

**Palladium-Catalyzed Synthesis of Aryl Ketones by Coupling of
Aryl Bromides with an Acyl Anion equivalent**

Supporting Information

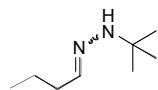
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General Comments. All reactions were performed under nitrogen atmosphere using standard Schlenk and drybox techniques. THF was dried by passing it through column of activated alumina. 1, 4-dioxane was purchased from commercial sources and was used under nitrogen without further purification. $\text{Pd}_2(\text{dba})_3$, DPEphos and Sodium *tert*-butoxide were purchased from commercial sources and were used without further purification. NMR spectra were recorded on a 400 MHz instrument. GC-MS data were obtained with an Alltech EC-1 capillary column.

Synthesis of *N*-*tert*-butyl hydrazones

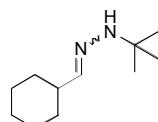
N-*tert*-butyl-*N'*-butylidenehydrazine¹ [50265-96-8]



A literature procedure¹ involving the reaction of *tert*-butylhydrazine hydrochloride neutralized with NaOH and the aldehyde in the presence of catalytic acetic acid was followed with butyraldehyde (2.40 ml, 26.8 mmol) and *tert*-butylhydrazine hydrochloride (4.00 g, 32.1 mmol). The crude product was distilled under reduced pressure to give the title compound as *ca.* 2.6 : 1 *E* / *Z* mixture. (2.80 g, 19.7 mmol, 74%)

¹H NMR (400 MHz, CDCl_3 , TMS) δ 0.93 (t, 2.2H, J = 8.4 Hz), 0.93 (t, 0.8 H, J = 8.4 Hz), 1.16 (s, 6.5H), 1.19 (s, 2.5H), 1.45-1.62 (m, 2H), 2.00-2.05 (m, 0.5H), 2.13-2.18 (m, 1.5H), 4.66 (br, 1H), 6.48 (t, 0.3 H, J = 4.9 Hz), 7.01 (t, 0.7 H, J = 5.3 Hz); ¹³C NMR (100 MHz, CDCl_3) δ 13.5, 13.8, 19.4, 20.1, 27.6, 28.1, 28.3, 34.0, 52.8, 52.9, 141.8, 142.5; MS, m/e: 142 [M⁺], 127[M⁺-Me].

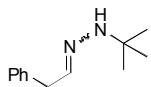
N-*tert*-butyl-*N'*-cyclohexylmethylenehydrazine



The literature procedure¹ involving the reaction of *tert*-butylhydrazine hydrochloride neutralized with NaOH and the aldehyde in the presence of catalytic acetic acid was followed with cyclohexanecarboxaldehyde (4.00 ml, 33.3 mmol) and *tert*-butylhydrazine hydrochloride (4.98 g, 40.0 mmol). The crude product was distilled under reduced pressure to give the title compound as *ca.* 12 : 1 *E/Z* mixture. (4.25 g, 23.3 mmol, 70%)

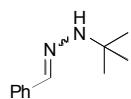
¹H NMR (400 MHz, CDCl_3 , TMS) δ 1.15-1.28 (m, 14H), 1.70-1.79 (m, 5H), 2.14-2.28 (m, 1H), 4.53 (br, 1H), 6.32 (d, 0.07 H, J = 7.2 Hz), 6.92 (d, 0.93 H, J = 5.5 Hz); ¹³C NMR (100 MHz, CDCl_3) δ 25.7, 25.9, 26.3, 26.5, 27.2, 28.7, 29.7, 31.1, 34.6, 40.8, 53.5, 146.5, 147.5; MS, m/e: 182 [M⁺], 167 [M⁺-Me], 125 [M⁺-tBu]; Anal. Calcd. for $\text{C}_{11}\text{H}_{22}\text{N}_2$: C, 72.47, H, 12.16, N, 15.37. Found: C, 72.48; H, 12.18, N, 15.62.

N-*tert*-butyl-*N'*-phenethylidenehydrazine



The literature procedure¹ involving the reaction of *tert*-butylhydrazine hydrochloride neutralized with NaOH and the aldehyde in the presence of catalytic acetic acid was followed with phenylacetaldehyde (4.70 ml, 40.1 mmol) and *tert*-butylhydrazine hydrochloride (6.00 g, 48.2 mmol). The crude product was distilled under reduced pressure to give the title compound as *ca.* 3 : 1 *E* / *Z* mixture. (6.47 g, 34.0 mmol, 85%). ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.19 (s, 9H), 3.42 (d, 0.5H, *J* = 4.9 Hz), 3.53 (d, 1.5H, *J* = 5.7 Hz), 4.69 (br, 1H), 6.68 (t, 0.25H, *J* = 4.9 Hz), 7.06 (t, 0.75H, *J* = 5.7 Hz), 7.20-7.35 (m, 5H); ¹³C NMR (100 MHz, CDCl₃) δ 28.4, 28.5, 33.1, 38.9, 53.3, 53.3, 126.4, 126.6, 128.5, 128.6, 128.8, 128.8, 137.2, 138.0, 139.4, 140.7; MS, m/e: 190 [M⁺], 167 [M⁺-Me], 91 [PhCH₂⁺].

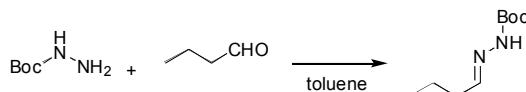
N-Benzylidene-*N'*-*tert*-butylhydrazine² [32818-95-4]



A literature procedure¹ involving the reaction of *tert*-butylhydrazine hydrochloride neutralized with NaOH and the aldehyde in the presence of catalytic acetic acid was followed with phenylaldehyde (2.00 ml, 18.0 mmol) and *tert*-butylhydrazine hydrochloride (2.69 g, 21.6 mmol). The crude product was distilled under reduced pressure to give the title compound as *ca.* >95 : <5 *E* / *Z* mixture. (2.36 g, 13.4 mmol, 74%). ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.21 (s, 9H), 5.47 (br, 1H), 7.15-7.19 (m, 1H), 7.24-7.27 (m, 2H), 7.48-7.52 (m, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 28.6, 54.0, 125.9, 127.9, 128.4, 136.0, 138.4; MS, m/e: 176 [M⁺], 161 [M⁺-Me], 119 [M⁺-tBu], 77 [Ph⁺].

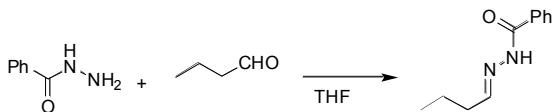
Synthesis of other hydrazones

N'-Butylidene-hydrazinecarboxylic acid *tert*-butyl ester [149268-07-5]



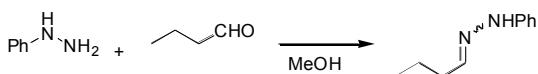
To a toluene (30 mL) solution of *tert*-butylcarabazate (2.00g, 15.1 mmol), butyraldehyde (1.63 ml, 18.2 mmol) was added at room temperature. The reaction mixture was stirred at 60 °C for 1 h. After the reaction, toluene was evaporated. The crude product was triturated with hexane (15 mL) and was filtered and dried under reduced pressure to give the title compound as white solid (1.98 g, 10.6 mmol, 57%). ¹H NMR (400 MHz, CDCl₃, TMS) δ 0.94 (t, 3H, *J* = 7.4 Hz), 1.49-1.53 (m, 11H), 2.25 (t, 2H, *J* = 7.3 Hz), 7.21 (s, 1H), 8.14 (br, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 13.6, 19.9, 28.1, 34.0, 80.5, 147.3; MS, m/e: 186 [M⁺].

Benzoic acid butylidenehydrazide [99840-61-6]



To a THF (40 mL) solution of benzhydrazide (2.00 g, 14.7 mmol), butyraldehyde (1.71 mL, 19.1 mmol) was added and was stirred at room temperature for 16 h. After the reaction, THF was evaporated. The crude product was triturated with diethyl ether (25 mL) and was filtered then dried under reduced pressure to give the title compound as white solid (2.64 g, 13.9 mmol, 95%). ^1H NMR (400 MHz, CDCl_3 , TMS) δ 0.90 (t, 3H, J = 7.3 Hz), 1.45-1.51 (m, 2H), 2.24 (t, 2H, J = 7.3 Hz), 7.28-7.35 (m, 2H), 7.42-7.46 (m, 1H), 7.72 (t, 1H, J = 5.5 Hz), 7.73-7.84 (m, 2H), 10.5 (br, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 13.8, 20.0, 34.4, 127.5, 128.4, 131.7, 133.2, 153.2, 164.6; MS, m/e: 190 [M^+], 105[PhCO^+], 77[Ph^+].

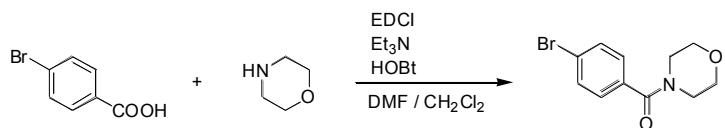
N-Butylidene-N'-phenylhydrazine [940-54-5]



To a methanol (40 mL) solution of phenylhydrazine (4.00 mL), butyraldehyde (4.80 mL, 52.7 mmol) was added and was stirred at room temperature for 16 h. After the reaction, methanol was evaporated. To the crude mixture, diethyl ether (40 mL) and magnesium sulfate was added. After filtration and concentration, the crude product was distilled under reduced pressure to give the title compound as *ca.* 4 : 1 *E* / *Z* mixture. ^1H NMR (400 MHz, CDCl_3 , TMS) δ 0.89-0.94 (m, 3H), 1.43-1.54 (m, 2H), 1.97-2.02 (m, 0.4H), 2.14-2.19 (m, 1.6H), 6.43 (t, 0.2H, J = 5.1 Hz), 6.73-6.83 (m, 1.6H), 6.90-6.92 (m, 1.6H), 7.00-7.20 (m, 3.6H); ^{13}C NMR (100 MHz, CDCl_3) δ 13.5, 13.6, 19.3, 20.1, 27.6, 33.8, 112.2, 112.7, 118.9, 119.8, 128.9, 129.0, 141.0, 141.4, 145.0, 145.3; MS, m/e: 162 [M^+], 92 [PhNH $^+$], 77[Ph^+].

Synthesis of aryl bromides

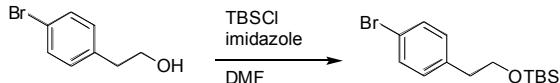
Synthesis of (4-Bromophenyl)-morpholin-4-yl-methanone³ [127580-92-1]



To a mixture of 4-bromobenzoic acid (1.00 g, 4.97 mmol), morpholine (565 μl , 6.46 mmol) and triethyl amine (1.00 ml, 7.46 mmol) in DMF (10 mL) and CH_2Cl_2 (6 mL), EDCI (1.43 g, 7.46 mmol) and 1-hydroxybenzotriazole (336 mg, 2.49 mmol) were added at room temperature. The reaction mixture was stirred at room temperature for 20 h. After the reaction, water was added to the reaction mixture. The organic layer was extracted with ethyl acetate and was dried over magnesium sulfate. The crude product was purified by flash silica gel chromatography (65% EtOAc in hexane) to give the title compound as colorless solid. (1.34 g, 4.96 mmol, quant.) ^1H NMR (400 MHz, CDCl_3 , TMS) δ 3.44-3.73 (m, 8H), 7.29 (d, 2H, J = 8.4 Hz), 7.56 (d, 2H, J = 8.4 Hz); ^{13}C NMR (100 MHz, CDCl_3) δ

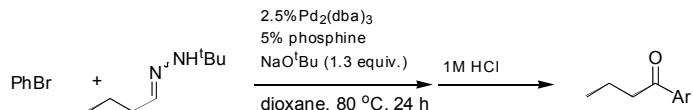
42.5(broad), 48.3(broad), 66.8, 124.2, 128.8, 131.8, 134.0, 169.3; MS, m/e 270 [M⁺], 184 [M⁺ - C₄H₈NO], 155 [BrC₆H₄⁺].

Synthesis of [2-(4-Bromophenyl)-ethoxy]-*tert*-butyl-dimethylsilane ⁴ [73899-15-7]



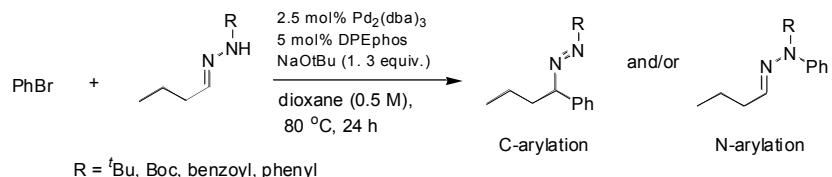
To a mixture of 4-bromophenethyl alcohol (1.50 g, 7.46 mmol) and imidazole (762 mg, 11.2 mmol) in DMF (15 mL), *tert*-butyldimethylsilyl chloride (1.35 g, 8.95 mmol) was added at room temperature. The reaction mixture was stirred at room temperature for 8 h. After the reaction, water was added at 0 °C. The organic layer was extracted with diethyl ether and was dried over magnesium sulfate. The crude product was purified by flash silica gel chromatography (2% EtOAc in hexane) to give the title compound as clear oil. (2.20 g, 6.98 mmol, 94%) ¹H NMR (400 MHz, CDCl₃, TMS) δ 0.09 (s, 6H), 0.91 (s, 9H), 2.79 (d, 2H, *J* = 6.8 Hz), 3.81 (d, 2H, *J* = 6.8 Hz), 7.10 (d, 2H, *J* = 8.4 Hz), 7.41 (d, 2H, *J* = 8.4 Hz); ¹³C NMR (100 MHz, CDCl₃) δ -5.5, 18.2, 25.9, 38.9, 64.0, 119.9, 130.9, 131.2, 138.2; MS, m/e: 315 [M⁺], 257 [M⁺ - C₆H₉].

