

# Synthesis of $\beta$ -Carbolines through an Electrocyclic Cyclization of 3-Nitrovinylindoles

Nicolai A. Aksenov,<sup>1,\*</sup> Nikolai A. Arutiunov,<sup>1</sup> Alexander V. Aksenov,<sup>1</sup> Nikita K. Kirilov,<sup>1</sup> Inna V. Aksenova,<sup>1</sup> Dmitrii A. Aksenov,<sup>1</sup> Elena V. Aleksandrova,<sup>1</sup> Michael Rubin<sup>1</sup> and Alexander Kornienko<sup>2,\*</sup>

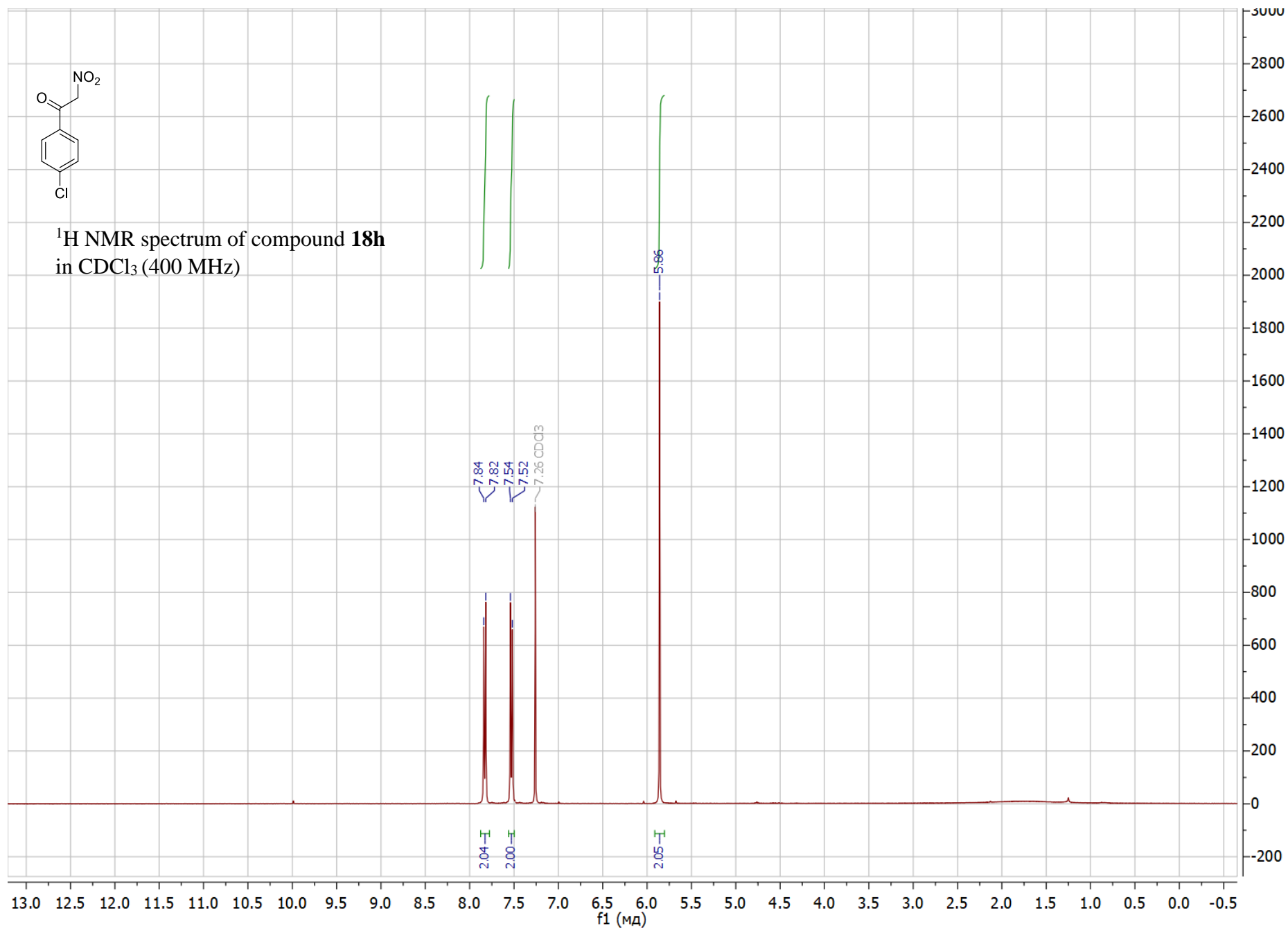
<sup>1</sup> Department of Chemistry, North Caucasus Federal University, 1a Pushkin St., Stavropol 355009, Russia

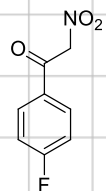
<sup>2</sup> Department of Chemistry and Biochemistry, Texas State University, 601 University Dr., San Marcos, Texas 78666, USA

\* To whom correspondence should be addressed: [naksenov@ncfu.edu](mailto:naksenov@ncfu.edu); [a\\_k76@txstate.edu](mailto:a_k76@txstate.edu)

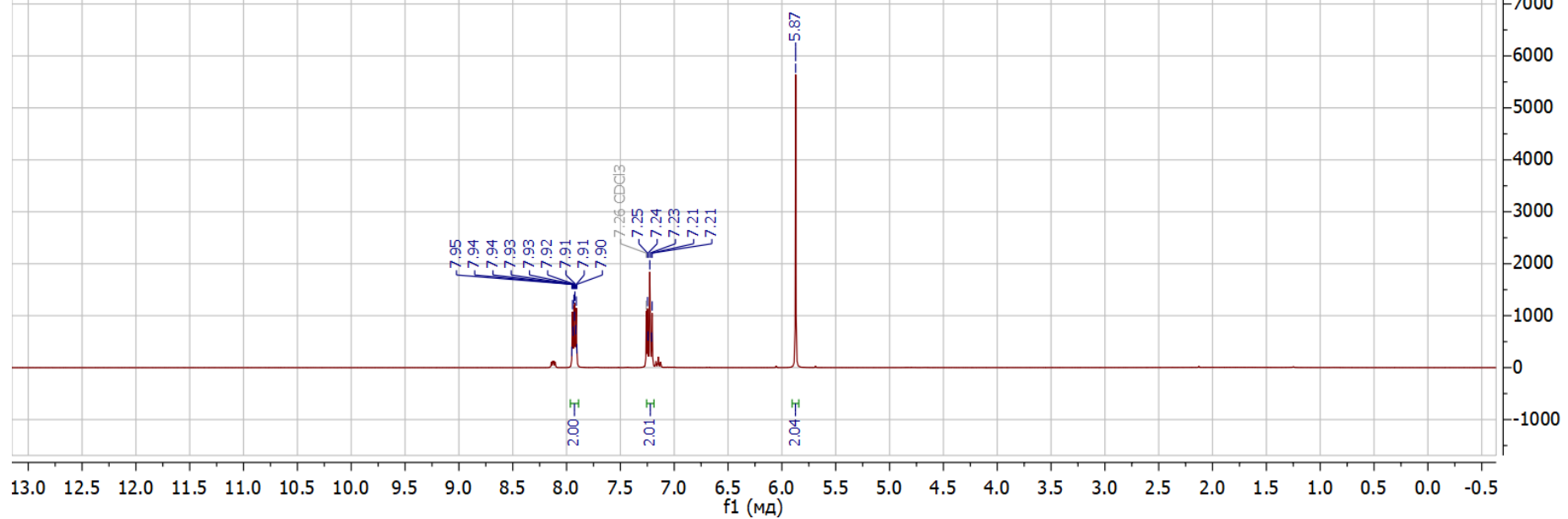
## Supplementary Materials

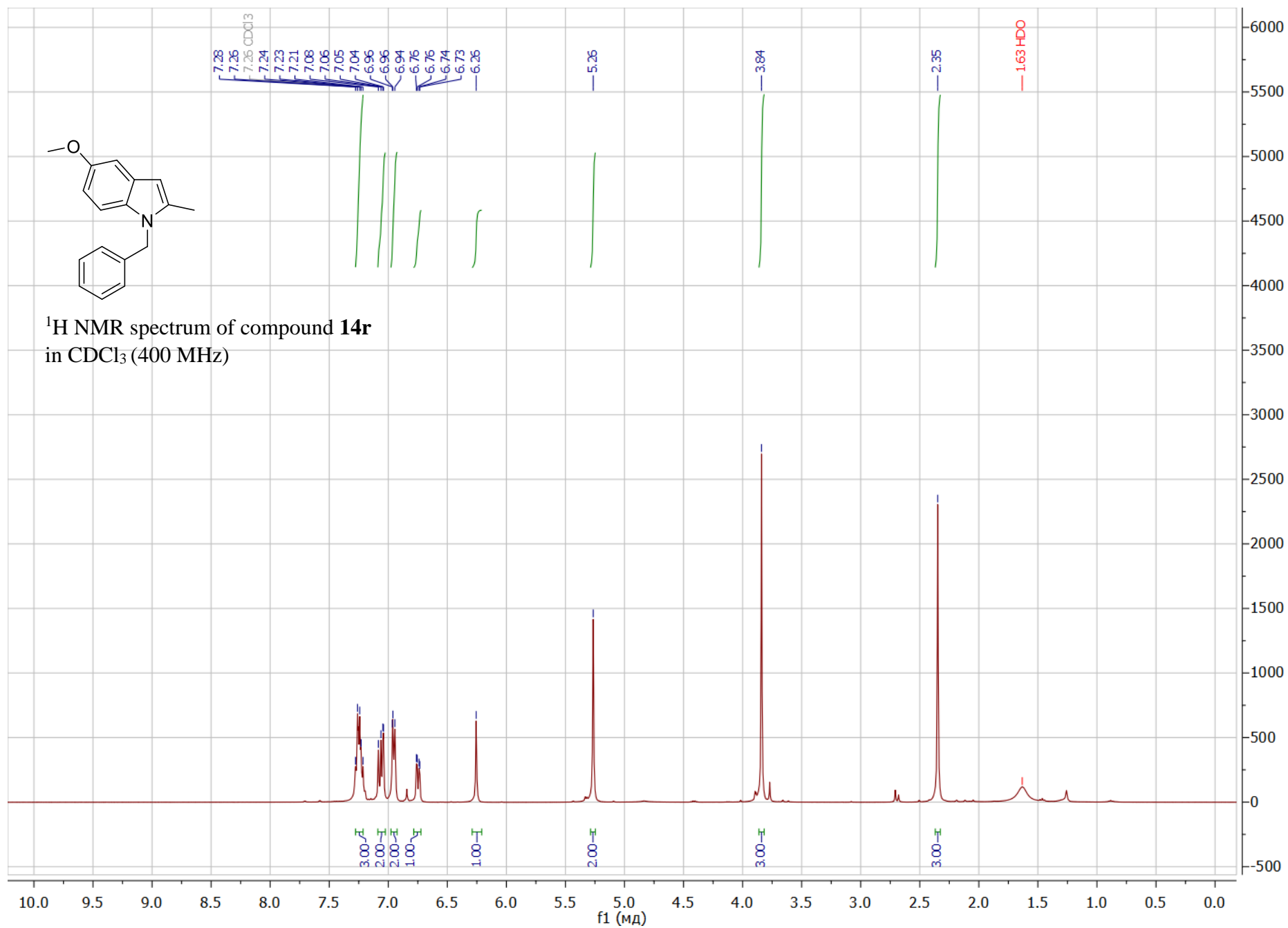
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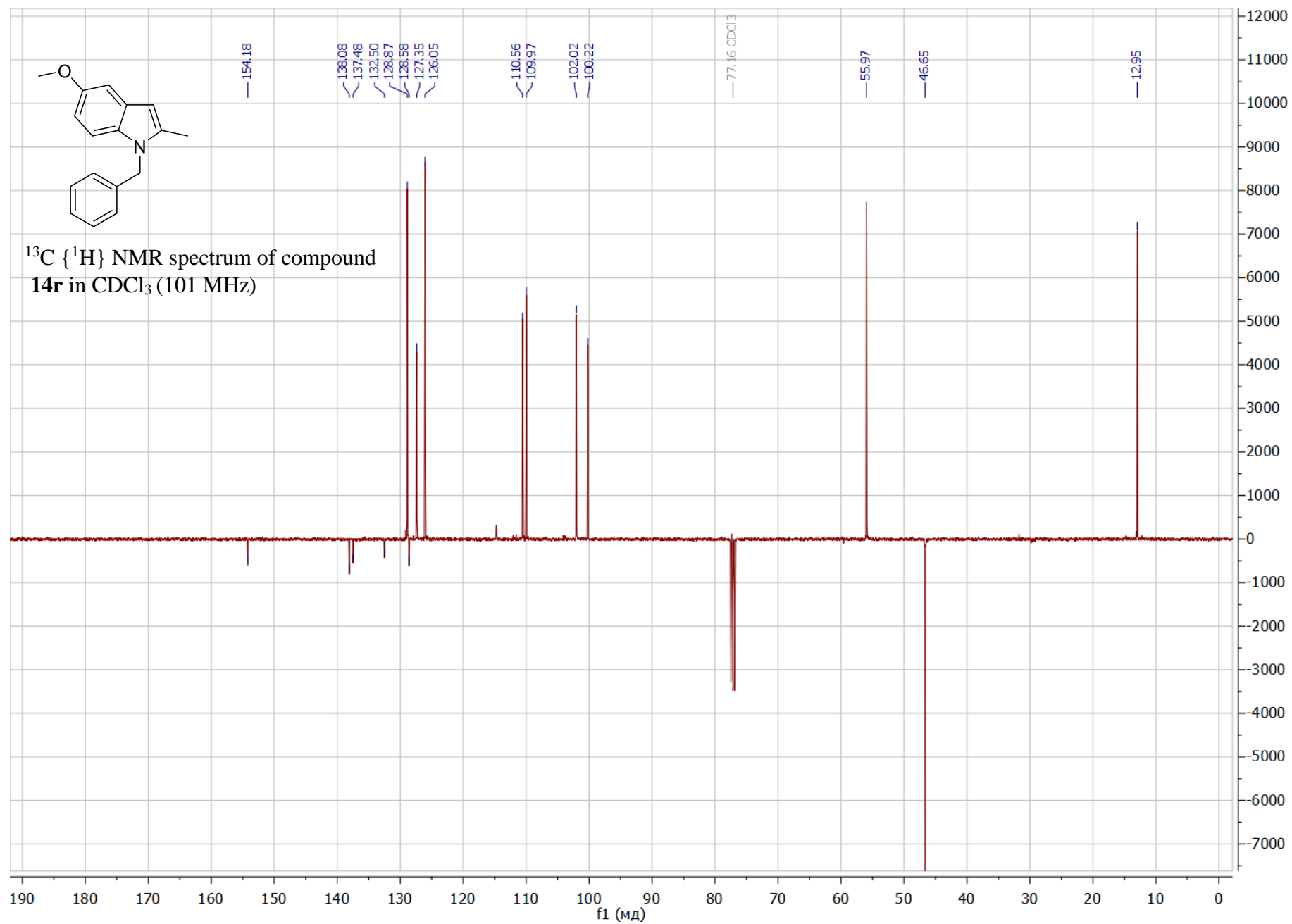


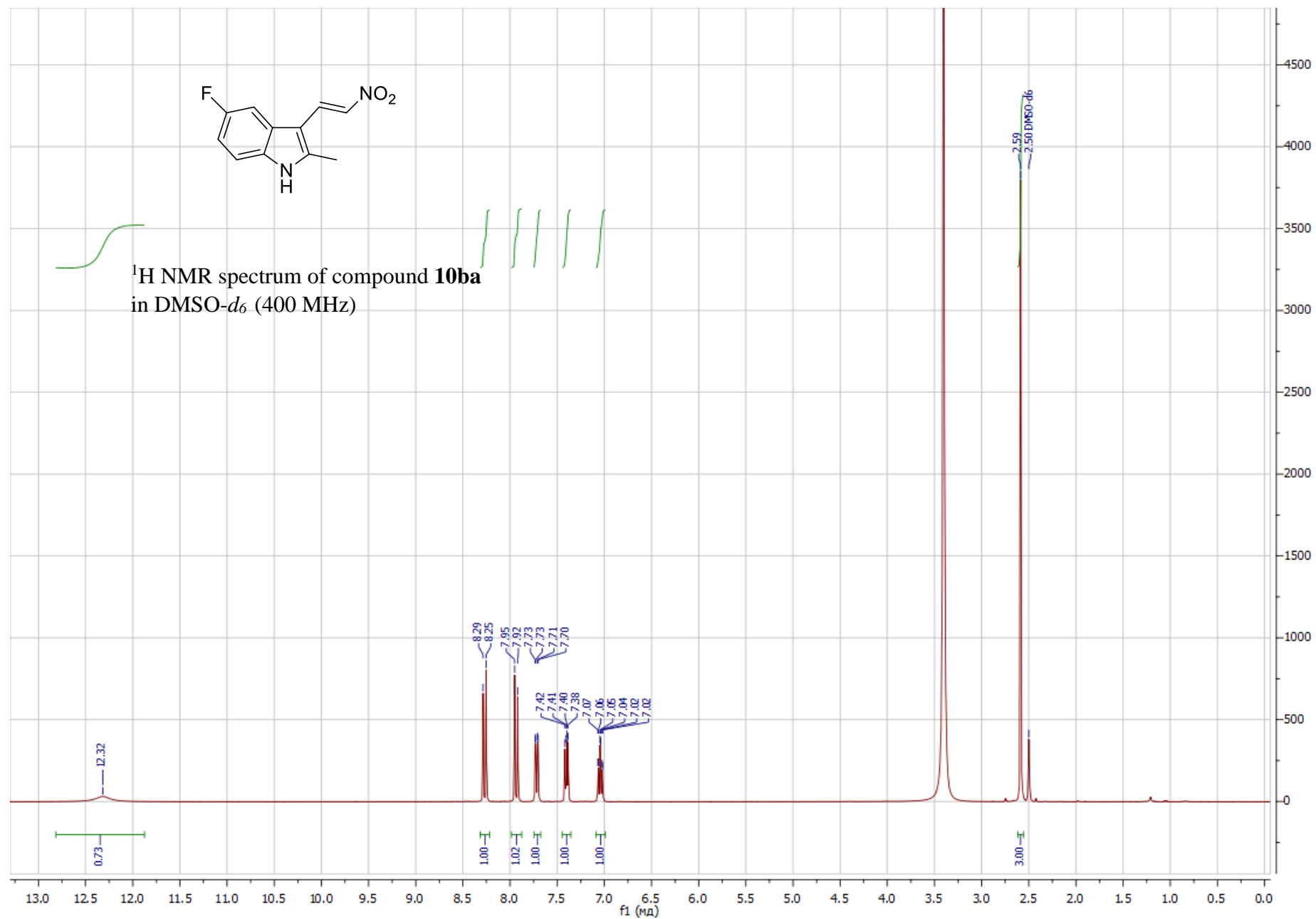


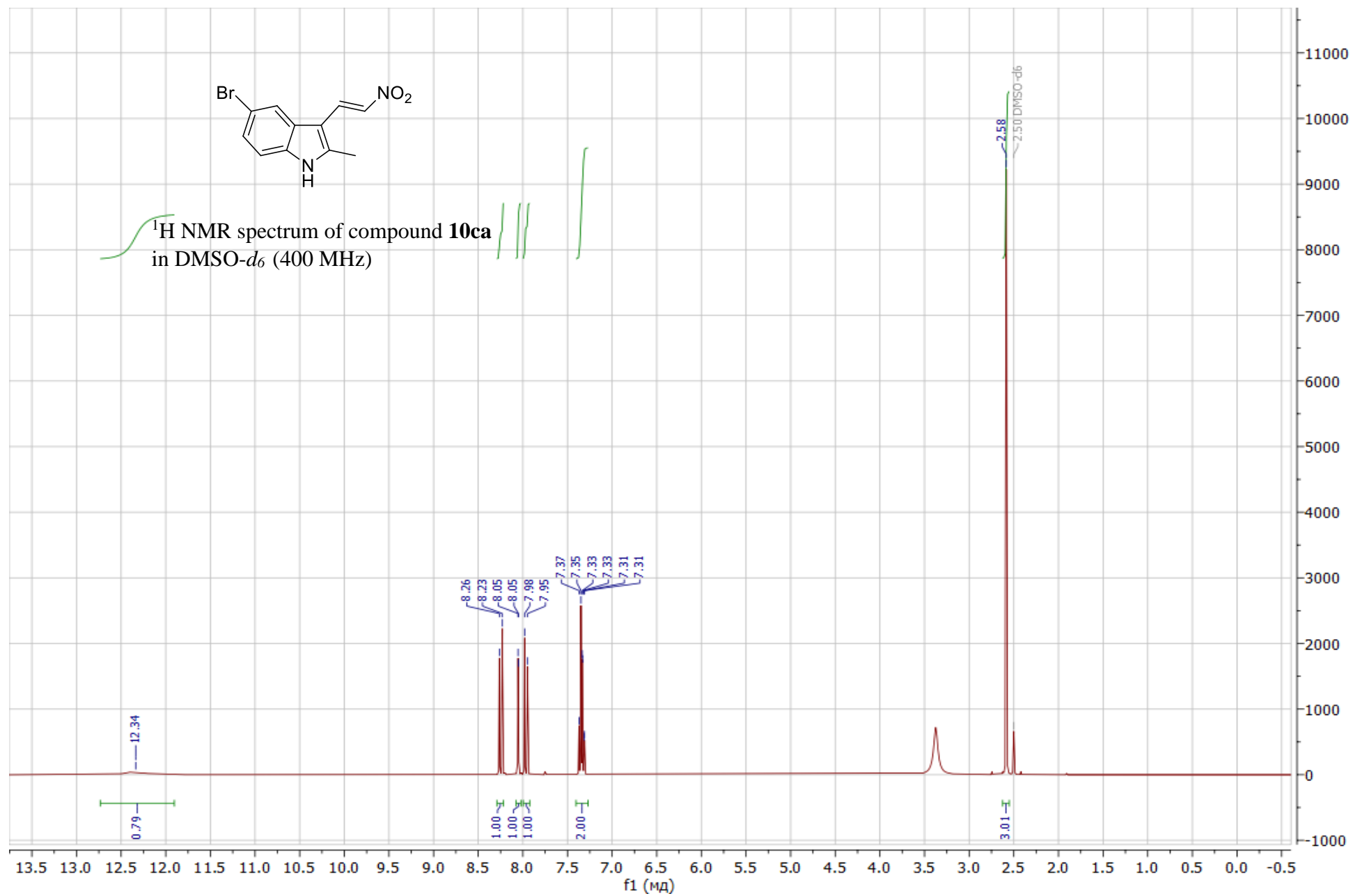
$^1\text{H}$  NMR spectrum of compound **18g**  
in  $\text{CDCl}_3$  (400 MHz)





