

**Highly Regio- and Stereoselective Synthesis of Polysubstituted Cyclopropane
Compounds via Pd(0)-Catalyzed Coupling-Cyclization Reaction of
2-(2',3'-Allenyl)malonates with Organic Halides**

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Supporting Information

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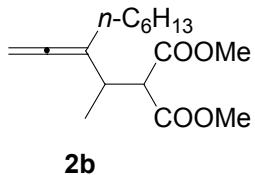
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Experimental Section

Starting Materials.

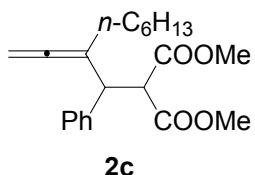
The following compounds were prepared from 2,3-alkadienyl acetates 1a-1e¹ according to the Typical Procedures A and B in the text.

(1) Dimethyl 2-(1'-methyl-2'-hexyl-2',3'-butadienyl)malonate (2b).



The reaction of **1b** (2.77 g, 13.2 mmol), dimethyl malonate (4.5 mL, 3.0 equiv.), and Pd(PPh₃)₄ (765 mg, 5 mol%) afforded 3.24 g (87%) of **2b**; viscous liquid; IR(neat): 2956, 1955, 1761, 1740, 1436 cm⁻¹; ¹H NMR (300 MHz, CDCl₃): δ 4.58-4.73 (m, 2 H), 3.64 (s, 3 H), 3.60 (s, 3 H), 3.41 (d, *J* = 10.55 Hz, 1 H), 2.54-2.71 (m, 1 H), 1.82-1.97 (m, 2 H), 1.08-1.42 (m, 8 H), 1.01 (d, *J* = 6.74 Hz, 3 H), 0.81 (t, *J* = 7.04 Hz, 3 H); ¹³C NMR (75.4 MHz, CDCl₃): δ 204.4, 169.0, 168.7, 106.6, 78.2, 56.9, 52.3, 52.3, 36.1, 31.6, 30.9, 28.9, 27.3, 22.6, 17.7, 14.00; MS m/z (%): 282 (M⁺, 10.29) 93 (100); HRMS m/z (EI) for C₁₆H₂₆O₄: 282.18311; Found: 282.18533.

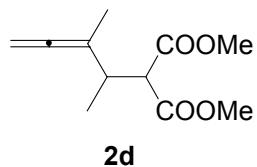
(2) Dimethyl 2-(1'-phenyl-2'-hexyl-2',3'-butadienyl)malonate (2c).



The reaction of **1c** (1.83 g, 6.73 mmol), dimethyl malonate (2.42 mL, 3.0 equiv.), and Pd(PPh₃)₄ (390 mg, 5 mol%) afforded 1.90 g (82%) of **2c**; viscous liquid; IR(neat): 2955, 1957, 1760, 1742, 1602, 1495, 1435, 1259 cm⁻¹; ¹H NMR (300 MHz, CDCl₃):

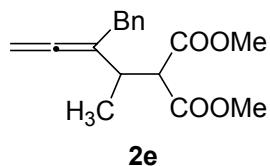
δ 7.08-7.24 (m, 5 H), 4.82-4.92 (m, 1 H), 4.73-4.81 (m, 1 H), 3.85 (d, J = 12.0 Hz, 1 H), 3.70-3.79 (m, 1 H), 3.67 (s, 3 H), 3.30 (s, 3 H), 1.44-1.88 (m, 2 H), 1.05-1.40 (m, 8 H), 0.75 (t, J = 6.55 Hz, 3 H); ^{13}C NMR (75.4 MHz, CDCl_3): δ 204.5, 168.2, 168.2, 139.2, 128.4, 128.2, 127.3, 105.9, 79.1, 57.4, 52.4, 52.1, 47.2, 31.5, 31.3, 28.6, 27.0, 22.5, 14.0; MS m/z (%) 344 (M^+ , 23.29), 212 (100); Anal. calcd for $\text{C}_{21}\text{H}_{28}\text{O}_4$: C, 73.26, H, 8.14; Found: C, 73.13, H, 7.96.

(3) **Dimethyl 2-(1'-methyl-2'-methyl-2',3'-butadienyl)malonate (2d).**



The reaction of **1d** (5.03 g, 35.9 mmol), dimethyl malonate (12.9 mL, 3.0 equiv.), and $\text{Pd}(\text{PPh}_3)_4$ (1.55 mg, 3.7 mol%) afforded 5.53 g (85%) of **2d**; viscous liquid; IR(neat): 2957, 1959, 1759, 1738, 1436, 1201 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3): δ 4.54-4.63 (m, 2 H), 3.68 (s, 3 H), 3.66 (s, 3 H), 3.41 (d, J = 10.55 Hz, 1 H), 2.62-2.76 (m, 1 H), 1.68 (t, J = 3.23 Hz, 3 H), 1.03 (d, J = 6.74 Hz, 3 H); ^{13}C NMR (75.4 MHz, CDCl_3): δ 204.9, 168.8, 168.7, 101.1, 76.3, 56.6, 52.3, 52.3, 37.0, 17.2, 17.0; MS m/z (%) 212 (M^+ , 46.93), 121 (100); HRMS m/z (EI) for $\text{C}_{11}\text{H}_{16}\text{O}_4$: 212.10486; Found 212.10286.

(4) **Dimethyl 2-(1'-methyl-2'-benzyl-2',3'-butadienyl)malonate (2e).**



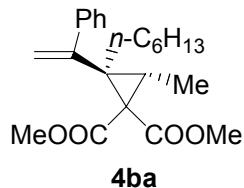
The reaction of **1e** (2.63 g, 13.0 mmol), dimethyl malonate (4.68 mL, 3.0 equiv.), and $\text{Pd}(\text{PPh}_3)_4$ (754 mg, 5 mol%) afforded 3.07 g (82%) of **2e**; viscous liquid; IR(neat):

2955, 1956, 1758, 1737, 1602, 1496, 1435, 1282 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3): δ 7.16-7.33 (m, 5 H), 4.73-4.68 (m, 2 H), 3.71 (s, 3 H), 3.66 (s, 3 H), 3.48 (d, J = 10.26 Hz, 1 H), 3.37-3.35 (m, 2 H), 2.80-2.68 (m, 1 H), 1.02 (d, J = 6.75 Hz, 3 H); ^{13}C NMR (75.4 MHz, CDCl_3): δ 204.5, 167.8, 167.5, 137.8, 128.0, 127.1, 125.2, 105.2, 77.2, 56.0, 51.3, 51.2, 37.4, 34.4, 16.7; MS m/z (%) 288 (M^+ , 4.01), 156 (100); Anal. calcd for $\text{C}_{17}\text{H}_{20}\text{O}_4$: C 70.83, H 6.94; Found: C 70.90, H 7.00.

Pd(0)-Catalyzed Coupling-Cyclization Reaction of allenylmalonates with Organic Halides.

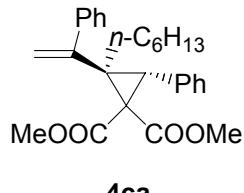
The following compounds were prepared according to Conditions A and B in the text.

- (1) **1,1-Bis(methoxycarbonyl)-2-hexyl-2-(1'-phenylethenyl)-3-methyl cyclopropane (4ba).**



The reaction of **2b** (53 mg, 0.19 mmol) and PhI (49 mg, 0.24 mmol) afforded 58 mg (86%) of **4ba** (*cis*-**4ba**:*trans*-**4ba** = 5:95) using Conditions A;

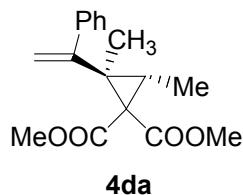
- (2) **1,1-Bis(methoxycarbonyl)-2-hexyl-2-(1'-phenylethenyl)-3-phenyl cyclopropane (4ca).**



The reaction of **2c** (69 mg, 0.2 mmol) and PhI (49 mg, 0.24 mmol) afforded 72 mg (86%) of **4ca** (*cis*-**4ca**:*trans*-**4ca** = 4:96) using Conditions A; The reaction of **2c** (85

mg, 0.25 mmol) and PhI (61 mg, 0.3 mmol) afforded 96 mg (91%) of **4ca** (*cis*-**4ca**:*trans*-**4ca** = 4:96) using Conditions B; viscous liquid; IR(neat): 2953, 1720, 1603, 1435, 1225 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) *trans*-**4ca**: δ 7.61 (d, *J* = 8.00 Hz, 2 H), 7.18-7.37 (m, 8 H), 5.74 (s, 1 H), 5.36 (s, 1 H), 3.79 (s, 3 H), 3.57 (s, 1 H), 3.46 (s, 3 H), 2.08-2.21 (m, 1H), 1.54-1.68 (m, 1 H), 1.13-1.30 (m, 1 H), 0.78-1.12 (m, 7 H), 0.73 (t, *J* = 7.10 Hz, 3 H); The following data were discernible for the *cis* isomer, *cis*-**4ca**: δ 7.68 (d, *J* = 8.00 Hz, 2 H), 7.29-7.18 (m, 8 H), 5.86 (s, 1 H), 4.93 (s, 1 H), 3.90 (s, 3 H), 3.39 (s, 3 H); MS m/z (%) 420 (M⁺, 1.21), 361 (100); Anal. calcd for C₂₇H₃₂O₄: C 77.14, H 7.62; Found: C 77.16, H 7.65.

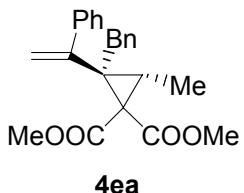
(3) **1,1-Bis(methoxycarbonyl)-2-methyl-2-(1'-phenylethenyl)-3-methyl cyclopropane (4da).**



The reaction of **2d** (53 mg, 0.25 mmol) and PhI (61 mg, 0.3 mmol) afforded 67 mg (93%) of **4da** (*cis*-**4da**:*trans*-**4da** = 6:94) using Conditions A; The reaction of **2d** (56 mg, 0.25 mmol) and PhI (61 mg, 0.3 mmol) afforded 52 mg (72%) of **4da** (*cis*-**4da**:*trans*-**4da** = 5:95) using Conditions B; viscous liquid; IR(neat): 2953, 1734, 1623, 1435, 1233 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) *trans*-**4da**: δ 7.55 (d, *J* = 7.60 Hz, 2 H), 7.18-7.36 (m, 3 H), 5.62 (s, 1 H), 5.23 (s, 1 H), 3.80 (s, 3 H), 3.37 (s, 3 H), 2.21 (q, *J* = 6.80 Hz, 1 H), 1.45 (s, 3 H), 1.26 (d, *J* = 6.80 Hz, 3 H); The following data were discernible for the *cis* isomer, *cis*-**4da**: δ 7.66 (d, *J* = 6.00 Hz, 2 H), 7.18-7.36 (m, 3 H), 5.78 (s, 1 H), 5.14 (s, 1 H), 3.85 (s, 3 H), 3.34 (s, 3 H), 1.47 (s, 3

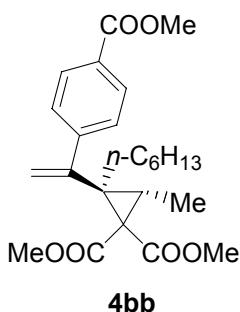
H); MS m/z (%) 288 (M^+ , 5.08), 228 (100); Anal. calcd for C₁₇H₂₀O₄: C 70.83, H 6.94; Found: C 70.82, H 6.88.

