Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry

A Versatile and Practical Method for Regioselective Synthesis of Polysubstituted Furanonaphthoquinones

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Supplementary Data

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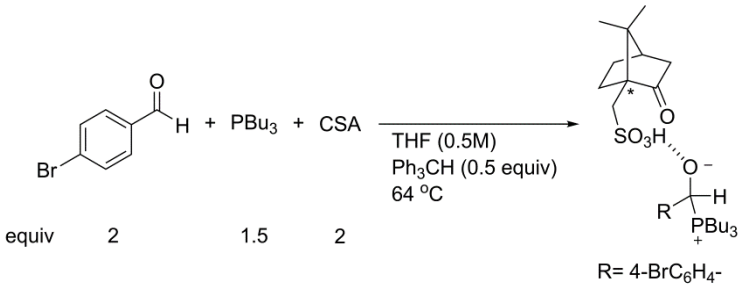
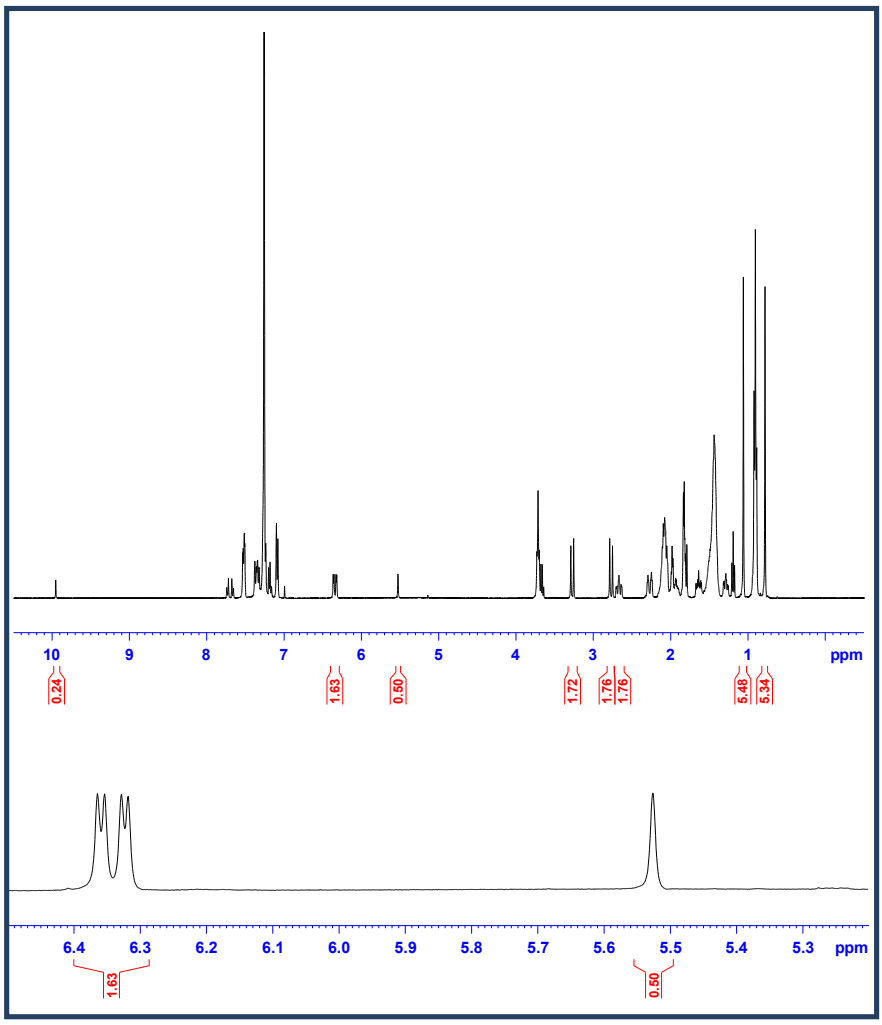
Ⅰ. Extra Schemes and Figures:

(1) Controlled experiments for mechanism studies:

Three controlled experiments were performed with 4-bromobenzaldehyde **2a**, CSA, Bu_3P, and a known amount of Ph_3CH (as internal reference for calculating the ratio of NMR integrals) in dry THF (0.5 mL) at 64 °C under nitrogen, and the ^1H NMR spectra of their crude products were measured and discussed as below.

(a)

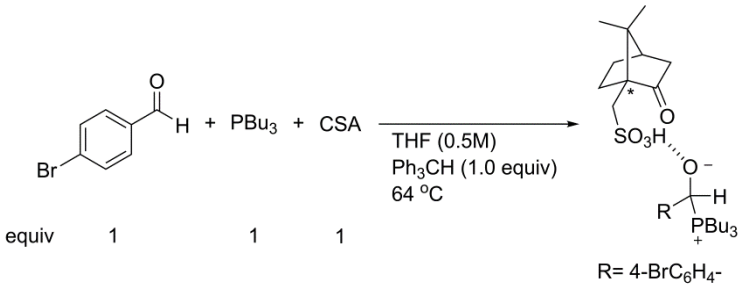


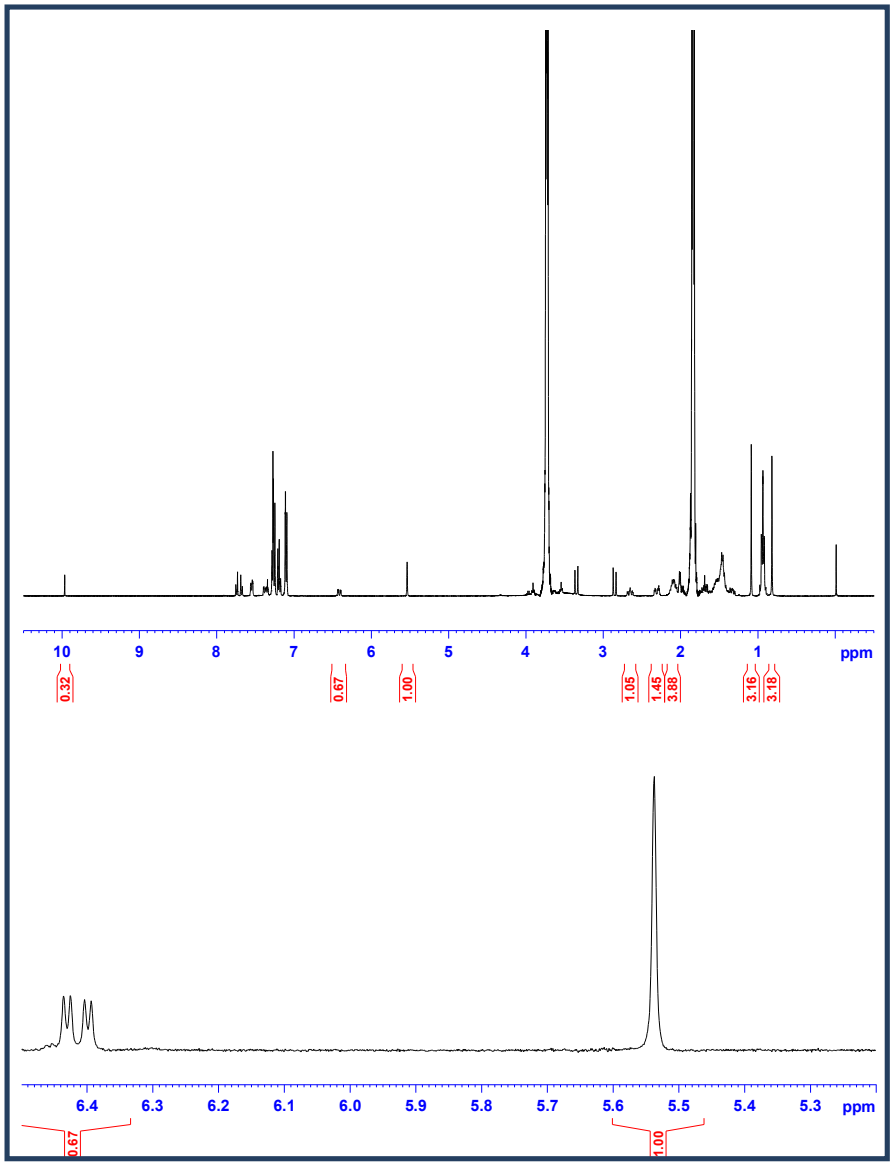


The ^1H NMR spectra of the crude product indicated three kinds of protons as singlet, doublet of doublets, and singlet signals near δ 10, 6.3, and 5.5 ppm assignable to RC**H**O (remaining aldehyde **2a**), CSA-$RP^+Ph_3C\mathbf{H}O^-$, and $Ph_3C\mathbf{H}$ protons respectively. For the signal ratio, the integral value of CSA-$RP^+Ph_3C\mathbf{H}O^-$ was similar to the equivalent of PPh_3, and the sum of signals near δ 10 and 6.3 ppm was close to the equivalent of RCHO **2a** initially used. These results showed that aldehyde **2a** reacted with

PPh_3 almost quantitatively catalyzed by CSA.

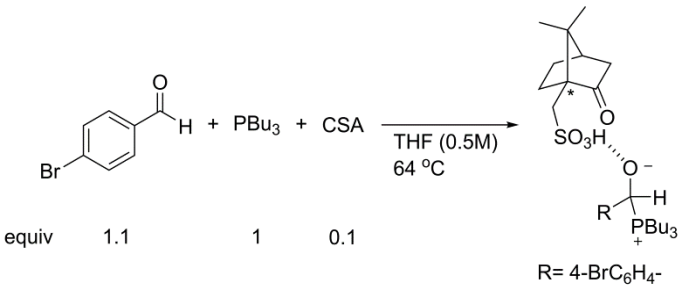
(b)

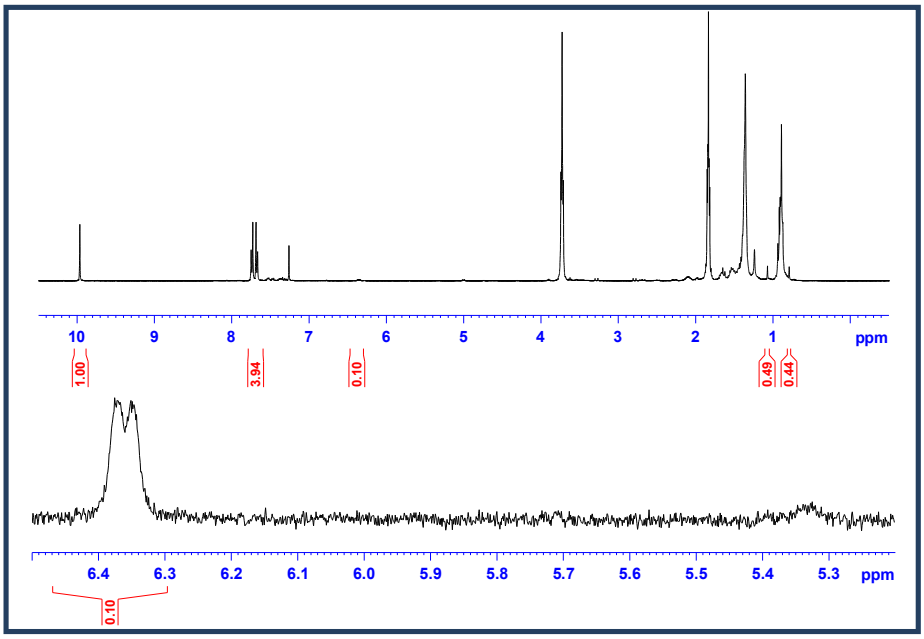




Similarly, when the reaction was performed with equal amounts of **2a**, CSA, Bu_3P, and Ph_3CH, the sum of signals near δ 10 and 6.4 ppm was also very close to the equivalent of **2a** initially used.

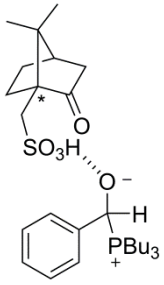
(c)



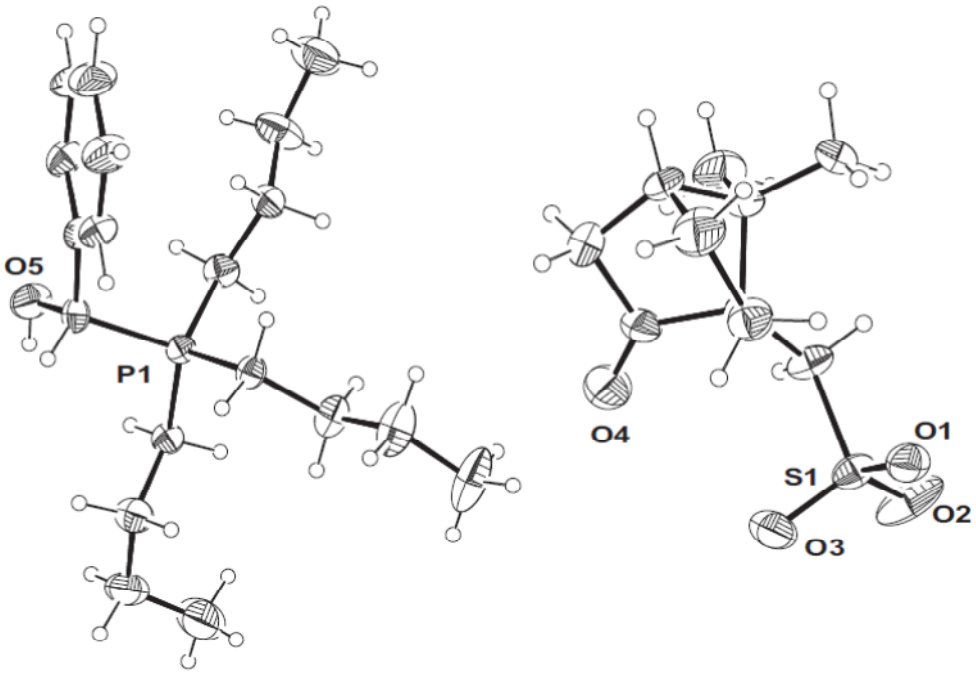


Finally, even when the reaction was performed with catalytic amounts of CSA, the amount of intermediate **I** (CSA-RP^{+}Ph$_3$C**H**O^{-}) formed from the reaction of **2a** and Bu$_3$P was equal to that of CSA, and the sum of signals near δ 10 and 6.3 ppm was exactly the same as the equivalent of **2a** initially used. Based on the above results, it was apparent that Bu$_3$P can react with **2a** to form the intermediate **I** as mentioned in our proposed mechanism and the extent of this reaction depended on the amount of CSA.

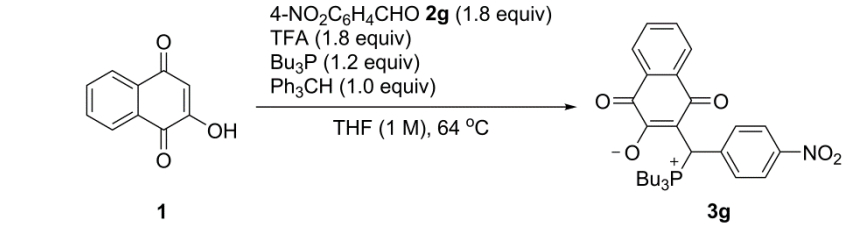
(d) Furthermore, the crude products from controlled experiments were purified by recrystallization, and the structure of the intermediate **I** (R = Ph) was also determined by X-ray analysis (**CCDC Number: 887788**).



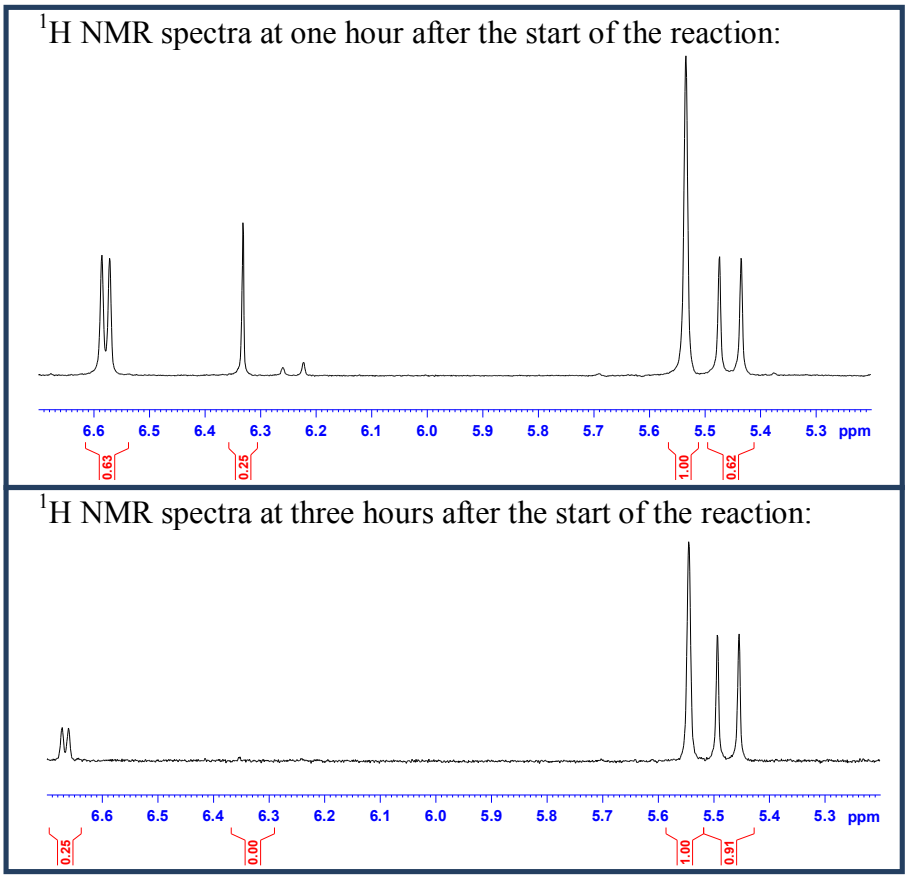
Intermediate **I** (R = Ph)



(e) The intermediate Ⅰ could be observed not only in the controlled experiments without 2-hydroxynaphthoquinone **1** but in the reactions with **1**.



1 **3g**

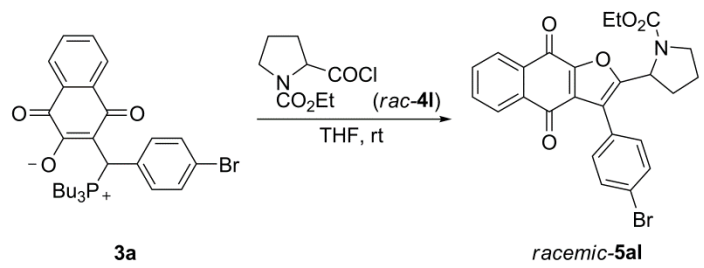


The ^{1}H NMR spectra during the course of the reaction indicated four kinds of protons as doublet, singlet, singlet, and doublet signals near δ 6.6, 6.3, 5.5 and 5.4 ppm assignable to intermediate Ⅰ, 2-hydroxynaphthoquinone **1**, Ph_3CH, and product **3g** protons respectively. At one hour after the start of the reaction, the sum of signals near δ 6.3 (remaining **1**) and 5.4 (producing **3g**, consuming **1**) ppm was close to the equivalent of **1** initially used, and it indicated that 2-hydroxynaphthoquinone **1** was effectively transformed to product without wasting on forming [2+1] side product Ⅲ. In addition, the sum of signals near δ 6.6 (intermediate Ⅰ, remaining Bu_3P) and 5.4 (producing **3g**, consuming Bu_3P) ppm was close to the equivalent of Bu_3P initially used, and it showed that Bu_3P was completely transformed to intermediate Ⅰ and product **3g** without being oxidized by air under such conditions.

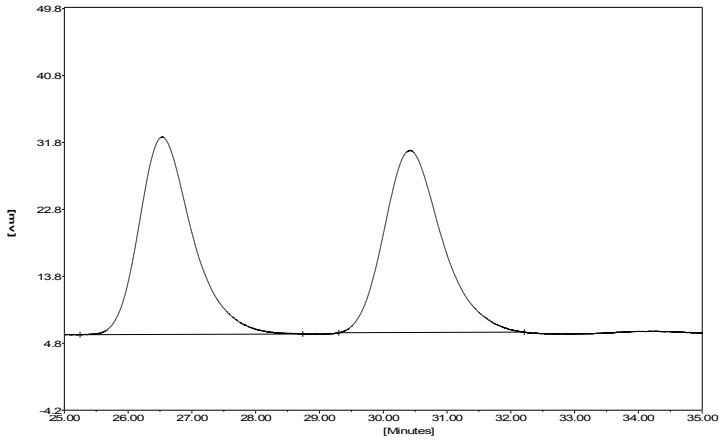
One the other hand, after three hours of the reaction, most of the remaining **1** was converted to the product **3g** (δ 5.4 ppm) to achieve a 91% NMR yield and the peak near δ 6.3 ppm disappeared. Moreover, the intermediate Ⅰ (δ 6.6 ppm) also decomposed to provide the necessary aldehyde **2g** and Bu_3P for reaction with **1** and intermediate Ⅱ respectively, along with a corresponding increase in product **3g**. Therefore, these results proved that the intermediate Ⅰ could be served as a well-protected species to reversibly store and prevent Bu_3P from being oxidized and consumed by air before reacting with intermediate Ⅱ and gradually release Bu_3P and aldehyde **2** for further steps during the course of the

reaction.

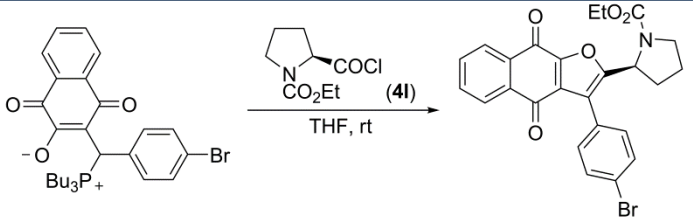
(2) HPLC analysis for optical study:



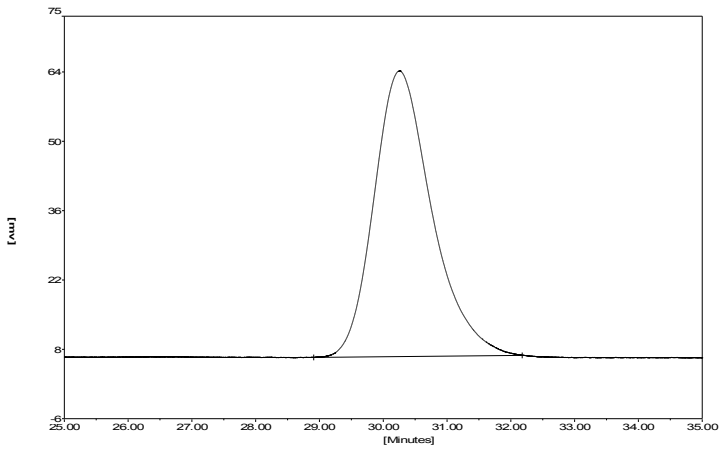
3a *racemic*-**5al**



AD-H column 254 nm 1.0 mL/min	Retention time (min)	Height (mv)	Area (mv•sec)	Area (%)
	26.53	26.56	1541.28	49.9803
	30.42	24.49	1542.49	50.0197



3a **5al**



AD-H column 254 nm 1.0 mL/min	Retention time (min)	Height (mv)	Area (mv•sec)	Area (%)
	30.25	57.68	3629.60	100.0000

Ⅱ. General Considerations:

All reactions were carried out under a nitrogen atmosphere in dried glassware. The starting materials purchased from commercial sources were used without further purification. THF was continuously refluxed and freshly distilled from sodium benzophenone ketyl under nitrogen. Yields refer to isolated yields of compounds estimated to be > 95 % pure as determined by ^{1}H-NMR. ^{1}H and ^{13}C spectra were generally recorded in a AV-400 or AV-500 Bruker using $CDCl_3$ as solvent at 400 or 500 and 100 or 125 MHz, respectively. Chemical shifts are reported in ppm relative to $CDCl_3$ (δ 7.26 ppm) in indicated cases. Analytical thin layer chromatography (TLC) was performed using Merck 60 F254 precoated silica gel plate (0.2 mm thickness). Flash chromatography was performed using Merck silica gel 60.

Ⅲ. Representative Experimental procedures:

(A) Typical procedure-Ⅰ (TP-Ⅰ)

Preparation of **3a** (Table 5, entry 1): A dry and nitrogen-flushed 10-mL Schlenk flask, equipped with a magnetic stirring bar and a septum, was sequentially charged with a solution of **1** (87.1 mg, 0.5 mmol), **2a** (166.5 mg, 1.8 equiv), trifluoroacetic acid (68.9μL, 1.8 equiv) and Bu_3P (150 μL, 1.2 equiv) in dry THF (0.5 mL). The reaction mixture was stirred for 8 h at 60-64 ^{o}C. Thereafter, the solvent was removed by evaporation *in vacuo*. Purification by flash chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH_2Cl_2: 1/125) furnished **3a** as red solids (225.0 mg, 83% yield).

(B) Typical procedure-Ⅱ (TP-Ⅱ)

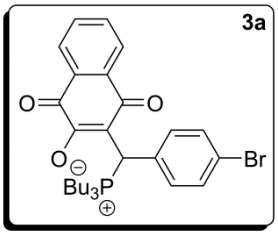
Preparation of **5aa** (Table 7, entry 1): A dry and nitrogen-flushed 25-mL Schlenk tube, equipped with a magnetic stirring bar and a septum, was charged with a solution of **3a** (271.7 mg, 0.5 mmol), **4a** (75.6 μL, 1.3 equiv), and Et_3N (105 μL, 1.5 equiv) in dry THF (2.5mL). The reaction mixture was stirred for 1.5 h at room temperature (25-28 ^{o}C). Thereafter, the solvent was removed by evaporation *in vacuo*. Purification by flash chromatography (CH_2Cl_2/hexanes: 1/2.8) furnished **5aa** as pale yellow solids (197.7 mg, 92% yield).

(C) Typical procedure-Ⅲ (TP-Ⅲ)

Preparation of **7a** (Scheme 5): A dry and nitrogen-flushed 10-mL Schlenk flask, equipped with a magnetic stirring bar and a septum, was sequentially charged with a solution of 4-hydroxycoumarin (81.1 mg, 0.5 mmol), **5qa** (189.2 mg, 1 equiv), Bu_3P (150 μL, 1.2 equiv), $PhCO_2H$ (6.1 mg, 0.1 equiv), and pyrrolidine (4 μL, 0.1 equiv) in dry THF (2.5 mL). The reaction mixture was stirred for 1 h at room temperature (25-28 ^{o}C). Thereafter, the solvent was removed by evaporation *in vacuo*. Purification by flash chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH_2Cl_2: 1/100) furnished **7a** as orange solids (263.4 mg, 73 %).

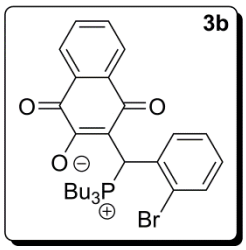
Ⅳ. Spectra data of the substrates:

Synthesis of 3a:



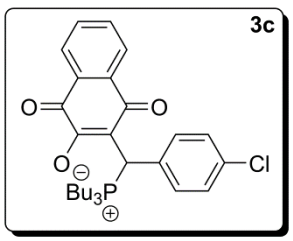
Prepared according to **TP- Ⅰ** from **1** (87.1 mg, 0.5 mmol), **2a** (166.5 mg, 1.8 equiv), trifuloroacetic acid (68.9 μL, 1.8 equiv), and tributylphosphine (150.0 μL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 8h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH_2Cl_2: 1/125) yielded **3** as red solid (225.0 mg, 83%). mp.: 148.6-149.6 °C; R_f 0.33 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.07-7.98 (m, 2H), 7.53 (*pseudo* t, 1H, J = 7.2 Hz), 7.43 (*pseudo* t, 1H, J = 7.5 Hz), 7.39-7.29 (m, 4H), 5.24 (d, 1H, J = 14.9 Hz), 2.35-2.20 (m, 3H), 2.16-1.98 (m, 3H), 1.43-1.24 (m, 12H), 0.82 (t, 3H, J = 6.5 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 185.3, 180.0 (d, J = 7.7 Hz), 171.4, 135.0, 134.7, 133.4, 132.1 (d, J = 2.0 Hz), 131.7, 131.5 (d, J = 4.9 Hz), 126.1, 125.7, 122.2 (J = 3.9 Hz), 113.3, 36.3 (J = 49.0 Hz), 24.2 (J = 4.9 Hz), 24.0 (J = 15.0 Hz), 20.8 (J = 47.0 Hz), 13.2. **^{31}P** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 32.8. **MS** (ESI) *m/z* (%): 567 $[M+2+Na]^+$ (100), 565 (100), 545 (80), 543 (80). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2947 (m), 1676 (m), 1586 (m), 1533 (s), 1367 (m), 1271 (m), 557 (m). **HRMS** (ESI) for **$C_{29}H_{37}BrO_3P^+$, $[M+H]^+$** (543.1658) found: 543.1683.

Synthesis of 3b:



Prepared according to **TP- Ⅰ** from **1** (87.1 mg, 0.5 mmol), **2b** (105.0 μL, 1.8 equiv), trifuloroacetic acid (68.9 μL, 1.8 equiv), and tributylphosphine (150.0 μL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 5h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH2Cl2: 1/125) yielded **3b** as red solid (206.6 mg, 76%). mp.:149.3-150.0 °C; R_f 0.28 (dichloromethane/methane: 50/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.13-7.96 (m, 3H), 7.63-7.53 (m, 3H), 7.23 (*pseudo* t, 1H, J = 7.5 Hz), 7.10 (*pseudo* t, 1H, J = 7.5 Hz), 6.02 (d, 1H, J = 14.8 Hz), 2.51-2.19 (m, 6H), 1.51-1.29 (m, 12H), 0.87 (t, 3H, J = 6.6 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 185.6, 180.2 (d, J = 7.9 Hz), 171.4 (d, J = 2.1 Hz), 136.4 (d, J = 2.0 Hz), 135.0, 133.5, 133.2 (d, J = 2.0 Hz), 133.1 (d, J = 3.5 Hz), 131.7, 130.7, 129.5 (d, J = 2.9 Hz), 128.4 (d, J = 2.7 Hz), 125.9 (d, J = 8.9 Hz), 124.0 (d, J = 7.2 Hz), 114.9 (d, J = 1.9 Hz), 35.3 (d, J = 49.9 Hz), 24.3 (d, J = 4.9 Hz), 24.0 (d, J = 15.4 Hz), 21.1 (d, J = 46.7 Hz), 13.3. **^{31}P** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 36.1. **MS** (ESI) *m/z* (%): 567 (90), 565 $[M+Na]^+$ (100), 261 (33). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2957 (m), 1681 (m), 1586 (m), 1524 (s), 1362 (m), 1238 (m), 548 (w). **HRMS** (ESI) for **$C_{29}H_{37}BrO_3P^+$, $[M+H]^+$** (543.1658) found: 543.1673.

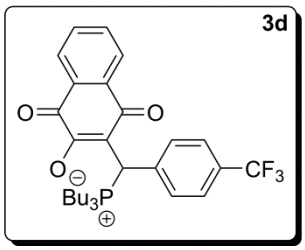
Synthesis of 3c:



Prepared according to **TP- Ⅰ** from **1** (87.1 mg, 0.5 mmol), **2c** (126.5 mg, 1.8 equiv), trifuloroacetic acid (68.9 μL, 1.8 equiv), and tributylphosphine (150.0 μL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 8h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH_2Cl_2: 1/125) yielded **3c** as red solid (227.1 mg, 91%). mp.: 149.1-150.1 °C; R_f 0.34 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.09-8.00 (m, 2H), 7.60 (t, 1H, J = 7.4 Hz), 7.51 (m, 1H, J = 7.4 Hz), 7.48-7.43 (m, 2H), 7.30-7.24 (m, 2H),

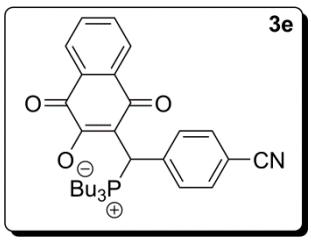
5.33 (d, 1H, J = 15.0 Hz), 2.42-2.26 (m, 3H) , 2.23-2.08 (m, 3H), 1.50-1.28 (m, 12H), 0.89 (t, 3H, J = 7.0 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 185.2, 179.8 (d, J = 7.4 Hz), 171.3, 134.8, 134.0 (d, J = 2.9 Hz), 133.9 (d, J = 3.7 Hz), 133.3, 131.5, 131.1 (d, J = 4.8 Hz), 130.6, 128.9 (d, J = 2.1 Hz), 125.9, 125.6, 113.3, 36.0 (d, J = 49.0 Hz), 24.1 (d, J = 5.0 Hz), 23.8 (d, J = 15.0 Hz), 20.5 (d, J = 47.1 Hz), 13.1. **^{31}P** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 33.0. **MS** (ESI) *m/z* (%): 499 $[M+H]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2947 (m), 1681 (m), 1581(m), 1533 (s), 1367 (m), 1276 (M), 729 (w). **HRMS** (ESI) for **$C_{29}H_{37}ClO_3P^+$, $[M+H]^+$** (499.2163) found: 499.2134.

Synthesis of 3d:



Prepared according to **TP-Ⅰ** from **1** (87.1 mg, 0.5 mmol), **2d** (122.9 μL, 1.8 equiv), trifuloroacetic acid (68.9 μL, 1.8 equiv), and tributylphosphine (150.0 μL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 4h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH_2Cl_2: 1/125) yielded **3d** as red solid (250.3 mg, 94%). mp.: 160.5-161.5 °C; R_f 0.34 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.10-7.98 (m, 2H), 7.70-7.47 (m, 6H), 5.41 (d, 1H, J = 15.2 Hz), 2.45-2.28 (m, 3H), 2.27-2.10 (m, 3H), 1.51-1.26 (m, 12H), 0.88 (t, 9H, J = 7.0 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 185.0, 179.8 (d, J = 7.5 Hz), 171.3 (d, J = 2.8 Hz), 139.8, 134.7, 133.3, 131.4, 130.6, 130.1 (d, J = 4.8 Hz), 130.0 (d, J = 32.5 Hz), 125.8, 125.6 (m), 125.5, 123.5 (d, J = 163.3 Hz), 112.9 (d, J = 2.5 Hz), 36.4 (d, J = 48.8 Hz), 24.0 (d, J = 4.9 Hz), 23.7 (d, J = 15.1 Hz), 20.5 (d, J = 46.9 Hz), 12.9. **^{31}P** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 33.4. **MS** (ESI) *m/z* (%): 533 $[M+H]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2938 (m), 1676 (m), 1581 (m), 1533 (s), 1319 (s), 1124 (m), 1067 (m), 733 (m). **HRMS** (ESI) for $C_{30}H_{37}F_3O_3P^+$, **$[M+H]^+$** (533.2427) found: 533.2402.

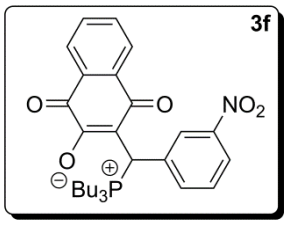
Synthesis of 3e:



Prepared according to **TP-Ⅰ** from **1** (87.1 mg, 0.5 mmol), **2e** (118.0 mg, 1.8 equiv), trifuloroacetic acid (68.9 μL, 1.8 equiv), and tributylphosphine (150.0 μL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 2h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH2Cl2: 1/125) yielded **3e** as red solid (191.3 mg, 78%). mp.: 185.4-186.0 °C; R_f 0.29 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.10-7.98 (m, 2H), 7.69-7.57 (m, 5H), 7.53 (*pseudo* t, 1H, J = 7.5 Hz), 5.41 (d, 1H, J = 15.2 Hz), 2.45-2.28 (m, 3H), 2.24-2.08 (m, 3H), 1.50-1.30 (m, 12H), 0.89 (t, 9H, J = 6.9 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 184.8, 179.7 (d, J = 6.9 Hz), 171.3, 141.2, 134.5, 133.3, 132.3, 131.4, 130.6, 130.4 (d, J = 4.5 Hz), 125.8, 125.4, 117.9, 112.5, 111.6 (d, J = 2.9 Hz), 36.7 (d, J = 48.7 Hz), 23.9 (d, J = 4.9 Hz), 23.6 (d, J = 15.2 Hz), 20.5 (d, J = 46.8 Hz), 13.0. **^{31}P** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 33.6. **MS** (ESI) *m/z* (%): 490 $[M+H]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3052 (w), 2947 (m), 2354 (w), 2220 (m), 1680 (s), 1581 (s), 1538 (s), 1366 (s), 1271 (m), 738 (m). **HRMS** (ESI) for **$C_{30}H_{37}NO_3P^+$, $[M+H]^+$** (490.2506) found: 490.2487.

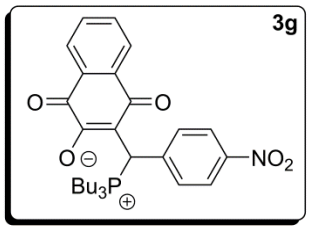
Synthesis of 3f:

Prepared according to **TP-Ⅰ** from **1** (87.1 mg, 0.5 mmol), **2f** (136.0 mg, 1.8 equiv), trifuloroacetic acid (68.9 μL, 1.8 equiv), and tributylphosphine (150.0 μL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition:



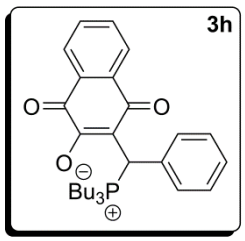
60-64 °C for 4h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH2Cl2: 1/125) yielded **3f** as red solid (234.1 mg, 92%). mp.: 153.4-154.5 °C; R_f 0.29 (dichloromethane/methane: 30/1) **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.27 (*pseudo* s, 1H), 8.14 (d, 1H, J = 7.8 Hz), 8.09-8.00 (m, 2H), 7.98 (d, 1H, J = 7.4 Hz), 7.62 (t, 1H, J = 7.6 Hz), 7.56-7.45 (m, 2H), 5.47 (d, 1H, J = 15.2 Hz), 2.45-2.29 (m, 3H), 2.26-2.10 (m, 3H), 1.51-1.31 (m, 12H), 0.89 (t, 9H, J = 6.9 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 185.1, 180.0 (d, J = 7.3 Hz), 171.6, 148.1, 138.0, 136.4 (d, J = 4.1 Hz), 134.7, 133.6, 131.7, 130.9, 130.2, 126.2, 125.7, 124.1 (d, J = 5.3 Hz), 123.0, 112.8, 36.5 (d, J = 49.4 Hz), 24.2 (d, J = 4.9 Hz), 23.9 (d, J = 15.1 Hz), 20.8 (d, J = 46.9 Hz), 13.2. **^{31}P** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 33.7. **MS** (ESI) *m/z* (%): 532 $[M+Na]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3072 (w), 2957 (m), 1676 (m), 1585 (m), 1529 (s), 1367 (m), 1348 (m), 1271 (m), 710 (w). **HRMS** (ESI) for **$C_{29}H_{37}NO_5P^+$, $[M+H]^+$** (510.2404) found: 510.2390.

Synthesis of 3g:



Prepared according to **TP- I** from **1** (87.1 mg, 0.5 mmol), **2g** (136.1 mg, 1.8 equiv), trifuloroacetic acid (68.9 µL, 1.8 equiv), and tributylphosphine (150.0 µL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 3h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH_2Cl_2: 1/125) yielded **3g** as red solid (227.1 mg, 90%). mp.: 168.8-169.4 °C; R_f 0.32 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.15 (d, 2H, J = 8.5 Hz), 8.06 (d, 1H, J = 7.5 Hz), 8.01 (d, 1H, J = 7.5 Hz), 7.71 (d, 2H, J = 7.0 Hz), 7.61 (t, 1H, J = 7.4 Hz), 7.52 (t, 1H, J = 7.3 Hz), 5.46 (d, 1H, J = 15.4 Hz), 2.47-2.32 (m, 3H), 2.23-2.08 (m, 3H), 1.50-1.33 (m, 12H), 0.88 (t, 9H, J = 6.8 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 184.9, 179.8 (d, J = 7.3 Hz), 171.4, 147.3 (d, J = 3.2 Hz), 143.4 (d, J = 2.3 Hz), 134.6, 133.5, 131.5, 130.8, 130.7, 126.0, 125.6, 123.8 (d, J = 1.7 Hz), 112.5 (d, J = 2.5 Hz), 36.6 (d, J = 48.6 Hz), 24.1 (d, J = 5.0 Hz), 23.8 (d, J = 15.1 Hz), 20.7 (d, J = 46.8 Hz), 13.1. **^{31}P-NMR** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 33.6. **MS** (ESI) *m/z* (%): 510 $[M+H]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2956 (m), 1680 (s), 1590 (s), 1523 (s), 1371 (s), 1271 (s), 738 (s). **HRMS** (ESI) for **$C_{29}H_{37}NO_5P$, $[M+H]^+$** (510.2409), found: 510.2414.

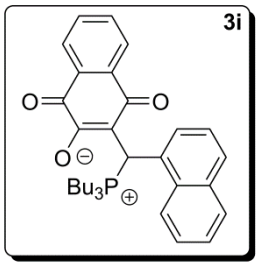
Synthesis of 3h:



Prepared according to **TP- I** from **1** (87.1 mg, 0.5 mmol), **2h** (91.5 µL, 1.8 equiv), trifuloroacetic acid (68.9 µL, 1.8 equiv), and tributylphosphine (150.0 µL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 12h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH_2Cl_2: 1/125) yielded **3h** as red solid (184.0 mg, 79 %). mp.: 175.0-176.0 °C; R_f 0.31 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.04 (*pseudo* t, 2H, J = 7.8 Hz), 7.60 (*pseudo* t, 1H, J = 7.2 Hz), 7.54-7.45 (m, 3H), 7.33-7.22 (m, 3H), 5.36 (d, 1H, J = 15.0 Hz), 2.42-2.11 (m, 6H), 1.48-1.23 (m, 12H), 0.87 (t, 9H, J = 6.6 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 185.6, 180.1 (d, J = 7.9 Hz), 171.5, 135.4 (d, J = 3.4 Hz), 135.2, 133.4, 131.8, 130.7, 129.9 (d, J = 4.9 Hz), 129.0 (d, J = 2.4 Hz), 128.1 (d, J = 3.0 Hz), 126.1, 125.7, 113.7, 36.6 (d, J = 48.8 Hz), 24.3 (d, J = 5.0 Hz), 24.0 (d, J = 15.1 Hz), 20.7 (d, J = 47.2 Hz), 13.3. **^{31}P** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 32.9. **MS** (ESI) *m/z* (%): 465 $[M+H]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3072 (w), 2957 (m), 1671 (m), 1586 (s),

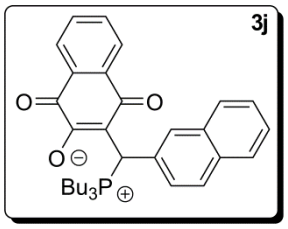
1529 (s), 1362 (m), 957 (m). **HRMS** (ESI) for **$C_{29}H_{38}O_3P^+$, $[M+H]^+$** (465.2553) found: 465.2522.

Synthesis of 3i:



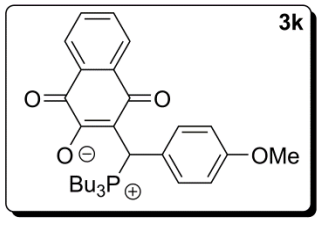
Prepared according to **TP- I** from **1** (87.1 mg, 0.5 mmol), **2i** (122.3 µL, 1.8 equiv), trifuloroacetic acid (68.9 µL, 1.8 equiv), and tributylphosphine (150.0 µL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 8h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH2Cl2: 1/125) yielded **3i** as red solid (149.2 mg, 58%). mp.: 193.1-194.0 °C; R_f 0.36 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.53 (d, 1H, J = 8.5 Hz), 8.17-8.12 (m, 1H,), 8.08-7.99 (m, 2H), 7.85 (d, 1H, J = 8.1 Hz), 7.77 (d, 1H, J = 8.0 Hz), 7.64 (t, 1H, J = 7.6 Hz), 7.57 (d, 1H, J = 7.3 Hz), 7.53-7.45 (m, 2H), 7.41 (t, 1H, J = 7.7 Hz), 6.39 (d, 1H, J = 15.4 Hz), 2.41-2.12 (m, 6H), 1.40-1.22 (m, 12H), 0.82 (t, 9H, J = 6.7 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 185.6, 180.3 (d, J = 8.0 Hz), 171.5, 140.0, 133.8, 133.3, 132.2 (d, J = 2.7 Hz), 131.7, 131.4 (d, J = 5.4 Hz), 130.5, 129.7 (d, J = 5.2 Hz), 129.0, 128.5 (d, J = 3.1 Hz), 126.7, 125.9, 125.7, 122.8, 115.2, 30.8 (d, J = 52.8 Hz), 24.1 (d, J = 4.9 Hz), 23.9 (d, J = 15.1 Hz), 21.0 (d, J = 46.7 Hz), 13.1. **^{31}P-NMR** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 35.3. **MS** (ESI) *m/z* (%): 515 $[M+H]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3052 (w), 2956 (m), 1671 (m), 1580 (m), 1519 (s), 1361 (m), 1271 (m), 776 (w). **HRMS** (ESI) for **$C_{33}H_{40}O_3P$, $[M+H]^+$** (515.2715), found: 515.2689.

Synthesis of 3j:



Prepared according to **TP- I** from **1** (87.1 mg, 0.5 mmol), **2j** (85.6 µL, 1.8 equiv), trifuloroacetic acid (68.9 µL, 1.8 equiv), and tributylphosphine (150.0 µL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 8h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH2Cl2: 1/125) yielded **3j** as red solid (180.3 mg, 70%). mp.: 203.9-204.5 °C; R_f 0.31 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.06 (d, 1H, J = 7.5 Hz), 8.02 (d, 1H, J = 7.6 Hz), 7.94-7.90 (m, 1H), 7.84-7.74 (m, 3H), 7.66 (d, 1H, J = 8.6 Hz), 7.59 (t, 1H, J = 7.9 Hz), 7.52-7.43 (m, 3H), 5.52 (d, 1H, J = 15.1 Hz), 2.48-2.33 (m, 3H), 2.27-2.13 (m, 3H), 1.49-1.31 (m, 12H), 0.86 (t, 9H, J = 6.9 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 185.4, 180.1 (d, J = 8.1 Hz), 171.3, 135.0, 133.3, 133.1 (d, J = 2.5 Hz), 132.8 (d, J = 7.5 Hz), 132.7, 131.7, 130.6, 128.7, 128.6 (d, J = 6.9 Hz), 127.7, 127.5 (d, J = 3.4 Hz), 127.4, 126.2, 126.1, 125.9, 125.6, 113.5, 36.8 (d, J = 49.1 Hz), 24.2 (d, J = 4.9 Hz), 23.9 (d, J = 15.1 Hz), 20.7 (d, J = 47.2 Hz), 13.1. **^{31}P-NMR** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 33.1. **MS** (ESI) *m/z* (%): 515 $[M+H]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3043 (w), 2956 (m), 1671 (s), 1585 (s), 1533 (s), 1452 (m), 1352 (m), 1276 (s), 733 (m). **HRMS** (ESI) for **$C_{33}H_{40}O_3P$, $[M+H]^+$** (515.2715), found: 515.2692.

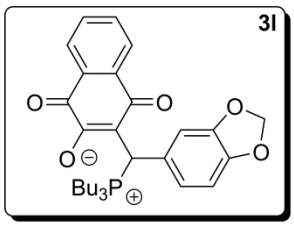
Synthesis of 3k:



Prepared according to **TP- I** from **1** (87.1 mg, 0.5 mmol), **2k** (109.5 µL, 1.8 equiv), trifuloroacetic acid (68.9 µL, 1.8 equiv), and tributylphosphine (150.0 µL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 15h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH2Cl2: 1/125) yielded **3k** as red solid (190.4 mg, 77%). mp.: 164.6-165.6 °C; R_f 0.31 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.03

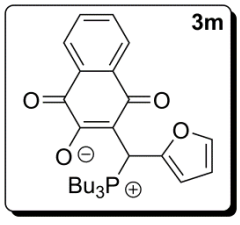
(d, 2H, J = 7.8 Hz), 7.59 (t, 1H, J = 7.3 Hz), 7.49 (t, 1H, J = 7.5 Hz), 7.42 (d, 2H, J = 8.2 Hz), 6.81 (d, 2H, J = 8.2 Hz), 5.31 (d, 1H, J = 14.7 Hz), 3.76 (s, 3H), 2.38-2.25 (m, 3H), 2.23-2.09 (m, 3H), 1.47-1.30 (m, 12H), 0.88 (t, 9H, J = 6.6 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 185.1, 179.5 (d, J = 8.3 Hz), 170.9, 159.0 (d, J = 2.5 Hz), 134.7, 133.0, 131.3, 130.5 (d, J = 4.7 Hz), 130.1, 126.8 (d, J = 3.0 Hz), 125.4, 125.3, 126.8 (d, J = 3.0 Hz), 125.4, 125.3, 113.9, 113.6, 54.8, 35.3 (d, J = 48.9 Hz), 23.8 (d, J = 4.9 Hz), 23.6 (d, J = 15.0 Hz), 20.2 (d, J = 47.1 Hz), 12.9. **^{31}P-NMR** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 32.7. **MS** (ESI) *m/z* (%): 495 $[M+H]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2956 (m), 1676 (s), 1585 (s), 1533 (s), 1271 (s), 1252 (s), 1176 (s), 733 (s). **HRMS** (ESI) for **$C_{30}H_{40}O_4P$, $[M+H]^+$** (495.2664), found: 495.2642.

Synthesis of 3l:



Prepared according to **TP- I** from **1** (87.1 mg, 0.5 mmol), **2l** (135.1 µL, 1.8 equiv), trifuloroacetic acid (68.9 µL, 1.8 equiv), and tributylphosphine (150.0 µL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 5h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH2Cl2: 1/125) yielded **3l** as red solid (124.6 mg, 49%). mp.: 203.7-204.5 °C; R_f 0.28 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.04 (t, 1H J = 7.2 Hz), 7.60 (t, 1H J = 7.5 Hz), 7.50 (t, 1H J = 7.5 Hz), 7.06-7.03 (m, 1H), 6.97-6.91 (m, 3H), 6.72 (d, 1H, J = 8.0 Hz), 5.91 (d, 1H, J = 4.3 Hz), 5.27 (d, 1H, J = 14.8 Hz), 2.39-2.12 (m, 6H), 1.50-1.32 (m, 12H), 0.89 (t, 9H, J = 6.7 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 185.2, 179.7 (d, J = 7.9 Hz), 171.2, 148.0, 147.3 (d, J = 3.0 Hz), 135.0, 133.2, 131.6, 130.4, 128.8, 125.8, 125.5, 123.0 (d, J = 5.9 Hz), 113.6, 110.1, 108.2, 101.0, 36.3 (d, J = 49.1 Hz), 24.1 (d, J = 4.7 Hz), 23.8 (d, J = 14.9 Hz), 20.5 (d, J = 47.1 Hz), 13.1. **^{31}P-NMR** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 32.8. **MS** (ESI) *m/z* (%): 509 $[M+H]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3071 (w), 2947 (m), 1676 (s), 1590 (s), 1533 (s), 1366 (m), 1266 (m), 1242 (m), 723 (m). **HRMS** (ESI) for **$C_{30}H_{38}O_5P$, $[M+H]^+$** (509.2457), found: 509.2413.

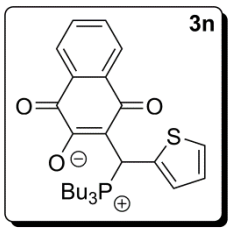
Synthesis of 3m:



Prepared according to **TP- I** from **1** (87.1 mg, 0.5 mmol), **2m** (74.6 µL, 1.8 equiv), trifuloroacetic acid (68.9 µL, 1.8 equiv), and tributylphosphine (150.0 µL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 8.5h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH2Cl2: 1/125) yielded **3m** as red solid (175.3 mg, 77%). mp.: 134.9-135.9 °C; R_f 0.3 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.10-8.05 (m, 2H), 7.63 (t, 1H, J = 7.5 Hz), 7.52 (t, 1H, J = 7.6 Hz), 7.34-7.32 (m, 1H), 6.32-6.29 (m, 2H), 5.71 (d, 1H, J = 14.2 Hz), 2.31-2.19 (m, 6H), 1.48-1.36 (m, 12H), 0.89 (t, 9H, J = 6.8 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 184.8, 179.4 (d, J = 5.6 Hz), 171.7, 147.6 (d, J = 5.9 Hz), 141.5, 134.9, 133.3, 131.6, 130.5, 125.9, 125.6, 111.2, 110.2 (d, J = 6.7 Hz), 108.8 (d, J = 4.4 Hz), 29.9 (d, J = 50.2 Hz), 23.8 (d, J = 15.4 Hz), 23.7 (d, J = 5.0 Hz), 20.3 (d, J = 45.8 Hz), 13.0. **^{31}P-NMR** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 34.7. **MS** (ESI) *m/z* (%): 455 $[M+H]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3100 (w), 2956 (m), 1676 (s), 1580 (s), 1528 (s), 1371 (s), 1266 (s), 1223 (m), 957 (m), 761 (m). **HRMS** (ESI) for **$C_{27}H_{36}O_4P$, $[M+H]^+$** (455.2351), found: 455.2331.

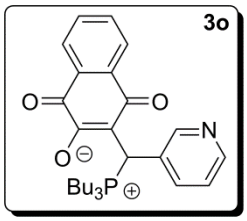
Synthesis of 3n:

Prepared according to **TP- I** from **1** (87.1 mg, 0.5 mmol), **2n** (84.1 µL, 1.8 equiv), trifuloroacetic acid (68.9



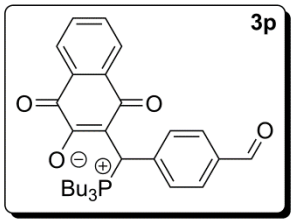
μL, 1.8 equiv), and tributylphosphine (150.0 μL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 14.5h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH2Cl2: 1/125) yielded **3n** as red solid (120.1 mg, 51%). mp.: 148.1-148.9 °C; R_f 0.27 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.08-8.02 (m, 2H), 7.61 (t, 1H, J = 7.5 Hz), 7.50 (t, 1H, J = 7.6 Hz), 7.20-7.15 (m, 2H), 6.93-6.89 (m, 1H), 5.82 (d, 1H, J = 14.6 Hz), 2.32-2.21 (m, 6H), 1.47-1.33 (m, 12H), 0.88 (t, 9H, J = 6.9 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 185.1, 179.5 (d, J = 6.3 Hz), 171.5, 136.2 (d, J = 3.3 Hz), 135.0, 133.4, 131.7, 130.6, 128.3 (d, J = 6.7 Hz), 126.8 (d, J = 2.8 Hz), 126.1, 126.0 (d, J = 4.0 Hz), 125.7, 112.8, 31.6 (d, J = 51.3 Hz), 24.0 (d, J = 5.6 Hz), 23.9 (d, J = 15.3 Hz), 20.3 (d, J = 46.1 Hz), 13.2. **^{31}P-NMR** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 33.4. **MS** (ESI) *m/z* (%): 471 $[M+H]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3052 (w), 2956 (m), 1676 (m), 1580 (m), 1533 (s), 1366 (m), 1266 (m), 738 (w), 704 (w). **HRMS** (ESI) for **$C_{27}H_{36}O_3PS$, $[M+H]^+$** (471.2123), found: 471.2102.

Synthesis of 3o:



Prepared according to **TP- Ⅰ** from **1** (87.1 mg, 0.5 mmol), **2o** (84.5 μL, 1.8 equiv), trifuloroacetic acid (68.9 μL, 1.8 equiv), and tributylphosphine (150.0 μL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 8 h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH2Cl2: 1/125) yielded **3o** as red solid (153.9 mg, 66%). mp.: 151.2-152.1 °C; R_f 0.23 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.66-8.62 (m, 1H), 8.55-8.50 (m, 1H), 8.09-7.95 (m, 3H), 7.62 (t, 1H, J = 7.3 Hz), 7.52 (t, 1H, J = 7.4 Hz), 7.26-7.21 (m, 1H), 5.42 (d, 1H, J = 15.0 Hz), 2.42-2.28 (m, 3H), 2.25-2.11 (m, 3H), 1.49-1.30 (m, 12H), 0.88 (t, 9H, J = 6.8 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 185.2, 180.0, (d, J = 7.3 Hz), 171.8 (d, J = 2.9 Hz), 150.0 (d, J = 5.6 Hz), 149.5 (d, J = 2.9 Hz), 138.0 (d, J = 3.9 Hz), 135.0, 133.6, 132.0 (d, J = 2.6 Hz), 131.8, 130.9, 126.2, 125.8, 124.1, 112.8, 34.2 (d, J = 49.5 Hz), 24.3 (d, J = 5.0 Hz), 24.0 (d, J = 15.0 Hz), 20.8 (d, J = 46.9 Hz), 13.2. **^{31}P-NMR** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 33.8. **MS** (ESI) *m/z* (%): 466 $[M+H]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3043 (w), 2956 (w), 1680 (m), 1604 (w), 1580 (m), 1509 (s), 1395 (m), 1266 (w), 719 (w). **HRMS** (ESI) for **$C_{28}H_{37}NO_3P$, $[M+H]^+$** (466.2511), found: 466.2498.

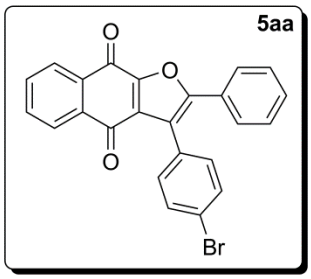
Synthesis of 3p:



Prepared according to **TP- Ⅰ** from **1** (87.1 mg, 0.5 mmol), **2p** (72.4 μL, 1.8 equiv), trifuloroacetic acid (68.9 μL, 1.8 equiv), and tributylphosphine (150.0 μL, 1.2 equiv) in dry THF (0.5 mL) [reaction condition: 60-64 °C for 8 h]. Purification by *flash*-chromatography (ethyl acetate/hexanes: 1/3; then MeOH/CH2Cl2: 1/125) yielded **3p** as red solid (158.1 mg, 64%). mp.:166.7-167.1 °C; R_f 0.28 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 9.97 (s, 1H), 8.11-7.99 (m, 2H), 7.82 (d, 2H, J = 8.0 Hz), 7.70 (d, 2H, J = 7.6 Hz), 7.61 (*pseudo* t, 1H, J = 7.4 Hz), 7.52 (*pseudo* t, 1H, J = 7.5 Hz), 5.44 (d, 1H, J = 15.3 Hz), 2.46-2.29 (m, 3H), 2.25-2.10 (m, 3H), 1.52-1.29 (m, 12H), 0.88 (t, 9H, J = 6.8 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 191.2, 185.0, 179.8 (d, J = 7.3 Hz), 171.3, 142.5 (d, J = 2.9 Hz), 135.7 (d, J = 2.7 Hz), 134.7, 133.4, 131.5, 130.6, 130.4 (d, J = 4.7 Hz), 130.0, 125.9, 125.5, 112.7, 36.8 (d, J = 48.8 Hz), 24.0 (d, J = 5.0 Hz), 23.7 (d, J = 15.2 Hz), 20.6 (d, J = 46.9 Hz), 13.0. **^{31}P** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 33.4. **MS** (ESI) *m/z* (%): 515 $[M+Na]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w),

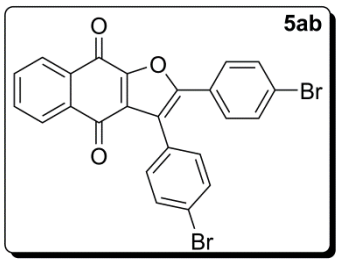
2957 (m), 2861 (m), 2727 (w), 1690 (s), 1605 (m), 1581 (m), 1519 (s), 1395 (m), 1366 (m), 1205 (m), 733 (w). **HRMS** (ESI) for **$C_{30}H_{37}NaO_4P^+$, [M+Na]$^+$** (515.2322) found: 515.2314.

Synthesis of 5aa:



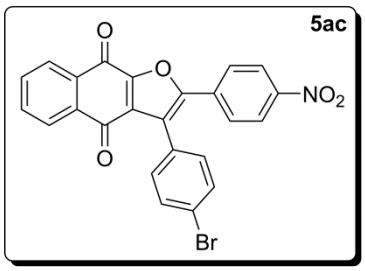
Prepared according to **TP-Ⅱ** from **3a** (271.7 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **4a** (75.5 μL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 1.5 h]. Purification by *flash*-chromatography (CH_2Cl_2/hexanes: 1/2.8) yielded **5aa** as pale yellow solid (197.7 mg, 92 %). mp.: 207.9-208.8 °C; R_f 0.23 (dichloromethane/hexanes: 1/2.8). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.22 (d, 1H, J = 7.7 Hz), 8.08 (d, 1H, J = 7.1 Hz), 7.80-7.67 (m, 2H), 7.64-7.51 (m, 4H), 7.40-7.28 (m, 5H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.7, 173.3, 155.5, 151.3, 133.9, 133.8, 133.4, 132.4, 131.9, 131.8, 130.0, 129.3, 129.2, 128.7, 128.2, 127.3, 126.9, 126.6, 122.9, 120.4. **MS** (70eV, EI) *m/z* (%): 430 (95), 428 [M]$^+$ (100), 262 (20), 104 (40), 77 (30). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3053 (w), 1667 (s), 1590 (m), 1214 (m), 971 (m), 681 (m). **HRMS** (FAB) for **$C_{24}H_{14}BrO_3^+$, [M+H]$^+$** (429.0121) found: 429.0126.

Synthesis of 5ab:



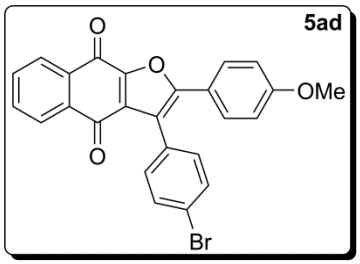
Prepared according to **TP-Ⅱ** from **3a** (271.7 mg, 0.5 mmol), triethylamine (118.5 μL, 1.7 equiv), and **4b** (164.7 mg, 1.5 equiv) in dry THF (2.5 mL) [reaction condition: 60 °C for 0.5 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 2/1) yielded **5ab** as pale yellow solid (244.9 mg, 96 %). mp.: 237.9-238.9 °C; R_f 0.23 (hexanes/ dichloromethane: 2/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.22 (d, 1H, J = 7.5 Hz), 8.08 (d, 1H, J = 7.8 Hz), 7.80-7.68 (m, 2H), 7.61 (d, 2H, J = 8.5 Hz), 7.52-7.37 (m, 4H), 7.33 (d, 2H, J = 8.8 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.5, 173.3, 154.4, 151.4, 133.9, 133.4, 132.4, 132.1, 131.7, 129.3, 128.9, 128.6, 127.2, 126.9, 126.7, 124.6, 123.2, 120.9. **MS** (70eV, EI) *m/z* (%): 510 (55) [M+4]$^+$, 508 [M+2]$^+$ (100), 506 (55) [M]$^+$, 348 (45), 261 (40), 105 (50), 76 (60). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3072 (w), 1667 (s), 1581 (m), 1533 (m), 1214 (s), 1190 (m), 705 (m). **HRMS** (EI) for **$C_{24}H_{12}Br_2O_3$, [M]$^+$** (505.9153) found: 505.9150.

Synthesis of 5ac:



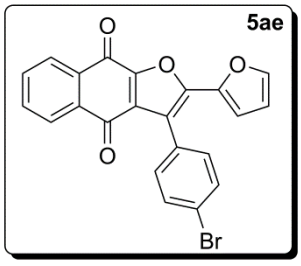
Prepared according to **TP-Ⅱ** from **3a** (271.7 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **4c** (120.6 mg, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 0.5 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 2/1) yielded **5ac** as pale yellow solid (186.5 mg, 79 %). mp.: 333.0-334.0 °C; R_f 0.23 (hexanes/ dichloromethane: 2/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.27 (d, 1H, J = 7.3 Hz), 8.21 (d, 2H, J = 8.7 Hz), 8.13 (d, 1H, J = 7.6 Hz), 7.84-7.73 (m, 4H), 7.66 (d, 2H, J = 8.4 Hz), 7.34 (d, 2H, J = 8.4 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.3, 173.5, 152.5, 152.1, 148.0, 134.3, 134.2, 134.1, 133.4, 132.4, 132.3, 131.5, 129.1, 128.3, 127.8, 127.1, 126.9, 124.1, 123.8, 123.4. **MS** (70eV, EI) *m/z* (%): 475 [M+2]$^+$ (100), 473 (95). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3081 (w), 1676 (s), 1595 (m), 1514 (m), 1338 (s), 1214 (s), 971 (m), 690 (m). **HRMS** (ESI) for **$C_{24}H_{13}BrNO_5^+$, [M+H]$^+$** (473.9972) found: 473.9993.

Synthesis of 5ad:



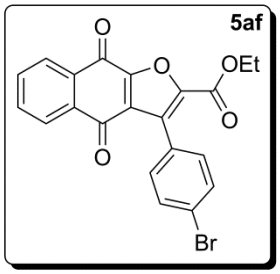
Prepared according to **TP-Ⅱ** from **3a** (271.7 mg, 0.5 mmol), triethylamine (118.5 μL, 1.7 equiv), and **4d** (101.5 μL, 1.5 equiv) in dry THF (2.5 mL) [reaction condition: 60 °C for 0.5 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 2/1) yielded **5ad** as orange solid (205.8 mg, 90 %). mp.: 247.3-248.3 °C; R_f 0.28 (hexanes/ dichloromethane: 2/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.22 (d, 1H, J = 7.6 Hz), 8.07 (d, 1H, J = 7.3 Hz), 7.79-7.66 (m, 2H), 7.60 (d, 2H, J = 8.5 Hz), 7.50 (d, 2H, J = 8.8 Hz), 7.34 (d, 2H, J = 8.4 Hz), 6.84 (d, 2H, J = 8.8 Hz), 3.81 (s, 3H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.9, 173.1, 160.9, 155.9, 150.8, 133.8, 133.7, 133.4, 132.5, 131.9, 131.8, 129.5, 129.4, 128.9, 126.8, 126.6, 122.8, 120.7, 118.9, 114.2, 55.3. **MS** (70eV, EI) *m/z* (%): 460 $[M+2]^+$ (100), 458 (95), 135 (40), 104 (40). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2919 (w), 1667 (s), 1604 (m), 1252 (s), 1214 (s), 1176 (m), 709 (m). **HRMS** (FAB) for **$C_{25}H_{15}BrO_4$, $[M+H]^+$** (459.0232) found: 459.0227.

Synthesis of 5ae:



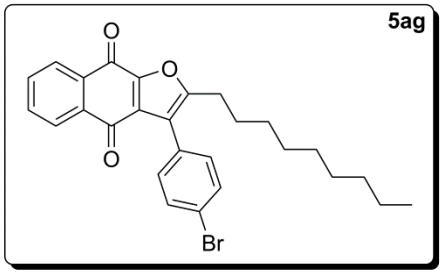
Prepared according to **TP-Ⅱ** from **3a** (271.7 mg, 0.5 mmol), triethylamine (118.5 μL, 1.7 equiv), and **4e** (73.9 μL, 1.5 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 1.5 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 2/1) yielded **5ae** as red solid (167.7 mg, 80 %). mp.: 260.1-260.8 °C; R_f 0.23 (hexanes/dichloromethane: 2/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.24 (d, 1H, J = 7.1 Hz), 8.10 (d, 1H, J = 7.1 Hz), 7.82-7.67 (m, 2H), 7.62 (d, 2H, J = 8.4 Hz), 7.46 (s, 1H), 7.41 (d, 2H, J = 8.4 Hz), 6.77 (d, 1H, J = 3.6 Hz), 6.50-6.46 (m, 1H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.6, 173.1, 151.1, 147.5, 144.5, 143.8, 133.9, 133.8, 133.5, 132.5, 131.9, 131.4, 129.0, 128.1, 127.0, 126.7, 123.0, 119.6, 112.1, 111.9. **MS** (70eV, EI) *m/z* (%): 420 $[M+2]^+$ (100), 418 (95), 226 (100), 76 (50). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3148 (w), 1667 (s), 1590 (m), 1562 (m), 1238 (m), 1214 (m), 1195 (m), 705 (m). **HRMS** (FAB) for **$C_{22}H_{12}BrO_4^+$, $[M+H]^+$** (418.9919) found: 418.9915.

Synthesis of 5af:



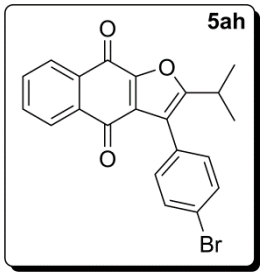
Prepared according to **TP-Ⅱ** from **3a** (271.7 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **4f** (72.6 μL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 0.42 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 1/1) yielded **5af** as Olivine (197.3 mg, 93 %). mp.: 243.3-244.3 °C; R_f 0.30 (hexanes/ dichloromethane: 1/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.33-8.21 (m, 1H), 8.19-8.10 (m, 1H), 7.85-7.76 (m, 2H), 7.6111 (d, 2H, J = 8.3 Hz), 7.39 (d, 2H, J = 8.1 Hz), 4.35 (q, 2H, J = 7.0 Hz), 1.30 (t, 3H, J = 7.3 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 179.8, 173.8, 157.8, 152.6, 144.0, 134.5, 134.2, 133.6, 132.2, 131.7, 131.1, 131.0, 127.7, 127.3, 127.1, 127.0, 123.6, 62.1, 14.0. **MS** (70eV, EI) *m/z* (%): 426 $[M+2]^+$ (100), 424 (95), 187 (40). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3081 (w), 2986 (w), 1719 (s), 1671 (s), 1581 (m), 1238 (m), 1162 (m), 714 (m). **HRMS** (ESI) for **$C_{21}H_{14}BrO_5^+$, $[M+H]^+$** (425.0025) found: 425.0024.

Synthesis of 5ag:



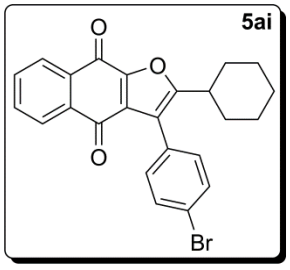
Prepared according to **TP-Ⅱ** from **3a** (271.7 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **4g** (134.9 μL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 1 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 2/1) yielded **5ag** as pale yellow solid (212.6 mg, 89 %). mp.: 93.1-93.8 °C; R_f 0.33 (hexanes/ dichloromethane: 2/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.18 (d, 1H, J = 7.0 Hz), 8.06 (d, 1H, J = 7.0 Hz), 7.78-7.65 (m, 2H), 7.59 (d, 2H, J = 8.2 Hz), 7.31 (d, 2H, J = 8.0 Hz), 2.76 (t, 2H, J = 7.6 Hz), 1.80-1.68 (m, 2H), 1.40-1.15 (m, 12H), 0.87 (t, 3H, J = 6.7 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.7, 173.1, 160.9, 151.4, 133.6, 133.4, 132.2, 131.4, 128.8, 128.1, 126.8, 126.5, 122.4, 120.6, 31.8, 29.3, 29.2, 29.1, 29.0, 28.0, 26.4, 22.6, 14.0. **MS** (70eV, EI) *m/z* (%): 480 $[M+2]^+$ (100), 478 (95), 286 (35), 258 (35), 55 (20). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2909 (m), 2833 (m), 1676 (s), 1538 (m), 1371 (m), 1190 (m), 538 (m). **HRMS** (FAB) for **$C_{27}H_{28}BrO_3^+$, $[M+H]^+$** (479.1222) found: 479.1214.

