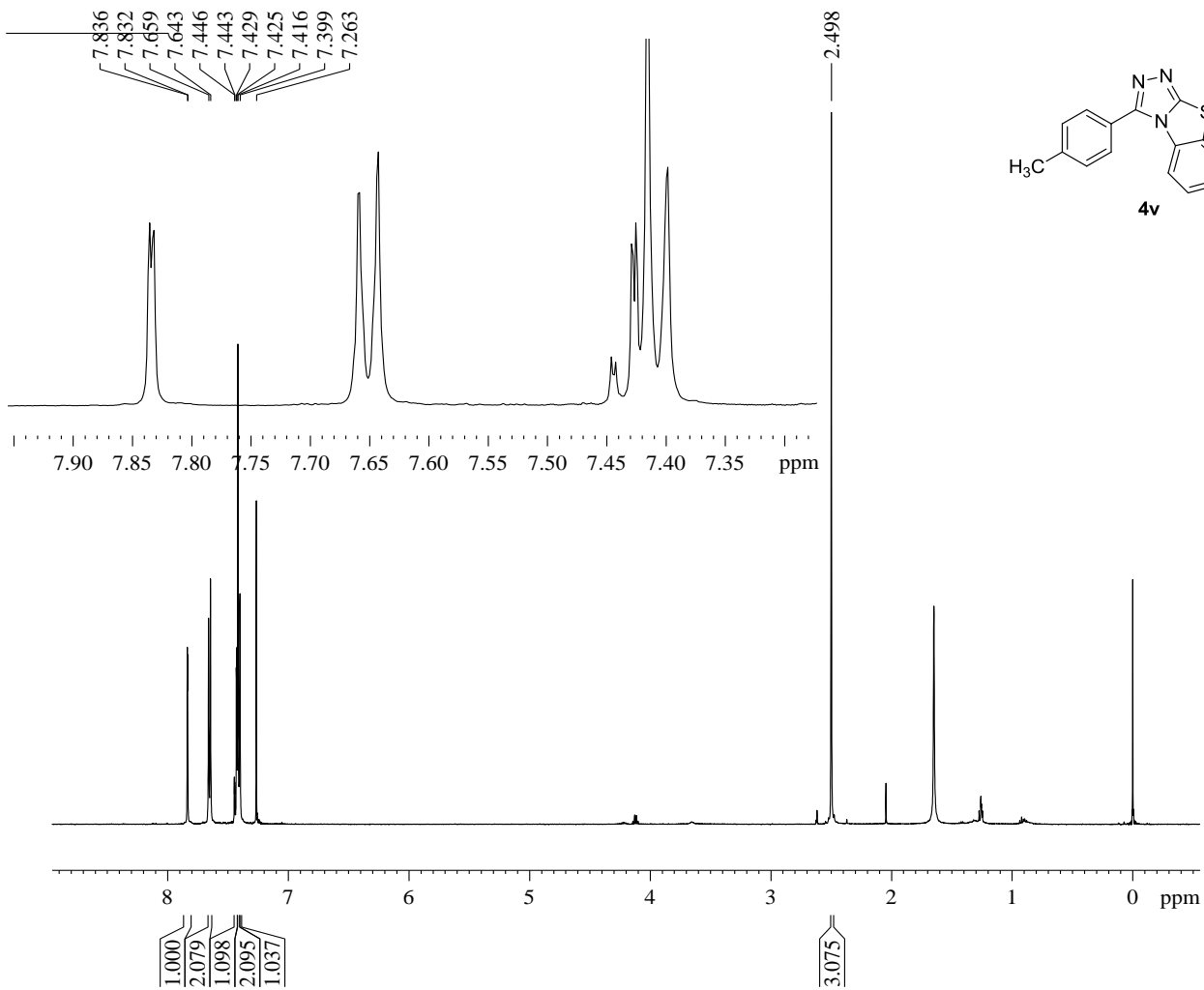
===== CHANNEL f1 =====
 NUC1 1H
 P1 13.00 usec
 PL1 2.00 dB
 SFO1 500.0338500 MHz
 SI 16384
 SF 500.0300085 MHz
 WDW EM
 SSB 0
 LB 0.60 Hz
 GB 0
 PC 4.00



NAME lm-2-26b
EXPNO 2
PROCNO 1
Date_ 20130623
Time 22.31
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 11125
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 5160
DW 15.300 usec
DE 6.00 usec
TE 299.6 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 40

