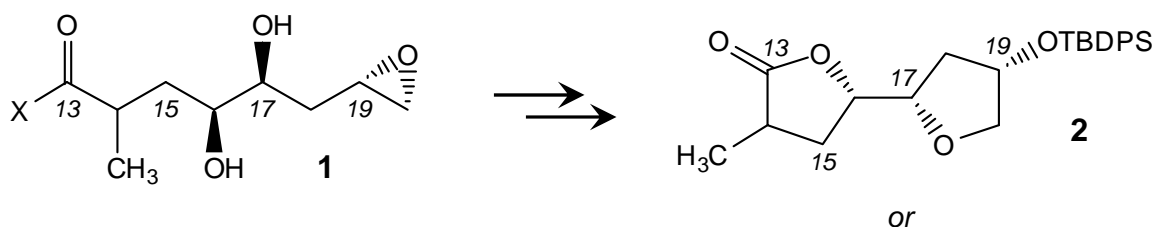


### Workshop 3

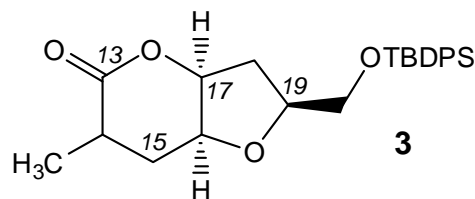
#### Interpreting 2D COSY Spectra

Amy Dounay (Forsyth group, back when they were here) subjected the diol epoxide **1** to a series of reactions intended to form a bicyclic ether lactone. However, because the synthetic intermediates in the process were difficult to purify, Amy was not able to characterize the final product until the end. At that point, she predicted that she should have one of the two products **2** or **3**. In this problem, you will decide whether Amy actually made one of these two products, and if so, which one.



Carbon atoms are labeled according to their eventual position in azaspiracid, a natural product.  $^1\text{H}$  and  $^1\text{H}$ - $^1\text{H}$  COSY (both 500 MHz, in  $\text{CDCl}_3$ ) are shown on the following pages.

- a. Fill in the entries in the chemical shift table below. You do not need to know which product was formed before doing this; although the products are different, they have the same C and H connectivity.



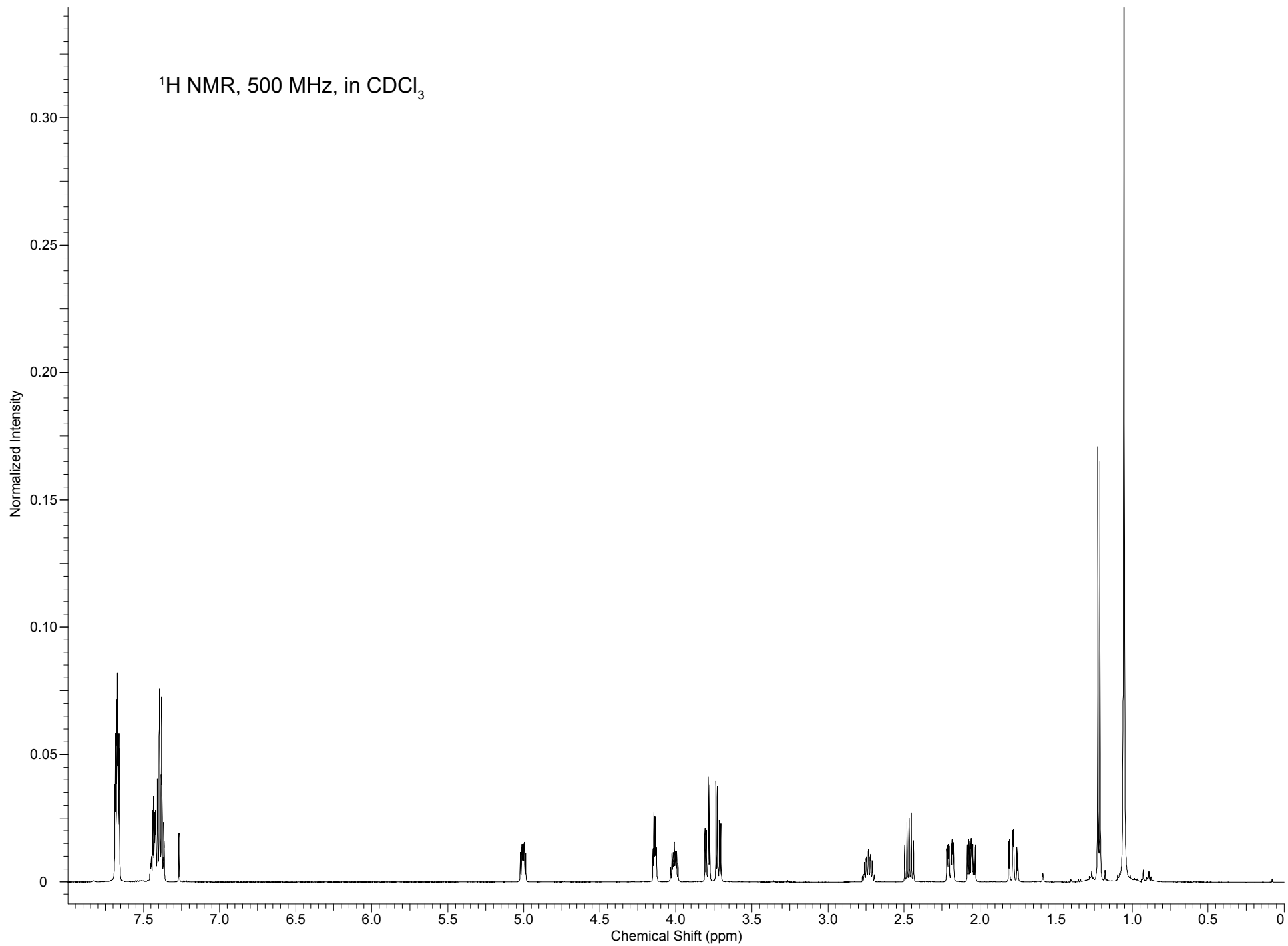
-TBDPS =  $-\text{Si}(t\text{Bu})\text{Ph}_2$

