

Electronic Supplementary Information

Rhodium-Catalyzed Z-Alkenylation of *gem*-Difluoropropenes: Access to Fluorinated (1Z,4Z)-Dienes

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400715, P. R. China.

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I General Information

¹H NMR and ¹³C NMR spectra were recorded on a Bruker Avance 600 MHz instruments. Chemical shifts were reported in parts per million (ppm), and the residual solvent peak was used as an internal reference: proton (chloroform δ 7.26), carbon (chloroform δ 77.16) or tetramethylsilane (TMS δ 0.00) was used as a reference. Multiplicity was indicated as follows: s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet), dd (doublet of doublet), bs (broad singlet). Coupling constants were reported in Hertz (Hz). All high resolution mass spectra (HRMS) were obtained on a Bruker Apex-2. For thin layer chromatography (TLC), Qingdao Haiyang Chemical was used, and compounds were visualized with a UV light at 254 nm. Further visualization was achieved by staining with iodine, or potassium permanganate solution followed by heating using a heat gun. Flash chromatography separations were performed on Qingdao Haiyang Chemical 200-300 mesh silica gel. All reactions were carried out under a nitrogen atmosphere. All commercially available reagents were used as received for the reactions without any purification. All solvents were dried on alumina columns using a solvent dispensing system.

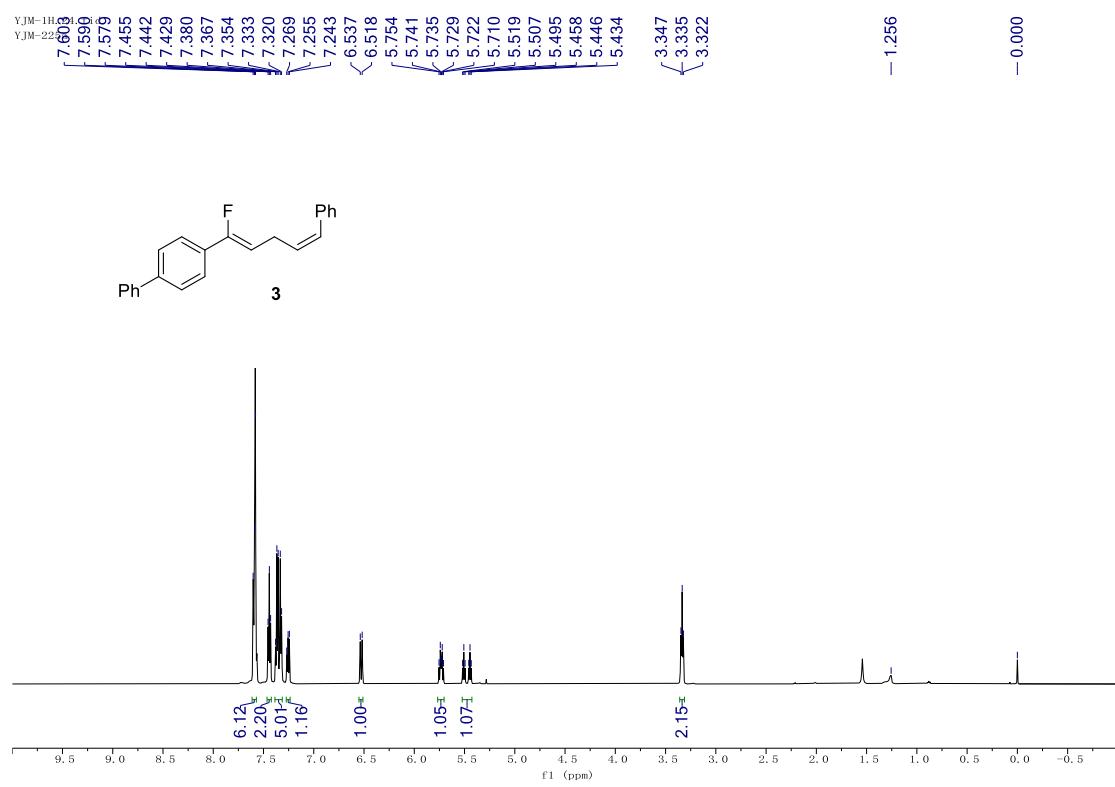
Materials: $[\text{Rh}(\text{COD})_2]\text{BF}_4$ and $\text{LiO}'\text{Bu}$ were obtained from commercial suppliers and used without further purification. All Solvents were purified by standard procedure before use. Allylic *gem*-Difluorides,¹⁻² allylic alcohols³⁻⁴ are synthesis via the known procedures.

II References

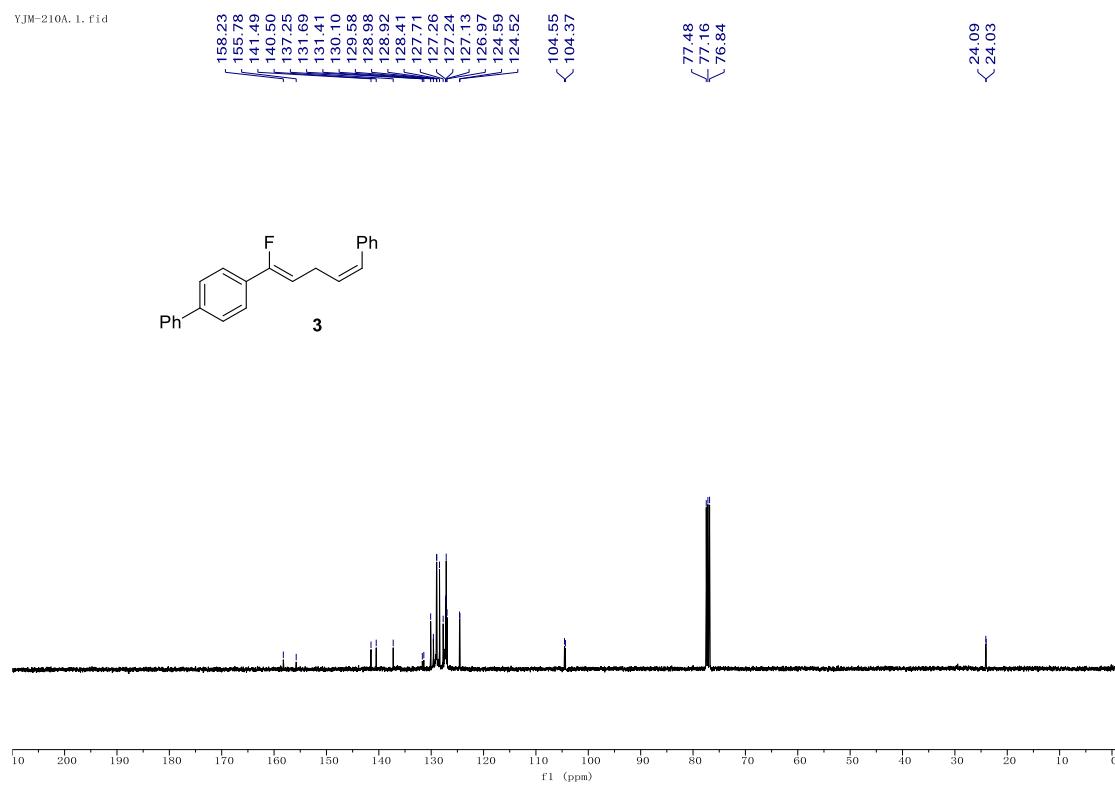
- 1 Q.-Q. Min, Z. Yin, Z. Feng, W.-H. Guo and X. Zhang, *J. Am. Chem. Soc.* 2014, **136**, 1230-1233.
- 2 T. W. Butcher, J. L. Yang, W. M. Amberg, N. B. Watkins, N. D. Wilkinson and J. F. Hartwig, *Nature* 2020, **583**, 548-553.
- 3 Loui, H. J.; Schneider, C., *Org. Lett.* 2022, **24**, 1496-1501.
- 4 X. Wen, X. Shi, X. Qiao, Z. Wu and G. Bai, *Chem. Commun.* 2017, **53**, 5372-5375.

III NMR spectra

¹H NMR (600 MHz, CDCl₃)

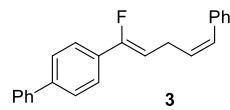


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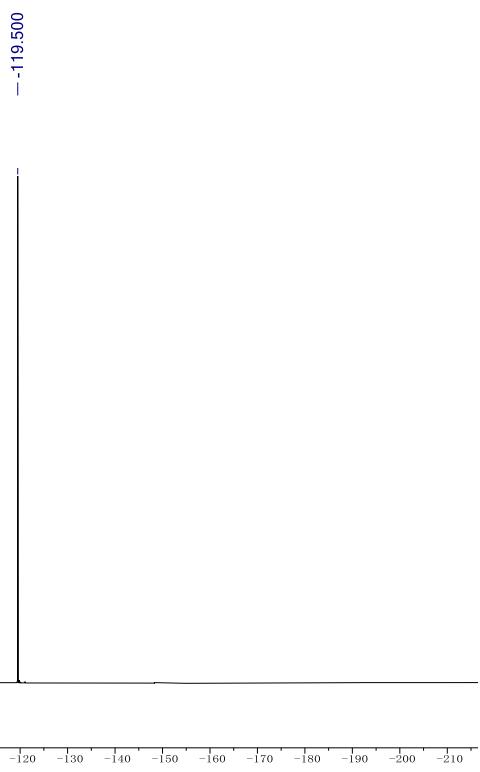
¹⁹F NMR (565 MHz, CDCl₃)

YJM-19F, 2, fid
YJM-225A

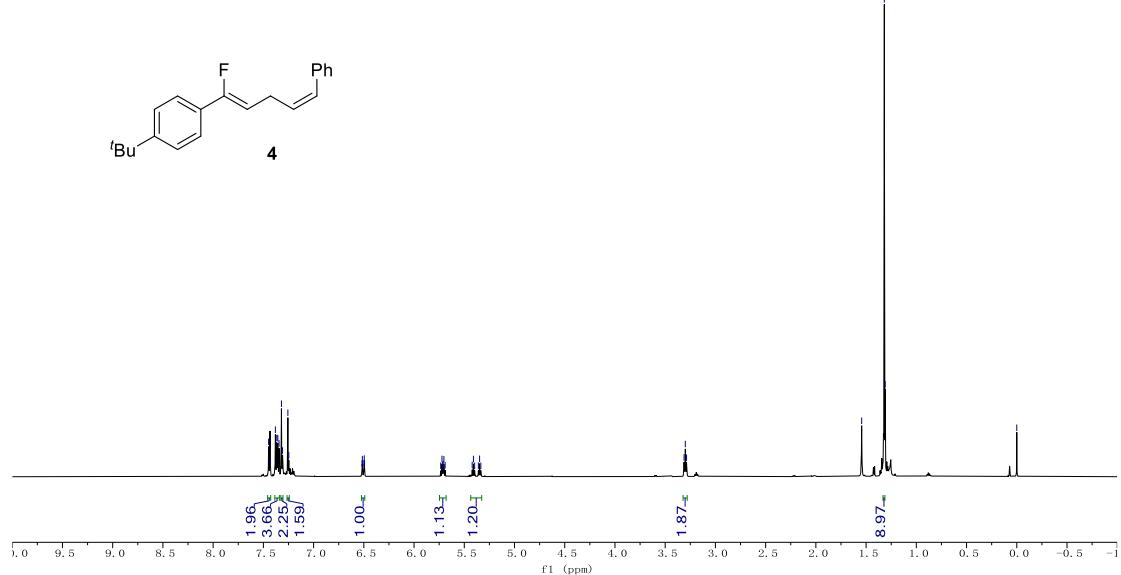


¹H NMR (600 MHz, CDCl₃)

氢谱/235A
YJM-235A

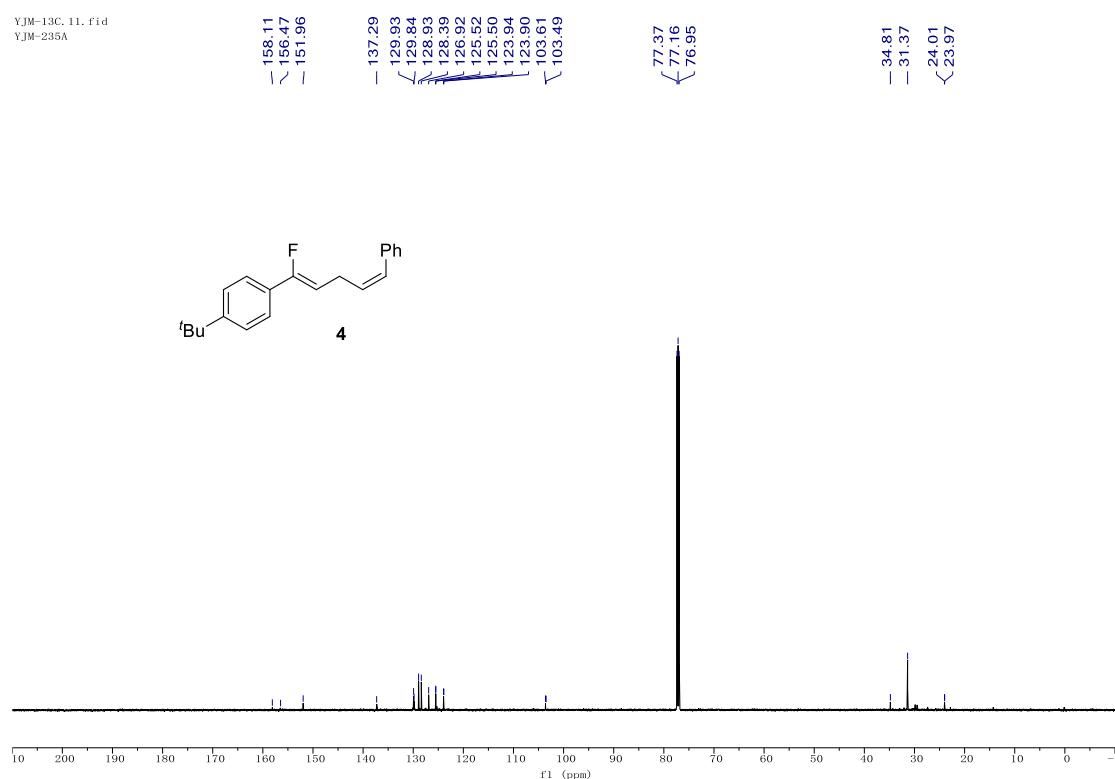


1.544
3.312
3.300
3.287
1.319
1.310
0.000

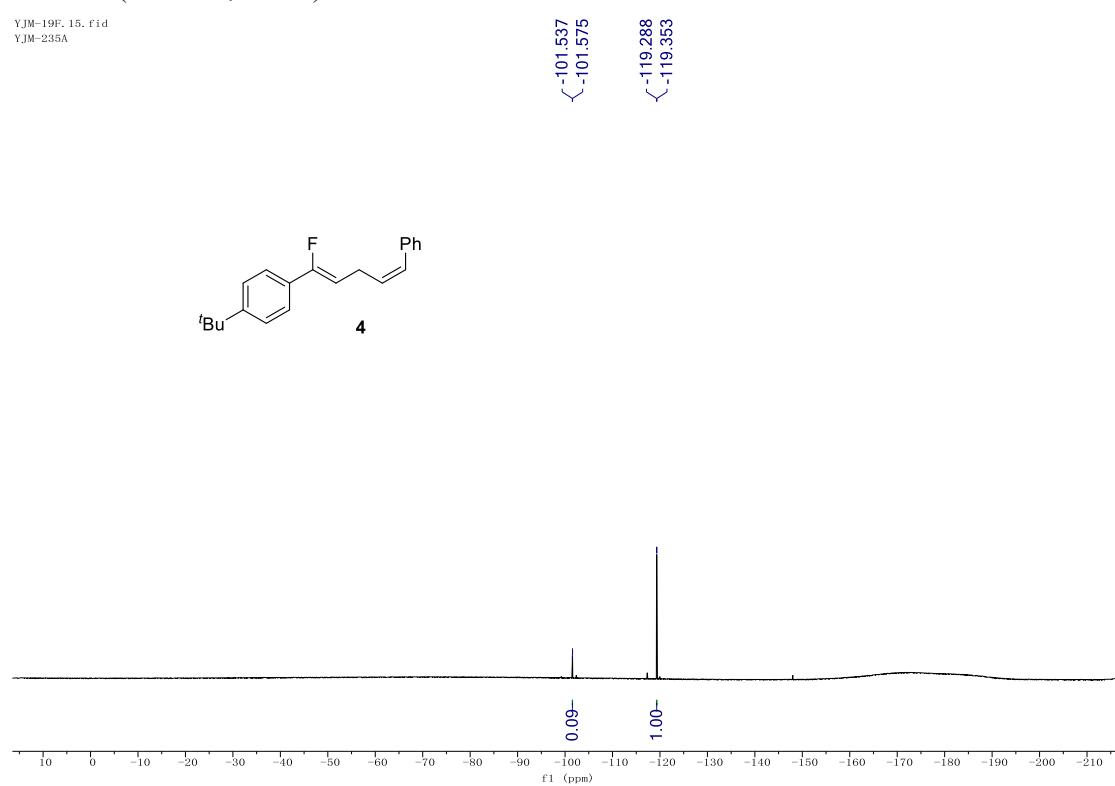


¹³C NMR (151 MHz, CDCl₃)

