

Phospha-Michael Addition to N-Aryl Maleimides Employing N-Heterocyclic Phosphine-Thiourea as Phosphonylation Reagent: Synthesis of 1-Aryl-Pyrrolidine-2,5-Diones

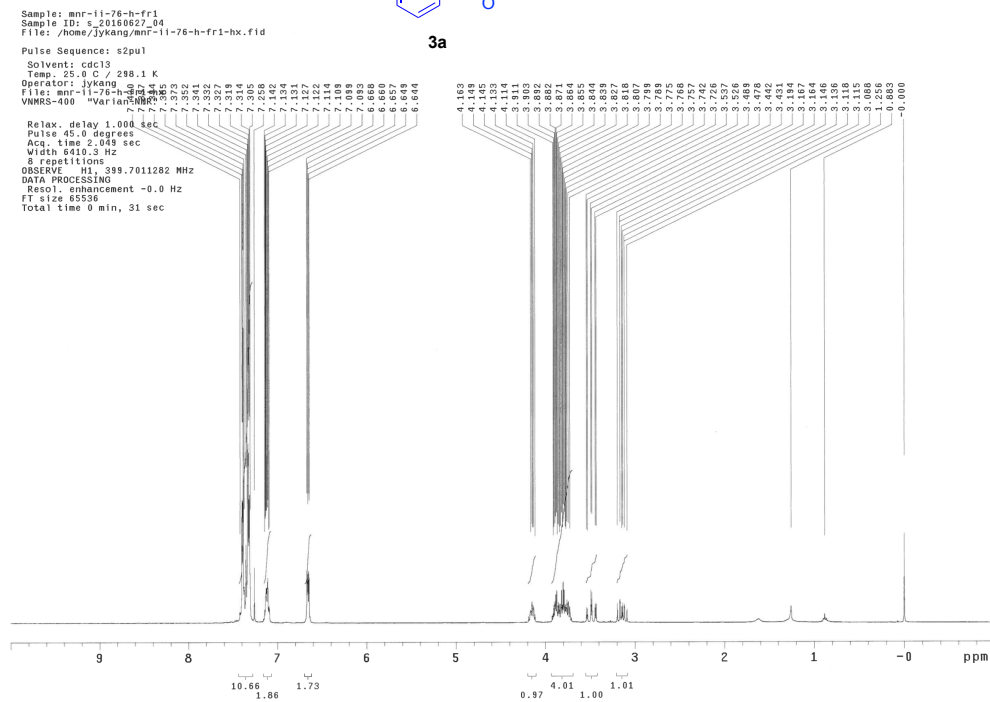
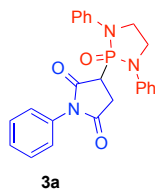
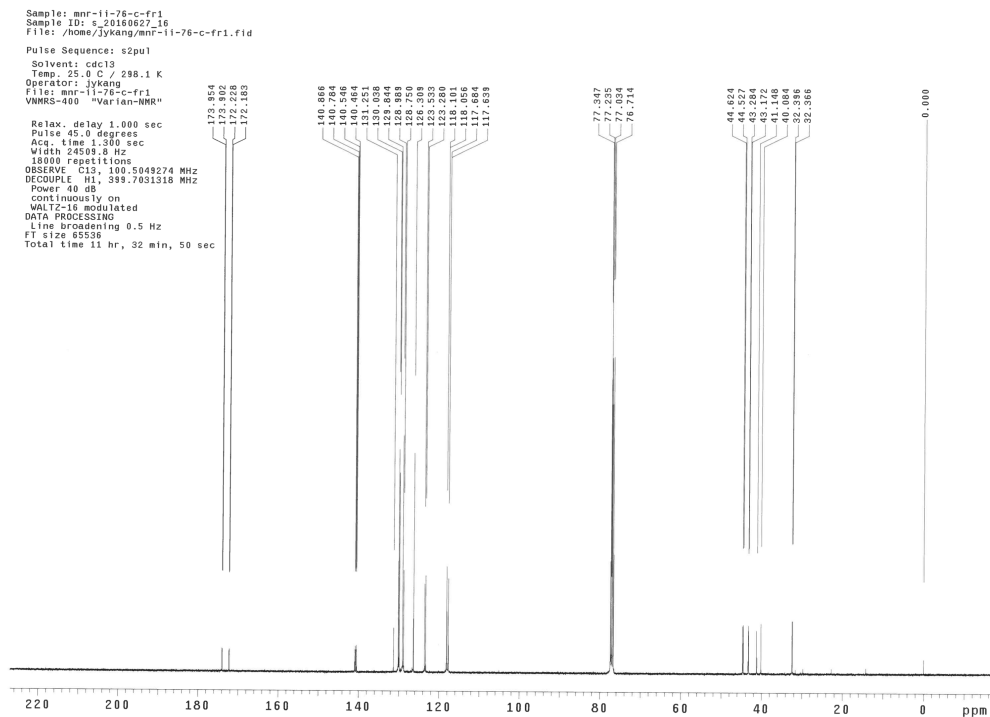
Nagaraju Molleti, Chad Bjornberg and Jun Yong Kang*

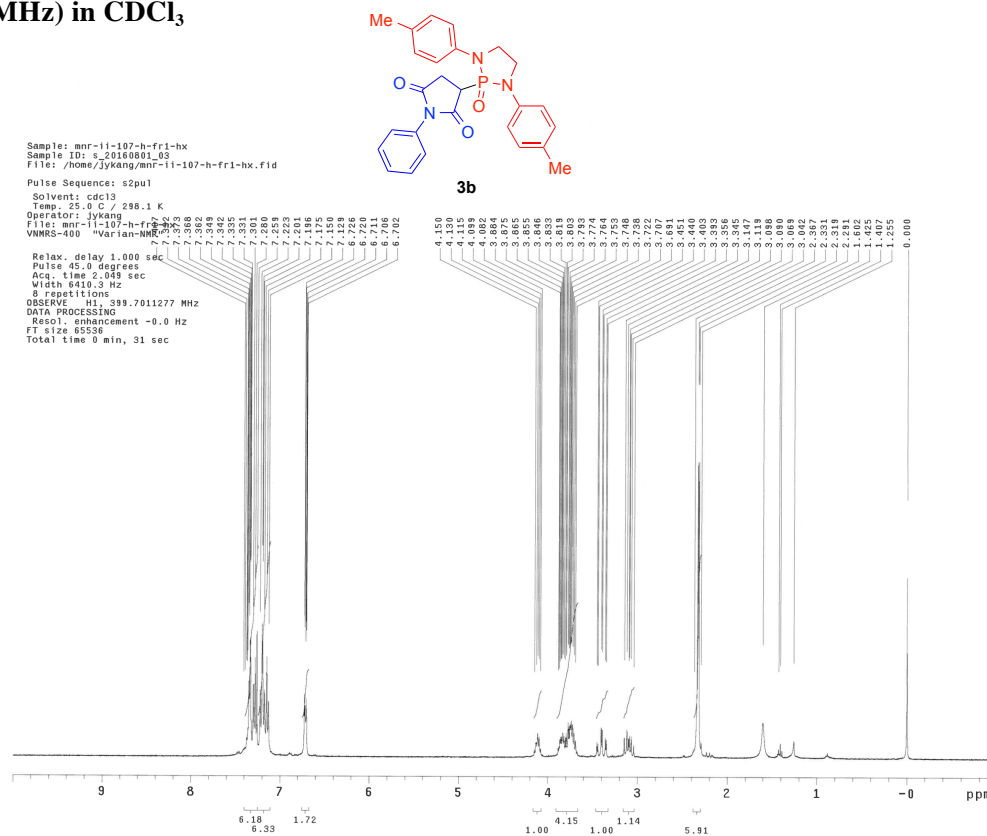
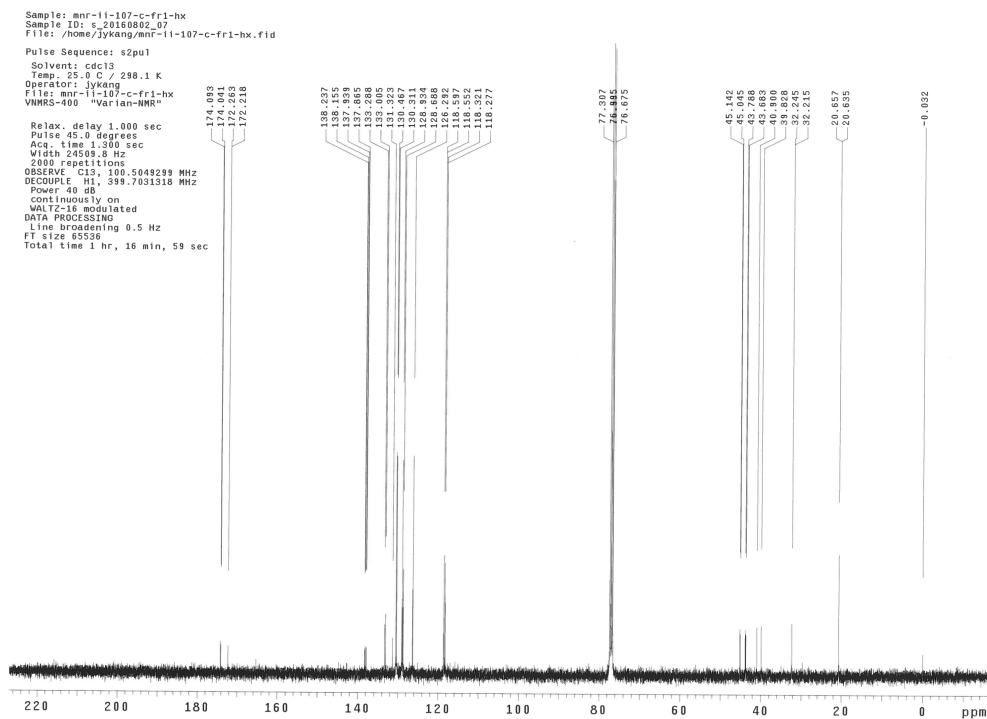
Department of Chemistry and Biochemistry, University of Nevada Las Vegas,
4505 S. Maryland Parkway, Las Vegas, Nevada, 89154-4003, United States

