

## Electronic Supplementary information (ESI)

### Contrasting reactivity of fluorinated 2,6-heptanediones towards amines and ammonia leading to cyclohexanediones or 2-oxa-6-azabicyclo[2.2.2]octanes and evaluation of their cytotoxicity

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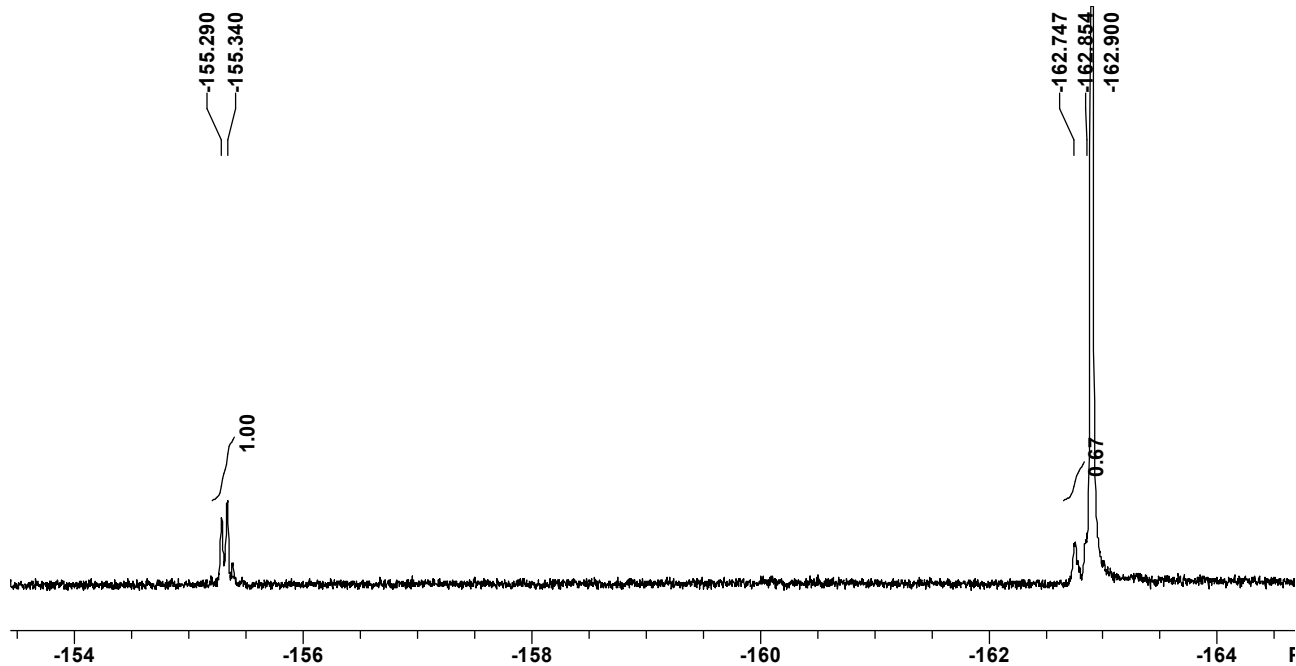
<sup>a</sup> Latvian Institute of Organic Synthesis, Aizkraukles str. 21, Riga, LV-1006, Latvia.

<sup>b</sup> Institute of Organic Chemistry NAS of Ukraine, Murmanska str. 5, 02660 Kyiv, Ukraine.

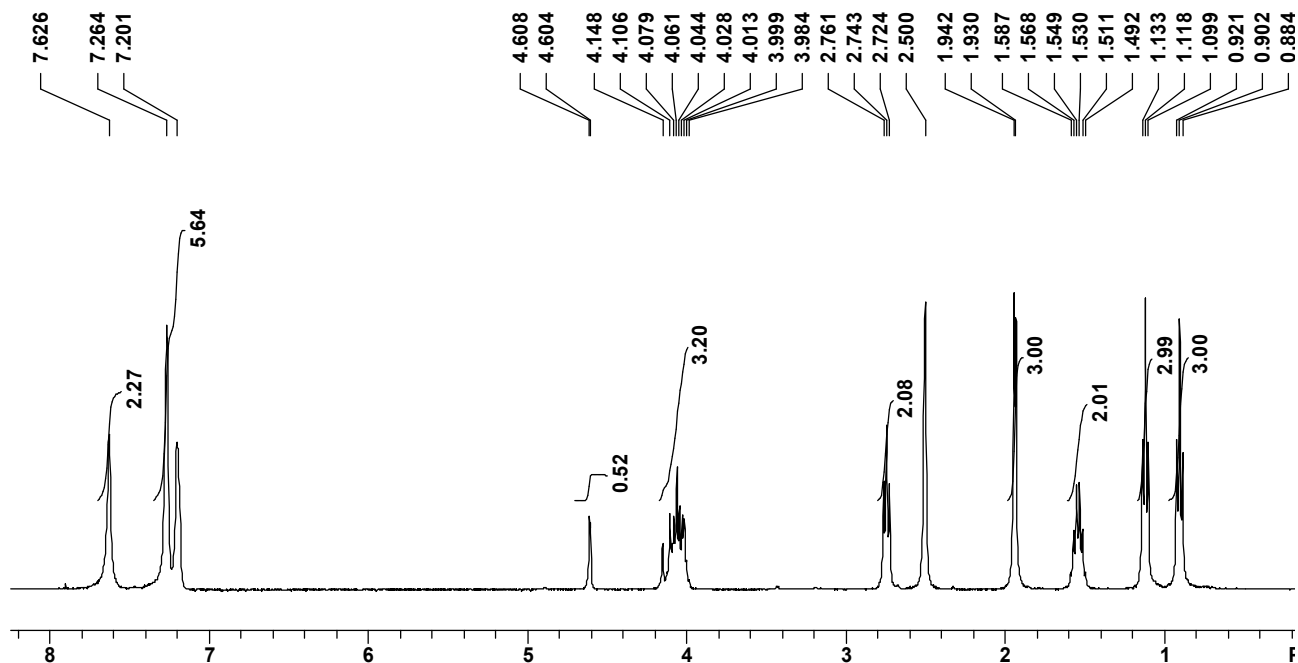
<sup>\*</sup>Corresponding author.

<sup>1</sup>H, <sup>19</sup>F and <sup>13</sup>C NMR spectra of compounds:

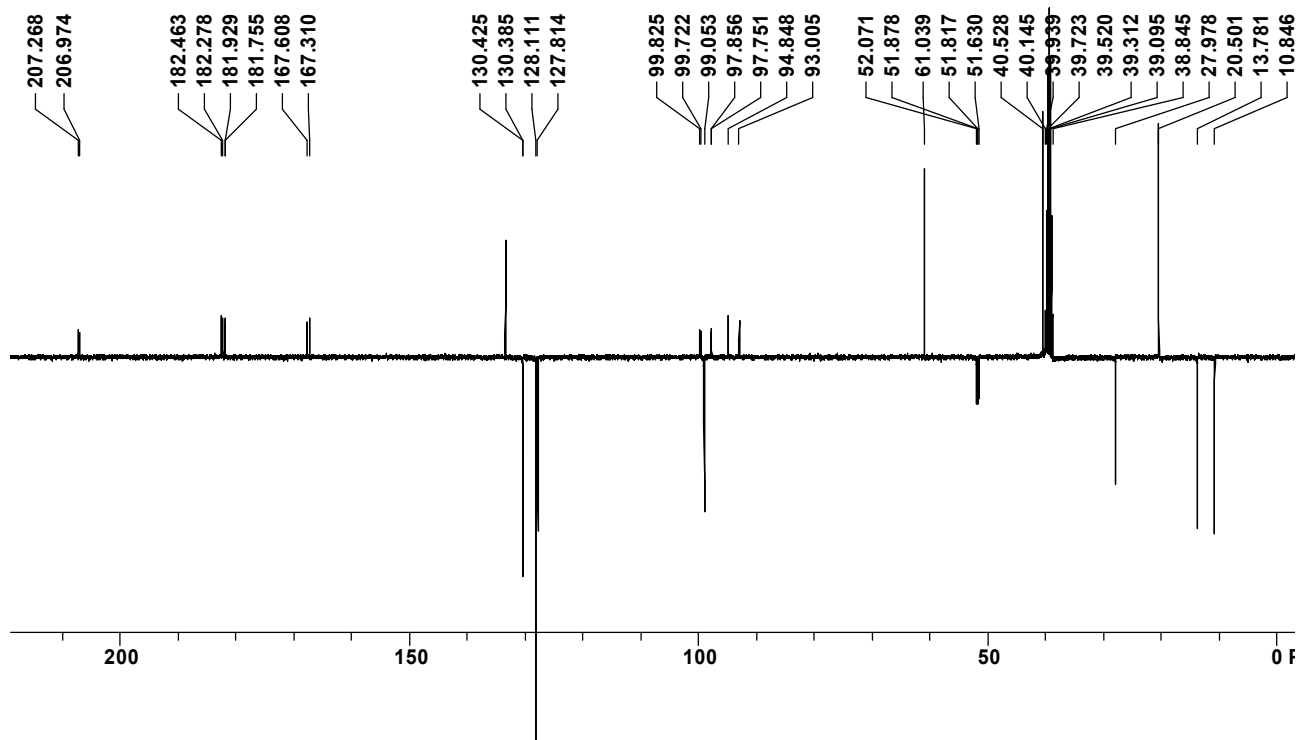
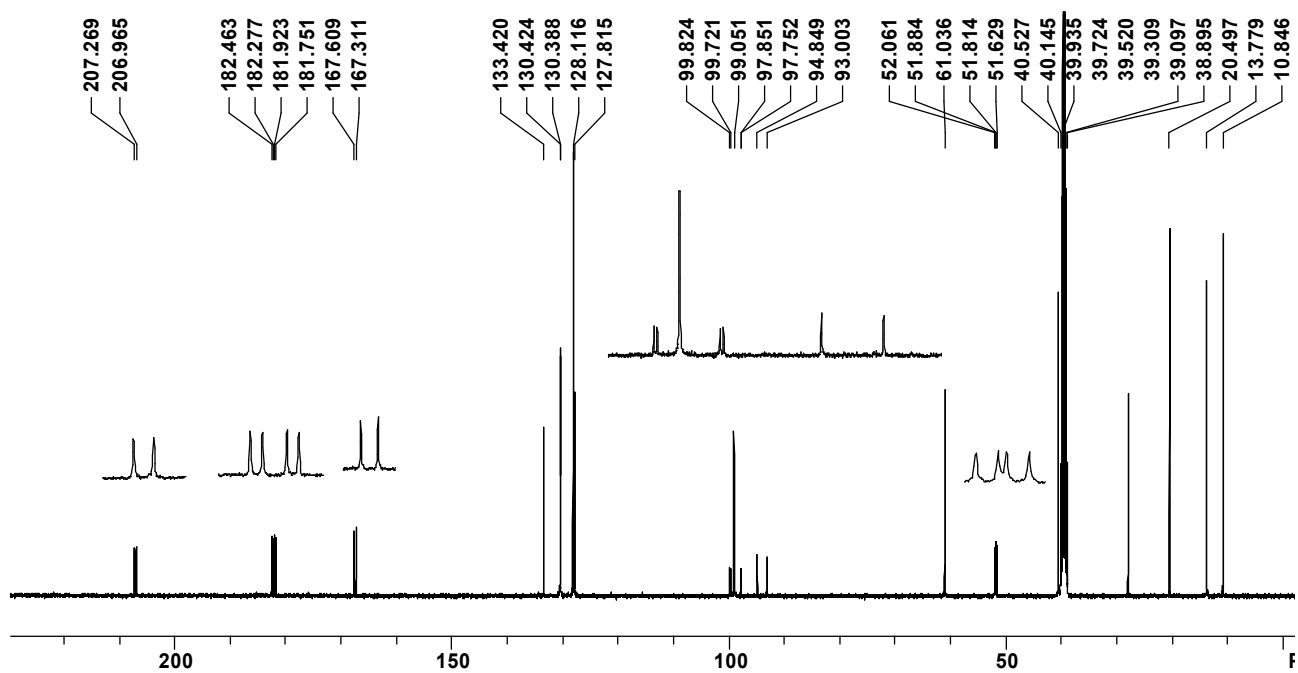
<sup>19</sup>F NMR Spectrum of propan-1-aminium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (**2a**) in DMSO-d<sub>6</sub>