YJM-13C, 11. fid
YJM-235A

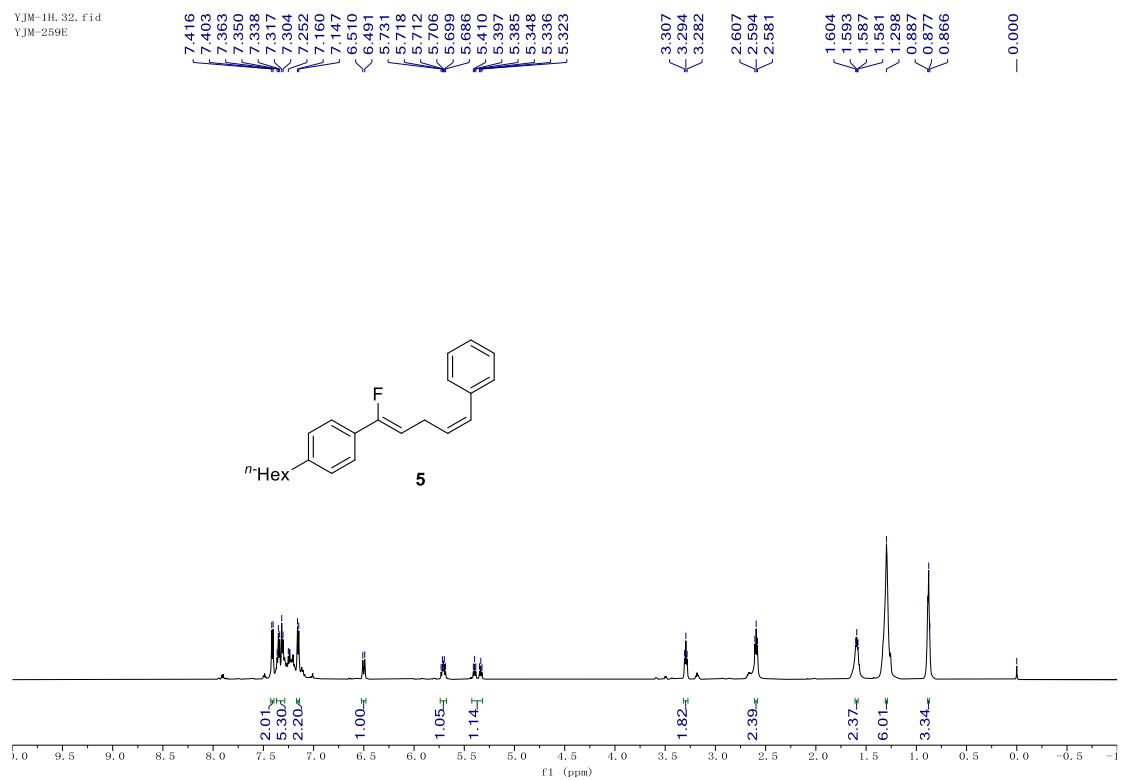


YJM-19F, 15. fid
YJM-235A



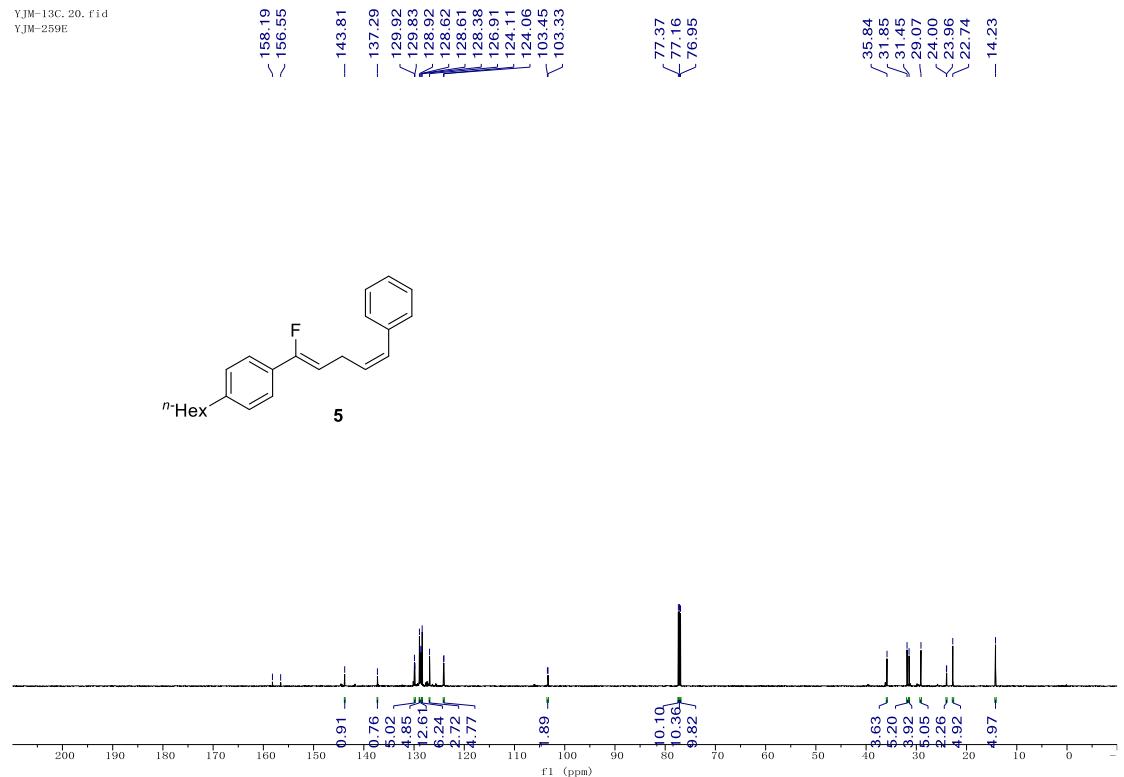
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YJM-1H, 32, fid
YJM-259E



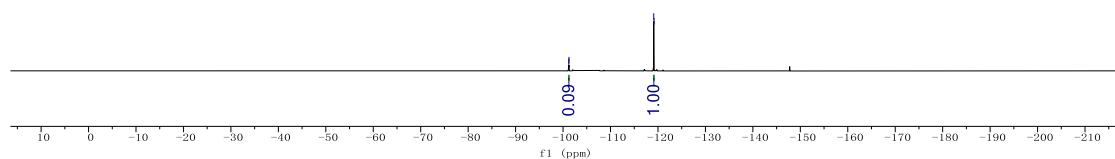
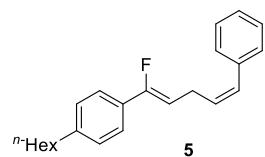
¹³C NMR (151 MHz, CDCl₃)

YJM-13C, 20, fid
YJM-259E



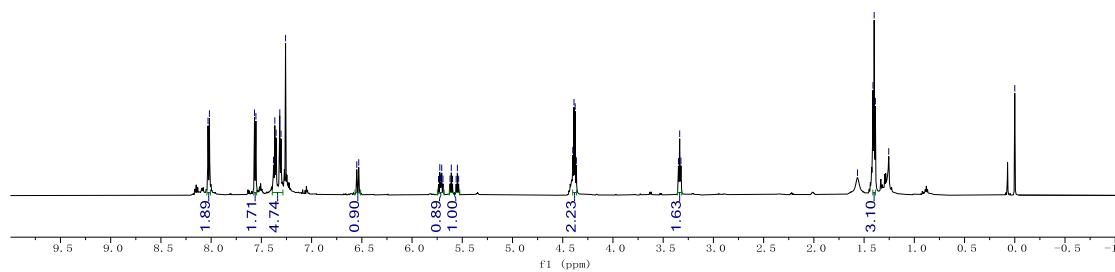
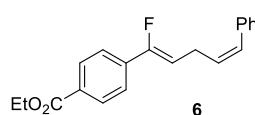
¹⁹F NMR (565 MHz, CDCl₃)

YJM-19F, 22, fid
YJM-259E



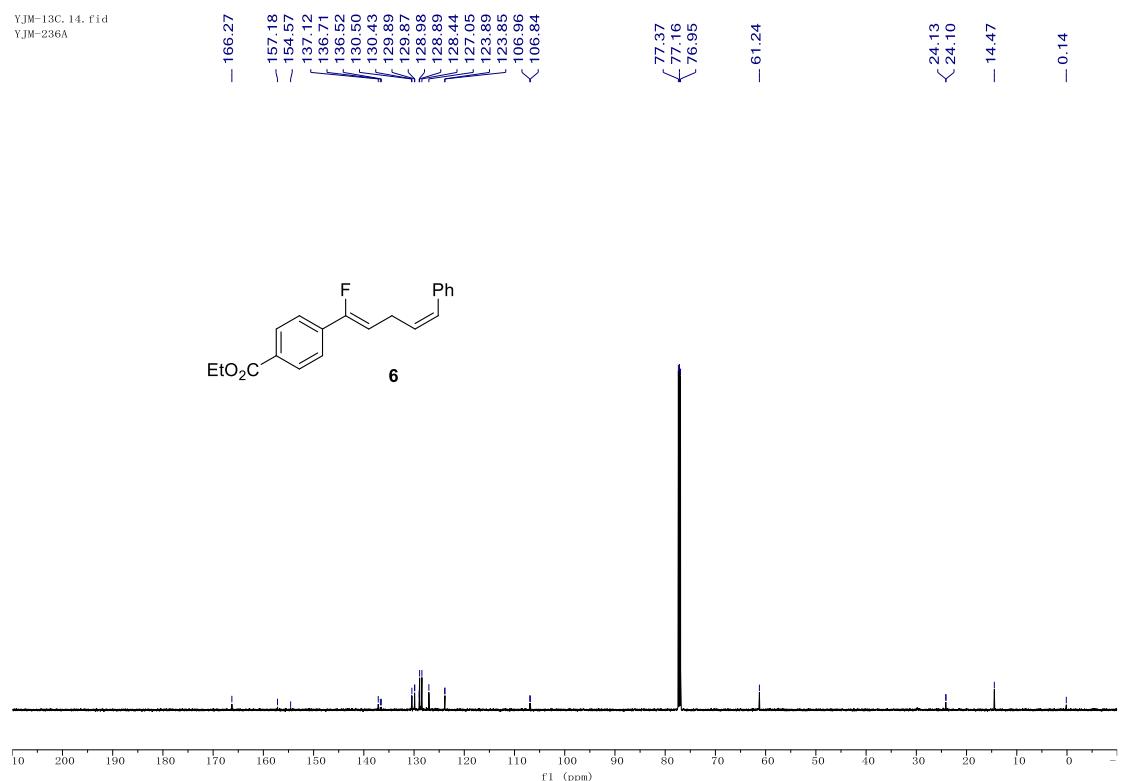
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YJM-1H. 97. fid
YJM-236a



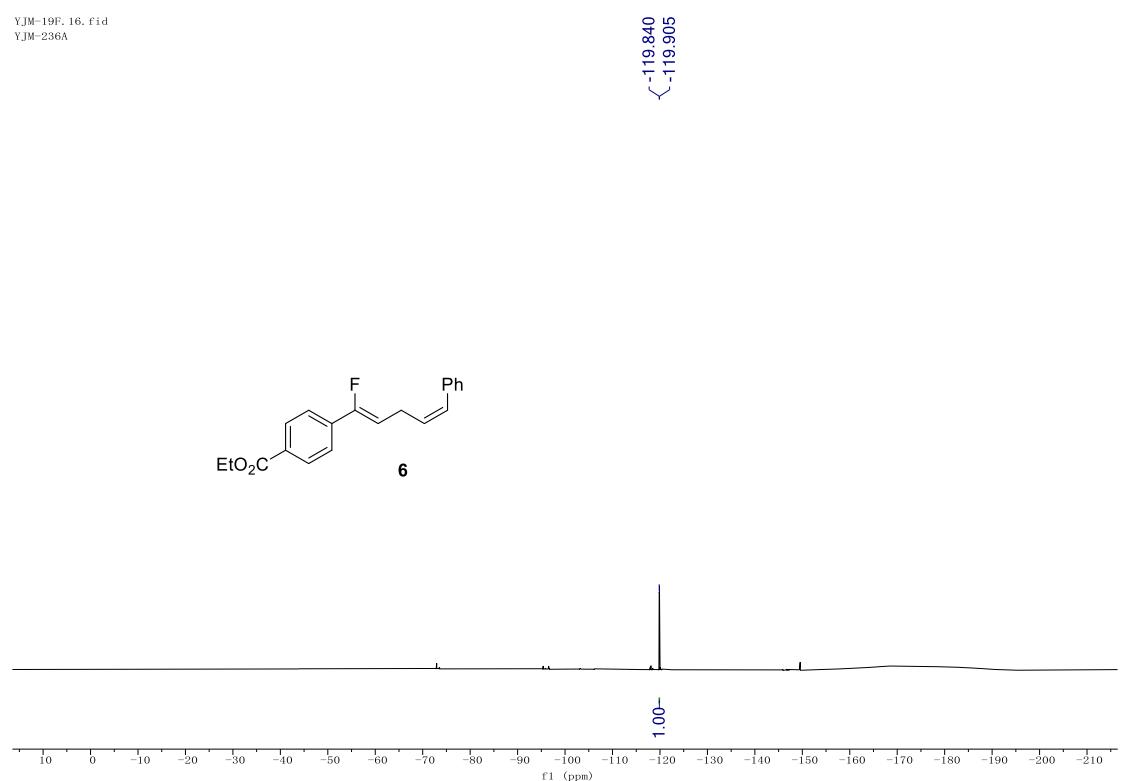
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YJM-13C. 14. fid
YJM-236A

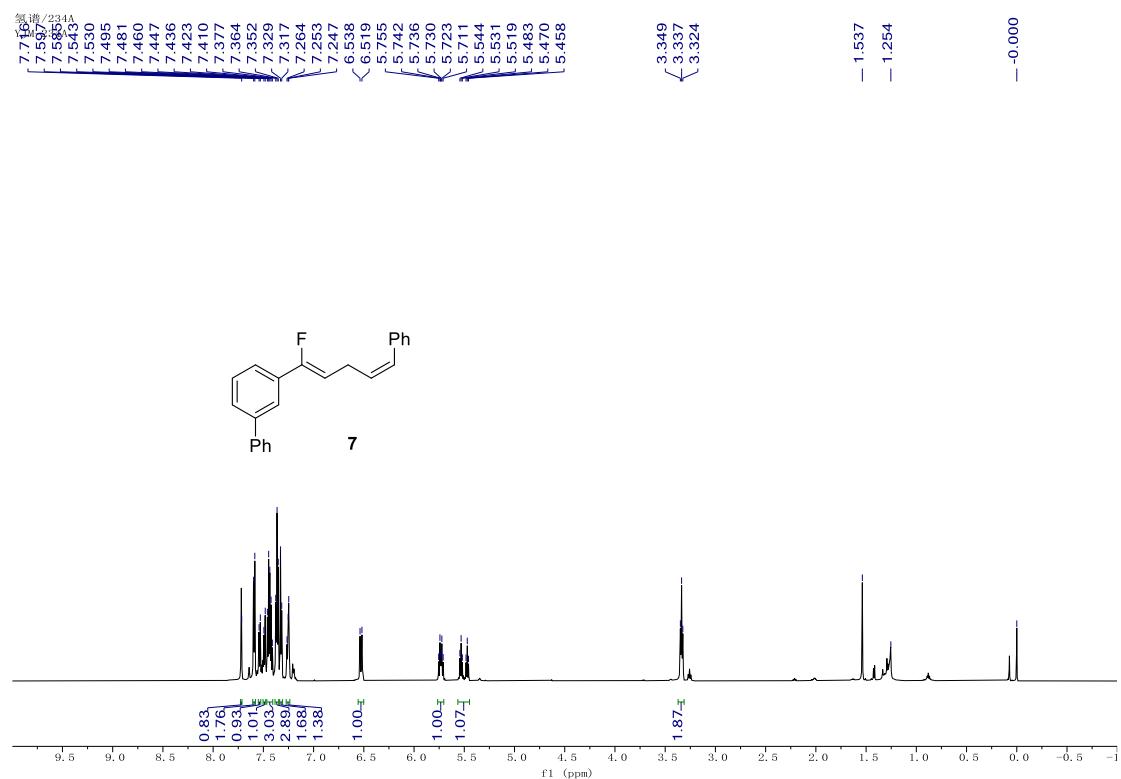


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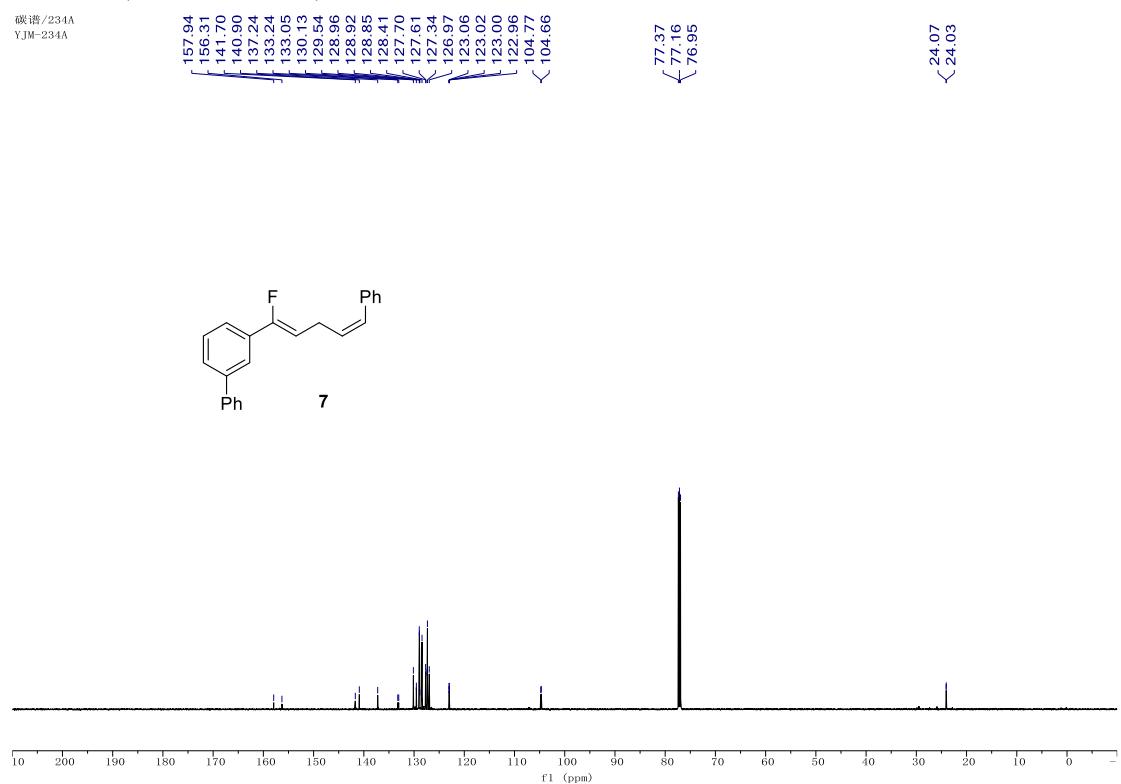
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YJM-236A



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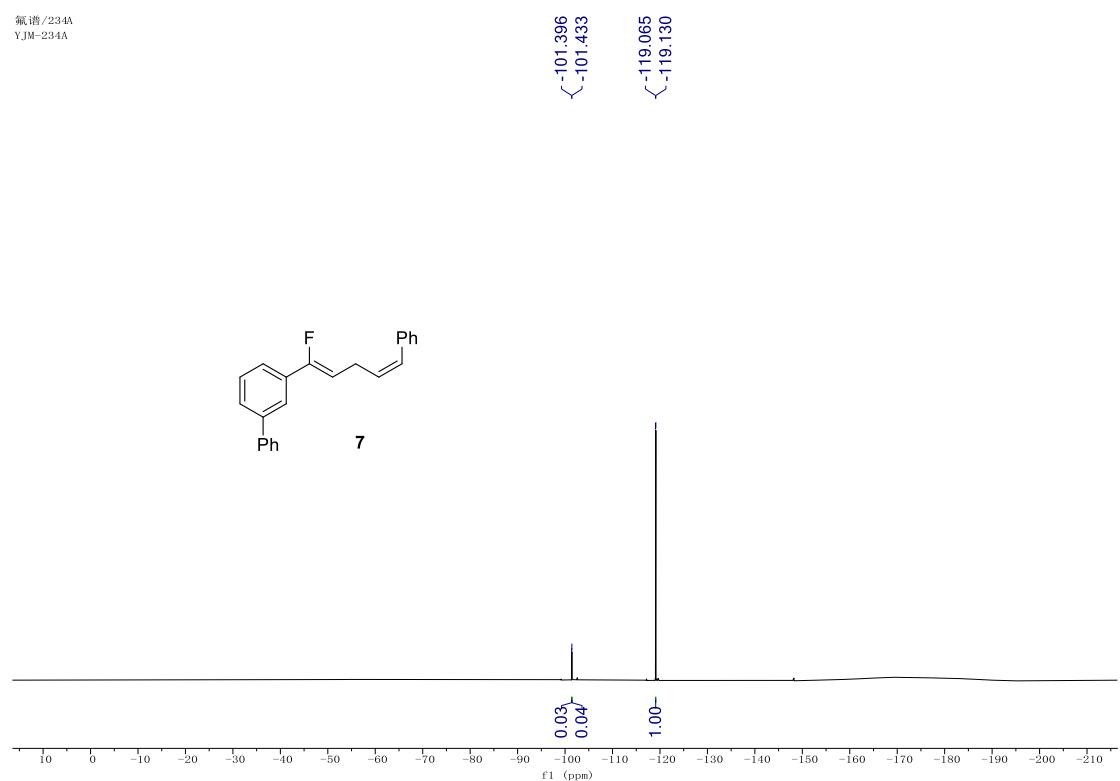