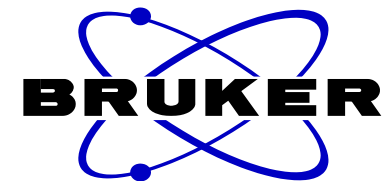
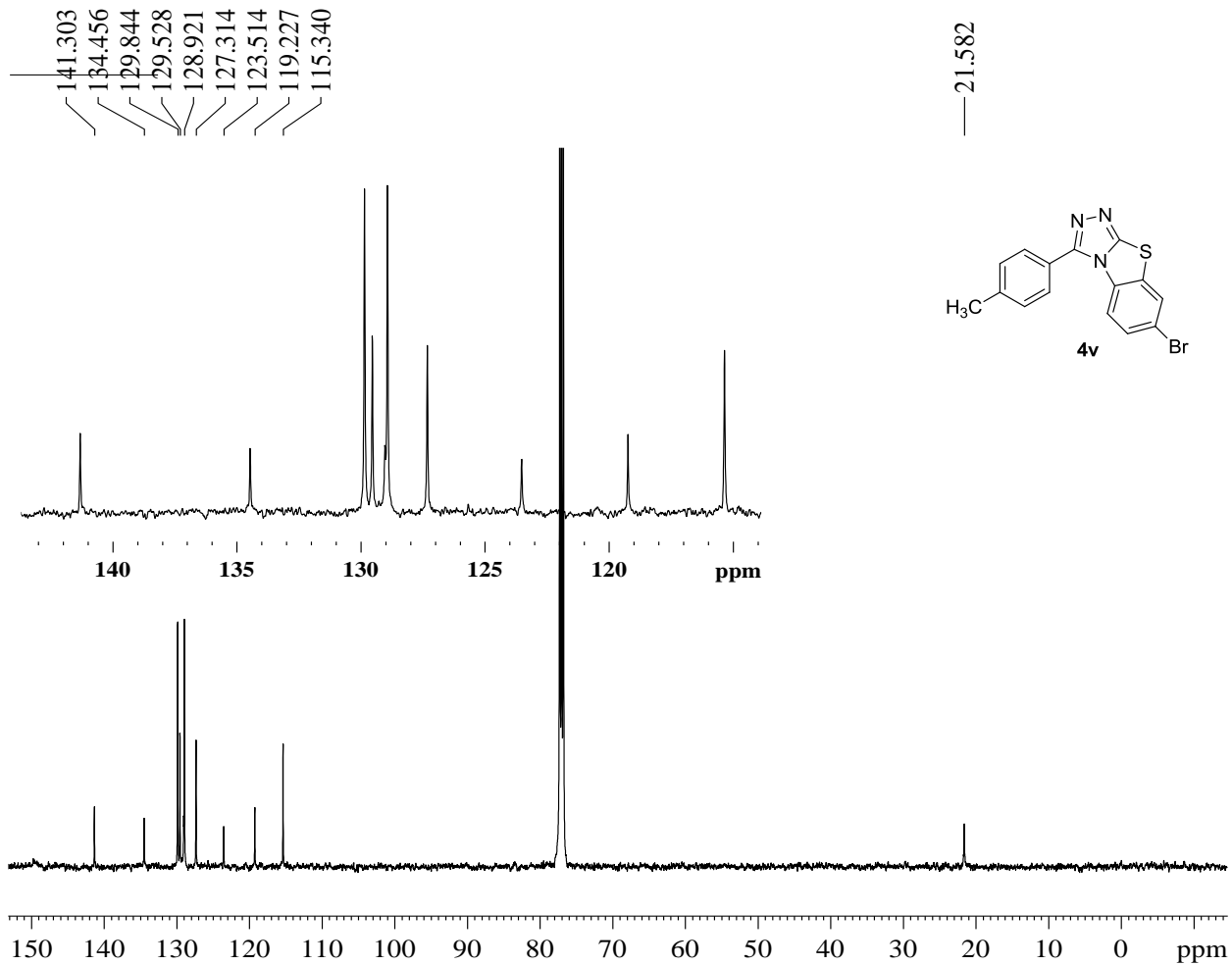
===== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

===== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326422 MHz
WDW EM



NAME lm-2-27b
 EXPNO 1
 PROCNO 1
 Date_ 20130702
 Time 17.19
 INSTRUM spect
 PROBHD 5 mm PABBO BB-
 PULPROG zg30
 TD 16384
 SOLVENT CDCl3
 NS 8
 DS 1
 SWH 10000.000 Hz
 FIDRES 0.610352 Hz
 AQ 0.8193000 sec
 RG 724
 DW 50.000 usec
 DE 8.00 usec
 TE 297.9 K
 D1 1.00000000 sec
 TD0 1

===== CHANNEL f1 =====
 NUC1 1H
 P1 13.00 usec
 PL1 2.00 dB
 SFO1 500.0338500 MHz
 SI 16384
 SF 500.0300085 MHz
 WDW EM
 SSB 0
 LB 0.30 Hz
 GB 0
 PC 2.00

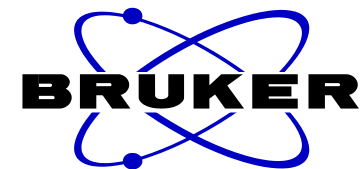
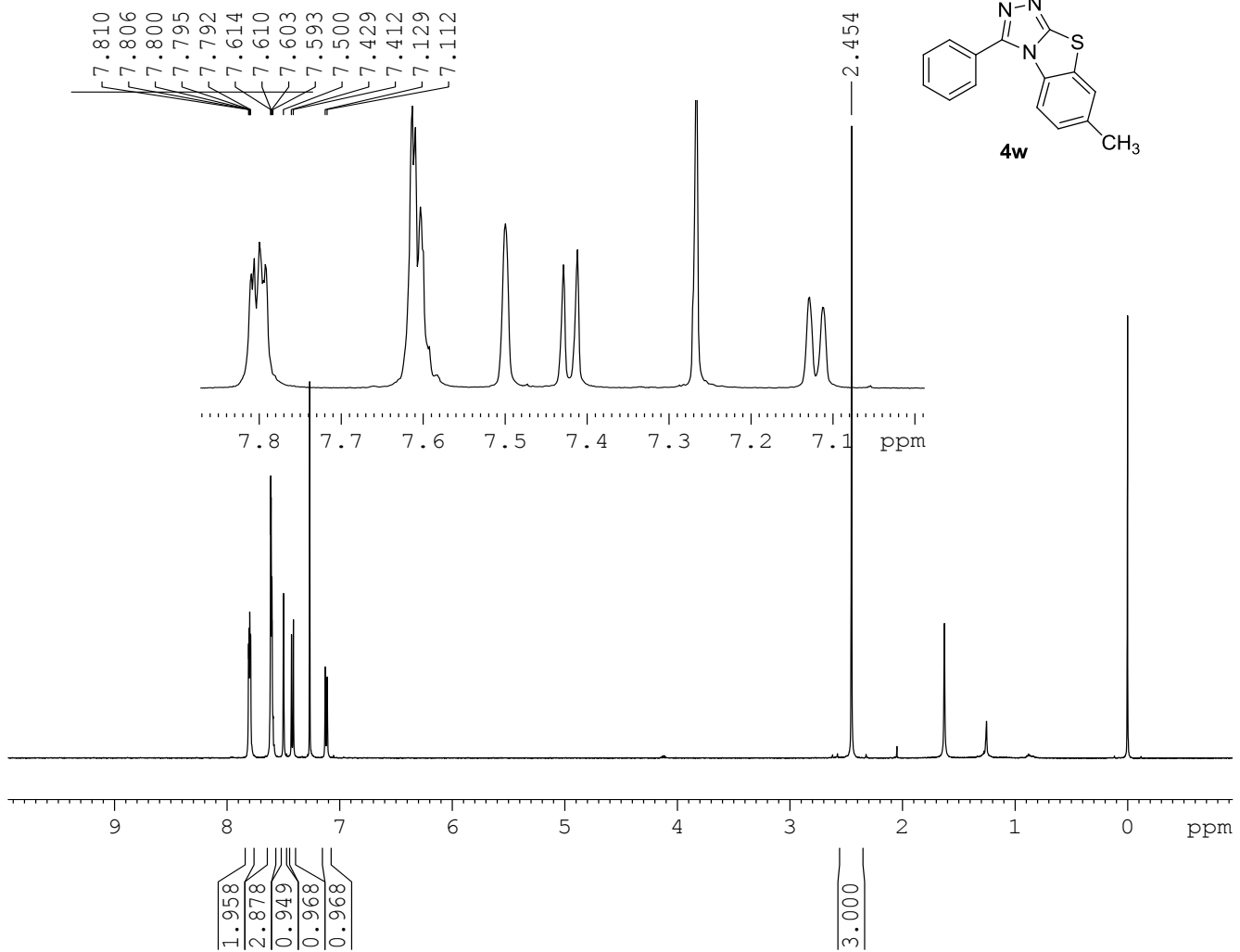