Ligand screening procedure for the cross-coupling of *N*-*tert*-butyl hydrazone with bromobenzene.



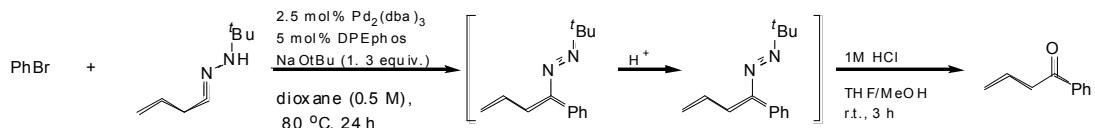
In a dry box, Pd₂(dba)₃ (11.4 mg, 0.0125 mmol), phosphine (0.0250 mmol), and sodium *tert*-butoxide (62.5 mg, 0.0650 mmol) were dissolved in dioxane (0.5 mL). To this solution, *N*-*tert*-butyl-*N*'-butylidene-hydrazine (85.3 mg, 0.600 mmol), bromobenzene (52.7 μL, 0.500 mmol), and dodecane (10.0 μL, 0.0439 mmol, as an internal standard) were added followed by dioxane (0.5 mL). The vial was sealed with a cap containing a PTFE septum and removed from the dry box. The reaction mixture was stirred at the indicated temperature for 24 h. After the reaction, the reaction mixture was filtered through celite pad and was dissolved in THF (1 mL) and MeOH (1 mL). To this solution, 1 M HCl (2 mL) was added, and the reaction mixture was stirred at room temperature for 3 h. After the hydrolysis, small aliquot was taken from the reaction mixture and was analyzed GC to determine conversion of bromobenzene and yield of butyrophenone.

Coupling of bromobenzene with various hydrazones.



In a dry box, $\text{Pd}_2(\text{dba})_3$ (11.4 mg, 0.0125 mmol), DPEphos (13.5 mg, 0.0250 mmol), and sodium *tert*-butoxide (62.5 mg, 0.0650 mmol) were dissolved in dioxane (0.5 mL). To this solution, hydrazone (0.600 mmol) and the bromobenzene (52.7 μl , 0.500 mmol) were added, followed by dioxane (0.5 mL). The vial was sealed with a cap containing a PTFE septum and removed from the dry box. The reaction mixture was stirred at the indicated temperature for 24 h. After the reaction, the reaction mixture was analyzed GC and TLC.

(R = *t*Bu): The crude product was hydrolyzed without isolating the C-arylation product due to instability of C-arylation product.

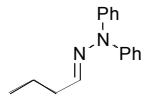


The reaction mixture was filtered through a silica gel plug (0.5 cm) and was washed with diethyl ether. The filtrate was concentrated and was dissolved in THF (3 mL) and MeOH (3 mL). To this solution, 1 M HCl (2 mL) was added, and the reaction mixture was stirred at room temperature for 3 h. After hydrolysis, the solvent was evaporated. The organic layer was extracted with diethyl ether twice and was dried over magnesium sulfate. After filtration and concentration of the organic layer, the reaction mixture was purified by preparative TLC (10% EtOAc in hexane) to give 72.4 mg (98%) of butyrophenone as a clear oil.

(R = Boc, benzoyl): No reaction was observed.

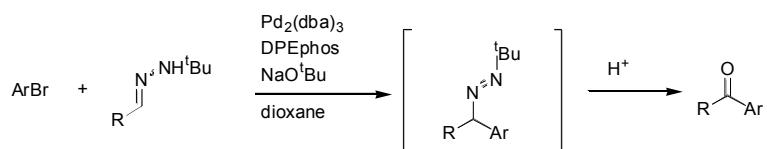
(R = phenyl): The reaction was filtered through a silica gel plug (0.5 cm) and was washed with diethyl ether. The crude mixture was concentrated and was purified by flash silica gel chromatography (5% EtOAc in hexane) to give 108.3 mg (91%) of the N-arylation product as pale brown oil.

N'-Butyldene-*N,N*-diphenyl-hydrazine [861598-53-0]



^1H NMR (400 MHz, CDCl_3 , TMS) δ 0.92 (t, 3H, J = 7.4 Hz), 1.47-1.53 (m, 2H), 2.23-2.29 (m, 2H), 6.53 (t, 1H, J = 5.4 Hz), 7.07-7.13 (m, 6H), 7.34-7.38 (m, 4H); ^{13}C NMR (100 MHz, CDCl_3) δ 13.7, 20.3, 34.6, 122.3, 123.7, 129.6, 139.9, 144.3; MS, m/e: 238 [M^+], 77 [Ph^+].

General procedure for the cross-coupling of *N*-*tert*-butyl hydrazone with aryl halide under optimized condition.



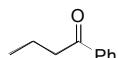
In a dry box, $\text{Pd}_2(\text{dba})_3$ (11.4 mg, 0.0125 mmol), DPEphos (13.5 mg, 0.0250 mmol), and sodium *tert*-butoxide (62.5 mg, 0.0650 mmol) were dissolved in dioxane (0.5 mL). To this solution, *N*-*tert*-butyl hydrazone (0.600 mmol) and the aryl bromide (0.500 mmol) were added, followed by dioxane (0.5 mL). The vial was sealed with a cap containing a PTFE septum and removed from the dry box. The reaction mixture was stirred at the indicated temperature for 24 h. After the reaction, the reaction mixture was filtered through a silica gel plug (0.5 cm) and was washed with diethyl ether.

(R = *n*-Pr) The filtrate was concentrated and was dissolved in THF (3 mL) and MeOH (3 mL). To this solution, 1 M HCl (2 mL) was added, and the reaction mixture was stirred at room temperature for 3 h. After hydrolysis, the solvent was evaporated. The organic layer was extracted with diethyl ether twice and was dried over magnesium sulfate. After filtration and concentration of the organic layer, the crude product was purified by flash silica gel chromatography or preparative TLC.

(R = cyclohexyl or phenyl) The filtrate was concentrated and was dissolved in THF (3 mL). To this solution was added 10% aqueous sulfuric acid (2 mL), and the reaction mixture was stirred at room temperature for 24 h. After hydrolysis, the solvent was evaporated. The organic layer was extracted with diethyl ether (R = cyclohexyl) or ethyl acetate (R = phenyl) twice and was dried over magnesium sulfate. After filtration and concentration of the organic layer, the crude product was purified by flash silica gel chromatography or preparative TLC.

(R = benzyl) The filtrate was concentrated and was dissolved in THF/MeOH (3 mL / 3 mL). To this solution, 1 M HCl (2 mL) was added, and the reaction mixture was stirred at room temperature for 16 h. After hydrolysis, the solvent was evaporated. The organic layer was extracted with diethyl ether twice and was dried over magnesium sulfate. After filtration and concentration of the organic layer, the crude product was purified by flash silica gel chromatography or preparative TLC.

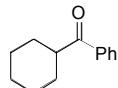
1-Phenylbutan-1-one⁵ [495-40-9]



The general procedure was followed with bromobenzene and *N*-*tert*-butyl-*N'*-butyldene-hydrazine. The reaction mixture was purified by preparative TLC (10% EtOAc in hexane) to give 72.4 mg (98%) of the product as a clear oil. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.01 (t, 3H, *J* = 7.4 Hz), 1.73-1.82 (m, 2H), 2.95 (t, 2H, *J* = 7.3 Hz), 7.44-7.48 (m, 2H), 7.53-7.69 (m, 1H), 7.96 (d, 2H, *J* = 7.2 Hz); ¹³C NMR

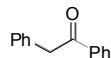
(100 MHz, CDCl_3) δ 13.9, 17.7, 40.5, 128.0, 128.5, 132.8, 137.0, 200.4; MS, m/e: 148 [M^+], 105 [PhCO^+], 77 [Ph^+].

Cyclohexylphenylmethanone⁵ [712-50-5]



The general procedure was followed with bromobenzene and *N*-*tert*-butyl-*N*'-cyclohexylmethylenehydrazine. The reaction mixture was purified by preparative TLC (11% EtOAc in hexane) to give 76.6 mg (81%) of the product as a white solid. ^1H NMR (400 MHz, CDCl_3 , TMS) δ 1.19-1.55 (m, 5H), 1.72-1.76 (m, 1H), 1.83-1.91 (m, 4H), 3.23-3.30 (m, 1H), 7.44-7.48 (m, 2H), 7.52-7.56 (m, 1H), 7.94 (d, 2H, J = 8.2 Hz); ^{13}C NMR (100 MHz, CDCl_3) δ 25.9, 26.0, 29.4, 45.6, 128.2, 128.5, 132.7, 136.4, 203.8; MS, m/e: 188 [M^+], 105 [PhCO^+], 77 [Ph^+].

1,2-Diphenylethanone⁶ [451-40-1]



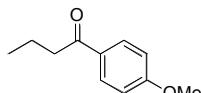
The general procedure was followed with bromobenzene and *N*-*tert*-butyl-*N*'-phenethylidenehydrazine. The reaction mixture was purified by flash silica gel chromatography (6% EtOAc in hexane) to give 94.1 mg (96%) of the product as white solid. ^1H NMR (400 MHz, CDCl_3 , TMS) δ 4.29 (s, 2H), 7.23-7.28 (m, 3H), 7.31-7.35 (m, 2H), 7.44-7.48 (m, 2H), 7.54-7.58 (m, 1H), 8.00-8.03 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ 45.5, 126.7, 128.6, 128.6, 128.6, 129.4, 133.1, 134.5, 136.5, 197.6; MS, m/e: 196 [M^+], 105 [PhCO^+], 91 [PhCH_2^+], 77 [Ph^+].

Benzophenone⁷ [119-61-9]



The general procedure was followed with bromobenzene and *N*-Benzylidene-*N*'-*tert*-butylhydrazine. The reaction mixture was purified by flash silica gel chromatography (5% EtOAc in hexane) to give 77.0 mg (85%) of the product as a white solid. ^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.45-7.49 (m, 4H), 7.56-7.59 (m, 2H), 7.79 (m, 4H); ^{13}C NMR (100 MHz, CDCl_3) δ 128.2, 130.0, 132.4, 137.5, 196.7; MS, m/e: 182 [M^+], 105 [PhCO^+], 77 [Ph^+].

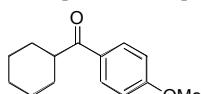
1-(4-Methoxyphenyl)-butan-1-one⁸ [4160-51-4]



The general procedure was followed with 4-bromoanisole and *N*-*tert*-butyl-*N*'-butylidenehydrazine.

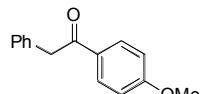
The reaction mixture was purified by flash silica gel chromatography (3% EtOAc in hexane) to give 83.7 mg (94%) of the product as pale yellow oil. ^1H NMR (400 MHz, CDCl_3 , TMS) δ 0.99 (t, 3H, J = 7.4 Hz), 1.75 (m, 2H), 2.88 (t, 2H, J = 7.3 Hz), 3.85 (s, 3H), 6.92 (d, 2H, J = 8.8 Hz), 7.94 (d, 2H, J = 8.8 Hz); ^{13}C NMR (100 MHz, CDCl_3) δ 13.8, 17.9, 40.1, 55.3, 113.5, 130.1, 130.2, 163.2, 198.9; MS, m/e: 178 [M^+], 135 [$\text{MeOC}_6\text{H}_4\text{CO}^+$], 107 [$\text{MeOC}_6\text{H}_4^+$].

Cyclohexyl-(4-methoxyphenyl)-methanone⁹ [7469-80-9]



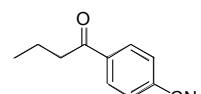
The general procedure was followed with 4-bromoanisole and *N*-*tert*-butyl-*N'*-cyclohexylmethylenehydrazine. The reaction mixture was purified by flash silica gel chromatography (3% EtOAc in hexane) to give 86.3 mg (79%) of the product as clear oil. ^1H NMR (400 MHz, CDCl_3 , TMS) δ 1.21-1.55 (m, 5H), 1.71-1.74 (m, 1H), 1.81-1.88 (m, 4H), 3.18-3.26 (m, 1H), 3.85 (s, 3H), 6.93 (d, 2H, J = 8.8 Hz), 7.94 (d, 2H, J = 8.8 Hz); ^{13}C NMR (100 MHz, CDCl_3) δ 25.9, 26.1, 29.6, 45.3, 55.4, 113.7, 129.2, 130.5, 163.2, 202.4; MS, m/e: 218 [M^+], 135 [$\text{MeOC}_6\text{H}_4\text{CO}^+$], 107 [$\text{MeOC}_6\text{H}_4^+$].