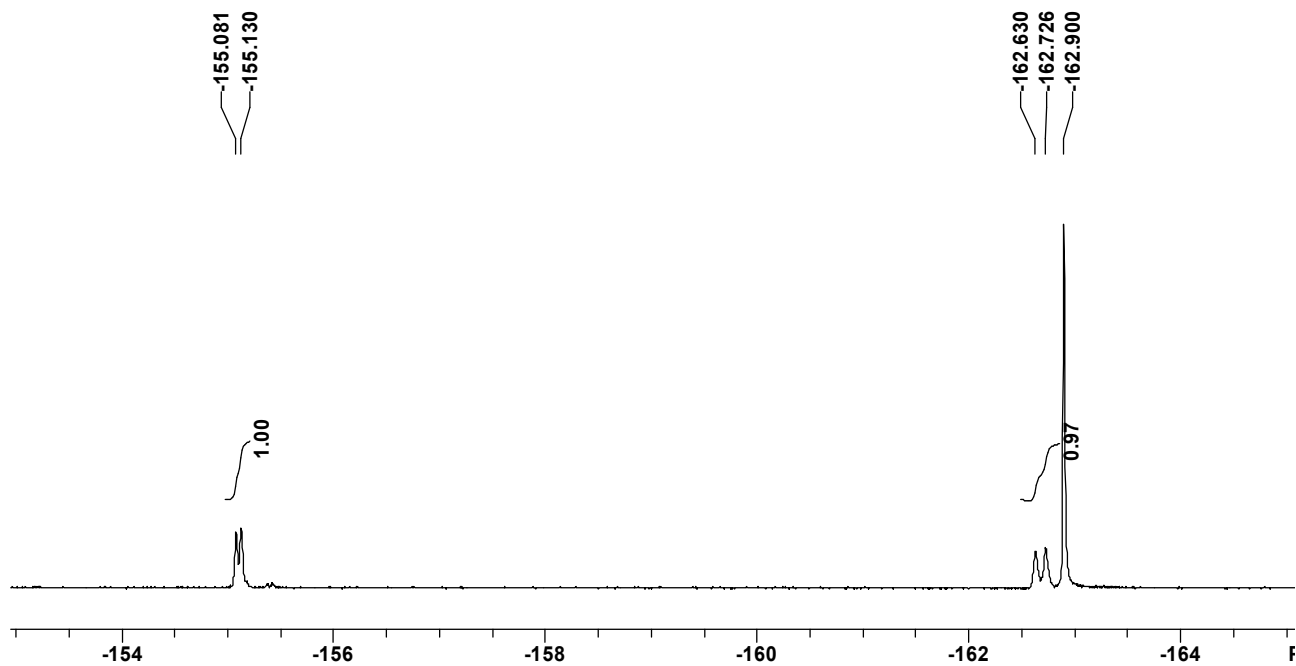
<sup>1</sup>H NMR Spectrum of propan-1-aminium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (**2a**) in DMSO-d<sub>6</sub>



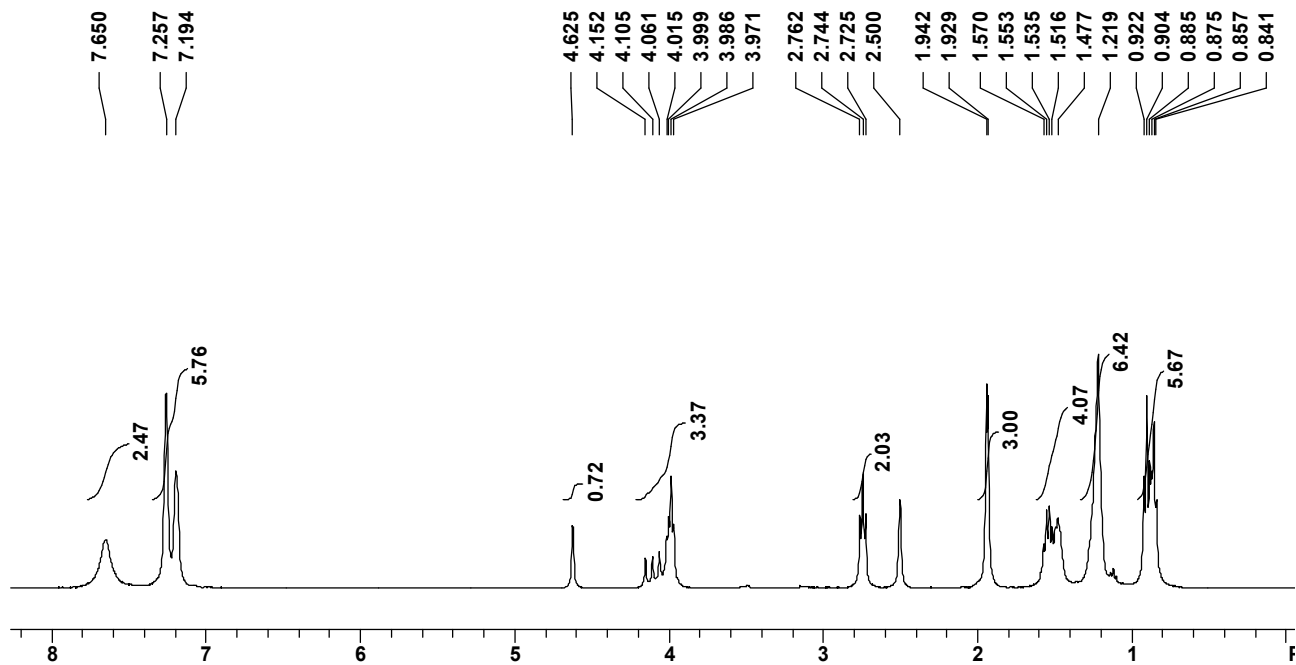
*<sup>13</sup>C NMR Spectrum of propan-1-aminium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2a) in DMSO-d<sub>6</sub>*



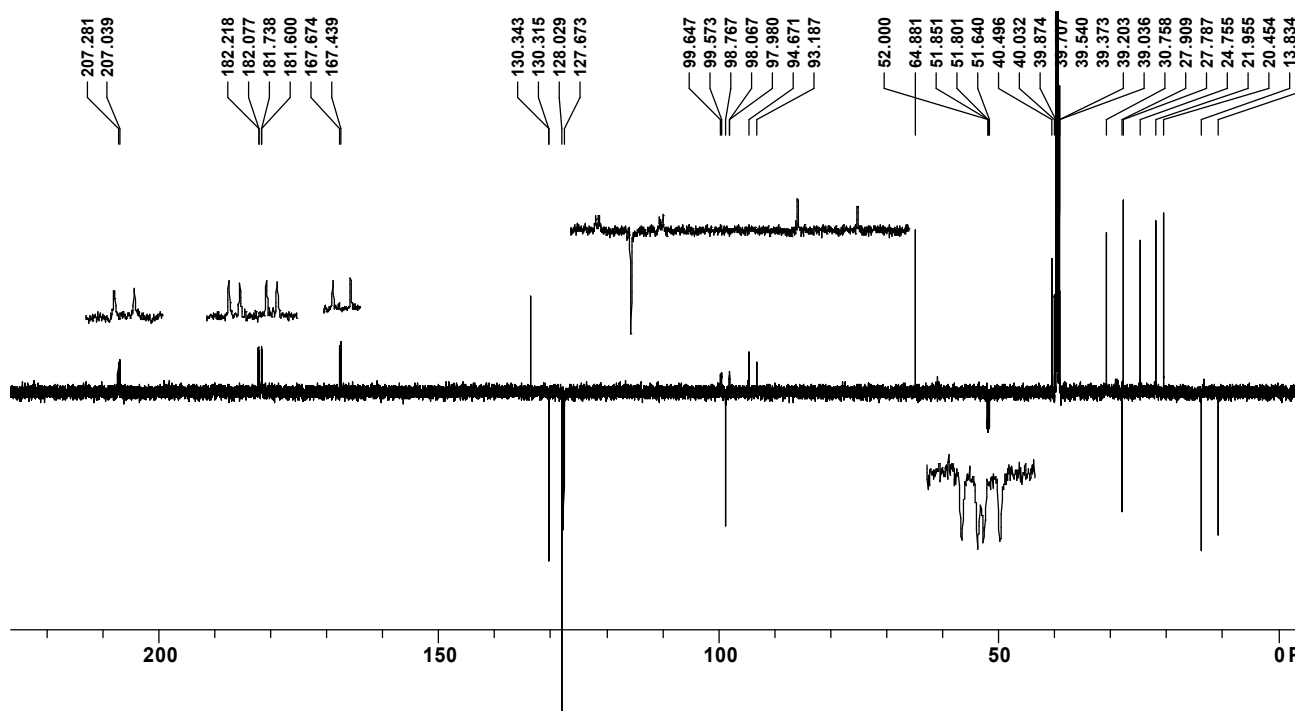
*<sup>19</sup>F NMR Spectrum of propan-1-aminium 3-acetyl-3,5-difluoro-5-((hexyloxy)carbonyl)-2,6-dioxo-4-phenylcyclohexan-1-ide (2b) in DMSO-d<sub>6</sub>*



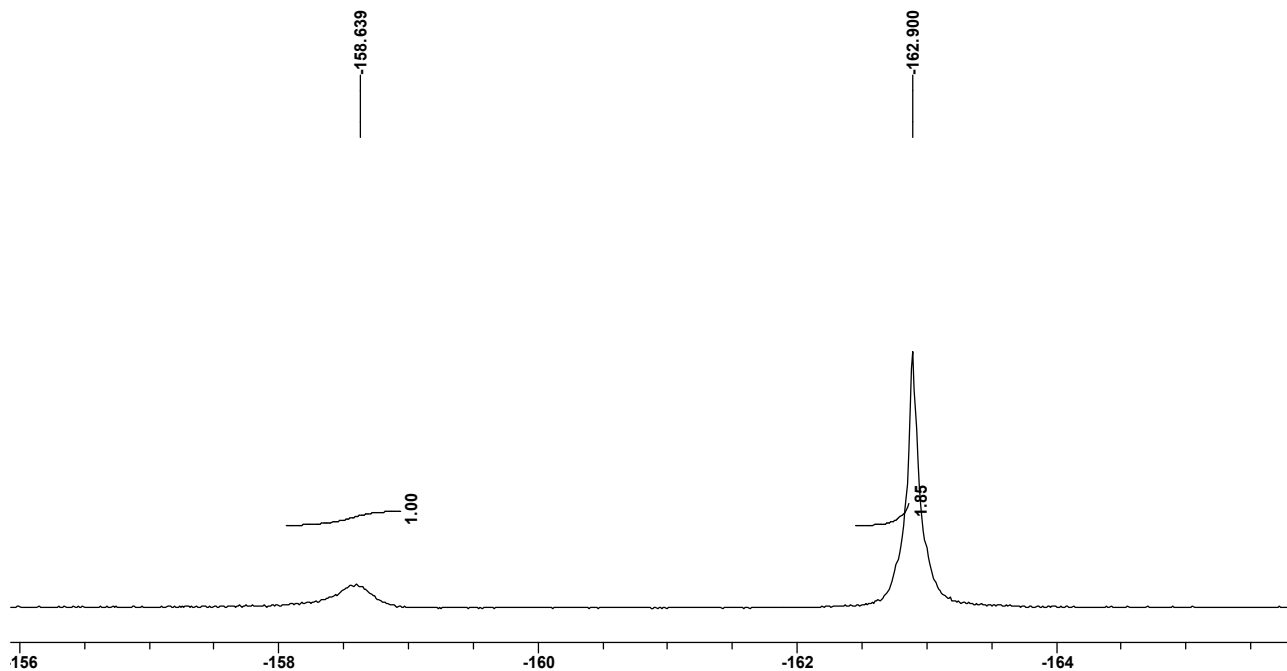
*<sup>1</sup>H NMR Spectrum of propan-1-aminium 3-acetyl-3,5-difluoro-5-((hexyloxy)carbonyl)-2,6-dioxo-4-phenylcyclohexan-1-ide (2b) in DMSO-d<sub>6</sub>*



