

Supporting information

I. Single crystal X-ray diffraction

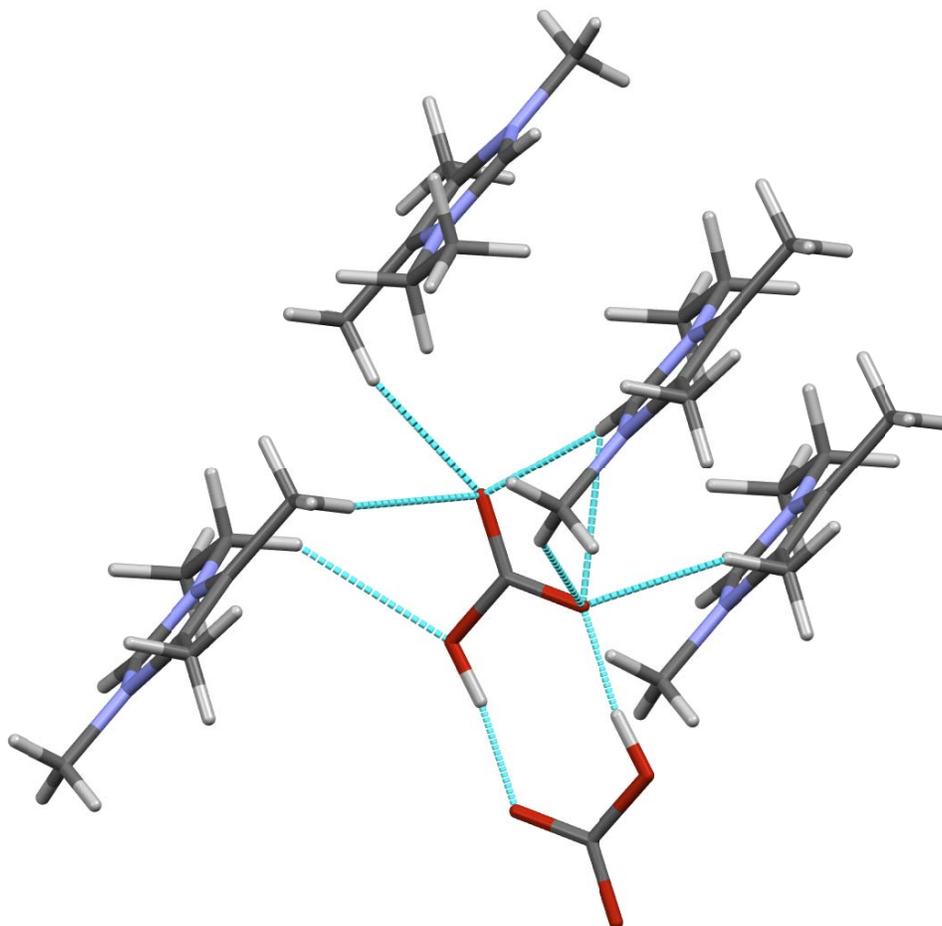
- a.* 1-Ethyl-3,4,5-trimethylimidazolium hydrogen carbonate [C₂m₃im][HCO₃] (**9c**)
- b.* 1-Ethyl-3,4,5-trimethylimidazolium chloride [C₂m₃im][Cl] (**18c**)
- c.* 1-Ethyl-2,3,4,5-tetramethylimidazolium chloride [C₂C₁m₃im][Cl] (**18a**)