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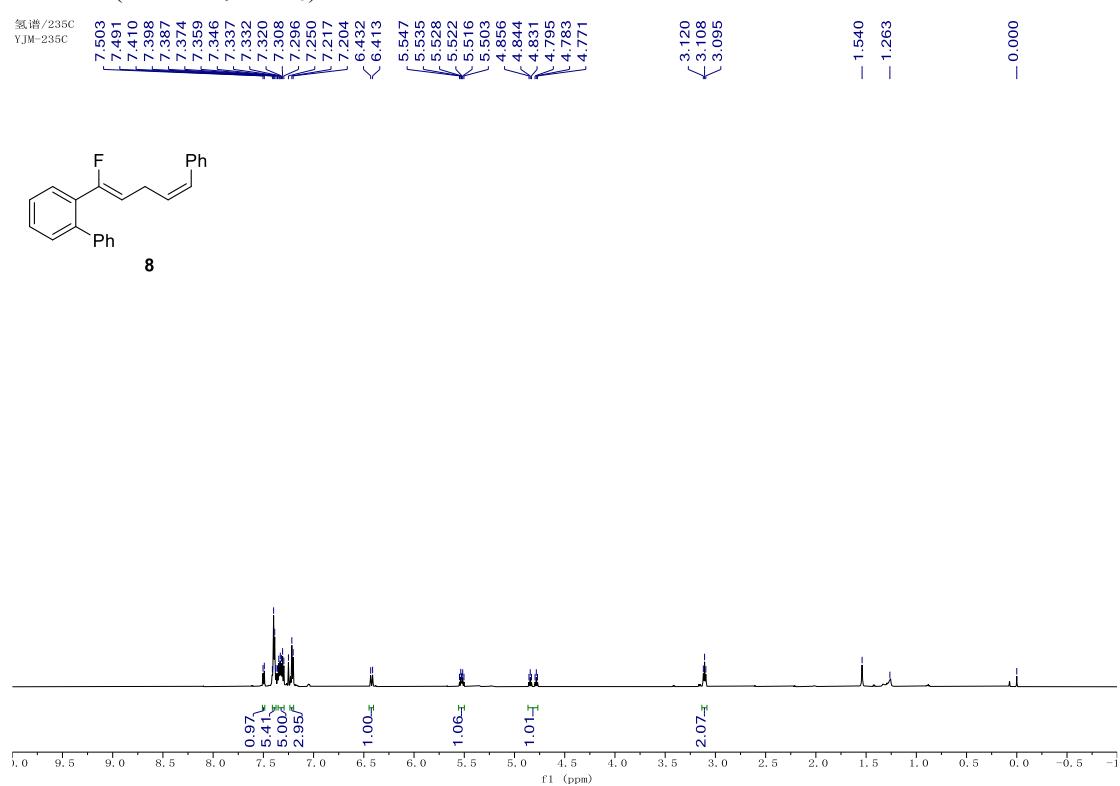
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氢谱/234A
YJM-234A

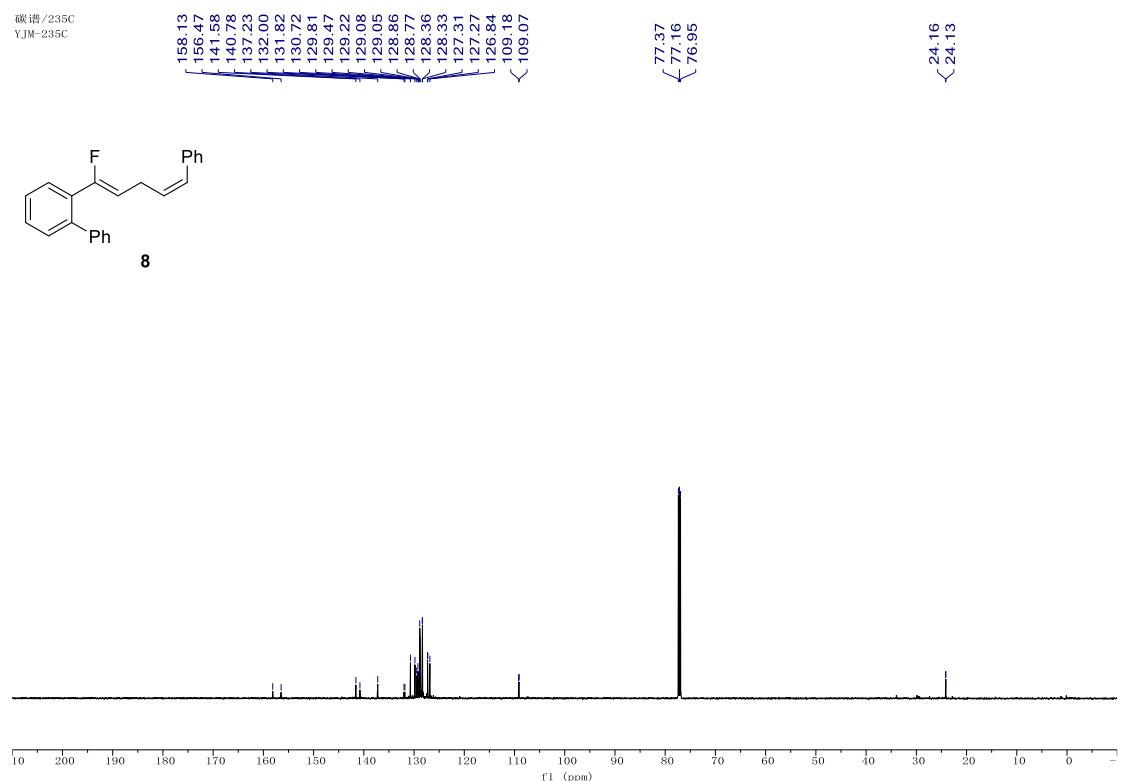


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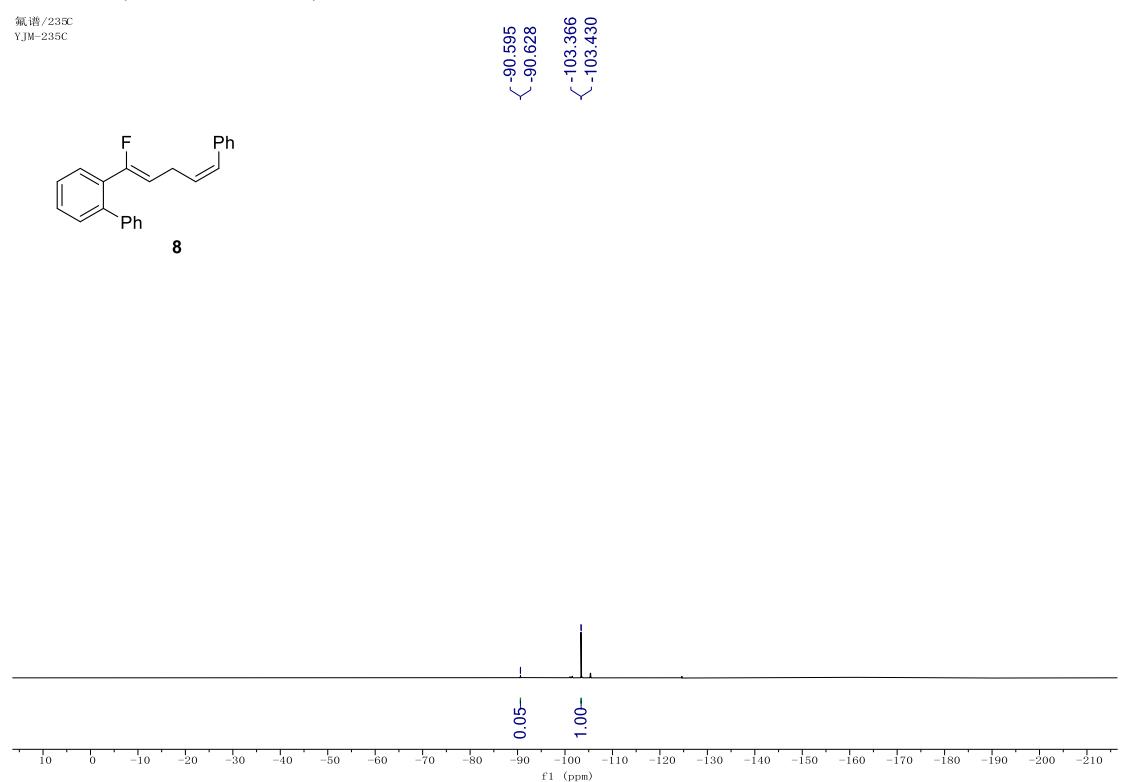
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YJM-235C



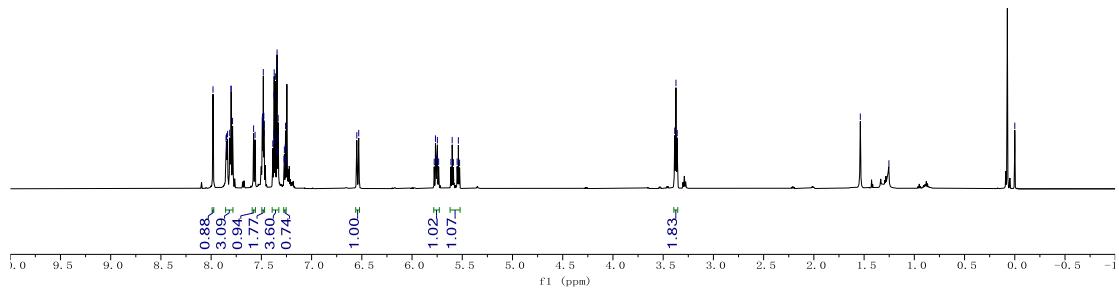
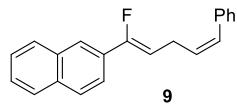
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¹⁹F NMR (565 MHz, CDCl₃)

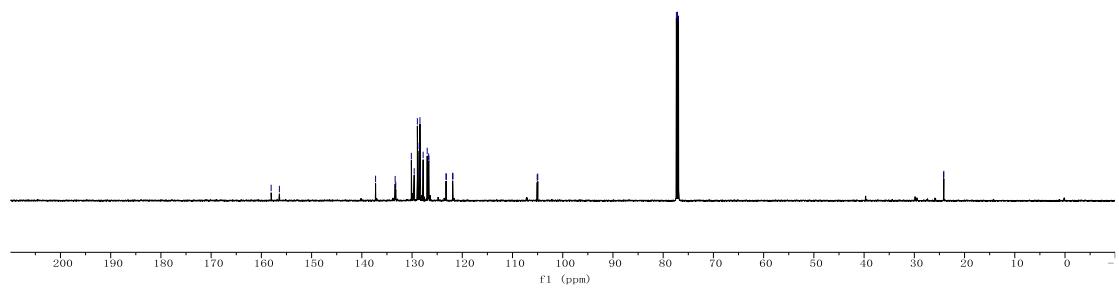
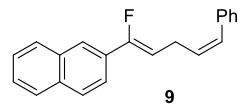


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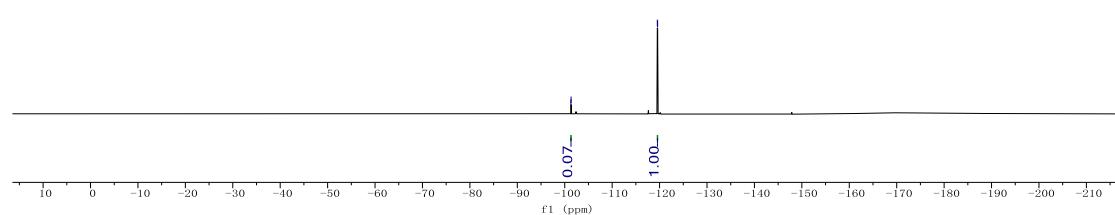
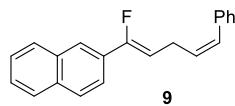
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碳谱/235B
YJM-235B



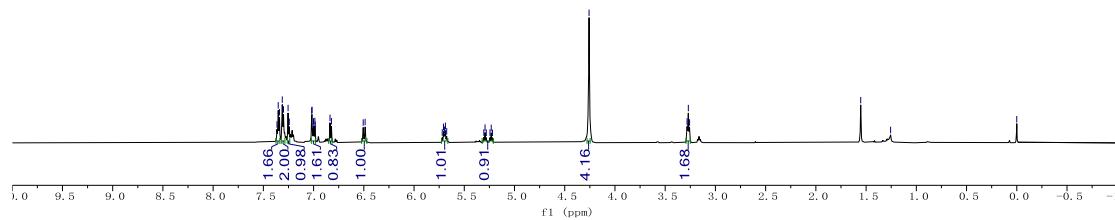
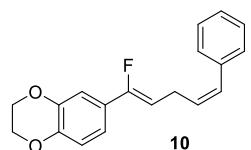
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YJM-235B
YJM-235B



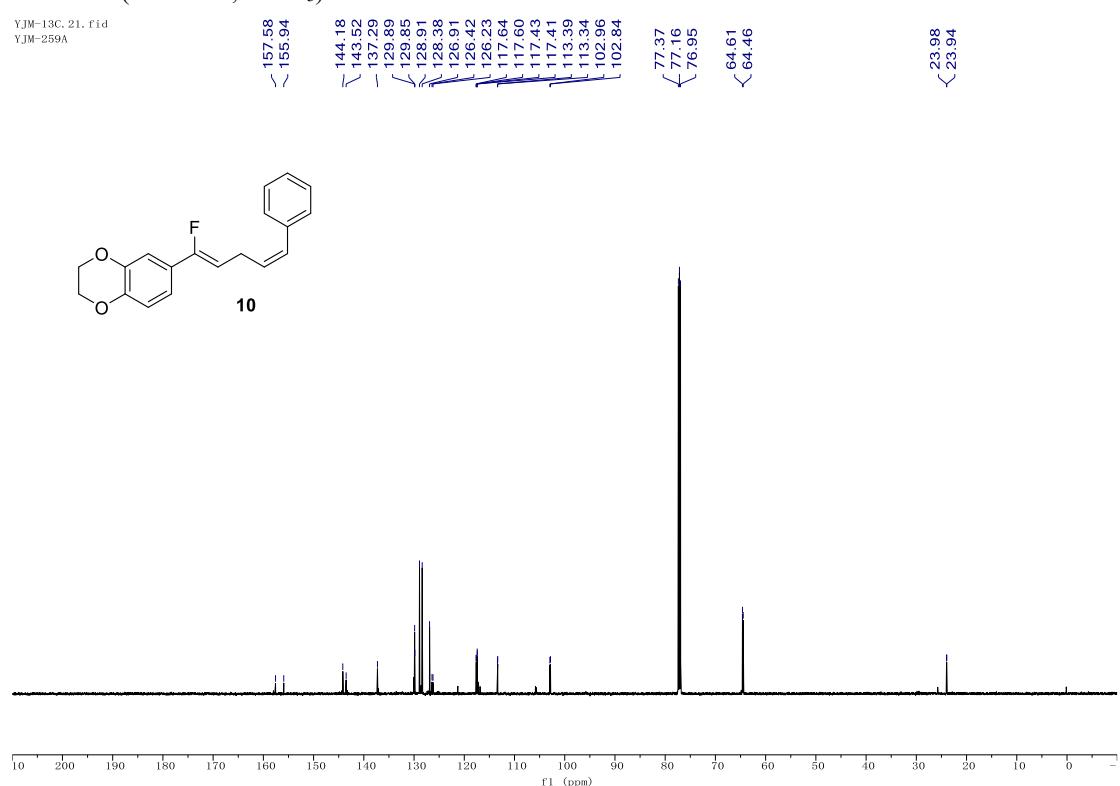
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YJM-1H, 28, f1dA
YJM-259A



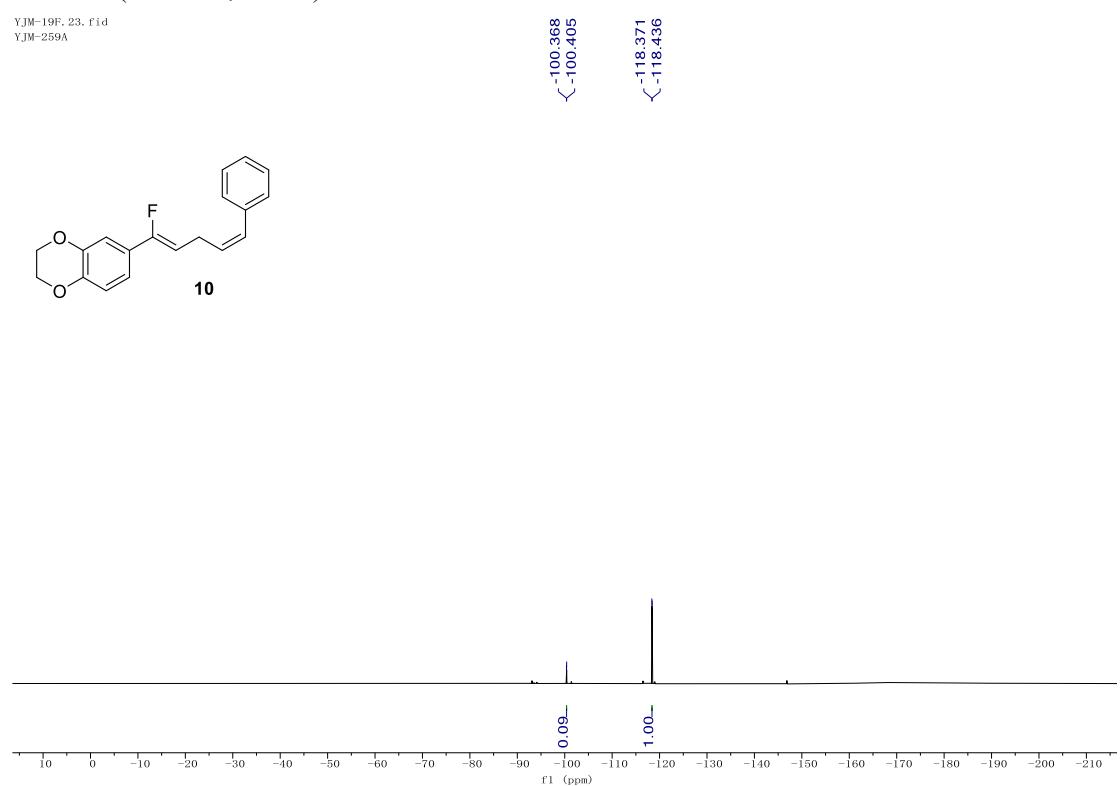
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YJM-13C, 21, fid
YJM-259A

