

**Highly Efficient Cu(I)-Catalyzed Oxidation of Alcohols to Ketones and Aldehydes
with Diaziridinone**

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Supporting Information

General methods. All commercially available reagents were used without further purification. Column chromatography was performed on silica gel (200-400 mesh). ¹H NMR spectra were recorded on a 300 MHz NMR spectrometer and ¹³C NMR spectra were recorded on a 75 MHz NMR spectrometer. IR spectra were recorded on a FT-IR spectrometer. Melting points were uncorrected. Optical rotation was recorded on an Autopol III polarimeter.

Alcohols **2k**,¹ **2m**,¹ **2t**,² **2v**,³ **2w**,⁴ **2aa**,⁵ and **4l**⁶ were prepared according to the literature methods. Di-*tert*-butyldiaziridinone (**1**) was prepared according to the reported procedures.⁷

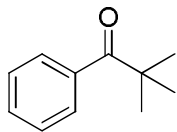
- (1) Sheppard, C. I.; Taylor, J. L.; Wiskur, S. L. *Org. Lett.* **2011**, *13*, 3794–3797.
- (2) Uyanik, M.; Akakura, M.; Ishihara, K. *J. Am. Chem. Soc.* **2009**, *131*, 251–262.
- (3) Barbe, G.; Charette, A. B. *J. Am. Chem. Soc.* **2008**, *130*, 18–19.
- (4) Venuti, M. C.; Jones, G. H.; Alvarez, R.; Bruno, J. J. *J. Med. Chem.* **1987**, *30*, 303–318.
- (5) (a) Huang, Q.; Herdewijn, P. *J. Org. Chem.* **2011**, *76*, 3742–3753. (b) Yoshimura, Y.; Sano, T.; Matsuda, A.; Ueda, T. *Chem. Pharm. Bull.* **1988**, *36*, 162–167.
- (6) de Jesus Oliveira, D.; Coelho, F. *Synth. Commun.* **2000**, *30*, 2143–2159.
- (7) Du, H.; Zhao, B.; Shi, Y. *Org. Synth.* **2009**, *86*, 315–324.

Representative procedure for the oxidation of alcohols (Table 2, entry 1): To a 4 mL vial equipped with a stir bar were added 2,2-dimethyl-1-phenyl-1-propanol (**2a**) (0.0986 g, 0.60 mmol), CuBr (0.0086 g, 0.06 mmol), and CH₃CN (1.2 mL). After the mixture was stirred at rt under Ar for 3 min, di-*tert*-butyldiaziridinone (**1**) (0.1124 g, 0.66 mmol) was added in one portion. The reaction mixture was vigorously stirred at rt under Ar for 2 h and purified by flash chromatography (silica gel, hexanes:ethyl acetate = 35:1 to 25:1) to give ketone **3a** as a colorless oil (0.092 g, 95%).

Representative procedure for gram-scale oxidation of alcohols (Table 2, entry 3): To a 50 mL single-necked flask equipped with a stir bar were added benzhydrol (**2c**) (1.842 g, 10.0 mmol), CuBr (0.1434 g, 1.0 mmol), and CH₃CN (20 mL). After the mixture was stirred at rt for 3 min, di-*tert*-butyldiaziridinone (**1**) (1.872 g, 11.0 mmol) was added in one portion. The reaction mixture was vigorously stirred at rt for 12 h, concentrated, and purified by flash chromatography (silica gel, hexanes:ethyl acetate = 40:1 to 25:1) to give ketone **3c** as a white solid (1.804 g, 99%).

Characterization data

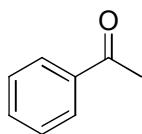
Table 2, entry 1



2,2-Dimethyl-1-phenyl-propan-1-one: Colorless oil; IR (film) 1676 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.70-7.67 (m, 2H), 7.45-7.35 (m, 3H), 1.34 (s, 9H); ^{13}C NMR (75 MHz, CDCl_3) δ 209.4, 138.7, 130.9, 128.2, 128.0, 44.3, 28.2.

Shibuya, M.; Tomizawa, M.; Sasano, Y.; Iwabuchi, Y. *J. Org. Chem.* **2009**, *74*, 4619–4622.

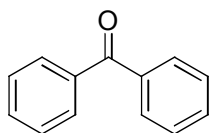
Table 2, entry 2



Acetophenone: Light yellow oil; IR (film) 1684 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.97-7.90 (m, 2H), 7.57-7.50 (m, 1H), 7.46-7.41 (m, 2H), 2.58 (s, 3H); ^{13}C NMR (75 MHz, CDCl_3) δ 198.3, 137.2, 133.2, 128.7, 128.4, 26.7.

Genna, D. T.; Posner, G. H. *Org. Lett.* **2011**, *13*, 5358–5361.

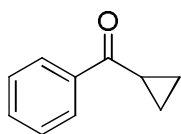
Table 2, entry 3



Benzophenone: White solid; mp 46-48 $^{\circ}\text{C}$ (lit. mp 47-48 $^{\circ}\text{C}$); IR (film) 1654 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.84-7.78 (m, 4H) 7.62-7.54 (m, 2H), 7.52-7.44 (m, 4H); ^{13}C NMR (75 MHz, CDCl_3) δ 196.8, 137.7, 132.6, 130.2, 128.4.

(a) Miao, C.-X.; He, L.-N.; Wang, J.-L.; Wu, F. *J. Org. Chem.* **2010**, *75*, 257–260. (b) Kumar, R. A.; Maheswari, C. U.; Ghantasala, S.; Jyothi, C.; Reddy, K. R. *Adv. Synth. Catal.* **2011**, *353*, 401–410.

Table 2, entry 4

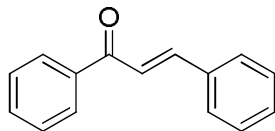


Cyclopropyl phenyl ketone: Colorless oil; IR (film) 1668 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 8.04-

8.00 (m, 2H) 7.56 (tt, $J = 7.5, 1.5$ Hz, 1H), 7.49-7.44 (m, 2H), 2.68 (tt, $J = 8.1, 4.5$ Hz, 1H), 1.28-1.20 (m, 2H), 1.08-1.00 (m, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 200.8, 138.2, 132.9, 128.7, 128.2, 17.3, 11.8.

Clarke, C.; Fox, D. J.; Pedersen, D. S.; Warren, S. *Org. Biomol. Chem.* **2009**, 7, 1329–1336.

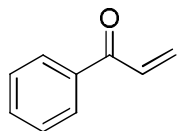
Table 2, entry 5



Chalcone: Light yellow solid; mp 56-57 °C (lit. mp 55-56 °C); IR (film) 1664, 1606 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 8.07-7.99 (m, 2H) 7.83 (d, $J = 15.9$ Hz, 1H), 7.68-7.60 (m, 2H), 7.59-7.46 (m, 4H), 7.44-7.37 (m, 3H); ^{13}C NMR (75 MHz, CDCl_3) δ 190.5, 144.9, 138.3, 135.0, 132.9, 130.7, 129.1, 128.7, 128.6, 128.5, 122.1.

Mahesh, M.; Murphy, J. A.; Wessel, H. P. *J. Org. Chem.* **2005**, 70, 4118–4123.

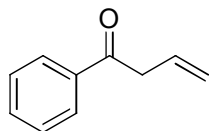
Table 2, entry 6



1-Phenyl-propenone: Light yellow oil; IR (film) 1678 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.96-7.91 (m, 2H), 7.56 (tt, $J = 7.2, 1.2$ Hz, 1H), 7.50-7.43 (m, 2H), 7.15 (dd, $J = 17.1, 10.5$ Hz, 1H), 6.43 (dd, $J = 17.1, 1.5$ Hz, 1H), 5.92 (dd, $J = 10.5, 1.5$ Hz, 1H); ^{13}C NMR (75 MHz, CDCl_3) δ 191.2, 137.4, 133.2, 132.5, 130.3, 128.9, 128.8.

Chen, M. S.; Prabakaran, N.; Labenz, N. A.; White, M. C. *J. Am. Chem. Soc.* **2005**, 127, 6970–6971.

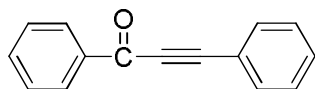
Table 2, entry 7



1-Phenyl-3-buten-1-one: Colorless oil; IR (film) 1685 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.99-7.93 (m, 2H) 7.60-7.52 (m, 1H), 7.50-7.42 (m, 2H), 6.16-6.02 (m, 1H), 5.26-5.16 (m, 2H), 3.79-3.72 (m, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 198.2, 136.7, 133.3, 131.2, 128.8, 128.4, 118.9, 43.6.

Kurono, N.; Nii, N.; Sakaguchi, Y.; Uemura, M.; Ohkuma, T. *Angew. Chem., Int. Ed.* **2011**, 50, 5541–5544.

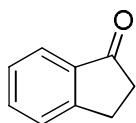
Table 2, entry 8



1,3-Diphenylprop-2-yn-1-one: Yellow solid; mp 46-47 °C (lit. mp 46-48 °C); IR (film) 2200, 1641 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 8.26-8.17 (m, 2H) 7.71-7.58 (m, 3H), 7.55-7.36 (m, 5H); ^{13}C NMR (75 MHz, CDCl_3) δ 178.1, 137.0, 134.3, 133.2, 130.9, 129.7, 128.8, 128.7, 120.2, 93.2, 87.0.

Liu, J.; Peng, X.; Sun, W.; Zhao, Y.; Xia, C. *Org. Lett.* **2008**, *10*, 3933–3936.

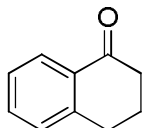
Table 2, entry 9



Indan-1-one: Light yellow oil; IR (film) 1712 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.73 (d, J = 7.5 Hz, 1H) 7.56 (t, J = 7.5 Hz, 1H), 7.45 (d, J = 7.5 Hz, 1H), 7.34 (t, J = 7.5 Hz, 1H), 3.12 (t, J = 6.0 Hz, 2H), 2.66 (t, J = 6.0 Hz, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 207.1, 155.3, 137.2, 134.7, 127.4, 126.8, 123.8, 36.3, 25.9.

Kumar, R. A.; Maheswari, C. U.; Ghantasala, S.; Jyothi, C.; Reddy, K. R. *Adv. Synth. Catal.* **2011**, 353, 401–410.

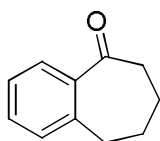
Table 2, entry 10



3,4-Dihydro-2H-naphthalen-1-one: Light yellow oil; IR (film) 1683 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 8.03 (dd, J = 7.5, 1.5 Hz, 1H), 7.47 (dt, J = 7.5, 1.5 Hz, 1H), 7.34-7.22 (m, 2H), 2.97 (t, J = 6.0 Hz, 2H), 2.66 (t, J = 6.0 Hz, 2H), 2.14 (quintet, J = 6.0 Hz, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 198.2, 144.5, 133.3, 132.6, 128.8, 127.0, 126.5, 39.1, 29.6, 23.3.

Kumar, R. A.; Maheswari, C. U.; Ghantasala, S.; Jyothi, C.; Reddy, K. R. *Adv. Synth. Catal.* **2011**, 353, 401–410.

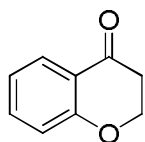
Table 2, entry 11



1-Benzosuberone: Colorless oil; IR (film) 1676 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.69 (d, J = 7.8 Hz, 1H), 7.42-7.32 (m, 1H), 7.26 (t, J = 7.5 Hz, 1H), 7.17 (d, J = 7.5 Hz, 1H), 2.89 (t, J = 6.3 Hz, 2H), 2.70 (t, J = 6.3 Hz, 2H), 1.87-1.73 (m, 4H); ^{13}C NMR (75 MHz, CDCl_3) δ 206.2, 141.4, 138.9, 132.3, 129.8, 128.6, 126.7, 40.9, 32.5, 25.3, 21.0.

Zhang, T.; Huang, X.; Xue, J.; Sun, S. *Tetrahedron Lett.* **2009**, 50, 1290–1294.

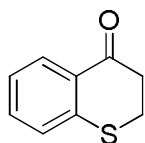
Table 2, entry 12



Chroman-4-one: Colorless oil; IR (film) 1687 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.89 (dd, J = 8.1, 1.5 Hz, 1H), 7.50-7.42 (m, 1H), 7.04-6.94 (m, 2H), 4.53 (t, J = 6.6 Hz, 2H), 2.80 (t, J = 6.6 Hz, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 191.9, 162.0, 136.1, 127.2, 121.5, 118.0, 67.1, 37.9.

He, J.; Zheng, J.; Liu, J.; She, X.; Pan, X. *Org. Lett.* **2006**, 8, 4637–4640.

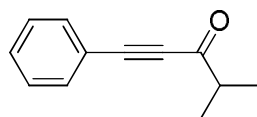
Table 2, entry 13



Thiochroman-4-one: Light yellow oil; IR (film) 1681 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 8.04 (dd, J = 8.1, 1.5 Hz, 1H), 7.35-7.26 (m, 1H), 7.23-7.17 (m, 1H), 7.15-7.06 (m, 1H), 3.21-3.13 (m, 2H), 2.95-2.86 (m, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 193.9, 142.2, 133.3, 130.9, 129.2, 127.6, 125.0, 39.6, 26.6.

Chauhan, M. S.; Still, I. W. J. *Can. J. Chem.* **1975**, 53, 2880–2890.

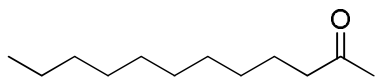
Table 2, entry 14



4-Methyl-1-phenyl-pent-1-yn-3-one: Light yellow oil; IR (film) 2200, 1670 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.59-7.54 (m, 2H) 7.47-7.33 (m, 3H), 2.75 (septet, J = 6.9 Hz, 1H), 1.26 (d, J = 6.9 Hz, 6H); ^{13}C NMR (75 MHz, CDCl_3) δ 192.3, 133.1, 130.8, 128.8, 120.3, 91.7, 87.0, 43.2, 18.2.

Li, Z.; Gevorgyan, V. *Angew. Chem., Int. Ed.* **2011**, 50, 2808–2810.

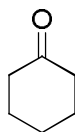
Table 2, entry 15



Dodecan-2-one: Colorless oil; IR (film) 1719 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 2.37 (t, $J = 7.5$ Hz, 2H), 2.09 (s, 3H), 1.59-1.46 (m, 2H), 1.33-1.13 (m, 14H), 0.83 (t, $J = 6.9$ Hz, 3H); ^{13}C NMR (75 MHz, CDCl_3) δ 209.4, 43.9, 32.0, 29.9, 29.7, 29.6, 29.5, 29.4, 29.3, 24.0, 22.8, 14.2.

Mitsudo, K.; Kaide, T.; Nakamoto, E.; Yoshida, K.; Tanaka, H. *J. Am. Chem. Soc.* **2007**, *129*, 2246–2247.

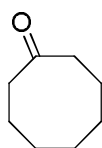
Table 2, entry 16



Cyclohexanone: Colorless oil; IR (film) 1716 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 2.29-2.17 (m, 4H), 1.83-1.69 (m, 4H), 1.68-1.56 (m, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 211.9, 41.9, 27.0, 24.9.

Maji, T.; Karmakar, A.; Reiser, O. *J. Org. Chem.* **2011**, *76*, 736–739.

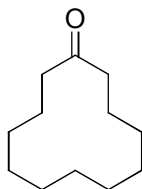
Table 2, entry 17



Cyclooctanone: White solid; mp 40-41 $^{\circ}\text{C}$ (lit. mp 43.80 $^{\circ}\text{C}$); IR (film) 1699 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 2.38-2.28 (m, 4H), 1.87-1.74 (m, 4H), 1.53-1.41 (m, 4H), 1.35-1.24 (m, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 218.4, 42.0, 27.2, 25.7, 24.8.

(a) Tanaka, H.; Kubota, J.; Miyahara, S.; Kuroboshi, M. *Bull. Chem. Soc. Jpn.* **2005**, *78*, 1677–1684. (b) Kohler, E. P.; Tishler, M.; Potter, H.; Thompson, H. T. *J. Am. Chem. Soc.* **1939**, *61*, 1057–1061.

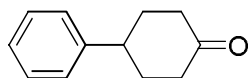
Table 2, entry 18



Cyclododecanone: White solid; mp 59-60 $^{\circ}\text{C}$ (lit. mp 60-61 $^{\circ}\text{C}$); IR (film) 1706 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 2.47-2.43 (m, 4H), 1.75-1.61 (m, 4H), 1.39-1.18 (m, 14H); ^{13}C NMR (75 MHz, CDCl_3) δ 213.0, 40.5, 24.9, 24.7, 24.4, 22.7, 22.5.

(a) Kamijo, S.; Matsumura, S.; Inoue, M. *Org. Lett.* **2010**, *12*, 4195–4197. (b) Nozaki, H.; Noyori, R. *J.*

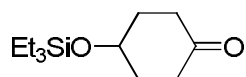
Table 2, entry 19



4-Phenylcyclohexanone: White solid; mp 75–77 °C (lit. mp 76–79 °C); IR (film) 1716 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 7.43–7.21 (m, 5H), 3.14–2.98 (m, 1H), 2.62–2.48 (m, 4H), 2.31–2.18 (m, 2H), 2.10–1.88 (m, 2H); ¹³C NMR (75 MHz, CDCl₃) δ 211.2, 144.9, 128.7, 126.8, 126.7, 42.8, 41.4, 34.0.

(a) Maji, T.; Karmakar, A.; Reiser, O. *J. Org. Chem.* **2011**, *76*, 736–739. (b) Hajipour, A. R.; Mallakpour, S. E.; Khoee, S. *Synth. Commun.* **2002**, *32*, 9–15.

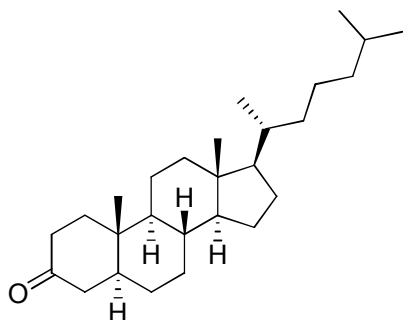
Table 2, entry 20



4-(triethylsilyloxy)cyclohexanone: Colorless oil; IR (film) 1720 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 4.13–4.06 (m, 1H), 2.68–2.56 (m, 2H), 2.25–2.14 (m, 2H), 1.99–1.80 (m, 4H), 0.94 (t, *J* = 8.0 Hz, 9H), 0.59 (q, *J* = 8.0 Hz, 6H); ¹³C NMR (75 MHz, CDCl₃) δ 211.9, 66.1, 37.2, 34.5, 7.0, 5.0.

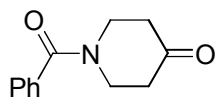
Uyanik, M.; Akakura, M.; Ishihara, K. *J. Am. Chem. Soc.* **2009**, *131*, 251–262.

Table 2, entry 21



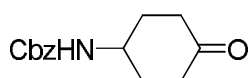
(5α)-Cholestan-3-one: White solid; mp 127–128 °C (lit. mp 128–129 °C); IR (film) 1717 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 2.44–2.33 (m, 1H), 2.32–2.18 (m, 2H), 2.11–2.06 (m, 1H), 2.05–1.92 (m, 2H), 1.87–1.74 (m, 1H), 1.72–1.63 (m, 1H), 1.60–1.42 (m, 5H), 1.40–1.01 (m, 17H), 0.99 (s, 3H), 0.89 (d, *J* = 6.6 Hz, 3H), 0.85 (d, *J* = 6.6 Hz, 3H), 0.84 (d, *J* = 6.6 Hz, 3H), 0.76–0.69 (m, 1H), 0.66 (s, 3H); ¹³C NMR (75 MHz, CDCl₃) δ 212.2, 56.5, 54.0, 46.9, 44.9, 42.8, 40.1, 39.7, 38.7, 38.4, 36.3, 36.0, 35.8, 35.6, 31.9, 29.2, 28.4, 28.2, 24.4, 24.0, 23.0, 22.7, 21.6, 18.8, 12.2, 11.6.

(a) Kamijo, S.; Amaoka, Y.; Inoue, M. *Synthesis* **2010**, 2475–2489. (b) Barton, D. H. R.; Campos-Neves, A. D. S.; Cookson, R. C. *J. Chem. Soc.* **1956**, 3500–3506.

Table 2, entry 22

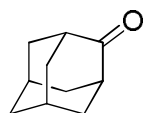
1-Benzoylpiperidin-4-one: Viscous colorless oil; IR (film) 1717, 1635 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.44-7.31 (m, 5H), 3.87 (br, s, 2H), 3.74 (br, s, 2H), 2.43 (br, s, 4H); ^{13}C NMR (75 MHz, CDCl_3) δ 206.7, 170.9, 135.2, 130.2, 128.7, 126.9, 46.4, 41.2.

(a) Barbe, G.; Charette, A. B. *J. Am. Chem. Soc.* **2008**, *130*, 18–19. (b) Hirsch, J. A.; Havinga, E. *J. Org. Chem.* **1976**, *41*, 455–462.

Table 2, entry 23

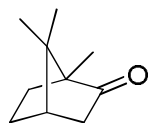
Benzyl 4-oxocyclohexylcarbamate: Off-white solid; mp 79-81 $^{\circ}\text{C}$ (lit. mp 83-85 $^{\circ}\text{C}$); IR (film) 1713, 1531 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.40-7.29 (m, 5H), 5.11 (s, 2H), 4.72 (br, s, 1H), 3.99 (br, s, 1H), 2.48-2.34 (m, 4H), 2.32-2.16 (m, 2H), 1.78-1.60 (m, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 210.0, 155.8, 136.4, 128.6, 128.3, 128.2, 66.8, 47.9, 38.9, 32.0.

(a) Hayashi, M.; Shibuya, M.; Iwabuchi, Y. *J. Org. Chem.* **2012**, *77*, 3005–3009. (b) Büttner, A.; Cottin, T.; Xu, J.; Tzagkaroulaki, L.; Giannis, A. *Bioorg. Med. Chem.* **2010**, *18*, 3387–3402.

Table 2, entry 24

2-Adamantanone: White solid; mp 255-257 $^{\circ}\text{C}$ (lit. mp 256-259 $^{\circ}\text{C}$); IR (film) 1719 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 2.52 (s, 2H), 2.11-1.91 (m, 12H); ^{13}C NMR (75 MHz, CDCl_3) δ 218.6, 47.1, 39.4, 36.4, 27.6.

(a) Singh, C.; Singh, A. S.; Naikade, N. K.; Verma, V. P.; Hassam, M.; Gupta, N.; Pandey, S. *Synthesis* **2010**, 1014–1022. (b) Tucker-Schwartz, A. K.; Garrell, R. L. *Chem.-Eur. J.* **2010**, *16*, 12718–12726.

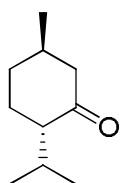
Table 2, entry 25

(–)-Camphor: White solid; mp 176-178 $^{\circ}\text{C}$ (lit. mp 176.9-177.5 $^{\circ}\text{C}$); IR (film) 1743 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 2.32 (dt, $J = 18, 3.9$ Hz, 1H), 2.05 (t, $J = 4.5$ Hz, 1H), 1.97-1.85 (m, 1H), 1.80 (d, J

= 18 Hz, 1H), 1.70-1.57 (m, 1H), 1.42-1.25 (m, 2H), 0.92 (s, 3H), 0.87 (s, 3H), 0.80 (s, 3H); ^{13}C NMR (75 MHz, CDCl_3) δ 219.8, 57.9, 46.9, 43.5, 43.2, 30.1, 27.2, 19.9, 19.3, 9.4.

a) Tanaka, H.; Chou, J.; Mine, M.; Kuroboshi, M. *Bull. Chem. Soc. Jpn.* **2004**, 77, 1745–1755. (b) Meyer, W. L.; Capsheaw, C. E.; Johnson, J. H.; Klusener, A. R.; Lobo, A. P.; McCarty, R. N. *J. Org. Chem.* **1977**, 42, 527–534.

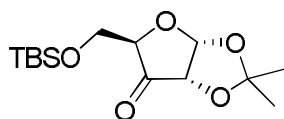
Table 2, entry 26



(–)-Menthone: Colorless oil; IR (film) 1711 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 2.31 (ddd, $J = 12.6, 3.6, 2.1\text{ Hz}$, 1H), 2.15-1.74 (m, 6H), 1.41-1.22 (m, 2H), 0.97 (d, $J = 6.0\text{ Hz}$, 3H), 0.87 (d, $J = 6.9\text{ Hz}$, 3H), 0.81 (d, $J = 6.9\text{ Hz}$, 3H); ^{13}C NMR (75 MHz, CDCl_3) δ 212.5, 56.0, 51.0, 35.6, 34.1, 28.0, 26.0, 22.4, 21.4, 18.8.

Hodgson, D. M.; Salik, S.; Fox, D. J. *J. Org. Chem.* **2010**, 75, 2157–2168.

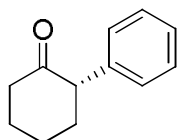
Table 2, entry 27



5-*O*-*tert*-Butyldimethylsilyl-1,2-*O*-isopropylidene- α -D-erythro-3-pentulofuranose: Viscous colorless oil; IR (film) 1777 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 6.13 (d, $J = 4.5\text{ Hz}$, 1H), 4.38-4.34 (m, 1H), 4.27 (dd, $J = 4.5, 1.1\text{ Hz}$, 1H), 3.88 (dd, $J = 10.8, 1.8\text{ Hz}$, 1H), 3.81 (dd, $J = 10.8, 2.3\text{ Hz}$, 1H), 1.43 (s, 6H), 0.84 (s, 9H), 0.04 (s, 3H), 0.02 (s, 3H); ^{13}C NMR (75 MHz, CDCl_3) δ 211.1, 114.2, 103.9, 81.9, 77.3, 64.1, 27.9, 27.4, 25.9, 18.3, -5.4, -5.6.

(a) Shibuya, M.; Osada, Y.; Sasano, Y.; Tomizawa, M.; Iwabuchi, Y. *J. Am. Chem. Soc.* **2011**, 133, 6497–6500. (b) Yoshimura, Y.; Sano, T.; Matsuda, A.; Ueda, T. *Chem. Pharm. Bull.* **1988**, 36, 162–167.

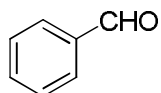
Table 2, entry 28



(*S*)-2-Phenylcyclohexanone: White solid; mp 38-39 °C (lit. mp 39-40 °C); $[\alpha]_D^{26} = -107.5$ (c 0.96, CHCl_3) (99.9% ee); IR (film) 1714 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.39-7.23 (m, 3H), 7.19-7.12 (m,

2H), 3.63 (dd, $J = 12.0, 5.4$ Hz, 1H), 2.59-2.41 (m, 2H), 2.34-2.23 (m, 1H), 2.21-1.95 (m, 3H), 1.92-1.77 (m, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 210.4, 138.9, 128.7, 128.5, 127.0, 57.5, 42.3, 35.2, 27.9, 25.4.
Leung, D.; Anslyn, E. V. *Org. Lett.* **2011**, *13*, 2298–2301.

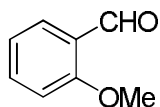
Table 3, entry 1



Benzaldehyde: Colorless oil; IR (film) 1686 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 10.01 (s, 1H), 7.90-7.82 (m, 2H), 7.66-7.58 (m, 1H), 7.56-7.48 (m, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 192.5, 136.6, 134.6, 129.9, 129.2.

Yuan, Y.; Shi, X.; Liu, W. *Synlett* **2011**, 559–564.

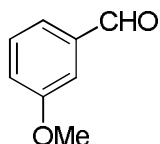
Table 3, entry 2



2-Methoxybenzaldehyde: Light yellow solid; mp $37\text{--}39\text{ }^\circ\text{C}$ (lit. mp $36\text{--}38\text{ }^\circ\text{C}$); IR (film) 1688 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 10.47 (s, 1H), 7.82 (dd, $J = 7.8, 2.1$ Hz, 1H), 7.58-7.51 (m, 1H), 7.05-6.96 (m, 2H), 3.92 (s, 3H); ^{13}C NMR (75 MHz, CDCl_3) δ 189.9, 162.0, 136.1, 128.6, 124.9, 120.8, 111.8, 55.7.

Miao, C.-X.; He, L.-N.; Wang, J.-L.; Wu, F. *J. Org. Chem.* **2010**, *75*, 257–260.

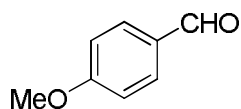
Table 3, entry 3



3-Methoxybenzaldehyde: Colorless oil; IR (film) 1703 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 9.95 (s, 1H), 7.46-7.40 (m, 2H), 7.39-7.35 (m, 1H), 7.19-7.11 (m, 1H), 3.84 (s, 3H); ^{13}C NMR (75 MHz, CDCl_3) δ 192.3, 160.3, 138.0, 130.2, 123.6, 121.6, 112.2, 55.6.

Miao, C.-X.; He, L.-N.; Wang, J.-L.; Wu, F. *J. Org. Chem.* **2010**, *75*, 257–260.

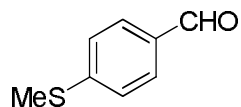
Table 3, entry 4



4-Methoxybenzaldehyde: Light yellow oil; IR (film) 1684 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 9.82 (s, 1H), 7.78 (d, $J = 8.4\text{ Hz}$, 2H), 6.94 (d, $J = 8.4\text{ Hz}$, 2H), 3.82 (s, 3H); ^{13}C NMR (75 MHz, CDCl_3) δ 190.8, 164.7, 132.0, 130.0, 114.4, 55.6.

Yuan, Y.; Shi, X.; Liu, W. *Synlett* **2011**, 559–564.

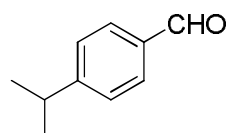
Table 3, entry 5



4-(Methylthio)benzaldehyde: Light yellow oil; IR (film) 1696 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 9.89 (s, 1H), 7.74 (d, $J = 9.0\text{ Hz}$, 2H), 7.29 (d, $J = 9.0\text{ Hz}$, 2H), 2.50 (s, 3H); ^{13}C NMR (75 MHz, CDCl_3) δ 191.3, 148.0, 133.0, 130.1, 125.3, 14.8.

Hayashi, M.; Shibuya, M.; Iwabuchi, Y. *J. Org. Chem.* **2012**, 77, 3005–3009.

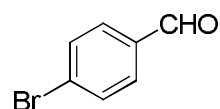
Table 3, entry 6



4-Isopropylbenzaldehyde: Colorless oil; IR (film) 1702 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 9.97 (s, 1H), 7.81 (d, $J = 8.4\text{ Hz}$, 2H), 7.38 (d, $J = 8.4\text{ Hz}$, 2H), 2.98 (septet, $J = 6.9\text{ Hz}$, 1H), 1.27 (d, $J = 6.9\text{ Hz}$, 6H); ^{13}C NMR (75 MHz, CDCl_3) δ 192.1, 156.4, 134.7, 130.2, 127.3, 34.6, 23.8.

Han, C.; Buchwald, S. L. *J. Am. Chem. Soc.* **2009**, 131, 7532–7533.

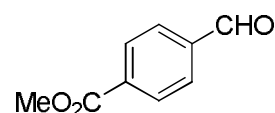
Table 3, entry 7



4-Bromobenzaldehyde: White solid; mp $56\text{--}57\text{ }^\circ\text{C}$ (lit. mp $59\text{--}60\text{ }^\circ\text{C}$); IR (film) 1689 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 9.96 (s, 1H), 7.73 (d, $J = 8.4\text{ Hz}$, 2H); 7.67 (d, $J = 8.4\text{ Hz}$, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 191.2, 135.2, 132.6, 131.1, 129.9.

Shaikh, T. M. A.; Emmanuvel, L.; Sudalai, A. *J. Org. Chem.* **2006**, 71, 5043–5046.

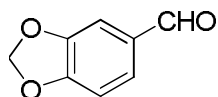
Table 3, entry 8



Methyl 4-formylbenzoate: White solid; mp 53-54 °C (lit. mp 54-55 °C); IR (film) 1724, 1685 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 10.05 (s, 1H), 8.14 (d, *J* = 8.4 Hz, 2H), 7.90 (d, *J* = 8.4 Hz, 2H), 3.91 (s, 3H); ¹³C NMR (75 MHz, CDCl₃) δ 191.7, 166.1, 139.3, 135.2, 130.3, 129.6, 52.7.

Pelletier, G.; Bechara, W. S.; Charette, A. B. *J. Am. Chem. Soc.* **2010**, *132*, 12817–12819.

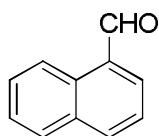
Table 3, entry 9



3,4-Methylenedioxybenzaldehyde: White crystalline solid; mp 35-36 °C (lit. mp 35-37 °C); IR (film) 1686 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 9.79 (s, 1H), 7.40 (dd, *J* = 7.8, 1.2 Hz, 1H), 7.31 (d, *J* = 1.2 Hz, 1H), 6.92 (d, *J* = 7.8 Hz, 1H), 6.06 (s, 2H); ¹³C NMR (75 MHz, CDCl₃) δ 190.4, 153.2, 148.9, 132.0, 128.8, 108.5, 107.0, 102.3.

Qian, W.; Jin, E.; Bao, W.; Zhang, Y. *Angew. Chem., Int. Ed.* **2005**, *44*, 952–955.

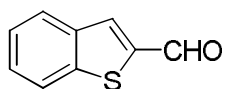
Table 3, entry 10



1-Naphthaldehyde: Light yellow oil; IR (film) 1689 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 10.30 (s, 1H), 9.24 (d, *J* = 8.7 Hz, 1H), 7.96 (d, *J* = 8.4 Hz, 1H), 7.86-7.78 (m, 2H), 7.66-7.58 (m, 1H), 7.56-7.44 (m, 2H); ¹³C NMR (75 MHz, CDCl₃) δ 193.4, 136.6, 135.1, 133.6, 131.2, 130.4, 128.9, 128.4, 126.8, 124.8.

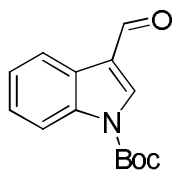
Lee, K.; Maleczka, Jr., R. E. *Org. Lett.* **2006**, *8*, 1887–1888.

Table 3, entry 11



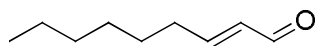
Benzo[b]thiophene-2-carbaldehyde: Light yellow solid; mp 33-35 °C (lit. mp 34-35 °C); IR (film) 1670 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 10.05 (s, 1H), 7.95 (s, 1H), 7.91-7.81 (m, 2H), 7.49-7.43 (m, 1H), 7.42-7.36 (m, 1H); ¹³C NMR (75 MHz, CDCl₃) δ 184.7, 143.3, 142.6, 138.6, 134.6, 128.2, 126.3, 125.3, 123.3.

(a) Pessoa-Mahana, H.; Kosche C., J.; Ron H., N.; Recabarren-Gajardo, G.; Saitz B., C.; Araya-Maturana, R.; Pessoa-Mahana, C. D. *Heterocycles* **2008**, *75*, 1913–1929. (b) Podea, P. V.; Toşa, M. I.; Paizs, C.; Irimie, F. D. *Tetrahedron: Asymmetry* **2008**, *19*, 500–511.

Table 3, entry 12

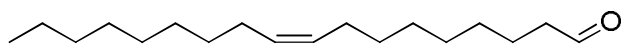
tert-Butyl 3-formyl-1H-indole-1-carboxylate: White solid; mp 127-129 °C (lit. mp 124-126 °C); IR (film) 1743, 1680 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 10.06 (s, 1H), 8.29-8.24 (m, 1H), 8.19 (s, 1H), 8.15-8.09 (m, 1H), 7.44-7.30 (m, 2H), 1.70 (s, 9H); ^{13}C NMR (75 MHz, CDCl_3) δ 185.9, 148.9, 136.7, 136.1, 126.2, 124.7, 122.3, 121.7, 115.3, 85.8, 28.2.

Waser, J.; Gaspar, B.; Nambu, H.; Carreira, E. M. *J. Am. Chem. Soc.* **2006**, *128*, 11693–11712.

Table 3, entry 13

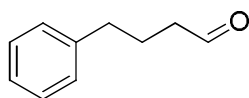
(E)-Non-2-enal: Colorless oil; IR (film) 1698 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 9.46 (d, J = 7.8 Hz, 1H), 6.81 (dt, J = 15.6, 6.9 Hz, 1H), 6.11 (ddt, J = 15.6, 7.8, 1.5 Hz, 1H), 2.34-2.26 (m, 2H), 1.51-1.40 (m, 2H), 1.36-1.19 (m, 6H), 0.85 (t, J = 6.6 Hz, 3H); ^{13}C NMR (75 MHz, CDCl_3) δ 194.2, 159.1, 133.1, 32.8, 31.6, 28.9, 27.9, 22.6, 14.1.

Ren, H.; Krasovskiy, A.; Knochel, P. *Org. Lett.* **2004**, *6*, 4215–4217.

Table 3, entry 14

Olealdehyde: Colorless oil; IR (film) 1729 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 9.75 (t, J = 1.8 Hz, 1H), 5.39-5.26 (m, 2H), 2.40 (td, J = 7.2, 1.8 Hz, 2H), 2.04-1.92 (m, 4H), 1.66-1.55 (m, 2H), 1.37-1.17 (m, 20H), 0.87 (t, J = 6.6 Hz, 3H); ^{13}C NMR (75 MHz, CDCl_3) δ 202.9, 130.2, 129.9, 44.1, 32.1, 30.0, 29.9, 29.7, 29.5, 29.4, 29.3, 29.2, 27.4, 27.3, 22.9, 22.3, 14.3.

(a) Uyanik, M.; Suzuki, D.; Yasui, T.; Ishihara, K. *Angew. Chem., Int. Ed.* **2011**, *50*, 5331–5334. (b) Uyanik, M.; Akakura, M.; Ishihara, K. *J. Am. Chem. Soc.* **2009**, *131*, 251–262.

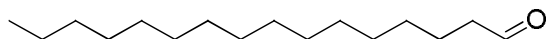
Table 3, entry 15

4-Phenylbutanal: Colorless oil; IR (film) 1708 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 9.76 (t, J = 1.5 Hz, 1H), 7.35-7.16 (m, 5H), 2.67 (t, J = 7.5 Hz, 2H), 2.46 (td, J = 7.5, 1.5 Hz, 2H), 1.98 (quintet, J = 7.5 Hz, 2H); ^{13}C NMR (75 MHz, CDCl_3) δ 202.4, 141.4, 128.6, 126.2, 43.3, 35.1, 23.8.

(a) Zhang, X.; Cao, B.; Yu, S.; Zhang, X. *Angew. Chem., Int. Ed.* **2010**, *49*, 4047–4050. (b) Uyanik, M.;

Akakura, M.; Ishihara, K. *J. Am. Chem. Soc.* **2009**, *131*, 251–262.

Table 3, entry 16



1-Hexadecanal: White solid; mp 34–35 °C (lit. mp 33–35 °C); IR (film) 1712 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 9.75 (t, *J* = 1.5 Hz, 1H), 2.41 (td, *J* = 7.2, 1.5 Hz, 2H), 1.68–1.55 (m, 2H), 1.34–1.20 (m, 24H), 0.87 (t, *J* = 6.5 Hz, 3H); ¹³C NMR (75 MHz, CDCl₃) δ 203.1, 44.1, 32.1, 29.9, 29.8, 29.6, 29.5, 29.4, 22.9, 22.3, 14.3.

Ma, S.; Liu, J.; Li, S.; Chen, B.; Cheng, J.; Kuang, J.; Liu, Y.; Wan, B.; Wang, Y.; Ye, J.; Yu, Q.; Yuan, W.; Yu, S. *Adv. Synth. Catal.* **2011**, *353*, 1005–1017.