NAME lm-2-27b
 EXPNO 2
 PROCNO 1
 Date_ 20130705
 Time 12.18
 INSTRUM spect
 PROBHD 5 mm PABBO BB-
 PULPROG zgpg30
 TD 65536
 SOLVENT CDCl3
 NS 2500
 DS 2
 SWH 32679.738 Hz
 FIDRES 0.498653 Hz
 AQ 1.0027661 sec
 RG 1820
 DW 15.300 usec
 DE 6.00 usec
 TE 298.0 K
 D1 2.00000000 sec
 d11 0.03000000 sec
 DELTA 1.89999998 sec
 TD0 5

===== CHANNEL f1 =====
 NUC1 13C
 P1 12.20 usec
 PL1 3.00 dB
 SFO1 125.7464750 MHz

===== CHANNEL f2 =====
 CPDPRG2 waltz16
 NUC2 1H
 PCPD2 80.00 usec
 PL2 2.00 dB
 PL12 17.70 dB
 PL13 17.70 dB
 SFO2 500.0355000 MHz
 SI 32768
 SF 125.7326466 MHz
 WDW EM

LM-2-12B 1H 2012 04 12



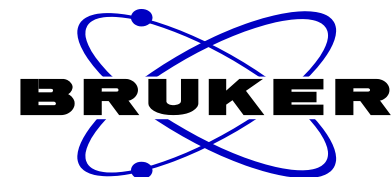
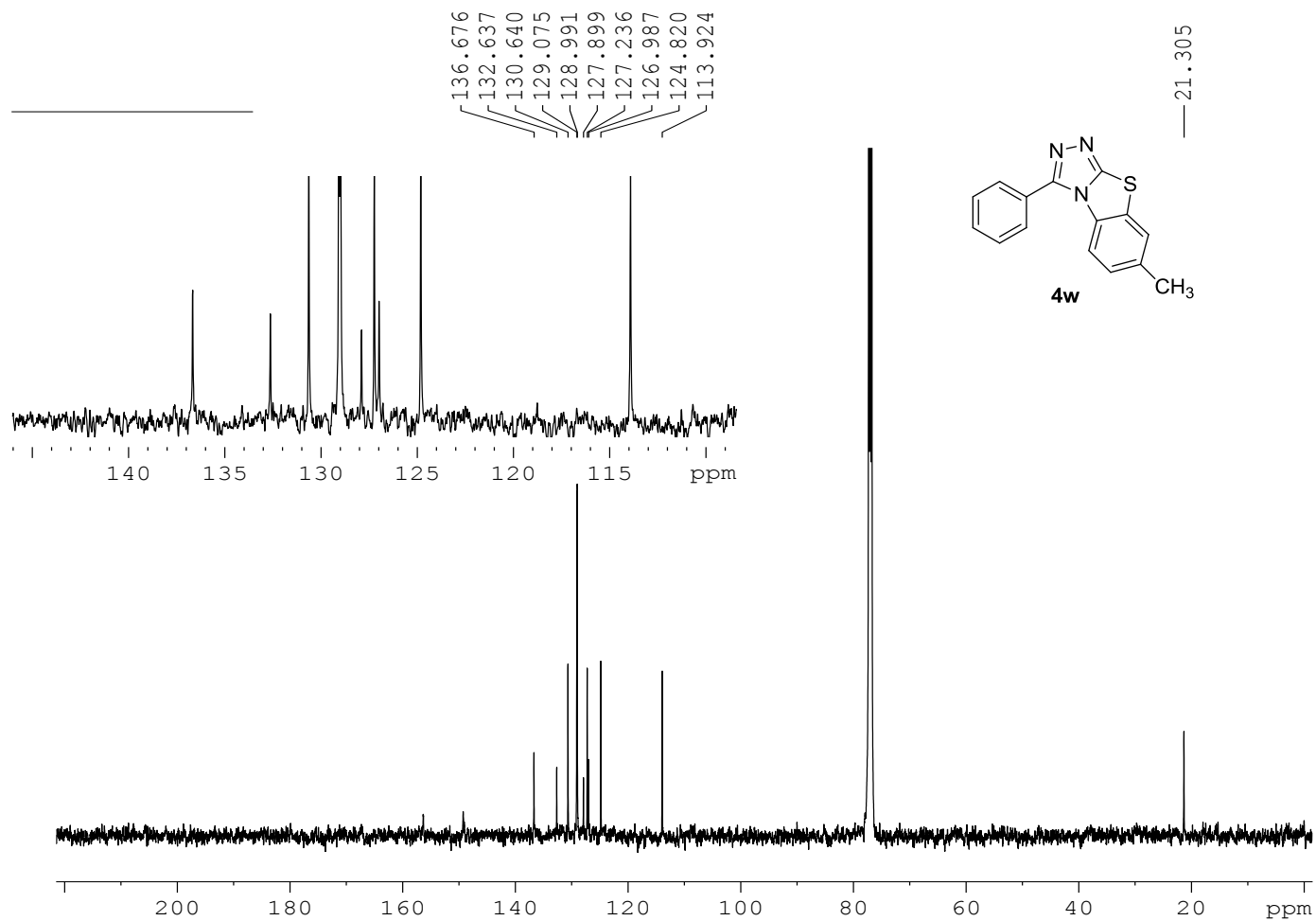
| | |
|---------|----------------|
| NAME | LM-2-12B |
| EXPNO | 1 |
| PROCNO | 1 |
| Date_ | 20120412 |
| Time_ | 9.59 |
| INSTRUM | av500 |
| PROBHD | 5 mm PABBO BB- |
| PULPROG | zg30 |
| TD | 32768 |
| SOLVENT | CDCl3 |
| NS | 8 |
| DS | 1 |
| SWH | 10000.000 Hz |
| FIDRES | 0.305176 Hz |
| AQ | 1.6385000 sec |
| RG | 645 |
| DW | 50.000 usec |
| DE | 6.00 usec |
| TE | 293.0 K |
| D1 | 2.00000000 sec |
| TD0 | 1 |

