

**Cooperative *N*-heterocyclic carbene (NHC)-Lewis acid-mediated regioselective
umpolung formal [3+2] annulations of alkynyl aldehydes with isatins**

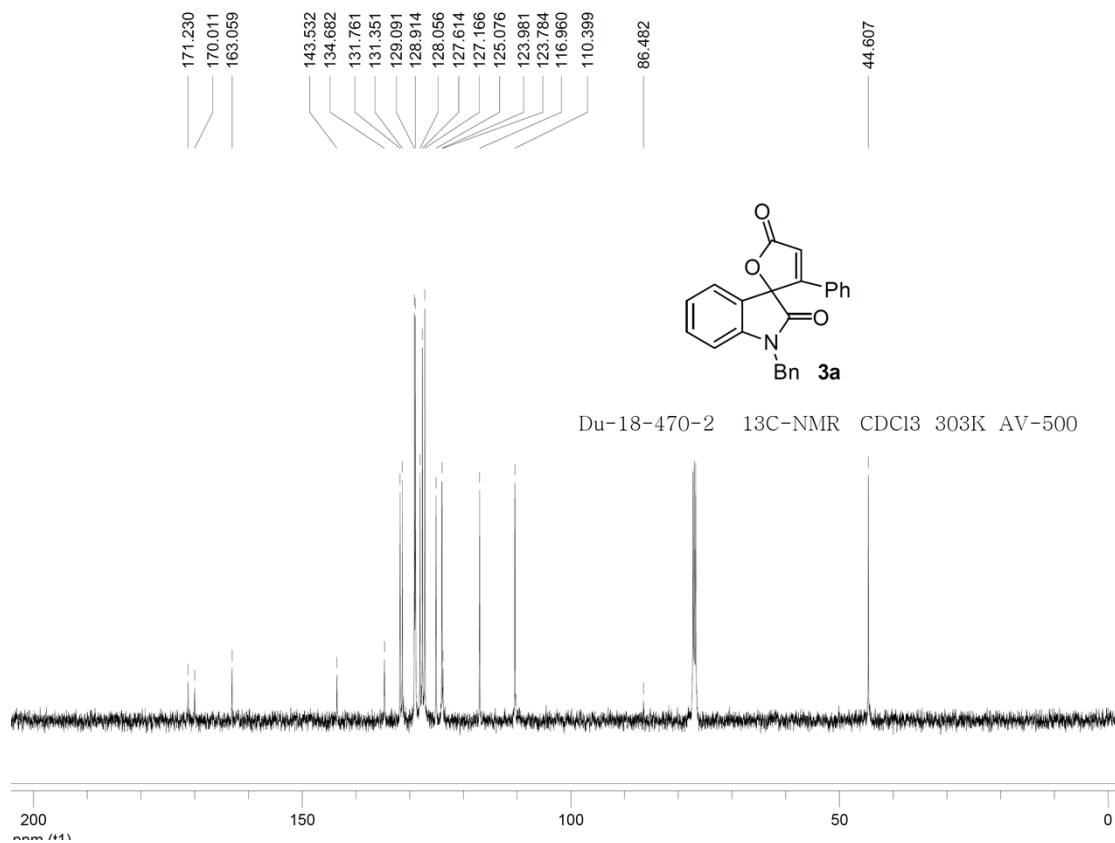
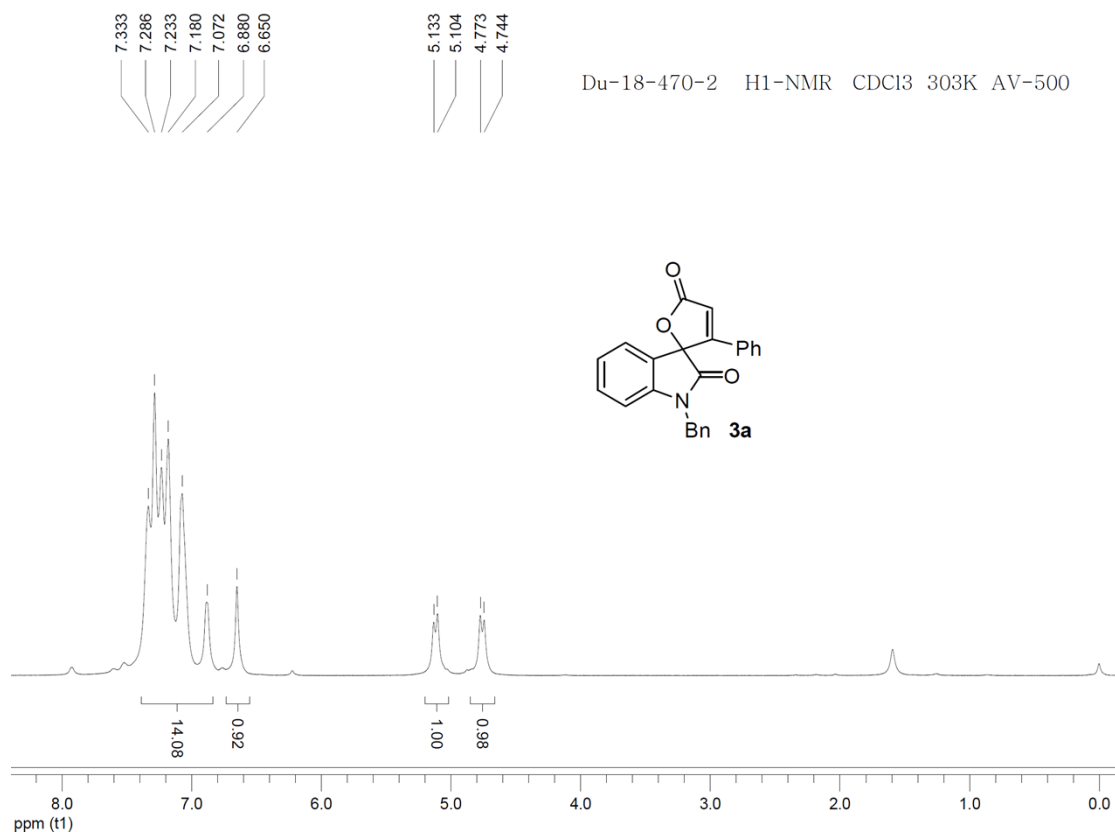
Yu Zhang, Yingyan Lu, Weifang Tang, Tao Lu* and Ding Du*

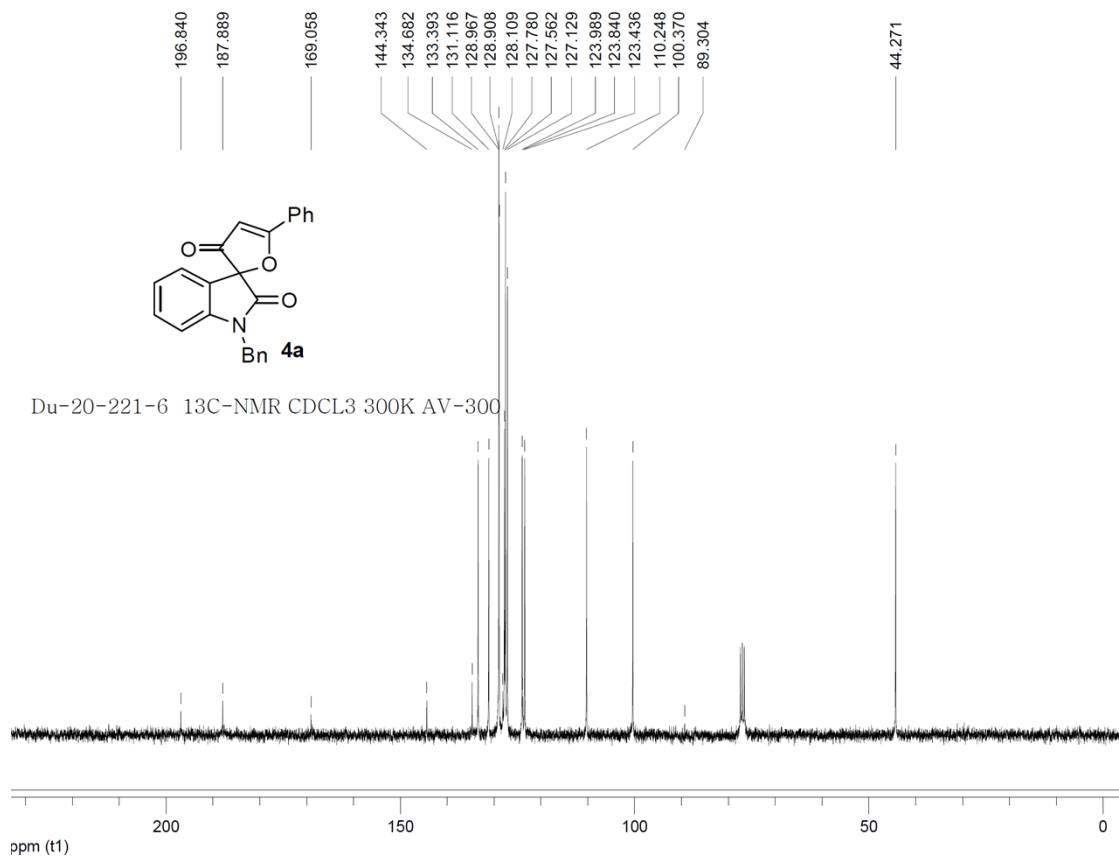
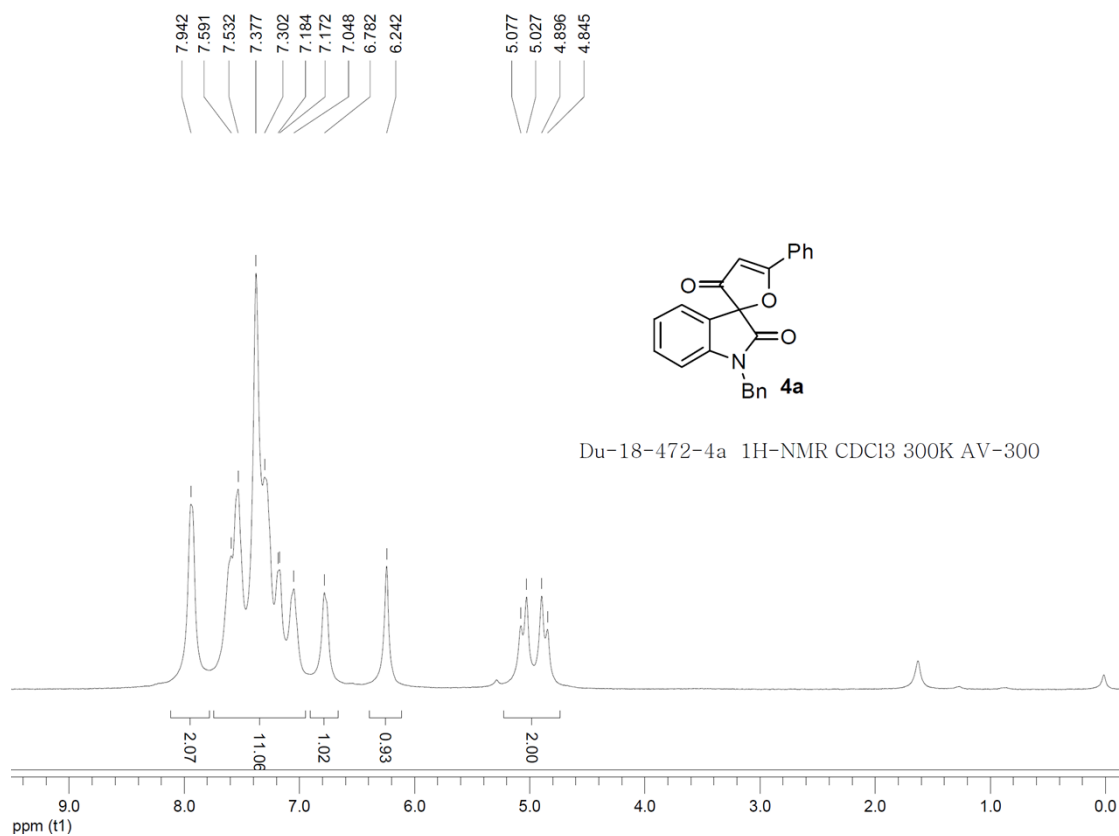
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Pharmaceutical University, Nanjing, 210009, P. R. China. Email: lut163@163.com (T. Lu) and
ddmn9999@cpu.edu.cn (D. Du)*