STANDARD 1H OBSERVE

Pulse Sequence: szpu1
Solvent: CDCl3
Ambient temperature
F1: 501.136 MHz
INOV-500 "epoxide"
Relax. delay 1.000 sec
Pulse: 49.6 degrees
Acq. time 1.998 sec
Width 4500.5 Hz
4 repetitions
OBSERVE: H1, 300.1592196 MHz
DATA PROCESSING
F1 size 32788
Total time 0 min, 12 sec

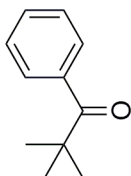
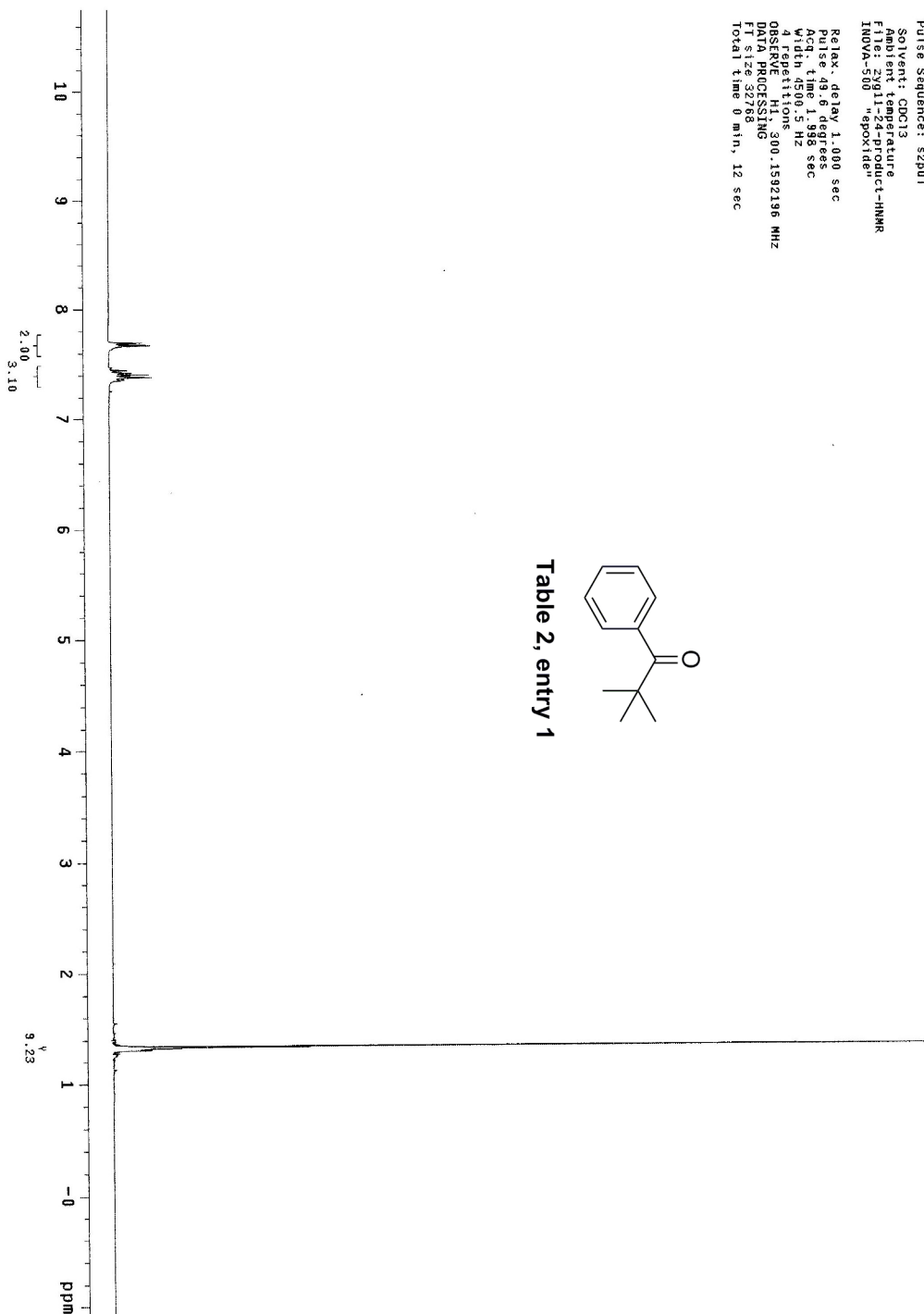


Table 2, entry 1



13C OBSERVE

Pulse Sequence: szpu1
Solvent: CDCl3
Ambient temperature
File: ZYG11-24-product-CNMR
INDVA-500 "epoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
SFO 125.761 MHz
OBSERVED F1 300.160837 MHz
DECOUPLE H1 300.160800 MHz
Power 40 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
F1 size 131072
F2 size 131072
Total time 30 min, 23 sec

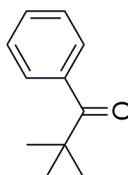
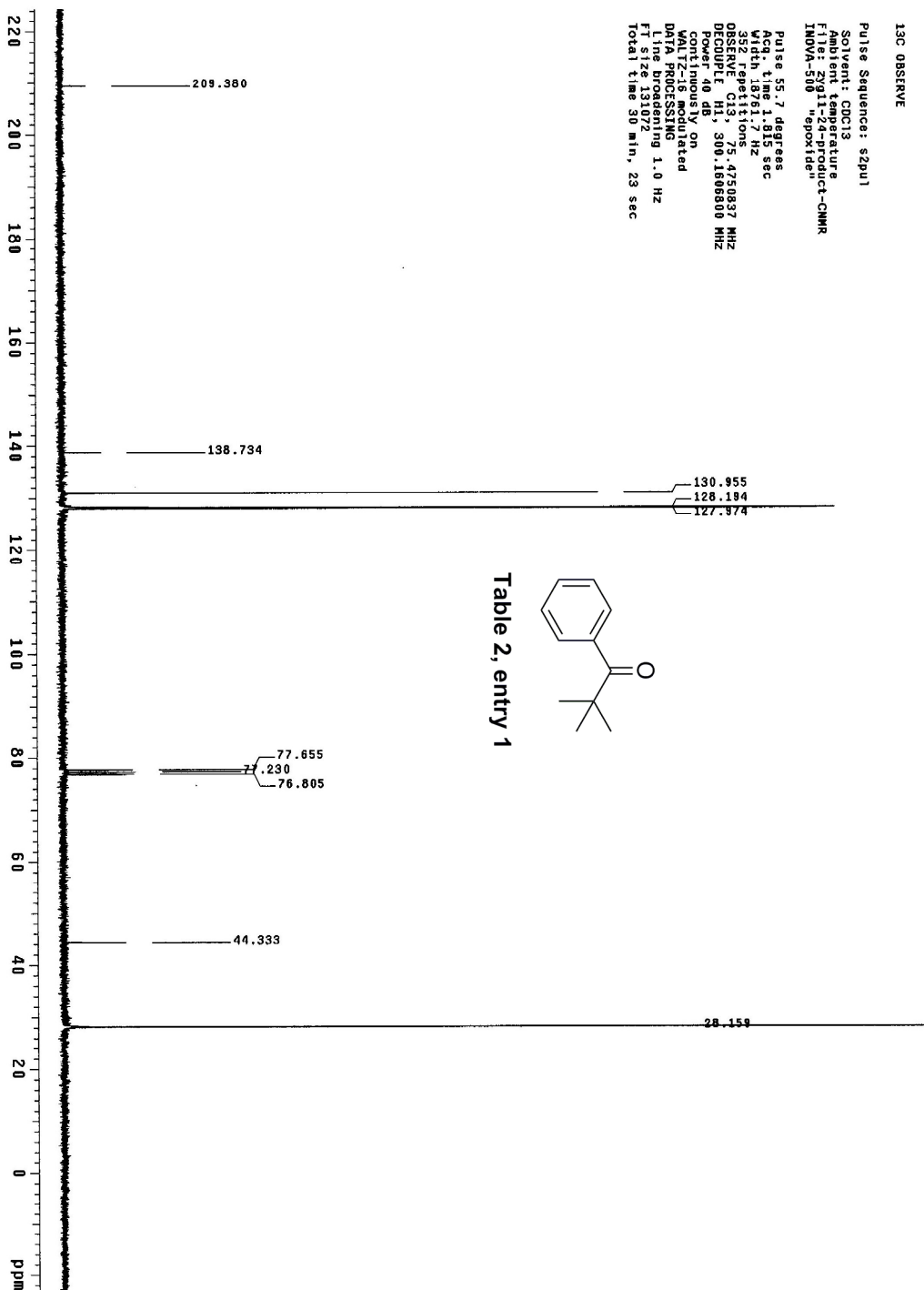


Table 2, entry 1



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: zy911-14-2-product-HMR
INOVA-500 "epoxide"
Relax. delay 1.000 sec
Pulse 49.6 degrees
Acq. time 1.398 sec
Sweep 4360 Hz
4 repetitions
OBSERVE H1: 300.1592196 MHz
DATA PROCESSING
F1 size 32768
Total time 0 min. 12 sec

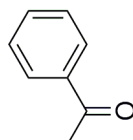
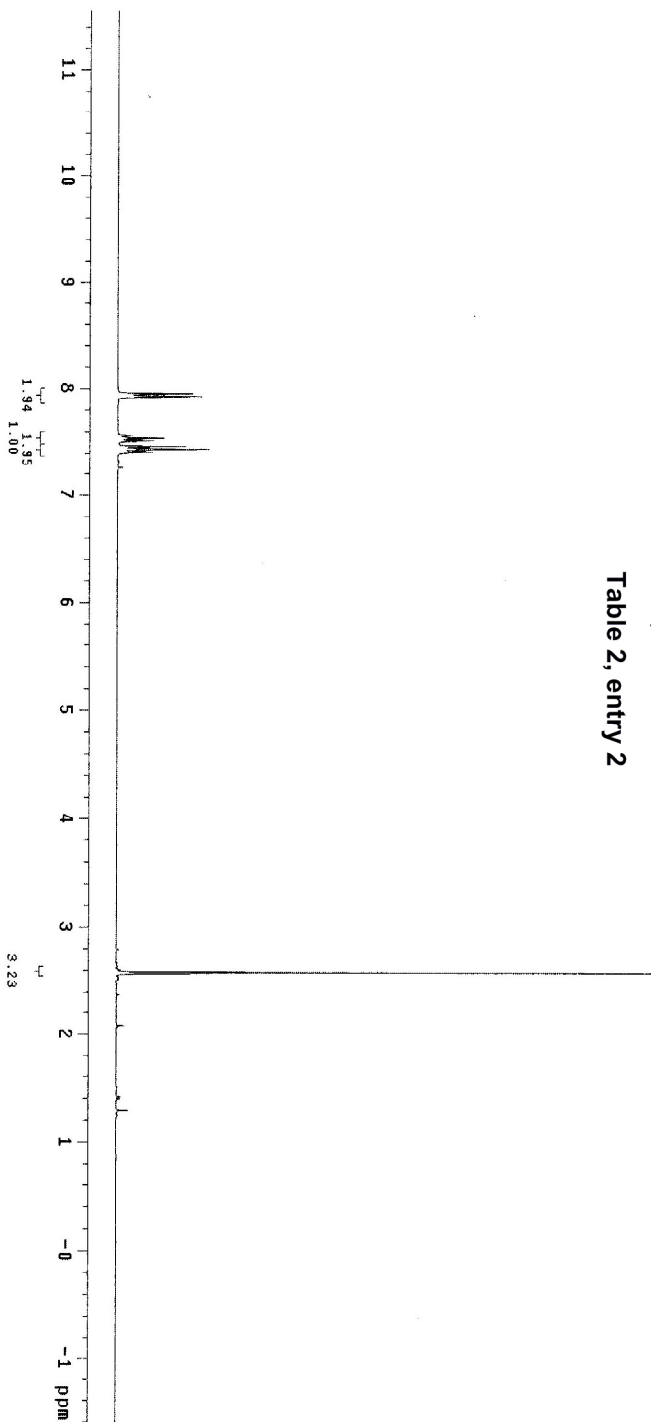


Table 2, entry 2



13C OBSERVE

Pulse Sequence: szpu1

Solvent: CDCl3

Ambient temperature

File: ZYG11-18-2-product-CNMR

INOVA-500 "epoxide"

Pulse 55.7 degrees

Acq. time 1.85 sec

Width 18761.7 Hz

394 repetitions

OBSERVE C13, 75.475063 MHz

DECOUPLE H1, 300.1606500 MHz

Power 40 dB

Gate 100.00000000

WAITZ-18 modulated

DATA PROCESSING

Line broadening 1.0 Hz

FT size 131072

Total time 30 min, 23 sec

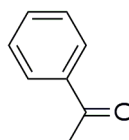
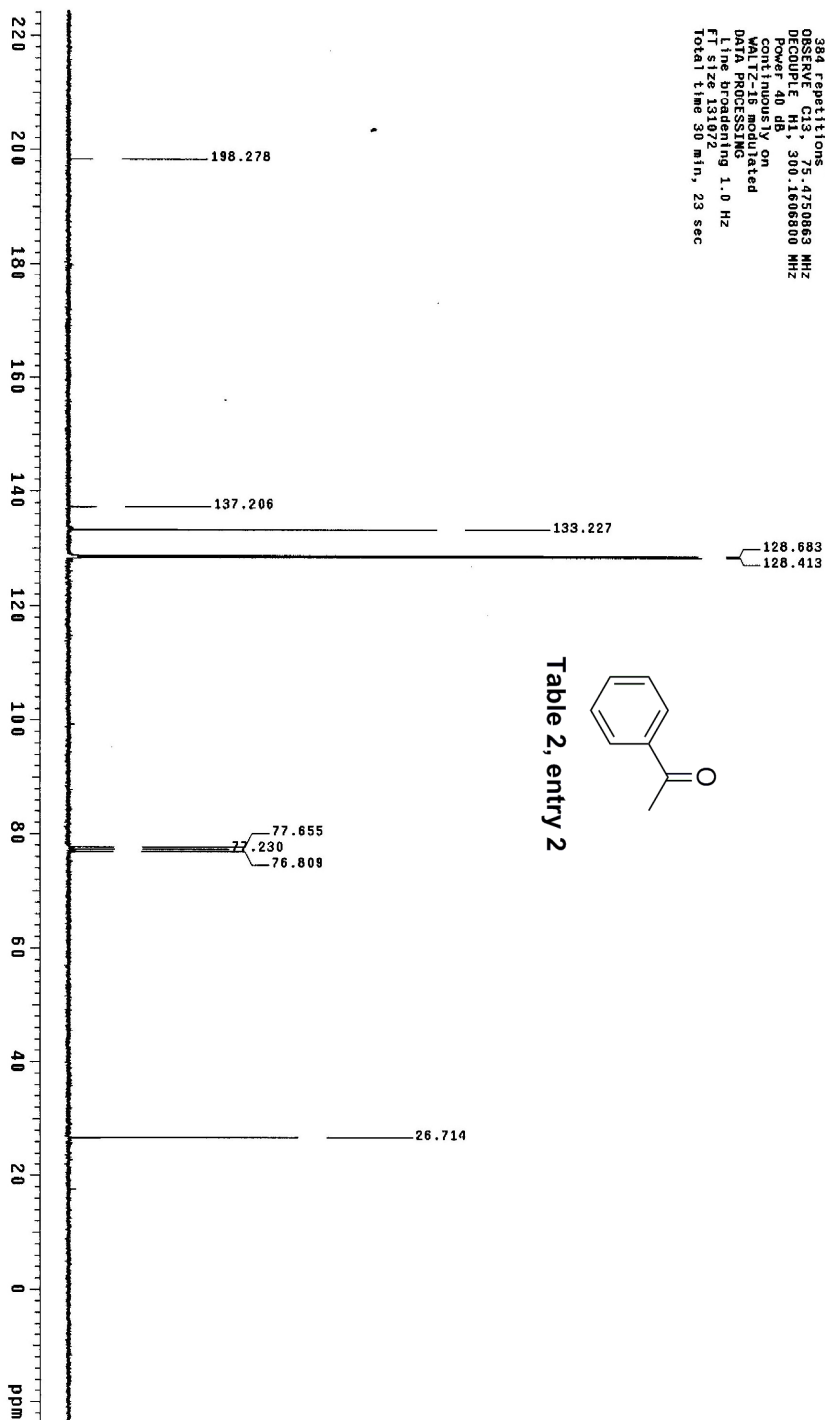


Table 2, entry 2



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: ZYG15-11-product-1HMR
INOVA-500 "epoxide"
Relax, delay 1.000 sec
Pulse 19.6 degrees
Acq time 1.383 sec
Width 4500.5 Hz
4 repetitions
OBSERVE H1, 300.1592196 MHz
DATA PROCESSING
F1 size 32768
Total time 0 min, 12 sec

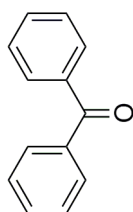
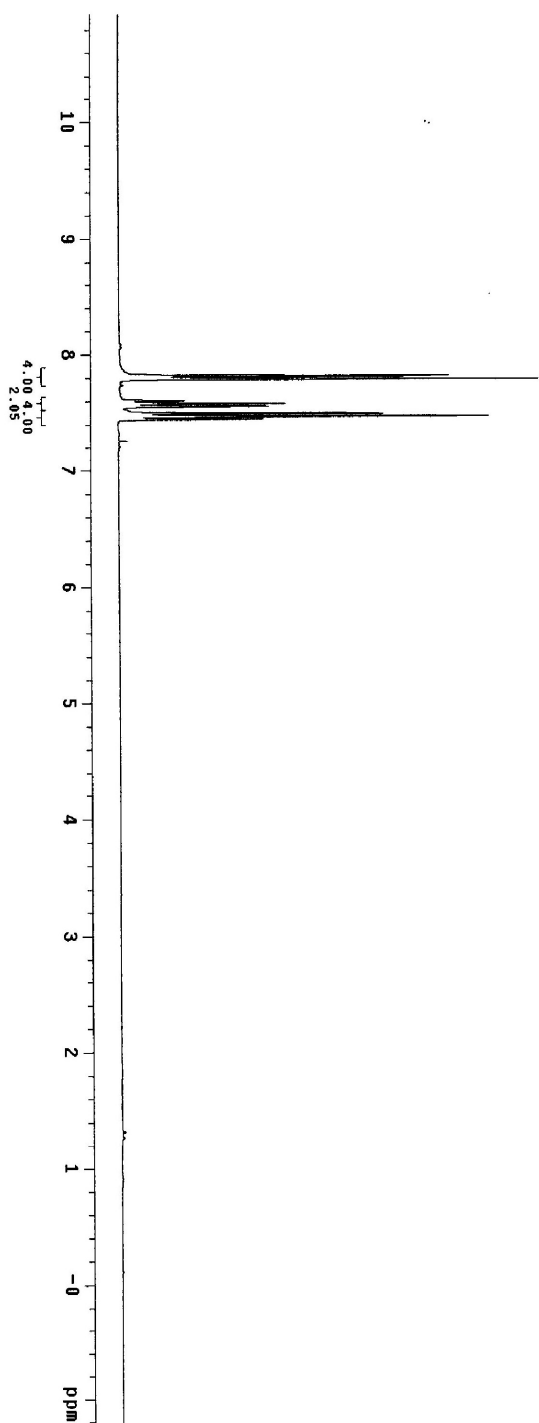


Table 2, entry 3



¹³C OBSERVE

Pulse Sequence: szpul
Solvent: CDCl₃
Sample Temperature: 300 K
File: NY15-417product-CNMR
INDV-500 "epoxide"

Relax. delay 1.500 sec
Pulse 39.1 degrees
Acq. time 0.800 sec
Width 2000.0 Hz
220 repetitions
Observed 420579 MHz
Decouple H₁ 298.3518068 MHz
Power 36 dB
Continuously on
WALTZ-16 modulated
DATA PROCESSING
Time broadening 1.0 Hz
F0 125.76248
Total time 38 min, 28 sec

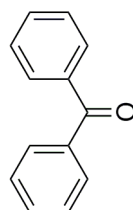
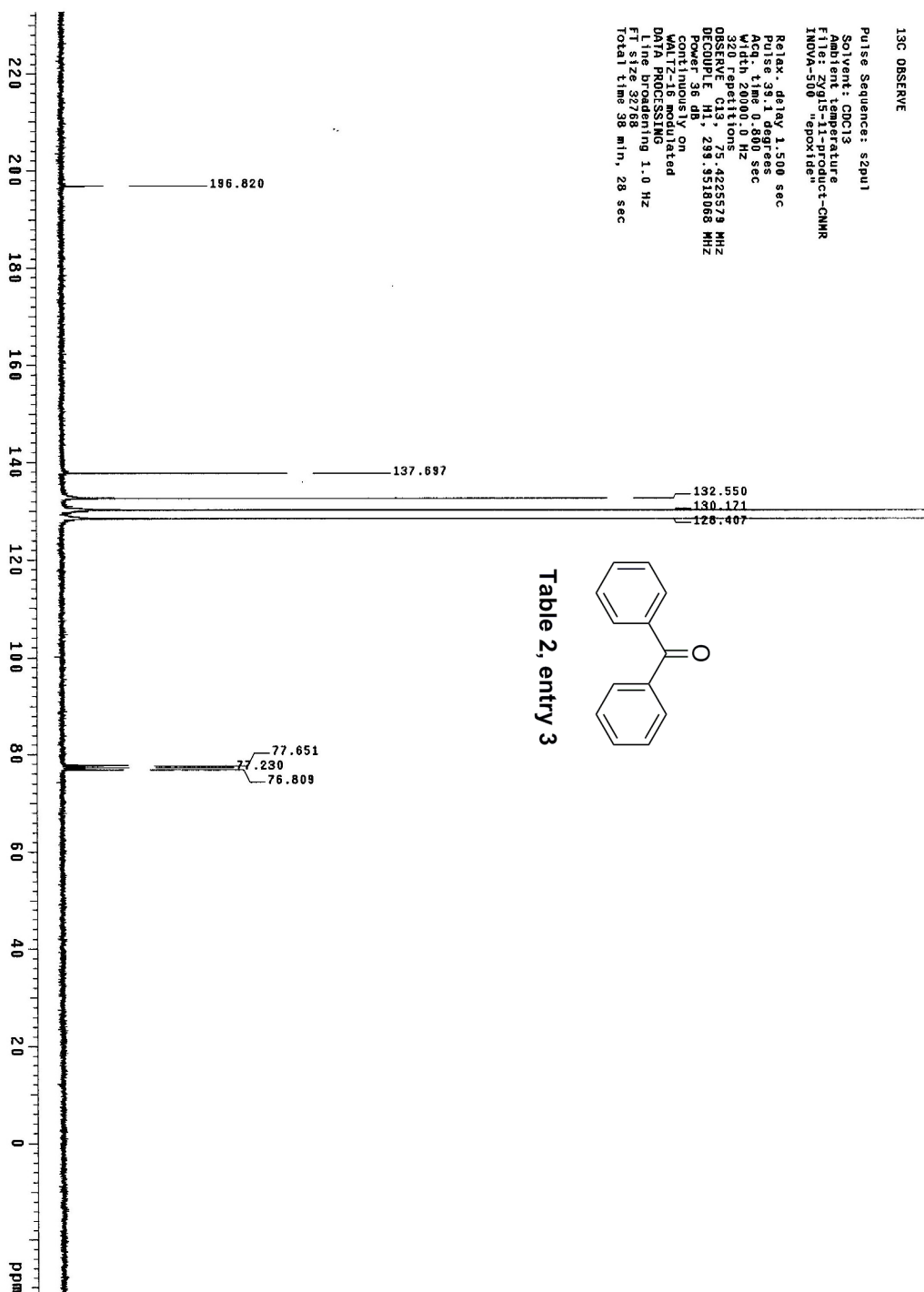


Table 2, entry 3



STANDARD 1H OBSERVE

Pulse Sequence: szpu1
 Solvent: CDCl3
 Ambient temperature
 File: 29G11-15-1 product-HMR
 INOVA-500 epoxide
 Relax. delay 1.000 sec
 Pulse 49.6 degrees
 Acq. time 1.398 sec
 Width 4500.5 Hz
 4 repetitions
 OBSERVE H1, 300.1592196 MHz
 DATA PROCESSING
 F1 127.32584
 Total time 0 min, 12 sec

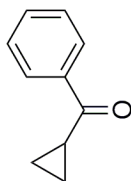
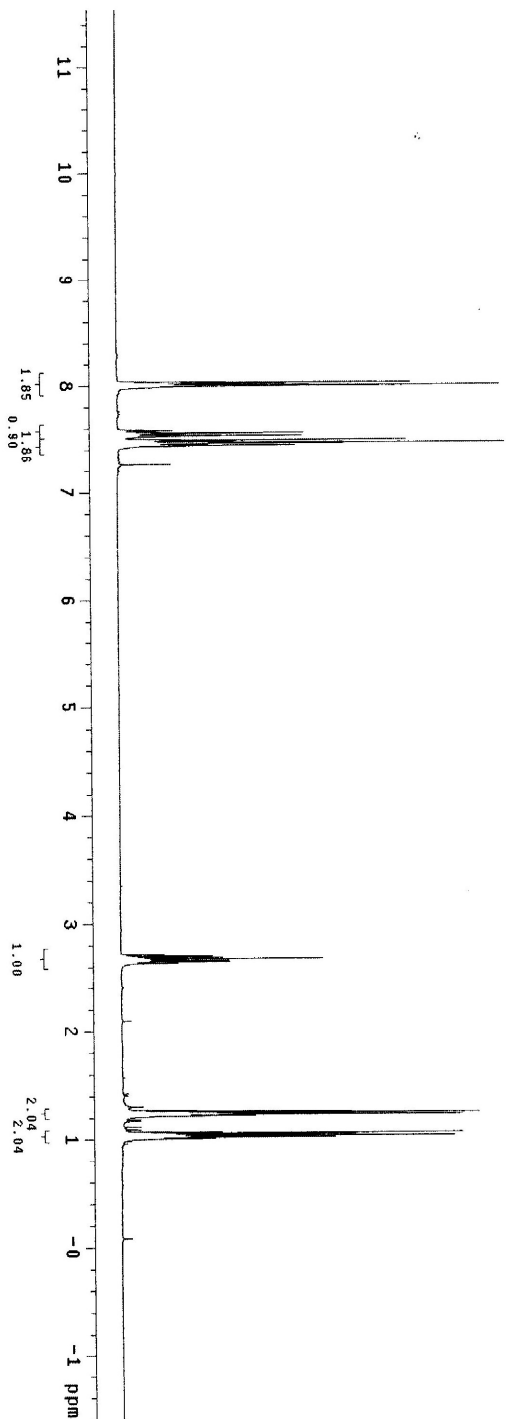


Table 2, entry 4



13C OBSERVE

Pulse Sequence: szpu1

Solvent: CDCl3

Ambient temperature

File: 2yg11-15-1-product-CNMR

INOVA-500 "epoxide"

Pulse 55.7 degrees

Acq. time 1.815 sec

Width 1861.0 Hz

Resolution 0.3 Hz

OBSERVE C13, 75.4750831 MHz

DECOUPLE H1, 300.1606800 MHz

Power 40 dB

continuously on

WALTZ-16 modulated

DHAPASSIVE

Time broadening 1.0 Hz

FI size 131072

Total time 30 min, 23 sec

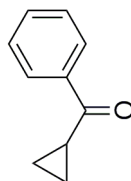
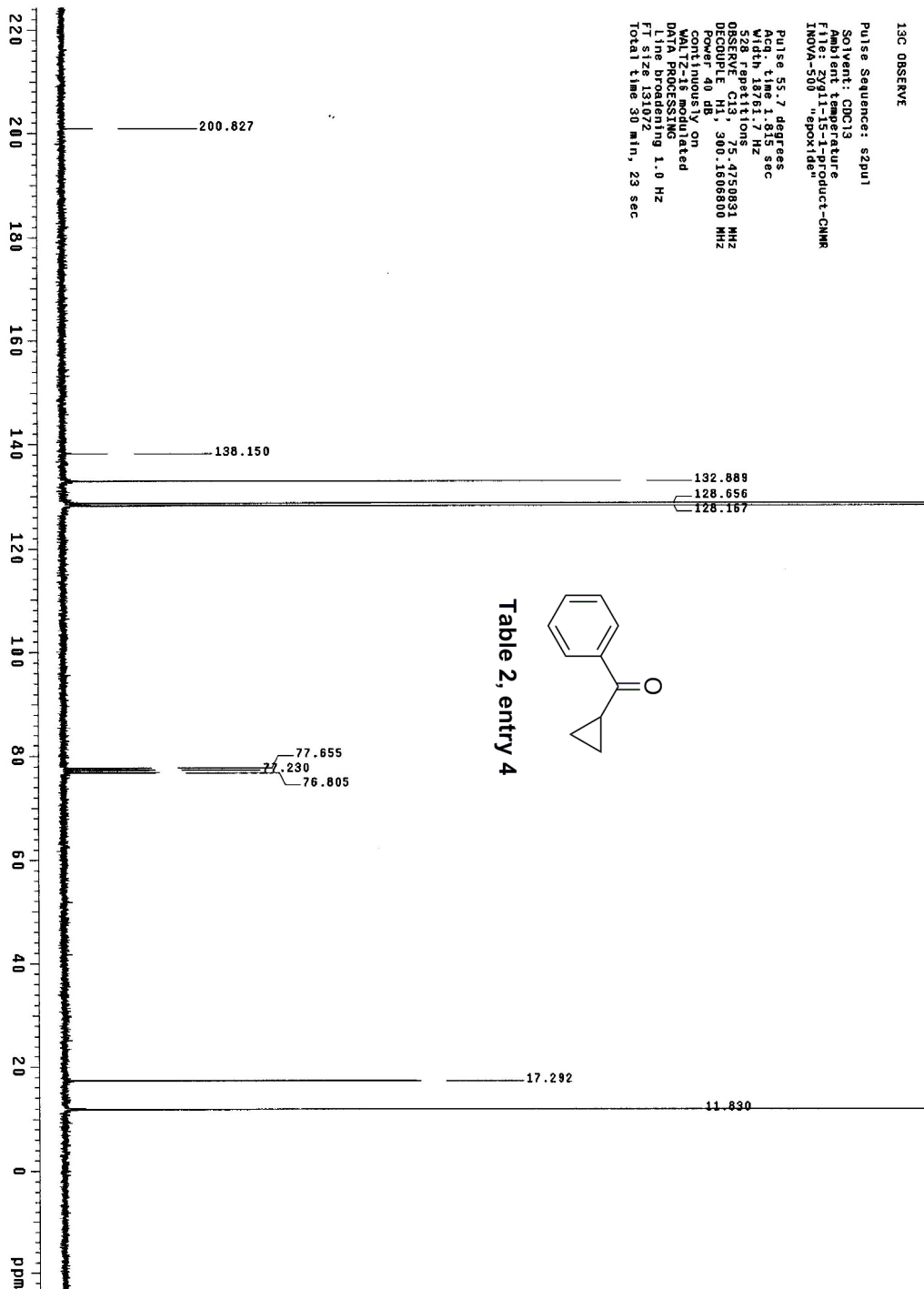


Table 2, entry 4



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: ZYG15-13-product-HNMR
INOVA-500 "epoxide"
Relax. delay 1.000 sec
Pulse 19.6 degrees
Pulse 14.183 sec
Width 4500.5 Hz
4 repetitions
OBSERVE H1, 300.1592196 MHz
DATA PROCESSING
F1 size 32768
Total time 9 min, 12 sec

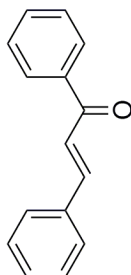
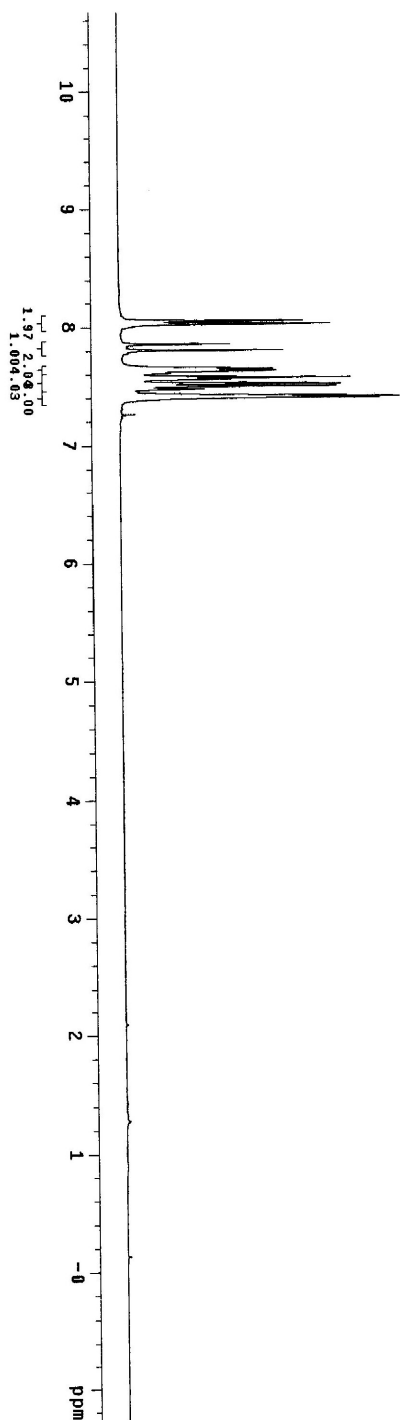


Table 2, entry 5



13C OBSERVE

Pulse Sequence: zgpg30

Solvent: CDCl3

Ambient temperature

File: ZYG15-13-product-CDMK

INOVA-500 "epoxide"

Pulse 55.7 degrees

Acq. 1.55 sec

Width 18261.7 Hz

288 repetitions

OBSERVE C13, 75.475000 MHz

DECOUPLE H1, 300.160600 MHz

Power 40 dB

Continuously on

Watergate

DATA PROCESSING

Line broadening 1.0 Hz

FT size 131072

Total time 30 min, 23 sec

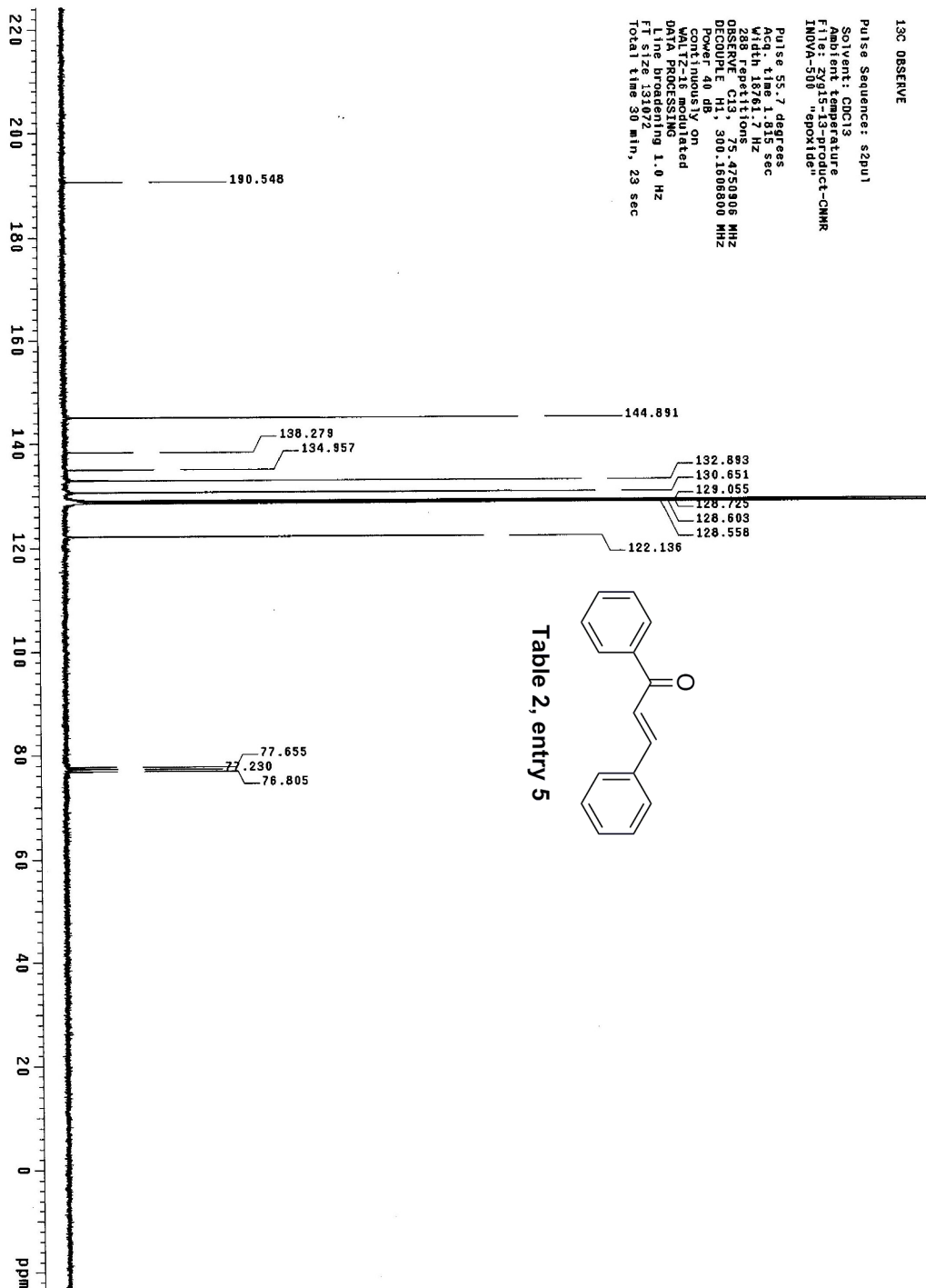


Table 2, entry 5

STANDARD 1H OBSERVE

```
Pulse Sequence: zgpu
Solvent: CDCl3
Ambient temperature
File: 20151214_128-
INMVA-500 "p"probe-
Relax. delay 1.000 sec
Pulse 45.6 degrees
Acq. time 1.935 Sec
Width 4300.3 Hz
Offset 100.613 MHz
DSSREF1: Homs300.15092186 MHz
DATA PROCESSING
File size 32768
Total time 0 min, 12 sec
```

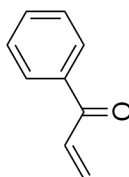
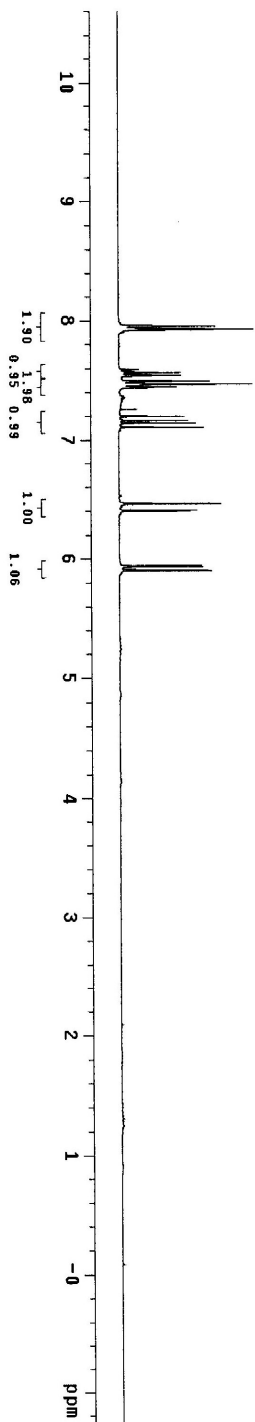


Table 2, entry 6



¹³C OBSERVE

Pulse Sequence: zgpg30

Solvent: CDCl₃

Ambient temperature

File: ZYG12-34-1-Product-CMR

INOVA-500 "epoxide"

Pulse 55.7 degrees

Pd1. time 1.513 sec

Width 186.71 Hz

352 repetitions

OBSERVE C13. 75.4750837 MHz

DECOUPLE H1. 300.160800 MHz

Power 40 dB

cont.Indusly on

Acquisition

DATA PROCESSING

Line broadening 1.0 Hz

FT size 131072

Total time 30 min, 23 sec

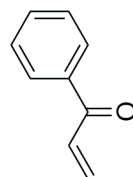
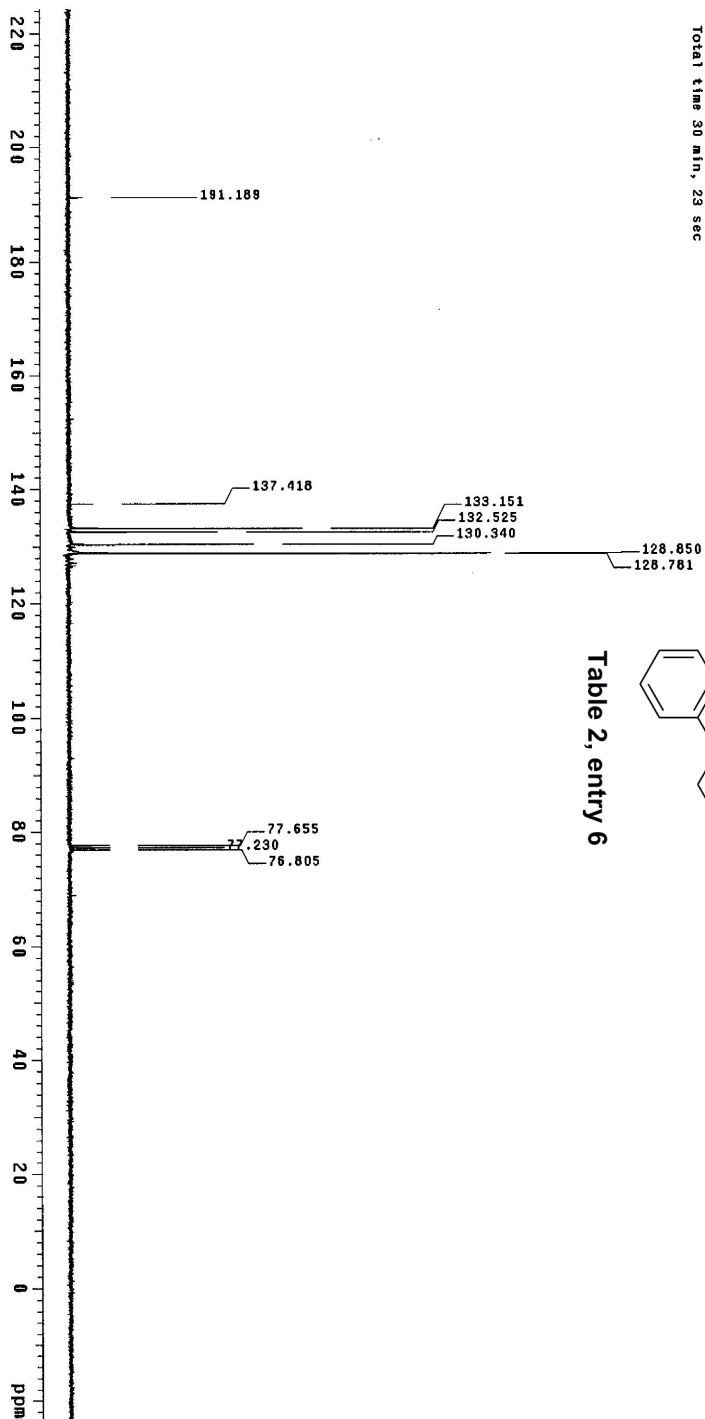


Table 2, entry 6



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1

Solvent: CDCl3

Amplifier: temperature

File: ZY913-24-1-Product-HNMR

INOVA-500 "epoxide"

Relax. delay 1.000 sec

Pulse 49.6 degrees

Acq. time 1.396 sec

NUC1 13C 101.3 MHz

4 repetitions

OBSERVE H1 300.1592196 MHz

DATA PROCESSING

FT size 32768

Total time 0 min. 12 sec

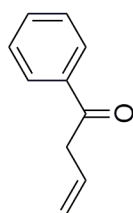
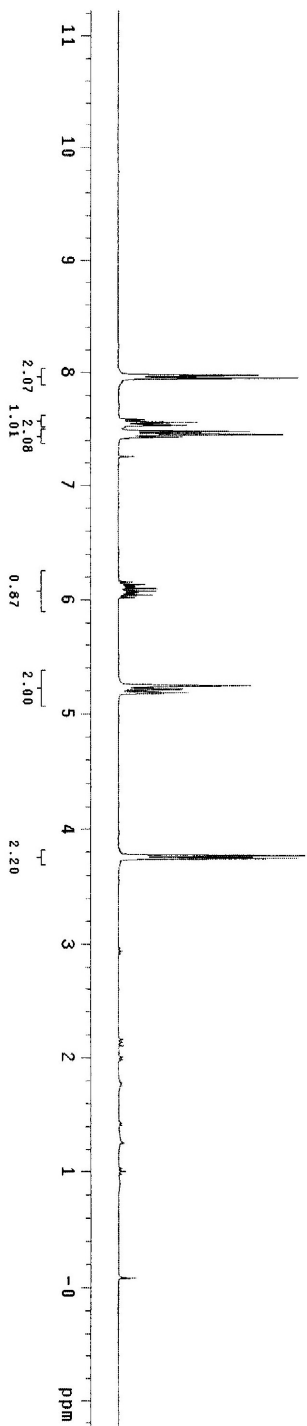


Table 2, entry 7



¹³C OBSERVE

Pulse Sequence: szpul

Solvent: CDCl₃

Ambient temperature

File: ZYG13-24-1-Product-CNMR

INDVA-500 "epoxide"