(4) **1,1-Bis(methoxycarbonyl)-2-benzyl-2-(1'-phenylethenyl)-3-methylcyclopropane (4ea).**



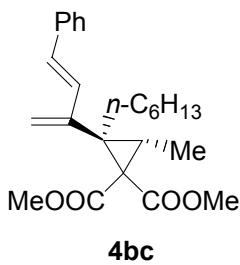
The reaction of **1e** (86 mg, 0.3 mmol) and PhI (74 mg, 0.36 mmol) afforded 96 mg (88%) of **4ea** (*cis*-**4ea**:*trans*-**4ea** = 20:80) using Conditions A; The reaction of **1e** (72 mg, 0.25 mmol) and PhI (61 mg, 0.3 mmol) afforded 73 mg (80%) of **4ea** (*cis*-**4ea**:*trans*-**4ea** = 13:87) using Conditions B; viscous liquid; IR(neat): 2953, 1732, 1602, 1435, 1232, 703 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) *trans*-**4ea**: δ 7.09-7.41 (m, 8 H), 6.97 (d, *J* = 9.30 Hz, 2 H), 5.53 (s, 1 H), 4.99 (s, 1 H), 3.87 (s, 3 H), 3.49 (s, 3 H), 3.43 (AB, A part of AB, *J* = 15.0 Hz, Δ *v* = 186.0 Hz, 1 H), 2.81 (AB, B part of AB, *J* = 15.0 Hz, Δ *v* = 186.0 Hz, 1 H), 2.41 (q, *J* = 6.75 Hz, 1 H), 1.51 (d, *J* = 6.75 Hz, 3 H); The following data were discernible for the *cis* isomer, *cis*-**4ea**: δ 7.68 (d, *J* = 10.0 Hz, 2H), 7.09-7.41 (m, 6 H), 7.03 (d, *J* = 10.0 Hz, 2 H), 5.64 (s, 1 H), 4.42 (s, 1 H), 3.92 (s, 3 H), 3.38 (s, 3 H), 3.30 (AB, A part of AB, *J* = 15.00 Hz, Δ *v* = 297.2 Hz, 1 H), 2.30 (AB, B part of AB, *J* = 15.00 Hz, Δ *v* = 297.2 Hz, 1 H), 1.29 (d, *J* = 6.30 Hz, 3 H); MS m/z (%) 364 (M^+ , 2.10), 91 (100); Anal. calcd for C₂₃H₂₄O₄: C 75.82, H 6.59; Found: C 75.78, H 6.87.

(5) **1,1-Bis(methoxycarbonyl)-2-hexyl-2-(1'-(4''-methoxycarbonyl)phenylethenyl)-3-methylcyclopropane (4bb).**



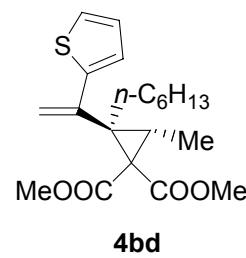
The reaction of **2b** (71 mg, 0.25 mmol) and 4-iodobenzoic acid methyl ester (79 mg, 0.3 mmol) afforded 80 mg (77%) of **4bb** (*cis*-**4bb**:*trans*-**4bb** = 6:94) using Conditions A; The reaction of **2b** (71 mg, 0.25 mmol) and 4-iodobenzoic acid methyl ester (79 mg, 0.3 mmol) afforded 51 mg (49%) of **4bb** (*cis*-**4bb**:*trans*-**4bb** = 6:94) using Conditions B; viscous liquid; IR(neat): 2954, 1728, 1608, 1436, 1281 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) *trans*-**4bb**: δ 7.98 (d, *J* = 8.40 Hz, 2 H), 7.65 (d, *J* = 8.40 Hz, 2 H), 5.81 (s, 1 H), 5.30 (s, 1 H), 3.90 (s, 3 H), 3.81 (s, 3 H), 3.42 (s, 3 H), 2.26 (q, *J* = 6.80 Hz, 1 H), 1.84-1.94 (m, 1 H), 1.29 (d, *J* = 6.80 Hz, 3 H), 1.08-1.32 (m, 9 H), 0.79 (t, *J* = 6.90 Hz, 3 H); The following data were discernible for the *cis* isomer, *cis*-**4bb**: δ 8.11 (d, *J* = 8.40 Hz, 2 H), 7.77 (d, *J* = 8.40 Hz, 2 H), 5.98 (s, 1 H), 5.17 (s, 1 H), 3.94 (s, 3 H), 3.84 (s, 3 H), 3.36 (s, 3 H); MS m/z (%) 416 (M⁺, 7.48), 356 (100); Anal. calcd for C₂₄H₃₂O₆: C 69.23, H 8.17; Found: C 69.43, H 7.82.

(6) **1,1-Bis(methoxycarbonyl)-2-hexyl-2-(1'-methylene-3'-phenyl-2'-(E)-propenyl)-3-methylcyclopropane (4bc).**



The reaction of **2b** (71 mg, 0.25 mmol) and (*E*)-1-iodo-2-phenylethylene (69 mg, 0.3 mmol) afforded 94 mg (98%) of **4bc** (*cis*-**4bc**:*trans*-**4bc** = 11:89) using Conditions A; The reaction of **2b** (71 mg, 0.25 mmol) and (*E*)-1-iodo-2-phenylethylene (69 mg, 0.3 mmol) afforded 69 mg (72%) of **4bc** (*cis*-**4bc**:*trans*-**4bc** = 7:93) using Conditions B; viscous liquid; IR(neat): 2954, 1734, 1603, 1435, 1223 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) *trans*-**4bc**: δ 7.35 (d, *J* = 8.79 Hz, 2 H), 7.11-7.28 (m, 3 H), 6.97 (d, *J* = 16.72 Hz, 1 H), 6.58 (d, *J* = 16.72 Hz, 1 H), 5.29 (s, 1 H), 5.10 (s, 1 H), 3.77 (s, 3 H), 3.39 (s, 3 H), 2.12 (q, *J* = 6.74 Hz, 1 H), 1.92-2.08 (m, 1 H), 1.21 (d, *J* = 6.74 Hz, 3 H), 0.99-1.38 (m, 9 H), 0.77 (t, *J* = 6.75 Hz, 3 H); The following data were discernible for the *cis* isomer, *cis*-**4bc**: δ 5.38 (s, 1 H), 4.97 (s, 1 H), 3.81 (s, 3 H), 3.45 (s, 3 H); MS m/z (%) 384 (M⁺, 7.22), 325 (100); Anal. calcd for C₂₄H₃₂O₄: C 75.00, H 8.33; Found: C 74.74, H 8.40.

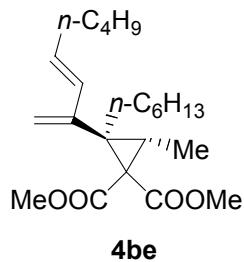
(7) **1,1-Bis(methoxycarbonyl)-2-hexyl-2-(1'-(2"-thienyl)ethenyl)-3-methyl cyclopropane (4bd).**



The reaction of **2b** (71 mg, 0.25 mmol) and 2-iodothiophene (63 mg, 0.3 mmol) afforded 76 mg (83%) of **4bd** (*cis*-**4bd**:*trans*-**4bd** = 8:92) using Conditions A; The reaction of **2b** (71 mg, 0.25 mmol) and 2-iodothiophene (63 mg, 0.3 mmol) afforded 56 mg (61%) of **4bd** (*cis*-**4bd**:*trans*-**4bd** = 7:93) using Conditions B; viscous liquid; IR(neat): 2954, 1735, 1615, 1435 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) *trans*-**4bd**: δ

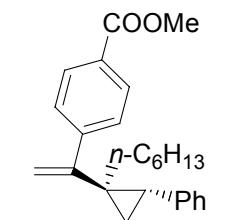
7.21-7.31 (m, 1 H), 7.06 (dd, $J = 5.13, 1.03$ Hz, 1 H), 6.89 (dd, $J = 5.13, 3.66$ Hz, 1 H), 5.56 (s, 1 H), 4.99 (s, 1 H), 3.75 (s, 3 H), 3.36 (s, 3 H), 2.21 (q, $J = 6.77$ Hz, 1 H), 1.83-2.08 (m, 1 H), 1.21 (d, $J = 6.77$ Hz, 3 H), 1.00-1.40 (m, 9 H), 0.76 (t, $J = 6.75$ Hz, 3 H); The following data were discernible for the *cis* isomer, **cis-4bd**: 5.64 (s, 1 H), 4.86 (s, 1 H), 3.77 (s, 3 H), 3.39 (s, 3 H); MS m/z (%) 364 (M^+ , 12.23), 304 (100); Anal. calcd for $C_{20}H_{28}O_4S$: C 65.93, H 7.69; Found: C 66.33, H 7.53.

(8) 1,1-Bis(methoxycarbonyl)-2-hexyl-2-(1'-methylene-2'-(*E*)-heptenyl)-3-methylcyclopropane (4be).



The reaction of **2b** (71 mg, 0.25 mmol) and (*E*)-1-iodo-1-hexene (63 mg, 0.3 mmol) afforded 80 mg (88%) of **4be** (*cis*-**4be**:*trans*-**4be** = 6:94) using Conditions A; The reaction of **2b** (71 mg, 0.25 mmol) and (*E*)-1-iodo-1-hexene (63 mg, 0.3 mmol) afforded 55 mg (60%) of **4be** (*cis*-**4be**:*trans*-**4be** = 5:95) using Conditions B; viscous liquid; IR (neat): 2956, 1737, 1604, 1435, 1222 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) *trans*-**4be**: δ 6.07 (dt, $J = 15.90, 6.90$ Hz, 1 H), 5.89 (d, $J = 15.90$ Hz, 1 H), 5.10 (s, 1 H), 4.93 (s, 1 H); 3.77 (s, 3 H), 3.57 (s, 3 H), 1.90-2.18 (m, 5 H), 0.98-1.44 (m, 15 H), 0.80-0.96 (m, 6 H); The following data were discernible for the *cis* isomer, *cis*-**4be**: δ 5.19 (s, 1 H), 4.83 (s, 1 H), 3.78 (s, 3 H), 3.59 (s, 3 H); MS m/z (%) 364 (M^+ , 3.56), 41 (100); Anal. calcd for $C_{22}H_{36}O_4$: C 72.49, H 9.95; Found: C 72.08, H 9.72.

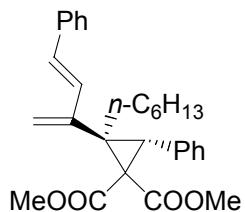
(9) **1,1-Bis(methoxycarbonyl)-2-hexyl-2-(1'-(4"-methoxycarbonyl)phenylethenyl)-3-phenylcyclopropane (4cb).**



4cb

The reaction of **2c** (86 mg, 0.25 mmol) and 4-iodobenzoic acid methyl ester (79 mg, 0.3 mmol) afforded 91 mg (76%) of **4cb** (*cis*-**4cb**:*trans*-**4cb** = 5:95) using Conditions A; The reaction of **2c** (90 mg, 0.26 mmol) and 4-iodobenzoic acid methyl ester (79 mg, 0.3 mmol) afforded 72 mg (60%) of **4cb** (*cis*-**4cb**:*trans*-**4cb** = 7:93) using Conditions B; viscous liquid; IR(neat): 2954, 1724, 1608, 1501, 1435, 1281 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) *trans*-**4cb**: δ 8.01 (d, *J* = 8.40 Hz, 2 H), 7.68 (d, *J* = 8.40 Hz, 2 H), 7.20-7.35 (m, 5 H), 5.84 (s, 1 H), 5.47 (s, 1 H), 3.91 (s, 3 H), 3.80 (s, 3 H), 3.55 (s, 1 H), 3.46 (s, 3 H), 2.05-2.19 (m, 1 H), 1.52-1.68 (m, 1 H), 0.80-1.40 (m, 8 H), 0.72 (t, *J* = 7.10 Hz, 3 H); The following data were discernible for the *cis* isomer, *cis*-**4cb**: δ 8.12 (d, *J* = 8.60 Hz, 2 H), 7.75 (d, *J* = 8.60 Hz, 2 H), 5.95 (s, 1 H), 5.01 (s, 1 H), 3.96 (s, 3 H), 3.39 (s, 3 H); MS m/z (%) 478 (M⁺, 4.79), 418 (100); Anal. calcd for C₂₉H₃₄O₆: C 72.80, H 7.11; Found: C 72.80, H 7.22.