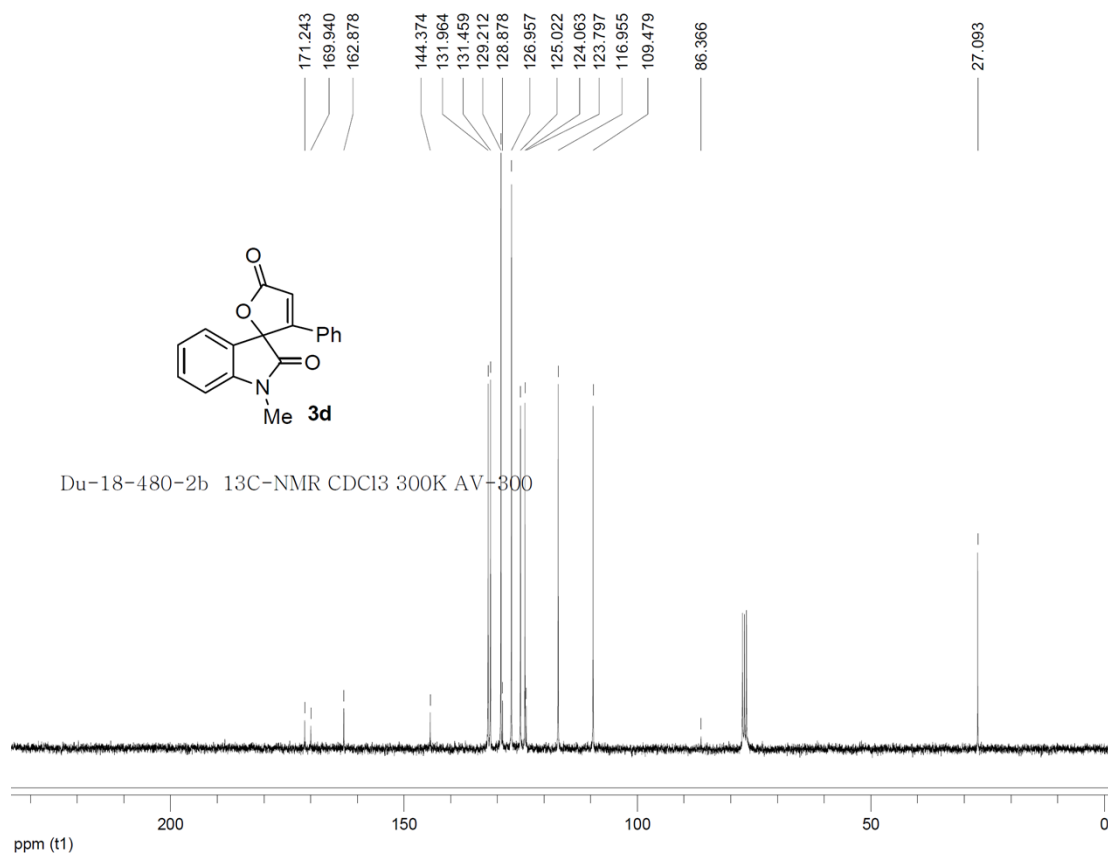
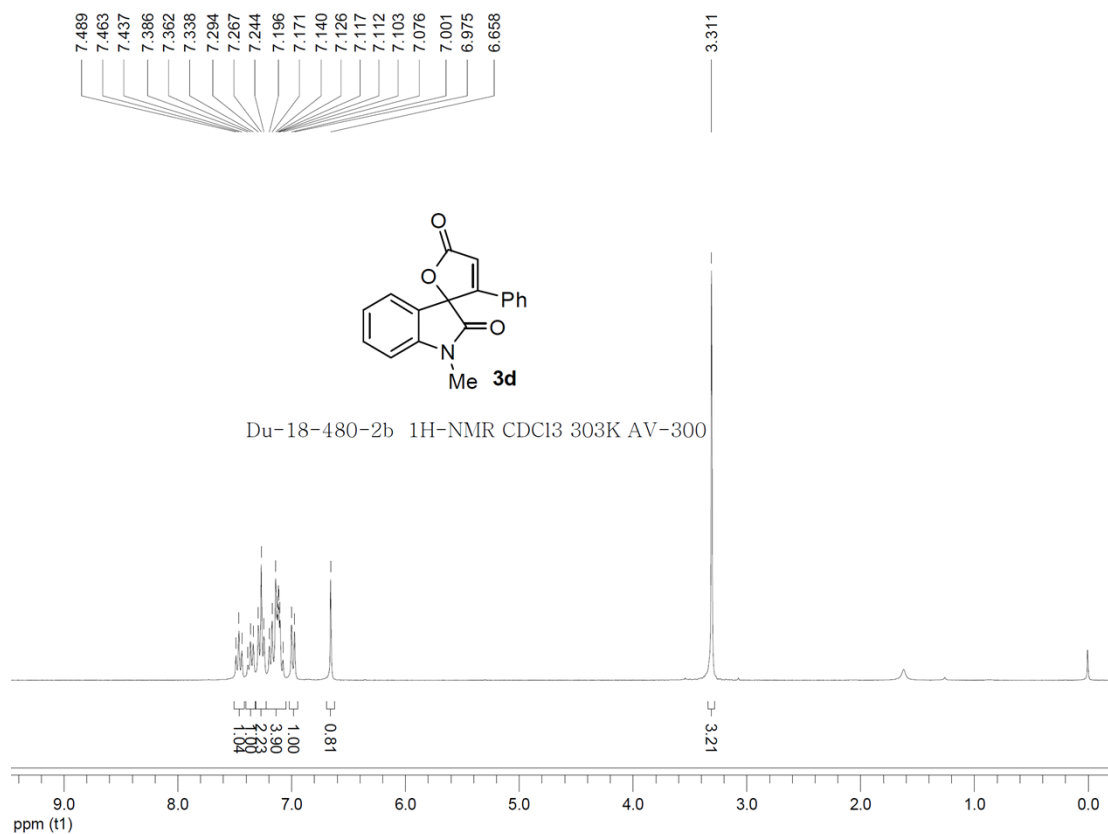
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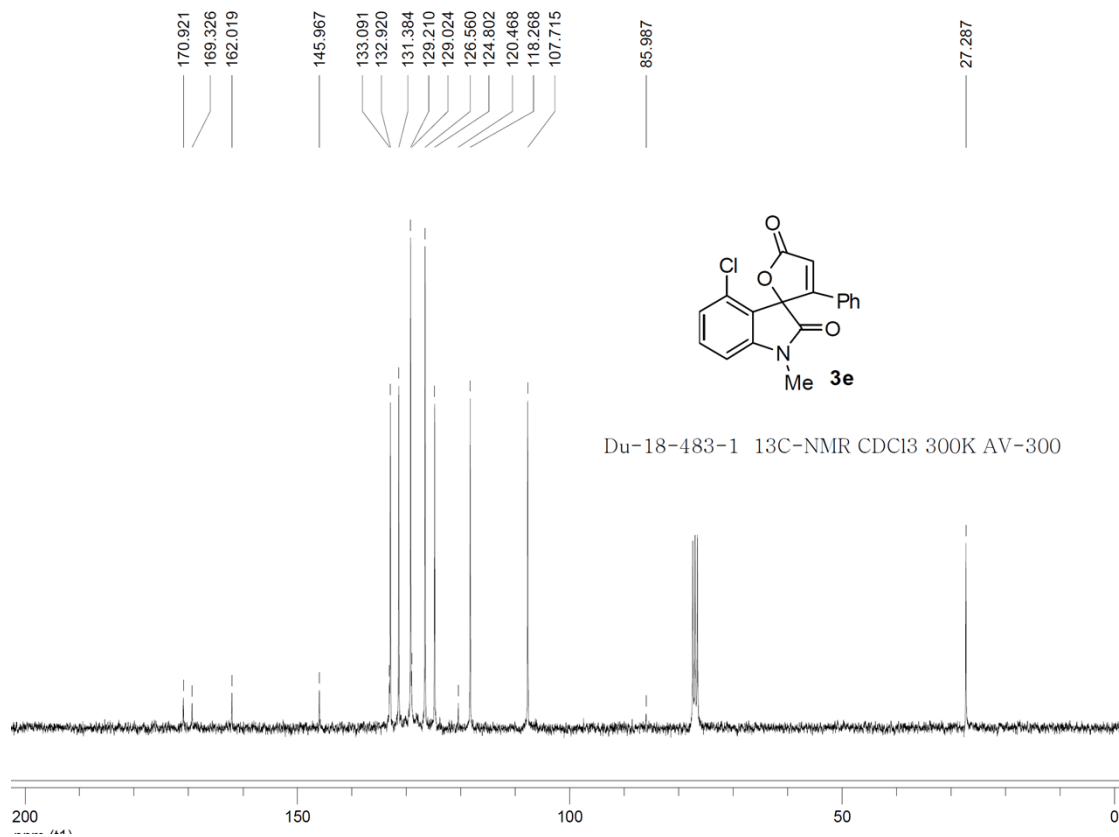
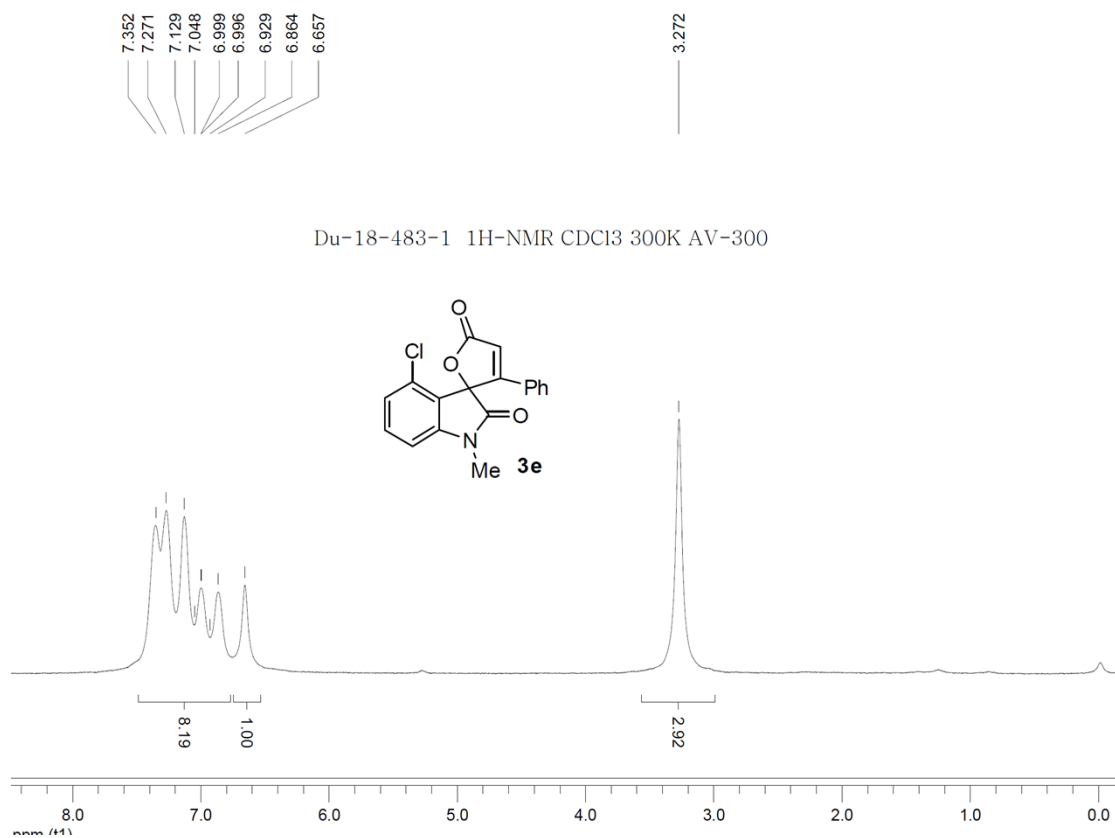
1. NMR Spectra of products **3** and **4**
2. Spectra of e.e. value determination of **3d** via chiral HPLC

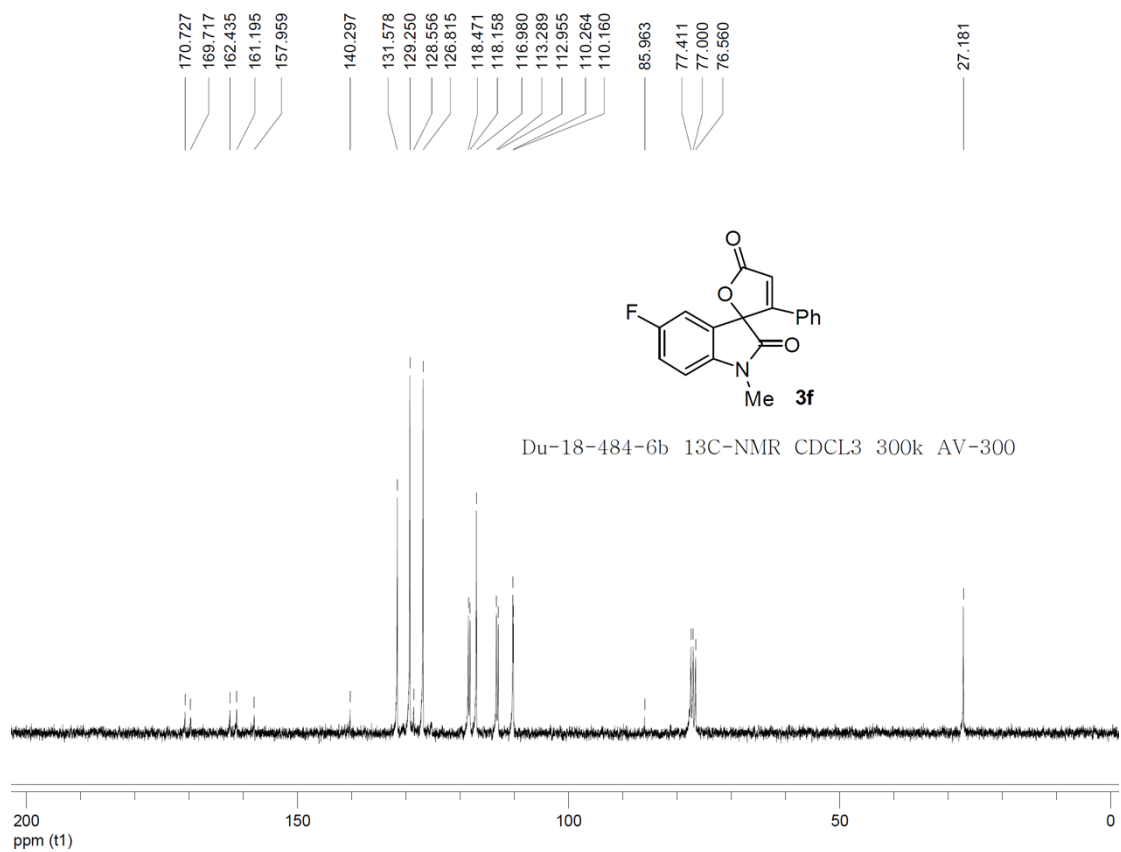
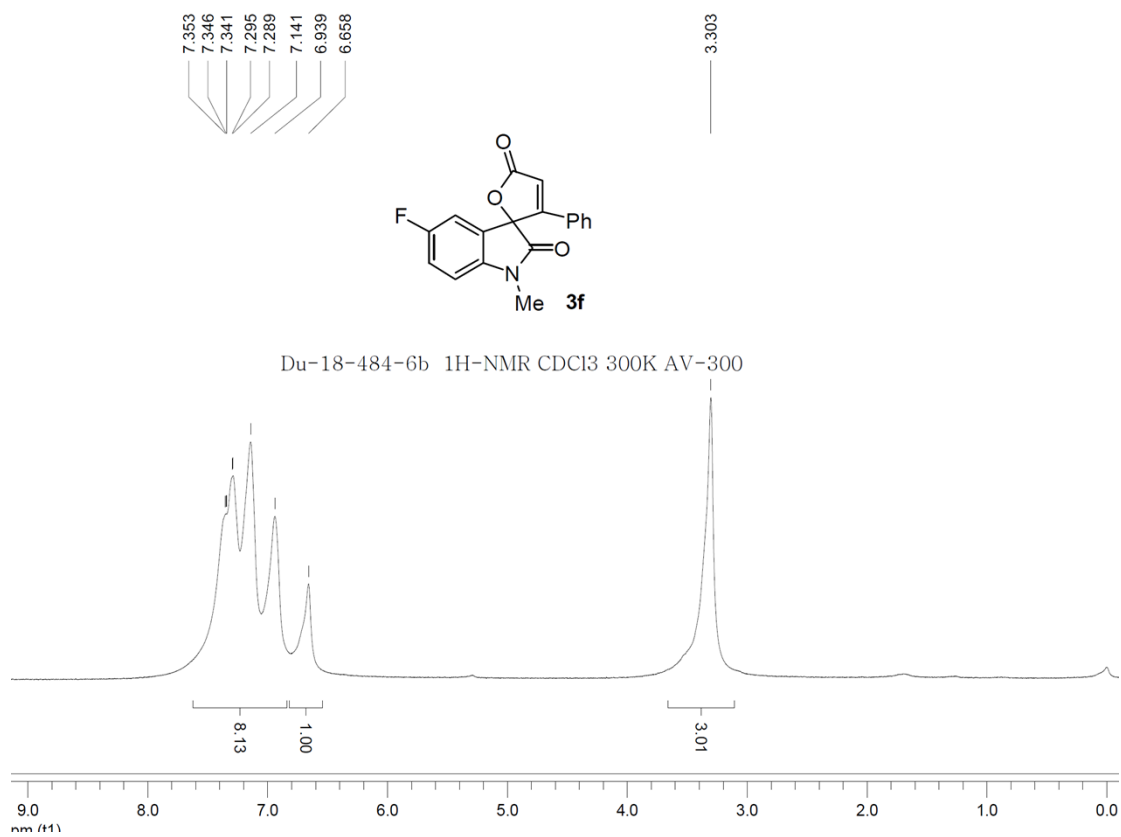
1. NMR Spectra of products **3** and **4**



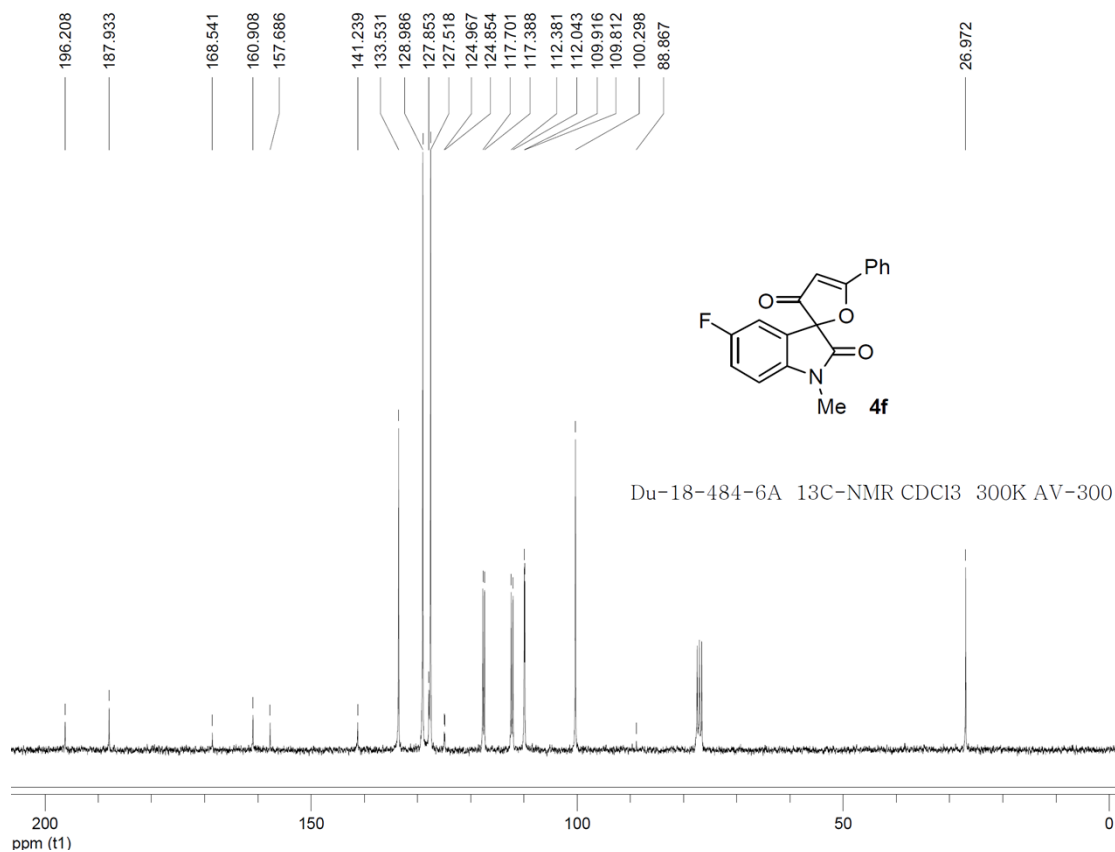
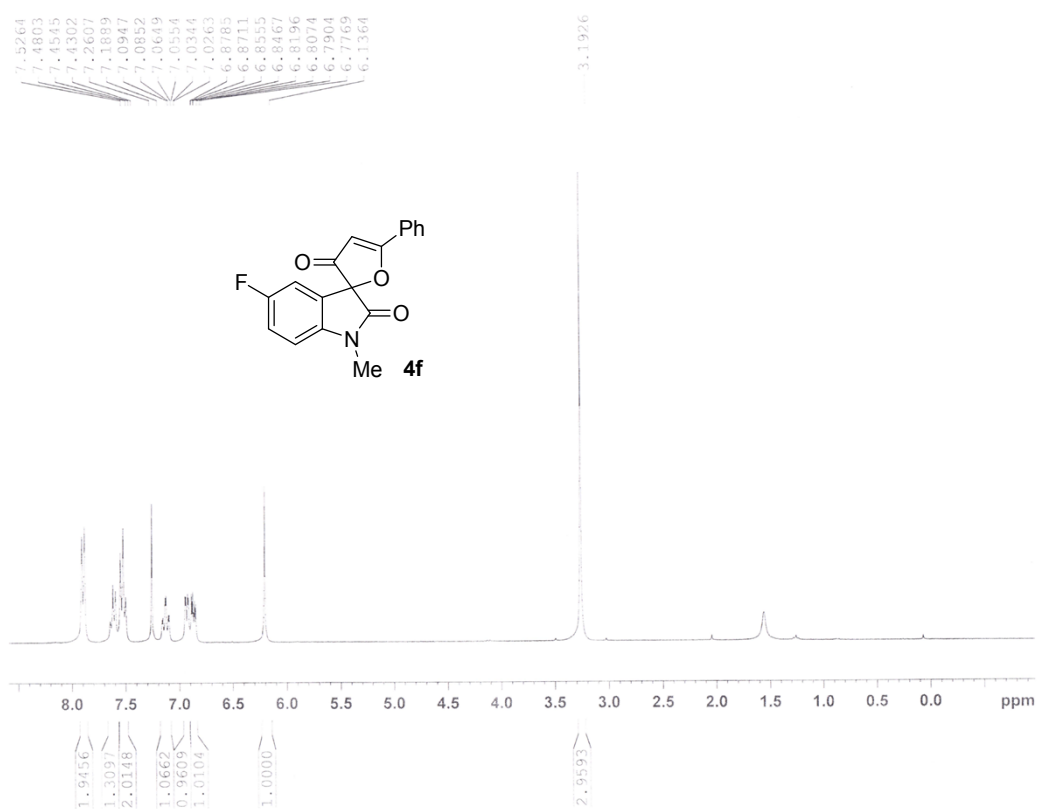