1-(4-Methoxyphenyl)-2-phenylethanone¹⁰ [1023-17-2]



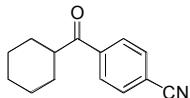
The general procedure was followed with 4-bromoanisole and *N*-*tert*-butyl-*N'*-phenethylidene-hydrazine. The reaction mixture was purified by flash silica gel chromatography (6% EtOAc in hexane) to give 103 mg (91%) of the product as pale yellow solid. ^1H NMR (400 MHz, CDCl_3 , TMS) δ 3.85 (s, 3H), 4.23 (s, 2H), 6.92 (d, 2H, J = 8.9 Hz), 7.22-7.33 (m, 5H), 7.99 (d, 2H, J = 8.9 Hz); ^{13}C NMR (100 MHz, CDCl_3) δ 45.2, 55.4, 113.7, 126.7, 128.6, 129.3, 129.6, 130.9, 134.9, 163.7, 196.2; MS, m/e: 226 [M^+], 135 [$\text{MeOC}_6\text{H}_4\text{CO}^+$], 107 [$\text{MeOC}_6\text{H}_4^+$].

4-Butyrylbenzonitrile¹¹ [90819-57-1]



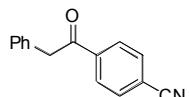
The general procedure was followed with 4-bromobenzonitrile and *N*-*tert*-butyl-*N'*-butyliidene-hydrazine. The reaction mixture was purified by flash silica gel chromatography (3% EtOAc in hexane) to give 61.0 mg (70%) of the product as white solid. ^1H NMR (400 MHz, CDCl_3 , TMS) δ 1.02 (t, 3H, J = 7.4 Hz), 1.86-1.72 (m, 2H), 2.97 (t, 2H, J = 7.23 Hz), 7.77 (d, 2H, J = 8.4 Hz), 8.05 (d, 2H, J = 8.4 Hz); ^{13}C NMR (100 MHz, CDCl_3) δ 13.8, 17.5, 40.8, 116.2, 118.0, 128.5, 132.5, 140.1, 198.9; MS, m/e: 173 [M^+], 130 [$\text{NCC}_6\text{H}_4\text{CO}^+$], 102 [NCC_6H_4^+].

4-Cyclohexanecarbonylbenzonitrile



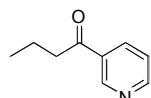
The general procedure was followed with 4-bromobenzonitrile and *N*-*tert*-butyl-*N'*-cyclohexylmethylenehydrazine. The reaction mixture was purified by preparative TLC (10% EtOAc in hexane) to give 49.2 mg (46%) of the product as pale yellow oil. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.23-1.58 (m, 5H), 1.74-1.77 (m, 1H), 1.84-1.89 (m, 4H), 3.22 (tt, 1H, *J* = 11.3, 3.1 Hz), 7.77 (d, 2H, *J* = 8.2 Hz), 8.01 (d, 2H, *J* = 8.2 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 25.4, 25.6, 28.9, 45.7, 115.7, 117.8, 128.5, 132.3, 139.2, 202.2; MS, m/e: 213 [M⁺], 130 [NCC₆H₄CO⁺], 102 [NCC₆H₄⁺]; Anal. Calcd. for C₁₄H₁₅NO: C, 78.84, H, 7.09, N, 6.57. Found: C, 78.57; H, 6.89; N, 6.61.

4-Phenylacetylbenzonitrile¹² [60694-99-7]



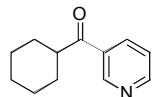
The general procedure was followed with 4-bromobenzonitrile and *N*-*tert*-butyl-*N'*-phenethylidenehydrazine. The reaction mixture was purified by flash silica gel chromatography (12% EtOAc in hexane) to give 81.0 mg (73%) of the product as white solid. ¹H NMR (400 MHz, CDCl₃, TMS) δ 4.30 (s, 2H), 7.24-7.30 (m, 3H), 7.33-7.36 (m, 2H), 7.75 (d, 2H, *J* = 8.2 Hz), 8.08 (d, 2H, *J* = 8.2 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 45.8, 116.4, 117.8, 127.3, 128.9, 129.0, 129.3, 132.5, 133.4, 139.5, 196.2; MS, m/e: 221 [M⁺], 130 [NCC₆H₄CO⁺], 102 [NCC₆H₄⁺], 91 [PhCH₂⁺].

1-Pyridin-3-yl-butan-1-one¹³ [1701-70-8]



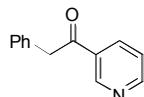
The general procedure was followed with 3-bromopyridine and *N*-*tert*-butyl-*N'*-butylidenehydrazine. After the hydrolysis, saturated aqueous sodium bicarbonate was added to the reaction mixture. The organic layer was extracted with ethyl acetate. The reaction mixture was purified by flash silica gel chromatography (40% EtOAc in hexane) to give 73.0 mg (98%) of the product as clear oil. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.02 (t, 3H, *J* = 7.4 Hz), 1.87-1.73 (m, 2H), 2.98 (t, 2H, *J* = 7.2 Hz), 7.43 (dd, 1H, *J* = 7.8, 4.8 Hz), 8.24 (m, 1H), 8.78 (dd, 1H, *J* = 4.8, 1.6 Hz), 9.18 (d, 1H, *J* = 1.9 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 13.6, 17.3, 40.6, 123.5, 132.1, 135.2, 149.4, 153.2, 198.9; MS, m/e: 149 [M⁺], 106 [C₅H₄NCO⁺], 78 [C₅H₄N⁺].

1-Pyridin-3-yl-butan-1-one¹⁴ [60148-00-7]



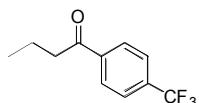
The general procedure was followed with 3-bromopyridine and *N*-*tert*-butyl-*N'*-cyclohexylmethylenehydrazine. After the hydrolysis, saturated aqueous sodium bicarbonate was added to the reaction mixture. The organic layer was extracted with ethyl acetate. The reaction mixture was flash silica gel chromatography (40% EtOAc in hexane) to give 80.3 mg (85%) of the product as clear oil. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.23-1.33 (m, 1H), 1.36-1.56 (m, 4H), 1.73-1.78 (m, 1H), 1.85-1.93 (m, 4H), 3.21-3.28 (m, 1H), 7.43 (dd, 1H, *J* = 7.9, 4.8 Hz), 8.22 (m, 1H), 8.77 (d, *J* = 4.8 Hz, 1H), 9.16 (s, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 25.6, 25.7, 29.0, 45.9, 123.6, 131.3, 135.6, 149.6, 153.0, 202.4; MS, m/e: 189 [M⁺], 106 [C₅H₄NCO⁺], 78 [C₅H₄N⁺].

2-Phenyl-1-pyridin-3-yl-ethanone¹⁵ [14627-92-0]



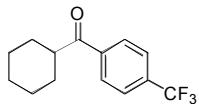
The general procedure was followed with 3-bromopyridine and *N*-*tert*-butyl-*N'*-phenethylidenehydrazine. After the hydrolysis, saturated aqueous sodium bicarbonate was added to the reaction mixture. The organic layer was extracted with ethyl acetate. The reaction mixture was purified by flash silica gel chromatography (45% EtOAc in hexane) to give 70.0 mg (71%) of the product as white solid. ¹H NMR (400 MHz, CDCl₃, TMS) δ 4.29 (s, 2H), 7.26-7.41 (m, 6H), 8.24-8.27 (m, 1H), 8.8 (dd, 1H, *J* = 4.8, 1.3 Hz), 9.23 (d, 1H, *J* = 1.9 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 45.7, 123.6, 127.1, 128.7, 129.3, 131.7, 133.4, 135.8, 149.9, 153.3, 196.3; MS, m/e: 197 [M⁺], 106 [C₅H₄NCO⁺], 78 [C₅H₄N⁺].

1-(4-Trifluoromethylphenyl)-butan-1-one¹⁶ [37851-10-8]



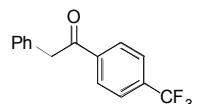
The general procedure was followed with 4-bromobenzotrifluoride and *N*-*tert*-butyl-*N'*-butylidenehydrazine. The reaction mixture was purified by preparative TLC (2.5% EtOAc in hexane) to give 97.2 mg (90%) of the product as clear oil. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.02 (t, 3H, *J* = 7.4 Hz), 1.74-1.84 (m, 2H), 2.98 (t, 2H, *J* = 7.3 Hz), 7.72 (d, 2H, *J* = 8.3 Hz), 8.06 (d, 2H, *J* = 8.3 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 13.7, 17.5, 40.7, 123.5 (q, *J* = 272.6 Hz), 125.70 (q, *J* = 3.7 Hz), 128.4, 134.3 (q, *J* = 32.6 Hz), 139.8, 199.4; MS, m/e: 216 [M⁺], 173 [CF₃C₆H₄NCO⁺], 145 [CF₃C₆H₄⁺].

Cyclohexyl-(4-trifluoromethylphenyl)-methanone¹⁷ [419543-02-5]



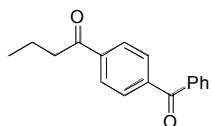
The general procedure was followed with 4-bromobenzotrifluoride and *N*-*tert*-butyl-*N'*-cyclohexylmethylenehydrazine. The reaction mixture was purified by preparative TLC (2.5% EtOAc in hexane) to give 85.0 mg (66%) of the product as clear oil. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.22-1.55 (m, 5H), 1.73-1.77 (m, 1H), 1.84-1.92 (m, 4H), 3.26 (tt, 1H, *J* = 11.4, 3.2 Hz), 7.72 (d, 2H, *J* = 8.1 Hz), 8.04 (d, 2H, *J* = 8.1 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 25.8, 25.9, 29.3, 46.0, 123.7 (q, *J* = 272.6 Hz), 125.7 (q, *J* = 3.7 Hz), 128.6, 134.1 (q, *J* = 32.6 Hz), 139.2, 202.9; MS, m/e: 256 [M⁺], 173 [CF₃C₆H₄NCO⁺], 145 [CF₃C₆H₄⁺].

2-Phenyl-1-(4-trifluoromethylphenyl)-ethanone¹⁸ [61062-55-3]



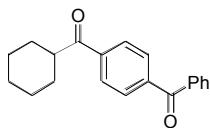
The general procedure was followed with 4-bromobenzotrifluoride and *N*-*tert*-butyl-*N'*-phenethylidenehydrazine. The reaction mixture was purified by flash silica gel chromatography (2.5% EtOAc in hexane) to give 106 mg (80%) of the product as pale yellow solid. ¹H NMR (400 MHz, CDCl₃, TMS) δ 4.31 (s, 2H), 7.25-7.36 (m, 5H), 7.71 (d, 2H, *J* = 8.5 Hz), 8.10 (d, 2H, *J* = 8.5 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 45.8, 123.5 (q, *J* = 272.8 Hz), 125.7 (q, *J* = 3.7 Hz), 127.2, 128.8, 128.9, 129.3, 133.7, 134.4 (q, *J* = 32.7 Hz), 139.1, 196.6; MS, m/e: 264 [M⁺], 173 [CF₃C₆H₄NCO⁺], 145 [CF₃C₆H₄⁺].

1-(4-Benzoylphenyl)-butan-1-one



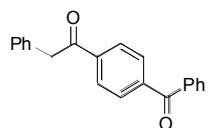
The general procedure was followed with 4-bromobenzophenone and *N*-*tert*-butyl-*N'*-butylidenehydrazine. The reaction mixture was purified by preparative TLC (4% EtOAc in hexane) to give 110 mg (87%) of the product as pale yellow solid. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.03 (t, 3H, *J* = 7.4 Hz), 1.76-1.85 (m, 2H), 3.00 (t, 2H, *J* = 7.3 Hz), 7.45-7.51 (m, 2H), 7.60-7.64 (m, 1H), 7.80 (d, 2H, *J* = 7.2 Hz), 7.86 (d, 2H, *J* = 8.3 Hz), 8.06 (d, 2H, *J* = 8.3 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 13.7, 17.5, 40.8, 127.8, 128.4, 129.9, 130.0, 132.9, 136.8, 139.5, 141.0, 195.9, 199.7; MS, m/e: 252 [M⁺], 209 [M⁺ - C₃H₇], 105 [PhCO⁺], 77 [Ph⁺]; Anal. Calcd. for C₁₇H₁₆O₂: C, 80.93, H, 6.39. Found: C, 81.06; H, 6.30.

