

# **Mechanochemistry Enabled Highly Efficient Solvent-Free Deoxygenation of Phosphine Oxides in Air**

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## 1. Chemicals and Instrumentation

The starting materials were obtained from commercial suppliers and used as received. Solvents were purchased from commercial suppliers, and further dried over molecular sieve (MS 4Å). All mechanochemical reactions were carried out using grinding vessels in a Retsch MM400 mill (Figure S1). Both jars (5 mL) and balls (10 mm) are made of stainless (Figure S2). The heat gun with temperature control function HG-1450B was used (Figure S3). NMR spectra were recorded on JEOL JNM-ECX400P and JNM-ECS400 spectrometers ( $^1\text{H}$ : 392 MHz,  $^{13}\text{C}$ : 99 MHz,  $^{31}\text{P}$ : 159 MHz).  $\text{CD}_2\text{Cl}_2$  ( $^1\text{H}$ ,  $^{13}\text{C}$ ,  $^{31}\text{P}$ ) and  $\text{CDCl}_3$  ( $^1\text{H}$ ,  $^{13}\text{C}$ ) was employed as external standards, respectively. Multiplicity was recorded as follows: s = singlet, brs = broad singlet, d = doublet, t = triplet, q = quartet, quint = quintet, sept = septet, o = octet, m = multiplet. 1,1,2,2-Tetrachloroethane was used as an internal standard to determine NMR yields. Recycle preparative gel permeation chromatography (GPC) was conducted with a JAI LC-9101 using  $\text{CHCl}_3$  as an eluent with JAIGEL-1H. The internal temperature of the jar after ball milling was confirmed by thermography was recorded with an NEC Avio Thermo GEAR G120. High-resolution mass spectra were recorded at the Global Facility Center, Hokkaido University.



**Figure S1.** Retsch MM400 used in this study.

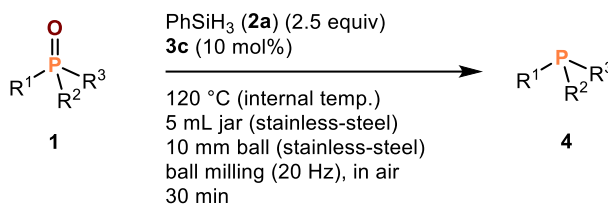


**Figure S2.** Stainless jar and ball used in this study.



**Figure S3.** The temperature controllable heat-gun used in this study.

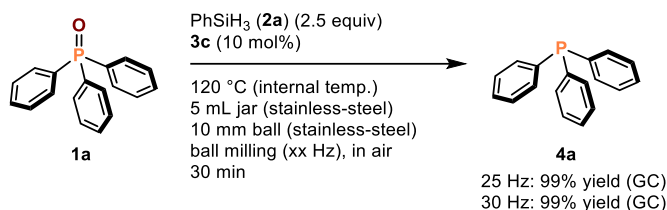
## 2. General Procedure for Deoxygenation of Phosphine Oxide in Air



Phosphine Oxide **1** (0.3 mmol), PhSiH<sub>3</sub> (**2a**) (0.75 mmol, 2.5 equiv) and **3c** (0.03 mmol, 10 mol %) were placed in a ball milling vessel (stainless, 5 mL) loaded with one grinding ball (stainless, diameter: 10 mm). After the vessel was closed in air without purging with inert gas, the vessel was placed in the ball mill (Retch MM400, 30 min at 20 Hz) and heat gun (pre-set temperature at 250 °C). After 30 min, the mixture was filtrated with CH<sub>2</sub>Cl<sub>2</sub>. The crude mixture was then purified by flash column chromatography (SiO<sub>2</sub>, CH<sub>2</sub>Cl<sub>2</sub>/hexane, typically 0:100→10:90) to give the corresponding reduced product **4**.

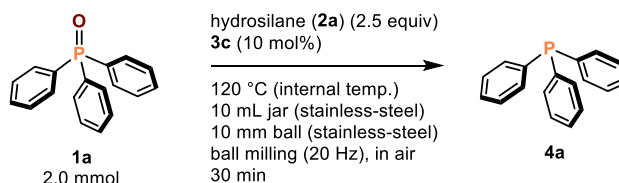
**Caution:** Phenylsilane (**2a**) is potentially hazardous as the flash point of **2a** is 7 °C. Although we did not experience any accidents during this study, but pay attention to its handling.

### Reactions at higher frequencies



The reactions at higher frequencies also gave the desired product in excellent yield (99%).

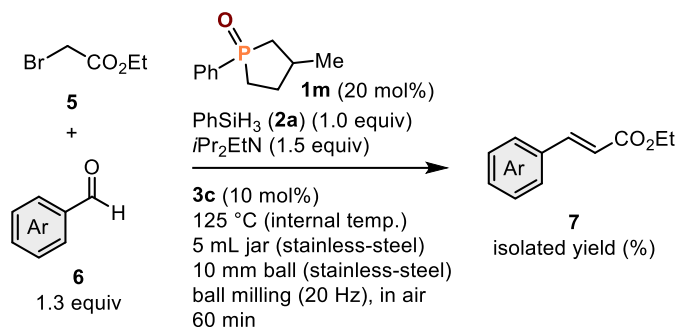
### Procedure for scaled-up reaction



Phosphine oxide **1a** (556.5 mg, 2.0 mmol), PhSiH<sub>3</sub> (**2a**) (615 μL, 5.0 mmol, 2.5 equiv) and **3c** (69.1 mg, 0.20 mmol, 10 mol %) were placed in a ball milling vessel (stainless, 10 mL) loaded with one grinding ball (stainless, diameter: 10 mm). After the vessel was closed in air without purging with inert gas, the vessel was placed in the ball mill (Retch MM400, 30 min at 20 Hz) and a heat gun (pre-

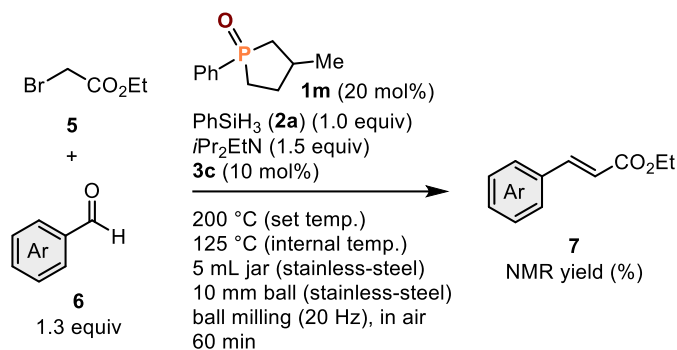
set temperature at 250 °C). After 30 min, the mixture was filtrated with CH<sub>2</sub>Cl<sub>2</sub>. The crude mixture was then purified by flash column chromatography (SiO<sub>2</sub>, CH<sub>2</sub>Cl<sub>2</sub>/hexane, 0:100→10:90) to give the corresponding reduced product **4a** (99%).

### 3. General Procedure for Catalytic Wittig Reaction Using Mechanochemistry



Ethyl 2-bromoacetate (**5**) (0.3 mmol), aldehyde (0.39 mmol, 1.3 equiv), phosphine oxide **1m** (0.06 mmol, 20 mol%), PhSiH<sub>3</sub> (**2a**) (0.3 mmol, 1.0 equiv), *i*Pr<sub>2</sub>EtN (0.45 mmol, 1.5 equiv) and **3c** (0.03 mmol, 10 mol %) were placed in a ball milling vessel (stainless, 5 mL) loaded with one grinding ball (stainless, diameter: 10 mm). After the vessel was closed in air without purging with inert gas, the vessel was placed in the ball mill (Retch MM400, 60 min at 20 Hz) and heat gun (pre-set temperature at 250 °C). After 60 min, the mixture was filtration with CH<sub>2</sub>Cl<sub>2</sub>. The crude mixture was then purified by flash column chromatography (SiO<sub>2</sub>, typically CH<sub>2</sub>Cl<sub>2</sub>/hexane, typically 0-10:90) to give the corresponding reduced product **7**.

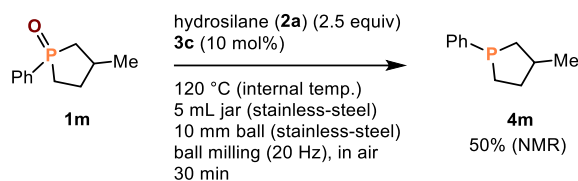
#### 4. Optimization Study on Mechanochemical Catalytic Wittig Reaction



entry	conditions	NMR yield (%)
1	none	77
2	150 °C (set temp.)	74
3	250 °C (set temp.)	63
4	300 °C (set temp.)	46
5 <sup>a</sup>	$\text{K}_2\text{CO}_3$ instead of $i\text{Pr}_2\text{EtN}$	N.D.
6 <sup>a</sup>	$\text{Na}_2\text{CO}_3$ instead of $i\text{Pr}_2\text{EtN}$	16
7 <sup>a</sup>	$\text{Et}_3\text{N}$ instead of $i\text{Pr}_2\text{EtN}$	12
8 <sup>a</sup>	w/o phosphoric acid	40

<sup>a</sup>250 °C (set temp.)

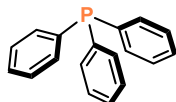
#### Mechanochemical deoxygenation of **1m**



We have investigated the reaction of **1m** under the optimized conditions, providing the desired reduction product **4m** in moderate yield (50%). Although the mechanochemical reduction of **1m** was less efficient compared to the reaction of **1a**, the catalytic reaction using **1m** was much better than using **1a**. These conflicting results emphasize the need for further mechanistic studies to guide for improving reaction efficiency in mechanochemical conditions.

## 5. Characterization of Obtained Products.

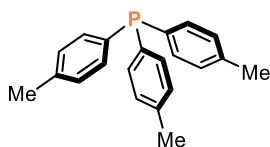
### Triphenylphosphine (4a).



4a

The reaction was carried out with 83.4 mg (0.3 mmol) of **1a**. The product **4a** was obtained as a white powder (74.8 mg, 0.285 mmol, 95% yield) after purification by silica-gel column chromatography (SiO<sub>2</sub>, CH<sub>2</sub>Cl<sub>2</sub>/hexane, 0:100→10:90). <sup>1</sup>H, <sup>13</sup>C and <sup>31</sup>P NMR were in agreement with the literature.<sup>1</sup> <sup>1</sup>H NMR (392 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 7.26–7.38 (m, 15H). <sup>13</sup>C NMR (99 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 128.9 (d, *J* = 7.5 Hz, CH), 129.1 (CH<sub>3</sub>), 134.1 (d, *J* = 19.7 Hz, CH), 137.7 (d, *J* = 11.3 Hz, C). <sup>31</sup>P NMR (159 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): –5.5. HRMS-EI (*m/z*): [M]<sup>+</sup> calcd for C<sub>18</sub>H<sub>15</sub>P, 262.0911; found, 262.0914.

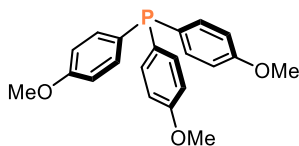
### Tri-*p*-tolylphosphine (4b).



4b

The reaction was carried out with 96.1 mg (0.3 mmol) of **1b**. The product **4b** was obtained as a white powder (70.6 mg, 0.232 mmol, 77% yield) after purification by silica-gel column chromatography (SiO<sub>2</sub>, CH<sub>2</sub>Cl<sub>2</sub>/hexane, 0:100→10:90). <sup>1</sup>H, <sup>13</sup>C and <sup>31</sup>P NMR were in agreement with the literature.<sup>2</sup> <sup>1</sup>H NMR (392 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 2.34 (s, 9H), 7.12–7.21 (m, 12H). <sup>13</sup>C NMR (99 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 21.4 (CH<sub>3</sub>), 129.6 (d, *J* = 7.6 Hz, CH), 133.9 (d, *J* = 19.7 Hz, CH), 134.7 (d, *J* = 10.3 Hz, C), 139.1 (C). <sup>31</sup>P NMR (159 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): –8.0. HRMS-ESI (*m/z*): [M+H]<sup>+</sup> calcd for C<sub>21</sub>H<sub>22</sub>P, 305.1454; found, 305.1447.

### Tris(4-methoxyphenyl)phosphine (4c).



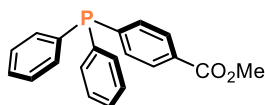
4c

The reaction was carried out with 110.5 mg (0.3 mmol) of **1c**. The product **4c** was obtained as a white powder (79.7 mg, 0.226 mmol, 75% yield) after purification by flash column chromatography with

CH<sub>2</sub>Cl<sub>2</sub>/hexane (0:100 → 10:90 → 20:80 → 40:60). <sup>1</sup>H and <sup>13</sup>C NMR were in agreement with the literature.<sup>1</sup>

<sup>1</sup>H NMR (392 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 3.79 (s, 9H), 6.84–6.91 (m, 6H), 7.17–7.25 (m, 6H). <sup>13</sup>C NMR (99 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 55.5 (CH<sub>3</sub>), 114.4 (d, *J* = 7.5 Hz, CH), 129.5 (d, *J* = 8.5 Hz, C), 135.3 (d, *J* = 20.7 Hz, CH), 160.6 (C). <sup>31</sup>P NMR (159 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): –10.3. HRMS-ESI (*m/z*): [M+H]<sup>+</sup> calcd for C<sub>21</sub>H<sub>22</sub>O<sub>3</sub>P, 353.1301; found, 353.1298.

#### Methyl 4-(diphenylphosphaneyl)benzoate (**4d**).

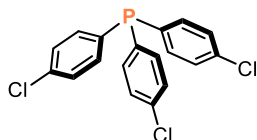


**4d**

The reaction was carried out with 96.6 mg (0.30 mmol) of **1d**. The product **4d** was obtained as a brown oil (91.0 mg, 0.297 mmol, 99% yield) after purification by flash column chromatography with EtOAc/Hexane (0:100 → 3:97). <sup>1</sup>H, <sup>13</sup>C and <sup>31</sup>P NMR were in agreement with the literature.<sup>2</sup>

<sup>1</sup>H NMR (392 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 3.88 (s, 3H), 7.29–7.41 (m, 12H), 7.95 (dd, *J* = 1.4, 8.0 Hz, 2H). <sup>13</sup>C NMR (99 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 52.4 (CH<sub>3</sub>), 129.1 (d, *J* = 7.5 Hz, CH), 129.6 (d, *J* = 4.7 Hz, CH), 130.6 (C), 133.5 (d, *J* = 18.7 Hz, CH), 134.3 (d, *J* = 19.8 Hz, CH), 136.7 (d, *J* = 10.3 Hz, C), 144.5 (d, *J* = 15.0 Hz, C), 167.0 (C). <sup>31</sup>P NMR (159 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): –5.0. HRMS-EI (*m/z*): [M]<sup>+</sup> calcd for C<sub>20</sub>H<sub>17</sub>O<sub>2</sub>P, 320.0966; found, 320.0959.

#### Tris(4-chlorophenyl)phosphine (**4e**).



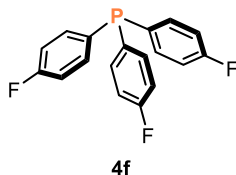
**4e**

The reaction was carried out with 114.6 mg (0.30 mmol) of **1e**. The product **4e** was obtained as a white powder (101.3 mg, 0.277 mmol, 92% yield) after purification by flash column chromatography with CH<sub>2</sub>Cl<sub>2</sub>/hexane (0:100 → 10:90). <sup>1</sup>H and <sup>13</sup>C NMR were in agreement with the literature.<sup>3</sup>

<sup>1</sup>H NMR (392 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 7.18–7.25 (m, 6H), 7.31–7.38 (m, 6H). <sup>13</sup>C NMR (99 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 129.3 (d, *J* = 7.5 Hz, CH), 135.3 (d, *J* = 20.7 Hz, CH), 135.5 (C), 135.8 (C). <sup>31</sup>P NMR (159 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): –8.4. HRMS-APCI (*m/z*): [M+H]<sup>+</sup> calcd for C<sub>18</sub>H<sub>13</sub>Cl<sub>3</sub>P, 364.9815; found, 364.9816.



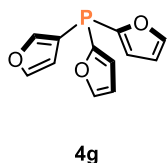
#### Tris(4-fluorophenyl)phosphine (**4f**).



The reaction was carried out with 99.6 mg (0.30 mmol) of **1f**. The product **4f** was obtained as a white powder (80.4 mg, 0.254 mmol, 85% yield) after purification by reprecipitation from CH<sub>2</sub>Cl<sub>2</sub>/Hexane (0:100→10:90). <sup>1</sup>H and <sup>13</sup>C NMR were in agreement with the literature.<sup>4</sup>

<sup>1</sup>H NMR (392 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 7.02–7.11 (m, 6H), 7.22–7.32 (m, 6H). <sup>13</sup>C NMR (99 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 116.2 (dd, *J* = 7.5, 20.6 Hz, CH), 133.1 (dd, *J* = 2.8, 11.3 Hz, C), 135.9 (dd, *J* = 8.0, 21.1 Hz, CH), 163.9 (d, *J* = 248.9 Hz, C). <sup>31</sup>P NMR (159 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): -9.0. HRMS-APCI (*m/z*): [M+H]<sup>+</sup> calcd for C<sub>18</sub>H<sub>13</sub>F<sub>3</sub>P, 317.0702; found, 317.0698.

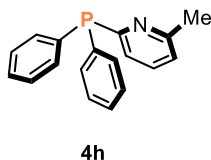
#### Tri(furan-2-yl)phosphine (**4g**).



The reaction was carried out with 74.5 mg (0.30 mmol) of **1g**. The product **4g** was obtained as a white powder (32.4 mg, 0.140 mmol, 46% yield) after purification by silica-gel column chromatography (CH<sub>2</sub>Cl<sub>2</sub>/hexane, 0:100→10:90). <sup>1</sup>H and <sup>13</sup>C NMR were in agreement with the literature.<sup>1</sup>

<sup>1</sup>H NMR (392 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 6.42–6.47 (m, 3H), 6.80 (dd, *J* = 2.0, 3.1 Hz, 3H), 7.67 (d, *J* = 1.6 Hz, 3H). <sup>13</sup>C NMR (99 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 111.2 (d, *J* = 6.6 Hz, CH), 121.6 (d, *J* = 24.4 Hz, CH), 147.9 (d, *J* = 2.8 Hz, CH), 149.3 (d, *J* = 2.9 Hz, C). <sup>31</sup>P NMR (159 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): -77.0. HRMS-EI (*m/z*): [M]<sup>+</sup> calcd for C<sub>12</sub>H<sub>9</sub>O<sub>3</sub>P, 232.0289; found, 232.0288.

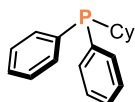
#### 2-Diphenylphosphino-6-methylpyridine (**4h**).



The reaction was carried out with 88.0 mg (0.30 mmol) of **1h**. The product **4h** was obtained as a white powder (73.5 mg, 0.265 mmol, 88% yield) after purification by silica-gel column chromatography (CH<sub>2</sub>Cl<sub>2</sub>/hexane, 0:100→10:90→20:80→40:60→60:40→100:0). <sup>1</sup>H, <sup>13</sup>C and <sup>31</sup>P NMR were in agreement with the literature.<sup>2</sup>

$^1\text{H}$  NMR (392 MHz,  $\text{CD}_2\text{Cl}_2$ ,  $\delta$ ): 2.53 (s, 3H), 6.85 (d,  $J = 7.8$  Hz, 1H), 7.06 (d,  $J = 7.8$  Hz, 1H), 7.32–7.41 (m, 10H), 7.45 (td,  $J = 2.1, 7.7$  Hz, 1H).  $^{13}\text{C}$  NMR (99 MHz,  $\text{CD}_2\text{Cl}_2$ ,  $\delta$ ): 24.7 ( $\text{CH}_3$ ), 122.3 (CH), 125.2 (d,  $J = 15.1$  Hz, CH), 128.9 (d,  $J = 7.5$  Hz, CH), 129.3 (CH), 134.5 (d,  $J = 19.7$  Hz, CH), 136.2 (CH), 137.1 (d,  $J = 11.3$  Hz, C), 159.4 (d,  $J = 13.1$  Hz, C), 163.1 (d,  $J = 6.5$  Hz, C).  $^{31}\text{P}$  NMR (159 MHz,  $\text{CD}_2\text{Cl}_2$ ,  $\delta$ ):  $-5.0$ . HRMS-ESI ( $m/z$ ):  $[\text{M}+\text{Na}]^+$  calcd for  $\text{C}_{18}\text{H}_{16}\text{NNaP}$ , 300.0913; found, 300.0907.

#### Cyclohexyldiphenylphosphine (**4i**).

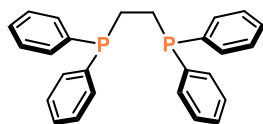


**4i**

The reaction was carried out with 85.1 mg (0.30 mmol) of **1i**. The product **4i** was obtained as a white powder (75.4 mg, 0.281 mmol, 94% yield) after purification by flash column chromatography with  $\text{CH}_2\text{Cl}_2$ /Hexane (0:100 $\rightarrow$ 10:90).  $^1\text{H}$ ,  $^{13}\text{C}$  and  $^{31}\text{P}$  NMR were in agreement with the literature.<sup>2</sup>

$^1\text{H}$  NMR (392 MHz,  $\text{CD}_2\text{Cl}_2$ ,  $\delta$ ): 1.12–1.38 (m, 5H), 1.60–1.81 (m, 5H), 2.17–2.29 (m, 1H), 7.28–7.36 (m, 6H), 7.43–7.54 (m, 4H).  $^{13}\text{C}$  NMR (99 MHz,  $\text{CD}_2\text{Cl}_2$ ,  $\delta$ ): 26.8 ( $\text{CH}_2$ ), 27.2 (d,  $J = 11.2$  Hz,  $\text{CH}_2$ ), 30.0 (d,  $J = 16.0$  Hz,  $\text{CH}_2$ ), 35.7 (d,  $J = 9.5$  Hz, CH), 128.6 (d,  $J = 7.5$  Hz, CH), 128.9 (CH), 134.0 (d,  $J = 18.8$  Hz, CH), 137.9 (d,  $J = 15.0$  Hz, C).  $^{31}\text{P}$  NMR (159 MHz,  $\text{CD}_2\text{Cl}_2$ ,  $\delta$ ):  $-4.1$ . HRMS-ESI ( $m/z$ ):  $[\text{M}+\text{H}]^+$  calcd for  $\text{C}_{18}\text{H}_{22}\text{P}$ , 269.1454; found, 269.1449.

#### 1,2-Bis(diphenylphosphino)ethane (**4j**).

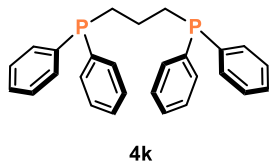


**4j**

The reaction was carried out with 129.0 mg (0.3 mmol) of **1j**. The product **4j** was obtained as a white powder (66.7 mg, 0.167 mmol, 56% yield) after purification by silica-gel column chromatography ( $\text{SiO}_2$ ,  $\text{CH}_2\text{Cl}_2$ /hexane, 0:100 $\rightarrow$ 10:90 $\rightarrow$ 20:80).  $^1\text{H}$ ,  $^{13}\text{C}$  and  $^{31}\text{P}$  NMR were in agreement with the literature.<sup>2</sup>

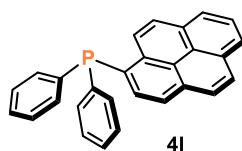
$^1\text{H}$  NMR (392 MHz,  $\text{CD}_2\text{Cl}_2$ ,  $\delta$ ): 2.08 (t,  $J = 4.2$  Hz, 4H), 7.26–7.36 (m, 20H).  $^{13}\text{C}$  NMR (99 MHz,  $\text{CD}_2\text{Cl}_2$ ,  $\delta$ ): 24.1 ( $\text{CH}_2$ ), 128.8 (t,  $J = 2.9$  Hz, CH), 129.0 (CH), 133.0 (t,  $J = 9.5$  Hz, CH), 138.8 (t,  $J = 7.2$  Hz, C).  $^{31}\text{P}$  NMR (159 MHz,  $\text{CD}_2\text{Cl}_2$ ,  $\delta$ ):  $-12.8$ . HRMS-EI ( $m/z$ ):  $[\text{M}]^+$  calcd for  $\text{C}_{26}\text{H}_{24}\text{P}_2$ , 398.1353; found, 398.1342.

### 1,3-Bis(diphenylphosphino)propane (**4k**).



The reaction was carried out with 133.4 mg (0.3 mmol) of **1k**. The product **4k** was obtained as a yellow oil (85.4 mg, 0.207 mmol, 69% yield) after purification by silica-gel column chromatography (SiO<sub>2</sub>, CH<sub>2</sub>Cl<sub>2</sub>/hexane, 0:100→10:90→20:80). <sup>1</sup>H, <sup>13</sup>C and <sup>31</sup>P NMR were in agreement with the literature.<sup>2</sup> <sup>1</sup>H NMR (392 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 1.50–1.64 (m, 2H), 2.20 (t, *J* = 7.8 Hz, 4H), 7.27–7.41 (m, 20H). <sup>13</sup>C NMR (99 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 22.9 (t, *J* = 17.4 Hz, CH<sub>2</sub>), 29.8 (t, *J* = 12.7 Hz, CH<sub>2</sub>), 128.8 (d, *J* = 6.5 Hz, CH), 128.9 (CH), 133.0 (d, *J* = 18.8 Hz, CH), 139.2 (d, *J* = 14.1 Hz, C). <sup>31</sup>P NMR (159 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): –17.5. HRMS-EI (*m/z*): [M]<sup>+</sup> calcd for C<sub>27</sub>H<sub>26</sub>P<sub>2</sub>, 412.1510; found, 412.1501.

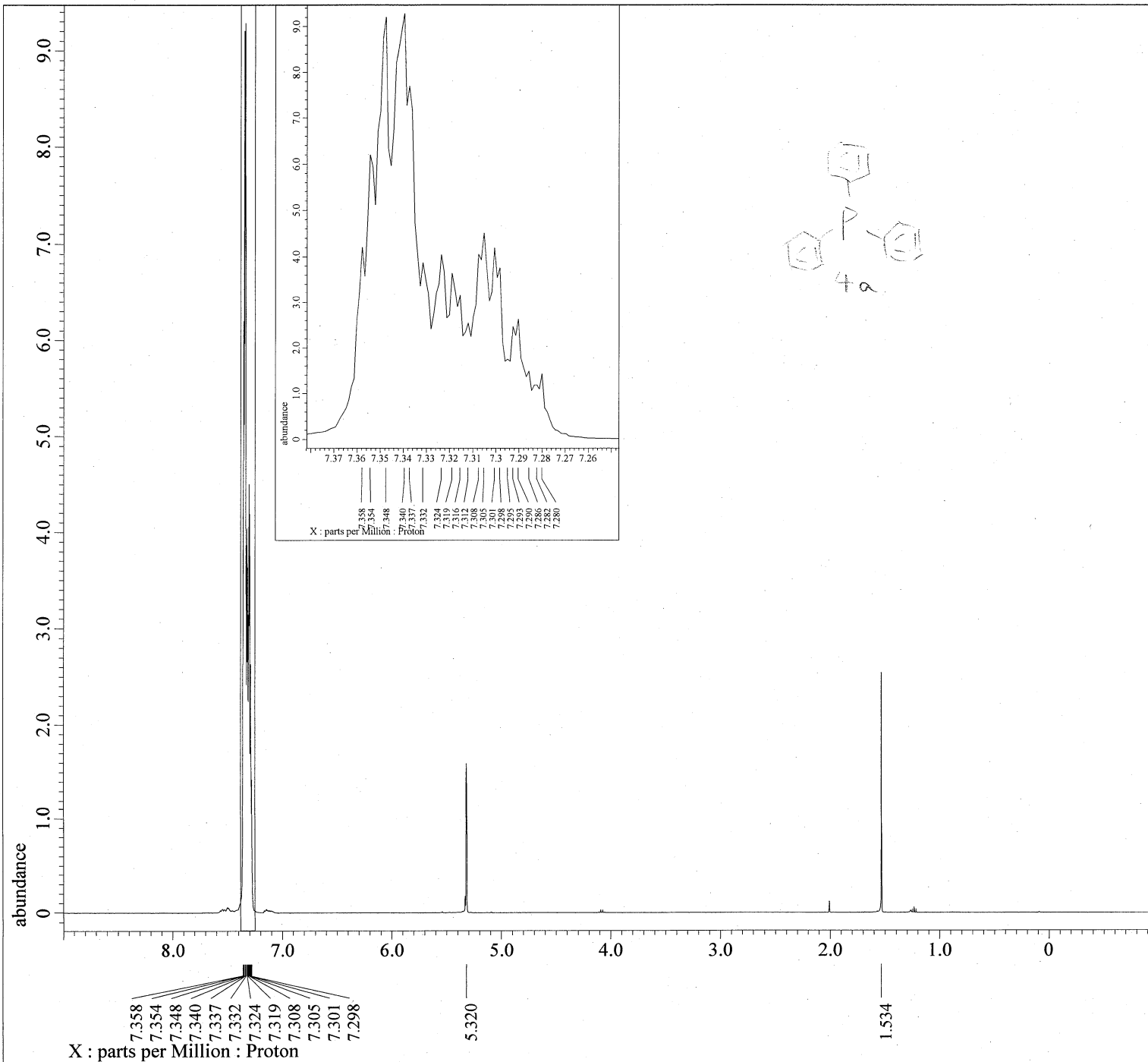
### Diphenyl(pyren-1-yl)phosphine (**4l**).