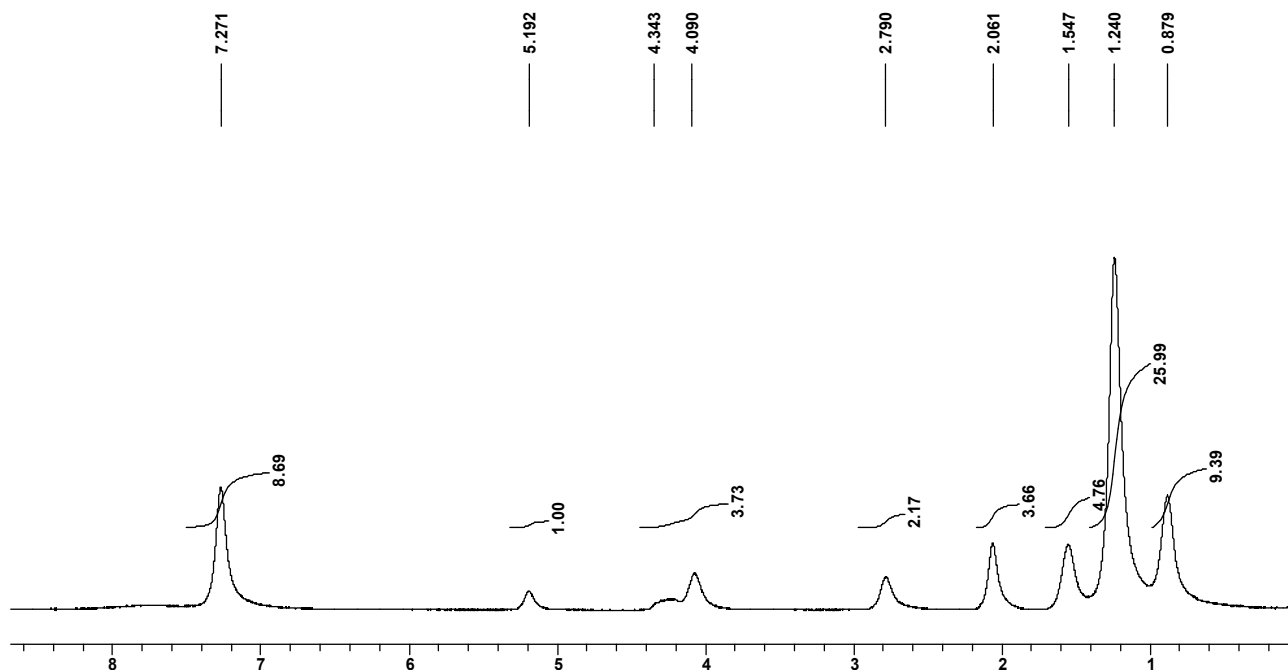
$^{13}\text{C}$  NMR Spectrum of propan-1-aminium 3-acetyl-3,5-difluoro-5-((hexyloxy)carbonyl)-2,6-dioxo-4-phenylcyclohexan-1-ide (**2b**) in  $\text{DMSO-}d_6$



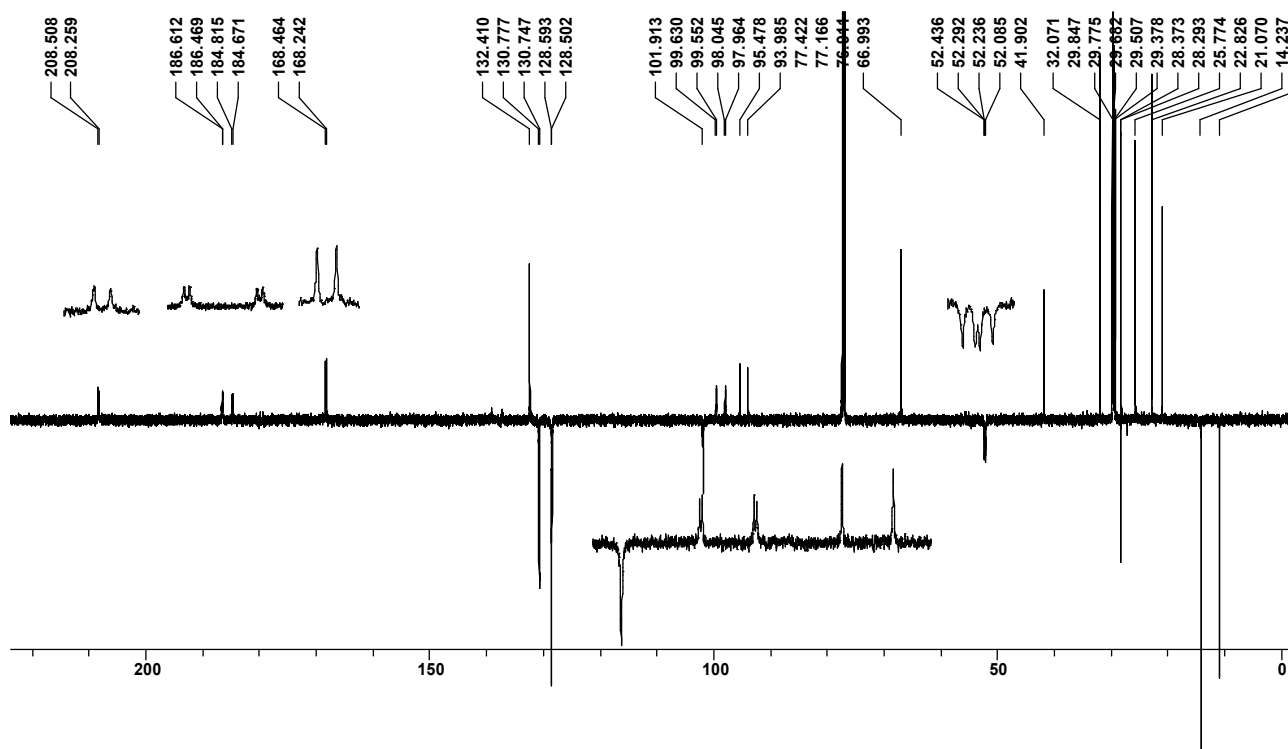
$^{19}\text{F}$  NMR Spectrum of propan-1-aminium 3-acetyl-5-((dodecyloxy)carbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (**2c**) in  $\text{CDCl}_3$



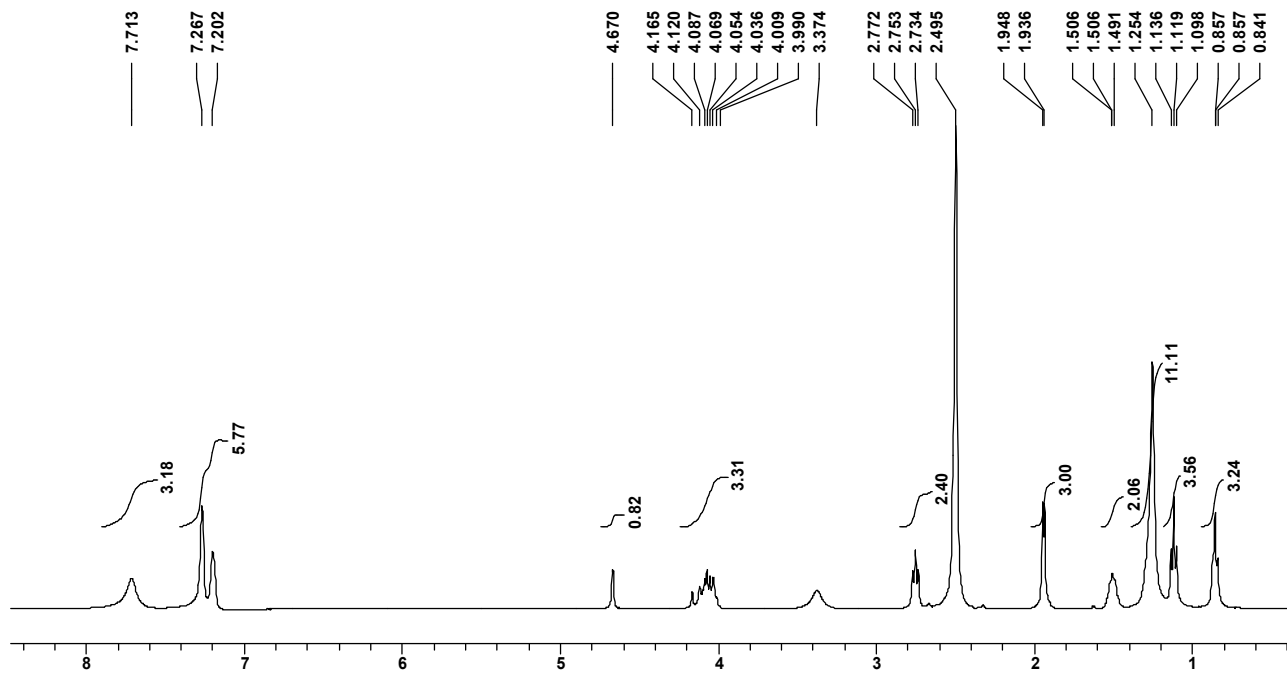
*<sup>1</sup>H NMR Spectrum of propan-1-aminium 3-acetyl-5-((dodecyloxy)carbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2c) (in CDCl<sub>3</sub>)*



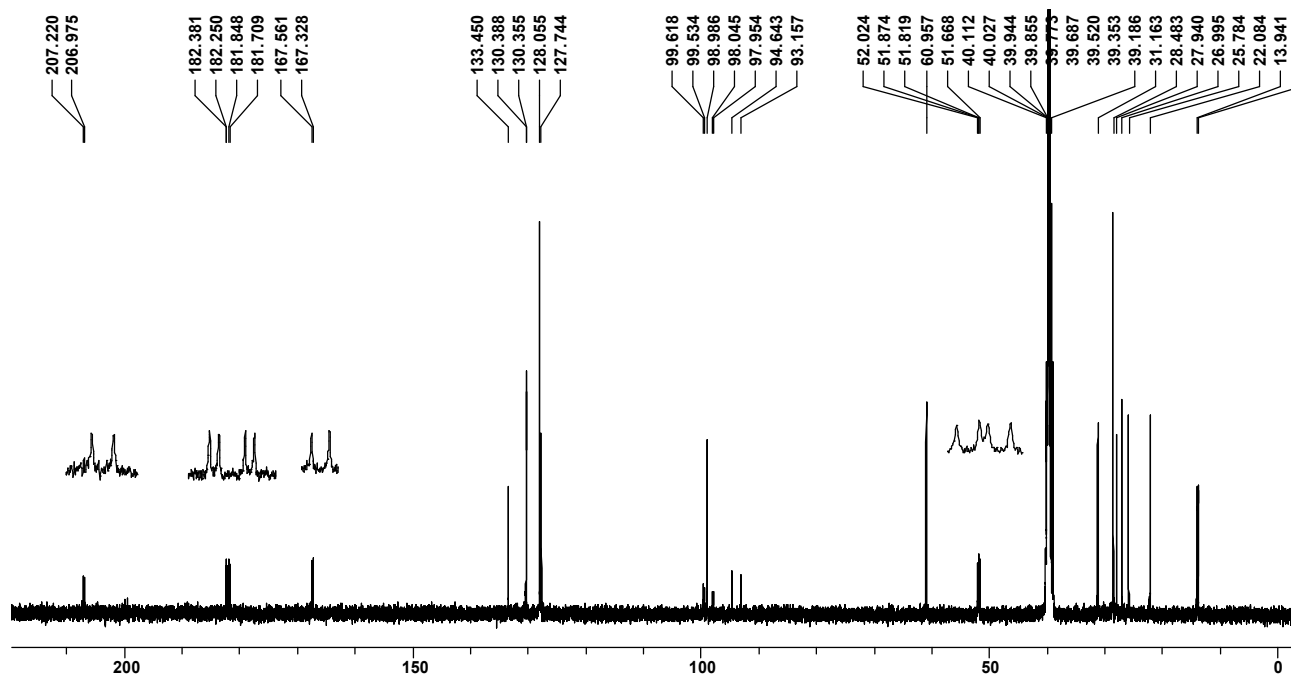
*<sup>13</sup>C NMR Spectrum of propan-1-aminium 3-acetyl-5-((dodecyloxy)carbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2c) (in CDCl<sub>3</sub>)*



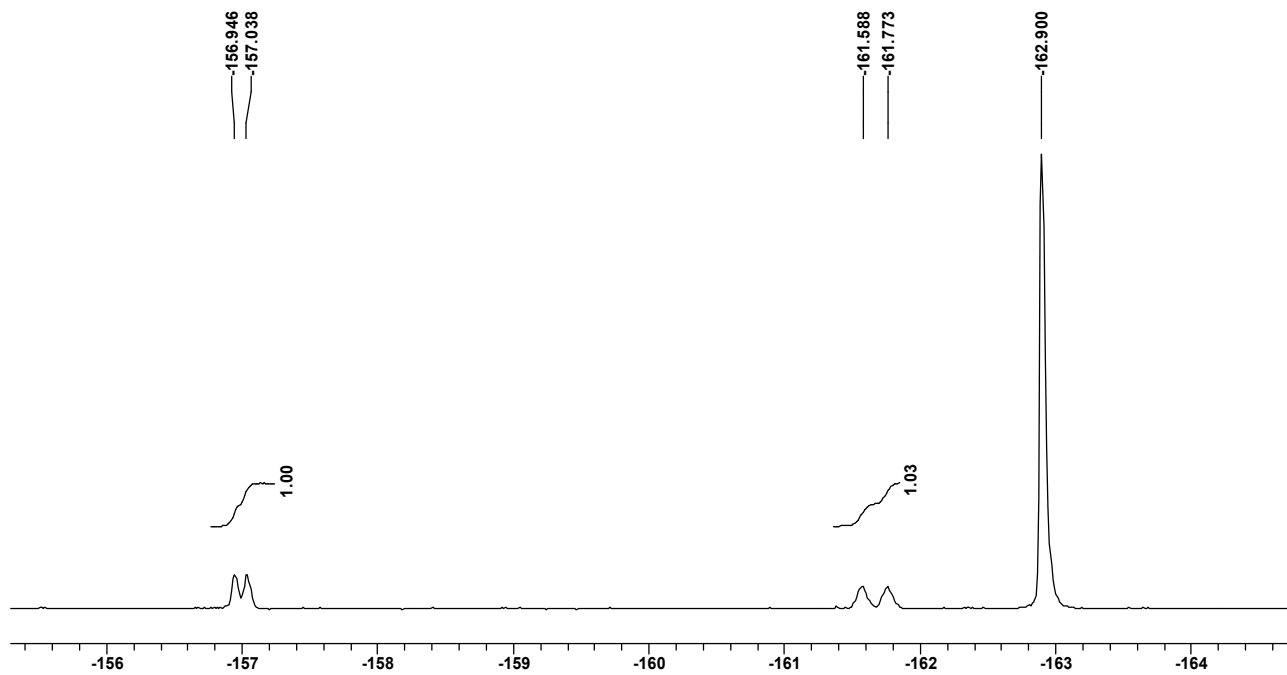
*<sup>1</sup>H NMR Spectrum of octan-1-aminium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2d) (in DMSO-d<sub>6</sub>)*