Pulse 55.7 degrees

Acq. time 1.815 sec

Width 18761.7 Hz

NUC1 13C

OBSERVE C13, 75.4750837 MHz

DECOUPLE H1, 300.1608800 MHz

Power 40 dB

Continuously on

WALTZ16 modulated

D11a PROSS300

Time Broadening 1.0 Hz

FT size 131072

Total time 30 min, 23 sec

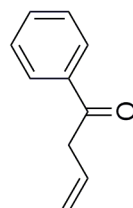
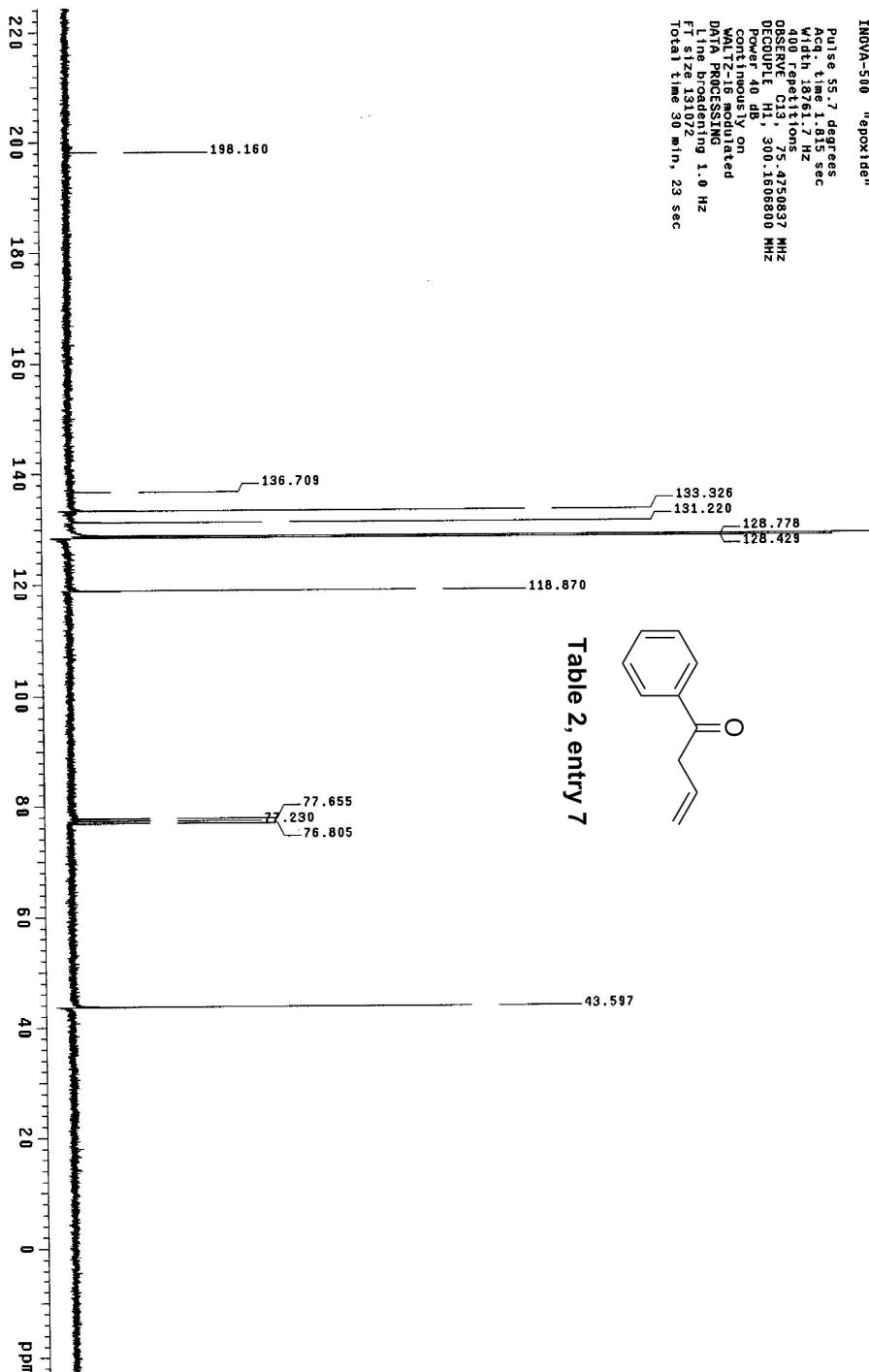


Table 2, entry 7



STANDARD 1H OBSERVE

Pulse Sequence: zgpg30
Solvent: CDCl3
Ambient temperature
File: 2912-27-2-product-HMR
INOVA-500 "epoxide"
Relax: delay 1.000 sec
Pulse: 49.8 degrees
Acq: 128.130 MHz
Width: 12.395 sec
Waltz: 450.5 Hz
4 repetitions
OBSERVE: H1, 300.1592136 MHz
DATA PROCESSING
FT size 32768
Total time 0 min, 12 sec

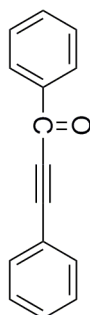
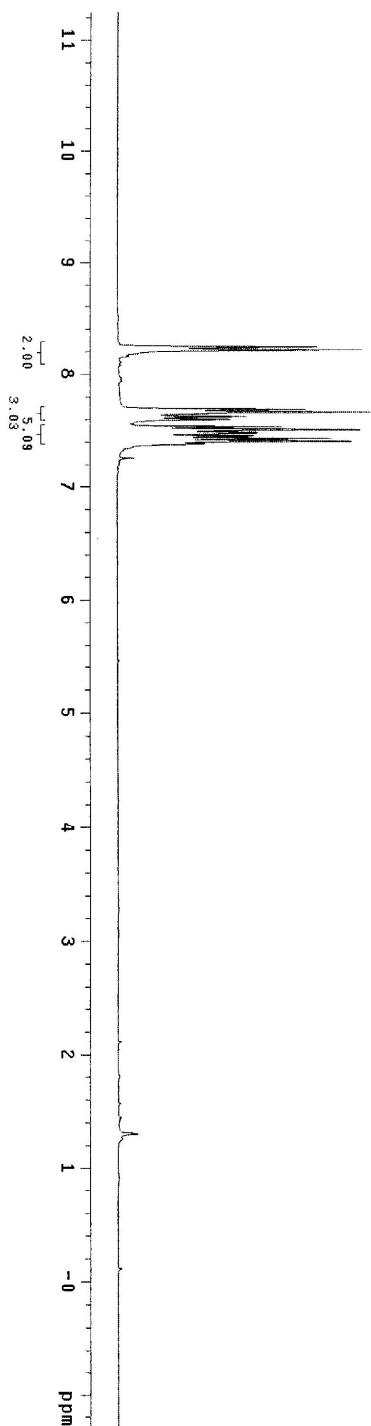


Table 2, entry 8



13C OBSERVE

Pulse Sequence: szpul
Solvent: CDCl3
Acquisition Temperature
File: 2012-27-2-product-CHMR
INOVA-500 "spoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
304 repetitions
Observed C13, 300.475088 MHz
DECUPLE H1, 300.160800 MHz
Power 40 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
F1 size 32768
Total time 30 min, 23 sec

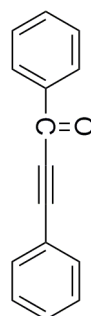
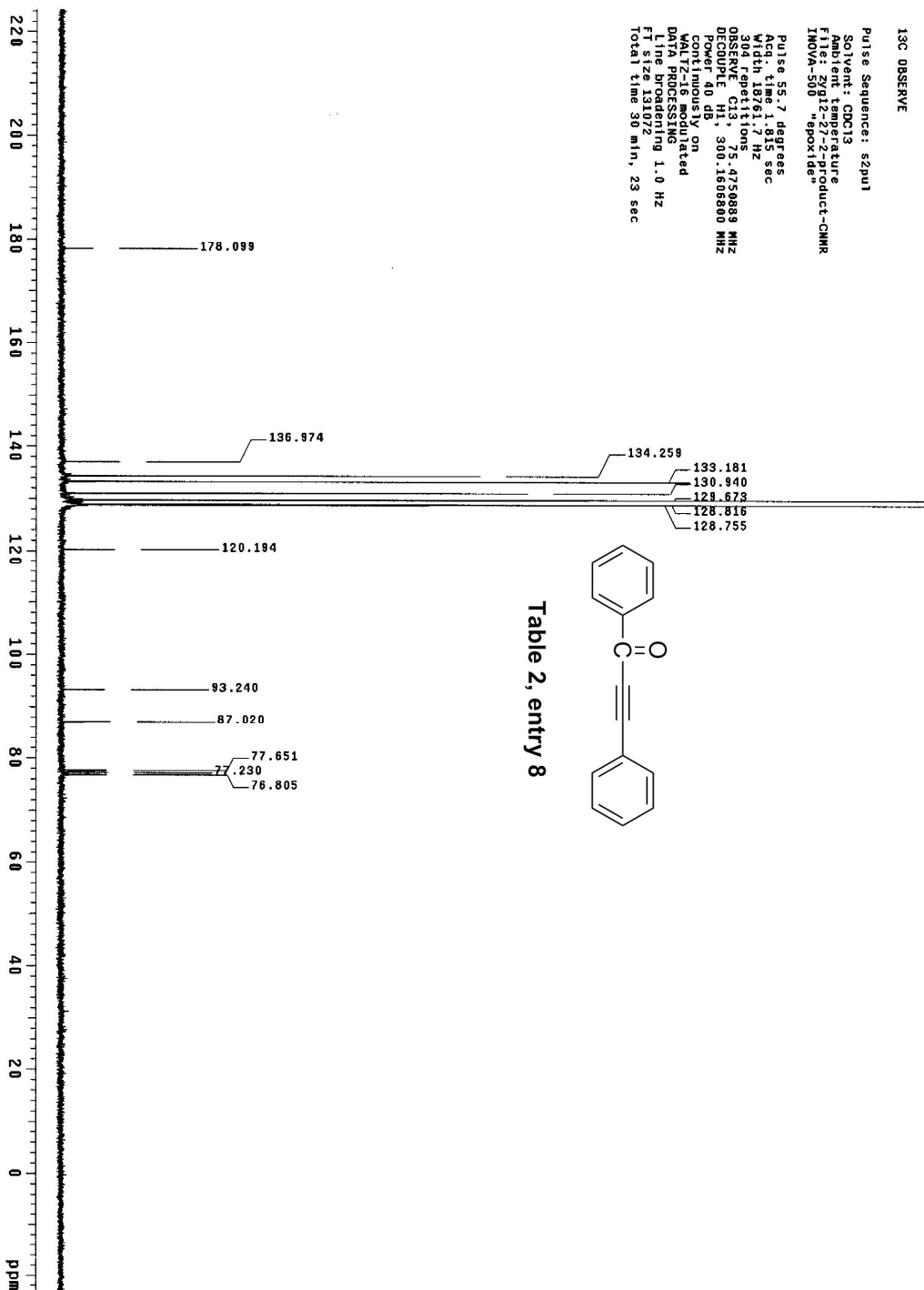


Table 2, entry 8



STANDARD 1H OBSERVE

Pulse Sequence: szpu1
 Solvent: CDCl3
 Ambient temperature
 File: ZYG10-42-product-HMR
 INOVA-500 "epoxide"

Relax. delay 1.000 sec
 Pulse time 0.092 sec
 Acquisition time 2.732 sec
 Width 6000.2 Hz
 4 repetitions

OBSERVE H1: 299.9503069 MHz
 DATA PROCESSING
 Gauss apertization 0.024 sec
 F2 453.333
 Total time 0 min., 22 sec

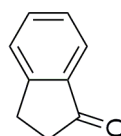
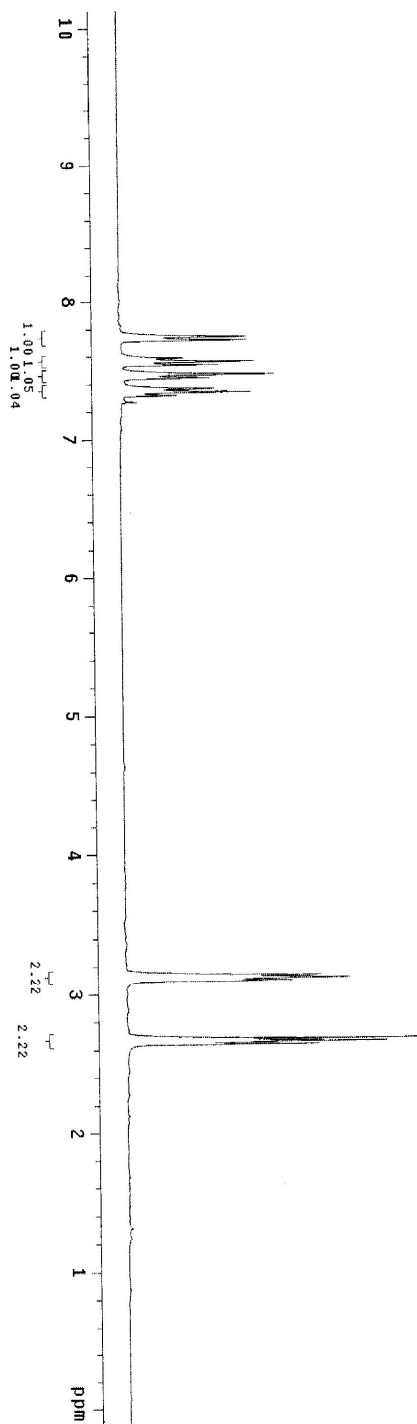


Table 2, entry 9



13C OBSERVE

Pulse Sequence: szpu1

Solvent: CDCl3

Ambient temperature

File: ZYG10-42-product-CNMR

INDOVA-500 epoxide

Relax. delay 1.500 sec

Pulse 32.100 sec

Acq. time 0.680 sec

Width 20000.0 Hz

336 repetitions

OBSERVE C13, 75.425554 MHz

DECOUPLE H1, 299.5518088 MHz

Power 36.00 dB

Spool usually on

WAITZ-16 modulated

DATA PROCESSING

Line broadening 1.0 Hz

FT size 32768

Total time 36 min, 28 sec

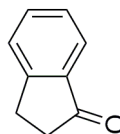
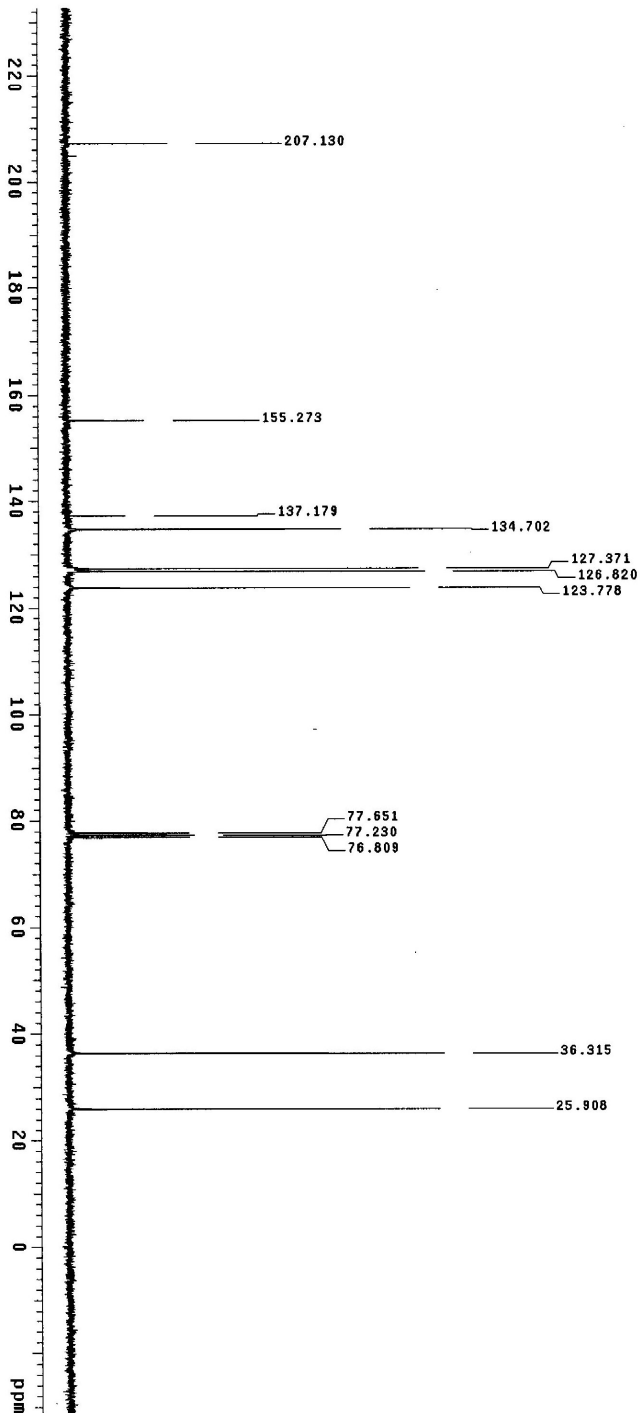


Table 2, entry 9



STANDARD 1H OBSERVE

Pulse Sequence: szpu1
 Solvent: CDCl3
 Ambient temperature
 File: zyg15-18-product-1HMR
 INOVA-500 "epoxide"

Relax. delay 1.000 sec
 Pulse 49.6 degrees
 Acq. time 1.395 sec
 Acq. date 05/05/05
 10 Repetitions
 OBSERVE H1 300.1592186 MHz
 DATA PROCESSING
 FT size 32768
 Total time 0 min, 30 sec

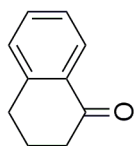
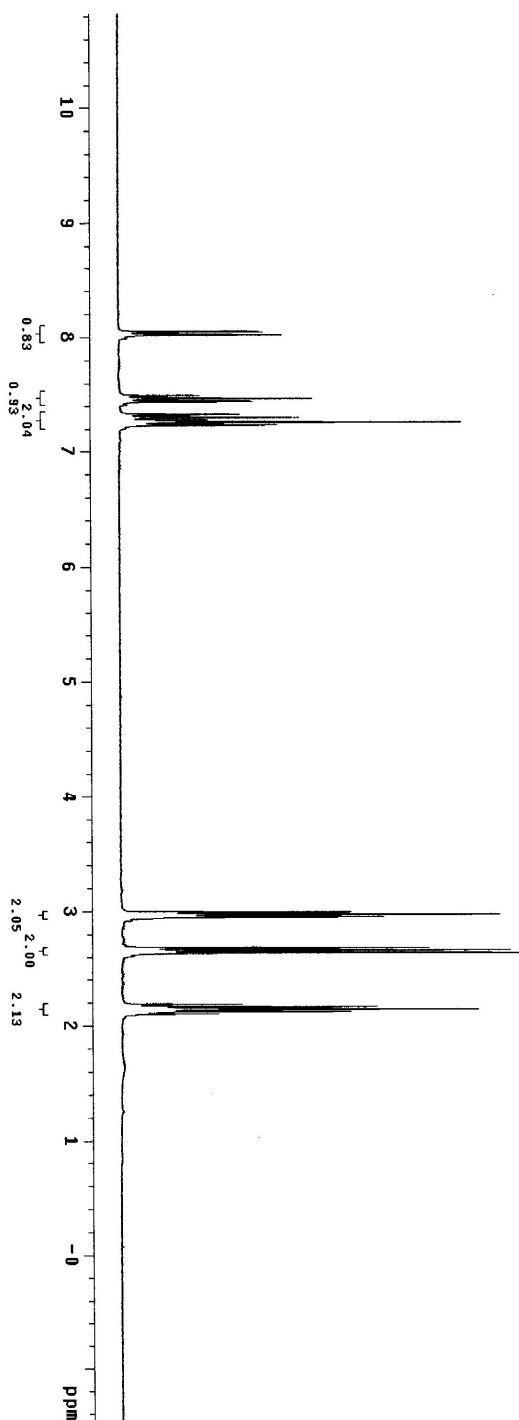


Table 2, entry 10



13C OBSERVE

Pulse Sequence: szpu1
Solvent: CDCl3
Acq. Temp: 30.0
F1: 101.253 MHz
INNOVA-500 "epoxide"
Relax. delay: 1.500 sec
Pulse: 39.1 degrees
Acq. time: 0.800 sec
Width: 20000.0 Hz
160 repetitions
OBSERVE: C13, 99.425664 MHz
DECOUPLE: 13C, 283.551808 MHz
Power: 36 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening: 1.0 Hz
F1 size: 32768
Total time: 38 min, 28 sec

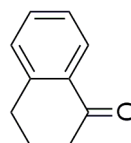
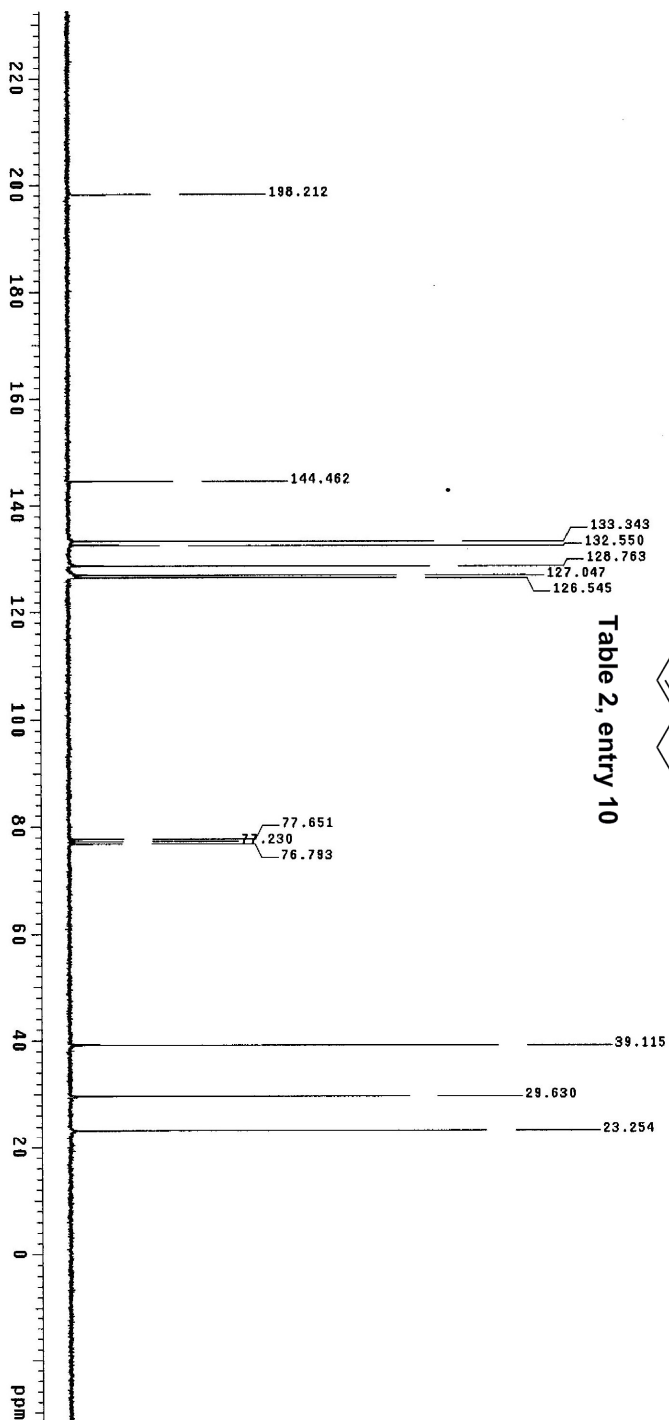


Table 2, entry 10



STANDARD 1H OBSERVE

Pulse Sequence: s2pul

Solvent: CDCl3
Sample Name: 15-Product-HNMR
File: 15-Product-HNMR
INOVA-500 "epoxide"

Relax. delay 1.000 sec
Pulse 49.6 degrees
Acq. time 1.398 sec
Width 4500.5 Hz
Spectrum 500.1592186 MHz
OBSERVE: 1H
DATA PROCESSING
FT size 32768
Total time 0 min, 12 sec

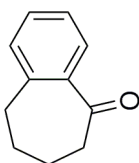
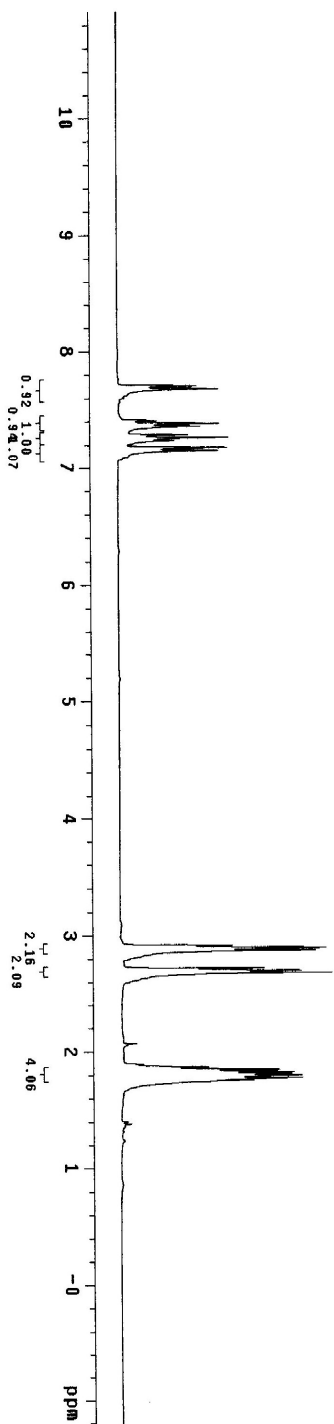


Table 2, entry 11



13C OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: ZYG15-15-product-CNMR
INOVA-500 "epoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
Sweep rate 141.1 Hz
Observed frequency 475084 MHz
Decouple H1: 300.1606800 MHz
Power 40 dB
Continuously on
WALTZ-16 modulated
DATA PROCESSING
F2 size 13072
F1 size 13072
Total time 30 min, 23 sec

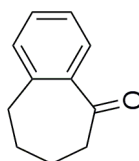
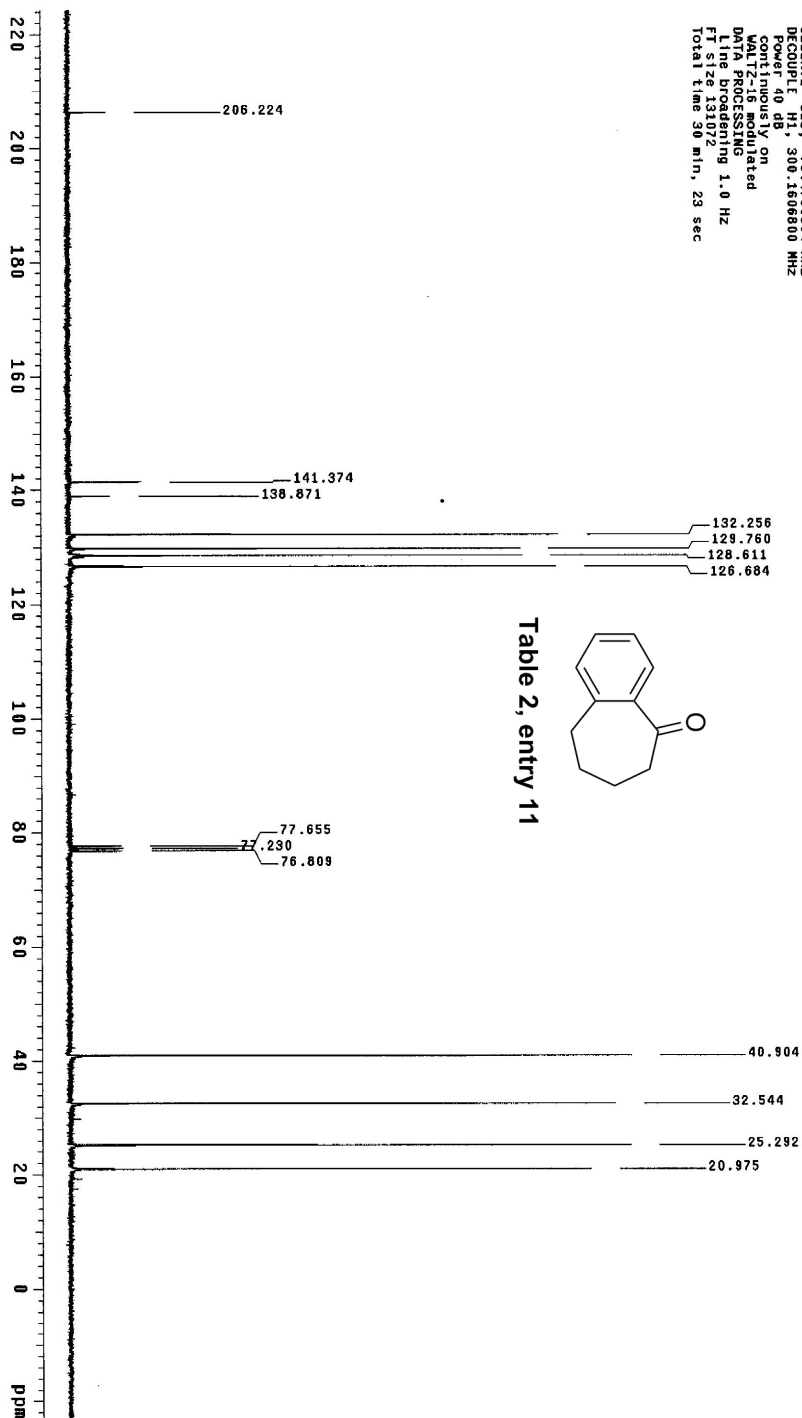


Table 2, entry 11



STANDARD 1H OBSERVE

Pulse Sequence: szpu1
Solvent: CDCl3
Ambient temperature
File: zy10-44-product-HMR
INOVA-500 "epoxide"
Relax: delay 1.000 sec
Pulse: 9.00 degrees
Acq: time 2.00 sec
Width 6000.2 Hz
10 repetitions
OBSERVE H1, 299.9503069 MHz
DATA PROCESSING
Gauss: apodization 0.824 sec
F2: 125.0056
Total time 0 min, 44 sec

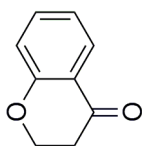
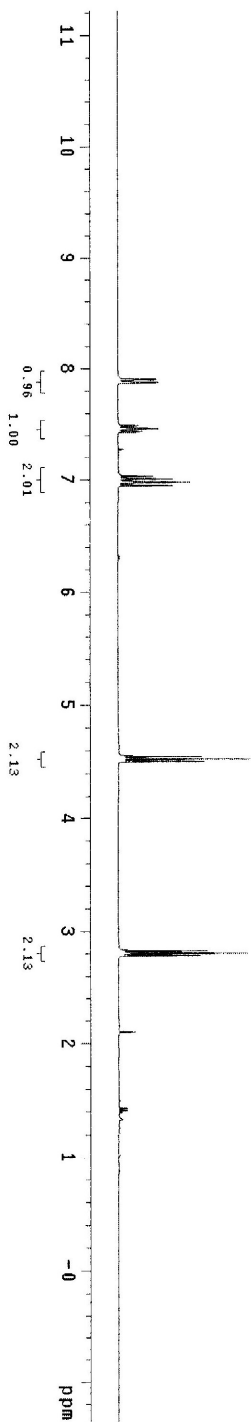


Table 2, entry 12



¹³C OBSERVE

Pulse Sequence: s2pul
Solvent: CDCl₃
Ambient temperature
File: 20910-44-product-CMR
INOVA-500 6poxide
Relax delay 1.500 sec
Pulse 391 degrees
Acq time 0.800 sec
Width 20000.0 Hz
240 repetitions
OBSERVE C13, 75.425554 MHz
DECOUPLE H1, 299.3518068 MHz
SFO 125.761815 MHz
Continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 32768
Total time 36 min, 28 sec

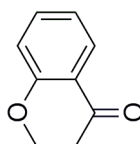
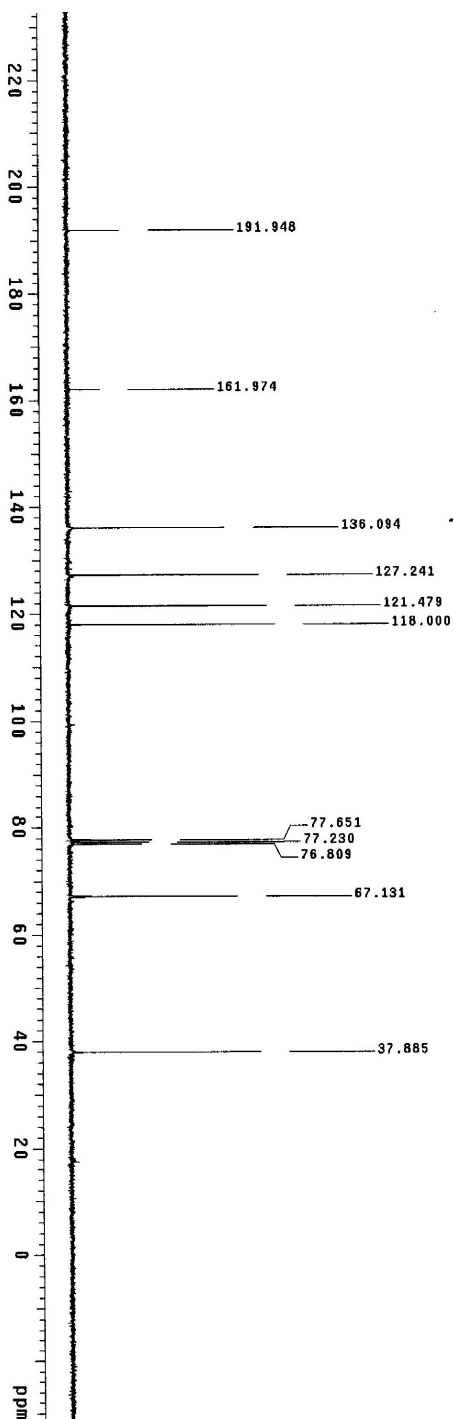


Table 2, entry 12



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: zyg23-04-product-1HMR
INOVA-500 "epoxide"
Relax. delay 1.000 sec
Pulse width 12.000 sec
Acq. time 1.986 sec
Width 4500.5 Hz
4 Repetitions
OBSERVE H1, 300.1592196 MHz
DATA PROCESSING
FT size 32768
Total time 0 min, 12 sec

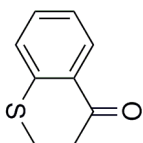
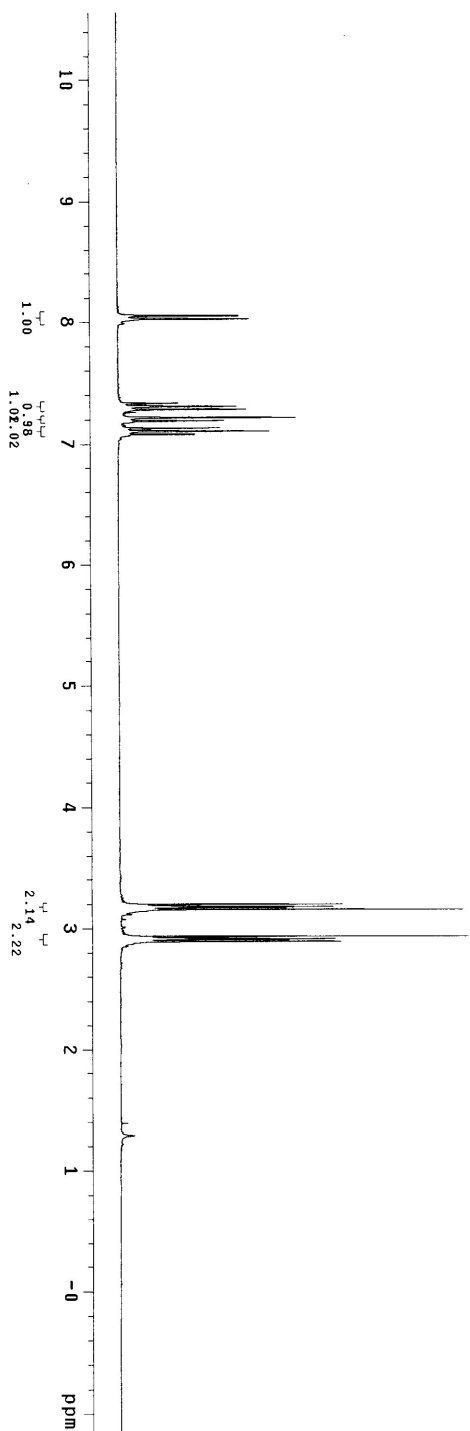


Table 2, entry 13



13C OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient Temperature
F1: 125.76 MHz
INOVA-500 "epoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
160 repetitions
OBSERVE C13, 75.4750946 MHz
DECOUPLE H1, 300.1606600 MHz
SFO 100.626150 MHz
Continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 131072
Total time 30 min, 23 sec

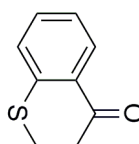
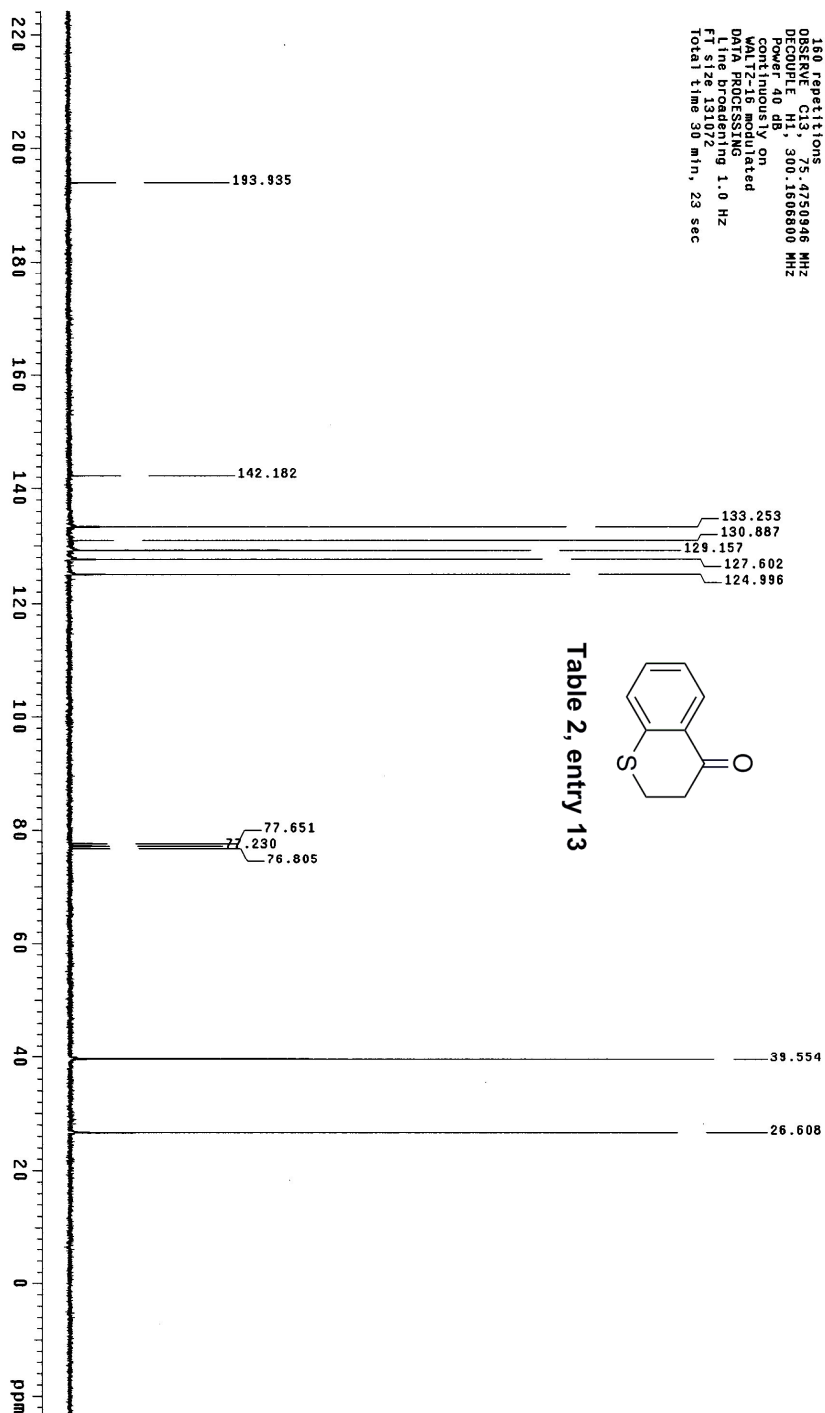


Table 2, entry 13



STANDARD 1H OBSERVE

Pulse Sequence: szpu1
 Solvent: CDCl3
 Ambient Temperature
 Frequency: 125.762 MHz
 INOVA-500 "epoxide"
 Relax. delay 1.000 sec
 Pulse 49.6 degrees
 Acq. time 1.398 sec
 Width 4500.5 Hz
 8 repetitions
 Observed 500.1592196 MHz
 DATA PROCESSING
 FT size 32768
 Total time 0 min, 12 sec