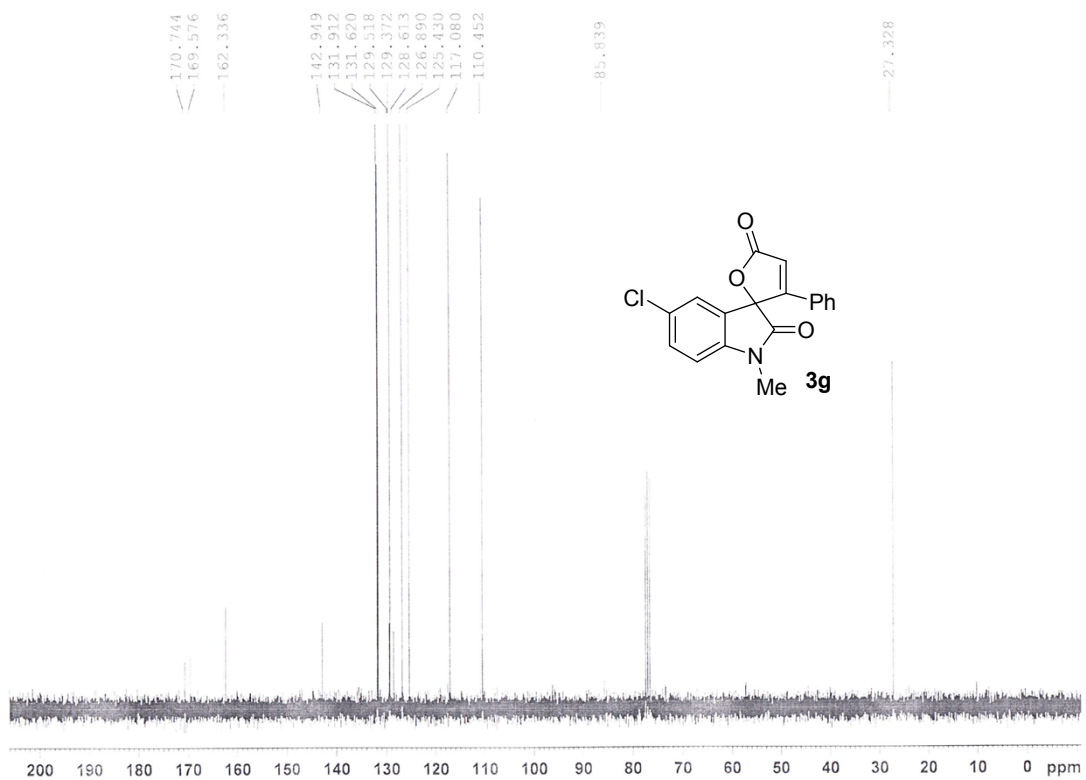
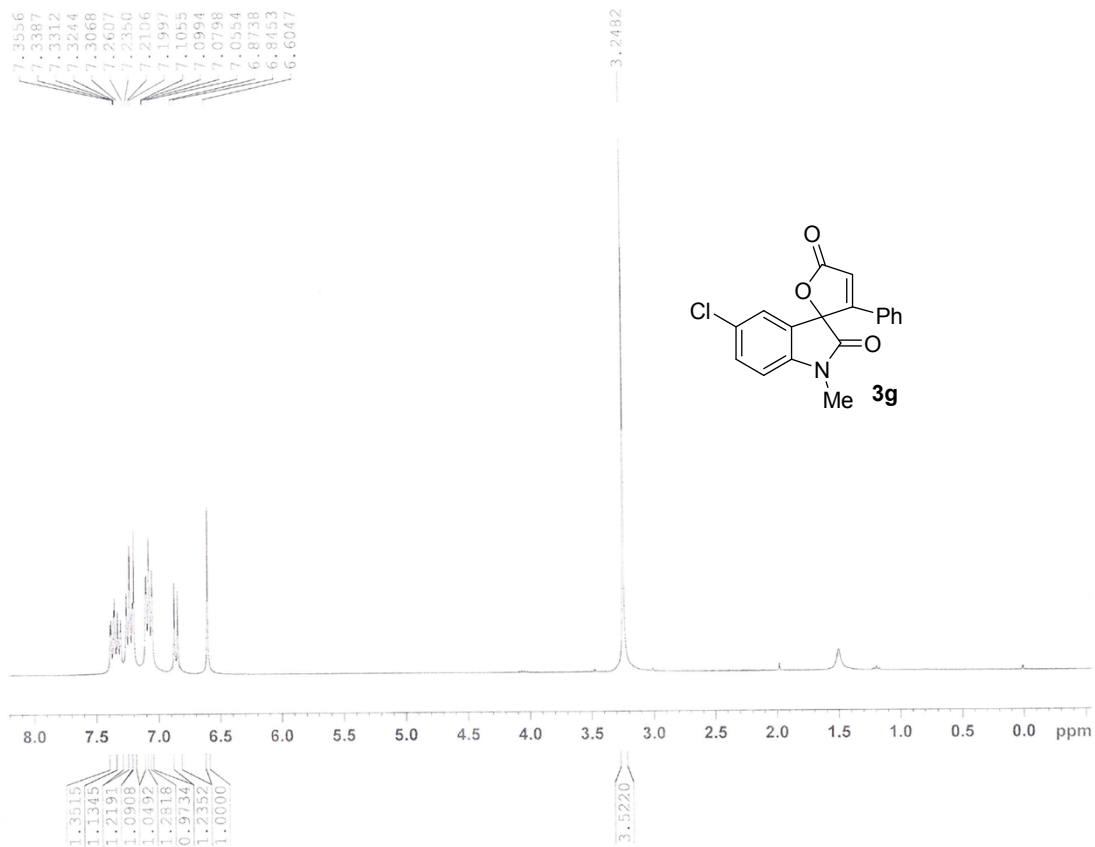


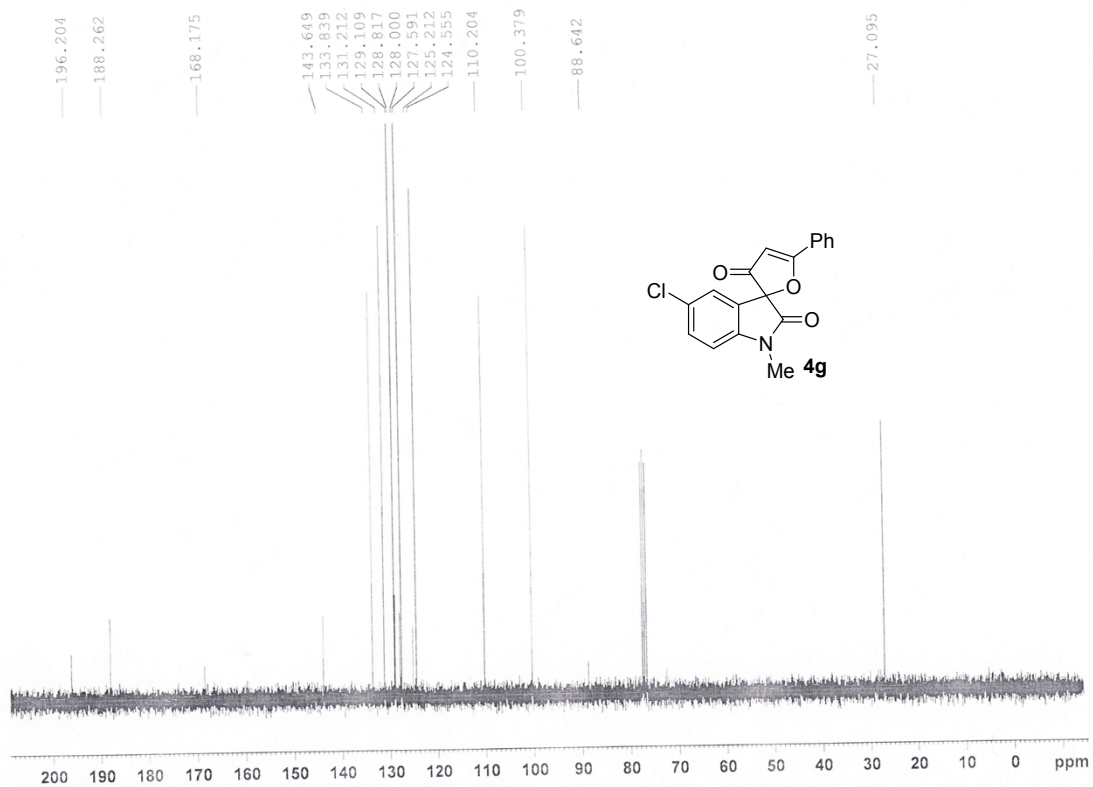
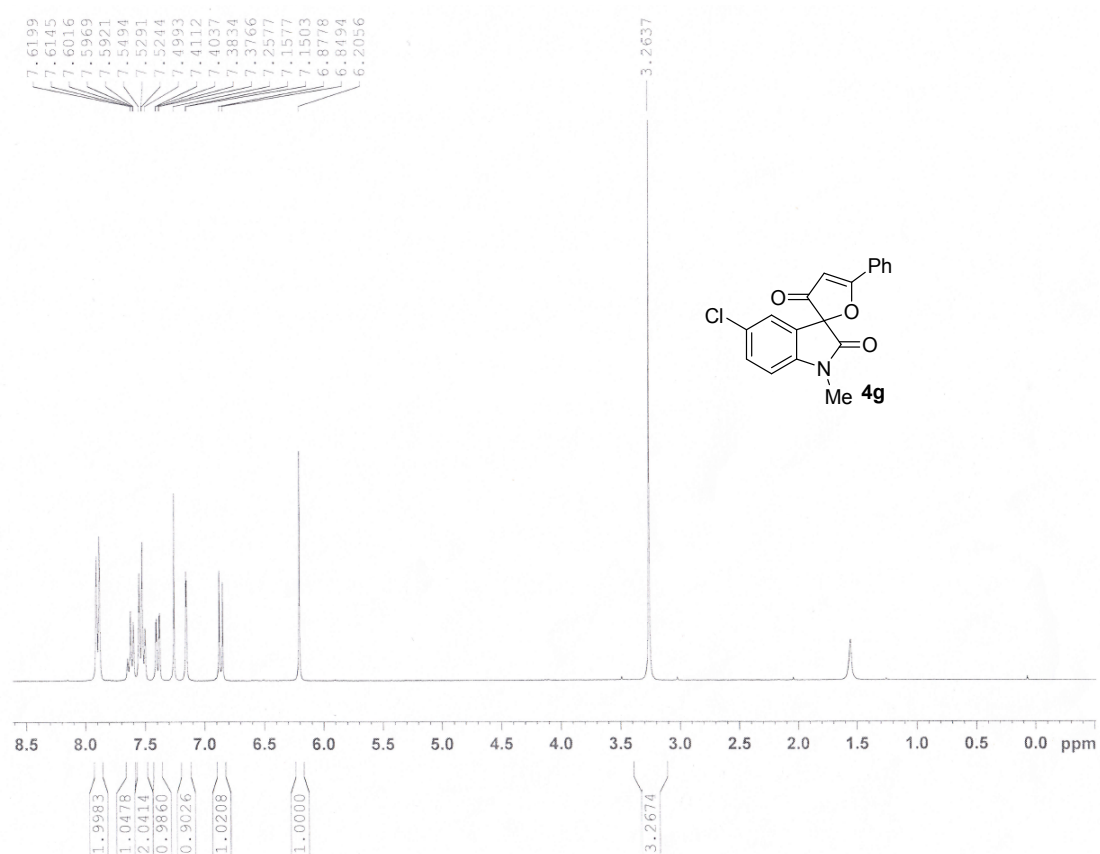