===== CHANNEL f1 =====

| | |
|------|-----------------|
| NUC1 | 1H |
| P1 | 13.50 usec |
| PL1 | 2.20 dB |
| SFO1 | 500.0335010 MHz |
| SI | 16384 |
| SF | 500.0300064 MHz |
| WDW | EM |
| SSB | 0 |
| LB | 0.30 Hz |
| GB | 0 |
| PC | 2.00 |

LM-2-12B

13C 1D 2012 04 12

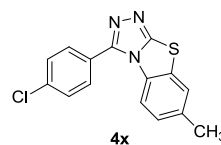


```
NAME LM-2-12B
EXPNO 2
PROCNO 1
Date_ 20120414
Time_ 12.13
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 2707
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 812
DW 15.300 usec
DE 6.00 usec
TE 295.9 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

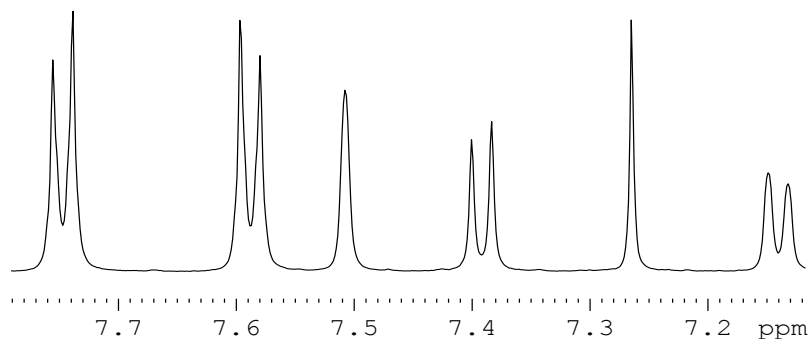
===== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

===== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326482 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 2.00
```

