Broadening the Catalyst and Reaction Scope of Regio- and Chemoselective C-H Oxygenation: A Convenient and Scalable Approach to 2-Acylphenols by Intriguing Rh(II) and Ru(II) Catalysis

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SUPPORTING INFORMATION

Table of Contents **Page**

Materials and Methods

All commercial materials (Alfa Aesar, Aladdin, J&K Chemical LTD.) were used without further purification. All solvents were analytical grade. The ^{1}H-NMR and ^{13}C-NMR spectra were recorded on a Bruker 400 MHz spectrometer in $CDCl_3$ using TMS or solvent peak as a standard. All ^{13}C-NMR spectra were recorded with complete proton decoupling. Low-resolution mass spectral analyses were performed with a Waters AQUITY UPLC^{TM}/MS. All reactions were carried out in oven-dried sealed tube. Analytical TLC was performed on Yantai Chemical Industry Research Institute silica gel 60 F254 plates and flash column chromatography was performed on Qingdao Haiyang Chemical Co. Ltd silica gel 60 (200-300 mesh). The rotavapor was BUCHI's Rotavapor R-3. Aryl ketones were commercially available or easily synthesized from acyl chlorides and Grignard reagents or from Friedel-Crafts reaction.

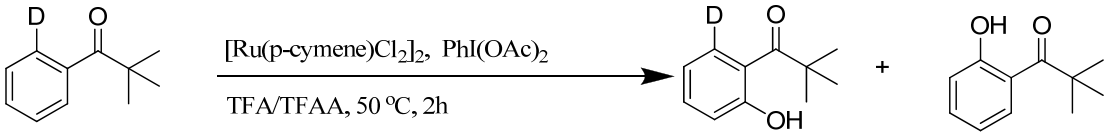
Ⅰ General procedure for ruthenium and rhodium catalyzed ortho hydroxylation of aryl ketones

To a 15ml sealed-tube were added ketone (1.0 equiv), oxidants $PhI(OAc)_2$, $K_2S_2O_8$ or Selectfluor (2.0 equiv), $[Ru(p\text{-cymene})Cl_2]_2$ or $Rh_2(OAc)_4$ (0.025 equiv), TFAA (0.6 ml) and TFA (1.4ml). The tube was sealed and heated at 50^{o}C or 80 ^{o}C. The reaction was monitored by TLC (petroleum ether: toluene = 3:1). After completion of the reaction, dichloromethane was added to dilute the reaction mixture and saturated aqueous $NaHCO_3$ was added to neutralize TFA and TFAA. Then the organic layer was dried over anhydrous Na_2SO_4 and concentrated on rotavapor under reduced pressure. Finally, the residue was purified by silica gel column chromatography to give the desired product.

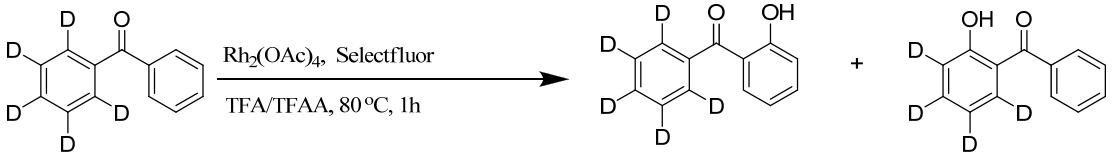
For $Rh_2(OAc)_4$, 5% of catalyst was used. Selectfluor is the best oxidant for $Rh_2(OAc)_4$.

Ⅱ Procedure for preliminary mechanism study

1. Intramolecular Experiments



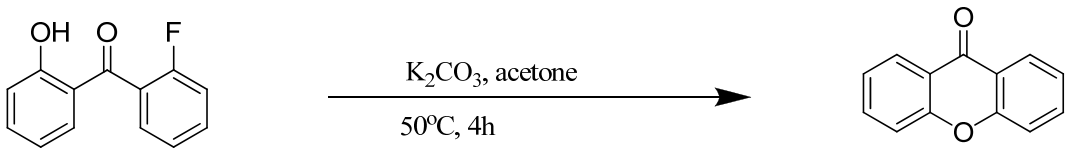
To a 15ml sealed-tube were added 2`-deuterio-2,2-dimethylpropiophenone (24mg, 0.15mmol), $PhI(OAc)_2$ (100mg, 0.30 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (2mg, 0.0038mmol), TFAA (0.6 ml) and TFA (1.4 ml). The tube was sealed and heated at 50 ^{o}C for 2h. The reaction mixture was cooled to room temperature. Then dichloromethane was added to dilute the reaction mixture and saturated aqueous $NaHCO_3$ was added to neutralize TFA and TFAA. The organic layer was dried over anhydrous Na_2SO_4 and concentrated on rotavapor under reduced pressure. The residue was eluted with DCM through a short pad of silica gel. Then the clear solution was concentrated on rotavapor under reduced pressure. ^{1}H-NMR shows $k_H/k_D = 2.7:1$.



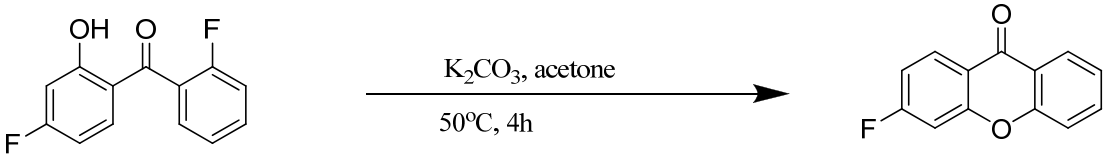
To a 15ml sealed-tube were added benzophenone – d5 (19mg, 0.10mmol), Selecfluor (71mg, 0.20 mmol), $Rh_2(OAc)_4$ (2mg, 0.005mmol), TFAA (0.2 ml) and TFA (1.8 ml). The tube was sealed and heated at 80 °C for 1h. The reaction mixture was cooled to room temperature. Then dichloromethane was added to dilute the reaction mixture and saturated aqueous $NaHCO_3$ was added to neutralize TFA and TFAA. The organic layer was dried over anhydrous Na_2SO_4 and concentrated on rotavapor under reduced pressure. The residue was eluted with DCM through a short pad of silica gel. Then the clear solution was concentrated on rotavapor under reduced pressure. ^{1}H-NMR shows $k_H/k_D = 2.1:1$.

Ⅲ Further transformations of 2-hydroxy aromatic ketones

1. Synthesis of 9*H*-xanthen-9-one

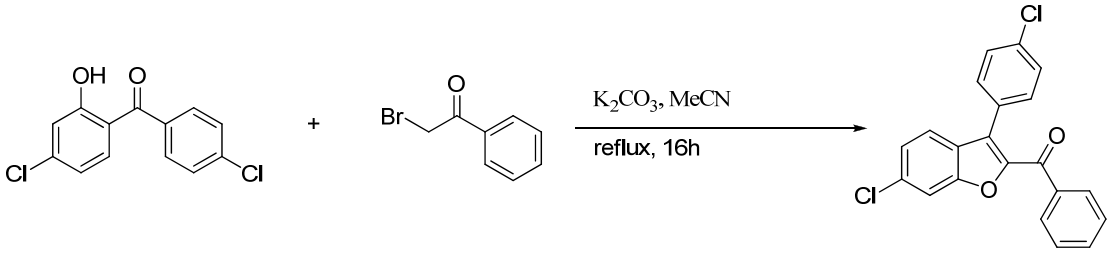


To a 15ml sealed-tube were added (2-fluorophenyl)(2-hydroxyphenyl)methanone (33 mg, 1 equiv), K_2CO_3 (42 mg, 2 equiv) and 2ml of acetone at room temperature. The tube was sealed and heated at 50 °C for 4h.Then the resulting mixture was allowed to cool to room temperature and extracted with CH_2Cl_2. The organic layer was dried over anhydrous Na_2SO_4 and concentrated on rotavapor under reduced pressure. Finally, the residue was purified by silica gel column chromatography to give the desired product **(38)** in 98% (29 mg, white solid) yield.



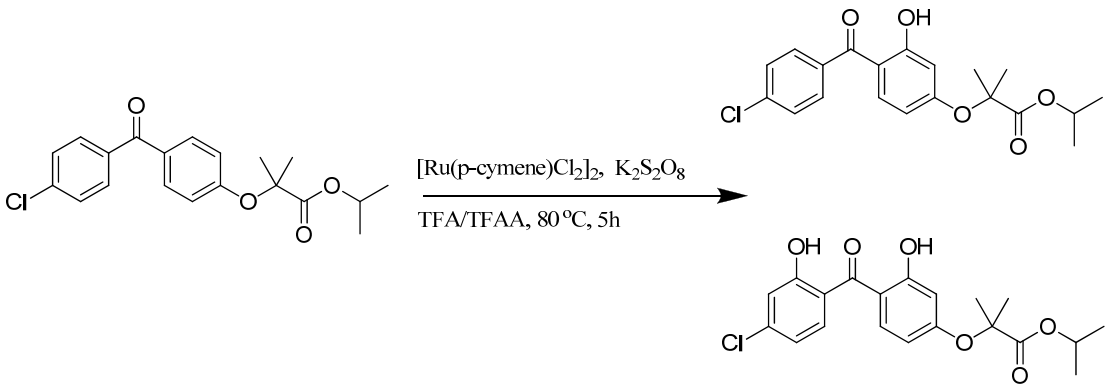
To a 15ml sealed-tube were added (4-fluoro-2-hydroxyphenyl)(2-fluorophenyl) M-ethanone (47 mg, 1 equiv), K_2CO_3 (55 mg, 2 equiv) and 2ml of acetone at room temperature. The tube was sealed and heated at 50 °C for 4h.Then the resulting mixture was allowed to cool to room temperature and extracted with CH_2Cl_2. The organic layer was dried over anhydrous Na_2SO_4 and concentrated on rotavapor under reduced pressure. Finally, the residue was purified by silica gel column chromatography to give the desired product compound **(39)** in 93% (40 mg, white solid) yield.

2. Synthesis of (6-chloro-3-(4-chlorophenyl)benzofuran-2-yl)(phenyl)methanone



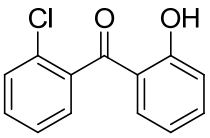
To a solution of (4-chloro-2-hydroxyphenyl)(4-chlorophenyl)methanone (80 mg, 0.30 mmol) in CH_3CN (5 mL) was added K_2CO_3 (124 mg, 0.90 mmol) and 2-bromo acetophenone (72 mg, 0.36 mmol) and the mixture refluxed for 16 h. The solvents were removed under reduced pressure and the residue dissolved in EtOAc and washed with water. The organic layer was dried over $MgSO_4$, concentrated, and the residue was purified by column chromatography on silica gel (hexane/EtOAc: 20/1) to give (6-chloro-3-(4-chlorophenyl)benzofuran-2-yl)(phenyl)methanone **(36)** in 95% (104 mg, pale yellow solid) yield.

Ⅳ Drug modification: Hydroxylation of Fenofibrate

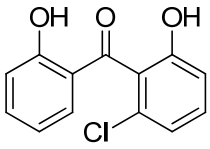


To a 15ml sealed-tube were added Fenofibrate (73mg, 0.20mmol), $K_2S_2O_8$ (108mg, 0.40 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1mg, 0.005mmol), TFAA (0.6 ml) and TFA (1.4 ml). The tube was sealed and heated at 80 ^oC for 5h. The reaction mixture was cooled to room temperature. Then dichloromethane was added to dilute the reaction mixture and saturated aqueous $NaHCO_3$ was added to neutralize TFA and TFAA. Then the organic layer was dried over anhydrous Na_2SO_4 and concentrated on rotavapor under reduced pressure. Finally, the residue was purified by silica gel column chromatography (Petroleum ether: Ethylacetate = 200:1) to give a mixture of Mono-OH- Fenofibrate **(41a)** and Di-OH- Fenofibrate **(41b)** (41.3mg, yellow oil) in 54% yield. ^1H-NMR shows the ratio is 1:0.55. Mono-OH- Fenofibrate **(41a)** LRMS (ESI) calcd for $C_{20}H_{22}ClO_5$ $[M+H]^+$: 377.11, found 377.04; Di-OH-Fenofibrate **(41b)** LRMS (ESI) calcd for $C_{20}H_{22}ClO_6$ $[M+H]^+$: 393.10, found 393.03;

Data of products



（**2a**）



（**2b**）

(2-Chlorophenyl)(2-hydroxyphenyl)methanone **(2a)**

(2-Chloro-6-hydroxyphenyl)(2-hydroxyphenyl)methanone（**2b**）

1) Small-scale

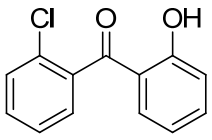
Following the general procedure Ⅰ, 2-chlorobenzophenone (44 mg, 0.20 mmol), $PhI(OAc)_2$ (129 mg, 0.40 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 80 ^oC for 3h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 5:1). Finally, compound **(2a)** (34 mg, yellow oil) was isolated in 72% yield.

2) One-gram-scale

Following the general procedure Ⅰ, 2-chlorobenzophenone (1g, 4.6 mmol), $PhI(OAc)_2$ (2.2 g, 6.9 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (28.3 mg, 0.046 mmol), 12ml TFA and 18ml TFAA were used. The reaction mixture was stirred at 80 ^oC for 14h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 5:1 or Petroleum ether: Ethylacetate = 100:1). Finally, compound **(2a)** (606 mg, yellow oil) and compound **(2b)** (178 mg, yellow solid) were isolated in 56% and 15% yield respectively.

3) Two-gram-scale

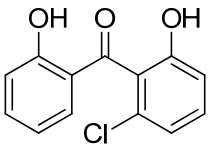
Following the general procedure Ⅰ, 2-chlorobenzophenone (2g, 9.2 mmol), $PhI(OAc)_2$ (4.5 g, 13.6 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (56.5 mg, 0.092 mmol), 12ml TFA and 18ml TFAA were used. The reaction mixture was stirred at 80 ^oC for 14h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 5:1 or Petroleum ether: Ethylacetate = 100:1). Finally, compound **(2a)** (1.2 g, yellow oil) and compound **(2b)** (548 mg, yellow solid) were isolated in 56% and 24% yield respectively.



（**2a**）

(2-Chlorophenyl)(2-hydroxyphenyl)methanone **(2a)**

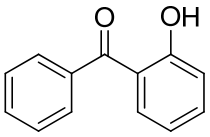
^1H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.95 (s, 1H), 7.53 – 7.34 (m, 5H), 7.25 (d, J = 8.44 Hz, 1H), 7.07 (d, J = 8.44 Hz, 1H), 6.83 (t, J = 7.60 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 200.7, 163.4, 137.5, 137.3, 133.7, 131.4, 131.0, 130.2, 128.7, 126.9, 119.5, 119.3, 118.5; LRMS (ESI) calcd for $C_{13}H_{10}ClO_2$ $[M+H]^+$: 233.04, found 232.97



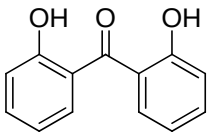
（2b）

(2-Chloro-6-hydroxyphenyl)(2-hydroxyphenyl)methanone（**2b**）

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.73 (s, 1H), 7.51 (t, *J* = 8.16 Hz, 1H), 7.35 (d, *J* = 8.00 Hz, 1H), 7.29 (t, *J* = 8.16 Hz, 1H), 7.06 – 7.03 (m, 2H), 6.88 – 6.83 (m, 2H), 6.16 (s, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 200.0, 163.0, 154.7, 137.5, 133.2, 131.97, 131.93, 124.4, 122.1, 120.0, 119.4, 118.4, 115.4; HRMS (ESI) calcd for $C_{13}H_{10}ClO_3$ $[M+H]^+$: 249.0313, found 249.0315



(3a)



(3b)

2-Hydroxybenzophenone **(3a)**

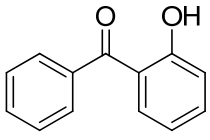
2, 2`-Dihydroxybenzophenone **(3b)**

1) $[Ru(p\text{-cymene})Cl_2]_2$

Following the general procedure Ⅰ, benzophenone (36.4 mg, 0.20 mmol), $K_2S_2O_8$ (108 mg, 0.40 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4 ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 80 ^{o}C for 3h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 5:1). Finally, compound **(3a)** (25 mg, yellow oil) and compound **(3b)** (13 mg, yellow solid) were isolated in 62% yield and 31% yield respectively.

2) $Rh_2(OAc)_4$

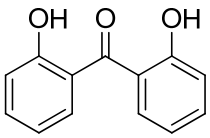
5% $Rh_2(OAc)_4$, 1.1eq. of Selectfluor, 1.8ml TFA and 0.2ml TFAA were used. The reaction mixture were stirred at 70 ^{o}C for 10h. Compound **(3a)** was isolated in 62% yield.



(3a)

2-Hydroxybenzophenone **(3a)**

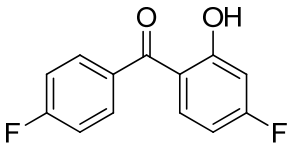
^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.03 (s, 1H), 7.68 (d, *J* = 7.08 Hz, 2H), 7.61 – 7.57 (m, 2H), 7.50 (m, 3H), 7.07 (d, *J* = 8.36 Hz, 1H), 6.87 (t, *J* = 7.96 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 201.8, 163.4, 138.1, 136.5, 133.8, 132.1, 129.3, 128.5, 119.3, 118.8, 118.6; LRMS (ESI) calcd for $C_{13}H_{11}O_2$ $[M+H]^+$: 199.08, found 199.02;



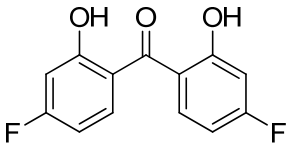
(3b)

2, 2`-Dihydroxybenzophenone **(3b)**

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 10.59 (s, 2H), 7.63 (d, *J* = 7.96 Hz, 2H), 7.52 (t, *J* = 7.88 Hz, 2H), 7.10 (d, *J* = 8.36 Hz, 2H), 6.95 (t, *J* = 7.58 Hz, 2H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 202.6, 161.9, 136.1, 133.2, 120.0, 119.0, 118.8; LRMS (ESI) calcd for $C_{13}H_{11}O_3$ $[M+H]^+$: 215.06, found 215.01



(4a)



(4b)

(4-Fluoro-2-hydroxyphenyl)(4-fluorophenyl)methanone **(4a)**

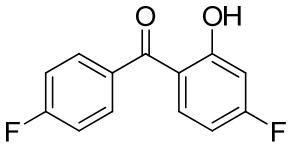
Bis(4-fluoro-2-hydroxyphenyl)methanone **(4b)**

1) $[Ru(p\text{-cymene})Cl_2]_2$

Following the general procedure Ⅰ, 4,4'-difluorobenzophenone (44 mg, 0.20 mmol), $K_2S_2O_8$ (108 mg, 0.40 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 80 ^{o}C for 6h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 5:1). Finally, compound **(4a)** (26 mg, yellow solid) was isolated in 56% yield and **(4b)**（16mg, yellow solid) in 33% yield.

2) $Rh_2(OAc)_4$

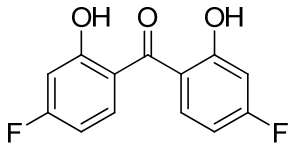
5% $Rh_2(OAc)_4$, 1.1eq. of Selectfluor, 1.8ml TFA and 0.2ml TFAA were used.The reaction mixture were stirred at 70 ^{o}C for 10h. Compound **(4a)** and compound **(4b)** were isolated in 68% yield and 17% yield respectively.



(4a)

(4-Fluoro-2-hydroxyphenyl)(4-fluorophenyl)methanone **(4a)**

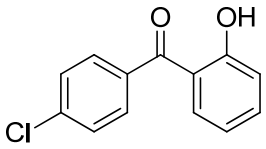
^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.28 (s, 1H), 7.69 (dd, *J* = 8.44 Hz, *J* = 5.48 Hz, 2H), 7.59 (dd, *J* = 8.84 Hz, *J* = 6.60 Hz, 1H), 7.20 (t, *J* = 8.52 Hz, 2H), 6.76 (dd, *J* = 8.84 Hz, *J* = 10.32Hz, 1H), 6.61 (td, *J* = 10.68 Hz, *J* = 2.36 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 199.1, 167.7 (d, *J* = 247 Hz, 1C), 165.1 (d, *J* = 243 Hz, 1C), 166.4 (d, *J* = 15 Hz, 1C), 135.8 (d, *J* = 16 Hz, 1C), 134.0 (d, *J* = 3.2 Hz, 1C), 131.8 (d, *J* = 9 Hz, 2C), 116.2 (d, *J* = 2.1 Hz, 1C), 115.9 (d, *J* = 22 Hz, 2C), 107.2 (d, *J* = 23 Hz, 1C), 105.4 (d, *J* = 24 Hz, 1C); LRMS (ESI) calcd for $C_{13}H_9F_2O_2$ $[M+H]^+$: 235.06, found 234.94;



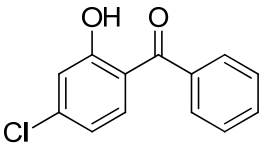
(4b)

Bis(4-fluoro-2-hydroxyphenyl)methanone **(4b)**

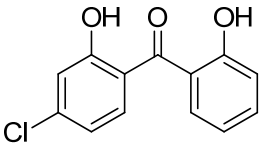
^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 10.86 (s, 2H), 7.60 (dd, *J* = 8.84 Hz, *J* = 6.44 Hz, 2H), 6.78 (dd, *J* = 10.20 Hz, *J* = 2.40 Hz, 2H), 6.67 (td, *J* = 8.38 Hz, *J* = 2.40 Hz, 2H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 200.2, 167.4 (d, *J* = 266.0 Hz), 164.5 (d, *J* = 14.0 Hz), 135.1 (d, *J* = 11.6 Hz), 116.7 (d, *J* = 2.5 Hz), 107.4 (d, *J* = 22.6 Hz), 105.7 (d, *J* = 23.9 Hz); LRMS (ESI) calcd for $C_{13}H_9F_2O_3$ $[M+H]^+$: 251.05, found 251.03



(5a)



(5b)



(5c)

(4-Chlorophenyl)(2-hydroxyphenyl)methanone **(5a)**

(4-Chloro-2-hydroxyphenyl)(phenyl)methanone **(5b)**

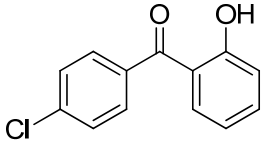
(4-Chloro-2-hydroxyphenyl)(phenyl)methanone **(5c)**

1)$[Ru(p\text{-cymene})Cl_2]_2$

Following the general procedure Ⅰ, 4-chlorobenzophenone (65 mg, 0.30 mmol), $PhI(OAc)_2$ (200 mg, 0.60 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 80 ^{o}C for 15h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 5:1). Finally, compound **(5a)** (22 mg, yellow solid) and compound **(5c)** (45 mg, yellow solid) were isolated in 32% yield and 63% yield respectively.

2) $Rh_2(OAc)_4$

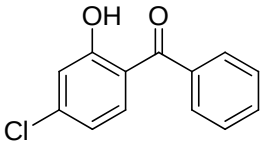
0.1mmol of 4-chlorobenzophenone , 5% $Rh_2(OAc)_4$, 1.2eq. of Selectfluor, 1.8ml TFA and 0.2ml TFAA were used.The reaction mixture were stirred at 80 ^{o}C for 10.5h. The conversion ratio for compound **(5a)**, compound **(5b)** and compound **(5c)** were 44% ,11% and 7% respectively.



(5a)

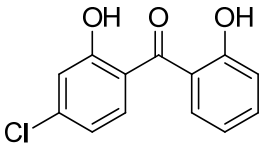
(4-Chlorophenyl)(2-hydroxyphenyl)methanone **(5a)**

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.87 (s, 1H), 7.64 (d, *J* = 7.96 Hz, 2H), 7.55 – 7.48 (m, 4H), 7.08 (d, *J* = 8.48 Hz, 1H), 6.89 (t, *J* = 7.72 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 200.4, 163.4, 138.6, 136.7, 136.3, 133.4, 130.8, 128.9, 119.1, 118.9, 118.7; LRMS (ESI) calcd for $C_{13}H_{10}ClO_2$ $[M+H]^+$: 233.04, found 232.95



(4-Chloro-2-hydroxyphenyl)(phenyl)methanone (5b)

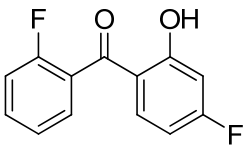
^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.18 (s, 1H), 7.67 – 7.59 (m, 3H), 7.54 – 7.50 (m, 3H), 7.10 (s, 1H), 6.86 (d, *J* = 8.56 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 201.0, 164.1, 142.4, 137.7, 134.6, 132.3, 129.2, 128.6, 119.5, 118.7, 117.9; LRMS (ESI) calcd for $C_{13}H_{10}ClO_2$ $[M+H]^+$: 233.04, found 232.95

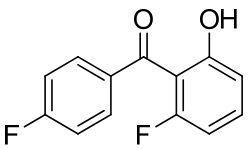


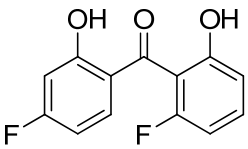
(5c)

(4-Chloro-2-hydroxyphenyl)(phenyl)methanone **(5c)**

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 10.81 (s, 1H), 10.43 (s, 1H), 7.58 – 7.53 (m, 3H), 7.12 – 7.09 (m, 2H), 6.95 – 6.92 (m, 2H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 201.6, 162.7, 161.8, 142.1, 136.3, 134.2, 132.8, 119.8, 119.7, 119.2, 118.9, 118.4; HRMS (ESI) calcd for $C_{13}H_{10}ClO_3$ $[M+H]^+$: 249.0313, found 249.0315







(6a) **(6b)** **(6c)**

(4-Fluoro-2-hydroxyphenyl)(2-fluorophenyl)methanone **(6a)**

(2-Fluoro-6-hydroxyphenyl)(4-fluorophenyl)methanone **(6b)**

(4-Fluoro-2-hydroxyphenyl)(2-fluoro-6-hydroxyphenyl)methanone **(6c)**

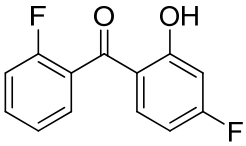
1)[Ru(*p*-cymene)Cl_2]$_2$

Following the general procedure Ⅰ , 2,4'-difluorobenzophenone (44 mg, 0.20 mmol), $PhI(OAc)_2$ (133 mg, 0.40 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 80 ^{o}C for 6h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 4 : 1). Finally, compound **(6a)** (14mg, white solid) and **(6b)** (24 mg, white solid) were isolated in 30% and 51% yield.

2) $Rh_2(OAc)_4$

0.1mmol of 2,4'-difluorobenzophenone , 5% $Rh_2(OAc)_4$, 1.2eq. of Selectfluor, 1.8ml

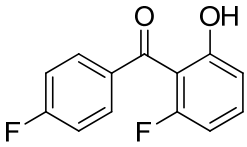
TFA and 0.2ml TFAA were used.The reaction mixture were stirred at 80 °C for 8h. The conversion ratio for compound **(6a)**, compound **(6b)** and compound **(6c)** were 16% ,40% and 16% respectively.



(6a)

(4-Fluoro-2-hydroxyphenyl)(2-fluorophenyl)methanone **(6a)**

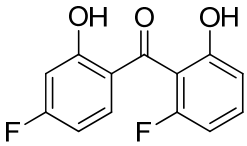
^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.30 (s, 1H), 7.60 – 7.50 (m, 1H), 7.48 – 7.41 (m, 2H), 7.30 (t, *J* = 7.52 Hz, 1H), 7.20 (t, *J* = 9.00 Hz, 1H), 6.73 (dd, *J* = 10.28 Hz, *J* = 2.40Hz, 1H), 6.58 (dd, *J* = 8.48 Hz, *J* = 2.40 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 197.4, 168.0 (d, *J* = 256.7 Hz), 165.7 (d, *J* = 14.54 Hz), 159.1 (d, *J* = 250.0 Hz), 136.1 (d, *J* = 2.6 Hz), 136.0 (d, *J* = 2.3 Hz), 133.2 (d, *J* = 8.2 Hz), 129.9 (d, *J* = 2.7 Hz), 126.3 (d, *J* = 15.6 Hz), 124.6 (d, *J* = 3.6 Hz), 117.1 (d, *J* = 2.2 Hz), 116.5 (d, *J* = 21.2 Hz), 107.6 (d, *J* = 21.9 Hz), 105.1 (d, *J* = 23.9 Hz); LRMS (ESI) calcd for $C_{13}H_9F_2O_2$ $[M+H]^+$: 235.06, found 234.97



(6b)

(2-Fluoro-6-hydroxyphenyl)(4-fluorophenyl)methanone **(6b)**

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 10.86 (s, 1H), 7.76 – 7.73 (m, 2H), 7.44 (m, 1H), 7.14 (t, *J* = 8.48 Hz, 2H), 6.89 (d, *J* = 8.44 Hz, 1H), 6.63 (t, *J* = 8.48 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) 196.5, 165.7 (d, *J* = 253.1 Hz), 162.4 (d, *J* = 3.7 Hz), 161.6 (d, *J* = 254.0 Hz), 136.1 (d, *J* = 11.6 Hz), 135.92 (d, *J* = 3.4 Hz), 135.89 (d, *J* = 3.4 Hz), 131.6 (d, *J* = 3.7 Hz), 131.5 (d, *J* = 3.6 Hz), 115.6 (d, *J* = 22.0 Hz), 114.2 (d, *J* = 3.3 Hz), 110.5 (d, *J* = 14.7 Hz), 106.9 (d, *J* = 22.8 Hz); LRMS (ESI) calcd for $C_{13}H_9F_2O_2$ $[M+H]^+$: 235.06, found 234.96

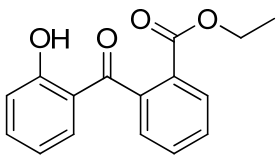


(6c)

(4-Fluoro-2-hydroxyphenyl)(2-fluoro-6-hydroxyphenyl)methanone **(6c)**

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.66 (s, 1H), 8.49 (s, 1H), 7.55 – 7.53 (m, 1H), 7.45 – 7.39 (m, 1H), 6.88 (d, *J* = 8.36 Hz, 1H), 6.74 – 6.69 (m, 2H), 6.62 (td, *J* = 8.46 Hz, *J* = 2.08 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) 197.9, 168.17 (d, *J* = 257.3 Hz), 165.3 (d, *J* = 14.6 Hz), 160.0 (d, *J* = 251.3 Hz), 159.0 (d, *J* = 17.6 Hz), 136.0 (d, *J* = 7.0 Hz), 135.9 (d, *J* = 7.2 Hz), 135.1 (d, *J* = 11.1 Hz), 117.8, 114.1(d, *J* = 3 Hz),

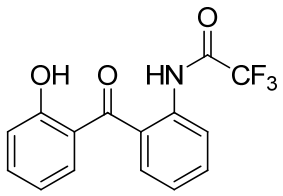
112.0 (d, J = 17.3 Hz), 107.9 (d, J = 22.8 Hz), 107.6 (d, J = 22.6 Hz), 105.1 (d, J = 24Hz); LRMS (ESI) calcd for $C_{13}H_9F_2O_3$ $[M+H]^+$: 251.05, found 250.91



(7)

Ethyl 2-(2-hydroxybenzoyl)benzoate **(7)**

Following the general procedure Ⅰ, ethyl 2-benzoylbenzoate (76 mg, 0.30 mmol), $K_2S_2O_8$ (162 mg, 0.60 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 0.8ml TFA and 1.2 ml TFAA were used. The reaction mixture was stirred at 80 ^oC for 18h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(7)** (38 mg, white solid) was isolated in 47% yield.^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.97 (s, 1H), 8.11 (dd, J = 7.64 Hz, J = 0.84 Hz, 1H), 7.66 (td, J = 7.48 Hz, J = 1.24 Hz, 1H), 7.59 (td, J = 8.52 Hz, J = 1.32 Hz, 1H), 7.46 (td, J = 7.80 Hz, J = 1.60 Hz, 1H), 7.38 (dd, J = 7.56 Hz, J = 1.04 Hz, 1H), 7.09 (dd, J = 7.96 Hz, J = 1.56 Hz, 1H), 7.04 (d, J = 8.12 Hz, 1H), 6.76 (td, J = 7.58 Hz, J = 0.88 Hz, 1H), 4.14 (q, J = 7.16 Hz, 2H), 1.09 (t, J = 7.16 Hz, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 203.0, 165.6, 162.6, 140.0, 136.5, 132.7, 132.6, 130.5, 130.0, 129.0, 127.4, 120.5, 119.0, 118.3, 61.8, 13.6; LRMS (ESI) calcd for $C_{16}H_{15}O_4$ $[M+H]^+$: 271.10, found 271.06



(8)

2,2,2-Trifluoro-N-(2-(2-hydroxybenzoyl)phenyl)acetamide **(8)**

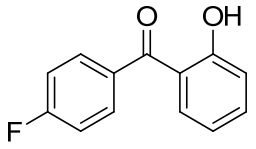
1)$[Ru(p\text{-cymene})Cl_2]_2$

Following the general procedure Ⅰ, N-(2-benzoylphenyl)-2,2,2-trifluoroacetamide (88 mg, 0.30 mmol), $K_2S_2O_8$ (162 mg, 0.60 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (6 mg, 0.01 mmol), 1.0ml TFA and 1.0 ml TFAA were used. The reaction mixture was stirred at 80 ^oC for 15h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1 or Petroleum ether: Ethylacetate = 10:1). Finally, compound **(8)** (71 mg, yellow solid) was isolated in 77% yield.

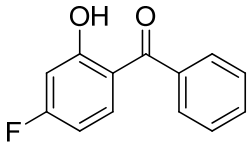
2) $Rh_2(OAc)_4$

0.1mmol of 2-aminobenzophenone , 5% $Rh_2(OAc)_4$, 1.2eq. of Selectfluor, 1.8ml TFA and 0.2ml TFAA were used.The reaction mixture was stirred at 80 ^oC for 7h. The conversion ratio for compound **(8)** was 61%. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.27 (s, 1H), 10.62 (s, 1H), 8.46 (d, J = 8.32 Hz, 1H), 7.66 (t, J = 7.68 Hz, 1H), 7.61 (d, J = 7.48 Hz, 1H), 7.56 (t, J = 7.32 Hz, 1H), 7.52 (d, J = 8.00 Hz, 1H), 7.32 (d, J =

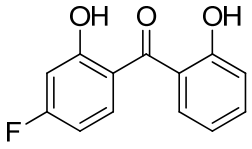
7.64 Hz, 1H), 7.10 (d, *J* = 8.36 Hz, 1H), 6.92 (d, *J* = 7.44 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 201.81, 163.56, 155.34 (q, *J* = 38 Hz), 137.4, 136.1, 133.87, 133.78, 132.7, 126.0, 124.7, 122.8, 119.6, 119.2, 119.0, 115.8 (q, *J* = 286.8 Hz); ^{19}F-NMR (376 MHz, $CDCl_3$) δ (ppm) -76.14; LRMS (ESI) calcd for $C_{15}H_{11}F_3NO_3$ $[M+H]^+$: 310.07, found 310.09



(9a)



(9b)



(9c)

(4-Fluorophenyl)(2-hydroxyphenyl)methanone **(9a)**

(4-Fluoro-2-hydroxyphenyl)(phenyl)methanone **(9b)**

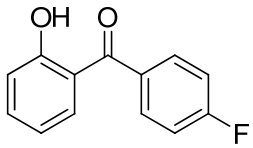
(4-Fluoro-2-hydroxyphenyl)(2-hydroxyphenyl)methanone **(9c)**

1)[Ru(*p*-cymene)Cl_2]$_2$

Following the general procedure Ⅰ, 4-fluorobenzophenone (60 mg, 0.30 mmol), $PhI(OAc)_2$ (200 mg, 0.60 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 60 ^{o}C for 15h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 5:1). Finally, compound **(9a)** (17.5 mg, yellow solid) and compound **(9c)** (43.5 mg, yellow solid) was isolated in 27% yield and 65% yield respectively.

2) $Rh_2(OAc)_4$

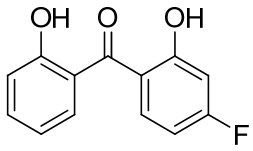
0.1mmol of 4-fluorobenzophenone , 5% $Rh_2(OAc)_4$, 1.2eq. of Selectfluor, 1.8ml TFA and 0.2ml TFAA were used.The reaction mixture was stirred at 80 ^{o}C for 7h. The conversion ratio for compound **(9a)**, compound **(9b)** and compound **(9c)** were 51% ,8% and 13% respectively.



(9a)

(4-Fluorophenyl)(2-hydroxyphenyl)methanone **(9a)**

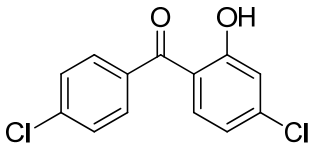
^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.88 (s, 1H), 7.74-7.71 (m, 2H), 7.56 (d, *J* = 8.0 Hz, 1H), 7.52 (t, *J* = 8.0 Hz, 1H), 7.19 (t, *J* = 8.4 Hz, 2H), 7.08 (d, *J* = 8.4 Hz, 1H), 6.89 (t, *J* = 7.2 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 200.1, 165.2(d, *J* = 252.1 Hz, 1C), 163.3, 136.5, 134.2 (d, *J* = 3.1 Hz, 1C), 133.4, 131.9 (d, *J* = 8.9 Hz, 1C), 119.2, 118.9, 118.7, 115.7 (d, *J* = 21.7 Hz, 1C); LRMS (ESI) calcd for $C_{13}H_{10}FO_2$ $[M+H]^+$: 217.06, found 216.90



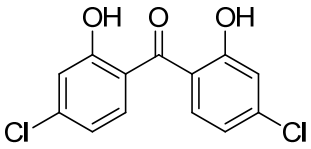
(9c)

(4-Fluoro-2-hydroxyphenyl)(2-hydroxyphenyl)methanone **(9c)**

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.12 (s, 1H), 10.33 (s, 1H), 7.67-7.63 (m, 1H), 7.56-7.50 (m, 2H), 7.09 (d, *J* = 8.3 Hz, 1H), 6.95 (t, *J* = 7.6 Hz, 1H), 6.77 (dd, *J* = 10.2 Hz, *J* = 2.0 Hz, 1H), 6.68-6.64 (m, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 201.3, 167.4 (d, *J* = 256 Hz, 1C), 164.8 (d, *J* = 15 Hz, 1C), 161.6, 136.1, 135.7 (d, *J* = 11.4 Hz, 1C), 132.7, 120.0, 119.1, 118.8, 116.7 (d, *J* = 2.2 Hz, 1C), 107.3 (d, *J* = 23 Hz, 1C), 105.6 (d, *J* = 24 Hz, 1C); HRMS (ESI) calcd for $C_{13}H_{10}FO_3$ $[M+H]^+$: 233.0608, found 232.0605



(10a)



(10b)

(4-Chloro-2-hydroxyphenyl)(4-chlorophenyl)methanone **(10a)**

Bis(4-chloro-2-hydroxyphenyl)methanone **(10b)**

1) $[Ru(p\text{-cymene})Cl_2]_2$

Following the general procedure Ⅰ, 4,4'-dichlorobenzophenone (51 mg, 0.20 mmol), $K_2S_2O_8$ (108 mg, 0.40 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 80 ^{o}C for 5.5h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 4:1). Finally, compound **(10a)** (30 mg, yellow solid) was isolated in 56% yield and **(10b)**（17mg, yellow solid) in 29% yield.

2) $Rh_2(OAc)_4$

0.1mmol of 4-fluorobenzophenone , 5% $Rh_2(OAc)_4$, 1.2eq. of Selectfluor, 1.8ml TFA and 0.2ml TFAA were used.The reaction mixture was stirred at 80 ^{o}C for 11h. The conversion ratio for compound **(10a)** and compound **(10b)** were 62% and 20% respectively.

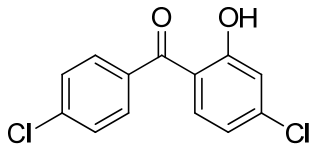
3) one-gram-scale

Following the general procedure Ⅰ, 4,4'-dichlorobenzophenone (1 g, 4.0 mmol), $K_2S_2O_8$ (2160 mg, 8.0 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (12 mg, 0.020 mmol), 14ml TFA and 6ml TFAA were used. The reaction mixture was stirred at 80 ^{o}C for 24h. The residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 4:1 or Petroleum ether: Ethylacetate = 100:1). Finally, compound **(10a)** (650 mg, yellow solid) was isolated in 65% yield. Some staring material remained.

4) two-gram-scale

Following the general procedure Ⅰ, 4,4'-dichlorobenzophenone (2 g, 7.96 mmol), $K_2S_2O_8$ (4300 mg, 15.9 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (48.8 mg, 0.080 mmol), 21ml TFA and 9ml TFAA were used. The reaction mixture was stirred at 80 ^{o}C for 24h.

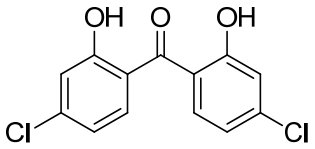
After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 4:1 or Petroleum ether: Ethylacetate = 100:1). Finally, compound **(10a)** (650 mg, yellow solid) and **(10b)**（435mg, yellow solid) were isolated in 51% and 23% yield respectively.



(10a)

(4-Chloro-2-hydroxyphenyl)(4-chlorophenyl)methanone **(10a)**

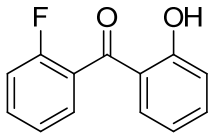
^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.03 (s, 1H), 7.62 (d, *J* = 8.40 Hz, 2H), 7.51 – 7.47 (m, 3H), 7.10 (s, 1H), 6.87 (d, *J* = 8.60 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 199.6, 164.0, 142.7, 138.9, 136.0, 134.2, 130.7, 129.0, 119.7, 118.9, 117.6; LRMS (ESI) calcd for $C_{13}H_9Cl_2O_2$ $[M+H]^+$: 264.99, found 265.01

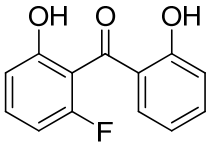


(10b)

Bis(4-chloro-2-hydroxyphenyl)methanone **(10b)**

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 10.65 (s, 2H), 7.50 (d, *J* = 8.60 Hz, 2H), 7.11 (s, 2H), 6.93 (d, *J* = 8.56 Hz, 2H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 200.6, 162.5, 142.3, 133.5, 119.8, 118.9, 118.3; HRMS (ESI) calcd for $C_{13}H_9Cl_2O_3$ $[M+H]^+$: 282.9923, found 282.9923





(11a) **(11b)**

(2-Fluorophenyl)(2-hydroxyphenyl)methanone **(11a)**

(2-Fluoro-6-hydroxyphenyl)(2-hydroxyphenyl)methanone **(11b)**

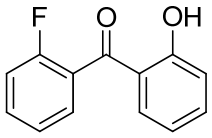
1) [Ru(*p*-cymene)Cl_2]$_2$

Following the general procedure Ⅰ, 2-fluorobenzophenone (60 mg, 0.30 mmol), $PhI(OAc)_2$ (200 mg, 0.60 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 80 ^{o}C for 2h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 5:1). Finally, compound **(11a)** (20 mg, yellow solid) and compound **(11b)** (40 mg, yellow solid) were isolated in 30% yield and 57% yield respectively.

2) $Rh_2(OAc)_4$

0.1mmol of 2-fluorobenzophenone , 5% $Rh_2(OAc)_4$, 1.2eq. of Selectfluor, 1.8ml TFA

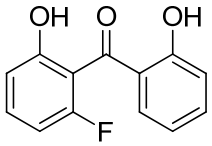
and 0.2ml TFAA were used.The reaction mixture was stirred at 80 °C for 10h. The conversion ratio for compound **(11a)** and compound **(11b)** were 10% and 42% respectively.



(11a)

(2-Fluorophenyl)(2-hydroxyphenyl)methanone **(11a)**

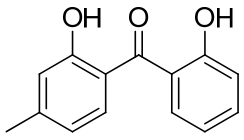
^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.96 (s, 1H), 7.54-7.45 (m, 3H), 7.41 (d, *J* = 8.0 Hz, 1H), 7.28 (t, *J* = 7.5 Hz, 1H), 7.19 (t, *J* = 9.0 Hz, 1H), 7.06 (d, *J* = 8.4 Hz, 1H), 6.86 (t, *J* = 7.5 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 198.7, 163.2, 159.2 (d, *J* = 250 Hz, 1C), 137.2, 133.5 (d, *J* = 2.1 Hz, 1C), 133.0 (d, *J* = 8 Hz, 1C), 130.0 (d, *J* = 2.8 Hz, 1C), 126.5 (d, *J* = 15 Hz, 1C), 124.5 (d, *J* = 3.6 Hz, 1C), 119.9, 119.2, 118.4, 116.4 (d, *J* = 21 Hz, 1C); LRMS (ESI) calcd for $C_{13}H_{10}FO_2$ $[M+H]^+$: 217.06, found 216.93



(11b)

(2-Fluoro-6-hydroxyphenyl)(2-hydroxyphenyl)methanone **(11b)**

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.23 (s, 1H), 8.62 (s, 1H), 7.54-7.48 (m, 2H), 7.45-7.39 (m, 1H), 7.05 (d, *J* = 8.4 Hz, 1H), 6.92-6.87 (m, 2H), 6.71 (t, *J* = 8.8 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 199.3, 162.6, 160.2 (d, *J* = 252 Hz, 1C), 159.3 (d, *J* = 4.5 Hz, 1C), 137.4, 135.0 (d, *J* = 11 Hz, 1C), 133.2 (d, *J* = 7.1 Hz, 1C), 120.8, 119.3, 118.4, 114.0 (d, *J* = 3 Hz, 1C), 112.0 (d, *J* = 17 Hz, 1C), 107.5 (d, *J* = 23 Hz, 1C); HRMS (ESI) calcd for $C_{13}H_{10}FO_3$ $[M+H]^+$: 233.0608, found 233.0609

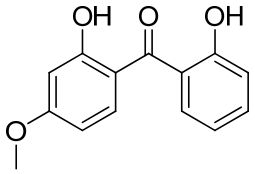


(12)

(2-Hydroxy-4-methylphenyl)(2-hydroxyphenyl)methanone **(12)**

Following the general procedure Ⅰ, 4-methylbenzophenone (59 mg, 0.30 mmol), $PhI(OAc)_2$ (200 mg, 0.60 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 80 °C for 4h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 5:1). Finally, compound **(12)** (41 mg, yellow solid) was isolated in 65% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 10.84 (s, 1H), 10.50 (s, 1H), 7.61 (d, *J* = 8.00 Hz, 1H), 7.53 – 7.48 (m, 2H), 7.08 (d, *J* =

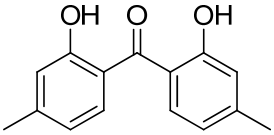
8.36 Hz, 1H), 6.95 – 6.90 (m, 2H), 6.74 (d, *J* = 8.12 Hz, 1H), 2.39 (s, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 202.0, 162.4, 161.6, 148.0, 135.7, 133.2, 133.0, 120.3, 120.2, 118.92, 118.88, 118.7, 117.5, 22.1; LRMS (ESI) calcd for $C_{14}H_{13}O_3$ $[M+H]^+$: 229.08, found 228.94



(13)

(2-Hydroxy-4-methoxyphenyl)(2-hydroxyphenyl)methanone **(13)**

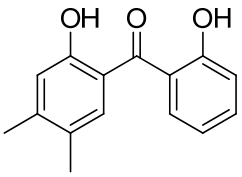
Following the general procedure Ⅰ, (2-hydroxy-4-methoxyphenyl)(phenyl)methanone (69 mg, 0.30 mmol), $K_2S_2O_8$ (162 mg, 0.20 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.0ml TFA and 1.0 ml TFAA were used. The reaction mixture was stirred at 80 ^oC for 20h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(13)** (37 mg, pale yellow solid) was isolated in 51% yield ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.63 (s, 1H), 10.28 (s, 1H), 7.60 – 7.55 (m, 2H), 7.48 (t, *J* = 7.32 Hz, 1H), 7.07 (d, *J* = 8.32 Hz, 1H), 6.93 (t, *J* = 7.60 Hz, 1H), 6.53 (d, *J* = 2.40 Hz, 1H), 6.47 (dd, *J* = 8.96 Hz, *J* = 2.44 Hz, 1H), 3.88 (s, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 200.6, 166.4, 165.8, 161.0, 135.3, 135.2, 132.6, 120.5, 118.9, 118.6, 113.4, 107.7, 101.6, 55.8; LRMS (ESI) calcd for $C_{14}H_{13}O_4$ $[M+H]^+$: 245.08, found 245.11



(14)

Bis(2-hydroxy-4-methylphenyl)methanone **(14)**

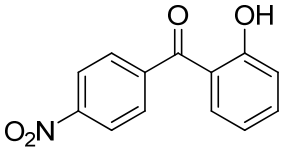
Following the general procedure Ⅰ, 4,4`-dimethylbenzophenone (63 mg, 0.30 mmol), $PhI(OAc)_2$ (300 mg, 0.90 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 80 ^oC for 12h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 5:1). Finally, compound **(14)** (45 mg, yellow solid) was isolated in 62% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 10.75 (s, 2H), 7.49 (d, *J* = 8.12 Hz, 2H), 6.87 (s, 2H), 6.73 (d, *J* = 8.12 Hz, 2H), 2.37 (s, 6H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 201.6, 162.1, 147.5, 133.0, 120.2, 118.8, 117.7, 22.0; LRMS (ESI) calcd for $C_{15}H_{15}O_3$ $[M+H]^+$: 243.09, found 242.93



(15)

(2-Hydroxy-4,5-dimethylphenyl)(2-hydroxyphenyl)methanone **(15)**

Following the general procedure Ⅰ, 3,4-dimethylbenzophenone (42 mg, 0.20 mmol), $PhI(OAc)_2$ (129 mg, 0.40 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 80 °C for 3h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 5:1). Finally, compound **(15)** (30 mg, yellow solid) was isolated in 61% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 10.62 (s, 1H), 10.54 (s, 1H), 7.62 (d, *J* = 7.92 Hz, 1H), 7.50 (t, *J* = 7.68 Hz, 1H), 7.36 (s, 1H), 7.08 (d, *J* = 8.28 Hz, 1H), 6.94 (t, *J* = 7.56 Hz, 1H), 6.89 (s, 1H), 2.31 (s, 3H), 2.21 (s, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 202.0, 161.6, 160.5, 146.8, 135.6, 133.4, 133.0, 127.4, 120.3, 119.4, 118.9, 118.6, 117.7, 20.6, 19.1; HRMS (ESI) calcd for $C_{15}H_{15}O_3$ $[M+H]^+$: 243.1016, found 243.1019



(16)

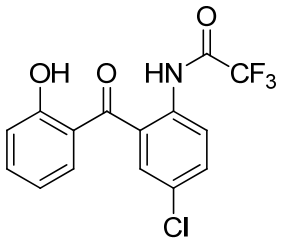
(2-Hydroxyphenyl)(4-nitrophenyl)methanone **(16)**

1) $[Ru(p\text{-cymene})Cl_2]_2$

Following the general procedure Ⅰ, 4-nitrobenzophenone (68 mg, 0.30 mmol), $PhI(OAc)_2$ (200 mg, 0.60 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 80 °C for 14h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 1:1). Finally, compound **(16)** (61 mg, pale yellow solid) was isolated in 77% yield.

2) $Rh_2(OAc)_4$

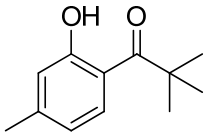
0.1mmol of 2-fluorobenzophenone , 5% $Rh_2(OAc)_4$, 1.2eq. of Selectfluor, 1.8ml TFA and 0.2ml TFAA were used.The reaction mixture were stirred at 80 °C for 10h. The conversion ratio for compound **(16)** was 55% .^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.77 (s, 1H), 8.37 (d, *J* = 8.68 Hz, 2H), 7.83 (d, *J* = 8.68 Hz, 2H), 7.57 (td, *J* = 7.80 Hz, *J* = 1.48 Hz, 1H), 7.45 (dd, *J* = 8.00 Hz, *J* = 1.44 Hz, 1H), 7.11 (d, *J* = 8.36 Hz, 1H), 6.91 (td, *J* = 7.60 Hz, *J* = 0.68 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 199.7, 163.6, 149.7, 143.4, 137.5, 133.2, 130.0, 123.8, 119.3, 119.0, 118.7; LRMS (ESI) calcd for $C_{13}H_{10}NO_4$ $[M+H]^+$: 244.06, found 243.95



(17)

N-(4-chloro-2-(2-hydroxybenzoyl)phenyl)-2,2,2-trifluoroacetamide **(17)**

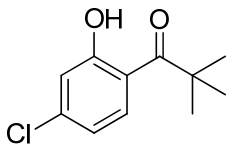
Following the general procedure Ⅰ, 2-amino-5-chlorobenzophenone (46 mg, 0.20 mmol), $K_2S_2O_8$ (108 mg, 0.40 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (4 mg, 0.007 mmol), 1.0ml TFA and 1.0 ml TFAA were used. The reaction mixture was stirred at 80 ^oC for 16-23h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1 or Petroleum ether: Ethylacetate = 10:1). Finally, compound **(17)** (56 mg, yellow solid) was isolated in 81% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 11.15 (s, 1H), 10.41 (br s, 1H), 8.41 (d, *J* = 8.8 Hz, 1H), 7.62-7.57 (m, 3H), 7.50 (d, *J* = 8.0 Hz, 1H), 7.11 (d, *J* = 8.4 Hz, 1H), 6.96 (t, *J* = 7.6 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 200.3, 163.7, 155.3 (q, *J* = 38 Hz), 137.9, 134.4, 133.5, 133.4, 132.0, 130.4, 127.4, 124.2, 119.5, 119.2, 115.7 (q, *J* = 286 Hz); HRMS (ESI) calcd for $C_{15}H_8ClF_3NO_3$ $[M+H]^+$: 344.0296, found 342.0296.



(18)

1-(2-Hydroxy-4-methylphenyl)-2,2-dimethylpropan-1-one **(18)**

Following the general procedure Ⅰ, 2,2-dimethyl-1-p-tolylpropan-1-one (54 mg, 0.10 mmol), $PhI(OAc)_2$ (200 mg, 0.60 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 60 ^oC for 4h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(18)(** 35 mg, yellow oil) was isolated in 60% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.78 (s, 1H), 7.90 (d, *J* = 8.28 Hz, 1H), 6.82 (s, 1H), 6.66 (d, *J* = 8.20 Hz, 1H), 2.33 (s, 3H), 1.44 (s, 9H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 211.7, 164.0, 146.9, 130.9, 119.4, 119.2, 115.3, 44.6, 28.9, 21.9; LRMS (ESI) calcd for $C_{12}H_{17}O_2$ $[M+H]^+$: 193.12, found 193.02



(19)

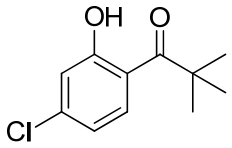
1-(4-Chloro-2-hydroxyphenyl)-2,2-dimethylpropan-1-one **(19)**

1)[Ru(*p*-cymene)Cl_2]$_2$

Following the general procedure Ⅰ, 1-(4-chlorophenyl)-2,2-dimethylpropan-1-one (40 mg, 0.20 mmol), PhI(OAc)$_2$ (133 mg, 0.40 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 50 ^{o}C for 4h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(19)** (22 mg, pale yellow solid) was isolated in 51% yield.

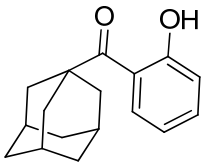
2) $Rh_2(OAc)_4$

0.1mmol of 1-(4-chlorophenyl)-2,2-dimethylpropan-1-one ,5% $Rh_2(OAc)_4$, 2.0eq. of Selectfluor, 1.8ml TFA and 0.2ml TFAA were used.The reaction mixture were stirred at 110 ^{o}C for 10h. The conversion ratio for compound **(19)** was 24%.



(19)

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.86 (s, 1H), 7.94 (d, *J* = 8.80 Hz, 1H), 7.02 (d, *J* = 2.08 Hz, 1H), 6.82 (dd, *J* = 8.80 Hz, *J* = 2.04 Hz, 1H), 1.44 (s, 9H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 211.6, 164.7, 141.1, 132.0, 119.4, 118.6, 116.1, 44.8, 28.8; LRMS (ESI) calcd for $C_{11}H_{14}ClO_2$ $[M+H]^+$: 213.07, found 213.03

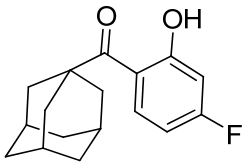


(20)

Adamantan-1-yl-(2-hydroxy-phenyl)-methanone **(20)**

Following the general procedure Ⅰ, adamantan-1-yl-phenyl-methanone (48 mg, 0.20 mmol), PhI(OAc)$_2$ (133 mg, 0.40 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 50 ^{o}C for 4h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(20)** (34 mg, pale yellow solid) was isolated in 67% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.76 (s, 1H), 8.21 (dd, *J* = 8.24 Hz, *J* = 1.16 Hz, 1H), 7.40 (td, *J* = 7.78 Hz, *J* = 1.24 Hz, 1H), 7.00 (d, *J* = 8.28 Hz, 1H), 6.84 (t, *J* = 7.96 Hz, 1H), 2.17 – 2.13 (m, 9H), 1.81 (s, 6H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 211.7, 163.6, 135.3, 130.7, 119.5, 118.2, 117.7, 48.0, 39.9, 36.8, 28.5; LRMS (ESI) calcd for $C_{17}H_{21}O_2$ $[M+H]^+$: 257.15,

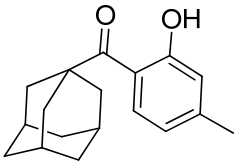
found 257.12



(21)

Adamantan-1-yl-(4-fluorophenyl-2-hydroxy-phenyl)-methanone **(21)**

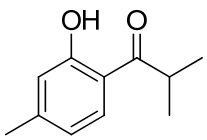
Following the general procedure Ⅰ, adamantan-1-yl-(4-fluorophenyl)-methanone (77 mg, 0.30 mmol), $PhI(OAc)_2$ (133 mg, 0.40 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 0.8ml TFA and 1.2ml TFAA were used. The reaction mixture was stirred at 50 °C for 6h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1 or Petroleum ether: Ethylacetate = 100:1). Finally, compound **(21)** (32 mg, pale yellow solid) was isolated in 59% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 13.19 (s, 1H), 8.23 (dd, J = 9.16 Hz, J = 2.56 Hz, 1H), 6.66 (dd, J = 10.40 Hz, J = 2.60 Hz, 1H), 6.55 (td, J = 8.50 Hz, J = 2.60 Hz, 1H), 2.14 (s, 9H), 1.80 (m, 6H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 210.5, 166.4 (d, J = 254 Hz, 1C), 166.6 (d, J = 14 Hz, 1C), 133.0 (d, J = 11 Hz, 1C), 115.1 (d, J = 2.4 Hz, 1C), 105.9 (d, J = 22 Hz, 1C), 105.71 (d, J = 15 Hz, 1C), 47.9, 39.9, 36.7, 28.4; LRMS (ESI) calcd for $C_{17}H_{20}FO_2$ $[M+H]^+$: 275.14, found 275.08



(22)

Adamantan-1-yl-(4-methyl-2-hydroxy-phenyl)-methanone **(22)**

Following the general procedure Ⅰ, adamantan-1-yl-(4-methyl-phenyl)-methanone (51 mg, 0.20 mmol), $PhI(OAc)_2$ (133 mg, 0.40 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 50 °C for 5.5h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(22)** (31 mg, white solid) was isolated in 56% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.88 (s, 1H), 8.09 (d, J = 8.40 Hz, 1H), 6.81 (s, 1H), 6.65 (d, J = 8.36 Hz, 1H), 2.33 (s, 3H), 2.16 – 2.13 (m, 9H), 1.81 (s, 6H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 211.1, 164.0, 146.7, 130.5, 119.5, 119.0, 115.8, 47.9, 39.9, 36.8, 28.5, 21.9; LRMS (ESI) calcd for $C_{18}H_{23}O_2$ $[M+H]^+$: 271.17, found 271.10

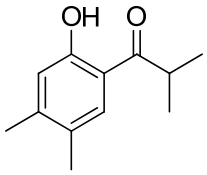


(23)

1-(2-Hydroxy-4-methylphenyl)-2-methylpropan-1-one **(23)**

Following the general procedure Ⅰ, 2-methyl-1-p-tolylpropan-1-one (33 mg, 0.20

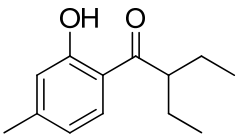
mmol), $PhI(OAc)_2$ (133 mg, 0.40 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 50 °C for 5.5h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(23)** (15 mg, colourless oil) was isolated in 40% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.55 (s, 1H), 7.66 (d, J = 8.20 Hz, 1H), 6.80 (s, 1H), 6.71 (d, J = 8.20 Hz, 1H), 3.62 – 3.52 (m, 1H), 2.35 (s, 3H), 1.23 (d, J = 6.84 Hz, 6H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 210.3, 163.4, 147.9, 129.9, 120.2, 118.9, 116.1, 34.9, 22.0, 19.5; LRMS (ESI) calcd for $C_{11}H_{15}O_2$ $[M+H]^+$: 179.11, found 179.09

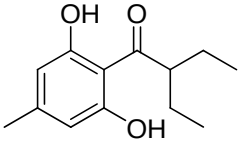


(24)

1-(2-Hydroxy-4,5-dimethylphenyl)-2-methylpropan-1-one **(24)**

Following the general procedure Ⅰ, 1-(3,4-dimethylphenyl)-2-methylpropan-1-one (35 mg, 0.20 mmol), $PhI(OAc)_2$ (133 mg, 0.40 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 50 °C for 5.5h.. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(24)** (20 mg, colourless oil) was isolated in 52% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.37 (s, 1H), 7.50 (s, 1H), 6.79 (s, 1H), 3.62 – 3.55 (m, 1H), 2.26 (s, 3H), 2.22 (s, 3H), 1.23 (d, J = 6.84 Hz, 6H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 210.3, 161.6, 146.8, 130.1, 127.1, 119.4, 116.2, 34.8, 20.6, 19.5, 19.2; LRMS (ESI) calcd for $C_{12}H_{17}O_2$ $[M+H]^+$: 193.12, found 193.10



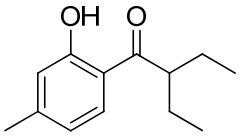


(25a) **(25b)**

2-Ethyl-1-(2-hydroxy-4-methylphenyl)butan-1-one **(25a)**

1-(2,6-Dihydroxy-4-methylphenyl)-2-ethylbutan-1-one **(25b)**

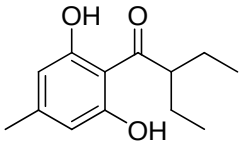
Following the general procedure Ⅰ, 2-ethyl-1-p-tolylbutan-1-one (19 mg, 0.10 mmol), $PhI(OAc)_2$ (65 mg, 0.20 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.5ml TFA and 0.5ml TFAA were used. The reaction mixture was stirred at 50 °C for 12h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1 or Petroleum ether: Ethylacetate = 100:1). Finally, compound **(25a)** (4 mg, colourless oil) and compound **(25b)** (12mg, white solid) were isolated in 13% and 65% yield respectively.