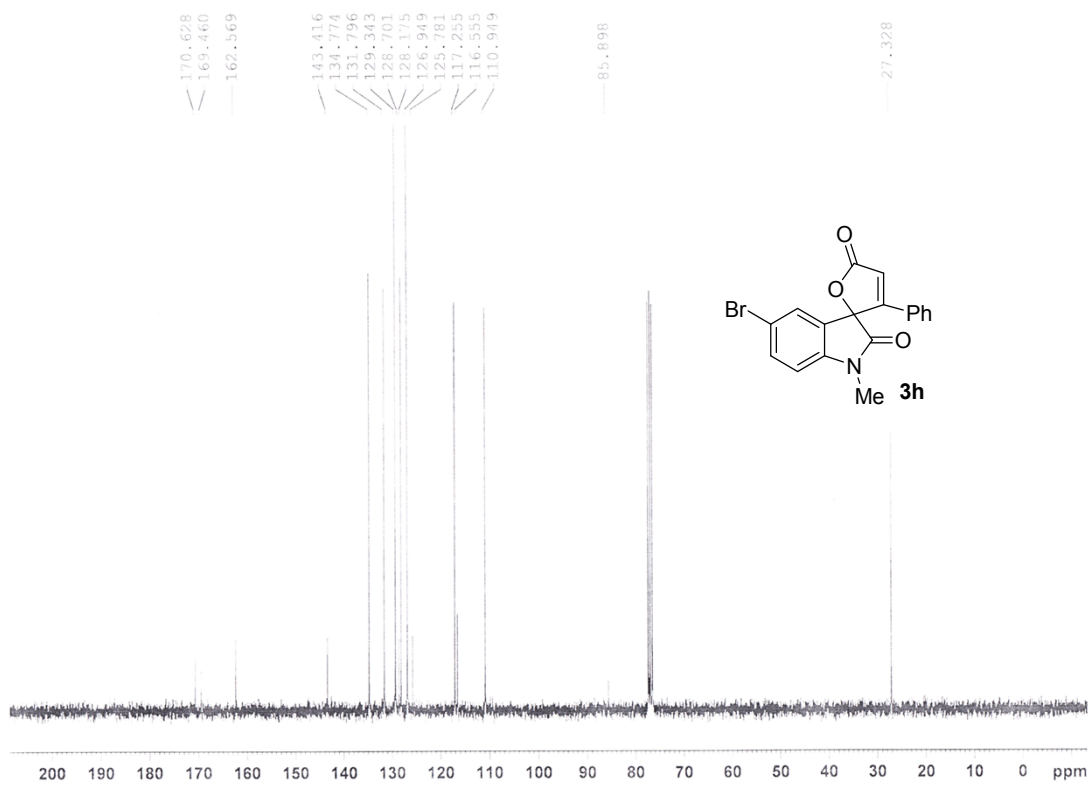
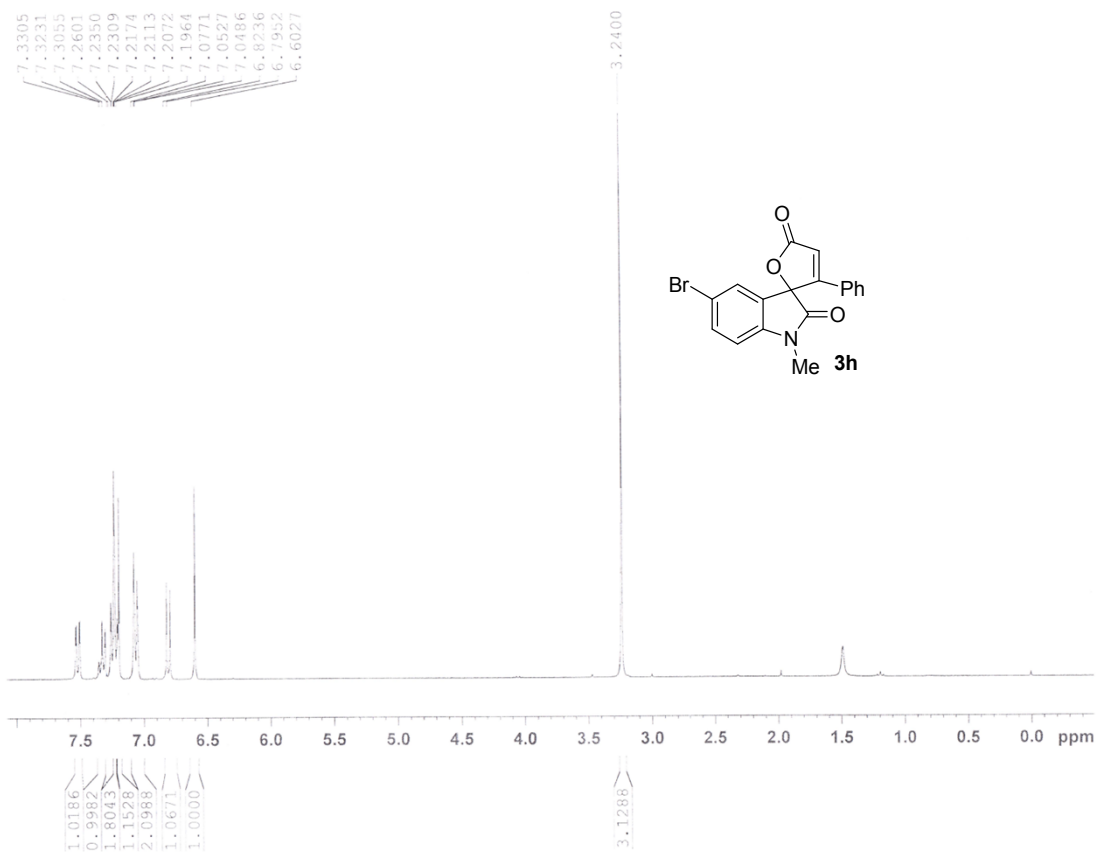
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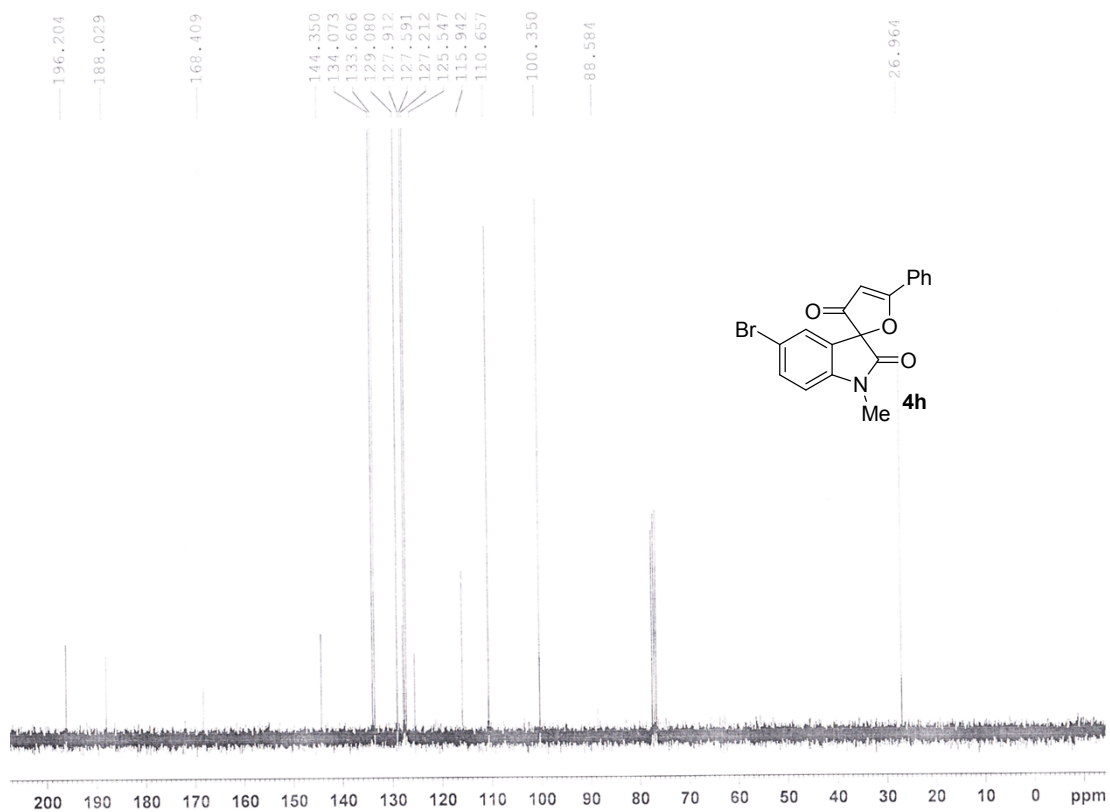
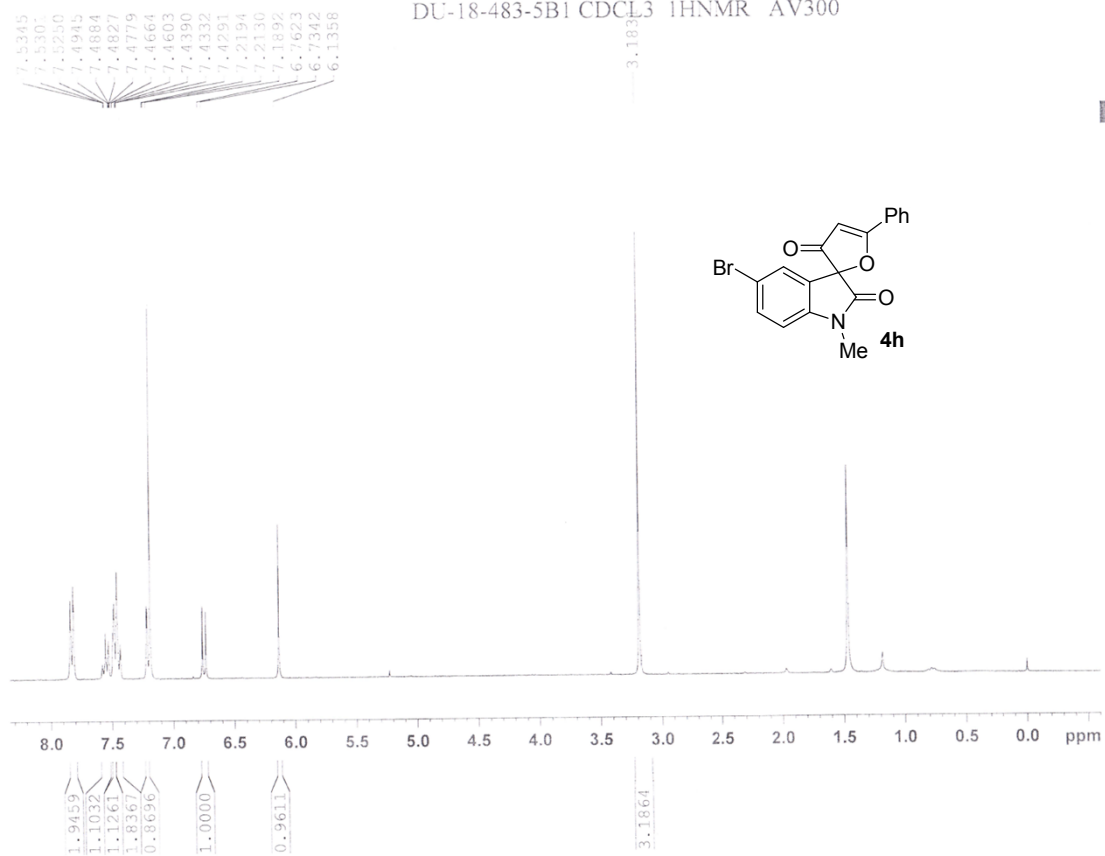
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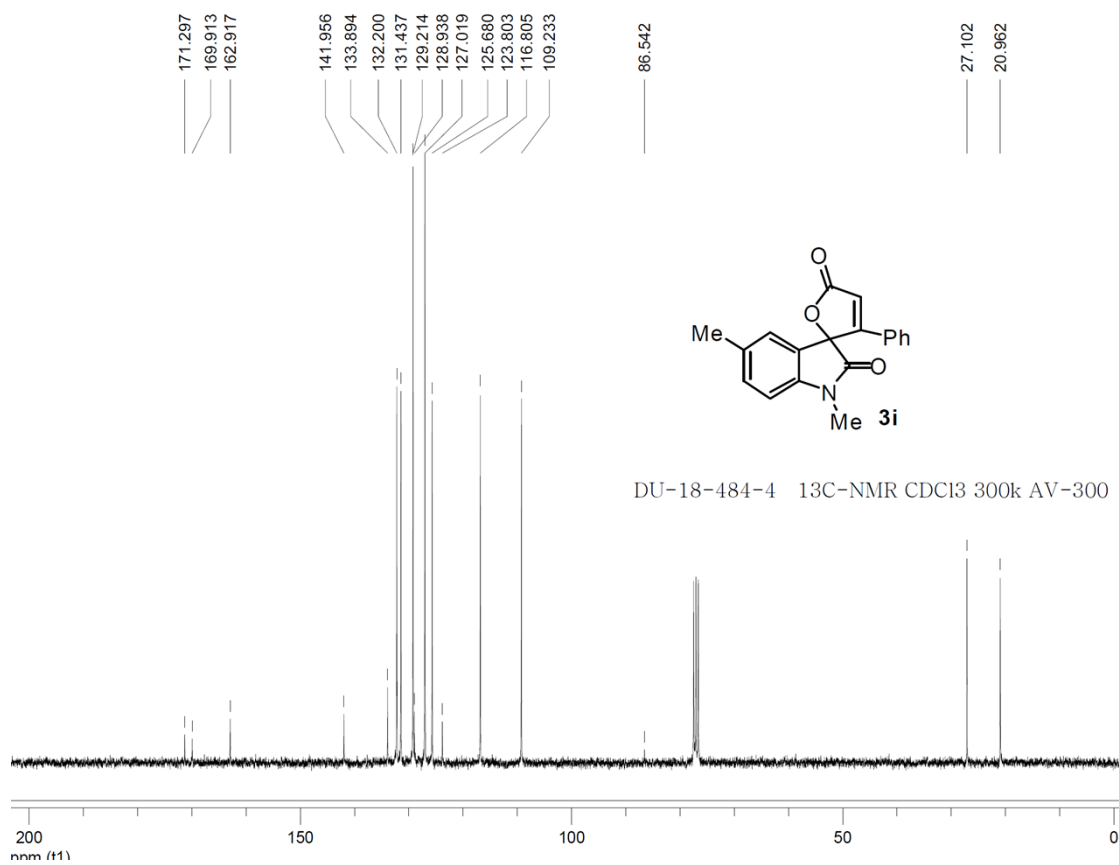
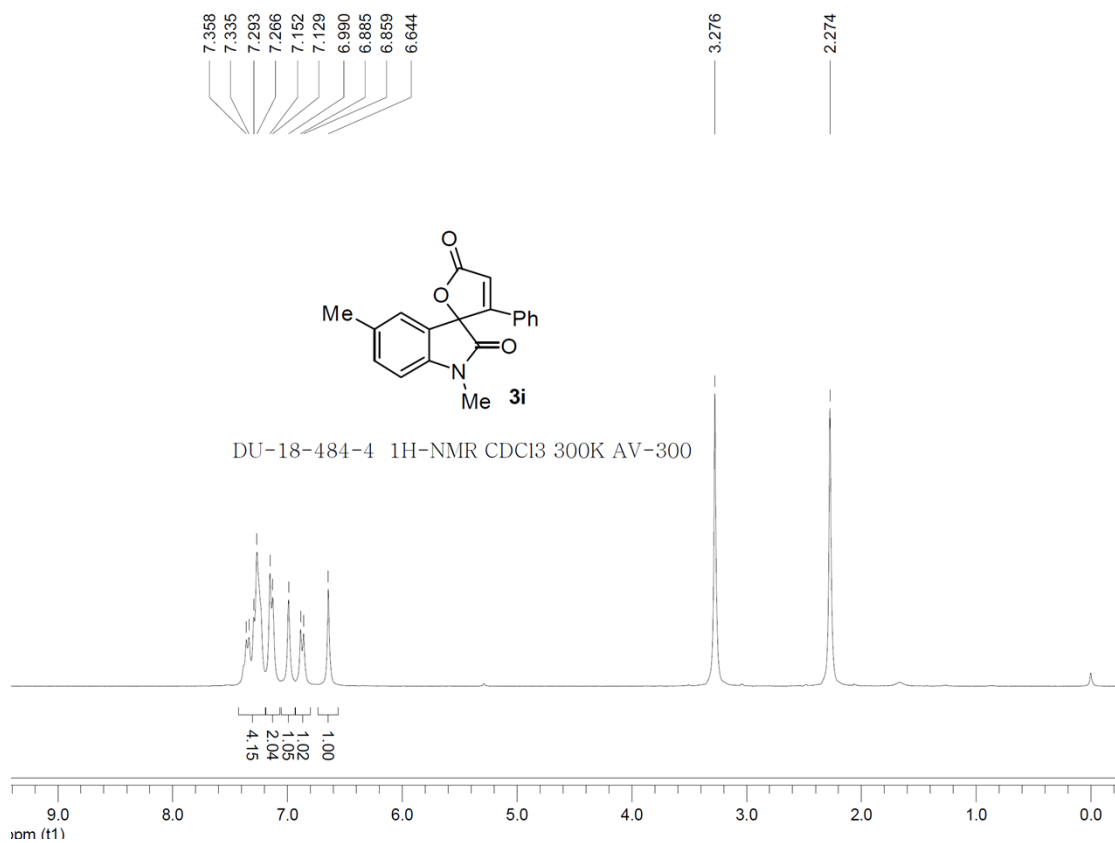




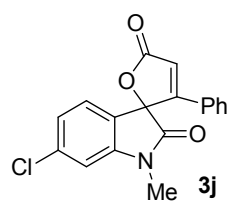
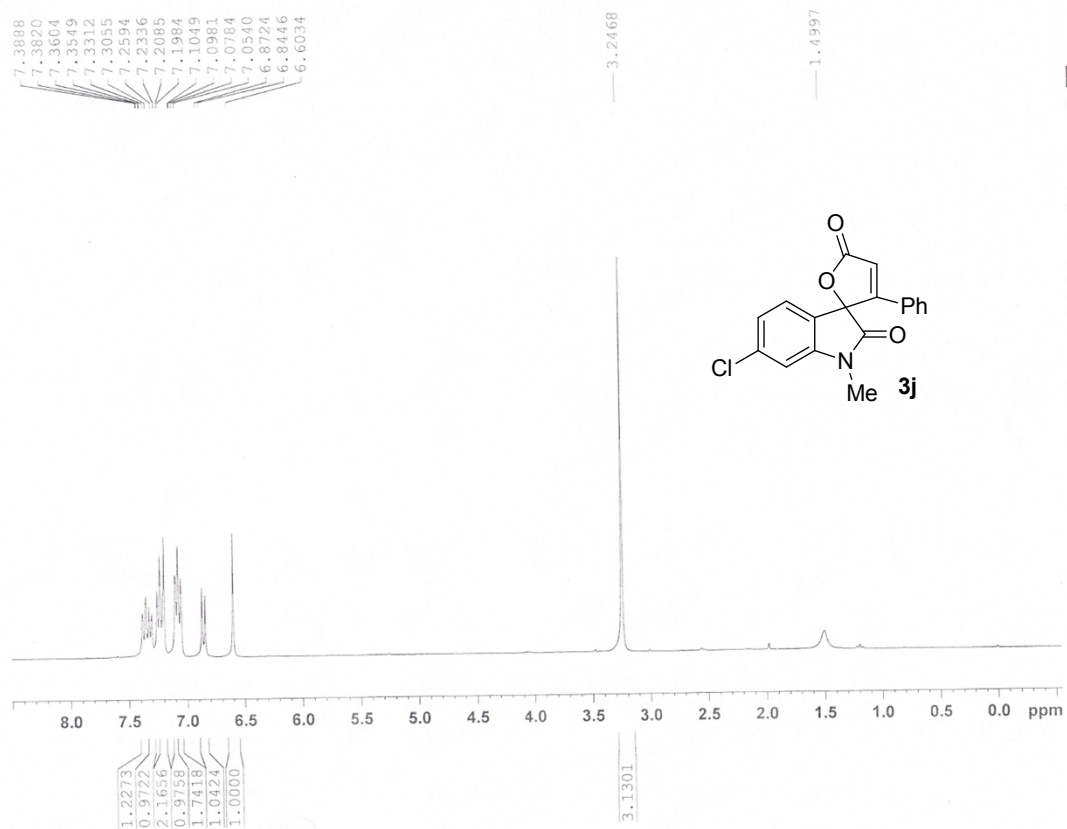