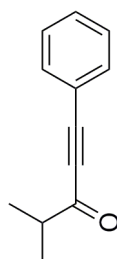
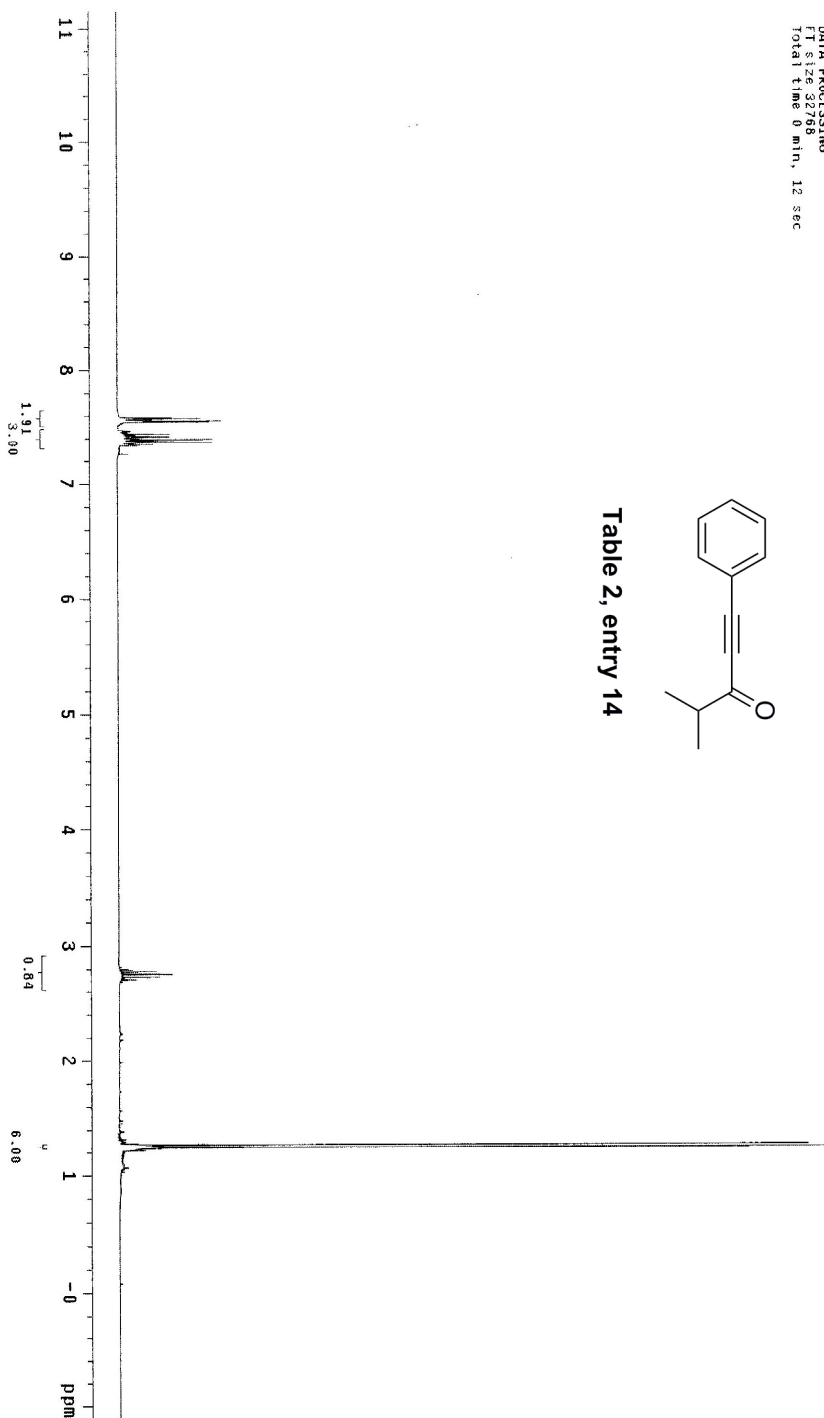


Table 2, entry 14



13C OBSERVE

Pulse Sequence: zgpg30
Solvent: CDCl3
Ambient temperature
File: ZV912-46-2-product-CNMR
INDVA-500 "epoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
Sweep rate 4750840 MHz
Observed 13C 300.1606800 MHz
Decouple H1 300.1606800 MHz
Power 40 dB
Continuously on
WALTZ-16 modulated
Data processing
F2 size 131072
F1 size 131072
Total time 30 min, 23 sec

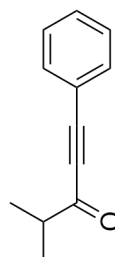
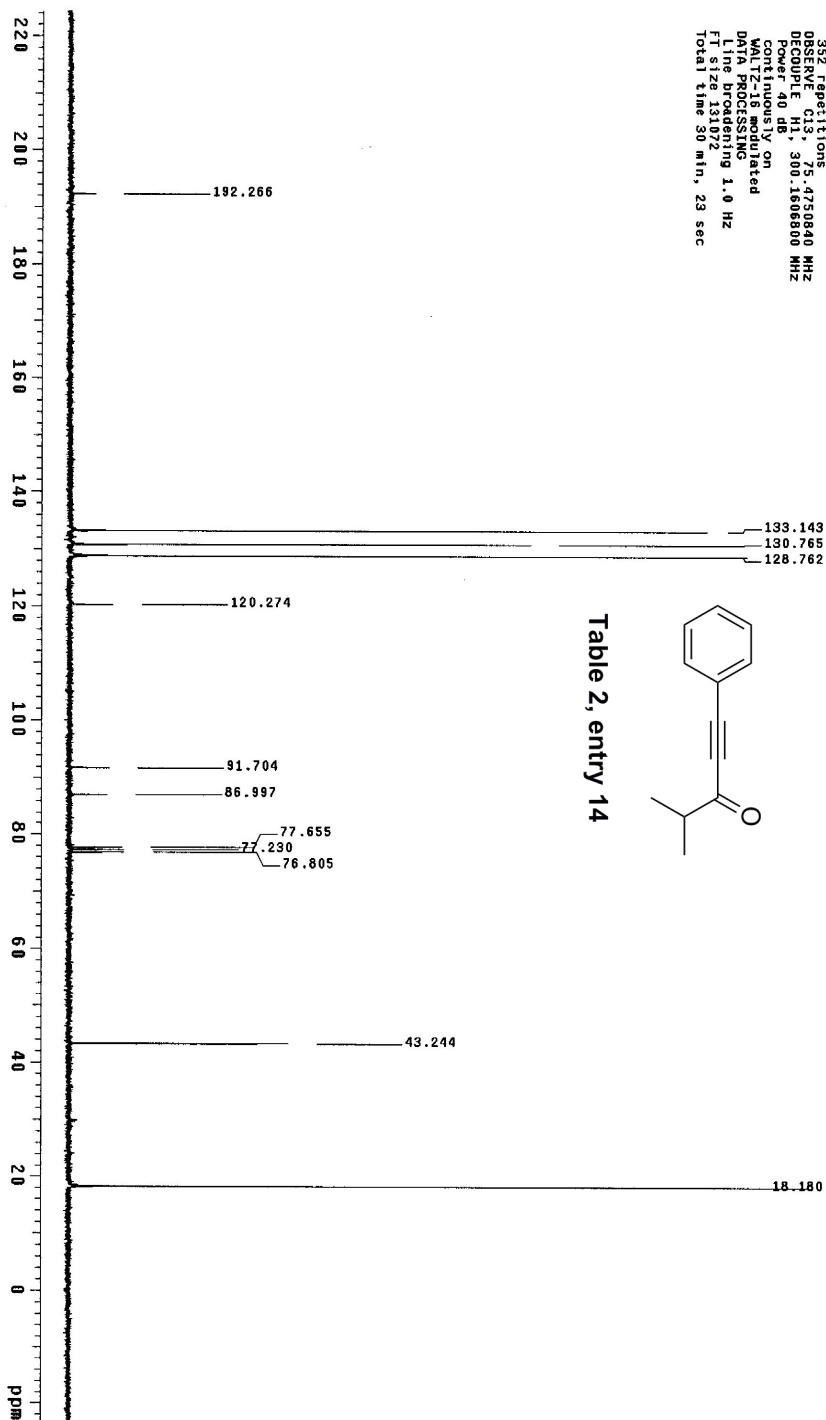


Table 2, entry 14

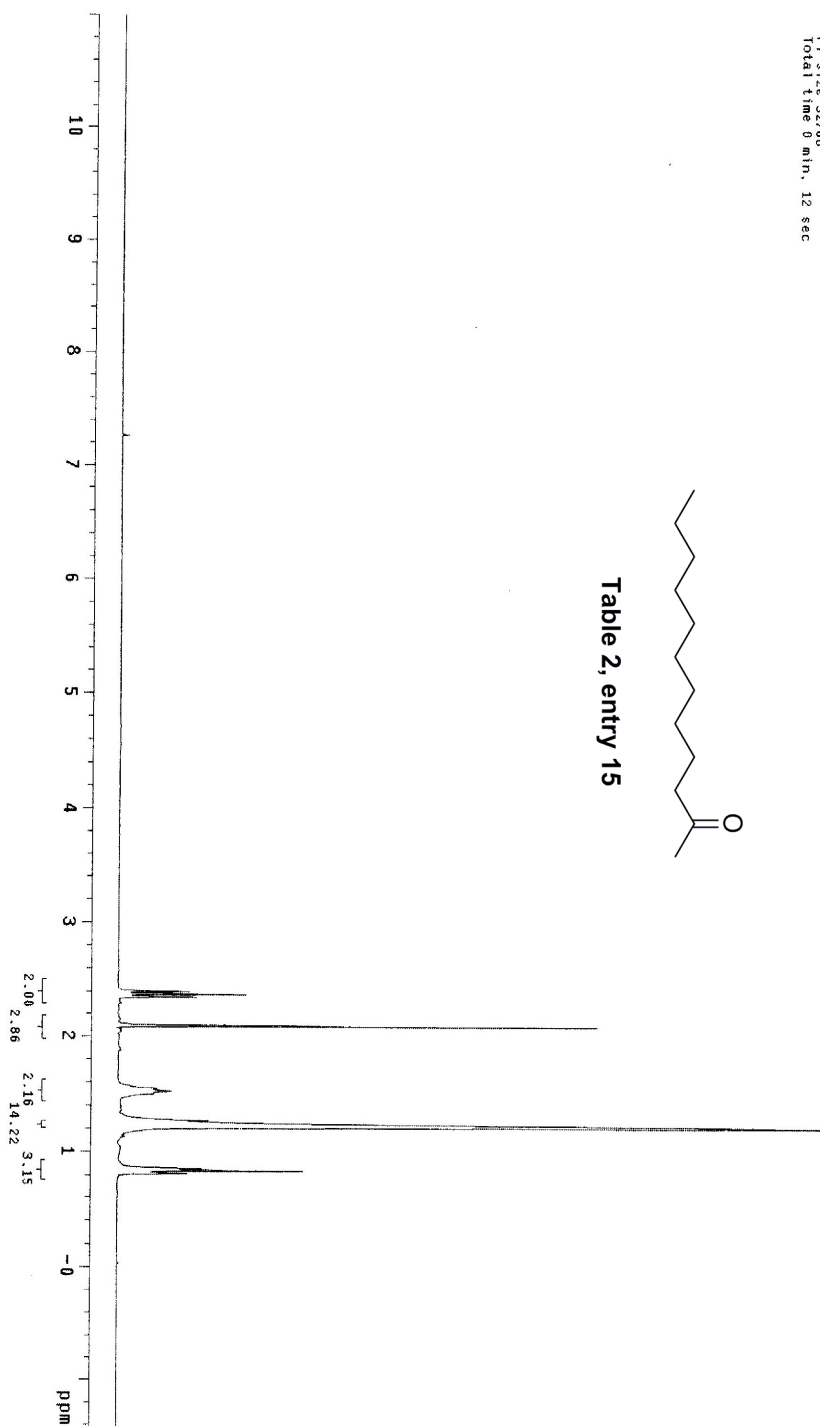


STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: ZYG12-35-1-Product-HMR
INOVA-500 "epoxide"
Relax delay 1.000 sec
Pulse delay 0.050 sec
Acq time 1.998 sec
Width 4500.5 Hz
4 Repetitions
OBSERVE H1, 300.1592196 MHz
DATA PROCESSING
F1 120.222 MHz
Total time 0 min, 12 sec



Table 2, entry 15



13C OBSERVE

Pulse Sequence: szpu1

Solvent: CDCl3

Ambient temperature

File: zy12-33-1-product-CMR

INDVA-500 "epoxide"

Pulse 55.7 degrees

Acq. time 1.815 sec

Width 1861.7 Hz

300 MHz

OBSERVE C13 300.4750811 MHz

DECOUPLE H1 300.1606800 MHz

Power 40 dB

continuously on

WALTZ-16 modulated

DATA PROCESSING

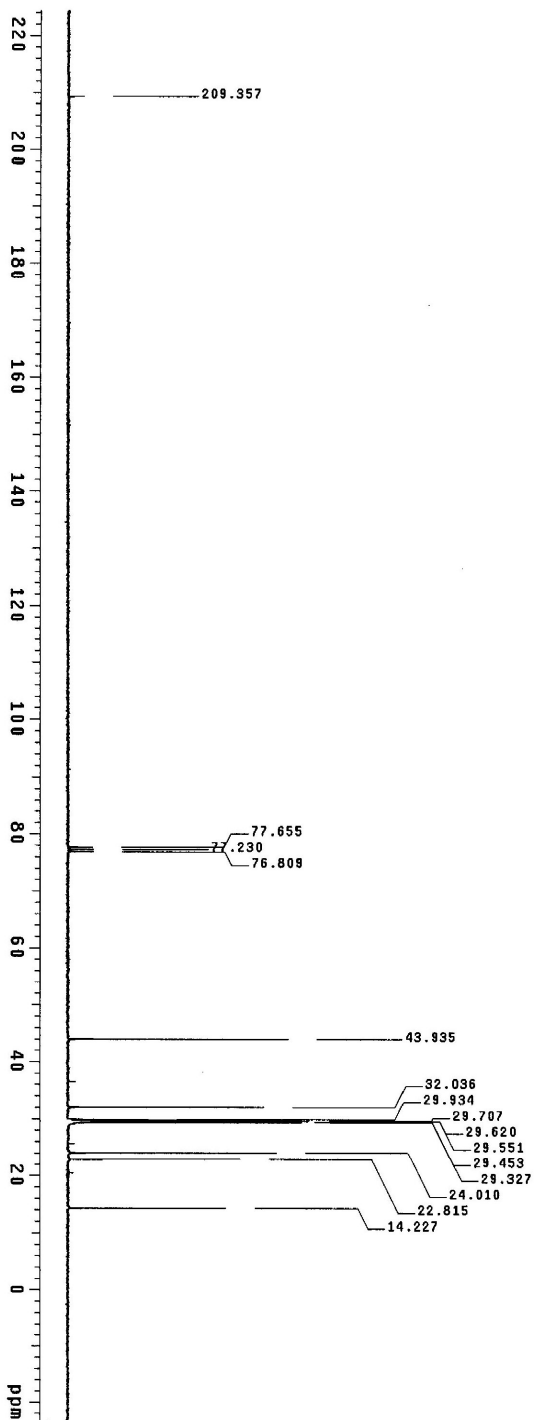
File Processing 1.0 Hz

FI size 131072

Total time 30 min, 23 sec



Table 2, entry 15



STANDARD 1H OBSERVE
Pulse Sequence: s2pu1
Solvent: CDCl3
Acquisition Temperature
File: 2V915-48-product-1HMR
INOVA-500 "epoxide"
Relax. delay 1.000 sec
Pulse 49.6 degrees
Acq. time 1.898 sec
Width 4500.5 Hz
Sweep 11.000 Hz
OBSERVE H1 300.1592186 MHz
DATA PROCESSING
FT size 32768
Total time 0 min, 12 sec

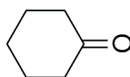
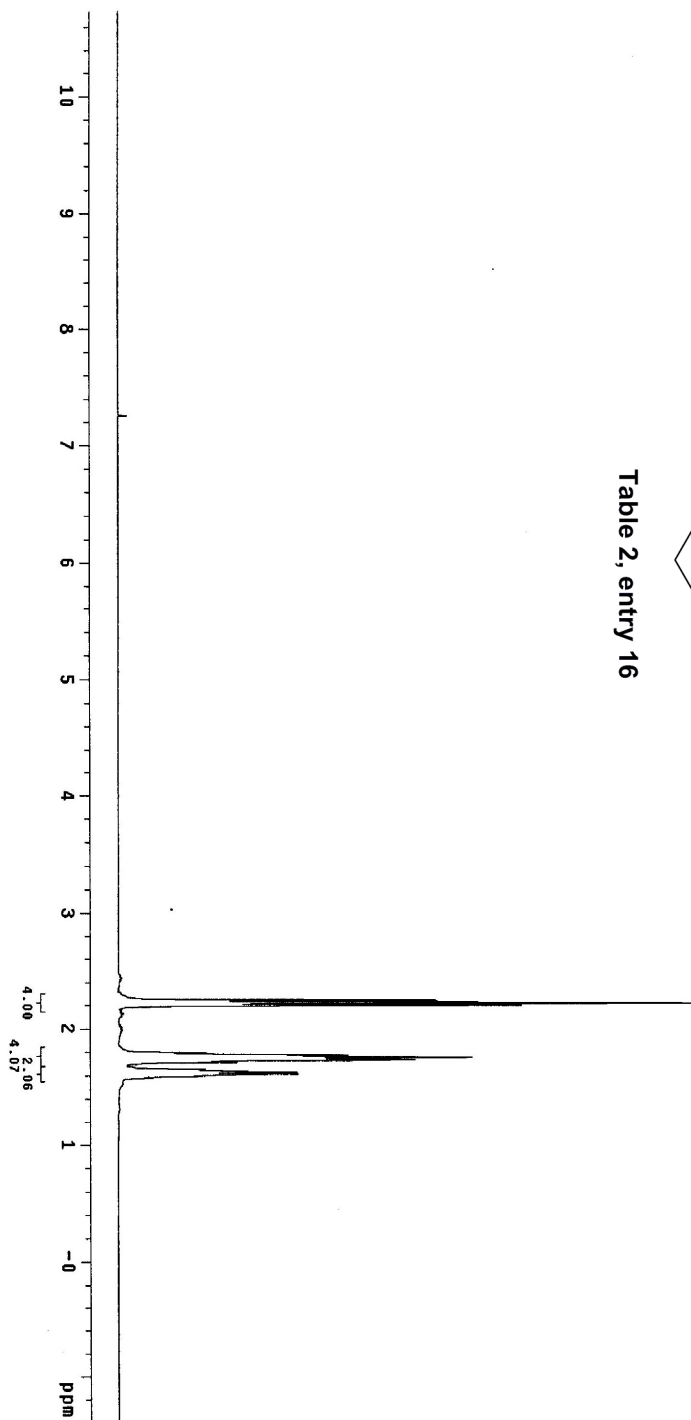


Table 2, entry 16



13C OBSERVE

Pulse Sequence: szpu1
Solvent: CDCl3
Ambient temperature
File: zy915-46-product-CNMR
INOVA-500 "apoxia"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18781.7 Hz
F2 offset 10.000 MHz
Observations 5.4750903 MHz
Decouple "H1" 300.165800 MHz
Power 40 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
File processing 1.0 Hz
F1 size 131072
Total time 30 min, 23 sec

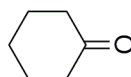
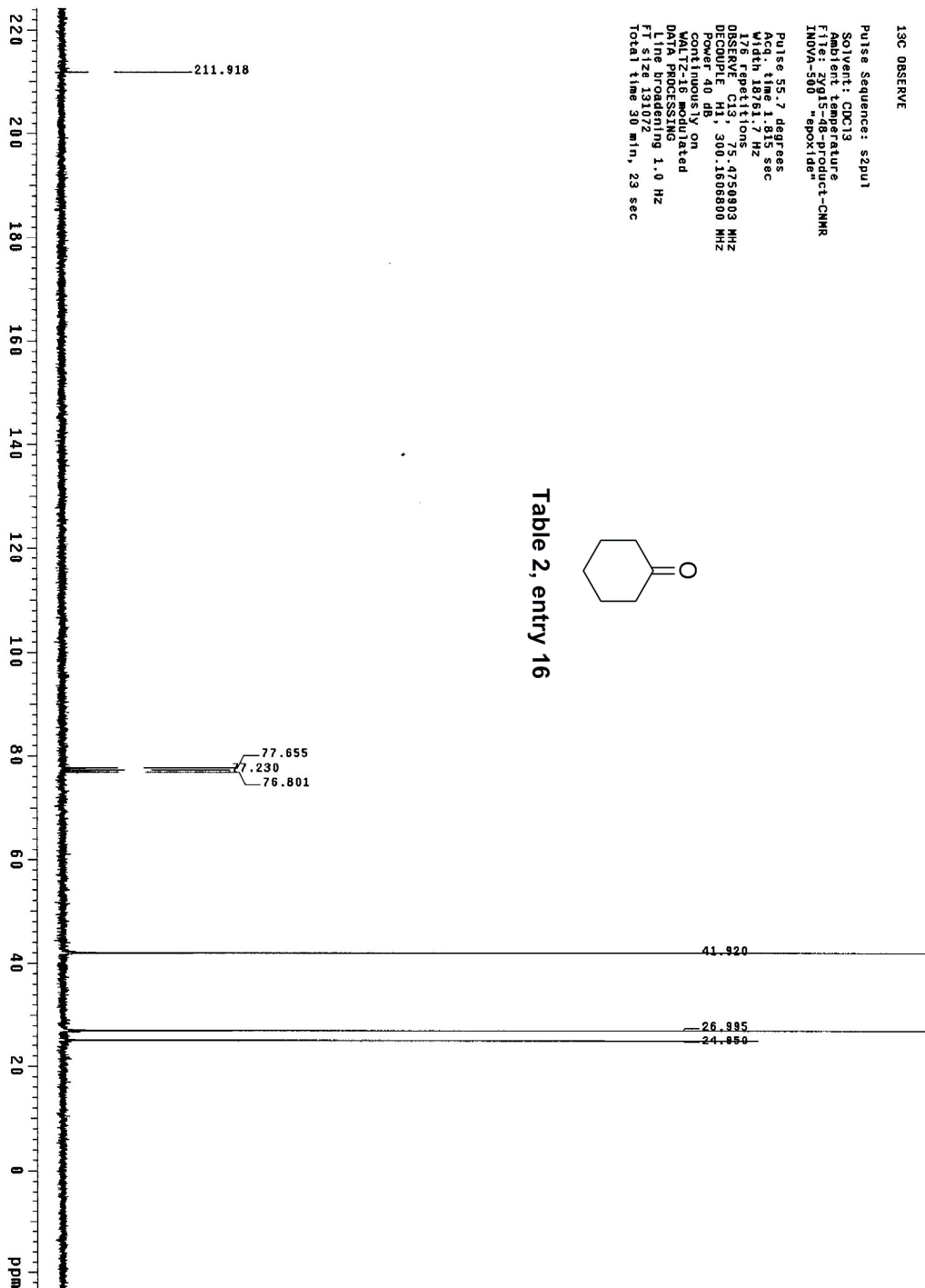


Table 2, entry 16



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: Zyg11-43-product-HMR
INOVA-500 "epoxide"
Relax, delay 1.000 sec
Pulse 49.6 degrees
Acq time 1.930 sec
Width 4500.5 Hz
4 repetitions
OBSERVE H1, 300.1592196 MHz
DATA PROCESSING
F1 size 32768
Total time 0 min, 12 sec

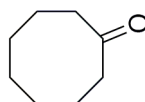
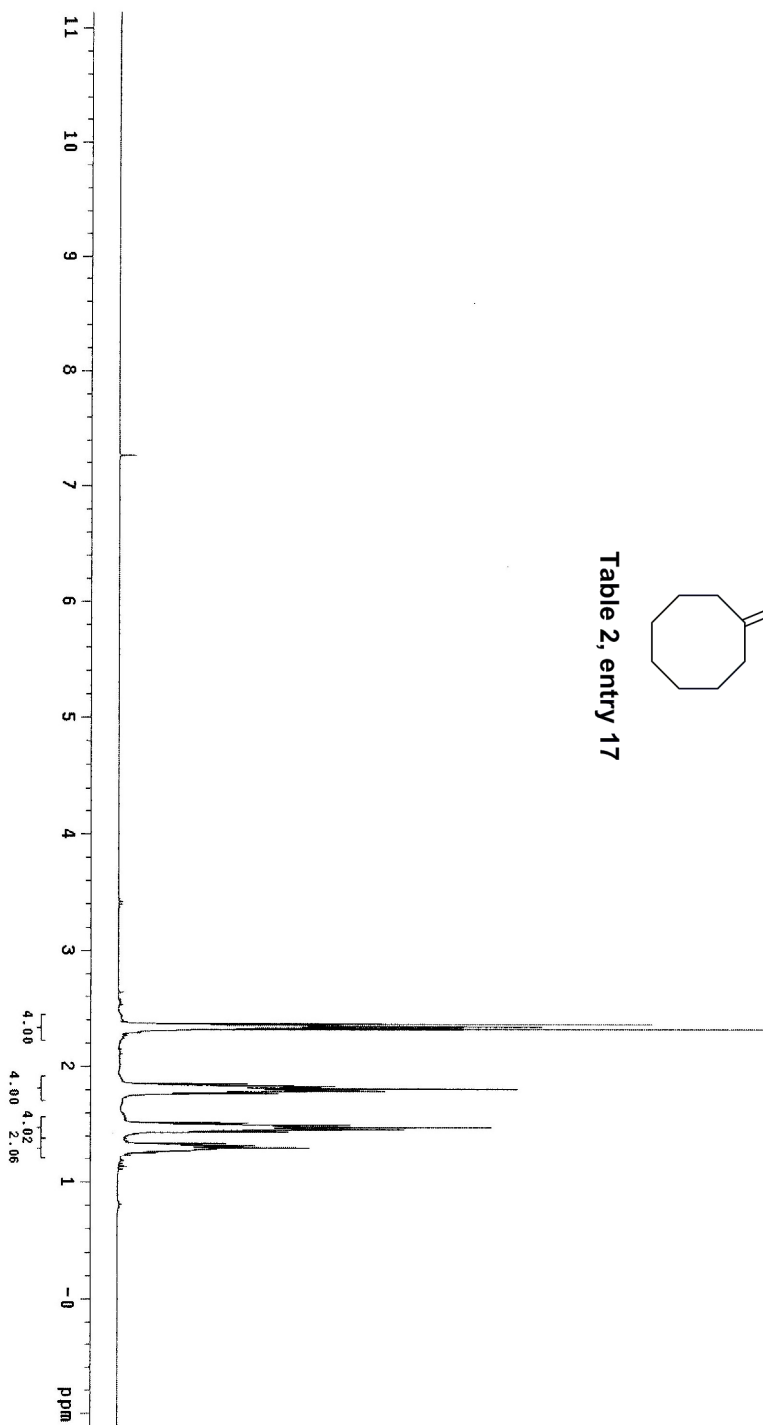


Table 2, entry 17



13C OBSERVE

Pulse Sequence: szpu1

Solvent: CDCl3
Acquisition Temperature
File: ZYd13-43-product-CHMR
INDVA-500 "epoxide"

Pulse: 55.7 degrees
Acq. time: 1.815 sec
Width: 18761.7 Hz
384 repetitions
Observed C13, 300.1606800 MHz
P2: 10.00 dB
Power: 40 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening: 1.0 Hz
F2: 125.263192 MHz
Total time: 30 min, 23 sec

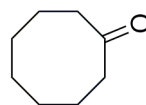
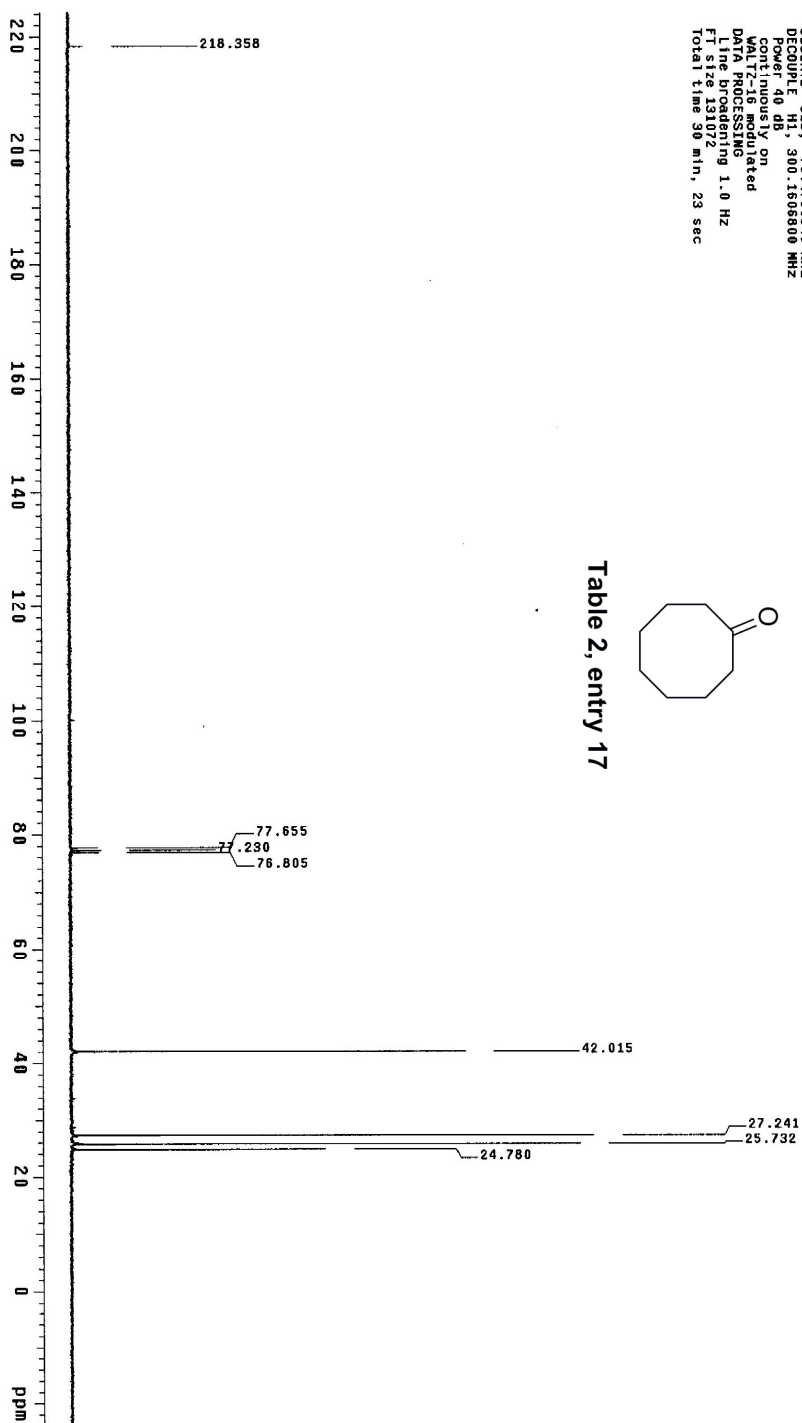


Table 2, entry 17



STANDARD 1H OBSERVE

Pulse Sequence: s2pul

Solvent: CDCl3

Ambient temperature

File: ZYG12-05-Product-HMNR

INDVA-500 "epoxide"

Relax. delay 1.000 sec

Pulse 49.6 degrees

Acq. time 1.389 sec

Width 400.5 Hz

4 repetitions

OBSERVE H1, 300.1592196 MHz

DATA PROCESSING

FT size 32768

Total time 0 min, 12 sec

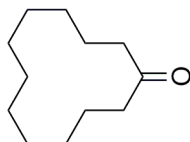
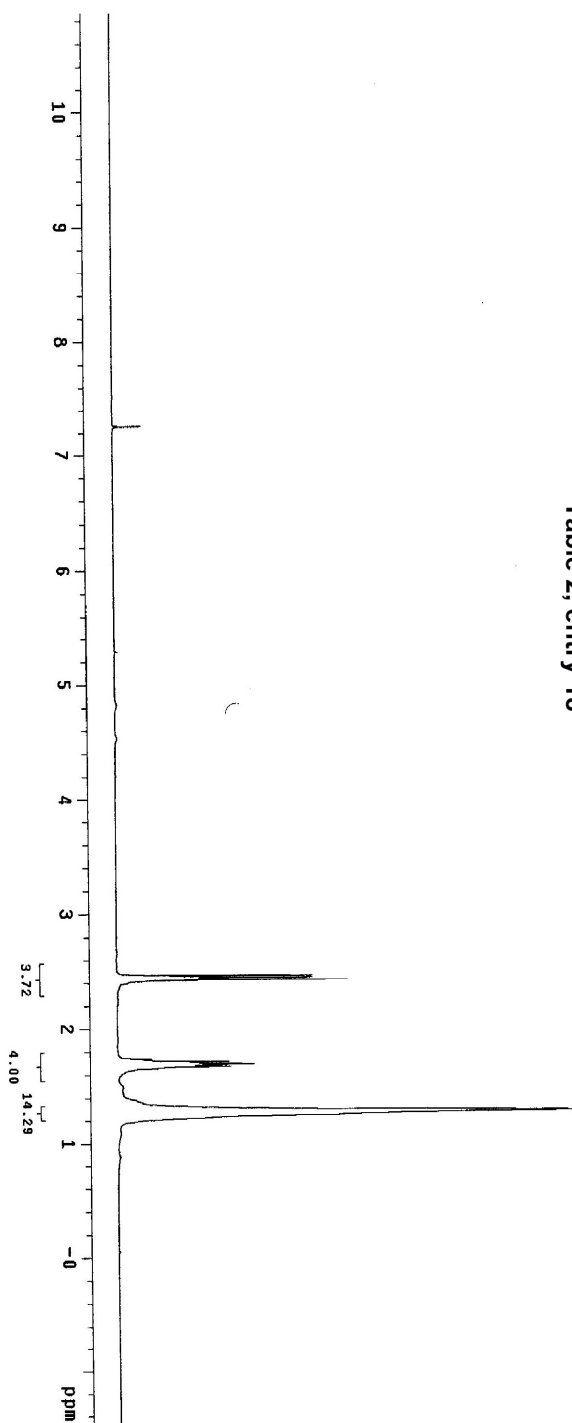


Table 2, entry 18



13C OBSERVE

Pulse Sequence: szpu1

Solvent: CDCl3

Ambient temperature

File: ZYG12-05-product-CNMR

INOVA-500 "epoxide"

Pulse 55.7 degrees

Acq. time 1.815 sec

NUC1 13C1013 MHz

248.00000000000000

OBSERVE C13 75.4750826 MHz

DECOUPLE H1 300.1606800 MHz

Power 40 dB

continuously on

WALTZ16 modulated

DELTA processing

line broadening 1.0 Hz

FT size 131072

Total time 30 min, 23 sec

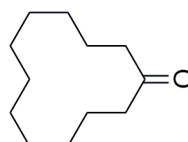
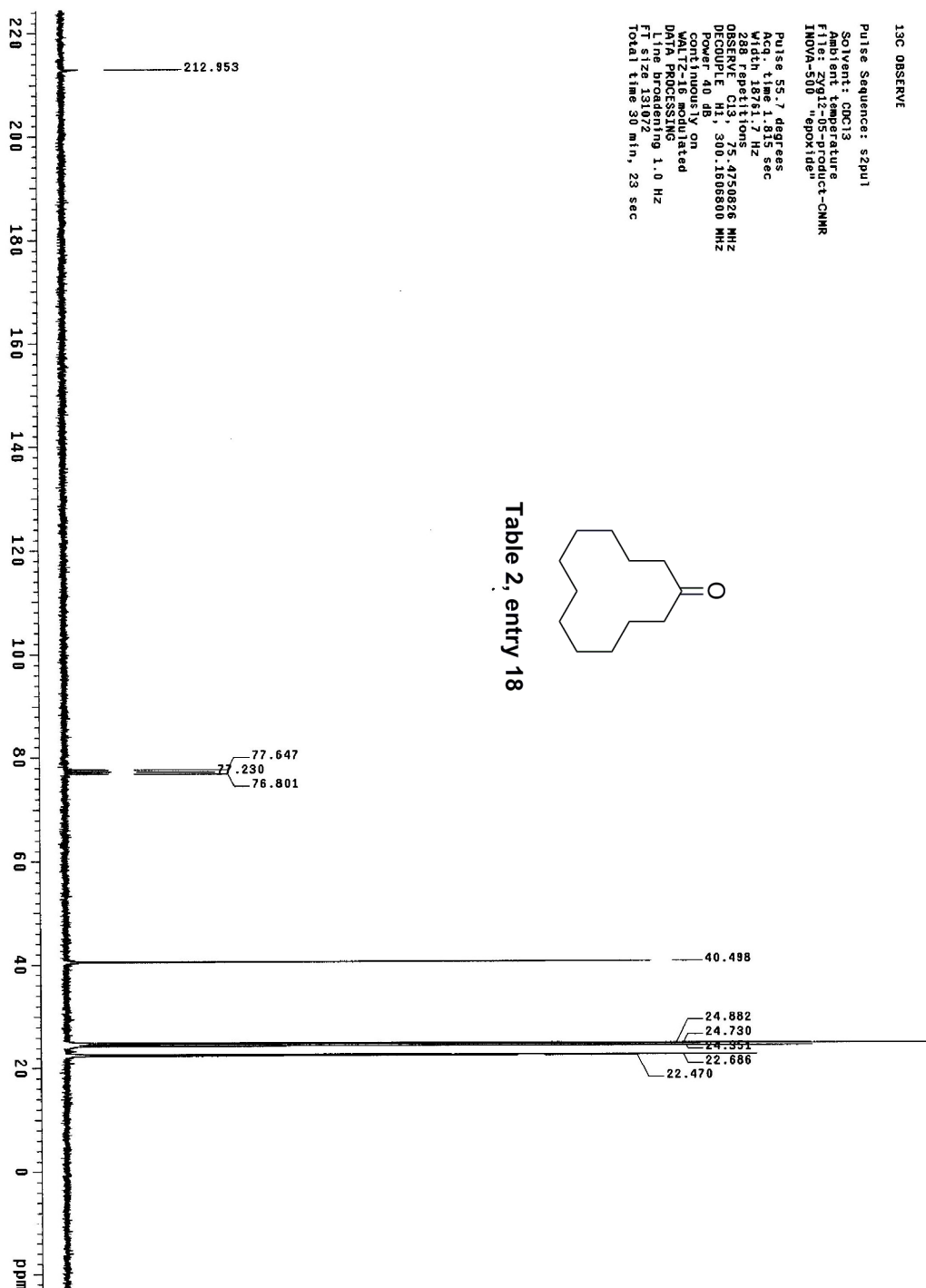


Table 2, entry 18



STANDARD 1H OBSERVE

Pulse Sequence: szpu1
Solvent: CDCl3
Ambient temperature
F1 size 65536
INOVA-500 "epoxide"
Relax. delay 1.000 sec
Pulse 34.0 degrees
Acq. time 2.732 sec
Width 6000.2 Hz
4 repetitions
OBSERVED 299.9503069 MHz
DATA PROCESSING
Gauss apodization 0.824 sec
F1 size 65536
Total time 0 min. 22 sec

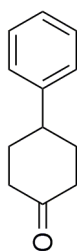
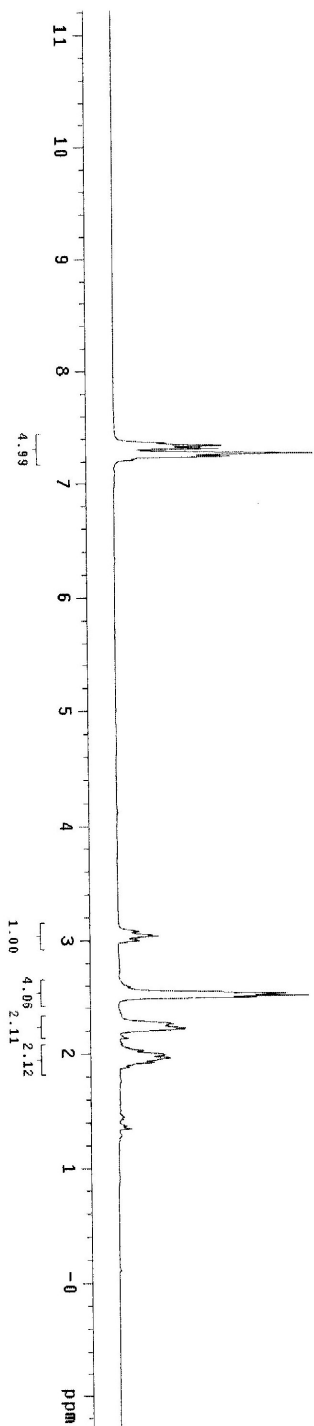


Table 2, entry 19



13C OBSERVE

Pulse Sequence: szpul
Solvent: CDCl3
Ambient temperature
File: zy910-45-Product-CNMR
INOVA-500 "epoxide"

Relax. delay 1.500 sec
Pulse 3s.1 degrees
Acq. time 0.808 sec
Nuc1 129.000 MHz
Nuc2 75.425603 MHz
OBSERVE C13, 75.425603 MHz
DECOUPLE H1, 299.5518068 MHz
Power 36 dB
continuously on
MULTI-DECOUPLED
DATA ACQUISITION
Line broadening 1.0 Hz
FI size 32768
Total time 38 min, 28 sec

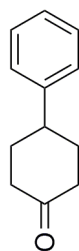
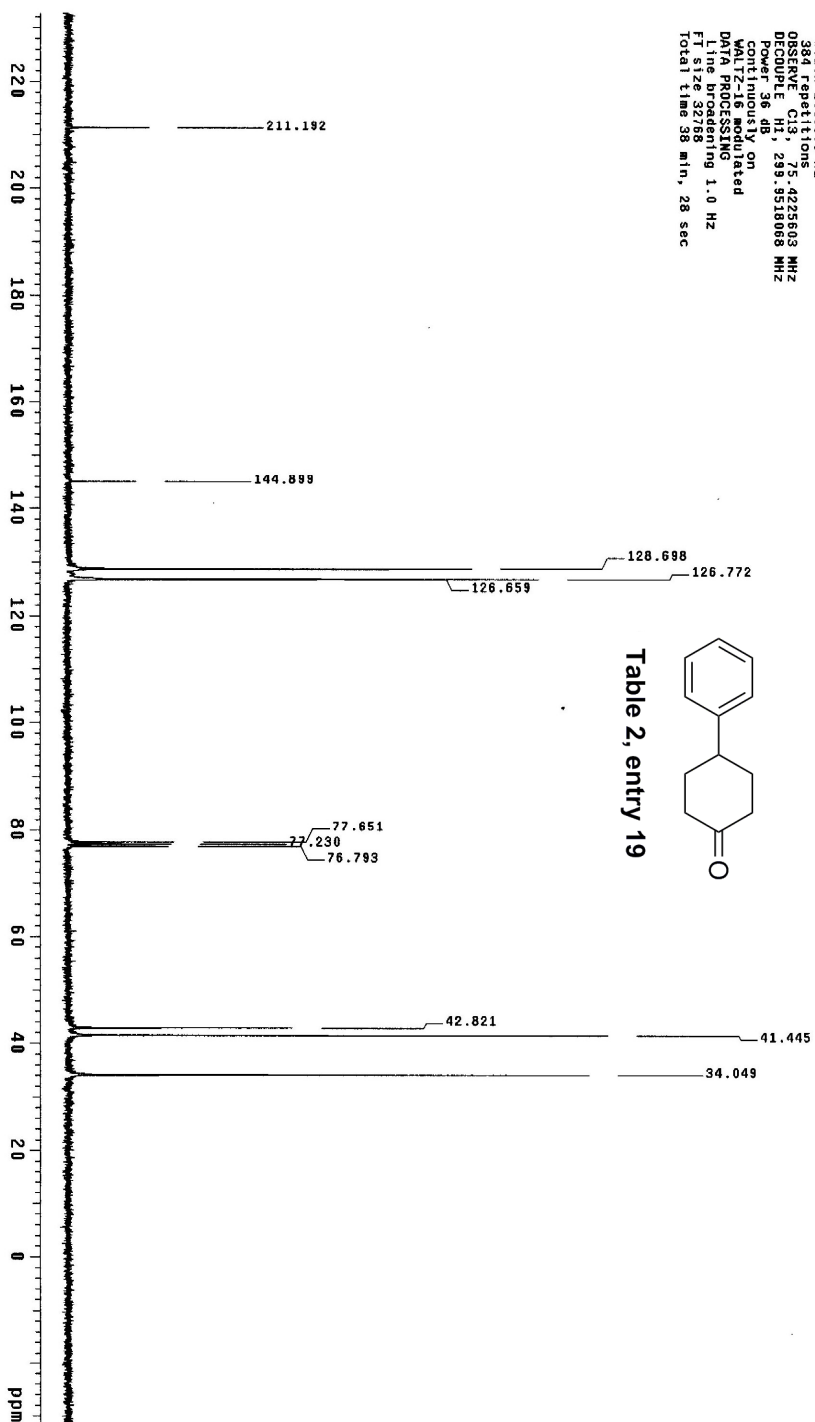