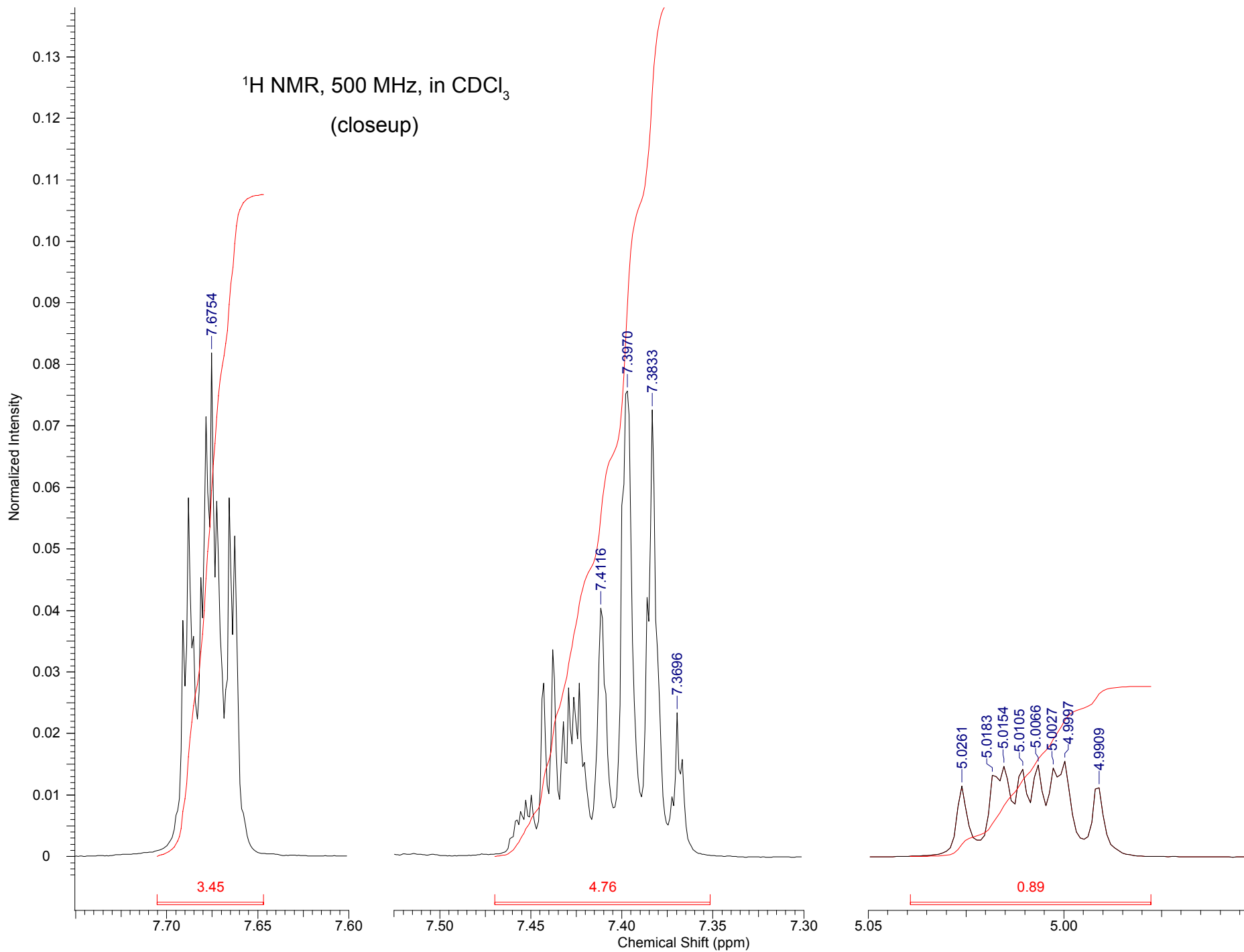
proton	$\delta$ (ppm)	multiplicity
-CH <sub>3</sub>		
H <sub>14</sub>		
H <sub>15a</sub>		
H <sub>15b</sub>		
H <sub>16</sub>		
H <sub>17</sub>		

