# Supporting Information

# Photoredox/Copper-Catalyzed Formal Cyclopropanation of Olefins

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# 1. General Infromation

Experiments involving moisture and/or air sensitive components were performed under a positive pressure of argon in oven-dried glassware equipped with a rubber septum inlet. Dried solvents and liquid reagents were transferred by oven-dried syringes or hypodermic syringe cooled to ambient temperature in a desiccator. Reactions mixtures were stirred in 10 mL sample vial with Teflon-coated magnetic stirring bars unless otherwise stated. Moisture in non-volatile reagents/compounds was removed in high vacuo by means of an oil pump and subsequent purging with nitrogen. Solvents were removed in vacuo under ~30 mmHg and heated with a water bath at 40 – 45 ° C using rotary evaporator with aspirator. The condenser was cooled with running water at 0 ° C. All experiments were monitored by analytical thin layer chromatography (TLC). TLC was performed on pre-coated plates, 60 F254. After elution, plate was visualized under UV illumination at 254 nm for UV active material. Further visualization was achieved by staining $Ce(SO_4)_2$ and phosphomolybdic acid solution. For those using the aqueous stains, the TLC plates were heated on a hot plate.

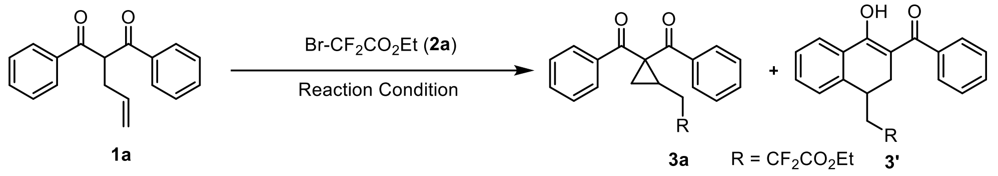
All the products were purified by *SepaBean® Machine*. *SepaFlash®* column were purchased from *Santaitech* Company. All commercial reagents were purchased with the highest purity grade. They were used without further purification unless specified.

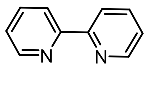
All solvents used, mainly petroleum ether (PE) and ethyl acetate (EtOAc) were distilled. Anhydrous dichloromethane (DCM), $CH_3CN$, $CHCl_3$ were freshly distilled from $CaH_2$ and stored under Ar atmosphere. Tetrahydrofuran (THF), $Et_2O$, 1,2-dimethoxyethane, mesitylene and toluene were freshly distilled from sodium/benzophenone before use. All compounds synthesized were stored in a −20 ° C freezer and light-sensitive compounds were protected with aluminium foil.

$^1H$ and $^{13}C$ NMR spectra were recorded on a Bruker advance III400 spectrometer (400 MHz for $^1H$ and 100 MHz for $^{13}C$) and III600 spectrometer (600 MHz for $^1H$ and 150 MHz for $^{13}C$) in $CDCl_3$, DMSO-$d_6$ and DMF-$d_7$. Chemical shifts ($\delta$) were measured in ppm relative to TMS $\delta = 0$ for $^1H$, or to chloroform $\delta = 77.0$ for $^{13}C$ as internal standard. $^{19}F$ NMR were recorded on the same instrument. Data are reported as follows: Chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet), Coupling constants, *J*, are reported in hertz. The starting materials were purchased from Aldrich, Acros Organics, J&K Chemicals Adamas-beta or TCI and used without further purification. Thin-layer chromatography (TLC) was performed using 60 mesh silica gel plates visualized with short-wavelength UV light (254 nm).

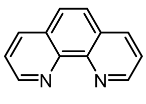
# 2. Optimization of Reaction Conditions

## 2.1 Reaction conditions screening [a,b]





**L1**



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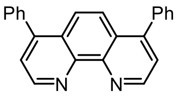

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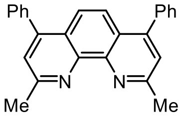

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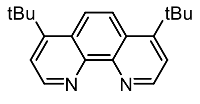

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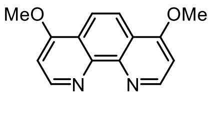

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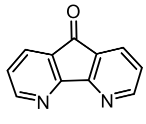

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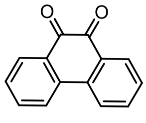

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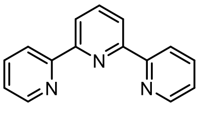

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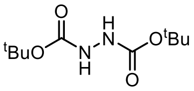

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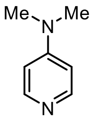
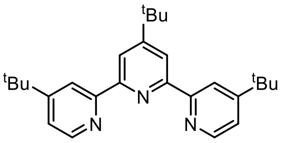


**DMAP**
**L11**



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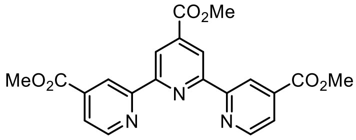

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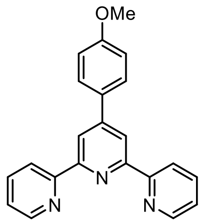


**L14**

| Entry | PC | [Cu] | Ligand | Base | Solvent | Yield of **3a** (%) | Yield of **3’** (%) |
|---|---|---|---|---|---|---|---|
| 1 | Ir(ppy)$_3$ | -- | -- | $K_2CO_3$ | DCM | ND | 85 |
| 2 | Ir(ppy)$_3$ | -- | -- | KOAc | DCM | ND | 77 |
| 3 | Ir(ppy)$_3$ | -- | -- | $K_3PO_4$ | DCM | ND | 82 |
| 4 | Ir(ppy)$_3$ | -- | -- | $NEt_3$ | DCM | ND | 68 |
| 5 | Ir(ppy)$_3$ | -- | -- | TMEDA | DMSO | ND | 90 |
| 6 | Ir(ppy)$_3$ | -- | -- | DMAP | DCM | ND | ND |
| 7 | Ir(ppy)$_3$ | -- | -- | 2,6-lutidine | DCM | ND | ND |
| 8 | Ir(ppy)$_3$ | Cu(MeCN)$_4$PF$_6$ | **L1** | $K_2CO_3$ | DCM | messy | <10 |

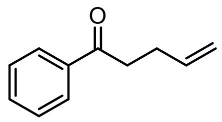
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L2** | $K_2CO_3$ | DCM | 22 | <10 |
| 10 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L3** | $K_2CO_3$ | DCM | 23 | <10 |
| 11 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L4** | $K_2CO_3$ | DCM | 15 | <10 |
| 12 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L5** | $K_2CO_3$ | DCM | 27 | <10 |
| 13 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L6** | $K_2CO_3$ | DCM | 36 | <10 |
| 14 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L7** | $K_2CO_3$ | DCM | trace | <10 |
| 15 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L8** | $K_2CO_3$ | DCM | 14 | 32 |
| 16 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L9** | $K_2CO_3$ | DCM | 67 | 25 |
| 17 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L10** | $K_2CO_3$ | DCM | trace | <10 |
| 18 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L11** (DMAP) | $K_2CO_3$ | DCM | 72 | nd |
| 19 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L12** | $K_2CO_3$ | DCM | 52 | 20 |
| 20 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L13** | $K_2CO_3$ | DCM | trace | <10 |
| 21 | $Ir(ppy)_3$ | $Cu(MeCN)_4PF_6$ | **L14** | $K_2CO_3$ | DCM | 45 | 11 |
| **22** | **$Ir(ppy)_3$** | **CuI** | **DMAP** | **$K_2CO_3$** | **DCM** | **88** | ND |
| 23 | $Ir(ppy)_3$ | CuCN | DMAP | $K_2CO_3$ | DCM | 78 | <10 |
| 24 | $Ir(ppy)_3$ | CuTc | DMAP | $K_2CO_3$ | DCM | 61 | <10 |
| 25 | $Ir(ppy)_3$ | $CuBr_2$ | DMAP | $K_2CO_3$ | DCM | 52 | <10 |
| 26 | $Ir(ppy)_3$ | $Cu(OAc)_2$ | DMAP | $K_2CO_3$ | DCM | 47 | <10 |
| 27 | $Ir(ppy)_3$ | $Cu(acac)_2$ | DMAP | $K_2CO_3$ | DCM | 37 | <10 |
| 28 | $Ir(ppy)_3$ | $Cu(acac\text{-}F)_2$ | DMAP | $K_2CO_3$ | DCM | 44 | <10 |
| 29 | $Ir(ppy)_3$ | $Cu(acac\text{-}{}^tBu)_2$ | DMAP | $K_2CO_3$ | DCM | 51 | <10 |
| 30 | $Ir(ppy)_3$ | CuI | DMAP | KOAc | DCM | 81 | <10 |
| 31 | $Ir(ppy)_3$ | CuI | DMAP | CsOH | DCM | NR | <10 |
| 32 | $Ir(ppy)_3$ | CuI | DMAP | $^t$BuOLi | DCM | ND | <10 |
| 33 | $Ir(ppy)_3$ | CuI | DMAP | $Li_2CO_3$ | DCM | 61 | <10 |
| 34 | $Ir(ppy)_3$ | CuI | DMAP | $Na_2CO_3$ | DCM | 67 | <10 |
| 35 | $Ir(ppy)_3$ | CuI | DMAP | NaOAc | DCM | 66 | <10 |
| 36 | $Ir(ppy)_3$ | CuI | DMAP | $Cs_2CO_3$ | DCM | 54 | <10 |
| 37 | $Ir(ppy)_3$ | CuI | DMAP | TMEDA | DCM | 46 | <10 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 38 | Ir(ppy)$_3$ | CuI | DMAP | NEt$_3$ | DCM | 22 | <10 |
| 39 | Ir(ppy)$_3$ | CuI | DMAP | K$_2$CO$_3$ | DCE | 69 | <10 |
| 40 | Ir(ppy)$_3$ | CuI | DMAP | K$_2$CO$_3$ | MeCN | 28 | <10 |
| 41 | Ir(ppy)$_3$ | CuI | DMAP | K$_2$CO$_3$ | THF | trace | <10 |
| 42 | Ir(ppy)$_3$ | CuI | DMAP | K$_2$CO$_3$ | Dioxane | trace | <10 |
| 43 | Ir(ppy)$_3$ | CuI | DMAP | K$_2$CO$_3$ | DMF | trace | <10 |
| 44 | Ir(ppy)$_3$ | CuI | DMAP | K$_2$CO$_3$ | DMSO | 12 | <10 |
| 45 | Ir(ppy)$_3$ | CuI | DMAP | K$_2$CO$_3$ | Toluene | trace | -- |
| 46 | -- | CuI | DMAP | K$_2$CO$_3$ | DCM | NR | ND |
| 47[c] | Ir(ppy)$_3$ | CuI | DMAP | K$_2$CO$_3$ | DCM | NR | ND |
| 48 | Ir(ppy)$_3$ | CuI | -- | K$_2$CO$_3$ | DCM | 17 | 56 |
| 50 | Ir(ppy)$_3$ | -- | DMAP | K$_2$CO$_3$ | DCM | nd | 45 |

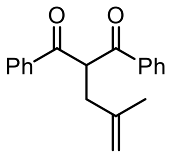
[a] Reaction conditions: **1a** (0.2 mmol), **2a** (0.4 mmol), Ir(ppy)$_3$ (1 mol%), CuI (10 mol%), DMAP (20 mol%), K$_2$CO$_3$ (0.4 mmol), DCM (2.0 mL), 25 °C, 450 nm blue LEDs. [b] Yield of isolated product. [c] no light. NR is no reaction. ND is no detected.

## 2.2 Limited substrate scopes.

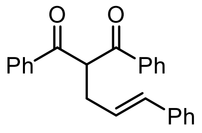
Alkenes



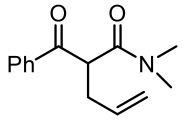
ND



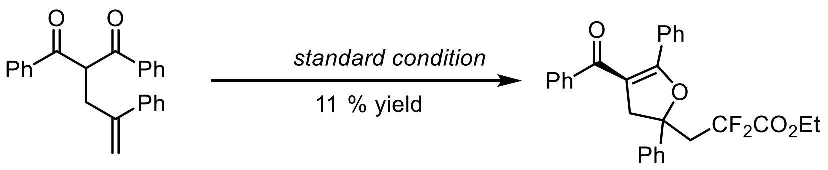
ND



messy

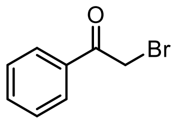


messy

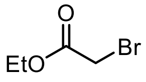


determined by $^1$H NMR

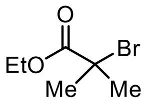
Halides



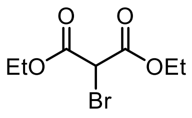
NR



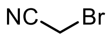
NR



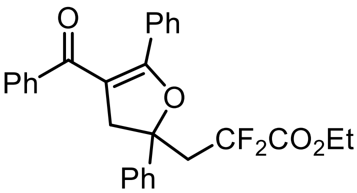
NR



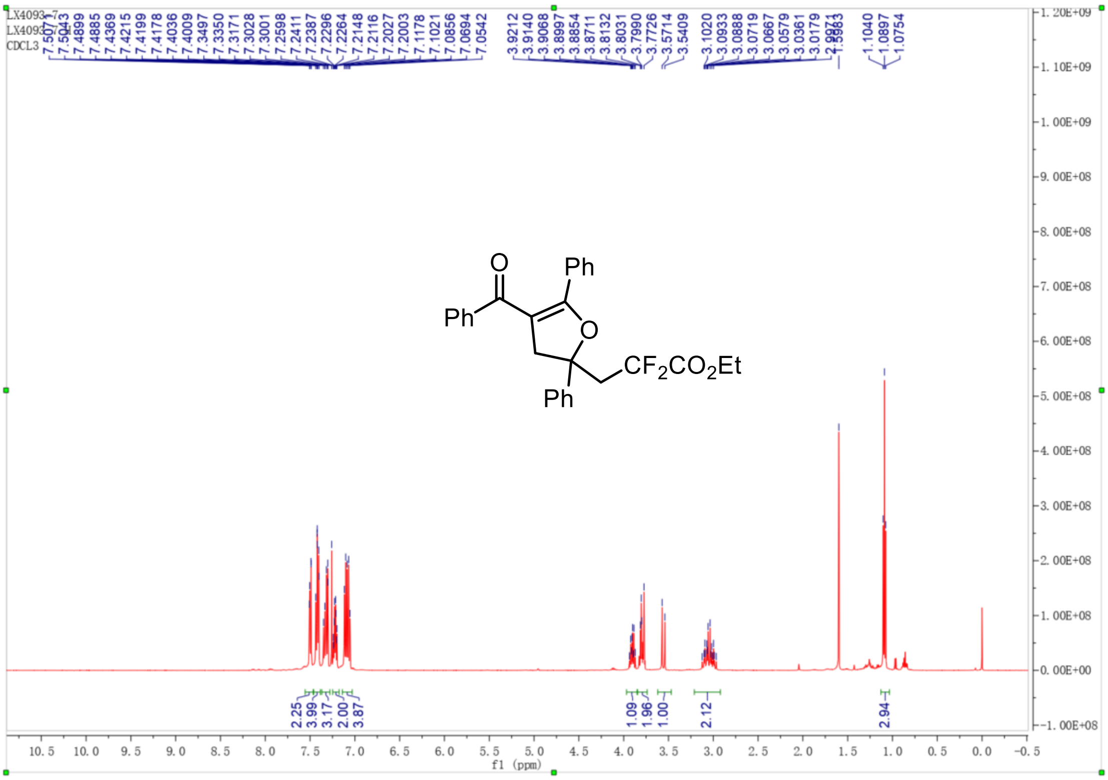
mixtures, can not isolated



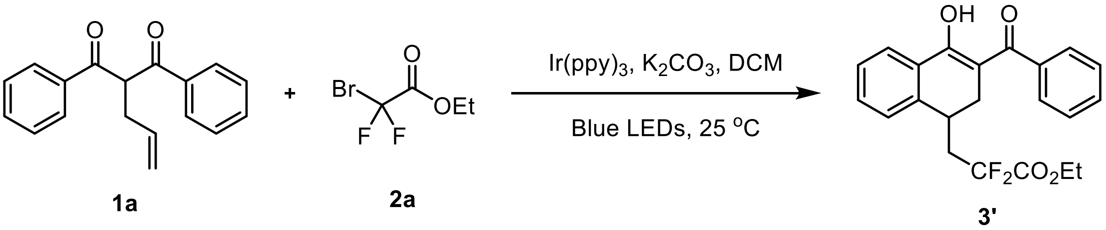
NR



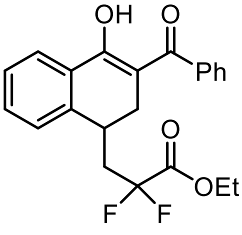
**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.50 – 7.48 (m, 2H), 7.42 – 7.40 (m, 4H), 7.34 – 7.30 (m, 3H), 7.24 – 7.20 (m, 2H), 7.15 – 7.05 (m, 4H), 3.93 – 3.87 (m, 1H), 3.81 – 3.77 (m, 2H), 3.57 – 3.54 (m, 1H), 3.12 – 2.96 (m, 2H), 1.08 (t, *J* = 5.7 Hz, 3H).



## 3. General procedure for products and Data.



To a 10 mL Schlenk tube was added $Ir(ppy)_3$ (1 mol%), $K_2CO_3$ (2.0 equiv.) under Argon atmosphere. Subsequently, DCM (2.0 mL), **1a** (0.2 mmol) and **2a** (0.4 mmol) was sequentially added into the tube, degassed three times (10 minutes every time) by freeze-pump-thaw method. The reaction mixture was stirred under Argon atmosphere at 25 °C in an incubator with 450 nm blue LEDs for 24 hours. After reaction completed, the reaction mixture was transfer into a 100 mL round-bottom flask, follow by *silica gel* (about 20-50 mg) was added into, then the solvent was removed under reduced conditions. The residue was directly loaded onto a short SepaFlash® column, and the pure products **3’** were purified by SepaBean® Machine in 85% yield.



**3'**

**Ethyl 3-(3-benzoyl-4-hydroxy-1,2-dihydronaphthalen-1-yl)-2,2-difluoropropanoate (3’):**

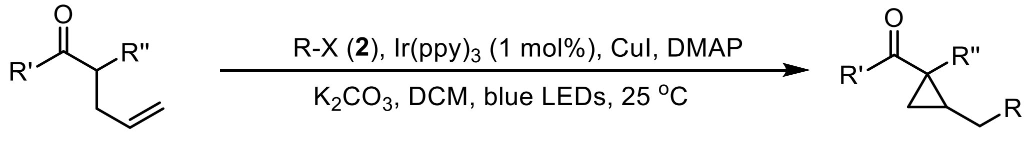
**Yield:** 65.5 mg, 85%, colorless oil.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 8.04 – 8.02 (m, 1H), 7.57 – 7.55 (m, 2H), 7.49 – 7.45 (m, 4H), 7.42 – 7.40 (m, 1H), 7.25 – 7.23 (m, 1H), 4.08 – 4.04 (m, 2H), 3.25 – 3.23 (m, 1H), 3.02 -2.97 (m, 1H), 2.82 -2.77 (m,1H), 2.33 (dt, $J$ = 6.8 Hz, 15.8 Hz, 2H), 1.21 (t, $J$ = 7.2 Hz, 3H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -102.00 (d, $J$ = 263.2 Hz, 1F), -105.86 (d, $J$ = 263.3 Hz, 1F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ -186.76, 183.21, 163.69 (t, $J$ = 32.5 Hz), 143.00, 136.00, 132.93, 131.25, 130.75, 128.33, 127.86, 127.81, 127.64, 126.75, 115.65 (t, $J$ = 250.3 Hz), 105.99, 62.93, 38.36 (t, $J$ = 22.5 Hz), 32.24, 29.84, 13.82.

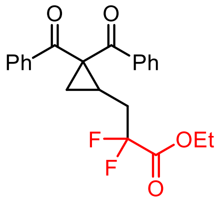
**HRMS** (ESI) m/z calcd for $C_{22}H_{20}F_2O_4Na$ [M+Na$^+$] 409.1222, found 409.1224.



**1**

**3** or **4**

To a 10 mL Schlenk tube was added Ir(ppy)$_3$ (1 mol%), CuI (10 mol%), DMAP (20 mol%), $K_2CO_3$ (2.0 equiv.) under Argon atmosphere. Subsequently, DCM (2.0 mL), **1** (1.0 equiv.) and **2** (2.0 equiv.) was sequentially added into the tube, degassed three times (10 minutes every time) by freeze-pump-thaw method. The reaction mixture was stirred under Argon atmosphere at 25 °C in an incubator with 450 nm blue LEDs for 12 - 24 hours. After reaction completed, the reaction mixture was transfer into a 100 mL round-bottom flask, follow by *silica gel* (about 20-50 mg) was added into, then the solvent was removed under reduced conditions. The residue was directly loaded onto a short SepaFlash® column, and the crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent.



**3a**

**Ethyl 3-(2,2-dibenzoylcyclopropyl)-2,2-difluoropropanoate (3a)** was prepared via typical procedure, using alkene **1a** (0.2 mmol) and ethyl bromodifluoroacetate (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 67.9 mg, 88% yield.

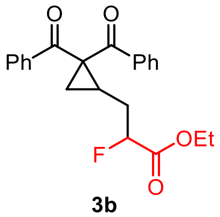
**Gram scale**: using alkene **1a** (10.0 mmol) and ethyl bromodifluoroacetate (15.0 mmol) in DCM (30.0 mL) with 0.5 mmol% Ir(ppy)$_3$ as photocatalyst, the reaction was stirred for 24 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 3.32 g, 86% yield.

**$^1$H NMR** (400 MHz, CDCl$_3$) δ 7.72 - 7.70 (m, 4H), 7.41 - 7.35 (m, 2H), 7.29 - 7.24 (m, 4H), 4.35 (q, $J$ = 6.8 Hz, 2H), 2.83 - 2.76 (m, 1H), 2.37 - 2.33 (m, 1H), 2.13 (dd, $J$ = 4.5 Hz, 7.2 Hz, 1H), 1.94 - 1.80 (m, 1H), 1.49 (dd, $J$ = 4.5 Hz, 8.7 Hz, 1H), 1.37 (t, $J$ = 7.1 Hz, 3H).

**$^{19}$F NMR** (376 MHz, CDCl$_3$) δ -103.91 (d, $J$ = 260.6 Hz, 1F), -106.01 (d, $J$ = 260.8 Hz, 1F).

**$^{13}$C NMR** (100 MHz, CDCl$_3$) δ 196.54, 196.12, 163.80 (t, $J$ = 32.3 Hz), 137.94, 137.35, 133.31, 133.07, 128.66, 128.61,128.51, 115.59 (t, $J$ = 250.3 Hz), 63.07, 44.09, 32.85 (t, $J$ = 23.7 Hz), 20.86, 20.17 (t, $J$ = 6.8 Hz), 13.97.

**HRMS** (ESI) m/z calcd for $C_{22}H_{20}F_2O_4Na$ [M+Na$^+$] 409.1222, found 409.1223.



**3b**

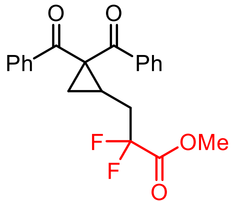
**Ethyl 3-(2,2-dibenzoylcyclopropyl)-2-fluoropropanoate (3b)** was prepared via typical procedure, using alkene **1a** (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 24 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 39.7 mg, 54% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.74 - 7.70 (m, 4H), 7.39 - 7.35 (m, 2H), 7.30 - 7.23 (m, 4H), 5.05 – 4.90 (m, 1H), 4.29 – 4.21 (m, 2H),2.86 – 2.78 (m, 1H), 2.21 – 2.05 (m, 1H), 1.82 – 1.57 (m, 1H), 1.46 (ddd, $J$ = 1.6 Hz, 4.2 Hz, 8.5 Hz, 1H), 1.30 (dt, $J$ = 6.1 Hz, 7.1 Hz 3H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -191.19 (d, $J$ = 385.6 Hz, 1F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.83, 196.36, 169.28 (d, $J$ = 23.5 Hz), 138.03, 137.53, 133.23, 132.97, 129.16, 128.93, 128.63, 128.48, 89.43 (d, $J$ = 184.7 Hz), 61.77, 45.27, 30.89 (d, $J$ = 20.8 Hz), 23.29 (d, $J$ = 4.4 Hz), 20.90, 14.12.

**HRMS** (ESI) m/z calcd for $C_{22}H_{21}FO_4Na$ [M+Na$^+$] 391.1316, found 391.1315.



**3c**

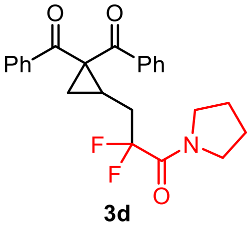
**Methyl 3-(2,2-dibenzoylcyclopropyl)-2,2-difluoropropanoate (3c)** was prepared via typical procedure, using alkene **1a** (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 61.0 mg, 82% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.72 - 7.70 (m, 4H), 7.41 - 7.35 (m, 2H), 7.30 - 7.24 (m, 4H), 3.88 (s, 3H), 2.83 – 2.75 (m, 1H), 2.38 – 2.30 (m, 1H), 2.11 (dd, $J$ = 4.5 Hz, 7.2 Hz, 1H), 1.95 – 1.80 (m, 1H), 1.48 (dd, $J$ = 4.5 Hz, 8.2 Hz, 1H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -104.06 (d, $J$ = 261.7 Hz, 1F), -105.83 (d, $J$ = 261.4 Hz).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.54, 196.11, 164.26 (t, J = 32.0 Hz), 137.90, 137.33, 133.33, 133.09, 128.67, 128.61, 128.52, 115.60 (t, $J$ = 250.3 Hz), 53.46, 44.05, 32.88 (t, $J$ = 23.6 Hz), 20.79, 20.10 (t, $J$ = 6.3 Hz).

**HRMS** (ESI) m/z calcd for $C_{21}H_{18}F_2O_4Na$ [M+Na$^+$] 395.1065, found 395.1069.



**3d**

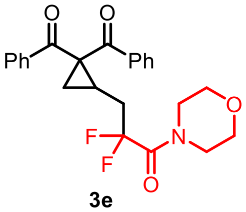
**(2-(2,2-difluoro-3-oxo-3-(pyrrolidin-1-yl)propyl)cyclopropane-1,1-diyl)bis(phenylmethanone) (3d)** was prepared via typical procedure, using alkene **1a** (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 24 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give white solid, 63.3 mg, 77% yield.

**$^{1}$H NMR** (400 MHz, $CDCl_3$) δ 7.73 - 7.70 (m, 4H), 7.39 - 7.33 (m, 2H), 7.27 - 7.22 (m, 4H), 3.66 (t, *J* = 6.7 Hz), 3.50 (t, *J* = 7.0 Hz), 2.94 – 2.86 (m, 1H), 2.50 – 2.36 (m, 1H), 2.16 (dd, J = 4.4 Hz, 7.3 Hz), 1.98 – 1.91 (m, 3H), 1.88 – 1.83 (m, 2H), 1.48 (dd, J = 4.4 Hz, 8.8Hz).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -102.80 - -102.81 (m, 2F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 197.02, 196.34, 161.03 (t, *J* = 29.5 Hz); 138.10, 137.61, 133.12, 132.89, 128.68, 128.55, 128.49, 128.45, 118.57 (t, *J* = 253.0 Hz), 47.41, 46.52 (t, *J* = 6.3 Hz), 44.32, 32.48 (t, *J* = 23.5 Hz), 26.50, 23.28, 21.38, 20.95 (t, J = 5.8 Hz).

**HRMS** (ESI) m/z calcd for $C_{24}H_{23}F_2NO_3Na$ [M+Na$^+$] 434.1538, found 434.1539.



**3e**

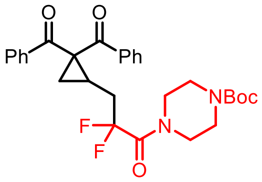
**(2-(2,2-difluoro-3-morpholino-3-oxopropyl)cyclopropane-1,1-diyl)bis(phenylmethanone) (3e)** was prepared via typical procedure, using alkene **1a** (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 24 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give white solid, 63.2 mg, 74% yield.

**$^{1}$H NMR** (400 MHz, $CDCl_3$) δ 7.73 - 7.70 (m, 4H), 7.39 - 7.33 (m, 2H), 7.28 - 7.22 (m, 4H), 3.73 – 3.59 (m, 8H), 2.94 – 2.89 (m, 1H), 2.48 – 2.39 (m, 1H), 2.17 (dd, *J* = 4.4 Hz, 7.3 Hz), 2.05 – 1.90 (m, 1H), 1.49 (m, 4.4 Hz, 8.8 Hz).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ - 98.76 (s, 1F), - 99.07 (s, 1F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.98, 196.36, 161.53 (t, *J* = 28.8 Hz), 138.10, 137.56, 133.15, 132.92, 128.64, 128.56, 128.48, 128.46, 121.60, 119.06, 116.52, 66.75, 66.69, 46.45 (t, *J* = 6.0 Hz), 44.39, 43.34, 32.78 (t, *J* = 23.0 Hz), 21.39, 20.95 (t, *J* = 6.0 Hz).

**HRMS** (ESI) m/z calcd for $C_{24}H_{23}F_2NO_4Na$ [M+Na$^+$] 450.1487, found 450.1489.



**3f**

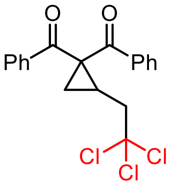
**tert-butyl 4-(3-(2,2-dibenzoylcyclopropyl)-2,2-difluoropropanoyl)piperazine-1-carboxylate (3f)** was prepared via typical procedure, using alkene **1a** (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 24 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give white solid, 63.1 mg, 60% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.73 - 7.70 (m, 4H), 7.39 - 7.33 (m, 2H), 7.28 - 7.22 (m, 4H), 3.66 - 3.65 (m, 2H), 3.59 – 3.57 (m, 2H), 3.49 – 3.45 (m, 4H), 2.95 – 2.88 (m, 1H), 2.51 – 2.38 (m, 1H), 2.16 (dd, $J$ = 4.4 Hz, 7.3 Hz), 2.05 – 1.91 (m, 1H), 1.50 -1.46 (m, 10H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ - 98.67 (s, 1F), - 98.94 (s, 1F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.97, 196.35, 161.65 (t, $J$ = 28.7 Hz), 154.45, 138.09, 137.55, 133.15, 132.92, 128.64, 128.56, 128.48, 128.46, 119.04 (t, J = 254.4 Hz), 80.45, 45.63 (t, $J$ = 6.3 Hz), 44.30, 42.98, 32.78 (t, $J$ = 23.0 Hz), 28.36, 26.91, 21.38, 20.94 (t, J = 5.9 Hz). 18.44.

**HRMS** (ESI) m/z calcd for $C_{29}H_{32}F_2N_2O_5Na$ [$M+Na^+$] 549.2171, found 549.2170.



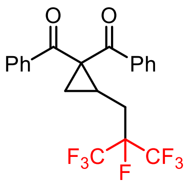
**3g**

**(2-(2,2,2-trichloroethyl)cyclopropane-1,1-diyl)bis(phenylmethanone) (3g)** was prepared via typical procedure, using alkene **1a** (0.2 mmol) and alkyl bromide (0.6 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 65.5 mg, 86% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.75 - 7.72 (m, 4H), 7.43 - 7.39 (m, 2H), 7.37 - 7.25 (m, 4H), 3.08 – 2.98 (m, 2H), 2.42 – 2.34 (m, 2H), 1.66 (dd, $J$ = 4.7 Hz, 9.0 Hz, 1H).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.50, 196.08, 137.79, 136.38, 133.45, 137.30, 133.46, 133.15, 128.78, 128.64, 128.56, 128.54, 98.87, 52.75, 43.85, 24.46, 22.10.

**HRMS** (ESI) m/z calcd for $C_{19}H_{16}Cl_3O_2$ [$M+H^+$] 381.0210, found 381.0212.



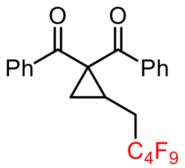
**3h**

**(2-(2,3,3,3-tetrafluoro-2-(trifluoromethyl)propyl)cyclopropane-1,1-diyl)bis(phenylmethanone) (3h)** was prepared via typical procedure, using alkene **1a** (0.2 mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 55.3 mg, 64% yield.

**$^1$H NMR** (400 MHz, CDCl$_3$) δ 7.72 - 7.70 (m, 4H), 7.42 - 7.35 (m, 2H), 7.31 - 7.24 (m, 4H), 2.88 – 2.81 (m, 1H), 2.44 (dt, *J* = 3.2 Hz, 16.3 Hz), 2.18 – 2.15 (m, 1H), 1.95 – 1.82 (m, 1H), 1.55 (t, *J* = 4.7 Hz, 8.6 Hz).

**$^{19}$F NMR** (376 MHz, CDCl$_3$) δ – 75.33 - -75.42 (m, 3F), -76.36 – 76.45 (m, 3F), -183.38 - -183.45 (m, 1F). **$^{13}$C NMR** (100 MHz, CDCl$_3$) δ 196.28, 196.07, 137.91, 137.16, 133.47, 133.20, 128.76, 128.58, 128.52, 44.50, 27.60 (d, *J* = 20.1 Hz), 21.44, 20.15 (t, *J* = 5.2 Hz).

**HRMS** (ESI) m/z calcd for $C_{21}H_{15}F_7O_2Na$ $[M+Na^+]$ 455.0852, found 455.0853.



**3i**

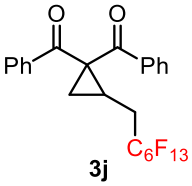
**(2-(5,5,5,5,5,5,5,5,5-nonafluoro-5l12-penta-2,4-diyn-1-yl)cyclopropane-1,1-diyl)bis(phenylme-thanone) (3i)** was prepared via typical procedure, using alkene **1a** (0.2 mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 80.0 mg, 83% yield.

**$^1$H NMR** (400 MHz, CDCl$_3$) δ 7.73 - 7.69 (m, 4H), 7.42 - 7.36 (m, 2H), 7.30 - 7.24 (m, 4H), 2.92 – 2.84 (m, 1H), 2.44 – 2.29 (m, 1H), 2.17 (dd, *J* = 4.6 Hz, 7.2 Hz, 1H), 2.03 – 1.88 (m, 1H), 1.56 (dd, *J* = 4.6 Hz, 8.8 Hz,1H).

**$^{19}$F NMR** (376 MHz, CDCl$_3$) δ -81.04 (dt, *J* = 3.5 Hz, 7.0 Hz, 3F), -113.35 – 113.67(m, 2F), -123.94 -124.02 (m, 2F), -125.96 – 126.64 (m, 2F).

**$^{13}$C NMR** (100 MHz, CDCl$_3$) δ 196.38, 196.13, 137.89, 137.18, 133.39, 133.17, 128.69, 128.56, 128.54, 128.53, 43.89, 29.49 (t, *J* = 21.86 Hz), 20.91, 19.31, (t, *J* = 4.9 Hz).

**HRMS** (ESI) m/z calcd for $C_{22}H_{16}F_9O_2$ [M+H$^+$] 483.1001, found 483.1004.



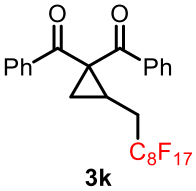
**3j**

**(2-(7,7,7,7,7,7,7,7,7,7,7,7,7-tridecafluoro-7l16-hepta-2,4,6-triyn-1-yl)cyclopropane-1,1-diyl) - bis(phenylmethanone) (3j)** was prepared via typical procedure, using alkene **1a** (0.2 mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 90.8 mg, 78% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.73 - 7.69 (m, 4H), 7.42 - 7.36 (m, 2H), 7.30 - 7.24 (m, 4H), 2.92 – 2.84 (m, 1H), 2.44 – 2.30 (m, 1H), 2.17 (dd, *J* = 4.6 Hz, 7.2 Hz, 1H), 2.03 – 1.88 (m, 1H), 1.56 (dd, *J* = 4.6 Hz, 8.8 Hz,1H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -80.79 (t, *J* = 10.2 Hz, 3F), -113.13 – 113.43 (m, 2F), -122.85 - 126.18 (m, 8F); $^{13}$C NMR (100 MHz, $CDCl_3$) δ 196.38, 196.13, 137.90, 137.19, 133.38, 133.16, 128.69, 128.55, 128.54, 128.52, 43.89, 29.57 (t, *J* = 22.22 Hz), 20.91, 19.34, (t, *J* = 5.2 Hz).

**HRMS** (ESI) m/z calcd for $C_{24}H_{16}F_{13}O_2$ [M+H$^+$] 583.0937, found 583.0934.



**3k**

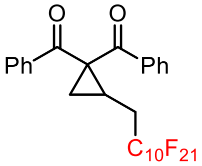
**(2-(9,9,9,9,9,9,9,9,9,9,9,9,9,9,9,9,9-heptadecafluoro-9l20-nona-2,4,6,8-tetrayn-1-yl)cyclo prop - ane-1,1-diyl)bis(phenylmethanone) (3k)** was prepared via typical procedure, using alkene **1a** (0.2 mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 95.4 mg, 70% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.73 - 7.70 (m, 4H), 7.42 - 7.36 (m, 2H), 7.30 - 7.25 (m, 4H), 2.92 – 2.85 (m, 1H), 2.44 – 2.30 (m, 1H), 2.17 (dd, *J* = 4.6 Hz, 7.2 Hz, 1H), 2.04 – 1.88 (m, 1H), 1.57 (dd, *J* = 4.6 Hz, 8.8 Hz, 1H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -80.79 (t, *J* = 10.2 Hz, 3F), -113.12 – 113.43 (m, 2F), -121.66 - 126.16 (m, 12F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.38, 196.13, 137.91, 137.19, 133.38, 133.16, 128.68, 128.55, 128.54, 43.90, 29.58 (t, $J$ = 21.70 Hz), 20.91, 19.35, (t, $J$ = 4.3 Hz).

**HRMS** (ESI) m/z calcd for $C_{26}H_{16}F_{17}O_2$ [M+H$^+$] 683.0873, found 683.0899.



**3l**

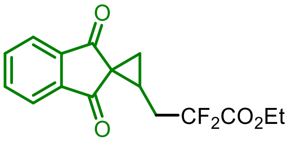
**(2-(11,11,11,11,11,11,11,11,11,11,11,11,11,11,11,11,11,11,11,11,11-henicosafluoro-11l24-undeca-2,4,6,8,10-pentayn-1-yl)cyclopropane-1,1-diyl)bis(phenylmethanone) (3l)** was prepared via typical procedure, using alkene **1a** (0.2 mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 103.2 mg, 66% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.73 - 7.69 (m, 4H), 7.41 - 7.36 (m, 2H), 7.30 - 7.24 (m, 4H), 2.92 – 2.85 (m, 1H), 2.43 – 2.30 (m, 1H), 2.17 (dd, $J$ = 4.6 Hz, 7.2 Hz, 1H), 2.04 - 1.88 (m, 1H),1.56 (dd, $J$ = 4.7 Hz, 8.8 Hz, 1H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -59.19 (t, $J$ = 32.2 Hz, 1F); -80.89 (t, $J$ = 11.28 Hz, 3F); -113.12 - -113.49 (m, 2F), -120.91 - -123.06 (m, 13 F), -126.15 - -126.25 (m, 2F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.38, 196.13, 137.91, 137.20, 133.36, 133.14, 128.67, 128.54, 128.52, 43.89, 29.58, (t, $J$ = 21.9 Hz), 20.89, 19.34.

**HRMS** (ESI) m/z calcd for $C_{28}H_{15}F_{21}O_2$ [M+H$^+$] 783.0809, found 783.0818.



**4a**

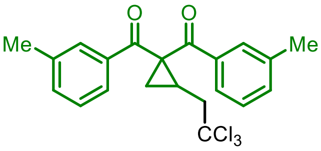
**ethyl 3-(1',3'-dioxo-1',3'-dihydrospiro[cyclopropane-1,2'-inden]-2-yl)-2,2-difluoropropanoate (4a)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 44.3 mg, 72% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.97 - 7.95 (m, 2H), 7.82 - 7.81 (m, 2H), 7.30 - 7.24 (m, 4H), 4.25 (dq, $J$ = 1.6 Hz, 5.7 Hz), 2.70 – 2.52 (m, 2H), 2.36 – 2.30 (m, 1H), 2.01 (dd, $J$ = 3.2 Hz, 7.1 Hz, 1H), 1.75 (m, $J$ = 3.2 Hz, 6.4Hz, 1H), 1.31 (t, $J$ = 5.7 Hz, 3H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -106.24 - -106.25 (m, 2F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 198.05, 197.87, 163.63 (t, *J* = 32.1 Hz), 142.49, 141.58, 135.03, 134.99, 122.65, 122.55, 115.19 (t, *J* = 250.2 Hz), 63.03, 37.82, 31.35 (t, *J* = 23.6 Hz), 27.76 (t, *J* = 5.7 Hz), 23.82, 13.88.

**HRMS** (ESI) m/z calcd for $C_{16}H_{14}F_2O_4Na$ [M+Na$^+$] 331.0752, found 331.0755.



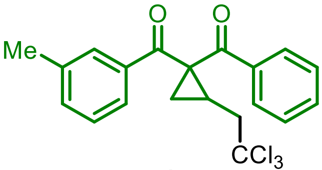
**4b**

**(2-(2,2,2-trichloroethyl)cyclopropane-1,1-diyl)bis(m-tolylmethanone) (4b)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.6 mmol), the reaction was stirred for 24 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 68.5 mg, 84% yield.

**$^{1}$H NMR** (400 MHz, $CDCl_3$) δ 7.70- 7.68 (m, 4H), 7.11 - 7.07 (m, 4H), 7.30 - 7.24 (m, 4H), 3.00 – 2.94 (m, 2H), 2.34 – 2.31 (m, 1H), 2.30 (s, 3H), 2.29 (s, 3H), 1.58 – 1.55 (m, 2H).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 195.86, 195.40, 144.53, 144.12, 135.18, 134.58, 129.50, 129.28, 128.92, 128.83, 99.01, 52.84, 43.66, 23.77, 21.67, 21.63, 21.51.

**HRMS** (ESI) m/z calcd for $C_{21}H_{19}Cl_3O_2Na$ [M+Na$^+$] 431.0343, found 431.0358.



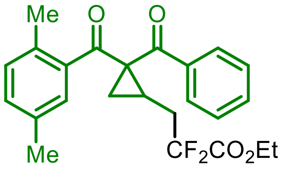
**4c**

**(1-benzoyl-2-(2,2,2-trichloroethyl)cyclopropyl)(m-tolyl)methanone 4c** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.6 mmol), the reaction was stirred for 24 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 64.6 mg, 84% yield.

**$^{1}$H NMR** (400 MHz, $CDCl_3$) δ 7.75- 7.73 (m, 2H), 7.55 – 7.53 (m, 2H), 7.41 – 7.37 (m, 1H), 7.32 – 7.26 (m, 2H), 7.21 – 7.15 (m, 2H), 3.07 – 2.97 (m, 2H), 2.40 -2.31 (m, 2H), 2.28 – 2.27 (m, 3H), 1.64 – 1.61 (m, 1H).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.56, 196.53, 196.10, 138.69, 138.44, 137.83, 137.75, 137.32, 137.27, 134.34, 133.98, 133.40, 133.09, 129.00, 128.95, 128.77, 128.62, 128.56, 128.53, 128.41, 126.04, 125.89, 98.92, 52.75, 43.85, 26.92, 24.40, 24.36, 22.07, 21.25.

**HRMS** (ESI) m/z calcd for $C_{20}H_{17}Cl_3O_2Na$ [M+Na$^+$] 417.0186, found 417.0205.



**4d**

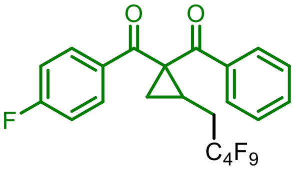
**Ethyl 3-(2-benzoyl-2-(2,5-dimethylbenzoyl)cyclopropyl)-2,2-difluoropropanoate (4d)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 66.2 mg, 80% yield.

$^1$**H NMR** (400 MHz, $CDCl_3$) δ 7.57- 7.55 (m, 2H), 7.40 – 7.33 (m, 1H), 7.29 – 7.22 (m, 3H), 6.99 – 6.93 (m, 1H), 6.84 – 6.80 (m, 1H), 4.38 – 4.31 (m, 2H), 2.84 – 2.77 (m, 1H), 2.43 – 2.34 (m, 1H), 2.26 – 2.18 (m, 6H), 2.15 – 2.10 (m, 1H), 2.04 – 1.79 (m, 1H), 1.59 – 1.46 (m, 1H), 1.40 – 1.35 (m, 3H).

$^{19}$**F NMR** (376 MHz, $CDCl_3$) δ -103.81 - -104.55 (m, 1F), -105.92 - -106.62 (m, 1F).

$^{13}$**C NMR** (100 MHz, $CDCl_3$) δ 199.15, 198.11, 196.89, 196.37, 163.89 (t, *J* = 32.2 Hz), 163.79 (t, *J* = 32.3 Hz), 138.60, 138.13, 137.95, 137.74, 135.29, 135.22, 134.93, 134.54, 132.93, 132.69,132.52, 132.17, 131.59, 131.40, 129.31, 128.91, 128.49, 128.35, 127.95, 127.82, 115.74 (t, *J* = 250.4 Hz), 115.58 (t, *J* = 250.6 Hz), 63.07, 45.04, 45.00, 33.18 (t, *J* = 23.6 Hz), 32.49 (t, *J* = 23.6 Hz), 22.65, 21.69, 21.31 (t, *J* = 5.2 Hz), 21.13 (t, *J* = 5.4 Hz), 20.87, 20.80, 19.79, 19.63, 13.99, 13.97.

**HRMS** (ESI) m/z calcd for $C_{24}H_{24}F_2O_4Na$ [M+Na$^+$] 437.1535, found 437.1536.



**4f**

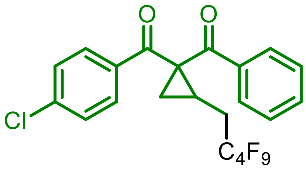
**(1-benzoyl-2-(5,5,5,5,5,5,5,5,5-nonafluoro-5l12-penta-2,4-diyn-1-yl)cyclopropyl)(4-fluorophenyl)methanone (4f)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 75.0 mg, 75% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.79 - 7.72 (m, 4H), 7.44 - 7.39 (m, 1H), 7.32 - 7.29 (m, 2H), 6.97 - 6.93 (m, 2H), 2.90 -2.84 (m, 1H), 2.40 – 2.28 (m, 1H), 2.17 -2.16 (m, 1H), 2.03 – 1.92 (m, 1H), 1.58-1.53 (m, 1H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -81.11 - -81.17 (m, 3F), -103.79 (d, *J* = 164.9 Hz), -124.03 - -126.11 (m, 4F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.21, 195.97, 194.68, 194.41, 166.94 (d, *J* = 254.7 Hz), 166.83 (d, *J* = 254.2 Hz), 137.74, 137.02, 134.27(d, *J* = 77.01 Hz), 134.24, (d, *J* = 77.2 Hz), 133.55, 133.33, 131.30 (d, *J* = 9.3 Hz), 131.22 (d, *J* = 9.2 Hz), 128.77, 128.64, 128.53, 116.03 (d, *J* = 21.9 Hz), 115.90 (d, *J* = 21.8 Hz), 43.87, 43.81, 29.68, (t, *J* = 26.9 Hz), 29.62(t, *J* = 21.7 Hz), 20.76, 20.68, 19.29 (t, *J* = 5.0 Hz).

**HRMS** (ESI) m/z calcd for $C_{22}H_{14}F_{10}O_2Na$ $[M+Na^+]$ 523.0726, found 523.0701.



**4g**

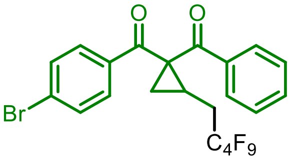
**(1-benzoyl-2-(5,5,5,5,5,5,5,5,5-nonafluoro-5l12-penta-2,4-diyn-1-yl)cyclopropyl)(4-chlorophenyl)methanone (4g)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 80.4 mg, 78% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.74(t, *J* = 5.7 Hz, 2H), 7.61 - 7.56 (m, 2H), 7.42 (t, *J* = 6.1 Hz), 7.33 -7.27 (m, 2H), 2.89 -2.84 (m, 1H), 2.39 – 2.30 (m, 1H), 2.16 -2.15 (m, 1H), 2.01 – 1.91 (m, 1H), 1.65-1.53 (m, 1H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -81.05 - -81.11 (m, 3F), -113.37 - -113.68 (m, 2F), -124.00 - -126.07 (m, 4F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.03, 195.77, 195.30, 195.07, 137.69, 136.95, 136.53, 135.81, 133.66, 133.44, 132..05, 133.33, 131.94, 129.97, 129.96, 128.84, 128.71, 128.57, 43.88, 43.81, 29.45 (t, *J* = 21.7 Hz), 29.36, (m, *J* = 21.5 Hz), 20.83, 19.49, 19.36.

**HRMS** (ESI) m/z calcd for $C_{22}H_{14}F_{10}ClO_2Na$ [M+Na$^+$] 539.0431, found 539.0480.



**4h**

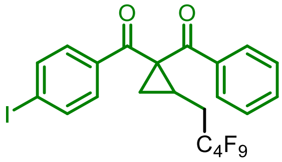
**(1-benzoyl-2-(5,5,5,5,5,5,5,5,5-nonafluoro-5l12-penta-2,4-diyn-1-yl)cyclopropyl)(4-bromophenyl)methanone (4h)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 82.8 mg, 74% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.74 - 7.66 (m, 4H), 7.43 - 7.30 (m, 1H), 7.33 - 7.24 (m, 4H), 2.90 - 2.84 (m, 1H), 2.39 -2.27 (m, 1H), 2.16 – 2.14 (m, 1H), 2.05 -1.93 (m, 1H),1.58 – 1.53 (m, 1H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -81.02 - -81.09 (m, 3F), -113.34 - -113.69 (m, 2F), -124.01 - -126.05 (m, 4F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.07, 195.82, 195.10, 194.85, 139.96, 139.70, 136.97, 136.13, 135.40, 133.64, 133.43, 129.91, 129.88, 129.06, 128.95, 128.83, 128.70, 128.55, 43.87, 43.83, 29.47 (t, *J* = 23.6 Hz), 29.38(t, *J* = 21.5 Hz), 20.83, 19.46 (t, *J* = 4.8 Hz), 19.35 (t, *J* = 5.0 Hz).

**HRMS** (ESI) m/z calcd for $C_{22}H_{14}F_9BrO_2Na$ [M+Na$^+$] 582.9926, found 582.9927.



**4i**

**(1-benzoyl-2-(5,5,5,5,5,5,5,5,5-nonafluoro-5l12-penta-2,4-diyn-1-yl)cyclopropyl)(4-iodophenyl)methanone (4i)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 78.9 mg, 65% yield.

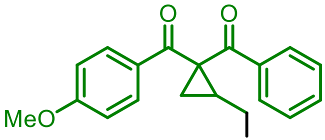
**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.80 - 7.62 (m, 4H), 7.54 - 7.26 (m, 5H), 2.89 – 2.81 (m, 1H), 2.41 – 2.24 (m, 1H), 2.15 – 2.12 (m, 1H), 2.04 – 1.89 (m, 1H), 1.62 – 1.51 (m, 1H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -81.00 - -81.06 (m, 3F), -111.77 - -113.66 (m, 2F), -122.94 - - 126.03

(m, 4F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 195.98, 195.73, 195.58, 195.36, 138.04, 137.93, 137.67, 137.04, 136.94, 136.31, 133.68, 133.46, 129.79, 128.84, 128.71, 128.58, 101.71, 101.35, 43.84, 43.77, 29.46 (t, *J* = 21.9 Hz), 29.38 (t, *J* = 21.8 Hz), 20.81, 19.46, 19.36.

**HRMS** (ESI) m/z calcd for $C_{22}H_{15}F_9IO_2$ [M+H$^+$] 608.9968, found 608.9979.



**4j**

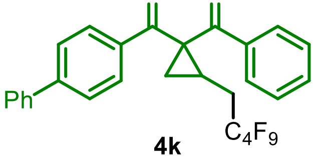
**(1-benzoyl-2-(5,5,5,5,5,5,5,5,5-nonafluoro-5l12-penta-2,4-diyn-1-yl)cyclopropyl)(4-methoxyphenyl)methanone (4j)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 73.7 mg, 72% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.79 - 7.74 (m, 4H), 7.42 - 7.38 (m, 1H), 7.32 - 7.27 (m, 2H), 6.78 - 6.74 (m, 2H), 3.76 -3.75 (m, 3H), 2.86 – 2.79 (m, 1H), 2.89 -2.30 (m, 1H), 2.14 - 2.11 (m, 1H), 1.95-1.83 (m, 1H), 1.50 (dd, *J* = 3.7 Hz, 6.9Hz, 1H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -81.13 (t, *J* = 10.4 Hz,3F), -113.43 - -113.68 (m, 2F) -124.03 - -126.11 (m, 4F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.52, 196.28, 194.32, 193.88, 163.75, 163.56, 137.81, 137.08, 133.29, 133.17, 131.08, 131.01, 130.78, 129.92, 128.68, 128.62, 128.54, 113.95, 113.81, 55.34, 55.32, 43.65, 29.74 (t, *J* = 21.6 Hz, major), 29.45(t, *J* = 29.8 Hz, minor), 20.42, 20.17, 18.84 (t, *J* = 4.8 Hz), 18.49 (t, *J* = 5.2 Hz).

**HRMS** (ESI) m/z calcd for $C_{23}H_{17}F_9NaO_3$ [M+Na$^+$] 535.0926, found 535.0917.



**4k**

**(1-([1,1'-biphenyl]-4-carbonyl)-2-(5,5,5,5,5,5,5,5,5-nonafluoro-5l12-penta-2,4-diyn-1-yl)cyclopropyl)(phenyl)methanone (4k)** was prepared via typical procedure, using alkene (0.2

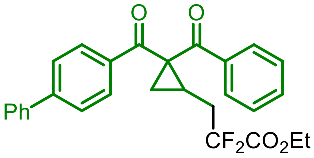
mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 85.9 mg, 77% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.83 - 7.76 (m, 4H), 7.52 - 7.49 (m, 4H), 7.43 - 7.26 (m, 6H), 2.92 - 2.86 (m, 1H), 2.43 – 2.35 (m, 1H), 2.18 (dd, *J* = 4.5 Hz,7.2 Hz ,1H), 2.12 (dd, *J* = 4.5 Hz,7.2 Hz ,1H), 1.95 – 1.80 (m, 1H), 1.48 (dd, *J* = 3.8 Hz, 5.5 Hz, 1H), 2.03 -1.91 (m, 1H), 1.58 -1.55 (m, 1H);

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -81.06 (t, *J* = 10.6 Hz,3F), - 113.34 - -113.66 (m ,2F), - 123.94 - -126.05 (m ,4F);

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.36, 196.11, 195.72, 195.46, 146.03, 145.81, 139.47, 139.39, 137.88, 137.16, 135.77, 133.49, 133.26, 129.22, 129.93, 129.21, 128.75, 128.64, 128.41, 128.35, 127.28, 127.17, 127.15, 43.94, 27.58 (t, *J* = 21.48 Hz, minor) 29.54 (t, *J* = 21.5 Hz, major) 20.77, 20.72, 19.21, 19.16.

**HRMS** (ESI) m/z calcd for $C_{28}H_{19}F_9O_2Na$ [$M+Na^+$] 581.1134, found 581.1140.



**4l**

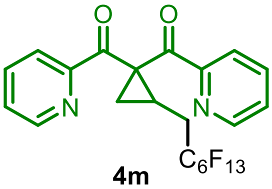
**Ethyl 3-(2-([1,1'-biphenyl]-4-carbonyl)-2-benzoylcyclopropyl)-2,2-difluoropropanoate (4l)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 67.4 mg, 73% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.82 - 7.76 (m, 4H), 7.52 - 7.48 (m, 4H), 7.43 - 7.35 (m, 4H), 7.31 - 7.27 (m, 2H), 4.35 (q, *J* = 5.6 Hz, 2H), 2.84 – 2.78 (m, 1H), 2.39 -2.35 (m, 1H), 2.13 (q, *J* = 3.8 Hz,1H), 1.94-1.83 (m, 1H), 1.49 -1.47 (m, 1H), 1.37 (t, *J* = 5.7 Hz ,3H);

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -103.85 (d, *J* = 260.6 Hz,1F), - 105.96 (d, *J* = 260.7 Hz 1F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 196.53, 196.11, 195.89, 195.47, 163.83 (t, *J* = 32.3 Hz), 145.94, 145.71, 139.51, 139.44, 137.91, 137.31, 136.56, 135.92, 133.42, 133.18, 129.29, 129.19, 128.94, 128.73, 128.62, 128.58, 128.39, 128.33, 127.26, 127.18, 127.16, 127.13, 115.63 (t, *J* = 250.4 Hz), 63.09 44.14, 32.94 (t, *J* = 23.2 Hz, minor), 32.91 (t, *J* = 23.44 Hz, major); 20.74, 20.68, 20.08, 20.02, 13.98.

**HRMS** (ESI) m/z calcd for $C_{28}H_{25}F_2O_4$ [M+H$^+$] 463.1715, found 463.1791.



**4m**

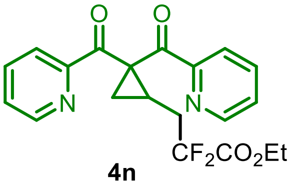
**(2-(7,7,7,7,7,7,7,7,7,7,7,7,7-tridecafluoro-7l16-hepta-2,4,6-triyn-1-yl)cyclopropane-1,1-diyl)bis(pyridin-2-ylmethanone) (4m)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give yellow oil, 78.3 mg, 67% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 8.27 – 8.25 (m, 2H), 8.08 – 8.05 (m, 2H), 7.72 – 7.67 (m, 2H), 7.18-7.15 (m, 2H), 2.96 -2.93 (m, 1H), 2.31 -2.22 (m, 1H), 2.13 (dd, *J* = 4.4 Hz, 7.4Hz), 2.08 – 2.02 (m, 2H), 1.44 (dd, *J* = 4.4 Hz, 8.8Hz, 1H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -80.03 – -80.89 (m,3F), -113.56 – -113.68 (m,2F), -121.96 – -123.27 (m,6F), -126.14 – -126.24 (m,2F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 193.78, 193.72, 153.58, 152.94, 147.89, 147.73, 136.75, 136.73, 125.97, 122.26 ,121.81, 40.53, 28.98 (t, *J* = 21.85 Hz), 20.30 (t, *J* = 4.4 Hz).

**HRMS** (ESI) m/z calcd for $C_{22}H_{14}F_{13}N_2O_2$ [M+H$^+$] 585.0842, found 585.0845.



**4n**

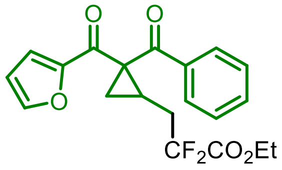
**ethyl 3-(2,2-dipicolinoylcyclopropyl)-2,2-difluoropropanoate (4n)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give yellow oil, 56.6 mg, 73% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 8.26 – 8.23 (m, 2H), 8.08 – 8.03 (m, 2H), 7.71 – 7.66 (m, 2H), 7.17 – 7.13 (m, 2H), 4.34 (dq, *J* = 2.5 Hz, 7.2 Hz), 2.88 – 2.81 (m, 1H), 2.26 – 2.14 (m, 1H), 2.09 – 2.06 (m, 1H), 2.04 – 1.91 (m, 1H), 1.37 – 1.33 (m, 4H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -103.88 - -104.57 (m, 1F), -106.22 - -106.91 (m, 1F).

**$^{13}$C NMR** (100 MHz, CDCl$_3$) δ 194.01, 193.69, 163.93 (t, *J* = 32.17 Hz), 153.70, 152.97, 147.94, 147.69, 136.74, 136.70, 125.95, 125.91, 122.26, 121.79, 115.76 (t, *J* = 249.7 Hz), 62.89, 40.66, 32.30 (t, *J* = 23.7 Hz), 26.91, 22.00, 21.35 (t, *J* = 6.6 Hz), 13.94.

**HRMS** (ESI) m/z calcd for $C_{20}H_{18}F_2N_2O_4Na$ [M+Na$^+$] 411.1127, found 411.1129.



**4o**

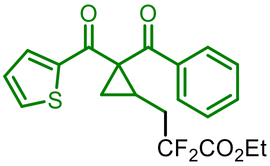
**ethyl 3-(2-benzoyl-2-(furan-2-carbonyl)cyclopropyl)-2,2-difluoropropanoate (4o)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give yellow oil as inseparable 1:1 mixture of diastereomers, 48.1 mg, 64% yield.

**$^1$H NMR** (400 MHz, CDCl$_3$) δ 7.84 – 7.81 (m, 2H), 7.47 – 7.31 (m, 4H), 7.09 (m, *J* = 3.6 Hz, 1H), 6.35 (dt, *J* = 1.6 Hz, 3.8 Hz, 1H), 4.34 (q, *J* =7.0 Hz, 2H), 2.79 -2.67 (m, 1H), 2.40 -2.20 (m,1H), -2.67 (m, 1H), 2.09 -1.97 (m,1H), 1.98 -1.74 (m, 1H), 1.42 (dd, *J* =4.6 Hz, 8.7 Hz, 1H), 1.36 (dt, *J* =2.1 Hz, 7.1 Hz, 3H).

**$^{19}$F NMR** (376 MHz, CDCl$_3$) δ -103.93 – -104.94 (m,1F), -106.06 – -106.94 (m,1F).

**$^{13}$C NMR** (100 MHz, CDCl$_3$) δ 195.18, 194.68, 183.62, 183.02, 163.79 (t, *J* = 32.1 Hz), 163.77 (t, *J* = 32.0 Hz), 152.68, 151.71, 146.99, 146.78, 137.82 ,137.26, 133.11, 133.05, 128.79, 128.62, 128.48, 128.38, 119.07, 118.89 ,118.04 (t, *J* = 217.3 Hz), 117.98 (t, *J* = 219.4 Hz), 112.57, 112.47, 63.03, 42.26, 42.99, 32.84 (t, *J* = 24.0 Hz), 32.57 (t, *J* = 23.8 Hz), 29.70, 20.87, 20.14, 20.07 (t, *J* = 5.6 Hz); 19.81, 13.95.

**HRMS** (ESI) m/z calcd for $C_{20}H_{18}F_2O_5Na$ [M+Na$^+$] 399.1015, found 399.1013.



**4p**

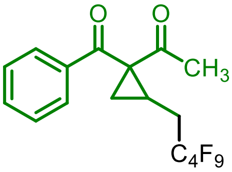
**Ethyl 3-(2-benzoyl-2-(thiophene-2-carbonyl)cyclopropyl)-2,2-difluoropropanoate (4p)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give yellow oil as inseparable 1:1 mixture of diastereomers, 44.6 mg, 57% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.88 – 7.86 (m, 2H), 7.60 – 7.58 (m, 1H), 7.54 – 7.45 (m,2H), 7.38 –7.34 (m, 2H), 6.97 – 6.94 (m, 1H), 4.34 (q, $J$ = 7.2 Hz), 2.72-2.64 (m,1H), 2.41 – 2.29 (m, 1H), 2.06 -1.99 (m,1H), 1.92 -1.72 (m, 1H), 1.47 - 1.42 (m, 1H), 1.37 (dt, $J$ =2.0 Hz, 7.2 Hz, 3H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -103.93 – -104.64 (m,1F), -105.95 – -106.68 (m,1F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 195.76, 195.38, 187.85, 187.35, 163.80 (t, $J$ = 32.3 Hz), 163.78 (t, $J$ = 32.3 Hz), 144.25, 143.23, 137.56, 136.95, 134.84 ,134.44, 133.89, 133.60, 133.55, 133.34, 128.87, 128.85, 128.26, 128.71 ,128.37, 128.18, 115.56 (t, $J$ = 249.6 Hz), 63.06, 44.21, 44.09, 33.06 (t, $J$ = 23.7 Hz), 32.94 (t, $J$ = 23.5 Hz), 20.28, 20.09, 19.70 (t, $J$ = 6.8 Hz), 19.48 (t, $J$ = 6.8 Hz),13.96.

**HRMS** (ESI) m/z calcd for $C_{20}H_{18}F_2SO_4Na$ [M+Na$^+$] 415.0786, found 415.0787.



**4q**

**1-(1-benzoyl-2-(5,5,5,5,5,5,5,5,5-nonafluoro-5l12-penta-2,4-diyn-1-yl)cyclopropyl)ethan-1-one (4q)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl iodine (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as major product, 35.3 mg, 42% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.93 (d, $J$ = 5.9 Hz, 2H), 7.62 (t, $J$ = 6.0 Hz, 1H), 7.49 (t, $J$ = 6.3 Hz, 2H), 2.53 -2.47 (m, 1H), 2.37 – 2.28 (m, 1H), 2.25 – 2.18 (m, 1H), 2.06 (s, 3H), 1.94 (dd, $J$ = 3.7 Hz, 6.0Hz, 1H), 1.41 (dd, $J$ = 3.8 Hz, 7.2 Hz).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -81.00 - -81.07(m, 3F), -114.17 - -114.26 (m, 2F), -124.28 - -126.04 (m, 4F);$^{13}$C NMR (100 MHz, $CDCl_3$) δ 202.47, 195.21, 136.29, 133.90, 129.12, 128.79, 45.49, 139.51, 30.86, 28.04 (t, $J$ = 21.4 Hz), 20.14, 19.85 (t, $J$ = 4.7 Hz).

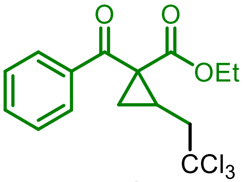
Minor products, 23.5 mg, 28% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.91 (t, $J$ = 6.0 Hz, 2H), 7.52 (t, $J$ = 6.2 Hz, 2H), 2.56 – 2.50 (m, 1H), 2.45 – 2.34 (m, 1H), 2.08 (s, 3H), 1.73(dd, $J$ = 3.7 Hz, 1H), 1.67 – 1.60(m, 1H), 1.53(m, dd, $J_1$

= 3.7 Hz, $J_2$ = 7.0 Hz, 1H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -81.05 - -81.12(m, 3F), -113.68 - -113.81 (m, 2F), -123.99 - -126.12 (m, 4F);$^{13}$C NMR (100 MHz, $CDCl_3$) δ 202.58, 195.10, 136.92, 134.15, 129.26, 128.80, 44.73, 30.47 (t, $J$ = 21.4 Hz), 29.54, 21.85 ,20.43 (t, $J$ = 5.5 Hz).

**HRMS** (ESI) m/z calcd for $C_{17}H_{13}F_9O_2Na$ [M+Na$^+$] 443.0664, found 443.0664.



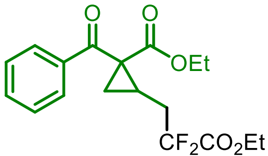
**4r**

**Ethyl 1-benzoyl-2-(2,2,2-trichloroethyl)cyclopropane-1-carboxylate (4r)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 61.0 mg, 88% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.90 – 7.87 (m, 2H), 7.61 – 7.53 (m, 1H), 7.50 – 7.43 (m, 2H), 4.13 – 3.97 (m, 2H), 3.11 – 3.05 (m, 1H), 2.97 – 2.91 (m, 0.5H), 2.67 – 2.57 (m, 1H), 2.13 – 2.06 (m, 0.5H), 1.95 – 1.91 (m, 1H), 1.74 – 1.58 (m, 1H), 0.97 – 0.88 (m, 3H).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 193.78, 193.41, 170.95, 169.71, 137.16, 136.83, 133.37, 132.99, 128.76, 128.56, 128.43, 128.18, 98.81, 98.60, 61.78, 61.73, 53.42, 52.02, 37.52, 35.82, 25.48, 23.16, 21.37, 21.20, 13.68, 13.66.

**HRMS** (ESI) m/z calcd for $C_{15}H_{15}Cl_3O_3Na$ [M+Na$^+$] 370.9979, found 371.0002.



**4s**

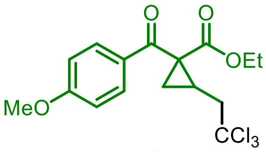
**Ethyl 1-benzoyl-2-(3-ethoxy-2,2-difluoro-3-oxopropyl)cyclopropane-1-carboxylate (4s)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 3:1 mixture of diastereomers, 50.3 mg, 71% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.87 – 7.85 (m, 2H), 7.59 – 7.44 (m, 3H), 4.35 – 4.28 (m, 2H), 4.11 – 3.97 (m, 2H), 2.40 – 2.34 (m, 2H), 1.71 – 1.68 (m, 1H), 1.55 – 1.52 (m, 2H), 1.42 – 1.32 (m, 3H), 0.96 – 0.89 (m, 3H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -104.07 - -105.03 (m, 1F), -106.10 - -106.81 (m, 1F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 193.99(minor), 193.51, 170.96, 169.65(minor), 163.67 (t, *J* = 32.2 Hz), 137.29, 136.93(minor), 133.26, 132.91(minor), 128.66, 128.51(minor), 128.40, 128.16(minor), 115.40 (t, *J* = 250.4 Hz), 63.07, 63.03(minor), 61.68, 37.40(minor), 36.21, 33.69 (t, *J* = 23.7 Hz), 32.35 (t, *J* = 23.7 Hz, minor), 21.30 (t, *J* = 6.7 Hz), 20.79(minor), 19.81, 19.02 (t, *J* = 5.9 Hz, minor), 13.94(minor), 13.92, 13.65, 13.61(minor).

**HRMS** (ESI) m/z calcd for $C_{18}H_{20}F_2O_5Na$ [M+Na$^+$] 377.1171, found 377.1171.



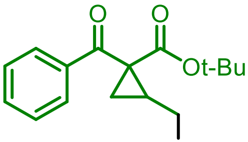
**4t**

**Ethyl 1-(4-methoxybenzoyl)-2-(2,2,2-trichloroethyl)cyclopropane-1-carboxylate (4t)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.6 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 3:2 mixture of diastereomers, 56.7 mg, 75% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.89 - 7.88 (m, 2H), 6.97 – 6.93 (m, 2H), 4.15 – 4.04 (m, 2H), 3.89 -3.87 (m, 3H), 3.10 -3.03 (m, 1H), 2.95 – 2.91 (m, 0.42H, minor), 2.60 -2.52 (m, 1H),2.07 – 2.02 (m, 0.55H, major), 1.72-1.69 (m, 0.63H, major), 1.57-1.54 (m, 0.47H, minor), 1.05-0.97 (m, 3H, major), 1.72-1.69 (m, 0.63H, major).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 192.02, 191.55, 171.25, 170.03, 163.80, 163.52, 130.96, 130.68, 129.92, 129.39, 113.97, 113.79, 98.89, 61.79, 61.75, 55.56, 55.51, 53.65 52.06, 37.25, 35.53, 24.99, 23.02, 21.18, 20.96, 13.85.

**HRMS** (ESI) m/z calcd for $C_{16}H_{17}Cl_3O_4Na$ [M+Na$^+$] 401.0085, found 401.0098.



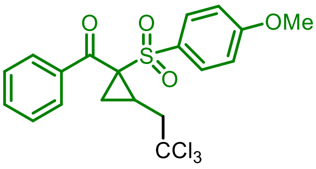
**4u**

**tert-butyl 1-benzoyl-2-(2,2,2-trichloroethyl)cyclopropane-1-carboxylate (4u)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.6 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 57.9 mg, 77% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 7.89 - 7.87 (m, 4H), 7.61 - 7.55 (m, 2H), 7.49 - 7.45 (m, 4H), 3.10 - 3.04 (m, 2H), 2.94 -2.89 (m, 1H), 2.61 – 2.56 (m, 2H), 2.11 (dd, *J* = 8.8 Hz, 11.7 Hz, 1H),1.93 – 1.85 (m, 2H), 1.66 – 1.63 (m, 1H), 1.58 – 1.54 (m, 1H), 1.19 (s, 9H), 1.17 (s, 9H).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 194.53, 194.06, 169.83, 168.56, 137.72, 137.69, 133.15, 132.77, 128.66, 128.47, 128.31, 128.09, 98.94, 98.70, 82.77, 82.60, 53.36, 51.92, 38.38, 36.84, 27.57, 27.54, 25.26, 22.68, 22.18, 20.74.