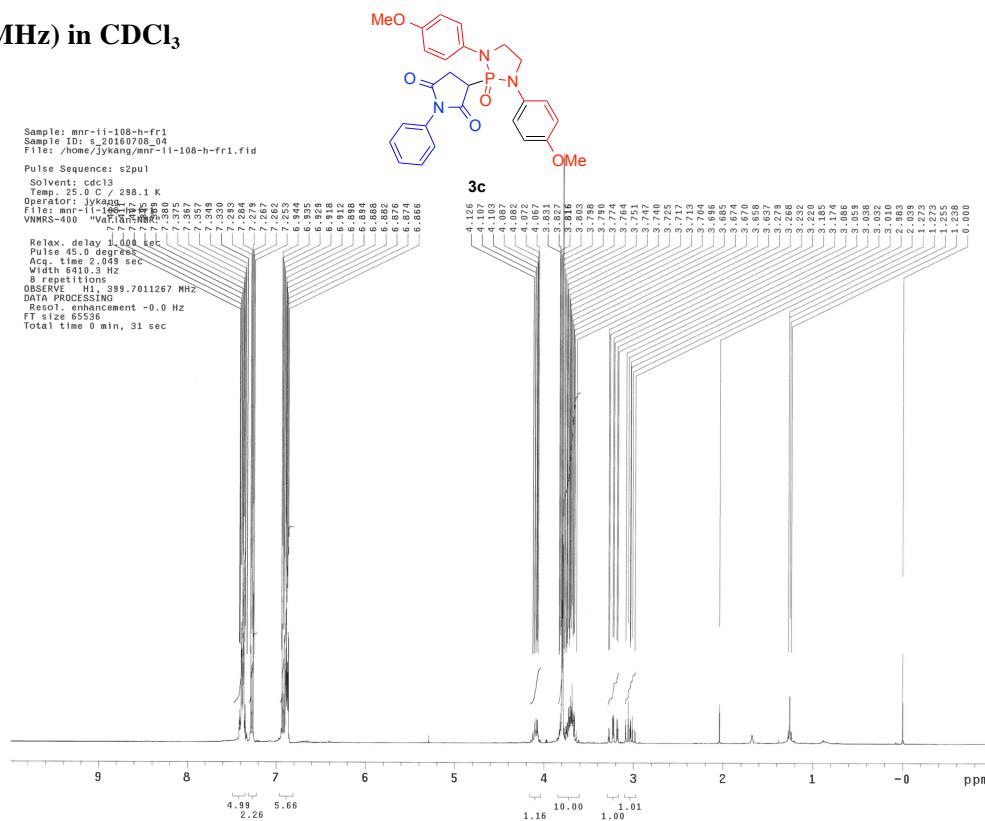
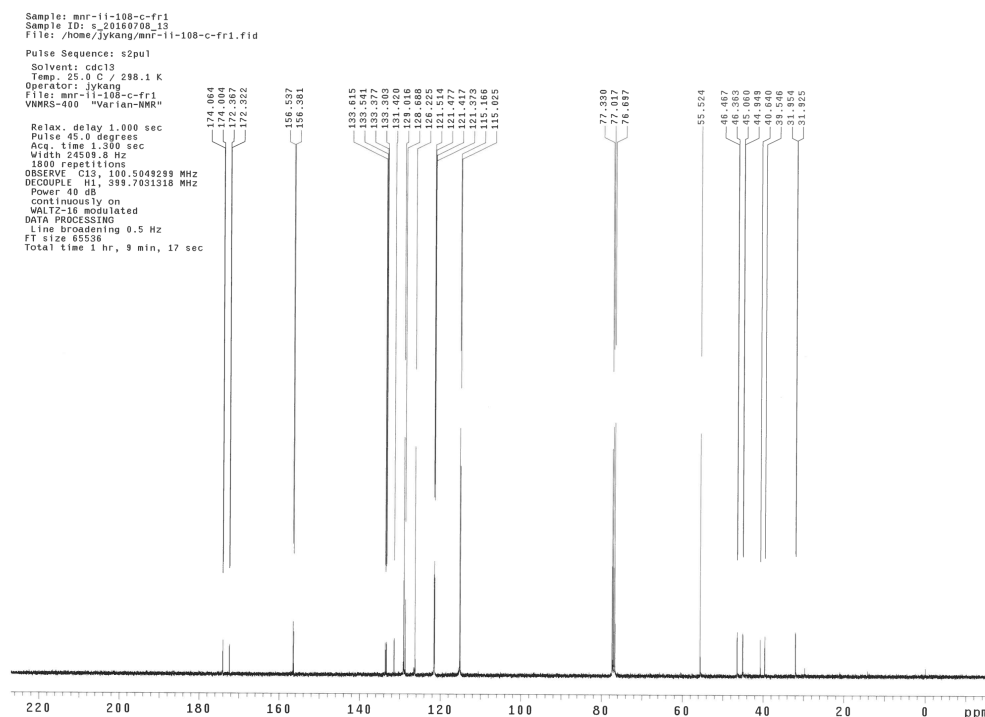
E-mail: junyong.kang@unlv.edu.

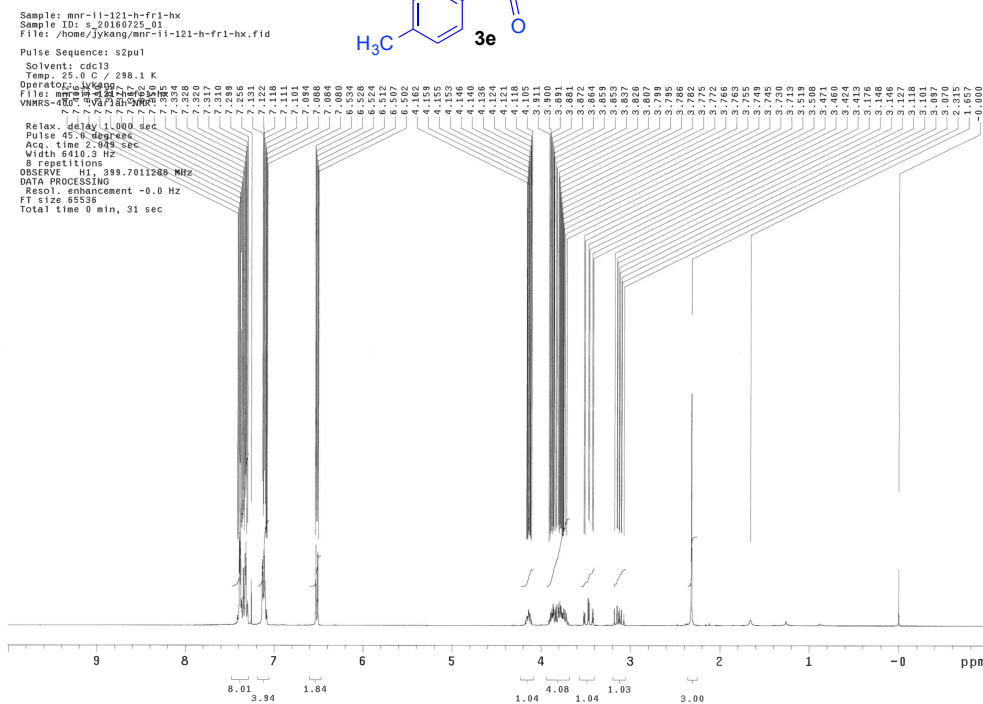
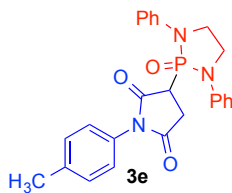
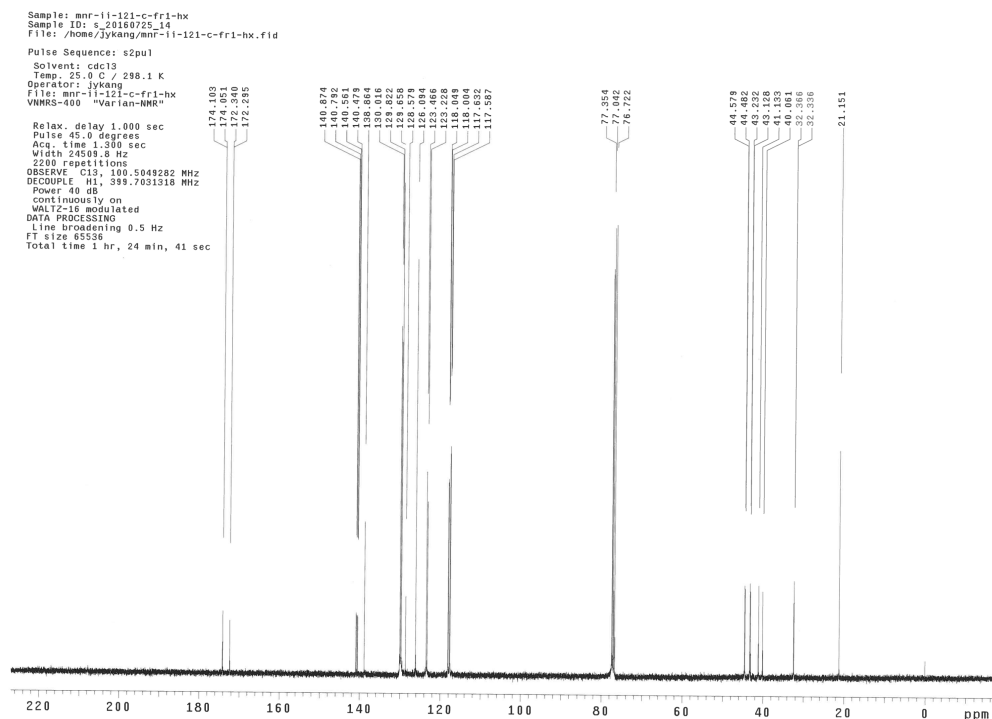
Supporting Information

¹H and ¹³C NMR Spectra.....S2-26

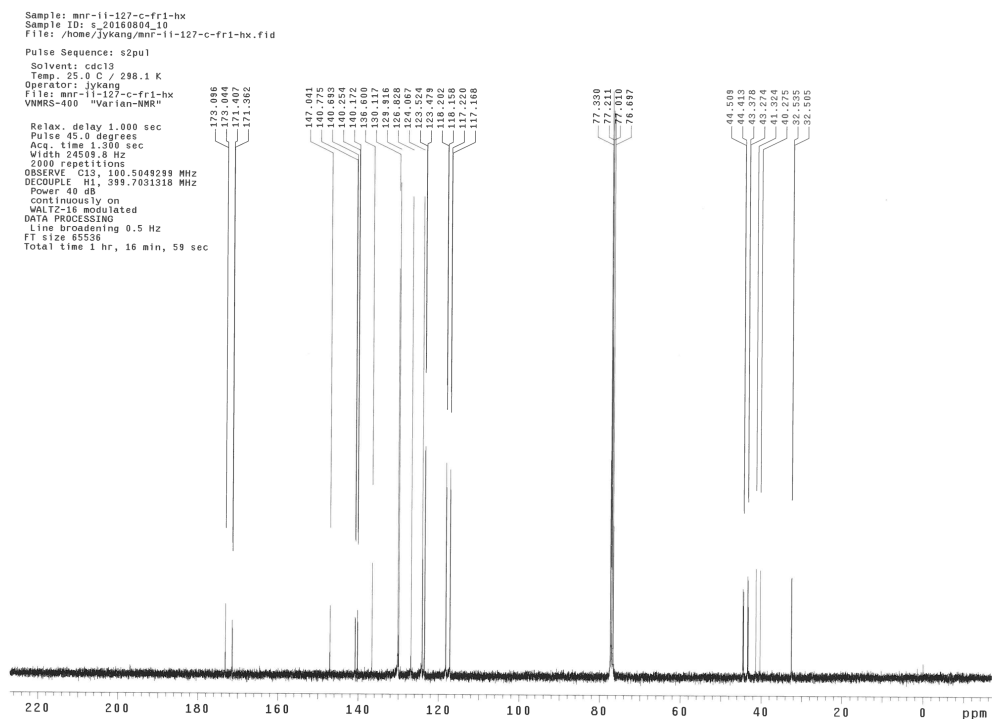
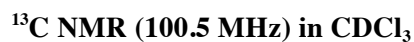
¹H NMR (400 MHz) in CDCl₃**¹³C NMR (100.5 MHz) in CDCl₃**