(10) **1,1-Bis(methoxycarbonyl)-2-hexyl-2-(1'-methylene-3'-phenyl-2'-(E)-propenyl)-3-phenylcyclopropane (4cc).**



4cc

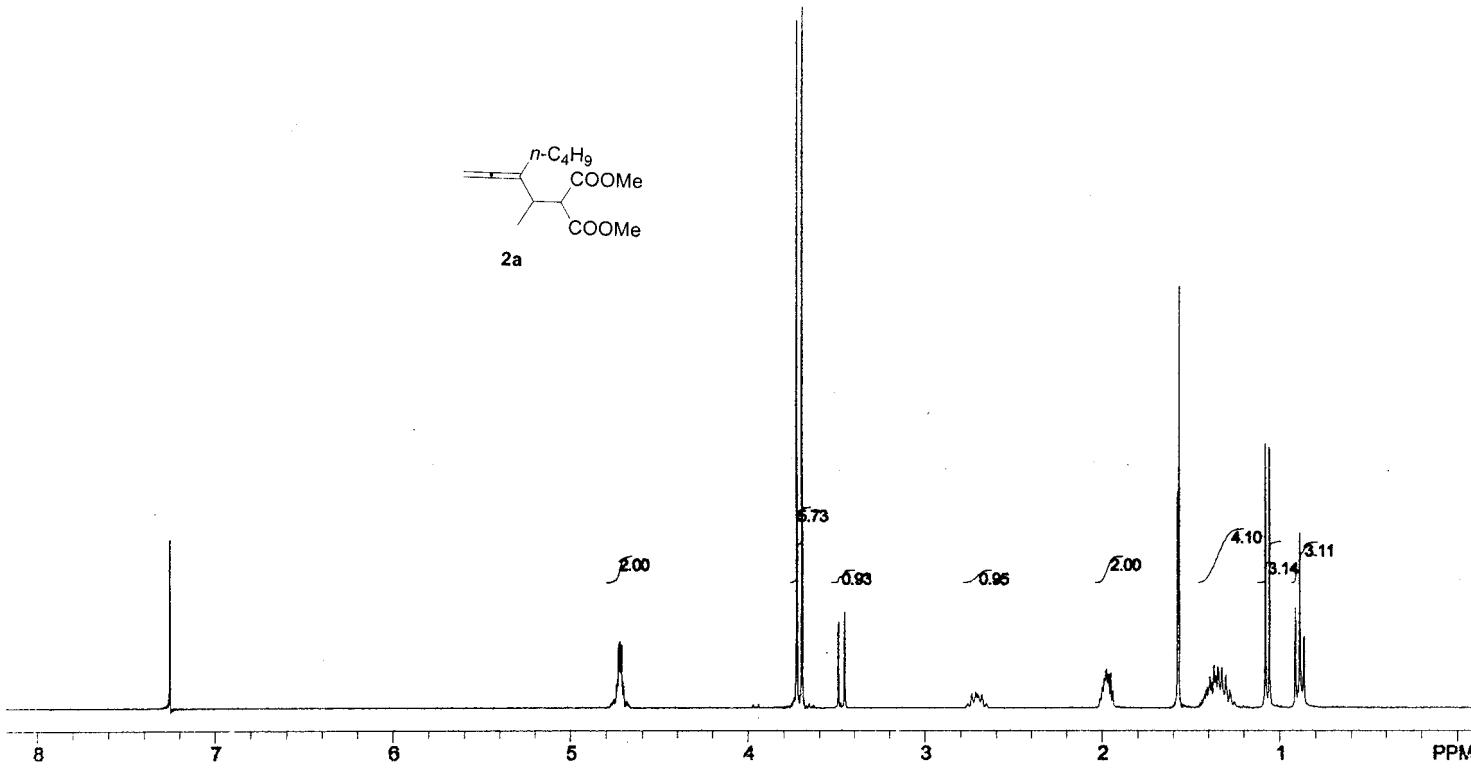
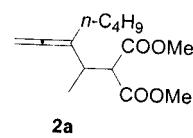
The reaction of **2c** (86 mg, 0.25 mmol) and (*E*)-1-iodo-2-phenylethylene (69 mg, 0.3 mmol) afforded 96 mg (86%) of **4cc** (*cis*-**4cc**:*trans*-**4cc** = 6:94) using Conditions A; The reaction of **2c** (84 mg, 0.24 mmol) and (*E*)-1-iodo-2-phenylethylene (69 mg, 0.3 mmol) afforded 96 mg (88%) of **4cc** (*cis*-**4cc**:*trans*-**4cc** = 6:94) using Conditions B; viscous liquid; IR(neat): 2953, 1735, 1604, 1499, 1435, 1253, 1224 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) *trans*-**4cc**: δ 7.45 (d, *J* = 8.40 Hz, 2 H), 7.19-7.38 (m, 8 H), 7.03 (d, *J* = 16.50 Hz, 1 H), 6.70 (d, *J* = 16.5 Hz, 1 H), 5.44 (s, 1 H), 5.33 (s, 1 H), 3.82 (s, 3 H), 3.52 (s, 3 H), 3.50 (s, 1 H), 2.16-2.30 (m, 1 H), 1.50-1.62 (m, 1 H), 0.83-1.33 (m, 8 H), 0.76 (t, *J* = 6.90 Hz, 3 H); The following data were discernible for the *cis* isomer, *cis*-**4cc**: δ 5.46 (s, 1 H), 4.96 (s, 1 H), 3.92 (s, 3 H); MS m/z (%) 446 (M⁺, 2.41), 91 (100); Anal. calcd for C₂₉H₃₄O₄: C 78.03, H 7.62; Found: C 77.66, H 7.83.

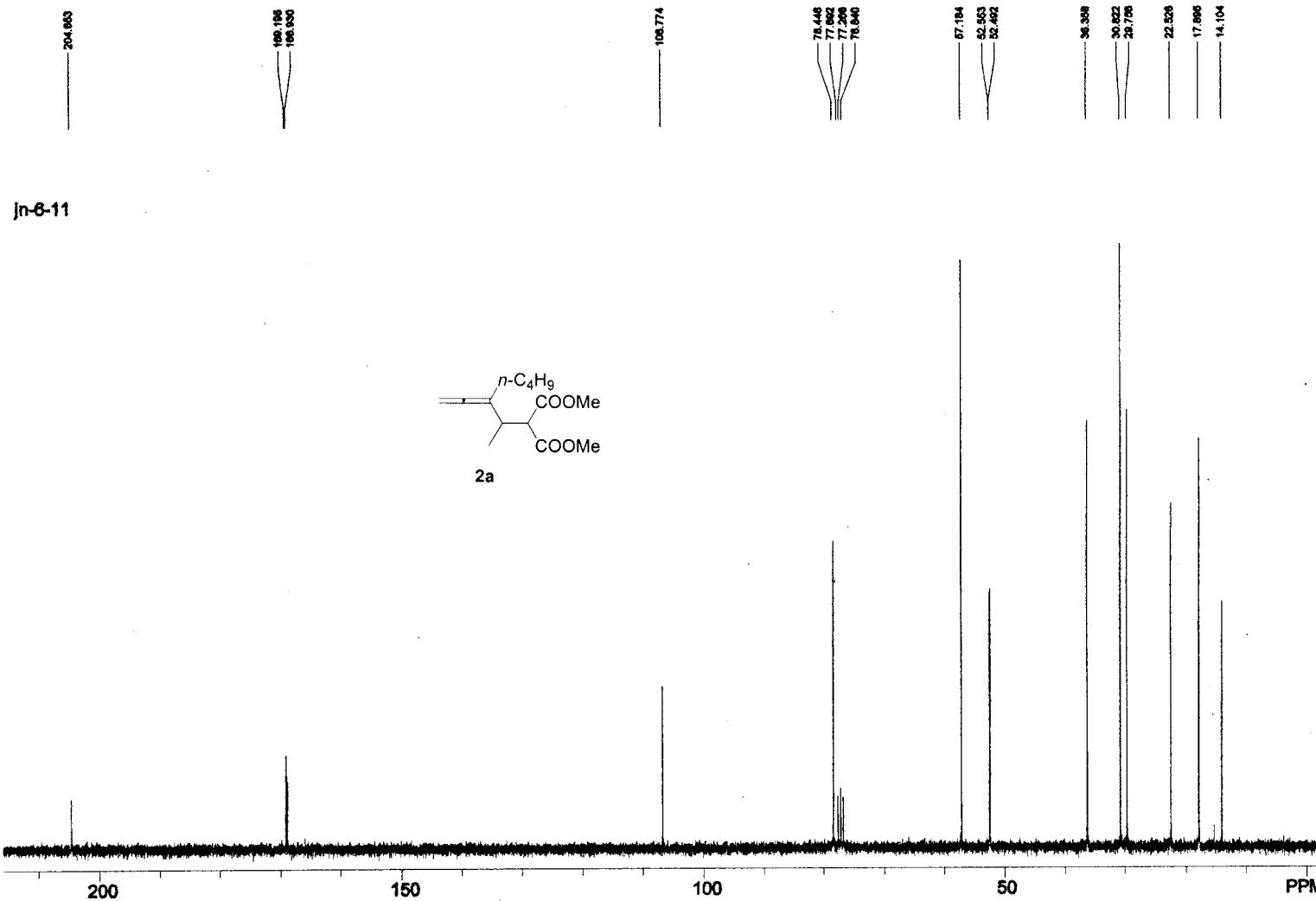
References:

1. Xu, D.; Li, Z.; Ma, S. *Chem. Eur. J.* **2002**, 8, 5012.

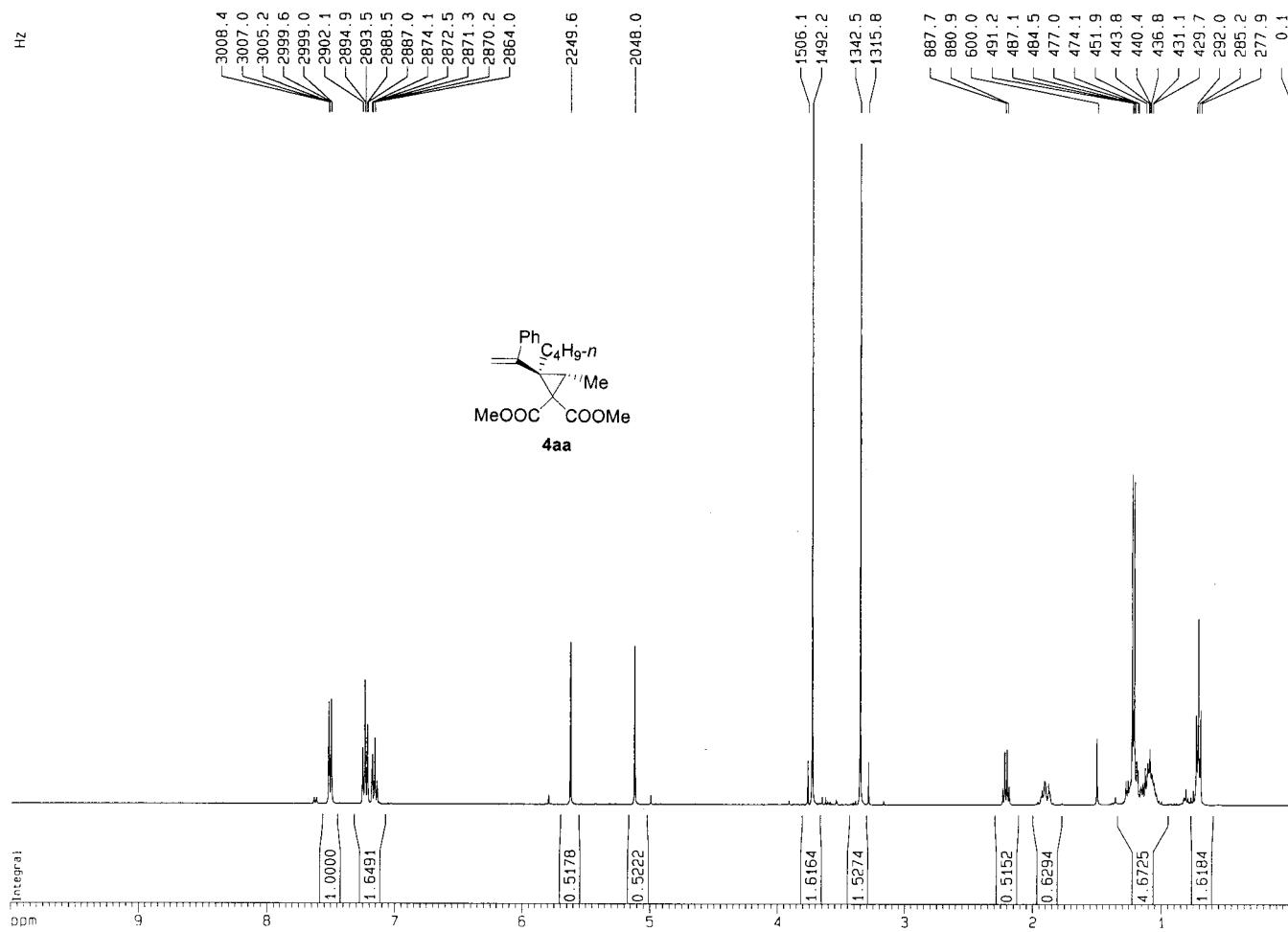
jn-6-11

2177.3



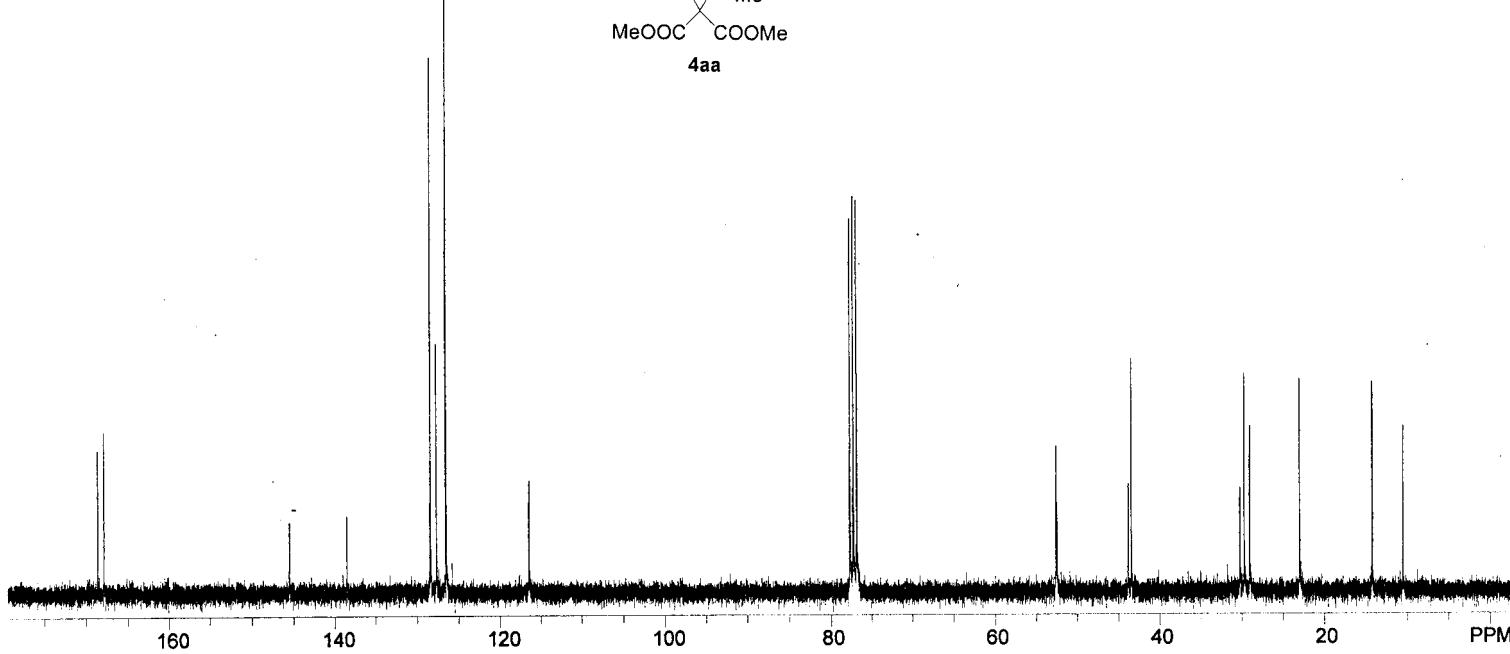
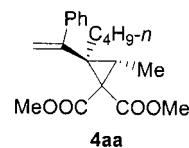


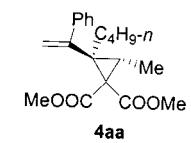
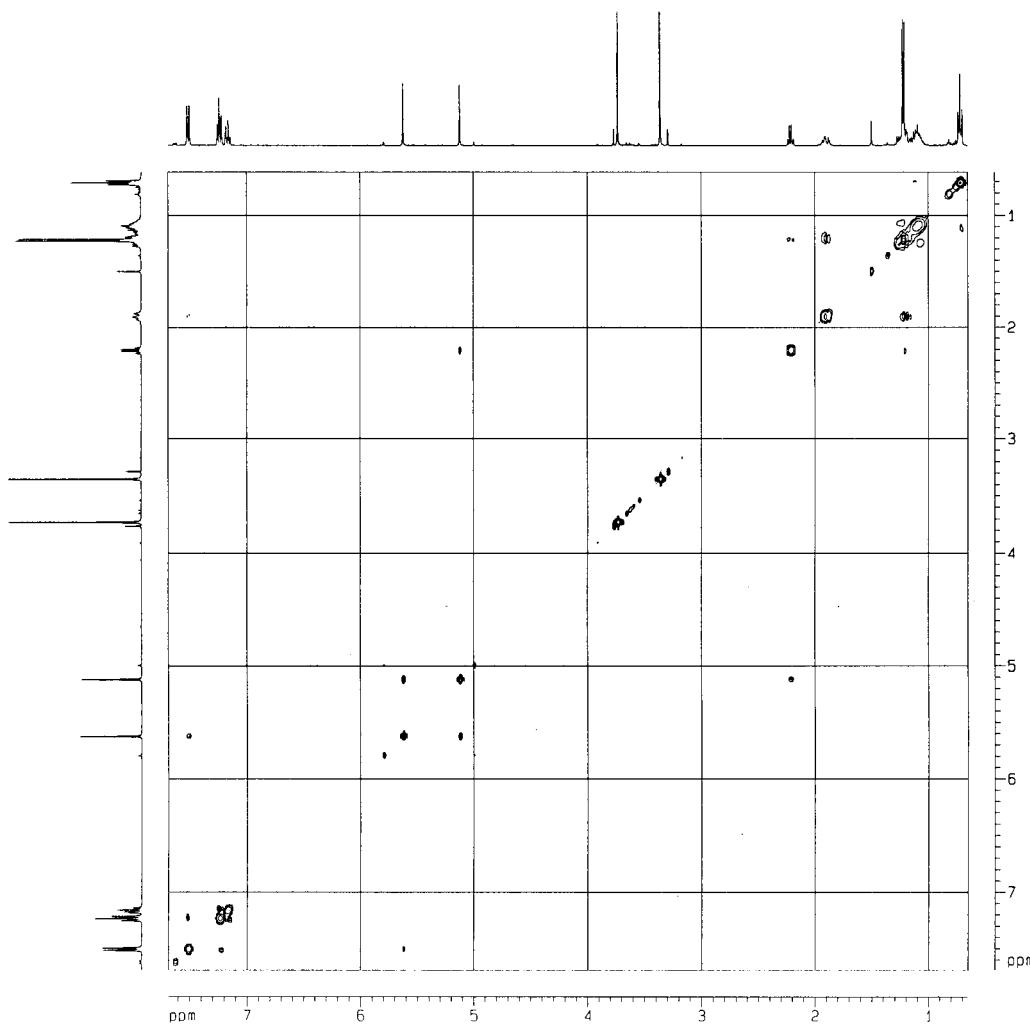
JN - 6-13