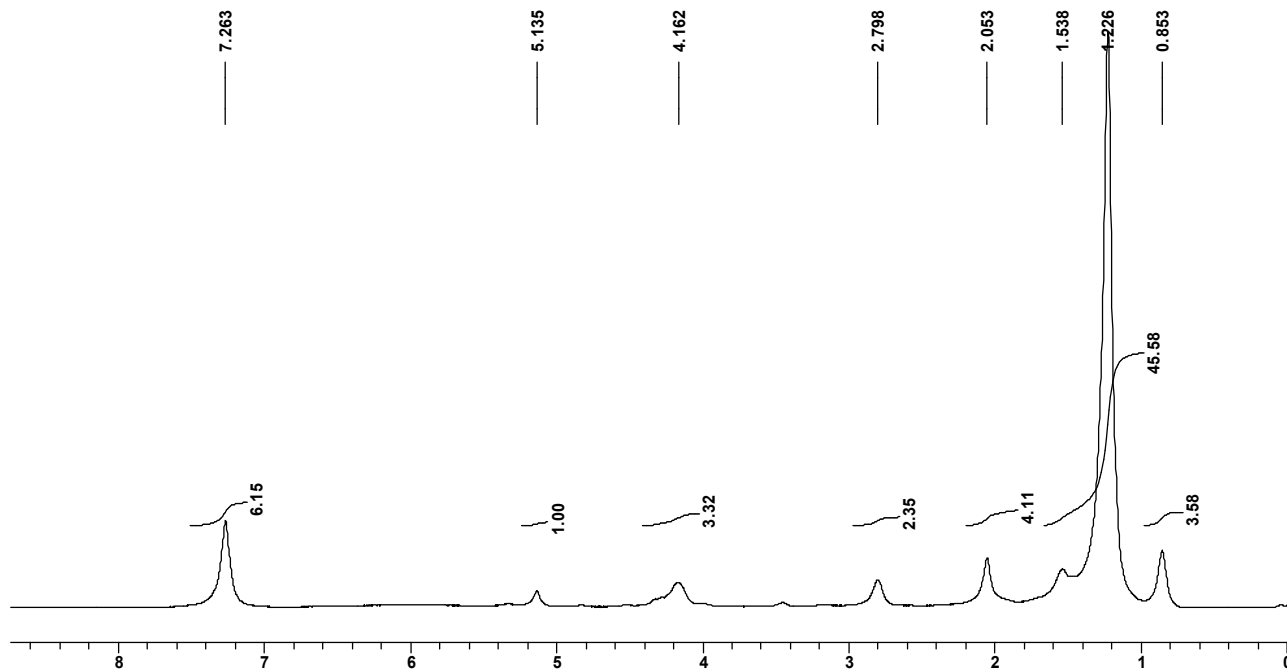
*<sup>13</sup>C NMR Spectrum of octan-1-aminium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2d) (in DMSO-d<sub>6</sub>)*



*<sup>19</sup>F NMR Spectrum of octadecan-1-aminium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2e) (in EtOH)*

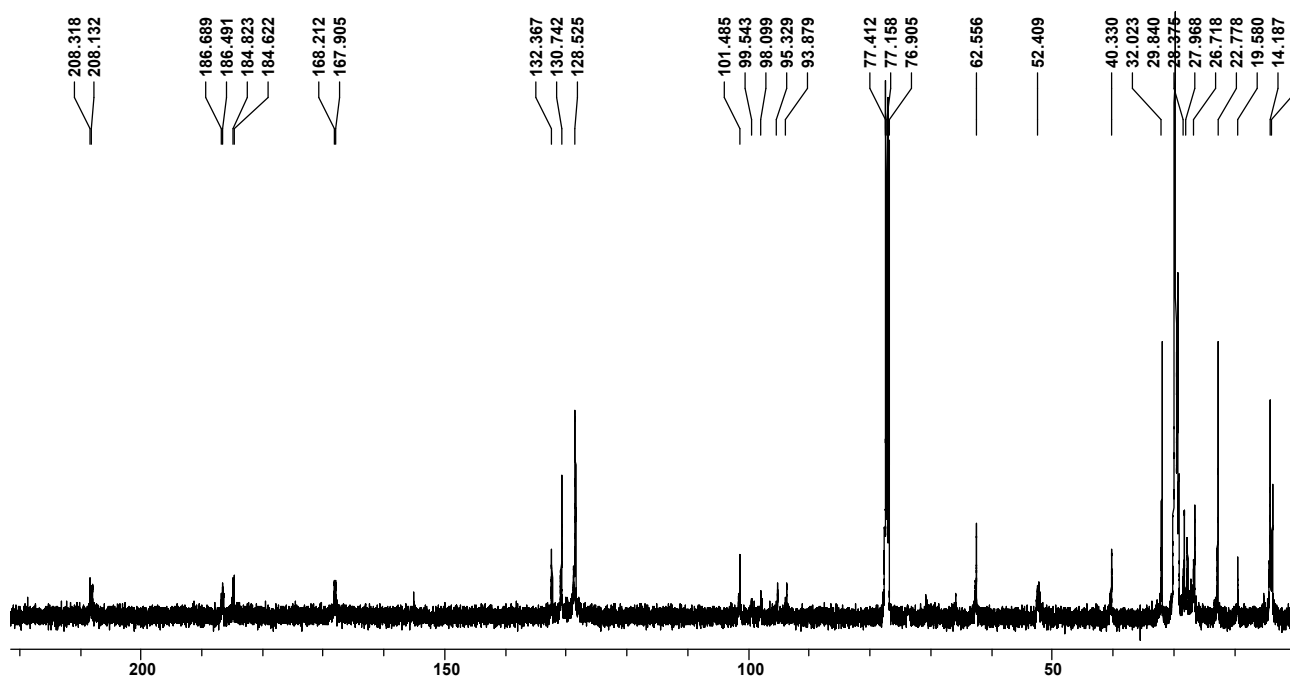


*<sup>1</sup>H NMR Spectrum of octadecan-1-aminium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2e) (in CDCl<sub>3</sub>)*

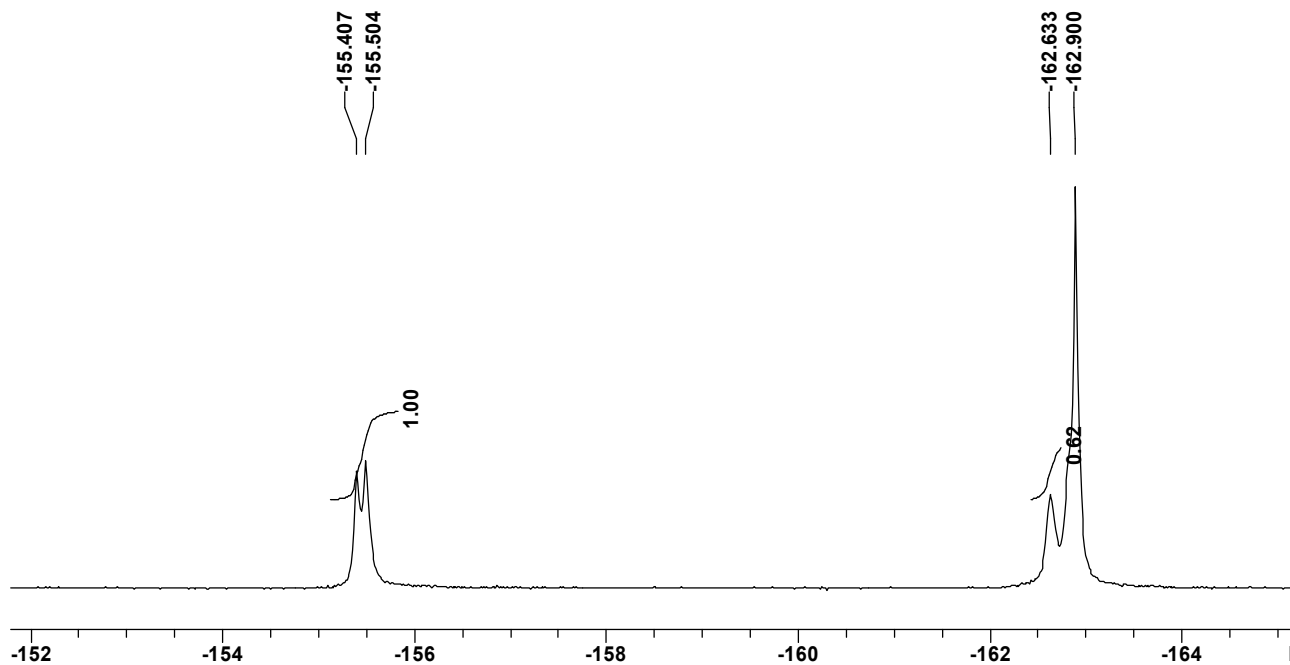




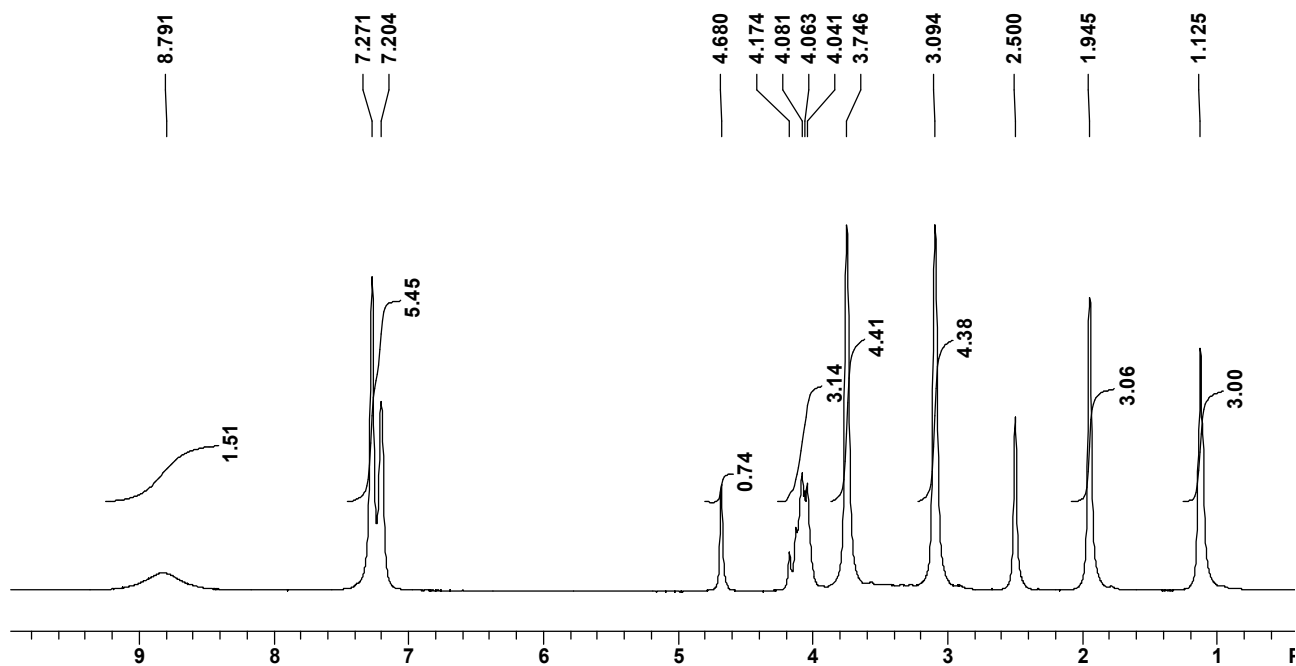
*<sup>13</sup>C NMR Spectrum of octadecan-1-aminium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2e) (in CDCl<sub>3</sub>)*