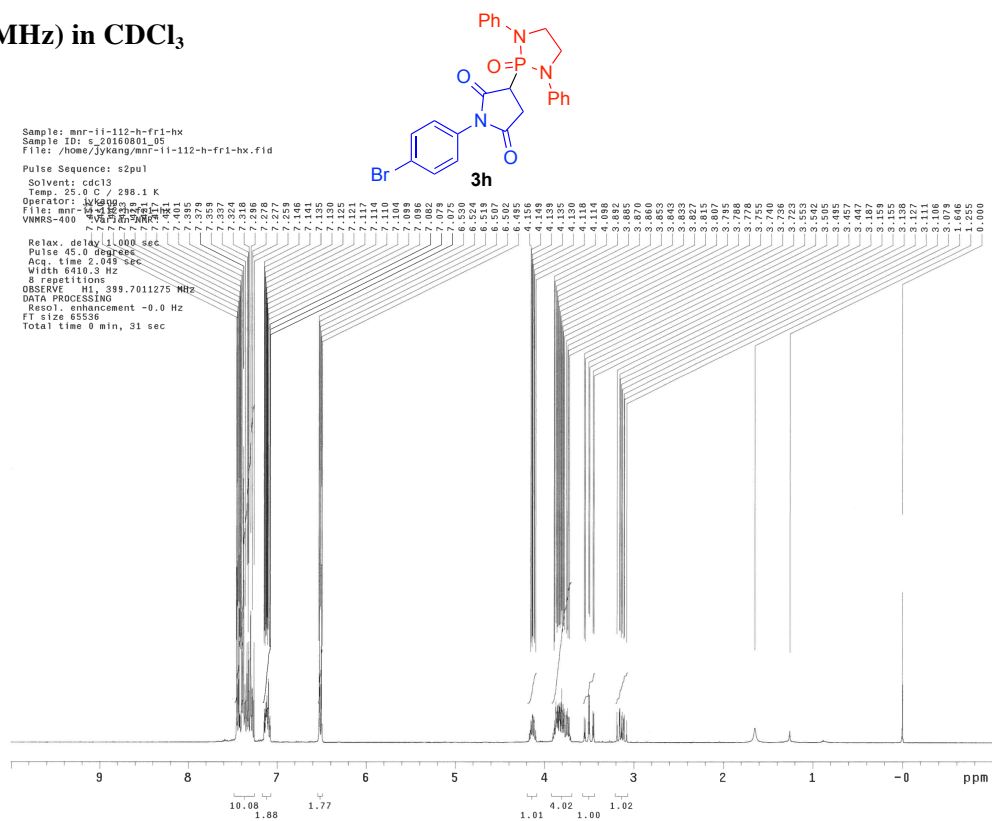
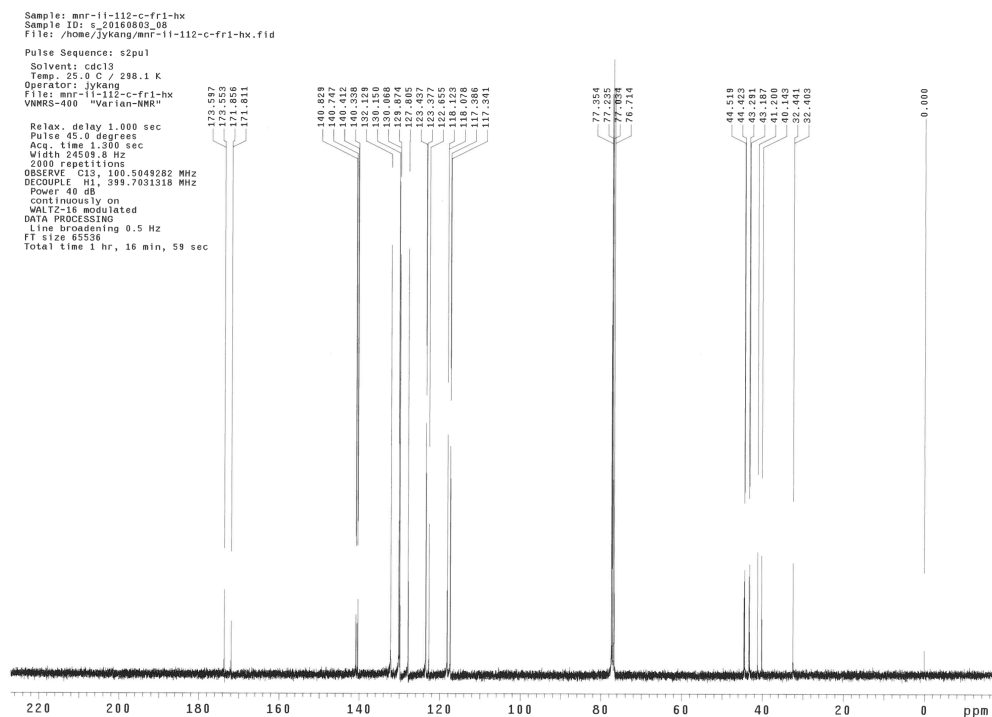
¹H NMR (400 MHz) in CDCl₃**¹³C NMR (100.5 MHz) in CDCl₃**

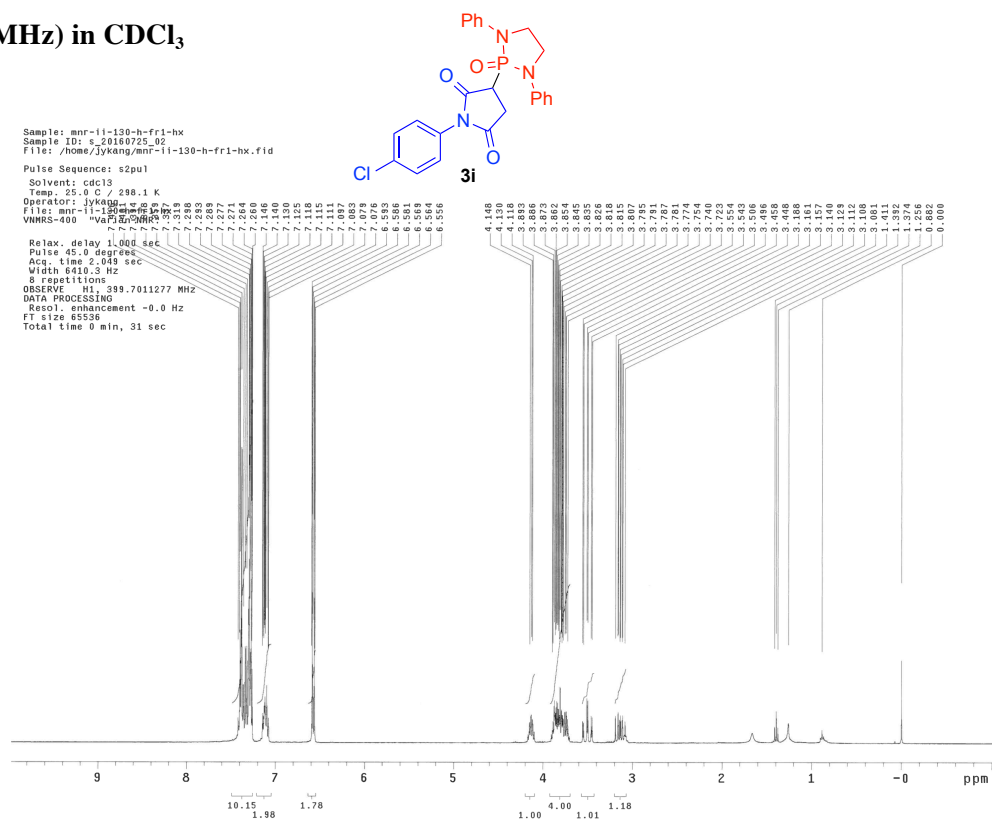
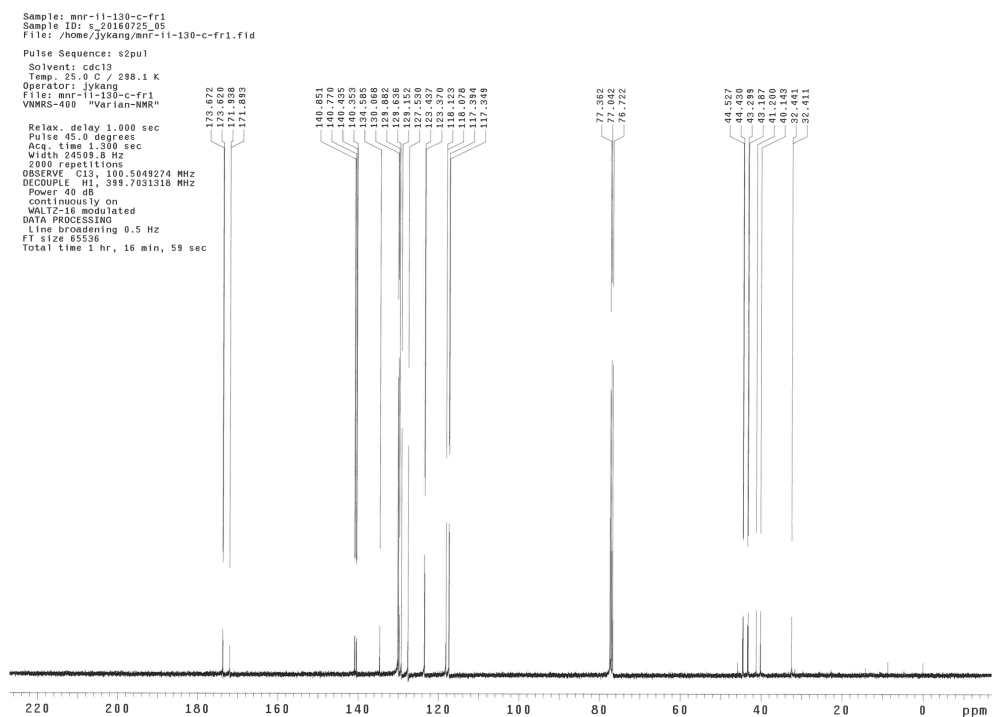
¹H NMR (400 MHz) in CDCl₃¹³C NMR (100.5 MHz) in CDCl₃

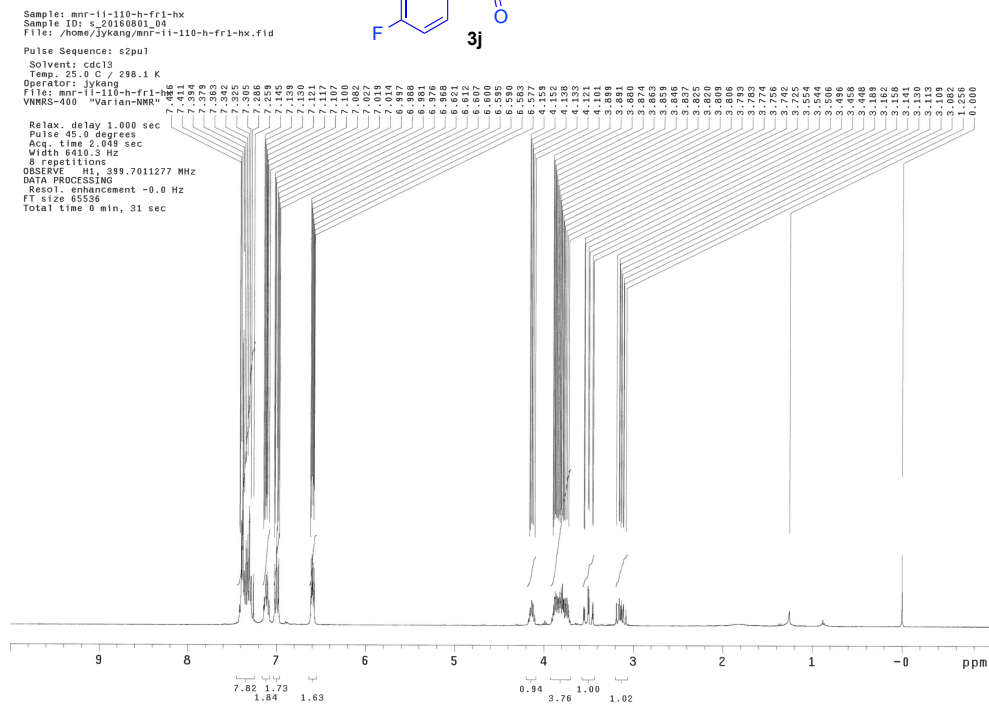
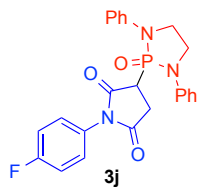
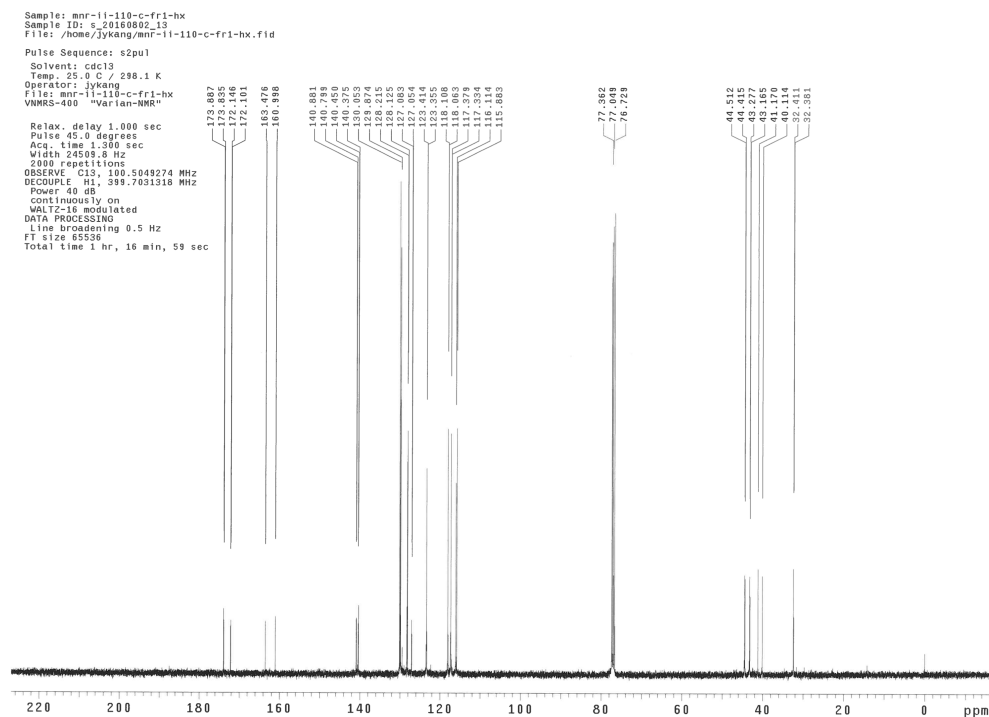
¹H NMR (400 MHz) in CDCl₃¹³C NMR (100.5 MHz) in CDCl₃