**HRMS** (ESI) m/z calcd for $C_{17}H_{19}Cl_3O_3Na$ [M+Na$^+$] 399.0292, found 399.0289.



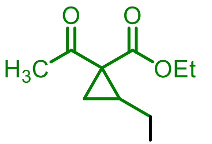
**4v**

**(1-((4-methoxyphenyl)sulfonyl)-2-(2,2,2-trichloroethyl)cyclopropyl)(phenyl)methanone (4v)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.6 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 5:1 mixture of diastereomers, 40.0 mg, 45% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 8.05 – 8.04 (m, 2H), 7.64 - 7.61 (m, 2H), 7.51 - 7.48 (m, 2H), 6.97 (d, *J* = 7.2 Hz, 1H), 3.88 (s, 3H), 3.21 (dd, *J* = 1.8 Hz, 11.8 Hz ,1H), 2.52 -2.43 (m, 2H),1.86 (dd, *J* = 8.6 Hz, 11.9 Hz ,1H).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 190.58, 164.15, 135.48, 134.38, 130.98, 130.61, 129.46, 128.60, 114.38, 98.05, 55.69, 54.57, 51.37, 22.63, 20.66.

**HRMS** (ESI) m/z calcd for $C_{19}H_{17}Cl_3O_4SNa$ [M+Na$^+$] 469.9805, found 469.9804.



**4w**

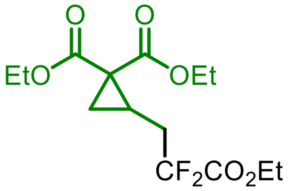
**Ethyl 1-acetyl-2-(3-ethoxy-2,2-difluoro-3-oxopropyl)cyclopropane-1-carboxylate (4w)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 1:1 mixture of diastereomers, 51.3 mg, 88% yield.

**$^1$H NMR** (400 MHz, $CDCl_3$) δ 4.33 (q, t, *J* = 7.1 Hz, 2H), 4.28 – 4.17 (m, 2H), 2.43 – 2.40 (m, 3H), 2.20 – 2.03 (m, 3H), 1.66 – 1.62 (m, 1H), 1.48 – 1.41 (m, 1H), 1.37 – 1.28 (m, 6H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -104.60 - -105.32 (m, 3F), -106.27 – 107.45 (m, 1F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 201.82(minor), 201.66, 170.33, 169.08(minor), -163.76 (t, *J* = 29.7 Hz, minor), 163.65 (t, J = 32.1 Hz), 115.37 (t, *J* = 249.8 Hz, minor), 115.24 (t, J = 249.7 Hz), 63.05, 61.77(minor), 61.64, 39.83(minor), 39.17, 32.77 (t, *J* = 23.7 Hz, minor), 31.90 (t, *J* = 23.6 Hz), 30.76, 29.39(minor), 23.60 (t, *J* = 6.4 Hz), 22.54 (t, *J* = 5.6 Hz), 21.94 (minor), 20.26, 14.11(minor), 14.04, 13.90.

**HRMS** (ESI) m/z calcd for $C_{13}H_{18}F_2O_5Na$ [$M+Na^+$] 315.1015, found 315.0910.



**4x**

**diethyl 2-(3-ethoxy-2,2-difluoro-3-oxopropyl)cyclopropane-1,1-dicarboxylate (4x)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 12 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 52.8 mg, 81% yield.

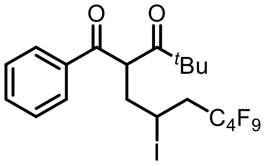
**Gram scale**: using alkene (10.0 mmol) and alkyl bromide (15.0 mmol) with 0.5 mol% $Ir(ppy)_3$ as the photocatalyst in DCM (30.0 mL), the reaction was stirred for 24 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil, 2.99 g, 93% yield.

**$^{1}$H NMR** (400 MHz, $CDCl_3$) δ 4.34 (q, t, $J$ = 7.1 Hz, 2H), 4.29 – 4.12 (m, 4H), 2.50 – 2.37 (m, 1H), 2.02 – 2.00 (m, 1H), 1.99 – 1.85 (m, 1H), 1.48 – 1.42 (m, 2H), 1.35 (t, $J$ = 7.1 Hz, 3H), 1.31 – 1.25 (m, 6H).

**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -104.39 - -106.69 (m, 2F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 169.39, 167.71, 163.75 (t, $J$ = 32.2 Hz), 115.36 (t, $J$ = 250.0 Hz), 63.02, 61.75, 61.71, 33.48 (t, $J$ = 24.0 Hz), 32.85, 20.16 (t, $J$ = 6.2 Hz), 20.08, 14.00 (t, $J$ = 7.9 Hz).

**HRMS** (ESI) m/z calcd for $C_{14}H_{20}F_2O_6Na$ [M+Na$^+$] 345.1120, found 345.1120.



**5y**

**4,4-dimethyl-2-(7,7,7,7,7,7,7,7,7-nonafluoro-2-iodo-7l12-hepta-4,6-diyn-1-yl)-1-phenylpentane-1,3-dione (5y)** was prepared via typical procedure, using alkene (0.2 mmol) and alkyl bromide (0.4 mmol), the reaction was stirred for 24 hours. The crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give colorless oil as inseparable 3:1 mixture diastereomers, 108.5 mg, 92% yield.

**$^{1}$H NMR** (400 MHz, $CDCl_3$) δ 8.12 – 8.00 (m, 2H), 7.68 – 7.51 (m, 3H), 5.32 – 5.29 (m, 1H), 4.21 – 4.14 (m, 1H), 2.96 – 2.75 (m, 2H), 2.59 – 2.53 (m, 1H), 2.35 – 1.97 (m, 1H), 1.17 – 1.64 (m, 9H).

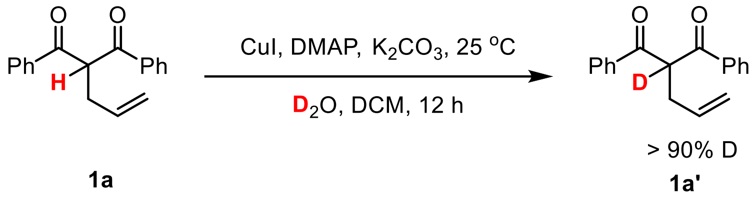
**$^{19}$F NMR** (376 MHz, $CDCl_3$) δ -80.99 - -81.06 (m, 3F), -111.37 - -114.41 (m, 2F), -124.54 - -125.94 (m, 4F).

**$^{13}$C NMR** (100 MHz, $CDCl_3$) δ 209.29, 208.64(minor), 195.21, 194.85(minor), 136.67(minor), 134.65, 134.12, 133.76(minor), 129.18, 128.97(minor), 128.82, 128.62(minor), 56.80, 56.64(minor), 45.64(minor), 44.58, 42.05 (t, $J$ = 20.8 Hz), 41.09(minor), 39.85, 26.87(minor), 26.61, 20.05, 18.35(minor).

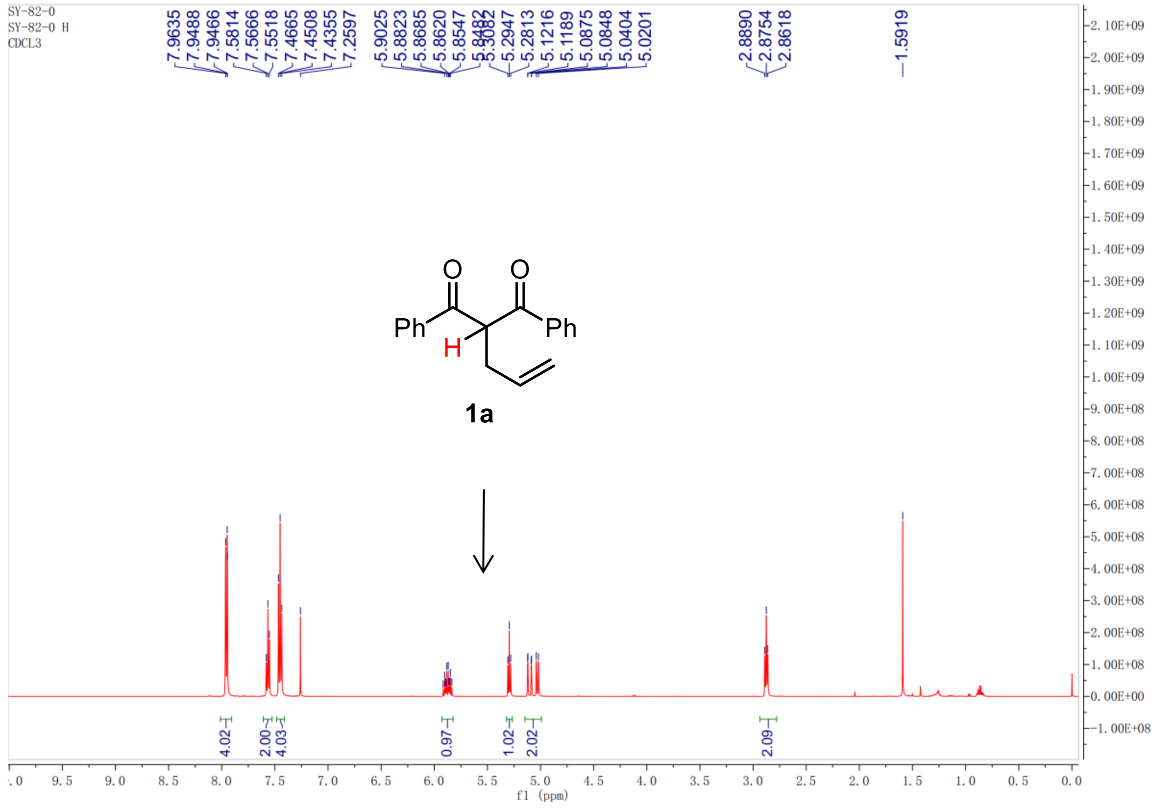
**HRMS** (ESI) m/z calcd for $C_{20}H_{20}F_9O_2NaI$ [M+Na$^+$] 613.0256, found 613.0261.

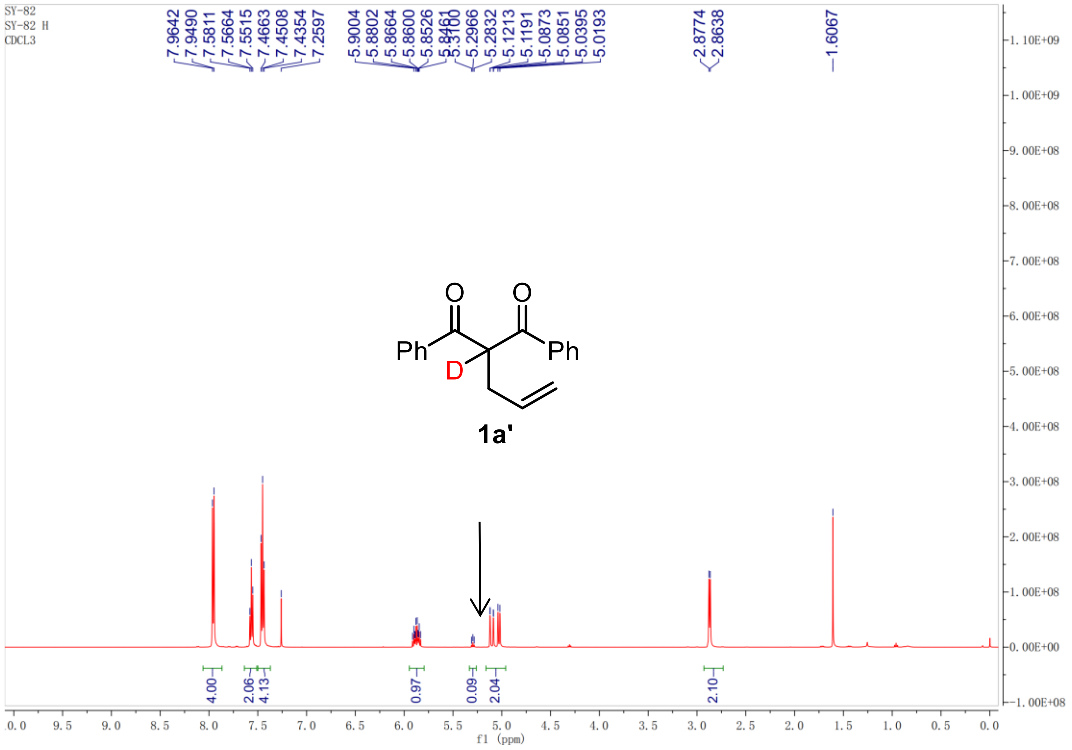
## 4. Mechanism studies

**Deuterium experiment**

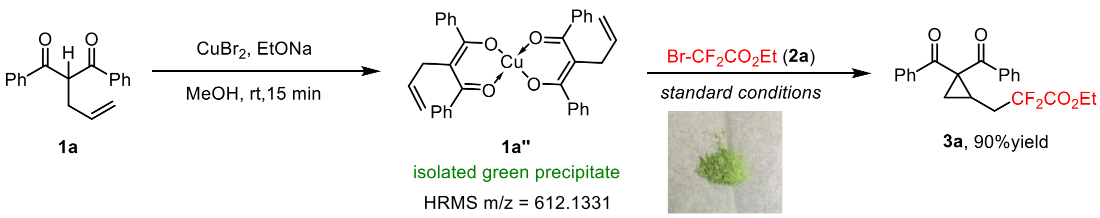


To a dried Schlenk tube was added CuI (10 mol%), DMAP (20 mol%), $K_2CO_3$ (2.0 equiv.), followed by DCM (1.0 mL), **1a** (0.2 mmol) and $D_2O$ (0.5 mL) was injected into mixture. The mixture was shanked three times, degassed three times (10 minutes every time) by freeze-pump-thaw method. The reaction mixture was stirred under Argon atmosphere at 25 °C in an incubator for 12 hours. After reaction completed, the reaction mixture was transfer into a 100 mL round-bottom flask, follow by *silica gel* (about 20-50 mg) was added into, then the solvent was removed under reduced conditions. The residue was directly loaded onto a short SepaFlash® column, and the crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give desired product as white solid in quantitative yield, the structure of **1a’** was checked by $^1$H NMR.

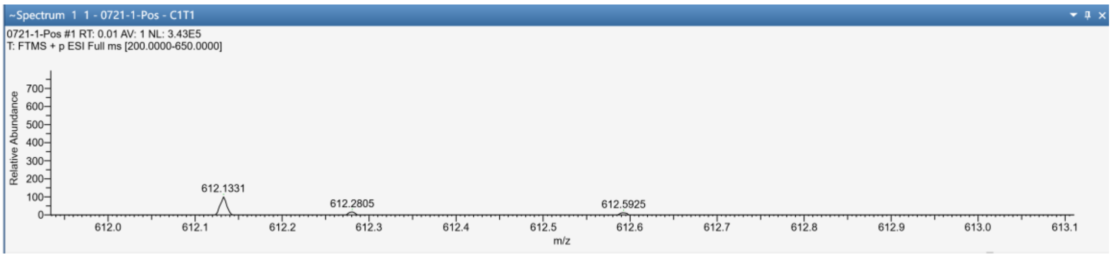




## Preparation of Copper complex

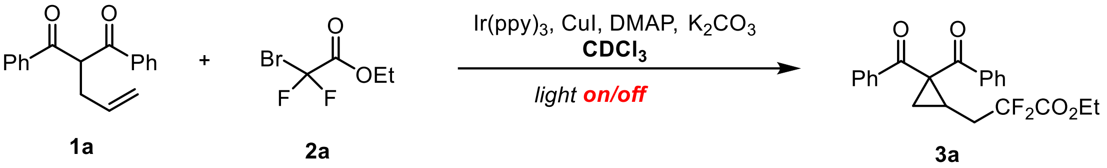


To a 25 mL seal tube was added **1a** (2.2 mmol) and MeOH (10.0 mL) under open air, then mixture was stirred at room temperature until the solid was completely dissolved. Subsequently, $CuBr_2$ (1.0 mmol) was added in one portion, then EtONa (2.2 mmol) was added slowly (green solids will slowly precipitate). The reaction mixture was stirred about 15 minutes, filter to give a green precipitate, and rinse with MeOH to obtain a pure product **1a"**, 420 mg, 68% yield.

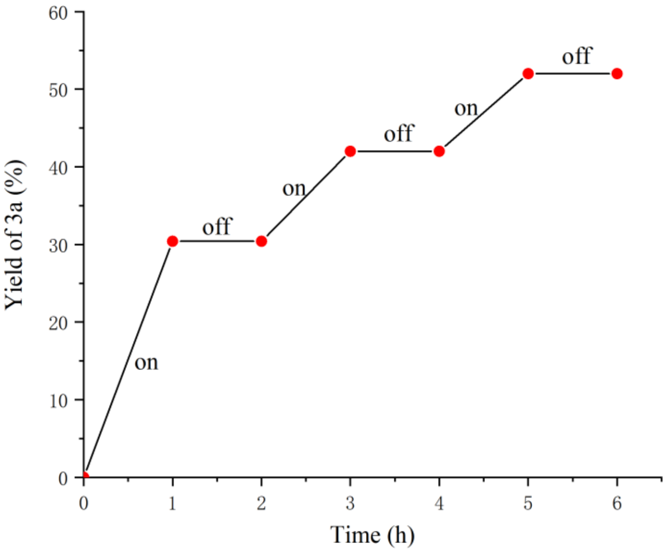


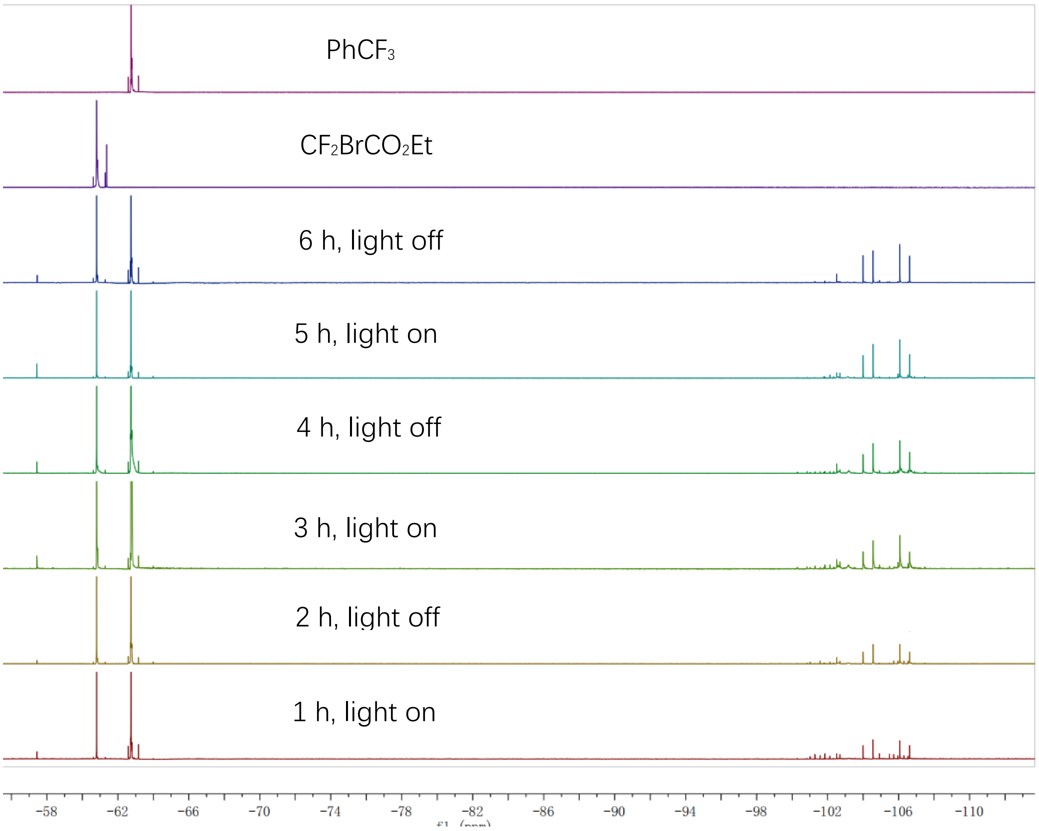
To a dried 10 mL Schlenk tube was added **1a"** (122.4 mg, 0.2 mmol), DMAP (20 mol%), $K_2CO_3$ (2.0 equiv.) and $Ir(ppy)_3$ (1 mol%) under Argon atmosphere. Subsequently, DCM (2.0 mL), **2a** (0.4 mmol) was added, the mixture was degassed three times (10 minutes every time) by freeze-pump-thaw method. The reaction mixture was stirred under Argon atmosphere at 25 °C in an incubator under 450 nm blue LEDs for 12 hours. After reaction completed, the reaction mixture was transfer into a 100 mL round-bottom flask, follow by *silica gel* (about 20-50 mg) was added into, then the solvent was removed under reduced conditions. The residue was directly loaded onto a short SepaFlash® column, and the crude products were purified by SepaBean® Machine with petroleum ether and ethyl acetate as eluent to give desired product as colorless oil in 90% yield.

### Light on/off experiment



To a dried 10 mL Schlenk tube was added **1a** (0.05 mmol), DMAP (20 mol%), $K_2CO_3$ (2.0 equiv.) and Ir(ppy)$_3$ (1 mol%) under Argon atmosphere. Subsequently, $CDCl_3$ (0.5 mL), **2a** (0.1 mmol) was added, the mixture was degassed three times (10 minutes every time) by freeze-pump-thaw method. Reaction mixture was stirred under Argon atmosphere at 25 °C in an incubator under 450 nm blue LEDs for one hour. The product yield was then measured by $^{19}$F-NMR with $PhCF_3$ as an internal standard. After which the reaction mixture was kept in dark for another one hour and further analyzed by $^{19}$F-NMR analysis. These on-off measurements were repeated, which showed that the product is formed only upon constant irradiation and the reaction was not a chain reaction.




PhCF3
CF2BrCO2Et
6 h, light off
5 h, light on
4 h, light off
3 h, light on
2 h, light off
1 h, light on
8
7
6
5
4
3
2
1
-58
-62
-66
-70
-74
-78
-82
-86
-90
-94
-98
-102
-106
-110
f1 (ppm)

## Luminescence quenching experiments

Cyclic Voltammetry was performed on a CH Instruments Electrochemical Workstation model CHI600E. A solution of sample in MeCN (0.001M) was tested with 0.1 M $Bu_4NP_6$ as the supporting electrolyte, using a glassy carbon as the working electrode, a Pt as the counter electrode, an a saturated calomel electrode reference electrode. Scan rate = 0.05 V/s, 2 sweep segments, a sample interval of 0.001 V.

## UV-vis absorption spectra

UV-vis absorption spectroscopy was conducted using a spectrophotometer, equipped with a temperature control unit at 25 °C. The samples were measured in 1.5 mL quartz cuvettes fitted with a PTFE stopper. **1a**, **2a**, CuI, *fac*-Ir, DMAP, and their mixture were prepared as a 0.1 mM solution with fresh MeCN as the solvent for measurement.

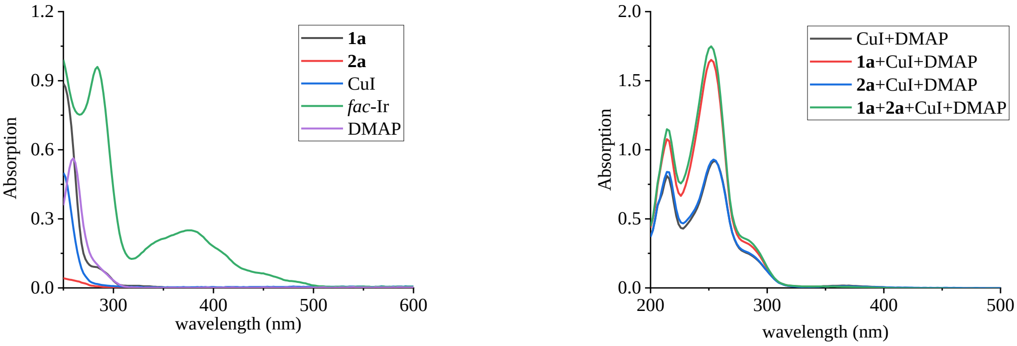


**Figure S1.** UV-vis absorption spectra.

## Stern-Volmer Fluorescence Quenching Experiments

Emission intensities were recorded using Microplate Accessory 5JO-0139 spectrometer for all experiments. All *fac*-Ir(ppy)$_3$ solutions were excited at 380 nm and the emission intensity was collected at 528 nm. In a typical experiment, the solution of *fac*-Ir(ppy)$_3$ in MeCN ($3.33*10^{-5}$) was added the appropriate amount of quencher in a screw-up 3.0 cm quartz cuvette. After degassing with Argon for 10 min, the emission spectra of the samples were collected.

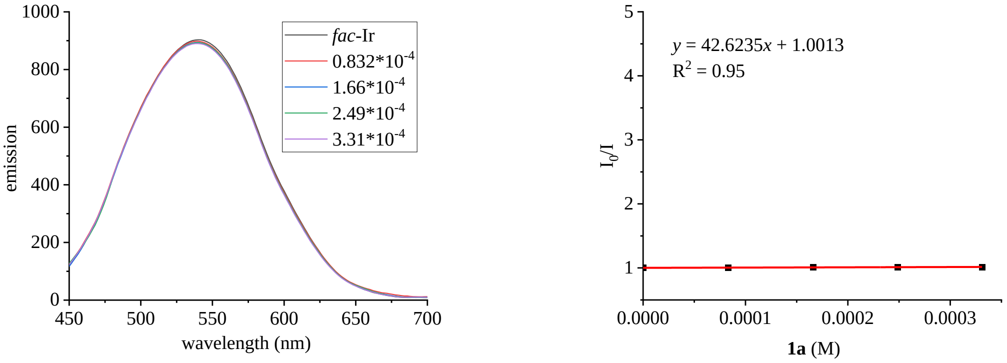


**Figure S2.** The luminescence spectrum of *fac*-Ir ($3.33\times10^{-5}$ M) as a function of concentration of **1a** in degassed MeCN with excitation at 380 nm (left). Quenching constant (right).

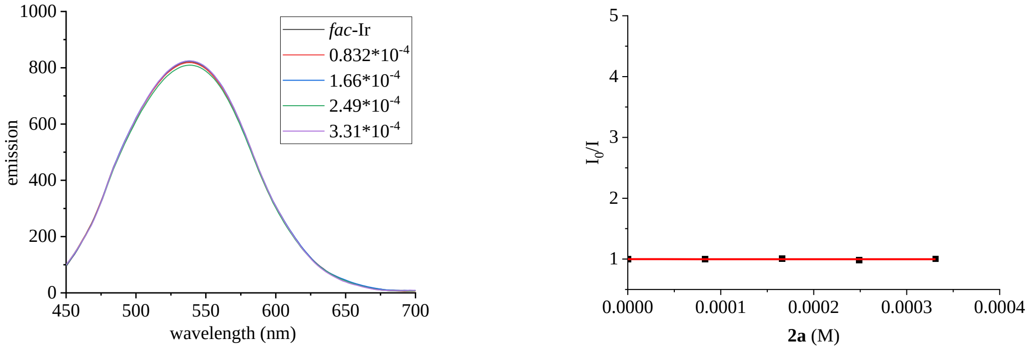


**Figure S3.** The luminescence spectrum of *fac*-Ir ($3.33\times10^{-5}$ M) as a function of concentration of **2a** in degassed MeCN with excitation at 380 nm (left). Quenching constant (right).

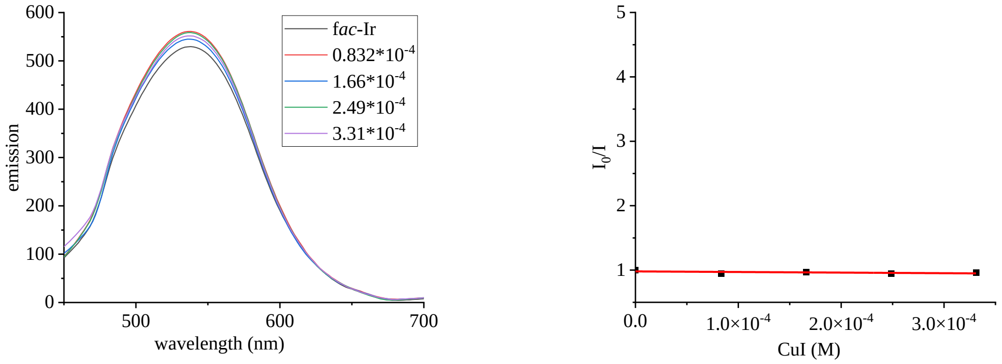


**Figure S4.** The luminescence spectrum of *fac*-Ir ($3.33\times10^{-5}$ M) as a function of concentration of CuI in degassed MeCN with excitation at 380 nm (left). Quenching constant (right).

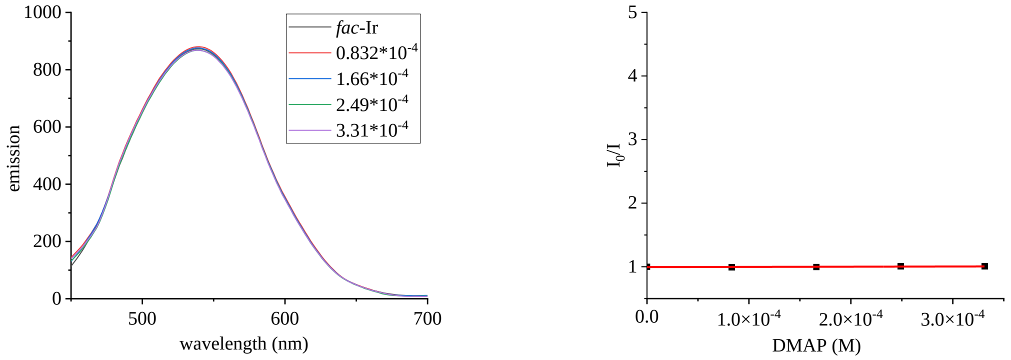


**Figure S5.** The luminescence spectrum of *fac*-Ir ($3.33\times10^{-5}$ M) as a function of concentration of DMAP in degassed MeCN with excitation at 380 nm (left). Quenching constant (right).

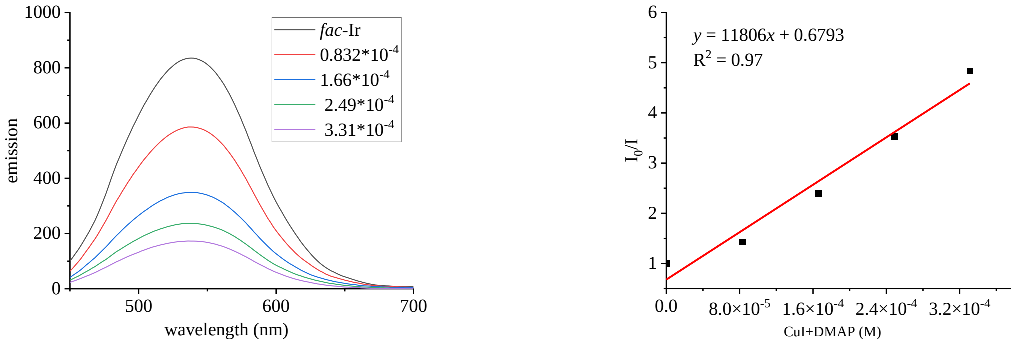


**Figure S6.** The luminescence spectrum of *fac*-Ir ($3.33\times10^{-5}$ M) as a function of concentration of the combination of 1.0 equiv CuI and 1.0 equiv DMAP in degassed MeCN with excitation at 380 nm (left). Quenching constant (right).

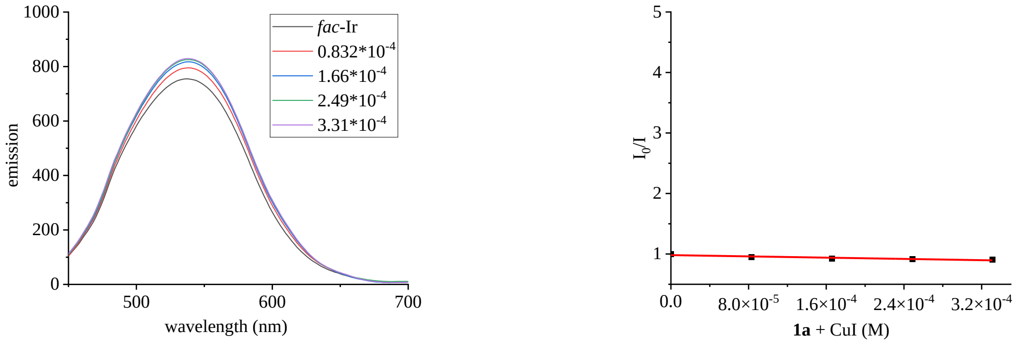


**Figure S7.** The luminescence spectrum of *fac*-Ir ($3.33\times10^{-5}$ M) as a function of concentration of the combination of 1.0 equiv **1a** and 1.0 equiv CuI in degassed MeCN with excitation at 380 nm (left). Quenching constant (right).

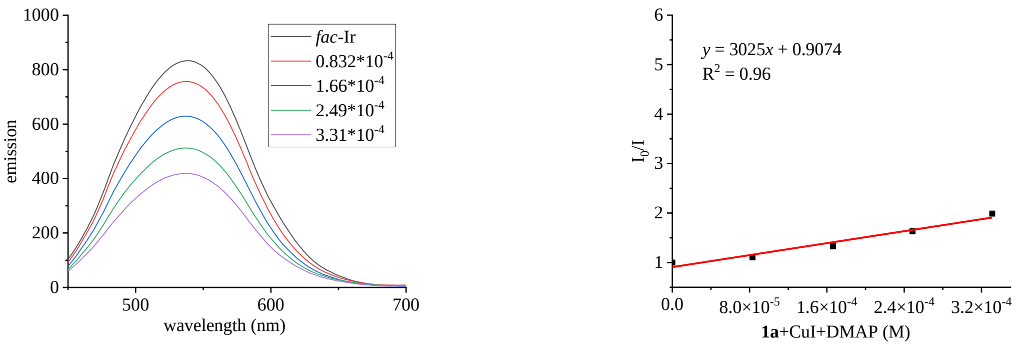


**Figure S8.** The luminescence spectrum of *fac*-Ir ($3.33\times10^{-5}$ M) as a function of concentration of the combination of 1.0 equiv **1a**, 1.0 equiv CuI and 1.0 equiv DMAP in degassed MeCN with excitation at 380 nm (left). Quenching constant (right).

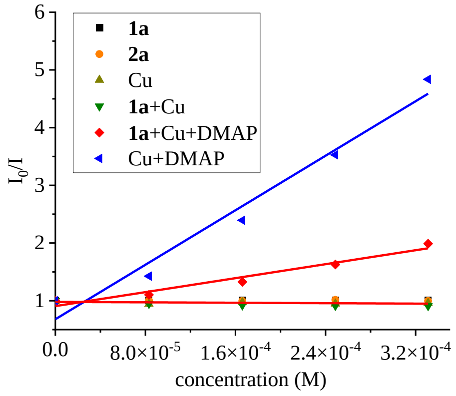
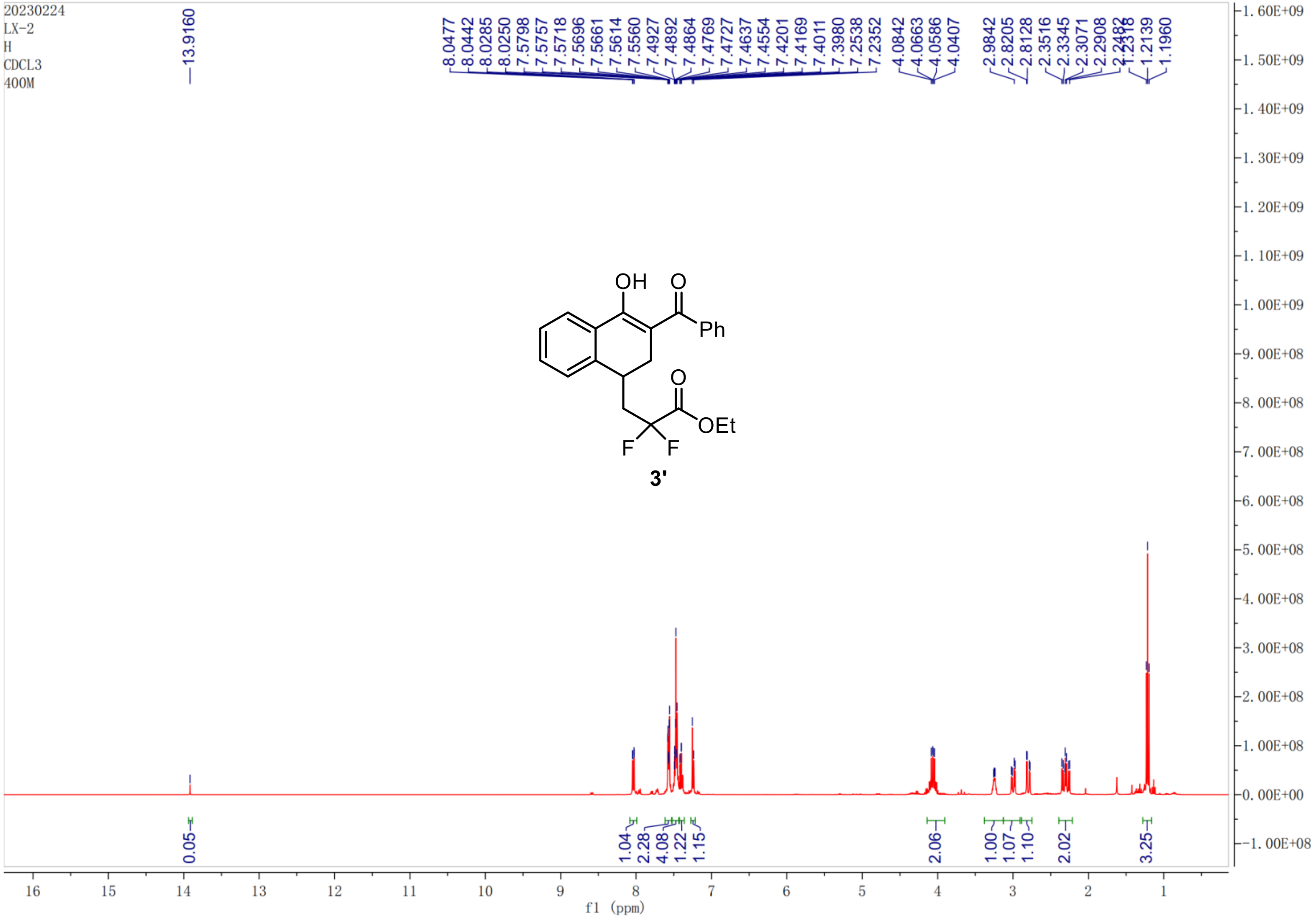
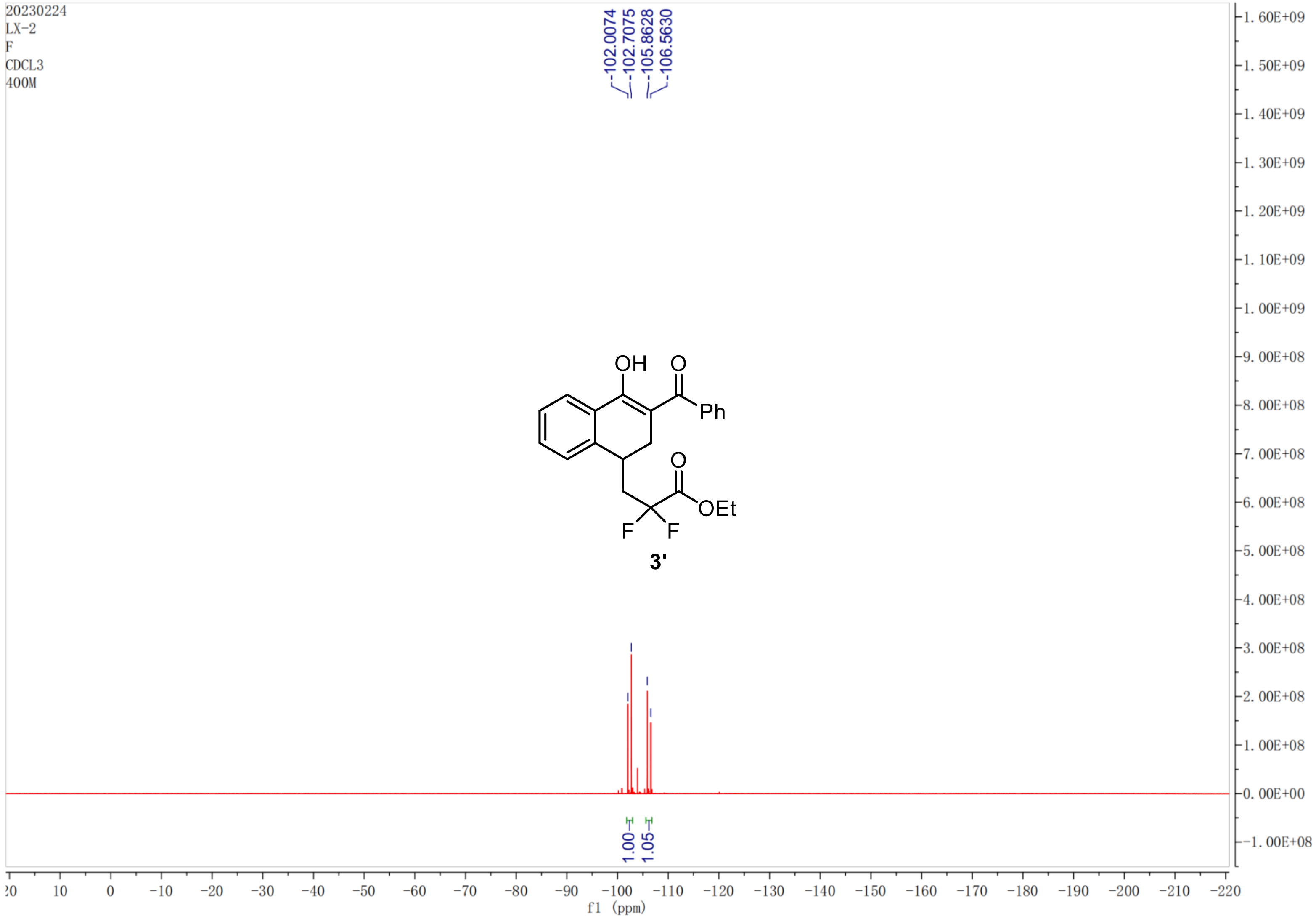


**Figure S9.** The luminescence spectrum of *fac*-Ir ($3.33\times10^{-5}$ M) with different compounds.

## 5. Copes of NMR Spectra


20230224
LX-2
H
CDCL3
400M
13.9160
8.0477
8.0442
8.0285
8.0250
7.5798
7.5757
7.5718
7.5696
7.5661
7.5614
7.5560
7.4927
7.4892
7.4864
7.4769
7.4727
7.4637
7.4554
7.4201
7.4169
7.4011
7.3980
7.2538
7.2352
4.0842
4.0663
4.0586
4.0407
2.9842
2.8205
2.8128
2.3516
2.3345
2.3071
2.2908
2.2482
1.2318
1.2139
1.1960
OH
O
Ph
O
OEt
F
F
3'
0.05
1.04
2.28
4.08
1.22
1.15
2.06
1.00
1.07
1.10
2.02
3.25
1.60E+09
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
f1 (ppm)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F
CDCL3
400M
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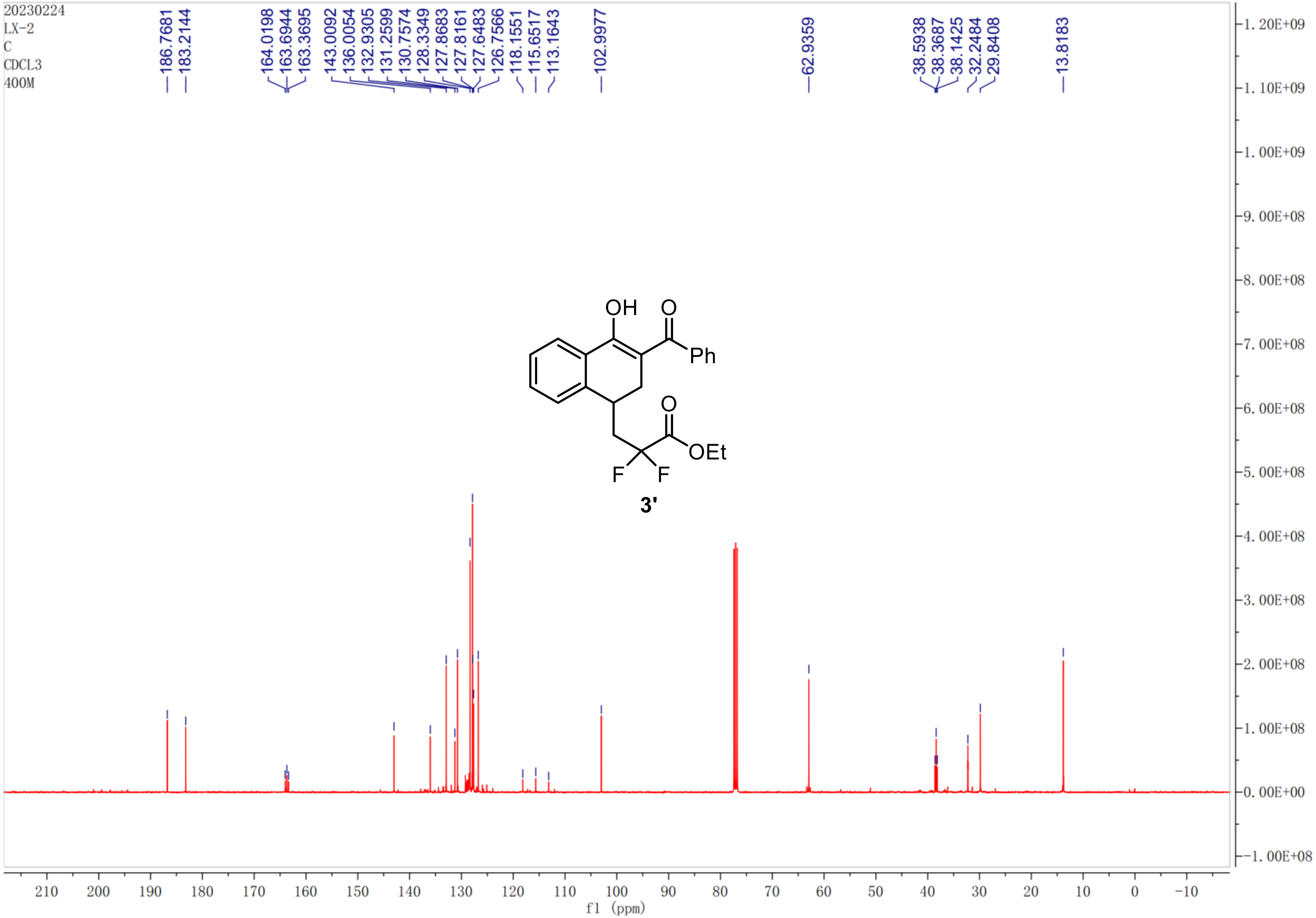
-105.8628
-106.5630
OH
O
Ph
O
OEt
F
F
1.00
1.05
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)
1. 60E+09
1. 50E+09
1. 40E+09
1. 30E+09
1. 20E+09
1. 10E+09
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00
−1. 00E+08

**3'**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LX-2
C
CDCL3
400M
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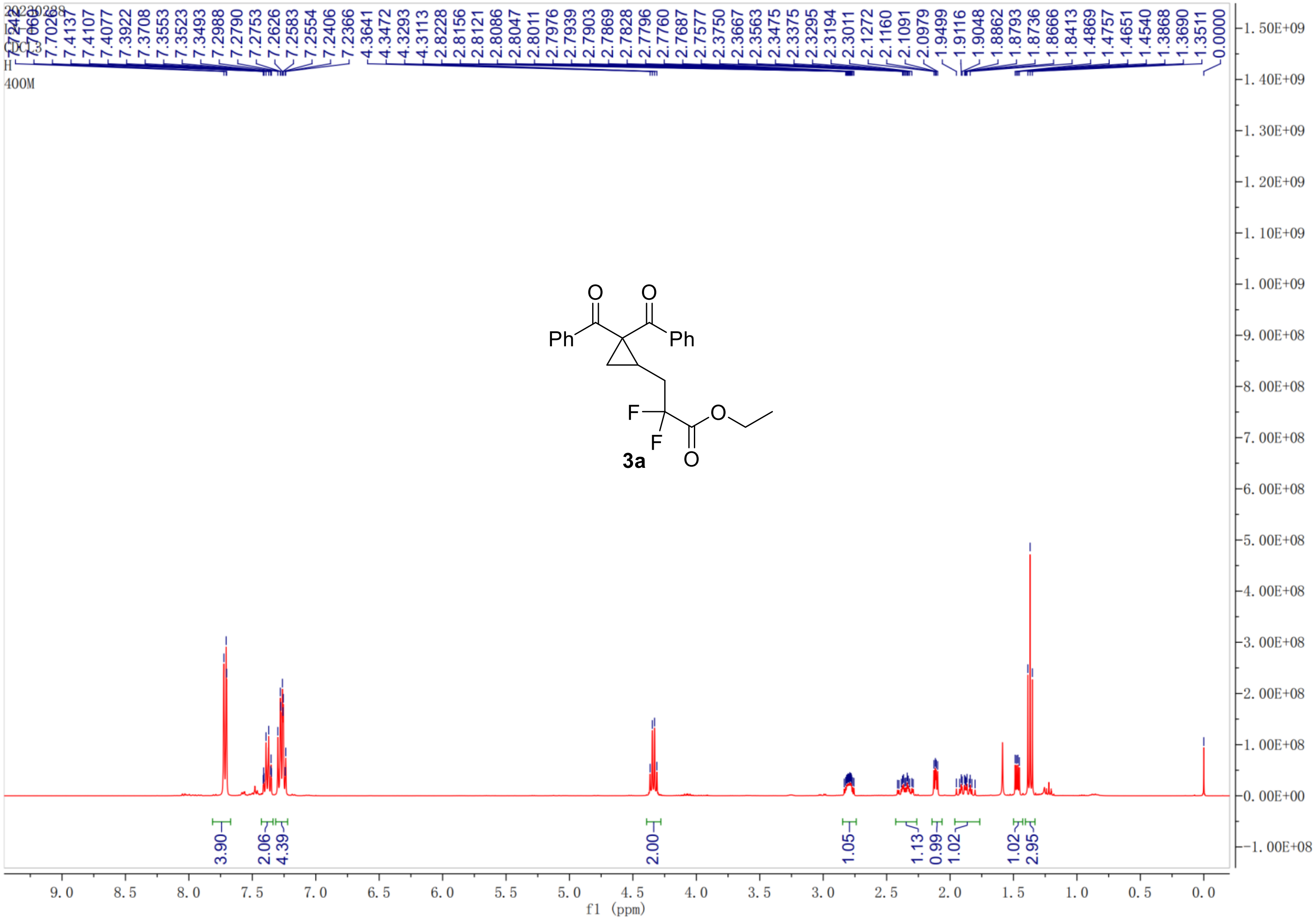
164.0198
163.6944
163.3695
143.0092
136.0054
132.9305
131.2599
130.7574
128.3349
127.8683
127.8161
127.6483
126.7566
118.1551
115.6517
113.1643
102.9977
62.9359
38.5938
38.3687
38.1425
32.2484
29.8408
13.8183
OH
O
Ph
O
OEt
F
F
3'
1. 20E+09
1. 10E+09
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00
−1. 00E+08
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)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H
400M
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7.4107
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7.3922
7.3708
7.3553
7.3523
7.3493
7.2988
7.2790
7.2753
7.2626
7.2583
7.2554
7.2406
7.2366
4.3641
4.3472
4.3293
4.3113
2.8228
2.8156
2.8121
2.8086
2.8047
2.8011
2.7976
2.7939
2.7903
2.7869
2.7828
2.7796
2.7760
2.7687
2.7577
2.3750
2.3667
2.3563
2.3475
2.3375
2.3295
2.3194
2.3011
2.1272
2.1160
2.1091
2.0979
1.9499
1.9116
1.9048
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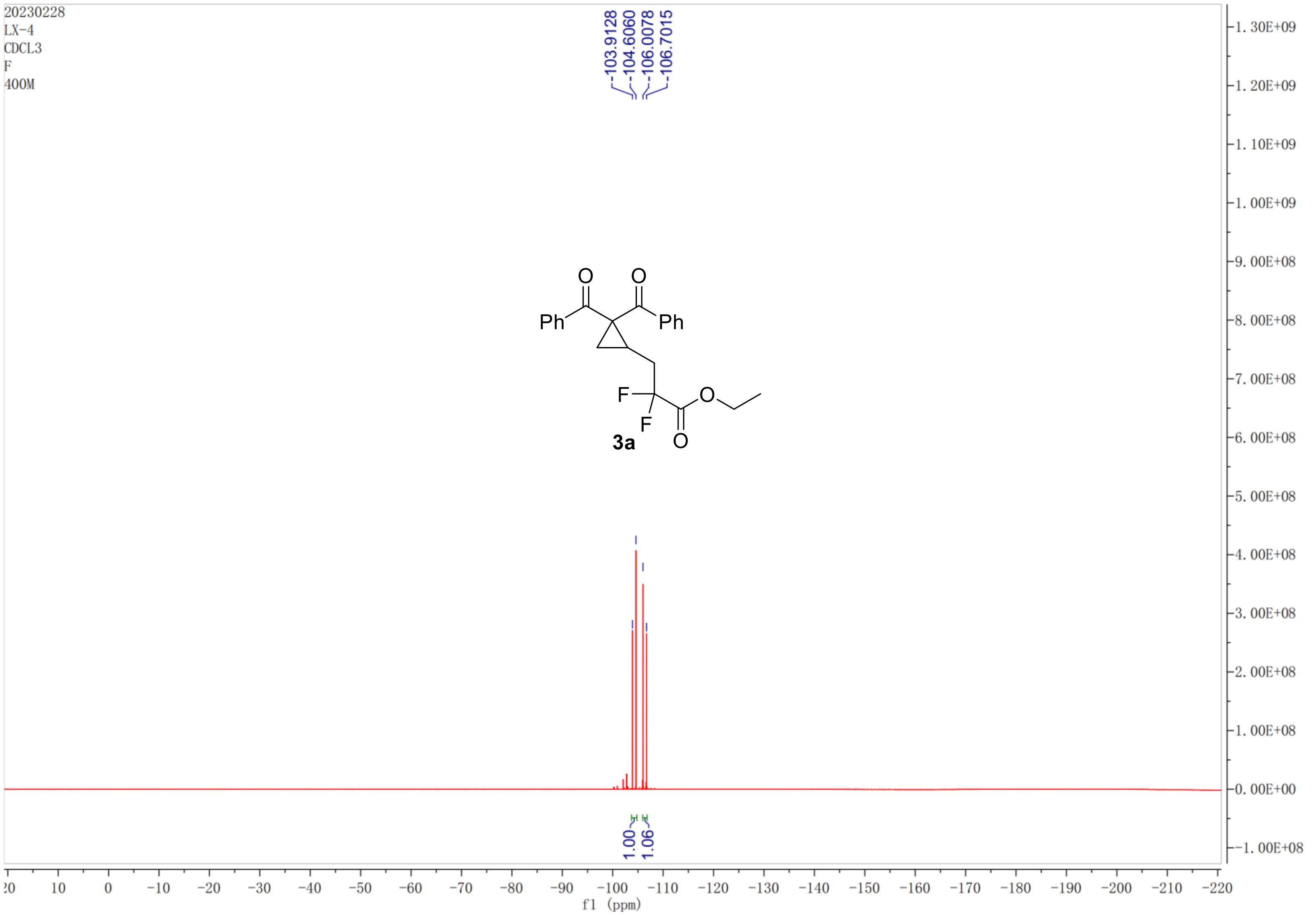
1.8736
1.8666
1.8413
1.4869
1.4757
1.4651
1.4540
1.3868
1.3690
1.3511
0.0000
O
O
Ph
Ph
F
F
O
O
3a
3.90
2.06
4.39
2.00
1.05
1.13
0.99
1.02
1.02
2.95
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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400M
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-106.7015
Ph
Ph
O
O
F
F
O
O
3a
1.00
1.06
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
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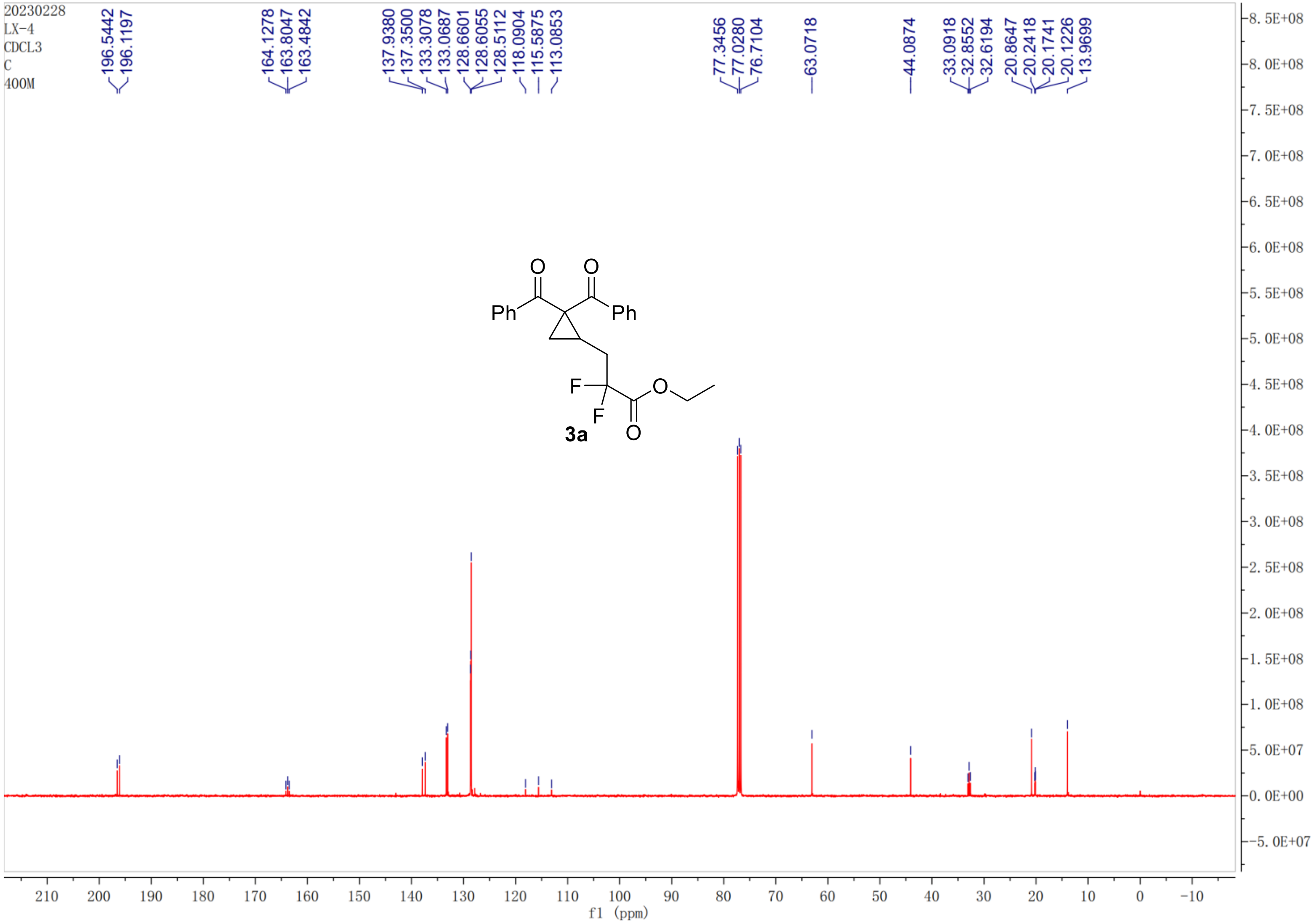
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
f1 (ppm)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CDCL3
C
400M
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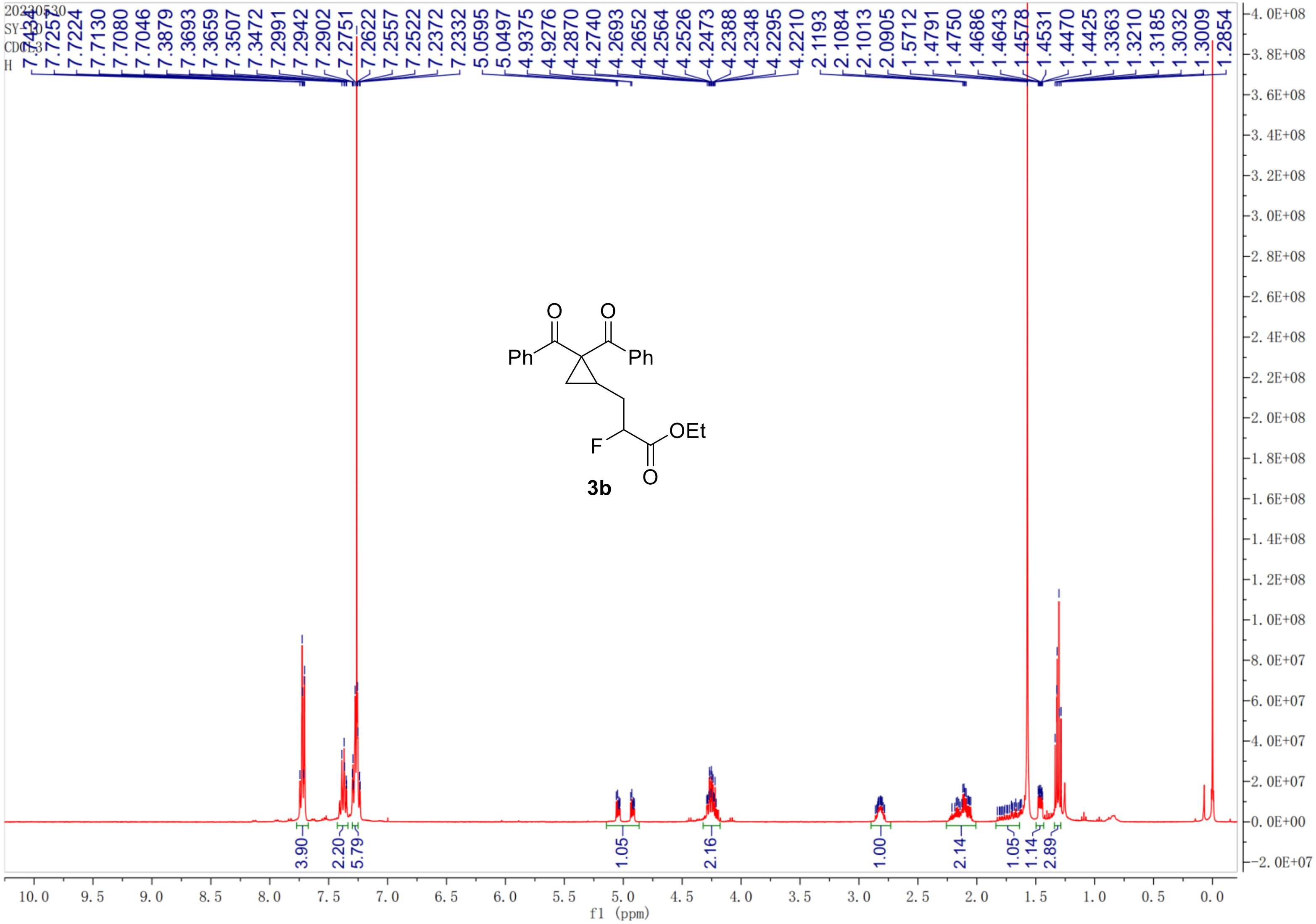
137.3500
133.3078
133.0687
128.6601
128.6055
128.5112
118.0904
115.5875
113.0853
77.3456
77.0280
76.7104
63.0718
44.0874
33.0918
32.8552
32.6194
20.8647
20.2418
20.1741
20.1226
13.9699
O
O
Ph
Ph
F
O
F
O
3a
8. 5E+08
8. 0E+08
7. 5E+08
7. 0E+08
6. 5E+08
6. 0E+08
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
-5. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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7.3659
7.3507
7.3472
7.2991
7.2942
7.2902
7.2751
7.2622
7.2557
7.2522
7.2372
7.2332
5.0595
5.0497
4.9375
4.9276
4.2870
4.2740
4.2693
4.2652
4.2564
4.2526
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2.0905
1.5712
1.4791
1.4750
1.4686
1.4643
1.4578
1.4531
1.4470
1.4425
1.3363
1.3210
1.3185
1.3032
1.3009
1.2854
O
O
Ph
Ph
OEt
F
O
3b
3.90
2.20
5.79
1.05
2.16
1.00
2.14
1.05
1.14
2.89
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
4.0E+08
3.8E+08
3.6E+08
3.4E+08
3.2E+08
3.0E+08
2.8E+08
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1.6E+08
1.4E+08
1.2E+08
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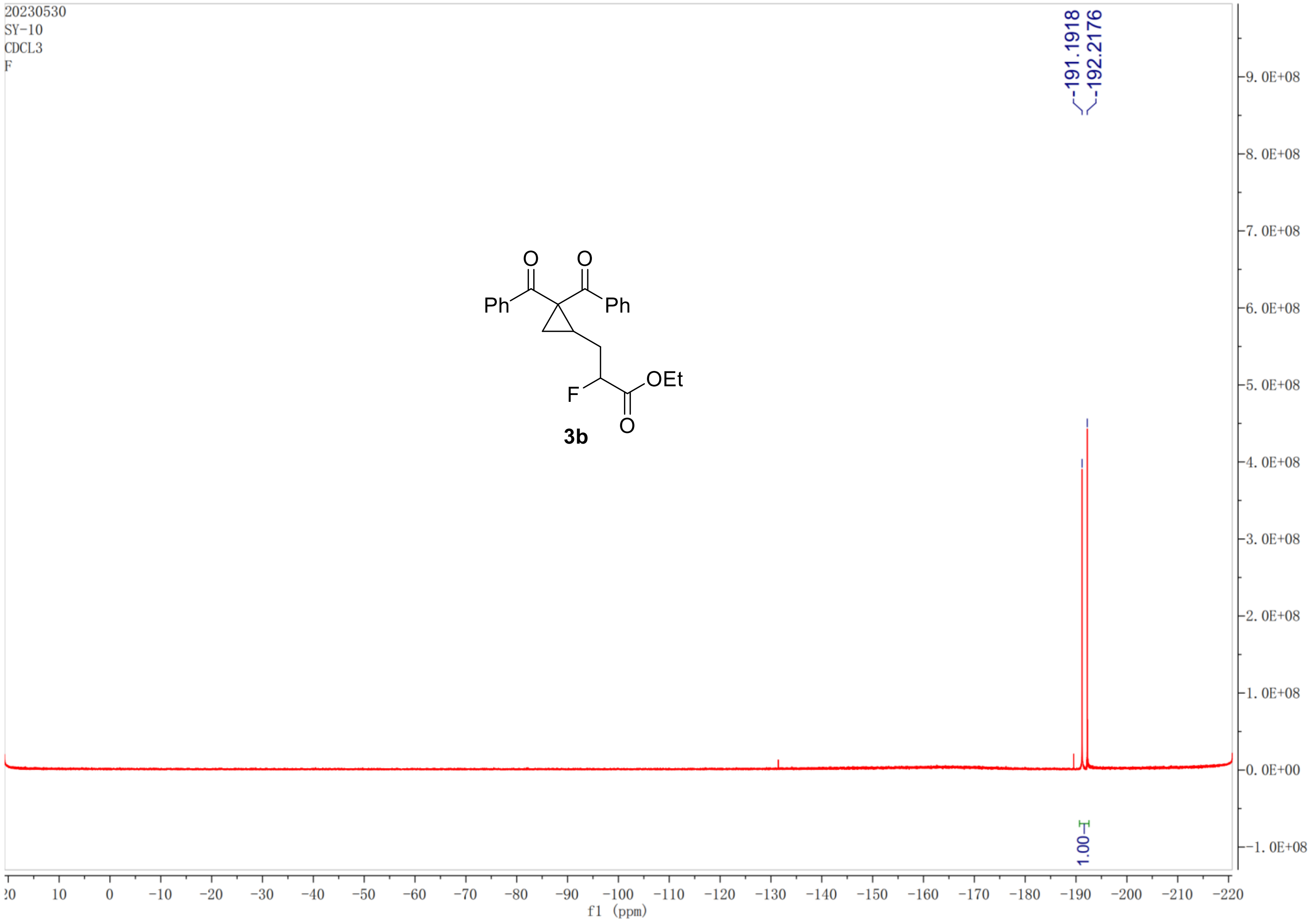
8.0E+07
6.0E+07
4.0E+07
2.0E+07
0.0E+00
-2.0E+07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SY-10
CDCL3
F
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-192.2176
O
O
Ph
Ph
OEt
F
O
3b
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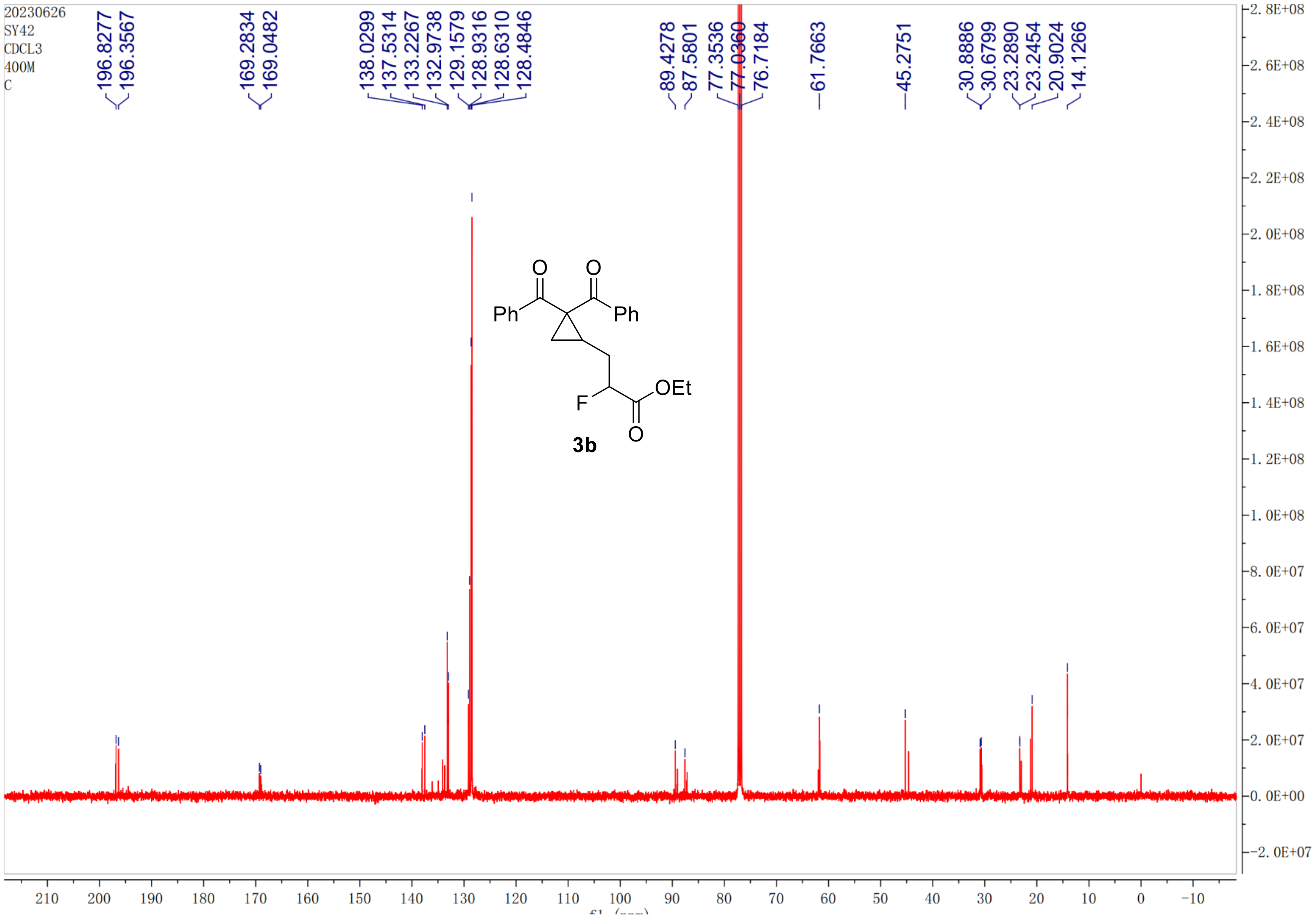
8. 0E+08
7. 0E+08
6. 0E+08
5. 0E+08
4. 0E+08
3. 0E+08
2. 0E+08
1. 0E+08
0. 0E+00
-1. 0E+08
1.00
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
f1 (ppm)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137.5314
133.2267
132.9738
129.1579
128.9316
128.6310
128.4846
89.4278
87.5801
77.3536
77.0360
76.7184
61.7663
45.2751
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30.6799
23.2890
23.2454
20.9024
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Ph
Ph
OEt
F
O
3b
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2.6E+08
2.4E+08
2.2E+08
2.0E+08
1.8E+08
1.6E+08
1.4E+08
1.2E+08
1.0E+08
8.0E+07
6.0E+07
4.0E+07
2.0E+07
0.0E+00
-2.0E+07
210
200
190
180
170
160
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120
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100
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80
70
60
50
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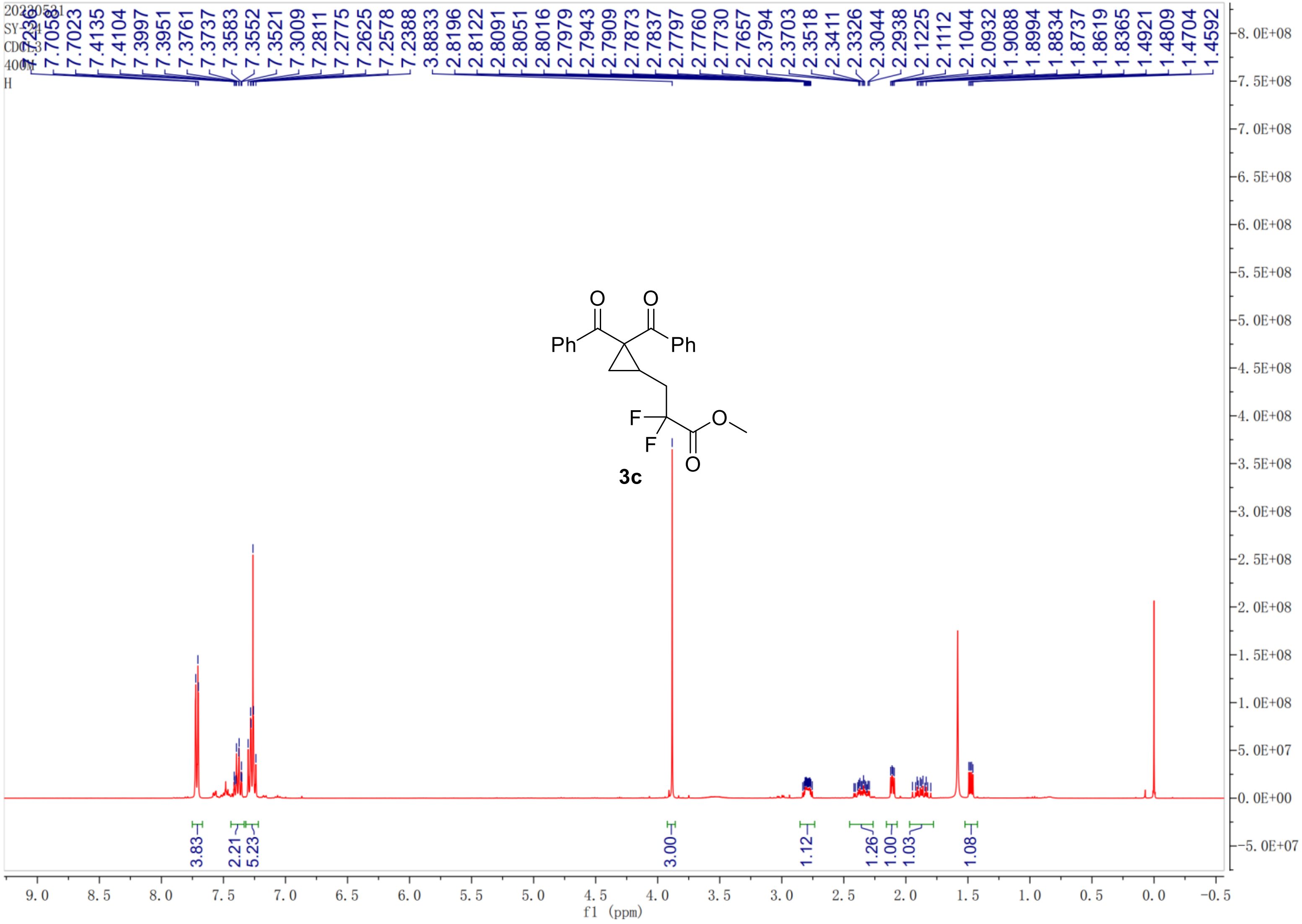
30
20
10
0
-10