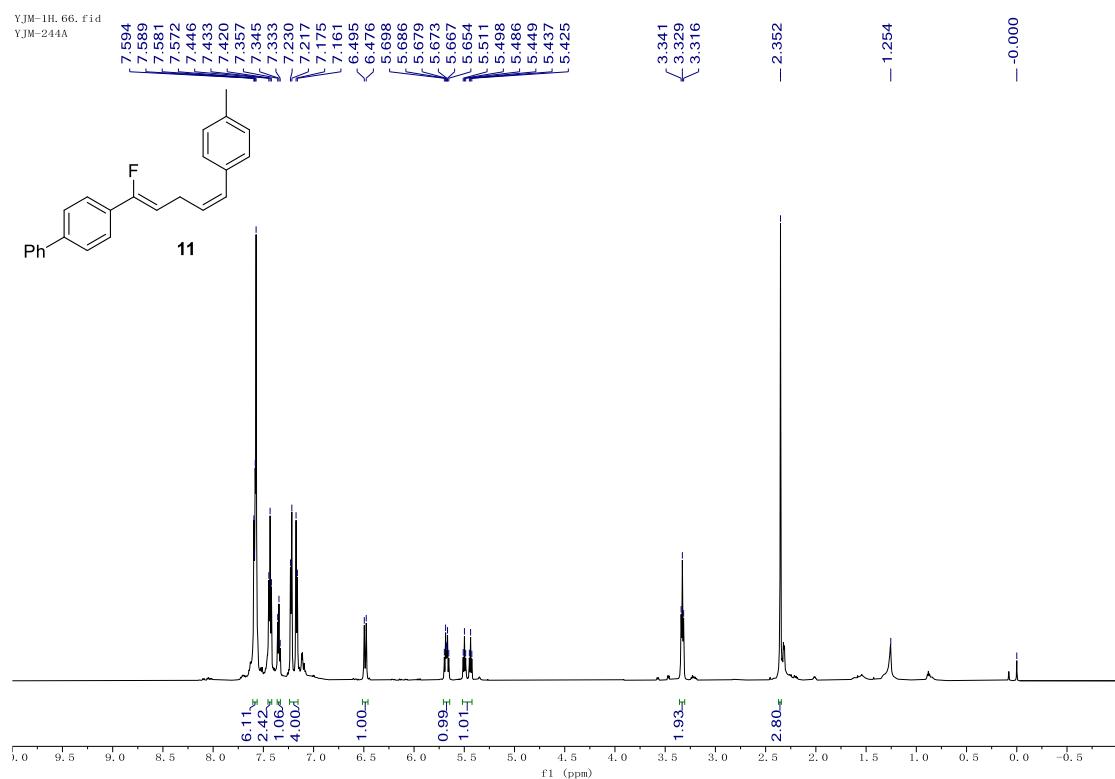


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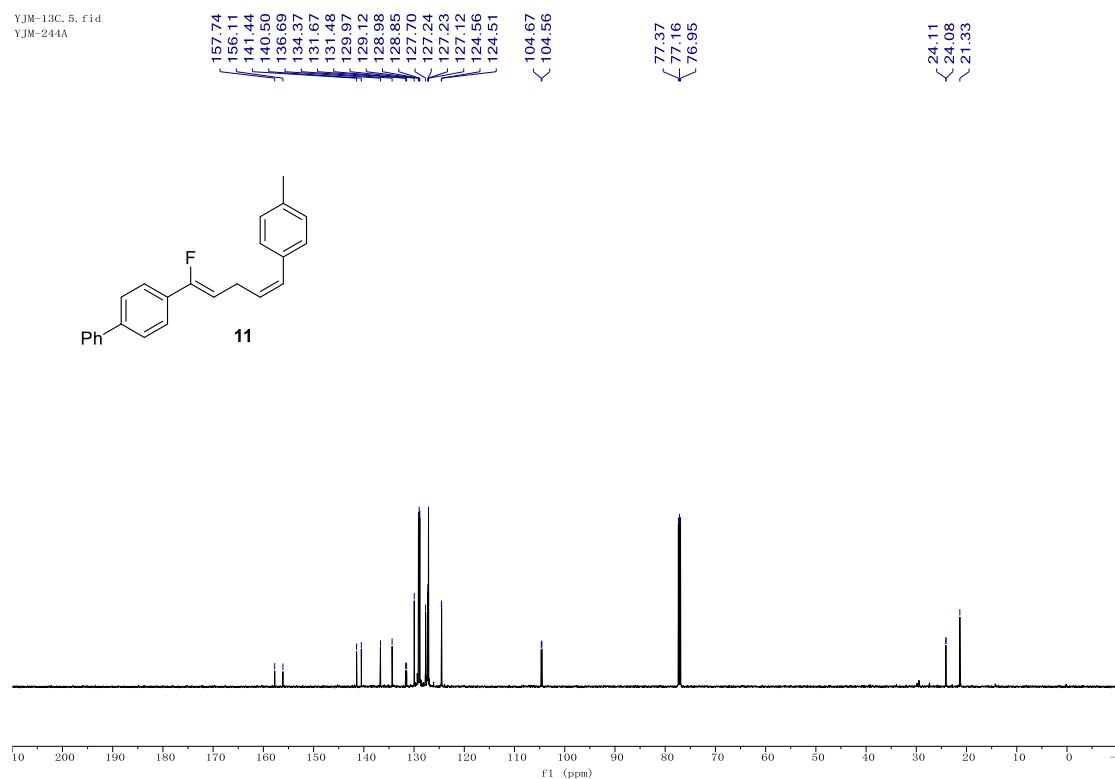
YJM-19F, 23, fid
YJM-259A



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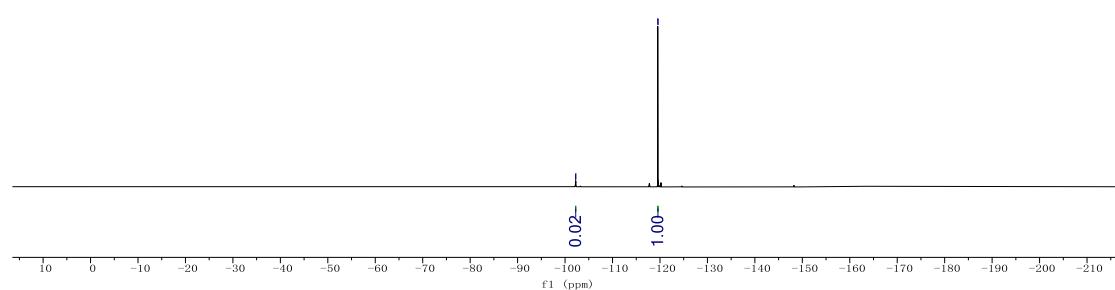
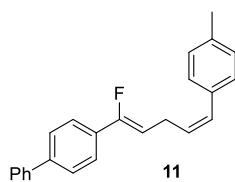


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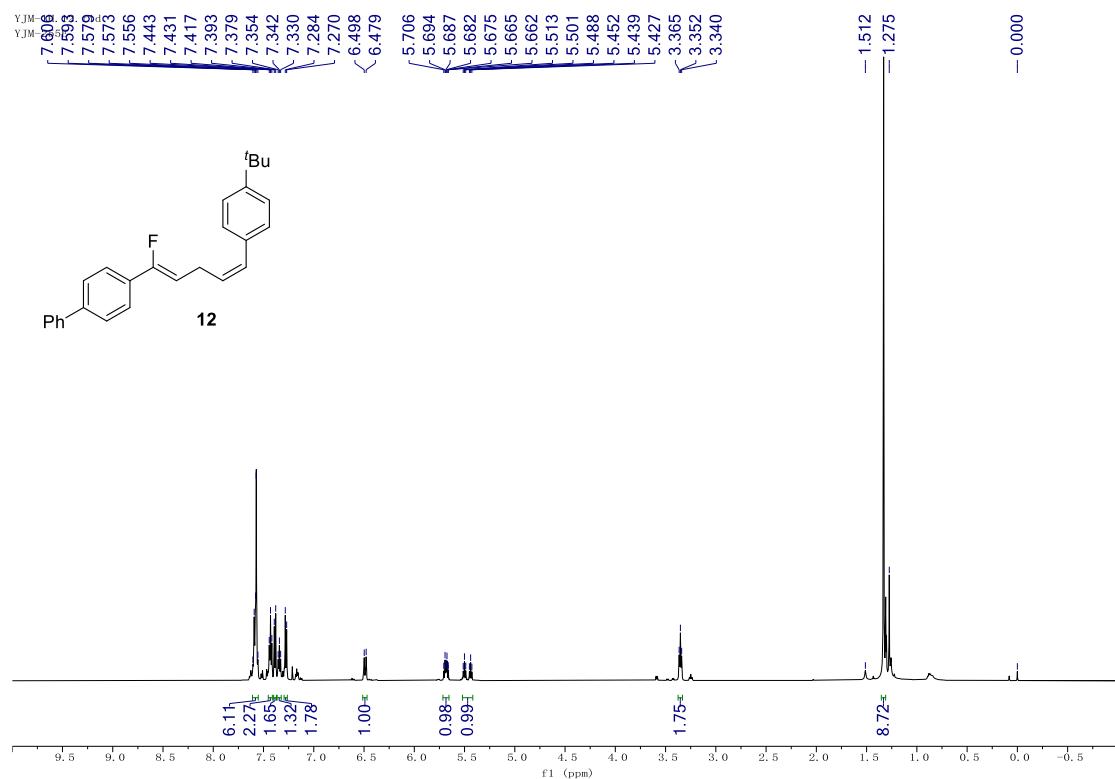
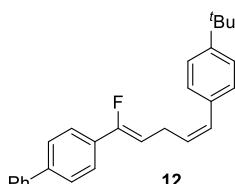
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YJM-19F. 8. fid
YJM-244A



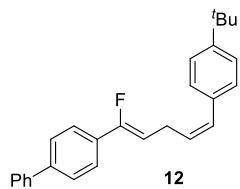
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YJM-401. 3. 593
YJM-405. 579



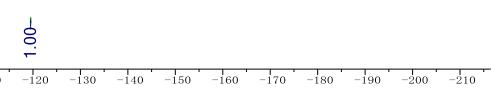
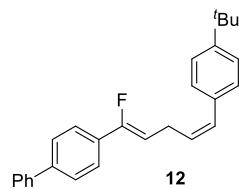
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YJM-13C. 17. fid
YJM-255E

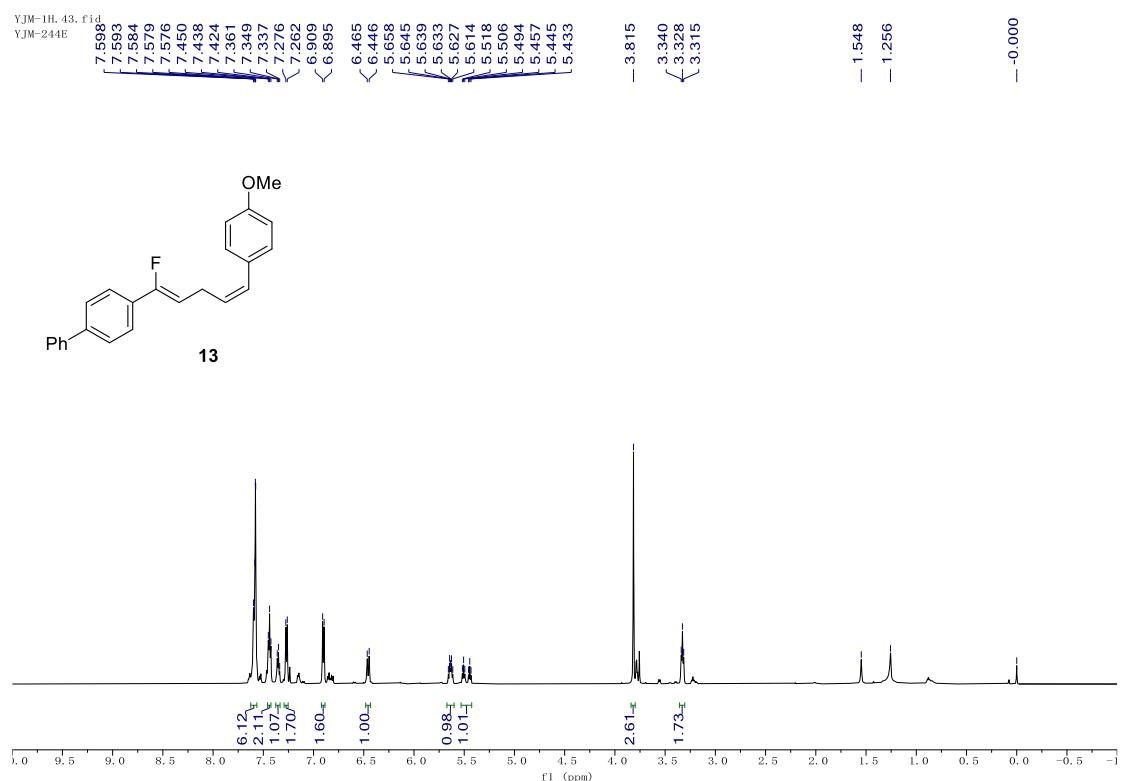


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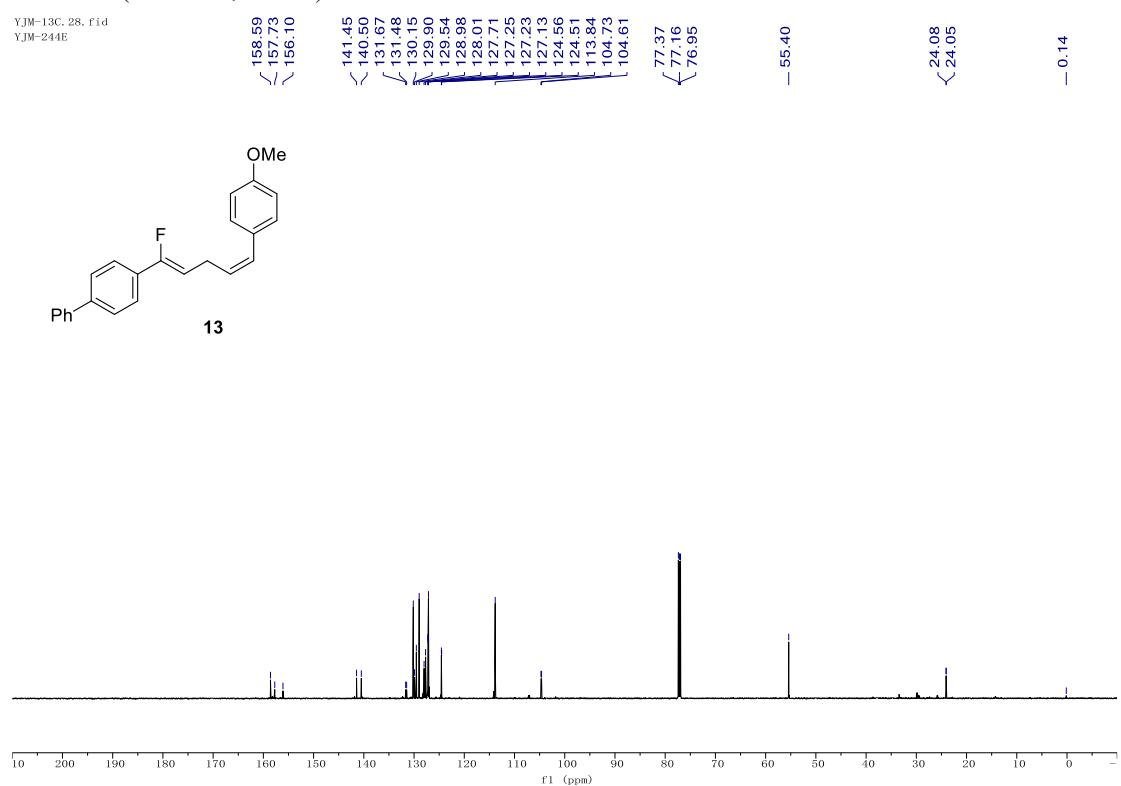
YJM-19F. 19. fid
YJM-255E



¹H NMR (600 MHz, CDCl₃)

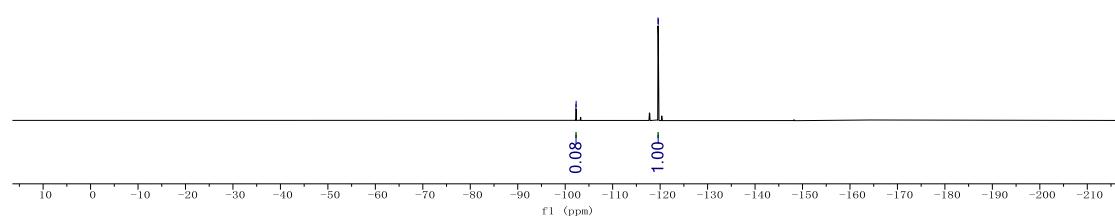
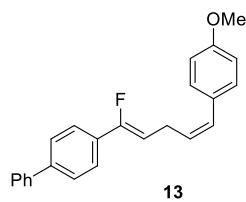