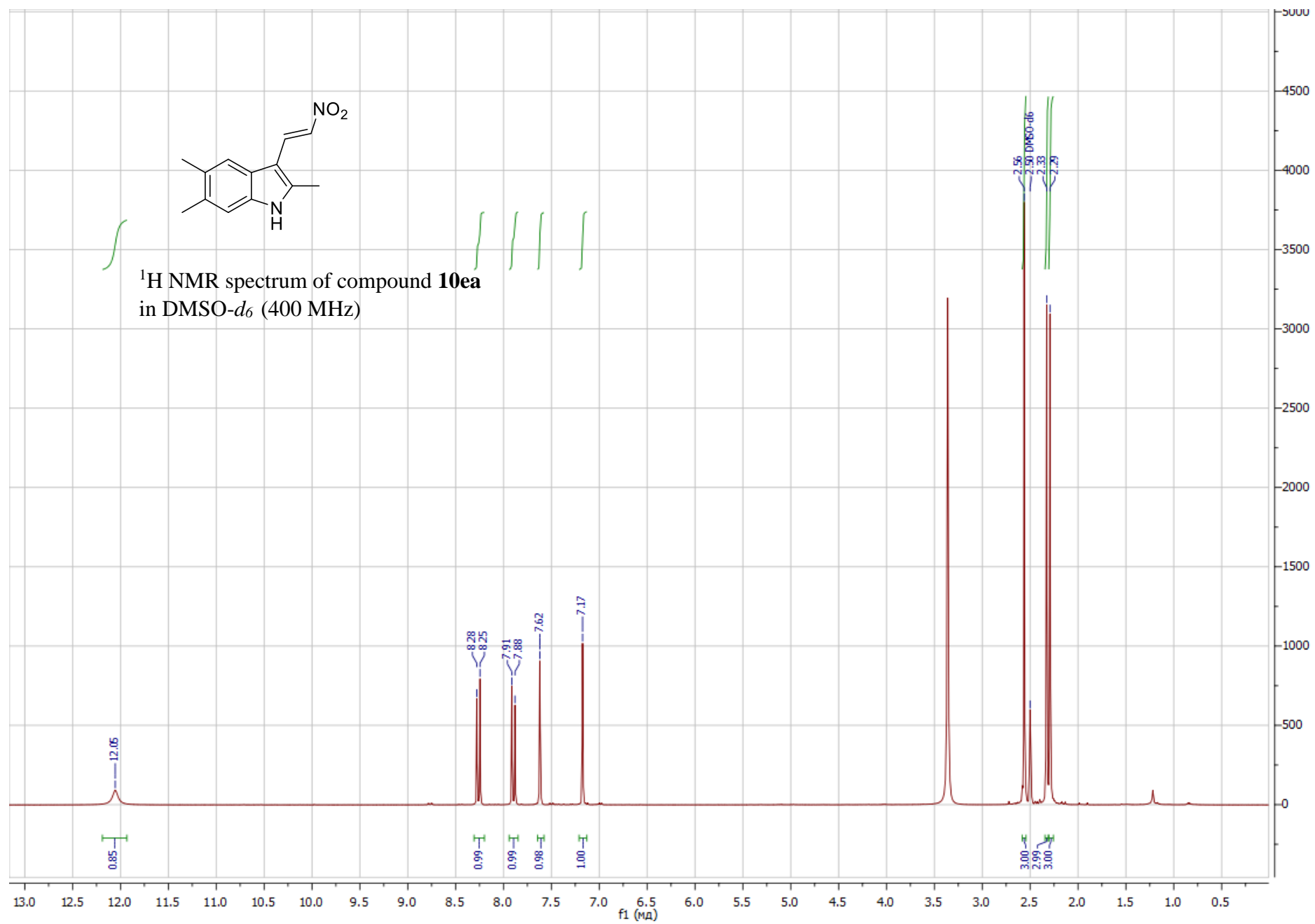


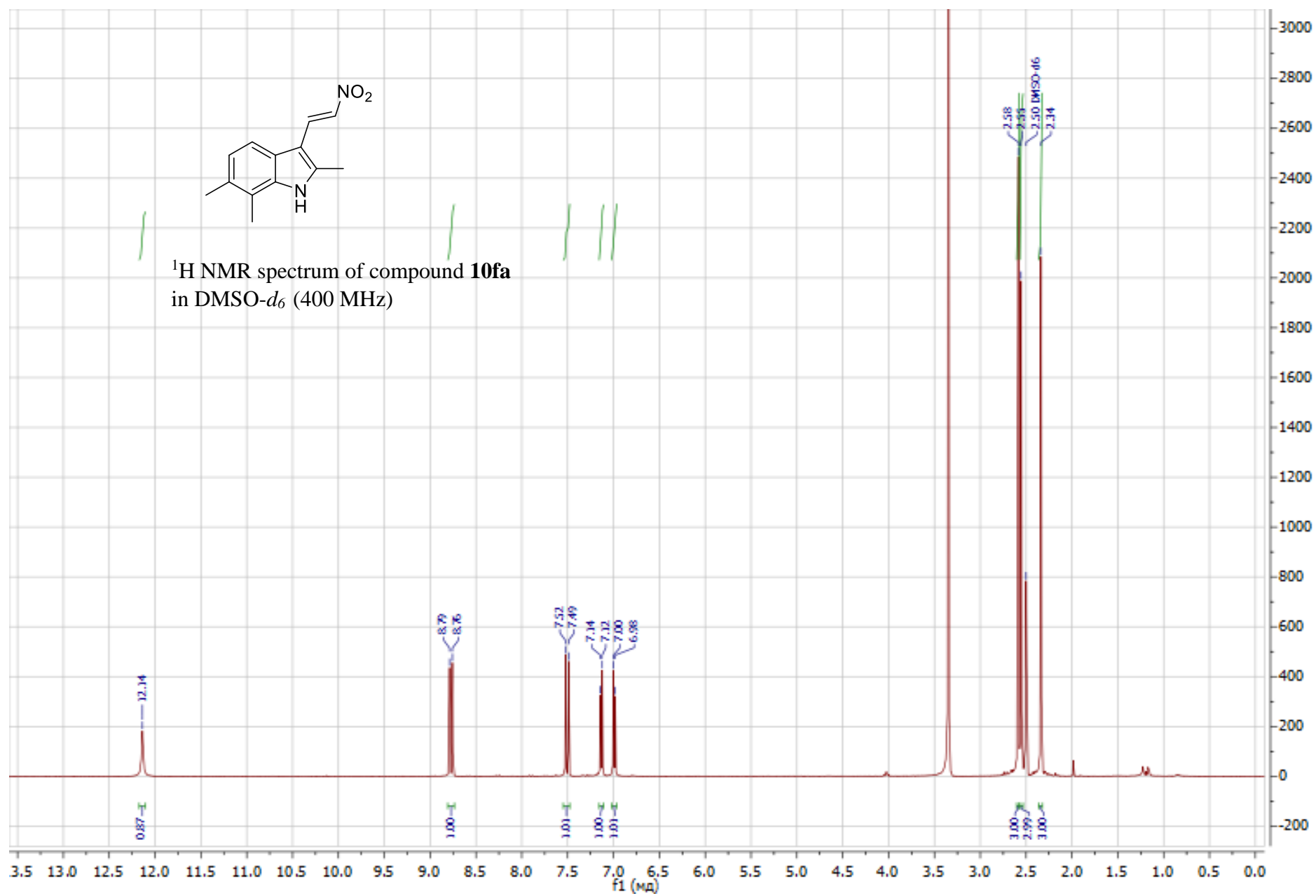


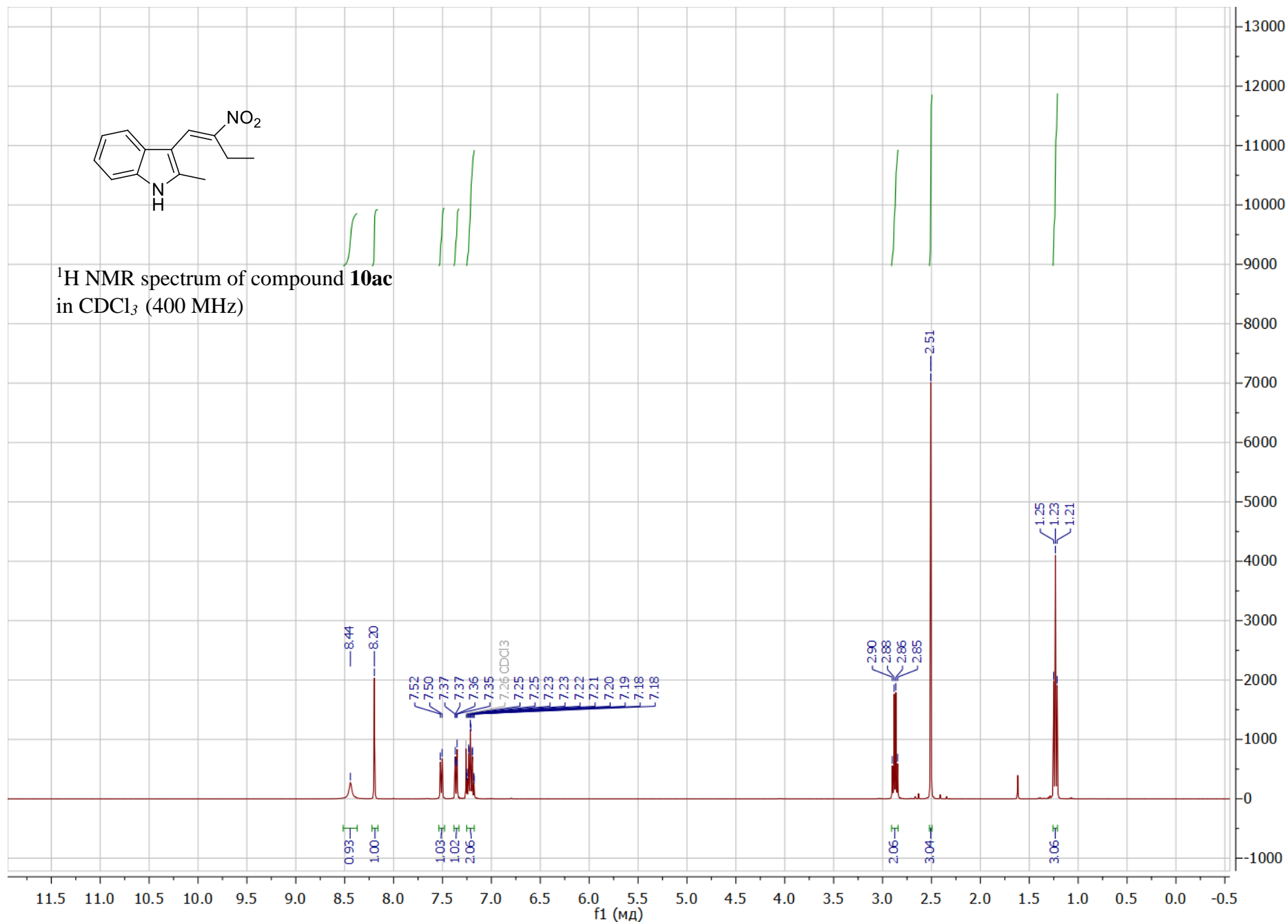


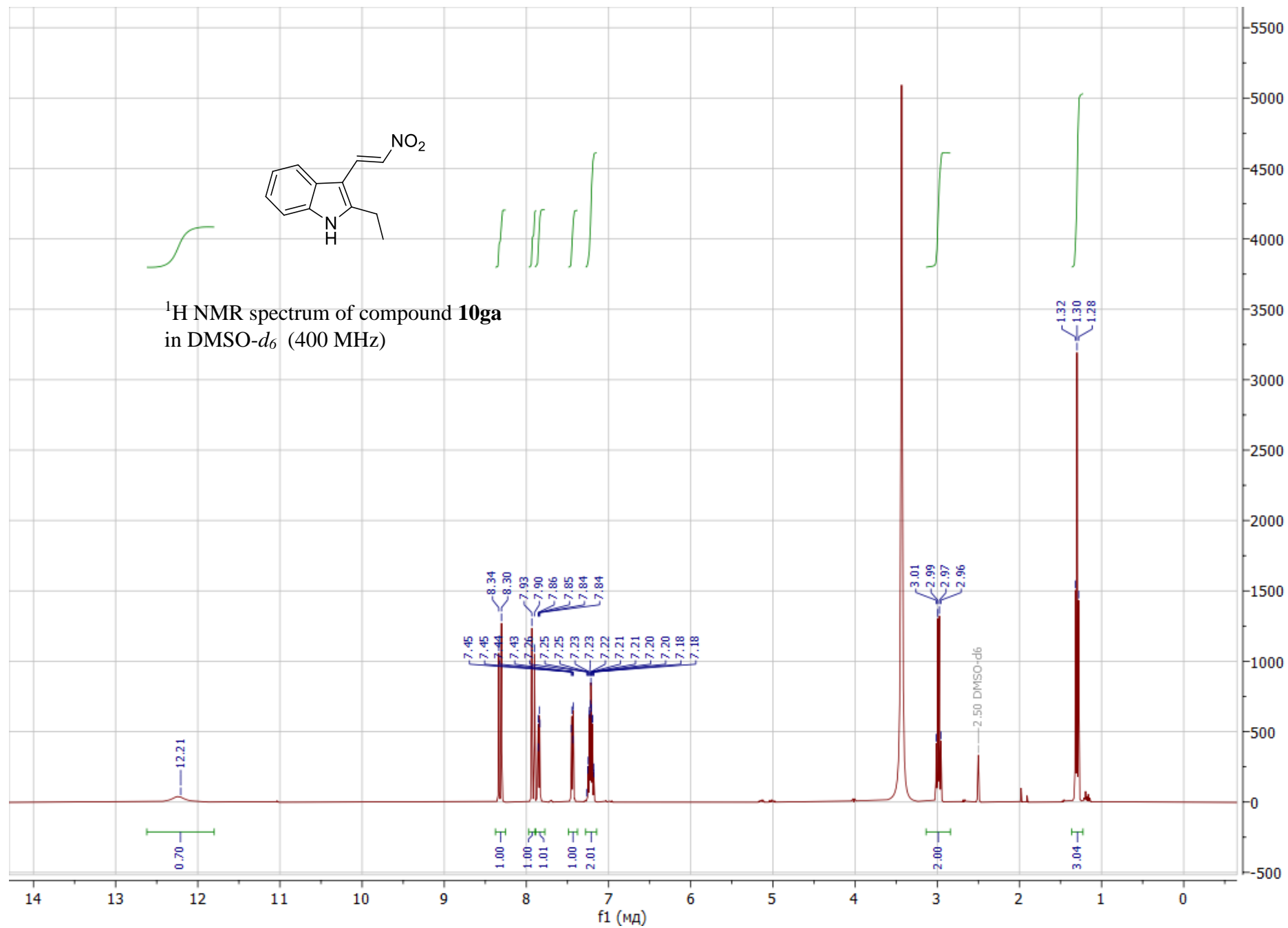


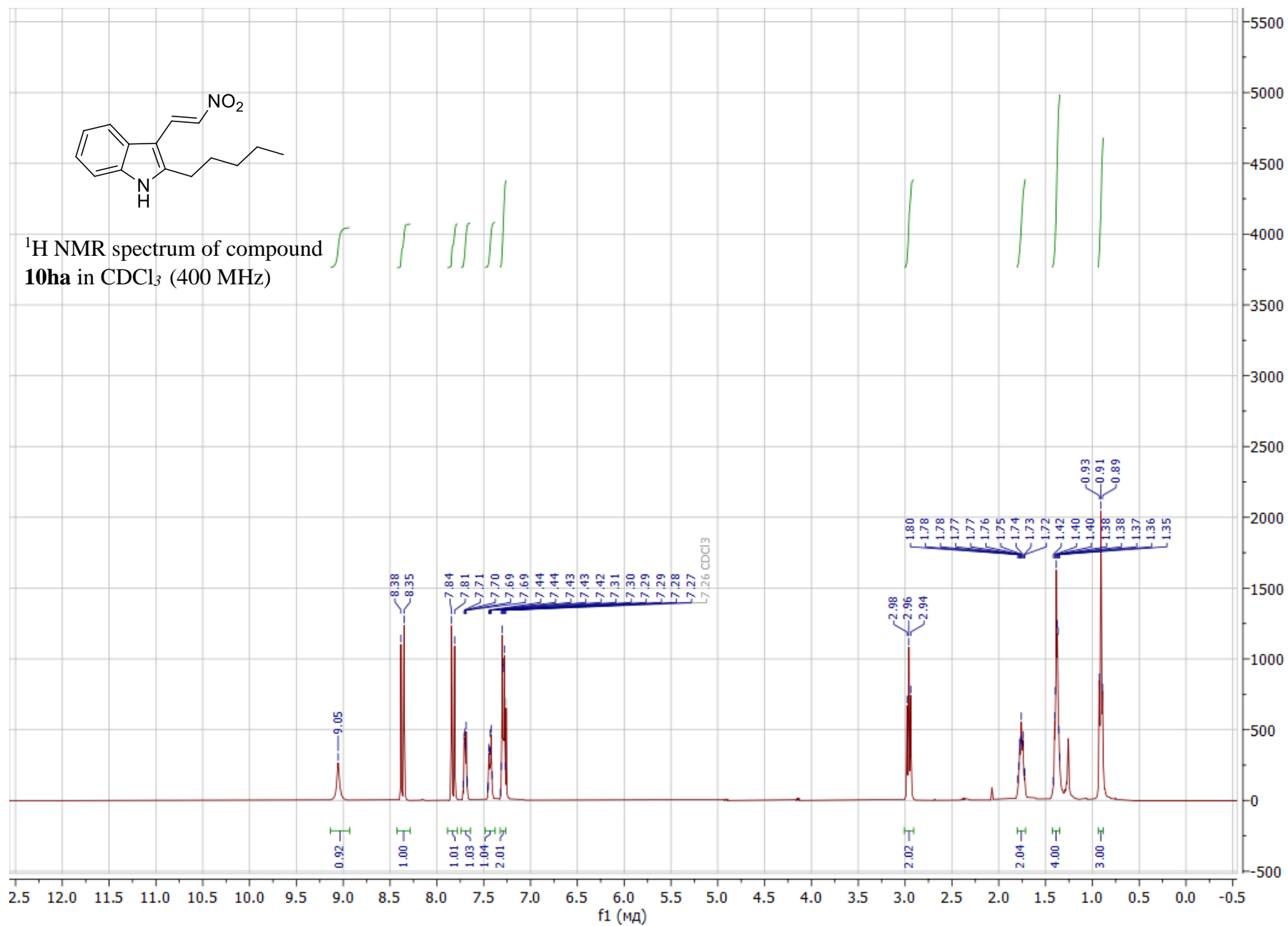


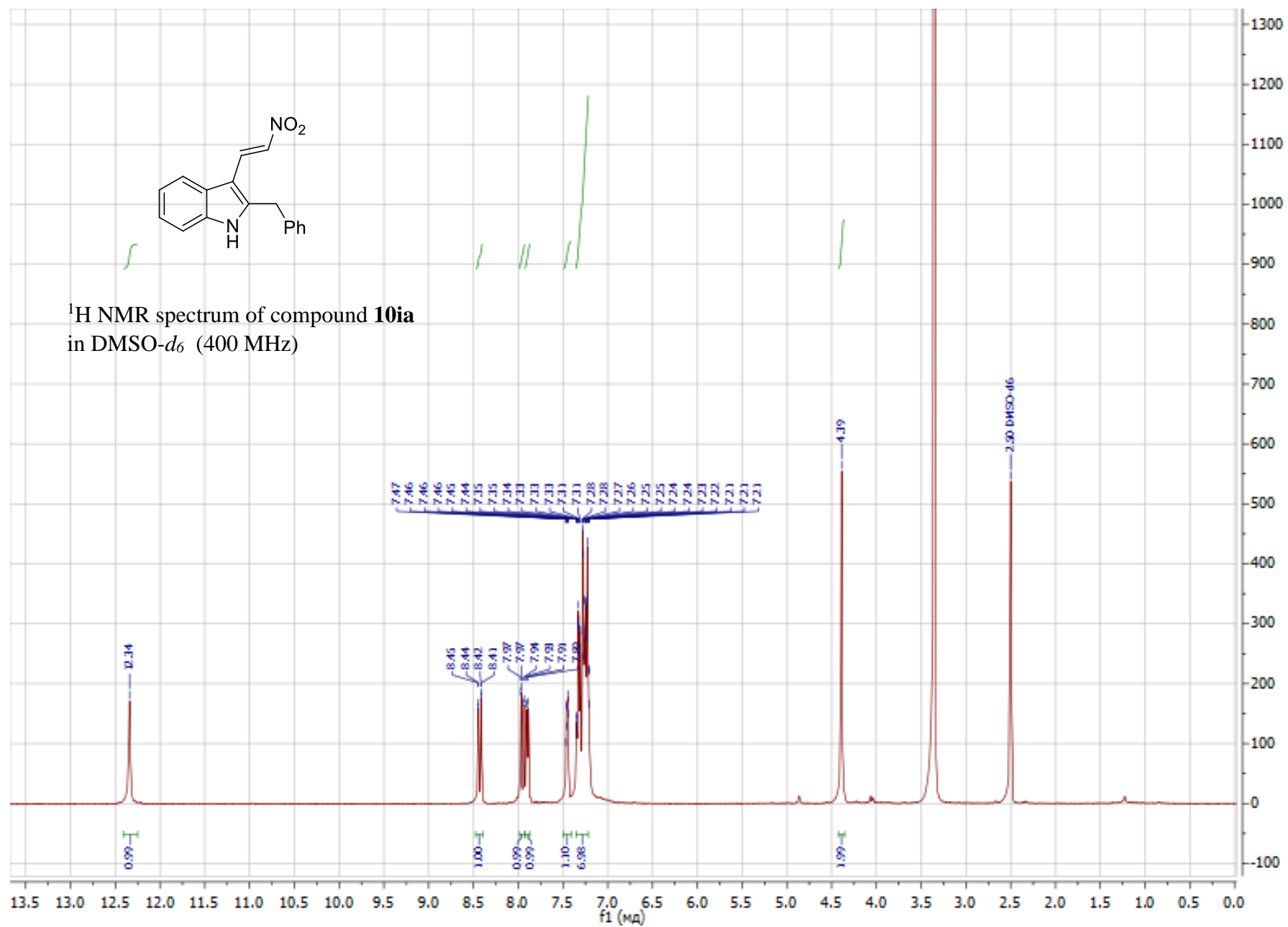


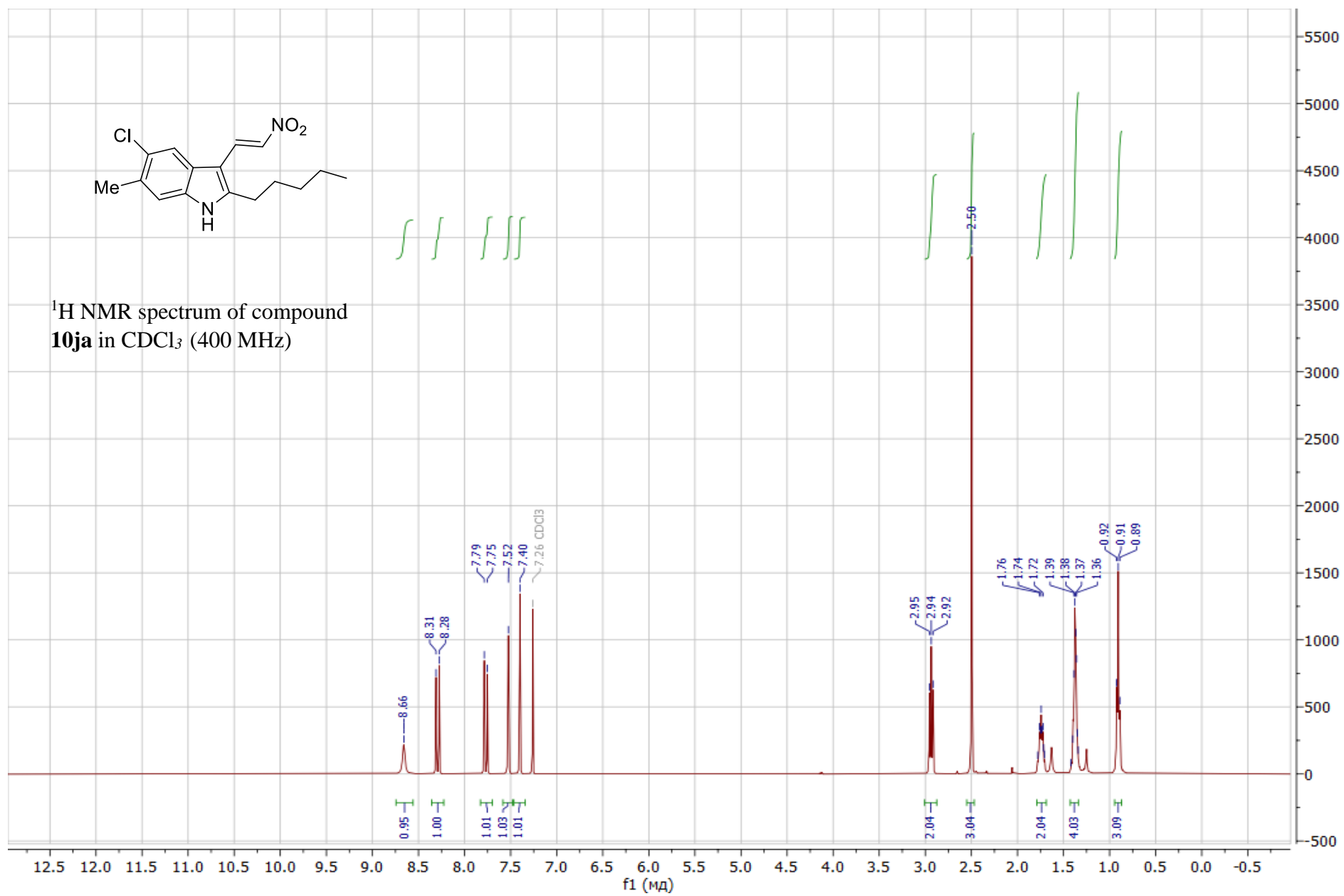


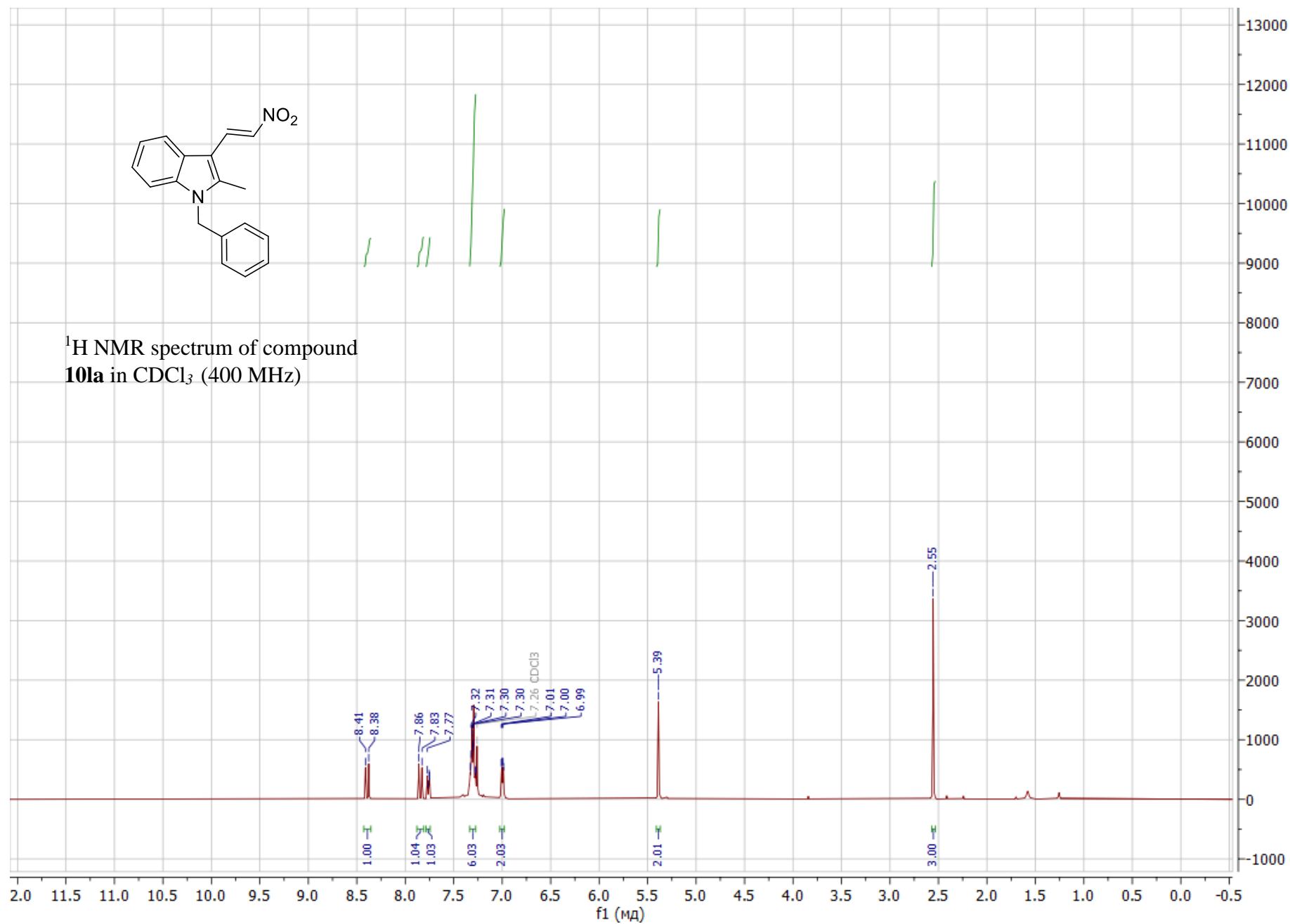




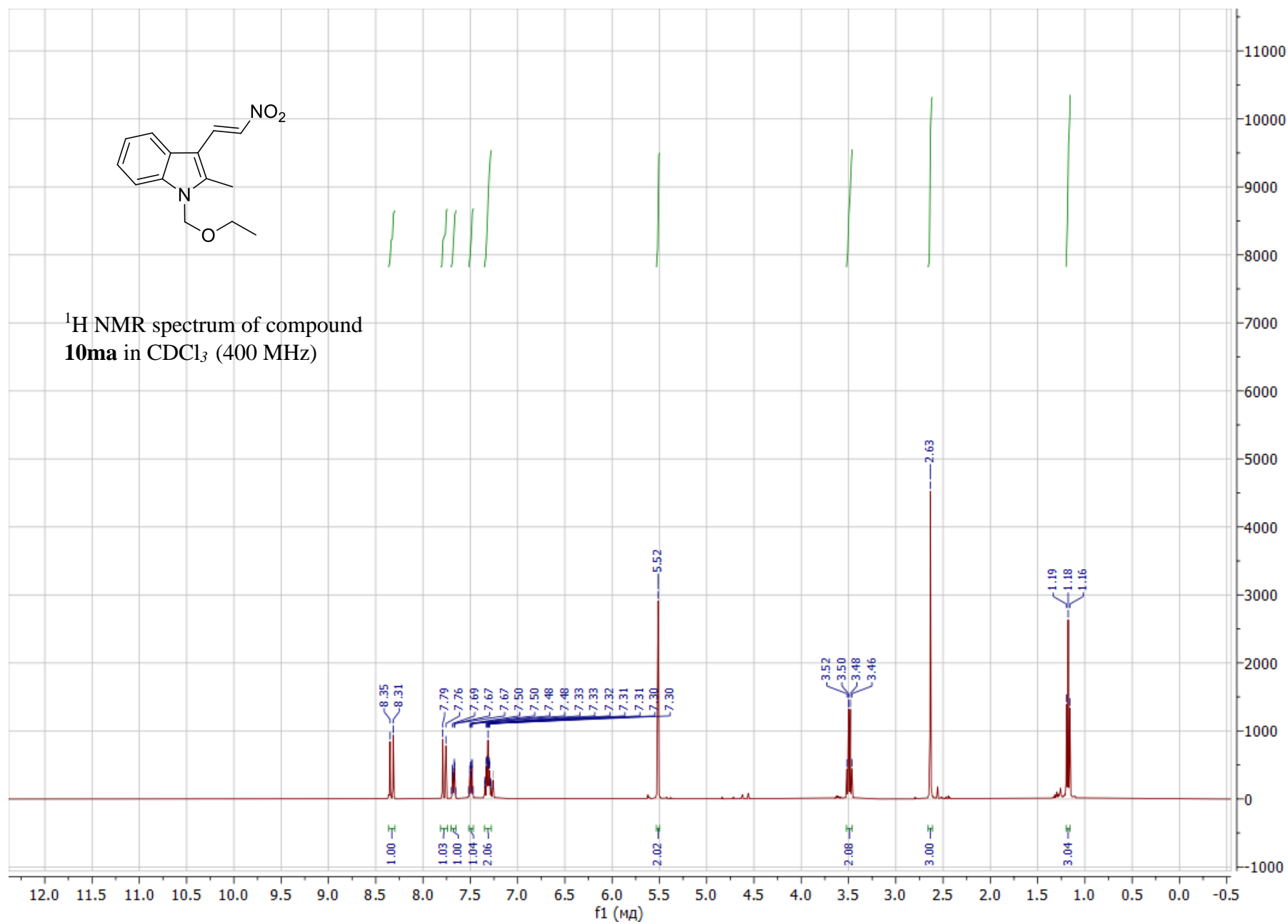


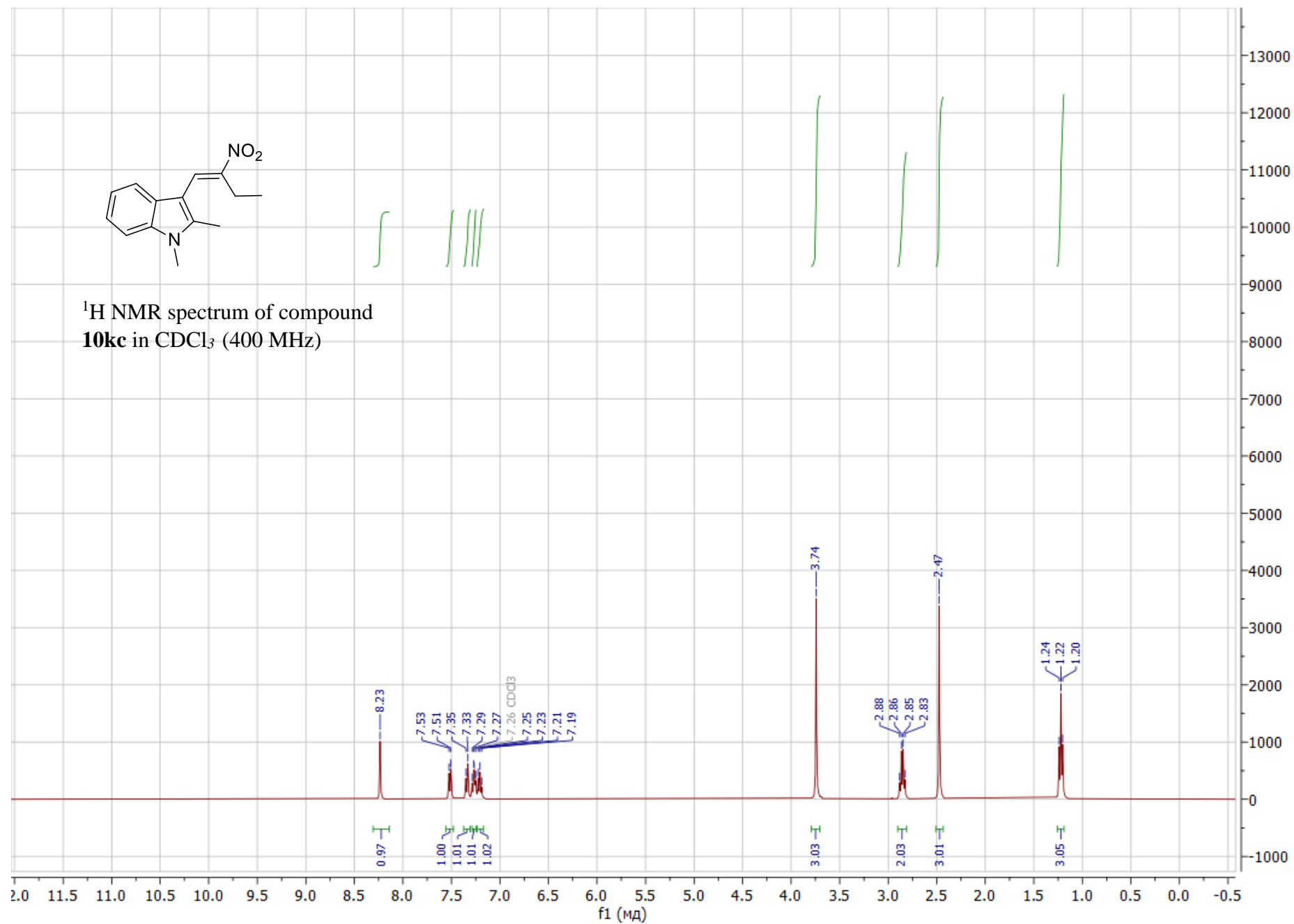


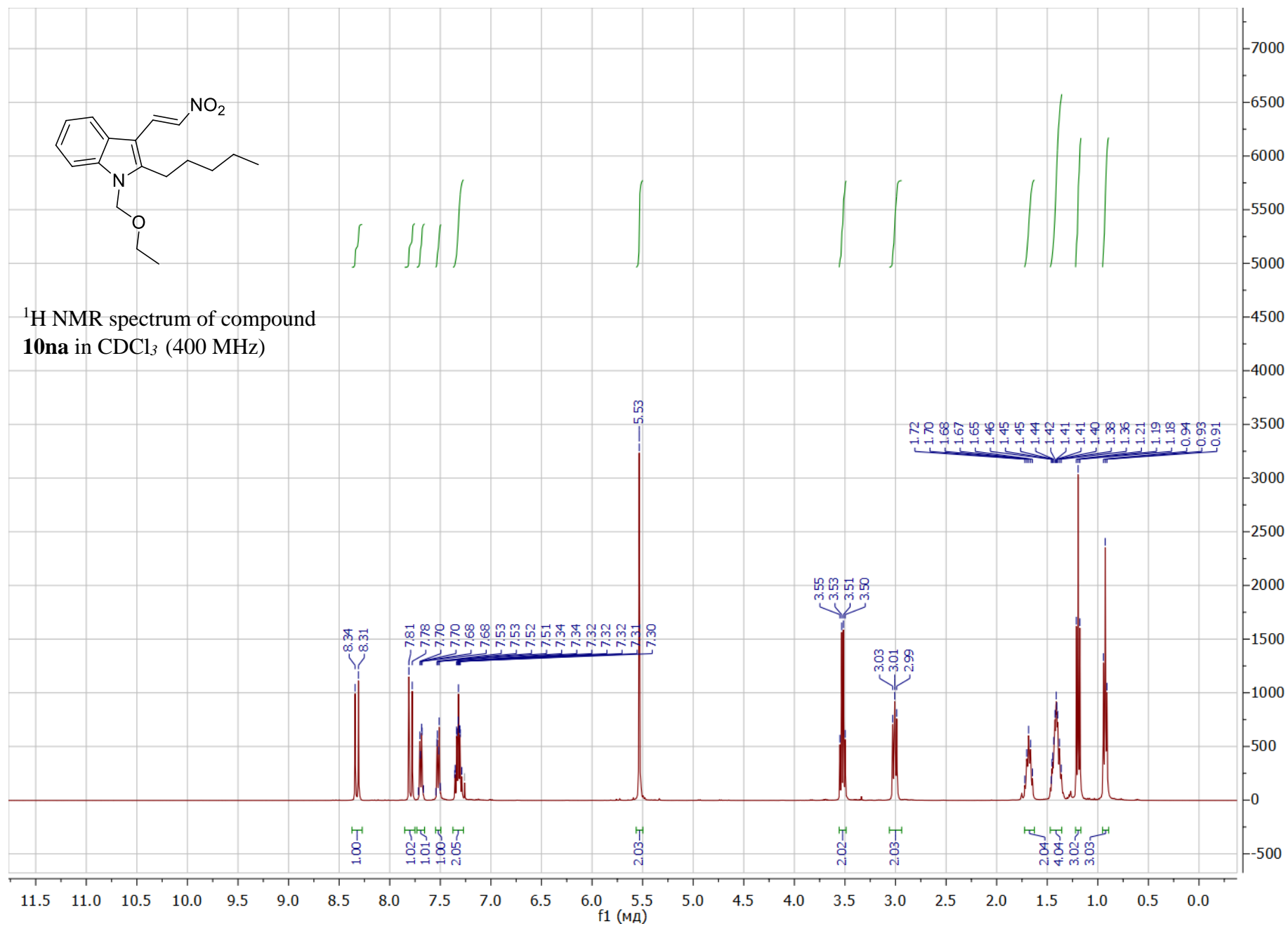


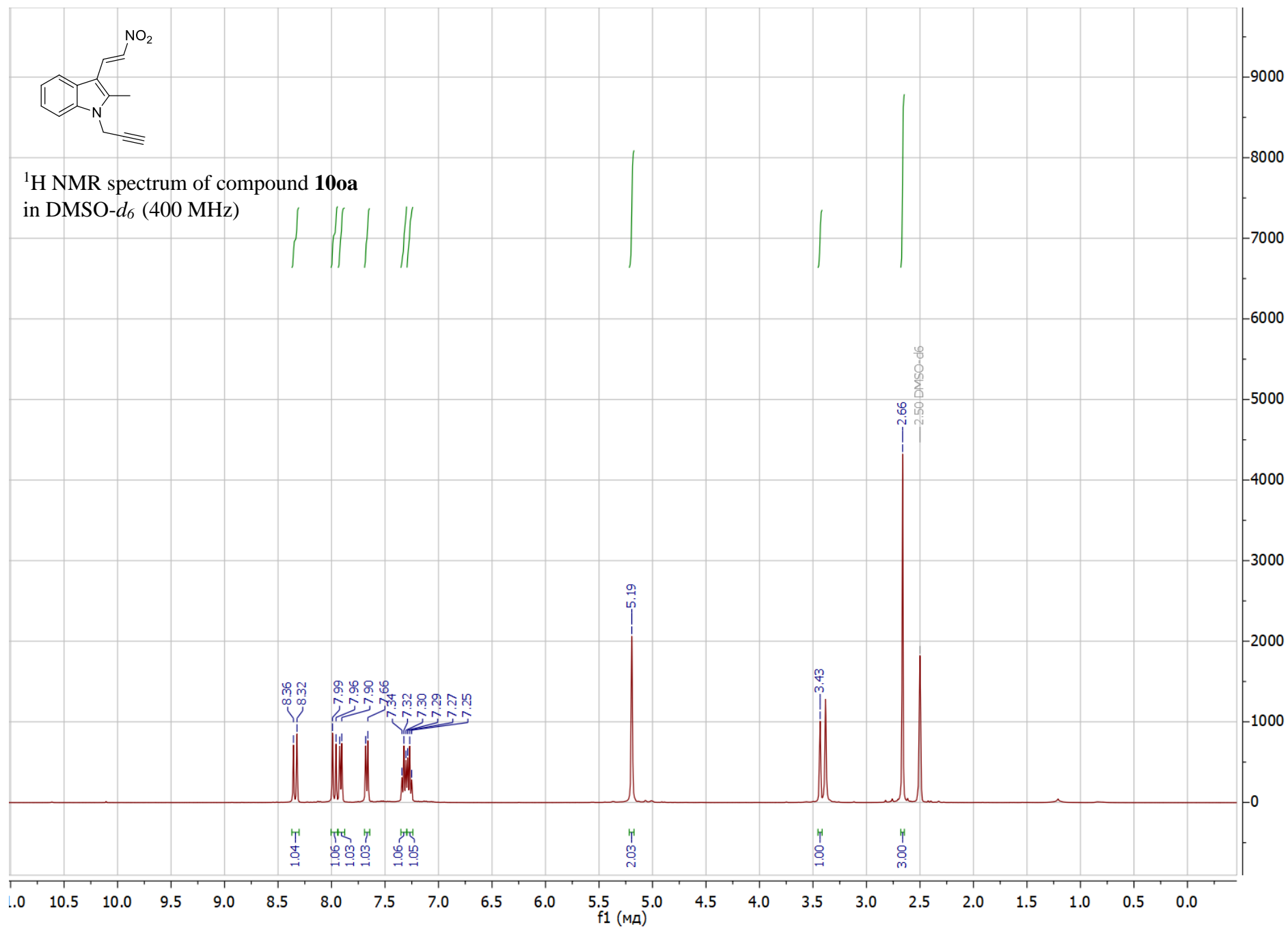


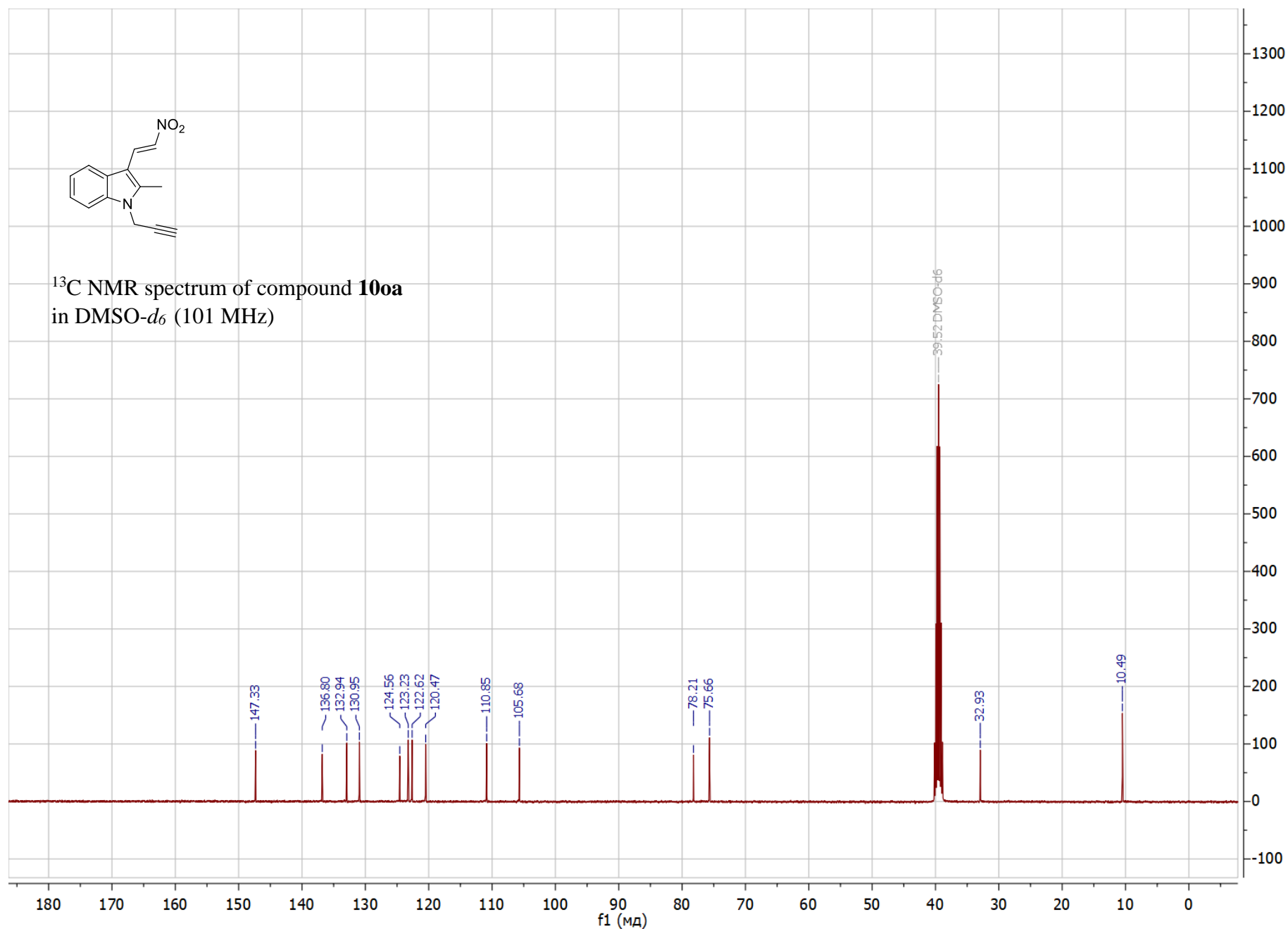


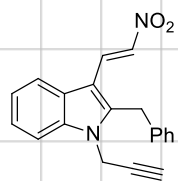




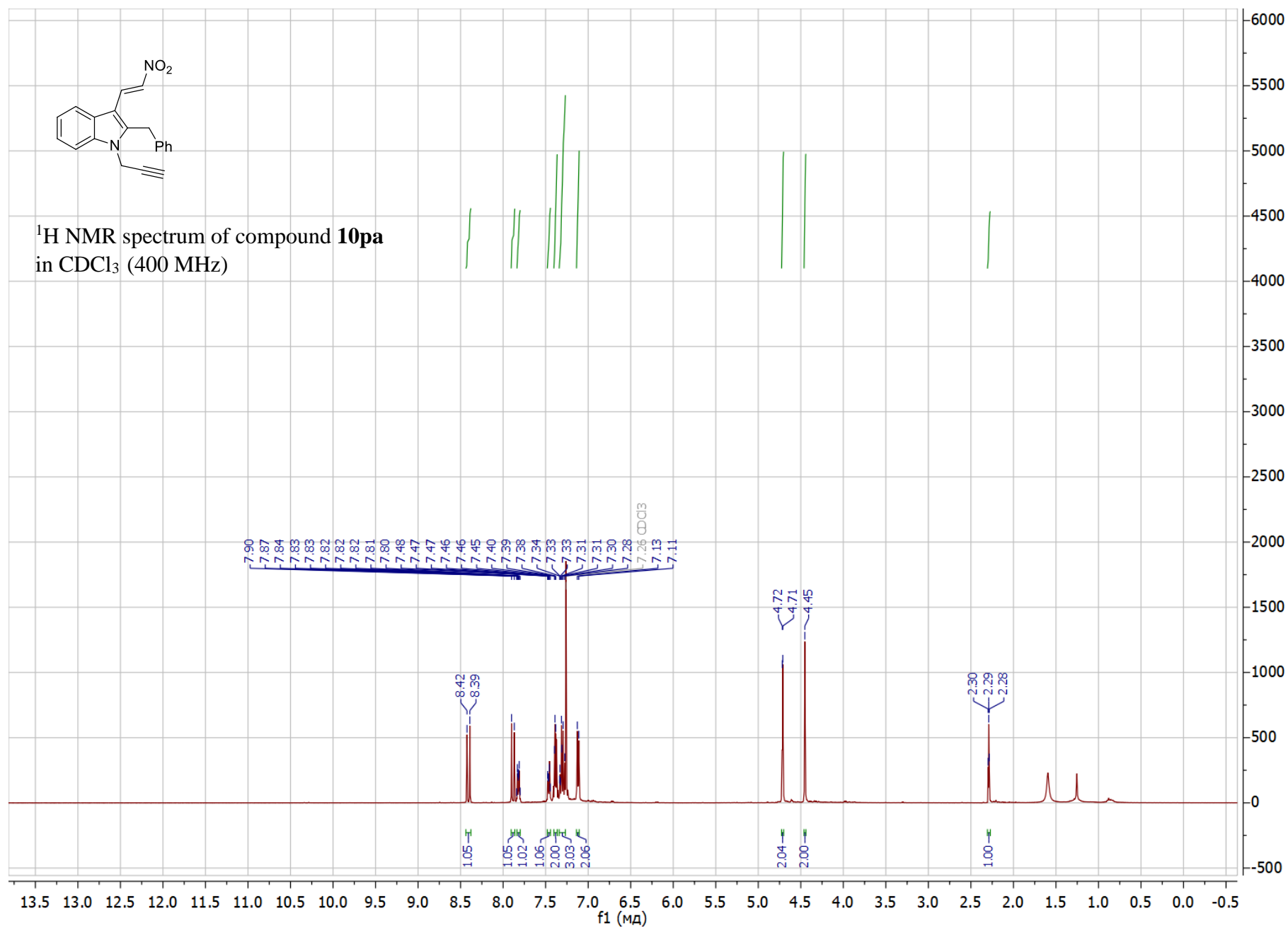


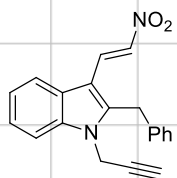




