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*Supporting information-2 (copies of spectra)*

## Formal Total Synthesis of ( $\pm$ )-Estrone via a Furano Diene Approach

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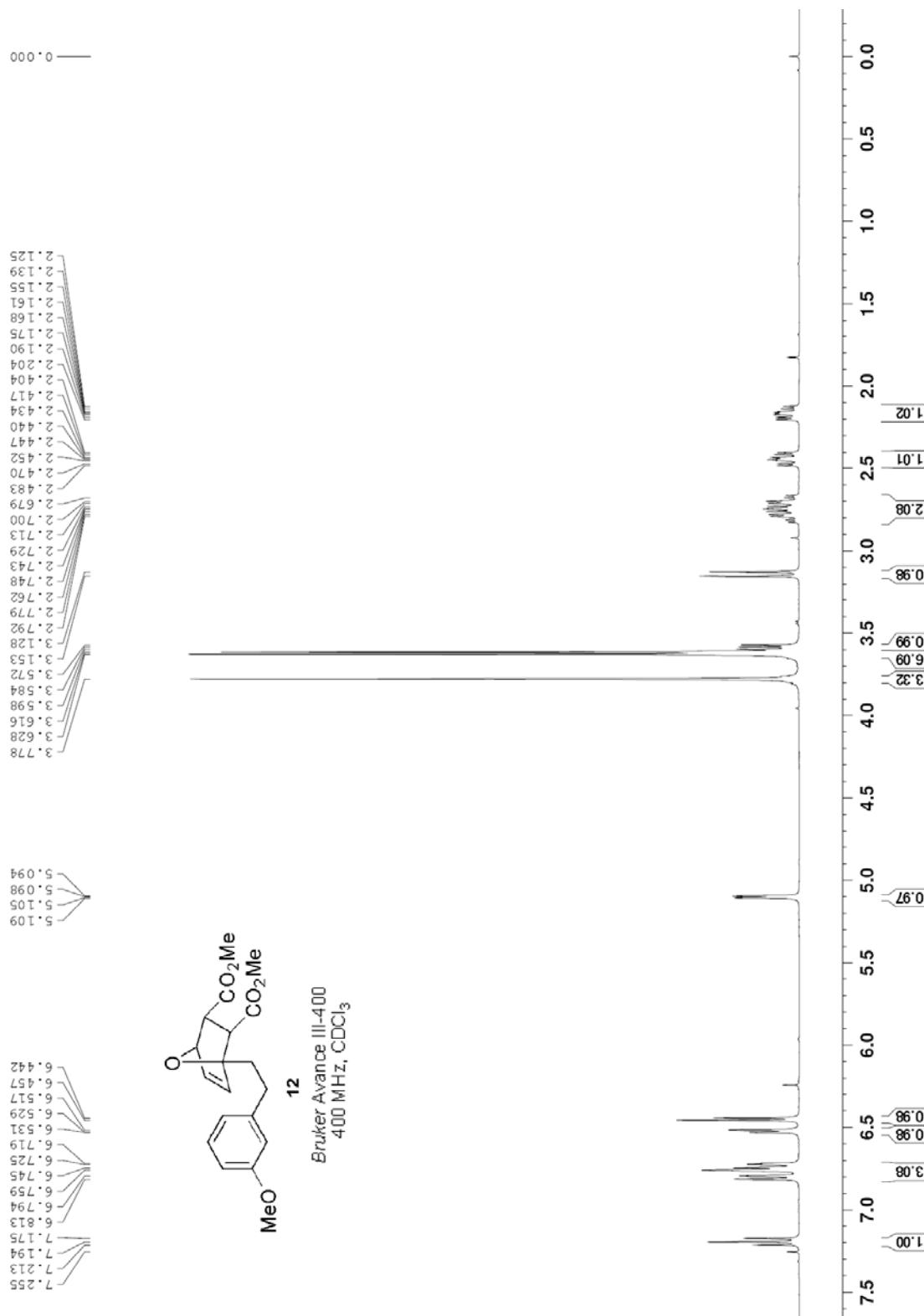
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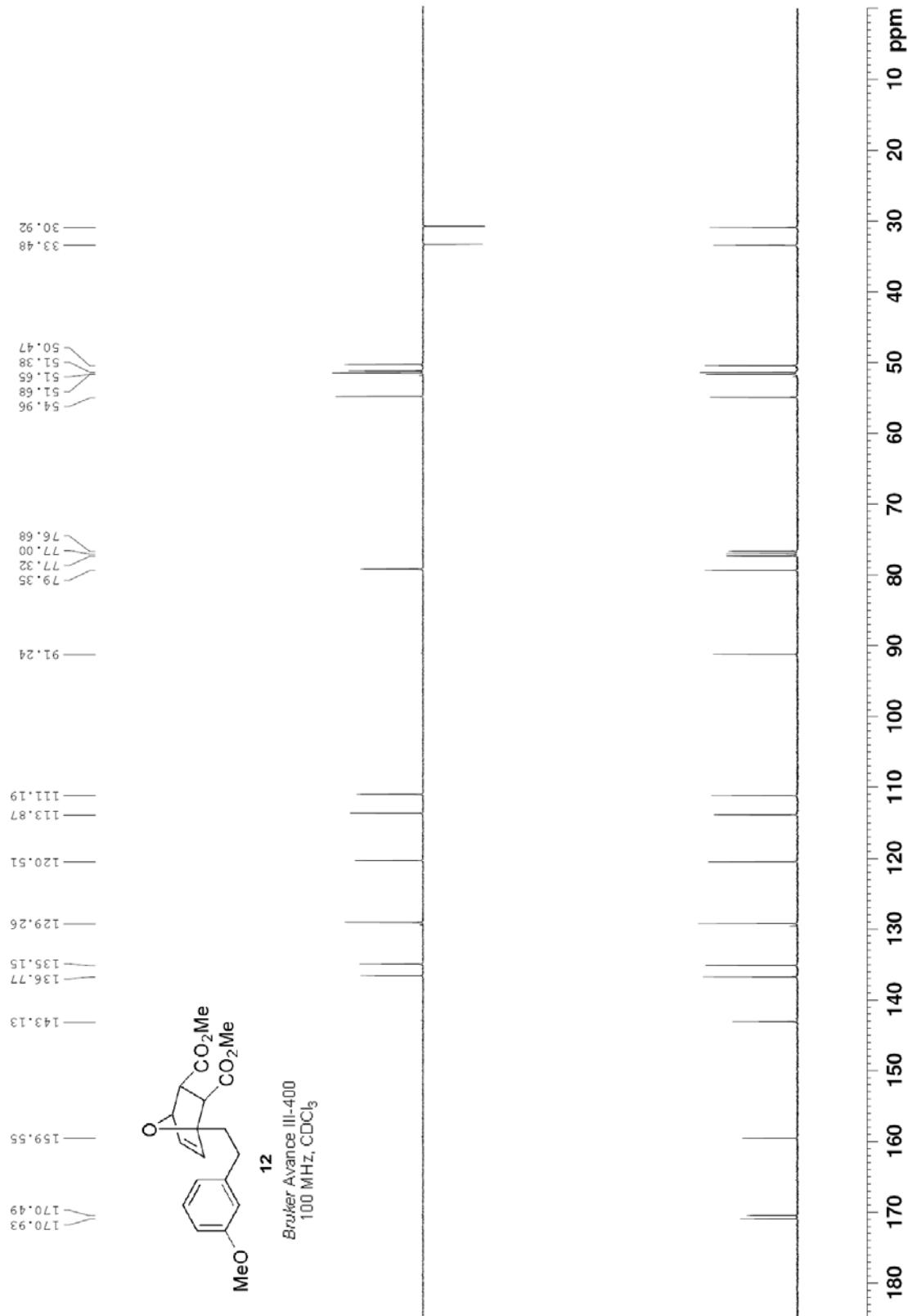
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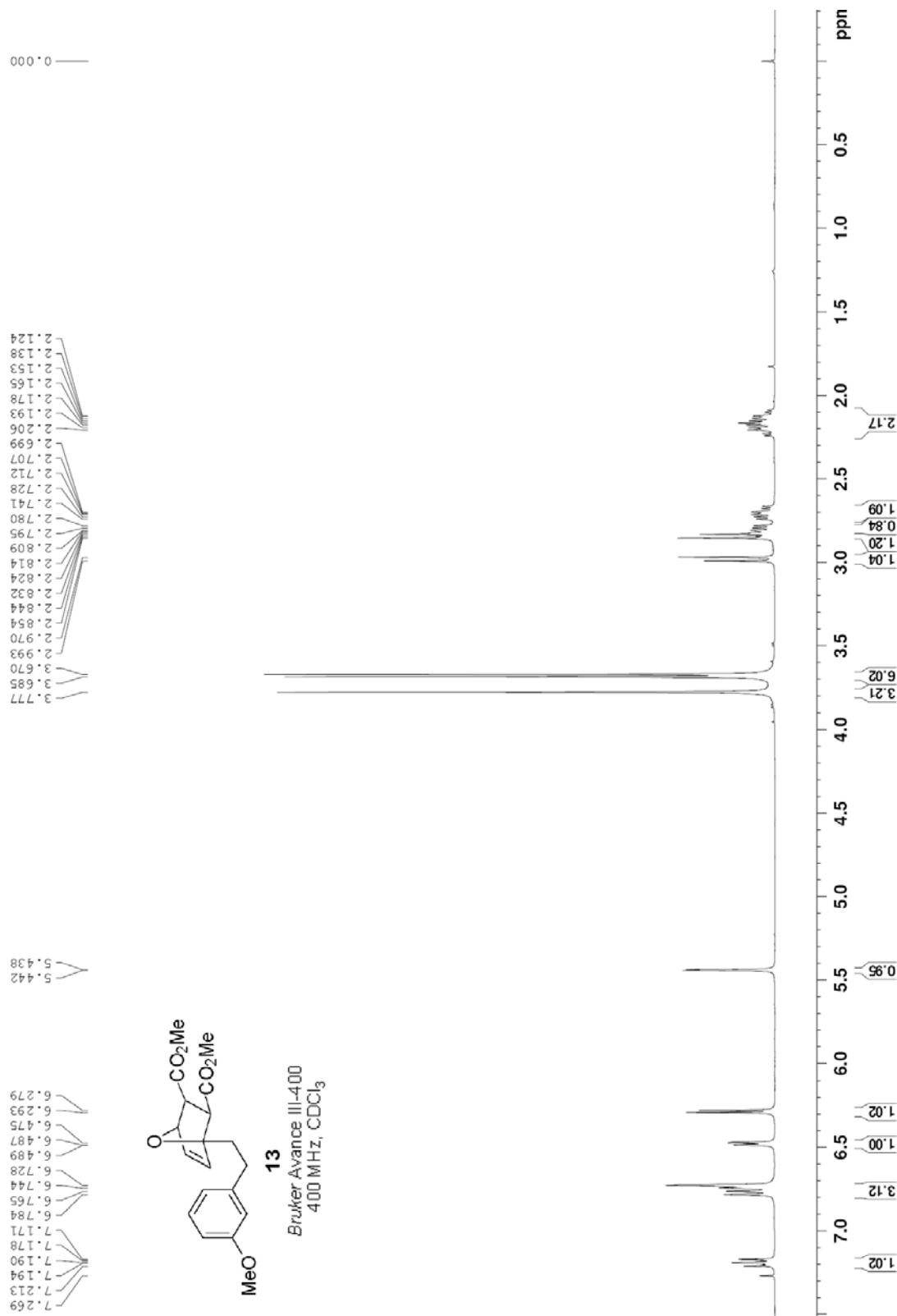
**Compound 12:**  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



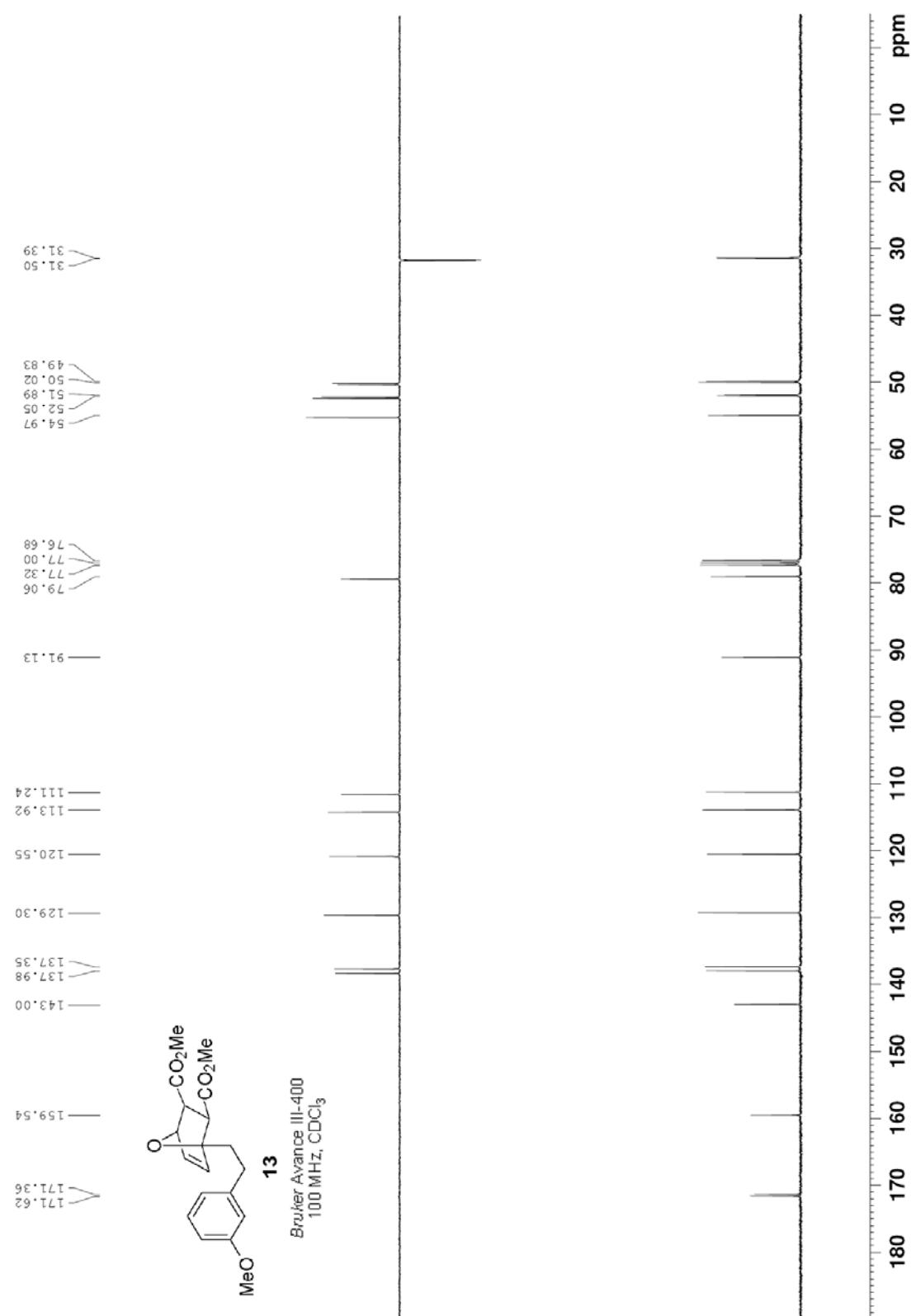
Compound **12**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



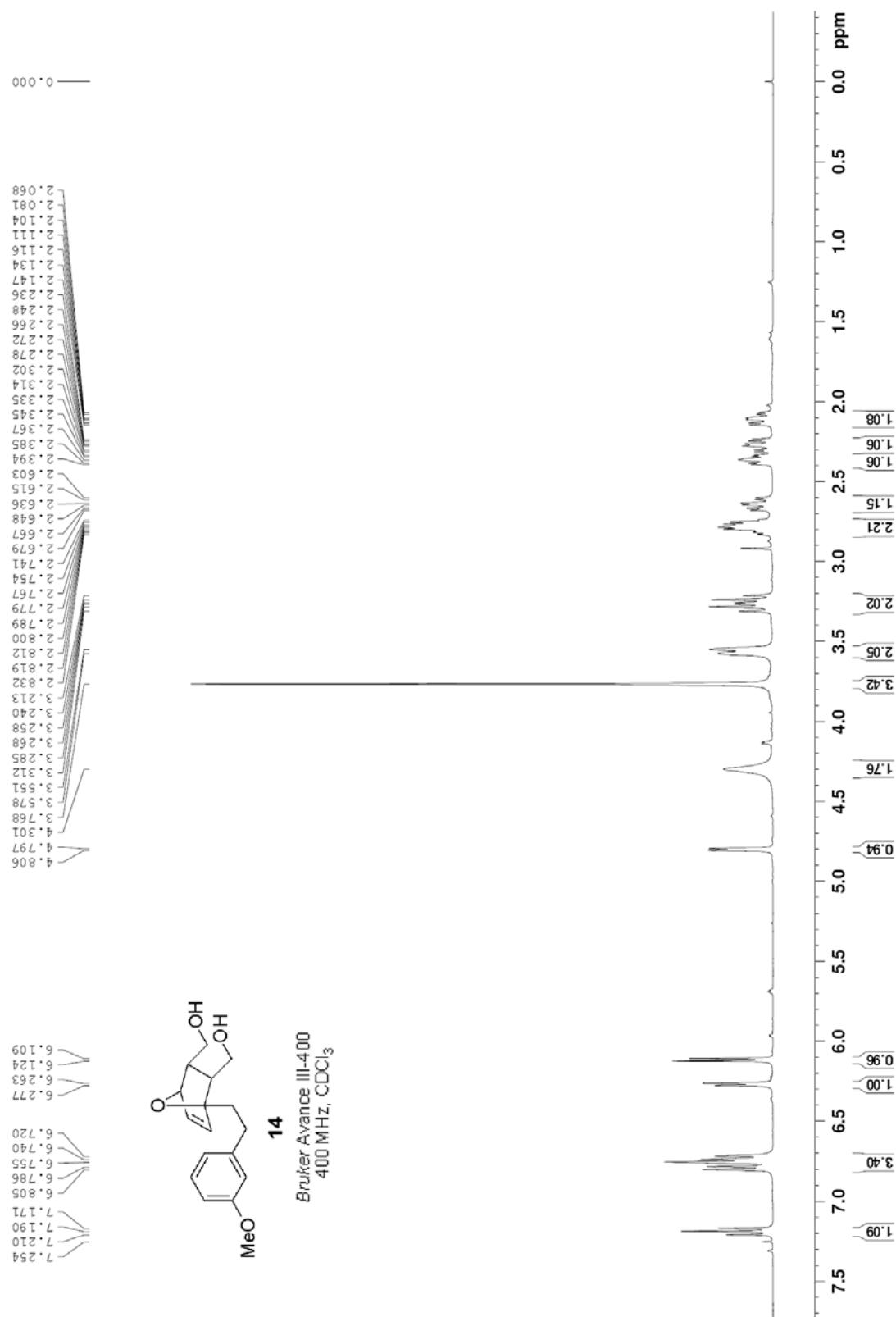
**Compound 13:**  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



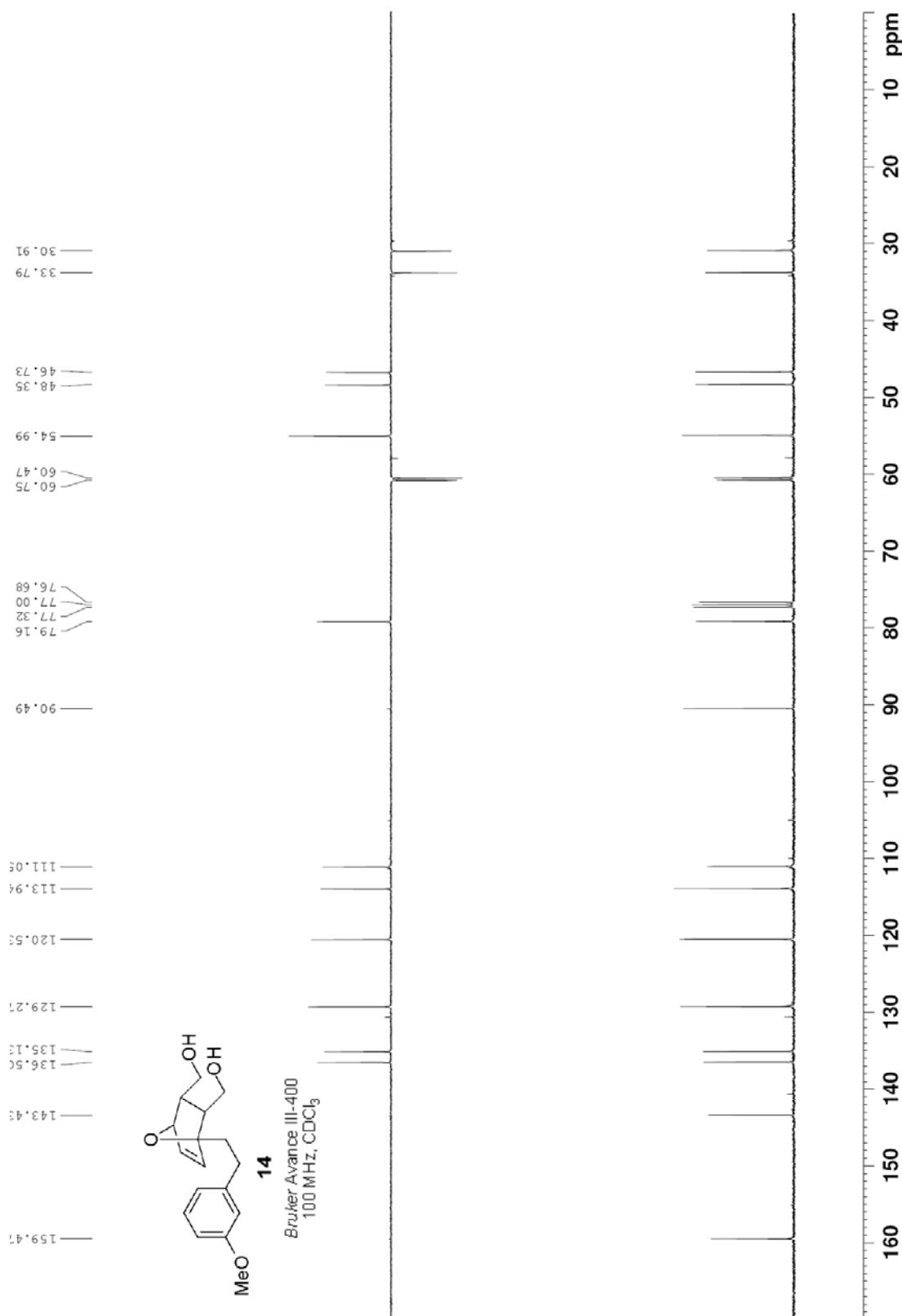
Compound **13**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



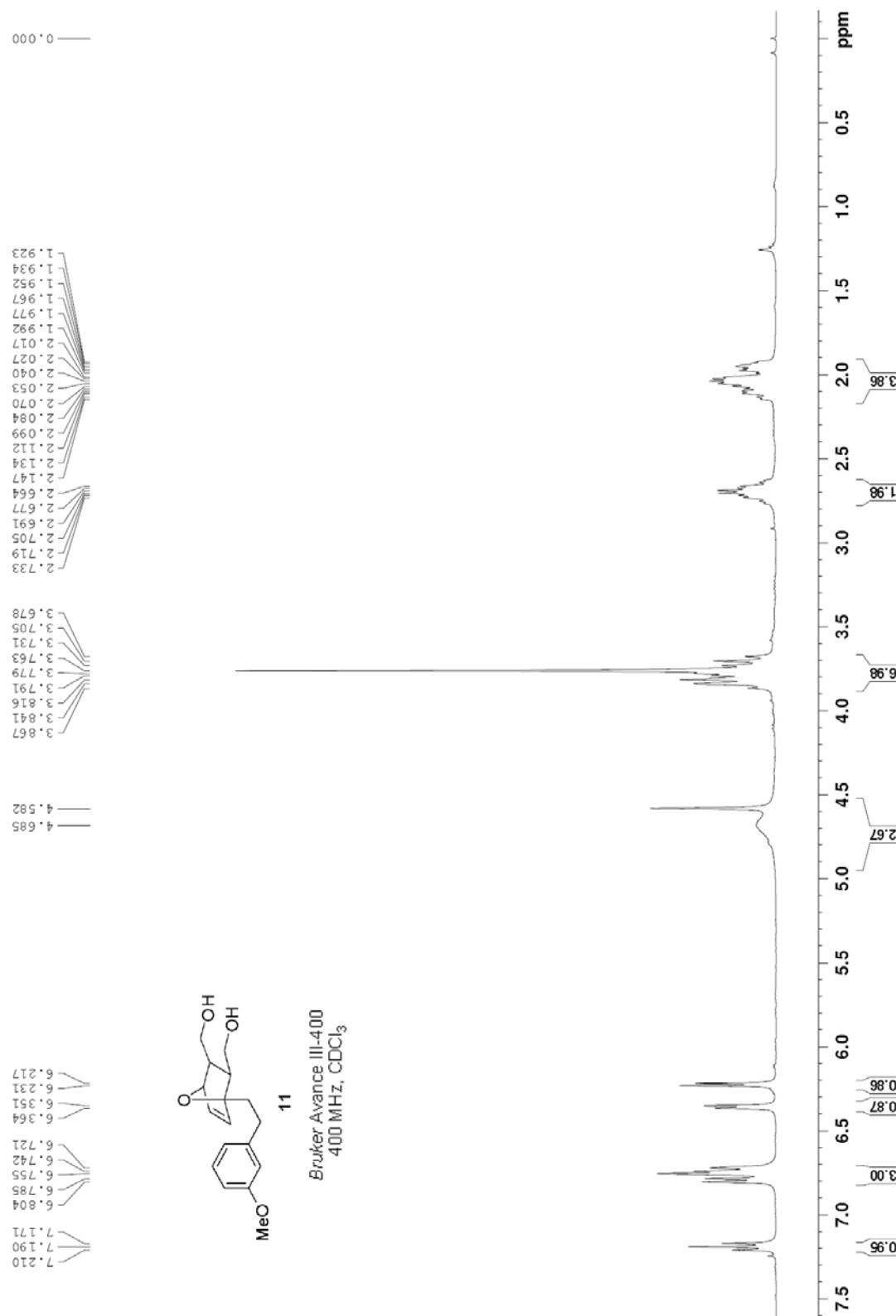
**Compound 14:**  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



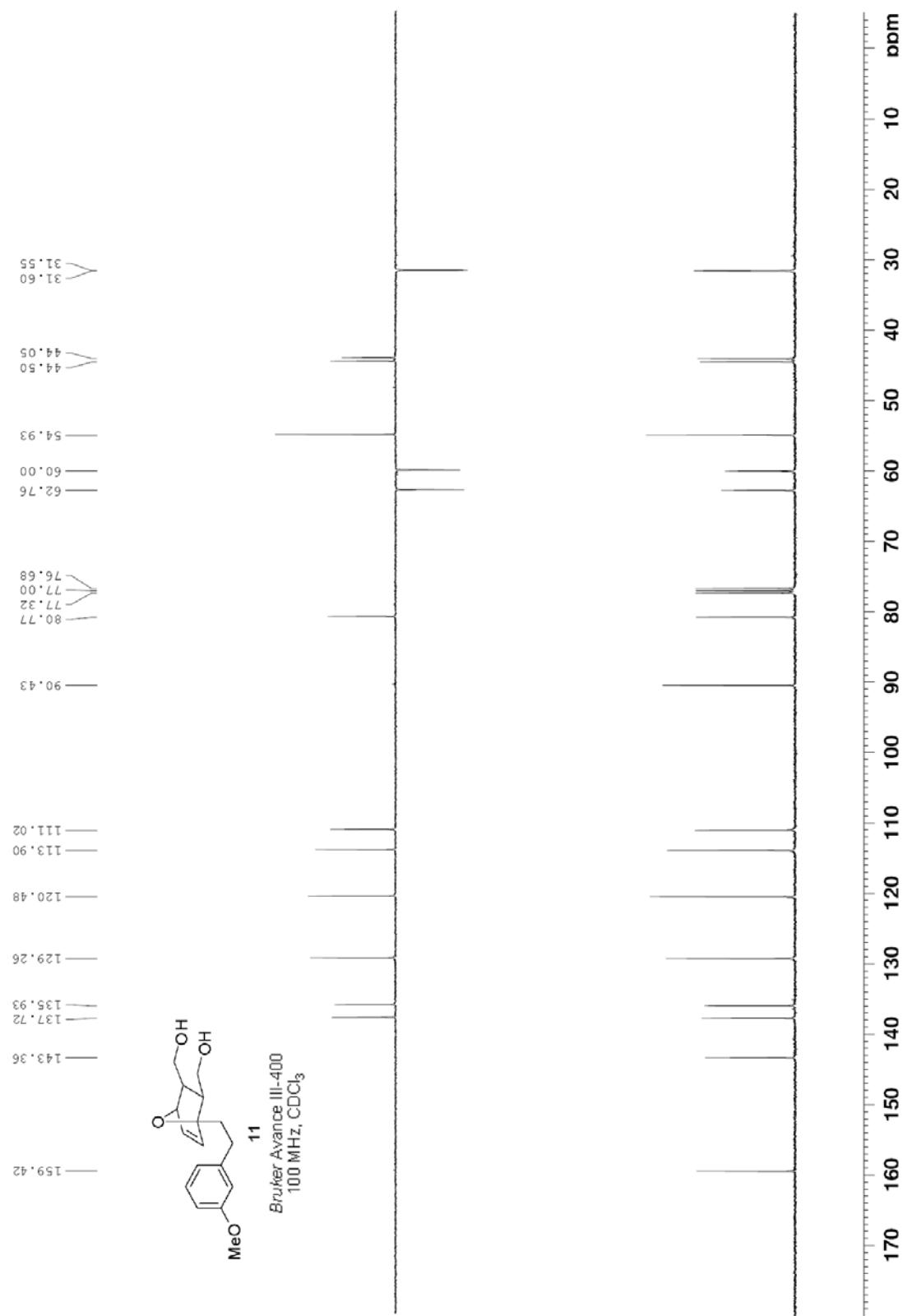
Compound **14**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



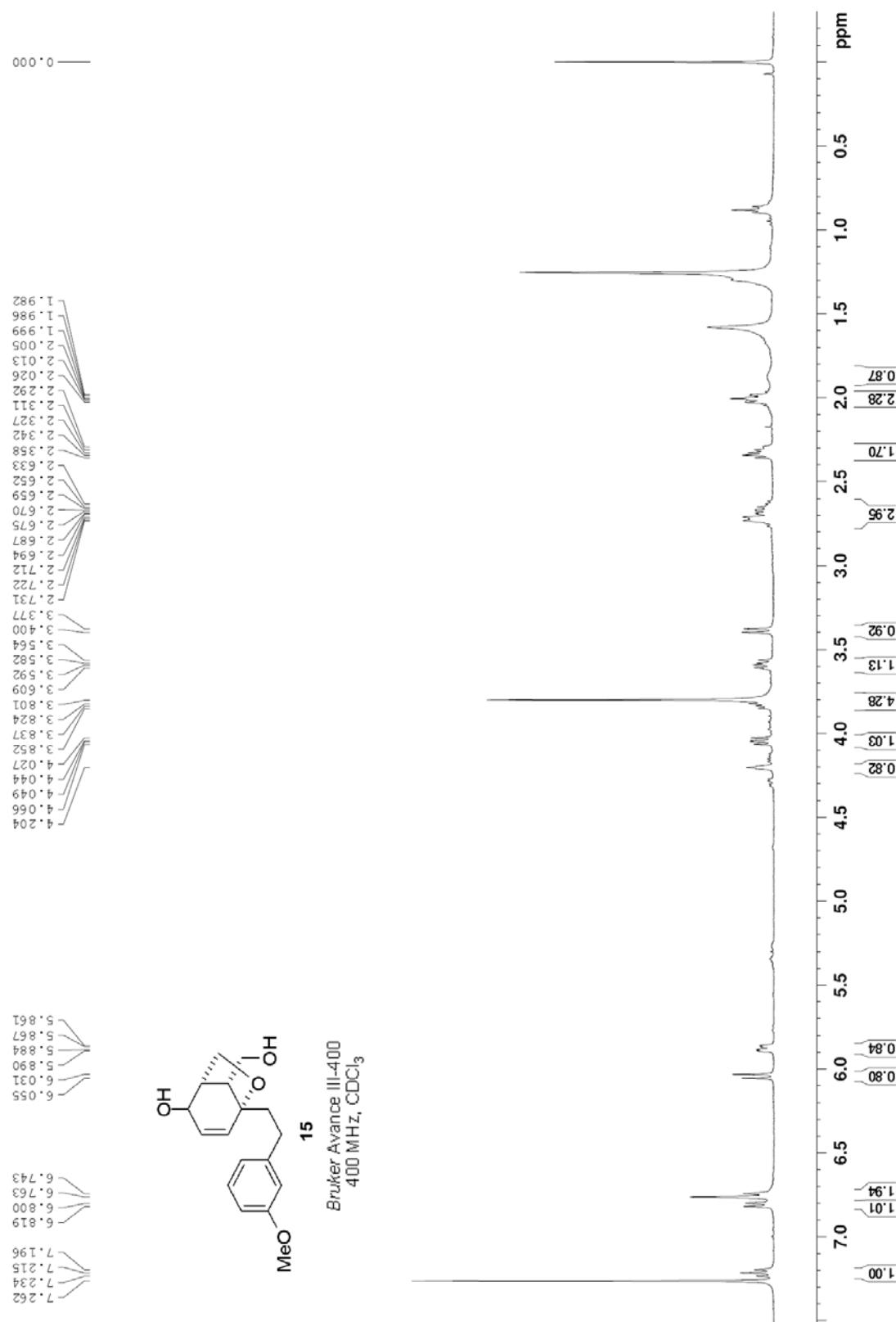
Compound **11**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