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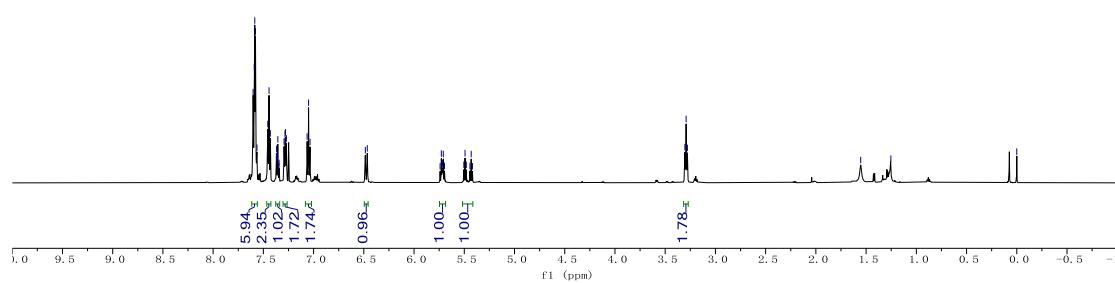
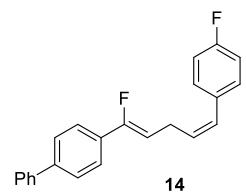
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YJM-19F, 30. fid
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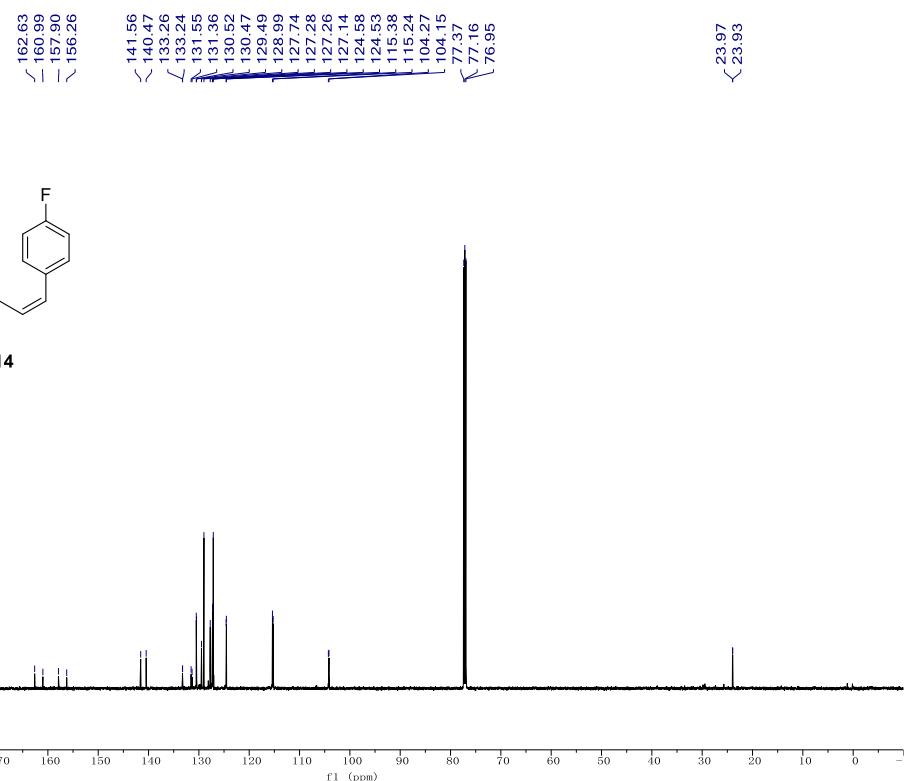
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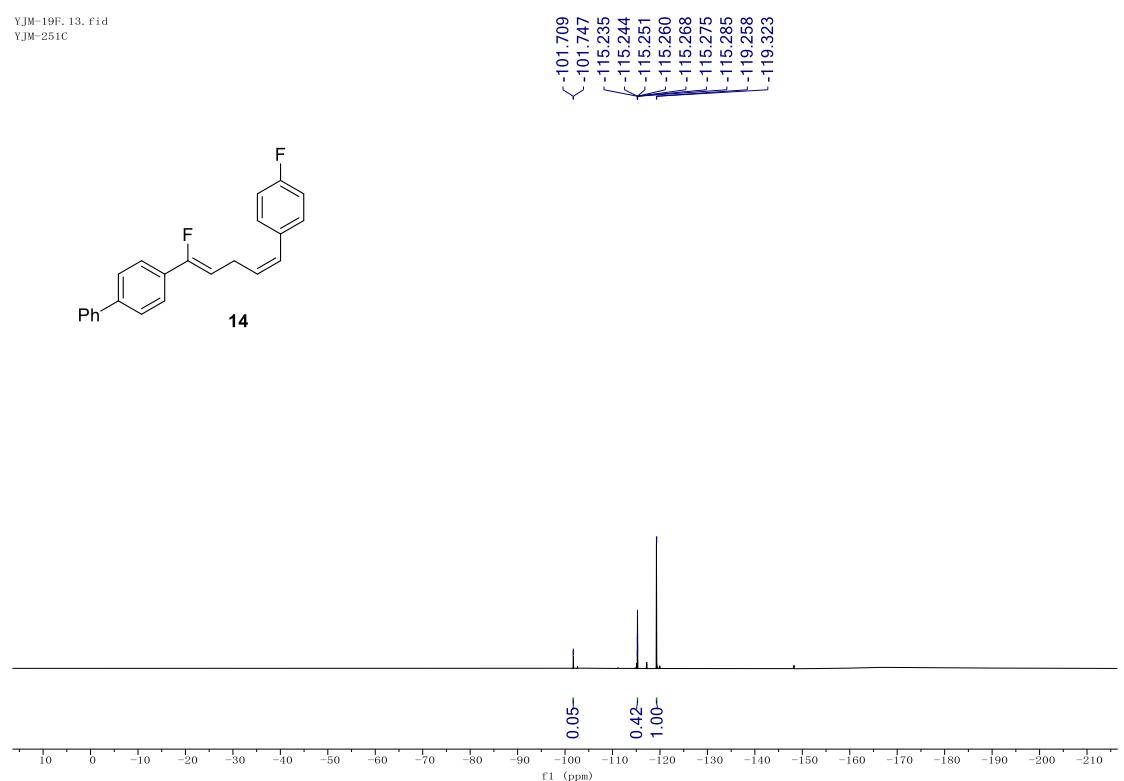
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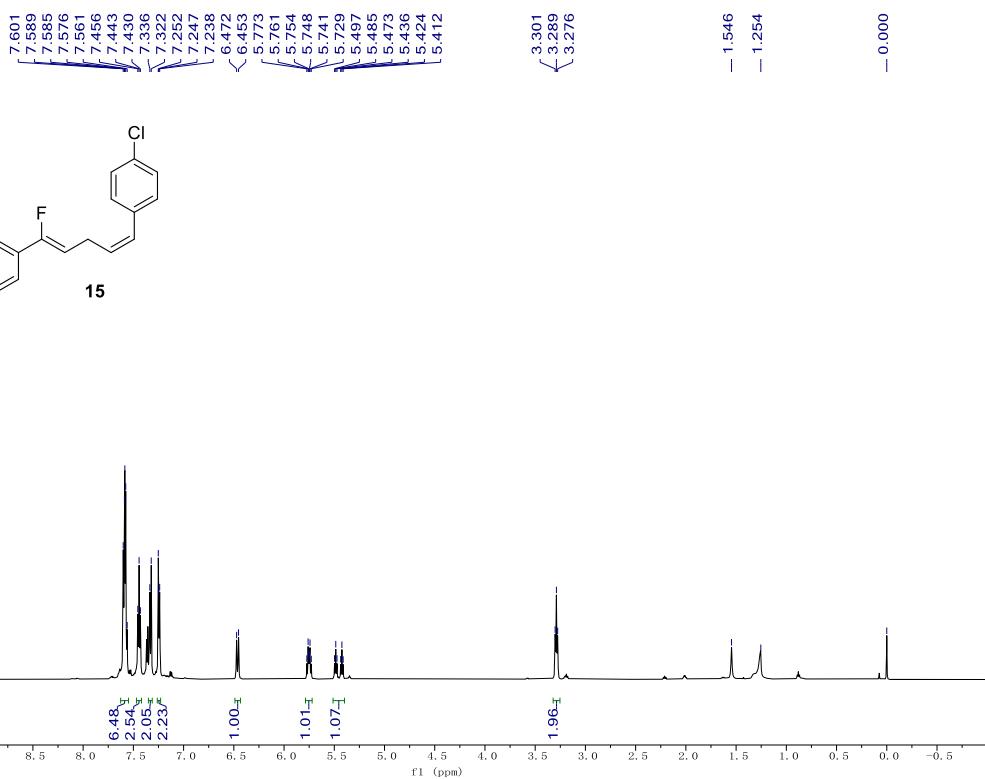
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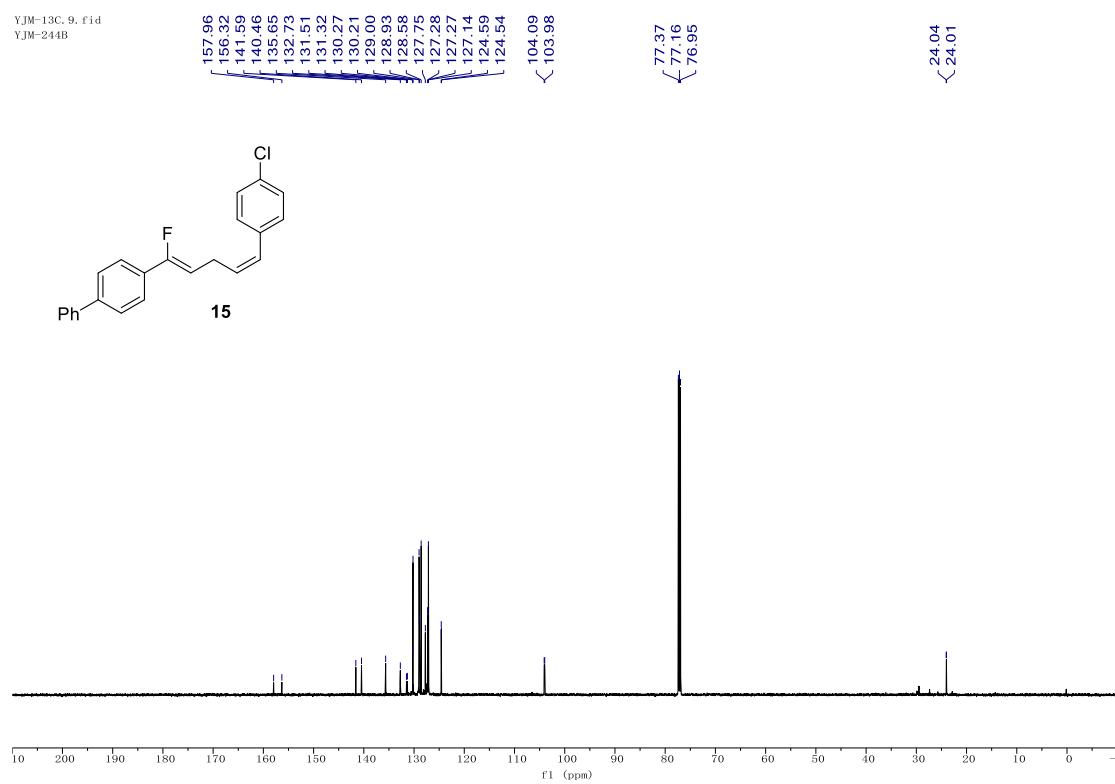
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YJM-1H, 93. fid
YJM-244b



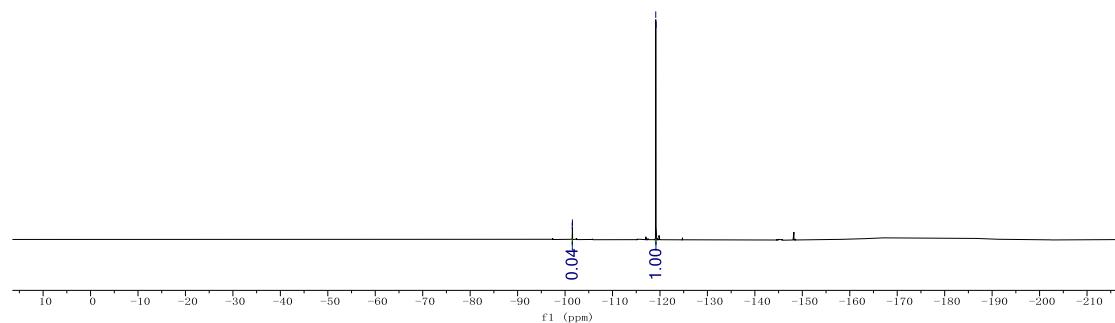
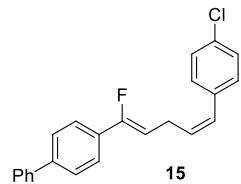
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YJM-244B



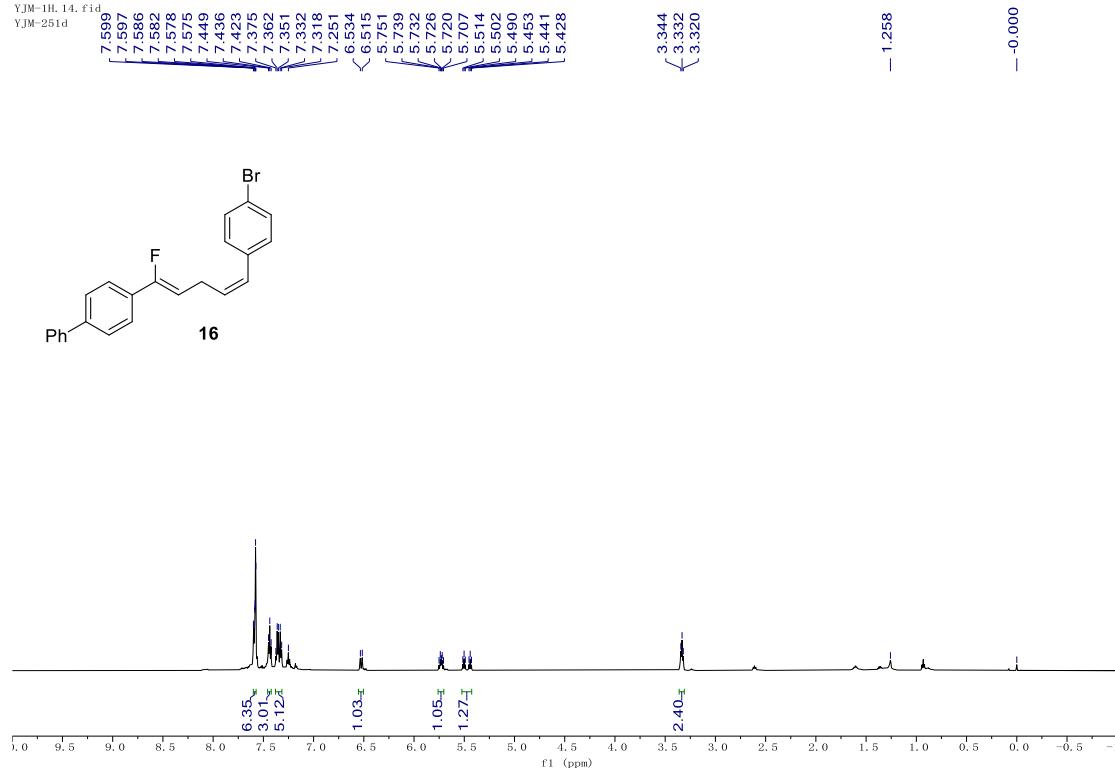
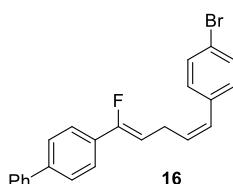
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YJM-244B



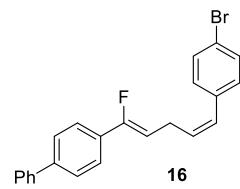
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YJM-1H. 14. fid
YJM-251d



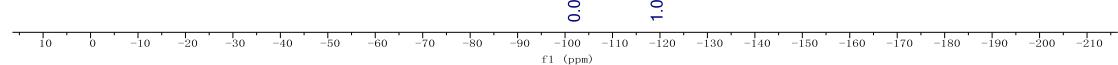
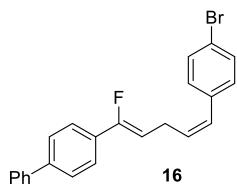
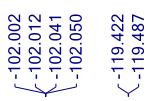
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YJM-25101



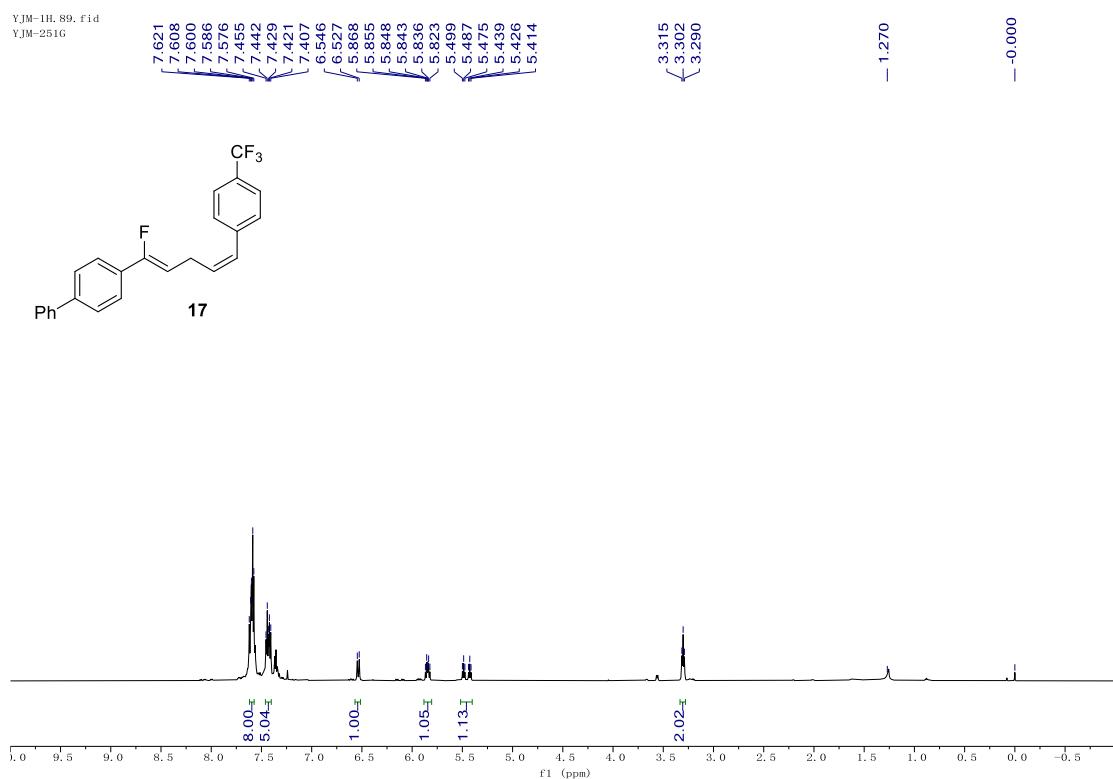
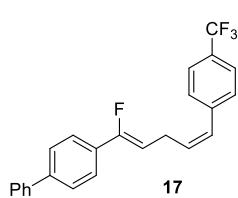
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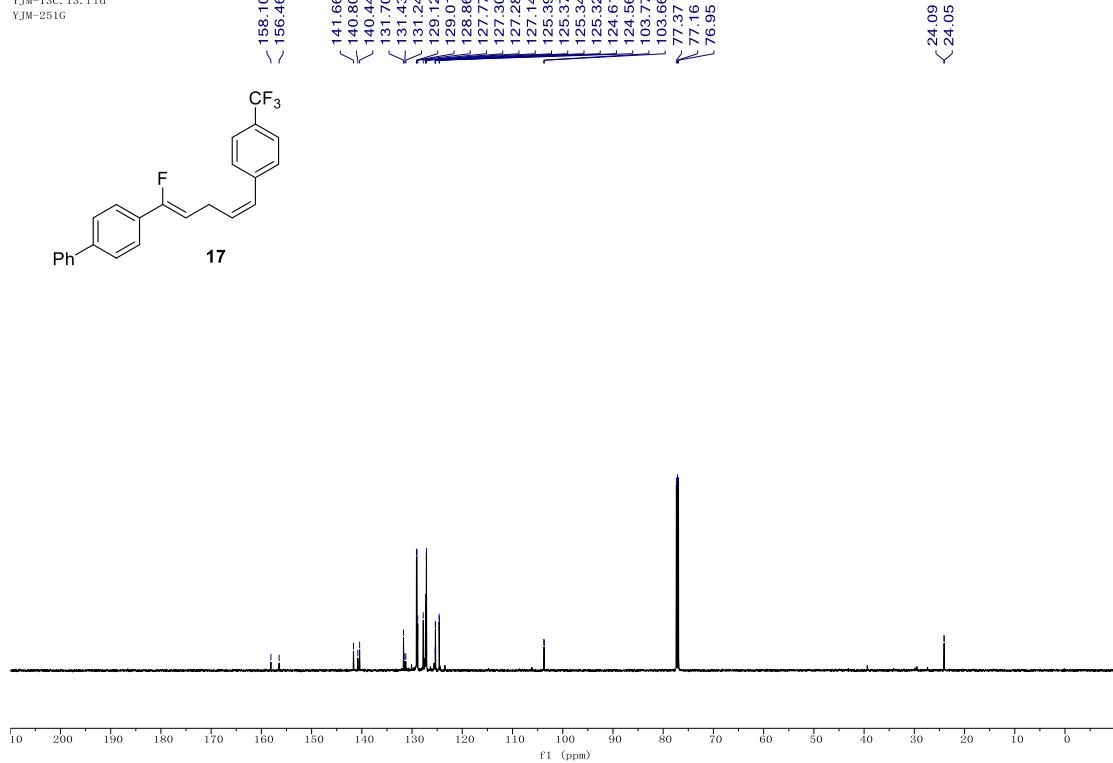
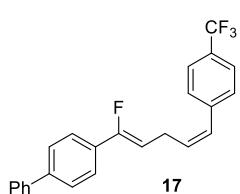
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YJM-1H. 89. fid
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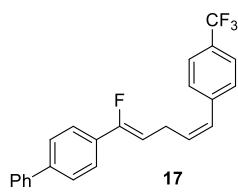
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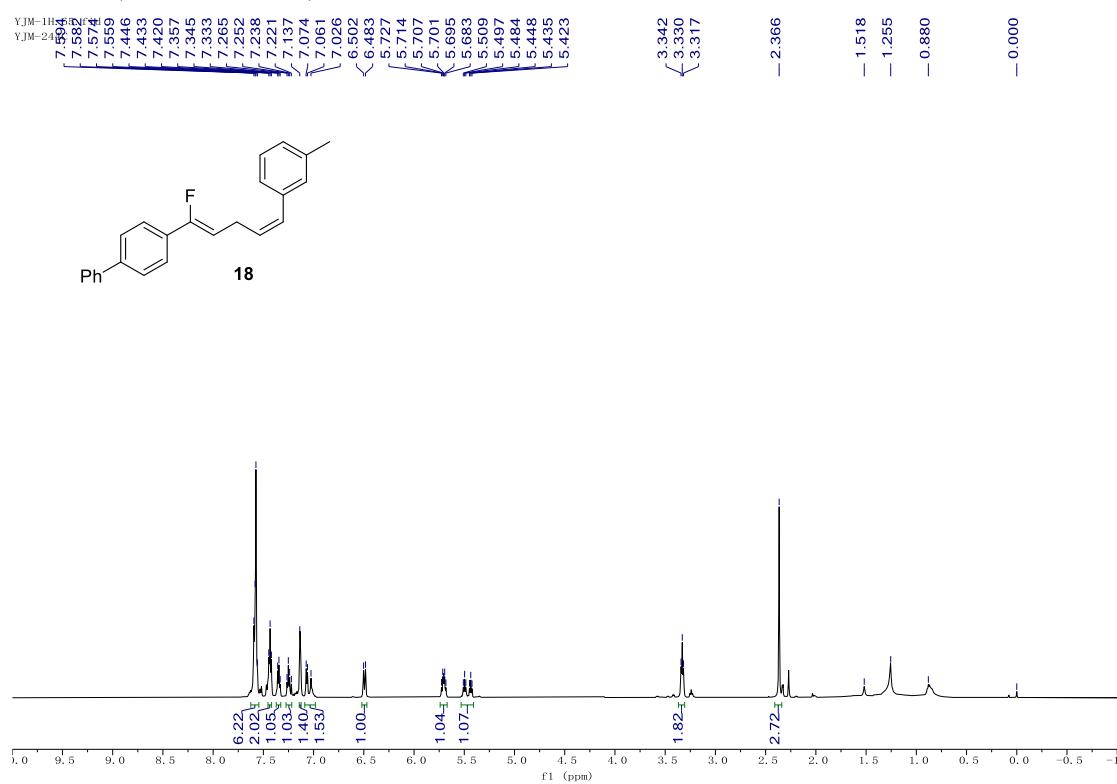
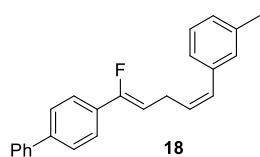
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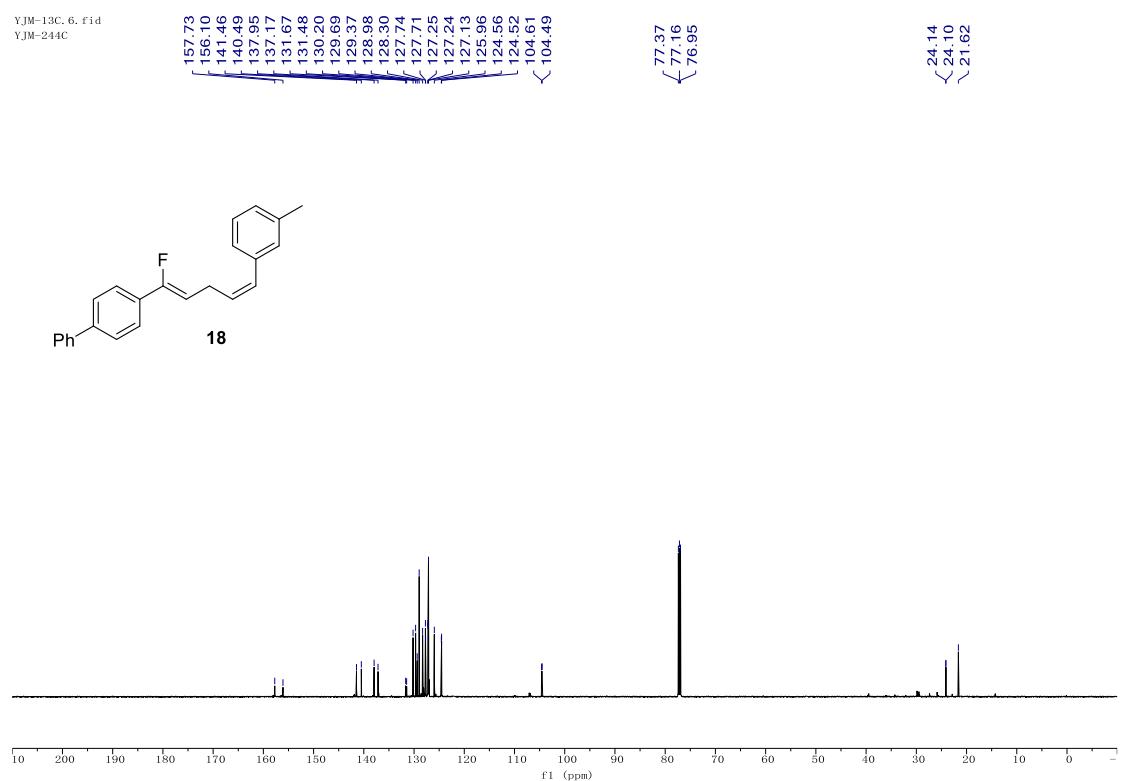
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YJM-1H.65
YJM-24