The reaction was carried out with 120.7 mg (0.30 mmol) of **1l**. The product **4l** was obtained as a yellow powder (99.4 mg, 0.257 mmol, 86% yield) after purification by silica-gel column chromatography (CH<sub>2</sub>Cl<sub>2</sub>/hexane, 0:100→10:90). <sup>1</sup>H and <sup>13</sup>C NMR were in agreement with the literature.<sup>5</sup> <sup>1</sup>H NMR (392 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 7.30–7.42 (m, 10H), 7.54–7.59 (m, 1H), 8.00–8.15 (m, 5H), 8.22 (t, *J* = 6.4 Hz, 2H), 8.72–8.80 (m, 1H). <sup>13</sup>C NMR (99 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): 124.8 (C), 125.0 (d, *J* = 4.7 Hz, C), 125.2 (CH), 125.5 (CH), 125.8 (CH), 125.9 (d, *J* = 6.6 Hz, CH), 126.5 (CH), 128.1 (d, *J* = 77.0 Hz, CH), 128.1 (d, *J* = 1.9 Hz, CH), 129.0 (d, *J* = 6.5 Hz, CH), 129.3 (CH), 131.2 (C), 131.3 (CH), 131.7 (C), 132.0 (d, *J* = 15.0 Hz, C), 132.2 (C), 134.4 (d, *J* = 22.6 Hz, C), 134.5 (d, *J* = 19.8 Hz, CH), 137.2 (d, *J* = 10.3 Hz, C). <sup>31</sup>P NMR (159 MHz, CD<sub>2</sub>Cl<sub>2</sub>, δ): –14.1. HRMS-EI (*m/z*): [M]<sup>+</sup> calcd for C<sub>28</sub>H<sub>19</sub>P, 386.1224; found, 386.1214.

## 6. References.

1. C. Laye, J. Lusseau, F. Robert, Y. Landais, *Adv. Synth. Catal.* **2021**, *363*, 3035–3043.
2. Y. Li, L. Lu, S. Das, S. Pisiewicz, K. Junge, M. Beller, *J. Am. Chem. Soc.* **2012**, *134*, 18325–18329.
3. J. Jeschke, M. Korb, T. Ruffer, C. Gabler, H. Lang, *Adv. Synth. Catal.* **2015**, *357*, 4069–4081.
4. J. Xiao, J. Wang, H. Zhang, J. Zhang, L. Han, *J. Org. Chem.* **2023**, *88*, 3909–3915.
5. C. Sire, H. Cattey, A. Tsivory, J. Hierso, J. Roger, *Adv. Synth. Catal.* **2022**, *364*, 440–452.



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 0.2[Hz], 0.0[s] )
trapezoid( 0[%], 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm
Derived from: REO-123-pure-1H_Proton-1-1.jdf

```

```

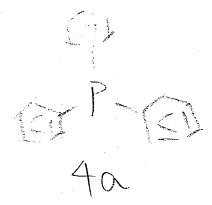
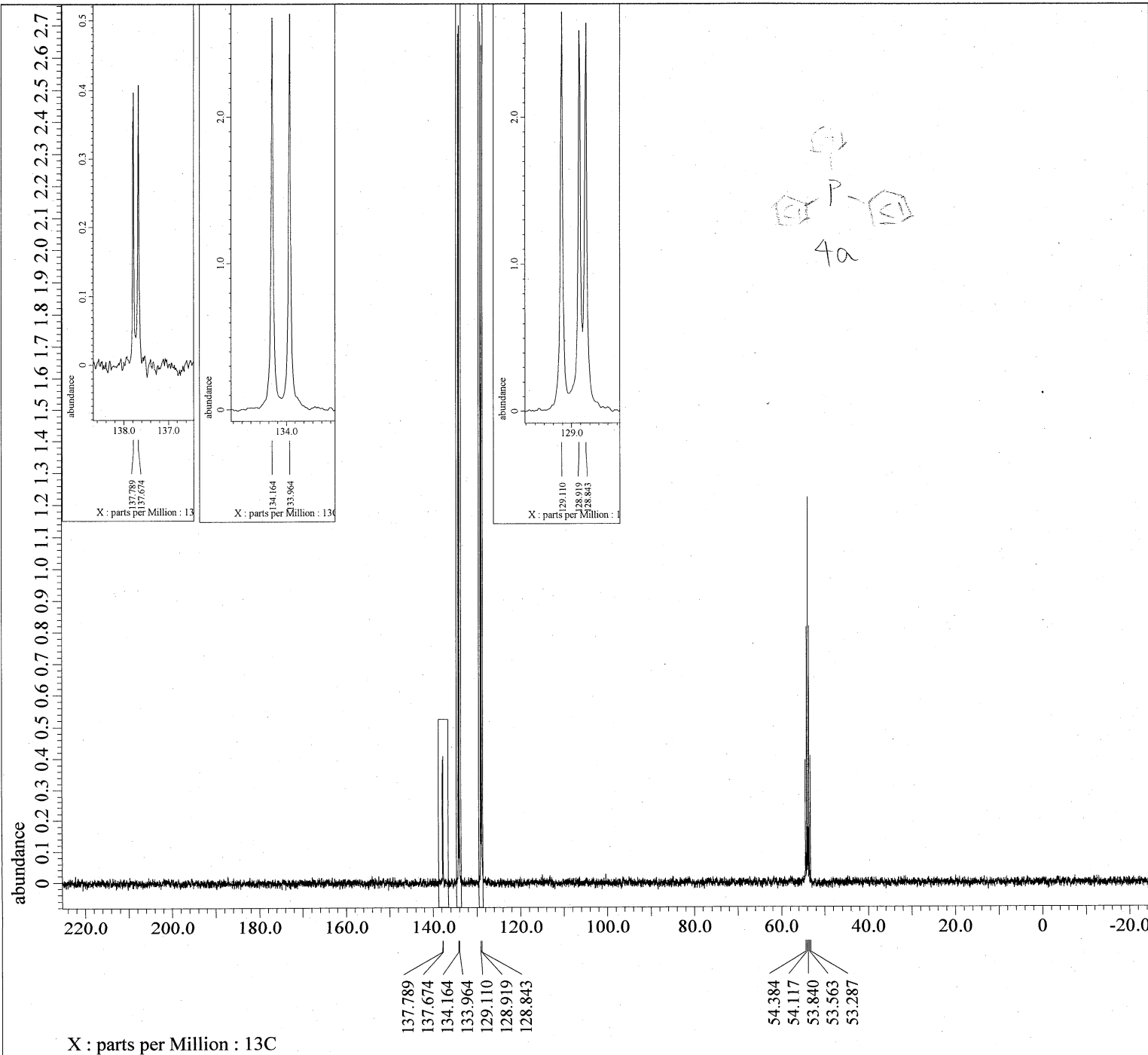
Filename      = REO-123-pure-1H_Proton-1-
Author       = element
Experiment    = proton.jxp
Sample_Id    = REO-123-pure-31P
Solvent      = METHYLENE-CHLORIDE-D2
Actual_Start_Time = 22-SEP-2022 16:26:30
Revision_Time  = 22-SEP-2022 19:12:33

Comment      = single pulse
Data_Format  = 1D COMPLEX
Dim_Size     = 13107
X_Domain    = Proton
Dim_Title   = Proton
Dim_Units   = [ppm]
Dimensions  = X
Site        = JNM-ECS400
Spectrometer = DELTA2_NMR

Field_Strength = 9.37221[T] (400[MHz])
X_Acq_Duration = 2.1889024[s]
X_Domain      = 1H
X_Freq       = 399.03472754[MHz]
X_Offset     = 5.0[ppm]
X_Points     = 16384
X_Prescans   = 1
X_Resolution = 0.45684997[Hz]
X_Sweep      = 7.48502994[kHz]
X_Sweep_Clippped = 5.98802395[kHz]
Irr_Domain   = Proton
Irr_Freq    = 399.03472754[MHz]
Irr_Offset  = 5.0[ppm]
Tri_Domain  = Proton
Tri_Freq    = 399.03472754[MHz]
Tri_Offset  = 5.0[ppm]
Clipped     = FALSE
Scans       = 8
Total_Scans = 8

Relaxation_Delay = 5[s]
Recvr_Gain      = 44
Temp_Get       = 19.4[dC]
X_90_Width     = 6.6[us]
X_Acq_Time     = 2.1889024[s]
X_Angle       = 45[deg]
X_Atn         = 1[dB]
X_Pulse       = 3.3[us]
Irr_Mode      = Off
Tri_Mode      = Off
Dante_Preset  = FALSE
Initial_Wait  = 1[s]
Repetition_Time = 7.1889024[s]

```



---- PROCESSING PARAMETERS ----  
 dc\_balance( 0, FALSE )  
 sexp( 2.0[Hz], 0.0[s] )  
 trapezoid3( 0[%], 80[%], 100[%] )  
 zerofill( 1 )  
 fft( 1, TRUE, TRUE )  
 machinephase  
 ppm  
 Derived from: REO-123-pure-13C-1.jdf

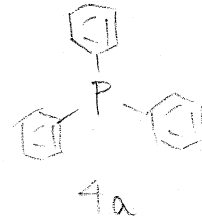
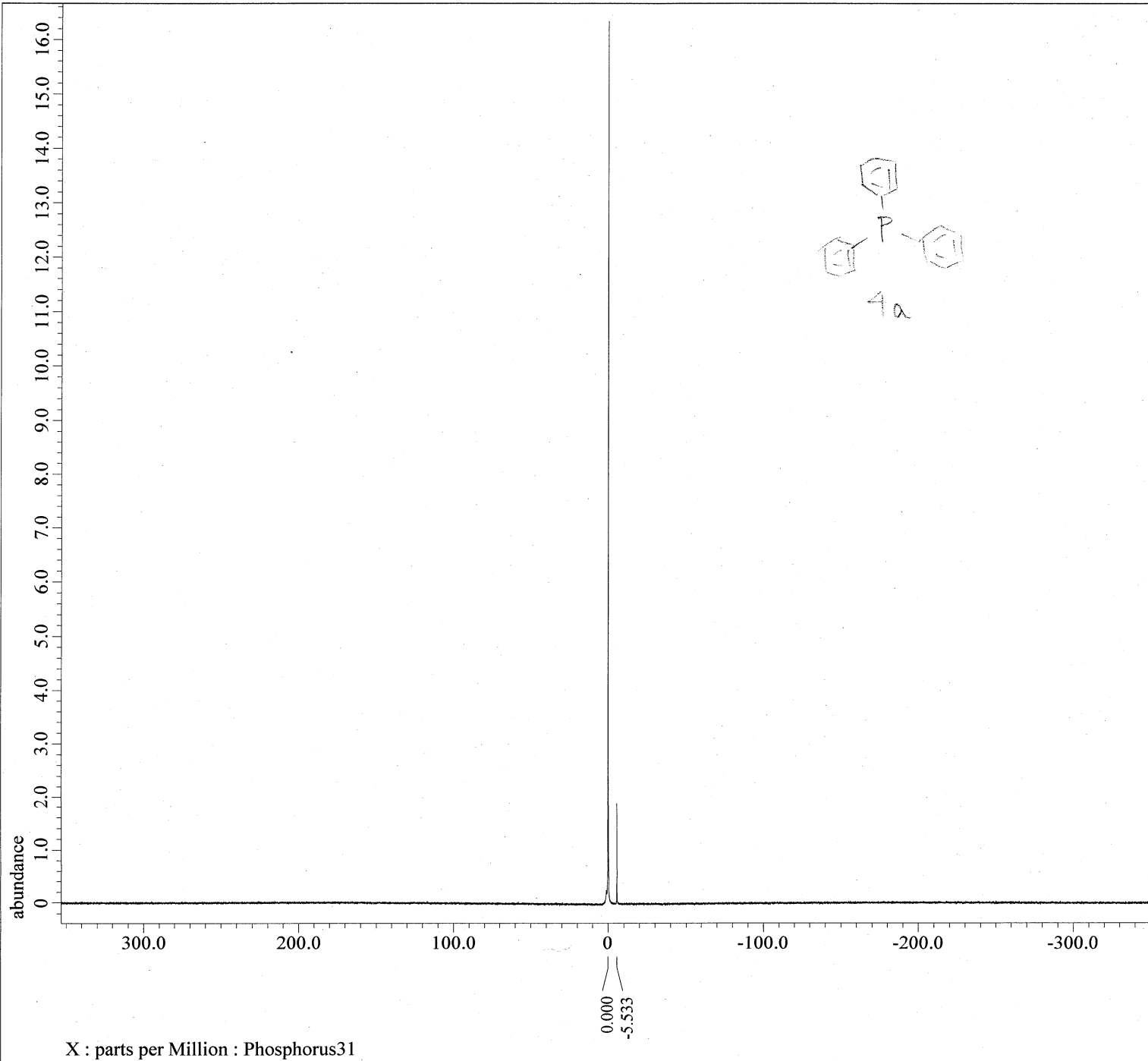
Filename = REO-123-pure-13C-2.jdf  
 Author = element  
 Experiment = single\_pulse\_dec  
 Sample\_id = 1  
 Solvent = METHYLENE-CHLORI  
 Actual\_Start\_Time = 22-SEP-2022 22:50:39  
 Revision\_Time = 22-SEP-2022 19:13:11

Comment = single pulse decoupled ga  
 Data Format = 1D COMPLEX  
 Dim\_Size = 26214  
 X\_Domain = 13C  
 Dim Title = 13C  
 Dim Units = [ppm]  
 Dimensions = X  
 Site = ECS 400  
 Spectrometer = JNM-ECS400

Field Strength = 9.20197068[T] (390[MHz])  
 X\_Acq\_Duration = 1.06430464[s]  
 X\_Domain = 13C  
 X\_Freq = 98.51479726[MHz]  
 X\_Offset = 100[ppm]  
 X\_Points = 32768  
 X\_Prescans = 4  
 X\_Resolution = 0.93958061[Hz]  
 X\_Sweep = 30.78817734[kHz]  
 Irr\_Domain = 1H  
 Irr\_Freq = 391.78655441[MHz]  
 Irr\_Offset = 5[ppm]  
 Clipped = FALSE  
 Scans = 100  
 Total\_Scans = 100

Relaxation\_Delay = 2[s]  
 Recvr\_Gain = 60  
 Temp\_Get = 20.2[dC]  
 X\_90\_Width = 8.7[us]  
 X\_Acq\_Time = 1.06430464[s]  
 X\_Angle = 30[deg]  
 X\_Atn = 4.9[dB]  
 X\_Pulse = 2.9[us]  
 Irr\_Atn\_Dec = 22.45[dB]  
 Irr\_Atn\_Noise = 22.45[dB]  
 Irr\_Noise = WALTZ  
 Decoupling = TRUE  
 Initial\_Wait = 1[s]  
 Noe = TRUE  
 Noe\_Time = 2[s]  
 Repetition\_Time = 3.06430464[s]

X : parts per Million : 13C



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid( 0[%], 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-123-pure-internal-31P_Carbo

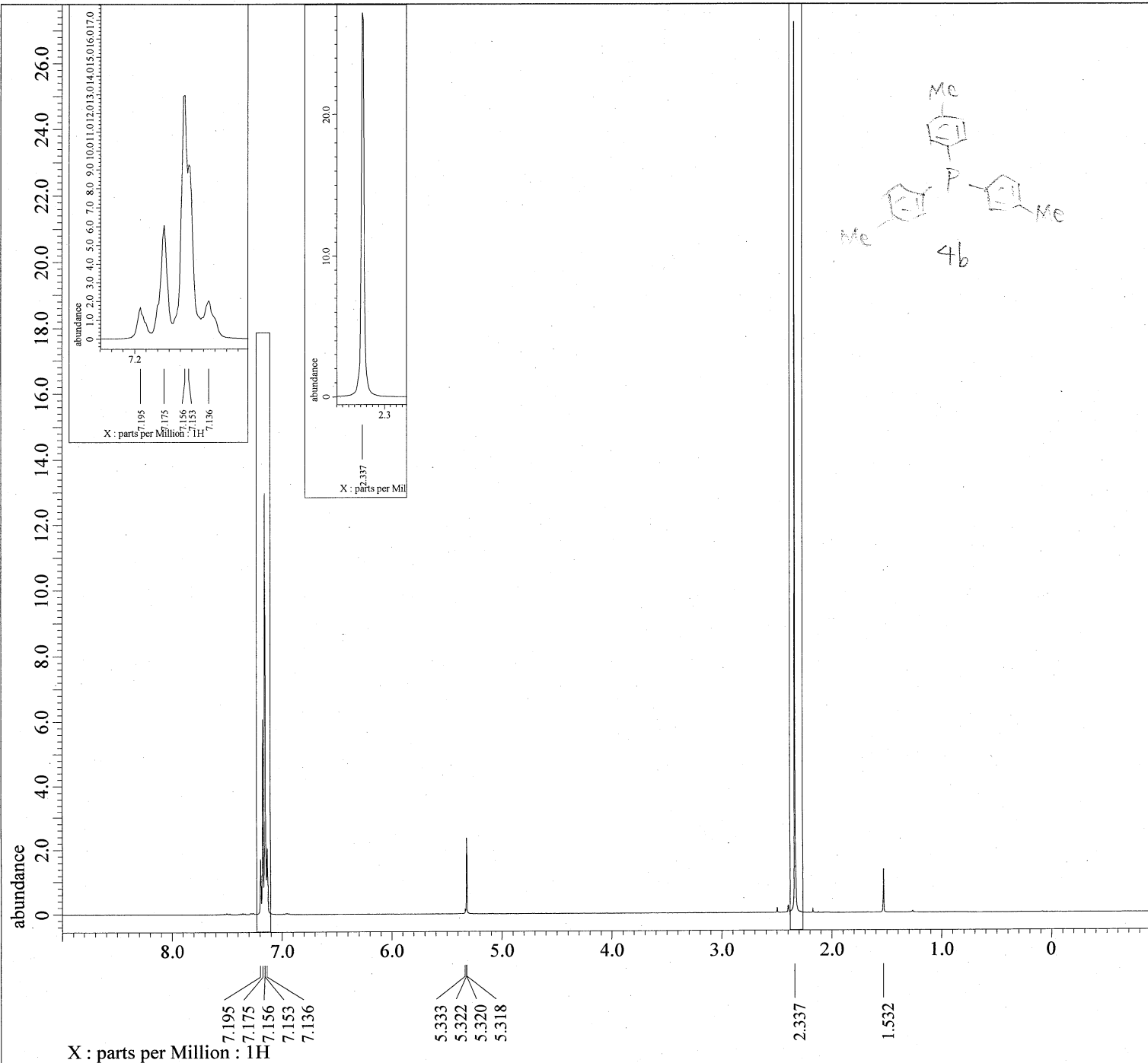
Filename      = REO-123-pure-internal-31P
Author       = element
Experiment   = carbon.jxp
Sample_Id    = REO-123-pure-internal-31P
Solvent      = METHYLENE-CHLORIDE-D2
Actual_Start_Time = 22-SEP-2022 16:36:20
Revision_Time   = 22-SEP-2022 19:15:03

Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim_Size     = 26214
X_Domain     = Phosph
Dim_Title    = Phosphorus31
Dim_Units    = [ppm]
Dimensions   = X
Site         = JNM-ECS400
Spectrometer = DELTA2_NMR

Field_Strength = 9.37221[T] (400[MHz])
X_Acq_Duration = 0.229376[s]
X_Domain       = 31P
X_Freq        = 161.53211155[MHz]
X_Offset      = 0[ppm]
X_Points      = 32768
X_Prescans    = 4
X_Resolution  = 4.35965402[Hz]
X_Sweep       = 142.85714286[kHz]
X_Sweep_Clippped = 114.28571429[kHz]
Irr_Domain    = Proton
Irr_Freq     = 399.03472754[MHz]
Irr_Offset   = 5.0[ppm]
Clipped      = FALSE
Scans        = 100
Total_Scans  = 100

Relaxation_Delay = 2[s]
Recvr_Gain       = 50
Temp_Get        = 19.5[dC]
X_90_Width     = 16.75[us]
X_Acq_Time     = 0.229376[s]
X_Angle        = 30[deg]
X_Atn          = 4.7[dB]
X_Pulse        = 5.58333333[us]
Irr_Atn_Dec    = 25.823[dB]
Irr_Atn_Noe    = 25.823[dB]
Irr_Noise     = WALTZ
Irr_Pwidth    = 0.115[ms]
Decoupling     = TRUE
Initial_Wait   = 1[s]
Noe            = TRUE
Noe_Time       = 2[s]
Repetition_Time = 2.229376[s]

```



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 0.2[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

```

Derived from: REO-053-pure-1H-3-1.jdf

```

Filename      = REO-053-pure-1H-3-2.jdf
Author        = element
Experiment     = single_pulse.ex2
Sample_Id     = S#519347
Solvent       = METHYLENE-CHLORI
Actual_Start_Time = 13-SEP-2022 21:09:52
Revision_Time  = 15-SEP-2022 11:47:27

```

```

Comment       = single_pulse
Data Format    = 1D COMPLEX
Dim_Size      = 13107
X_Domain      = 1H
Dim Title     = 1H
Dim Units     = [ppm]
Dimensions    = X
Site          = ECS 400
Spectrometer  = JNM-ECS400

```

```

Field Strength = 9.20197068[T] (390[MHz])
X_Acq Duration = 2.228224[s]
X_Domain       = 1H
X_Freq         = 391.78655441[MHz]
X_Offset       = 5[ppm]
X_Points       = 16384
X_Prescans     = 1
X_Resolution   = 0.44878791[Hz]
X_Sweep        = 7.35294118[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Tri_Domain     = 1H
Tri_Freq       = 391.78655441[MHz]
Tri_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 8
Total_Scans    = 8

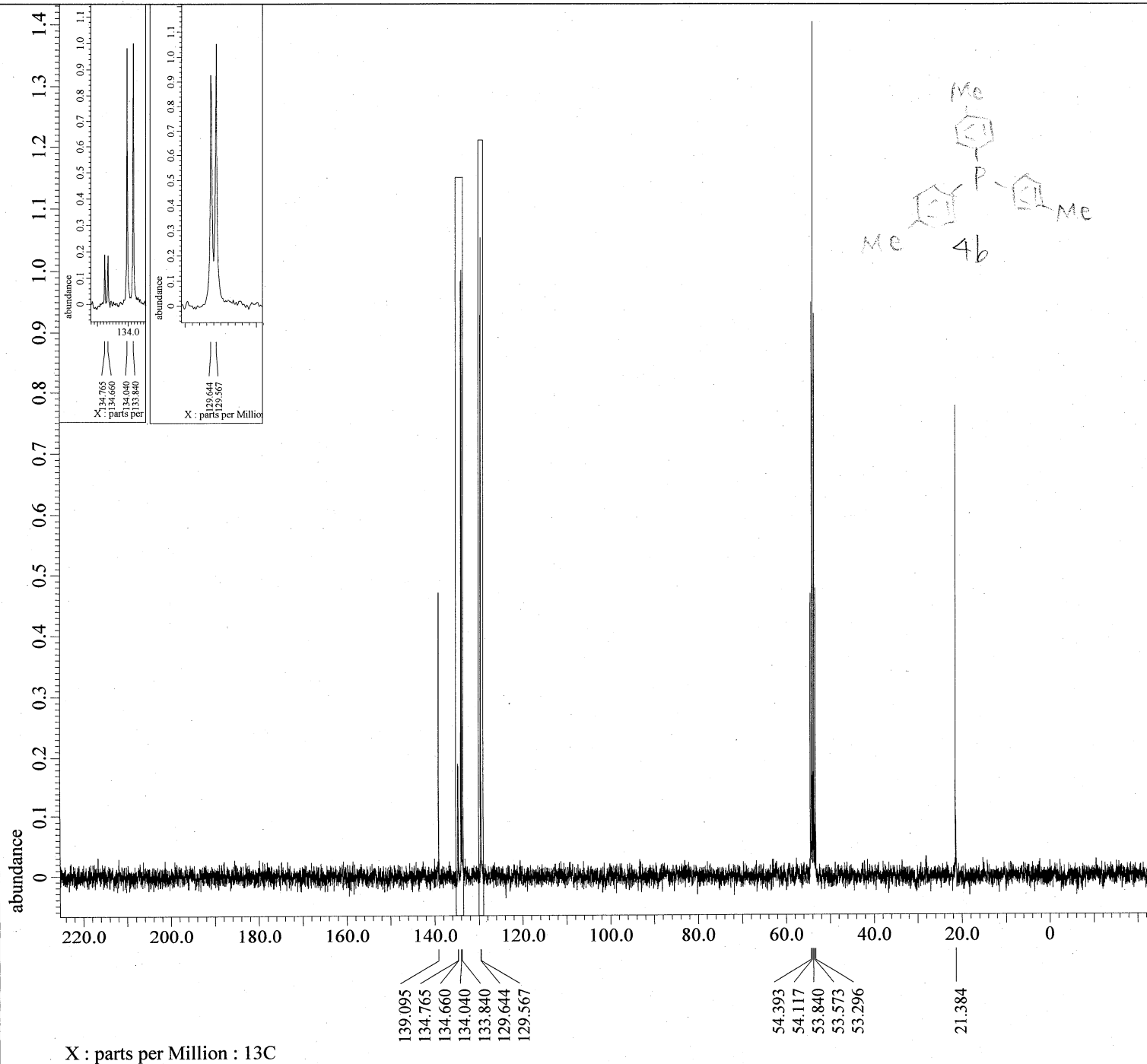
```

```

Relaxation_Delay = 5[s]
Recvr_Gain       = 46
Temp_Get         = 21.1[dC]
X_90_Width       = 10.8[us]
X_Acq Time       = 2.228224[s]
X_Angle          = 45[deg]
X_Atn            = 1.9[dB]
X_Pulse          = 5.4[us]
Irr_Mode         = Off
Tri_Mode         = Off
Dante_Presat    = FALSE
Initial_Wait     = 1[s]
Repetition_Time  = 7.228224[s]

```