II. NMR spectroscopy: ¹³C and ¹H spectroscopy

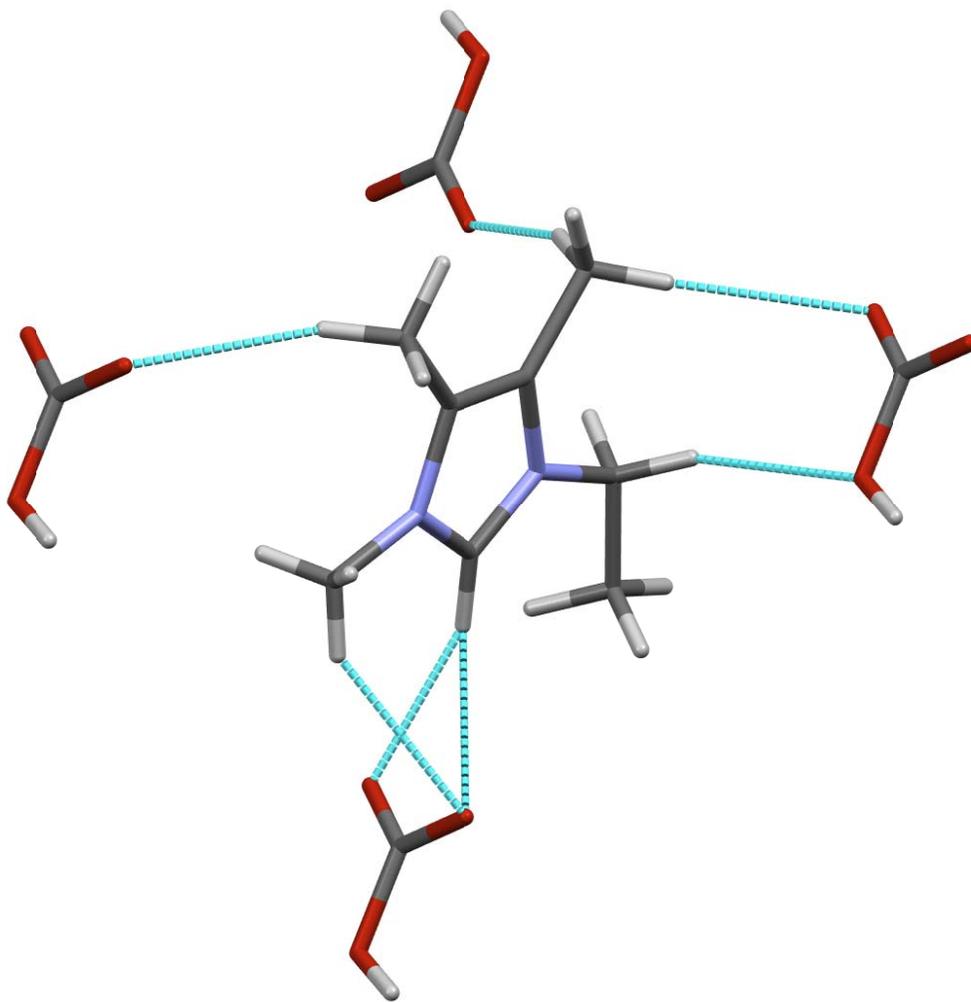
- a.* 1-Ethyl-3,4,5-trimethylimidazolium hydrogen carbonate [C₂m₃im][HCO₃] (**9c+12**)
- b.* 1-Ethyl-3,4,5-trimethylimidazolium hydrogen carbonate [C₂m₃im][HCO₃] (**9c**)
- c.* 1-Ethyl-3,4,5-trimethylimidazolium methyl carbonate [C₂m₃im][CH₃CO₃] (**8c**)
- d.* 1-Ethyl-2,3,4,5-tetramethylimidazolium hydrogen carbonate [C₂C₁m₃im][HCO₃] (**9a**)
- e.* 1-Ethyl-2-isopropyl-3,4,5-trimethylimidazolium hydrogen carbonate [C₂C_{i3}m₃im][HCO₃] (**9b**)
- f.* 1-Ethyl-3,4,5-trimethylimidazolium chloride [C₂m₃im][Cl] (**18c**)
- g.* 1-Ethyl-2,3,4,5-tetramethylimidazolium chloride [C₂C₁m₃im][Cl] (**18a**)

a) Compound 9c

Hydrogen bonding around each $[\text{HCO}_3]^-$ anion includes interactions with four $[\text{C}_2\text{m}_3\text{im}]^+$ cations, with a total of seven hydrogen bonds: $\text{C1-H1}\cdots\text{O3} = 2.241(10) \text{ \AA}$; $\text{C1-H1}\cdots\text{O2} = 2.609(8) \text{ \AA}$; $\text{C4-H4}\cdots\text{O2} = 2.510(11) \text{ \AA}$; $\text{C5-H5}\cdots\text{O2} = 2.465(12) \text{ \AA}$; $\text{C6-H6A}\cdots\text{O3} = 2.558(9) \text{ \AA}$; $\text{C6-H6C}\cdots\text{O3} = 2.480(11) \text{ \AA}$; $\text{C7-H7A}\cdots\text{O1} = 2.633(7) \text{ \AA}$. Hydrogen bonding around each $[\text{C}_2\text{m}_3\text{im}]^+$ cation includes the same interactions with four $[\text{HCO}_3]^-$ anions (Figure S1, S2).