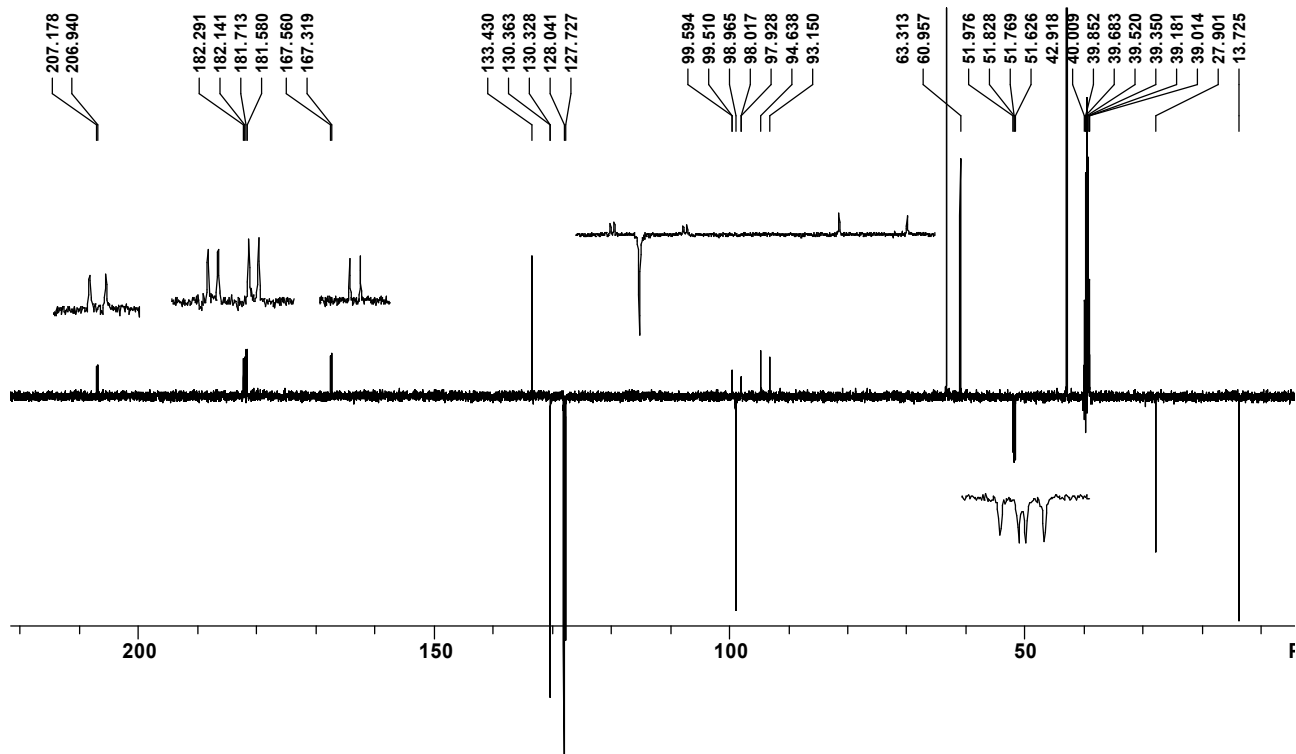
*<sup>19</sup>F NMR Spectrum of morpholin-4-ium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2f) in DMSO-d<sub>6</sub>*



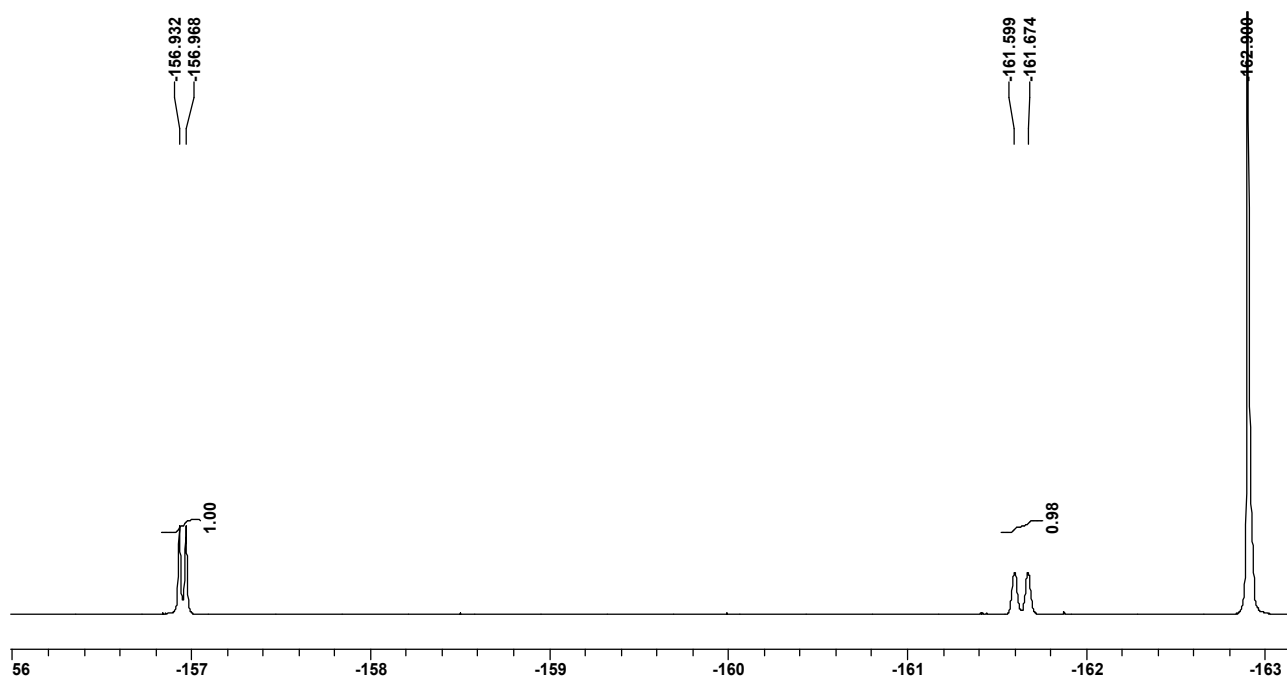
*<sup>1</sup>H NMR Spectrum of morpholin-4-ium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2f) in DMSO-d<sub>6</sub>*



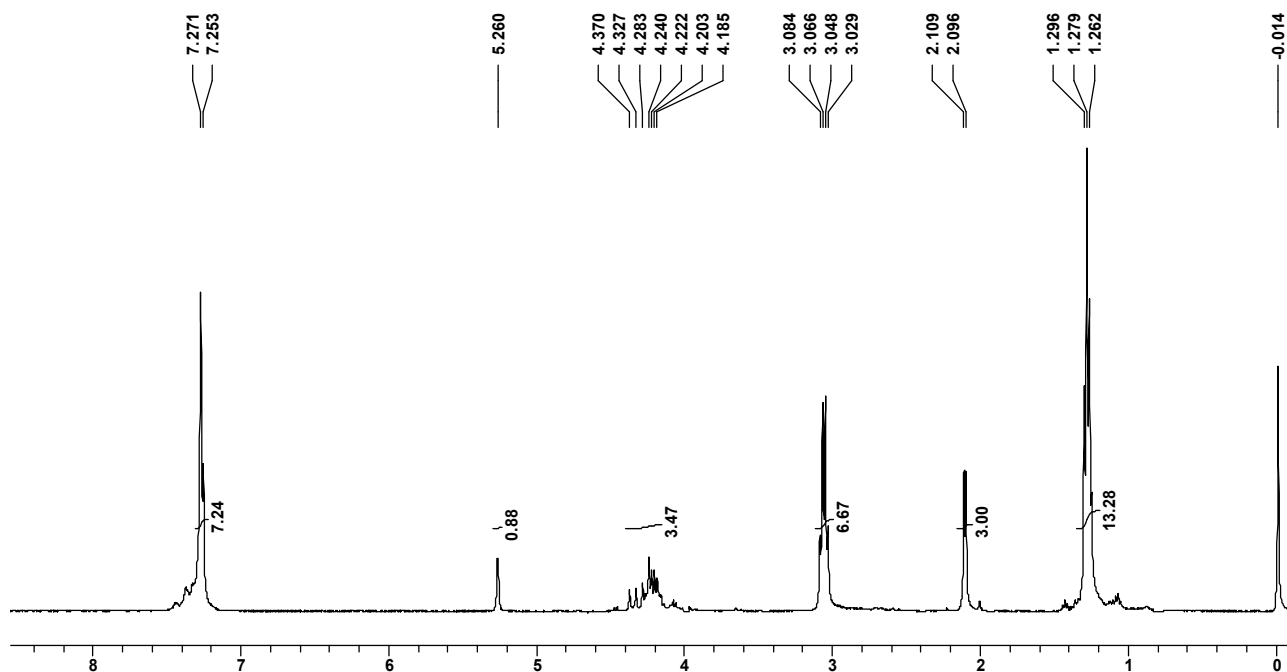
*<sup>13</sup>C NMR Spectrum of morpholin-4-ium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2f) in DMSO-d<sub>6</sub>*



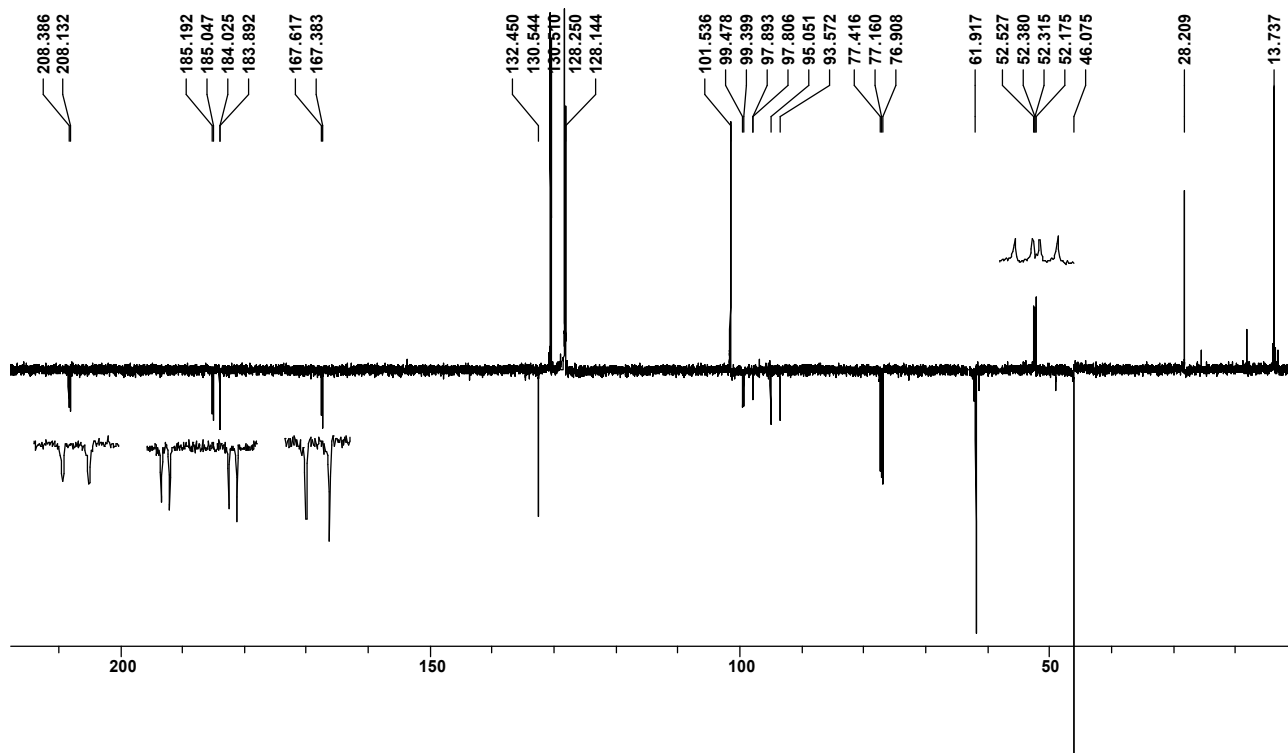
*<sup>19</sup>F NMR Spectrum of triethylammonium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2g) (in EtOH)*