(25a)

2-Ethyl-1-(2-hydroxy-4-methylphenyl)butan-1-one **(25a)**

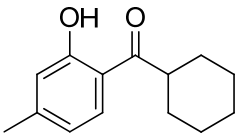
^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.76 (s, 1H), 7.68 (d, *J* = 8.24 Hz, 1H), 6.80 (s, 1H), 6.71 (d, *J* = 8.20 Hz, 1H), 3.30 – 3.20 (m, 1H), 2.35 (s, 3H), 1.83 – 1.76 (m, 2H), 1.62 – 1.55 (m, 2H), 0.88 (t, *J* = 7.44 Hz, 6H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 210.4, 163.3, 148.0, 130.0, 120.2, 118.8, 117.9, 48.5, 25.4, 22.0, 12.0; LRMS (ESI) calcd for $C_{13}H_{19}O_2$ $[M+H]^+$: 207.12, found 207.17



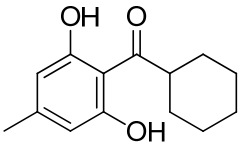
(25b)

1-(2,6-Dihydroxy-4-methylphenyl)-2-ethylbutan-1-one **(25b)**

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 9.59 (br s, 2H), 6.21 (s, 2H), 3.75 (m, 1H), 2.23 (s, 3H), 1.85-1.72 (m, 2H), 1.57-1.43 (m, 2H), 0.89 (t, *J* = 7.20Hz, 6H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 211.4, 161.2, 147.5, 109.5, 108.7, 53.2, 24.7, 21.9, 12.0; HRMS (ESI) calcd for $C_{13}H_{19}O_3$ $[M+H]^+$: 223.1329, found 223.1332



(26a)



(26b)

Cyclohexyl(2-hydroxy-4-methylphenyl)methanone **(26a)**

Cyclohexyl(2,6-dihydroxy-4-methylphenyl)methanone **(26b)**

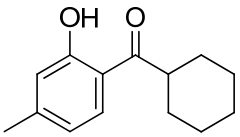
1) small-scale

Following the general procedure Ⅰ, cyclohexyl(2-hydroxy-4-methylphenyl)Methanone (21 mg, 0.10 mmol), $PhI(OAc)_2$ (65 mg, 0.20 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.5ml TFA and 0.5ml TFAA were used.The reaction mixture was stirred at 50 °C for 11h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1 or Petroleum ether: Ethylacetate = 100:1). Finally, compound **(26a)** (3.3 mg, yellow oil) and compound **(26b)** (13 mg, white solid) were isolated in 15% and 56% yield respectively.

2) Two gram-scale

Following the general procedure Ⅰ, cyclohexyl(2-hydroxy-4-methylphenyl)methanone (2 g, 9.9 mmol), $PhI(OAc)_2$ (6.4g , 19.3 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (121 mg, 0.20 mmol), 21ml TFA and 7ml TFAA were used.. The reaction mixture was stirred at 50 °C for 14h. The residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1 or Petroleum ether: Ethylacetate = 100:1). Finally,

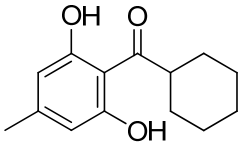
compound **(26a)** (1080 mg, yellow oil) and compound **(26b)** (139 mg, white solid) were isolated in 50% and 6% yield respectively.



(26a)

Cyclohexyl(2-hydroxy-4-methylphenyl)methanone **(26a)**

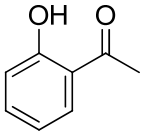
^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.61 (s, 1H), 7.65 (d, *J* = 8.20 Hz, 1H), 6.79 (s, 1H), 6.70 (d, *J* = 8.20 Hz, 1H), 3.29 – 3.23 (m, 1H), 2.34 (s, 3H), 1.88 – 1.34 (m, 10H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 209.6, 163.4, 147.8, 129.8, 129.1, 118.9, 116.2, 45.2, 29.7, 26.0, 25.9, 22.0; LRMS (ESI) calcd for $C_{14}H_{19}O_2$ $[M+H]^+$: 219.14, found 219.09



(26b)

Cyclohexyl(2,6-dihydroxy-4-methylphenyl)methanone **(26b)**

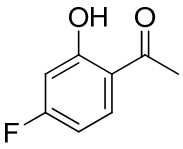
^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 9.41 (br s, 2H), 6.21 (s, 2H), 3.60 (m, 1H), 2.23 (s, 3H), 1.96-1.93 (m, 2H), 1.84-1.81 (m, 2H), 1.73-1.70 (m, 1H), 1.47-1.23 (m, 5H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 210.6, 161.2, 147.3, 109.5, 107.5, 50.3, 29.6, 26.3, 21.9; HRMS (ESI) calcd for $C_{14}H_{19}O_3$ $[M+H]^+$: 235.1329, found 235.1324



(27)

1-(2-Hydroxyphenyl)ethanone **(27)**

Following the general procedure Ⅰ, acetophenone (36 mg, 0.30 mmol), $PhI(OAc)_2$ (200 mg, 0.60 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 50 ^{o}C for 4h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(27)** (13 mg, pale yellow oil) was isolated in 30% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.26 (s, 1H), 7.73 (d, *J* = 8.00 Hz, 1H), 7.47 (t, *J* = 8.08 Hz, 1H), 6.98 (d, *J* = 8.40 Hz, 1H), 6.90 (t, *J* = 7.76 Hz, 1H), 2.63 (s, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 204.7, 162.5, 136.6, 130.9, 119.9, 119.1, 118.6, 26.8; LRMS (ESI) calcd for $C_8H_9O_2$ $[M+H]^+$: 137.06, found 137.00



(28)

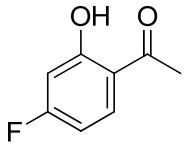
1-(4-Fluoro-2-hydroxyphenyl)ethanone **(28)**

1)[Ru(*p*-cymene)Cl_2]$_2$

Following the general procedure Ⅰ, 4'-Fluoroacetophenone (41 mg, 0.30 mmol), PhI(OAc)$_2$ (200 mg, 0.60 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at rt for 24h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(28)** (12 mg, yellow oil) was isolated in 26% yield.

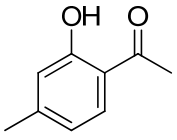
2) $Rh_2(OAc)_4$

0.1mmol of 4'-Fluoroacetophenone ,5% $Rh_2(OAc)_4$, 2.0eq. of Selectfluor, 0.9ml TFA and 0.1ml TFAA were used.The reaction mixture were stirred at 75 ^oC for 11h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(28)** was isolated in 41% yield.



(28)

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.59 (s, 1H), 7.47 (dd, *J* = 6.60 Hz, *J* = 8.72 Hz, 1H), 6.68 – 6.60 (m, 2H), 2.61 (s, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 203.4, 167.6 (d, *J* = 255 Hz, 1C), 165.1 (d, *J* = 14 Hz, 1C), 133.2 (d, *J* = 12 Hz, 1C), 117.03 (d, *J* = 2.2 Hz, 1C), 107.03 (d, *J* = 23 Hz, 1C), 105.11 (d, *J* = 22 Hz, 1C), 26.75; LRMS (ESI) calcd for $C_8H_8FO_2$ $[M+H]^+$: 155.05, found 155.08

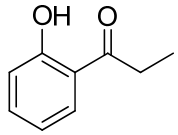


(29)

1-(2-Hydroxy-4-methylphenyl)ethanone **(29)**

Following the general procedure Ⅰ, 4'-methylacetophenone (41 mg, 0.30 mmol), PhI(OAc)$_2$ (200 mg, 0.60 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 50 ^oC for 4h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(29)** (25 mg, pale yellow oil) was isolated in 54% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm)

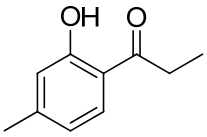
12.28 (s, 1H), 7.61 (d, *J* = 8.16 Hz, 1H), 6.78 (s, 1H), 6.71 (d, *J* = 8.16 Hz, 1H), 2.60 (s, 3H), 2.35 (s, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 204.0, 162.6, 148.2, 130.7, 120.3, 118.5, 117.7, 26.6, 22.1; LRMS (ESI) calcd for $C_9H_{11}O_2$ $[M+H]^+$: 151.08, found 151.07



(30)

1-(2-Hydroxyphenyl)propan-1-one **(30)**

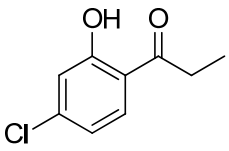
Following the general procedure Ⅰ, propiophenone (27 mg, 0.20 mmol), Selectfluor (106 mg, 0.30 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (3.1 mg, 0.005 mmol), 1.5ml TFA and 0.5ml TFAA were used. The reaction mixture was stirred at 50 ^{o}C for 6h and then at 60 ^{o}C for 5h . After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(30)** (16 mg, colourless oil) was isolated in 54% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.35 (s, 1H), 7.77 (dd, *J* = 1.12 Hz, *J* = 8.00 Hz, 1H), 7.46 (td, *J* = 1.32 Hz, *J* = 7.78 Hz, 1H), 6.98 (d, *J* = 8.40 Hz, 1H), 6.89 (t, *J* = 7.96 Hz, 1H), 3.04 (q, *J* = 7.28 Hz, 2H), 1.25 (t, *J* = 7.28 Hz, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 207.2, 162.5, 136.3, 130.0, 119.4, 119.0, 118.7, 31.7, 8.4; LRMS (ESI) calcd for $C_9H_9O_2$ $[M-H]^-$: 149.07, found 149.08



(31)

1-(2-Hydroxy-4-methylphenyl)propan-1-one **(31)**

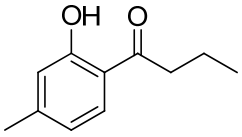
Following the general procedure Ⅰ, 4'-methylpropiophenone (45 mg, 0.30 mmol), PhI(OAc)$_2$ (200 mg, 0.60 mmol), [Ru(*p*-cymene)Cl_2]$_2$ (4.5 mg, 0.0074 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 35 ^{o}C for 12h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(31)** (25 mg, colourless oil) was isolated in 50% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.37 (s, 1H), 7.64 (d, *J* = 8.16 Hz, 1H), 6.79 (s, 1H), 6.70 (d, *J* = 8.12 Hz, 1H), 3.10 – 2.90 (m, 2H), 2.34 (s, 3H), 1.21 (t, *J* = 7.20 Hz, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 206.7, 162.7, 147.8, 129.9, 120.3, 118.7, 117.2, 31.5, 22.1, 8.5; LRMS (ESI) calcd for $C_{10}H_{13}O_2$ $[M+H]^+$: 165.08, found 164.92



(32)

1-(4-chloro-2-hydroxyphenyl)propan-1-one **(32)**

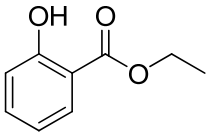
Following the general procedure Ⅰ, 4'-chloropropiophenone (34 mg, 0.20 mmol), $PhI(OAc)_2$ (133 mg, 0.40 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol), 1.4ml TFA and 0.6ml TFAA were used. The reaction mixture was stirred at 50 ^oC for 5.5h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(32)** (20 mg, colourless oil) was isolated in 55% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.47 (s, 1H), 7.67 (d, *J* = 8.60 Hz, 1H), 6.99 (d, *J* = 2.04 Hz, 1H), 6.86 (dd, *J* = 8.56 Hz, *J* = 2.00 Hz, 1H), 2.99 (q, *J* = 7.28 Hz, 2H), 1.24 (t, *J* = 7.28 Hz, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 206.5, 163.2, 142.0, 130.9, 119.7, 118.7, 117.9, 31.8, 8.3; LRMS (ESI) calcd for $C_9H_8ClO_2$ $[M-H]^-$: 183.03, found 182.89



(33)

1-(2-Hydroxy-4-methylphenyl)butan-1-one **(33)**

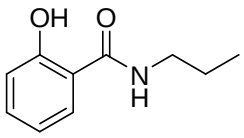
Following the general procedure Ⅰ, 4'-methylbutyrophenone (33 mg, 0.20 mmol), $PhI(OAc)_2$ (133 mg, 0.40 mmol), $[Ru(p\text{-cymene})Cl_2]_2$ (3.1 mg, 0.005 mmol),, 1.5ml TFA and 0.5ml TFAA were used. The reaction mixture was stirred at rt for 21h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 3:1). Finally, compound **(33)** (16 mg, colourless oil) was isolated in 45% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 12.43 (s, 1H), 7.64 (d, *J* = 8.16 Hz, 1H), 6.79 (s, 1H), 6.70 (d, *J* = 8.16 Hz, 1H), 2.93 (t, *J* = 7.32 Hz, 2H), 2.34 (s, 3H), 1.82 – 1.73 (m, 2H), 1.06 (t, *J* = 7.40 Hz, 3H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 206.4, 162.8, 147.9, 130.0, 120.2, 118.7, 117.4, 40.2, 22.0, 18.2, 14.0; LRMS (ESI) calcd for $C_{11}H_{15}O_2$ $[M+H]^+$: 179.11, found 179.17



Ethyl 2-hydroxybenzoate **(34)**

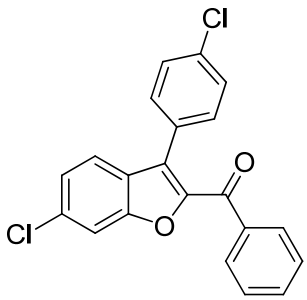
Following the general procedure Ⅰ, ethyl benzoate (15 mg, 0.10 mmol), $K_2S_2O_8$ (30mg, 0.11 mmol), $Rh_2(OAc)_4$ (2 mg, 0.005 mmol), 0.9 ml TFA and 0.1 ml TFAA were used. The reaction mixture was stirred at 90 ^oC for 9h. After completion of the reaction, the residue was purified by silical gel column chromatography (Petroleum ether: Toluene = 5:1). Finally, compound **(34)** (10.4 mg, colourless oil) was isolated

in 59% yield. ^{1}H-NMR (400 MHz, CDCl3) δ(ppm) 10.84 (s, 1H), 7.85 (dd, *J* = 1.68 Hz, J = 8.00 Hz, 1H), 7.42 - 7.47 (m, 1H), 6.98 (dd, *J* = 0.72 Hz, *J* = 8.40 Hz, 1H), 6.85 – 6.89 (m, 1H), 4.41 (q, *J* =7.16, 2H), 1.42 (t, *J* = 7.16 Hz, 3H); ^{13}C-NMR (100 MHz, CDCl3) δ (ppm) 170.3, 161.8, 135.7, 130.0, 119.2, 117.7, 112.8, 61.5, 14.32; LRMS (ESI) calcd for $C_9H_{11}O_3$ $[M+H]^+$: 167.06, found 166.71



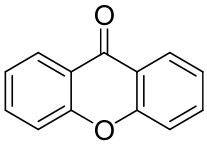
2-Hydroxy-N-propylbenzamide **(35)**

Following the general procedure Ⅰ, N-propylbenzamide (17 mg, 0.10 mmol), Selectfluor (56mg, 0.22 mmol), $Rh_2(OAc)_4$ (2 mg, 0.005 mmol), 0.9 ml TFA and 0.1 ml TFAA were used. The reaction mixture was stirred at 60 °C for 5.5h. ^{1}H-NMR shows the conversion ratio is 31%. ^{1}H-NMR (400 MHz, CDCl3) δ(ppm) 12.41 (s, 1H), 7.40 – 7.34 (m, 2H), 6.98 (d, *J* = 8.32 Hz, 1H), 6.83 (t, *J* = 7.56 Hz, 1H), 6.39 (s, 1H), 3.44 – 3.39 (m, 2H), 1.66 – 1.64 (m, 2H), 0.99 (t, *J* = 7.40 Hz, 1H); ^{13}C-NMR (100 MHz, CDCl3) δ (ppm) 170.1, 161.7, 134.2, 125.3, 118.8, 118.7, 114.5, 41.5, 22.9, 11.5; LRMS (ESI) calcd for $C_{10}H_{14}NO_2$ $[M+H]^+$: 180.09, found 179.98



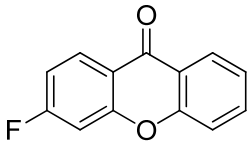
(6-Chloro-3-(4-chlorophenyl)benzofuran-2-yl)(phenyl)methanone **(36)**

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 7.89 (d, *J* = 7.88 Hz, 2H), 7.65 (s, 1H), 7.58 – 7.53 (m, 2H), 7.45 – 7.34 (m, 7H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 185.2, 154.6, 147.9, 137.0, 134.9, 134.5, 133.2, 131.3, 130.0, 129.0, 128.9, 128.4, 128.0, 126.7, 125.3, 122.9, 113.0; LRMS (ESI) calcd for $C_{21}H_{13}{}^{35}Cl_2O_2$ $[M+H]^+$: 367.0287, found 367.0288



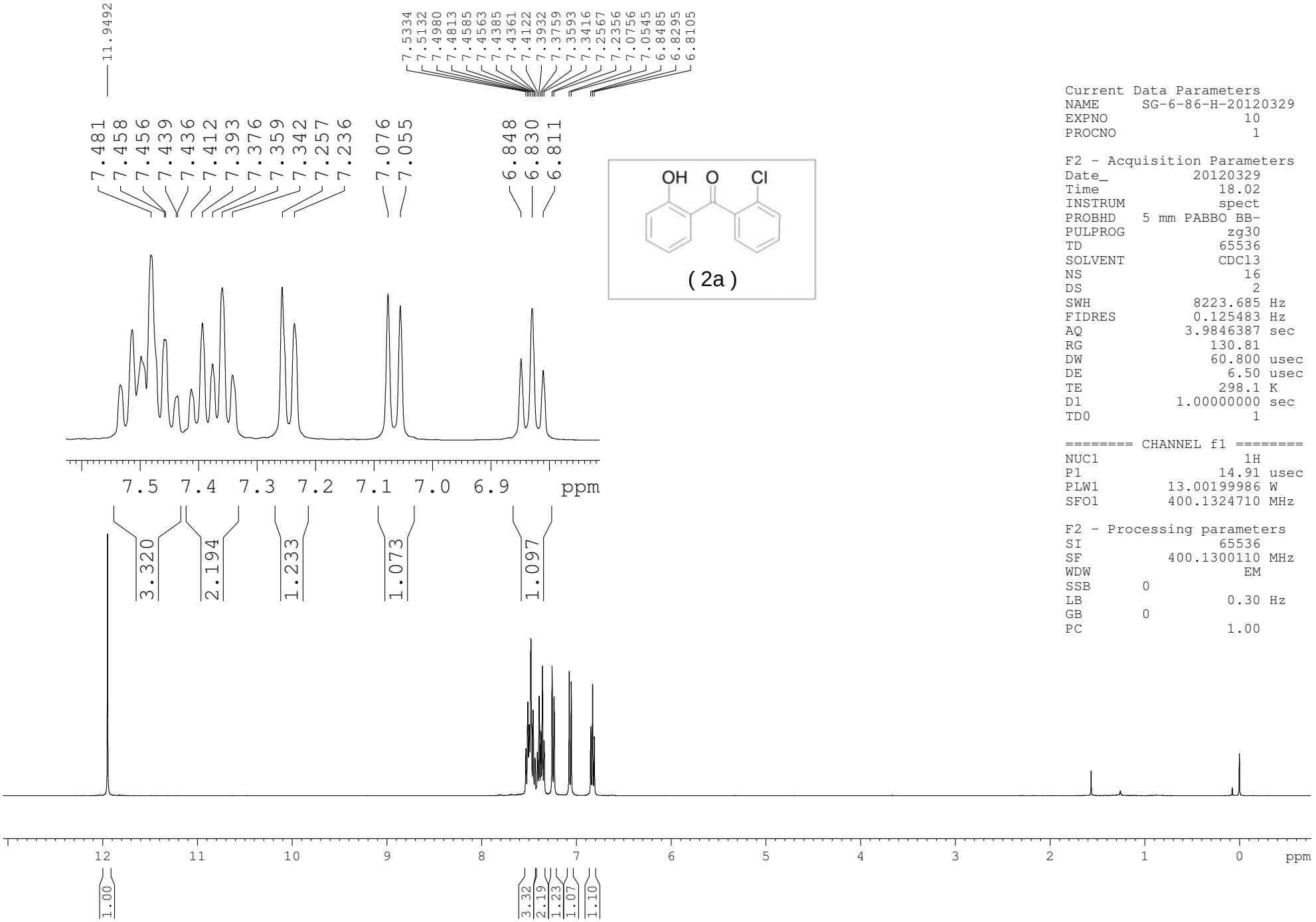
Xanthone **(38)**

^{1}H-NMR (400 MHz, CDCl3) δ (ppm) 8.35 (d, *J* = 7.88 Hz, 2H), 7.73 (t, *J* = 7.88 Hz, 2H), 7.50 (dd, *J* = 2.16 Hz, *J* = 8.36 Hz, 2H), 7.38 (d, *J* = 7.88 Hz, 2H); ^{13}C-NMR (100 MHz, CDCl3) δ (ppm) 177.4, 156.3, 135.0, 126.9, 124.1, 122.0, 118.1; LRMS (ESI) calcd for $C_{13}H_9O_2$ $[M+H]^+$: 197.06, found 197.09



3-Fluoro-9*H*-xanthen-9-one **(39)**

^{1}H-NMR (400 MHz, $CDCl_3$) δ (ppm) 8.38 – 8.33 (m, 2H), 7.73 (t, *J* = 7.44 Hz, 1H), 7.49 (d, *J* = 8.44 Hz, 1H), 7.40 (t, *J* = 7.52 Hz, 1H), 7.17(dd, *J* = 9.32 Hz, *J* = 1.80 Hz, 1H), 7.11 (td, *J* = 8.46 Hz, *J* = 1.96 Hz, 1H); ^{13}C-NMR (100 MHz, $CDCl_3$) δ (ppm) 176.3, 166.7 (d, *J* = 254 Hz, 1C), 157.5 (d, *J* = 13 Hz, 1C), 156.4, 135.04, 129.5 (d, *J* = 11 Hz, 1C), 126.9, 124.5, 121.9, 118.9, 118.0, 112.9 (d, *J* = 22 Hz, 1C), 104. 7 (d, *J* = 25 Hz, 1C); LRMS (ESI) calcd for $C_{13}H_8FO_2$ $[M+H]^+$: 215.04, found 214.91

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FIDRES          0.125483 Hz
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TE                298.1 K
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PLW1         13.00199986 W
SFO1         400.1324710 MHz

F2 - Processing parameters
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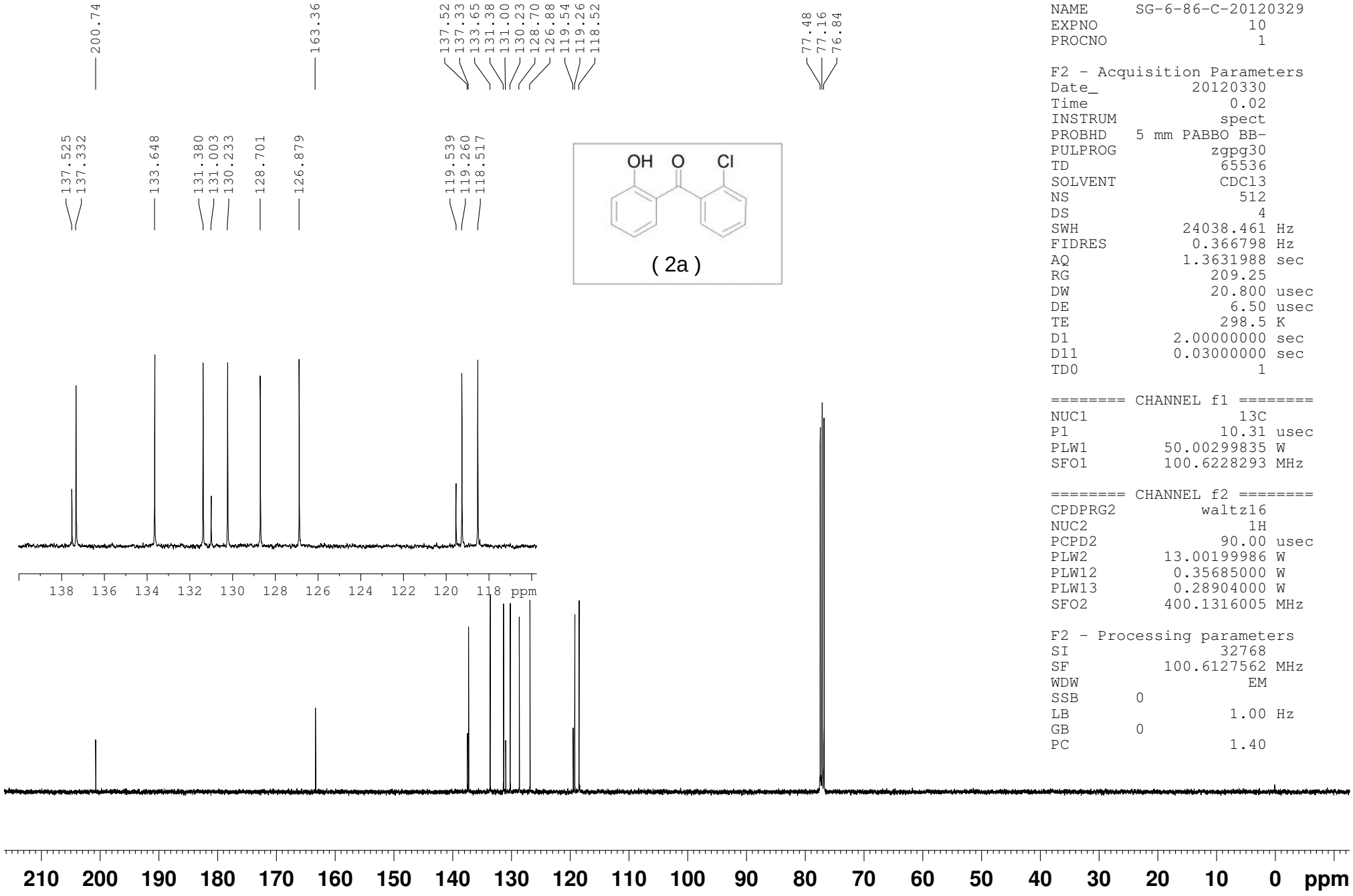


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PROCNO                    1

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TD                    65536
SOLVENT               CDCl3
NS                      512
DS                        4
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FIDRES            0.366798 Hz
AQ               1.3631988 sec
RG                   209.25
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TE                   298.5 K
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SFO1         100.6228293 MHz

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CPDPRG2            waltz16
NUC2                    1H
PCPD2                90.00 usec
PLW2          13.00199986 W
PLW12          0.35685000 W
PLW13          0.28904000 W
SFO2         400.1316005 MHz

F2 - Processing parameters
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WDW                      EM
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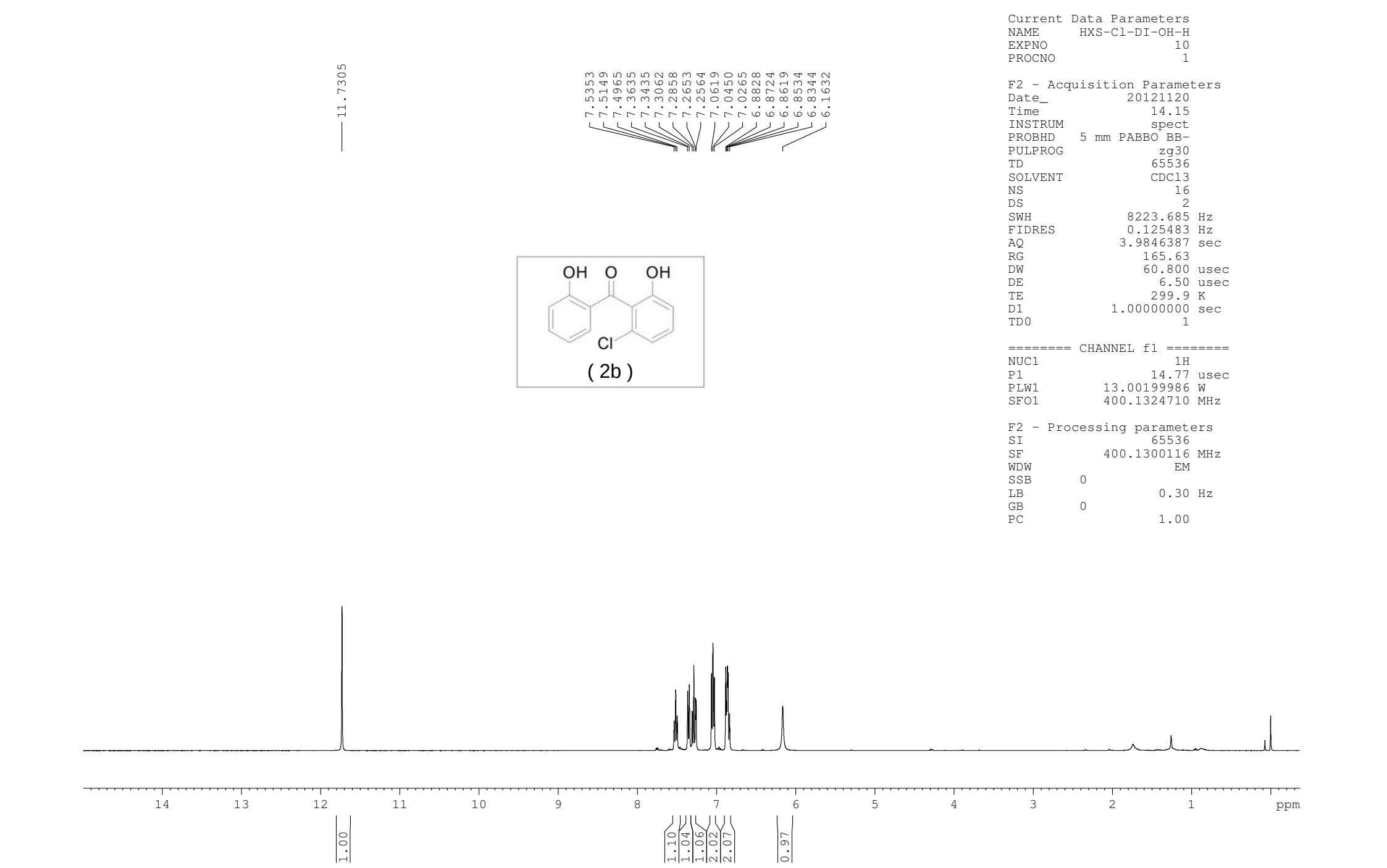

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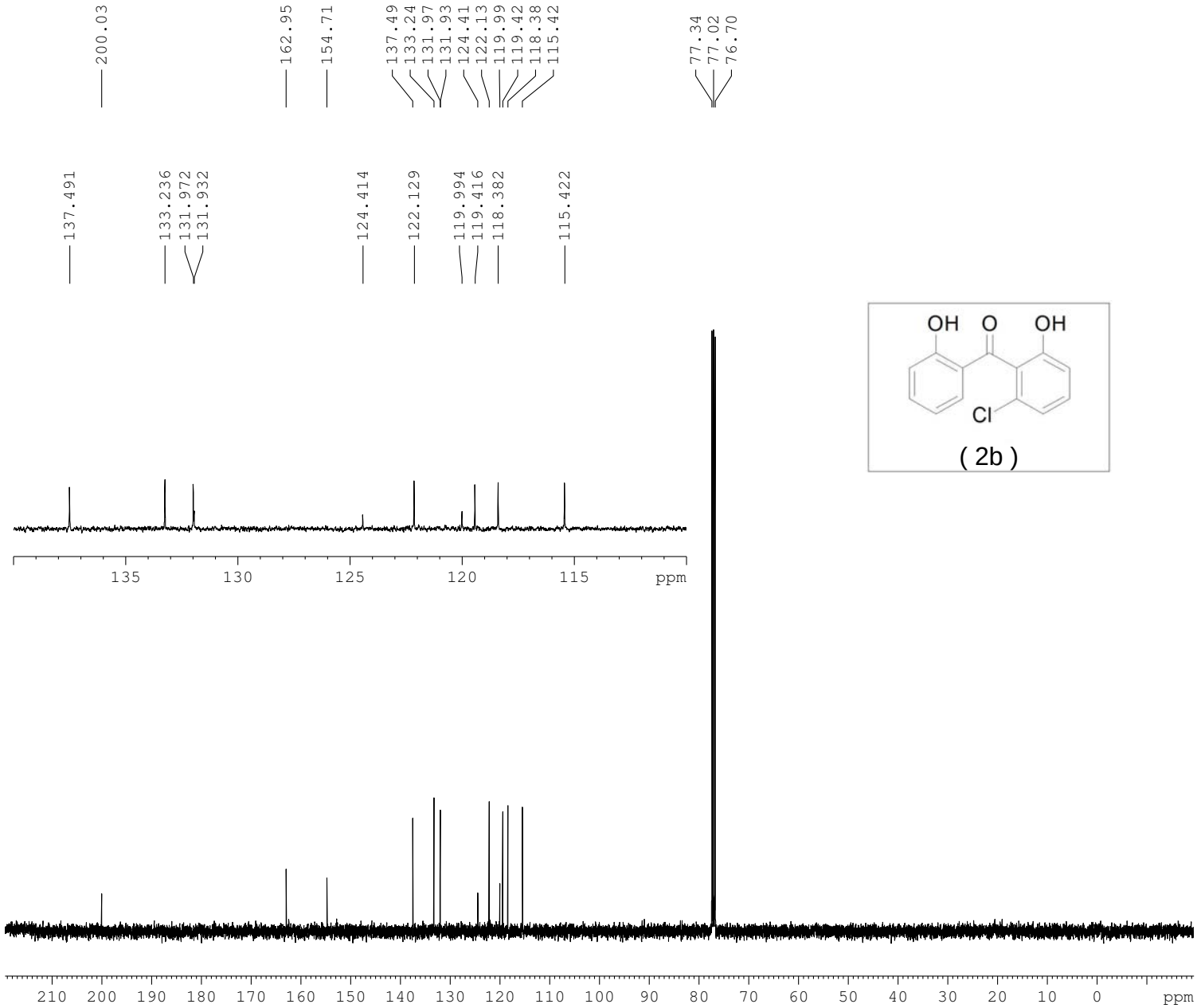

(2b)

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TD                65536
SOLVENT           CDCl3
NS                   86
DS                    4
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FIDRES         0.366798 Hz
AQ             1.3631988 sec
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TE                299.9 K
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D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
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P1                10.30 usec
PLW1        50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.35018000 W
PLW13        0.28364000 W
SFO2        400.1316005 MHz

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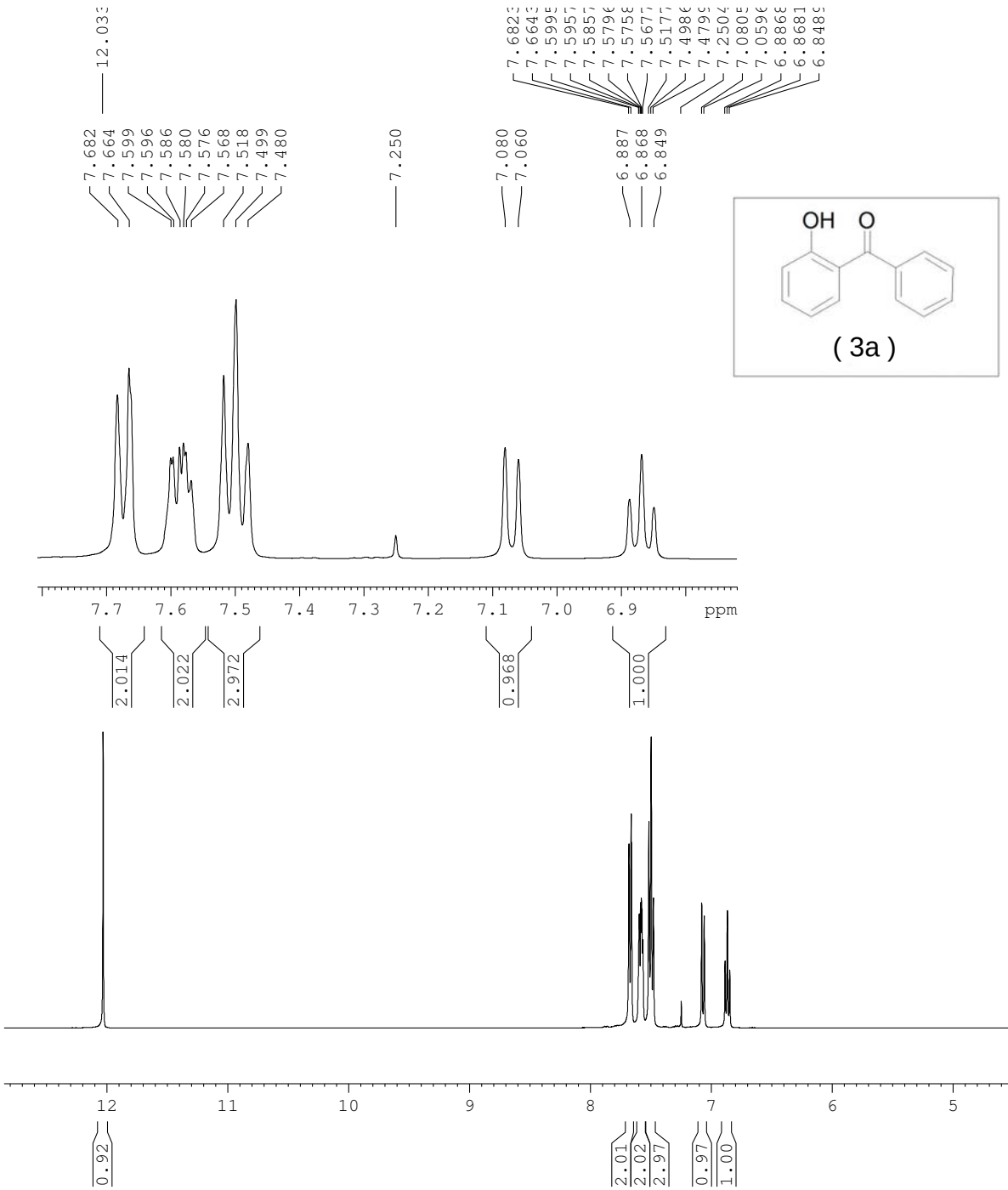


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PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
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FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                    70.24
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DE                    6.50 usec
TE                   298.1 K
D1              1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
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P1                     14.91 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
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SF             400.1300136 MHz
WDW                      EM
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LB                     0.30 Hz
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PC                     1.00
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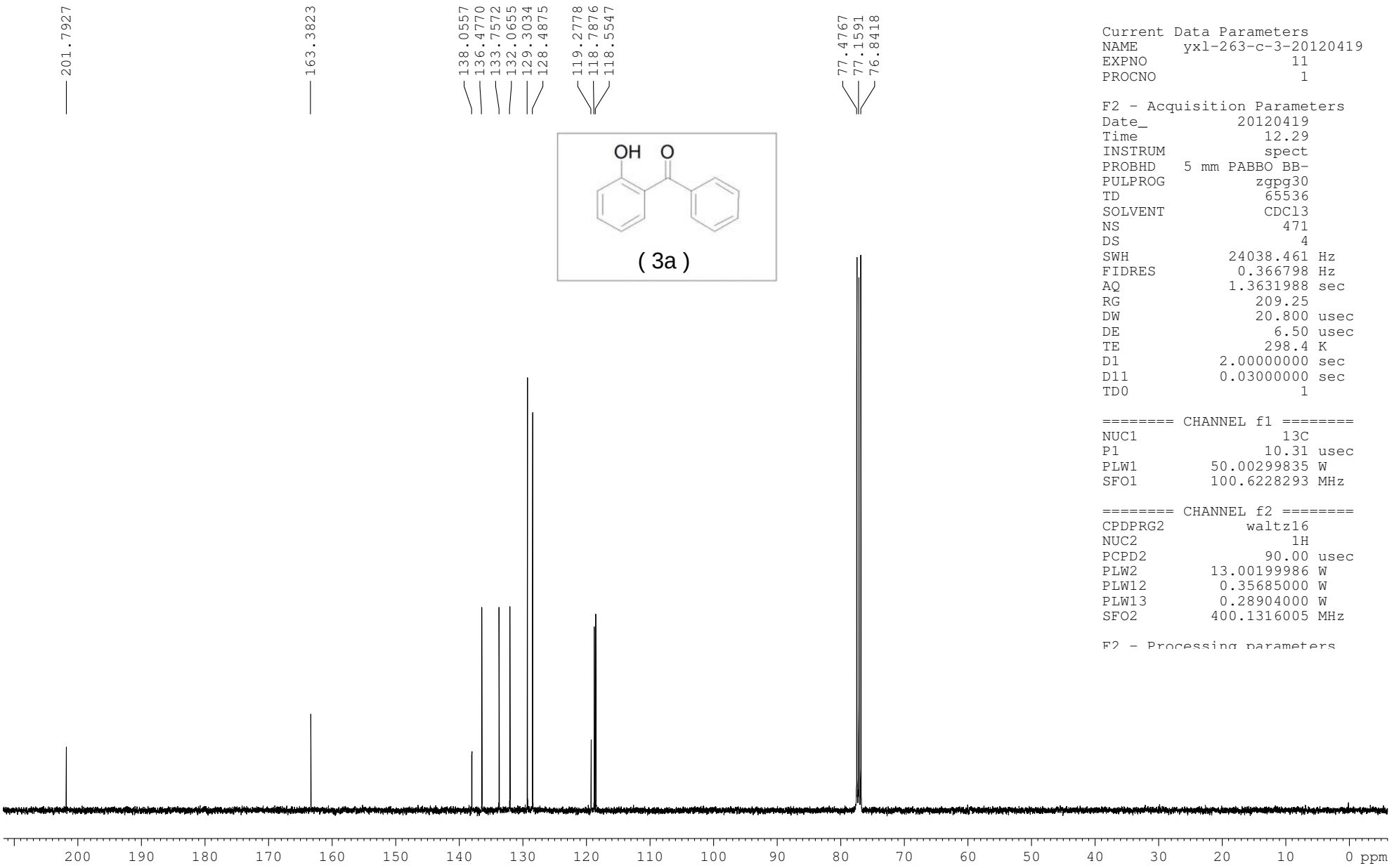


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TD                    65536
SOLVENT               CDCl3
NS                      471
DS                        4
SWH              24038.461 Hz
FIDRES            0.366798 Hz
AQ               1.3631988 sec
RG                  209.25
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DE                   6.50 usec
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D11            0.03000000 sec
TD0                       1

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NUC1                    13C
P1                   10.31 usec
PLW1          50.00299835 W
SFO1         100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2            waltz16
NUC2                    1H
PCPD2                90.00 usec
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PLW12          0.35685000 W
PLW13          0.28904000 W
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F2 - Processing parameters
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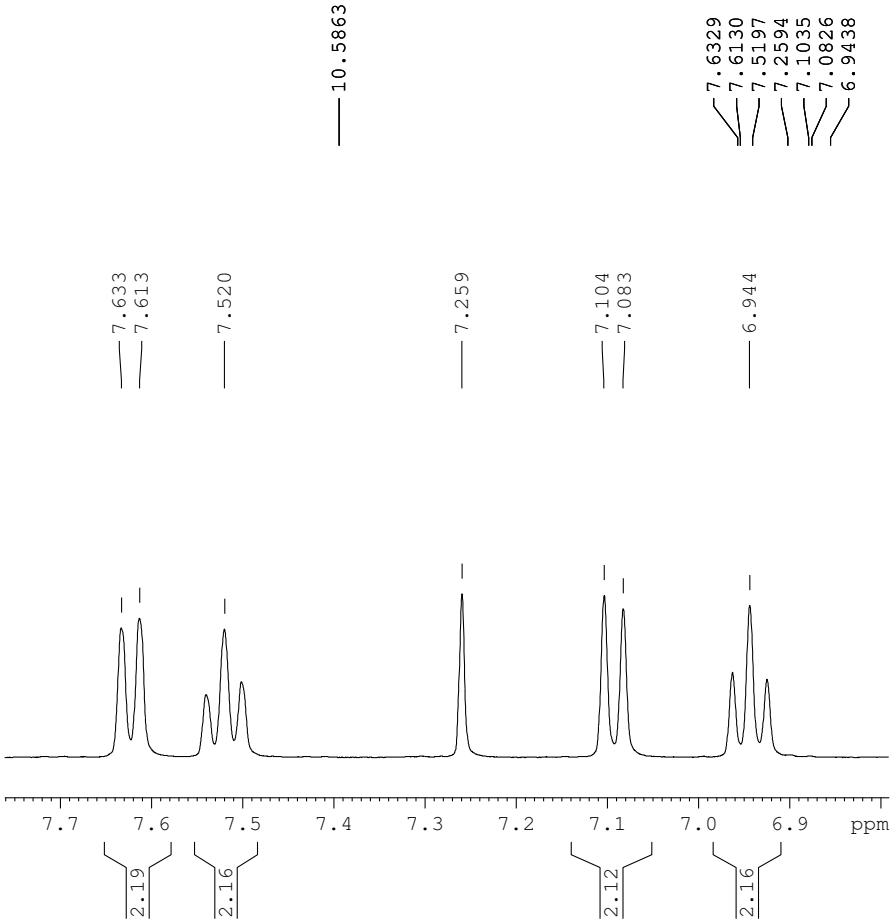

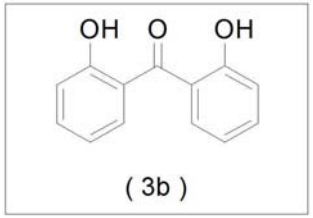


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PROCNO                 1

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PULPROG             zg30
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SOLVENT            CDCl3
NS                    16
DS                     2
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FIDRES          0.125483 Hz
AQ              3.9846387 sec
RG                209.25
DW                60.800 usec
DE                 6.50 usec
TE                299.9 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                 14.77 usec
PLW1         13.00199986 W
SFO1         400.1324710 MHz

F2 - Processing parameters
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SF           400.1300105 MHz
WDW                   EM
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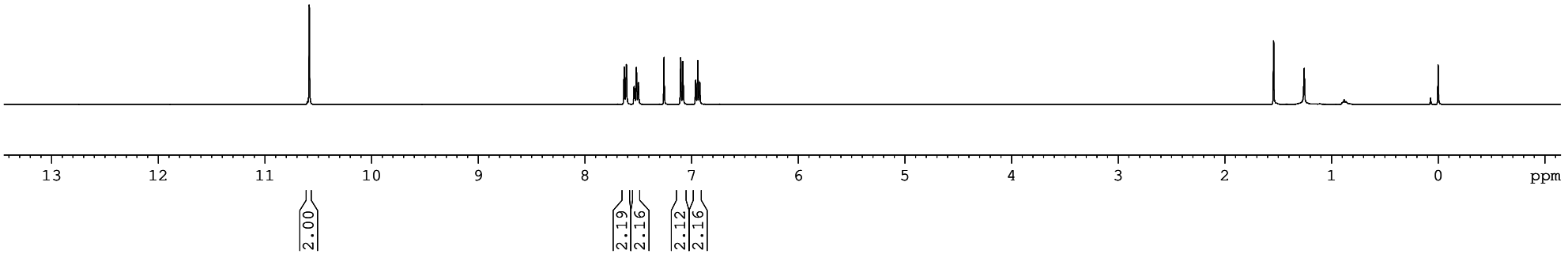

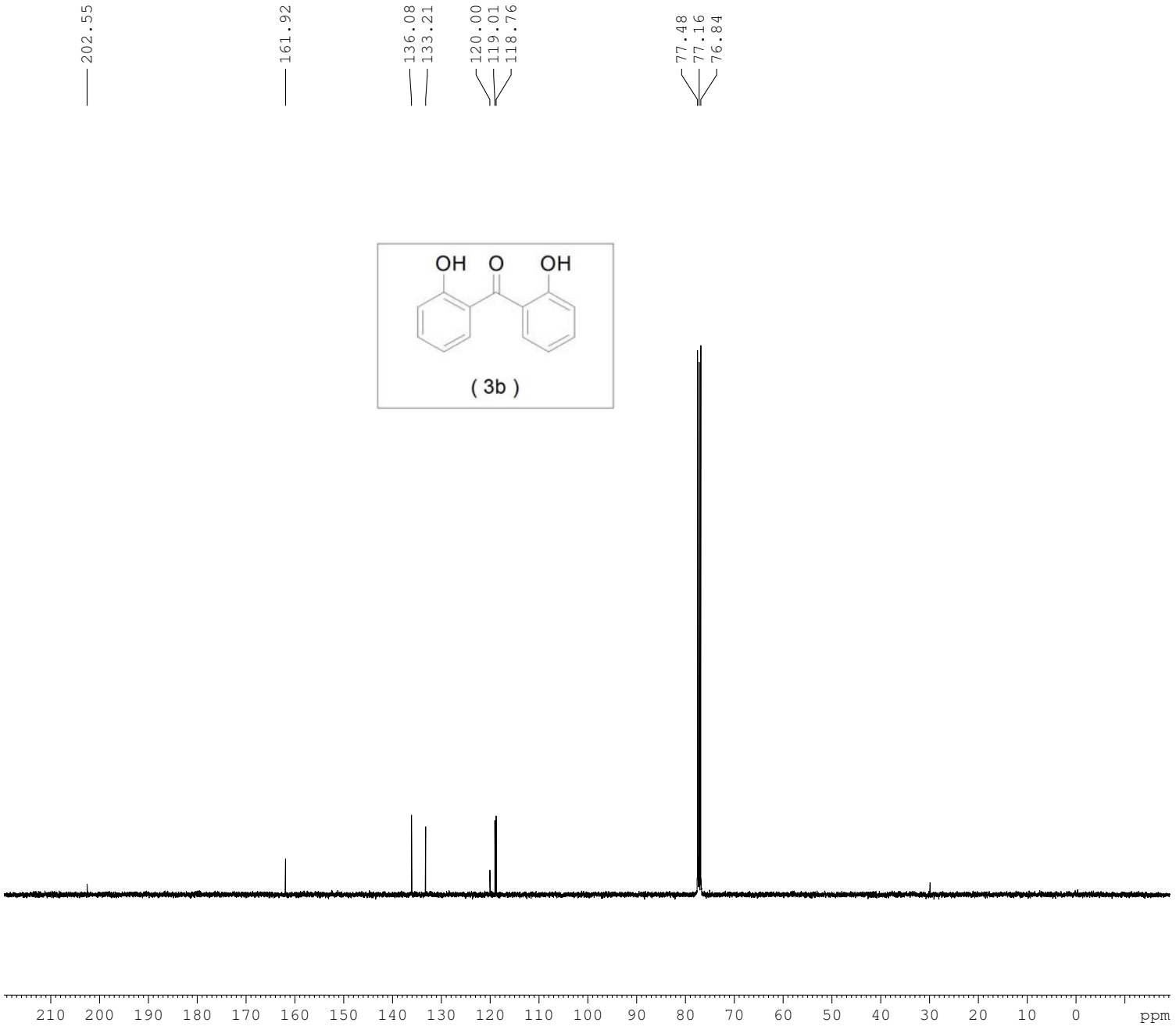


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PROCNO                 1

F2 - Acquisition Parameters
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TD                65536
SOLVENT           CDCl3
NS                  488
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ            1.3631988 sec
RG               165.63
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DE                6.50 usec
TE               299.9 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.30 usec
PLW1        50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
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NUC2                 1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.35018000 W
PLW13        0.28364000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
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SF          100.6127539 MHz
WDW                  EM
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LB                1.00 Hz
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PC                1.40
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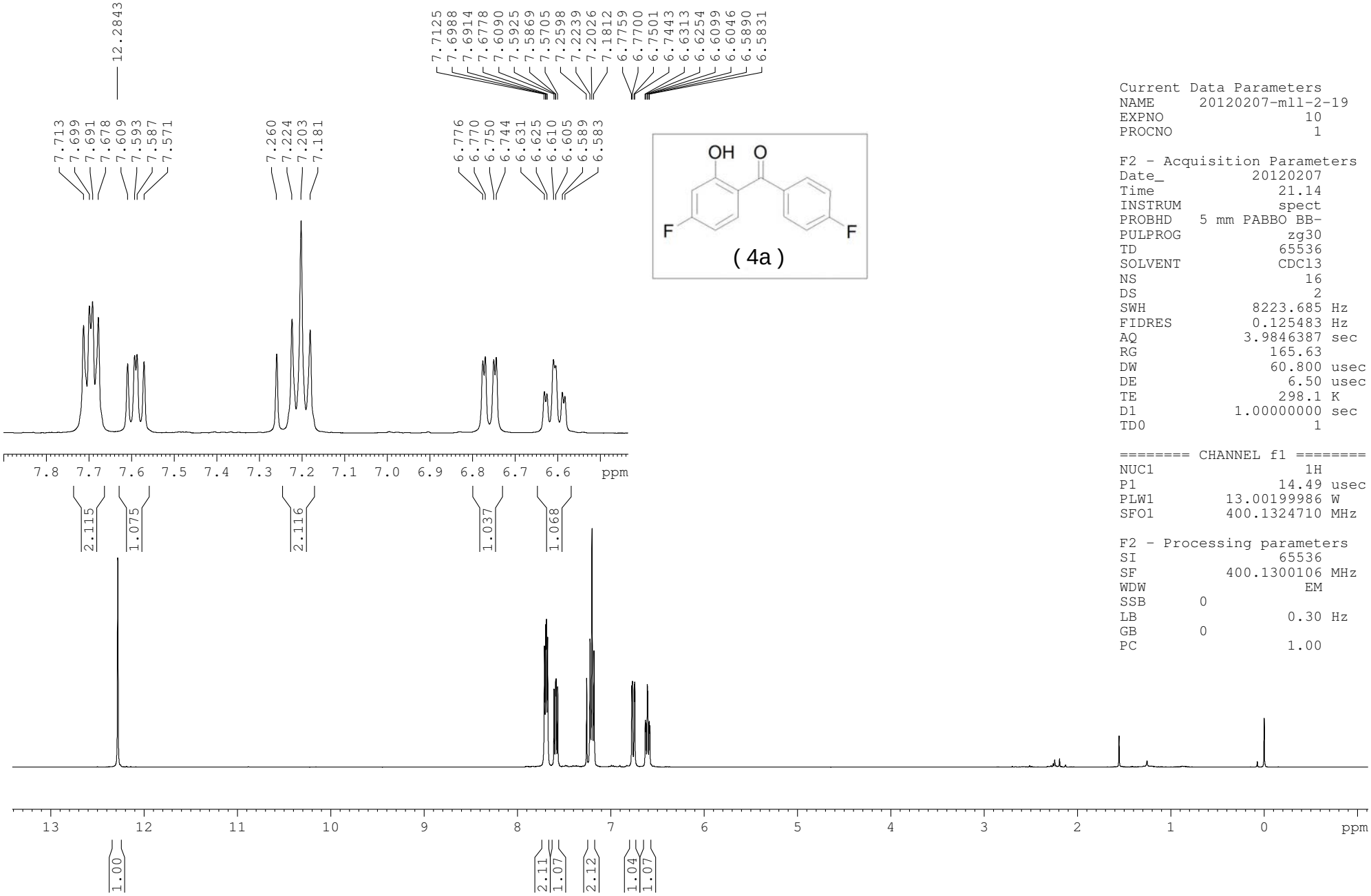


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PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
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FIDRES             0.125483 Hz
AQ                3.9846387 sec
RG                   165.63
DW                   60.800 usec
DE                    6.50 usec
TE                   298.1 K
D1              1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                     1H
P1                    14.49 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF             400.1300106 MHz
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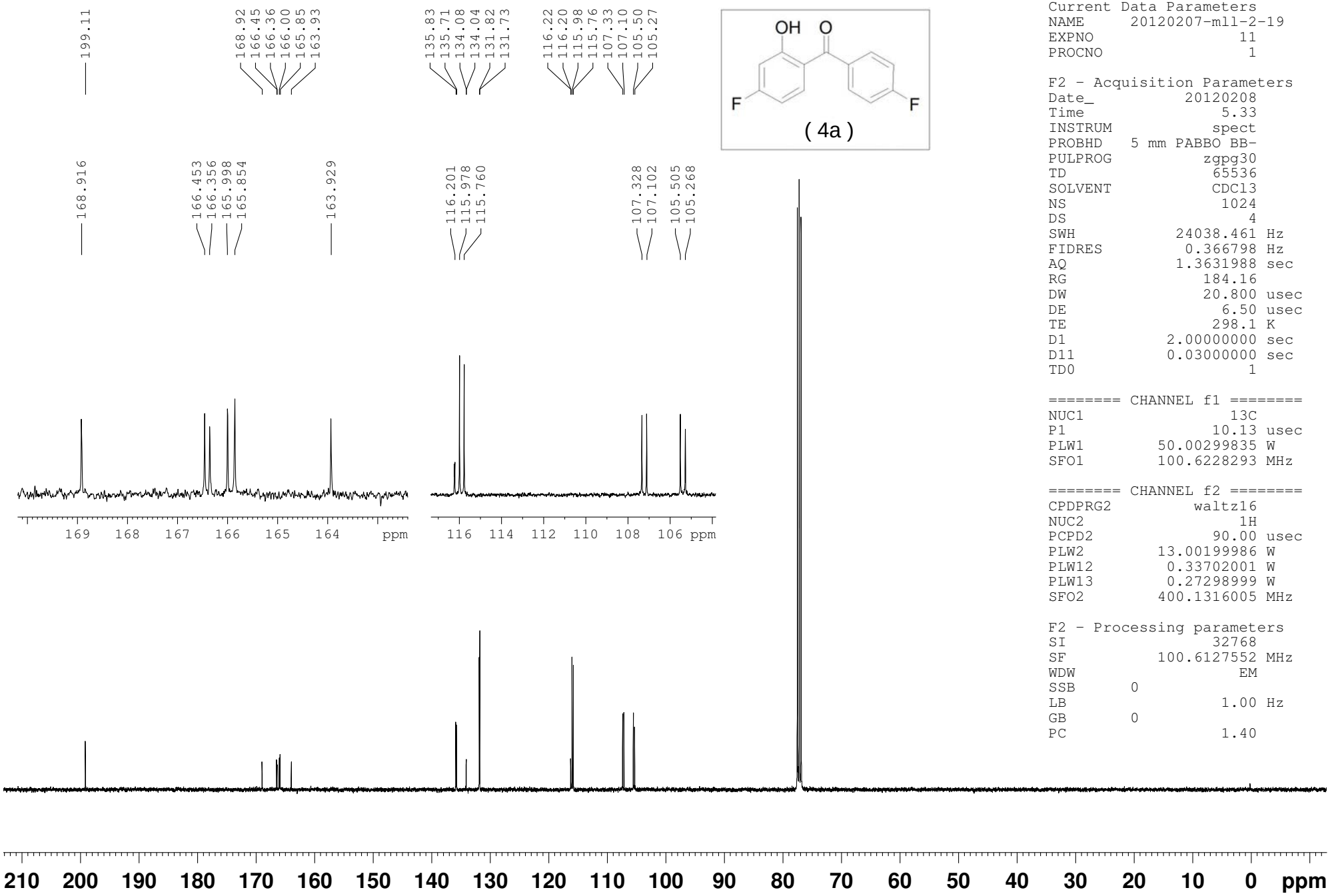


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PULPROG              zgpg30
TD                    65536
SOLVENT               CDCl3
NS                     1024
DS                        4
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FIDRES            0.366798 Hz
AQ               1.3631988 sec
RG                  184.16
DW                  20.800 usec
DE                   6.50 usec
TE                  298.1 K
D1             2.00000000 sec
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P1                   10.13 usec
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PLW13          0.27298999 W
SFO2         400.1316005 MHz

F2 - Processing parameters
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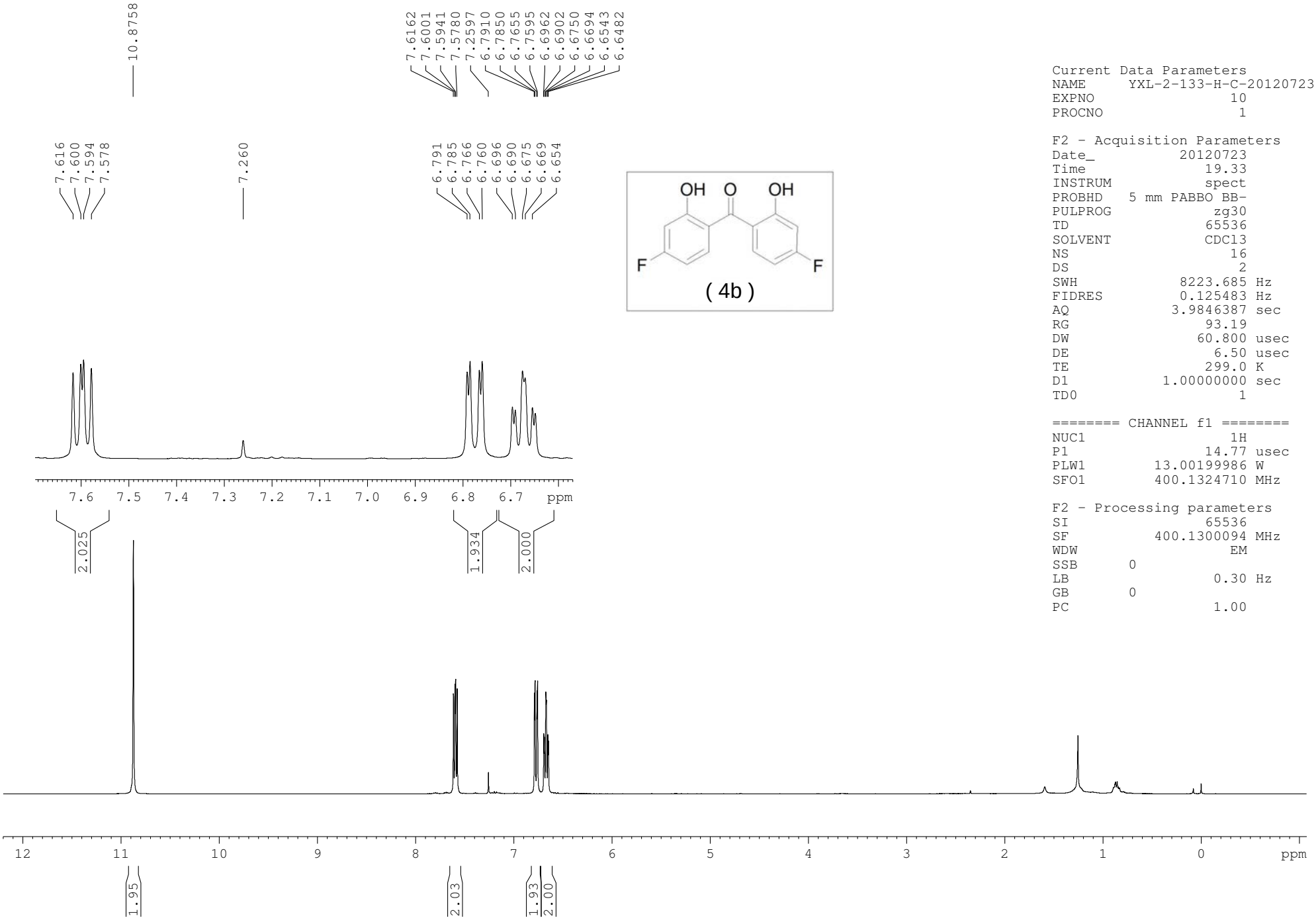