```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-053-pure-13C-2-1.jdf

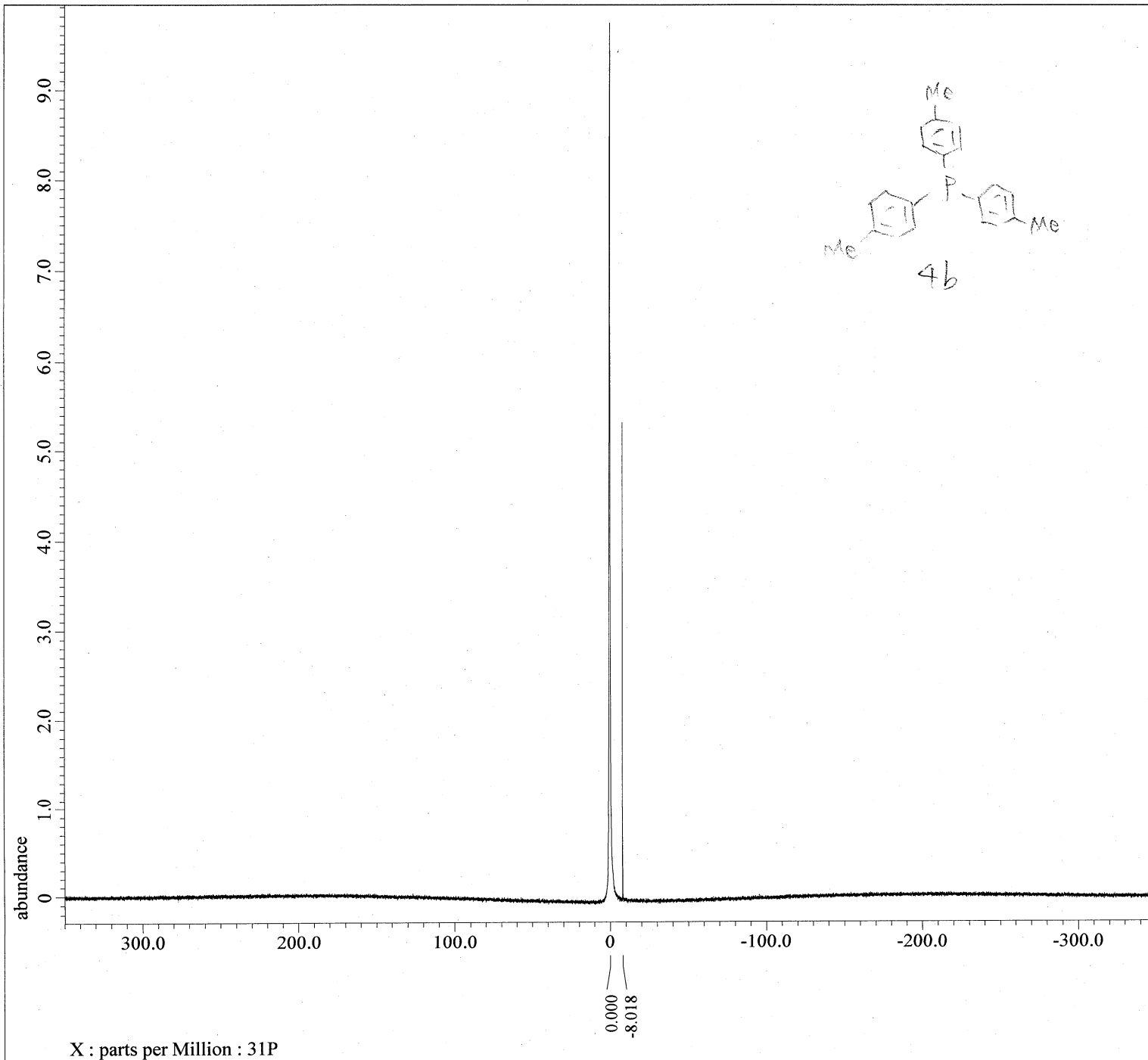
Filename      = REO-053-pure-13C-2-2.jdf
Author       = element
Experiment   = single_pulse_dec
Sample_Id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 13-SEP-2022 21:16:19
Revision_Time = 15-SEP-2022 11:48:32

Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim_Size     = 26214
X_Domain     = 13C
Dim_Title    = 13C
Dim_Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

Field Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 1.06430464[s]
X_Domain       = 13C
X_Freq        = 98.51479726[MHz]
X_Offset      = 100[ppm]
X_Points      = 32768
X_Prescans    = 4
X_Resolution  = 0.93958061[Hz]
X_Sweep       = 30.78817734[kHz]
Irr_Domain    = 1H
Irr_Freq     = 391.78655441[MHz]
Irr_Offset    = 5[ppm]
Clipped       = FALSE
Scans        = 52
Total_Scans   = 52

Relaxation_Delay = 2[s]
Recvr_Gain      = 60
Temp_Get       = 21.3[dC]
X_90_Width     = 8.7[us]
X_Acq_Time     = 1.06430464[s]
X_Angle        = 30[deg]
X_Atn          = 4.9[dB]
X_Pulse        = 2.9[us]
Irr_Atn_Dec    = 22.45[dB]
Irr_Atn_Noise = 22.45[dB]
Irr_Noise     = WALTZ
Decoupling     = TRUE
Initial_Wait   = 1[s]
Noe            = TRUE
Noe_Time       = 2[s]
Repetition_Time = 3.06430464[s]

```



X : parts per Million : 31P

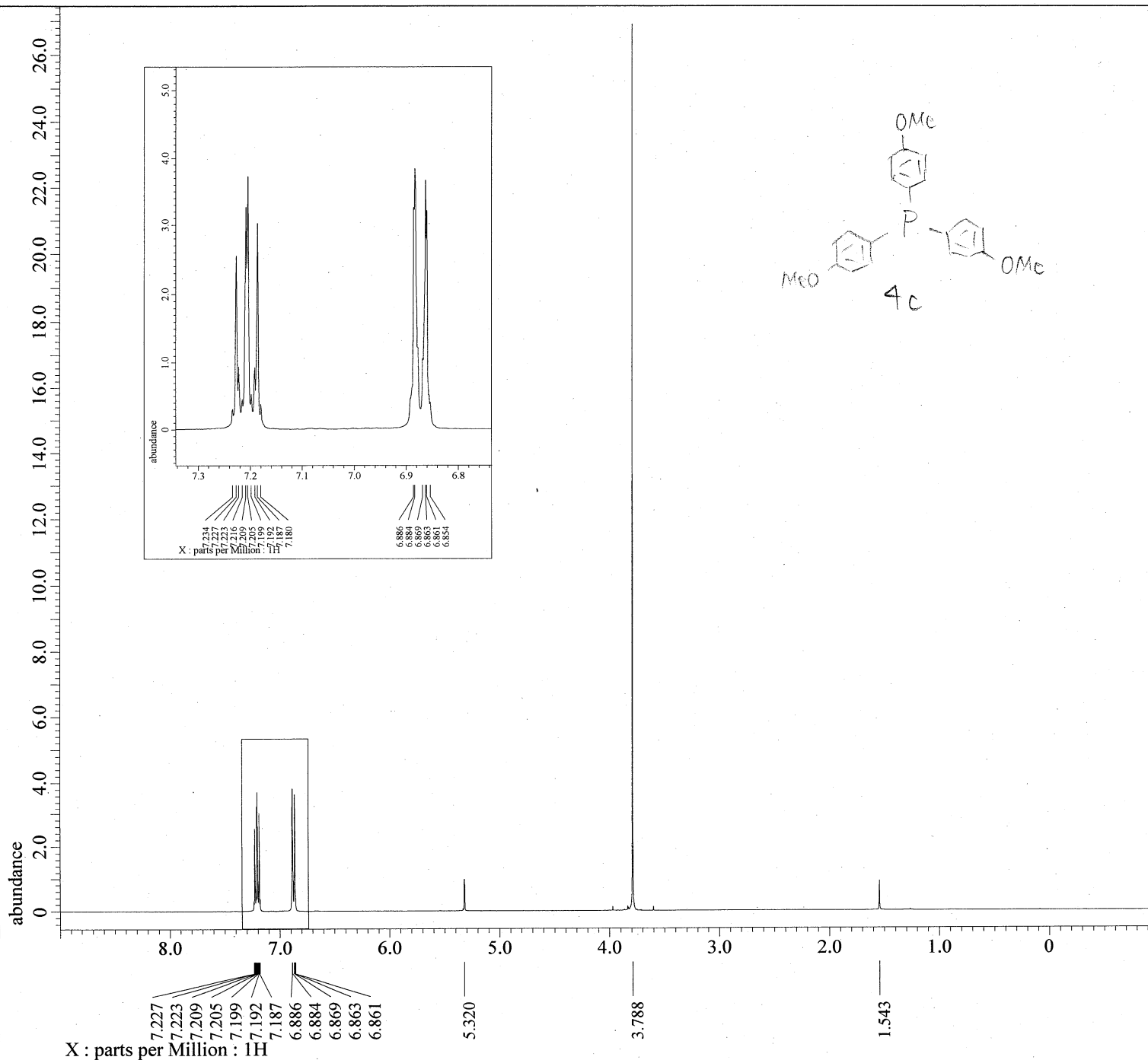
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 sexp( 2.0[Hz], 0.0[s] )  
 trapezoid3( 0[%], 80[%], 100[%] )  
 zerofill( 1 )  
 fft( 1, TRUE, TRUE )  
 machinephase  
 ppm  
 Derived from: REO-053-pure-internal-31P-1.jdf

Filename = REO-053-pure-internal-31P  
 Author = element  
 Experiment = single pulse\_dec  
 Sample\_Id = S#685547  
 Solvent = METHYLENE-CHLORI  
 Actual\_Start\_Time = 27-AUG-2022 01:44:45  
 Revision\_Time = 15-SEP-2022 11:51:49

Comment = single pulse decoupled ga  
 Data Format = 1D COMPLEX  
 Dim\_Size = 26214  
 X\_Domain = 31P  
 Dim\_Title = 31P  
 Dim\_Units = [ppm]  
 Dimensions = X  
 Site = ECS 400  
 Spectrometer = JNM-ECS400

Field\_Strength = 9.20197068[T] (390[MHz])  
 X\_Acq\_Duration = 0.2359296[s]  
 X\_Domain = 31P  
 X\_Freq = 158.59799923[MHz]  
 X\_Offset = 0[ppm]  
 X\_Points = 32768  
 X\_Prescans = 4  
 X\_Resolution = 4.23855252[Hz]  
 X\_Sweep = 138.88888889[kHz]  
 Irr\_Domain = 1H  
 Irr\_Freq = 391.78655441[MHz]  
 Irr\_Offset = 5[ppm]  
 Clipped = FALSE  
 Scans = 100  
 Total\_Scans = 100

Relaxation\_Delay = 2[s]  
 Recvr\_Gain = 50  
 Temp\_Get = 21.3[dC]  
 X\_90\_Width = 13.25[us]  
 X\_Acq\_Time = 0.2359296[s]  
 X\_Angle = 30[deg]  
 X\_Atn = 5.5[dB]  
 X\_Pulse = 4.41666667[us]  
 Irr\_Atn\_Dec = 22.05[dB]  
 Irr\_Atn\_Noise = 22.05[dB]  
 Irr\_Noise = WALTZ  
 Decoupling = TRUE  
 Initial\_Wait = 1[s]  
 Noe = TRUE  
 Noe\_Time = 2[s]  
 Repetition\_Time = 2.2359296[s]



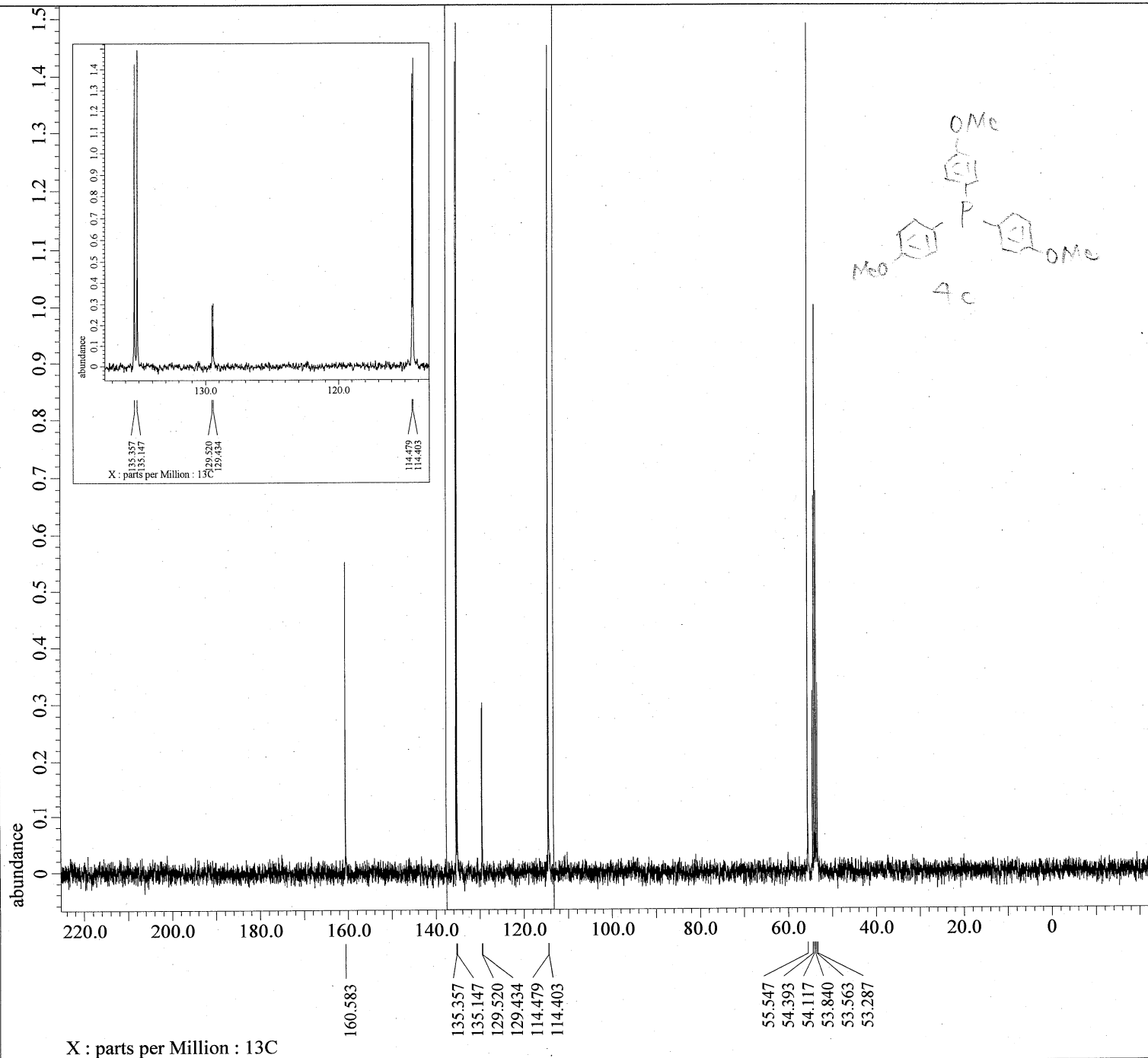
---- PROCESSING PARAMETERS ----  
 dc\_balance( 0, FALSE )  
 sexp( 0.2[Hz], 0.0[s] )  
 trapezoid3( 0[%], 80[%], 100[%] )  
 zerofill( 1 )  
 fft( 1, TRUE, TRUE )  
 machinephase  
 ppm  
 以下に由来: REO-063-pure-1H-2.jdf

Filename = REO-063-pure-1H-3.jdf  
 Author = element  
 Experiment = single\_pulse.ex2  
 Sample\_Id = S#490879  
 Solvent = METHYLENE-CHLORI  
 Actual\_Start\_Time = 30-AUG-2022 20:25:55  
 Revision\_Time = 2-SEP-2022 17:39:19

Comment = single\_pulse  
 Data Format = 1D COMPLEX  
 Dim\_Size = 13107  
 X\_Domain = 1H  
 Dim\_Title = 1H  
 Dim\_Units = [ppm]  
 Dimensions = X  
 Site = ECS 400  
 Spectrometer = JNM-ECS400

Field Strength = 9.20197068[T] (390[MHz])  
 X\_Acq\_Duration = 2.228224[s]  
 X\_Domain = 1H  
 X\_Freq = 391.78655441[MHz]  
 X\_Offset = 5[ppm]  
 X\_Points = 16384  
 X\_Prescans = 1  
 X\_Resolution = 0.44878791[Hz]  
 X\_Sweep = 7.35294118[kHz]  
 Irr\_Domain = 1H  
 Irr\_Freq = 391.78655441[MHz]  
 Irr\_Offset = 5[ppm]  
 Tri\_Domain = 1H  
 Tri\_Freq = 391.78655441[MHz]  
 Tri\_Offset = 5[ppm]  
 Clipped = FALSE  
 Scans = 8  
 Total\_Scans = 8

Relaxation\_Delay = 5[s]  
 Recvr\_Gain = 40  
 Temp\_Get = 21[dc]  
 X\_90\_Width = 11.2[us]  
 X\_Acq\_Time = 2.228224[s]  
 X\_Angle = 45[deg]  
 X\_Atn = 1.9[dB]  
 X\_Pulse = 5.6[us]  
 Irr\_Mode = Off  
 Tri\_Mode = Off  
 Dante\_Presat = FALSE  
 Initial\_Wait = 1[s]  
 Repetition\_Time = 7.228224[s]



---- PROCESSING PARAMETERS ----  
 dc balance( 0, FALSE )  
 sexp( 2.0[Hz], 0.0[s] )  
 trapezoid3( 0[%], 80[%], 100[%] )  
 zerofill( 1 )  
 fft( 1, TRUE, TRUE )  
 machinephase  
 ppm

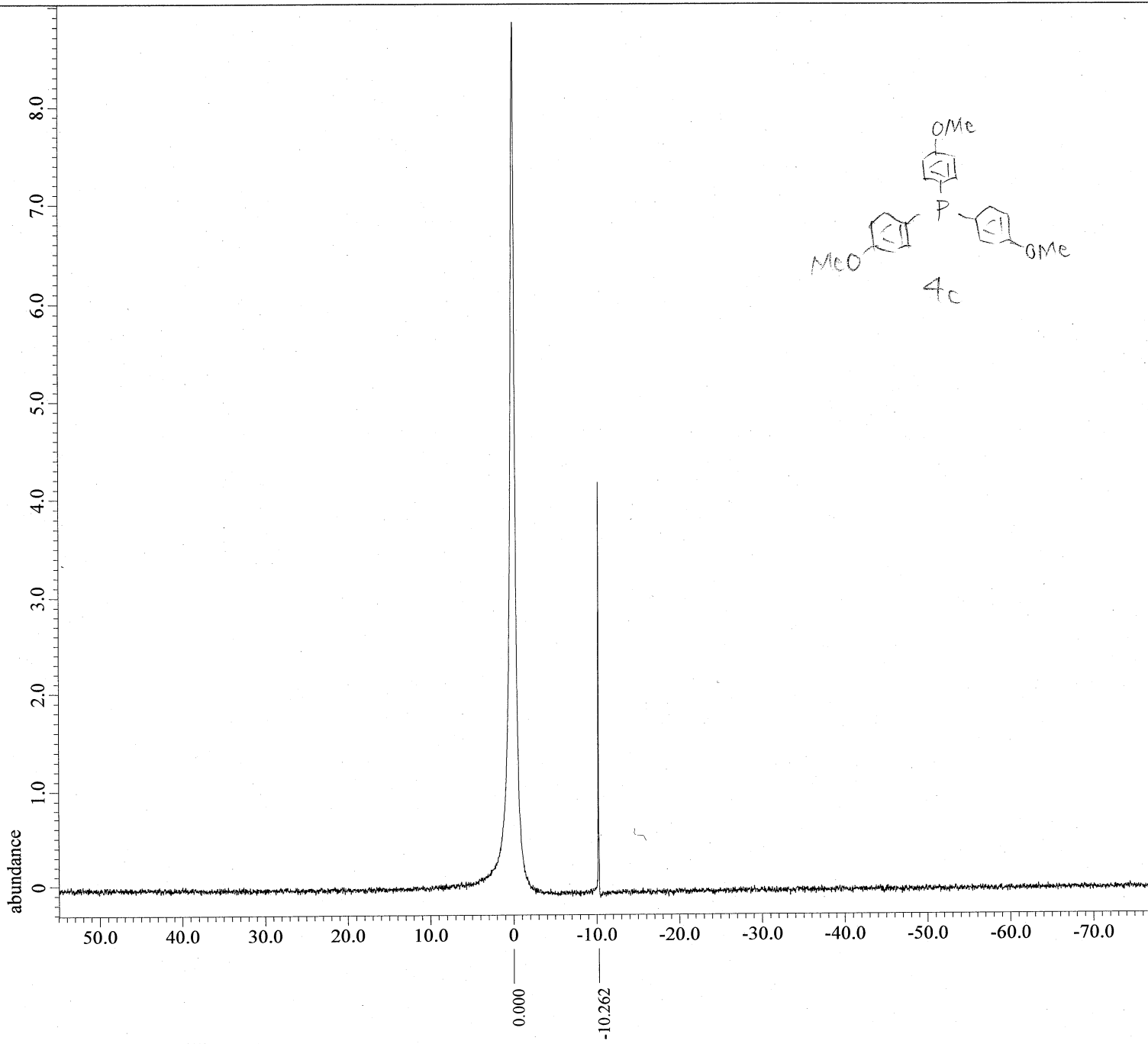
以下に由来: REO-063-pure-13C-1.jdf

Filename = REO-063-pure-13C-2.jdf  
 Author = element  
 Experiment = single\_pulse\_dec  
 Sample\_Id = 1  
 Solvent = METHYLENE-CHLORI  
 Actual\_Start\_Time = 30-AUG-2022 20:39:28  
 Revision\_Time = 2-SEP-2022 17:44:22

Comment = single pulse decoupled ga  
 Data Format = 1D COMPLEX  
 Dim\_Size = 26214  
 X\_Domain = 13C  
 Dim\_Title = 13C  
 Dim\_Units = [ppm]  
 Dimensions = X  
 Site = ECS 400  
 Spectrometer = JNM-ECS400

Field Strength = 9.20197068[T] (390[MHz])  
 X\_Acq\_Duration = 1.06430464[s]  
 X\_Domain = 13C  
 X\_Freq = 98.51479726[MHz]  
 X\_Offset = 100[ppm]  
 X\_Points = 32768  
 X\_Prescans = 4  
 X\_Resolution = 0.93958061[Hz]  
 X\_Sweep = 30.78817734[kHz]  
 Irr\_Domain = 1H  
 Irr\_Freq = 391.78655441[MHz]  
 Irr\_Offset = 5[ppm]  
 Clipped = FALSE  
 Scans = 49  
 Total\_Scans = 49

Relaxation\_Delay = 2[s]  
 Recvr\_Gain = 60  
 Temp\_Get = 21.2[dC]  
 X\_90\_Width = 11[us]  
 X\_Acq\_Time = 1.06430464[s]  
 X\_Angle = 30[deg]  
 X\_Atn = 4.9[dB]  
 X\_Pulse = 3.66666667[us]  
 Irr\_Atn\_Dec = 22.05[dB]  
 Irr\_Atn\_Noise = 22.05[dB]  
 Irr\_Noise = WALTZ  
 Decoupling = TRUE  
 Initial\_Wait = 1[s]  
 Noe = TRUE  
 Noe\_Time = 2[s]  
 Repetition\_Time = 3.06430464[s]



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

以下に由来: REO-063-pure-internal-31P-1.jdf

```

```

Filename      = REO-063-pure-internal-31P
Author       = element
Experiment    = single_pulse_dec
Sample_Id     = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 30-AUG-2022 20:32:13
Revision_Time  = 2-SEP-2022 17:54:51

```

```

Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim_Size     = 26214
X_Domain     = 31P
Dim_Title    = 31P
Dim_Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

```

```

Field_Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 0.2359296[s]
X_Domain       = 31P
X_Freq         = 158.59799923[MHz]
X_Offset       = 0[ppm]
X_Points       = 32768
X_Prescans     = 4
X_Resolution   = 4.23855252[Hz]
X_Sweep        = 138.88888889[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 42
Total_Scans    = 42

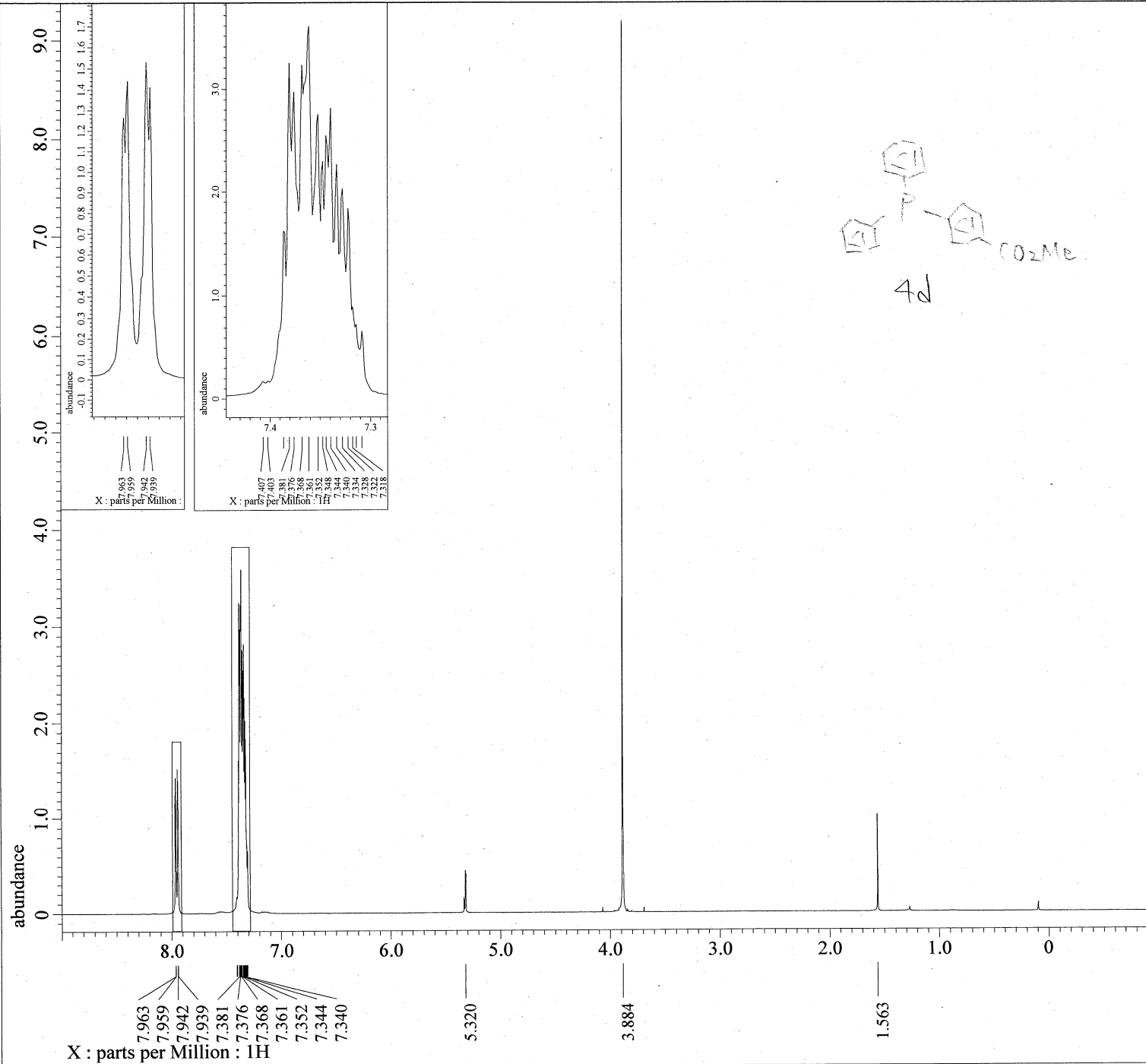
```

```

Relaxation_Delay = 2[s]
Recvr_Gain       = 50
Temp_Get         = 21.2[dC]
X_90_Width      = 13.25[us]
X_Acq_Time       = 0.2359296[s]
X_Angle         = 30[deg]
X_Atn           = 5.5[dB]
X_Pulse         = 4.41666667[us]
Irr_Atn_Dec     = 22.05[dB]
Irr_Atn_No     = 22.05[dB]
Irr_Noise       = WALTZ
Decoupling      = TRUE
Initial_Wait    = 1[s]
Noe              = TRUE
Noe_Time        = 2[s]
Repetition_Time = 2.2359296[s]

```

X : parts per Million : 31P



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 0.2[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-096-pure-1H-2.jdf