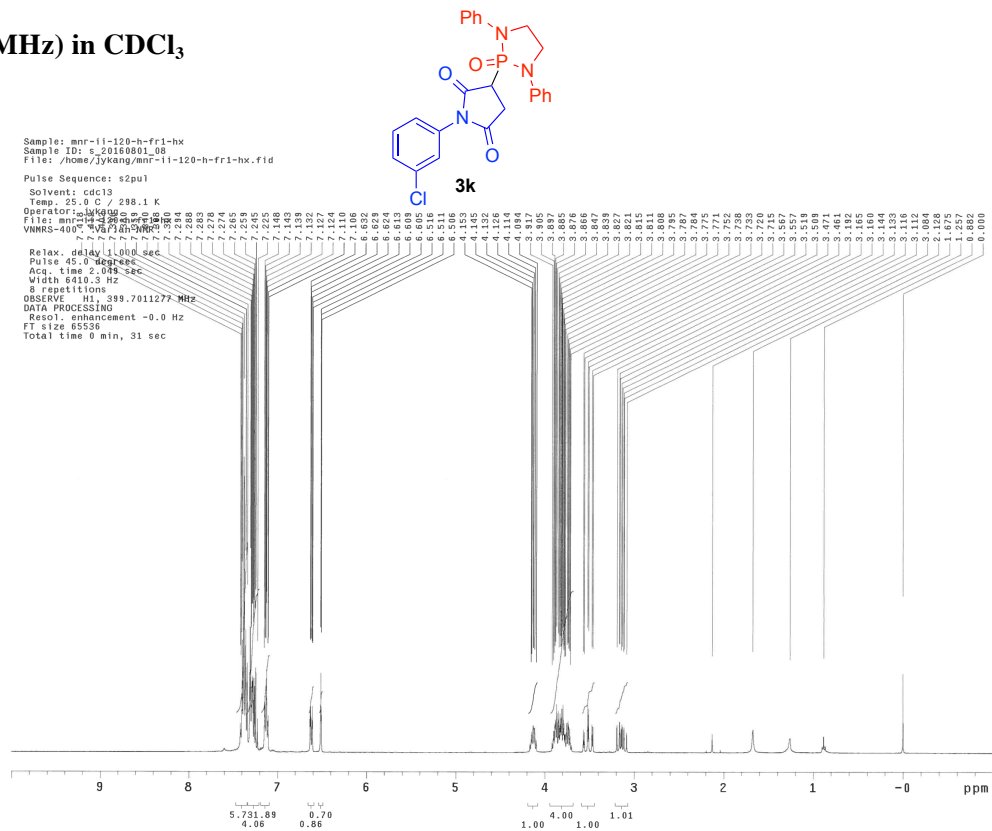
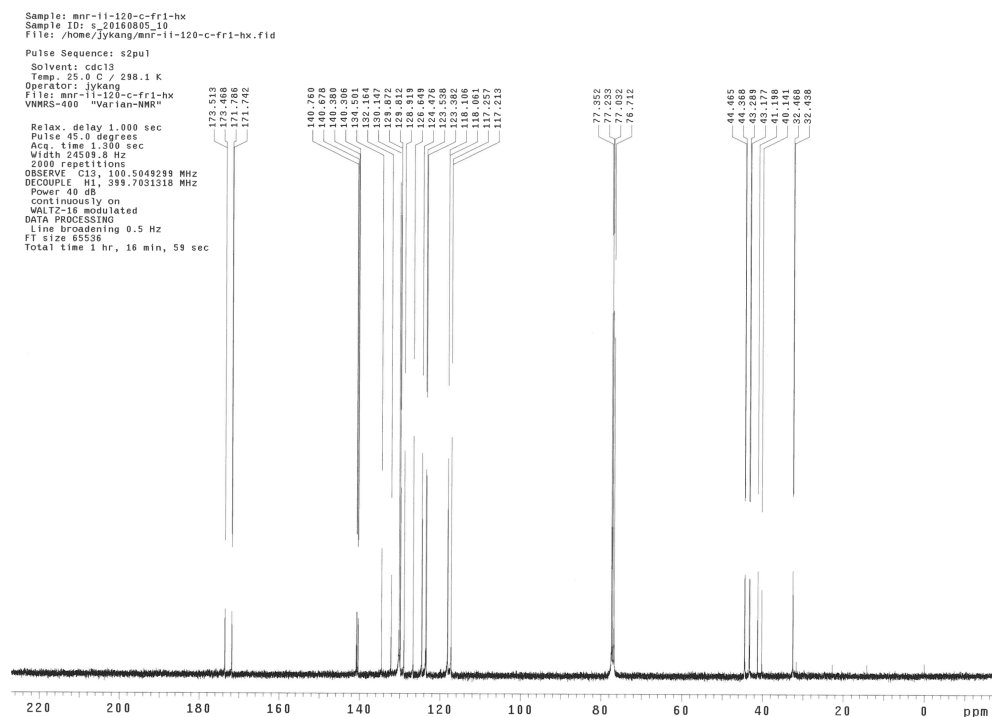
3g

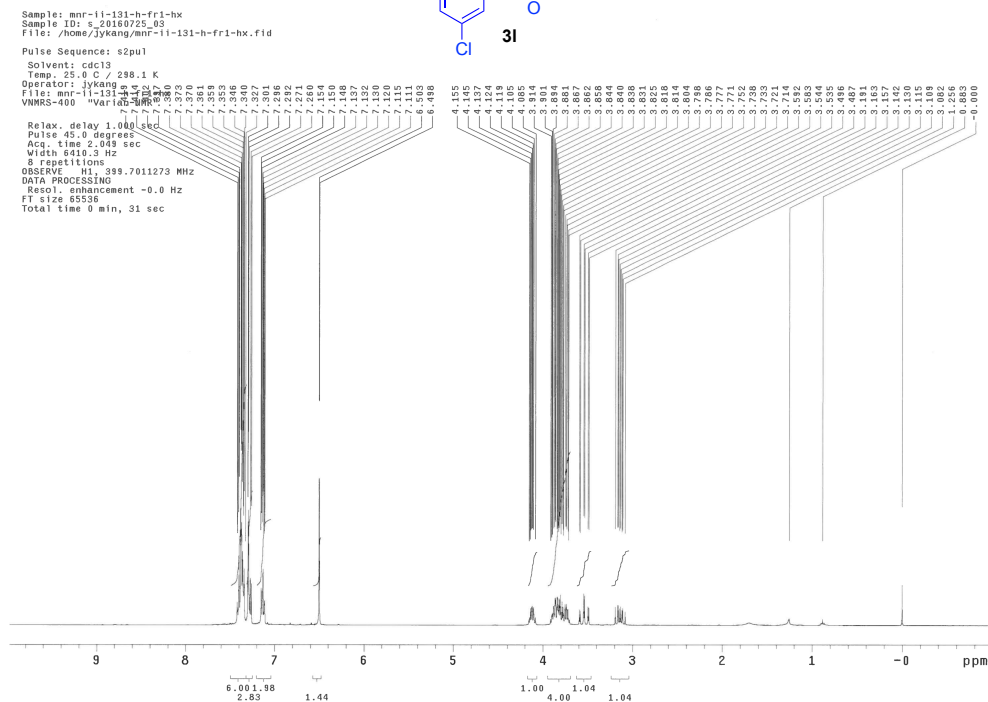
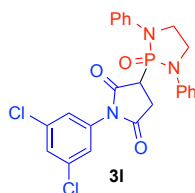
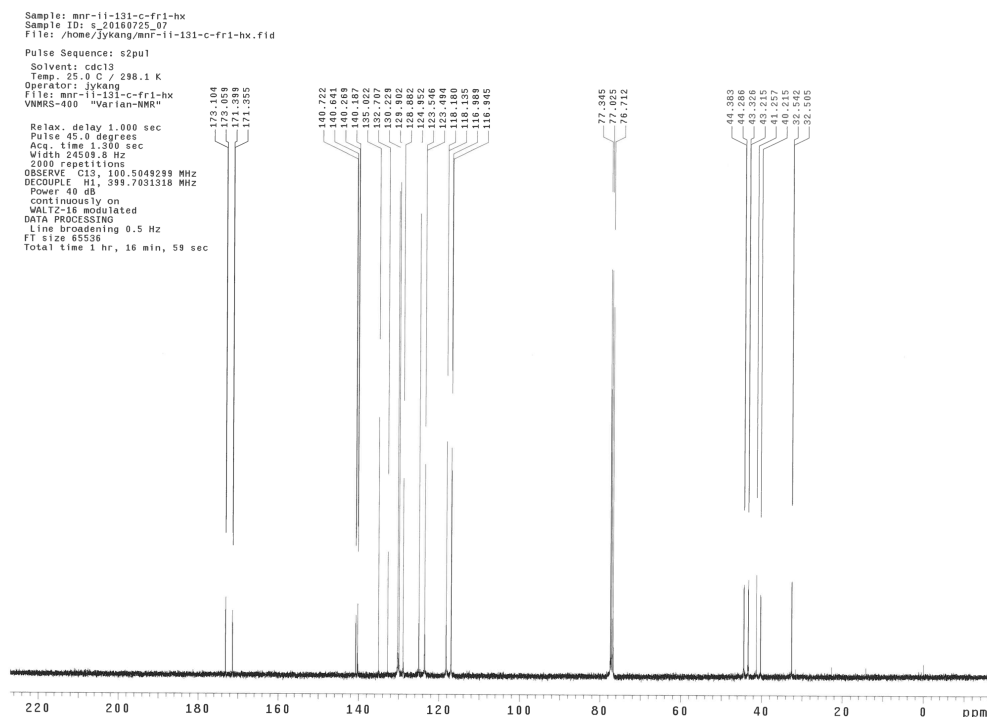