LM-2-20B 1H 2012 04 17

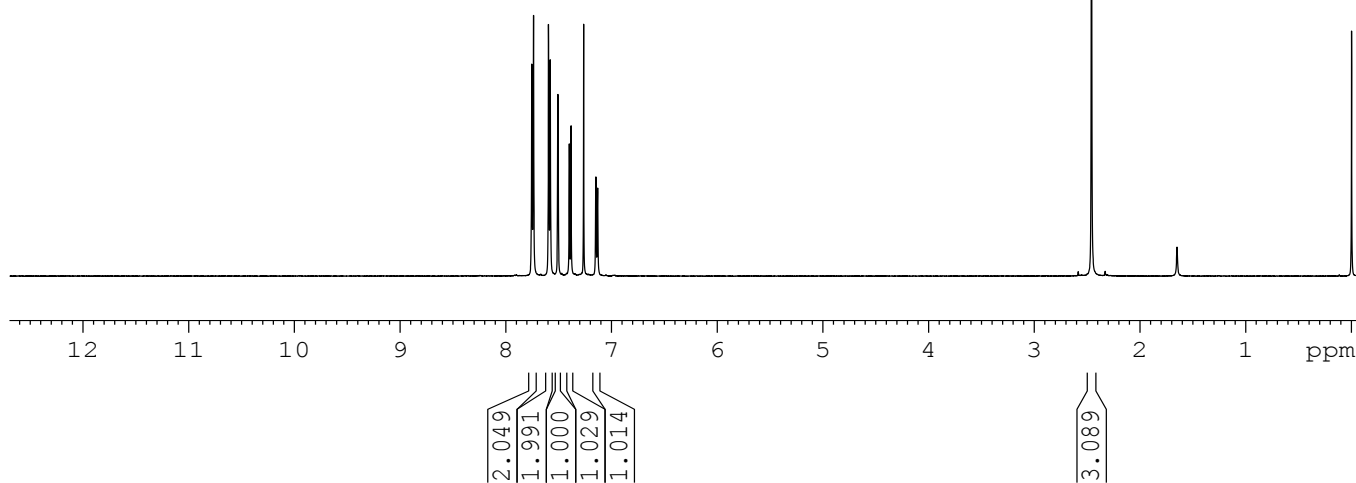


7.755
7.739
7.596
7.580
7.508
7.400
7.383
7.149
7.132

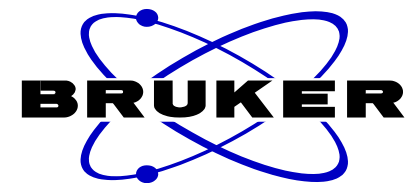
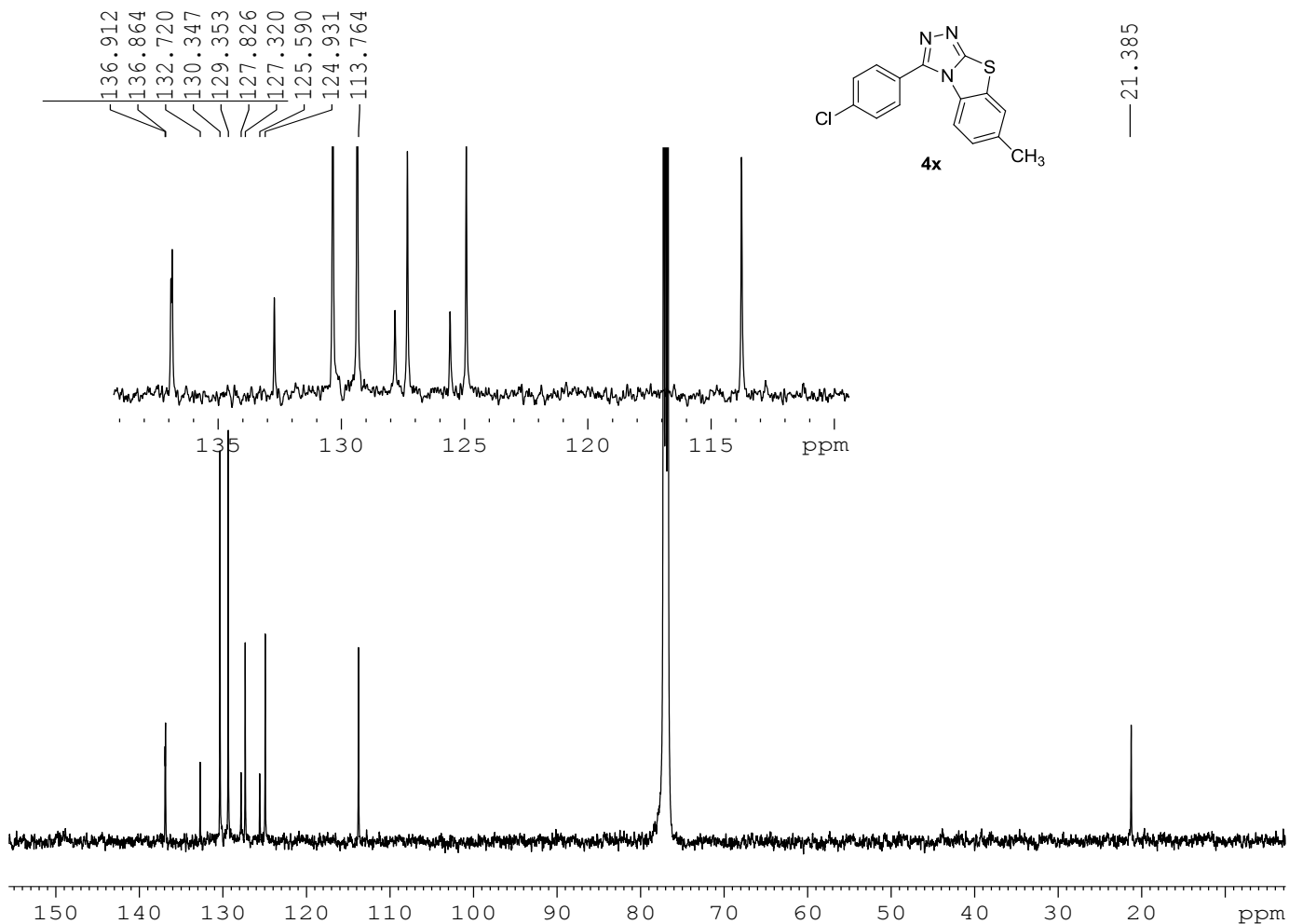


NAME LM-2-20B
EXPNO 1
PROCNO 1
Date_ 20120417
Time_ 16.56
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 645
DW 50.000 usec
DE 6.00 usec
TE 294.6 K
D1 2.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
SI 16384
SF 500.0300078 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 2.00