Table 2, entry 19



STANDARD 1H OBSERVE

Pulse Sequence: szpu1
 Solvent: CDCl3
 Ambient temperature
 File: Zyg10-48-product-1HMR
 INOVA-500 "epoxide"

Relax. delay 1.000 sec
 Pulse 49.6 degrees
 Acq. time 1.998 sec
 Width 4300.3 Hz
 NO frequency 500.130 MHz
 OBSERVE H1 300.1592196 MHz
 DATA PROCESSING
 FT size 32768
 Total time 0 min, 30 sec

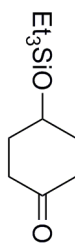
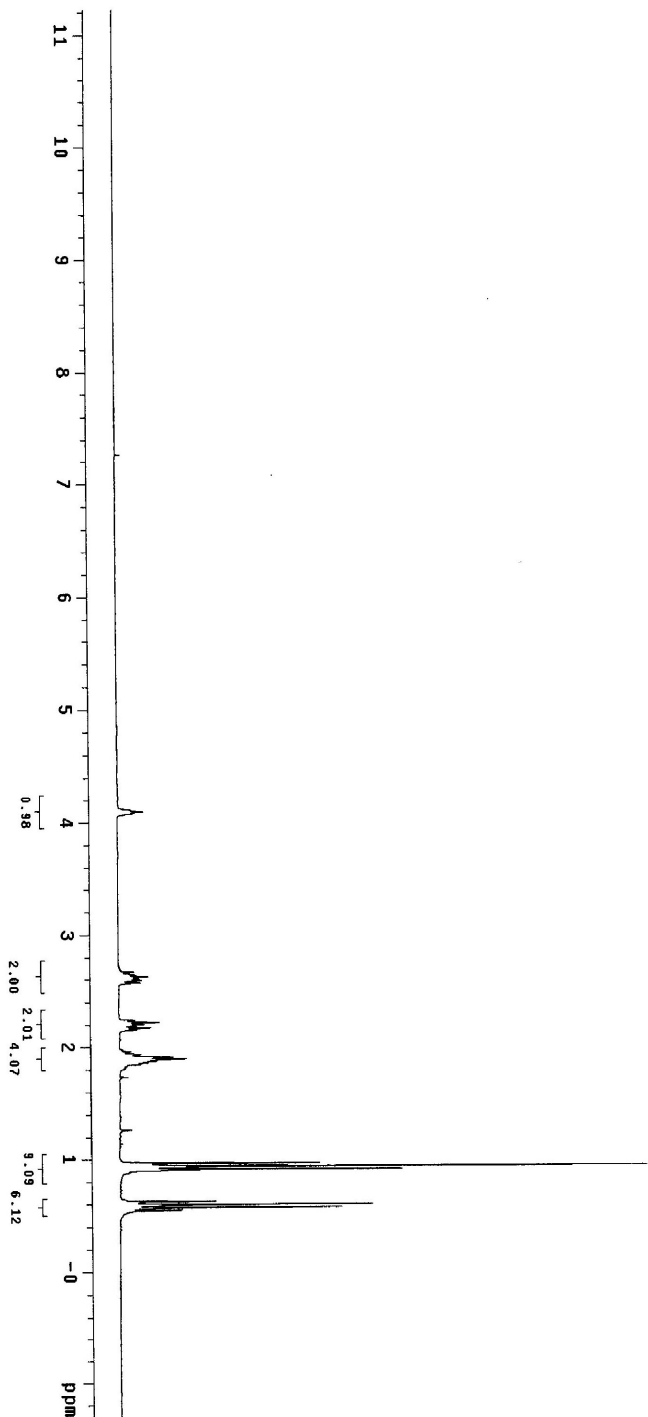


Table 2, entry 20



¹³C OBSERVE

Pulse Sequence: szpul
Solvent: CDCl₃
Ambient Temperature
File: zygi0-48-product-CNMR
INOVA-500 "epoxide"
Pulse 55.7 degrees
Acq. time 1.83 sec
Sweep 1462 Hz
208 repetitions
OBSERVE C13, 75.475086 MHz
DECUPLE H1, 300.1606800 MHz
Power 40 dB
Continuously on
Spectrum displayed
DATA PROCESSING
Line broadening 1.0 Hz
FT size 131072
Total time 30 min, 23 sec

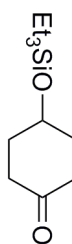
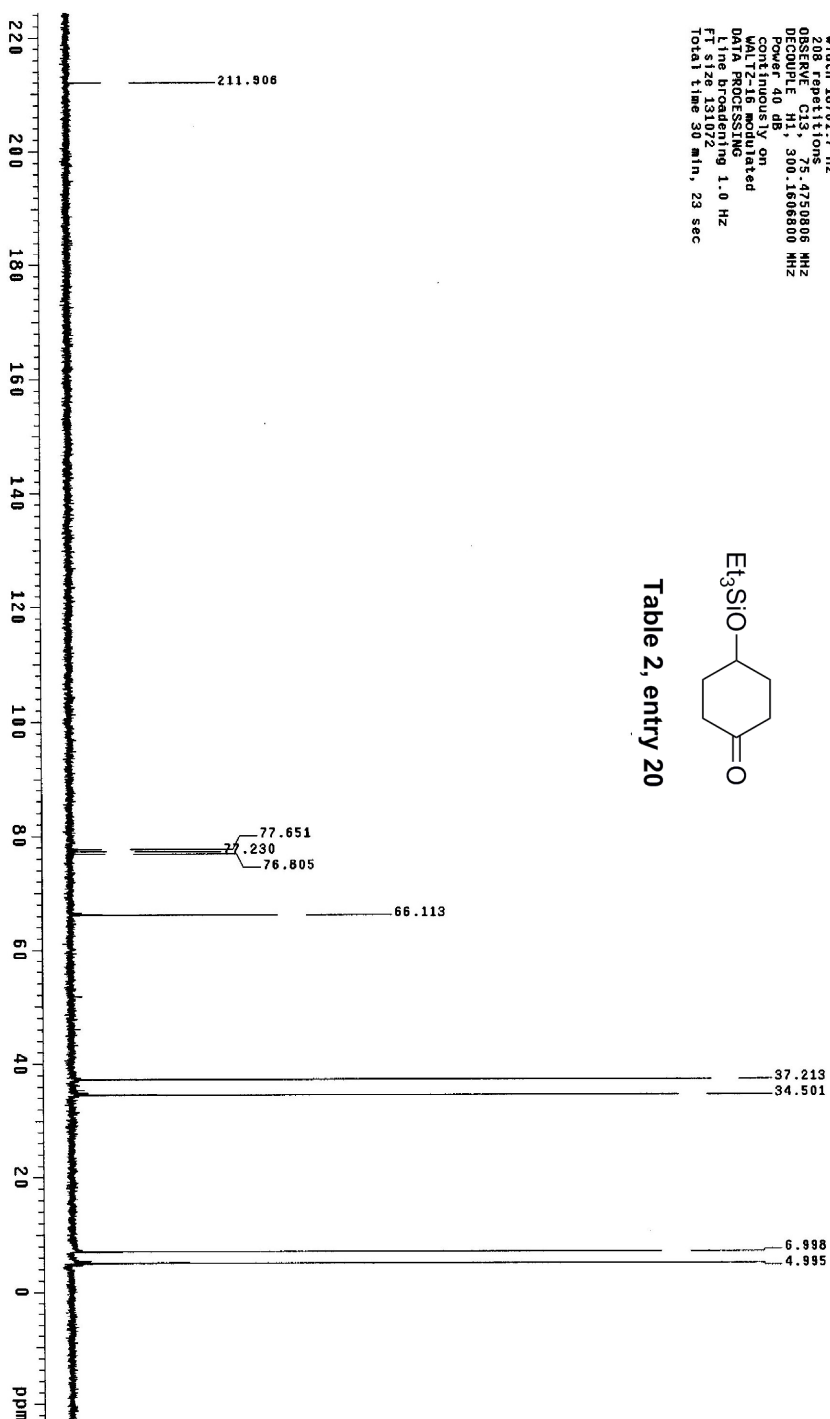


Table 2, entry 20



STANDARD 1H OBSERVE

Pulse Sequence: szpu1
 Solvent: CDCl3
 Ambient temperature
 File: 29912-12-product-1HMR
 INOVA-500 -epox106-
 Relax. delay 1.000 sec
 Pulse: 49.6 degrees
 Acq. time 1.398 sec
 Width 4500.5 Hz
 4 repetitions
 OBSERVE H1, 300.1592196 MHz
 DATA PROCESSING
 F1: 120.3258
 Total time 9 min, 12 sec

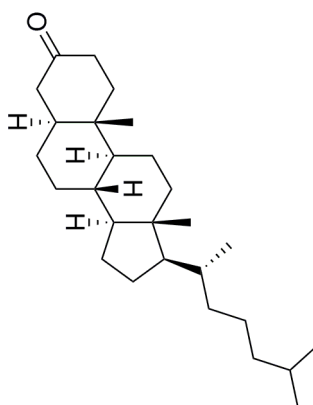
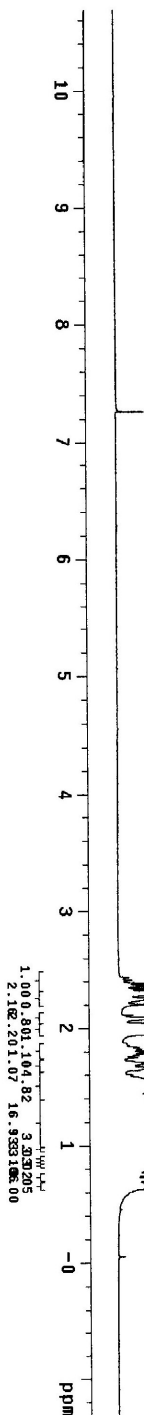


Table 2, entry 21



¹³C OBSERVE

Pulse Sequence: zgpg30
 Solvent: CDCl₃
 Acquisition Temperature: 300 K
 File Name: 12-12-Product-CMR
 INOVA-500 "epoxide"

Pulse 55.7 degrees
 Acq. time 1.815 sec
 Width 18761.7 Hz
 208 repetitions
 OBSERVE C13, 75.4750814 MHz
 OBSERVE H1, 300.1350600 MHz
 Power 40 dB
 continuously on
 WALTZ-16 modulated
 DATA PROCESSING
 Line broadening 1.0 Hz
 File size 13107
 Total time 50 min, 23 sec

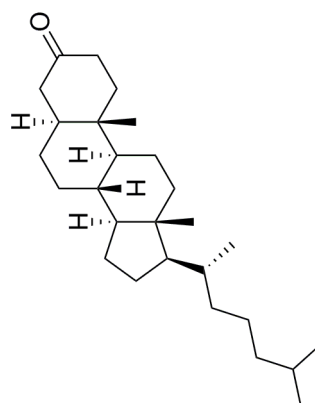
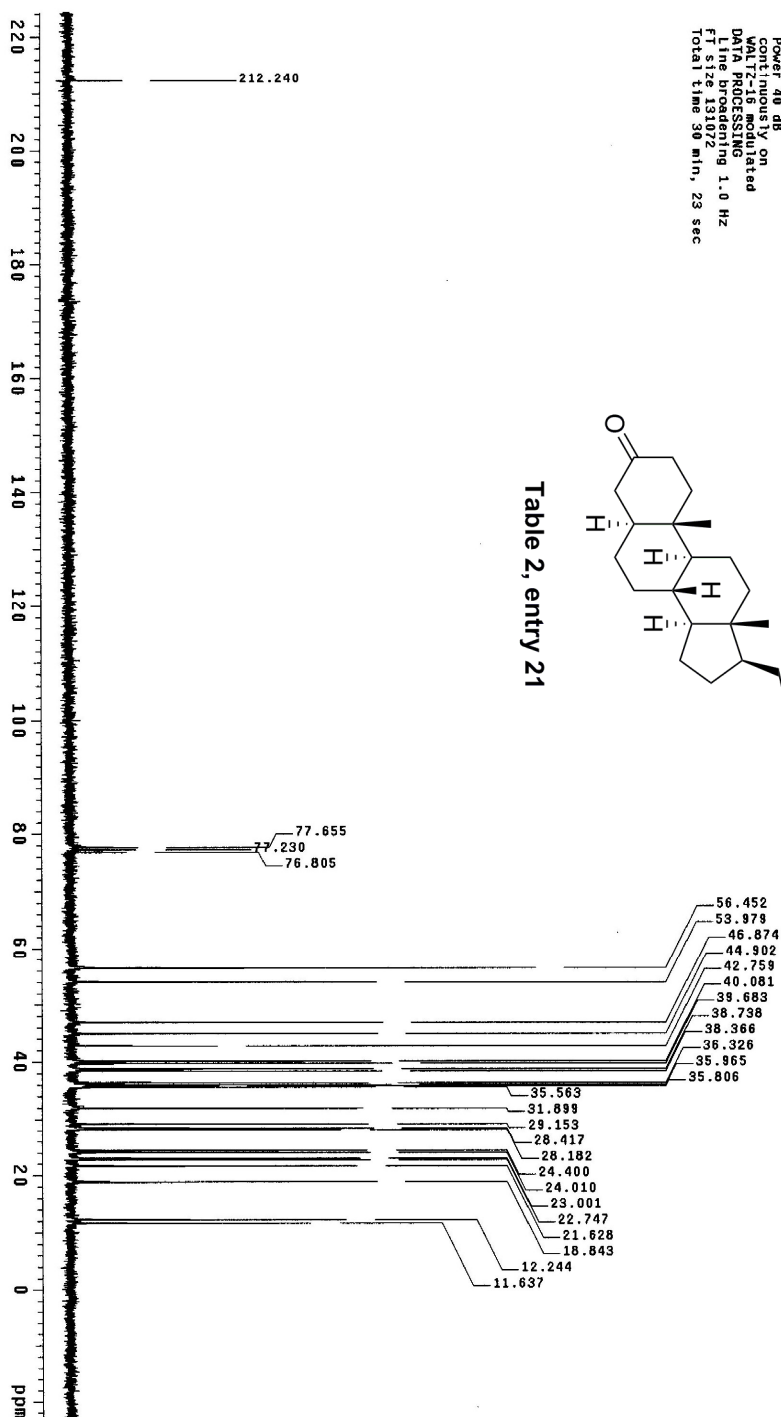


Table 2, entry 21



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
Solvent: C6D12
Ambient temperature
File: ZV412-14-1-Product-HNMR
INOVA-500 "epoxide"

Relax. delay 1.000 sec
Pulse 49.6 degrees
Acq. time 1.998 sec
Width 4500.5 Hz
A 4500.5 Hz
OBSERVE H1 300.1592136 MHz
DATA PROCESSING
FT size 32768
Total time 0 min, 12 sec

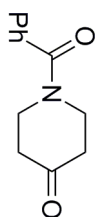
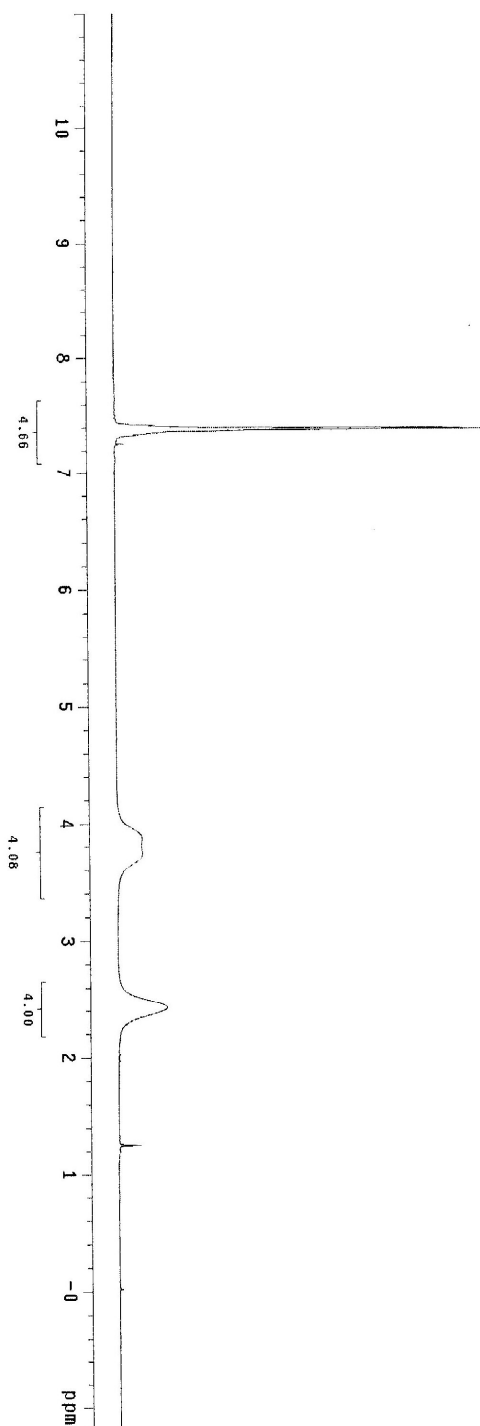


Table 2, entry 22



13C OBSERVE

Pulse Sequence: szput
Solvent: CDCl3
Sample Temperature: 299.15 K
F1: 201.254 MHz Product-CHMR
INOVA-500 "epoxide"

Pulse: 55.7 degrees
Acq. time: 1.815 sec
Width: 18761.7 Hz
338 repetitions
OBSERVE: C13, 55.4750926 MHz
DECOUPLE: 1H, 125.7603500 MHz
Power: 40 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening: 1.0 Hz
FT size: 131972
Total time: 50 min, 23 sec

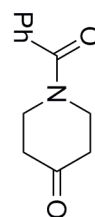
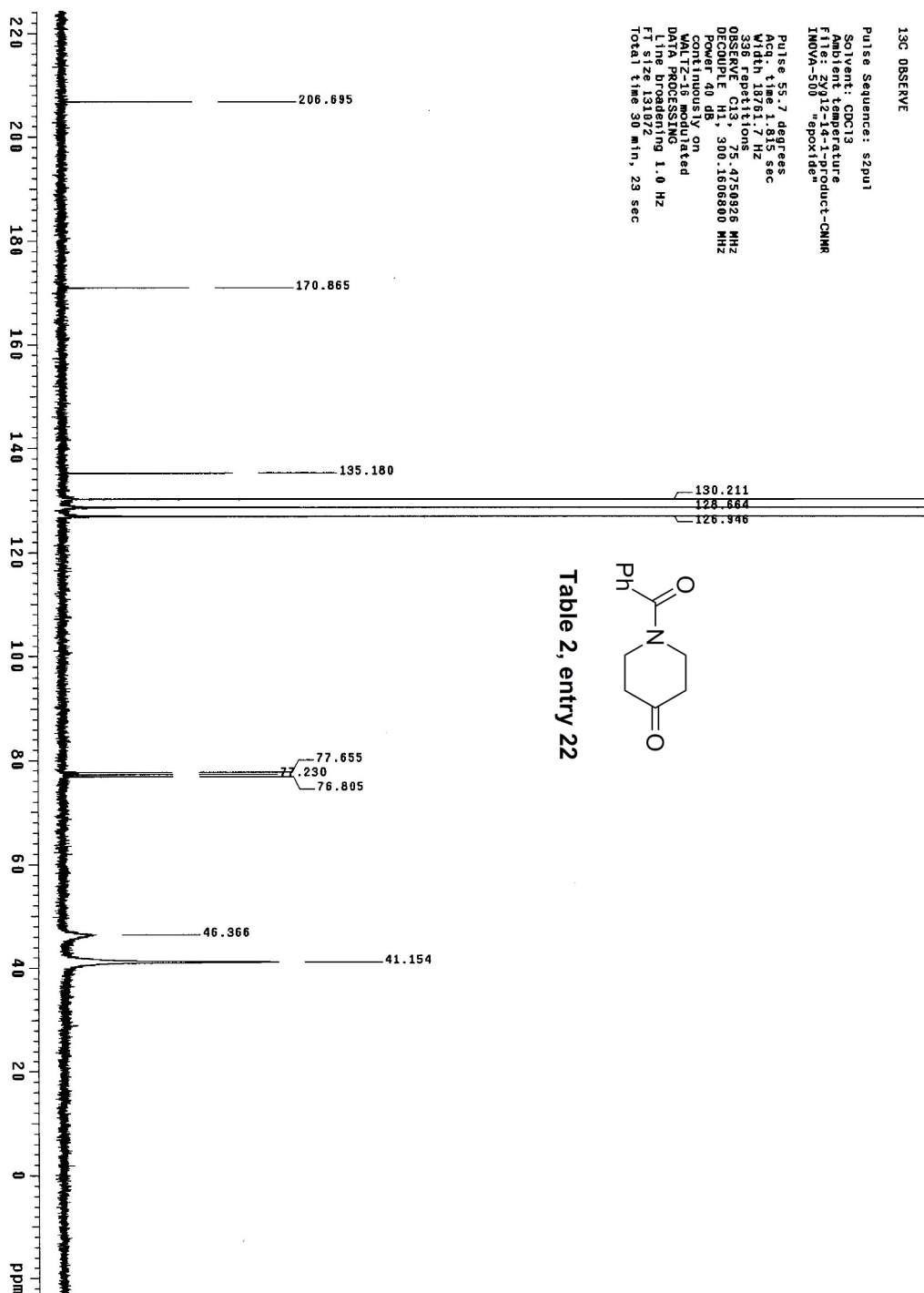


Table 2, entry 22



STANDARD IN OBSERVE

Pulse Sequence: zgpg30

Solvent: CDCl3
Sample: 423-03-03-Product-HNMR
File: 423-03-03-Product-HNMR
INOVA-500 "epoxide"

Relax. delay: 1.000 sec
Pulse: 49.6 degrees
Acq. time: 1.998 sec
Width: 4500.5 Hz
Repetitions: 4
SSE: 0.0001592196 MHz
DSS: 4.700000000000000
DATA PROCESSING
FT size: 32768
Total time: 0 min, 12 sec

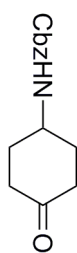
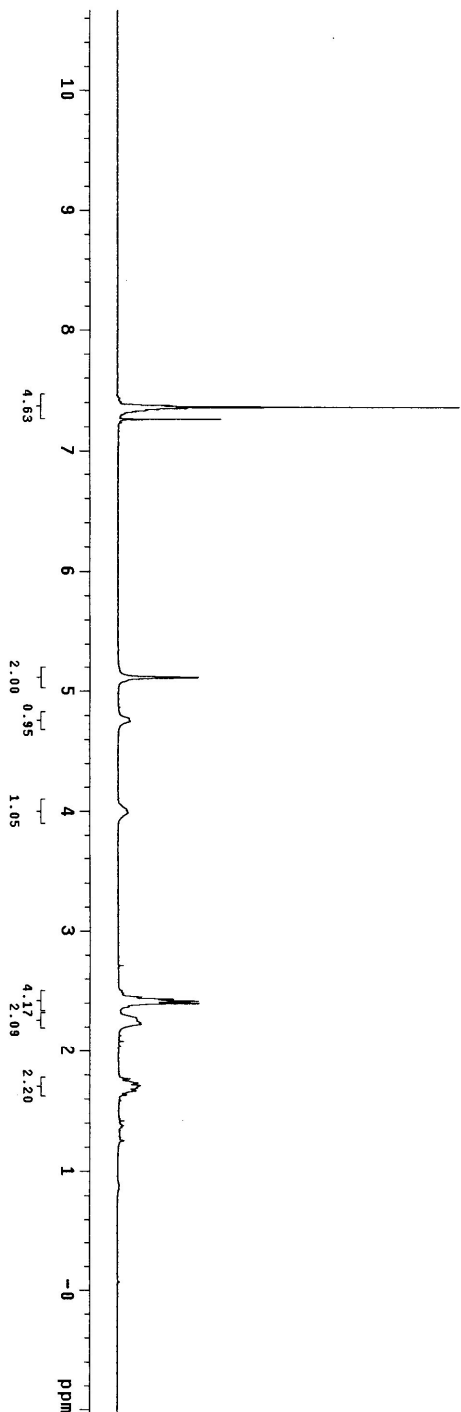


Table 2, entry 23



Pulse Sequence: szpu1
Solvent: CDCl3
Ambient temperature
File: zyg23-09-product-CNMR
INOVA-500 "epoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18.61.7 Hz
192 repetitions
OBSERVE C13, 75.4750923 MHz
DECUPLE H1, 300.1606800 MHz
Power 40 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
Ft size 131072
Total time 30 min, 23 sec

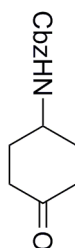
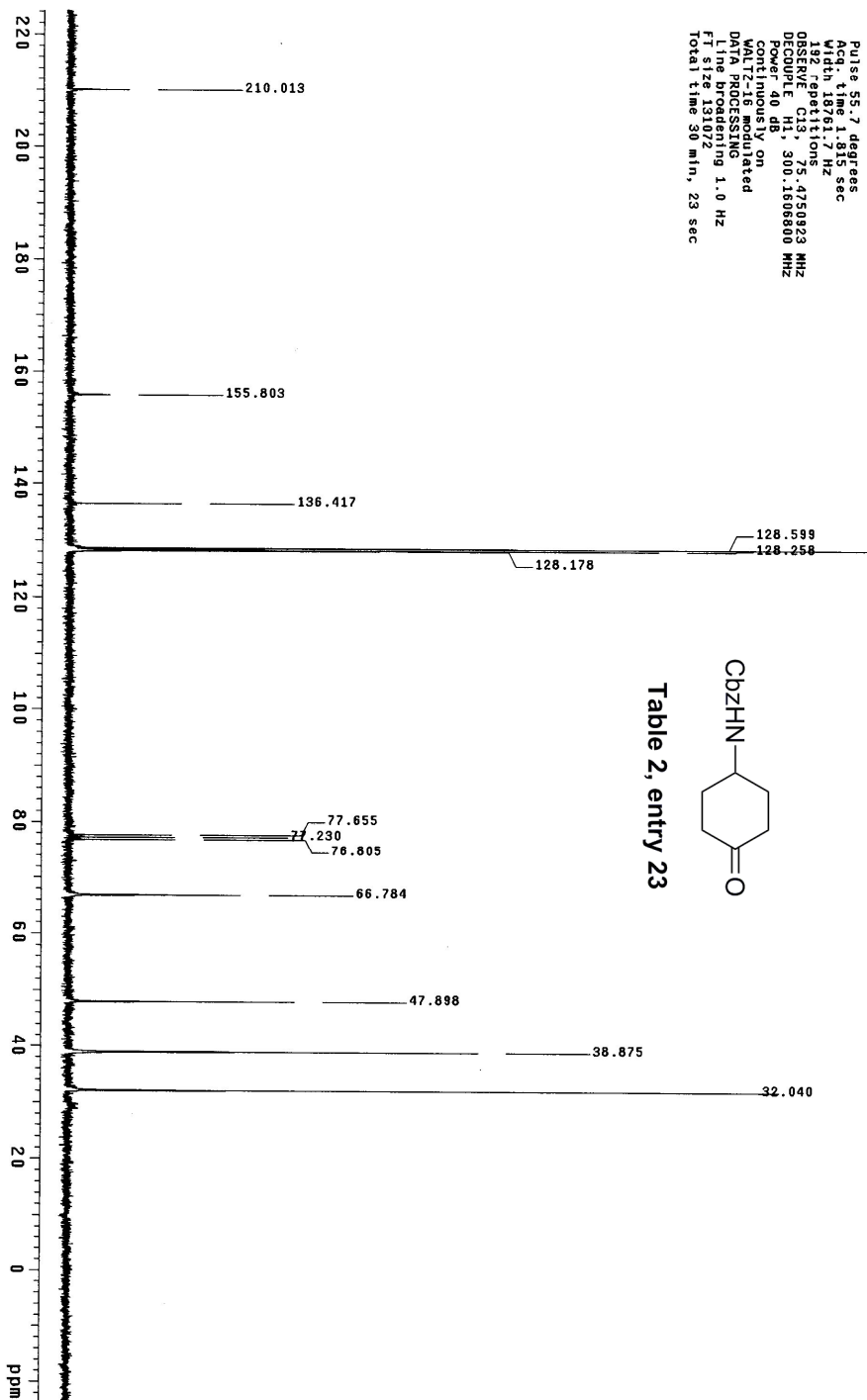


Table 2, entry 23



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: 2011-02-10 Product-HNMR
INOVA-S01 "epoxide"
Relax. delay: 1.000 sec
Pulse: 34.0 degrees
Acq. time: 2.792 sec
Width: 6000.2 Hz
10 repetitions
OBSERVED: 99.9503069 MHz
DRYING: 100%
Gauss amplification: 0.824 sec
FT size: 65536
Total time: 9 min, 44 sec

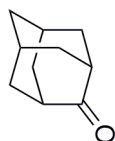
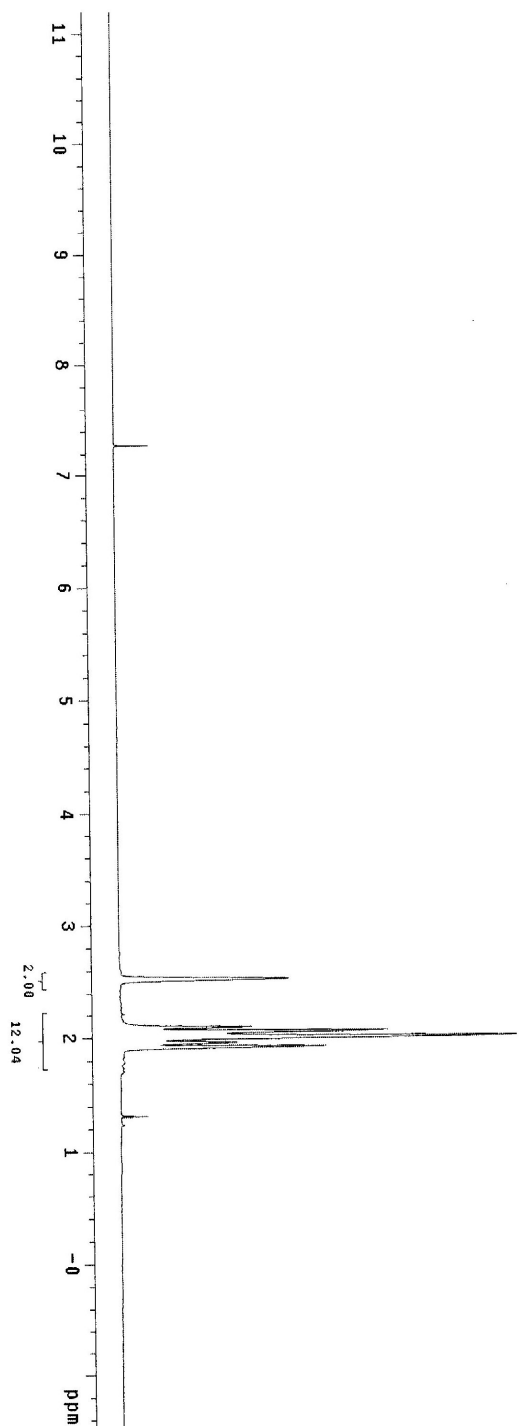


Table 2, entry 24



¹³C OBSERVE

Pulse Sequence: szpul

Solvent: CDCl₃
Sample Temperature: 25.00
F1: 125.761 MHz Product-CMR
INOVA-500 "epoxide"

Relax. delay 1.500 sec
Pulse 39.1 degrees
Acq. time 0.800 sec
Width 20000.0 Hz
256 repetitions
F2: 125.761 MHz
Observed C13: 25.425518 MHz
Decouple C13: 25.518068 MHz
Power 36 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
F1: 125.761 MHz
Total time 38 min, 28 sec

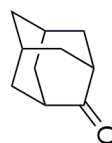
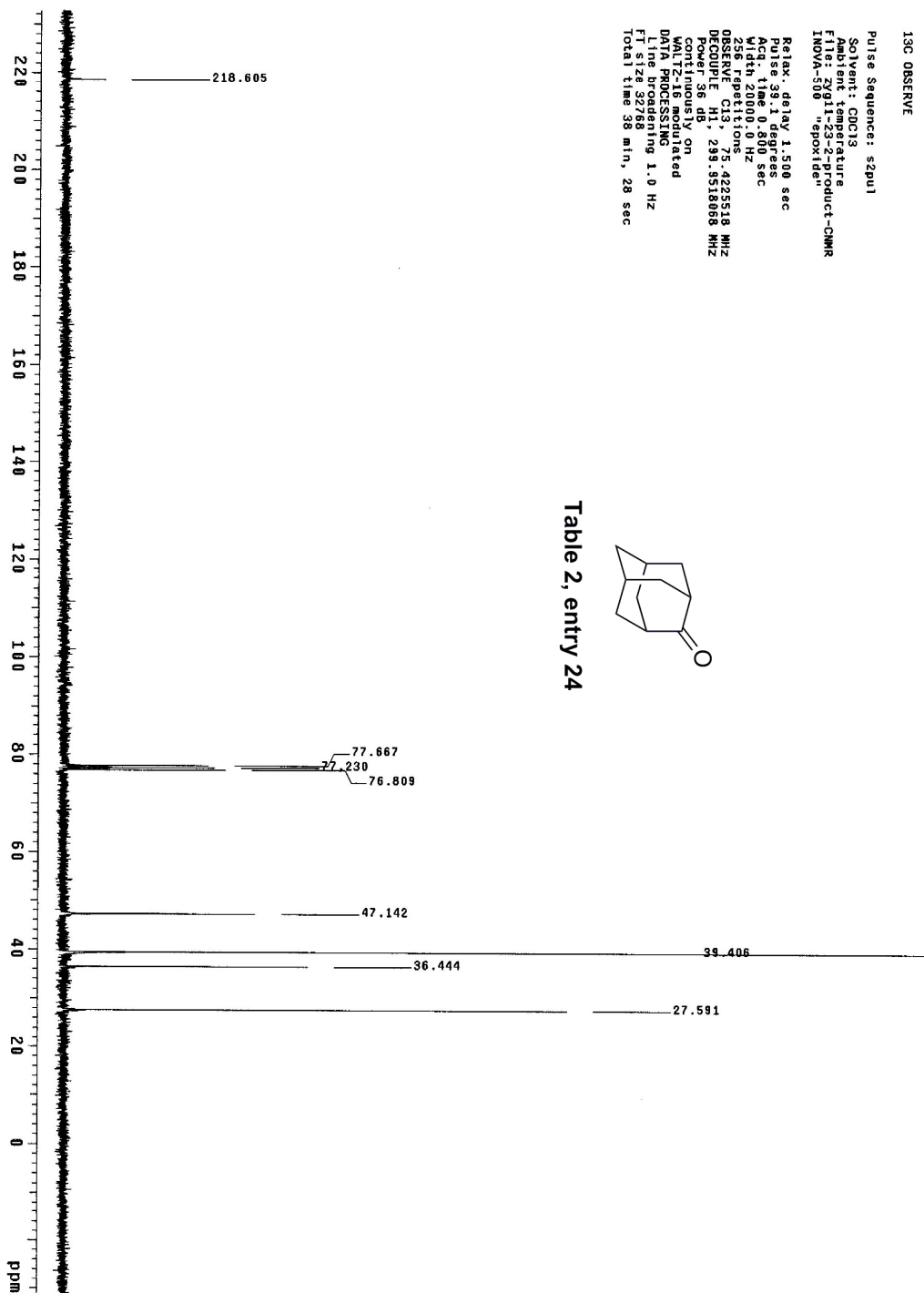


Table 2, entry 24



STANDARD 1H OBSERVE

Pulse Sequence: szpul
Solvent: CDCl3
Ambient temperature
File: 2y12-26-1-Product-1HMR
INOVA-500 "epoxide"
Relax. delay 1.000 sec
Pulse 49.6 degrees
Acq time 0.155 sec
Width 4500.5 Hz
4 repetitions
OBSERVE H1, 300.1592136 MHz
DATA PROCESSING
FT size 32768
Total time 0 min, 12 sec

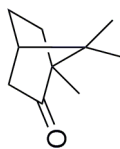
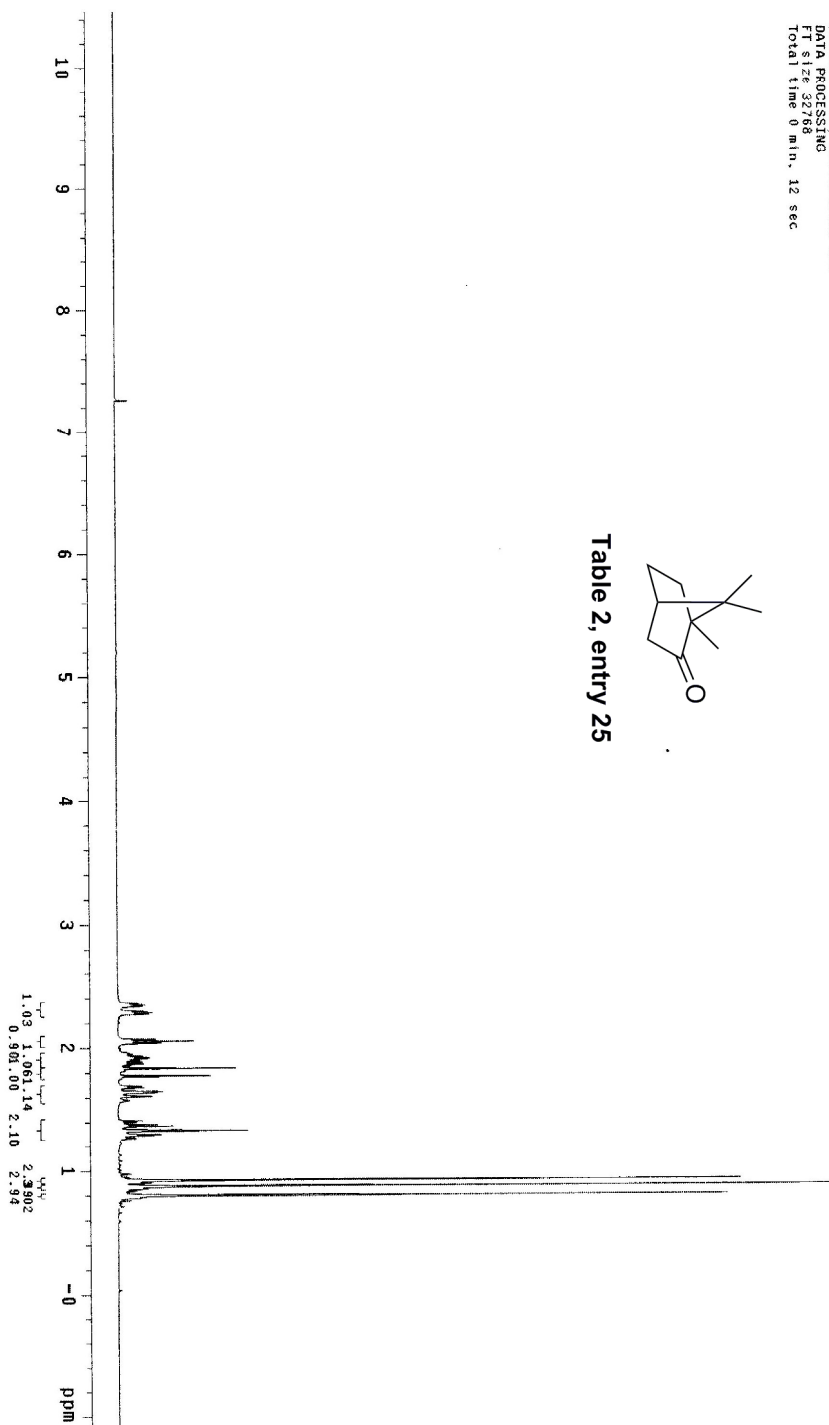


Table 2, entry 25



13C OBSERVE

Pulse Sequence: szpu1

Solvent: CDCl3

Ambient temperature

File: zyj12-25-1-product-CNMR

INDVA-500 "epoxide"

Pulse 55.7 degrees

Acq. time 1.915 sec

Width 1861.0 Hz

Observed C13 75.4750811 MHz

Decouple H1, 300.1606800 MHz

Power 40 dB

continuously on

WALTZ-16 modulated

DATA PROCESSING

File processing 1.0 Hz

FI size 131872

Total time 30 min, 23 sec

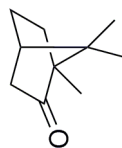
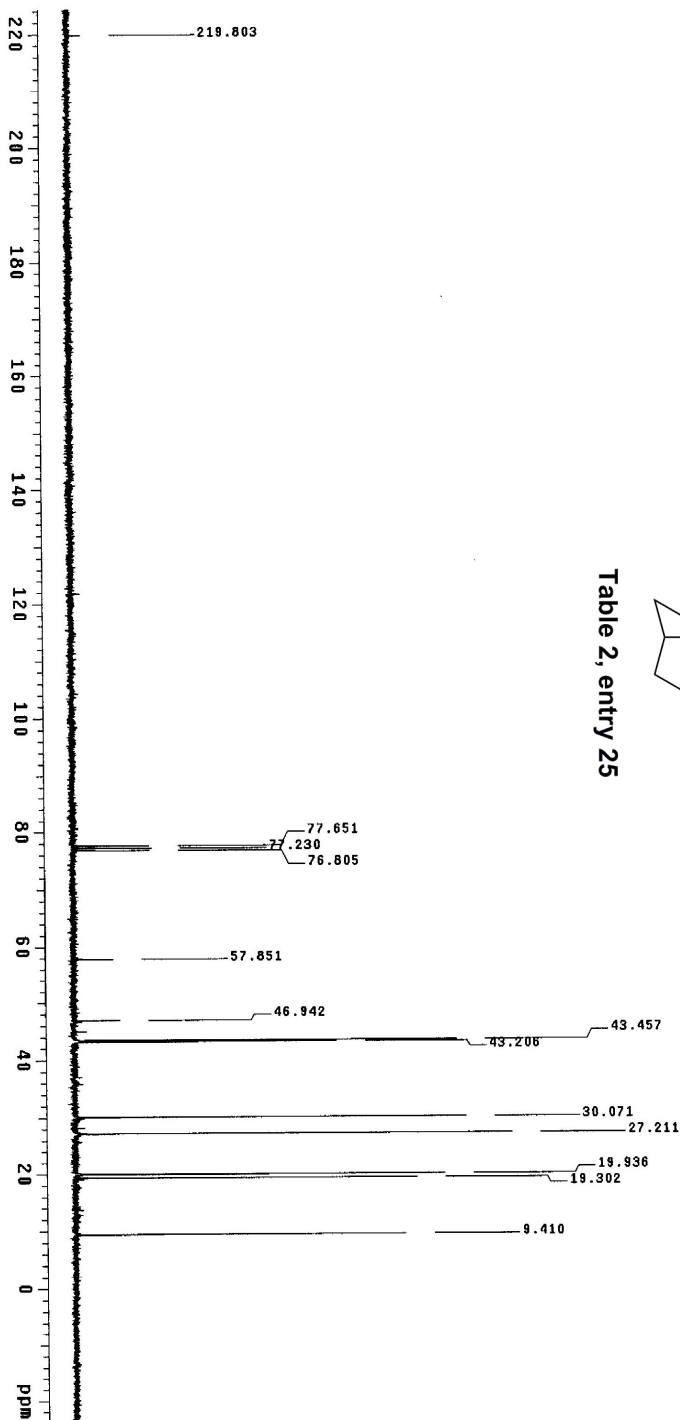