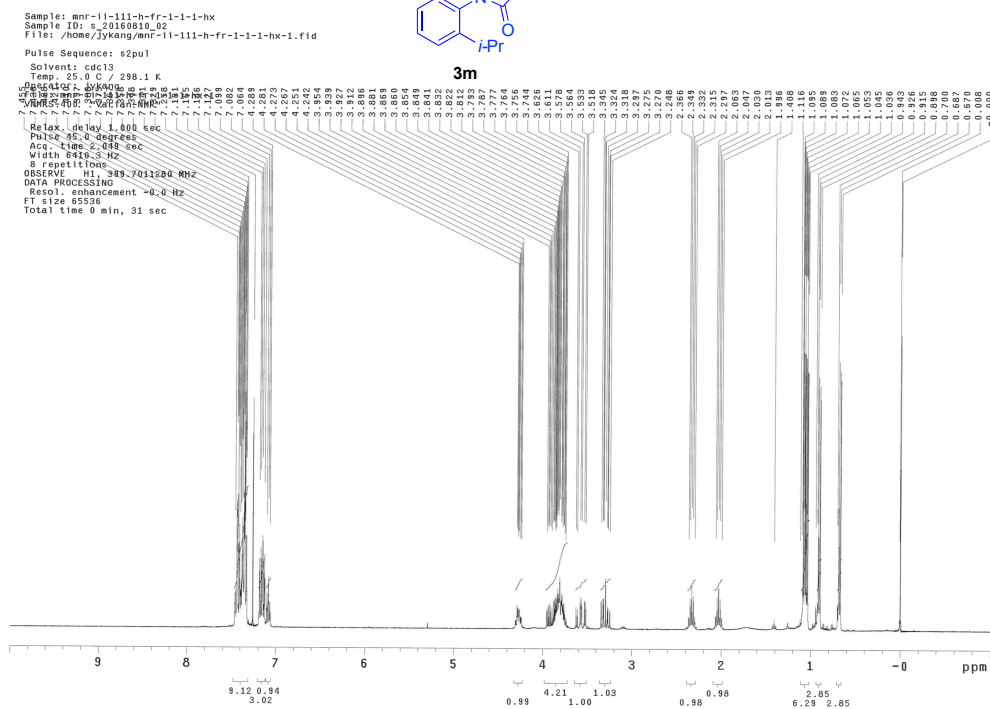
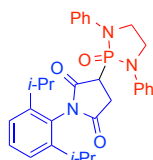
¹H NMR (400 MHz) in CDCl₃¹³C NMR (100.5 MHz) in CDCl₃

¹H NMR (400 MHz) in CDCl₃**¹³C NMR (100.5 MHz) in CDCl₃**

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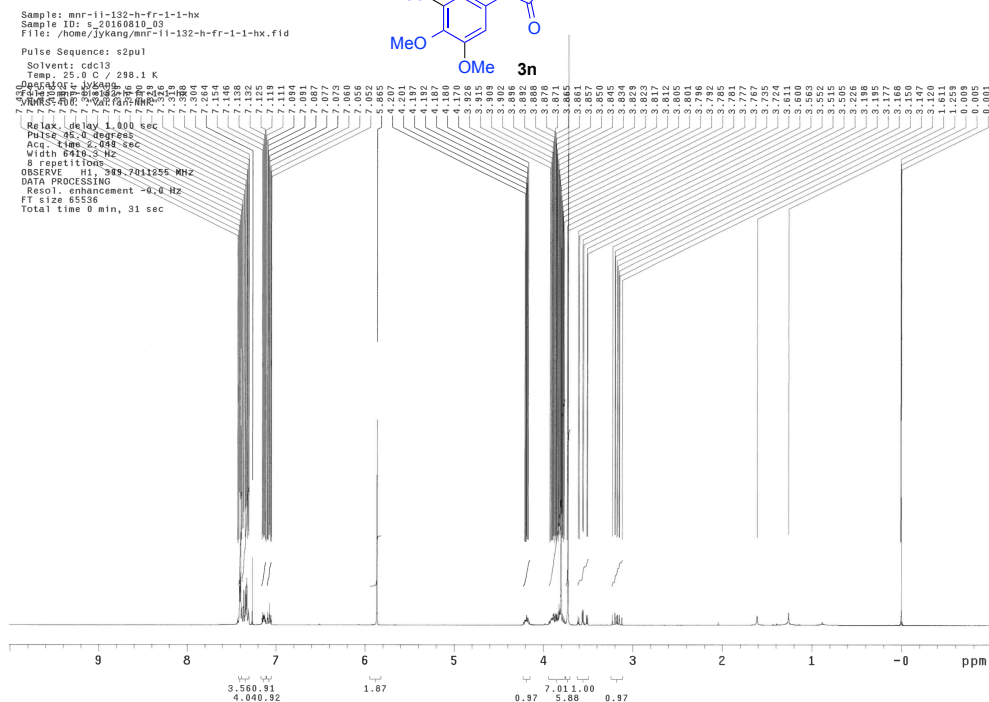
¹H NMR (400 MHz) in CDCl₃¹³C NMR (100.5 MHz) in CDCl₃

¹H NMR (400 MHz) in CDCl₃**¹³C NMR (100.5 MHz) in CDCl₃**

¹H NMR (400 MHz) in CDCl₃



3n



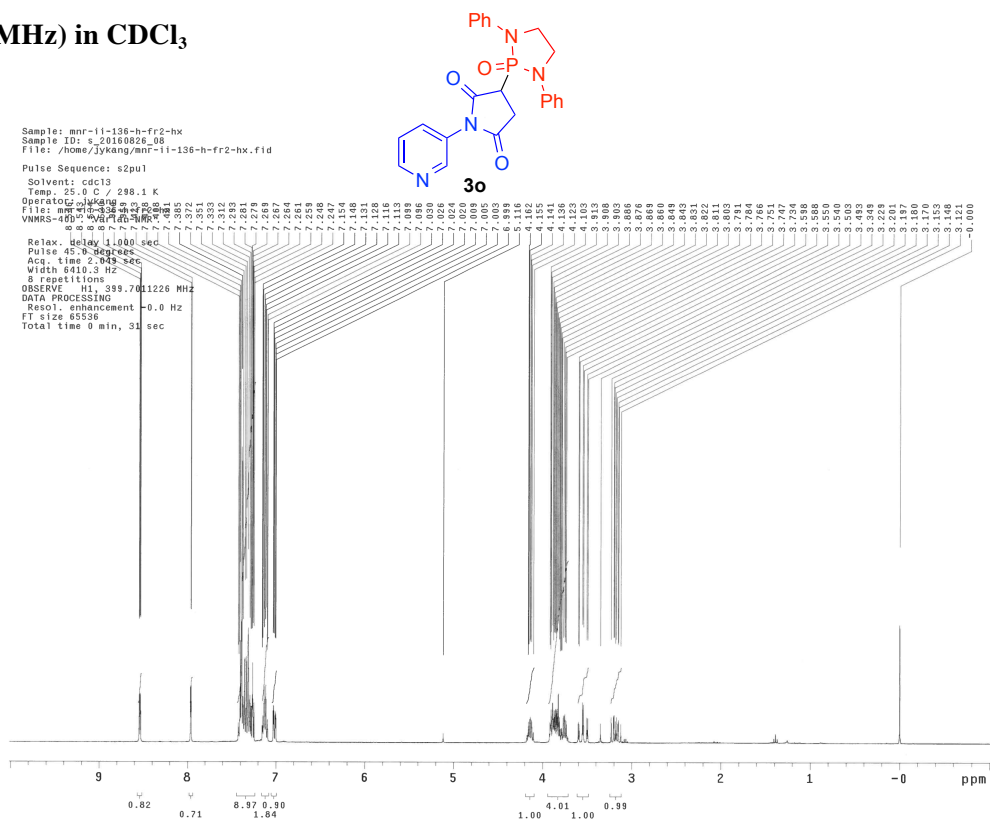
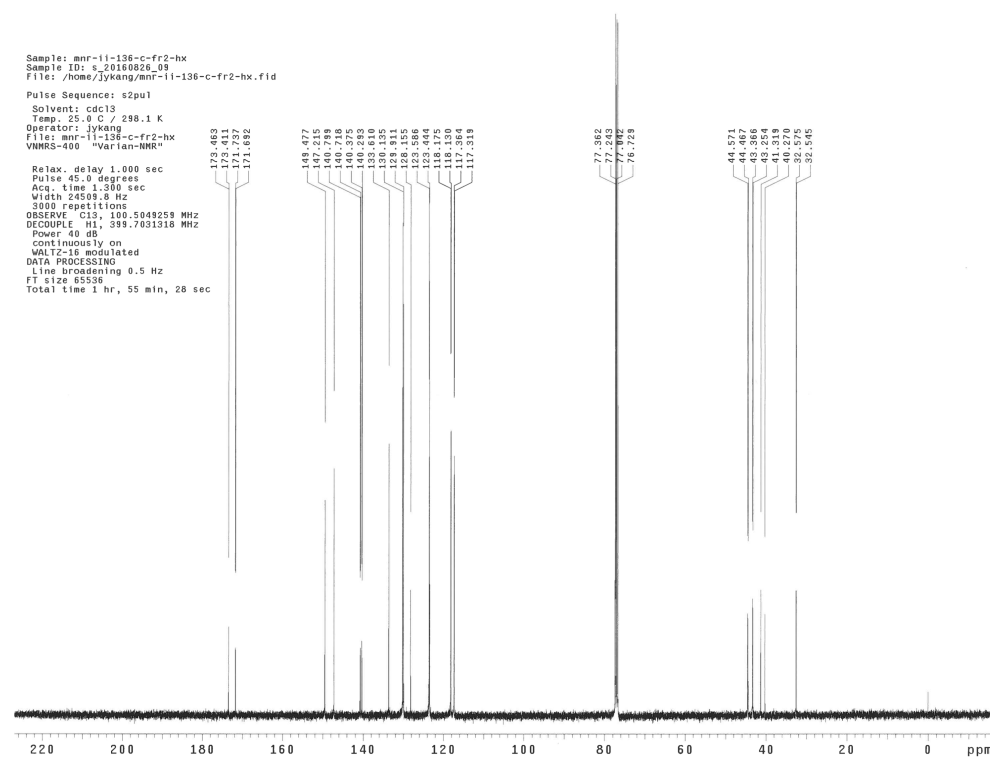
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Sample ID: s_20160819_06
File: /home/jykang/mnrl-11-132-c-fr1-1-hx.fid