Synthesis of 5ah:



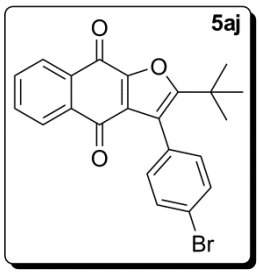
Prepared according to **TP-Ⅱ** from **3a** (271.7 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **4h** (68.1 μL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 60 °C for 0.5 h]. Purification by *flash*-chromatography (hexanes/ethyl acetate: 20/1) yielded **5ah** as yellow solid (184.3 mg, 93 %). mp.: 179.1-179.8 °C; R_f 0.3 (hexanes/ethyl acetate: 20/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.20 (d, 1H, J = 7.3 Hz), 8.06 (d, 1H, J = 7.3 Hz), 7.78-7.65 (m, 2H), 7.60 (d, 2H, J = 8.1 Hz), 7.30 (d, 2H, J = 8.3 Hz), 3.24-3.10 (m, 1H), 1.36 (d, 6H, J = 6.9 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.9, 173.2, 164.9, 151.3, 133.8, 133.7, 133.4, 132.3, 131.6, 131.5, 128.9, 128.3, 126.7, 126.6, 122.4, 119.1, 26.5, 21.1. **MS** (70eV, EI) *m/z* (%): 396 $[M+2]^+$ (100), 394 (90), 379 (60), 272 (60), 257 (35), 215 (40), 104 (35), 76 (40). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3072 (w), 2967 (m), 2870 (w), 1671 (s), 1590 (m), 1214 (m), 1181 (m), 710 (m). **HRMS** (ESI) for **$C_{21}H_{16}BrO_3^+$, $[M+H]^+$** (395.0283) found: 395.0298.

Synthesis of 5ai:



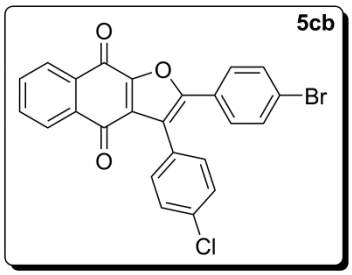
Prepared according to **TP-Ⅱ** from **3a** (271.7 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **4i** (87.0 μL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 0.25 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 2.8/1) yielded **5ai** as yellow solid (193.2 mg, 89 %). mp.: 190.2-191.2 °C; R_f 0.26 (hexanes/dichloromethane: 2.8/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.19 (d, 1H, J = 7.9 Hz), 8.06 (d, 1H, J = 7.0 Hz), 7.77-7.66 (m, 2H), 7.61 (d, 2H, J = 8.1 Hz), 7.30 (d, 2H, J = 8.4 Hz), 2.87-2.72 (m, 1H), 1.94-1.65 (m, 7H), 1.39-1.19 (m, 3H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.9, 173.2, 164.5, 151.2, 133.7, 133.6, 133.4, 132.3, 131.6, 131.5, 128.9, 128.2, 126.7, 126.65 122.4, 119.3, 36.2, 31.2, 25.9, 25.4. **MS** (70eV, EI) *m/z* (%): 436 $[M+2]^+$ (100), 434 (100), 393 (20), 299 (20), 257 (20), 55 (20). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2918 (m), 2842 (m), 1671 (s), 1595 (m), 1543 (m), 1200 (m), 976 (m), 705 (m). **HRMS** (ESI) for **$C_{24}H_{19}BrO_3$, $[M+H]^+$** (434.0518) found: 434.0510.

Synthesis of 5aj:



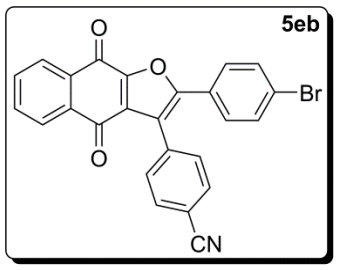
Prepared according to **TP-Ⅱ** from **3a** (271.7 mg, 0.5 mmol), triethylamine (118.5 μL, 1.7 equiv), and **4j** (92.4 μL, 1.5 equiv) in dry THF (2.5 mL) [reaction condition: 60 °C for 4 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 1.5/1) yielded **5aj** as Olivine solid (187.4 mg, 91%). mp.: 248.7-249.7 °C; R_f 0.23 (hexanes/ dichloromethane: 1.5/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.18 (d, 1H, J = 7.8 Hz), 7.99 (d, 1H, J = 7.3 Hz), 7.76-7.63 (m, 2H), 7.57 (d, 2H, J = 8.3 Hz), 7.21 (d, 2H, J = 8.3 Hz), 1.29 (s, 9H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.8, 173.2, 166.1, 149.9, 133.7, 133.6, 133.3, 132.4, 131.8, 131.2, 130.6, 129.7, 126.6, 126.5, 122.4, 118.9, 35.2, 29.7. **MS** (70eV, EI) *m/z* (%): 410 $[M+2]^+$ (60), 408 (60), 395 (100), 393 (70), 286 (30), 271 (20), 76 (20). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2957 (m), 1671 (s), 1590 (m), 1533 (m), 1233 (m), 1210 (m), 705 (m). **HRMS** (ESI) for **$C_{22}H_{18}BrO_3^+$, $[M+H]^+$** (409.0439) found: 409.0453.

Synthesis of 5cb:



Prepared according to **TP-Ⅱ** from **3c** (249.5 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **4b** (142.7 mg, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 0.5 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 2.6/1) yielded **5cb** as yellow solid (204.6 mg, 88 %). mp.: 256.5-257.3 °C; R_f 0.28 (hexanes/ethyl acetate: 2.6/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.23 (d, 1H, J = 6.7 Hz), 8.09 (d, 1H, J = 6.9 Hz), 7.79-7.70 (m, 2H), 7.50-7.36 (m, 8H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.6, 173.3, 154.4, 151.4, 134.9, 133.9, 133.4, 132.3, 131.4, 129.3, 128.6, 128.3, 127.1, 126.9, 126.7, 124.5, 120.9. **MS** (70 eV, EI) *m/z* (%): 462 $[M]^+$ (90), 464 (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3043 (w), 1671 (s), 1590 (m), 1395 (m), 1214 (m), 1080 (m), 709 (m), 676 (m). **HRMS** (ESI) for **$C_{24}H_{13}BrClO_3$, $[M+H]^+$** (462.9731), found: 462.9757.

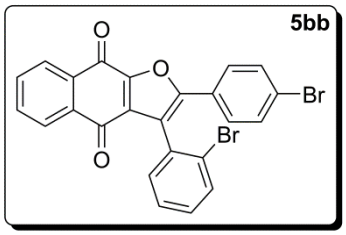
Synthesis of 5eb:



Prepared according to **TP-Ⅱ** from **3e** (244.8 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **4b** (142.7 mg, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 0 5 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 1/1) yielded **5eb** as yellow solid (221.1 mg, 97 %). mp.: 309.4-310.4 °C; R_f 0.3 (hexanes/ ethyl acetate: 8/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.25 (d, 1H, J = 7.5 Hz), 8.10 (d, 1H, J = 7.4 Hz), 7.82-7.72 (m, 4H), 7.59 (d, 2H, J = 8.2 Hz), 7.49 (d, 2H, J = 8.8 Hz), 7.38 (d, 2H, J = 8.4 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.5, 173.3, 154.7, 151.6, 135.0, 134.2, 134.1, 133.3, 132.5, 131.0, 129.0, 128.7, 127.0, 126.8, 126.7, 125.0, 120.1, 118.4, 112.7. **MS** (70eV, EI) *m/z* (%): 455 $[M+2]^+$ (100), 453 (100), 368 (30), 288 (50), 212 (30), 187 (20), 105 (40) 76 (60). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2230 (w), 1671 (s), 1590 (m), 1219 (m), 1186 (m), 705 (m). **HRMS** (ESI) for **$C_{25}H_{13}BrNO_3^+$, $[M+H]^+$** (454.0079) found: 454.0096.

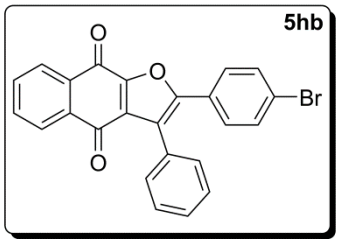
Synthesis of 5bb:

Prepared according to **TP-Ⅱ** from **3b** (271.7 mg, 0.5 mmol), triethylamine (118.5 μL, 1.7 equiv), and **4b** (164.7 mg, 1.5 equiv) in dry THF (2.5 mL) [reaction condition: 60 °C for 12 h]. Purification by



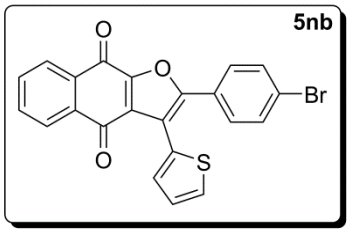
flash-chromatography (hexanes/dichloromethane: 2/1) yielded **5bb** as yellow solid (200.4 mg, 79%). mp.: 235.4-236.4 °C; R_f 0.26 (hexanes/dichloromethane: 2/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.26 (d, 1H, J = 7.5 Hz), 8.09 (d, 1H, J = 7.2 Hz), 7.81-7.70 (m, 3H), 7.50-7.33 (m, 7H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.3, 173.4, 154.5, 151.0, 138.9, 133.8, 133.3, 133.2, 132.6, 132.1, 131.8, 131.3, 130.1, 128.0, 127.9, 127.4, 126.9, 126.8, 124.6, 124.5, 120.6 **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3071 (w), 1660 (s), 1598 (s), 1528 (s), 1454 (m), 1347 (m). **HRMS** (70 eV, EI) for **$C_{24}H_{12}Br_2O_3$, [M]$^+$** (505.9153), found: 505.9159.

Synthesis of 5hb:



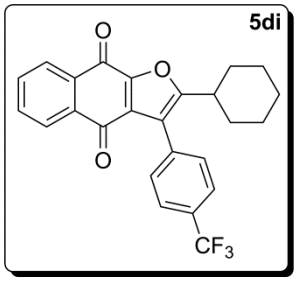
Prepared according to **TP-Ⅱ** from **3h** (271.7 mg, 0.5 mmol), triethylamine (104.5 µL, 1.5 equiv), and **4b** (142.7 mg, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 1 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 1/1) yielded **5hb** as yellow solid (177.1 mg, 83 %). mp.: 259.7-260.2 °C; R_f 0.30 (hexanes/ethyl acetate: 1/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.24 (d, 1H, J = 7.1 Hz), 8.09 (d, 1H, J = 7.2 Hz), 7.82-7.66 (m, 2H), 7.55-7.38 (m, 9H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.6, 173.4, 154.3, 151.3, 133.9, 133.8, 133.5, 132.4, 131.9, 130.0, 129.9, 129.6, 128.8, 128.6, 127.5, 126.9, 126.7, 124.2, 122.2. **MS** (70eV, EI) *m/z* (%): 430 $[M+2]^+$ (100), 428 (100), 345 (20), 263 (40), 187 (20), 105 (30) 77 (20). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 1671 (s), 1586 (m), 1214 (m), 1076 (m), 710 (m). **HRMS** (ESI) for **$C_{24}H_{14}BrO_3^+$, [M+H]$^+$** (431.0106) found: 431.0103.

Synthesis of 5nb:



Prepared according to **TP-Ⅱ** from **3n** (235.3 mg, 0.5 mmol), triethylamine (104.5 µL, 1.5 equiv), and **4b** (142.7 mg, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 0 5 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 3/1) yielded **5nb** as yellow solid (198.1 mg, 91 %). mp.: 224.3-225.3 °C; R_f 0.24 (hexanes/ dichloromethane: 3/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.24 (d, 1H, J = 7.7 Hz), 8.13 (d, 1H, J = 6.9 Hz), 7.80-7.71 (m, 2H), 7.55-7.47 (m, 5H), 7.25-7.21 (m, 1H), 7.20-7.16 (m, 1H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.2, 173.3, 155.4, 151.2, 133.9, 133.8, 133.4, 132.3, 131.9, 129.7, 129.3, 128.7, 127.7, 127.6, 127.1, 126.9, 126.6, 124.6, 114.9. **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3100 (w), 1671 (s), 1585 (m), 1552 (m), 1209 (s), 1071 (m), 952 (m), 704 (m)**. HRMS** (70 eV, EI) for **$C_{22}H_{11}BrO_3S$, [M]$^+$** (433.9612), found: 433.9611.

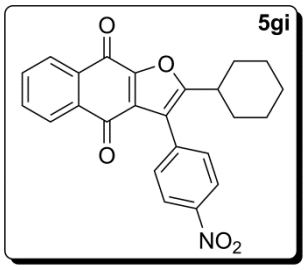
Synthesis of 5di:



Prepared according to **TP-Ⅱ** from **3d** (266.3 mg, 0.5 mmol), triethylamine (104.5 µL, 1.5 equiv), and **4i** (86.9 mg, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 0.5 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 3.5/1) yielded **5di** as yellow solid (192.4 mg, 91%). mp.: 198.4-199.4 °C; R_f 0.41 (hexanes/ dichloromethane: 2/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.21 (d, 1H, J = 7.2 Hz), 8,07 (d, 1H, J = 7.4 Hz), 7.78-7.68 (m, 4H), 7.55 (d, 2H, J = 8.0 Hz), 2.87-2.72 (m, 1H), 1.93-1.70 (m, 7H),

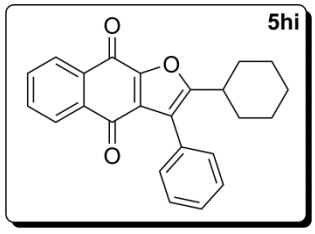
1.39-1.20 (m, 3H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.9, 173.3, 164.7, 151.4, 133.9, 133.8, 133.7, 133.4, 132.3, 130.3, 130.2 (q, J = 32.6 Hz), 128.2, 126.8, 126.6, 125.2 (q, J = 3.7 Hz), 124.1 (q, J = 272.0 Hz), 119.1, 36.3, 31.3, 25.9, 25.4. **^{31}P-NMR** (200 MHz, $CDCl_3$, 25 °C) δ/ppm: 34.7. **MS** (70 eV, EI) *m/z* (%): 424 $[M]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2928 (m), 2851 (m), 1671 (s), 1590 (m), 1328 (s), 1209 (s), 1119 (s), 842 (m), 704 (m). **HRMS** (ESI) for **$C_{25}H_{20}F_3O_3$, $[M+H]^+$** (425.1365), found: 425.1381.

Synthesis of 5gi:



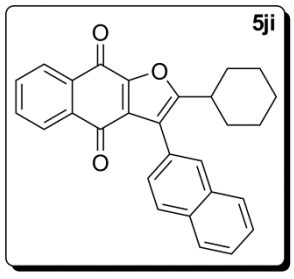
Prepared according to **TP-Ⅱ** from **3g** (254.8 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **4i** (86.9 mg, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 1.25 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 2/1) yielded **5gi** as yellow solid (194.1 mg, 97%). mp.: 181.4-182.4 °C; R_f 0.21 (hexanes/ dichloromethane: 2/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.34 (d, 2H, J = 8.5 Hz), 8,21 (d, 1H, J = 7.1 Hz), 8.07 (d, 1H, J = 8.5 Hz), 7.78-7.69 (m, 2H), 7.61 (d, 2H, J = 8.5 Hz), 2.85-2.74 (m, 1H), 1.92-1.71 (m, 7H), 1.37-1.22 (m, 3H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.8, 173.2, 164.8, 151.5, 147.6, 137.0, 133.9, 133.8, 133.3, 132.2, 130.9, 127.9, 126.7, 123.5, 118.5, 36.4, 31.2, 25.9, 25.3. **MS** (70 eV, EI) *m/z* (%): 401 $[M]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3072 (w), 2927 (w), s847 (w), 1667 (m), 1591 (w), 1519 (m), 1346 (m), 1208 (m), 706 (w). **HRMS** (ESI) for **$C_{24}H_{20}NO_5$, $[M+H]^+$** (402.1341), found: 402.1325.

Synthesis of 5hi:



Prepared according to **TP-Ⅱ** from **3h** (232.3 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **4i** (86.9 mg, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 0.66 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 4/1) yielded **5hi** as yellow solid (175.1 mg, 98%). mp.: 170.2-171.2 °C; R_f 0.28 (hexanes/ dichloromethane: 4/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25°C) δ/ppm: 8.19 (d, 1H, J = 6.6 Hz), 8.06 (t, 1H, J = 6.9 Hz), 7.75-7.64 (m, 2H), 7.53-7.40 (m, 5H), 2.90-2.79 (m, 1H), 1.93-1.68 (m, 7H), 1.38-1.21 (m, 3H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.9, 173.2, 164.5, 151.1, 133.6, 133.5, 132.3, 130.0, 129.9, 128.5, 128.2, 128.1, 126.7, 126.4, 120.4, 36.1, 31.2, 25.9, 25.4. **MS** (70 eV, EI) *m/z* (%): 356 $[M]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3052 (w), 2928 (s), 2851 (m), 1666 (s), 1590 (s), 1209 (s), 704 (s). **HRMS** (ESI) for **$C_{24}H_{21}O_3$, $[M+H]^+$** (357.1491), found: 357.1492.

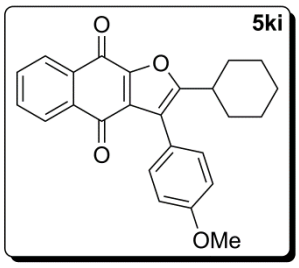
Synthesis of 5ji:



Prepared according to **TP-Ⅱ** from **3j** (257.3 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **4i** (86.9 mg, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 1.5 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 2/1) yielded **5ji** as yellow solid (191.5 mg, 94%). mp.: 192.6-193.6 °C; R_f 0.33 (hexanes/ dichloromethane: 2/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.21 (d, 1H, J = 7.0 Hz), 8,06 (d, 1H, J = 7.1 Hz), 7.98-7.83 (m, 4H), 7.74-7.64 (m, 2H), 7.58-7.48 (m, 3H), 2.96-2.84 (m, 1H), 1.95-1.75 (m, 7H), 1.35-1.19 (m, 3H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.9, 173.3, 164.7, 151.2, 133.5, 133.1, 133.0, 132.4, 128.8, 128.7, 128.1, 127.8, 127.7, 127.6, 126.8, 126.5, 126.4, 126.3, 120.5, 36.2, 31.3, 25.9, 25.4. **MS** (70 eV, EI) *m/z* (%): 401 $[M]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3052 (w), 2981 (m), 2842 (m), 1666 (s), 1580 (m), 1538 (m),

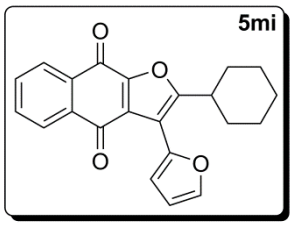
1204 (m), 747 (m). **HRMS** (ESI) for **$C_{28}H_{23}O_3$, $[M+H]^+$** (407.1647), found: 407.1623.

Synthesis of 5ki:



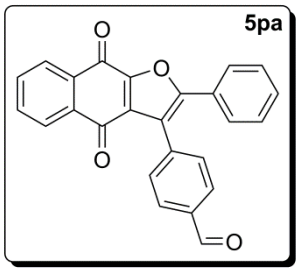
Prepared according to **TP-Ⅱ** from **3k** (248.3 mg, 0.5 mmol), triethylamine (104.5 µL, 1.5 equiv), and **4i** (86.9 mg, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 1 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 1.8/1) yielded **5ki** as yellow solid (143.5 mg, 74%). mp.: 174.3-175.0 °C; R_f 0.28 (hexanes/ dichloromethane: 1.8/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.19 (d, 1H, J = 7.2 Hz), 8,07 (d, 1H, J = 7.2 Hz), 7.74-7.65 (m, 4H), 7.35 (d, 2H, J = 8.6 Hz), 7.01 (d, 2H, J = 8.6 Hz), 3.88 (s, 1H), 2.89-2.78 (m, 1H), 1.90-1.74 (m, 7H), 1.38-1.22 (m, 3H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 181.0, 173.2, 164.4, 159.4, 133.6, 133.5, 132.4, 131.0, 128.6, 126.7, 126.4, 122.0, 120.2, 113.7, 55.2, 36.2, 31.2, 26.0, 25.5. **MS** (70 eV, EI) *m/z* (%): 386 $[M]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 2918 (m), 2842 (w), 1666 (s), 1585 (w), 1247 (m), 1204 (s), 709 (m). **HRMS** (ESI) for **$C_{25}H_{23}O_4$, $[M+H]^+$** (387.1596), found: 387.1602.

Synthesis of 5mi:



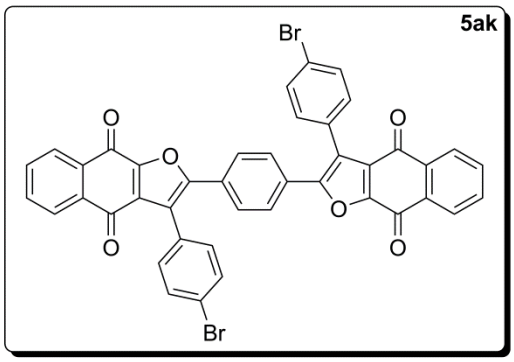
Prepared according to **TP-Ⅱ** from **3m** (227.3 mg, 0.5 mmol), triethylamine (104.5 µL, 1.5 equiv), and **4i** (86.9 mg, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 1.25 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 3/1) yielded **5mi** as orange solid (157.6 mg, 91%). mp.: 155.8-156.5 °C; R_f 0.23 (hexanes/ dichloromethane: 3/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.25-8.10 (m, 2H), 7,76-7.66 (m, 1H), 7.54 (brs, 1H), 7.36 (d, 2H, J = 3.2 Hz), 6.55 (brs, 2H), 3.47-3.33 (m, 1H), 2.02-1.69 (m, 7H), 1.51-1.19 (m, 3H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.4, 173.0, 164.7, 151.3, 144.7, 142.2, 133.6, 133.5, 132.0, 127.0, 126.9, 126.4, 112.1, 111.4, 110.9, 37.6, 30.9, 26.1, 25.6. **MS** (70 eV, EI) *m/z* (%): 346 $[M]^+$ (100), 303 (30), 105 (30), 55 (70). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3139 (w), 2928 (m), 2842 (m), 1667 (s), 1590 (m), 1224 (m), 1210 (m), 705 (m). **HRMS** (ESI) for **$C_{22}H_{19}O_4^+$, $[M+H]^+$** (347.1283), found: 347.1283.

Synthesis of 5pa:



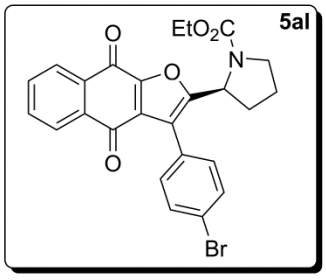
Prepared according to **TP-Ⅱ** from **3p** (246.3 mg, 0.5 mmol), triethylamine (118.5 µL, 1.7 equiv), and **4a** (87.5 µL, 1.5 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 0.5 h]. Purification by *flash*-chromatography (hexanes/dichoromethane: 1/1.5) yielded **5pa** as yellow solid (181.3 mg, 96 %). mp.: 242.4-243.4 °C; R_f 0.24 (hexanes/dichoromethane : 1.5/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 10.11 (s, 1H), 8.23 (d, 1H, J = 7.2 Hz), 8.08 (d, 1H, J = 7.1 Hz), 7.99 (d, 2H, J = 8.0 Hz), 7.81-7.69 (m, 2H), 7.66 (d, 2H, J = 7.9 Hz), 7.53 (d, 2H, J = 7.4 Hz), 7.41-7.28 (m, 3H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 191.7, 180.6, 173.3, 155.8, 151.4, 136.8, 136.2, 134.0, 133.9, 133.4, 132.3, 130.9, 130.2, 129.9, 129.2, 128.8, 128.0, 127.4, 126.9, 126.7, 120.3. **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3057 (w), 2746 (w), 1693 (s), 1668 (s), 1588 (m), 1220 (s), 685 (m). **HRMS** (EI) for **$C_{25}H_{14}O_4$, $[M]^+$** (378.0892) found: 378.0902.

Synthesis of 5ak:



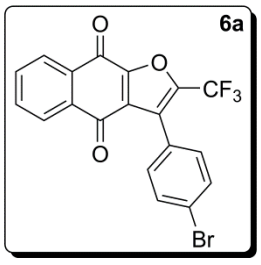
Prepared according to **TP-Ⅱ** from **3a** (597.8 mg, 2.2 eq), triethylamine (174.2 μL, 2.5 equiv), and **4k** (101.6 mg, 0.5 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 0.66 h]. Purification by *flash*-chromatography (hexanes/ dichloromethane: 1.6/1) yielded **5ak** as red solid (230.2 mg, 59 %). mp.: over 400°C; R_f 0.26 (hexanes/ dichloromethane: 1.6/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.25 (d, 2H, J = 7.5 Hz), 8.10 (d, 2H, J = 7.1 Hz), 7.81-7.71 (m, 4H), 7.62 (d, 4H, J = 8.2 Hz), 7.56 (*pseudo* s, 4H), 7.34 (d, 4H, J = 8.2 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.6, 173.4, 154.2, 151.6, 134.1, 134.0, 133.5, 132.4, 132.1, 131.6, 129.5, 129.3, 128.8, 127.4, 127.0, 123.3, 121.7. **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3062 (w), 1671 (s), 1595 (m), 1543 (m), 1214 (s), 971 (m), 704 (m). **HRMS** (EI) for **$C_{42}H_{20}Br_2O_6$, [M]$^+$** (777.9627) found: 777.9622.

Synthesis of 5al:



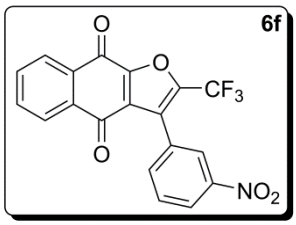
Prepared according to **TP-Ⅱ** from **3a** (271.7 mg, 0.5 mmol), triethylamine (120.6 μL, 1.7 equiv), and **4l** (1.5 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 0.83 h]. Purification by *flash*-chromatography (hexanes/ethyl acetate: 8/1) yielded **5al** as Olivine solid (173.2 mg, 70 %). mp.: 163.3-163.8 °C; R_f 0.23 (hexanes/ethyl acetate: 6/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.26-8.15 (m, 1H), 8.13-8.03 (m, 1H), 7.80-7.67 (m, 2H), 7.60 (d, 2H, J = 7.0 Hz), 7.56-7.30 (m, 2H), 5.07-4.94 (m, 1H), 4.17-3.90 (m, 2H), 3.72-3.46 (m, 2H), 2.39-1.85 (m, 4H), 1.34-0.92 (m, 3H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.7, 173.4, 173.2, 159.4, 159.1, 151.9, 154.3, 151.5, 133.8, 133.7, 133.4, 132.2, 131.7, 131.4, 128.3, 128.2, 127.9, 126.8, 126.6, 122.6, 121.1, 120.8, 61.3, 53.4, 52.7, 47.1, 46.8, 33.1, 32.3, 24.5, 23.9, 14.6. **MS** (70eV, EI) *m/z* (%): 495 [M+2]$^+$ (100), 493 (100), 419 (100), 351 (20), 311 (20), 105 (20). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3053 (w), 2967 (m), 2880 (w), 1705 (s), 1667 (s), 1586 (m), 1205 (m), 1119 (s), 714 (m). **HRMS** (EI) for **$C_{25}H_{20}BrNO_5$, [M]$^+$** (493.0525) found: 493.0533.

Synthesis of 6a:



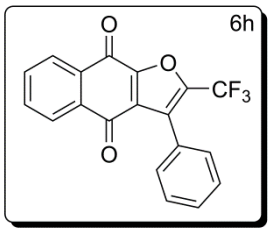
Prepared according to **TP-Ⅱ** from **3a** (271.7 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **TFAA** (90.4 μL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 10 min]. Purification by *flash*-chromatography (hexanes/ dichloromethane: 2.2/1) yielded **6a** as Olivine solid (198.0 mg, 94 %). mp.: 142.3-142.9 °C; R_f 0.30 (hexanes/ dichloromethane: 2.2/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.31-8.19 (m, 1H), 8.18-8.08 (m, 1H), 7.87-7.74 (m, 2H), 7.63 (d, 2H, J = 8.3 Hz), 7.35 (d, 2H, J = 8.5 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 179.4, 173.4, 152.5, 142.2 (quart, J = 41.4 Hz), 134.6, 134.3, 133.3, 131.9, 131.7, 131.5, 131.3, 127.3, 127.2, 127.0, 126.7 (quart, J = 2.3 Hz), 125.3, 124.1, 118.6 (quart, J = 271.0 Hz). **MS** (70eV, EI) *m/z* (%): 422 [M+2]$^+$ (100), 420 (95), 341 (40), 187 (20). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3052 (w), 1676 (s), 1580 (m), 1243 (s), 1200 (s), 1138 (s), 724 (m), 710 (m). **HRMS** (ESI) for **$C_{19}H_9BrF_3O_3^+$, [M]$^+$** (420.9699) found: 420.9687.

Synthesis of 6f:



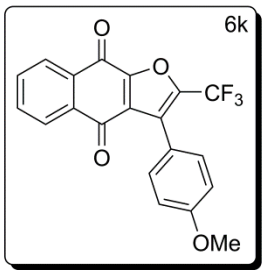
Prepared according to **TP-Ⅱ** from **3f** (254.8 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **TFAA** (90.4 μL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 5 min]. Purification by *flash*-chromatography (hexanes/dichloromethane: 3/1) yielded **6f** as Olivine solid (188.1 mg, 97 %). mp.: 180.7-181.4 °C; R_f 0.31 (hexanes/ dichloromethane: 3/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.43-8.35 (m, 2H), 8.31-8.25 (m, 1H), 8.17-8.10 (m, 1H), 7.87-7.78 (m, 3H), 7.75-7.66 (m, 1H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 179.4, 173.3, 152.7, 148.1, 142.8 (quart, J = 41.8 Hz), 135.6, 134.8, 134.5, 133.2, 131.9, 129.3, 128.3, 127.4, 127.2, 125.3 (quart, J = 2.2 Hz), 125.0, 124.4, 118.5 (quart, J = 271.1 Hz). **MS** (70eV, EI) *m/z* (%): 387 $[M]^+$ (80), 340 (100), 215 (30), 187 (40), 76 (30). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3079 (w), 1678 (s), 1606 (m), 1527 (s), 1350 (s), 1245 (s), 1187 (s), 1126 (s), 710 (m). **HRMS** (EI) for **$C_{19}H_8F_3NO_5$, $[M]^+$** (387.0355) found: 387.0360.

Synthesis of 6h:



Prepared according to **TP-Ⅱ** from **3h** (254.8 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **TFAA** (90.4 μL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 15 min]. Purification by *flash*-chromatography (hexanes/dichloromethane: 3/1) yielded **6h** as Olivine solid (145.5 mg, 85 %). mp.: 108.3-109.3 °C; R_f 0.30 (hexanes/dichloromethane: 3/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.29-8.24 (m, 1H), 8.16-8.10 (m, 1H), 7.83-7.76 (m, 2H), 7.54-7.44 (m, 5H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 179.5, 173.6, 152.4, 142.2 (quart, J = 41.3 Hz), 134.6, 134.2, 133.4, 131.9, 129.6, 129.5, 128.2, 127.8 (quart, J = 2.3 Hz), 127.5, 127.3, 127.0, 126.4, 118.7 (quart, J = 270.9 Hz). **MS** (70 eV, EI) *m/z* (%): 342 $[M]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3065 (w), 1678 (s), 1588 (m), 1241 (s), 1179 (s), 1129 (s), 710 (m), 684 (m). **HRMS** (ESI) for **$C_{19}H_{10}F_3O_3$, $[M+H]^+$** (343.0582), found: 343.0553.

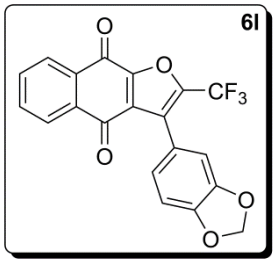
Synthesis of 6k:



Prepared according to **TP-Ⅱ** from **3k** (248.3 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **TFAA** (90.4 μL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 20 min]. Purification by *flash*-chromatography (hexanes/dichloromethane: 2.5/1) yielded **6k** as yellow solid (174.4 mg, 93 %). mp.: 147.7-148.5 °C; R_f 0.26 (hexanes/dichloromethane: 2.5/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.31-8.22 (m, 1H), 8.19-8.10 (m, 1H), 7.84-7.75 (m, 2H), 7.42 (d, 2H, J = 7.5 Hz), 7.04-6.98 (m, 2H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 179.6, 173.6, 160.5, 152.3, 141.8 (q, J = 41.3 Hz), 134.5, 134.1, 133.4, 131.8, 131.1, 127.7 (q, J = 2.6 Hz), 127.4, 127.2, 126.9, 118.8 (q, J = 270.7 Hz), 118.2, 113.6, 55.2. **MS** (70 eV, EI) *m/z* (%): 372 $[M]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3079 (w), 2971 (m), 1678 (s), 1613 (s), 1588 (s), 1528 (s), 1252 (s), 1194 (s), 1122 (s), 710 (m), 692 (m). **HRMS** (ESI) for **$C_{20}H_{12}F_3O_4$, $[M+H]^+$** (373.0688), found: 373.0672.

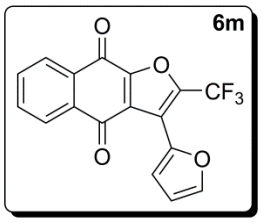
Synthesis of 6l:

Prepared according to **TP-Ⅱ** from **3l** (254.8 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **TFAA** (90.4 μL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 10 min]. Purification by



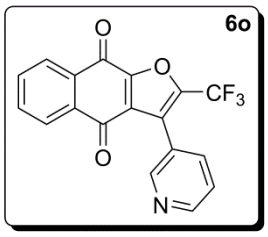
flash-chromatography (hexanes/dichloromethane: 2/1) yielded **6l** as orange solid (181.5 mg, 94 %). mp.: 144.3-145.3 °C; R_f 0.23 (hexanes/ dichloromethane: 2/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.30-8.19 (m, 1H), 8.18-8.08 (m, 1H), 7.86-7.74 (m, 2H), 7.00-6.83 (m, 3H), 6.06 (*pseudo* s, 2H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 179.5, 173.5, 152.3, 148.7, 147.5, 142.1 (quart, J = 42.1 Hz), 134.6, 134.2, 133.4, 131.8, 127.6 (quart, J = 2.3 Hz), 127.5, 127.3, 126.9, 123.8, 119.5, 118.7 (quart, J = 270.7 Hz), 110.1, 108.2, 101.5. **MS** (70eV, EI) *m/z* (%): 386 $[M]^+$ (60), 203 (20), 175 (20), 76 (10). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3072 (w), 2913 (w), 1689 (s), 1595 (m), 1230 (m), 1205 (m), 1143 (m), 1097 (m), 710 (m). **HRMS** (FAB) for **$C_{20}H_9F_3O_5$, $[M]^+$** (386.0402) found: 386.0400.

Synthesis of 6m:



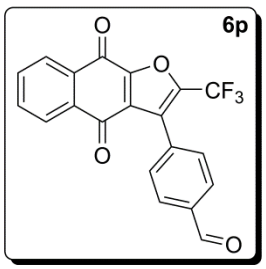
Prepared according to **TP-Ⅱ** from **3m** (227.3 mg, 0.5 mmol), triethylamine (104.5 µL, 1.5 equiv), and **TFAA** (90.4 µL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 5 min]. Purification by *flash*-chromatography (hexanes/ dichloromethane: 3.5/1) yielded **6m** as yellow solid (151.0 mg, 91 %). mp.: 156.5-157.5 °C; R_f 0.38 (hexanes/ dichloromethane: 3.5/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.29-8.23 (m, 2H), 7.86-7.84 (m, 2H), 7.66-7.61 (m, 2H), 6.62-6.59 (m, 1H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 179.1, 173.3, 152.3, 144.4, 141.3 (q, J = 43.2 Hz), 140.8, 134.6, 134.1, 133.5, 131.6, 127.5, 126.9, 125.9, 118.9 (q, J = 270.5 Hz), 117.5, 115.8, 111.8. **MS** (70 eV, EI) *m/z* (%): 332 $[M]^+$ (100). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3152 (w), 3065 (w), 1678 (s), 1591 (m), 1248 (s), 1172 (m), 1136 (s), 1136 (s), 760 (m), 706 (m). **HRMS** (ESI) for **$C_{17}H_8F_3O_4$, $[M+H]^+$** (333.0375), found: 333.0385

Synthesis of 6o:



Prepared according to **TP-Ⅱ** from **3o** (232.8 mg, 0.5 mmol), triethylamine (104.5 µL, 1.5 equiv), and **TFAA** (90.4 µL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 5 min]. Purification by *flash*-chromatography (hexanes/ethyl acetate: 3/1) yielded **6o** as yellow solid (152.7 mg, 89 %). mp.: 121.1-122.1 °C; R_f 0.3 (hexanes/ethyl acetate : 3/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.81-8.66 (m, 2H), 8.29-8.21 (m, 1H), 8.17-8.09 (m, 1H), 7.90-7.76 (m, 3H), 7.52-7.41 (m, 1H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 179.4, 173.3, 152.6, 150.5, 150.0, 142.6 (quart, J = 41.6 Hz), 137.2, 134.7, 134.4, 133.2, 131.8, 127.2, 127.0, 124.3 (quart, J = 2.2 Hz), 122.9, 122.8, 118.5 (quart, J = 271.1 Hz). **MS** (70eV, EI) *m/z* (%): 343 $[M]^+$ (100), 189 (20), 163 (20), 110 (20), 76 (30). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3094 (w), 1686 (s), 1584 (m), 1583 (m), 1245 (s), 1209 (s), 1122 (s), 714 (m). **HRMS** (EI) for **$C_{18}H_8F_3NO_3$, $[M]^+$** (343.0456) found: 343.0455.

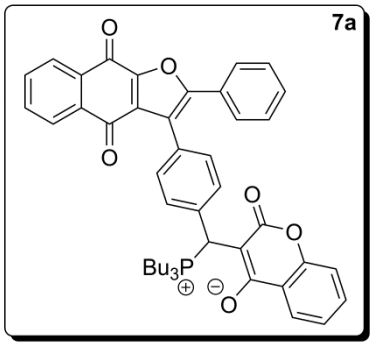
Synthesis of 6p:



Prepared according to **TP-Ⅱ** from **3p** (246.3 mg, 0.5 mmol), triethylamine (104.5 µL, 1.5 equiv), and **TFAA** (90.4 µL, 1.3 equiv) in dry THF (2.5 mL) [reaction condition: 25-28 °C for 5 min]. Purification by *flash*-chromatography (hexanes/dichloromethane: 2/1) yielded **6p** as Olivine solid (168.5 mg, 91 %). mp.: 136.4-137.4 °C; R_f 0.28 (hexanes/ dichloromethane: 2/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 10.1 (s, 1H), 8.29-8.21 (m, 1H), 8.15-8.08 (m, 1H), 8.02 (d,

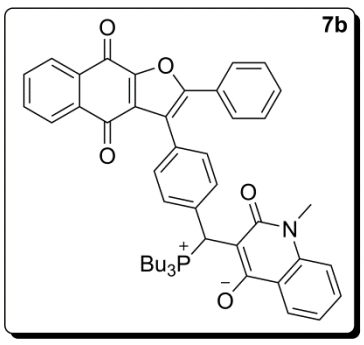
2H, J = 8.0 Hz), 7.85-7.77 (m, 2H), 7.67 (d, 2H, J = 7.2 Hz). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 191.5, 179.3, 173.3, 152.5, 142.3 (q, J = 41.7 Hz), 136.8, 134.7, 134.4, 133.1, 132.4, 131.7, 130.5, 129.3, 127.2, 127.1, 126.4 (q, J = 1.7 Hz), 118.5 (q, J = 271.1 Hz). **MS** (70 eV, EI) *m/z* (%): 370 $[M]^+$ (100), 340 (80). **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3065 (w), 2731 (w), 1700 (s), 1682 (s), 1617 (m), 1595 (m), 1241 (s), 1205 (s), 1125 (s), 706 (m). **HRMS** (FAB) for **$C_{20}H_{10}F_3O_4$, $[M+H]^+$** (371.0531), found: 371.0538.

Synthesis of 7a:



Prepared according to **TP-Ⅲ** from 4-hydroxycoumarin (81.1 mg, 0.5 mmol), **5pa** (189.2 mg, 1 equiv), tributylphosphine (150.0 μL, 1.2 equiv), pyrrolidine (4.1 μL, 0.1 equiv), and benzoic acid (6.1 mg, 0.1 equiv) in dry THF (0.5 mL) [reaction condition: 28-30 °C for 1 h]. Purification by *flash*-chromatography (hexanes/ethyl acetate: 3/1 and then dichloromethane/methanol: 100/1.2) yielded **7a** as orange solid (263.4 mg, 73 %). mp.: 238.4-239.2 °C; R_f 0.37 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.24 (d, 1H, J = 7.3 Hz), 8.06 (*pseudo* t, 2H, J = 8.7 Hz), 7.79-7.62 (m, 4H), 7.56 (d, 2H, J = 7.9 Hz), 7.49-7.37 (m, 3H), 7.34-7.25 (m, 4H), 7.22 (*pseudo* t, 1H, J = 7.5 Hz), 5.58-5.32 (m, 1H), 2.46-2.23 (m, 6H), 1.52-1.35 (m, 12H), 0.89-0.85 (m, 9H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.3, 174.8 (d, J = 4.2 Hz), 173.2, 166.1 (d, J = 6.1 Hz), 155.4, 153.8, 151.0, 135.8 (d, J = 2.0 Hz), 133.6, 133.4, 132.3, 130.8, 130.7, 130.6, 130.2 (d, J = 3.3 Hz), 129.9 (d, J = 4.7 Hz), 129.8, 129,5, 128.6, 128.2, 127.1, 126.6, 126.5, 124.9, 122.5, 122.3, 120.8, 116.3, 94.1, 37.2 (J = 46.3 Hz), 24.1 (J = 4.9 Hz), 24.0 (J = 15.0 Hz), 20.5 (J = 46.4 Hz), 13.2. **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3057 (w), 2956 (m), 2870 (m), 1671 (s), 1595 (s), 1538 (s), 1364 (m), 1216 (m). **HRMS** (EI) for **$C_{46}H_{46}O_6P^+$, $[M]^+$** (725.3032) found: 725.3026.

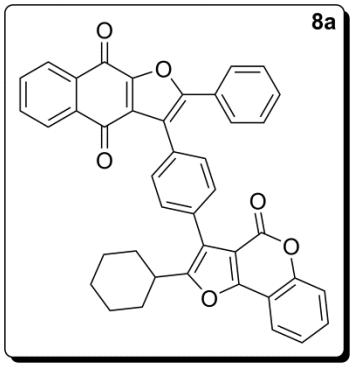
Synthesis of 7b:



Prepared according to **TP-Ⅲ** from 4-hydroxy-1-methyl-2(1*H*)-quinolone (87.6 mg, 0.5 mmol), **5pa** (189.2 mg, 1 equiv), tributylphosphine (150.0 μL, 1.2 equiv), pyrrolidine (4.1 μL, 0.1 equiv), and benzoic acid (6.1 mg, 0.1 equiv) in dry THF (0.5 mL) [reaction condition: 28-30 °C for 2.5 h]. Purification by *flash*-chromatography (dichloromethane/methanol: 50/1) yielded **7b** as orange solid (339.2 mg, 92 %). mp.: 137.8-138.8 °C; R_f 0.29 (dichloromethane/methane: 30/1). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.31 (d, 1H, J = 7.7 Hz), 8.23 (d, 1H, J = 7.0 Hz), 8.04 (d, 1H, J = 6.8 Hz), 7.81-7.66 (m, 4H), 7.59 (d, 2H, J = 7.1 Hz), 7.49 (*pseudo* t, 1H, J = 7.5 Hz), 7.38 (d, 2H, J = 7.8 Hz), 7.19 (*m*, 4H), 7.17 (*pseudo* t, 1H, J = 7.4 Hz), 5.95-5.45 (brs, 1H), 3.69(s, 3H), 2.52-2.22 (m, 6H), 1.54-1.34 (m, 12H), 0.98-0.84 (m, 9H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.3, 173.3, 172.3, 164.6, 155.4, 151.1, 140.2, 136.5, 133.6, 132.4, 130.6 (d, J = 2.3 Hz), 130.1 (d, J = 4.6 Hz), 130.0, 129.9, 129.8, 129.7, 128.7, 128.4, 127,3, 126.7, 126.6, 125.6, 123.3, 121.1, 120.2, 113.4, 29.1, 24.4 (J = 4.8 Hz), 24.1 (J = 14.9 Hz), 20.8 (J = 47.2 Hz), 13.3. **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3065 (w), 2957 (m), 2928 (m), 2862 (m), 1675 (s), 1584 (s), 1527 (s), 1216 (m), 685 (m). **HRMS** (EI) for **$C_{47}H_{49}NO_5P^+$, $[M]^+$** (738.3348) found: 738.3337.

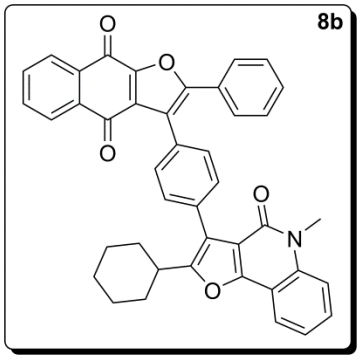
Synthesis of 8a:

Prepared according to **TP-Ⅱ** from **7a** (362.4 mg, 0.5 mmol), triethylamine (104.5 μL, 1.5 equiv), and **4i**

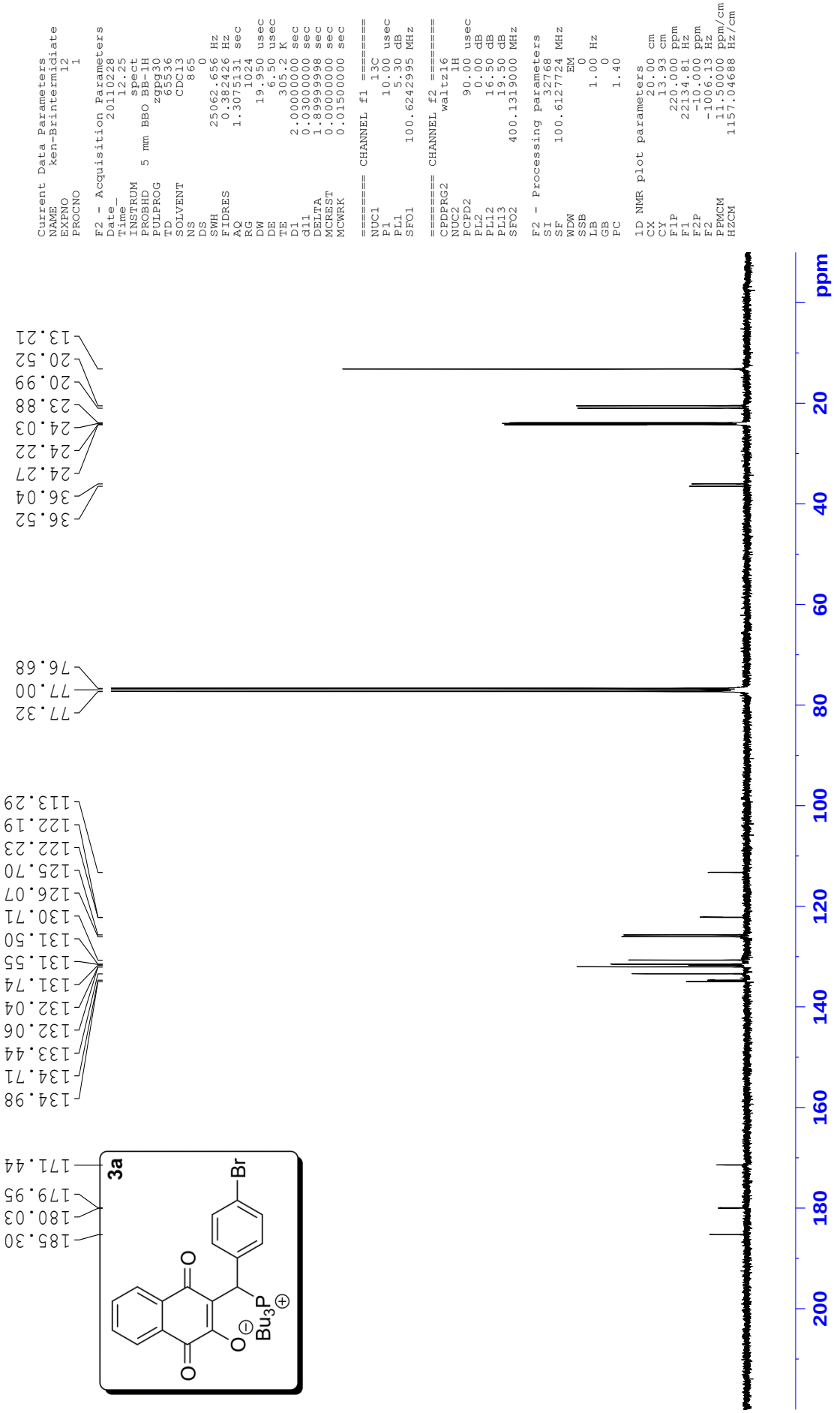


(87.0 µL, 1.3 equiv) in dry THF (5 mL) [reaction condition: 28-30 °C for 1 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 1/1.2) yielded **8a** as pale yellow solid (206.5 mg, 67 %). mp.: 291.4-292.9 °C; R_f 0.23 (hexanes/ dichloromethane: 1/1.2). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.26 (d, 1H, J = 6.7 Hz), 8,15 (d, 1H, J = 7.4 Hz), 7.94 (d, 1H, J = 7.4 Hz), 7.80-7.70 (m, 2H), 7.67-7.61 (m, 2H), 7.59 (*pseudo*-s, 4H), 7.54-7.42 (m, 2H), 7.40-7.30 (m, 4H), 3.06-2.95 (m, 1H), 2.01-1.74 (m, 7H), 1.46-1.33 (m, 3H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.9, 173.4, 159.7, 157.8, 156.2, 155.9, 152.4, 151.3, 133.8, 133.6, 132.5, 130.3, 130.2, 130.0, 129.9, 129.5, 129.4, 128.7, 128.4, 127.5, 126.9, 126.6, 124.2, 121.4, 120.7, 118.6, 117.0, 113.0, 109.7, 36.0, 31.8, 26.1, 25.7. **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3057 (w), 2920 (m), 2847 (m), 1747 (s), 1721 (s), 1667 (s), 1215 (s), 973 (m), 692 (m). **HRMS** (70 eV, EI) for **$C_{41}H_{28}O_6$, $[M]^+$** (616.1886), found: 616.1872.

Synthesis of 8b:



Prepared according to **TP-Ⅱ** from **7b** (368.9 mg, 0.5 mmol), triethylamine (104.5 µL, 1.5 equiv), and **4i** (87.0 µL, 1.3 equiv) in dry THF (5 mL) [reaction condition: 28-30 °C for 11.5 h]. Purification by *flash*-chromatography (hexanes/dichloromethane: 1/1.5) yielded **8b** as pale yellow solid (273.9 mg, 87 %). mp.: 365.4-366.4 °C; R_f 0.22 (hexanes/ dichloromethane: 1/1.5). **^{1}H-NMR** (400 MHz, $CDCl_3$, 25 °C) δ/ppm: 8.26 (d, 1H, J = 7.3 Hz), 8,14 (d, 1H, J = 6.9 Hz), 8.09 (d, 1H, J = 7.8 Hz), 7.79-7.66 (m, 4H), 7.65-7.52 (m, 5H), 7.46 (d, 1H, J = 8.4 Hz), 7.40-7.30 (m, 4H), 3.78 (s, 3H), 3.03-2.92 (m, 1H), 1.99-1.73 (m, 7H), 1.46-1.31 (m, 3H). **^{13}C-NMR** (100 MHz, $CDCl_3$, 25 °C) δ/ppm: 180.8, 173.5, 159.5, 159.0, 155.8, 153.8, 151.3, 137.9, 133.7, 133.7, 132.5, 131.9, 130.6, 129.8, 129.7, 129.6, 129.1, 128.9, 128.7, 128.6, 127.6, 127.0, 126.6, 122.0, 121.7, 121.1, 118.6, 114.8, 114.0, 113.1, 36.1, 32.0, 29.2, 26.2, 25.8. **IR** (KBr) $\tilde{\nu}$ (cm^{-1}): 3065 (w), 2920 (m), 2847 (m), 1663 (s), 1584 (m), 1215 (m), 684 (m). **HRMS** (FAB) for **$C_{42}H_{32}NO_5$, $[M+H]^+$** (630.2280), found: 630.2288.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PROCNO 1
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Time_ 12.25
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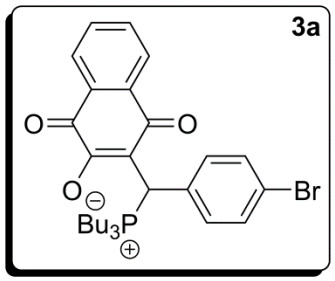
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 865
DS 0
SWH 25062.656 Hz
FIDRES 0.382426 Hz
AQ 1.30751310 sec
RG 1024
DW 19.950 usec
DE 6.50 usec
TE 305.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 10.00 usec
PL1 5.30 dB
SFO1 100.6242995 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 0.00 dB
PL12 16.50 dB
PL13 19.50 dB
SFO2 400.1319000 MHz
F2 - Processing parameters
SI 32768
SF 100.6127724 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
1D NMR plot parameters
CX 20.00 cm
CY 13.93 cm
F1P 220.000 ppm
F1 22134.81 Hz
F2P -10.000 ppm
F2 -1006.13 Hz
PPMCM 11.50000 ppm/cm
HZCM 1157.04688 Hz/cm
3a
Br
O
O
O
Bu3P
ppm
20
40
60
80
100
120
140
160
180
200
13.21
20.52
20.99
23.88
24.03
24.22
24.27
36.04
36.52
77.32
77.00
76.68
113.29
122.19
122.23
125.70
126.07
130.71
131.50
131.55
131.74
132.04
132.06
133.44
134.71
134.98
171.44
179.95
180.03
185.30

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EXPNO                    56
PROCNO                    1

F2 - Acquisition Parameters
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PULPROG             zgpg30
TD                   65536
SOLVENT              CDCl3
NS                      96
DS                       0
SWH             64724.918 Hz
FIDRES           0.987624 Hz
AQ              0.5063156 sec
RG                    6502
DW                 7.725 usec
DE                 6.50 usec
TE                 299.2 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   31P
P1                 10.60 usec
PL1                12.00 dB
SFO1         161.9674942 MHz

======== CHANNEL f2 ========
CPDPRG2           waltz16
NUC2                   1H
PCPD2              90.00 usec
PL2                 3.80 dB
PL12               21.60 dB
PL13               24.60 dB
SFO2         400.1316005 MHz

F2 - Processing parameters
SI                   32768
SF           161.9757146 MHz
WDW                     EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.00
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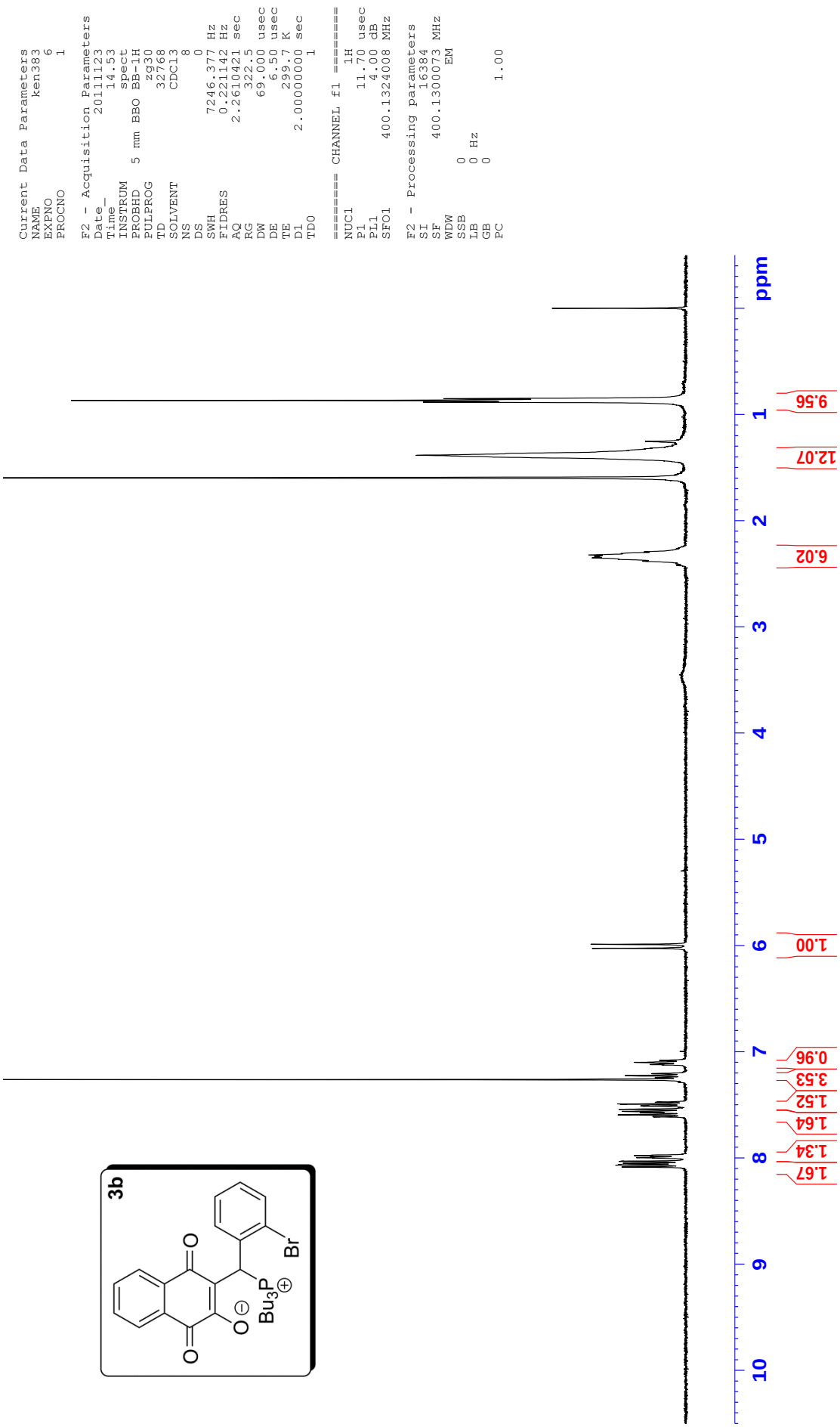
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EXPNO 6
PROCNO 1
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Time_ 14.53
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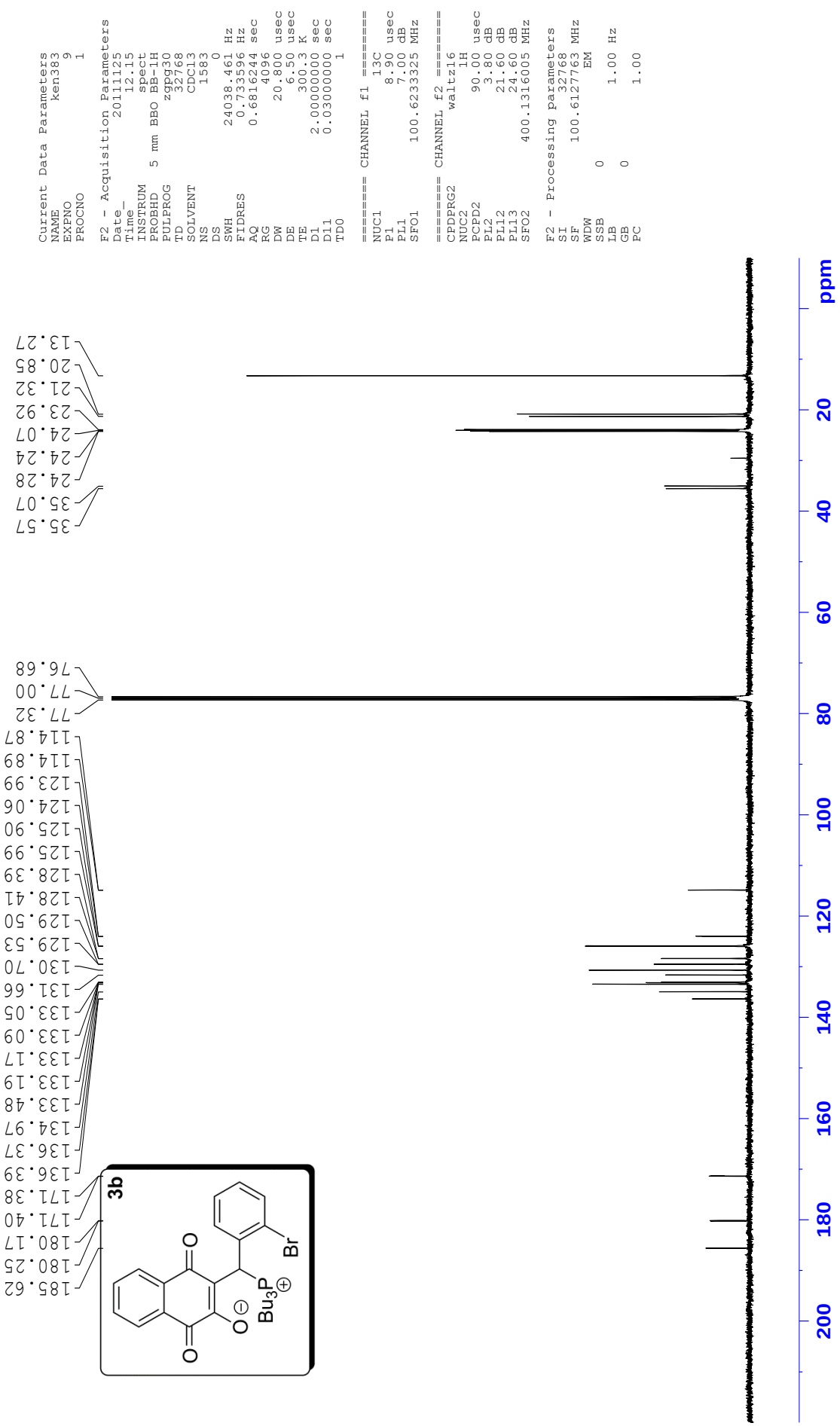
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 322.5
DW 69.000 usec
DE 6.50 usec
TE 299.7 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300073 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
9.56
12.07
6.02
1.00
0.96
3.53
1.52
1.64
1.34
1.67
3b
O
O
O
Bu3P
Br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PROCNO 1
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Time_ 12.15
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PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 1583
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 300.3 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127763 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
13.27
20.85
21.32
23.92
24.07
24.24
24.28
35.07
35.57
76.68
77.00
77.32
114.87
114.89
123.99
124.06
125.90
125.99
128.39
128.41
129.50
129.53
130.70
131.66
133.05
133.09
133.17
133.19
133.48
134.97
136.37
136.39
171.38
171.40
180.17
180.25
185.62
3b
Br
Bu3P
O
O
O
ppm
200
180
160
140
120
100
80
60
40
20

Current Data Parameters
NAME ken-P
EXPNO 54
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120602
Time 12.25
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 110
DS 0
SWH 64724.918 Hz
FIDRES 0.987624 Hz
AQ 0.5063156 sec
RG 5792.6
DW 7.725 usec
DE 6.50 usec
TE 299.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 31P
P1 10.60 usec
PL1 12.00 dB
SFO1 161.9674942 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 161.9757146 MHz
WDW EM
SSB 0
LB 1.00 Hz
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3b
Br
Bu3P
O
O
O
ppm
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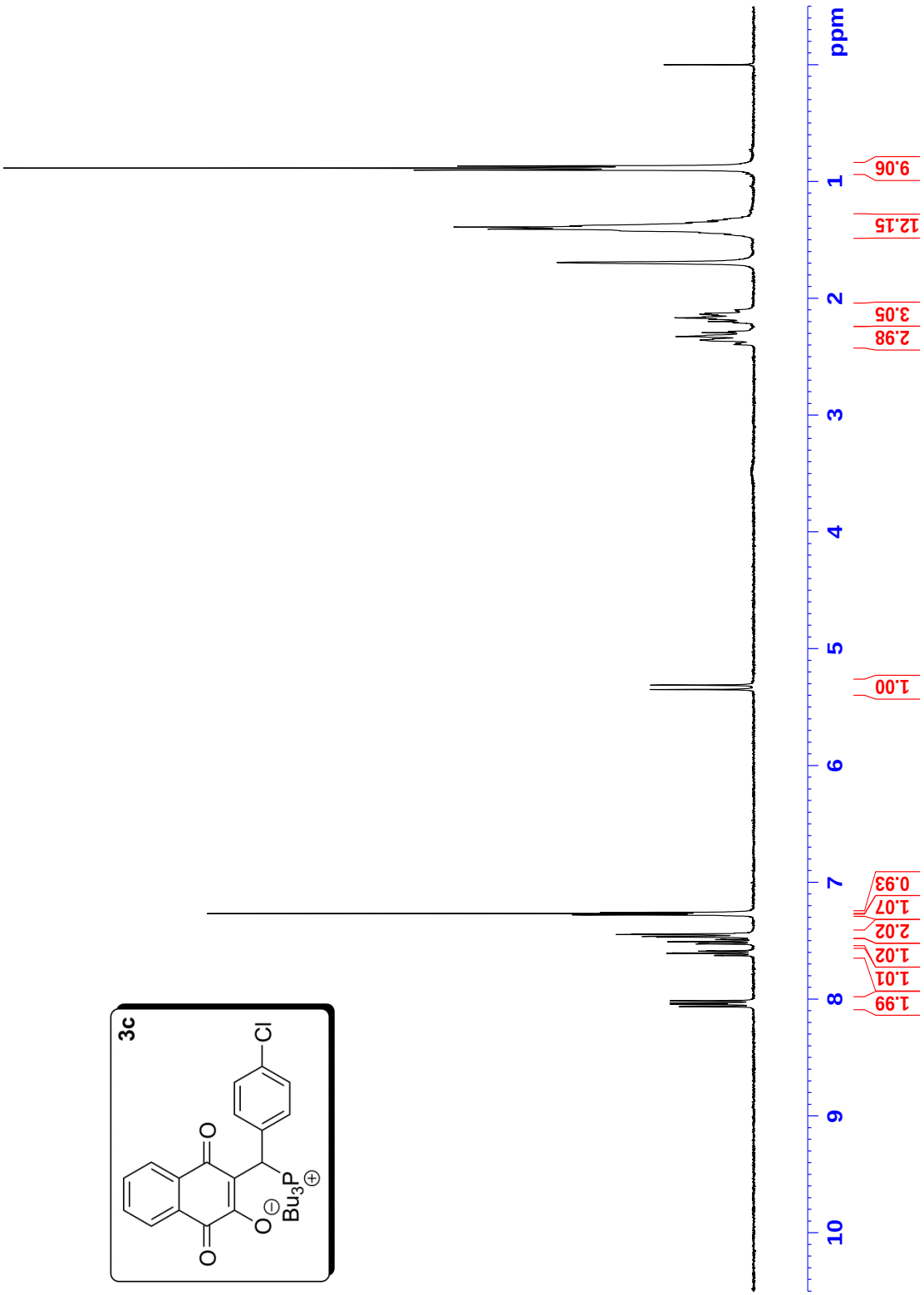
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PROCNO 1
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Time 17.17
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PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 812.7
DW 69.000 usec
DE 6.50 usec
TE 299.4 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300055 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
9.06
12.15
3.05
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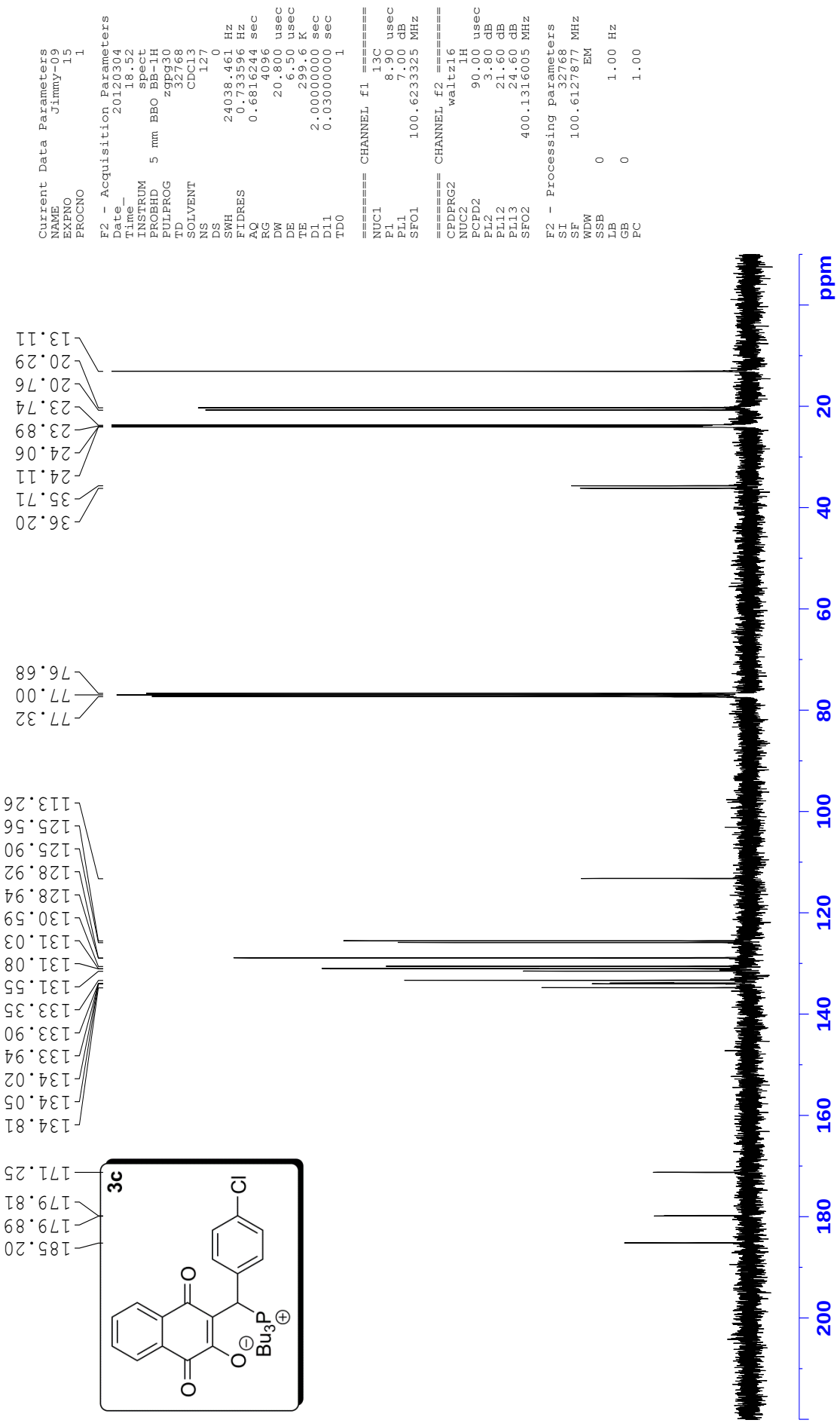
O
Bu3P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PROCNO 1
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Time 18.52
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PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 127
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 299.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127877 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
13.11
20.29
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23.74
23.89
24.06
24.11
35.71
36.20
76.68
77.00
77.32
113.26
125.56
125.90
128.92
128.94
130.59
131.03
131.08
131.55
133.35
133.90
133.94
134.02
134.05
134.81
171.25
179.81
179.89
185.20
3c
Cl
O
O
O
Bu3P
ppm
20
40
60
80
100
120
140
160
180
200