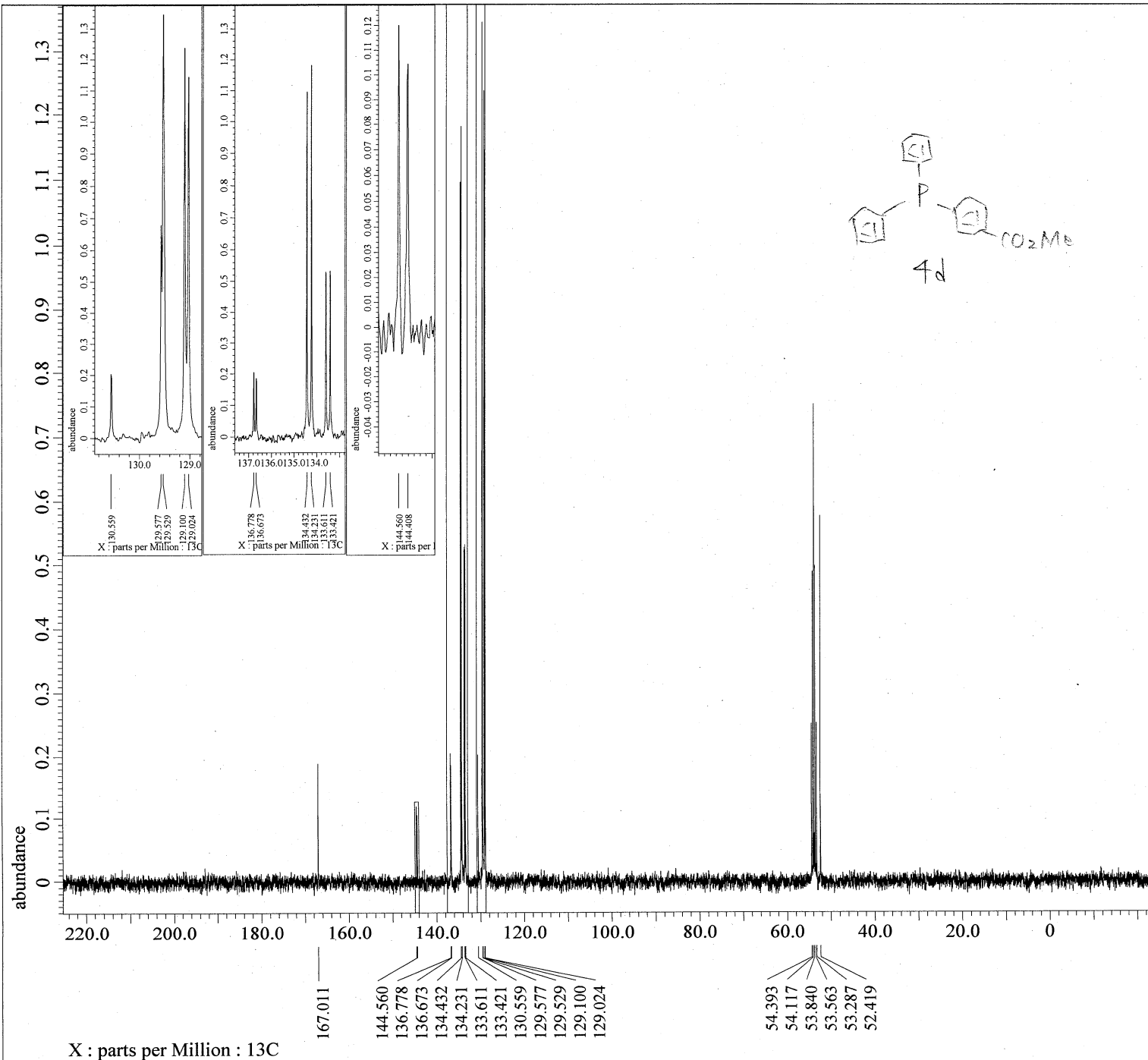
Filename      = REO-096-pure-1H-3.jdf
Author        = element
Experiment    = single_pulse.ex2
Sample_Id     = 1
Solvent       = METHYLENE-CHLORI
Actual_Start Time = 30-AUG-2022 15:49:24
Revision_Time = 3-SEP-2022 09:15:22

Comment       = single_pulse
Data Format    = 1D COMPLEX
Dim_Size      = 13107
X_Domain      = 1H
Dim Title     = 1H
Dim Units     = [ppm]
Dimensions    = X
Site          = ECS 400
Spectrometer  = JNM-ECS400

Field Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 2.228224[s]
X_Domain       = 1H
X_Freq        = 391.78655441[MHz]
X_Offset      = 5[ppm]
X_Points      = 16384
X_Prescans    = 1
X_Resolution  = 0.44878791[Hz]
X_Sweep       = 7.35294118[kHz]
Irr_Domain    = 1H
Irr_Freq      = 391.78655441[MHz]
Irr_Offset    = 5[ppm]
Tri_Domain    = 1H
Tri_Freq      = 391.78655441[MHz]
Tri_Offset    = 5[ppm]
Clipped       = FALSE
Scans         = 8
Total_Scans   = 8

Relaxation_Delay = 5[s]
Recvr_Gain       = 39
Temp_Get        = 21[dC]
X_90_Width     = 11.2[us]
X_Acq_Time      = 2.228224[s]
X_Angle        = 45[deg]
X_Atn          = 1.9[dB]
X_Pulse        = 5.6[us]
Irr_Mode       = Off
Tri_Mode       = Off
Dante_Presat   = FALSE
Initial_Wait   = 1[s]
Repetition_Time = 7.228224[s]

```



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-096-pure-13C-1.jdf

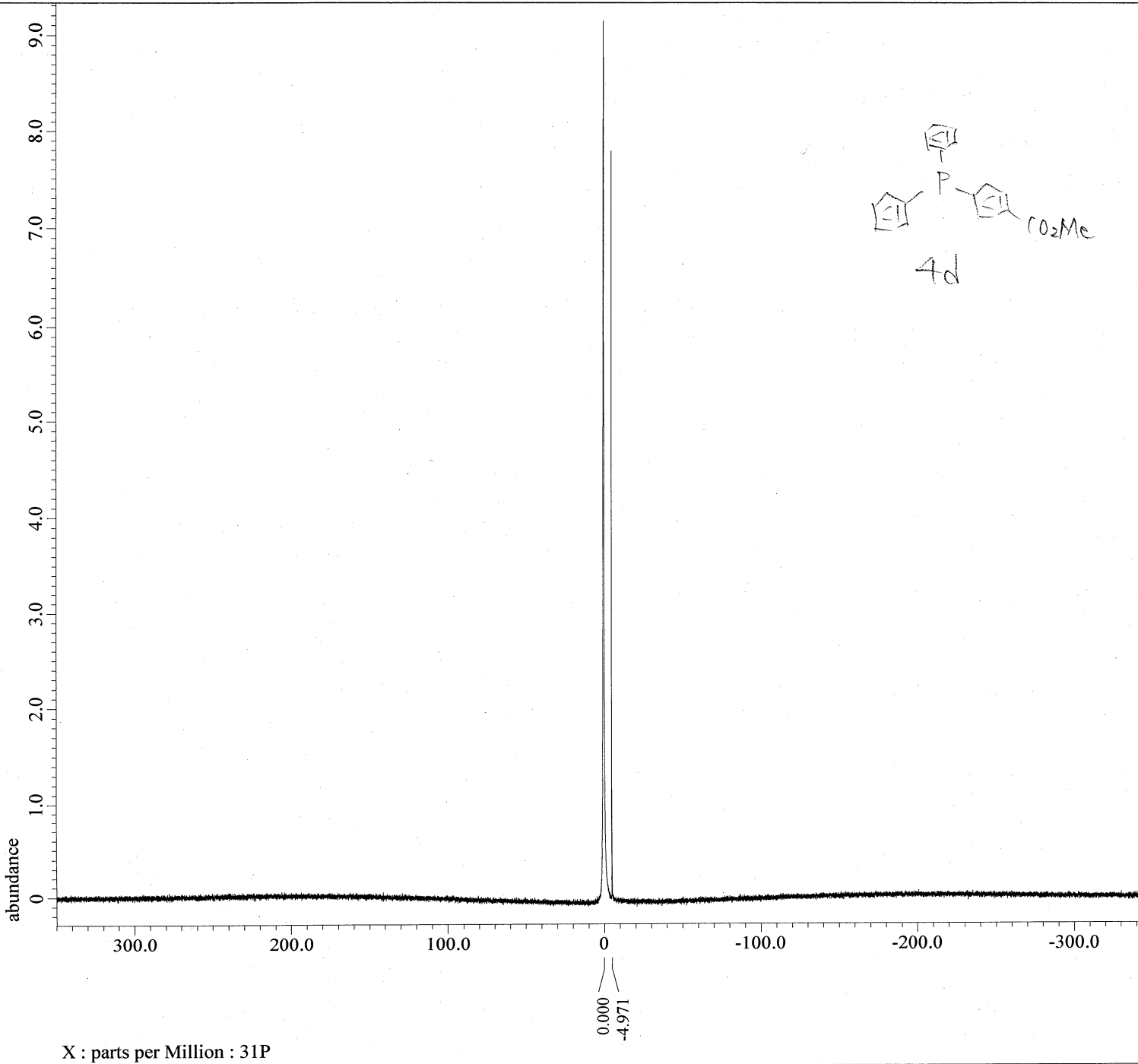
Filename      = REO-096-pure-13C-2.jdf
Author       = element
Experiment   = single_pulse_dec
Sample_Id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 30-AUG-2022 16:06:01
Revision_Time  = 3-SEP-2022 09:17:55

Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim_Size     = 26214
X_Domain     = 13C
Dim Title    = 13C
Dim Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

Field Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 1.06430464[s]
X_Domain       = 13C
X_Freq         = 98.51479726[MHz]
X_Offset       = 100[ppm]
X_Points       = 32768
X_Prescans     = 4
X_Resolution   = 0.93958061[Hz]
X_Sweep        = 30.78817734[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 66
Total_Scans    = 66

Relaxation_Delay = 2[s]
Recvr_Gain       = 58
Temp_Get         = 21.2[dC]
X_90_Width      = 11[us]
X_Acq_Time      = 1.06430464[s]
X_Angle         = 30[deg]
X_Atn           = 4.9[dB]
X_Pulse         = 3.66666667[us]
Irr_Atn_Dec     = 22.05[dB]
Irr_Atn_Noise  = 22.05[dB]
Irr_Noise       = WALTZ
Decoupling      = TRUE
Initial_Wait    = 1[s]
Noe              = TRUE
Noe_Time        = 2[s]
Repetition_Time = 3.06430464[s]

```



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm
Derived from: REO-096-pure-internal-31P-1.jdf

```

```

Filename      = REO-096-pure-internal-31P
Author       = element
Experiment   = single_pulse_dec
Sample_Id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 30-AUG-2022 15:58:12
Revision_Time   = 3-SEP-2022 09:24:03

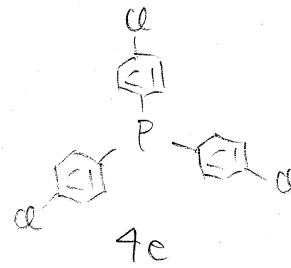
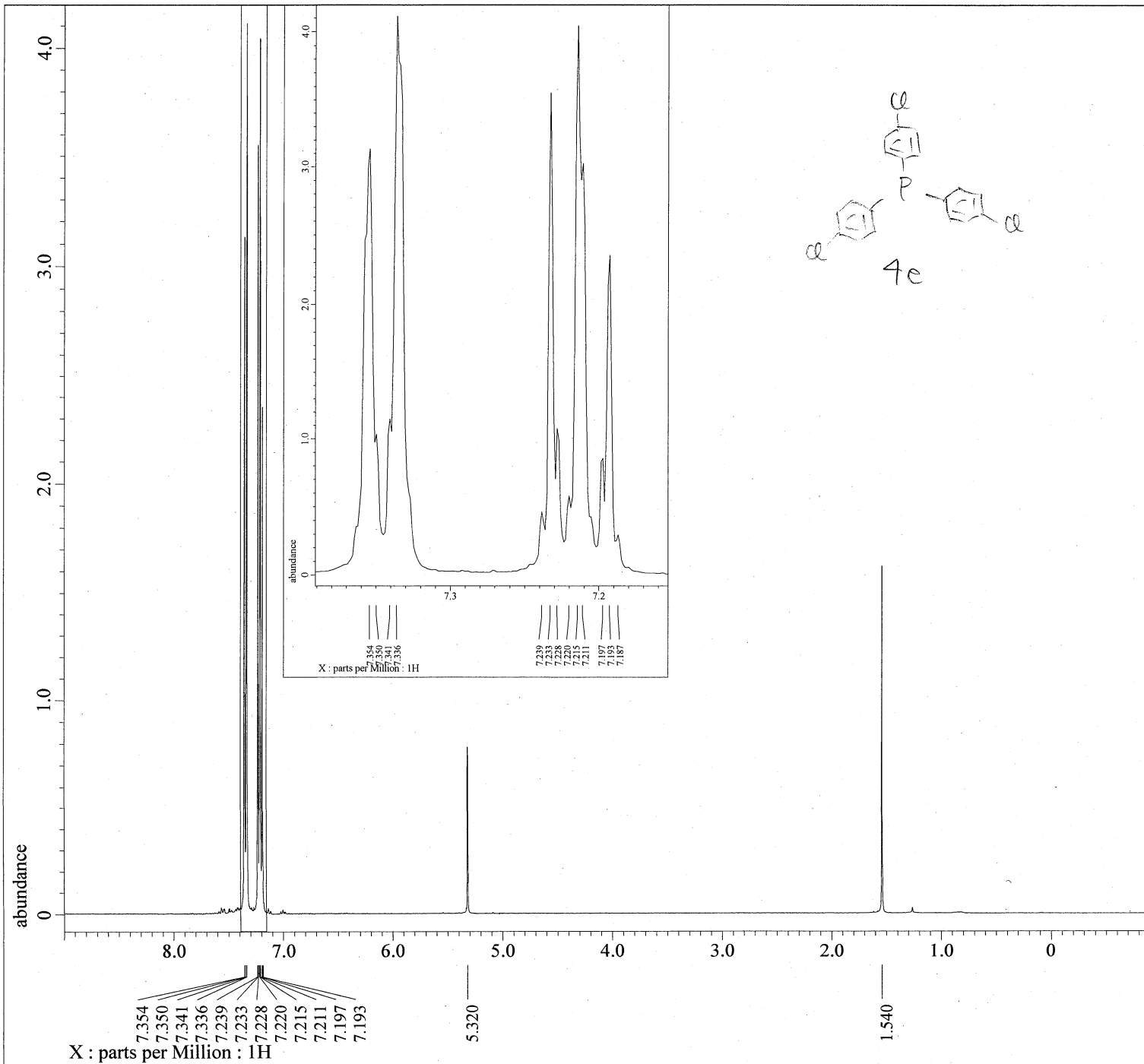
Comment      = single pulse decoupled ga
Data_Format  = 1D COMPLEX
Dim_Size     = 26214
X_Domain     = 31P
Dim_Title    = 31P
Dim_Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

Field_Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 0.2359296[s]
X_Domain       = 31P
X_Freq         = 158.59799923[MHz]
X_Offset       = 0[ppm]
X_Points       = 32768
X_Prescans     = 4
X_Resolution   = 4.23855252[Hz]
X_Sweep        = 138.88888889[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 53
Total_Scans    = 53

Relaxation_Delay = 2[s]
Recvr_Gain       = 50
Temp_Get         = 21.2[dC]
X_90_Width      = 13.25[us]
X_Acq_Time      = 0.2359296[s]
X_Angle         = 30[deg]
X_Atn           = 5.5[dB]
X_Pulse         = 4.41666667[us]
Irr_Atn_Dec     = 22.05[dB]
Irr_Atn_No     = 22.05[dB]
Irr_Noise       = WALTZ
Decoupling      = TRUE
Initial_Wait    = 1[s]
Noe             = TRUE
Noe_Time        = 2[s]
Repetition_Time = 2.2359296[s]

```





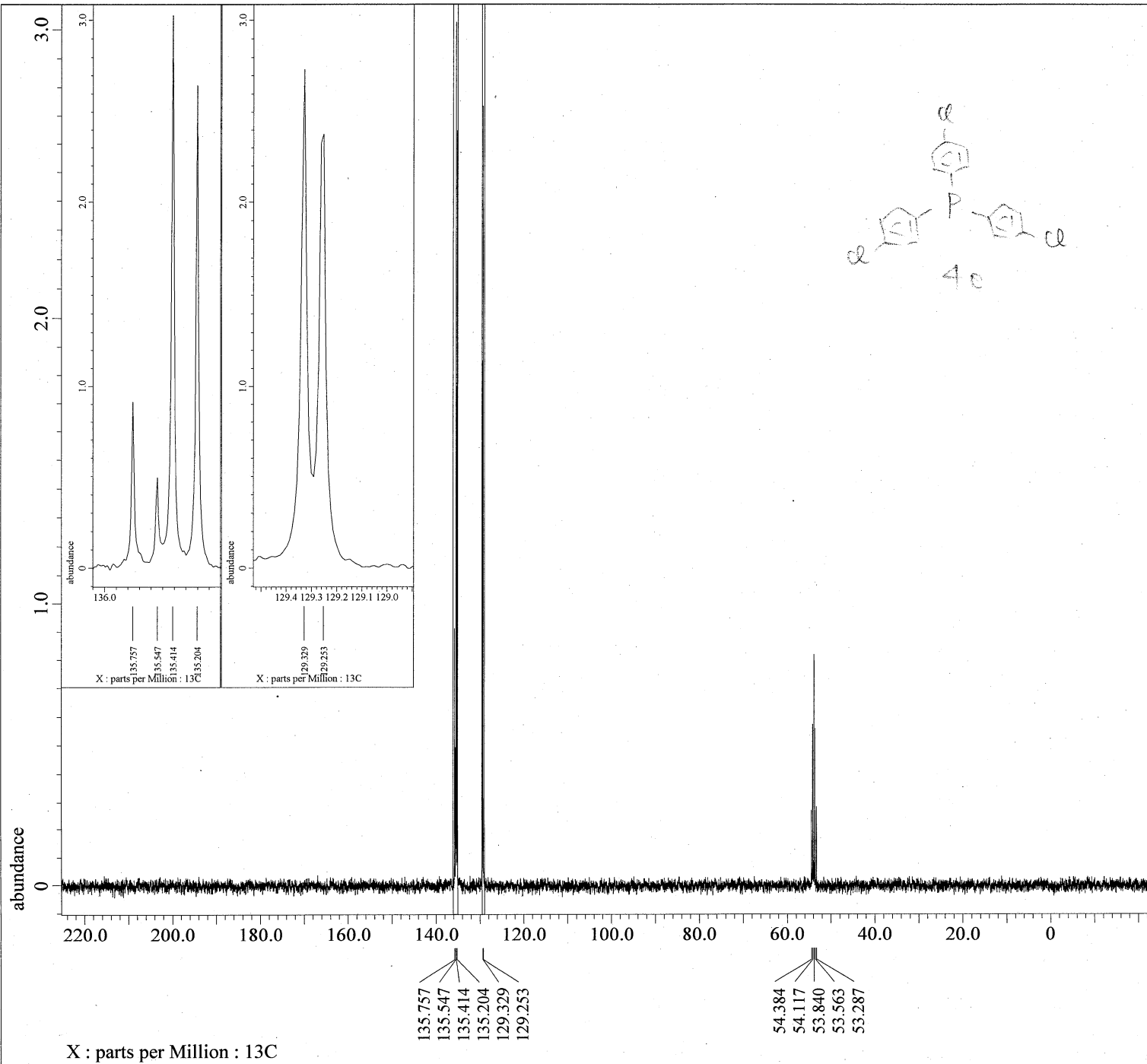
---- PROCESSING PARAMETERS ----  
 dc\_balance( 0, FALSE )  
 sexp( 0.2[Hz], 0.0[s] )  
 trapezoid3( 0[%], 80[%], 100[%] )  
 zerofill( 1 )  
 fft( 1, TRUE, TRUE )  
 machinephase  
 ppm  
 Derived from: REO-064-pure-1H-1.jdf

Filename = REO-064-pure-1H-2.jdf  
 Author = element  
 Experiment = single\_pulse.ex2  
 Sample\_Id = 1  
 Solvent = METHYLENE-CHLORI  
 Actual\_Start\_Time = 30-AUG-2022 22:05:21  
 Revision\_Time = 3-SEP-2022 08:34:21

Comment = single\_pulse  
 Data Format = 1D COMPLEX  
 Dim\_Size = 13107  
 X\_Domain = 1H  
 Dim Title = 1H  
 Dim Units = [ppm]  
 Dimensions = X  
 Site = ECS 400  
 Spectrometer = JNM-ECS400

Field\_Strength = 9.20197068[T] (390[MHz])  
 X\_Acq\_Duration = 2.228224[s]  
 X\_Domain = 1H  
 X\_Freq = 391.78655441[MHz]  
 X\_Offset = 5[ppm]  
 X\_Points = 16384  
 X\_Prescans = 1  
 X\_Resolution = 0.44878791[Hz]  
 X\_Sweep = 7.35294118[kHz]  
 Irr\_Domain = 1H  
 Irr\_Freq = 391.78655441[MHz]  
 Irr\_Offset = 5[ppm]  
 Tri\_Domain = 1H  
 Tri\_Freq = 391.78655441[MHz]  
 Tri\_Offset = 5[ppm]  
 Clipped = FALSE  
 Scans = 8  
 Total\_Scans = 8

Relaxation\_Delay = 5[s]  
 Recvr\_Gain = 40  
 Temp\_Get = 21[dc]  
 X\_90\_Width = 11.2[us]  
 X\_Acq\_Time = 2.228224[s]  
 X\_Angle = 45[deg]  
 X\_Atn = 1.9[dB]  
 X\_Pulse = 5.6[us]  
 Irr\_Mode = Off  
 Tri\_Mode = Off  
 Dante\_Presat = FALSE  
 Initial\_Wait = 1[s]  
 Repetition\_Time = 7.228224[s]



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

```

Derived from: REO-064-pure-13C-1.jdf

```

Filename      = REO-064-pure-13C-2.jdf
Author       = element
Experiment   = single_pulse_dec
Sample_Id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 30-AUG-2022 22:20:24
Revision_Time   = 3-SEP-2022 08:35:08

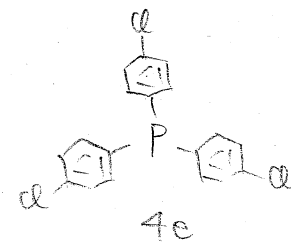
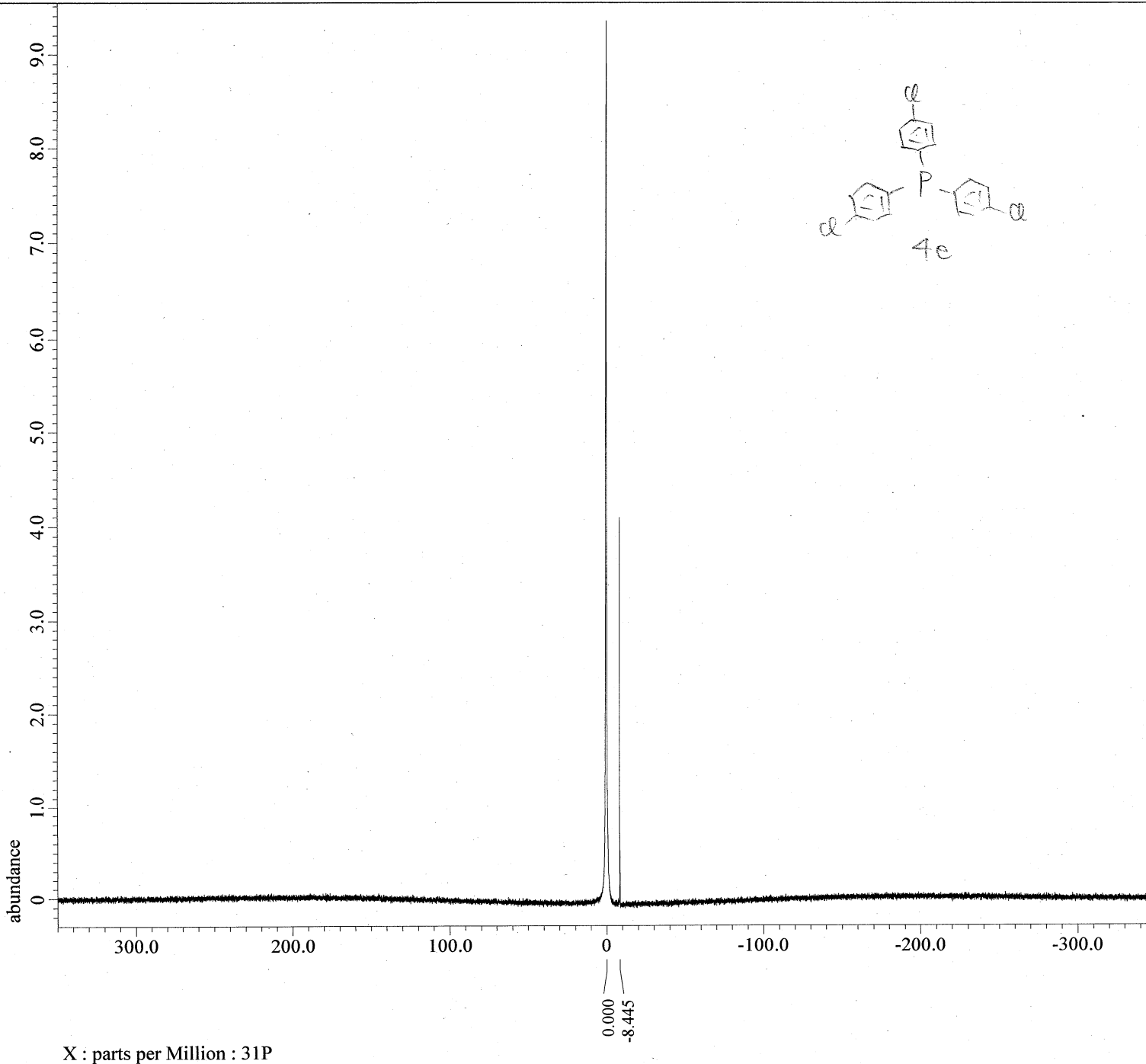
Comment      = single pulse decoupled ga
Data_Format  = 1D COMPLEX
Dim_Size     = 26214
X_Domain    = 13C
Dim_Title   = 13C
Dim_Units   = [ppm]
Dimensions  = X
Site        = ECS 400
Spectrometer = JNM-ECS400

Field_Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 1.06430464[s]
X_Domain      = 13C
X_Freq       = 98.51479726[MHz]
X_Offset     = 100[ppm]
X_Points     = 32768
X_Prescans   = 4
X_Resolution = 0.93958061[Hz]
X_Sweep      = 30.78817734[kHz]
Irr_Domain   = 1H
Irr_Freq    = 391.78655441[MHz]
Irr_Offset  = 5[ppm]
Clipped     = FALSE
Scans       = 33
Total_Scans = 33

Relaxation_Delay = 2[s]
Recvr_Gain      = 60
Temp_Get       = 21.2[dC]
X_90_Width     = 11[us]
X_Acq_Time     = 1.06430464[s]
X_Angle       = 30[deg]
X_Atn         = 4.9[dB]
X_Pulse       = 3.66666667[us]
Irr_Atn_Dec   = 22.05[dB]
Irr_Atn_Noe   = 22.05[dB]
Irr_Noise     = WALTZ
Decoupling    = TRUE
Initial_Wait  = 1[s]
Noe           = TRUE
Noe_Time      = 2[s]
Repetition_Time = 3.06430464[s]

```

X : parts per Million : 13C



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm
Derived from: REO-064-pure-internal-31P-1.jdf

```

```

Filename      = REO-064-pure-internal-31P
Author        = element
Experiment     = single_pulse_dec
Sample_Id     = 1
Solvent       = METHYLENE-CHLORI
Actual_Start_Time = 30-AUG-2022 22:11:36
Revision_Time  = 3-SEP-2022 08:48:59

```