Table 2, entry 25



STANDARD 1H OBSERVE

Pulse Sequence: szpul
 Solvent: CDCl3
 Acquisition Temperature: 300.15 K
 F1 (1): 500.131 MHz product-1H NMR
 INOVA-500 "epoxide"
 Relax, delay 1.000 sec
 Pulse 49.6 degrees
 Acq. time 1.338 sec
 Width 4500.5 Hz
 4 repetitions
 300.1542196 MHz
 DATA PROCESSING
 FT size 32768
 Total time 0 min, 12 sec

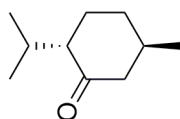
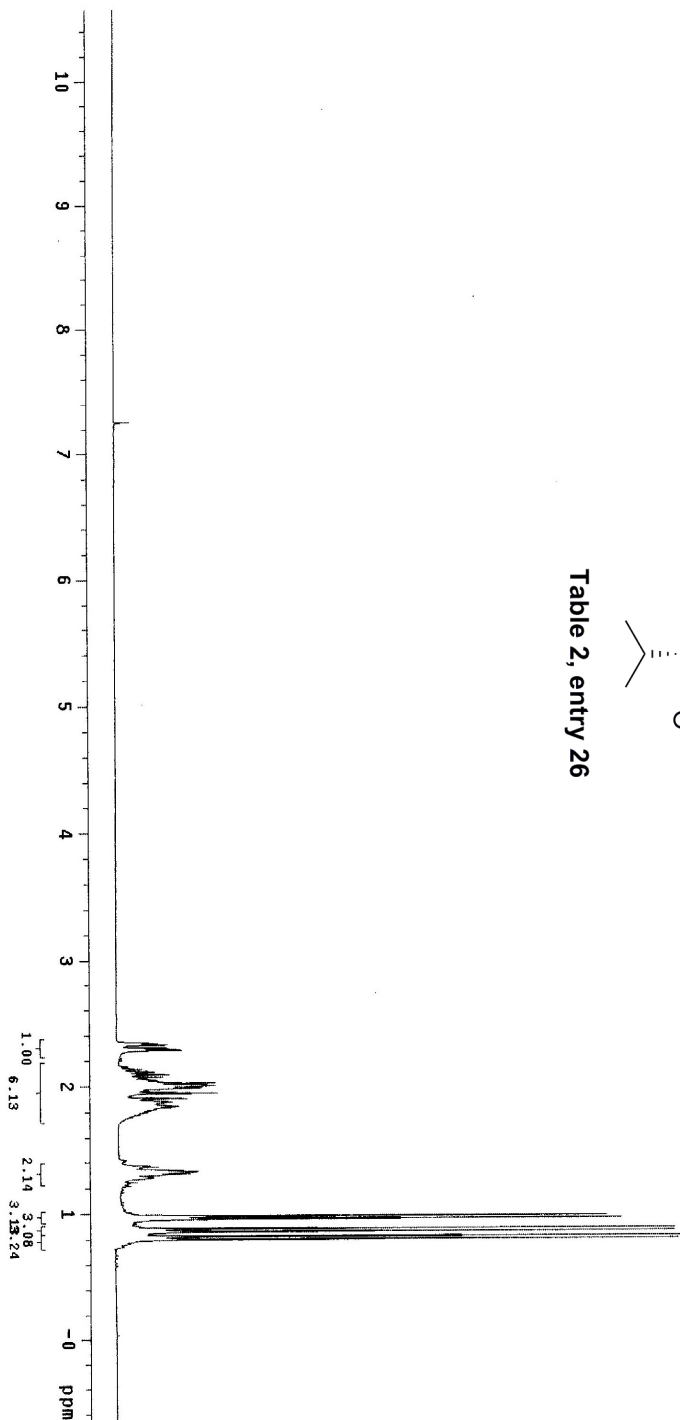


Table 2, entry 26



¹³C OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: ZYG11-31-product-CNMR
INOVA-500 "epoxide"
Pulse 55.7 degrees
Width 18761.2 Hz
272 repetitions
OBSERVE C13, 75.4750814 MHz
DECOUPLE H1, 300.1606800 MHz
Power 40 dB
CONTINUOUSLY ON
WALTZ16 computed
DATA PROCESSING
Line broadening 1.0 Hz
F1 size 131072
Total time 30 min, 23 sec

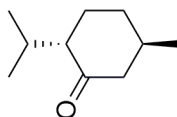
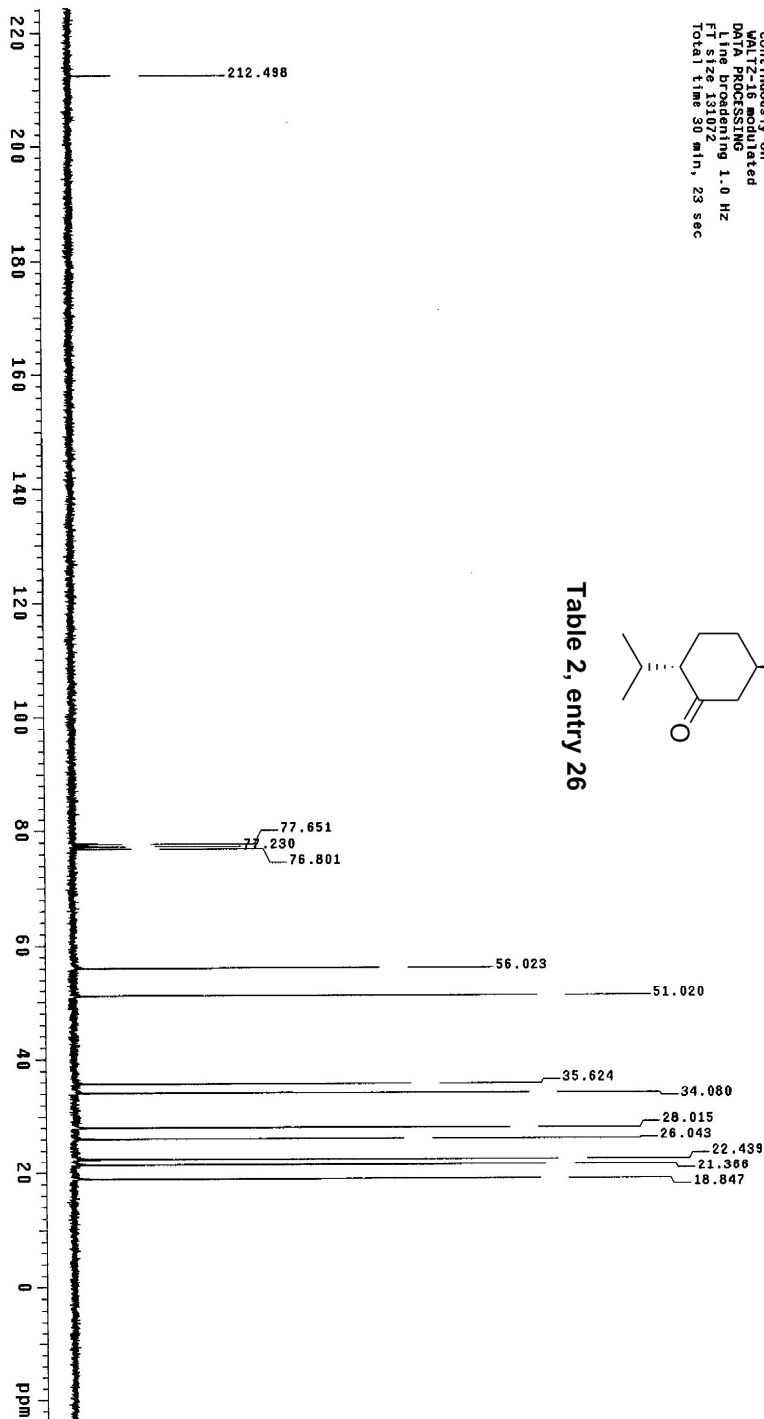


Table 2, entry 26

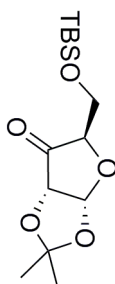


STANDARD 1H OBSERVE

Pulse Sequence: s2pu1

Solvent: CDCl3
Acquisition Temperature: 300.2 K
File: %012-48-1-Product-HMR
INDVA-500 "epoxide"

Relax. delay 1.000 sec
Pulse 49.6 degrees
Acq. time 1.998 sec
Width 4500.5 Hz
Observations 300.1592196 MHz
DATA PROCESSING
FT size 32768
Total time 0 min, 12 sec



¹³C OBSERVE

Pulse Sequence: szpu1
Solvent: CDCl3
Ambient temperature
F1: 75.4750778 MHz Product-CMR
INOVA-500 "epoxide"
Pulse: 55.7 degrees
Acq. time: 1.815 sec
Width: 18761.7 Hz
112 repetitions
OBSERVE: C13, 75.4750778 MHz
DECOUPLE: H1, 300.1506500 MHz
P2: 10 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening: 1.0 Hz
FT size: 131072
Total time: 50 min, 23 sec

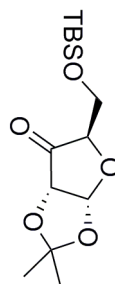
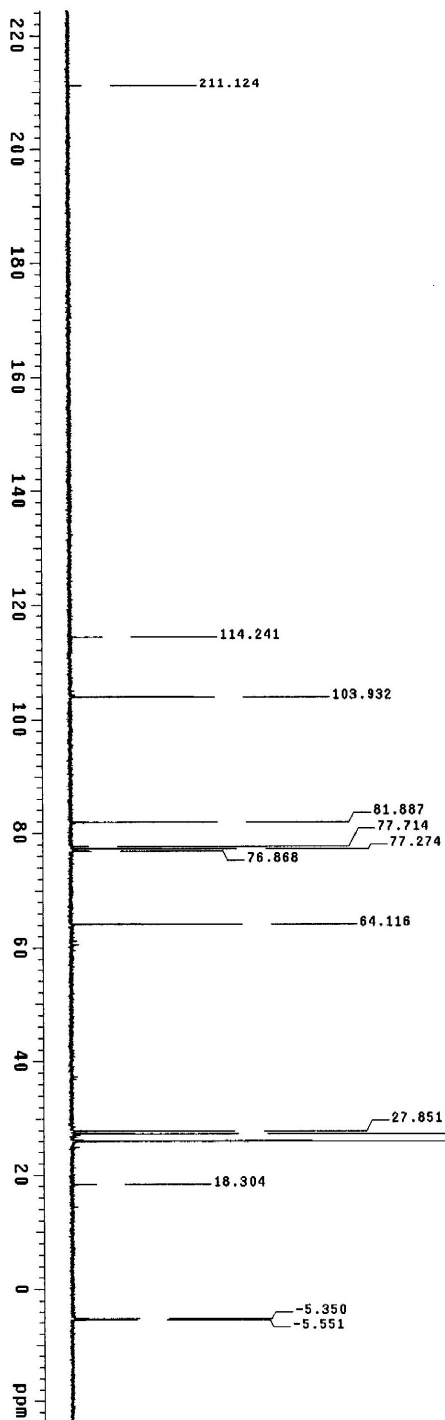


Table 2, entry 27



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
 Solvent: CDCl3
 Ambient temperature
 File: 2yg11-49-product-HMR
 INOVA-500 "epoxide"
 Relax. delay 1.000 sec
 Pulse 12.600 sec
 Acq. time 1.480 sec
 Width 4500.5 Hz
 4 repetitions
 OBSERVE H1, 300.1592196 MHz
 DATA PROCESSING
 F1 size 32768
 Total time 0 min, 12 sec

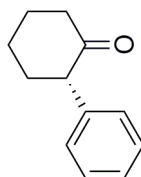
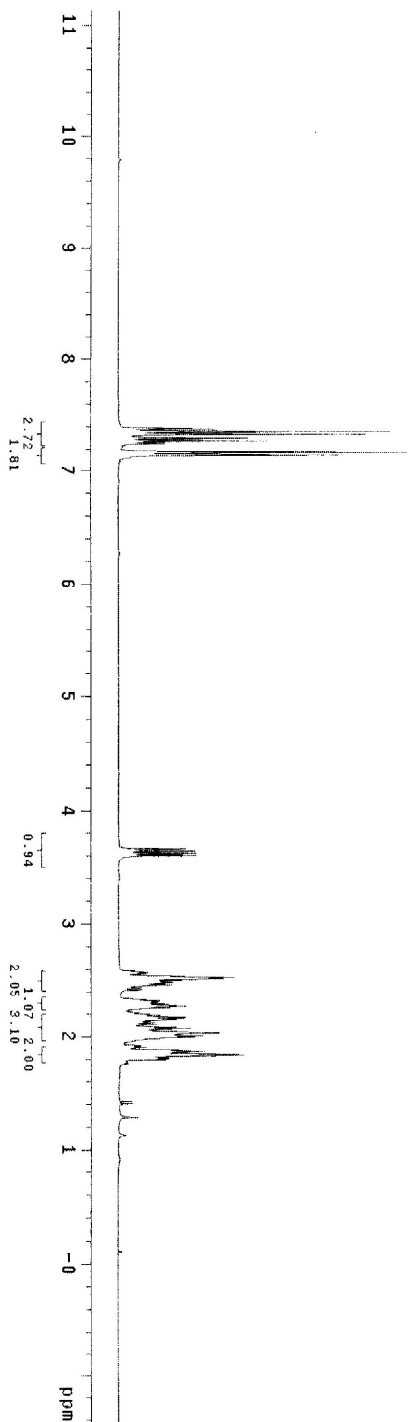


Table 2, entry 28



13C OBSERVE

Pulse Sequence: szpu1

Solvent: CDCl3

Ambient temperature

File: 29011-48-product-CHMR

INOVA-300 "epoxide"

Pulse: 55.7 degrees

Acquisition: 1.65 sec

Width: 18761.7 Hz

384 repetitions

OBSERVE: Q13, 75.4750877 MHz

DECOUPLE: H1, 300.1606000 MHz

Power: 40 dB

NOE: 1.00000000

WALTZ-16 modulated

DATA PROCESSING

Line broadening 1.0 Hz

FT size 131072

Total time 30 min, 23 sec

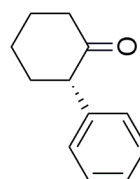
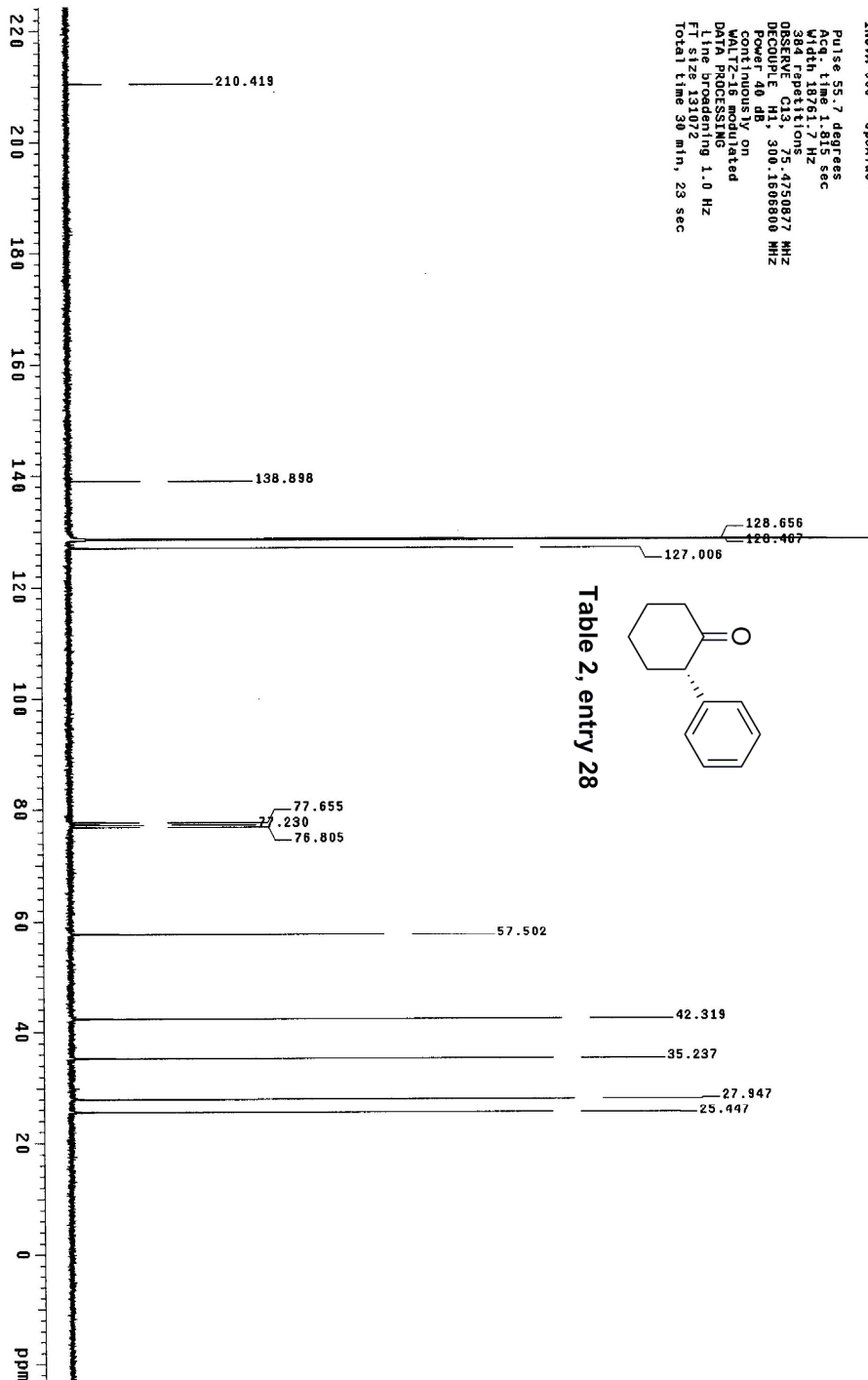


Table 2, entry 28



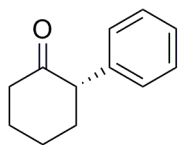
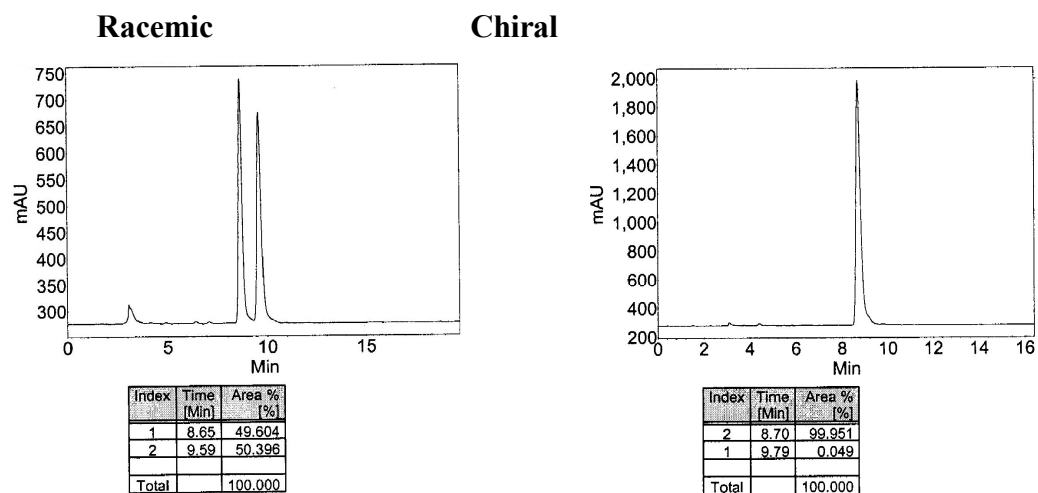


Table 2, entry 28

HPLC Conditions: **Column:** Chiralcel OD-H (Column No. ODH0CE-ME069), Daicel Chemical Industries, Ltd.; **Eluent:** Hexanes/IPA (95/5); **Flow rate:** 1.0 mL/min; **Detection:** UV 210 nm.



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1

Solvent: CDCl3

Acquisition Temperature

File: 2015-48-2-Product-1HMR

INOVA-500 "epoxide"

Relax. delay 1.000 sec

Pulse 49.6 degrees

Acq. time 1.398 sec

Width 4500.5 Hz

110000000.1592196 MHz

OBSERVED

DATA PROCESSING

FT size 32768

Total time 0 min, 30 sec

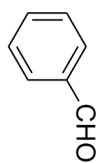
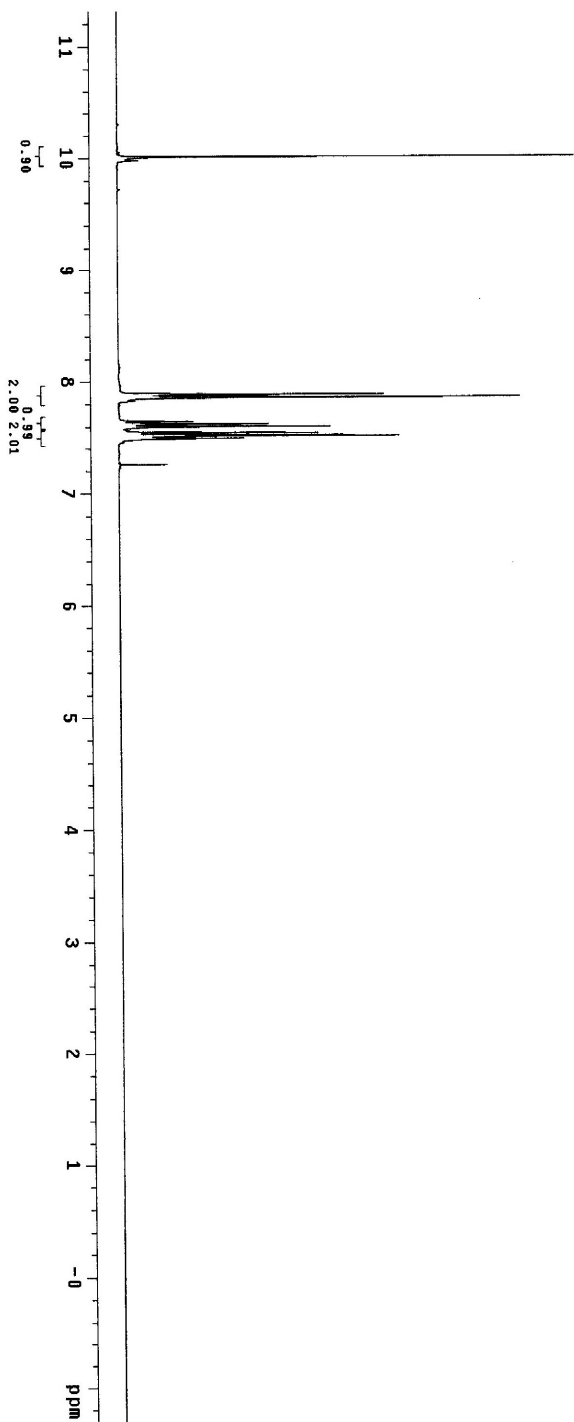


Table 3, entry 1



13C OBSERVE

Pulse Sequence: szpu1

Solvent: CDCl3

Ambient temperature

File: Zygis-49-2-product-CNMR

INOVA-500 "epoxide"

Pulse 55.7 degrees

Acq. time 1.815 sec

Width 1861.0 Hz

Y1 offset 10.0 Hz

OBSERVE C13 75.4750823 MHz

DECOUPLE H1, 300.1606800 MHz

Power 40 dB

continuously on

WALTZ-16 modulated

DATA PROCESSING

File processing 1.0 Hz

FI size 131872

Total time 30 min, 23 sec

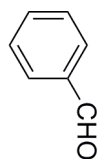
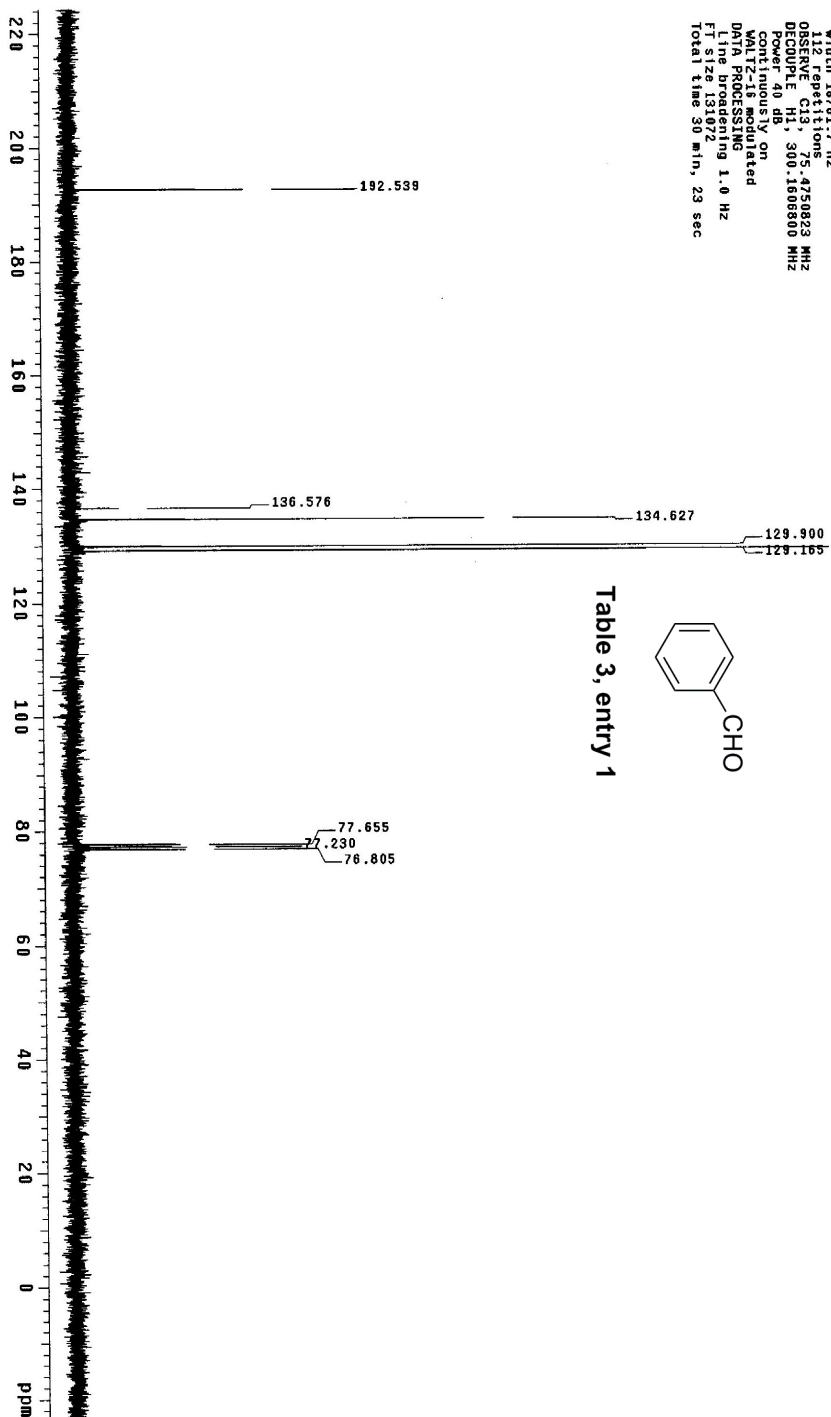


Table 3, entry 1



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
 Solvent: CDCl3
 Ambient temperature
 File: ZYG14-47-HNMK
 INOVA-500 "epoxide"

Relax. delay 5.000 sec
 Pulse 28.3 degrees
 Acq. time 1.998 sec
 Width 4500.5 Hz
 Freq 125.761 MHz
 OBSERVE 1H 300.1592196 MHz
 DATA PROCESSING
 FT size 32768
 Total time 0 min, 16 sec

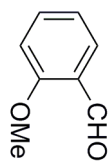
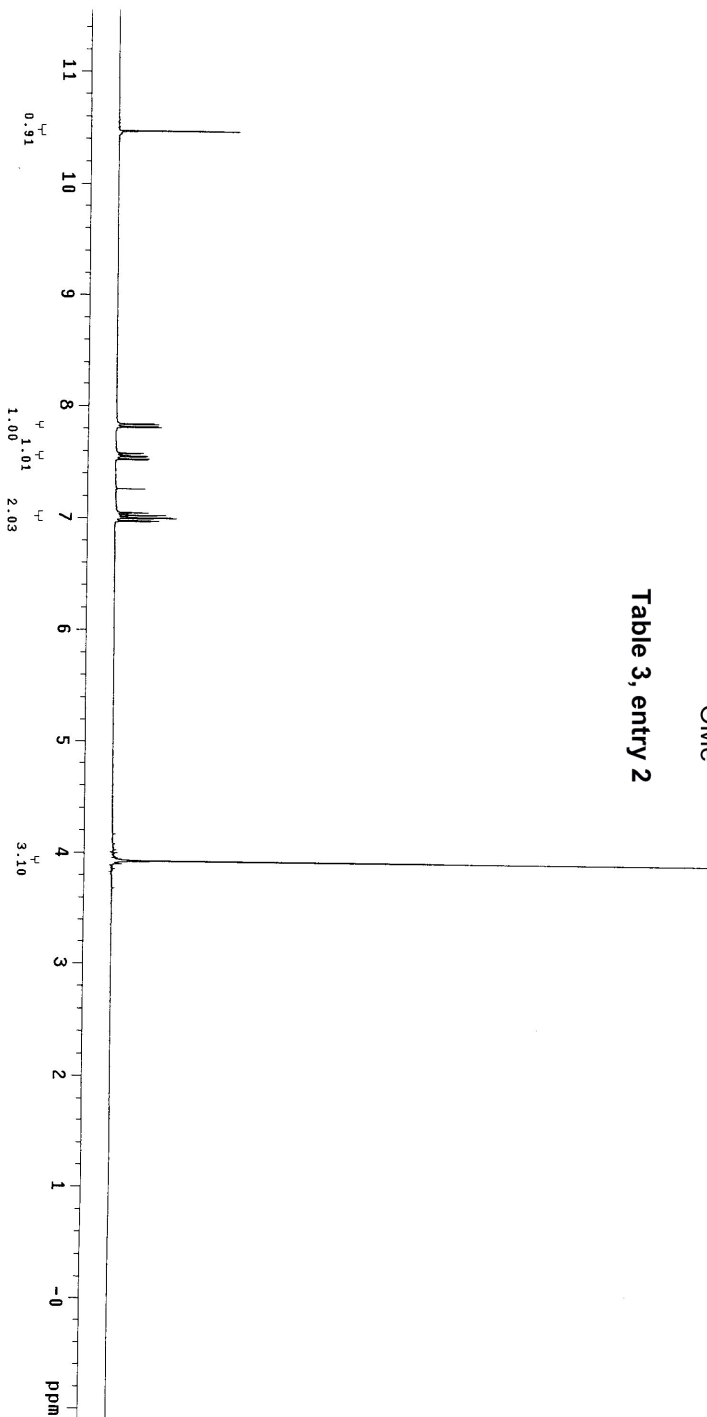


Table 3, entry 2



13C OBSERVE

Pulse Sequence: zgpg30
Solvent: CDCl3
Acquisition Temperature
File: zy014-47-product-CHMR
INOVA-500 "epoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 16761.7 Hz
228 repetitions 4750848 MHz
0.8500000000000000
DECOUPLE CH1 300.160800 MHz
Power 40 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
F1 4750848.0000000000
Total time 30 min, 23 sec

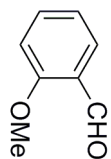
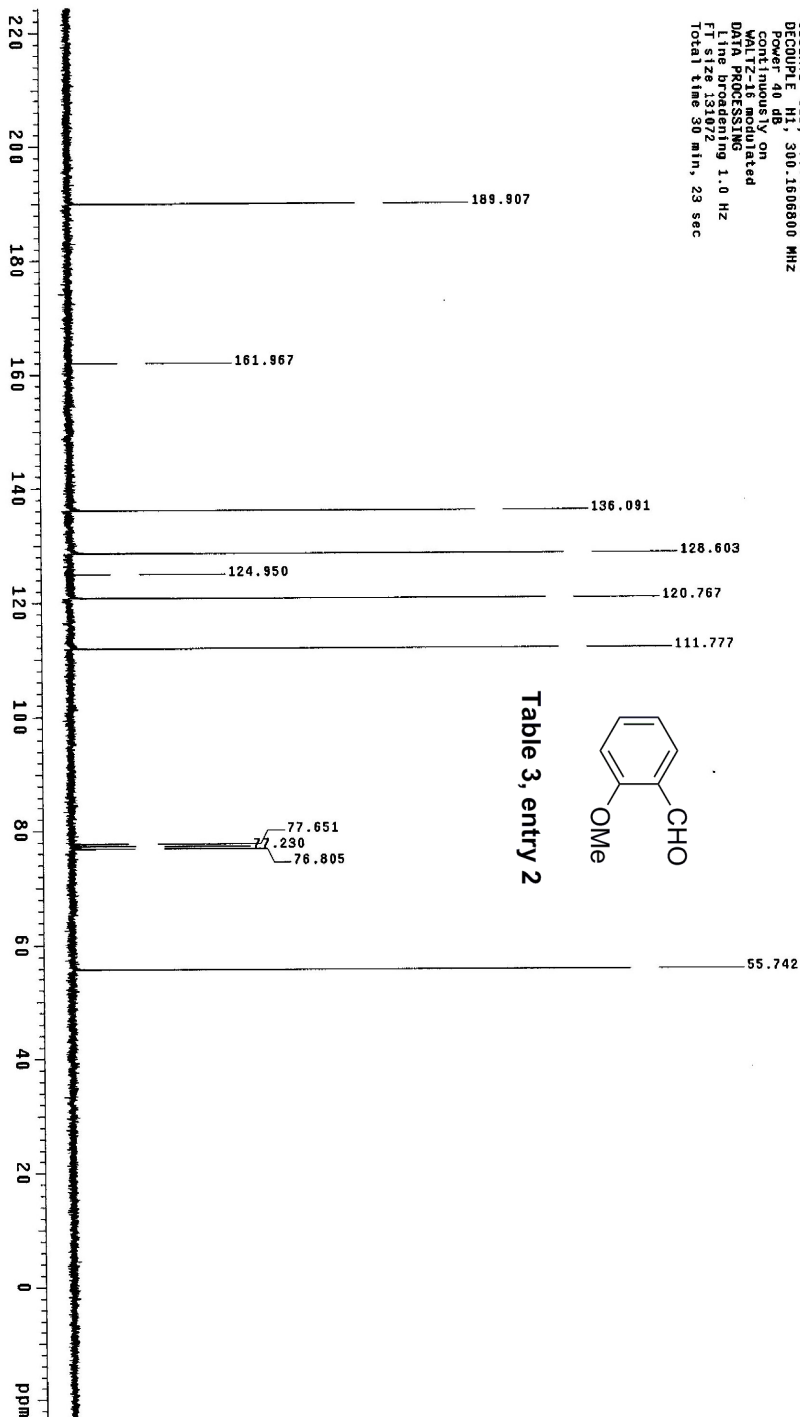


Table 3, entry 2



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
F1: 201.434 MHz
NUC1: 13C
XNMR-500 "apx100"
Relax. delay: 1.000 sec
Pulse: 49.6 degrees
Acq. time: 1.998 sec
Width: 4590.5 Hz
10 repetitions
OBSERVE: H1: 300.1592196 MHz
DECODE: PROCSSNO
F1: 12.32764 MHz
Total time: 0 min, 30 sec

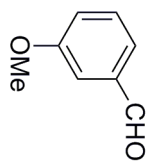
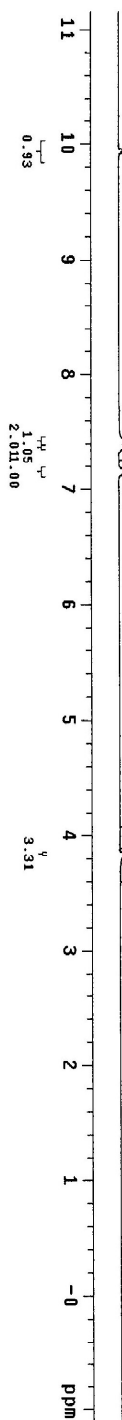


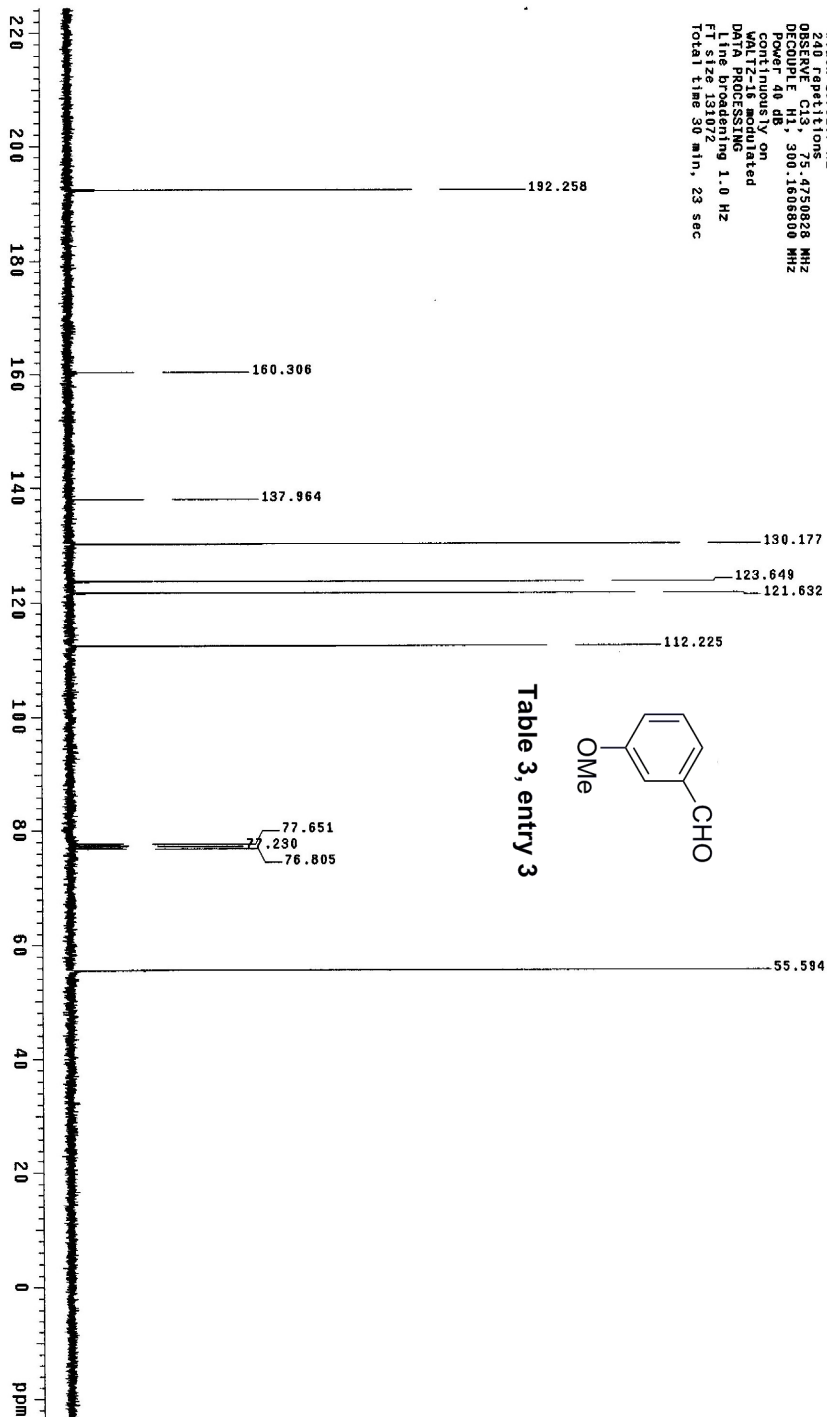
Table 3, entry 3



Pulse Sequence: s2put

Solvent: CDCl₃
Ambient temperature
File: Zyg14-44-product-CNMR
INOVA-500
"epoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 1861.7 Hz
240 repetitions
OBSERVE C13, 75.4750828 MHz
DECOUPLE H1, 300.160800 MHz
Power 40 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 131072
Total time 30 min, 23 sec



STANDARD 1H OBSERVE

Pulse Sequence: szpul
Solvent: CDCl3
Ambient temperature
File: zy914-30-1HMR
INDV-A-500 "epoxide"

Relax. delay 1.000 sec
Pulse 49.6 degrees
Acq. time 1.998 sec
SFO 100.625 MHz
419861100
OBSERVE H1, 300.1592196 MHz
DATA PROCESSING
FT size 32768
Total time 0 min, 12 sec

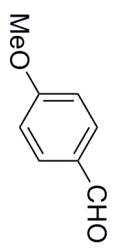
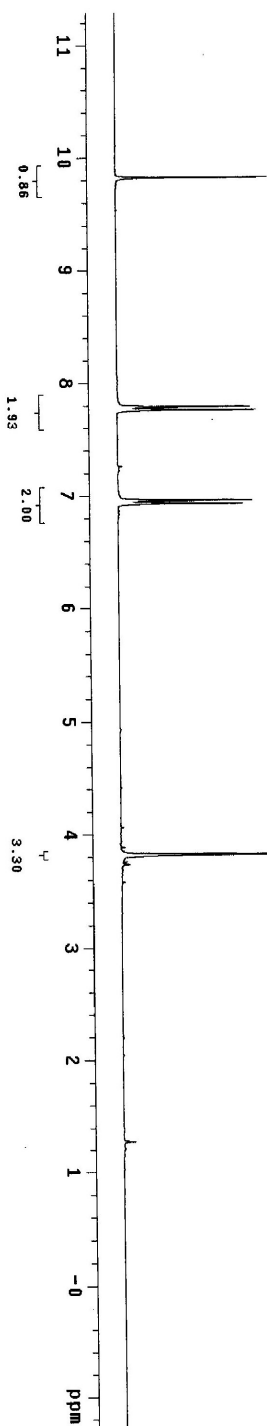