Pulse Sequence: s2pul
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Temp: 25.0 C / 298.1 K
Operator: jykang
File: mnrl-11-132-c-fr1-1-hx
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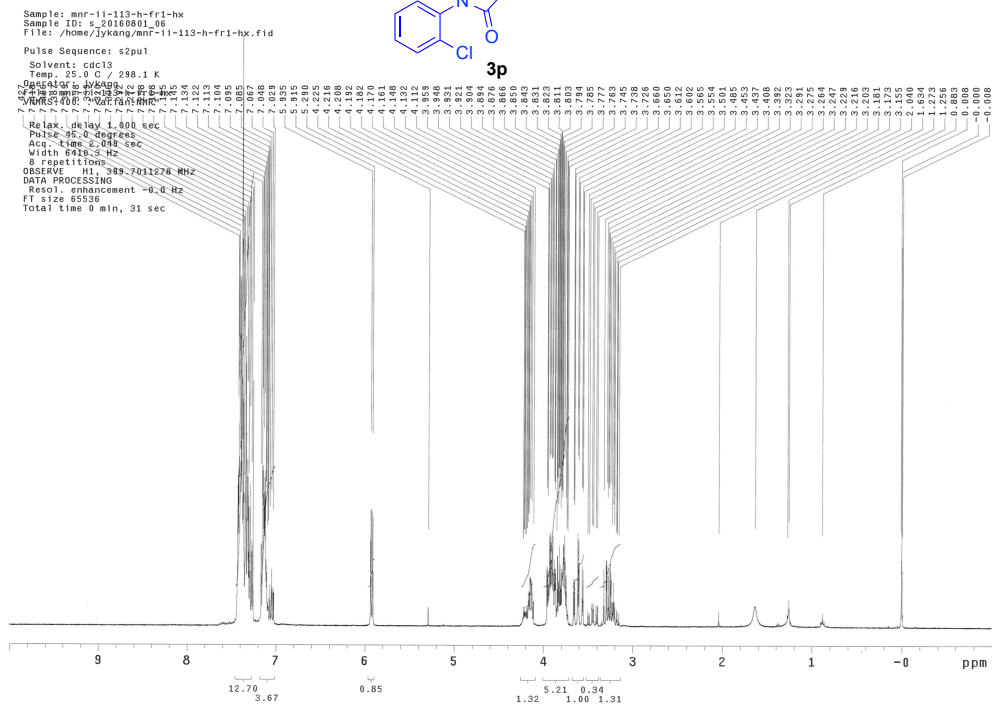
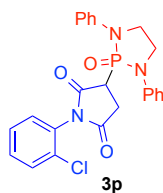
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DECOUPLE H1, 399.7031310 MHz
Power 40 dB
continuously on
WALTZ-16 modulated
DATA PROCESSING
Line broadening 0.5 Hz
FT size 65536
Total time 1 hr, 16 min, 59 sec

174.081
172.421
172.377
153.481
141.045
140.983
140.450
138.321
138.016
136.884
128.689
123.385
123.035
118.056
117.007
110.302
104.005
77.382
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32.483
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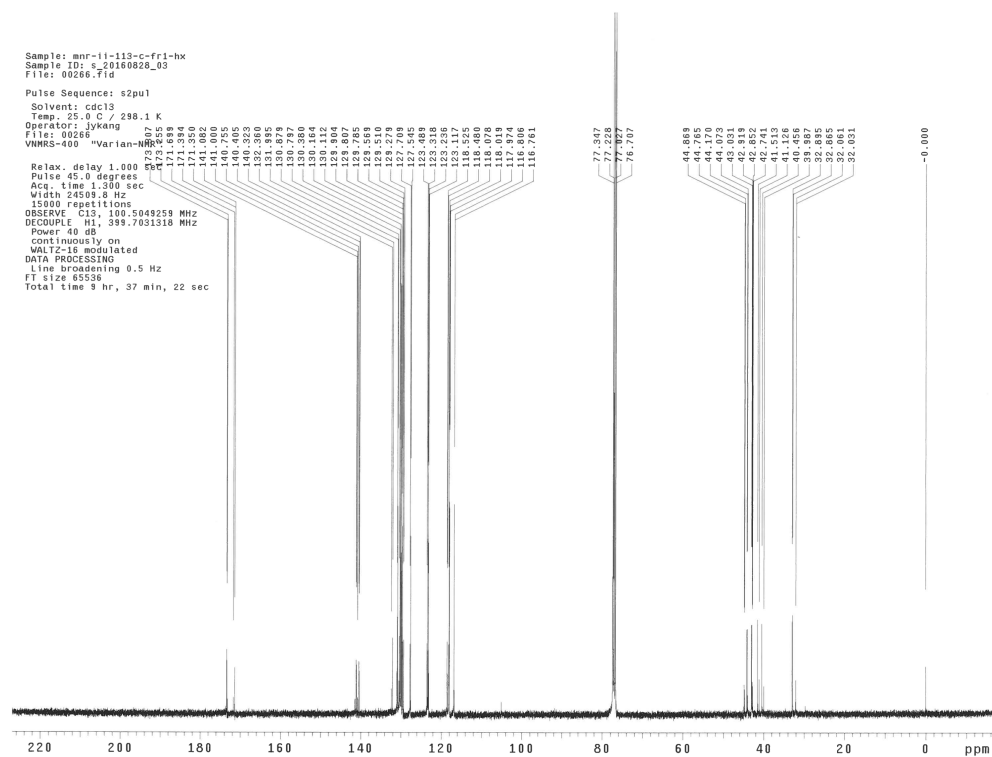
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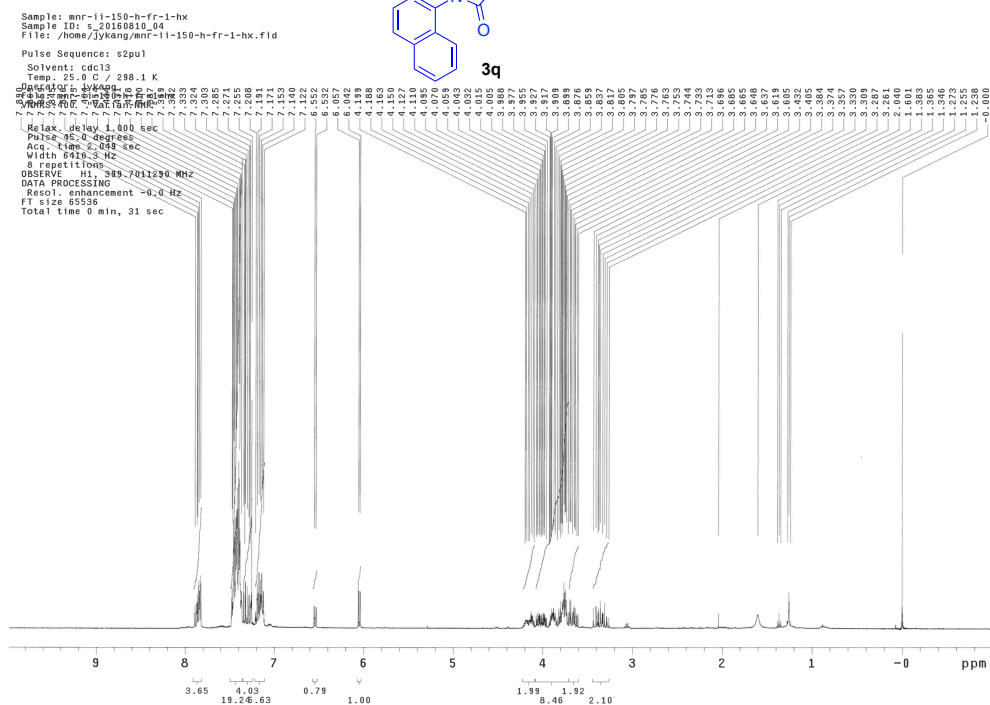
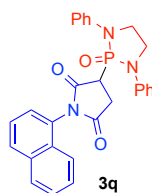
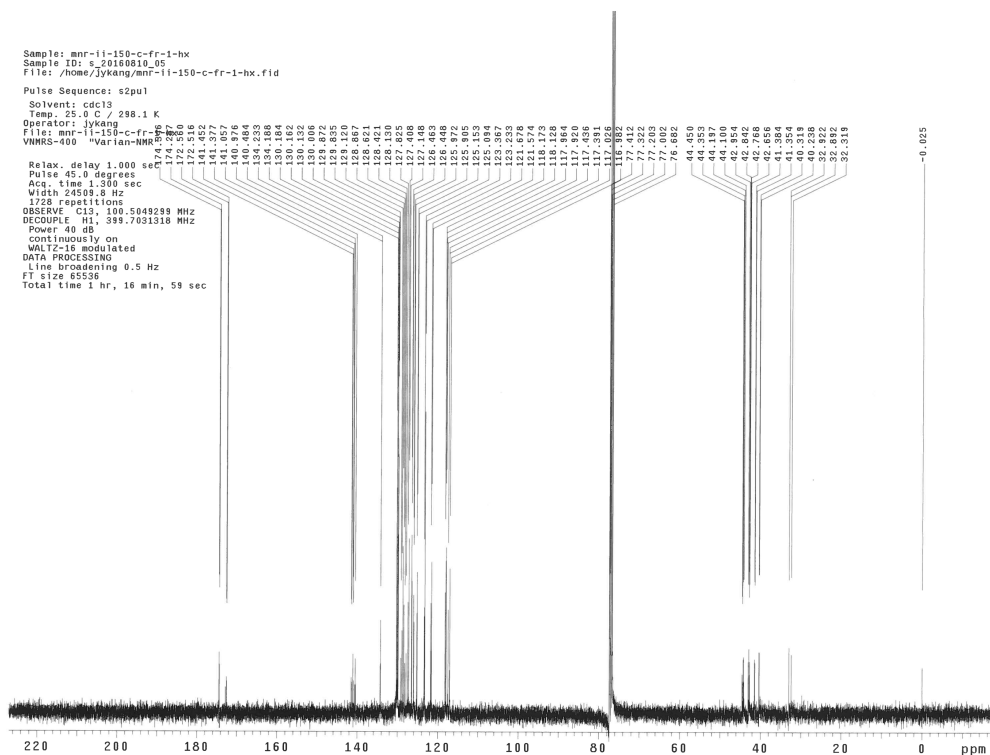
¹H NMR (400 MHz) in CDCl₃¹³C NMR (100.5 MHz) in CDCl₃