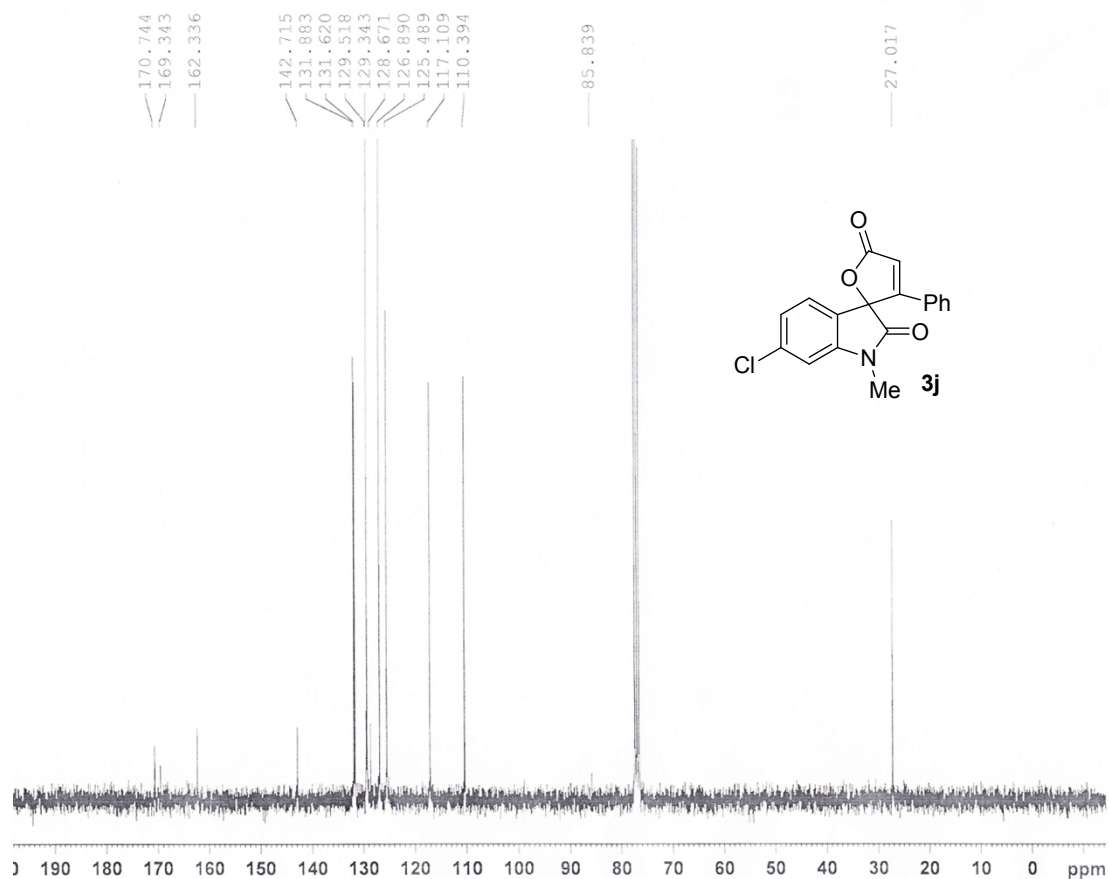
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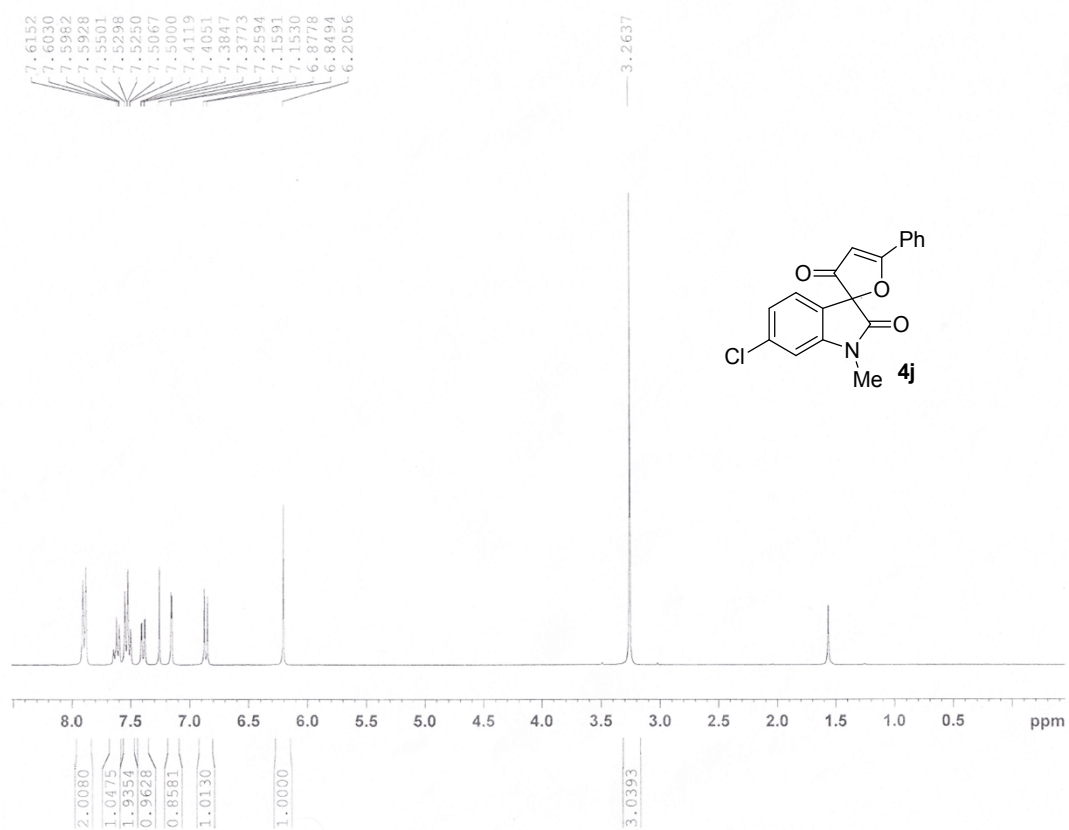


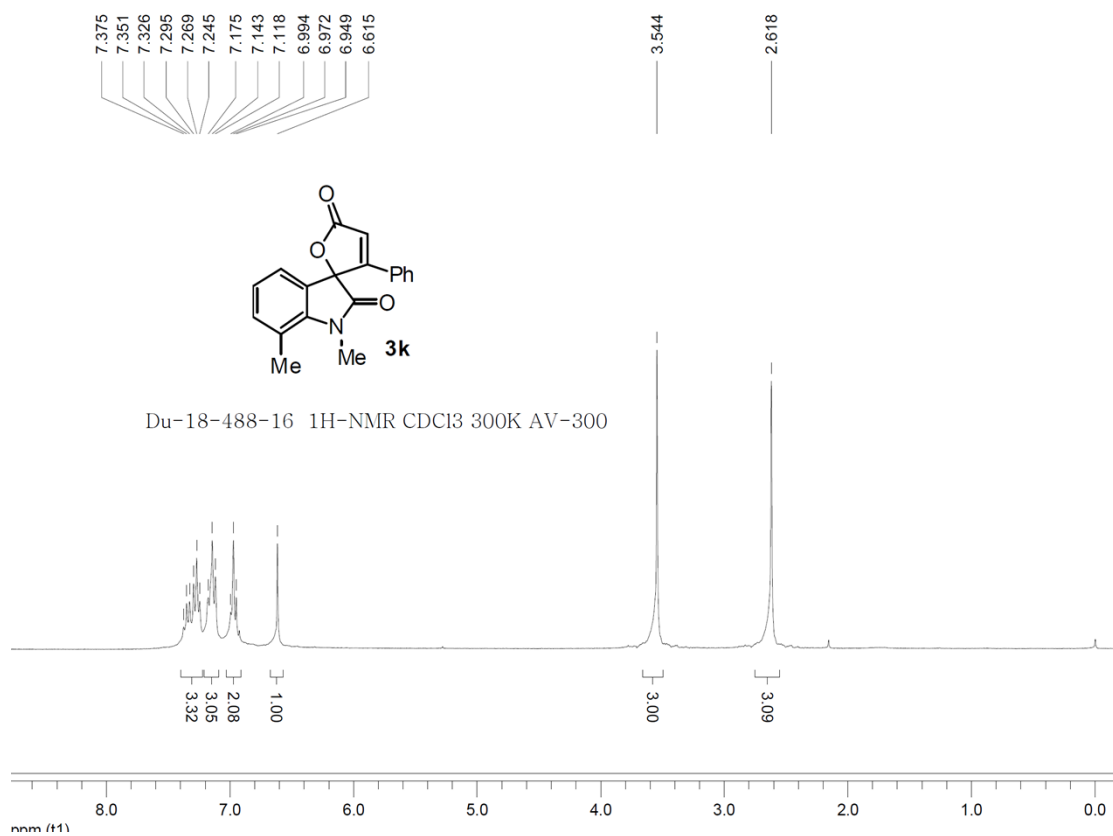
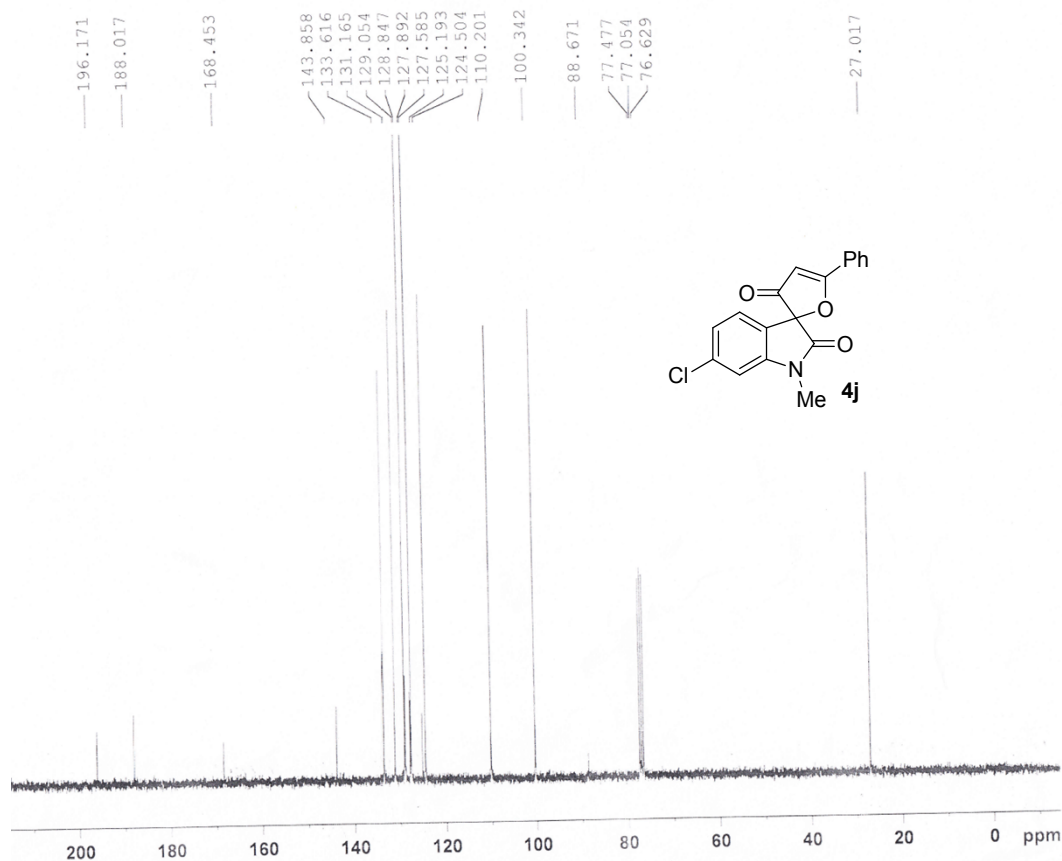
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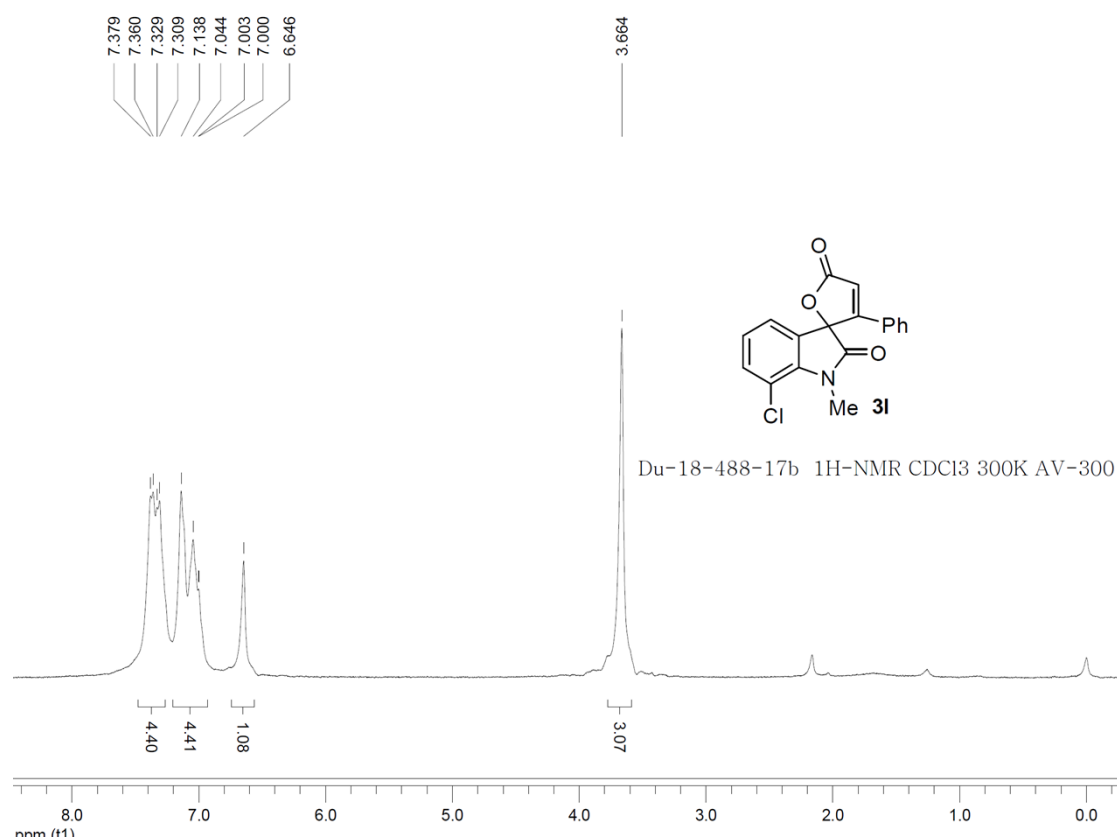
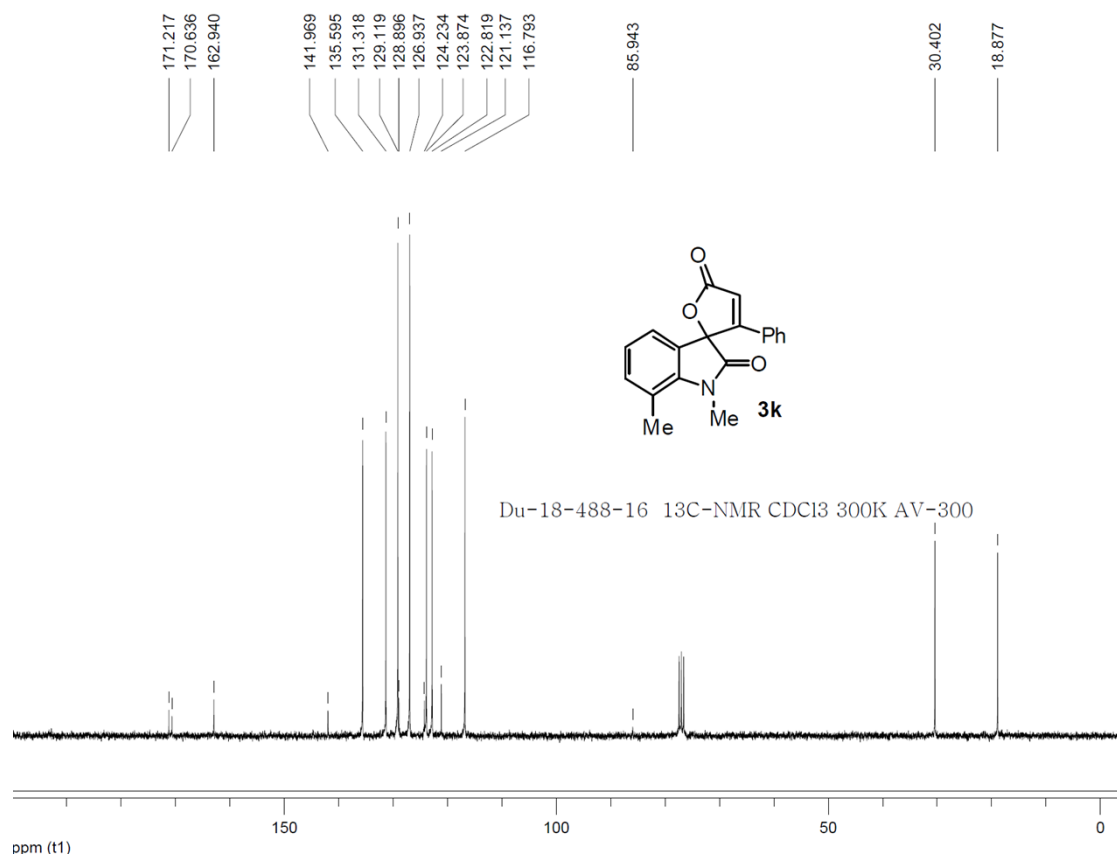