proton	$\delta$ (ppm)	multiplicity
H <sub>18a</sub>		
H <sub>18b</sub>		
H <sub>19</sub>		
H <sub>20a</sub>		
H <sub>20b</sub>		

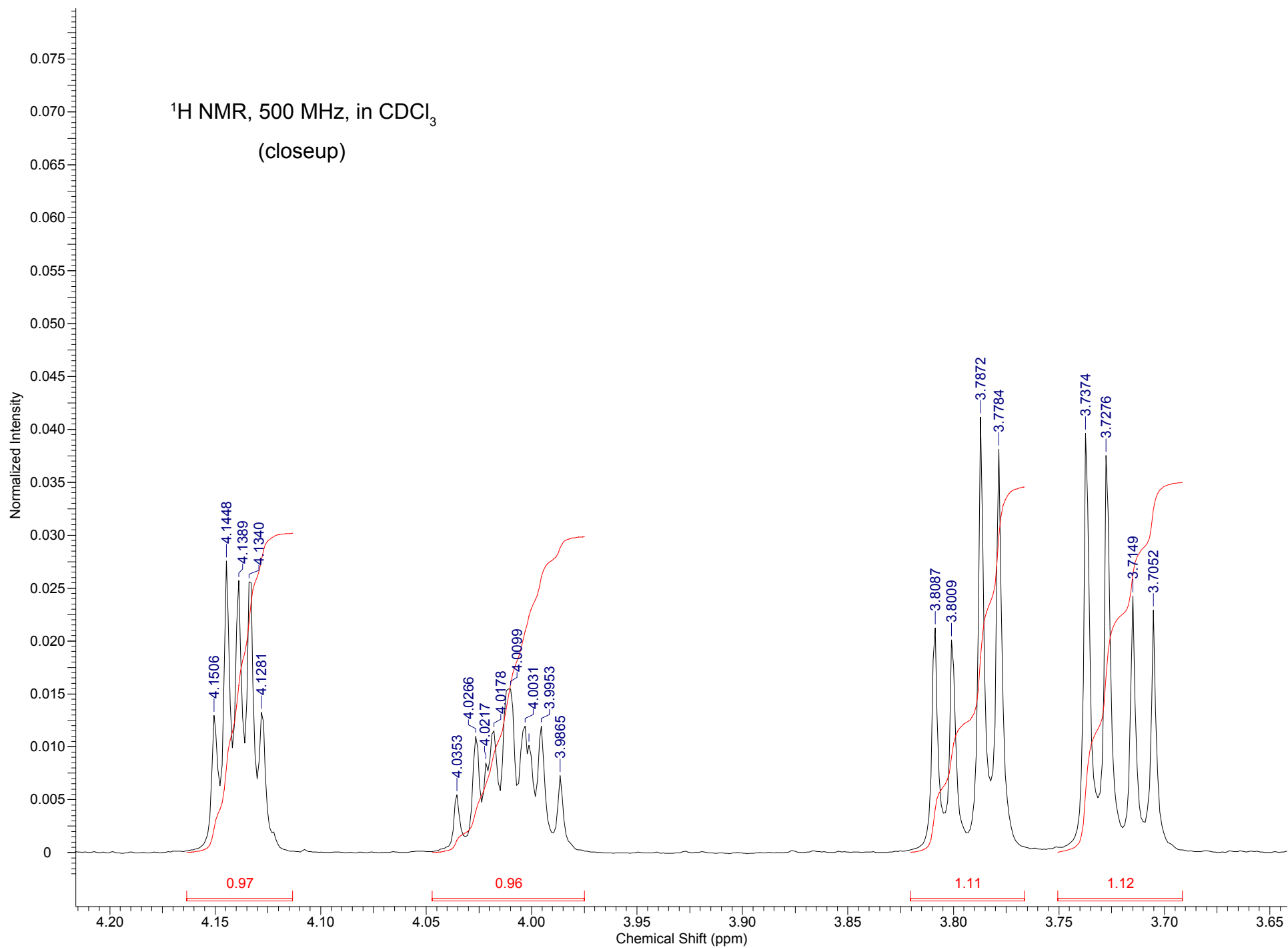
- b. Based on what you see in your table and in the spectra, which product did Amy make?
- c. COSY NMR spectra sometimes show long-range coupling ( $^4J$  or  $^5J$ ) in addition to the typical two- and three-bond coupling. Is that the case here? What coupled pairs do these crosspeaks correspond to?
- d. Are the coupling constants you measure consistent with the stereochemistry at positions 16, 17 and 19? (Can you tell?) Can you assign stereochemistry at position 14?