jn-6-13-c



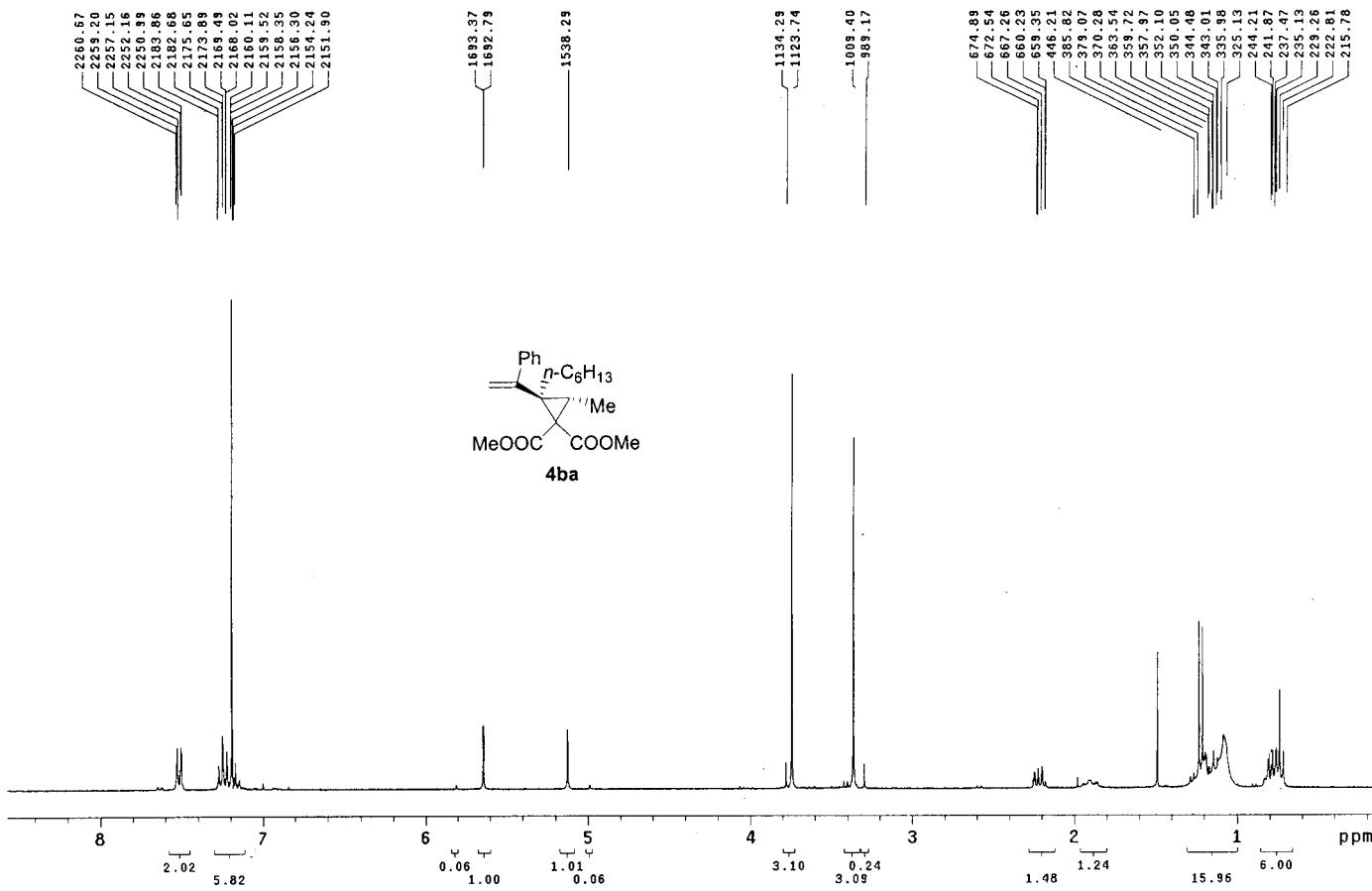


jn-9-52-1

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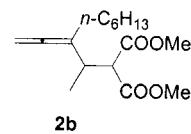
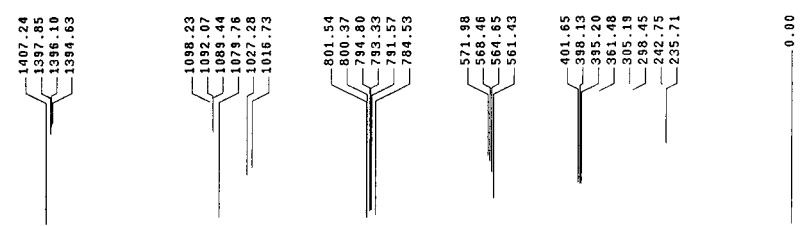


Jn-9-45-1

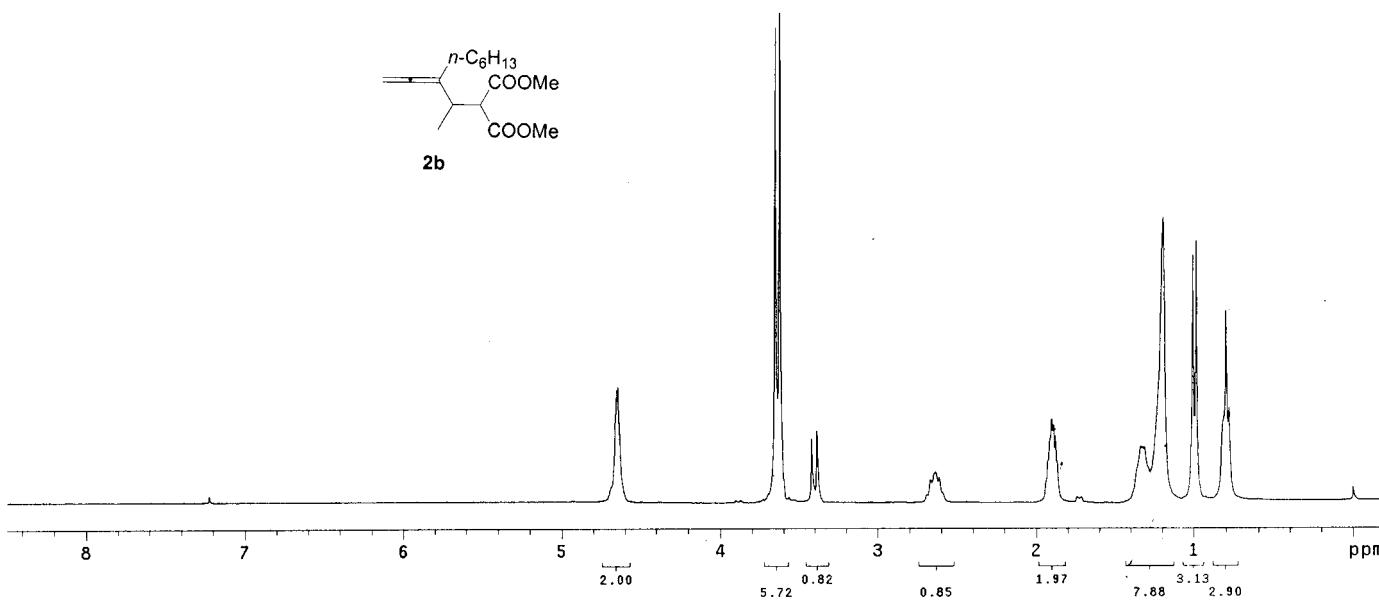
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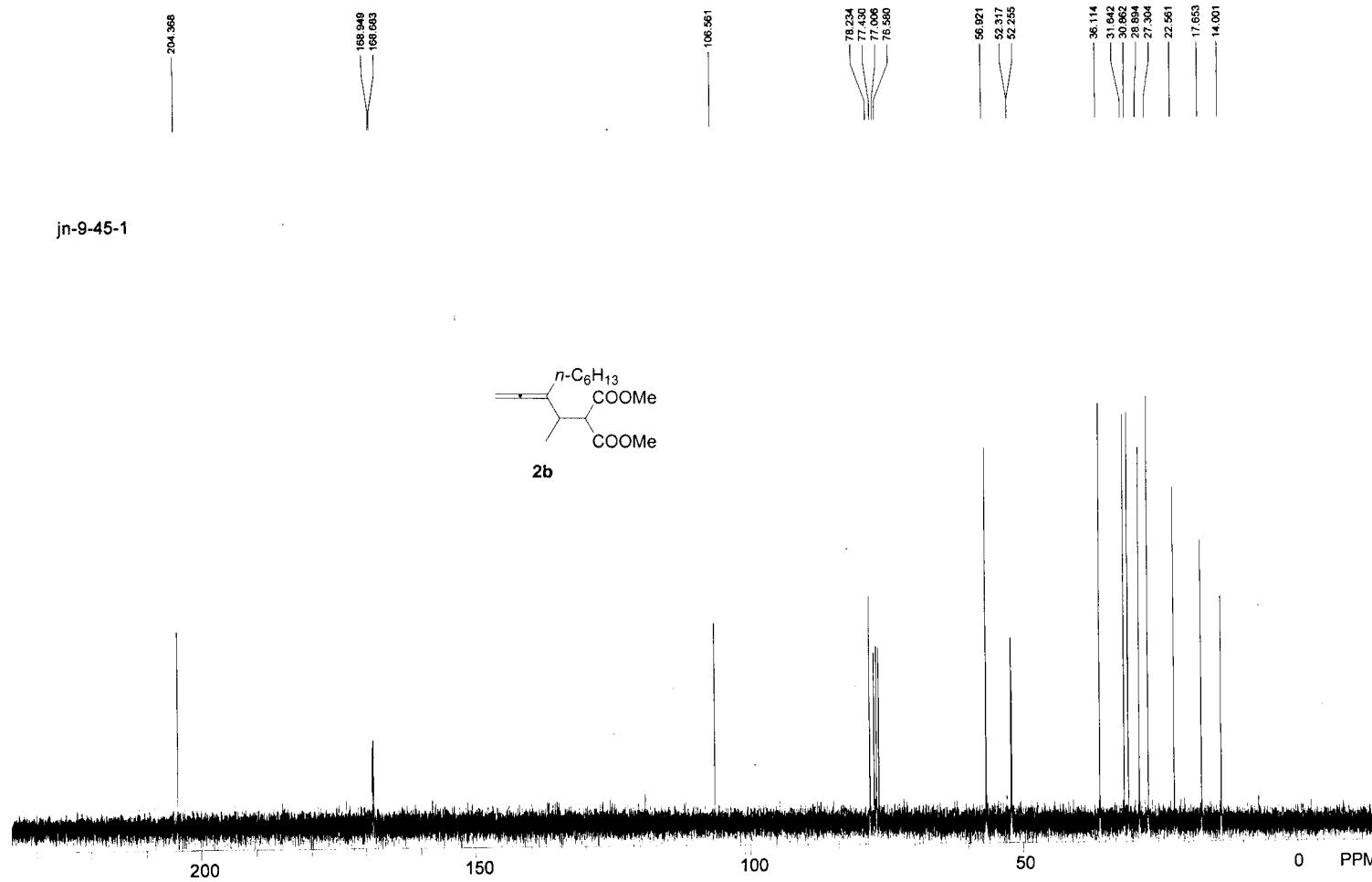
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2b



jn-9-45-1

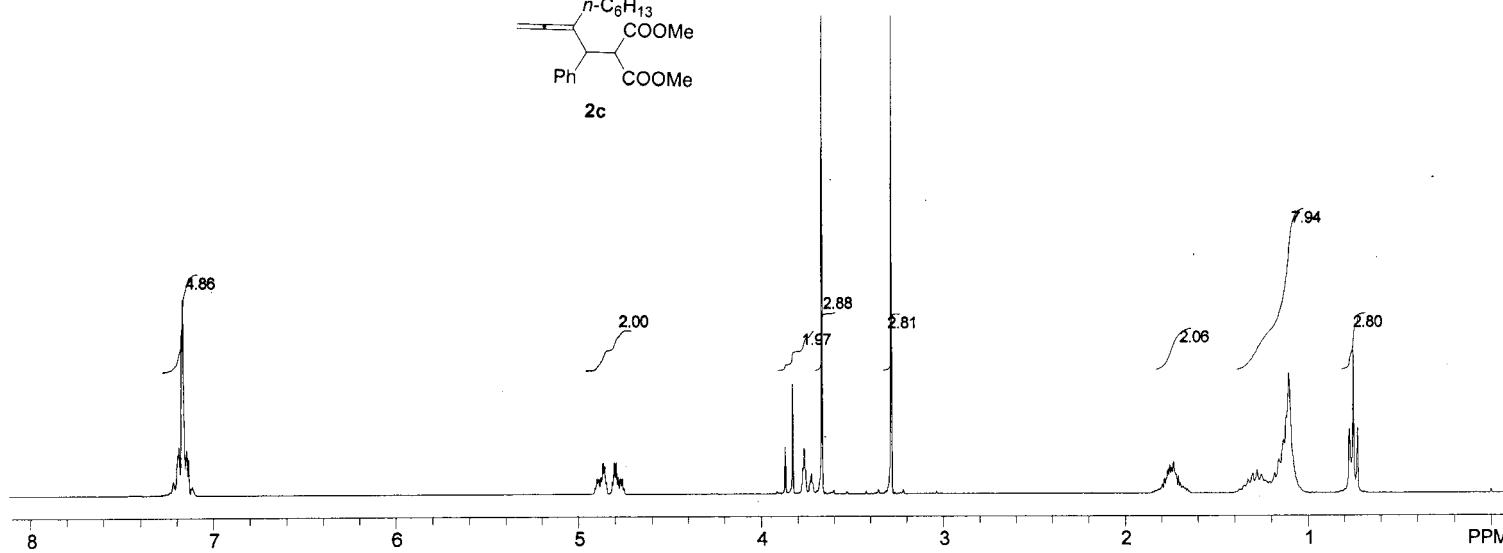
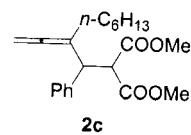