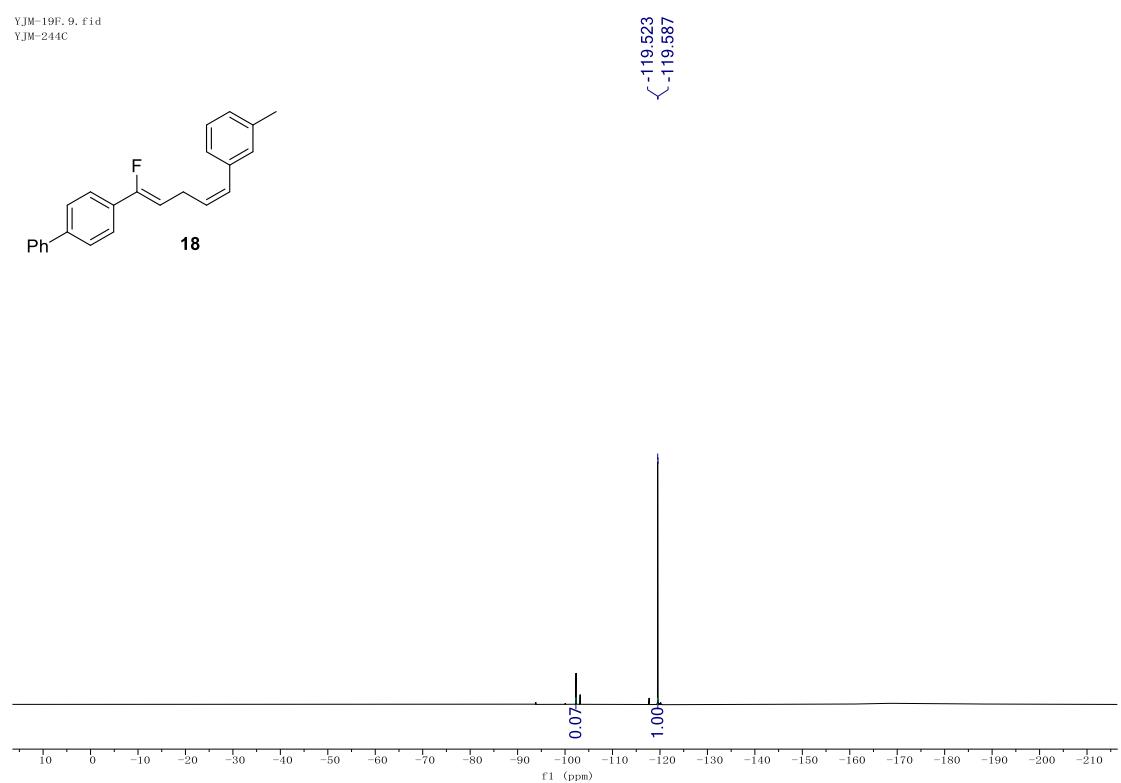
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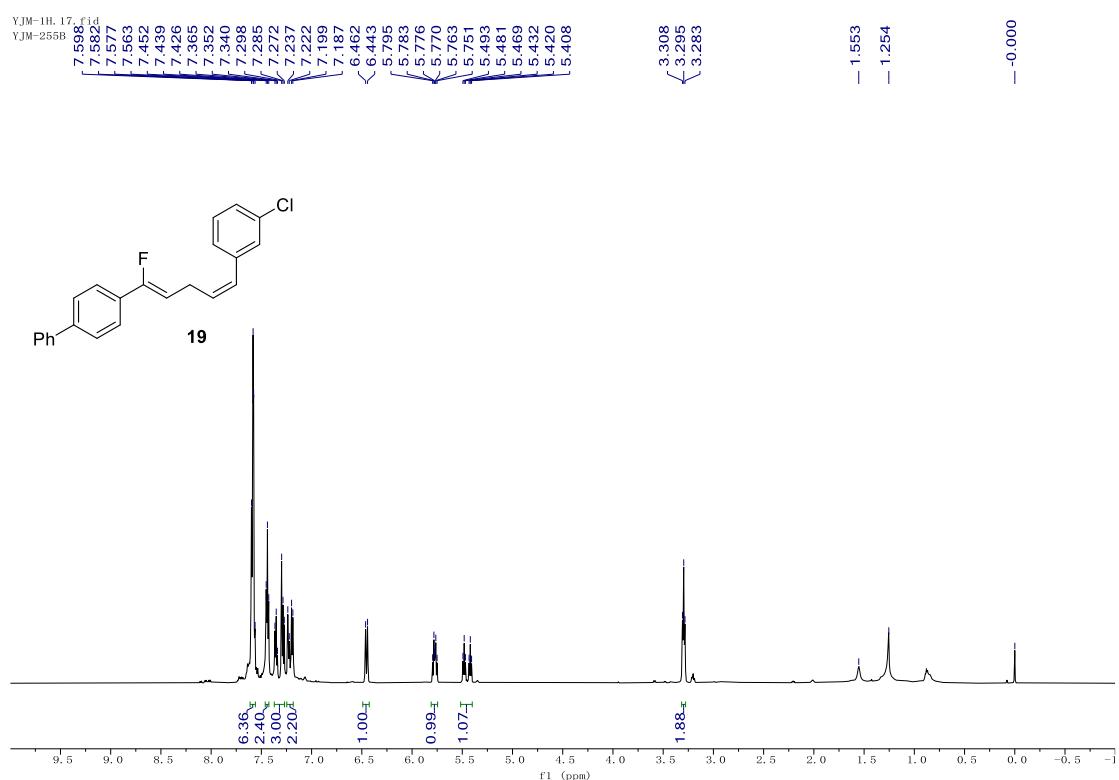


¹⁹F NMR (565 MHz, CDCl₃)

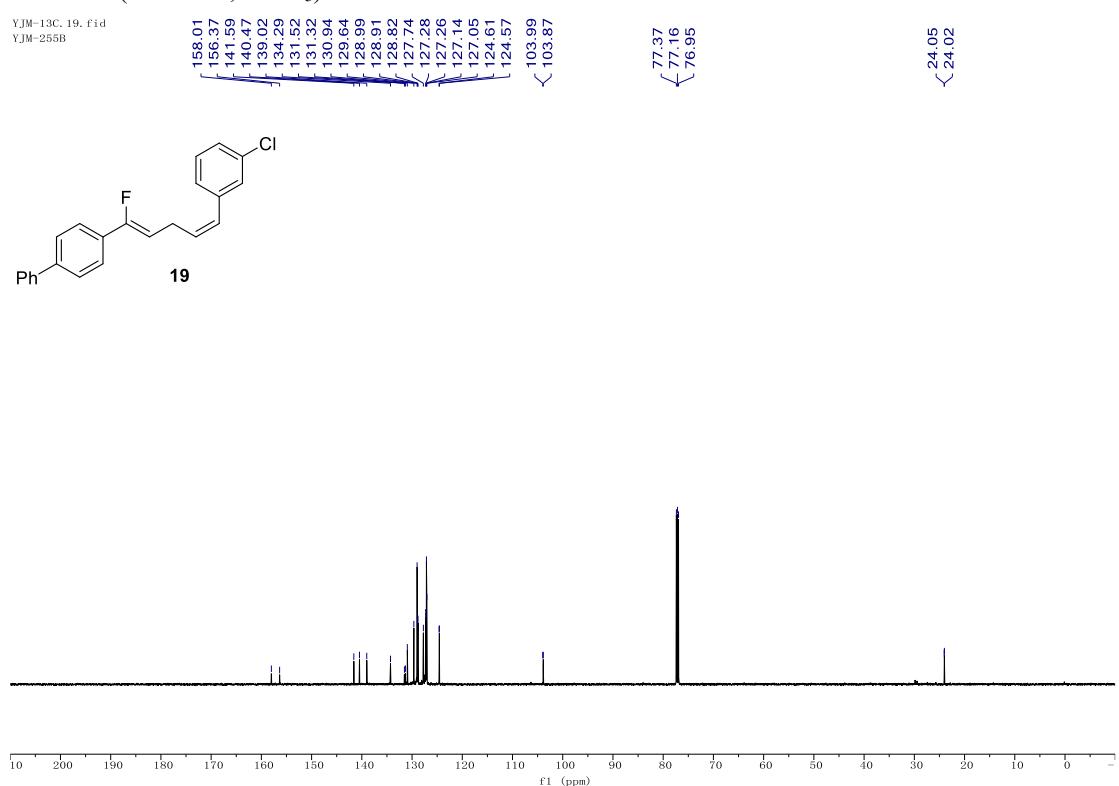
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¹H NMR (600 MHz, CDCl₃)

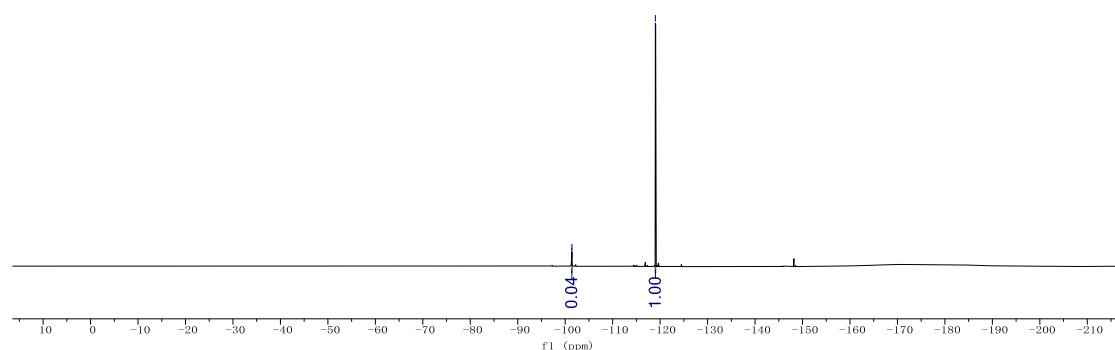
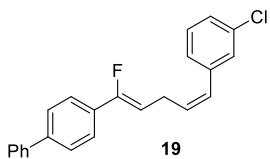


¹³C NMR (151 MHz, CDCl₃)



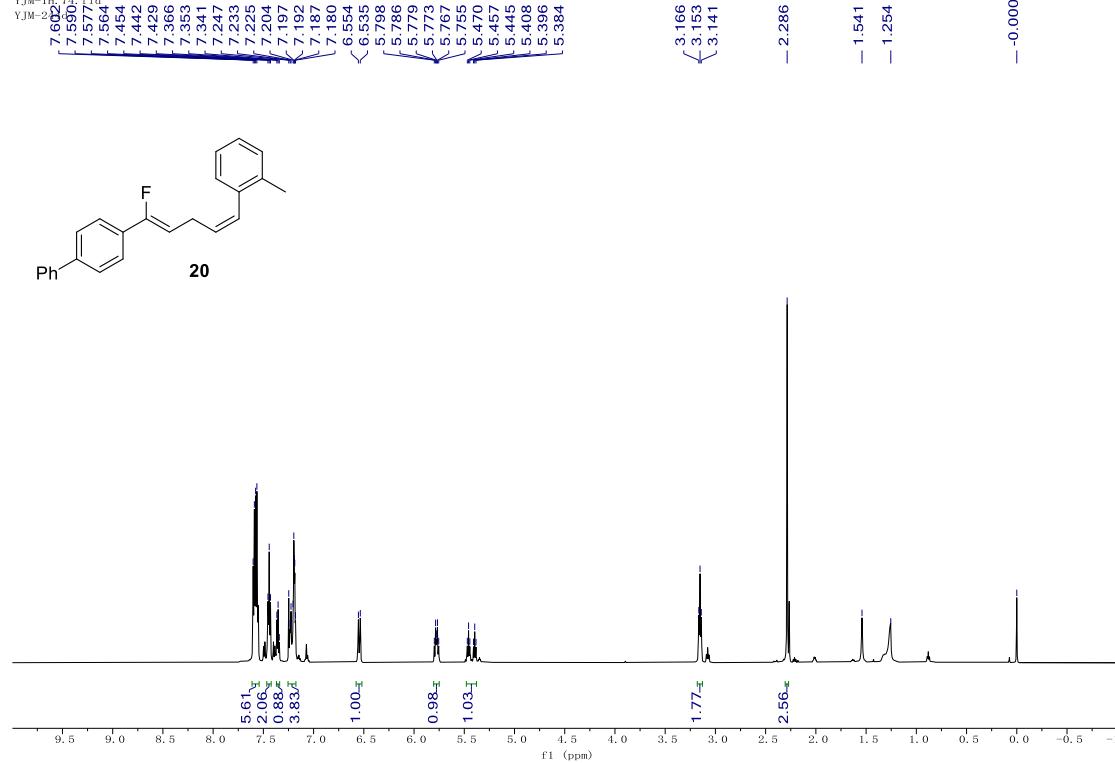
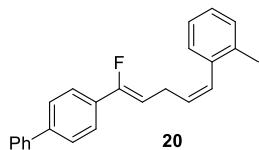
¹⁹F NMR (565 MHz, CDCl₃)

YJM-19F, 21, fid
YJM-255B



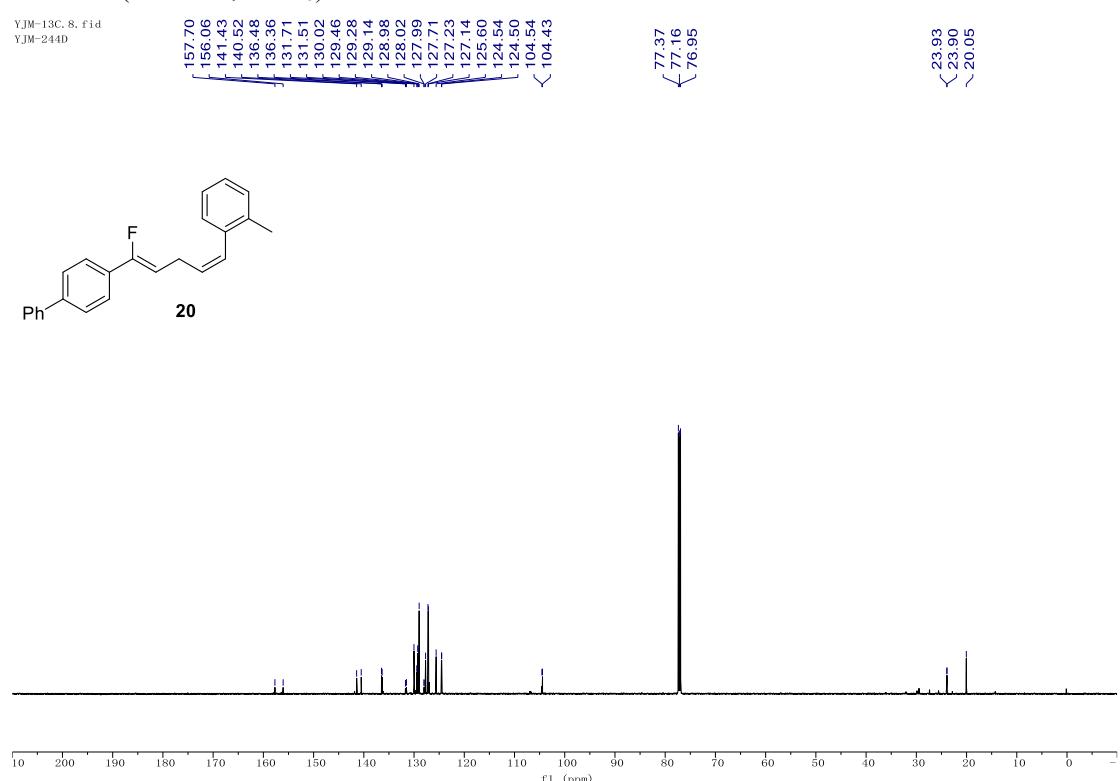
¹H NMR (600 MHz, CDCl₃)