20220531
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CDCL3
400M
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7.3761
7.3737
7.3583
7.3552
7.3521
7.3009
7.2811
7.2775
7.2625
7.2578
7.2388
3.8833
2.8196
2.8122
2.8091
2.8051
2.8016
2.7979
2.7943
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2.3044
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2.1225
2.1112
2.1044
2.0932
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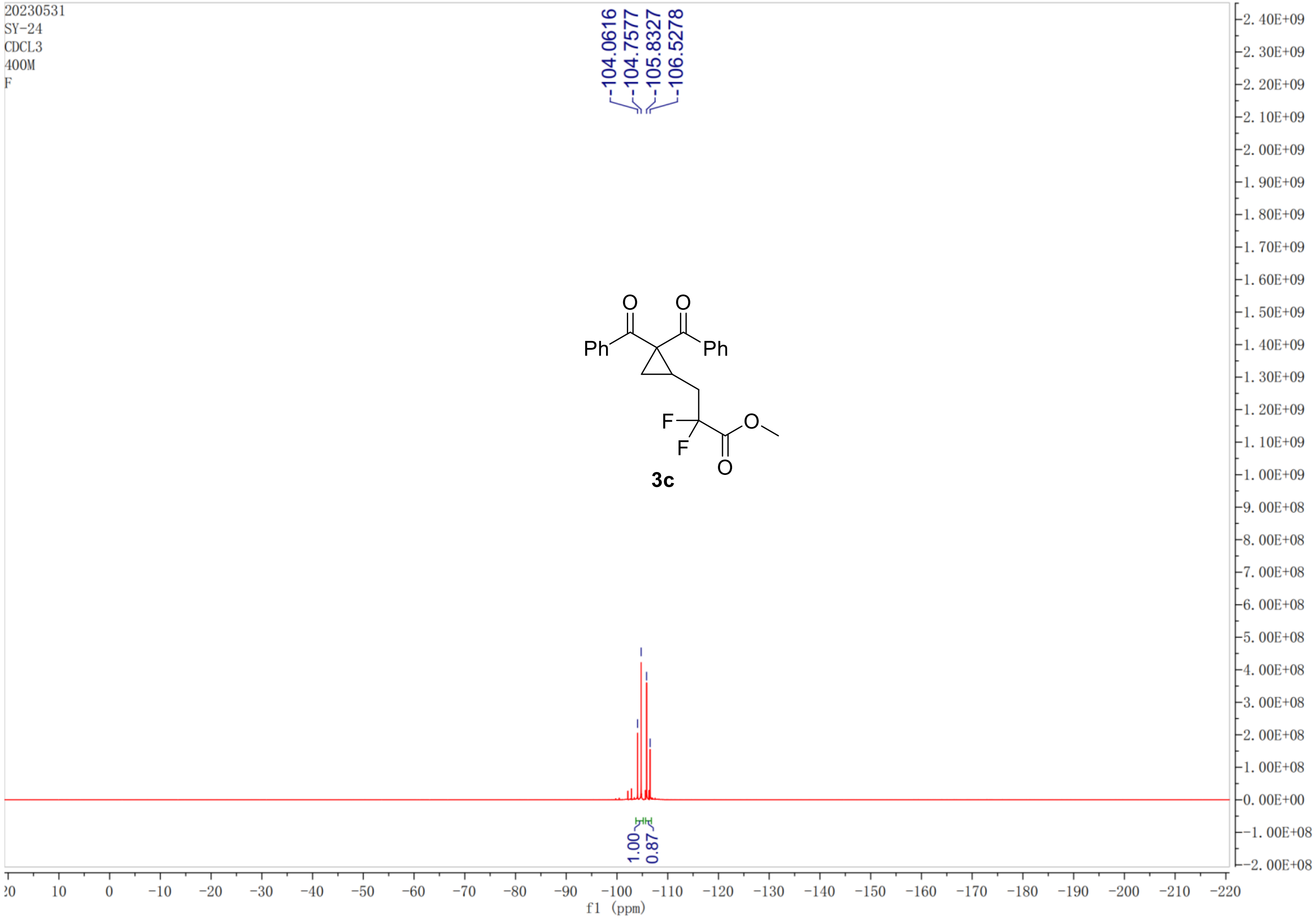
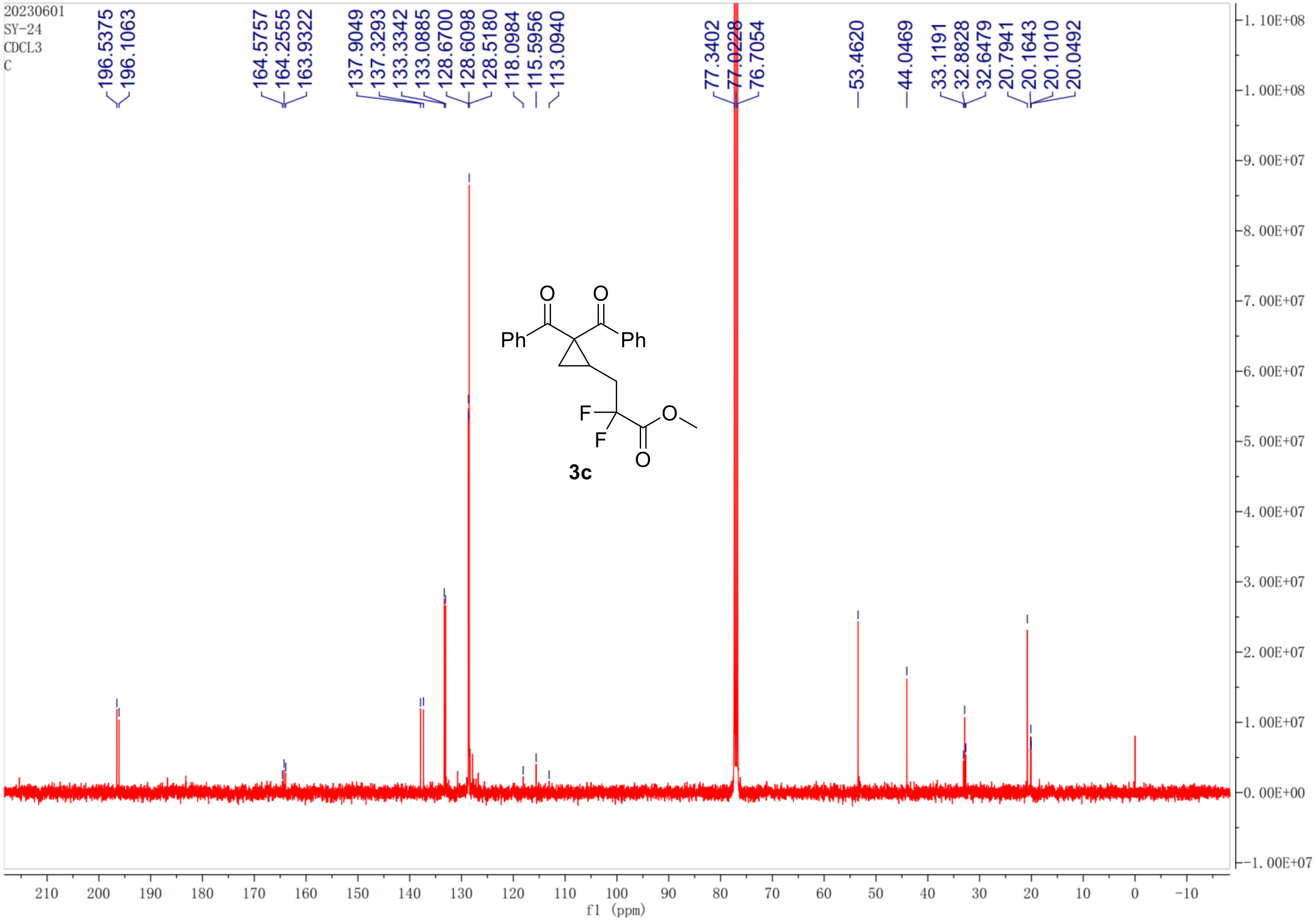
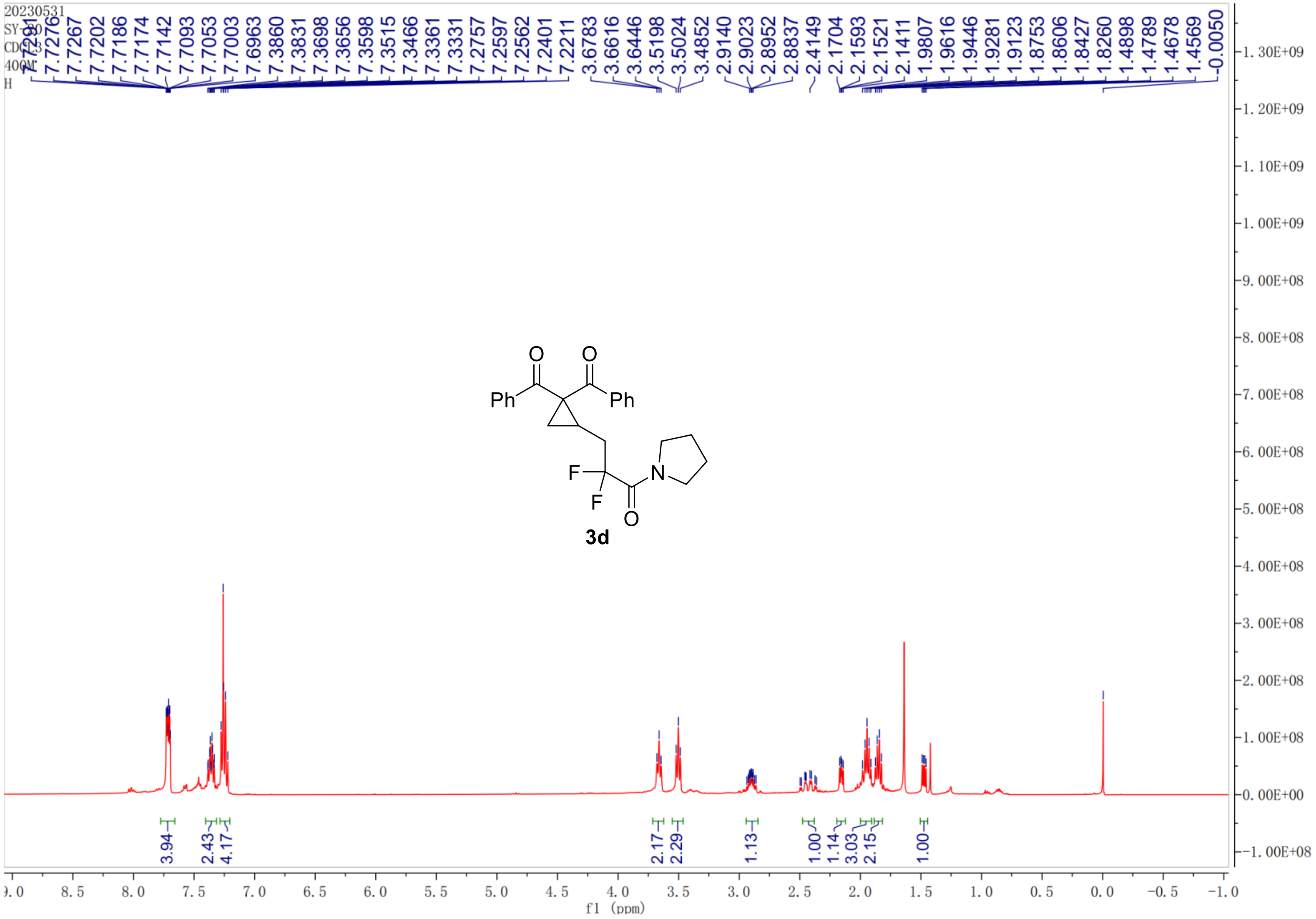
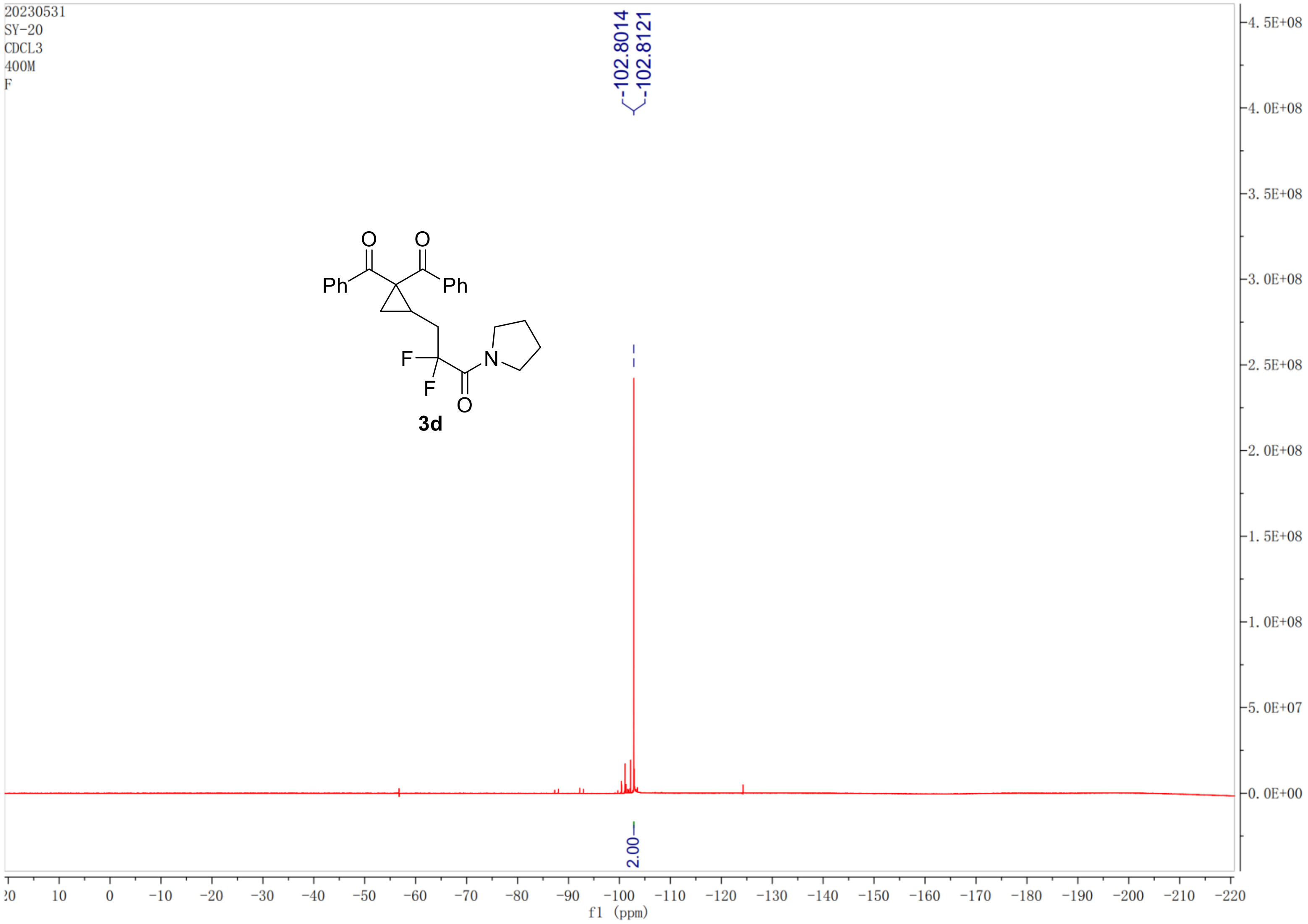
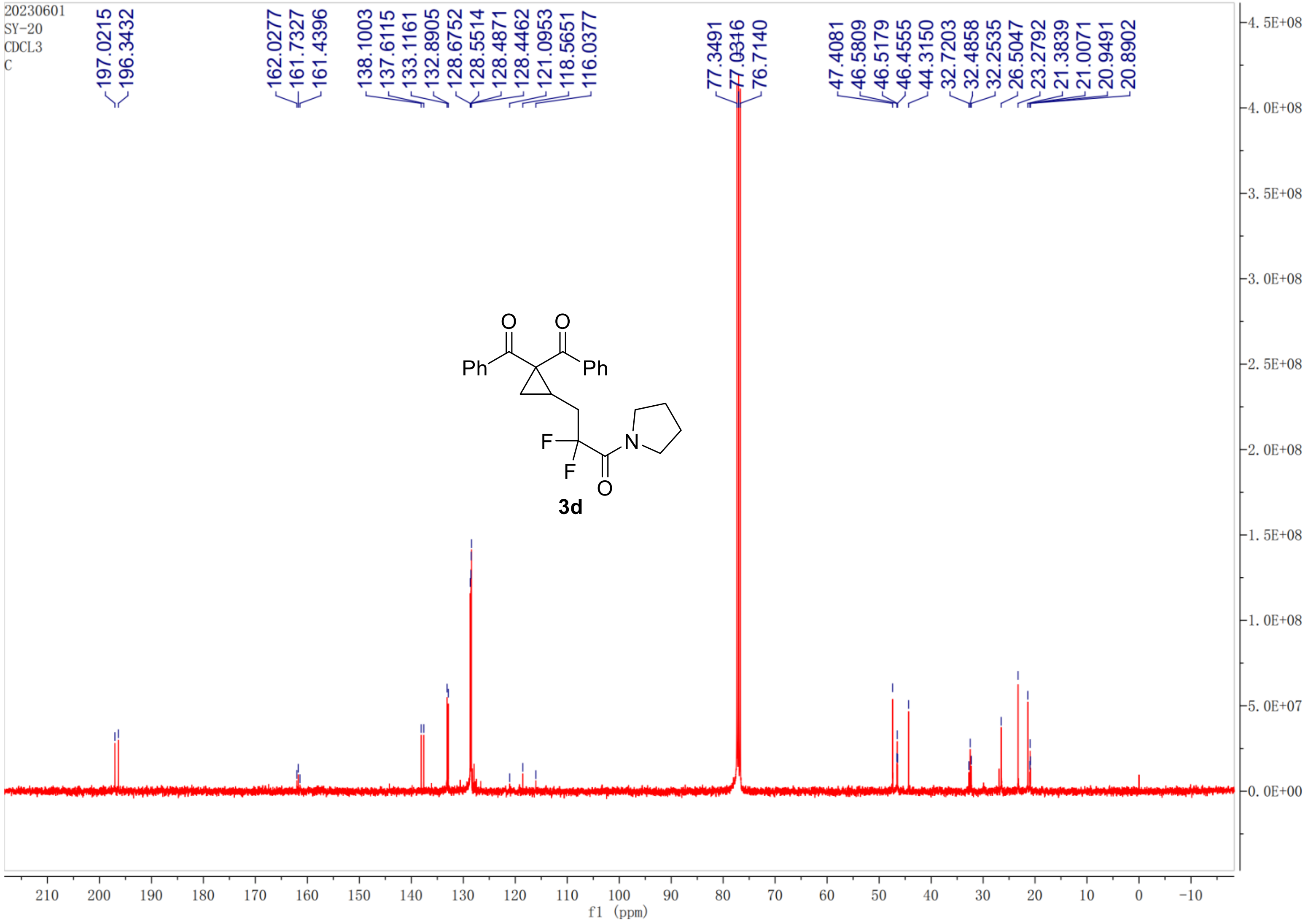
1.8994
1.8834
1.8737
1.8619
1.8365
1.4921
1.4809
1.4704
1.4592
O
O
Ph
Ph
F
F
O
O
3c
3.83
2.21
5.23
3.00
1.12
1.26
1.00
1.03
1.08
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)
8.0E+08
7.5E+08
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07


20230531
SY-24
CDCL3
400M
F
-104.0616
-104.7577
-105.8327
-106.5278
Ph
O
O
Ph
F
F
O
O
3c
1.00
0.87
2.40E+09
2.30E+09
2.20E+09
2.10E+09
2.00E+09
1.90E+09
1.80E+09
1.70E+09
1.60E+09
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
−1.00E+08
−2.00E+08
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)

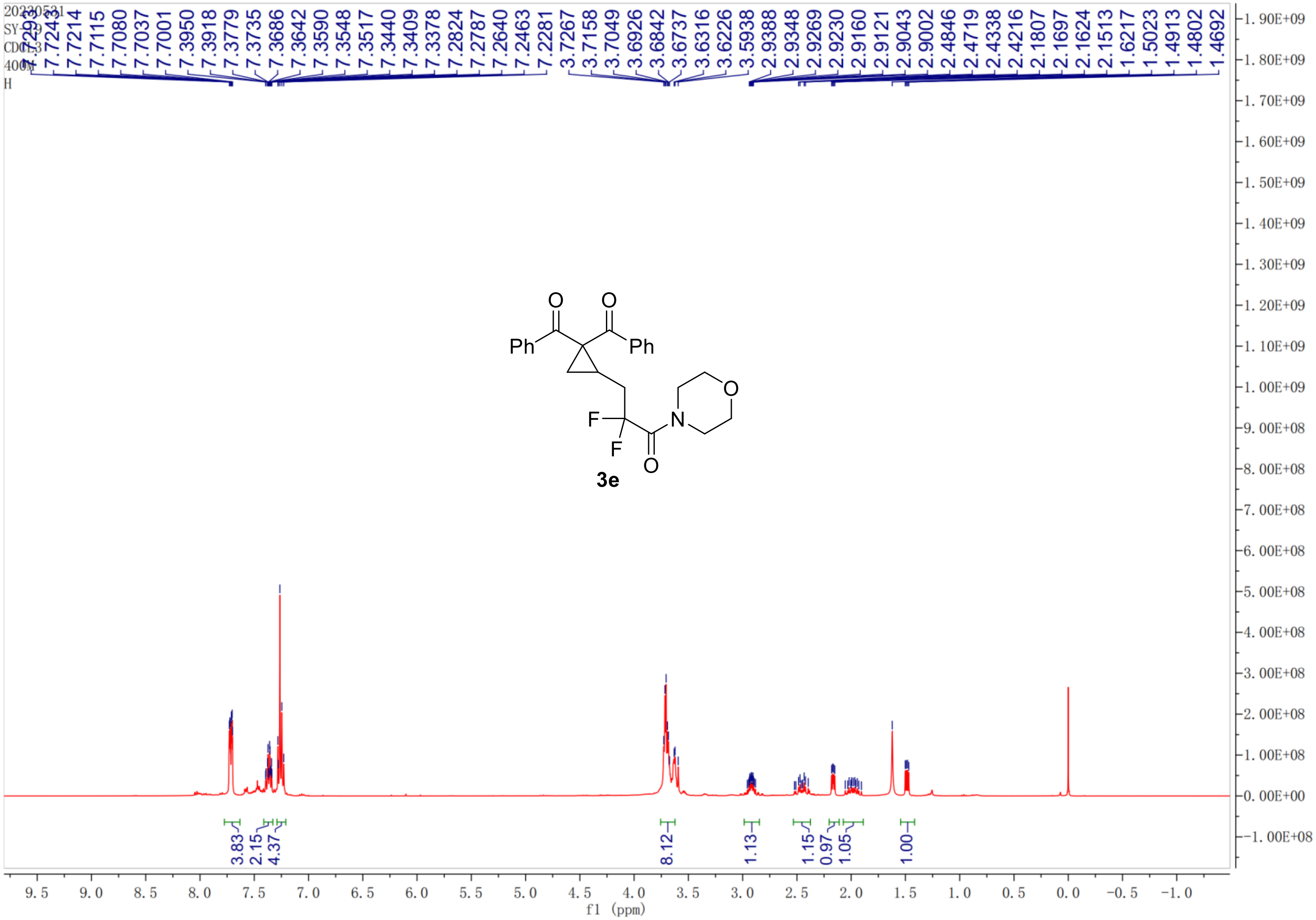

20230601
SY-24
CDCL3
C
196.5375
196.1063
164.5757
164.2555
163.9322
137.9049
137.3293
133.3342
133.0885
128.6700
128.6098
128.5180
118.0984
115.5956
113.0940
77.3402
77.0228
76.7054
53.4620
44.0469
33.1191
32.8828
32.6479
20.7941
20.1643
20.1010
20.0492
Ph
Ph
O
O
F
F
O
O
3c
1. 10E+08
1. 00E+08
9. 00E+07
8. 00E+07
7. 00E+07
6. 00E+07
5. 00E+07
4. 00E+07
3. 00E+07
2. 00E+07
1. 00E+07
0. 00E+00
−1. 00E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

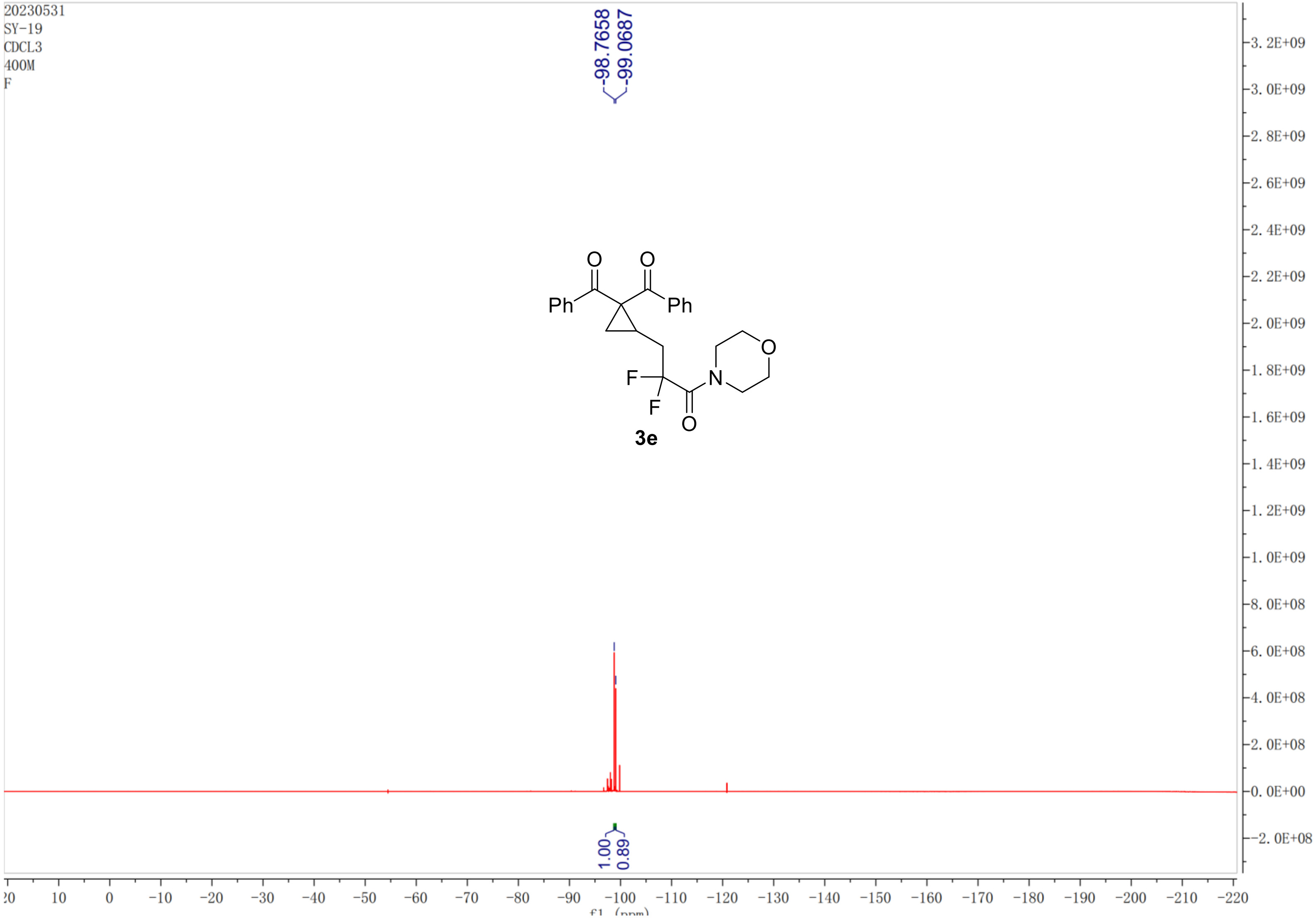

20230531
SY-?0
CDCl3
400M
H
7.7291
7.7276
7.7267
7.7202
7.7186
7.7174
7.7142
7.7093
7.7053
7.7003
7.6963
7.3860
7.3831
7.3698
7.3656
7.3598
7.3515
7.3466
7.3361
7.3331
7.2757
7.2597
7.2562
7.2401
7.2211
3.6783
3.6616
3.6446
3.5198
3.5024
3.4852
2.9140
2.9023
2.8952
2.8837
2.4149
2.1704
2.1593
2.1521
2.1411
1.9807
1.9616
1.9446
1.9281
1.9123
1.8753
1.8606
1.8427
1.8260
1.4898
1.4789
1.4678
1.4569
-0.0050
O
O
Ph
Ph
N
F
F
O
3d
3.94
2.43
4.17
2.17
2.29
1.13
1.00
1.14
3.03
2.15
1.00
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
−1.00E+08
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
f1 (ppm)

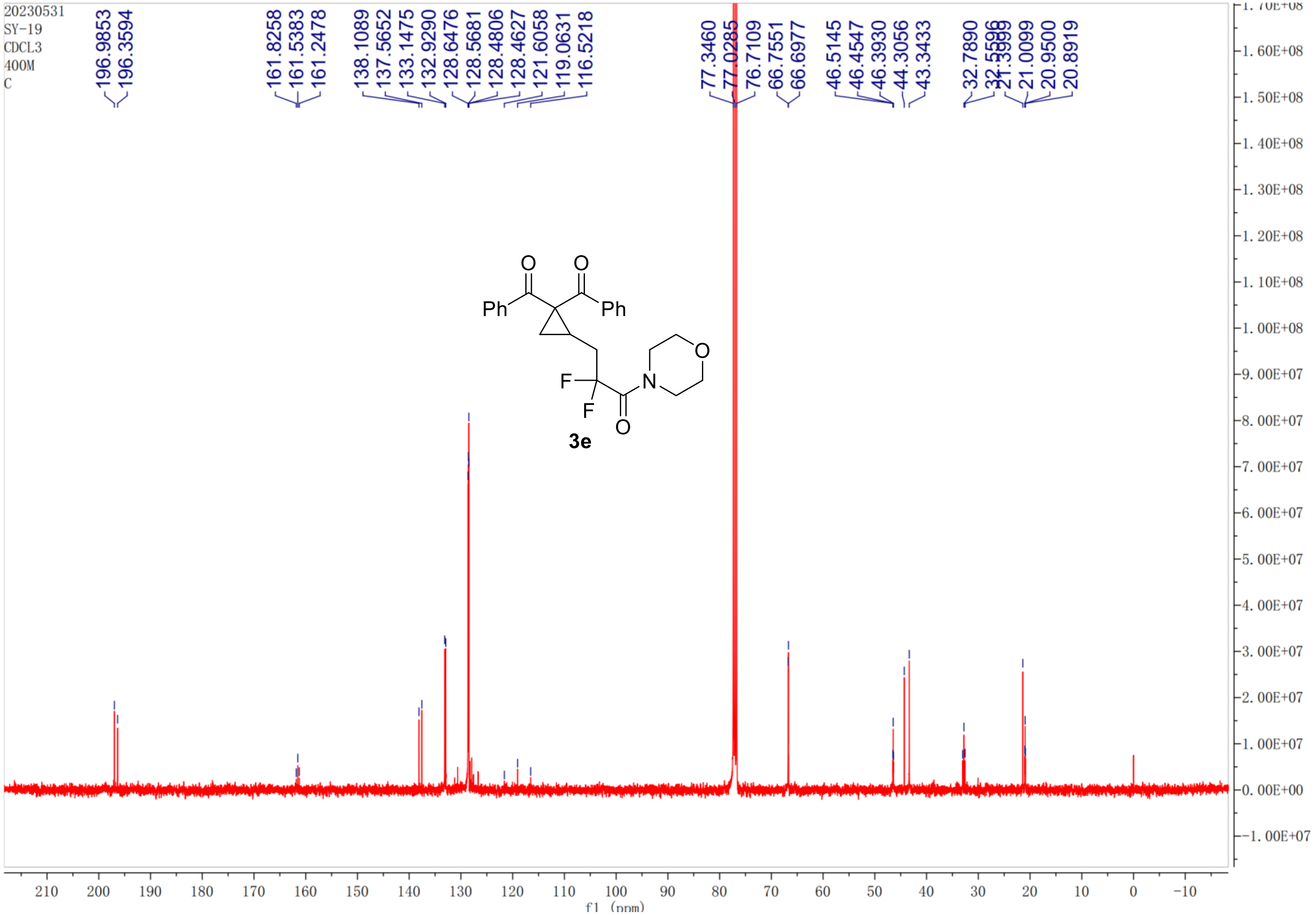

20230531
SY-20
CDCL3
400M
F
-102.8014
-102.8121
Ph
O
O
Ph
F
F
N
O
3d
2.00
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
f1 (ppm)

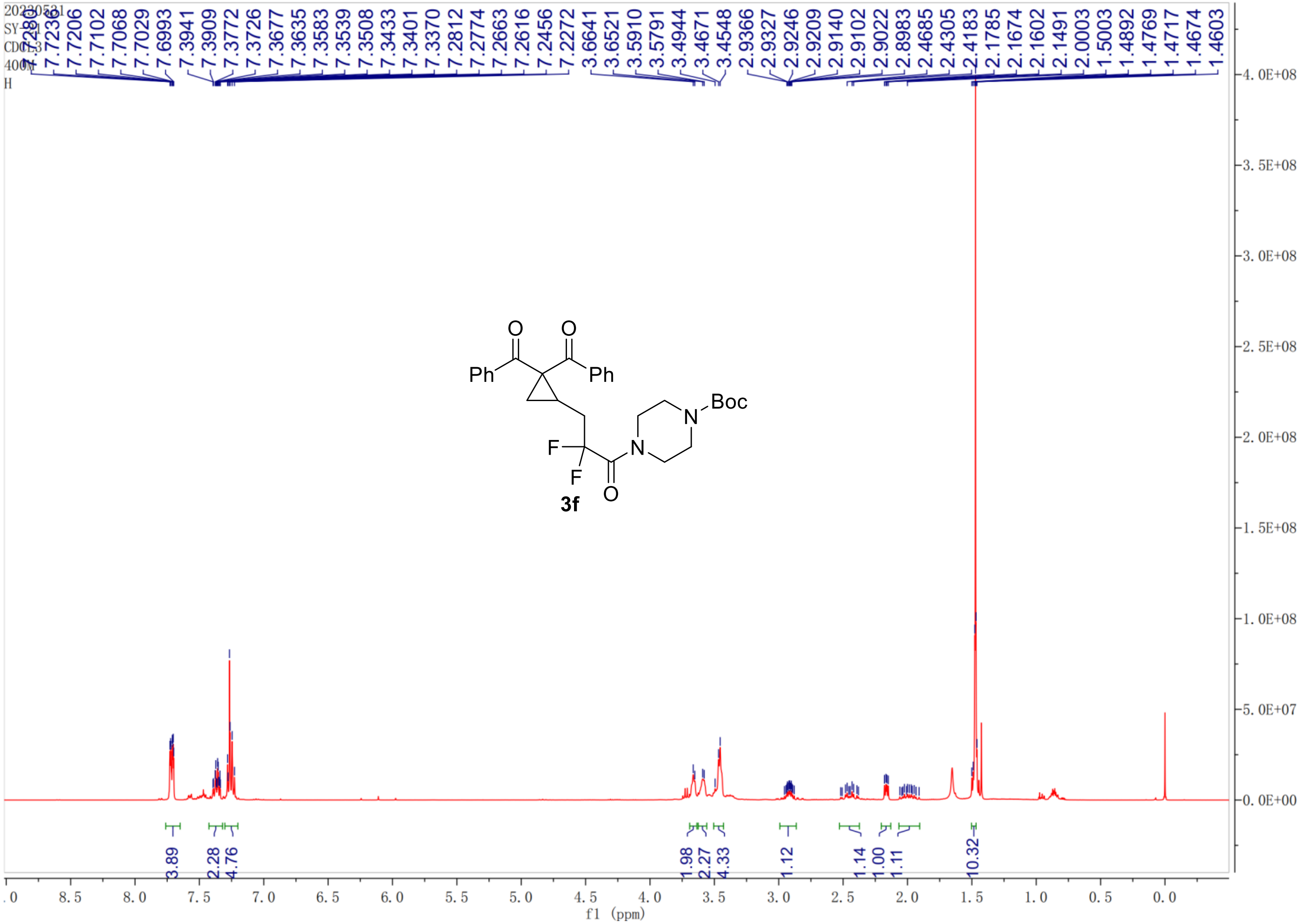

20230601
SY-20
CDCL3
C
197.0215
196.3432
162.0277
161.7327
161.4396
138.1003
137.6115
133.1161
132.8905
128.6752
128.5514
128.4871
128.4462
121.0953
118.5651
116.0377
77.3491
77.0316
76.7140
47.4081
46.5809
46.5179
46.4555
44.3150
32.7203
32.4858
32.2535
26.5047
23.2792
21.3839
21.0071
20.9491
20.8902
Ph
O
O
Ph
F
F
N
O
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

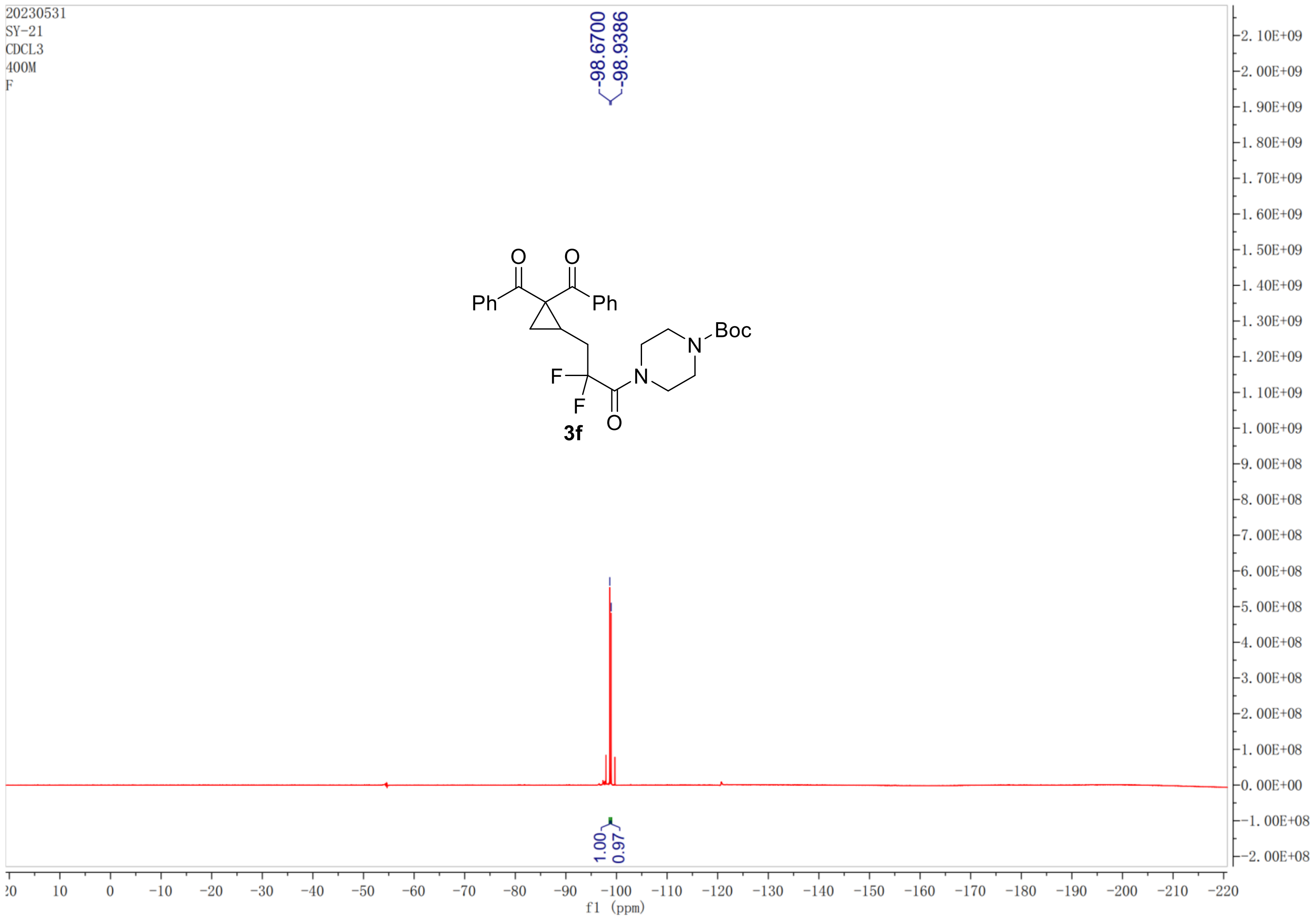
**3d**

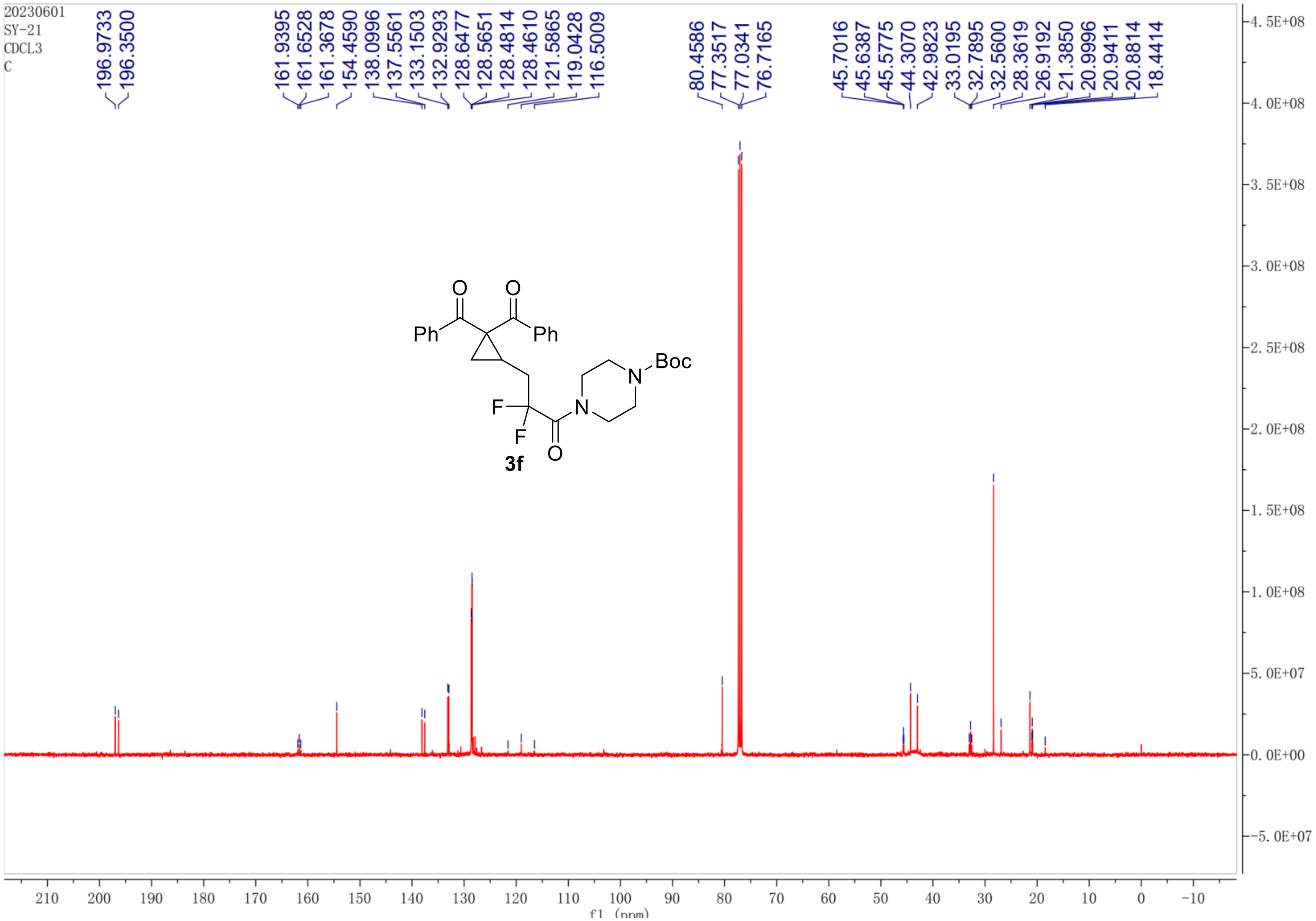

20230531
SY-19
CDCL3
400M
H
7.7293
7.7243
7.7214
7.7115
7.7080
7.7037
7.7001
7.3950
7.3918
7.3779
7.3735
7.3686
7.3642
7.3590
7.3548
7.3517
7.3440
7.3409
7.3378
7.2824
7.2787
7.2640
7.2463
7.2281
3.7267
3.7158
3.7049
3.6926
3.6842
3.6737
3.6316
3.6226
3.5938
2.9388
2.9348
2.9269
2.9230
2.9160
2.9121
2.9043
2.9002
2.4846
2.4719
2.4338
2.4216
2.1807
2.1697
2.1624
2.1513
1.6217
1.5023
1.4913
1.4802
1.4692
O
O
Ph
Ph
O
N
F
F
O
3e
3.83
2.15
4.37
8.12
1.13
1.15
0.97
1.05
1.00
9. 5
9. 0
8. 5
8. 0
7. 5
7. 0
6. 5
6. 0
5. 5
5. 0
4. 5
4. 0
3. 5
3. 0
2. 5
2. 0
1. 5
1. 0
0. 5
0. 0
−0. 5
−1. 0
f1 (ppm)
1. 90E+09
1. 80E+09
1. 70E+09
1. 60E+09
1. 50E+09
1. 40E+09
1. 30E+09
1. 20E+09
1. 10E+09
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00
−1. 00E+08


20230531
SY-19
CDCL3
400M
F
-98.7658
-99.0687
O
O
Ph
Ph
O
N
F
F
O
3e
3.2E+09
3.0E+09
2.8E+09
2.6E+09
2.4E+09
2.2E+09
2.0E+09
1.8E+09
1.6E+09
1.4E+09
1.2E+09
1.0E+09
8.0E+08
6.0E+08
4.0E+08
2.0E+08
0.0E+00
-2.0E+08
1.00
0.89
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
f1 (ppm)

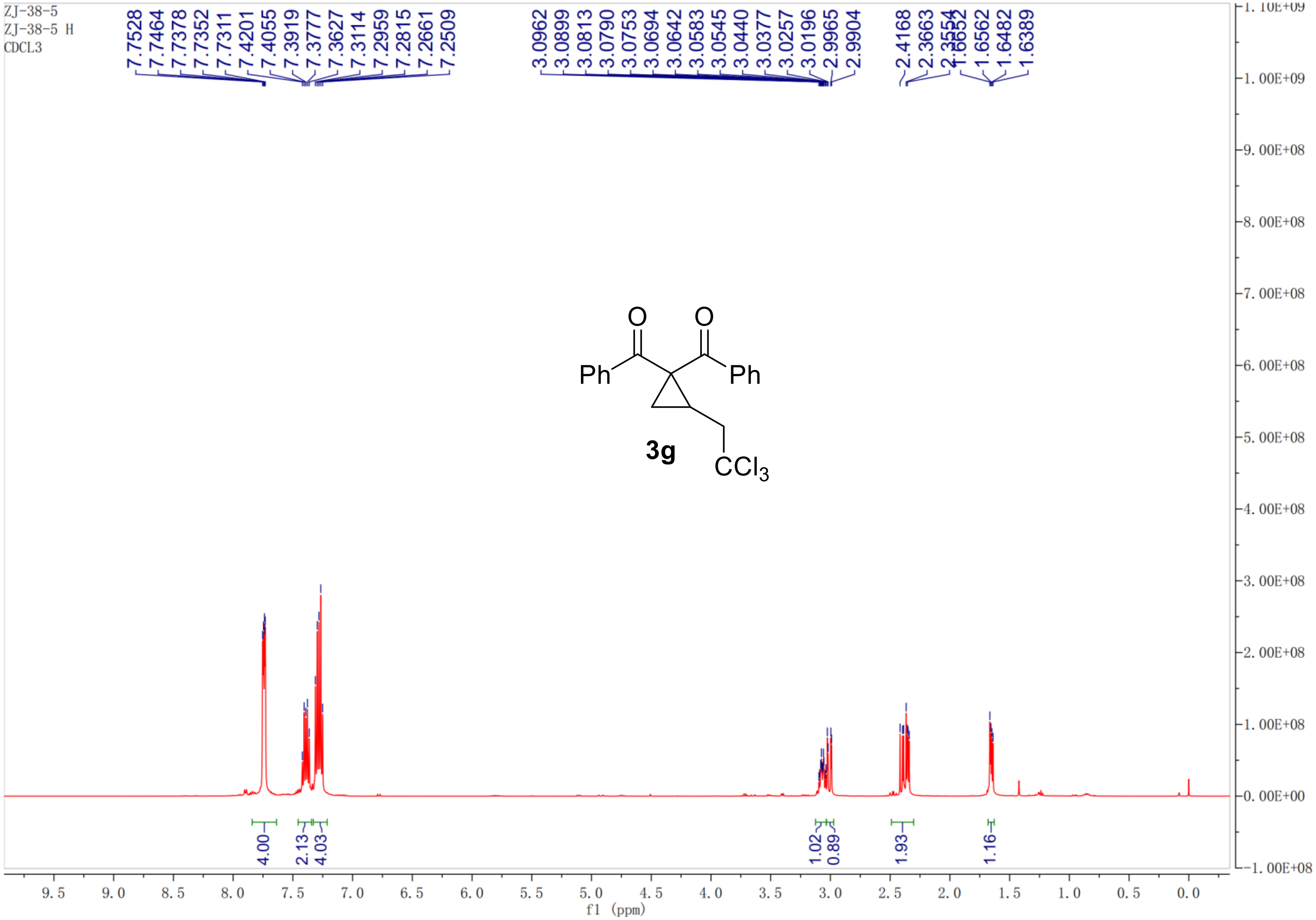

20230531
SY-19
CDCL3
400M
C
196.9853
196.3594
161.8258
161.5383
161.2478
138.1089
137.5652
133.1475
132.9290
128.6476
128.5681
128.4806
128.4627
121.6058
119.0631
116.5218
77.3460
77.0285
76.7109
66.7551
66.6977
46.5145
46.4547
46.3930
44.3056
43.3433
32.7890
32.5596
21.3999
21.0099
20.9500
20.8919
O
O
Ph
Ph
O
N
F
F
O
3e
1.70E+08
1.60E+08
1.50E+08
1.40E+08
1.30E+08
1.20E+08
1.10E+08
1.00E+08
9.00E+07
8.00E+07
7.00E+07
6.00E+07
5.00E+07
4.00E+07
3.00E+07
2.00E+07
1.00E+07
0.00E+00
-1.00E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

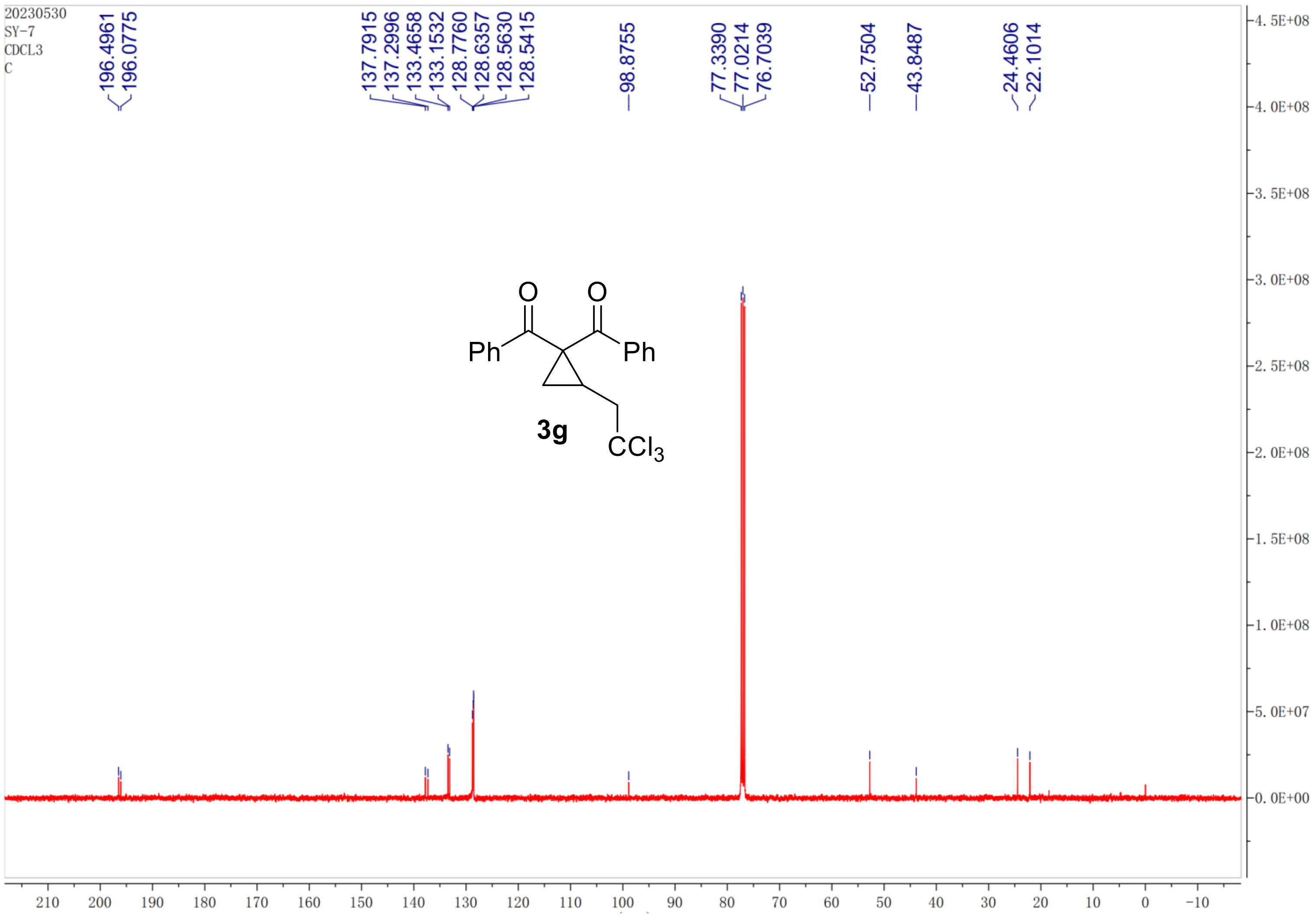

20230521
SY-2-1
CDCL3
400M
H
7.7280
7.7236
7.7206
7.7102
7.7068
7.7029
7.6993
7.3941
7.3909
7.3772
7.3726
7.3677
7.3635
7.3583
7.3539
7.3508
7.3433
7.3401
7.3370
7.2812
7.2774
7.2663
7.2616
7.2456
7.2272
3.6641
3.6521
3.5910
3.5791
3.4944
3.4671
3.4548
2.9366
2.9327
2.9246
2.9209
2.9140
2.9102
2.9022
2.8983
2.4685
2.4305
2.4183
2.1785
2.1674
2.1602
2.1491
2.0003
1.5003
1.4892
1.4769
1.4717
1.4674
1.4603
O
O
Ph
Ph
N
Boc
F
N
F
O
3f
3.89
2.28
4.76
1.98
2.27
4.33
1.12
1.14
1.00
1.11
10.32
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

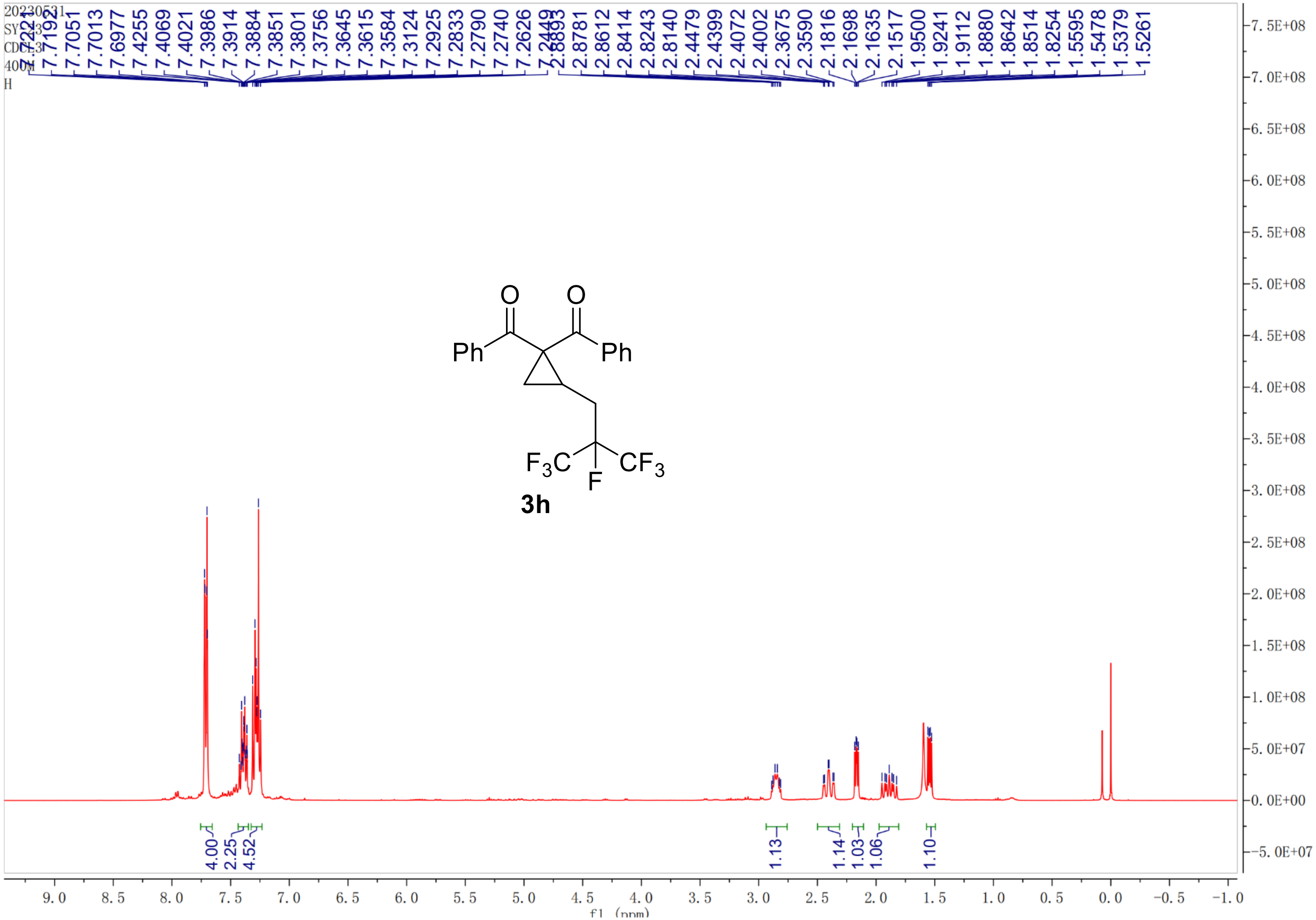

20230531
SY-21
CDCL3
400M
F
-98.6700
-98.9386
Ph
Ph
O
O
F
F
N
N
Boc
O
3f
1.00
0.97
f1 (ppm)
20 10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210 −220
2.10E+09 2.00E+09 1.90E+09 1.80E+09 1.70E+09 1.60E+09 1.50E+09 1.40E+09 1.30E+09 1.20E+09 1.10E+09 1.00E+09 9.00E+08 8.00E+08 7.00E+08 6.00E+08 5.00E+08 4.00E+08 3.00E+08 2.00E+08 1.00E+08 0.00E+00 −1.00E+08 −2.00E+08


20230601
SY-21
CDCL3
C
196.9733
196.3500
161.9395
161.6528
161.3678
154.4590
138.0996
137.5561
133.1503
132.9293
128.6477
128.5651
128.4814
128.4610
121.5865
119.0428
116.5009
80.4586
77.3517
77.0341
76.7165
45.7016
45.6387
45.5775
44.3070
42.9823
33.0195
32.7895
32.5600
28.3619
26.9192
21.3850
20.9996
20.9411
20.8814
18.4414
Ph
O
O
Ph
N
Boc
F
N
F
O
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
-5. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

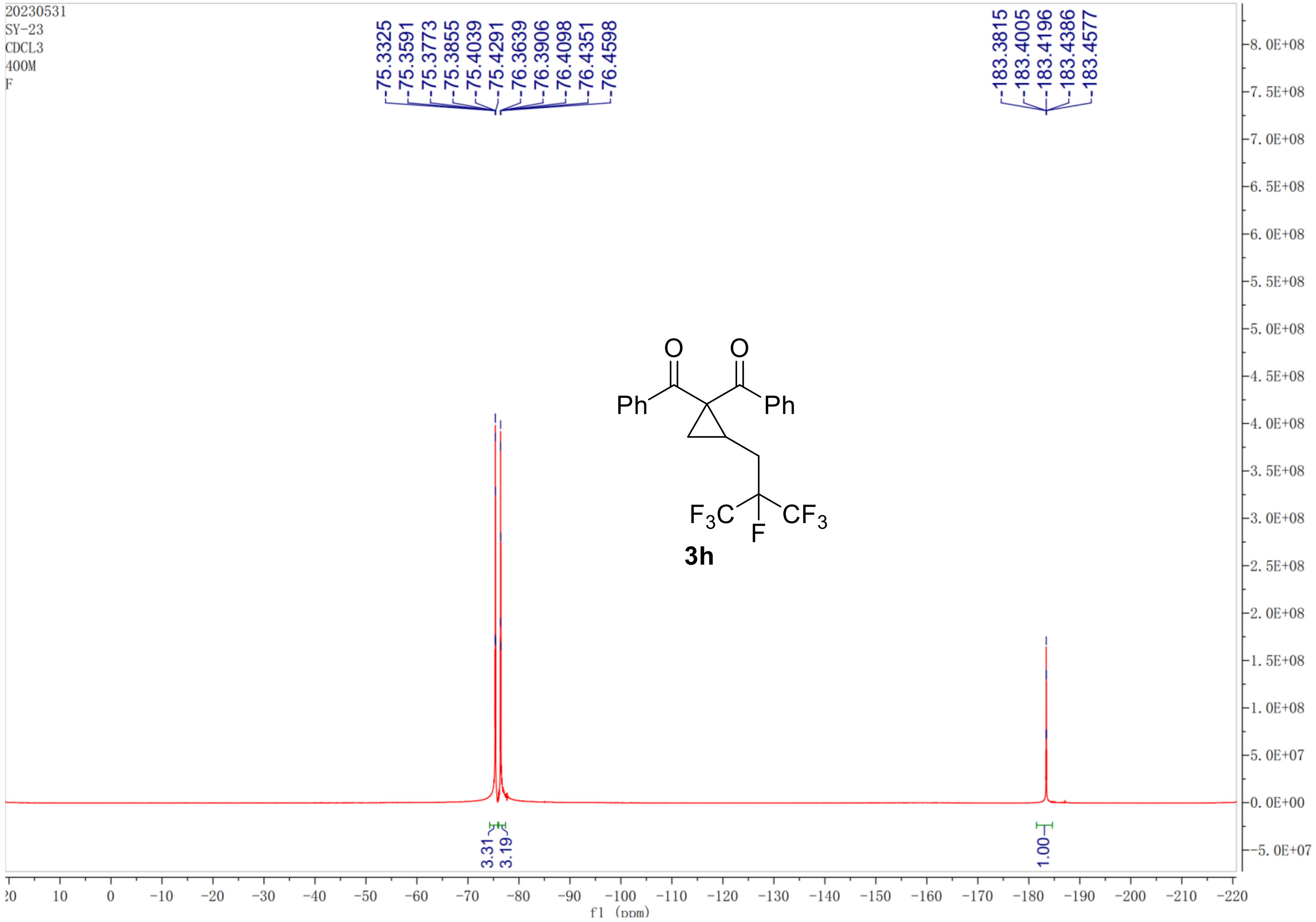
**3f**

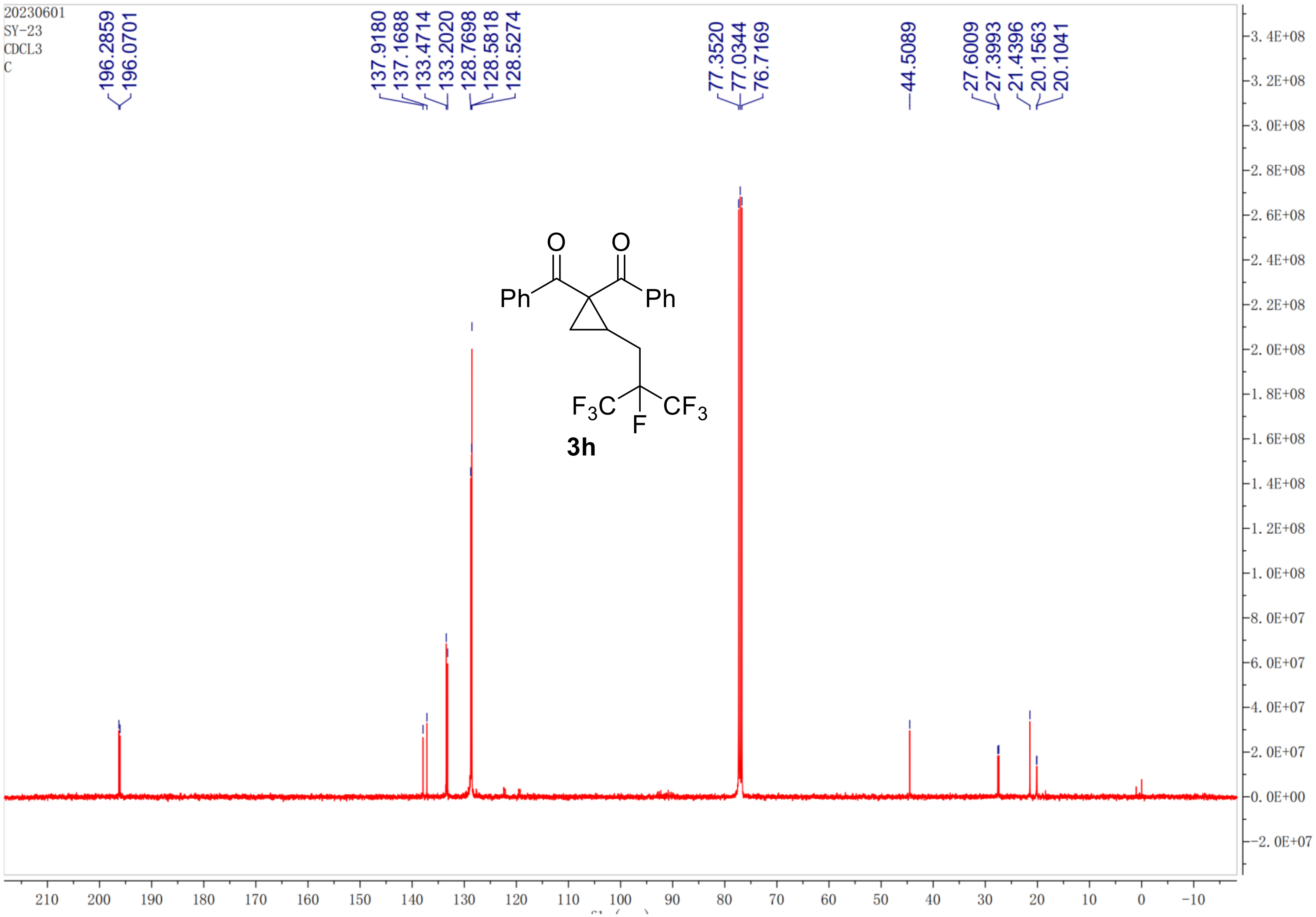

ZJ-38-5
ZJ-38-5 H
CDCL3
7.7528
7.7464
7.7378
7.7352
7.7311
7.4201
7.4055
7.3919
7.3777
7.3627
7.3114
7.2959
7.2815
7.2661
7.2509
3.0962
3.0899
3.0813
3.0790
3.0753
3.0694
3.0642
3.0583
3.0545
3.0440
3.0377
3.0257
3.0196
2.9965
2.9904
2.4168
2.3663
2.3554
1.6652
1.6562
1.6482
1.6389
O
O
Ph
Ph
CCl3
3g
4.00
2.13
4.03
1.02
0.89
1.93
1.16
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08