LM-2-20B 13C 1D 2012 04 19

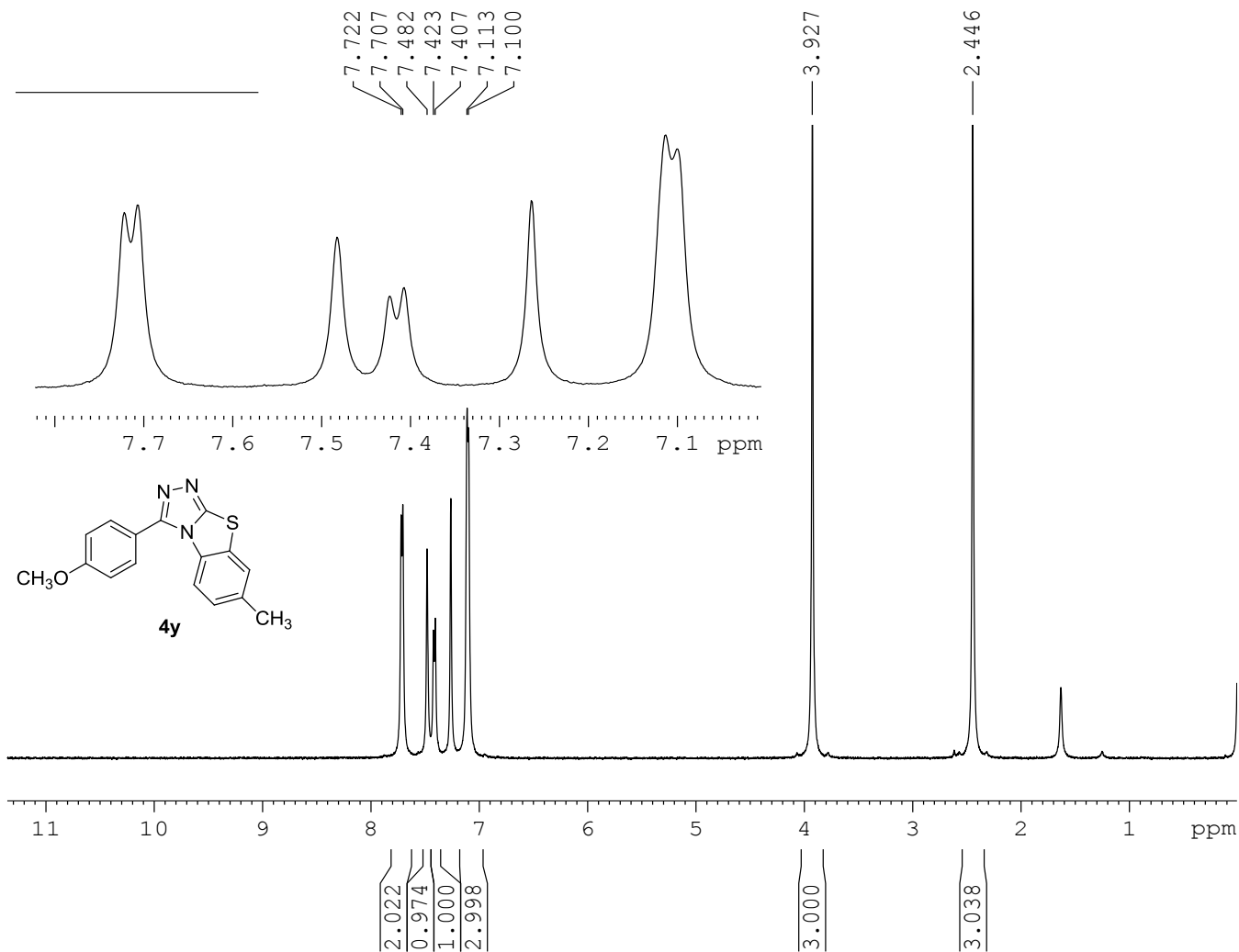
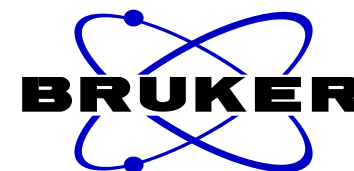


NAME LM-2-20B
EXPNO 2
PROCNO 1
Date_ 20120419
Time_ 13.48
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 2000
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 812
DW 15.300 usec
DE 6.00 usec
TE 298.7 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

==== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

==== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326482 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 2.00

LM-2-21B 1H 2012 04 17

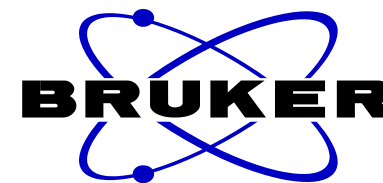
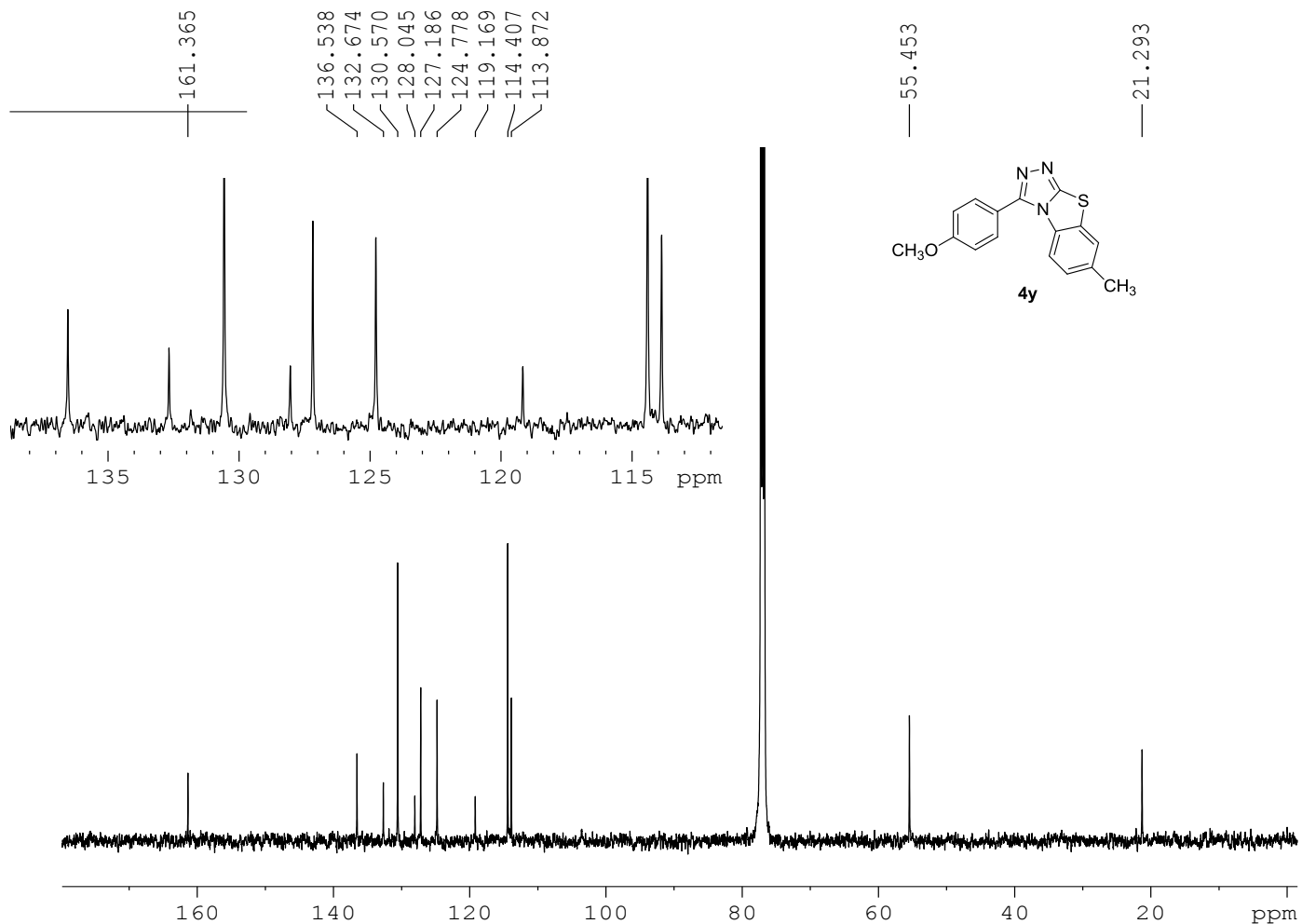