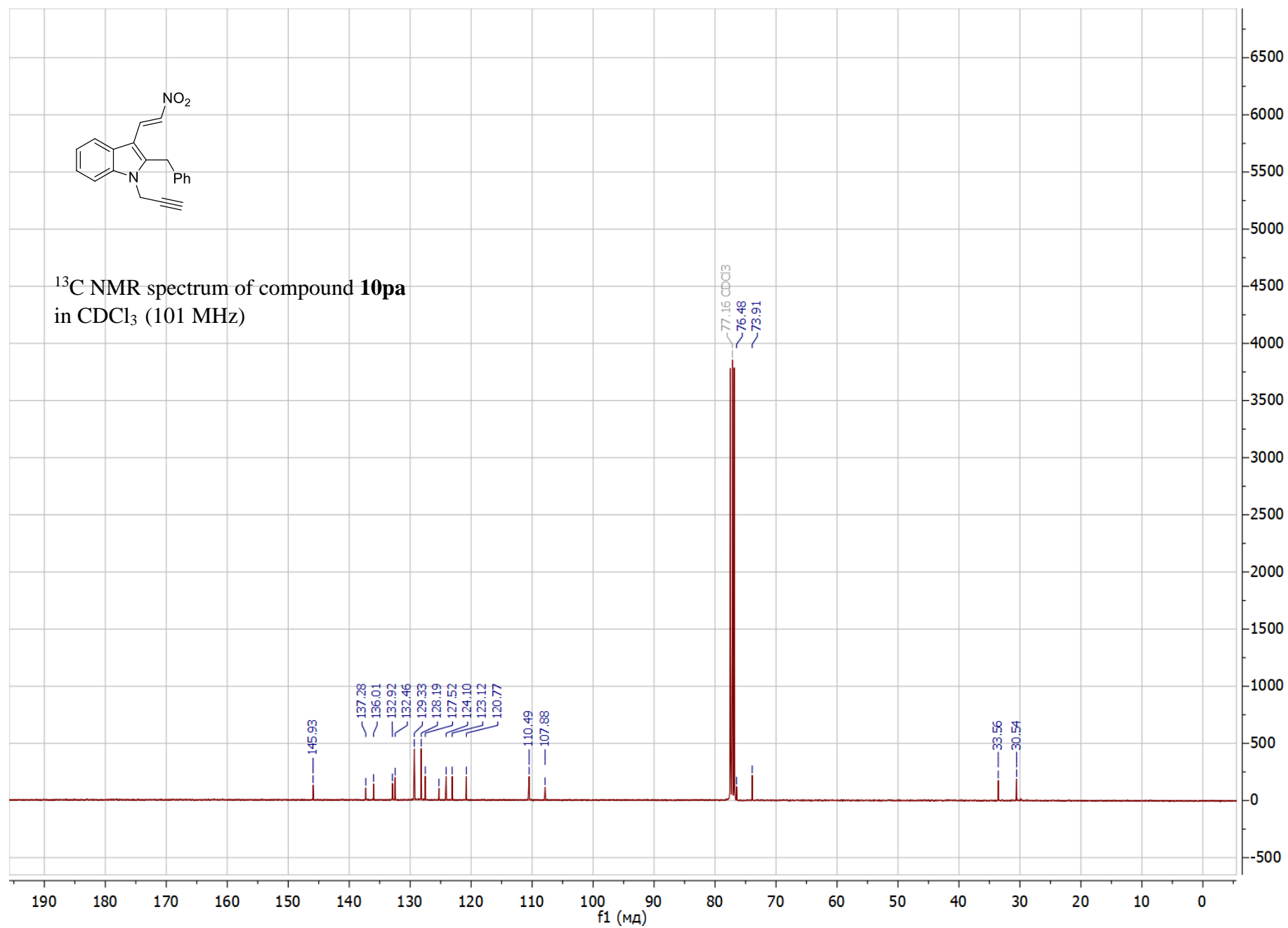


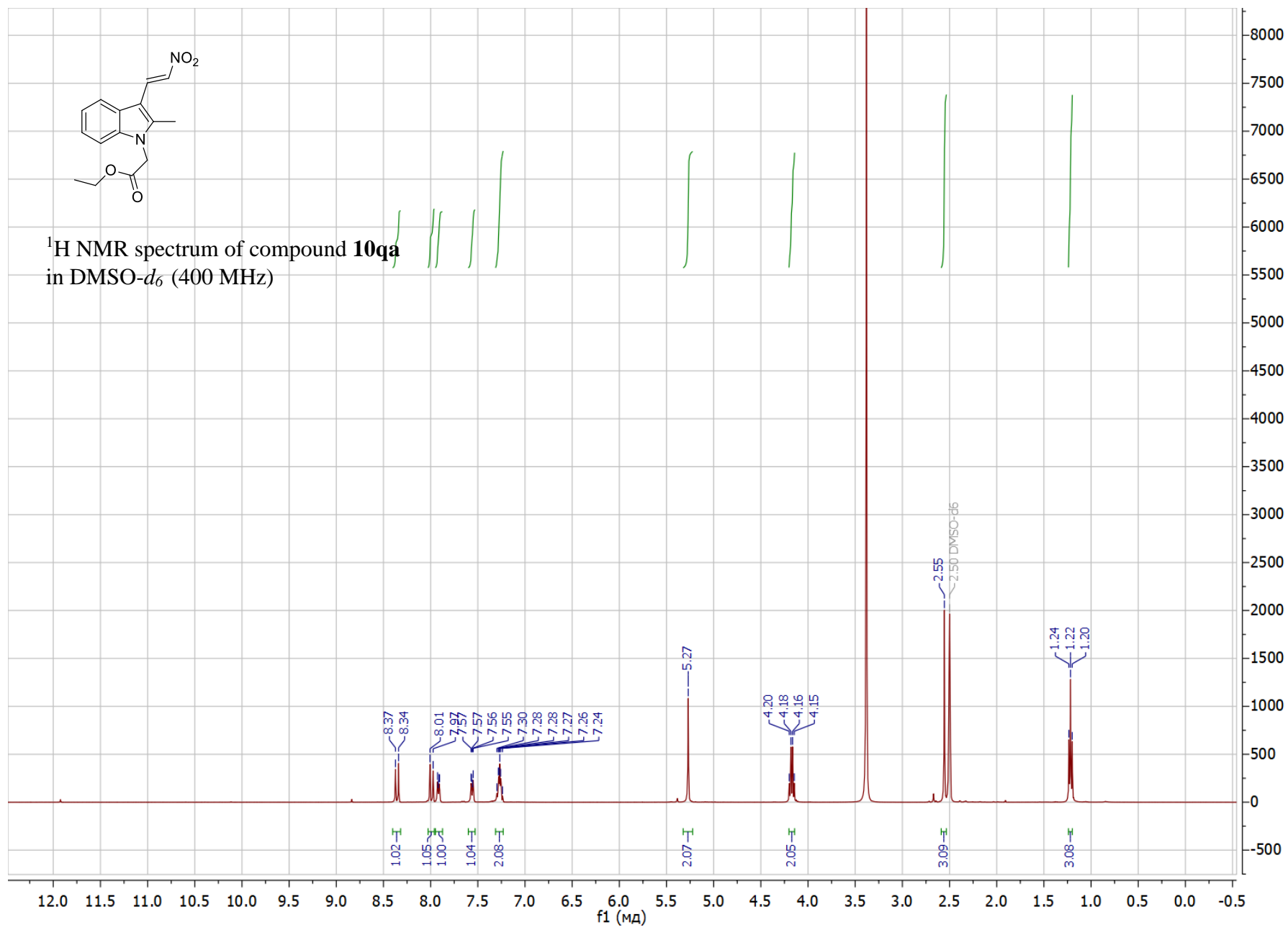
$^1\text{H}$  NMR spectrum of compound **10pa**  
in  $\text{CDCl}_3$  (400 MHz)



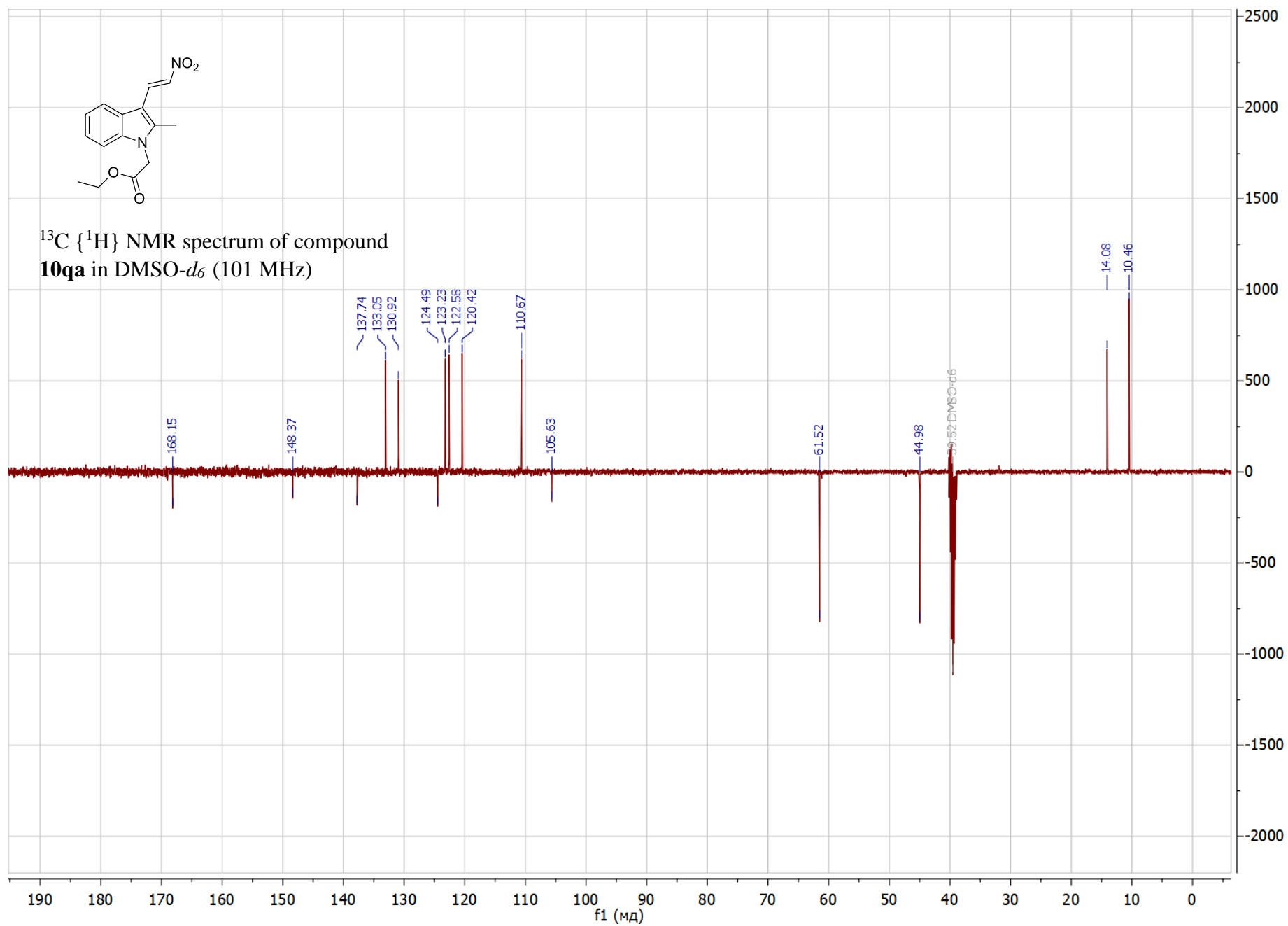


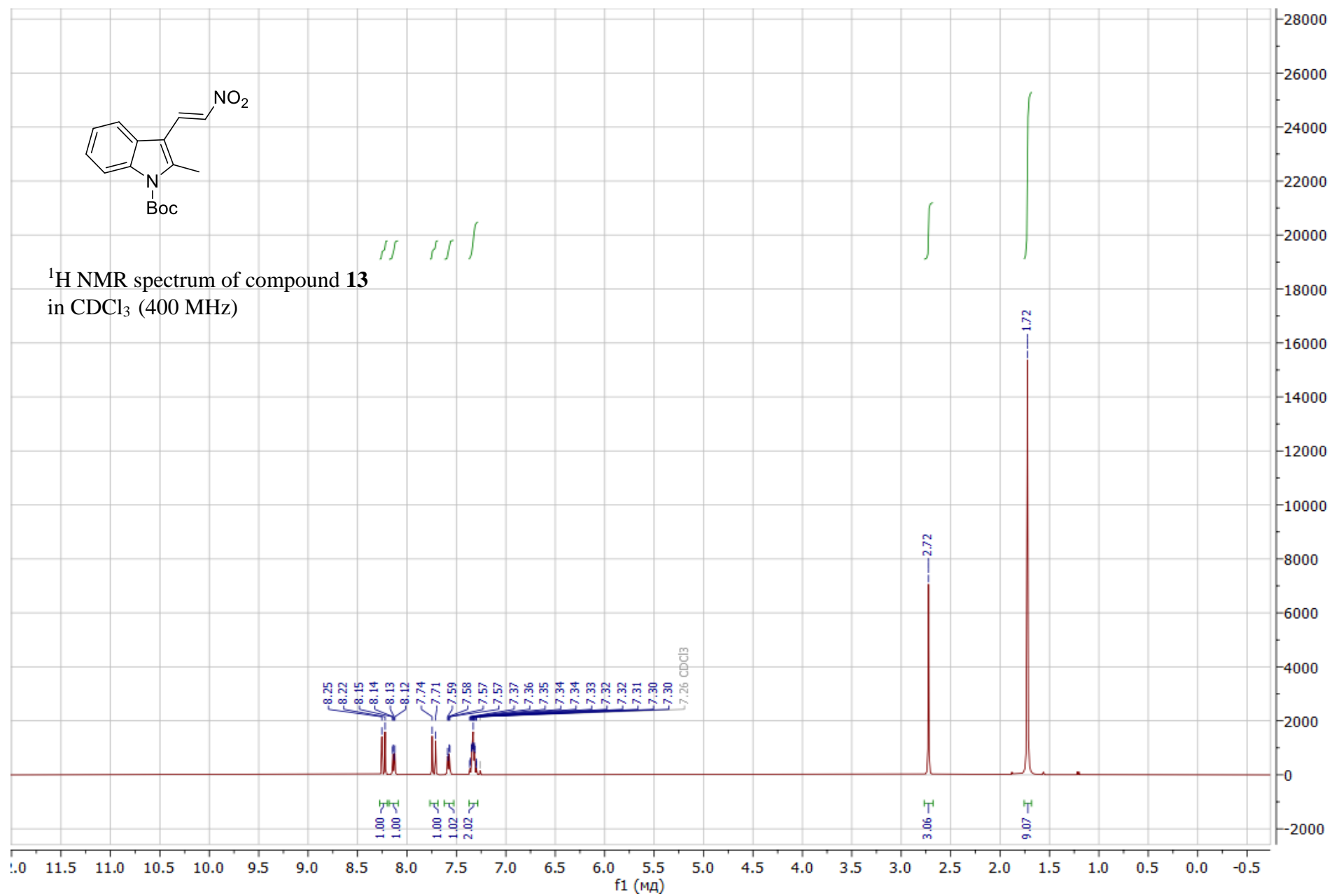
$^{13}\text{C}$  NMR spectrum of compound **10pa**  
in  $\text{CDCl}_3$  (101 MHz)

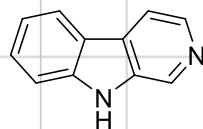




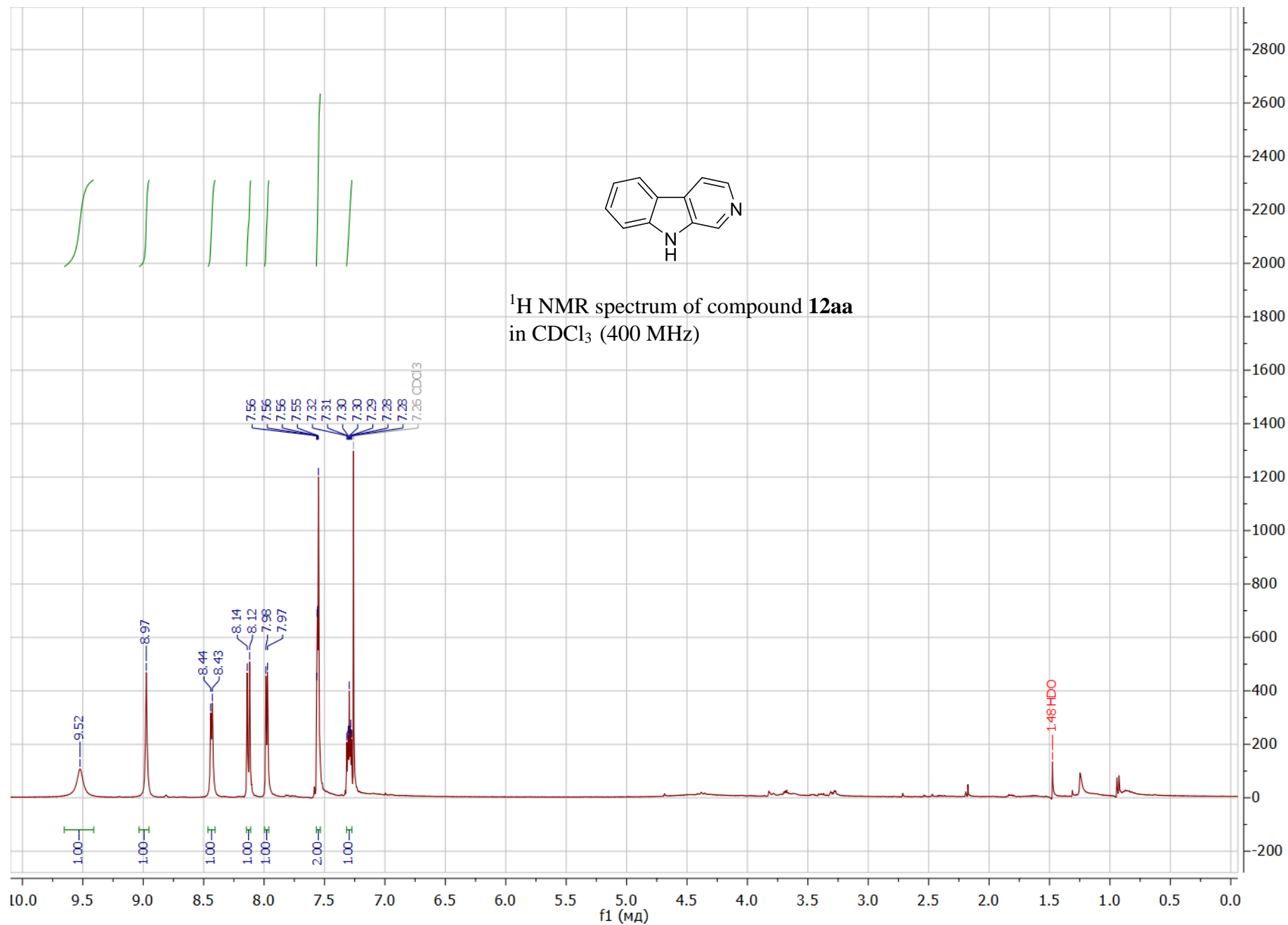


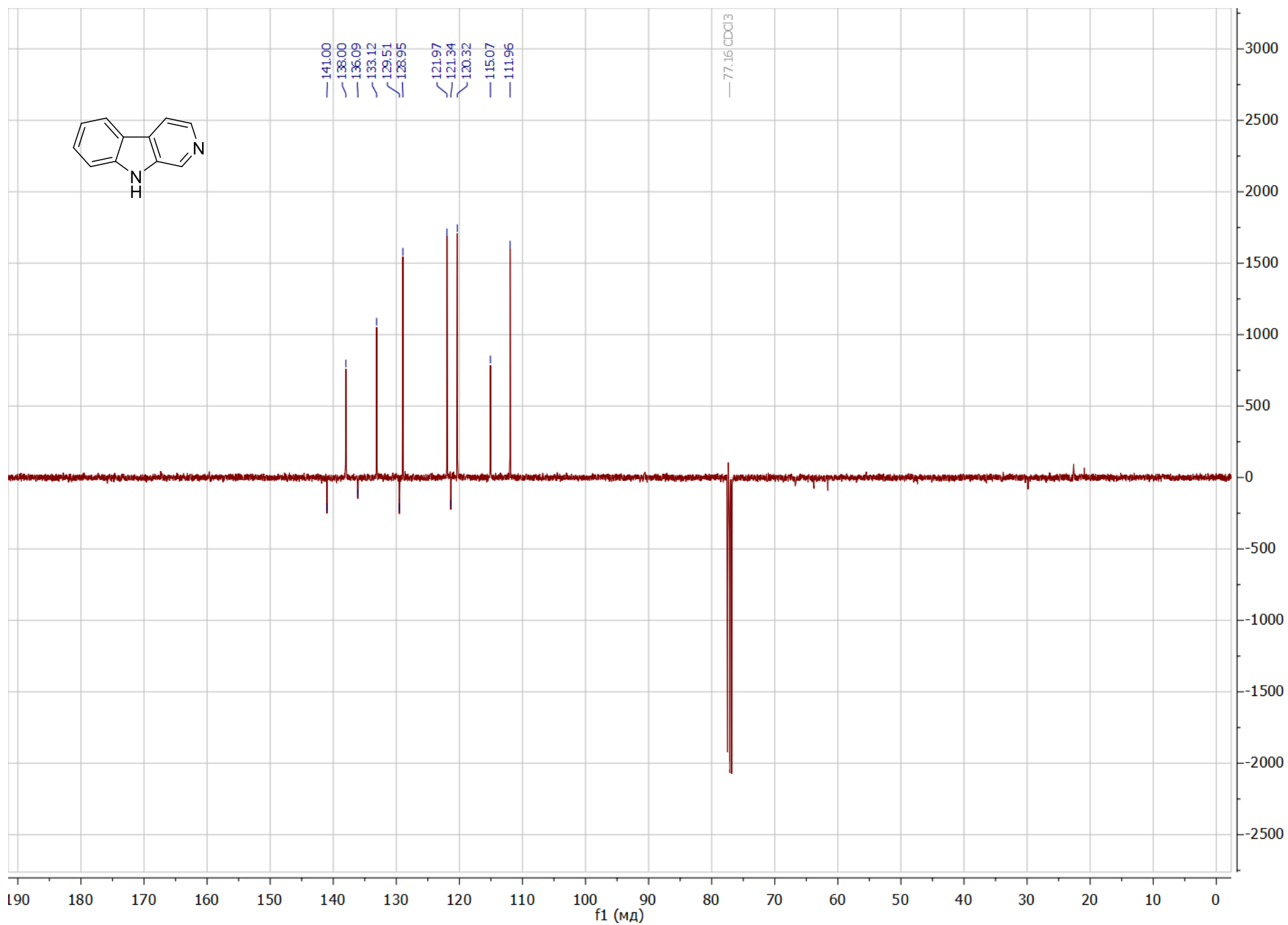


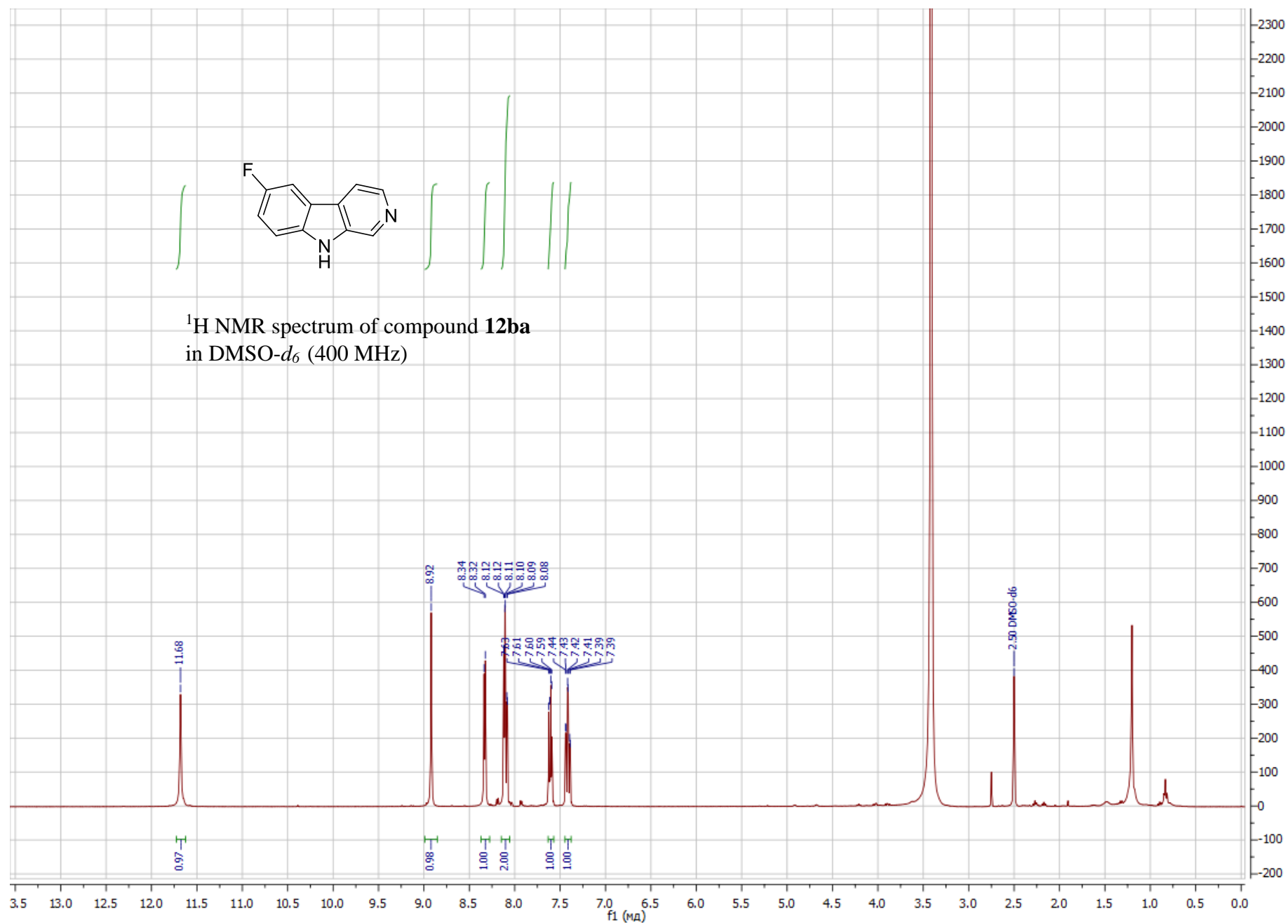


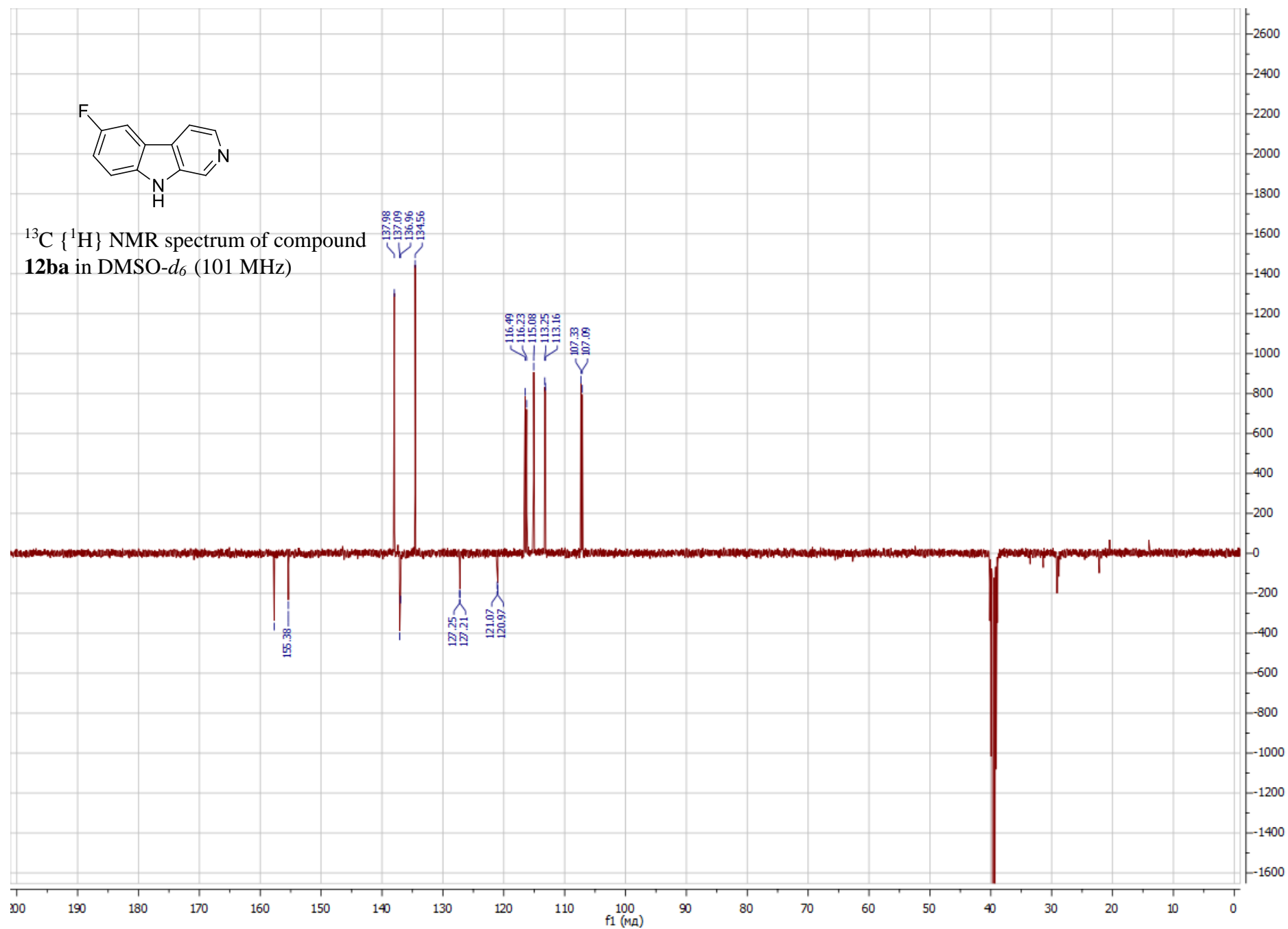


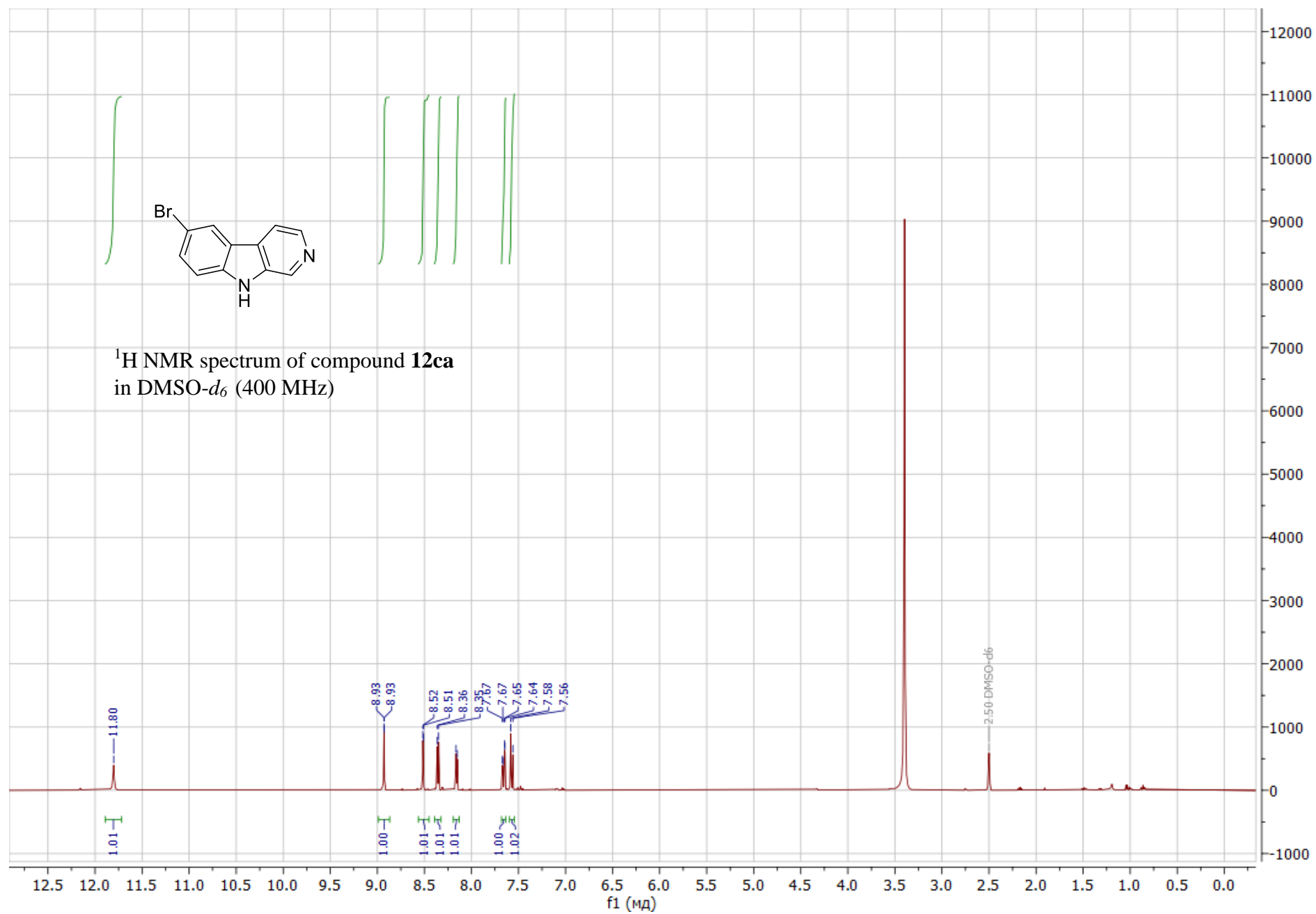
$^1\text{H}$  NMR spectrum of compound **12aa**  
in  $\text{CDCl}_3$  (400 MHz)