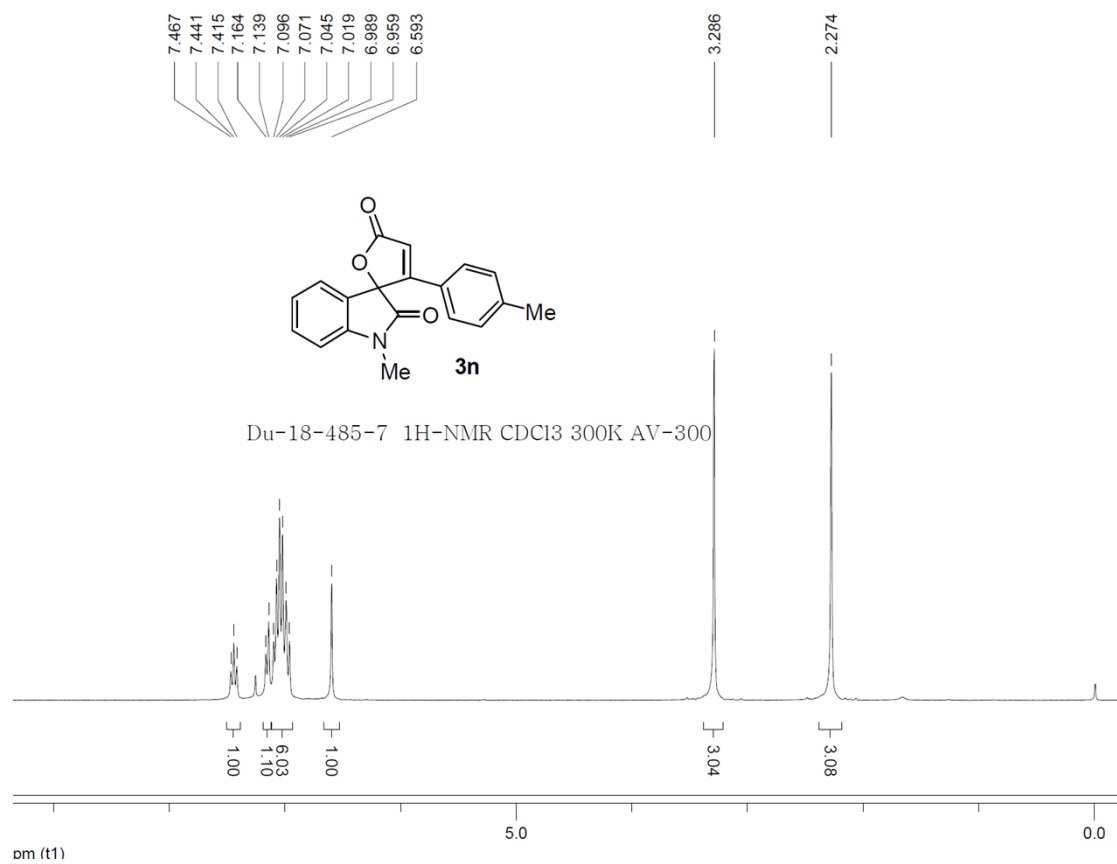
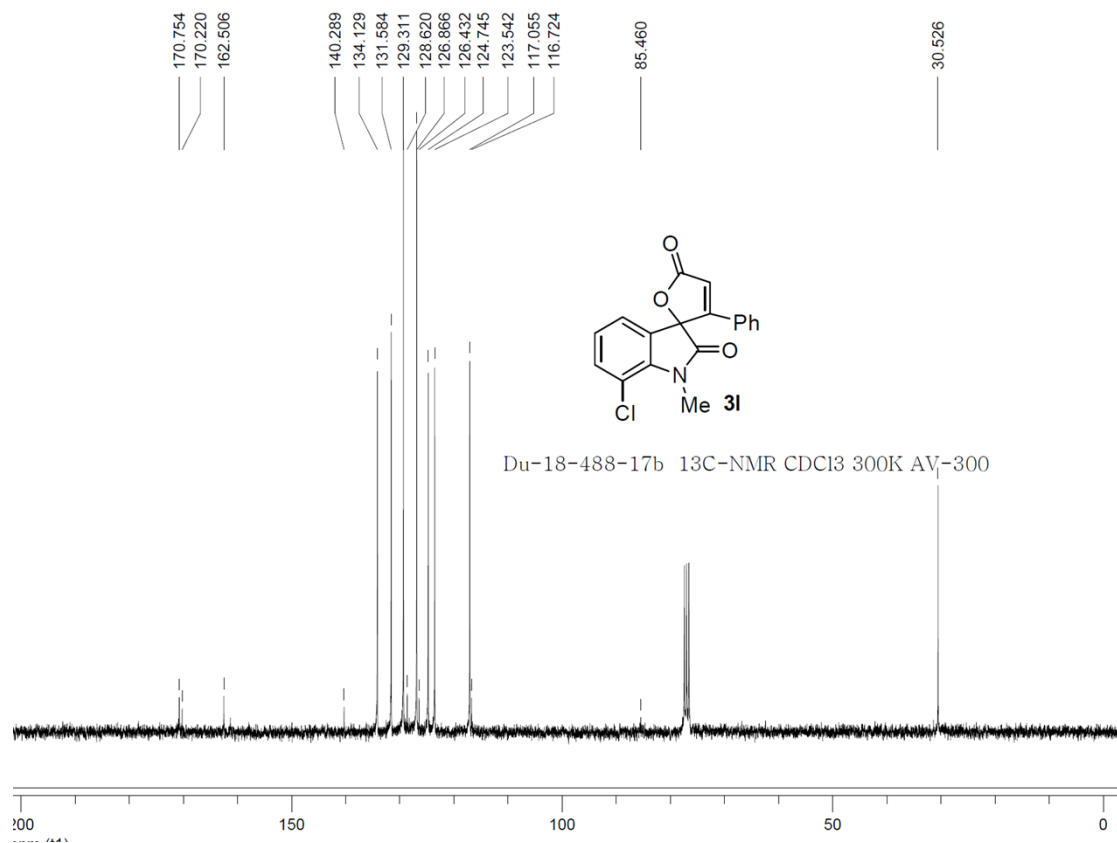


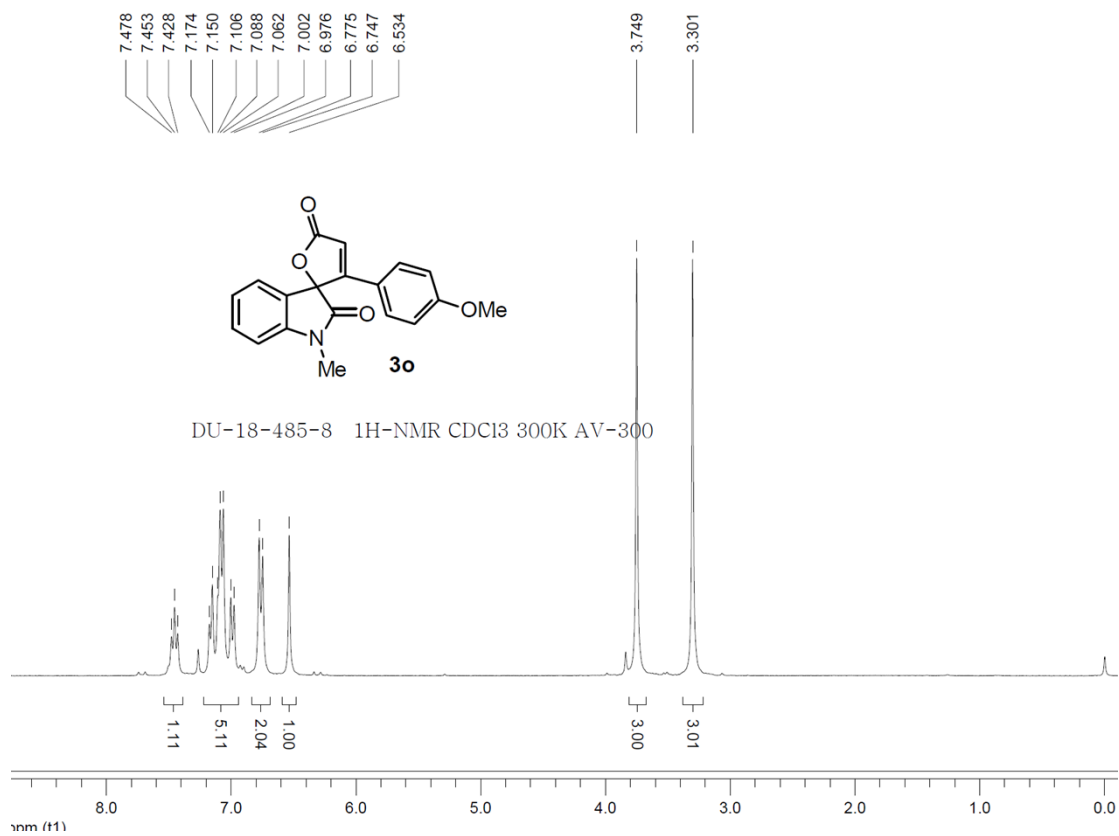
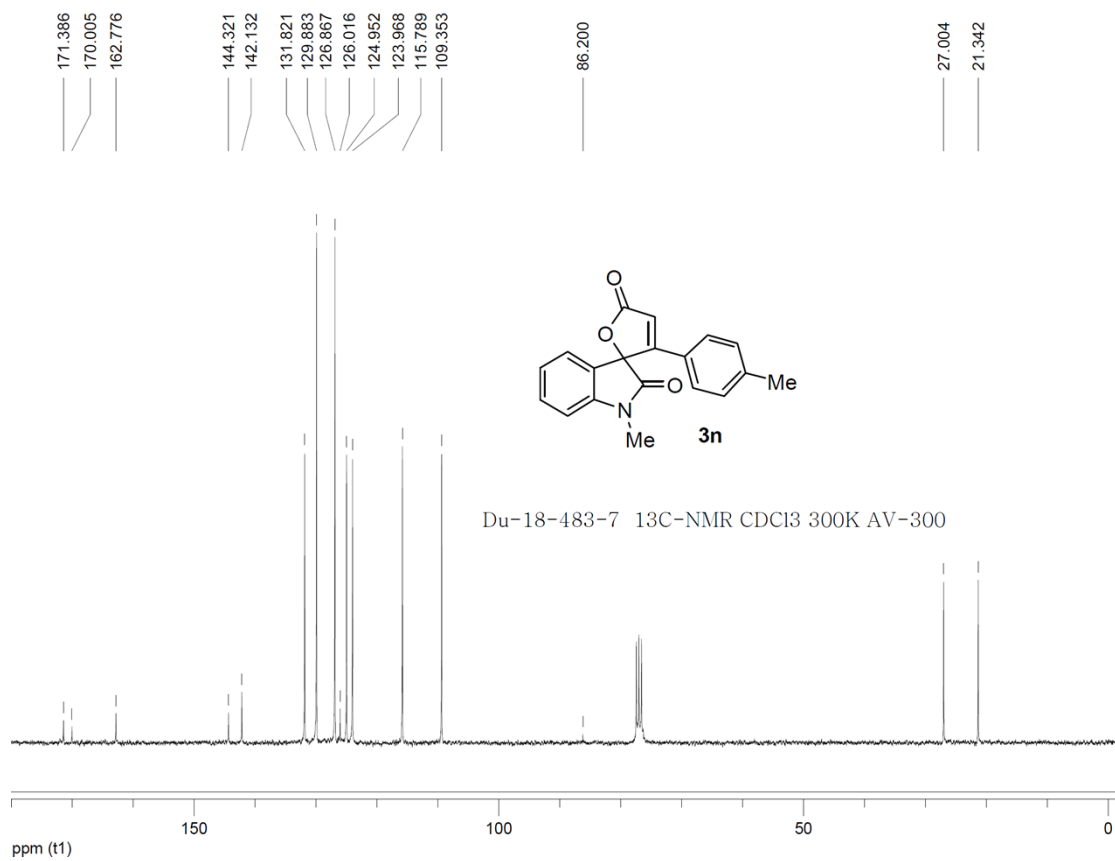
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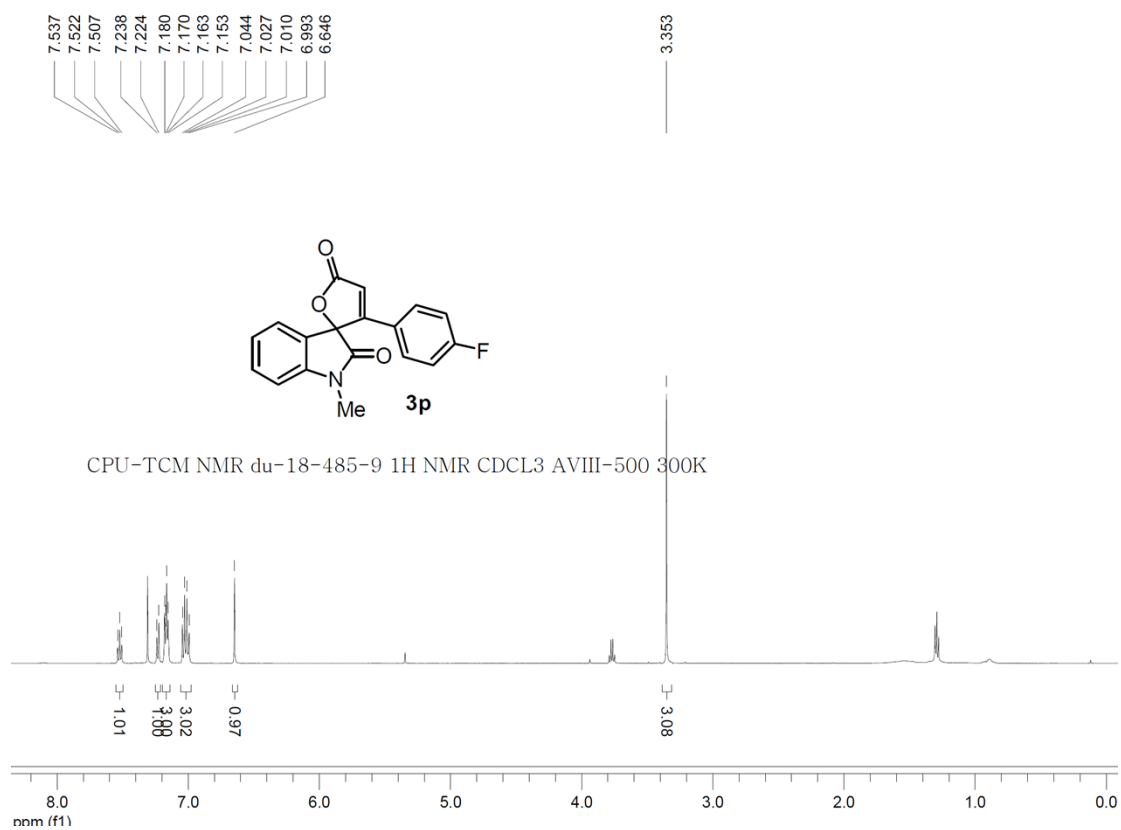
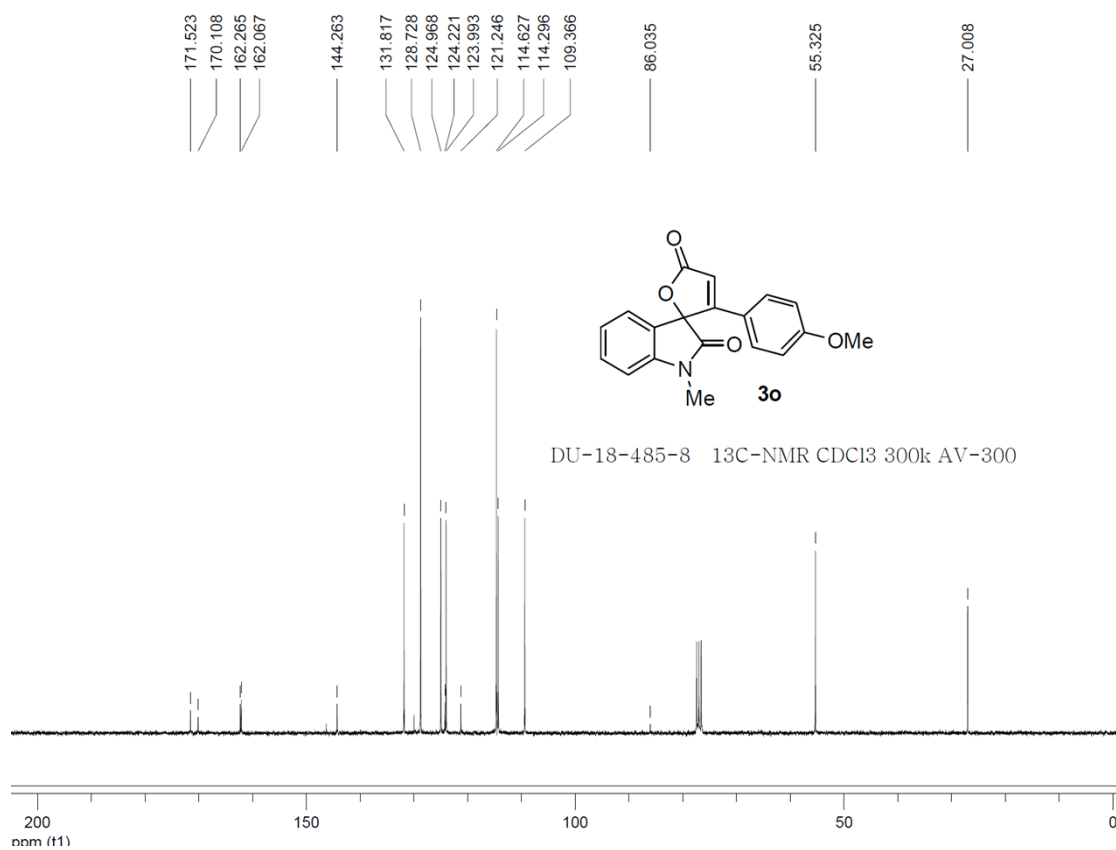