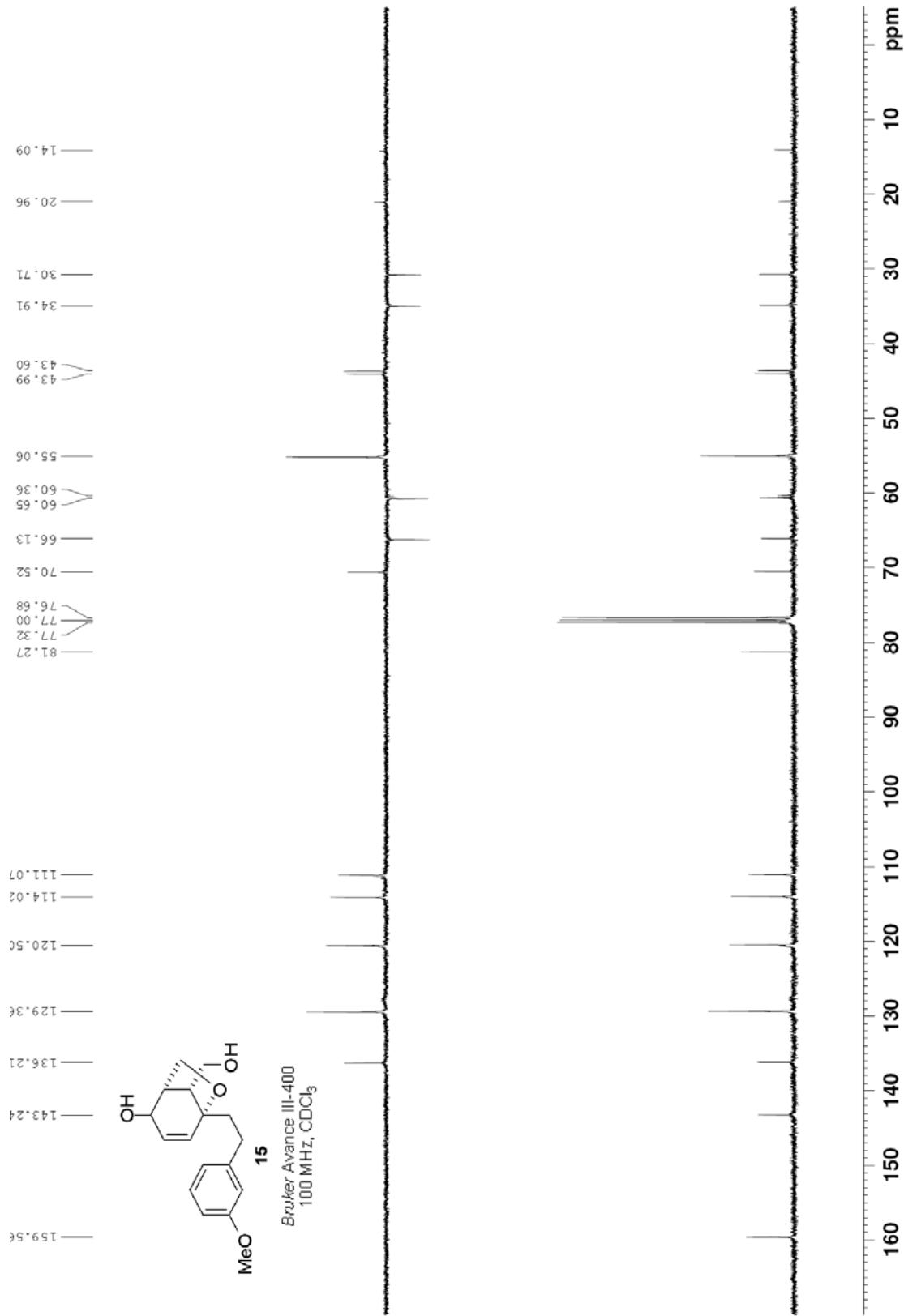
Compound **11**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



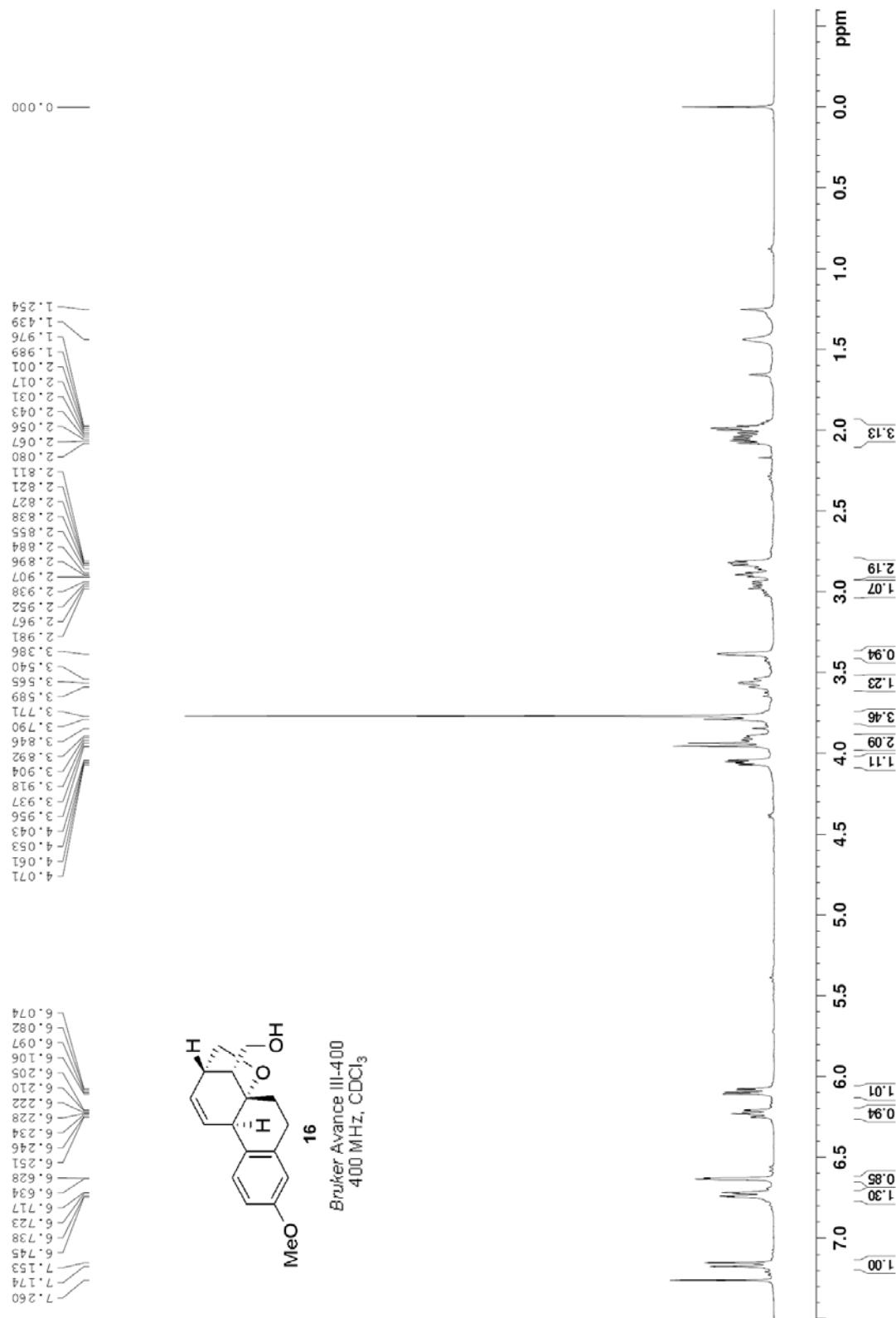
Compound **15**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



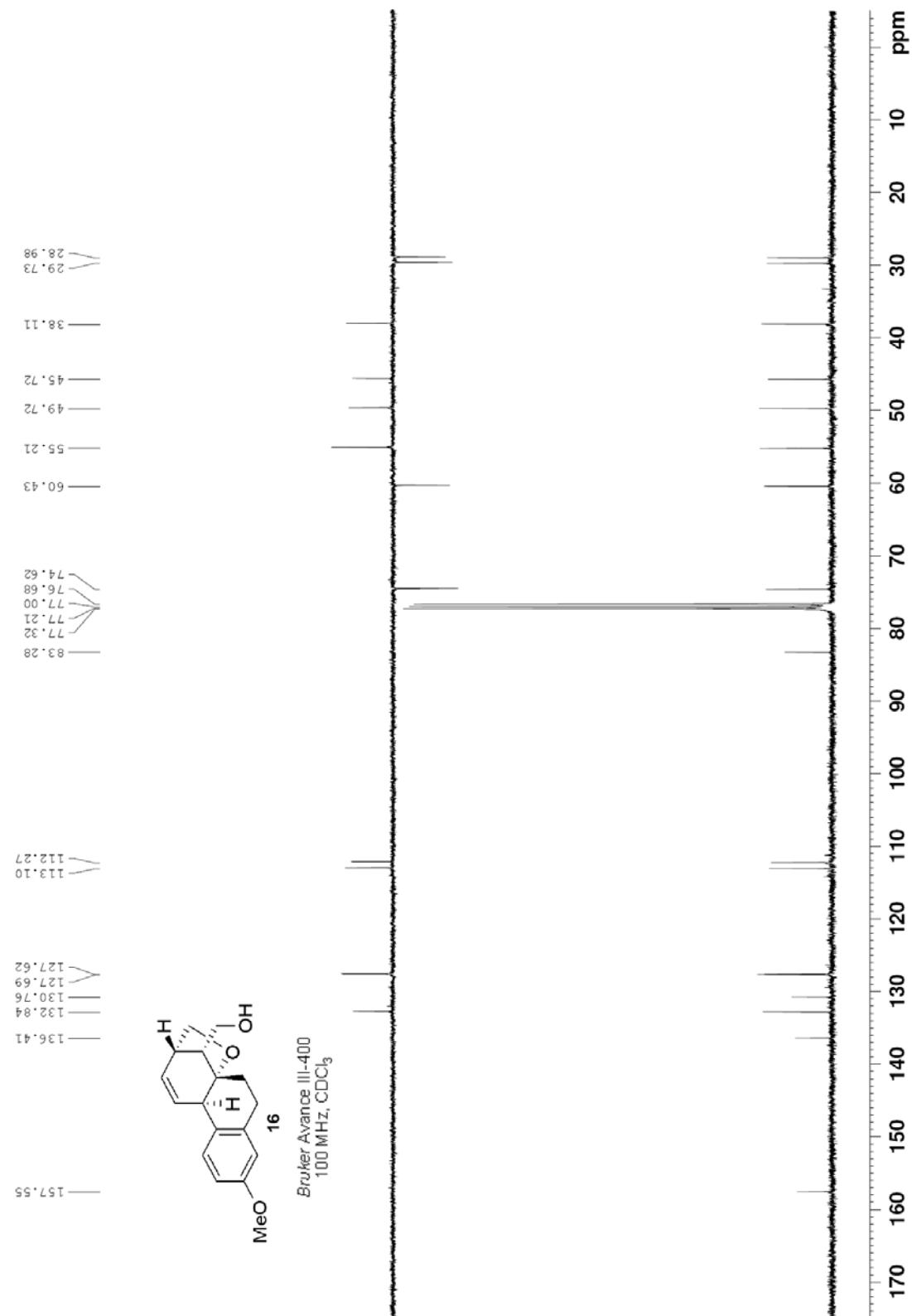
Compound **15**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



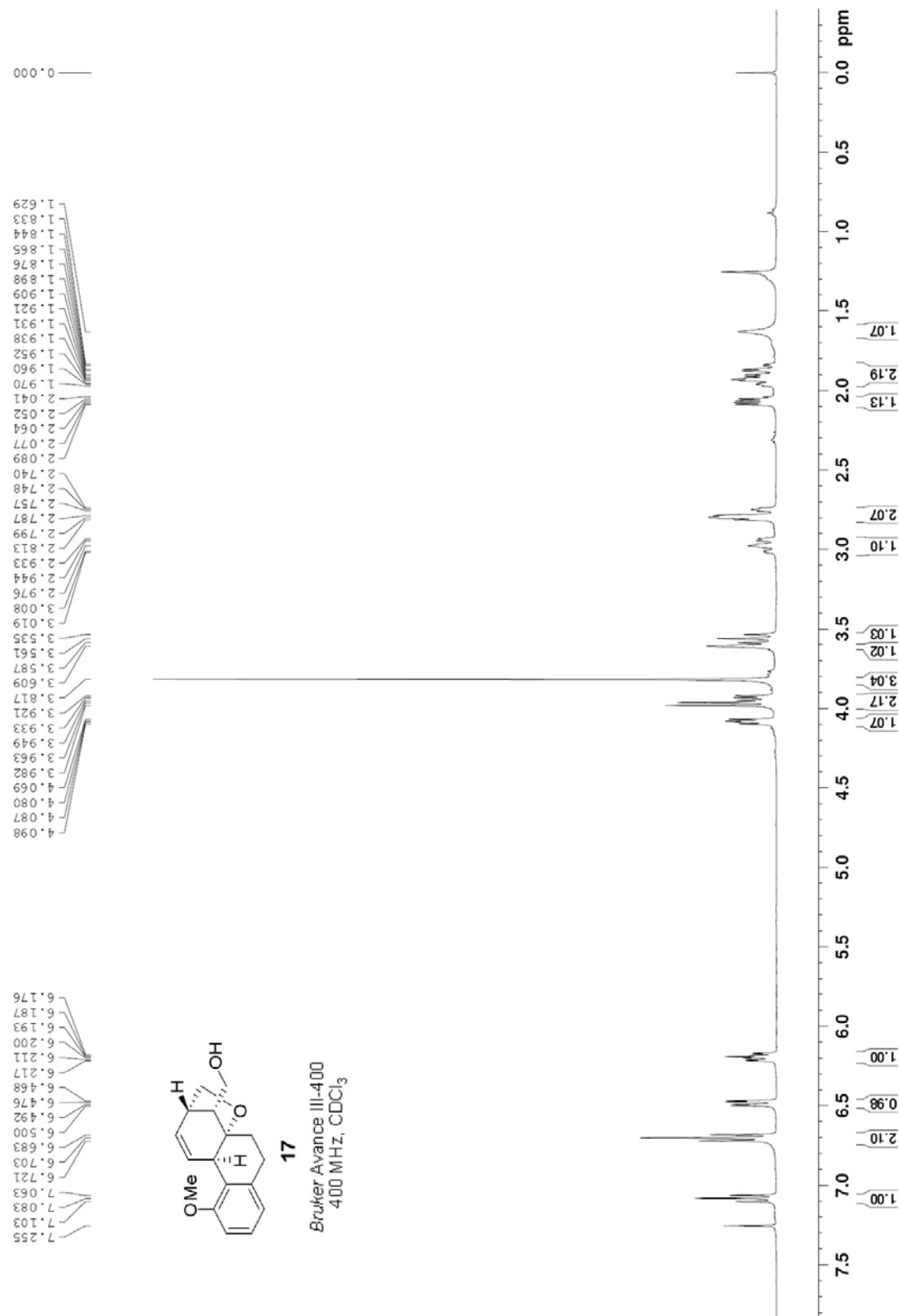
Compound **16**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



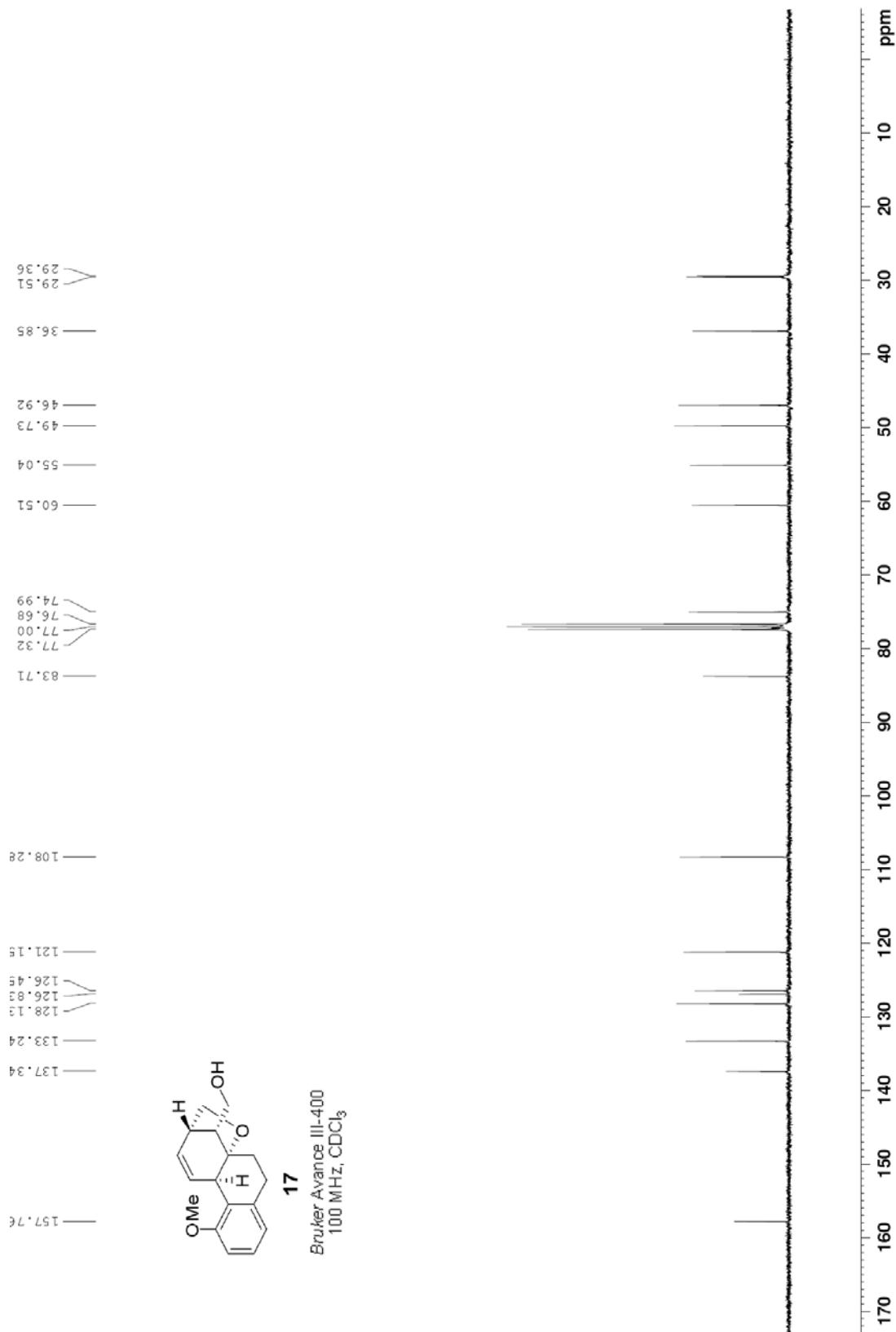
Compound **16**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



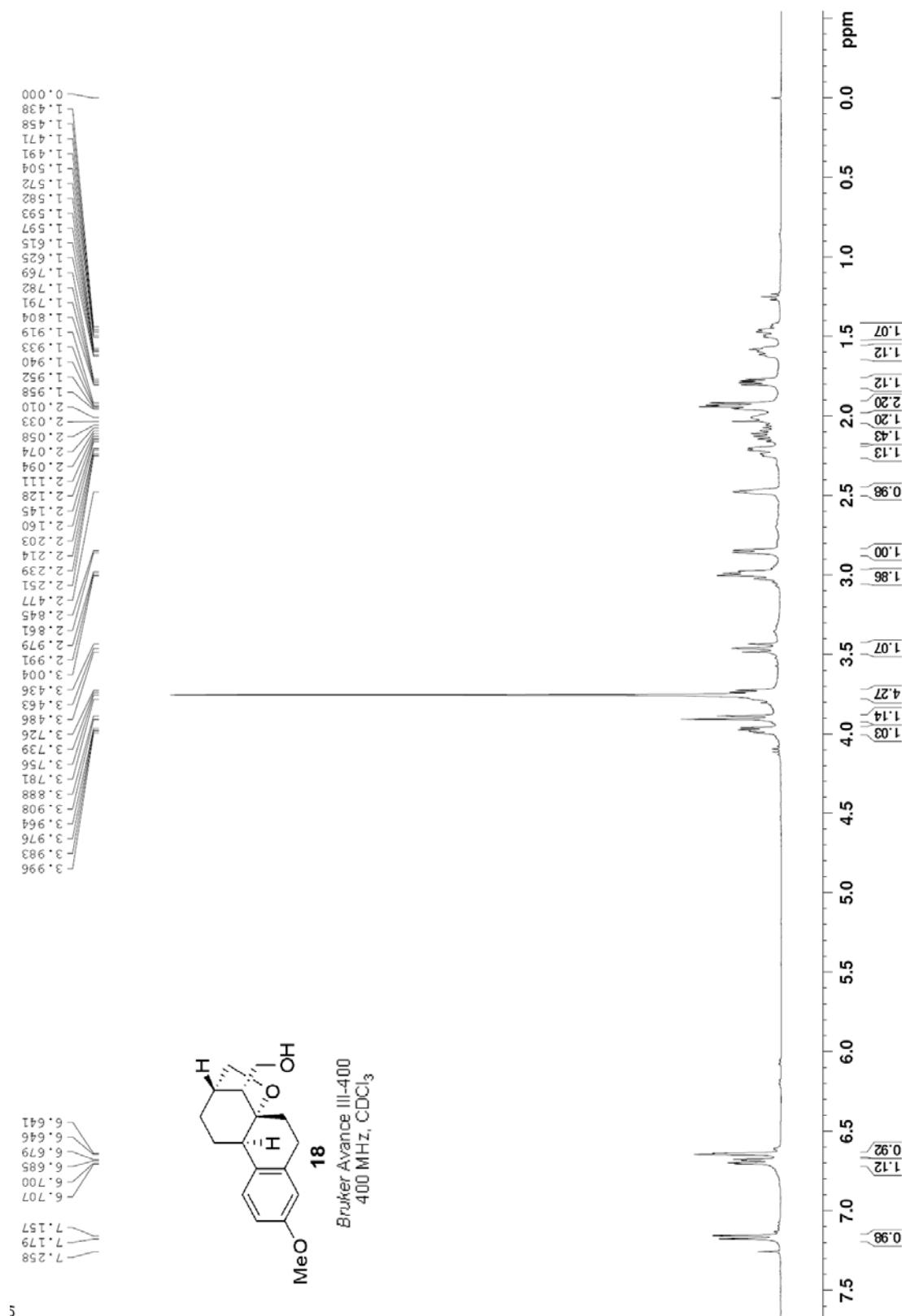
Compound **17**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



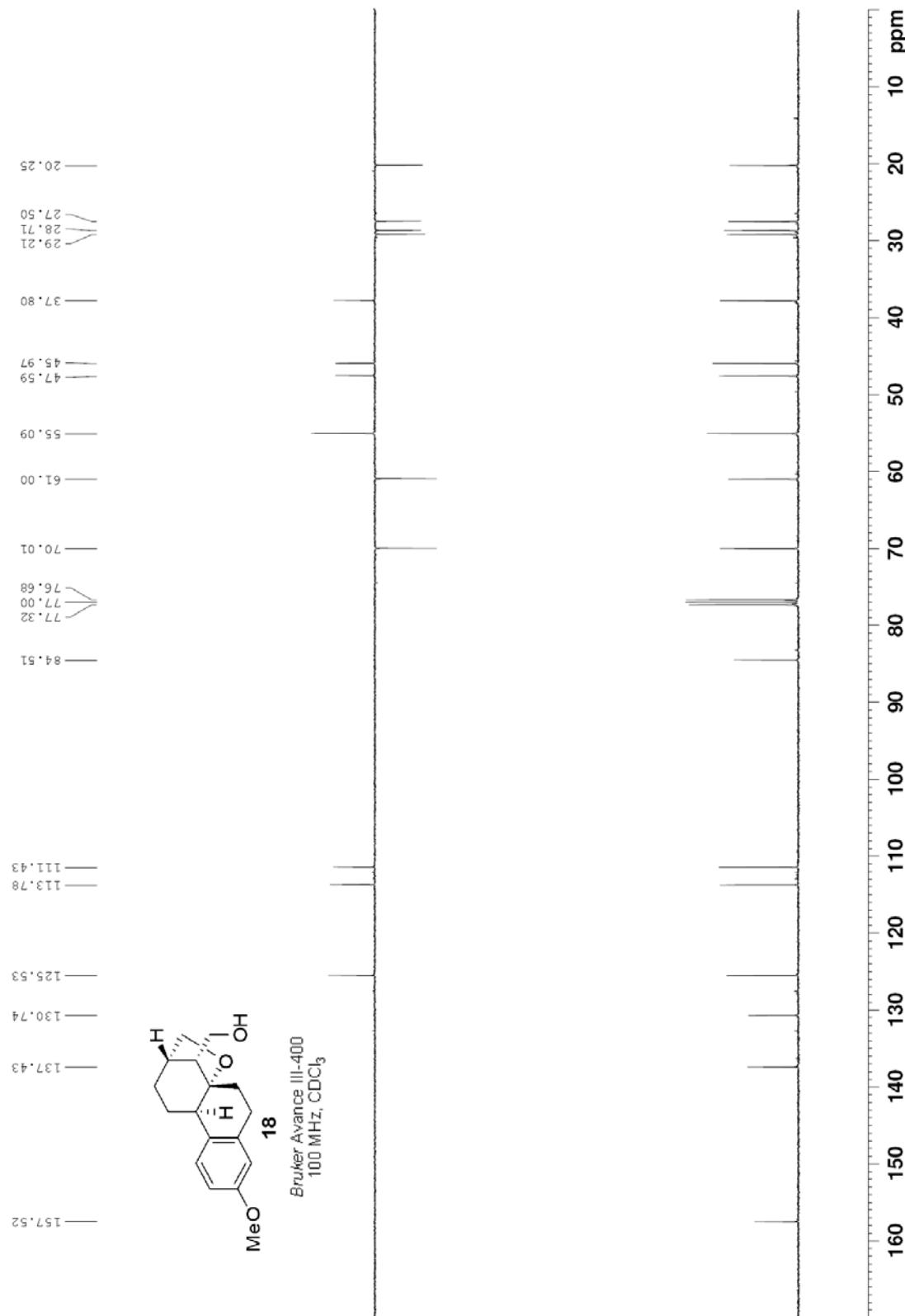
Compound **17**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



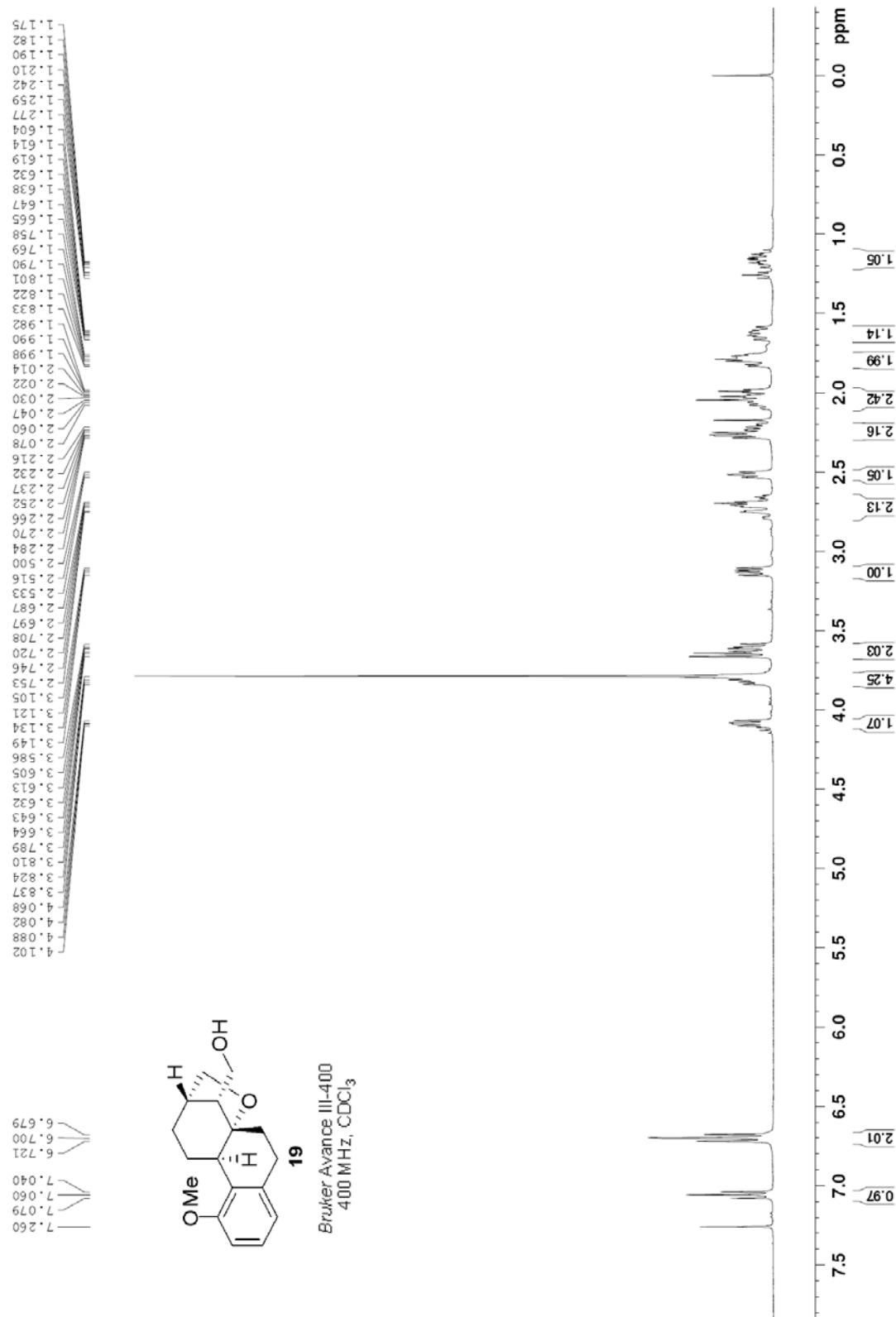
Compound **18**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