```

Comment       = single pulse decoupled ga
Data Format    = 1D COMPLEX
Dim_Size      = 26214
X_Domain      = 31P
Dim_Title     = 31P
Dim_Units     = [ppm]
Dimensions    = X
Site          = ECS 400
Spectrometer  = JNM-ECS400

```

```

Field_Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 0.2359296[s]
X_Domain       = 31P
X_Freq         = 158.59799923[MHz]
X_Offset       = 0[ppm]
X_Points       = 32768
X_Prescans     = 4
X_Resolution   = 4.23855252[Hz]
X_Sweep        = 138.88888889[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 44
Total_Scans    = 44

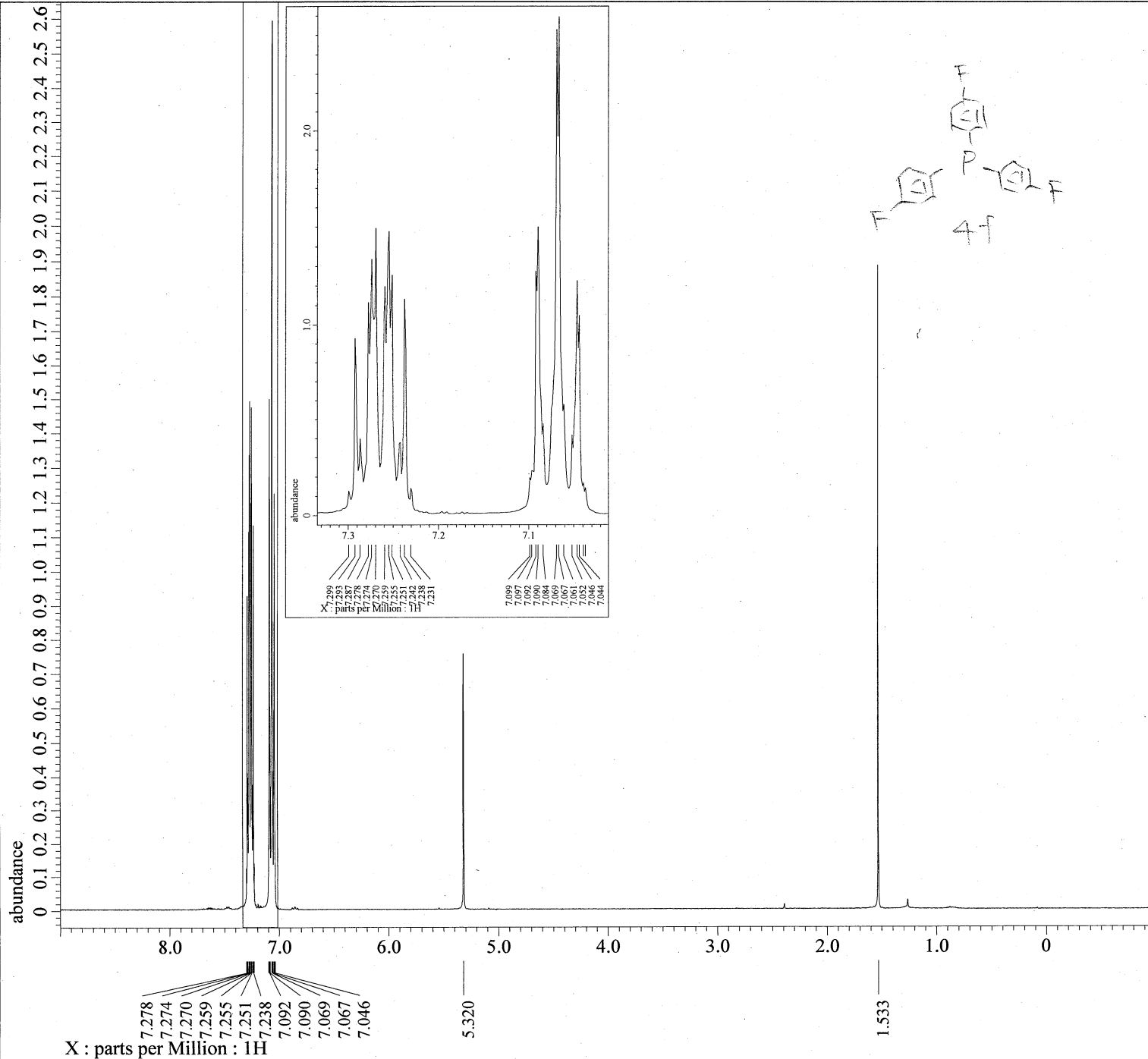
```

```

Relaxation_Delay = 2[s]
Recvr_Gain       = 50
Temp_Get         = 21.1[dC]
X_90_Width      = 13.25[us]
X_Acq_Time       = 0.2359296[s]
X_Angle         = 30[deg]
X_Atn           = 5.5[dB]
X_Pulse         = 4.41666667[us]
Irr_Atn_Dec     = 22.05[dB]
Irr_Atn_No     = 22.05[dB]
Irr_Noise       = WALTZ
Decoupling      = TRUE
Initial_Wait    = 1[s]
Noe              = TRUE
Noe_Time        = 2[s]
Repetition_Time = 2.2359296[s]

```

X : parts per Million : 31P



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 0.2[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-056-pure-1H-2.jdf

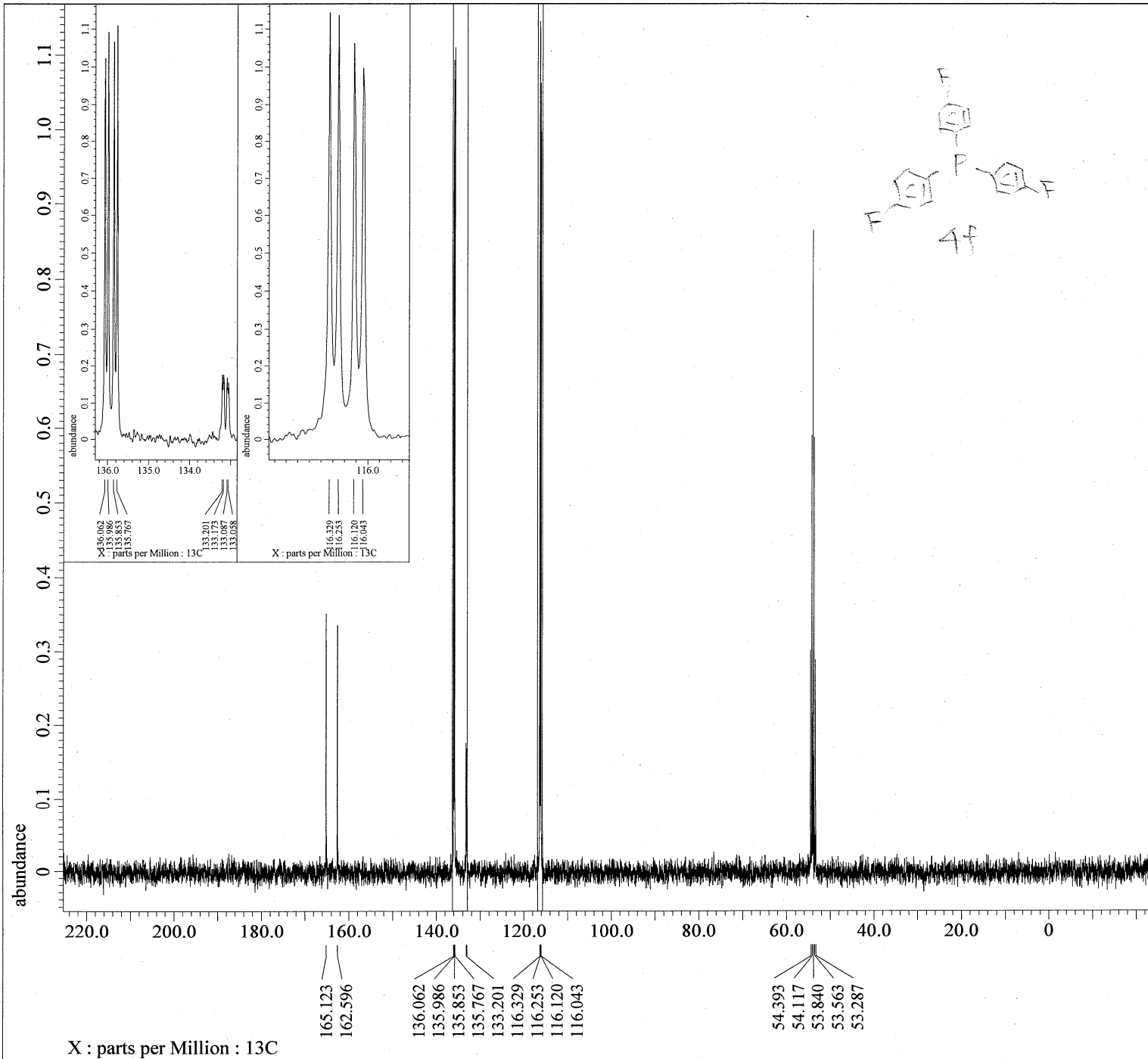
Filename      = REO-056-pure-1H-3.jdf
Author       = element
Experiment   = single_pulse.ex2
Sample_Id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 30-AUG-2022 16:20:08
Revision_Time  = 2-SEP-2022 18:41:08

Comment      = single_pulse
Data Format   = 1D COMPLEX
Dim Size     = 13107
X_Domain    = 1H
Dim Title    = 1H
Dim Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

Field_Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 2.228224[s]
X_Domain       = 1H
X_Freq         = 391.78655441[MHz]
X_Offset       = 5[ppm]
X_Points       = 16384
X_Prescans    = 1
X_Resolution   = 0.44878791[Hz]
X_Sweep        = 7.35294118[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Tri_Domain     = 1H
Tri_Freq       = 391.78655441[MHz]
Tri_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 8
Total_Scans    = 8

Relaxation_Delay = 5[s]
Recvr_Gain       = 40
Temp_Get         = 20.9[dC]
X_90_Width      = 11.2[us]
X_Acq_Time      = 2.228224[s]
X_Angle         = 45[deg]
X_Atn           = 1.9[dB]
X_Pulse         = 5.6[us]
Irr_Mode        = Off
Tri_Mode        = Off
Dante_Presat    = FALSE
Initial_Wait    = 1[s]
Repetition_Time = 7.228224[s]

```



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-056-pure-13C-1.jdf

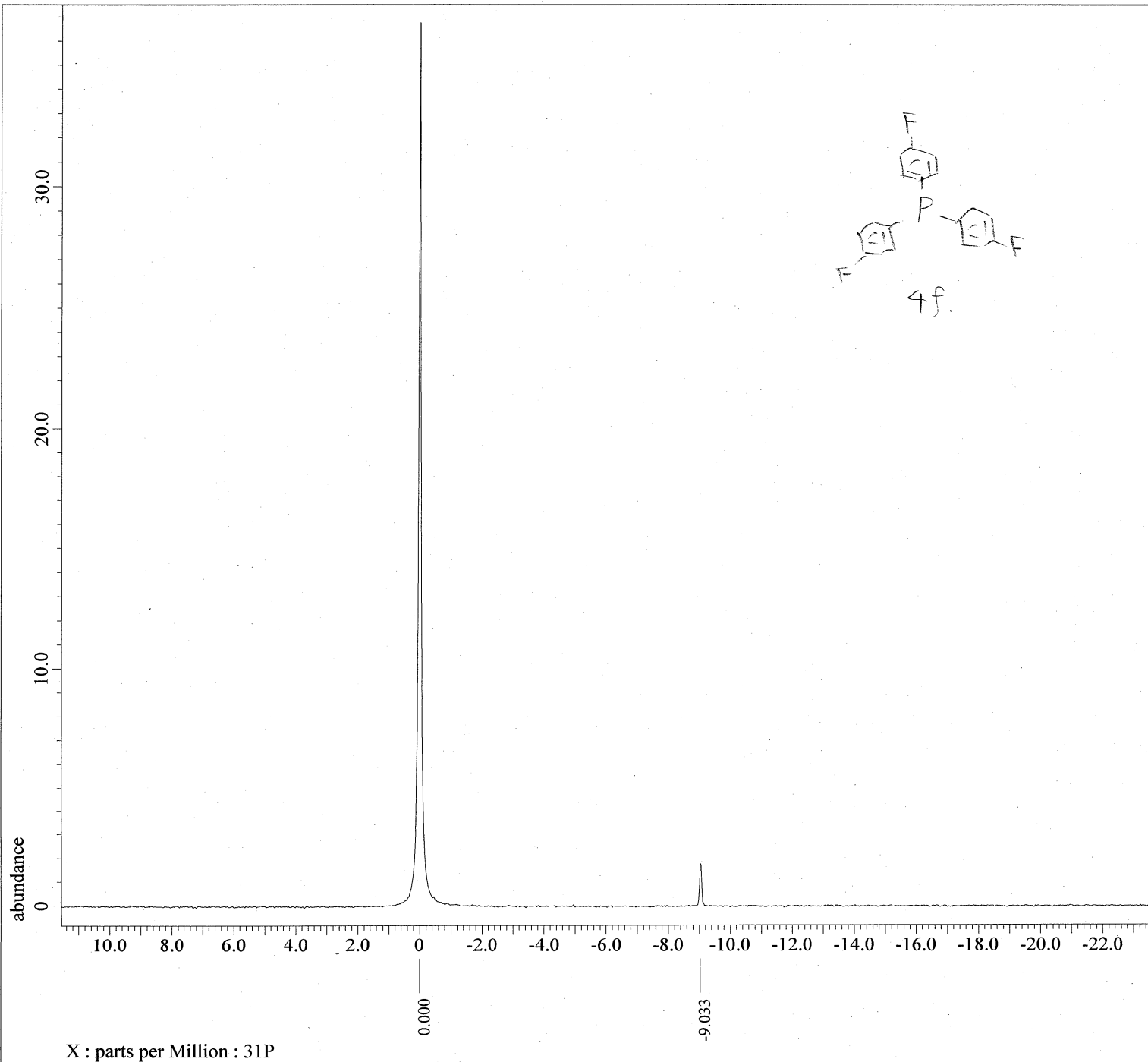
Filename      = REO-056-pure-13C-2.jdf
Author       = element
Experiment   = single_pulse_dec
Sample_id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 30-AUG-2022 16:36:58
Revision_Time = 2-SEP-2022 18:50:40

Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim_Size     = 26214
X_Domain     = 13C
Dim_Title    = 13C
Dim_Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

Field_Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 1.06430464[s]
X_Domain       = 13C
X_Freq         = 98.51479726[MHz]
X_Offset       = 100[ppm]
X_Points      = 32768
X_Prescans    = 4
X_Resolution  = 0.93958061[Hz]
X_Sweep       = 30.78817734[kHz]
Irr_Domain    = 1H
Irr_Freq      = 391.78655441[MHz]
Irr_Offset    = 5[ppm]
Clipped       = FALSE
Scans         = 63
Total_Scans   = 63

Relaxation_Delay = 2[s]
Recvr_Gain       = 60
Temp_Get        = 21.2[dc]
X_90_Width      = 11[us]
X_Acq_Time      = 1.06430464[s]
X_Angle         = 30[deg]
X_Atn           = 4.9[db]
X_Pulse         = 3.66666667[us]
Irr_Atn_Dec     = 22.05[db]
Irr_Atn_Noise  = 22.05[db]
Irr_Noise      = WALTZ
Decoupling      = TRUE
Initial_Wait    = 1[s]
Noe             = TRUE
Noe_Time        = 2[s]
Repetition_Time = 3.06430464[s]

```



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-056-pure-internal-31P-1.jdf

```

```

Filename      = REO-056-pure-internal-31P
Author       = element
Experiment    = single_pulse_dec
Sample_Id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 30-AUG-2022 16:30:12
Revision_Time = 2-SEP-2022 19:13:53

```

```

Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim_Size     = 26214
X_Domain     = 31P
Dim Title    = 31P
Dim Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

```

```

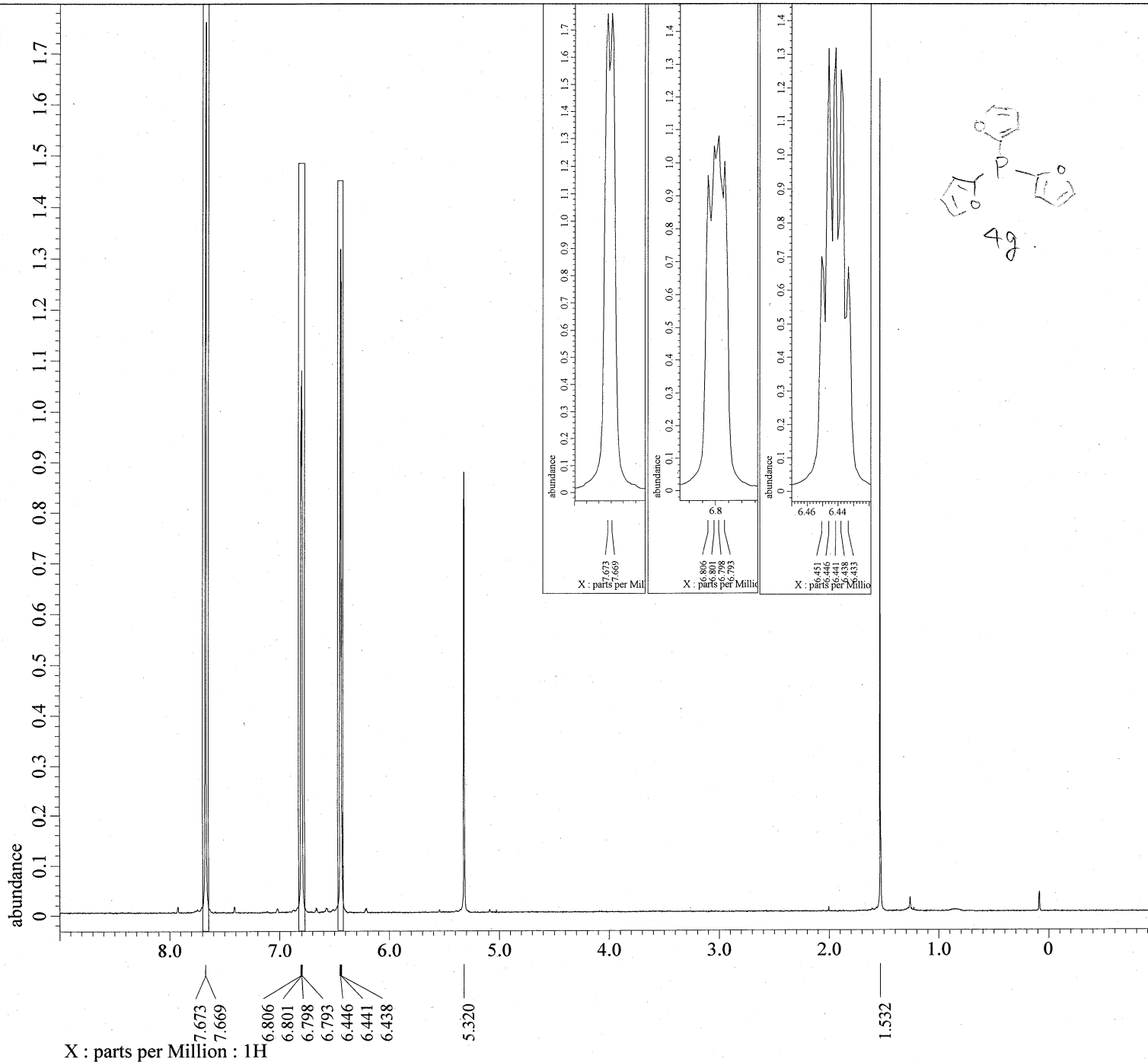
Field_Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 0.2359296[s]
X_Domain       = 31P
X_Freq         = 158.59799923[MHz]
X_Offset       = 0[ppm]
X_Points       = 32768
X_Prescans     = 4
X_Resolution   = 4.23855252[Hz]
X_Sweep        = 138.88888889[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 30
Total_Scans    = 30

```

```

Relaxation_Delay = 2[s]
Recvr_Gain       = 50
Temp_Get         = 21.1[dC]
X_90_Width      = 13.25[us]
X_Acq_Time       = 0.2359296[s]
X_Angle          = 30[deg]
X_Atn            = 5.5[dB]
X_Pulse          = 4.41666667[us]
Irr_Atn_Dec      = 22.05[dB]
Irr_Atn_No     = 22.05[dB]
Irr_Noise       = WALTZ
Decoupling       = TRUE
Initial_Wait     = 1[s]
Noe              = TRUE
Noe_Time         = 2[s]
Repetition_Time = 2.2359296[s]

```



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 0.2[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinphase
ppm

```

Derived from: REO-062-pure-1H-2.jdf

```

Filename      = REO-062-pure-1H-3.jdf
Author       = element
Experiment    = single_pulse.ex2
Sample_Id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start Time = 30-AUG-2022 18:10:43
Revision_Time = 6-SEP-2022 10:23:37

```

```

Comment      = single_pulse
Data Format   = 1D COMPLEX
Dim_Size     = 13107
X_Domain     = 1H
Dim_Title    = 1H
Dim_Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

```

```

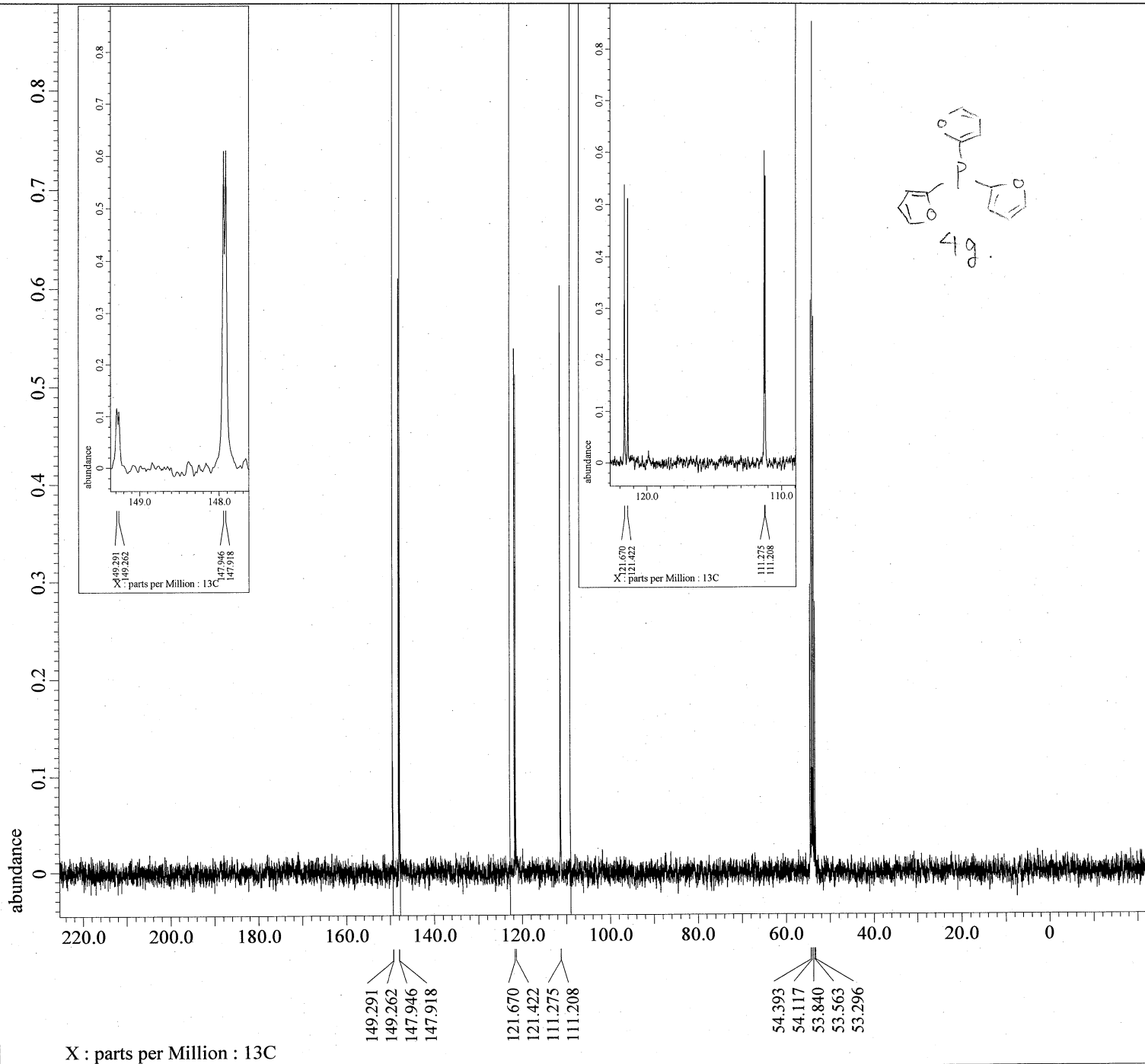
Field Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 2.228224[s]
X_Domain       = 1H
X_Freq         = 391.78655441[MHz]
X_Offset       = 5[ppm]
X_Points       = 16384
X_Prescans     = 1
X_Resolution   = 0.44878791[Hz]
X_Sweep        = 7.35294118[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Tri_Domain     = 1H
Tri_Freq       = 391.78655441[MHz]
Tri_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 8
Total_Scans    = 8

```