20230530
SY-7
CDCL3
C
196.4961
196.0775
137.7915
137.2996
133.4658
133.1532
128.7760
128.6357
128.5630
128.5415
98.8755
77.3390
77.0214
76.7039
52.7504
43.8487
24.4606
22.1014
O
O
Ph
Ph
3g
$CCl_3$
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10

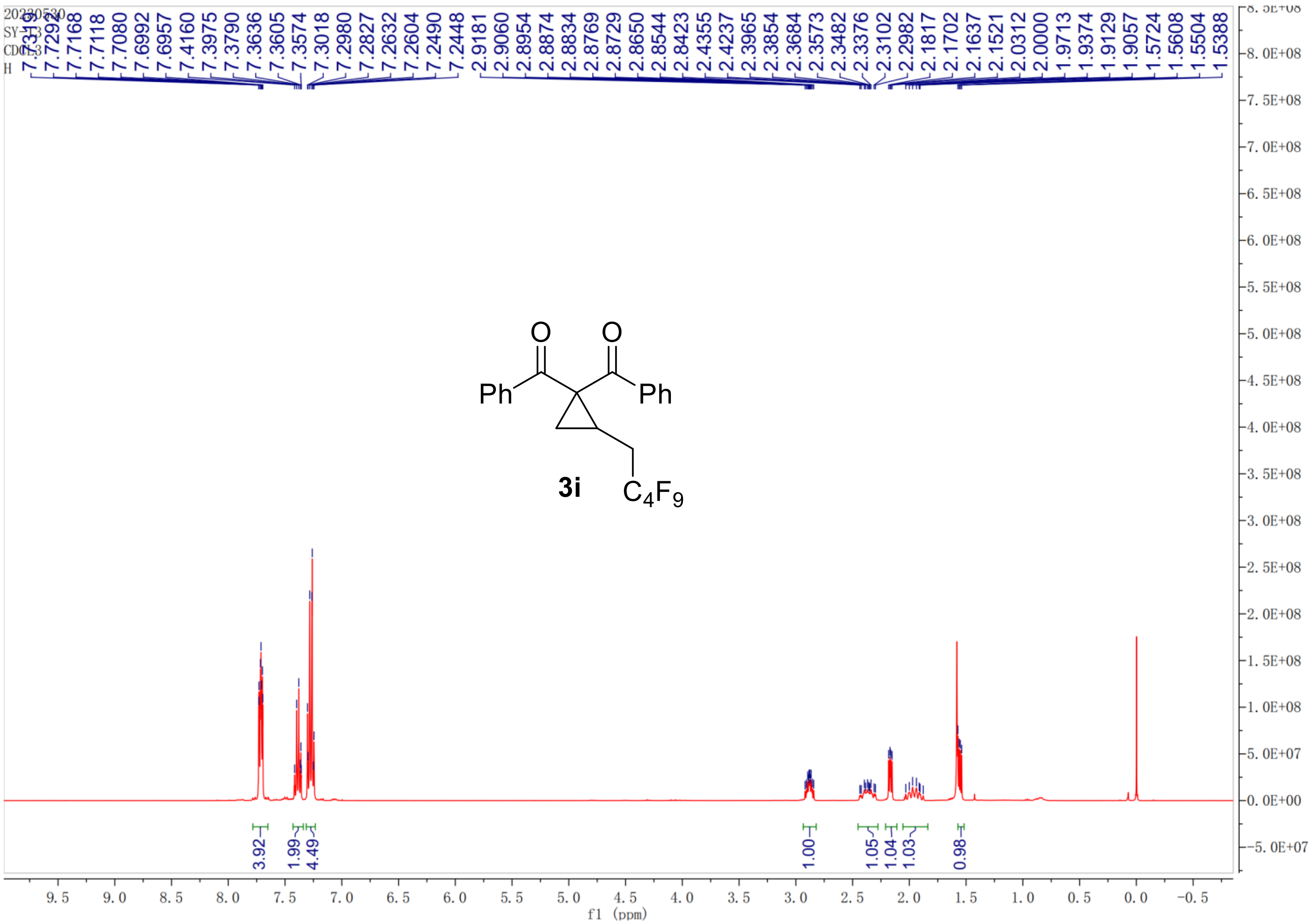

20230531
SY-23
CDCL3
400M
H
7.7221
7.7192
7.7051
7.7013
7.6977
7.4255
7.4069
7.4021
7.3986
7.3914
7.3884
7.3851
7.3801
7.3756
7.3645
7.3615
7.3584
7.3124
7.2925
7.2833
7.2790
7.2740
7.2626
7.2449
2.8893
2.8781
2.8612
2.8414
2.8243
2.8140
2.4479
2.4399
2.4072
2.4002
2.3675
2.3590
2.1816
2.1698
2.1635
2.1517
1.9500
1.9241
1.9112
1.8880
1.8642
1.8514
1.8254
1.5595
1.5478
1.5379
1.5261
O
O
Ph
Ph
$F_3C$
$CF_3$
F
4.00
2.25
4.52
1.13
1.14
1.03
1.06
1.10
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
f1 (ppm)
7.5E+08
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07

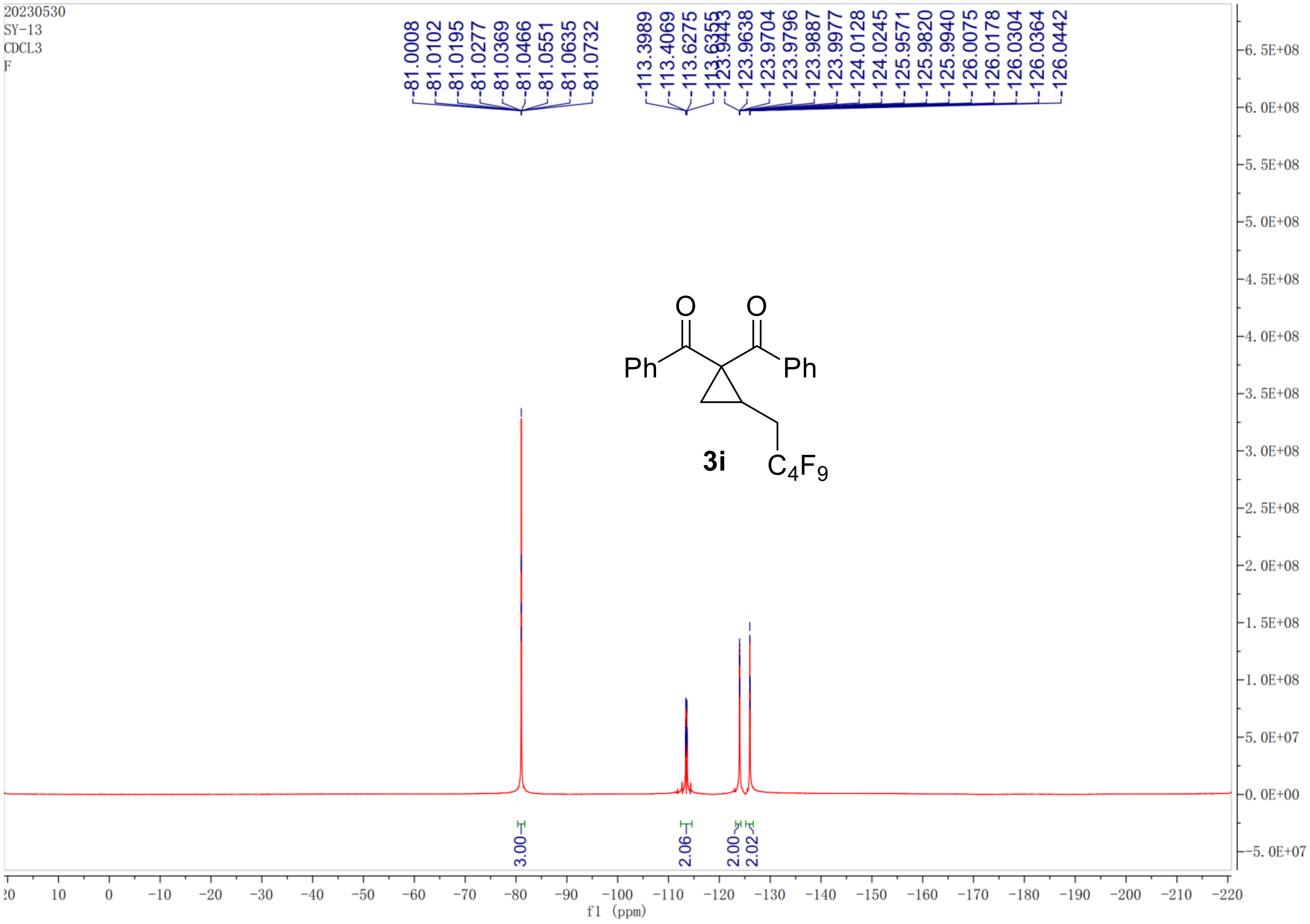
**3h**


20230531
SY-23
CDCL3
400M
F
-75.3325
-75.3591
-75.3773
-75.3855
-75.4039
-75.4291
-76.3639
-76.3906
-76.4098
-76.4351
-76.4598
-183.3815
-183.4005
-183.4196
-183.4386
-183.4577
O
O
Ph
Ph
F3C
CF3
F
3h
3.31
3.19
1.00
8.0E+08
7.5E+08
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
f1 (ppm)


20230601
SY-23
CDCL3
C
196.2859
196.0701
137.9180
137.1688
133.4714
133.2020
128.7698
128.5818
128.5274
77.3520
77.0344
76.7169
44.5089
27.6009
27.3993
21.4396
20.1563
20.1041
O
O
Ph
Ph
F3C
CF3
F
3.4E+08
3.2E+08
3.0E+08
2.8E+08
2.6E+08
2.4E+08
2.2E+08
2.0E+08
1.8E+08
1.6E+08
1.4E+08
1.2E+08
1.0E+08
8.0E+07
6.0E+07
4.0E+07
2.0E+07
0.0E+00
-2.0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10

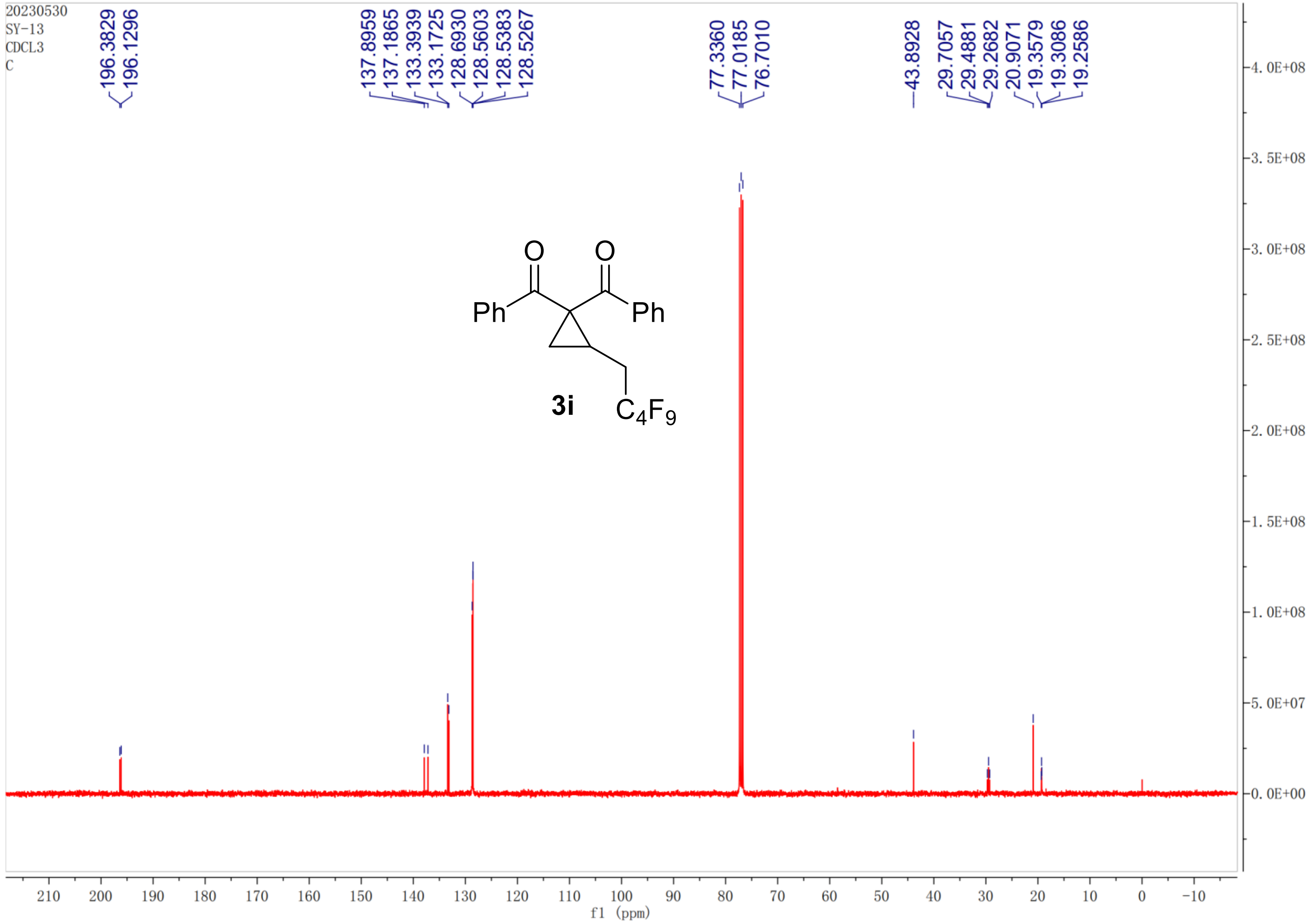
**3h**

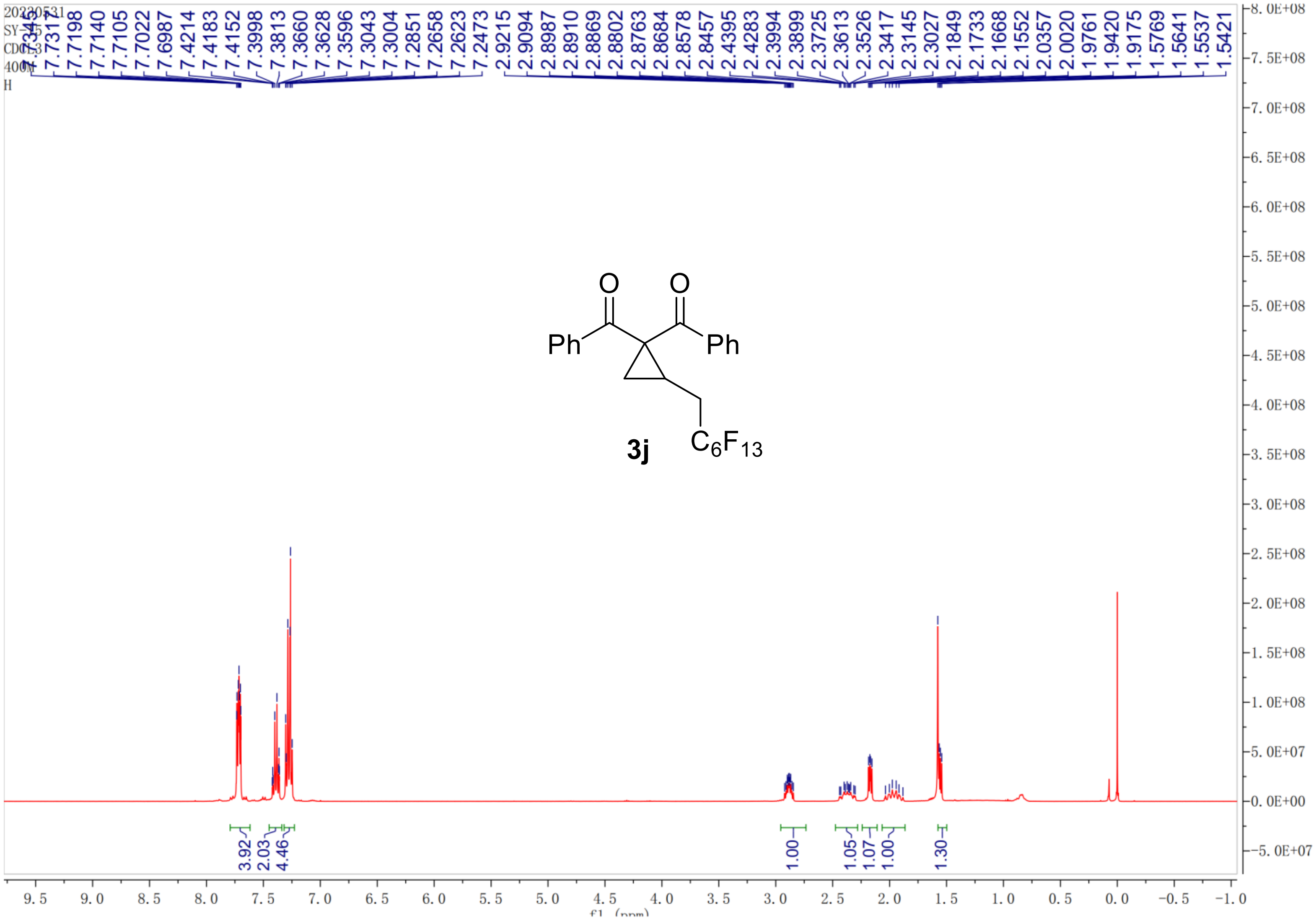

20230530
SY-1-3
CDCL3
H
7.7319
7.7292
7.7168
7.7118
7.7080
7.6992
7.6957
7.4160
7.3975
7.3790
7.3636
7.3605
7.3574
7.3018
7.2980
7.2827
7.2632
7.2604
7.2490
7.2448
2.9181
2.9060
2.8954
2.8874
2.8834
2.8769
2.8729
2.8650
2.8544
2.8423
2.4355
2.4237
2.3965
2.3854
2.3684
2.3573
2.3482
2.3376
2.3102
2.2982
2.1817
2.1702
2.1637
2.1521
2.0312
2.0000
1.9713
1.9374
1.9129
1.9057
1.5724
1.5608
1.5504
1.5388
O
O
Ph
Ph
C4F9
3i
3.92
1.99
4.49
1.00
1.05
1.04
1.03
0.98
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)
8.5E+08
8.0E+08
7.5E+08
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07

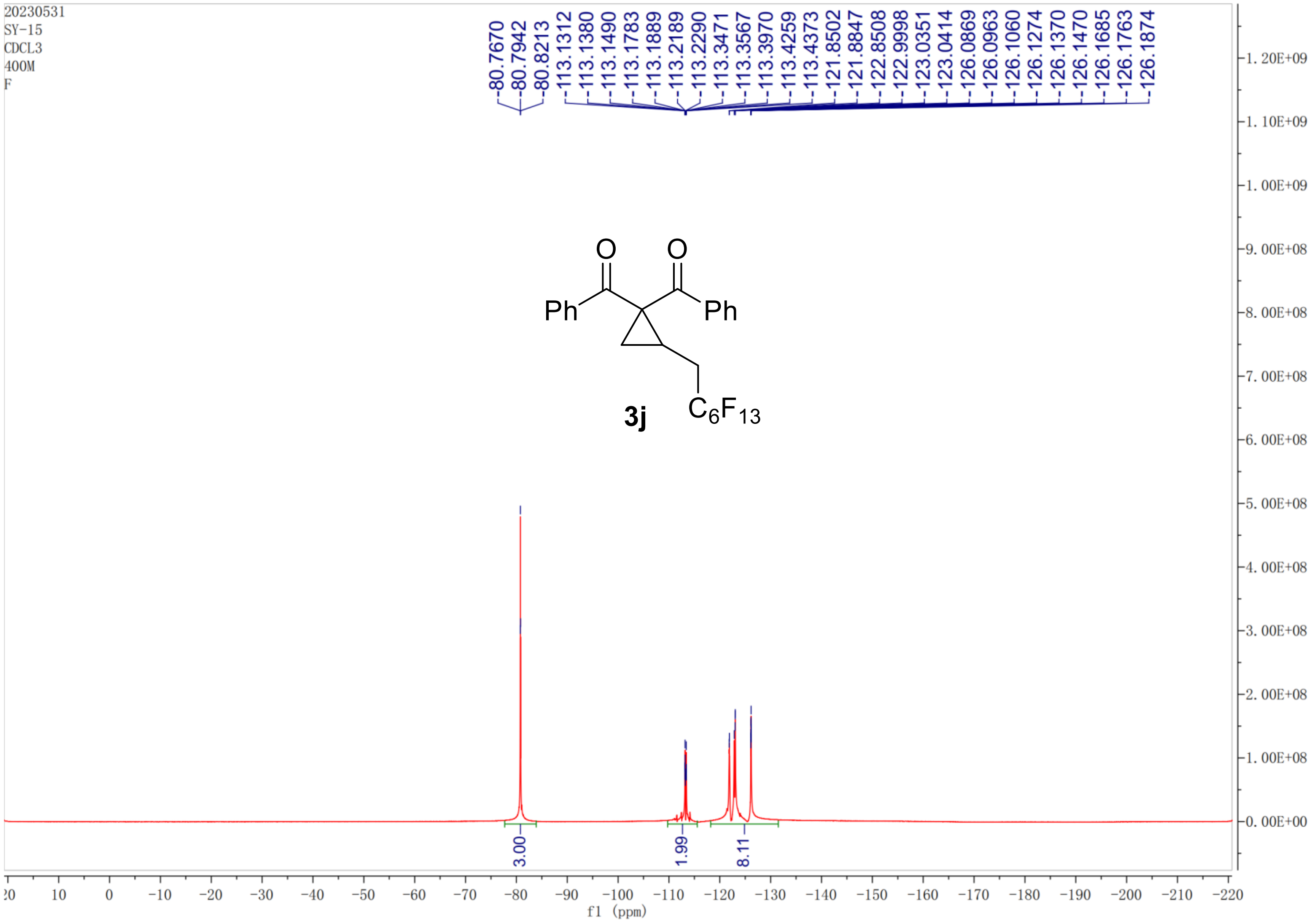


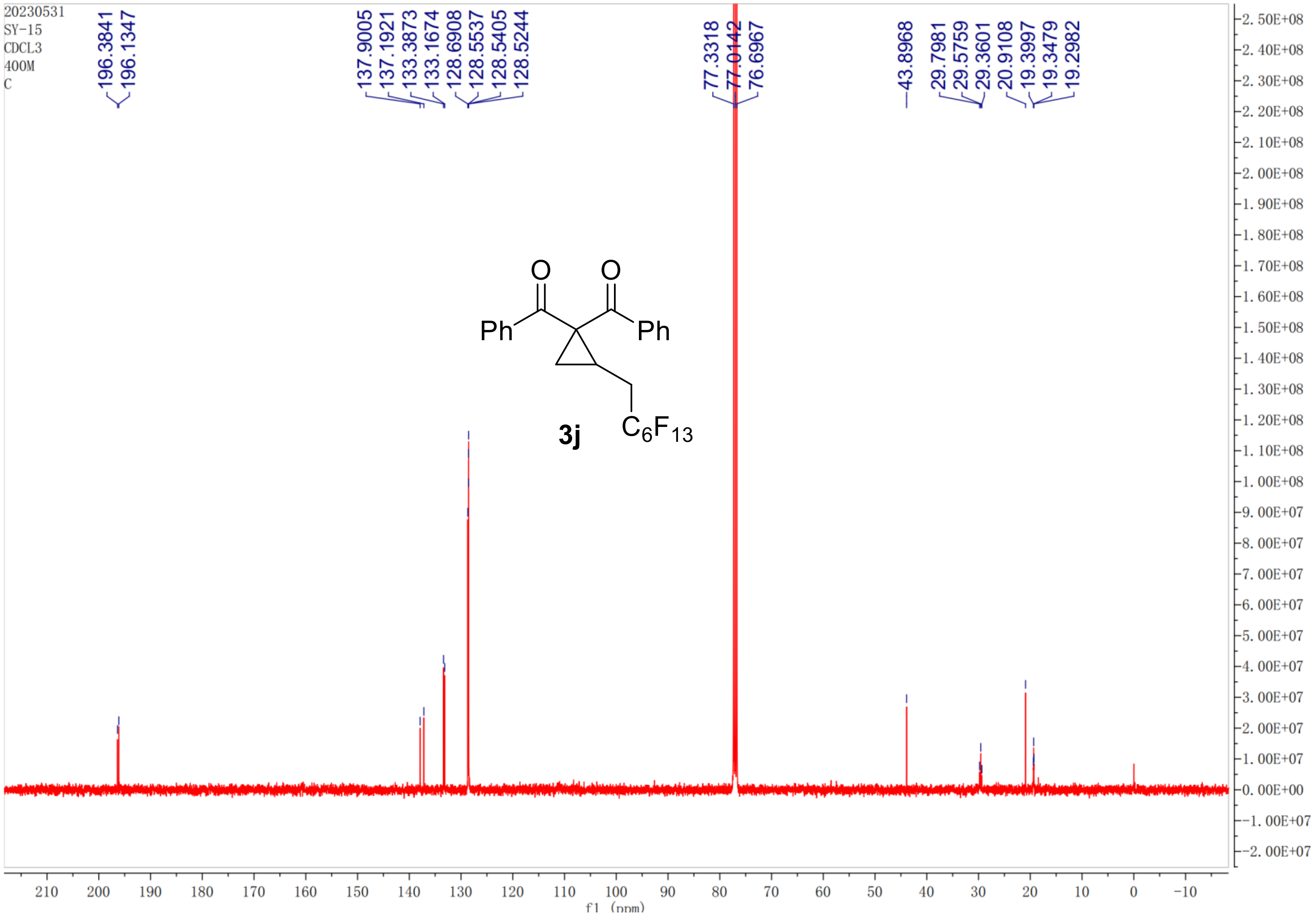
**3i**

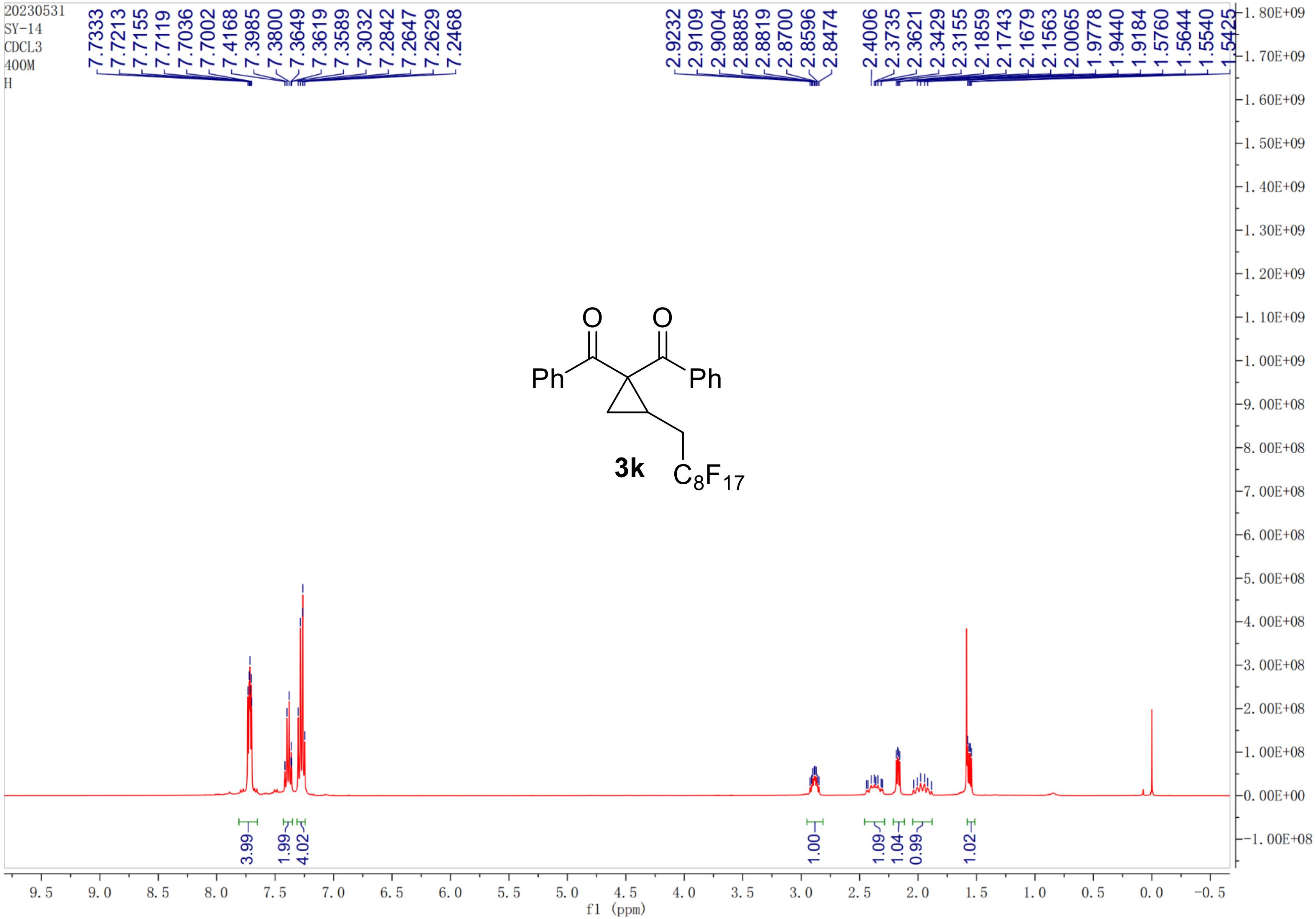
20230530
SY-13
CDCL3
F
-81.0008
-81.0102
-81.0195
-81.0277
-81.0369
-81.0466
-81.0551
-81.0635
-81.0732
-113.3989
-113.4069
-113.6275
-113.6355
-123.9443
-123.9638
-123.9704
-123.9796
-123.9887
-123.9977
-124.0128
-124.0245
-125.9571
-125.9820
-125.9940
-126.0075
-126.0178
-126.0304
-126.0364
-126.0442
O
O
Ph
Ph
$C_4F_9$
3.00
2.06
2.00
2.02
6. 5E+08
6. 0E+08
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
-5. 0E+07
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
f1 (ppm)


20230530
SY-13
CDCL3
C
196.3829
196.1296
137.8959
137.1865
133.3939
133.1725
128.6930
128.5603
128.5383
128.5267
77.3360
77.0185
76.7010
43.8928
29.7057
29.4881
29.2682
20.9071
19.3579
19.3086
19.2586
O
O
Ph
Ph
3i
$C_4F_9$
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

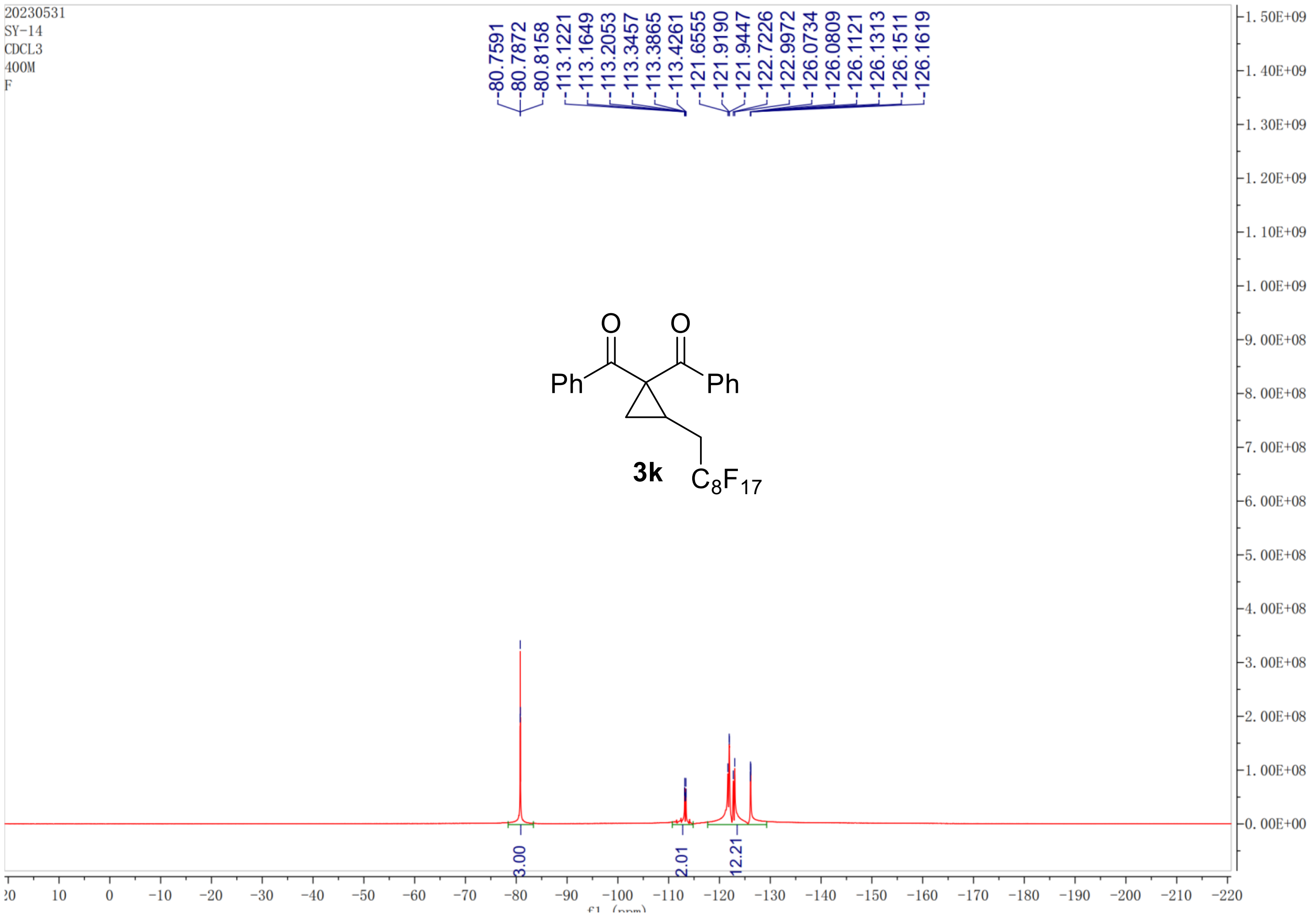

20220531
SY-5
CDCl3
400M
H
7.7345
7.7317
7.7198
7.7140
7.7105
7.7022
7.6987
7.4214
7.4183
7.4152
7.3998
7.3813
7.3660
7.3628
7.3596
7.3043
7.3004
7.2851
7.2658
7.2623
7.2473
2.9215
2.9094
2.8987
2.8910
2.8869
2.8802
2.8763
2.8684
2.8578
2.8457
2.4395
2.4283
2.3994
2.3899
2.3725
2.3613
2.3526
2.3417
2.3145
2.3027
2.1849
2.1733
2.1668
2.1552
2.0357
2.0020
1.9761
1.9420
1.9175
1.5769
1.5641
1.5537
1.5421
O
O
Ph
Ph
C6F13
3j
3.92
2.03
4.46
1.00
1.05
1.07
1.00
1.30
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
f1 (ppm)
8.0E+08
7.5E+08
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07

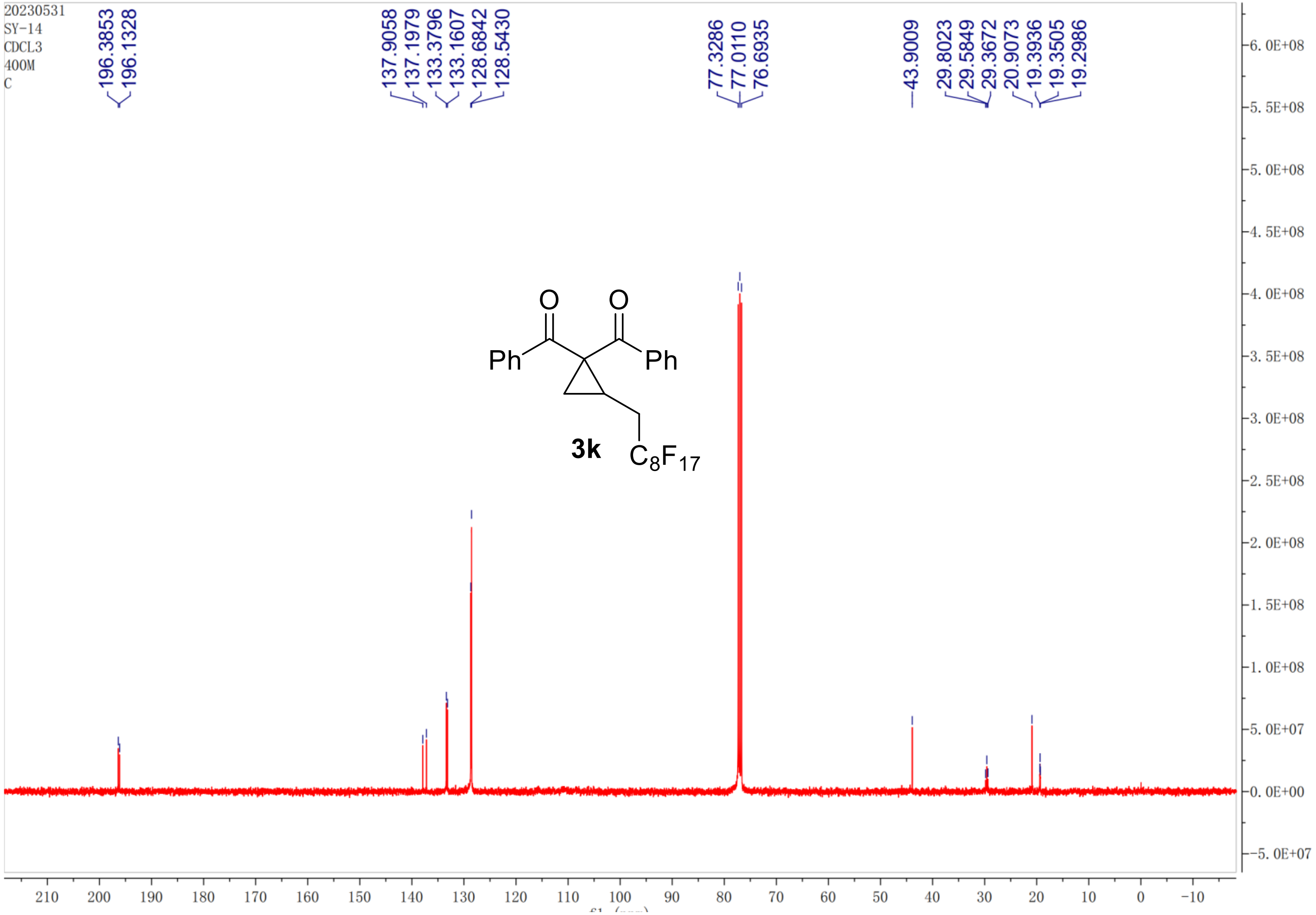

20230531
SY-15
CDCL3
400M
F
-80.7670
-80.7942
-80.8213
-113.1312
-113.1380
-113.1490
-113.1783
-113.1889
-113.2189
-113.2290
-113.3471
-113.3567
-113.3970
-113.4259
-113.4373
-121.8502
-121.8847
-122.8508
-122.9998
-123.0351
-123.0414
-126.0869
-126.0963
-126.1060
-126.1274
-126.1370
-126.1470
-126.1685
-126.1763
-126.1874
O
O
Ph
Ph
$C_6F_{13}$
3j
3.00
1.99
8.11
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)
1. 20E+09
1. 10E+09
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00

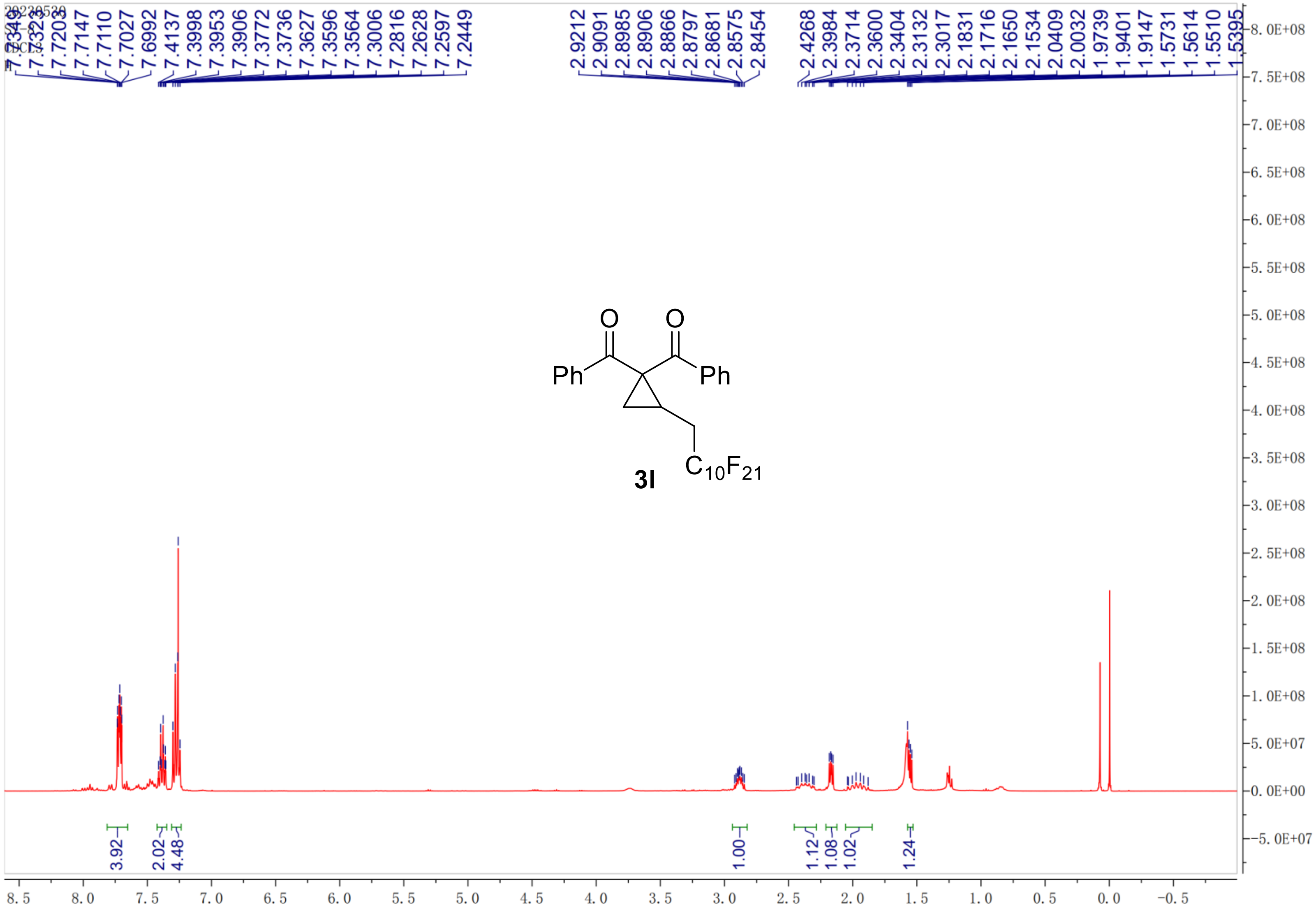

20230531
SY-15
CDCL3
400M
C
196.3841
196.1347
137.9005
137.1921
133.3873
133.1674
128.6908
128.5537
128.5405
128.5244
77.3318
77.0142
76.6967
43.8968
29.7981
29.5759
29.3601
20.9108
19.3997
19.3479
19.2982
O
O
Ph
Ph
$C_6F_{13}$
3j
2.50E+08
2.40E+08
2.30E+08
2.20E+08
2.10E+08
2.00E+08
1.90E+08
1.80E+08
1.70E+08
1.60E+08
1.50E+08
1.40E+08
1.30E+08
1.20E+08
1.10E+08
1.00E+08
9.00E+07
8.00E+07
7.00E+07
6.00E+07
5.00E+07
4.00E+07
3.00E+07
2.00E+07
1.00E+07
0.00E+00
-1.00E+07
-2.00E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

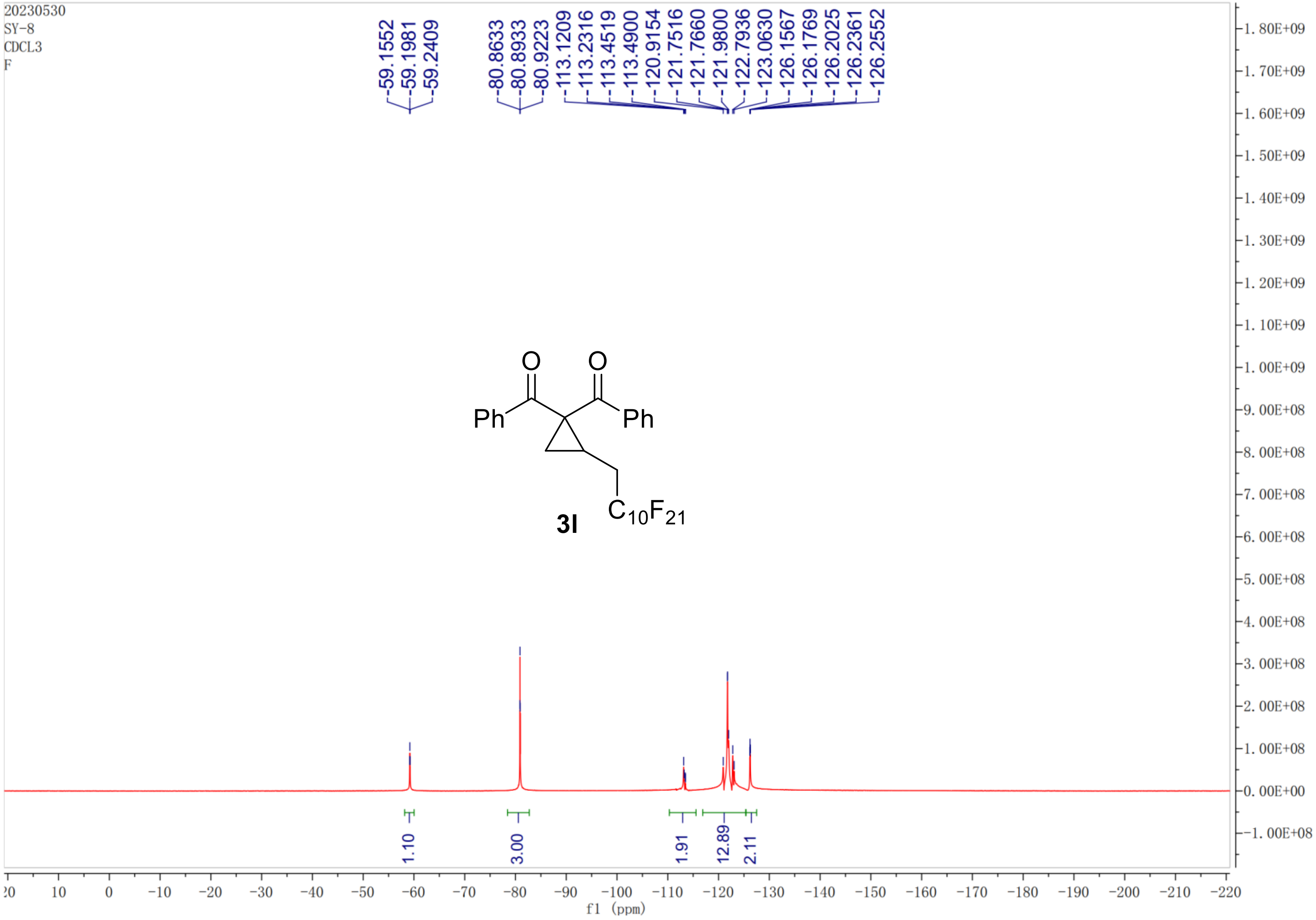

20230531
SY-14
CDCL3
400M
H
7.7333
7.7213
7.7155
7.7119
7.7036
7.7002
7.4168
7.3985
7.3800
7.3649
7.3619
7.3589
7.3032
7.2842
7.2647
7.2629
7.2468
2.9232
2.9109
2.9004
2.8885
2.8819
2.8700
2.8596
2.8474
2.4006
2.3735
2.3621
2.3429
2.3155
2.1859
2.1743
2.1679
2.1563
2.0065
1.9778
1.9440
1.9184
1.5760
1.5644
1.5540
1.5425
O
O
Ph
Ph
$C_8F_{17}$
3.99
1.99
4.02
1.00
1.09
1.04
0.99
1.02
9. 5
9. 0
8. 5
8. 0
7. 5
7. 0
6. 5
6. 0
5. 5
5. 0
4. 5
4. 0
3. 5
3. 0
2. 5
2. 0
1. 5
1. 0
0. 5
0. 0
-0. 5
f1 (ppm)
1. 80E+09
1. 70E+09
1. 60E+09
1. 50E+09
1. 40E+09
1. 30E+09
1. 20E+09
1. 10E+09
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00
-1. 00E+08

**3k**

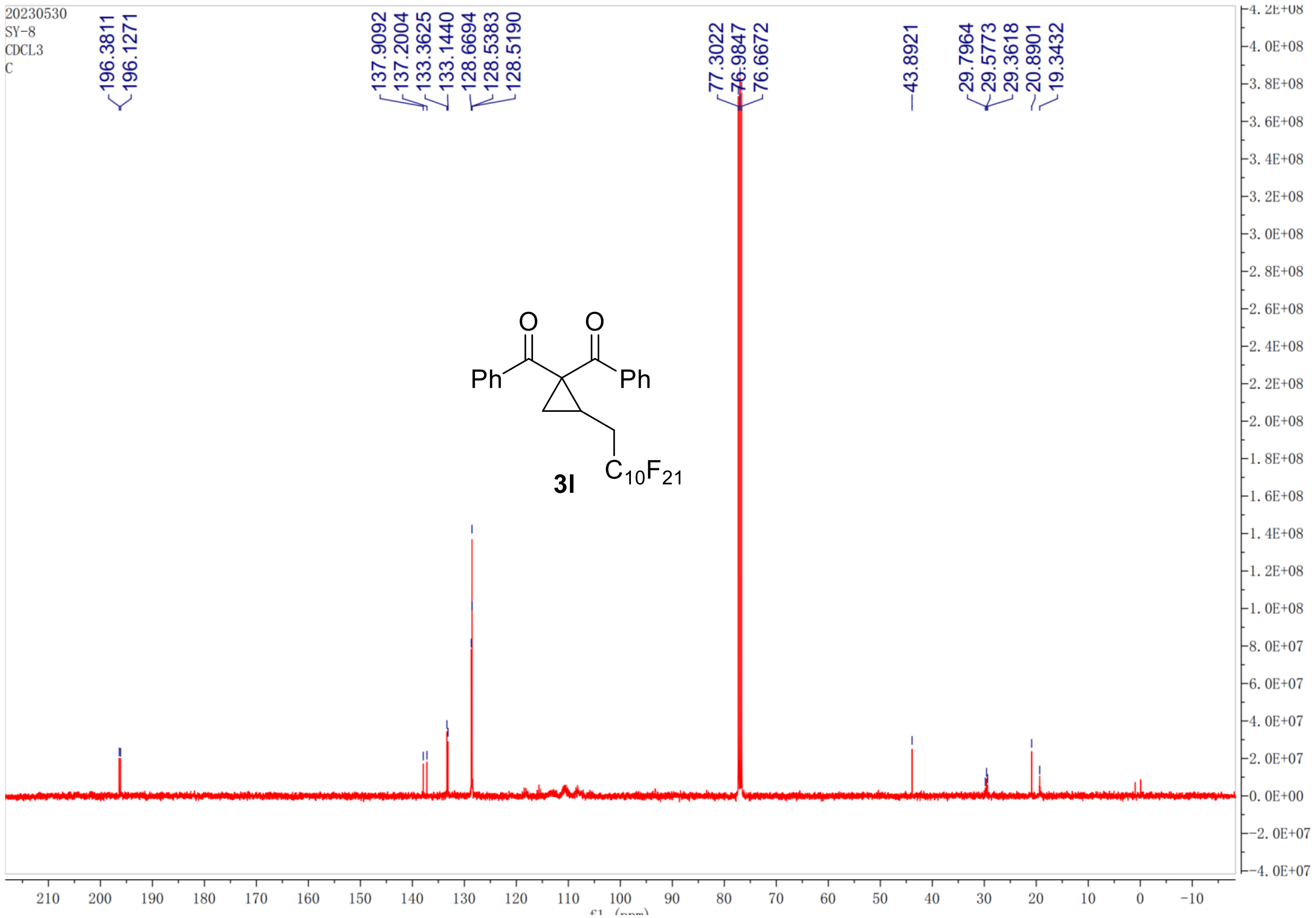

20230531
SY-14
CDCL3
400M
F
-80.7591
-80.7872
-80.8158
-113.1221
-113.1649
-113.2053
-113.3457
-113.3865
-113.4261
-121.6555
-121.9190
-121.9447
-122.7226
-122.9972
-126.0734
-126.0809
-126.1121
-126.1313
-126.1511
-126.1619
O
O
Ph
Ph
C8F17
3k
3.00
2.01
12.21
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)
1. 50E+09
1. 40E+09
1. 30E+09
1. 20E+09
1. 10E+09
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00


20230531
SY-14
CDCL3
400M
C
196.3853
196.1328
137.9058
137.1979
133.3796
133.1607
128.6842
128.5430
77.3286
77.0110
76.6935
43.9009
29.8023
29.5849
29.3672
20.9073
19.3936
19.3505
19.2986
O
O
Ph
Ph
3k
C8F17
6. 0E+08
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
-5. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10

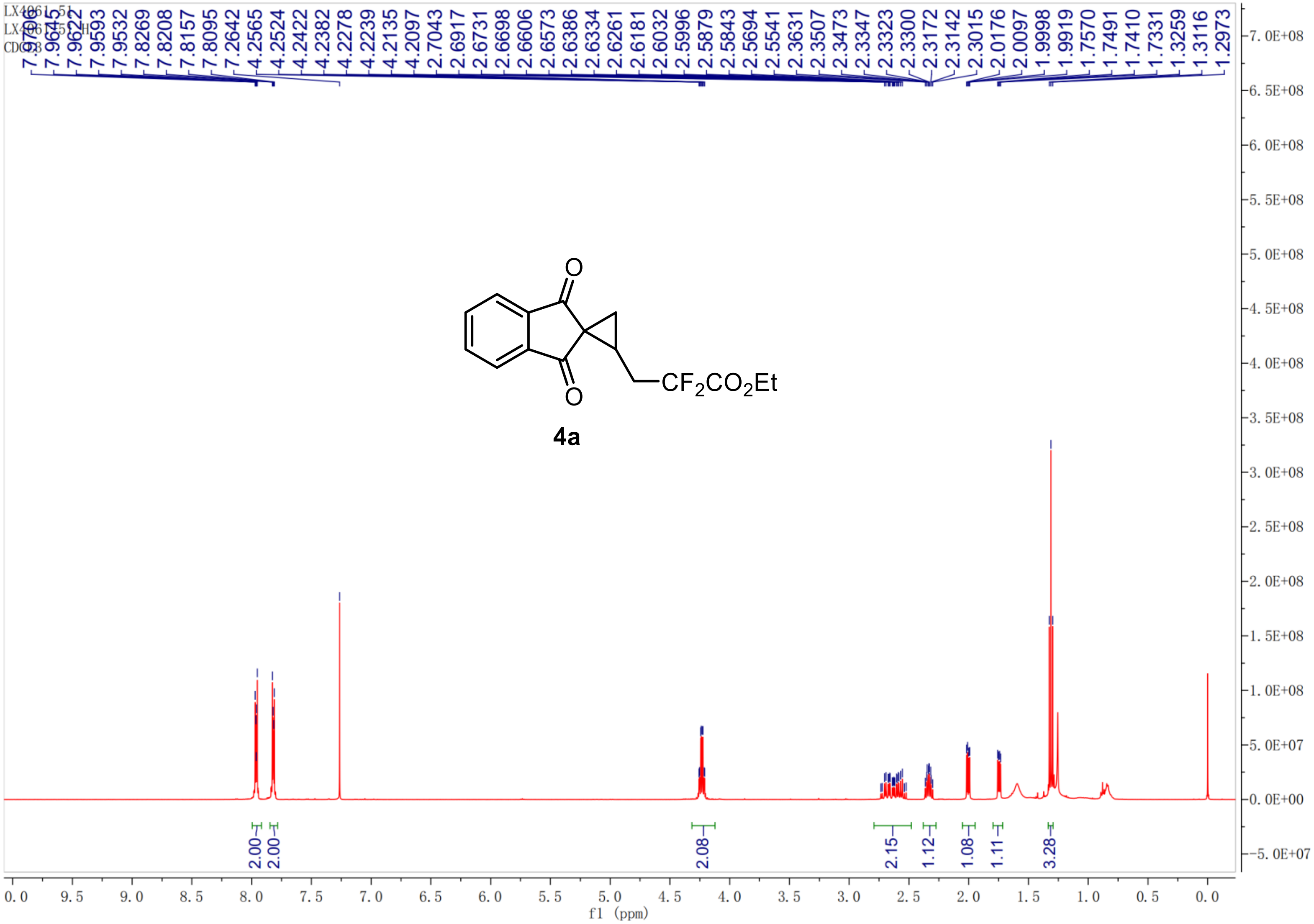
20230530
SZ-8
CDCL3
H
7.7349
7.7323
7.7203
7.7147
7.7110
7.7027
7.6992
7.4137
7.3998
7.3953
7.3906
7.3772
7.3736
7.3627
7.3596
7.3564
7.3006
7.2816
7.2628
7.2597
7.2449
2.9212
2.9091
2.8985
2.8906
2.8866
2.8797
2.8681
2.8575
2.8454
2.4268
2.3984
2.3714
2.3600
2.3404
2.3132
2.3017
2.1831
2.1716
2.1650
2.1534
2.0409
2.0032
1.9739
1.9401
1.9147
1.5731
1.5614
1.5510
1.5395
O
O
Ph
Ph
$C_{10}F_{21}$
3l
3.92
2.02
4.48
1.00
1.12
1.08
1.02
1.24
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
8.0E+08
7.5E+08
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07

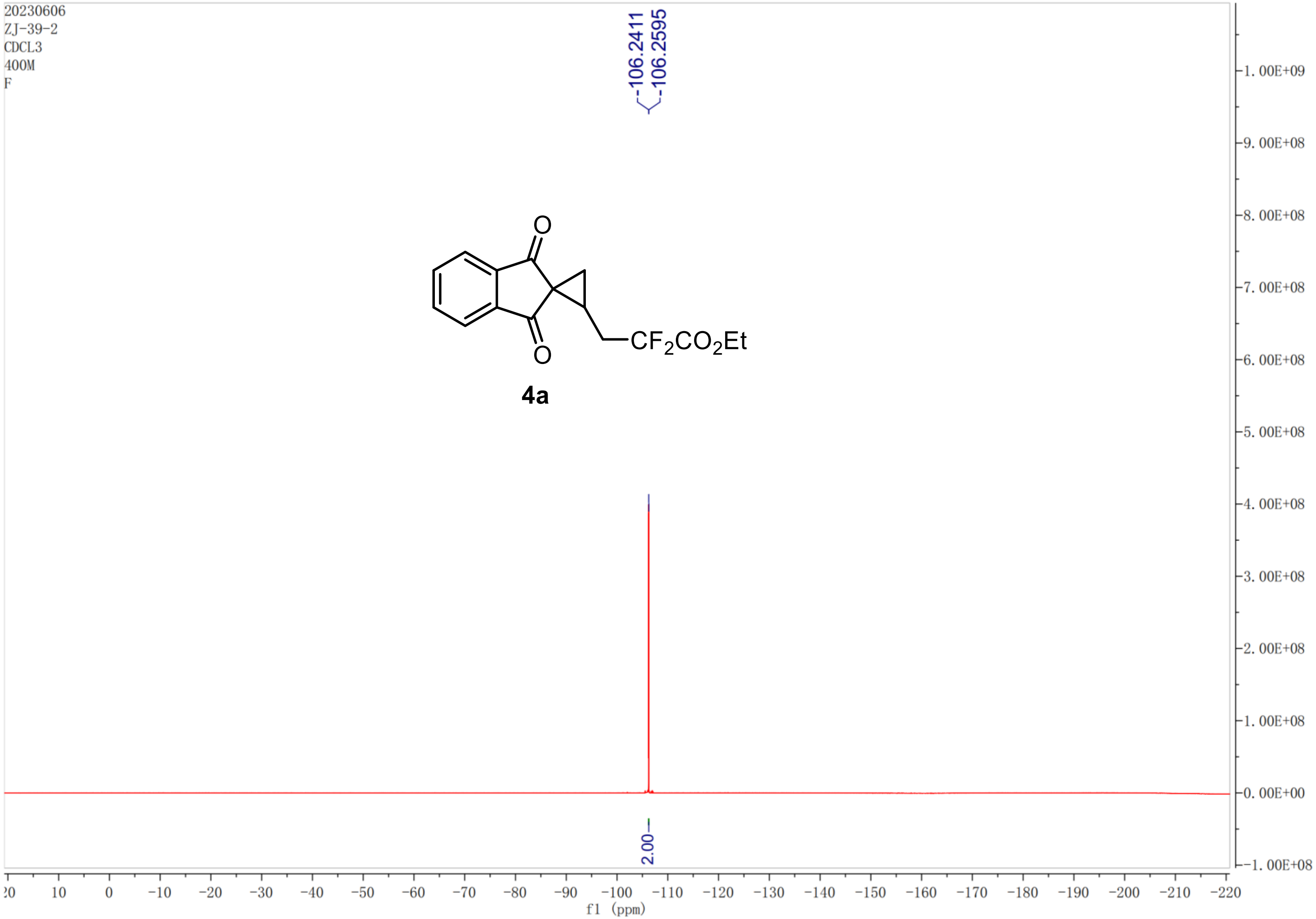

20230530
SY-8
CDCL3
F
-59.1552
-59.1981
-59.2409
-80.8633
-80.8933
-80.9223
-113.1209
-113.2316
-113.4519
-113.4900
-120.9154
-121.7516
-121.7660
-121.9800
-122.7936
-123.0630
-126.1567
-126.1769
-126.2025
-126.2361
-126.2552
O
O
Ph
Ph
$C_{10}F_{21}$
1.10
3.00
1.91
12.89
2.11
1.80E+09
1.70E+09
1.60E+09
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
f1 (ppm)

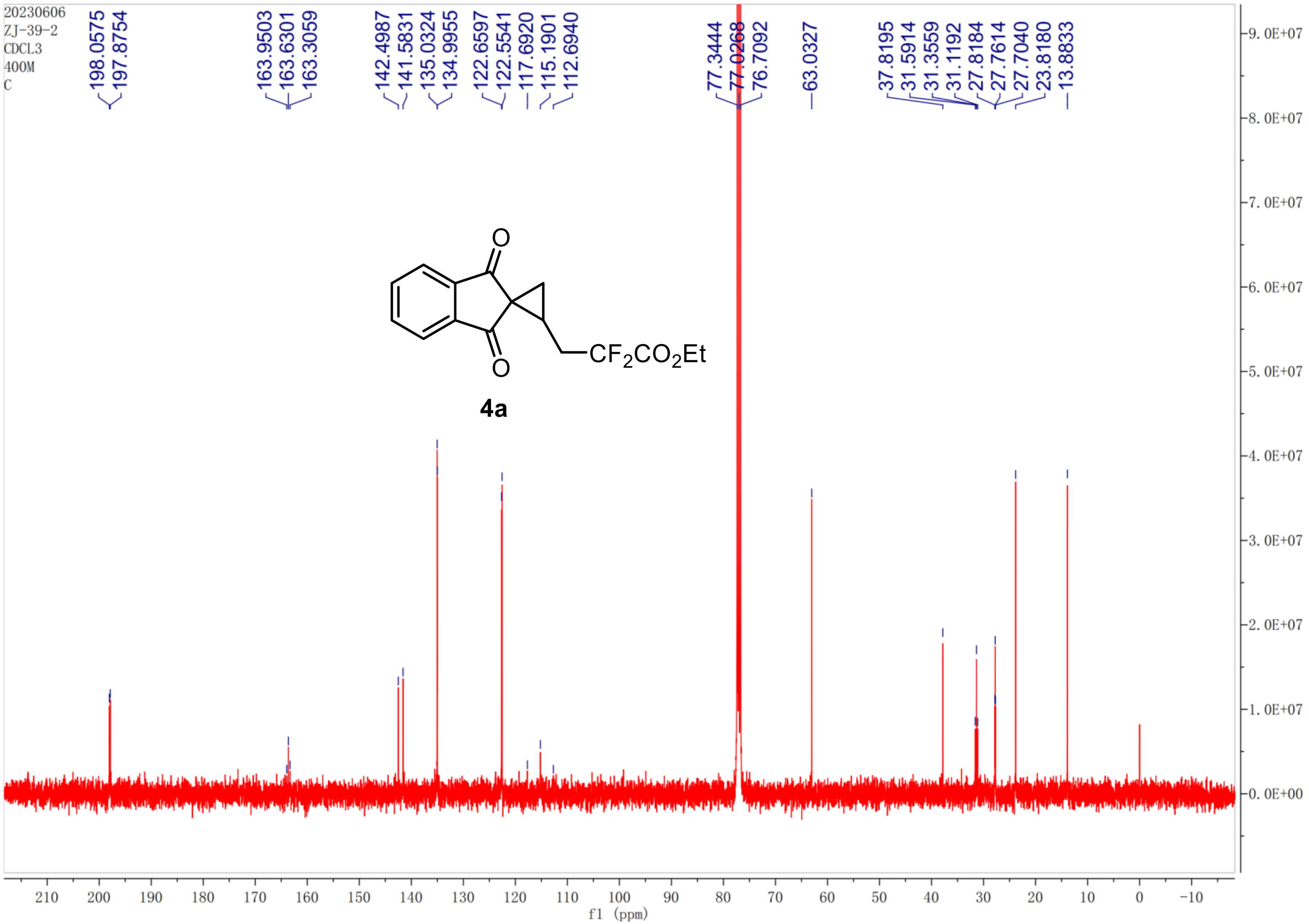
**3l**

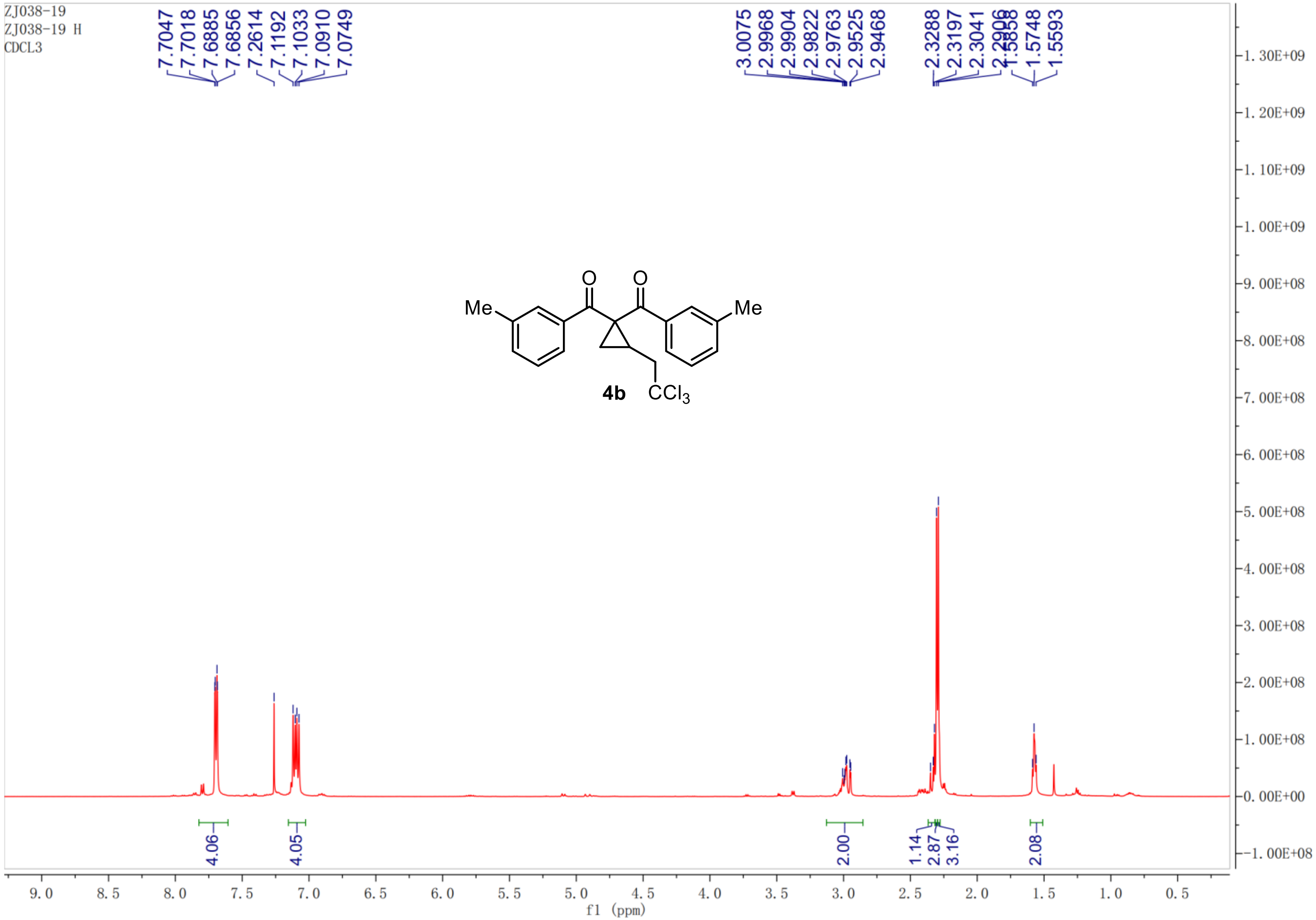

20230530
SY-8
CDCL3
C
196.3811
196.1271
137.9092
137.2004
133.3625
133.1440
128.6694
128.5383
128.5190
77.3022
76.9847
76.6672
43.8921
29.7964
29.5773
29.3618
20.8901
19.3432
O
O
Ph
Ph
C10F21
4. 2E+08
4. 0E+08
3. 8E+08
3. 6E+08
3. 4E+08
3. 2E+08
3. 0E+08
2. 8E+08
2. 6E+08
2. 4E+08
2. 2E+08
2. 0E+08
1. 8E+08
1. 6E+08
1. 4E+08
1. 2E+08
1. 0E+08
8. 0E+07
6. 0E+07
4. 0E+07
2. 0E+07
0. 0E+00
-2. 0E+07
-4. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