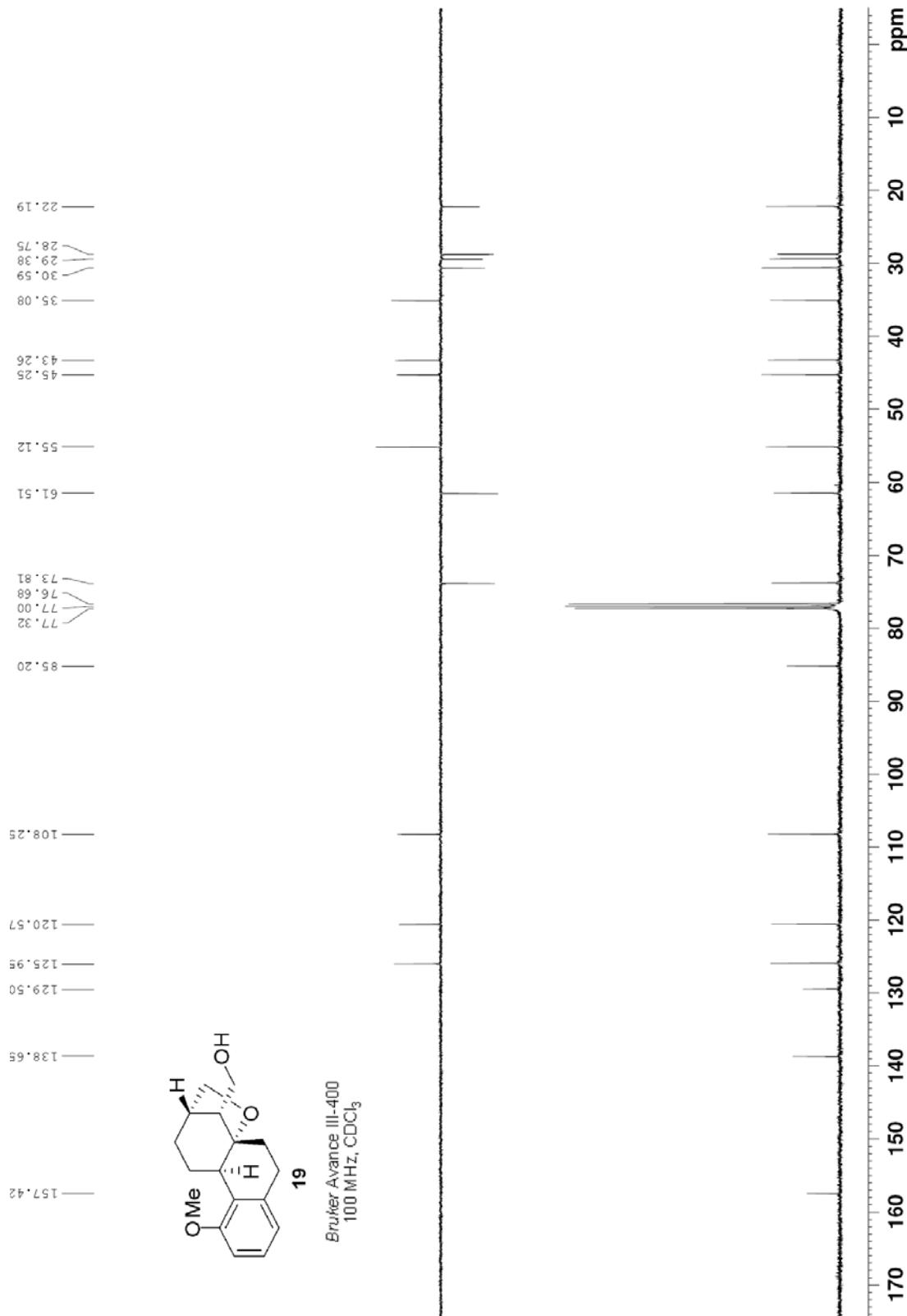
Compound **18**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



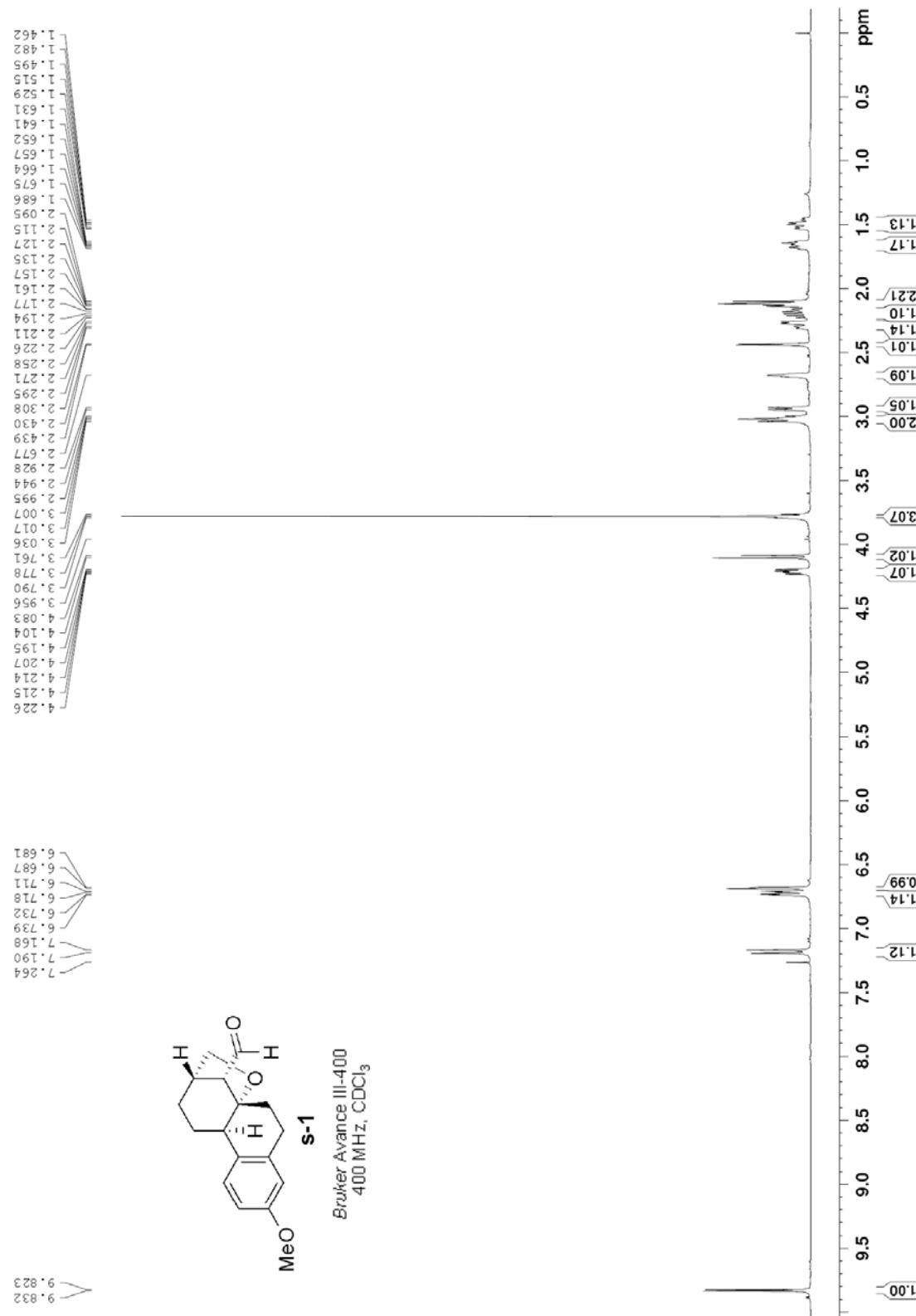
Compound **19**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



Compound **19**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):

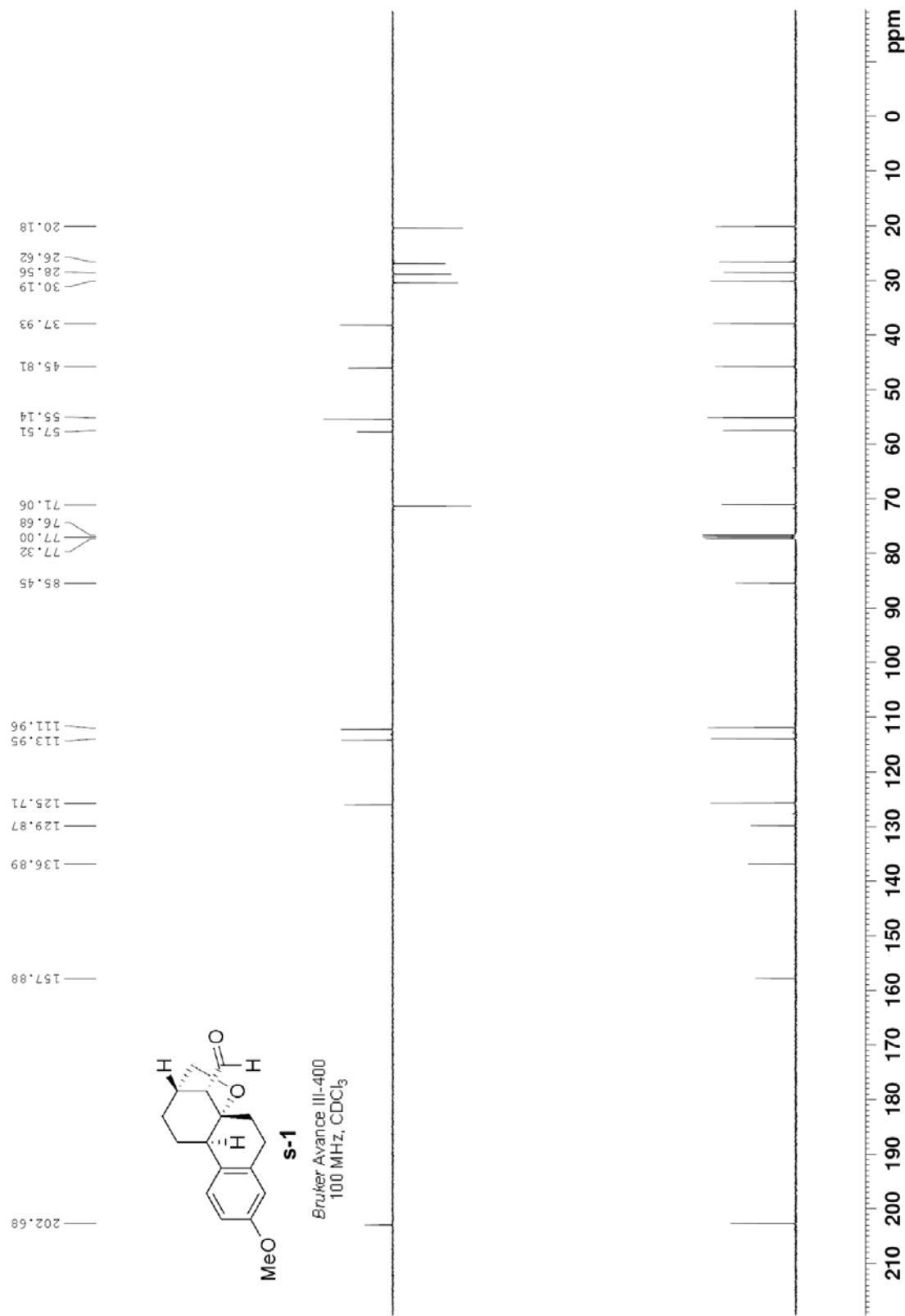


Compound s-1:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):

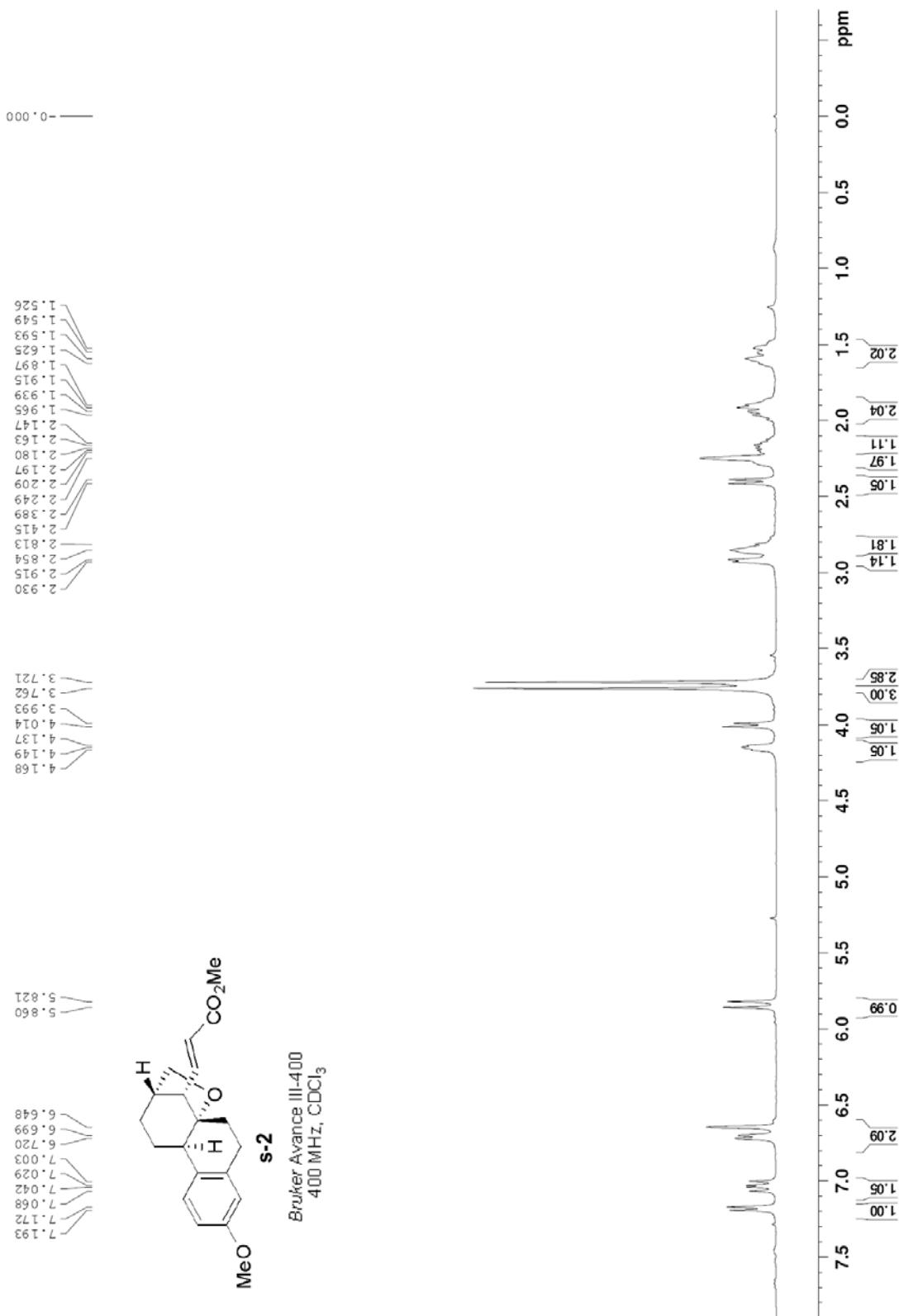


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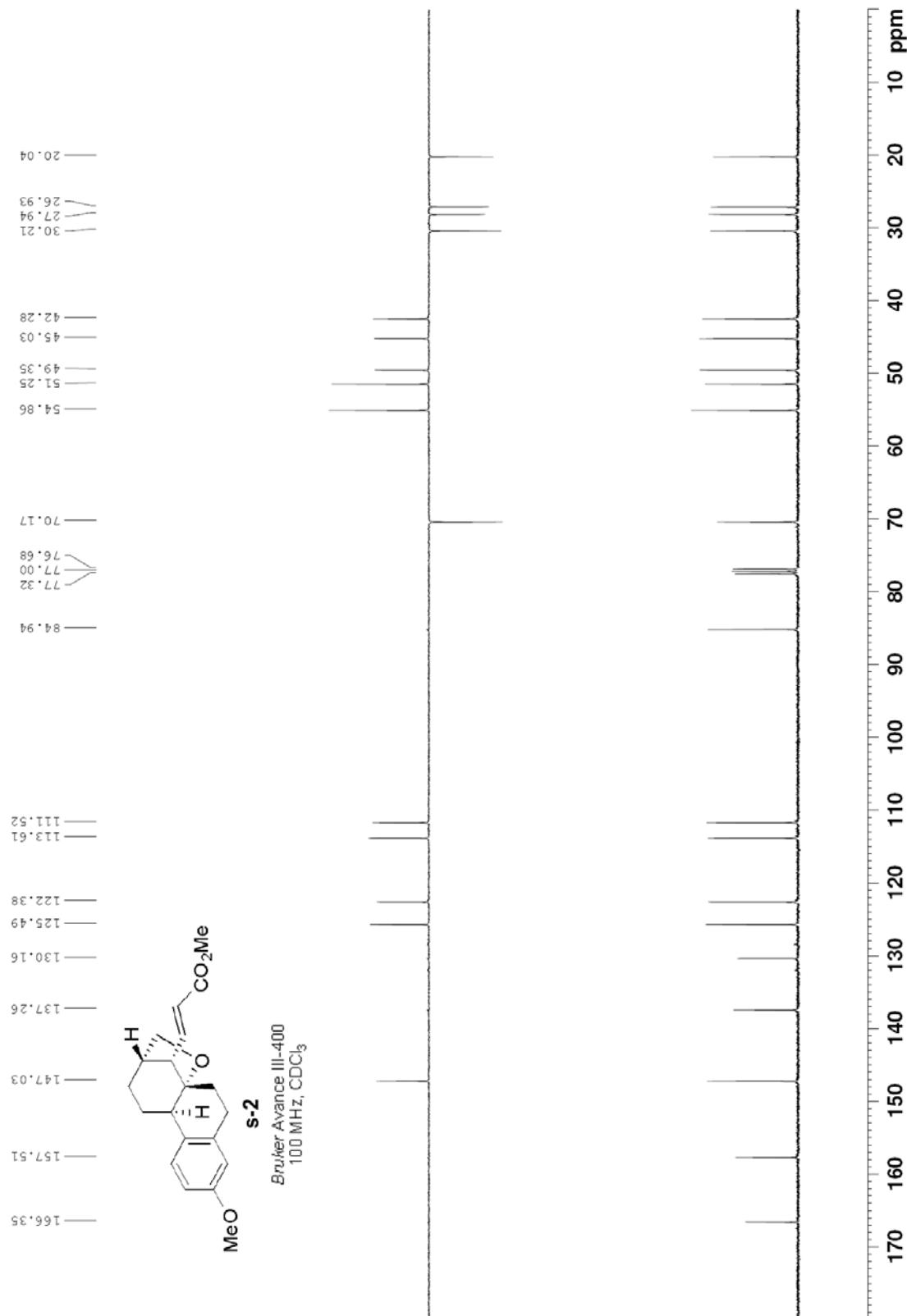
Compound **s-1**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



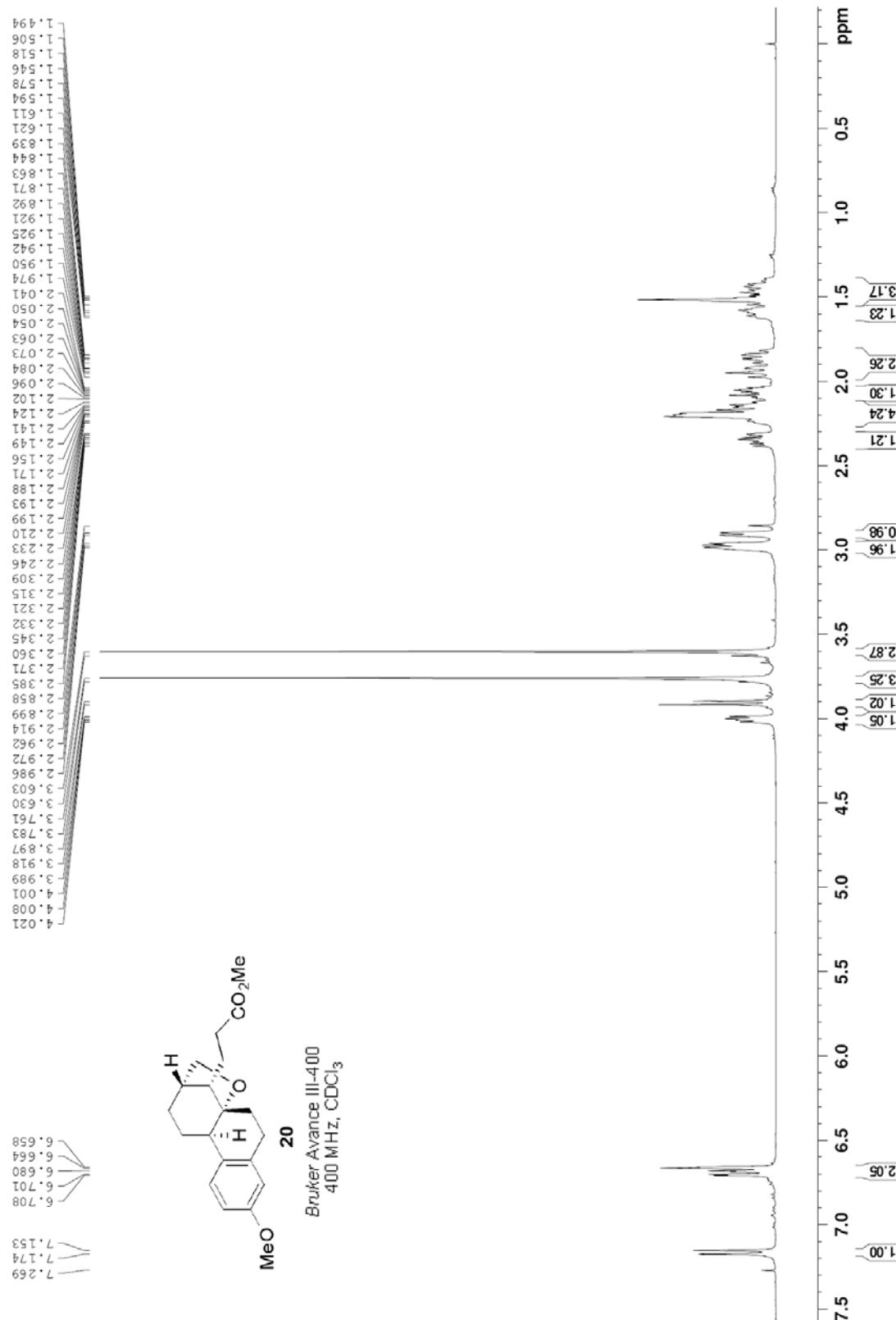
Compound s-2:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



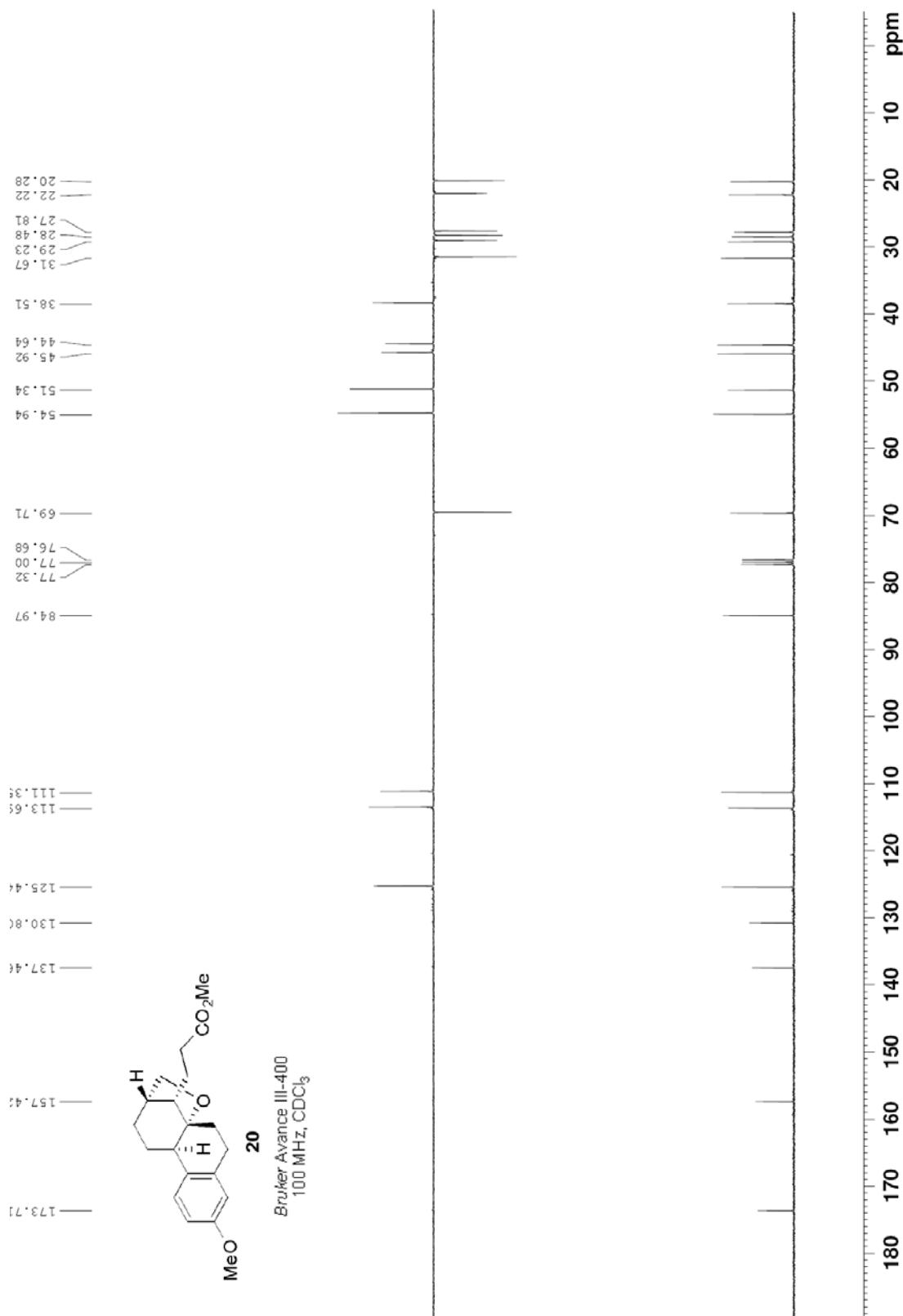
Compound s-2:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



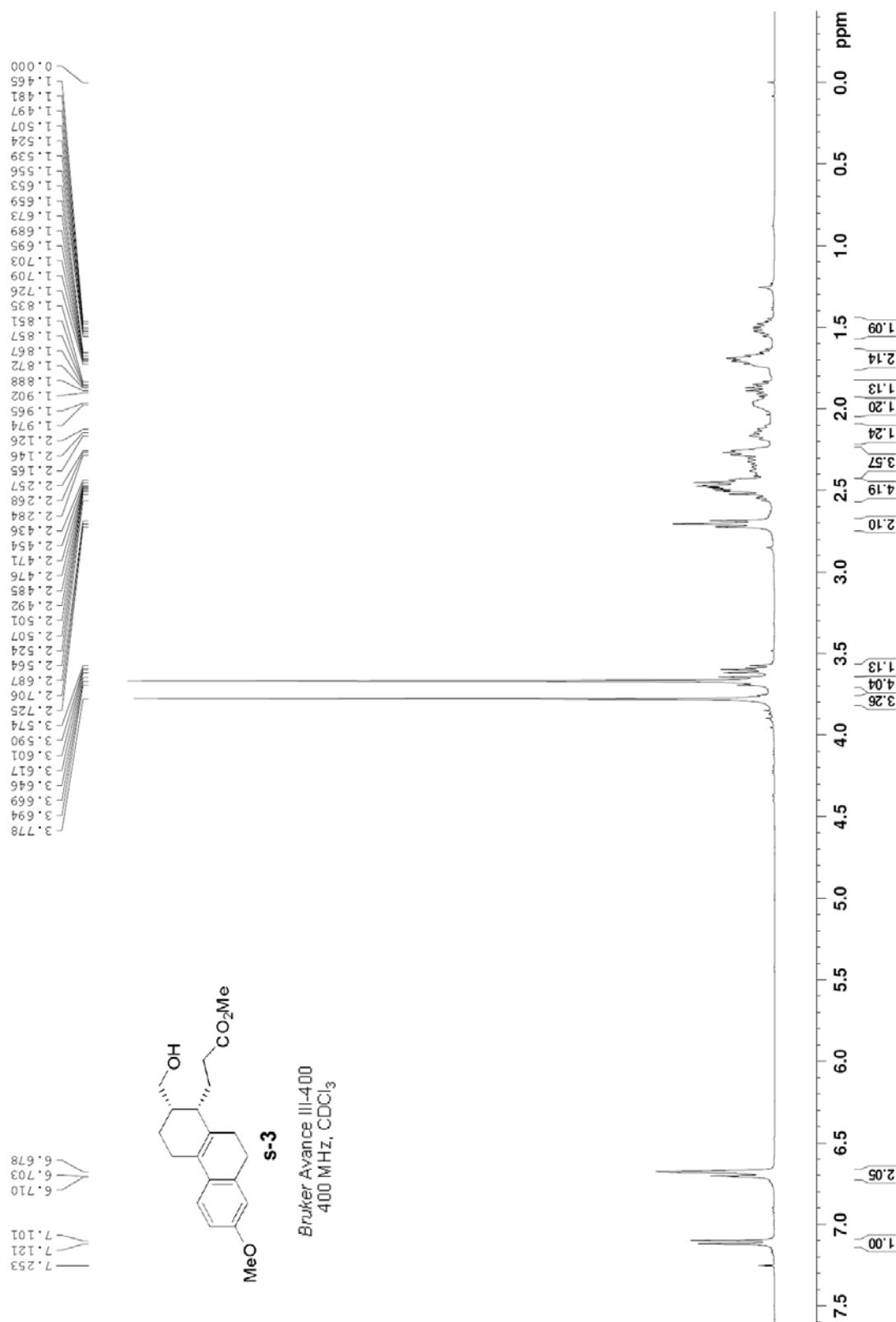
Compound 20:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



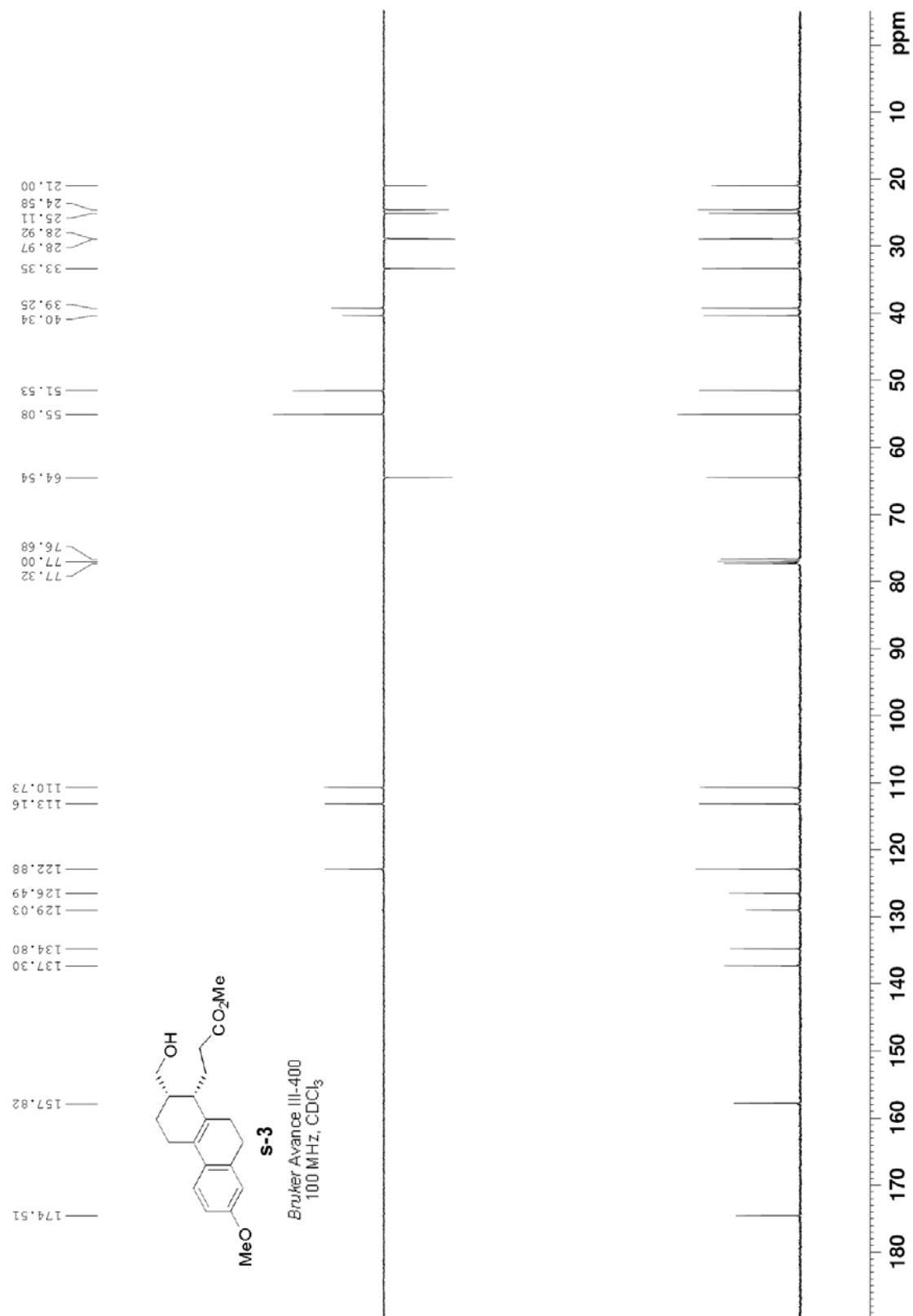
Compound **20**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