(4-Benzoylphenyl)-cyclohexylmethanone



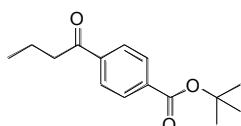
The general procedure was followed with 4-bromobenzophenone and *N*-*tert*-butyl-*N*'-cyclohexylmethylenehydrazine. The reaction mixture was purified by preparative TLC (3% EtOAc in hexane) to give 76.1 mg (52%) of the product as pale yellow solid. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.24-1.56 (m, 5H), 1.74-1.77 (m, 1H), 1.85-1.94 (m, 4H), 3.26-3.30 (m, 1H), 7.49-7.51 (m, 2H), 7.61-7.63 (m, 1H), 7.79-7.81 (m, 2H), 7.86 (d, 2H, *J* = 8.4 Hz), 8.03 (d, 2H, *J* = 8.3 Hz), ¹³C NMR (100 MHz, CDCl₃) δ 25.8, 25.9, 29.3, 46.1, 128.1, 128.5, 130.1, 130.1, 133.0, 137.0, 139.1, 141.0, 196.0, 203.4; MS, m/e: 292 [M⁺], 209 [M⁺- C₆H₁₁], 105 [PhCO⁺], 77 [Ph⁺]; Anal. Calcd. for C₂₀H₂₀O₂: C, 82.16, H, 6.89. Found: C, 81.94; H, 6.83.

1-(4-Benzoylphenyl)-2-phenylethanone

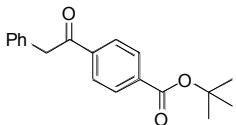


The general procedure was followed with 4-bromobenzophenone and *N*-*tert*-butyl-*N*'-phenethylidenehydrazine. The reaction mixture was purified by flash silica gel chromatography (5% EtOAc in hexane) to give 143 mg (95%) of the product as white solid. ¹H NMR (400 MHz, CDCl₃, TMS) δ 4.32 (s, 2H), 7.25-7.29 (m, 3H), 7.32-7.36 (m, 2H), 7.47-7.51 (m, 2H), 7.59-7.63 (m, 1H), 7.78-7.80 (m, 2H), 7.85 (d, 2H, *J* = 8.4 Hz), 8.10 (d, 2H, *J* = 8.4 Hz); ¹³C NMR (100 MHz, DMSO-*d*₆) δ 45.0, 1526.6, 128.3, 128.5, 128.7, 129.7, 129.7, 129.8, 133.2, 134.7, 136.4, 138.9, 140.7, 195.3, 197.4; MS, m/e: 300 [M⁺], 209 [M⁺- C₇H₇], 105 [PhCO⁺], 77 [Ph⁺]; Anal. Calcd. for C₁₇H₁₆O₂: C, 83.98, H, 5.37. Found: C, 83.81; H, 5.50.

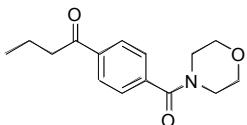
4-Butyrylbenzoic acid *tert*-butyl ester



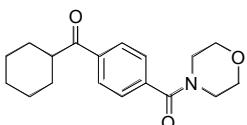
The general procedure was followed with *tert*-butyl 4-bromobenzoate and *N*-*tert*-butyl-*N*'-butylidenehydrazine. The reaction mixture was purified by flash silica gel chromatography (3% EtOAc in hexane) to give 93.6 mg (75%) of the product as white solid. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.01 (t, 3H, *J* = 7.4 Hz), 1.61, (s, 9H), 1.73-1.82 (m, 2H), 2.97 (t, 2H, *J* = 7.3 Hz), 7.98 (d, 2H, *J* = 8.3 Hz), 8.06 (d, 2H, *J* = 8.3 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 13.8, 17.6, 28.1, 40.8, 81.7, 127.8, 129.6, 135.6, 139.9, 164.9, 200.0; MS, m/e: 248 [M⁺], 205 [^tBuO₂CC₆H₄CO⁺], 175 [M⁺-O^tBu]; Anal. Calcd. for C₁₅H₂₀O₃: C, 72.55, H, 8.12. Found: C, 72.69; H, 8.40.

4-Phenylacetylbenzoic acid *tert*-butyl ester

The general procedure was followed with *tert*-butyl 4-bromobenzoate and *N*-*tert*-butyl-*N'*-phenethylidenehydrazine. The reaction mixture was purified by flash silica gel chromatography (6% EtOAc in hexane) to give 134 mg (91%) of the product as white solid. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.60 (s, 9H), 4.30 (s, 2H), 7.25-7.35 (m, 5H), 8.01-8.07 (m, 4H); ¹³C NMR (100 MHz, CDCl₃) δ 28.1, 45.9, 81.8, 127.0, 128.4, 128.7, 129.4, 129.7, 134.0, 135.8, 139.3, 164.8, 197.2; MS, m/e: 296 [M⁺], 205 [^tBuO₂CC₆H₄CO⁺]; Anal. Calcd. for C₁₉H₂₀O₃: C, 77.00; H, 6.80. Found: C, 77.01; H, 6.84.

1-[4-(Morpholine-4-carbonyl)-phenyl]-butan-1-one

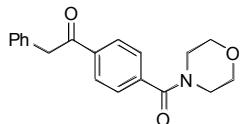
The general procedure was followed with (4-bromophenyl)-morpholin-4-yl-methanone and *N*-*tert*-butyl-*N'*-butylidenehydrazine. The reaction mixture was purified by flash silica gel chromatography (70% EtOAc in hexane) to give 109 mg (83%) of the product as white solid. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.01 (t, 3H, J = 7.4 Hz), 1.72-1.82 (m, 2H), 2.96 (t, 2H, J = 7.3 Hz), 3.42-3.89 (m, 8H), 7.50 (d, 2H, J = 7.8 Hz), 8.01 (d, 2H, J = 7.8 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 13.6, 17.4, 40.4, 42.3 (broad), 47.9 (broad), 66.6, 127.1, 128.1, 137.7, 139.2, 169.1, 199.4; MS, m/e: 261 [M⁺], 218 [M⁺ - C₃H₈], 175 [M⁺ - C₄H₈NO]; Anal. Calcd. for C₁₅H₁₉NO₃: C, 68.94; H, 7.33; N, 5.36. Found: C, 68.68; H, 7.61; N, 5.34.

Cyclohexyl-[4-(morpholine-4-carbonyl)-phenyl]-methanone

The general procedure was followed with (4-bromophenyl)-morpholin-4-yl-methanone and *N*-*tert*-butyl-*N'*-cyclohexylmethylenehydrazine. The reaction mixture was purified by flash silica gel chromatography (70% EtOAc in hexane) to give 90.1 mg (60%) of the product as white solid. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.22-1.54 (m, 5H), 1.72-1.77 (m, 1H), 1.83-1.91 (m, 4H), 3.24 (tt, 1H, J = 11.4, 3.1 Hz), 3.41-3.80 (m, 8H), 7.49 (d, 2H, J = 8.4 Hz), 7.98 (d, 2H, J = 8.4 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 25.8, 25.9, 29.3, 42.5 (broad), 45.8, 48.1 (broad), 66.8, 127.3, 128.6, 137.3, 139.3, 169.4, 203.1;

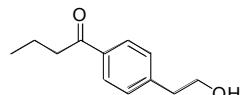
MS, m/e: 301 [M⁺], 218 [M⁺ - C₆H₁₁], 215 [M⁺ - C₄H₈NO]; Anal. Calcd. for C₁₈H₂₃NO₃: C, 71.73; H, 7.69; N, 4.65. Found: C, 71.47; H, 7.74; N, 4.48.

1-[4-(Morpholine-4-carbonyl)-phenyl]-2-phenylethanone



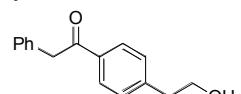
The general procedure was followed with (4-bromophenyl)-morpholin-4-yl-methanone and *N*-*tert*-butyl-*N'*-phenethylidenehydrazine. The reaction mixture was purified by flash silica gel chromatography (70% EtOAc in hexane) to give 136 mg (88%) of the product as white solid. ¹H NMR (400 MHz, CDCl₃, TMS) δ 3.39-3.79 (m, 8H), 4.29 (s, 2H), 7.25-7.28 (m, 3H), 7.32-7.35 (m, 2H), 7.48 (d, 2H, *J* = 8.5 Hz), 8.05 (d, 2H, *J* = 8.5 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 42.5 (broad), 45.7, 48.1 (broad), 66.8, 127.1, 127.4, 128.8, 128.9, 129.4, 134.0, 137.4, 139.7, 169.2, 196.8; MS, m/e: 309 [M⁺], 218 [M⁺ - C₇H₇]; Anal. Calcd. for C₁₉H₁₉NO₃: C, 73.77; H, 6.19; N, 4.53. Found: C, 73.48; H, 6.12; N, 4.41.

1-[4-(2-Hydroxyethyl)-phenyl]-butan-1-one



The general procedure was followed with [2-(4-bromophenyl)-ethoxy]-*tert*-butyl-dimethylsilane and *N*-*tert*-butyl-*N'*-butylidenehydrazine. After the hydrolysis step, the free alcohol was formed. The reaction mixture was purified by flash silica gel chromatography (45% EtOAc in hexane) to give 75.0 mg (78%) of the product as clear oil. ¹H NMR (400 MHz, CDCl₃, TMS) δ 0.99 (t, 3H, *J* = 7.4 Hz), 1.70-1.79 (m, 2H), 2.31 (br, 1H), 2.89-2.93 (m, 4H), 3.87 (t, 2H, *J* = 6.6 Hz), 7.31 (d, 2H, *J* = 8.1 Hz), 7.89 (d, 2H, *J* = 8.1 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 13.8, 17.7, 39.0, 40.3, 63.0, 128.2, 129.1, 135.2, 144.3, 200.3; MS, m/e: 191 [M⁺ - H], 149 [M⁺ - C₃H₇]; Anal. Calcd. for C₁₆H₁₆O₂: C, 74.97; H, 8.39. Found: C, 74.74; H, 8.20.

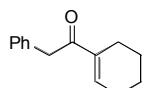
1-[4-(2-Hydroxyethyl)-phenyl]-2-phenylethanone



The general procedure was followed with [2-(4-bromophenyl)-ethoxy]-*tert*-butyl-dimethylsilane and *N*-*tert*-butyl-*N'*-phenethylidenehydrazine. After the hydrolysis step, the free alcohol was formed. The reaction mixture was purified by flash silica gel chromatography (45% EtOAc in hexane) to give 117 mg (97%) of the product as white solid. ¹H NMR (400 MHz, CDCl₃, TMS) δ 1.66 (br, 1H), 2.89 (t, 2H, *J* = 6.5 Hz), 3.86 (t, 2H, *J* = 6.5 Hz), 4.25 (s, 2H), 7.24-7.34 (m, 7H),

7.95 (d, 2H, $J = 8.3$ Hz); ^{13}C NMR (100 MHz, CDCl_3) δ 39.1, 45.5, 63.1, 126.9, 128.7, 129.0, 129.3, 129.4, 134.6, 134.9, 144.6, 197.3; MS, m/e: 239 [$\text{M}^+ - \text{H}$]; Anal. Calcd. for $\text{C}_{16}\text{H}_{16}\text{O}_2$: C, 79.97; H, 6.71. Found: C, 79.75; H, 6.67.

1-Cyclohex-1-enyl-2-phenylethanone¹⁹ [31142-52-6]



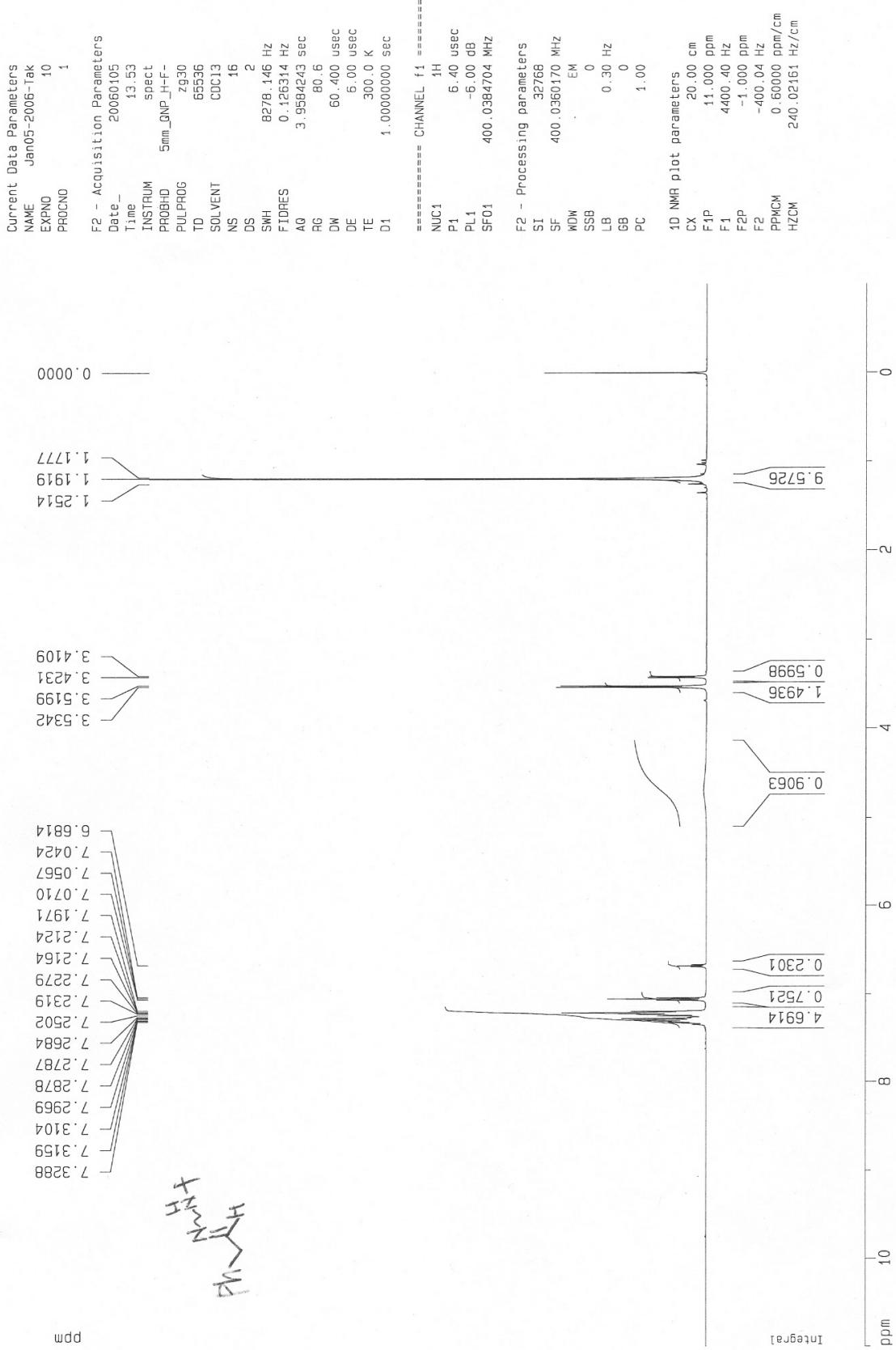
The general procedure was followed with 1-cyclohexenyl trifluoromethanesulfonate and *N*-*tert*-butyl-*N'*-phenethylidenehydrazine. The reaction mixture was purified by flash silica gel chromatography (6% EtOAc in hexane) to give 52.3 mg (52%) of the product as clear oil. δ ^1H NMR (400 MHz, CDCl_3 , TMS) δ 1.36-1.64 (m, 4H), 2.24-2.26 (m, 4H), 3.94 (s, 2H), 7.03 (t, 1H, $J = 1.7$ Hz), 7.19-7.32 (m, 5H); ^{13}C NMR (100 MHz, CDCl_3) δ 21.4, 21.9, 23.2, 26.2, 43.9, 126.5, 128.5, 129.2, 135.5, 139.0, 141.1, 198.6; MS, m/e: 200 [M^+].