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Current Data Parameters
NAME                  ken-P
EXPNO                    32
PROCNO                    1

F2 - Acquisition Parameters
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Time                  13.14
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PULPROG              zgpg30
TD                    65536
SOLVENT               CDCl3
NS                       25
DS                        0
SWH               64724.918 Hz
FIDRES                0.987624 Hz
AQ                    0.5063156 sec
RG                     4597.6
DW                      7.725 usec
DE                      6.50 usec
TE                     298.2 K
D1                    2.00000000 sec
D11                   0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
NUC1                      31P
P1                      10.60 usec
PL1                     12.00 dB
SFO1           161.9674942 MHz

======== CHANNEL f2 ========
CPDPRG2                waltz16
NUC2                       1H
PCPD2                   90.00 usec
PL2                      3.80 dB
PL12                    21.60 dB
PL13                    24.60 dB
SFO2           400.1316005 MHz

F2 - Processing parameters
SI                        32768
SF             161.9757133 MHz
WDW                        EM
SSB                     0
LB                      1.00 Hz
GB                      0
PC                      1.00
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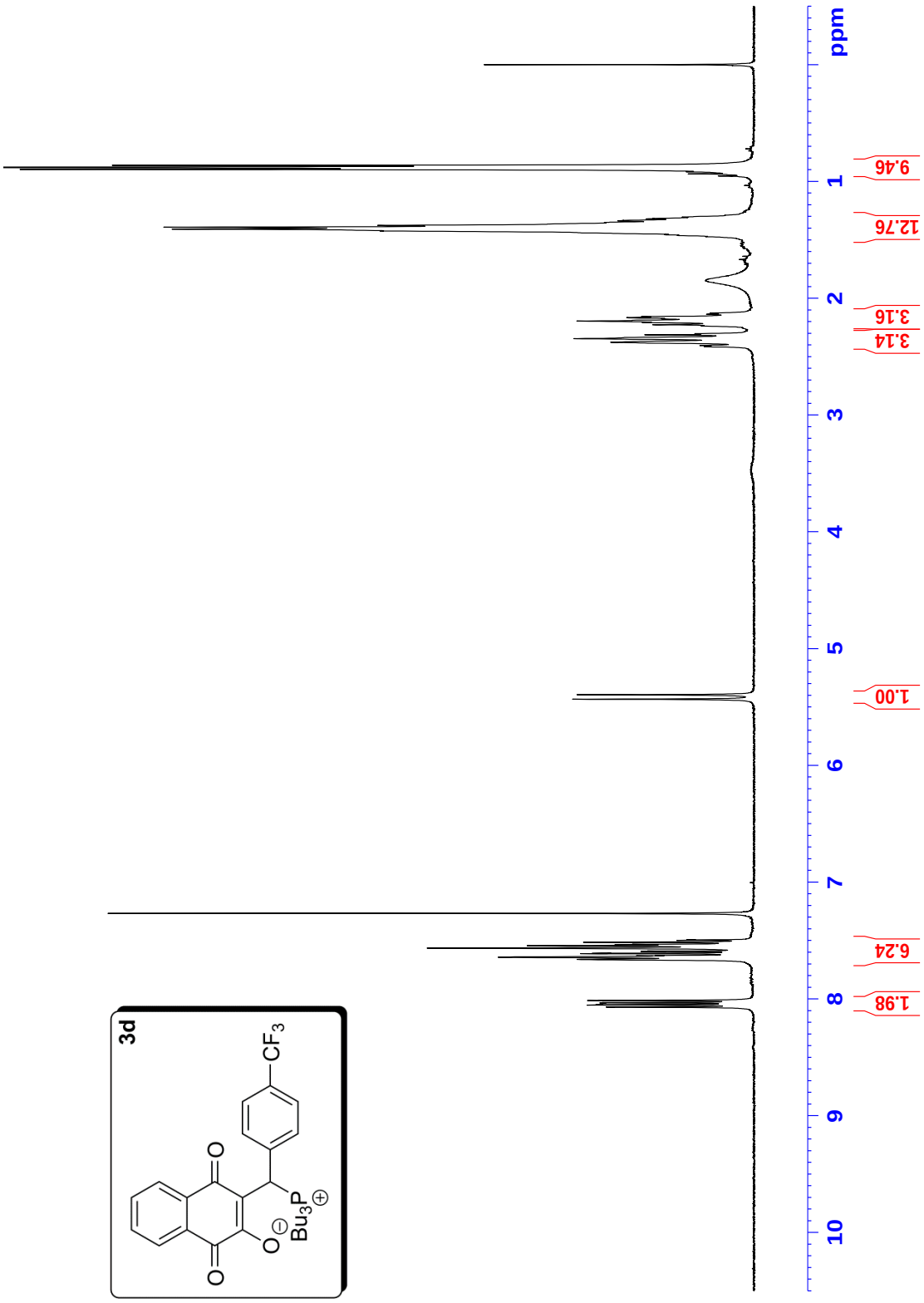
33.04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EXPNO 16
PROCNO 1
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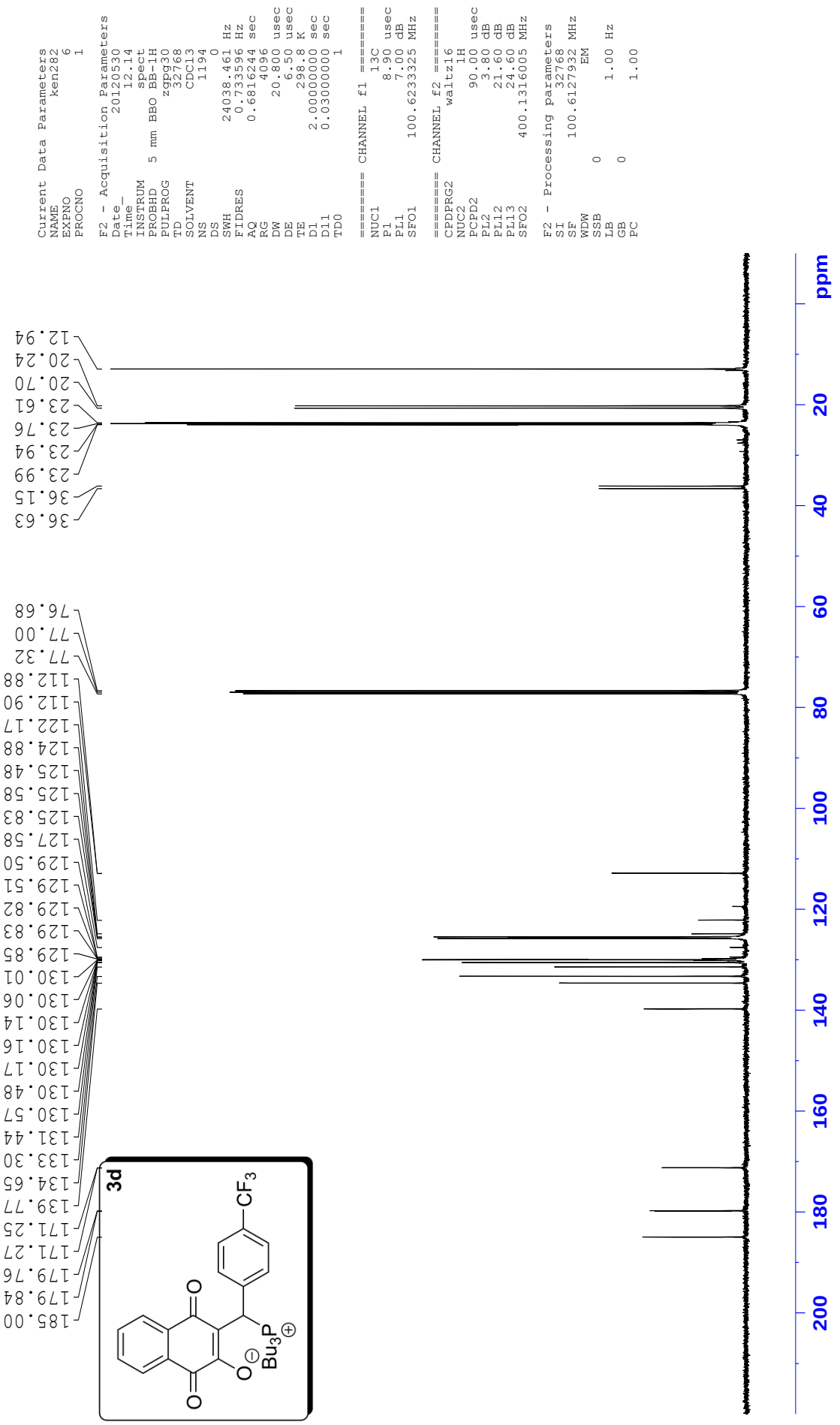
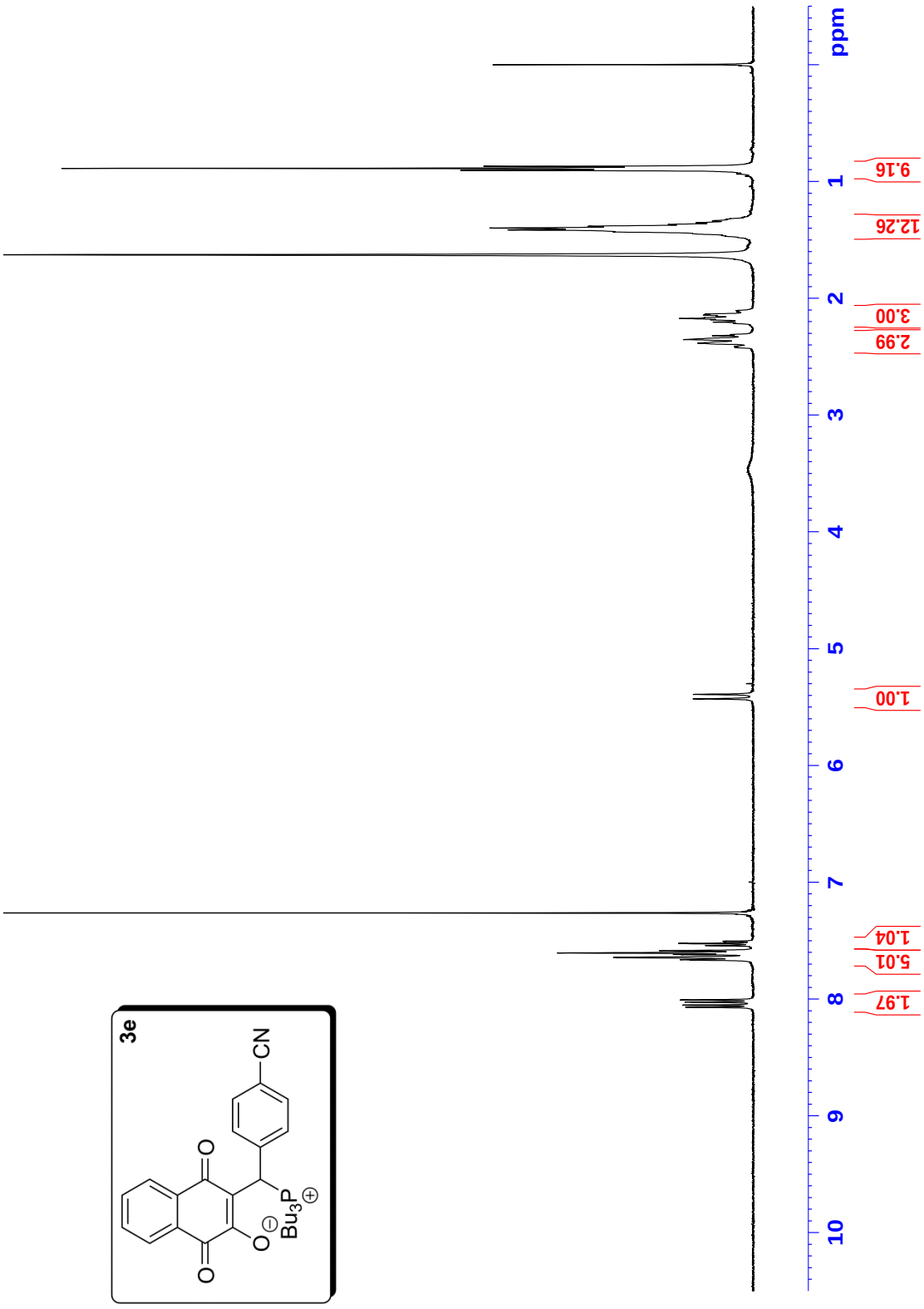
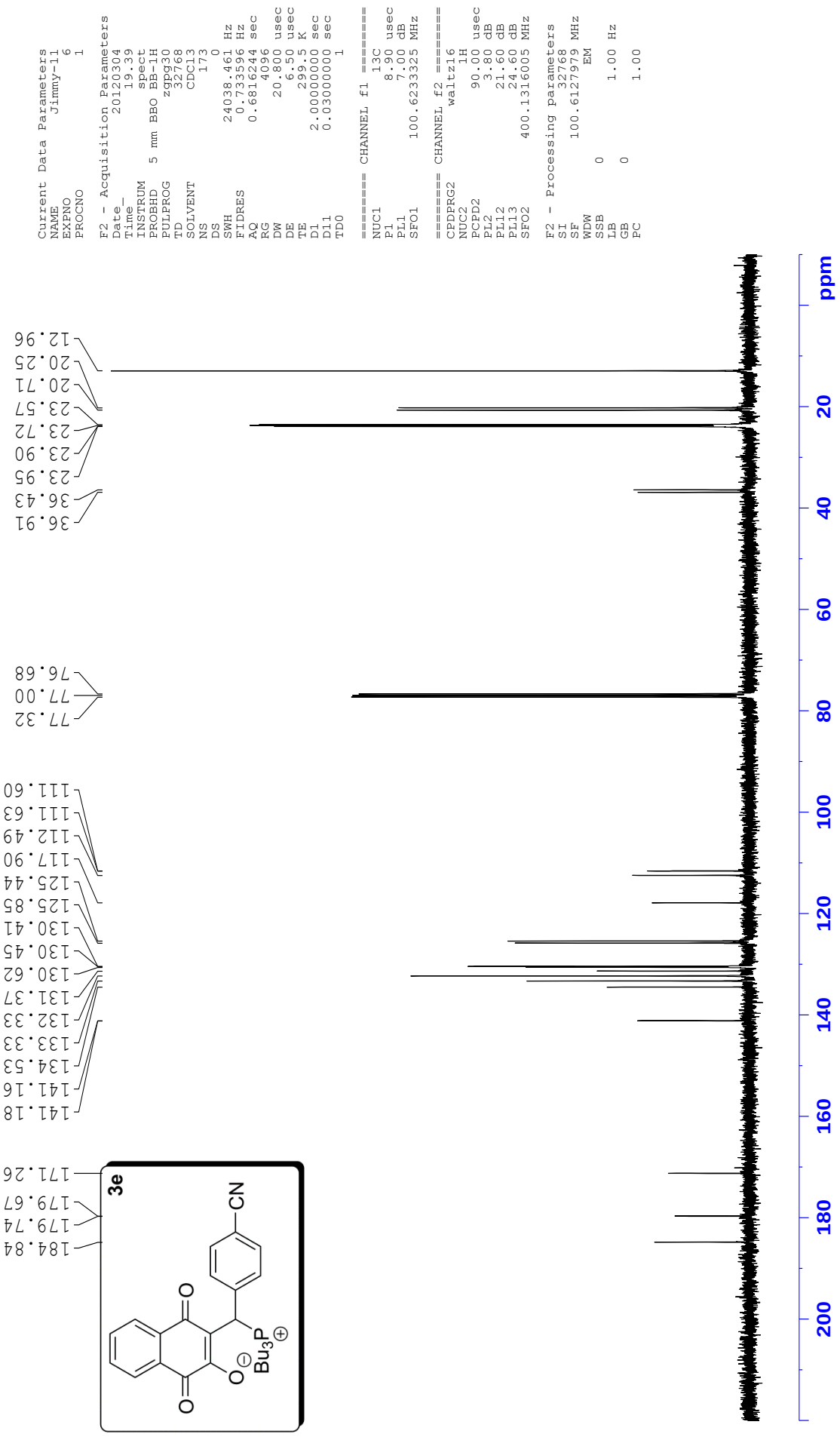
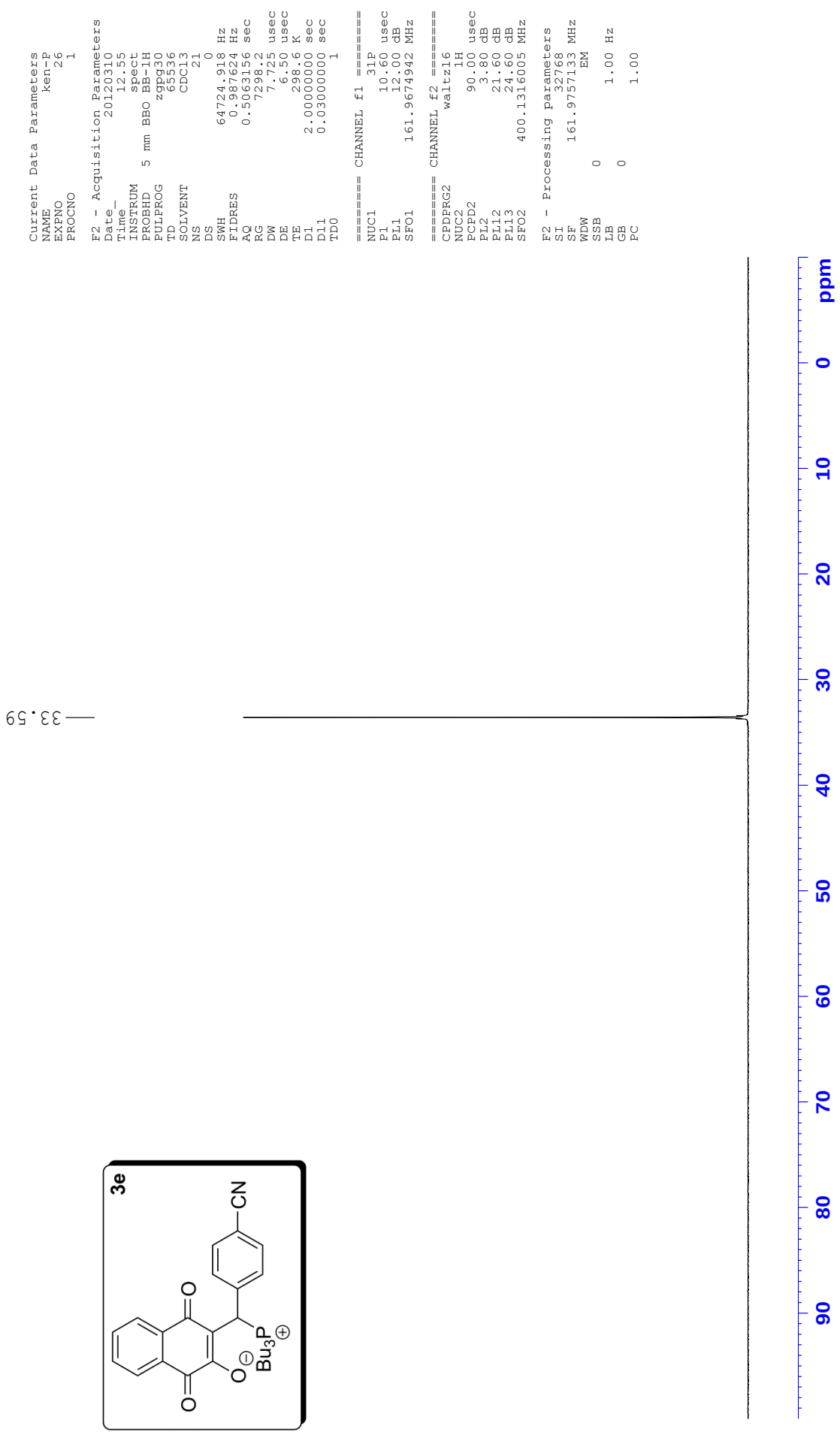
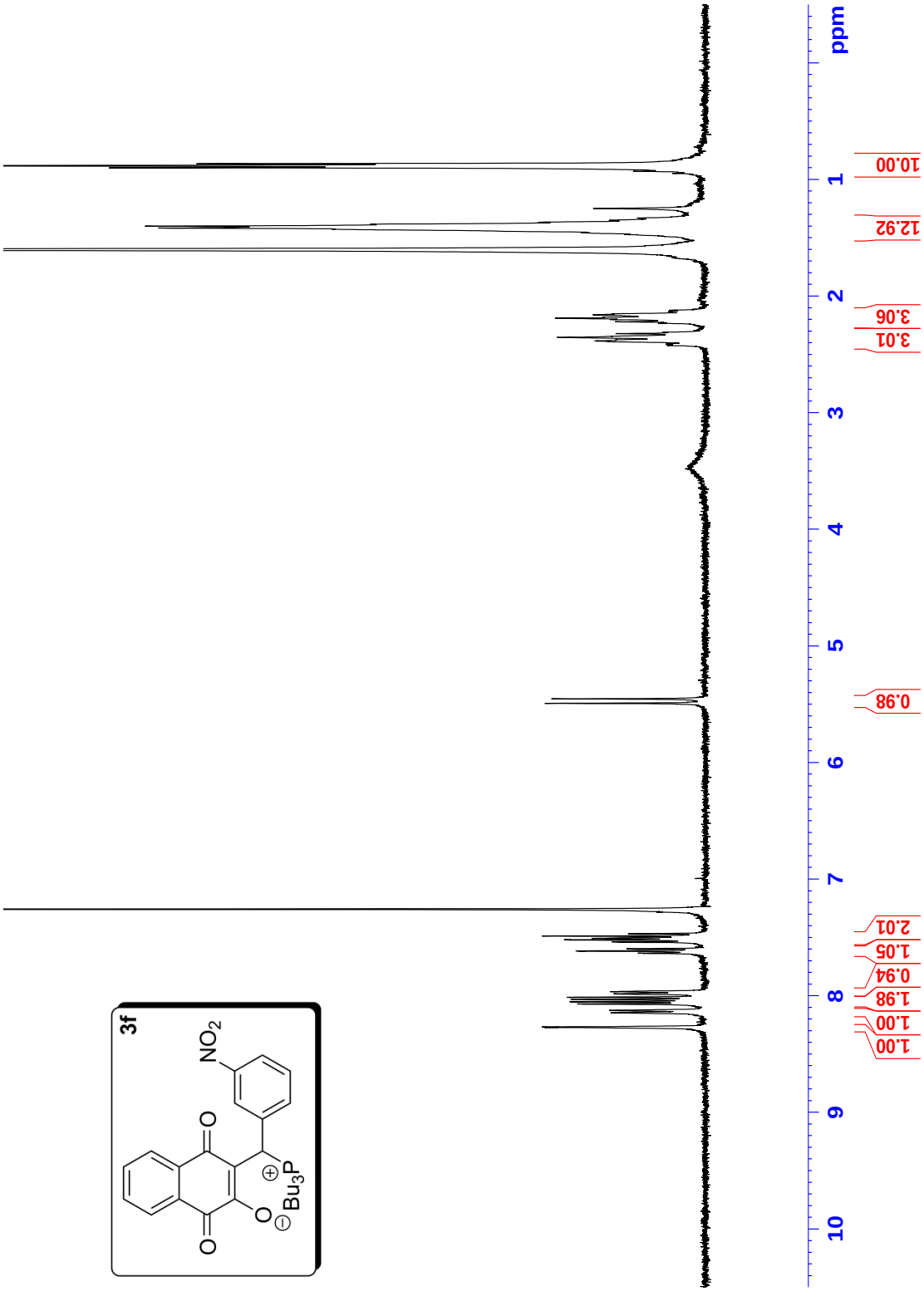
PULPROG zg30
TD 16384
SOLVENT CDCl3
NS 8
DS 0
SWH 6009.615 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 203.2
DW 83.200 usec
DE 6.50 usec
TE 299.4 K
D1 1.50000000 sec
MCREST 0 sec 0.01500000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1326008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300057 MHz
WDW EM
SSB 0
LB 0.10 Hz
GB 0
PC 1.00
3d
CF3
O
O
O
Bu3P
ppm
1
2
3
4
5
6
7
8
9
10
9.46
12.76
3.16
3.14
1.00
6.24
1.98

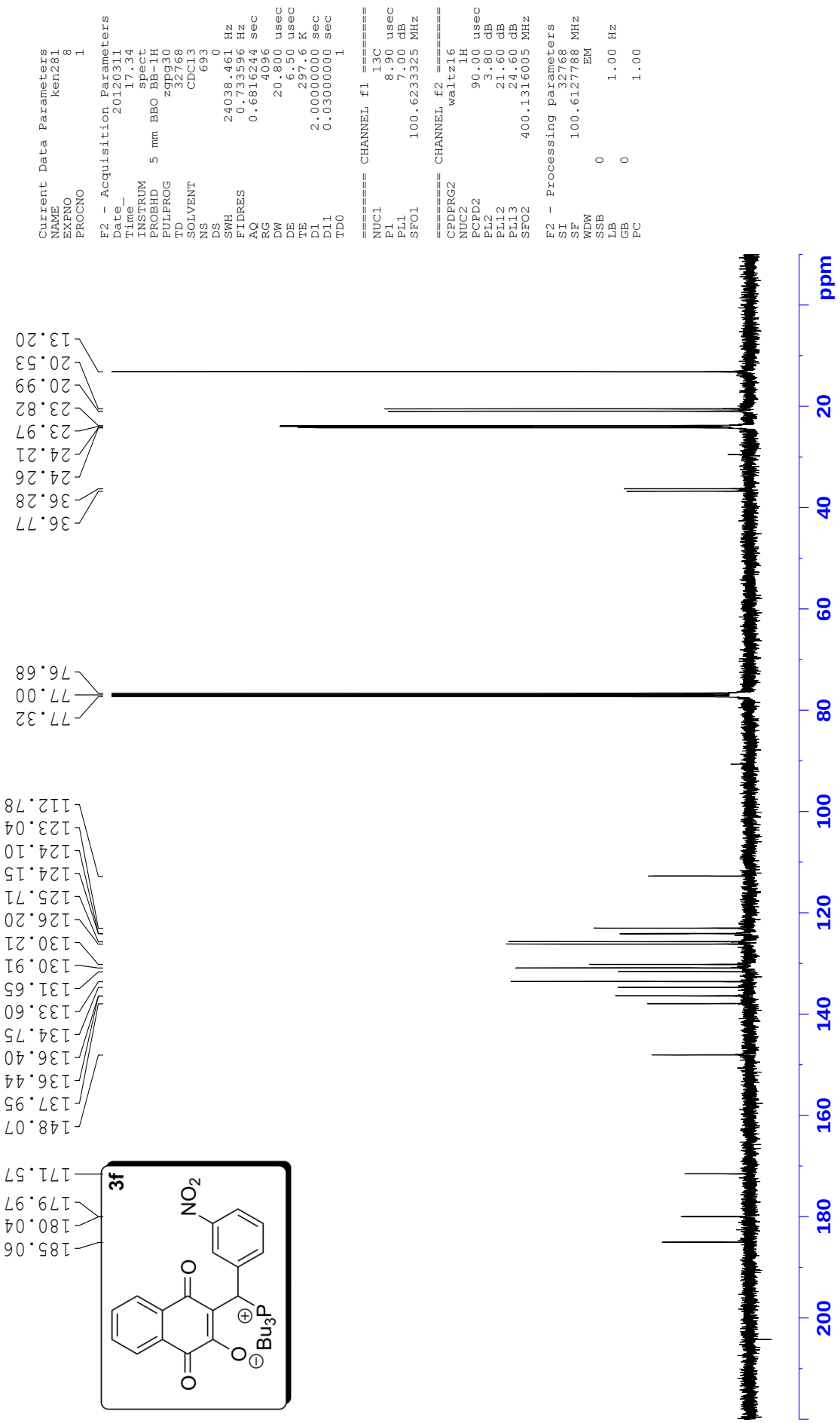


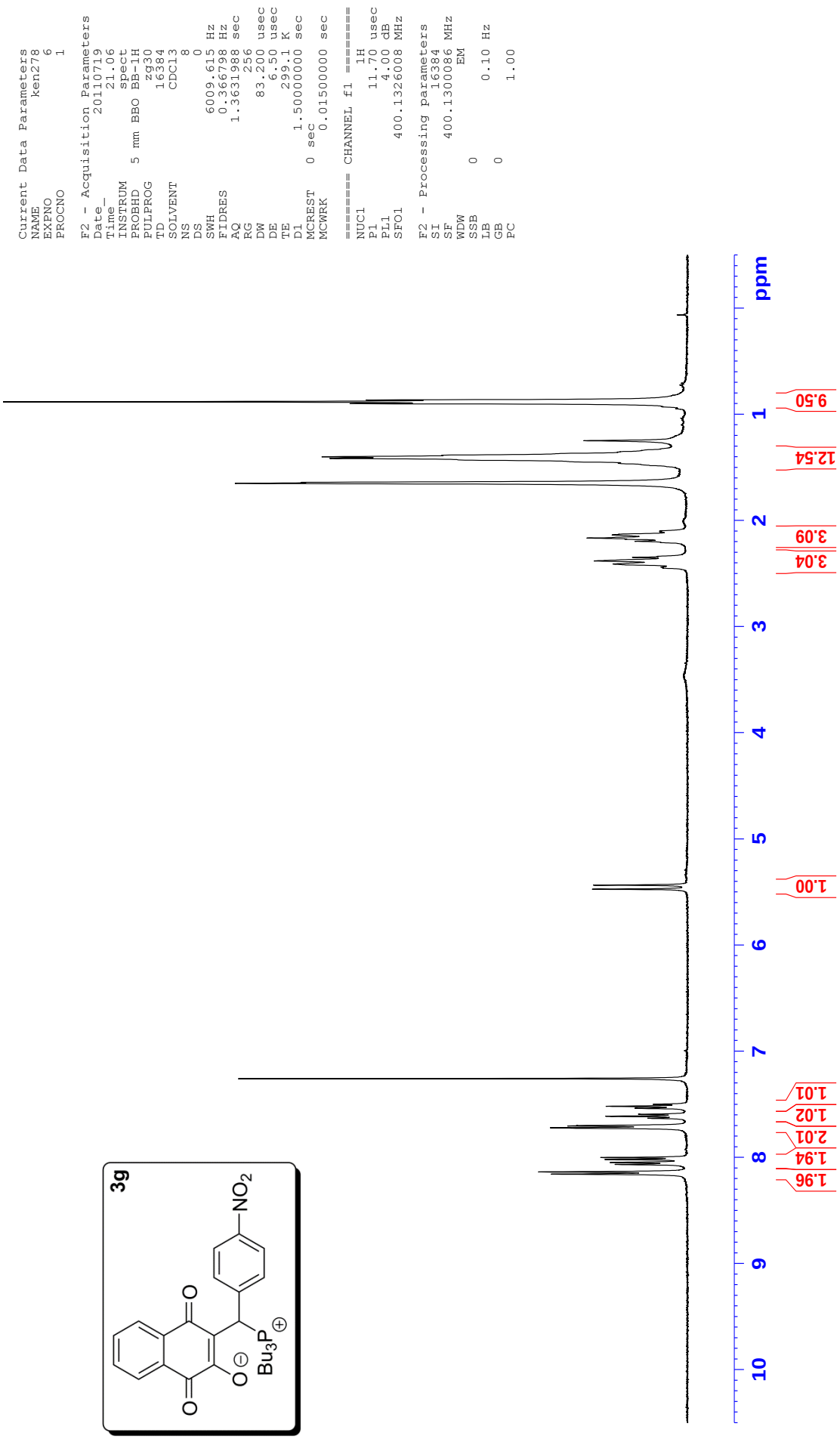

Current Data Parameters
NAME Jimmy-11
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110829
Time 10.33
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 16384
SOLVENT CDCl3
NS 8
DS 0
SWH 6009.615 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 322.5
DW 83.200 usec
DE 6.50 usec
TE 299.2 K
D1 1.50000000 sec
MCREST 0 sec
0.01500000 sec
MCWRK
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1326008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300072 MHz
WDW EM
SSB 0
LB 0.10 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
9.16
12.26
3.00
2.99
1.00
1.04
5.01
1.97
3e
CN
O
O
O
Bu3P

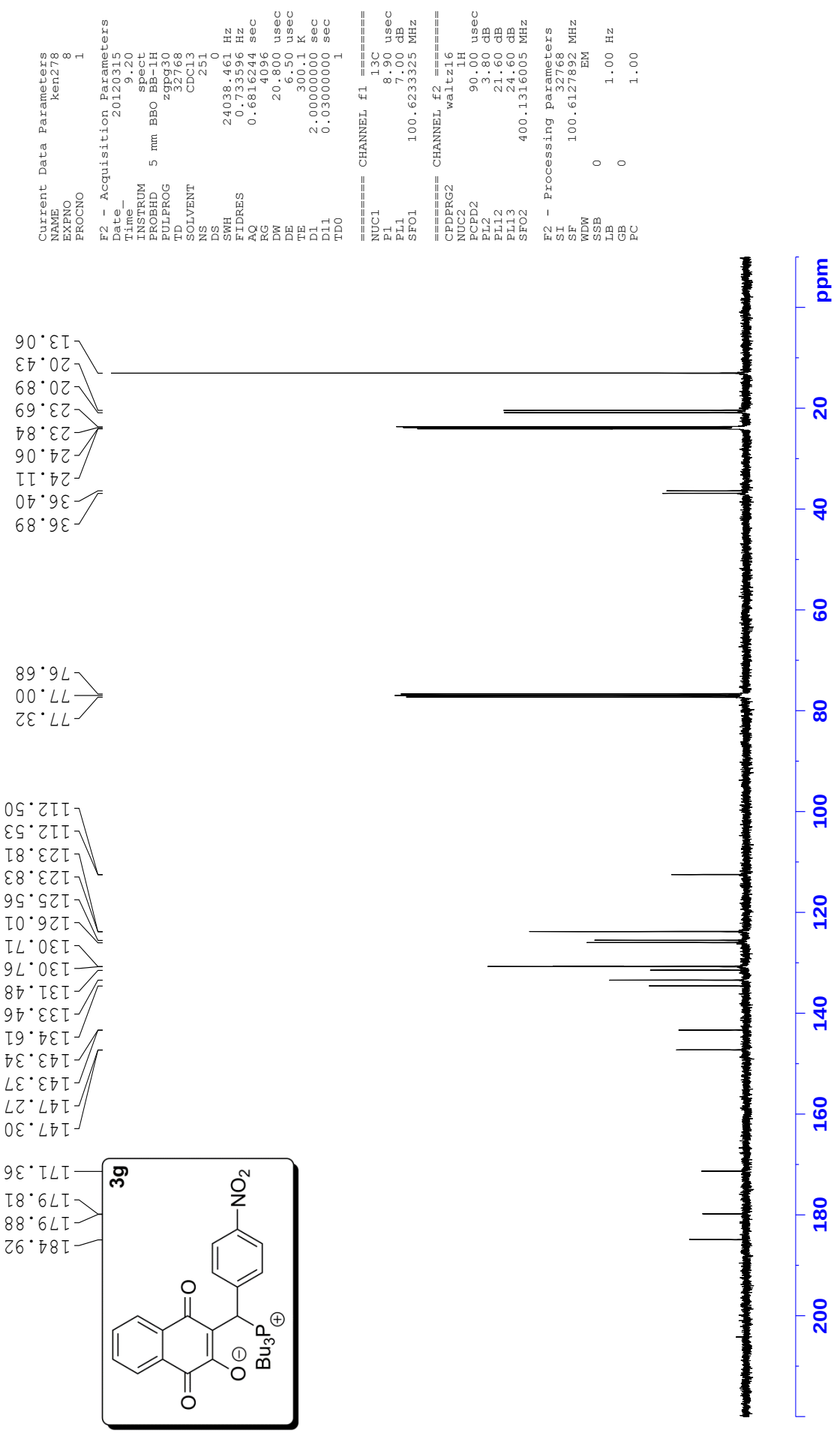

Current Data Parameters
NAME Jimmy-11
EXPNO 6
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120304
Time 19.39
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 173
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 299.5 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127979 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
12.96
20.25
20.71
23.57
23.72
23.90
23.95
36.43
36.91
76.68
77.00
77.32
111.60
111.63
112.49
117.90
125.44
125.85
130.41
130.45
130.62
131.37
132.33
133.33
134.53
141.16
141.18
171.26
179.67
179.74
184.84
3e
CN
O
O
O
Bu3P
ppm
20
40
60
80
100
120
140
160
180
200

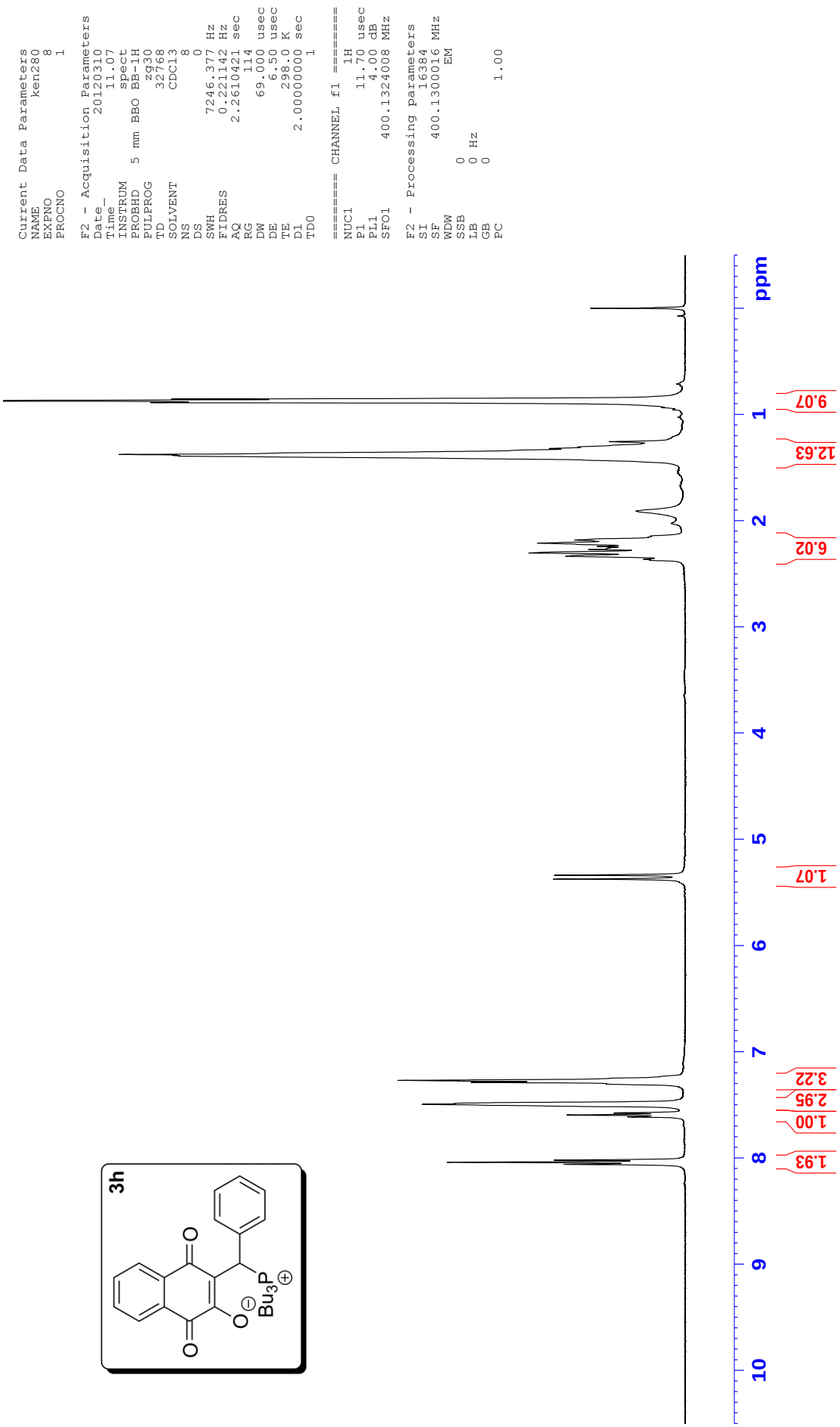


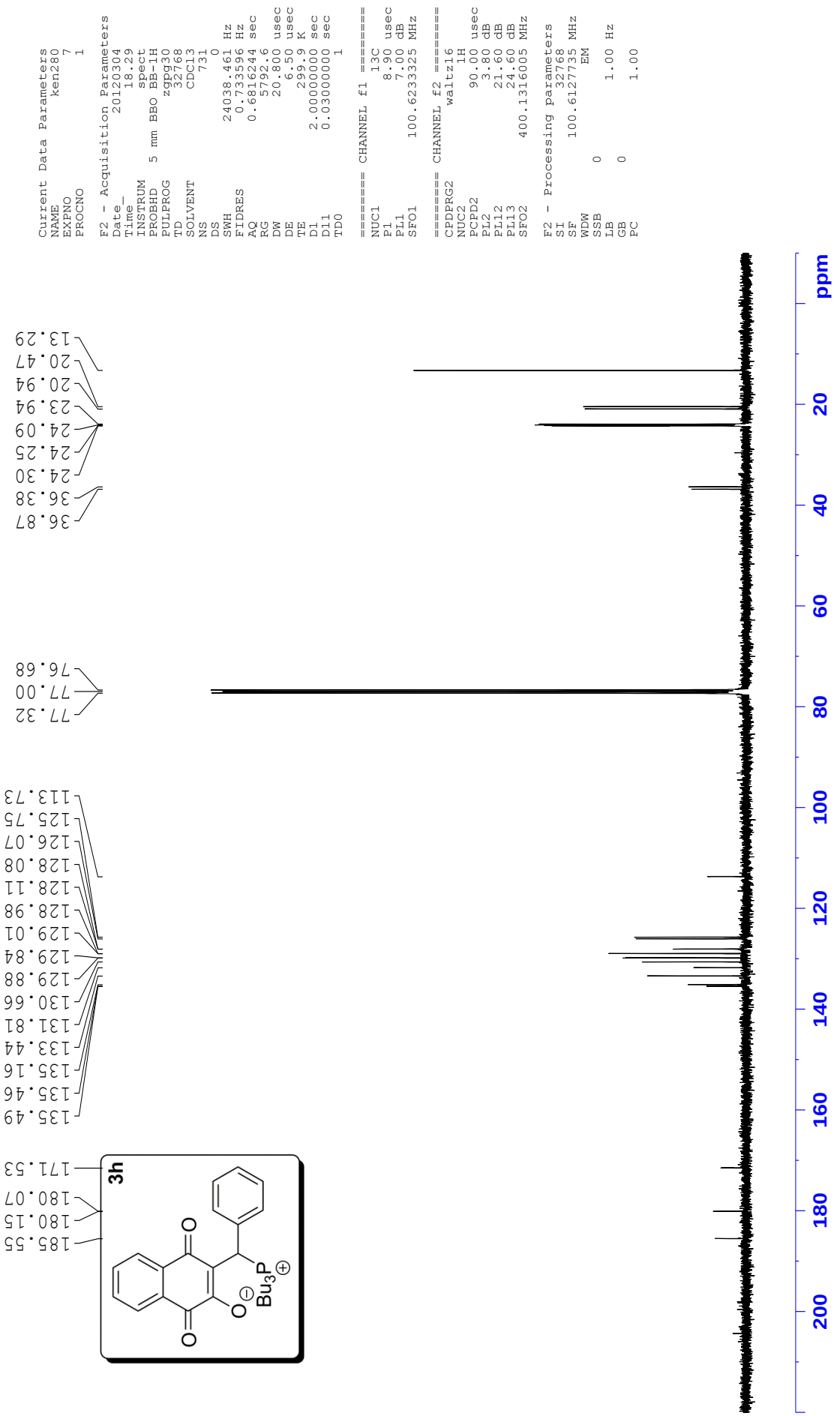


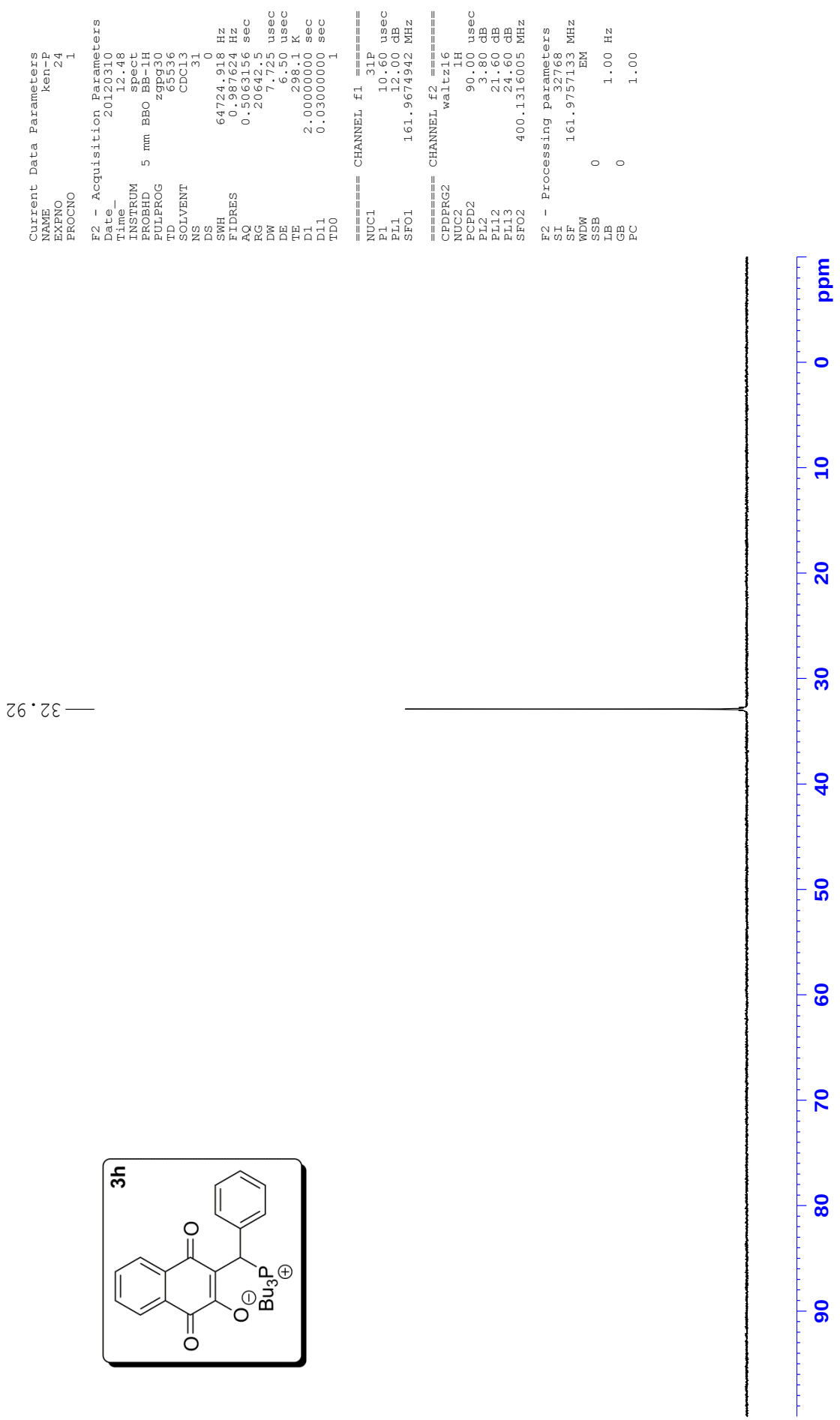

Current Data Parameters
NAME ken281
EXPNO 8
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120311
Time_ 17.34
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 693
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 297.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127788 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
13.20
20.53
20.99
23.82
23.97
24.21
24.26
36.28
36.77
76.68
77.00
77.32
112.78
123.04
124.10
124.15
125.71
126.20
130.21
130.91
131.65
133.60
134.75
136.40
136.44
137.95
148.07
171.57
179.97
180.04
185.06
3f
NO2
O
O
O
Bu3P
ppm
200
180
160
140
120
100
80
60
40
20

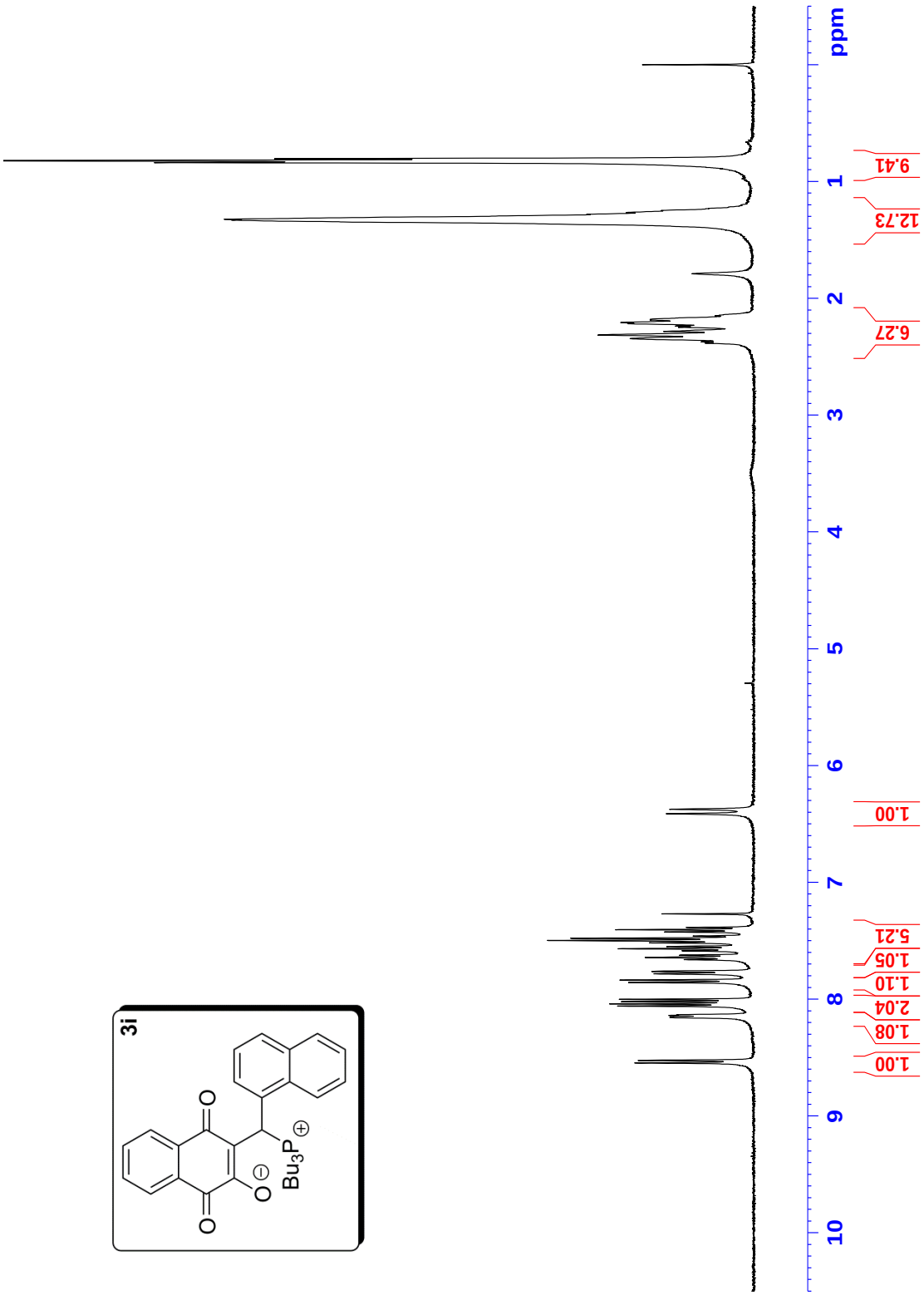

Current Data Parameters
NAME ken278
EXPNO 6
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110719
Time_ 21.06
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 16384
SOLVENT CDCl3
NS 8
DS 0
SWH 6009.615 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 256
DW 83.200 usec
DE 6.50 usec
TE 299.1 K
D1 1.50000000 sec
MCREST 0 sec 0.01500000 sec
MCWRK
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1326008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300086 MHz
WDW EM
SSB 0
LB 0.10 Hz
GB 0
PC 1.00
ppm
1 2 3 4 5 6 7 8 9 10
9.50
12.54
3.09
3.04
1.00
1.01
1.02
2.01
1.94
1.96
3g
NO2
O
O
O
Bu3P

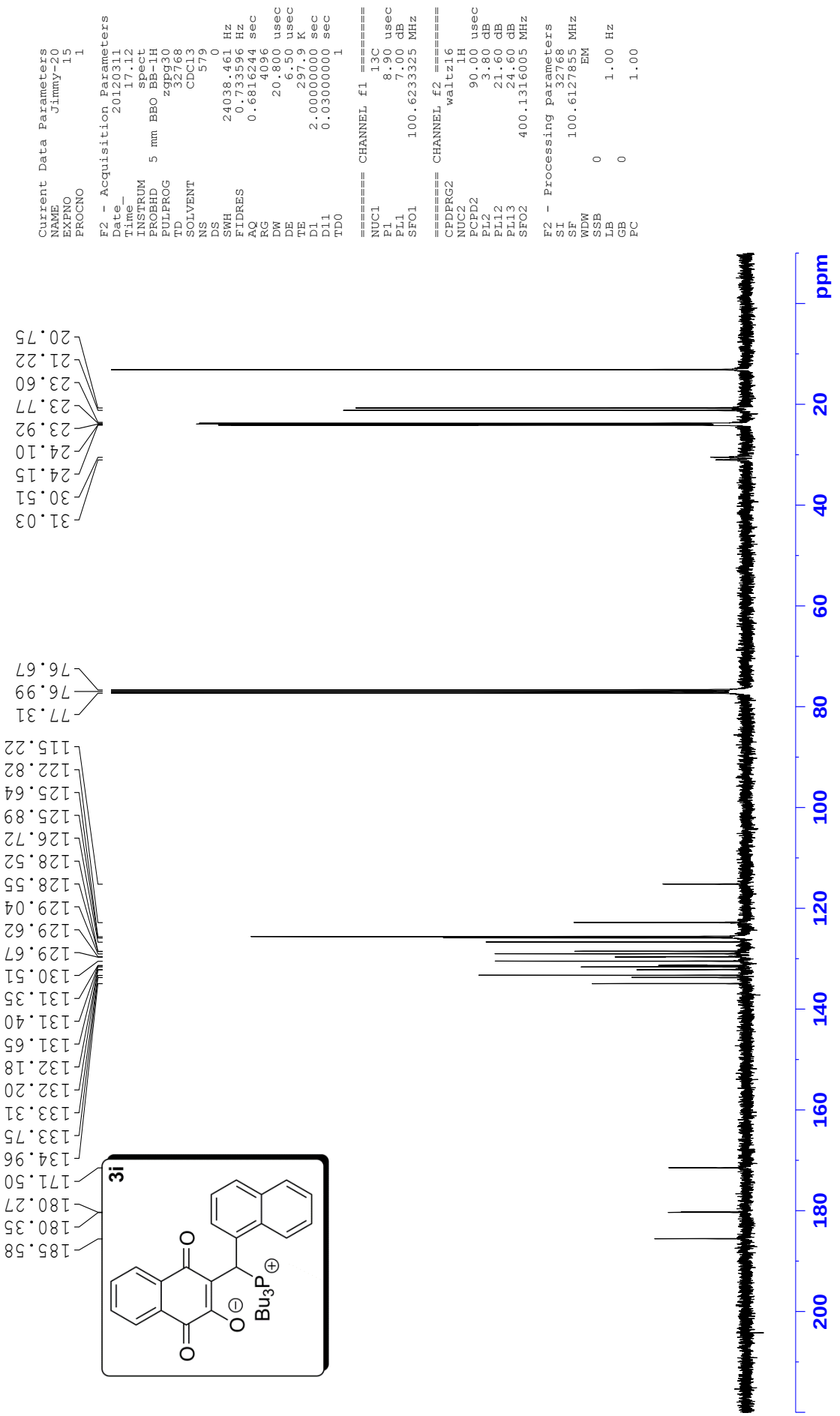



Current Data Parameters
NAME ken280
EXPNO 8
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120310
Time 11.07
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 114
DW 69.000 usec
DE 6.50 usec
TE 298.0 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300016 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
3h
O
O
O
Bu3P
ppm
1
2
3
4
5
6
7
8
9
10
9.07
12.63
6.02
1.07
3.22
2.95
1.00
1.93

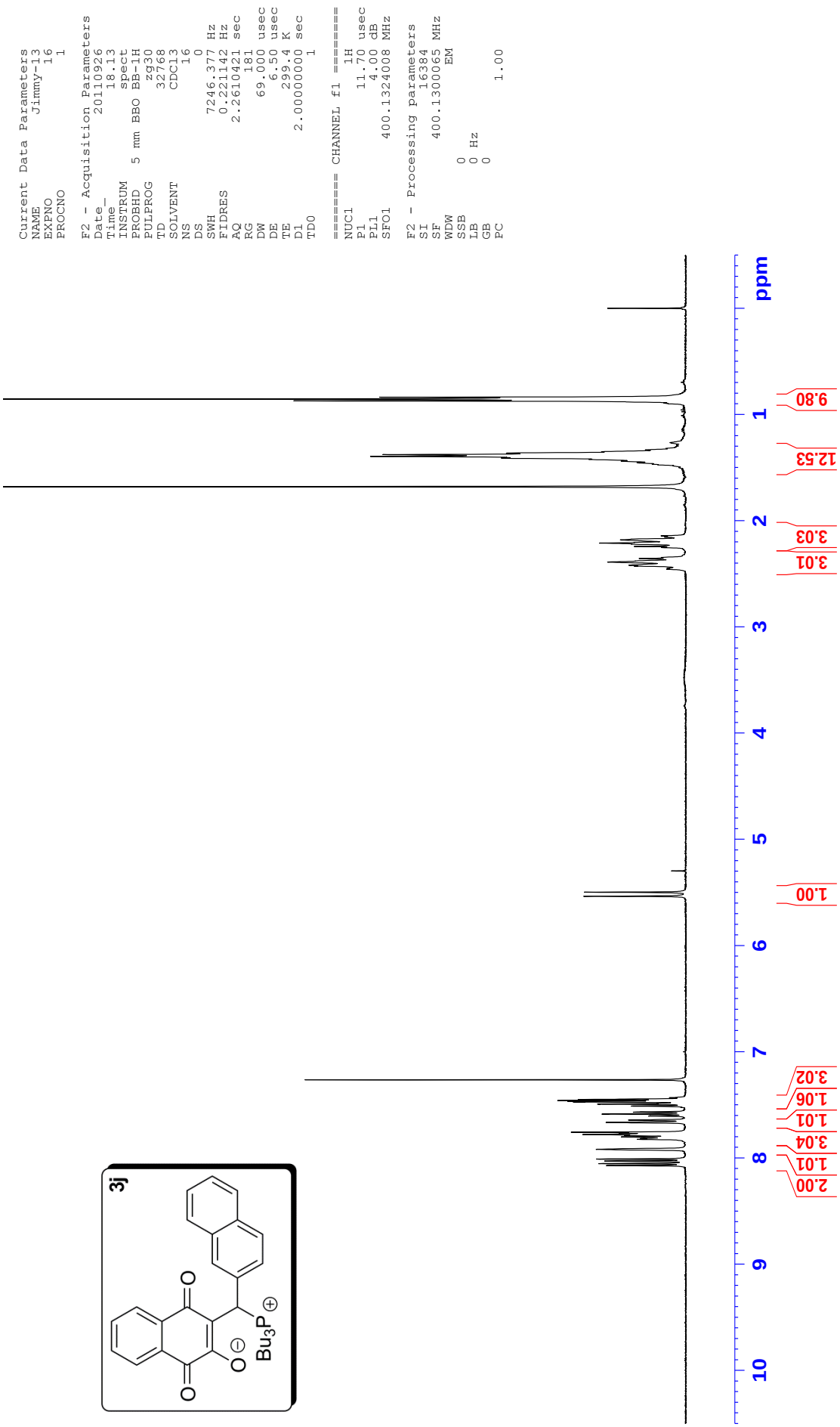

Current Data Parameters
NAME ken280
EXPNO 7
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120304
Time_ 18.29
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 731
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 5792.6
DW 20.800 usec
DE 6.50 usec
TE 299.9 K
D1 2.00000000 sec
D11 2.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127735 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
13.29
20.47
20.94
23.94
24.09
24.25
24.30
36.38
36.87
77.32
77.00
76.68
113.73
125.75
126.07
128.08
128.11
128.98
129.01
129.84
129.88
130.66
131.81
133.44
135.16
135.46
135.49
171.53
180.07
180.15
185.55
3h
O
O
O
Bu3P
ppm
200
180
160
140
120
100
80
60
40
20

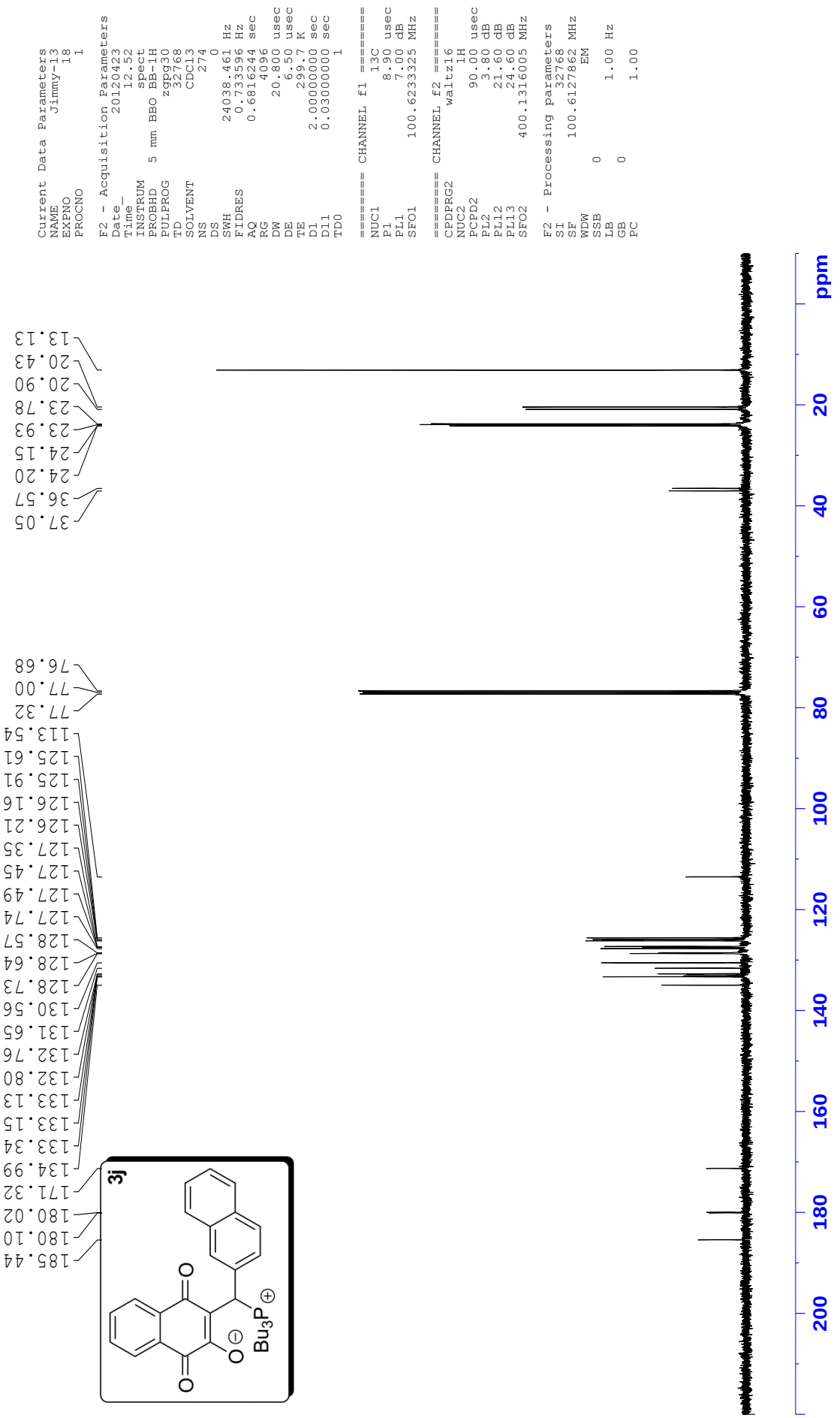


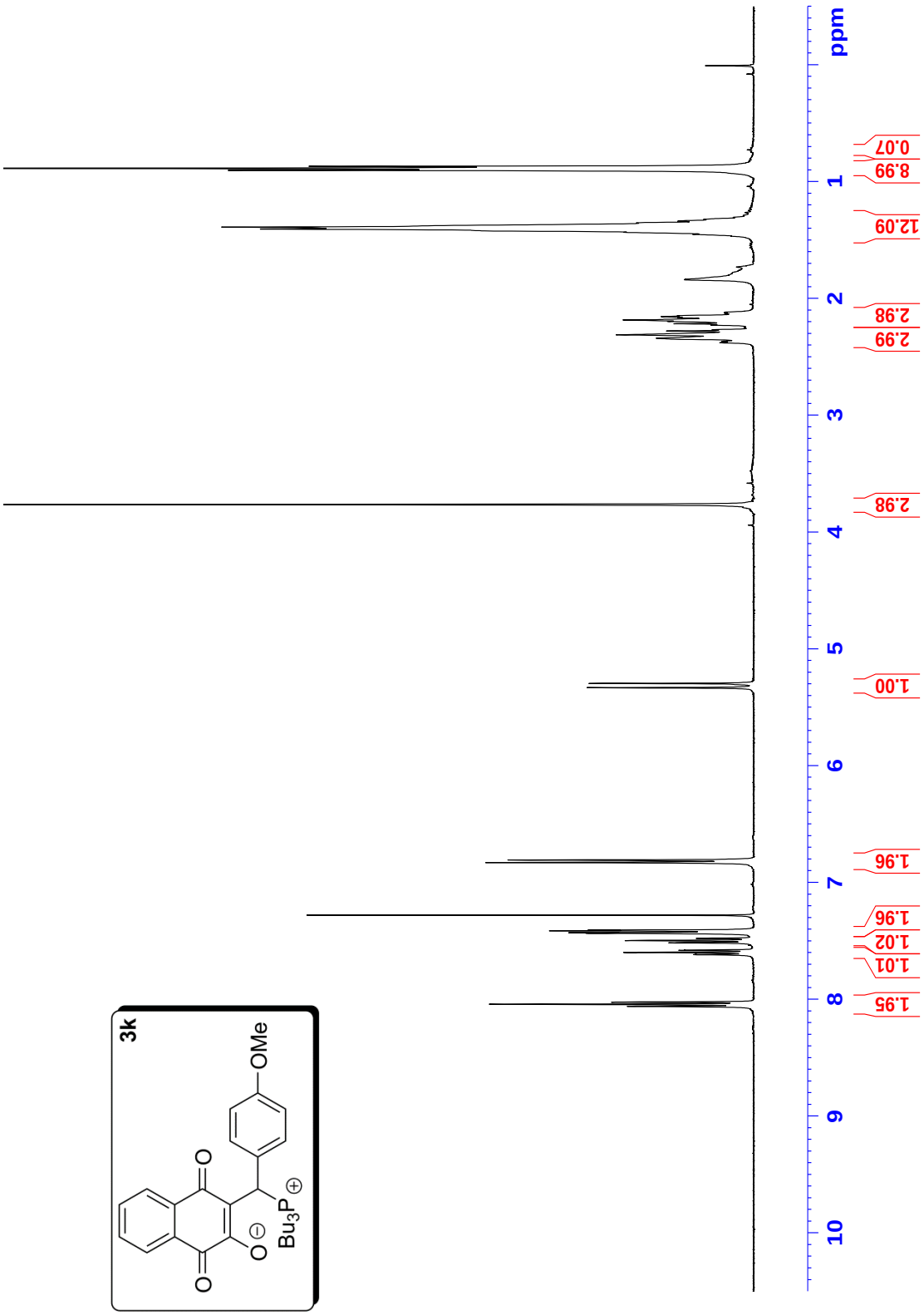


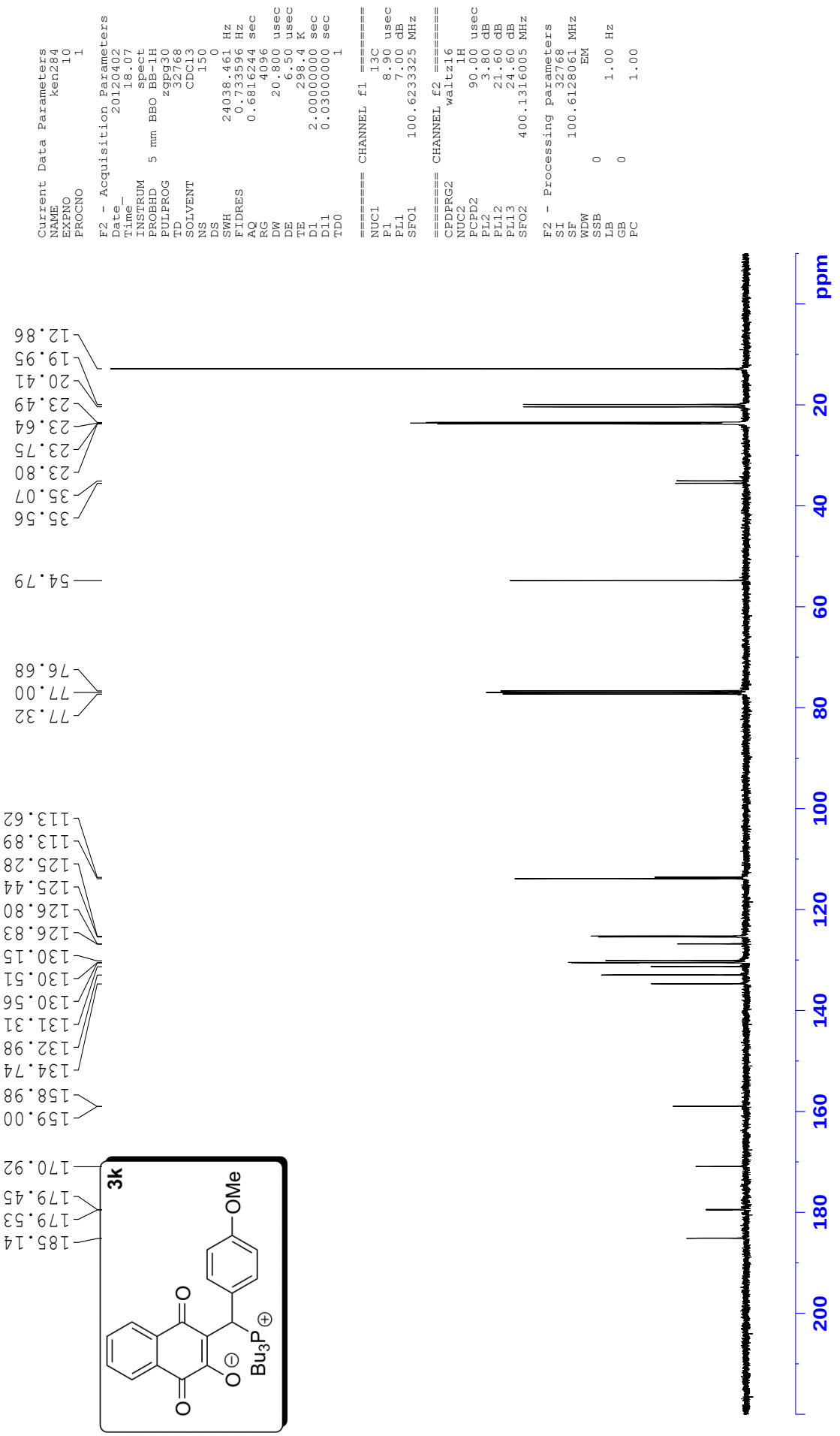

Current Data Parameters
NAME Jimmy-20
EXPNO 15
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120311
Time_ 17.12
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 579
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 297.9 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127855 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
20.75
21.22
23.60
23.77
23.92
24.10
24.15
30.51
31.03
76.67
76.99
77.31
115.22
122.82
125.64
125.89
126.72
128.52
128.55
129.04
129.62
129.67
130.51
131.35
131.40
131.65
132.18
132.20
133.31
133.75
134.96
171.50
180.27
180.35
185.58
3i
O
O
O⊖
Bu3P⊕
ppm
200
180
160
140
120
100
80
60
40
20