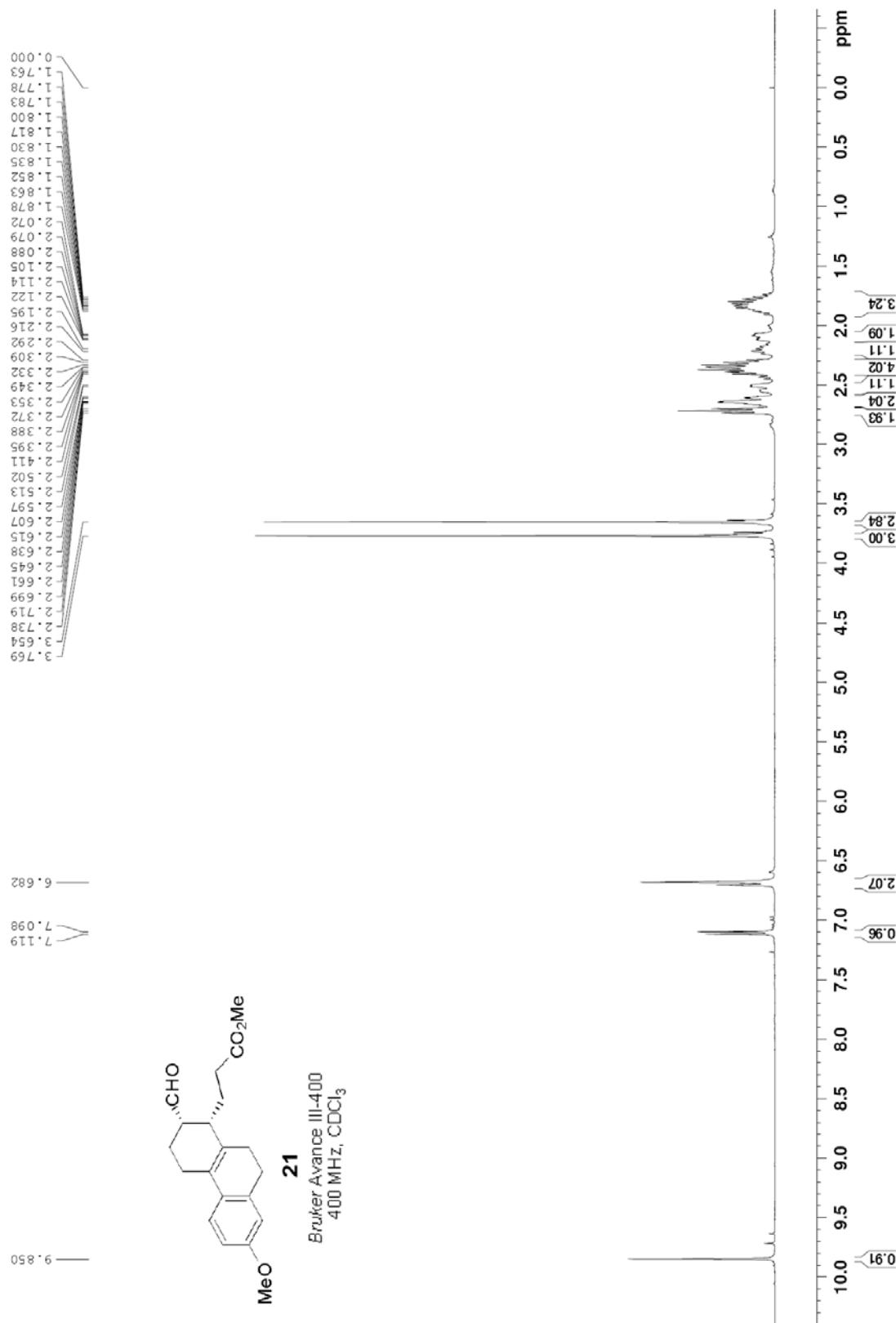
Compound s-3:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



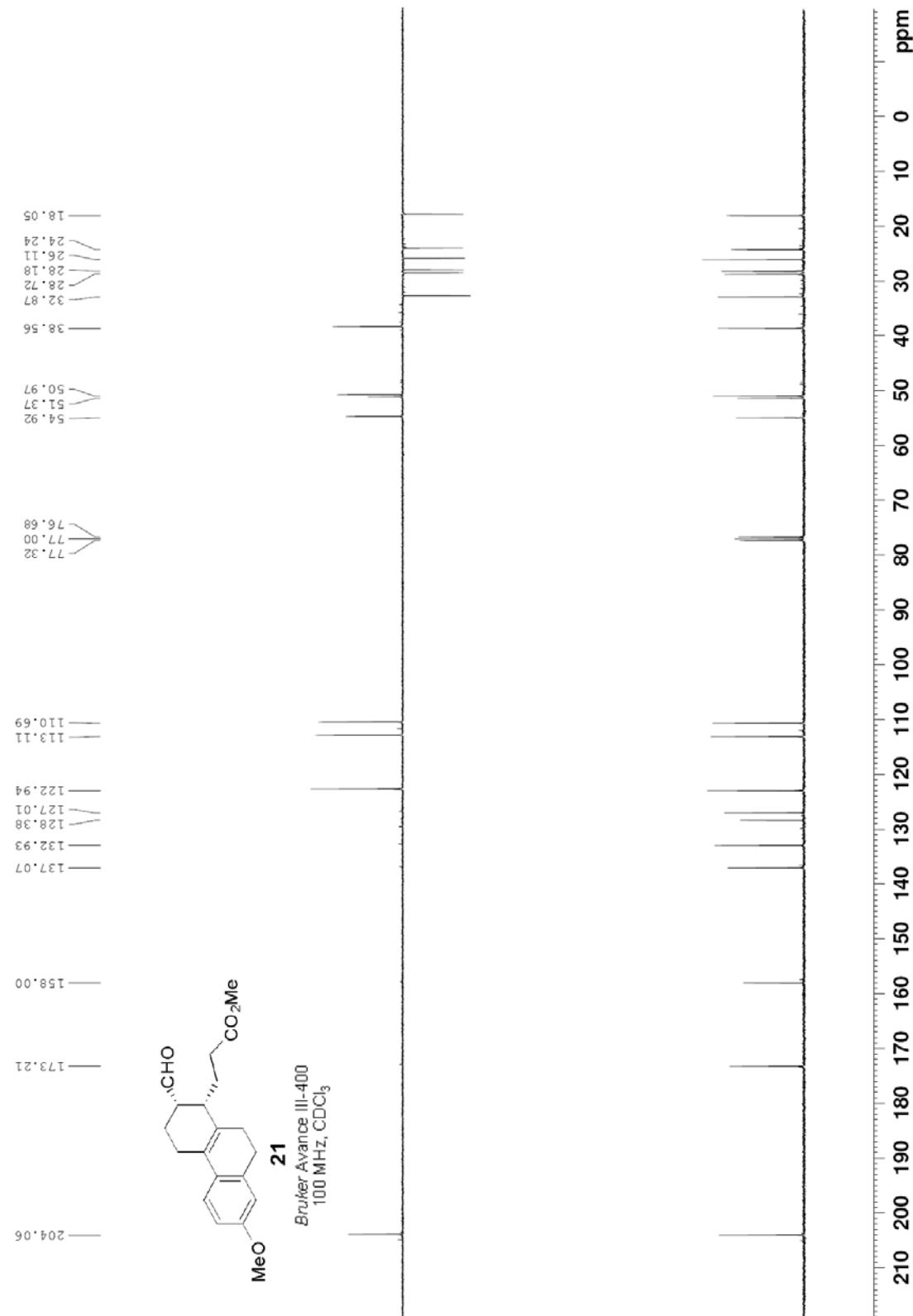
Compound s-3:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



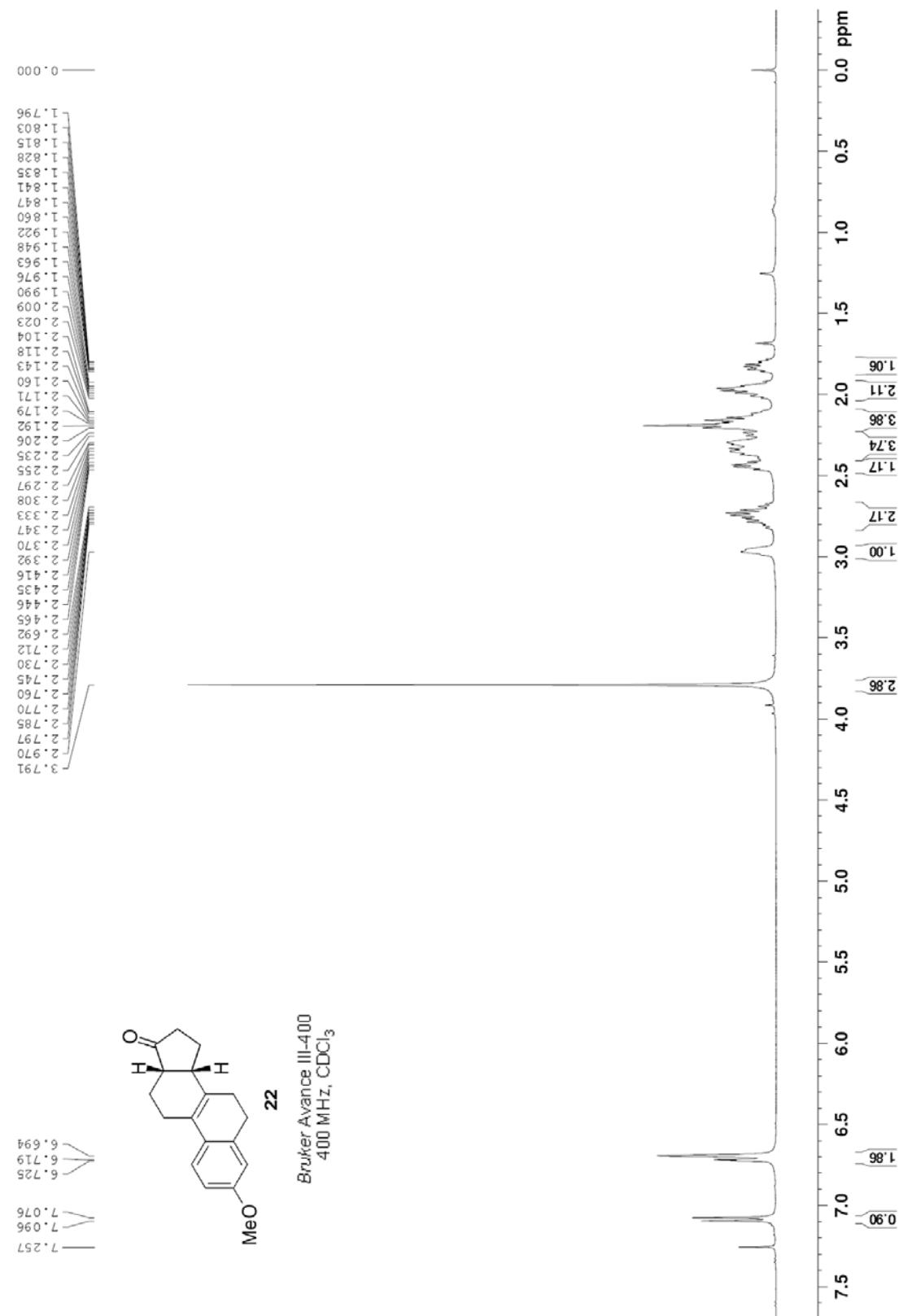
Compound **21**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



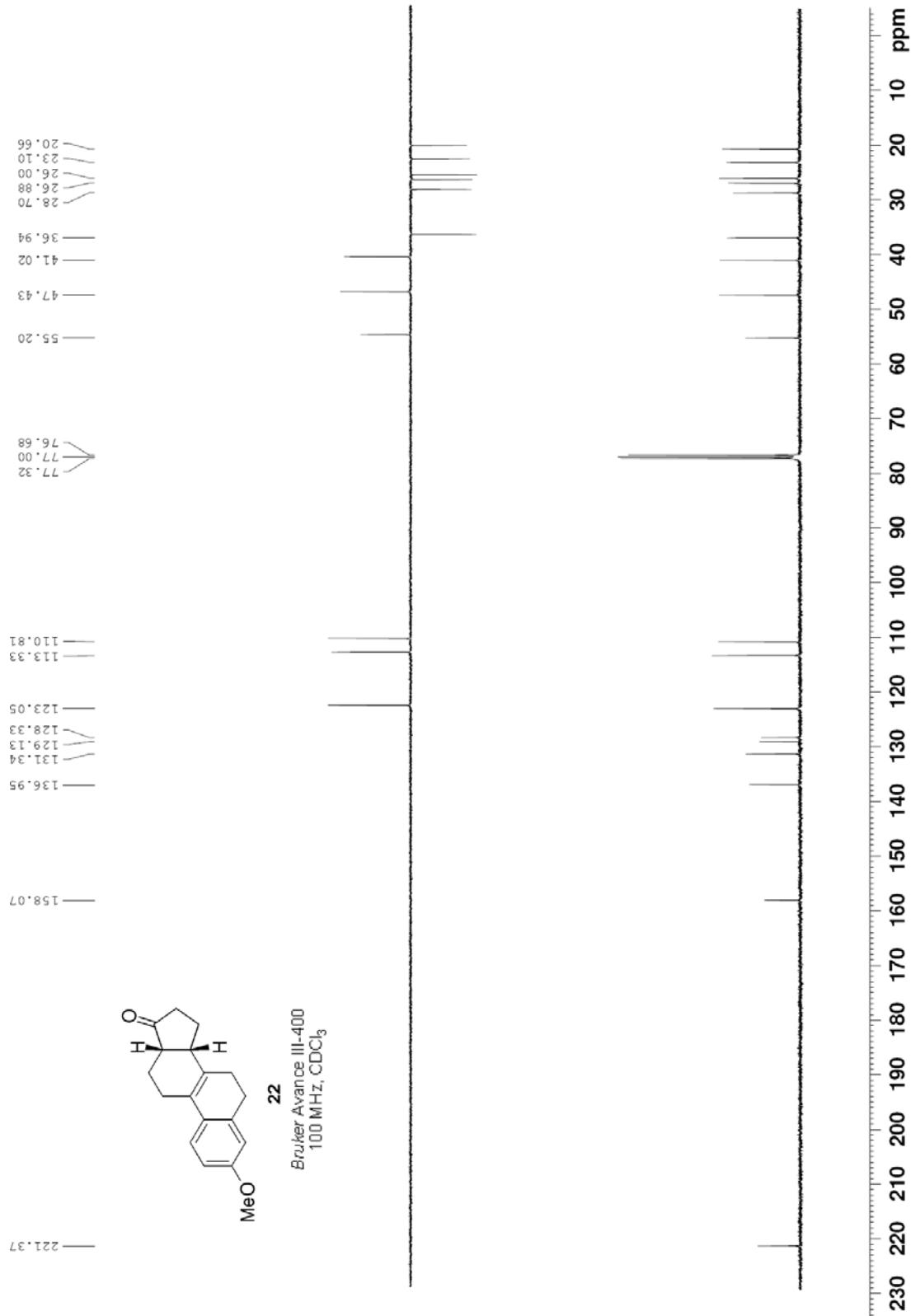
Compound **21**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



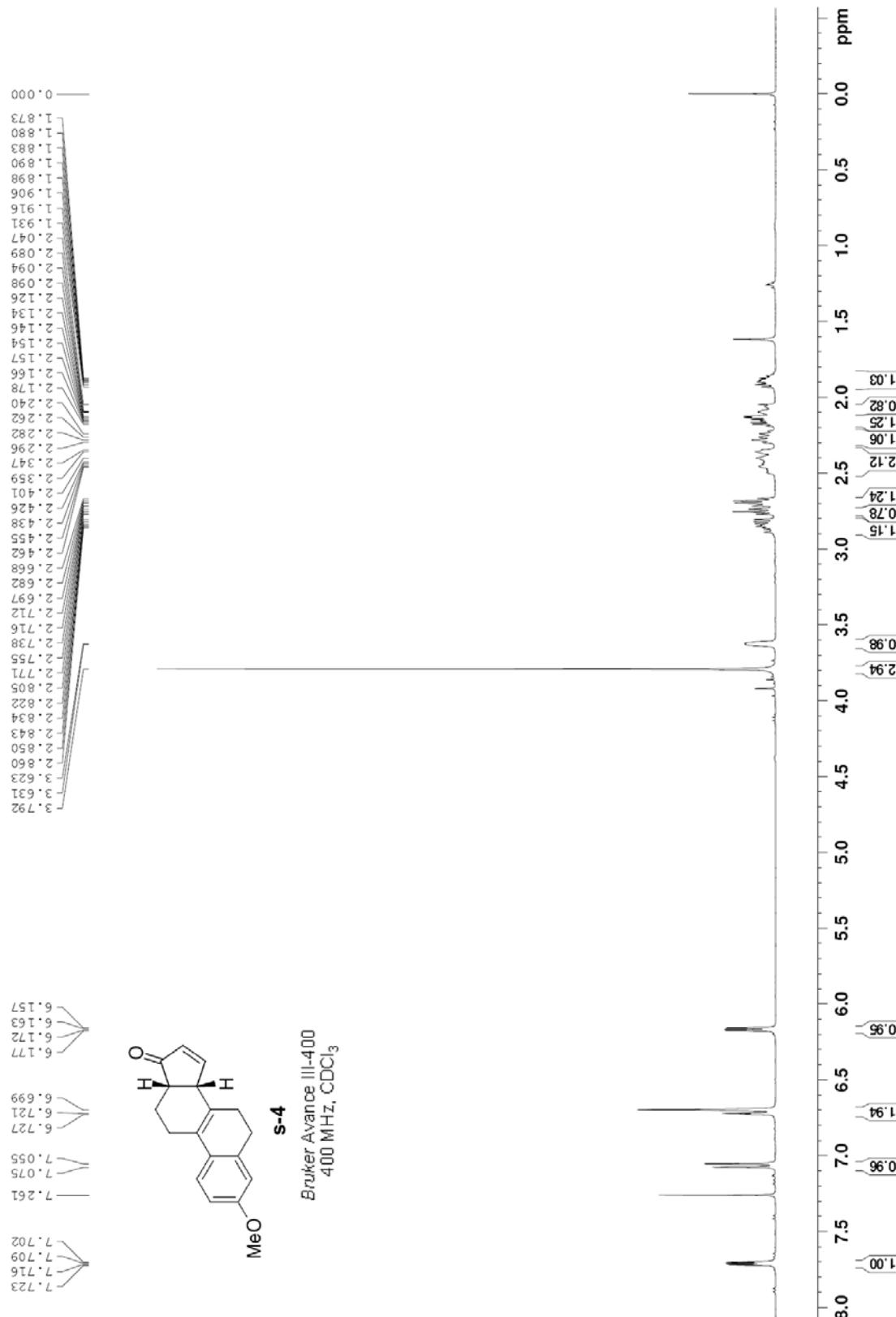
Compound 22:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



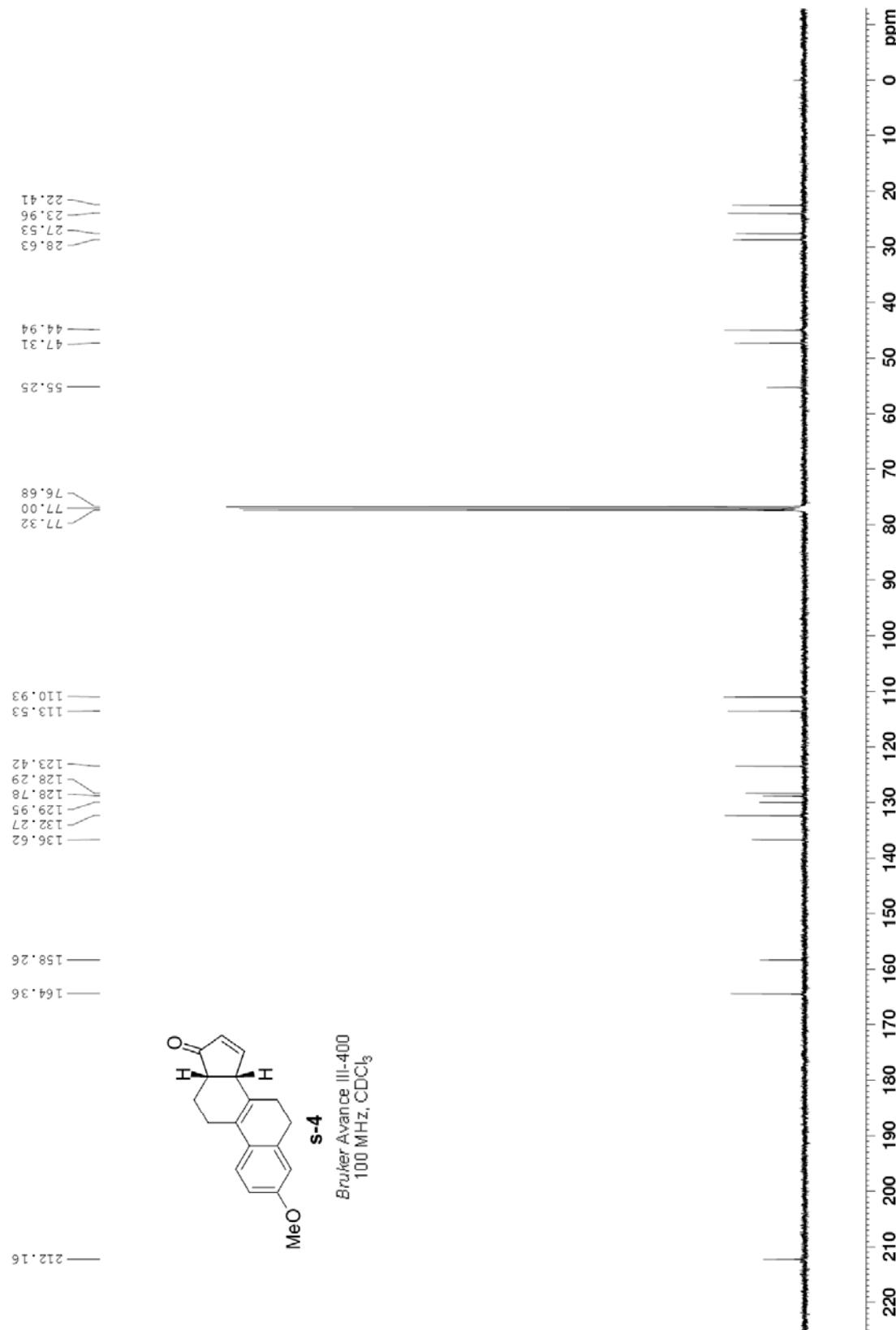
Compound **22**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



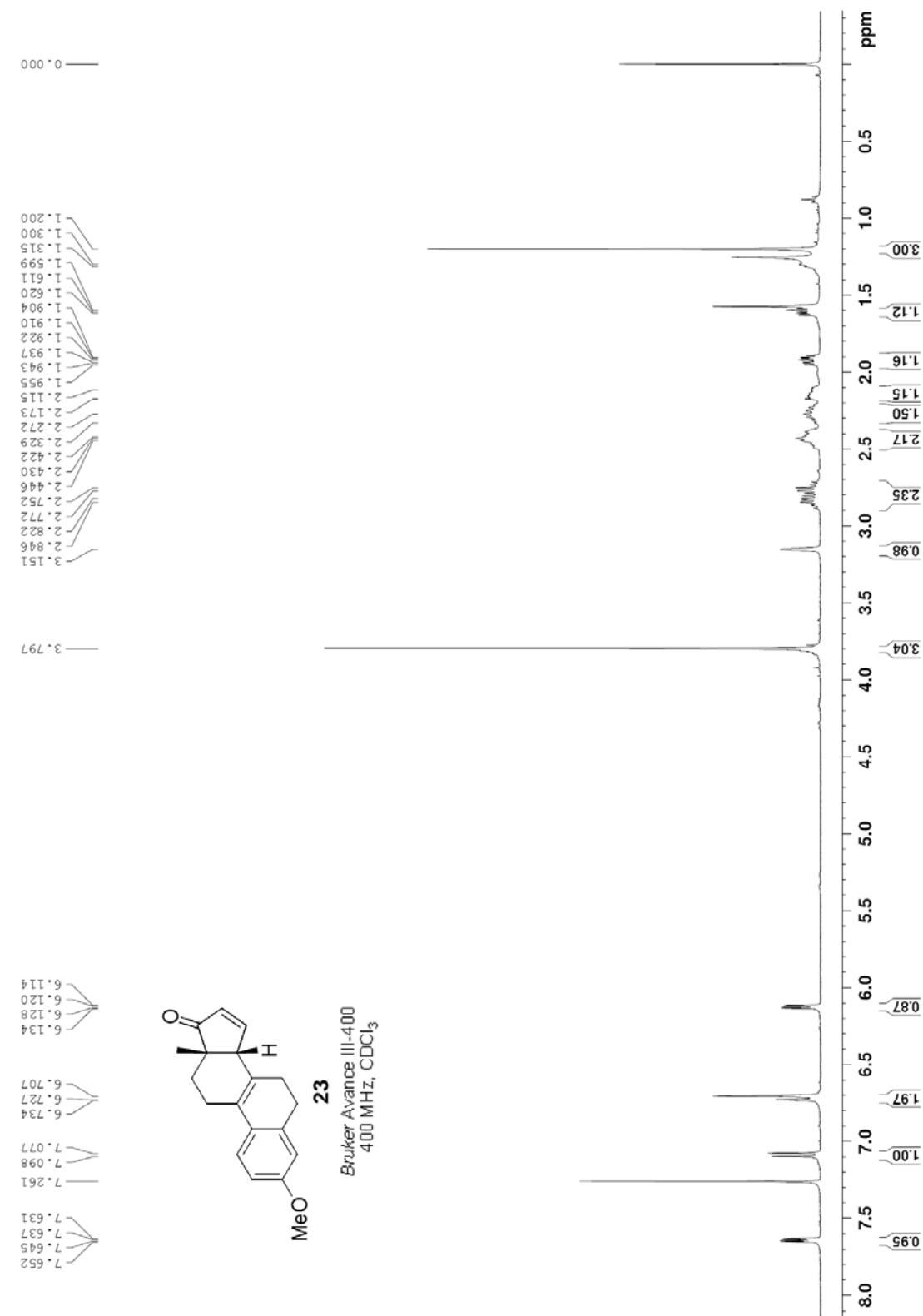
Compound s-4:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



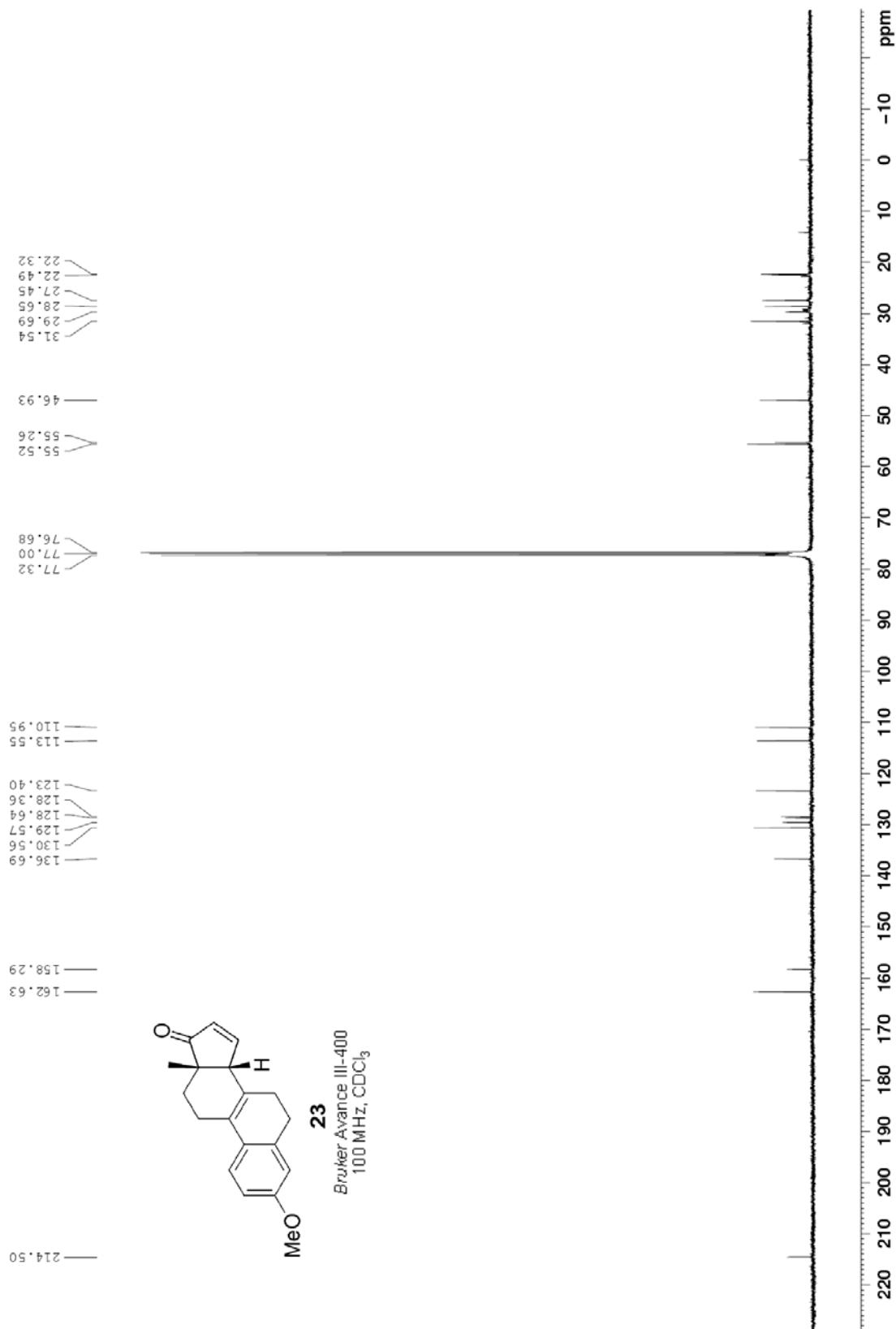
Compound s-4:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



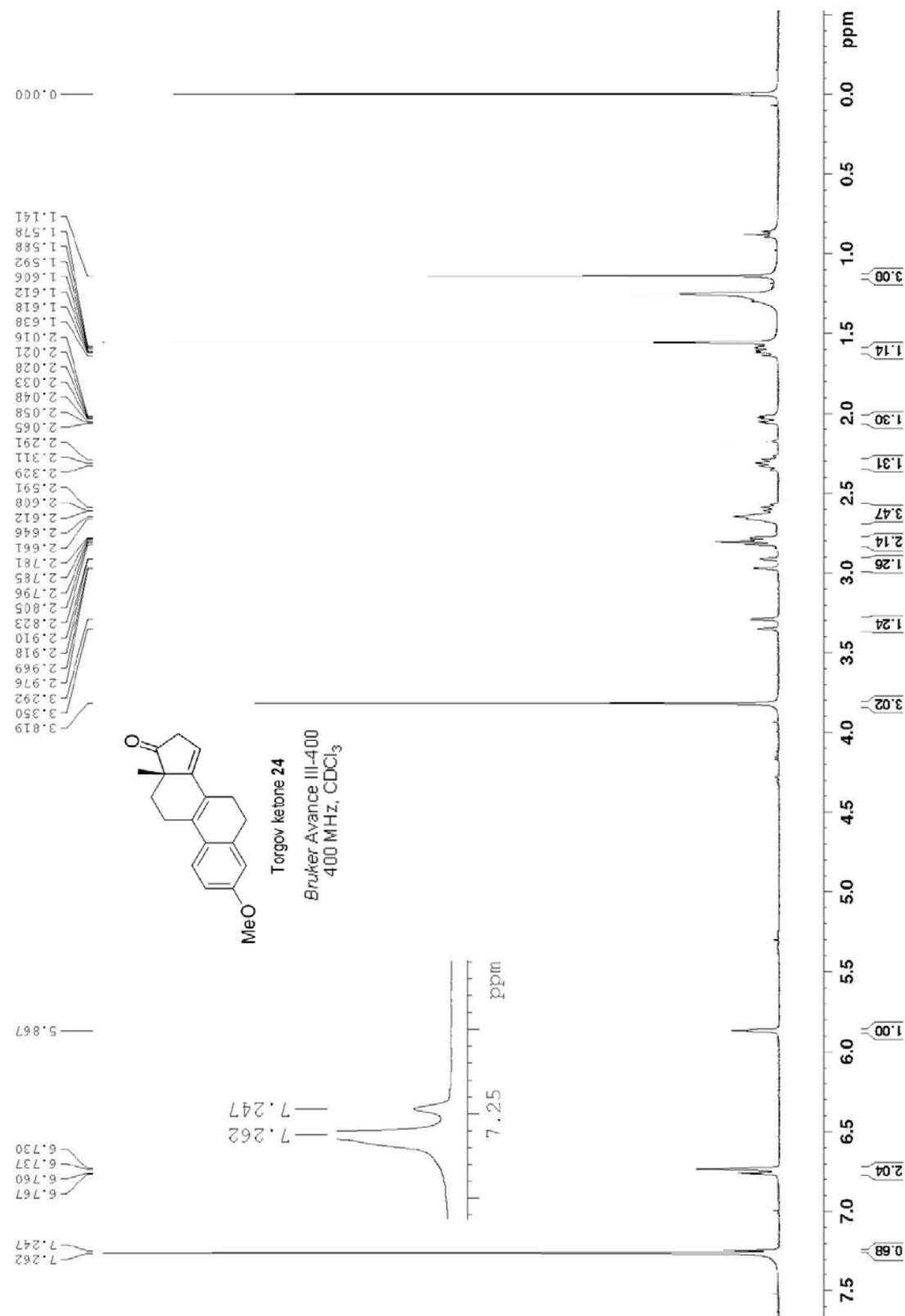
Compound **23**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