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TD                     65536
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NS                        16
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FIDRES              0.125483 Hz
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RG                     93.19
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DE                     6.50 usec
TE                    299.0 K
D1                1.00000000 sec
TD0                        1

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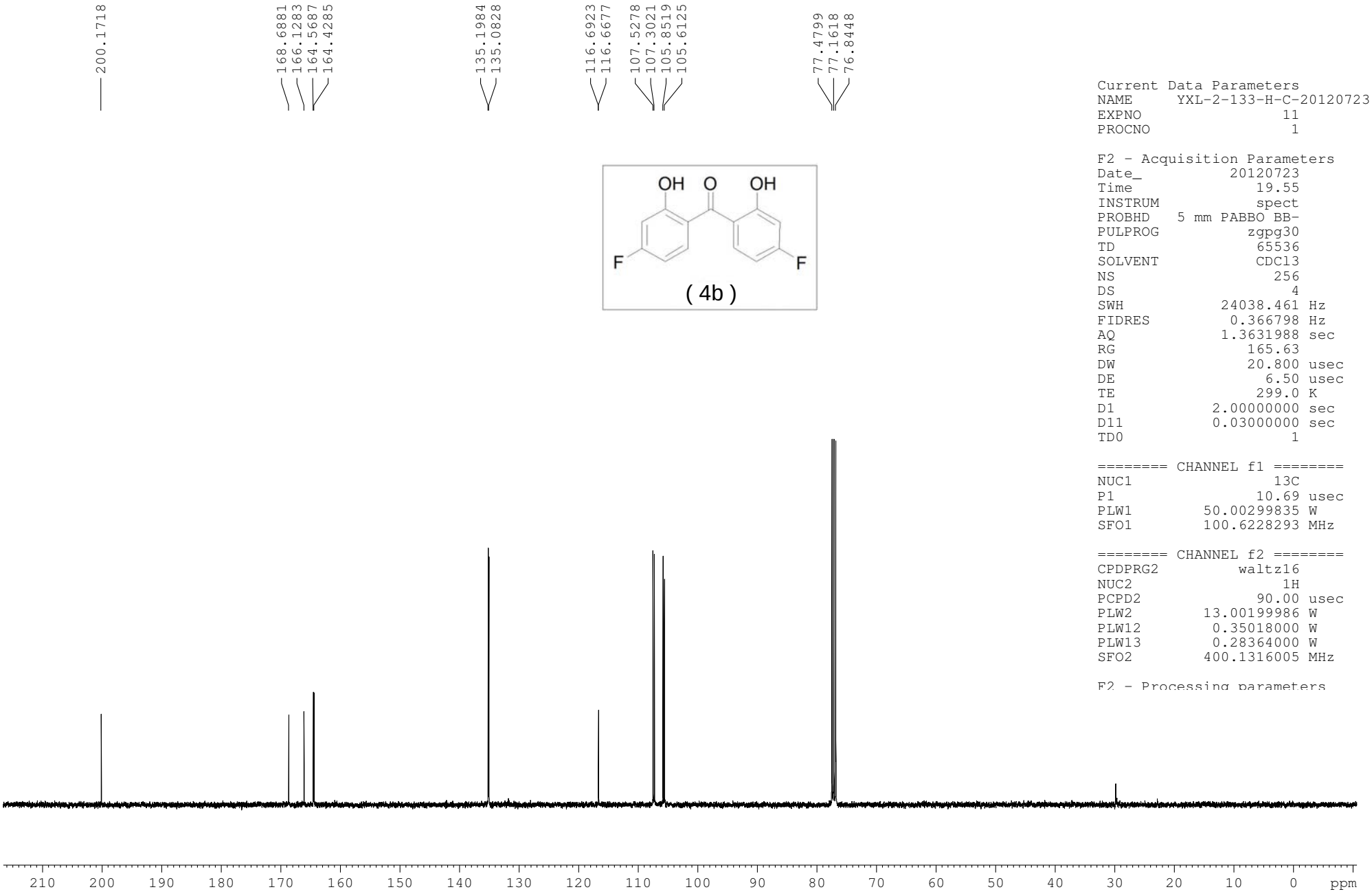
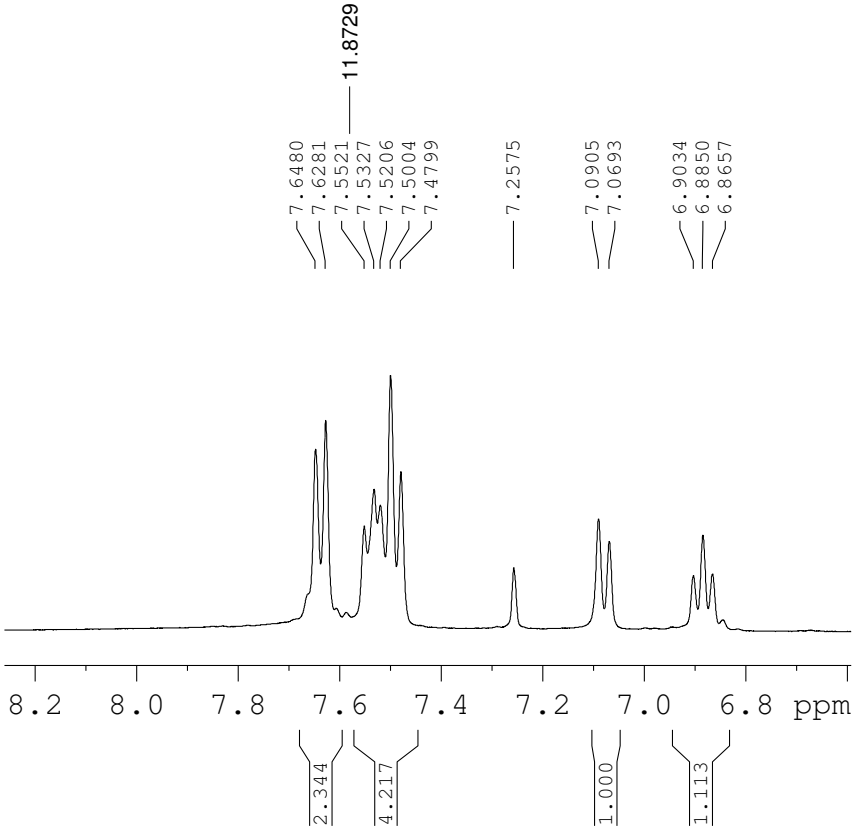
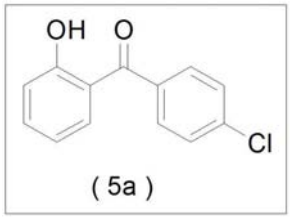
NUC1                       1H
P1                      14.77 usec
PLW1             13.00199986 W
SFO1            400.1324710 MHz

F2 - Processing parameters
SI                         65536
SF              400.1300094 MHz
WDW                        EM
SSB          0
LB                      0.30 Hz
GB           0
PC                      1.00
```





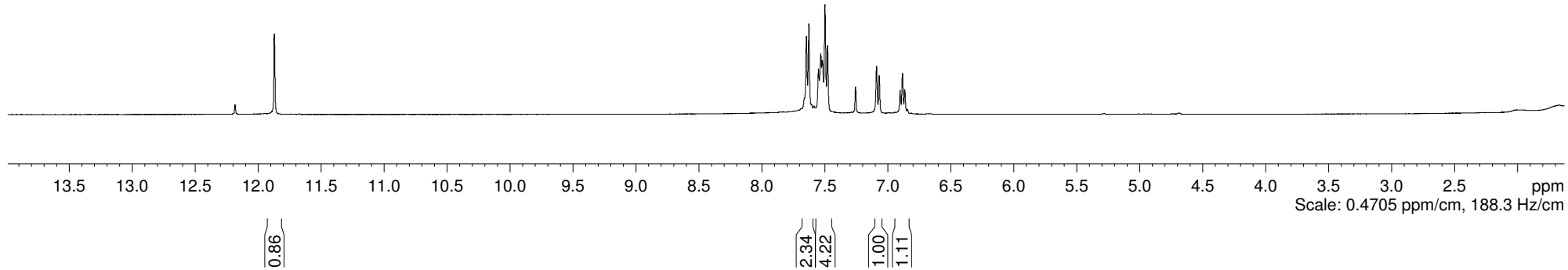


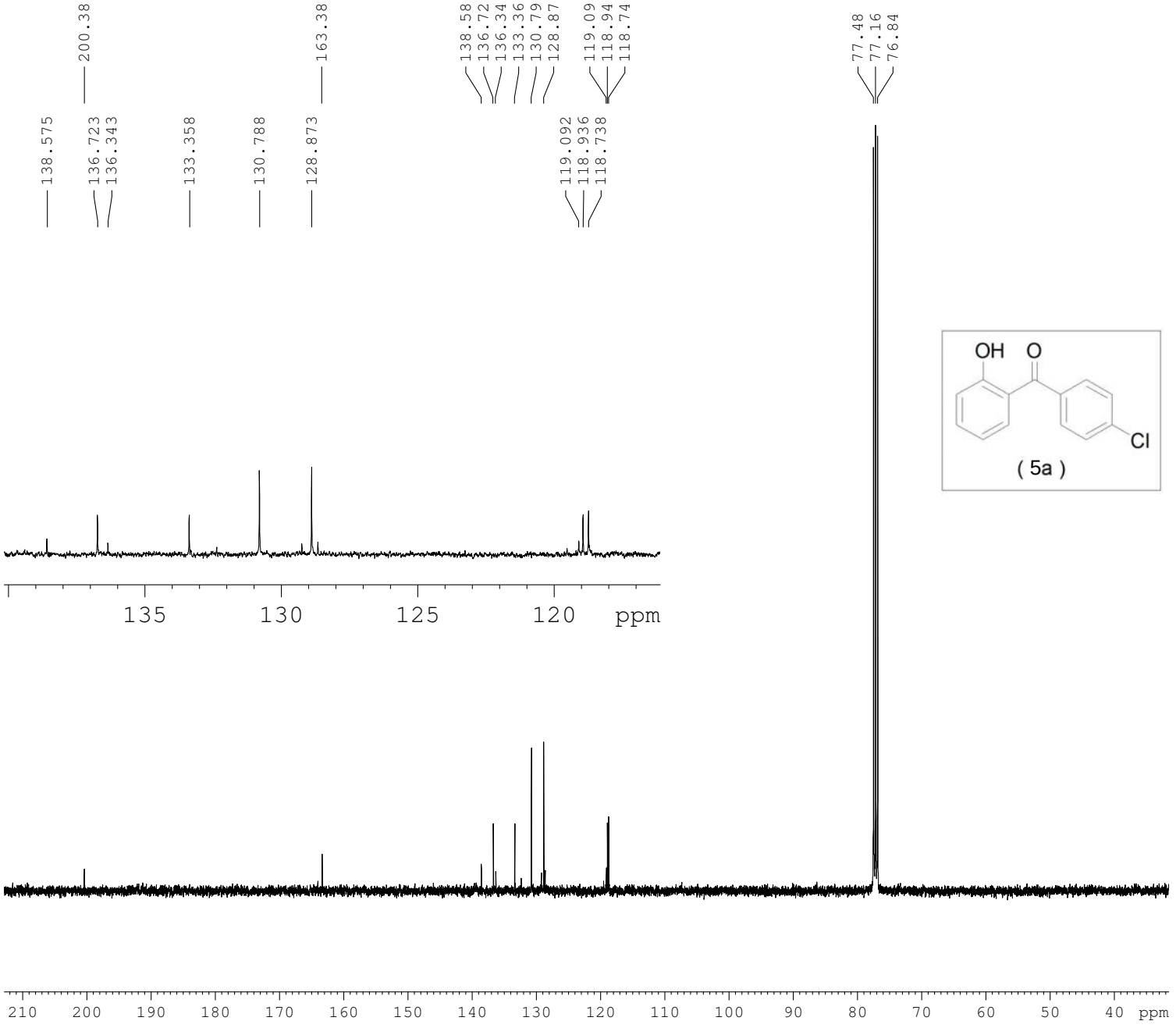

```
Current Data Parameters
NAME      20121127-ysy---1--mono
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121127
Time              17.31
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                   16
DS                    2
SWH            8223.685 Hz
FIDRES        0.125483 Hz
AQ            3.9846387 sec
RG               102.67
DW               60.800 usec
DE                6.50 usec
TE               299.9 K
D1            1.00000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 1H
P1                14.77 usec
PLW1        13.00199986 W
SFO1        400.1324710 MHz

F2 - Processing parameters
SI                65536
SF          400.1300117 MHz
WDW                   EM
```





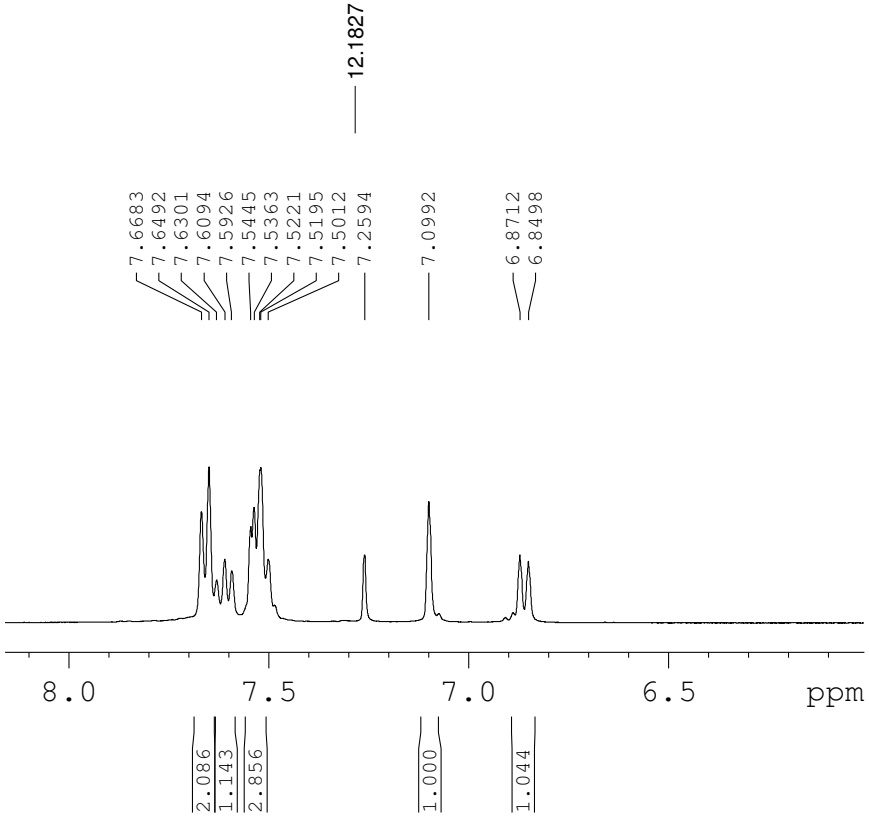

```
Current Data Parameters
NAME      20121128-ysy---1--4-lv
EXPNO                 10
PROCNO                 1

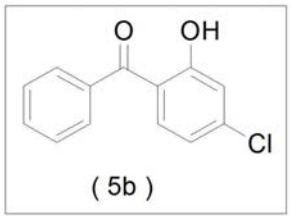
F2 - Acquisition Parameters
Date_           20121128
Time               18.17
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  512
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ            1.3631988 sec
RG               209.25
DW               20.800 usec
DE                6.50 usec
TE               299.9 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.30 usec
PLW1        50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.35018000 W
PLW13        0.28364000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127539 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



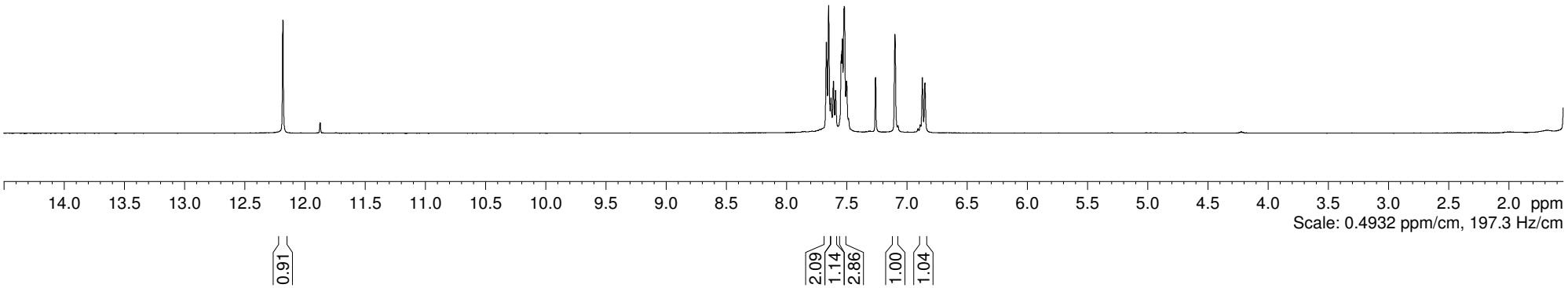



```
Current Data Parameters
NAME      20121128-ysy--1-lv--er
EXPNO                 10
PROCNO                 1

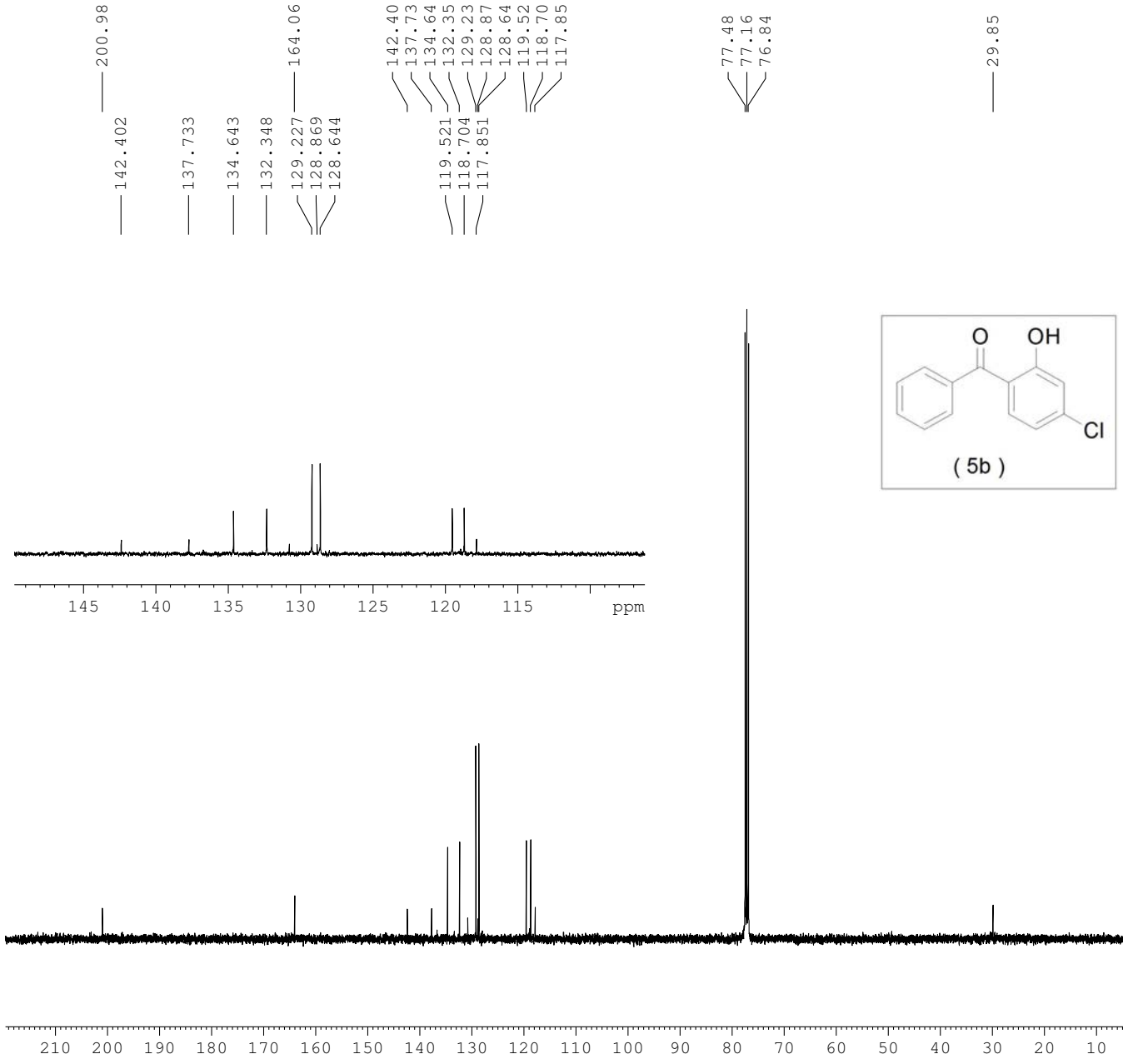
F2 - Acquisition Parameters
Date_           20121128
Time              19.51
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                   16
DS                    2
SWH            8223.685 Hz
FIDRES         0.125483 Hz
AQ             3.9846387 sec
RG                165.63
DW                60.800 usec
DE                 6.50 usec
TE                299.9 K
D1             1.00000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                  1H
P1                 14.77 usec
PLW1         13.00199986 W
SFO1         400.1324710 MHz

F2 - Processing parameters
SI                 65536
SF           400.1300103 MHz
WDW                   EM
```



C13CPD CDCl3 {D:\NMR_DATA} RY 32



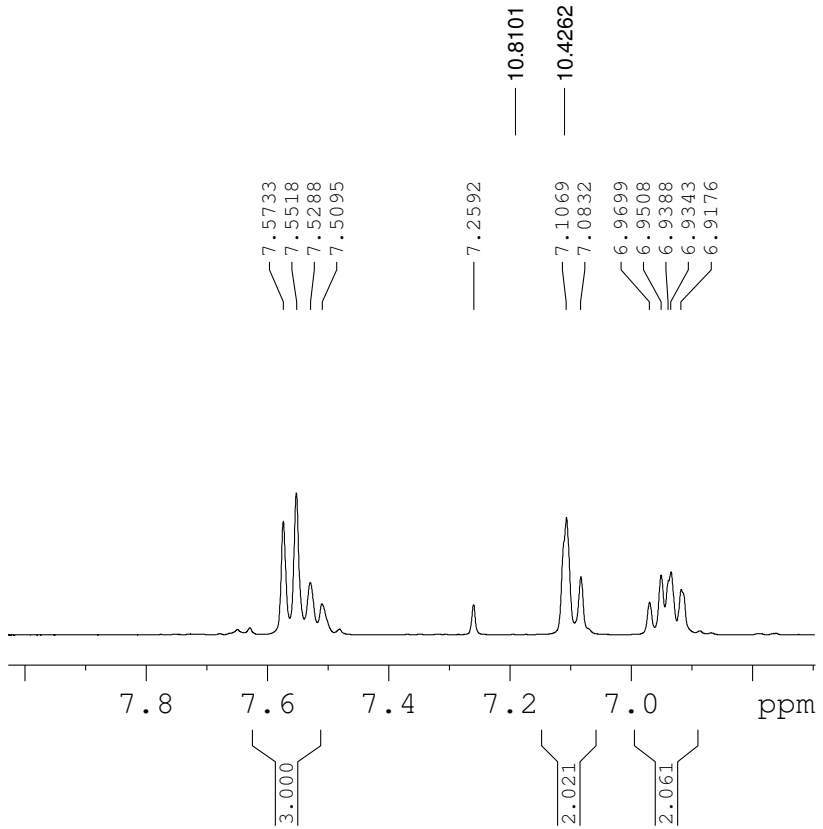

```
Current Data Parameters
NAME      20121128-ysy--1-lv--erbenjiatong
EXPNO                 11
PROCNO                 1

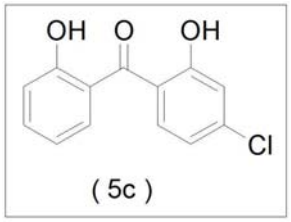
F2 - Acquisition Parameters
Date_           20121129
Time                0.19
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  512
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ            1.3631988 sec
RG               209.25
DW               20.800 usec
DE                6.50 usec
TE               299.9 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.30 usec
PLW1        50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.35018000 W
PLW13        0.28364000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127541 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



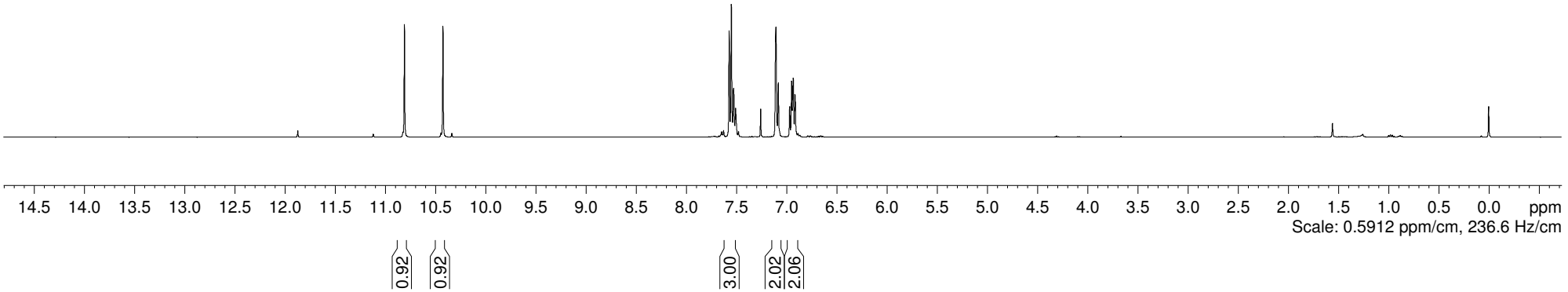



```
Current Data Parameters
NAME      20121123-ysy---duilv  erbenjiatc
EXPNO                      10
PROCNO                      1

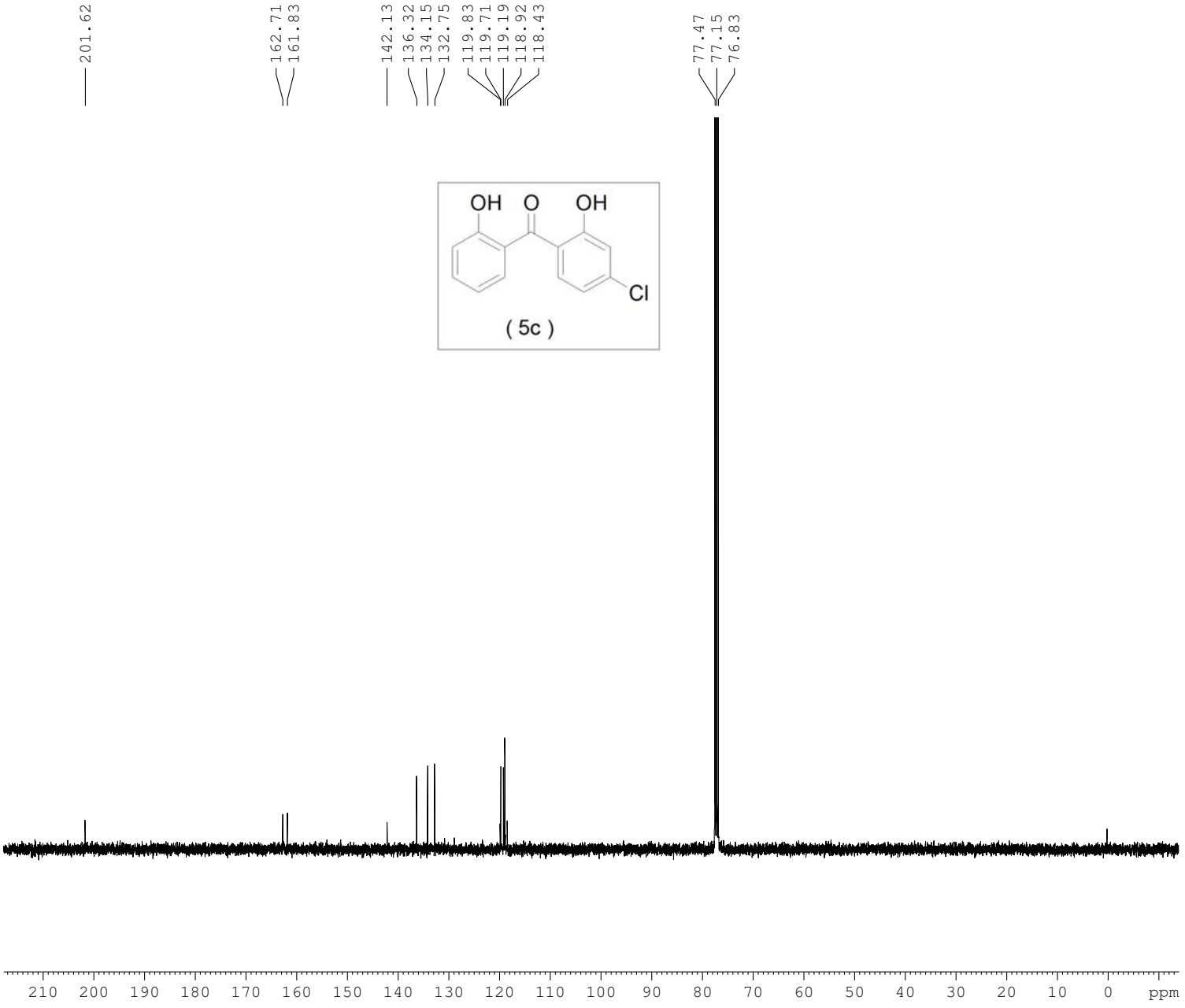
F2 - Acquisition Parameters
Date_               20121123
Time                   11.08
INSTRUM                spect
PROBHD   5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                 8223.685 Hz
FIDRES              0.125483 Hz
AQ                3.9846387 sec
RG                   144.49
DW                   60.800 usec
DE                    6.50 usec
TE                   299.9 K
D1                1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                     14.77 usec
PLW1            13.00199986 W
SFO1            400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF              400.1300105 MHz
WDW                      EM
```



C13CPD CDCl3 {D:\NMR_DATA} RY 36



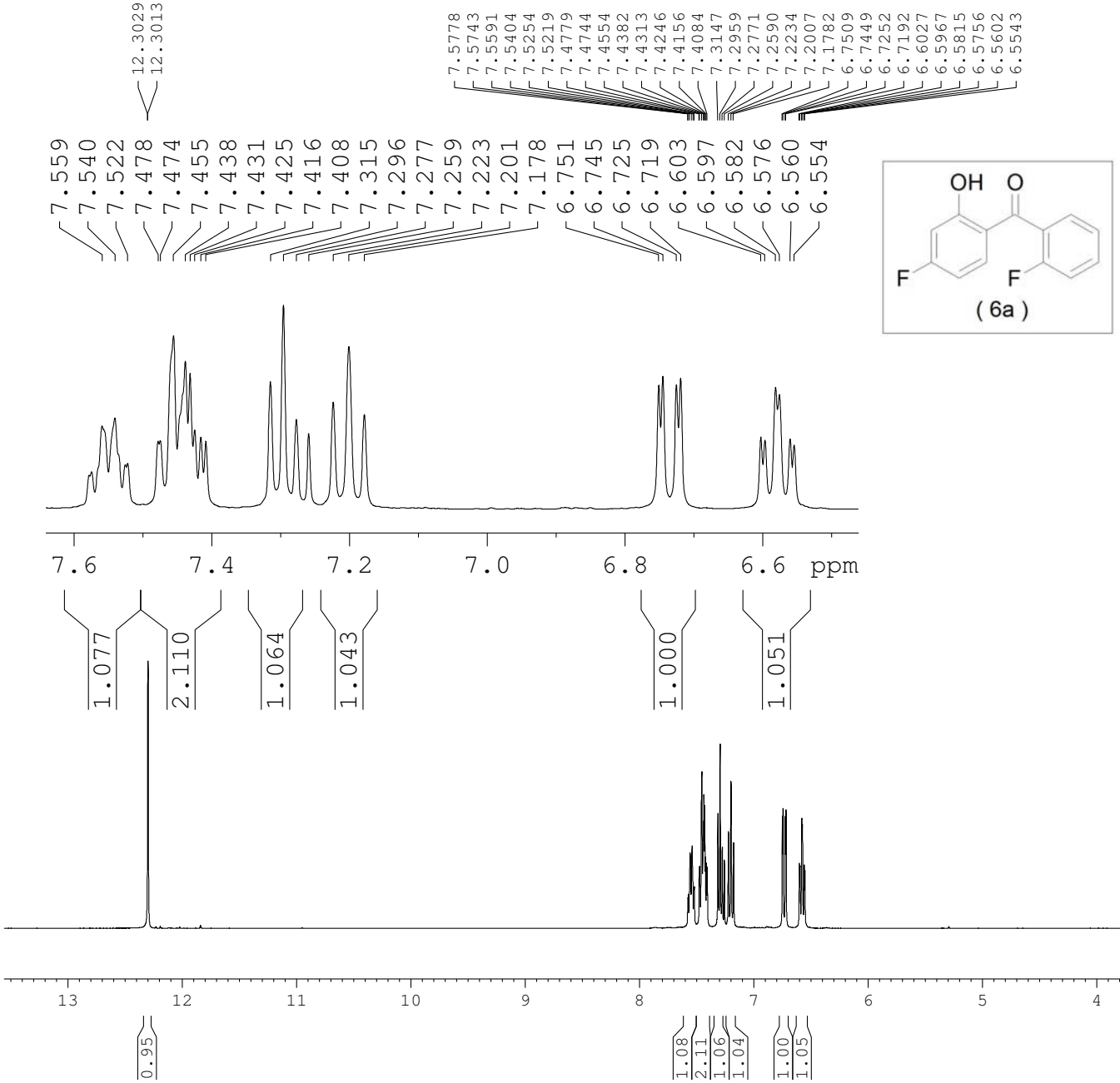

```
Current Data Parameters
NAME      ysy-1----16220121120-
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_               20121120
Time                   19.53
INSTRUM                spect
PROBHD    5 mm PABBO BB-
PULPROG                zgpg30
TD                     65536
SOLVENT                CDCl3
NS                       512
DS                         4
SWH                24038.461 Hz
FIDRES              0.366798 Hz
AQ                  1.3631988 sec
RG                     165.63
DW                     20.800 usec
DE                      6.50 usec
TE                     299.9 K
D1                 2.00000000 sec
D11                0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      13C
P1                     10.30 usec
PLW1            50.00299835 W
SFO1           100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2              waltz16
NUC2                      1H
PCPD2                  90.00 usec
PLW2            13.00199986 W
PLW12            0.35018000 W
PLW13            0.28364000 W
SFO2           400.1316005 MHz

F2 - Processing parameters
SI                     32768
SF             100.6127547 MHz
WDW                       EM
SSB          0
LB                      1.00 Hz
GB           0
PC                      1.40
```




```
Current Data Parameters
NAME      YXL-1-281-1-H-C-20120426
EXPNO                  10
PROCNO                  1

F2 - Acquisition Parameters
Date_           20120426
Time               20.41
INSTRUM            spect
PROBHD    5 mm PABBO BB-
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             8223.685 Hz
FIDRES          0.125483 Hz
AQ             3.9846387 sec
RG                130.81
DW                60.800 usec
DE                 6.50 usec
TE                299.0 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                   1H
P1                 14.91 usec
PLW1         13.00199986 W
SFO1         400.1324710 MHz

F2 - Processing parameters
SI                 65536
SF          400.1300102 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```

197.4464

169.3009
166.7341
165.7913
165.6459
160.3603
157.8605

136.0876
136.0620
135.9664
135.9433
133.2520
133.1700
129.9654
129.9378
126.3412
126.1846
124.6640
124.6280
117.0809
117.0590
116.6093
116.3965
107.7671
107.5384
105.2098
104.9705

77.4765
77.1595
76.8415

136.088
136.062
135.966
135.943
133.252
133.170

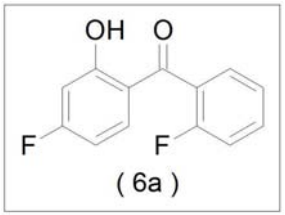
129.965
129.938

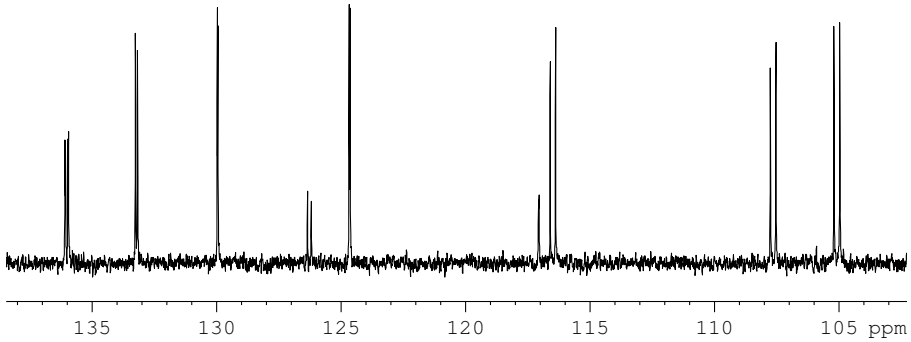
126.341
126.185
124.664
124.628

117.081
117.059
116.609
116.397

107.767
107.538

105.210
104.971





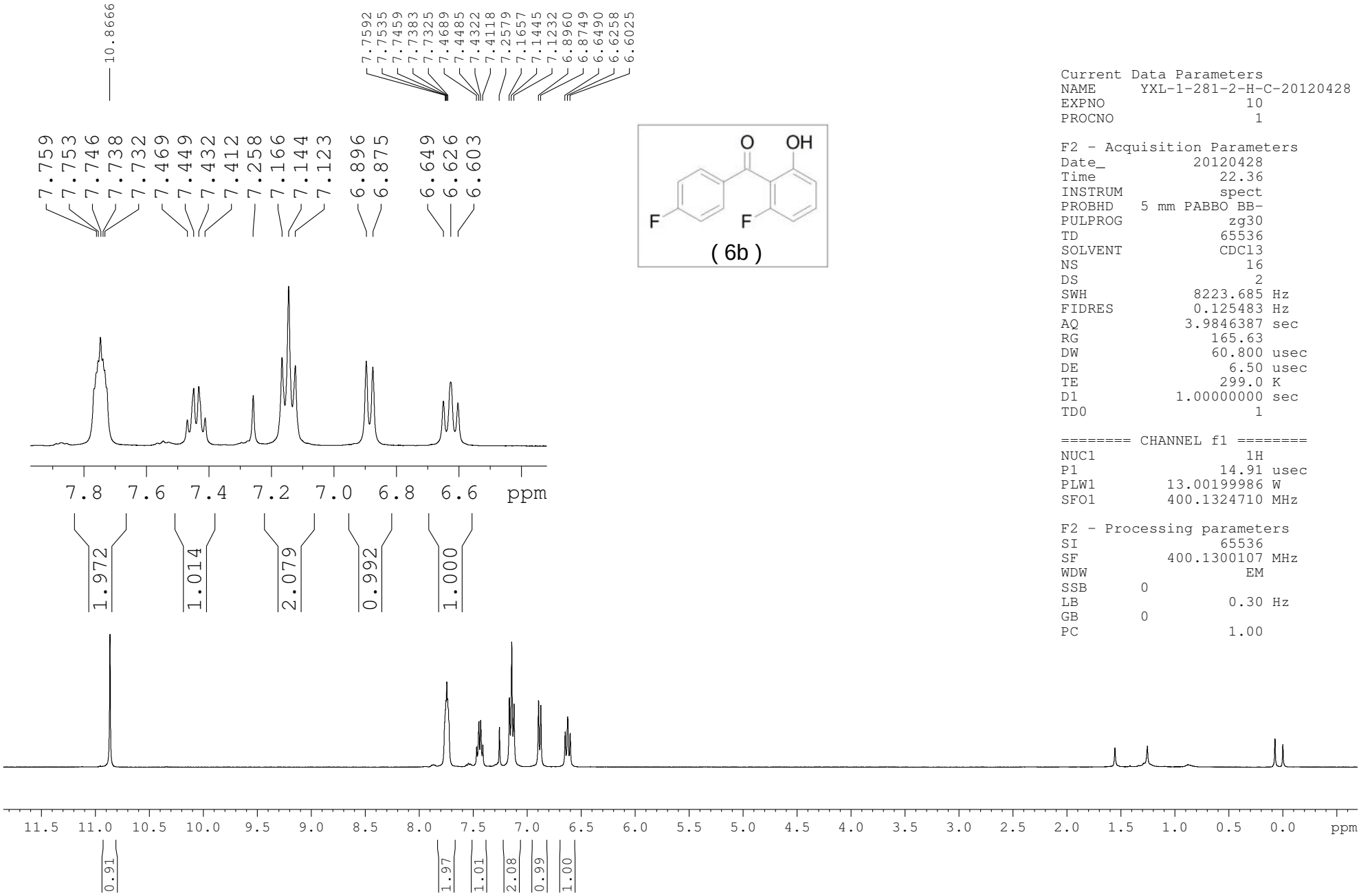

```
Current Data Parameters
NAME      YXL-1-281-1-H-C-20120428
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20120428
Time              22.48
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  256
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631988 sec
RG                209.25
DW                20.800 usec
DE                 6.50 usec
TE                299.1 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.31 usec
PLW1        50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2         waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.35685000 W
PLW13        0.28904000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127554 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

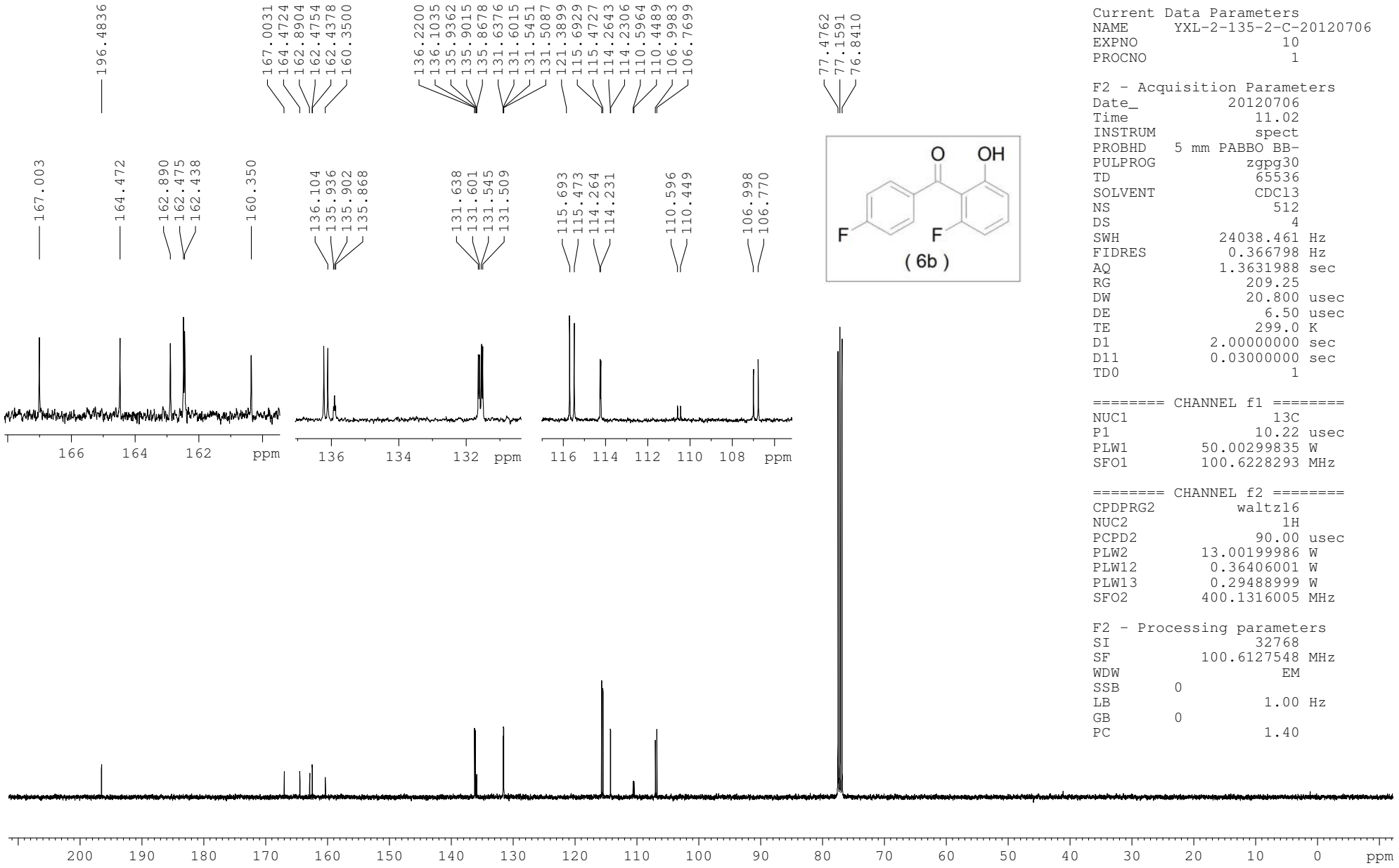



```
Current Data Parameters
NAME      YXL-1-281-2-H-C-20120428
EXPNO                  10
PROCNO                  1

F2 - Acquisition Parameters
Date_           20120428
Time               22.36
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             8223.685 Hz
FIDRES          0.125483 Hz
AQ             3.9846387 sec
RG                165.63
DW                60.800 usec
DE                 6.50 usec
TE                299.0 K
D1            1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                14.91 usec
PLW1        13.00199986 W
SFO1        400.1324710 MHz

F2 - Processing parameters
SI                 65536
SF          400.1300107 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



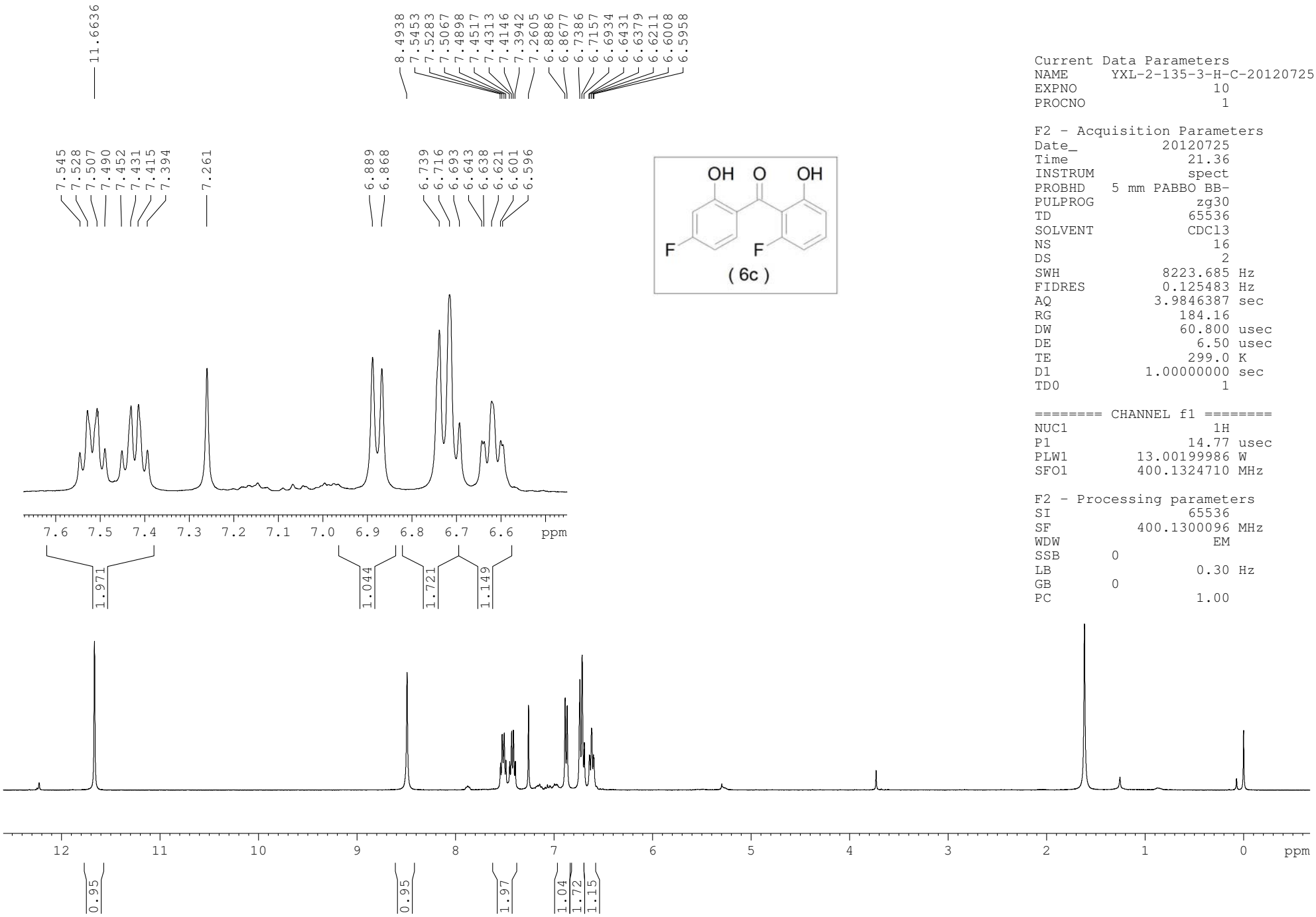

```
Current Data Parameters
NAME      YXL-2-135-2-C-20120706
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20120706
Time              11.02
INSTRUM           spect
PROBHD    5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  512
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631988 sec
RG                209.25
DW                20.800 usec
DE                 6.50 usec
TE                299.0 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.22 usec
PLW1        50.00299835 W
SFO1       100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.36406001 W
PLW13        0.29488999 W
SFO2       400.1316005 MHz

F2 - Processing parameters
SI                32768
SF           100.6127548 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

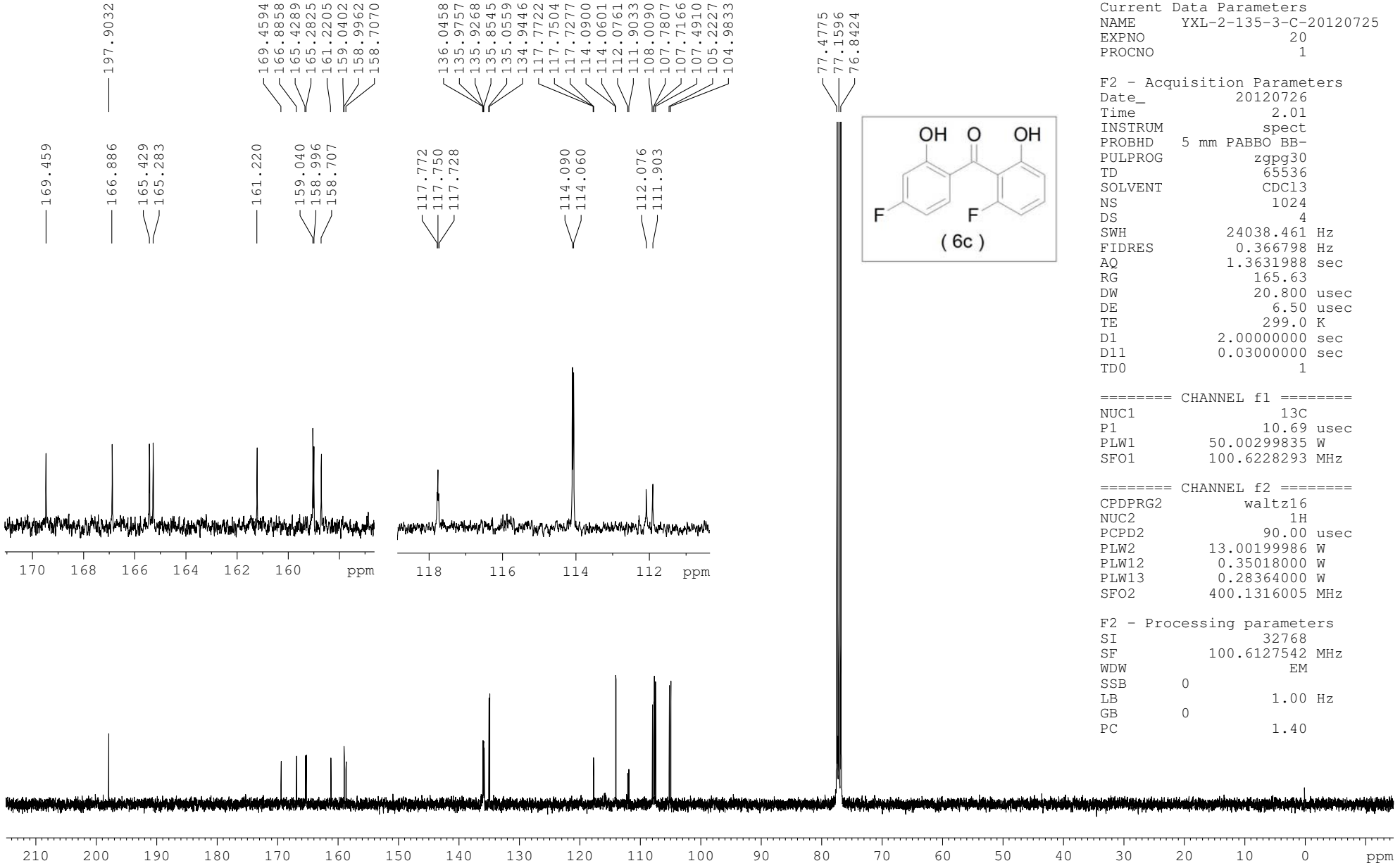



```
Current Data Parameters
NAME      YXL-2-135-3-H-C-20120725
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20120725
Time              21.36
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                   16
DS                    2
SWH            8223.685 Hz
FIDRES        0.125483 Hz
AQ            3.9846387 sec
RG               184.16
DW               60.800 usec
DE                6.50 usec
TE               299.0 K
D1            1.00000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                  1H
P1                14.77 usec
PLW1         13.00199986 W
SFO1         400.1324710 MHz

F2 - Processing parameters
SI                65536
SF           400.1300096 MHz
WDW                  EM
SSB       0
LB                0.30 Hz
GB        0
PC                1.00
```



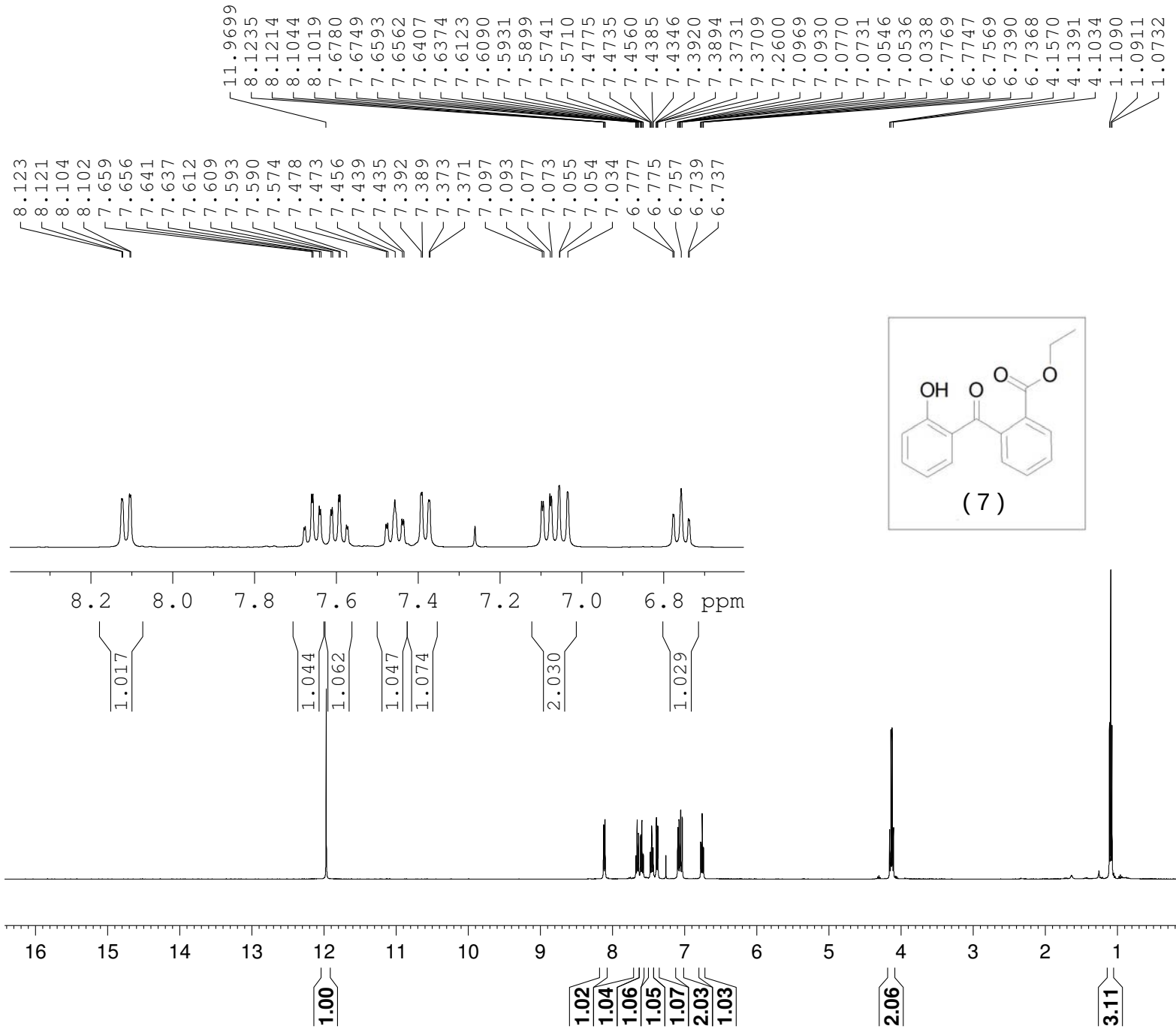

```
Current Data Parameters
NAME      YXL-2-135-3-C-20120725
EXPNO                 20
PROCNO                 1

F2 - Acquisition Parameters
Date_           20120726
Time                2.01
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                 1024
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ            1.3631988 sec
RG               165.63
DW               20.800 usec
DE                6.50 usec
TE               299.0 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.69 usec
PLW1         50.00299835 W
SFO1         100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2         13.00199986 W
PLW12         0.35018000 W
PLW13         0.28364000 W
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                32768
SF           100.6127542 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