Table 3, entry 4



¹³C OBSERVE

Pulse Sequence: zgpg30
Solvent: CDCl₃
Acquisition Temperature
File: zgpg30-13C-NMR
INNOVA-500 "epoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
180 repetitions
OBSERVE C13, 300.160800 MHz
PULSE 40 dB
Power 40 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 131072
Total time 30 min, 23 sec

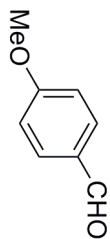
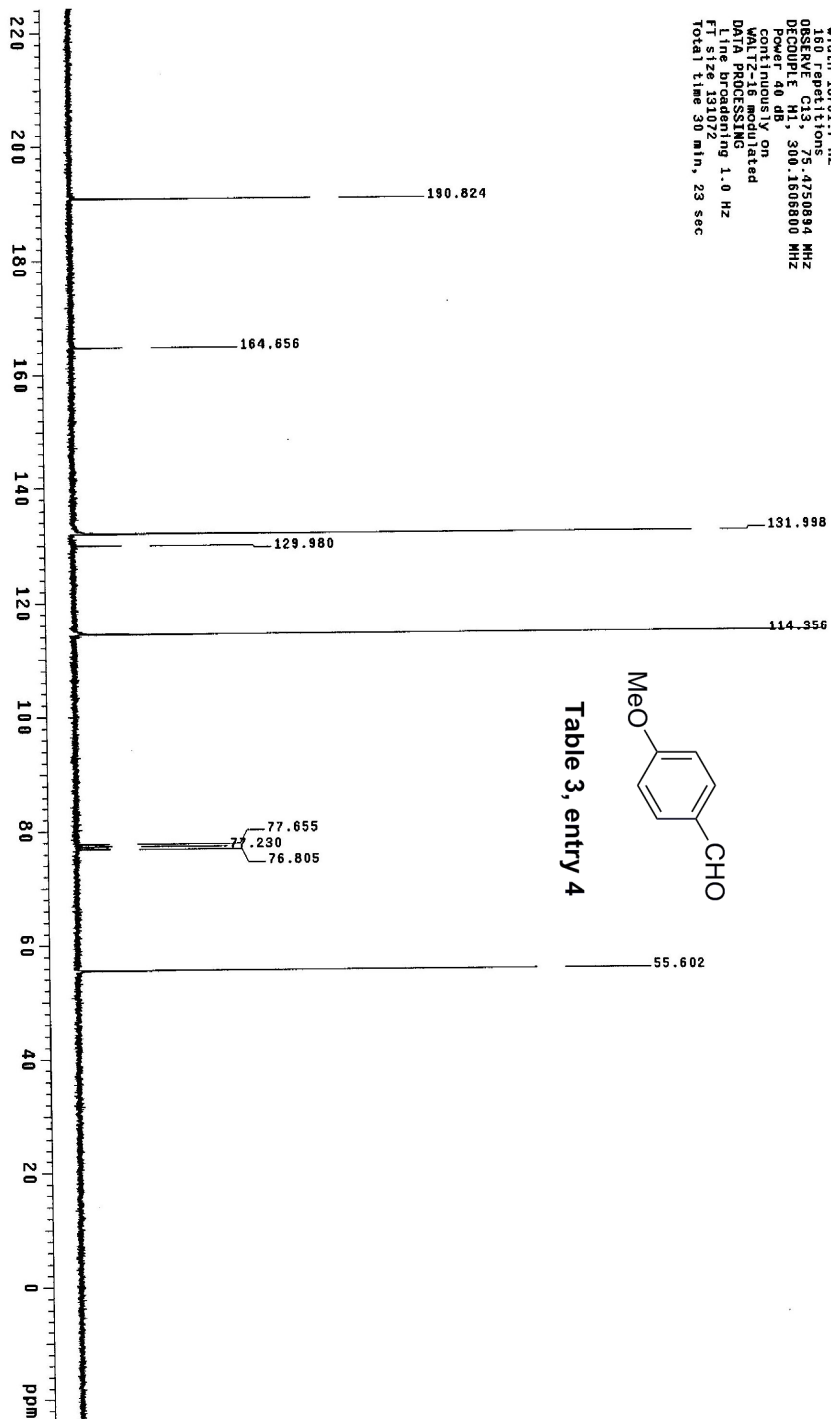


Table 3, entry 4



STANDARD 1H OBSERVE

Pulse Sequence: s2pul
 Solvent: CDCl3
 Ambient temperature
 File: ZYG22-40-1-1HMR
 INOVA-500 "epoxide"

Relax. delay 1.000 sec
 Pulse 49.6 degrees
 Acq. time 1.998 sec
 vlen 492.5 Hz
 4 CON 150 sec
 OBSERVE H1 300.1592196 MHz
 DATA PROCESSING
 FT size 32768
 Total time 0 min, 12 sec

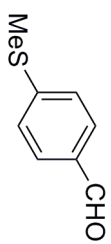
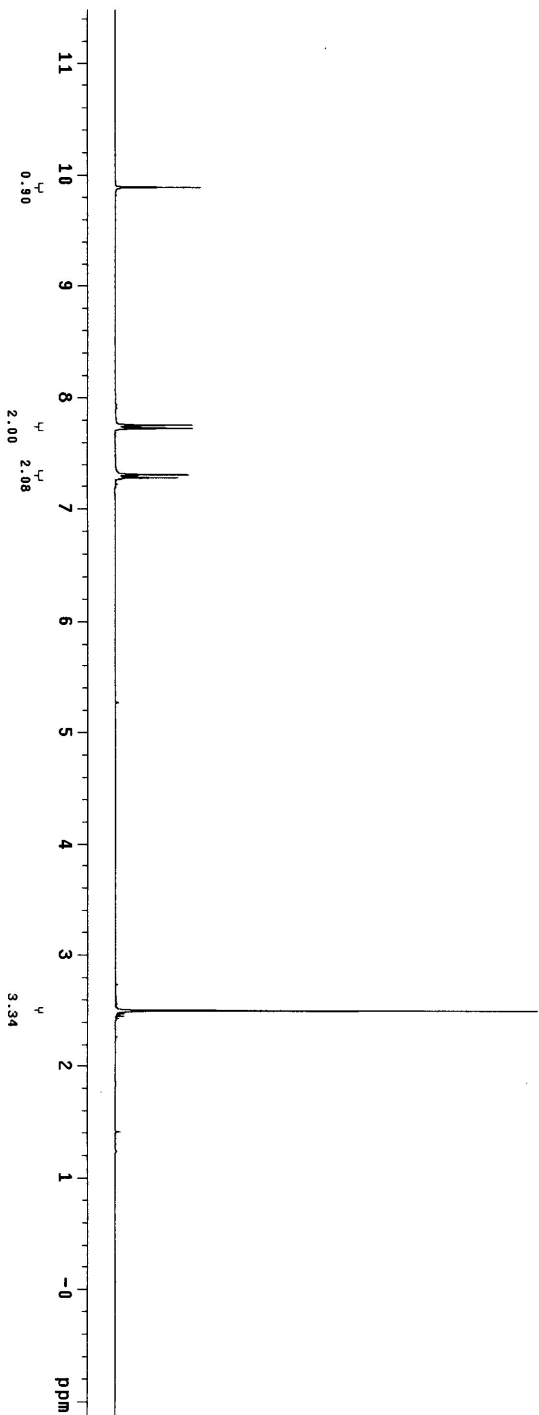


Table 3, entry 5



¹³C OBSERVE

Pulse Sequence: szpul
Solvent: CDCl₃
Sample Temperature: 300.2 K
F1: 125.762 MHz
INSTR: spect
PROBHD: 5mm QNP-1H
Pulse: 55.7 degrees
Acq. time: 1.815 sec
Width: 18761.7 Hz
64 repetitions
OBSERVE: C13, 75.4750860 MHz
DECOUPLE: H1, 300.1606800 MHz
SFO: 300.1350600 MHz
NUC1: 13C
WALTZ-16 modulated
CONTINUOUSLY ON
DATA PROCESSING
Line broadening 1.0 Hz
FT size 131072
Total time 30 min, 23 sec

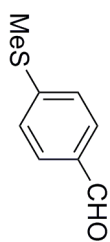
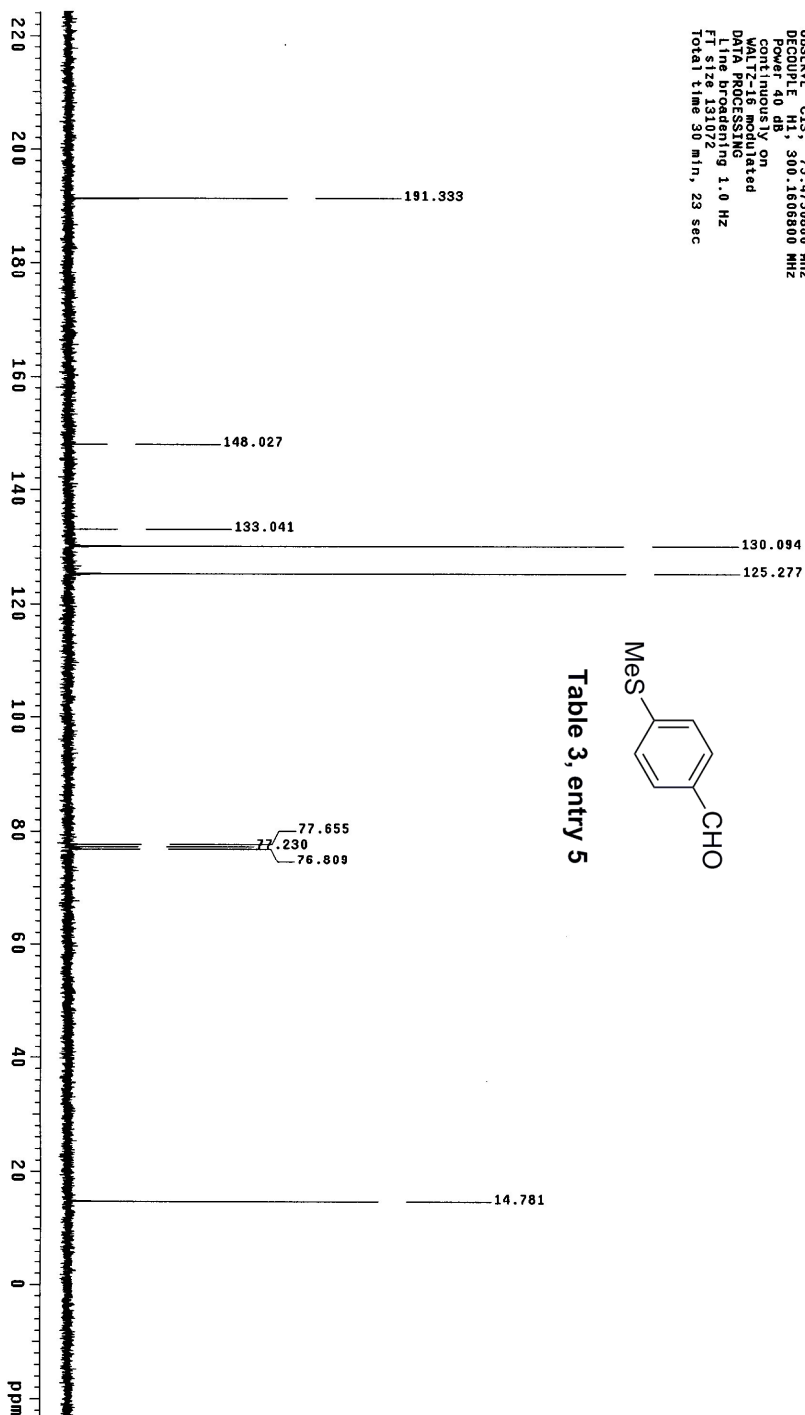


Table 3, entry 5



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: 2Yg14-38-Product-HMRK
INOVN-500 "epox1d8"
Relax: delay 1.000 sec
Pulse: 45 degrees
Acq: time 1.99 sec
Width 4500.5 Hz
4 repetitions
OBSERVE H1, 300.1592196 MHz
DATA PROCESSING
F1 size 32768
Total time 0 min, 12 sec

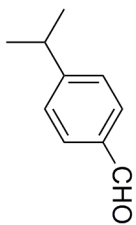
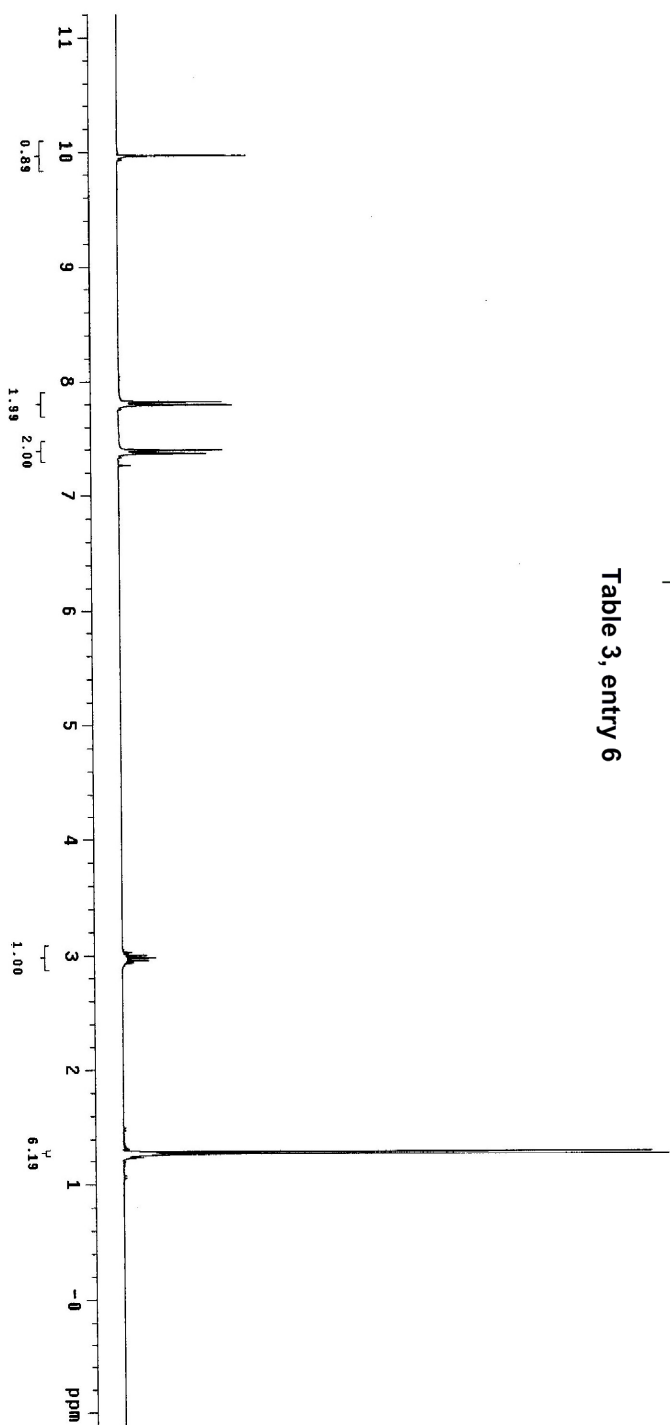


Table 3, entry 6



13C OBSERVE

Pulse Sequence: s2pul

Solvent: CDCl3

Ambient temperature

File: 29614-38-product-CDMK

INOVA-500 "epoxide"

Pulse 55.7 degrees

Acq time 1.15 sec

Width 18761.7 Hz

240 repetitions

OBSERVE C13, 75.4750826 MHz

DECOUPLE H1, 300.106800 MHz

Power 40 dB

Continuously ON

WALTZ16 simulated

DATA PROCESSING

Line broadening 1.0 Hz

FT size 131072

Total time 30 min, 23 sec

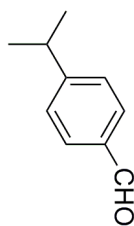
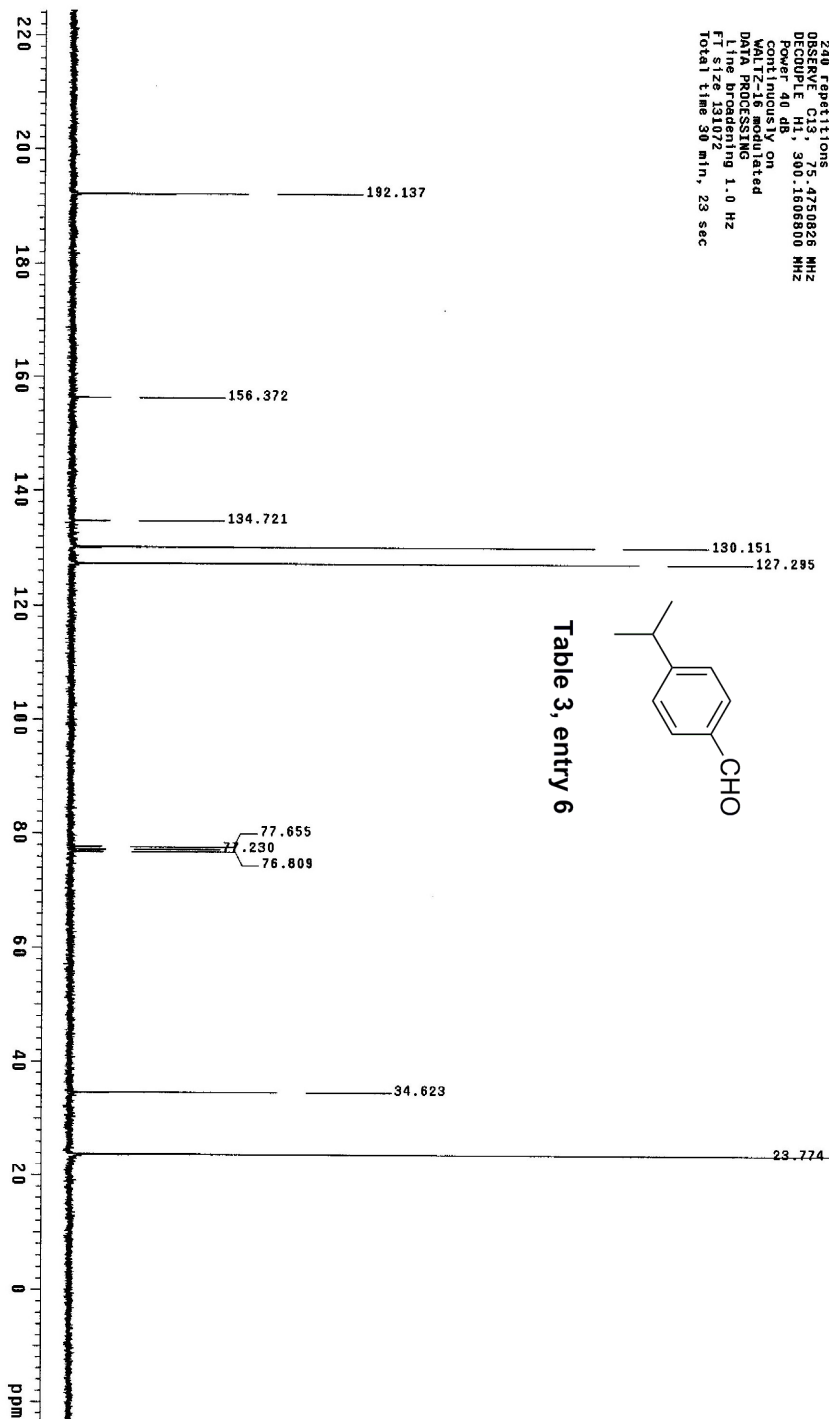


Table 3, entry 6



STANDARD 1H OBSERVE
Pulse Sequence: szpu1
Solvent: CDCl3
Acq. temperature: 300.15 K
File: ZY014-97-product-1HMR
INOVA-500 "apoxide"
Relax. delay 1.000 sec
Pulse 49.6 degrees
Acq. time 1.998 sec
Width 4500.5 Hz
of repetitions 500.1592196 MHz
OBSERVED F1
DATA PROCESSING
FT size 32768
Total time 0 min, 12 sec

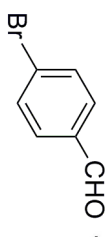
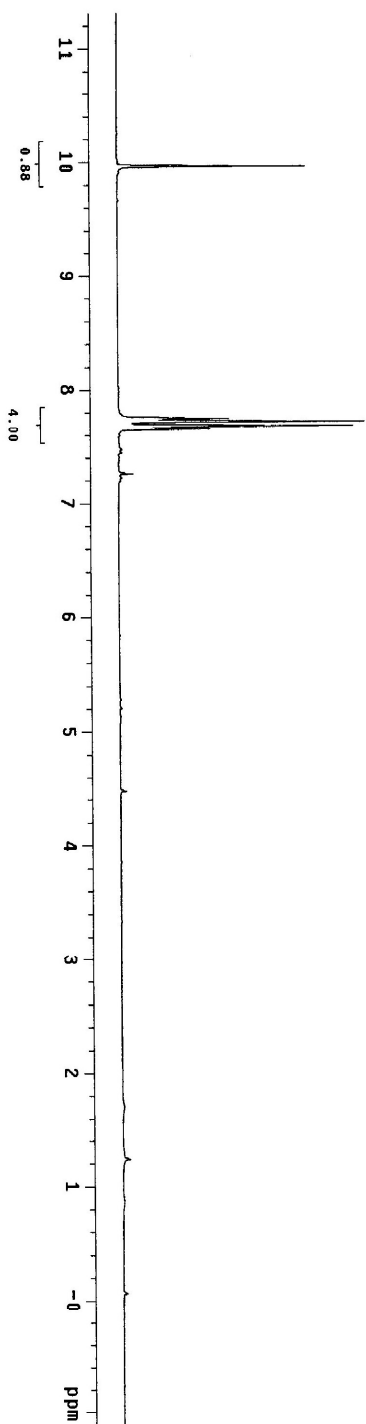


Table 3, entry 7



13C OBSERVE

Pulse Sequence: s2pul

Solvent: CDCl3

Ambient temperature

File: 57614-37-product-CMR

INOVA-500 "spok100"

Pulse 55.7 degFoc

Acq. time 1.815 sec

Width 18761.7 Hz

336 repetitions

OBSERVE C13, 75.4750823 MHz

DECOUPLE H1, 300.1606808 MHz

Power 40 dB on

Transmit on

WALTZ-16 modulated

DATA PROCESSING

Line broadening 1.0 Hz

FT size 131072

Total time 30 min, 23 sec

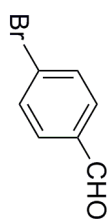
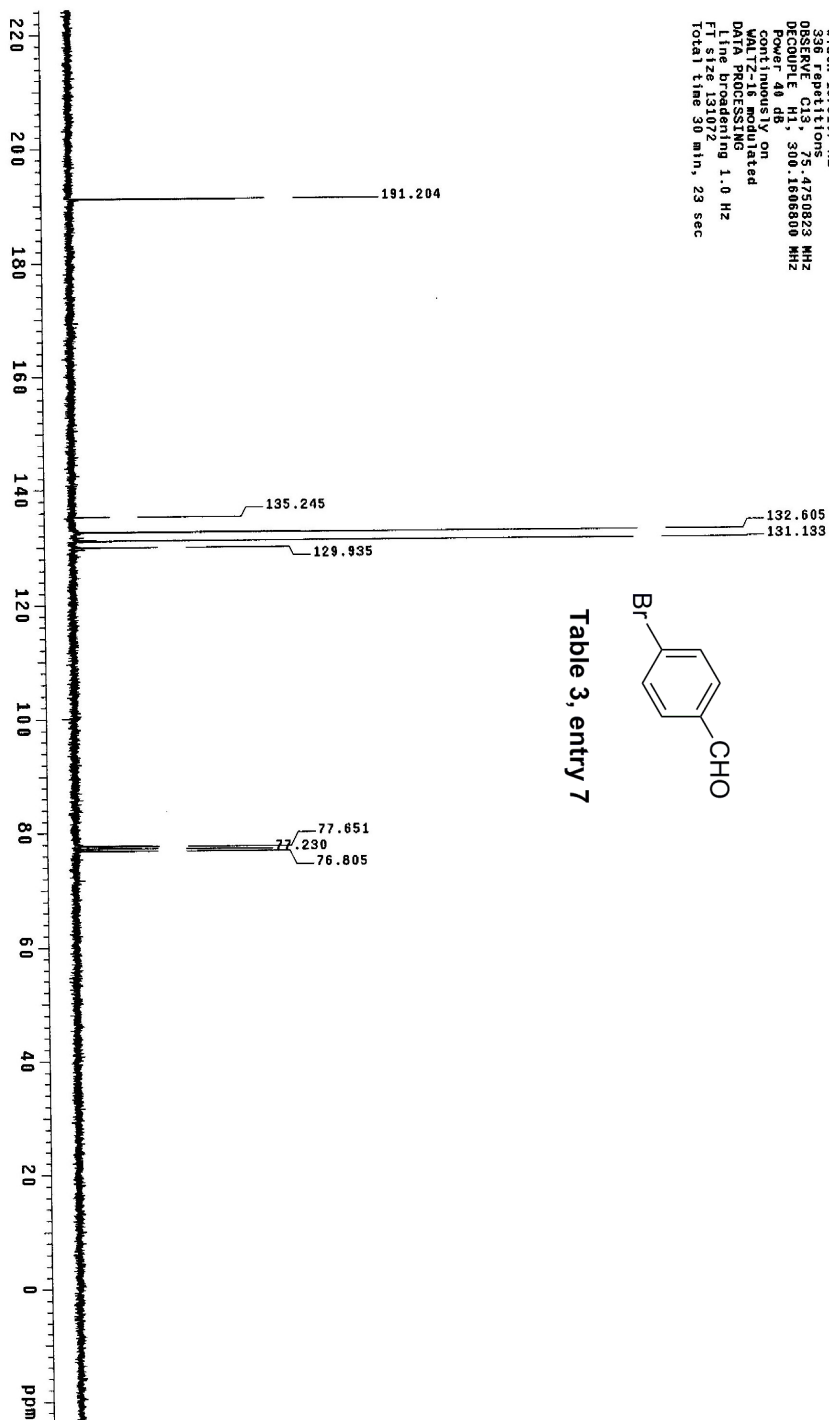


Table 3, entry 7



STANDARD 1H OBSERVE

Pulse Sequence: szpul

Solvent: CDCl3
Acquisition Temperature
File: zyol4-38-product-1HMR
INOVA-500 "epoxide"

Relax. delay 1.000 sec
Pulse 49.6 degrees
Acq. time 1.980 sec
Width 4500.5 Hz
VOffset 11.000 Hz
Observed 300.1592166 MHz
DATA PROCESSING
FT size 32768
Total time 0 min, 12 sec

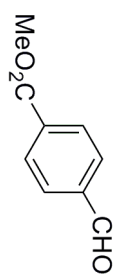
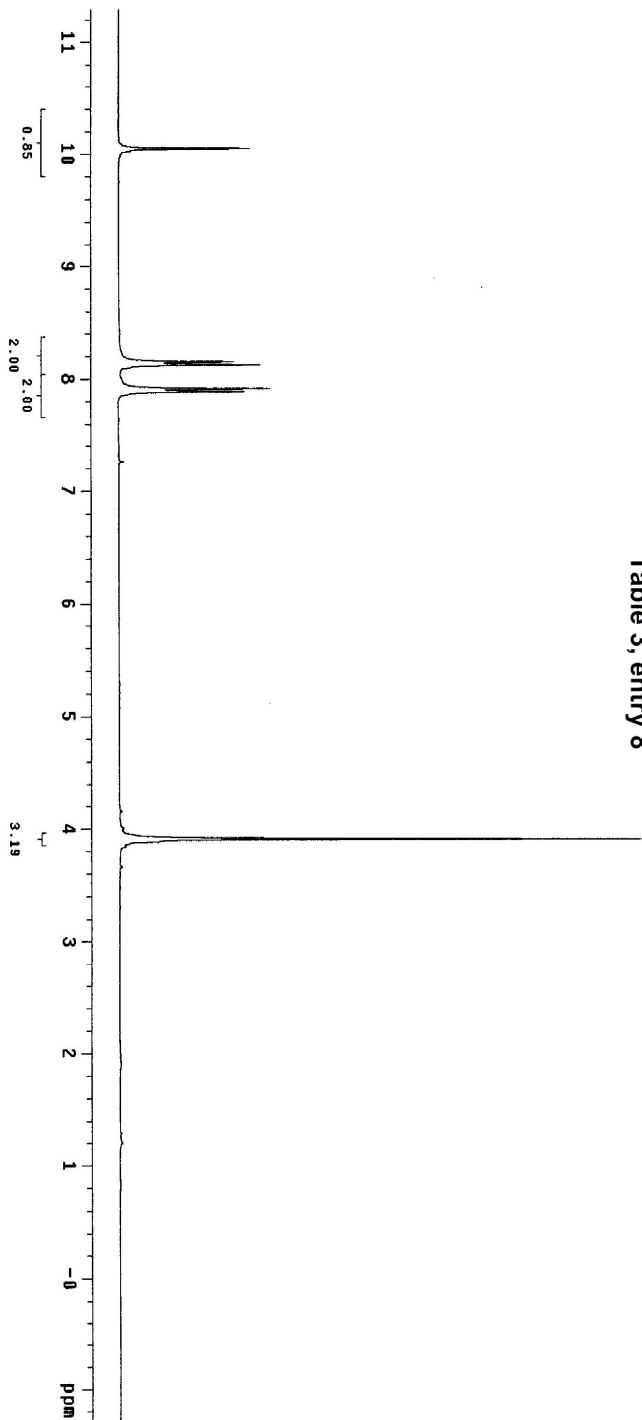


Table 3, entry 8



13C OBSERVE

Pulse Sequence: s2pu1

Solvent: CDCl3

Ambient temperature

File: EYB14-35-PRODUCT-CHMR

INOVA-500 -topo100

Pulse 55.7 degrees

Acq time 1.615 sec

Width 18761.7 Hz

432 Repetitions

OBSERVE C13, 75.4750848 MHz

DECOUPLE H1, 300.1606800 MHz

Power 40 dB ON

Topo 100

WALTZ-16 modulated

DATA PROCESSING

Line broadening 1.0 Hz

FT size 131072

Total time 30 min, 23 sec

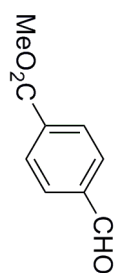
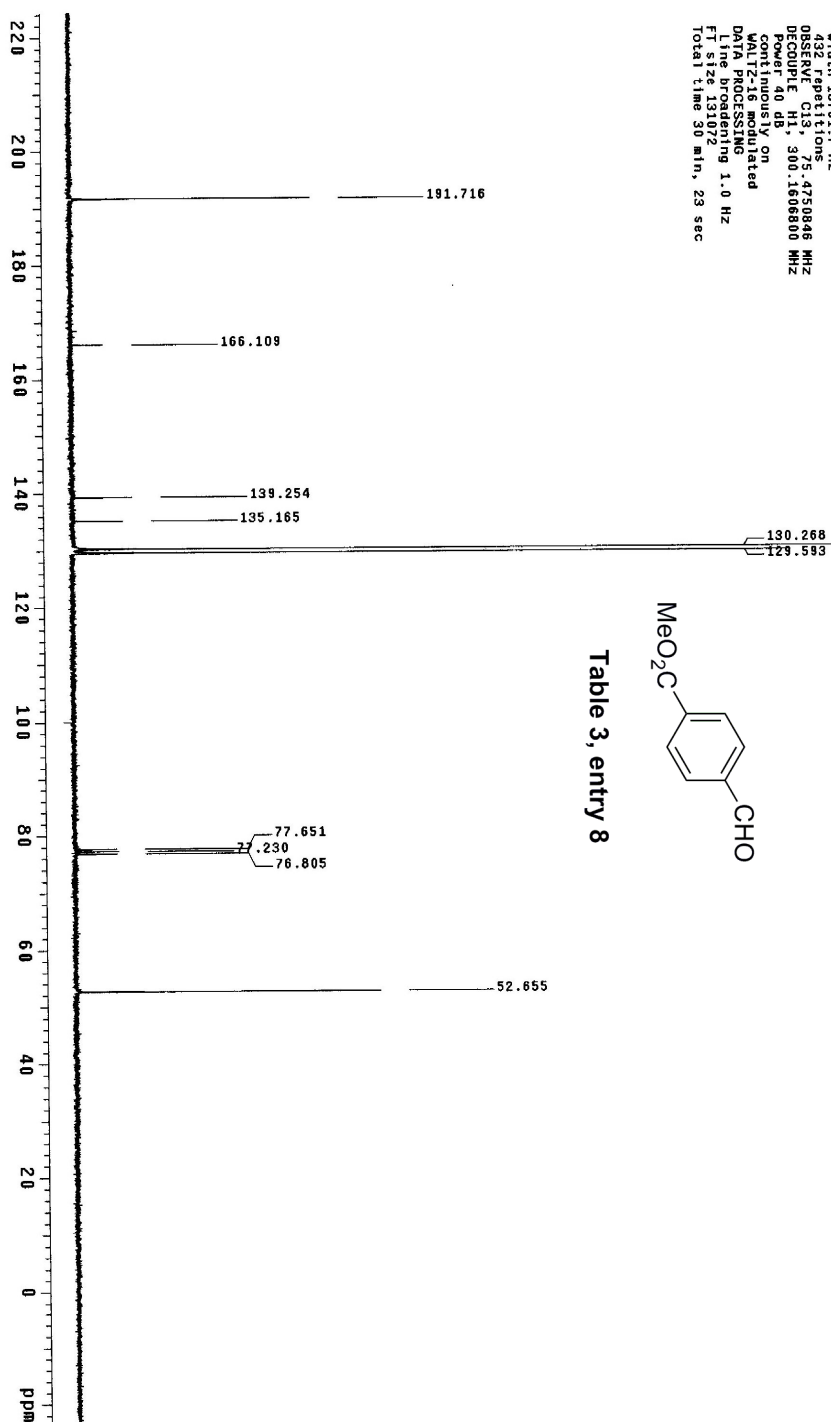


Table 3, entry 8



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
 Solvent: CDCl3
 Ambient temperature
 File: ZYG14-31-1HMR
 INOVA-500 "epoxide"

Relax. delay 1.000 sec
 Pulse 49.6 degrees
 Acq. time 1.38 sec
 Width 448 Hz
 10 repetitions
 OBSERVE H1, 300.1592196 MHz
 DATA PROCESSING
 FT size 32768
 Total time 0 min, 30 sec

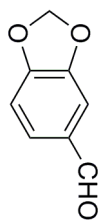
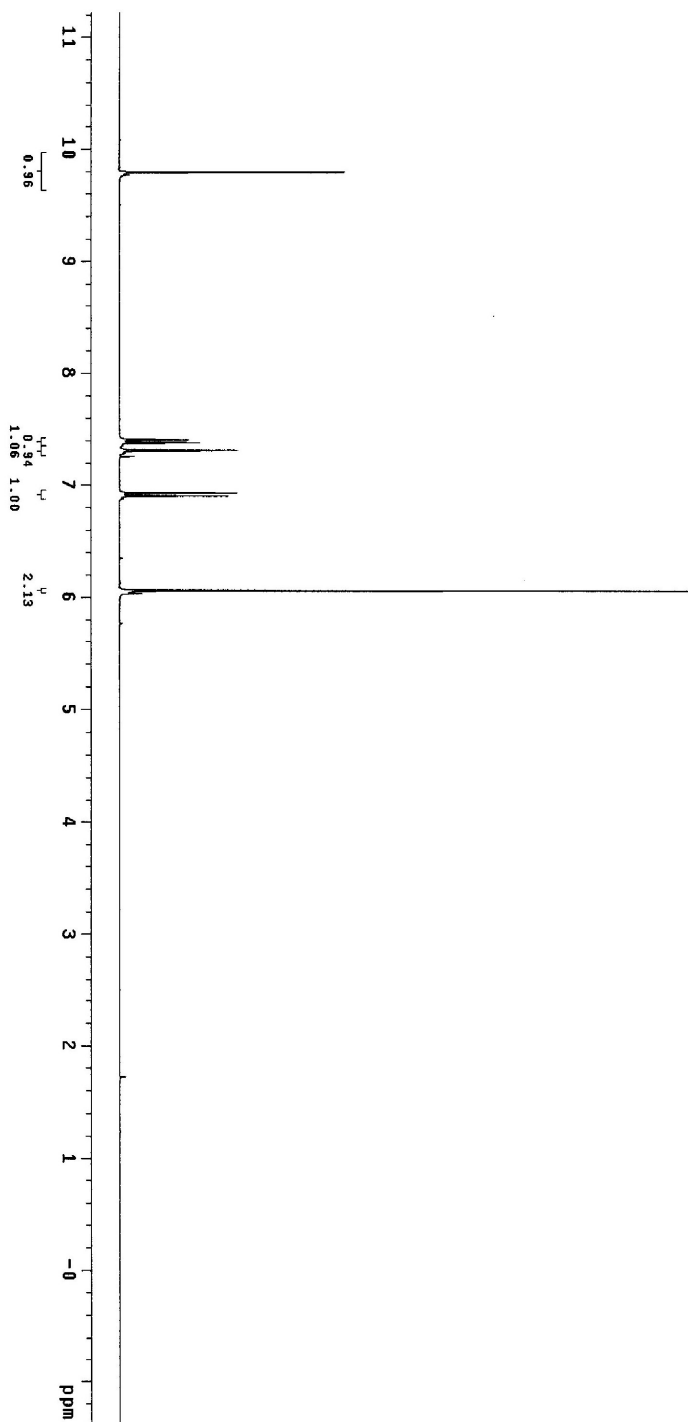


Table 3, entry 9



```
Pulse Sequence: sgn1
Solvent: CDCl3
Ambient temperature
File: ZYG4-43-CNRR
INNOVA-500 "reprotestae"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18.617 Hz
208 repetitions
FID 55.9831 MHz
DECODE CH1 300.108800 MHz
Power 40 dB
continuously on
WALTZ-16 modulated
Line broadening 1.0 Hz
Data processing
Total time 1307.27 sec
Total time 30 min., 23 sec
```

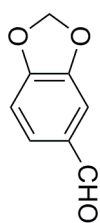
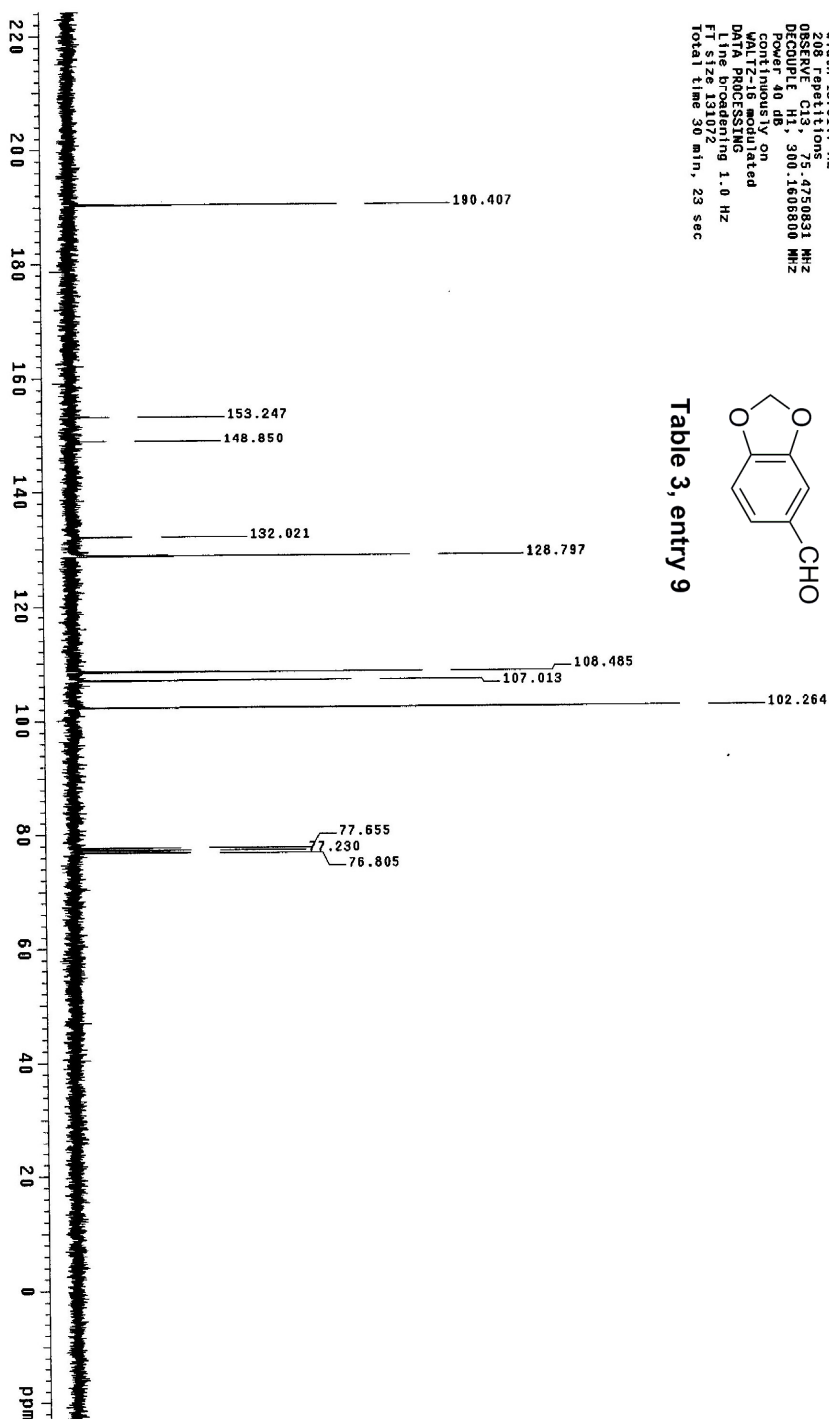