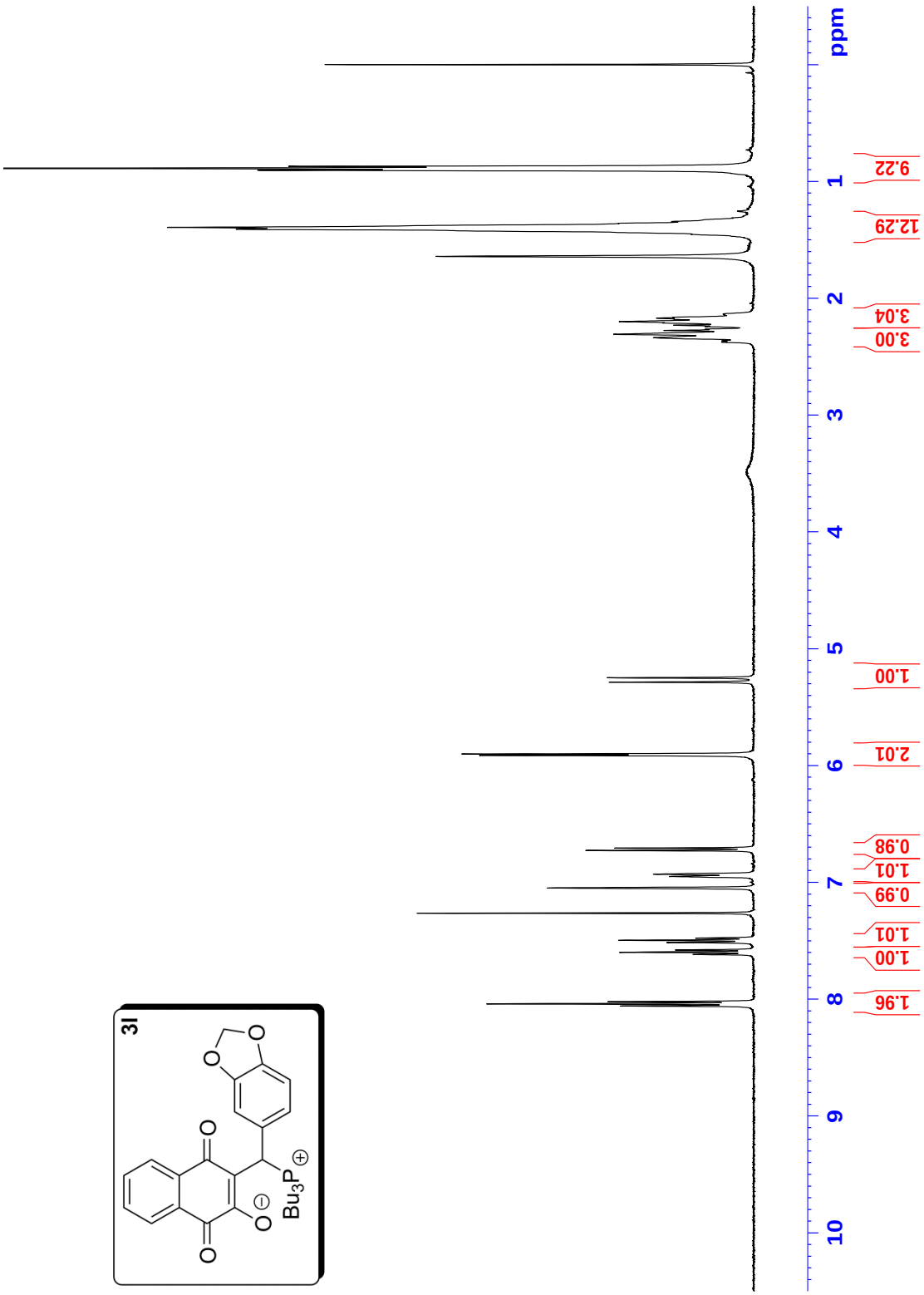
Current Data Parameters
NAME ken-P
EXPNO 6
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120315
Time 19.10
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 17
DS 0
SWH 64724.918 Hz
FIDRES 0.987624 Hz
AQ 0.5063156 sec
RG 5792.6
DW 7.725 usec
DE 6.50 usec
TE 300.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 31P
P1 10.60 usec
PL1 12.00 dB
SFO1 161.9674942 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 161.9757164 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
35.35
3i
O
O
O
Bu3P
ppm
0
10
20
30
40
50
60
70
80
90

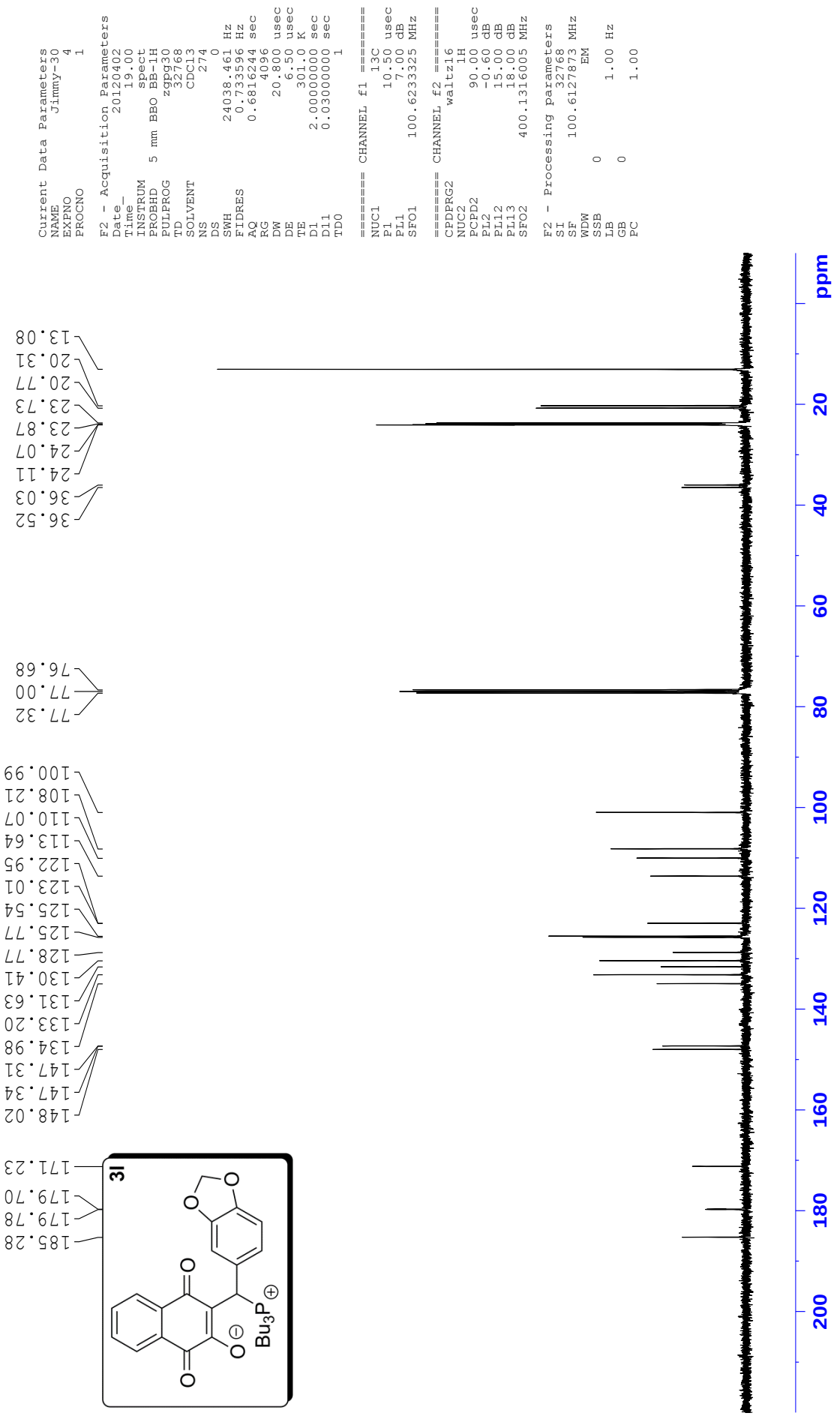

Current Data Parameters
NAME Jimmy-13
EXPNO 16
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110926
Time 18.13
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 181
DW 69.000 usec
DE 6.50 usec
TE 299.4 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300065 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
9.80
12.53
3.03
3.01
1.00
3.02
1.06
1.01
3.04
1.01
2.00
3j
O
O
O
Bu3P


Current Data Parameters
NAME Jimmy-13
EXPNO 18
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120423
Time_ 12.52
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 274
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
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 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127862 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
13.13
20.43
20.90
23.78
23.93
24.15
24.20
36.57
37.05
76.68
77.00
77.32
113.54
125.61
125.91
126.16
126.21
127.35
127.45
127.49
127.74
128.57
128.64
128.73
130.56
131.65
132.76
132.80
133.13
133.15
133.34
134.99
171.32
180.02
180.10
185.44
3j
O
O
O⊖
Bu3P⊕
ppm
20
40
60
80
100
120
140
160
180
200


Current Data Parameters
NAME ken284
EXPNO 7
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111117
Time_ 21.32
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 128
DW 69.000 usec
DE 6.50 usec
TE 299.3 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
0.07
8.99
12.09
2.98
2.99
2.98
1.00
1.96
1.96
1.02
1.01
1.95
3k
OMe
O
O
O
Bu3P


Current Data Parameters
NAME ken284
EXPNO 10
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120402
Time_ 18.07
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 150
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 298.4 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6128061 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
12.86
19.95
20.41
23.49
23.64
23.75
23.80
35.07
35.56
54.79
76.68
77.00
77.32
113.62
113.89
125.28
125.44
126.80
126.83
130.15
130.51
130.56
131.31
132.98
134.74
158.98
159.00
170.92
179.45
179.53
185.14
3k
OMe
O
O
O⊖
Bu3P⊕
ppm
20
40
60
80
100
120
140
160
180
200


Current Data Parameters
NAME Jimmy-30
EXPNO 5
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120602
Time_ 12.48
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 32
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 181
DW 69.000 usec
DE 6.50 usec
TE 298.7 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300068 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
9.22
12.29
3.04
3.00
1.00
2.01
0.98
1.01
0.99
1.01
1.00
1.96
3l
Bu3P⊕
O⊖


Current Data Parameters
NAME Jimmy-30
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120402
Time_ 19.00
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 274
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 301.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 10.50 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 -0.60 dB
PL12 15.00 dB
PL13 18.00 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127873 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
13.08
20.31
20.77
23.73
23.87
24.07
24.11
36.03
36.52
76.68
77.00
77.32
100.99
108.21
110.07
113.64
122.95
123.01
125.54
125.77
128.77
130.41
131.63
133.20
134.98
147.31
147.34
148.02
171.23
179.70
179.78
185.28
3l
Bu3P
ppm
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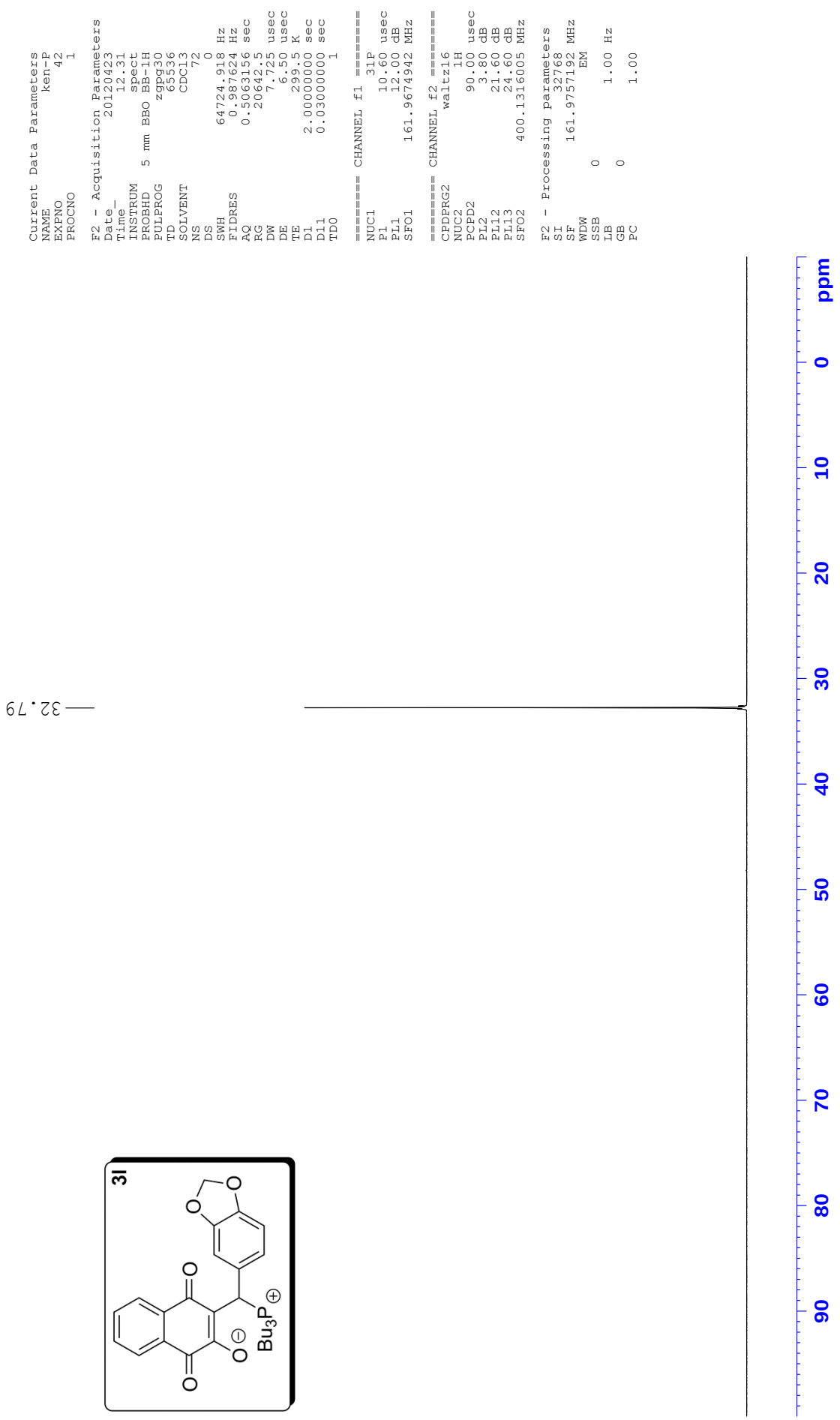
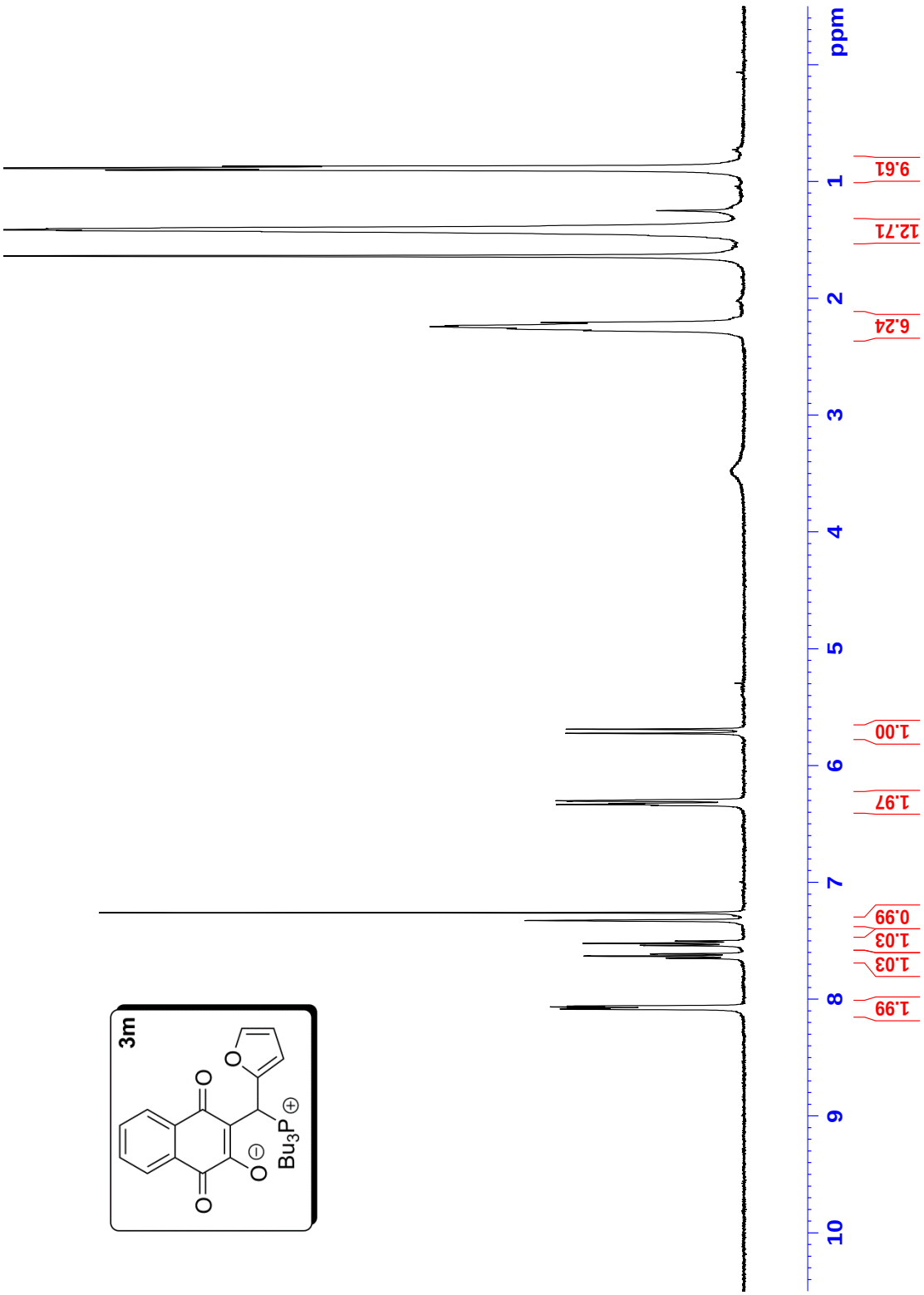
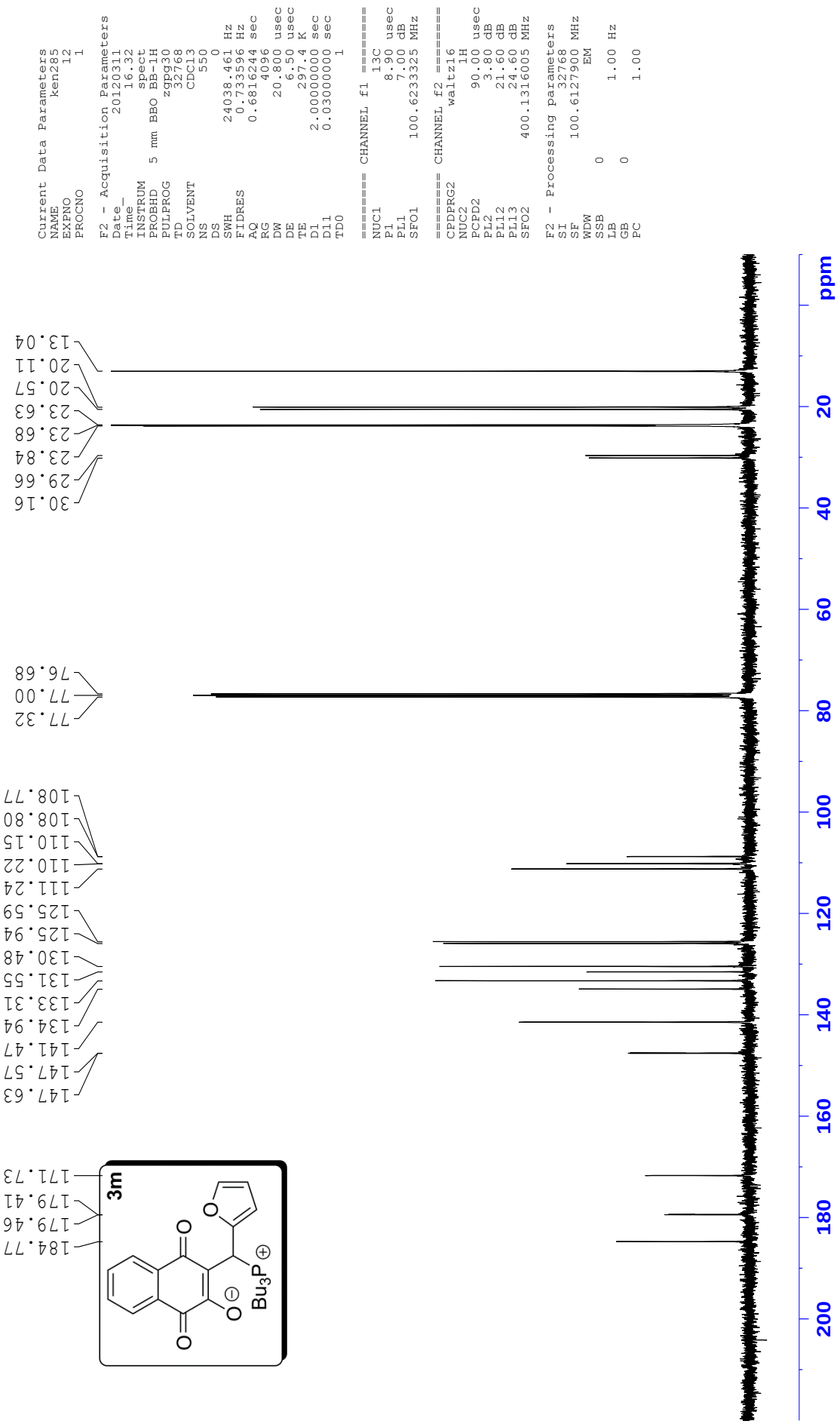
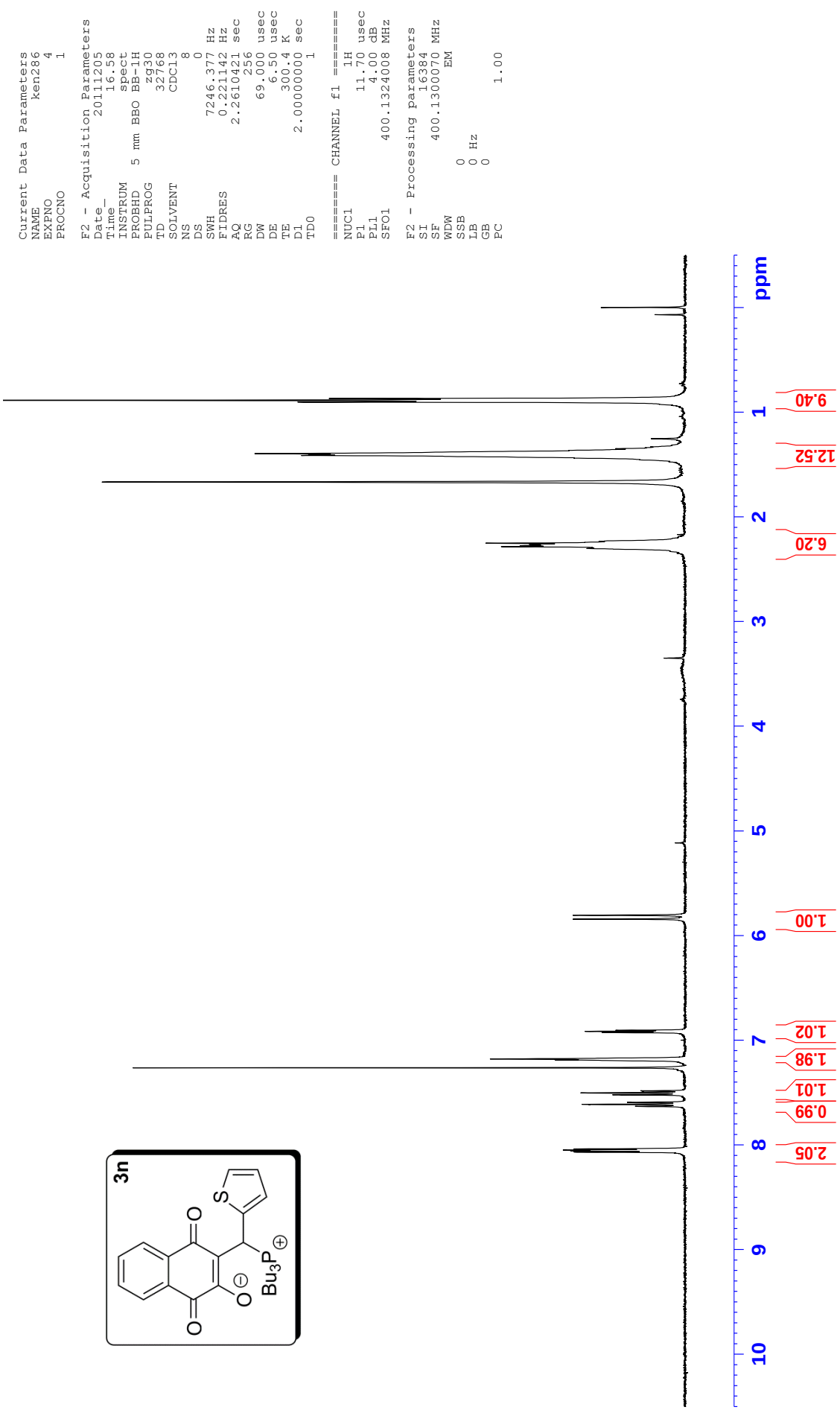
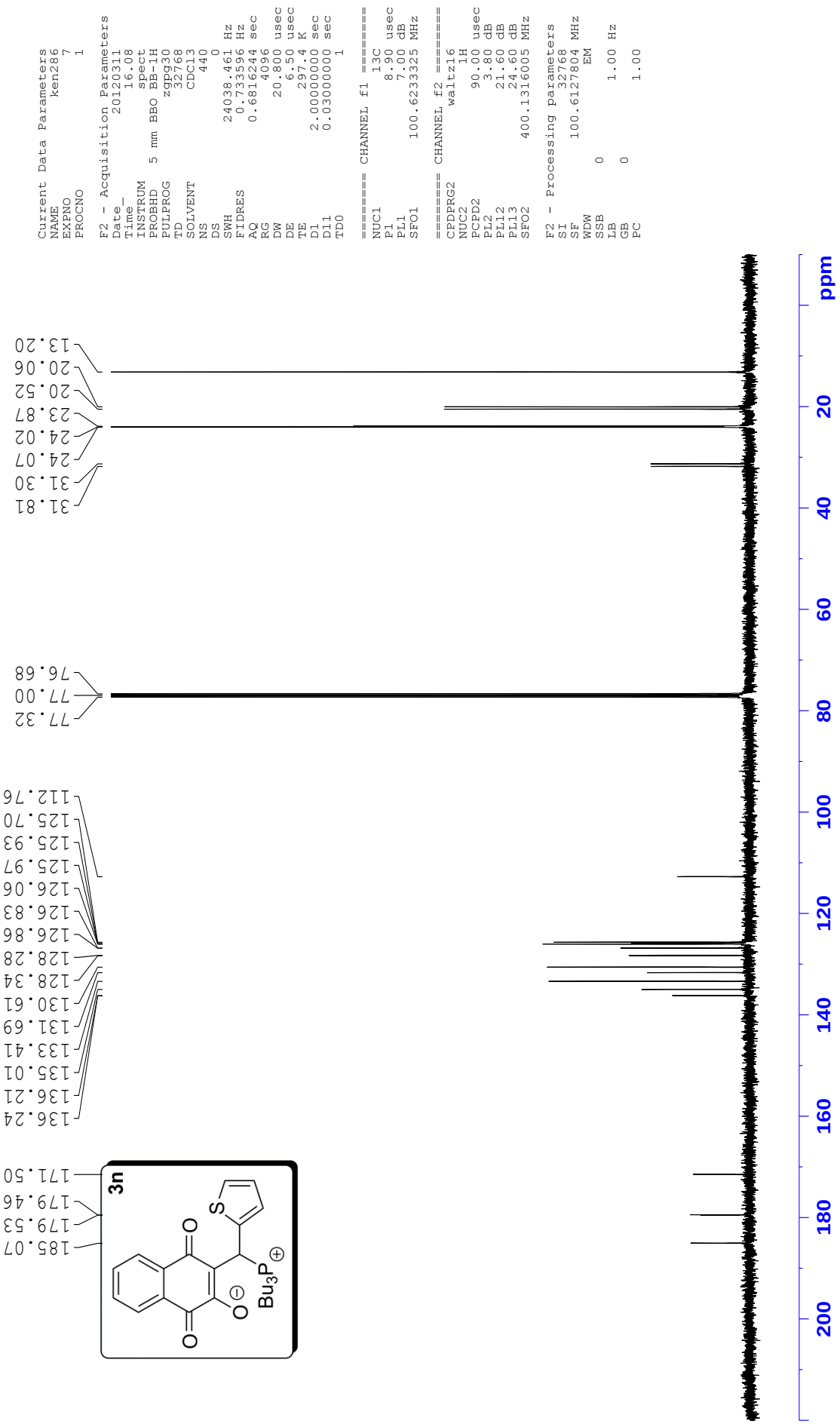
40
60
80
100
120
140
160
180
200


Current Data Parameters
NAME ken-P
EXPNO 42
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120423
Time_ 12.31
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 72
DS 0
SWH 64724.918 Hz
FIDRES 0.987624 Hz
AQ 0.5063156 sec
RG 20642.5
DW 7.725 usec
DE 6.50 usec
TE 299.5 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 31P
P1 10.60 usec
PL1 12.00 dB
SFO1 161.9674942 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 161.9757192 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
32.79
3l
Bu3P
ppm
0
10
20
30
40
50
60
70
80
90



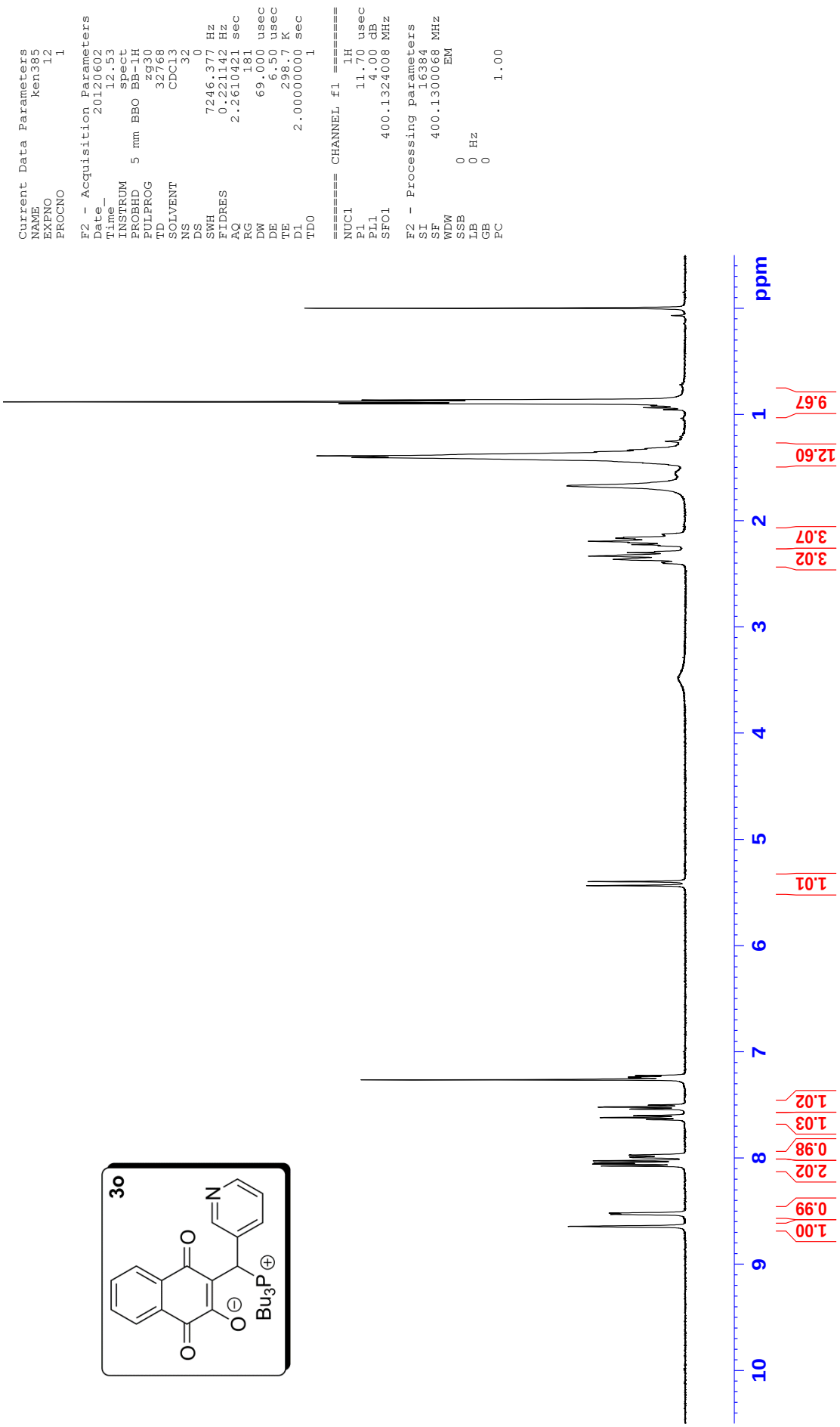

Current Data Parameters
NAME ken285
EXPNO 12
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120311
Time_ 16.32
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 550
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 297.4 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
========== CHANNEL f1 ==========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
========== CHANNEL f2 ==========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127900 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
13.04
20.11
20.57
23.63
23.68
23.84
29.66
30.16
77.32
77.00
76.68
108.77
108.80
110.15
110.22
111.24
125.59
125.94
130.48
131.55
133.31
134.94
141.47
147.57
147.63
171.73
179.41
179.46
184.77
3m
Bu3P
ppm
20
40
60
80
100
120
140
160
180
200

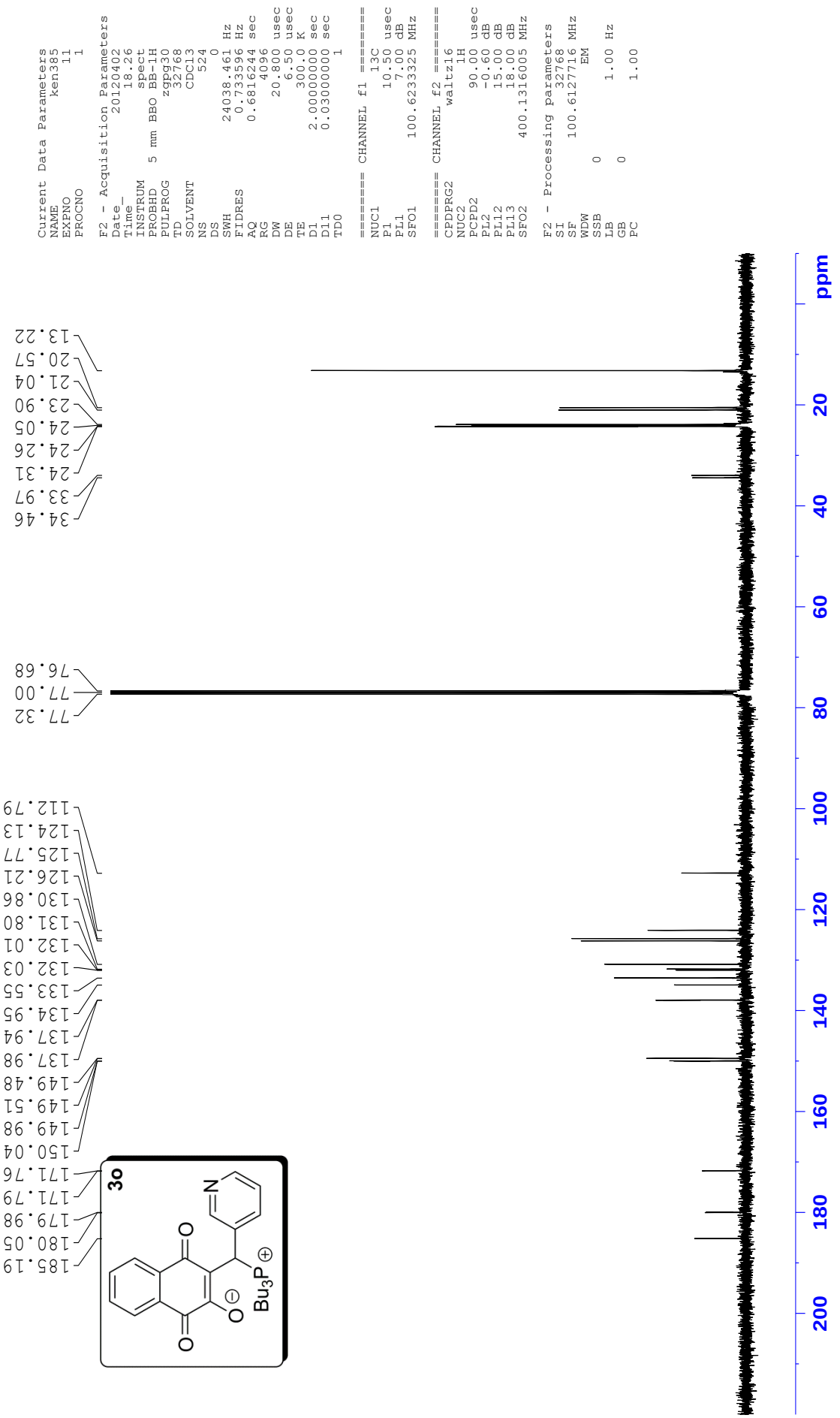

Current Data Parameters
NAME ken286
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111205
Time_ 16.58
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 256
DW 69.000 usec
DE 6.50 usec
TE 300.4 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300070 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
3n
S
O
O
O
Bu3P
ppm
1
2
3
4
5
6
7
8
9
10
9.40
12.52
6.20
1.00
1.02
1.98
1.01
0.99
2.05

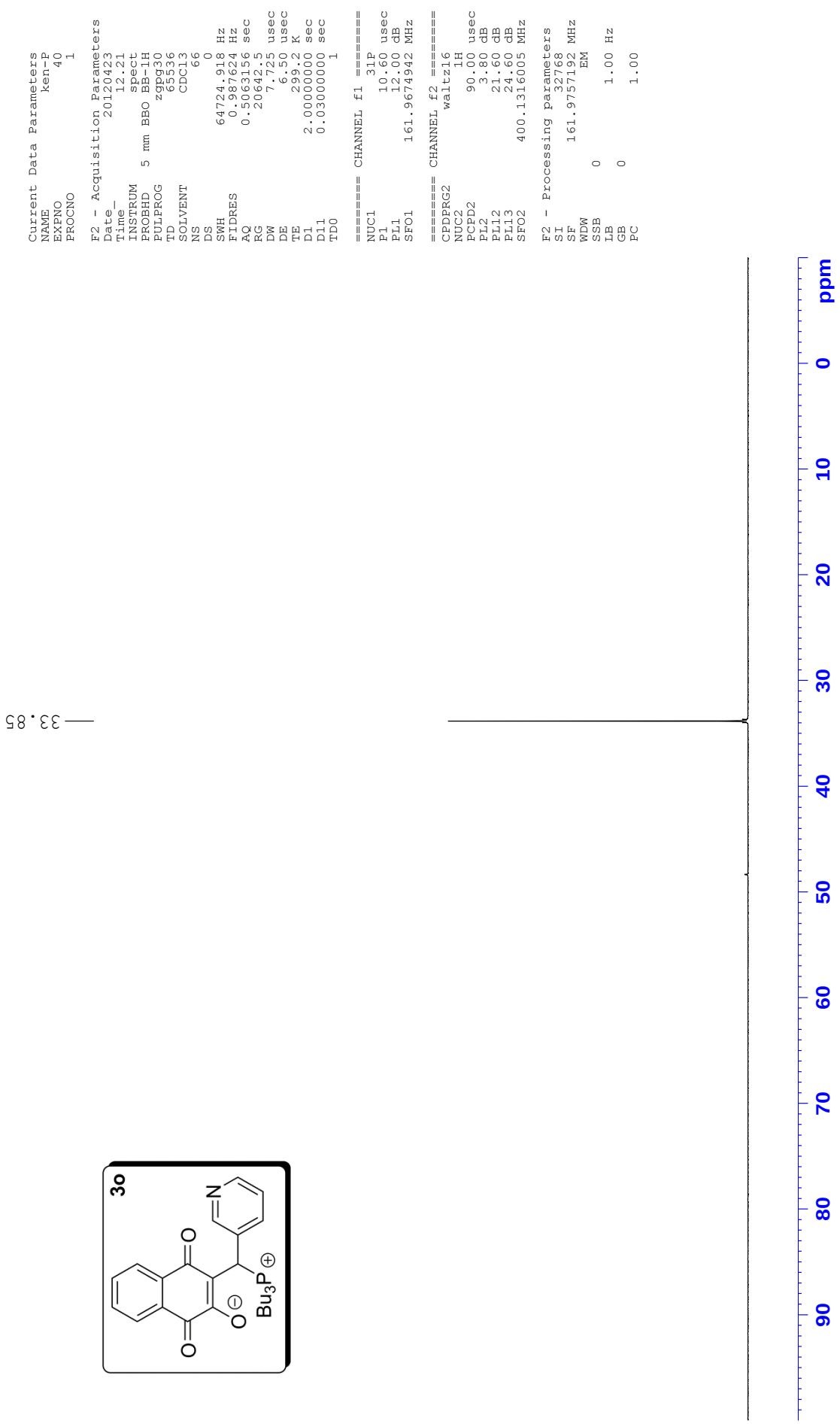

Current Data Parameters
NAME ken286
EXPNO 7
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120311
Time_ 16.08
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 440
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 297.4 K
D1 2.00000000 sec
D11 2.03000000 sec
TD0 1
========== CHANNEL f1 ==========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
========== CHANNEL f2 ==========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127804 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
13.20
20.06
20.52
23.87
24.02
24.07
31.30
31.81
77.32
77.00
76.68
112.76
125.70
125.93
125.97
126.06
126.83
126.86
128.28
128.34
130.61
131.69
133.41
135.01
136.21
136.24
171.50
179.46
179.53
185.07
3n
S
O
O
O
Bu3P
ppm
20
40
60
80
100
120
140
160
180
200

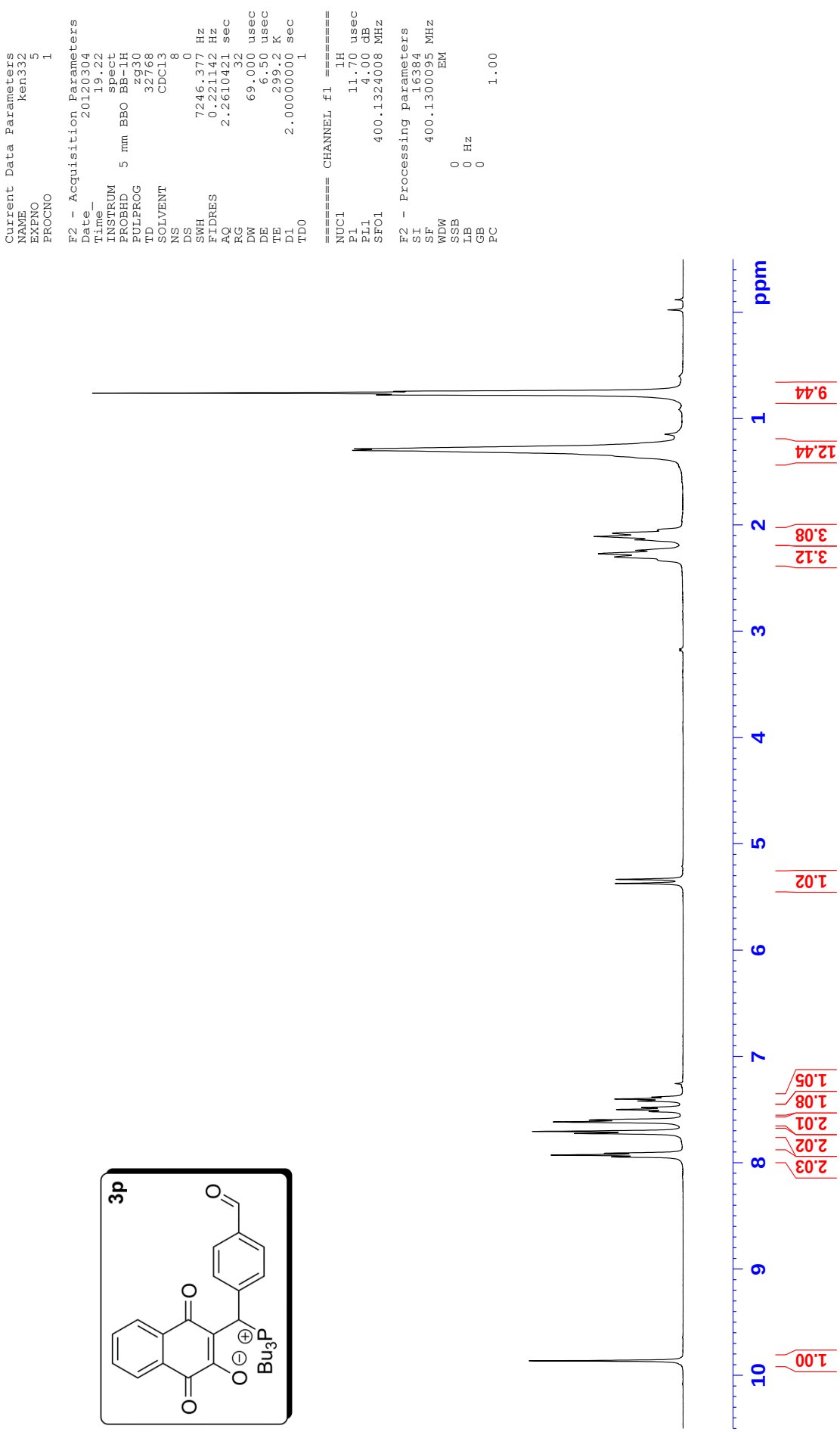
```
Current Data Parameters
NAME                  ken-P
EXPNO                    10
PROCNO                    1

F2 - Acquisition Parameters
Date_              20120315
Time                   19.21
INSTRUM                spect
PROBHD   5 mm BBO BB-1H
PULPROG              zgpg30
TD                    65536
SOLVENT               CDCl3
NS                       23
DS                        0
SWH                64724.918 Hz
FIDRES                0.987624 Hz
AQ                    0.5063156 sec
RG                         6502
DW                        7.725 usec
DE                         6.50 usec
TE                        300.7 K
D1                    2.00000000 sec
D11                   0.03000000 sec
TD0                           1

======== CHANNEL f1 ========
NUC1                       31P
P1                       10.60 usec
PL1                      12.00 dB
SFO1           161.9674942 MHz

======== CHANNEL f2 ========
CPDPRG2                waltz16
NUC2                        1H
PCPD2                    90.00 usec
PL2                       3.80 dB
PL12                     21.60 dB
PL13                     24.60 dB
SFO2           400.1316005 MHz

F2 - Processing parameters
SI                        32768
SF             161.9757164 MHz
WDW                        EM
SSB                     0
LB                         1.00 Hz
GB                      0
PC                         1.00
```

33.39


Current Data Parameters
NAME ken385
EXPNO 12
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120602
Time 12.53
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 32
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 181
DW 69.000 usec
DE 6.50 usec
TE 298.7 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300068 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
9.67
12.60
3.07
3.02
1.01
1.02
1.03
0.98
2.02
0.99
1.00
3o
N
O
O
O
Bu3P


Current Data Parameters
NAME ken385
EXPNO 11
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120402
Time_ 18.26
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 524
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 300.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 10.50 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 -0.60 dB
PL12 15.00 dB
PL13 18.00 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127716 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
13.22
20.57
21.04
23.90
24.05
24.26
24.31
33.97
34.46
77.32
77.00
76.68
112.79
124.13
125.77
126.21
130.86
131.80
132.01
132.03
133.55
134.95
137.94
137.98
149.48
149.51
149.98
150.04
171.76
171.79
179.98
180.05
185.19
3o
O
N
O
O
Bu3P
ppm
20
40
60
80
100
120
140
160
180
200




Current Data Parameters
NAME ken332
EXPNO 5
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120304
Time 19.22
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 32
DW 69.000 usec
DE 6.50 usec
TE 299.2 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300095 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
3p
Bu3P
ppm
1
2
3
4
5
6
7
8
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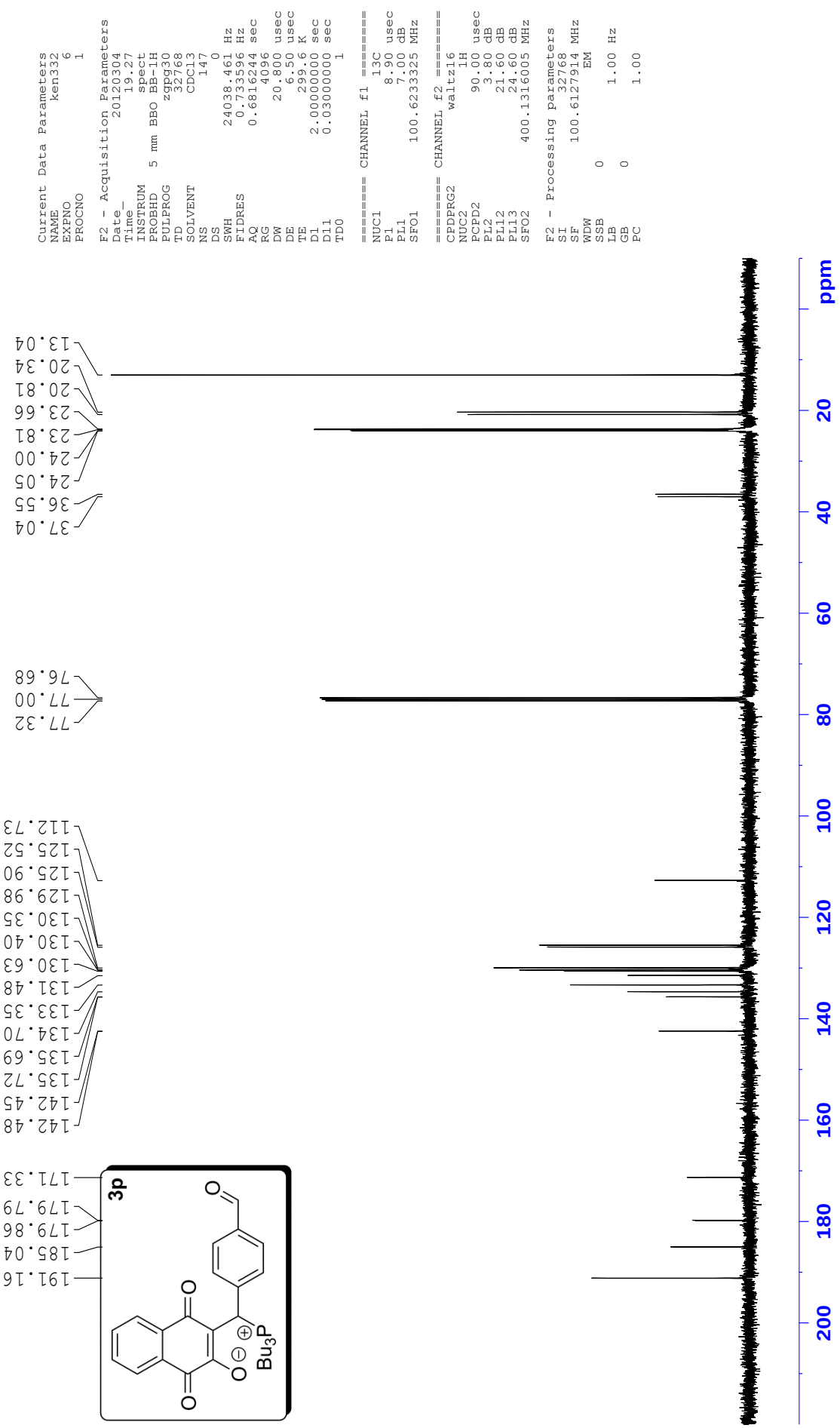
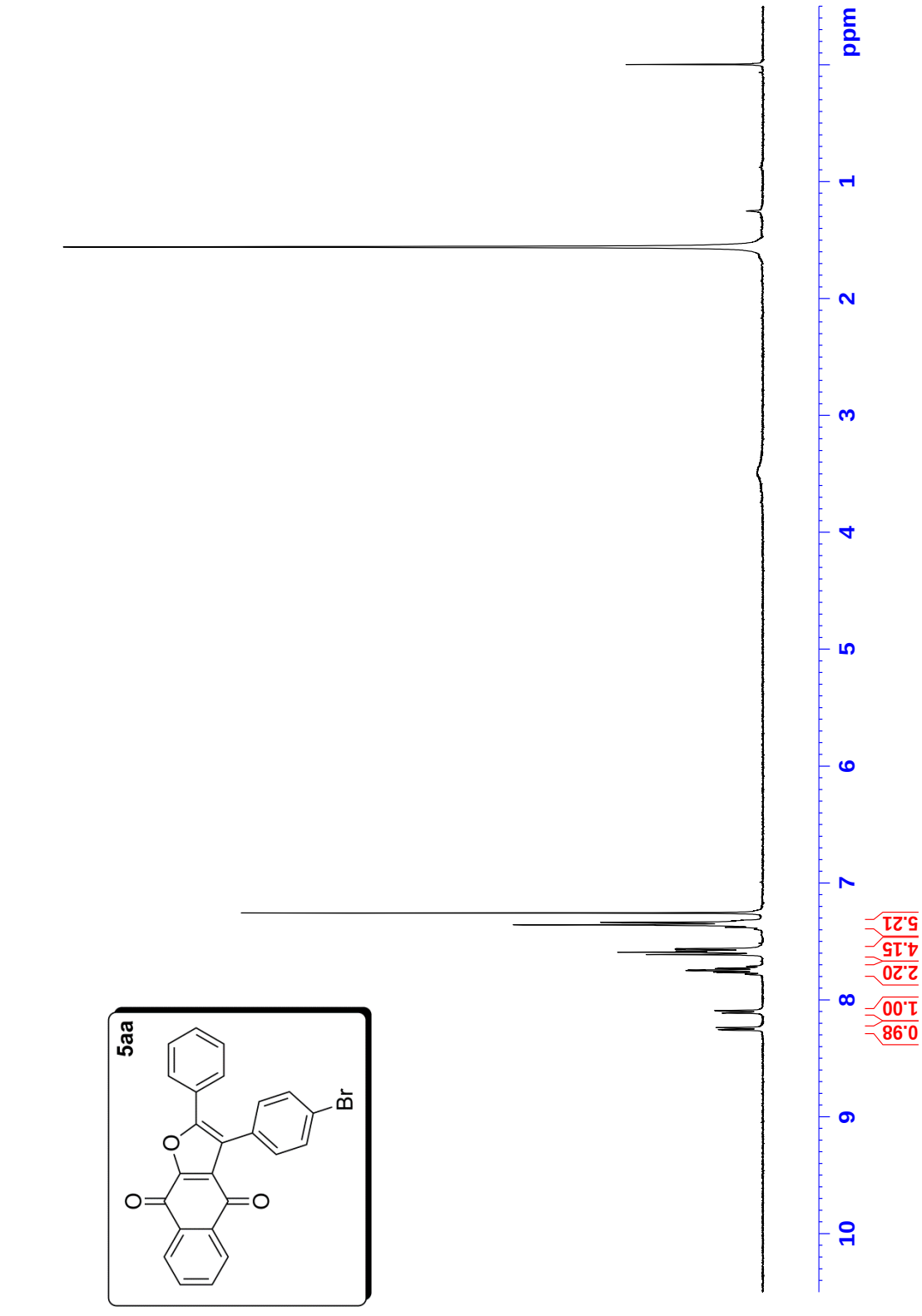
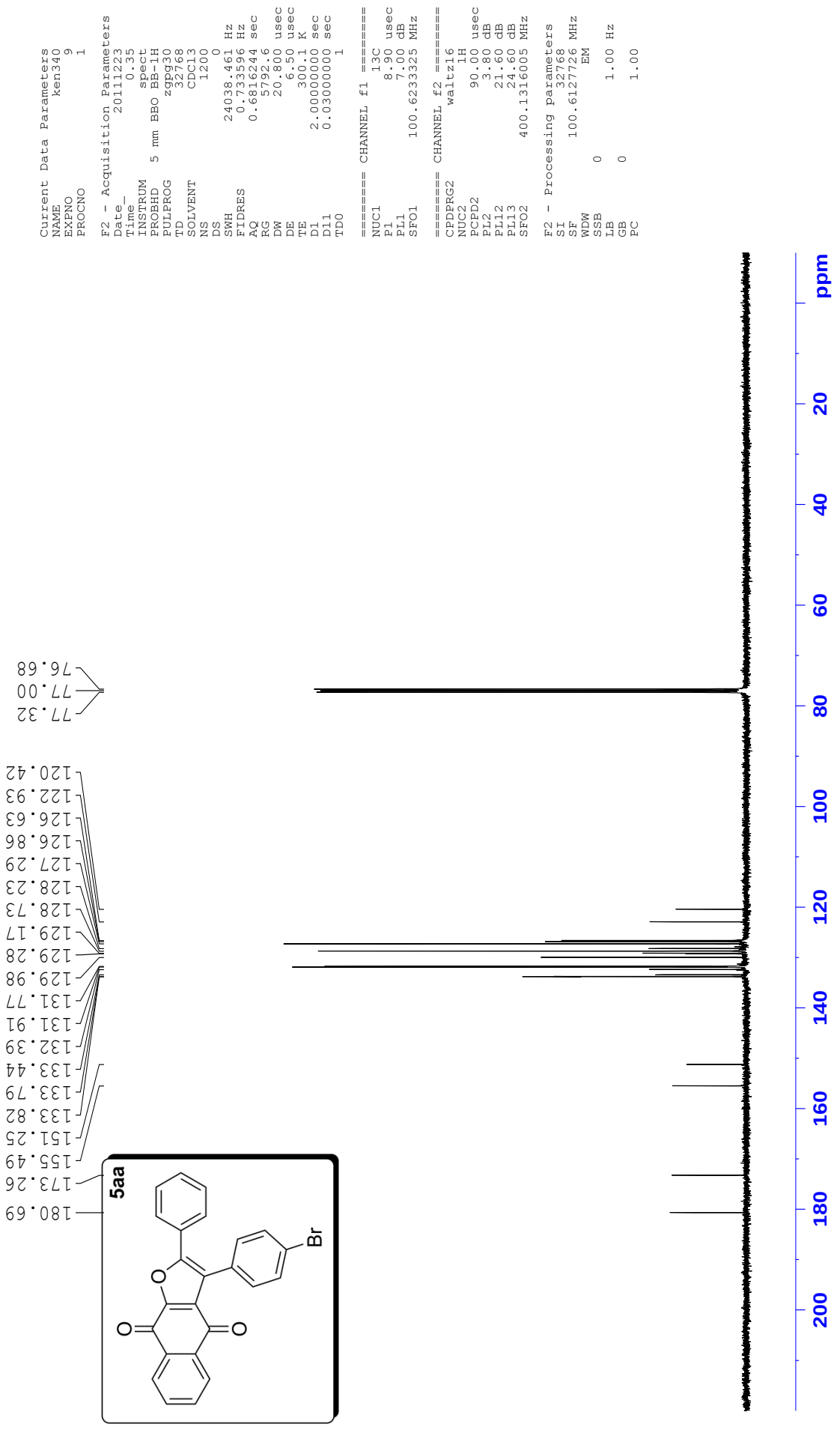
1.05
1.08
2.01
2.02
2.03
1.00

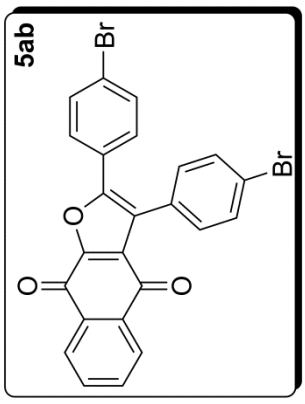


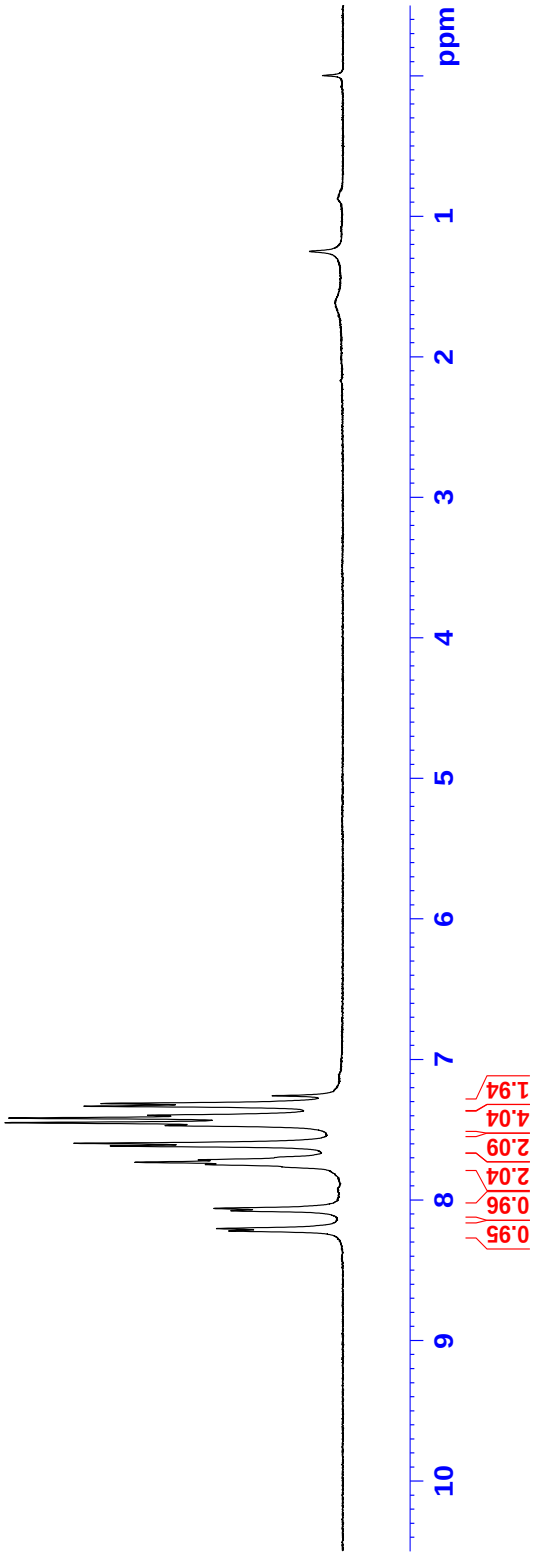
Current Data Parameters
NAME ken-P
EXPNO 30
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120310
Time 13.09
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 21
DS 0
SWH 64724.918 Hz
FIDRES 0.987624 Hz
AQ 0.5063156 sec
RG 5160.6
DW 7.725 usec
DE 6.50 usec
TE 298.3 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 31P
P1 10.60 usec
PL1 12.00 dB
SFO1 161.9674942 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 161.9757133 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
33.41
3p
O
O
O
O
Bu3P
ppm
0
10
20
30
40
50
60
70
80
90