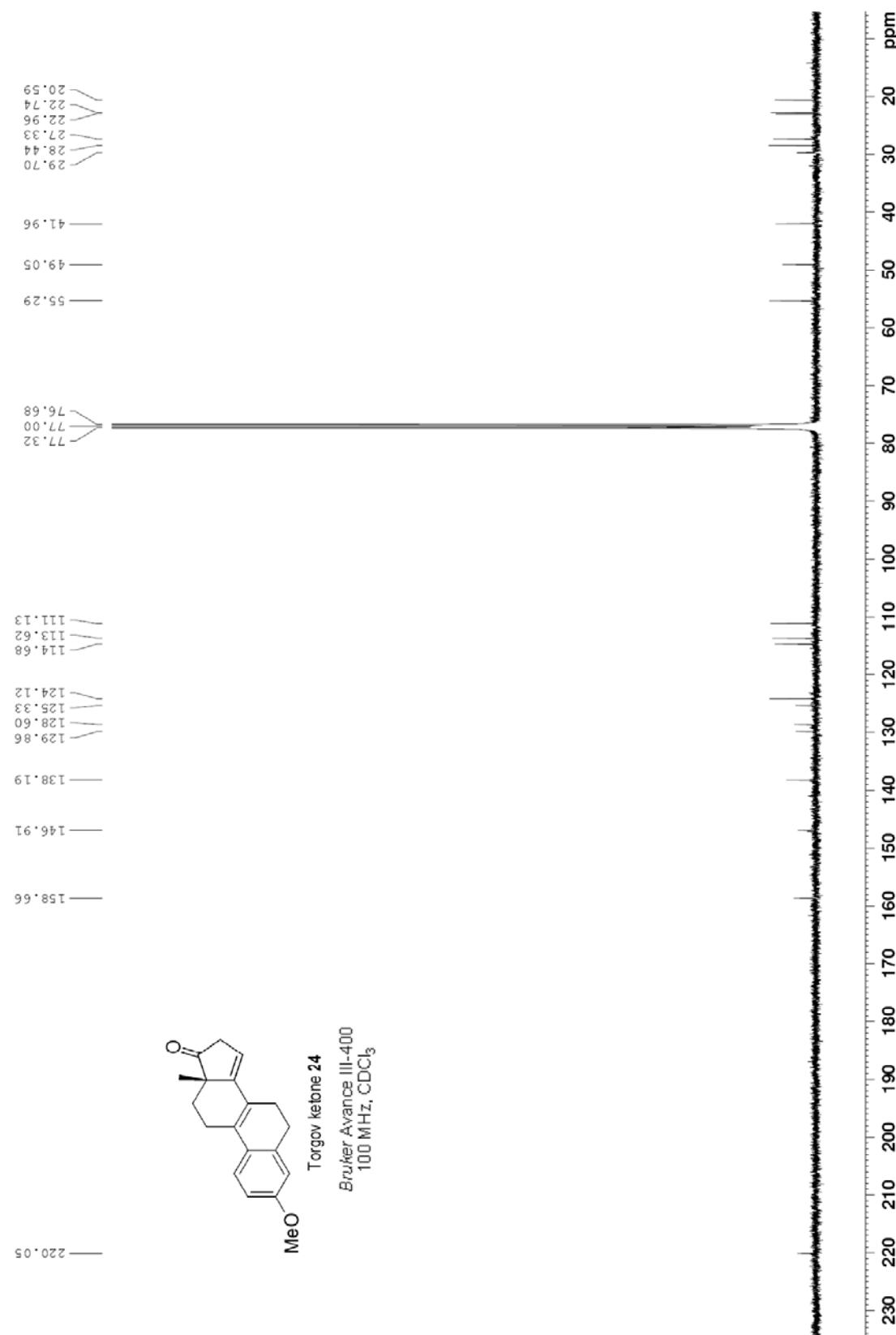
Compound **23**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



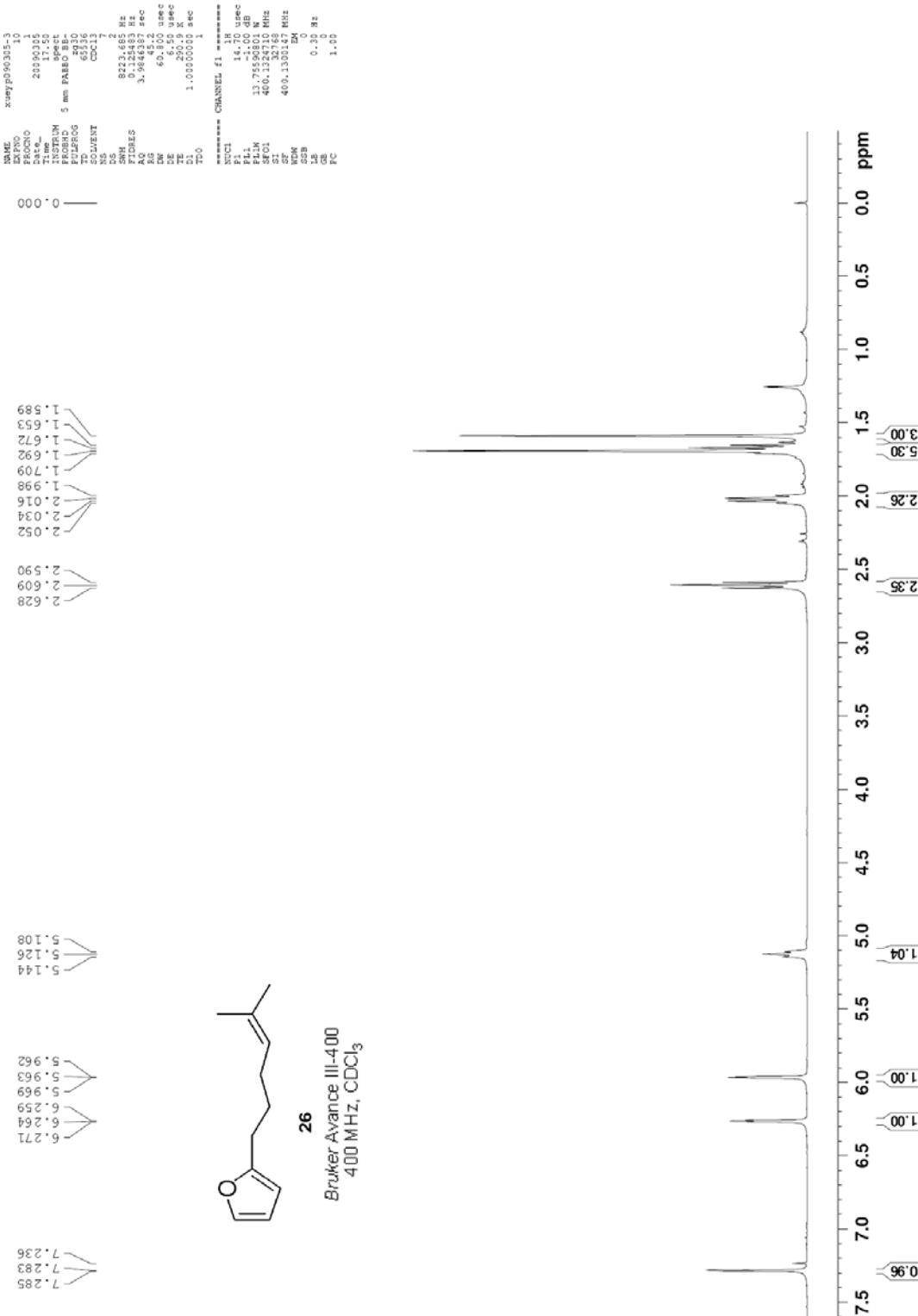
Compound 24:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



Compound 24:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):

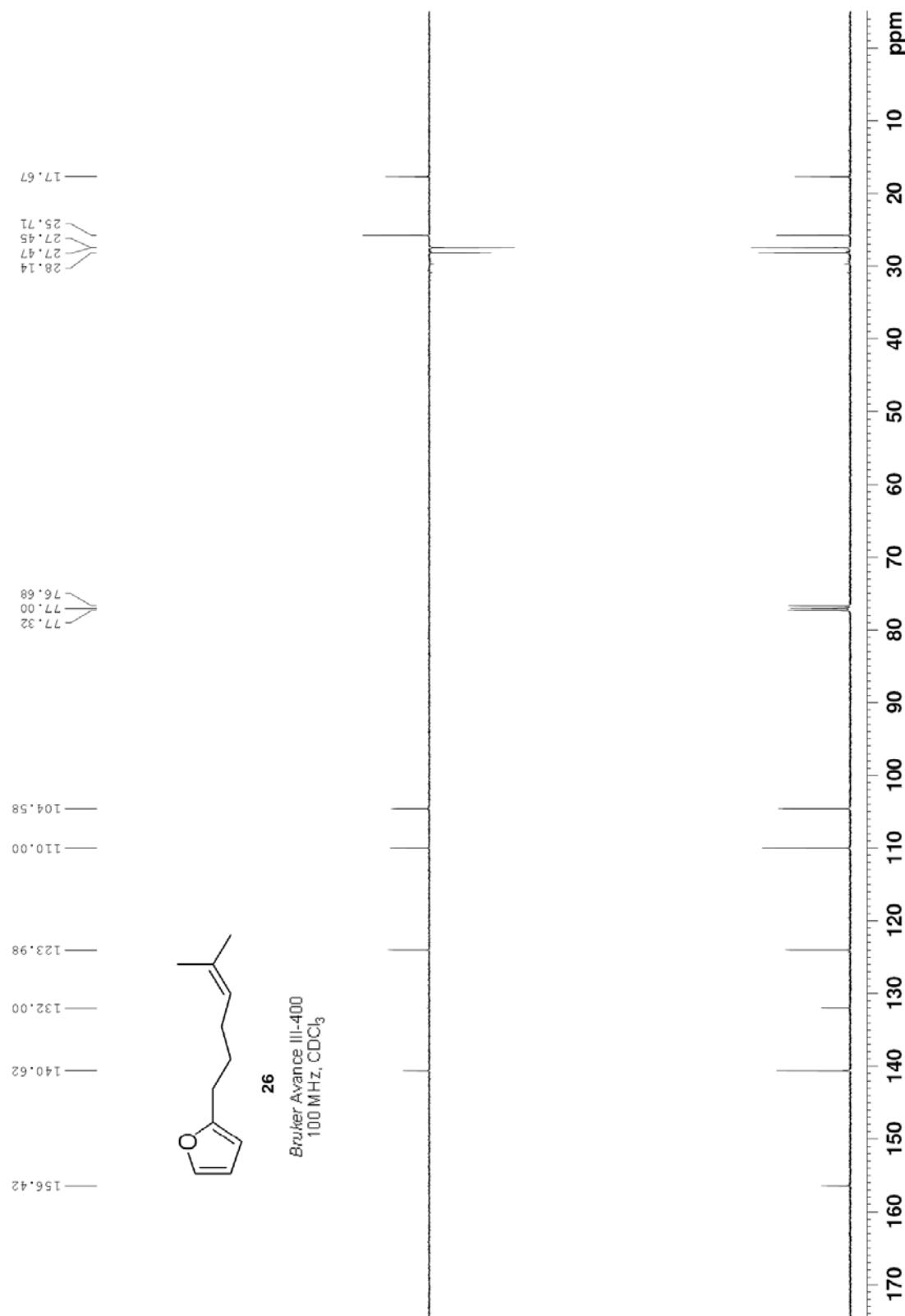


Compound **26**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):

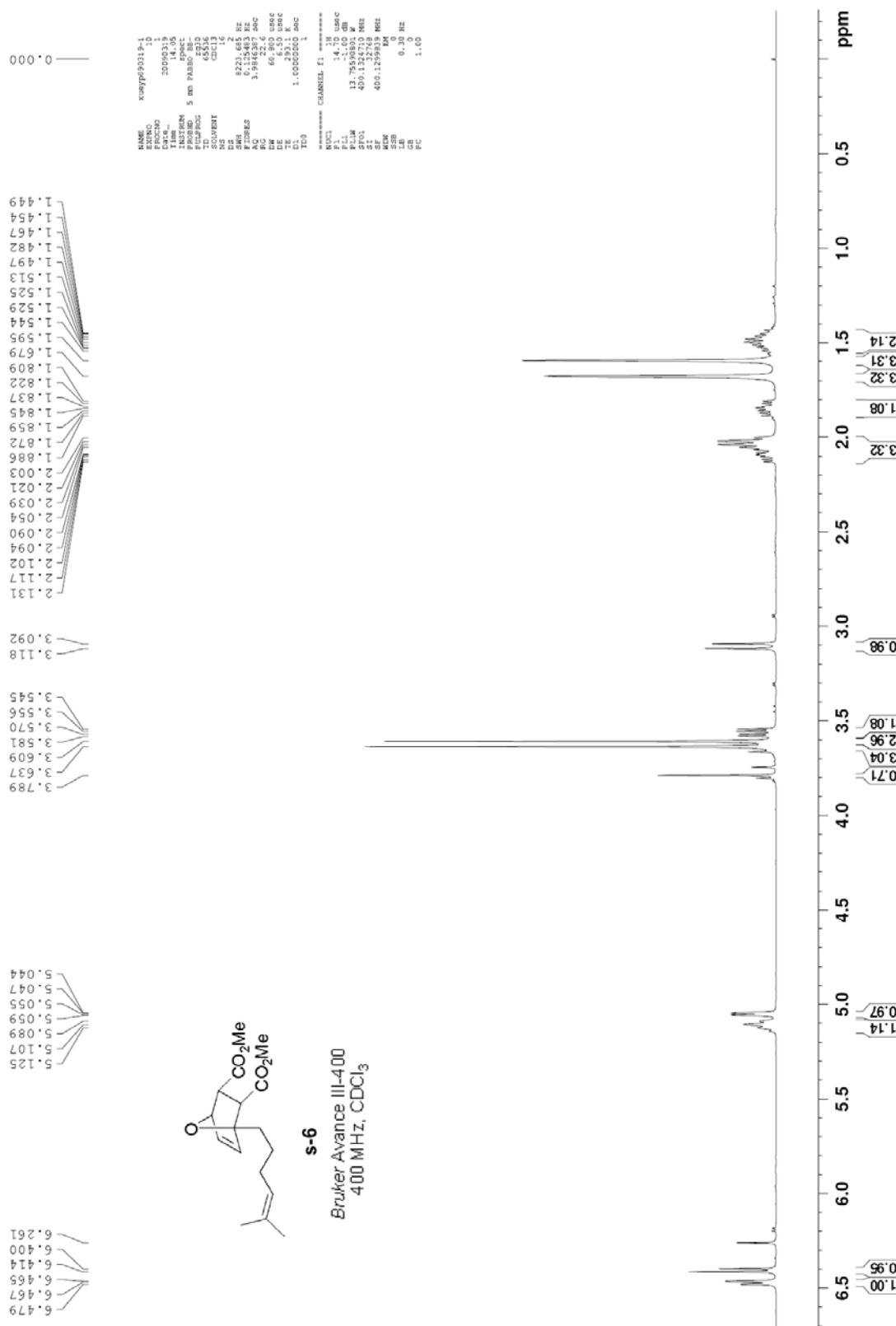


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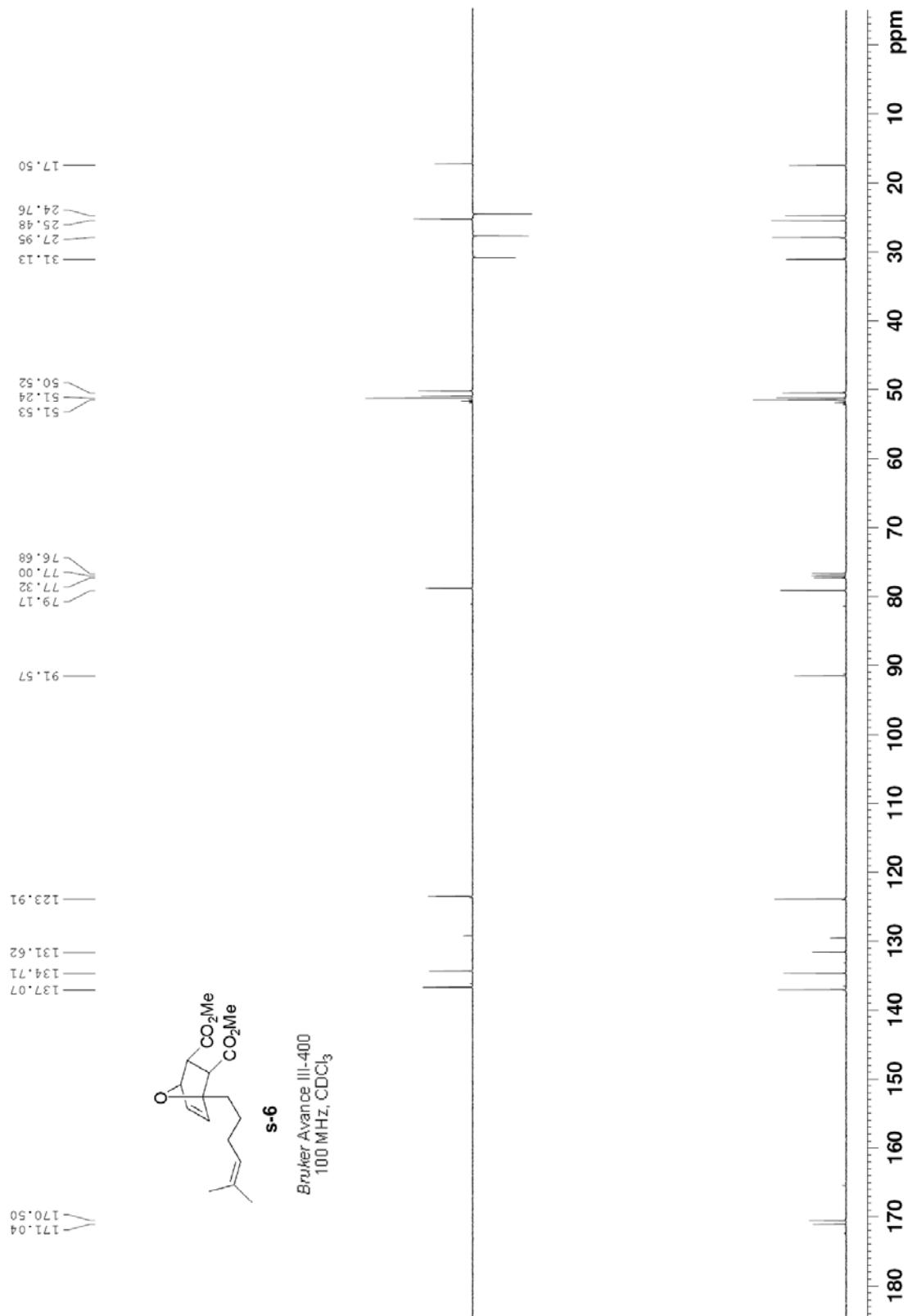
Compound **26**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



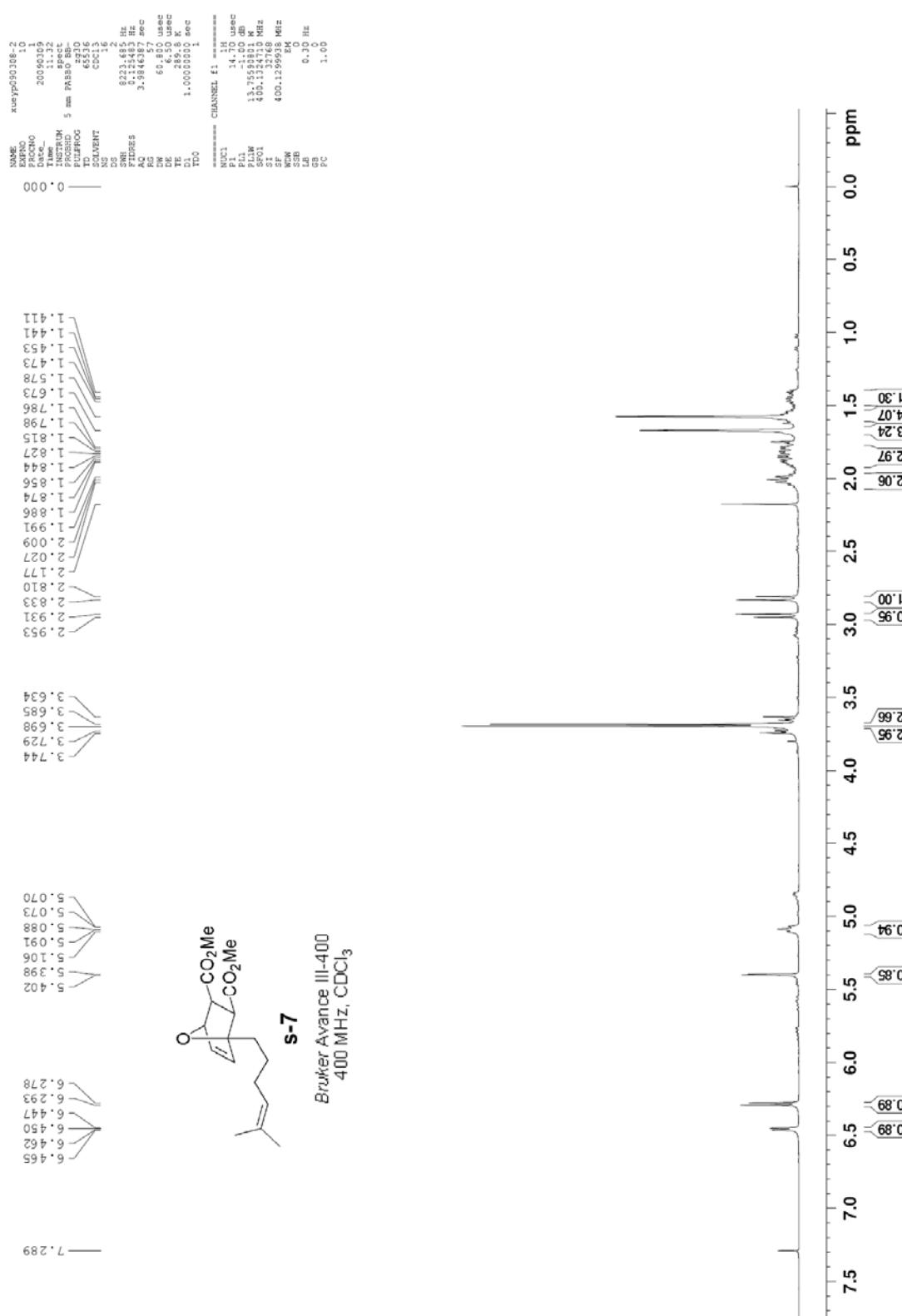
Compound s-6:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



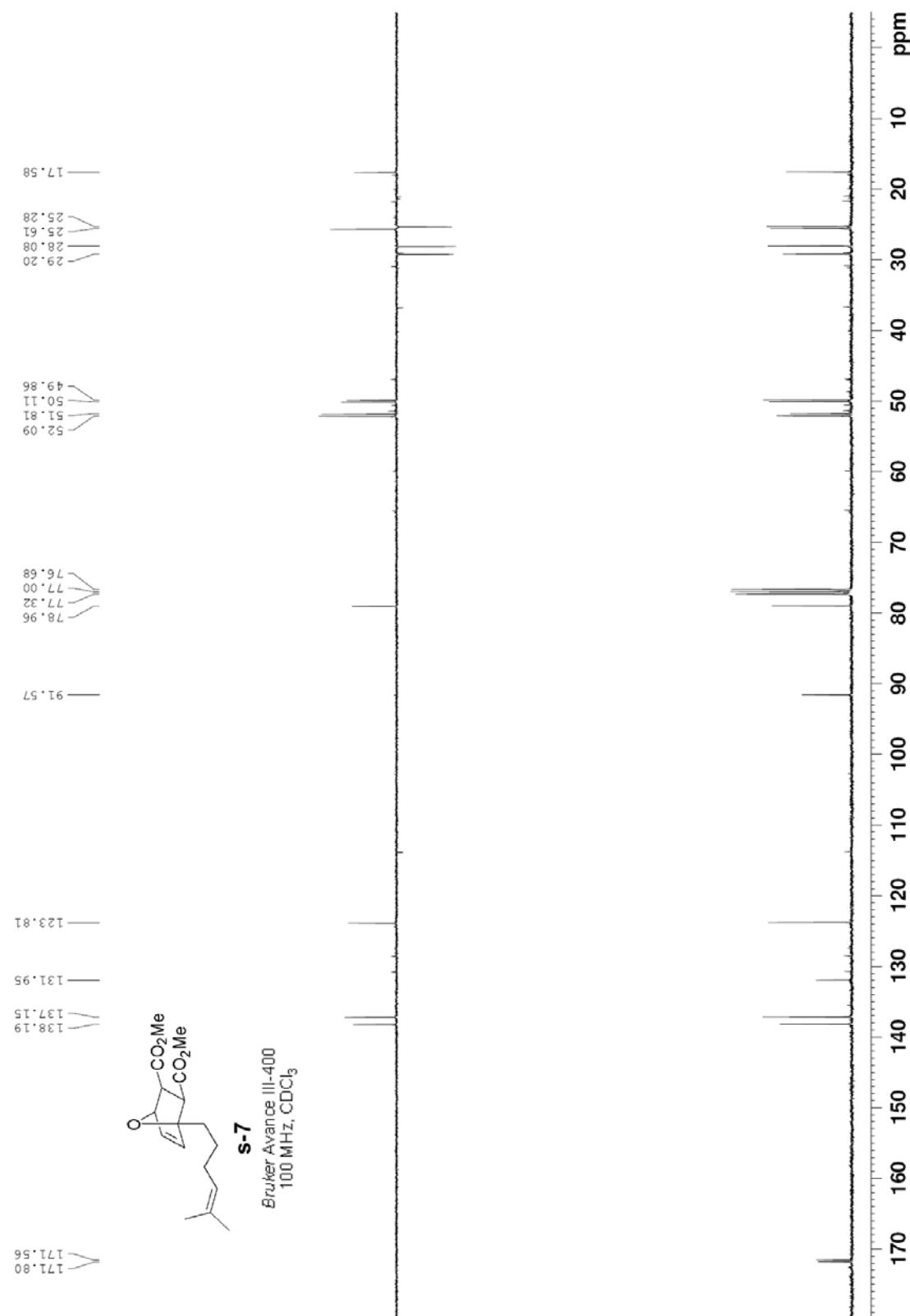
Compound **s-6**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



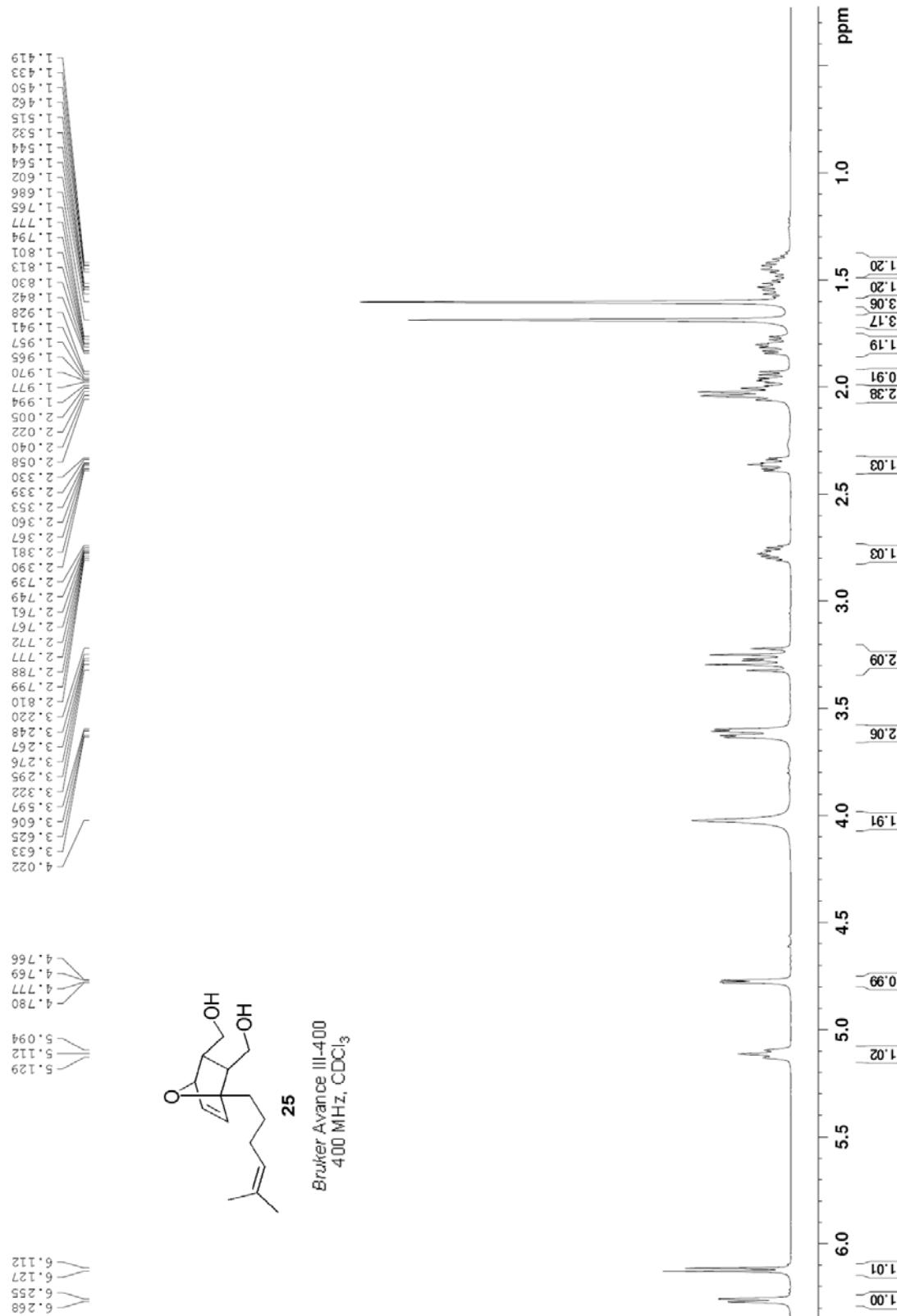
Compound **s-7**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