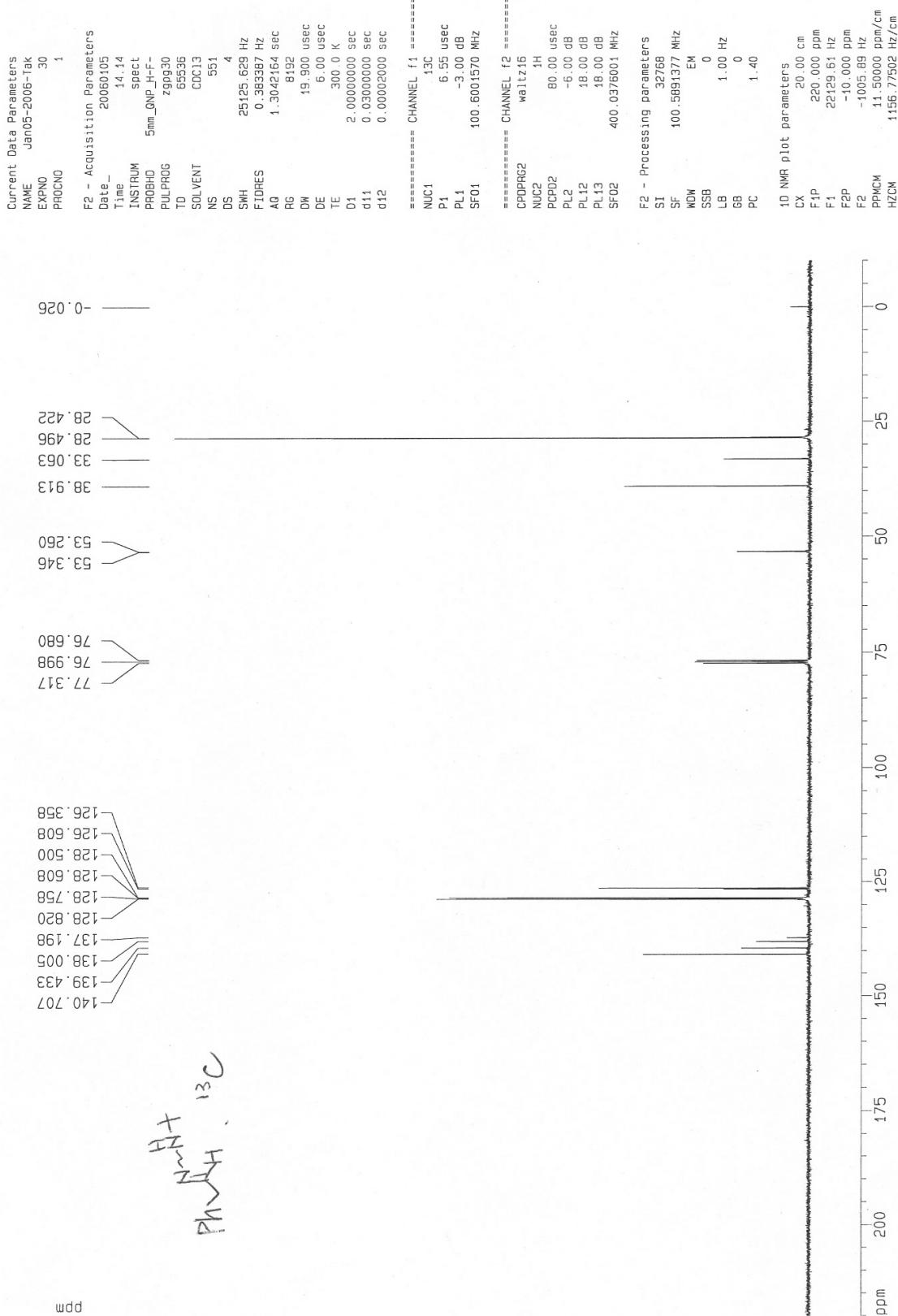
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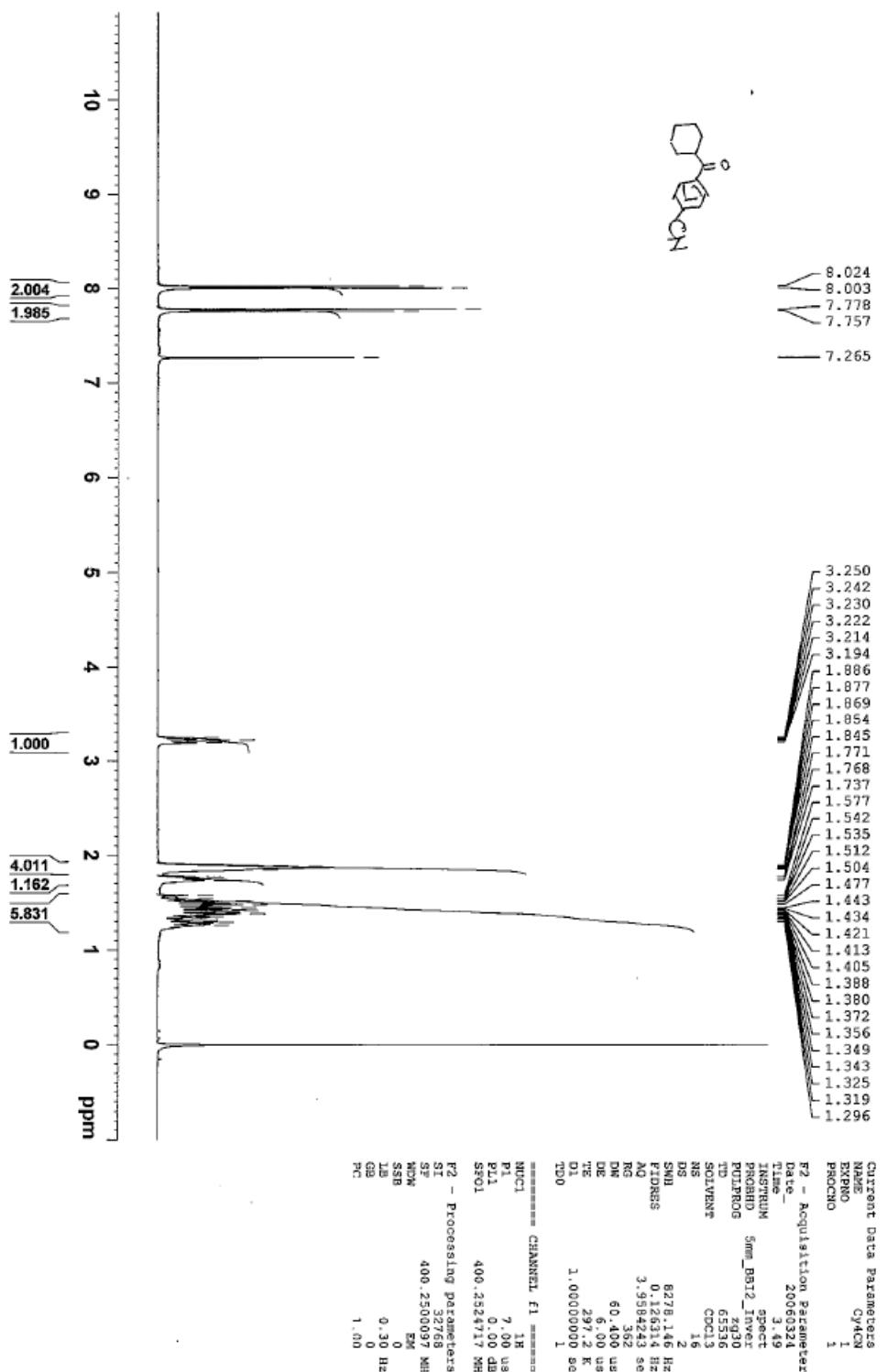
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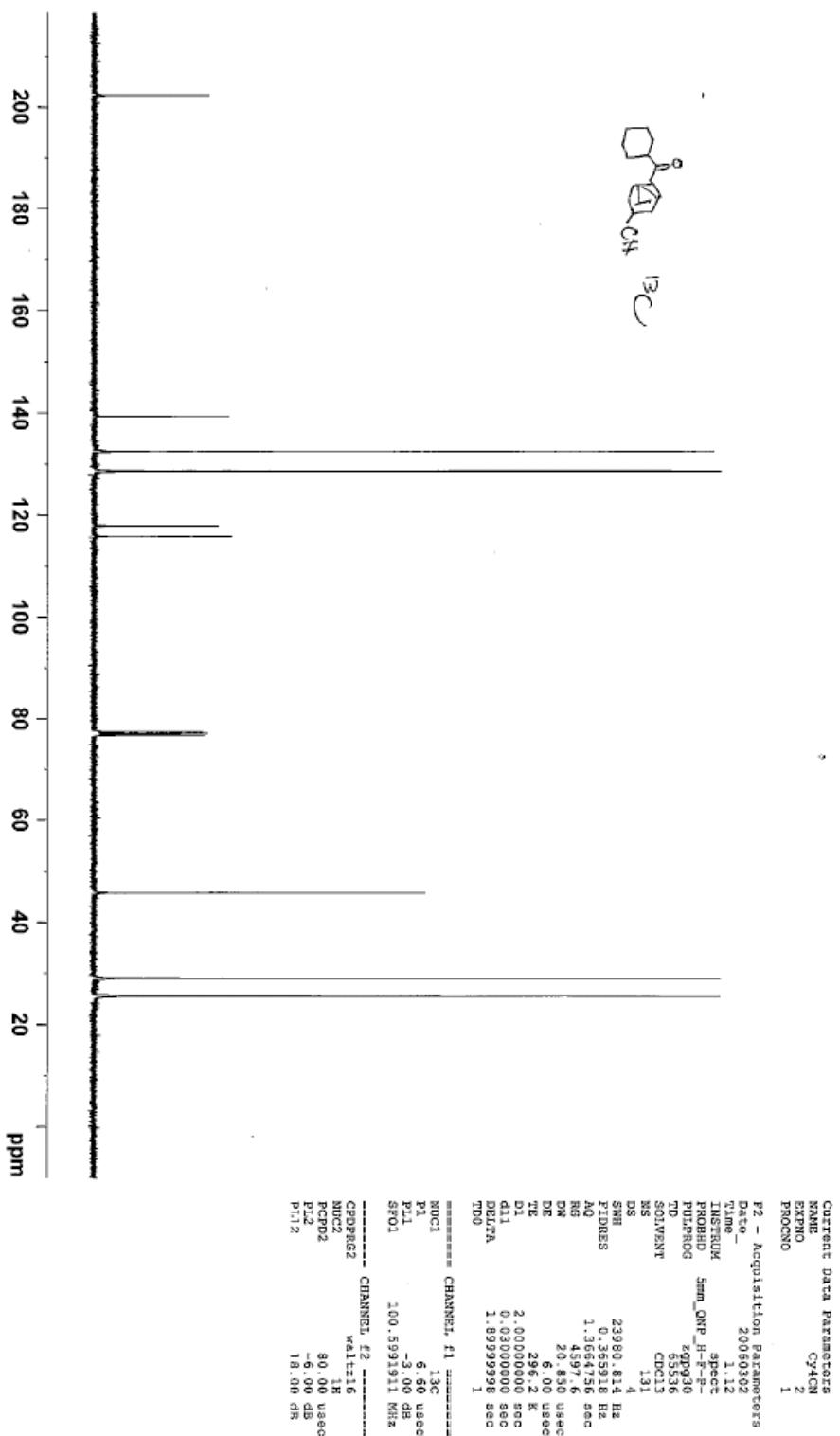
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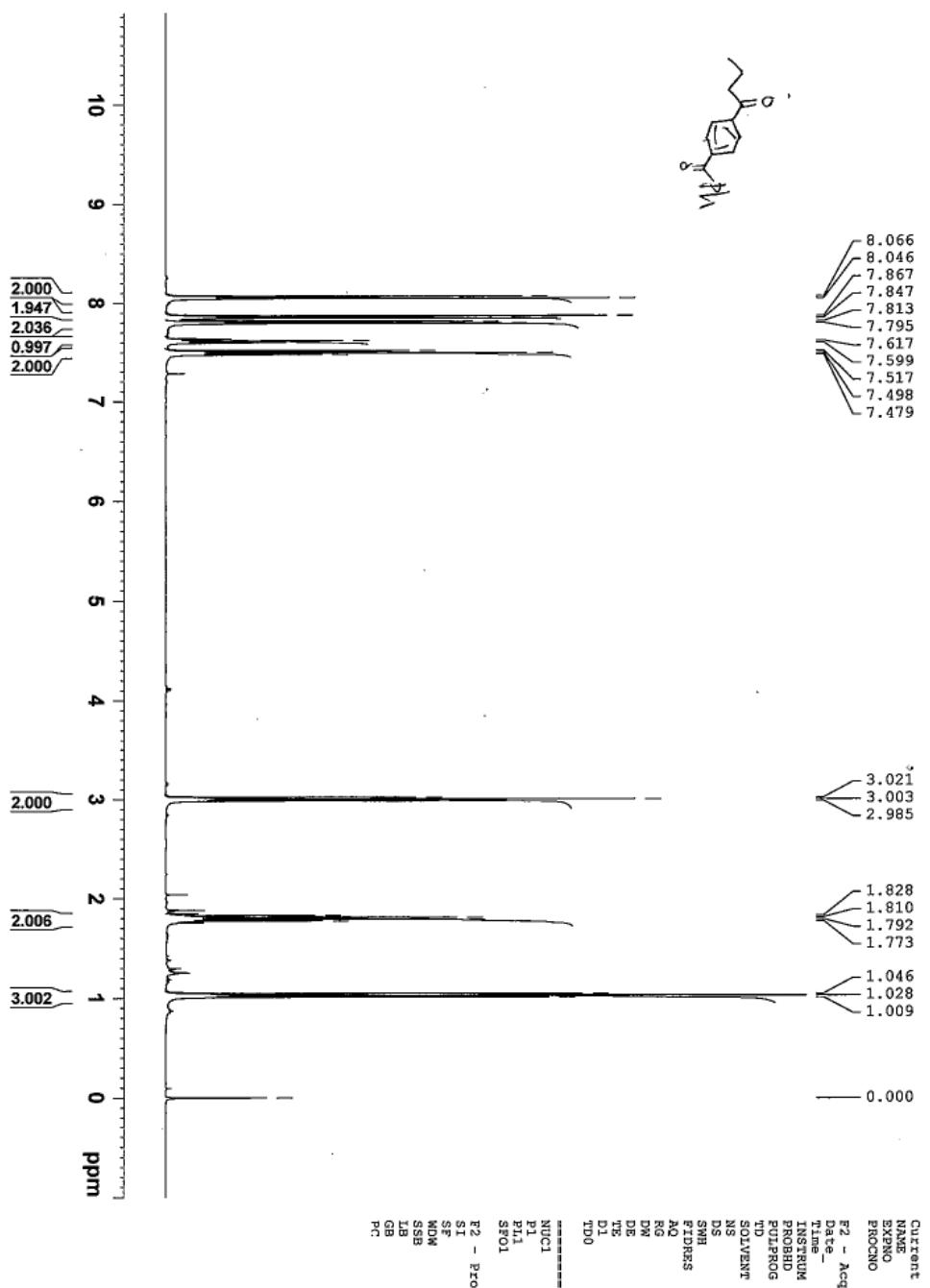
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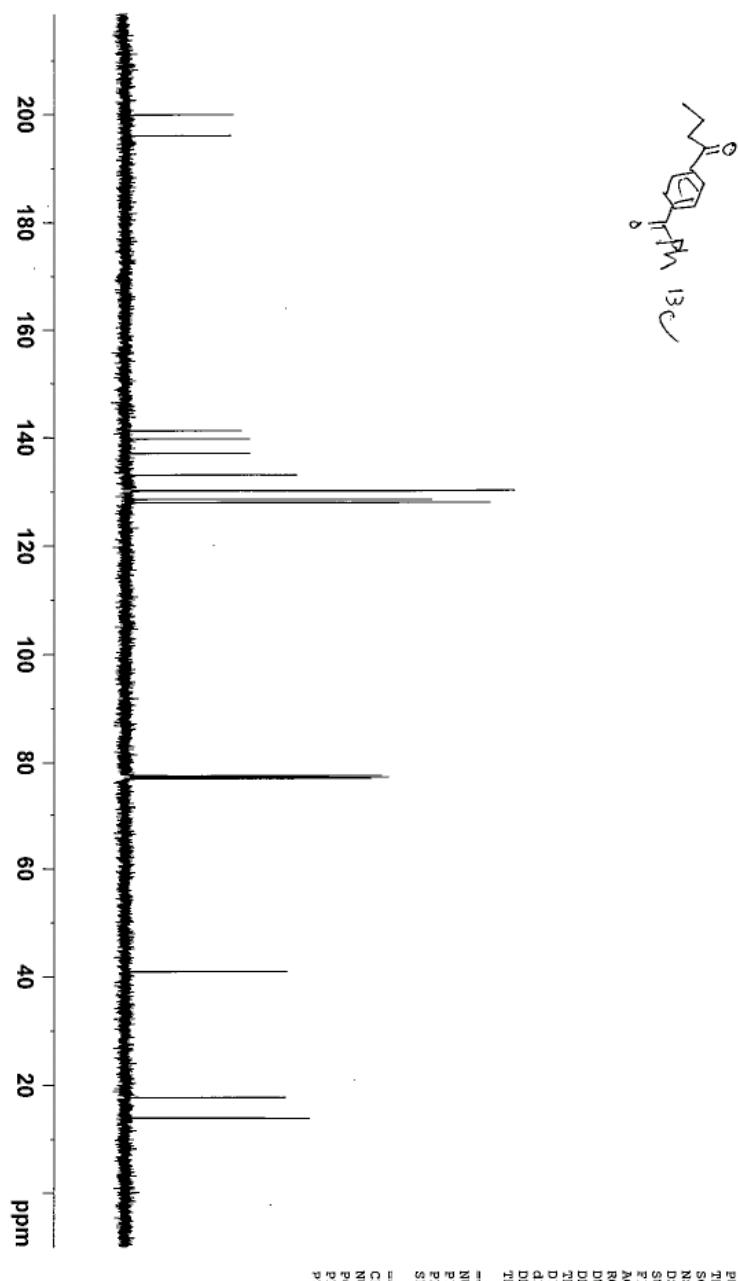