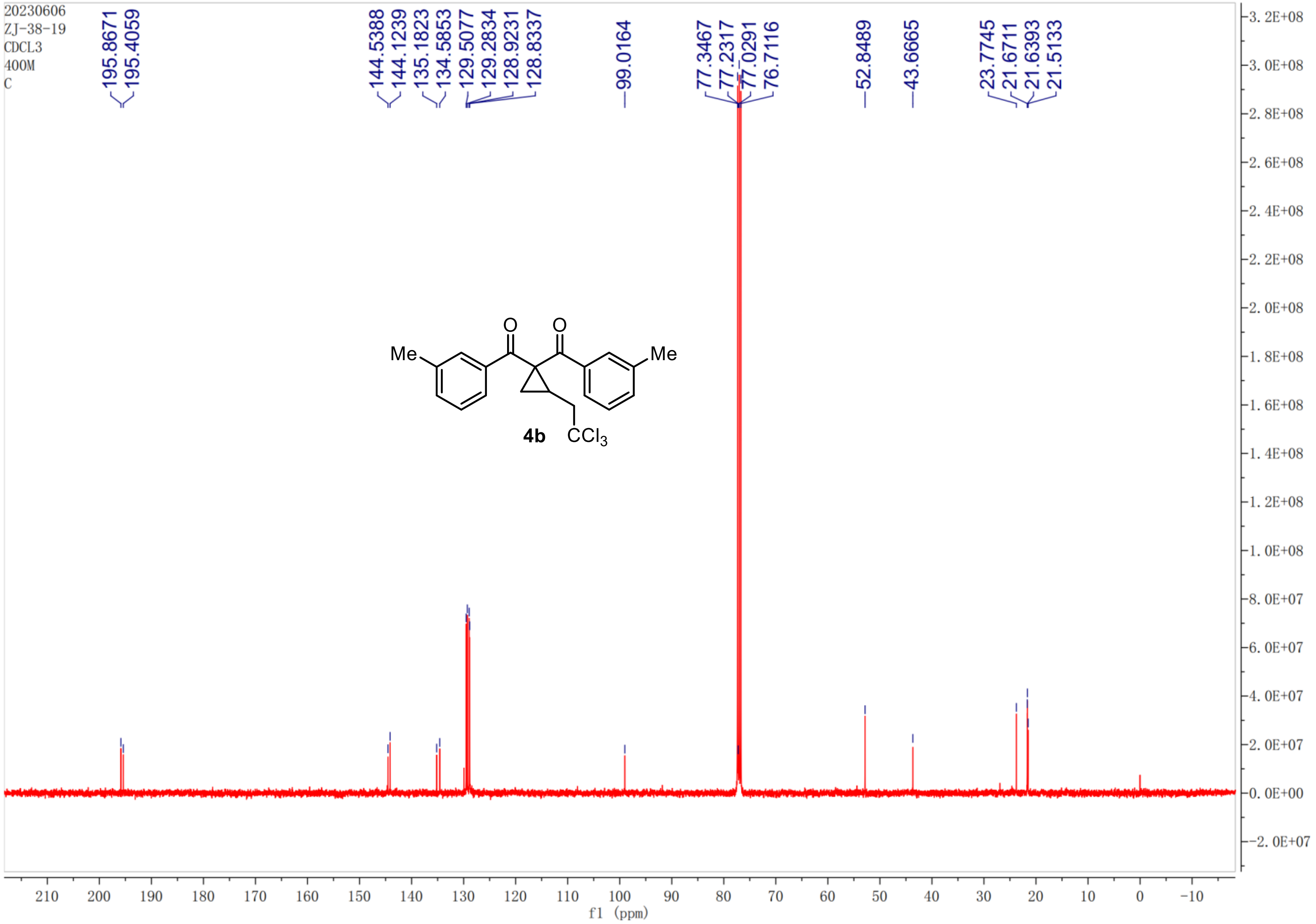
**3l**

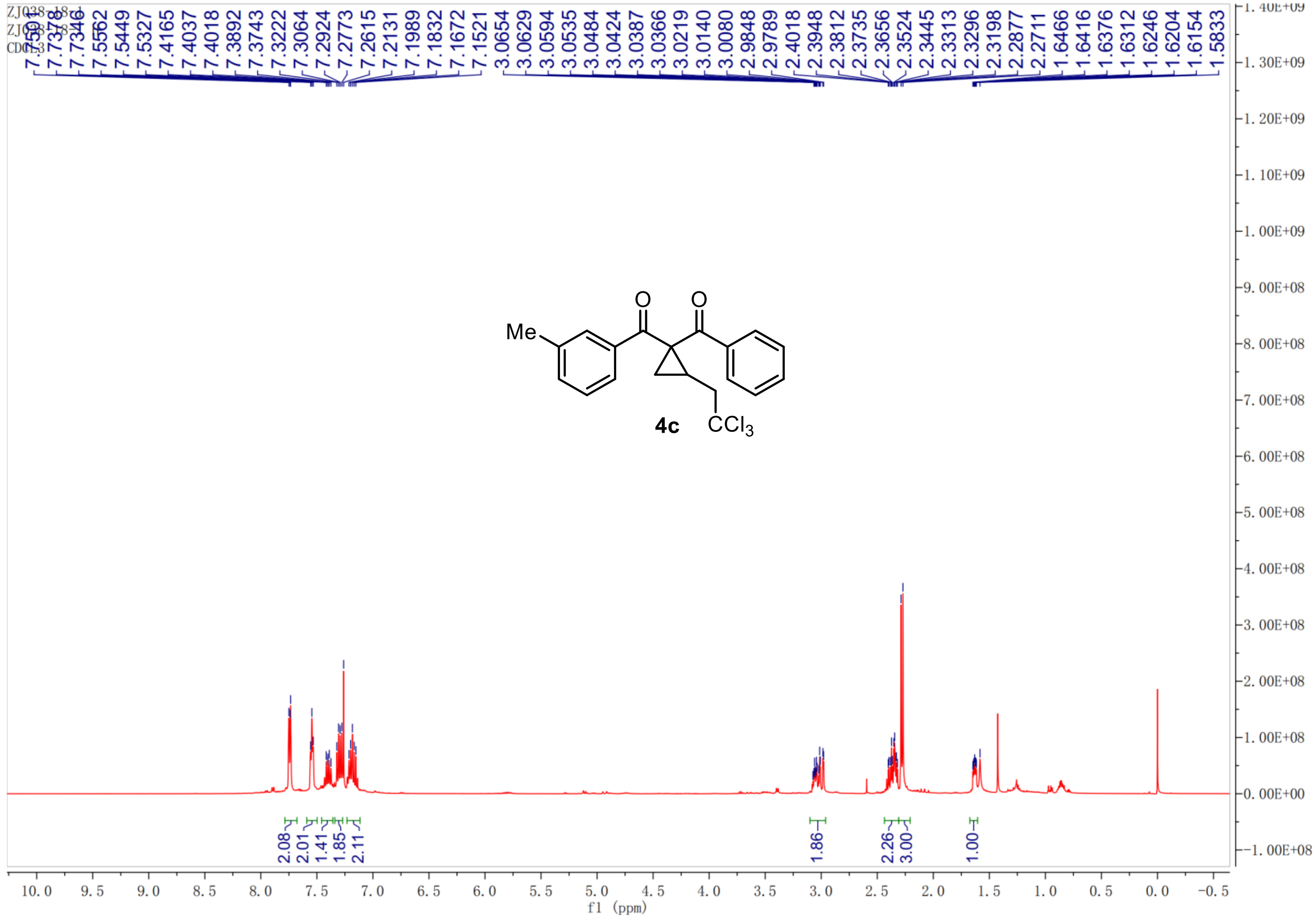

LX4061-51
LX4061-51-1H
CDCl3
7.9706
7.9645
7.9622
7.9593
7.9532
7.8269
7.8208
7.8157
7.8095
7.2642
4.2565
4.2524
4.2422
4.2382
4.2278
4.2239
4.2135
4.2097
2.7043
2.6917
2.6731
2.6698
2.6606
2.6573
2.6386
2.6334
2.6261
2.6181
2.6032
2.5996
2.5879
2.5843
2.5694
2.5541
2.3631
2.3507
2.3473
2.3347
2.3323
2.3300
2.3172
2.3142
2.3015
2.0176
2.0097
1.9998
1.9919
1.7570
1.7491
1.7410
1.7331
1.3259
1.3116
1.2973
O
O
CF2CO2Et
4a
2.00
2.00
2.08
2.15
1.12
1.08
1.11
3.28
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07
0.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

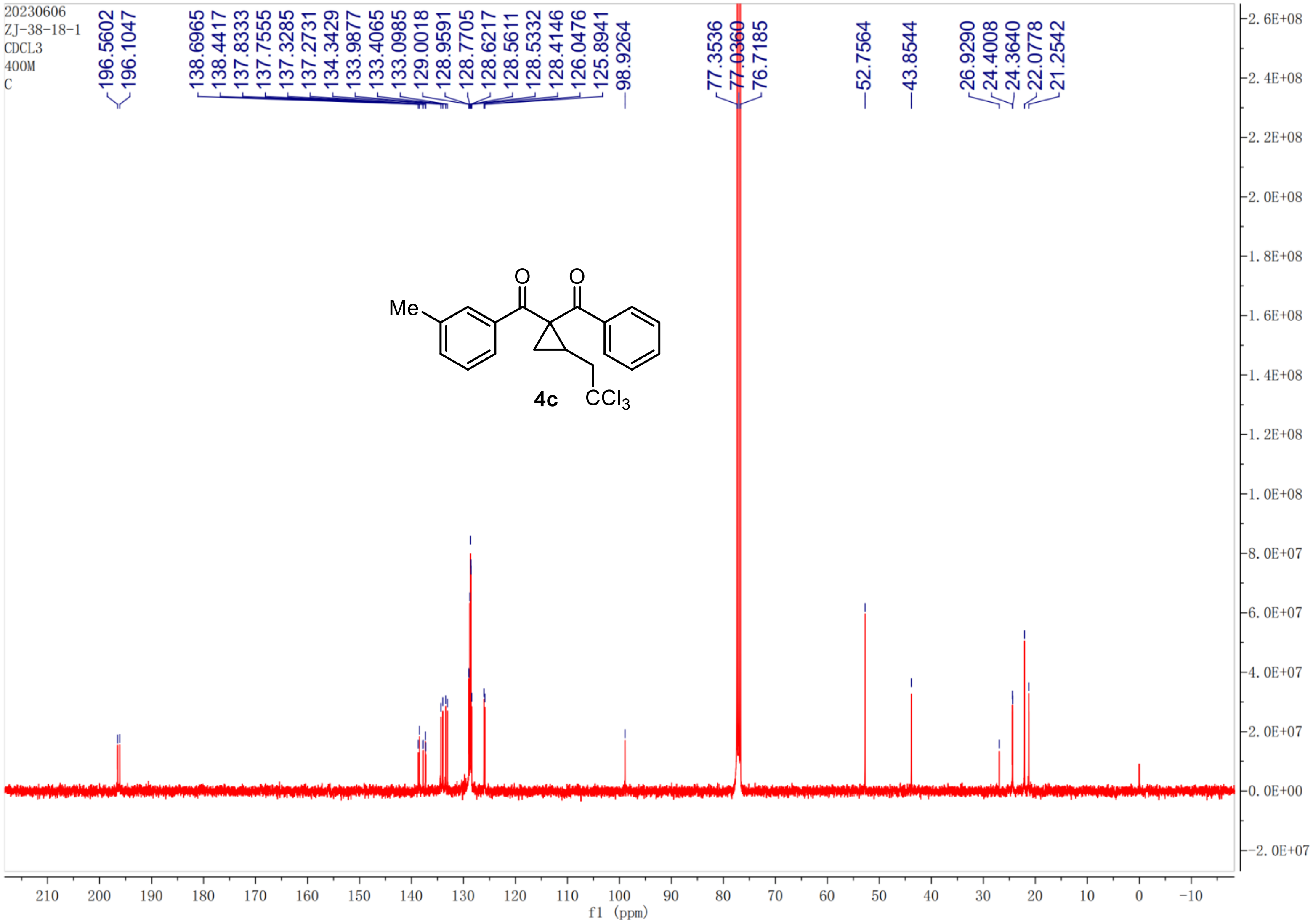

20230606
ZJ-39-2
CDCL3
400M
F
-106.2411
-106.2595
CF$_2$CO$_2$Et
4a
2.00
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)


20230606
ZJ-39-2
CDCL3
400M
C
198.0575
197.8754
163.9503
163.6301
163.3059
142.4987
141.5831
135.0324
134.9955
122.6597
122.5541
117.6920
115.1901
112.6940
77.3444
77.0268
76.7092
63.0327
37.8195
31.5914
31.3559
31.1192
27.8184
27.7614
27.7040
23.8180
13.8833
O
O
CF2CO2Et
4a
9. 0E+07
8. 0E+07
7. 0E+07
6. 0E+07
5. 0E+07
4. 0E+07
3. 0E+07
2. 0E+07
1. 0E+07
0. 0E+00
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

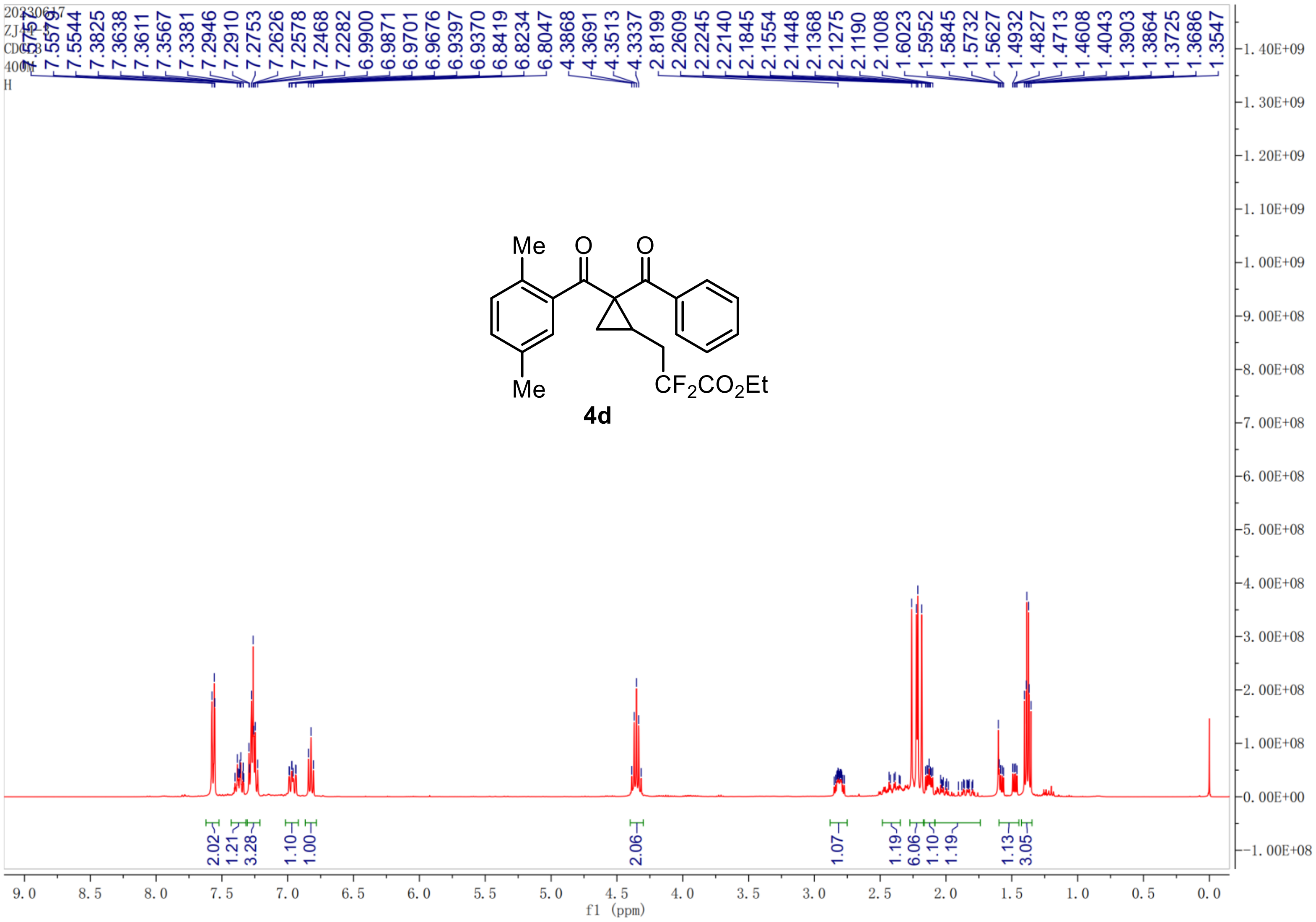

ZJ038-19
ZJ038-19 H
CDCL3
7.7047
7.7018
7.6885
7.6856
7.2614
7.1192
7.1033
7.0910
7.0749
3.0075
2.9968
2.9904
2.9822
2.9763
2.9525
2.9468
2.3288
2.3197
2.3041
2.2906
1.5858
1.5748
1.5593
Me
O
O
Me
4b
CCl3
4.06
4.05
2.00
1.14
2.87
3.16
2.08
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08

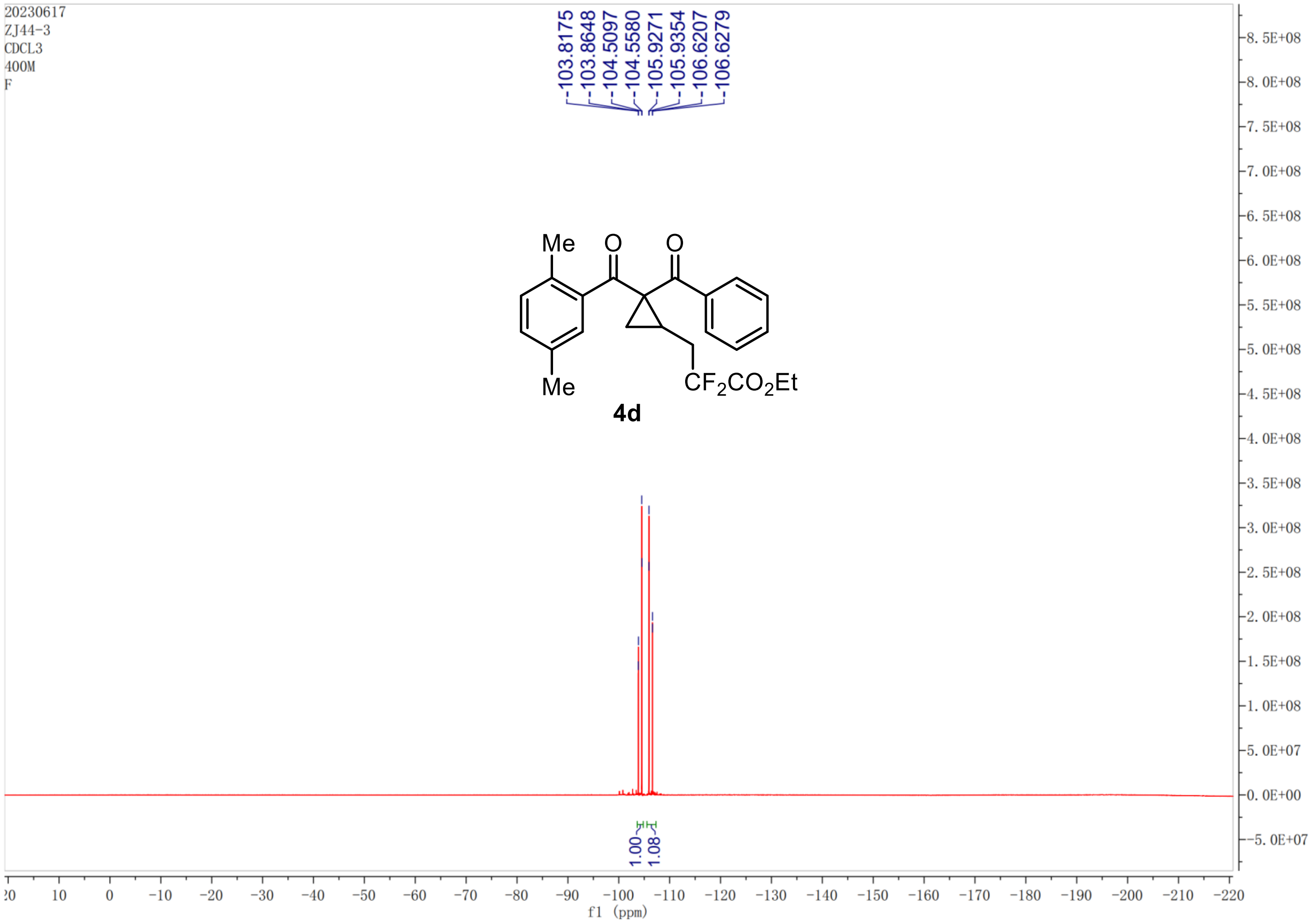

20230606
ZJ-38-19
CDCL3
400M
C
195.8671
195.4059
144.5388
144.1239
135.1823
134.5853
129.5077
129.2834
128.9231
128.8337
99.0164
77.3467
77.2317
77.0291
76.7116
52.8489
43.6665
23.7745
21.6711
21.6393
21.5133
Me
O
O
Me
4b
CCl$_3$
3. 2E+08
3. 0E+08
2. 8E+08
2. 6E+08
2. 4E+08
2. 2E+08
2. 0E+08
1. 8E+08
1. 6E+08
1. 4E+08
1. 2E+08
1. 0E+08
8. 0E+07
6. 0E+07
4. 0E+07
2. 0E+07
0. 0E+00
-2. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


ZJ038-18-1
ZJ038-18-
CDCL3
7.7501
7.7378
7.7346
7.5562
7.5449
7.5327
7.4165
7.4037
7.4018
7.3892
7.3743
7.3222
7.3064
7.2924
7.2773
7.2615
7.2131
7.1989
7.1832
7.1672
7.1521
3.0654
3.0629
3.0594
3.0535
3.0484
3.0424
3.0387
3.0366
3.0219
3.0140
3.0080
2.9848
2.9789
2.4018
2.3948
2.3812
2.3735
2.3656
2.3524
2.3445
2.3313
2.3296
2.3198
2.2877
2.2711
1.6466
1.6416
1.6376
1.6312
1.6246
1.6204
1.6154
1.5833
Me
O
O
4c
CCl3
2.08
2.01
1.41
1.85
2.11
1.86
2.26
3.00
1.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08

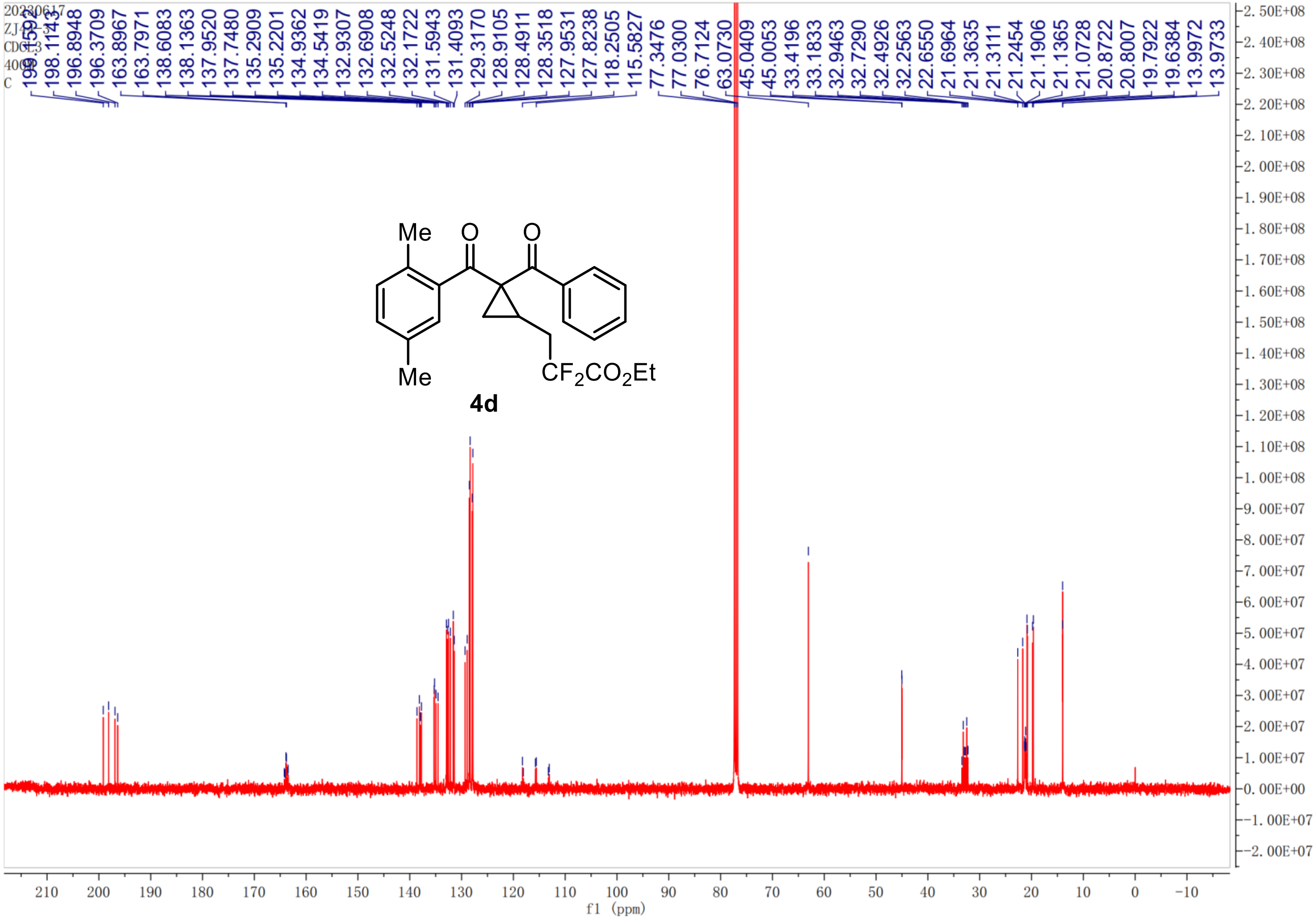

20230606
ZJ-38-18-1
CDCL3
400M
C
196.5602
196.1047
138.6965
138.4417
137.8333
137.7555
137.3285
137.2731
134.3429
133.9877
133.4065
133.0985
129.0018
128.9591
128.7705
128.6217
128.5611
128.5332
128.4146
126.0476
125.8941
98.9264
77.3536
77.0360
76.7185
52.7564
43.8544
26.9290
24.4008
24.3640
22.0778
21.2542
Me
O
O
CCl3
2.6E+08
2.4E+08
2.2E+08
2.0E+08
1.8E+08
1.6E+08
1.4E+08
1.2E+08
1.0E+08
8.0E+07
6.0E+07
4.0E+07
2.0E+07
0.0E+00
-2.0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

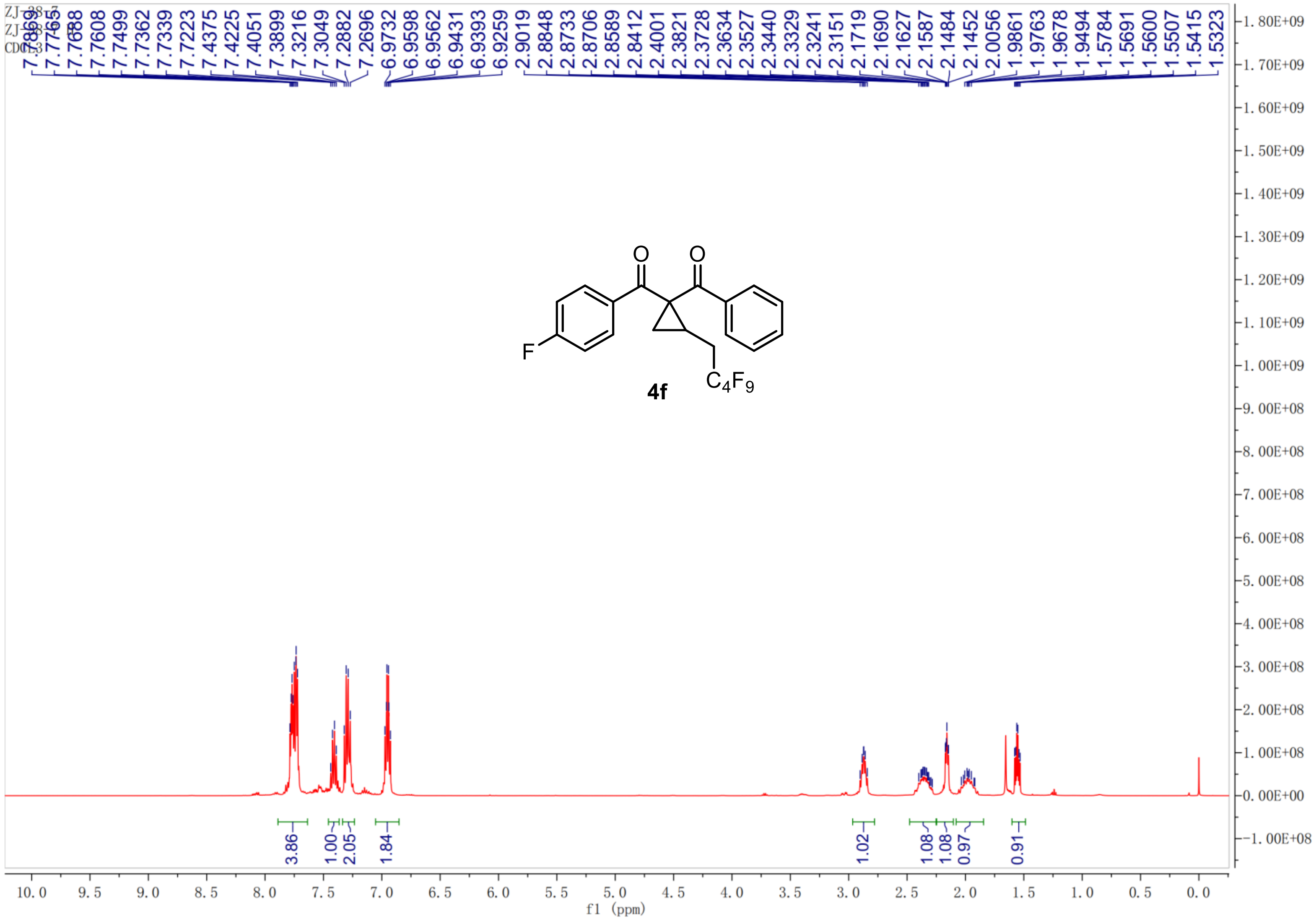
**4c**

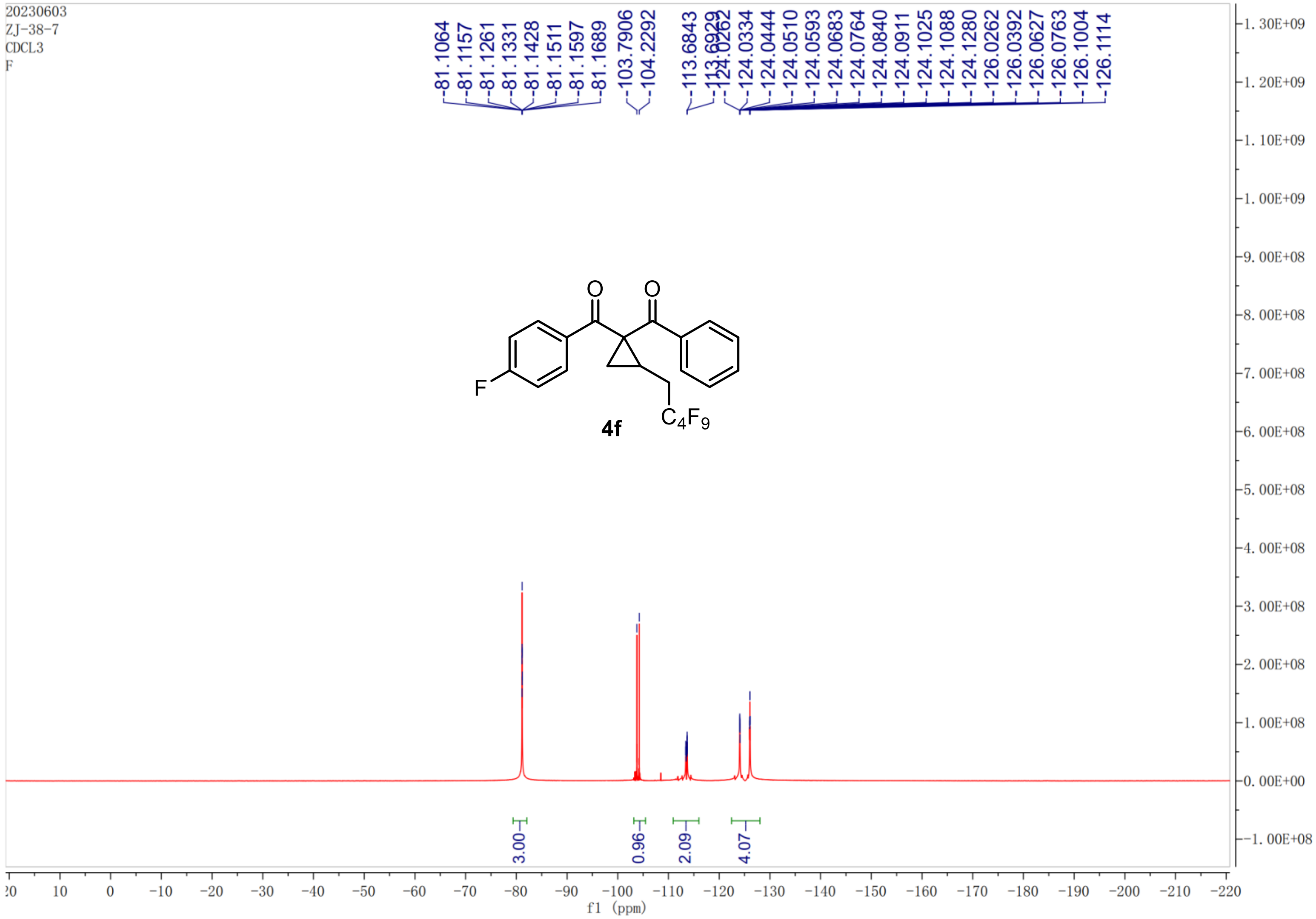

20230617
ZJ44-3
CDCL3
400M
H
7.5757
7.5579
7.5544
7.3825
7.3638
7.3611
7.3567
7.3381
7.2946
7.2910
7.2753
7.2626
7.2578
7.2468
7.2282
6.9900
6.9871
6.9701
6.9676
6.9397
6.9370
6.8419
6.8234
6.8047
4.3868
4.3691
4.3513
4.3337
2.8199
2.2609
2.2245
2.2140
2.1845
2.1554
2.1448
2.1368
2.1275
2.1190
2.1008
1.6023
1.5952
1.5845
1.5732
1.5627
1.4932
1.4827
1.4713
1.4608
1.4043
1.3903
1.3864
1.3725
1.3686
1.3547
Me
O
O
Me
CF2CO2Et
4d
2.02
1.21
3.28
1.10
1.00
2.06
1.07
1.19
6.06
1.10
1.19
1.13
3.05
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

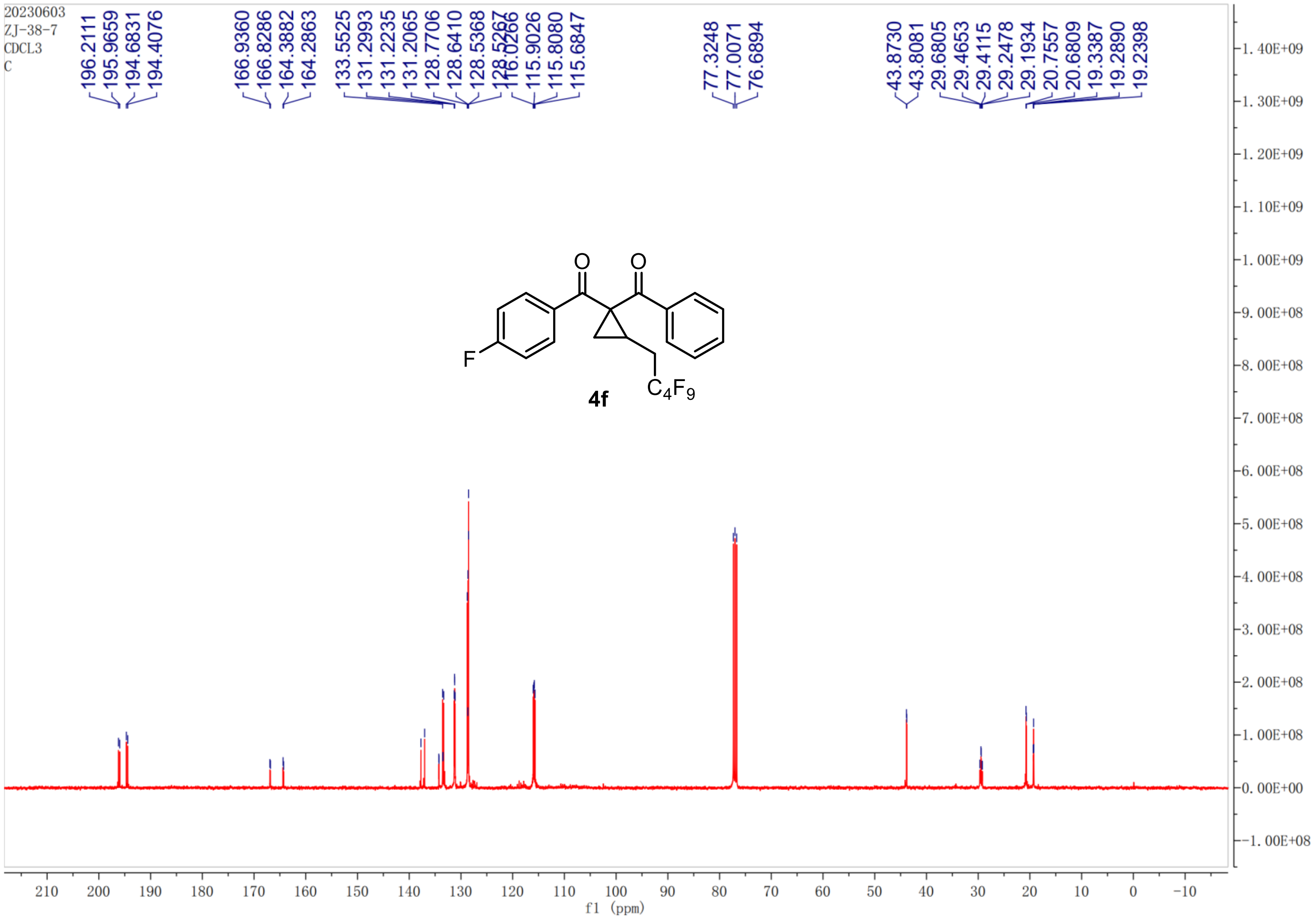
20230617
ZJ44-3
CDCL3
400M
F
-103.8175
-103.8648
-104.5097
-104.5580
-105.9271
-105.9354
-106.6207
-106.6279
Me
O
O
Me
CF2CO2Et
1.00
1.08
8.5E+08
8.0E+08
7.5E+08
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
f1 (ppm)

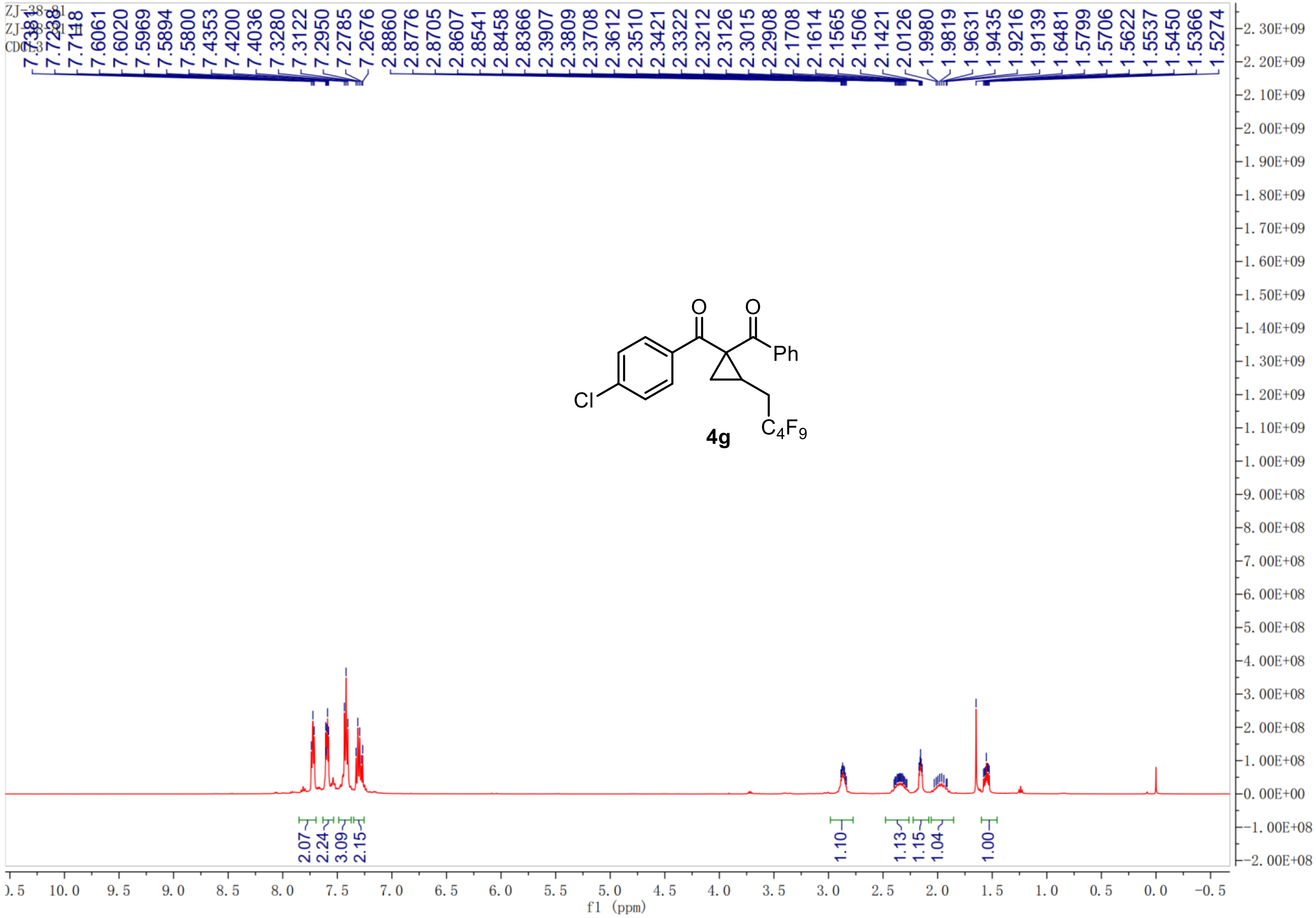
**4d**


20230617
ZJ44-3
CDCL3
400M
C
199.1592
198.1143
196.8948
196.3709
163.8967
163.7971
138.6083
138.1363
137.9520
137.7480
135.2909
135.2201
134.9362
134.5419
132.9307
132.6908
132.5248
132.1722
131.5943
131.4093
129.3170
128.9105
128.4911
128.3518
127.9531
127.8238
118.2505
115.5827
77.3476
77.0300
76.7124
63.0730
45.0409
45.0053
33.4196
33.1833
32.9463
32.7290
32.4926
32.2563
22.6550
21.6964
21.3635
21.3111
21.2454
21.1906
21.1365
21.0728
20.8722
20.8007
19.7922
19.6384
13.9972
13.9733
Me
O
O
Me
$CF_2CO_2Et$
4d
2.50E+08
2.40E+08
2.30E+08
2.20E+08
2.10E+08
2.00E+08
1.90E+08
1.80E+08
1.70E+08
1.60E+08
1.50E+08
1.40E+08
1.30E+08
1.20E+08
1.10E+08
1.00E+08
9.00E+07
8.00E+07
7.00E+07
6.00E+07
5.00E+07
4.00E+07
3.00E+07
2.00E+07
1.00E+07
0.00E+00
-1.00E+07
-2.00E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


4f
ZJ-38-7
ZJ-38-7_H
CDCL3
7.7869
7.7765
7.7688
7.7608
7.7499
7.7362
7.7339
7.7223
7.4375
7.4225
7.4051
7.3899
7.3216
7.3049
7.2882
7.2696
6.9732
6.9598
6.9562
6.9431
6.9393
6.9259
2.9019
2.8848
2.8733
2.8706
2.8589
2.8412
2.4001
2.3821
2.3728
2.3634
2.3527
2.3440
2.3329
2.3241
2.3151
2.1719
2.1690
2.1627
2.1587
2.1484
2.1452
2.0056
1.9861
1.9763
1.9678
1.9494
1.5784
1.5691
1.5600
1.5507
1.5415
1.5323
O
O
F
C4F9
3.86
1.00
2.05
1.84
1.02
1.08
1.08
0.97
0.91
1.80E+09
1.70E+09
1.60E+09
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
−1.00E+08
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

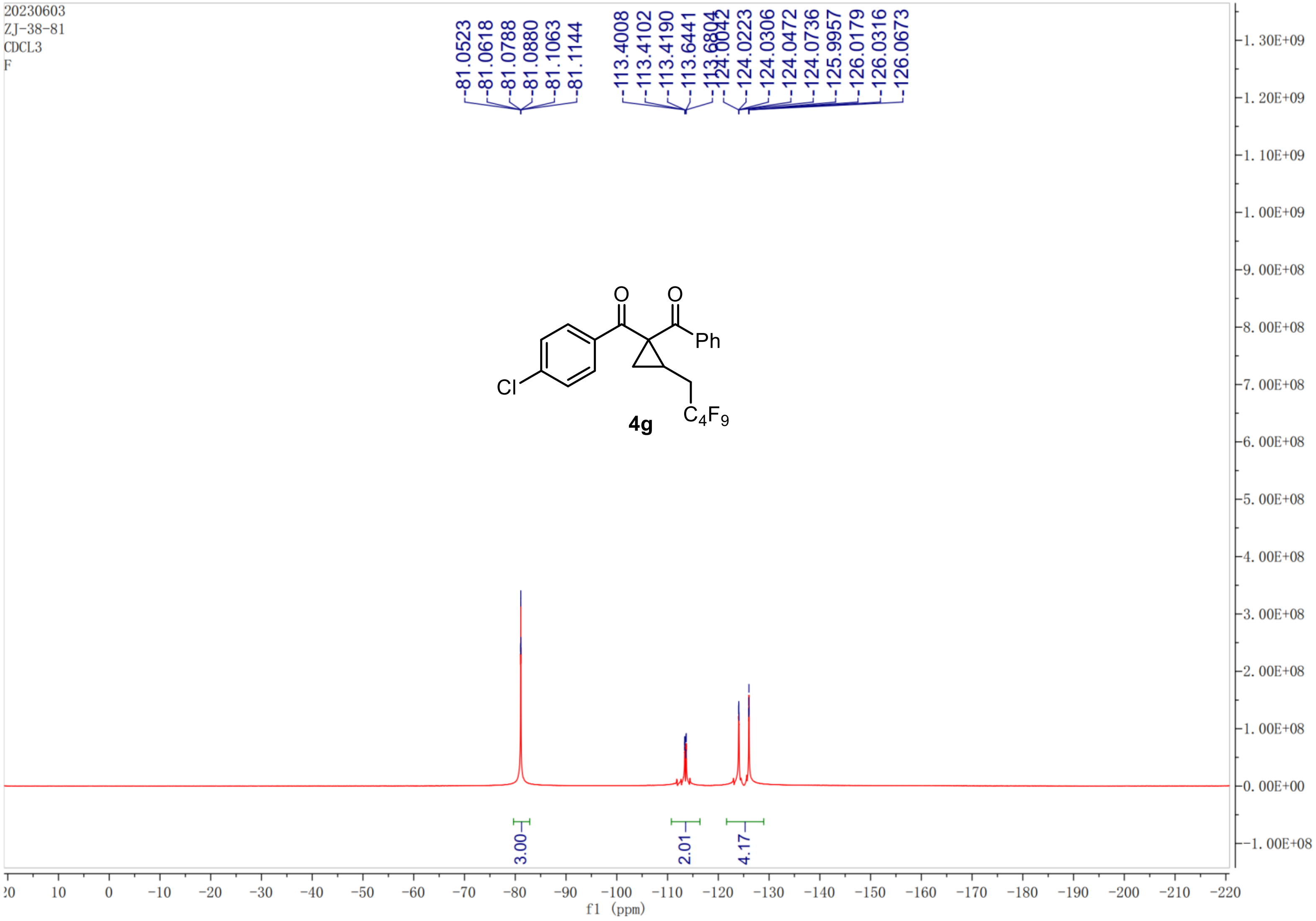
20230603
ZJ-38-7
CDCL3
F
-81.1064
-81.1157
-81.1261
-81.1331
-81.1428
-81.1511
-81.1597
-81.1689
-103.7906
-104.2292
-113.6843
-113.6929
-124.0262
-124.0334
-124.0444
-124.0510
-124.0593
-124.0683
-124.0764
-124.0840
-124.0911
-124.1025
-124.1088
-124.1280
-126.0262
-126.0392
-126.0627
-126.0763
-126.1004
-126.1114
O
O
F
$C_4F_9$
4f
3.00
0.96
2.09
4.07
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
f1 (ppm)
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08

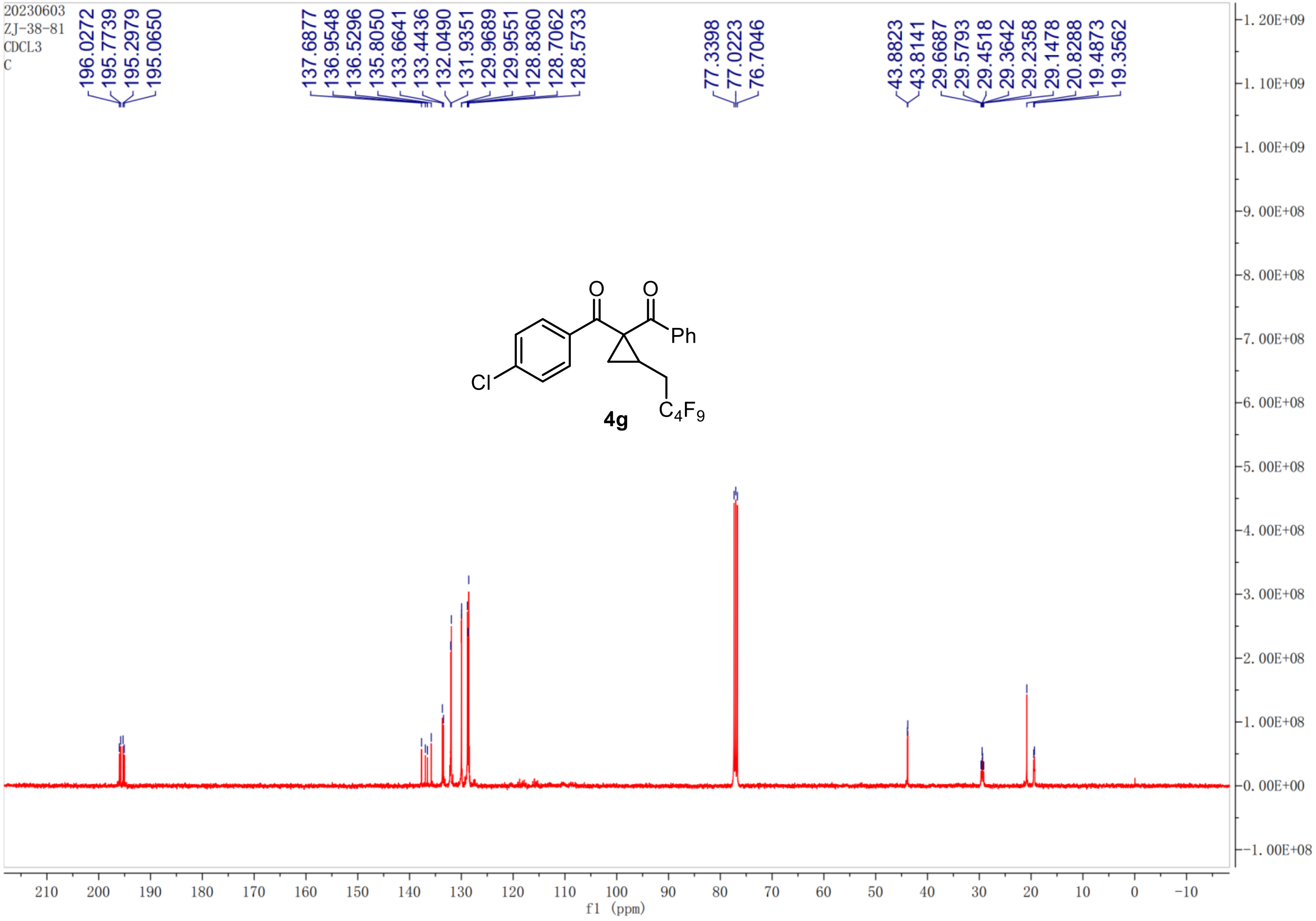

20230603
ZJ-38-7
CDCL3
C
196.2111
195.9659
194.6831
194.4076
166.9360
166.8286
164.3882
164.2863
133.5525
131.2993
131.2235
131.2065
128.7706
128.6410
128.5368
128.5267
116.0266
115.9026
115.8080
115.6847
77.3248
77.0071
76.6894
43.8730
43.8081
29.6805
29.4653
29.4115
29.2478
29.1934
20.7557
20.6809
19.3387
19.2890
19.2398
O
O
F
$C_4F_9$
4f
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

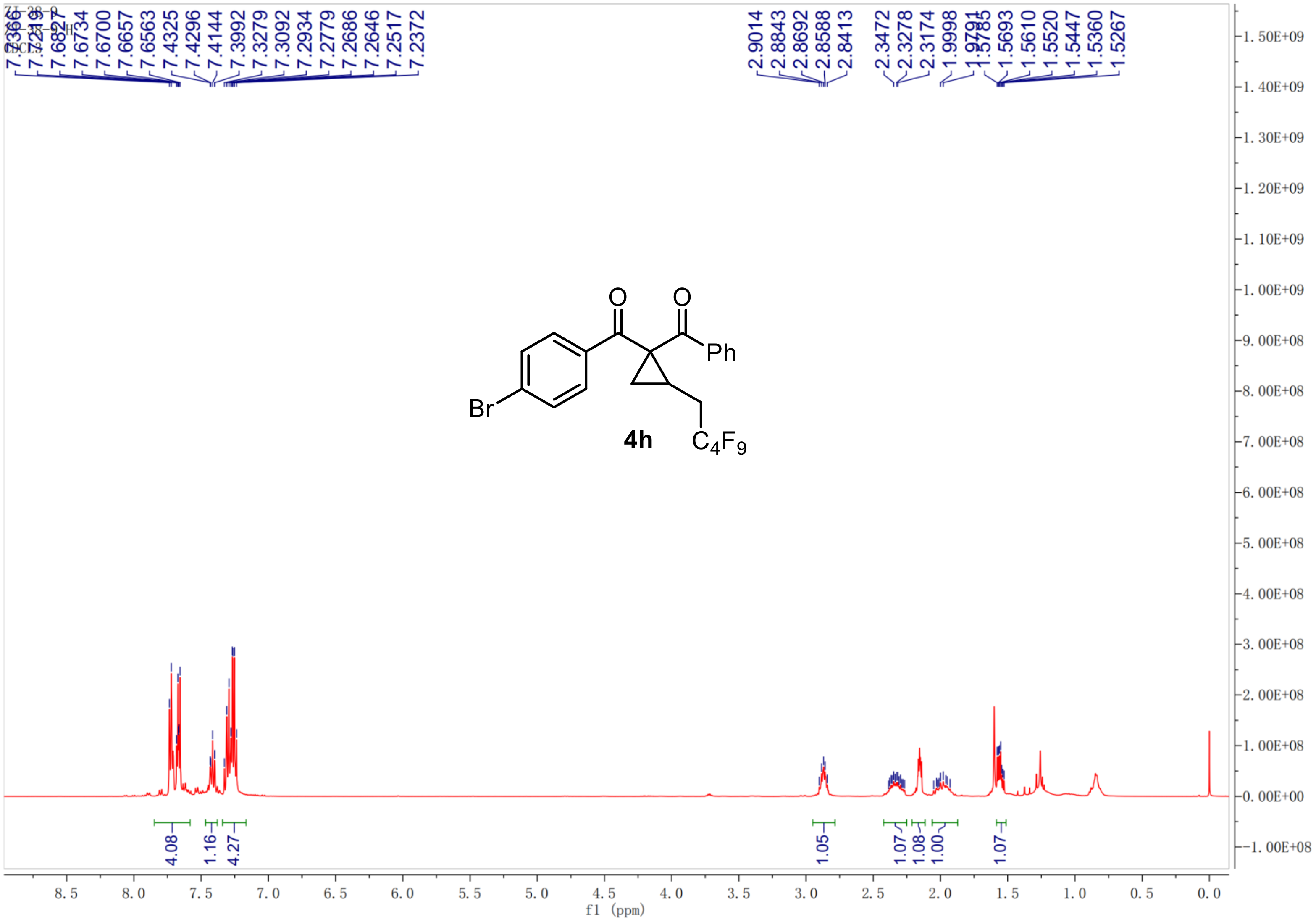


**4g**

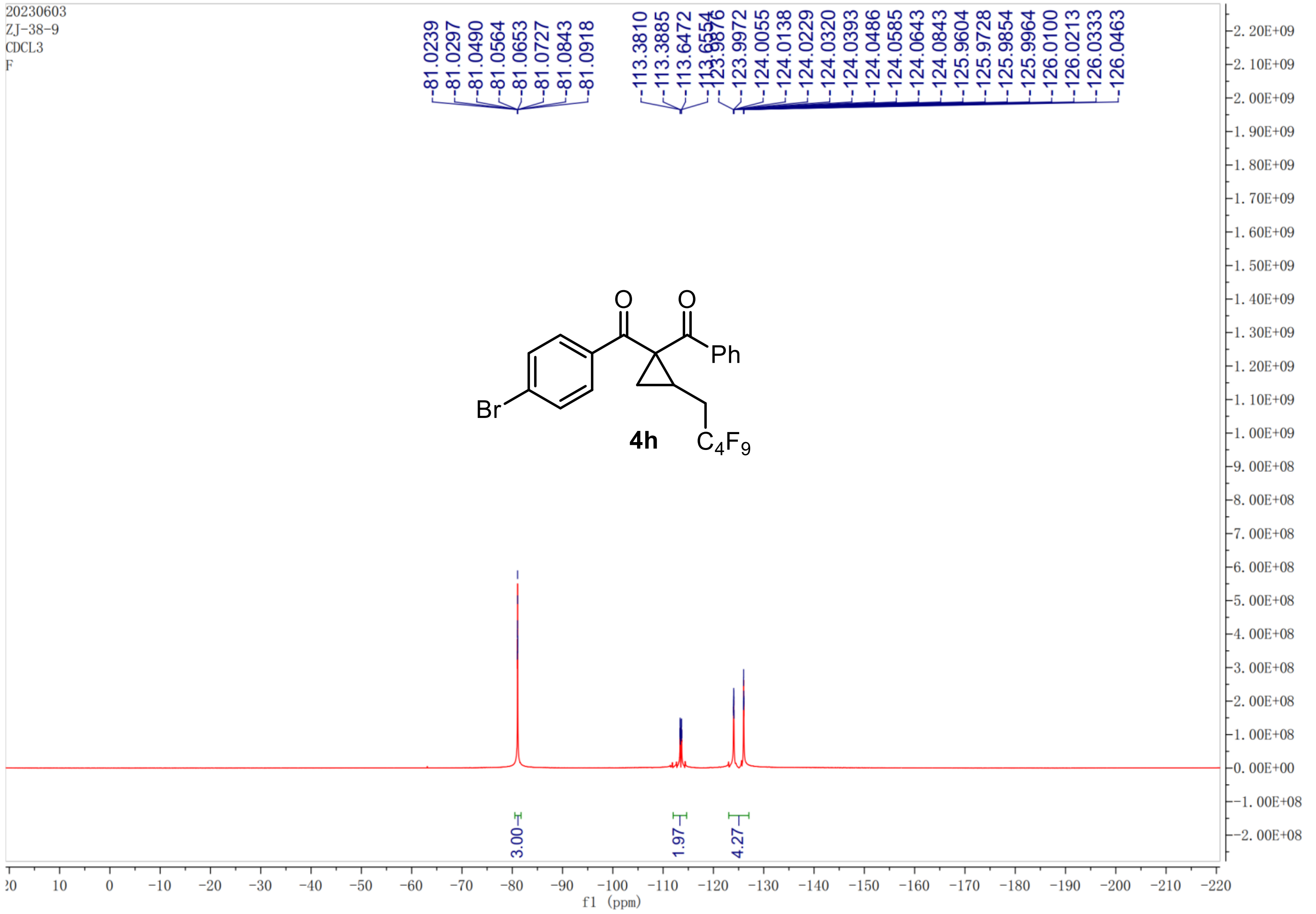
ZJ-38-81
ZJ-38-81 H
CDCl3
7.7381
7.7238
7.7118
7.6061
7.6020
7.5969
7.5894
7.5800
7.4353
7.4200
7.4036
7.3280
7.3122
7.2950
7.2785
7.2676
2.8860
2.8776
2.8705
2.8607
2.8541
2.8458
2.8366
2.3907
2.3809
2.3708
2.3612
2.3510
2.3421
2.3322
2.3212
2.3126
2.3015
2.2908
2.1708
2.1614
2.1565
2.1506
2.1421
2.0126
1.9980
1.9819
1.9631
1.9435
1.9216
1.9139
1.6481
1.5799
1.5706
1.5622
1.5537
1.5450
1.5366
1.5274
O
O
Ph
Cl
$C_4F_9$
2.07
2.24
3.09
2.15
1.10
1.13
1.15
1.04
1.00
0.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)
2.30E+09
2.20E+09
2.10E+09
2.00E+09
1.90E+09
1.80E+09
1.70E+09
1.60E+09
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
-2.00E+08

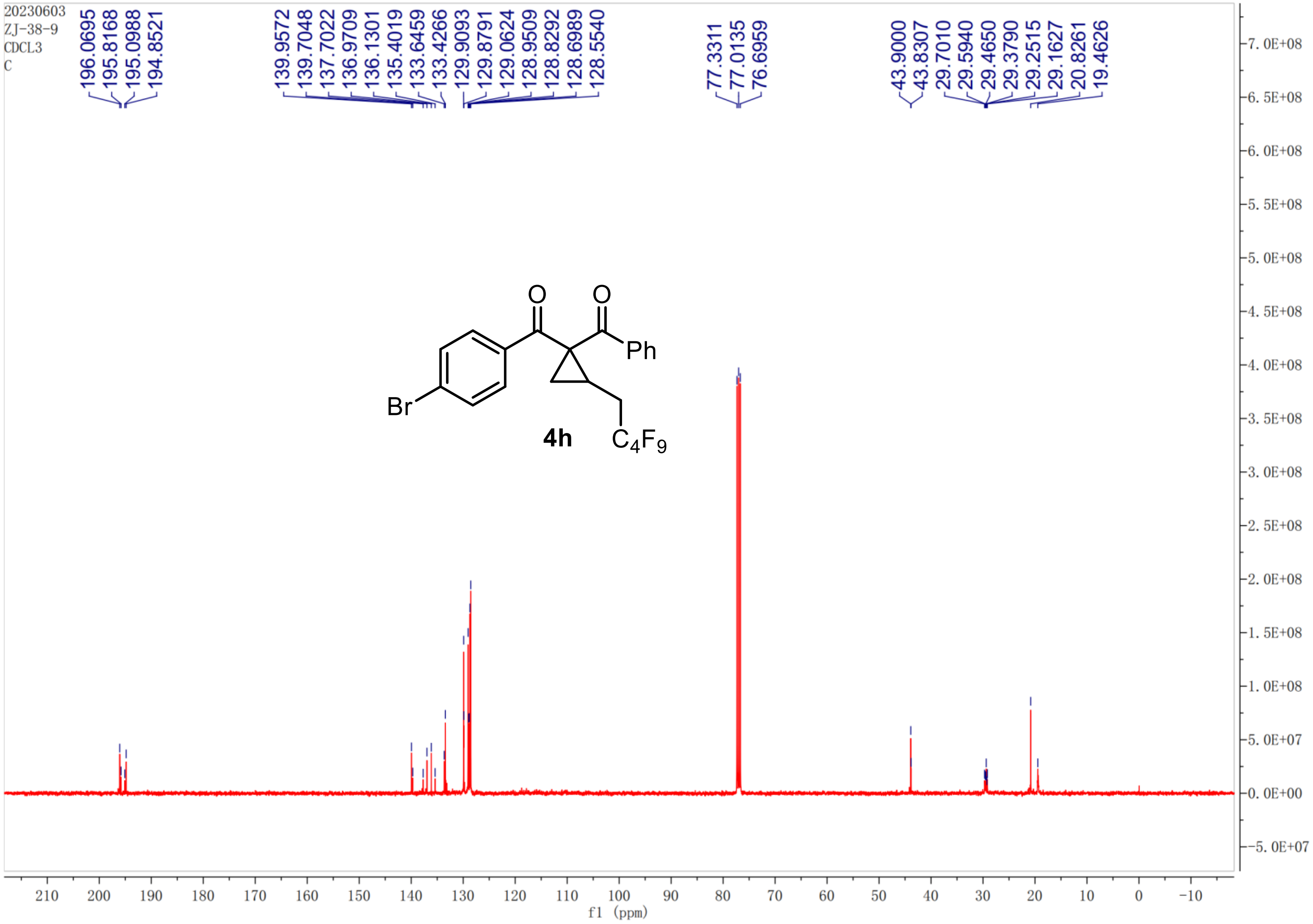

20230603
ZJ-38-81
CDCL3
F
-81.0523
-81.0618
-81.0788
-81.0880
-81.1063
-81.1144
-113.4008
-113.4102
-113.4190
-113.6441
-113.6804
-124.0042
-124.0223
-124.0306
-124.0472
-124.0736
-125.9957
-126.0179
-126.0316
-126.0673
O
O
Ph
Cl
$C_4F_9$
4g
3.00
2.01
4.17
1. 30E+09
1. 20E+09
1. 10E+09
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00
−1. 00E+08
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)

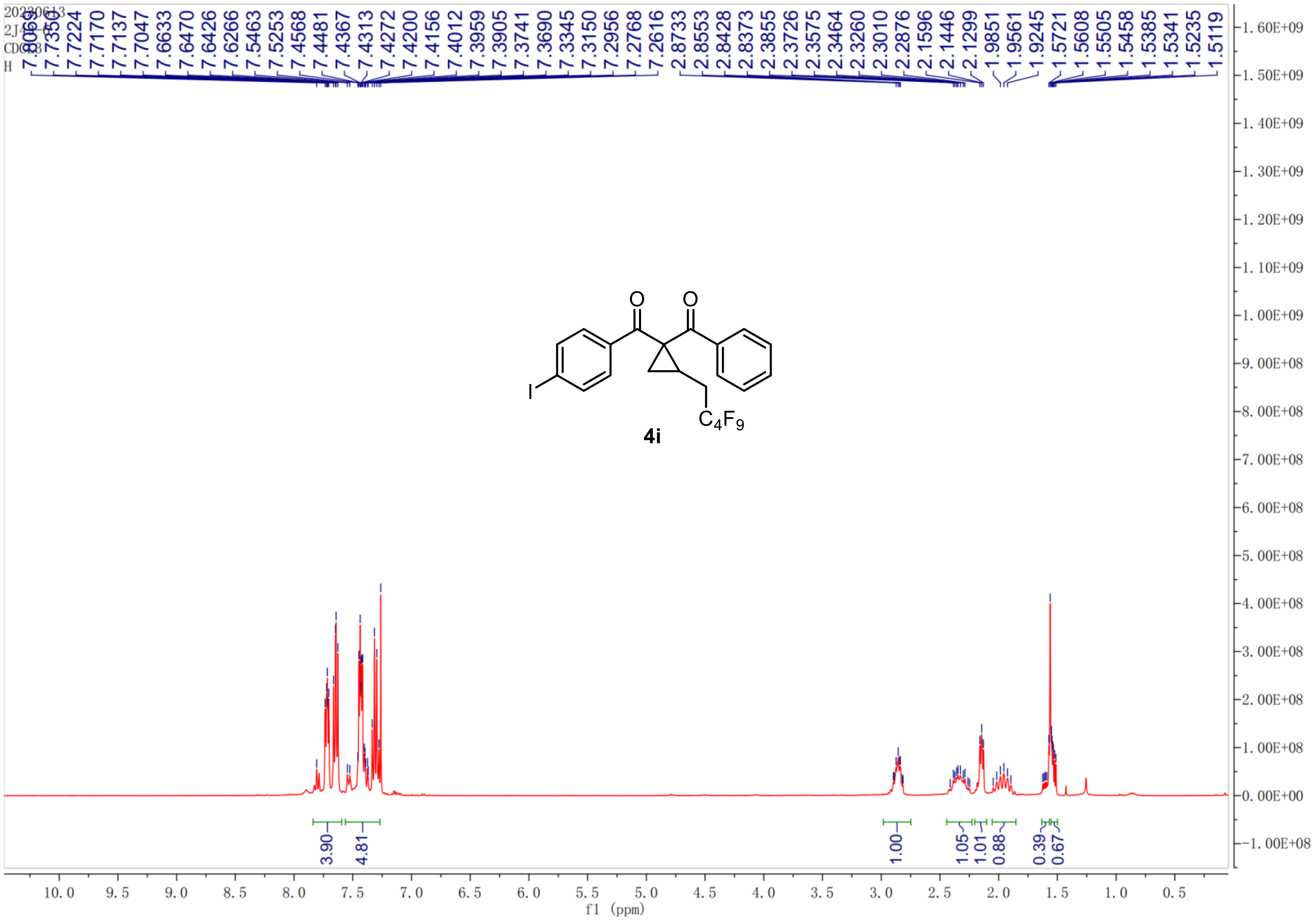

20230603
ZJ-38-81
CDCL3
C
196.0272
195.7739
195.2979
195.0650
137.6877
136.9548
136.5296
135.8050
133.6641
133.4436
132.0490
131.9351
129.9689
129.9551
128.8360
128.7062
128.5733
77.3398
77.0223
76.7046
43.8823
43.8141
29.6687
29.5793
29.4518
29.3642
29.2358
29.1478
20.8288
19.4873
19.3562
O
O
Ph
Cl
$C_4F_9$
4g
1. 20E+09
1. 10E+09
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00
-1. 00E+08
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