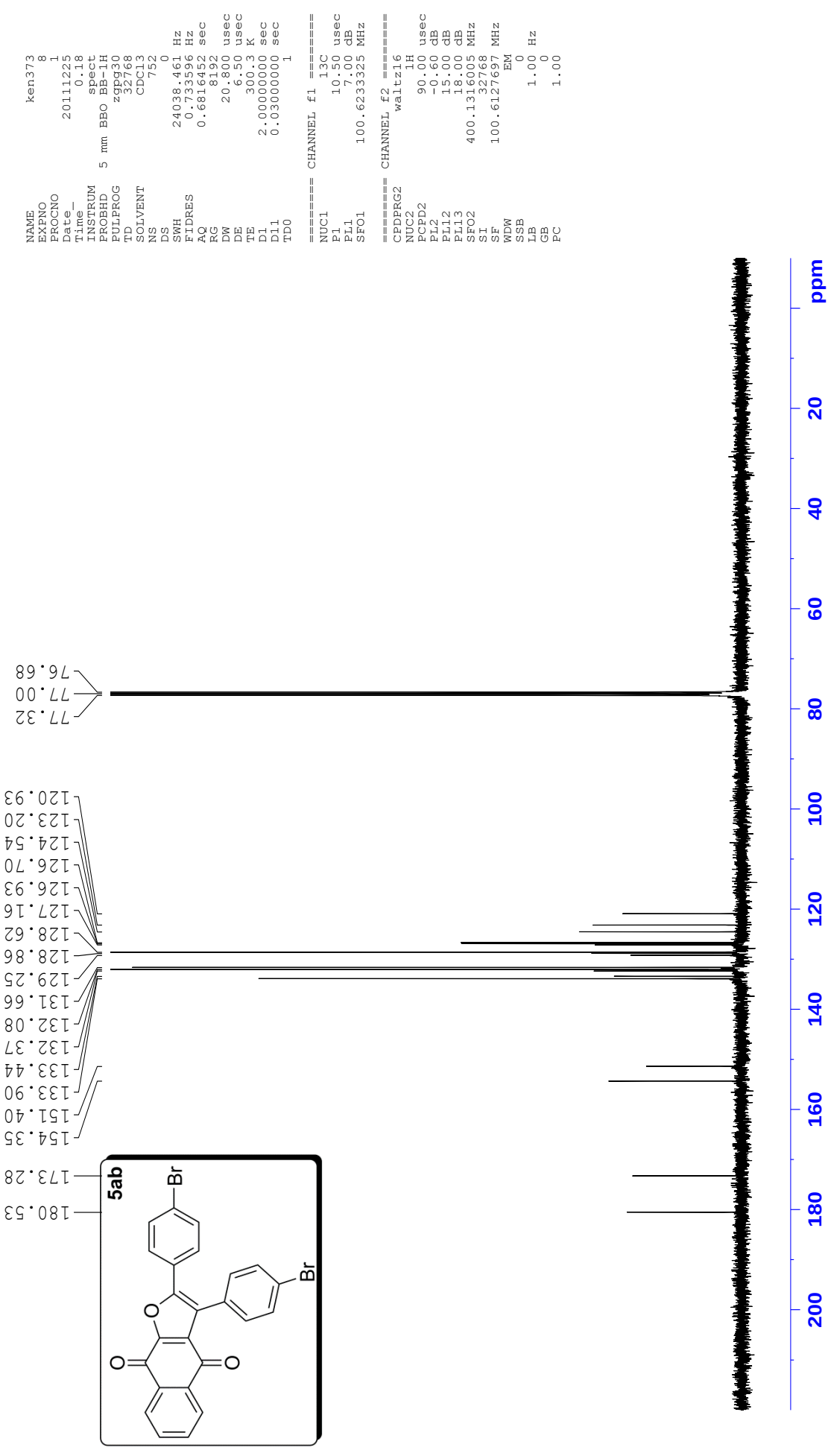


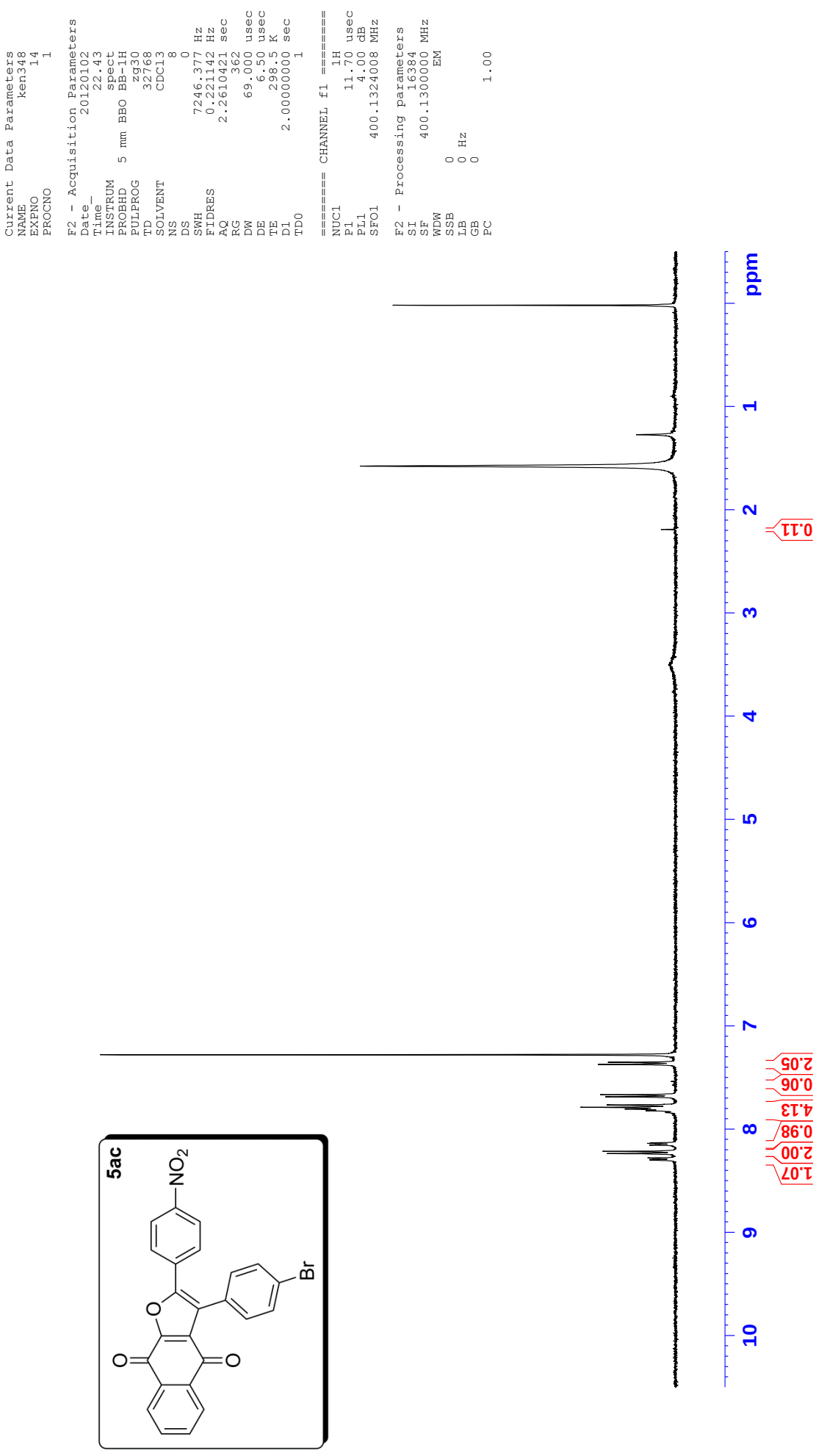


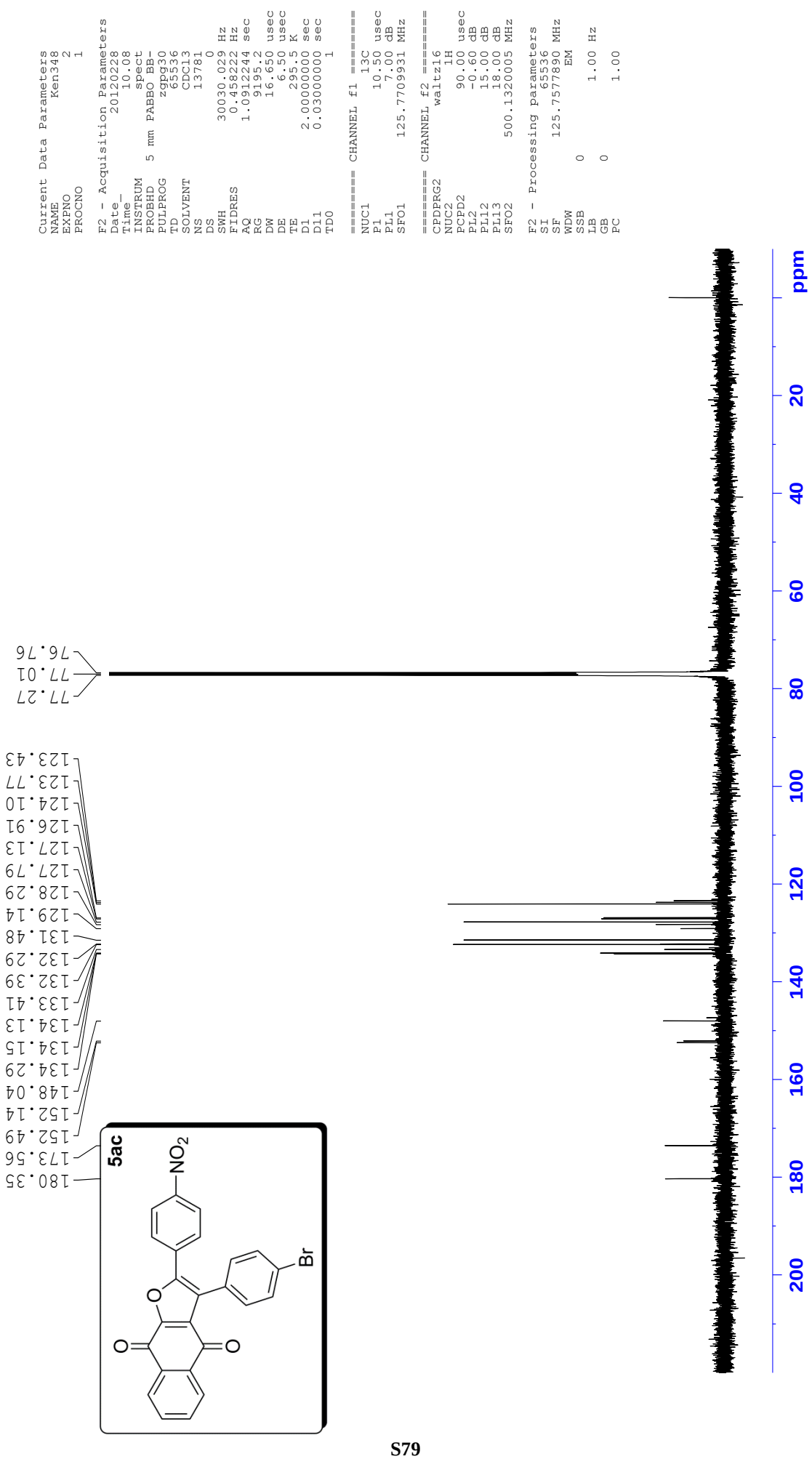
```
Current Data Parameters
NAME                  ken373
EXPNO                      4
PROCNO                     1

F2 - Acquisition Parameters
Date_              20111224
Time                  16.26
INSTRUM               spect
PROBHD  5 mm BBO BB-1H
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                        4
DS                        0
SWH                7246.377 Hz
FIDRES             0.221142 Hz
AQ                 2.2610421 sec
RG                      161.3
DW                 69.000 usec
DE                    6.50 usec
TE                   297.4 K
D1                 2.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                    11.70 usec
PL1                    4.00 dB
SFO1           400.1324008 MHz

F2 - Processing parameters
SI                    16384
SF             400.1300081 MHz
WDW                      EM
SSB                       0
LB                    0 Hz
GB                        0
PC                     1.00
```

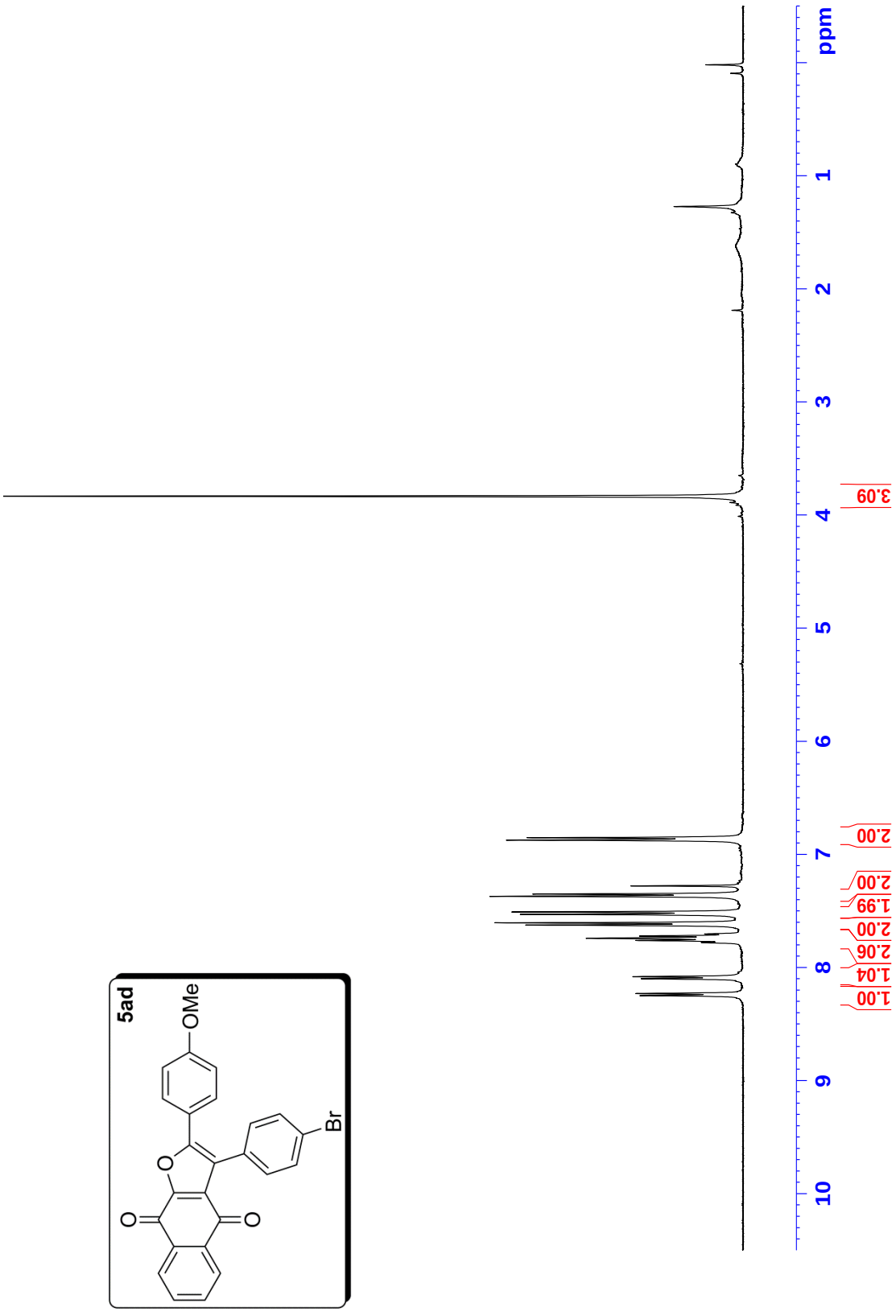


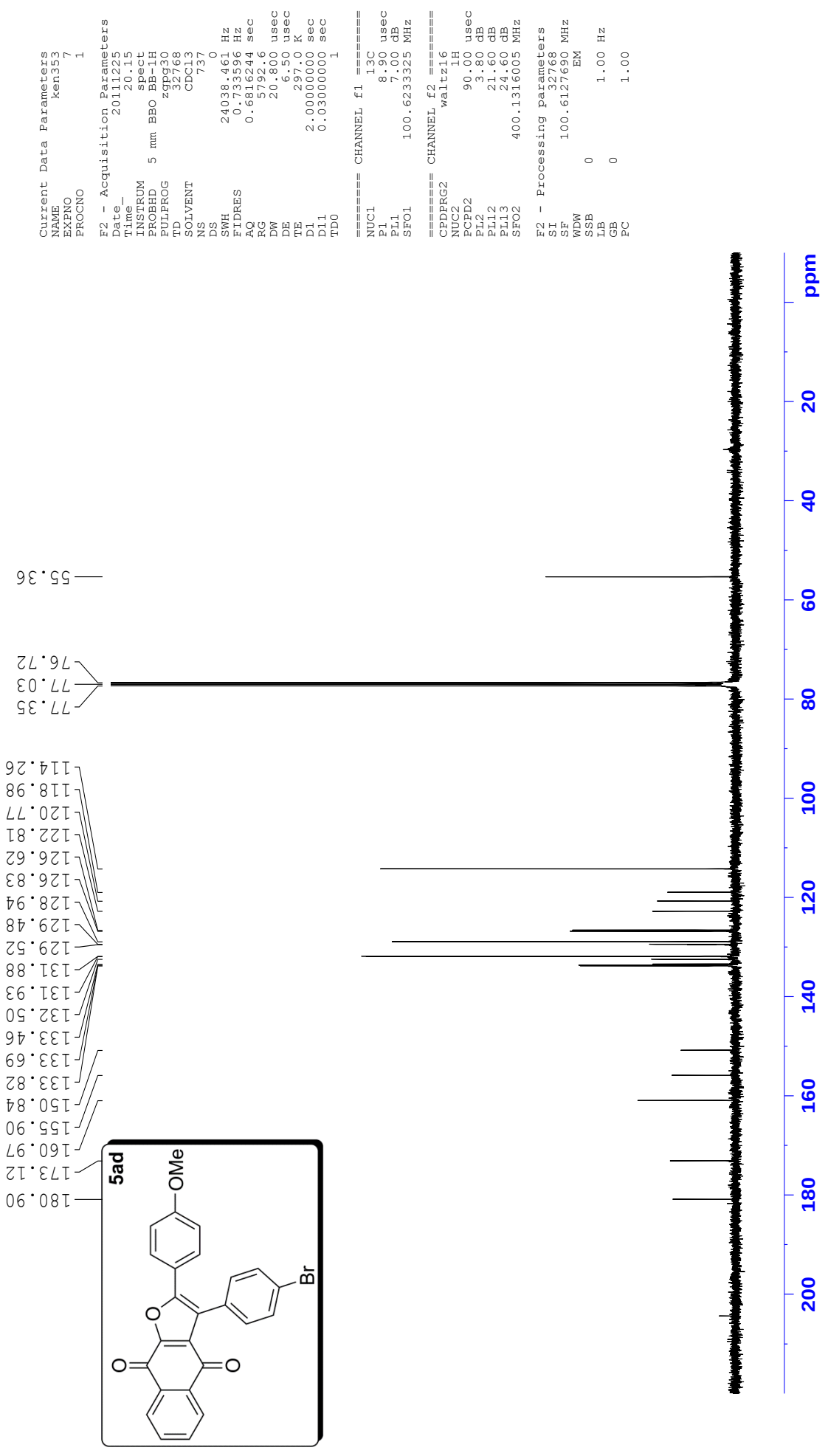


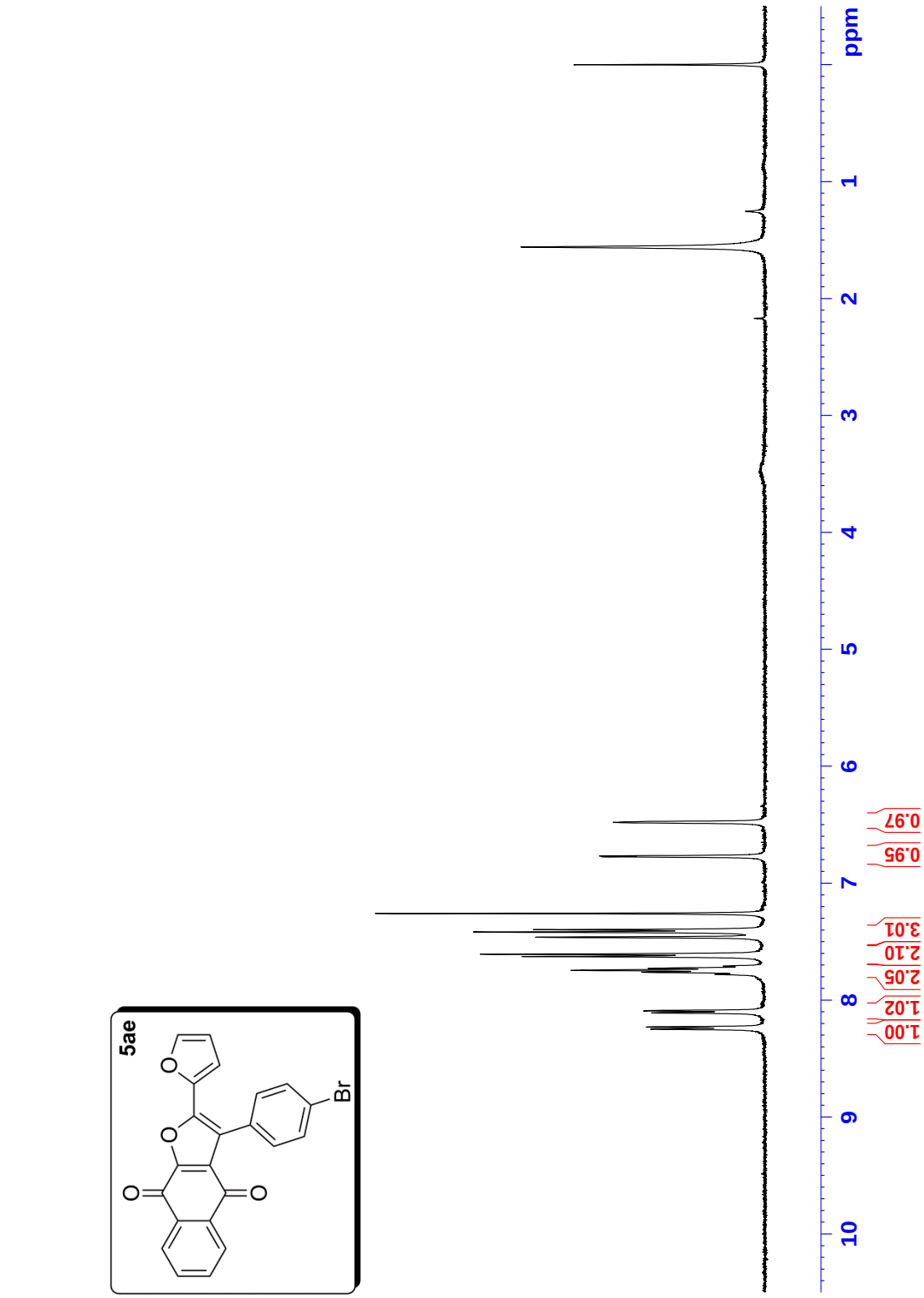


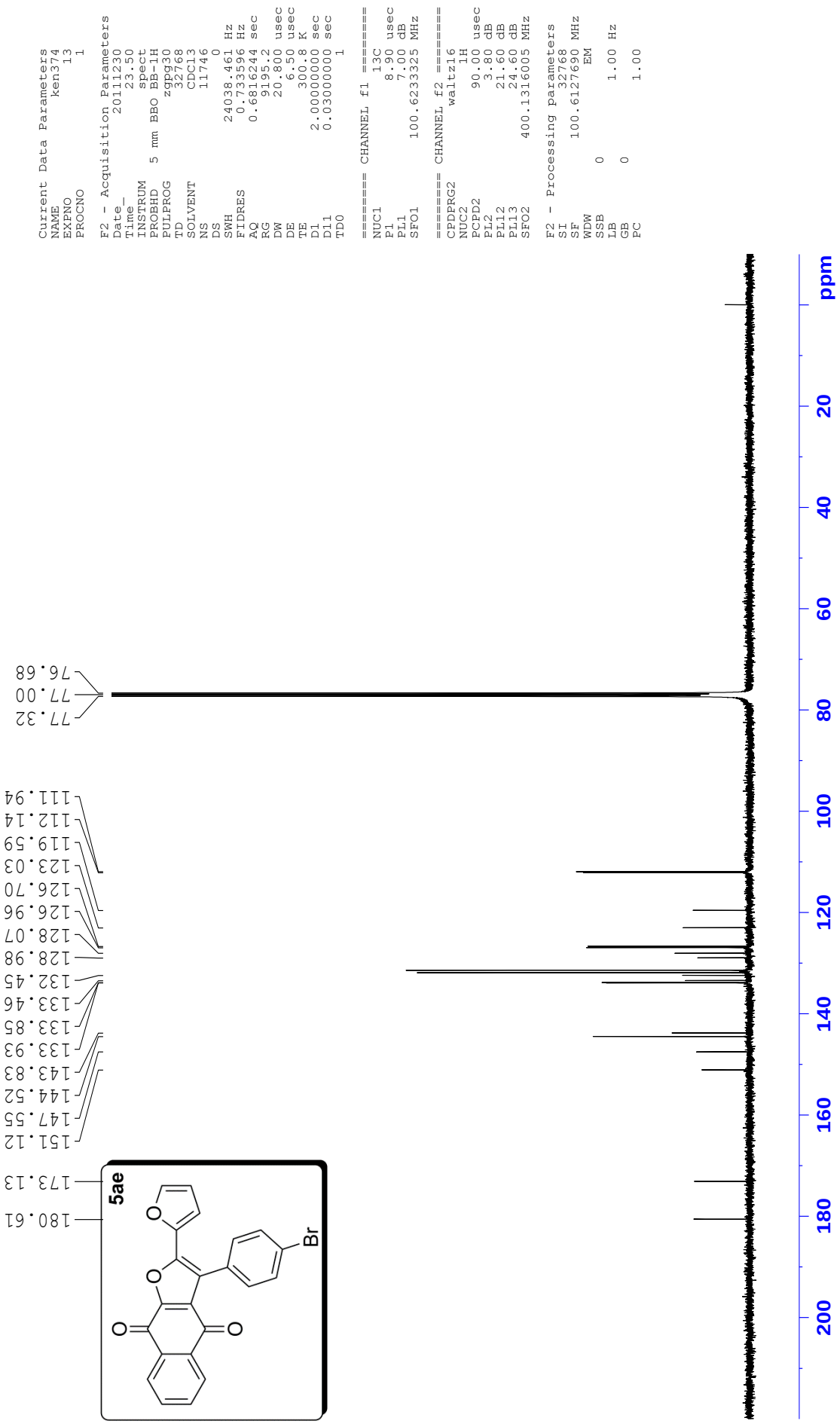

Current Data Parameters
NAME ken348
EXPNO 14
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120102
Time_ 22.43
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 362
DW 69.000 usec
DE 6.50 usec
TE 298.5 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5ac
NO2
Br
O
O
O
ppm
1
2
3
4
5
6
7
8
9
10
0.11
1.07
2.00
0.98
4.13
0.06
2.05

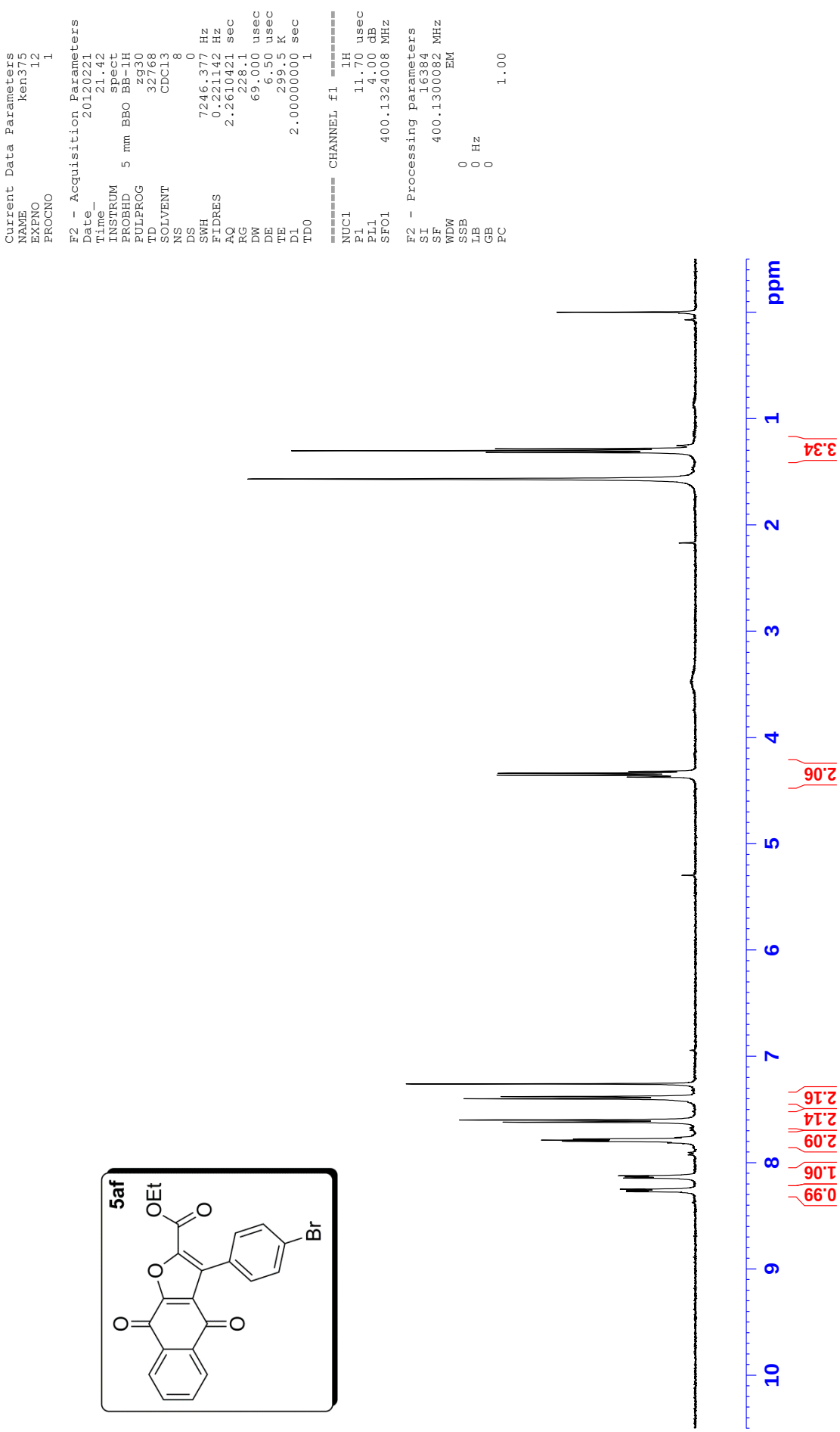


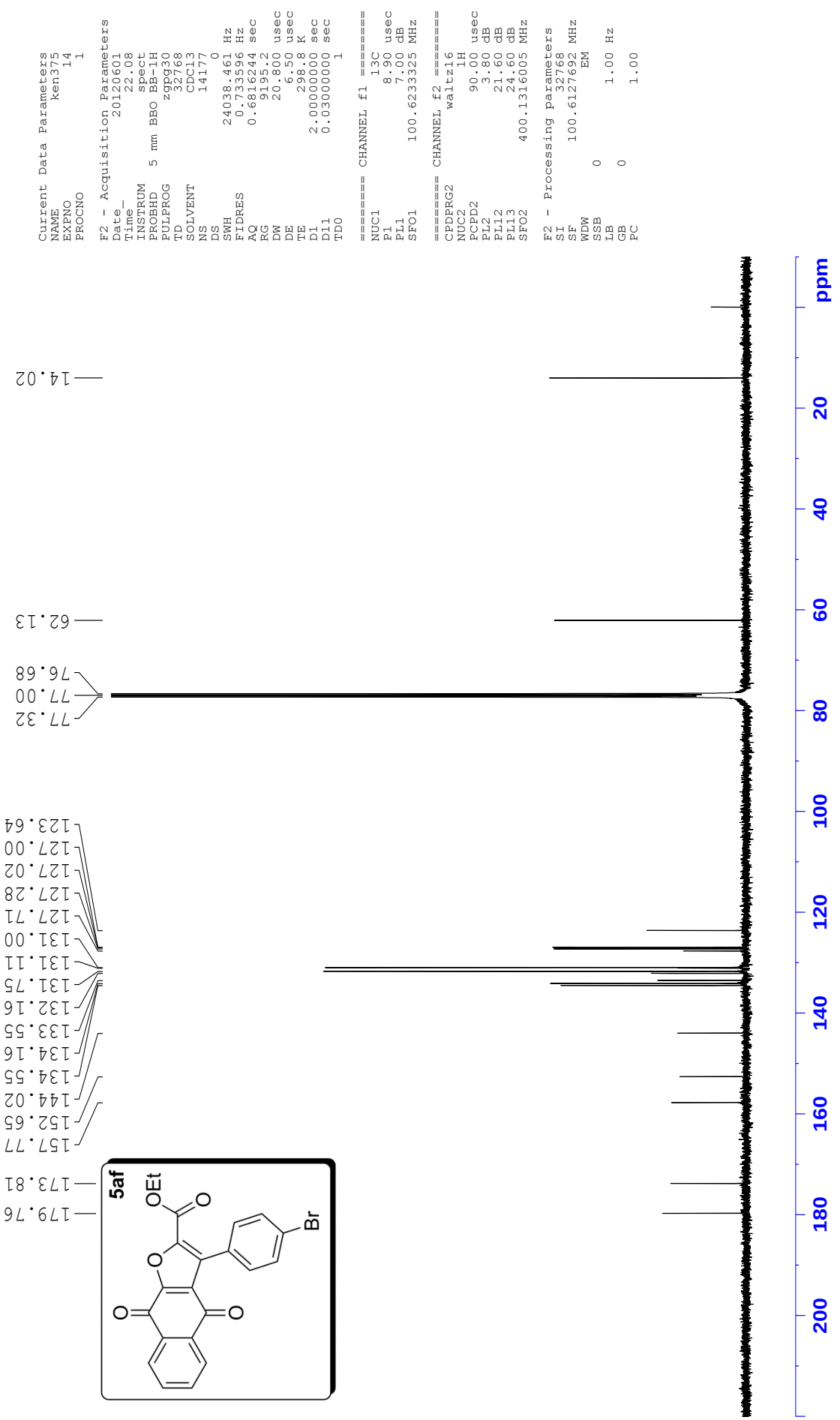

Current Data Parameters
NAME ken353
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111224
Time_ 22.16
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 4
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 181
DW 69.000 usec
DE 6.50 usec
TE 297.4 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
3.09
2.00
1.99
2.00
2.06
1.04
1.00
5ad
OMe
Br
O
O
O

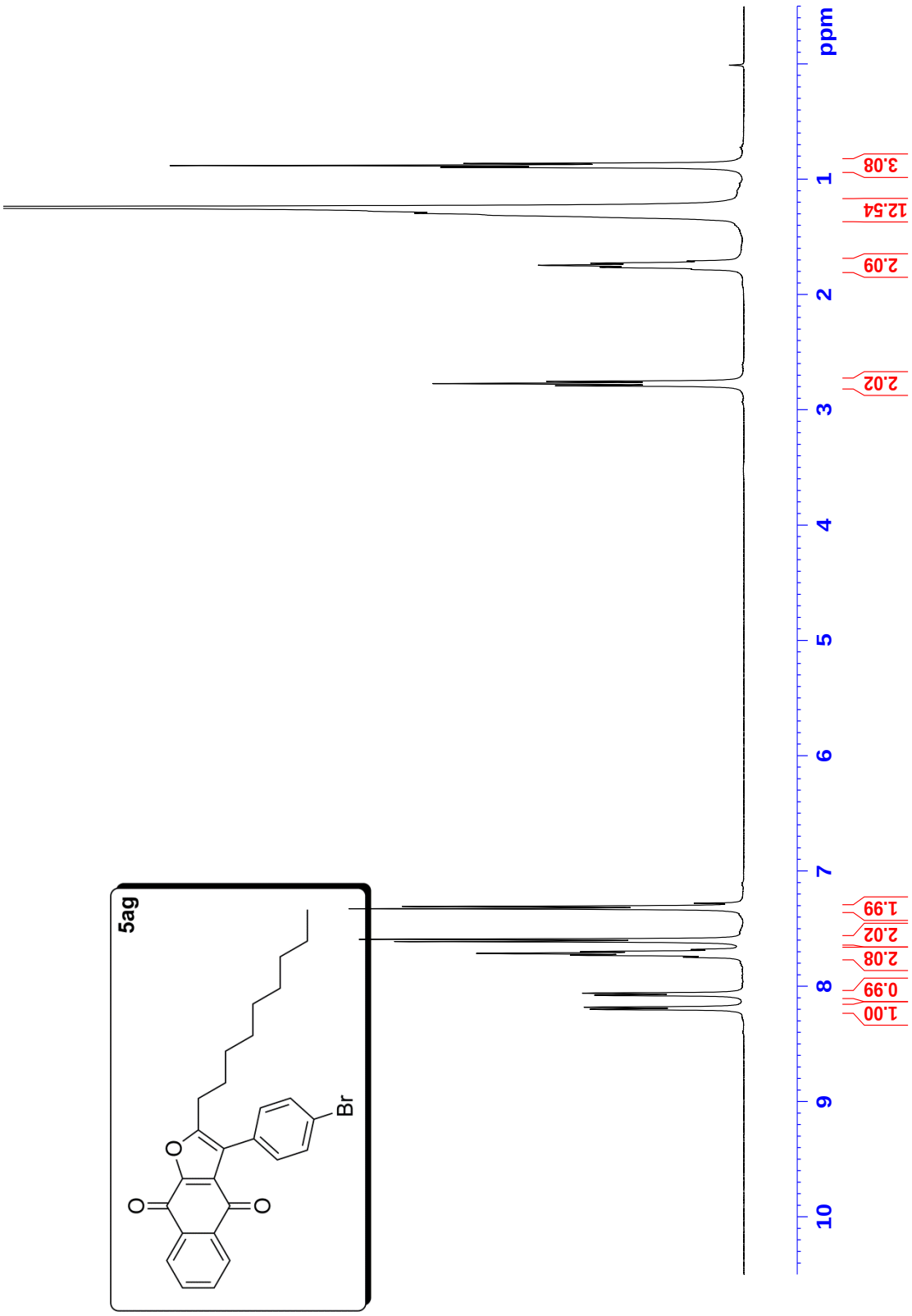

Current Data Parameters
NAME ken353
EXPNO 7
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111225
Time_ 20.15
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 737
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 5792.6
DW 20.800 usec
DE 6.50 usec
TE 297.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
55.36
76.72
77.03
77.35
114.26
118.98
120.77
122.81
126.62
126.83
128.94
129.48
129.52
131.88
131.93
132.50
133.46
133.69
133.82
150.84
155.90
160.97
173.12
180.90
5ad
OMe
Br
O
O
O
ppm
200
180
160
140
120
100
80
60
40
20

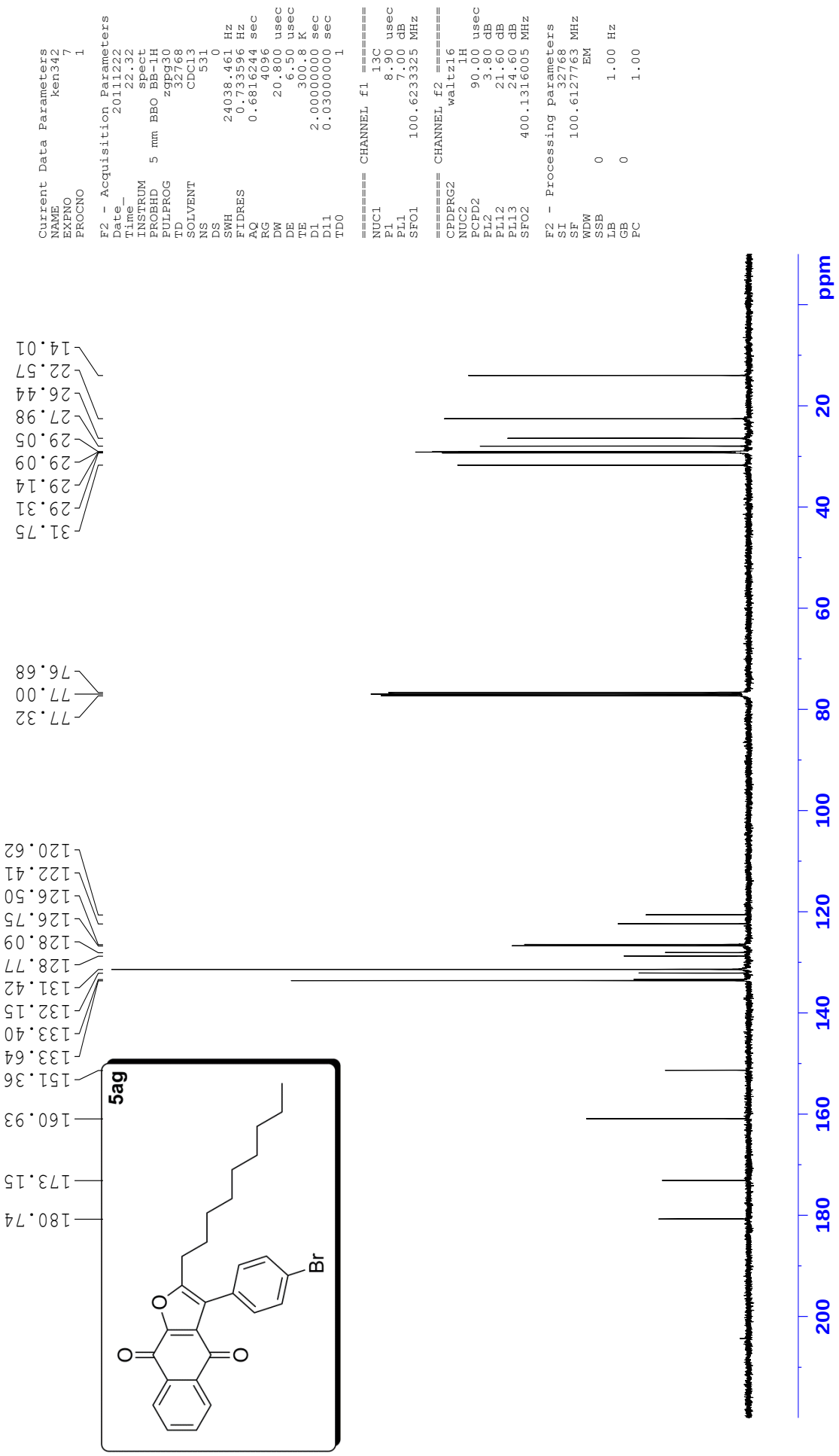

Current Data Parameters
NAME ken374
EXPNO 12
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111230
Time_ 23.00
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 322.5
DW 69.000 usec
DE 6.50 usec
TE 300.0 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300080 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5ae
Br
O
O
O
O
ppm
1
2
3
4
5
6
7
8
9
10
0.97
0.95
3.01
2.10
2.05
1.02
1.00

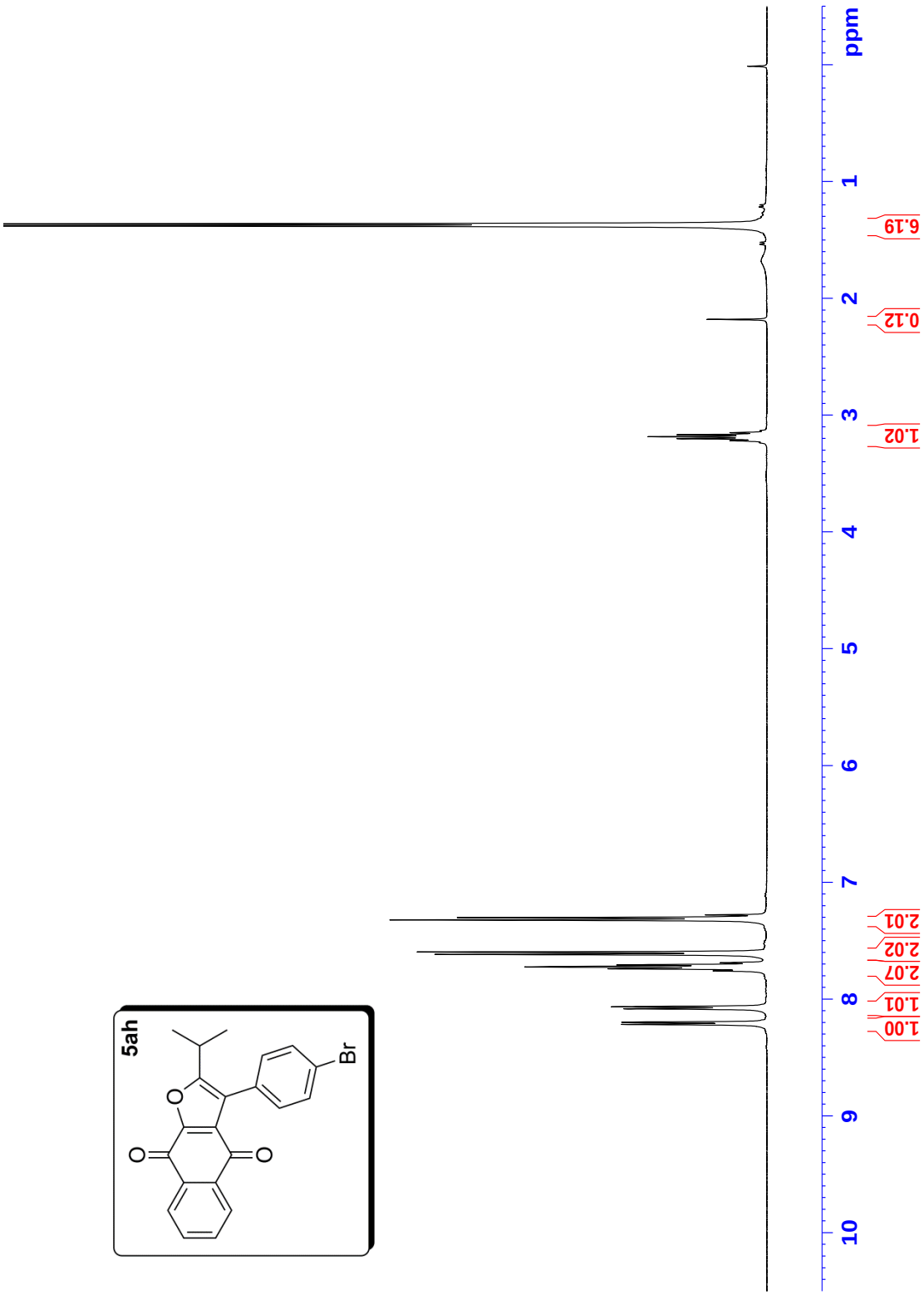

Current Data Parameters
NAME ken374
EXPNO 13
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111230
Time_ 23.50
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 11746
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6818244 sec
RG 9195.2
DW 20.800 usec
DE 6.50 usec
TE 300.8 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
77.32
77.00
76.68
111.94
112.14
119.59
123.03
126.70
126.96
128.07
128.98
132.45
133.46
133.85
133.93
143.83
144.52
147.55
151.12
173.13
180.61
5ae
O
O
O
O
Br
ppm
200
180
160
140
120
100
80
60
40
20

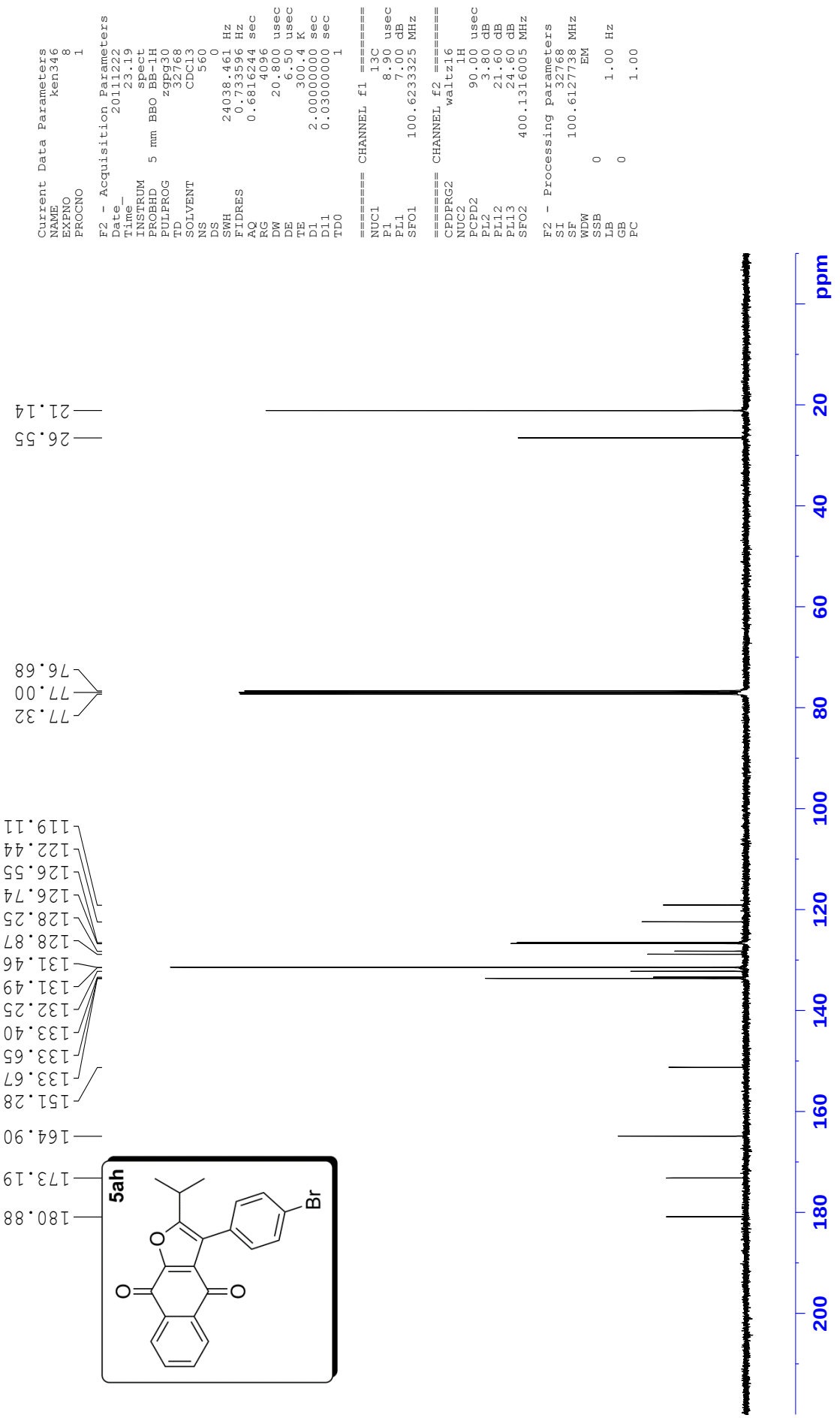

Current Data Parameters
NAME ken375
EXPNO 12
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120221
Time_ 21.42
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 228.1
DW 69.000 usec
DE 6.50 usec
TE 299.5 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300082 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5af
OEt
Br
O
ppm
1
2
3
4
5
6
7
8
9
10
3.34
2.06
2.16
2.14
2.09
1.06
0.99

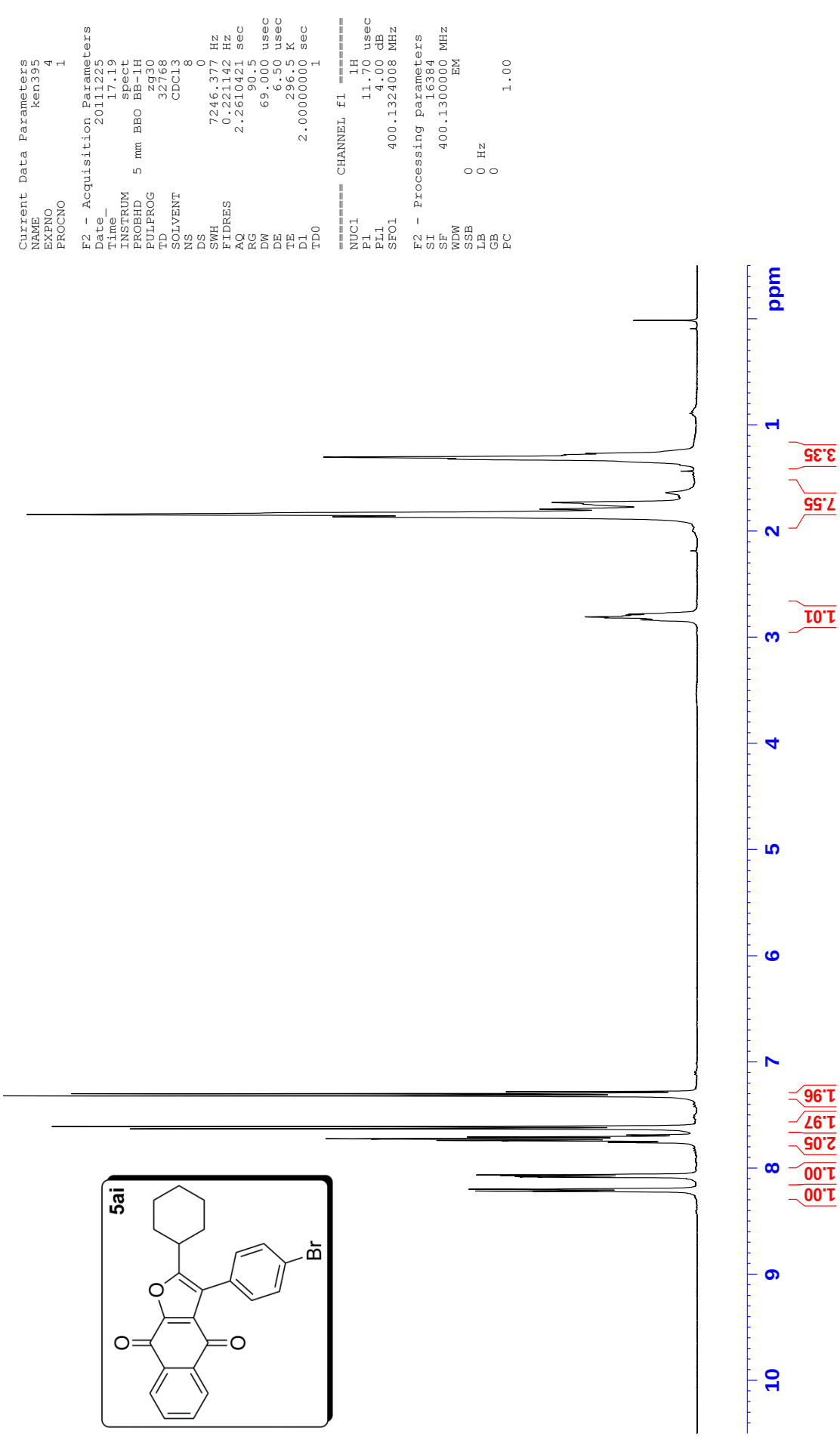

Current Data Parameters
NAME ken375
EXPNO 14
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120601
Time_ 22.08
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 14177
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6818244 sec
RG 9195.2
DW 20.800 usec
DE 6.50 usec
TE 298.8 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
========== CHANNEL f1 ==========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
========== CHANNEL f2 ==========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127692 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
14.02
62.13
76.68
77.00
77.32
123.64
127.00
127.02
127.28
127.71
131.00
131.11
131.75
132.16
133.55
134.16
134.55
144.02
152.65
157.77
173.81
179.76
5af
OEt
Br
O
ppm
200
180
160
140
120
100
80
60
40
20

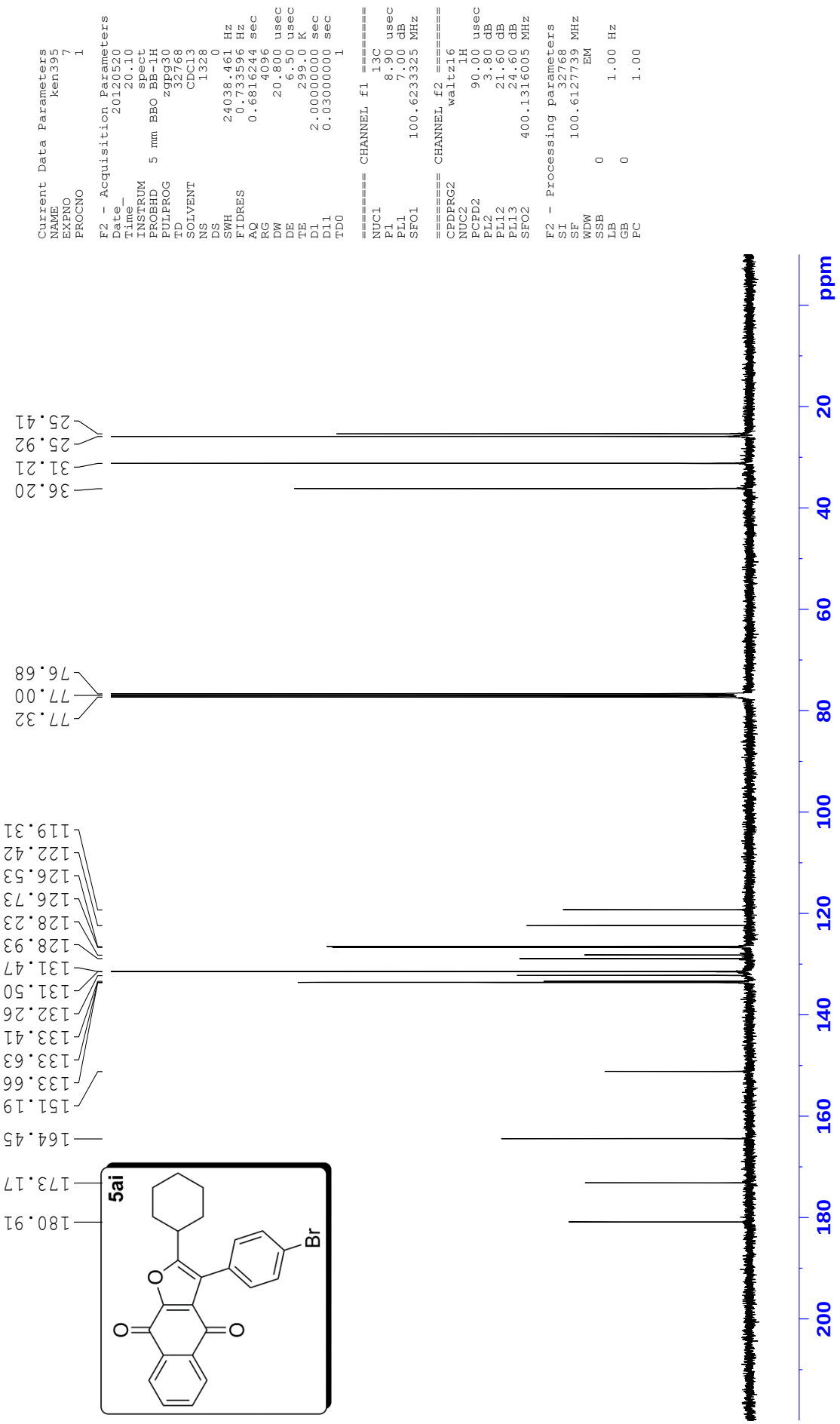

Current Data Parameters
NAME ken342
EXPNO 6
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111222
Time 22.14
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 40.3
DW 69.000 usec
DE 6.50 usec
TE 300.2 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5ag
Br
O
O
O
ppm
1
2
3
4
5
6
7
8
9
10
3.08
12.54
2.09
2.02
1.99
2.02
2.08
0.99
1.00

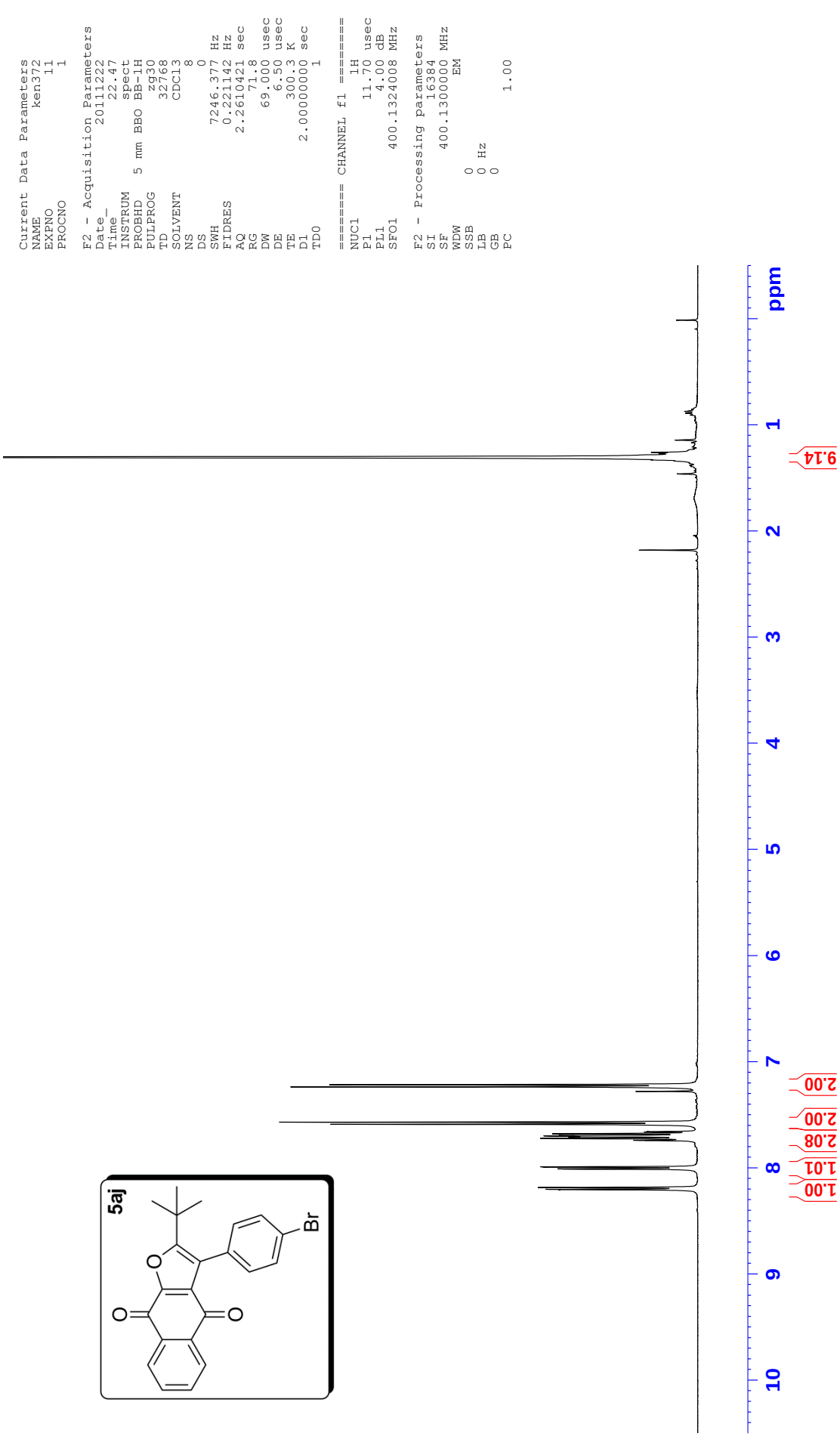

Current Data Parameters
NAME ken342
EXPNO 7
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111222
Time_ 22.32
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 531
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 300.8 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127763 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
14.01
22.57
26.44
27.98
29.05
29.09
29.14
29.31
31.75
77.32
77.00
76.68
120.62
122.41
126.50
126.75
128.09
128.77
131.42
132.15
133.40
133.64
151.36
160.93
173.15
180.74
5ag
Br
O
O
O
ppm
200
180
160
140
120
100
80
60
40
20

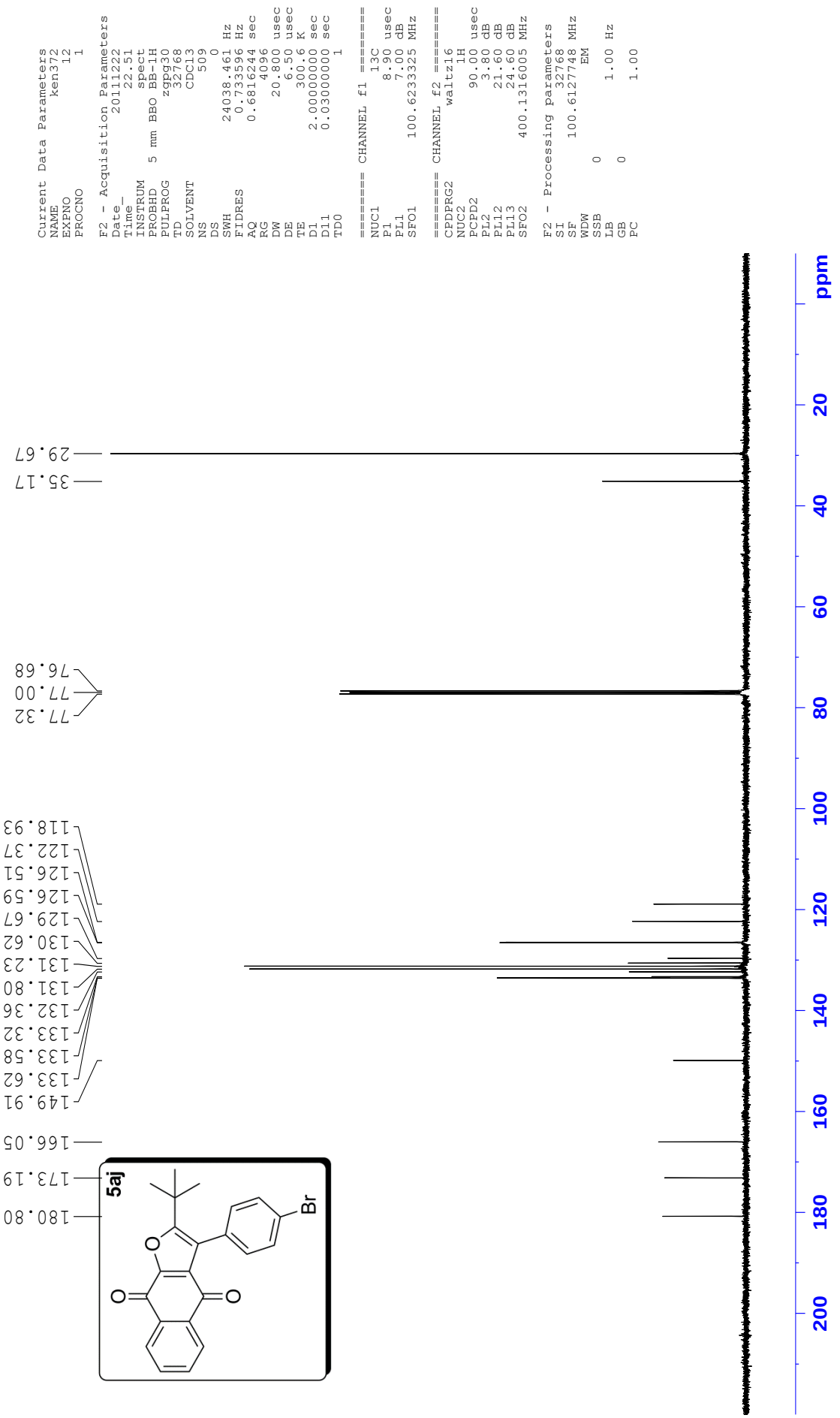

Current Data Parameters
NAME ken346
EXPNO 7
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111222
Time_ 23.16
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 90.5
DW 69.000 usec
DE 6.50 usec
TE 300.3 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5ah
Br
O
O
O
ppm
1
2
3
4
5
6
7
8
9
10
6.19
0.12
1.02
2.01
2.02
2.07
1.01
1.00

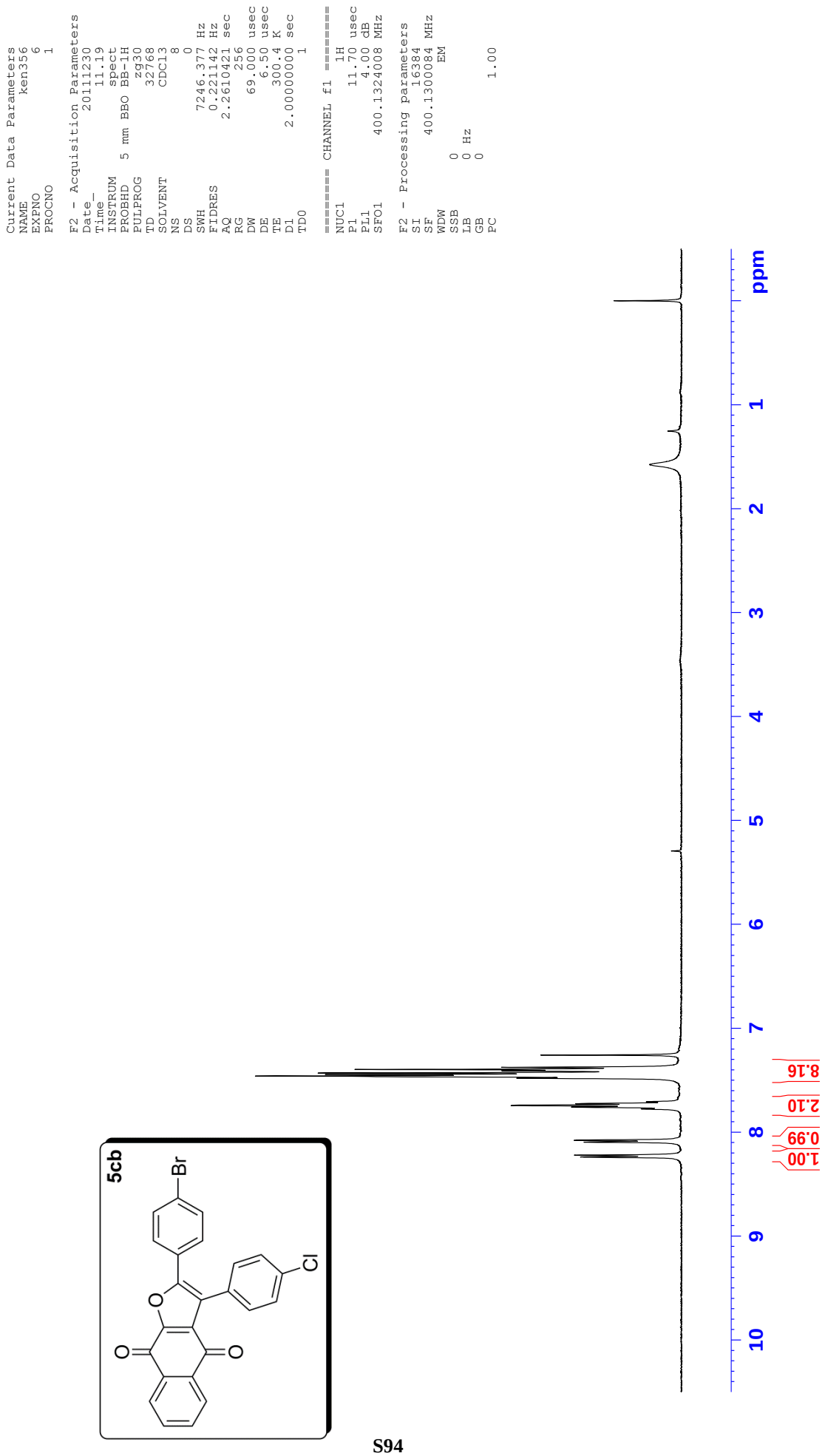

Current Data Parameters
NAME ken346
EXPNO 8
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111222
Time_ 23.19
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 560
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 300.4 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127738 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
21.14
26.55
76.68
77.00
77.32
119.11
122.44
126.55
126.74
128.25
128.87
131.46
131.49
132.25
133.40
133.65
133.67
151.28
164.90
173.19
180.88
5ah
Br
O
O
O
ppm
20
40
60
80
100
120
140
160
180
200

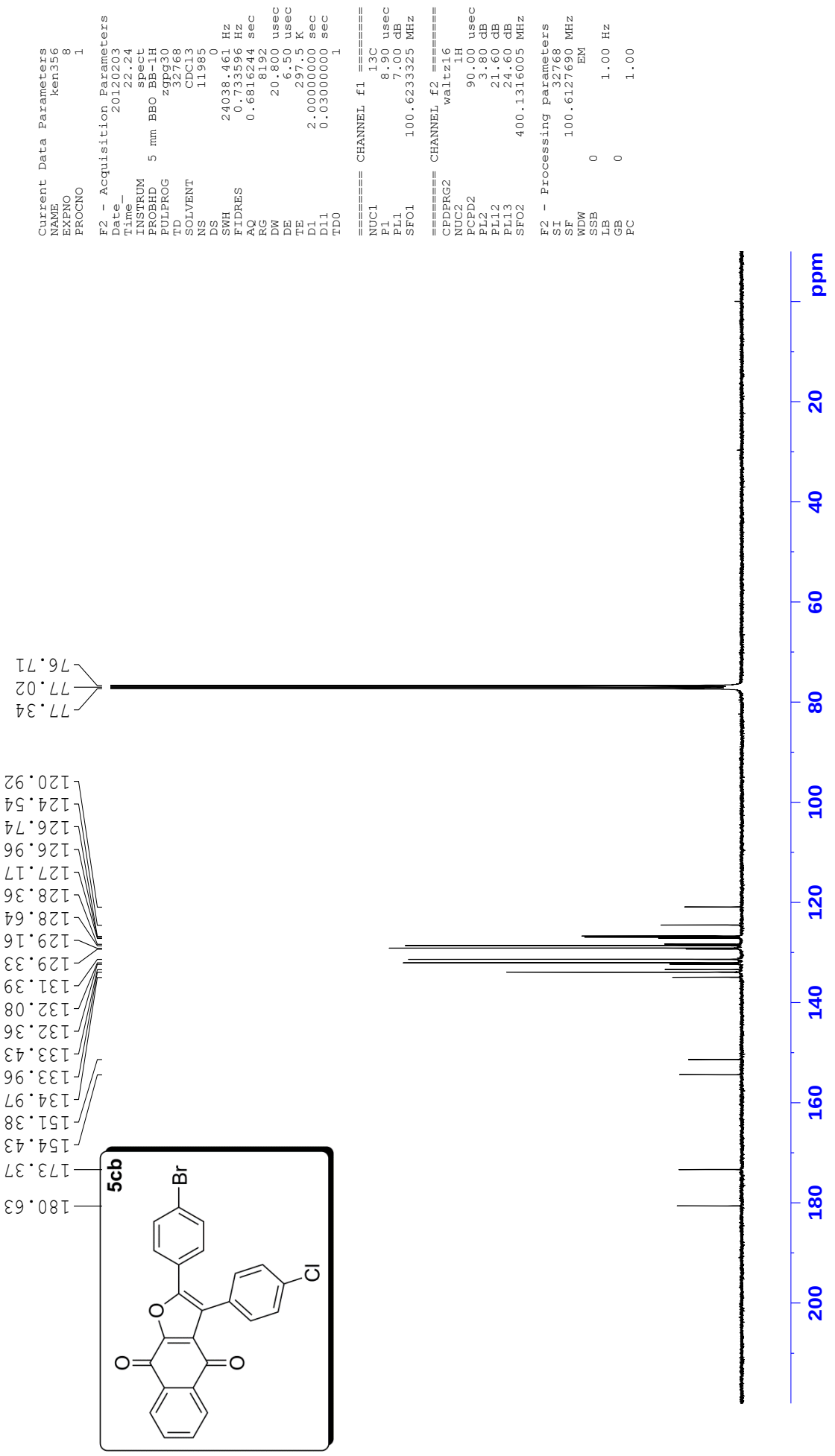

Current Data Parameters
NAME ken395
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111225
Time_ 17.19
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 90.5
DW 69.000 usec
DE 6.50 usec
TE 296.5 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
3.35
7.55
1.01
1.96
1.97
2.05
1.00
1.00
5ai
Br
O
O
O