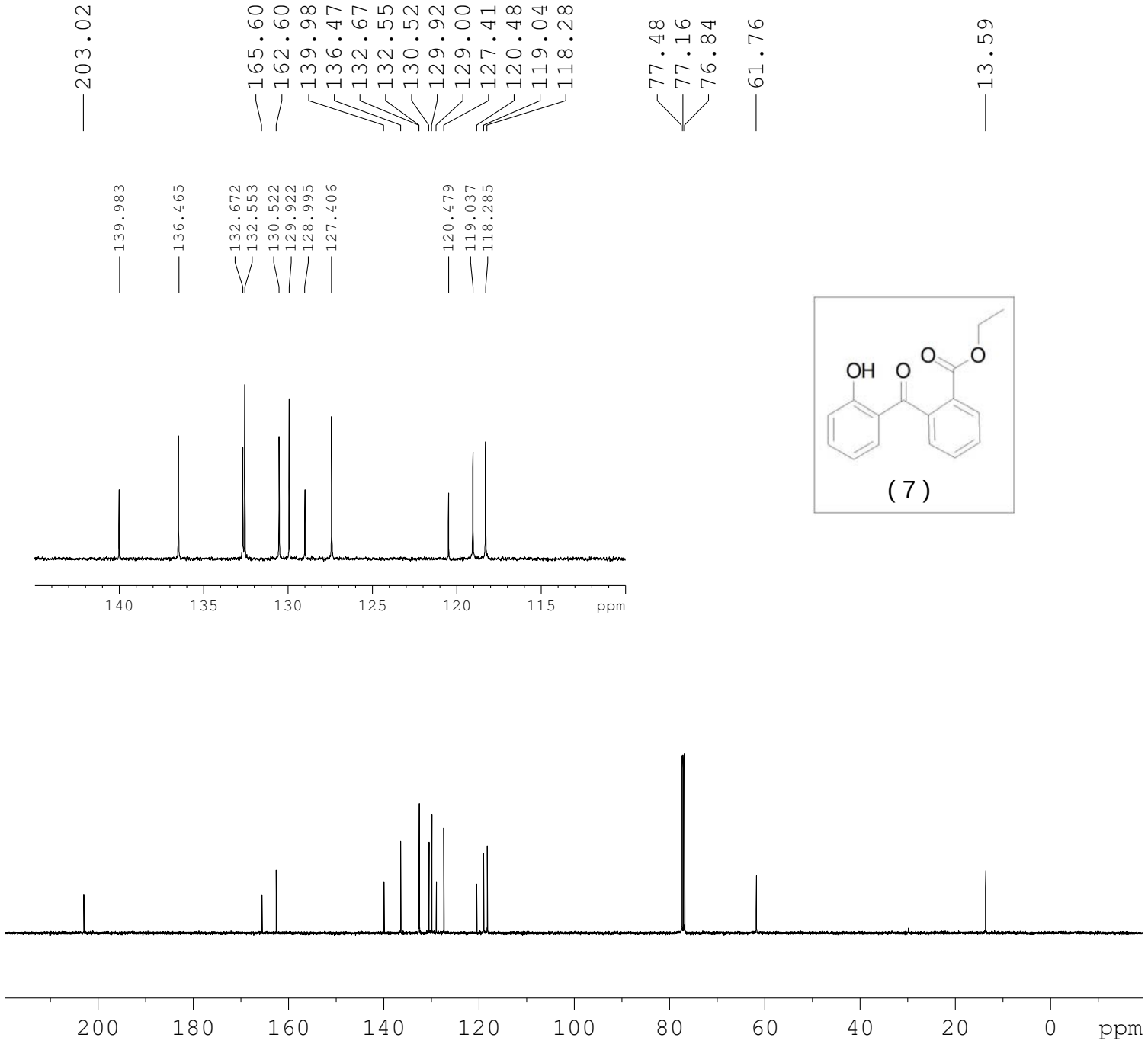



```
Current Data Parameters
NAME      20120526-mll-3-3-p1
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_            20120526
Time                16.58
INSTRUM             spect
PROBHD    5 mm PABBO BB-
PULPROG              zg30
TD                  65536
SOLVENT             CDCl3
NS                     16
DS                      2
SWH              8223.685 Hz
FIDRES           0.125483 Hz
AQ               3.9846387 sec
RG                  93.19
DW                 60.800 usec
DE                  6.50 usec
TE                 299.0 K
D1              1.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                  10.83 usec
PLW1          13.00199986 W
SFO1          400.1324710 MHz

F2 - Processing parameters
SI                  65536
SF            400.1300095 MHz
WDW                    EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```



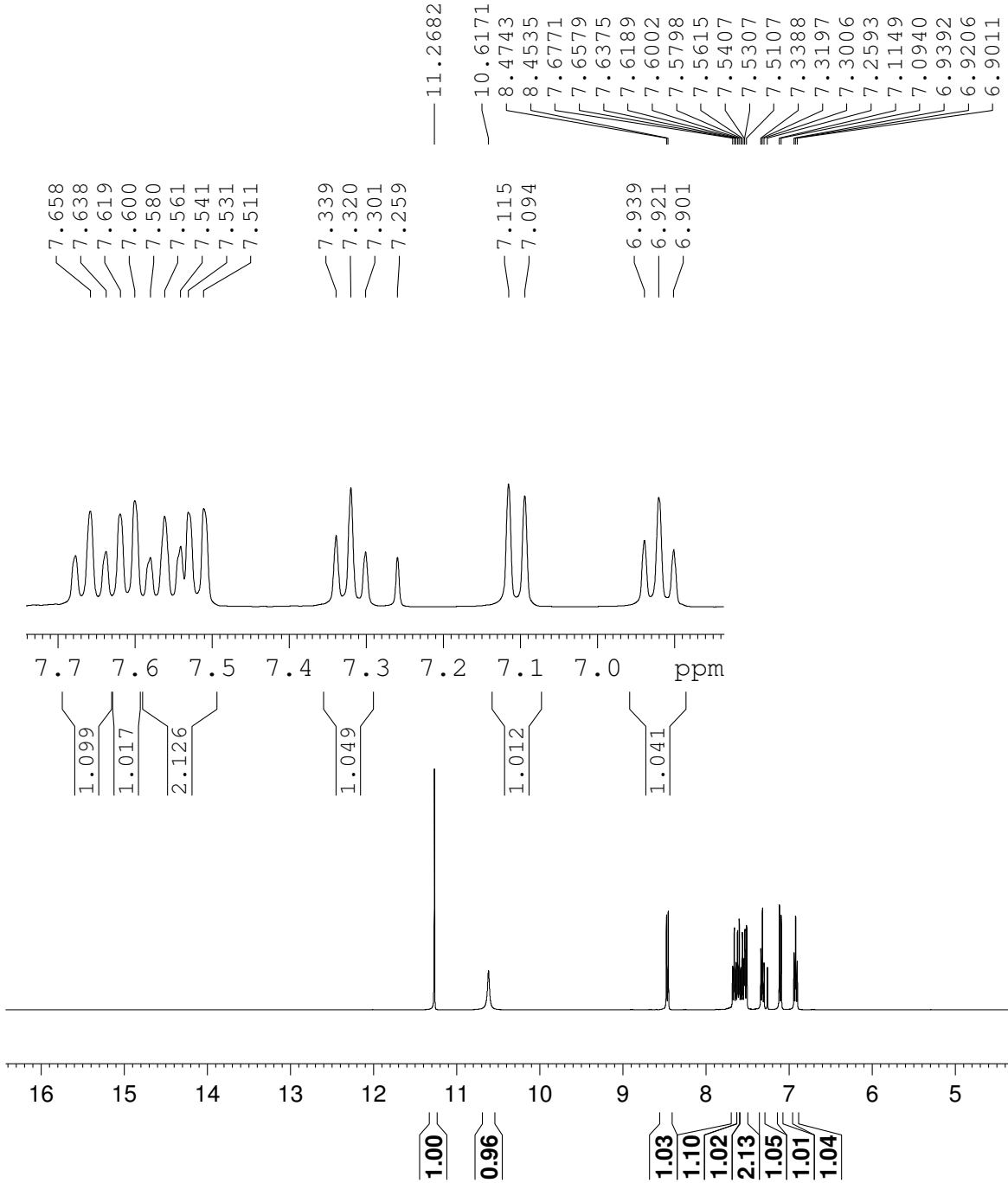

```
Current Data Parameters
NAME      20120530-mll-3-3-p1
EXPNO                     10
PROCNO                     1

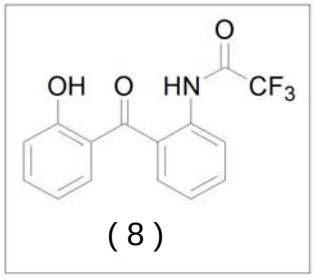
F2 - Acquisition Parameters
Date_              20120530
Time                  17.28
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG             zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     300
DS                       4
SWH              24038.461 Hz
FIDRES            0.366798 Hz
AQ                1.3631988 sec
RG                   209.25
DW                   20.800 usec
DE                    6.50 usec
TE                   299.0 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   10.38 usec
PLW1          50.00299835 W
SFO1         100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2            waltz16
NUC2                   1H
PCPD2                90.00 usec
PLW2          13.00199986 W
PLW12          0.18827000 W
PLW13          0.15250000 W
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF           100.6127584 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```





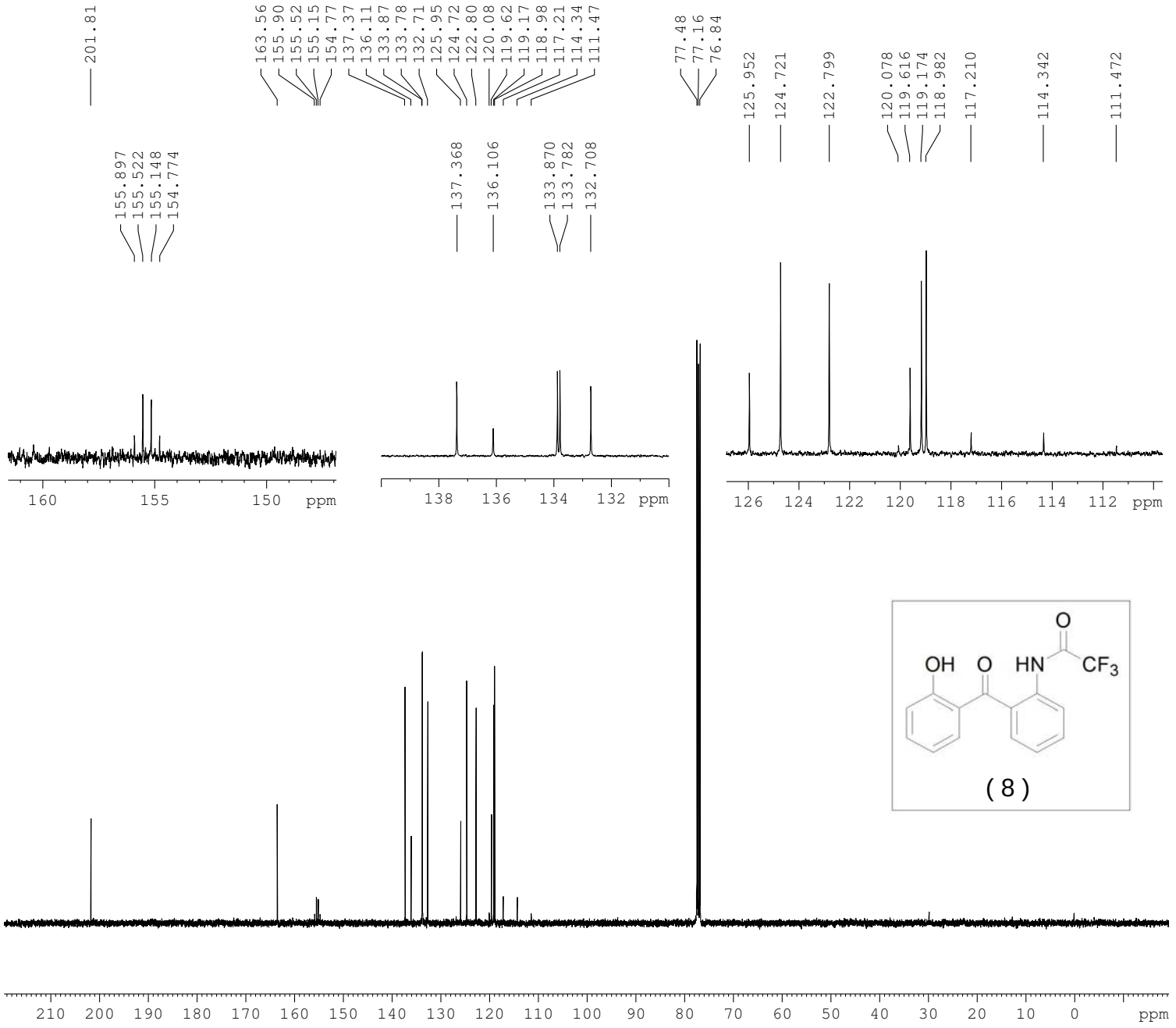
(8)

```
Current Data Parameters
NAME      SG-7-32-h-20120704
EXPNO                     20
PROCNO                     1

F2 - Acquisition Parameters
Date_           20120705
Time                9.32
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             8223.685 Hz
FIDRES          0.125483 Hz
AQ             3.9846387 sec
RG                115.38
DW                60.800 usec
DE                 6.50 usec
TE                299.0 K
D1           1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                15.06 usec
PLW1        13.00199986 W
SFO1        400.1324710 MHz

F2 - Processing parameters
SI                 65536
SF          400.1300098 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



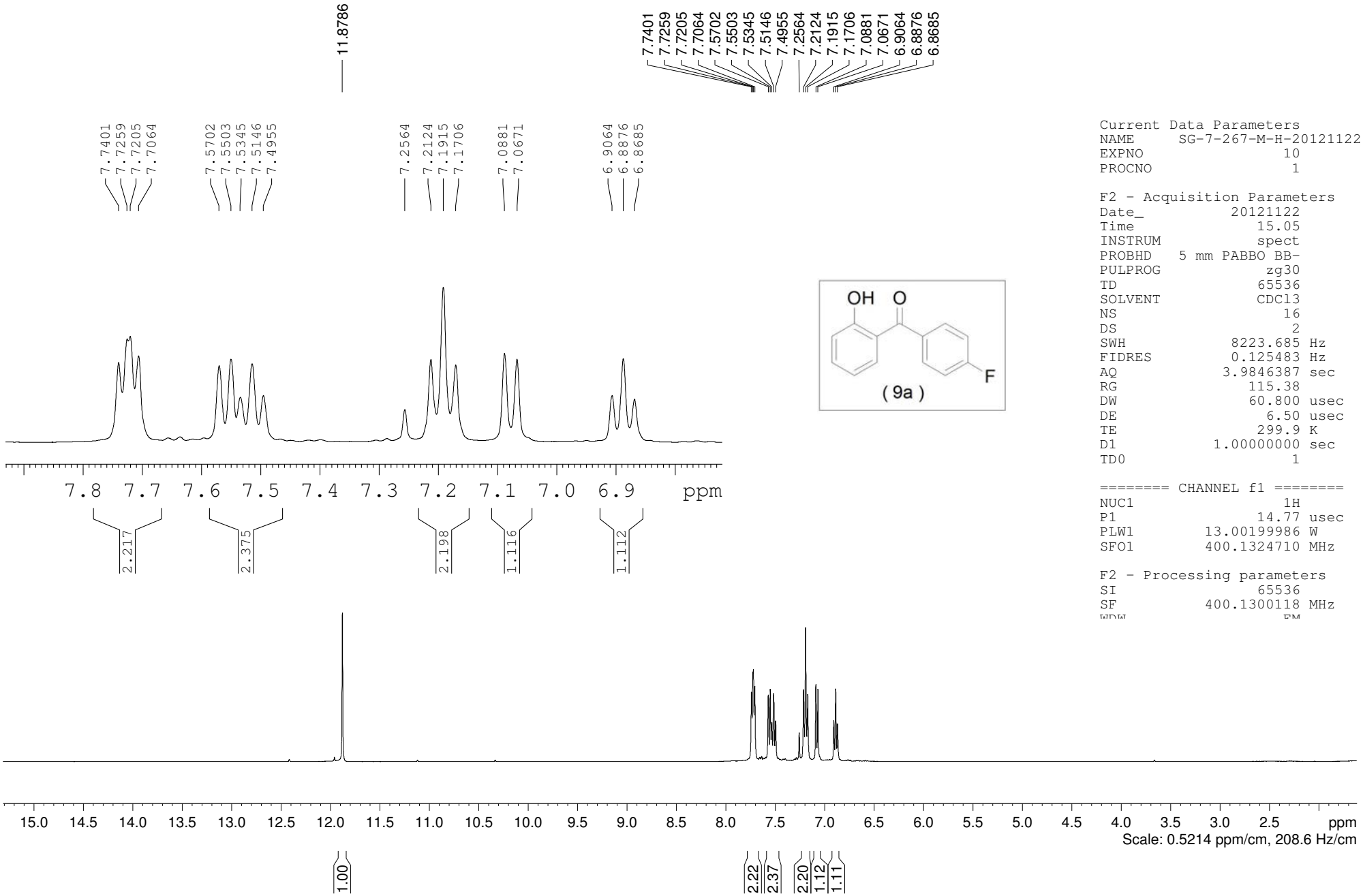

```
Current Data Parameters
NAME      SG-7-32-C-20120704
EXPNO                   10
PROCNO                   1

F2 - Acquisition Parameters
Date_              20120705
Time                  0.03
INSTRUM              spect
PROBHD    5 mm PABBO BB-
PULPROG             zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     512
DS                       4
SWH             24038.461 Hz
FIDRES           0.366798 Hz
AQ              1.3631988 sec
RG                  209.25
DW                20.800 usec
DE                 6.50 usec
TE                 299.1 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                 10.22 usec
PLW1         50.00299835 W
SFO1         100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2           waltz16
NUC2                   1H
PCPD2              90.00 usec
PLW2         13.00199986 W
PLW12         0.36406001 W
PLW13         0.29488999 W
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF           100.6127550 MHz
WDW                     EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```

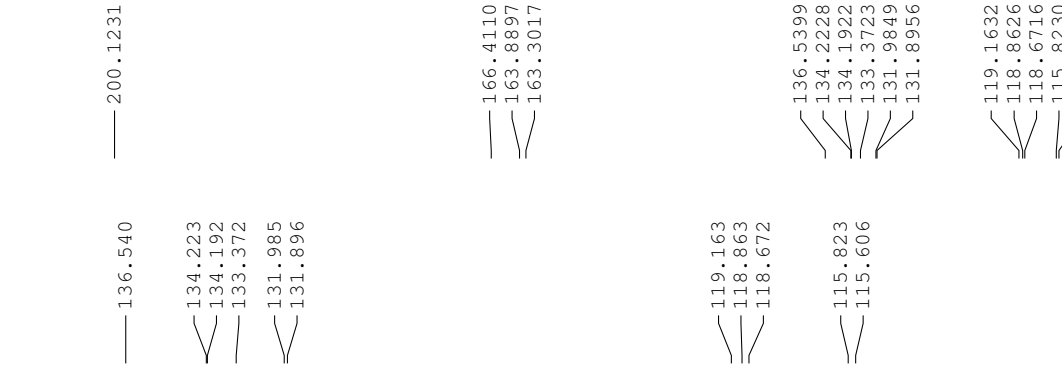


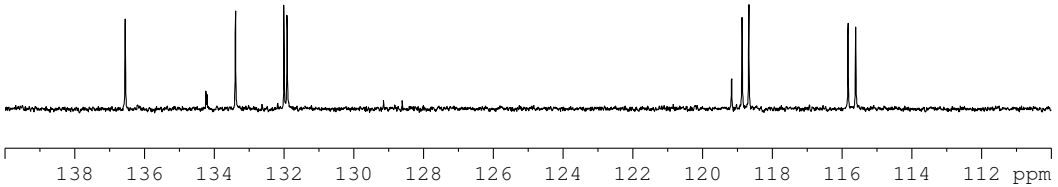

```
Current Data Parameters
NAME      SG-7-267-M-H-20121122
EXPNO                        10
PROCNO                        1

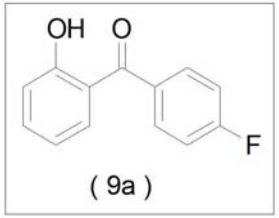
F2 - Acquisition Parameters
Date_              20121122
Time                  15.05
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                   115.38
DW                   60.800 usec
DE                    6.50 usec
TE                   299.9 K
D1              1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                     14.77 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF             400.1300118 MHz
WDW                       EM
```







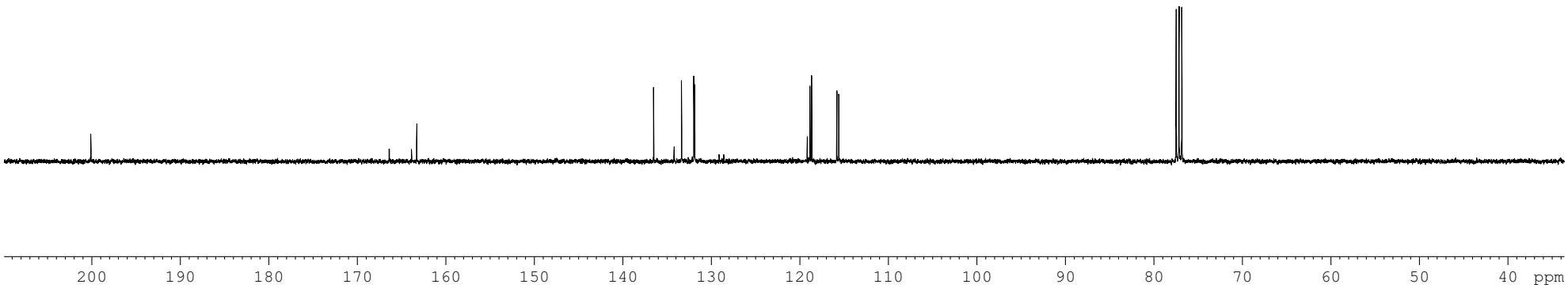

```
Current Data Parameters
NAME           HXS-4-F-C
EXPNO                 20
PROCNO                 1

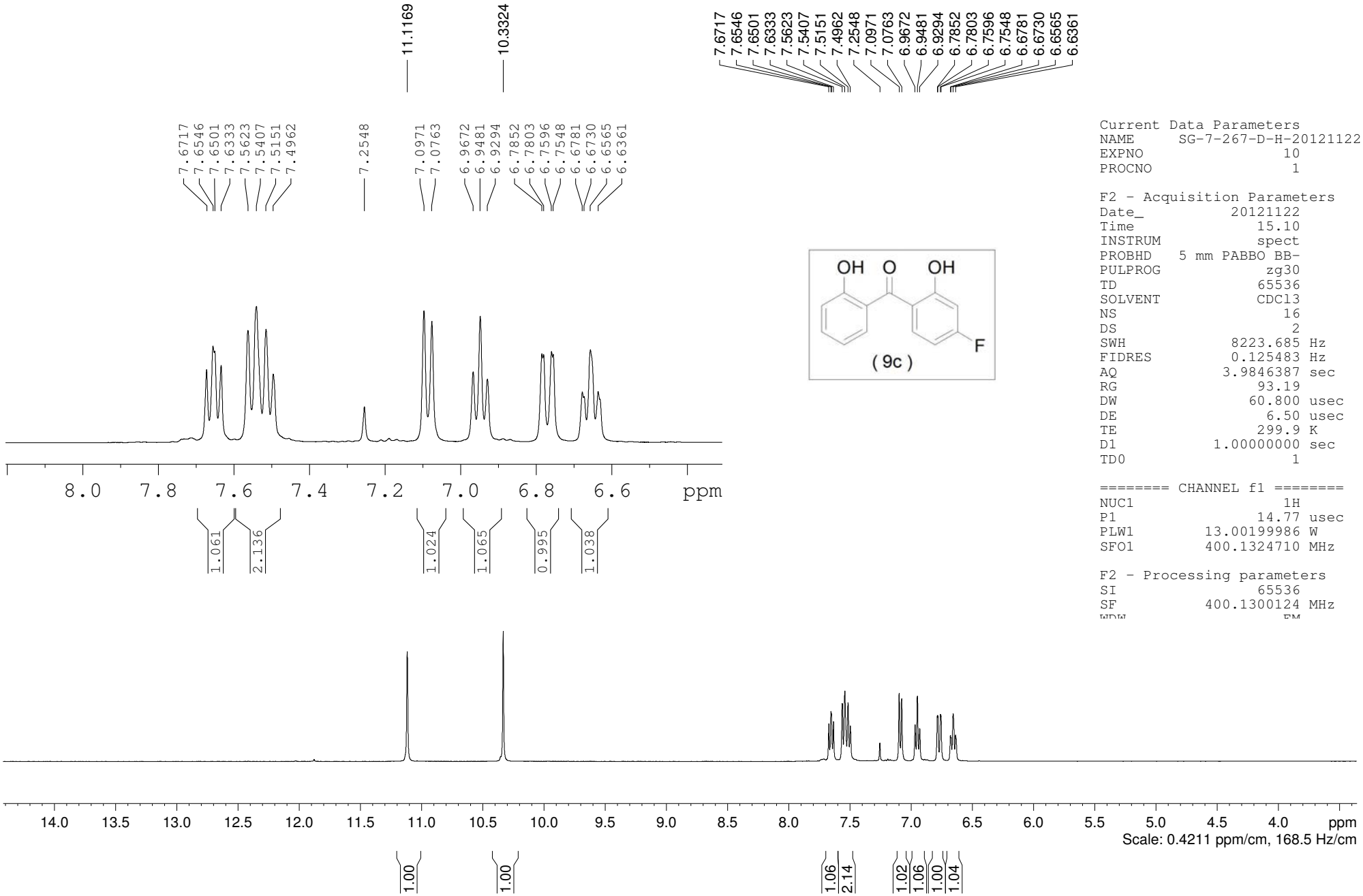
F2 - Acquisition Parameters
Date_           20121127
Time               22.54
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                   75
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631988 sec
RG                209.25
DW                20.800 usec
DE                 6.50 usec
TE                299.9 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.30 usec
PLW1        50.00299835 W
SFO1       100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.35018000 W
PLW13        0.28364000 W
SFO2       400.1316005 MHz

F2 - Processing parameters
```



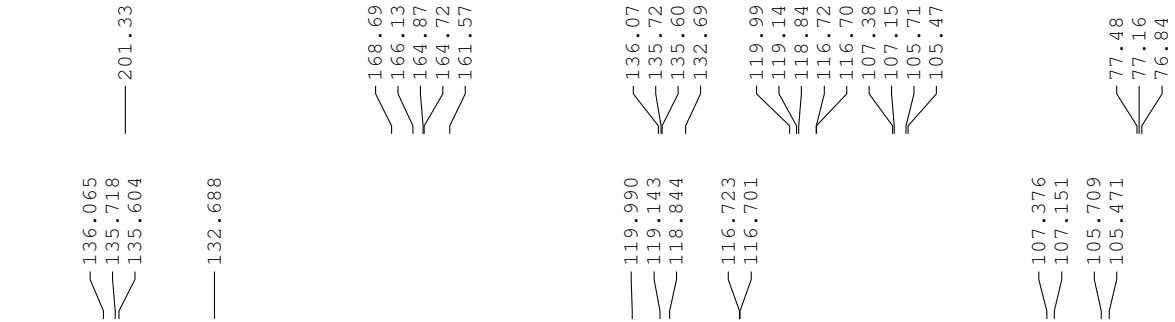


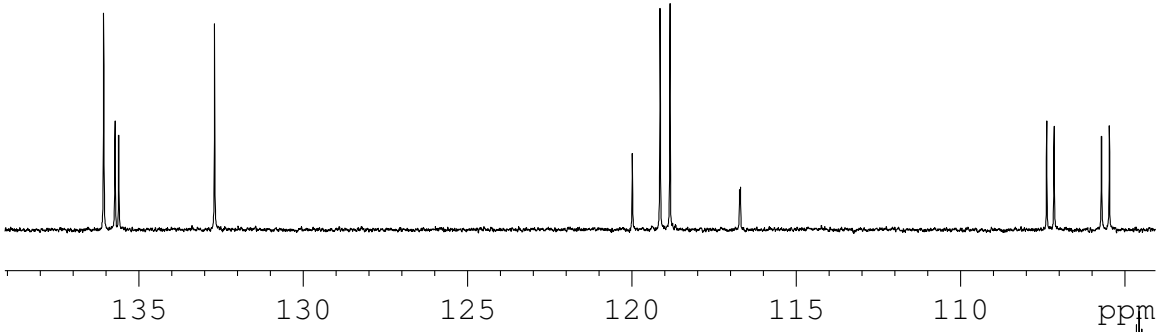

```
Current Data Parameters
NAME      SG-7-267-D-H-20121122
EXPNO                        10
PROCNO                        1

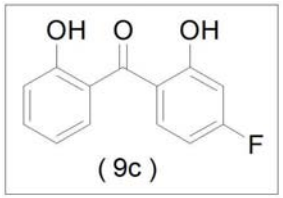
F2 - Acquisition Parameters
Date_              20121122
Time                  15.10
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                    93.19
DW                   60.800 usec
DE                    6.50 usec
TE                   299.9 K
D1              1.00000000 sec
TD0                       1

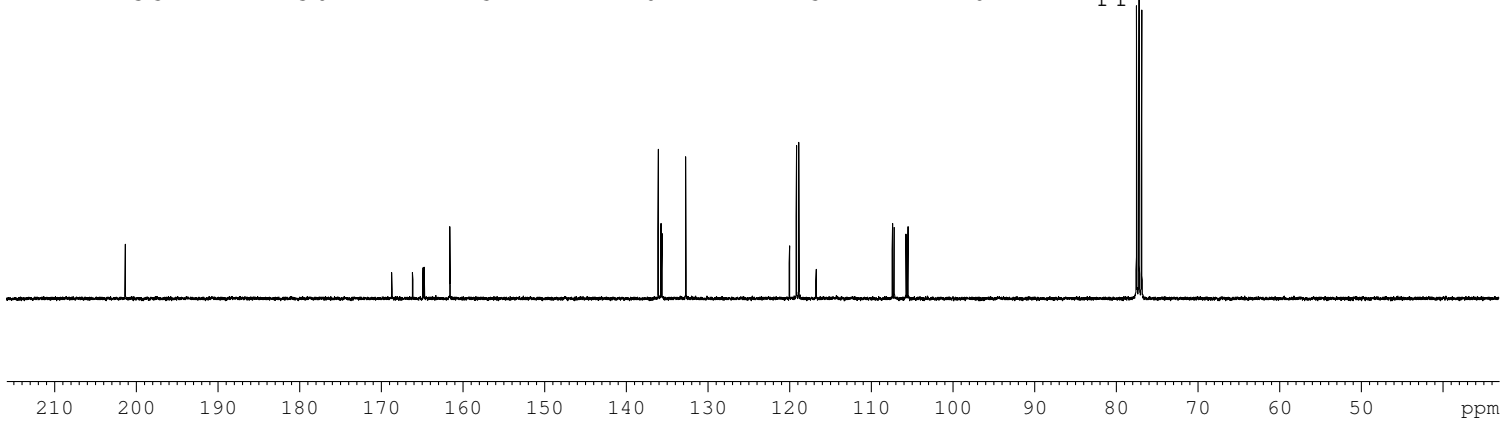
======== CHANNEL f1 ========
NUC1                      1H
P1                     14.77 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF             400.1300124 MHz
WDW                       EM
```









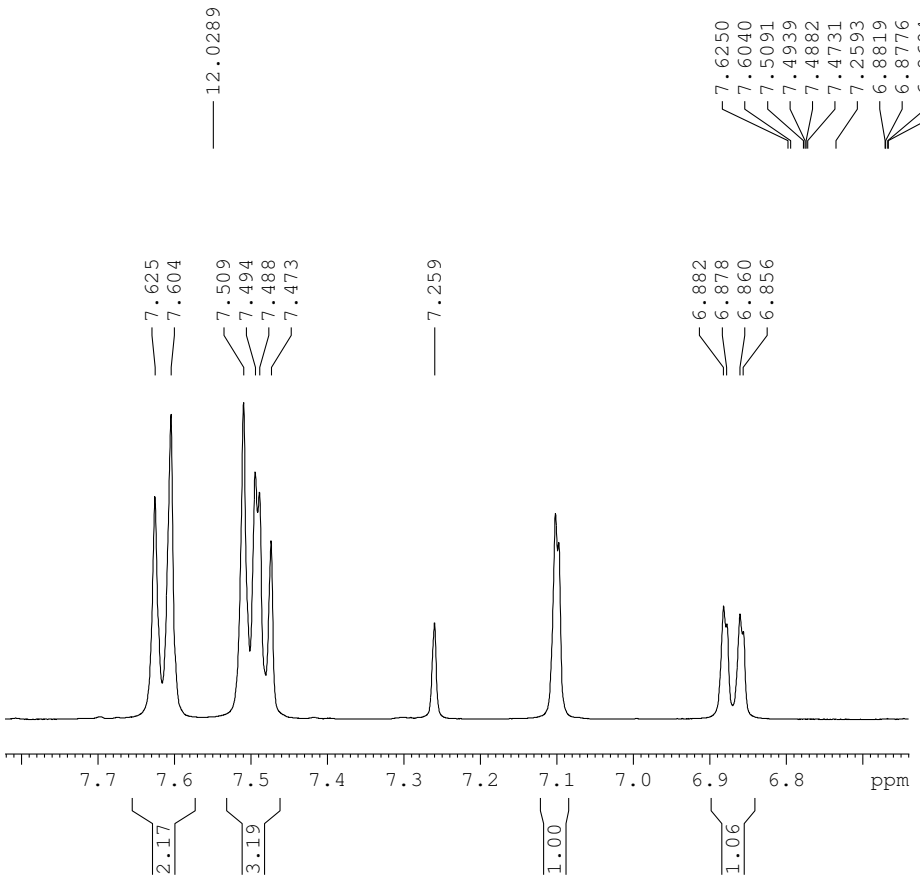

```
Current Data Parameters
NAME      SG-7-267-M-C-20121122
EXPNO                 10
PROCNO                 1

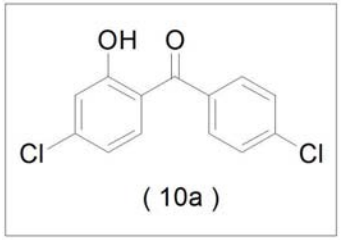
F2 - Acquisition Parameters
Date_           20121123
Time                5.33
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  512
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631988 sec
RG                209.25
DW                20.800 usec
DE                 6.50 usec
TE                299.9 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.30 usec
PLW1        50.00299835 W
SFO1       100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.35018000 W
PLW13        0.28364000 W
SFO2       400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127556 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



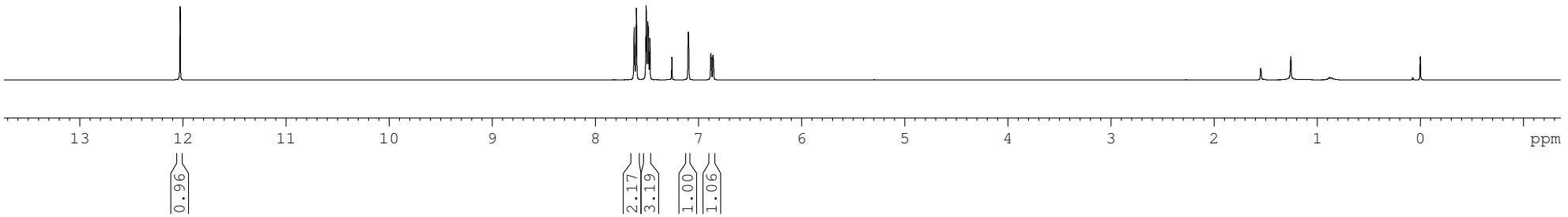



```
Current Data Parameters
NAME      20121112-ysy-1-150
EXPNO                    20
PROCNO                    1

F2 - Acquisition Parameters
Date_              20121112
Time                  20.29
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                   165.63
DW                   60.800 usec
DE                    6.50 usec
TE                   299.9 K
D1              1.00000000 sec
TD0                       1

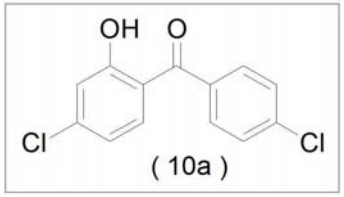
======== CHANNEL f1 ========
NUC1                     1H
P1                    14.77 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF             400.1300104 MHz
WDW                      EM
SSB       0
LB                    0.30 Hz
GB        0
PC                    1.00
```

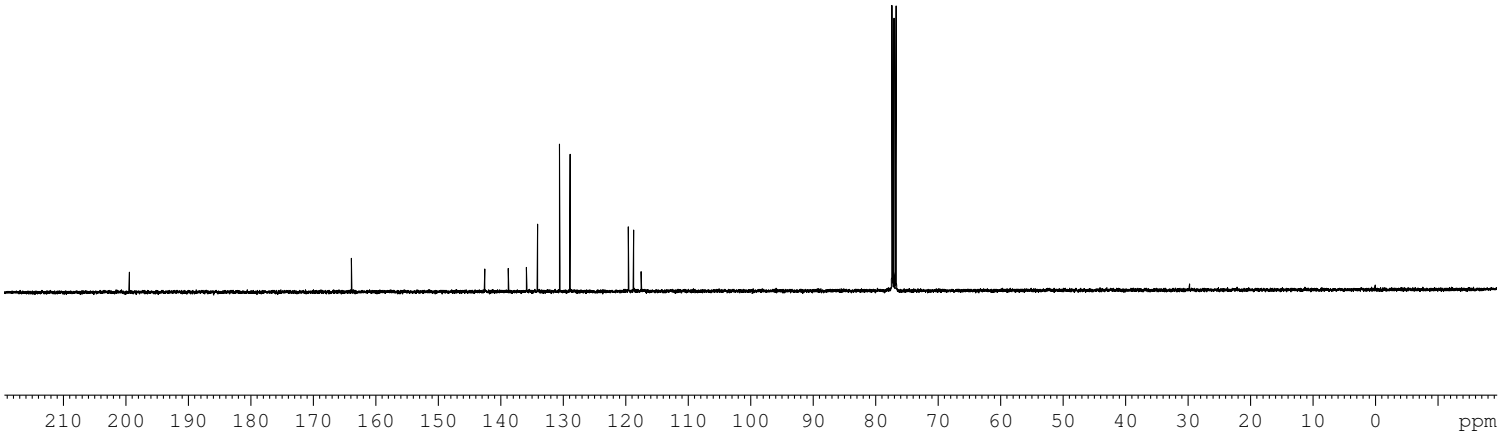


C13CPD CDCl3 {D:\NMR_DATA} RY 20

199.42
163.87
142.55
138.75
135.83
134.08
130.54
128.88
119.53
118.71
117.49
77.33
77.02
76.70



(10a)



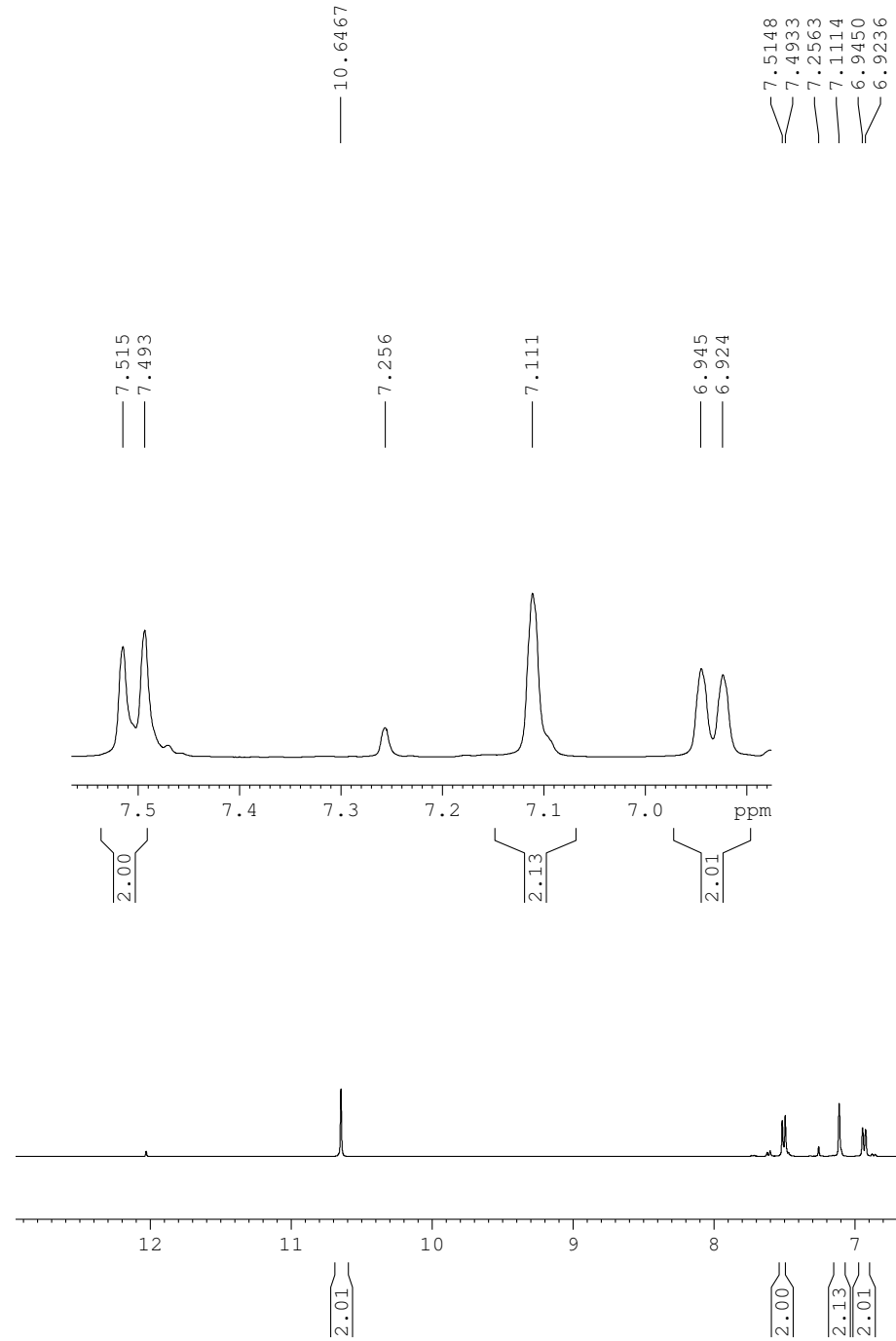

```
Current Data Parameters
NAME      20121112-YSY-1-151
EXPNO                    20
PROCNO                    1

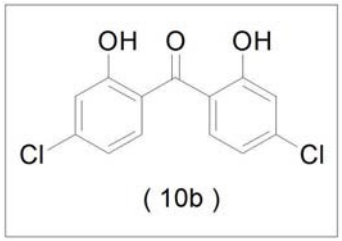
F2 - Acquisition Parameters
Date_            20121112
Time                21.51
INSTRUM             spect
PROBHD    5 mm PABBO BB-
PULPROG            zgpg30
TD                  65536
SOLVENT             CDCl3
NS                    512
DS                      4
SWH             24038.461 Hz
FIDRES           0.366798 Hz
AQ               1.3631988 sec
RG                 209.25
DW                 20.800 usec
DE                  6.50 usec
TE                 299.9 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   13C
P1                  10.30 usec
PLW1         50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                   1H
PCPD2               90.00 usec
PLW2         13.00199986 W
PLW12         0.35018000 W
PLW13         0.28364000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                  32768
SF           100.6127690 MHz
WDW                    EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```





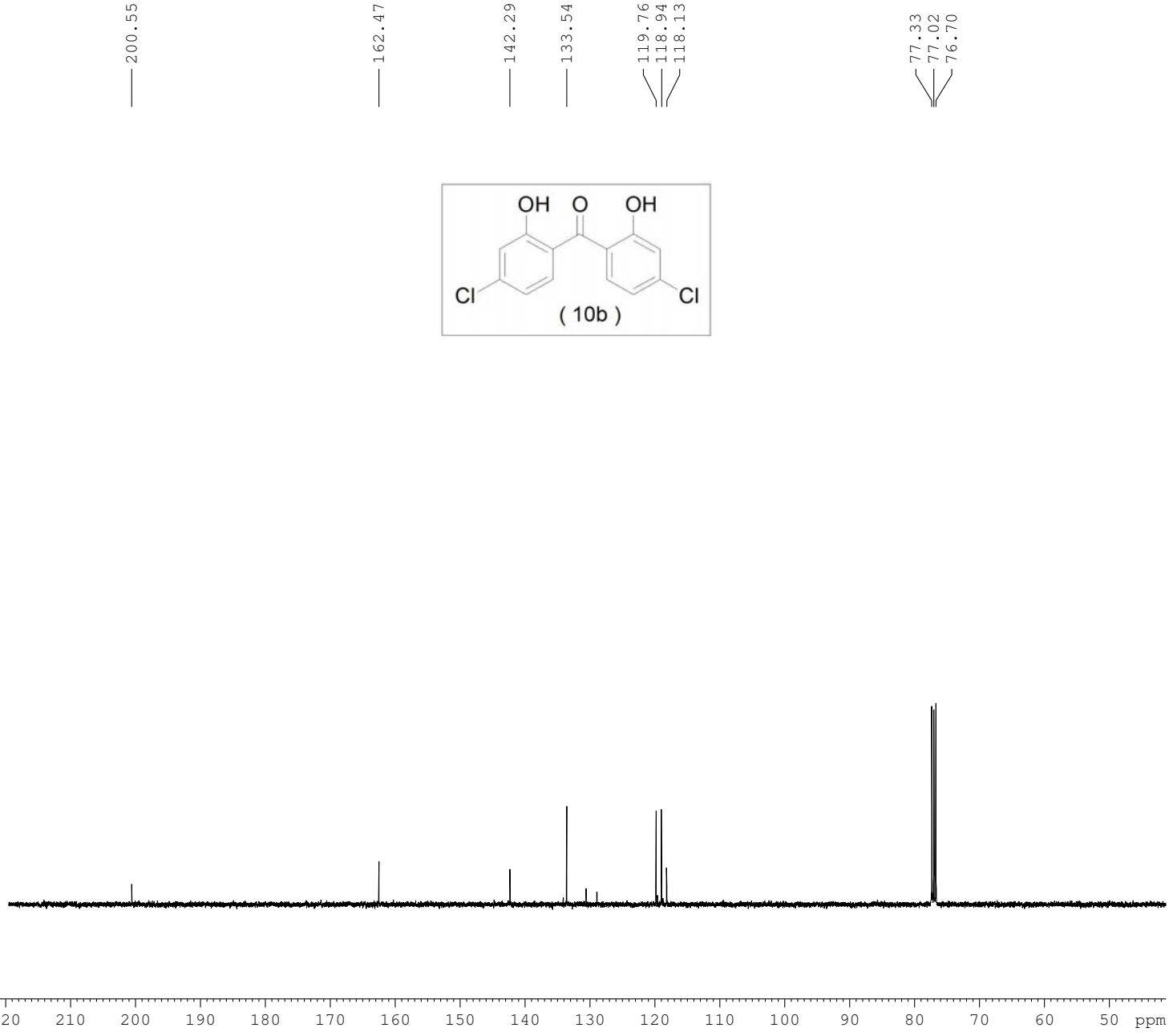

```
Current Data Parameters
NAME       HXS-3-249-2-H
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121021
Time               13.39
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             8223.685 Hz
FIDRES          0.125483 Hz
AQ             3.9846387 sec
RG                115.38
DW                60.800 usec
DE                 6.50 usec
TE                299.9 K
D1           1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                   1H
P1                 14.77 usec
PLW1         13.00199986 W
SFO1         400.1324710 MHz

F2 - Processing parameters
SI                 65536
SF           400.1300108 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```

C13CPD CDCl3 {D:\NMR_DATA} RY 60



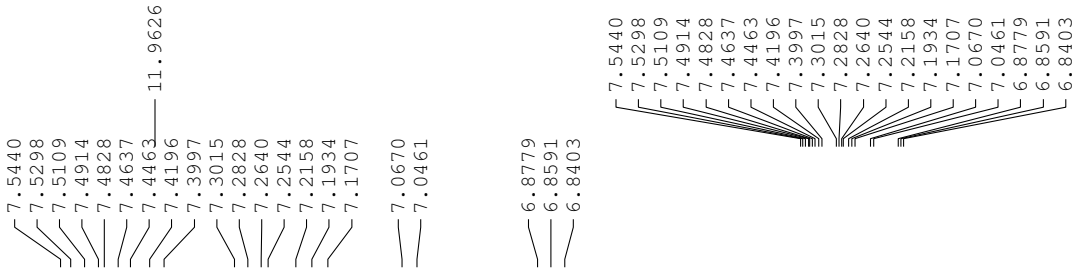

```
Current Data Parameters
NAME       HXS-3-249-2-C
EXPNO                 20
PROCNO                 1

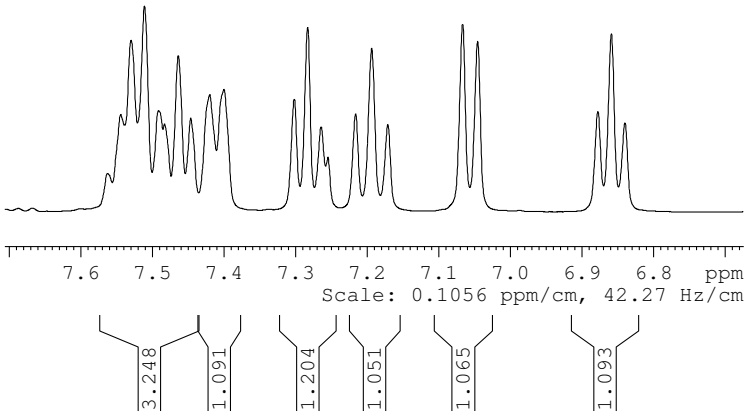
F2 - Acquisition Parameters
Date_           20121021
Time               13.59
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  100
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631988 sec
RG                165.63
DW                20.800 usec
DE                 6.50 usec
TE                299.9 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

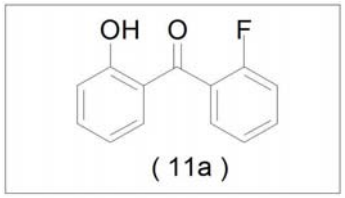
======== CHANNEL f1 ========
NUC1                 13C
P1                 10.30 usec
PLW1        50.00299835 W
SFO1       100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2              90.00 usec
PLW2        13.00199986 W
PLW12        0.35018000 W
PLW13        0.28364000 W
SFO2       400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF         100.6127690 MHz
WDW                  EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```





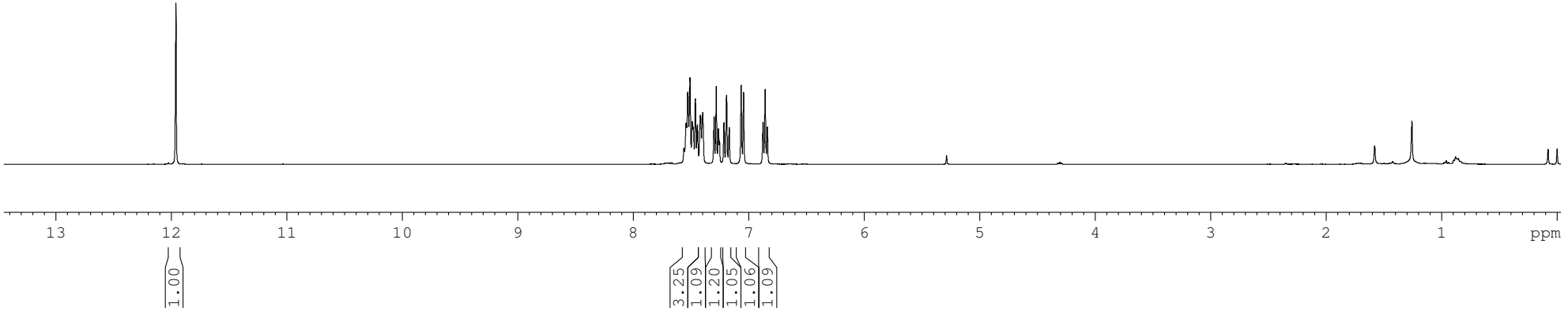



```
Current Data Parameters
NAME      SG-7-275-M-H-20121106
EXPNO                    20
PROCNO                    1

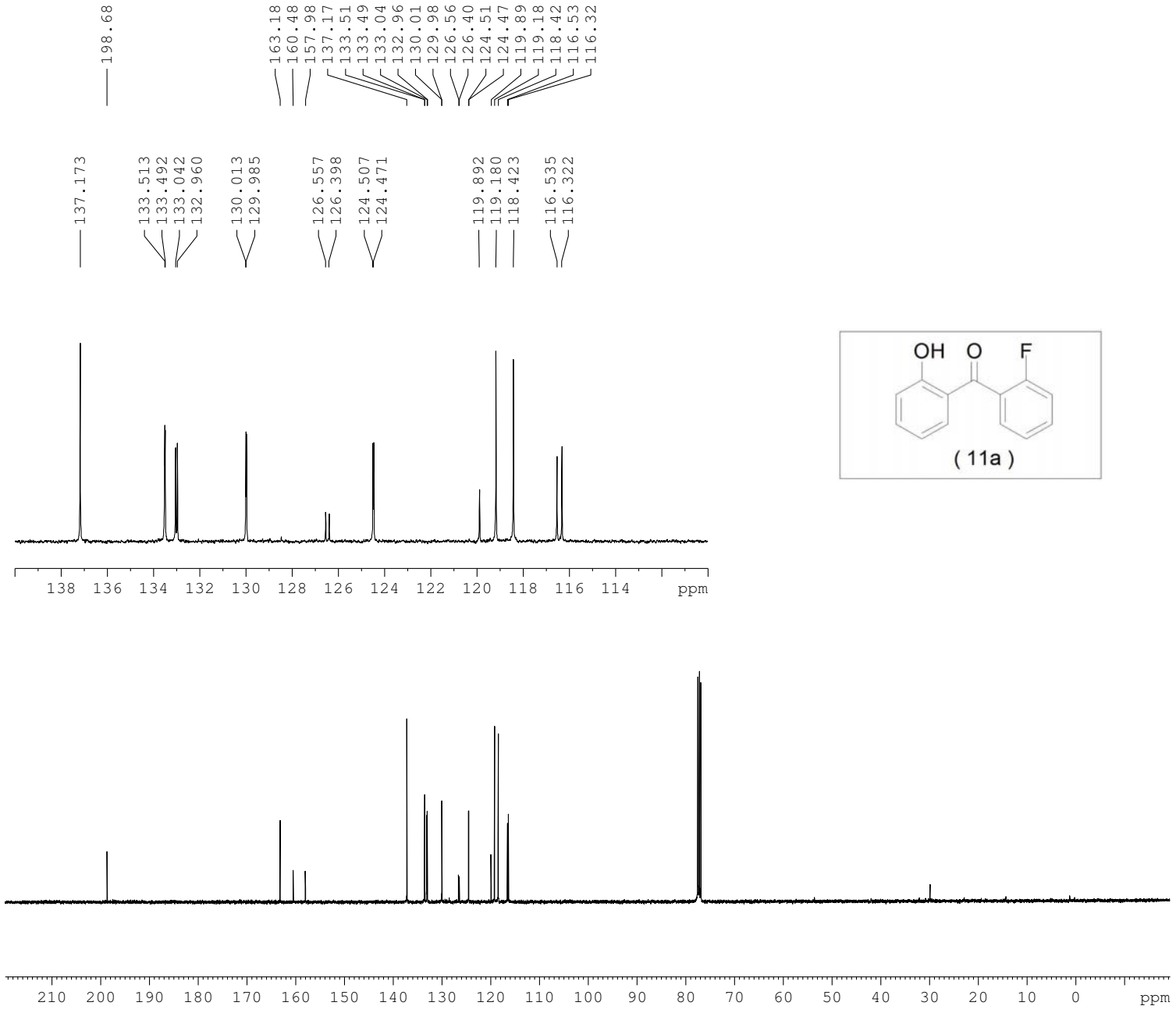
F2 - Acquisition Parameters
Date_           20121106
Time                23.49
INSTRUM             spect
PROBHD    5 mm PABBO BB-
PULPROG              zg30
TD                  65536
SOLVENT             CDCl3
NS                     16
DS                      2
SWH              8223.685 Hz
FIDRES           0.125483 Hz
AQ               3.9846387 sec
RG                  93.19
DW                 60.800 usec
DE                   6.50 usec
TE                  299.9 K
D1            1.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                 14.77 usec
PLW1         13.00199986 W
SFO1         400.1324710 MHz

F2 - Processing parameters
SI                  65536
SF           400.1300124 MHz
WDW                    EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```



C13CPD CDCl3 {D:\NMR_DATA} RY 5



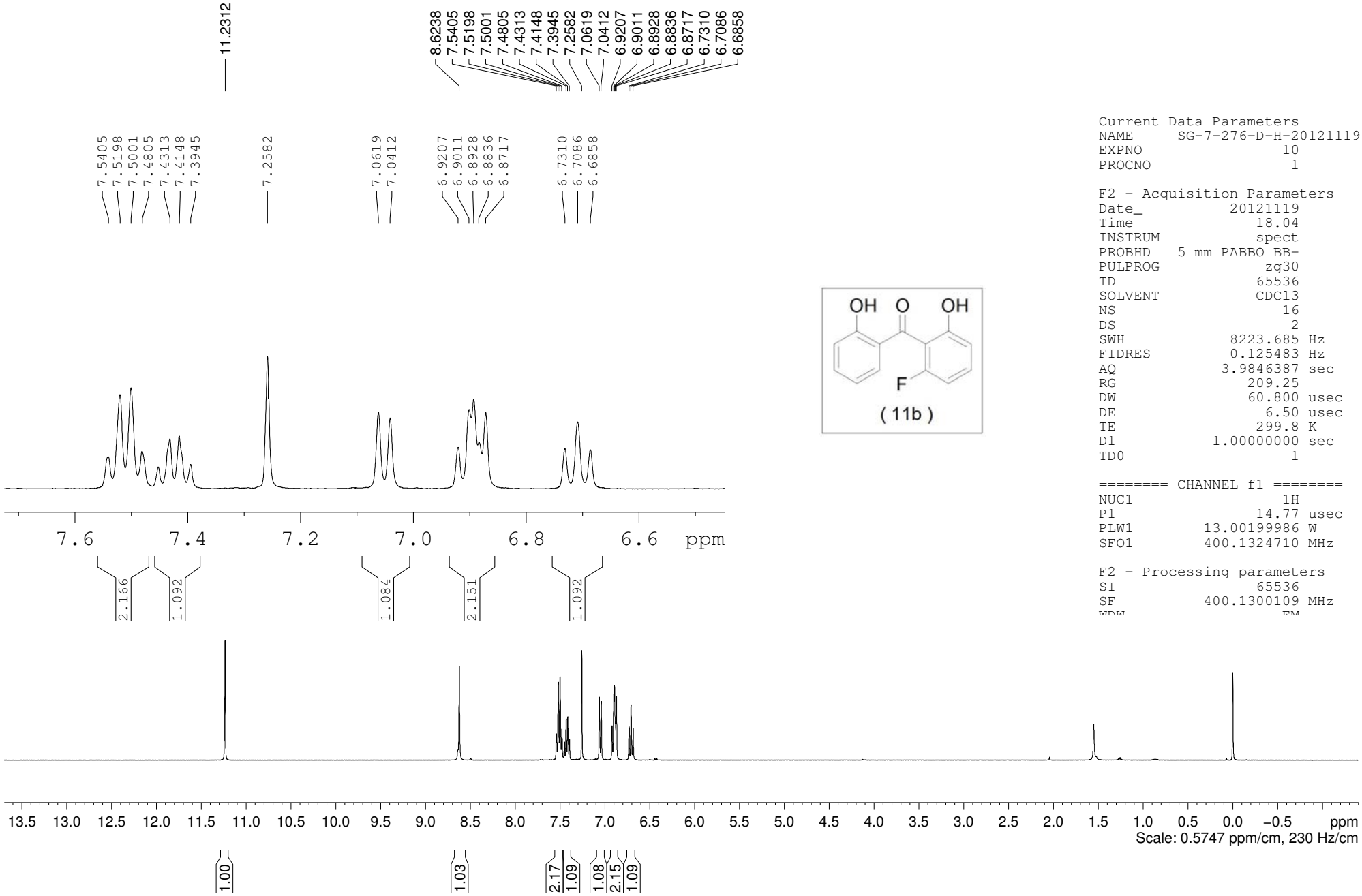

```
Current Data Parameters
NAME      SG-7-275-M-H-20121113
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121113
Time              23.33
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  512
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631988 sec
RG                209.25
DW                20.800 usec
DE                 6.50 usec
TE                299.9 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                13C
P1                10.30 usec
PLW1        50.00299835 W
SFO1       100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2         waltz16
NUC2                1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.35018000 W
PLW13        0.28364000 W
SFO2       400.1316005 MHz

F2 - Processing parameters
SI                32768
SF         100.6127572 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



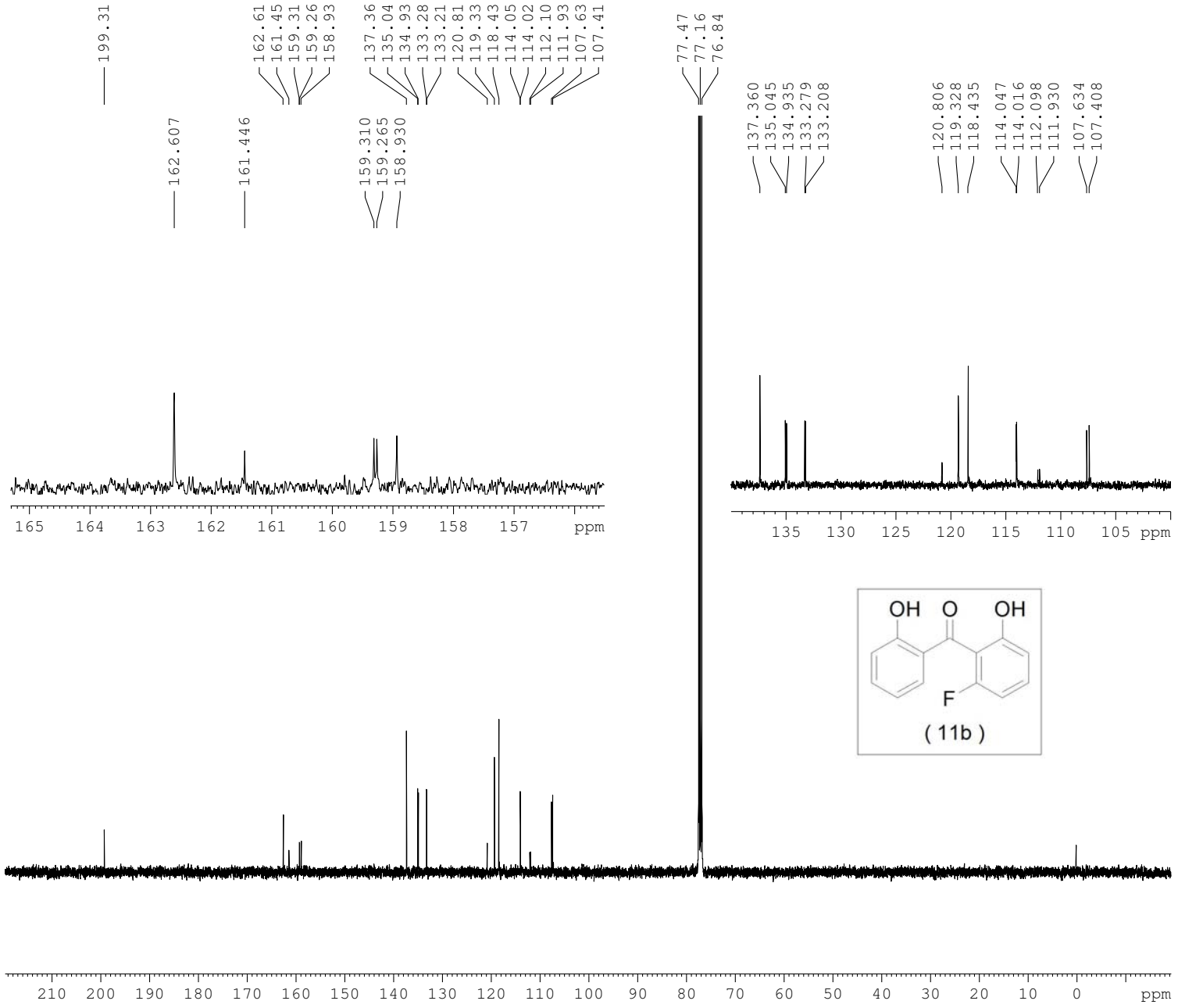

```
Current Data Parameters
NAME      SG-7-276-D-H-20121119
EXPNO                        10
PROCNO                        1

F2 - Acquisition Parameters
Date_              20121119
Time                  18.04
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                   209.25
DW                   60.800 usec
DE                    6.50 usec
TE                   299.8 K
D1              1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                     14.77 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF             400.1300109 MHz
WDW                       EM
```