YJM-1H, 74, fid
YJM-255B



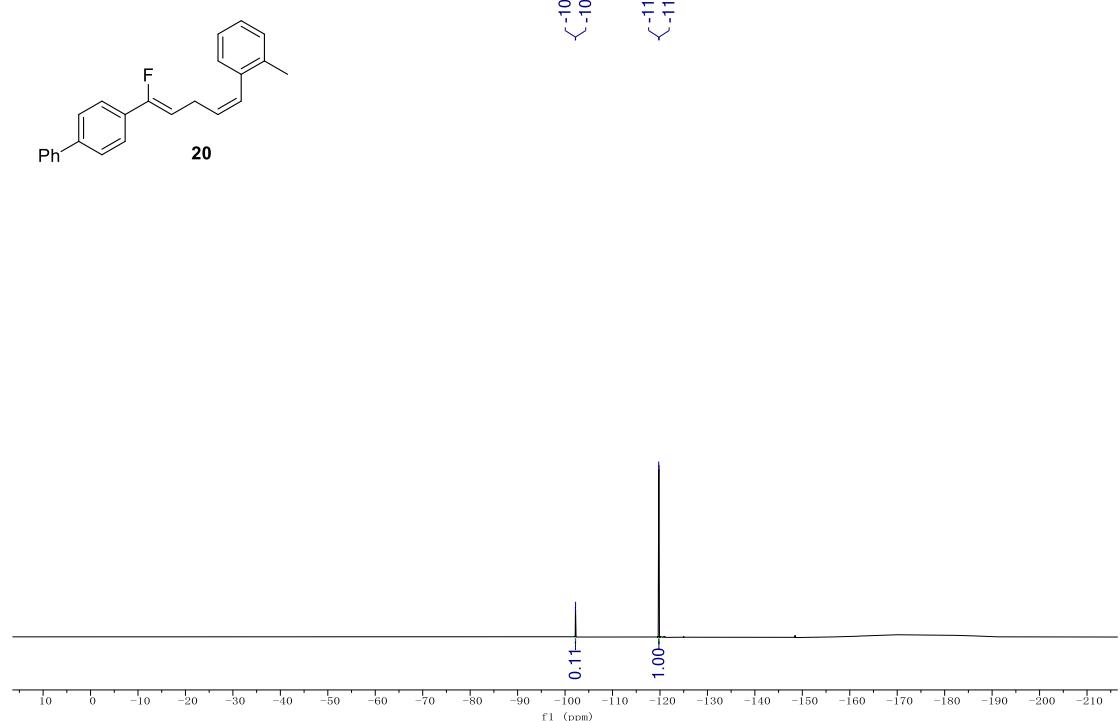
¹³C NMR (151 MHz, CDCl₃)

YJM-13C. 8. fid
YJM-244D



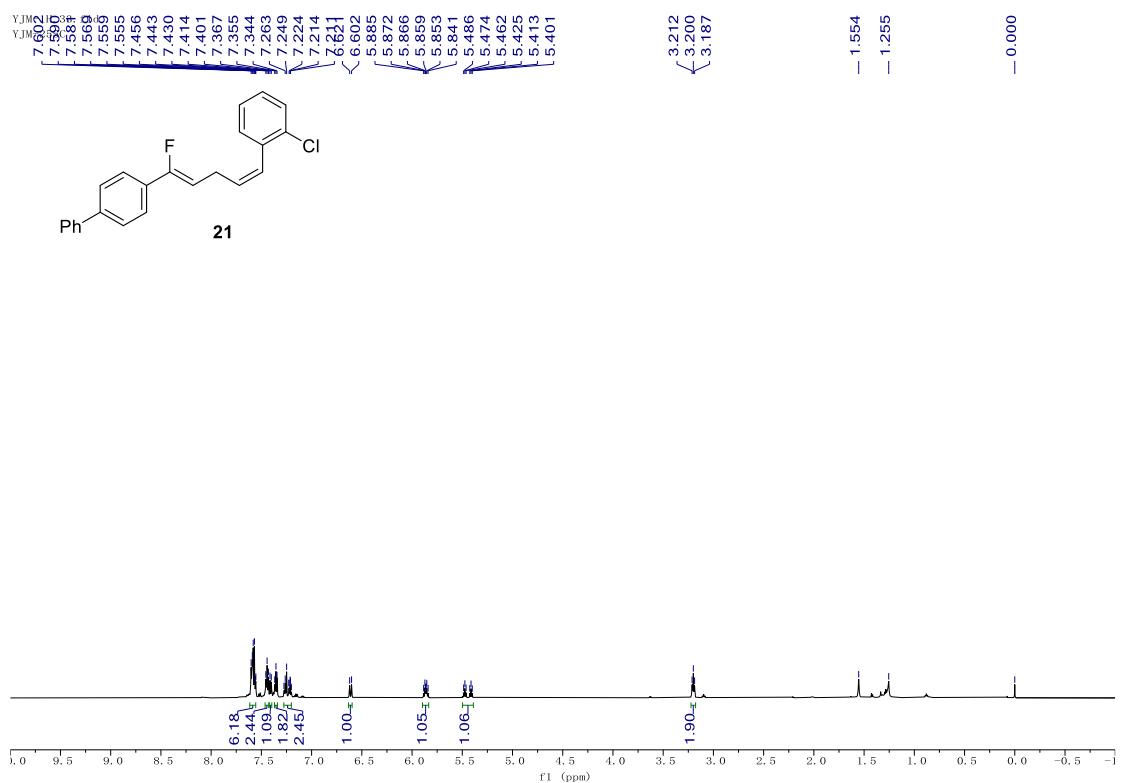
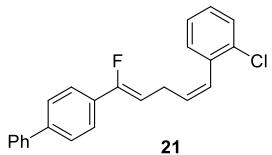
¹⁹F NMR (565 MHz, CDCl₃)

YJM-19F. 11. fid
YJM-244D



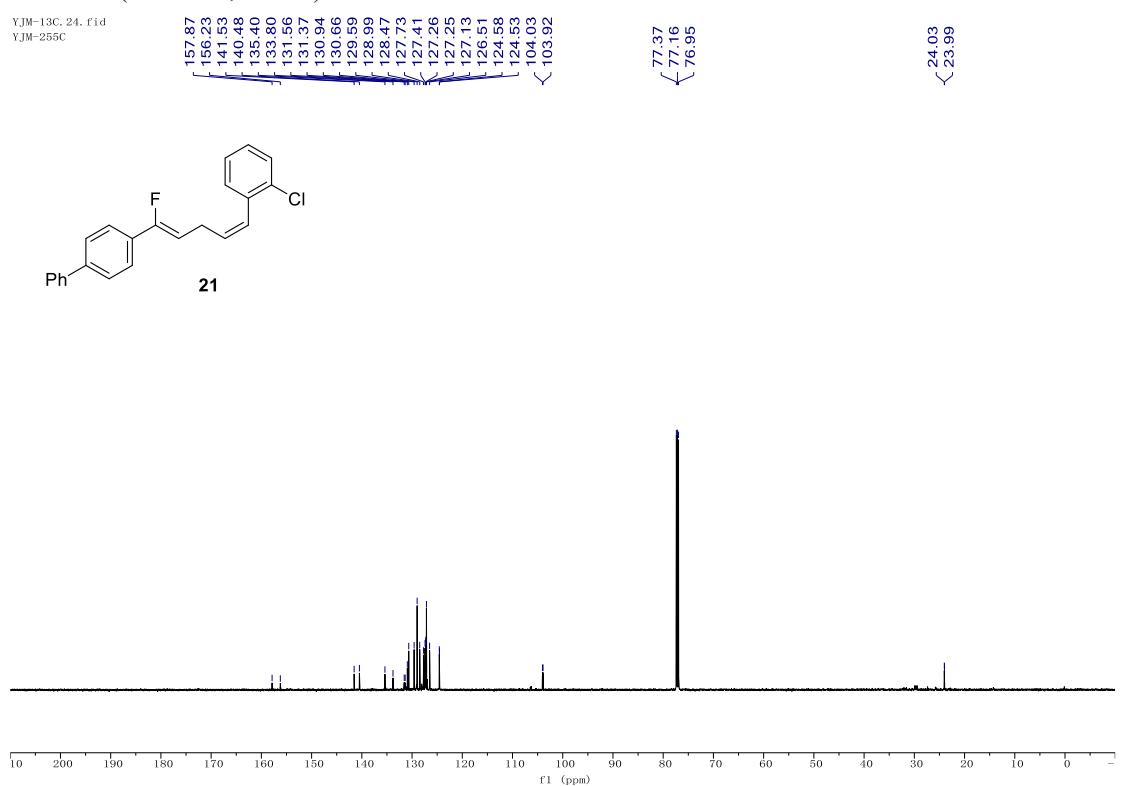
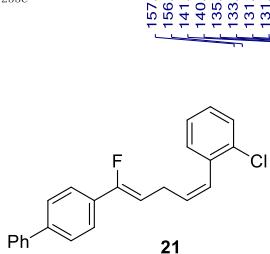
¹H NMR (600 MHz, CDCl₃)

YJMN 602 H 38: 1
YJM 25 C 58: 590



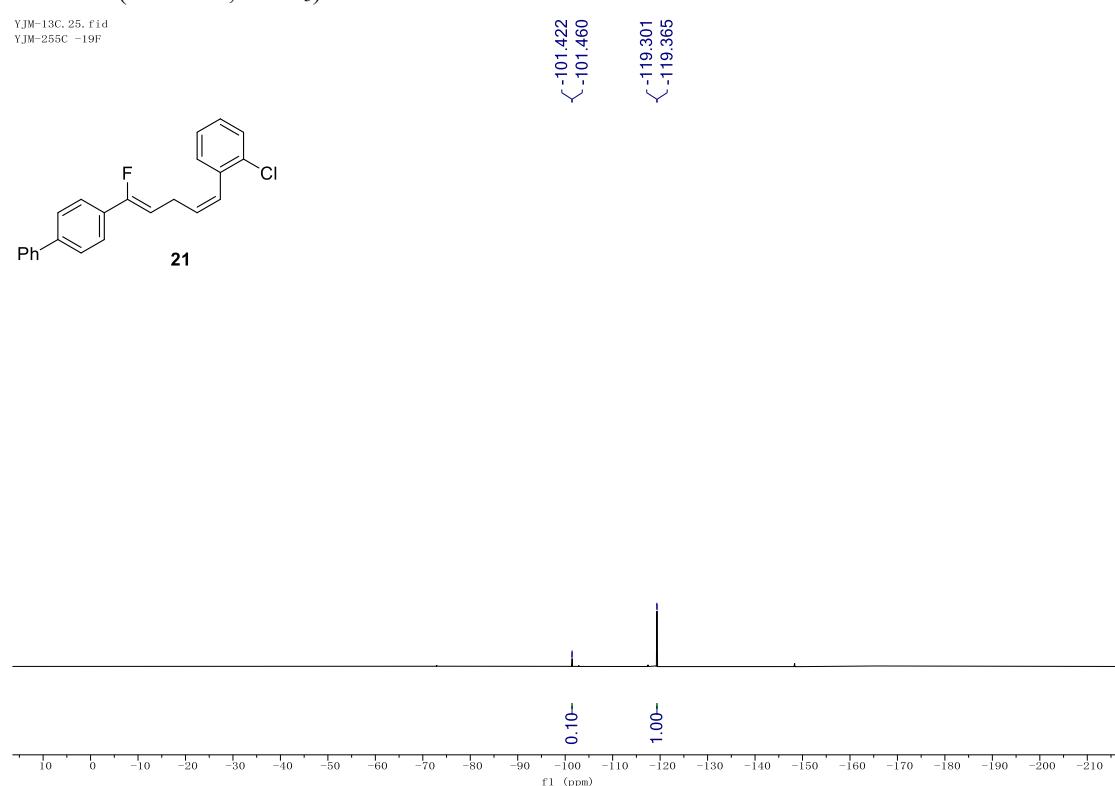
¹³C NMR (151 MHz, CDCl₃)

YJM-13C. 24. fid
YJM-255C



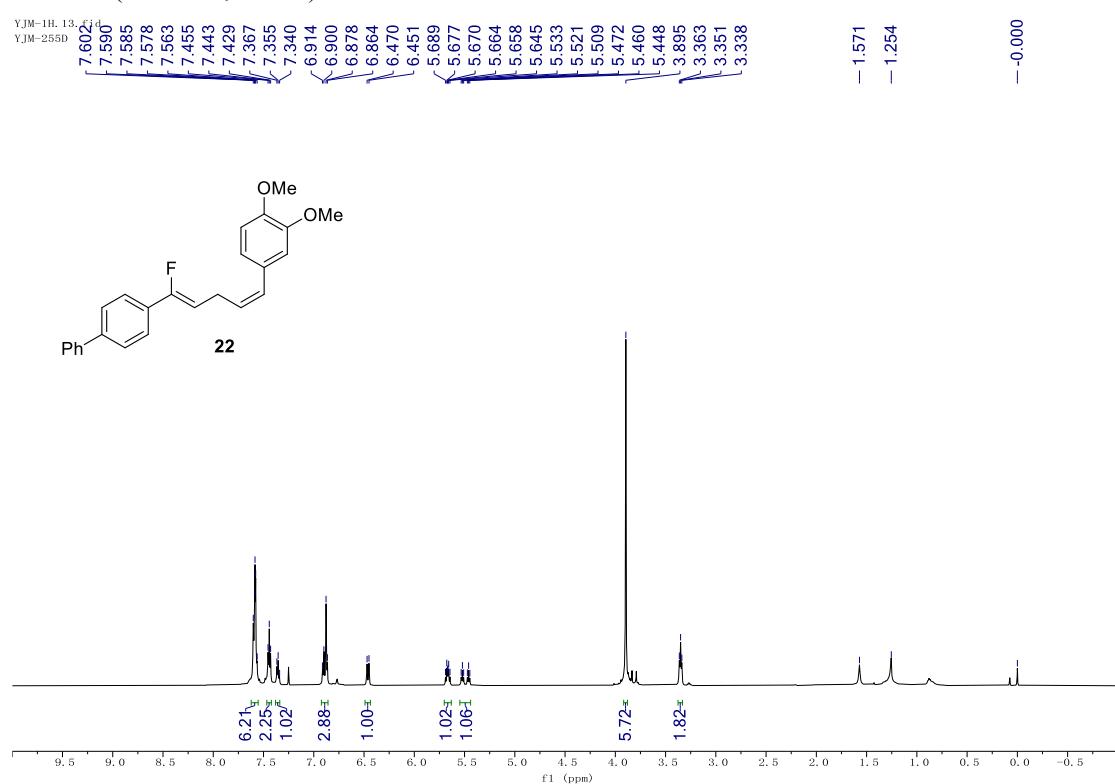
¹⁹F NMR (565 MHz, CDCl₃)

YJM-13C, 25, fid
YJM-255C -19F



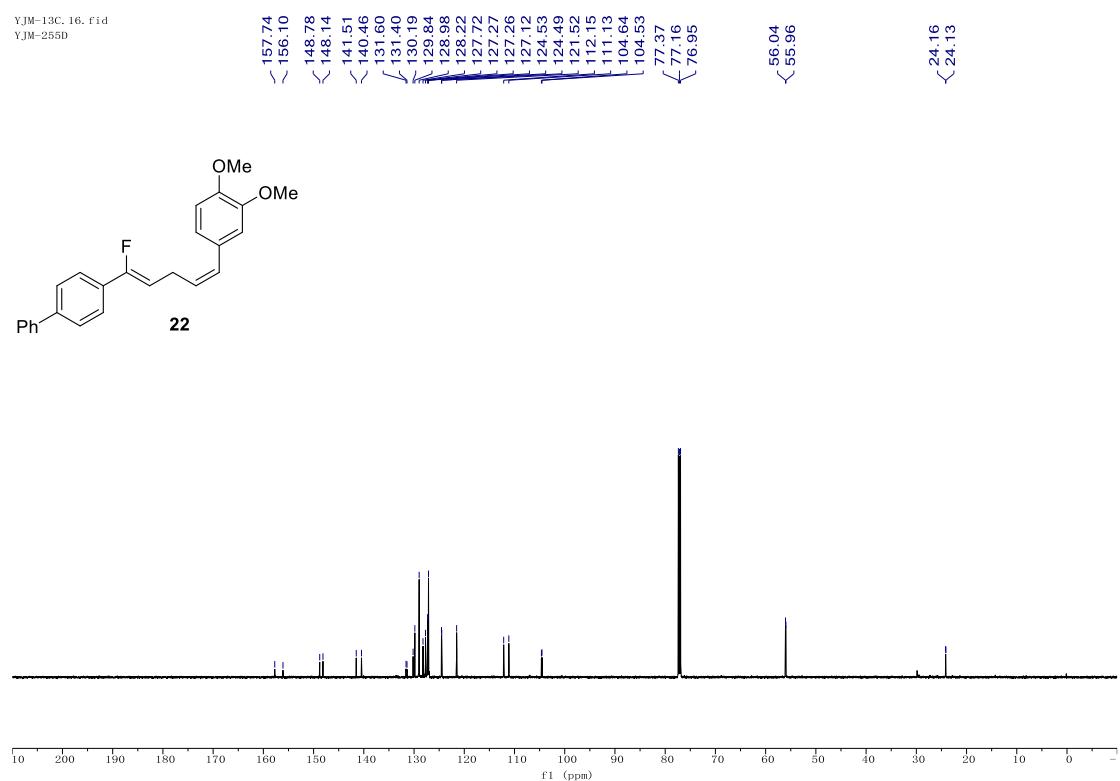
¹H NMR (600 MHz, CDCl₃)

YJM-1H, 13, fid
YJM-255D



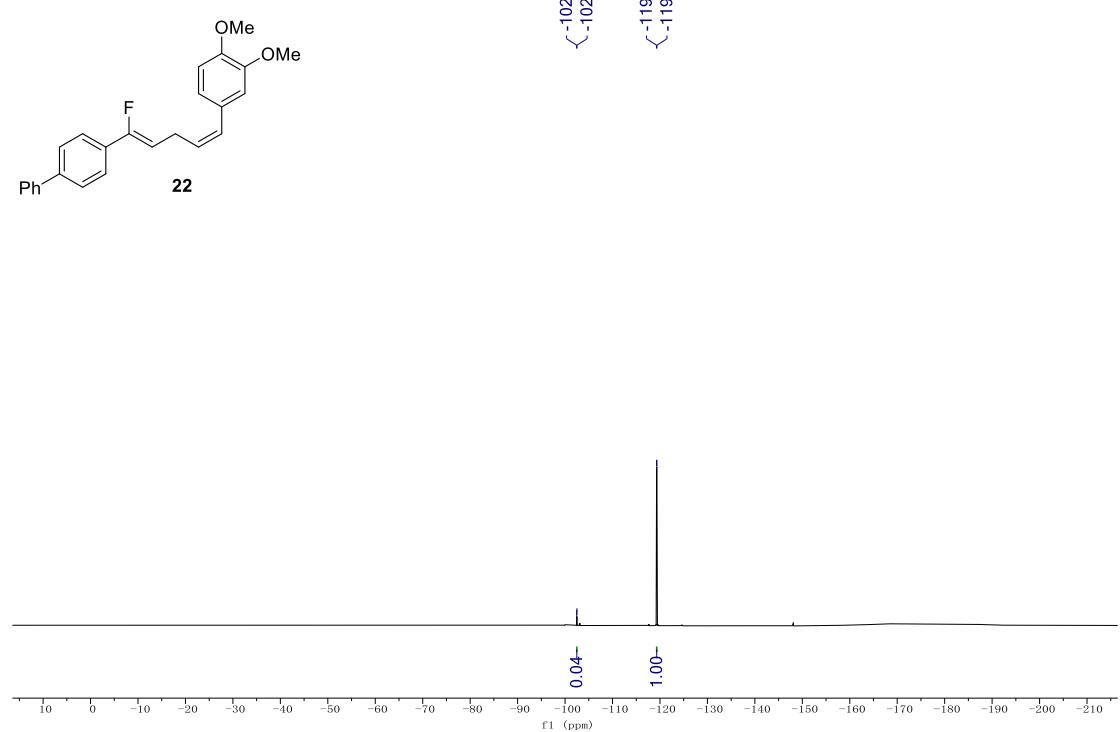
¹³C NMR (151 MHz, CDCl₃)