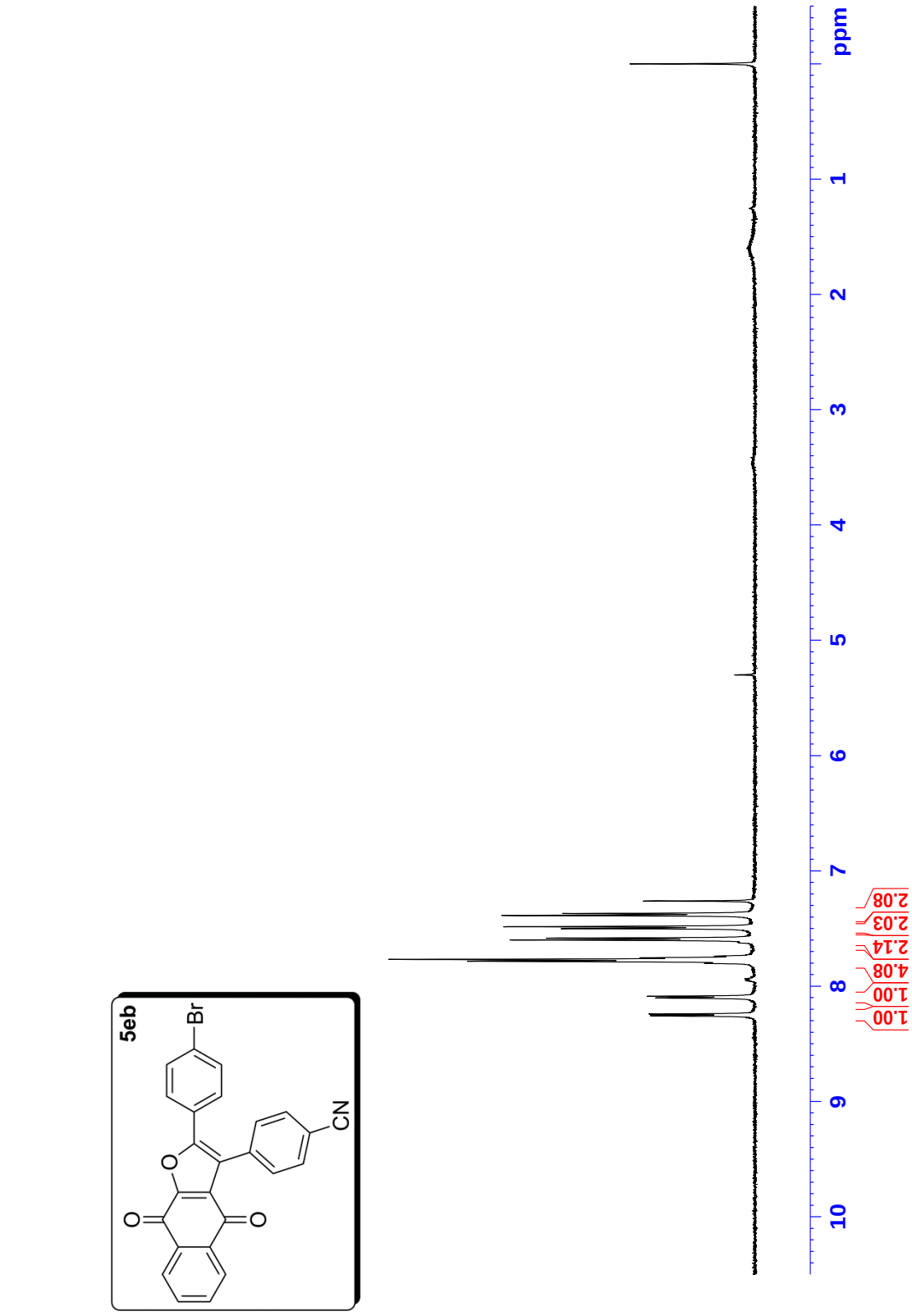

Current Data Parameters
NAME ken395
EXPNO 7
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120520
Time_ 20.10
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 1328
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 299.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127739 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
25.41
25.92
31.21
36.20
77.32
77.00
76.68
119.31
122.42
126.53
126.73
128.23
128.93
131.47
131.50
132.26
133.41
133.63
133.66
151.19
164.45
173.17
180.91
5ai
Br
O
O
O
ppm
20
40
60
80
100
120
140
160
180
200

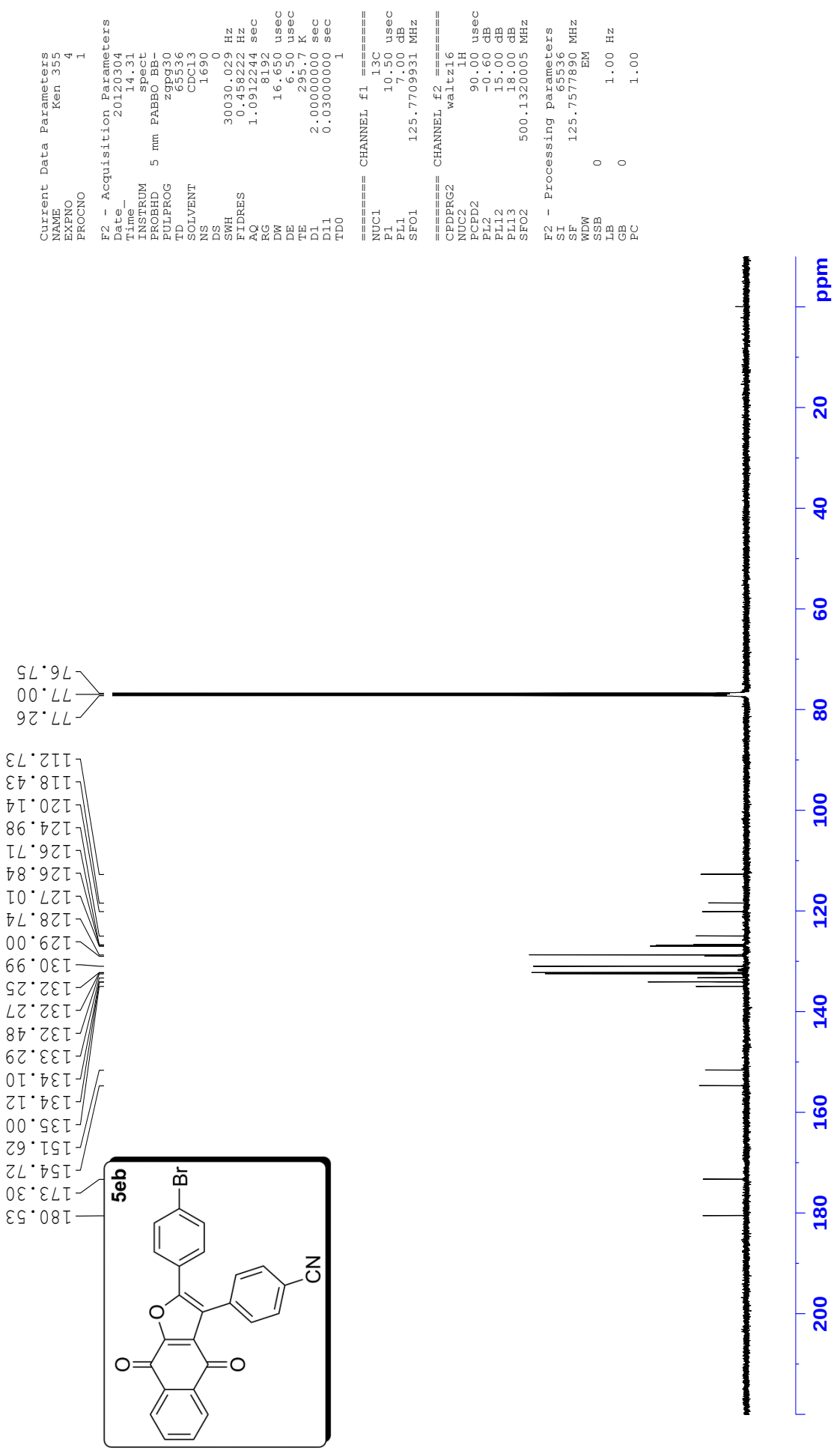

Current Data Parameters
NAME ken372
EXPNO 11
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111222
Time_ 22.47
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 71.8
DW 69.000 usec
DE 6.50 usec
TE 300.3 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5aj
Br
O
O
O
ppm
1
2
3
4
5
6
7
8
9
10
9.14
2.00
2.00
2.08
1.01
1.00


Current Data Parameters
NAME ken372
EXPNO 12
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111222
Time_ 22.51
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 509
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 300.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127748 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
29.67
35.17
76.68
77.00
77.32
118.93
122.37
126.51
126.59
129.67
130.62
131.23
131.80
132.36
133.32
133.58
133.62
149.91
166.05
173.19
180.80
5aj
O
O
O
Br
ppm
20
40
60
80
100
120
140
160
180
200


Current Data Parameters
NAME ken356
EXPNO 6
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111230
Time_ 11.19
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 256
DW 69.000 usec
DE 6.50 usec
TE 300.4 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300084 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
8.16
2.10
0.99
1.00
5cb
Br
Cl
O
O
O


Current Data Parameters
NAME ken356
EXPNO 8
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120203
Time_ 22.24
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 11985
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.68168244 sec
RG 8192
DW 20.800 usec
DE 6.50 usec
TE 297.5 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127690 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
77.34
77.02
76.71
120.92
124.54
126.74
126.96
127.17
128.36
128.64
129.16
129.33
131.39
132.08
132.36
133.43
133.96
134.97
151.38
154.43
173.37
180.63
5cb
Br
Cl
O
O
O
ppm
200
180
160
140
120
100
80
60
40
20


Current Data Parameters
NAME Ken 355
EXPNO 3
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120304
Time 14.28
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 1
DS 0
SWH 9057.971 Hz
FIDRES 0.276427 Hz
AQ 1.8088436 sec
RG 228.1
DW 55.200 usec
DE 6.50 usec
TE 295.3 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 14.00 usec
PL1 0 dB
SFO1 500.1330008 MHz
F2 - Processing parameters
SI 16384
SF 500.1300108 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5eb
Br
CN
O
O
O
ppm
1
2
3
4
5
6
7
8
9
10
1.00
1.00
4.08
2.14
2.03
2.08


Current Data Parameters
NAME Ken 355
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120304
Time_ 14.31
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 1690
DS 0
SWH 30030.029 Hz
FIDRES 0.458222 Hz
AQ 1.0912244 sec
RG 8192
DW 16.650 usec
DE 6.50 usec
TE 295.7 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 10.50 usec
PL1 7.00 dB
SFO1 125.7709931 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 -0.60 dB
PL12 15.00 dB
PL13 18.00 dB
SFO2 500.1320005 MHz
F2 - Processing parameters
SI 65536
SF 125.7577890 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
180.53
173.30
154.72
151.62
135.00
134.12
134.10
133.29
132.48
132.27
132.25
130.99
129.00
128.74
127.01
126.84
126.71
124.98
120.14
118.43
112.73
77.26
77.00
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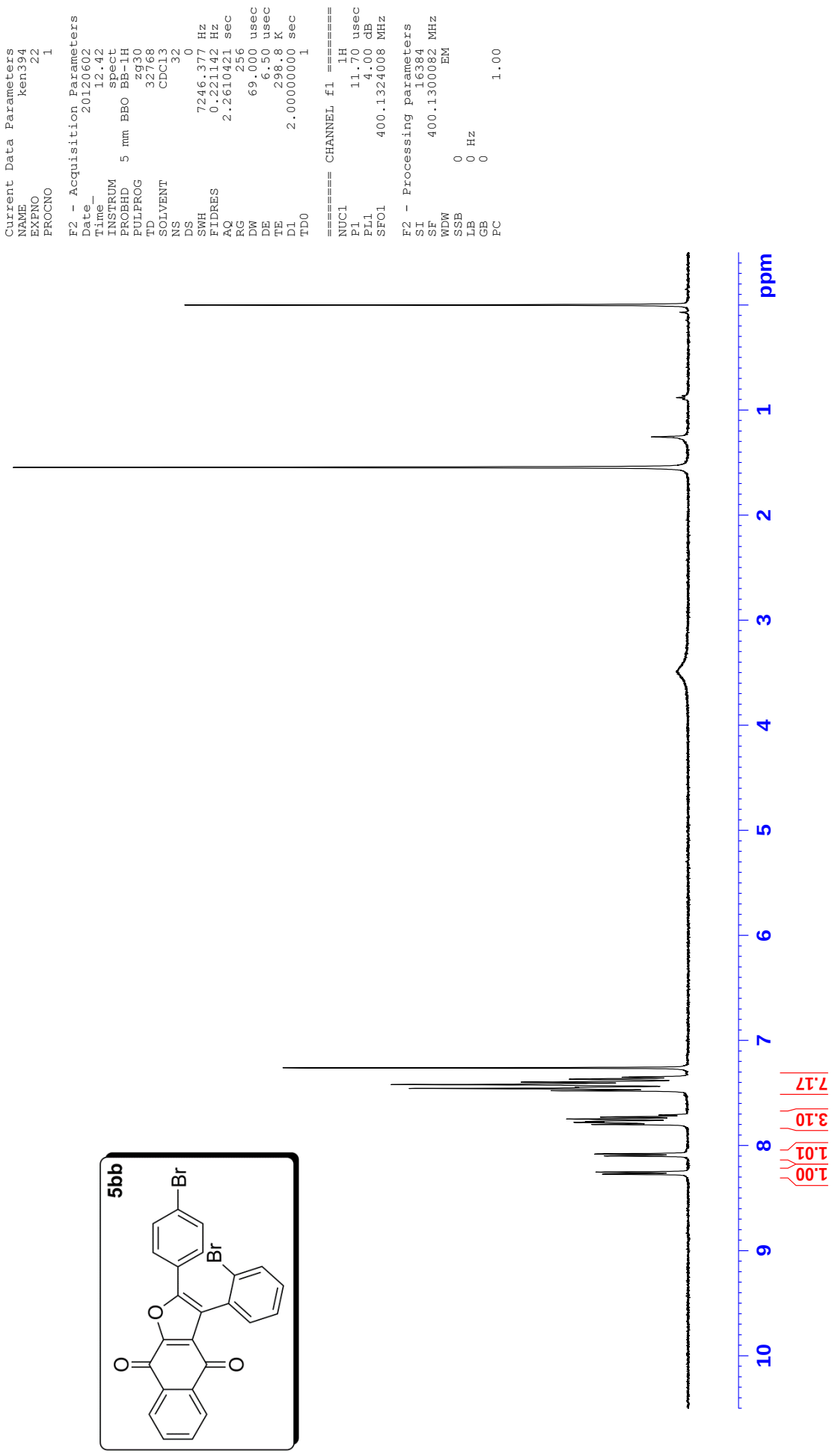
5eb
Br
CN
O
O
O
ppm
200
180
160
140
120
100
80
60
40
20


Current Data Parameters
NAME ken394
EXPNO 22
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120602
Time 12.42
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 32
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 256
DW 69.000 usec
DE 6.50 usec
TE 298.8 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300082 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5bb
Br
Br
O
O
O
ppm
1
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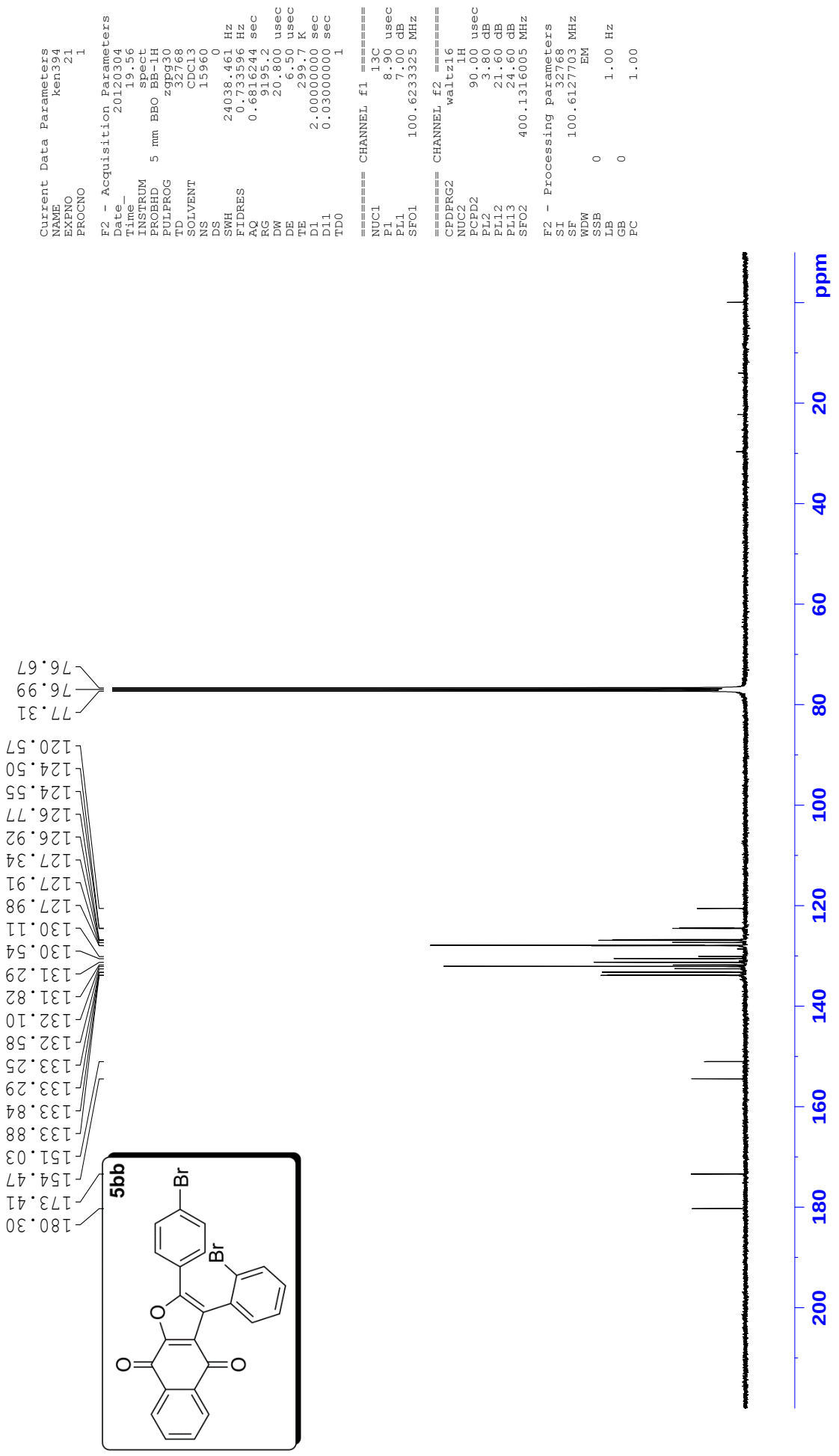
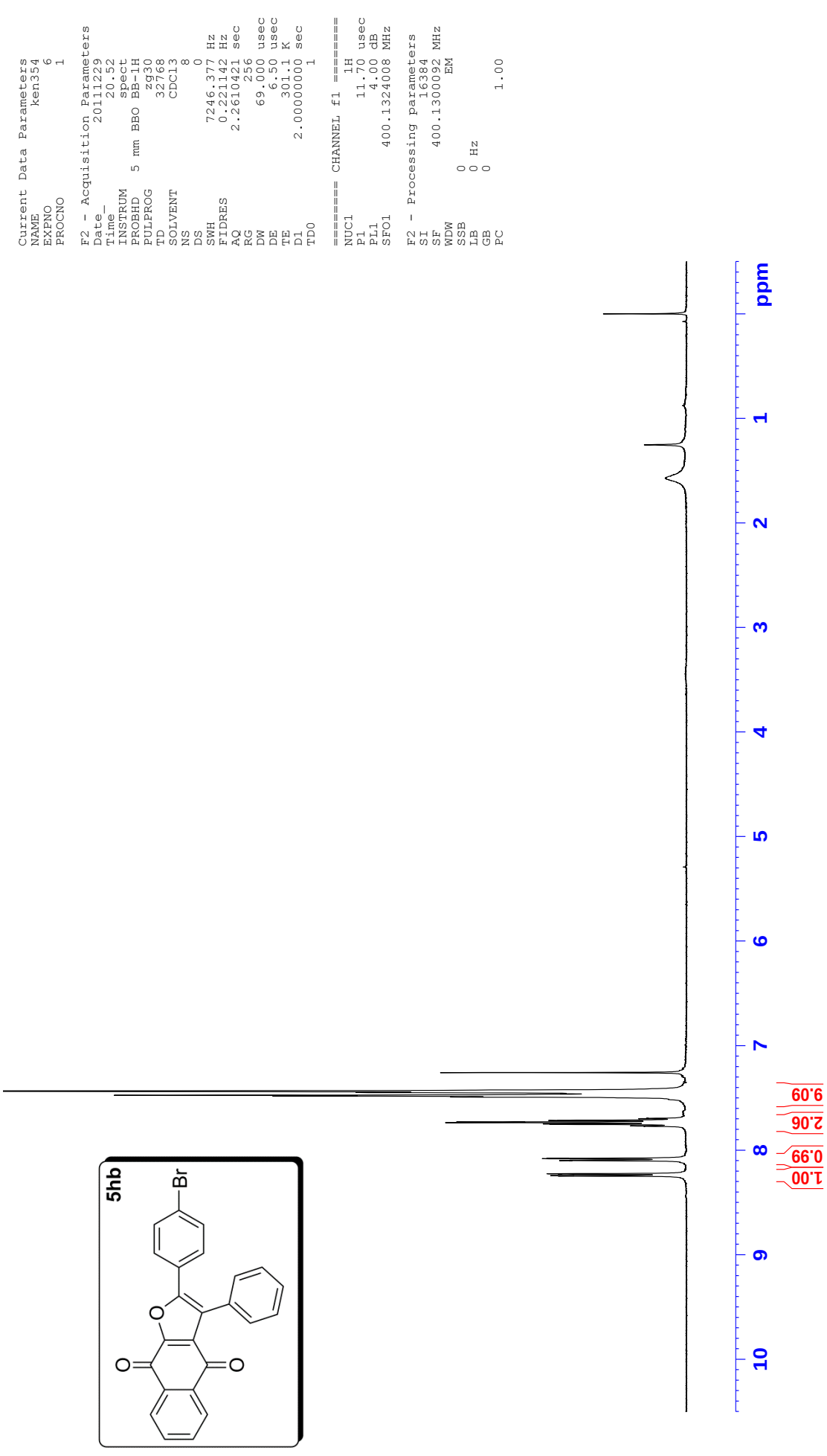
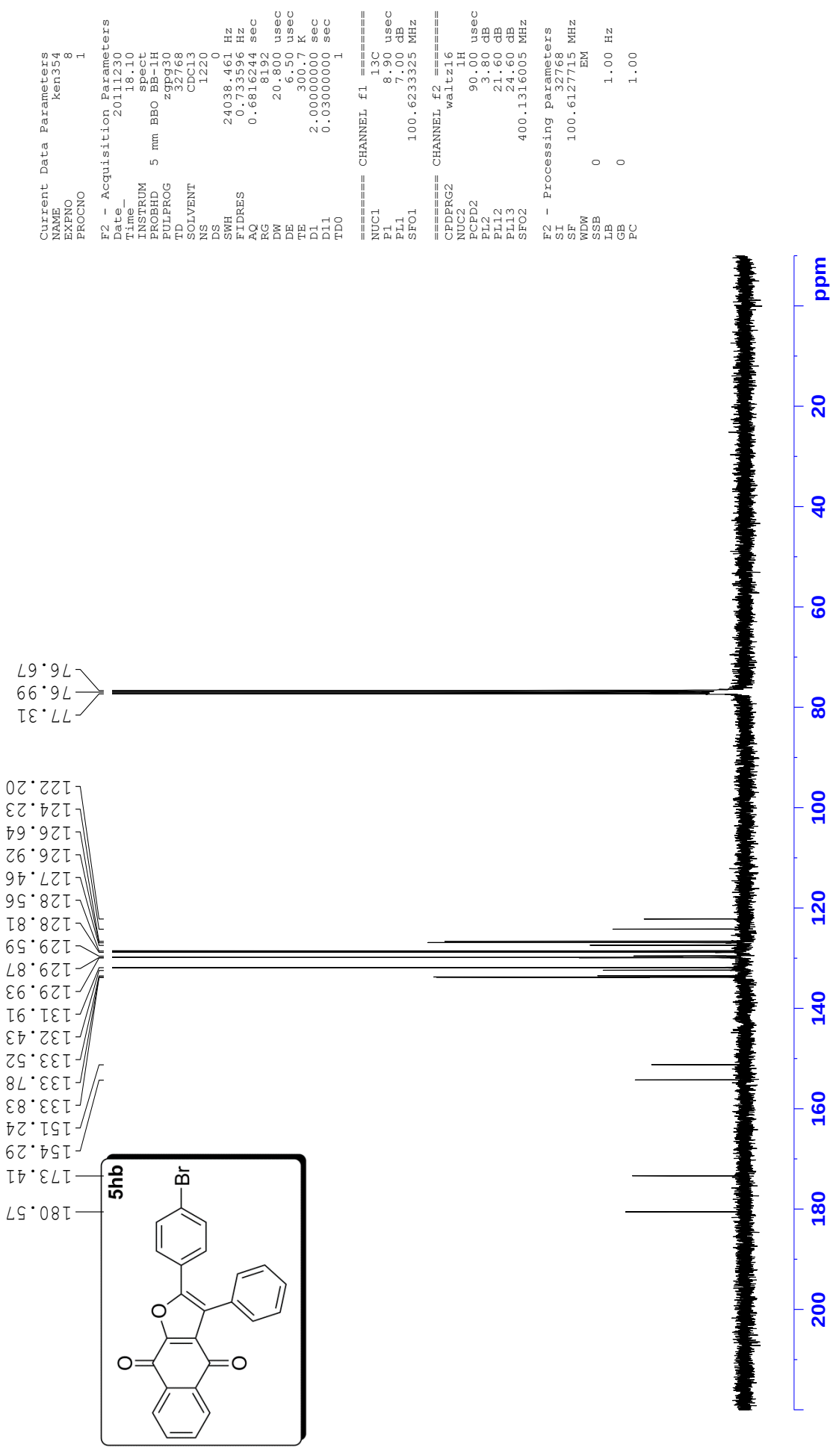
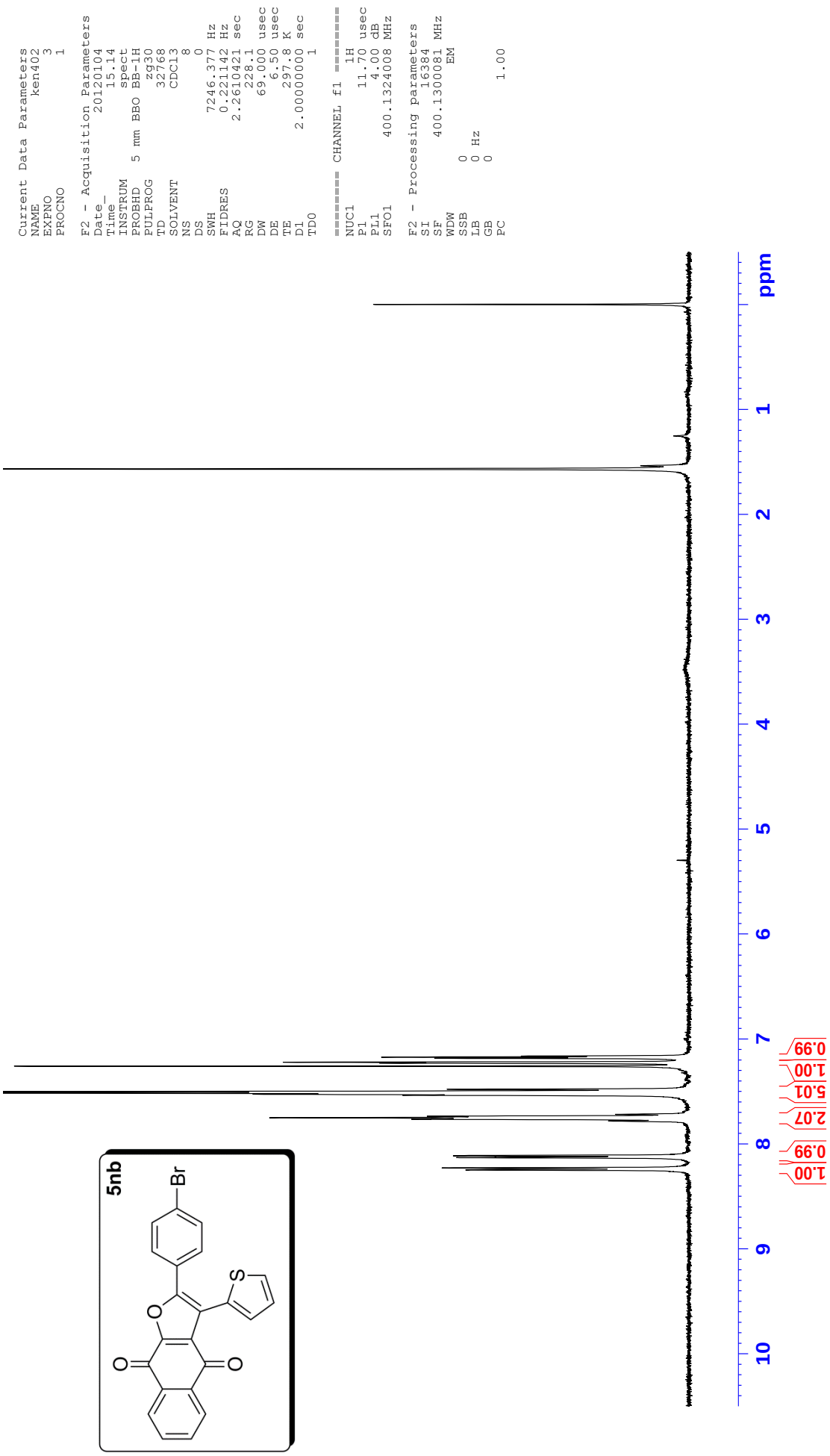
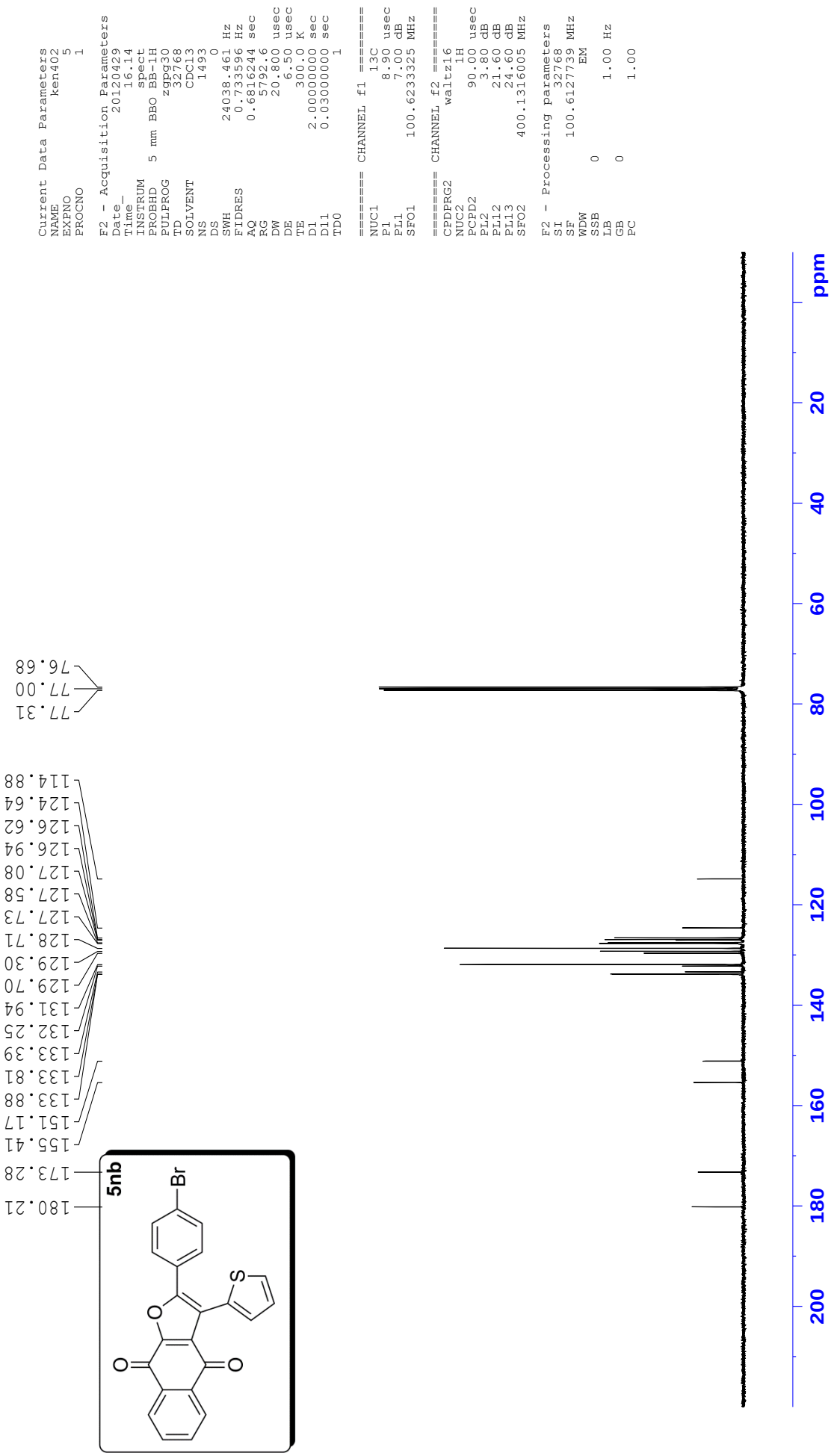
8
9
10
7.17
3.10
1.01
1.00

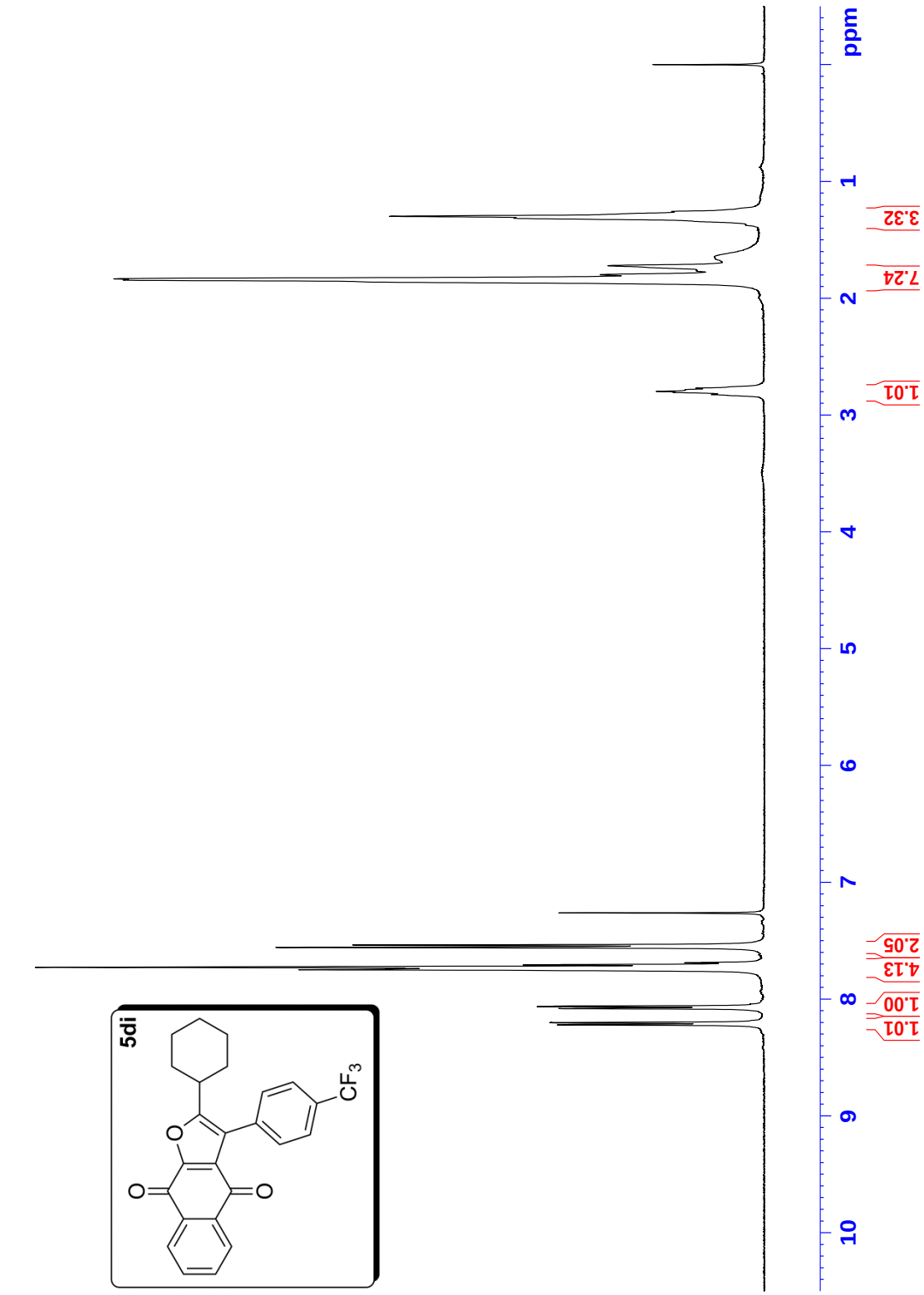

Current Data Parameters
NAME ken394
EXPNO 21
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120304
Time_ 19.56
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 15960
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6818244 sec
RG 9195.2
DW 20.800 usec
DE 6.50 usec
TE 299.7 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127703 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
77.31
76.99
76.67
120.57
124.50
124.55
126.77
126.92
127.34
127.91
127.98
130.11
130.54
131.29
131.82
132.10
132.58
133.25
133.29
133.84
133.88
151.03
154.47
173.41
180.30
5bb
Br
Br
O
O
O
ppm
200
180
160
140
120
100
80
60
40
20




Current Data Parameters
NAME ken354
EXPNO 8
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111230
Time_ 18.10
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 1220
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 8192
DW 20.800 usec
DE 6.50 usec
TE 300.7 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127715 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
77.31
76.99
76.67
122.20
124.23
126.64
126.92
127.46
128.56
128.81
129.59
129.87
129.93
131.91
132.43
133.52
133.78
133.83
151.24
154.29
173.41
180.57
5hb
Br
O
O
O
ppm
200
180
160
140
120
100
80
60
40
20


Current Data Parameters
NAME ken402
EXPNO 3
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120104
Time_ 15.14
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 228.1
DW 69.000 usec
DE 6.50 usec
TE 297.8 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300081 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
0.99
1.00
5.01
2.07
0.99
1.00
5nb
Br
S
O
O
O


Current Data Parameters
NAME ken402
EXPNO 5
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120429
Time_ 16.14
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 1493
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 5792.6
DW 20.800 usec
DE 6.50 usec
TE 300.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127739 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
180.21
173.28
155.41
151.17
133.88
133.81
133.39
132.25
131.94
129.70
129.30
128.71
127.73
127.58
127.08
126.94
126.62
124.64
114.88
77.31
77.00
76.68
5nb
Br
S
O
O
O
ppm
200
180
160
140
120
100
80
60
40
20


Current Data Parameters
NAME ken358
EXPNO 8
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111011
Time 12.08
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 128
DW 69.000 usec
DE 6.50 usec
TE 299.2 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300067 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5di
CF3
O
O
O
ppm
1
2
3
4
5
6
7
8
9
10
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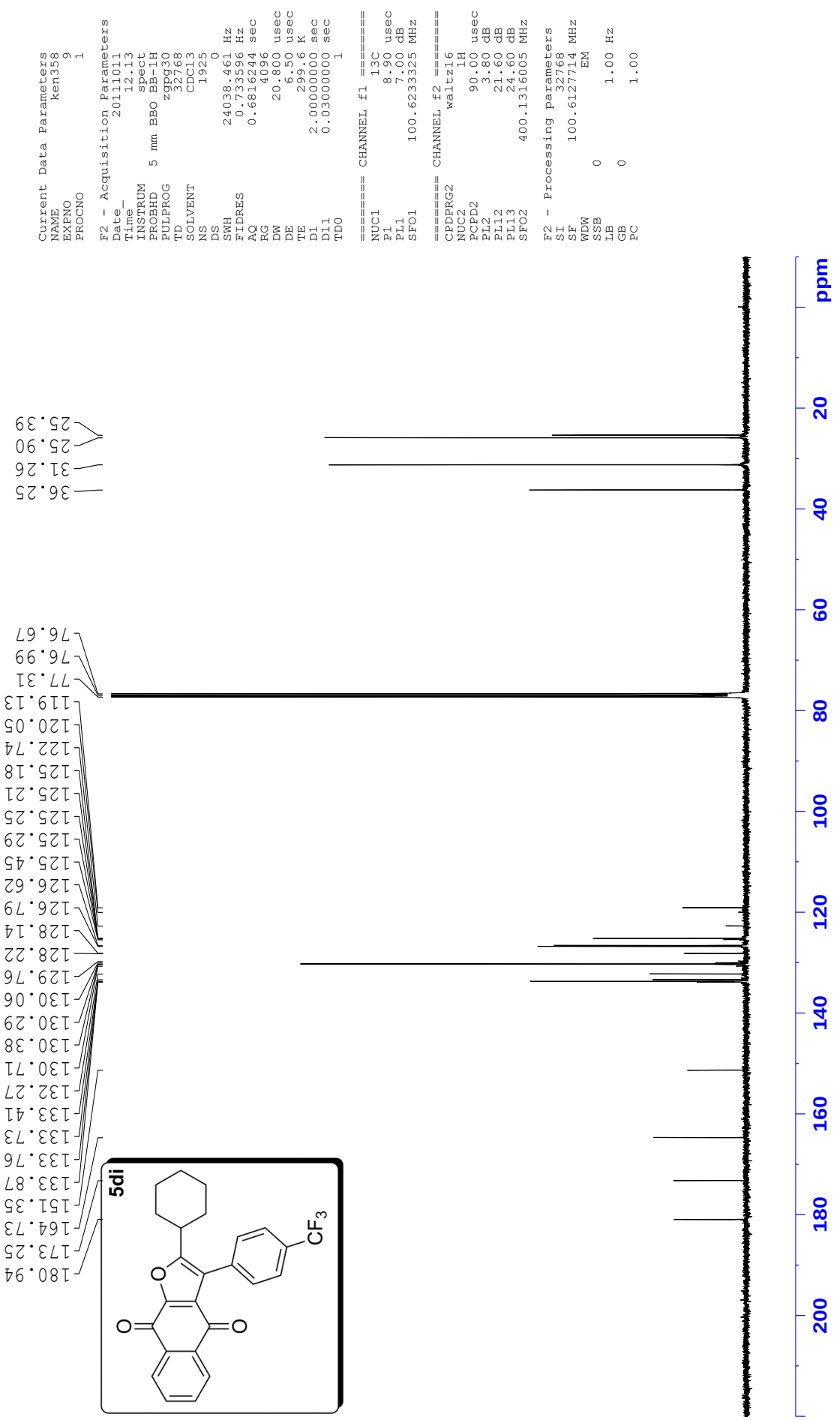
7.24
1.01
2.05
4.13
1.00
1.01


Current Data Parameters
NAME ken358
EXPNO 9
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111011
Time_ 12.13
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 1925
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 299.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127714 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
25.39
25.90
31.26
36.25
76.67
76.99
77.31
119.13
120.05
122.74
125.18
125.21
125.25
125.29
125.45
126.62
126.79
128.14
128.22
129.76
130.06
130.29
130.38
130.71
132.27
133.41
133.73
133.76
133.87
151.35
164.73
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CF3
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O
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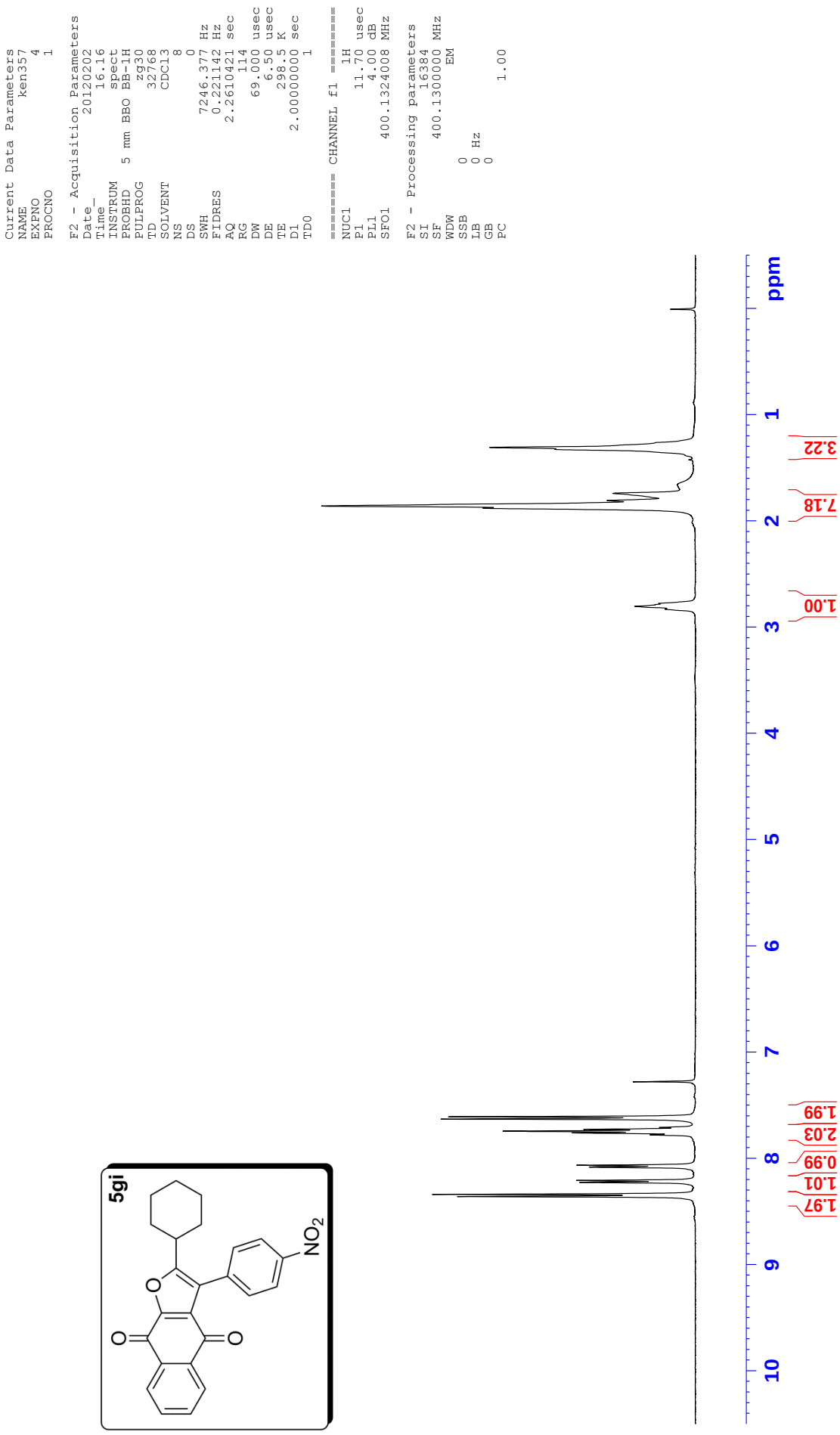
180
200


Current Data Parameters
NAME ken357
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120202
Time 16.16
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 114
DW 69.000 usec
DE 6.50 usec
TE 298.5 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5gi
O
O
O
NO2
ppm
1
2
3
4
5
6
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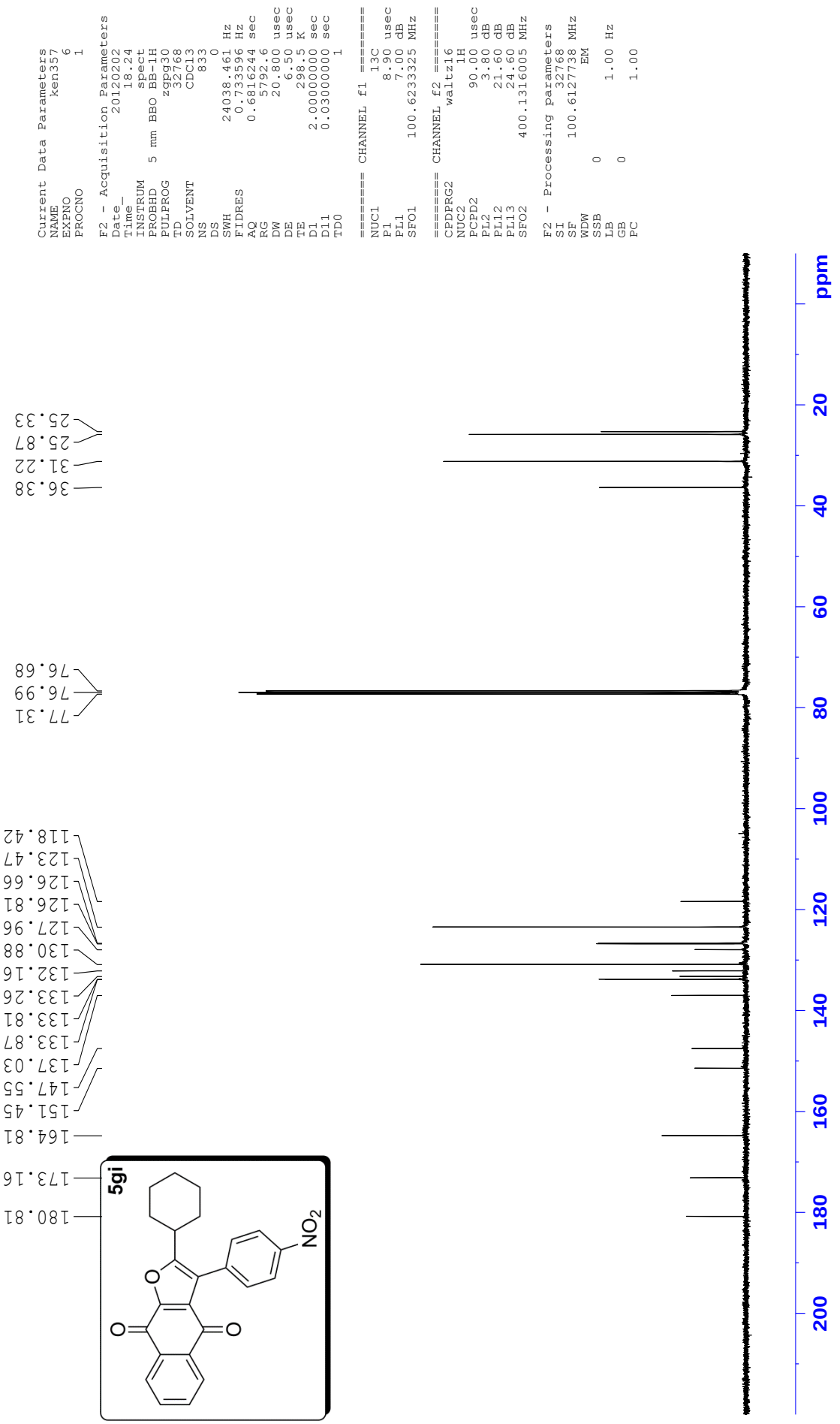
8
9
10
3.22
7.18
1.00
1.99
2.03
0.99
1.01
1.97


Current Data Parameters
NAME ken357
EXPNO 6
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120202
Time_ 18.24
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 833
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 5792.6
DW 20.800 usec
DE 6.50 usec
TE 298.5 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127738 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
25.33
25.87
31.22
36.38
76.68
76.99
77.31
118.42
123.47
126.66
126.81
127.96
130.88
132.16
133.26
133.81
133.87
137.03
147.55
151.45
164.81
173.16
180.81
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O
O
O
NO2
ppm
200
180
160
140
120
100
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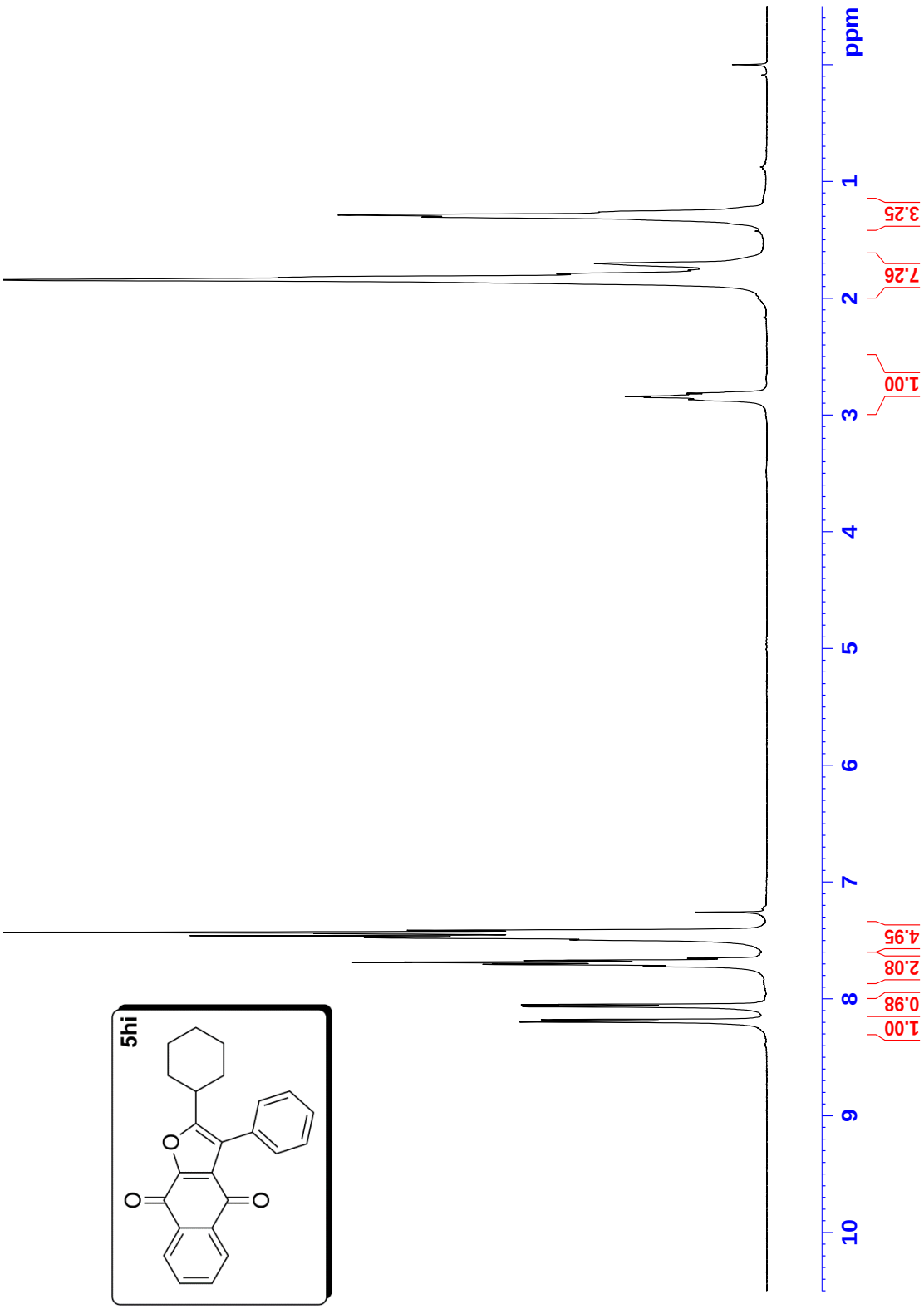
60
40
20


Current Data Parameters
NAME ken360
EXPNO 7
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111230
Time_ 17.33
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 64
DW 69.000 usec
DE 6.50 usec
TE 300.2 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300082 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5hi
ppm
1
2
3
4
5
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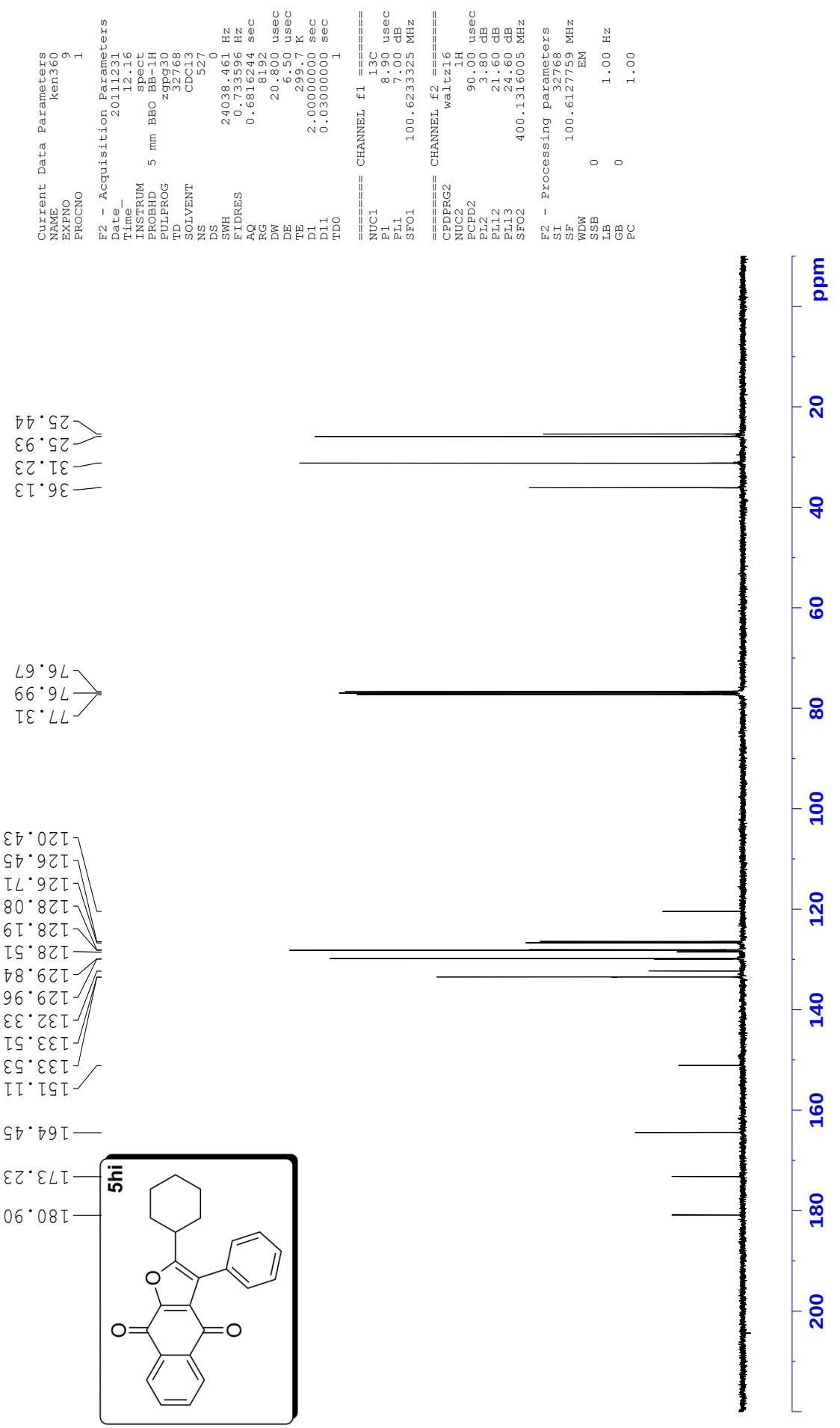
7.26
1.00
4.95
2.08
0.98
1.00


Current Data Parameters
NAME ken360
EXPNO 9
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111231
Time_ 12.16
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 527
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 8192
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 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
========== CHANNEL f2 ==========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127759 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
25.44
25.93
31.23
36.13
76.67
76.99
77.31
120.43
126.45
126.71
128.08
128.19
128.51
129.84
129.96
132.33
133.51
133.53
151.11
164.45
173.23
180.90
5hi
ppm
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80
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120
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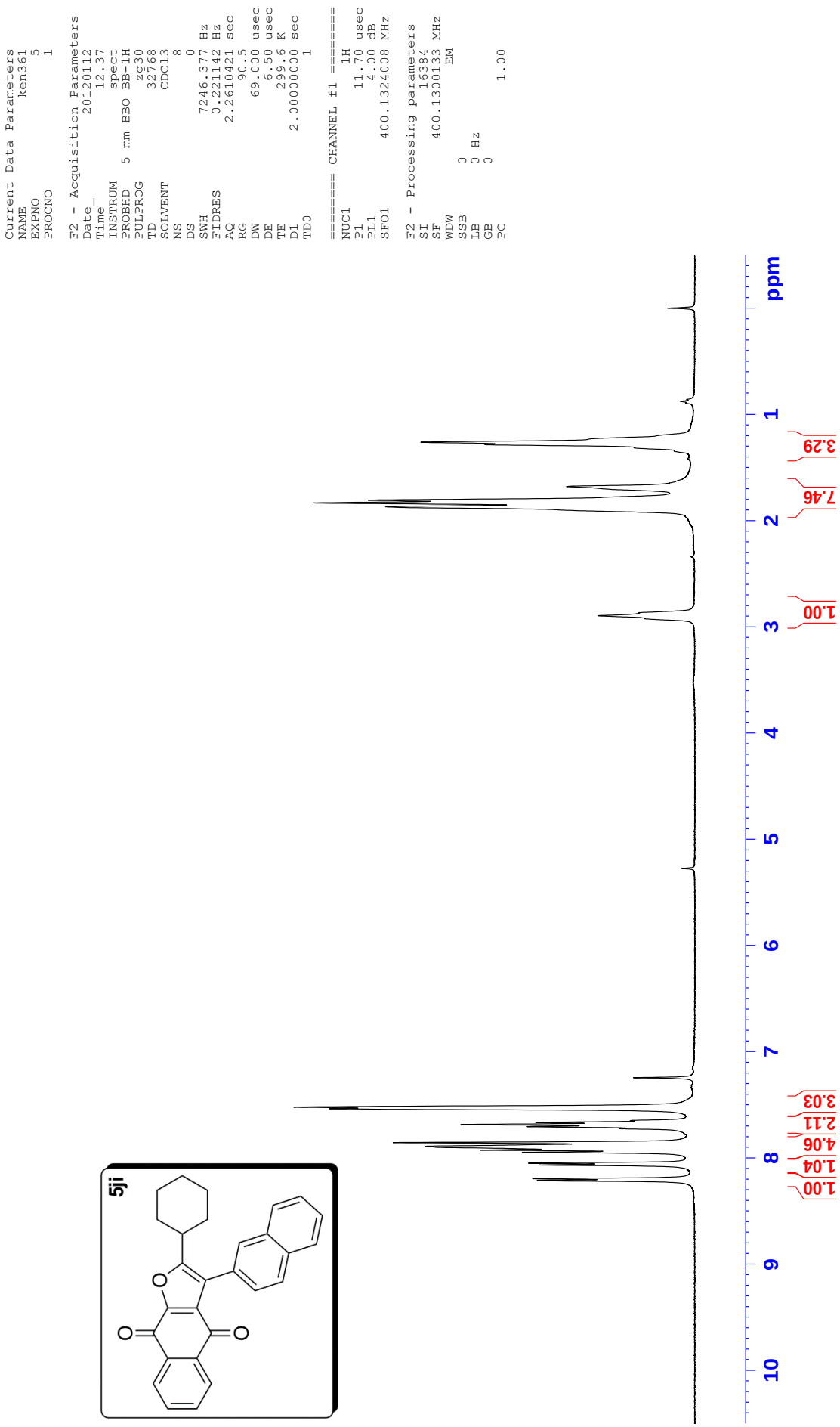
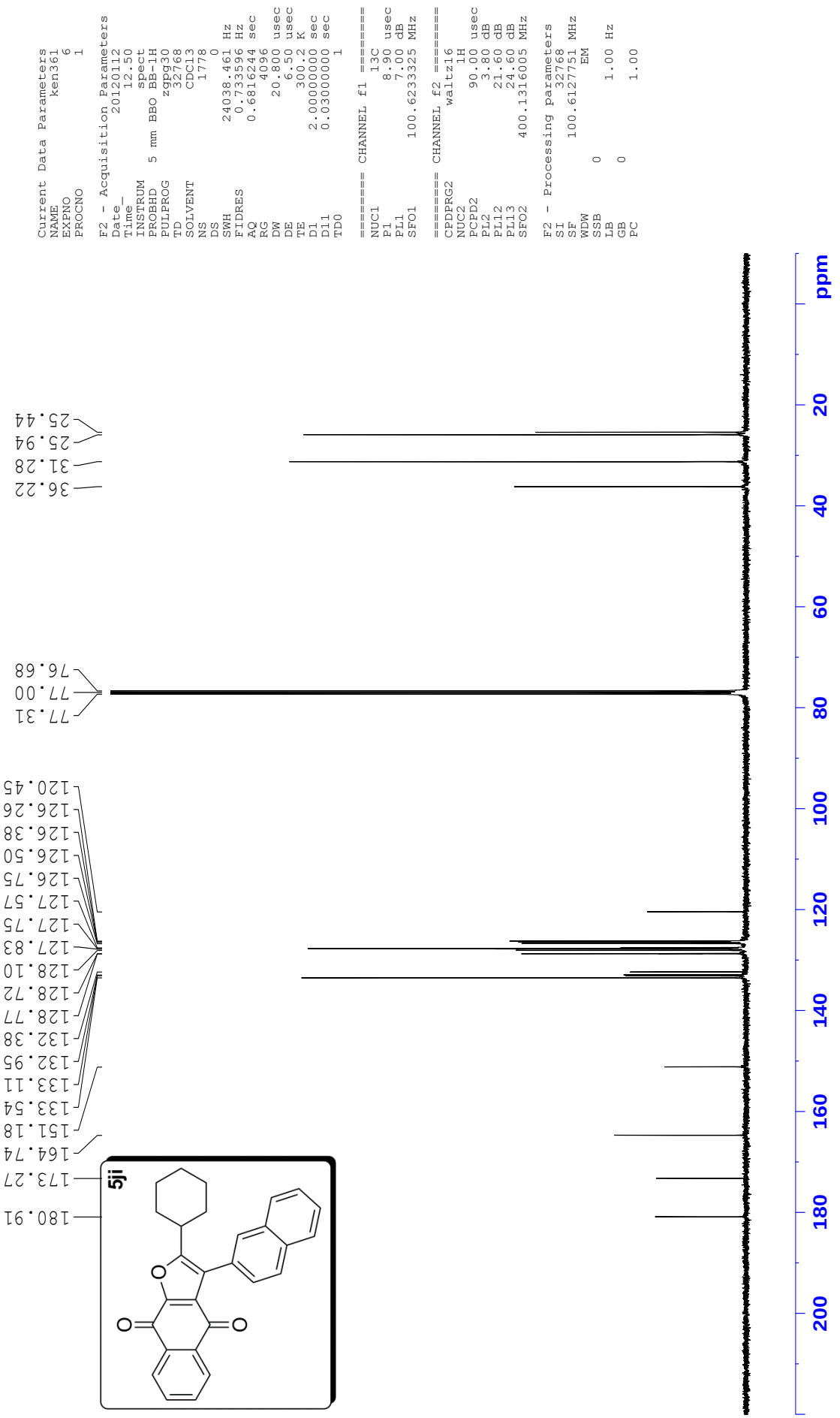
160
180
200


Current Data Parameters
NAME ken361
EXPNO 5
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120112
Time 12.37
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 90.5
DW 69.000 usec
DE 6.50 usec
TE 299.6 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300133 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5ji
ppm
1
2
3
4
5
6
7
8
9
10
3.29
7.46
1.00
3.03
2.11
4.06
1.04
1.00


Current Data Parameters
NAME ken361
EXPNO 6
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120112
Time_ 12.50
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 1778
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 300.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127751 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
25.44
25.94
31.28
36.22
76.68
77.00
77.31
120.45
126.26
126.38
126.50
126.75
127.57
127.75
127.83
128.10
128.72
128.77
132.38
132.95
133.11
133.54
151.18
164.74
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5ji
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O
O
ppm
200
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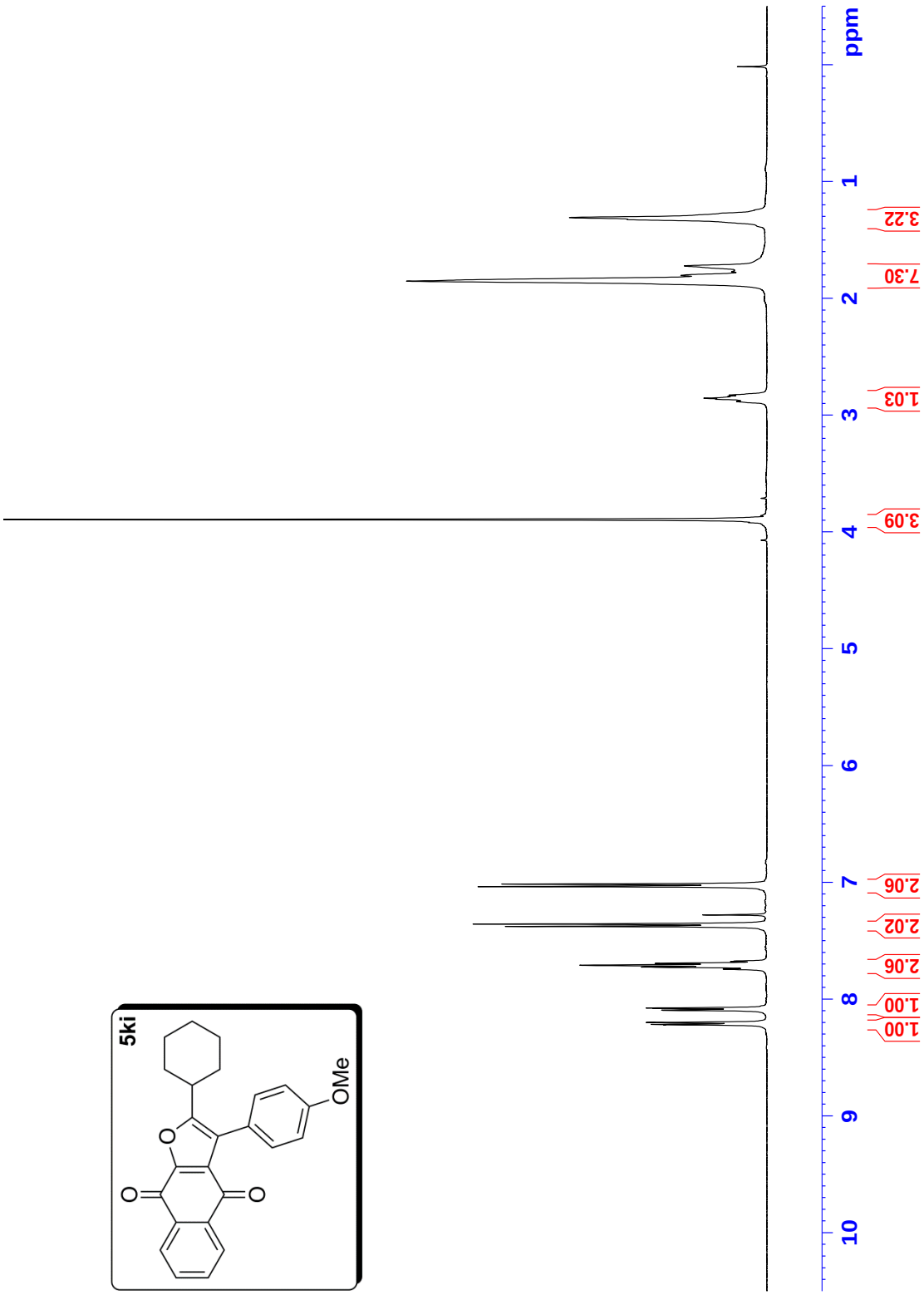
160
140
120
100
80
60
40
20