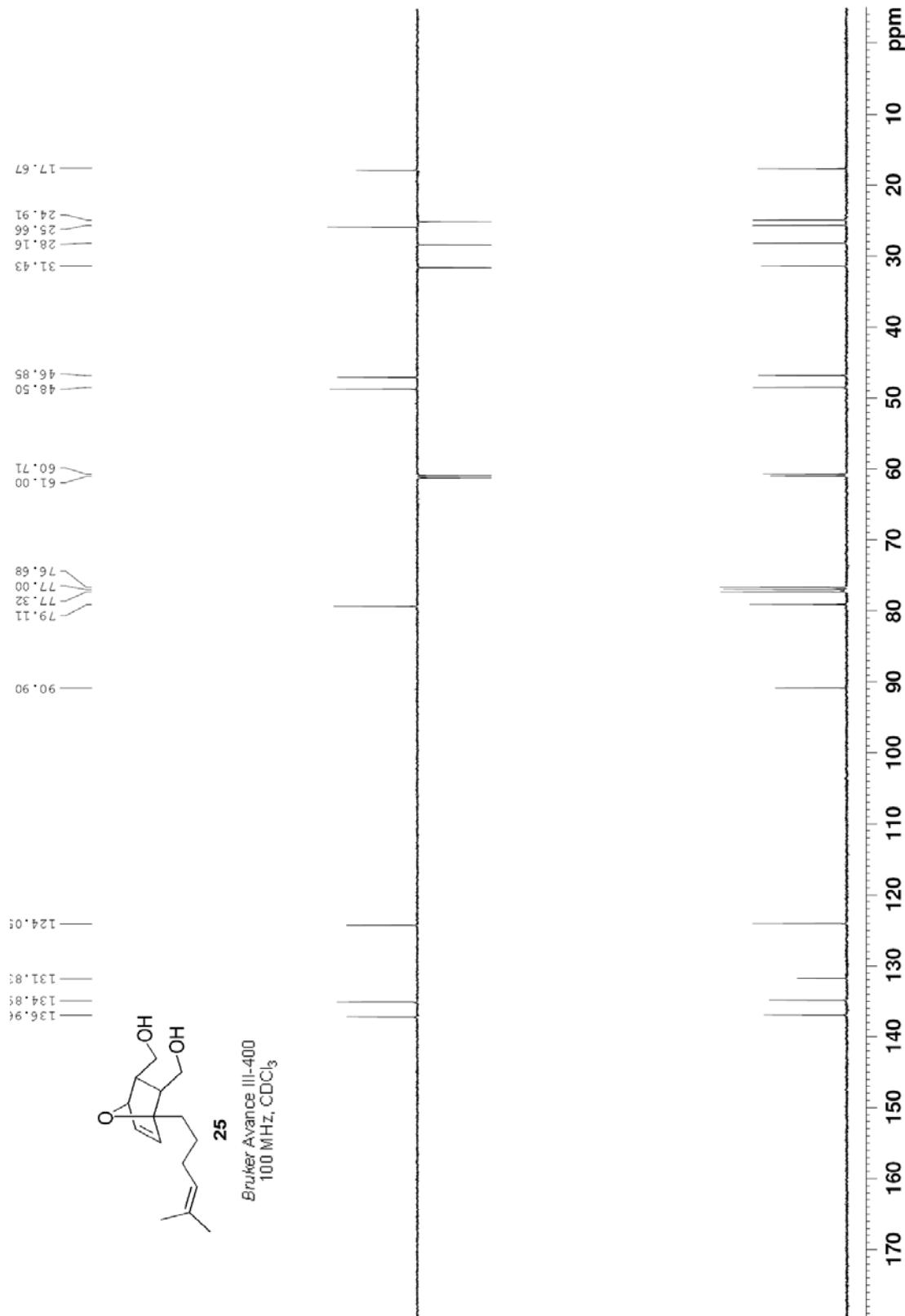
Compound s-7:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



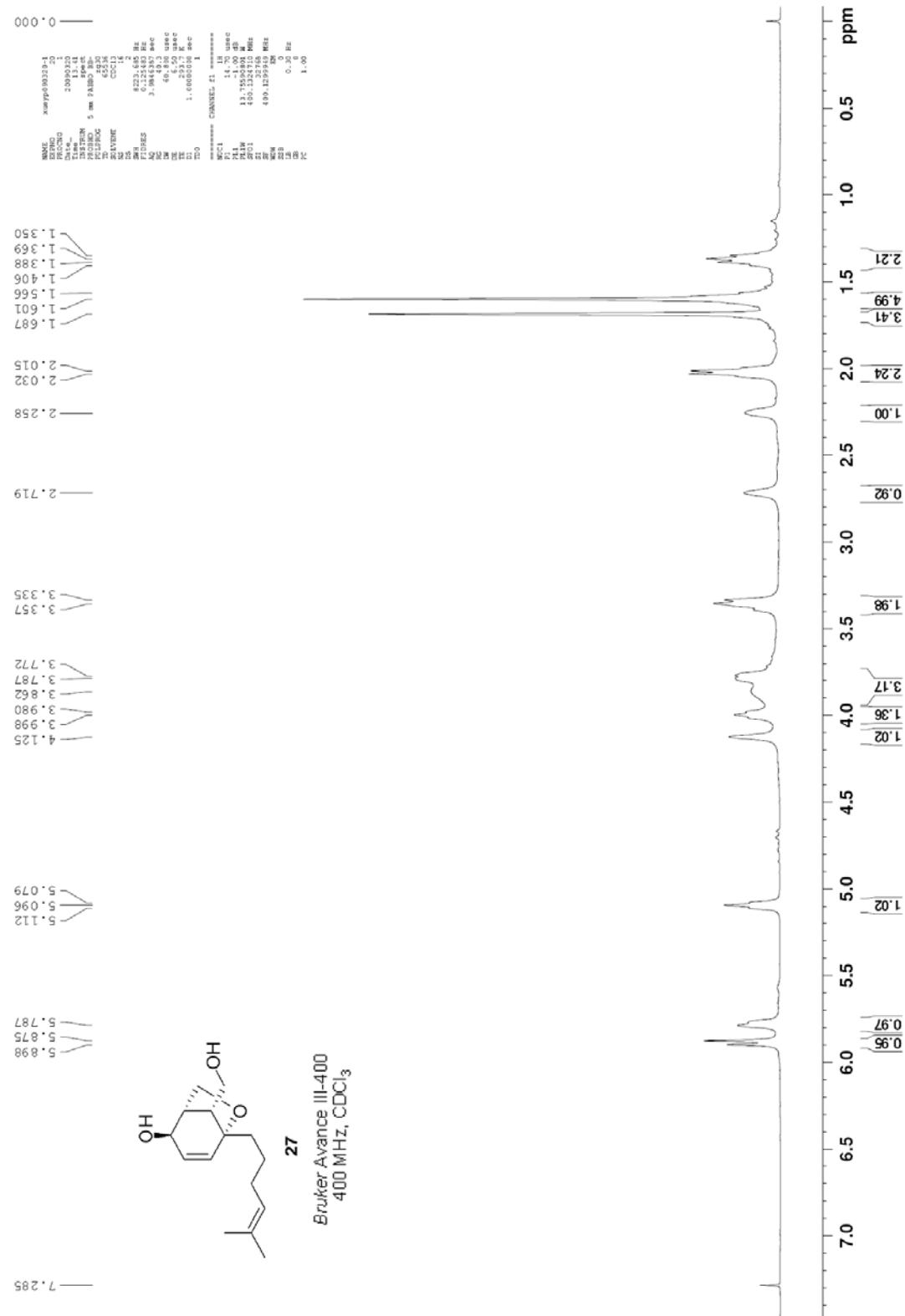
Compound 25:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



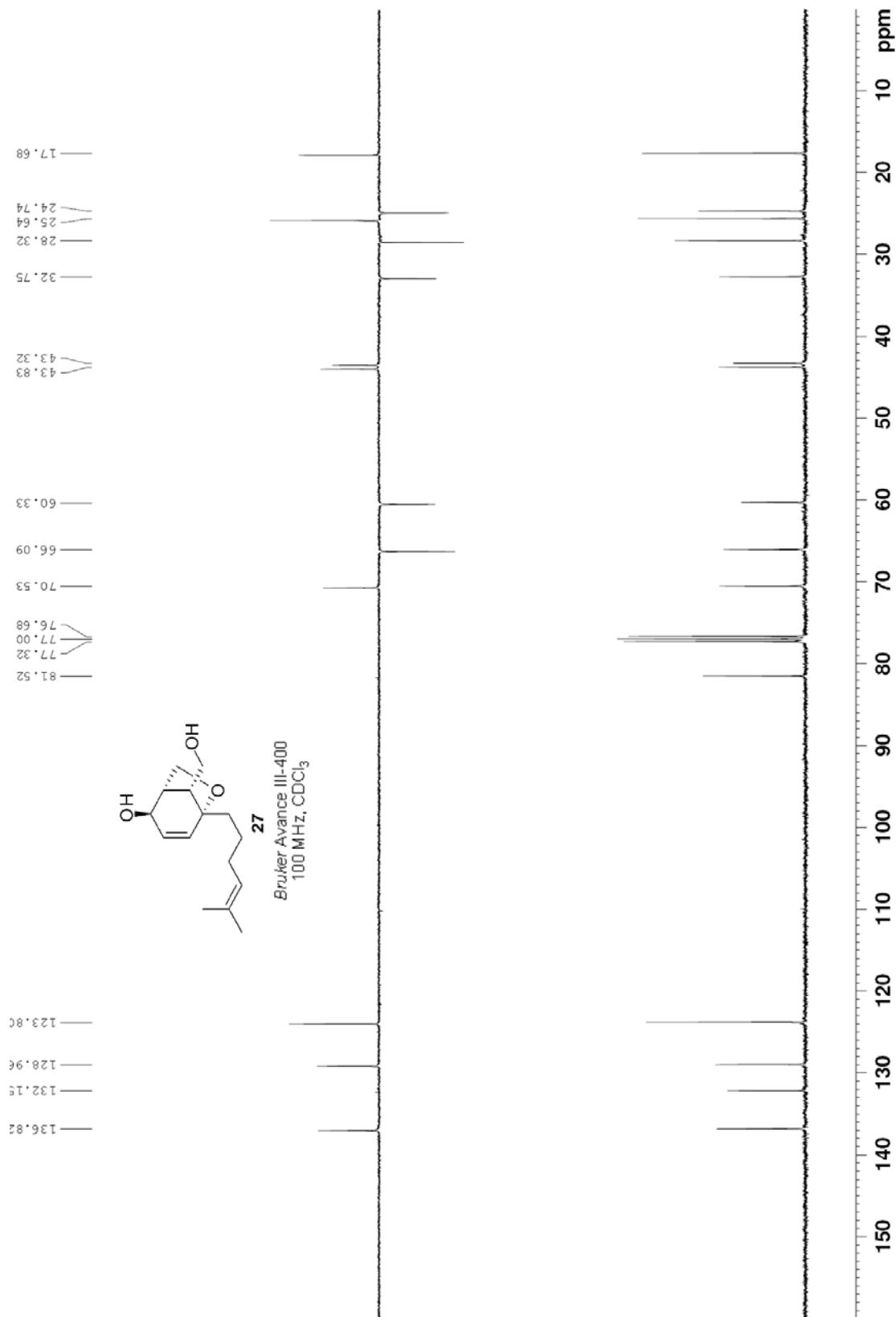
Compound **25**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



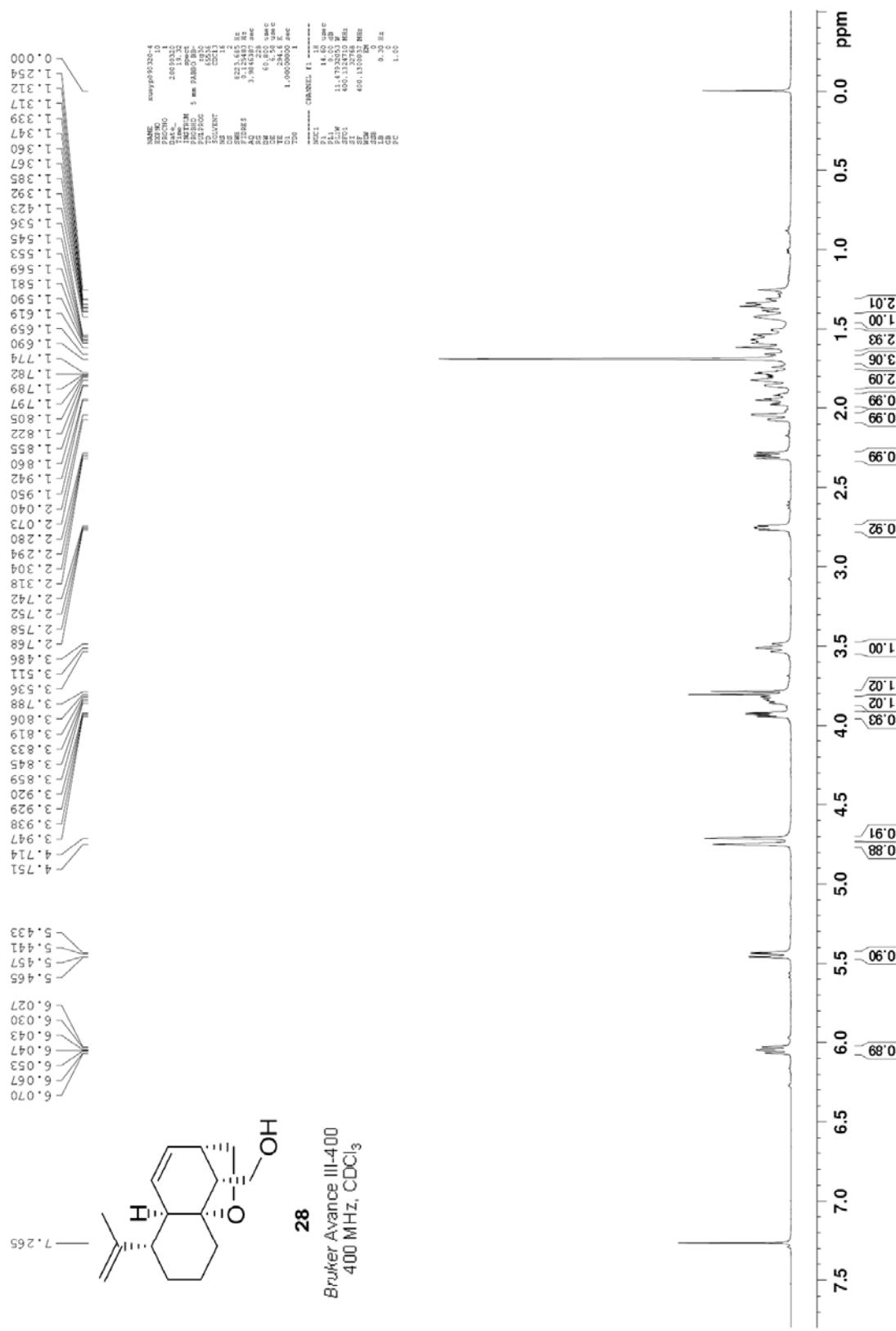
Compound **27**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



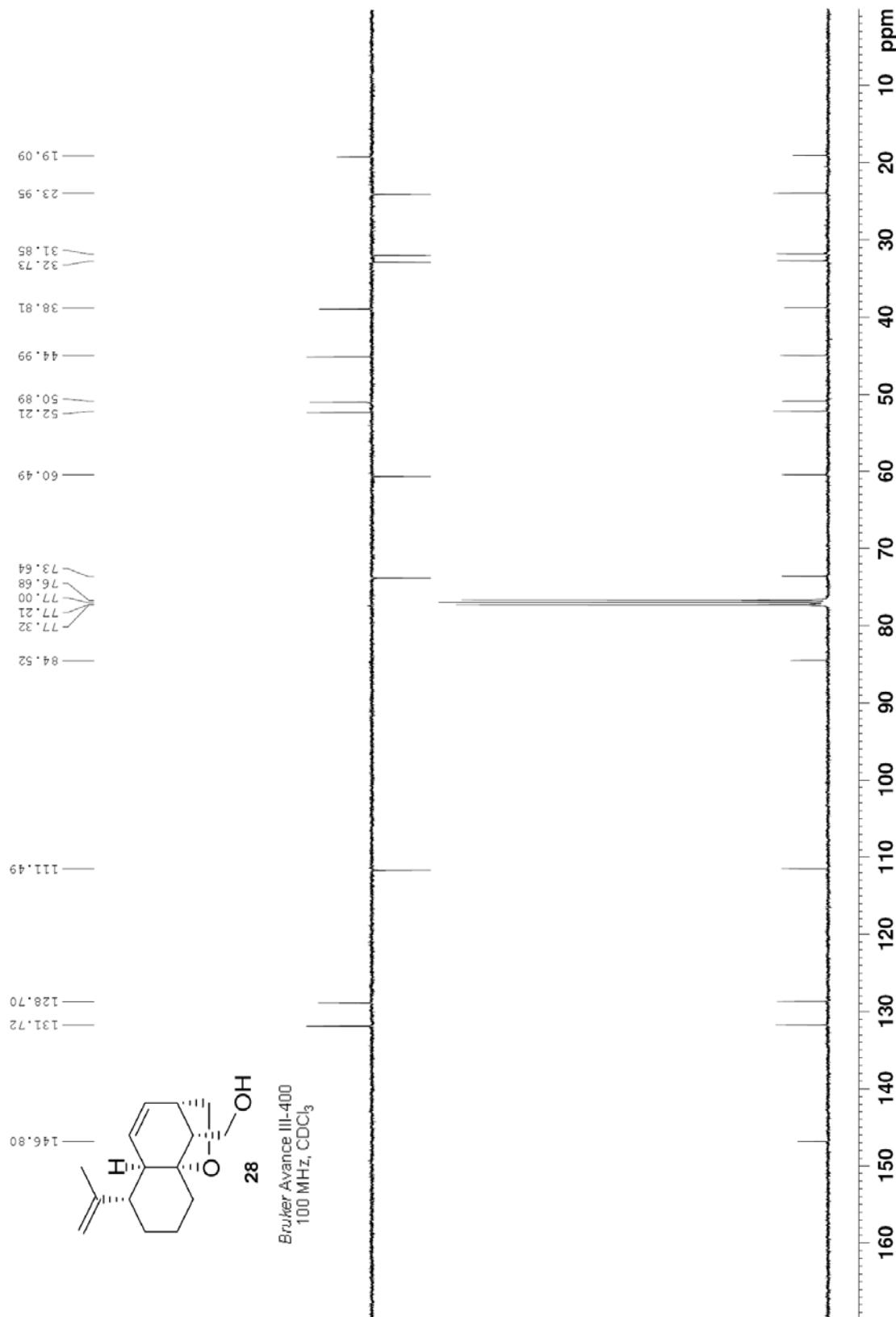
Compound **27**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



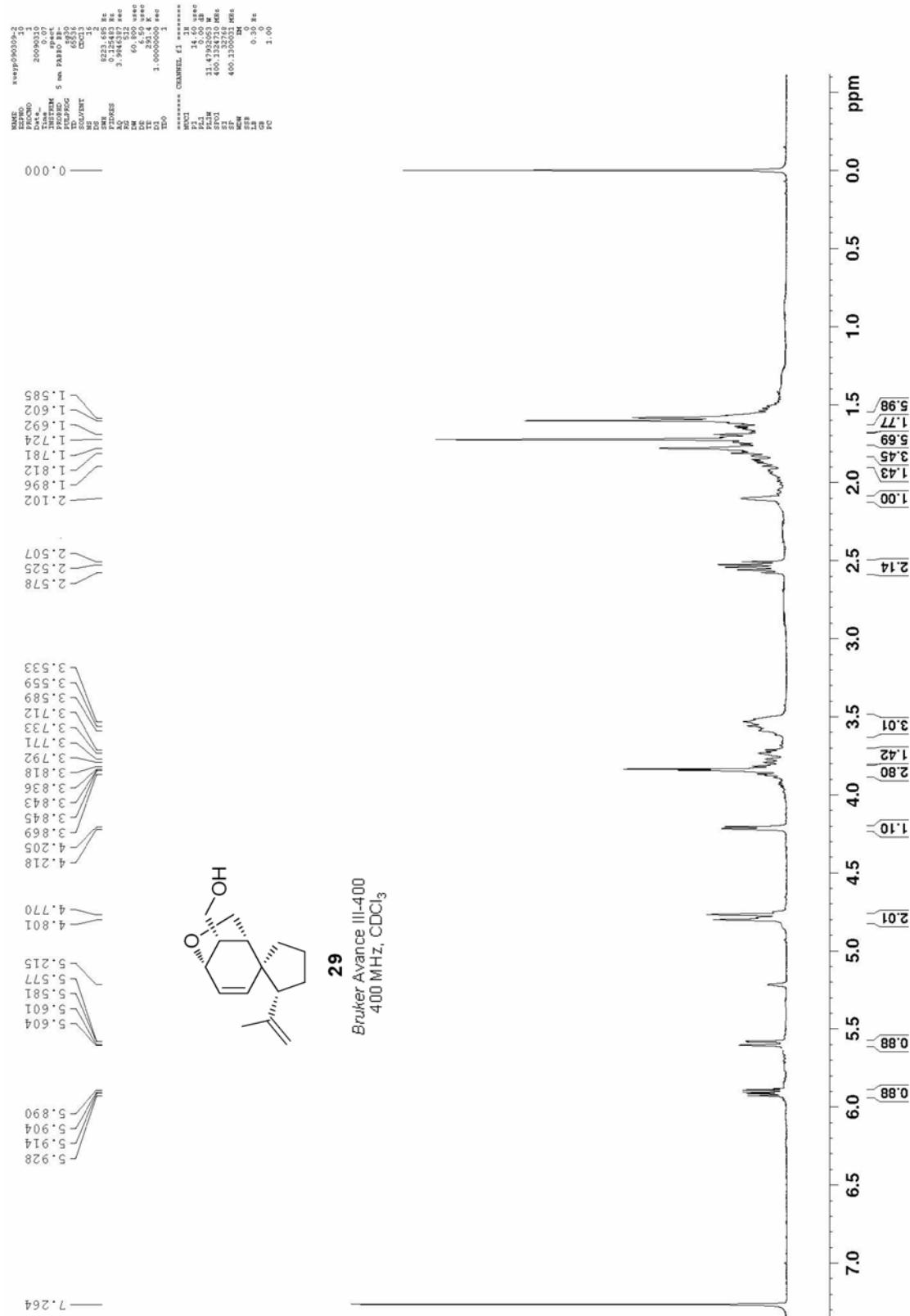
Compound **28**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



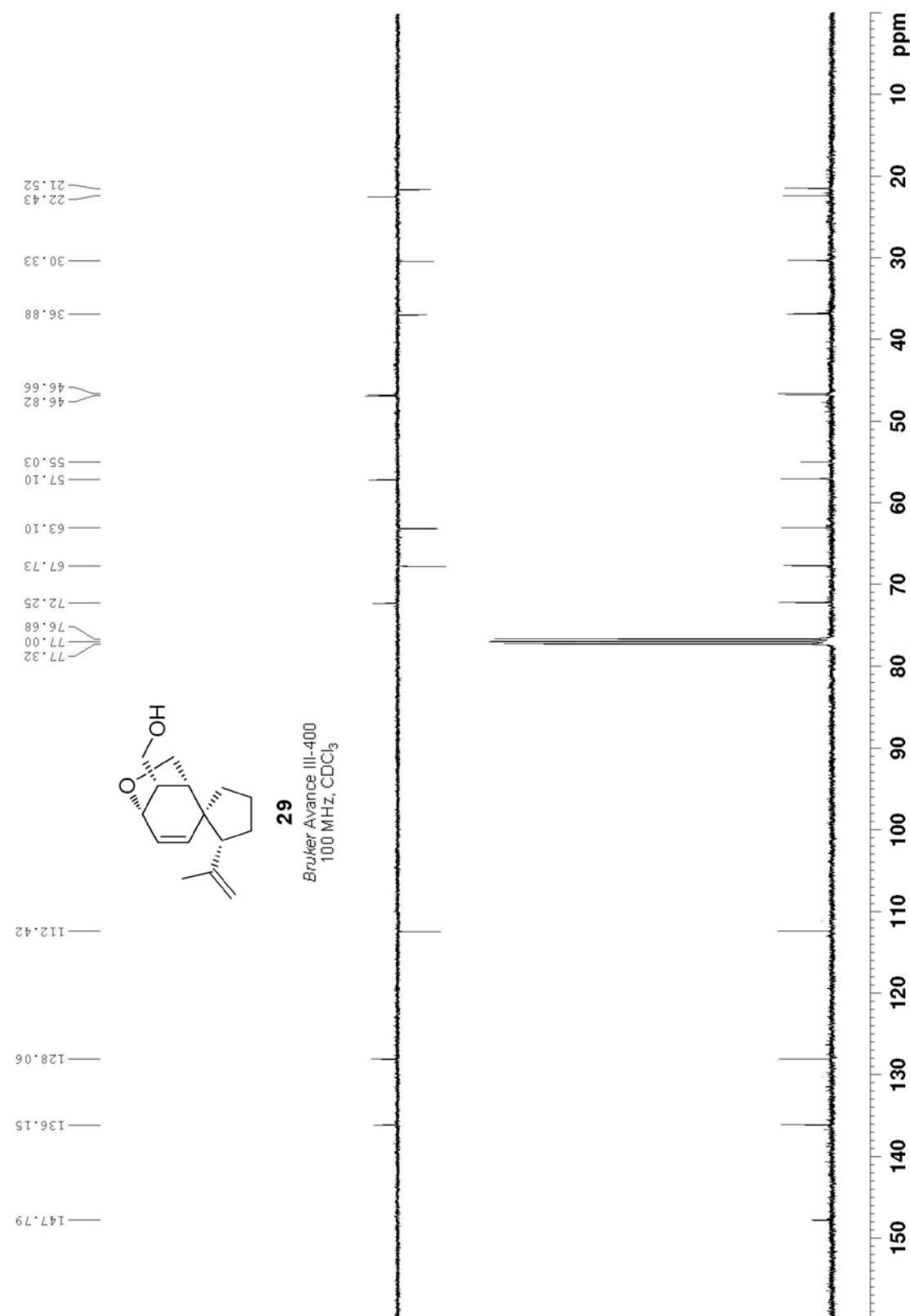
Compound **28**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



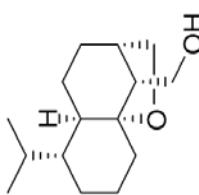
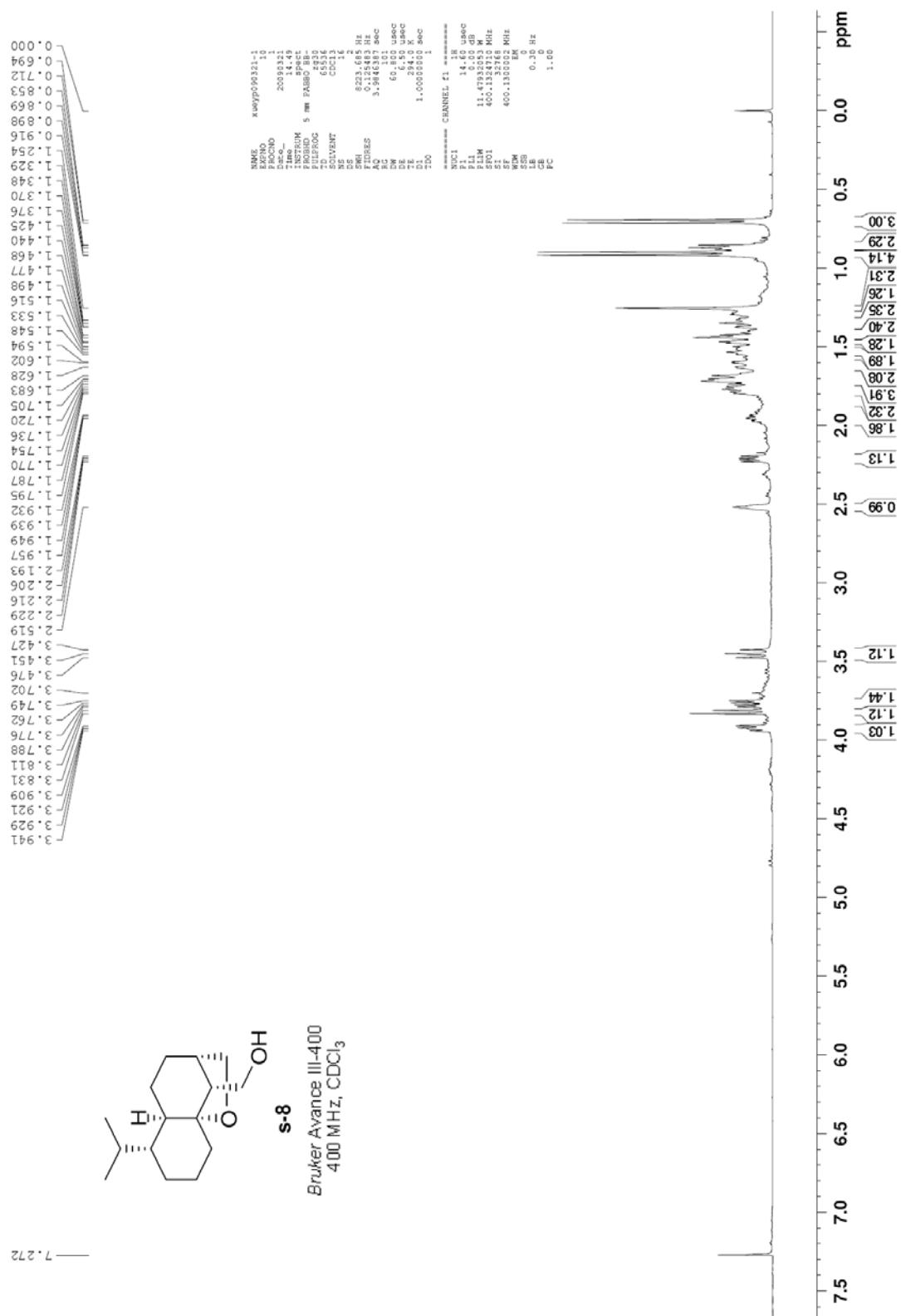
Compound **29**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



Compound **29**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):

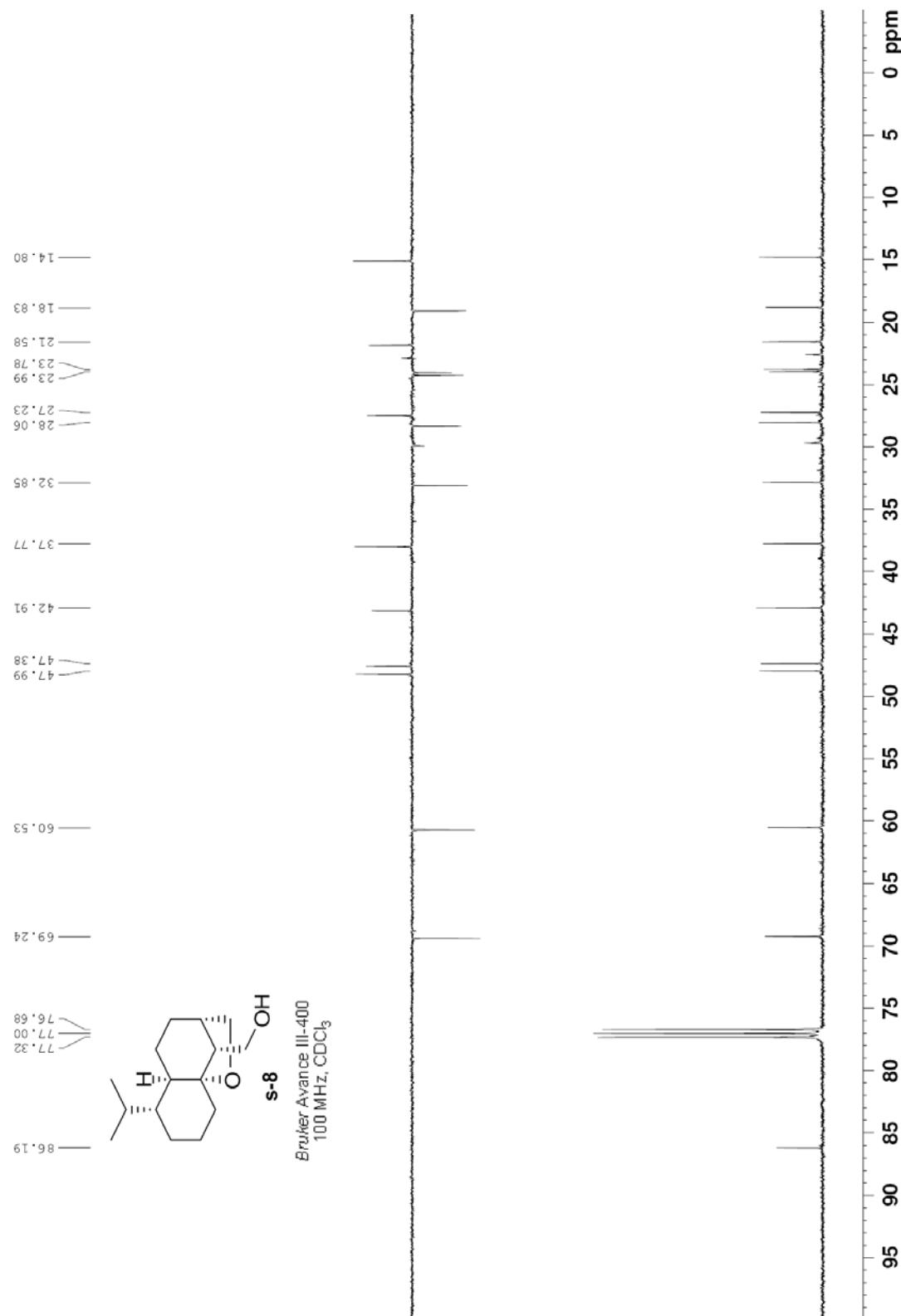


Compound **s-8**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):