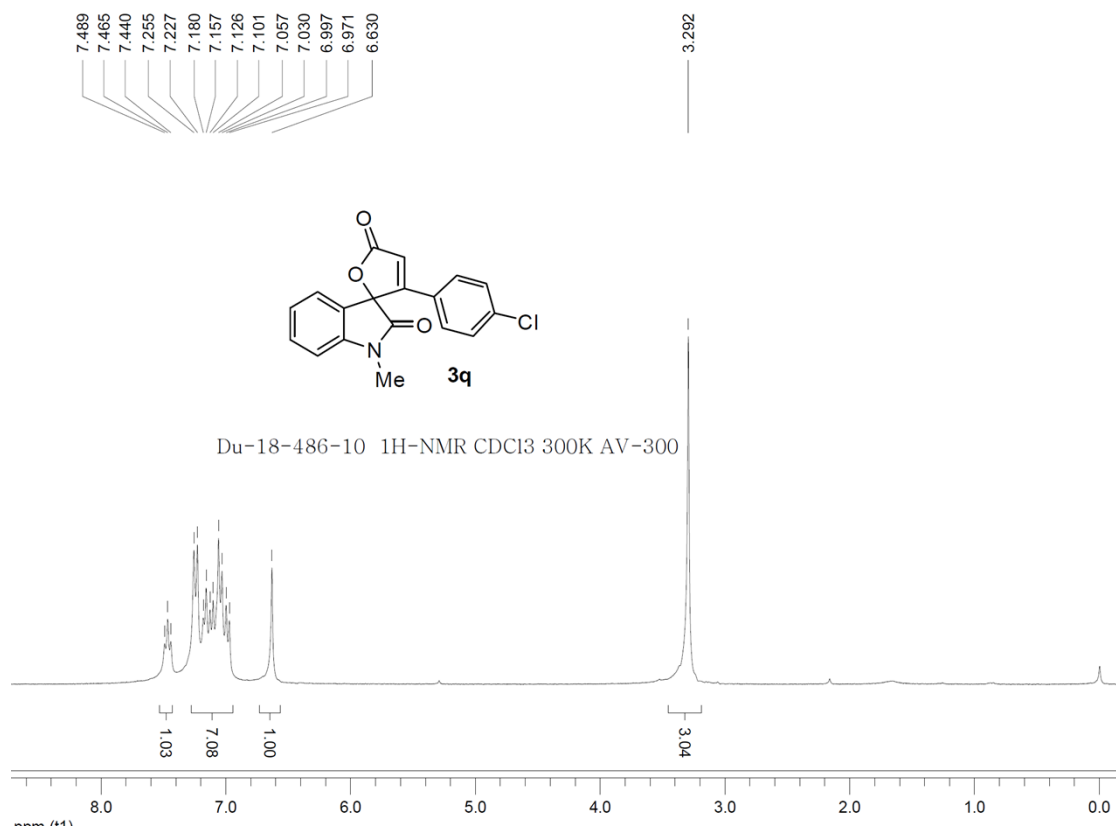
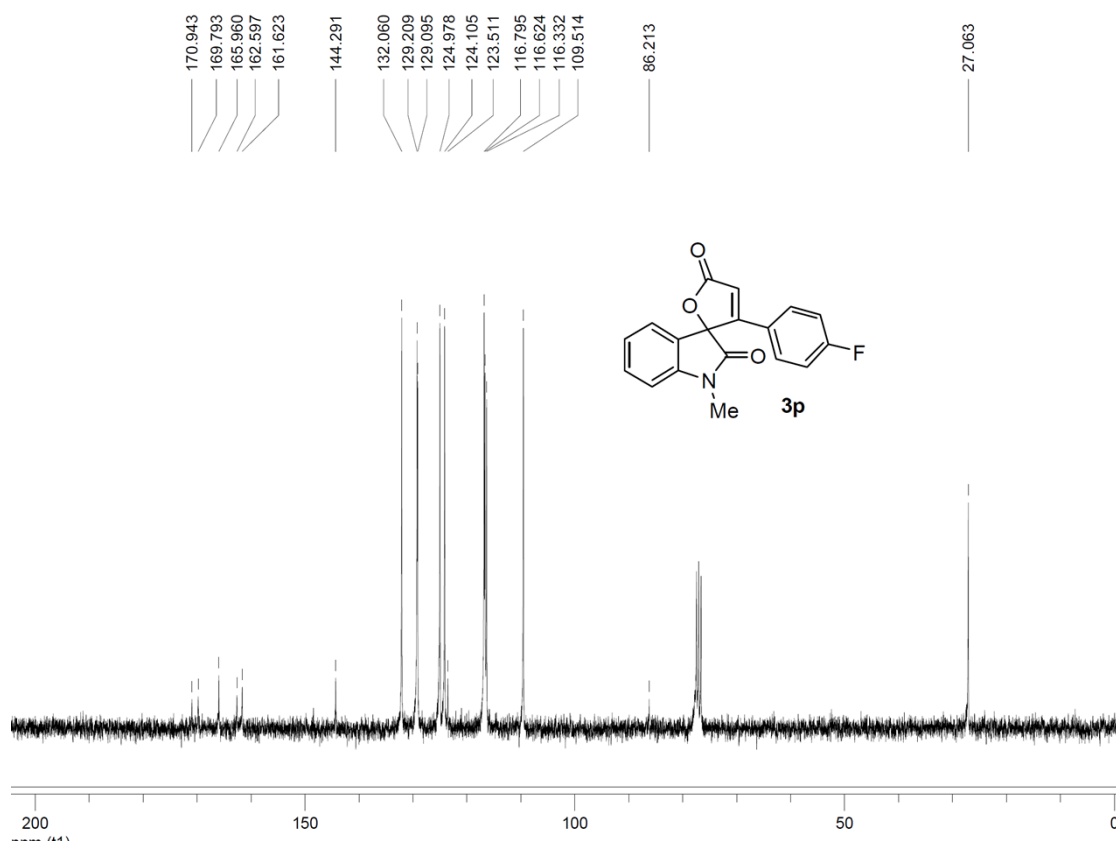


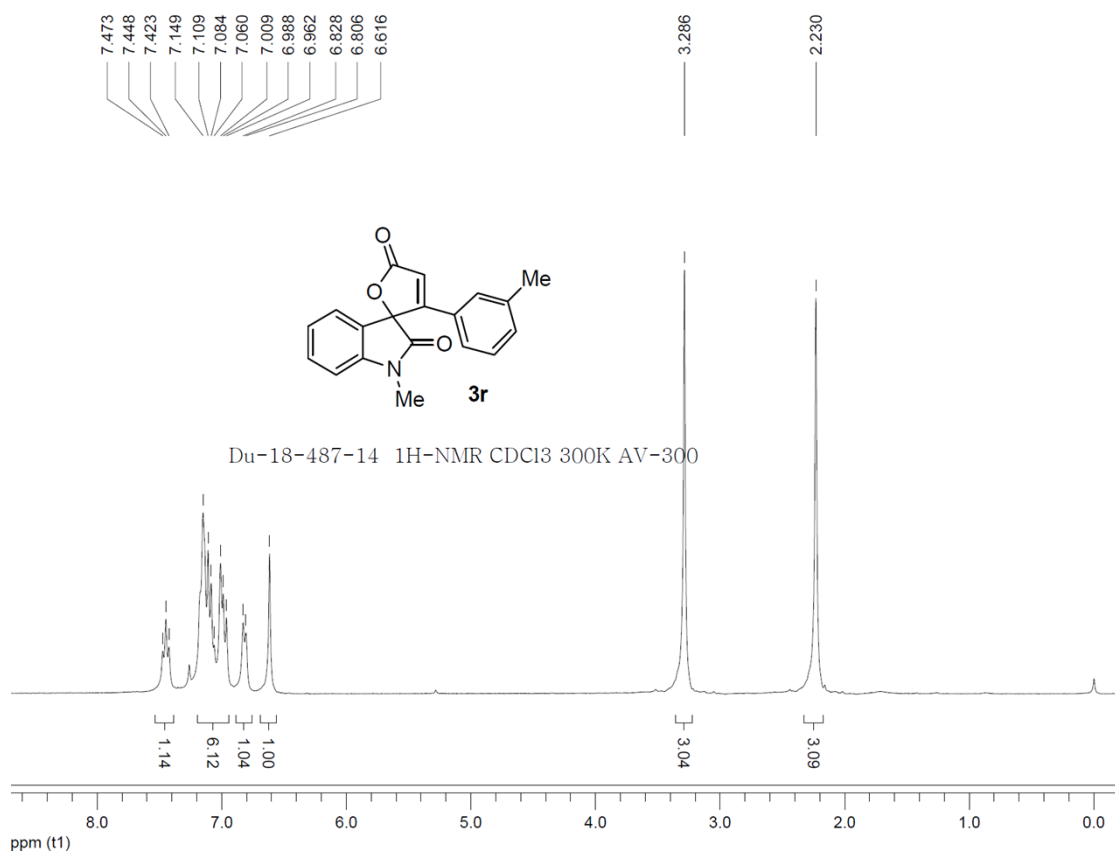
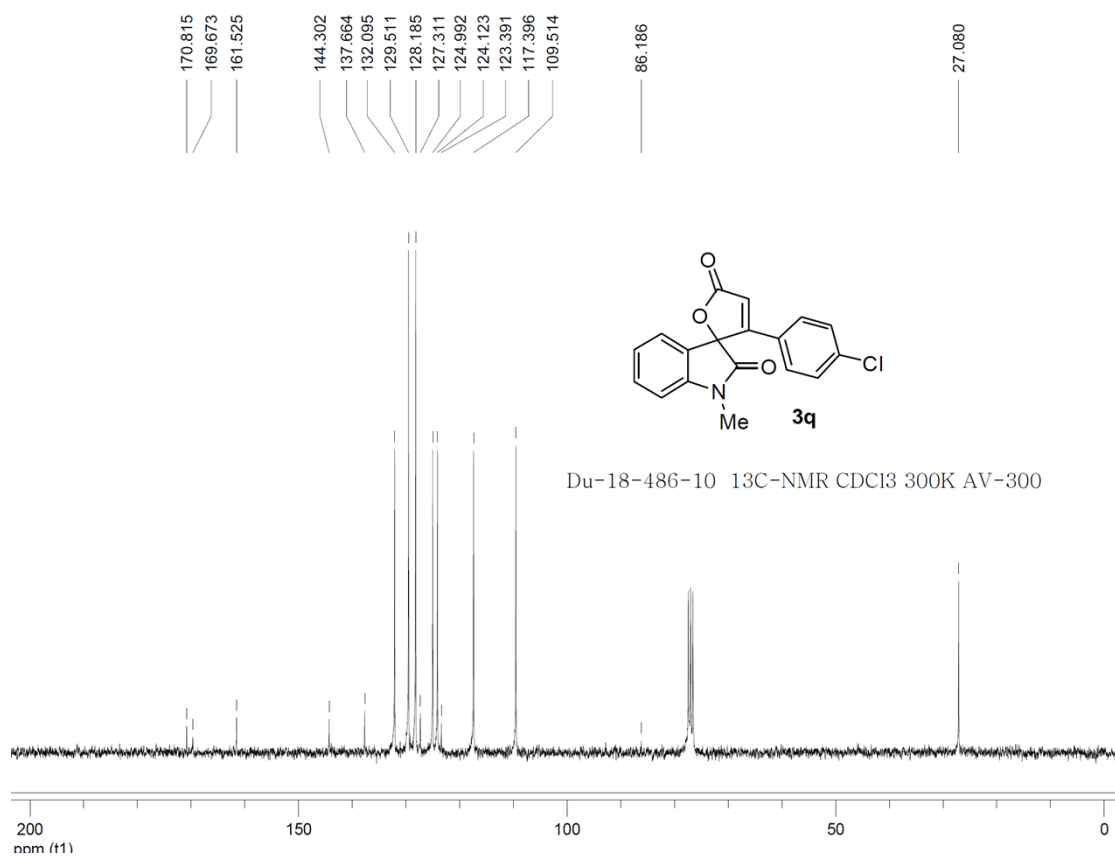


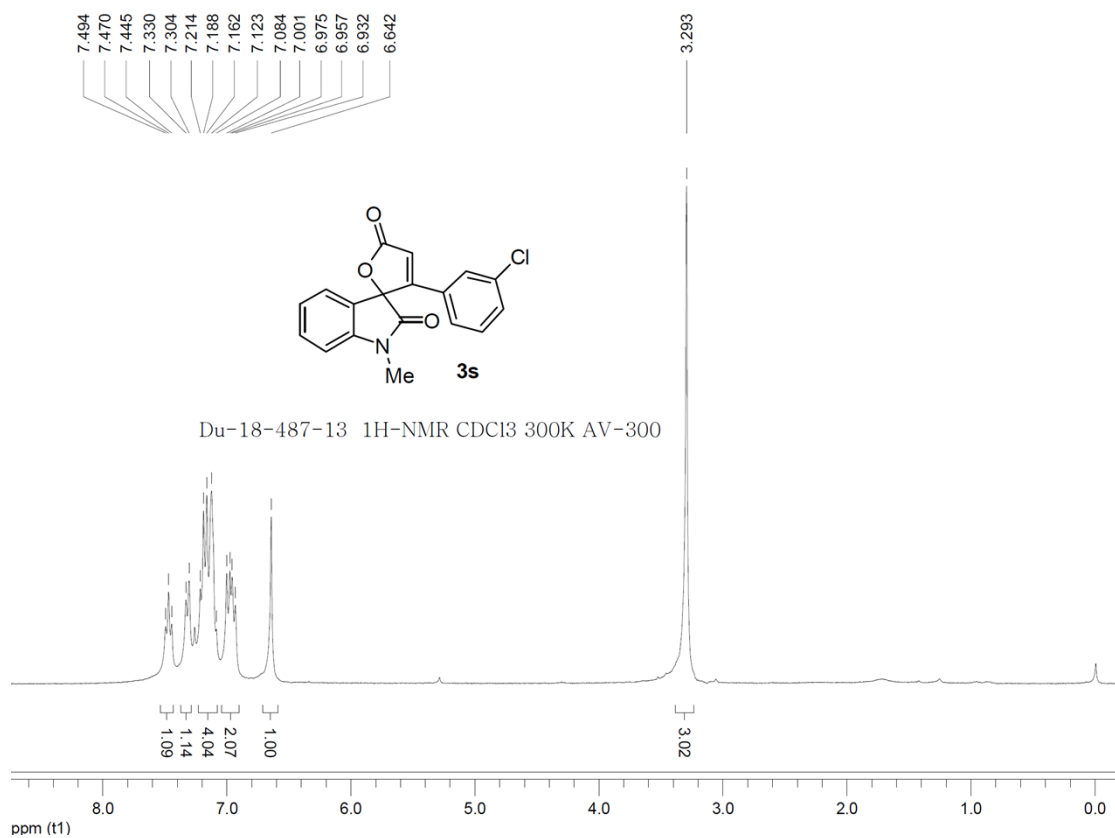
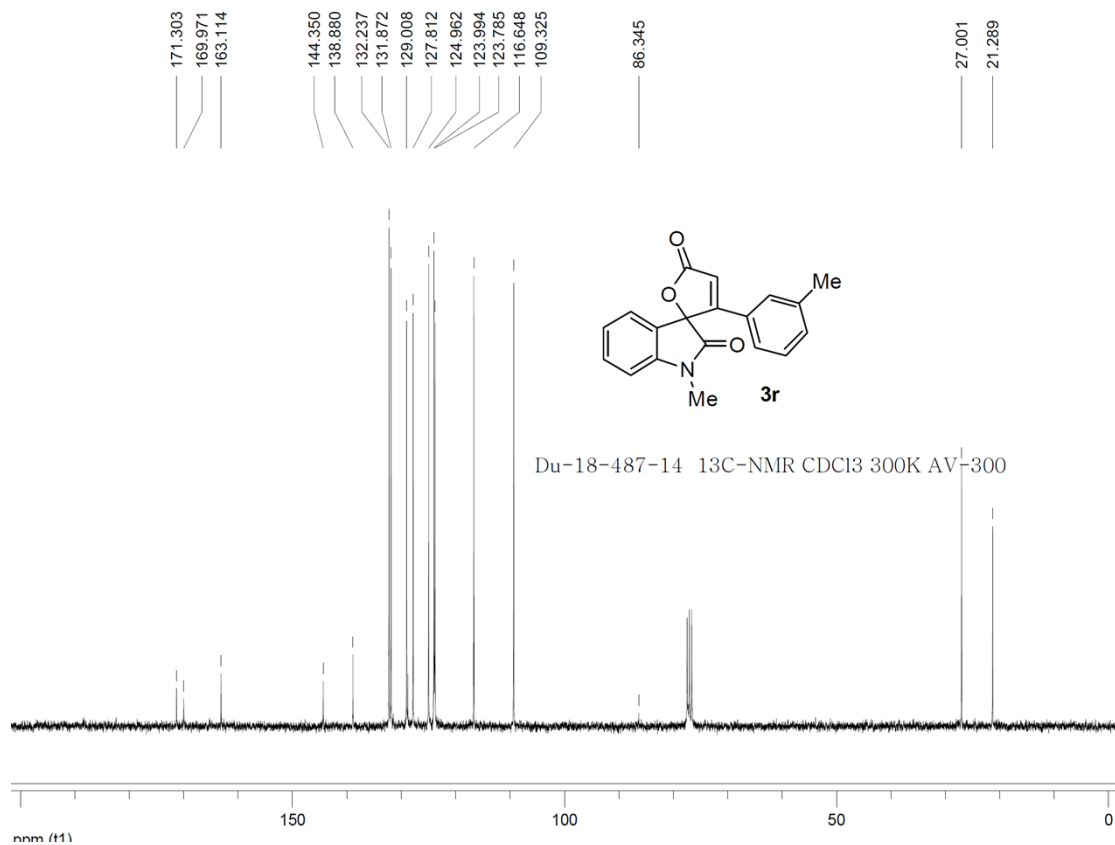