```

Relaxation_Delay = 5[s]
Recvr_Gain       = 42
Temp_Get         = 20.9[dC]
X_90_Width       = 11.2[us]
X_Acq_Time       = 2.228224[s]
X_Angle          = 45[deg]
X_Atn            = 1.9[dB]
X_Pulse          = 5.6[us]
Irr_Mode         = Off
Tri_Mode         = Off
Dante_Presat    = FALSE
Initial_Wait     = 1[s]
Repetition_Time = 7.228224[s]

```



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-062-pure-13C-1.jdf

Filename      = REO-062-pure-13C-2.jdf
Author       = element
Experiment   = single_pulse_dec
Sample_Id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 30-AUG-2022 18:25:39
Revision_Time  = 5-SEP-2022 15:17:46

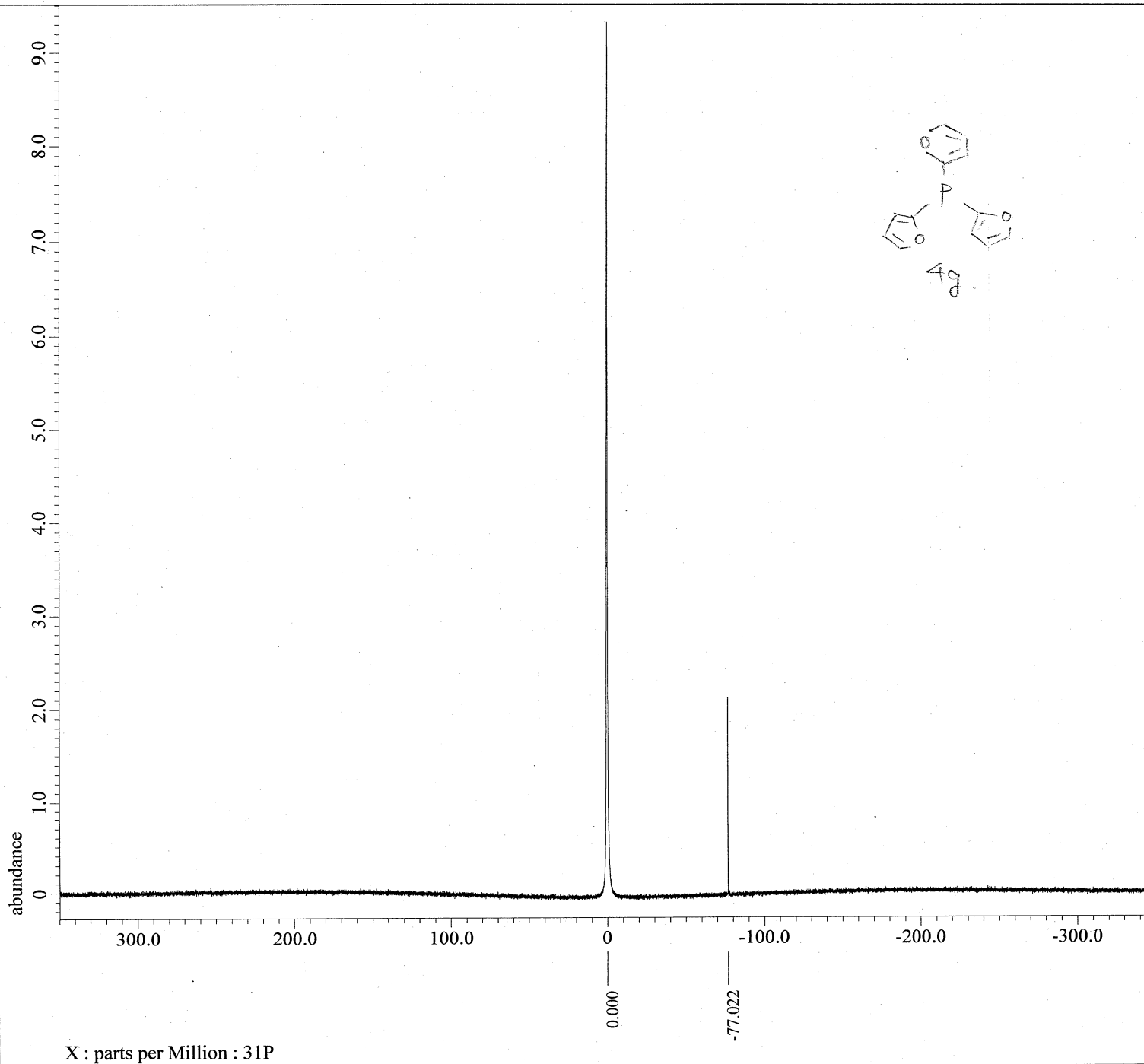
Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim_Size     = 26214
Dim_Domain   = 13C
Dim_Title    = 13C
Dim_Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

Field Strength = 9.20197068[T] (390[MHz])
X Acq Duration = 1.06430464[s]
X_Domain      = 13C
X_Freq       = 98.51479726[MHz]
X_Offset     = 100[ppm]
X_Points     = 32768
X_Prescans   = 4
X_Resolution = 0.93958061[Hz]
X_Sweep      = 30.78817734[kHz]
Irr_Domain   = 1H
Irr_Freq     = 391.78655441[MHz]
Irr_Offset   = 5[ppm]
Clipped      = FALSE
Scans        = 100
Total_Scans  = 100

Relaxation_Delay = 2[s]
Recvr_Gain       = 60
Temp_Get         = 21.2[dC]
X_90_Width      = 11[us]
X_Acq_Time      = 1.06430464[s]
X_Angle         = 30[deg]
X_Atn           = 4.9[dB]
X_Pulse         = 3.66666667[us]
Irr_Atn_Dec     = 22.05[dB]
Irr_Atn_Noe     = 22.05[dB]
Irr_Noise       = WALTZ
Decoupling      = TRUE
Initial_Wait    = 1[s]
Noe              = TRUE
Noe_Time        = 2[s]
Repetition_Time = 3.06430464[s]

```





```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm
phase( 0, 0, 50[%] )

Derived from: REO-062-pure-internal-31P-1.jdf

```

```

Filename      = REO-062-pure-internal-31P
Author       = element
Experiment    = single_pulse_dec
Sample_Id     = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 30-AUG-2022 18:16:52
Revision_Time = 5-SEP-2022 15:59:09

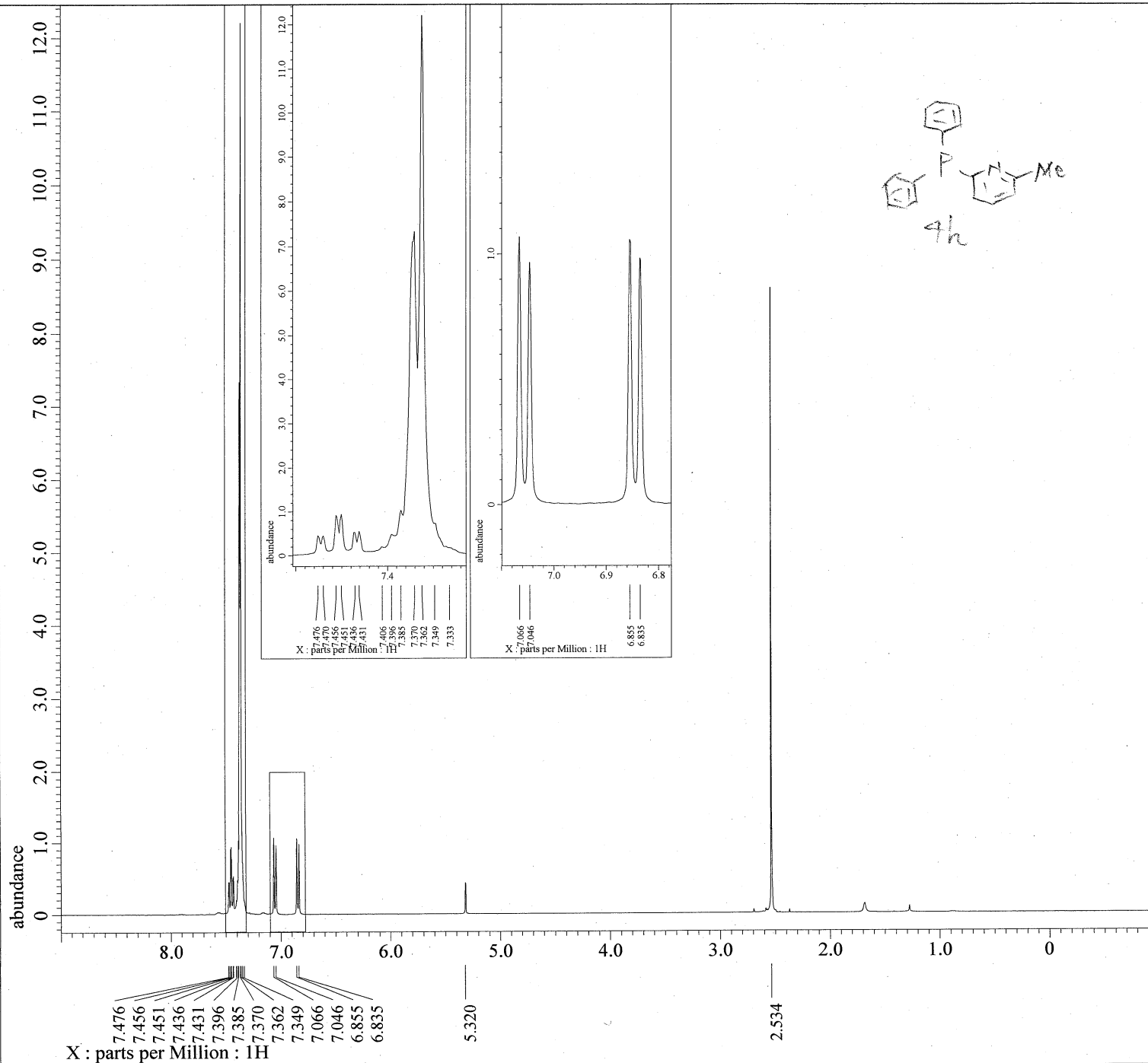
Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim_Size     = 26214
Dim_Domain   = 31P
Dim_Title    = 31P
Dim_Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

Field Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 0.2359296[s]
X_Domain       = 31P
X_Freq        = 158.59799923[MHz]
X_Offset      = 0[ppm]
X_Points      = 32768
X_Prescans    = 4
X_Resolution  = 4.23855252[Hz]
X_Sweep       = 138.88888889[kHz]
Irr_Domain    = 1H
Irr_Freq      = 391.78655441[MHz]
Irr_Offset    = 5[ppm]
Clipped       = TRUE
Scans         = 71
Total_Scans   = 71

Relaxation_Delay = 2[s]
Recvr_Gain       = 50
Temp_Get        = 21.1[dC]
X_90_Width      = 13.25[us]
X_Acq_Time      = 0.2359296[s]
X_Angle         = 30[deg]
X_Atn           = 5.5[dB]
X_Pulse         = 4.41666667[us]
Irr_Atn_Dec     = 22.05[dB]
Irr_Atn_Noise  = 22.05[dB]
Irr_Noise      = WALTZ
Decoupling      = TRUE
Initial_Wait    = 1[s]
Noe             = TRUE
Noe_Time        = 2[s]
Repetition_Time = 2.2359296[s]

```

X : parts per Million : 31P



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 0.2[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

```

Derived from: REO-077-pure-1H-1.jdf

```

Filename      = REO-077-pure-1H-2.jdf
Author       = element
Experiment    = single_pulse.ex2
Sample_Id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 31-AUG-2022 00:27:30
Revision_Time = 6-SEP-2022 11:09:24

```

```

Comment      = single_pulse
Data Format   = 1D COMPLEX
Dim_Size     = 13107
X_Domain     = 1H
Dim_Title    = 1H
Dim_Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

```

```

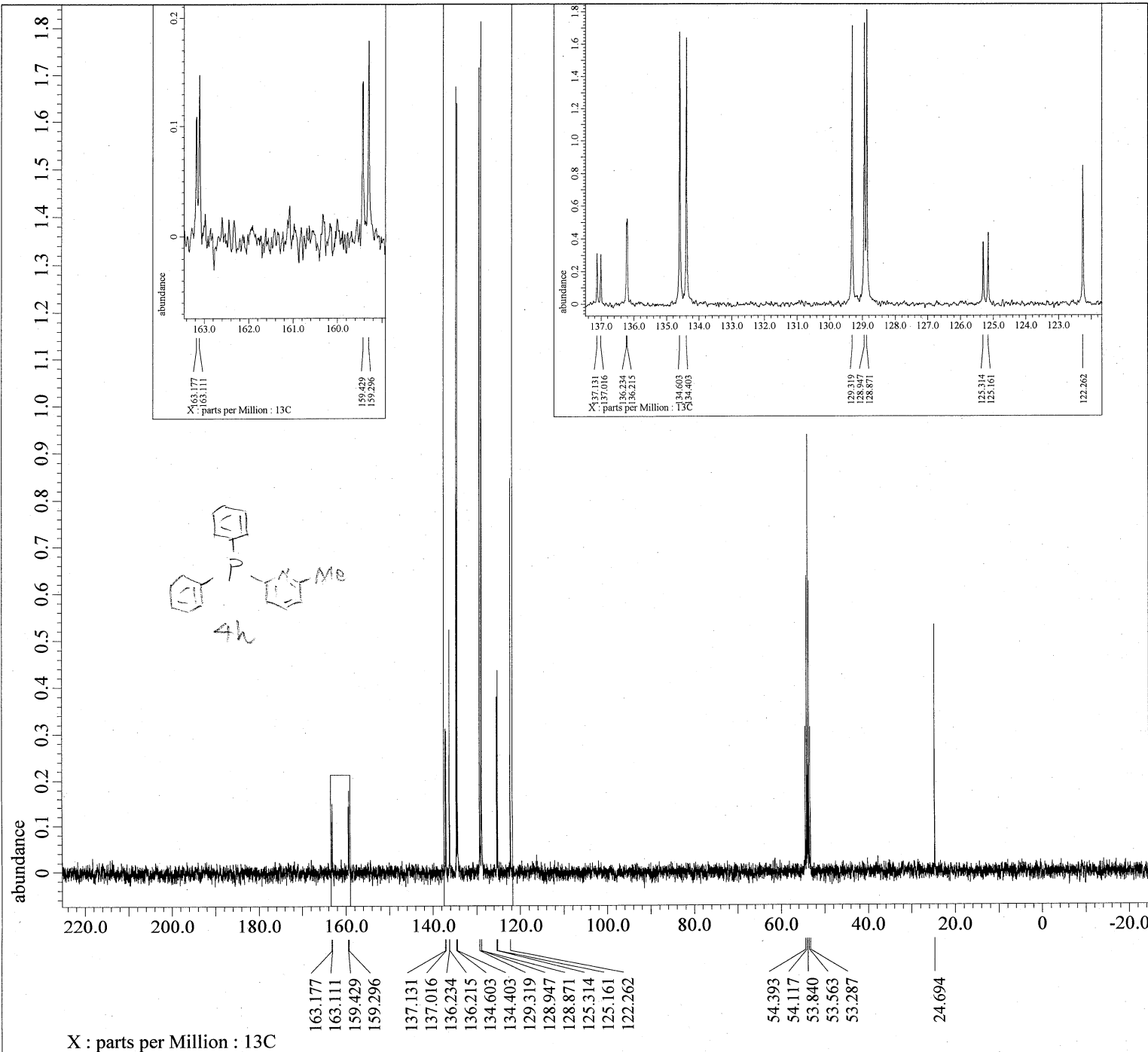
Field Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 2.228224[s]
X_Domain       = 1H
X_Freq         = 391.78655441[MHz]
X_Offset       = 5[ppm]
X_Points       = 16384
X_Prescans     = 1
X_Resolution   = 0.44878791[Hz]
X_Sweep        = 7.35294118[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Tri_Domain     = 1H
Tri_Freq       = 391.78655441[MHz]
Tri_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 8
Total_Scans    = 8

```

```

Relaxation_Delay = 5[s]
Recvr_Gain       = 36
Temp_Get         = 20.9[dC]
X_90_Width       = 11.2[us]
X_Acq_Time       = 2.228224[s]
X_Angle          = 45[deg]
X_Atn            = 1.9[dB]
X_Pulse          = 5.6[us]
Irr_Mode         = Off
Tri_Mode         = Off
Dante_Presat    = FALSE
Initial_Wait     = 1[s]
Repetition_Time = 7.228224[s]

```



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexf( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinphase
ppm

```

Derived from: REO-077-pure-13C-1.jdf

```

Filename      = REO-077-pure-13C-2.jdf
Author       = element
Experiment   = single_pulse_dec
Sample_Id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 31-AUG-2022 00:39:55
Revision_Time  = 6-SEP-2022 11:13:55

```

```

Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim Size     = 26214
X_Domain     = 13C
Dim Title    = 13C
Dim Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

```

```

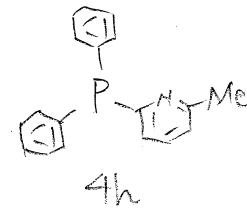
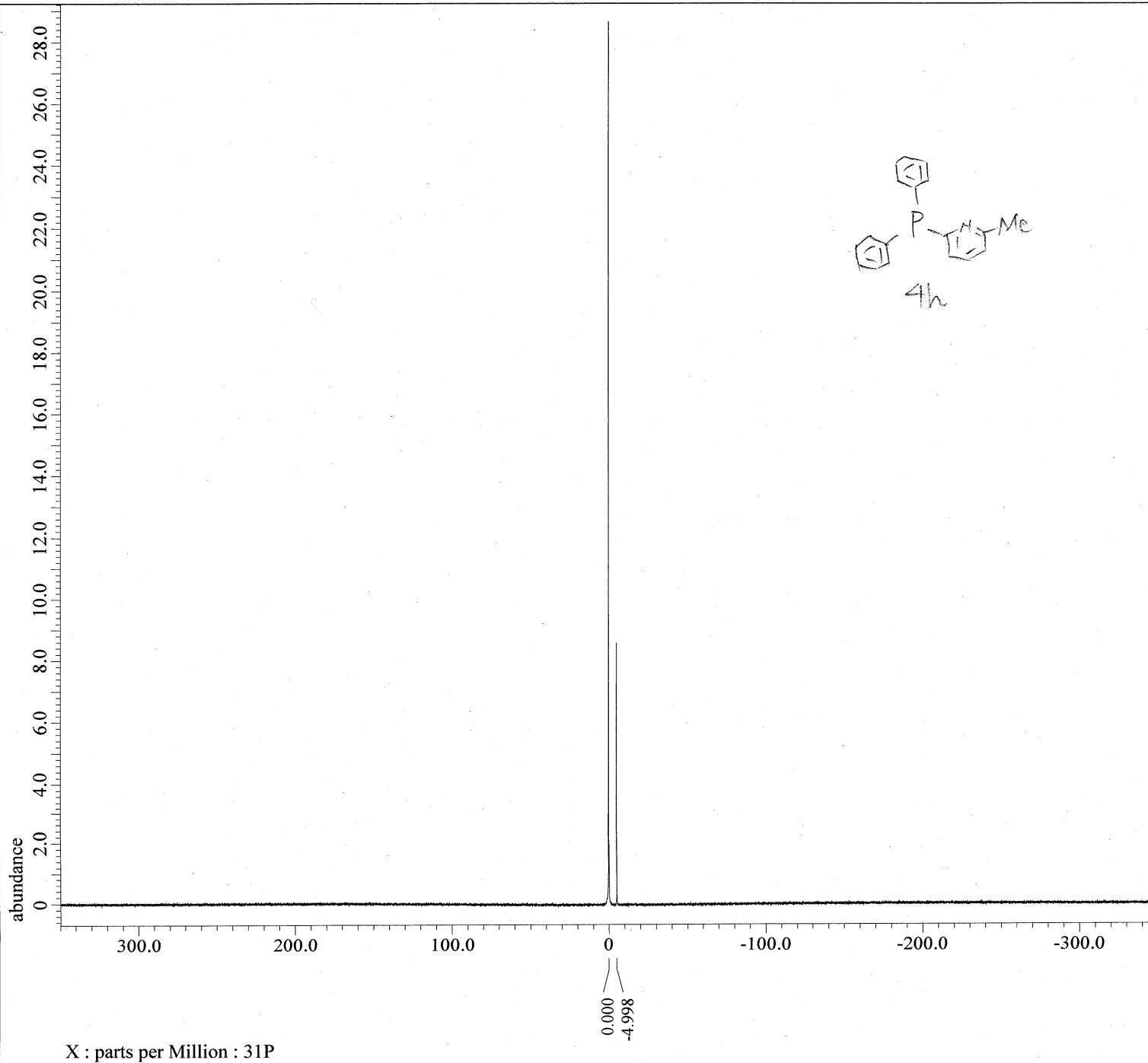
Field Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 1.06430464[s]
X_Domain       = 13C
X_Freq         = 98.51479726[MHz]
X_Offset       = 100[ppm]
X_Points       = 32768
X_Prescans     = 4
X_Resolution   = 0.93958061[Hz]
X_Sweep        = 30.78817734[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 52
Total_Scans    = 52

```

```

Relaxation_Delay = 2[s]
Recvr Gain       = 60
Temp_Get         = 21.1[dC]
X_90_Width      = 11[us]
X_Acq_Time       = 1.06430464[s]
X_Angle         = 30[deg]
X_Atn           = 4.9[dB]
X_Pulse         = 3.66666667[us]
Irr_Atn_Dec     = 22.05[dB]
Irr_Atn_Noe     = 22.05[dB]
Irr_Noise       = WALTZ
Decoupling      = TRUE
Initial_Wait    = 1[s]
Noe              = TRUE
Noe_Time        = 2[s]
Repetition_Time = 3.06430464[s]

```



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-077-pure-internal-31P-1.jdf

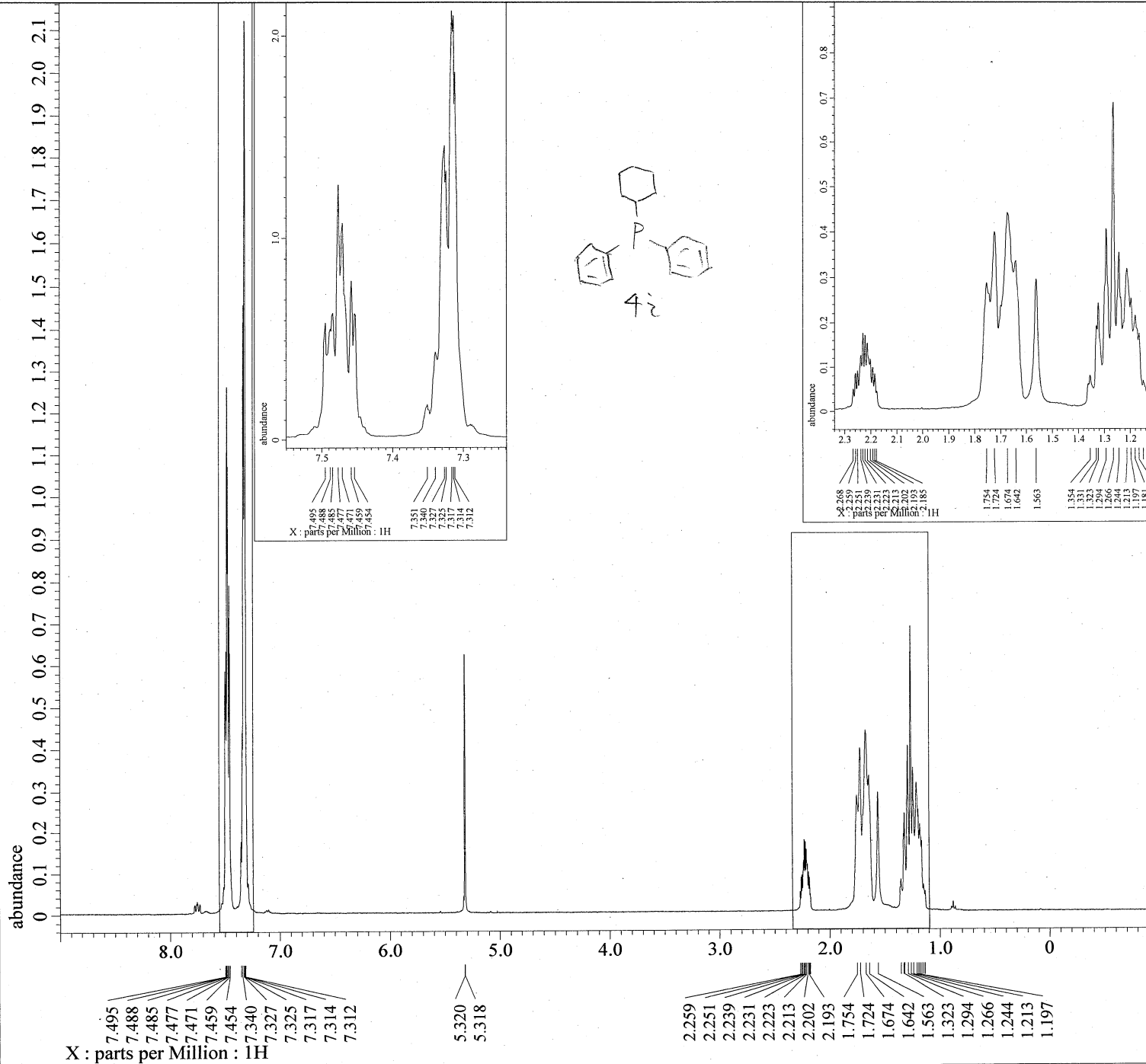
Filename      = REO-077-pure-internal-31P
Author       = element
Experiment   = single_pulse_dec
Sample_Id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 31-AUG-2022 00:33:41
Revision_Time   = 6-SEP-2022 11:17:49

Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim Size     = 26214
X_Domain     = 31P
Dim Title    = 31P
Dim Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

Field Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 0.2359296[s]
X_Domain       = 31P
X_Freq        = 158.59799923[MHz]
X_Offset      = 0[ppm]
X_Points      = 32768
X_Prescans    = 4
X_Resolution  = 4.23855252[Hz]
X_Sweep       = 138.88888889[kHz]
Irr_Domain    = 1H
Irr_Freq      = 391.78655441[MHz]
Irr_Offset    = 5[ppm]
Clipped       = FALSE
Scans         = 22
Total Scans   = 22