*Figure S1. Hydrogen-bond interactions between each $[\text{HCO}_3]^-$ anion and $[\text{C}_2\text{m}_3\text{im}]^+$ cations in the crystal structure of **9c**. One $[\text{HCO}_3]^-$ dimer is shown.*



*Figure S2. Hydrogen-bond interactions between each [C₂m₃im]⁺ cation and [HCO₃]⁻ anions in the crystal structure of **9c**.*

In the crystal packing, short ring-interactions are observed between the [C₂m₃im]⁺ cation imidazolium rings (ring centroid-centroid distances of 4.6055(8) Å and 5.1113(8) Å). C-H...ring interactions occur between C5-H5 and C8-H8 and the [C₂m₃im]⁺ cation imidazolium ring (distances of 2.815(9) Å and 2.780(13) Å, respectively). Furthermore, alternating layers of [HCO₃]⁻ anion dimers and [C₂m₃im]⁺ cations are detected, parallel with the (010) crystallographic plane (Figure S3).

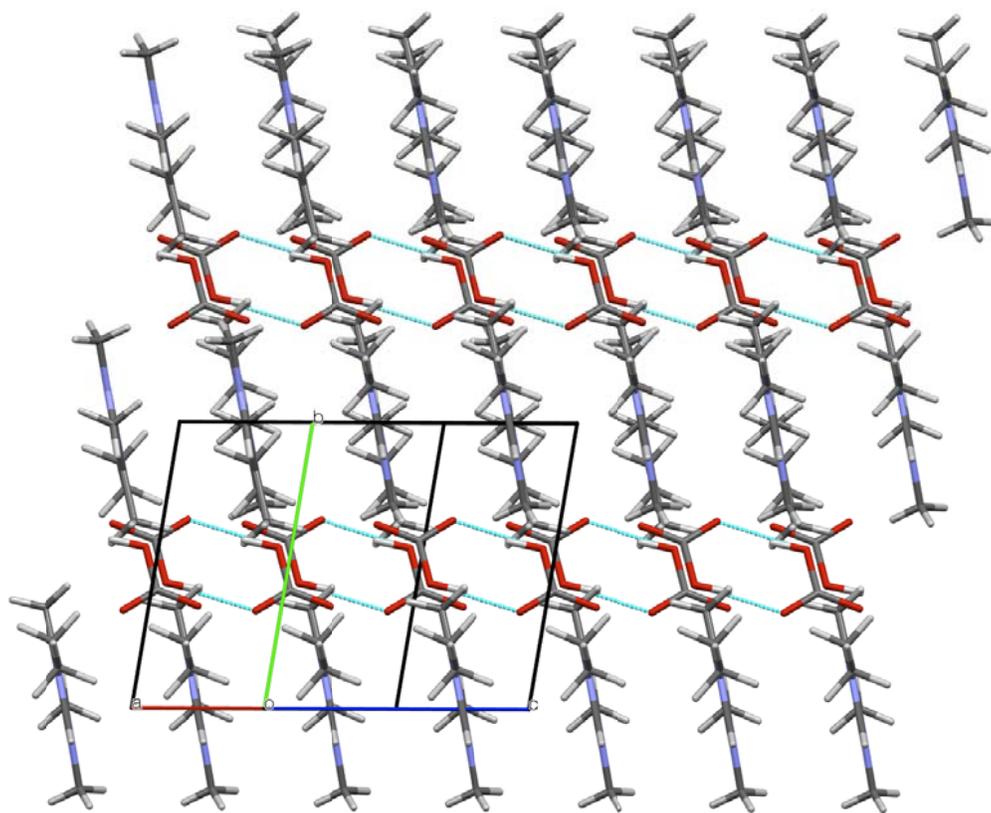


Figure S3. Packing diagram in the crystal structure of **9c**, showing alternating layers of [HCO₃]⁻ anion dimers and [C₂m₃im]⁺ cations, parallel with the (010) crystallographic plane.

b) Compound **18c**

Hydrogen bonding around each $[\text{Cl}]^-$ anion includes interactions with five $[\text{C}_2\text{m}_3\text{im}]^+$ cations: $\text{C1-H1}\cdots\text{Cl1} = 2.499(10) \text{ \AA}$; $\text{C4-H4B}\cdots\text{Cl1} = 2.794(9) \text{ \AA}$; $\text{C4-H4C}\cdots\text{Cl1} = 2.701(12) \text{ \AA}$; $\text{C7-H7A}\cdots\text{Cl1} = 2.702(9) \text{ \AA}$; $\text{C7-H7B}\cdots\text{Cl1} = 2.698(11) \text{ \AA}$. Hydrogen bonding around each $[\text{C}_2\text{m}_3\text{im}]^+$ cation includes the same interactions with four $[\text{Cl}]^-$ anions (Figure S4, S5).