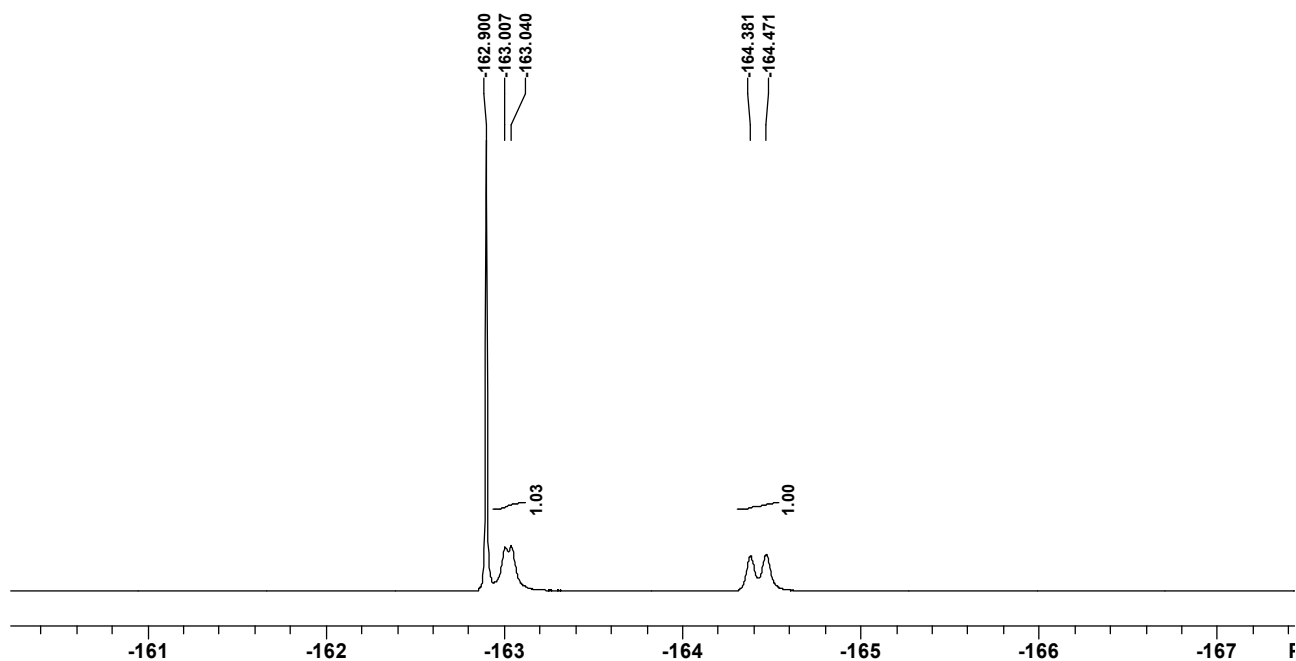
*<sup>1</sup>H NMR Spectrum of triethylammonium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2g) (in CDCl<sub>3</sub>)*



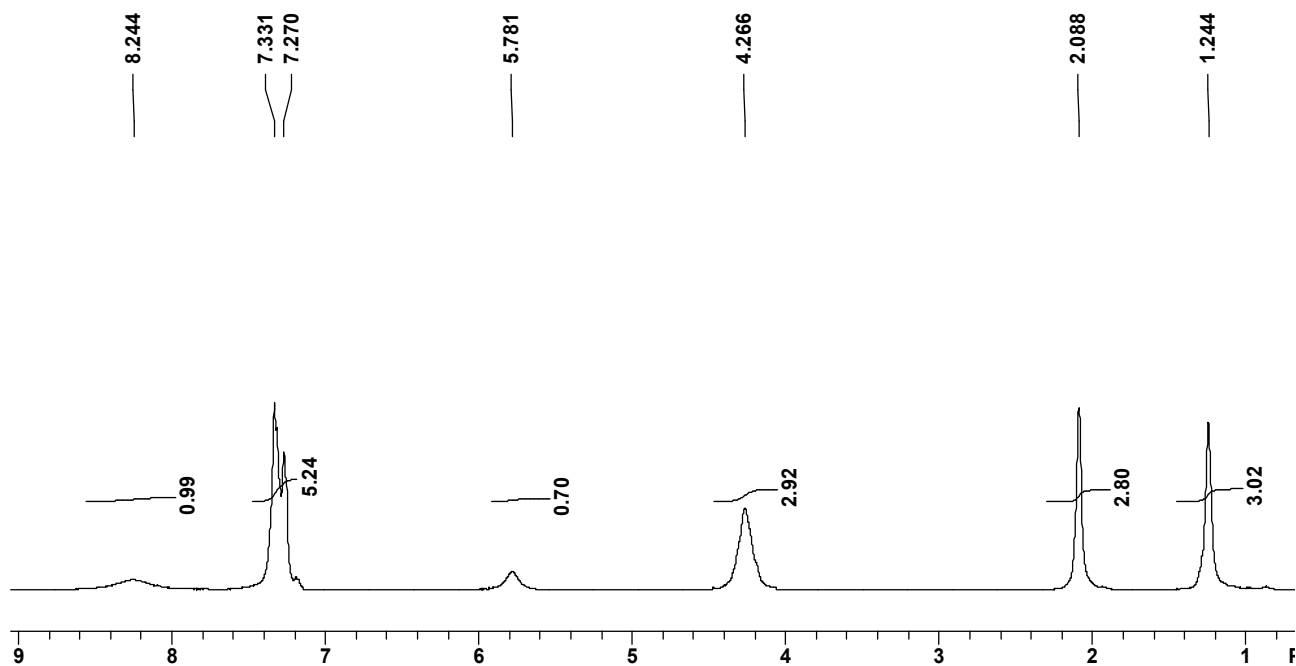
*<sup>13</sup>C NMR Spectrum of triethylammonium 3-acetyl-5-(ethoxycarbonyl)-3,5-difluoro-2,6-dioxo-4-phenylcyclohexan-1-ide (2g) (in CDCl<sub>3</sub>)*



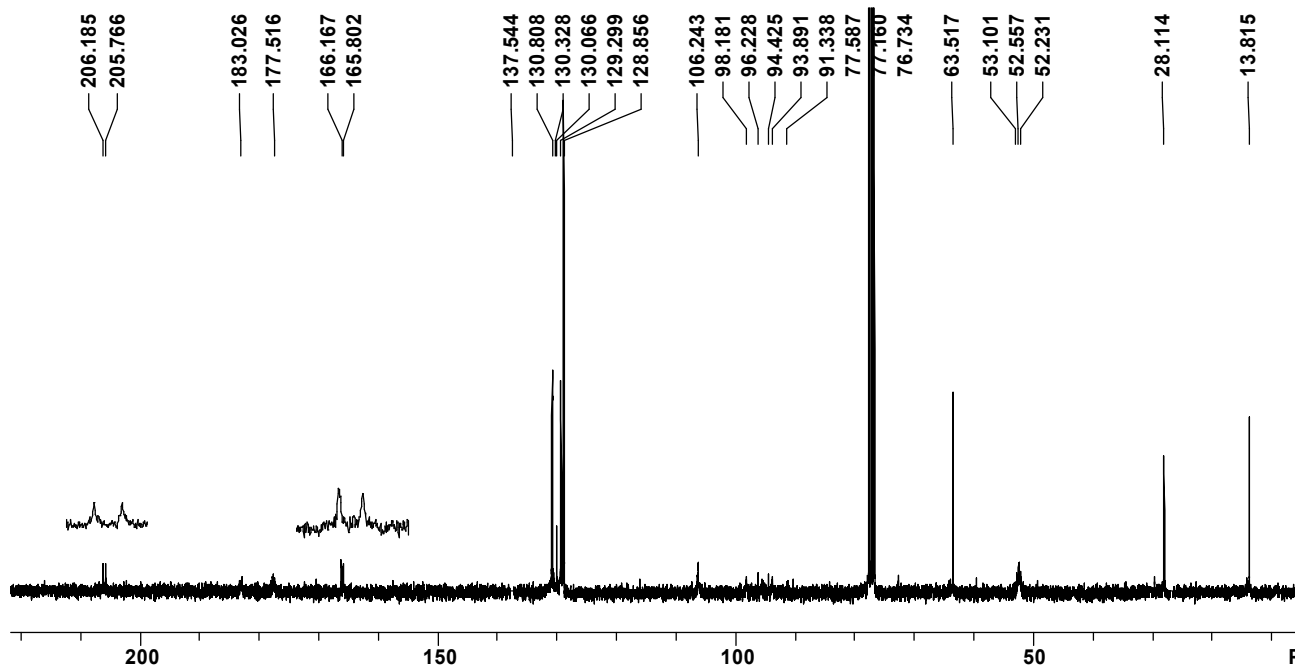
*<sup>19</sup>F NMR Spectrum of ethyl 3-acetyl-1,3-difluoro-4,6-dioxo-2-phenylcyclohexane-1-carboxylate (3a) (in CDCl<sub>3</sub>)*



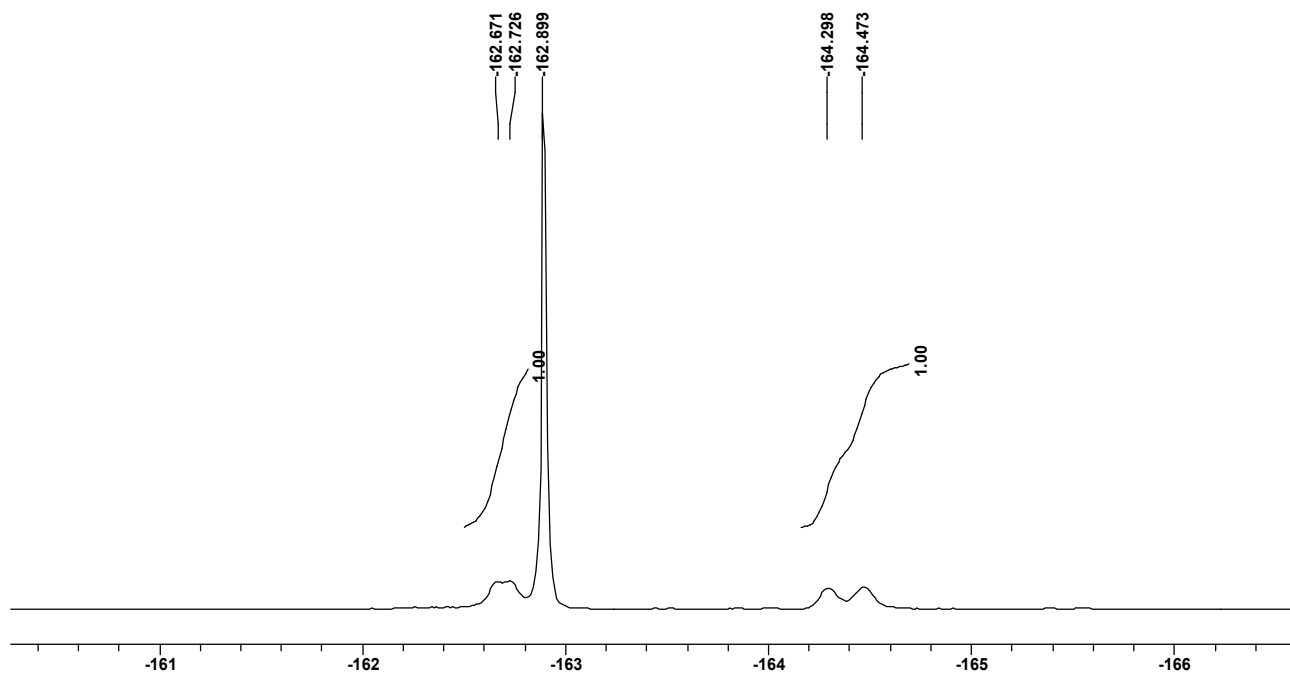
*<sup>1</sup>H NMR Spectrum of ethyl 3-acetyl-1,3-difluoro-4,6-dioxo-2-phenylcyclohexane-1-carboxylate (3a)*  
(in CDCl<sub>3</sub>)