YJM-13C. 16. fid
YJM-255D

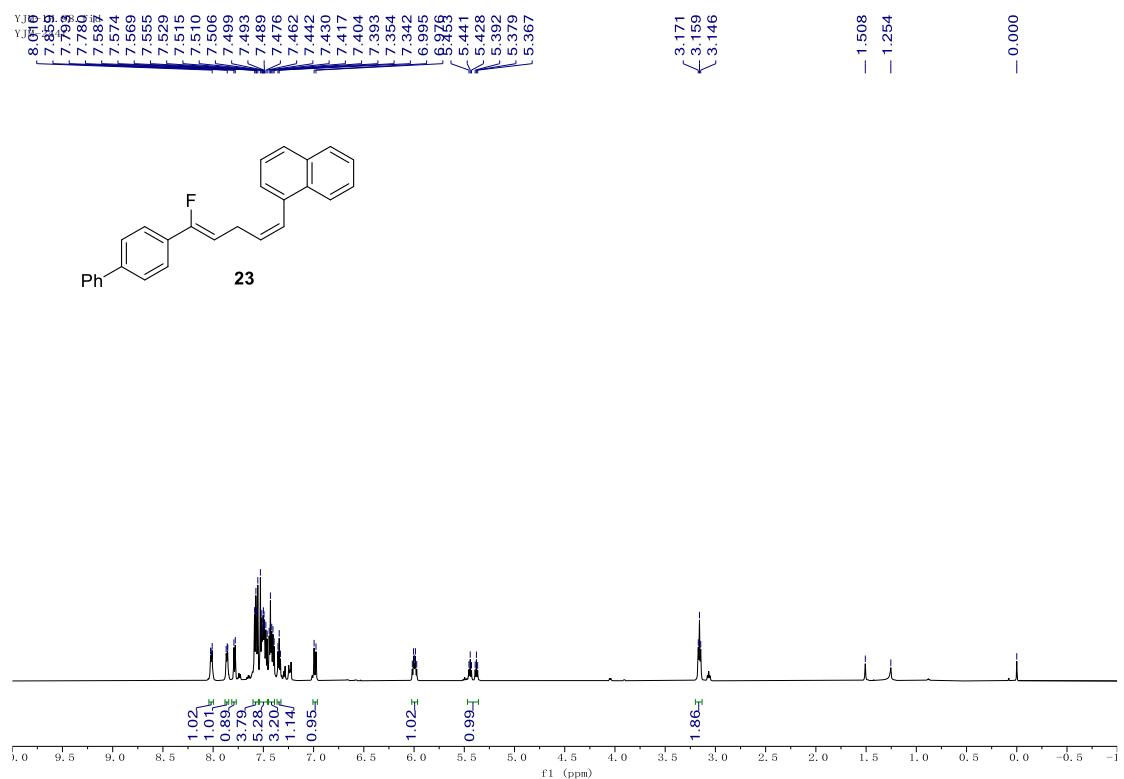


¹⁹F NMR (565 MHz, CDCl₃)

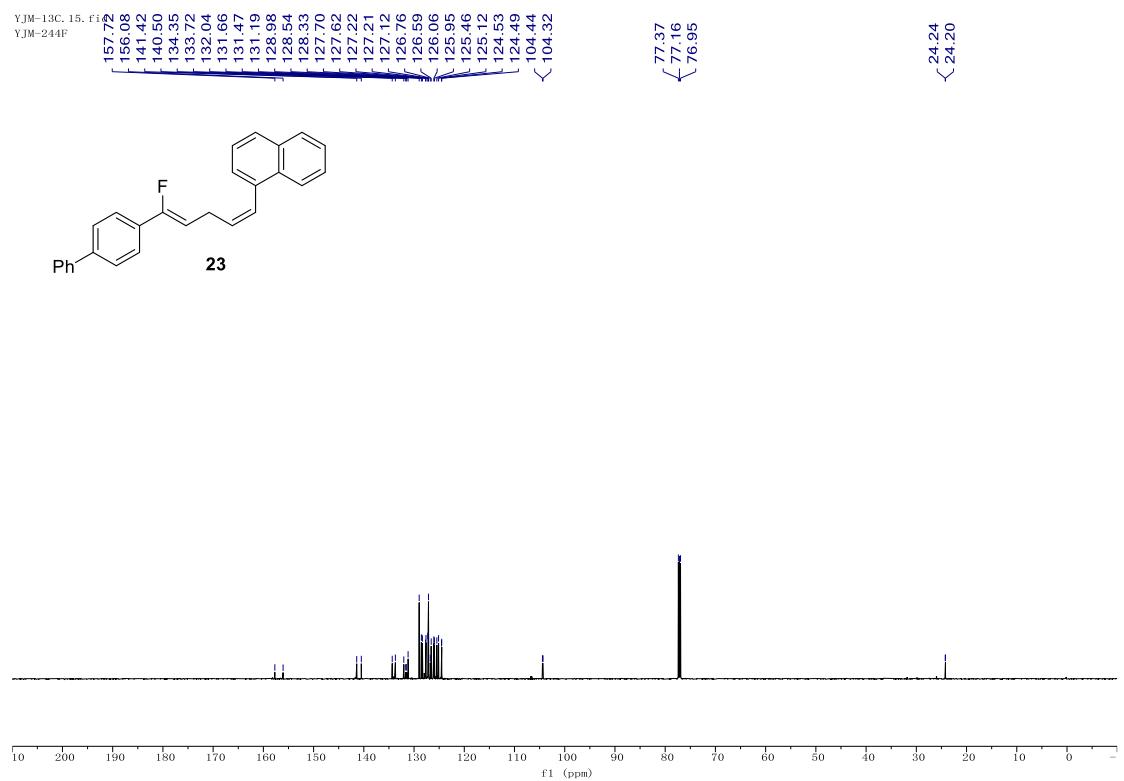
YJM-19F. 18. fid
YJM-255D



¹H NMR (600 MHz, CDCl₃)

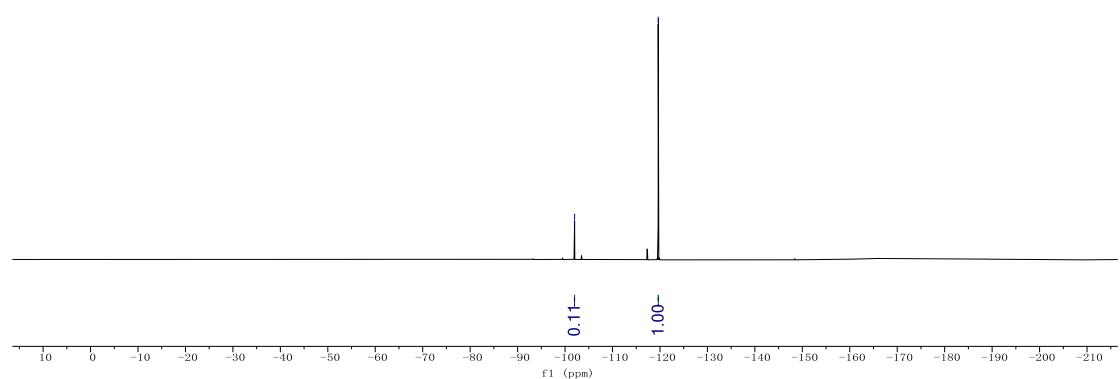
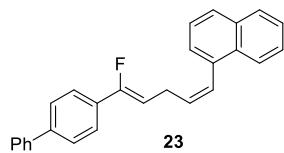


¹³C NMR (151 MHz, CDCl₃)



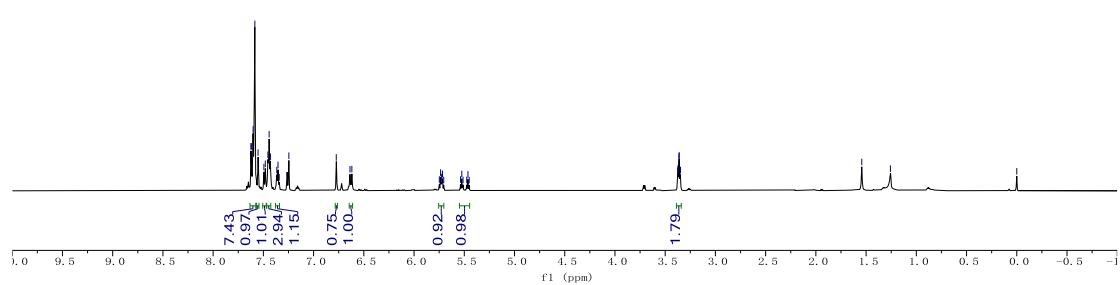
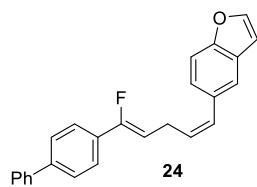
¹⁹F NMR (565 MHz, CDCl₃)

YJM-19F, 17. fid
YJM-244F



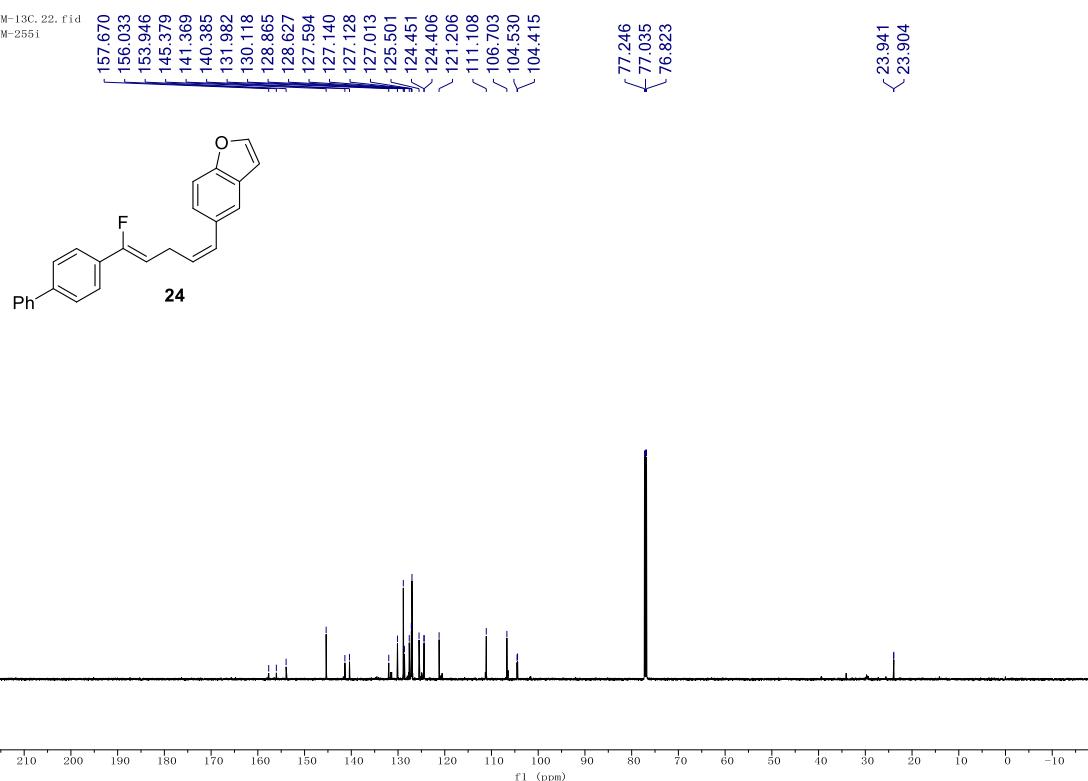
¹H NMR (600 MHz, CDCl₃)

YJM-1H, 34. fid
YJM-2251



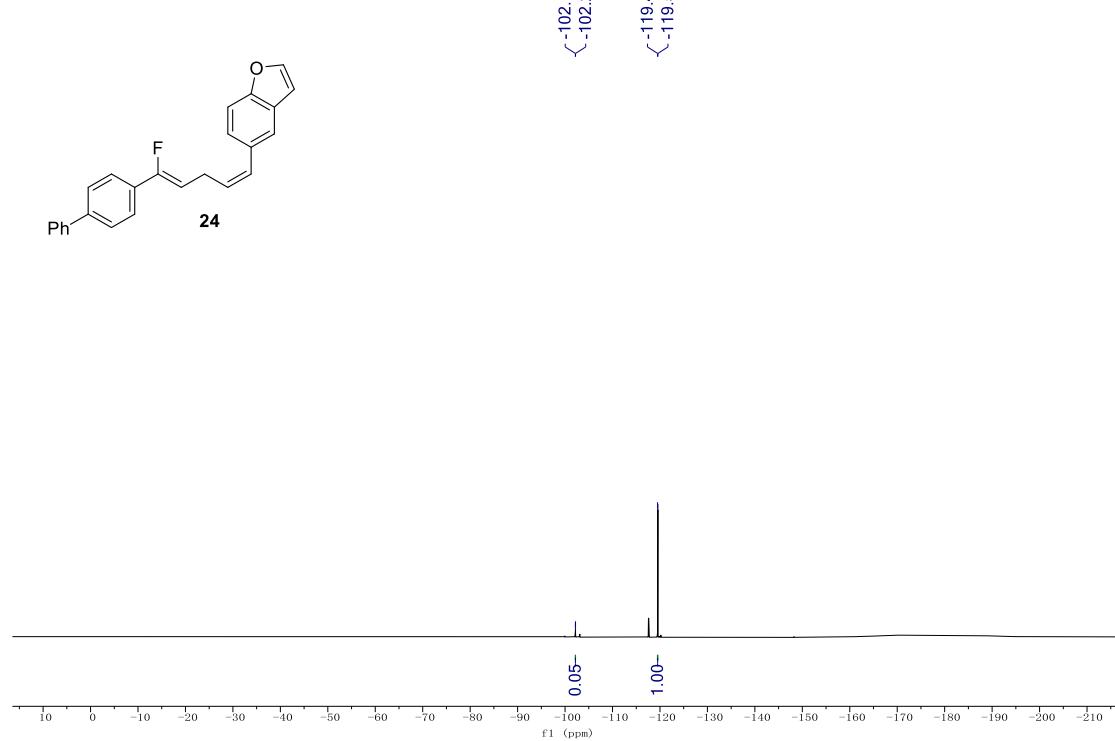
¹³C NMR (151 MHz, CDCl₃)

YJM-13C, 22, fid
YJM-2551



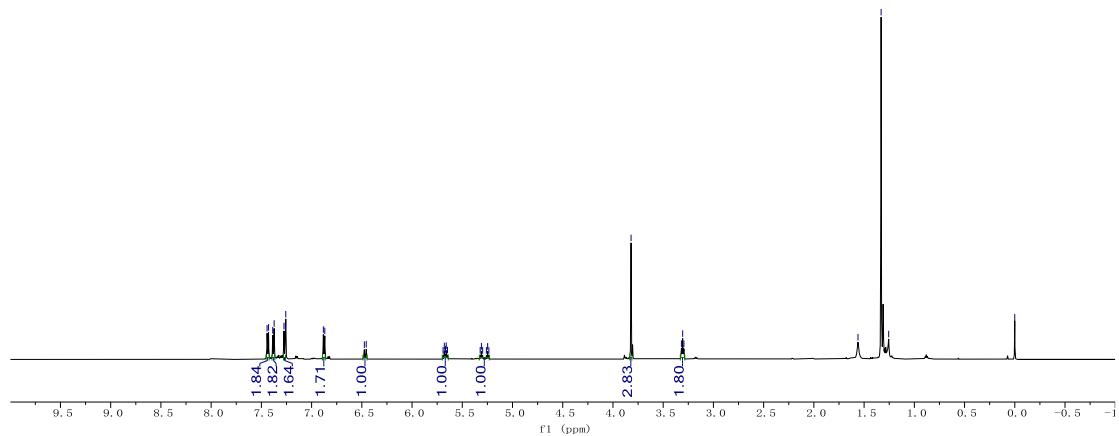
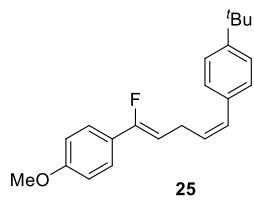
¹⁹F NMR (565 MHz, CDCl₃)

YJM-13C, 23, fid
YJM-2551 (19F no decoupling)



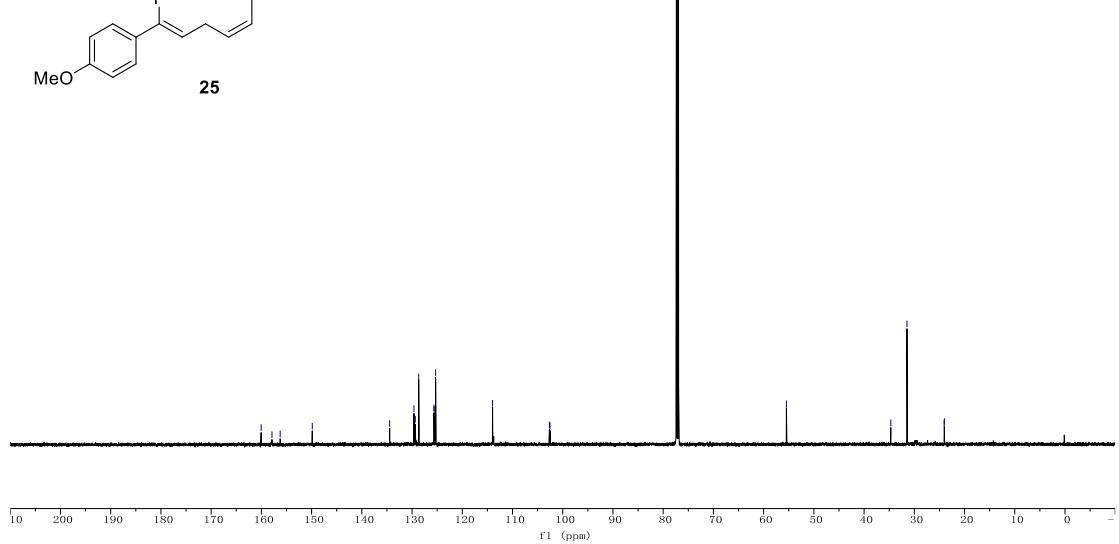
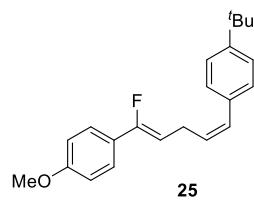
¹H NMR (600 MHz, CDCl₃)

YJM-1H. 36. fid
YJM-259A



¹³C NMR (151 MHz, CDCl₃)

YJM-13C. 27. fid
YJM-259a



¹⁹F NMR (565 MHz, CDCl₃)

YJM-13C, 26, fid
YJM-259a (19F, no decoupling)