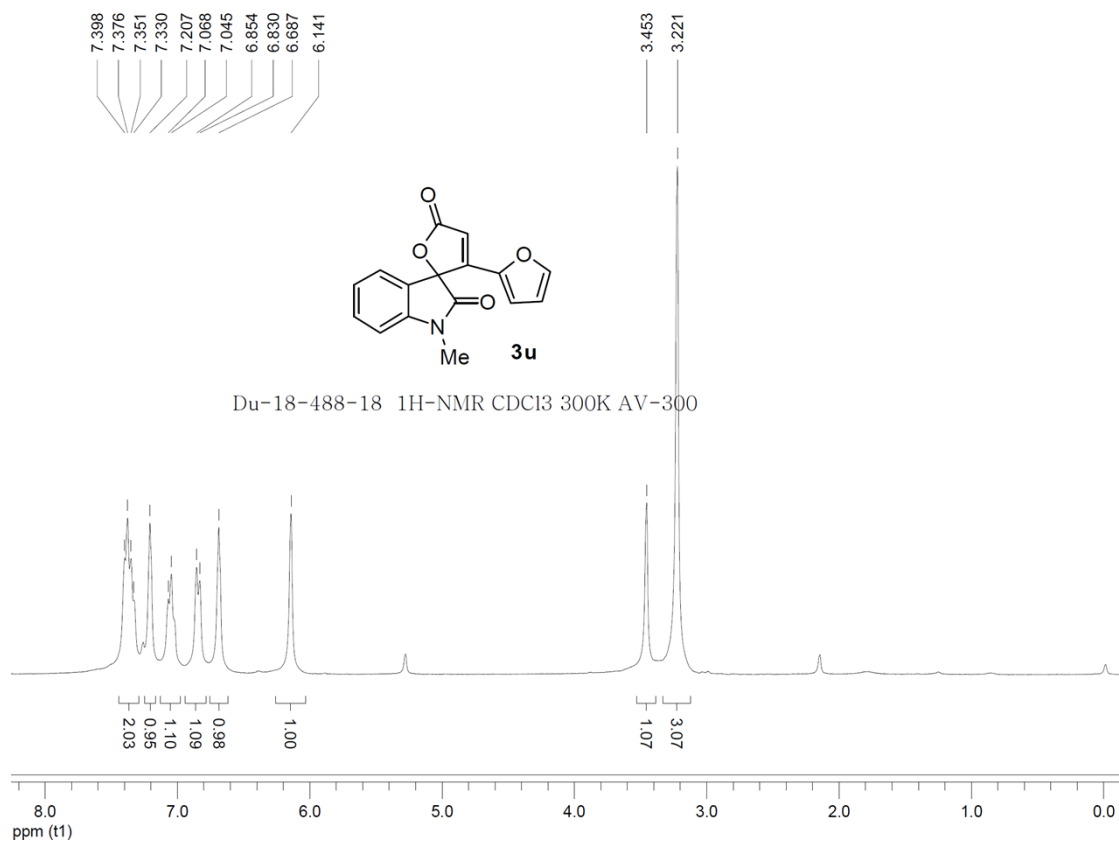
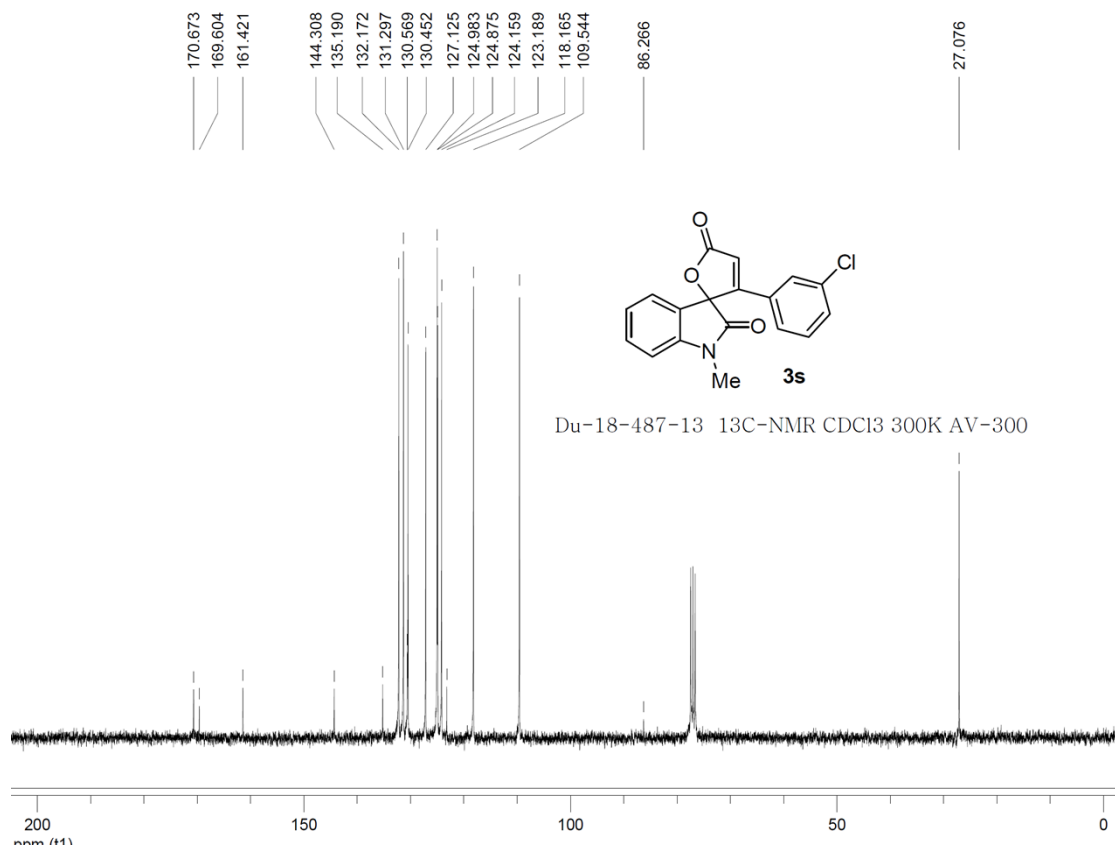


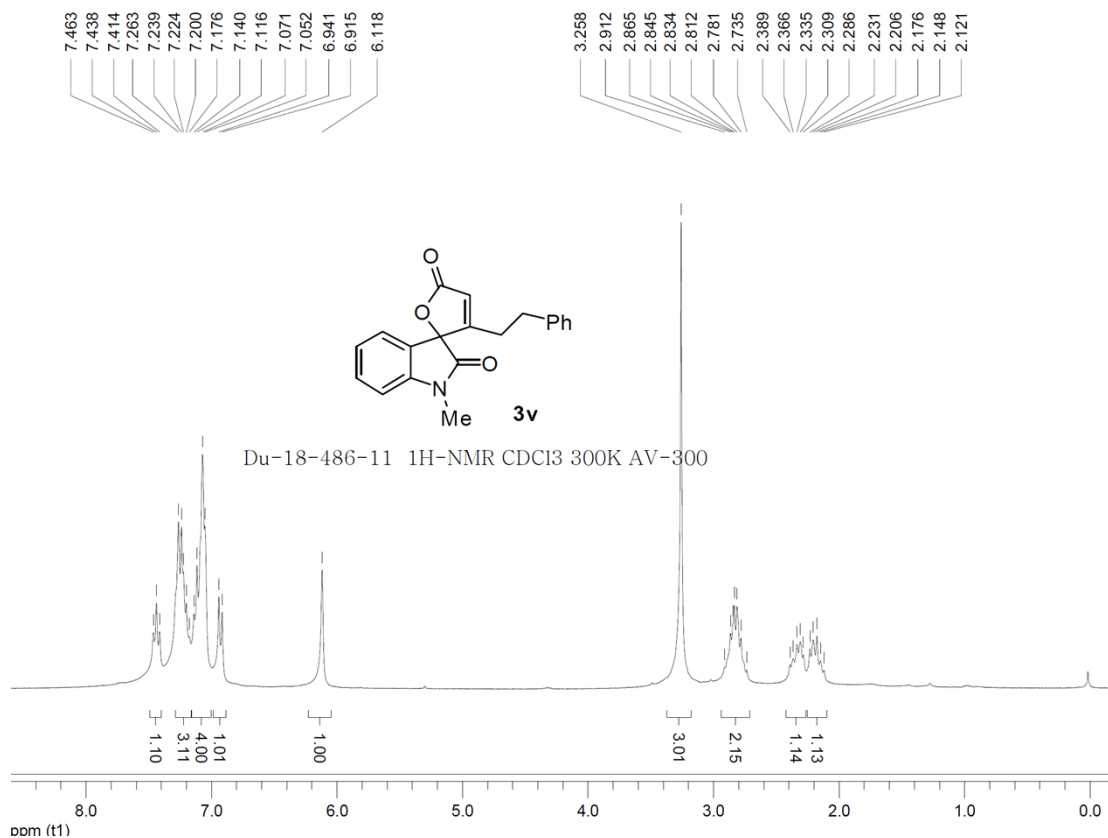
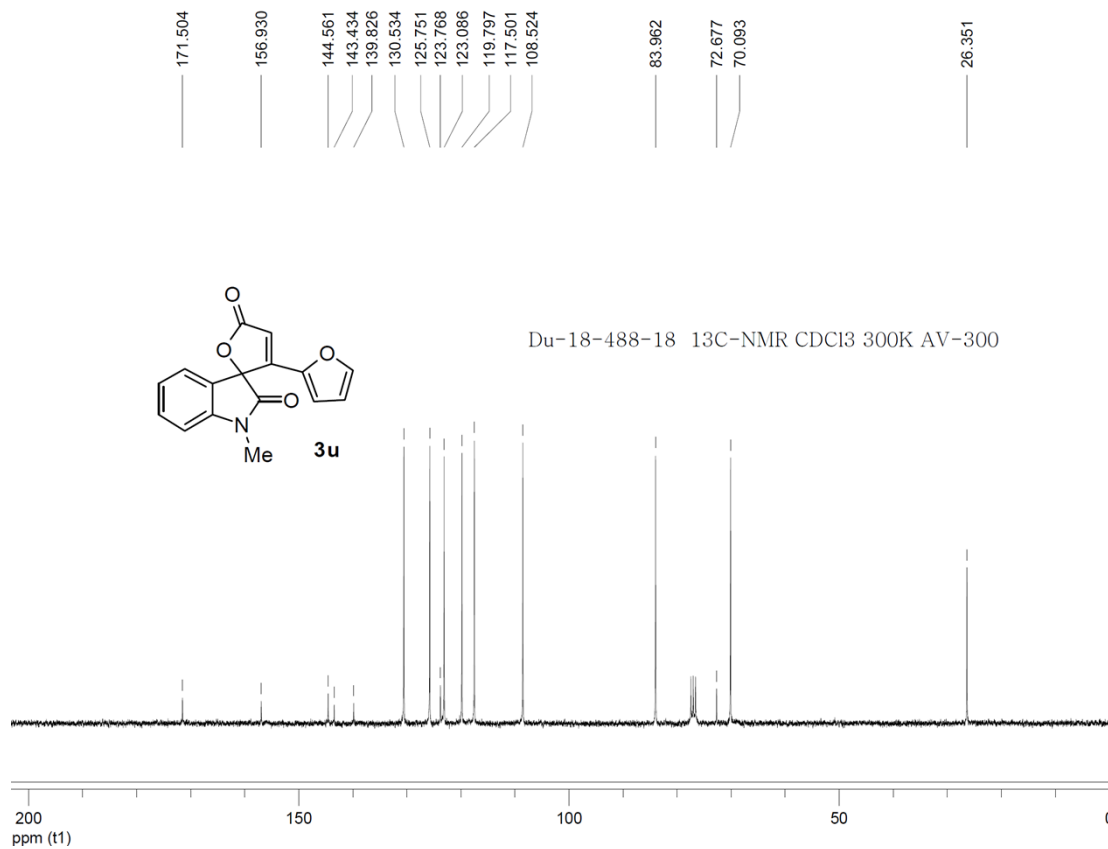


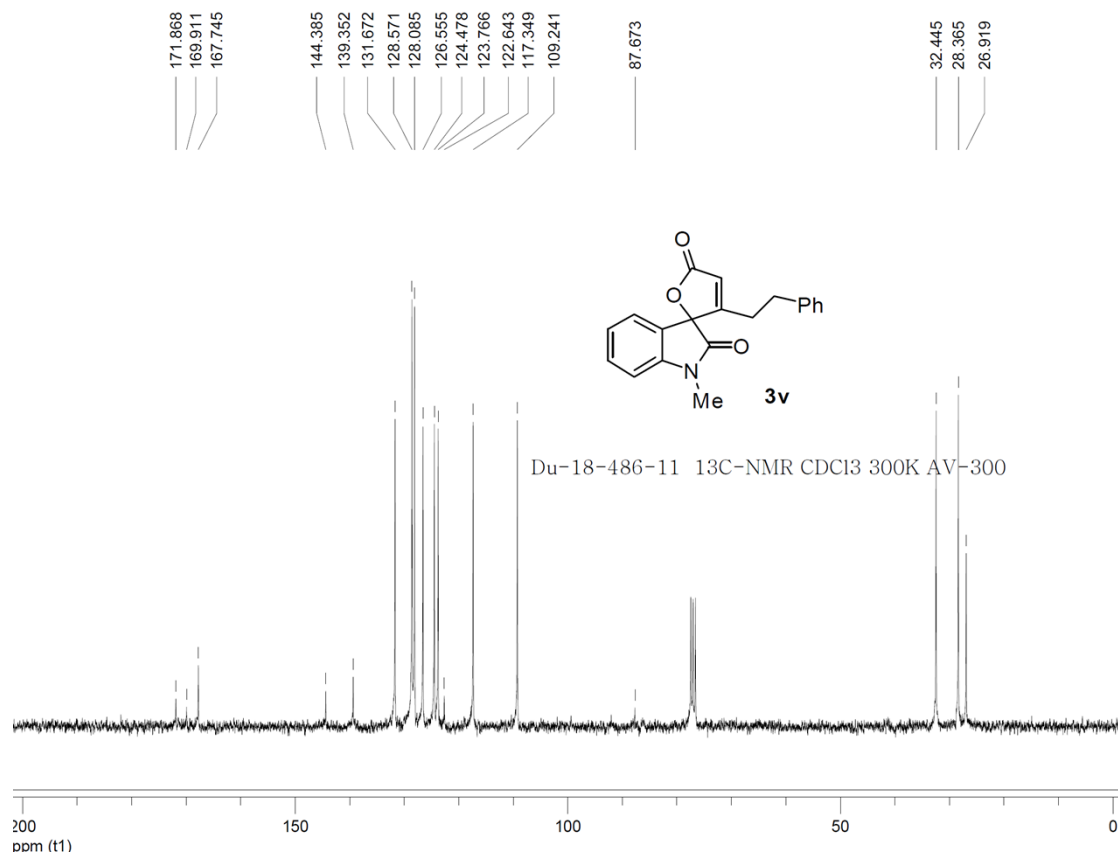






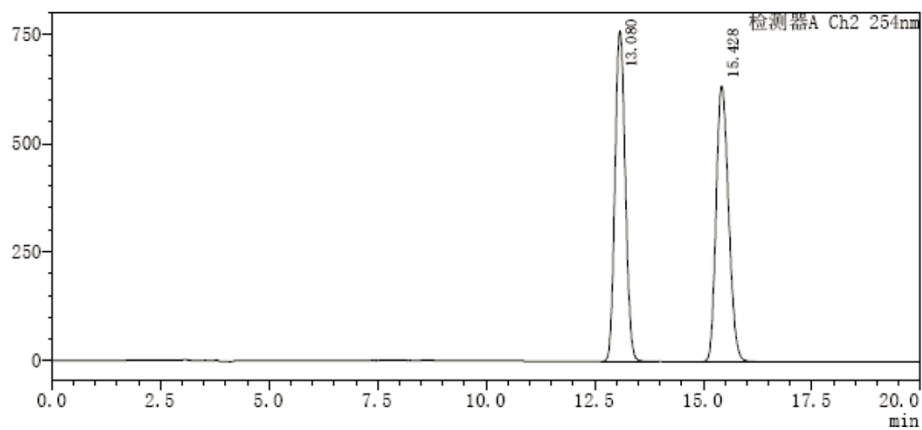






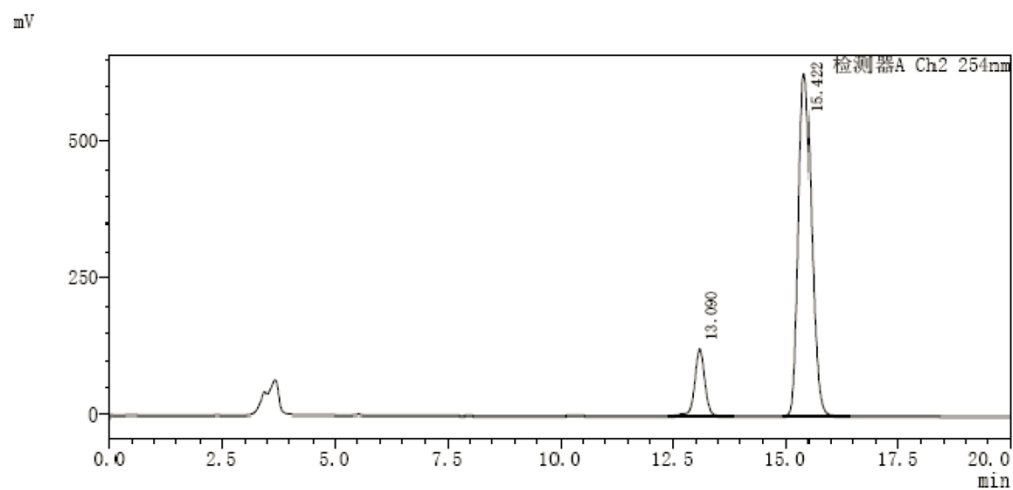
2. Spectra of e.e. value determination of **3d** via chiral HPLC.

3d-racemic



Peak No.	Time	Area	Area %	Plate number	Tailing	Resolution
1	13.080	12583384	49.794	14146	1.103	--
2	15.428	12687278	50.206	13581	1.184	4.844

3d-catalyst I



Peak No.	Time	Area	Area %	Plate number	Tailing	Resolution
1	13.090	1950434	13.698	15959	1.004	--
2	15.422	12288218	86.302	14012	1.184	4.984