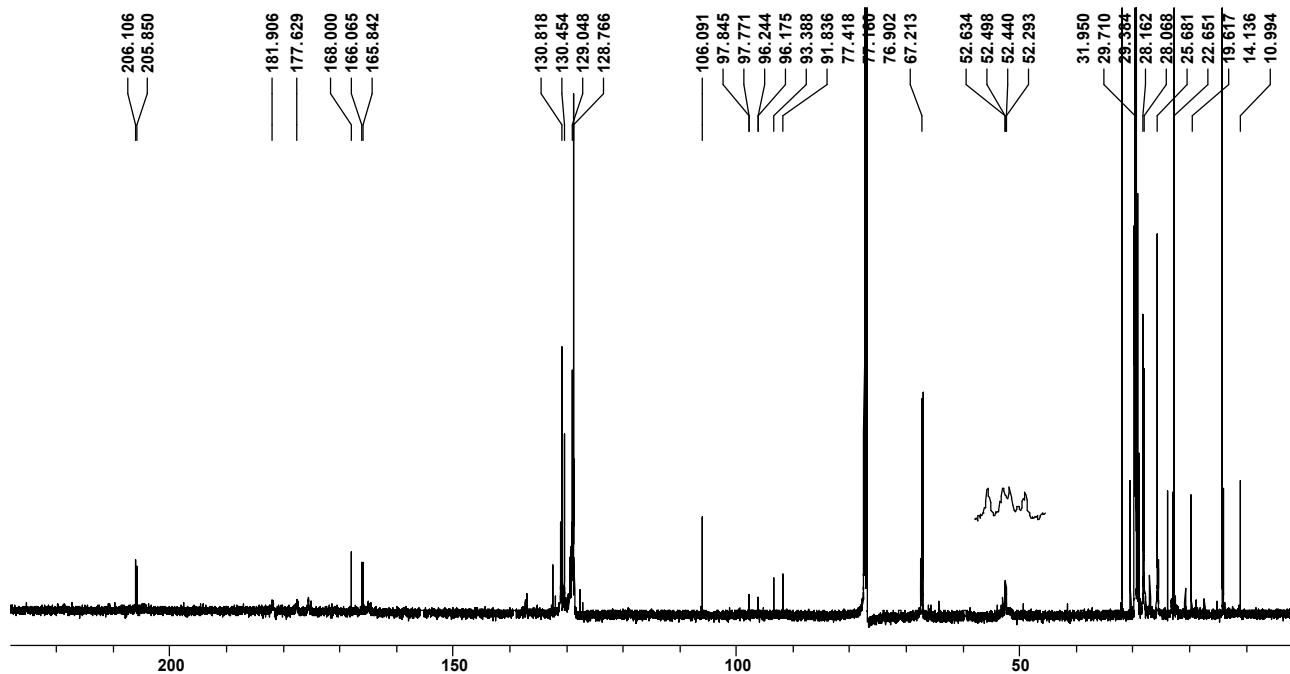
*<sup>13</sup>C NMR Spectrum of ethyl 3-acetyl-1,3-difluoro-4,6-dioxo-2-phenylcyclohexane-1-carboxylate (3a)*  
(in CDCl<sub>3</sub>)



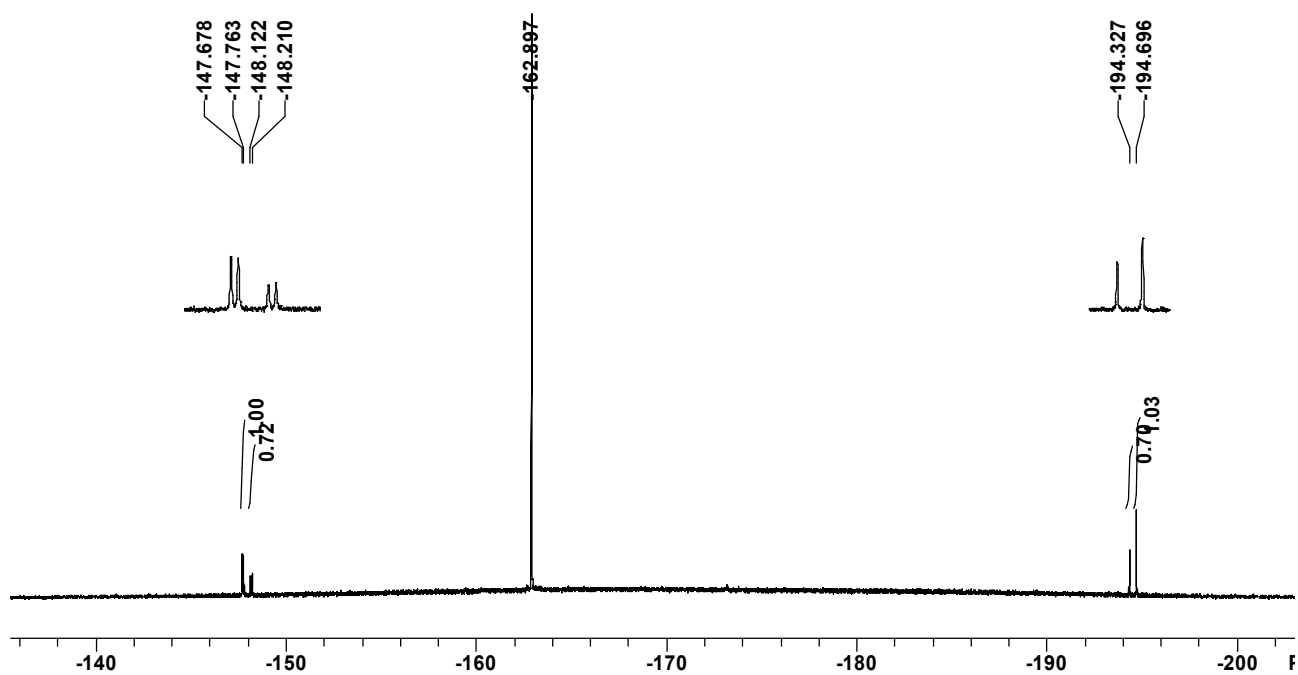
*<sup>19</sup>F NMR Spectrum of dodecyl 3-acetyl-1,3-difluoro-4,6-dioxo-2-phenylcyclohexane-1-carboxylate (3b) (in CDCl<sub>3</sub>)*



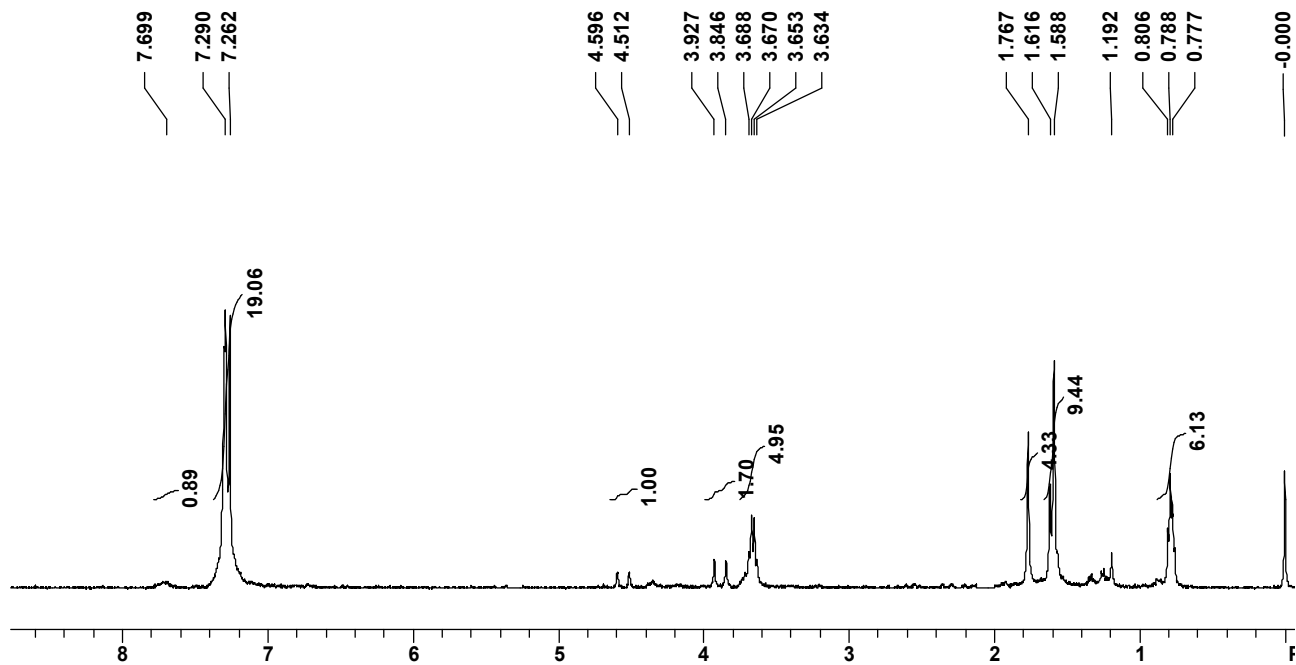
*<sup>13</sup>C NMR Spectrum of dodecyl 3-acetyl-1,3-difluoro-4,6-dioxo-2-phenylcyclohexane-1-carboxylate (3b) (in CDCl<sub>3</sub>)*



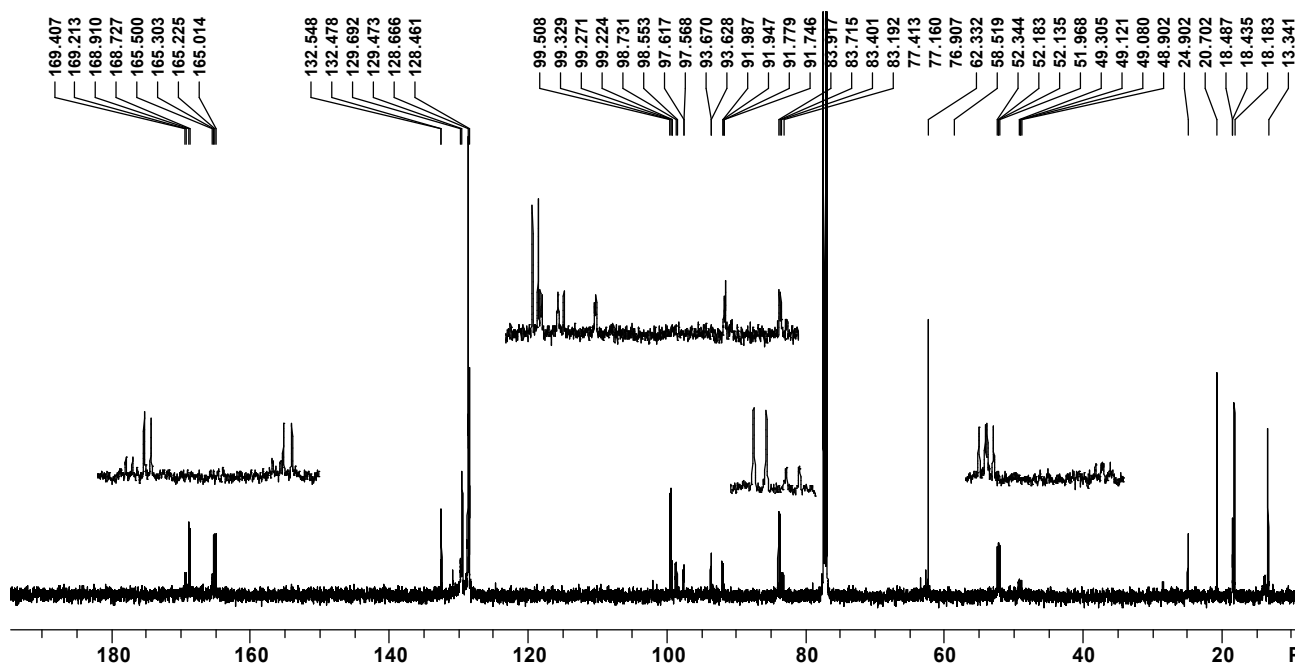
<sup>19</sup>F NMR Spectrum of ethyl (3*RS*,4*RS*,7*RS*,8*RS*)-4,7-difluoro-3-hydroxy-1,3-dimethyl-5-oxo-8-phenyl-2-oxa-6-azabicyclo[2.2.2]octane-7-carboxylate (**4a**) (in CDCl<sub>3</sub>)