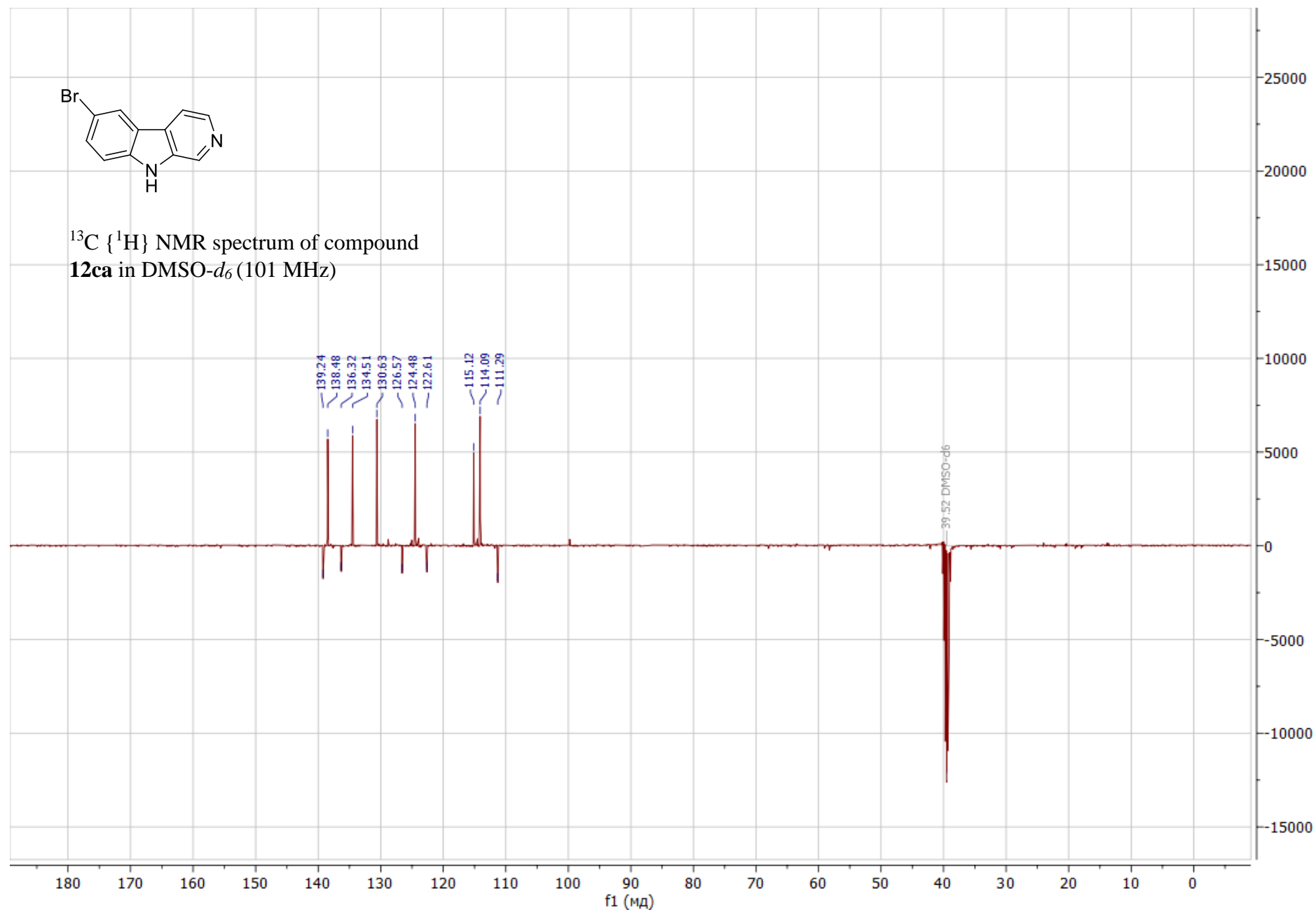




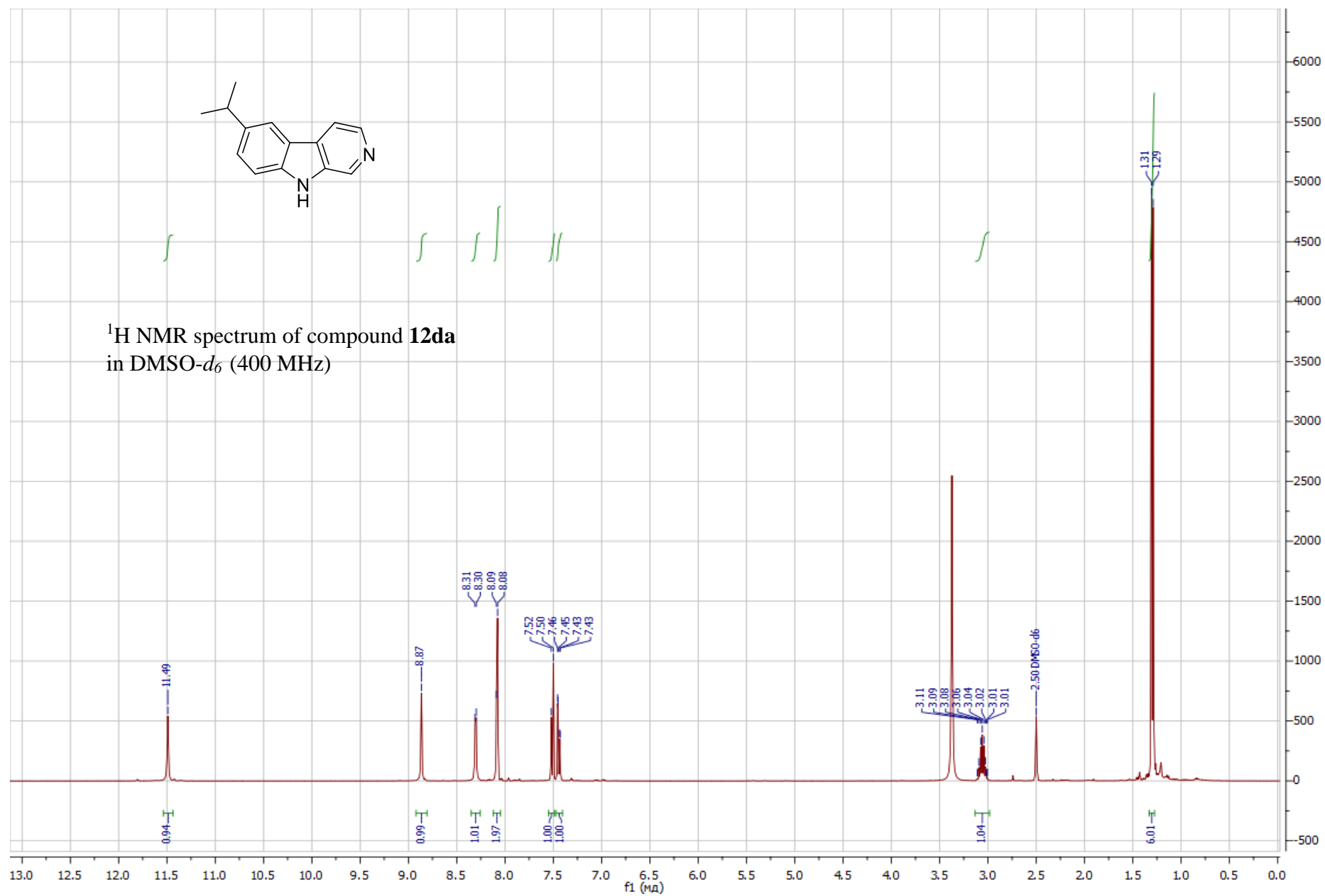


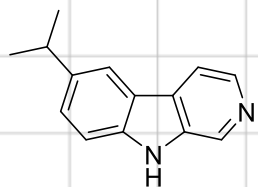




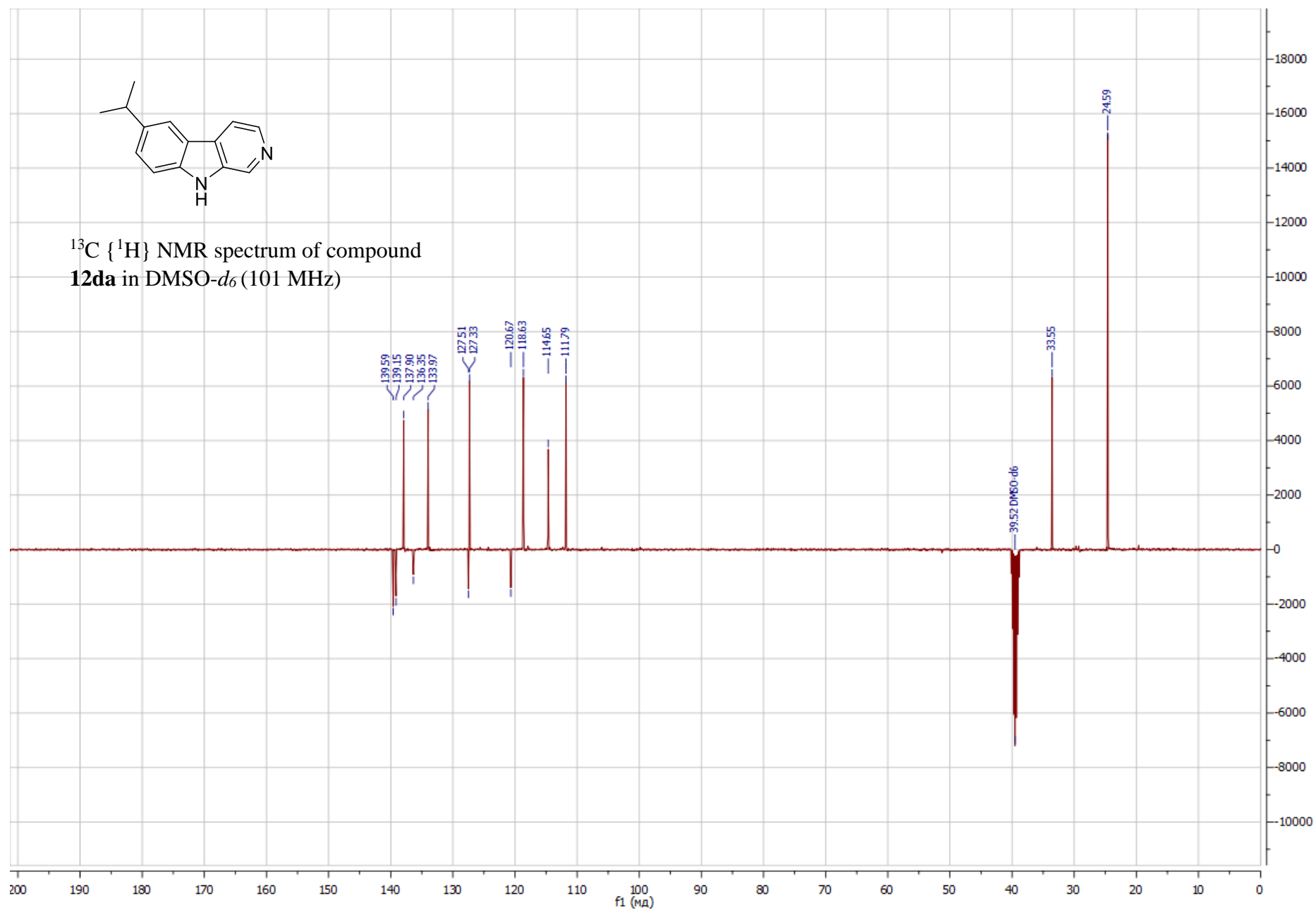


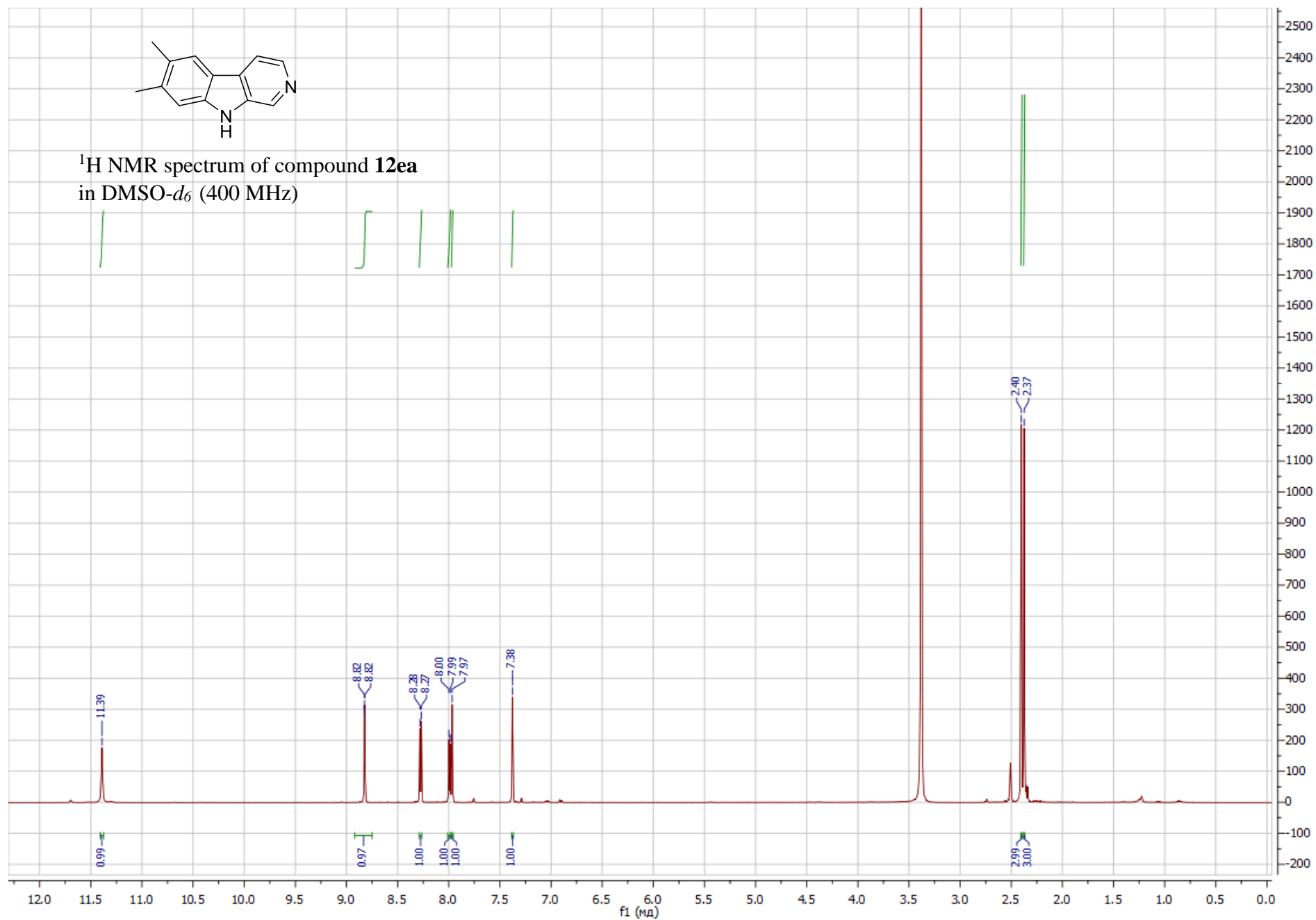


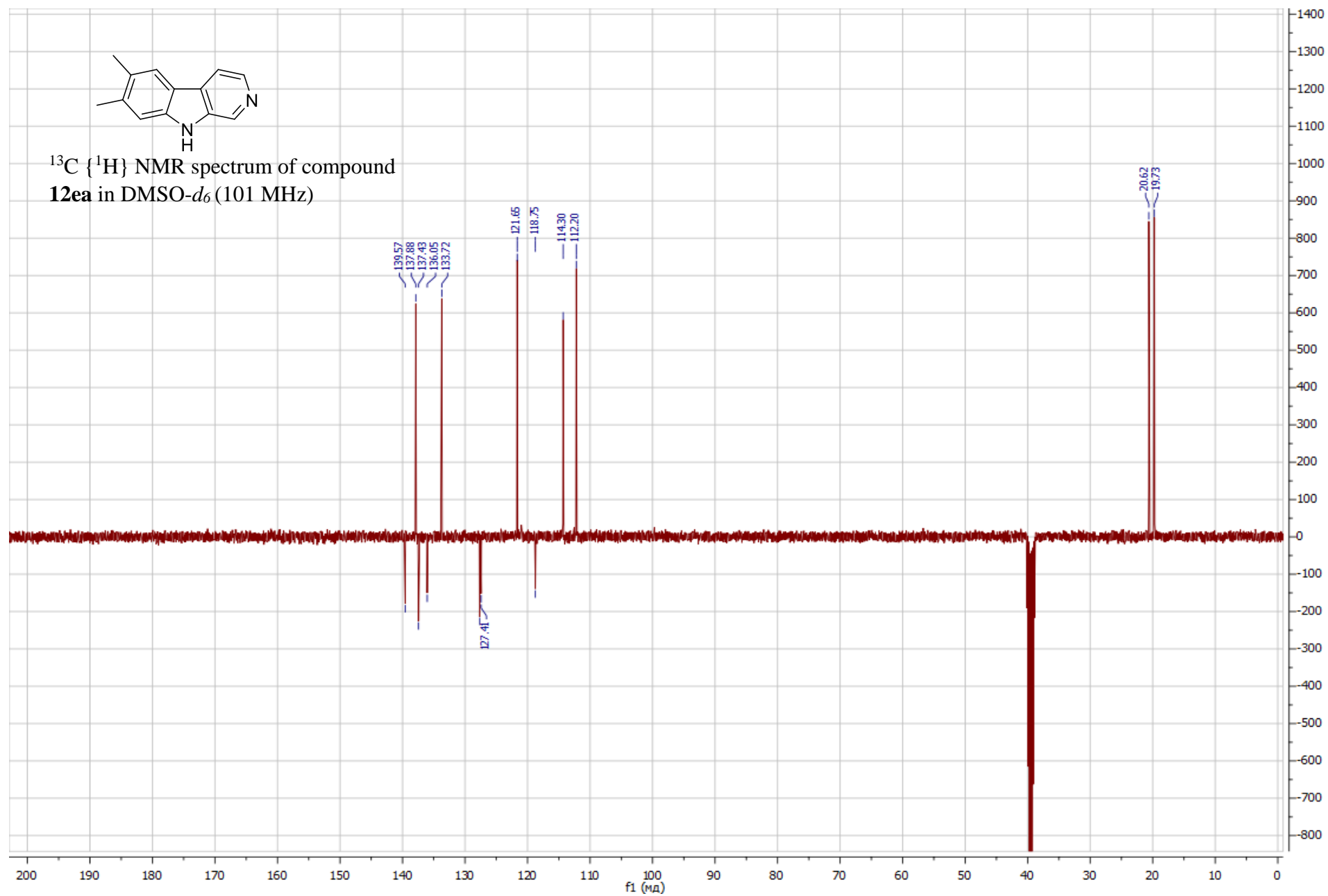


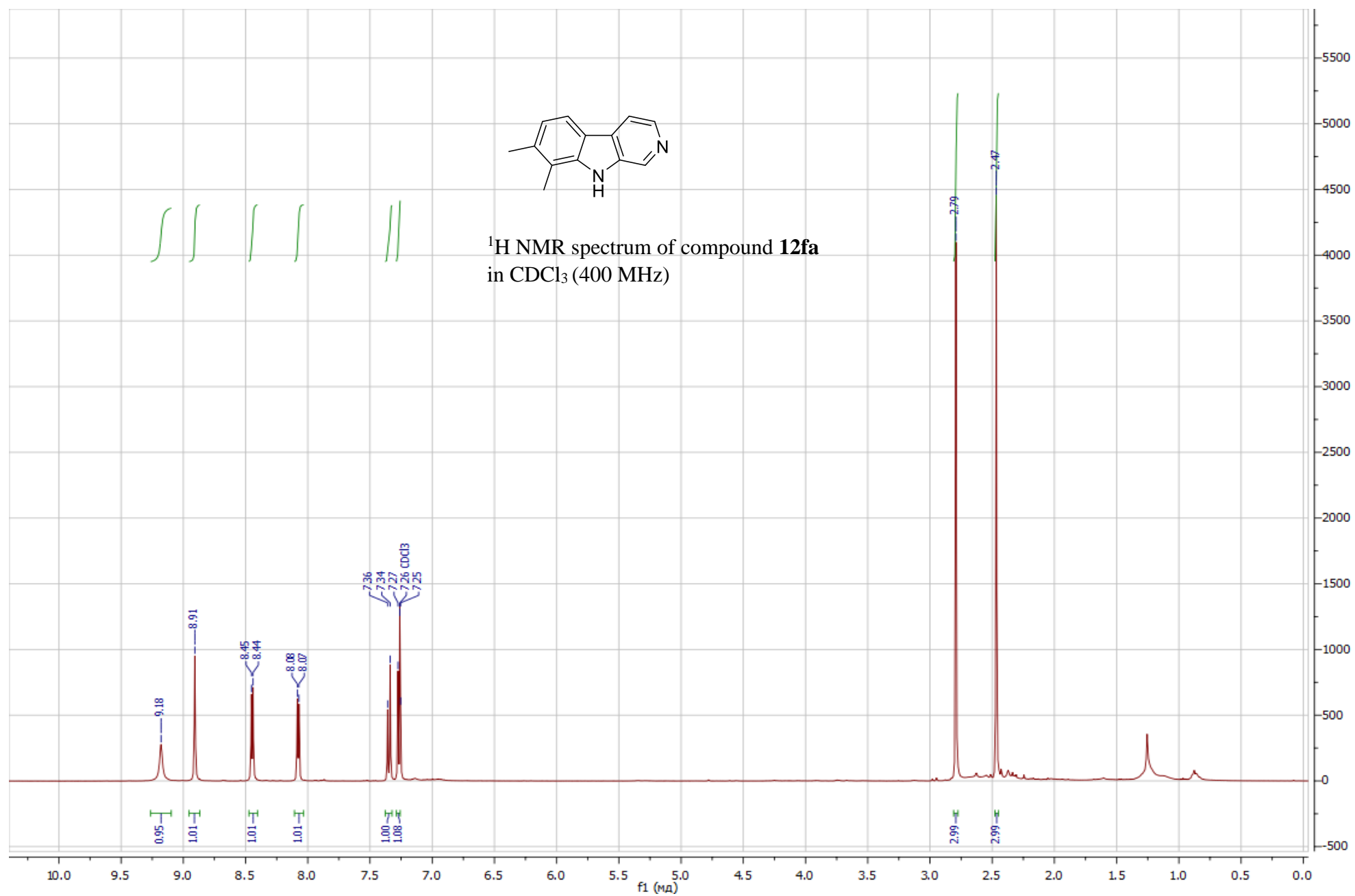


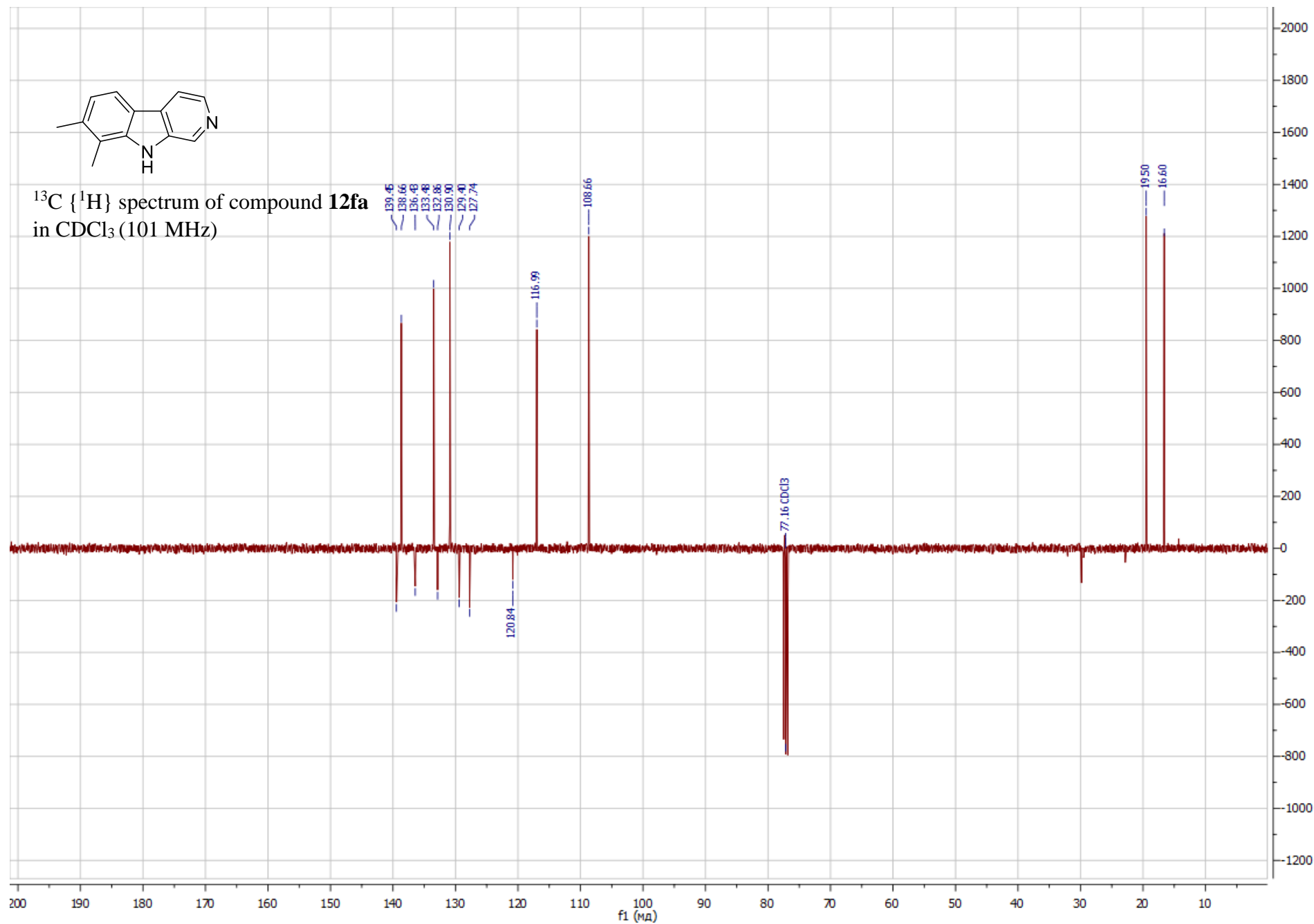
$^{13}\text{C}$  { $^1\text{H}$ } NMR spectrum of compound  
**12da** in DMSO- $d_6$  (101 MHz)

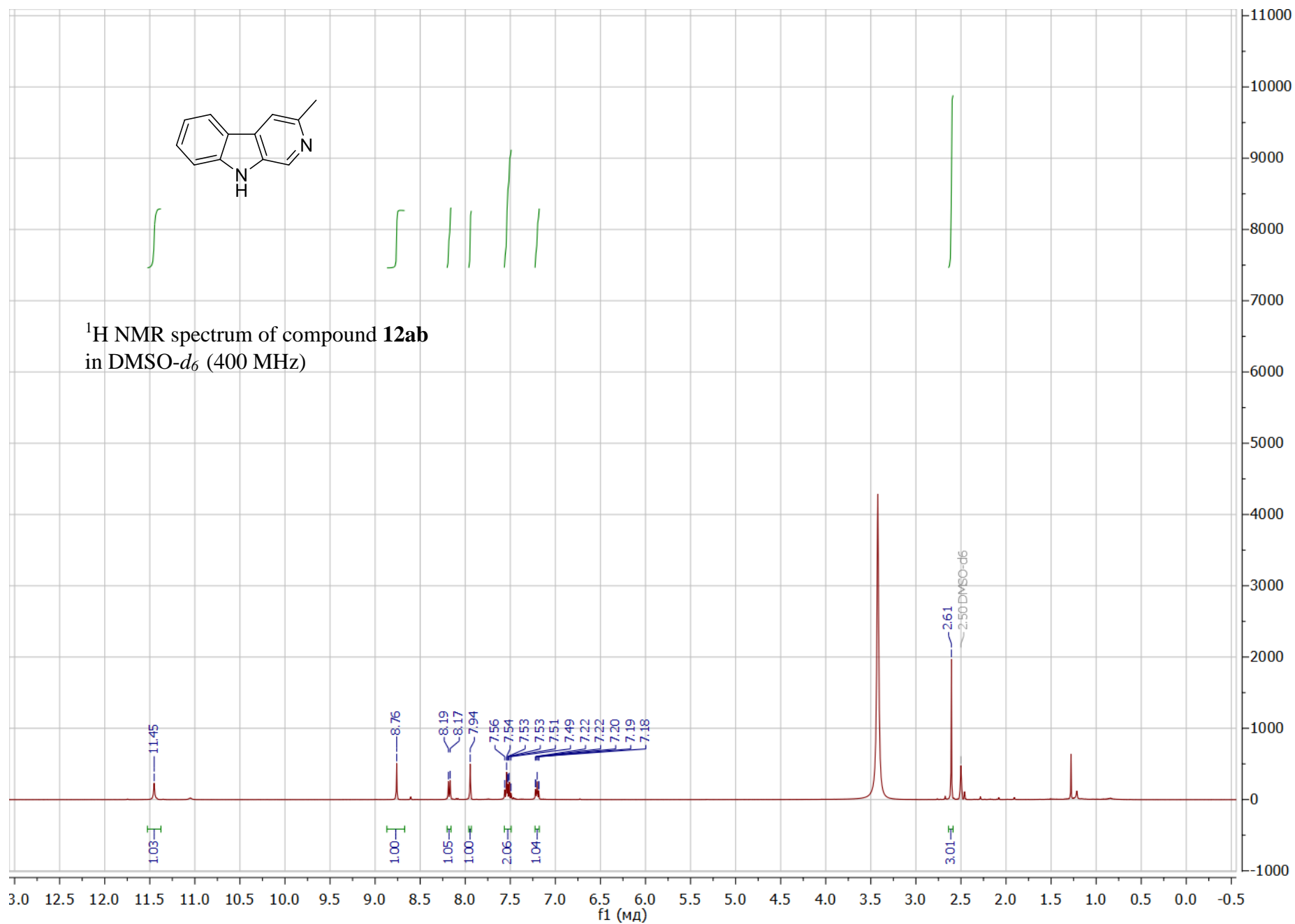


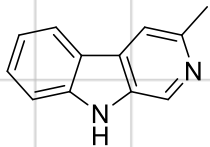




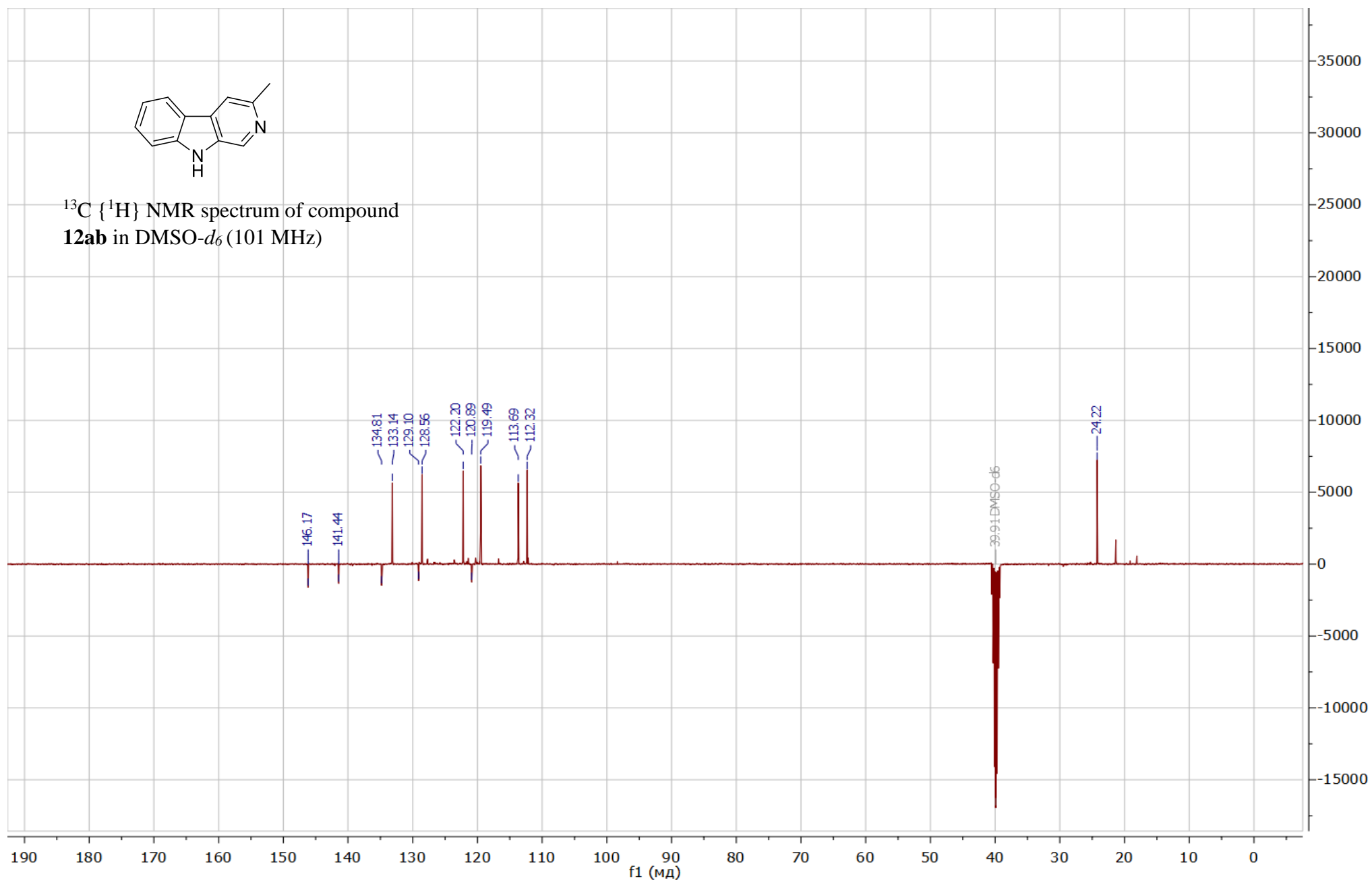




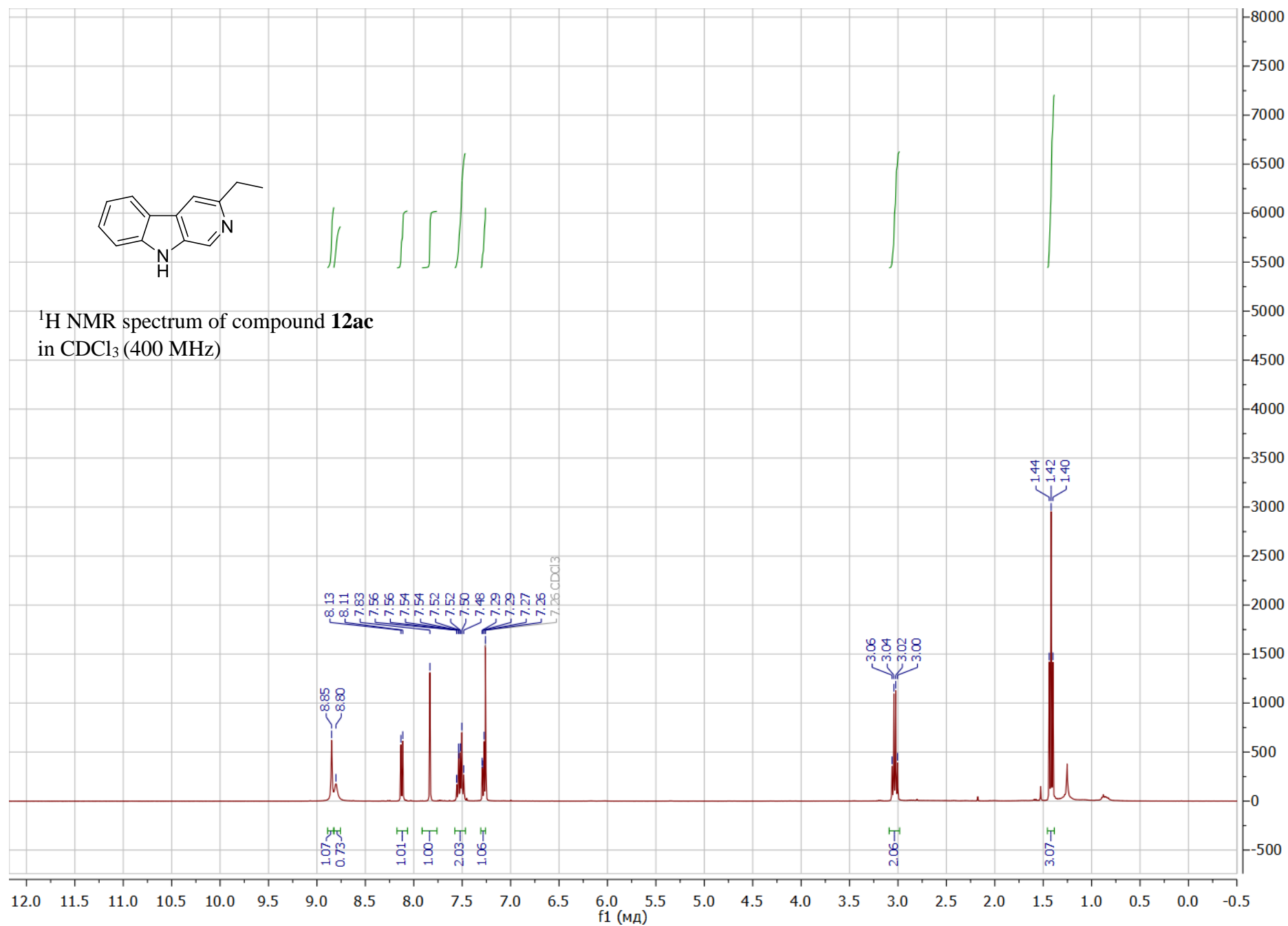


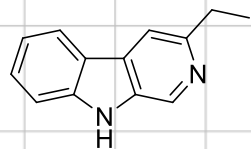


$^{13}\text{C}$  { $^1\text{H}$ } NMR spectrum of compound **12ab** in DMSO- $d_6$  (101 MHz)