C13CPD CDCl3 {D:\NMR_DATA} RY 41



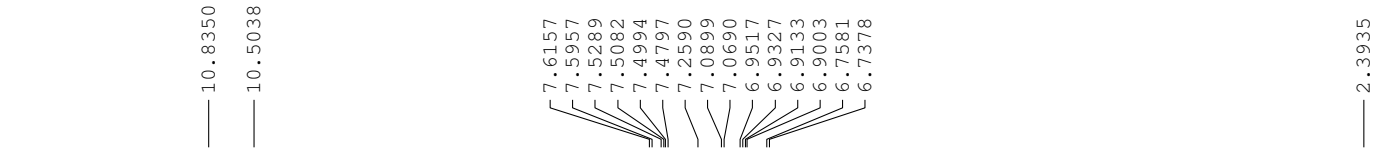
Current Data Parameters
NAME SG-7-275-D-C-20121121
EXPNO 10
PROCNO 1

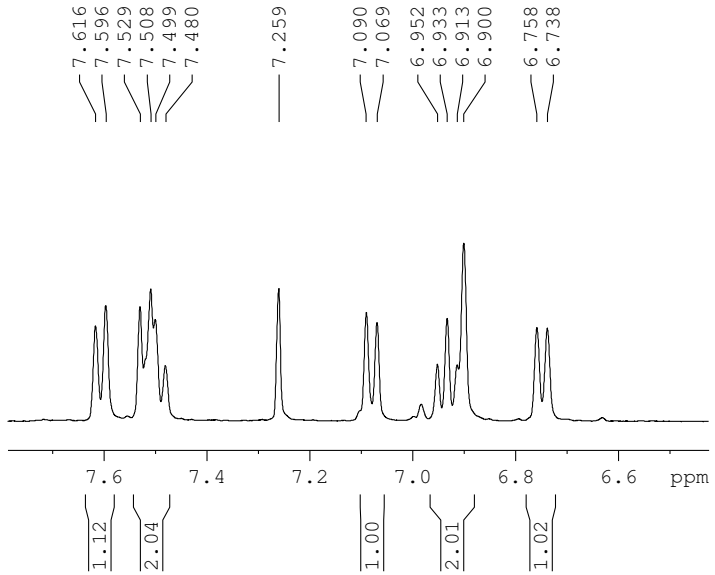
F2 - Acquisition Parameters
Date_ 20121121
Time 6.42
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 1600
DS 4
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 165.63
DW 20.800 usec
DE 6.50 usec
TE 299.9 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

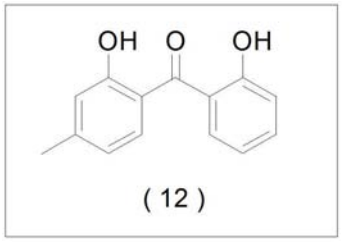
======== CHANNEL f1 ========
NUC1 13C
P1 10.30 usec
PLW1 50.00299835 W
SFO1 100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PLW2 13.00199986 W
PLW12 0.35018000 W
PLW13 0.28364000 W
SFO2 400.1316005 MHz

F2 - Processing parameters
SI 32768
SF 100.6127542 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40





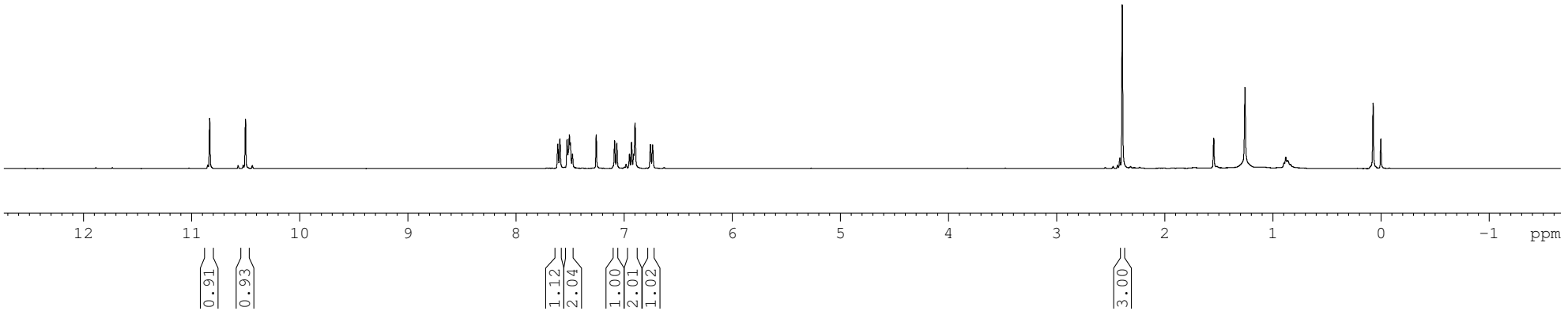



```
Current Data Parameters
NAME         20121105-yu
EXPNO                 10
PROCNO                 1

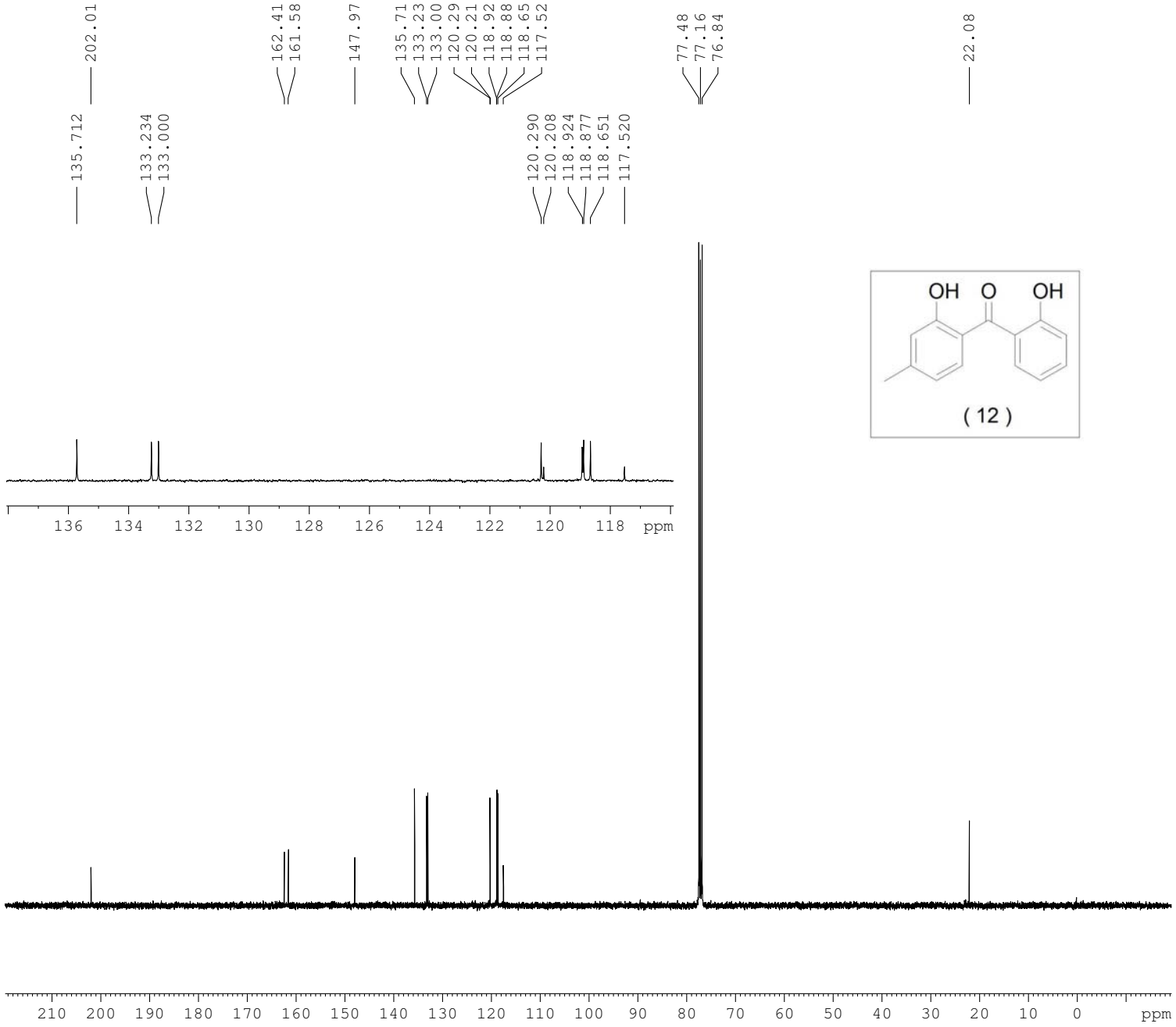
F2 - Acquisition Parameters
Date_           20121105
Time               20.11
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             8223.685 Hz
FIDRES          0.125483 Hz
AQ             3.9846387 sec
RG                184.16
DW                60.800 usec
DE                 6.50 usec
TE                299.9 K
D1            1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                   1H
P1                 14.77 usec
PLW1         13.00199986 W
SFO1         400.1324710 MHz

F2 - Processing parameters
SI                 65536
SF           400.1300106 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



C13CPD CDCl3 {D:\NMR_DATA} RY 55



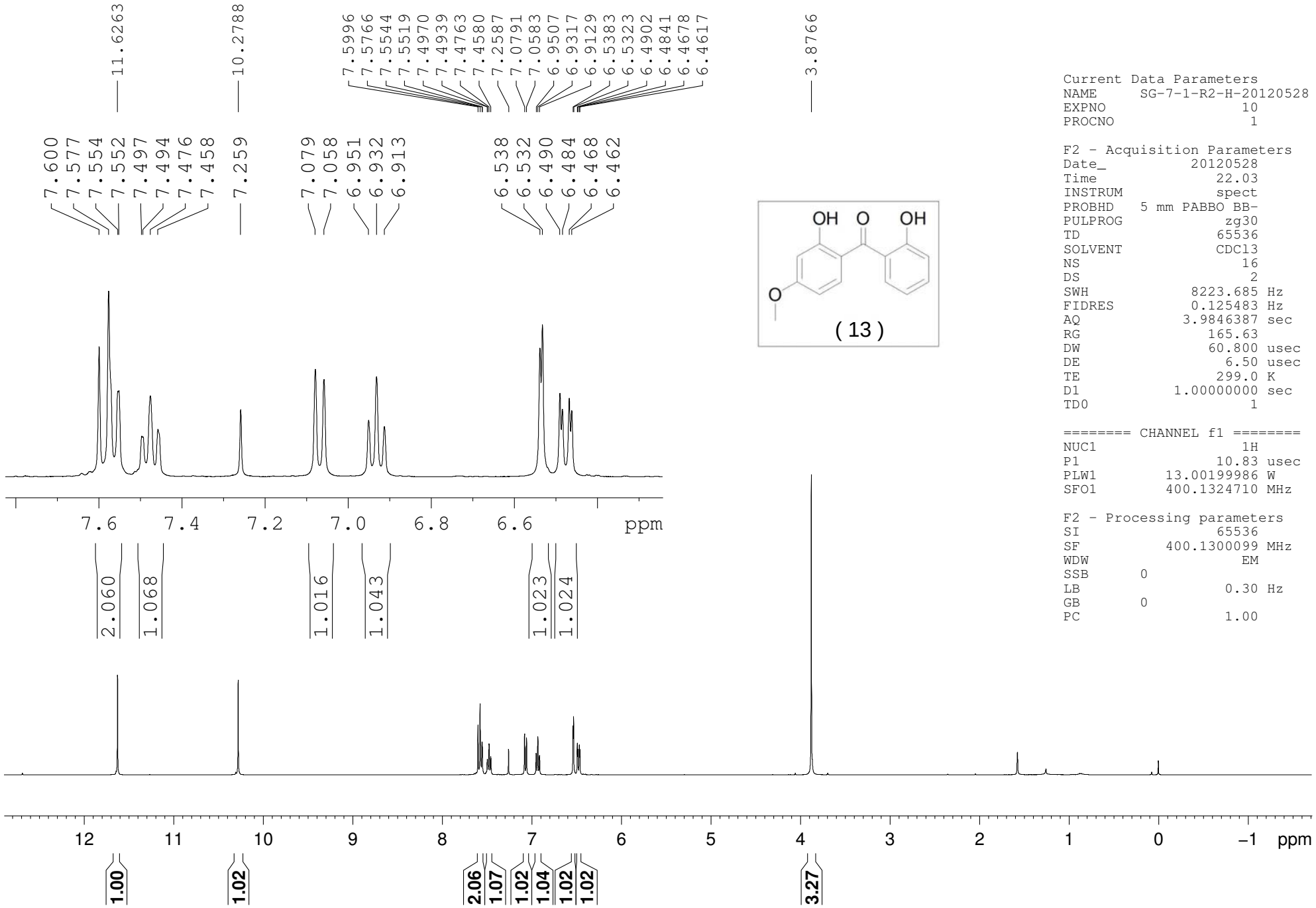

```
Current Data Parameters
NAME       20121107-yu-c
EXPNO                 20
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121107
Time               12.33
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  512
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631988 sec
RG                165.63
DW                20.800 usec
DE                 6.50 usec
TE                299.9 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.30 usec
PLW1         50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2         13.00199986 W
PLW12         0.35018000 W
PLW13         0.28364000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127546 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

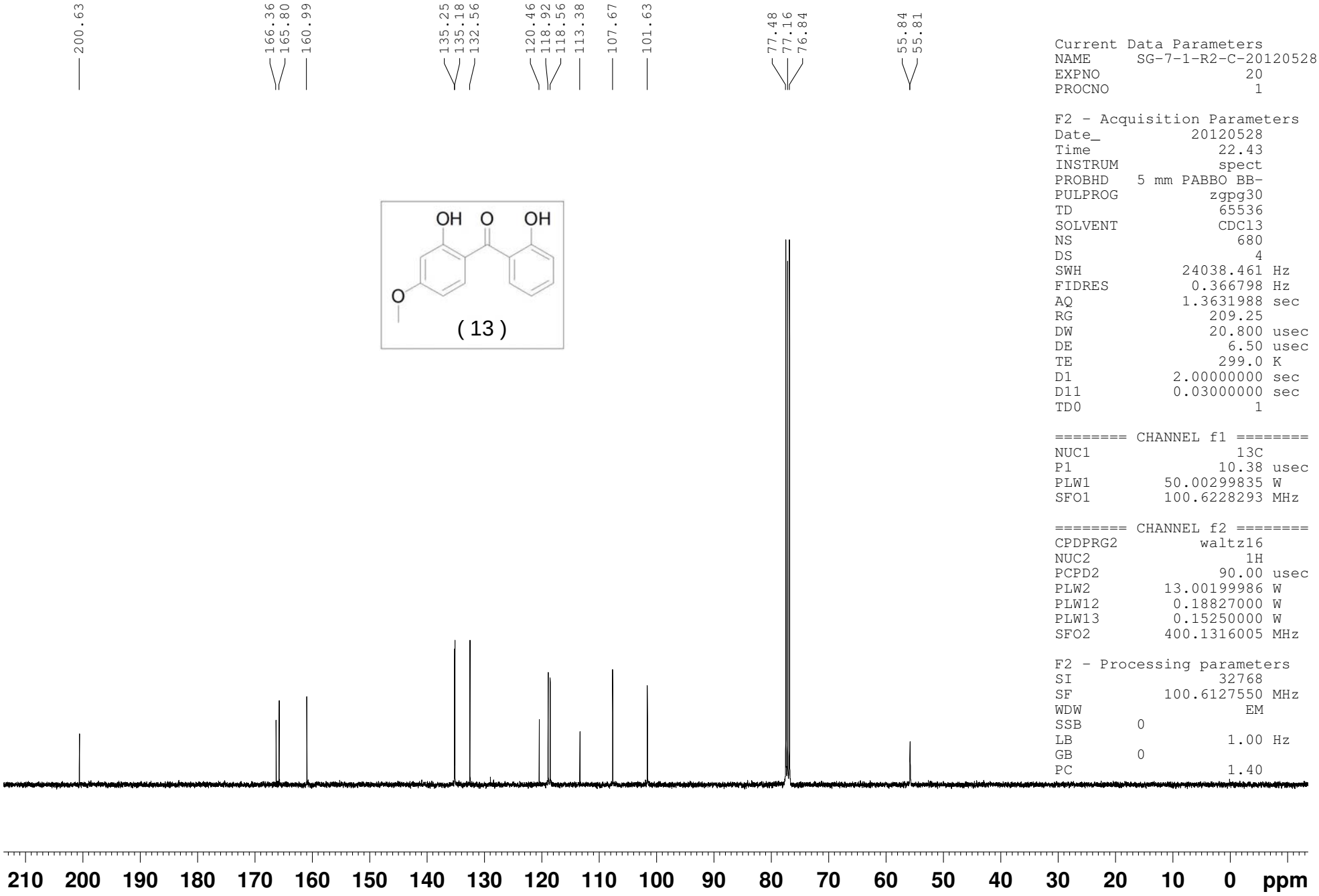



```
Current Data Parameters
NAME      SG-7-1-R2-H-20120528
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_              20120528
Time                  22.03
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                8223.685 Hz
FIDRES             0.125483 Hz
AQ                 3.9846387 sec
RG                    165.63
DW                    60.800 usec
DE                     6.50 usec
TE                    299.0 K
D1              1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                     10.83 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF             400.1300099 MHz
WDW                      EM
SSB       0
LB                     0.30 Hz
GB        0
PC                     1.00
```



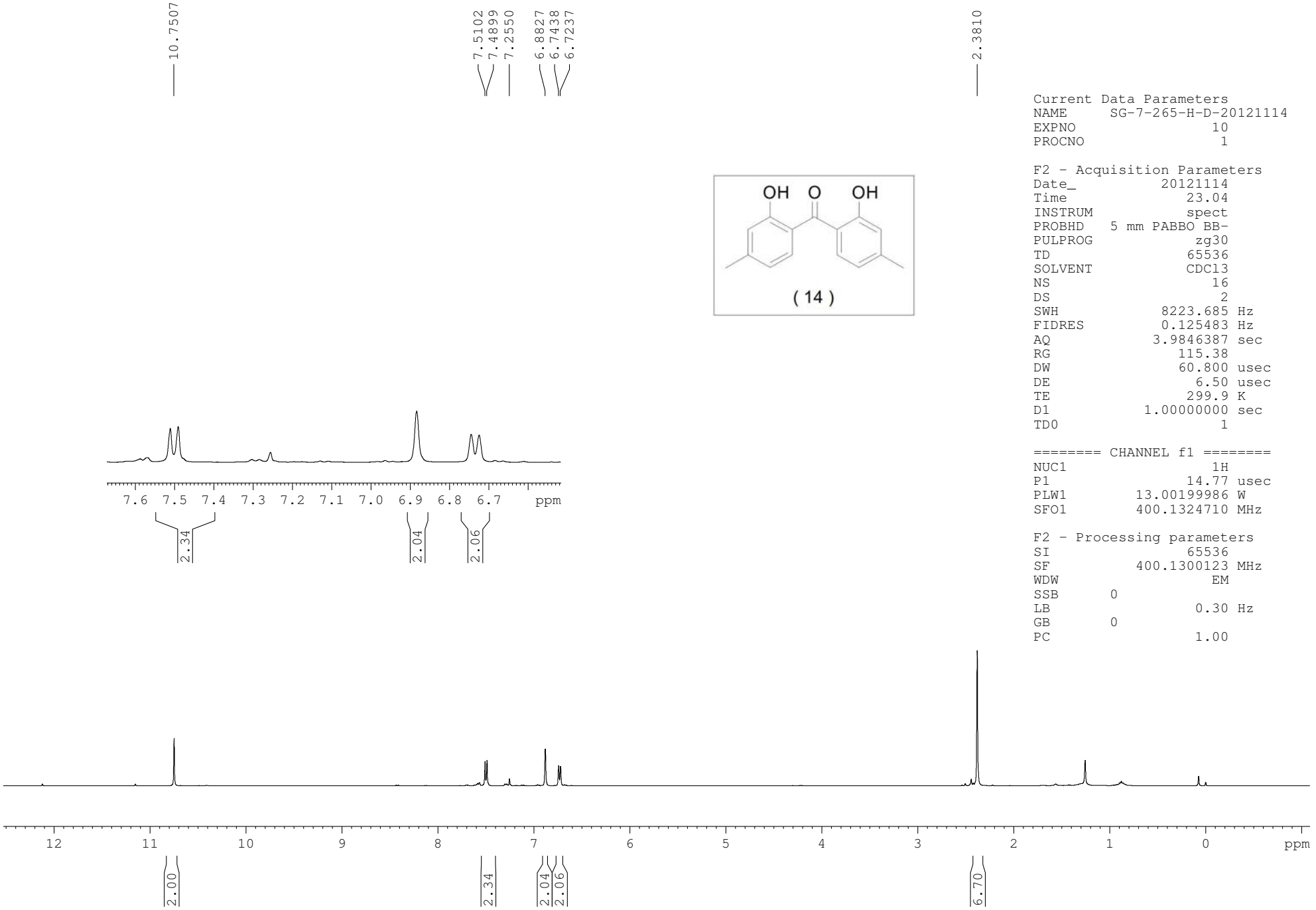

```
Current Data Parameters
NAME      SG-7-1-R2-C-20120528
EXPNO                      20
PROCNO                      1

F2 - Acquisition Parameters
Date_            20120528
Time                22.43
INSTRUM             spect
PROBHD   5 mm PABBO BB-
PULPROG            zgpg30
TD                  65536
SOLVENT             CDCl3
NS                    680
DS                      4
SWH             24038.461 Hz
FIDRES           0.366798 Hz
AQ               1.3631988 sec
RG                 209.25
DW                 20.800 usec
DE                  6.50 usec
TE                 299.0 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                  13C
P1                  10.38 usec
PLW1          50.00299835 W
SFO1         100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2           waltz16
NUC2                  1H
PCPD2               90.00 usec
PLW2          13.00199986 W
PLW12          0.18827000 W
PLW13          0.15250000 W
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                  32768
SF           100.6127550 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```



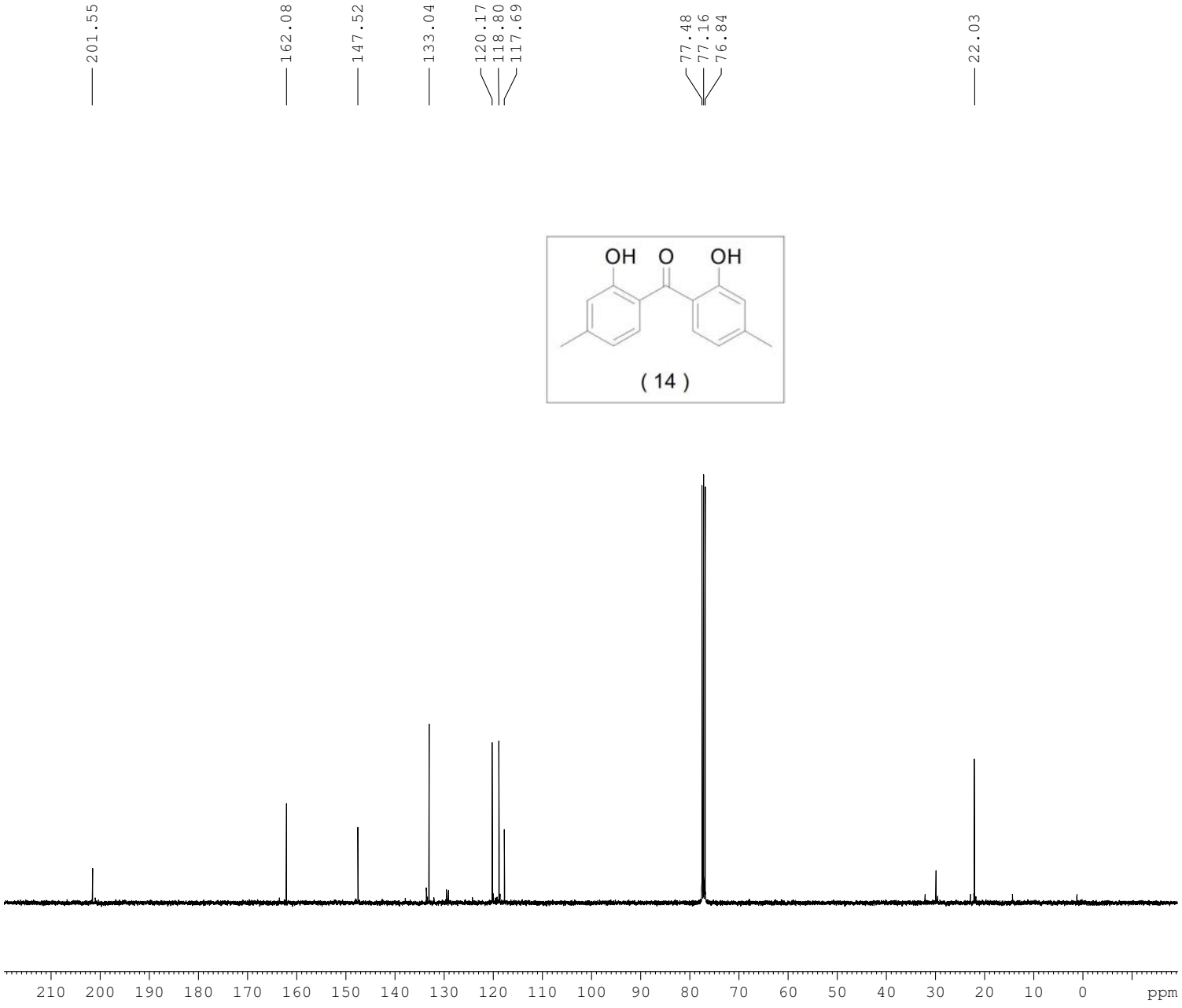

```
Current Data Parameters
NAME      SG-7-265-H-D-20121114
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_               20121114
Time                   23.04
INSTRUM                spect
PROBHD    5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                   115.38
DW                   60.800 usec
DE                    6.50 usec
TE                   299.9 K
D1              1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                    14.77 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF             400.1300123 MHz
WDW                      EM
SSB       0
LB                    0.30 Hz
GB        0
PC                    1.00
```

C13CPD CDCl3 {D:\NMR_DATA} RY 11



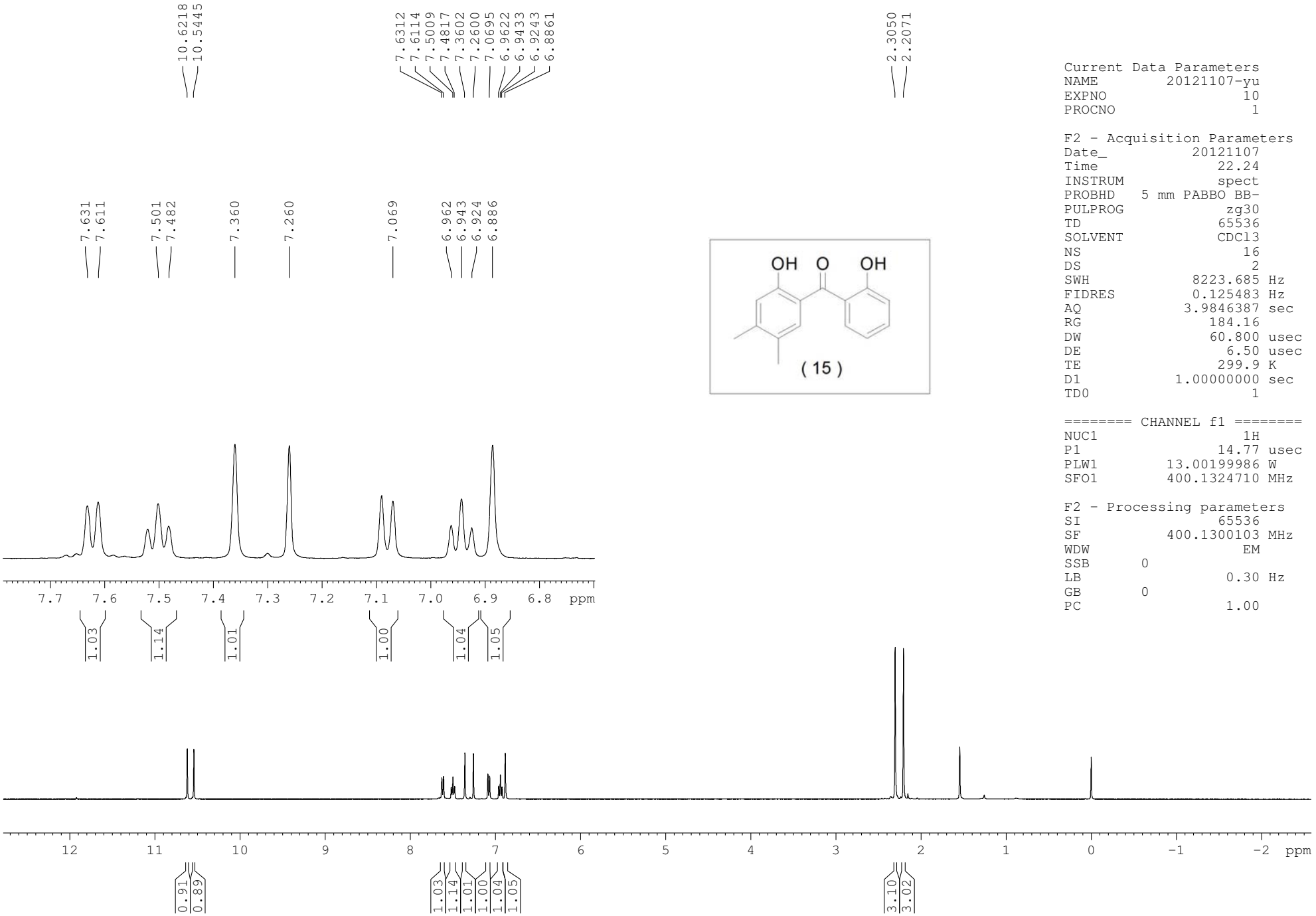

```
Current Data Parameters
NAME      SG-7-265-D-H-20121115
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_            20121115
Time                15.03
INSTRUM             spect
PROBHD    5 mm PABBO BB-
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   512
DS                     4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ              1.3631988 sec
RG                 184.16
DW                 20.800 usec
DE                  6.50 usec
TE                 299.9 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  13C
P1                  10.30 usec
PLW1         50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2           waltz16
NUC2                  1H
PCPD2               90.00 usec
PLW2         13.00199986 W
PLW12         0.35018000 W
PLW13         0.28364000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                  32768
SF          100.6127552 MHz
WDW                    EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```



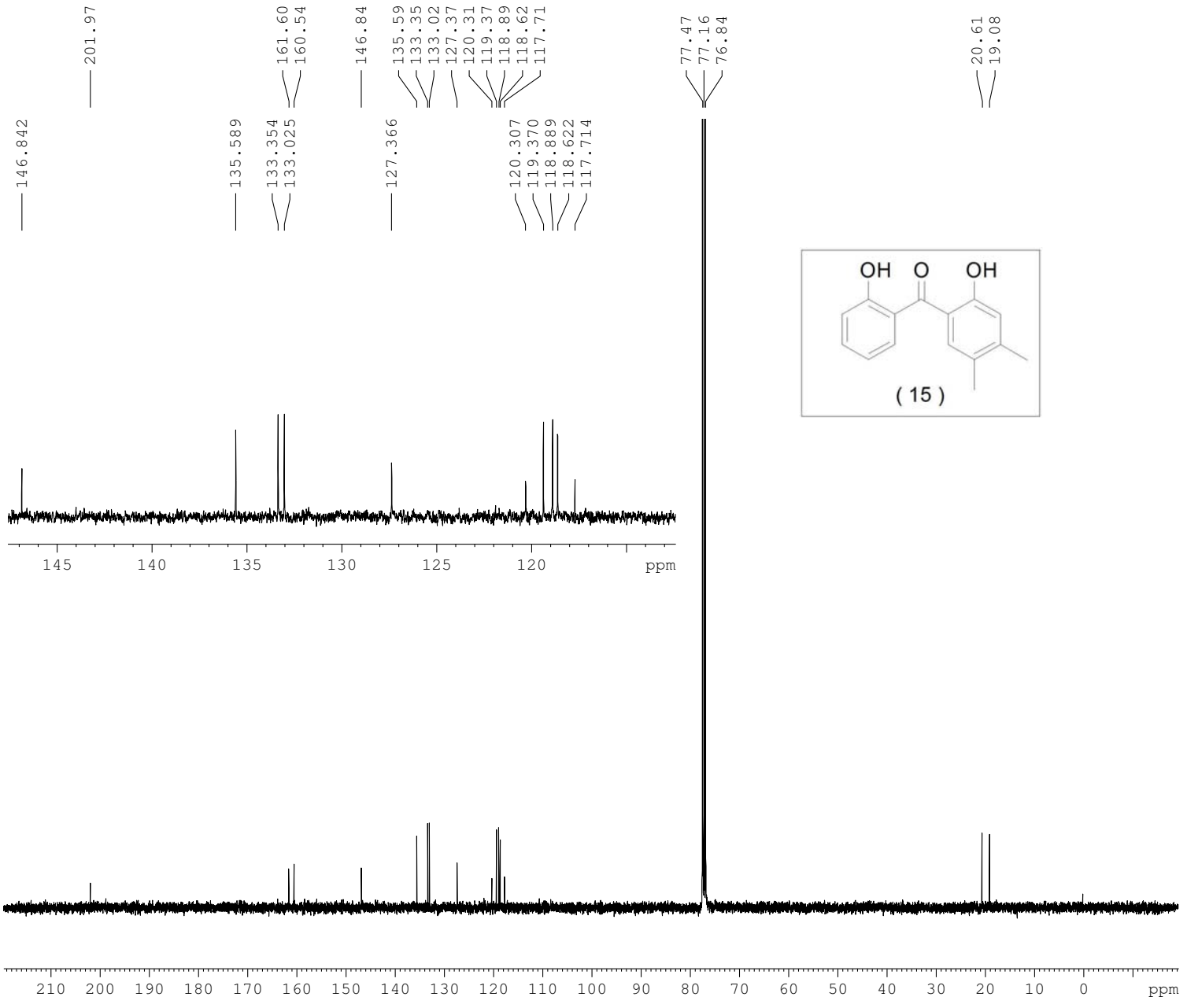

```
Current Data Parameters
NAME         20121107-yu
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121107
Time               22.24
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             8223.685 Hz
FIDRES          0.125483 Hz
AQ             3.9846387 sec
RG                184.16
DW                60.800 usec
DE                 6.50 usec
TE                299.9 K
D1           1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                14.77 usec
PLW1         13.00199986 W
SFO1         400.1324710 MHz

F2 - Processing parameters
SI                 65536
SF          400.1300103 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```

C13CPD CDCl3 {D:\NMR_DATA} RY 49



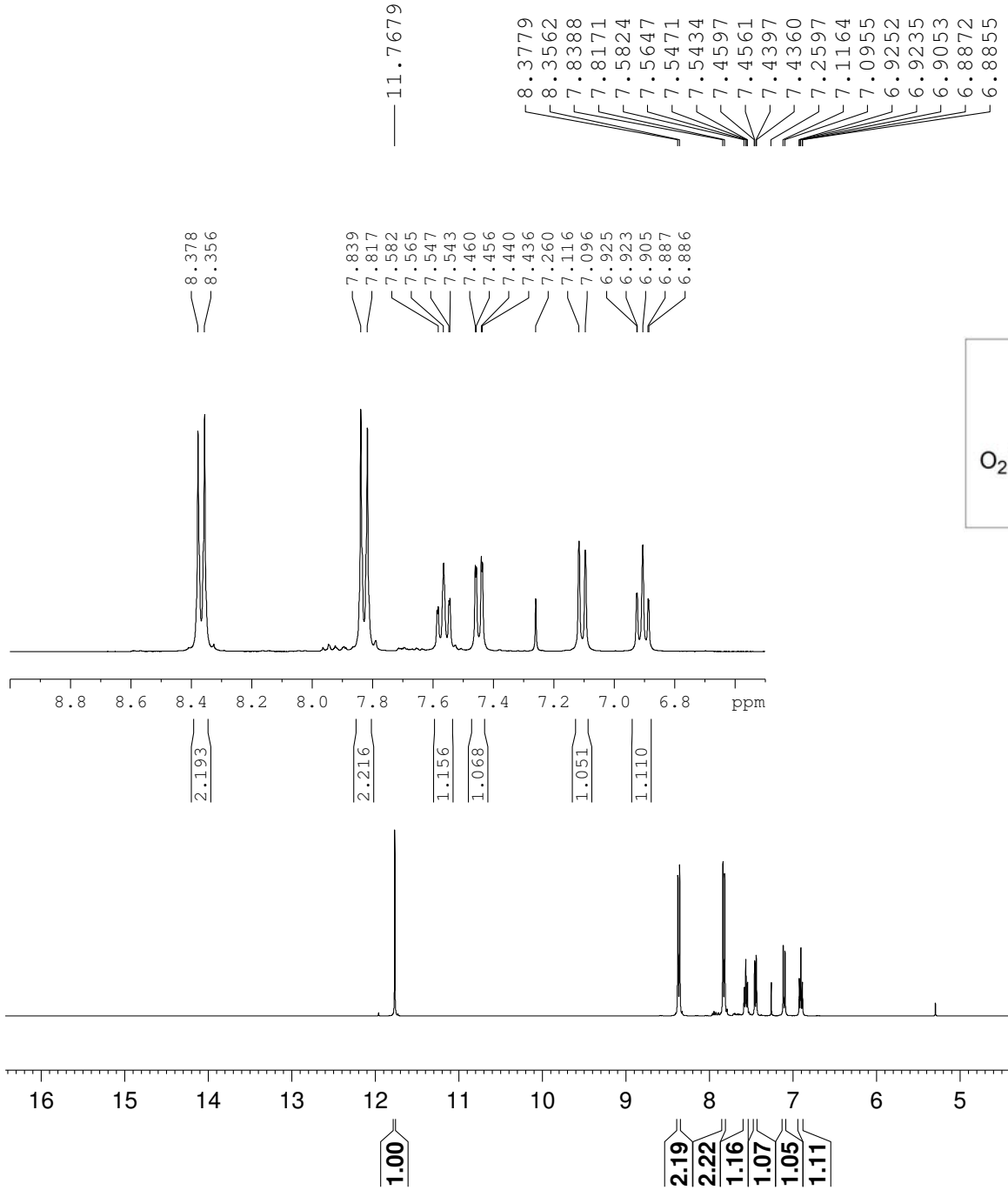

```
Current Data Parameters
NAME         20121107-yu
EXPNO                 11
PROCNO                 1

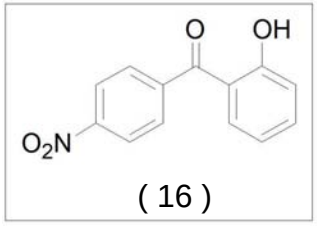
F2 - Acquisition Parameters
Date_           20121108
Time                2.10
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  512
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631988 sec
RG                209.25
DW                20.800 usec
DE                 6.50 usec
TE                299.9 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.30 usec
PLW1         50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2         13.00199986 W
PLW12         0.35018000 W
PLW13         0.28364000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF           100.6127541 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```





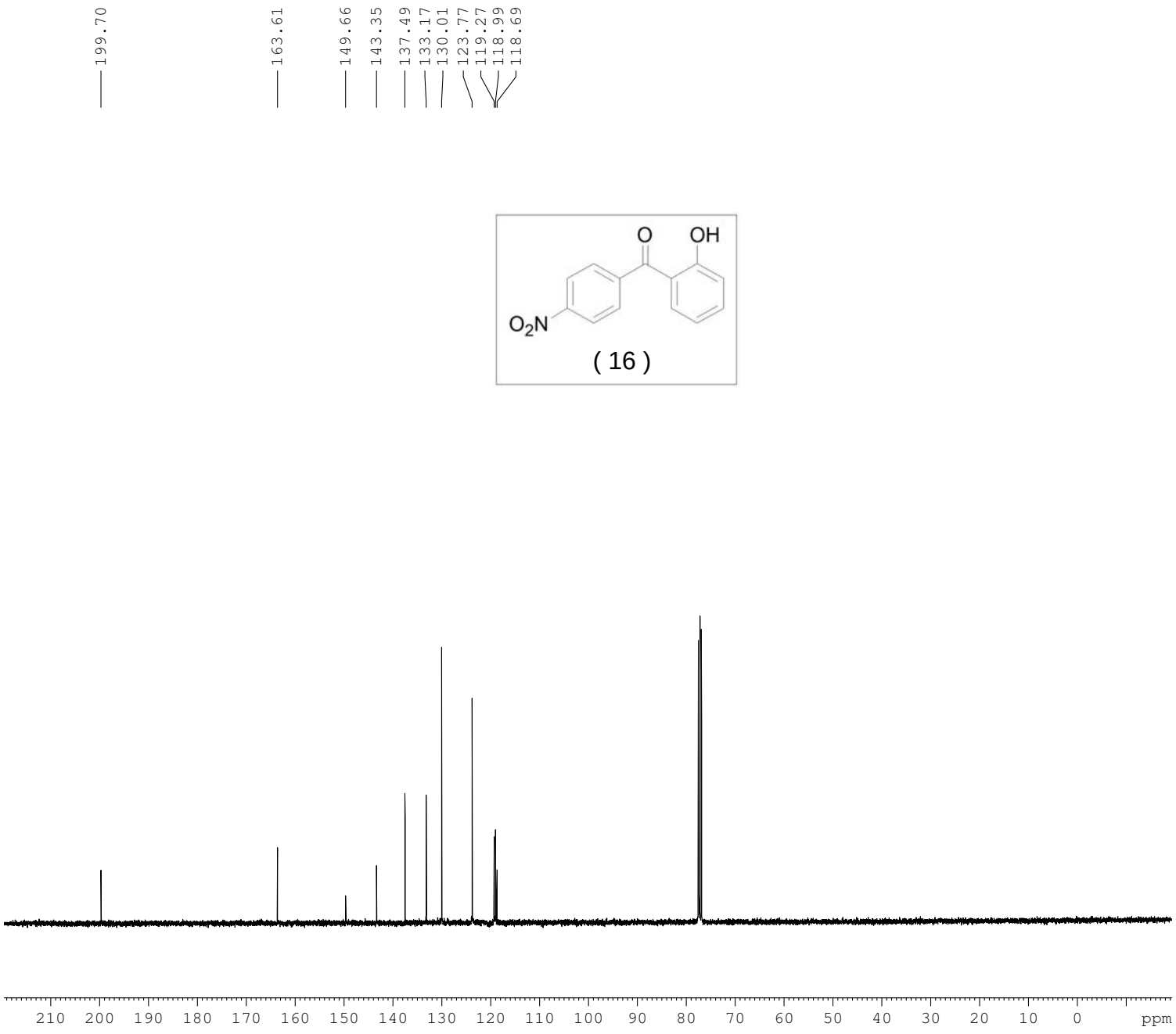
(16)

```
Current Data Parameters
NAME      20120516-mll-2-281
EXPNO                    11
PROCNO                    1

F2 - Acquisition Parameters
Date_              20120516
Time                  15.59
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                8223.685 Hz
FIDRES             0.125483 Hz
AQ                 3.9846387 sec
RG                    165.63
DW                    60.800 usec
DE                     6.50 usec
TE                    299.0 K
D1              1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                    10.83 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF             400.1300091 MHz
WDW                      EM
SSB       0
LB                    0.30 Hz
GB        0
PC                    1.00
```



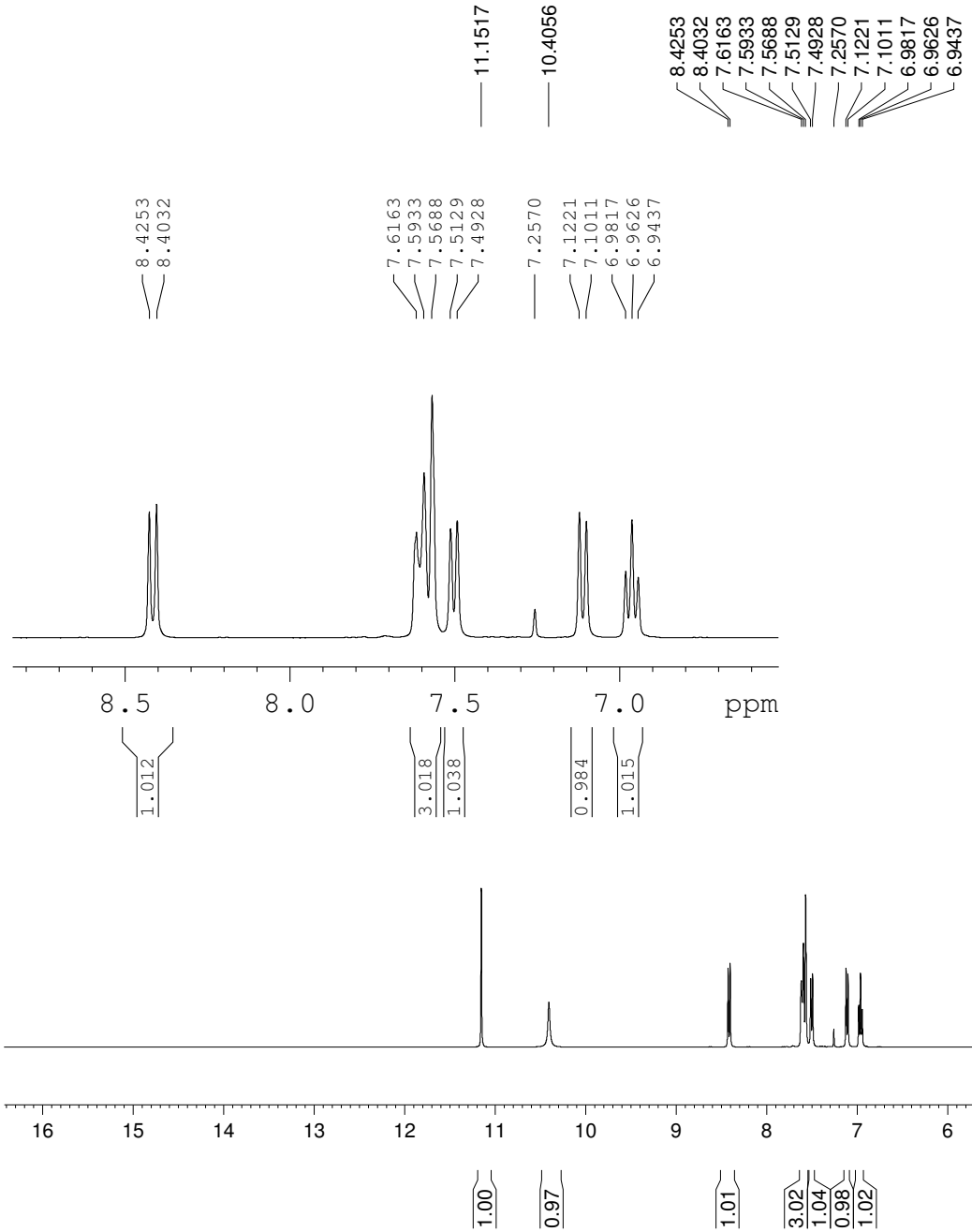

```
Current Data Parameters
NAME      20120516-mll-2-281-c
EXPNO                      12
PROCNO                      1

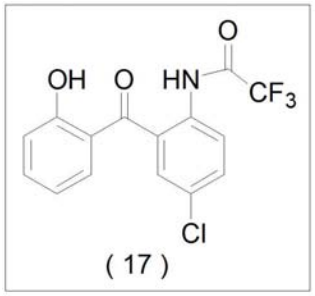
F2 - Acquisition Parameters
Date_              20120516
Time                  16.50
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG              zgpg30
TD                    65536
SOLVENT               CDCl3
NS                      203
DS                        4
SWH               24038.461 Hz
FIDRES             0.366798 Hz
AQ                 1.3631988 sec
RG                    209.25
DW                    20.800 usec
DE                     6.50 usec
TE                    299.0 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                         1

======== CHANNEL f1 ========
NUC1                      13C
P1                      10.38 usec
PLW1           50.00299835 W
SFO1           100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2              waltz16
NUC2                      1H
PCPD2                  90.00 usec
PLW2           13.00199986 W
PLW12           0.18827000 W
PLW13           0.15250000 W
SFO2           400.1316005 MHz

F2 - Processing parameters
SI                        32768
SF             100.6127564 MHz
WDW                        EM
SSB       0
LB                      1.00 Hz
GB        0
PC                      1.40
```





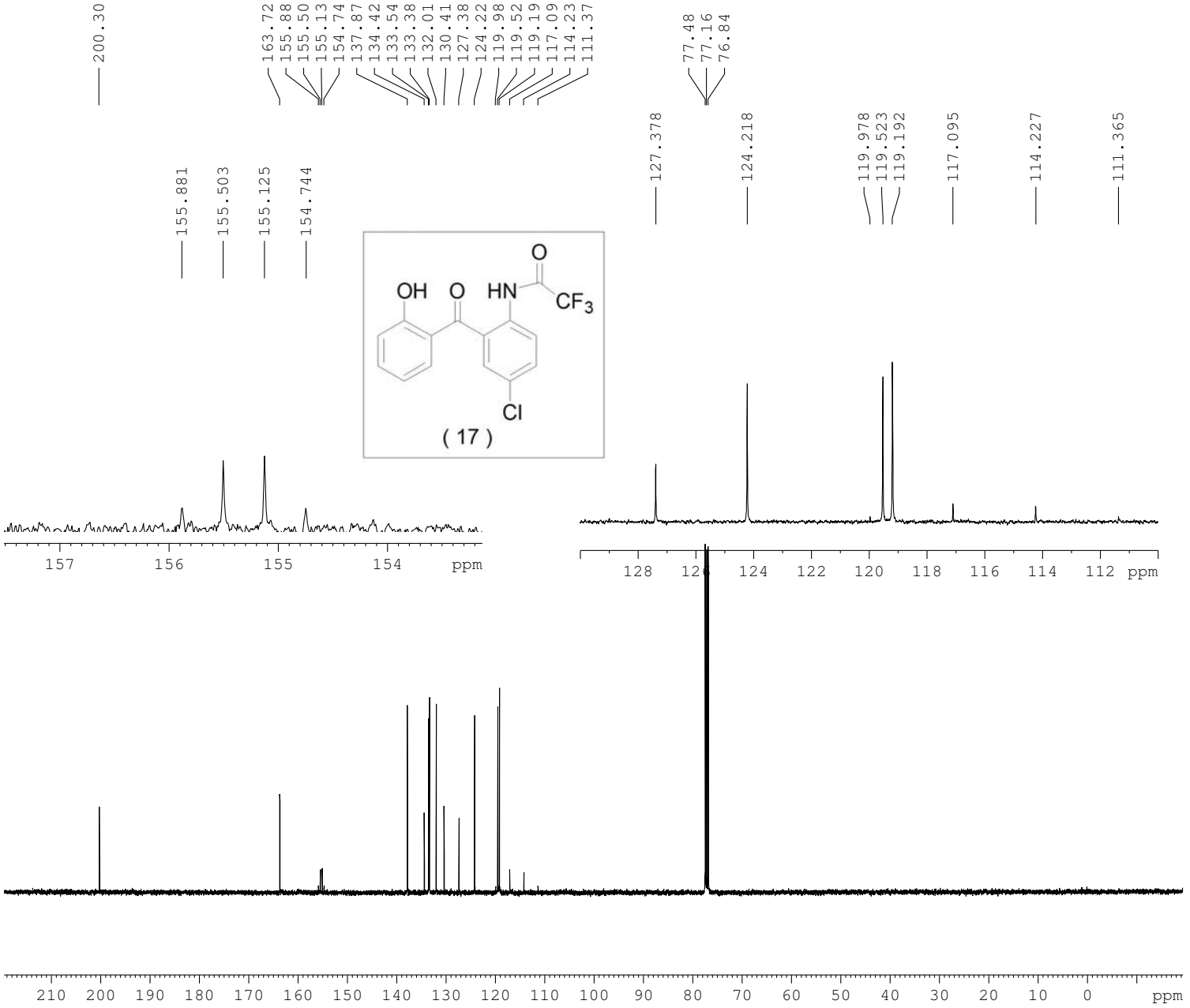

```
Current Data Parameters
NAME      SG-7-261-H-20121106
EXPNO                      20
PROCNO                      1

F2 - Acquisition Parameters
Date_              20121106
Time                  22.21
INSTRUM               spect
PROBHD   5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                    93.19
DW                   60.800 usec
DE                    6.50 usec
TE                   299.9 K
D1              1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                     14.77 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF             400.1300114 MHz
WDW                       EM
```

C13CPD CDCl3 {D:\NMR_DATA} RY 36



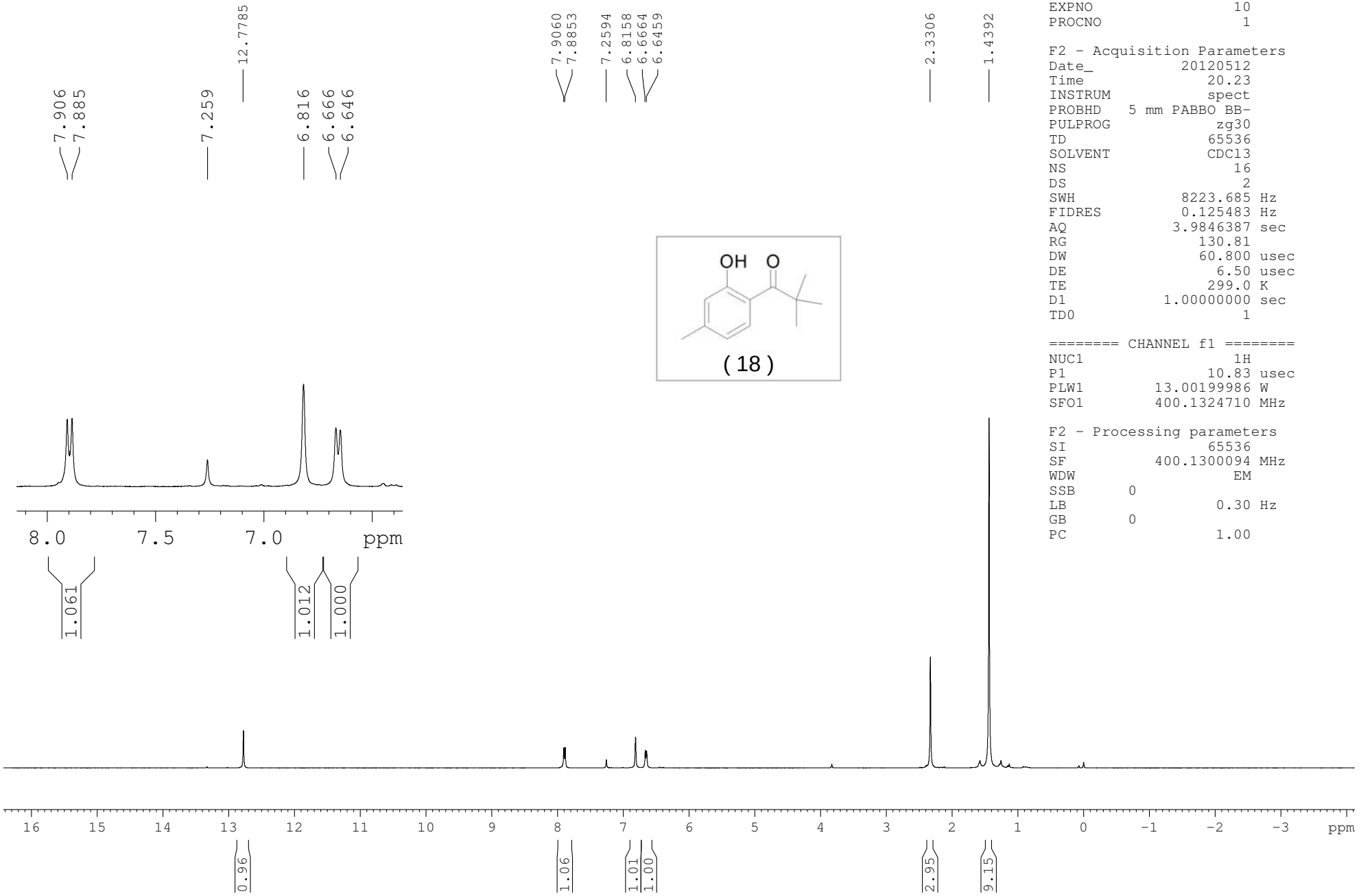

```
Current Data Parameters
NAME      SG-7-261-C-20121108
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_              20121108
Time                  23.18
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG             zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     256
DS                       4
SWH              24038.461 Hz
FIDRES            0.366798 Hz
AQ                1.3631988 sec
RG                   209.25
DW                   20.800 usec
DE                    6.50 usec
TE                   299.9 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   10.30 usec
PLW1          50.00299835 W
SFO1         100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2            waltz16
NUC2                   1H
PCPD2                90.00 usec
PLW2          13.00199986 W
PLW12          0.35018000 W
PLW13          0.28364000 W
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                     32768
SF            100.6127556 MHz
WDW                       EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```

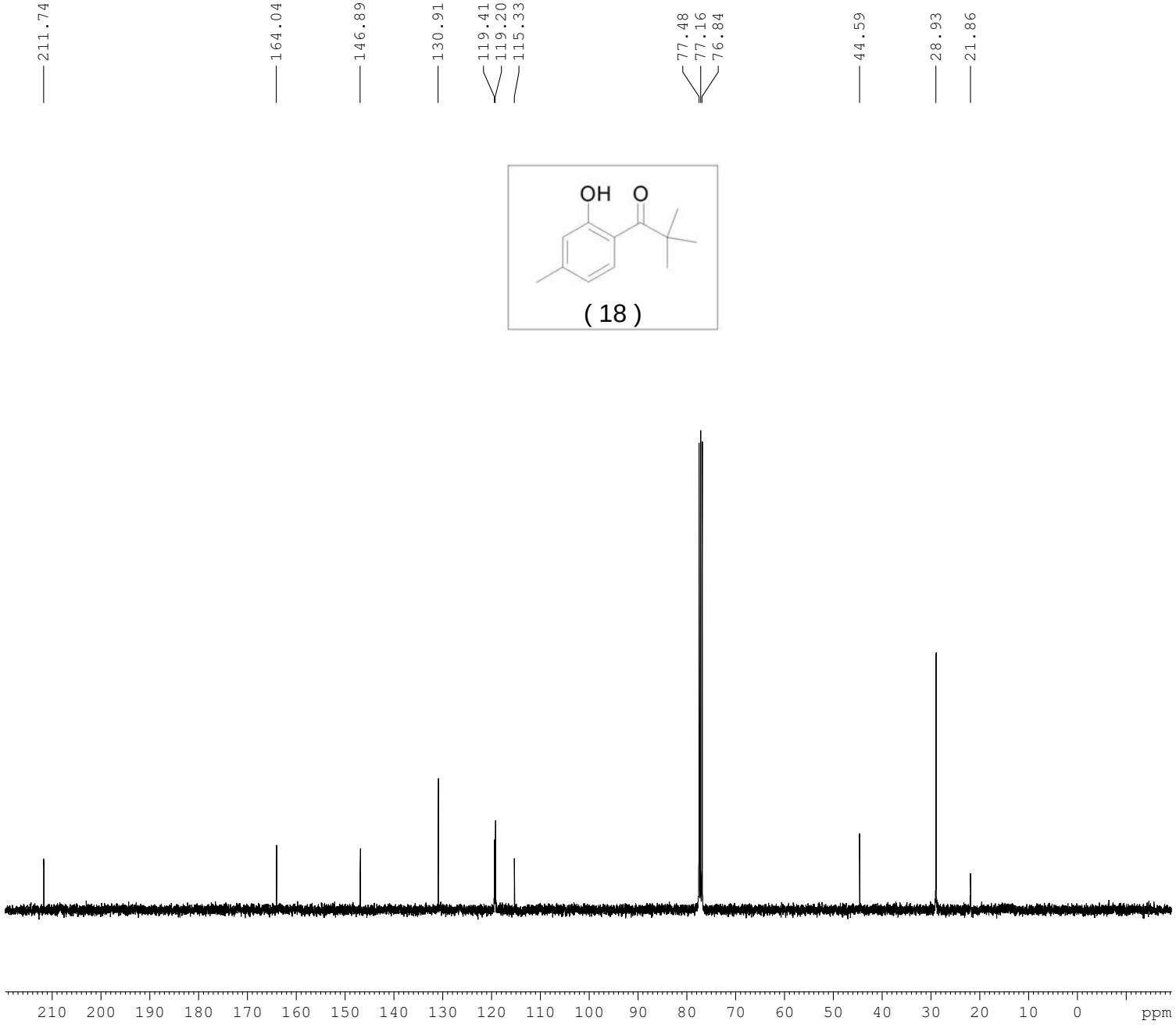



```
Current Data Parameters
NAME      YXL-2-54-H-C-20120512
EXPNO                   10
PROCNO                   1

F2 - Acquisition Parameters
Date_           20120512
Time               20.23
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             8223.685 Hz
FIDRES          0.125483 Hz
AQ             3.9846387 sec
RG                130.81
DW                60.800 usec
DE                 6.50 usec
TE                299.0 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                   1H
P1                 10.83 usec
PLW1         13.00199986 W
SFO1         400.1324710 MHz

F2 - Processing parameters
SI                 65536
SF          400.1300094 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