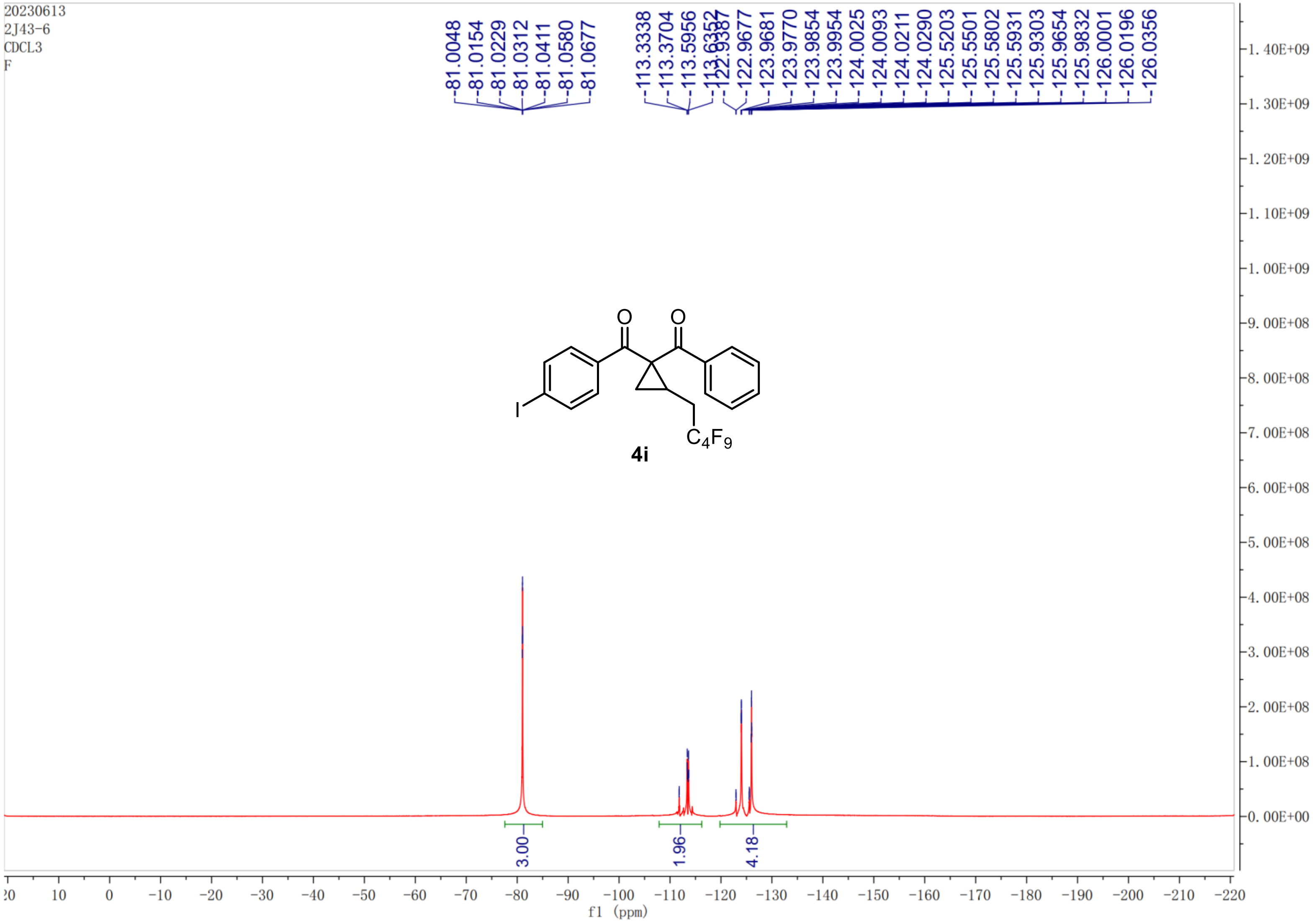
ZL-38-9
1H
CDCl3
7.7366
7.7219
7.6827
7.6734
7.6700
7.6657
7.6563
7.4325
7.4296
7.4144
7.3992
7.3279
7.3092
7.2934
7.2779
7.2686
7.2646
7.2517
7.2372
2.9014
2.8843
2.8692
2.8588
2.8413
2.3472
2.3278
2.3174
1.9998
1.9791
1.5785
1.5693
1.5610
1.5520
1.5447
1.5360
1.5267
O
O
Ph
Br
C4F9
4.08
1.16
4.27
1.05
1.07
1.08
1.00
1.07
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08

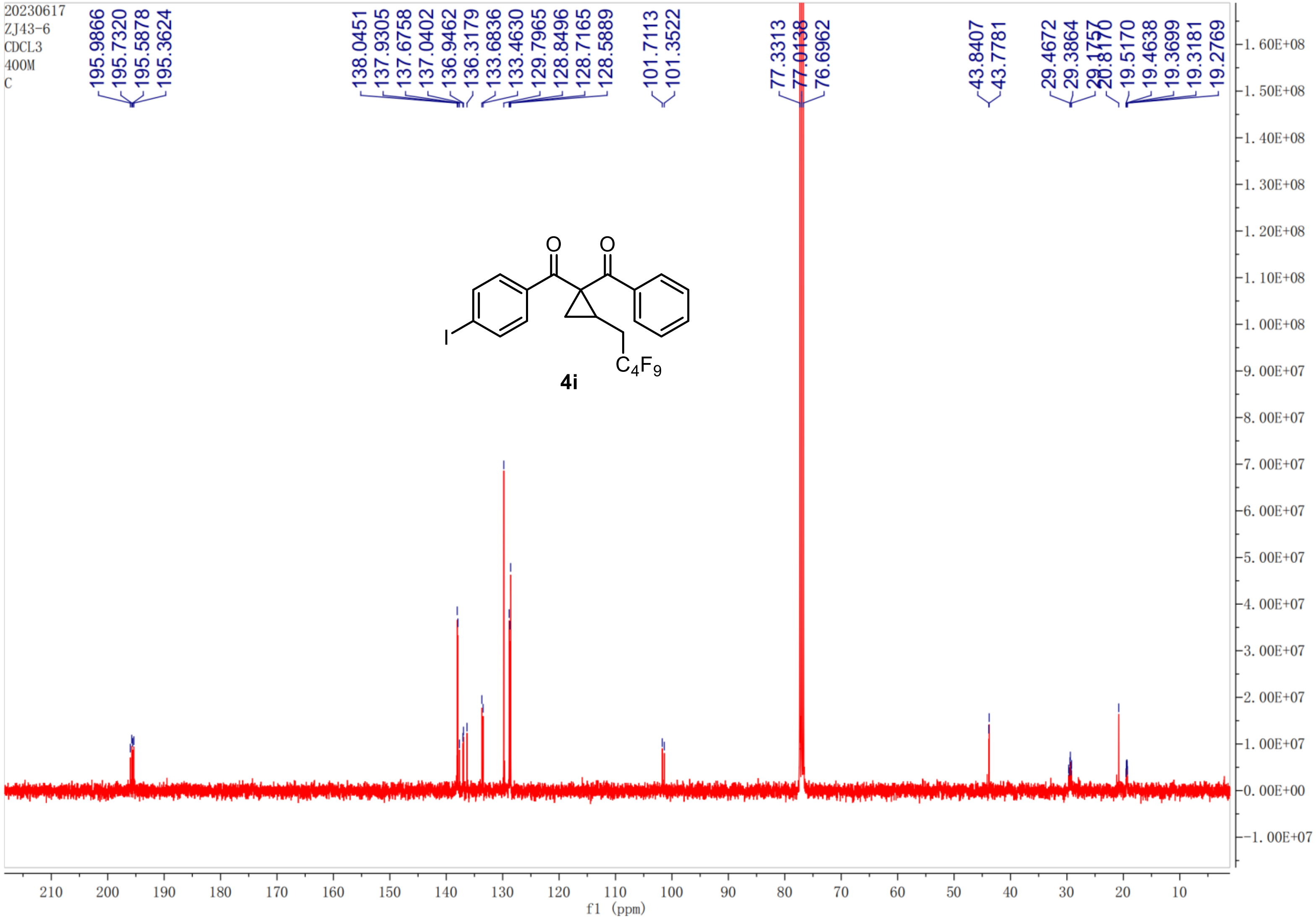
**4h**


20230603
ZJ-38-9
CDCL3
F
-81.0239
-81.0297
-81.0490
-81.0564
-81.0653
-81.0727
-81.0843
-81.0918
-113.3810
-113.3885
-113.6472
-113.6554
-123.9876
-123.9972
-124.0055
-124.0138
-124.0229
-124.0320
-124.0393
-124.0486
-124.0585
-124.0643
-124.0843
-125.9604
-125.9728
-125.9854
-125.9964
-126.0100
-126.0213
-126.0333
-126.0463
O
O
Ph
Br
4h
C4F9
3.00
1.97
4.27
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)
2.20E+09
2.10E+09
2.00E+09
1.90E+09
1.80E+09
1.70E+09
1.60E+09
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
−1.00E+08
−2.00E+08

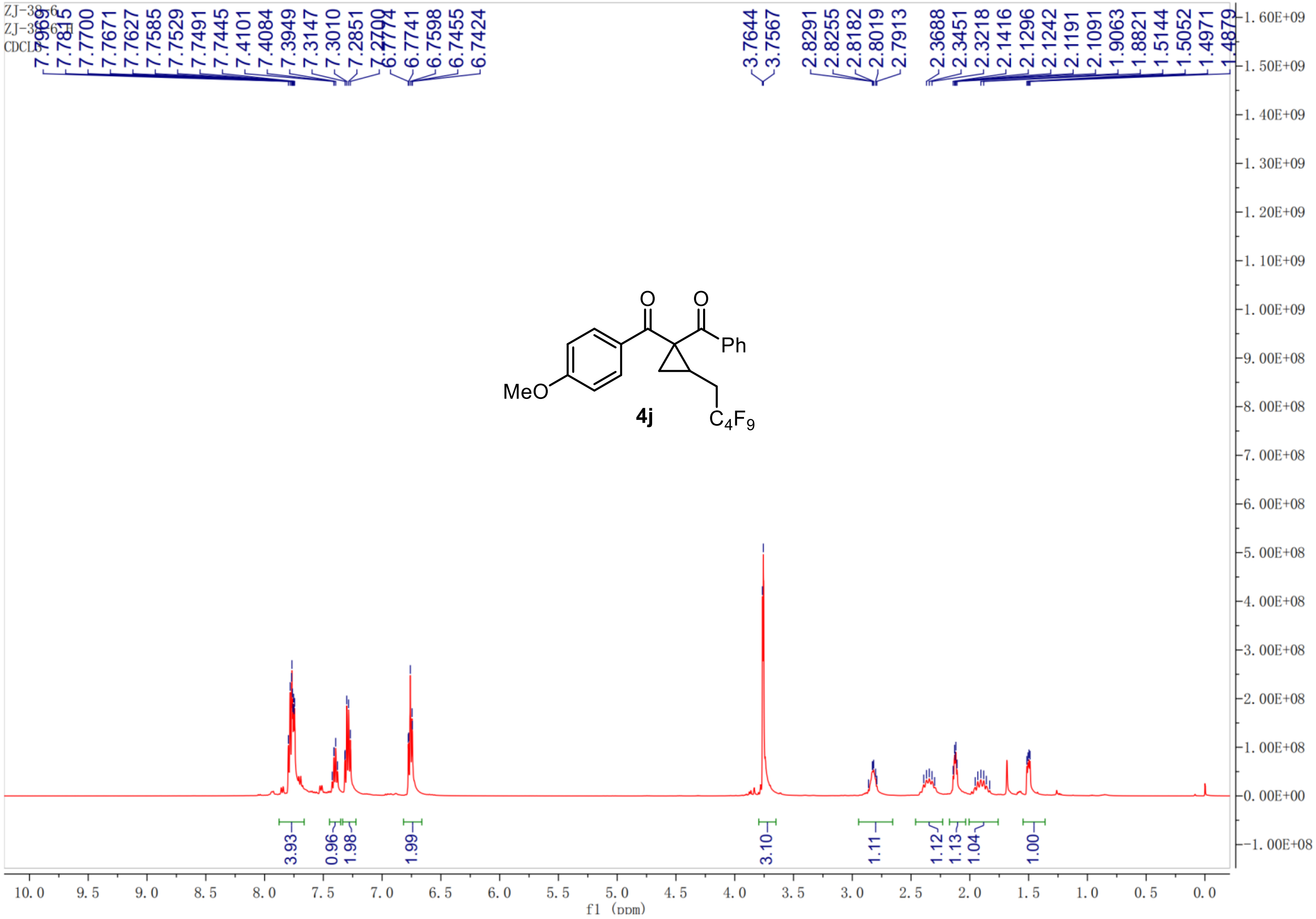

20230603
ZJ-38-9
CDCL3
C
196.0695
195.8168
195.0988
194.8521
139.9572
139.7048
137.7022
136.9709
136.1301
135.4019
133.6459
133.4266
129.9093
129.8791
129.0624
128.9509
128.8292
128.6989
128.5540
77.3311
77.0135
76.6959
43.9000
43.8307
29.7010
29.5940
29.4650
29.3790
29.2515
29.1627
20.8261
19.4626
O
O
Ph
Br
4h
C4F9
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

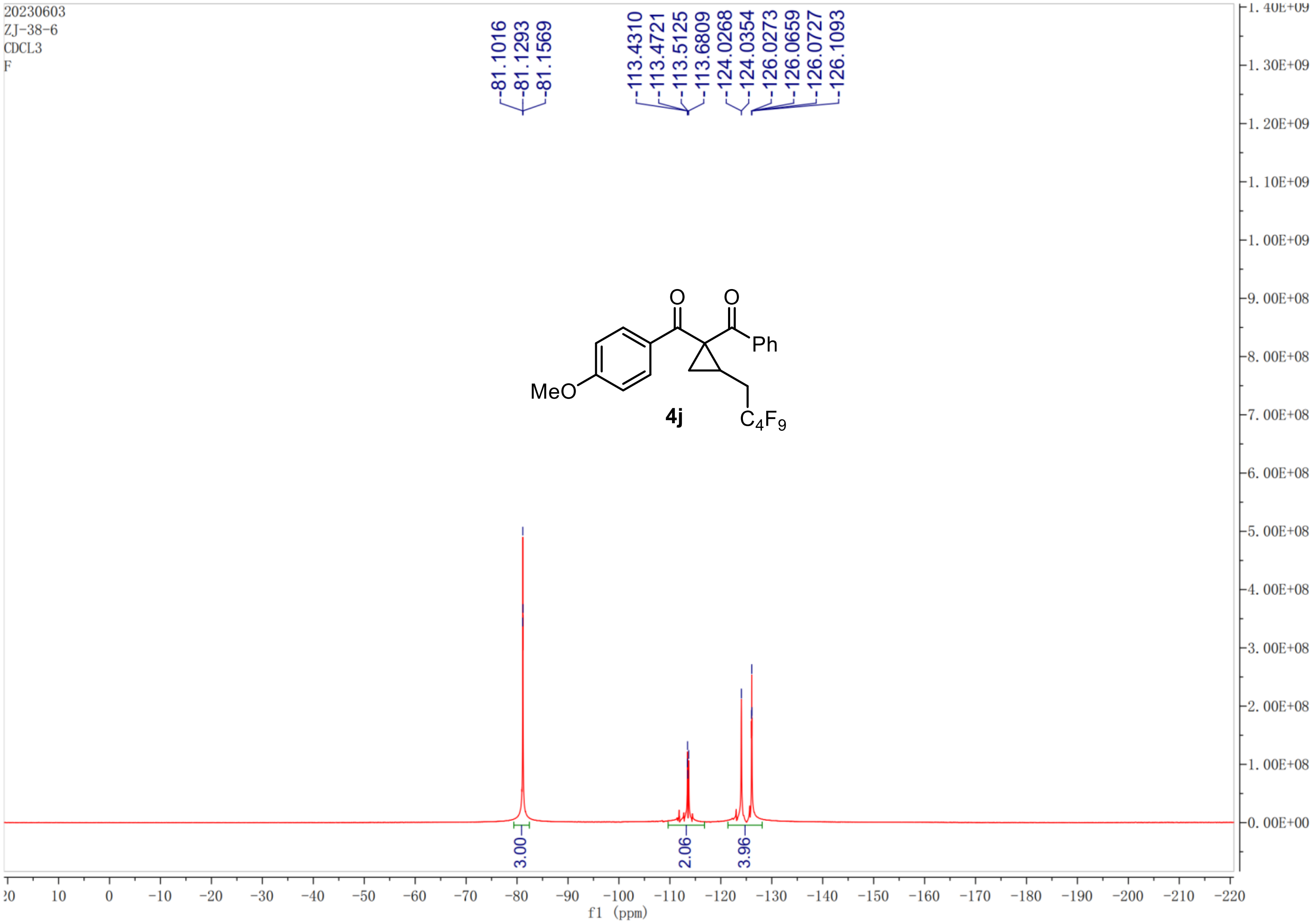

20230613
2J4-6
CDCl3
H
7.8069
7.7350
7.7224
7.7170
7.7137
7.7047
7.6633
7.6470
7.6426
7.6266
7.5463
7.5253
7.4568
7.4481
7.4367
7.4313
7.4272
7.4200
7.4156
7.4012
7.3959
7.3905
7.3741
7.3690
7.3345
7.3150
7.2956
7.2768
7.2616
2.8733
2.8553
2.8428
2.8373
2.3855
2.3726
2.3575
2.3464
2.3260
2.3010
2.2876
2.1596
2.1446
2.1299
1.9851
1.9561
1.9245
1.5721
1.5608
1.5505
1.5458
1.5385
1.5341
1.5235
1.5119
O
O
I
C4F9
4i
3.90
4.81
1.00
1.05
1.01
0.88
0.39
0.67
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)
1.60E+09
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08

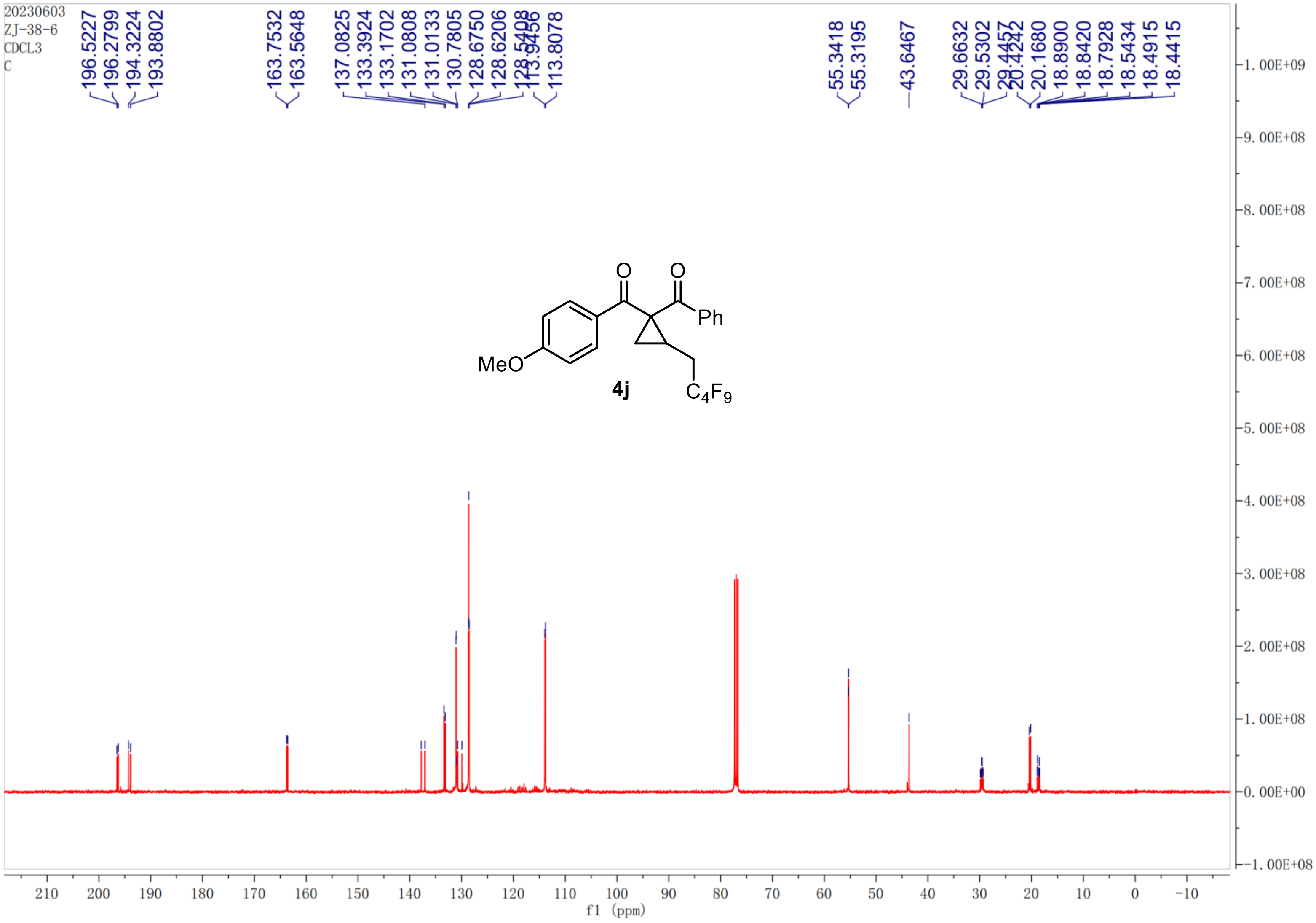

20230613
2J43-6
CDCL3
F
-81.0048
-81.0154
-81.0229
-81.0312
-81.0411
-81.0580
-81.0677
-113.3338
-113.3704
-113.5956
-113.6352
-122.9387
-122.9677
-123.9681
-123.9770
-123.9854
-123.9954
-124.0025
-124.0093
-124.0211
-124.0290
-125.5203
-125.5501
-125.5802
-125.5931
-125.9303
-125.9654
-125.9832
-126.0001
-126.0196
-126.0356
O
O
I
$C_4F_9$
4i
3.00
1.96
4.18
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)

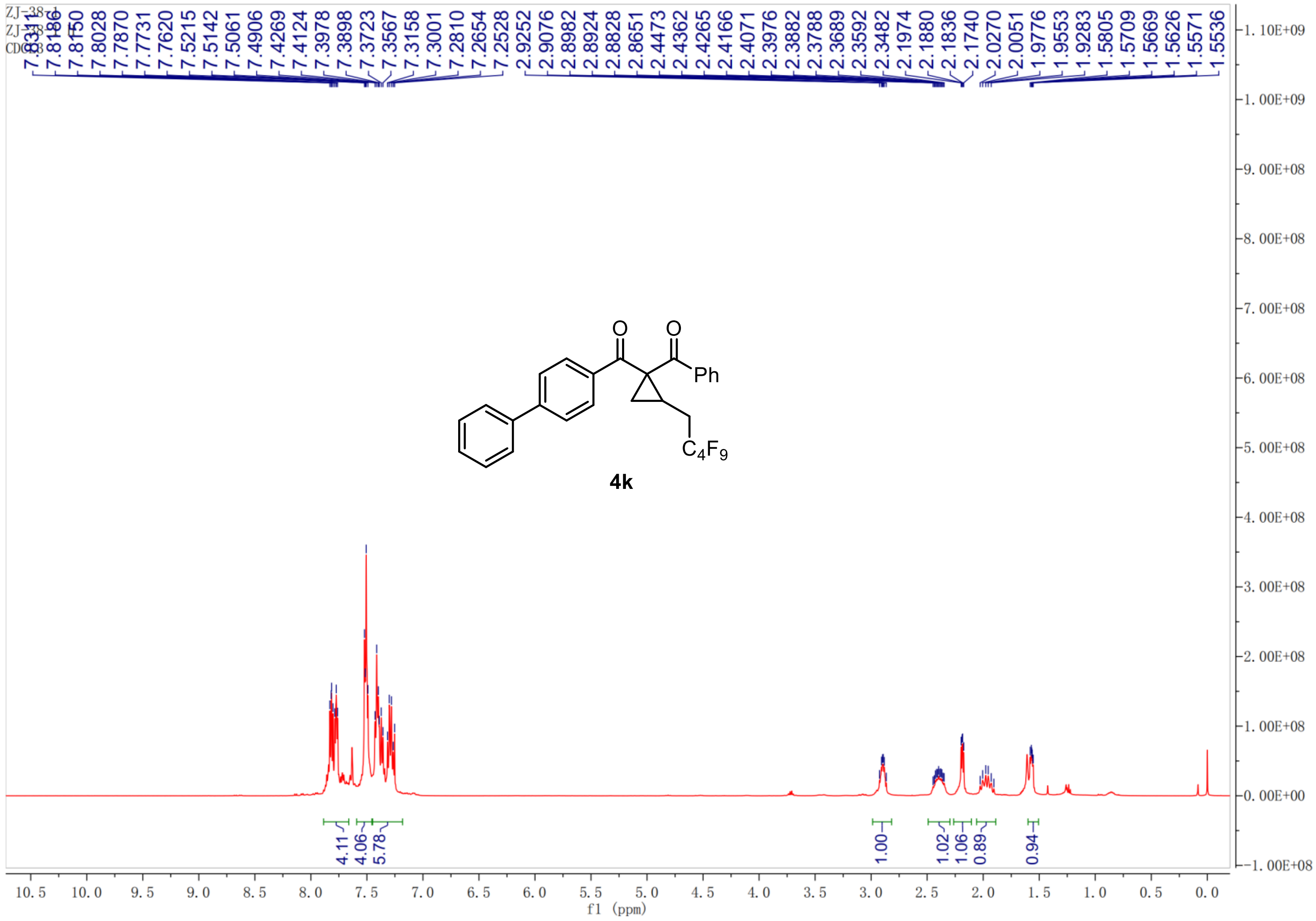

20230617
ZJ43-6
CDCL3
400M
C
195.9866
195.7320
195.5878
195.3624
138.0451
137.9305
137.6758
137.0402
136.9462
136.3179
133.6836
133.4630
129.7965
128.8496
128.7165
128.5889
101.7113
101.3522
77.3313
77.0138
76.6962
43.8407
43.7781
29.4672
29.3864
29.1757
20.8170
19.5170
19.4638
19.3699
19.3181
19.2769
O
O
I
$C_4F_9$
1.60E+08
1.50E+08
1.40E+08
1.30E+08
1.20E+08
1.10E+08
1.00E+08
9.00E+07
8.00E+07
7.00E+07
6.00E+07
5.00E+07
4.00E+07
3.00E+07
2.00E+07
1.00E+07
0.00E+00
-1.00E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

**4i**

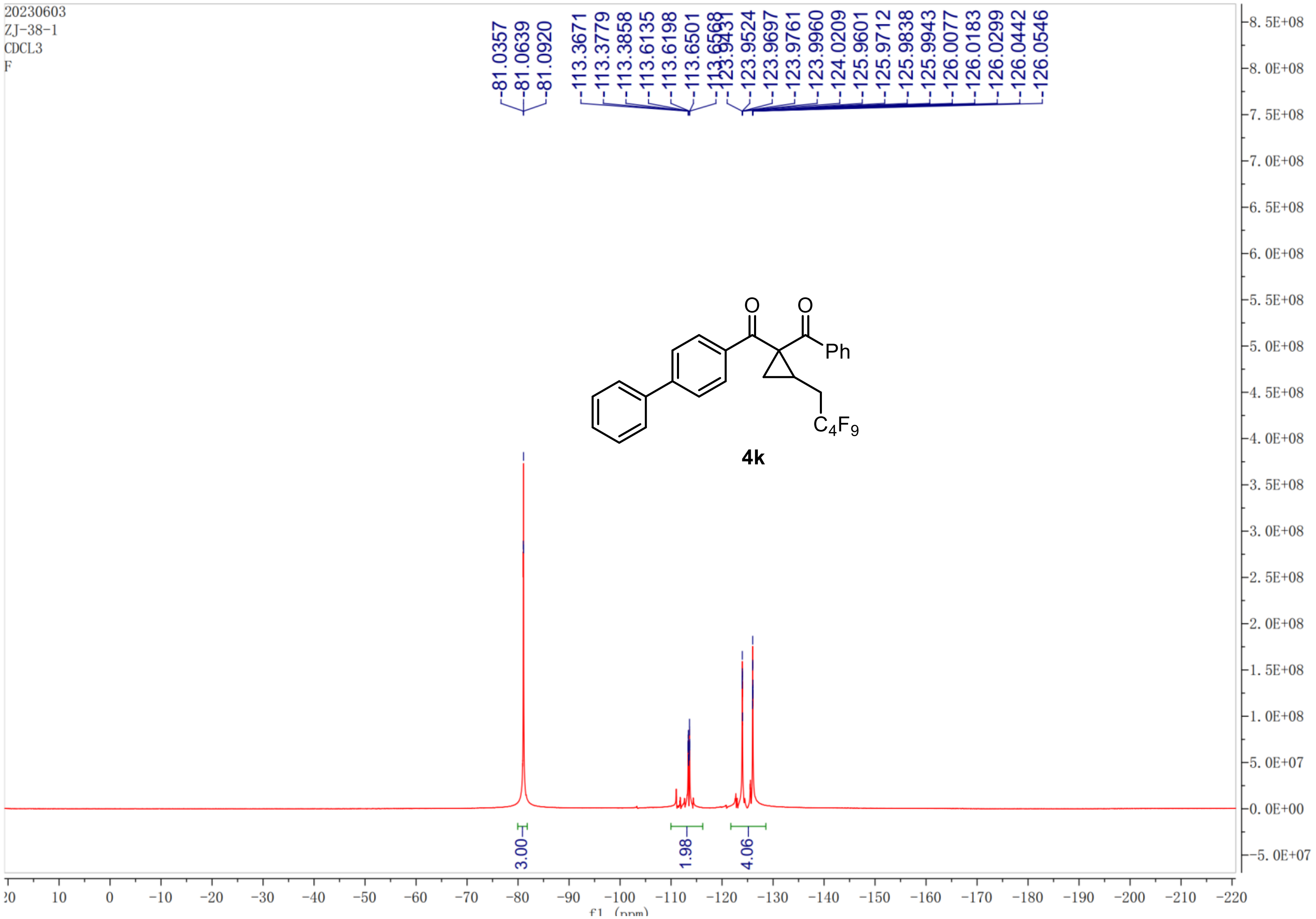
ZJ-38-6
ZJ-38-6_H
CDCL3
7.7969
7.7815
7.7700
7.7671
7.7627
7.7585
7.7529
7.7491
7.7445
7.4101
7.4084
7.3949
7.3147
7.3010
7.2851
7.2700
6.7774
6.7741
6.7598
6.7455
6.7424
3.7644
3.7567
2.8291
2.8255
2.8182
2.8019
2.7913
2.3688
2.3451
2.3218
2.1416
2.1296
2.1242
2.1191
2.1091
1.9063
1.8821
1.5144
1.5052
1.4971
1.4879
O
O
Ph
MeO
4j
$C_4F_9$
3.93
0.96
1.98
1.99
3.10
1.11
1.12
1.13
1.04
1.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
1.60E+09
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
−1.00E+08

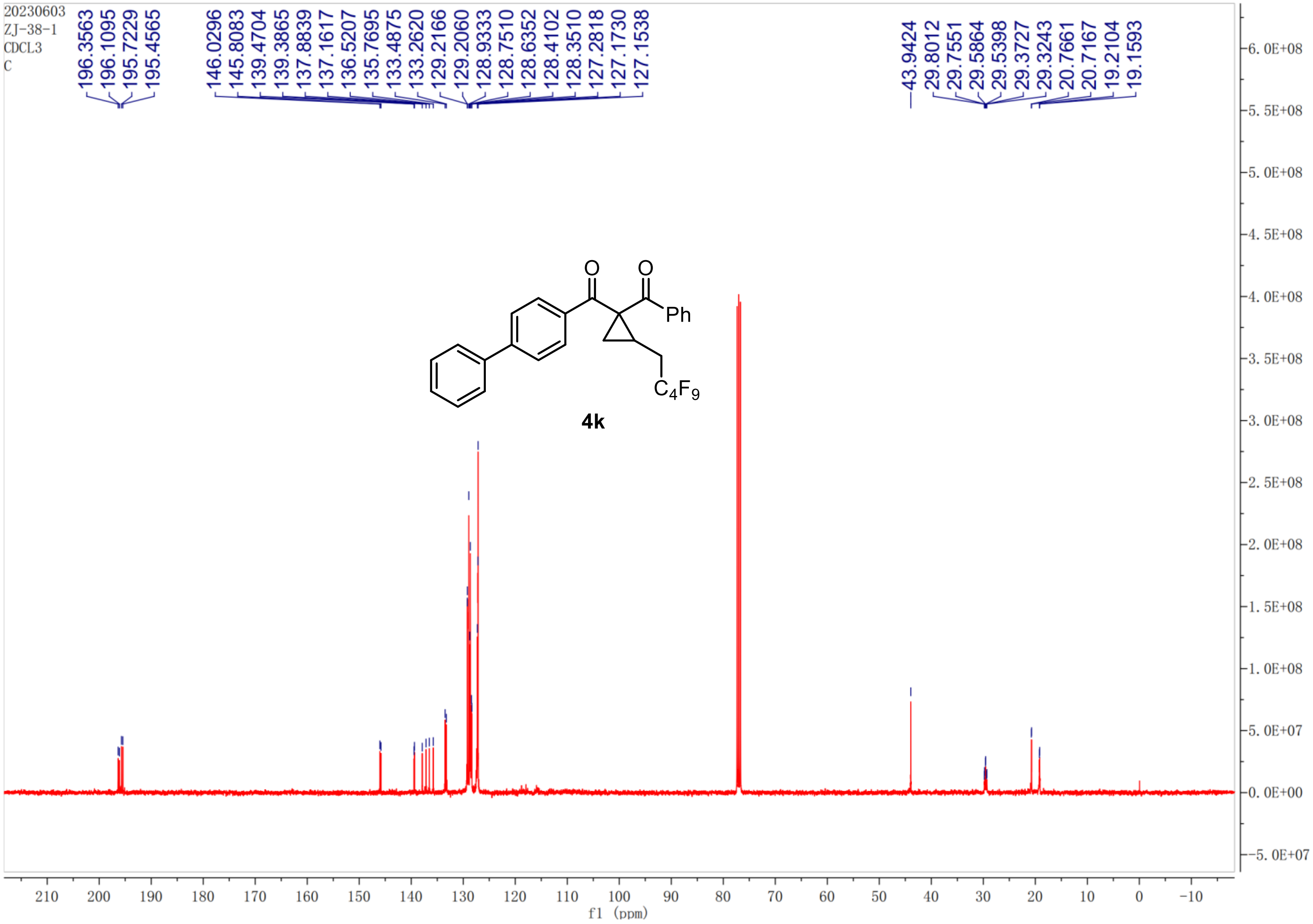

20230603
ZJ-38-6
CDCL3
F
-81.1016
-81.1293
-81.1569
-113.4310
-113.4721
-113.5125
-113.6809
-124.0268
-124.0354
-126.0273
-126.0659
-126.0727
-126.1093
MeO
O
O
Ph
C$_4$F$_9$
4j
3.00
2.06
3.96
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)
1. 40E+09
1. 30E+09
1. 20E+09
1. 10E+09
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00

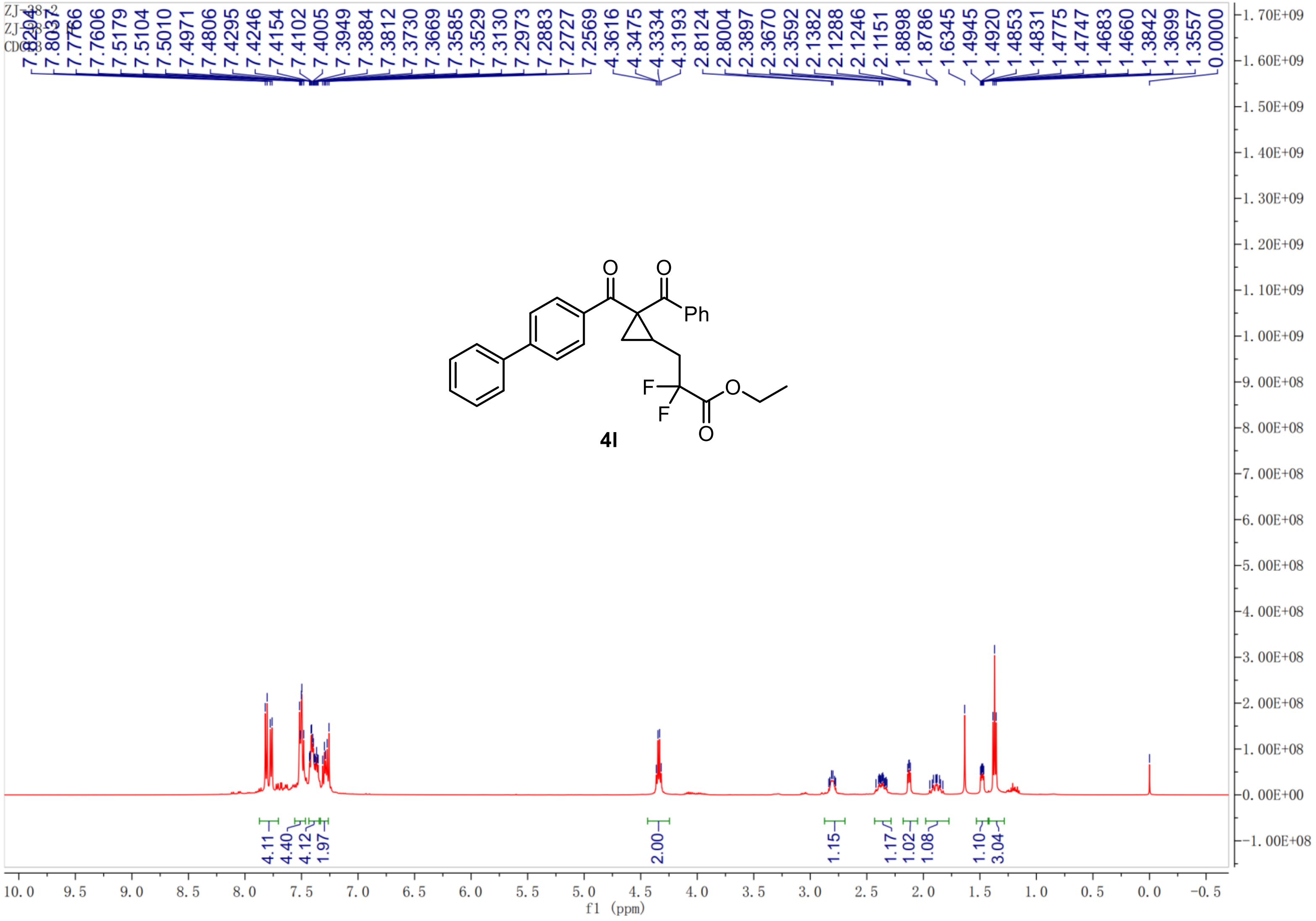

20230603
ZJ-38-6
CDCL3
C
196.5227
196.2799
194.3224
193.8802
163.7532
163.5648
137.0825
133.3924
133.1702
131.0808
131.0133
130.7805
128.6750
128.6206
128.5408
113.9456
113.8078
55.3418
55.3195
43.6467
29.6632
29.5302
29.4457
20.4242
20.1680
18.8900
18.8420
18.7928
18.5434
18.4915
18.4415
O
O
Ph
MeO
4j
$C_4F_9$
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00
−1. 00E+08
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

ZJ-38-1
ZJ-38-1-H
CDCl3
7.8311
7.8186
7.8150
7.8028
7.7870
7.7731
7.7620
7.5215
7.5142
7.5061
7.4906
7.4269
7.4124
7.3978
7.3898
7.3723
7.3567
7.3158
7.3001
7.2810
7.2654
7.2528
2.9252
2.9076
2.8982
2.8924
2.8828
2.8651
2.4473
2.4362
2.4265
2.4166
2.4071
2.3976
2.3882
2.3788
2.3689
2.3592
2.3482
2.1974
2.1880
2.1836
2.1740
2.0270
2.0051
1.9776
1.9553
1.9283
1.5805
1.5709
1.5669
1.5626
1.5571
1.5536
O
O
Ph
C4F9
4.11
4.06
5.78
1.00
1.02
1.06
0.89
0.94
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08

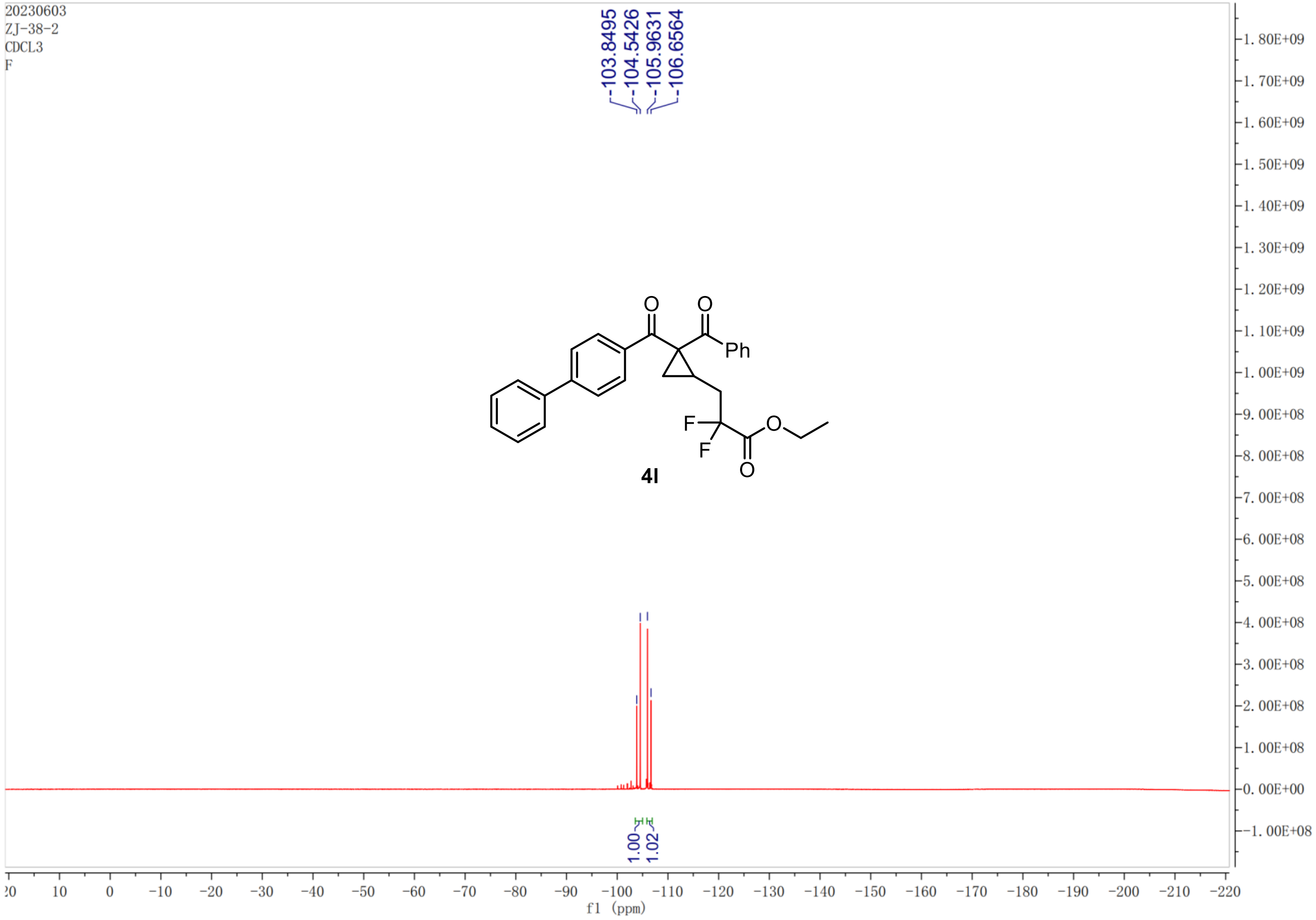
**4k**

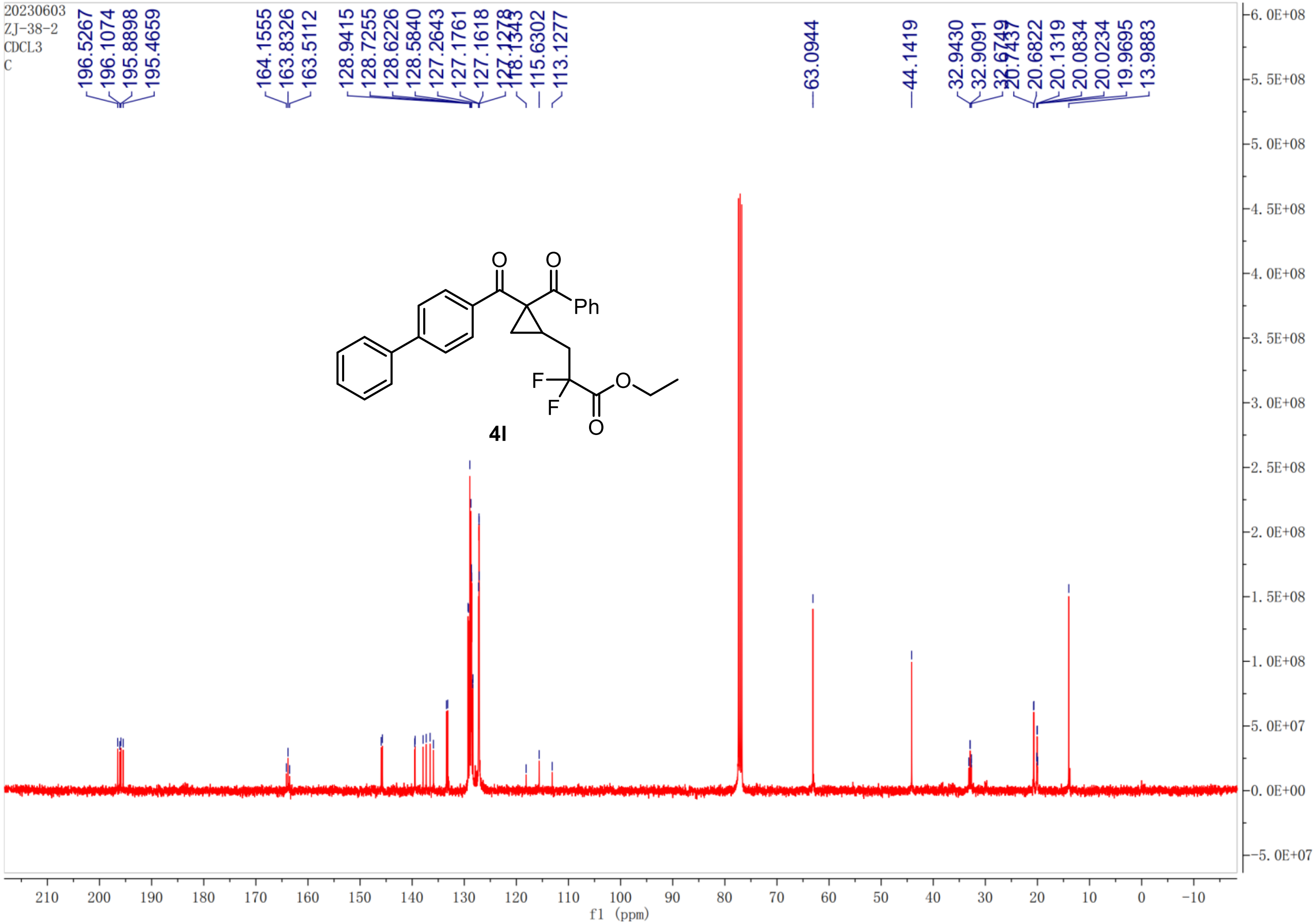

20230603
ZJ-38-1
CDCL3
F
-81.0357
-81.0639
-81.0920
-113.3671
-113.3779
-113.3858
-113.6135
-113.6198
-113.6501
-113.6568
-123.9431
-123.9524
-123.9697
-123.9761
-123.9960
-124.0209
-125.9601
-125.9712
-125.9838
-125.9943
-126.0077
-126.0183
-126.0299
-126.0442
-126.0546
O
O
Ph
C4F9
4k
3.00
1.98
4.06
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)
8. 5E+08
8. 0E+08
7. 5E+08
7. 0E+08
6. 5E+08
6. 0E+08
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
−5. 0E+07

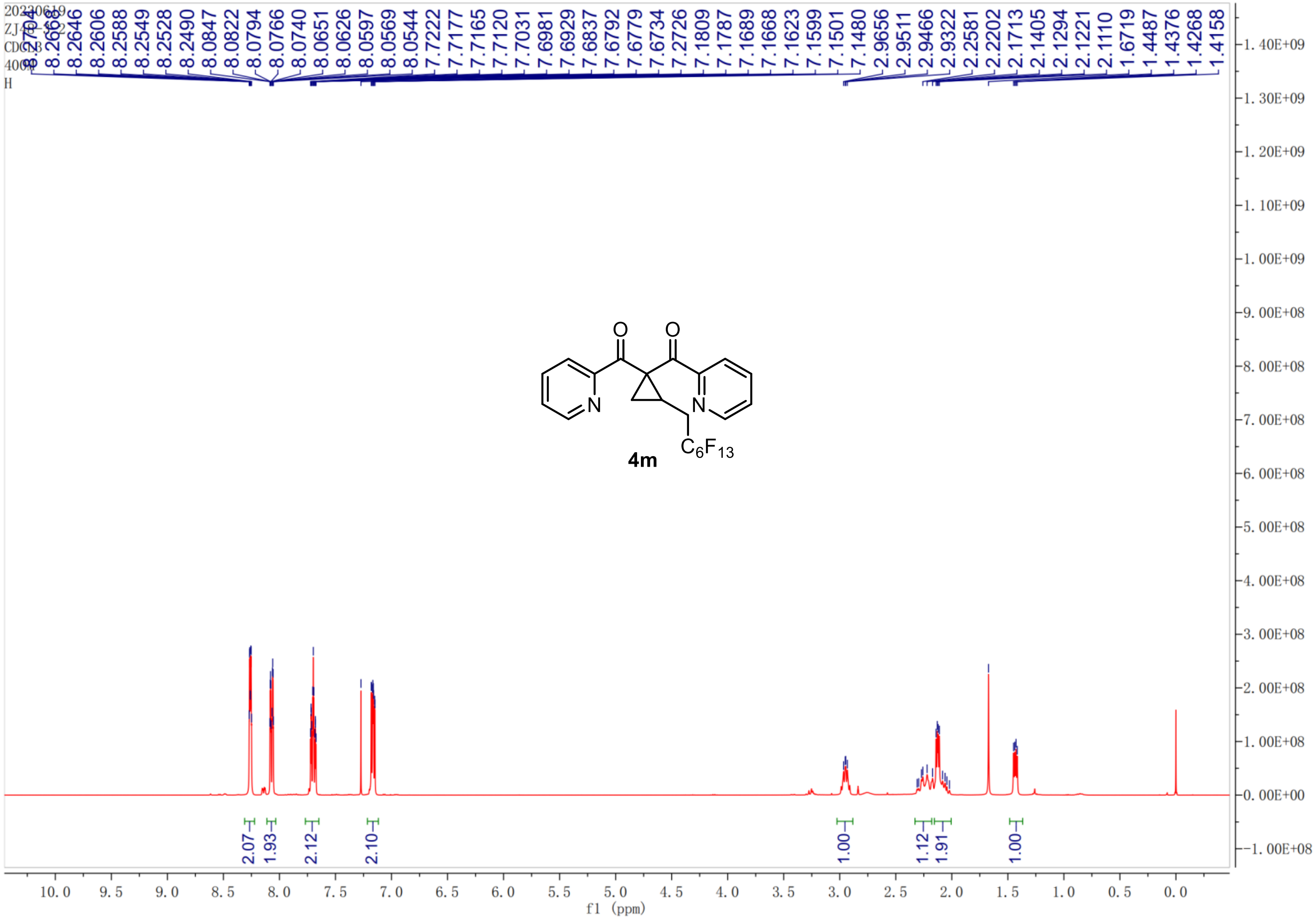
20230603
ZJ-38-1
CDCL3
C
196.3563
196.1095
195.7229
195.4565
146.0296
145.8083
139.4704
139.3865
137.8839
137.1617
136.5207
135.7695
133.4875
133.2620
129.2166
129.2060
128.9333
128.7510
128.6352
128.4102
128.3510
127.2818
127.1730
127.1538
43.9424
29.8012
29.7551
29.5864
29.5398
29.3727
29.3243
20.7661
20.7167
19.2104
19.1593
O
O
Ph
$C_4F_9$
4k
6. 0E+08
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
-5. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

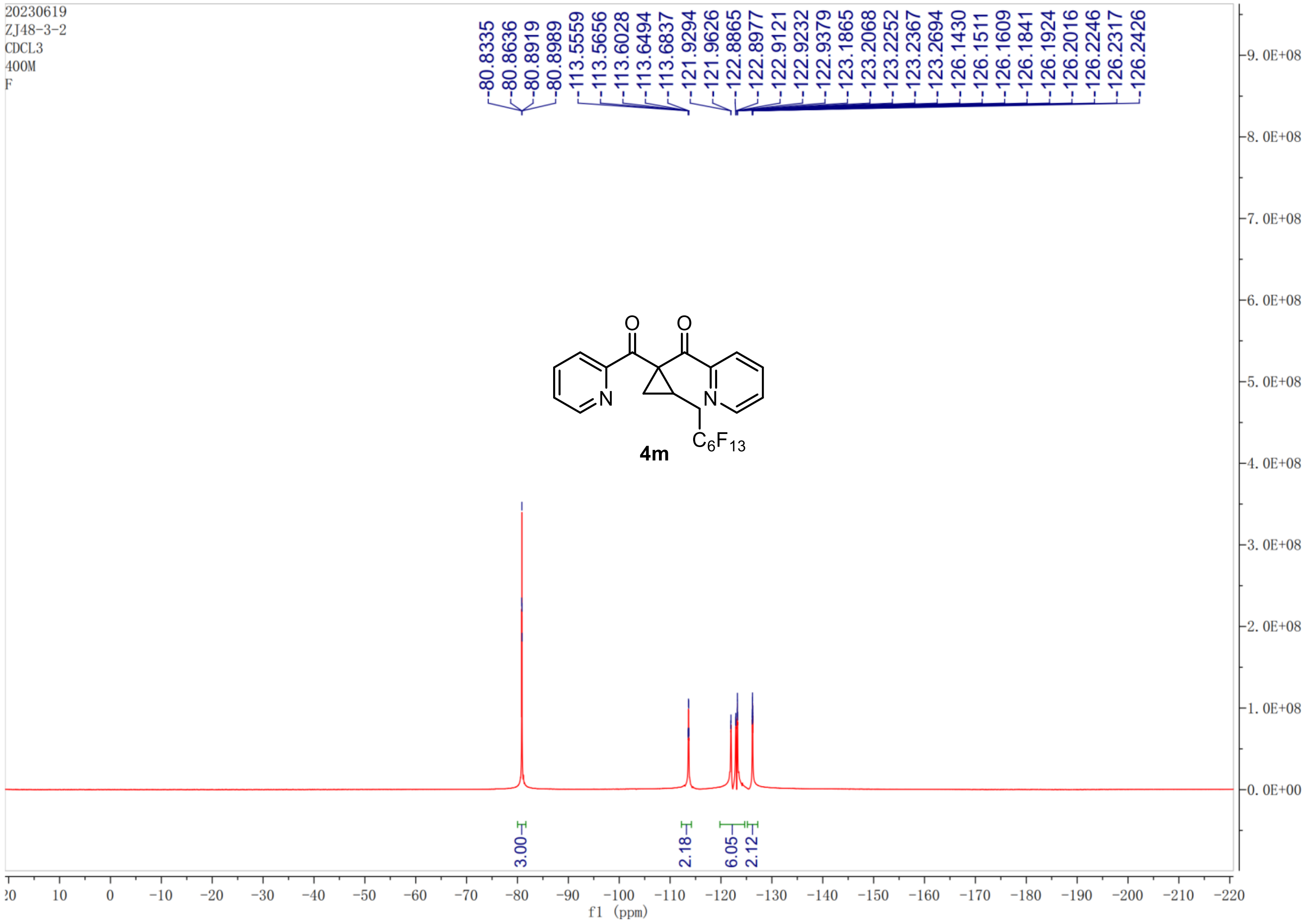

ZJ-38-2
ZJ-38-2 1H
CDCl3
7.8204
7.8037
7.7766
7.7606
7.5179
7.5104
7.5010
7.4971
7.4806
7.4295
7.4246
7.4154
7.4102
7.4005
7.3949
7.3884
7.3812
7.3730
7.3669
7.3585
7.3529
7.3130
7.2973
7.2883
7.2727
7.2569
4.3616
4.3475
4.3334
4.3193
2.8124
2.8004
2.3897
2.3670
2.3592
2.1382
2.1288
2.1246
2.1151
1.8898
1.8786
1.6345
1.4945
1.4920
1.4853
1.4831
1.4775
1.4747
1.4683
1.4660
1.3842
1.3699
1.3557
0.0000
O
O
Ph
F
F
O
O
4.11
4.40
4.12
1.97
2.00
1.15
1.17
1.02
1.08
1.10
3.04
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)
1.70E+09
1.60E+09
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08

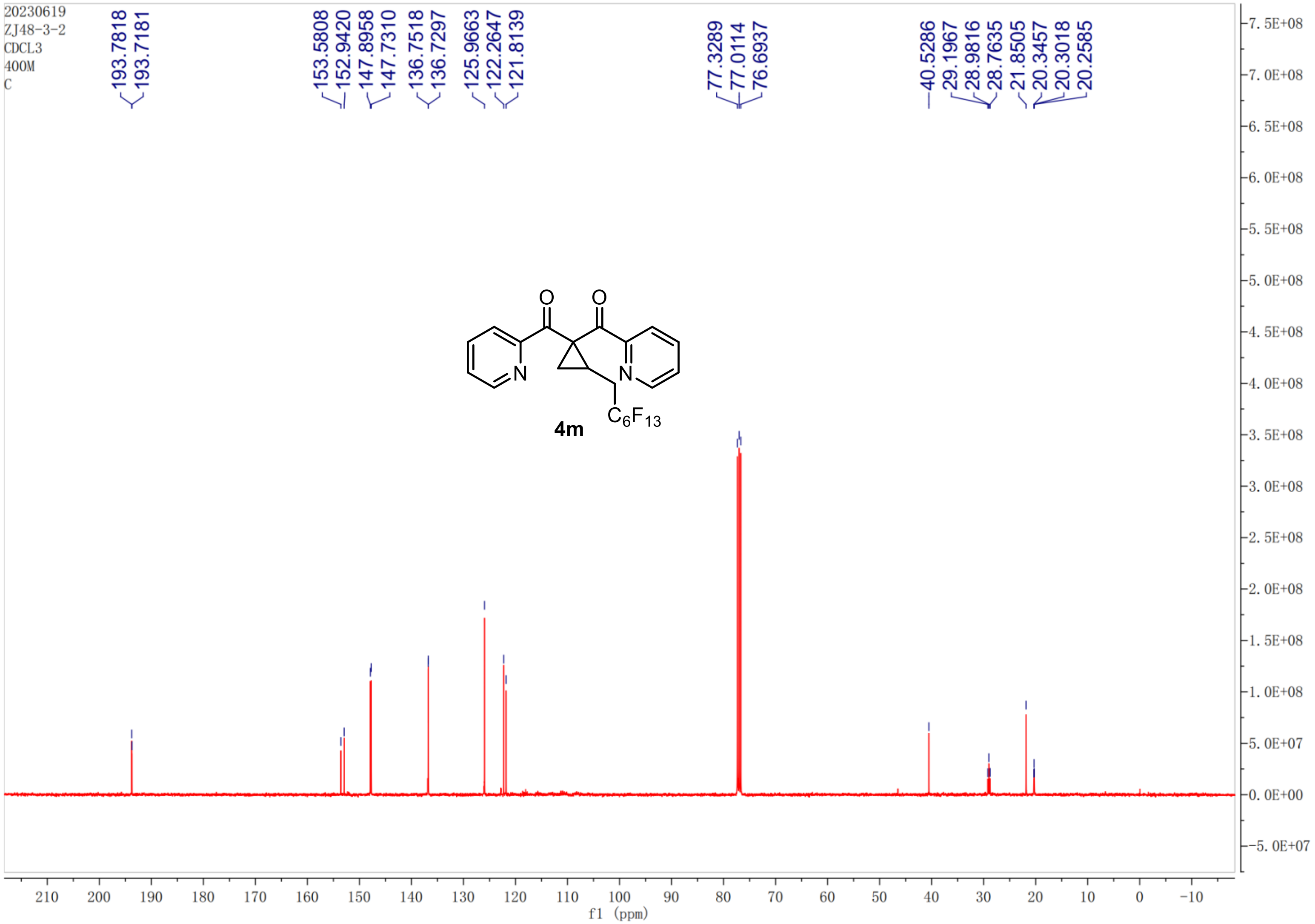
**4l**

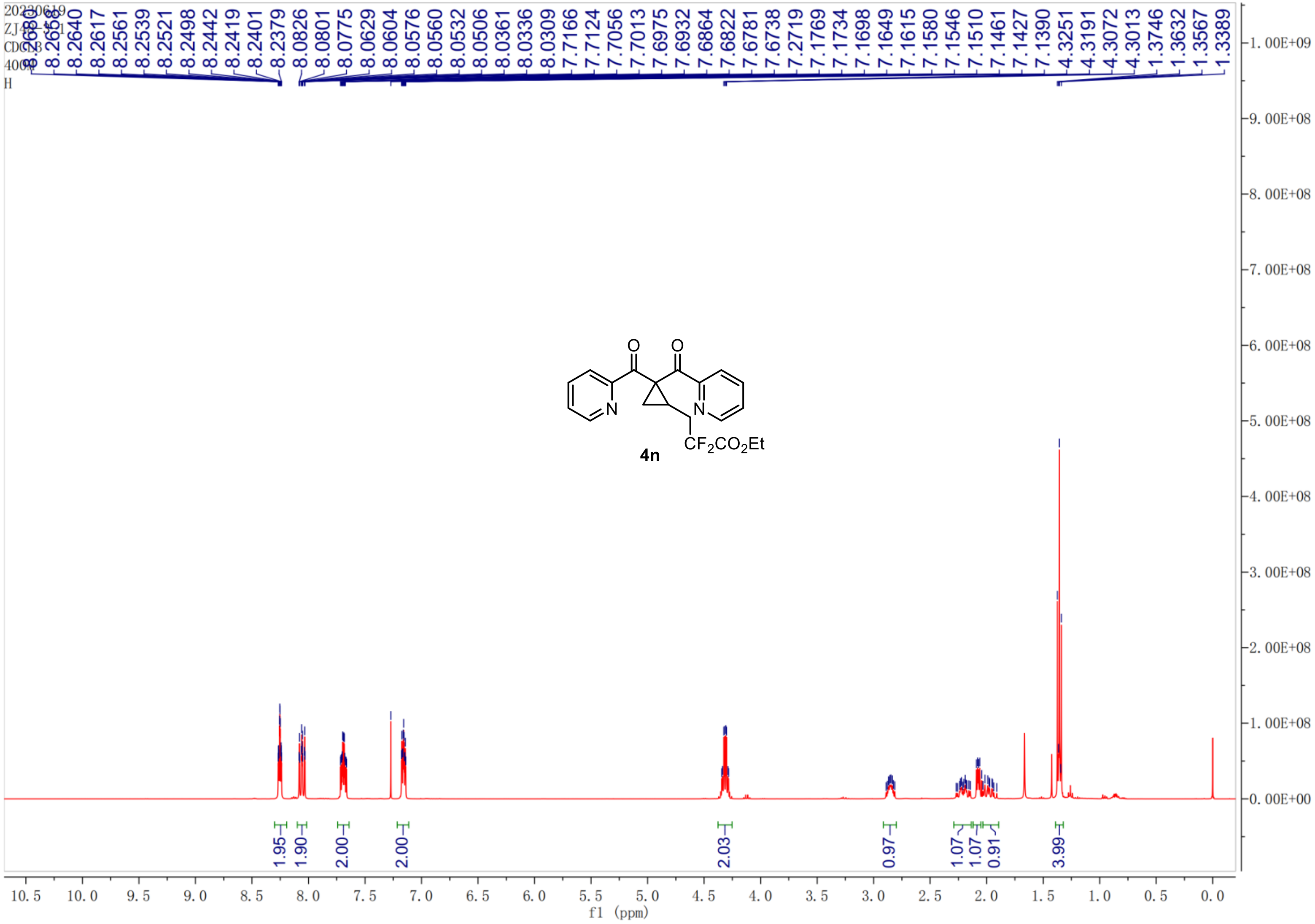

20230603
ZJ-38-2
CDCL3
F
-103.8495
-104.5426
-105.9631
-106.6564
O
O
Ph
F
F
O
O
4l
1.00
1.02
1. 80E+09
1. 70E+09
1. 60E+09
1. 50E+09
1. 40E+09
1. 30E+09
1. 20E+09
1. 10E+09
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00
−1. 00E+08
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)

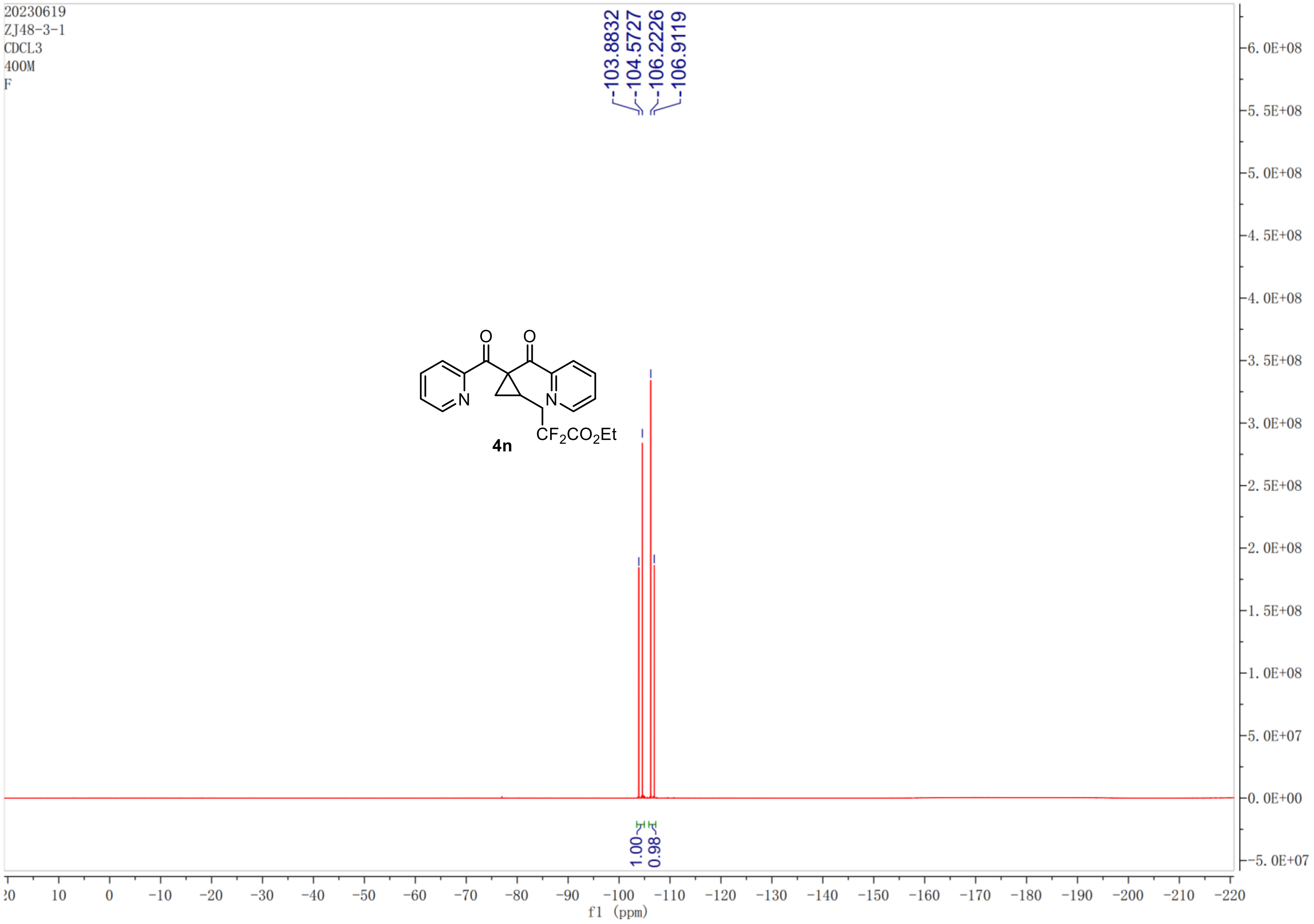

20230603
ZJ-38-2
CDCL3
C
196.5267
196.1074
195.8898
195.4659
164.1555
163.8326
163.5112
128.9415
128.7255
128.6226
128.5840
127.2643
127.1761
127.1618
127.1278
118.1343
115.6302
113.1277
63.0944
44.1419
32.9430
32.9091
32.6749
20.7437
20.6822
20.1319
20.0834
20.0234
19.9695
13.9883
O
O
Ph
F
F
O
O
4l
6. 0E+08
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
−5. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)

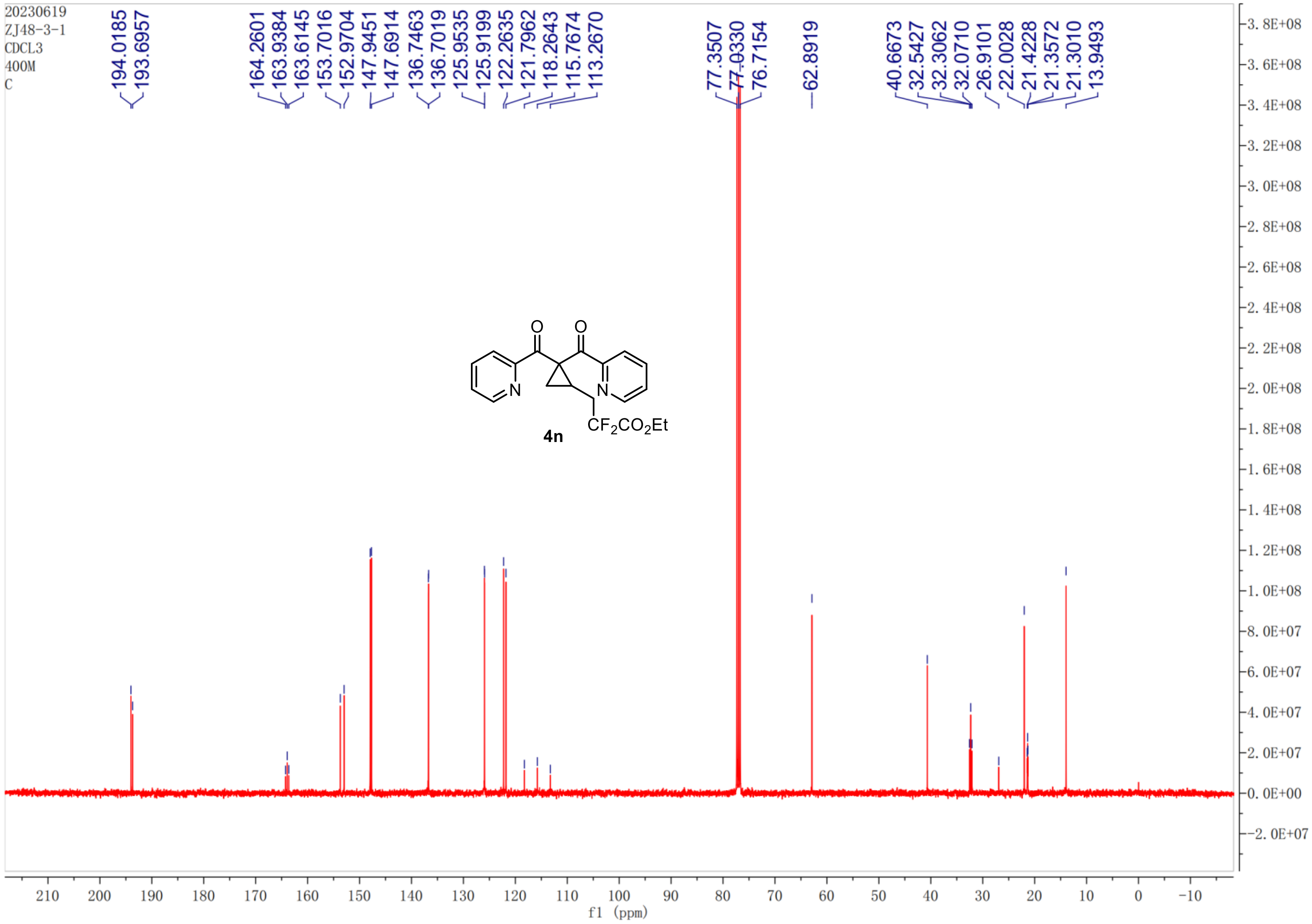

20230619
ZJ48-3-2
CDCl3
400M
H
8.2704
8.2668
8.2646
8.2606
8.2588
8.2549
8.2528
8.2490
8.0847
8.0822
8.0794
8.0766
8.0740
8.0651
8.0626
8.0597
8.0569
8.0544
7.7222
7.7177
7.7165
7.7120
7.7031
7.6981
7.6929
7.6837
7.6792
7.6779
7.6734
7.2726
7.1809
7.1787
7.1689
7.1668
7.1623
7.1599
7.1501
7.1480
2.9656
2.9511
2.9466
2.9322
2.2581
2.2202
2.1713
2.1405
2.1294
2.1221
2.1110
1.6719
1.4487
1.4376
1.4268
1.4158
O
O
N
N
C6F13
4m
2.07
1.93
2.12
2.10
1.00
1.12
1.91
1.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08