$^1\text{H}$  NMR, 500 MHz, in  $\text{CDCl}_3$

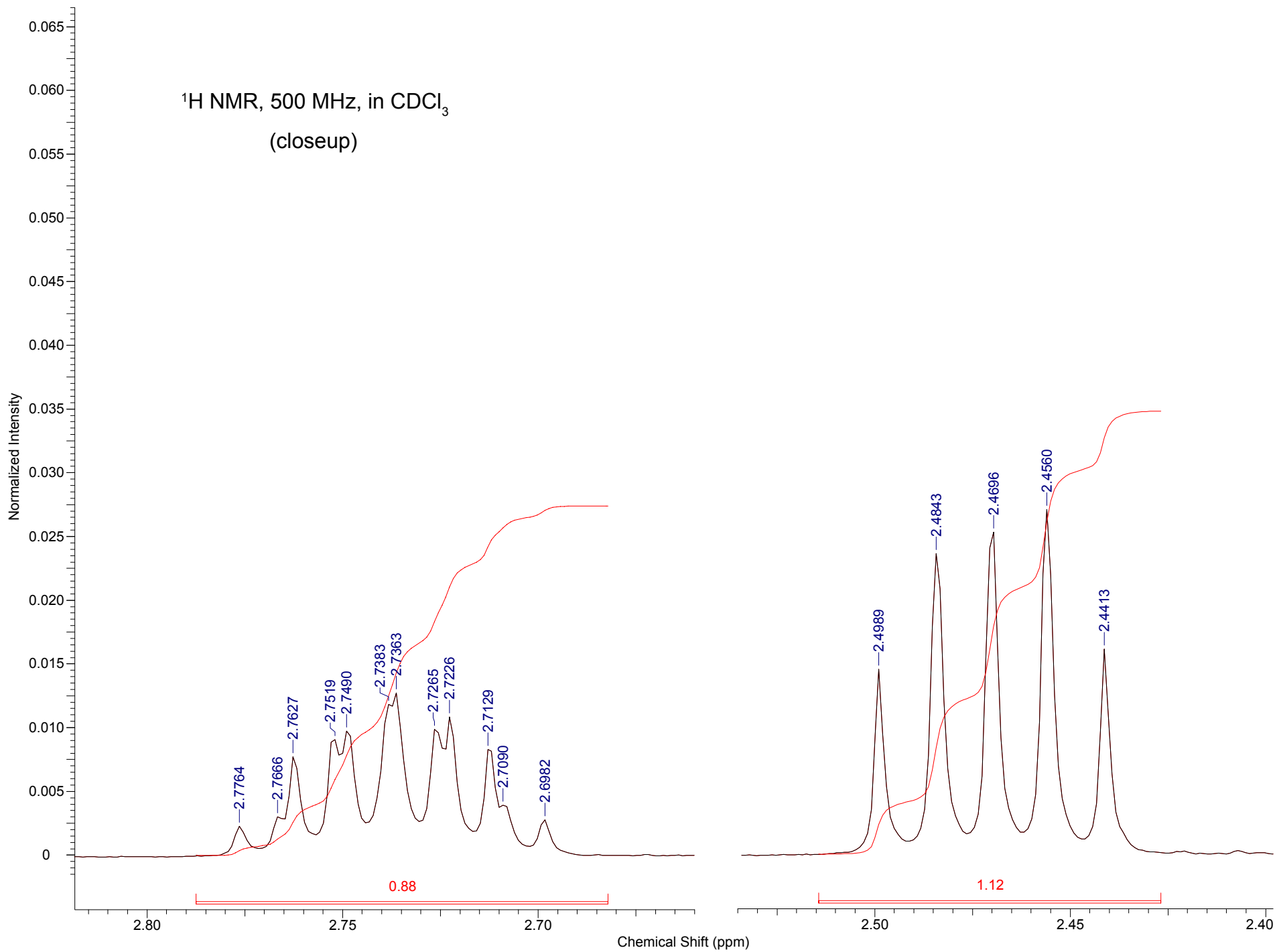