Current Data Parameters
NAME ken362
EXPNO 8
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120112
Time_ 12.03
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 90.5
DW 69.000 usec
DE 6.50 usec
TE 299.3 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5ki
OMe
O
O
O
ppm
1
2
3
4
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3.09
2.06
2.02
2.06
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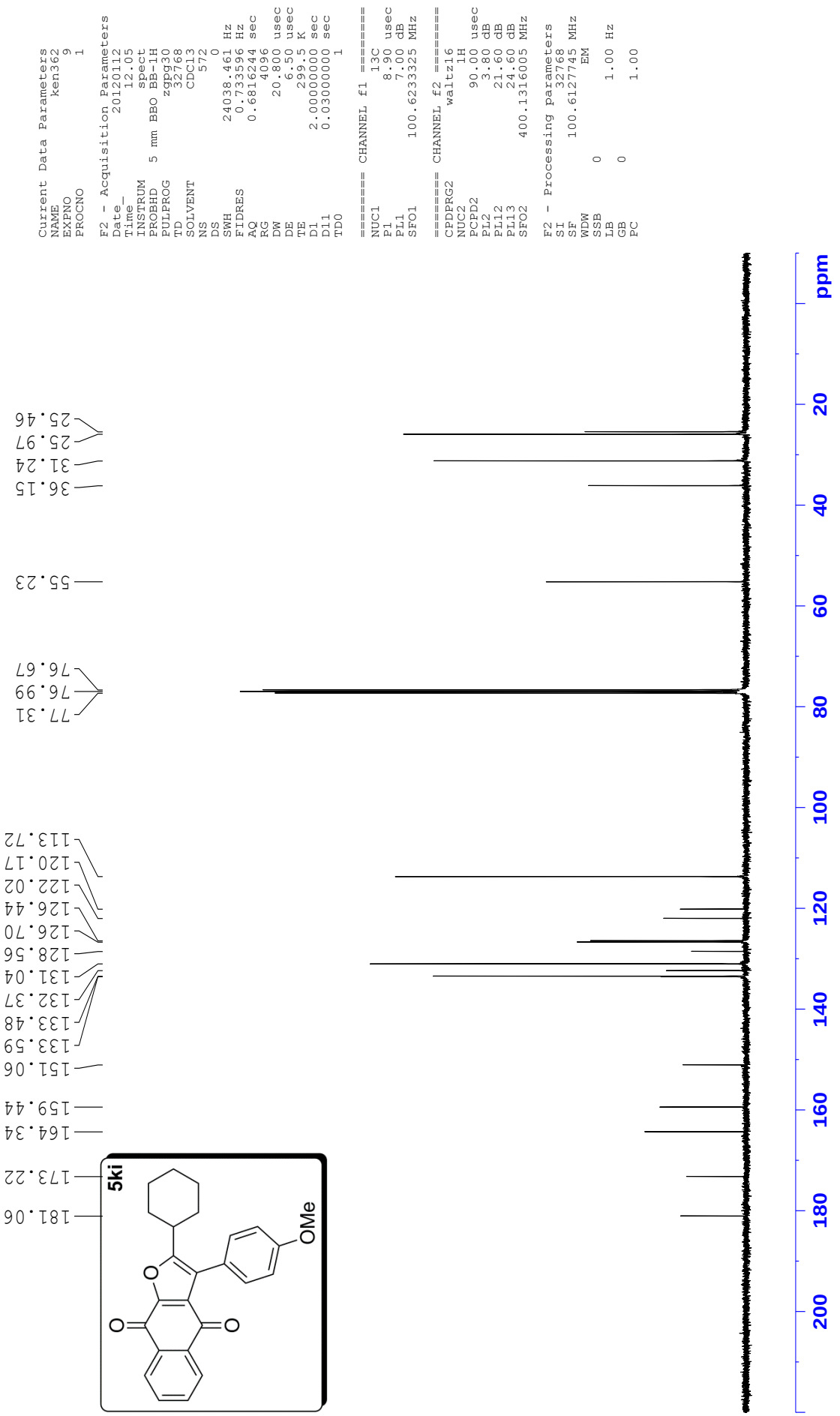
1.00


Current Data Parameters
NAME ken362
EXPNO 9
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120112
Time_ 12.05
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 572
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 299.5 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
========== CHANNEL f1 ==========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
========== CHANNEL f2 ==========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127745 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
25.46
25.97
31.24
36.15
55.23
76.67
76.99
77.31
113.72
120.17
122.02
126.44
126.70
128.56
131.04
132.37
133.48
133.59
151.06
159.44
164.34
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5ki
OMe
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O
O
ppm
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40
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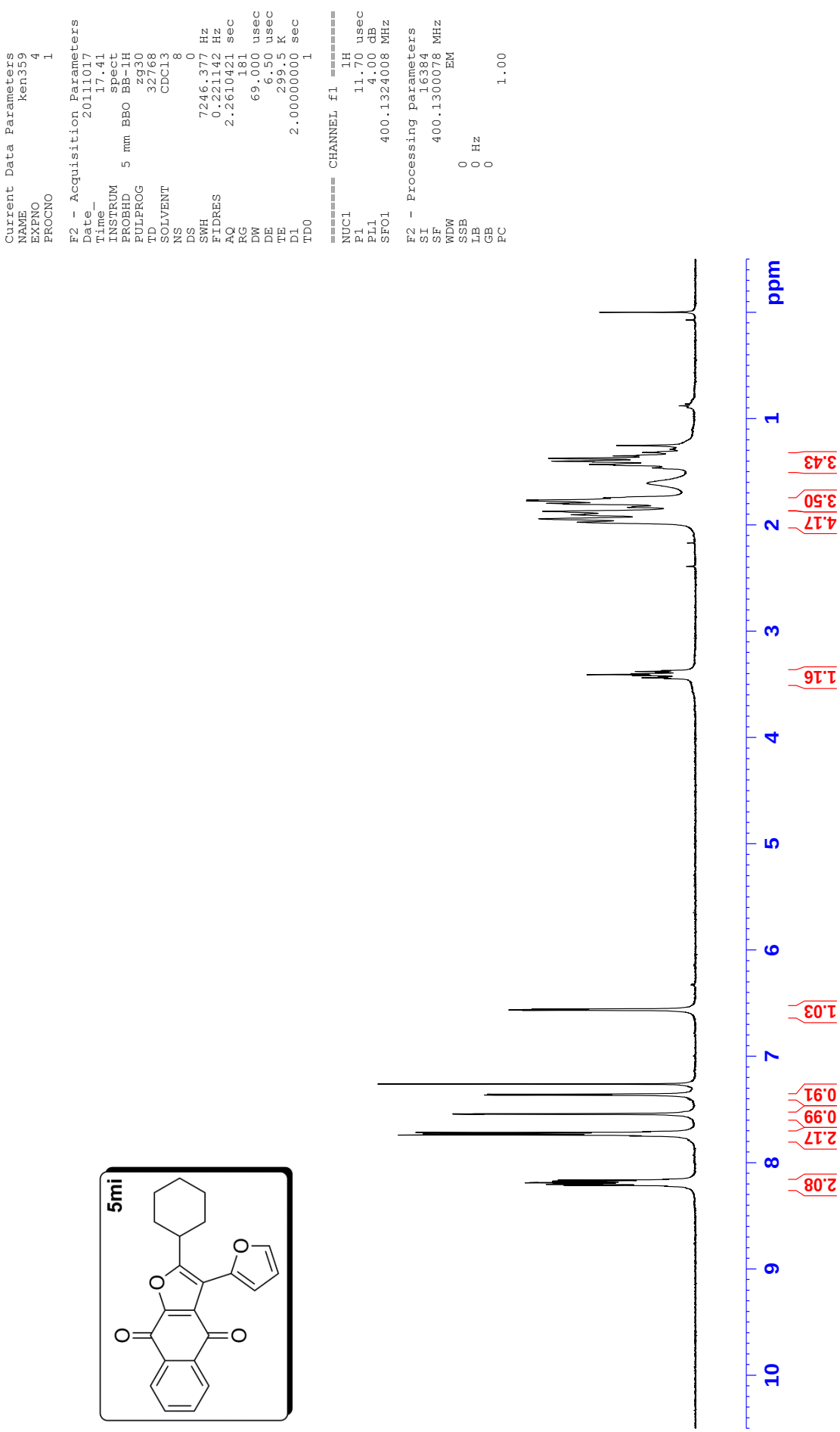
Current Data Parameters
NAME ken359
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111017
Time 17.41
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 181
DW 69.000 usec
DE 6.50 usec
TE 299.5 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300078 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5mi
ppm
1
2
3
4
5
6
7
8
9
10
3.43
3.50
4.17
1.16
1.03
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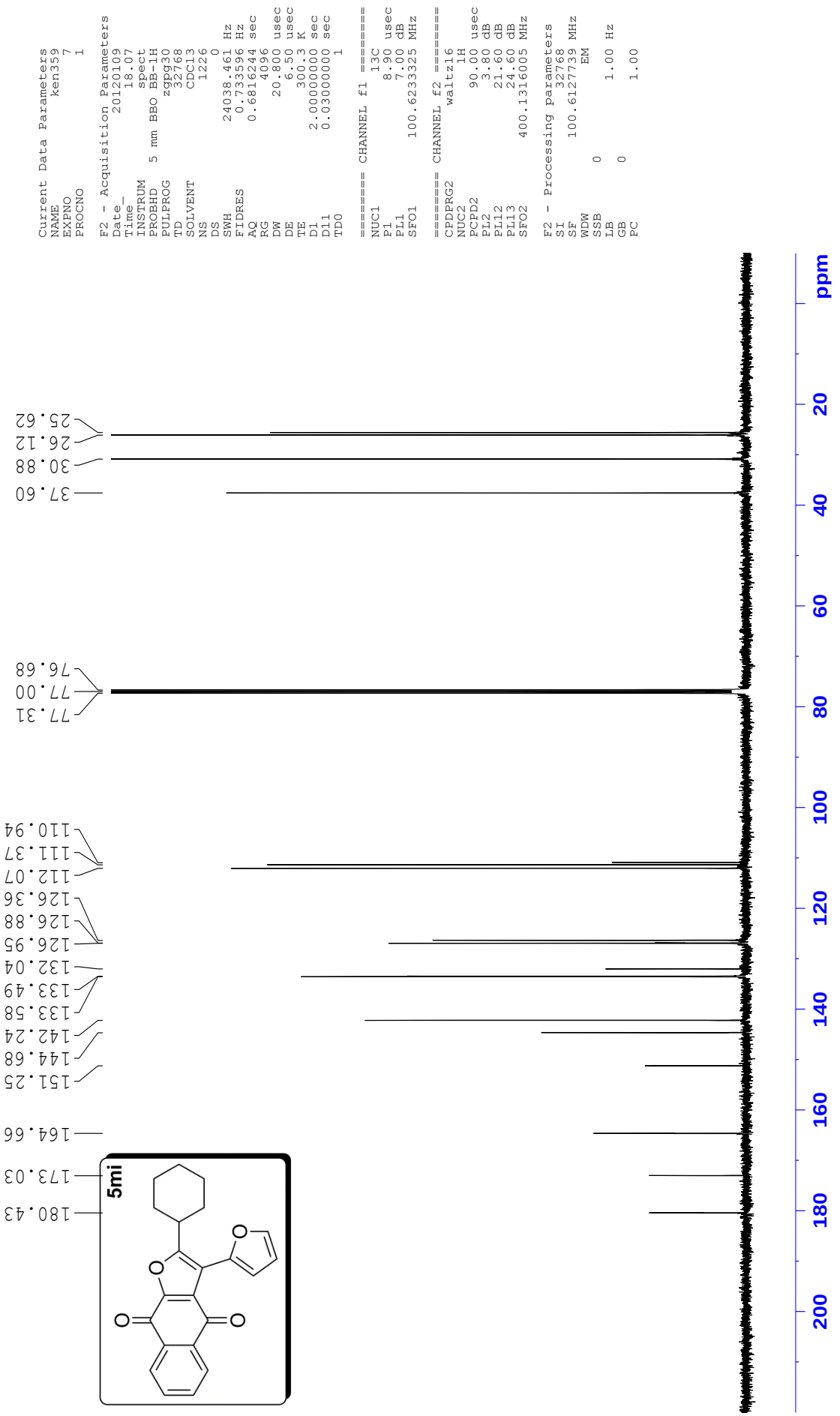
2.17
2.08


Current Data Parameters
NAME ken359
EXPNO 7
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120109
Time_ 18.07
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 1226
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 300.3 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127739 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
25.62
26.12
30.88
37.60
76.68
77.00
77.31
110.94
111.37
112.07
126.36
126.88
126.95
132.04
133.49
133.58
142.24
144.68
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164.66
173.03
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5mi
ppm
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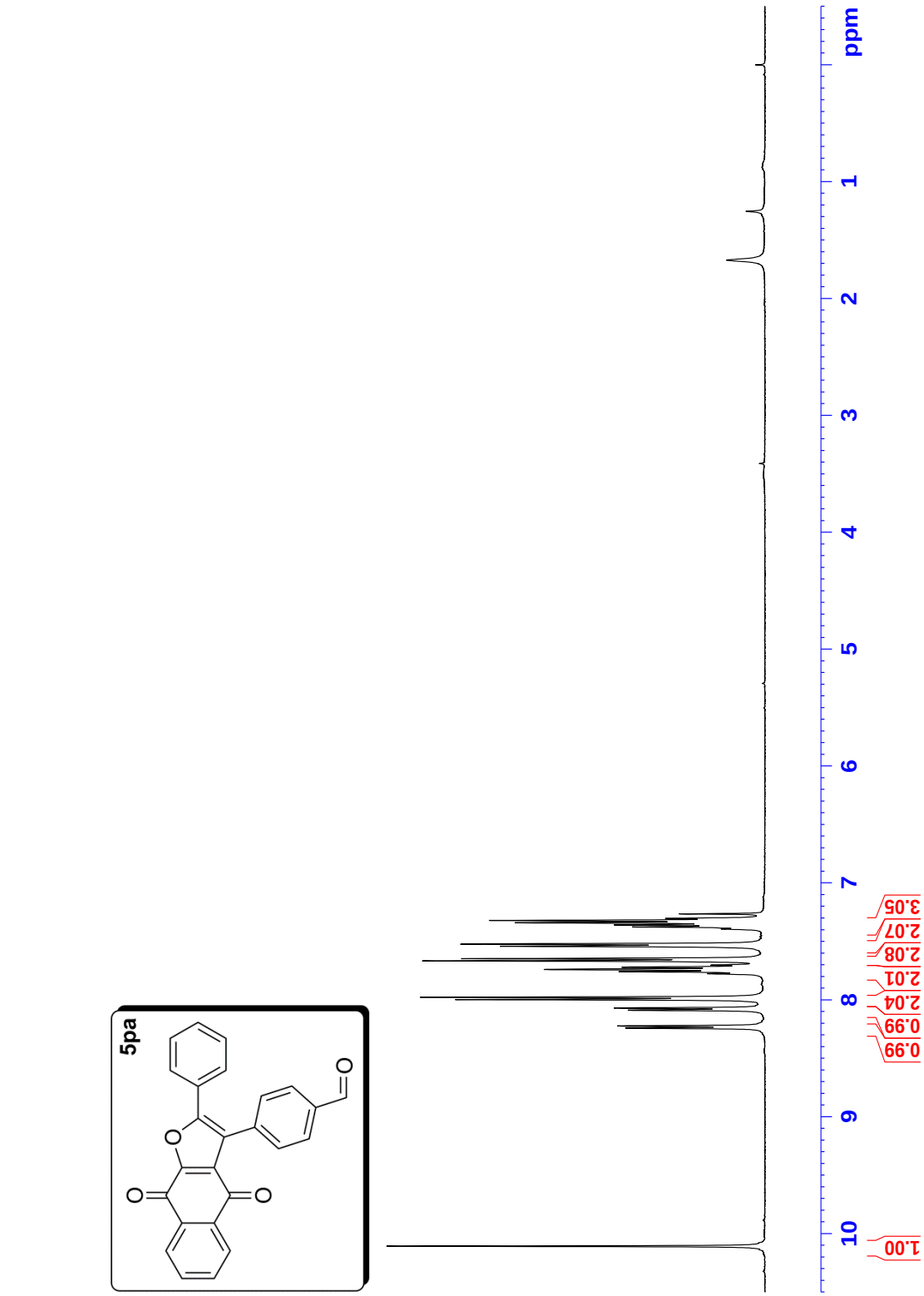
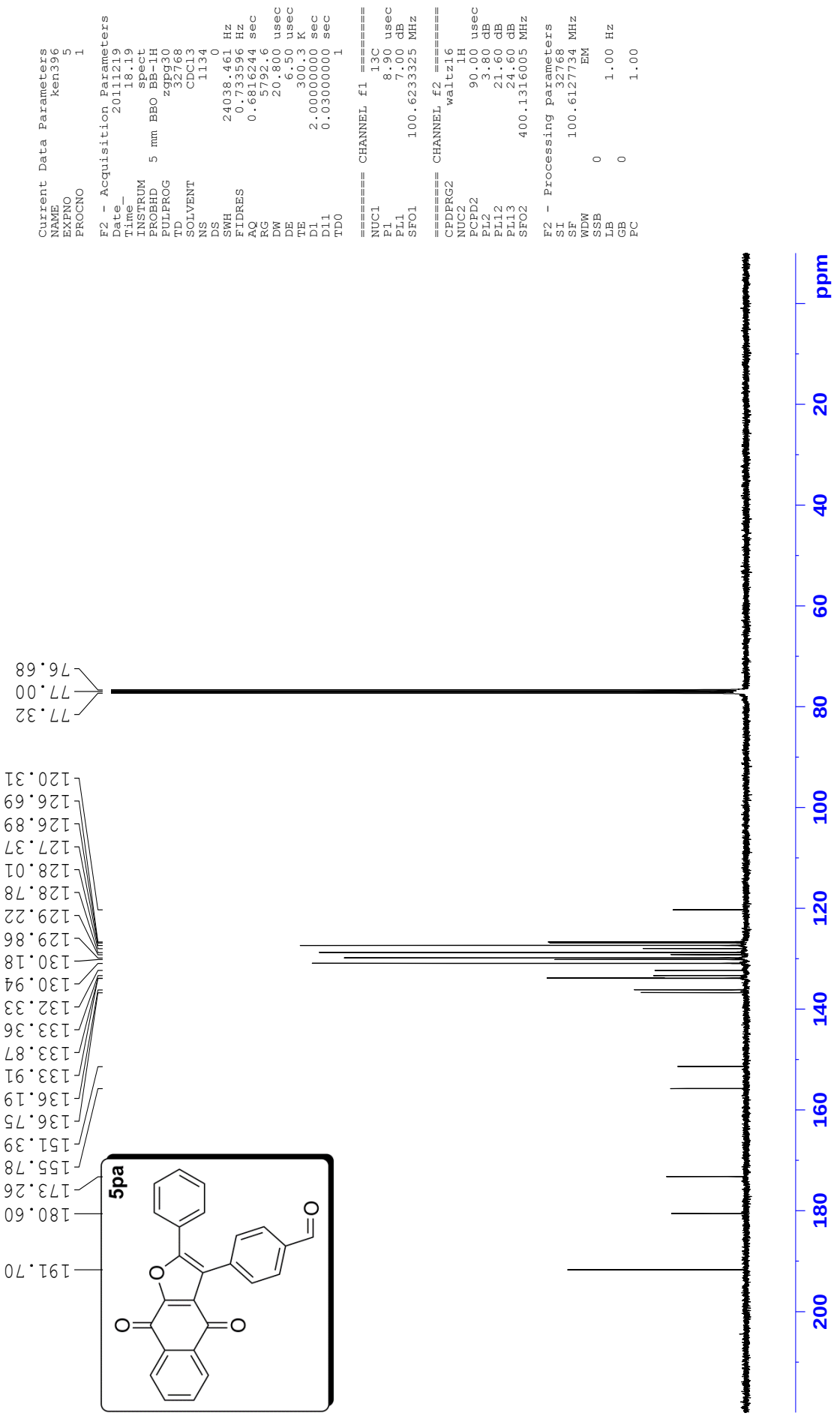
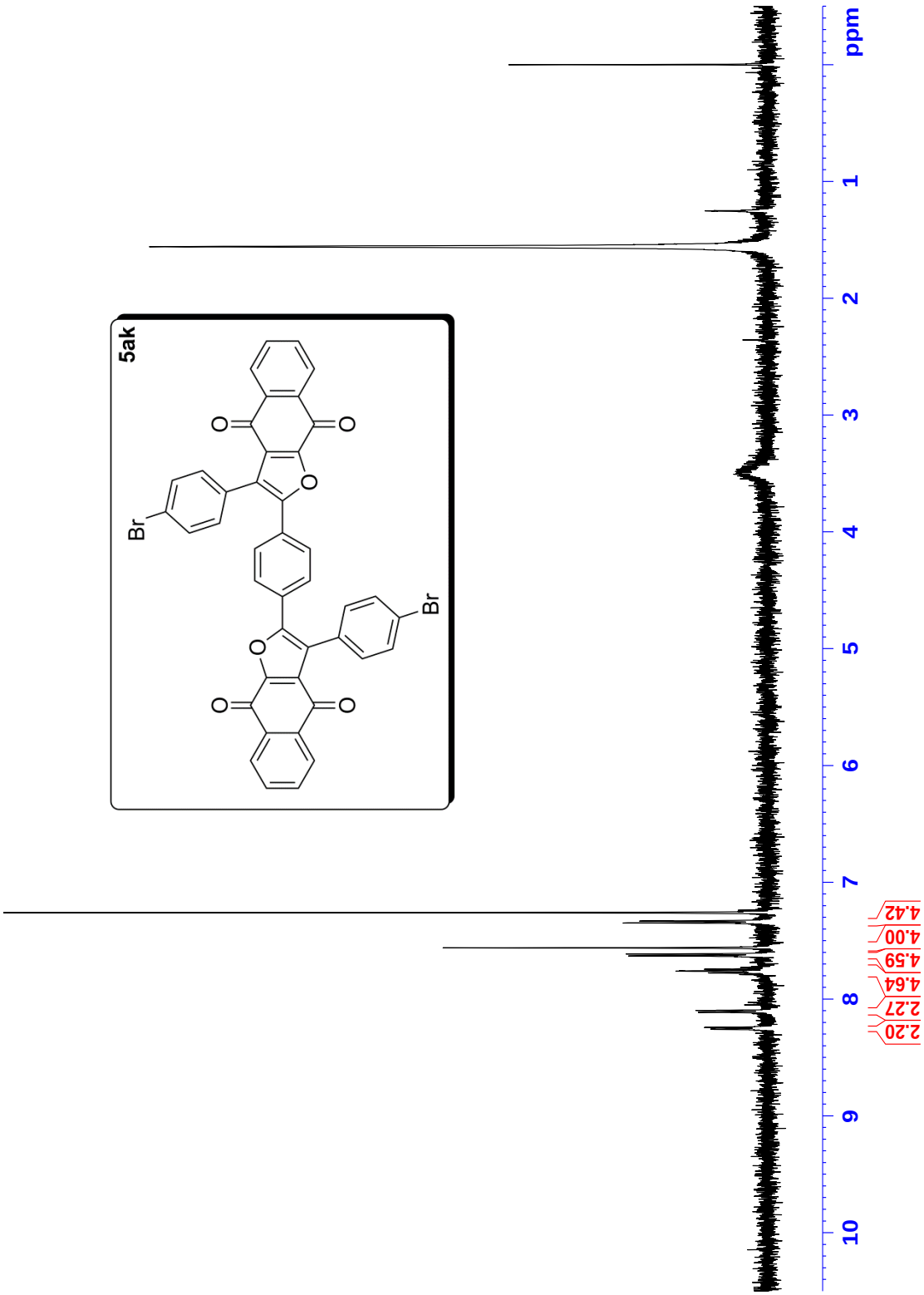
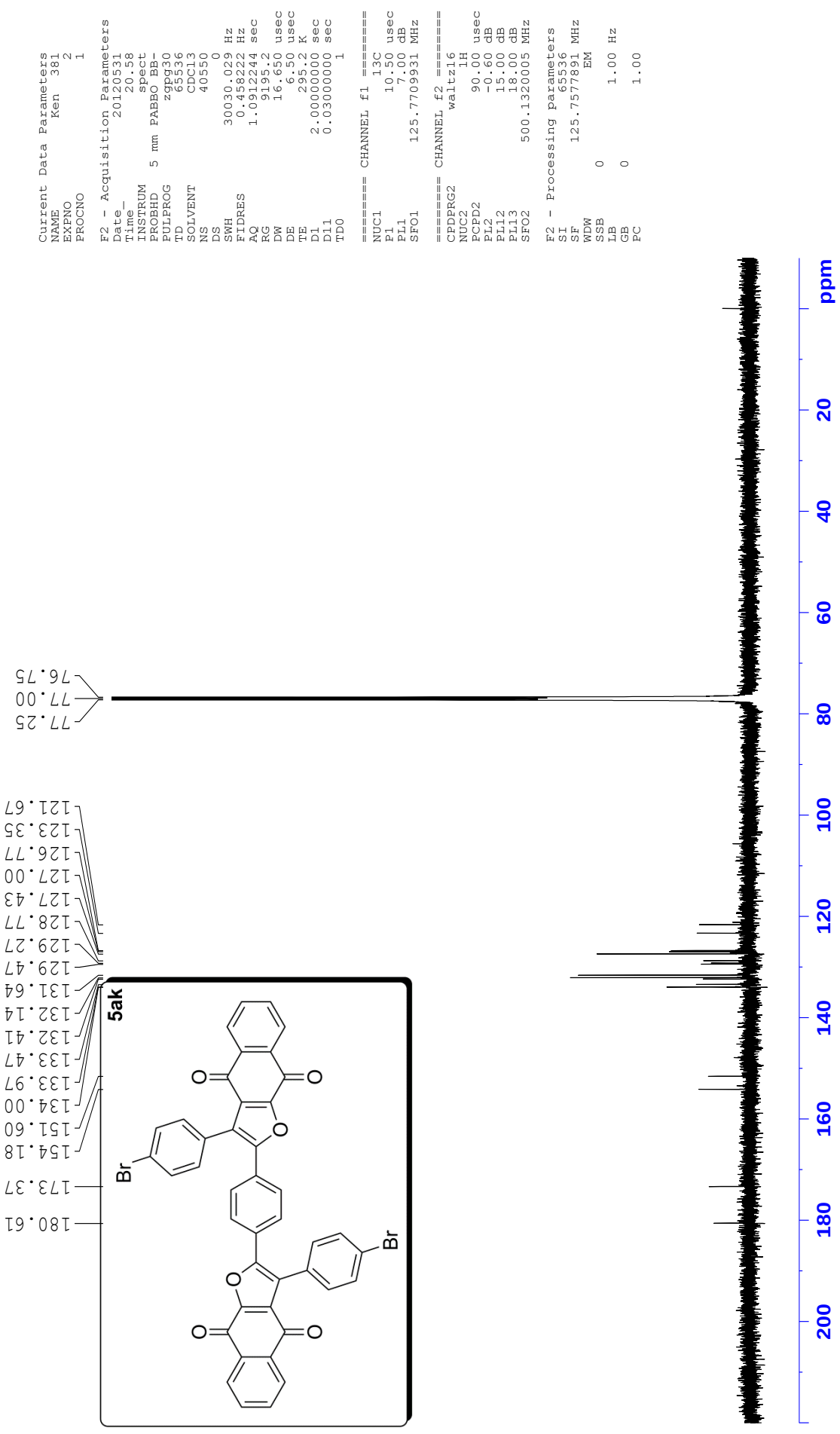
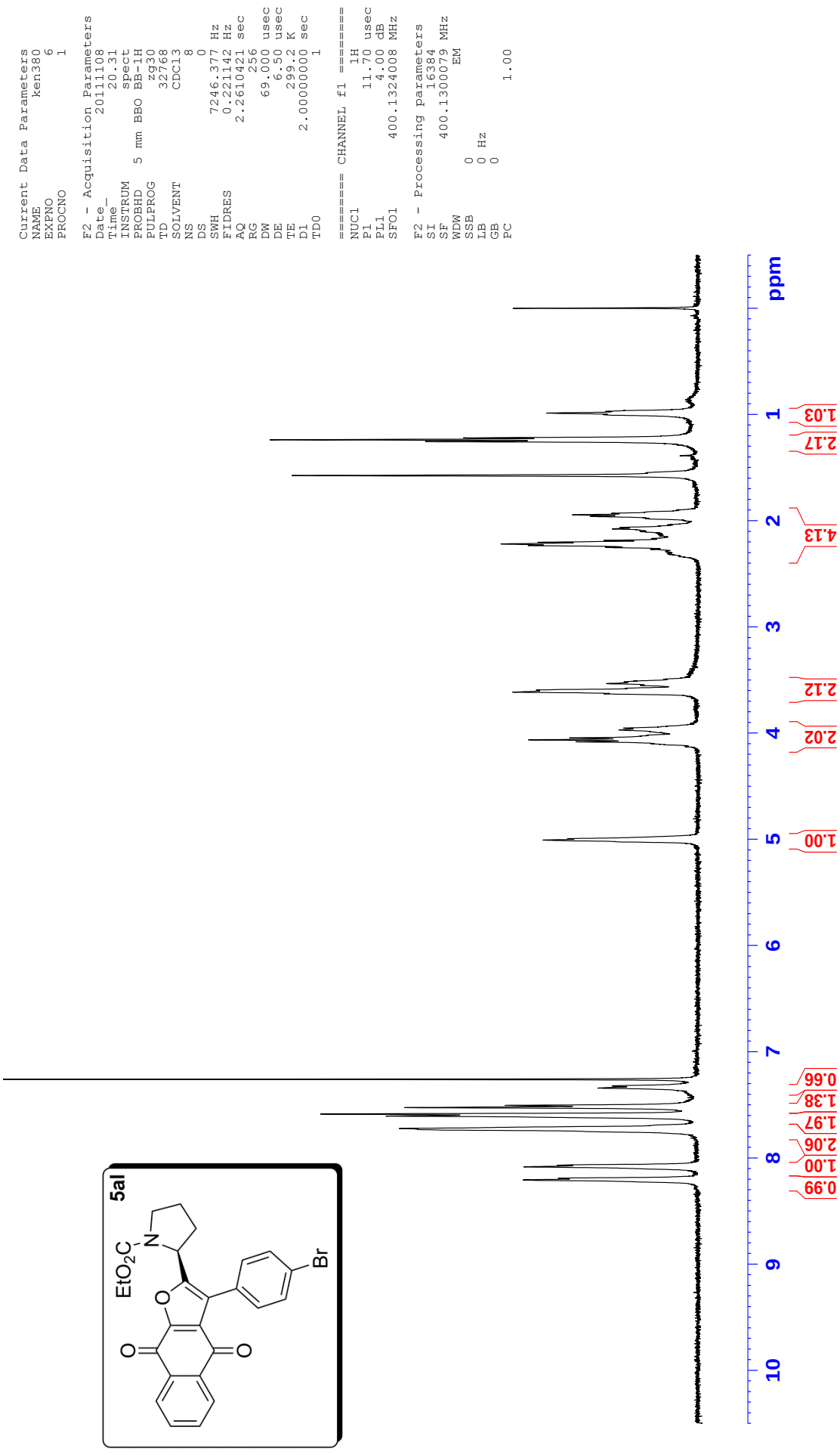
60
80
100
120
140
160
180
200


Current Data Parameters
NAME ken396
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111219
Time 18.10
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 128
DW 69.000 usec
DE 6.50 usec
TE 299.8 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300056 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
5pa
ppm
1
2
3
4
5
6
7
8
9
10
3.05
2.07
2.08
2.01
2.04
0.99
0.99
1.00


Current Data Parameters
NAME ken396
EXPNO 5
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111219
Time_ 18.19
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 1134
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 5792.6
DW 20.800 usec
DE 6.50 usec
TE 300.3 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127734 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
77.32
77.00
76.68
120.31
126.69
126.89
127.37
128.01
128.78
129.22
129.86
130.18
130.94
132.33
133.36
133.87
133.91
136.19
136.75
151.39
155.78
173.26
180.60
191.70
5pa
O
O
O
O
ppm
200
180
160
140
120
100
80
60
40
20




Current Data Parameters
NAME Ken
EXPNO 381
PROCNO 2
1
F2 - Acquisition Parameters
Date_ 20120531
Time_ 20.58
INSTRUM spect
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 40550
DS 0
SWH 30030.029 Hz
FIDRES 0.458222 Hz
AQ 1.0912244 sec
RG 9195.2
DW 16.650 usec
DE 6.50 usec
TE 295.2 K
D1 2.00000000 sec
D11 2.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 10.50 usec
PL1 7.00 dB
SFO1 125.7709931 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 -0.60 dB
PL12 15.00 dB
PL13 18.00 dB
SFO2 500.1320005 MHz
F2 - Processing parameters
SI 65536
SF 125.7577891 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
77.25
77.00
76.75
121.67
123.35
126.77
127.00
127.43
128.77
129.27
129.47
131.64
132.14
132.41
133.47
133.97
134.00
151.60
154.18
173.37
180.61
5ak
Br
Br
O
O
O
O
O
O
ppm
200
180
160
140
120
100
80
60
40
20


Current Data Parameters
NAME ken380
EXPNO 6
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111108
Time_ 20.31
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 256
DW 69.000 usec
DE 6.50 usec
TE 299.2 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300079 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1.03
2.17
4.13
2.12
2.02
1.00
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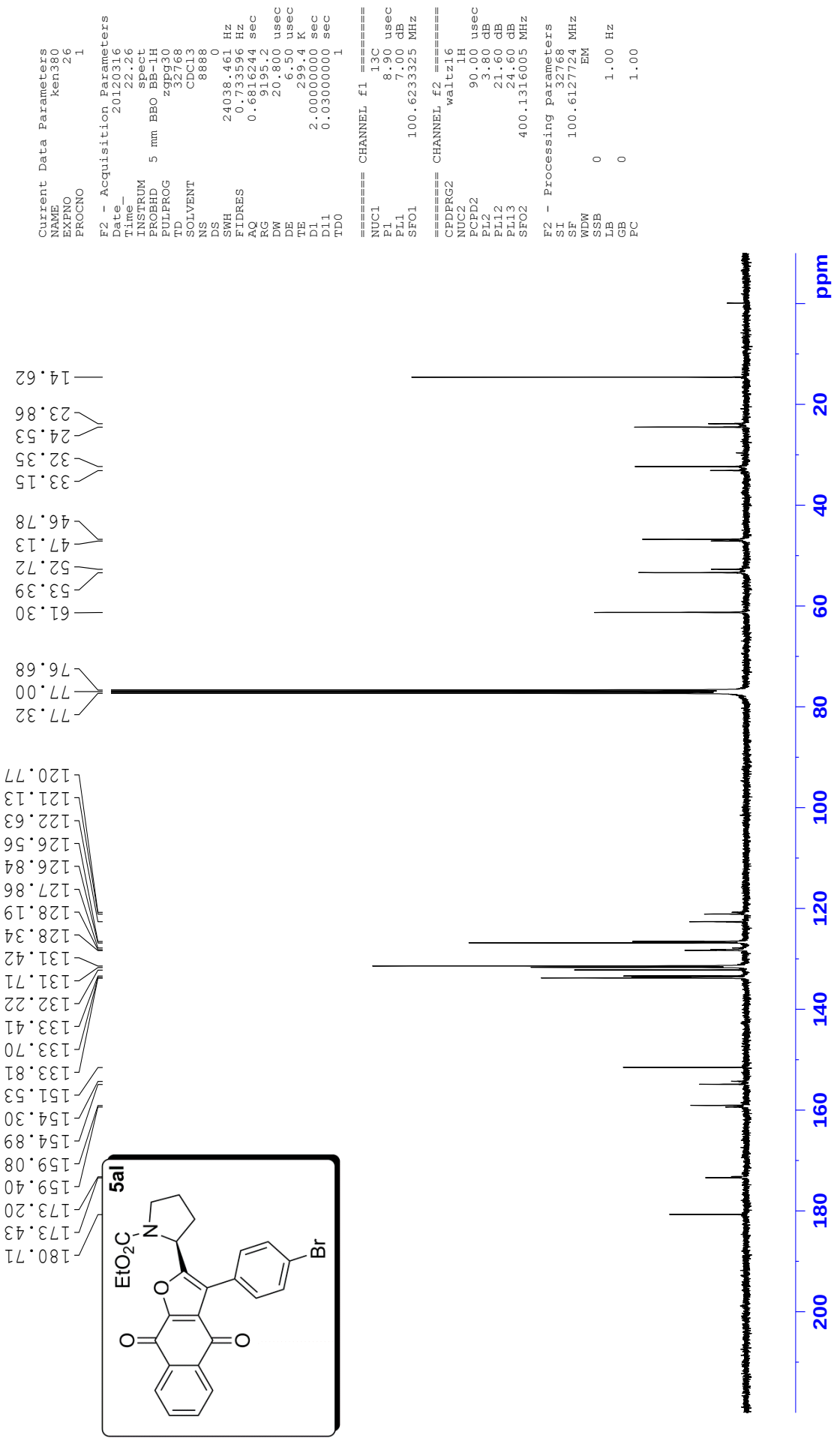
1.97
2.06
1.00
0.99
5al
EtO2C
N
O
O
O
Br


Current Data Parameters
NAME ken380
EXPNO 26
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120316
Time_ 22.26
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 8888
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6818244 sec
RG 9195.2
DW 20.800 usec
DE 6.50 usec
TE 299.4 K
D1 2.00000000 sec
D11 2.03000000 sec
TD0 1
========== CHANNEL f1 ==========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
========== CHANNEL f2 ==========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127724 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
14.62
23.86
24.53
32.35
33.15
46.78
47.13
52.72
53.39
61.30
76.68
77.00
77.32
120.77
121.13
122.63
126.56
126.84
127.86
128.19
128.34
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133.81
151.53
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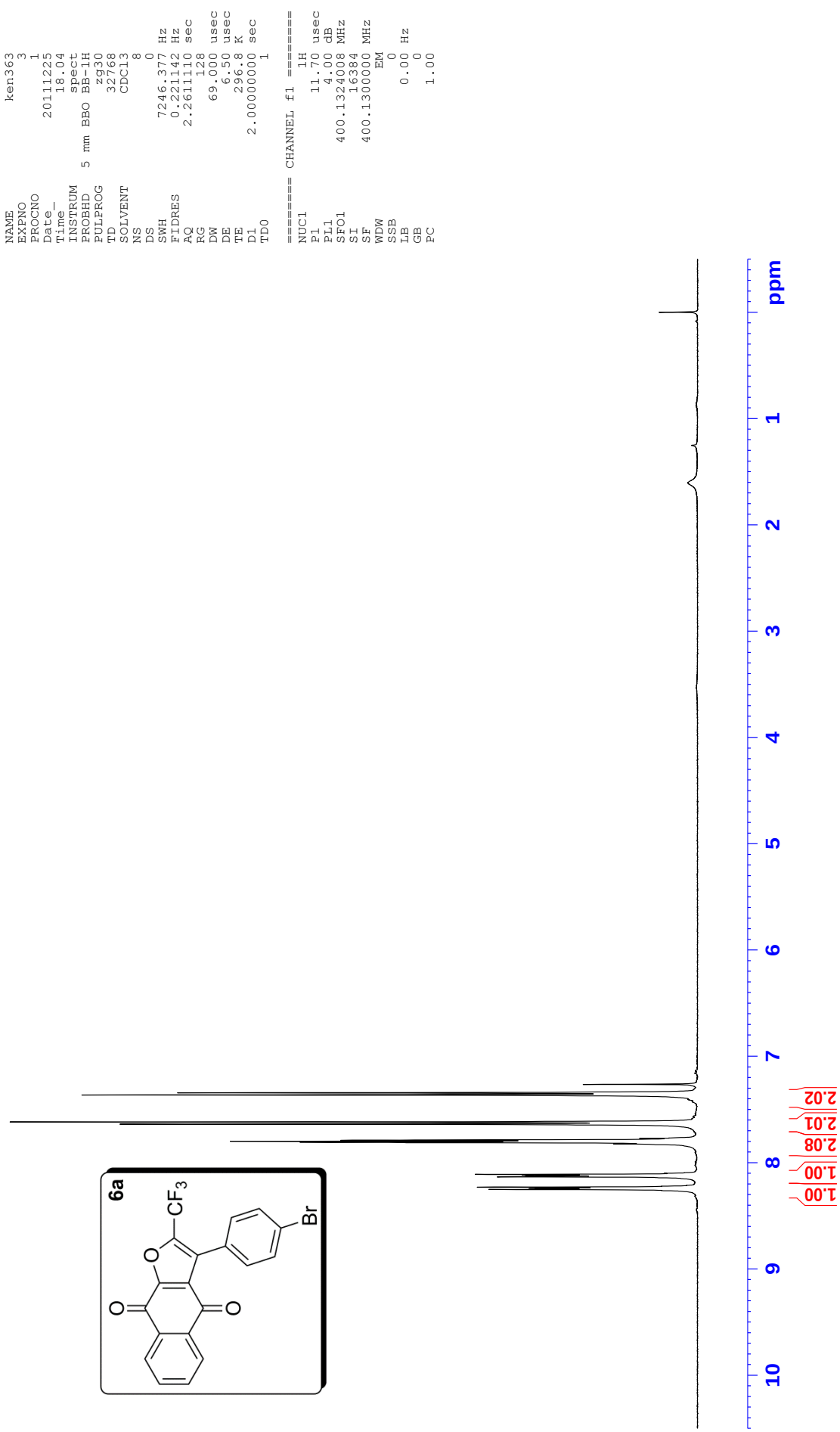

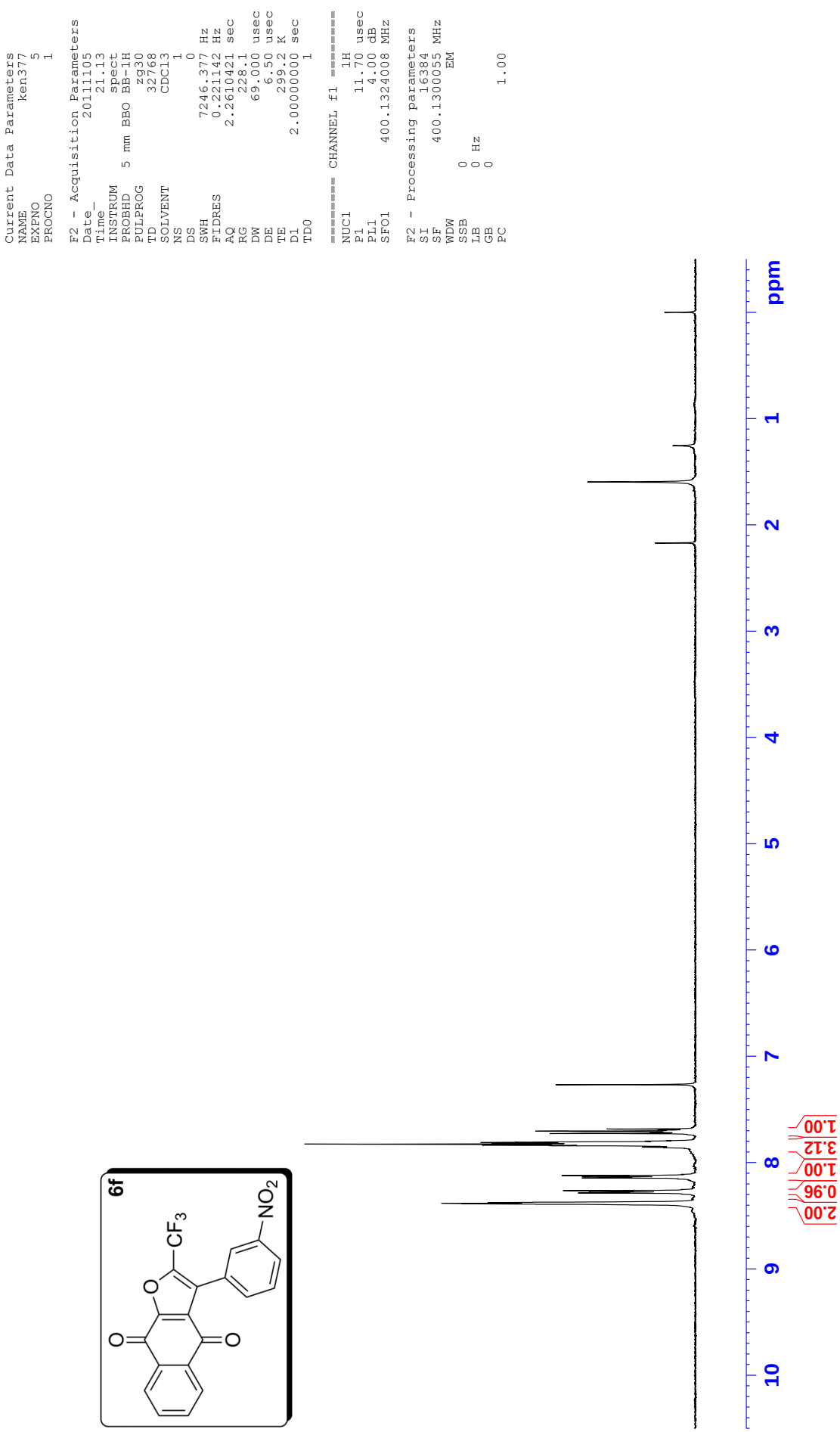
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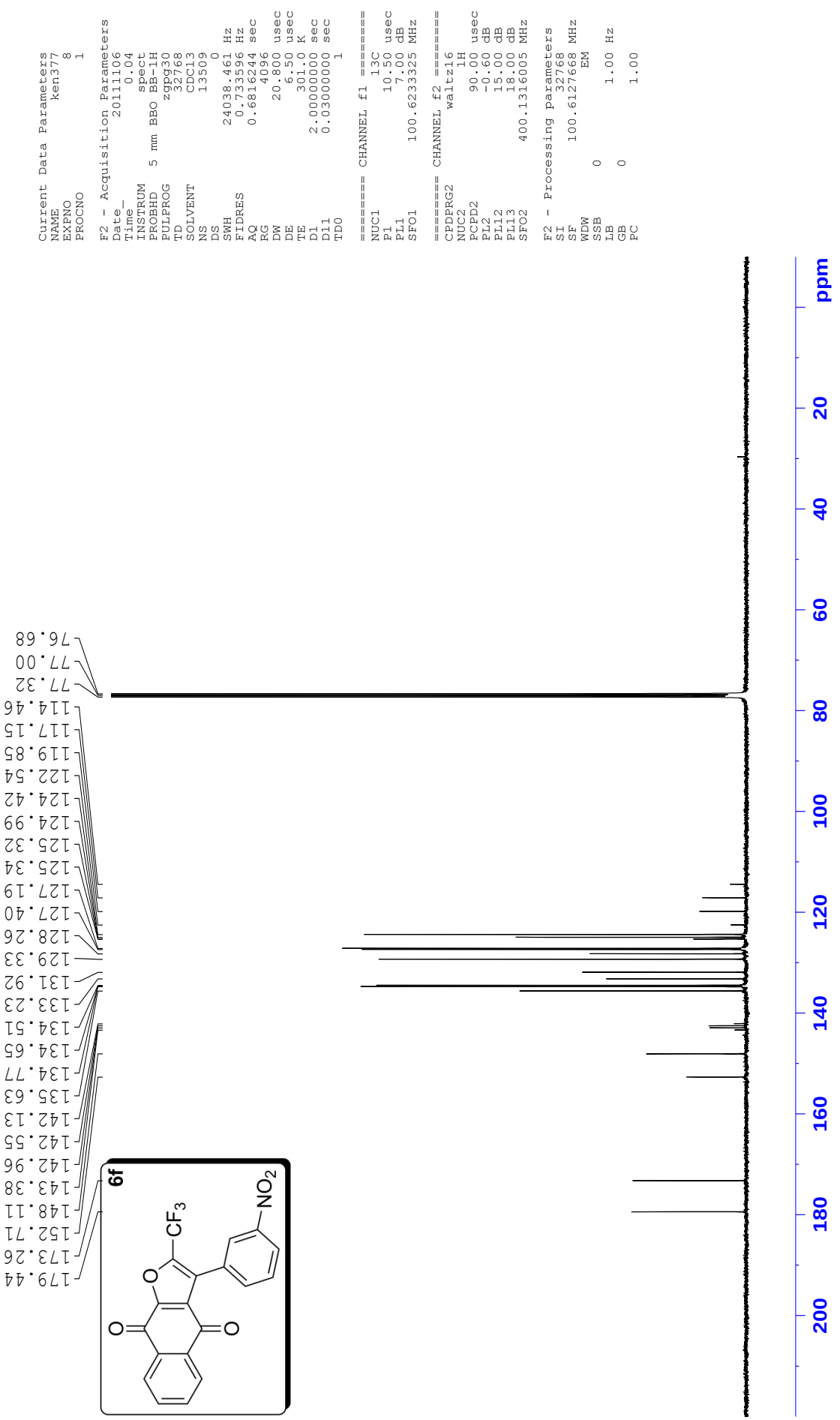
NAME ken377
EXPNO 5
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111105
Time_ 21.13
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 1
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 228.1
DW 69.000 usec
DE 6.50 usec
TE 299.2 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300055 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
6f
O
CF3
NO2
O
O
ppm
1
2
3
4
5
6
7
8
9
10
2.00
0.96
1.00
3.12
1.00


Current Data Parameters
NAME ken377
EXPNO 8
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111106
Time_ 0.04
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 13509
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 301.0 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 10.50 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 -0.60 dB
PL12 15.00 dB
PL13 18.00 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127668 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
77.32
77.00
76.68
114.46
117.15
119.85
122.54
124.42
124.99
125.32
125.34
127.19
127.40
128.26
129.33
131.92
133.23
134.51
134.65
134.77
135.63
142.13
142.55
142.96
143.38
148.11
152.71
173.26
179.44
6f
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CF3
O
NO2
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ppm
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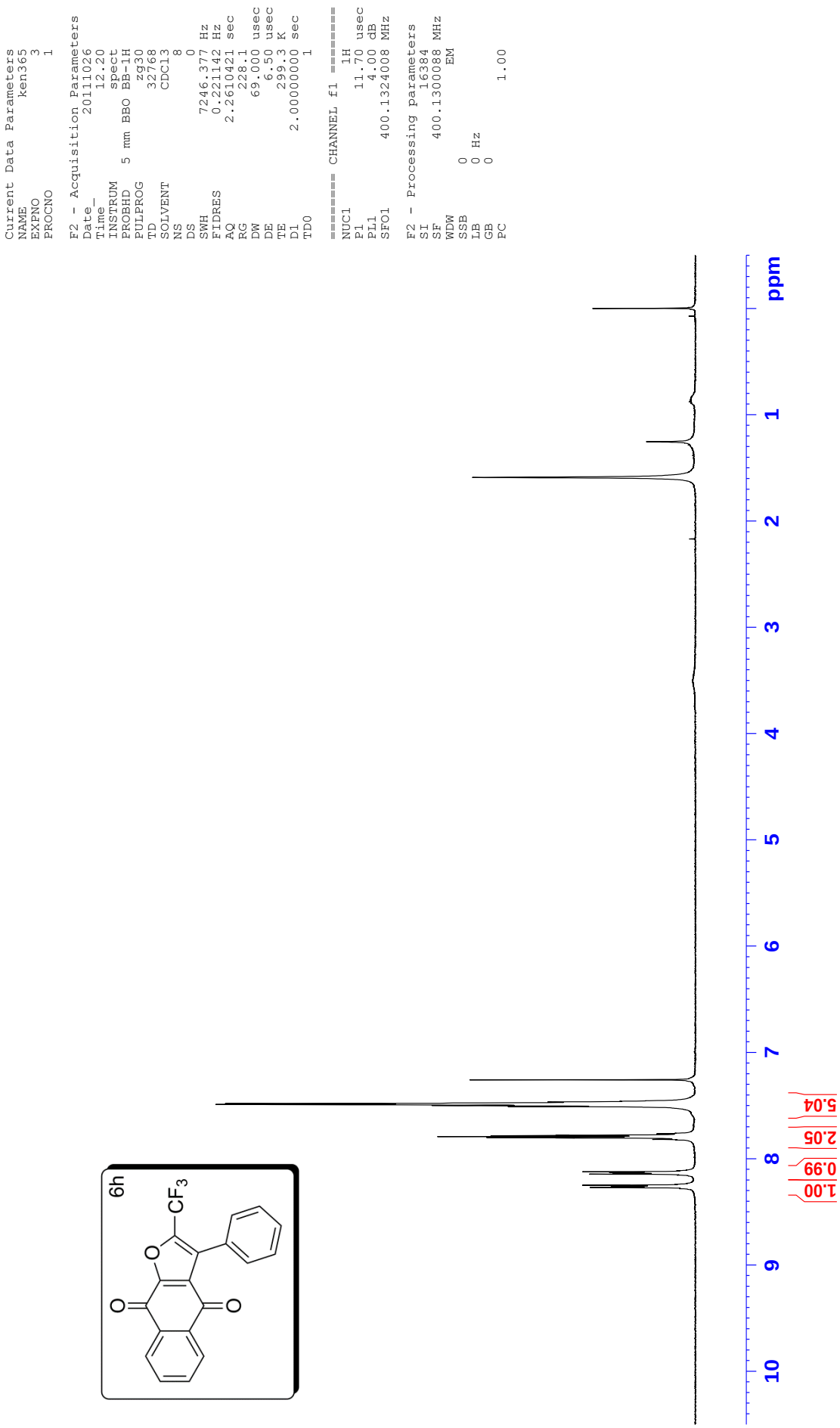
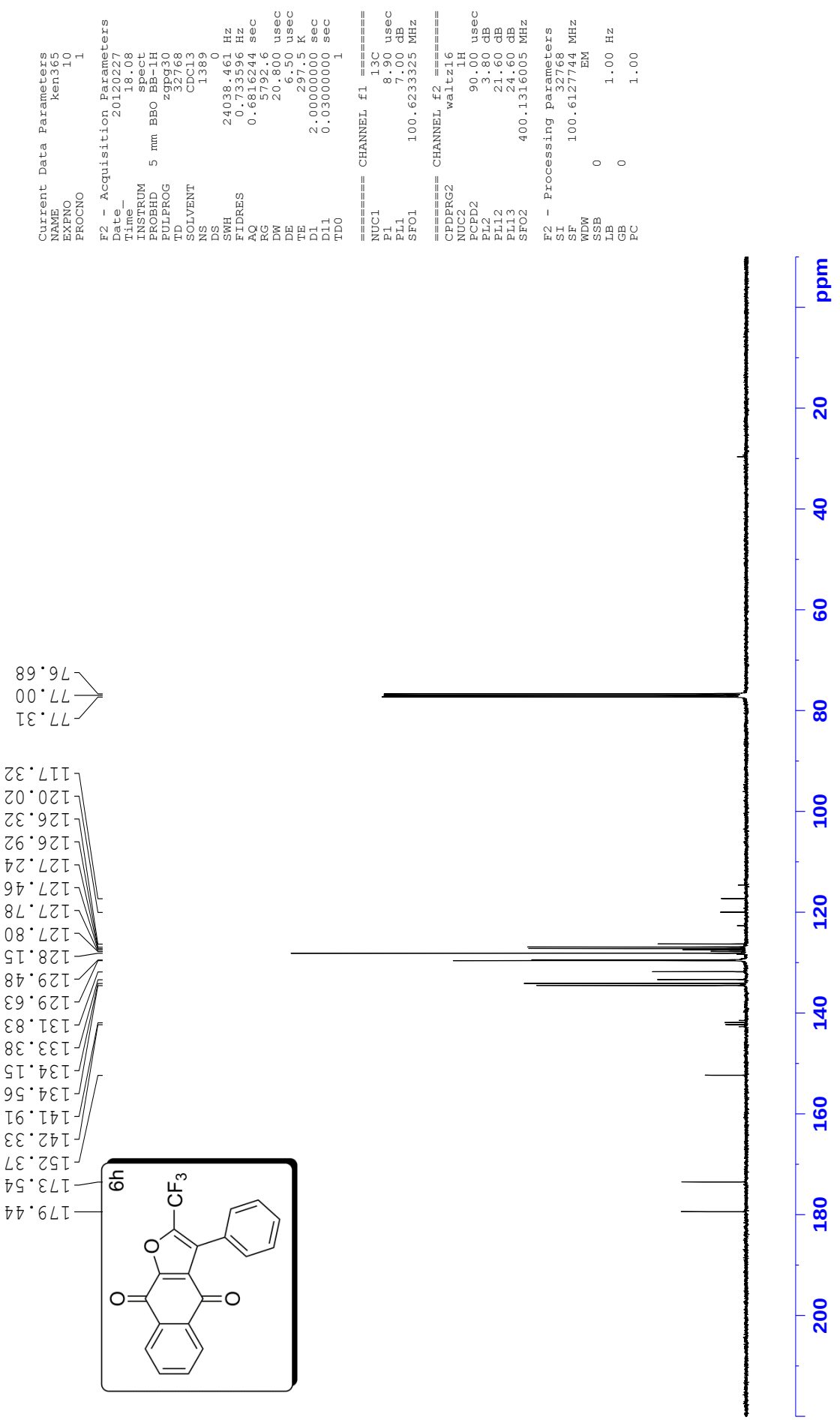
160
140
120
100
80
60
40
20


Current Data Parameters
NAME ken365
EXPNO 3
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111026
Time 12.20
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 228.1
DW 69.000 usec
DE 6.50 usec
TE 299.3 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300088 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
6h
CF3
O
O
O
ppm
1
2
3
4
5
6
7
8
9
10
1.00
0.99
2.05
5.04


Current Data Parameters
NAME ken365
EXPNO 10
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120227
Time_ 18.08
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 1389
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 5792.6
DW 20.800 usec
DE 6.50 usec
TE 297.5 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127744 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
77.31
77.00
76.68
117.32
120.02
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127.46
127.78
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128.15
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133.38
134.15
134.56
141.91
142.33
152.37
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CF3
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O
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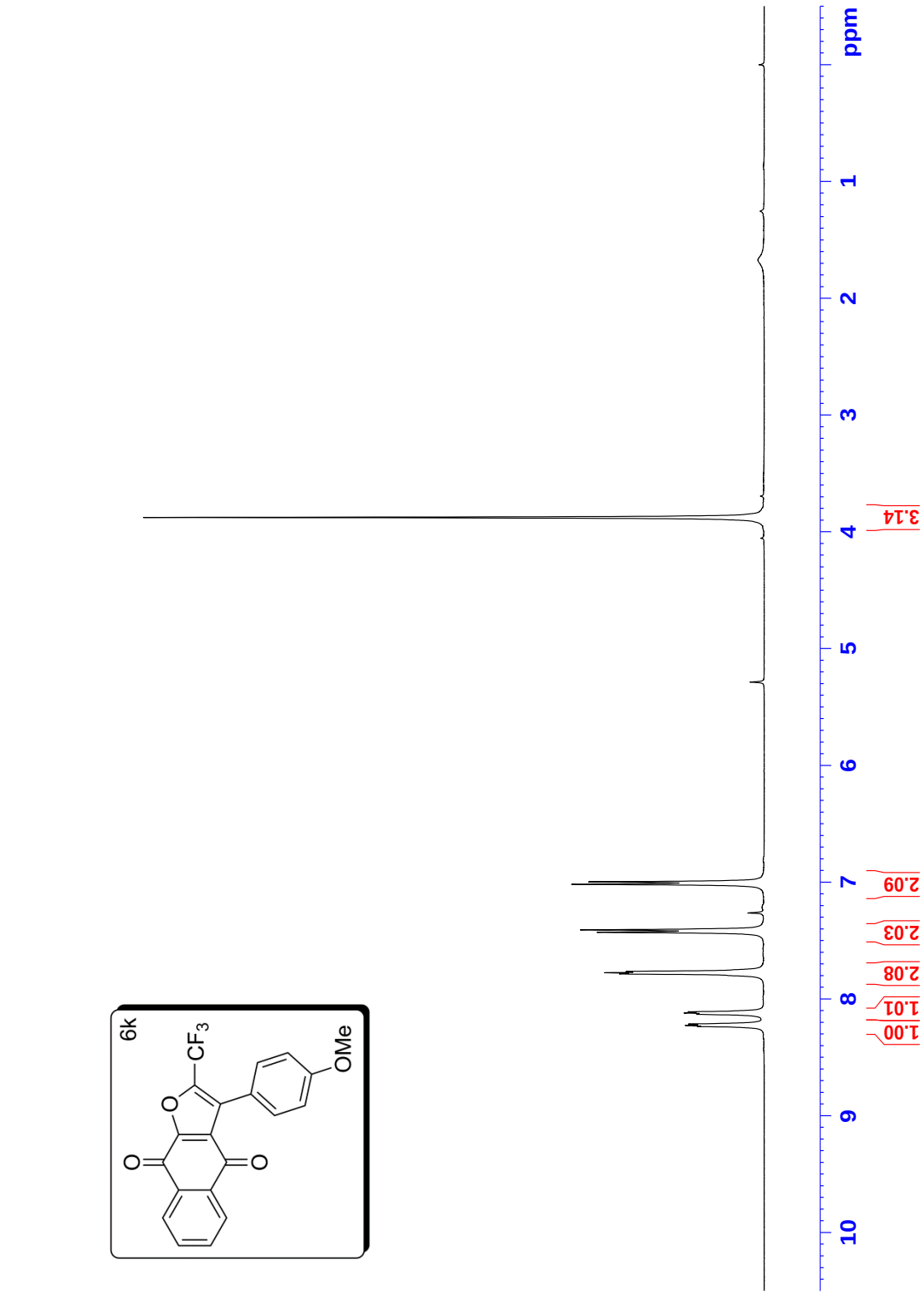
Current Data Parameters
NAME ken366
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120228
Time_ 10.39
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 90.5
DW 69.000 usec
DE 6.50 usec
TE 297.2 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300062 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
6k
CF3
OMe
O
O
O
ppm
1
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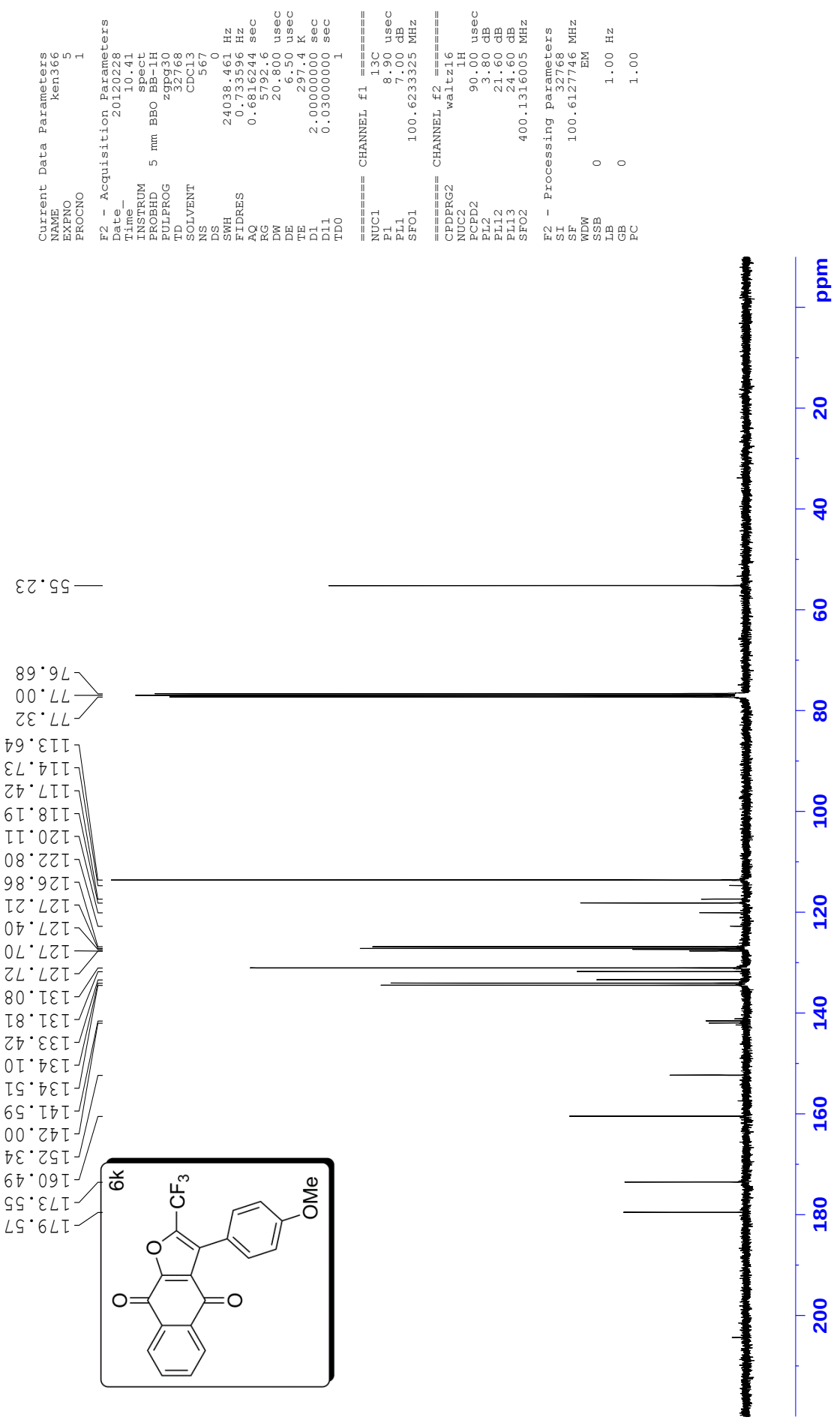
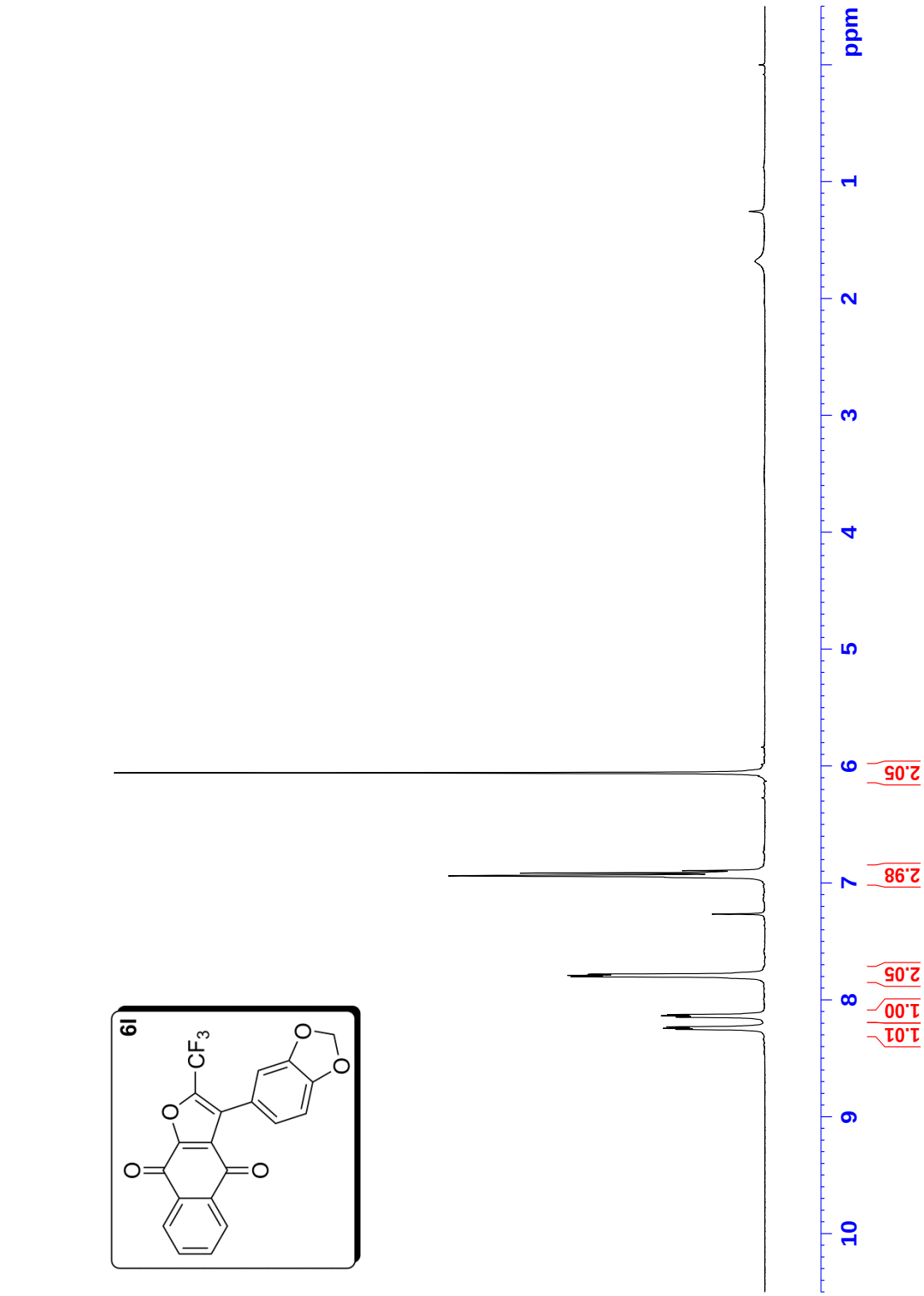
3.14
2.09
2.03
2.08
1.01
1.00