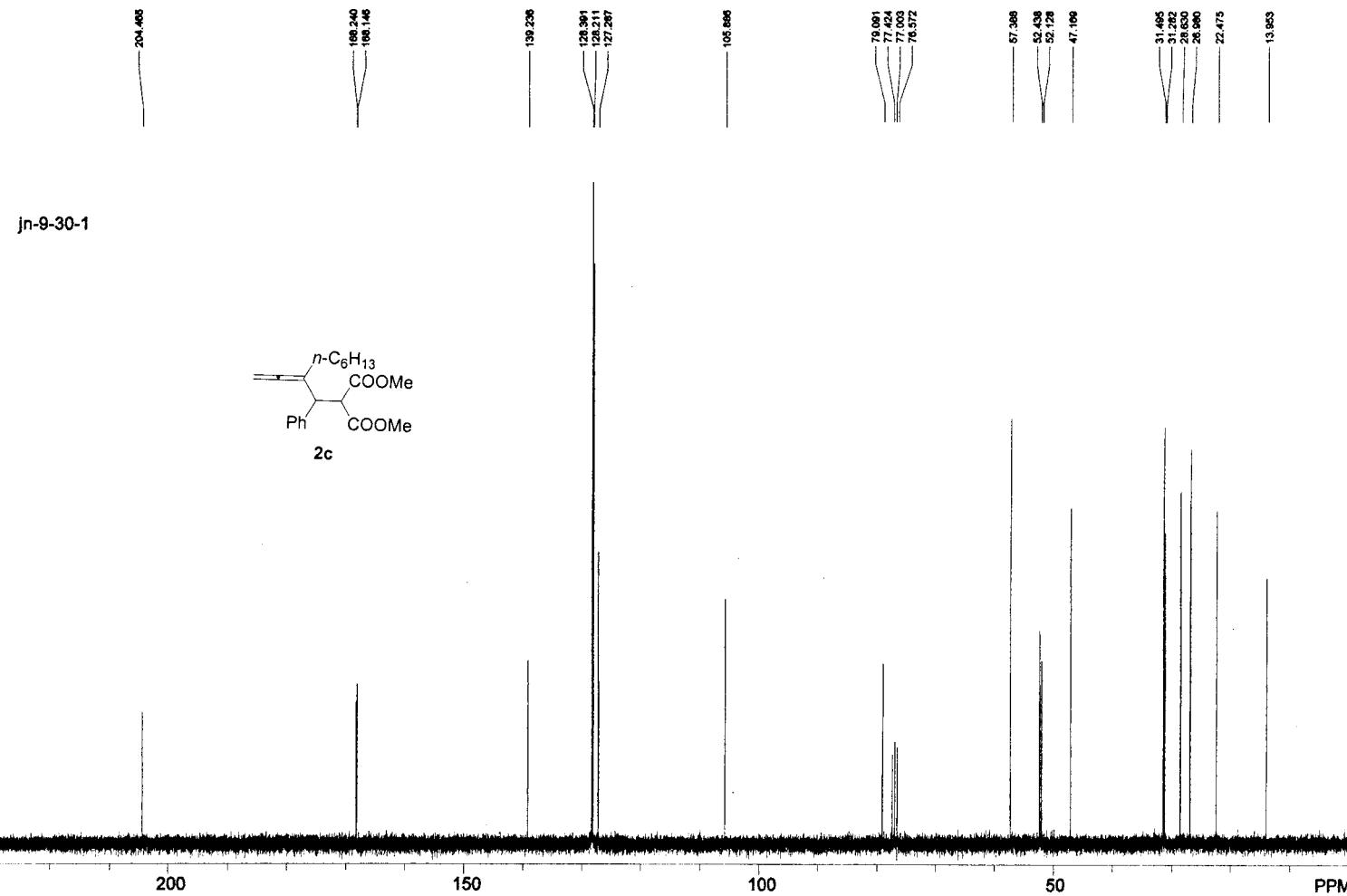
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2052.3
2050.2
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2044.0
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1970.4
1967.9
1967.1
1964.2
1960.7
1958.6
1957.4
1955.1
1945.4
1944.9
1939.0
1936.2
1932.4
1929.4
1916.3
1914.3
1913.2
1913.0
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1912.7
1911.8
1911.6
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1910.3
1909.3
1908.6
1908.4

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219.1

jn-9-30-1



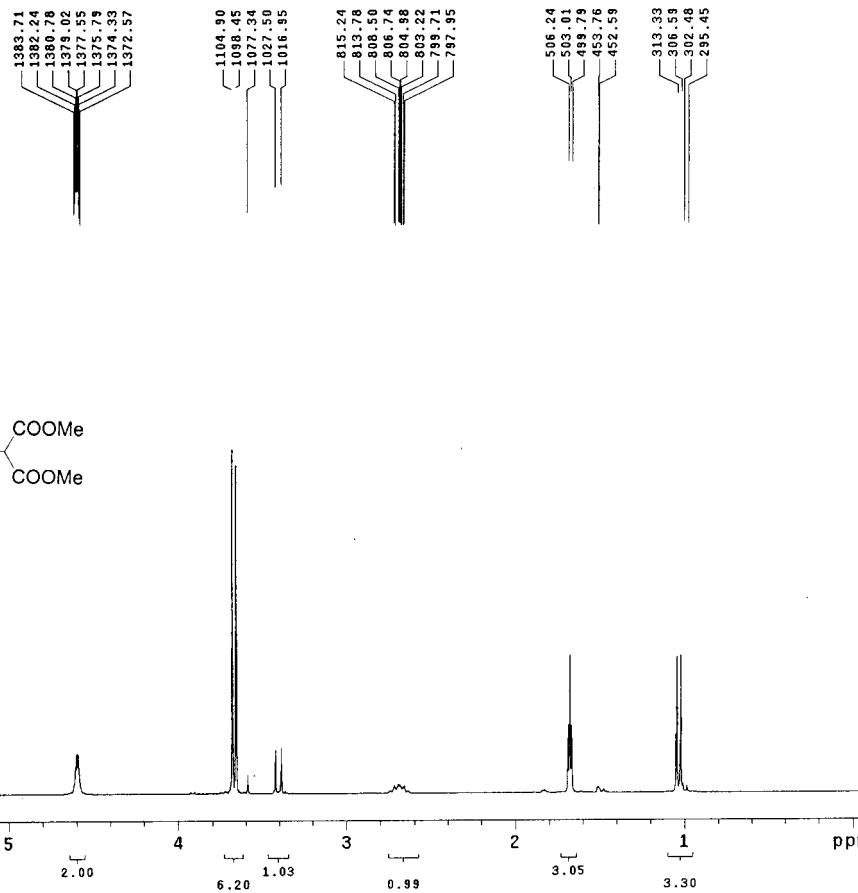


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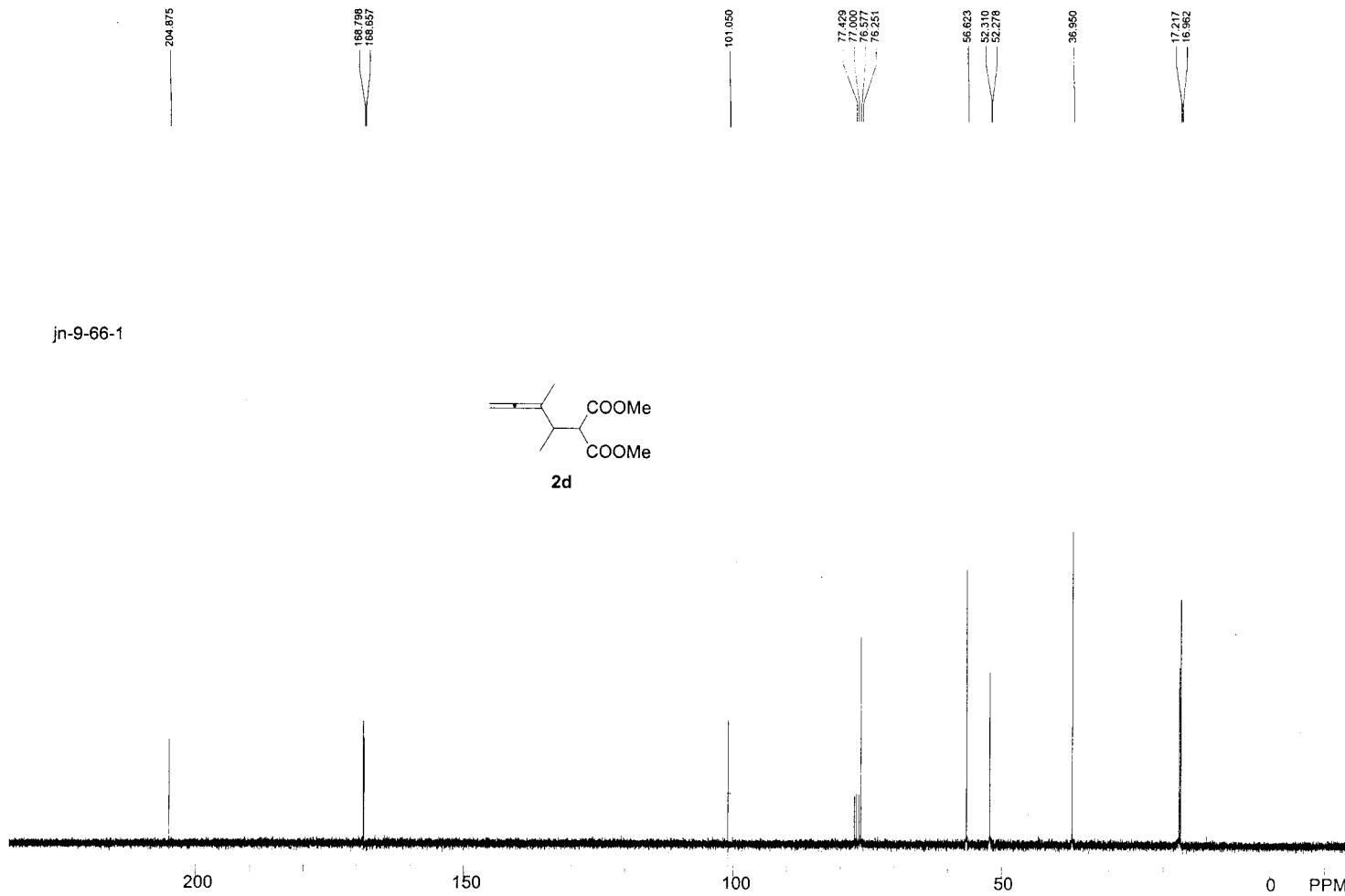
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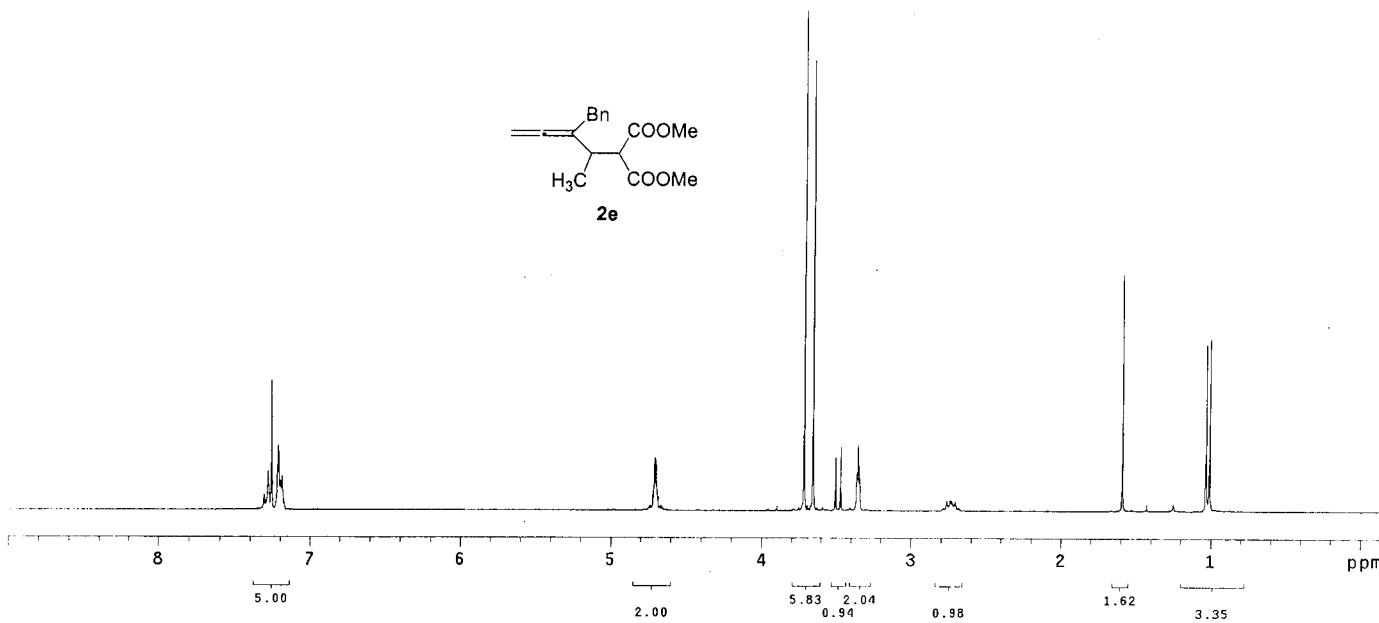
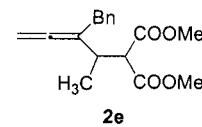
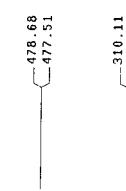
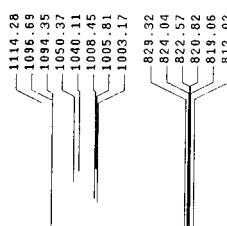
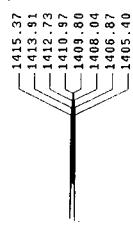
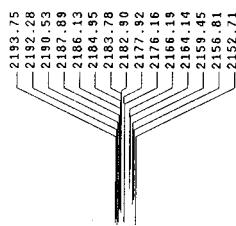