Relaxation_Delay = 2[s]
Recvr_Gain       = 50
Temp_Get         = 21[dC]
X_90_Width      = 13.25[us]
X_Acq_Time      = 0.2359296[s]
X_Angle         = 30[deg]
X_Atn           = 5.5[dB]
X_Pulse         = 4.41666667[us]
Irr_Atn_Dec     = 22.05[dB]
Irr_Atn_Noe    = 22.05[dB]
Irr_Noise      = WALTZ
Decoupling      = TRUE
Initial_Wait    = 1[s]
Noe             = TRUE
Noe_Time        = 2[s]
Repetition_Time = 2.2359296[s]

```



---- PROCESSING PARAMETERS ----  
 dc\_balance( 0, FALSE )  
 sexp( 0.2[Hz], 0.0[s] )  
 trapezoid3( 0[%], 80[%], 100[%] )  
 zerofill( 1 )  
 fft( 1, TRUE, TRUE )  
 machinephase  
 ppm

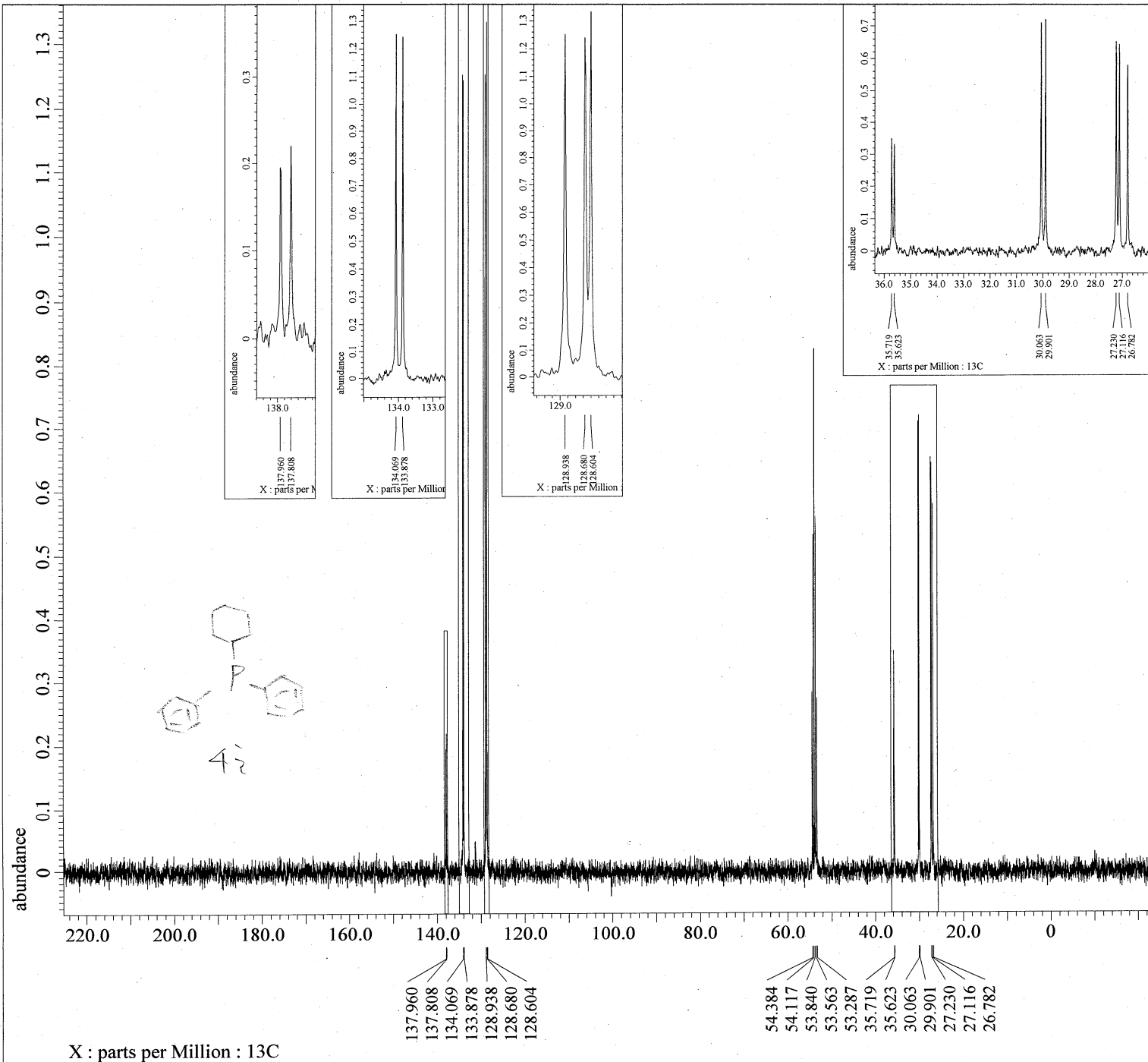
Derived from: REO-059-pure-1H-2.jdf

Filename = REO-059-pure-1H-3.jdf  
 Author = element  
 Experiment = single\_pulse.ex2  
 Sample\_Id = 1  
 Solvent = METHYLENE-CHLORI  
 Actual\_Start\_Time = 30-AUG-2022 17:55:32  
 Revision\_Time = 5-SEP-2022 14:22:55

Comment = single\_pulse  
 Data Format = 1D COMPLEX  
 Dim\_Size = 13107  
 X\_Domain = 1H  
 Dim Title = 1H  
 Dim Units = [ppm]  
 Dimensions = X  
 Site = ECS 400  
 Spectrometer = JNM-ECS400

Field Strength = 9.20197068[T] (390[MHz])  
 X Acq Duration = 2.228224[s]  
 X\_Domain = 1H  
 X Freq = 391.78655441[MHz]  
 X Offset = 5[ppm]  
 X Points = 16384  
 X Prescans = 1  
 X Resolution = 0.44878791[Hz]  
 X Sweep = 7.35294118[kHz]  
 Irr\_Domain = 1H  
 Irr\_Freq = 391.78655441[MHz]  
 Irr\_Offset = 5[ppm]  
 Tri\_Domain = 1H  
 Tri\_Freq = 391.78655441[MHz]  
 Tri\_Offset = 5[ppm]  
 Clipped = FALSE  
 Scans = 8  
 Total Scans = 8

Relaxation\_Delay = 5[s]  
 Recvr Gain = 40  
 Temp\_Get = 20.9[dC]  
 X\_90\_Width = 11.2[us]  
 X Acq Time = 2.228224[s]  
 X Angle = 45[deg]  
 X Atn = 1.9[dB]  
 X Pulse = 5.6[us]  
 Irr\_Mode = Off  
 Tri\_Mode = Off  
 Dante Presat = FALSE  
 Initial Wait = 1[s]  
 Repetition\_Time = 7.228224[s]



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

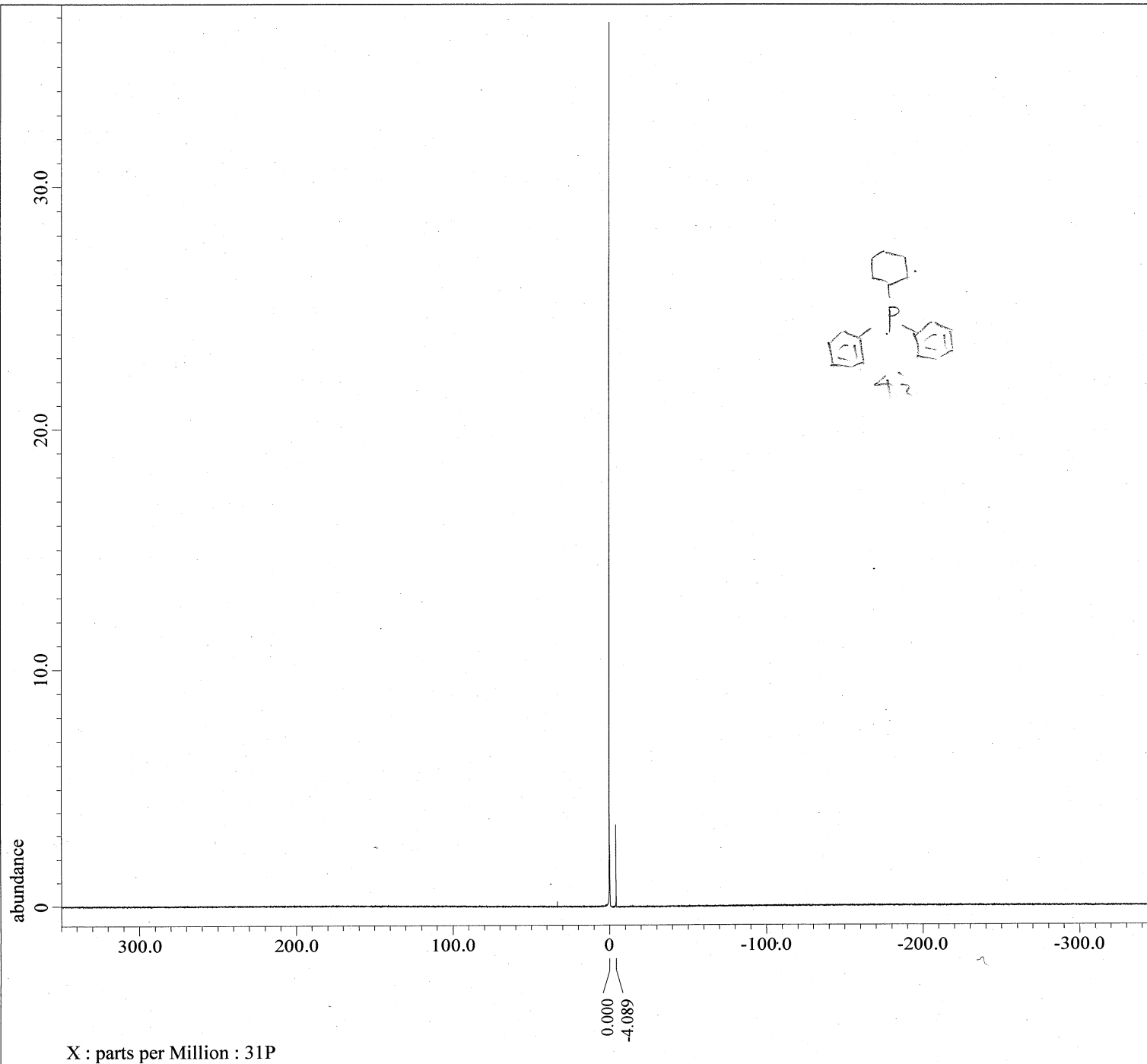
Derived from: REO-059-pure-13C-1.jdf

Filename      = REO-059-pure-13C-2.jdf
Author       = element
Experiment   = single_pulse_dec
Sample_Id    = 1
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 30-AUG-2022 20:06:00
Revision_Time  = 5-SEP-2022 14:27:15

Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim Size     = 26214
X_Domain     = 13C
Dim Title    = 13C
Dim Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

Field Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 1.06430464[s]
X_Domain       = 13C
X_Freq         = 98.51479726[MHz]
X_Offset       = 100[ppm]
X_Points       = 32768
X_Prescans    = 4
X_Resolution   = 0.93958061[Hz]
X_Sweep        = 30.78817734[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 57
Total_Scans    = 57

Relaxation_Delay = 2[s]
Recvr Gain       = 60
Temp_Get         = 21.3[dC]
X_90_Width      = 11[us]
X_Acq_Time      = 1.06430464[s]
X_Angle         = 30[deg]
X_Atn           = 4.9[dB]
X_Pulse         = 3.66666667[us]
Irr_Atn_Dec     = 22.05[dB]
Irr_Atn_No     = 22.05[dB]
Irr_Noise       = WALTZ
Decoupling      = TRUE
Initial_Wait    = 1[s]
Noe              = TRUE
Noe_Time        = 2[s]
Repetition_Time = 3.06430464[s]
  
```



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-059-pure-internal-31P-1.jdf

```

```

Filename      = REO-059-pure-internal-31P
Author        = element
Experiment    = single_pulse_dec
Sample_Id     = S#477548
Solvent       = METHYLENE-CHLORI
Actual_Start Time = 30-AUG-2022 19:58:32
Revision_Time = 5-SEP-2022 14:30:39

```

```

Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim_Size     = 26214
X_Domain     = 31P
Dim_Title    = 31P
Dim_Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400

```

```

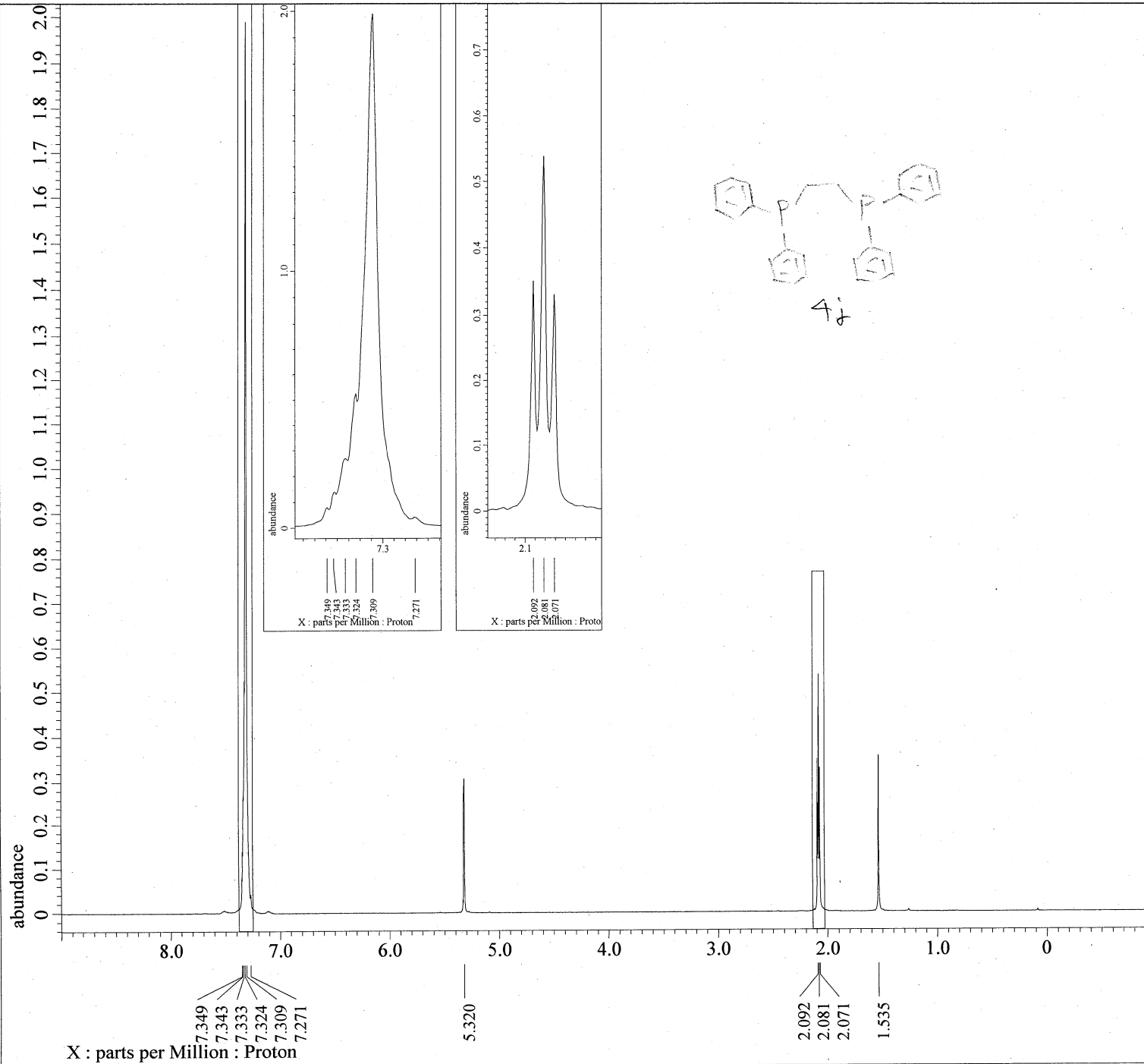
Field Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 0.2359296[s]
X_Domain       = 31P
X_Freq         = 158.59799923[MHz]
X_Offset       = 0[ppm]
X_Points       = 32768
X_Prescans     = 4
X_Resolution   = 4.23855252[Hz]
X_Sweep        = 138.88888889[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 43
Total_Scans    = 43

```

```

Relaxation_Delay = 2[s]
Recvr_Gain       = 50
Temp_Get         = 21.3[dC]
X_90_Width       = 13.25[us]
X_Acq_Time       = 0.2359296[s]
X_Angle          = 30[deg]
X_Atn            = 5.5[dB]
X_Pulse          = 4.41666667[us]
Irr_Atn_Dec     = 22.05[dB]
Irr_Atn_No     = 22.05[dB]
Irr_Noise       = WALTZ
Decoupling       = TRUE
Initial_Wait     = 1[s]
Noe              = TRUE
Noe_Time        = 2[s]
Repetition_Time = 2.2359296[s]

```



```

---- PROCESSING PARAMETERS ----
sexp( 0.2[Hz], 0.0[s] )
trapezoid( 0[%], 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-088-pure-1H-3_Proton-1-1.jd

```

```

Filename      = REO-088-pure-1H-3_Pro
Author        = element
Experiment    = proton auto.jxp
Sample_Id     = REO-088-pure-1H-3
Solvent       = METHYLENE-CHLORIDE-D2
Actual_Start_Time = 14-SEP-2022 14:01:57
Revision_Time  = 16-SEP-2022 19:50:36

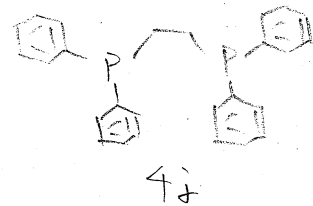
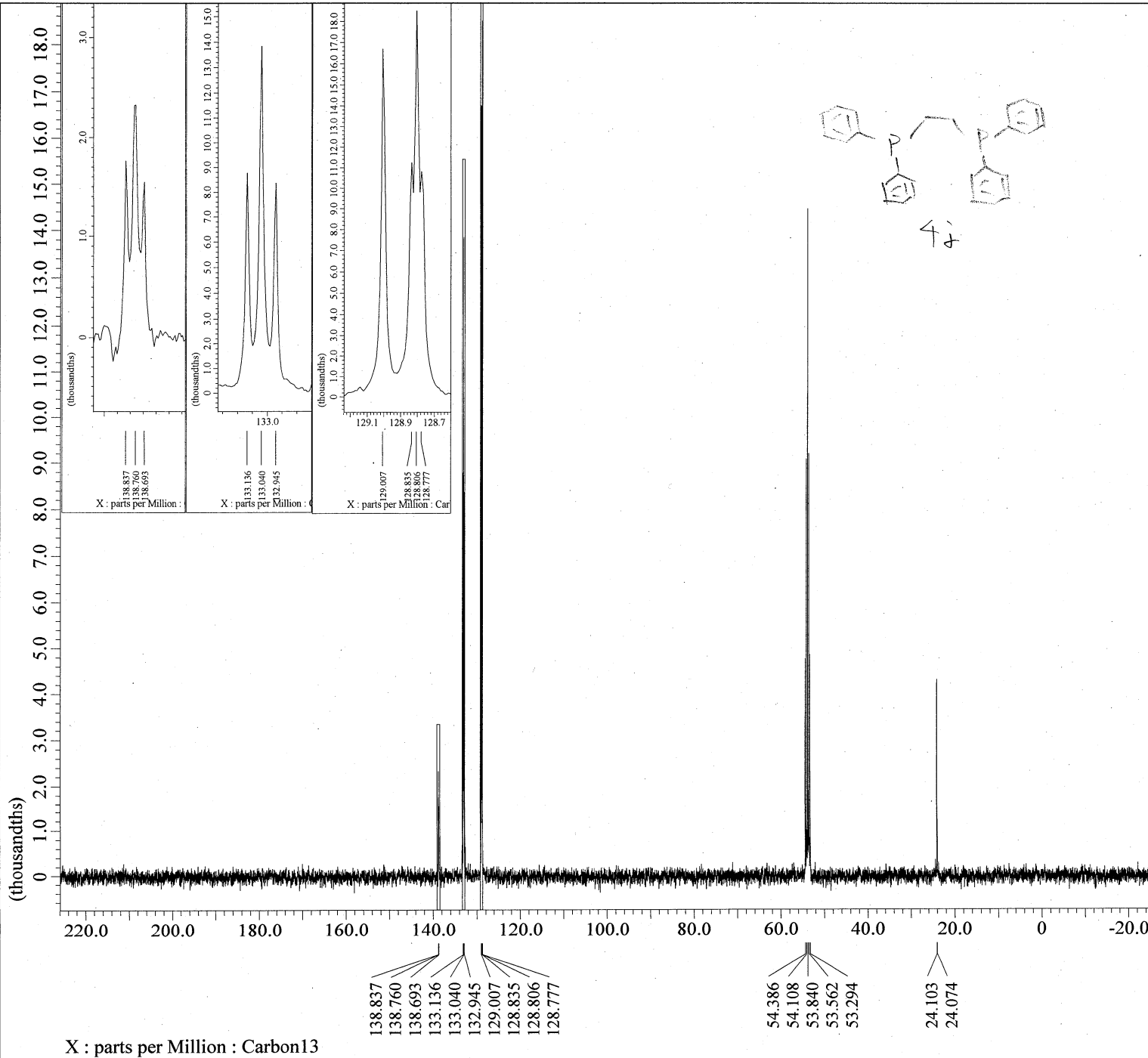
Comment       = single pulse
Data_Format   = 1D COMPLEX
Dim_Size      = 13107
X_Domain      = Proton
Dim_Title     = Proton
Dim_Units     = [ppm]
Dimensions    = X
Spectrometer  = DELTA2_NMR

Field Strength = 9.2982153[T] (400[MHz]
X_Acq_Duration = 2.20725248[s]
X_Domain       = Proton
X_Freq         = 395.88430144[MHz]
X_Offset       = 5[ppm]
X_Points       = 16384
X_Prescans     = 1
X_Resolution   = 0.45305193[Hz]
X_Sweep        = 7.42280285[kHz]
X_Sweep_Clippped = 5.93824228[kHz]
Irr_Domain     = Proton
Irr_Freq       = 395.88430144[MHz]
Irr_Offset     = 5[ppm]
Tri_Domain     = Proton
Tri_Freq       = 395.88430144[MHz]
Tri_Offset     = 5[ppm]
Blanking       = 2[us]
Clipped        = TRUE
Scans          = 8
Total_Scans    = 8

Relaxation_Delay = 5[s]
Recvr_Gain       = 56
Temp_Get         = 19.8[dC]
X_90_Width      = 9.5[us]
X_Acq_Time      = 2.20725248[s]
X_Angle         = 45[deg]
X_Atn           = 3.4[dB]
X_Pulse         = 4.75[us]
Irr_Mode        = Off
Tri_Mode        = Off
Dante_Loop      = 500
Dante_Presat    = FALSE
Decimation_Rate = 0
Experiment_Path = C:\Program Files\JEOL
Initial_Wait    = 1[s]
Phase           = {0, 90, 270, 180, 180
Presat_Time     = 5[s]

```





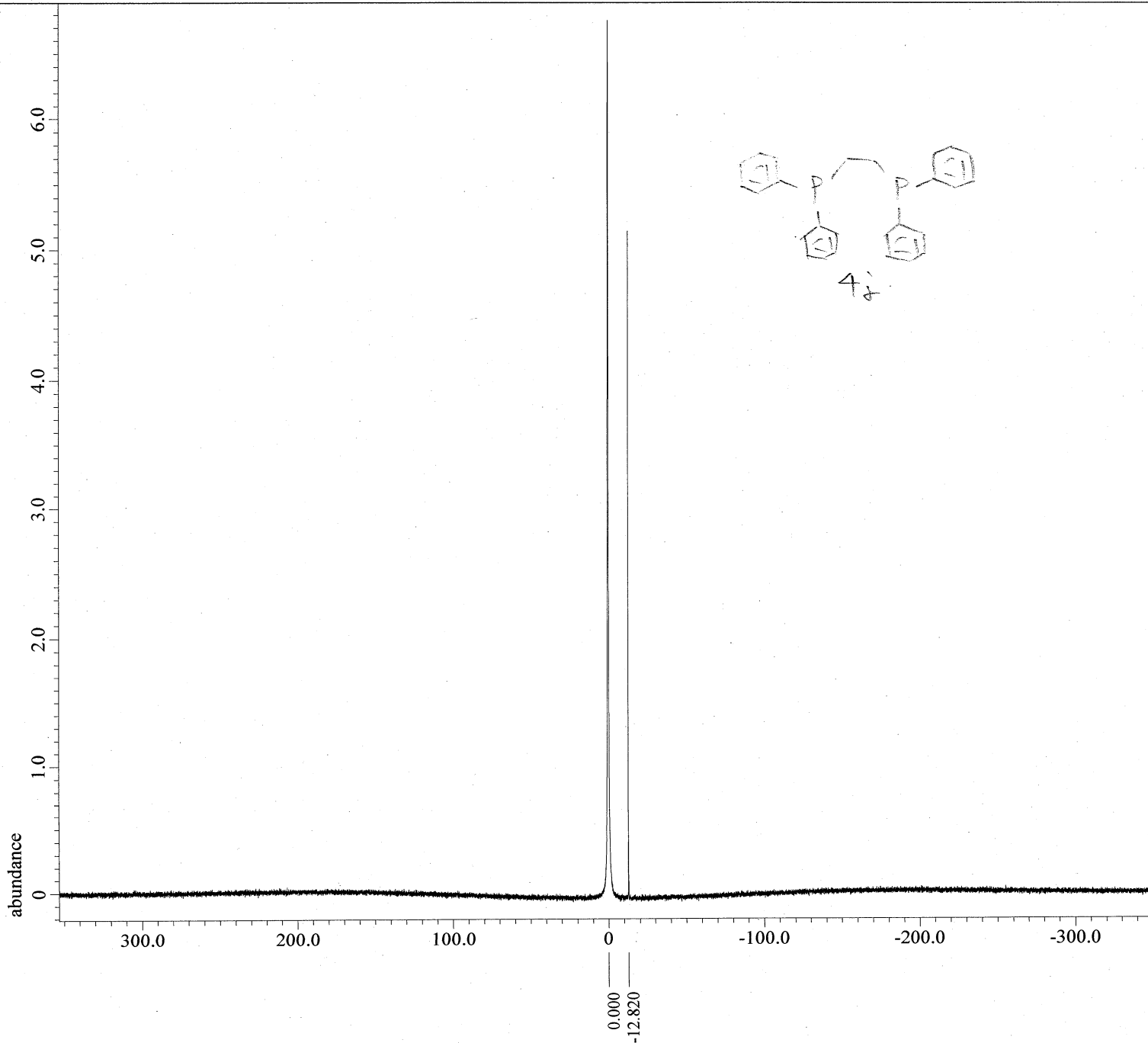
---- PROCESSING PARAMETERS ----  
 sexp( 2.0[Hz], 0.0[s] )  
 trapezoid( 0[%], 0[%], 80[%], 100[%] )  
 zerofill( 1 )  
 fft( 1, TRUE, TRUE )  
 machinephase  
 ppm  
 Derived from: REO-088-pure-13C-2\_Carbon-1-1.j

Filename = REO-088-pure-13C-2  
 Author = element  
 Experiment = carbon\_auto.jxp  
 Sample\_Id = REO-088-pure-13C-2  
 Solvent = METHYLENE-CHLORIDE  
 Actual\_Start\_Time = 14-SEP-2022 14:08:  
 Revision\_Time = 16-SEP-2022 19:59:

Comment = single pulse decou  
 Data Format = 1D COMPLEX  
 Dim\_Size = 26214  
 X\_Domain = Carbon13  
 Dim\_Title = Carbon13  
 Dim\_Units = [ppm]  
 Dimensions = X  
 Spectrometer = DELTA2\_NMR

Field Strength = 9.2982153[T] (400[  
 X\_Acq\_Duration = 1.048576[s]  
 X\_Domain = Carbon13  
 X\_Freq = 99.54517646[MHz]  
 X\_Offset = 100[ppm]  
 X\_Points = 32768  
 X\_Prescans = 4  
 X\_Resolution = 0.95367432[Hz]  
 X\_Sweep = 31.25[kHz]  
 X\_Sweep\_Clippped = 25[kHz]  
 Irr\_Domain = Proton  
 Irr\_Freq = 395.88430144[MHz]  
 Irr\_Offset = 5[ppm]  
 Blanking = 5[us]  
 Clipped = FALSE  
 Scans = 100  
 Total\_Scans = 100

Relaxation\_Delay = 2[s]  
 Recvr\_Gain = 50  
 Temp\_Get = 20.1[dC]  
 X\_90\_Width = 9.65[us]  
 X\_Acq\_Time = 1.048576[s]  
 X\_Angle = 30[deg]  
 X\_Atn = 8[dB]  
 X\_Pulse = 3.21666667[us]  
 Irr\_Atn\_Dec = 25.059[dB]  
 Irr\_Atn\_Dec\_Calc = 25.059[dB]  
 Irr\_Atn\_Dec\_Default\_Calc = 25.059[dB]  
 Irr\_Atn\_No = 25.059[dB]  
 Irr\_Dec\_Bandwidth\_Hz = 4.7826087[kHz]  
 Irr\_Dec\_Bandwidth\_Ppm = 12.08082432[ppm]  
 Irr\_Dec\_Freq = 395.88430144[MHz]  
 Irr\_Dec\_Merit\_Factor = 2.2  
 Irr\_Decoupling = TRUE  
 Irr\_No = TRUE  
 Irr\_Noise = WALTZ  
 Irr\_Offset\_Default = 5[ppm]



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid( 0[%], 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-088-pure-internal-31P_Carbo