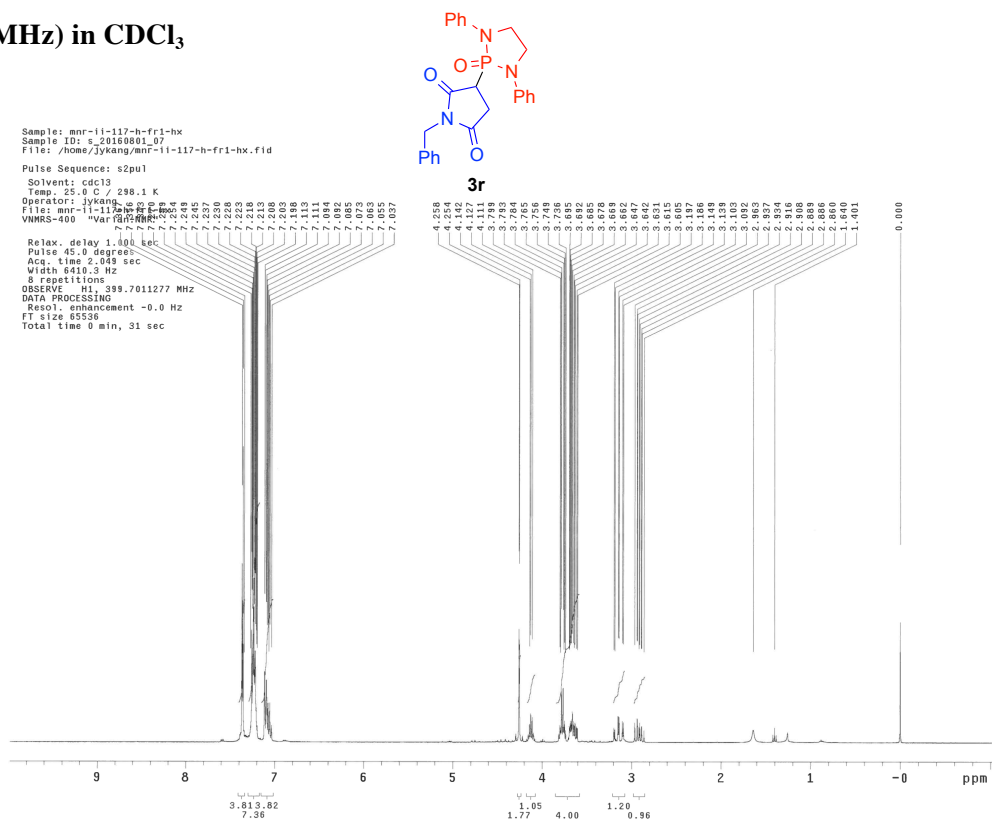
¹H NMR (400 MHz) in CDCl₃

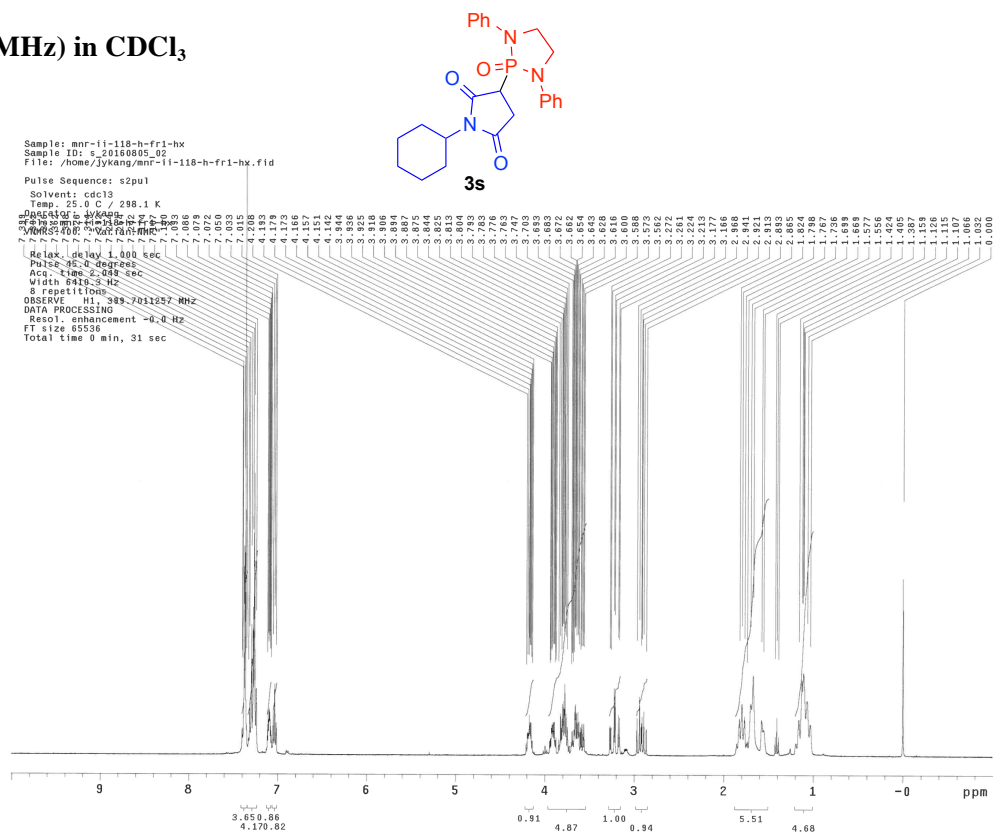
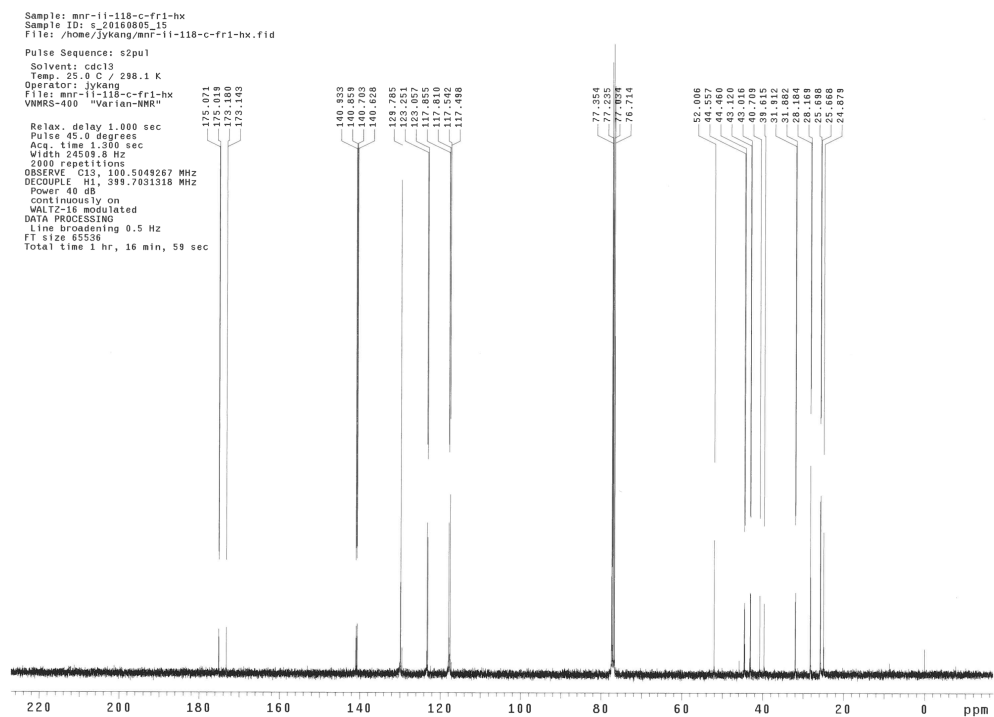


^{13}C NMR (100.5 MHz) in CDCl_3



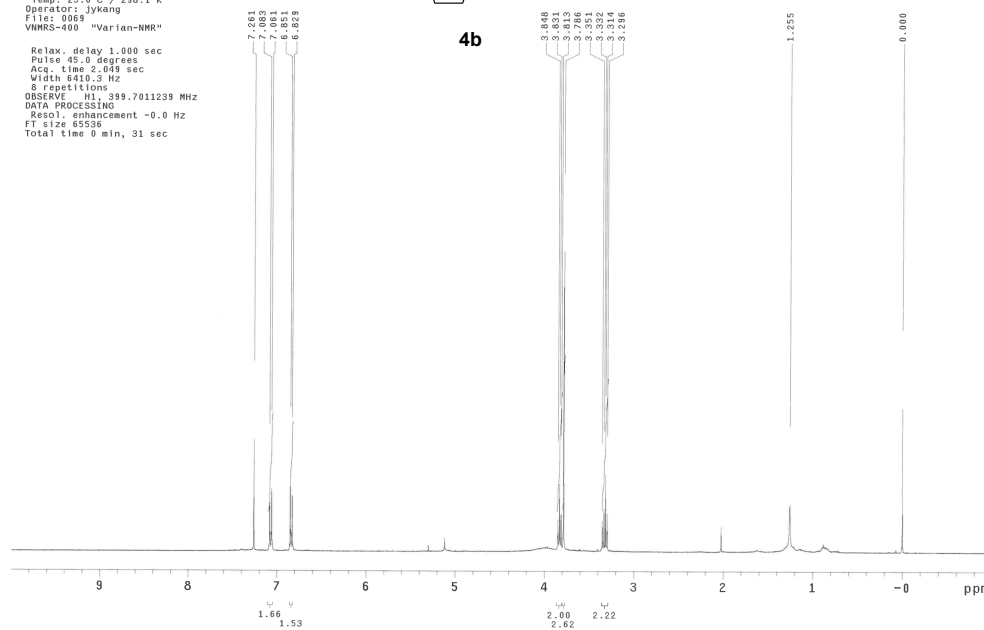
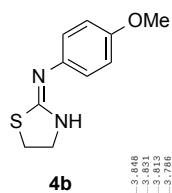
¹H NMR (400 MHz) in CDCl₃¹³C NMR (100.5 MHz) in CDCl₃

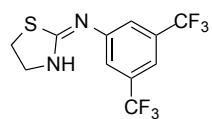
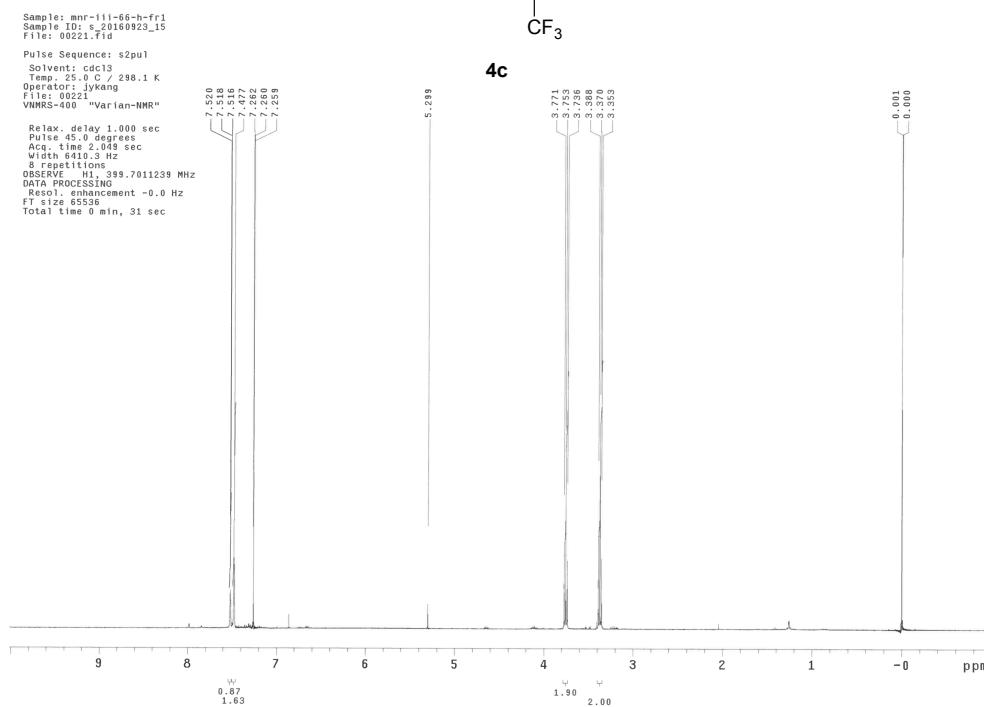
¹H NMR (400 MHz) in CDCl₃

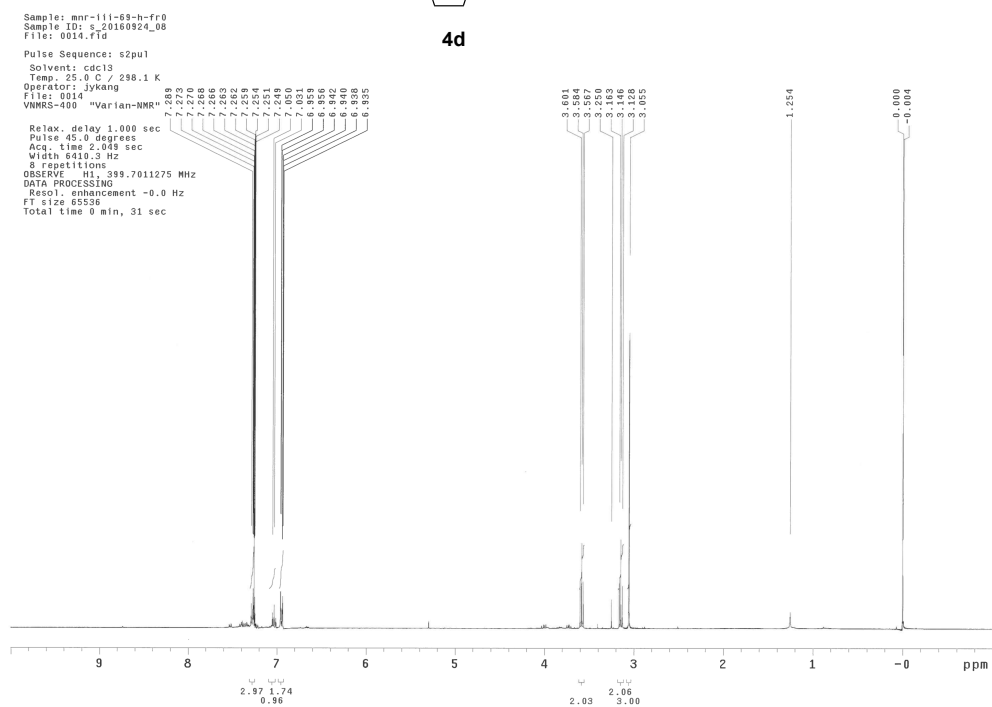
¹H NMR (400 MHz) in CDCl₃**¹³C NMR (100.5 MHz) in CDCl₃**