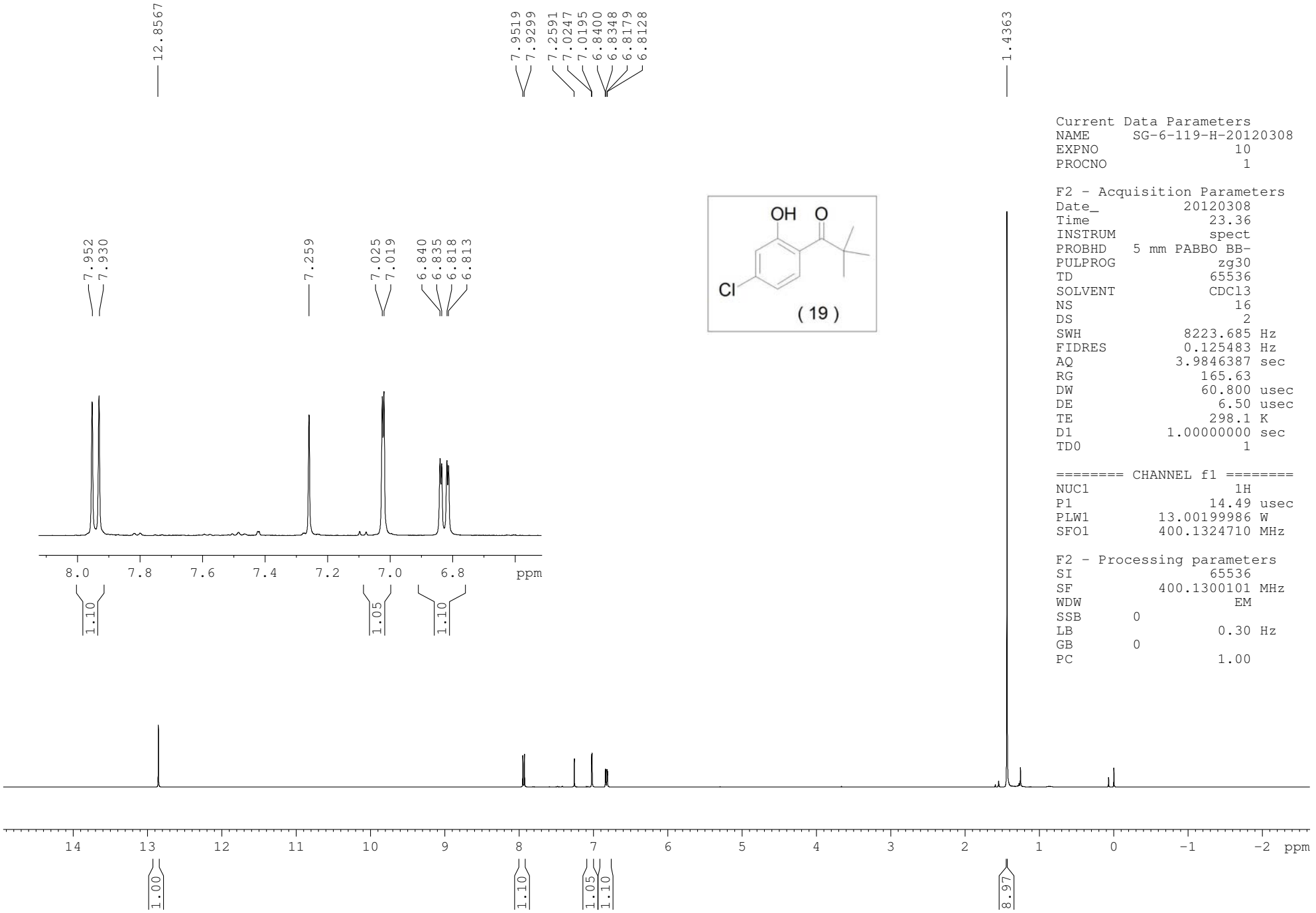

```
Current Data Parameters
NAME      YXL-2-21-C-20120512
EXPNO                      20
PROCNO                      1

F2 - Acquisition Parameters
Date_              20120512
Time                  20.53
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG             zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     256
DS                       4
SWH              24038.461 Hz
FIDRES            0.366798 Hz
AQ                1.3631988 sec
RG                   209.25
DW                   20.800 usec
DE                    6.50 usec
TE                   299.0 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   10.38 usec
PLW1          50.00299835 W
SFO1         100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2           waltz16
NUC2                   1H
PCPD2                90.00 usec
PLW2          13.00199986 W
PLW12          0.18827000 W
PLW13          0.15250000 W
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF           100.6127547 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```

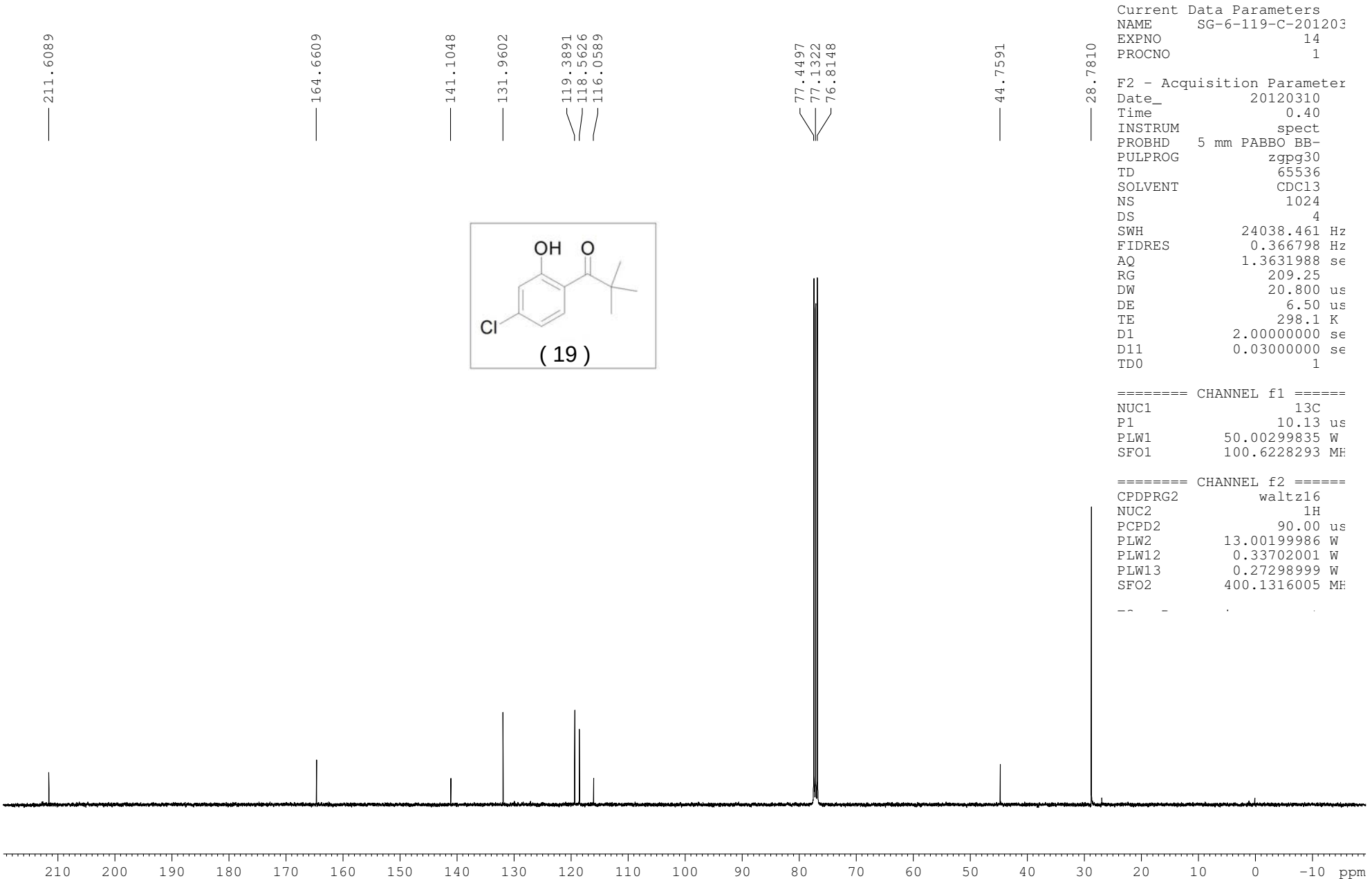


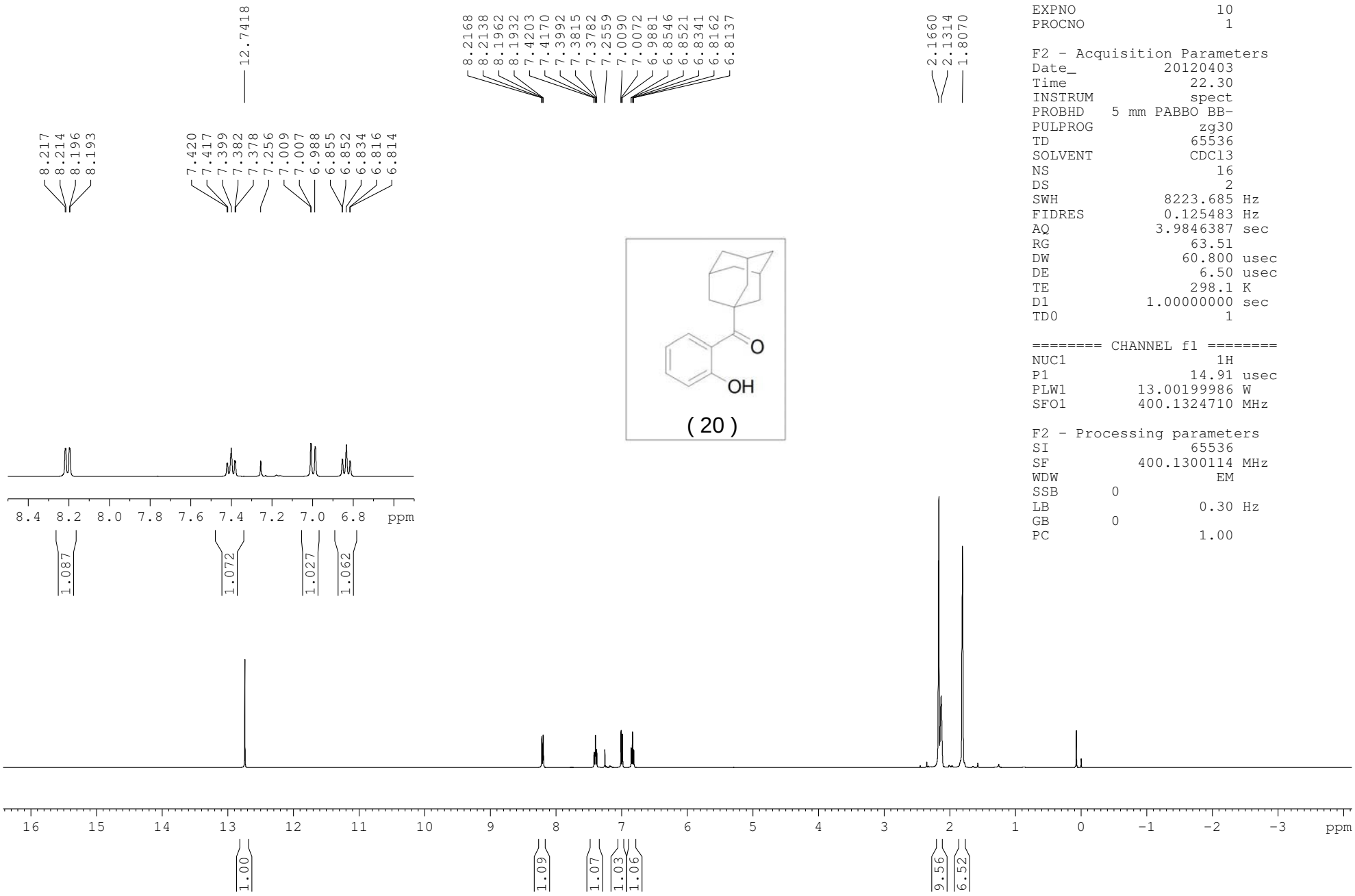
Current Data Parameters
NAME SG-6-119-H-20120308
EXPNO 10
PROCNO 1

F2 - Acquisition Parameters
Date_ 20120308
Time 23.36
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8223.685 Hz
FIDRES 0.125483 Hz
AQ 3.9846387 sec
RG 165.63
DW 60.800 usec
DE 6.50 usec
TE 298.1 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.49 usec
PLW1 13.00199986 W
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300101 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



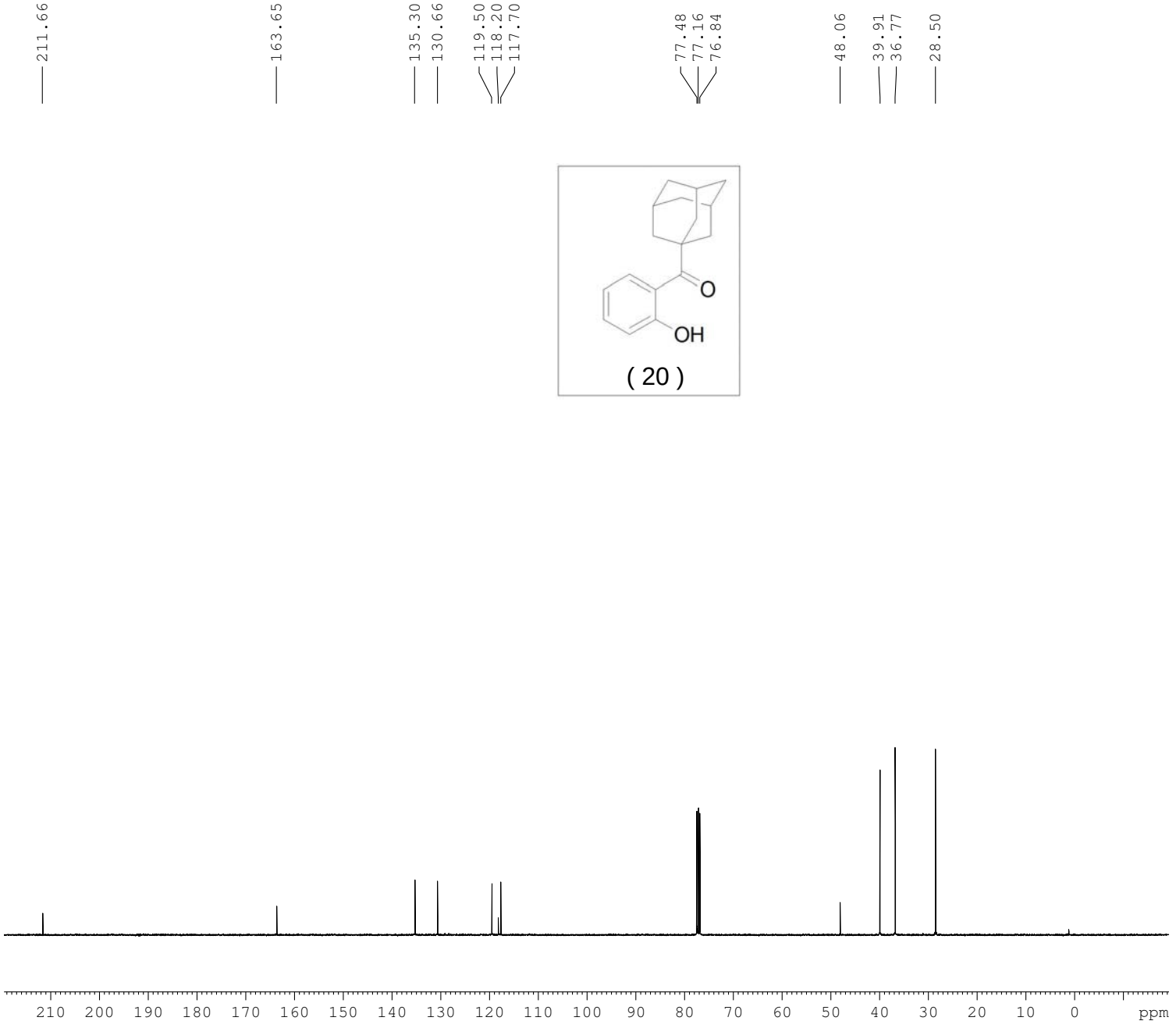



```
Current Data Parameters
NAME      SG-6-109-H-20120403
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_              20120403
Time                  22.30
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                    63.51
DW                   60.800 usec
DE                    6.50 usec
TE                   298.1 K
D1              1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                     14.91 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF             400.1300114 MHz
WDW                      EM
SSB       0
LB                    0.30 Hz
GB        0
PC                    1.00
```



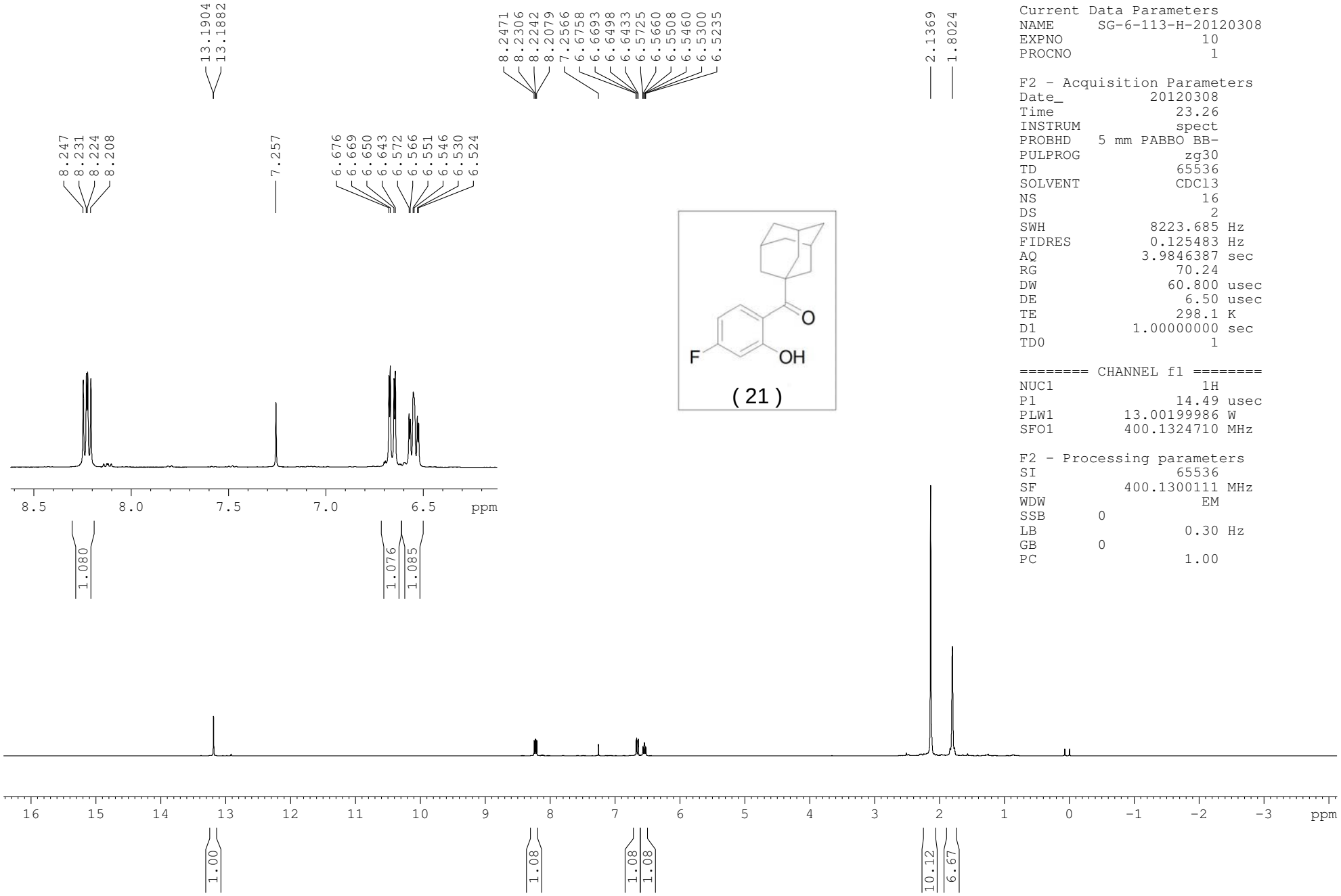

```
Current Data Parameters
NAME      SG-6-109-C-20120404
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_            20120404
Time                22.12
INSTRUM             spect
PROBHD   5 mm PABBO BB-
PULPROG           zgpg30
TD                 65536
SOLVENT            CDC13
NS                   512
DS                     4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ              1.3631988 sec
RG                184.16
DW                20.800 usec
DE                 6.50 usec
TE                298.1 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  13C
P1                 10.31 usec
PLW1         50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                  1H
PCPD2              90.00 usec
PLW2         13.00199986 W
PLW12         0.35685000 W
PLW13         0.28904000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF          100.6127565 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```

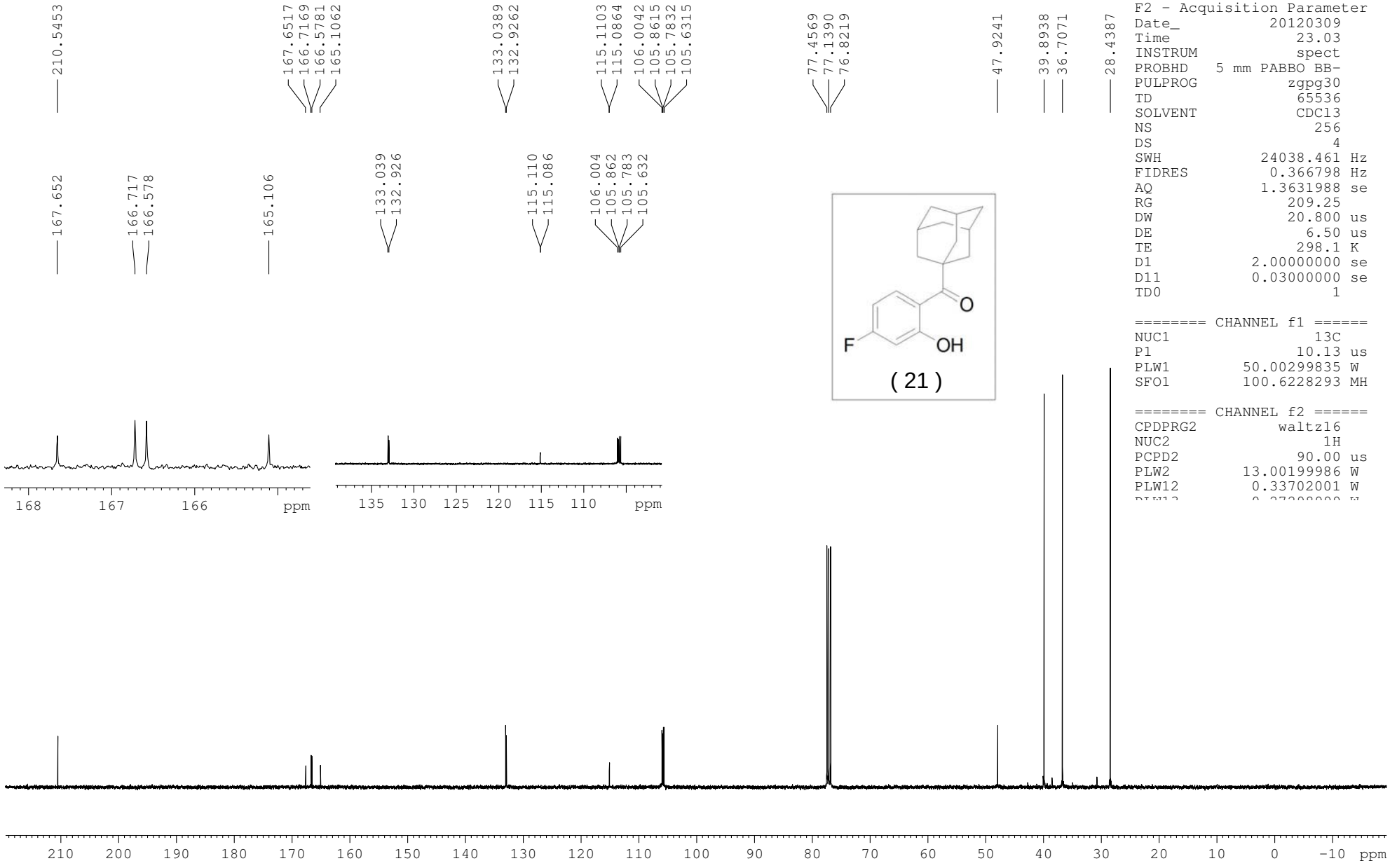



```
Current Data Parameters
NAME      SG-6-113-H-20120308
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_              20120308
Time                 23.26
INSTRUM              spect
PROBHD    5 mm PABBO BB-
PULPROG               zg30
TD                   65536
SOLVENT              CDCl3
NS                      16
DS                       2
SWH               8223.685 Hz
FIDRES           0.125483 Hz
AQ               3.9846387 sec
RG                   70.24
DW                  60.800 usec
DE                   6.50 usec
TE                  298.1 K
D1              1.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   14.49 usec
PLW1          13.00199986 W
SFO1          400.1324710 MHz

F2 - Processing parameters
SI                   65536
SF            400.1300111 MHz
WDW                     EM
SSB       0
LB                   0.30 Hz
GB        0
PC                   1.00
```

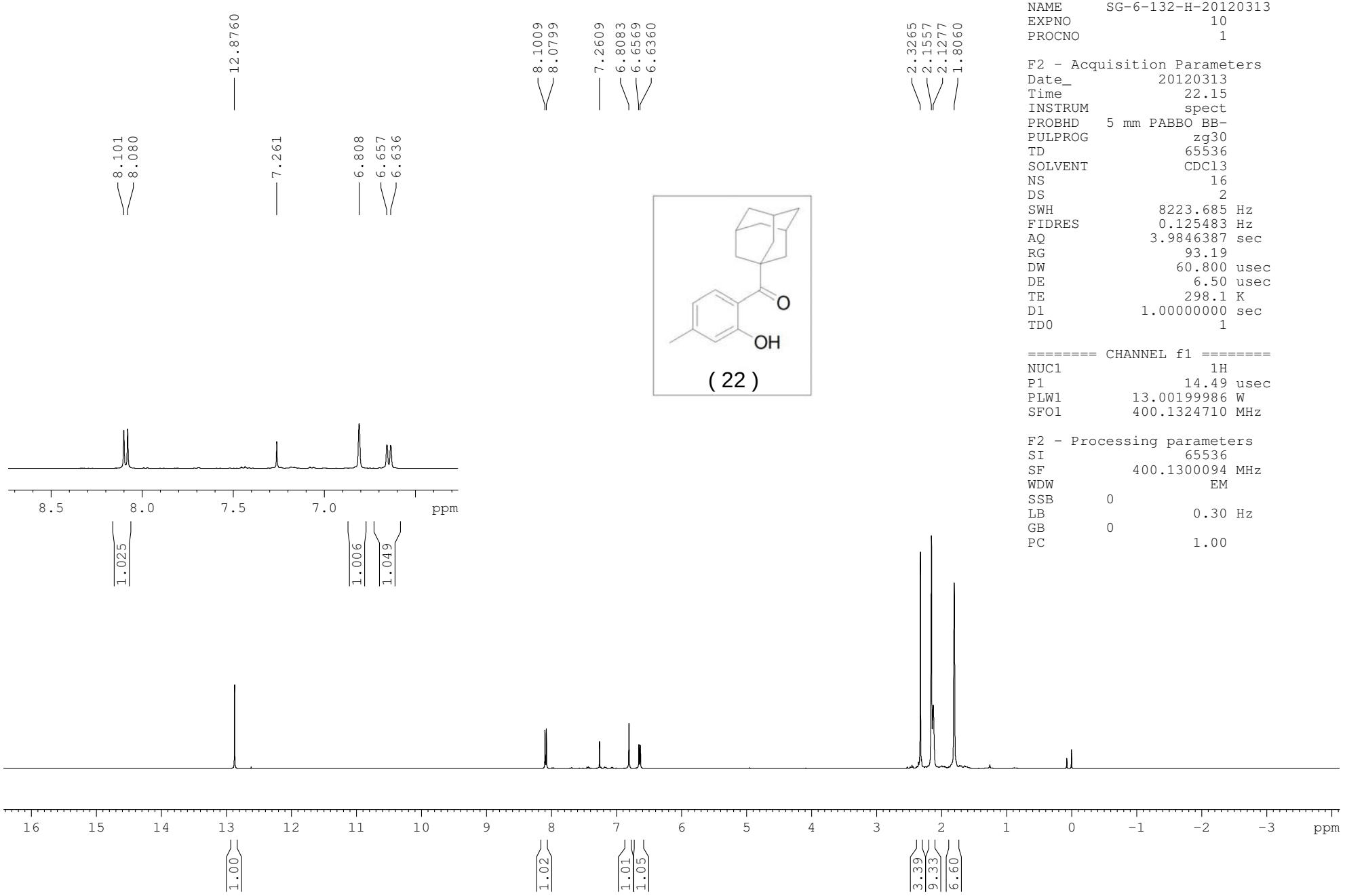



```
Current Data Parameters
NAME      SG-6-113-C-201203
EXPNO                   20
PROCNO                   1

F2 - Acquisition Parameter
Date_           20120309
Time              23.03
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  256
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ            1.3631988 se
RG                209.25
DW              20.800 us
DE               6.50 us
TE               298.1 K
D1           2.00000000 se
D11          0.03000000 se
TD0                   1

======== CHANNEL f1 ======
NUC1                13C
P1                10.13 us
PLW1        50.00299835 W
SFO1       100.6228293 MH

======== CHANNEL f2 ======
CPDPRG2          waltz16
NUC2                1H
PCPD2            90.00 us
PLW2        13.00199986 W
PLW12        0.33702001 W
```

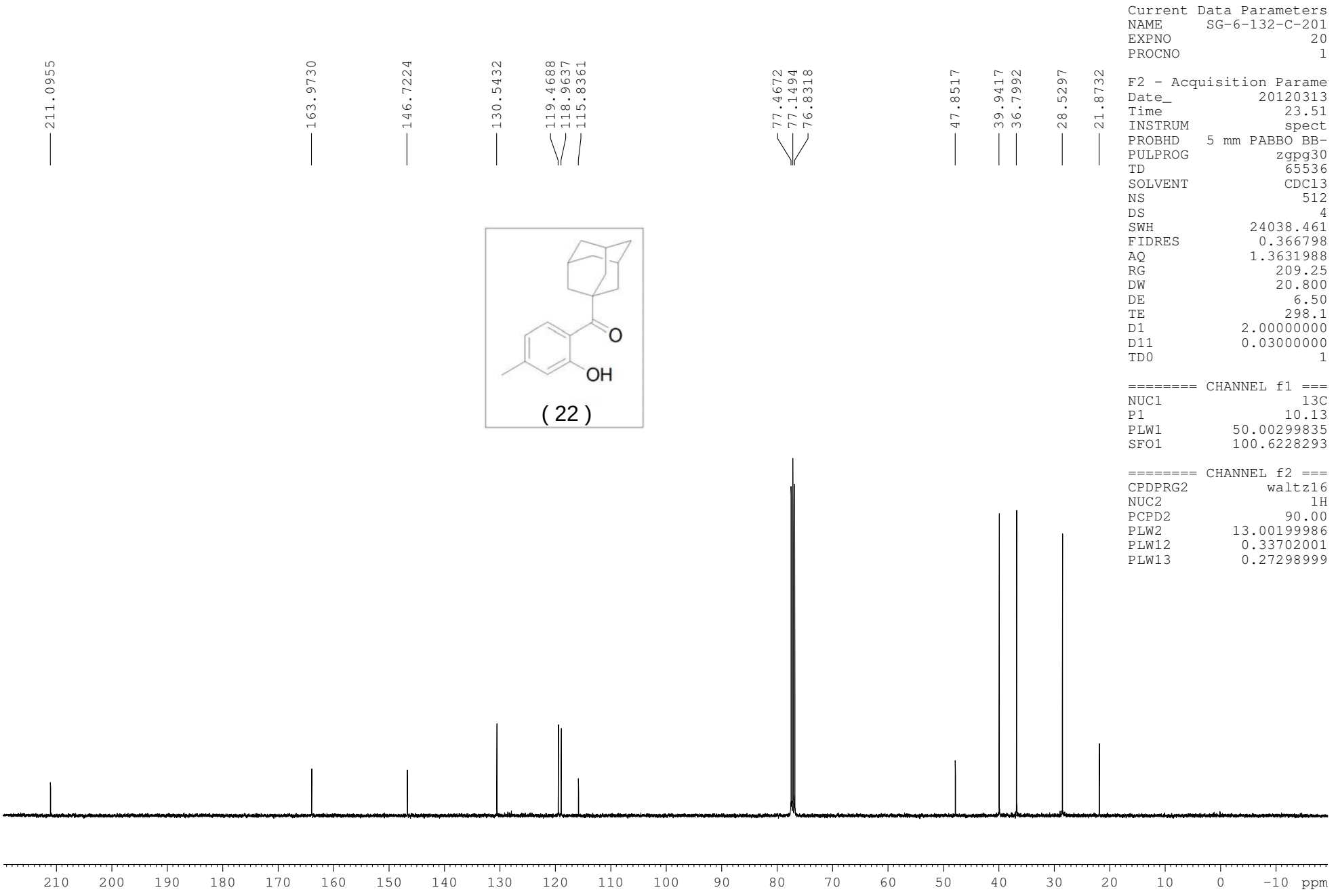


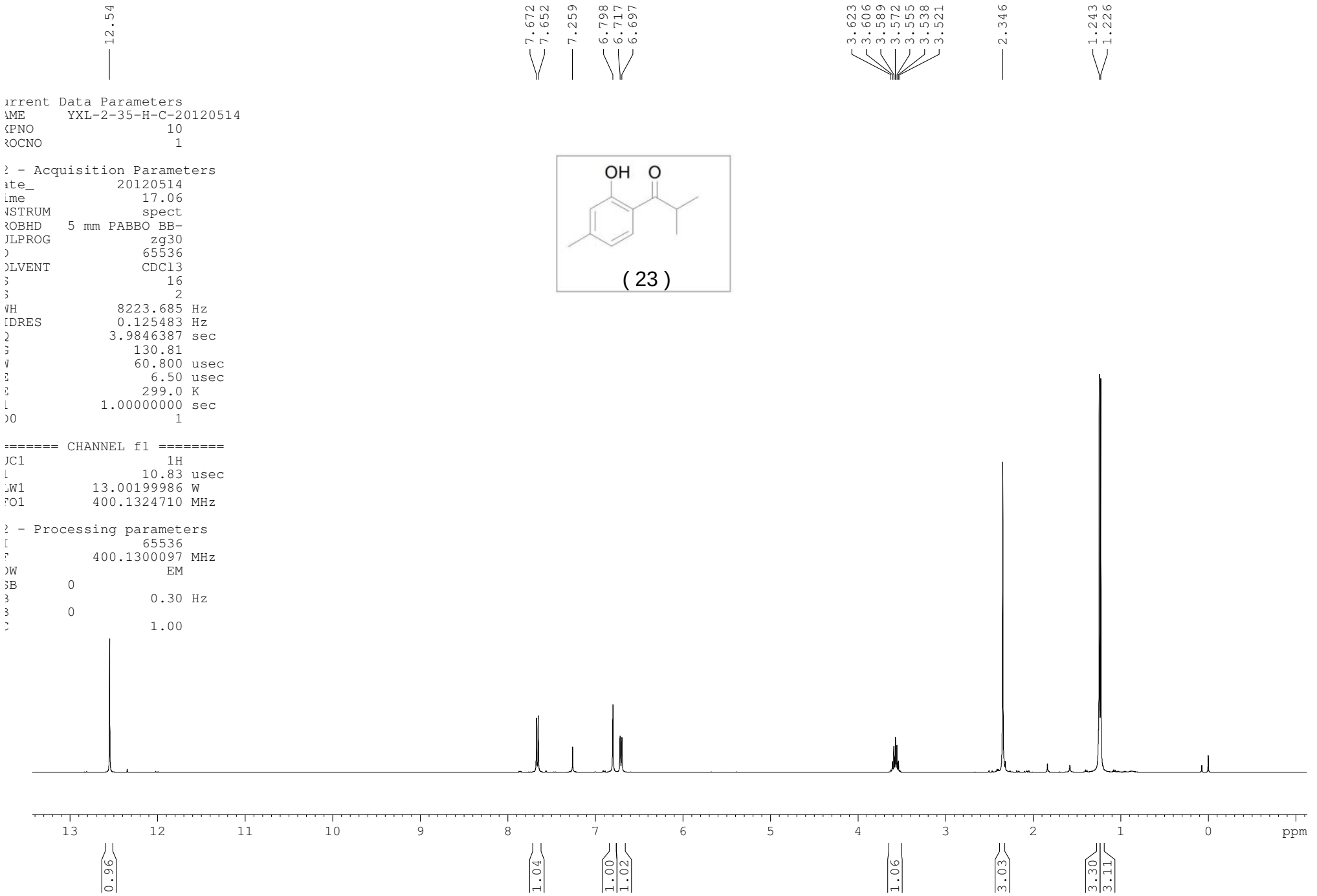

```
Current Data Parameters
NAME      SG-6-132-H-20120313
EXPNO                  10
PROCNO                  1

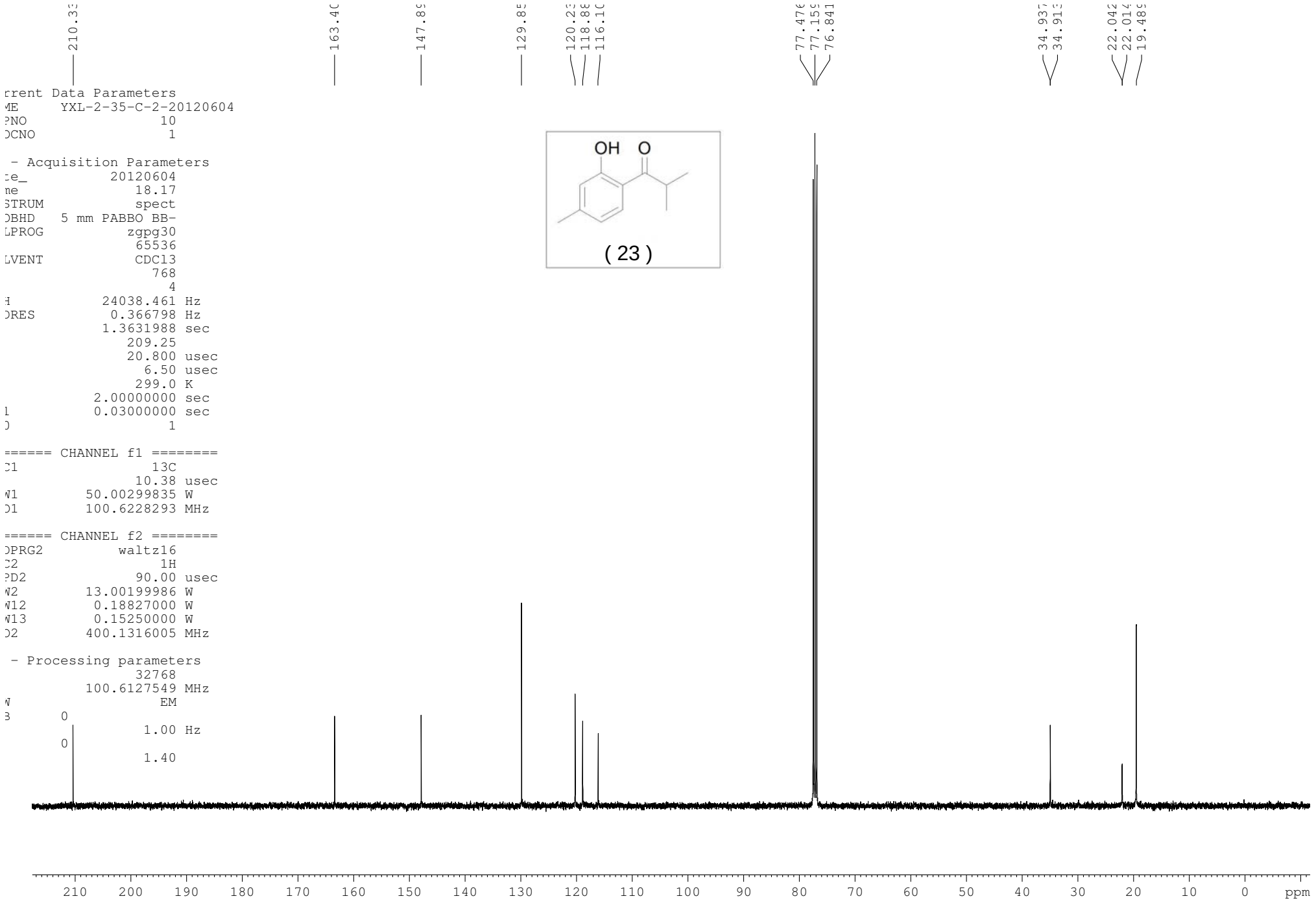
F2 - Acquisition Parameters
Date_           20120313
Time               22.15
INSTRUM            spect
PROBHD    5 mm PABBO BB-
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             8223.685 Hz
FIDRES          0.125483 Hz
AQ             3.9846387 sec
RG                 93.19
DW                60.800 usec
DE                 6.50 usec
TE                298.1 K
D1           1.00000000 sec
TD0                    1

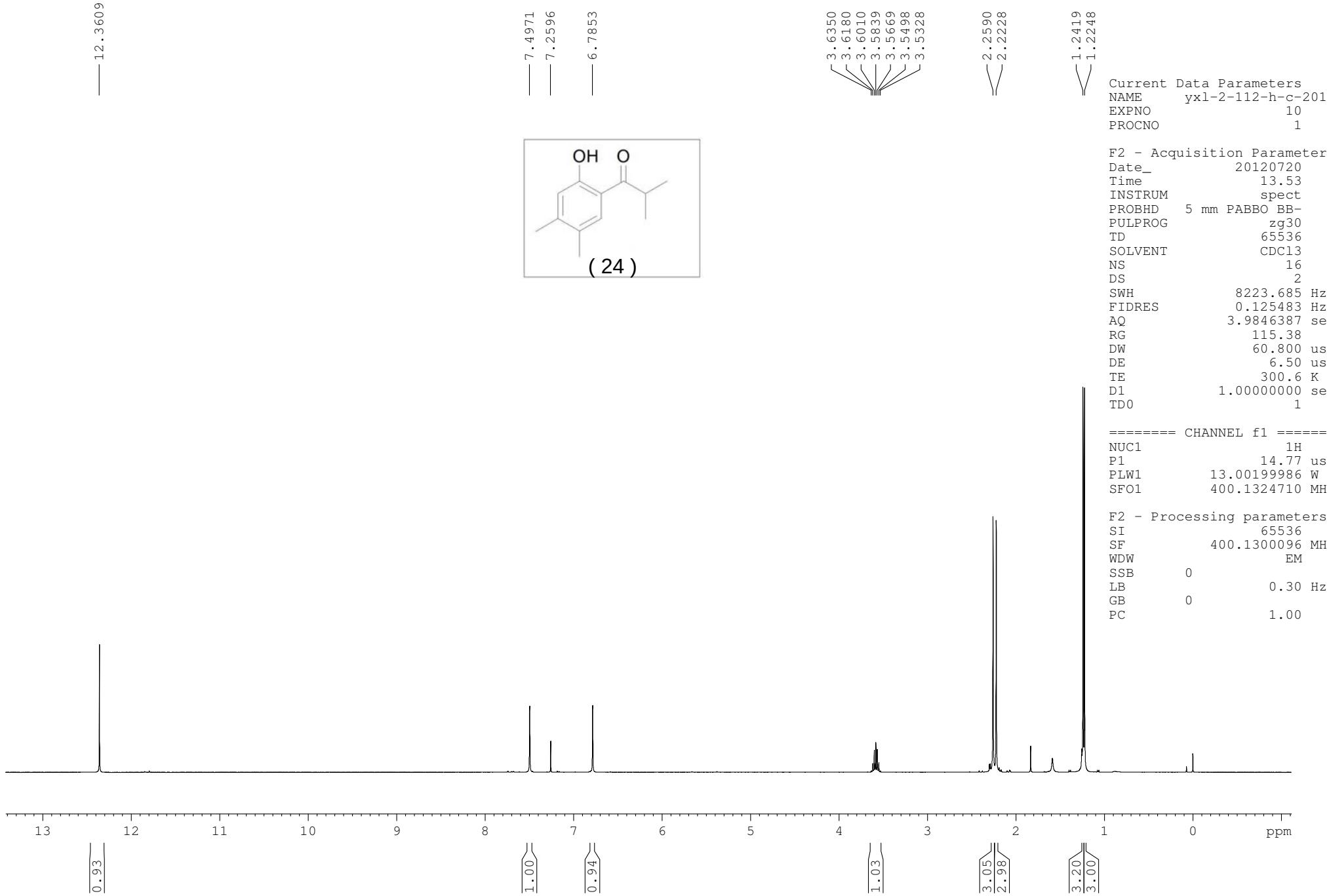
======== CHANNEL f1 ========
NUC1                  1H
P1                14.49 usec
PLW1         13.00199986 W
SFO1         400.1324710 MHz

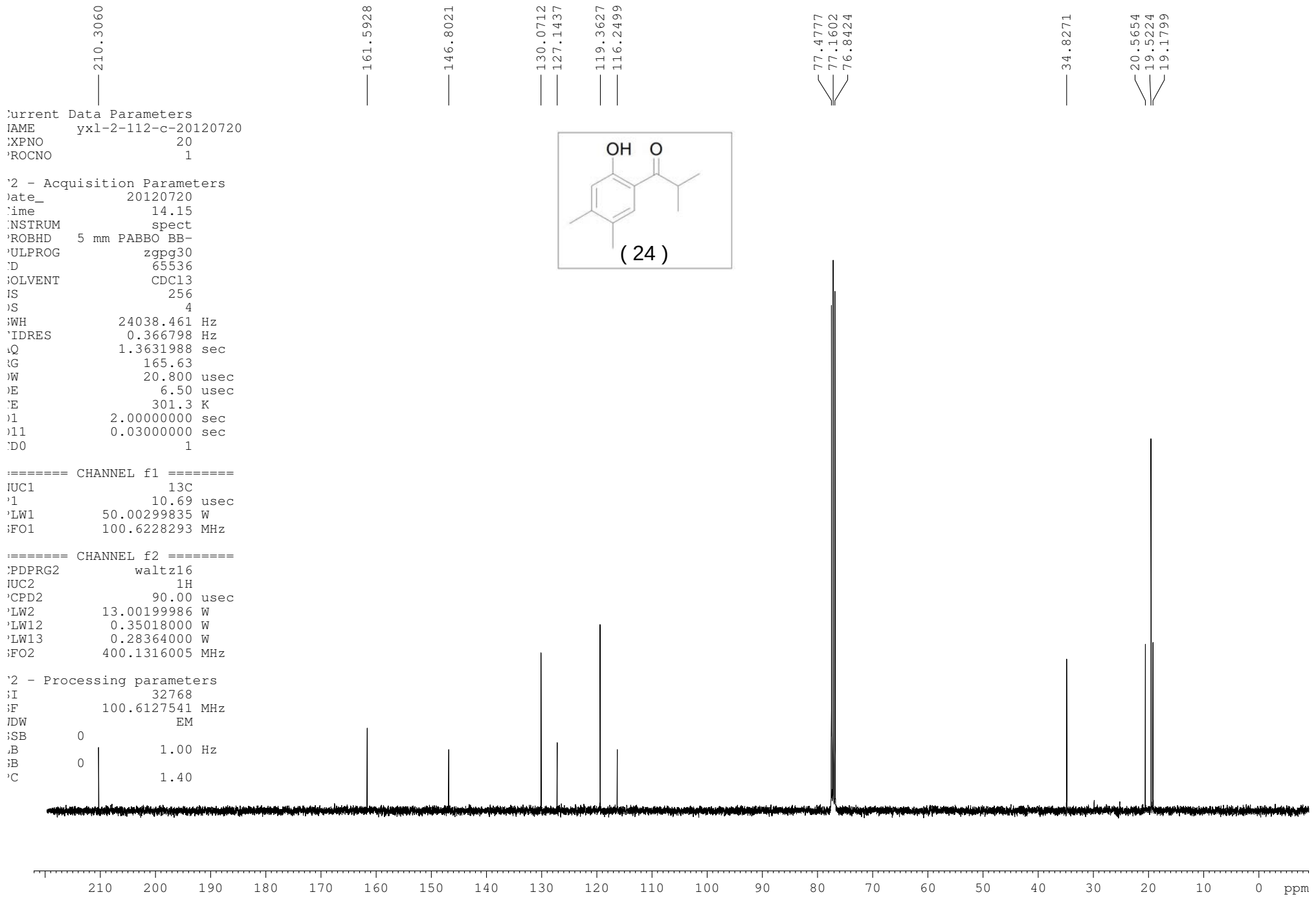
F2 - Processing parameters
SI                 65536
SF          400.1300094 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```

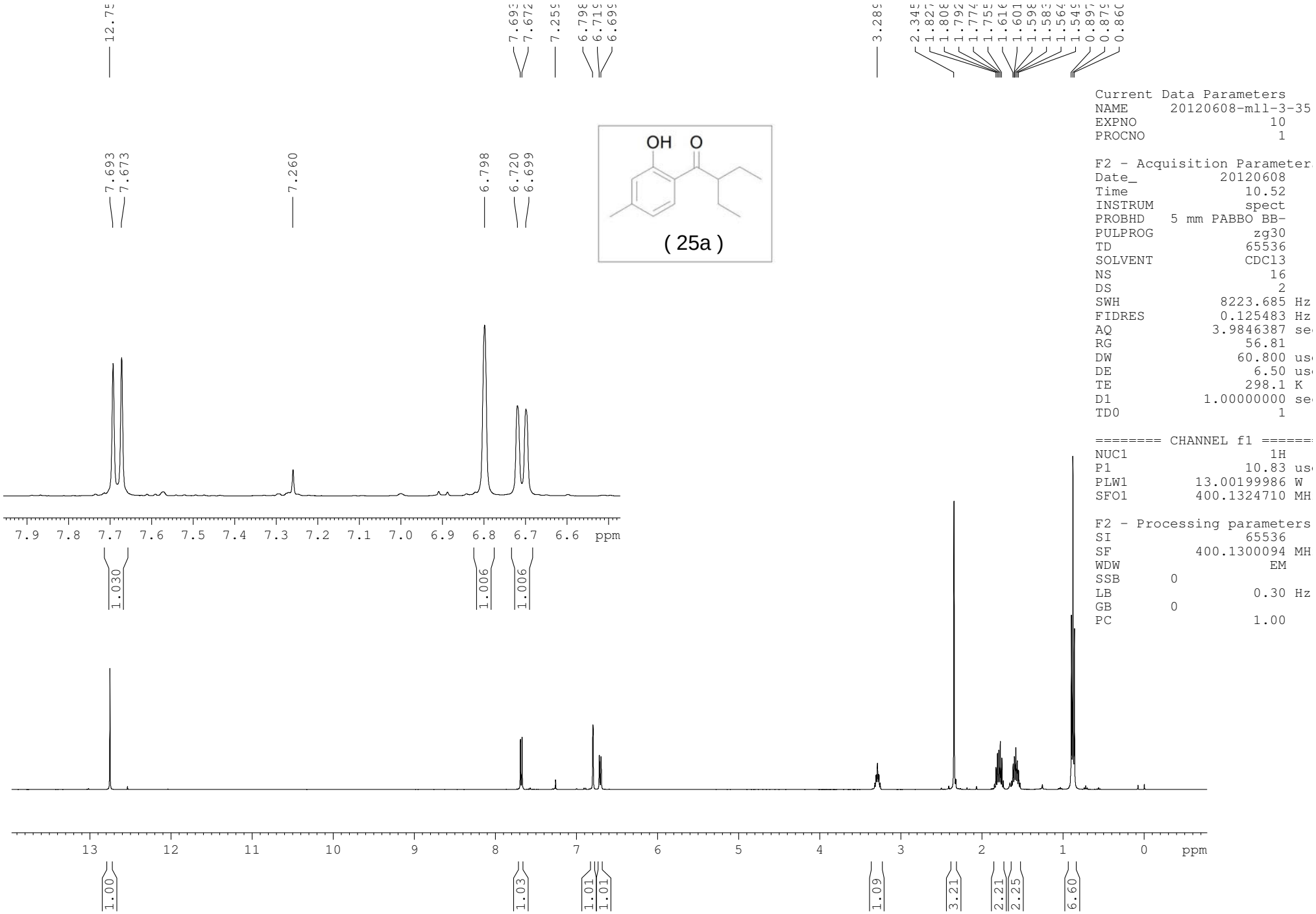


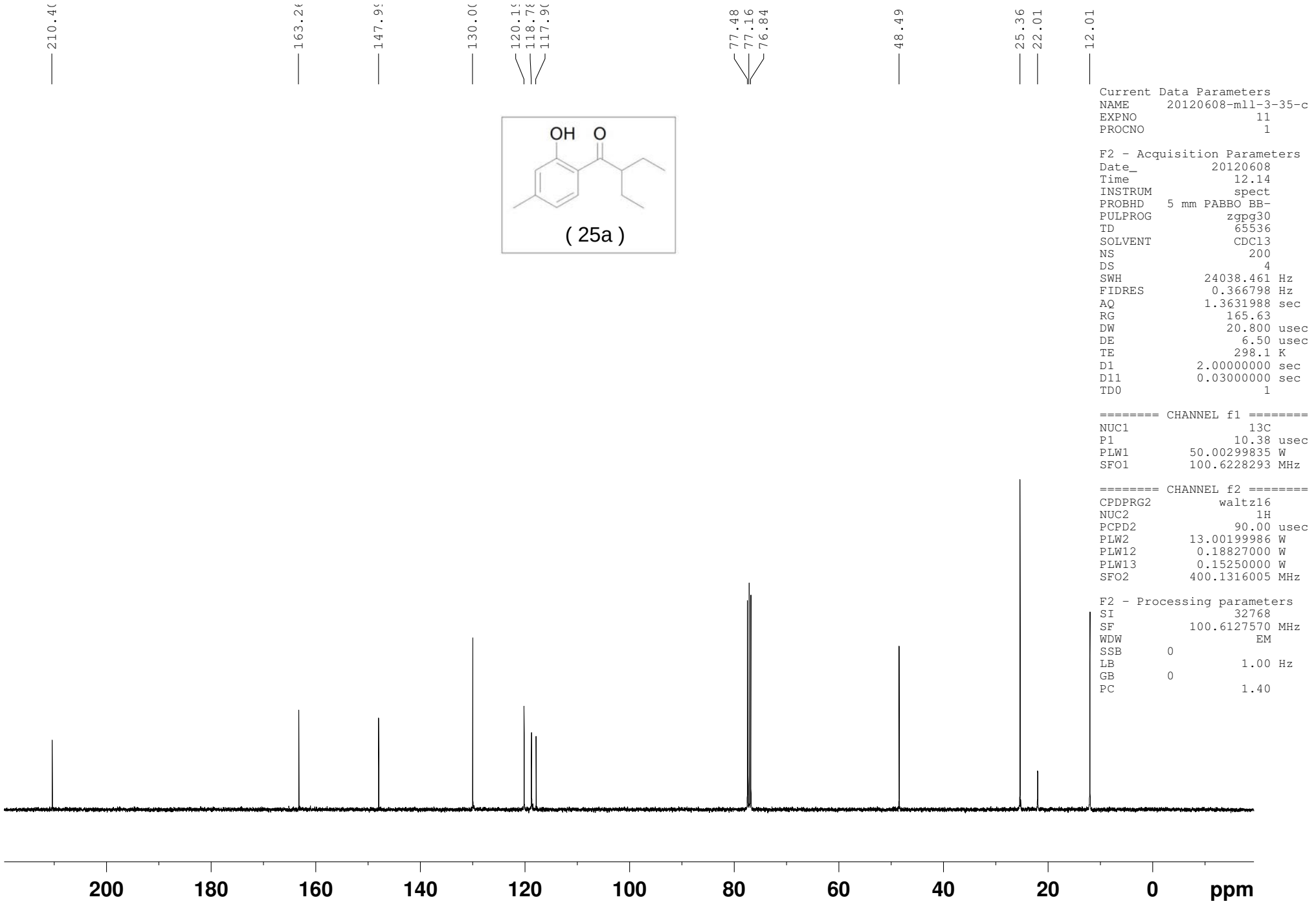












9.5888 7.2584 6.2126

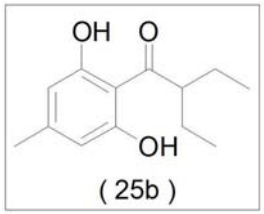
2.2284 1.8512 1.8329 1.8150 1.7981 1.7805 1.7623 1.7433 1.7217 1.6952 1.5734 1.5557 1.5391 1.5217 1.5048 1.4876 1.4695 1.4497 1.4308 1.2568 0.9093 0.8908 0.8725

```
Current Data Parameters
NAME     YXL-3-147-2-H-20121107
EXPNO                 20
PROCNO                 1

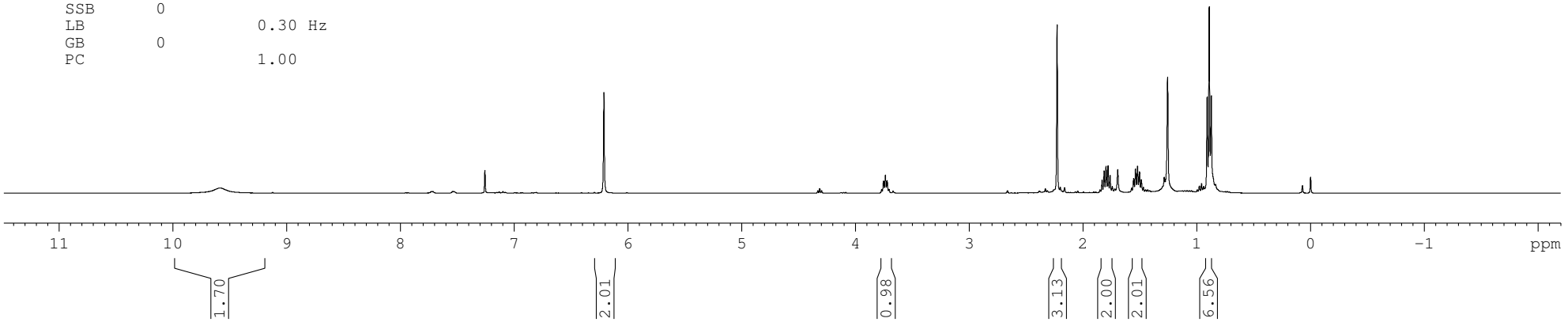
F2 - Acquisition Parameters
Date_           20121107
Time               22.14
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH             8223.685 Hz
FIDRES          0.125483 Hz
AQ             3.9846387 sec
RG                102.67
DW                60.800 usec
DE                 6.50 usec
TE                299.9 K
D1           1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  1H
P1                 14.77 usec
PLW1        13.00199986 W
SFO1        400.1324710 MHz

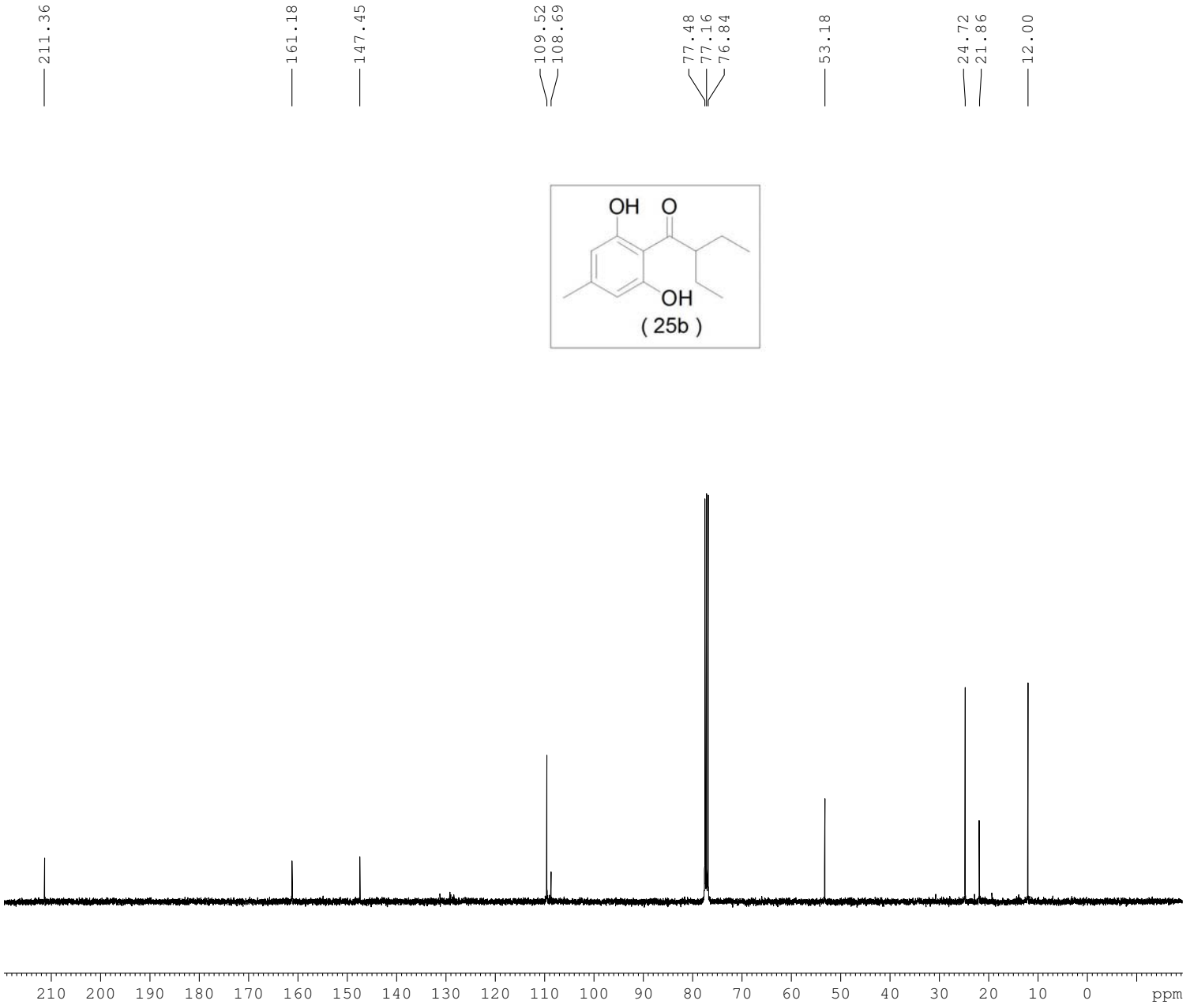
F2 - Processing parameters
SI                 65536
SF          400.1300108 MHz
WDW                   EM
SSB      0
LB                 0.30 Hz
GB       0
PC                 1.00
```



(25b)



C13CPD CDCl3 {D:\NMR_DATA} RY 32



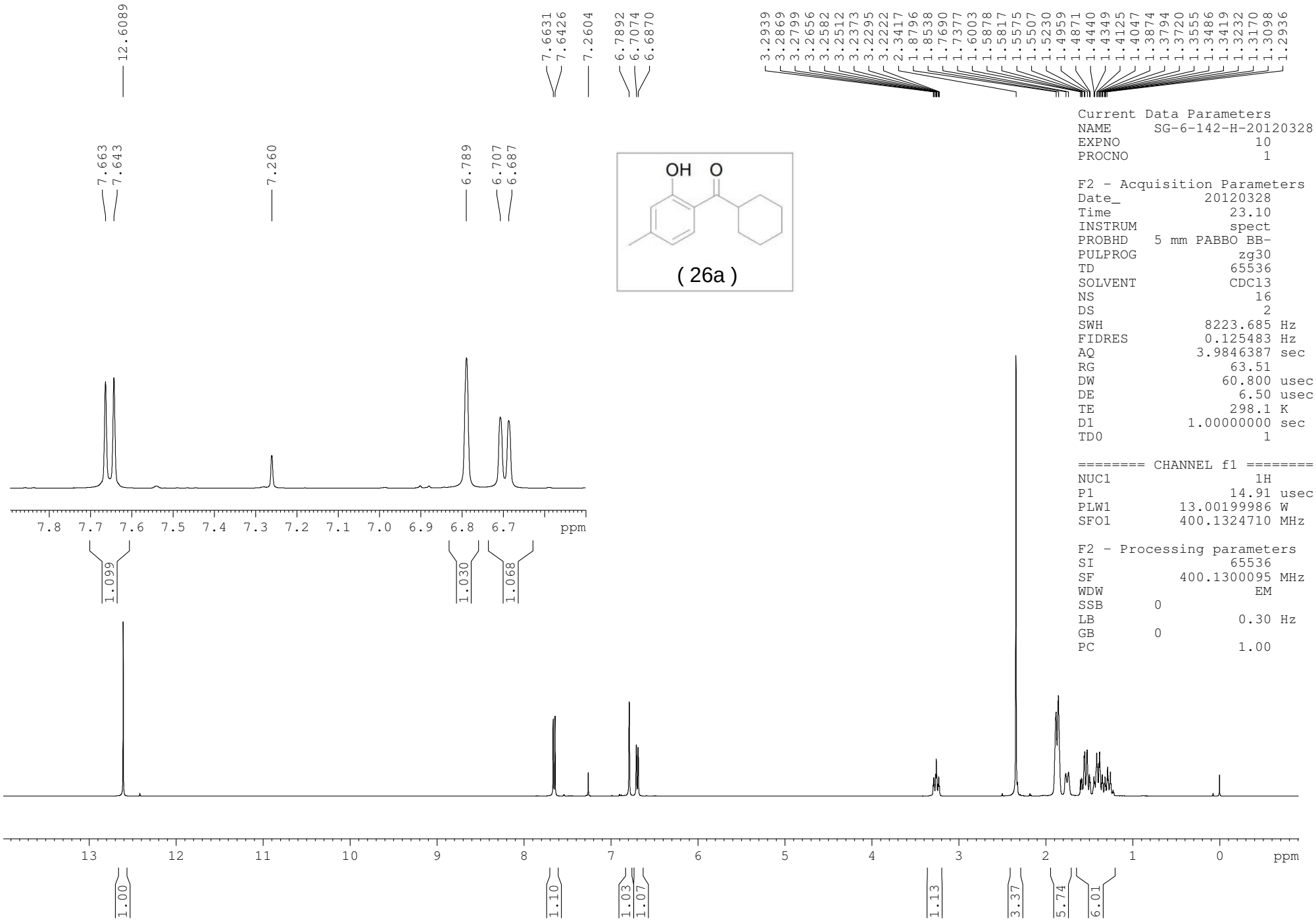