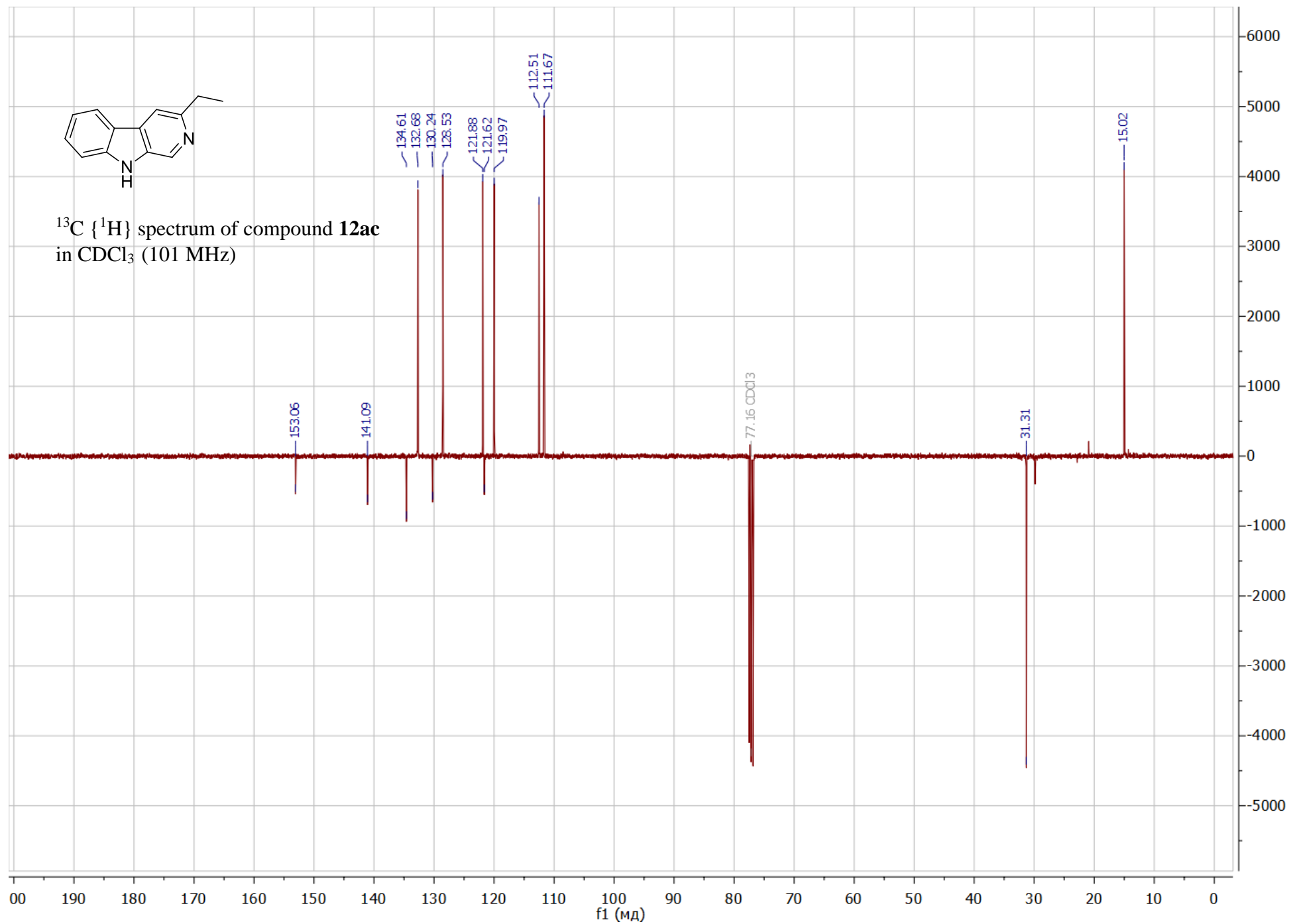


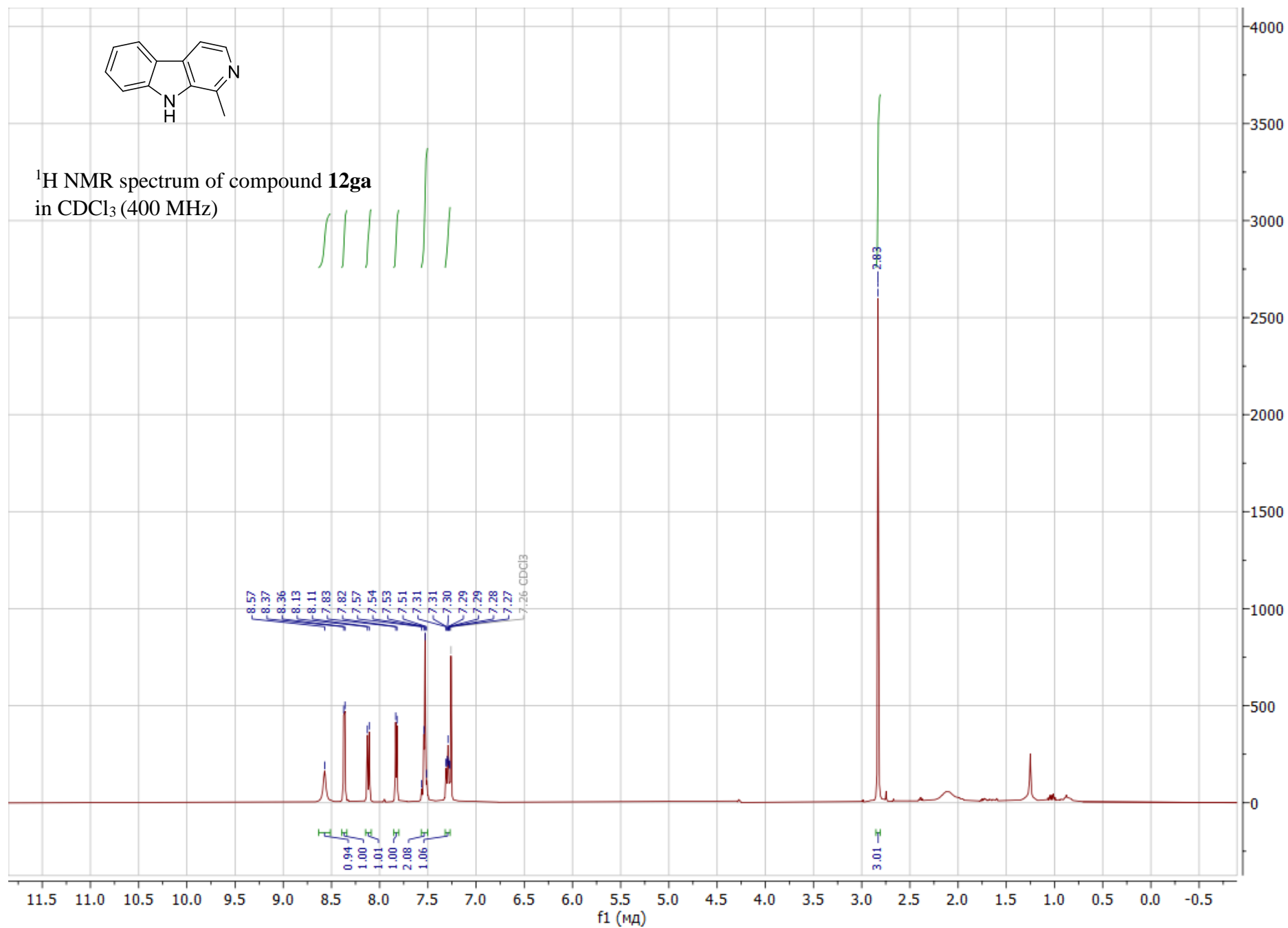


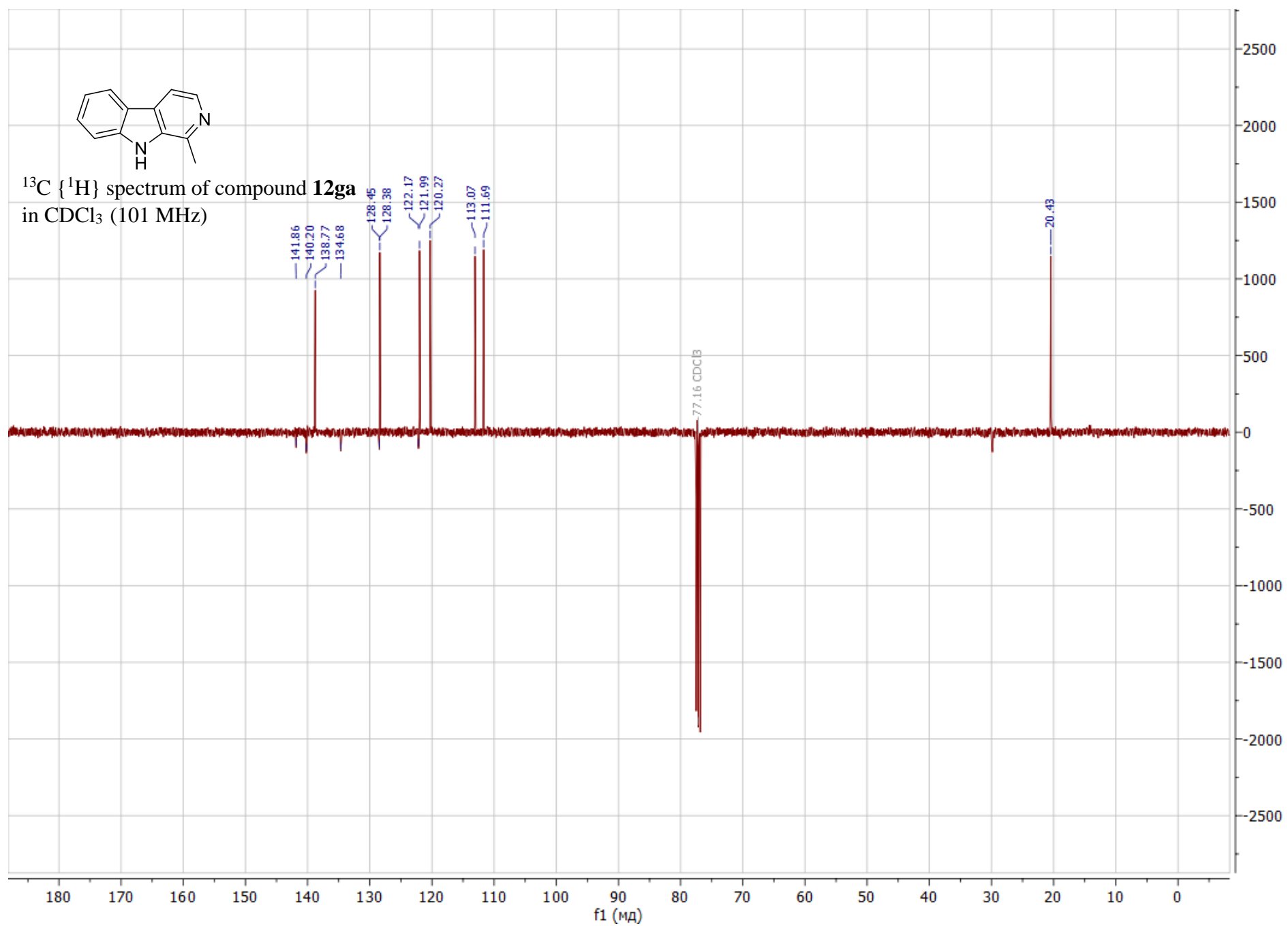


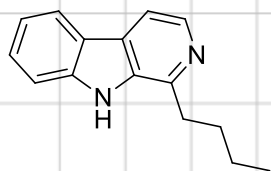


$^{13}\text{C}$  { $^1\text{H}$ } spectrum of compound **12ac**  
in  $\text{CDCl}_3$  (101 MHz)

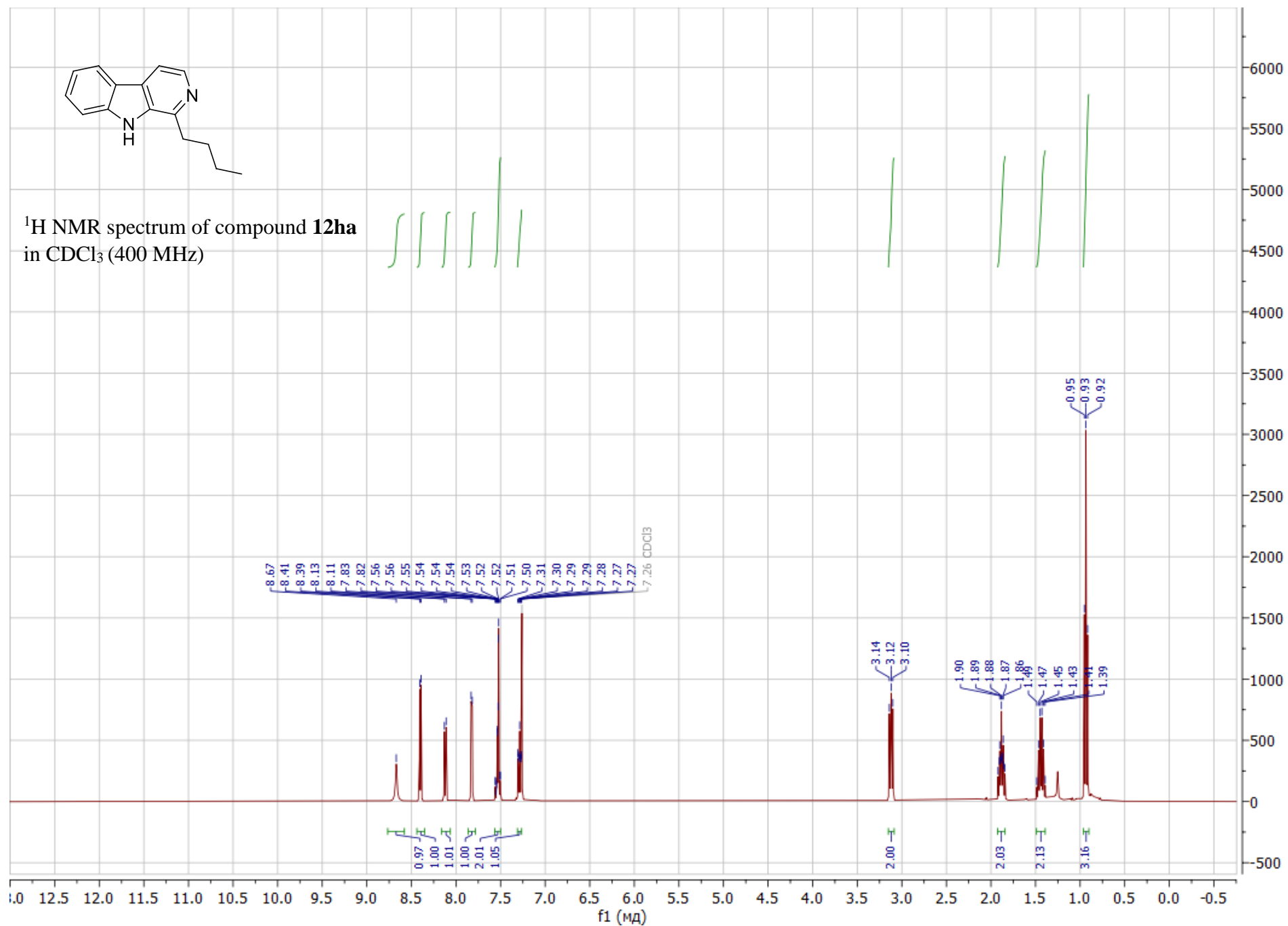


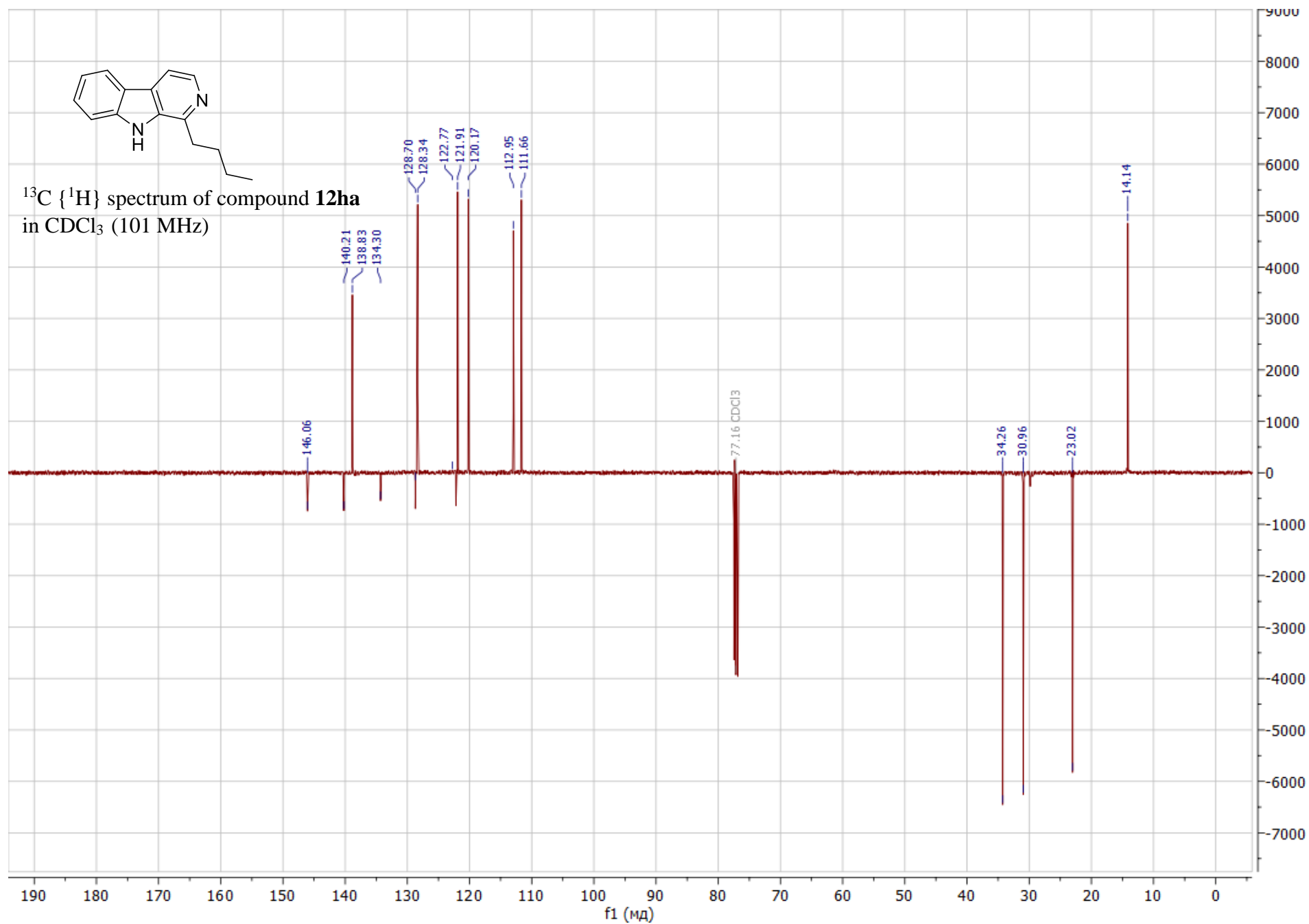


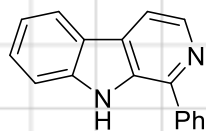




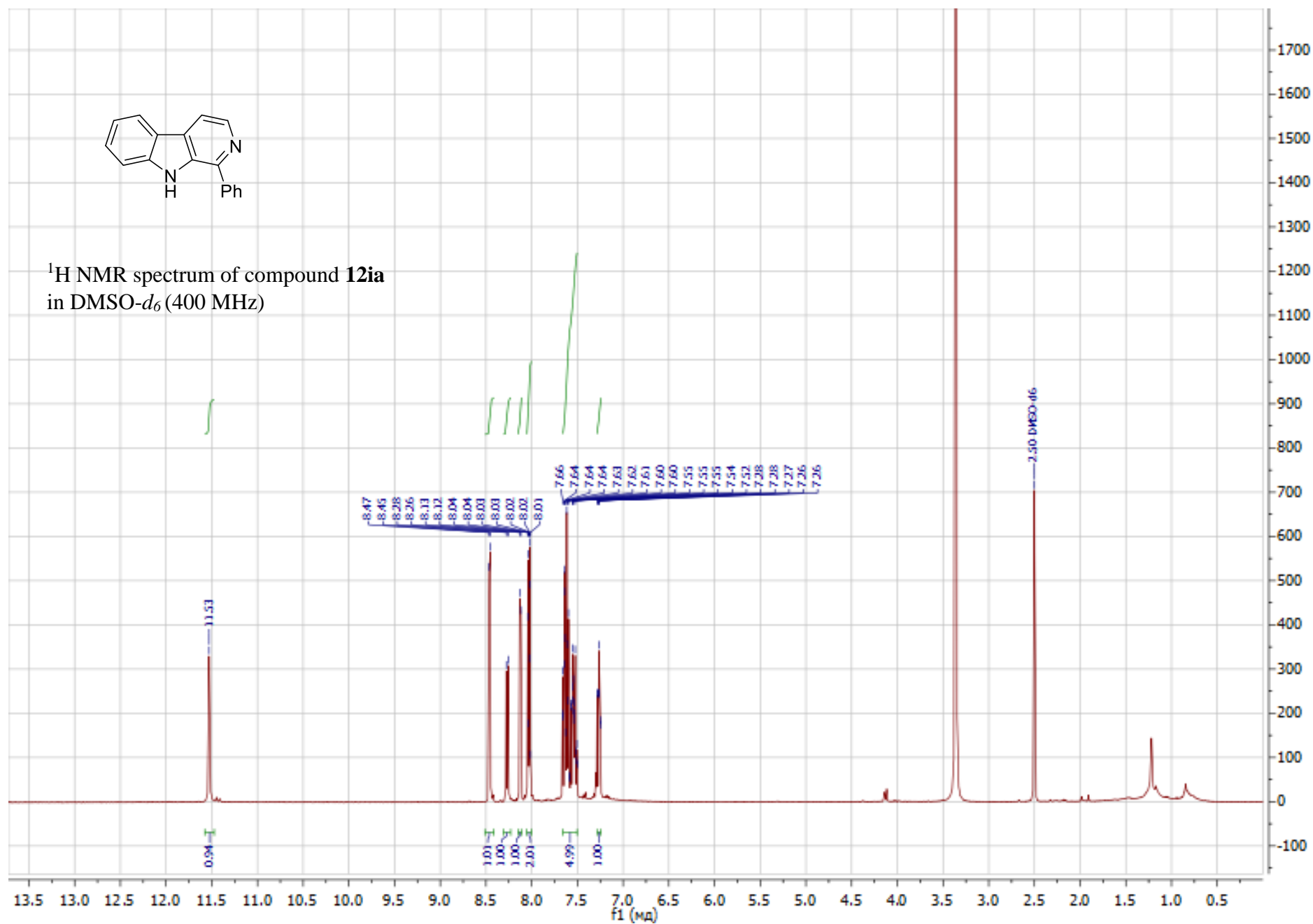
$^1\text{H}$  NMR spectrum of compound **12ha**  
in  $\text{CDCl}_3$  (400 MHz)

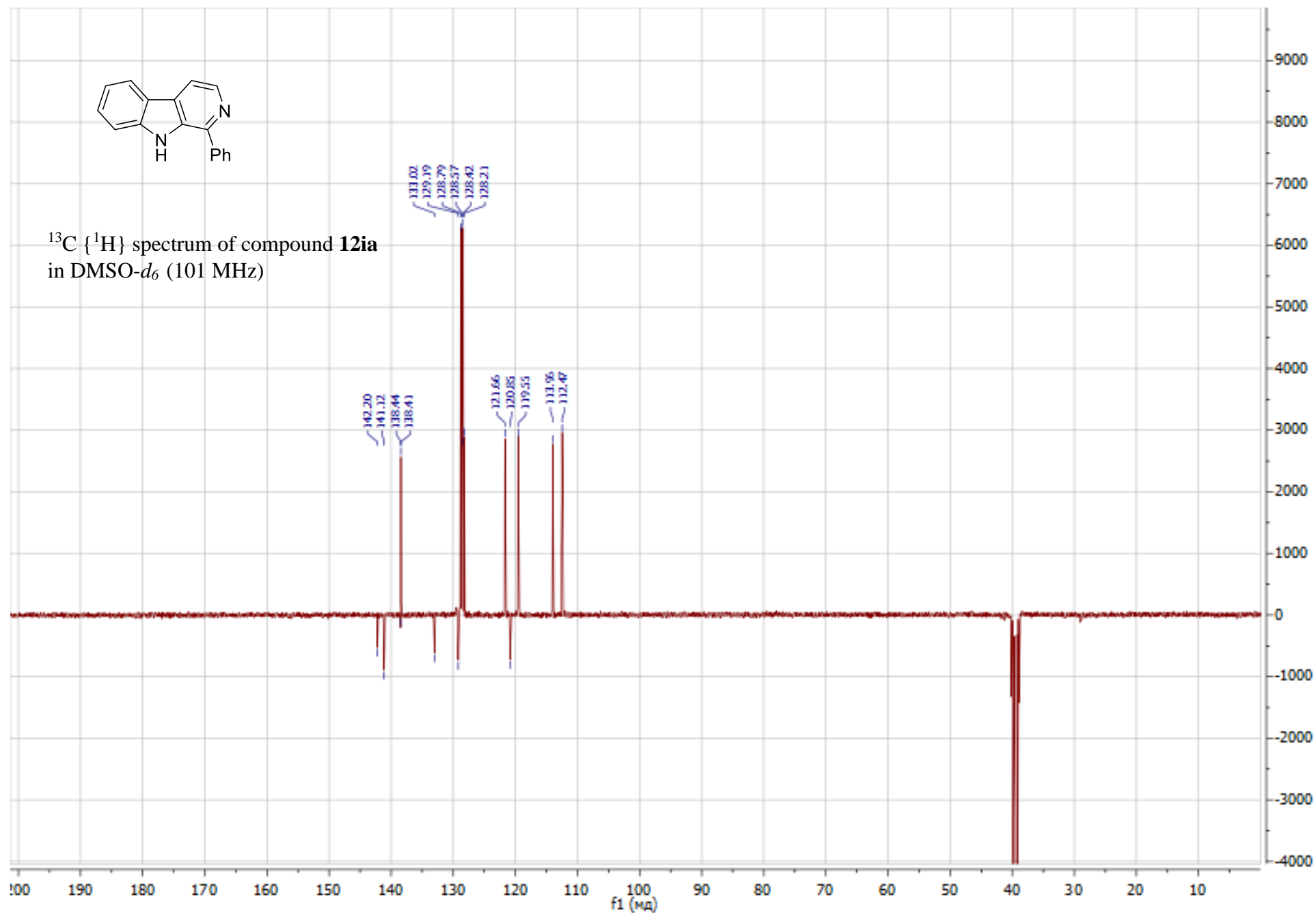




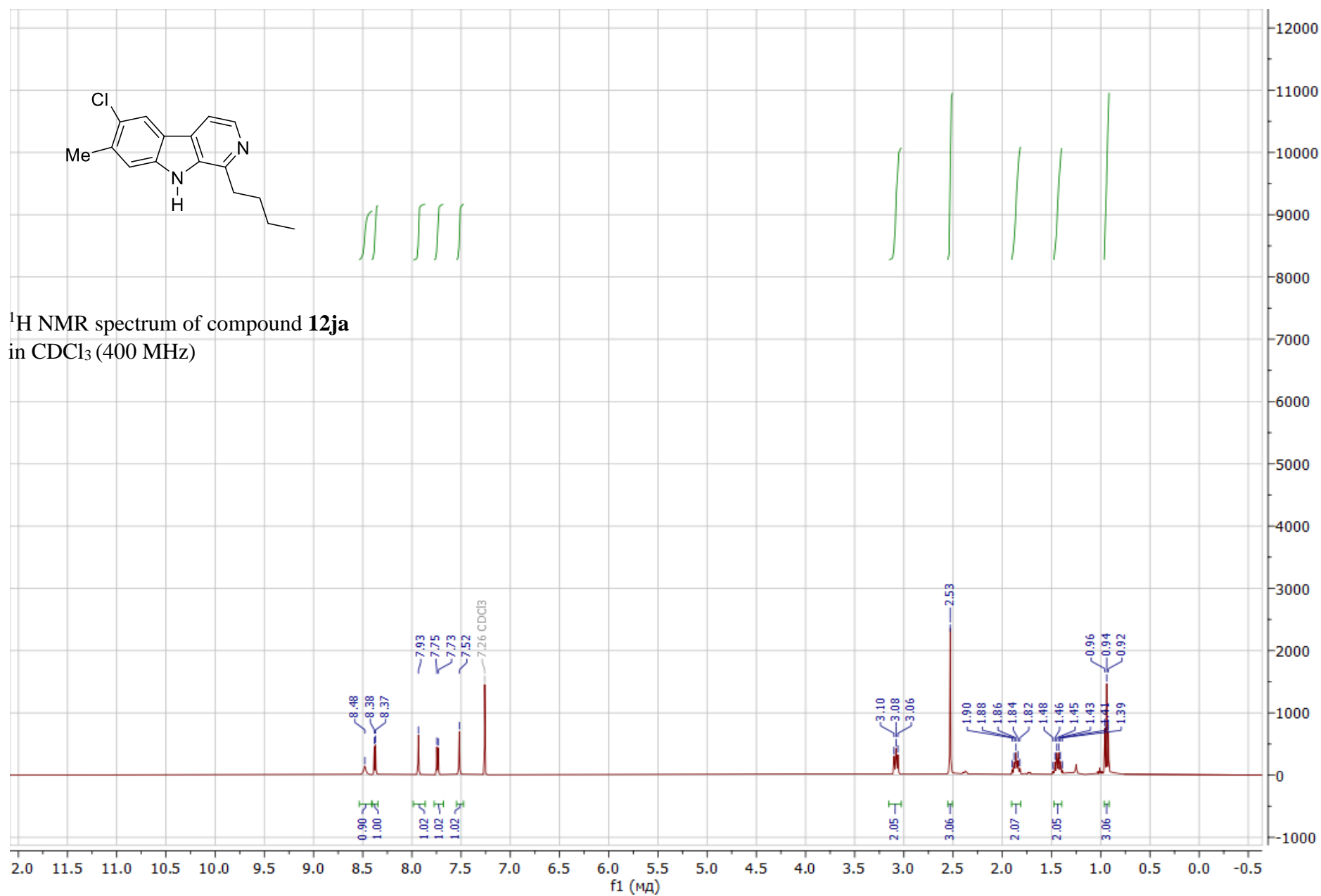


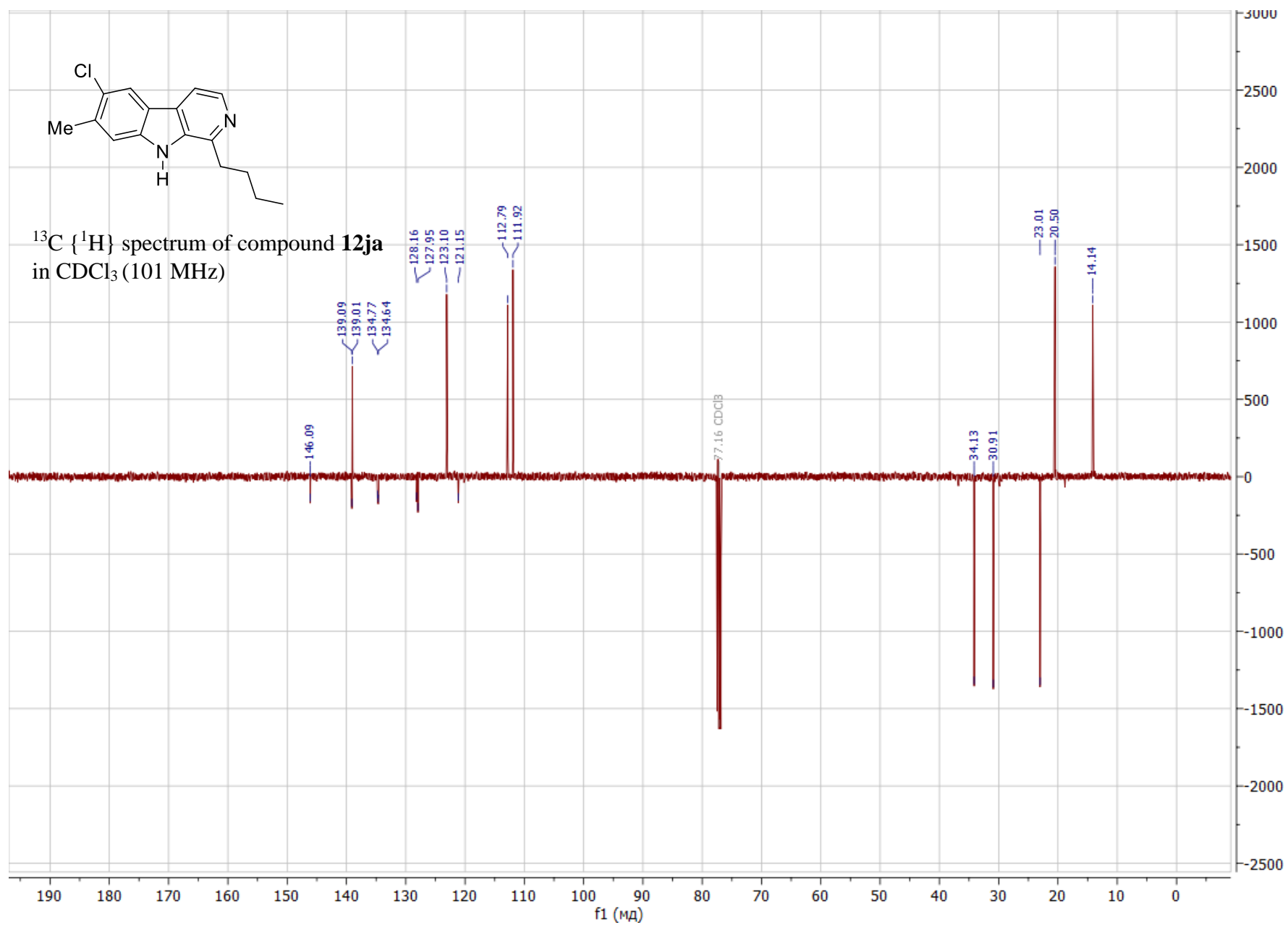
$^1\text{H}$  NMR spectrum of compound **12ia**  
in  $\text{DMSO-}d_6$  (400 MHz)