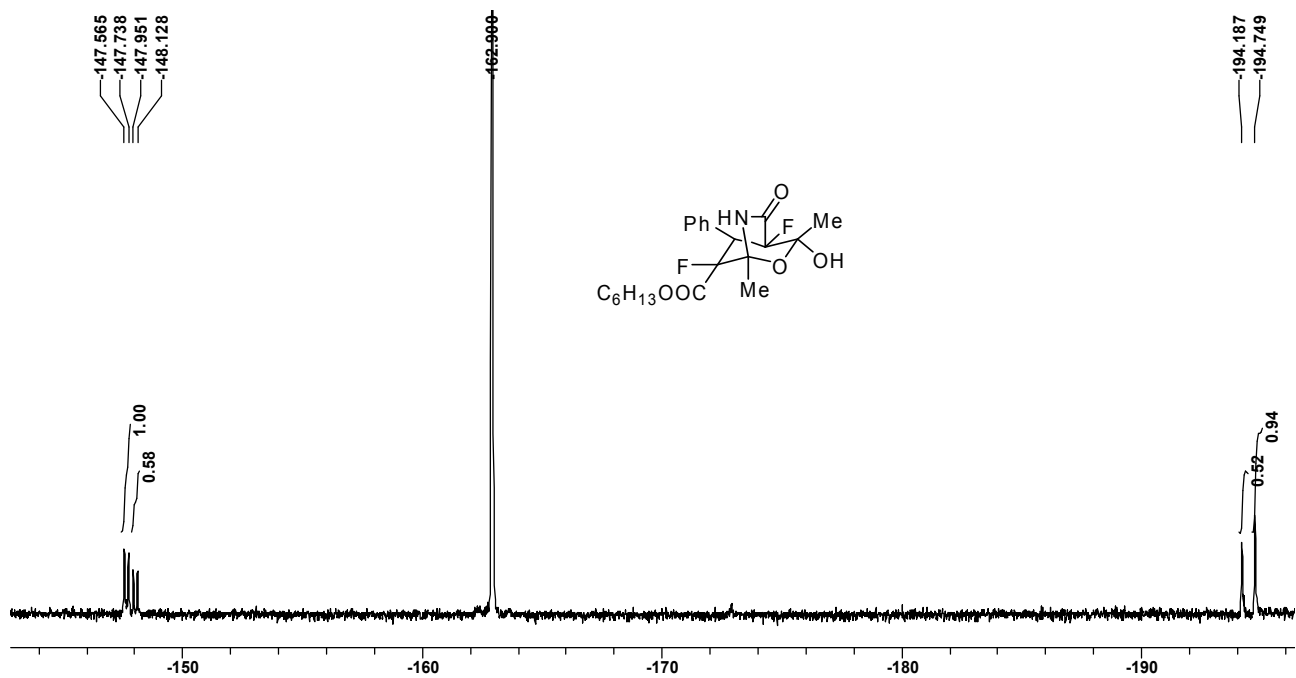
<sup>1</sup>H NMR Spectrum of ethyl (3*RS*,4*RS*,7*RS*,8*RS*)-4,7-difluoro-3-hydroxy-1,3-dimethyl-5-oxo-8-phenyl-2-oxa-6-azabicyclo[2.2.2]octane-7-carboxylate (**4a**) (in CDCl<sub>3</sub>)



<sup>13</sup>C NMR Spectrum of ethyl (3*RS*,4*RS*,7*RS*,8*RS*)-4,7-difluoro-3-hydroxy-1,3-dimethyl-5-oxo-8-phenyl-2-oxa-6-azabicyclo[2.2.2]octane-7-carboxylate (**4a**) (in CDCl<sub>3</sub>)

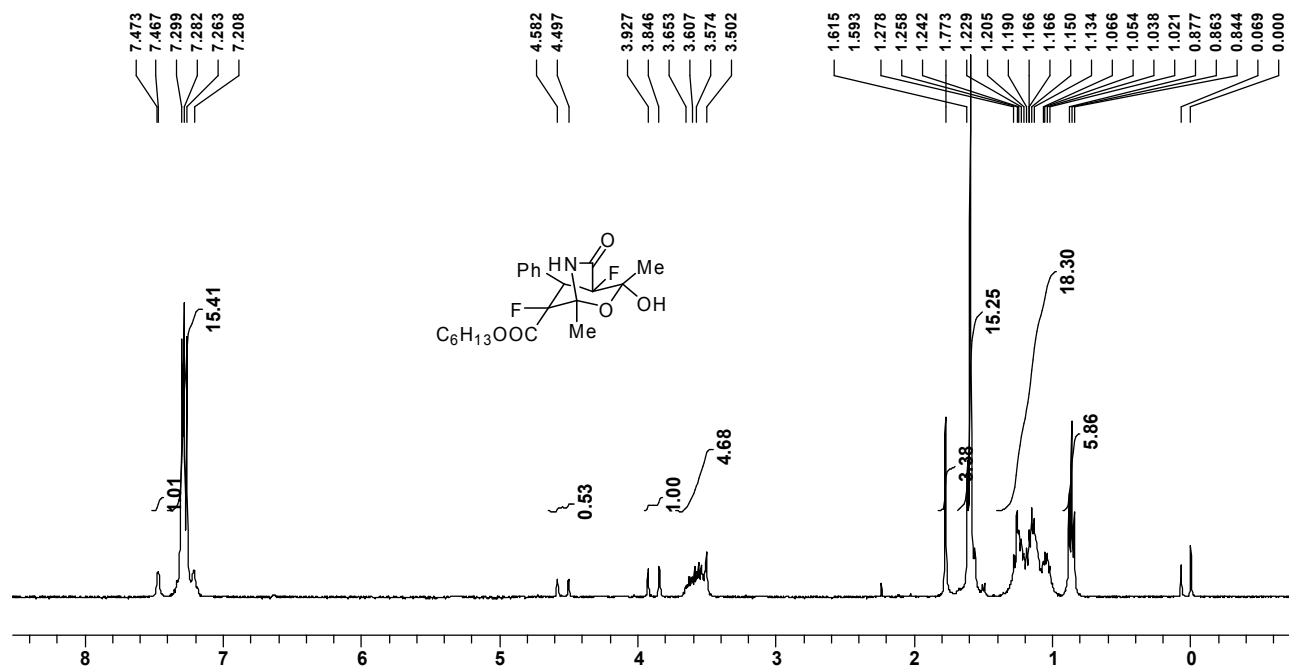


<sup>19</sup>F NMR Spectrum of hexyl (3*RS*,4*RS*,7*RS*,8*RS*)-4,7-difluoro-3-hydroxy-1,3-dimethyl-5-oxo-8-phenyl-2-oxa-6-azabicyclo[2.2.2]octane-7-carboxylate (**4b**) (in CDCl<sub>3</sub>)

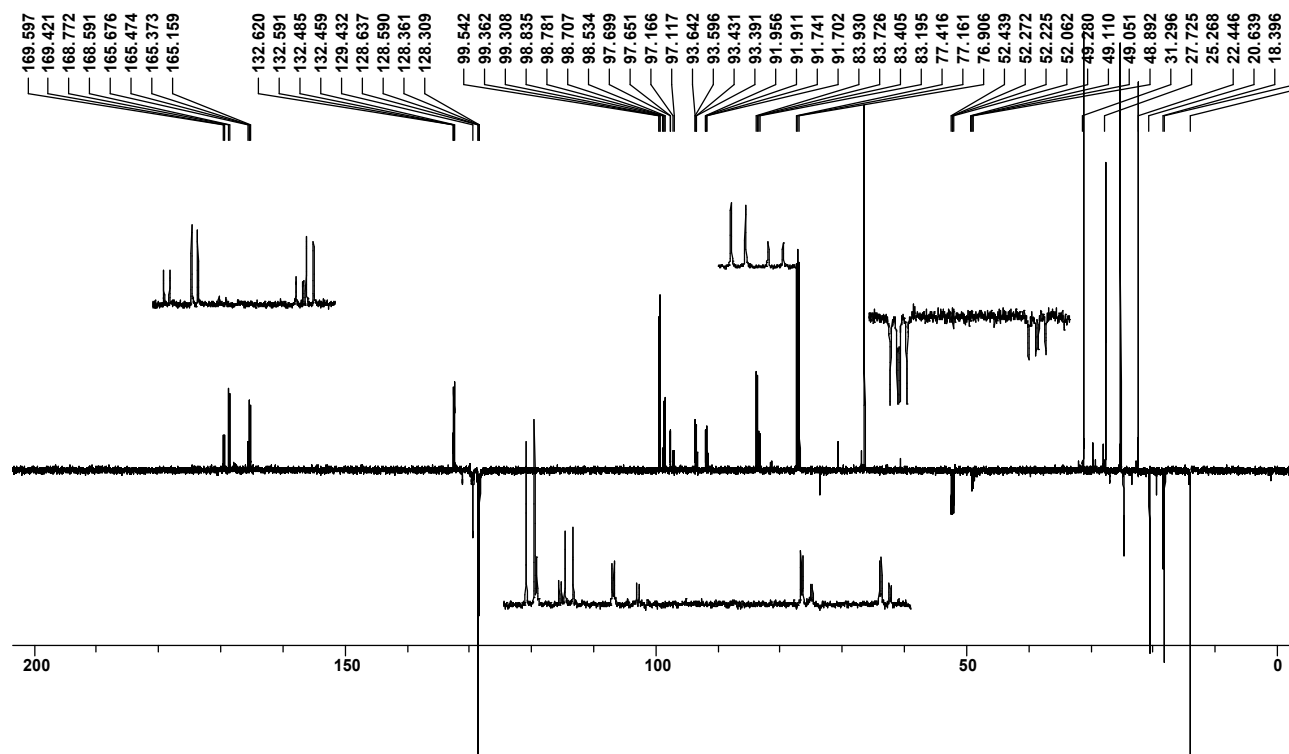




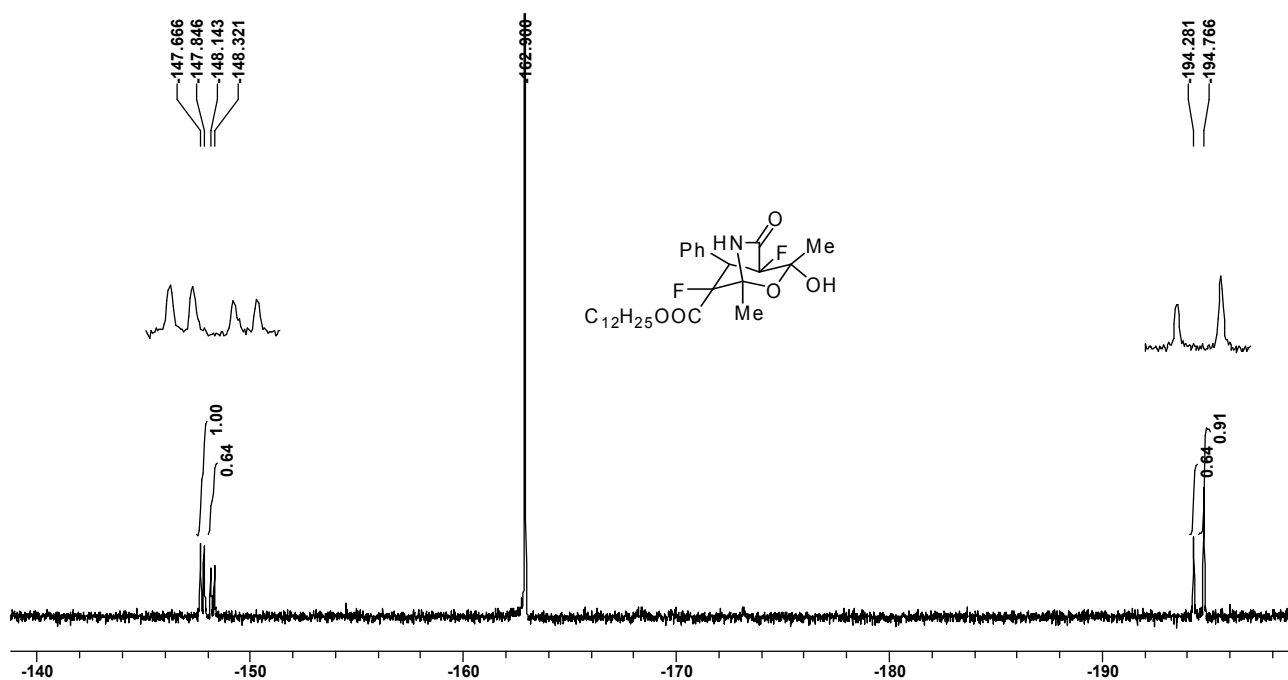
*<sup>1</sup>H NMR Spectrum of hexyl (3*RS*,4*RS*,7*RS*,8*RS*)-4,7-difluoro-3-hydroxy-1,3-dimethyl-5-oxo-8-phenyl-2-oxa-6-azabicyclo[2.2.2]octane-7-carboxylate (4b) (in CDCl<sub>3</sub>)*



*<sup>13</sup>C NMR Spectrum of hexyl (3*RS*,4*RS*,7*RS*,8*RS*)-4,7-difluoro-3-hydroxy-1,3-dimethyl-5-oxo-8-phenyl-2-oxa-6-azabicyclo[2.2.2]octane-7-carboxylate (4b) (in CDCl<sub>3</sub>)*



*<sup>19</sup>F NMR Spectrum of dodecyl (3*RS*,4*RS*,7*RS*,8*RS*)-4,7-difluoro-3-hydroxy-1,3-dimethyl-5-oxo-8-phenyl-2-oxa-6-azabicyclo[2.2.2]octane-7-carboxylate (4c) (in CDCl<sub>3</sub>)*



*<sup>13</sup>C NMR Spectrum of dodecyl (3*RS*,4*RS*,7*RS*,8*RS*)-4,7-difluoro-3-hydroxy-1,3-dimethyl-5-oxo-8-phenyl-2-oxa-6-azabicyclo[2.2.2]octane-7-carboxylate (4c) (in CDCl<sub>3</sub>)*