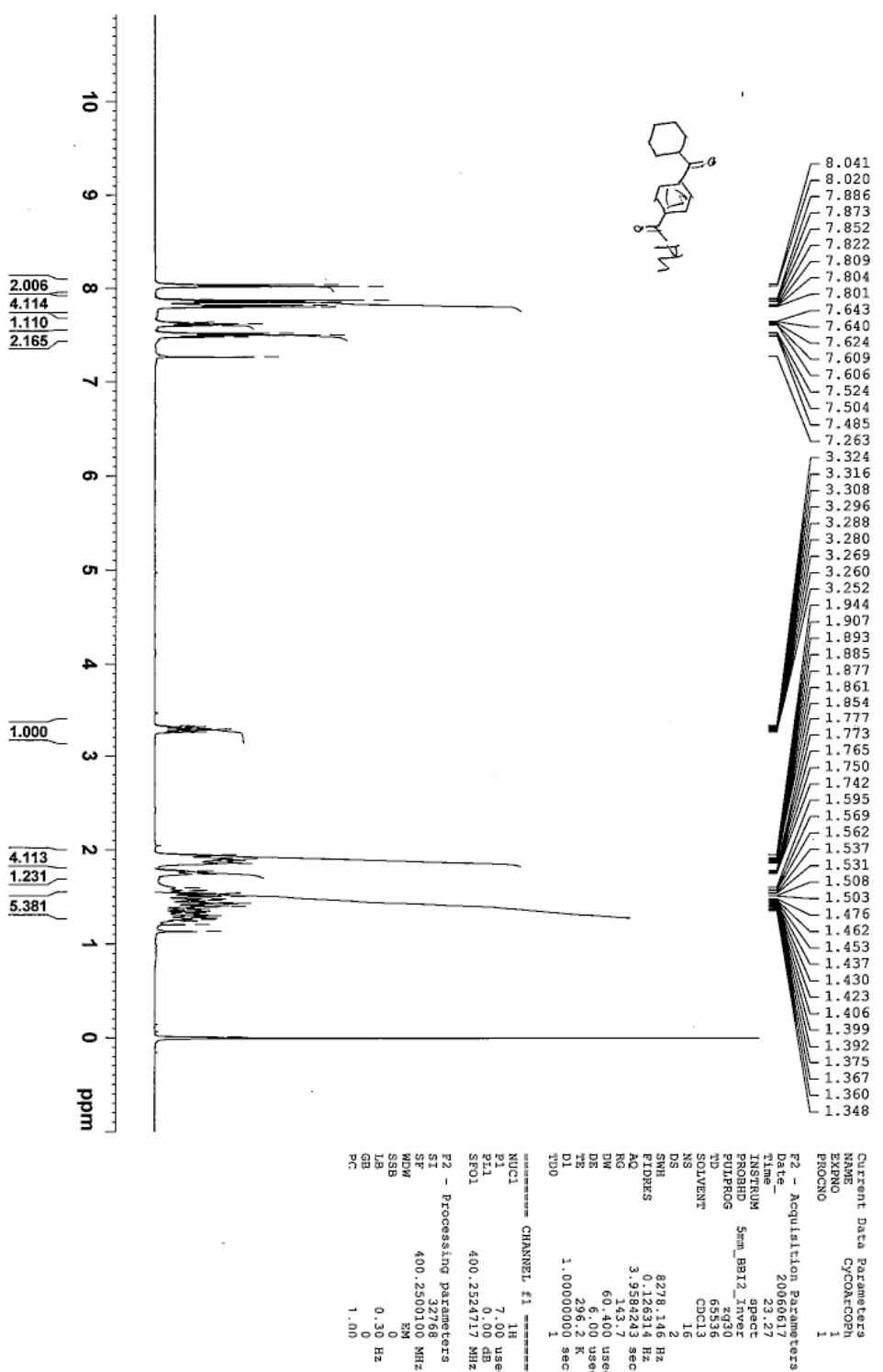


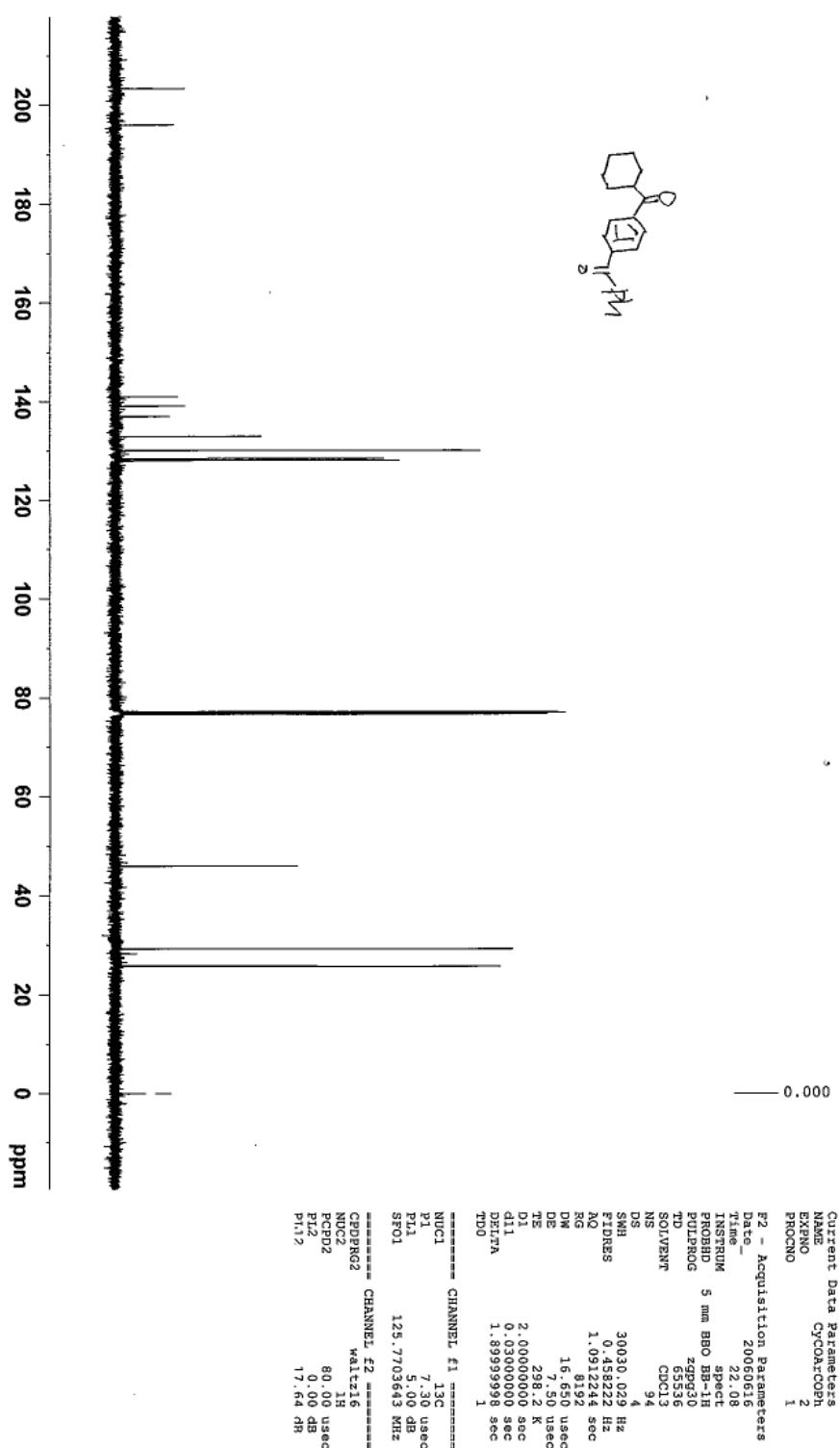


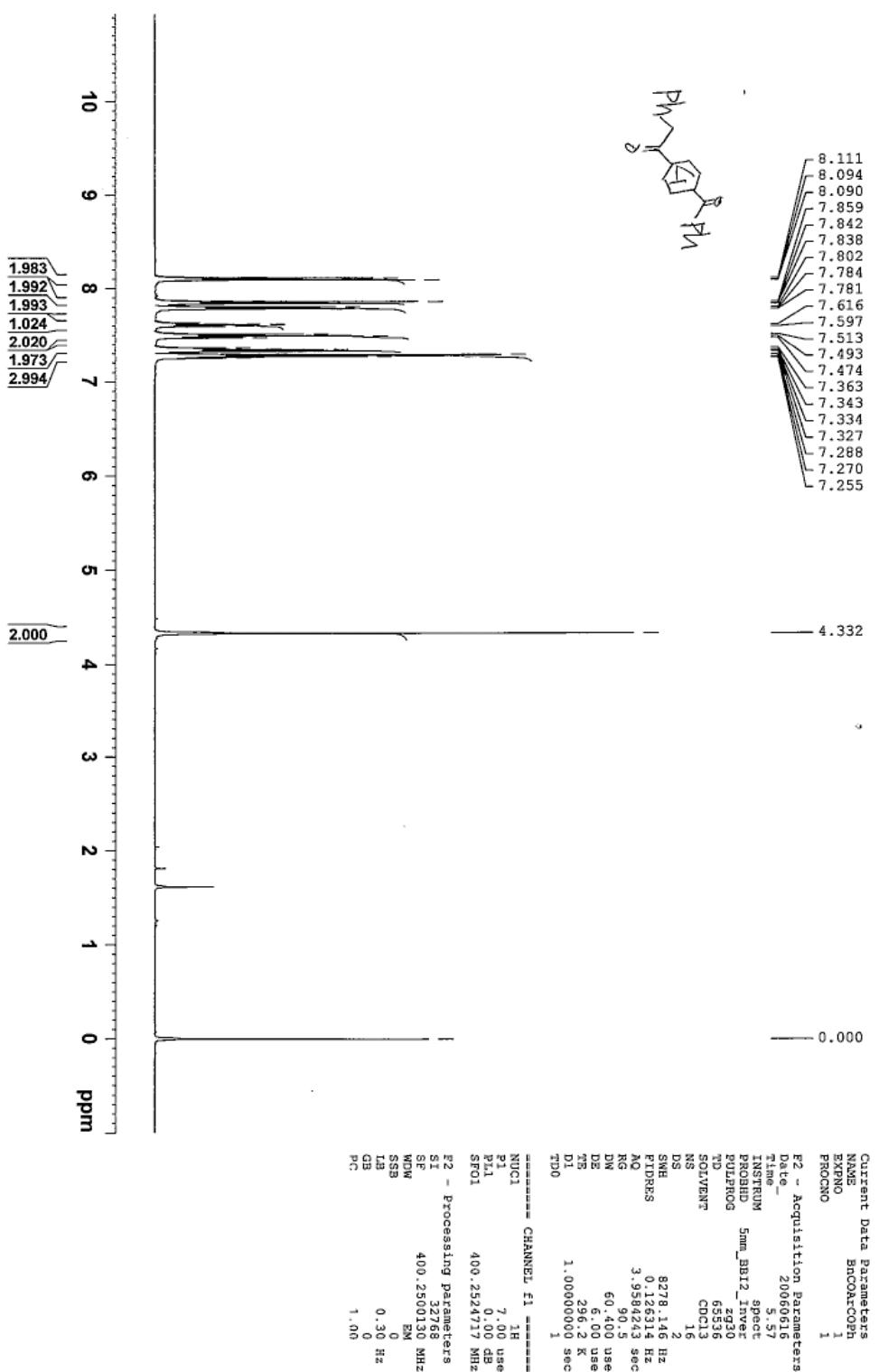
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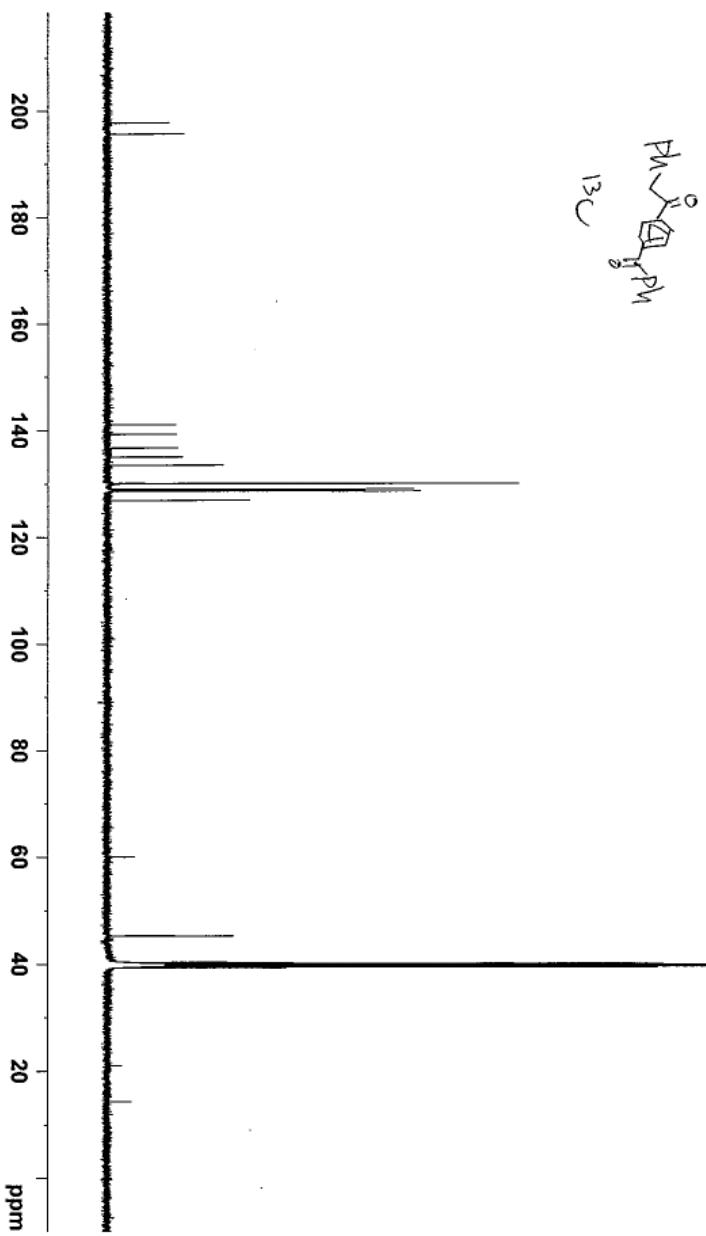
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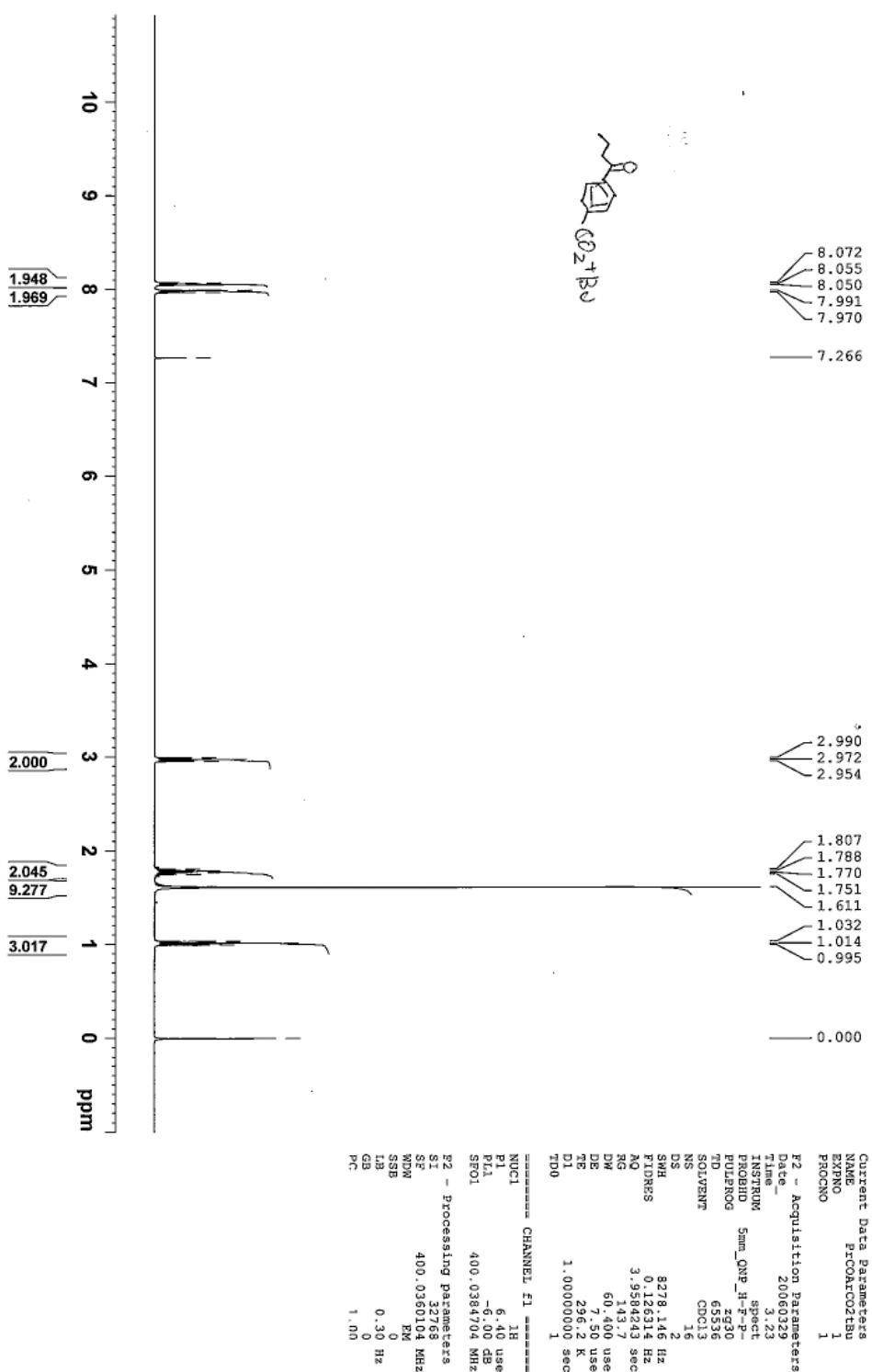
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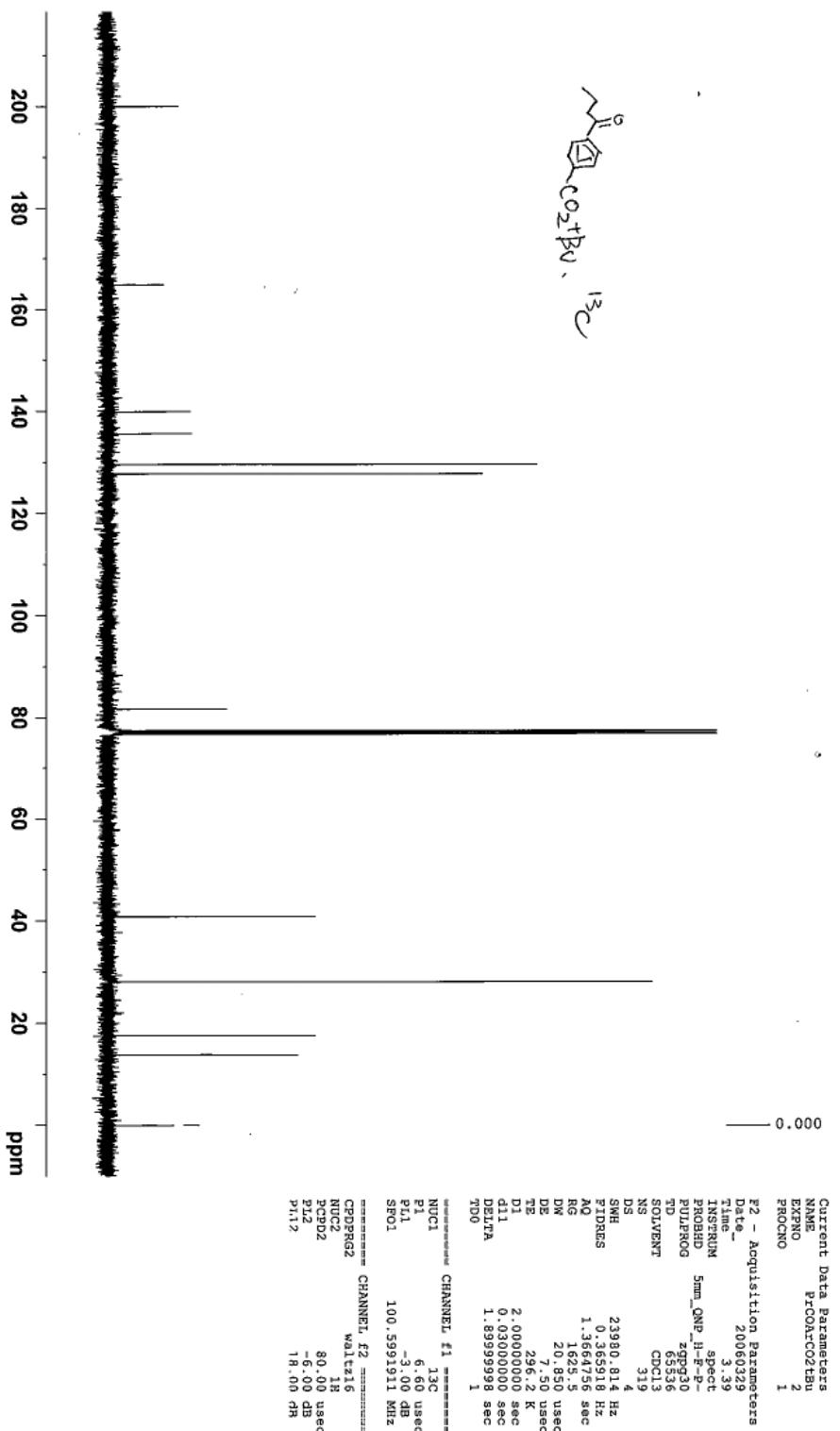
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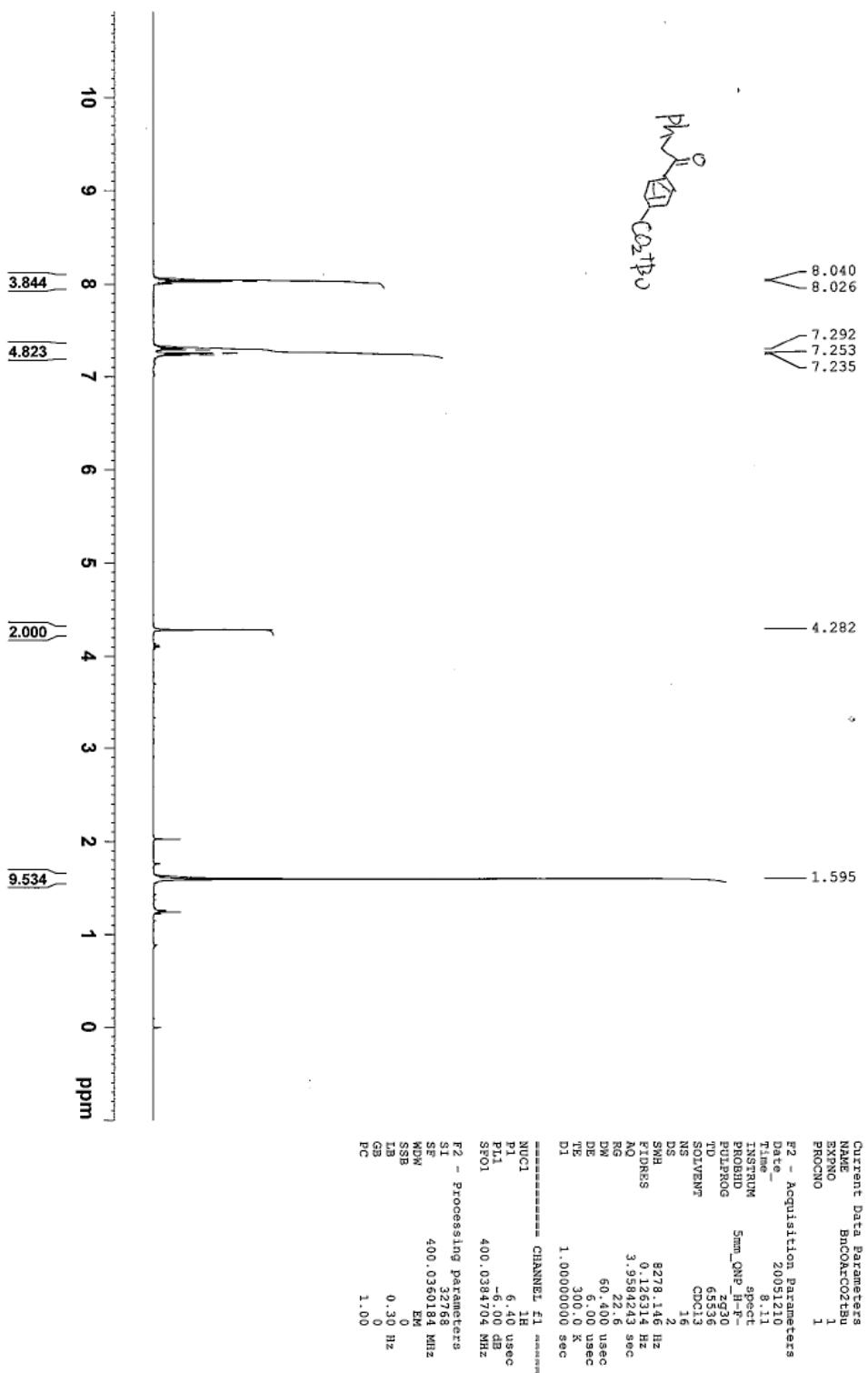
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 SWH: 0.458222 Hz