```
Current Data Parameters
NAME      20121116-YSY-1---157
EXPNO                      11
PROCNO                      1

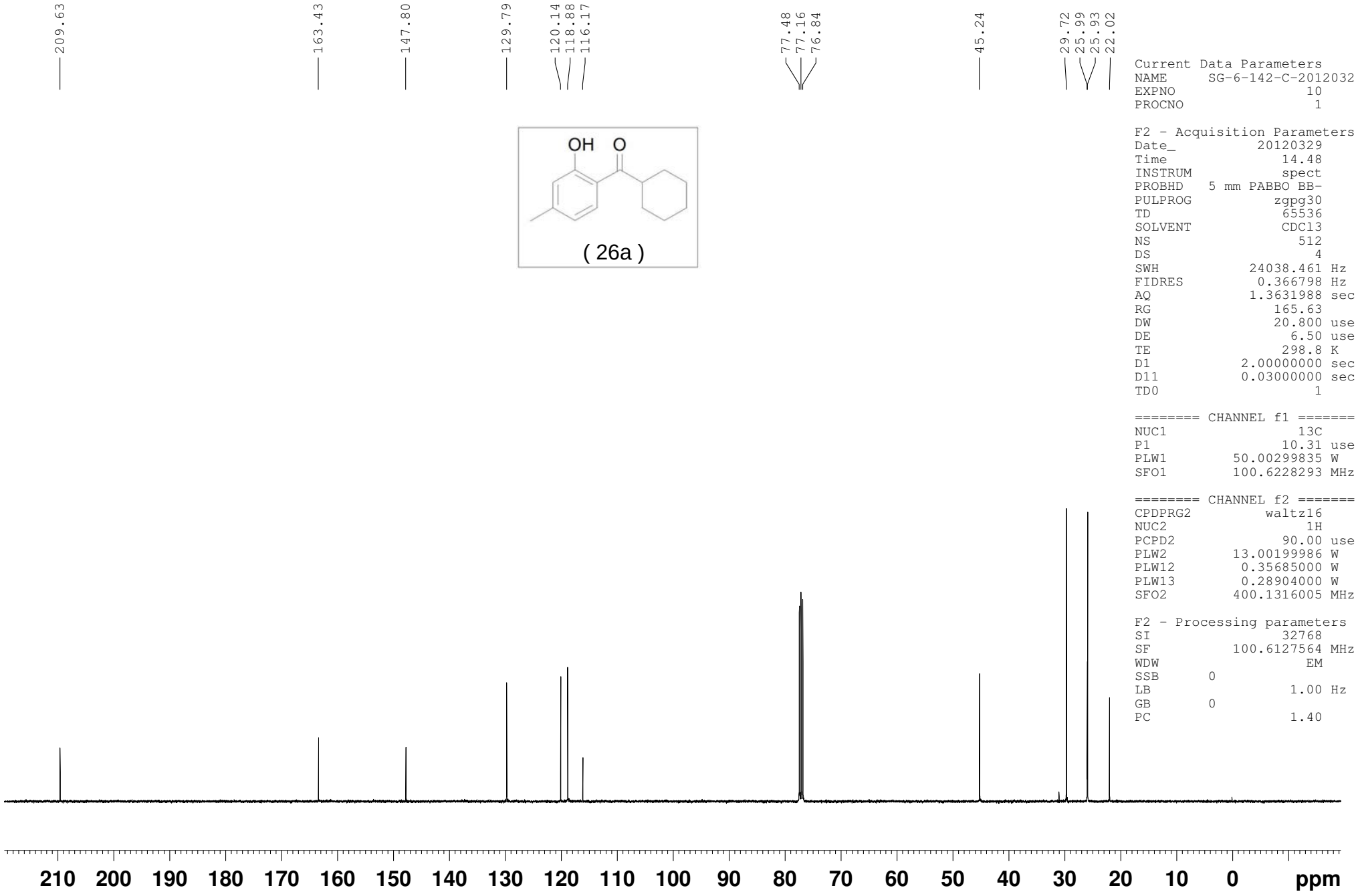
F2 - Acquisition Parameters
Date_              20121116
Time                  13.55
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG             zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     453
DS                       4
SWH              24038.461 Hz
FIDRES            0.366798 Hz
AQ                1.3631988 sec
RG                   165.63
DW                   20.800 usec
DE                    6.50 usec
TE                   299.9 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

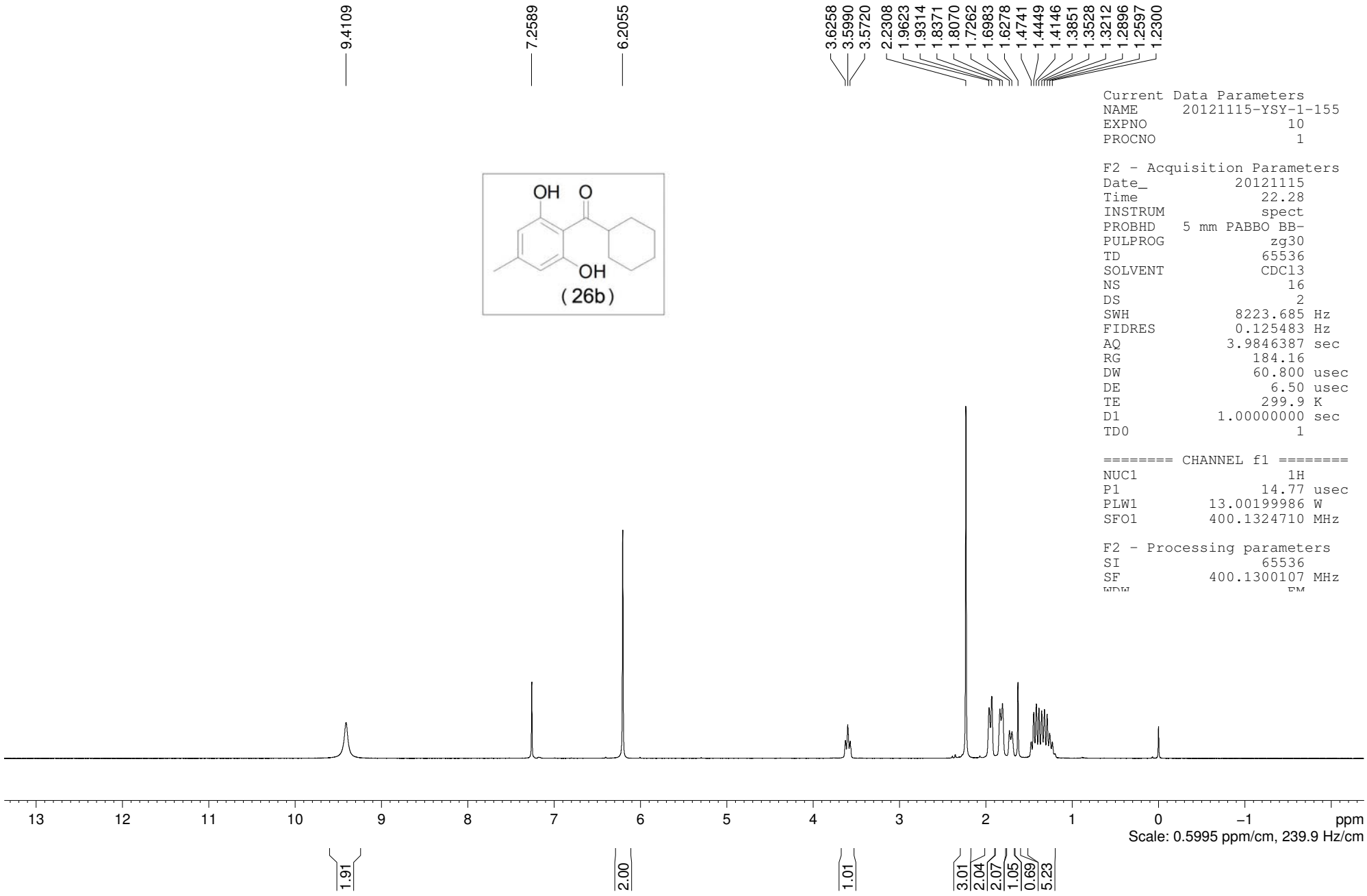
======== CHANNEL f1 ========
NUC1                   13C
P1                   10.30 usec
PLW1          50.00299835 W
SFO1         100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2            waltz16
NUC2                   1H
PCPD2                90.00 usec
PLW2          13.00199986 W
PLW12          0.35018000 W
PLW13          0.28364000 W
SFO2         400.1316005 MHz

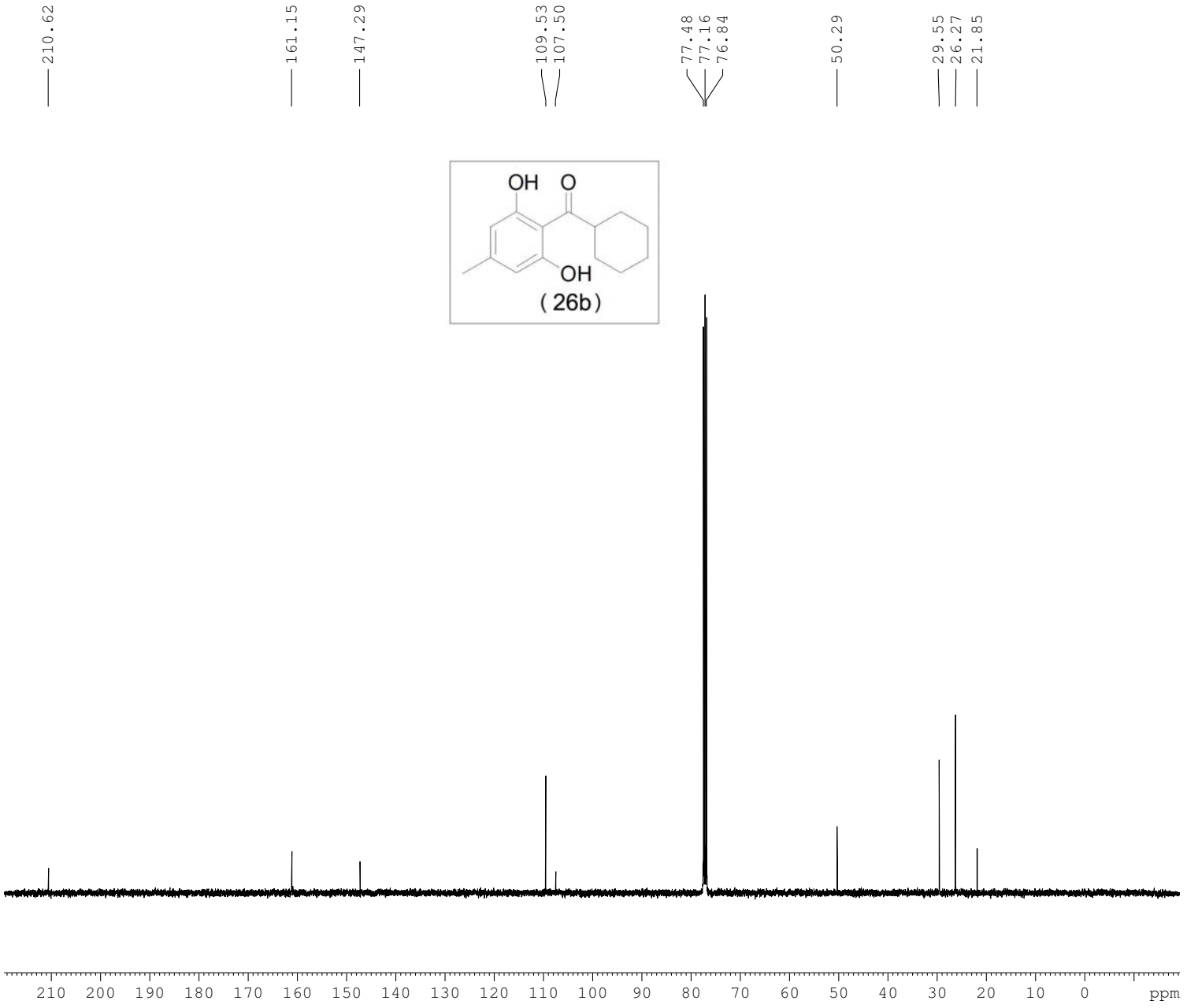
F2 - Processing parameters
SI                     32768
SF           100.6127548 MHz
WDW                    EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```







C13CPD CDCl3 {D:\NMR_DATA} RY 19



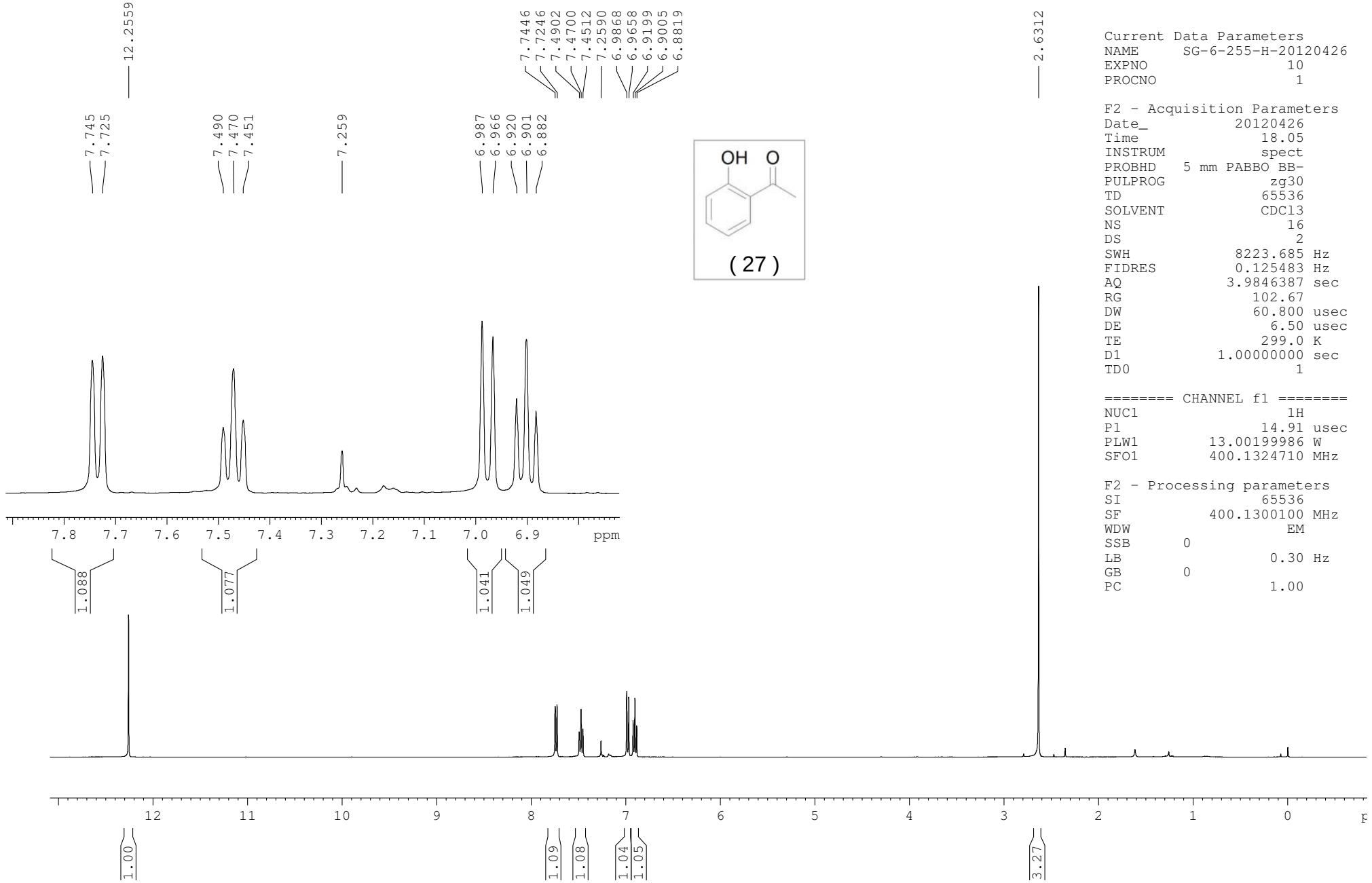

```
Current Data Parameters
NAME      20121115-YSY-1-155
EXPNO                    11
PROCNO                    1

F2 - Acquisition Parameters
Date_              20121116
Time                   7.05
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG              zgpg30
TD                    65536
SOLVENT               CDCl3
NS                      512
DS                        4
SWH              24038.461 Hz
FIDRES            0.366798 Hz
AQ               1.3631988 sec
RG                  184.16
DW                  20.800 usec
DE                   6.50 usec
TE                  299.9 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                    10.30 usec
PLW1           50.00299835 W
SFO1          100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2            waltz16
NUC2                    1H
PCPD2                90.00 usec
PLW2           13.00199986 W
PLW12           0.35018000 W
PLW13           0.28364000 W
SFO2          400.1316005 MHz

F2 - Processing parameters
SI                      32768
SF            100.6127541 MHz
WDW                        EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```

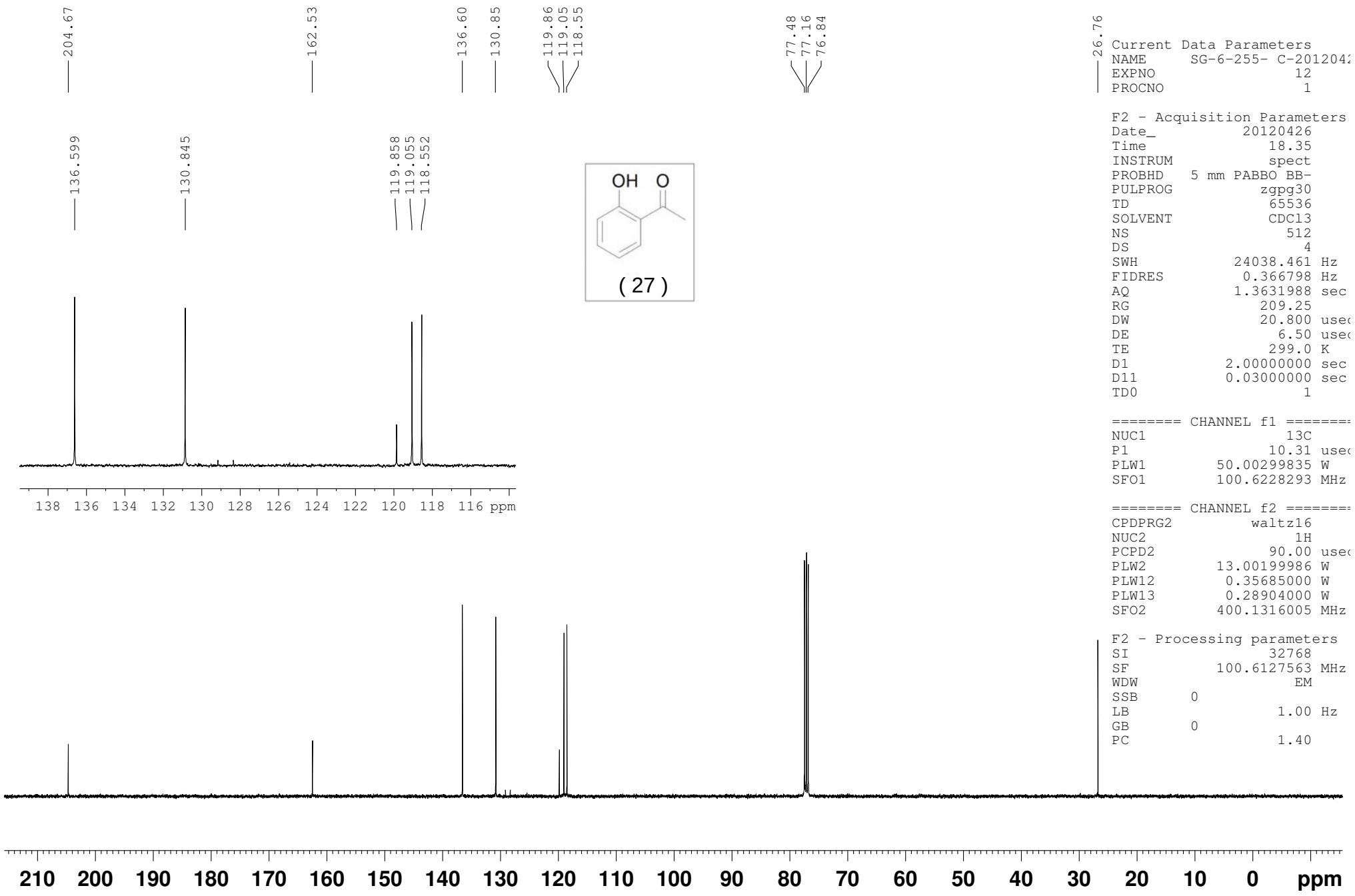



```
Current Data Parameters
NAME      SG-6-255-H-20120426
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_            20120426
Time                18.05
INSTRUM             spect
PROBHD    5 mm PABBO BB-
PULPROG              zg30
TD                  65536
SOLVENT             CDCl3
NS                     16
DS                      2
SWH              8223.685 Hz
FIDRES           0.125483 Hz
AQ              3.9846387 sec
RG                 102.67
DW                 60.800 usec
DE                   6.50 usec
TE                  299.0 K
D1             1.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                  14.91 usec
PLW1         13.00199986 W
SFO1        400.1324710 MHz

F2 - Processing parameters
SI                  65536
SF           400.1300100 MHz
WDW                    EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```



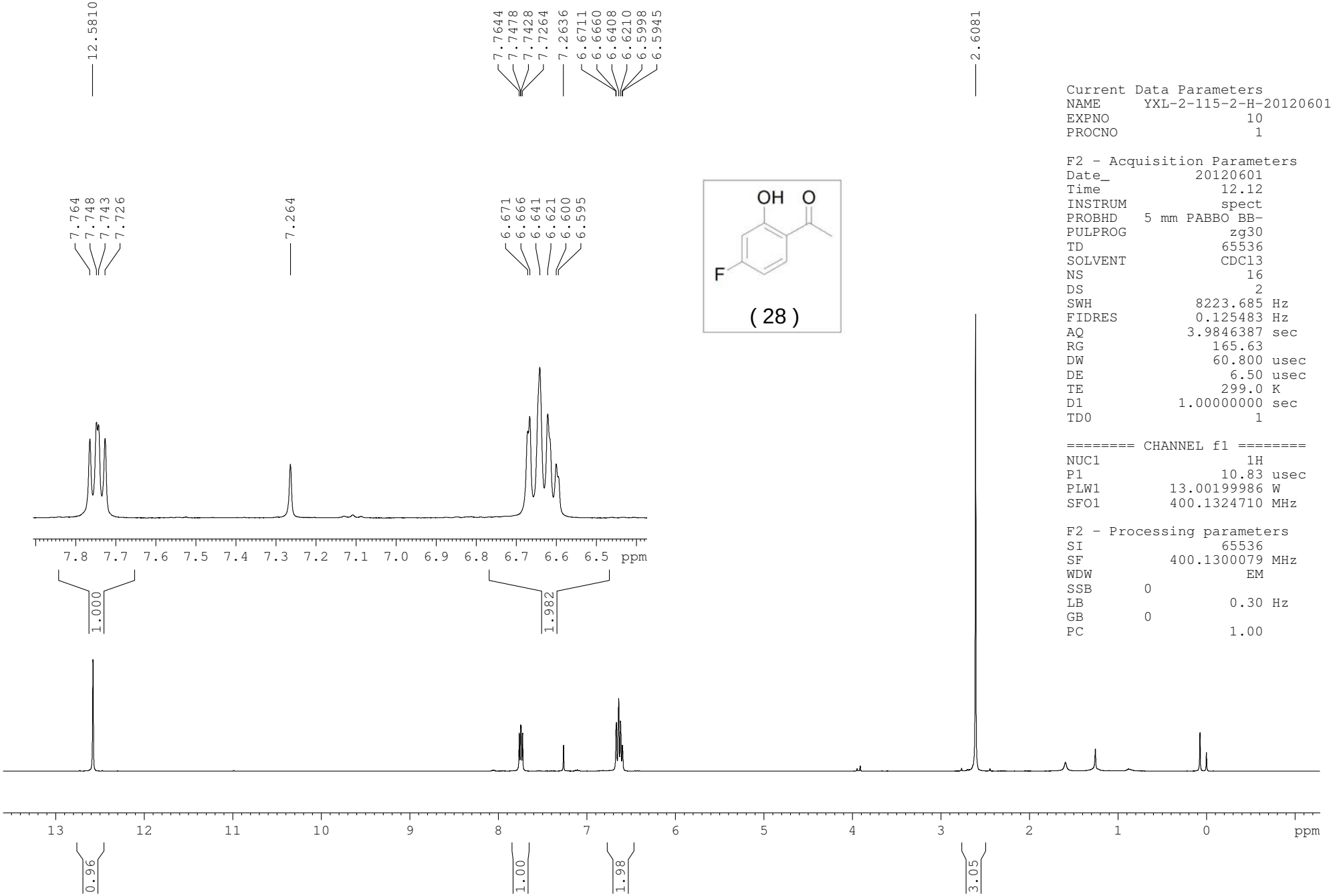

```
Current Data Parameters
NAME      SG-6-255- C-201204
EXPNO                 12
PROCNO                 1

F2 - Acquisition Parameters
Date_           20120426
Time              18.35
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  512
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631988 sec
RG                209.25
DW                20.800 use
DE                 6.50 use
TE                299.0 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                13C
P1                10.31 use
PLW1        50.00299835 W
SFO1       100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                1H
PCPD2             90.00 use
PLW2        13.00199986 W
PLW12        0.35685000 W
PLW13        0.28904000 W
SFO2       400.1316005 MHz

F2 - Processing parameters
SI                32768
SF         100.6127563 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

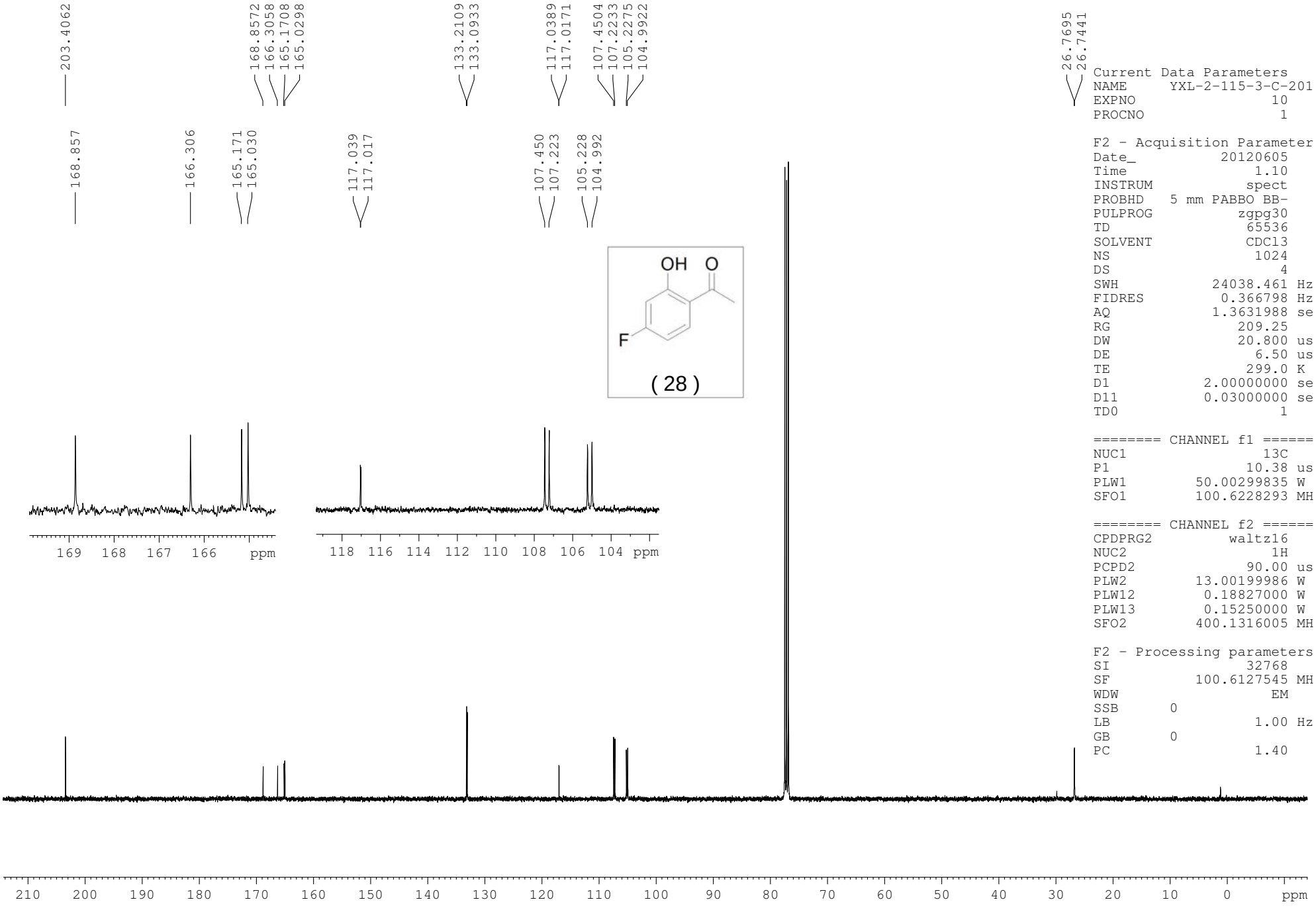



```
Current Data Parameters
NAME      YXL-2-115-2-H-20120601
EXPNO                        10
PROCNO                        1

F2 - Acquisition Parameters
Date_              20120601
Time                  12.12
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                8223.685 Hz
FIDRES             0.125483 Hz
AQ                 3.9846387 sec
RG                    165.63
DW                    60.800 usec
DE                     6.50 usec
TE                    299.0 K
D1              1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                     1H
P1                    10.83 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF             400.1300079 MHz
WDW                      EM
SSB       0
LB                     0.30 Hz
GB        0
PC                     1.00
```



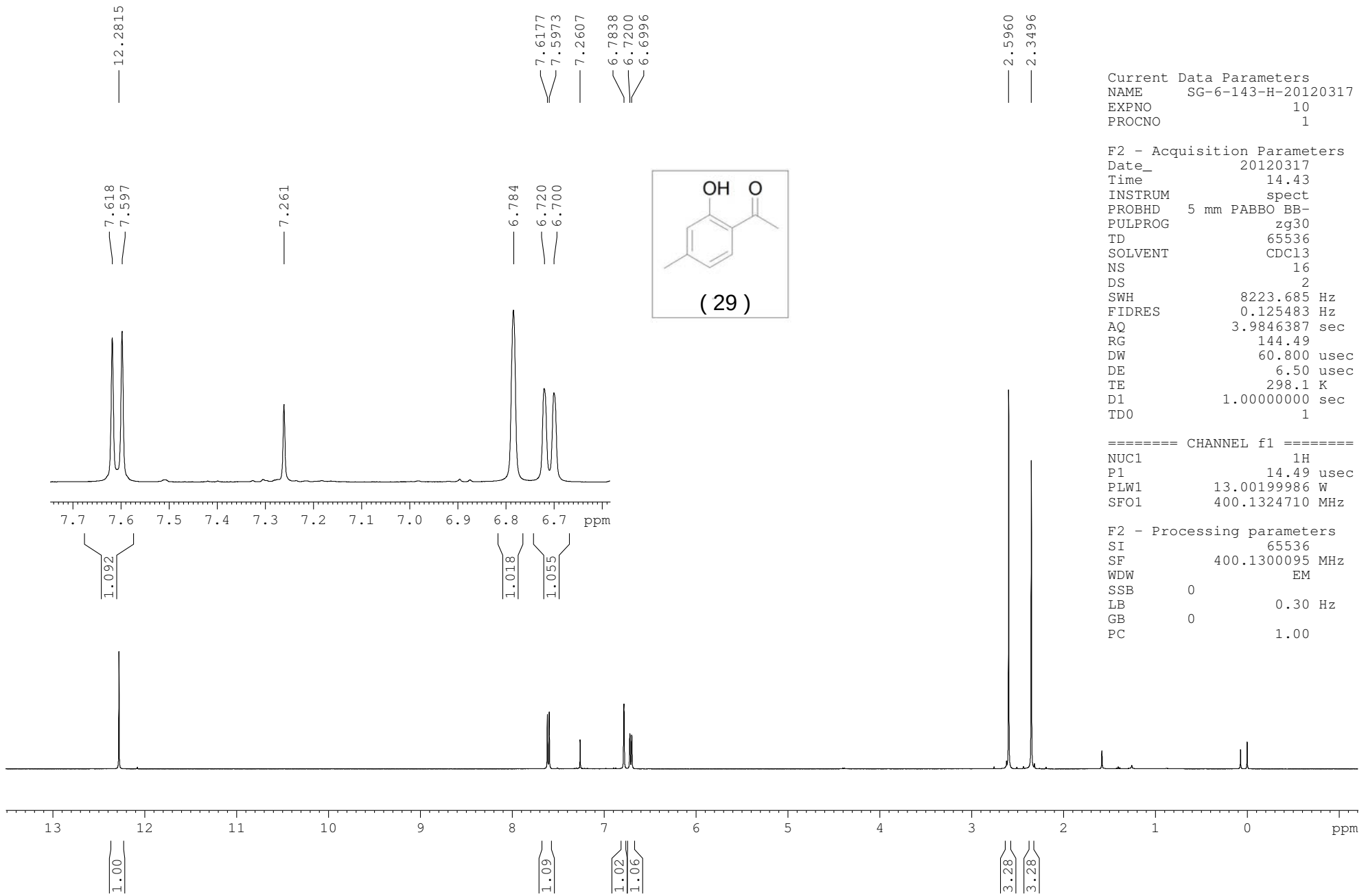

```
Current Data Parameters
NAME      YXL-2-115-3-C-201
EXPNO                   10
PROCNO                   1

F2 - Acquisition Parameter
Date_           20120605
Time                1.10
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ            1.3631988 se
RG               209.25
DW               20.800 us
DE                6.50 us
TE               299.0 K
D1          2.00000000 se
D11         0.03000000 se
TD0                    1

======== CHANNEL f1 ======
NUC1                 13C
P1                10.38 us
PLW1        50.00299835 W
SFO1       100.6228293 MH

======== CHANNEL f2 ======
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 us
PLW2        13.00199986 W
PLW12        0.18827000 W
PLW13        0.15250000 W
SFO2       400.1316005 MH

F2 - Processing parameters
SI                 32768
SF          100.6127545 MH
WDW                   EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

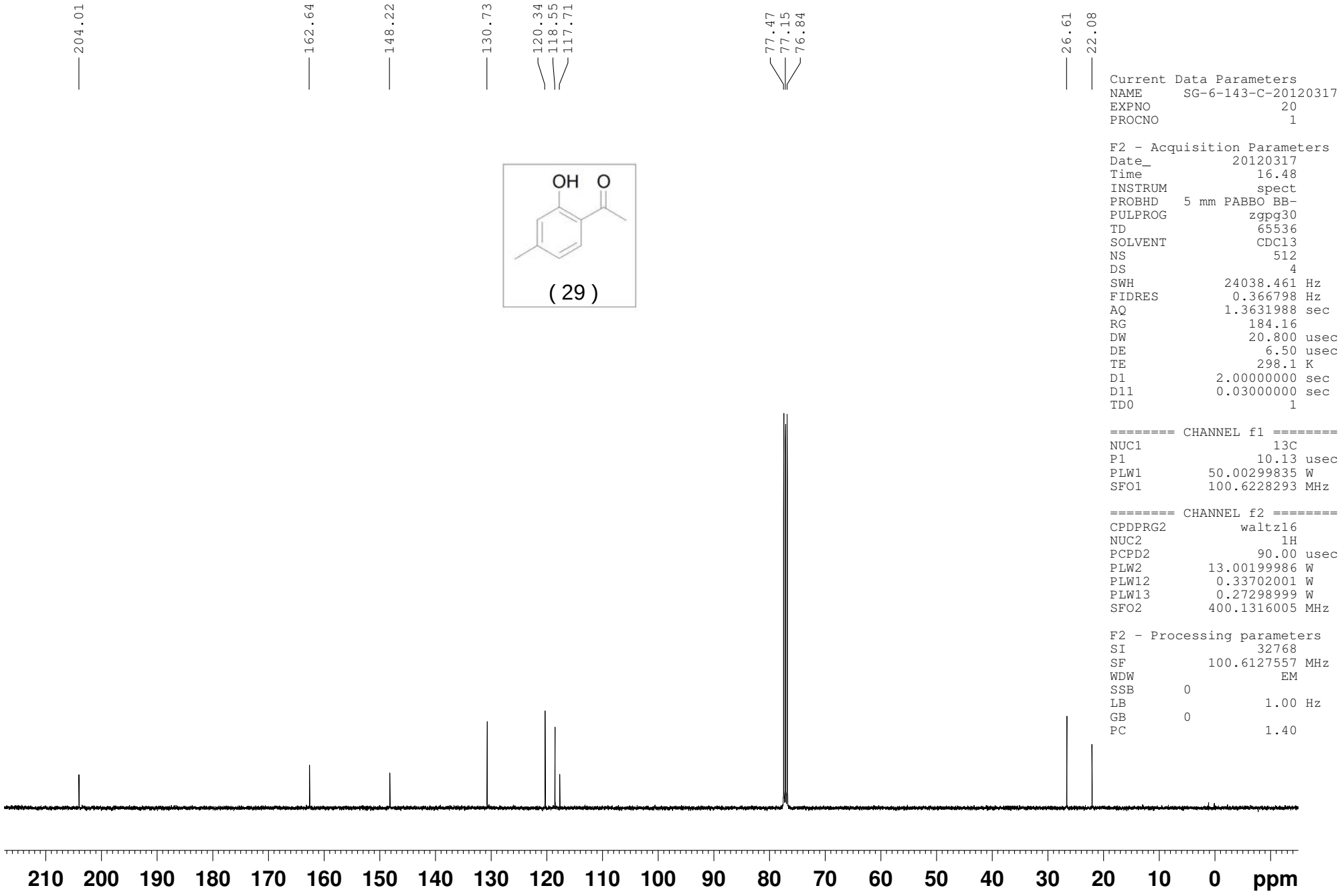


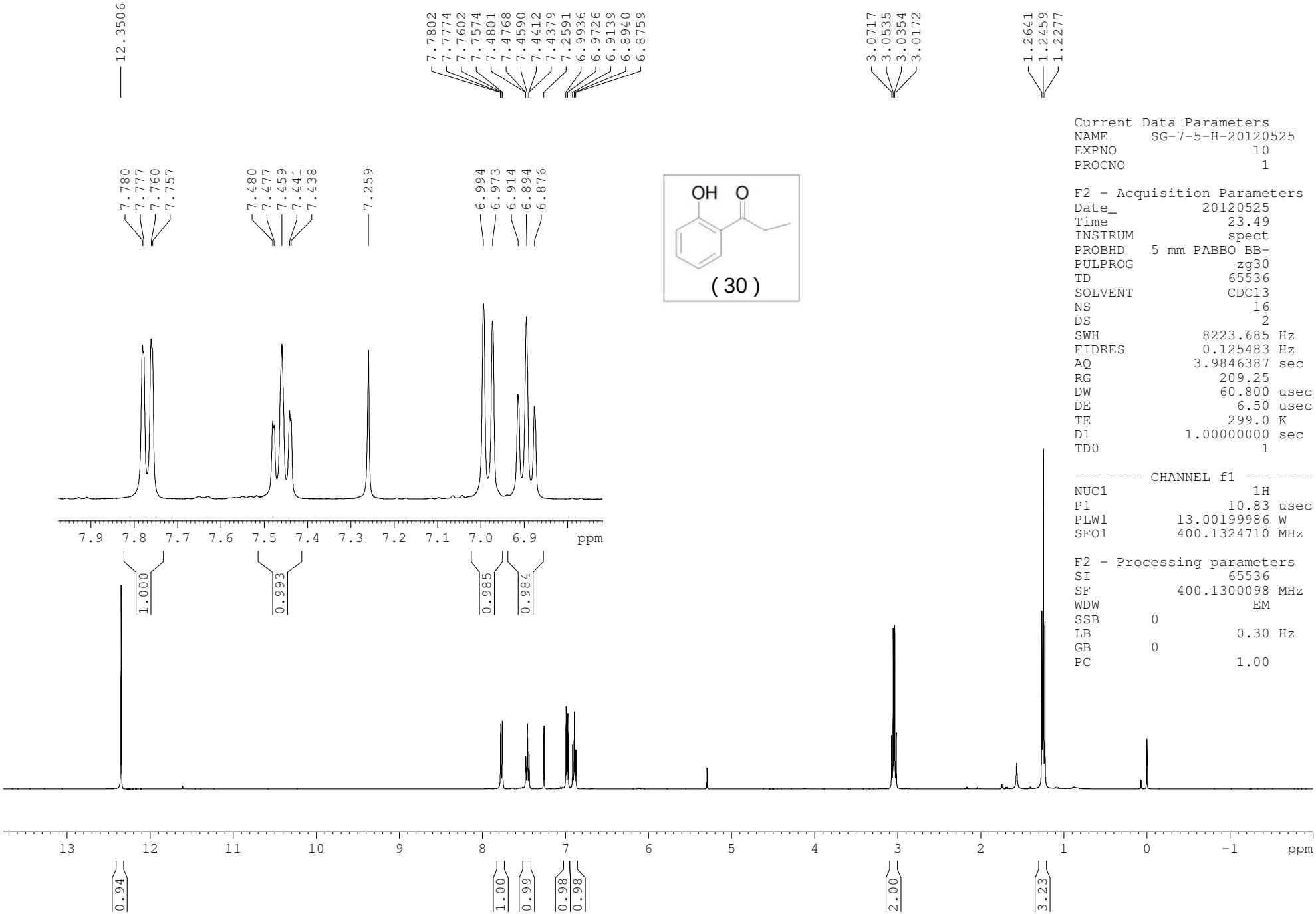
Current Data Parameters
NAME SG-6-143-H-20120317
EXPNO 10
PROCNO 1

F2 - Acquisition Parameters
Date_ 20120317
Time 14.43
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8223.685 Hz
FIDRES 0.125483 Hz
AQ 3.9846387 sec
RG 144.49
DW 60.800 usec
DE 6.50 usec
TE 298.1 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.49 usec
PLW1 13.00199986 W
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300095 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



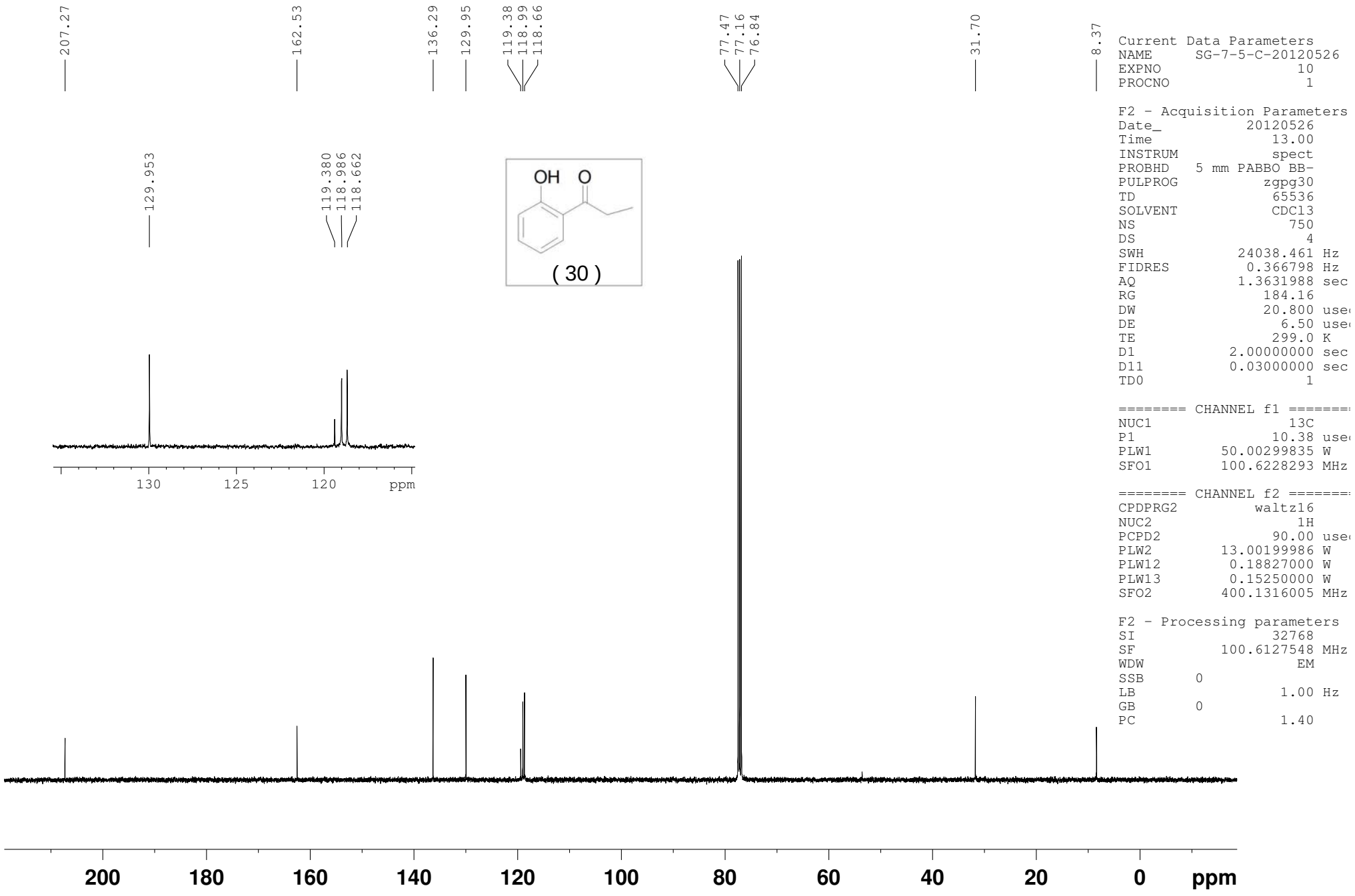


Current Data Parameters
NAME SG-7-5-H-20120525
EXPNO 10
PROCNO 1

F2 - Acquisition Parameters
Date_ 20120525
Time 23.49
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8223.685 Hz
FIDRES 0.125483 Hz
AQ 3.9846387 sec
RG 209.25
DW 60.800 usec
DE 6.50 usec
TE 299.0 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 10.83 usec
PLW1 13.00199986 W
SFO1 400.1324710 MHz

F2 - Processing parameters
SI 65536
SF 400.1300098 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00



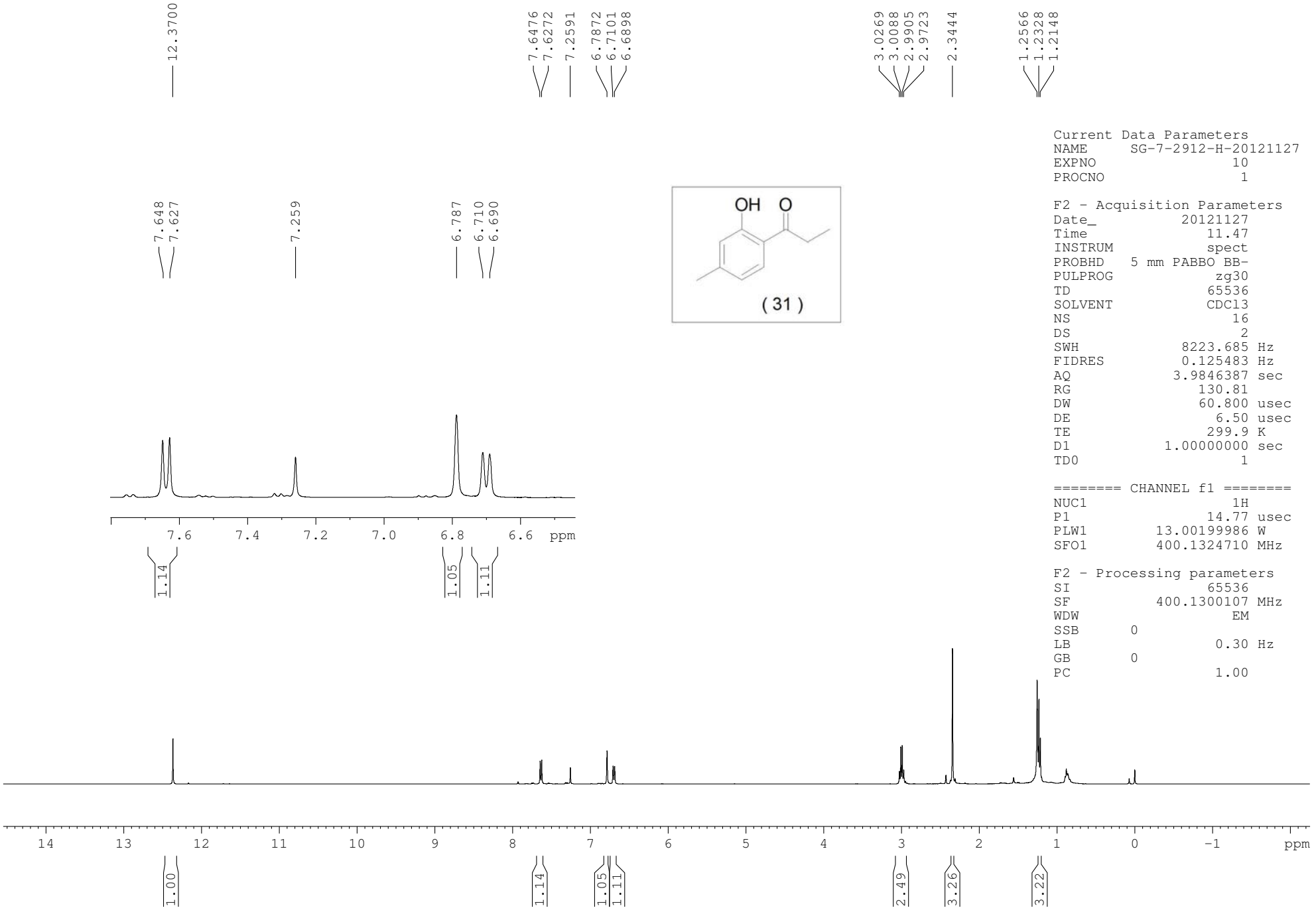

```
Current Data Parameters
NAME      SG-7-5-C-20120526
EXPNO                   10
PROCNO                   1

F2 - Acquisition Parameters
Date_           20120526
Time                13.00
INSTRUM             spect
PROBHD    5 mm PABBO BB-
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   750
DS                     4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ              1.3631988 sec
RG                184.16
DW                20.800 use
DE                 6.50 use
TE                299.0 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
NUC1                  13C
P1                 10.38 use
PLW1         50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                  1H
PCPD2              90.00 use
PLW2         13.00199986 W
PLW12         0.18827000 W
PLW13         0.15250000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF          100.6127548 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```



Current Data Parameters
NAME SG-7-2912-H-20121127
EXPNO 10
PROCNO 1

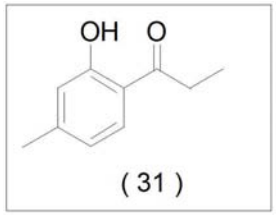
F2 - Acquisition Parameters
Date_ 20121127
Time 11.47
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8223.685 Hz
FIDRES 0.125483 Hz
AQ 3.9846387 sec
RG 130.81
DW 60.800 usec
DE 6.50 usec
TE 299.9 K
D1 1.00000000 sec
TD0 1

======== CHANNEL f1 ========
NUC1 1H
P1 14.77 usec
PLW1 13.00199986 W
SFO1 400.1324710 MHz

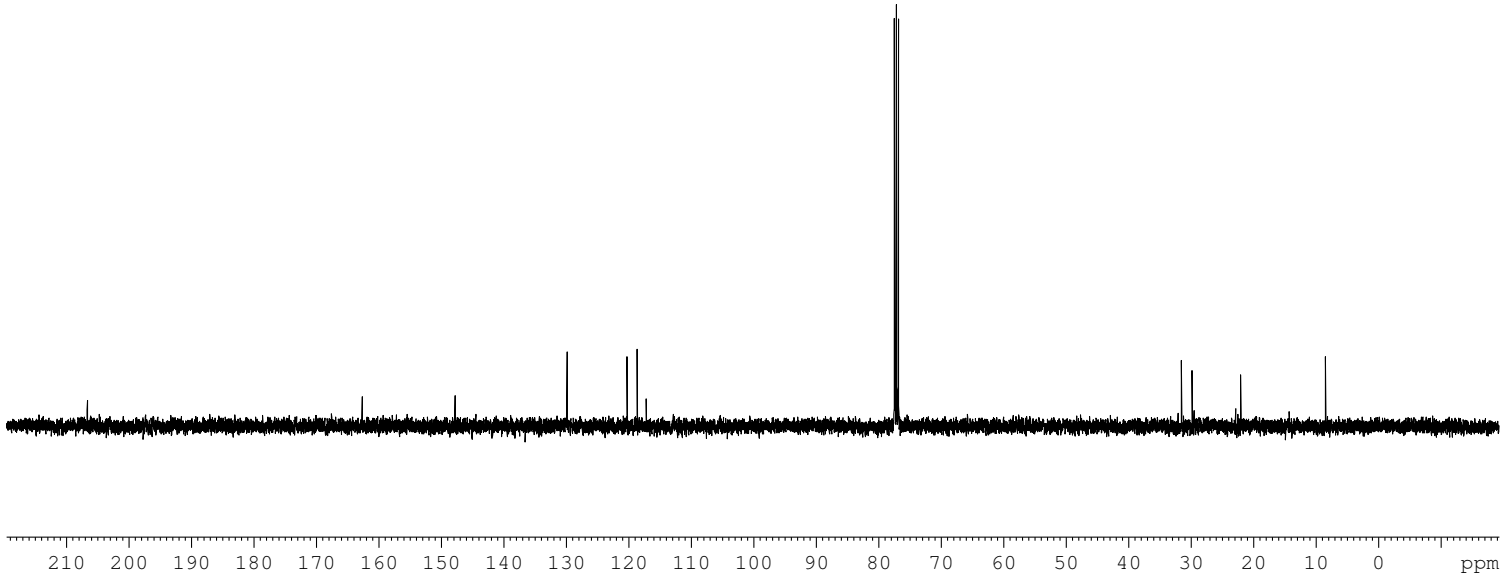
F2 - Processing parameters
SI 65536
SF 400.1300107 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

C13CPD CDCl3 {D:\NMR_DATA} RY 20

206.69 162.68 147.83 129.85 120.27 118.66 117.19 77.48 77.16 76.84 31.54 29.85 22.05 8.50



(31)



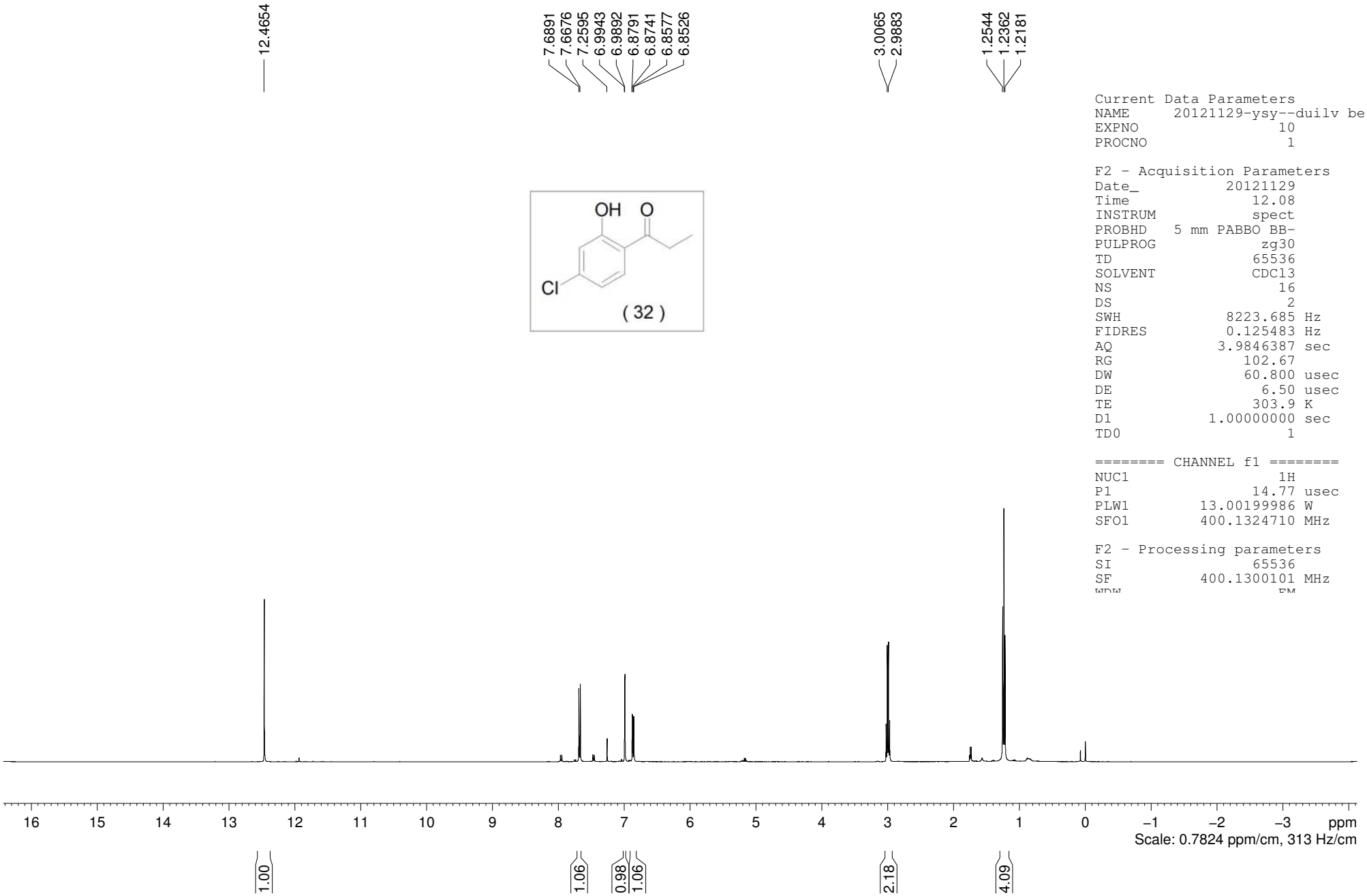

```
Current Data Parameters
NAME      SG-7-2912-C-20121127
EXPNO                   10
PROCNO                   1

F2 - Acquisition Parameters
Date_             20121127
Time                 15.31
INSTRUM              spect
PROBHD    5 mm PABBO BB-
PULPROG            zgpg30
TD                  65536
SOLVENT             CDCl3
NS                    512
DS                      4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ              1.3631988 sec
RG                184.16
DW                20.800 usec
DE                 6.50 usec
TE                299.8 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   13C
P1                  10.30 usec
PLW1         50.00299835 W
SFO1         100.6228293 MHz