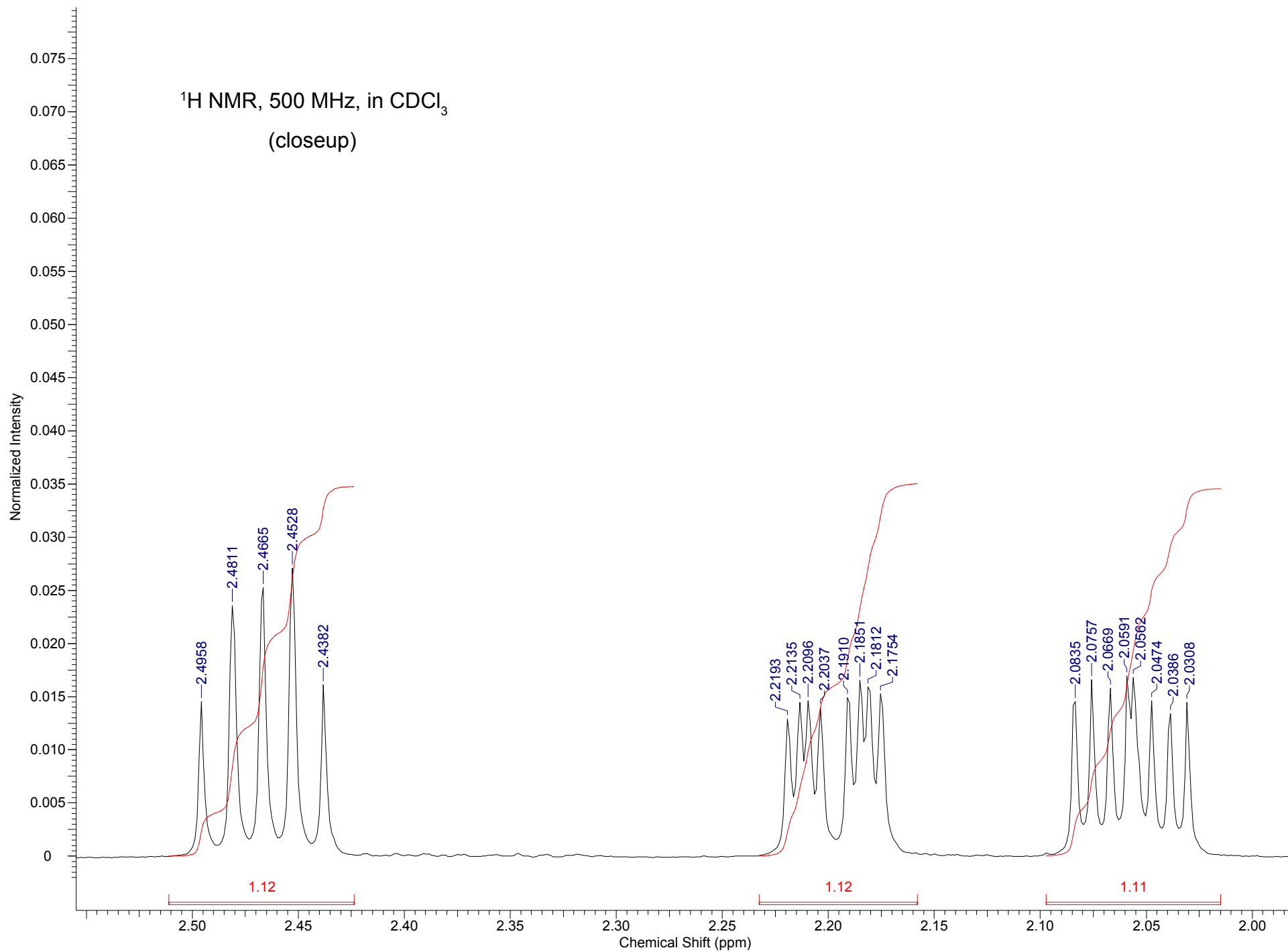
<sup>1</sup>H NMR, 500 MHz, in CDCl<sub>3</sub>  
(closeup)