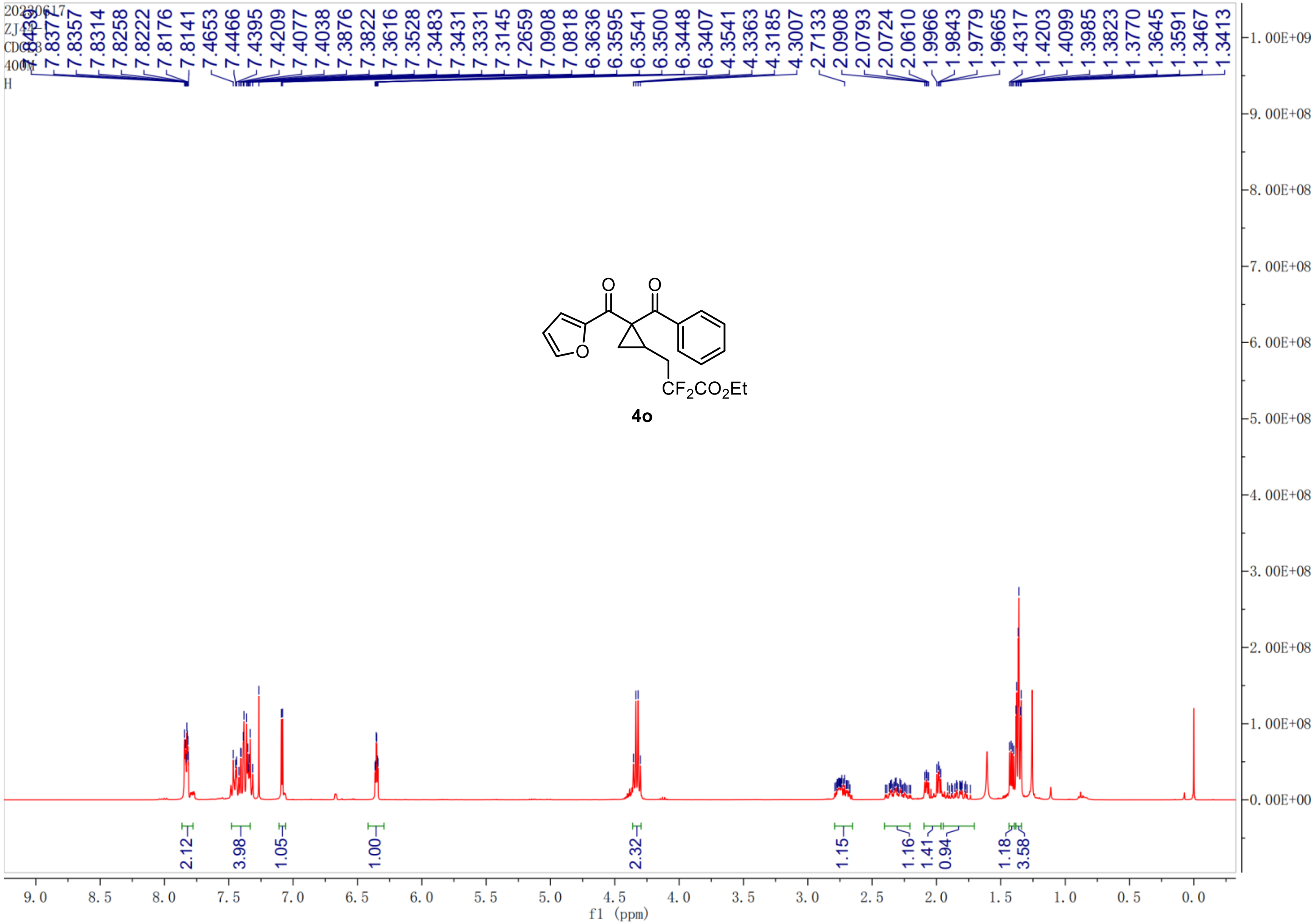

20230619
ZJ48-3-2
CDCL3
400M
F
-80.8335
-80.8636
-80.8919
-80.8989
-113.5559
-113.5656
-113.6028
-113.6494
-113.6837
-121.9294
-121.9626
-122.8865
-122.8977
-122.9121
-122.9232
-122.9379
-123.1865
-123.2068
-123.2252
-123.2367
-123.2694
-126.1430
-126.1511
-126.1609
-126.1841
-126.1924
-126.2016
-126.2246
-126.2317
-126.2426
O
O
N
N
$C_6F_{13}$
4m
3.00
2.18
6.05
2.12
9. 0E+08
8. 0E+08
7. 0E+08
6. 0E+08
5. 0E+08
4. 0E+08
3. 0E+08
2. 0E+08
1. 0E+08
0. 0E+00
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)

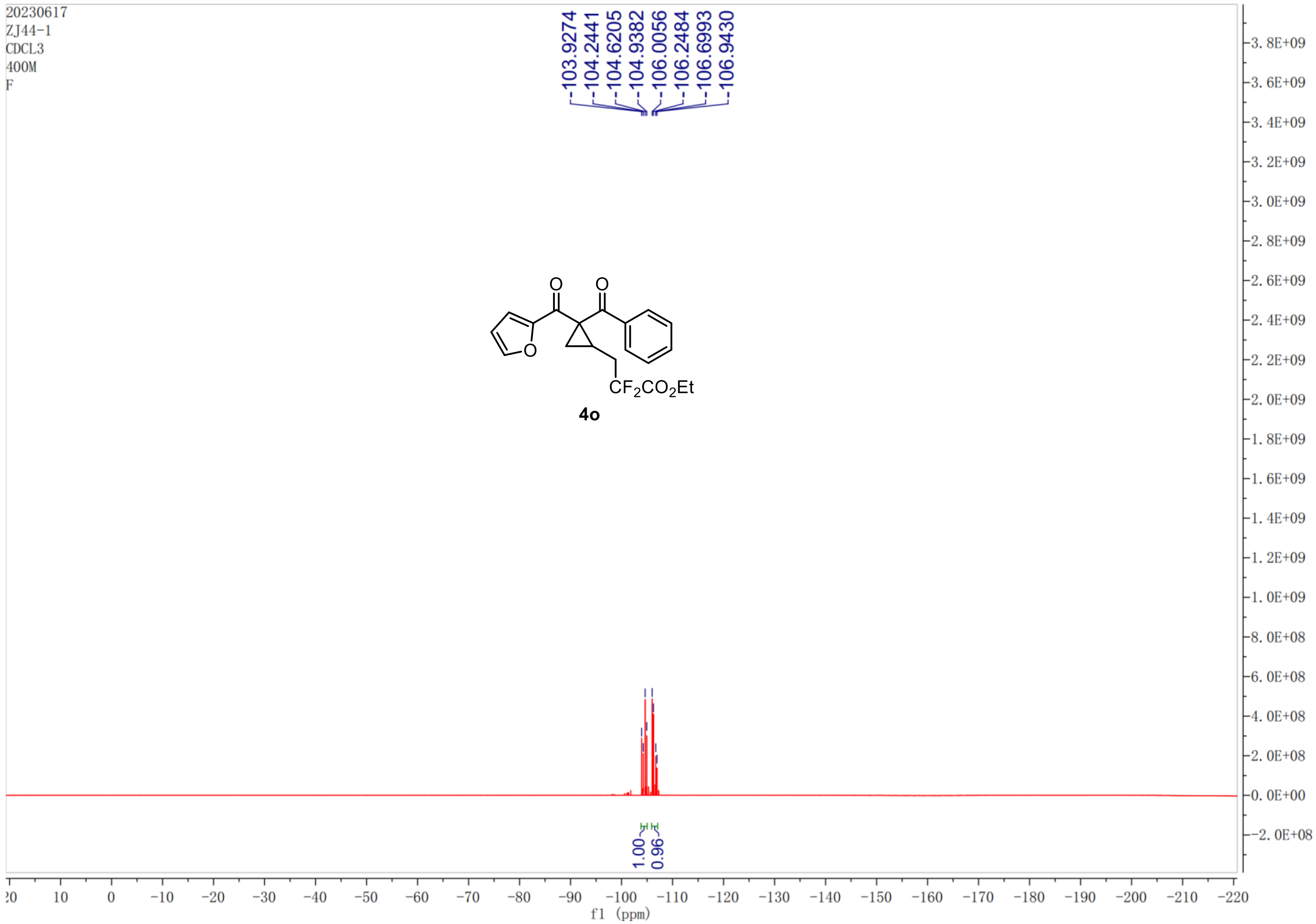

20230619
ZJ48-3-2
CDCL3
400M
C
193.7818
193.7181
153.5808
152.9420
147.8958
147.7310
136.7518
136.7297
125.9663
122.2647
121.8139
77.3289
77.0114
76.6937
40.5286
29.1967
28.9816
28.7635
21.8505
20.3457
20.3018
20.2585
O
O
N
N
C6F13
4m
7.5E+08
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

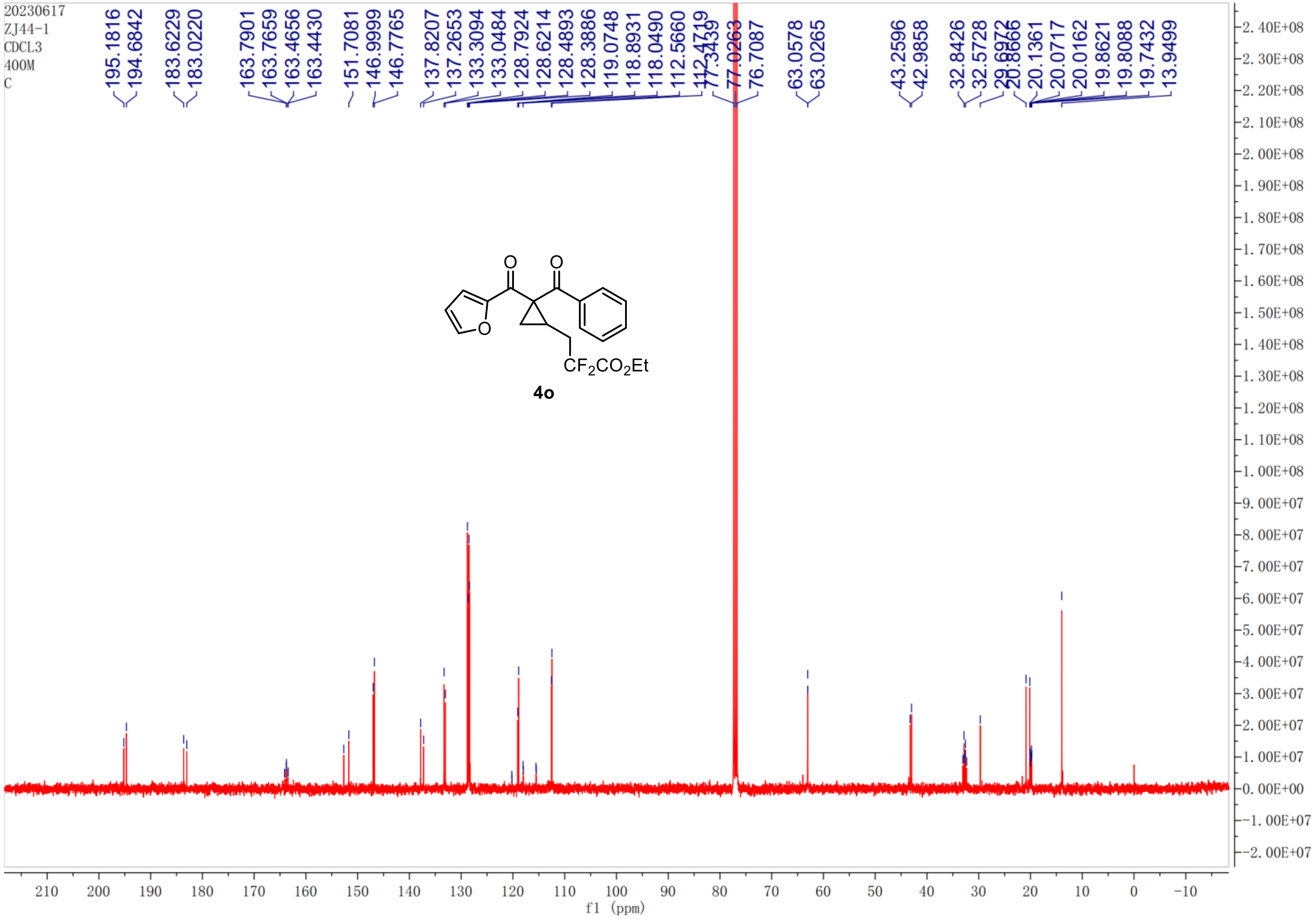

20230619
ZJ48-5-1
CDCl3
400M
H
8.2680
8.2658
8.2640
8.2617
8.2561
8.2539
8.2521
8.2498
8.2442
8.2419
8.2401
8.2379
8.0826
8.0801
8.0775
8.0629
8.0604
8.0576
8.0560
8.0532
8.0506
8.0361
8.0336
8.0309
7.7166
7.7124
7.7056
7.7013
7.6975
7.6932
7.6864
7.6822
7.6781
7.6738
7.2719
7.1769
7.1734
7.1698
7.1649
7.1615
7.1580
7.1546
7.1510
7.1461
7.1427
7.1390
4.3251
4.3191
4.3072
4.3013
1.3746
1.3632
1.3567
1.3389
O
O
N
N
CF2CO2Et
4n
1.95
1.90
2.00
2.00
2.03
0.97
1.07
1.07
0.91
3.99
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00

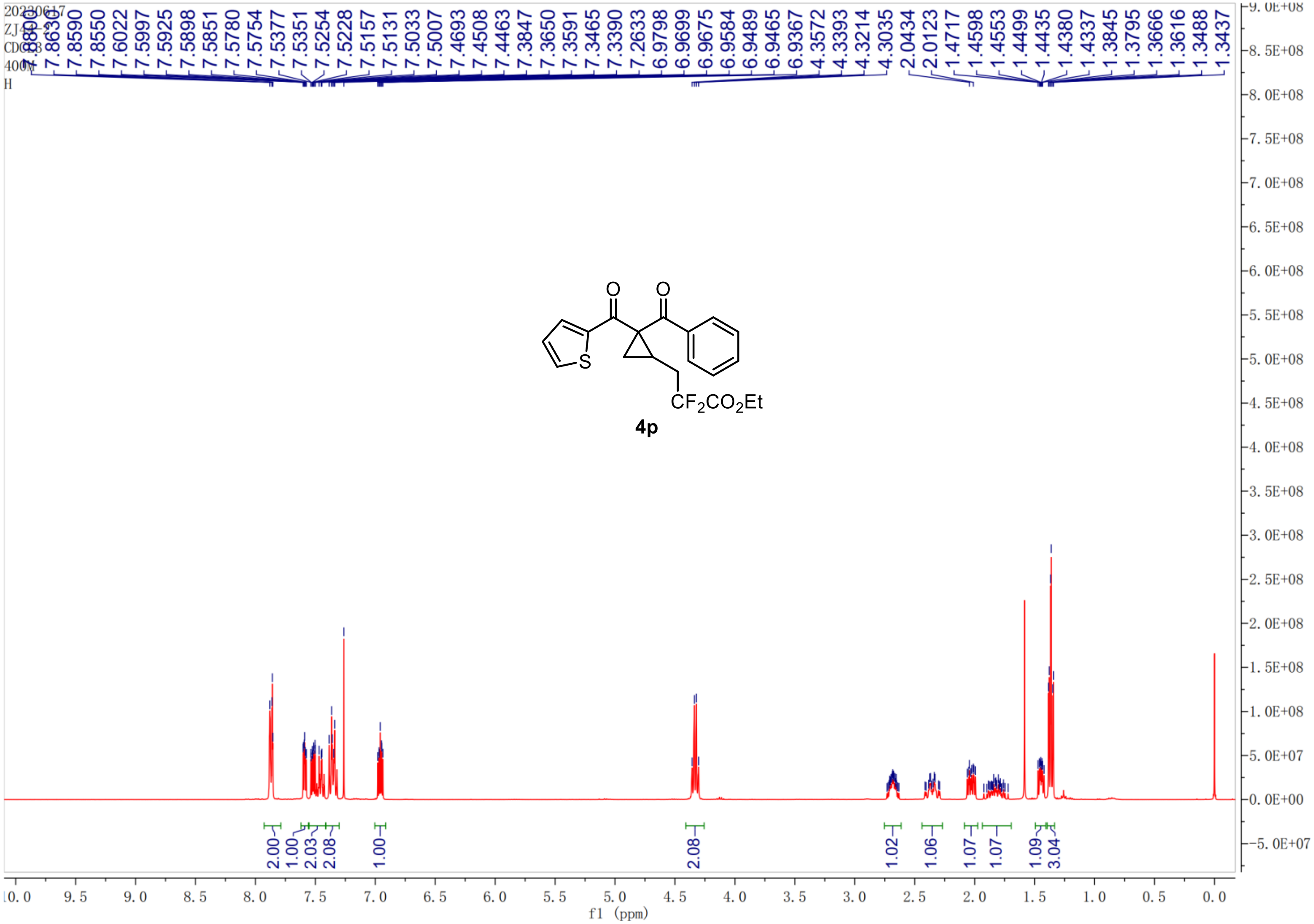

20230619
ZJ48-3-1
CDCL3
400M
F
-103.8832
-104.5727
-106.2226
-106.9119
4n
$CF_2CO_2Et$
1.00
0.98
6. 0E+08
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
−5. 0E+07
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)


20230619
ZJ48-3-1
CDCL3
400M
C
194.0185
193.6957
164.2601
163.9384
163.6145
153.7016
152.9704
147.9451
147.6914
136.7463
136.7019
125.9535
125.9199
122.2635
121.7962
118.2643
115.7674
113.2670
77.3507
77.0330
76.7154
62.8919
40.6673
32.5427
32.3062
32.0710
26.9101
22.0028
21.4228
21.3572
21.3010
13.9493
O
O
N
N
CF2CO2Et
4n
3. 8E+08
3. 6E+08
3. 4E+08
3. 2E+08
3. 0E+08
2. 8E+08
2. 6E+08
2. 4E+08
2. 2E+08
2. 0E+08
1. 8E+08
1. 6E+08
1. 4E+08
1. 2E+08
1. 0E+08
8. 0E+07
6. 0E+07
4. 0E+07
2. 0E+07
0. 0E+00
-2. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

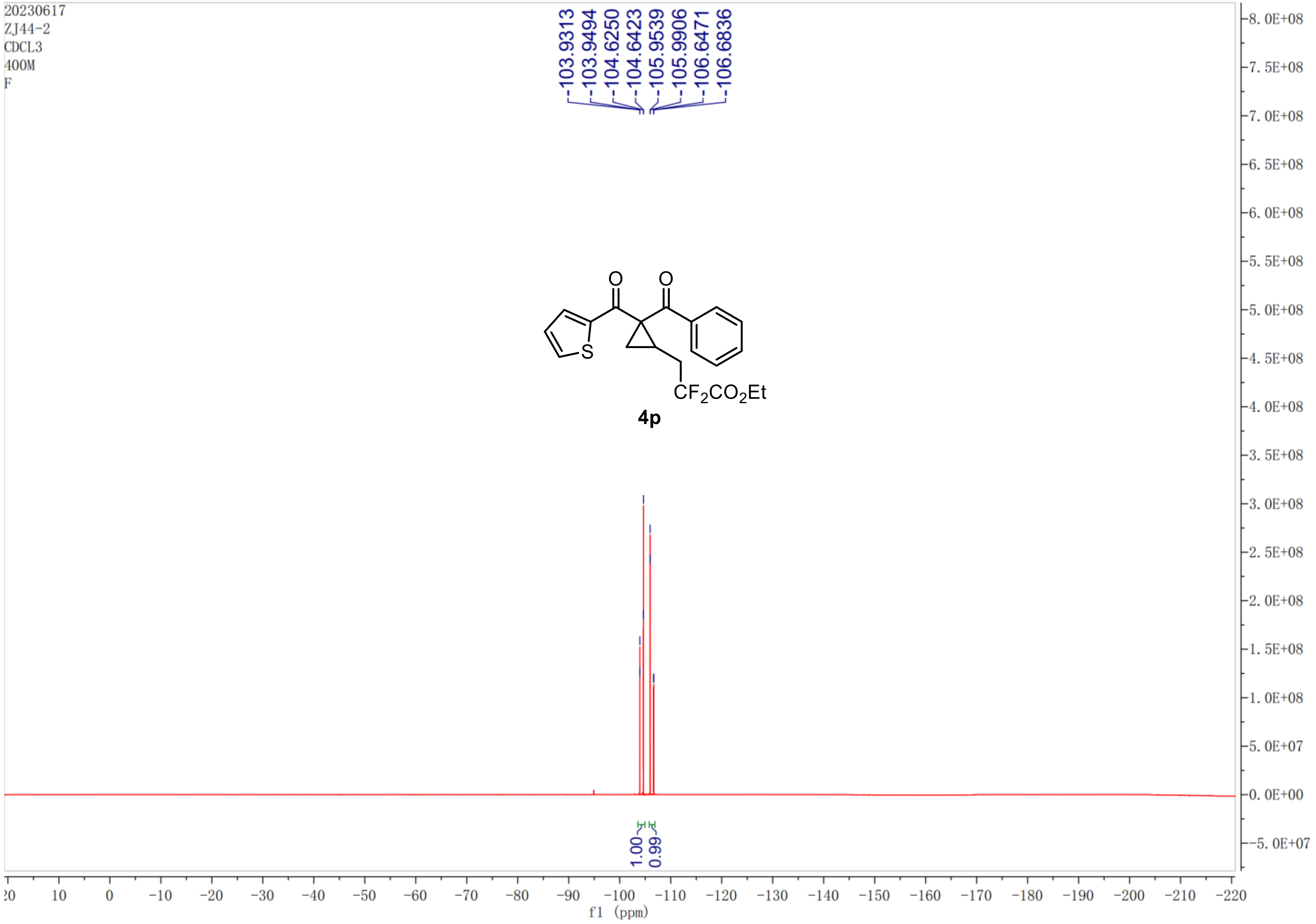

20230617
ZJ44-1
CDCl3
400M
H
7.8439
7.8377
7.8357
7.8314
7.8258
7.8222
7.8176
7.8141
7.4653
7.4466
7.4395
7.4209
7.4077
7.4038
7.3876
7.3822
7.3616
7.3528
7.3483
7.3431
7.3331
7.3145
7.2659
7.0908
7.0818
6.3636
6.3595
6.3541
6.3500
6.3448
6.3407
4.3541
4.3363
4.3185
4.3007
2.7133
2.0908
2.0793
2.0724
2.0610
1.9966
1.9843
1.9779
1.9665
1.4317
1.4203
1.4099
1.3985
1.3823
1.3770
1.3645
1.3591
1.3467
1.3413
O
O
O
CF2CO2Et
4o
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00
2.12
3.98
1.05
1.00
2.32
1.15
1.16
1.41
0.94
1.18
3.58
9. 0
8. 5
8. 0
7. 5
7. 0
6. 5
6. 0
5. 5
5. 0
4. 5
4. 0
3. 5
3. 0
2. 5
2. 0
1. 5
1. 0
0. 5
0. 0
f1 (ppm)

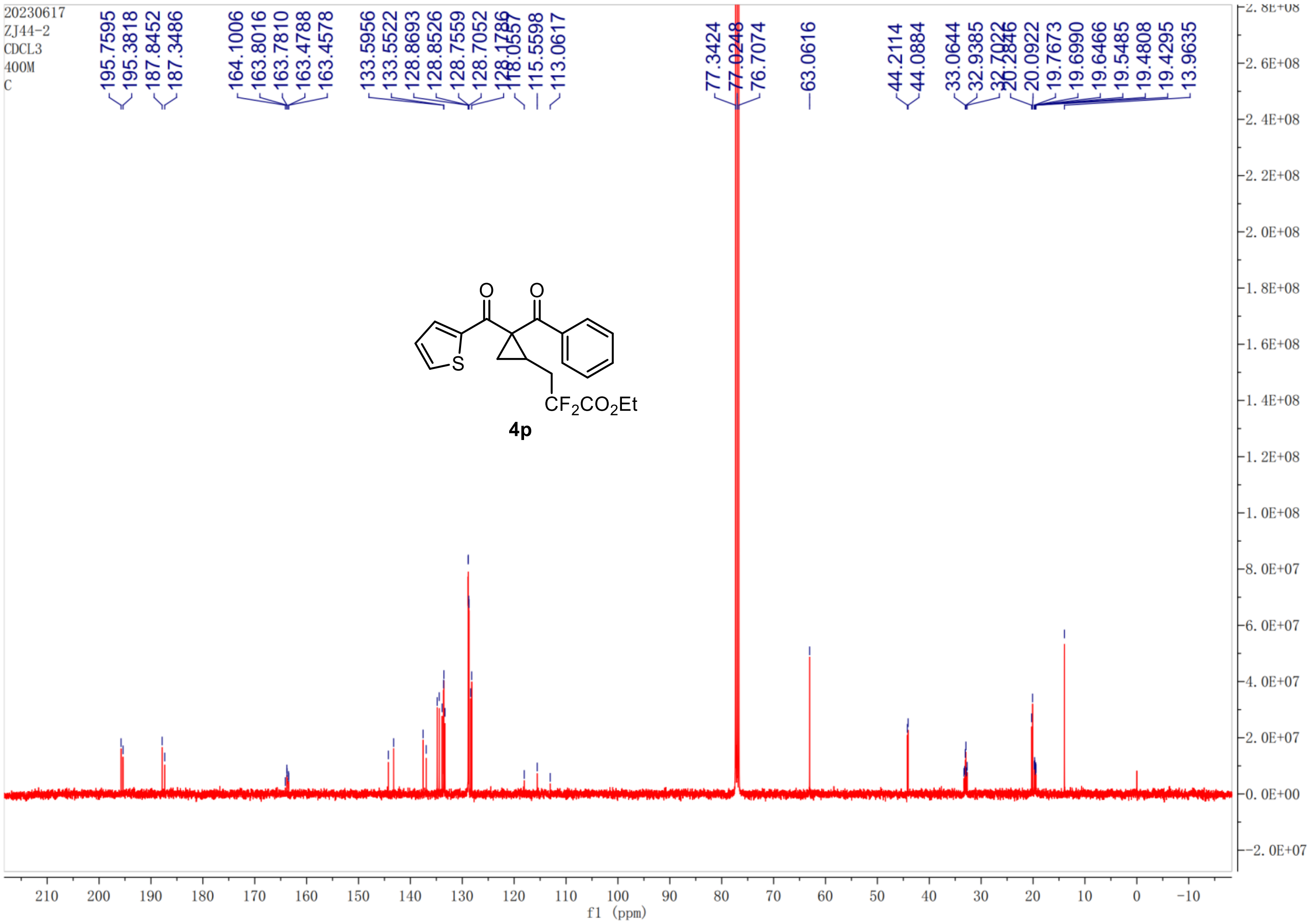

20230617
ZJ44-1
CDCL3
400M
F
-103.9274
-104.2441
-104.6205
-104.9382
-106.0056
-106.2484
-106.6993
-106.9430
O
O
O
CF2CO2Et
4o
1.00
0.96
3. 8E+09
3. 6E+09
3. 4E+09
3. 2E+09
3. 0E+09
2. 8E+09
2. 6E+09
2. 4E+09
2. 2E+09
2. 0E+09
1. 8E+09
1. 6E+09
1. 4E+09
1. 2E+09
1. 0E+09
8. 0E+08
6. 0E+08
4. 0E+08
2. 0E+08
0. 0E+00
−2. 0E+08
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)

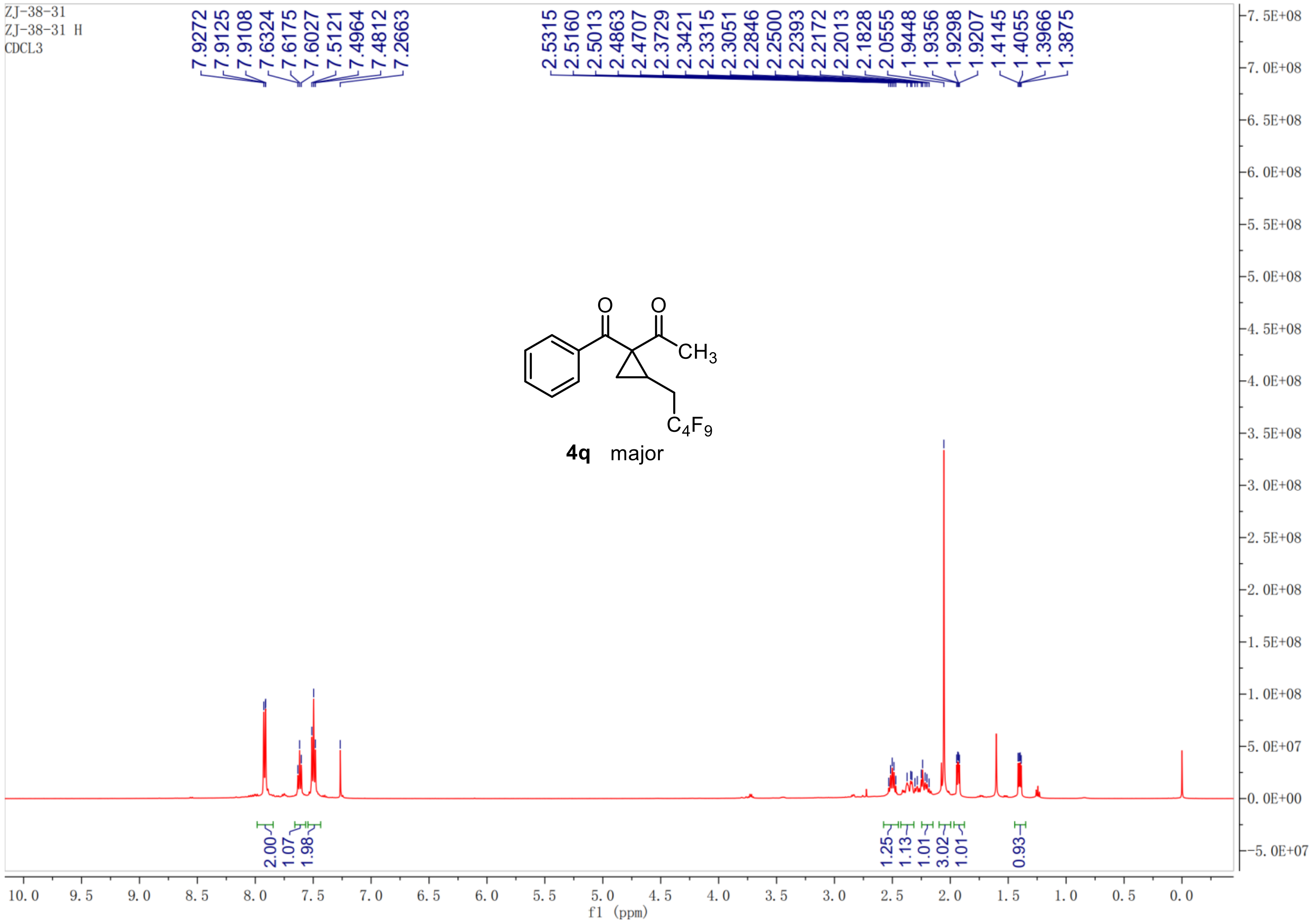
20230617
ZJ44-1
CDCL3
400M
C
195.1816
194.6842
183.6229
183.0220
163.7901
163.7659
163.4656
163.4430
151.7081
146.9999
146.7765
137.8207
137.2653
133.3094
133.0484
128.7924
128.6214
128.4893
128.3886
119.0748
118.8931
118.0490
112.5660
112.4719
77.3439
77.0263
76.7087
63.0578
63.0265
43.2596
42.9858
32.8426
32.5728
29.6972
20.8566
20.1361
20.0717
20.0162
19.8621
19.8088
19.7432
13.9499
O
O
O
CF2CO2Et
4o
2.40E+08
2.30E+08
2.20E+08
2.10E+08
2.00E+08
1.90E+08
1.80E+08
1.70E+08
1.60E+08
1.50E+08
1.40E+08
1.30E+08
1.20E+08
1.10E+08
1.00E+08
9.00E+07
8.00E+07
7.00E+07
6.00E+07
5.00E+07
4.00E+07
3.00E+07
2.00E+07
1.00E+07
0.00E+00
-1.00E+07
-2.00E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


20230617
ZJ44-2
CDCL3
400M
H
7.8800
7.8630
7.8590
7.8550
7.6022
7.5997
7.5925
7.5898
7.5851
7.5780
7.5754
7.5377
7.5351
7.5254
7.5228
7.5157
7.5131
7.5033
7.5007
7.4693
7.4508
7.4463
7.3847
7.3650
7.3591
7.3465
7.3390
7.2633
6.9798
6.9699
6.9675
6.9584
6.9489
6.9465
6.9367
4.3572
4.3393
4.3214
4.3035
2.0434
2.0123
1.4717
1.4598
1.4553
1.4499
1.4435
1.4380
1.4337
1.3845
1.3795
1.3666
1.3616
1.3488
1.3437
O
O
S
$CF_2CO_2Et$
2.00
1.00
2.03
2.08
1.00
2.08
1.02
1.06
1.07
1.07
1.09
3.04
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
9.0E+08
8.5E+08
8.0E+08
7.5E+08
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07

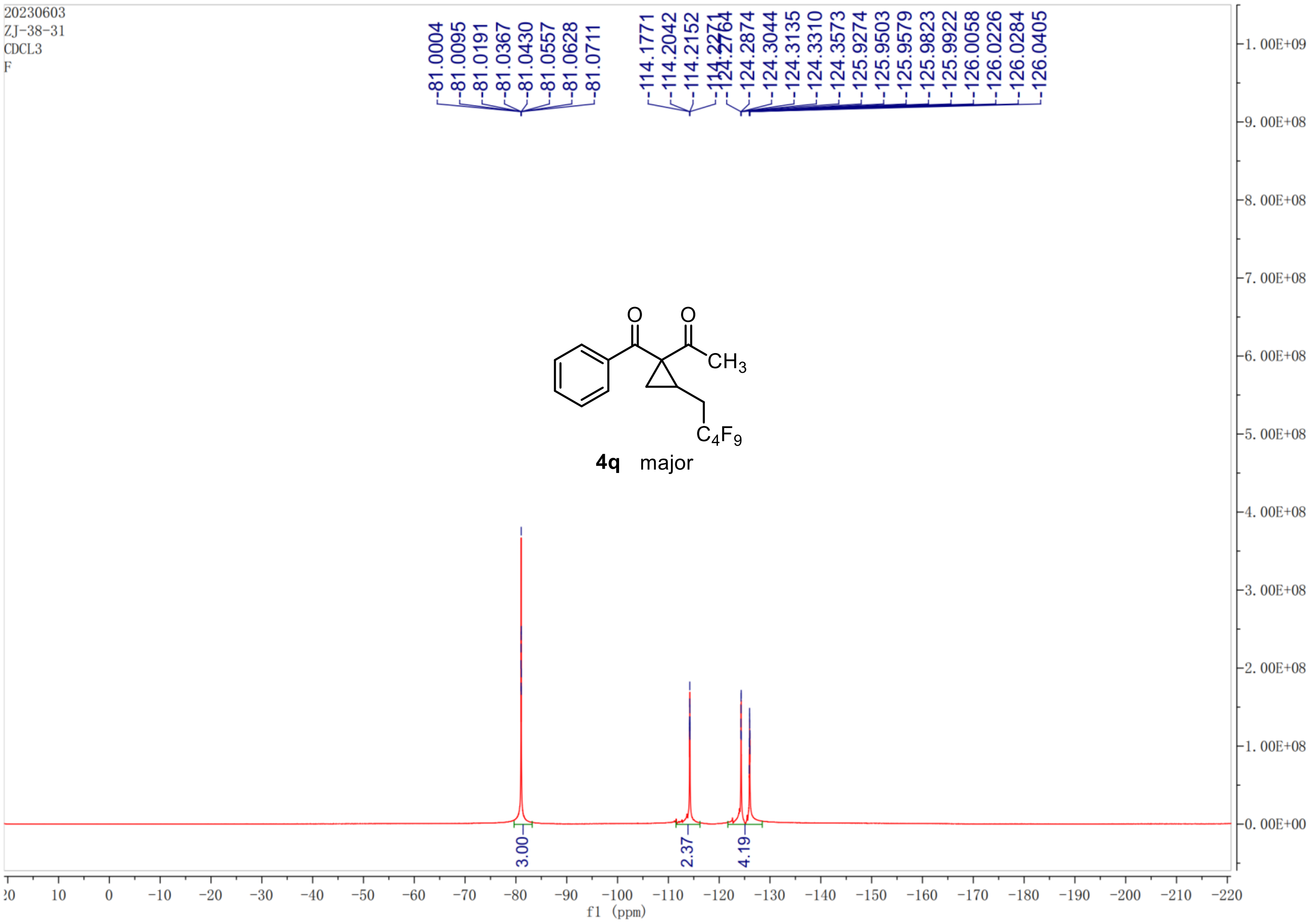
**4p**

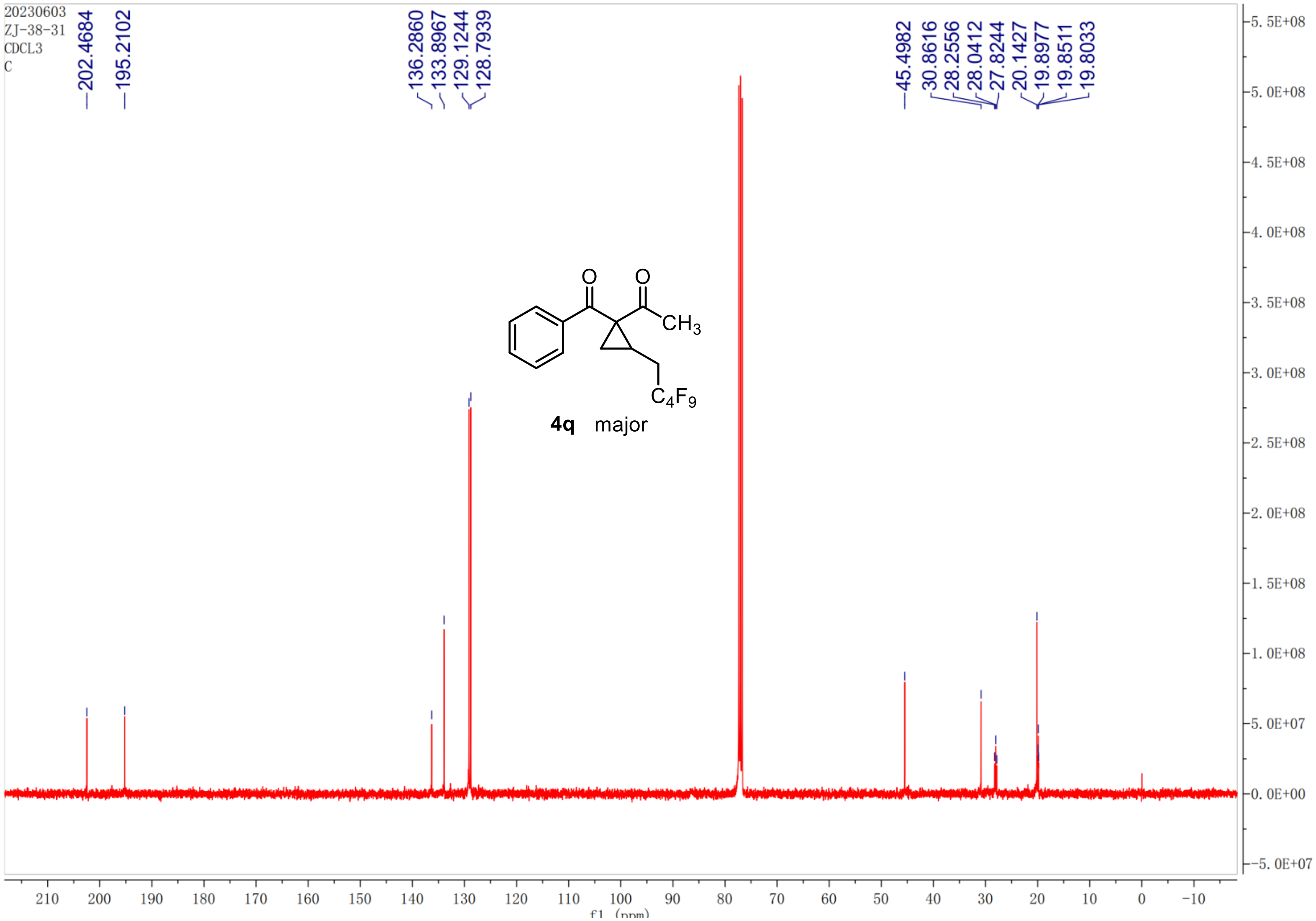

20230617
ZJ44-2
CDCL3
400M
F
-103.9313
-103.9494
-104.6250
-104.6423
-105.9539
-105.9906
-106.6471
-106.6836
O
O
S
$CF_2CO_2Et$
4p
1.00
0.99
8. 0E+08
7. 5E+08
7. 0E+08
6. 5E+08
6. 0E+08
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
−5. 0E+07
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)

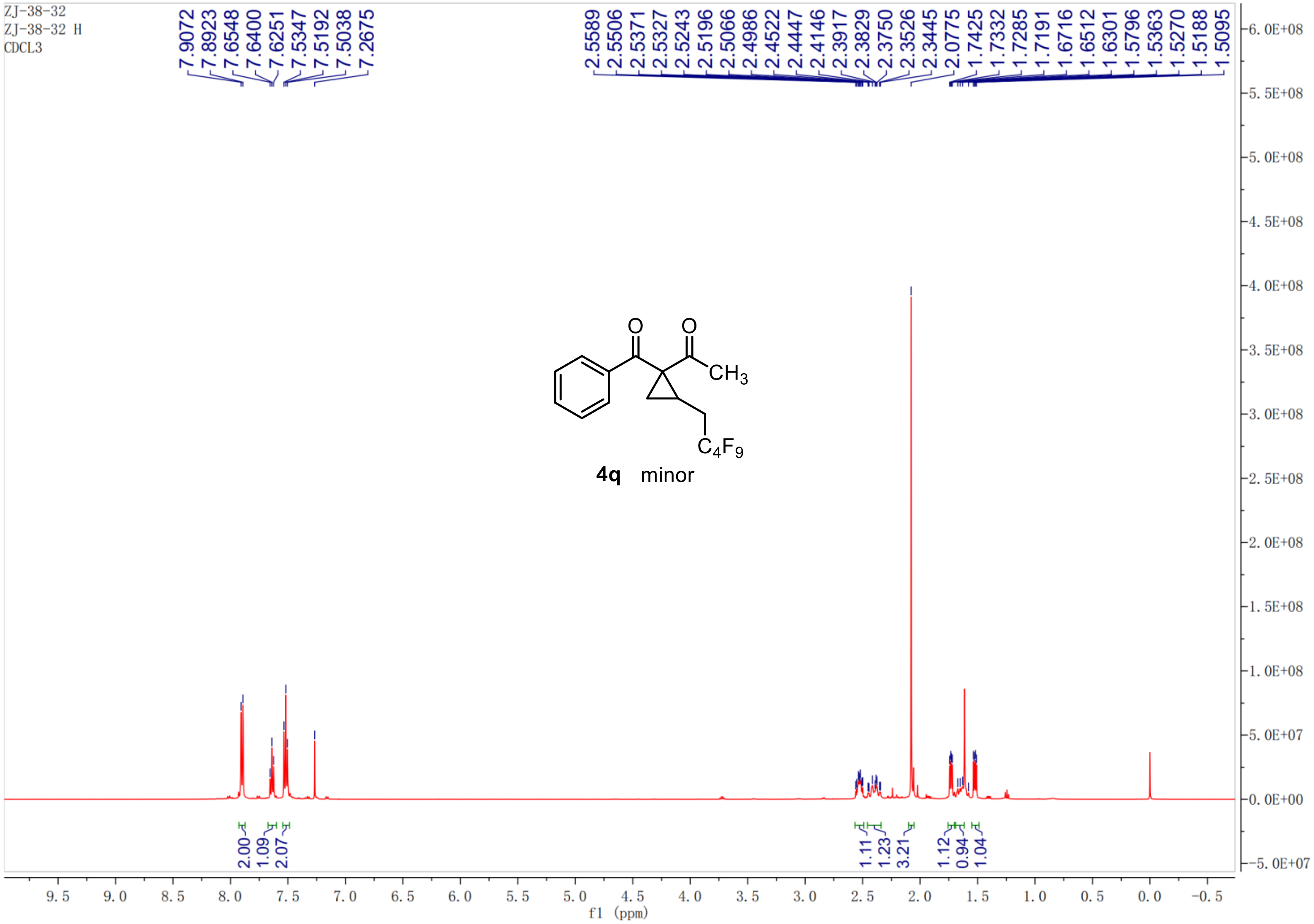

20230617
ZJ44-2
CDCL3
400M
C
195.7595
195.3818
187.8452
187.3486
164.1006
163.8016
163.7810
163.4788
163.4578
133.5956
133.5522
128.8693
128.8526
128.7559
128.7052
128.1786
118.0557
115.5598
113.0617
77.3424
77.0248
76.7074
63.0616
44.2114
44.0884
33.0644
32.9385
32.7022
20.2846
20.0922
19.7673
19.6990
19.6466
19.5485
19.4808
19.4295
13.9635
O
O
S
CF2CO2Et
4p
2.8E+08
2.6E+08
2.4E+08
2.2E+08
2.0E+08
1.8E+08
1.6E+08
1.4E+08
1.2E+08
1.0E+08
8.0E+07
6.0E+07
4.0E+07
2.0E+07
0.0E+00
-2.0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


ZJ-38-31
ZJ-38-31 H
CDCL3
7.9272
7.9125
7.9108
7.6324
7.6175
7.6027
7.5121
7.4964
7.4812
7.2663
2.5315
2.5160
2.5013
2.4863
2.4707
2.3729
2.3421
2.3315
2.3051
2.2846
2.2500
2.2393
2.2172
2.2013
2.1828
2.0555
1.9448
1.9356
1.9298
1.9207
1.4145
1.4055
1.3966
1.3875
O
O
CH3
C4F9
2.00
1.07
1.98
1.25
1.13
1.01
3.02
1.01
0.93
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
7.5E+08
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07

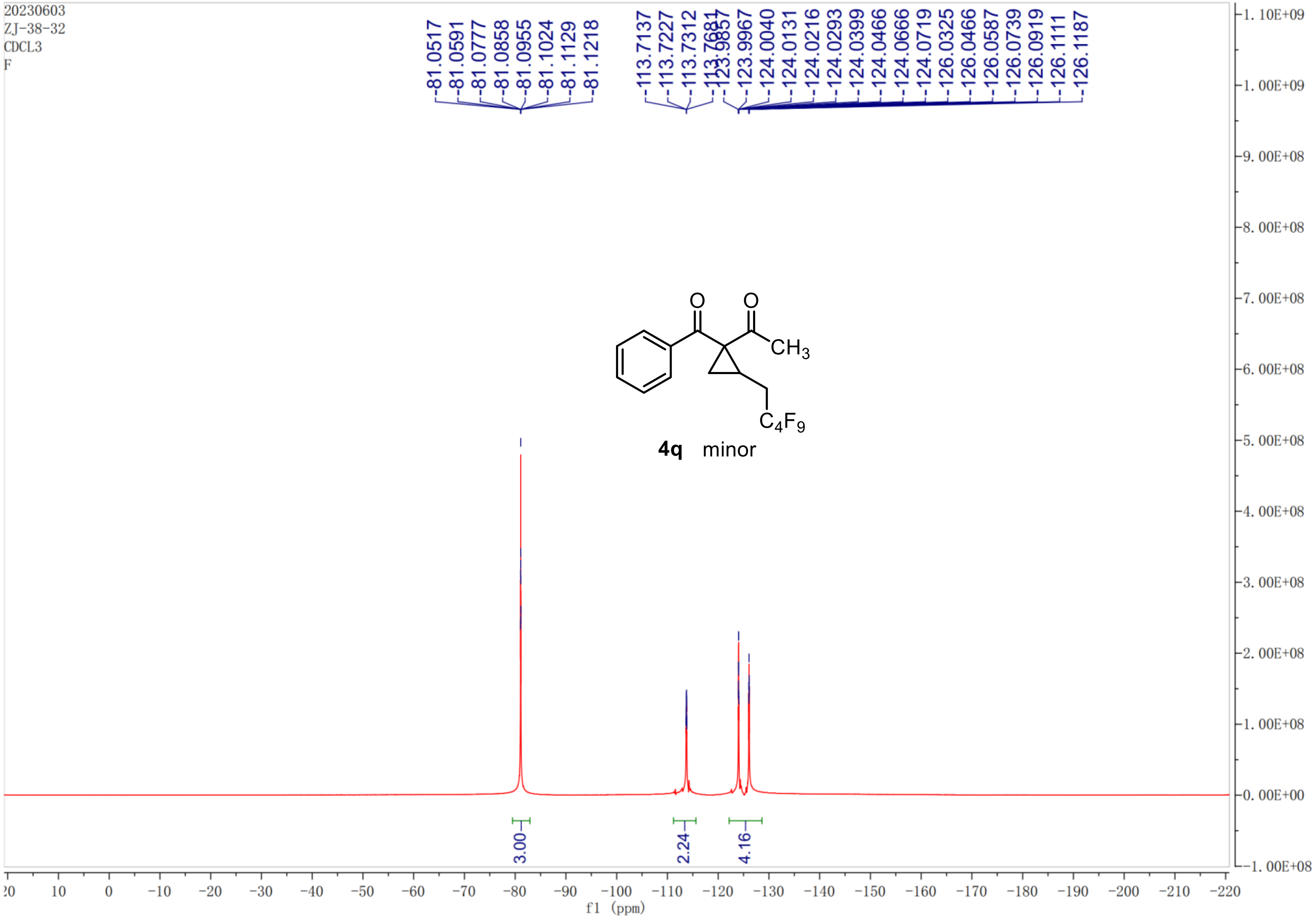
**4q** major

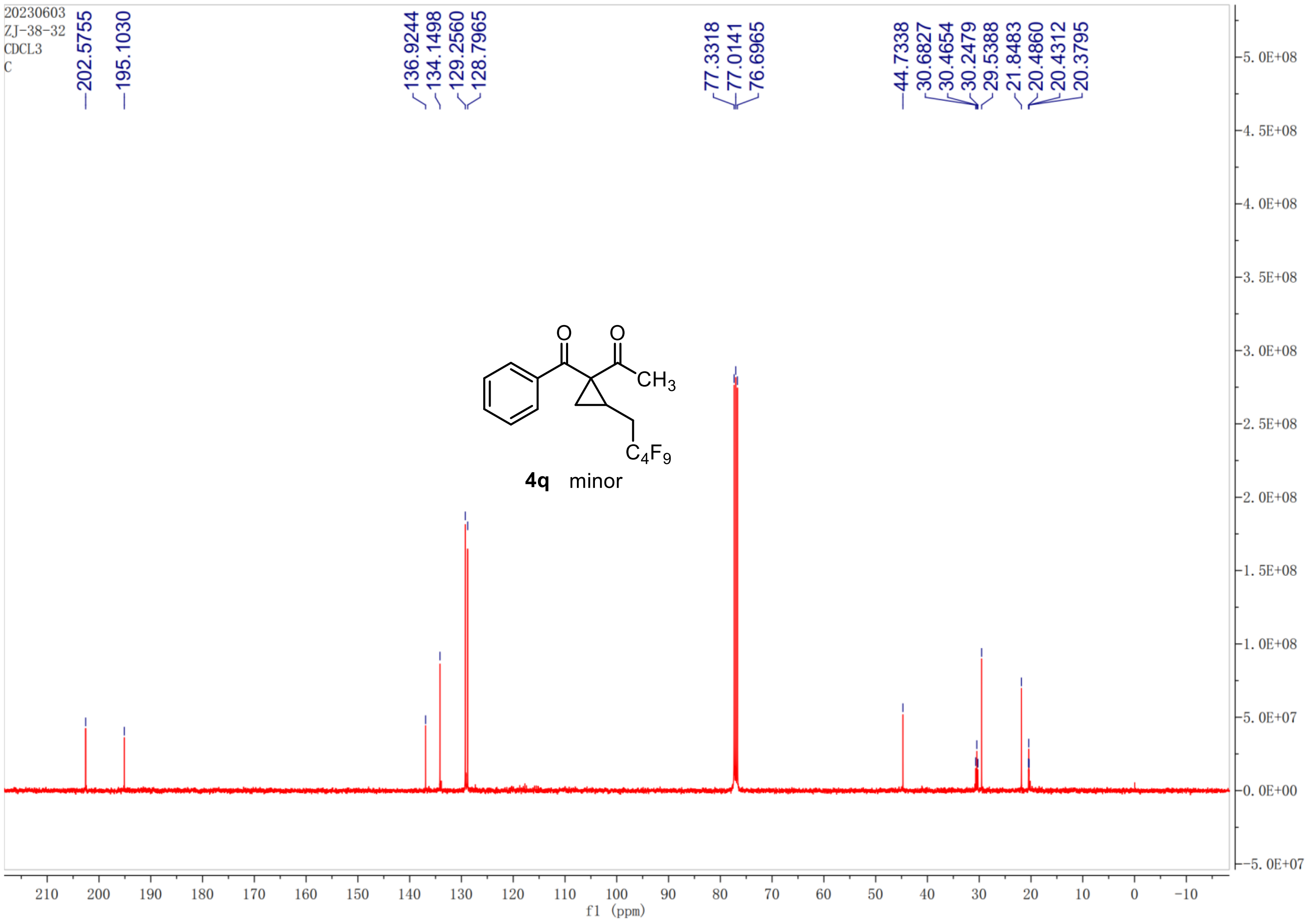

20230603
ZJ-38-31
CDCL3
F
-81.0004
-81.0095
-81.0191
-81.0367
-81.0430
-81.0557
-81.0628
-81.0711
-114.1771
-114.2042
-114.2152
-114.2271
-124.2764
-124.2874
-124.3044
-124.3135
-124.3310
-124.3573
-125.9274
-125.9503
-125.9579
-125.9823
-125.9922
-126.0058
-126.0226
-126.0284
-126.0405
O
O
CH3
C4F9
4q major
3.00
2.37
4.19
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)


20230603
ZJ-38-31
CDCL3
C
202.4684
195.2102
136.2860
133.8967
129.1244
128.7939
45.4982
30.8616
28.2556
28.0412
27.8244
20.1427
19.8977
19.8511
19.8033
O
O
CH3
C4F9
4q major
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
-5. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

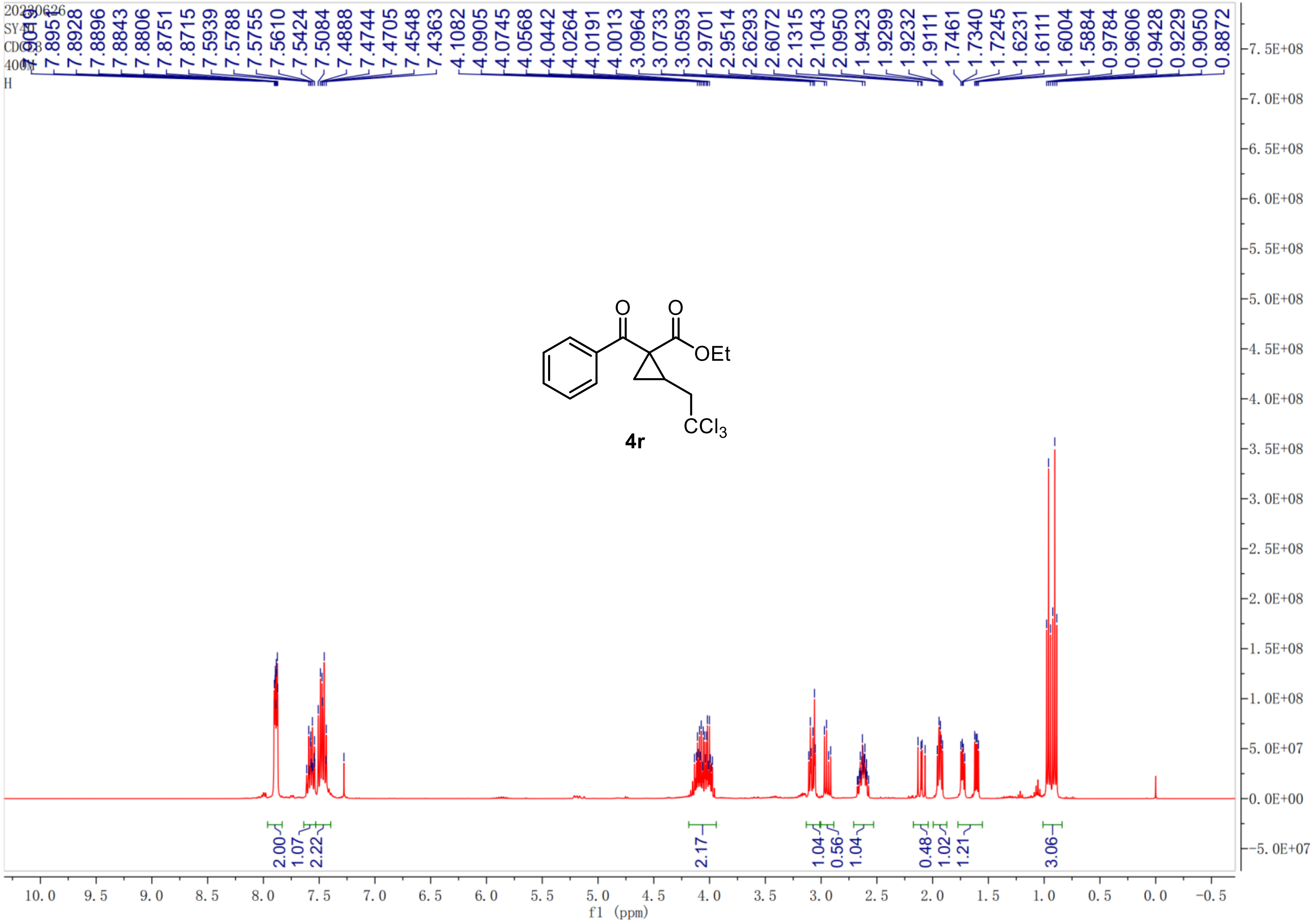

ZJ-38-32
ZJ-38-32 H
CDCL3
7.9072
7.8923
7.6548
7.6400
7.6251
7.5347
7.5192
7.5038
7.2675
2.5589
2.5506
2.5371
2.5327
2.5243
2.5196
2.5066
2.4986
2.4522
2.4447
2.4146
2.3917
2.3829
2.3750
2.3526
2.3445
2.0775
1.7425
1.7332
1.7285
1.7191
1.6716
1.6512
1.6301
1.5796
1.5363
1.5270
1.5188
1.5095
O
O
CH3
C4F9
2.00
1.09
2.07
1.11
1.23
3.21
1.12
0.94
1.04
6. 0E+08
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
-5. 0E+07
9. 5
9. 0
8. 5
8. 0
7. 5
7. 0
6. 5
6. 0
5. 5
5. 0
4. 5
4. 0
3. 5
3. 0
2. 5
2. 0
1. 5
1. 0
0. 5
0. 0
-0. 5
f1 (ppm)

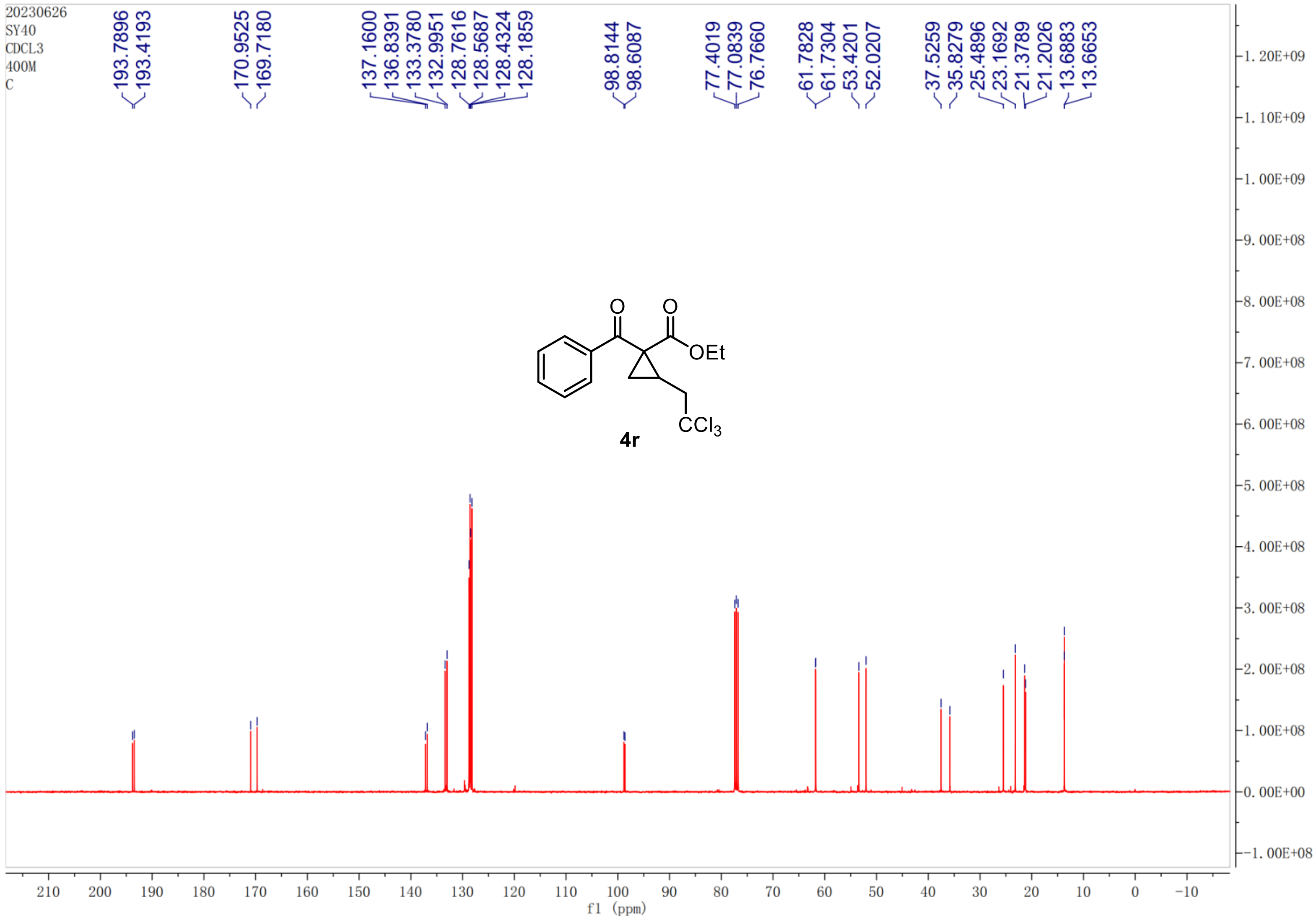
**4q** minor

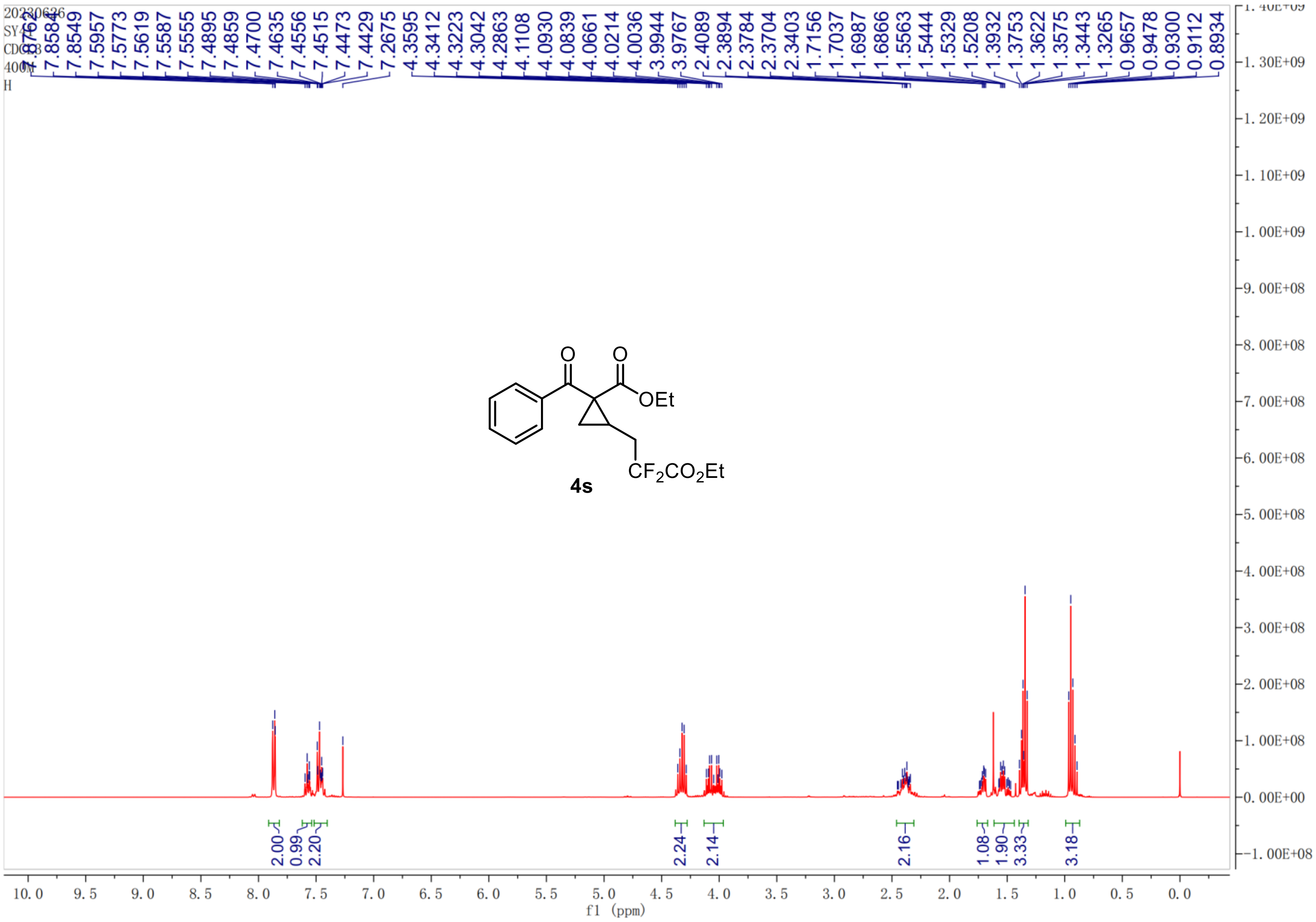

20230603
ZJ-38-32
CDCL3
F
-81.0517
-81.0591
-81.0777
-81.0858
-81.0955
-81.1024
-81.1129
-81.1218
-113.7137
-113.7227
-113.7312
-113.7681
-123.9857
-123.9967
-124.0040
-124.0131
-124.0216
-124.0293
-124.0399
-124.0466
-124.0666
-124.0719
-126.0325
-126.0466
-126.0587
-126.0739
-126.0919
-126.1111
-126.1187
O
O
CH3
C4F9
4q minor
3.00
2.24
4.16
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
f1 (ppm)
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08