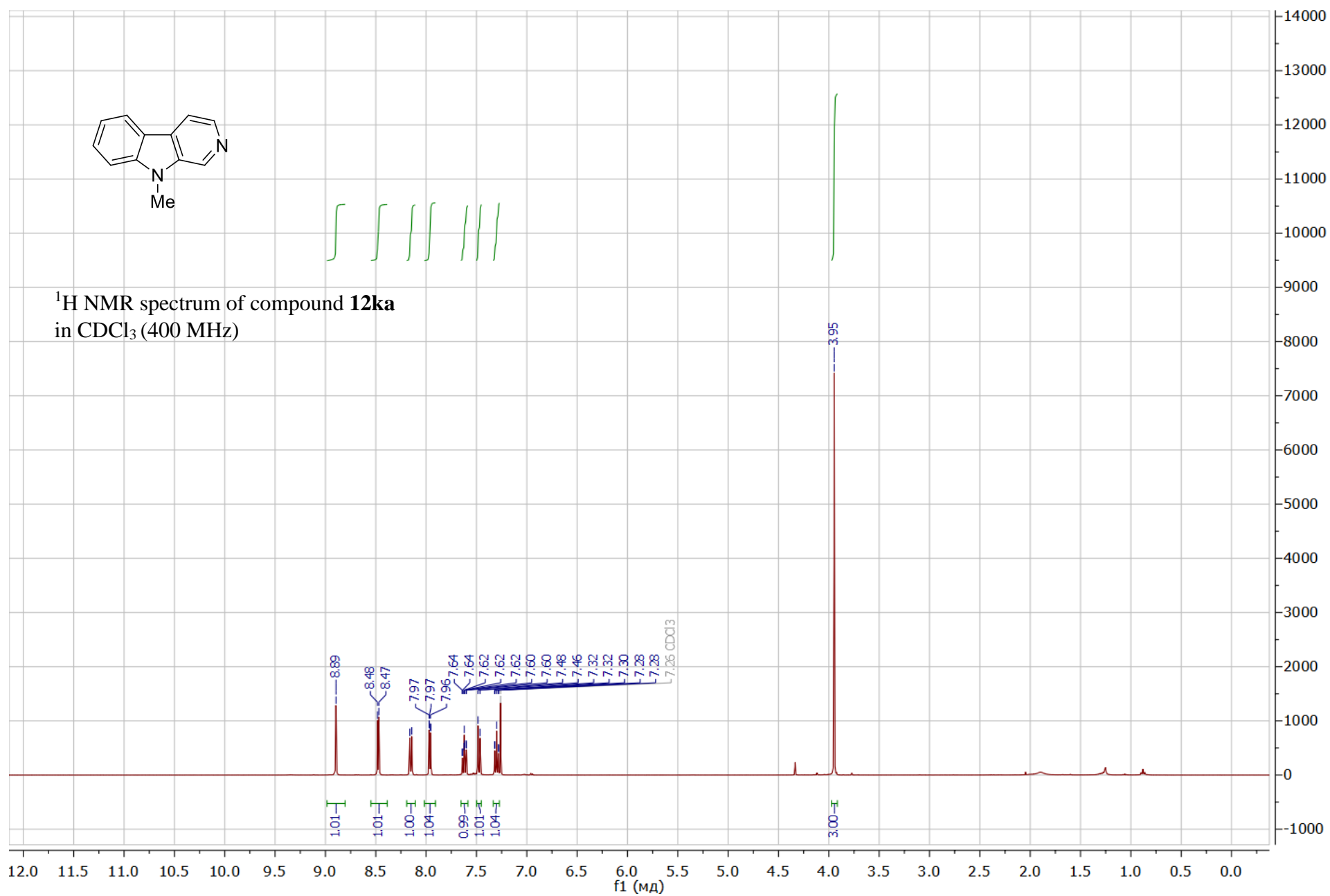


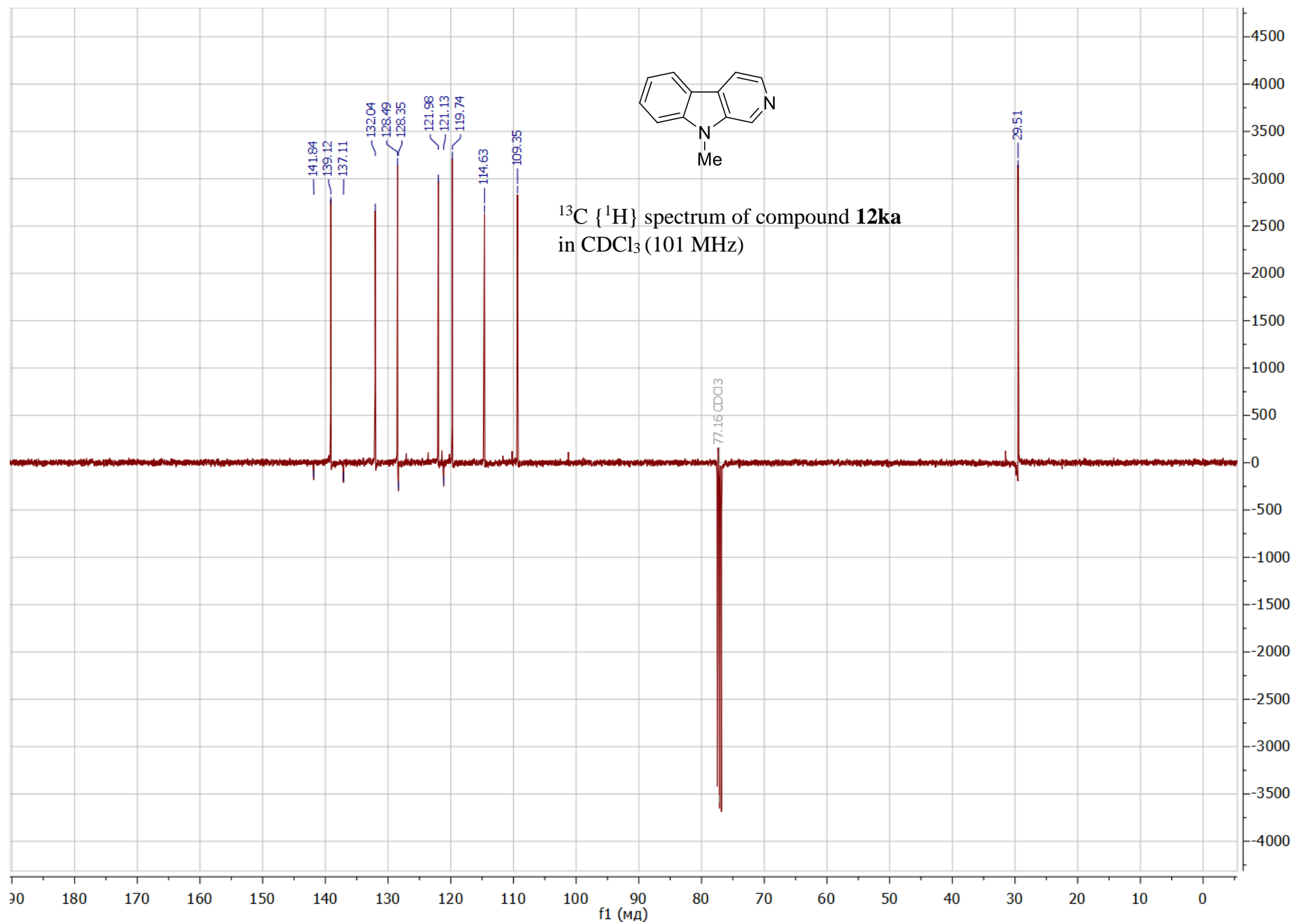


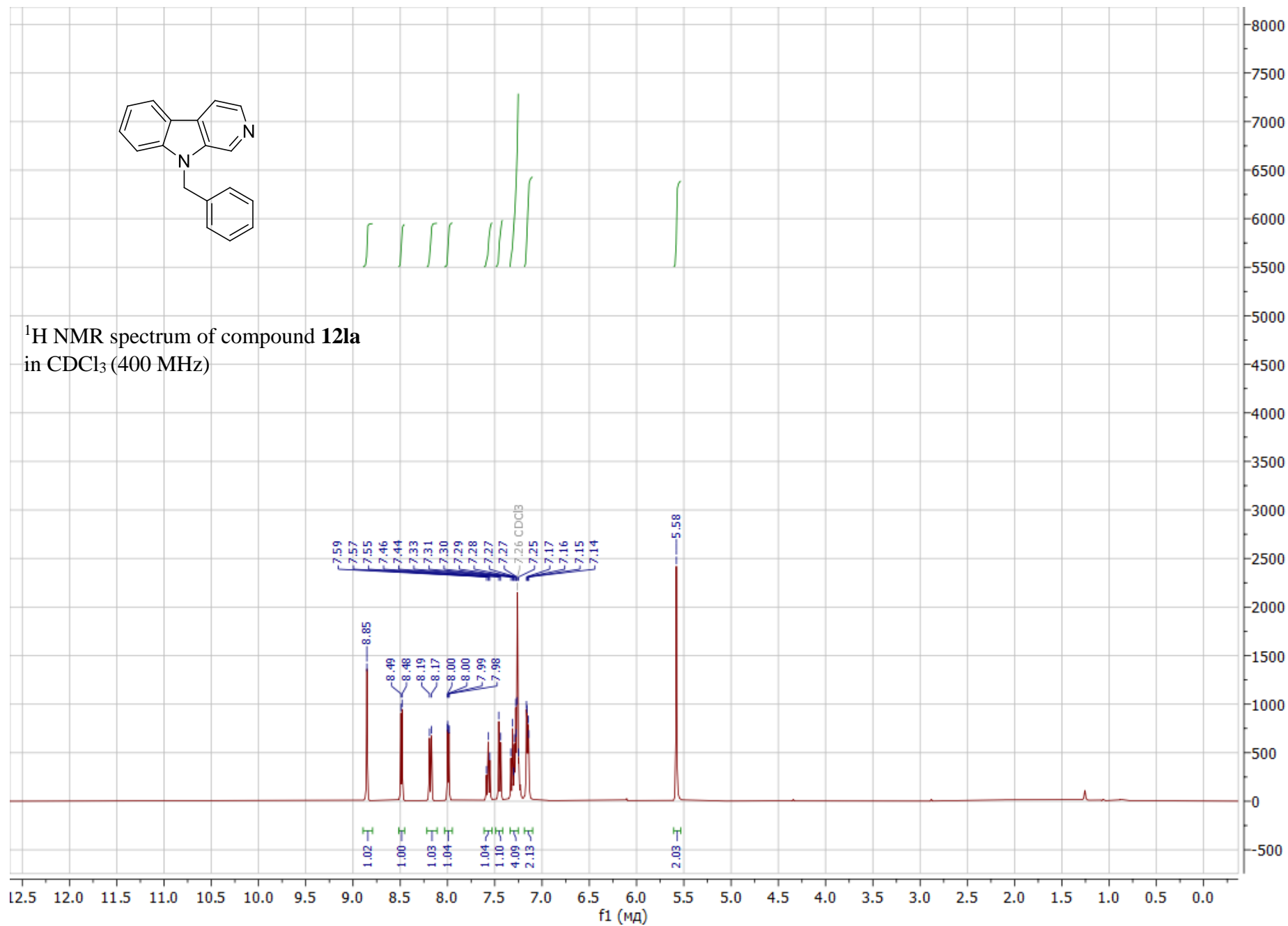


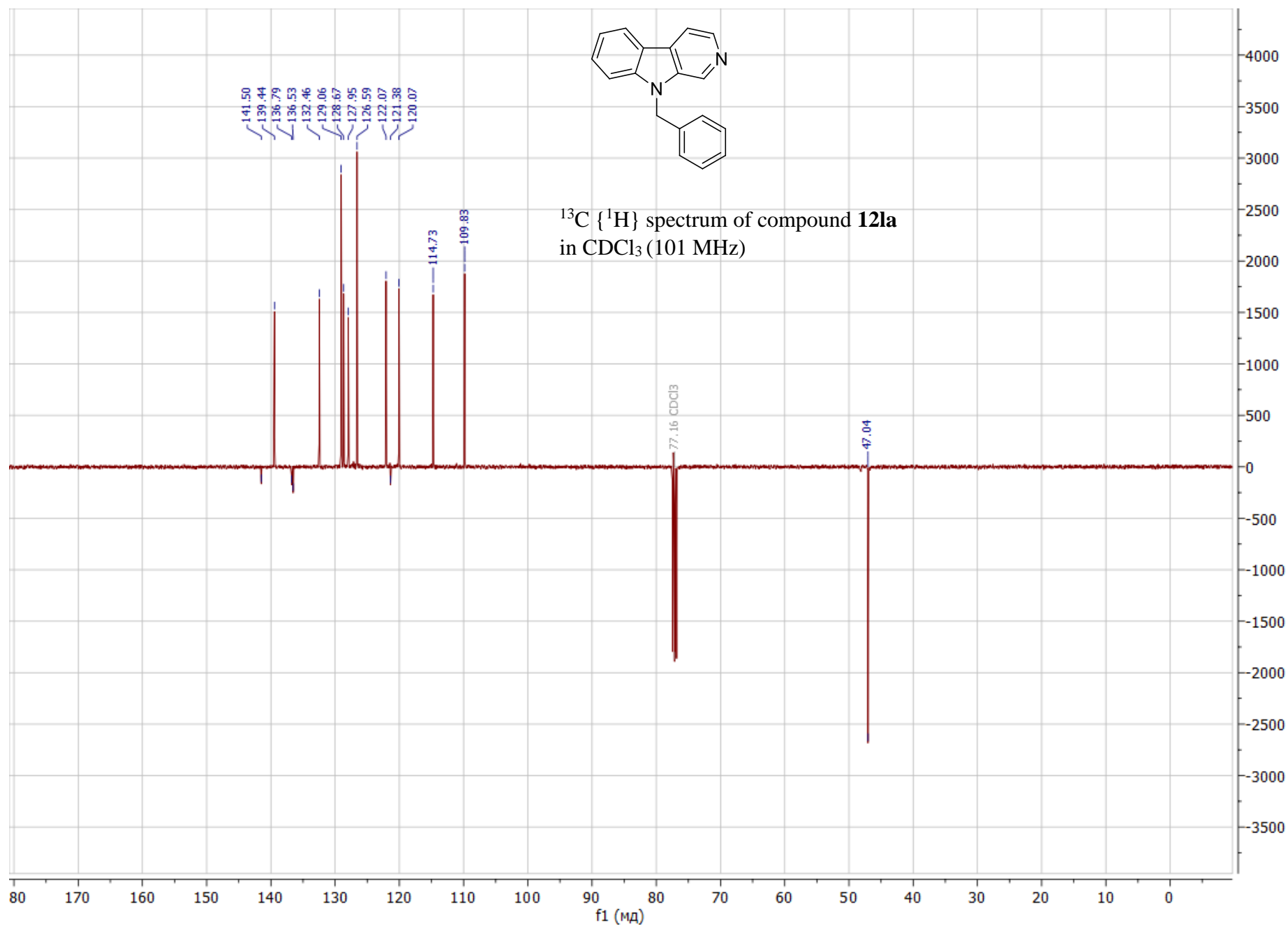


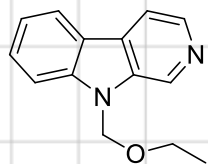




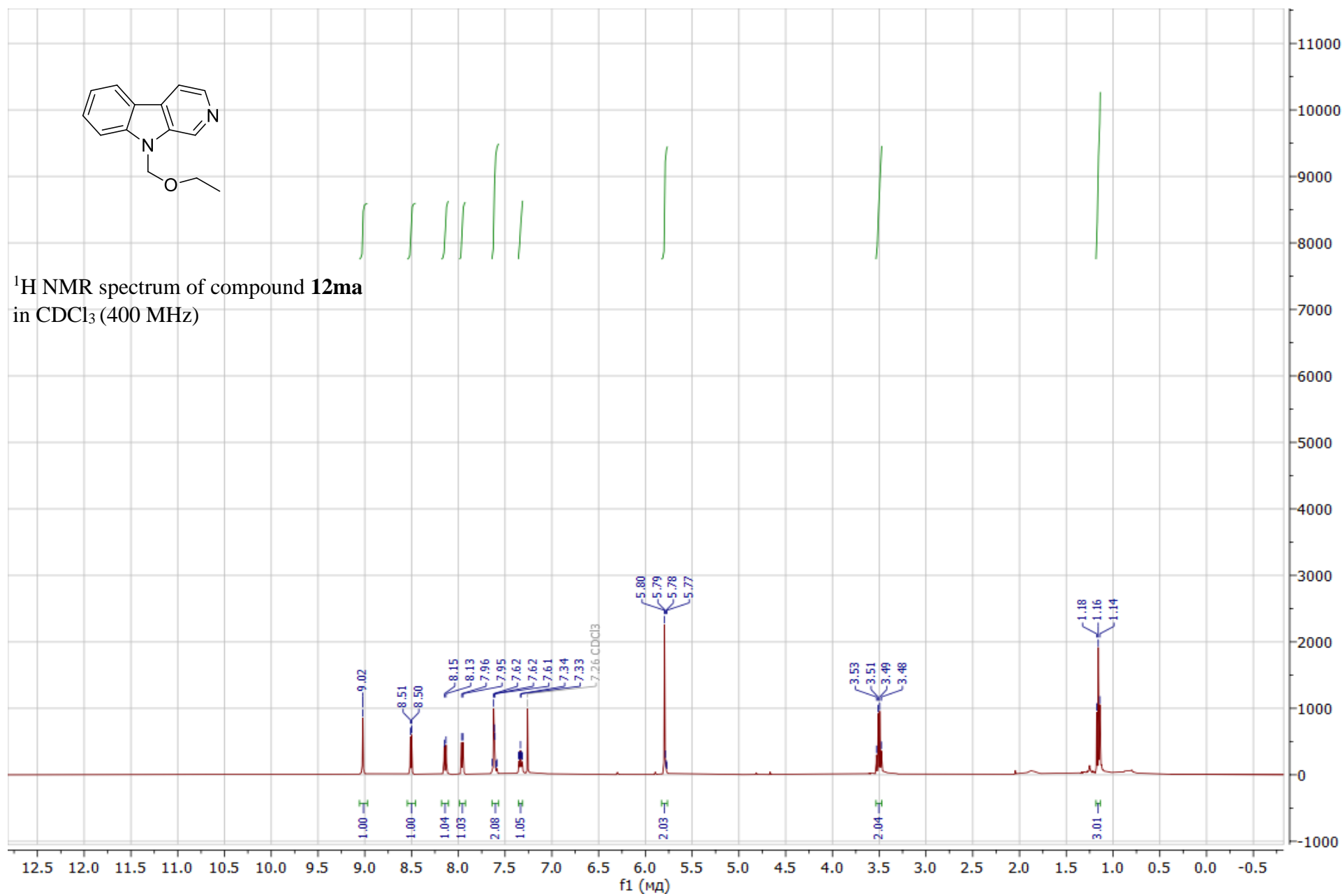


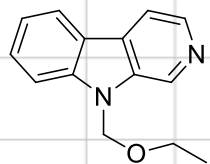




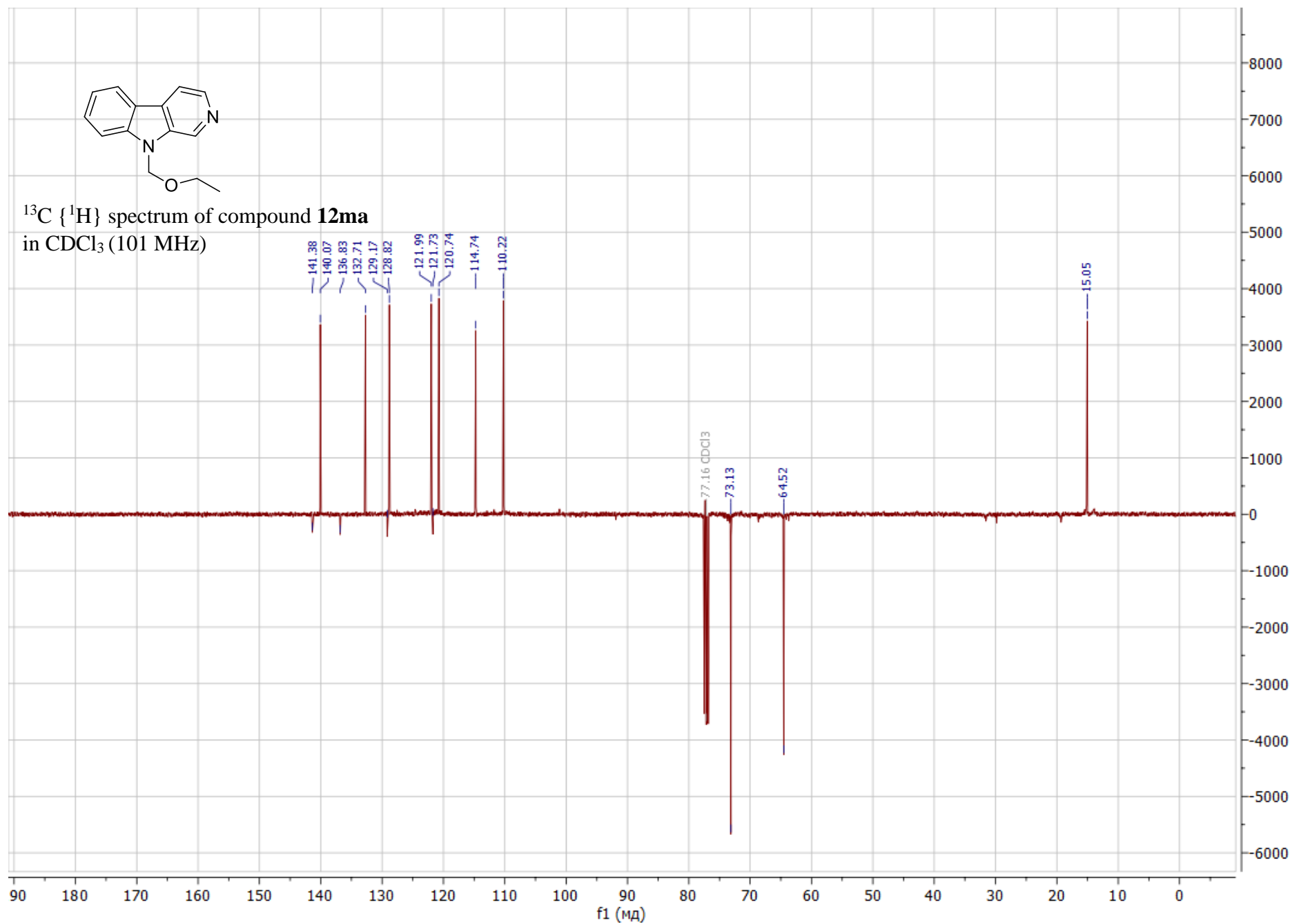


$^1\text{H}$  NMR spectrum of compound **12ma**  
in  $\text{CDCl}_3$  (400 MHz)

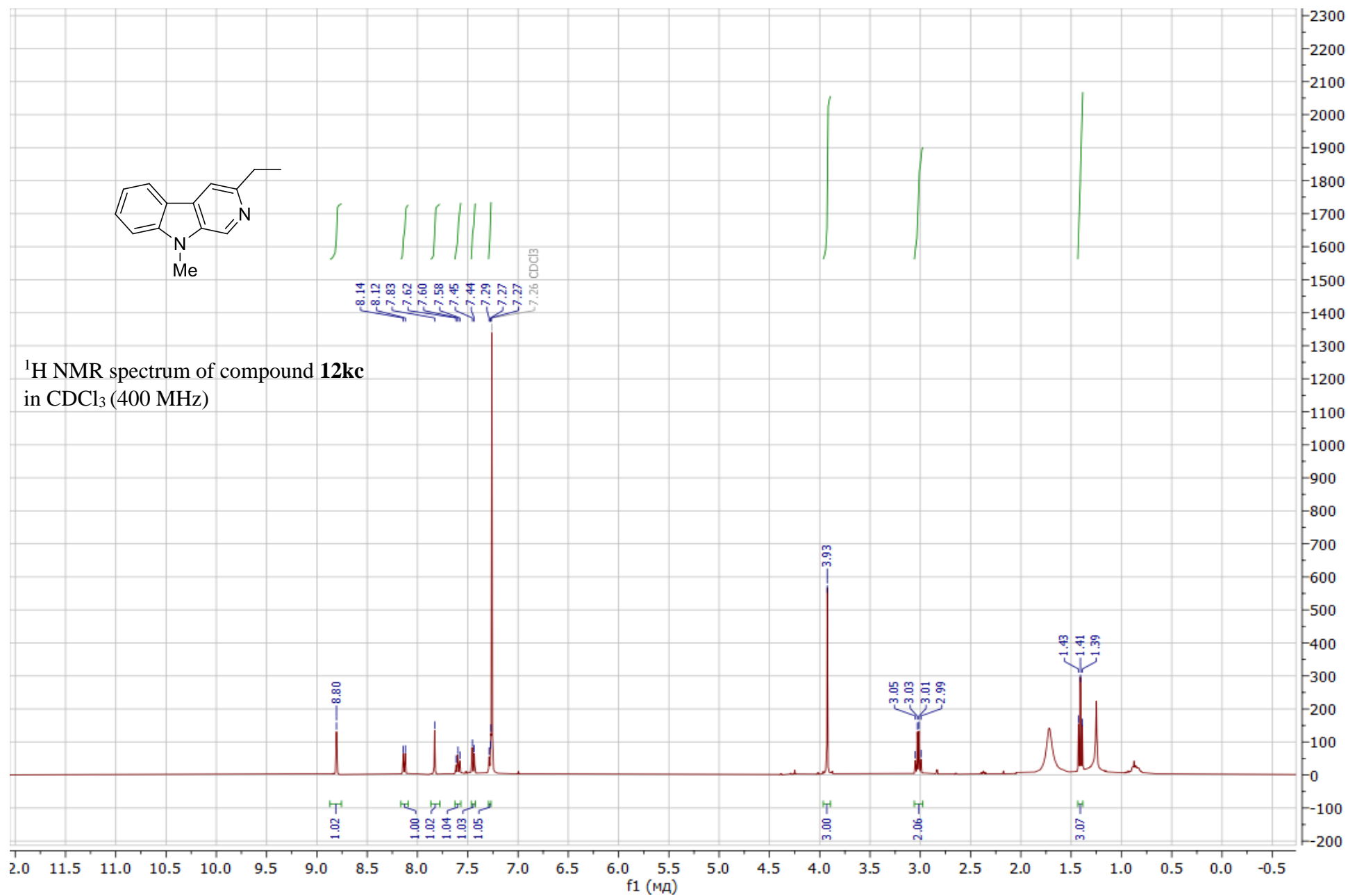


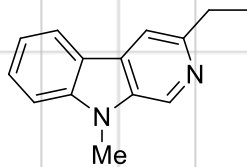


$^{13}\text{C}$  { $^1\text{H}$ } spectrum of compound **12ma**  
in  $\text{CDCl}_3$  (101 MHz)

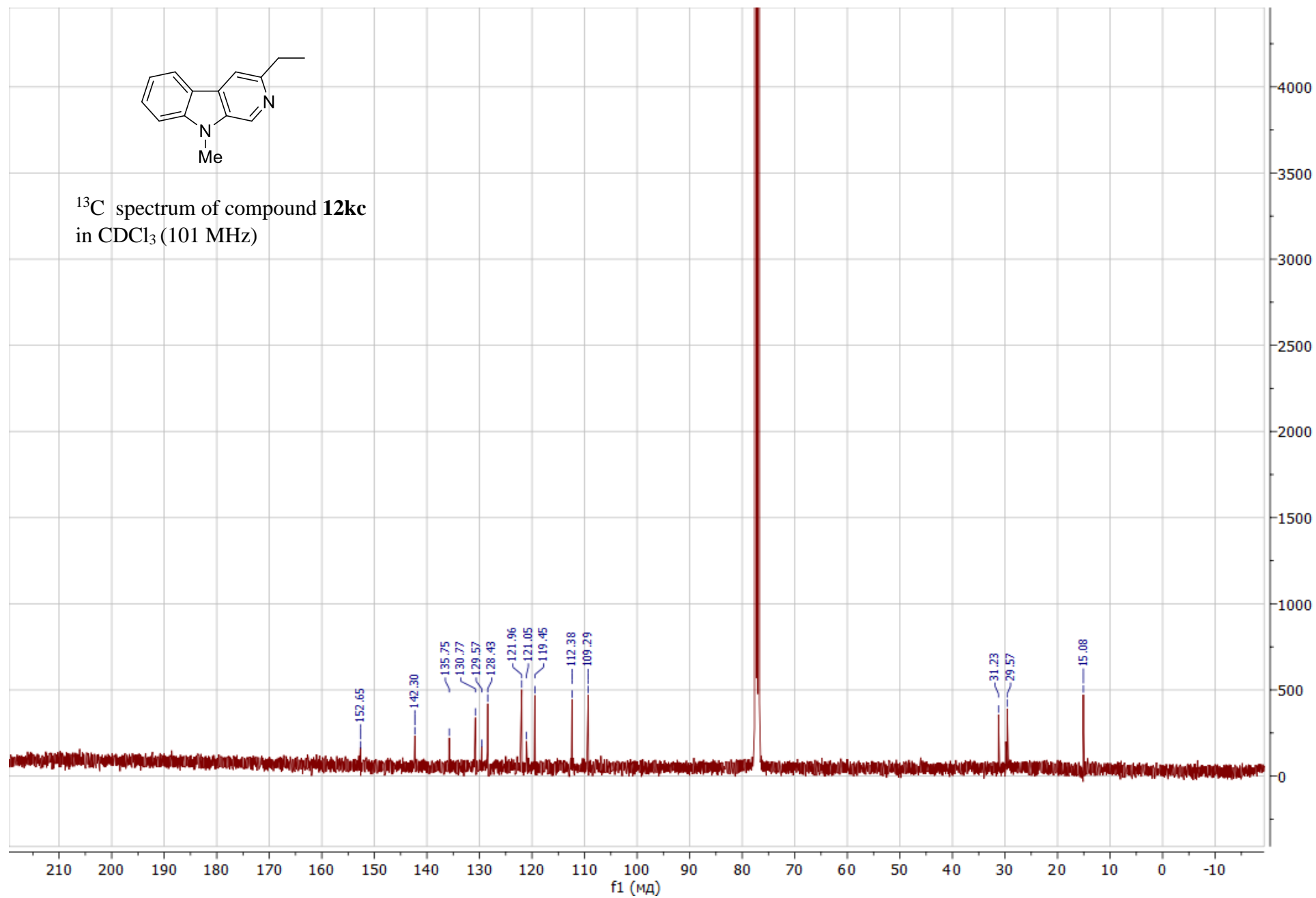


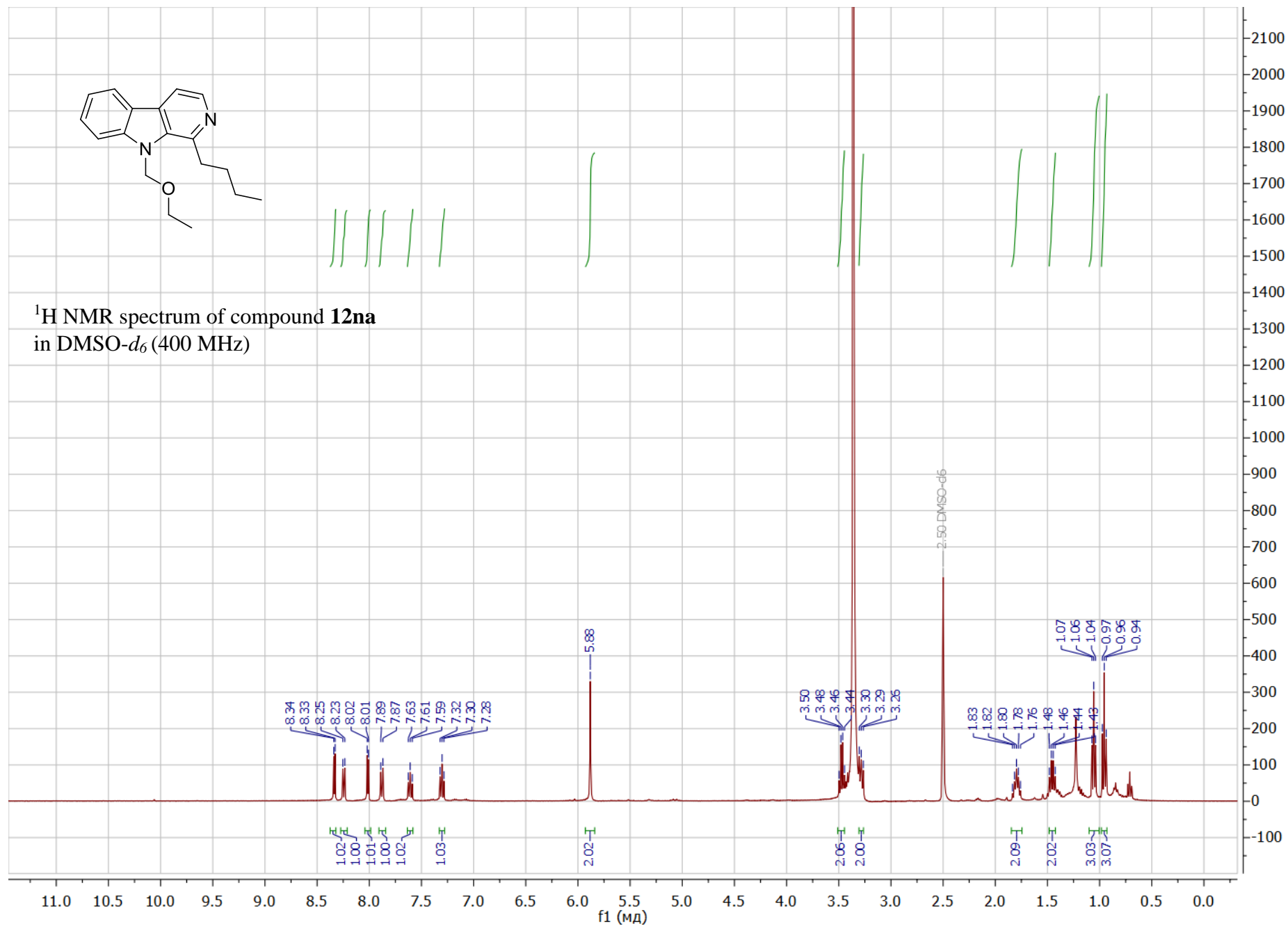


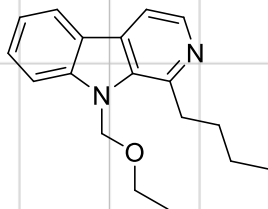




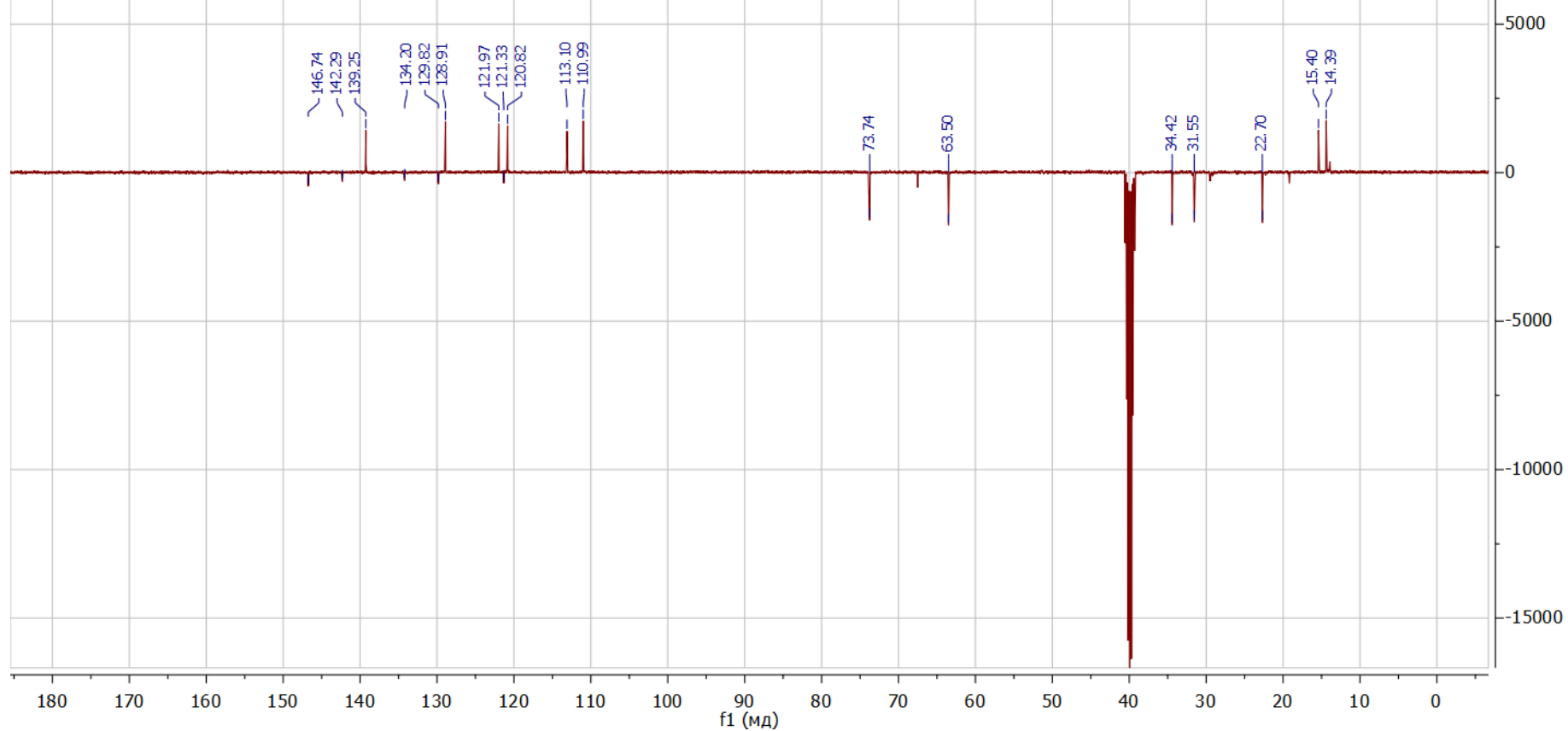
$^{13}\text{C}$  spectrum of compound **12kc**  
in  $\text{CDCl}_3$  (101 MHz)