NAME LM-2-21B
EXPNO 1
PROCNO 1
Date_ 20120417
Time_ 17.01
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDC13
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 645
DW 50.000 usec
DE 6.00 usec
TE 294.5 K
D1 2.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
SI 16384
SF 500.0300069 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 2.00

LM-2-21B

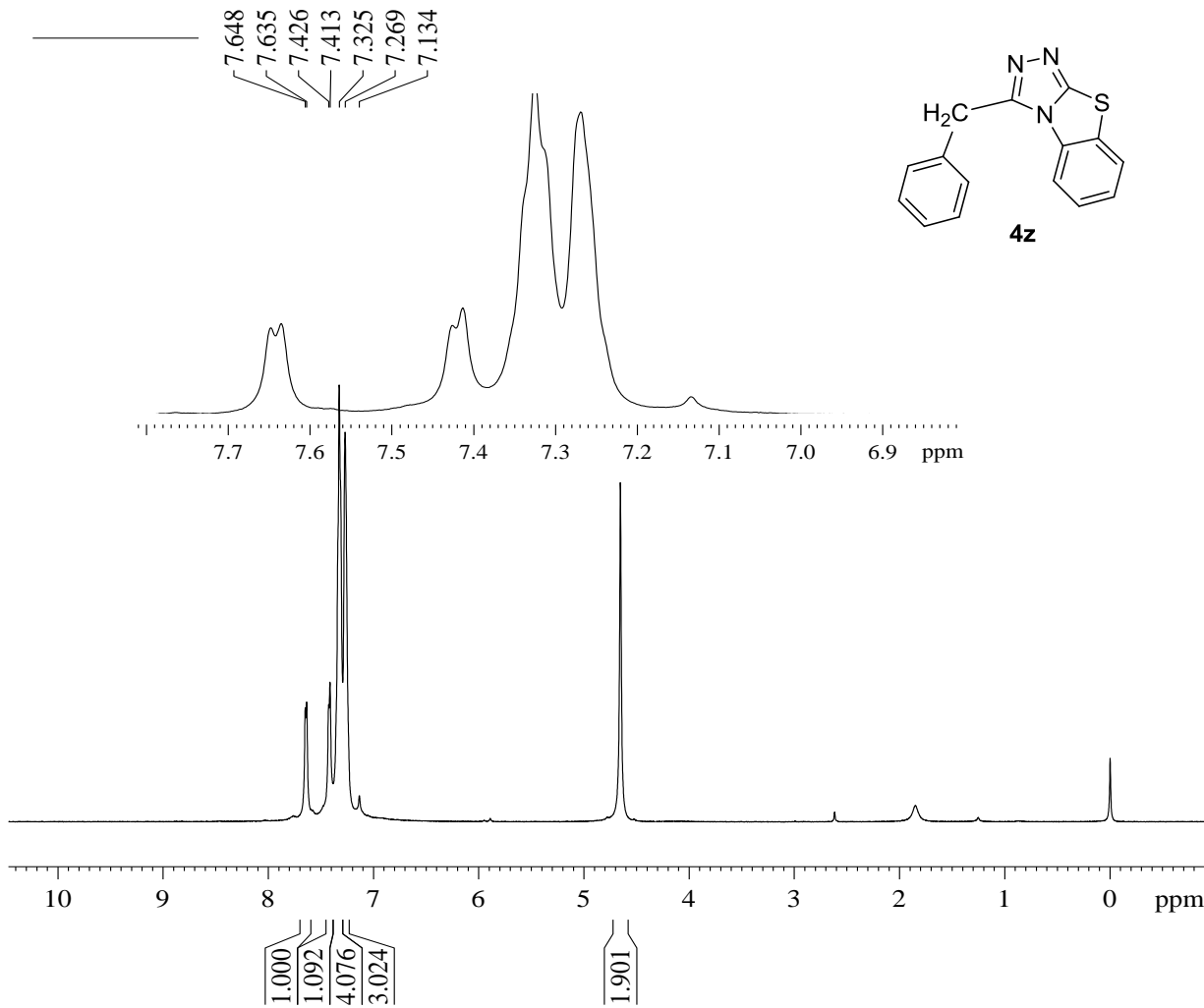
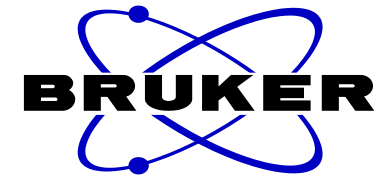
13C 1D 2012 04 20