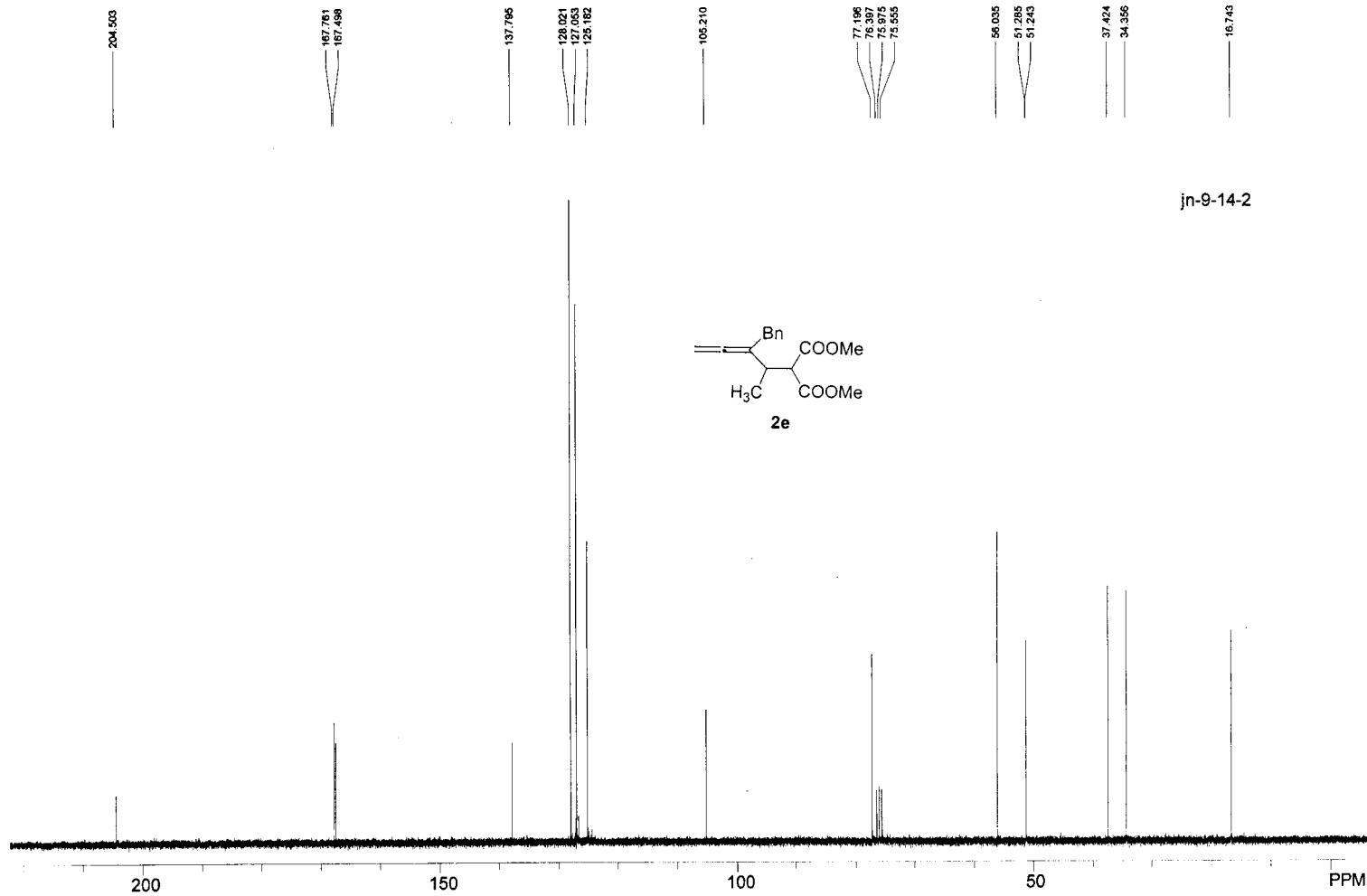
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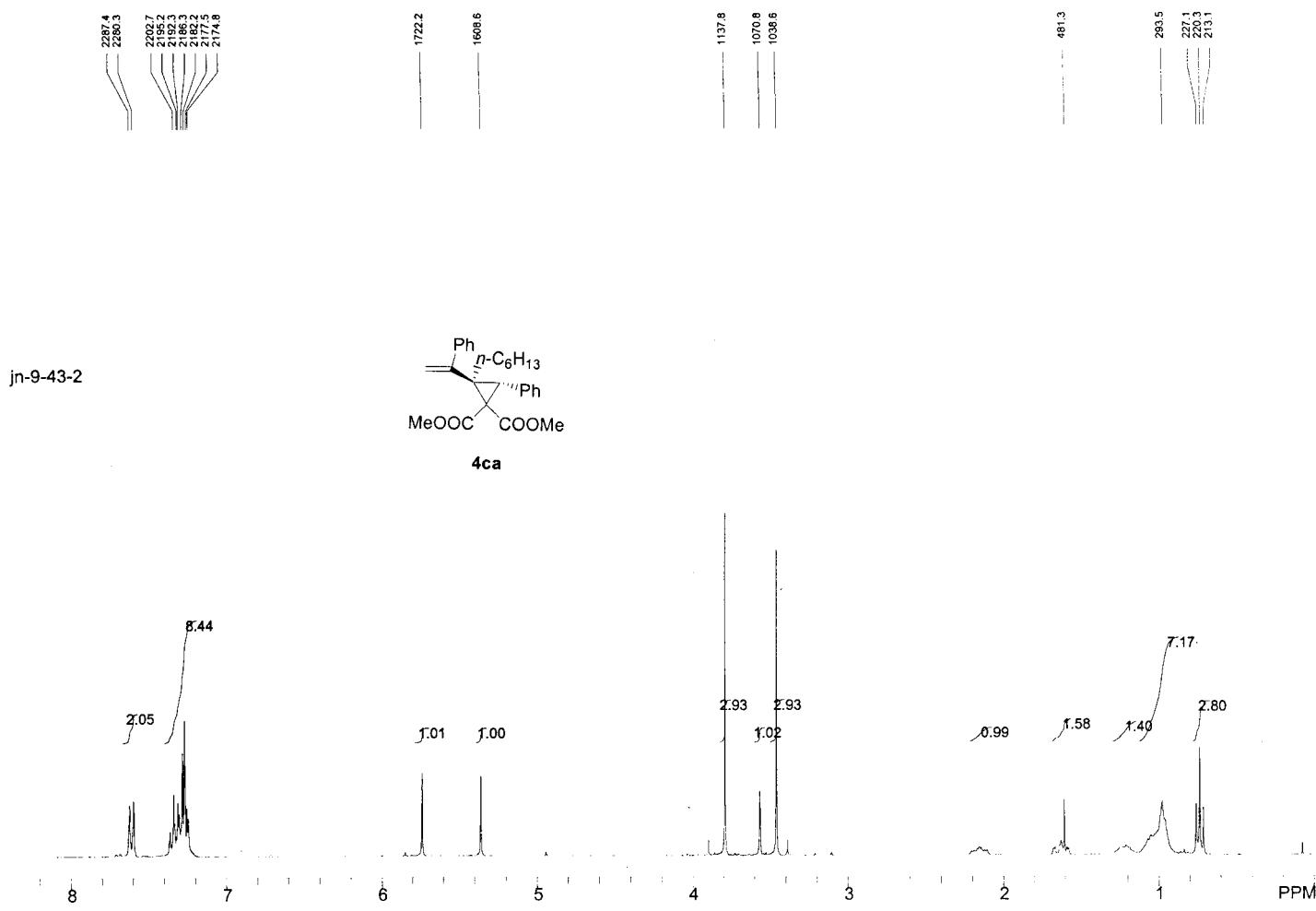
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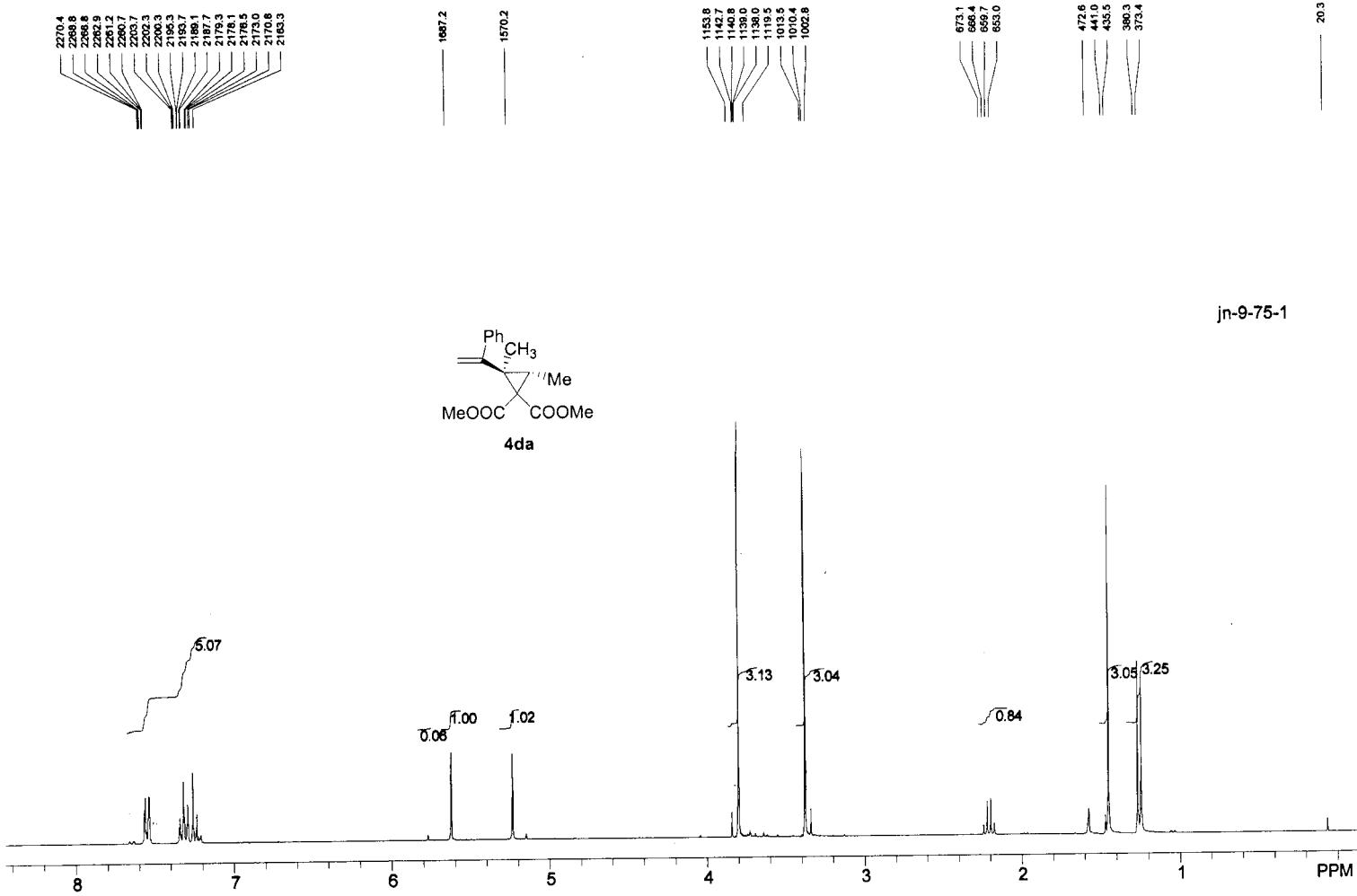
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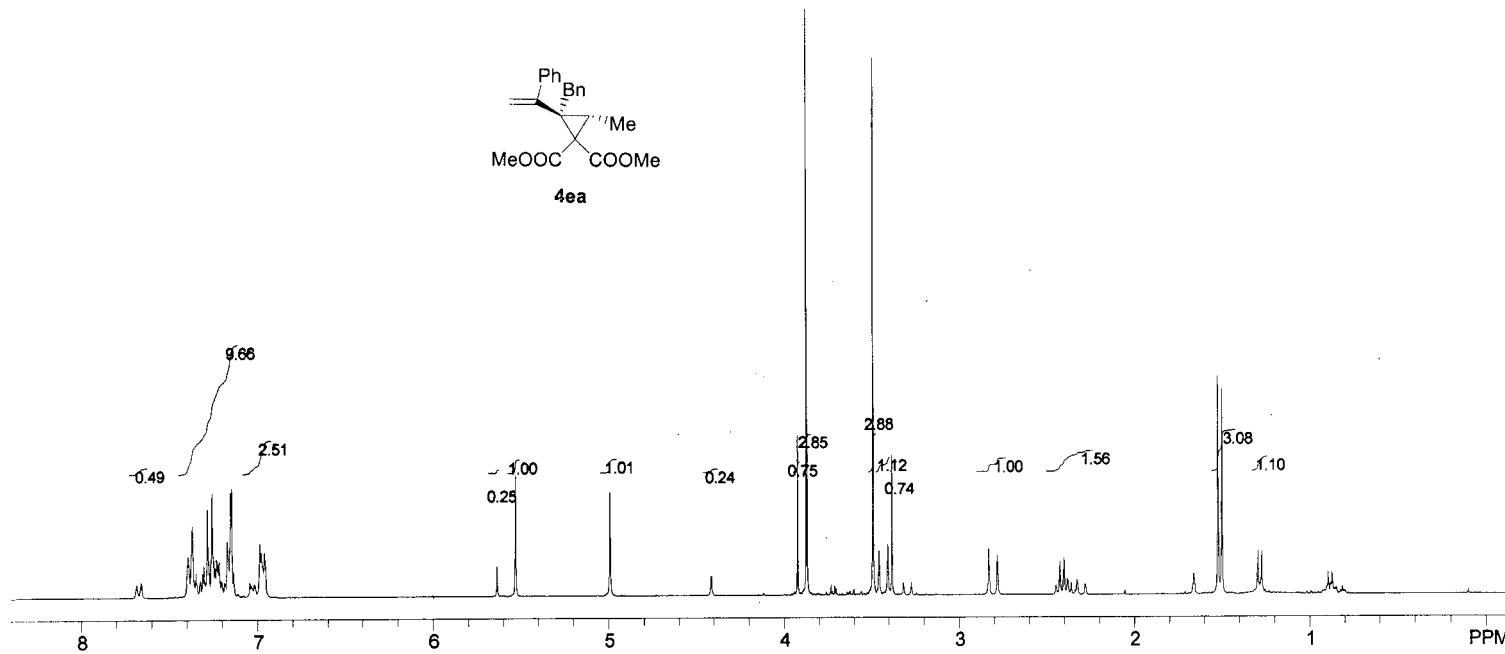