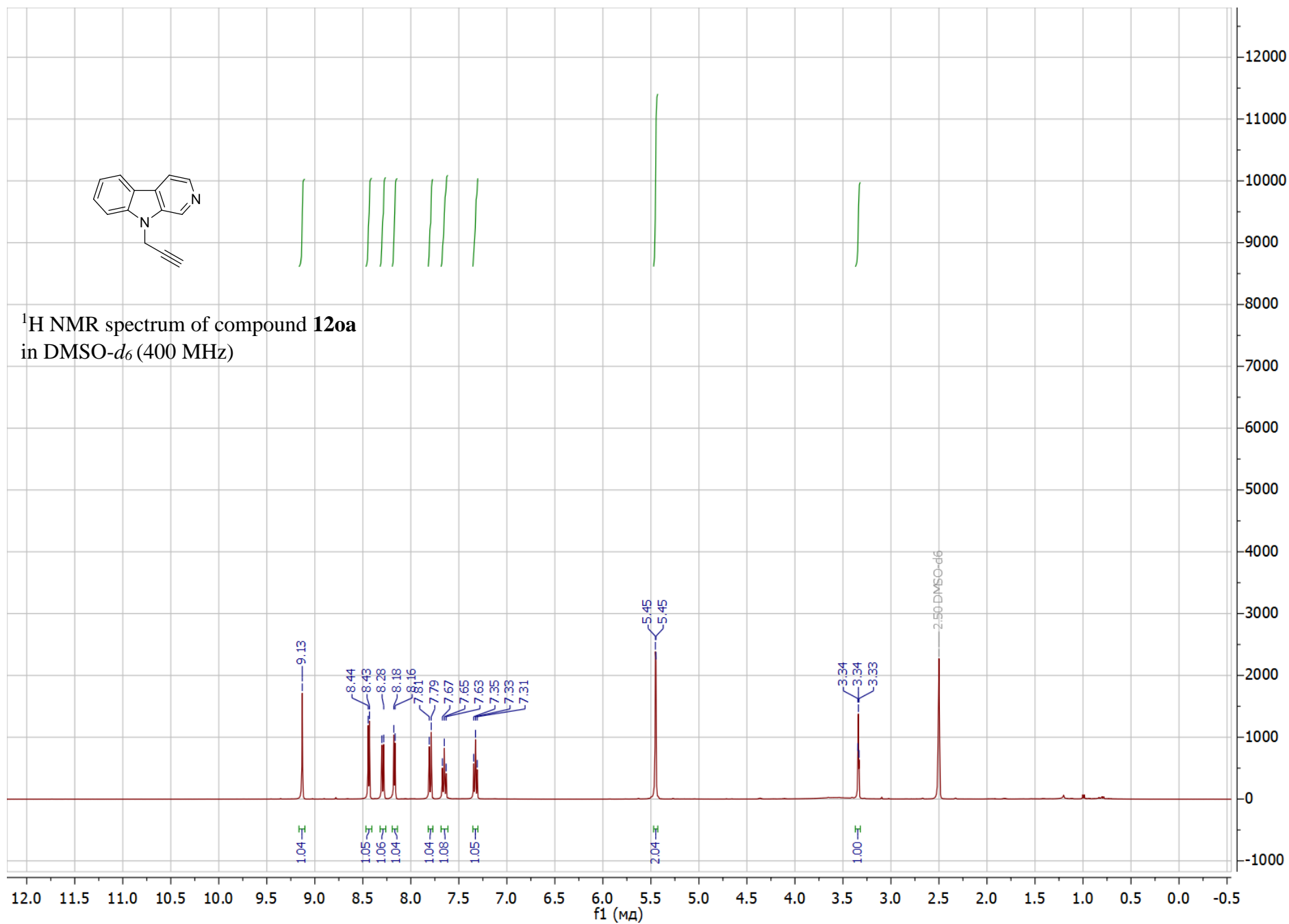


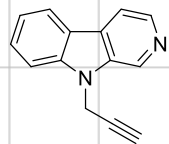




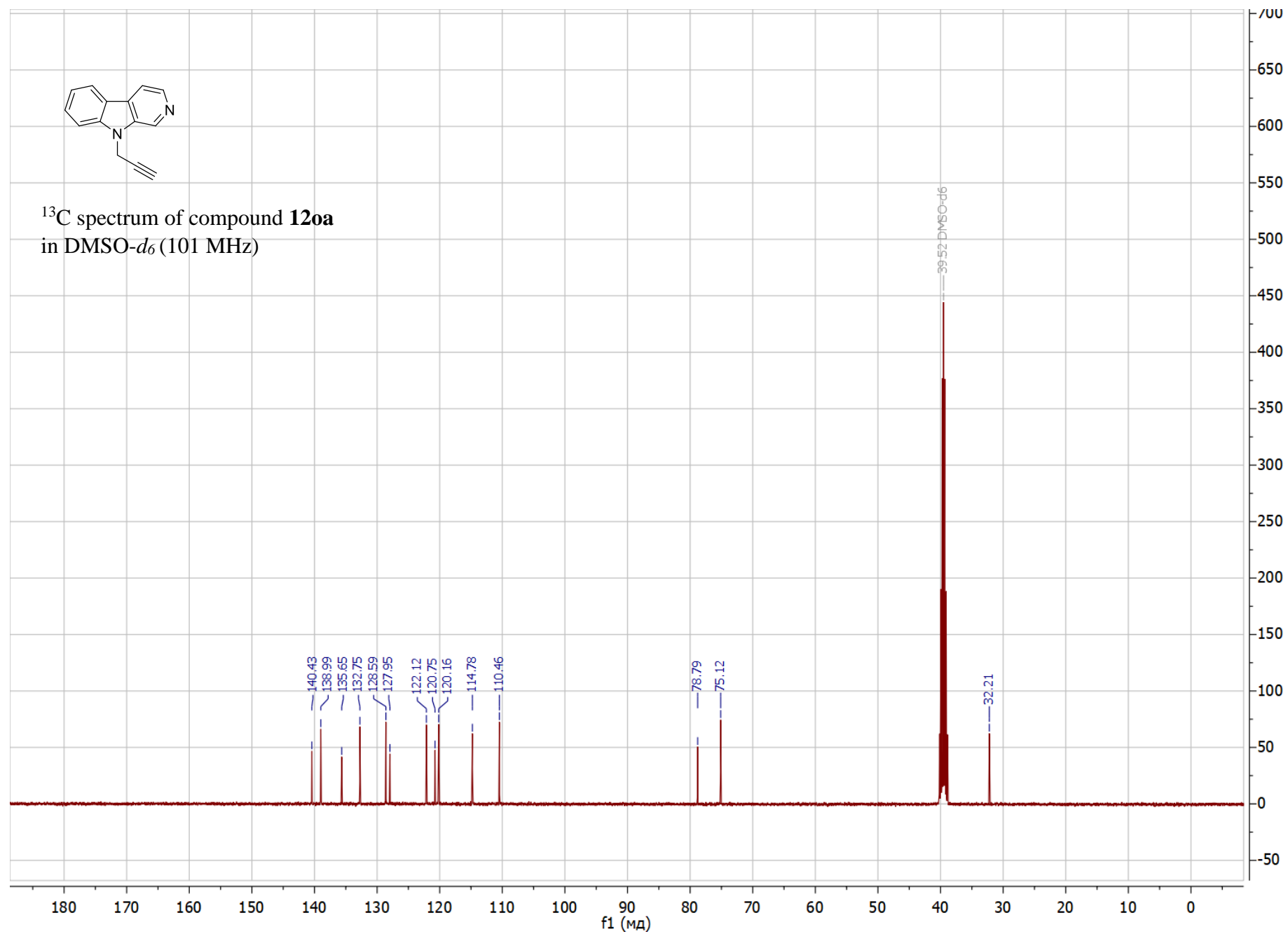
$^{13}\text{C}$  { $^1\text{H}$ } spectrum of compound **12na**  
in DMSO- $d_6$  (101 MHz)

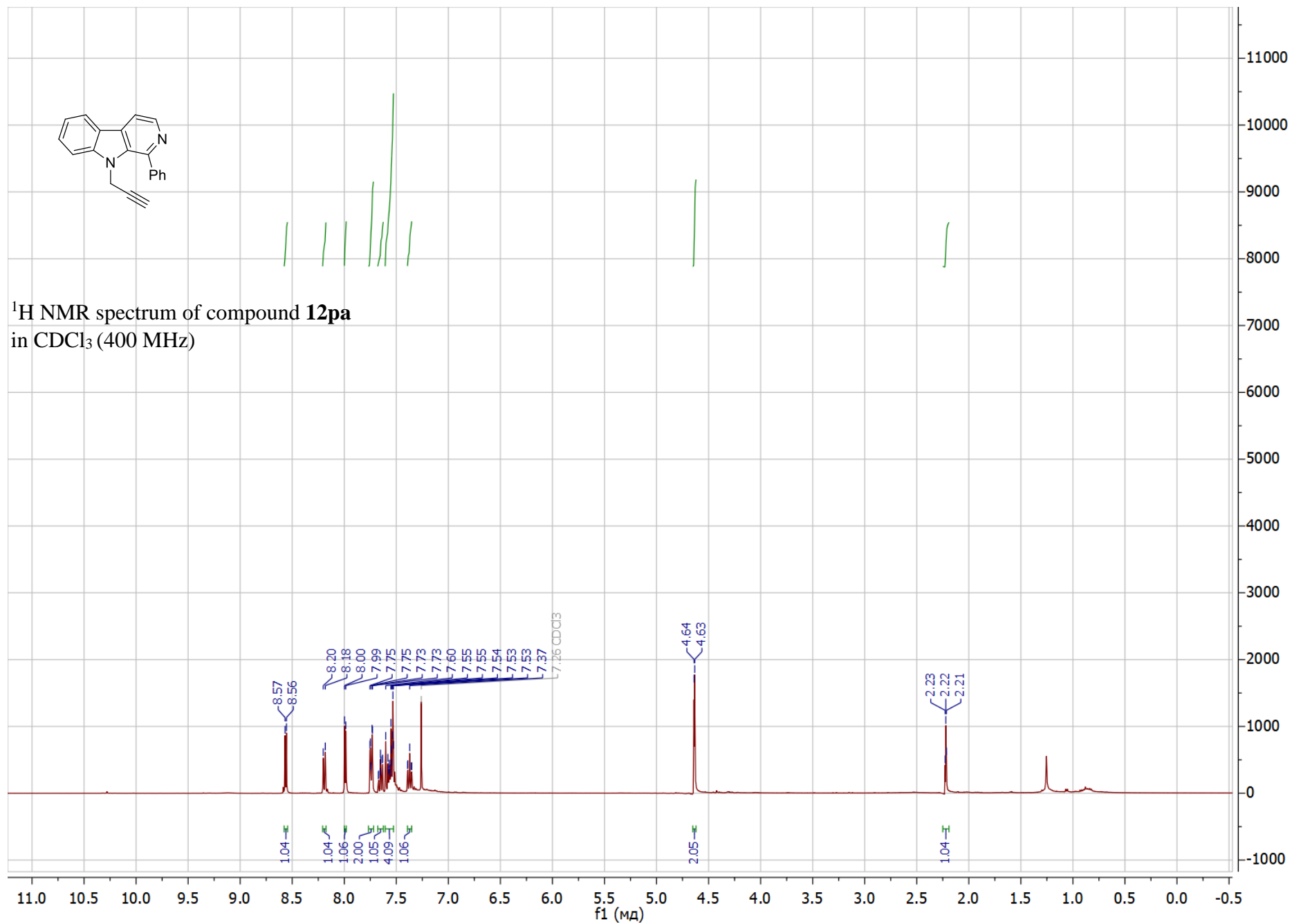


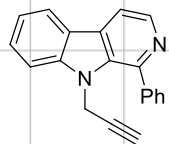




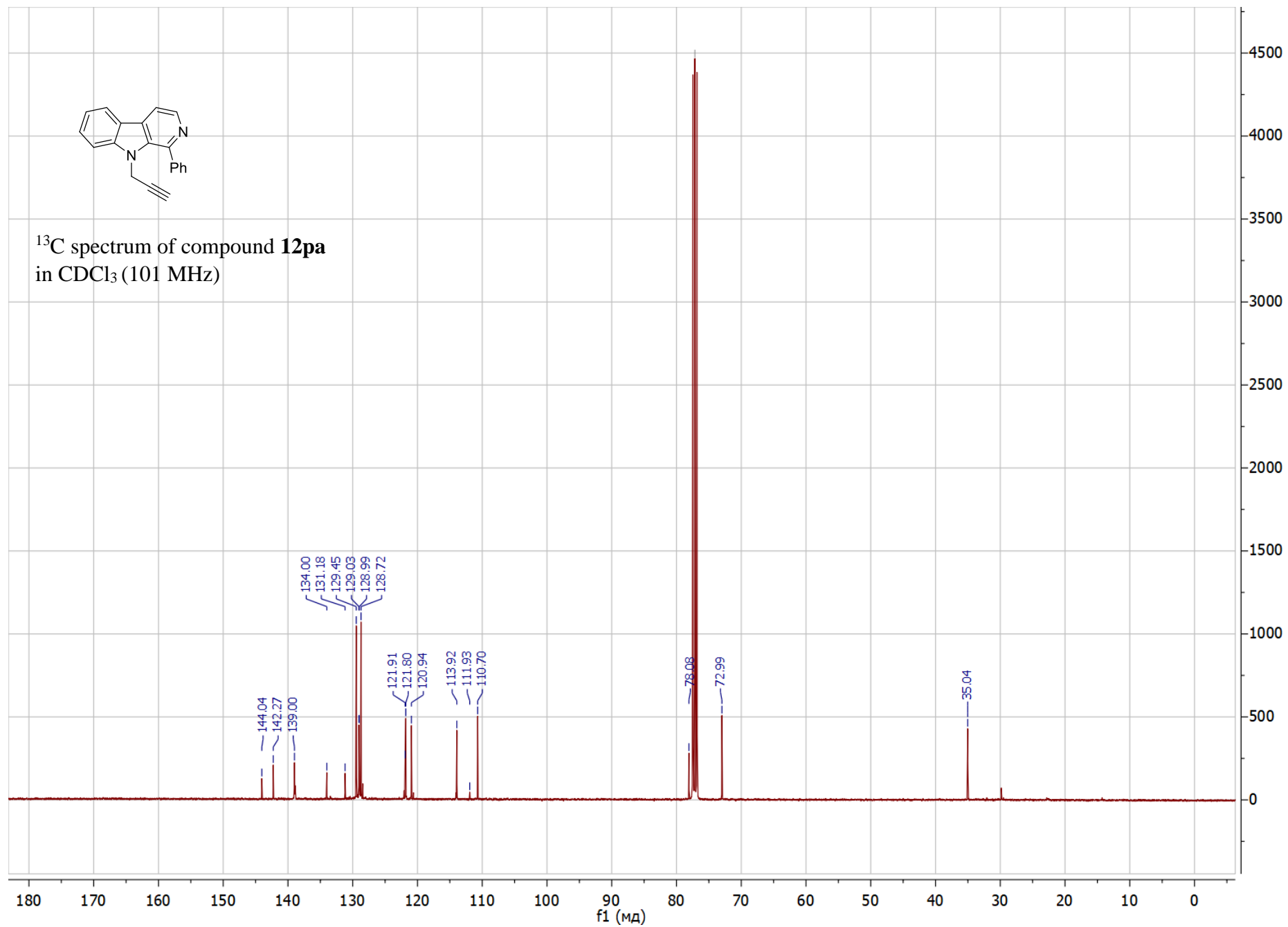
$^{13}\text{C}$  spectrum of compound **12oa**  
in DMSO- $d_6$  (101 MHz)



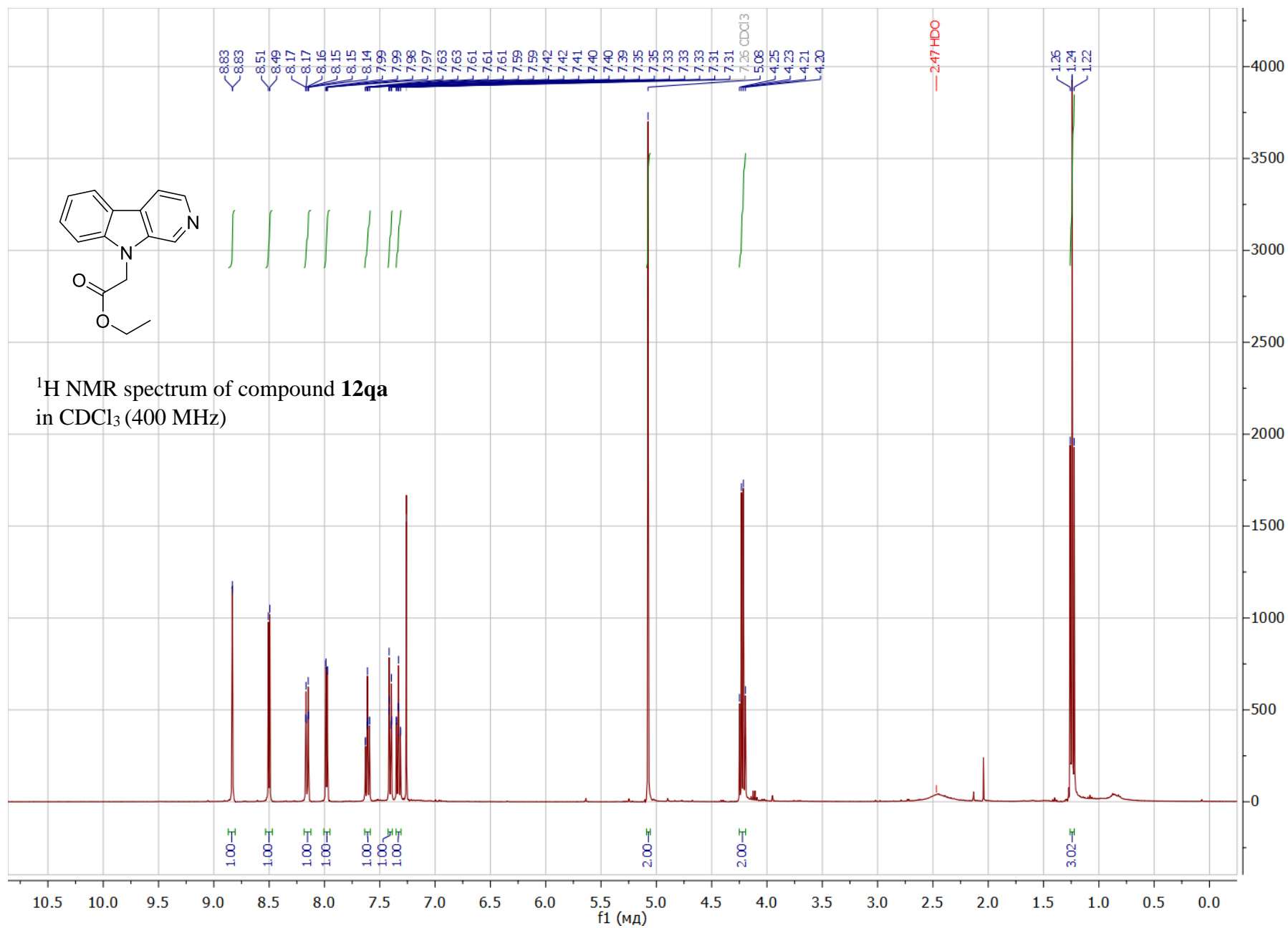


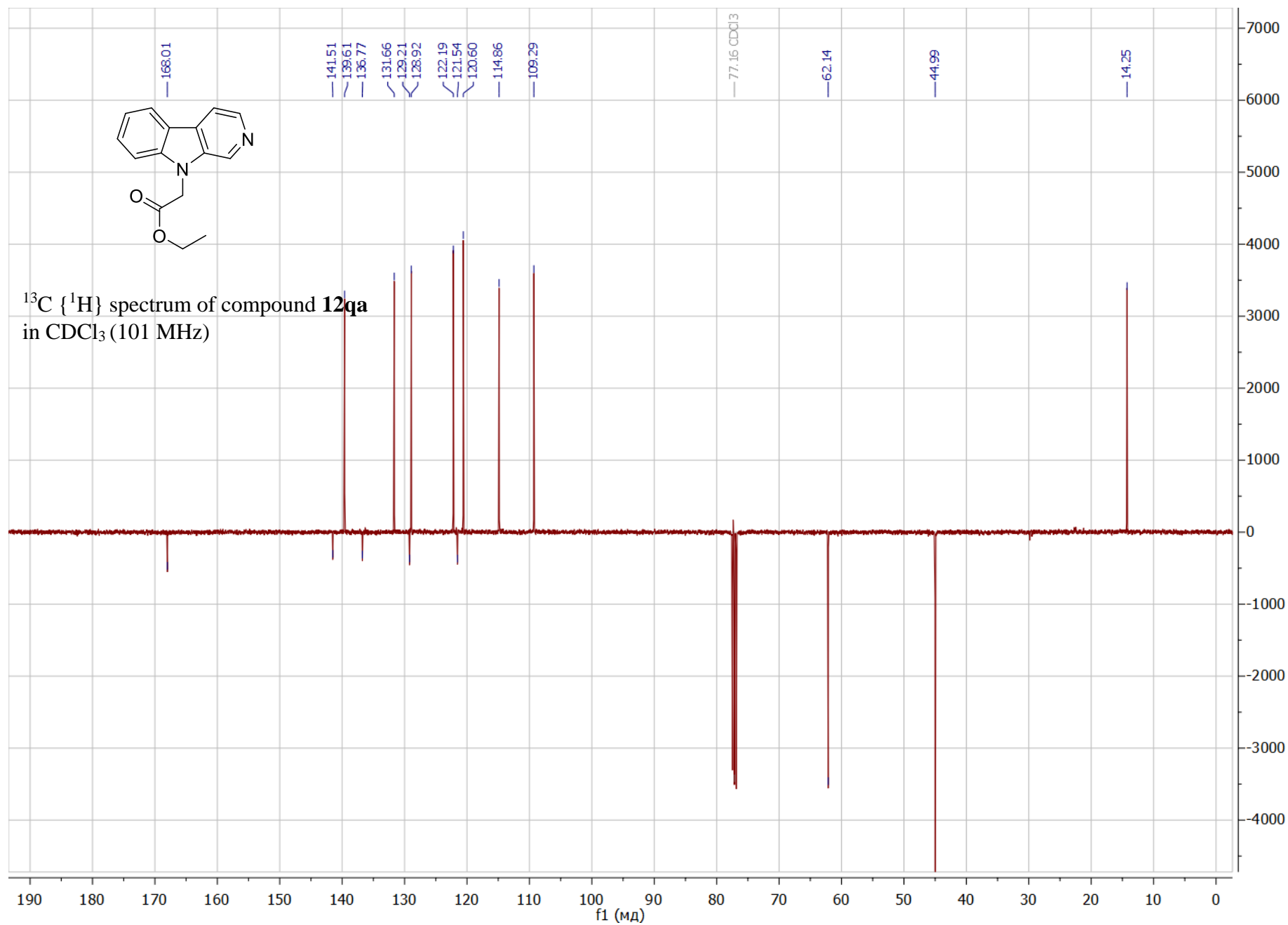


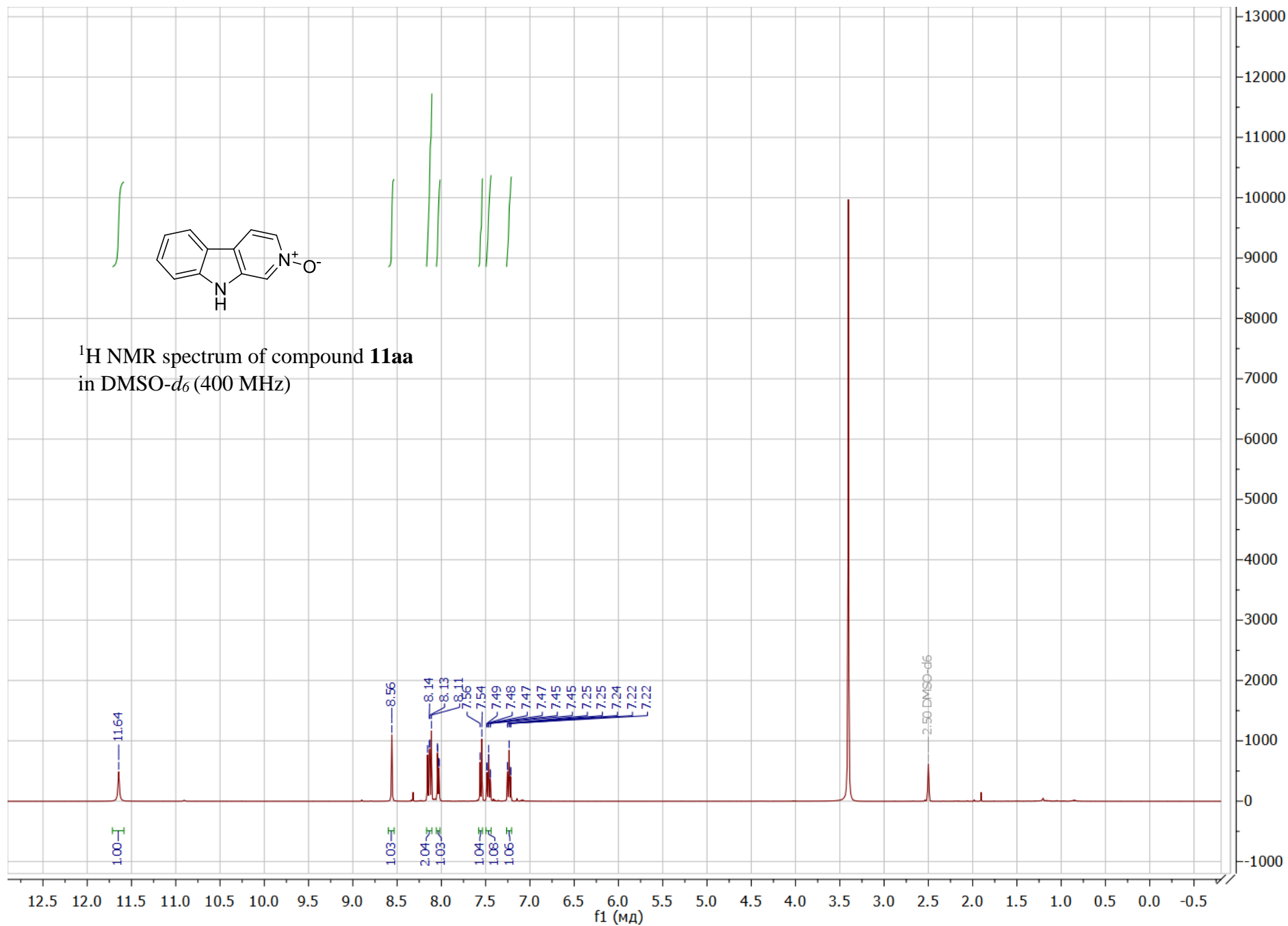
$^{13}\text{C}$  spectrum of compound **12pa**  
in  $\text{CDCl}_3$  (101 MHz)