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 AQ: 5.922.6
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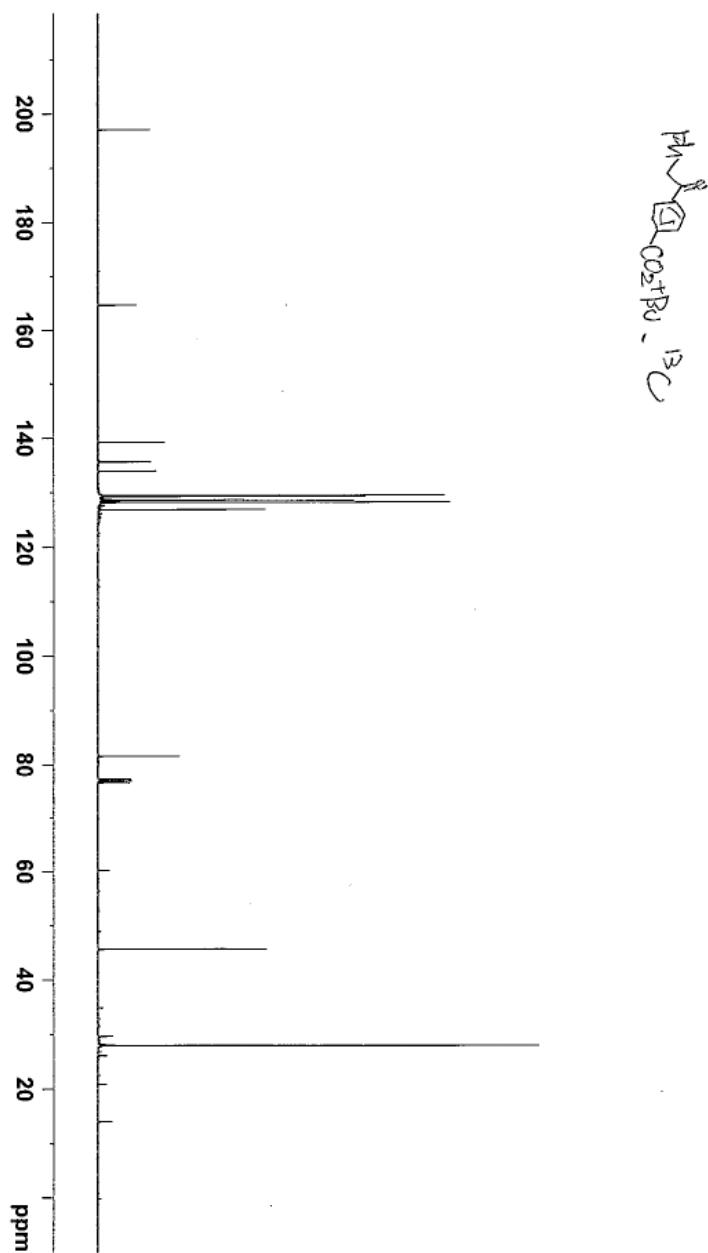
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===== CHANNEL E2 =====
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 CPDPRG2: Waltz16
 PCPD2: 80.00 usec
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Current Data Parameters
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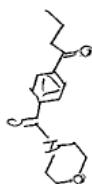
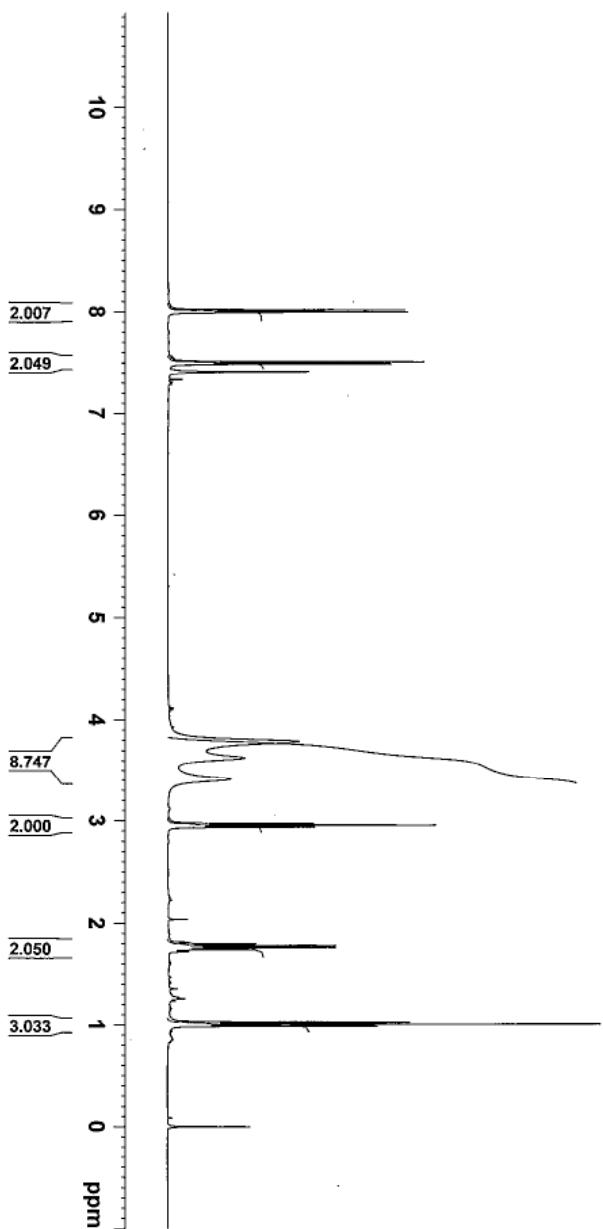
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 AQ: 1.3042164 sec
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 DE: 6.00 usec
 PB: 300.0 sec
 D1: 2.0000000 sec
 d11: 0.0300000 sec
 d12: 0.00002000 sec

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

NUC1: ¹³C
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 P1: 3.00 deg
 SP01: 100.6001570 MHz

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

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 P112: 18.00 deg
 P113: 18.00 deg



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Current Data Parameters
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