Table 3, entry 9



STANDARD 1H OBSERVE

```
Pulse Sequence: zgpu
Solvent: CDCl3
F1 (ms): 6.12
F2 (ms): 12.00
F3 (ms): 12.00
F4 (ms): 12.00
F5 (ms): 12.00
INVOA: 500
"aproximen"
Relax. delay 1.000 sec
Pulse 49.6 degrees
Acq. time 1.390 sec
Width 4500.5 Hz
NUC1: 13C
NUC2: 1H
DMSR: 300.1592196 MHz
DATA PROCESSING
F1 size 32768
Total time 0 min, 12 sec
```

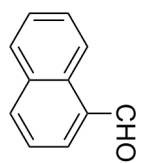
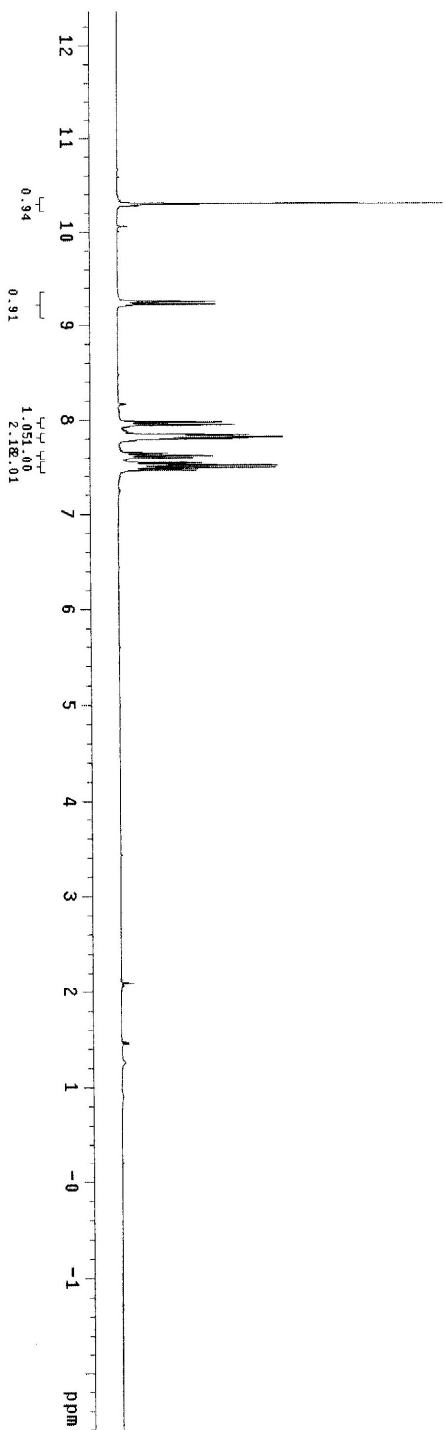


Table 3, entry 10



¹³C OBSERVE

Pulse Sequence: szpul
Solvent: CDCl₃
Ambient temperature
F1: 101.25 MHz
INSTR: 500 "epoxide"

Pulse: 55.7 degrees
Acq. time: 1.815 sec
Width: 18761.7 Hz
338 repetitions
OBSERVE: C13, 75.4751017 MHz
DECOUPLE: H1, 300.1606800 MHz
P2: 18.00
CONTINUOUSLY ON
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 131072
Total time 30 min, 23 sec

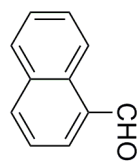
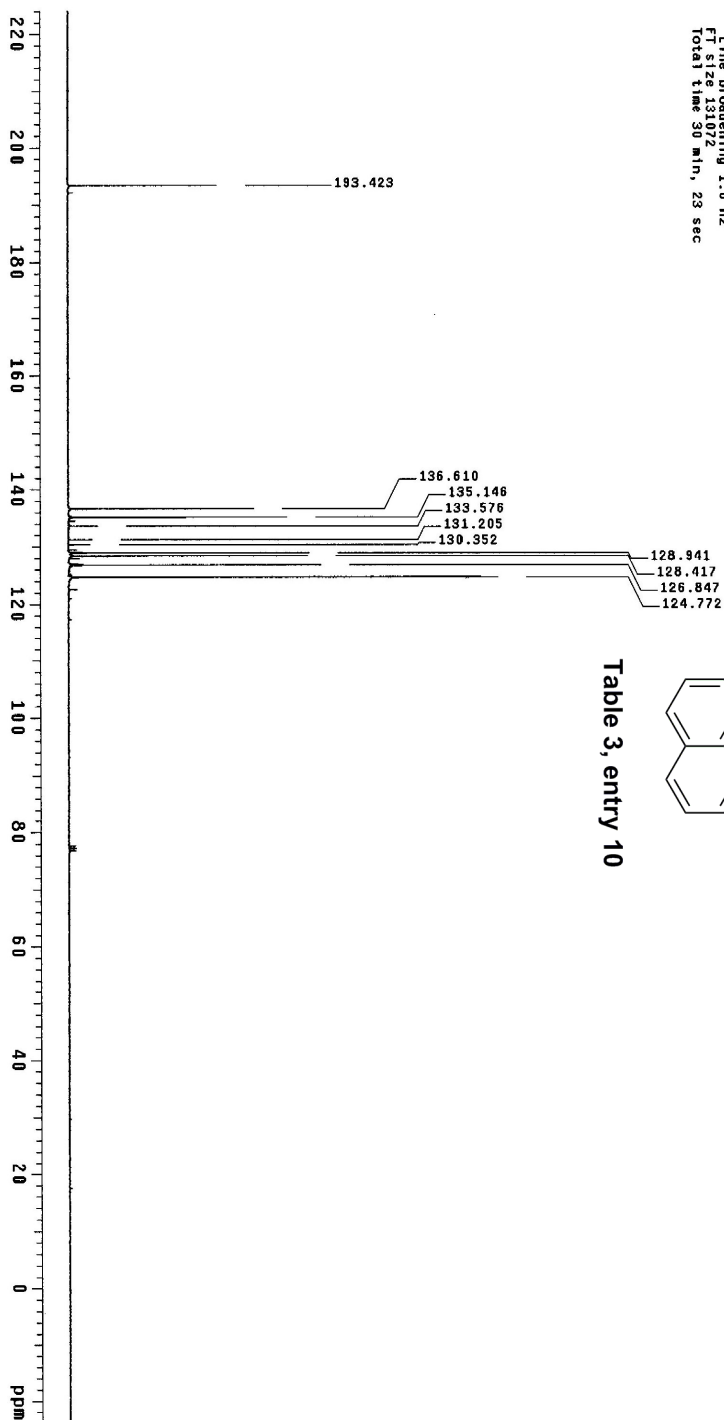


Table 3, entry 10



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1

Solvent: CDCl3

Ambient temperature

File: 29g13-10-1-product-HMR

INSTR-300 epoxide

Relax. delay 1.000 sec

Pulse 48.6447 sec

Acq. time 1.988 sec

Width 4500.5 Hz

4 repetitions

OBSERVE H1: 300.1592196 MHz

DATA PROCESSING

13.725888

Total time 0 min, 12 sec

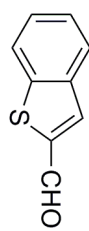
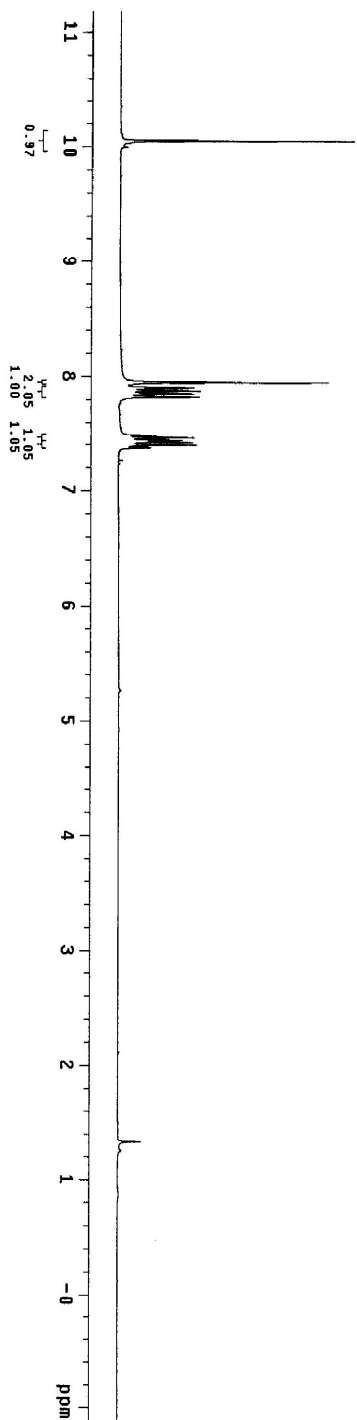


Table 3, entry 11



130 OBSERVE

Pulse Sequence: szpul

Solvent: CDCl₃

Ambient temperature
File: 2Y613-10-1-Product-CNMR
INOVA-300 "epoxide"

Pulse 55.7 degrees
Acq time 1.55 sec
Width 18761.7 Hz

128 repetitions
OBSERVE C13, 75.475046 MHz

DECOUPLE H1, 300.1606800 MHz
Power 40 dB
Decoupling by ON

WALTZ-16 modulated
DATA PROCESSING

Line broadening 1.0 Hz
FT size 131072

Total time 30 min, 23 sec

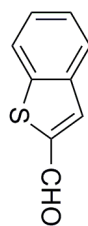
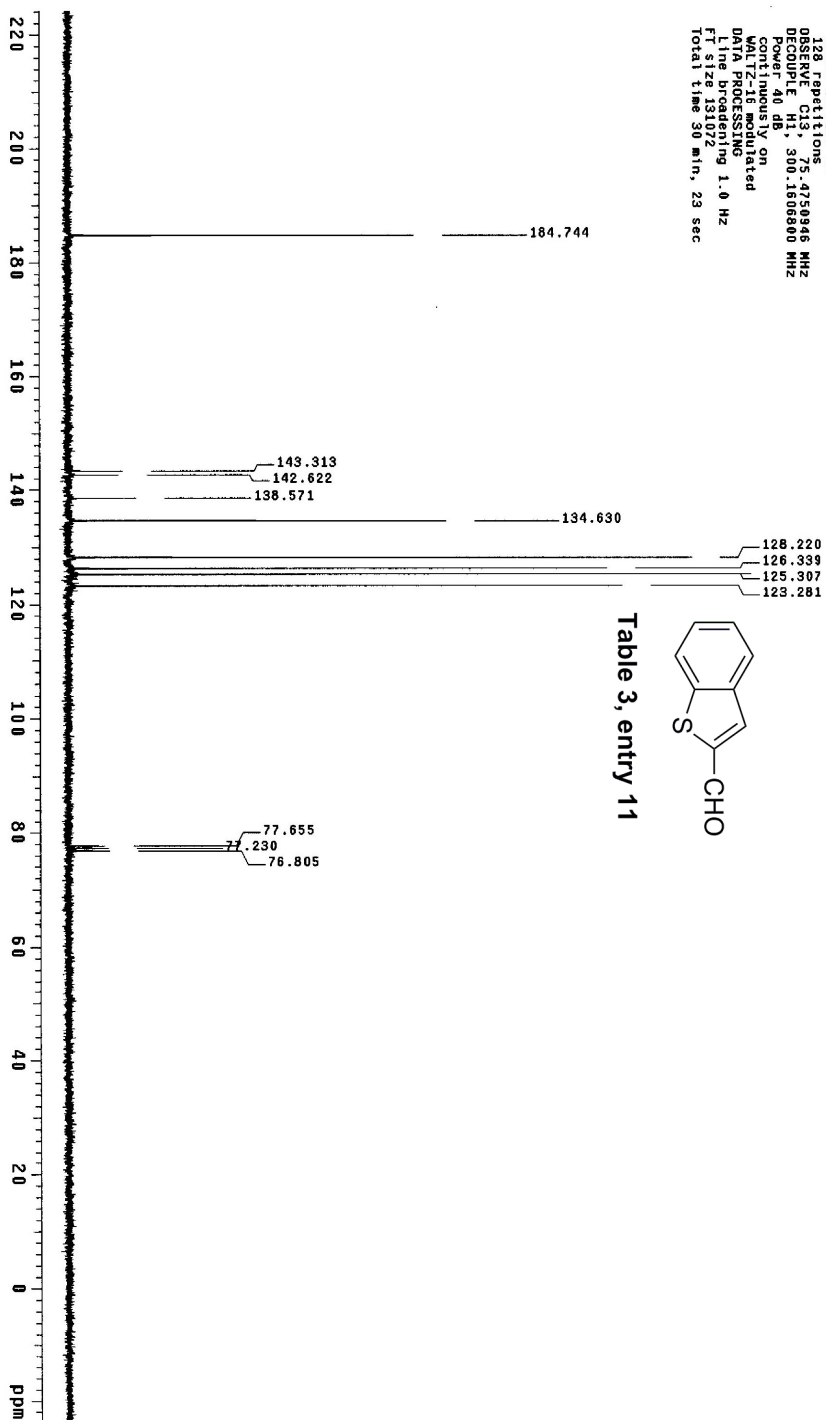


Table 3, entry 11



STANDARD 1H OBSERVE

Pulse Sequence: szpu1
Solvent: CDCl3
Ambient temperature
File: 2yg23-05-product-1HMR
INOVA-500 "epoxide"
Relax. delay 6.000 sec
Pulse 28.3 degrees
Acq. time 1.938 sec
SFO 400.1450 MHz
410000000
OBSERVE H1, 300.1592196 MHz
DATA PROCESSING
FT size 32768
Total time 0 min, 32 sec

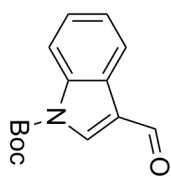
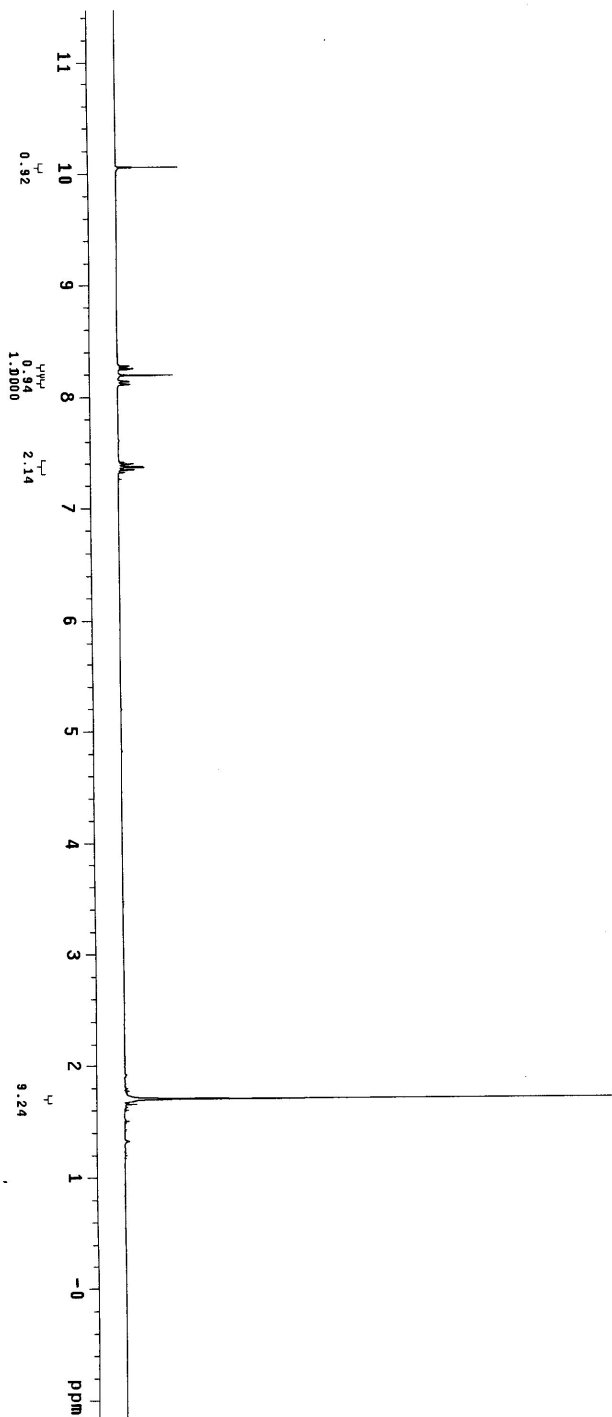


Table 3, entry 12



13C OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: zyq23-05-product-CMHR
INOVA-500 "epoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
256 repetitions
Observed C13: 4750831 MHz
Decouple H1: 300.160600 MHz
Power 40 dB
Continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
F2 125.0002 MHz
Total time 30 min, 23 sec

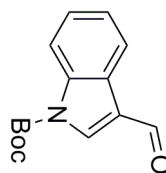
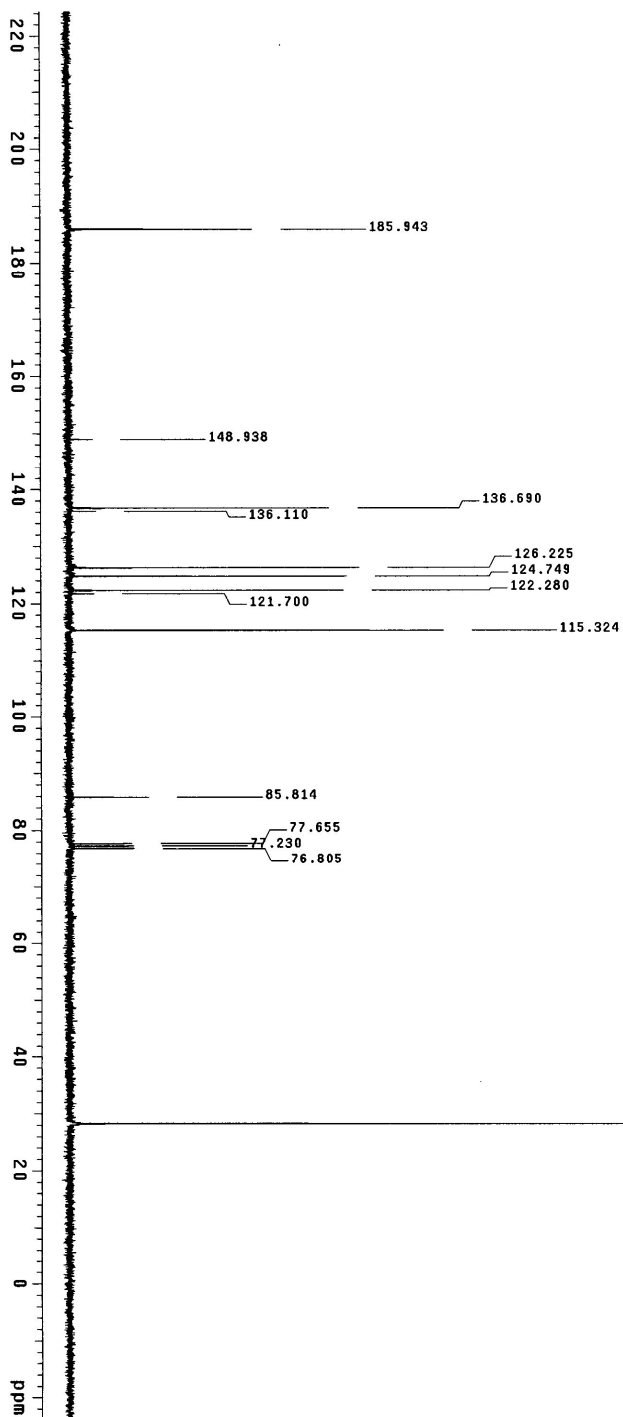


Table 3, entry 12

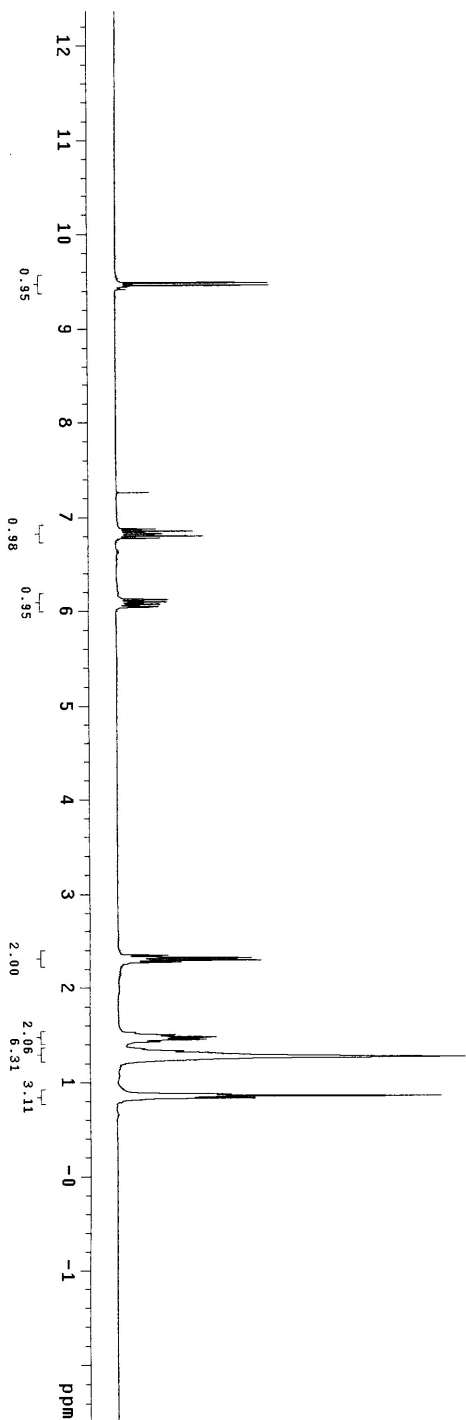


STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: 2y913-15-2-HMR
INOVA-500 "epoxide"
Relax: delay 6.000 sec
Pulse 28.3 degrees
Acq: 180.1395 sec
Width: 150.5 Hz
4 repetitions
OBSERVE H1: 300.1592136 MHz
DATA PROCESSING
F1 size 32768
Total time 0 min, 32 sec



Table 3, entry 13

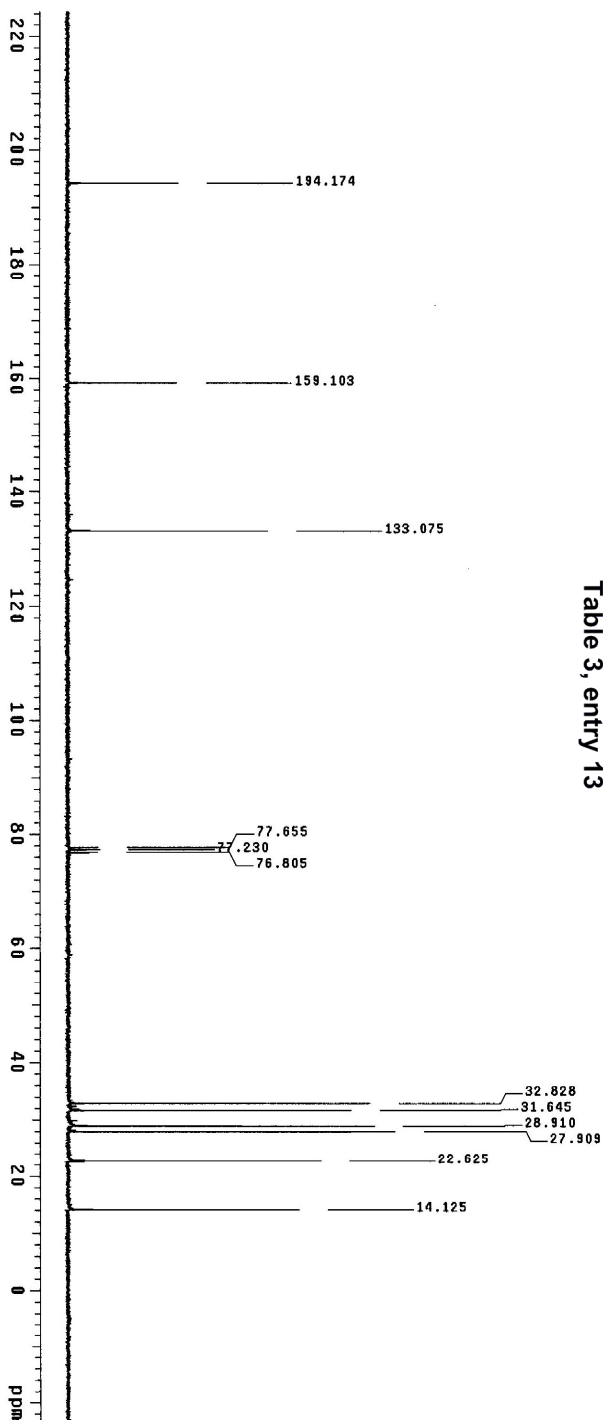


13C OBSERVE

Pulse Sequence: szpu1
Solvent: CDCl3
Ambient temperature
F1: 299.132 Product-CHMR
INOVA-500 "proxi80"
Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
208 Repetitions
OBSERVE C13, 75.4750837 MHz
DECOUPLE H1, 300.1506800 MHz
SFO 100.626130 MHz
Continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 131072
Total time 30 min, 23 sec



Table 3, entry 13



STANDARD 1H OBSERVE

Archive directory: /export/home/js300/vnmr/sys/data
Sample directory:

Pulse Sequence: szpul

Solvent: CDCl3

Ambient temperature

File: zy13-16-2-HMR

INOVA-500 "epoxide"

Relax. delay 12.000 sec

Pulse 14.2 degrees

Acq. time 1.995 sec

Width 103.1 Hz

4 repetitions

OBSERVE H1 300.1592196 MHz

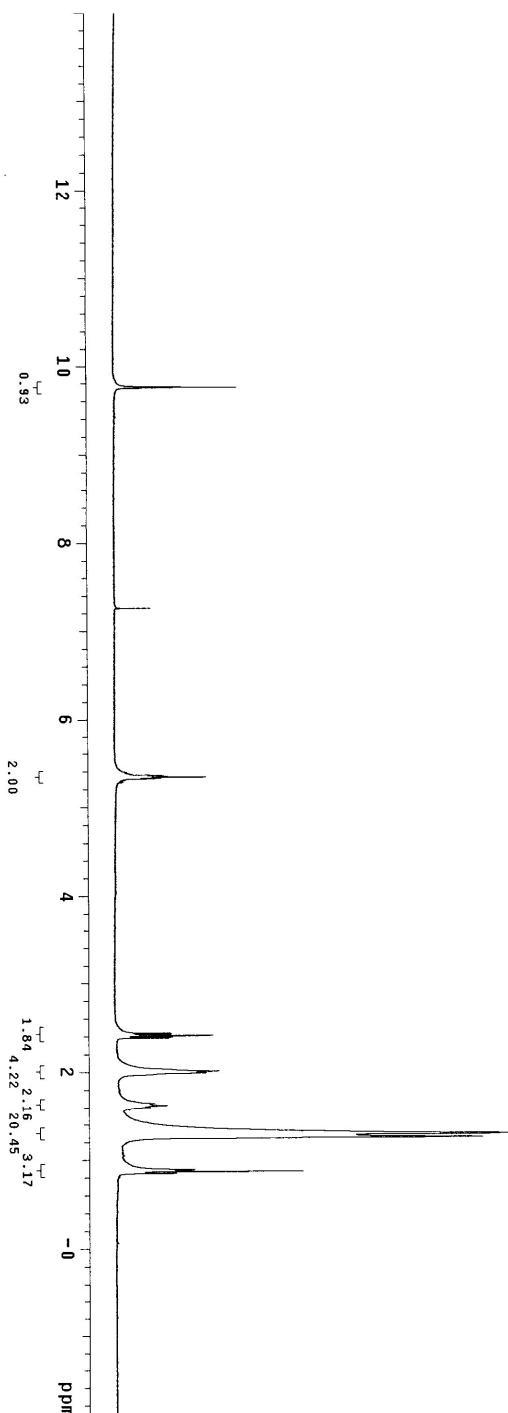
DATA PROCESSING

FT size 32768

Total time 0 min, 56 sec



Table 3, entry 14



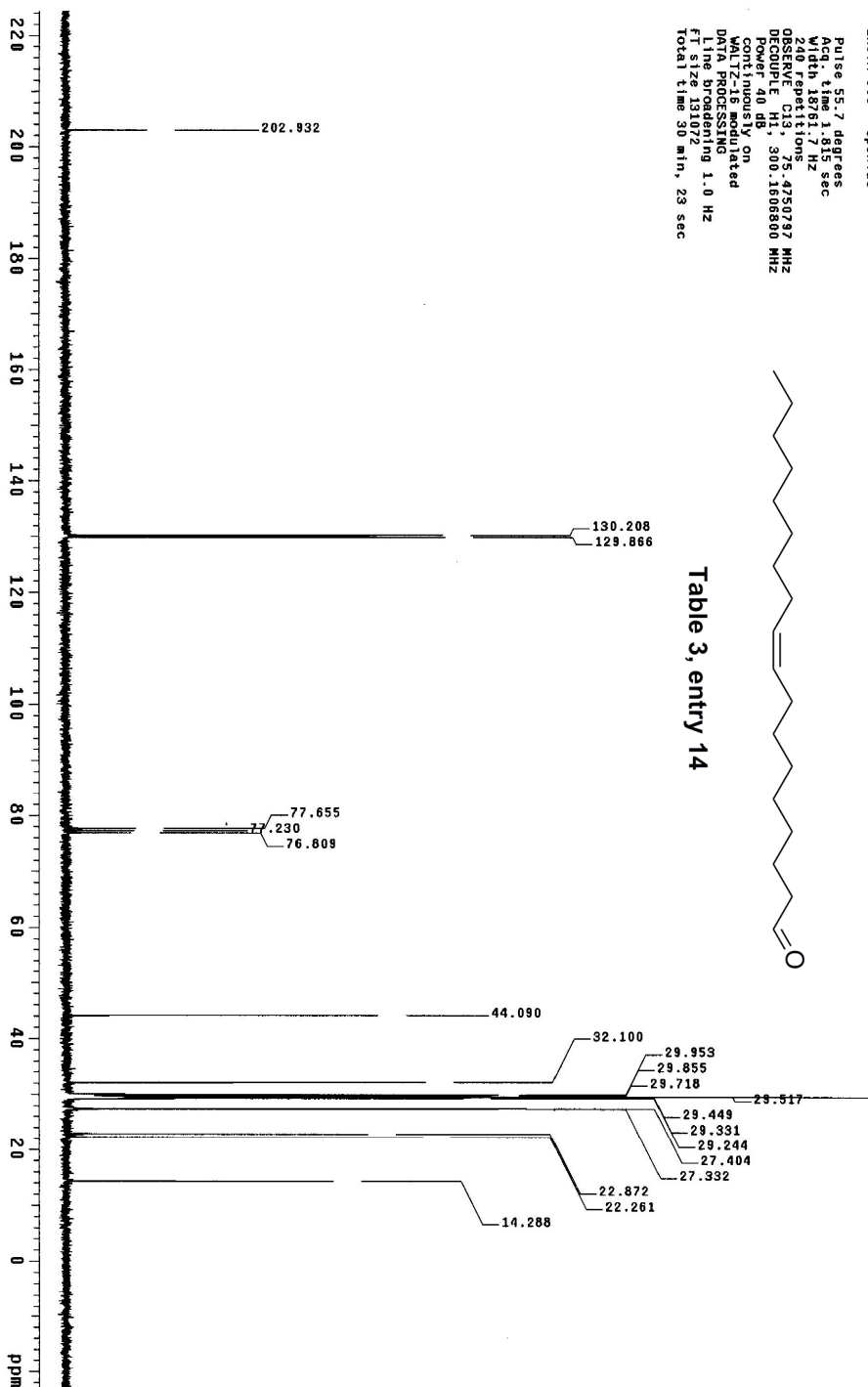
Pulse Sequence: s2pu1

Solvent: CDCl₃
Ambient temperature
File: Zyg13-46-2-product-CNMR
INOVA-500 "epoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
240 repetitions
OBSERVE C13, 75.4750797 MHz
DECUPLE H1, 300.160800 MHz
Power 40 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 131072
Total time 30 min, 23 sec



Table 3, entry 14



STANDARD 1H OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: ZYG11-35-1-HNMR
INOVA-500 "epoxide"
Relax. delay 12.000 sec
Pulse 14.2 degrees
Acq time 0.1396 sec
Width 400.5 Hz
4 repetitions
OBSERVE H1, 300.1592196 MHz
DATA PROCESSING
F1 size 32768
Total time 0 min, 56 sec

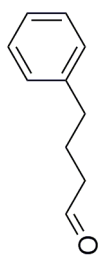
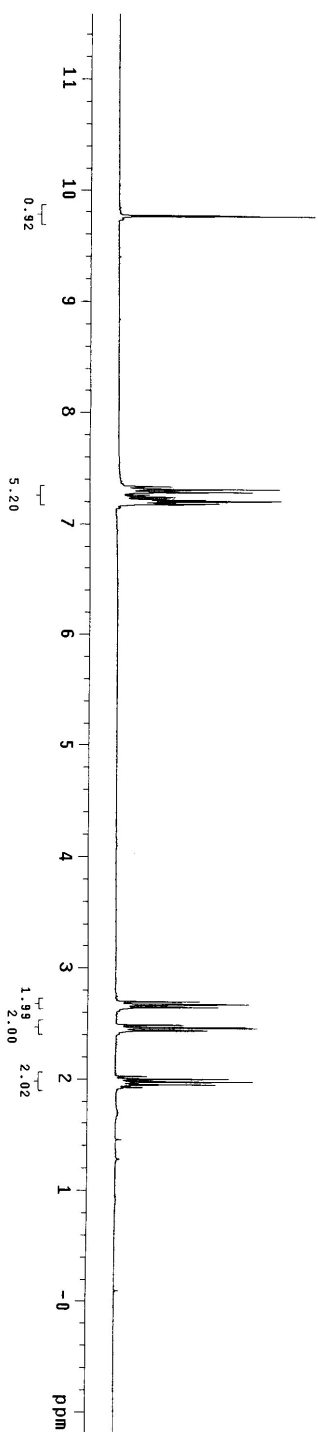


Table 3, entry 15



13C OBSERVE

Pulse Sequence: s2pu1
Solvent: CDCl3
Ambient temperature
File: Zyg11-35-1-Product-CNMR
INOVA-500 "epoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
NUC1 13C1
P1 12.00 sec
25.000 MHz
OBSERVE C13 75.4750857 MHz
DECOUPLE H1, 300.1606800 MHz
Power 40 dB
continuously on
WALTZ16 modulated
D1 1.00000000 sec
D11 1.00000000 sec
Line broadening 1.0 Hz
FT size 131072
Total time 30 min, 23 sec

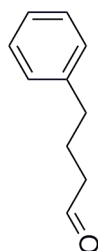
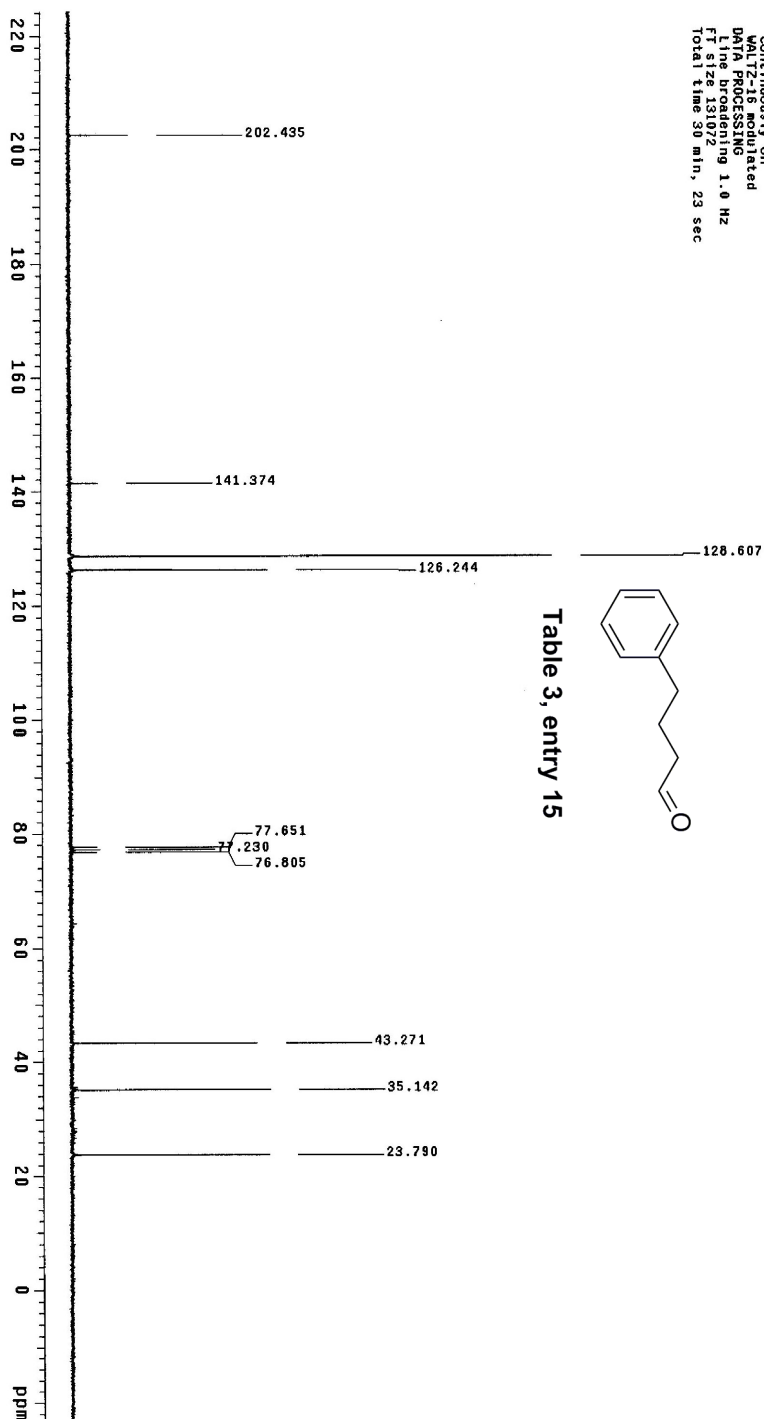


Table 3, entry 15

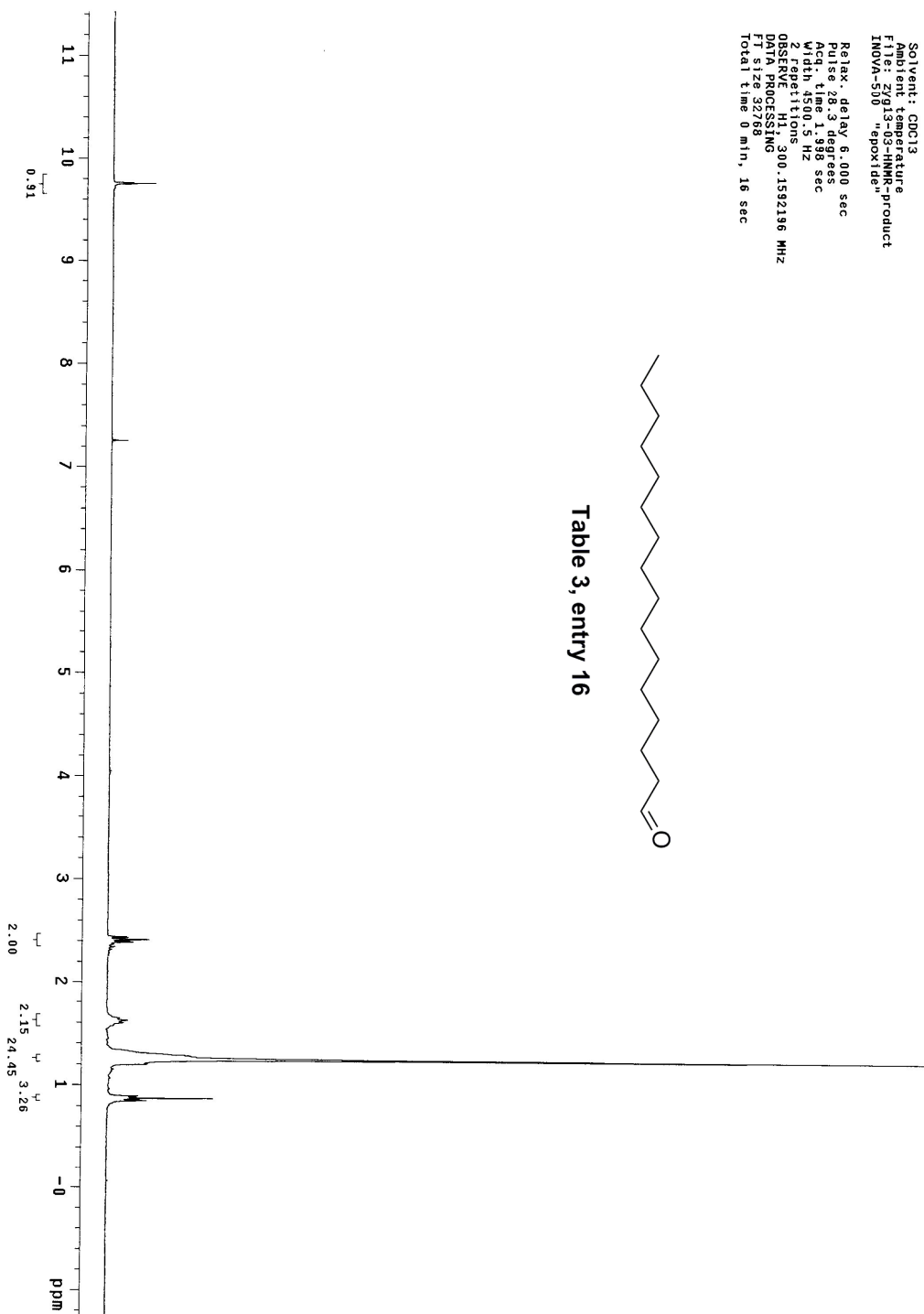


STANDARD 1H OBSERVE

Pulse Sequence: s2pul
Solvent: CDCl3
Ambient temperature
File: ZYG13-03-HMR-Product
INOVA-500 "epoxide"
Relax delay 6.000 sec
Pulse 12.3 degrees
Acq time 1.55 sec
Width 4500.5 Hz
2 repetitions
OBSERVE H1, 300.1592196 MHz
DATA PROCESSING
FT size 32768
Total time 0 min, 16 sec



Table 3, entry 16



13C OBSERVE

Pulse Sequence: szpul
Solvent: CDCl3
Acq. time 1.815 sec
F1: 125.1303-MHz
INVA-500 "epoxide"

Pulse 55.7 degrees
Acq. time 1.815 sec
Width 18761.7 Hz
288 repetitions
OBSERVE C13, 300.4750265 MHz
DECOUPLE H1, 300.1606800 MHz
SFO 40 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 1.0 Hz
FT size 131072
Total time 30 min, 23 sec



Table 3, entry 16