NAME LM-2-21B
EXPNO 2
PROCNO 1
Date_ 20120420
Time_ 10.14
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 2000
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 812
DW 15.300 usec
DE 6.00 usec
TE 295.6 K
D1 2.0000000 sec
d11 0.0300000 sec
DELTA 1.89999998 sec
TD0 1

==== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

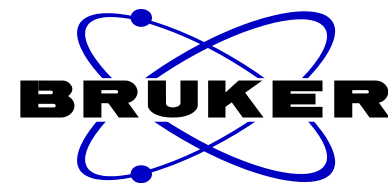
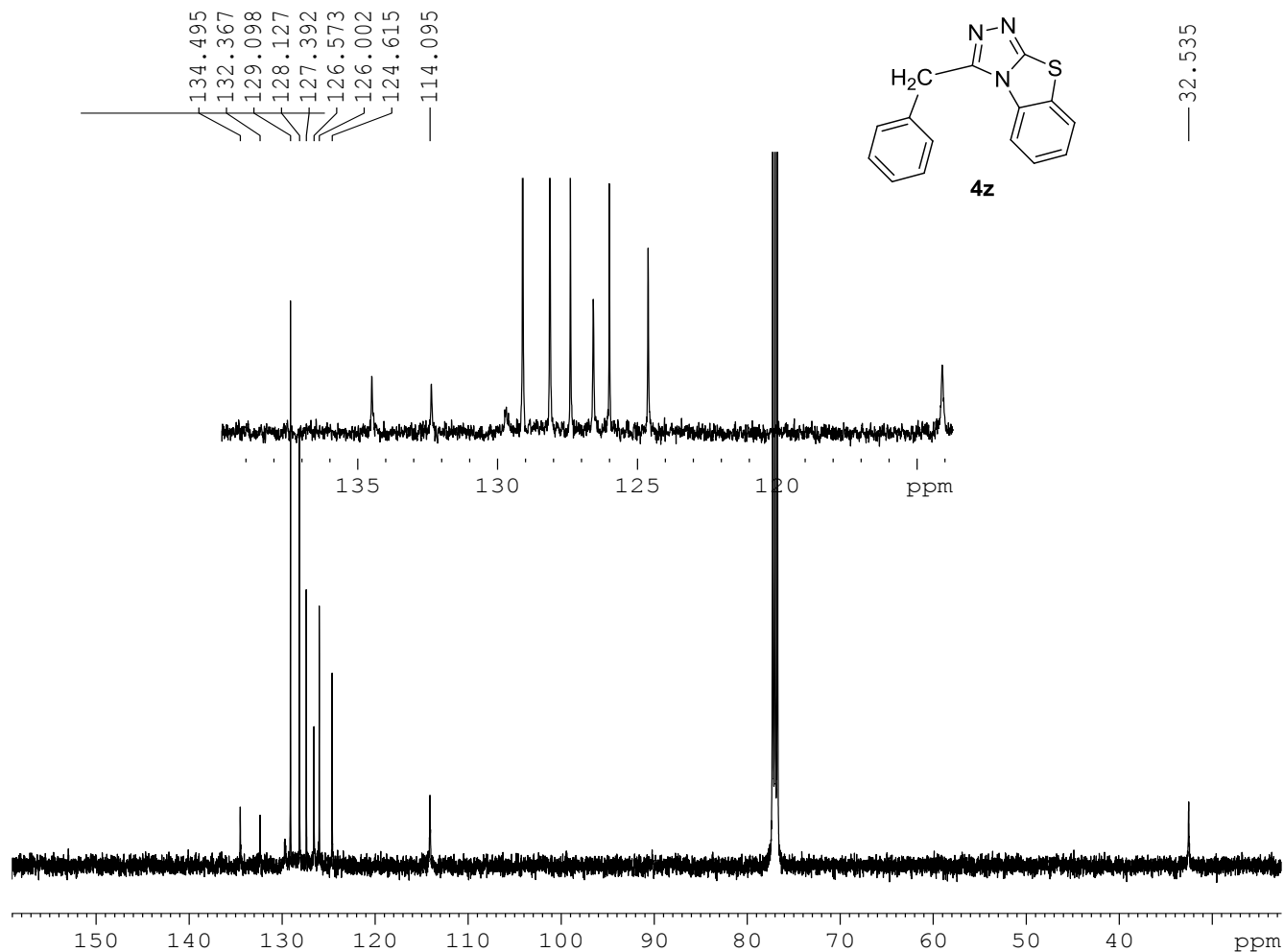
==== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326482 MHz
WDW EM
SSB 0
LB 5.00 Hz
GB 0
PC 2.00



NAME LM-2-9B
EXPNO 1
PROCNO 1
Date_ 20120327
Time 16.47
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 1
SWH 10000.000 Hz
FIDRES 0.305176 Hz
AQ 1.6385000 sec
RG 287
DW 50.000 usec
DE 6.00 usec
TE 293.9 K
D1 2.00000000 sec
TD0 1

===== CHANNEL f1 =====
NUC1 1H
P1 13.50 usec
PL1 2.20 dB
SFO1 500.0335010 MHz
SI 16384
SF 500.0300051 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 5.00

LM-2-9B 13C 1D 2012 04 06



NAME LM-2-9B
EXPNO 2
PROCNO 1
Date_ 20120406
Time_ 13.38
INSTRUM av500
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 1200
DS 2
SWH 32679.738 Hz
FIDRES 0.498653 Hz
AQ 1.0027661 sec
RG 4100
DW 15.300 usec
DE 6.00 usec
TE 295.1 K
D1 2.0000000 sec
d11 0.0300000 sec
DELTA 1.89999998 sec
TDO 1

==== CHANNEL f1 =====
NUC1 13C
P1 9.60 usec
PL1 2.00 dB
SFO1 125.7464750 MHz

==== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 2.60 dB
PL12 17.66 dB
PL13 17.66 dB
SFO2 500.0355000 MHz
SI 32768
SF 125.7326513 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 2.00