Current Data Parameters
NAME ken366
EXPNO 5
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120228
Time_ 10.41
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 567
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 5792.6
DW 20.800 usec
DE 6.50 usec
TE 297.4 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
========== CHANNEL f1 ==========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
========== CHANNEL f2 ==========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127746 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
55.23
76.68
77.00
77.32
113.64
114.73
117.42
118.19
120.11
122.80
126.86
127.21
127.40
127.70
127.72
131.08
131.81
133.42
134.10
134.51
141.59
142.00
152.34
160.49
173.55
179.57
6k
CF3
OMe
O
O
O
ppm
200
180
160
140
120
100
80
60
40
20


Current Data Parameters
NAME ken382
EXPNO 12
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111219
Time 12.06
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 161.3
DW 69.000 usec
DE 6.50 usec
TE 299.1 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300057 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
6l
CF3
O
O
O
O
O
ppm
1
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3
4
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6
7
8
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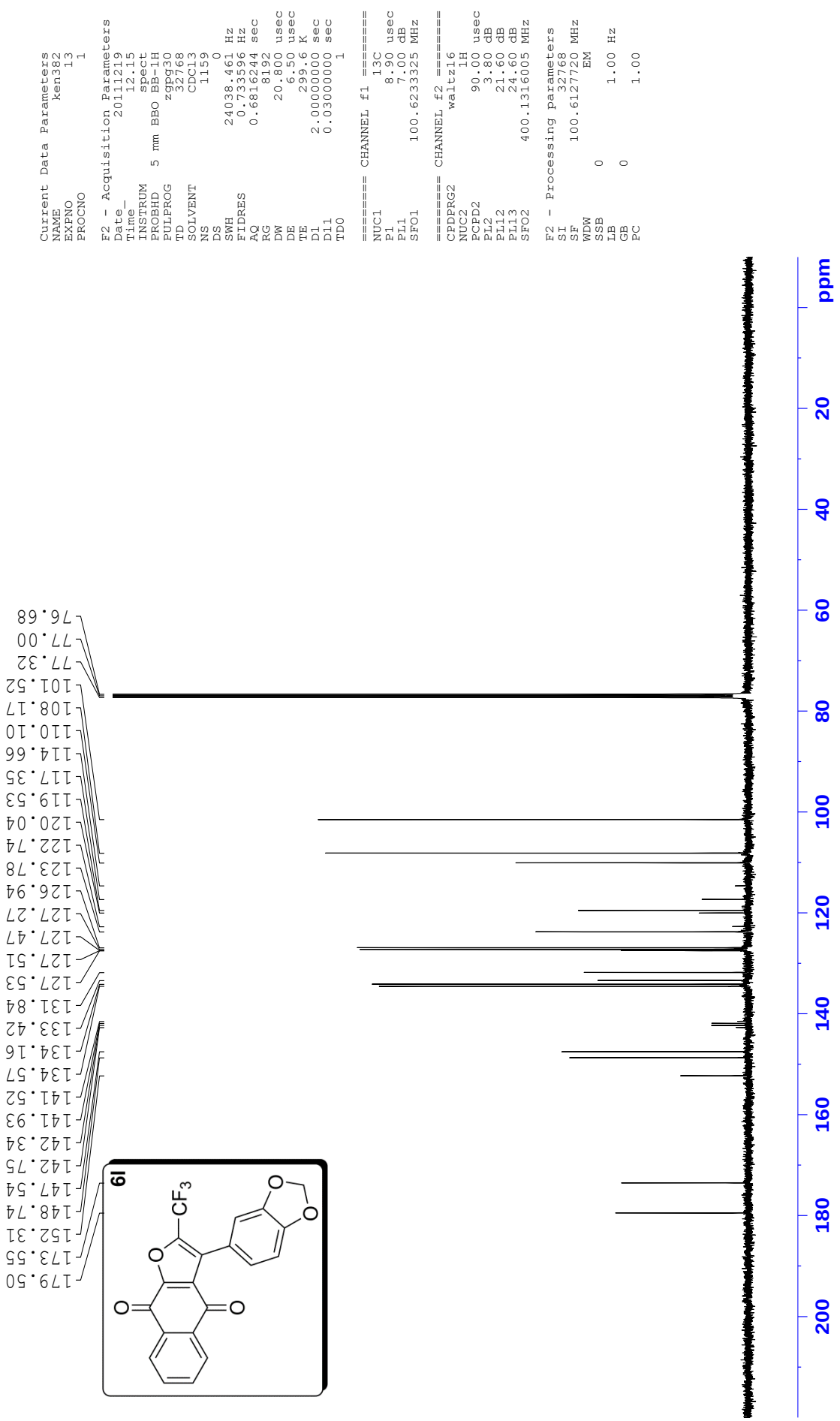
10
2.05
2.98
2.05
1.00
1.01


Current Data Parameters
NAME ken382
EXPNO 13
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111219
Time_ 12.15
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 1159
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 8192
DW 20.800 usec
DE 6.50 usec
TE 299.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127720 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
6l
CF3
O
O
O
O
O
179.50
173.55
152.31
148.74
147.54
142.75
142.34
141.93
141.52
134.57
134.16
133.42
131.84
127.53
127.51
127.47
127.27
126.94
123.78
122.74
120.04
119.53
117.35
114.66
110.10
108.17
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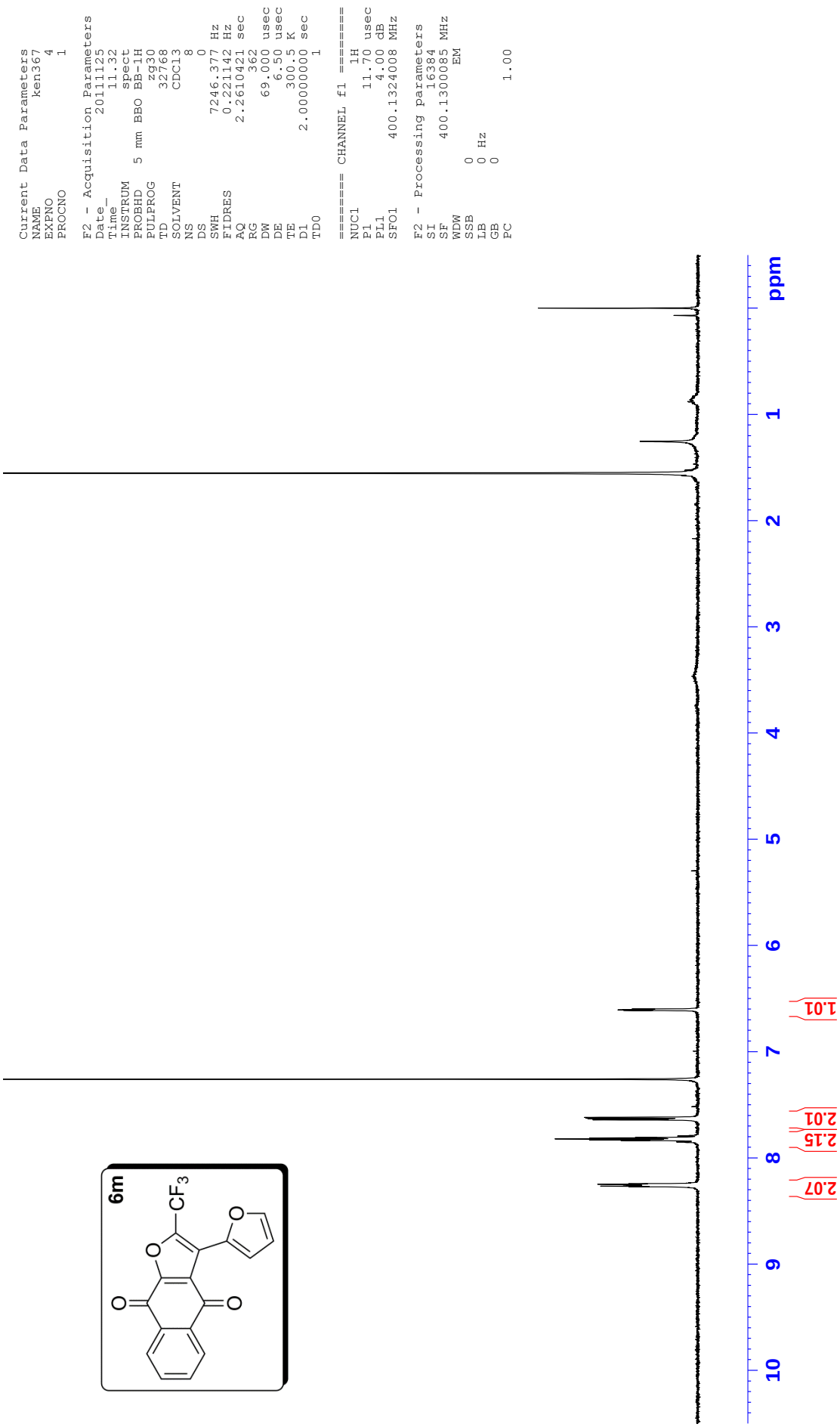
77.32
77.00
76.68
ppm
200
180
160
140
120
100
80
60
40
20


Current Data Parameters
NAME ken367
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111125
Time_ 11.32
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 362
DW 69.000 usec
DE 6.50 usec
TE 300.5 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300085 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
6m
CF3
O
O
O
O
ppm
1
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6
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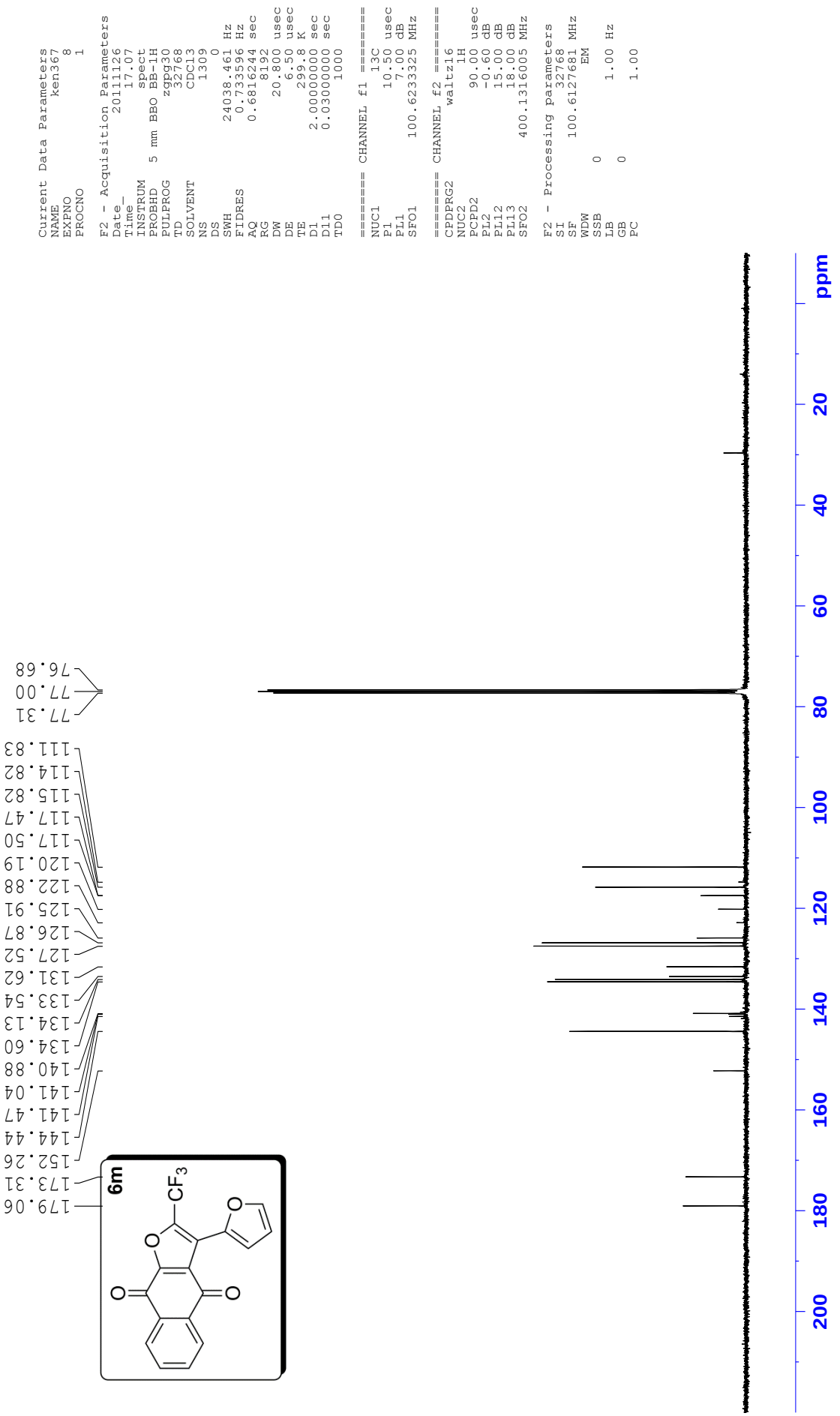
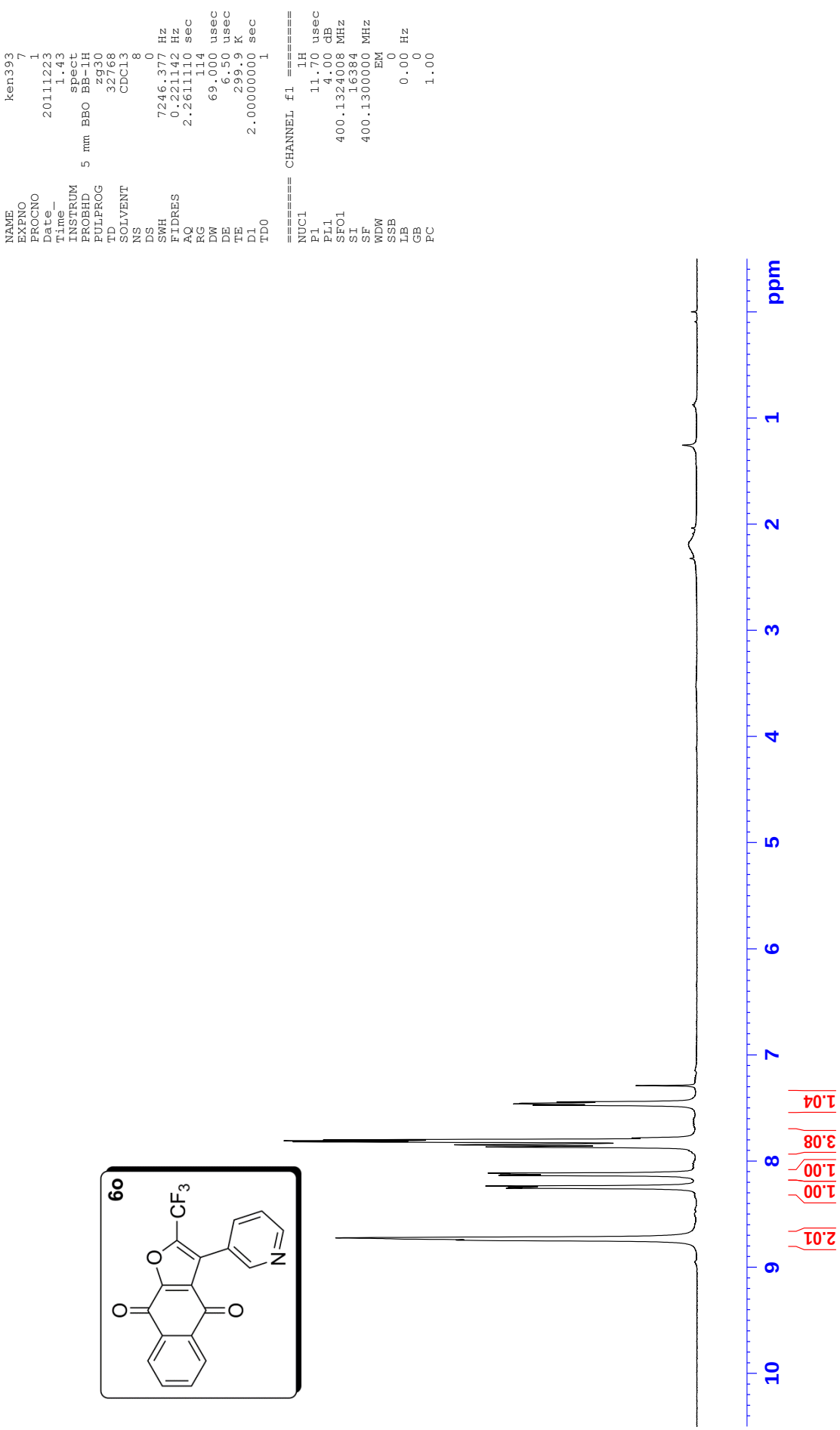
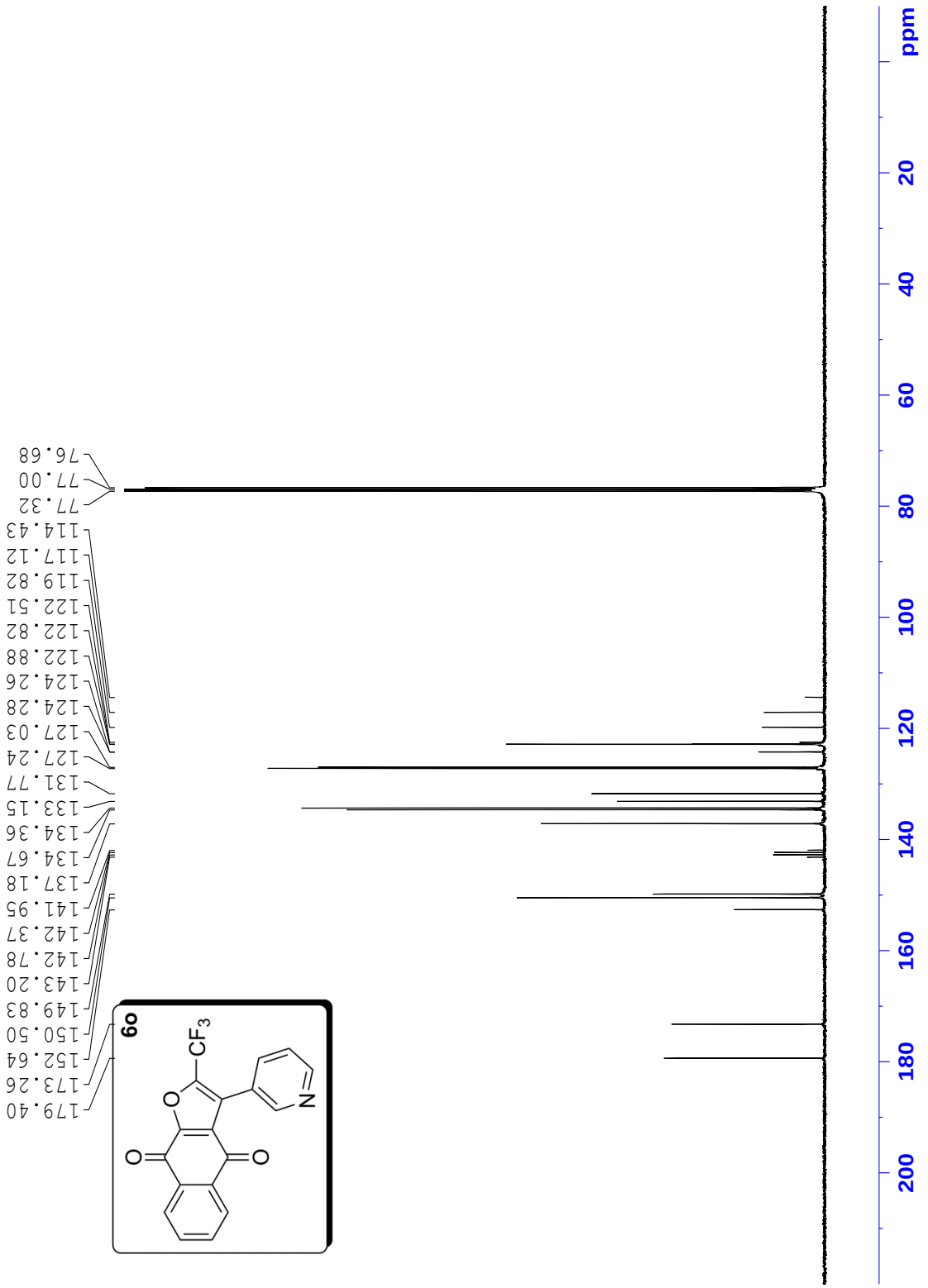
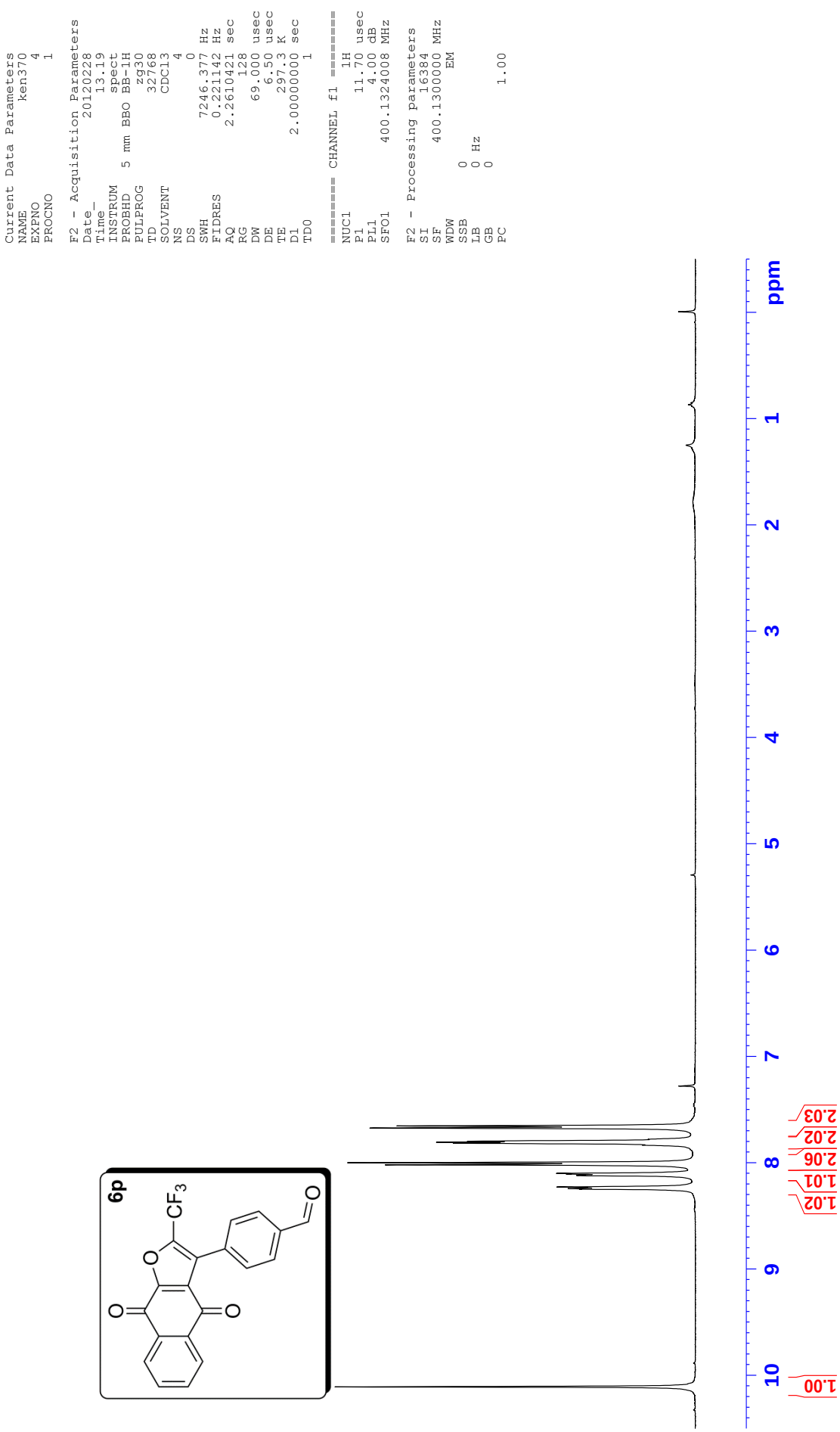
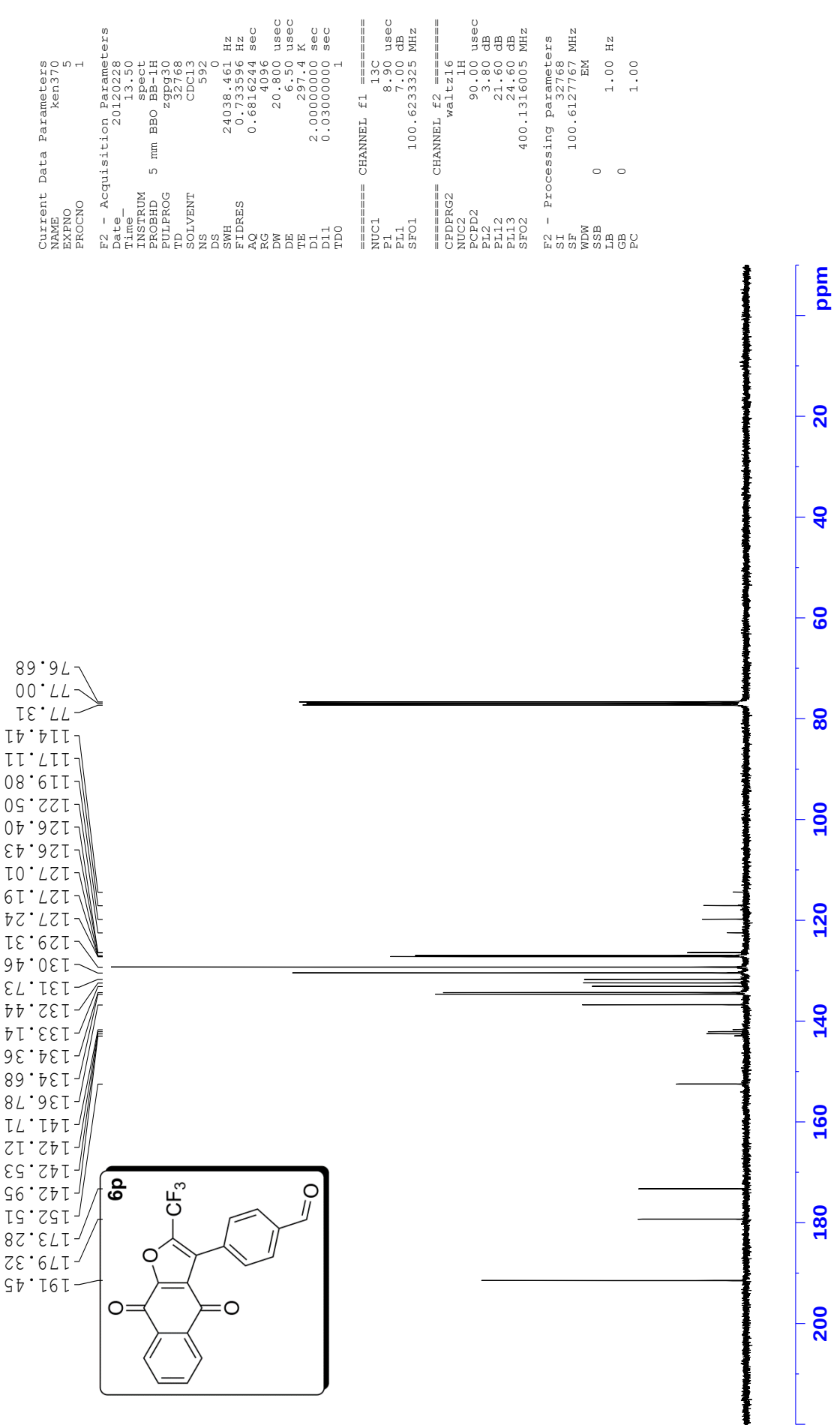
8
9
10
1.01
2.01
2.15
2.07

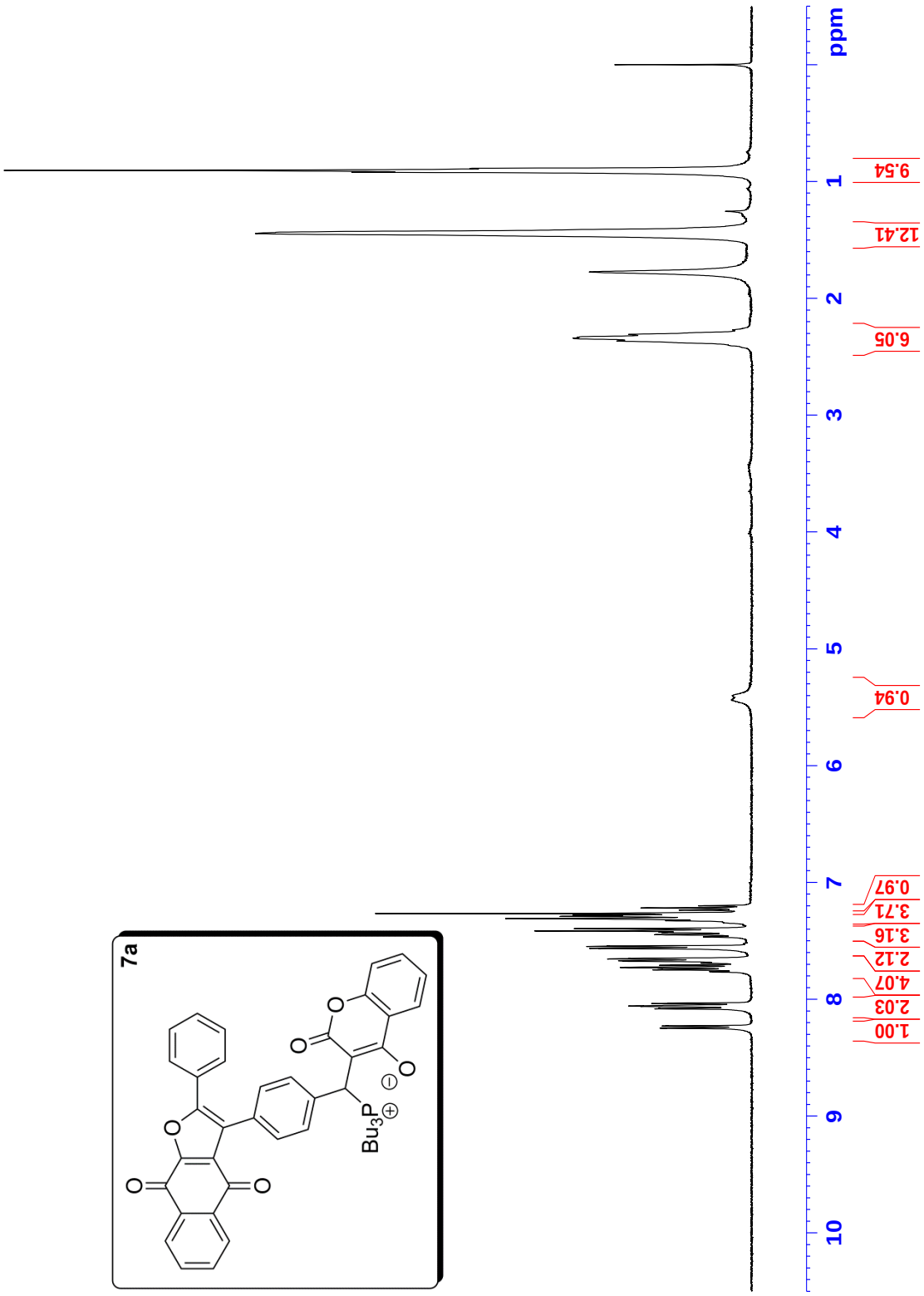

Current Data Parameters
NAME ken367
EXPNO 8
PROCNO 1
F2 - Acquisition Parameters
Date_ 20111126
Time_ 17.07
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 1309
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 8192
DW 20.800 usec
DE 6.50 usec
TE 299.8 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1000
======== CHANNEL f1 ========
NUC1 13C
P1 10.50 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 -0.60 dB
PL12 15.00 dB
PL13 18.00 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127681 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
77.31
77.00
76.68
111.83
114.82
115.82
117.47
117.50
120.19
122.88
125.91
126.87
127.52
131.62
133.54
134.13
134.60
140.88
141.04
141.47
144.44
152.26
173.31
179.06
6m
CF3
O
O
O
O
ppm
200
180
160
140
120
100
80
60
40
20

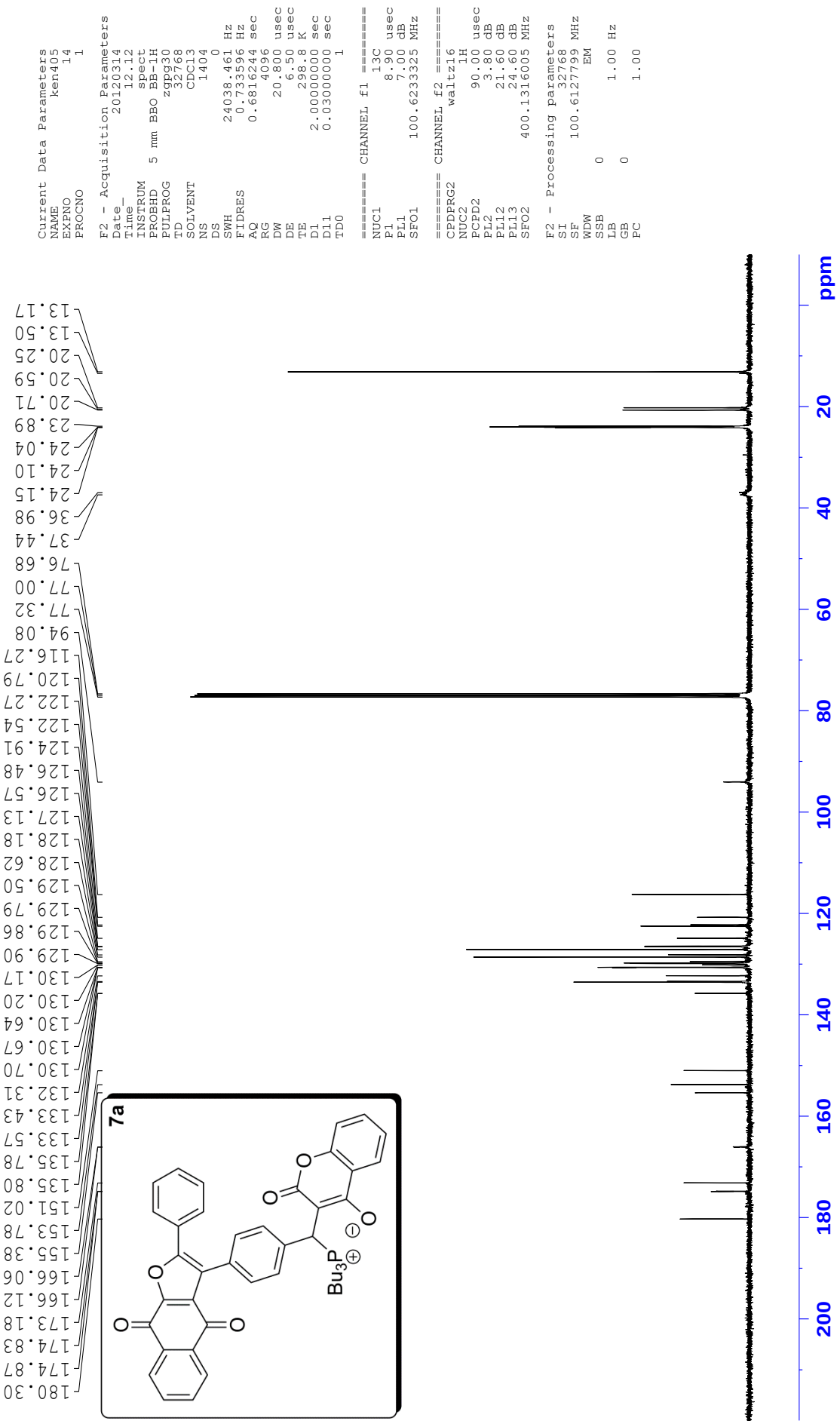


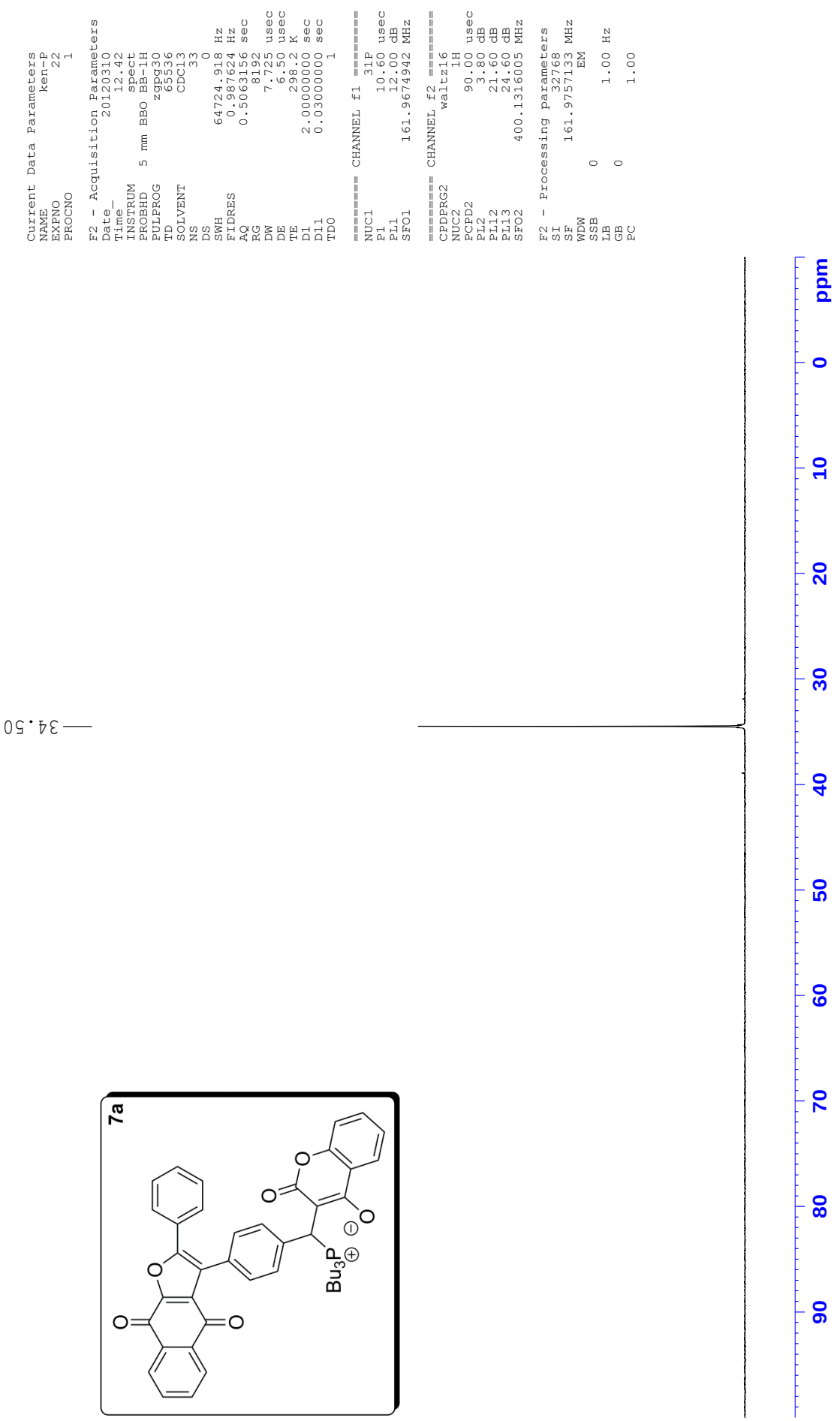


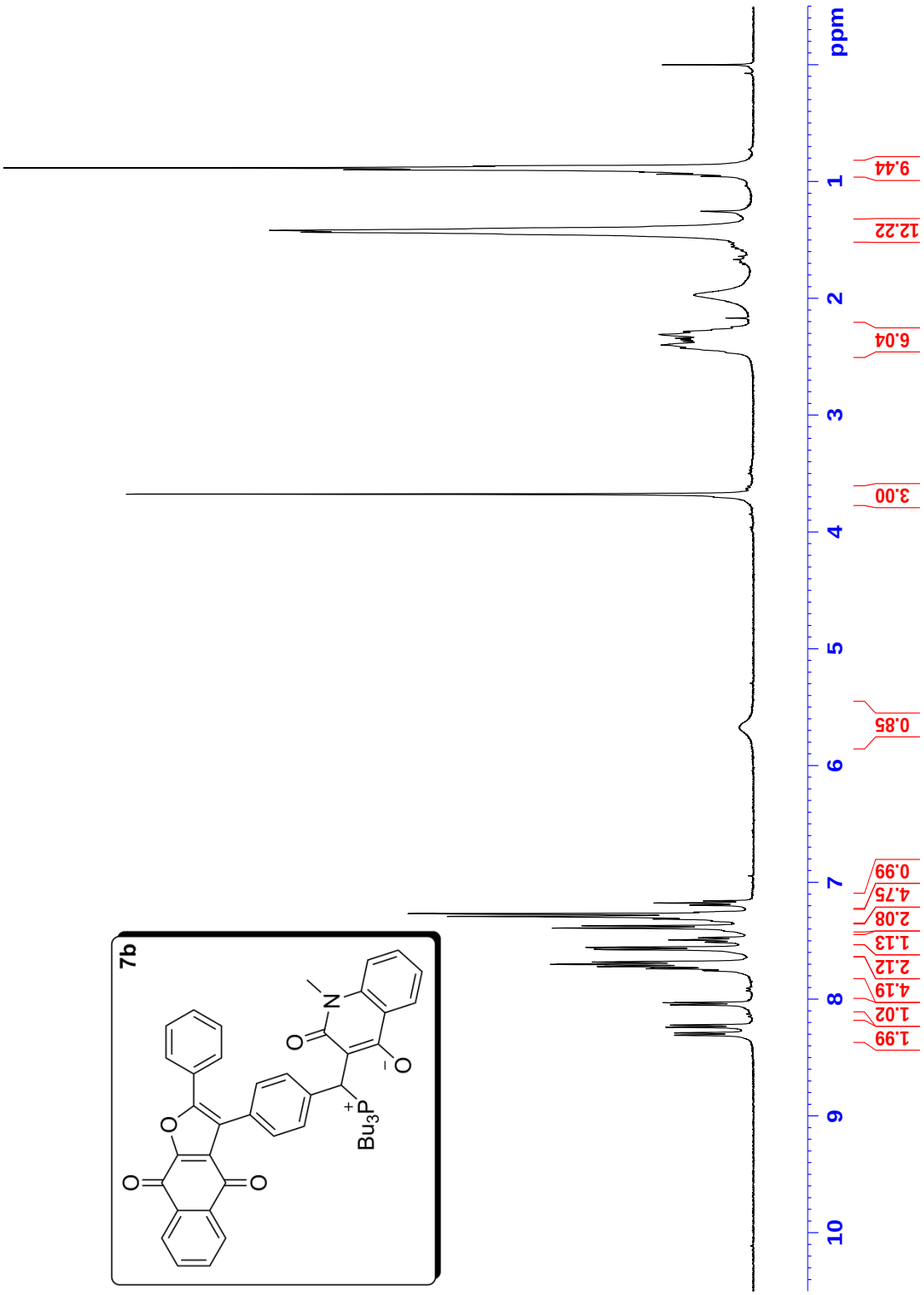

Current Data Parameters
NAME ken370
EXPNO 4
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120228
Time 13.19
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 4
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 128
DW 69.000 usec
DE 6.50 usec
TE 297.3 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300000 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
6p
CF3
O
O
O
O
ppm
1
2
3
4
5
6
7
8
9
10
1.00
1.02
1.01
2.06
2.02
2.03


Current Data Parameters
NAME ken370
EXPNO 5
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120228
Time_ 13.50
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 592
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 4096
DW 20.800 usec
DE 6.50 usec
TE 297.4 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127767 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
191.45
179.32
173.28
152.51
142.95
142.53
142.12
141.71
136.78
134.68
134.36
133.14
132.44
131.73
130.46
129.31
127.24
127.19
127.01
126.43
126.40
122.50
119.80
117.11
114.41
77.31
77.00
76.68
6p
CF3
O
O
O
O
200
180
160
140
120
100
80
60
40
20
ppm


Current Data Parameters
NAME ken405
EXPNO 11
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120130
Time_ 16.05
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 181
DW 69.000 usec
DE 6.50 usec
TE 299.6 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300057 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
9.54
12.41
6.05
0.94
0.97
3.71
3.16
2.12
4.07
2.03
1.00
7a
Bu3P




Current Data Parameters
NAME ken-P
EXPNO 22
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120310
Time 12.42
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 33
DS 0
SWH 64724.918 Hz
FIDRES 0.987624 Hz
AQ 0.5063156 sec
RG 8192
DW 7.725 usec
DE 6.50 usec
TE 298.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 31P
P1 10.60 usec
PL1 12.00 dB
SFO1 161.9674942 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 161.9757133 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
34.50
7a
Bu3P
ppm
0
10
20
30
40
50
60
70
80
90


Current Data Parameters
NAME ken409
EXPNO 14
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120213
Time 15.32
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 161.3
DW 69.000 usec
DE 6.50 usec
TE 299.1 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300053 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
ppm
1
2
3
4
5
6
7
8
9
10
9.44
12.22
6.04
3.00
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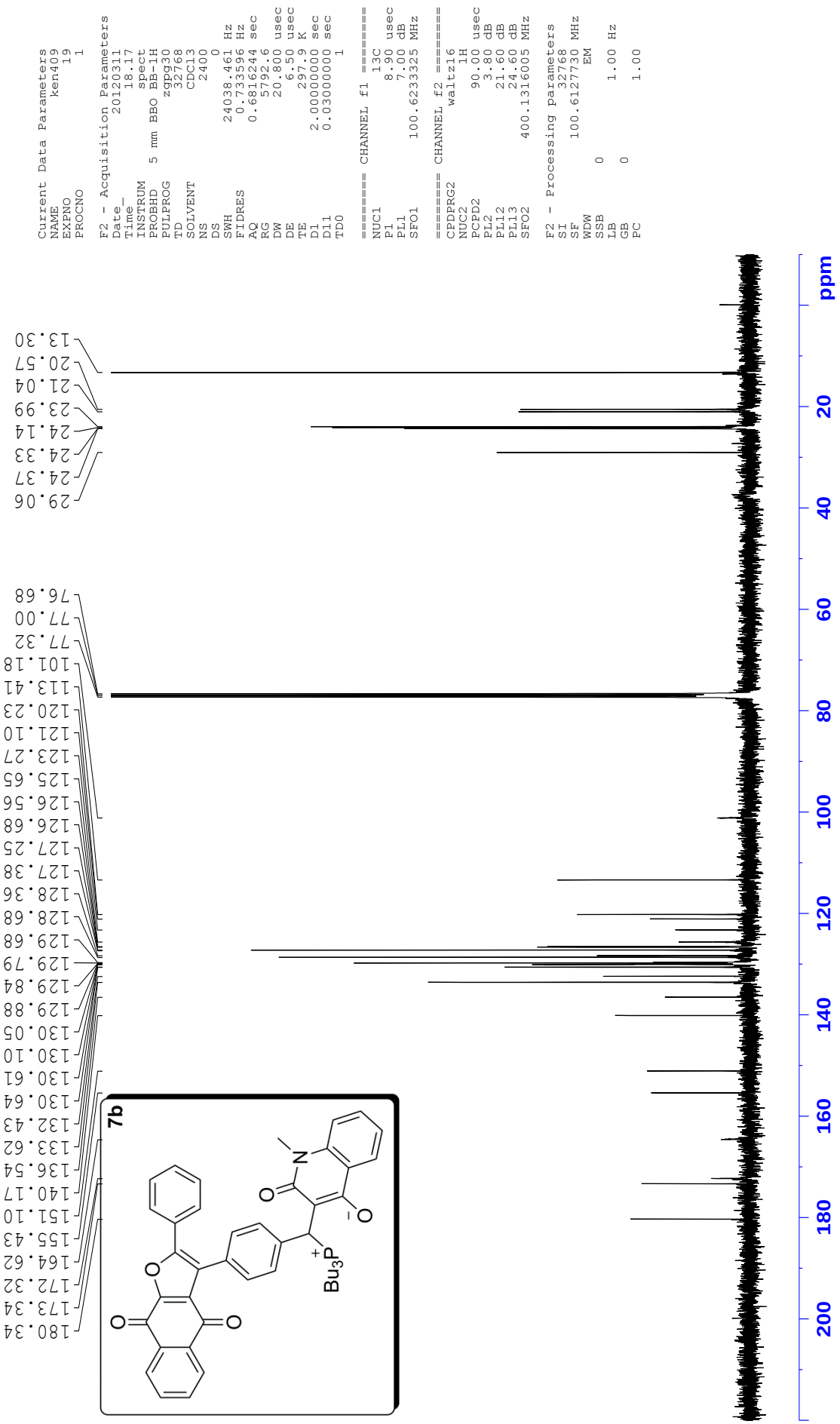
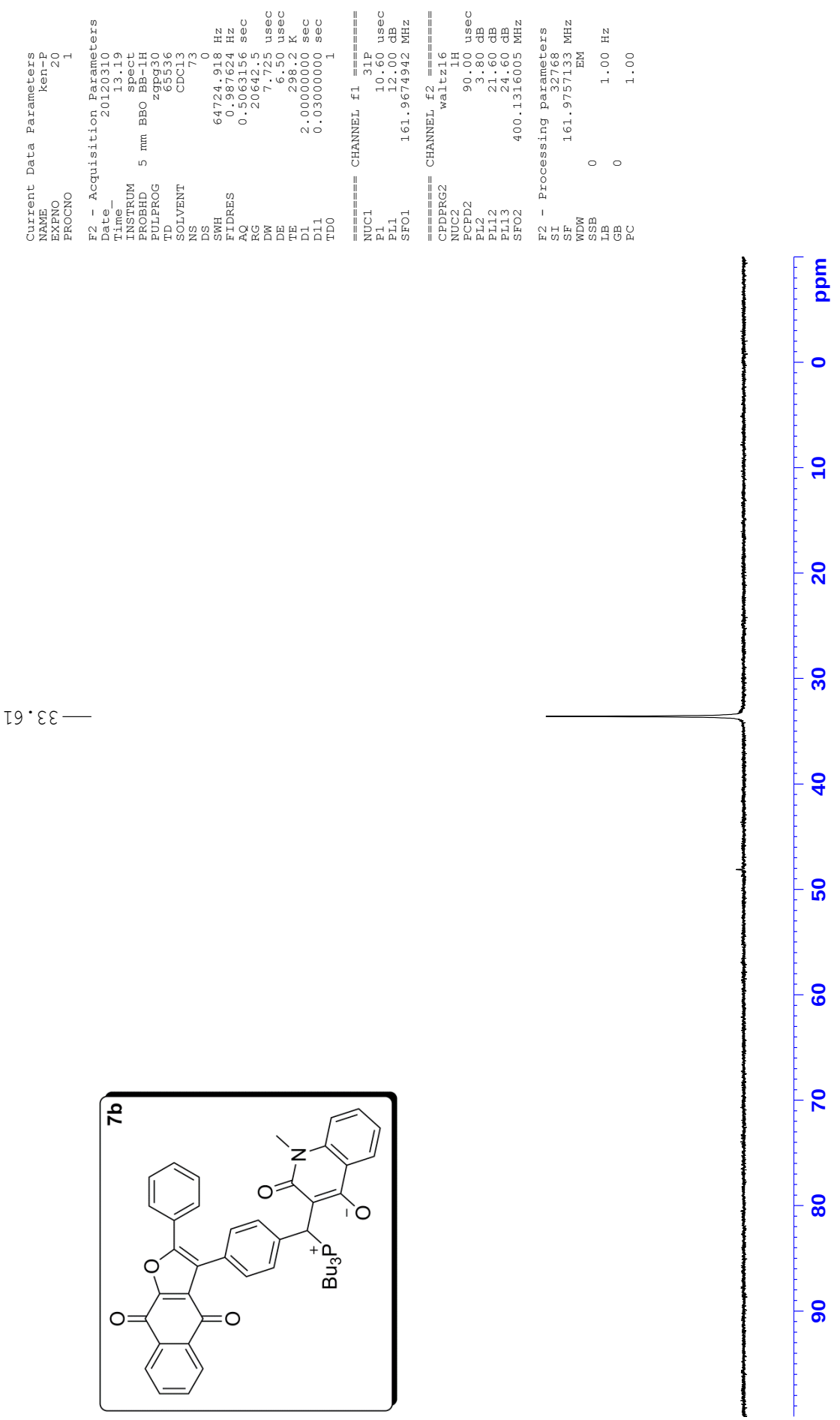
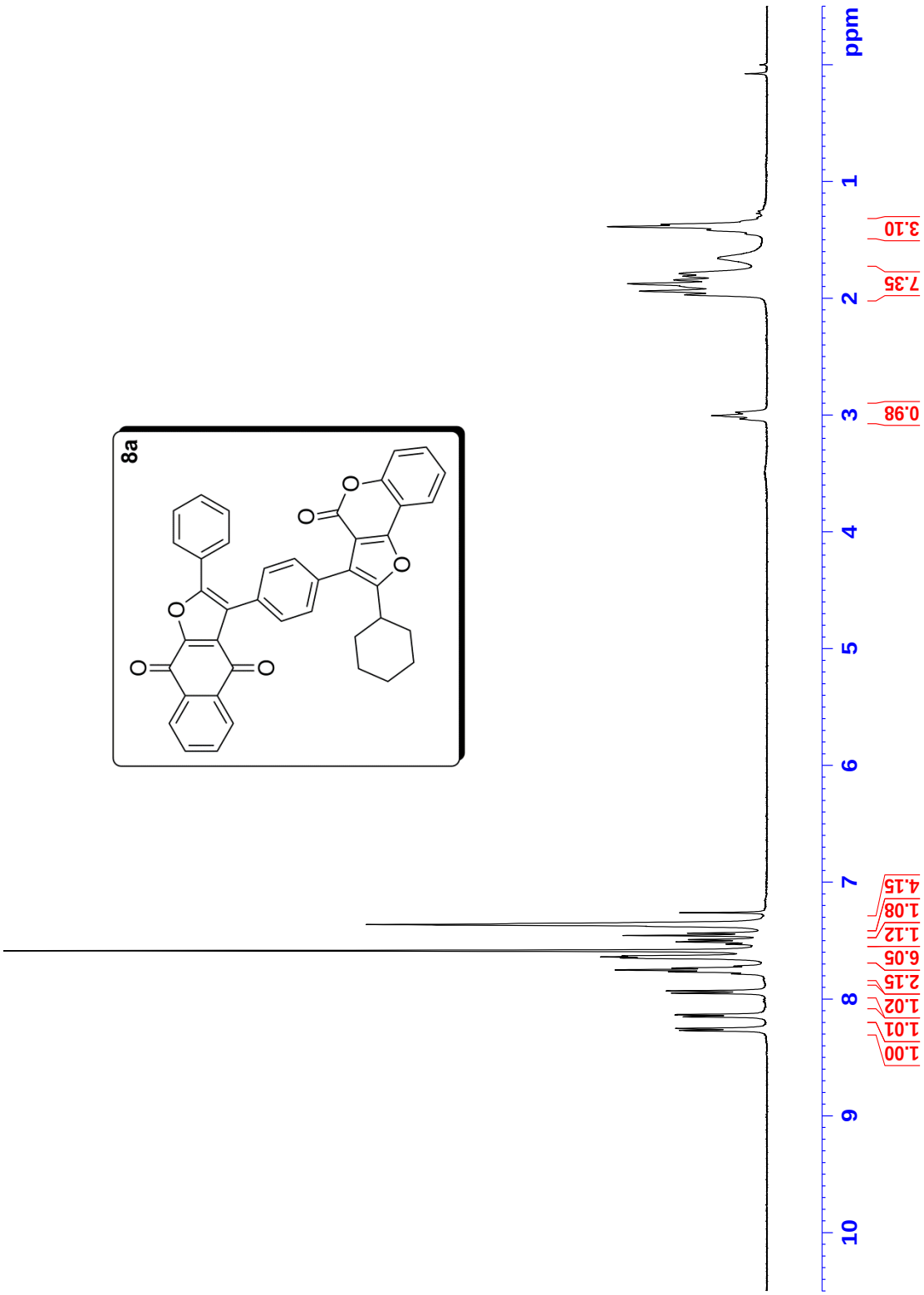
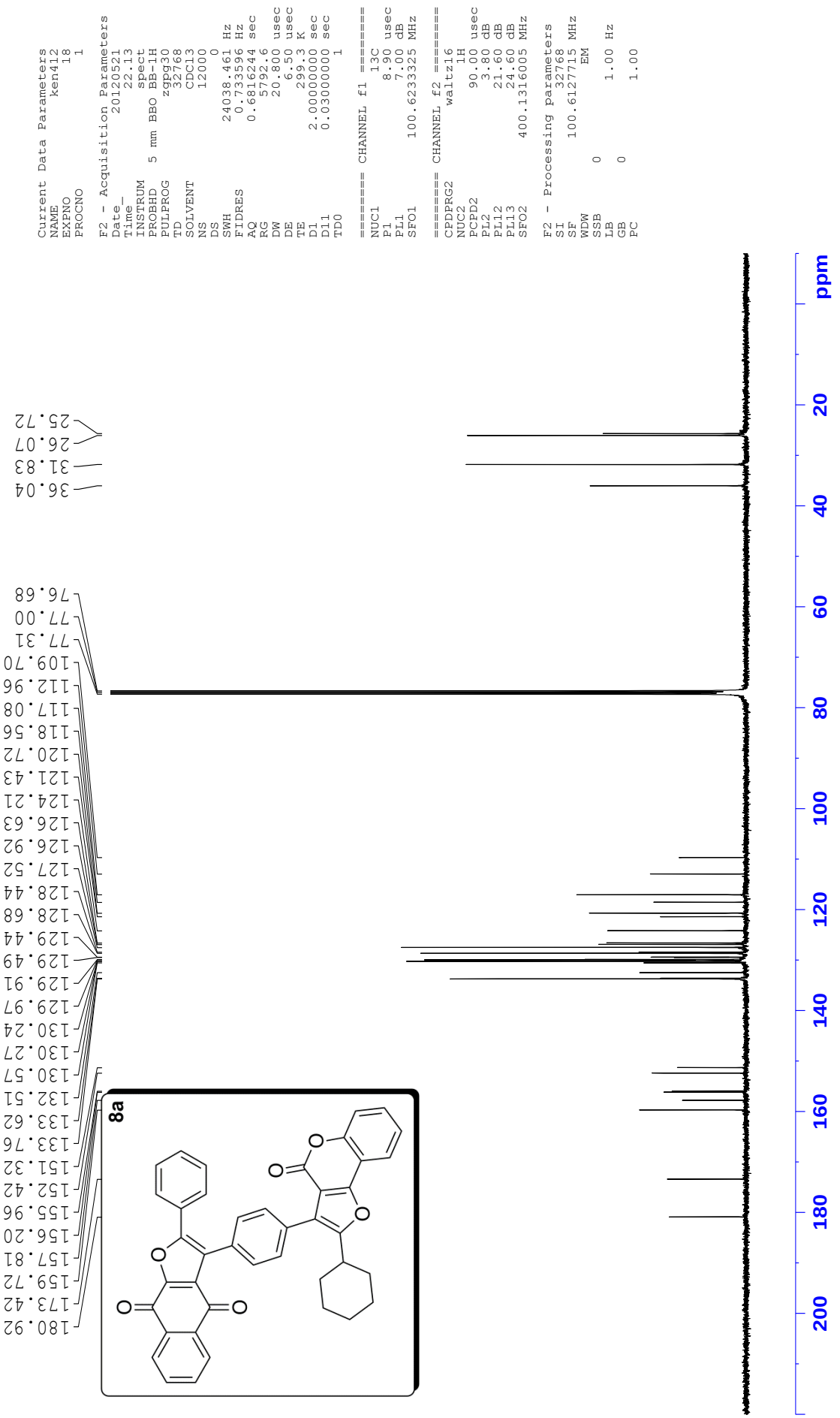
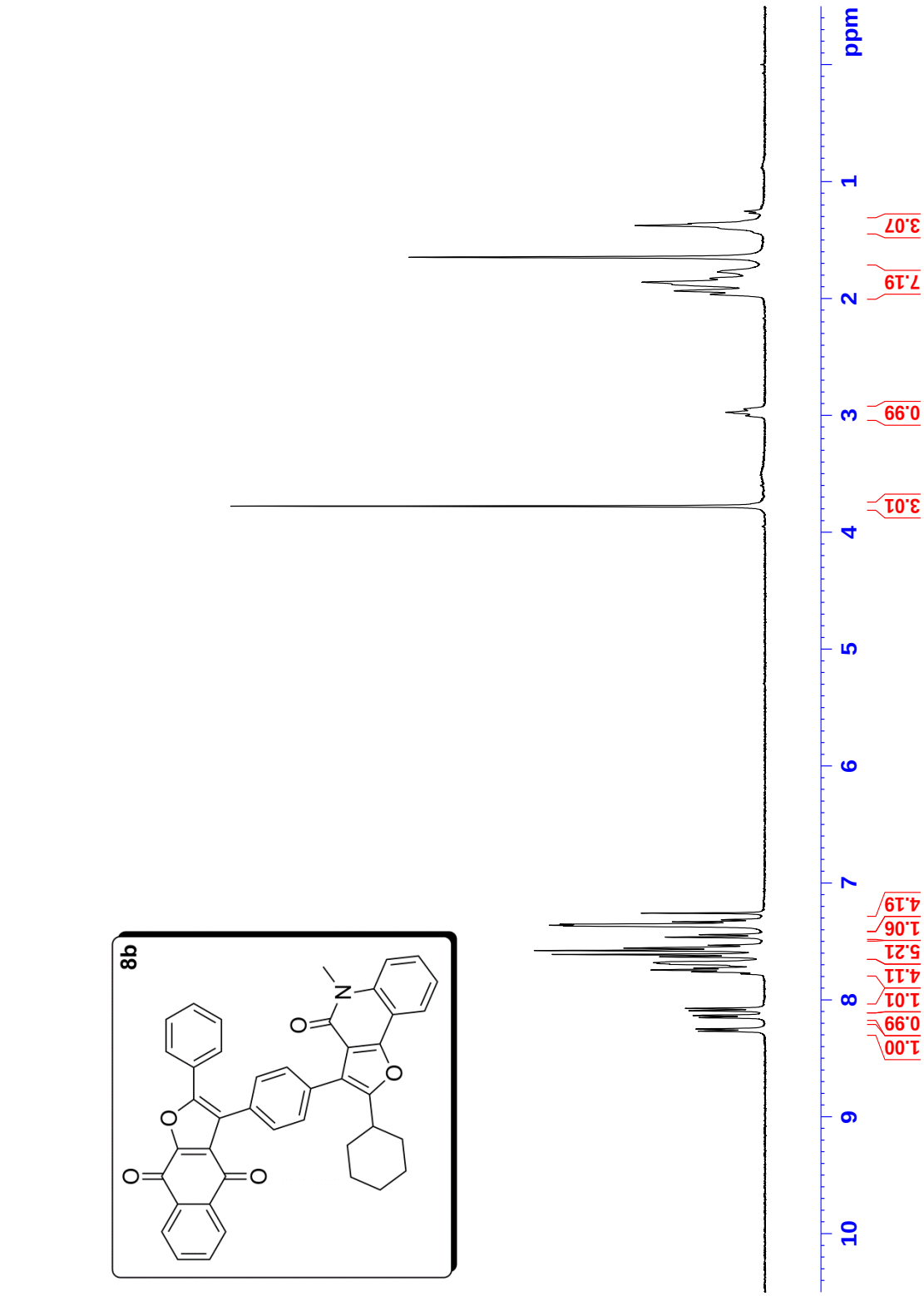
0.99
4.75
2.08
1.13
2.12
4.19
1.02
1.99
7b
Bu3P

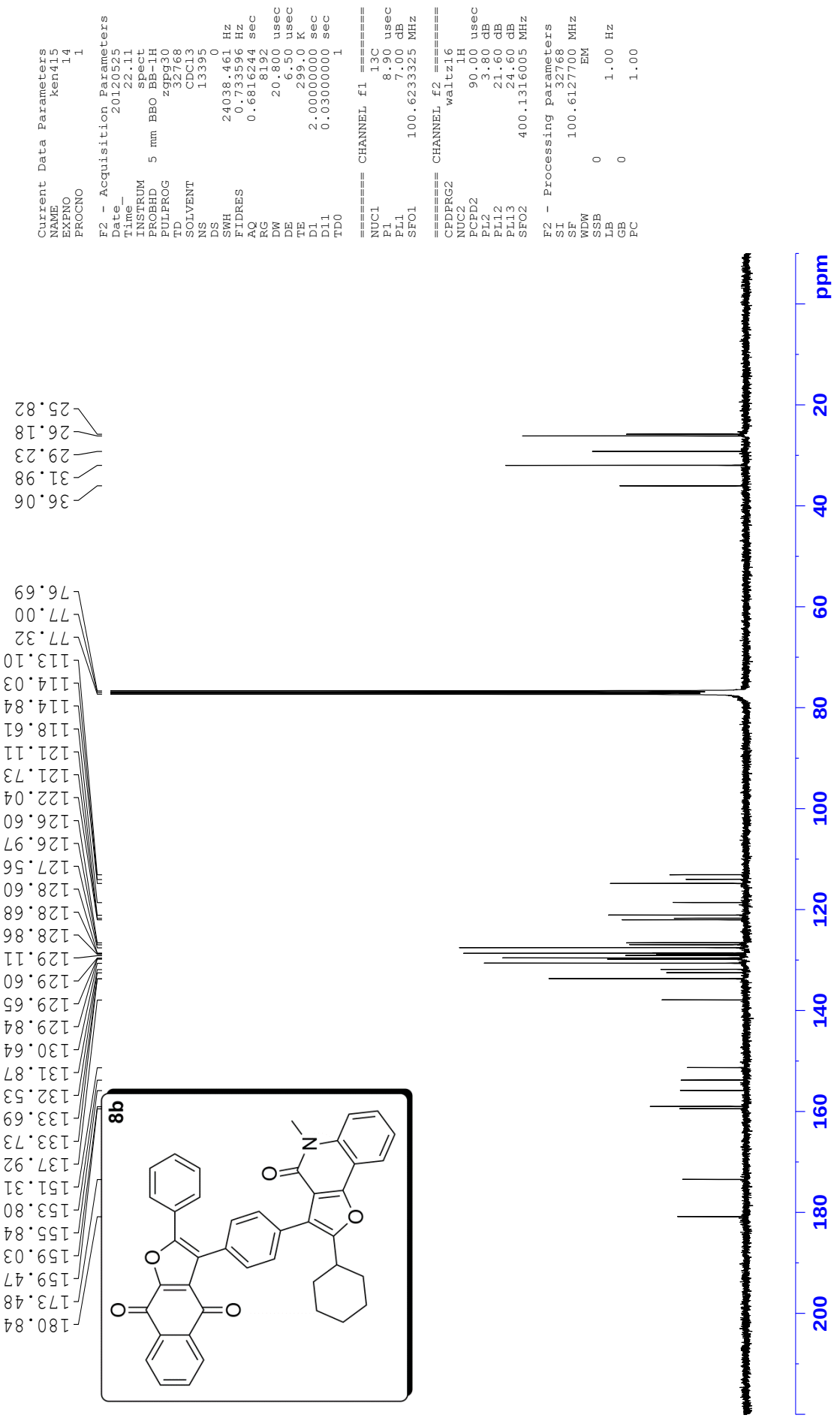

Current Data Parameters
NAME ken409
EXPNO 19
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120311
Time_ 18.17
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 2400
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 5792.6
DW 20.800 usec
DE 6.50 usec
TE 297.9 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127730 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
13.30
20.57
21.04
23.99
24.14
24.33
24.37
29.06
76.68
77.00
77.32
101.18
113.41
120.23
121.10
123.27
125.65
126.56
126.68
127.25
127.38
128.36
128.68
129.68
129.79
129.84
129.88
130.05
130.10
130.61
130.64
132.43
133.62
136.54
140.17
151.10
155.43
164.62
172.32
173.34
180.34
7b
Bu3P
ppm
200
180
160
140
120
100
80
60
40
20




Current Data Parameters
NAME ken412
EXPNO 17
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120521
Time_ 21.48
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 128
DW 69.000 usec
DE 6.50 usec
TE 298.7 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300078 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
8a
ppm
1
2
3
4
5
6
7
8
9
10
3.10
7.35
0.98
1.00
1.01
1.02
2.15
6.05
1.12
1.08
4.15


Current Data Parameters
NAME ken412
EXPNO 18
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120521
Time_ 22.13
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 12000
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6816244 sec
RG 5792.6
DW 20.800 usec
DE 6.50 usec
TE 299.3 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 13C
P1 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127715 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
25.72
26.07
31.83
36.04
76.68
77.00
77.31
109.70
112.96
117.08
118.56
120.72
121.43
124.21
126.63
126.92
127.52
128.44
128.68
129.44
129.49
129.91
129.97
130.24
130.27
130.57
132.51
133.62
133.76
151.32
152.42
155.96
156.20
157.81
159.72
173.42
180.92
8a
ppm
200
180
160
140
120
100
80
60
40
20


Current Data Parameters
NAME ken415
EXPNO 13
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120525
Time_ 22.04
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 8
DS 0
SWH 7246.377 Hz
FIDRES 0.221142 Hz
AQ 2.2610421 sec
RG 161.3
DW 69.000 usec
DE 6.50 usec
TE 298.7 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
NUC1 1H
P1 11.70 usec
PL1 4.00 dB
SFO1 400.1324008 MHz
F2 - Processing parameters
SI 16384
SF 400.1300084 MHz
WDW EM
SSB 0
LB 0 Hz
GB 0
PC 1.00
8b
ppm
1
2
3
4
5
6
7
8
9
10
3.07
7.19
0.99
3.01
1.00
0.99
1.01
4.11
5.21
1.06
4.19


Current Data Parameters
NAME ken415
EXPNO 14
PROCNO 1
F2 - Acquisition Parameters
Date_ 20120525
Time_ 22.11
INSTRUM spect
PROBHD 5 mm BBO BB-1H
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 13395
DS 0
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.68186244 sec
RG 8192
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 8.90 usec
PL1 7.00 dB
SFO1 100.6233325 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 90.00 usec
PL2 3.80 dB
PL12 21.60 dB
PL13 24.60 dB
SFO2 400.1316005 MHz
F2 - Processing parameters
SI 32768
SF 100.6127700 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.00
25.82
26.18
29.23
31.98
36.06
76.69
77.00
77.32
113.10
114.03
114.84
118.61
121.11
121.73
122.04
126.60
126.97
127.56
128.60
128.68
128.86
129.11
129.60
129.65
129.84
130.64
131.87
132.53
133.69
133.73
137.92
151.31
153.80
155.84
159.03
159.47
173.48
180.84
8b
O
O
O
O
N
ppm
20
40
60
80
100
120
140
160
180
200