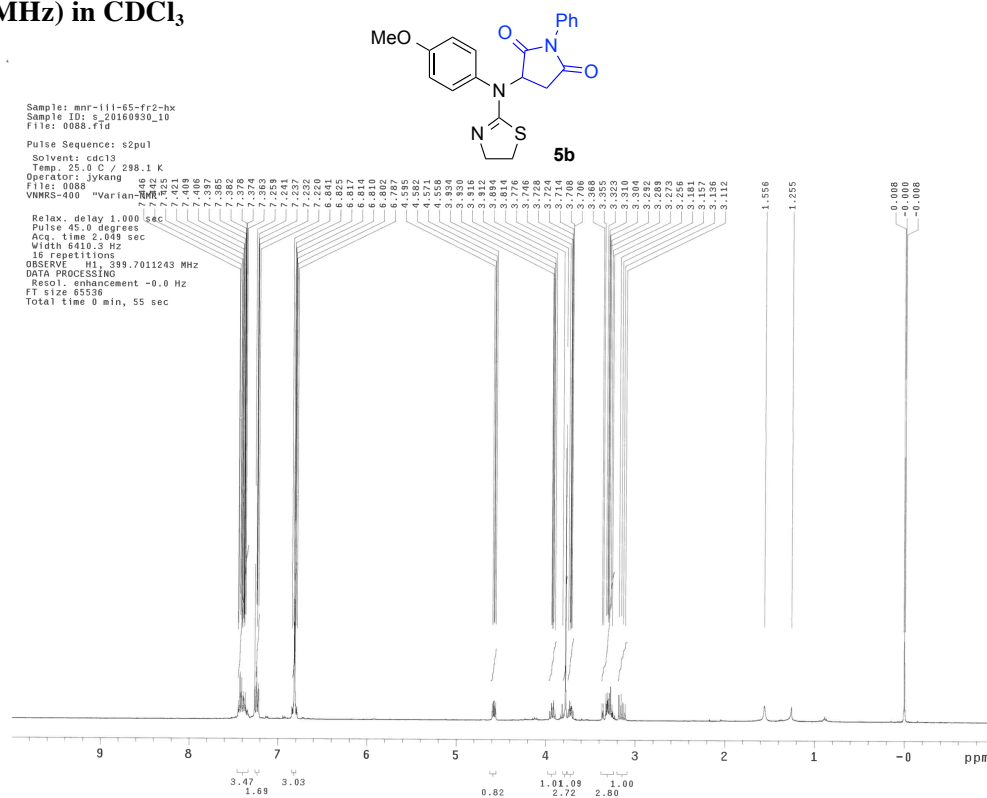
¹H NMR (400 MHz) in CDCl₃

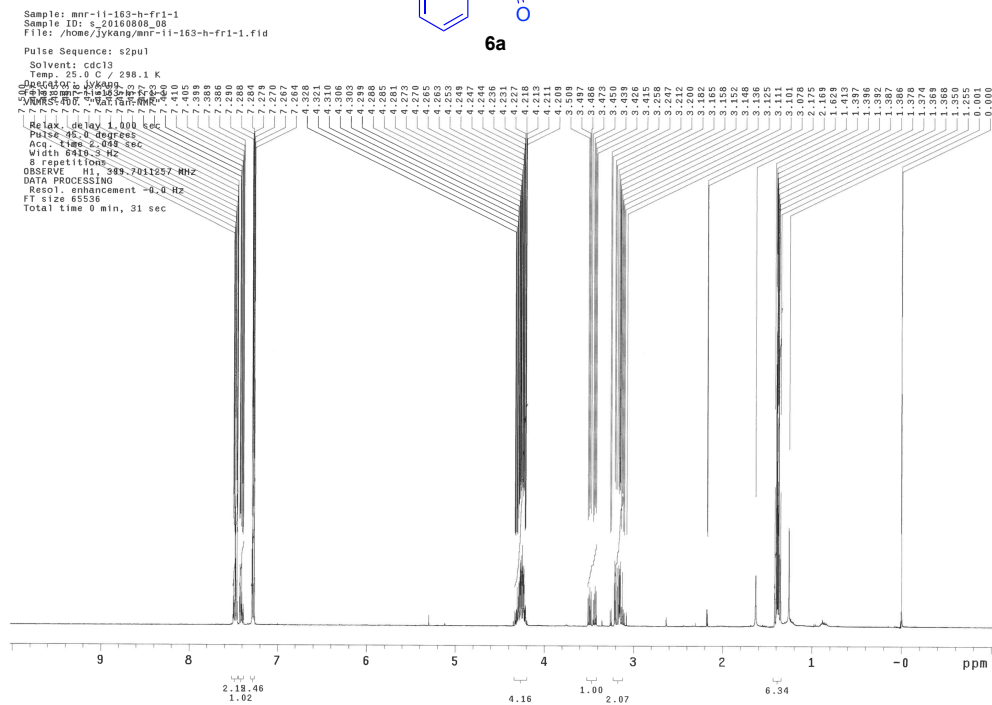
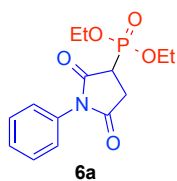
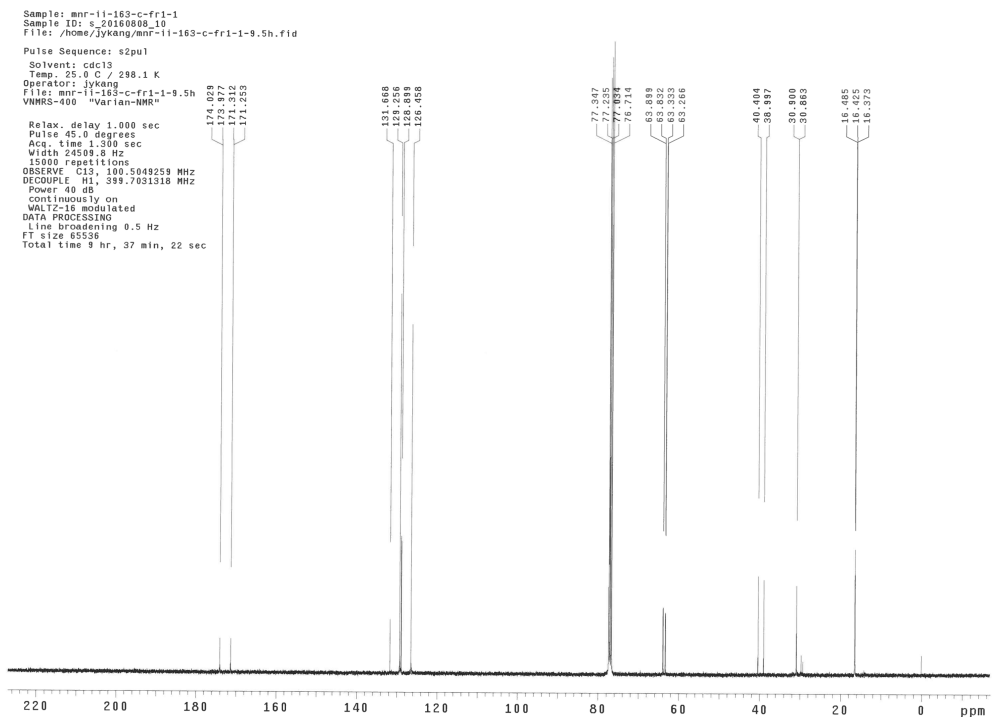
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Sample ID: s_20160929_02
File: 0069.fid
Pulse Sequence: s2pul
Solvents: cdcl3
Temp.: 25.0 C / 298.1 K
Operator: jykang
File: 0069
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Relax. delay 1.000 sec
Pulse 45.0 degrees
Acq. time 2.049 sec
Width 6410.3 Hz
8 repetitions
OBSERVE H1, 399.7011239 MHz
DATA PROCESSING
Resol. enhancement -0.0 Hz
FT size 65536
Total time 0 min, 31 sec

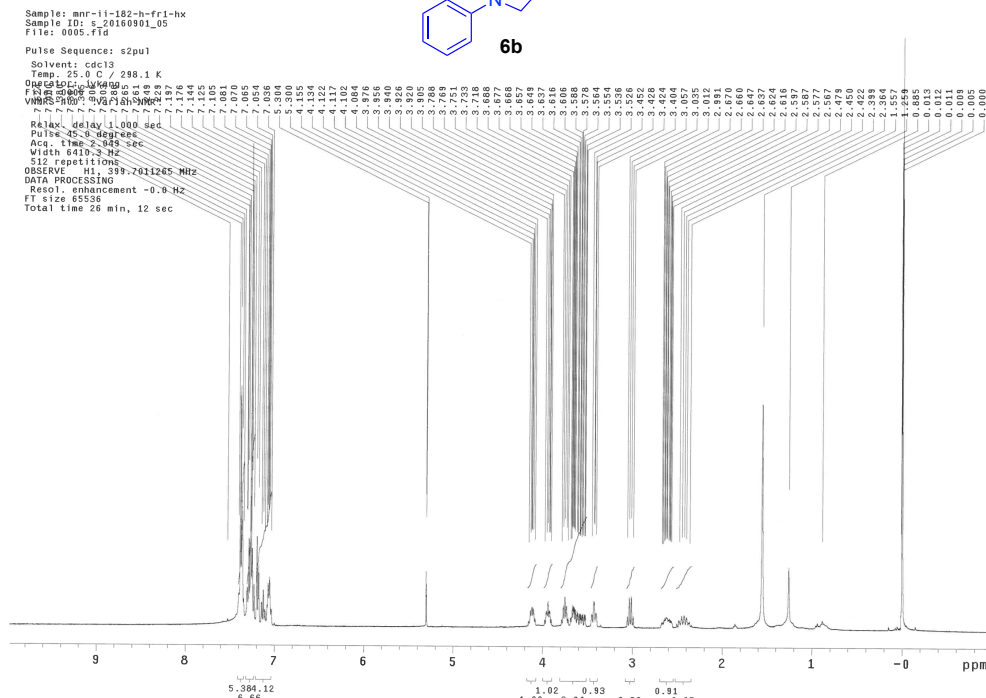
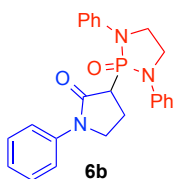


¹H NMR (400 MHz) in CDCl₃**4c**

CN1C(=Nc2ccccc2)SC1
4d

¹H NMR (400 MHz) in CDCl₃

¹H NMR (400 MHz) in CDCl₃¹³C NMR (100.5 MHz) in CDCl₃

¹H NMR (400 MHz) in CDCl₃**¹³C NMR (100.5 MHz) in CDCl₃**