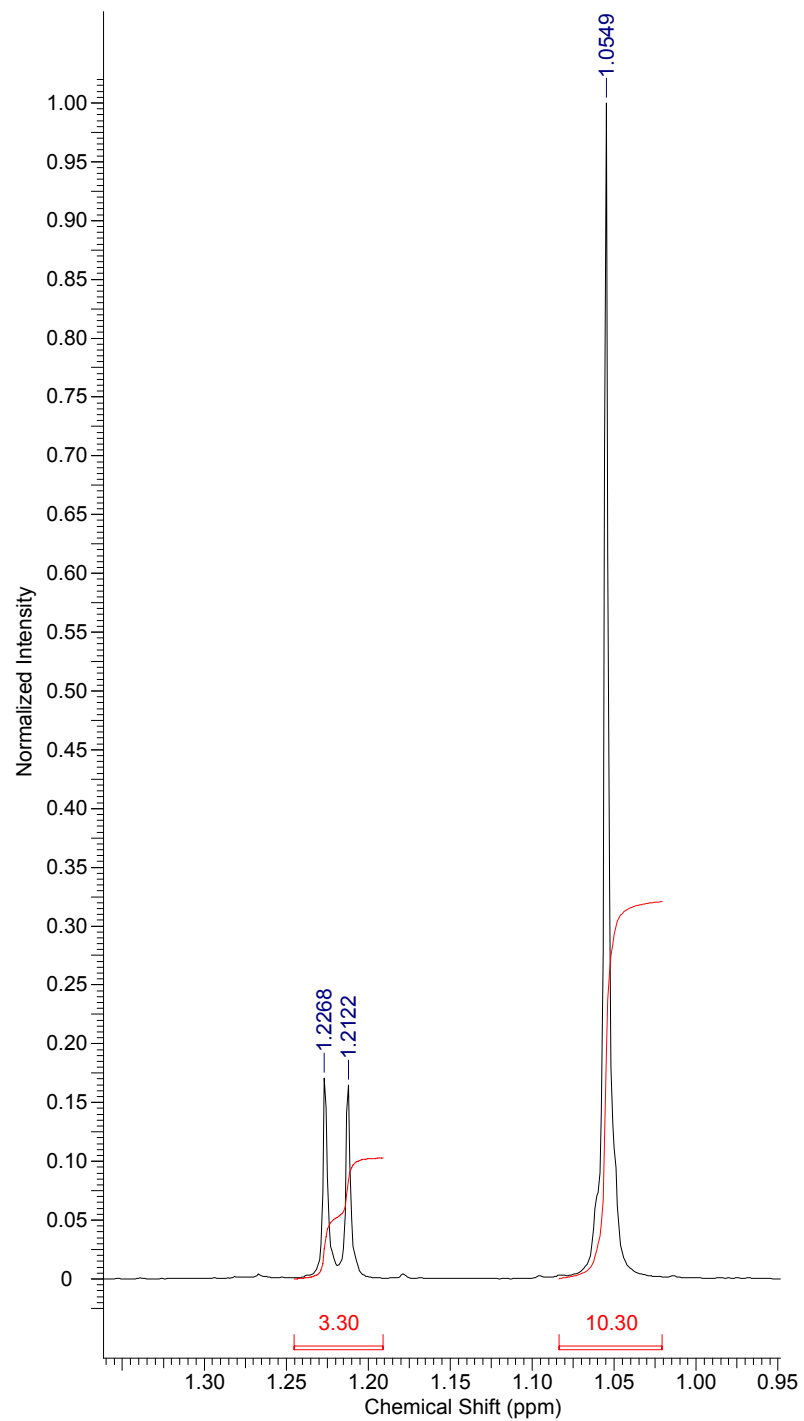
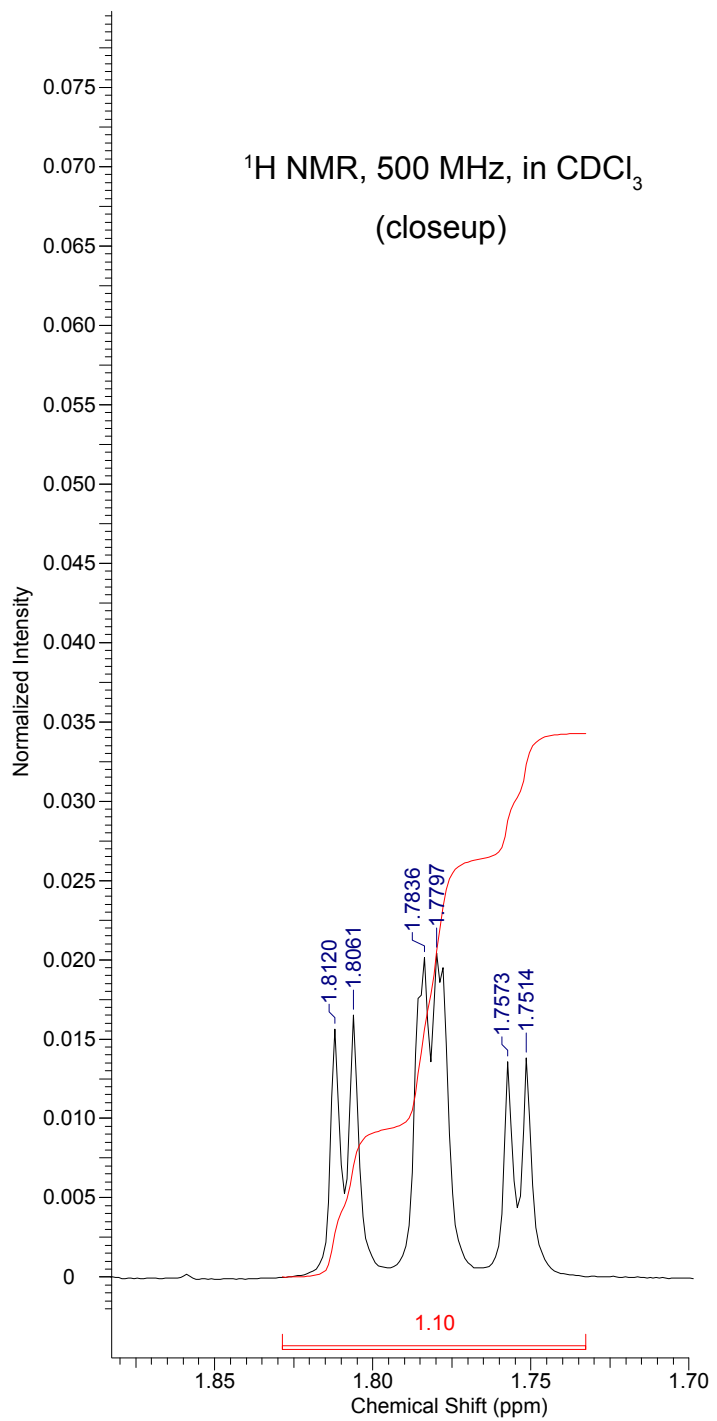


$^1\text{H}$  NMR, 500 MHz, in  $\text{CDCl}_3$   
(closeup)



$^1\text{H}$  NMR, 500 MHz, in  $\text{CDCl}_3$   
(closeup)







$^1\text{H}$ - $^1\text{H}$  COSY, 500 MHz, in  $\text{CDCl}_3$