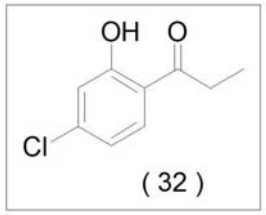
======== CHANNEL f2 ========
CPDPRG2           waltz16
NUC2                   1H
PCPD2               90.00 usec
PLW2         13.00199986 W
PLW12         0.35018000 W
PLW13         0.28364000 W
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                  32768
SF           100.6127541 MHz
WDW                    EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```



C13CPD CDCl3 {D:\NMR_DATA} RY 27

206.48 163.21 141.96 130.91 119.66 118.71 117.94 77.48 77.16 76.84 31.80 8.25



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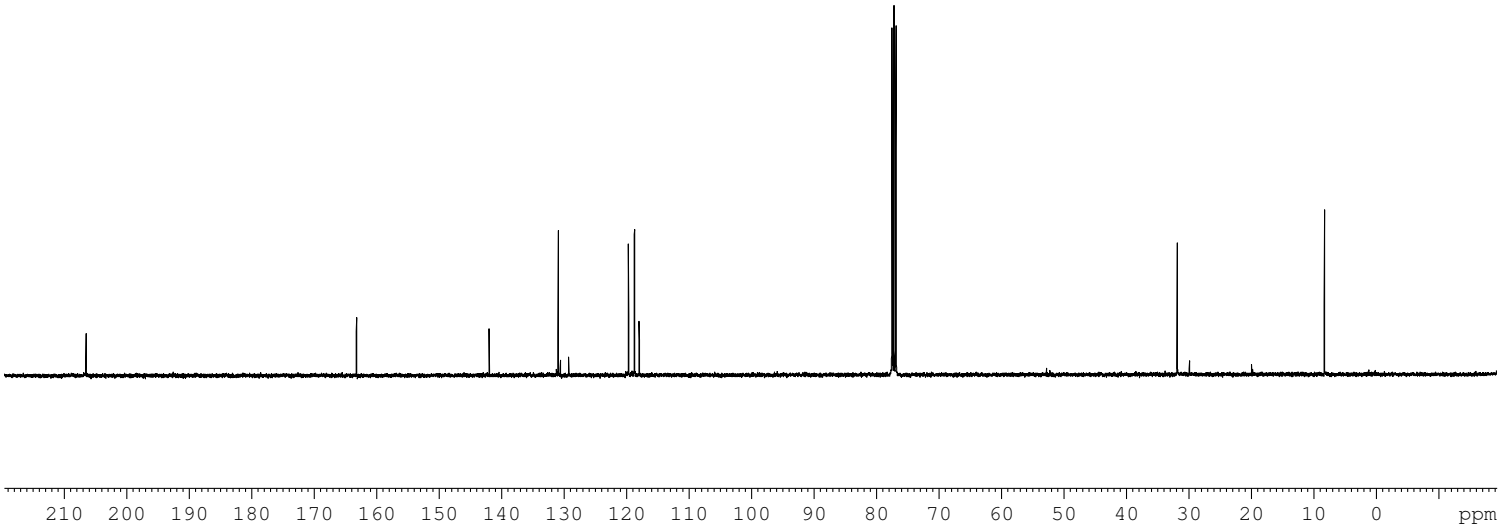


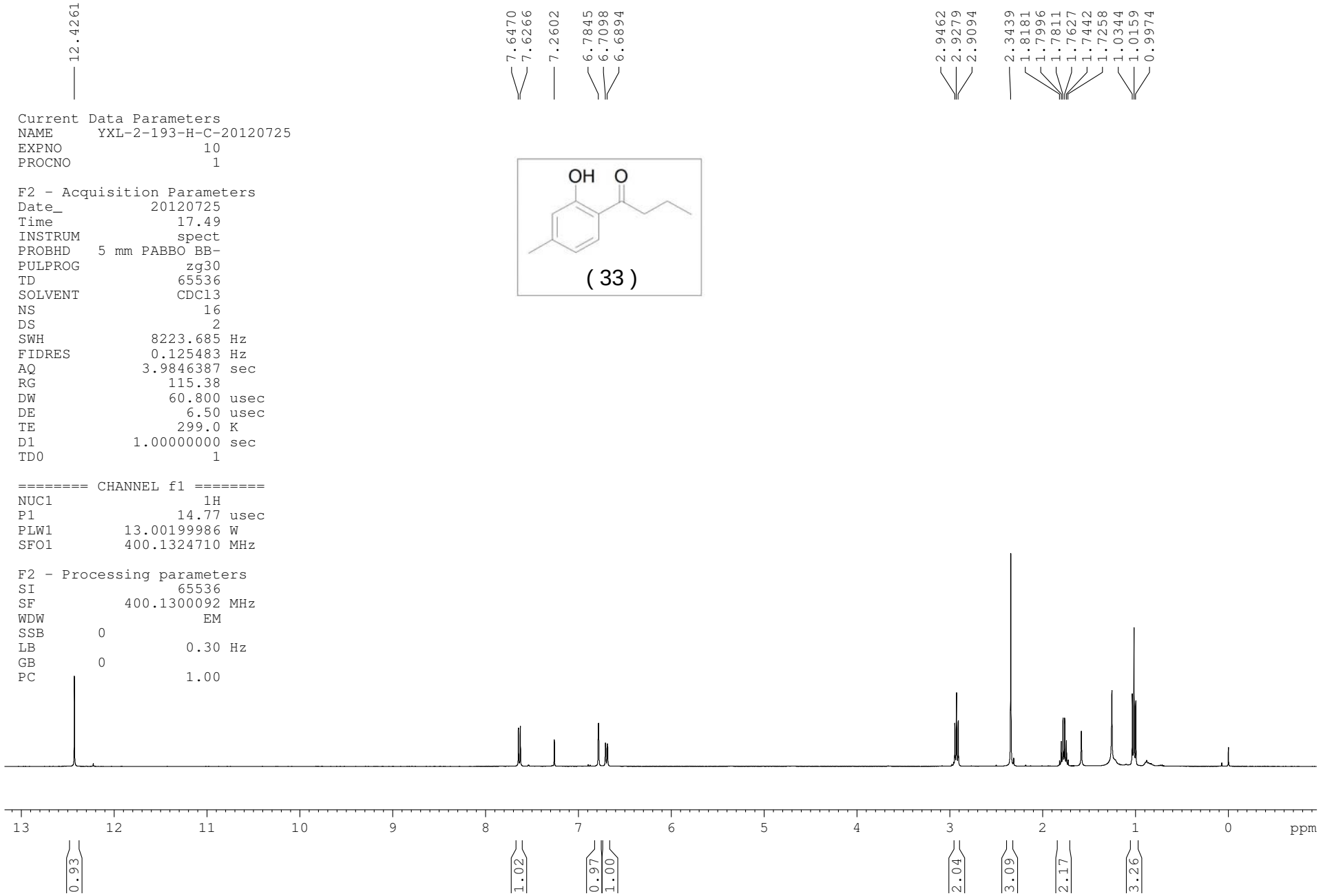

```
Current Data Parameters
NAME      20121129-ysy--duilv benbingtong--m-oh
EXPNO                 11
PROCNO                 1

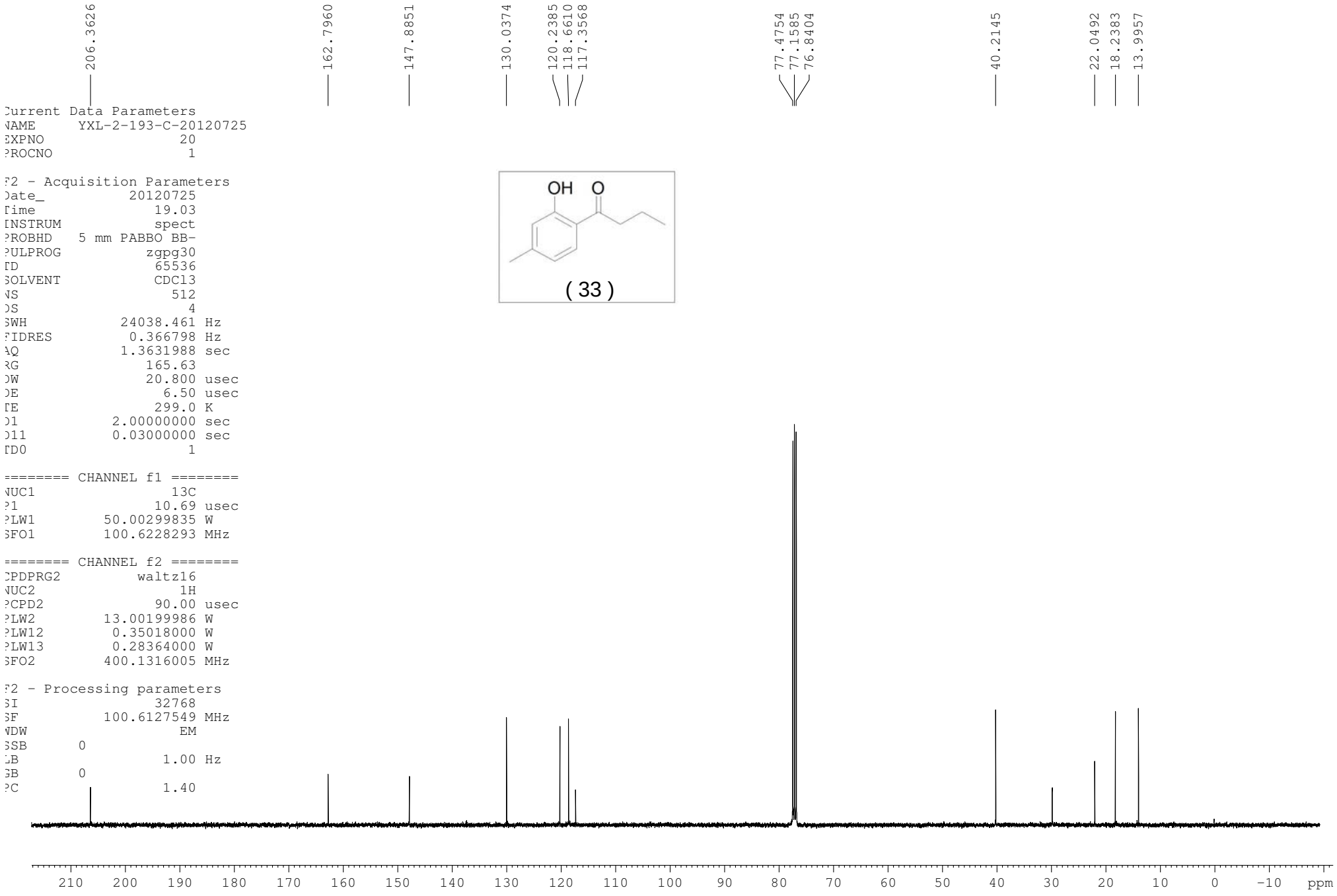
F2 - Acquisition Parameters
Date_           20121129
Time              12.38
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  512
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631988 sec
RG                209.25
DW               20.800 usec
DE                6.50 usec
TE               299.9 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

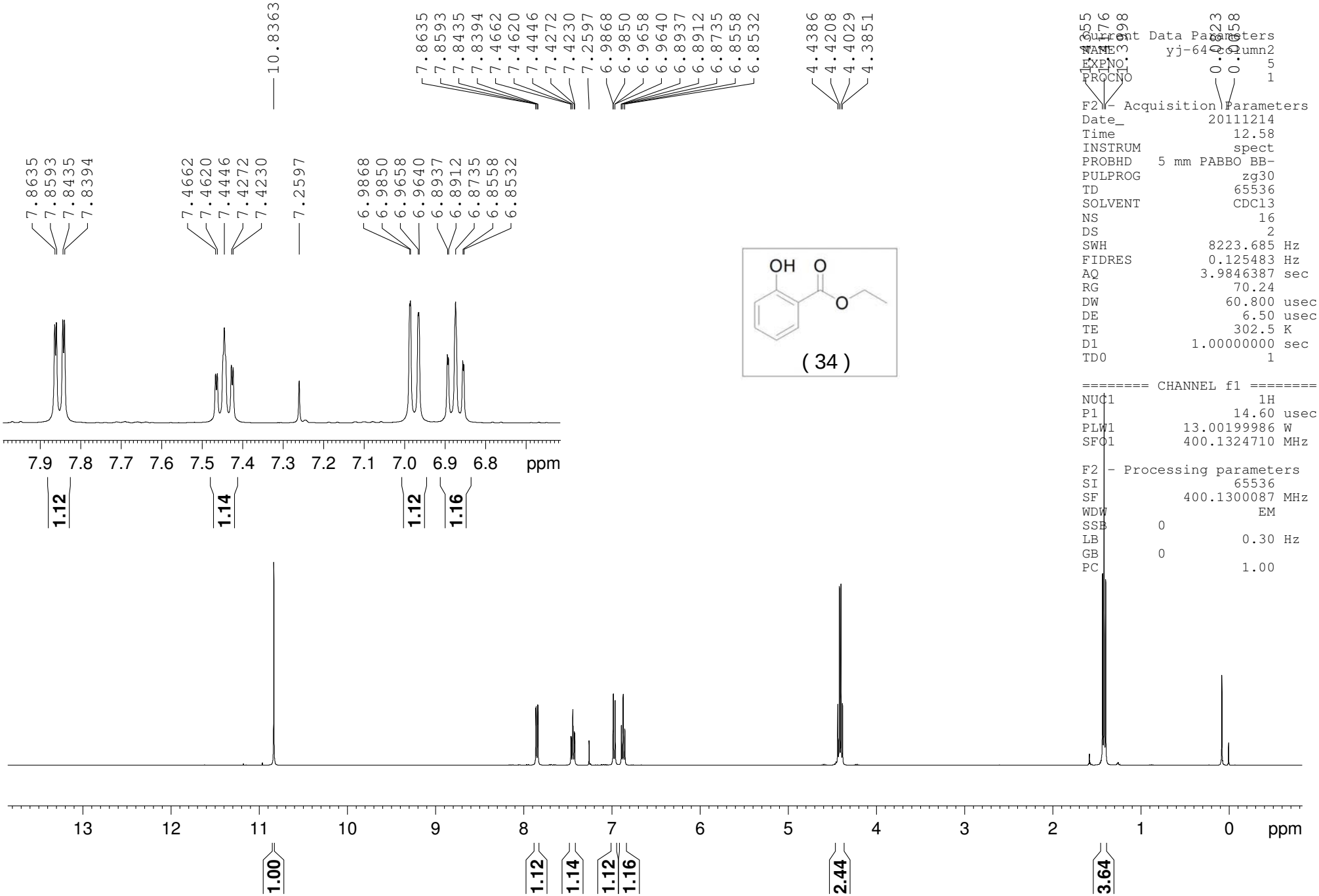
======== CHANNEL f1 ========
NUC1                 13C
P1                10.30 usec
PLW1        50.00299835 W
SFO1        100.6228293 MHz

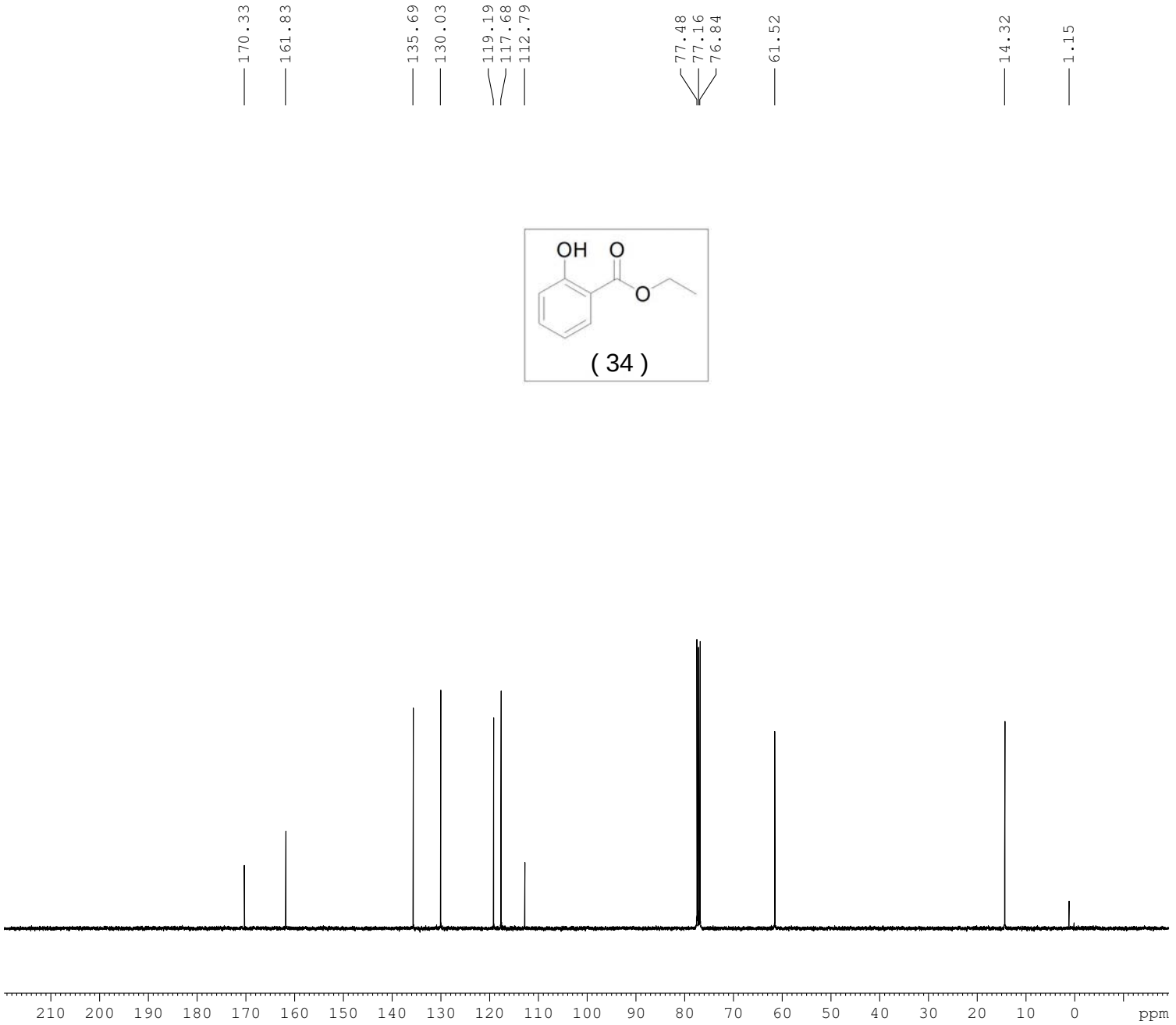
======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.35018000 W
PLW13        0.28364000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127547 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```









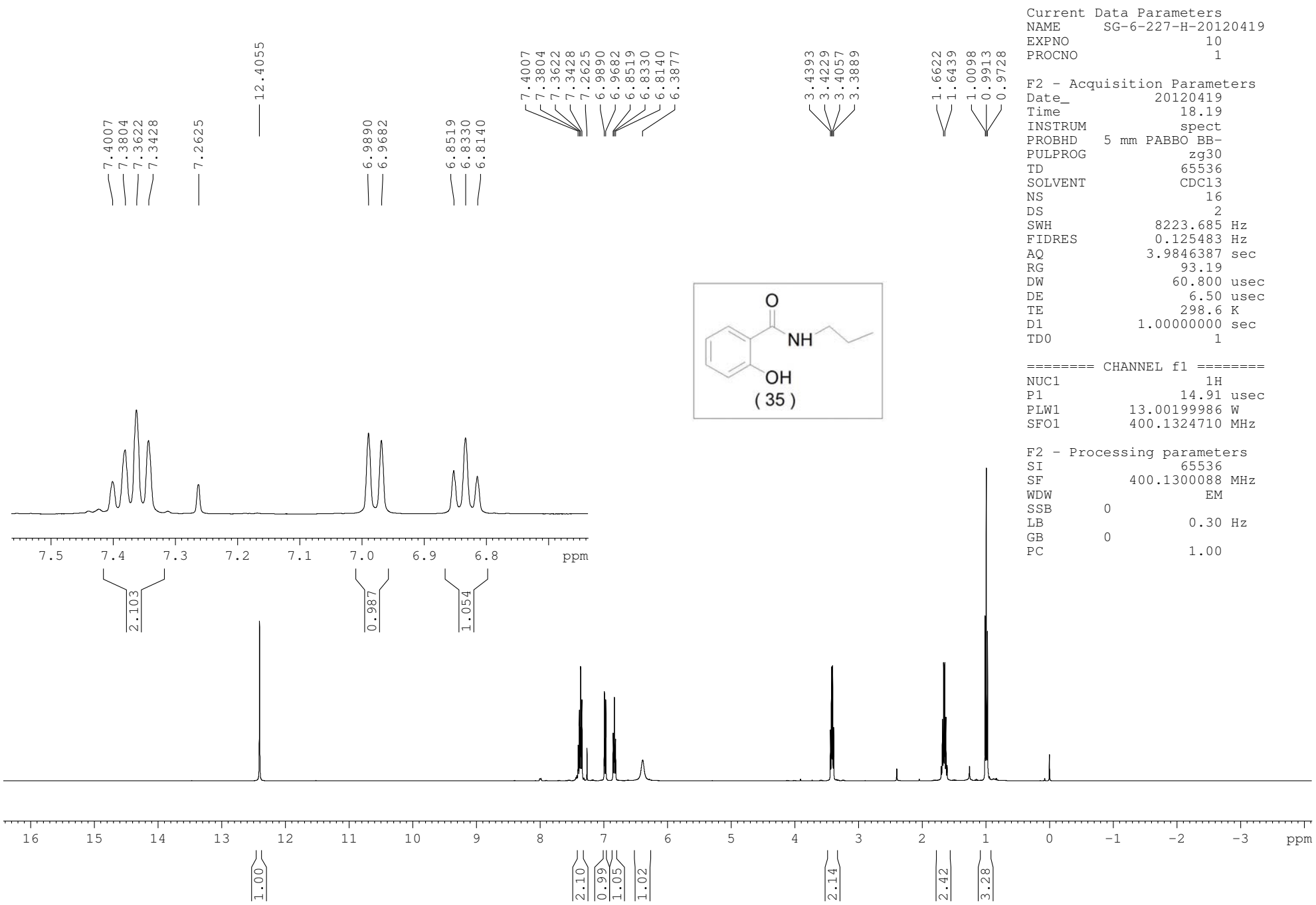

```
Current Data Parameters
NAME      yj-64-column2-C
EXPNO                  10
PROCNO                  1

F2 - Acquisition Parameters
Date_           20111214
Time               13.22
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDC13
NS                  400
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ            1.3631988 sec
RG               209.25
DW               20.800 usec
DE                6.50 usec
TE               302.5 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.00 usec
PLW1        50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.36116999 W
PLW13        0.29255000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127543 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

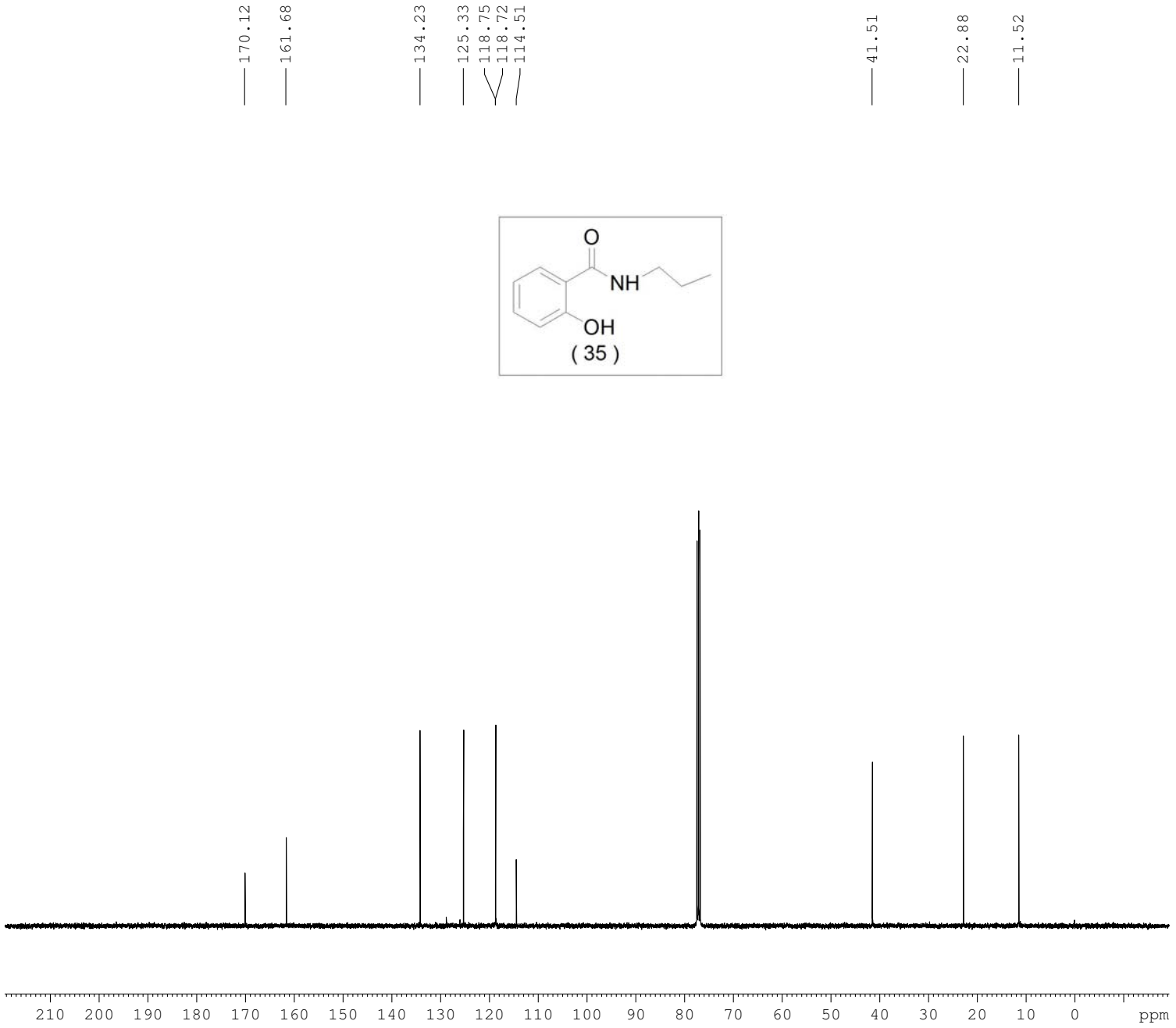



```
Current Data Parameters
NAME      SG-6-227-H-20120419
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_            20120419
Time                18.19
INSTRUM             spect
PROBHD    5 mm PABBO BB-
PULPROG              zg30
TD                  65536
SOLVENT             CDCl3
NS                     16
DS                      2
SWH              8223.685 Hz
FIDRES           0.125483 Hz
AQ               3.9846387 sec
RG                  93.19
DW                 60.800 usec
DE                  6.50 usec
TE                 298.6 K
D1              1.00000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   1H
P1                  14.91 usec
PLW1          13.00199986 W
SFO1          400.1324710 MHz

F2 - Processing parameters
SI                  65536
SF            400.1300088 MHz
WDW                    EM
SSB       0
LB                  0.30 Hz
GB        0
PC                  1.00
```



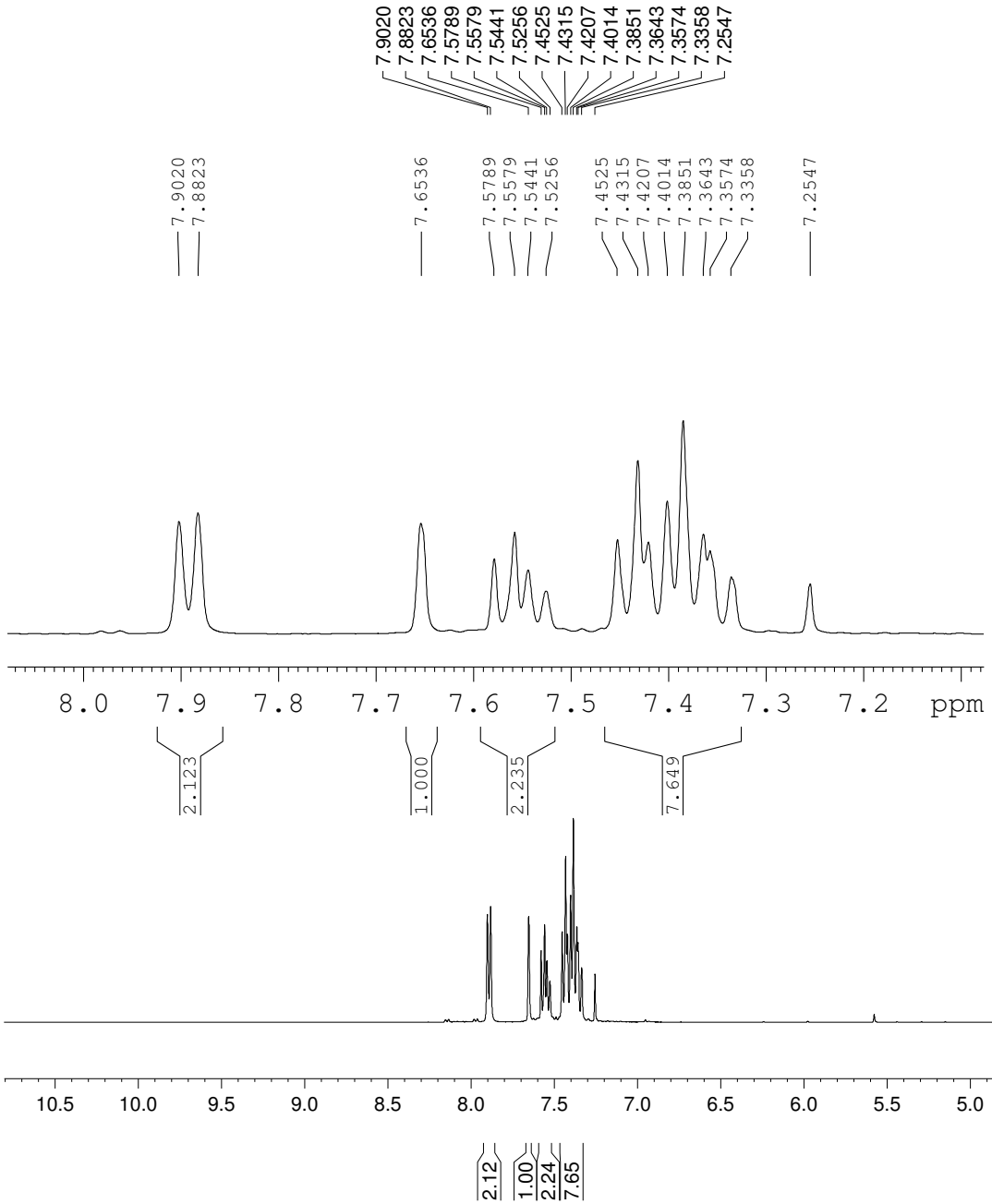

```
Current Data Parameters
NAME      SG-6-227-C-20120419
EXPNO                      20
PROCNO                      1

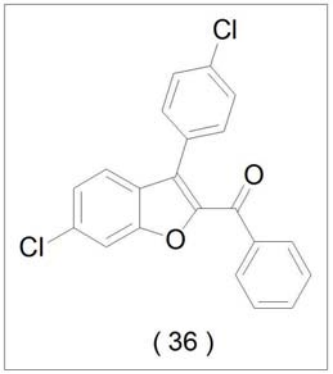
F2 - Acquisition Parameters
Date_            20120419
Time                21.02
INSTRUM             spect
PROBHD   5 mm PABBO BB-
PULPROG            zgpg30
TD                  65536
SOLVENT             CDCl3
NS                    512
DS                      4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ             1.3631988 sec
RG                 209.25
DW                 20.800 usec
DE                  6.50 usec
TE                 299.7 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
NUC1                   13C
P1                  10.31 usec
PLW1         50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2           waltz16
NUC2                   1H
PCPD2               90.00 usec
PLW2         13.00199986 W
PLW12         0.35685000 W
PLW13         0.28904000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                  32768
SF           100.6127563 MHz
WDW                    EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```





(36)

```
Current Data Parameters
NAME      SG-8-1-H-20121126
EXPNO                   10
PROCNO                   1

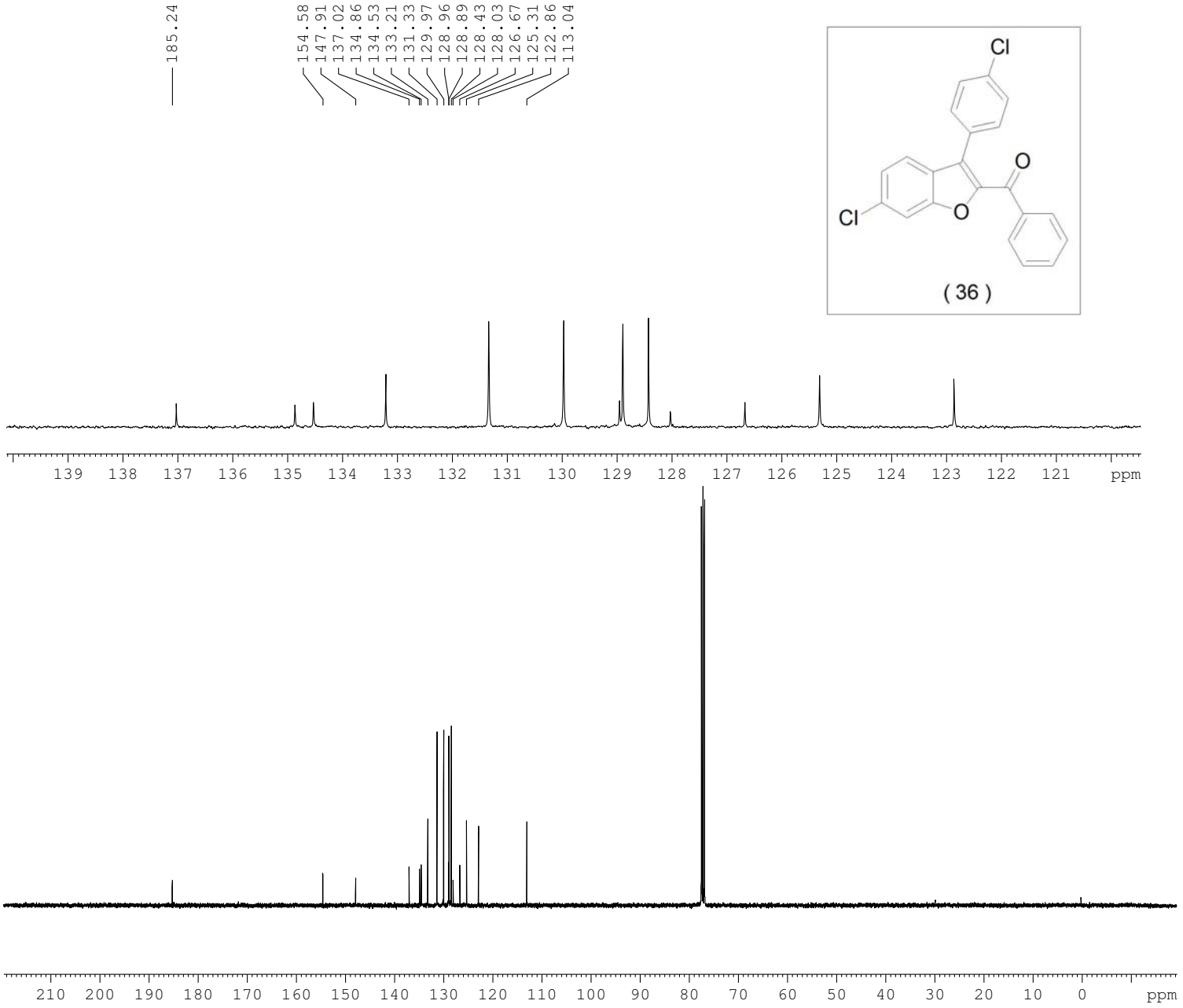
F2 - Acquisition Parameters
Date_             20121127
Time                  7.32
INSTRUM              spect
PROBHD    5 mm PABBO BB-
PULPROG               zg30
TD                   65536
SOLVENT              CDCl3
NS                      16
DS                       2
SWH               8223.685 Hz
FIDRES            0.125483 Hz
AQ               3.9846387 sec
RG                  144.49
DW                  60.800 usec
DE                   6.50 usec
TE                  299.9 K
D1              1.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   14.77 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                   65536
SF             400.1300123 MHz
WDW                     EM
```

Scale: 0.4197 ppm/cm, 167.9 Hz/cm

C13CPD CDCl3 {D:\NMR_DATA} RY 19



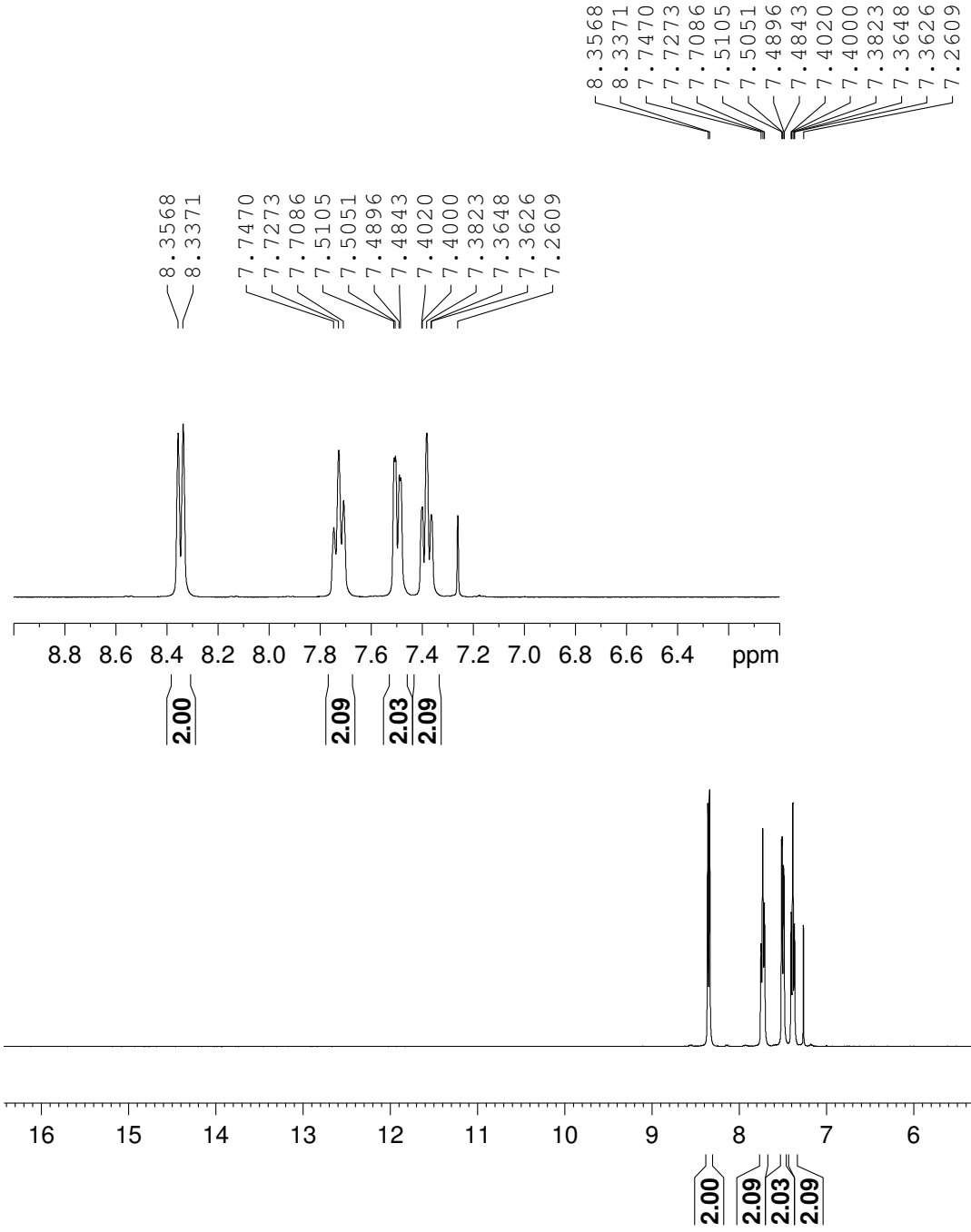

```
Current Data Parameters
NAME      SG-8-1-C-20121127
EXPNO                   10
PROCNO                   1

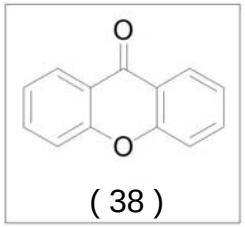
F2 - Acquisition Parameters
Date_           20121127
Time              11.32
INSTRUM           spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  512
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ            1.3631988 sec
RG               209.25
DW               20.800 usec
DE                6.50 usec
TE               299.9 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.30 usec
PLW1        50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.35018000 W
PLW13        0.28364000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF           100.6127554 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



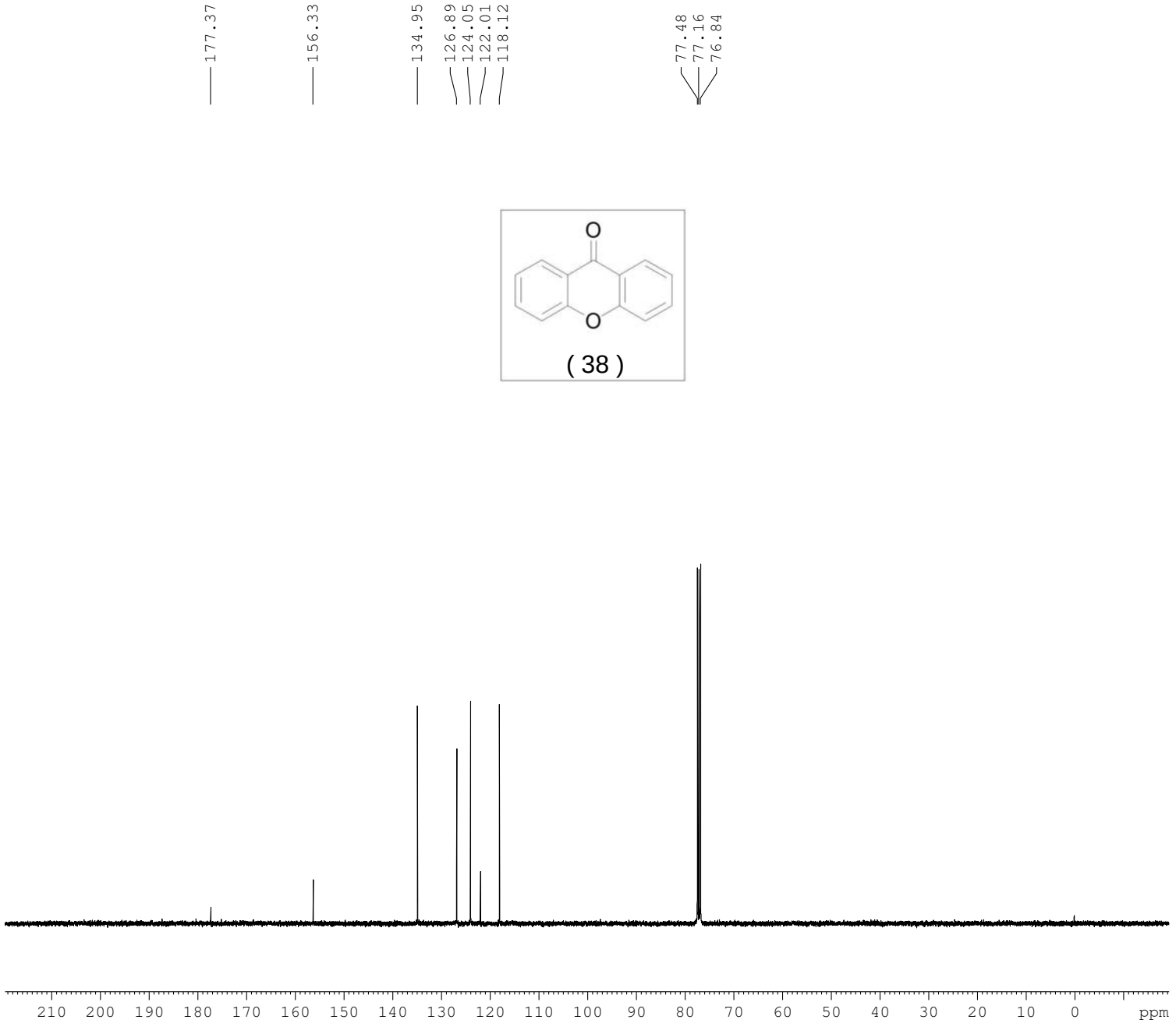



```
Current Data Parameters
NAME      SG-7-Xanthone-H-2012
EXPNO                      10
PROCNO                      1

F2 - Acquisition Parameters
Date_              20120815
Time                   2.34
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                8223.685 Hz
FIDRES             0.125483 Hz
AQ                 3.9846387 sec
RG                    165.63
DW                    60.800 usec
DE                     6.50 usec
TE                    299.0 K
D1                 1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                    14.77 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                        65536
SF             400.1300093 MHz
WDW                       EM
SSB       0
LB                     0.30 Hz
GB        0
PC                     1.00
```



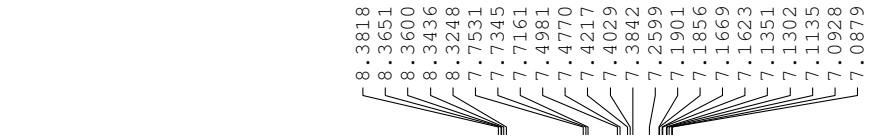

```
Current Data Parameters
NAME      SG-7-Xanthone-C-20120814
EXPNO                  12
PROCNO                  1

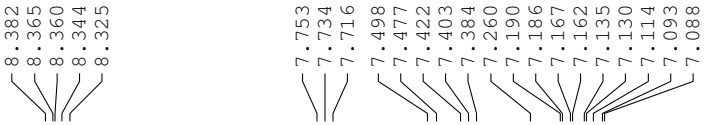
F2 - Acquisition Parameters
Date_           20120815
Time                3.04
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   512
DS                     4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ             1.3631988 sec
RG                165.63
DW                20.800 usec
DE                 6.50 usec
TE                299.0 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

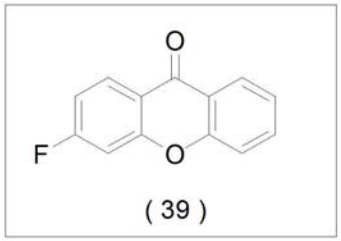
======== CHANNEL f1 ========
NUC1                  13C
P1                 10.69 usec
PLW1         50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                  1H
PCPD2              90.00 usec
PLW2         13.00199986 W
PLW12         0.35018000 W
PLW13         0.28364000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                 32768
SF          100.6127554 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```







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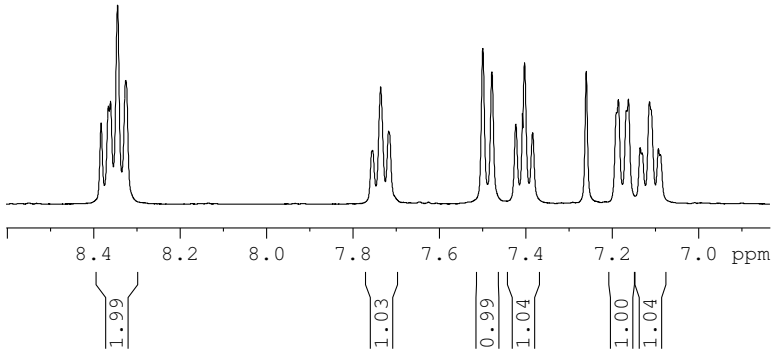
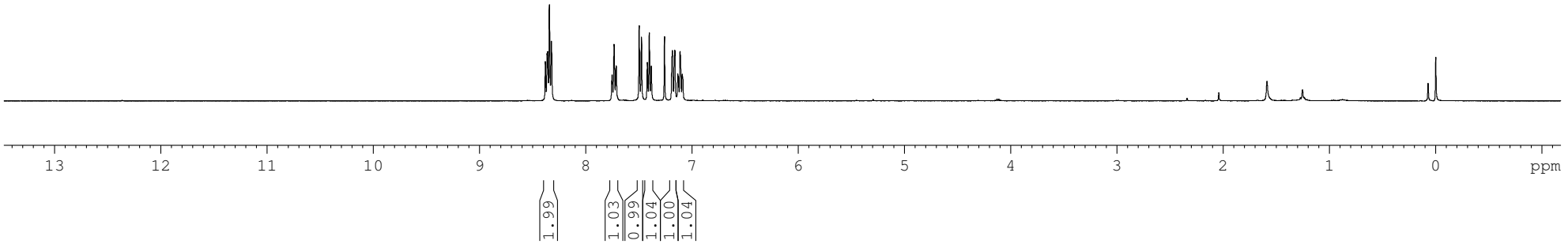



```
Current Data Parameters
NAME      20121124-ysy--1--171
EXPNO                      10
PROCNO                      1

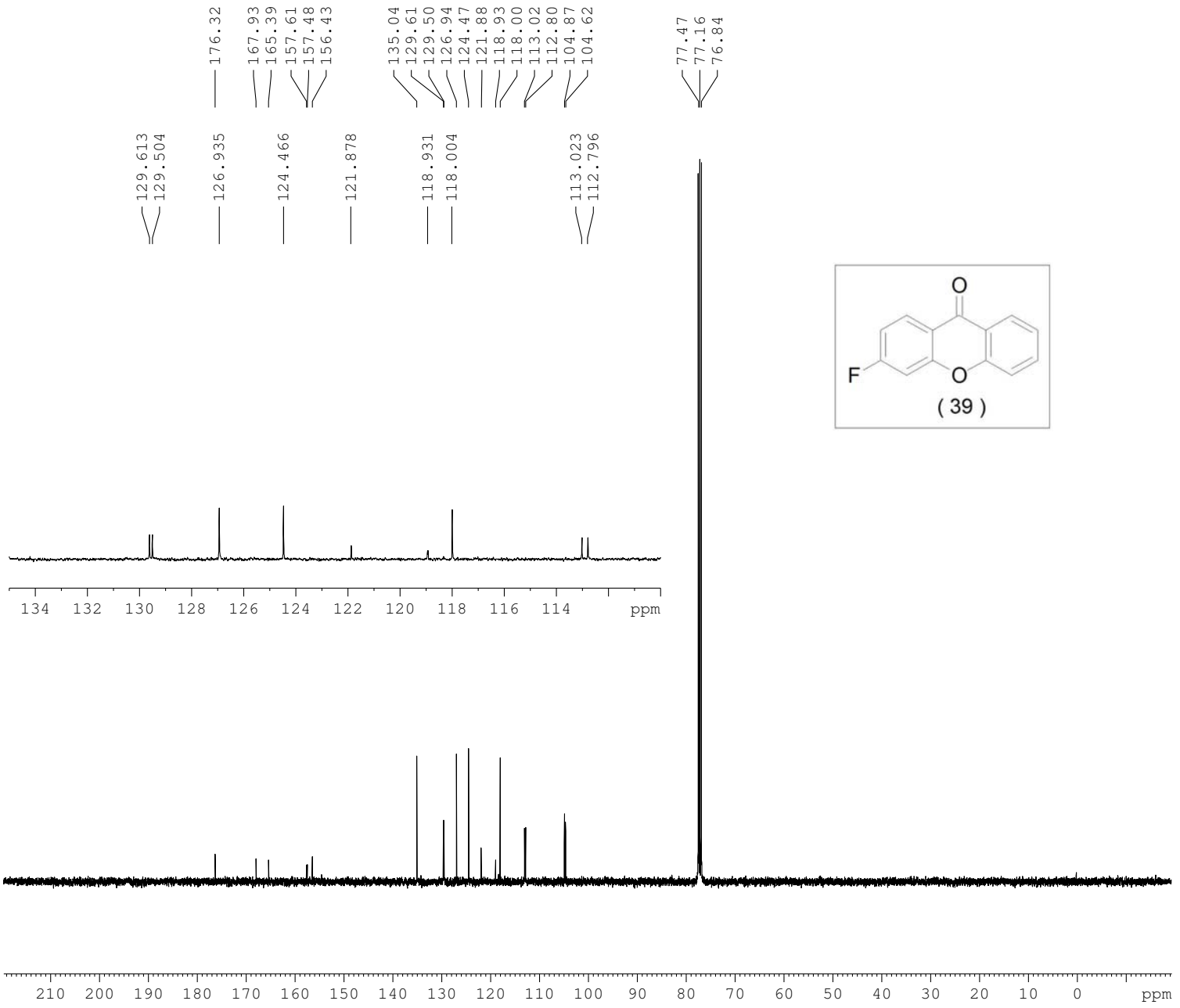
F2 - Acquisition Parameters
Date_              20121124
Time                  21.49
INSTRUM               spect
PROBHD    5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                       16
DS                        2
SWH                8223.685 Hz
FIDRES             0.125483 Hz
AQ                 3.9846387 sec
RG                    209.25
DW                    60.800 usec
DE                     6.50 usec
TE                    299.8 K
D1              1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                     14.77 usec
PLW1           13.00199986 W
SFO1           400.1324710 MHz

F2 - Processing parameters
SI                    65536
SF             400.1300104 MHz
WDW                      EM
SSB       0
LB                     0.30 Hz
GB        0
PC                     1.00
```



C13CPD CDCl3 {D:\NMR_DATA} RY 15




```
Current Data Parameters
NAME      20121124-ysy--1--171
EXPNO                   11
PROCNO                   1

F2 - Acquisition Parameters
Date_           20121126
Time               12.00
INSTRUM            spect
PROBHD    5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  465
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631988 sec
RG                165.63
DW                20.800 usec
DE                 6.50 usec
TE                673.1 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.30 usec
PLW1         50.00299835 W
SFO1         100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2         13.00199986 W
PLW12         0.35018000 W
PLW13         0.28364000 W
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                32768
SF           100.6127549 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
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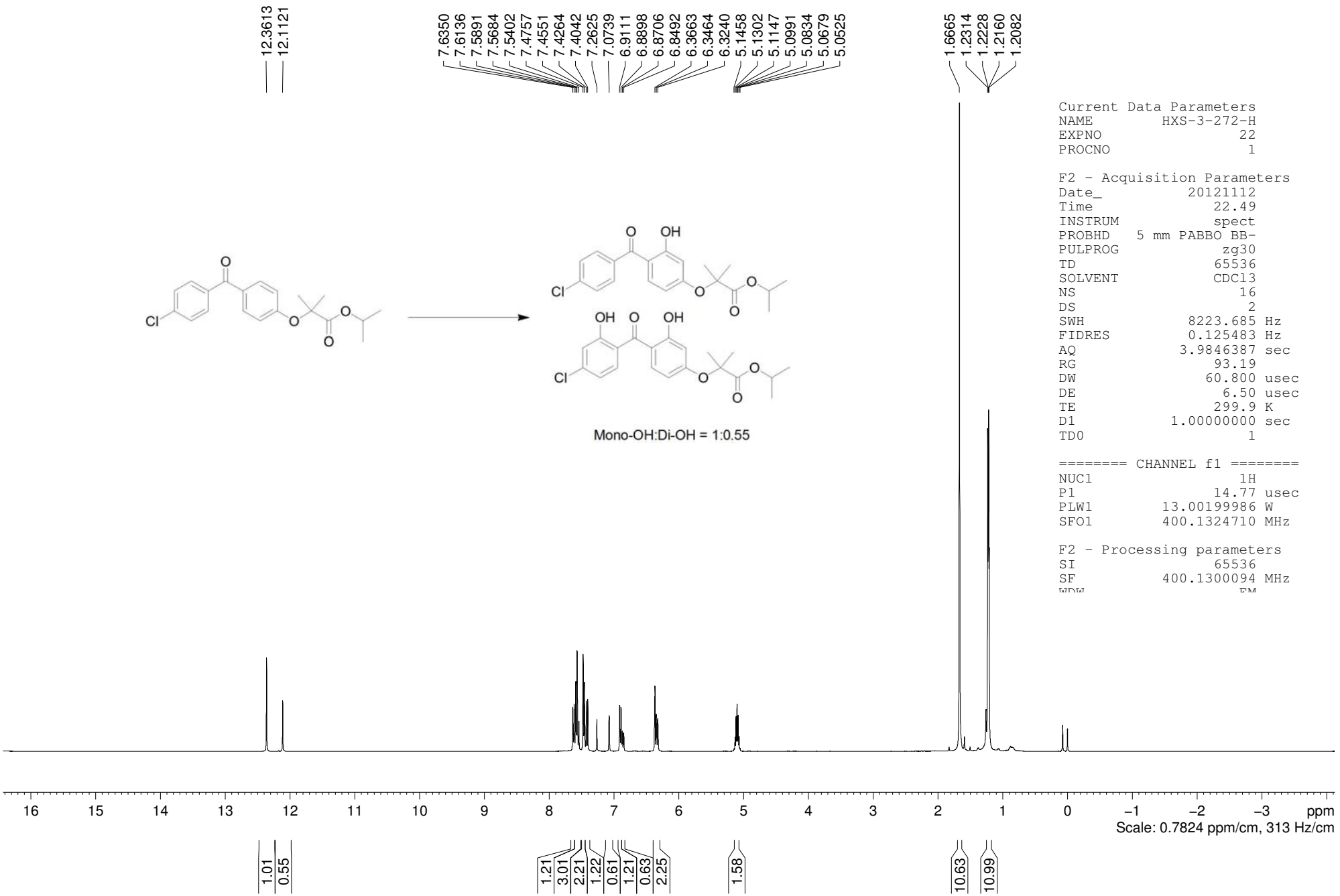

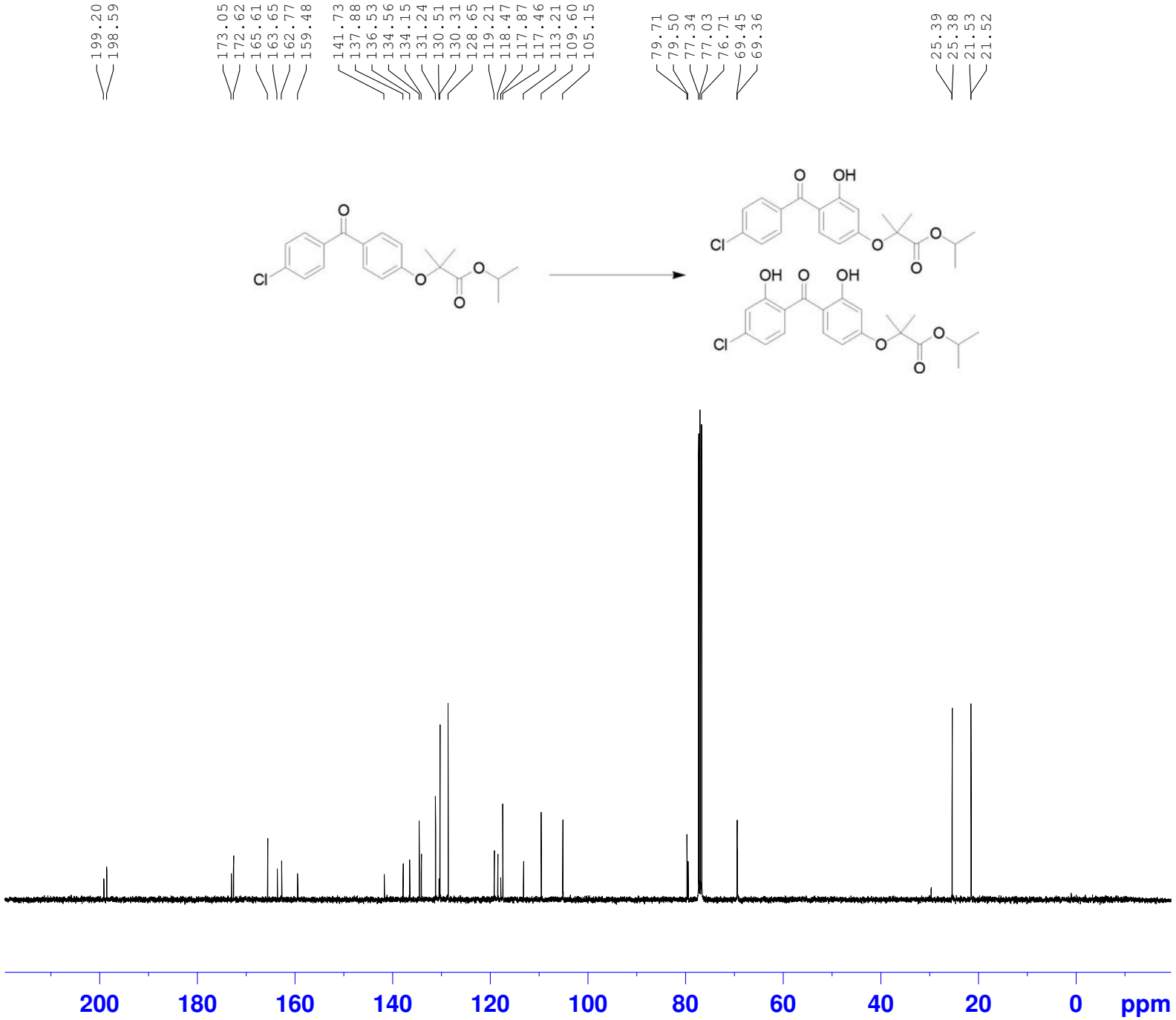


```
Current Data Parameters
NAME         HXS-3-272-C
EXPNO                 30
PROCNO                 1

F2 - Acquisition Parameters
Date_           20121112
Time               23.18
INSTRUM            spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  400
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ            1.3631988 sec
RG                209.25
DW                20.800 usec
DE                 6.50 usec
TE                299.9 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
NUC1                 13C
P1                10.30 usec
PLW1        50.00299835 W
SFO1        100.6228293 MHz

======== CHANNEL f2 ========
CPDPRG2          waltz16
NUC2                 1H
PCPD2             90.00 usec
PLW2        13.00199986 W
PLW12        0.35018000 W
PLW13        0.28364000 W
SFO2        400.1316005 MHz

F2 - Processing parameters
SI                32768
SF          100.6127690 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```