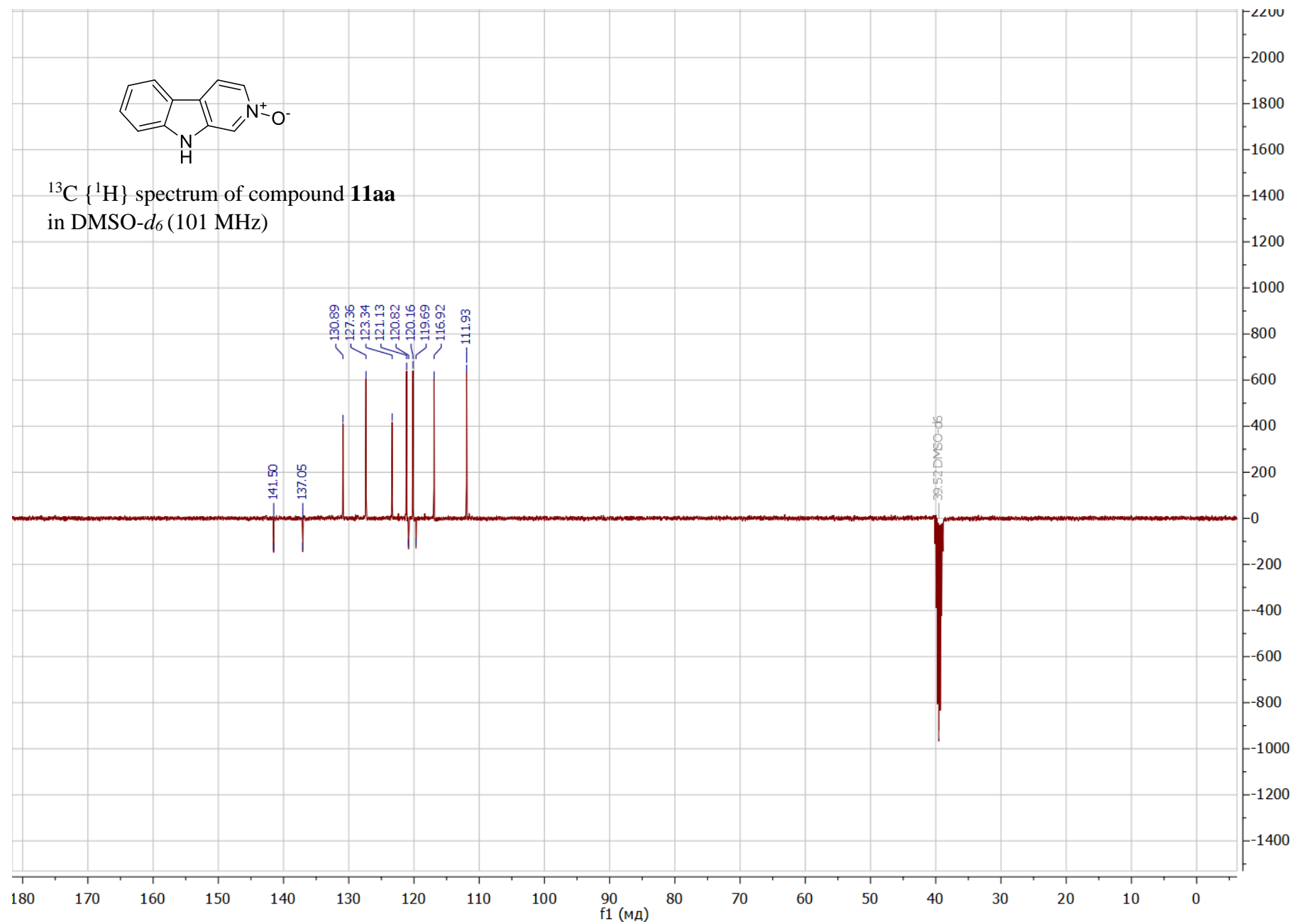


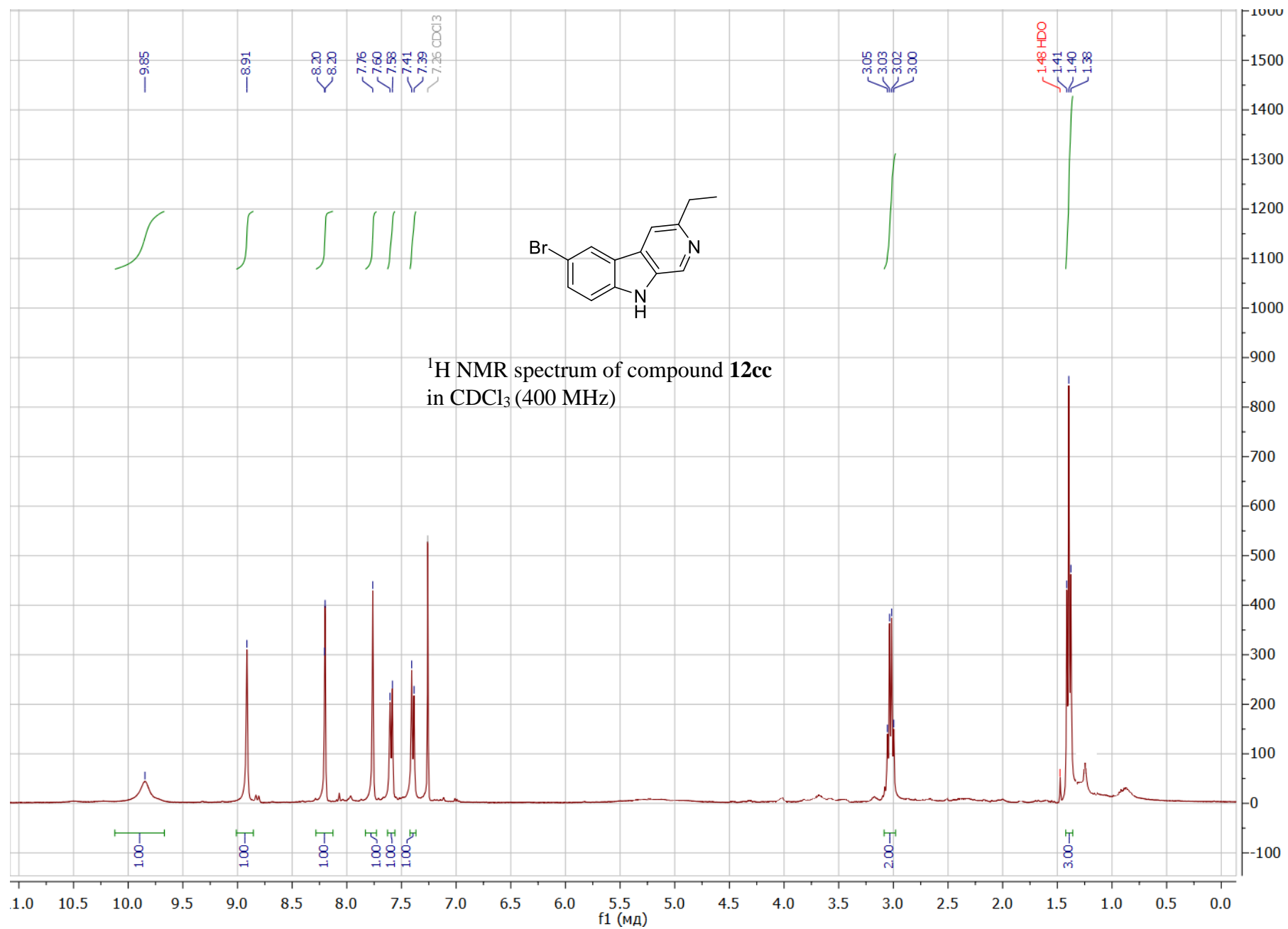


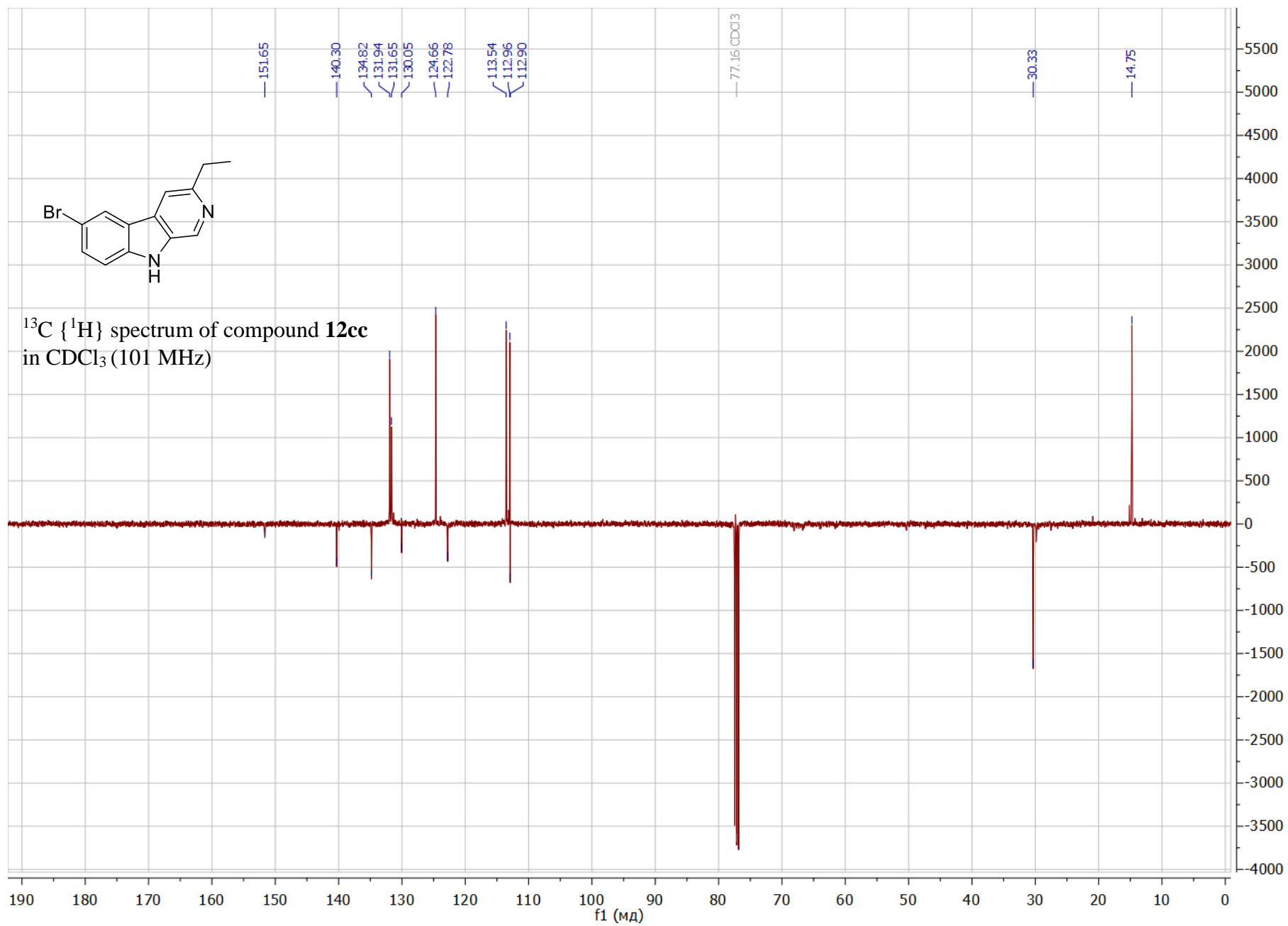


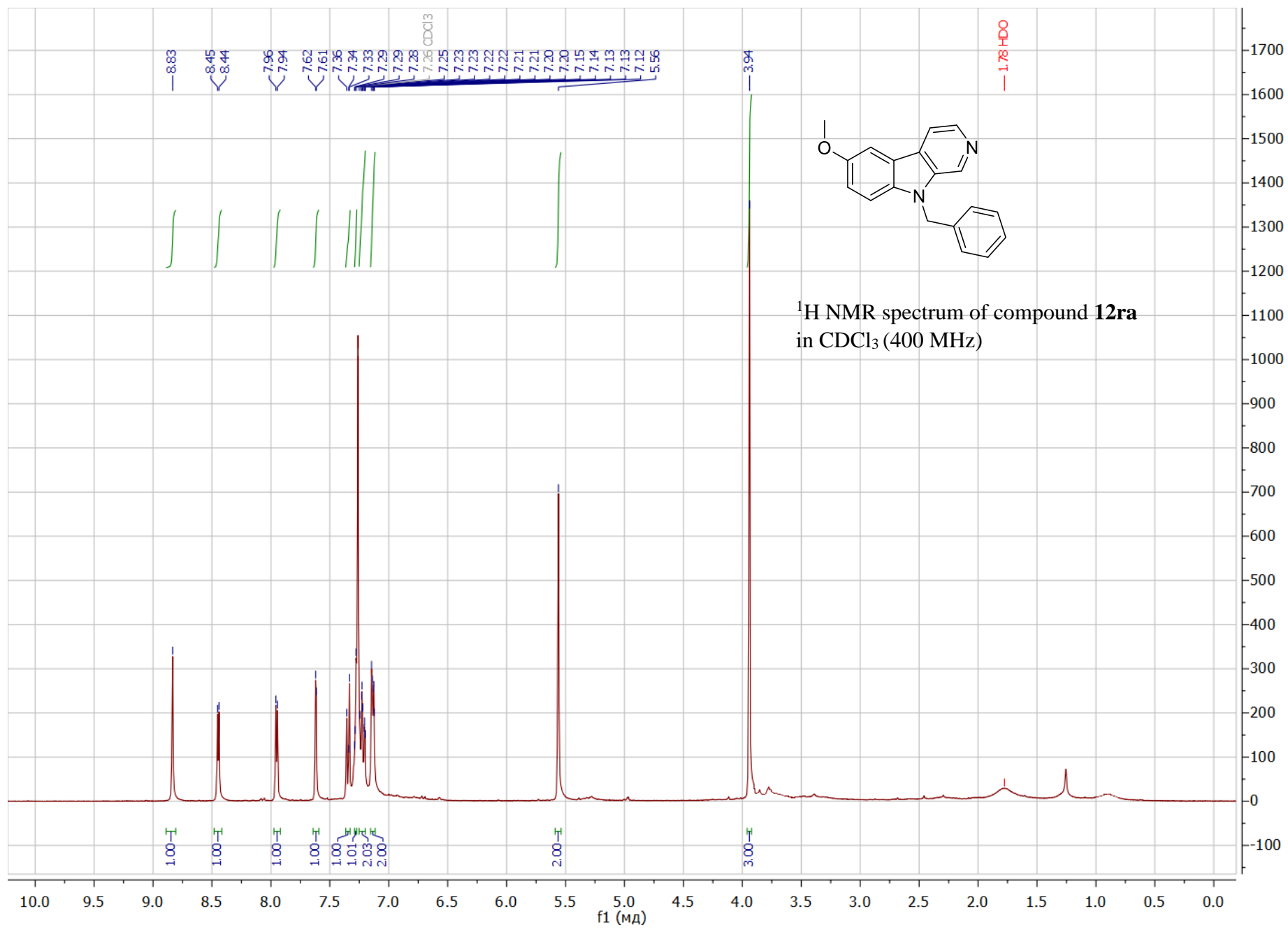


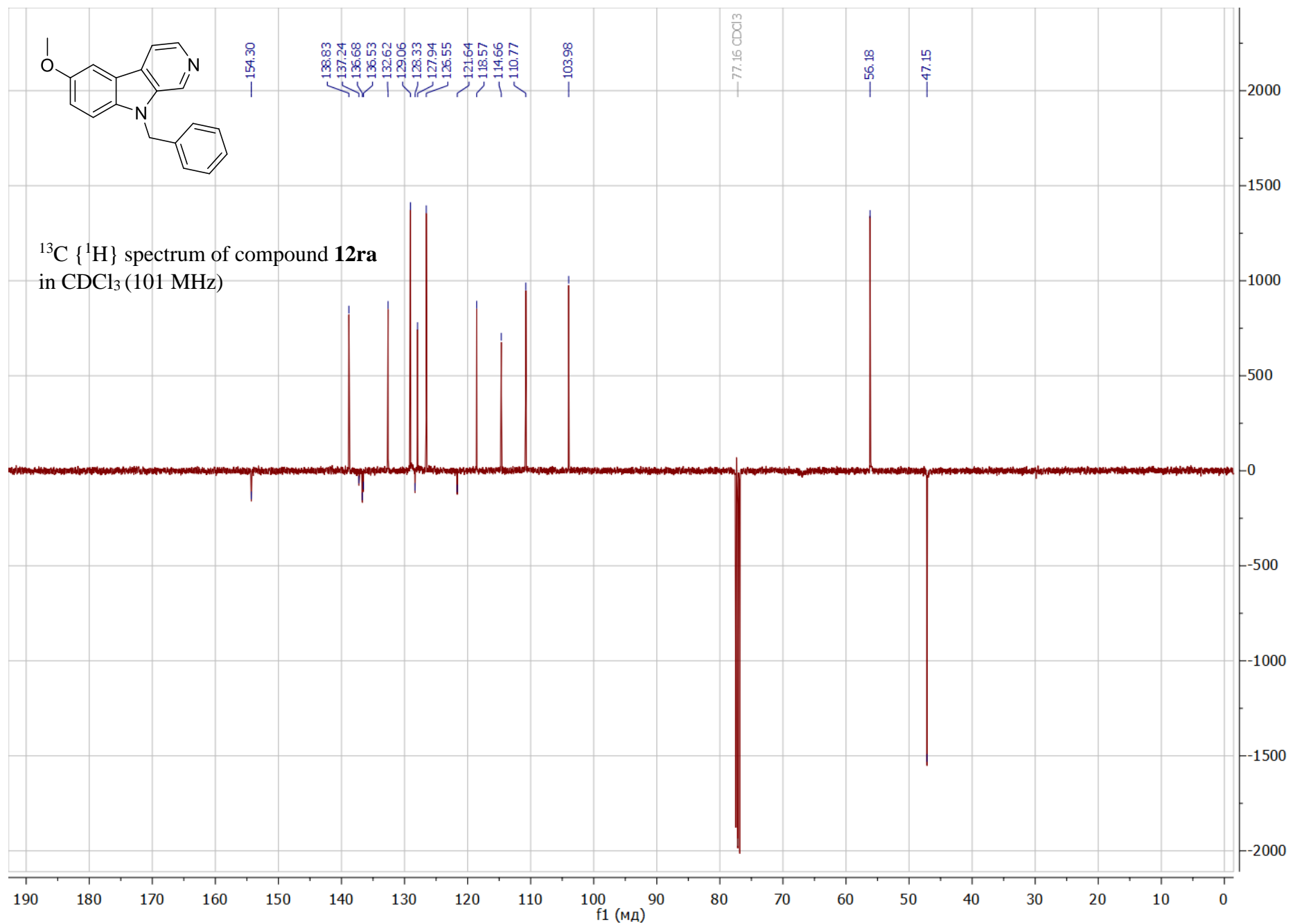




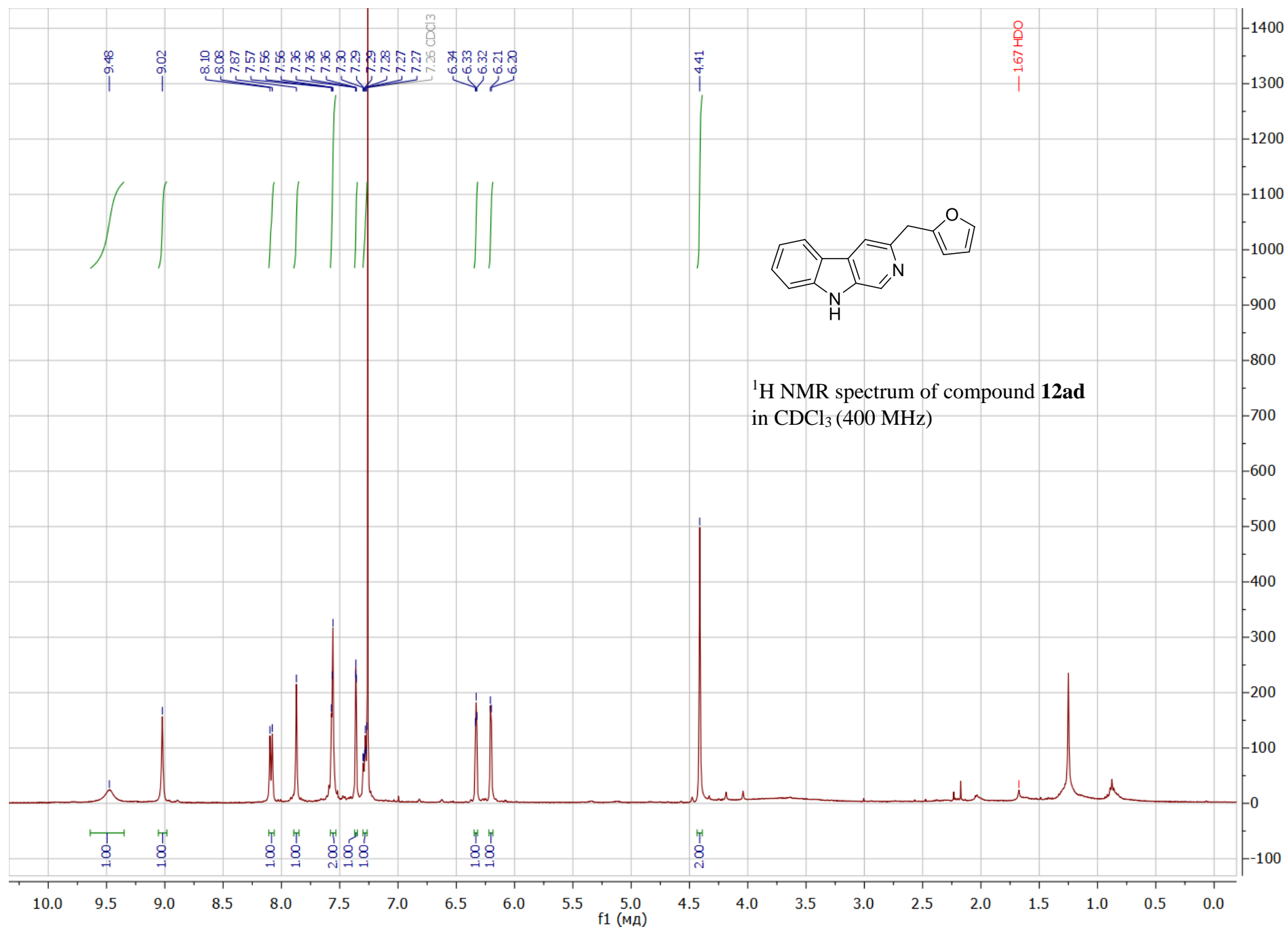


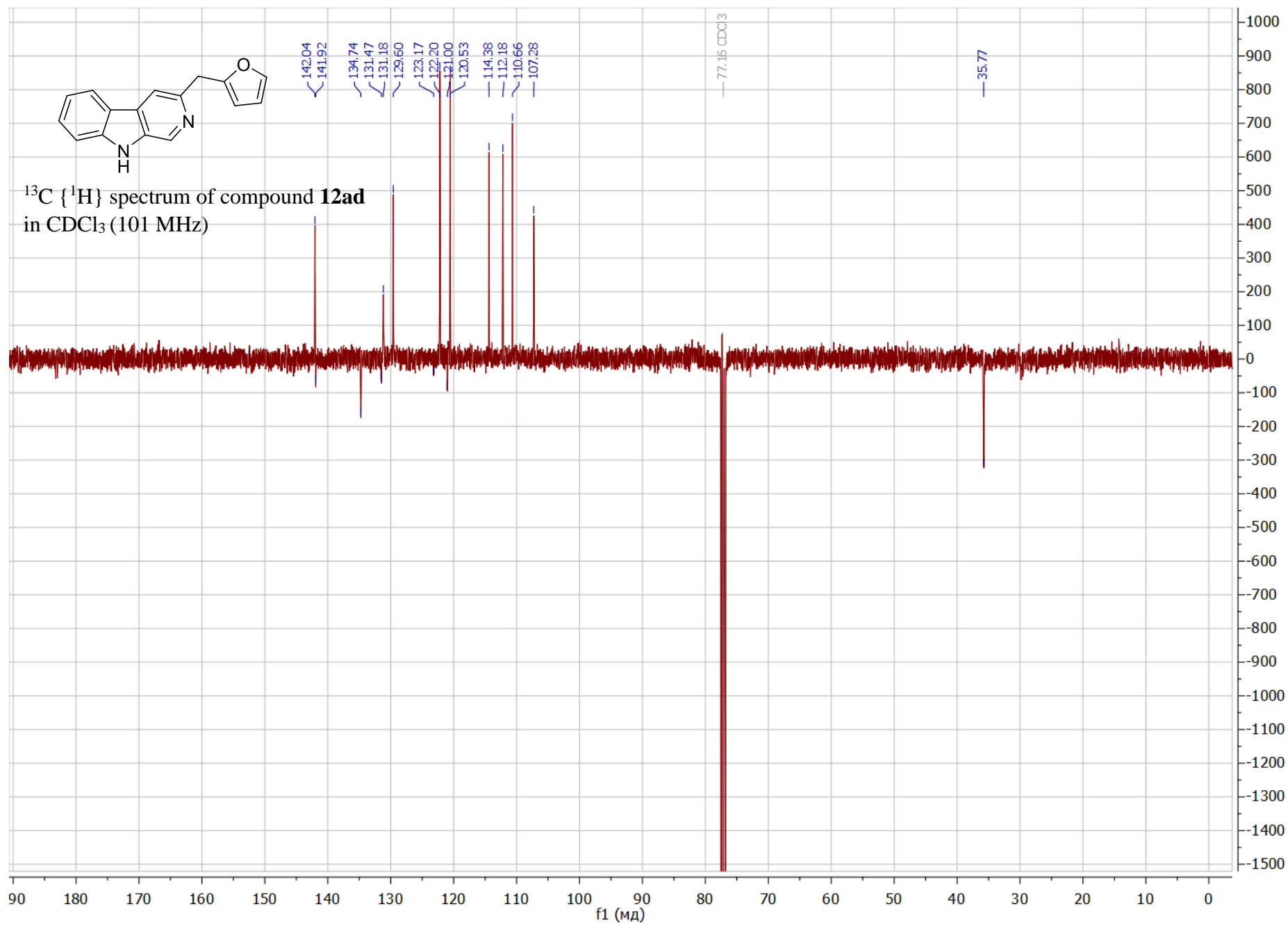


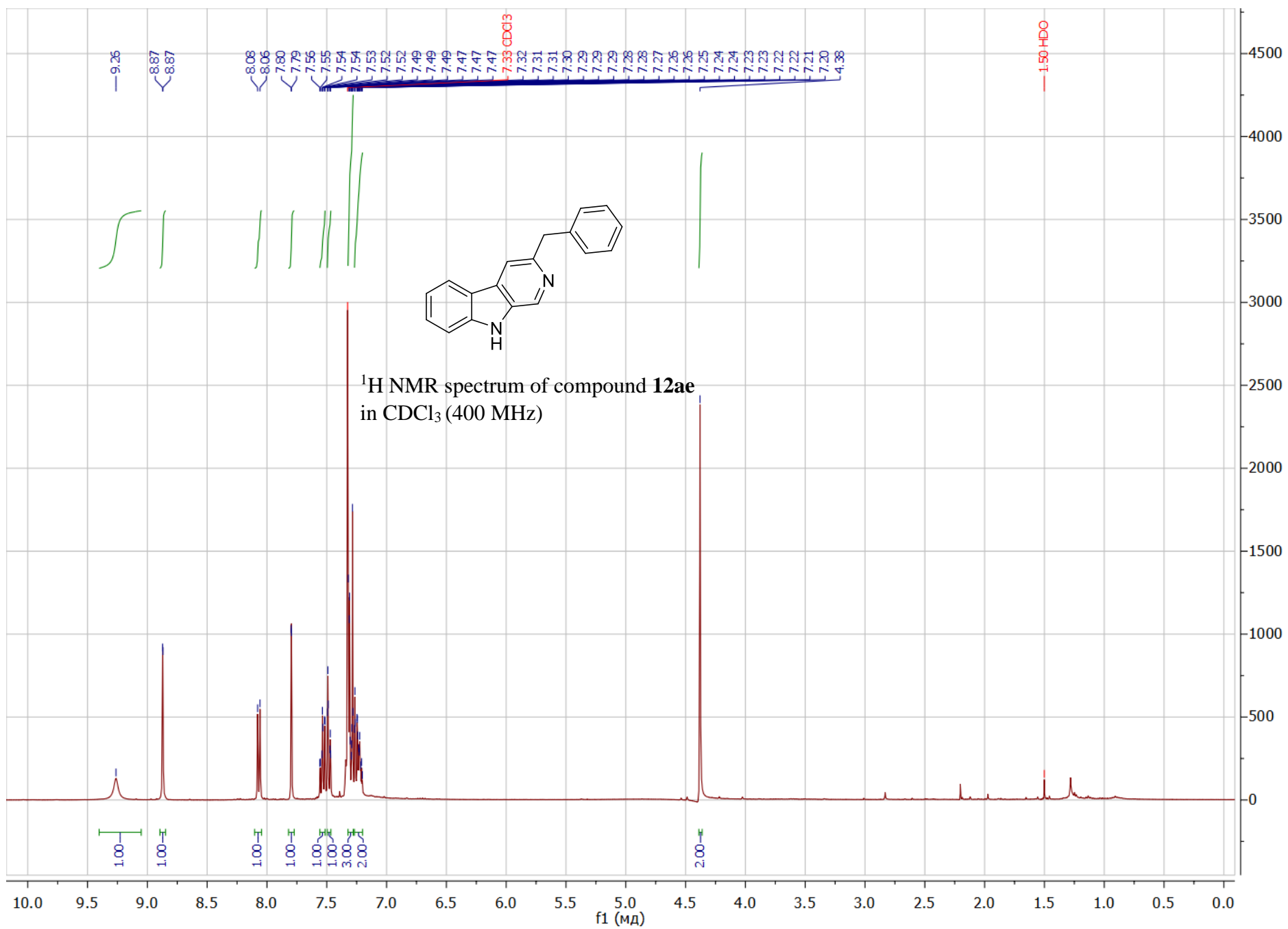


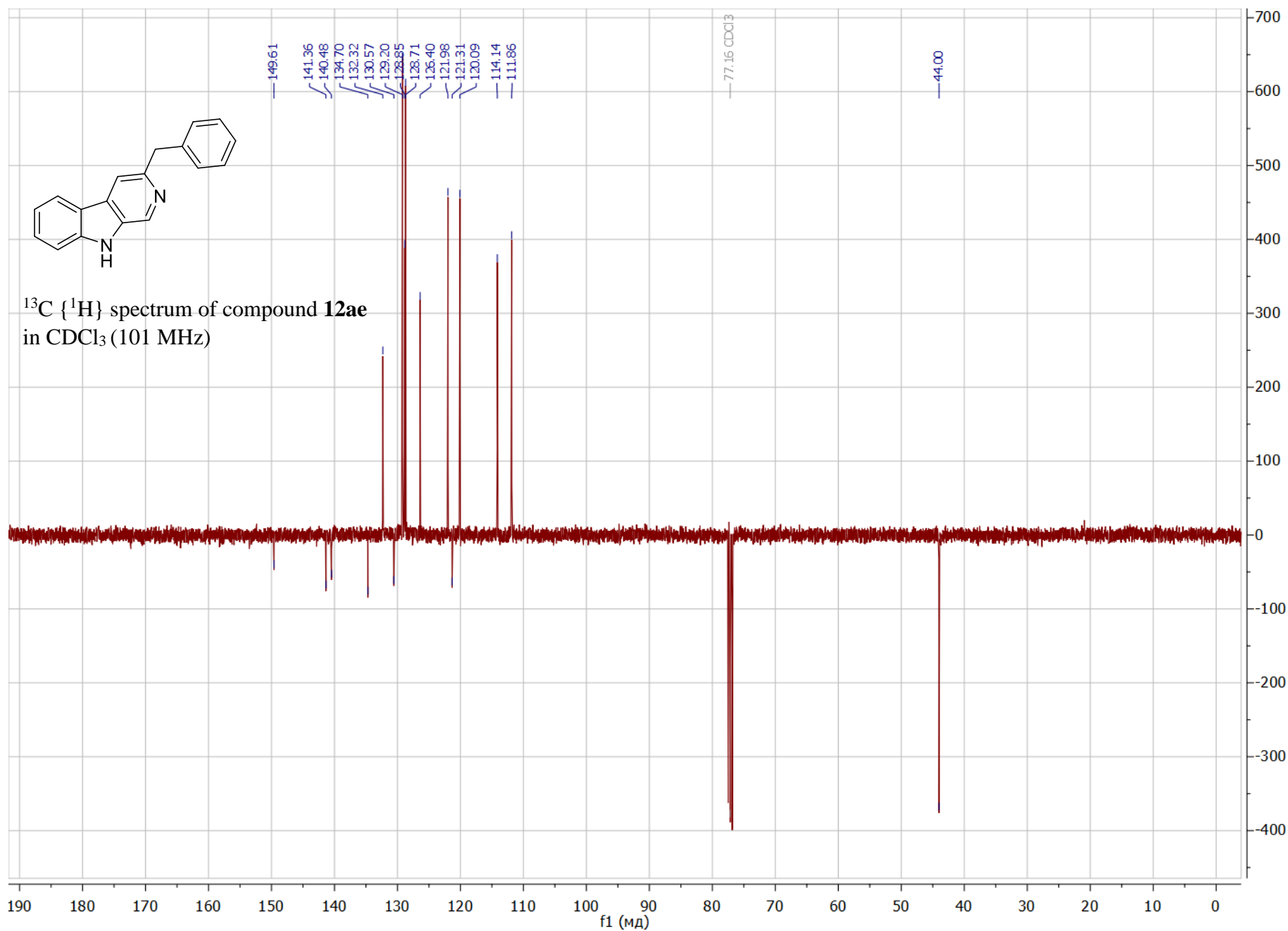


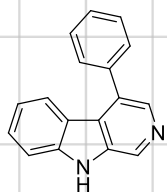




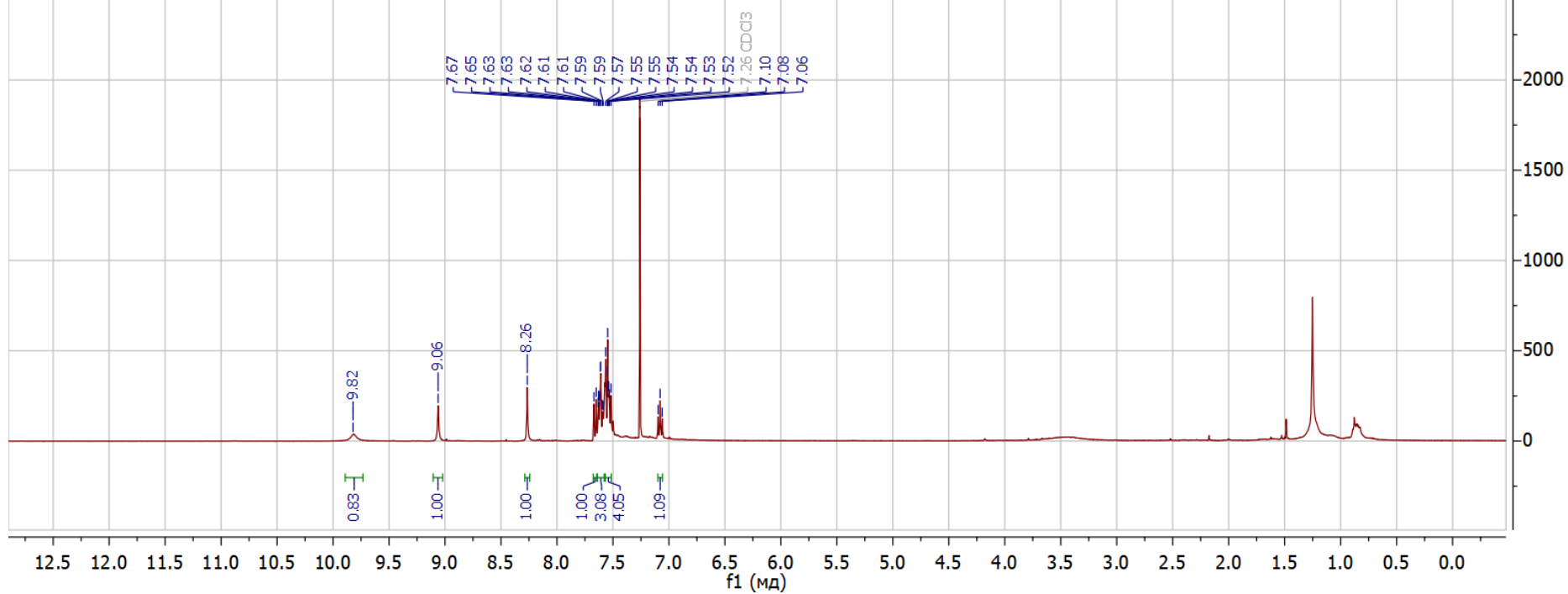


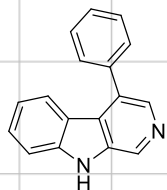




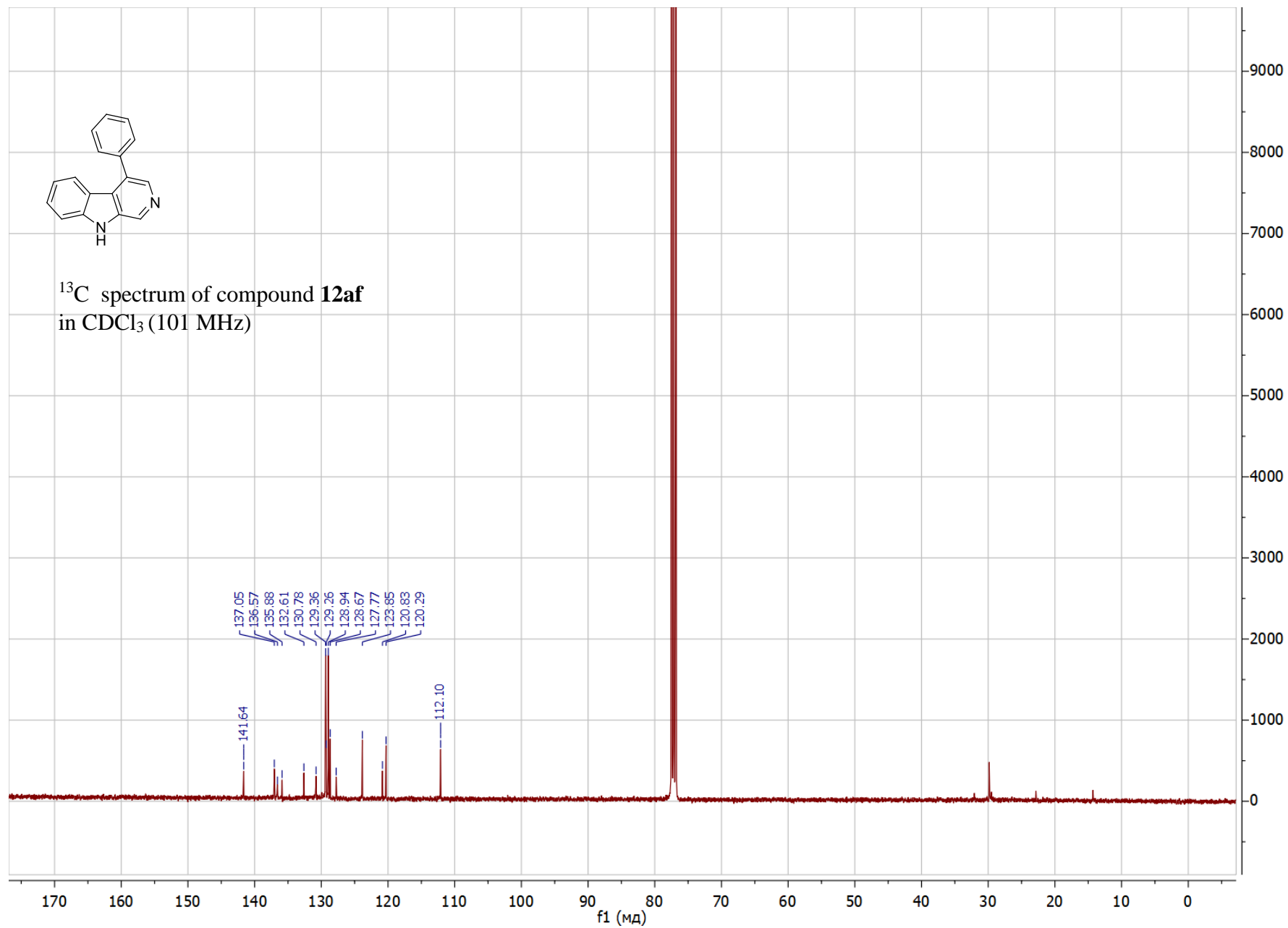


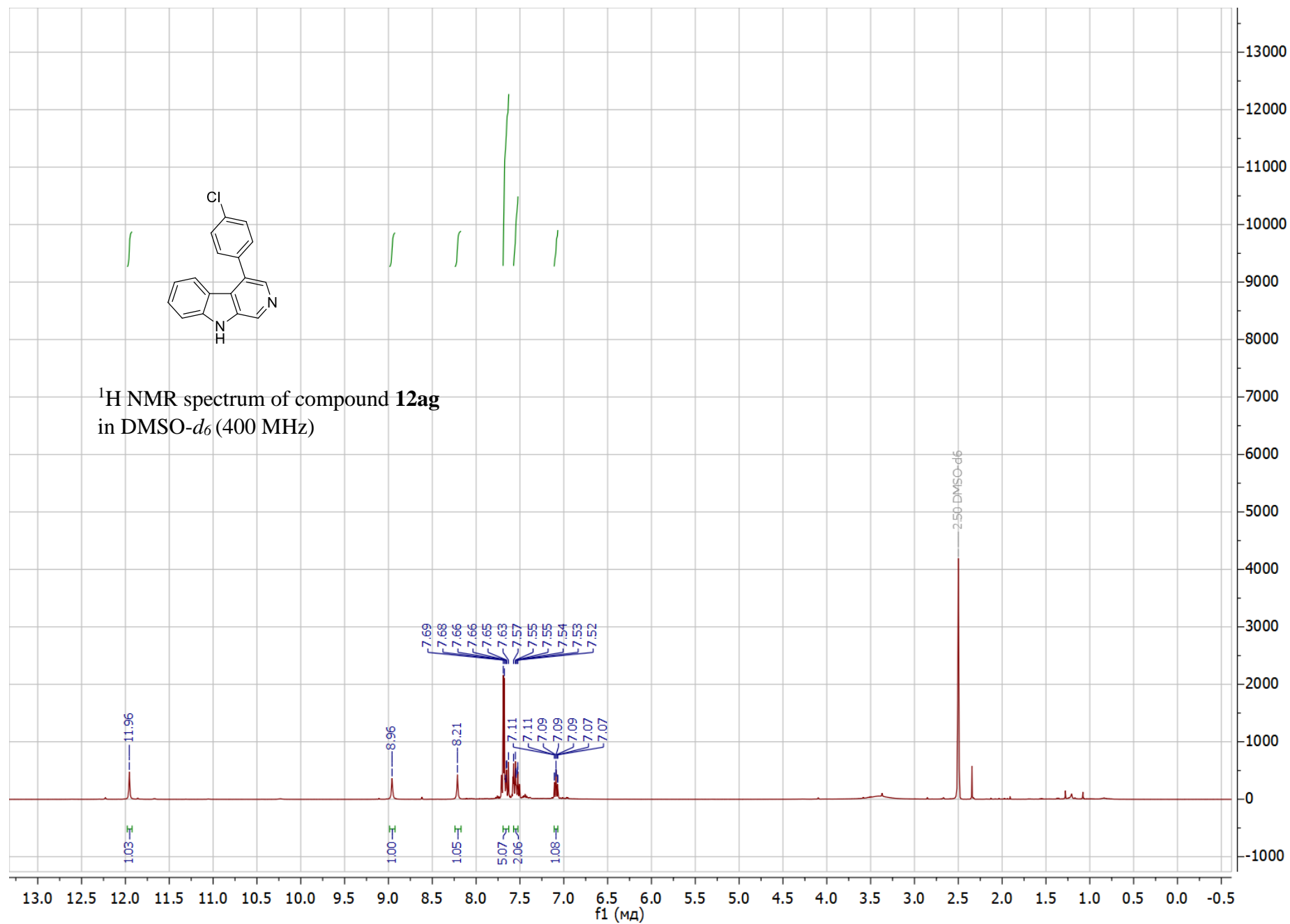
$^1\text{H}$  NMR spectrum of compound **12af**  
in  $\text{CDCl}_3$  (400 MHz)

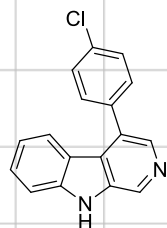




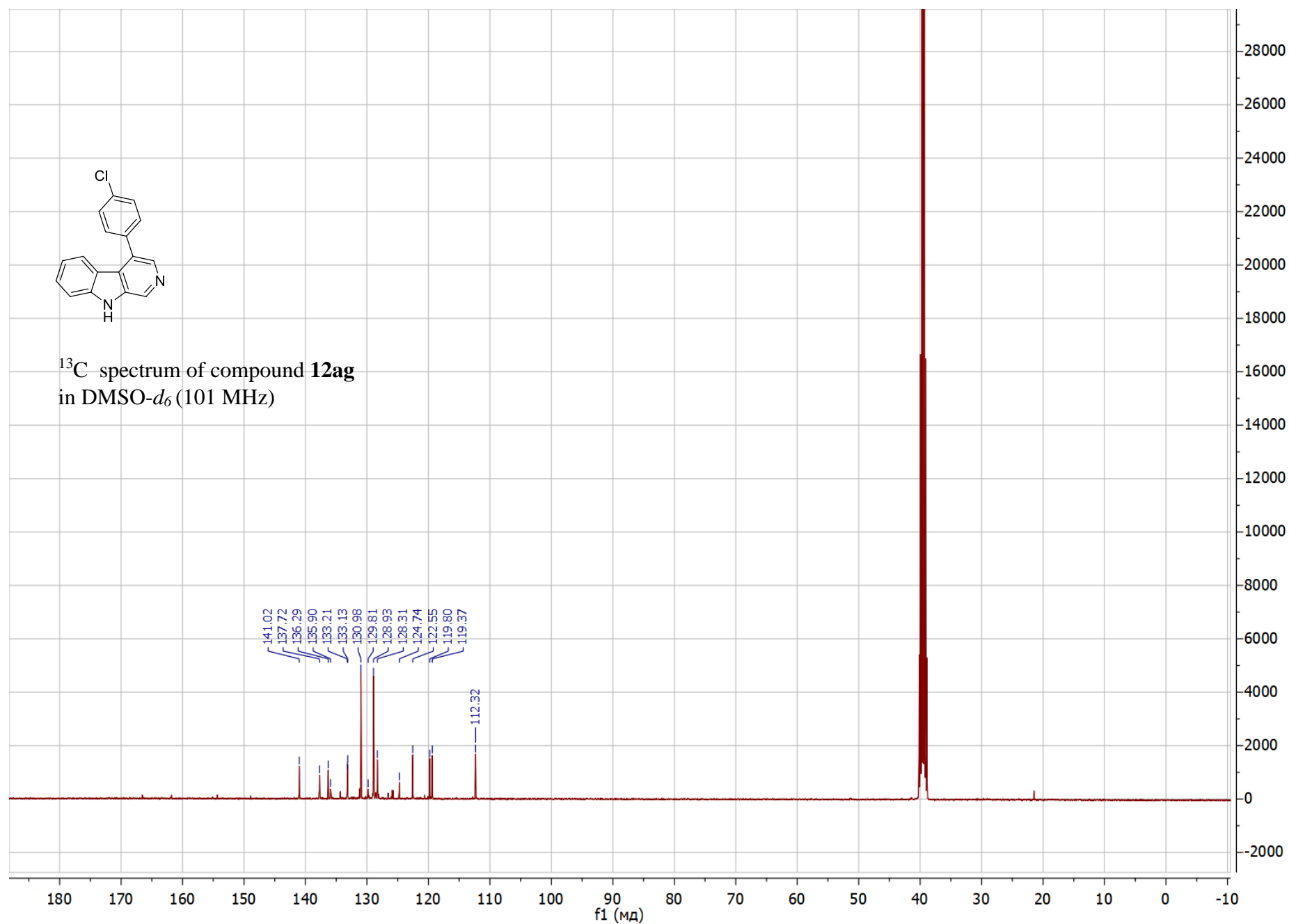
$^{13}\text{C}$  spectrum of compound **12af**  
in  $\text{CDCl}_3$  (101 MHz)





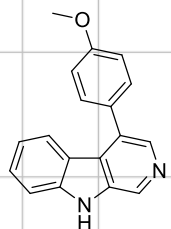


$^{13}\text{C}$  spectrum of compound **12ag**  
in DMSO- $d_6$  (101 MHz)









$^{13}\text{C}$  spectrum of compound **12ah**  
in  $\text{DMSO-}d_6$  (101 MHz)