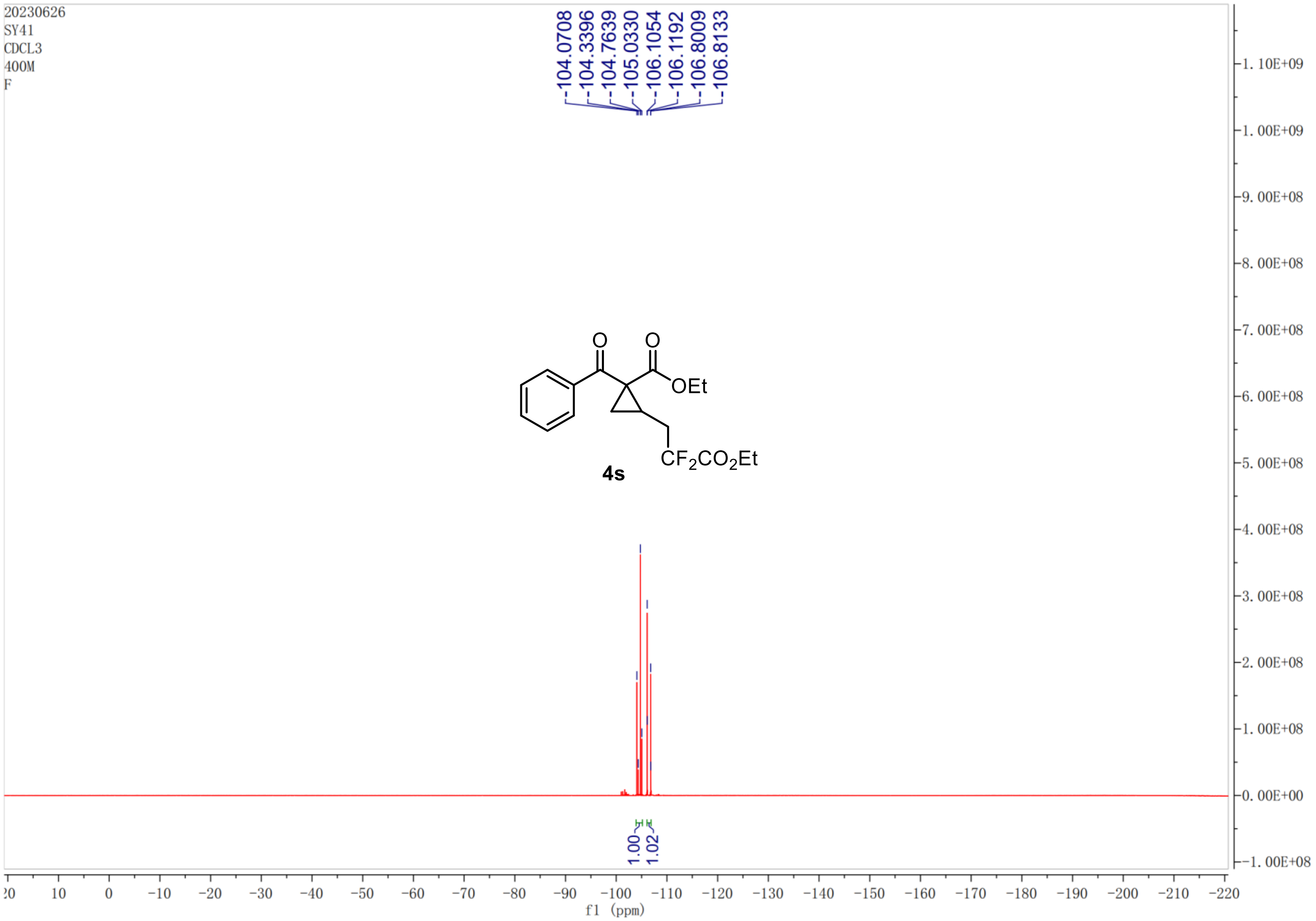

**4q** minor

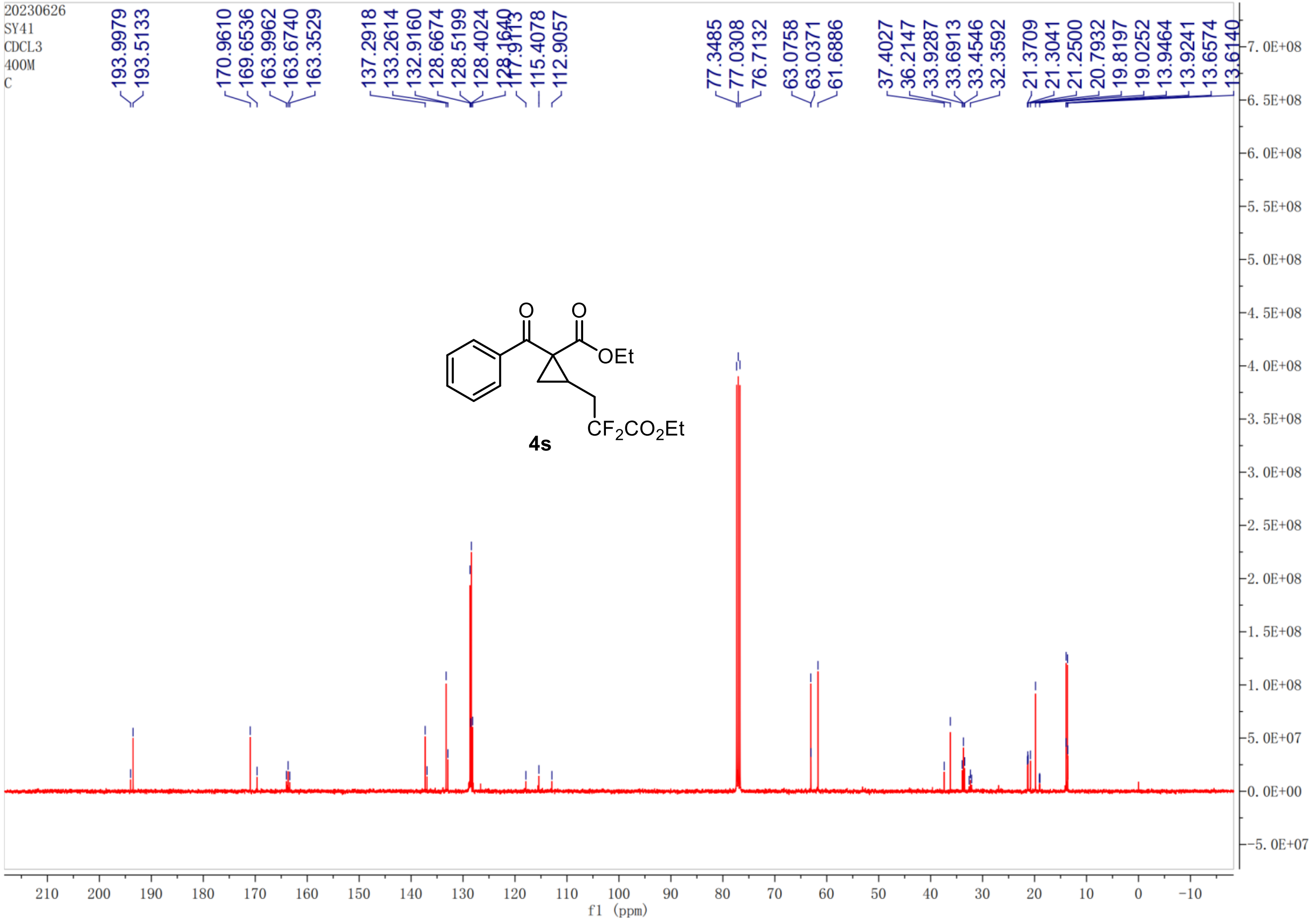
20230603
ZJ-38-32
CDCL3
C
202.5755
195.1030
136.9244
134.1498
129.2560
128.7965
77.3318
77.0141
76.6965
44.7338
30.6827
30.4654
30.2479
29.5388
21.8483
20.4860
20.4312
20.3795
O
O
CH3
C4F9
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
-5. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

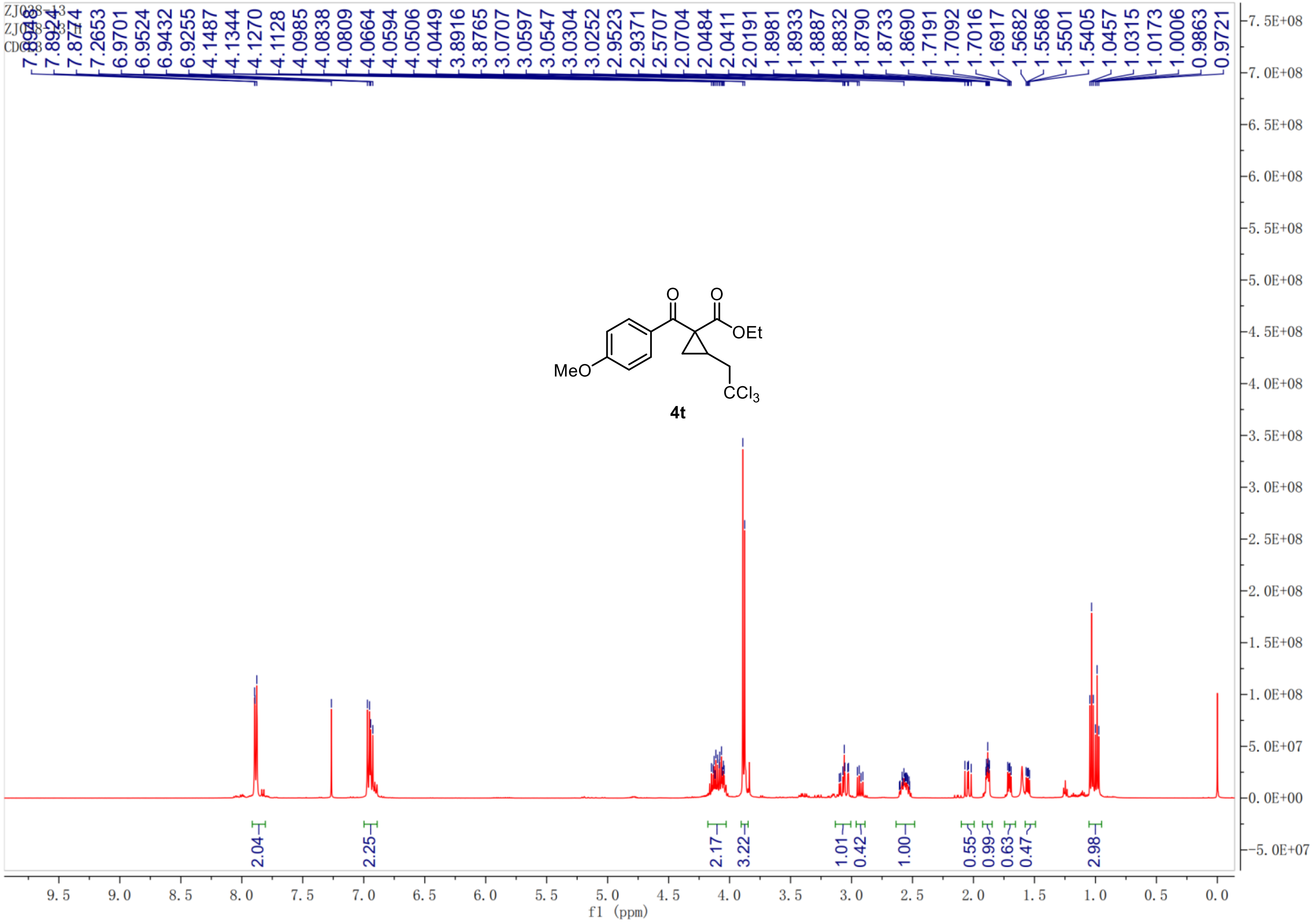

20230626
SY401
CDCl3
400M
H
7.8951
7.8928
7.8896
7.8843
7.8806
7.8751
7.8715
7.5939
7.5788
7.5755
7.5610
7.5424
7.5084
7.4888
7.4744
7.4705
7.4548
7.4363
4.1082
4.0905
4.0745
4.0568
4.0442
4.0264
4.0191
4.0013
3.0964
3.0733
3.0593
2.9701
2.9514
2.6293
2.6072
2.1315
2.1043
2.0950
1.9423
1.9299
1.9232
1.9111
1.7461
1.7340
1.7245
1.6231
1.6111
1.6004
1.5884
0.9784
0.9606
0.9428
0.9229
0.9050
0.8872
O
O
OEt
CCl3
4r
2.00
1.07
2.22
2.17
1.04
0.56
1.04
0.48
1.02
1.21
3.06
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)
7.5E+08
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07

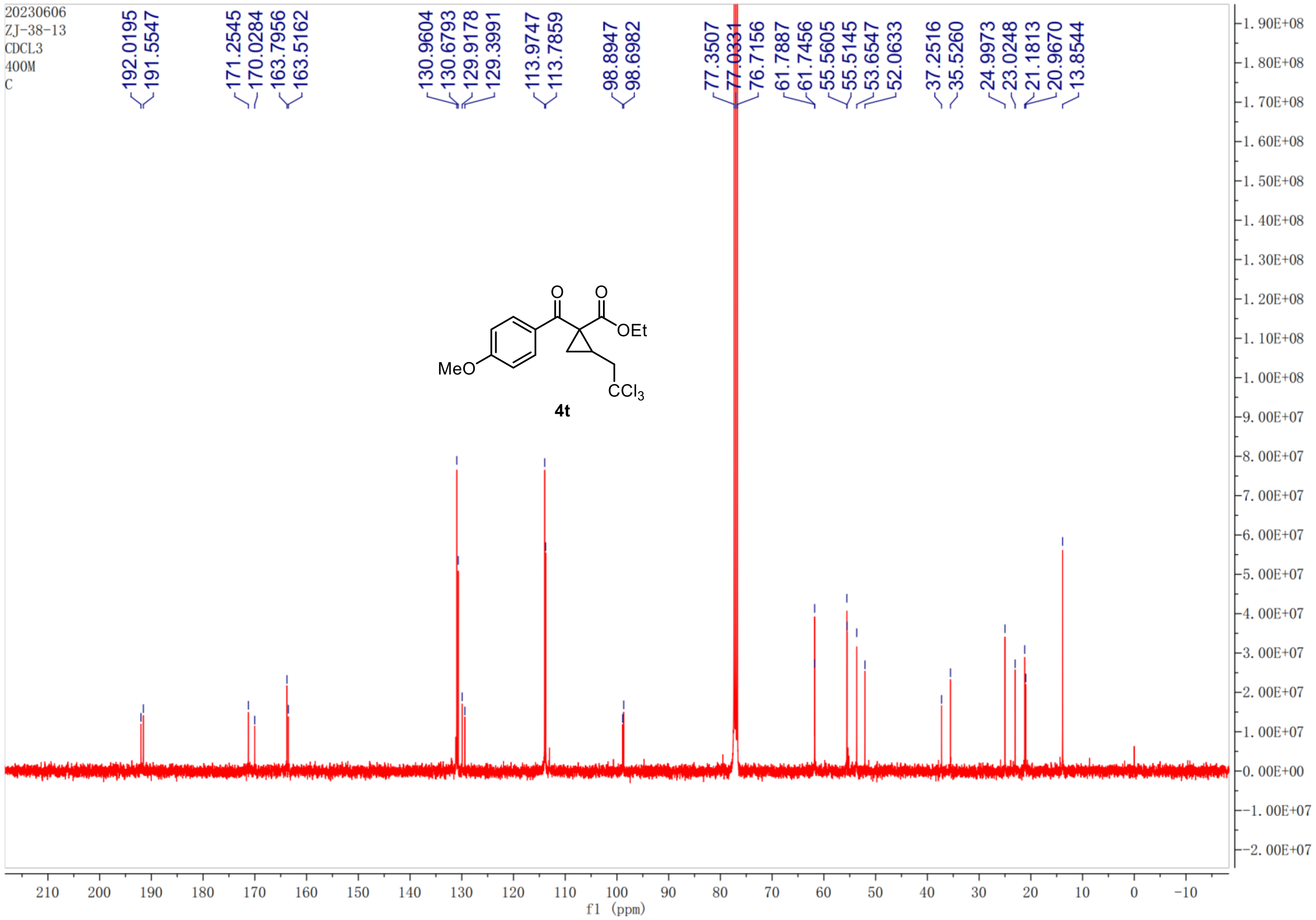

20230626
SY40
CDCL3
400M
C
193.7896
193.4193
170.9525
169.7180
137.1600
136.8391
133.3780
132.9951
128.7616
128.5687
128.4324
128.1859
98.8144
98.6087
77.4019
77.0839
76.7660
61.7828
61.7304
53.4201
52.0207
37.5259
35.8279
25.4896
23.1692
21.3789
21.2026
13.6883
13.6653
O
O
OEt
CCl3
4r
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

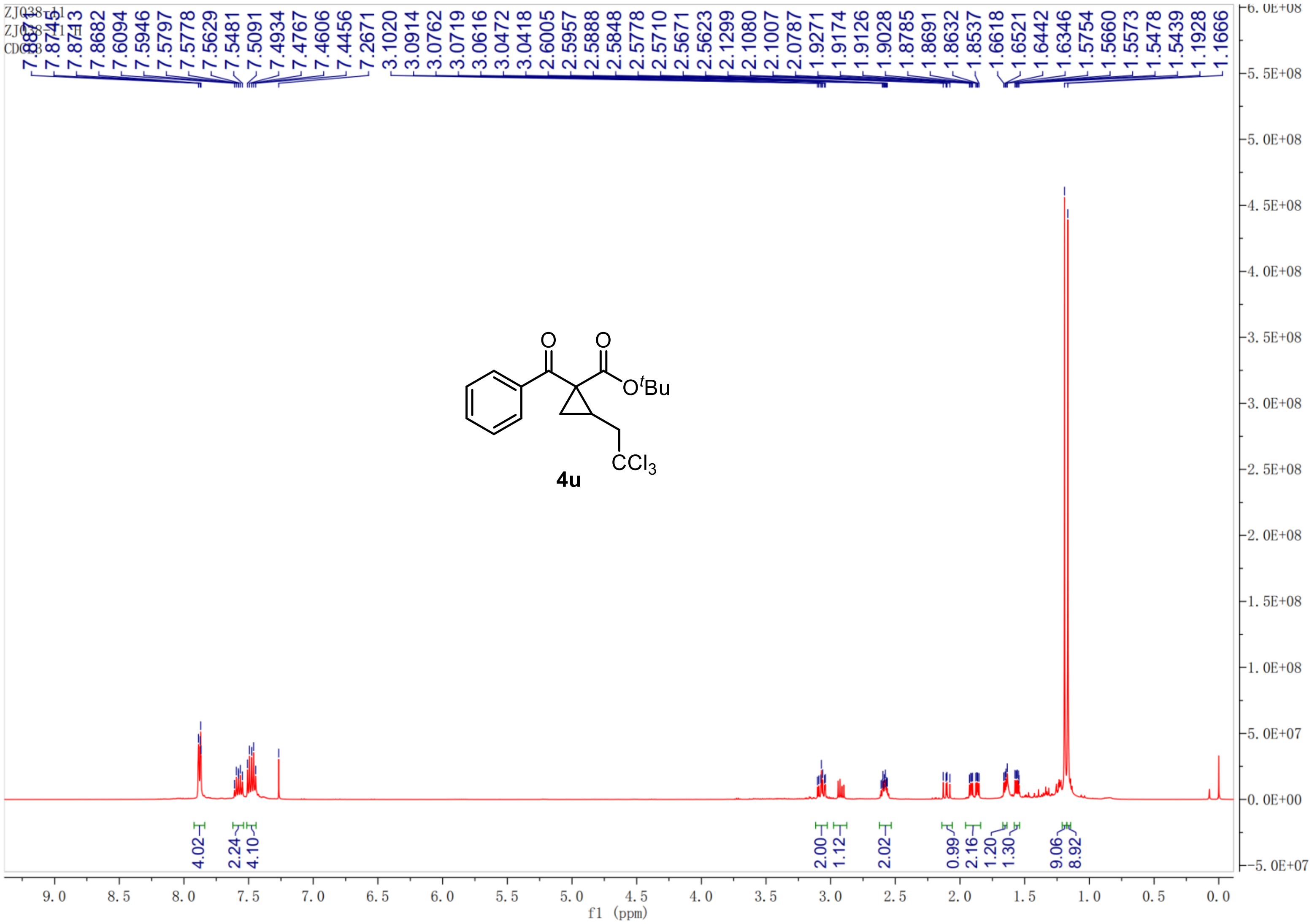
 
20230626
SY41
CDCl3
400M
H
7.8762
7.8584
7.8549
7.5957
7.5773
7.5619
7.5587
7.5555
7.4895
7.4859
7.4700
7.4635
7.4556
7.4515
7.4473
7.4429
7.2675
4.3595
4.3412
4.3223
4.3042
4.2863
4.1108
4.0930
4.0839
4.0661
4.0214
4.0036
3.9944
3.9767
2.4089
2.3894
2.3784
2.3704
2.3403
1.7156
1.7037
1.6987
1.6866
1.5563
1.5444
1.5329
1.5208
1.3932
1.3753
1.3622
1.3575
1.3443
1.3265
0.9657
0.9478
0.9300
0.9112
0.8934
O
O
OEt
CF2CO2Et
4s
2.00
0.99
2.20
2.24
2.14
2.16
1.08
1.90
3.33
3.18
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08

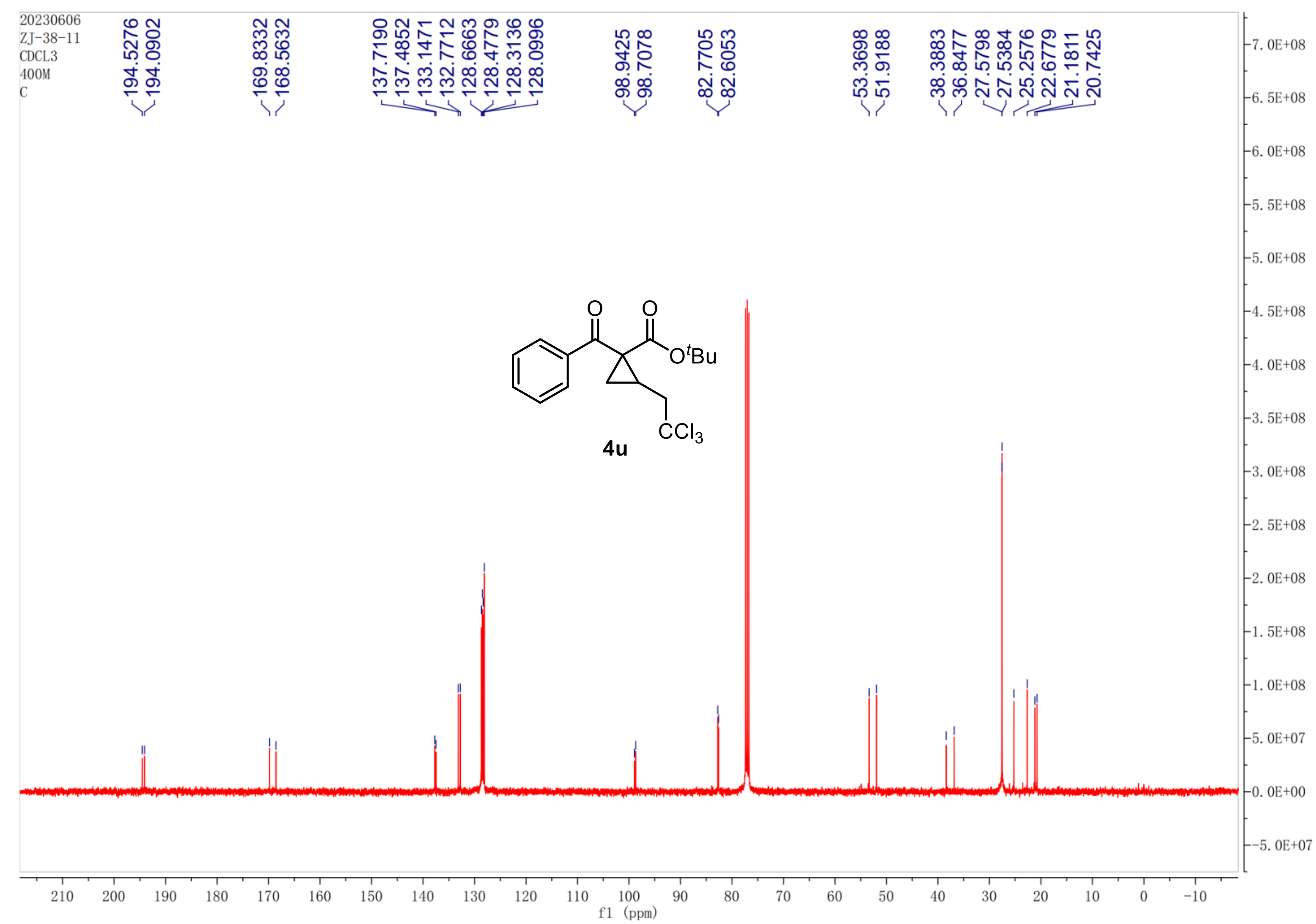

20230626
SY41
CDCL3
400M
F
-104.0708
-104.3396
-104.7639
-105.0330
-106.1054
-106.1192
-106.8009
-106.8133
O
O
OEt
CF2CO2Et
4s
1.00
1.02
1. 10E+09
1. 00E+09
9. 00E+08
8. 00E+08
7. 00E+08
6. 00E+08
5. 00E+08
4. 00E+08
3. 00E+08
2. 00E+08
1. 00E+08
0. 00E+00
-1. 00E+08
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
f1 (ppm)

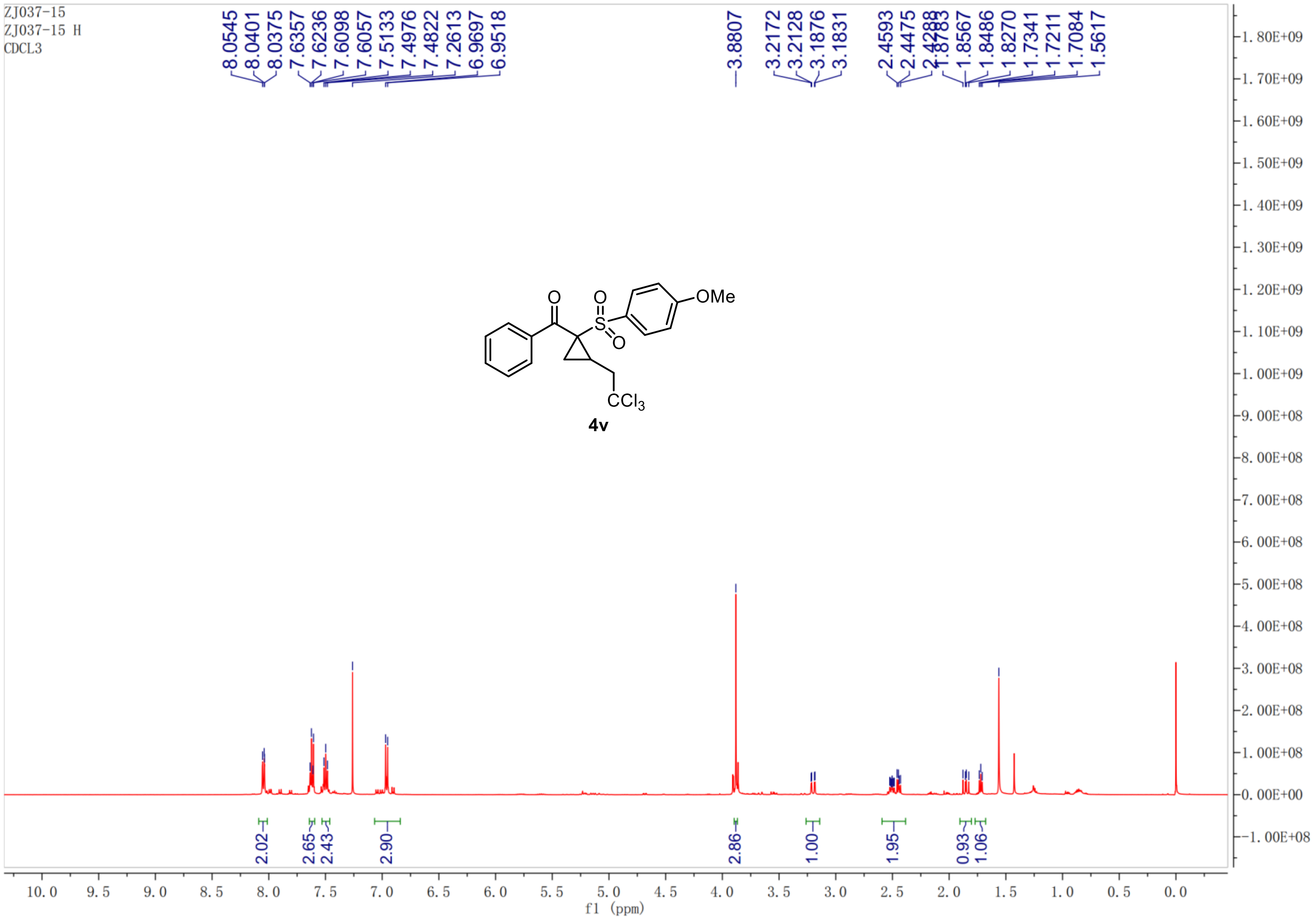

20230626
SY41
CDCL3
400M
C
193.9979
193.5133
170.9610
169.6536
163.9962
163.6740
163.3529
137.2918
133.2614
132.9160
128.6674
128.5199
128.4024
128.1640
117.9113
115.4078
112.9057
77.3485
77.0308
76.7132
63.0758
63.0371
61.6886
37.4027
36.2147
33.9287
33.6913
33.4546
32.3592
21.3709
21.3041
21.2500
20.7932
19.8197
19.0252
13.9464
13.9241
13.6574
13.6140
O
O
OEt
CF2CO2Et
4s
7. 0E+08
6. 5E+08
6. 0E+08
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
-5. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

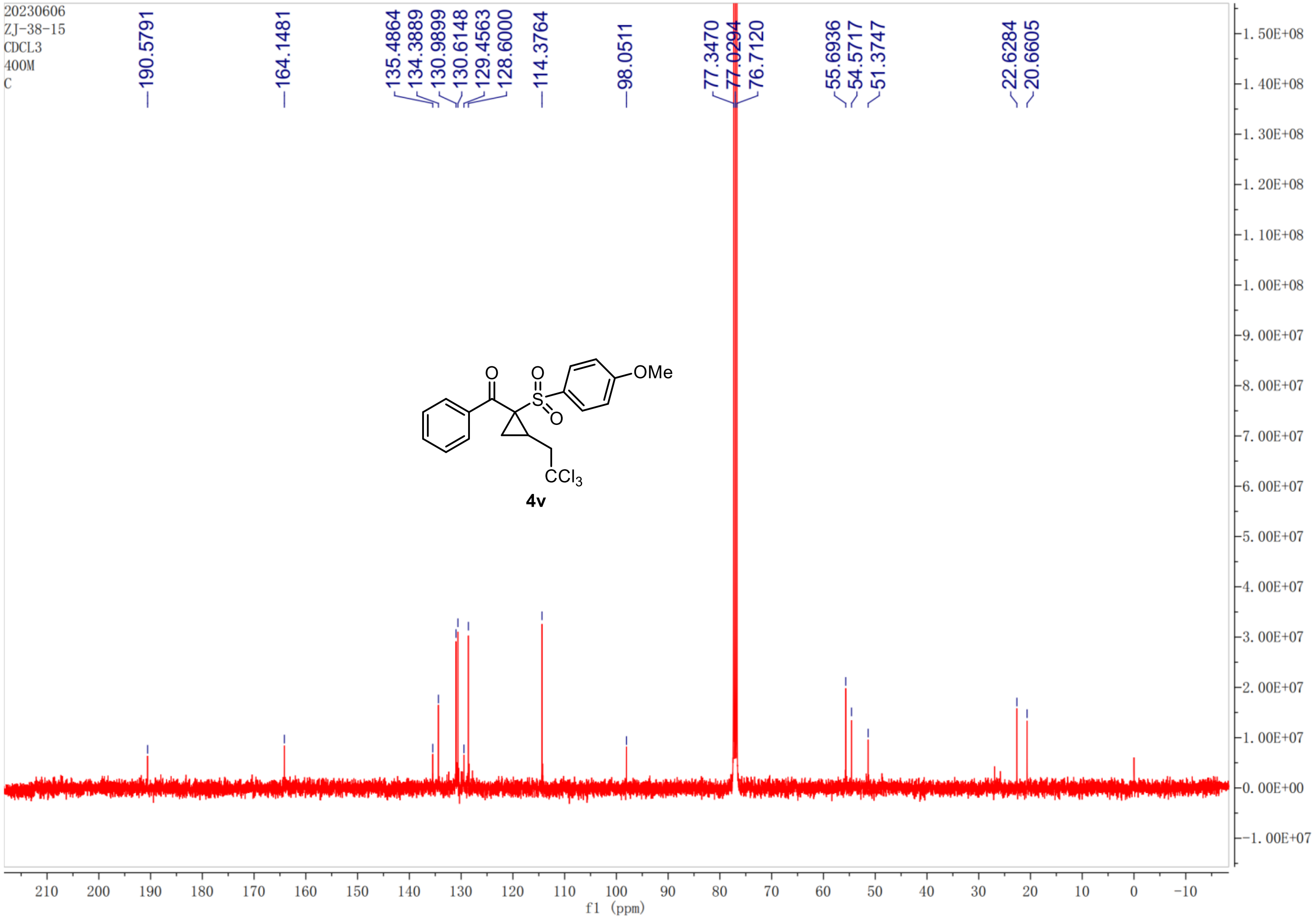

ZJ038-13
ZJ038-13 H
CDCl3
7.8948
7.8924
7.8774
7.2653
6.9701
6.9524
6.9432
6.9255
4.1487
4.1344
4.1270
4.1128
4.0985
4.0838
4.0809
4.0664
4.0594
4.0506
4.0449
3.8916
3.8765
3.0707
3.0597
3.0547
3.0304
3.0252
2.9523
2.9371
2.5707
2.0704
2.0484
2.0411
2.0191
1.8981
1.8933
1.8887
1.8832
1.8790
1.8733
1.8690
1.7191
1.7092
1.7016
1.6917
1.5682
1.5586
1.5501
1.5405
1.0457
1.0315
1.0173
1.0006
0.9863
0.9721
O
O
OEt
MeO
CCl3
4t
2.04
2.25
2.17
3.22
1.01
0.42
1.00
0.55
0.99
0.63
0.47
2.98
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
7.5E+08
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07

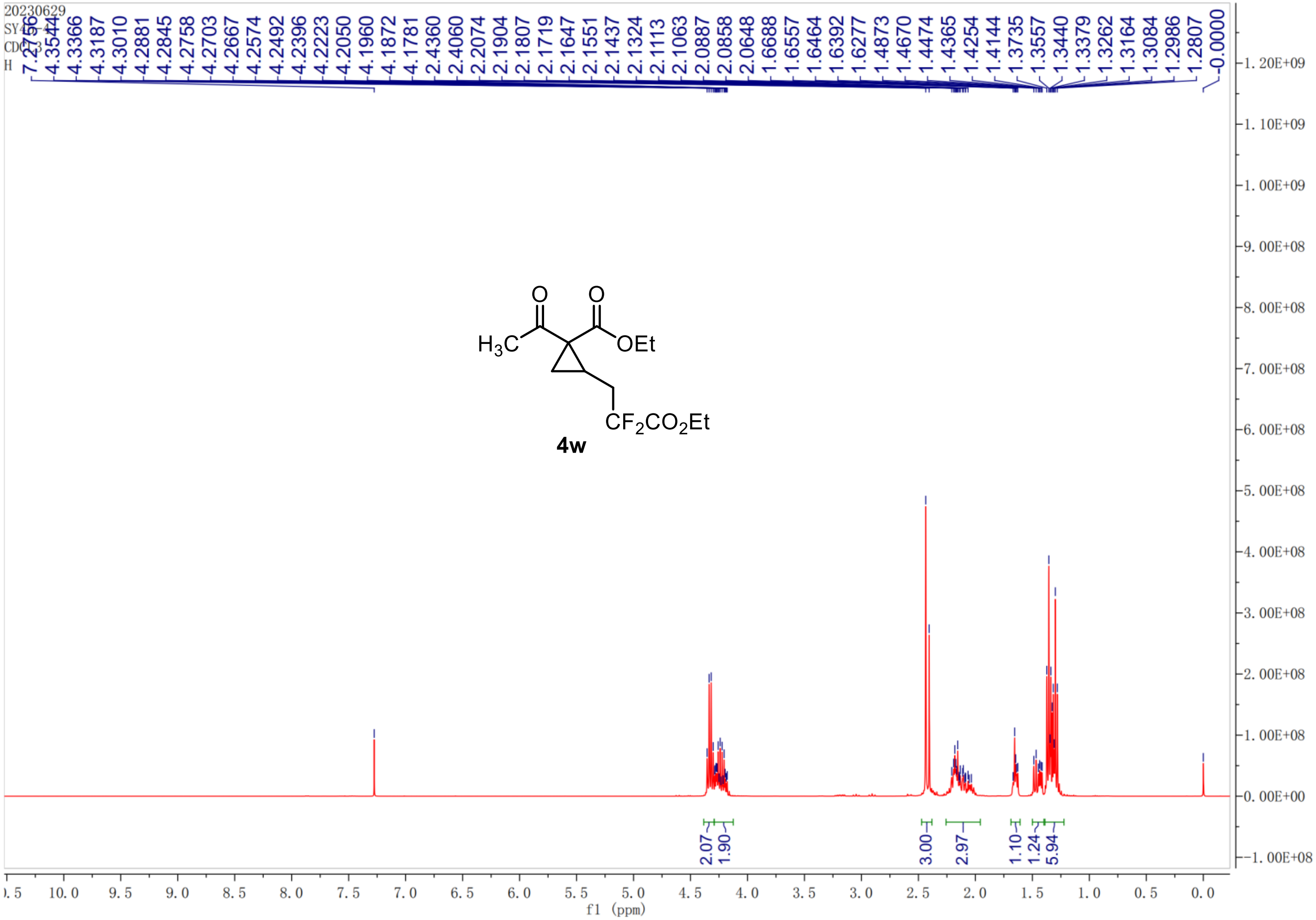

20230606
ZJ-38-13
CDCL3
400M
C
192.0195
191.5547
171.2545
170.0284
163.7956
163.5162
130.9604
130.6793
129.9178
129.3991
113.9747
113.7859
98.8947
98.6982
77.3507
77.0331
76.7156
61.7887
61.7456
55.5605
55.5145
53.6547
52.0633
37.2516
35.5260
24.9973
23.0248
21.1813
20.9670
13.8544
O
O
OEt
MeO
CCl3
4t
1. 90E+08
1. 80E+08
1. 70E+08
1. 60E+08
1. 50E+08
1. 40E+08
1. 30E+08
1. 20E+08
1. 10E+08
1. 00E+08
9. 00E+07
8. 00E+07
7. 00E+07
6. 00E+07
5. 00E+07
4. 00E+07
3. 00E+07
2. 00E+07
1. 00E+07
0. 00E+00
-1. 00E+07
-2. 00E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

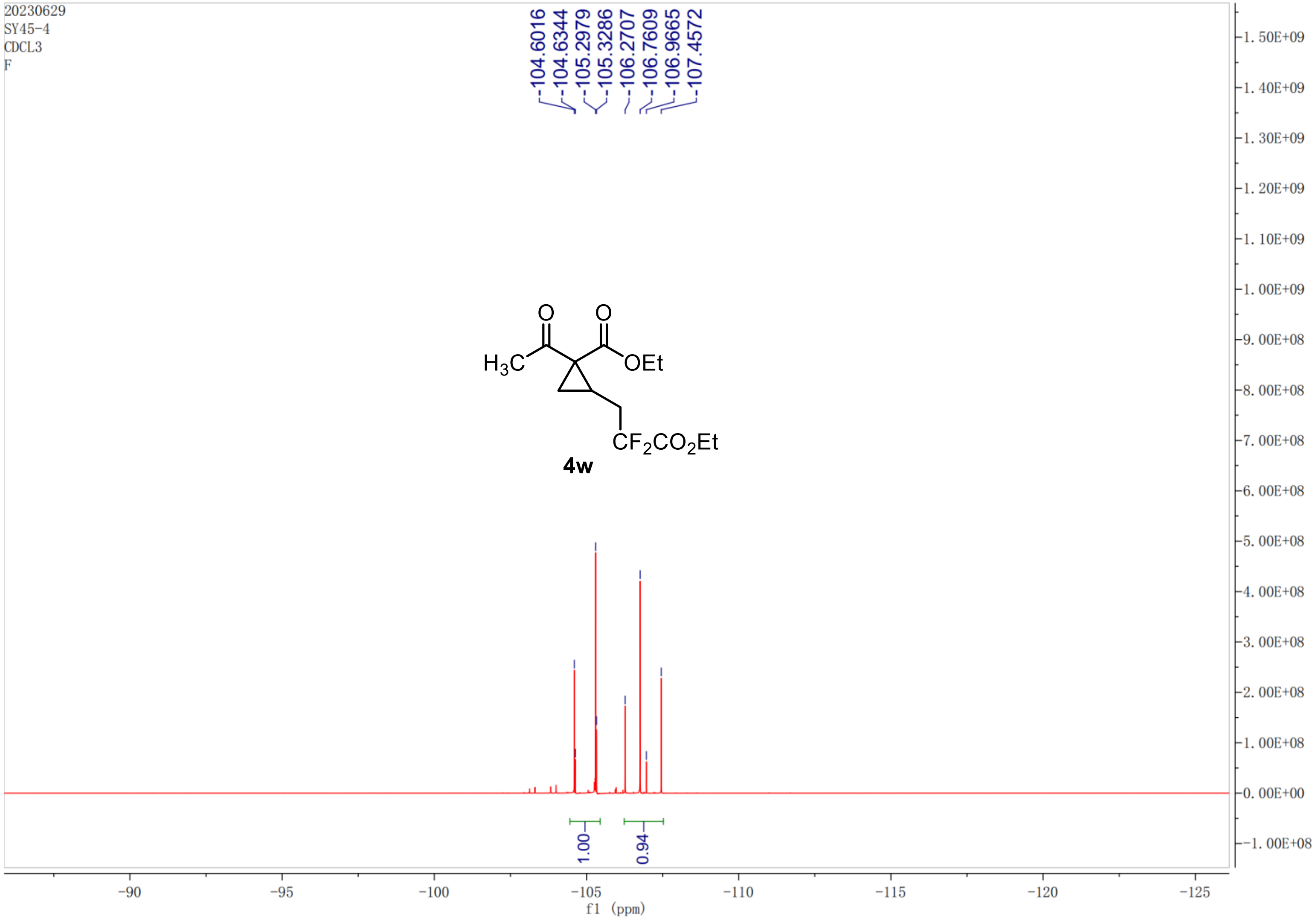

ZJ038-11
ZJ038-11-H
CDCl3
7.8871
7.8745
7.8713
7.8682
7.6094
7.5946
7.5797
7.5778
7.5629
7.5481
7.5091
7.4934
7.4767
7.4606
7.4456
7.2671
3.1020
3.0914
3.0762
3.0719
3.0616
3.0472
3.0418
2.6005
2.5957
2.5888
2.5848
2.5778
2.5710
2.5671
2.5623
2.1299
2.1080
2.1007
2.0787
1.9271
1.9174
1.9126
1.9028
1.8785
1.8691
1.8632
1.8537
1.6618
1.6521
1.6442
1.6346
1.5754
1.5660
1.5573
1.5478
1.5439
1.1928
1.1666
O
O
O$^t$Bu
CCl$_3$
4u
4.02
2.24
4.10
2.00
1.12
2.02
0.99
2.16
1.20
1.30
9.06
8.92
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07

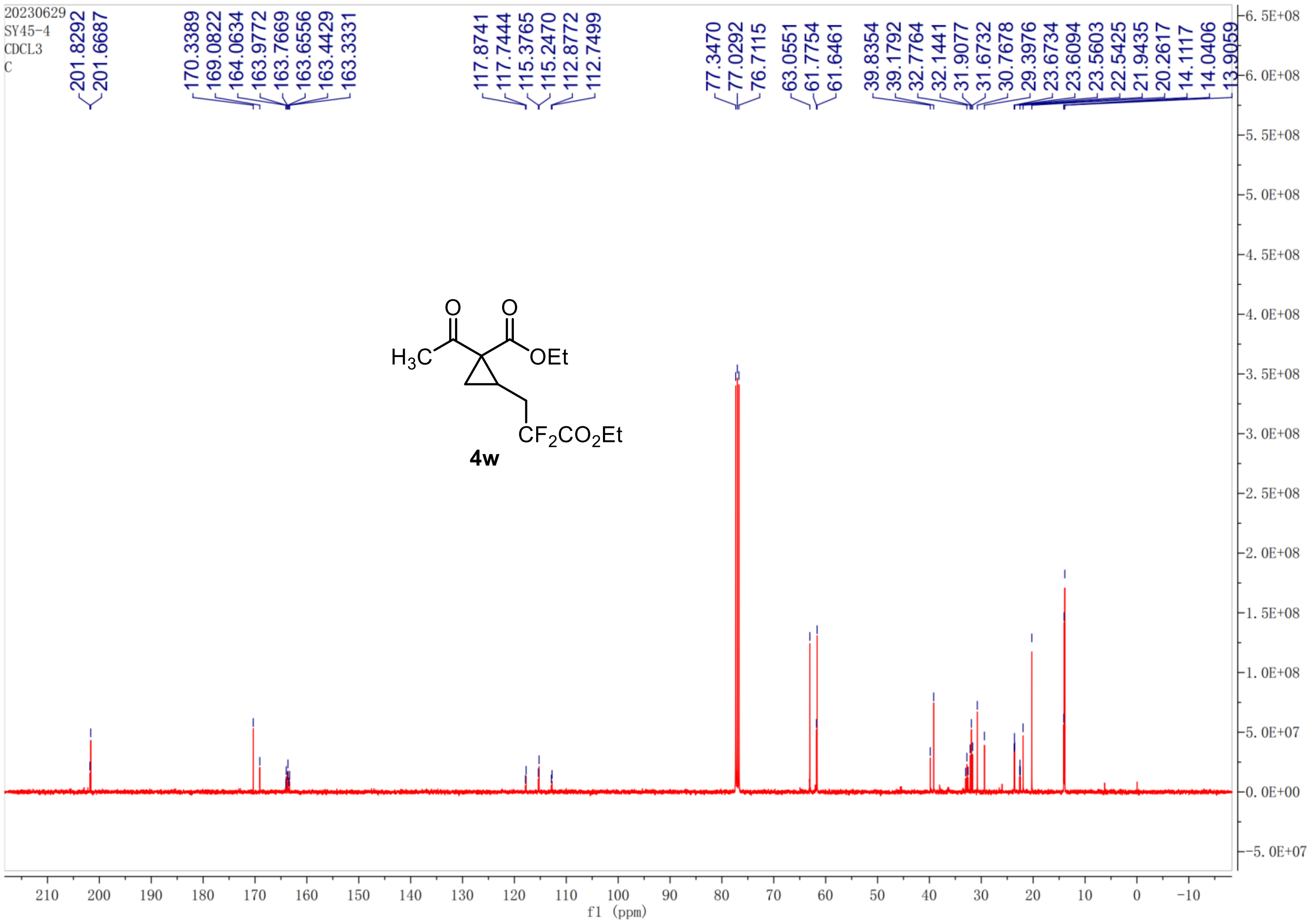

20230606
ZJ-38-11
CDCL3
400M
C
194.5276
194.0902
169.8332
168.5632
137.7190
137.4852
133.1471
132.7712
128.6663
128.4779
128.3136
128.0996
98.9425
98.7078
82.7705
82.6053
53.3698
51.9188
38.3883
36.8477
27.5798
27.5384
25.2576
22.6779
21.1811
20.7425
O
O
O$^t$Bu
CCl$_3$
4u
7. 0E+08
6. 5E+08
6. 0E+08
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
-5. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


ZJ037-15
ZJ037-15 H
CDCL3
8.0545
8.0401
8.0375
7.6357
7.6236
7.6098
7.6057
7.5133
7.4976
7.4822
7.2613
6.9697
6.9518
3.8807
3.2172
3.2128
3.1876
3.1831
2.4593
2.4475
2.4288
1.8783
1.8567
1.8486
1.8270
1.7341
1.7211
1.7084
1.5617
O
O
S
O
OMe
CCl3
4v
2.02
2.65
2.43
2.90
2.86
1.00
1.95
0.93
1.06
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
1.80E+09
1.70E+09
1.60E+09
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08

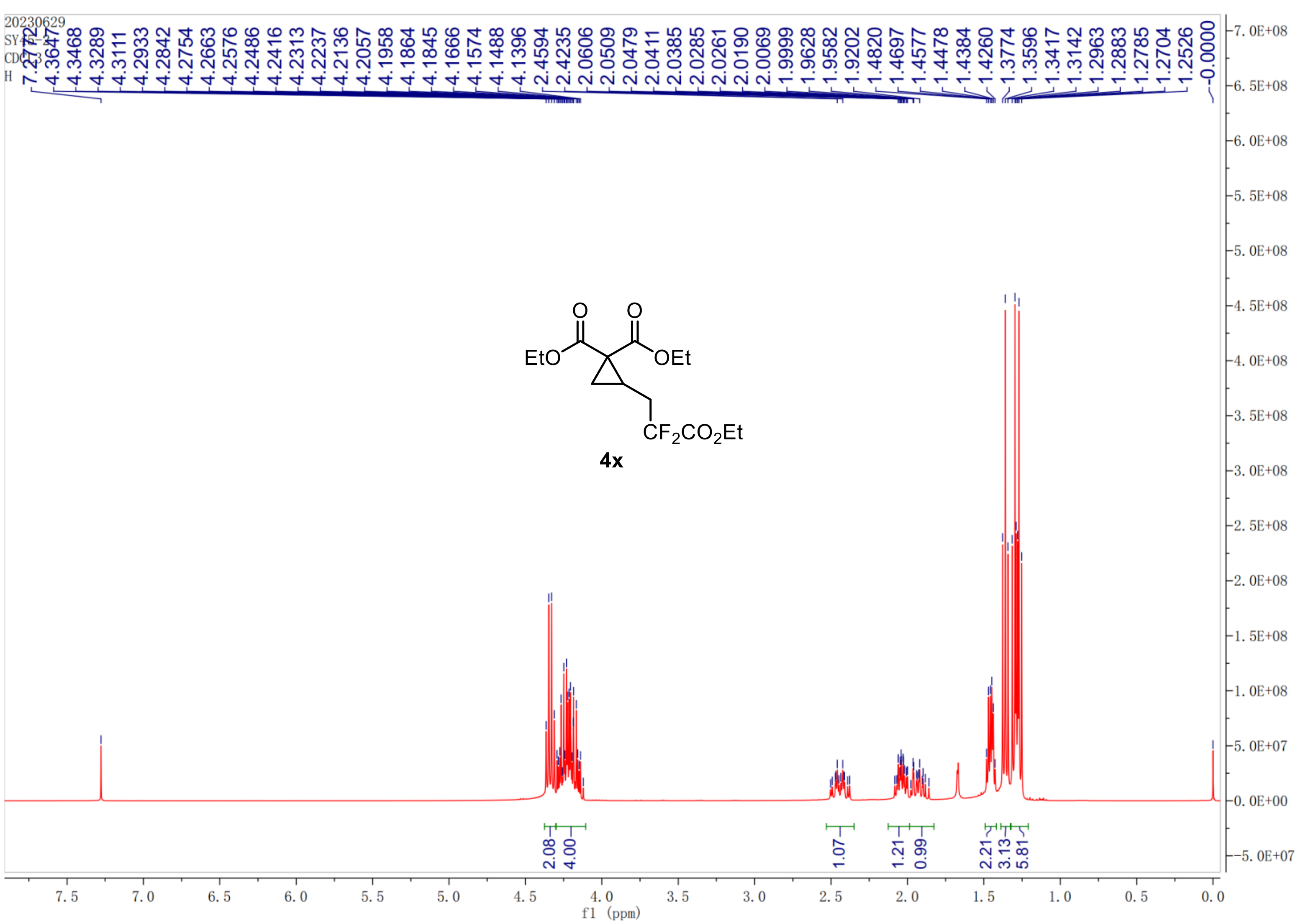

20230606
ZJ-38-15
CDCL3
400M
C
190.5791
164.1481
135.4864
134.3889
130.9899
130.6148
129.4563
128.6000
114.3764
98.0511
77.3470
77.0294
76.7120
55.6936
54.5717
51.3747
22.6284
20.6605
OMe
O
S
O
O
CCl3
4v
1.50E+08
1.40E+08
1.30E+08
1.20E+08
1.10E+08
1.00E+08
9.00E+07
8.00E+07
7.00E+07
6.00E+07
5.00E+07
4.00E+07
3.00E+07
2.00E+07
1.00E+07
0.00E+00
-1.00E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


20230629
SY45-4
CDCl3
H
7.2756
4.3544
4.3366
4.3187
4.3010
4.2881
4.2845
4.2758
4.2703
4.2667
4.2574
4.2492
4.2396
4.2223
4.2050
4.1960
4.1872
4.1781
2.4360
2.4060
2.2074
2.1904
2.1807
2.1719
2.1647
2.1551
2.1437
2.1324
2.1113
2.1063
2.0887
2.0858
2.0648
1.6688
1.6557
1.6464
1.6392
1.6277
1.4873
1.4670
1.4474
1.4365
1.4254
1.4144
1.3735
1.3557
1.3440
1.3379
1.3262
1.3164
1.3084
1.2986
1.2807
-0.0000
H3C
O
O
OEt
CF2CO2Et
4w
2.07
1.90
3.00
2.97
1.10
1.24
5.94
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


20230629
SY45-4
CDCL3
F
-104.6016
-104.6344
-105.2979
-105.3286
-106.2707
-106.7609
-106.9665
-107.4572
O
O
$H_3C$
OEt
$CF_2CO_2Et$
4w
1.00
0.94
1.50E+09
1.40E+09
1.30E+09
1.20E+09
1.10E+09
1.00E+09
9.00E+08
8.00E+08
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
−1.00E+08
−90
−95
−100
−105
−110
−115
−120
−125
f1 (ppm)


20230629
SY45-4
CDCL3
C
201.8292
201.6687
170.3389
169.0822
164.0634
163.9772
163.7669
163.6556
163.4429
163.3331
117.8741
117.7444
115.3765
115.2470
112.8772
112.7499
77.3470
77.0292
76.7115
63.0551
61.7754
61.6461
39.8354
39.1792
32.7764
32.1441
31.9077
31.6732
30.7678
29.3976
23.6734
23.6094
23.5603
22.5425
21.9435
20.2617
14.1117
14.0406
13.9059
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)
H3C
O
O
OEt
CF2CO2Et

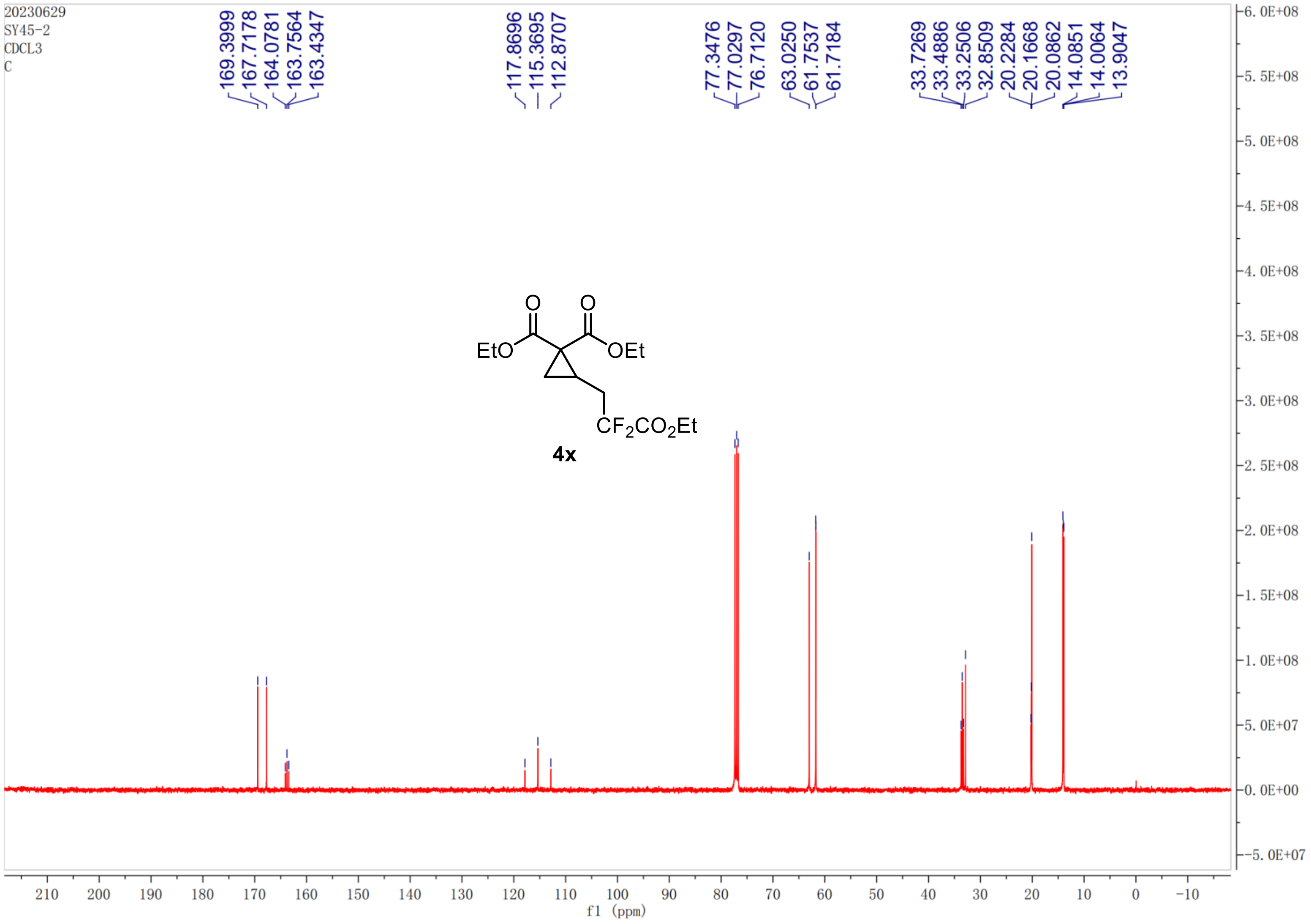
**4w**


20230629
SY45-2
CDCl3
H
7.2772
4.3647
4.3468
4.3289
4.3111
4.2933
4.2842
4.2754
4.2663
4.2576
4.2486
4.2416
4.2313
4.2237
4.2136
4.2057
4.1958
4.1864
4.1845
4.1666
4.1574
4.1488
4.1396
2.4594
2.4235
2.0606
2.0509
2.0479
2.0411
2.0385
2.0285
2.0261
2.0190
2.0069
1.9999
1.9628
1.9582
1.9202
1.4820
1.4697
1.4577
1.4478
1.4384
1.4260
1.3774
1.3596
1.3417
1.3142
1.2963
1.2883
1.2785
1.2704
1.2526
-0.0000
EtO
O
O
OEt
CF2CO2Et
2.08
4.00
1.07
1.21
0.99
2.21
3.13
5.81
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
7.0E+08
6.5E+08
6.0E+08
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07

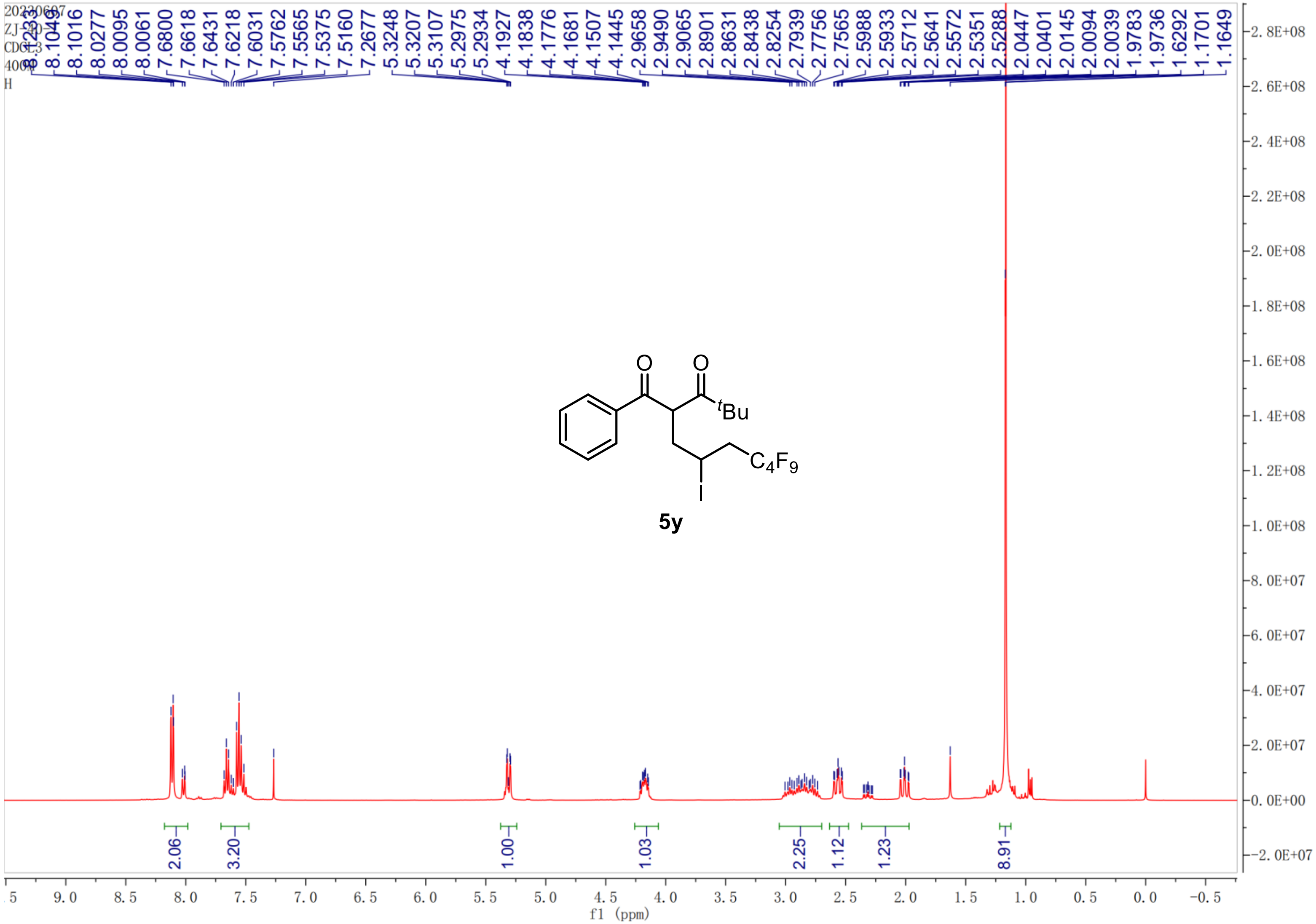
**4x**


20230629
SY45-2
CDCL3
F
-104.3990
-105.0951
-105.9980
-106.6941
EtO
O
O
OEt
$CF_2CO_2Et$
9. 0E+08
8. 0E+08
7. 0E+08
6. 0E+08
5. 0E+08
4. 0E+08
3. 0E+08
2. 0E+08
1. 0E+08
0. 0E+00
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
−220
f1 (ppm)

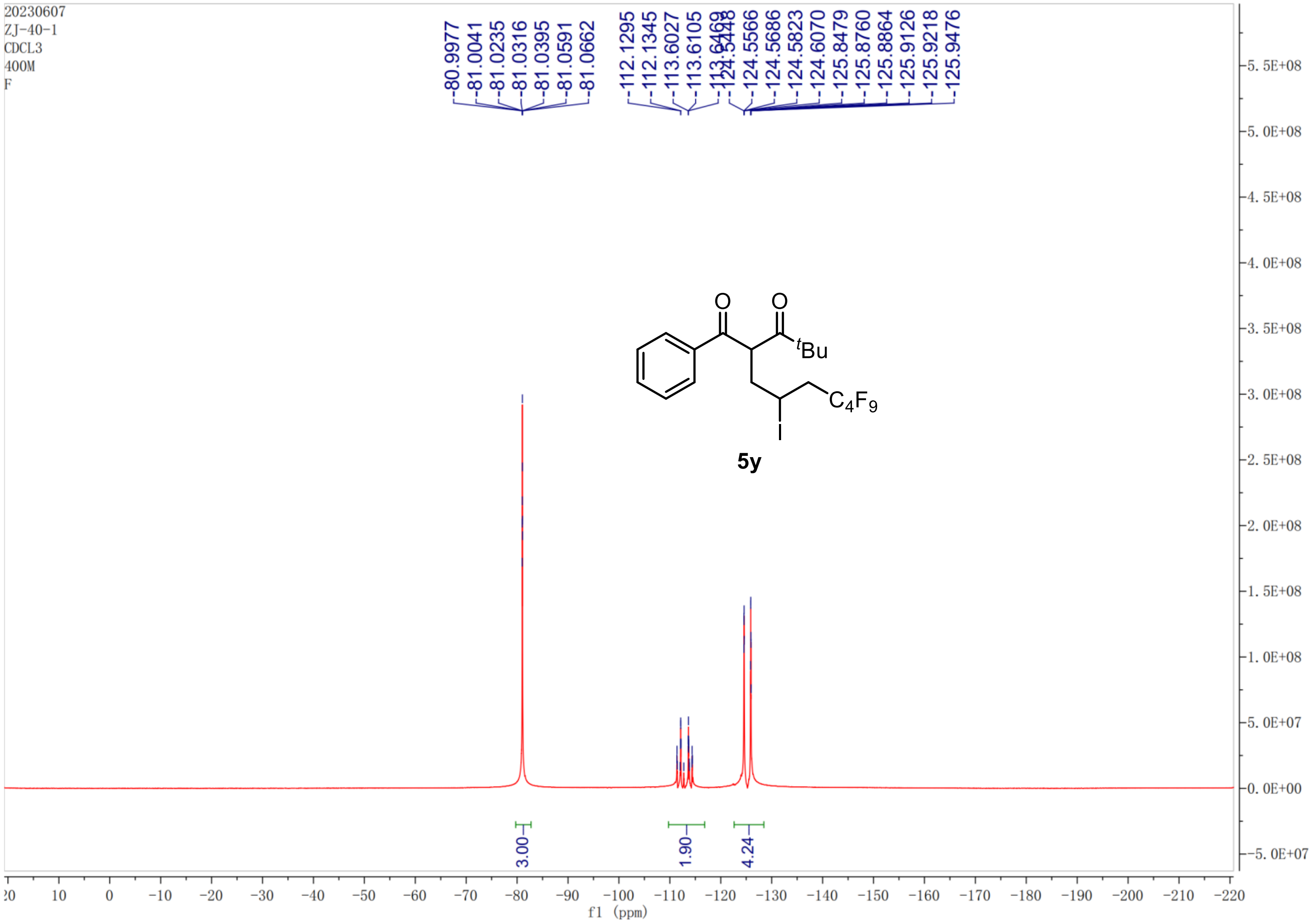
**4x**


20230629
SY45-2
CDCL3
C
169.3999
167.7178
164.0781
163.7564
163.4347
117.8696
115.3695
112.8707
77.3476
77.0297
76.7120
63.0250
61.7537
61.7184
33.7269
33.4886
33.2506
32.8509
20.2284
20.1668
20.0862
14.0851
14.0064
13.9047
EtO
O
O
OEt
CF2CO2Et
6. 0E+08
5. 5E+08
5. 0E+08
4. 5E+08
4. 0E+08
3. 5E+08
3. 0E+08
2. 5E+08
2. 0E+08
1. 5E+08
1. 0E+08
5. 0E+07
0. 0E+00
-5. 0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

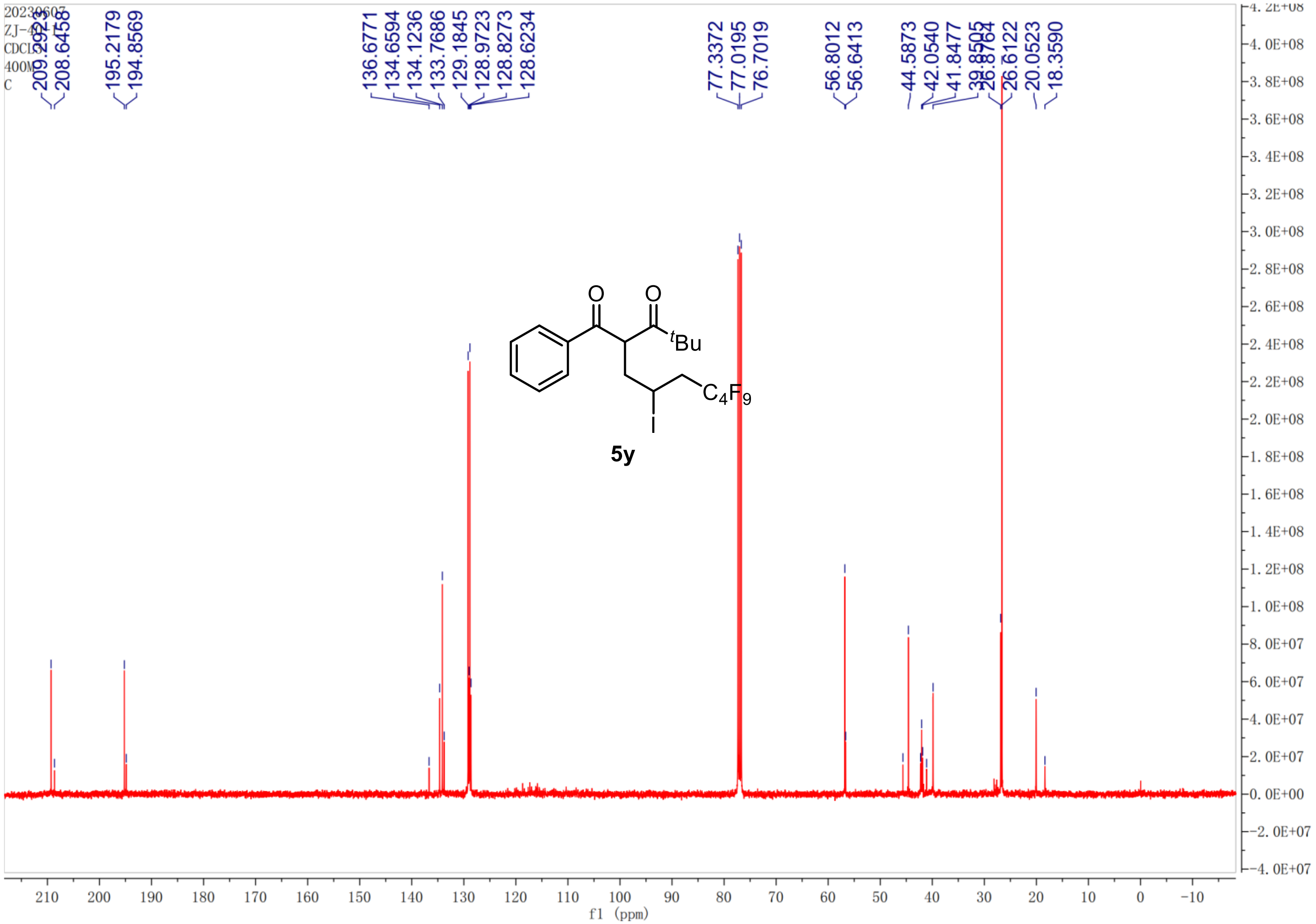
**4x**


20230607
ZJ-40-
CDCl3
400M
H
8.1233
8.1049
8.1016
8.0277
8.0095
8.0061
7.6800
7.6618
7.6431
7.6218
7.6031
7.5762
7.5565
7.5375
7.5160
7.2677
5.3248
5.3207
5.3107
5.2975
5.2934
4.1927
4.1838
4.1776
4.1681
4.1507
4.1445
2.9658
2.9490
2.9065
2.8901
2.8631
2.8438
2.8254
2.7939
2.7756
2.7565
2.5988
2.5933
2.5712
2.5641
2.5572
2.5351
2.5288
2.0447
2.0401
2.0145
2.0094
2.0039
1.9783
1.9736
1.6292
1.1701
1.1649
O
O
tBu
C4F9
I
2.06
3.20
1.00
1.03
2.25
1.12
1.23
8.91
.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)
2.8E+08
2.6E+08
2.4E+08
2.2E+08
2.0E+08
1.8E+08
1.6E+08
1.4E+08
1.2E+08
1.0E+08
8.0E+07
6.0E+07
4.0E+07
2.0E+07
0.0E+00
-2.0E+07

**5y**


20230607
ZJ-40-1
CDCL3
400M
F
-80.9977
-81.0041
-81.0235
-81.0316
-81.0395
-81.0591
-81.0662
-112.1295
-112.1345
-113.6027
-113.6105
-113.6469
-124.5448
-124.5566
-124.5686
-124.5823
-124.6070
-125.8479
-125.8760
-125.8864
-125.9126
-125.9218
-125.9476
O
O
tBu
C4F9
I
3.00
1.90
4.24
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
-220
f1 (ppm)
5.5E+08
5.0E+08
4.5E+08
4.0E+08
3.5E+08
3.0E+08
2.5E+08
2.0E+08
1.5E+08
1.0E+08
5.0E+07
0.0E+00
-5.0E+07

**5y**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ZJ-40-1
CDCL3
400M
C
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208.6458
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194.8569
136.6771
134.6594
134.1236
133.7686
129.1845
128.9723
128.8273
128.6234
77.3372
77.0195
76.7019
56.8012
56.6413
44.5873
42.0540
41.8477
39.8505
26.8764
26.6122
20.0523
18.3590
O
O
tBu
C4F9
I
4.2E+08
4.0E+08
3.8E+08
3.6E+08
3.4E+08
3.2E+08
3.0E+08
2.8E+08
2.6E+08
2.4E+08
2.2E+08
2.0E+08
1.8E+08
1.6E+08
1.4E+08
1.2E+08
1.0E+08
8.0E+07
6.0E+07
4.0E+07
2.0E+07
0.0E+00
-2.0E+07
-4.0E+07
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

**5y**