```

```

Filename      = REO-088-pure-internal-31P
Author        = element
Experiment    = carbon.jxp
Sample_Id     = REO-088-pure-internal-31P
Solvent       = METHYLENE-CHLORIDE-D2
Actual_Start_Time = 16-SEP-2022 11:12:00
Revision_Time  = 16-SEP-2022 19:56:09

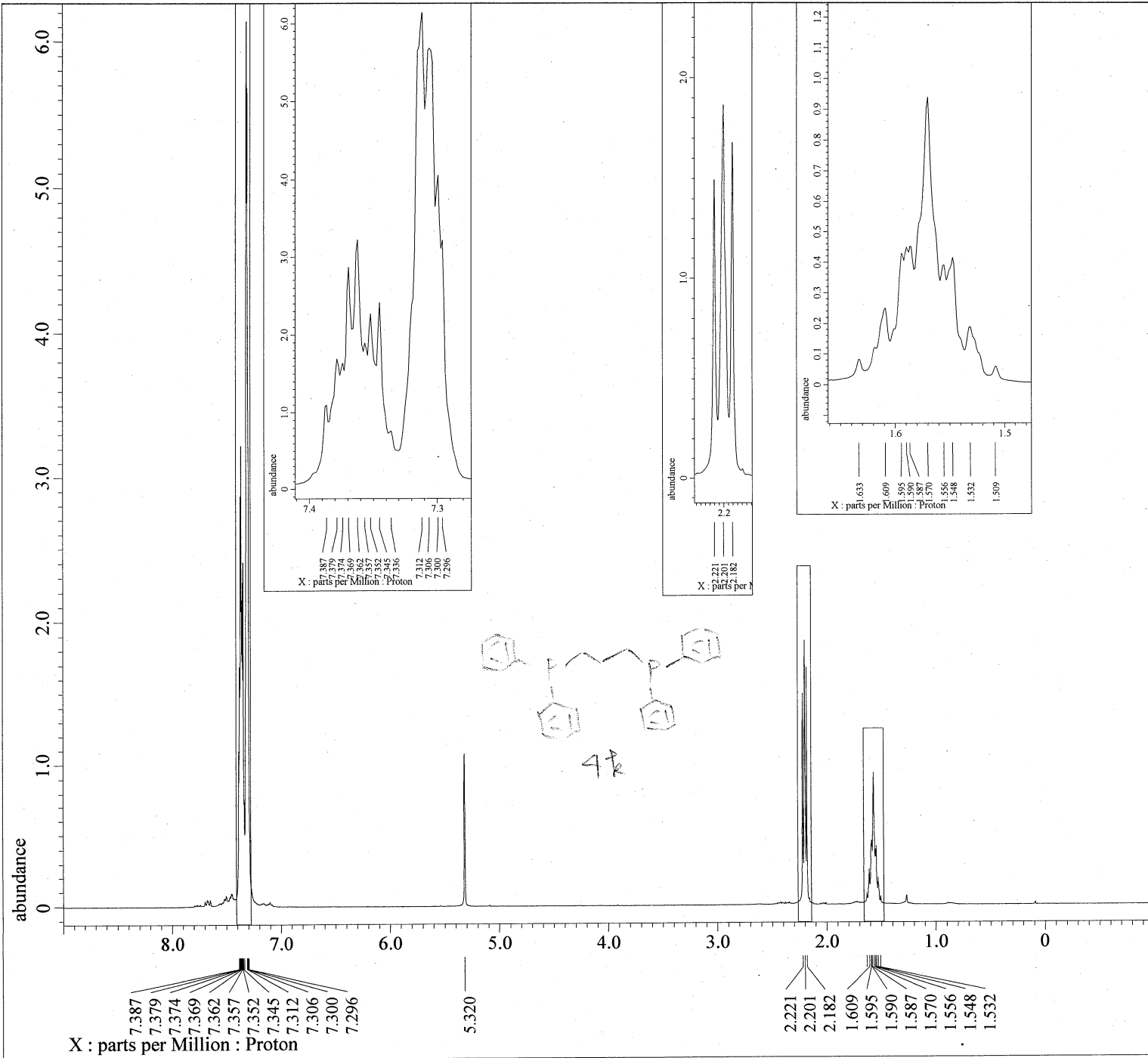
Comment       = single pulse decoupled ga
Data Format    = 1D COMPLEX
Dim_Size      = 26214
X_Domain      = Phosph
Dim_Title     = Phosphorus31
Dim_Units     = [ppm]
Dimensions    = X
Site          = JNM-ECS400
Spectrometer  = DELTA2_NMR

Field_Strength = 9.37221[T] (400[MHz])
X_Acq_Duration = 0.229376[s]
X_Domain       = 31P
X_Freq        = 161.53211155[MHz]
X_Offset      = 0[ppm]
X_Points      = 32768
X_Prescans    = 4
X_Resolution  = 4.35965402[Hz]
X_Sweep       = 142.85714286[kHz]
X_Sweep_Clippped = 114.28571429[kHz]
Irr_Domain    = Proton
Irr_Freq     = 399.03472754[MHz]
Irr_Offset    = 5.0[ppm]
Clipped       = FALSE
Scans        = 100
Total_Scans   = 100

Relaxation_Delay = 2[s]
Recvr_Gain       = 50
Temp_Get         = 19.7[dC]
X_90_Width      = 16.75[us]
X_Acq_Time      = 0.229376[s]
X_Angle         = 30[deg]
X_Atn           = 4.7[dB]
X_Pulse         = 5.58333333[us]
Irr_Atn_Dec     = 25.823[dB]
Irr_Atn_No     = 25.823[dB]
Irr_Noise      = WALTZ
Irr_Pwidth     = 0.115[ms]
Decoupling      = TRUE
Initial_Wait    = 1[s]
Noe             = TRUE
Noe_Time        = 2[s]
Repetition_Time = 2.229376[s]

```

X : parts per Million : Phosphorus31



```

----- PROCESSING PARAMETERS -----
dc_balance( 0, FALSE )
sexp( 0.2[Hz], 0.0[s] )
trapezoid( 0[%], 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-094-pure-1H-3_Proton-1-1.jd

Filename      = REO-094-pure-1H-3_Proton-
Author        = element
Experiment    = proton.jxp
Sample_Id     = REO-094-pure-1H-3
Solvent       = METHYLENE-CHLORIDE-D2
Actual_Start_Time = 18-SEP-2022 12:40:19
Revision_Time  = 20-SEP-2022 11:14:08

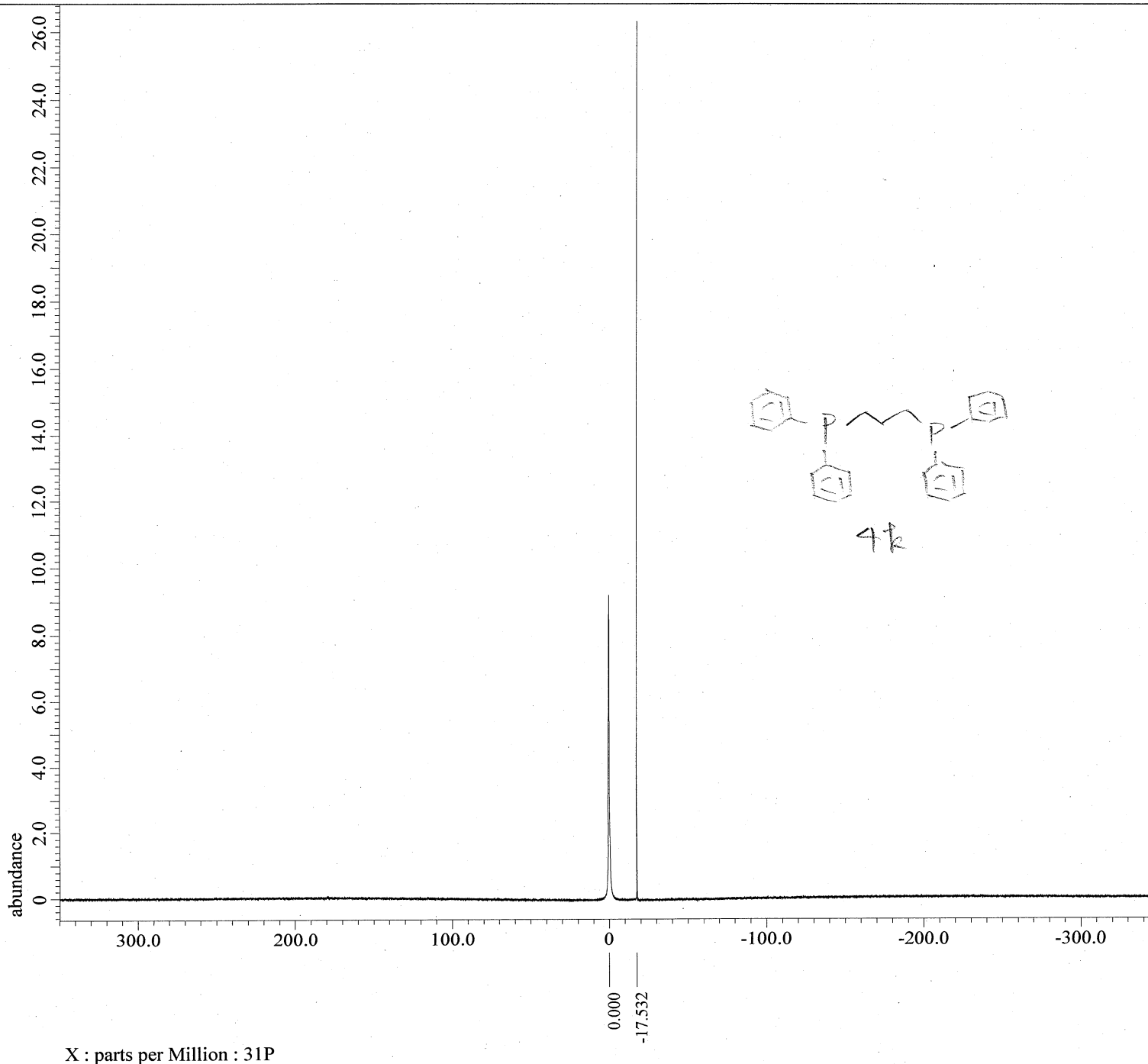
Comment       = single_pulse
Data Format    = ID COMPLEX
Dim_Size      = 13107
X_Domain      = Proton
Dim Title     = Proton
Dim Units     = [ppm]
Dimensions    = X
Site          = JNM-ECS400
Spectrometer  = DELTA2_NMR

Field Strength = 9.37221[T] (400[MHz])
X_Acq_Duration = 2.1889024[s]
X_Domain       = 1H
X_Freq        = 399.03472754[MHz]
X_Offset      = 5.0[ppm]
X_Points      = 16384
X_Prescans    = 1
X_Resolution  = 0.45684997[Hz]
X_Sweep       = 7.48502994[kHz]
X_Sweep_Clipped = 5.98802395[kHz]
Irr_Domain    = Proton
Irr_Freq     = 399.03472754[MHz]
Irr_Offset   = 5.0[ppm]
Tri_Domain   = Proton
Tri_Freq    = 399.03472754[MHz]
Tri_Offset  = 5.0[ppm]
Clipped     = FALSE
Scans       = 8
Total_Scans = 8

Relaxation_Delay = 5[s]
Recvr_Gain       = 42
Temp_Get        = 20.4[dC]
X_90_Width     = 6.6[us]
X_Acq_Time     = 2.1889024[s]
X_Angle        = 45[deg]
X_Atn          = 1[dB]
X_Pulse        = 3.3[us]
Irr_Mode       = Off
Tri_Mode       = Off
Dante_Preset  = FALSE
Initial_Wait   = 1[s]
Repetition_Time = 7.1889024[s]

```





```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm
Derived from: REO-094-pure-internal-31P-1.jdf
  
```

```

Filename      = REO-094-pure-internal-31P
Author       = element
Experiment    = single_pulse_dec
Sample_Id    = S#433325
Solvent      = METHYLENE-CHLORI
Actual_Start_Time = 29-AUG-2022 18:43:59
Revision_Time = 20-SEP-2022 09:40:18
  
```

```

Comment      = single pulse decoupled ga
Data Format   = 1D COMPLEX
Dim_Size     = 26214
X_Domain     = 31P
Dim_Title    = 31P
Dim_Units    = [ppm]
Dimensions   = X
Site         = ECS 400
Spectrometer = JNM-ECS400
  
```

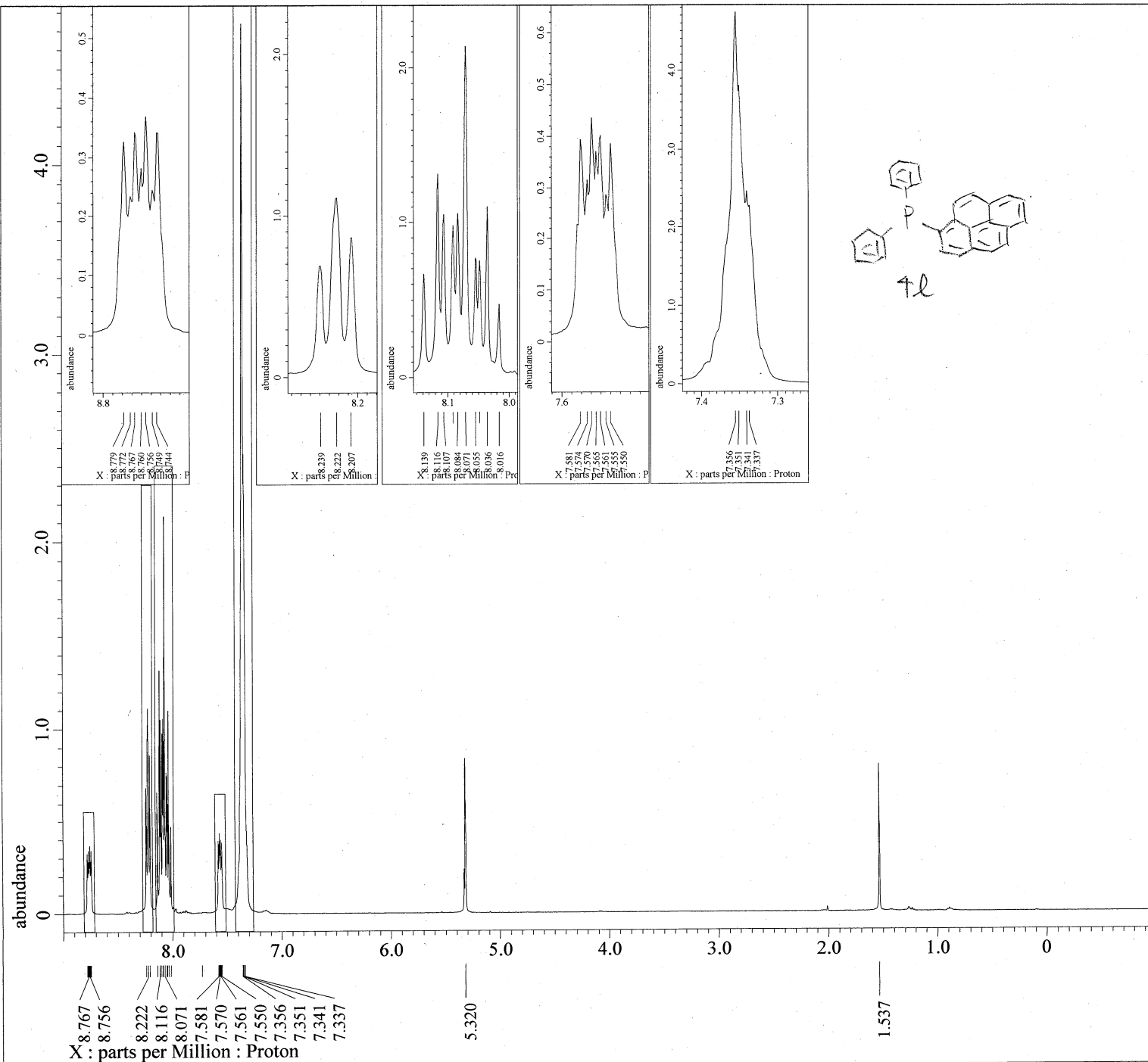
```

Field Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 0.2359296[s]
X_Domain       = 31P
X_Freq         = 158.59799923[MHz]
X_Offset       = 0[ppm]
X_Points       = 32768
X_Prescans    = 4
X_Resolution   = 4.2385252[Hz]
X_Sweep        = 138.88888889[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 31
Total_Scans    = 31
  
```

```

Relaxation_Delay = 2[s]
Recvr_Gain       = 50
Temp_Get        = 20.9[dC]
X_90_Width      = 13.25[us]
X_Acq_Time      = 0.2359296[s]
X_Angle         = 30[deg]
X_Atn           = 5.5[dB]
X_Pulse         = 4.41666667[us]
Irr_Atn_Dec     = 22.05[dB]
Irr_Atn_No     = 22.05[dB]
Irr_Noise       = WALTZ
Decoupling      = TRUE
Initial_Wait    = 1[s]
Noe              = TRUE
Noe_Time        = 2[s]
Repetition_Time = 2.2359296[s]
  
```

X : parts per Million : 31P



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 0.2[Hz], 0.0[s] )
trapezoid( 0[%], 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-121-pure-1H_Proton-1-1.jdf

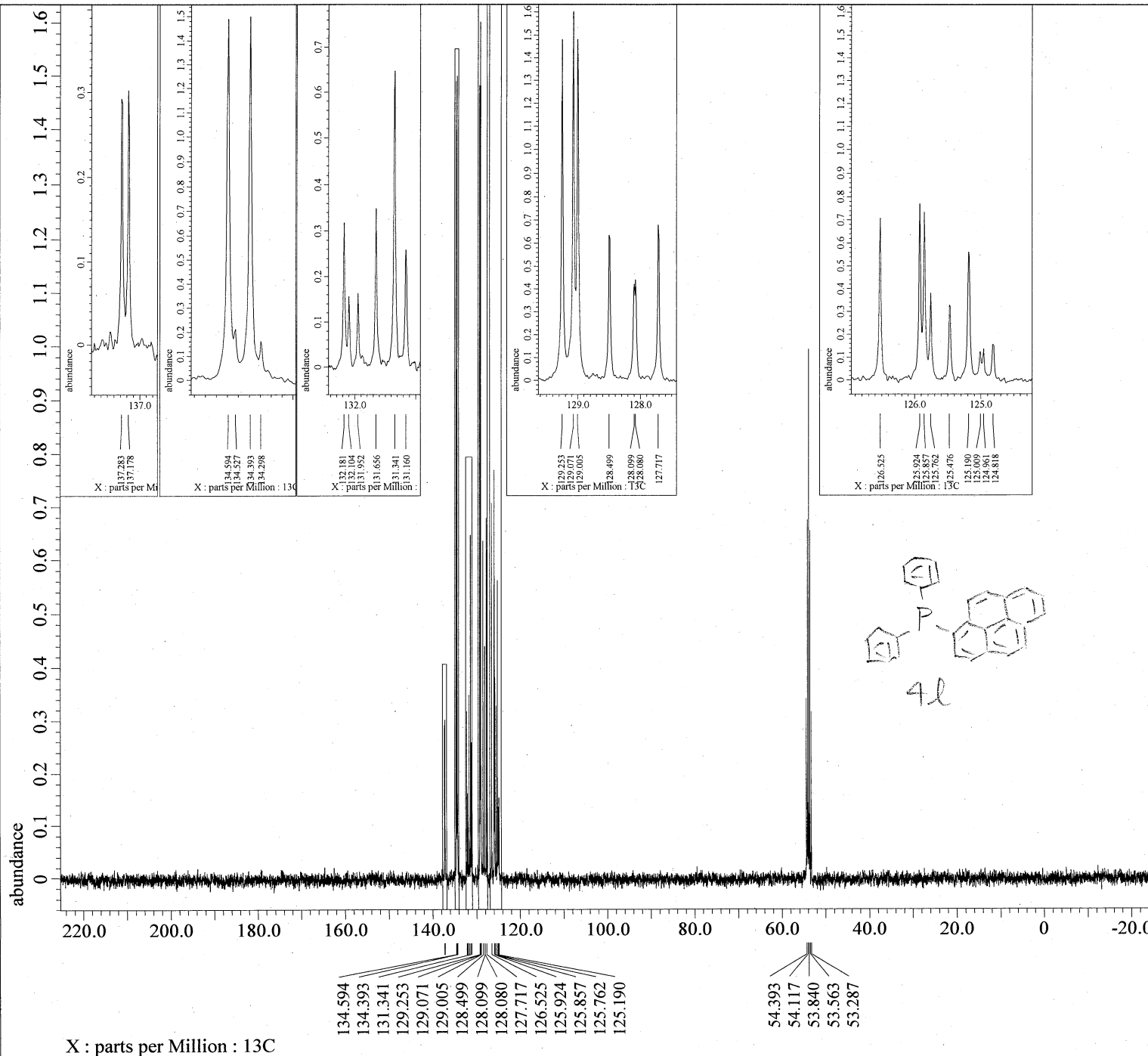
Filename      = REO-121-pure-1H_Proton-1-
Author        = element
Experiment     = proton.jxp
Sample_Id     = REO-121-pure-1H
Solvent       = METHYLENE-CHLORIDE-D2
Actual_Start_Time = 22-SEP-2022 16:07:11
Revision_Time  = 22-SEP-2022 19:04:37

Comment       = single_pulse
Data_Format   = 1D_COMPLEX
Dim_Size      = 13107
X_Domain      = Proton
Dim_Title     = Proton
Dim_Units     = [ppm]
Dimensions    = X
Site          = JNM-ECS400
Spectrometer  = DELTA2_NMR

Field_Strength = 9.37221[T] (400[MHz])
X_Acq_Duration = 2.1889024[s]
X_Domain       = 1H
X_Freq        = 399.03472754[MHz]
X_Offset      = 5.0[ppm]
X_Points      = 16384
X_Prescans    = 1
X_Resolution  = 0.45684997[Hz]
X_Sweep       = 7.48502994[kHz]
X_Sweep_Clippped = 5.98802395[kHz]
Irr_Domain    = Proton
Irr_Freq     = 399.03472754[MHz]
Irr_Offset   = 5.0[ppm]
Tri_Domain    = Proton
Tri_Freq     = 399.03472754[MHz]
Tri_Offset   = 5.0[ppm]
Clipped      = FALSE
Scans        = 8
Total_Scans  = 8

Relaxation_Delay = 5[s]
Recvr_Gain       = 40
Temp_Get        = 19.4[dc]
X_90_Width     = 6.6[us]
X_Acq_Time     = 2.1889024[s]
X_Angle        = 45[deg]
X_Atn          = 1[dB]
X_Pulse        = 3.3[us]
Irr_Mode       = Off
Tri_Mode       = Off
Dante_Preset   = FALSE
Initial_Wait   = 1[s]
Repetition_Time = 7.1889024[s]

```



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid3( 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

```

Derived from: REO-121-pure-13C-1.jdf

```

Filename      = REO-121-pure-13C-2.jdf
Author        = element
Experiment    = single_pulse_dec
Sample_Id     = 1
Solvent       = METHYLENE-CHLORI
Actual_Start_Time = 22-SEP-2022 22:29:49
Revision_Time  = 22-SEP-2022 19:07:23

```

```

Comment       = single pulse decoupled ga
Data Format    = 1D COMPLEX
Dim_Size      = 26214
X_Domain      = 13C
Dim_Title     = 13C
Dim_Units     = [ppm]
Dimensions    = X
Site          = ECS 400
Spectrometer  = JNM-ECS400

```

```

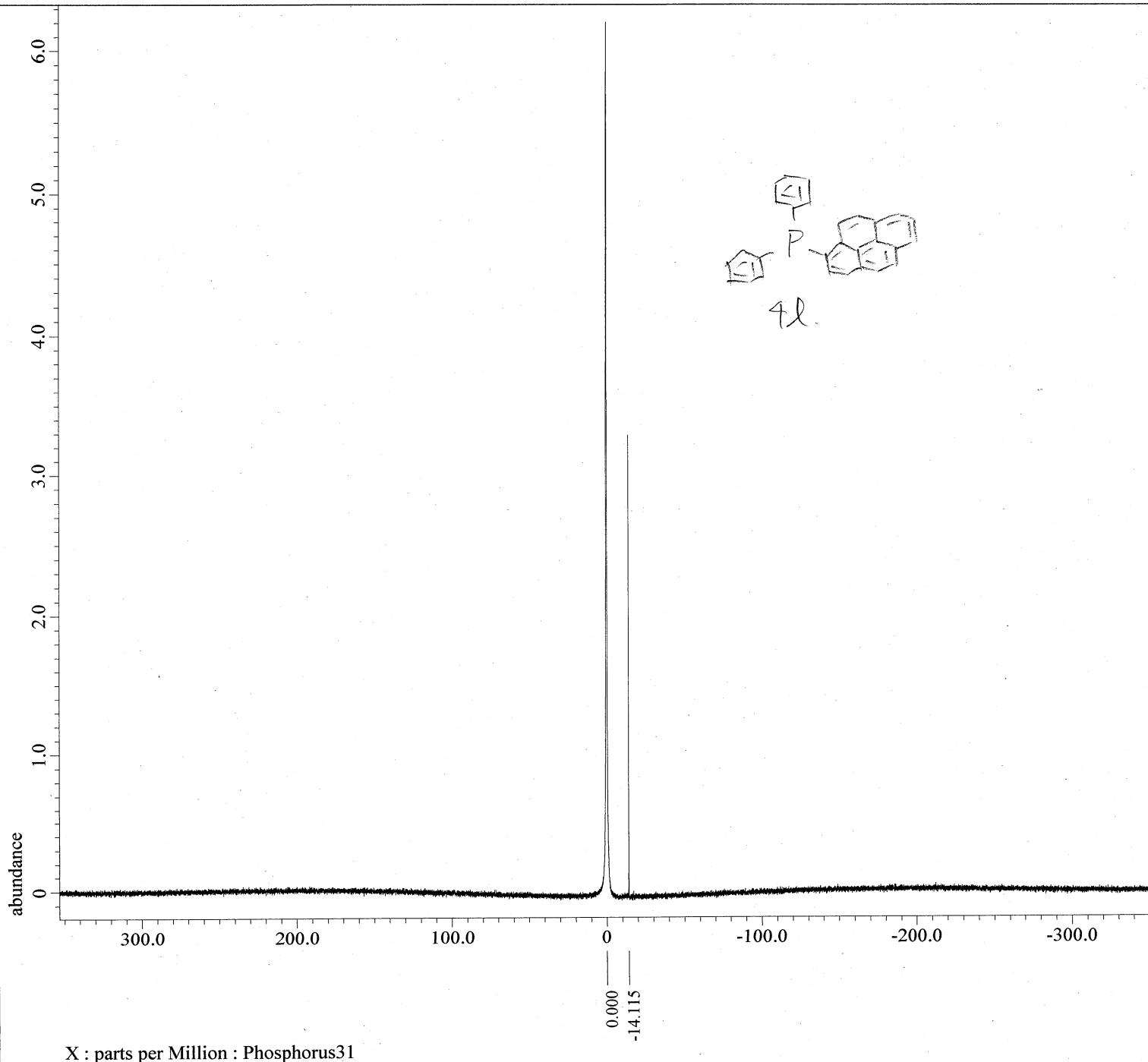
Field Strength = 9.20197068[T] (390[MHz])
X_Acq_Duration = 1.06430464[s]
X_Domain       = 13C
X_Freq         = 98.51479726[MHz]
X_Offset       = 100[ppm]
X_Points       = 32768
X_Prescans     = 4
X_Resolution   = 0.93958061[Hz]
X_Sweep        = 30.78817734[kHz]
Irr_Domain     = 1H
Irr_Freq       = 391.78655441[MHz]
Irr_Offset     = 5[ppm]
Clipped        = FALSE
Scans          = 100
Total_Scans    = 100

```

```

Relaxation_Delay = 2[s]
Recvr_Gain       = 60
Temp_Get         = 20.2[dC]
X_90_Width       = 8.7[us]
X_Acq_Time       = 1.06430464[s]
X_Angle          = 30[deg]
X_Atn            = 4.9[dB]
X_Pulse          = 2.9[us]
Irr_Atn_Dec     = 22.45[dB]
Irr_Atn_Noise   = 22.45[dB]
Irr_Noise       = WALTZ
Decoupling       = TRUE
Initial_Wait     = 1[s]
Noe              = TRUE
Noe_Time         = 2[s]
Repetition_Time  = 3.06430464[s]

```



```

---- PROCESSING PARAMETERS ----
dc_balance( 0, FALSE )
sexp( 2.0[Hz], 0.0[s] )
trapezoid( 0[%], 0[%], 80[%], 100[%] )
zerofill( 1 )
fft( 1, TRUE, TRUE )
machinephase
ppm

Derived from: REO-121-pure-internal-31P_Carbo

```

```

Filename      = REO-121-pure-internal-31P
Author       = element
Experiment    = carbon.jxp
Sample_Id     = REO-121-pure-internal-31P
Solvent      = METHYLENE-CHLORIDE-D2
Actual_Start_Time = 22-SEP-2022 16:13:19
Revision_Time  = 22-SEP-2022 19:10:26

```

```

Comment      = single pulse decoupled ga
Data_Format   = 1D COMPLEX
Dim_Size      = 26214
X_Domain      = Phosph
Dim_Title     = Phosphorus31
Dim_Units     = [ppm]
Dimensions    = X
Site          = JNM-ECS400
Spectrometer  = DELTA2_NMR

```

```

Field_Strength = 9.37221[T] (400[MHz])
X_Acq_Duration = 0.229376[s]
X_Domain       = 31P
X_Freq         = 161.53211155[MHz]
X_Offset       = 0[ppm]
X_Points       = 32768
X_Prescans     = 4
X_Resolution   = 4.35965402[Hz]
X_Sweep        = 142.85714286[kHz]
X_Sweep_Clippped = 114.28571429[kHz]
Irr_Domain     = Proton
Irr_Freq       = 399.03472754[MHz]
Irr_Offset     = 5.0[ppm]
Clipped        = FALSE
Scans          = 100
Total_Scans    = 100

```

```

Relaxation_Delay = 2[s]
Recvr_Gain       = 50
Temp_Get         = 19.4[dC]
X_90_Width       = 16.75[us]
X_Acq_Time       = 0.229376[s]
X_Angle          = 30[deg]
X_Atn            = 4.7[dB]
X_Pulse          = 5.58333333[us]
Irr_Atn_Dec      = 25.823[dB]
Irr_Atn_Noise   = 25.823[dB]
Irr_Noise        = WALTZ
Irr_Pwidth       = 0.115[ms]
Decoupling       = TRUE
Initial_Wait     = 1[s]
Noe              = TRUE
Noe_Time         = 2[s]
Repetition_Time  = 2.229376[s]

```