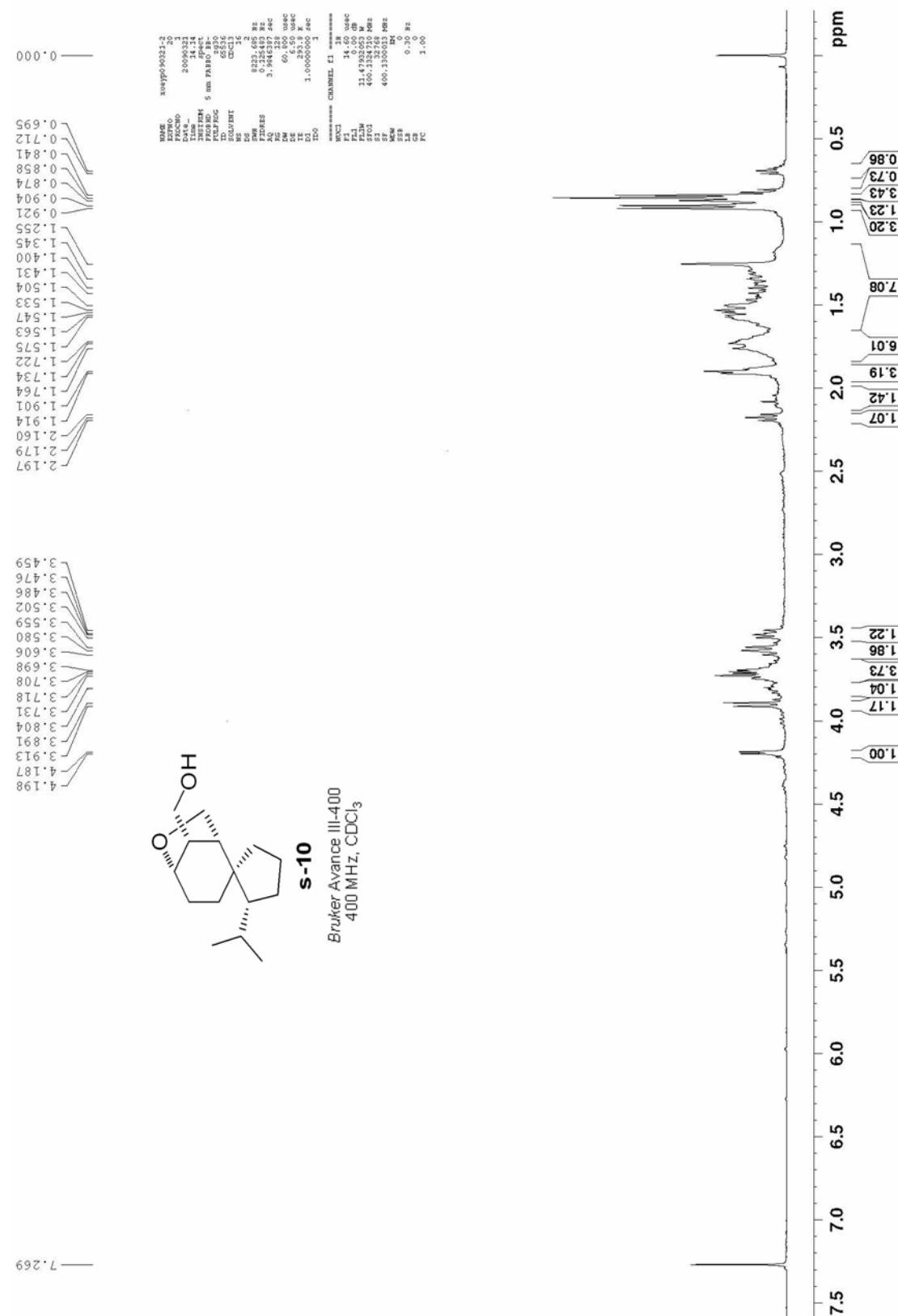


Bruker Avance III-400  
400 MHz, CDCl<sub>3</sub>

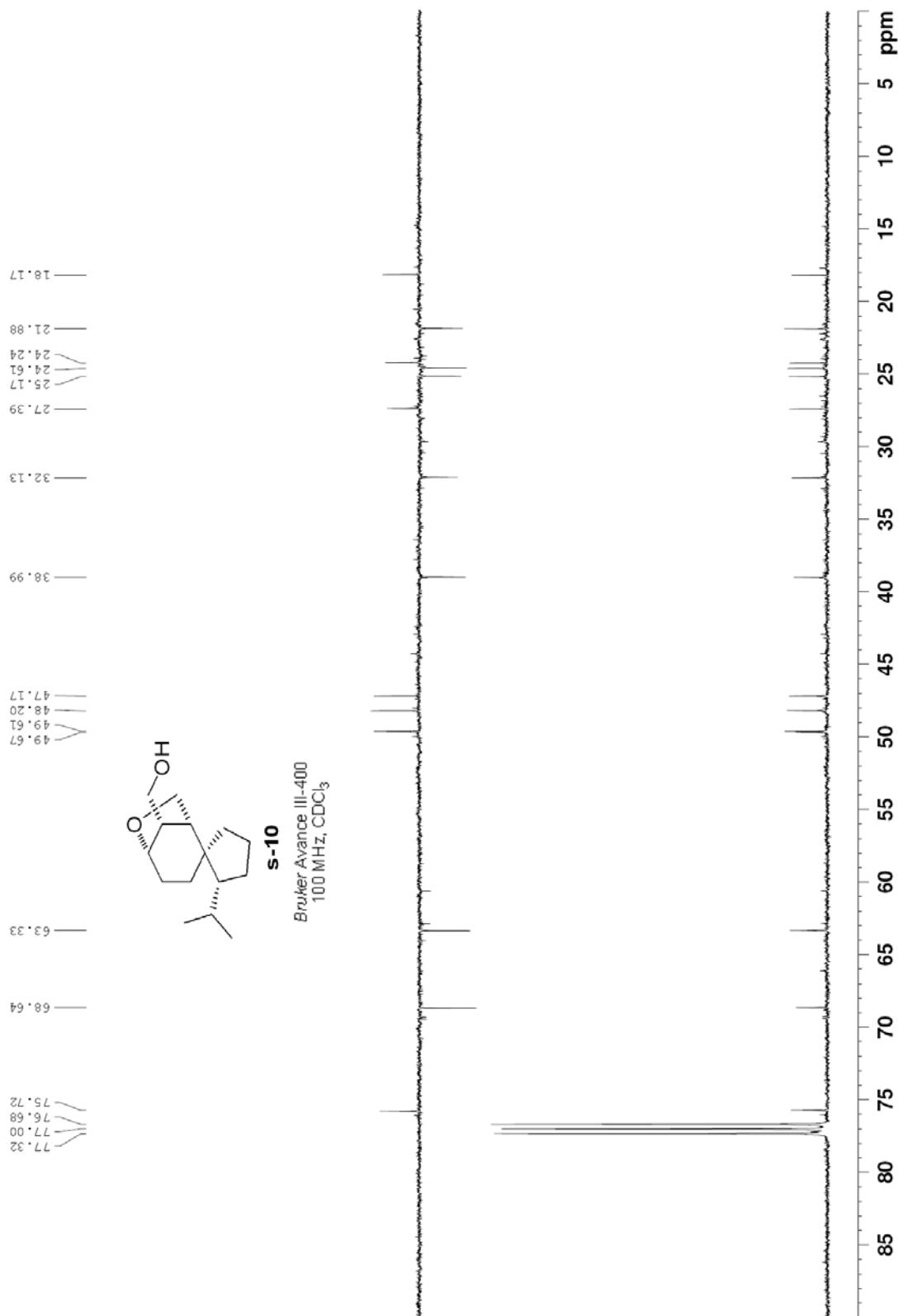
Compound s-8:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



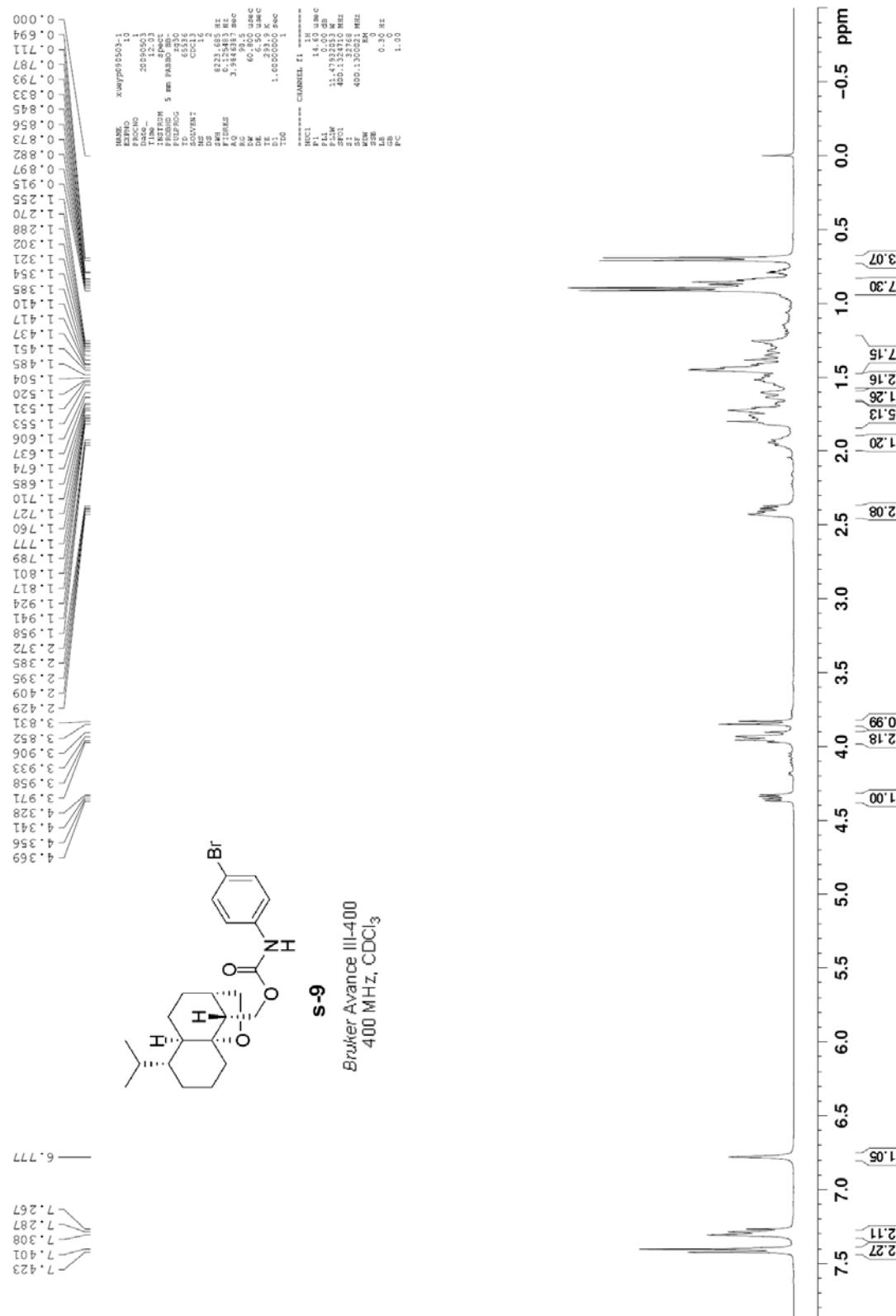
Compound s-10:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



Compound **s-10**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):

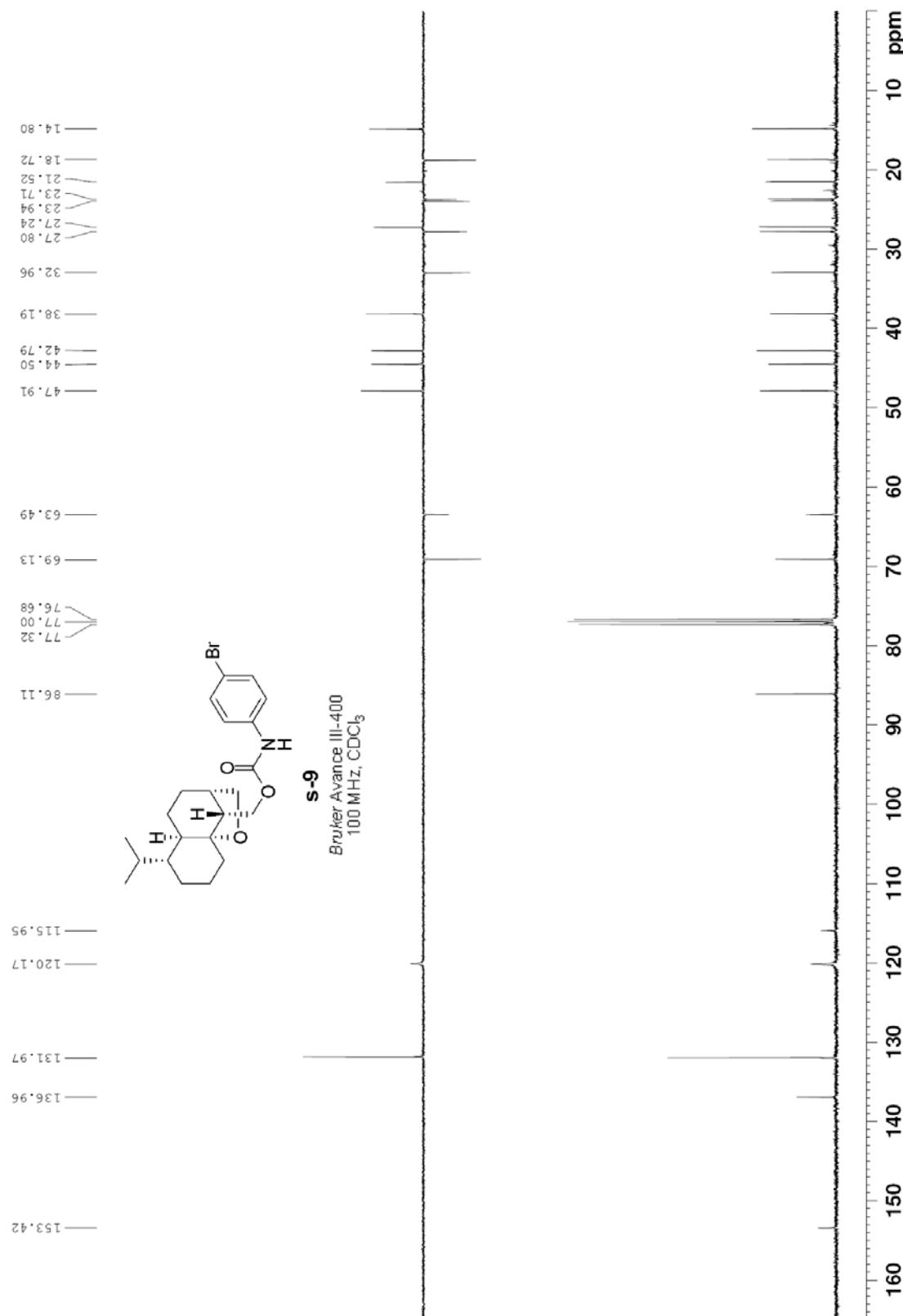


Compound s-9:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):

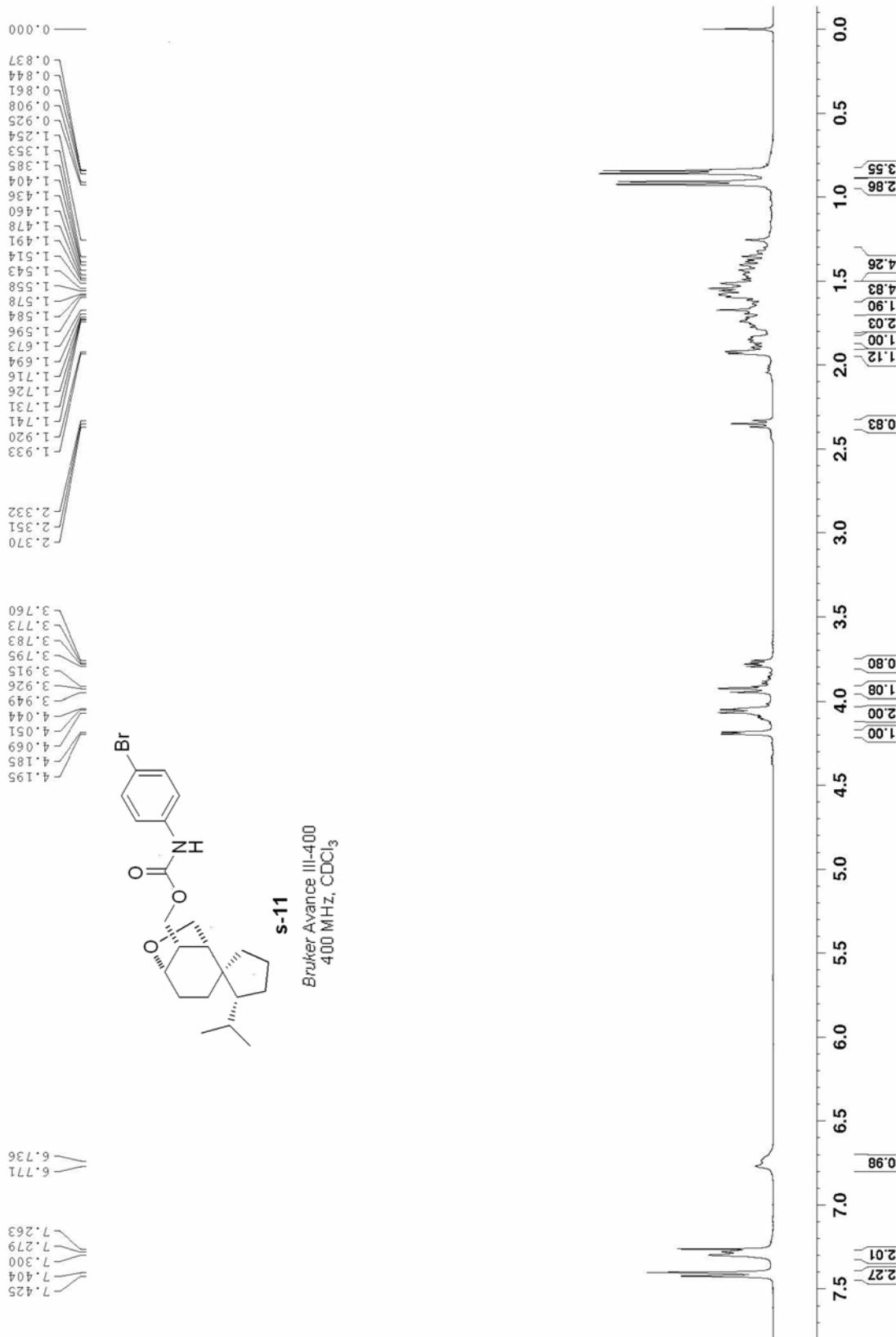


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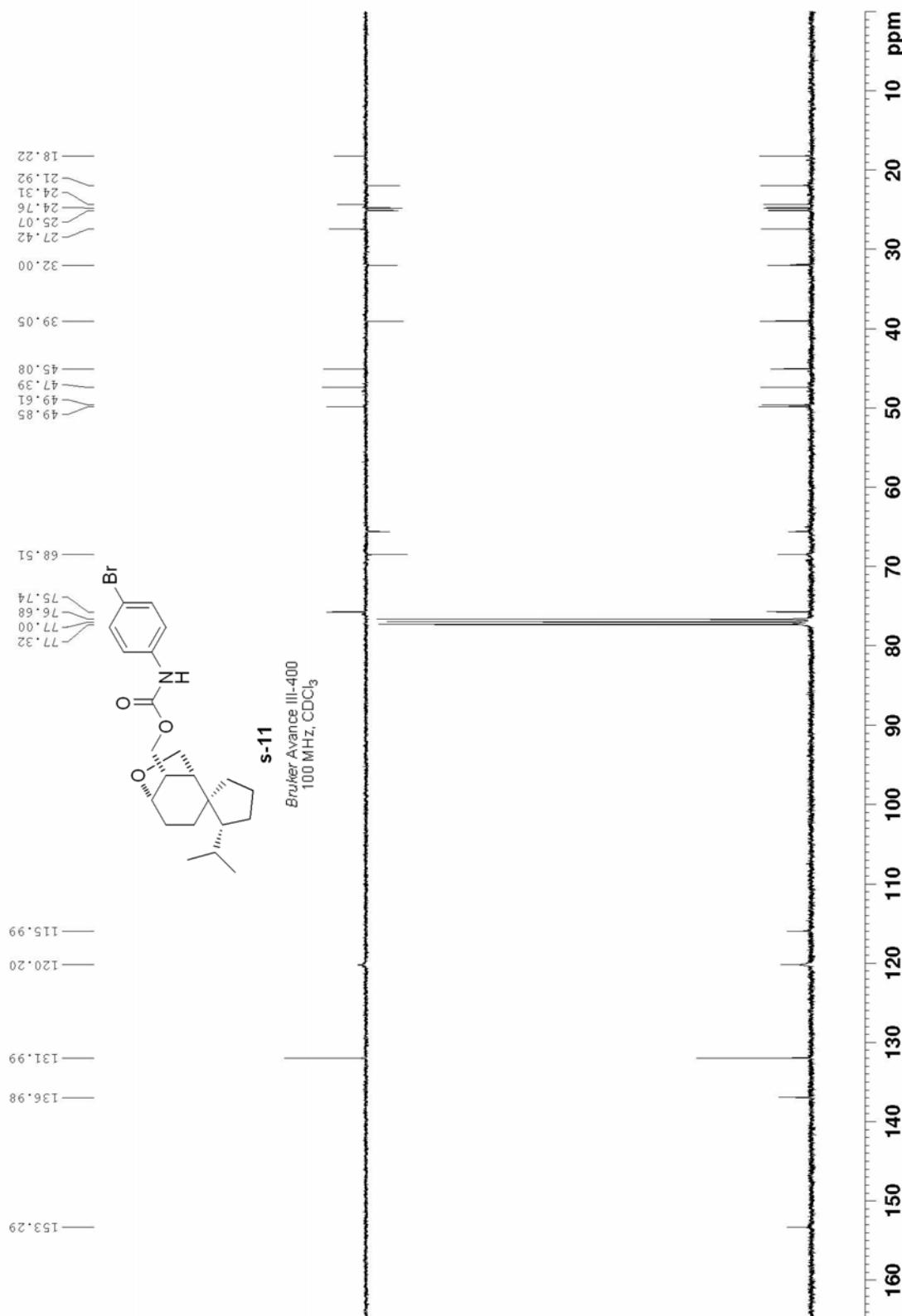
Compound s-9:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



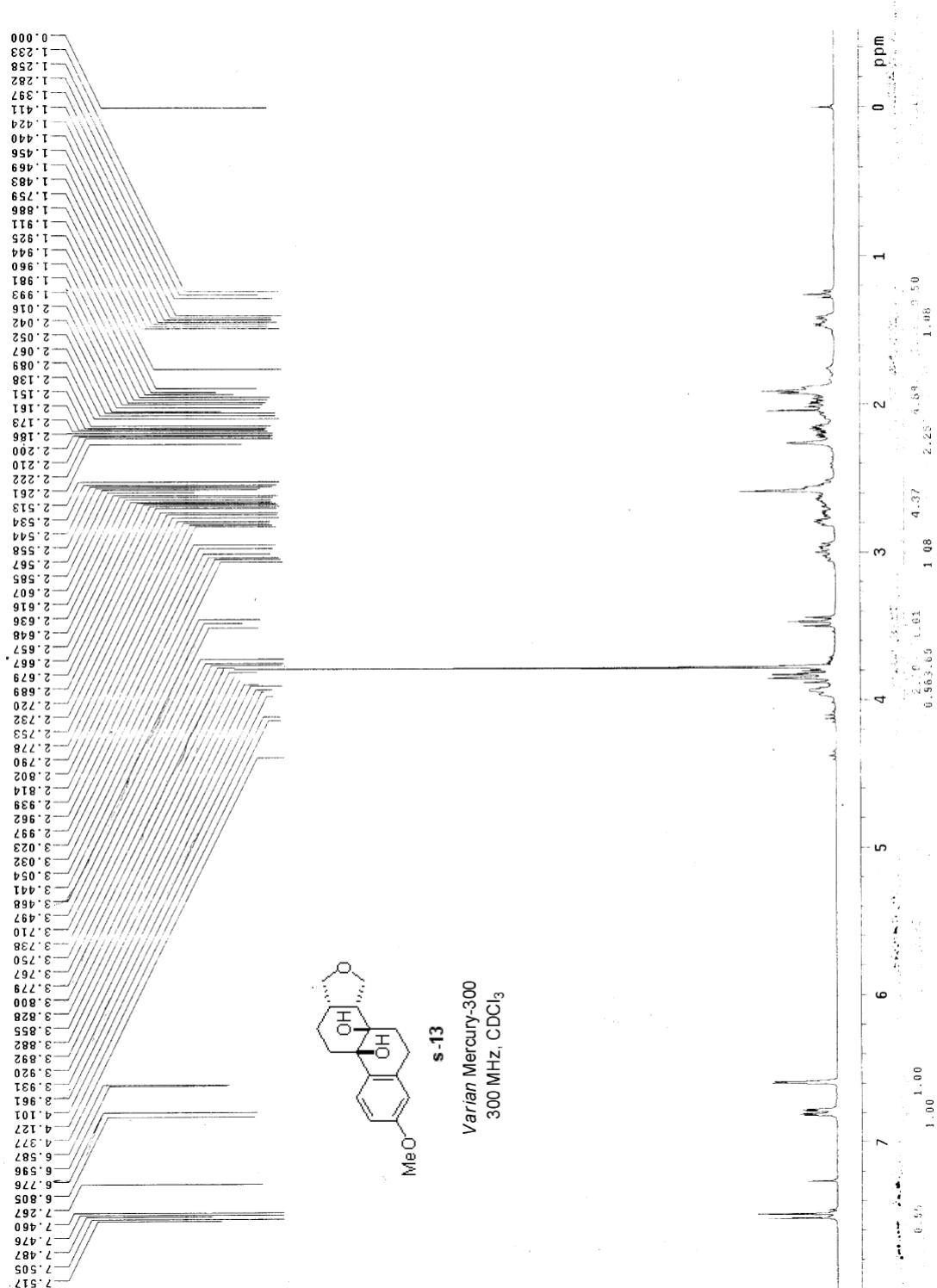
Compound **s-11**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



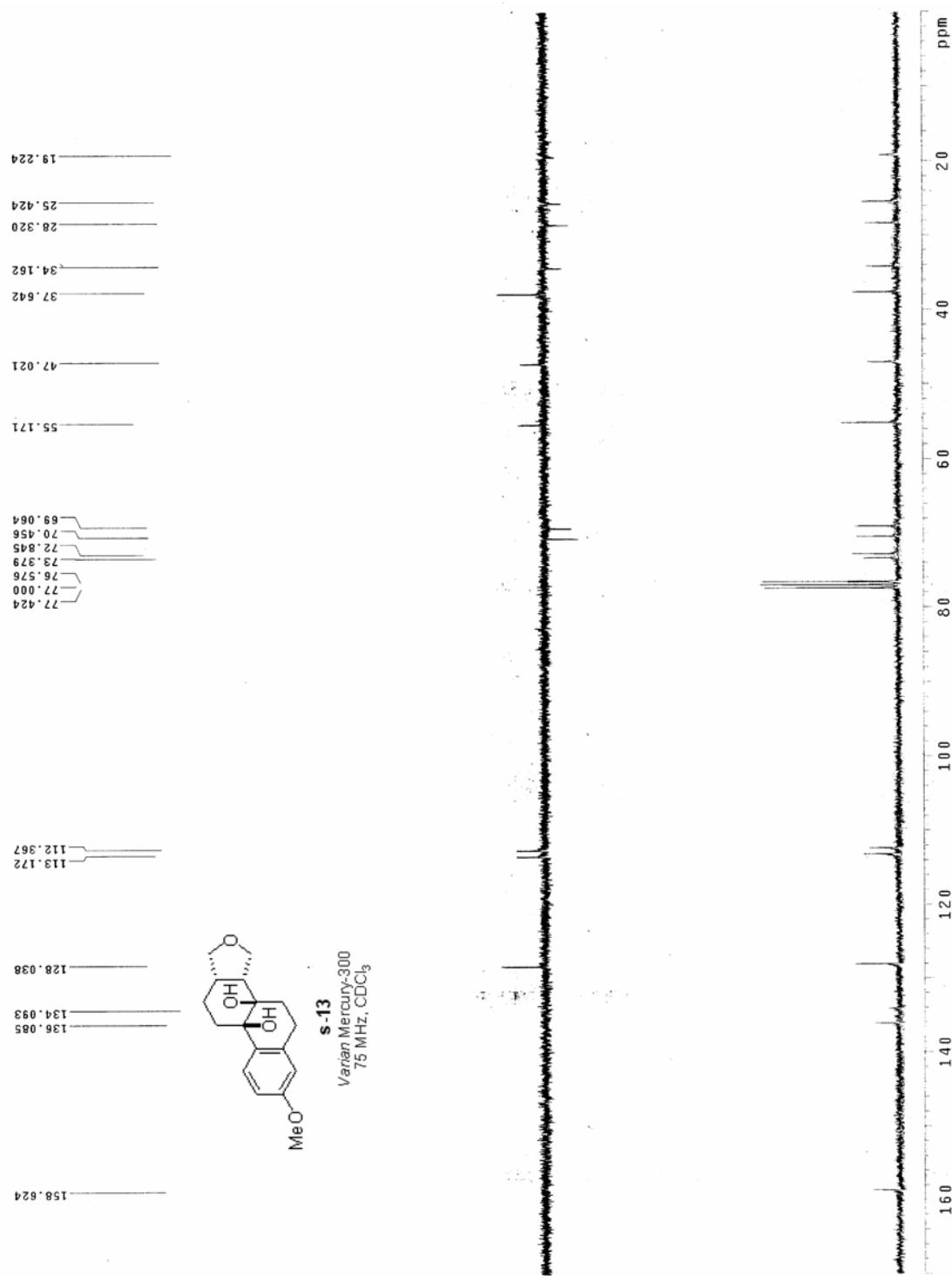
Compound s-11:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



Compound s-13:  $^1\text{H}$ NMR (300 MHz,  $\text{CDCl}_3$ ):

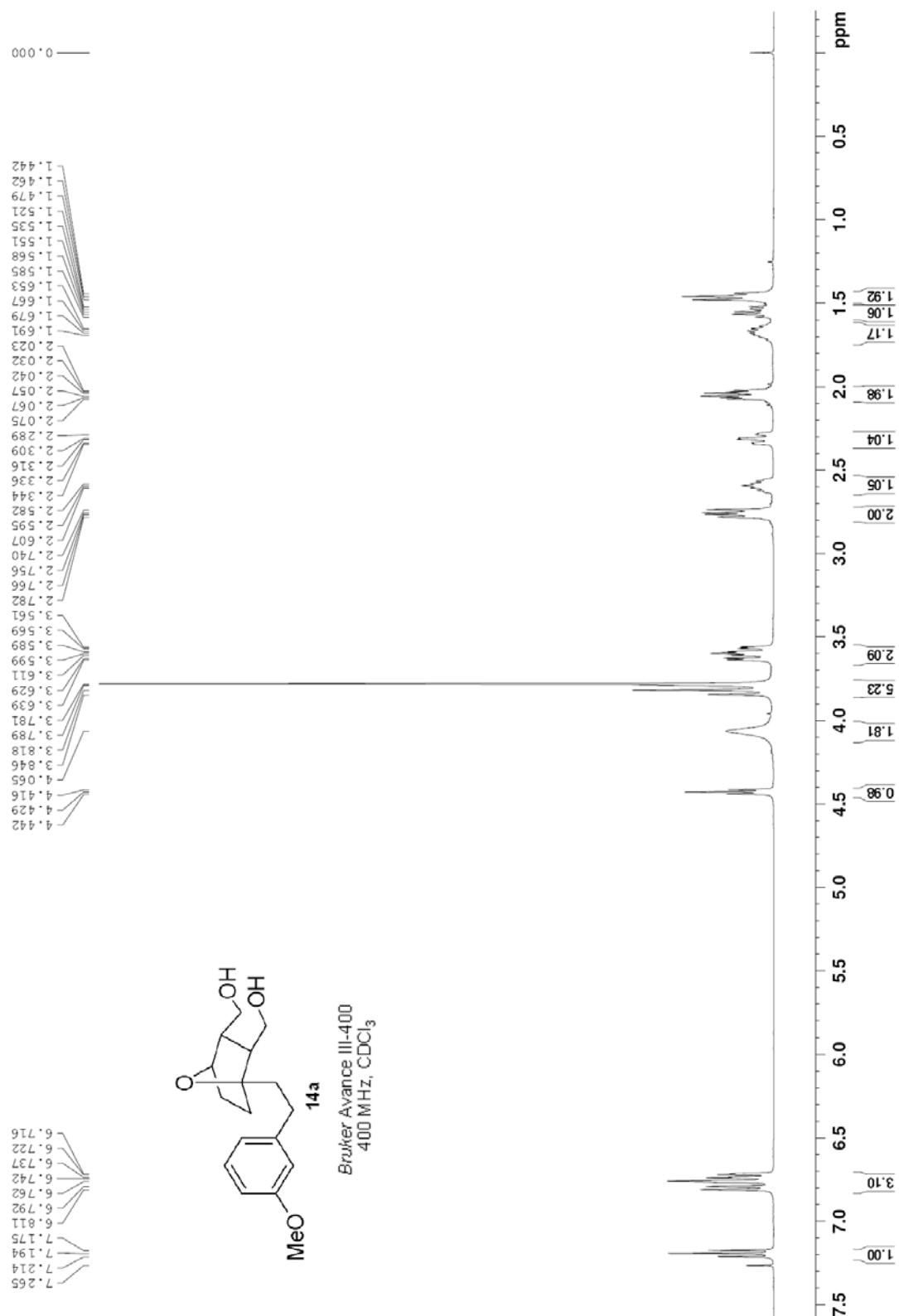


Compound s-13:  $^{13}\text{C}$ NMR (75 MHz,  $\text{CDCl}_3$ ):