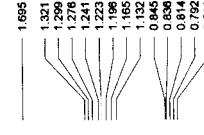
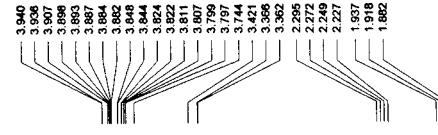
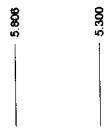
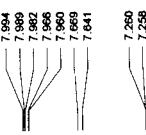




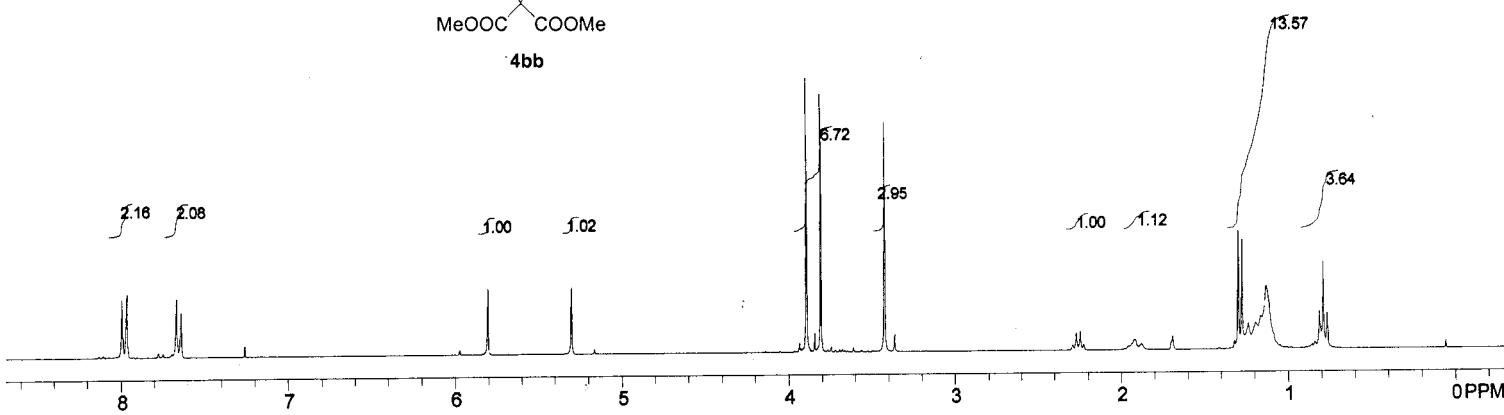
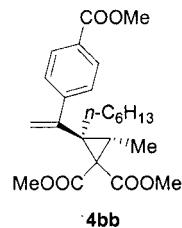


jn-9-40-2





jn-9-62-2

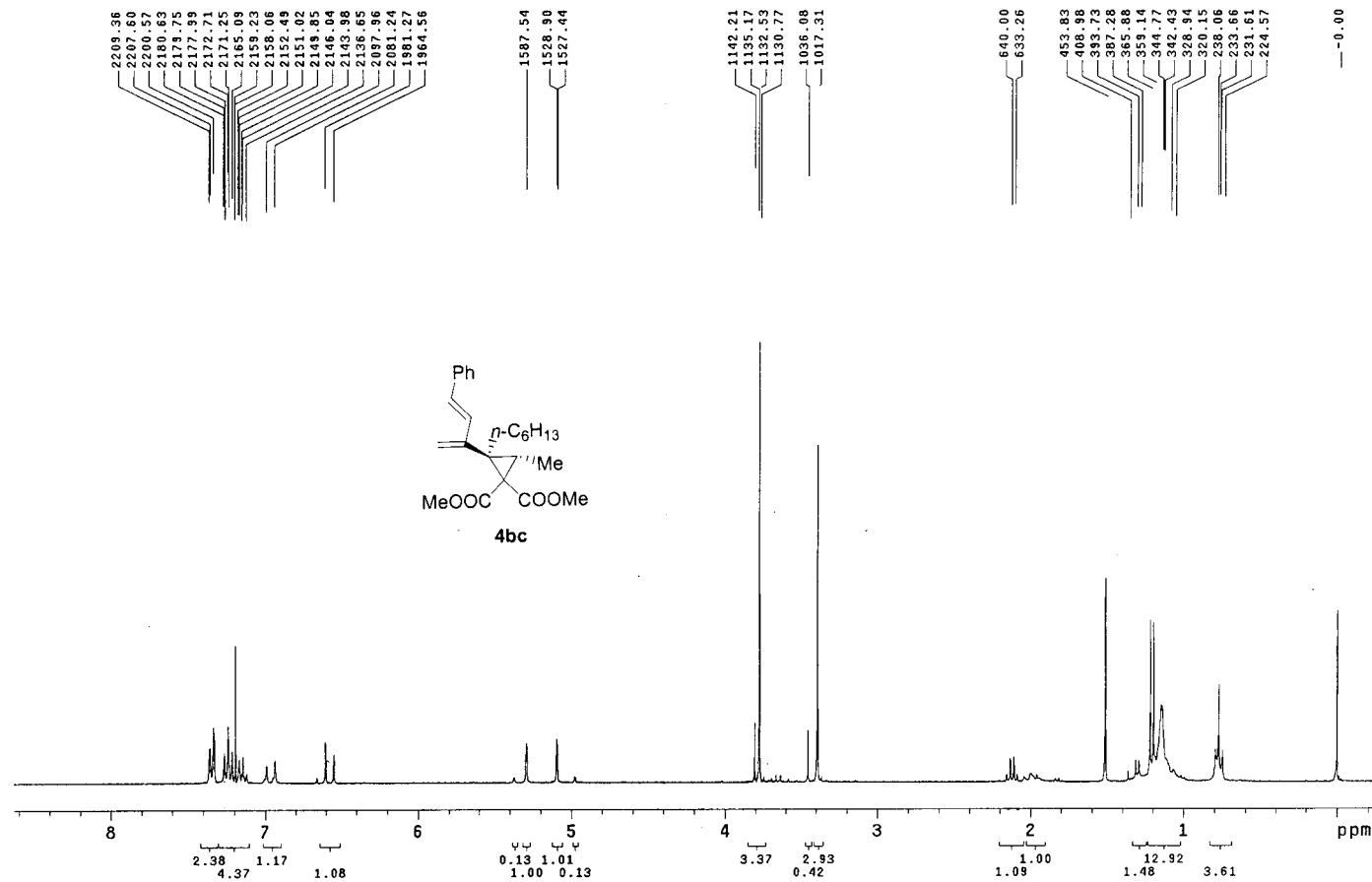


Jn-9-55-2

Archive directory: /export/home/masm/vnmrsys/data

Sample directory:

Pulse Sequence: s2pul



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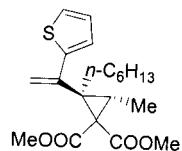
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jn-10-18-1



4bd