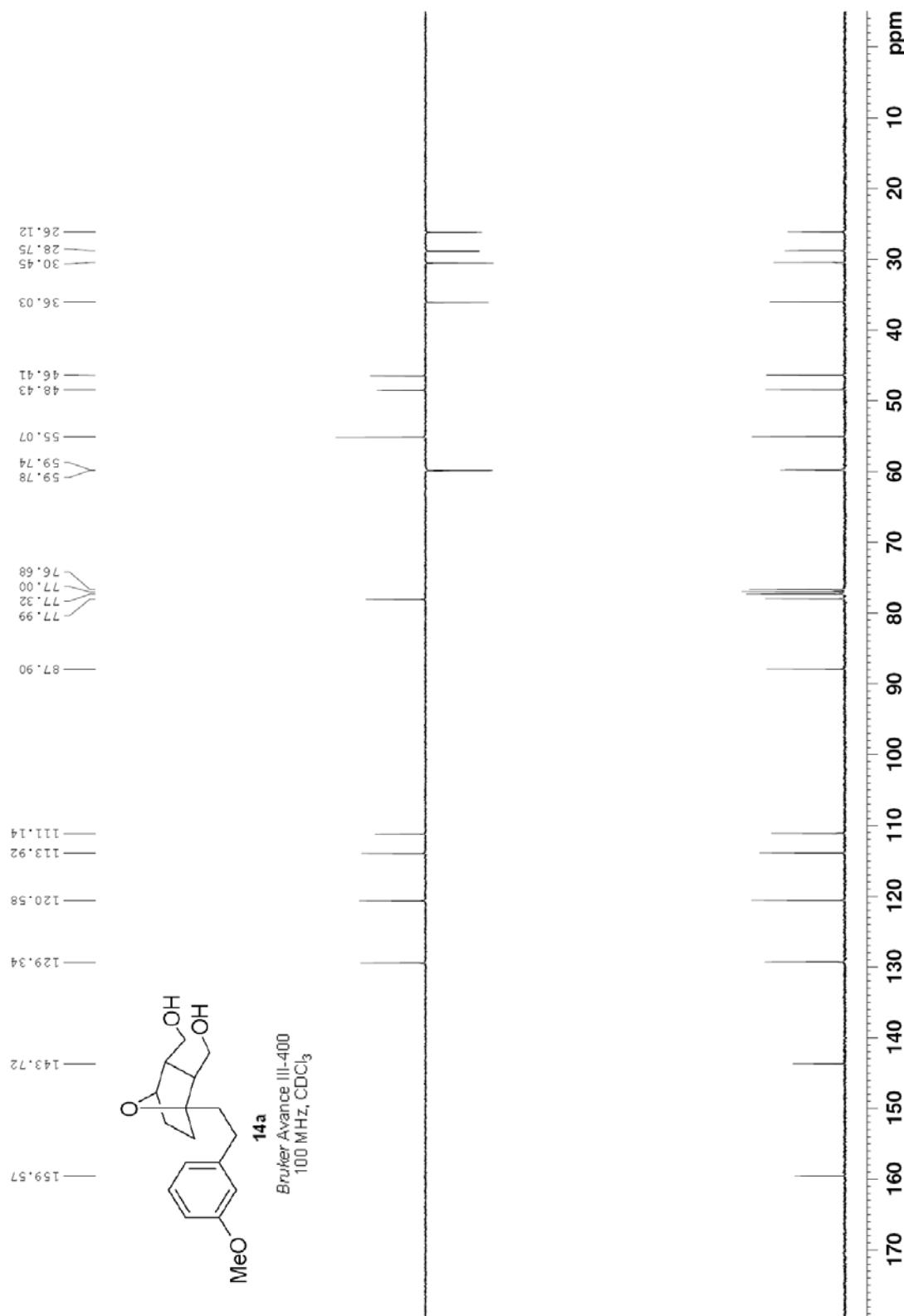


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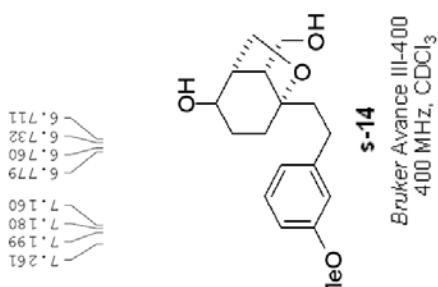
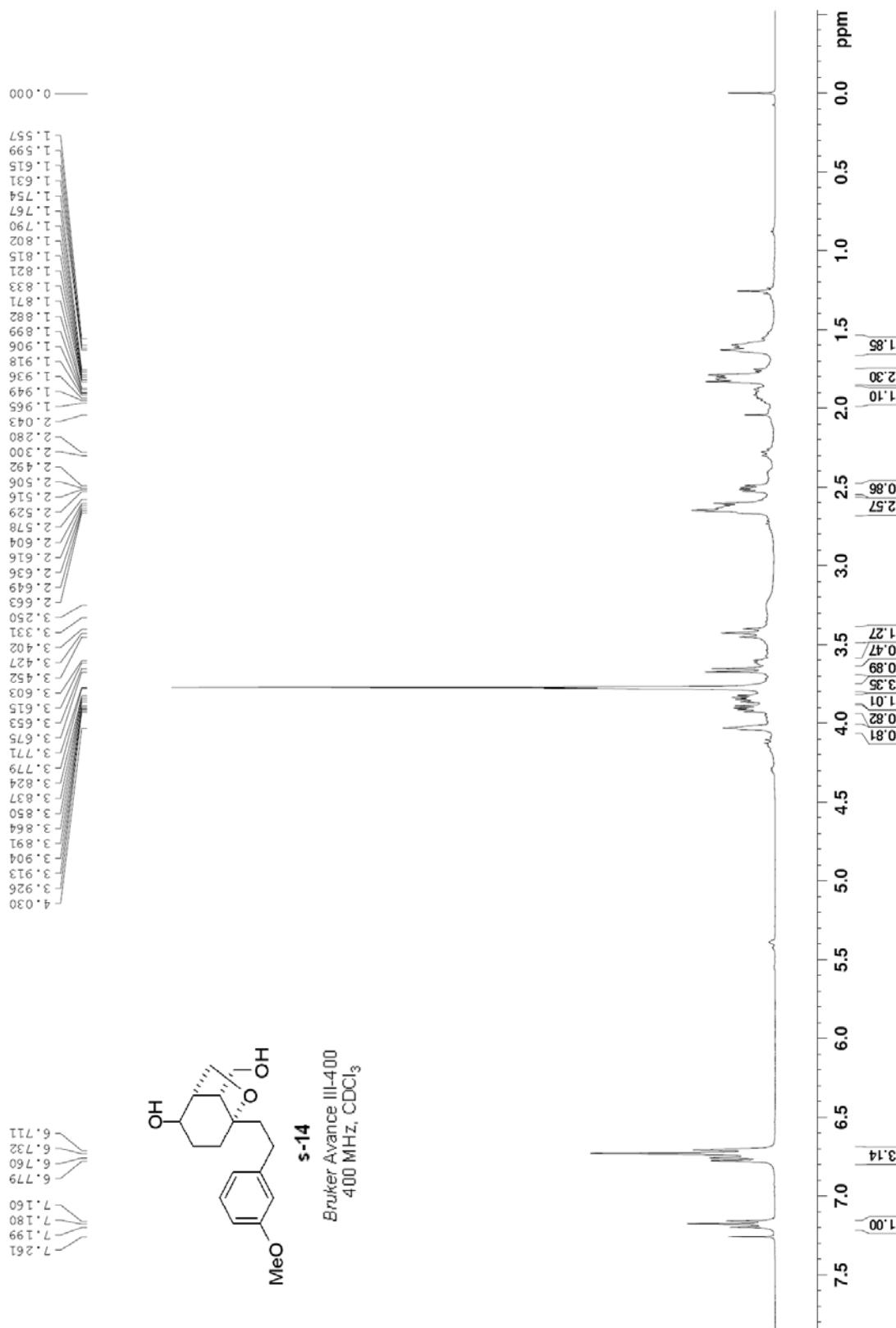
Compound **14a**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



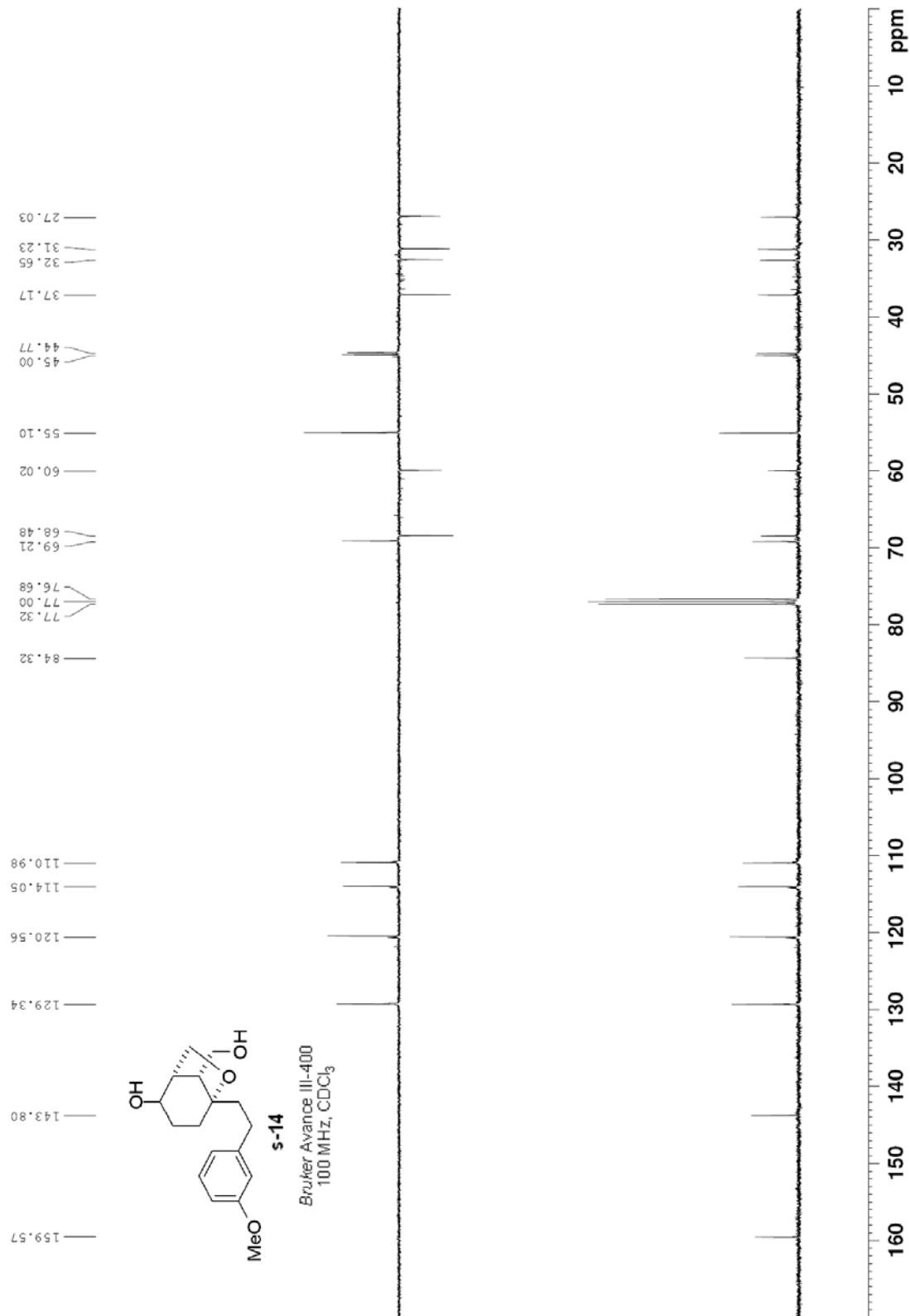
Compound **14a**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



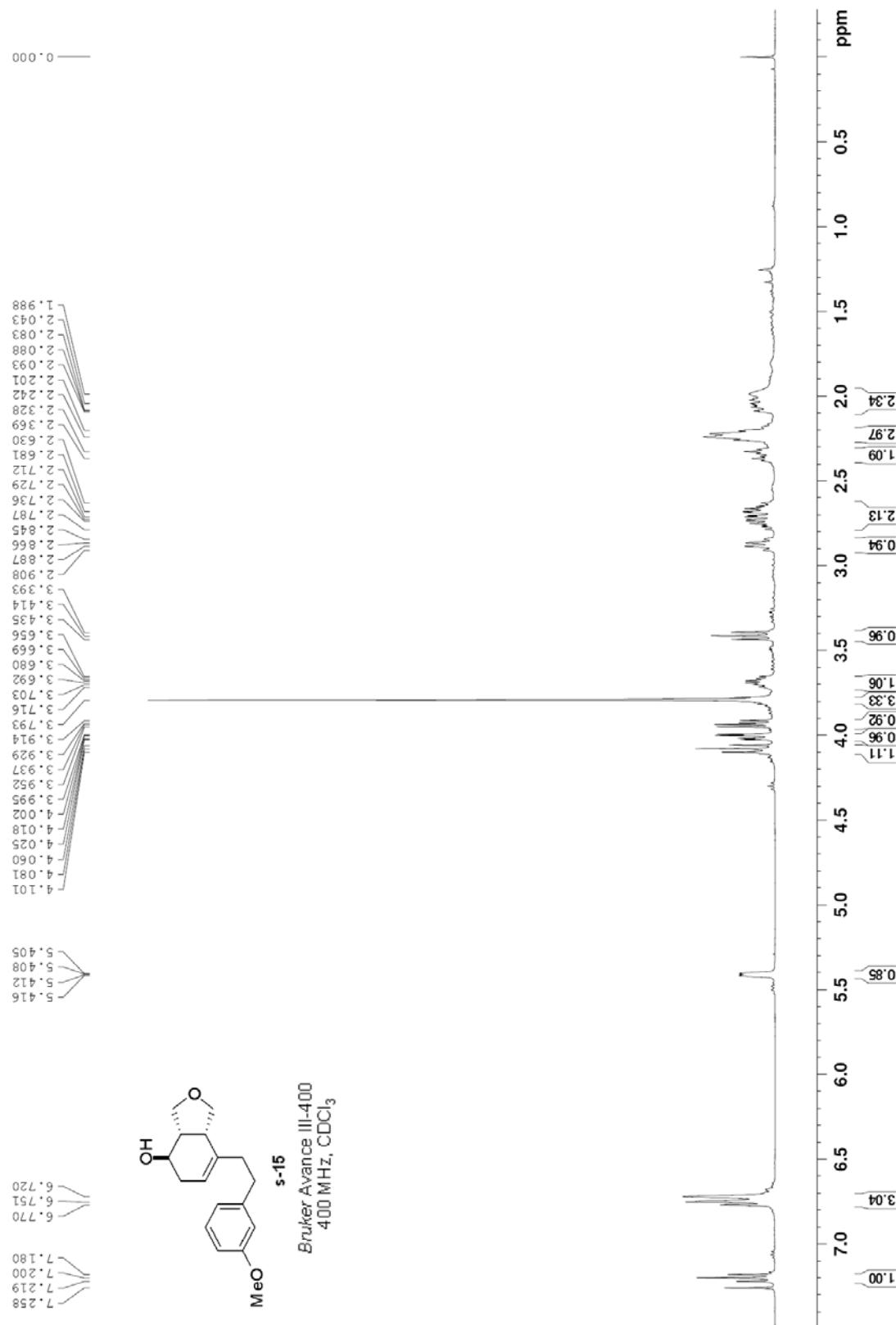
Compound **s-14**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



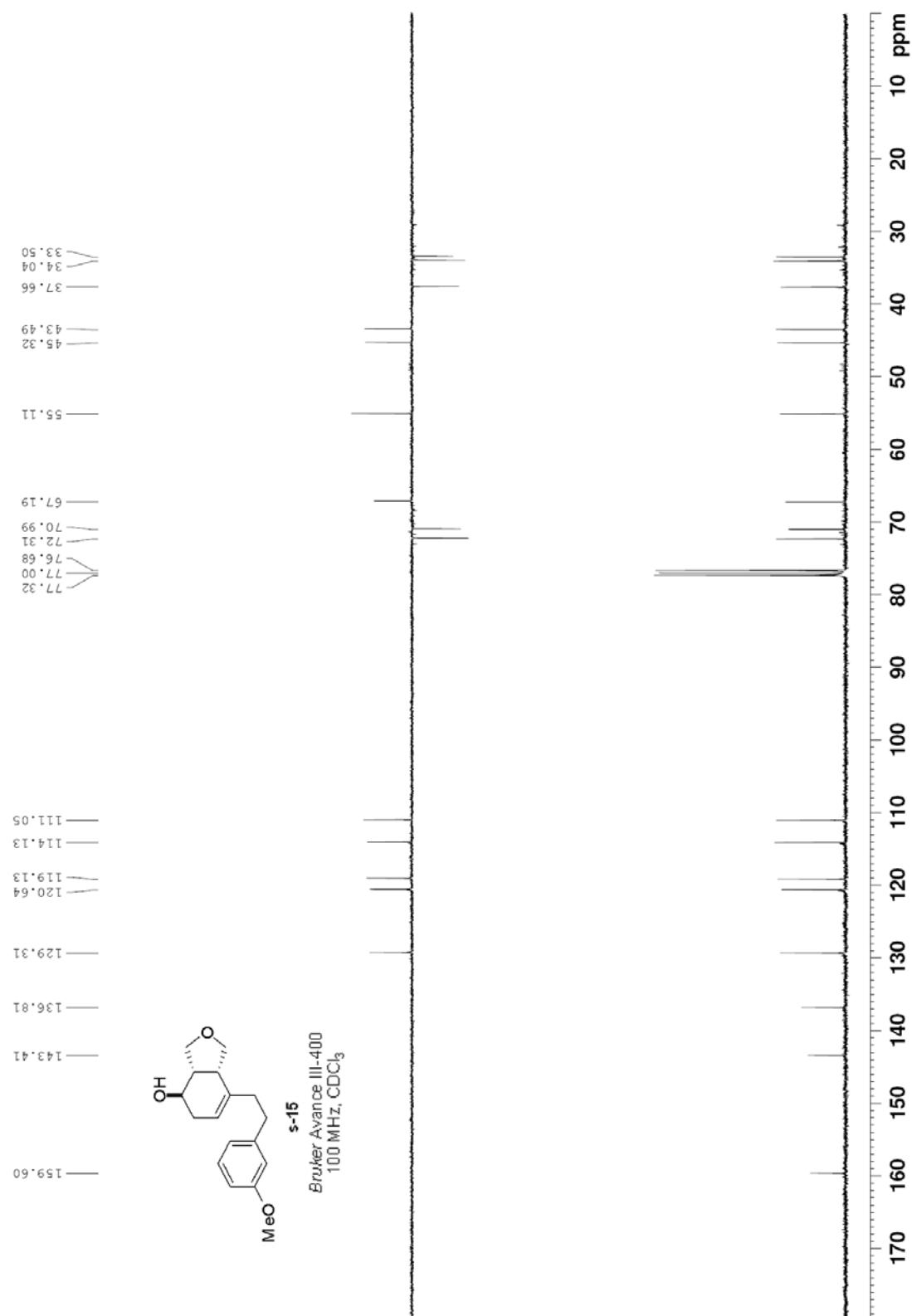
Compound s-14:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



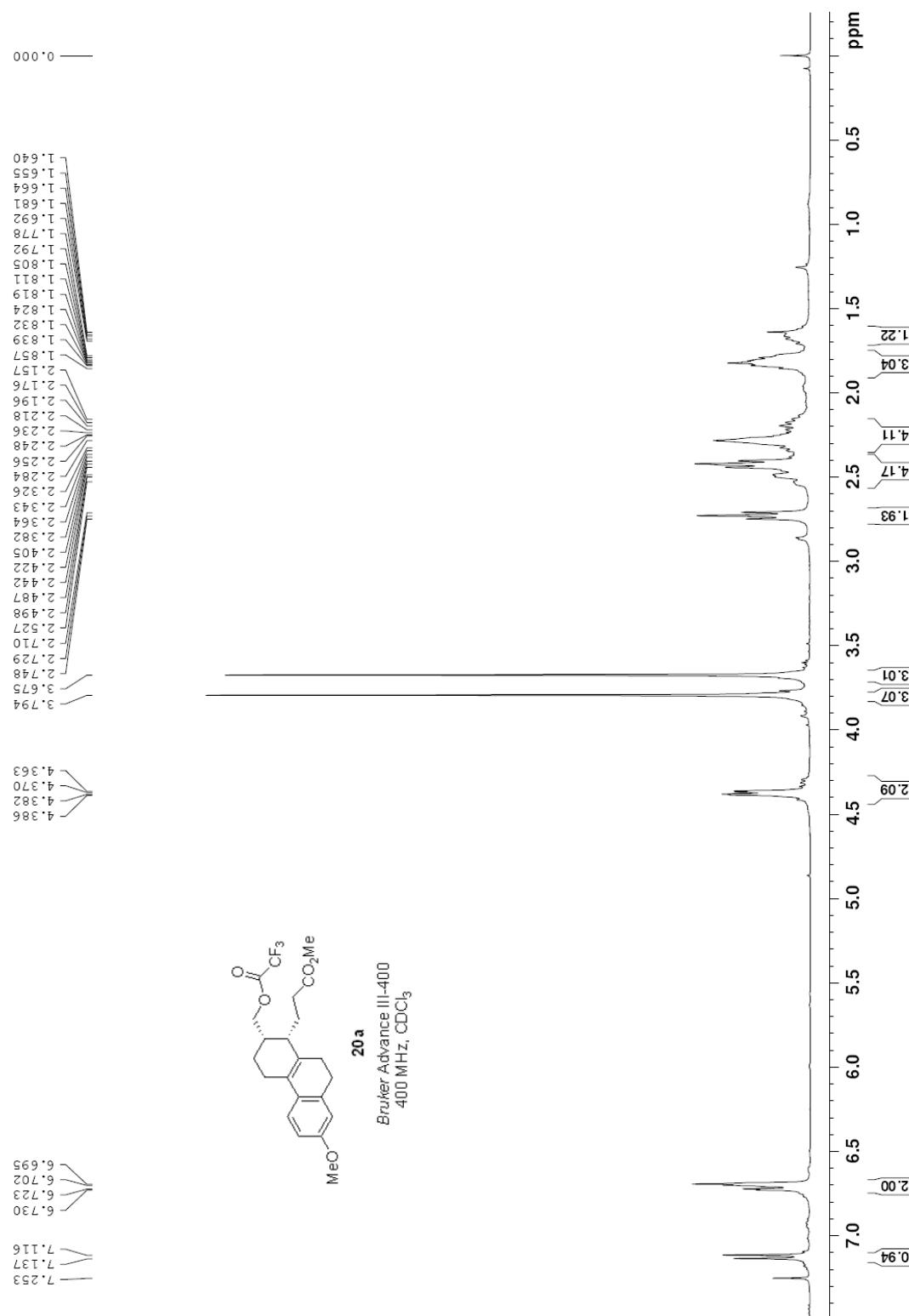
Compound s-15:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



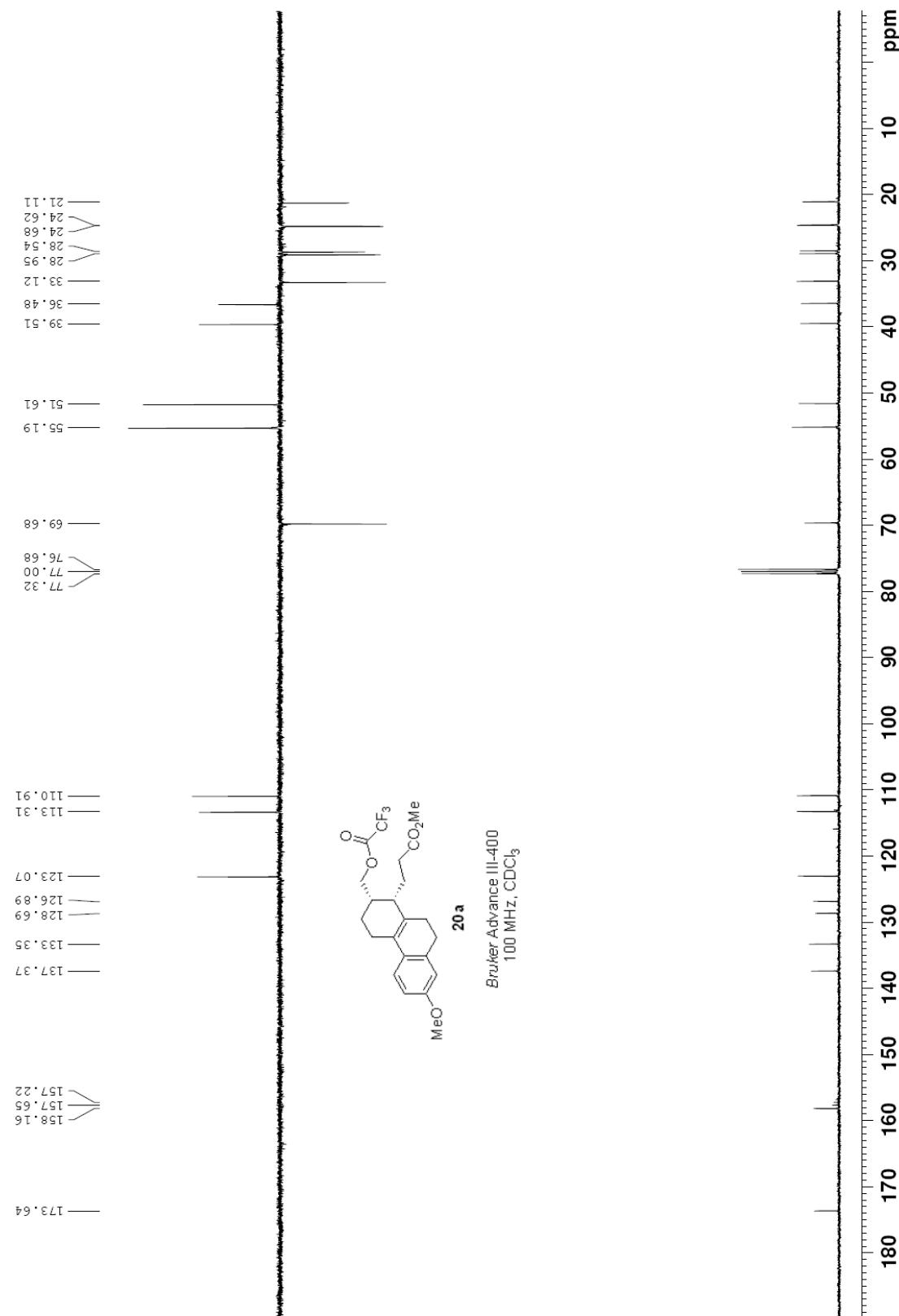
Compound s-15:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



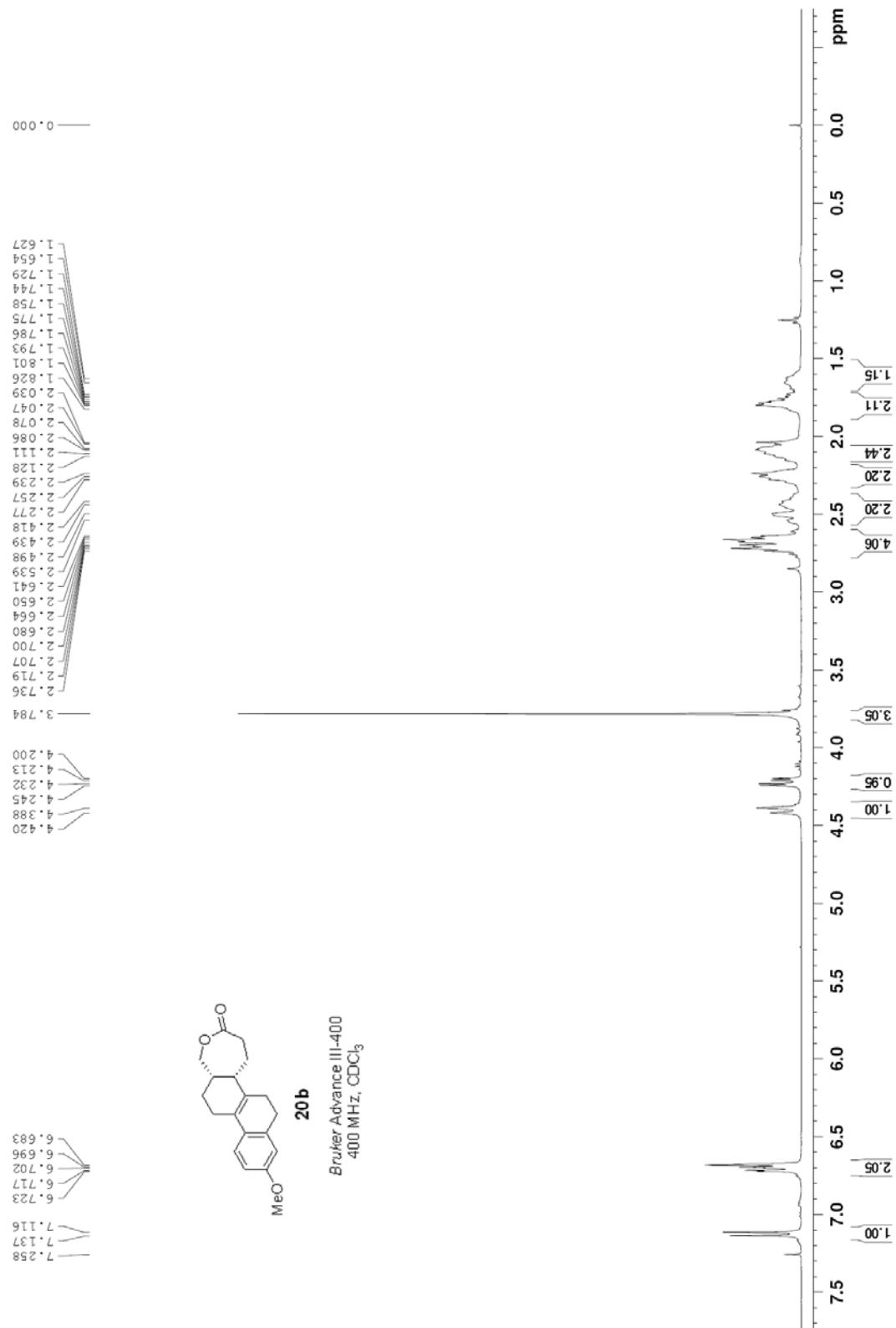
Compound **20a**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



Compound **20a**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):



Compound **20b**:  $^1\text{H}$ NMR (400 MHz,  $\text{CDCl}_3$ ):



Compound **20b**:  $^{13}\text{C}$ NMR (100 MHz,  $\text{CDCl}_3$ ):