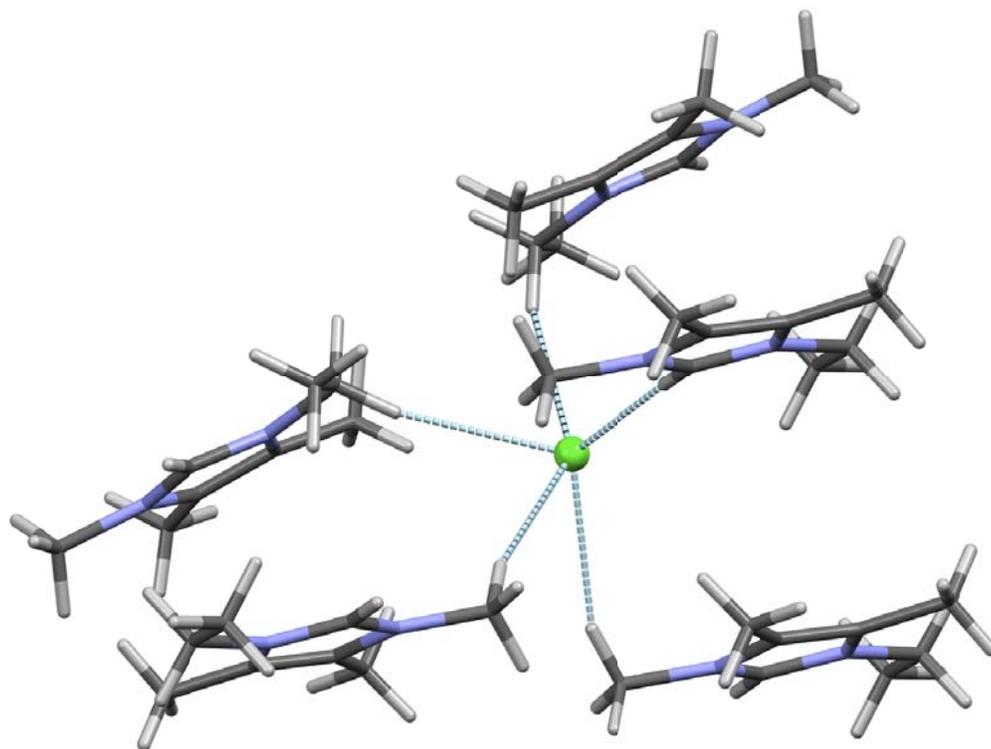


Figure S4. Hydrogen-bond interactions between each $[\text{Cl}]^-$ anion and $[\text{C}_2\text{m}_3\text{im}]^+$ cations in the crystal structure of **18c**.

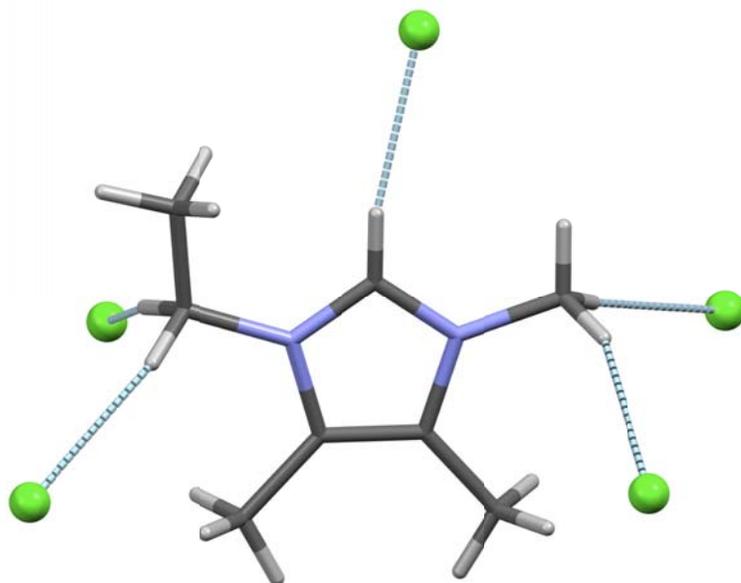


Figure S5. Hydrogen-bond interactions between each $[\text{C}_2\text{m}_3\text{im}]^+$ cation and $[\text{Cl}]^-$ anions in the crystal structure of **18c**.

In the crystal packing, short ring-interactions are observed between the $[\text{C}_2\text{m}_3\text{im}]^+$ cation imidazolium rings (ring centroid-centroid distances of $4.9493(9) \text{ \AA}$ and $4.9492(9) \text{ \AA}$) along the crystallographic $[001]$ direction (Figure S6). C-H \cdots ring interactions occur between C8-H8 and the $[\text{C}_2\text{m}_3\text{im}]^+$ cation imidazolium ring (distance of $2.981(11) \text{ \AA}$).

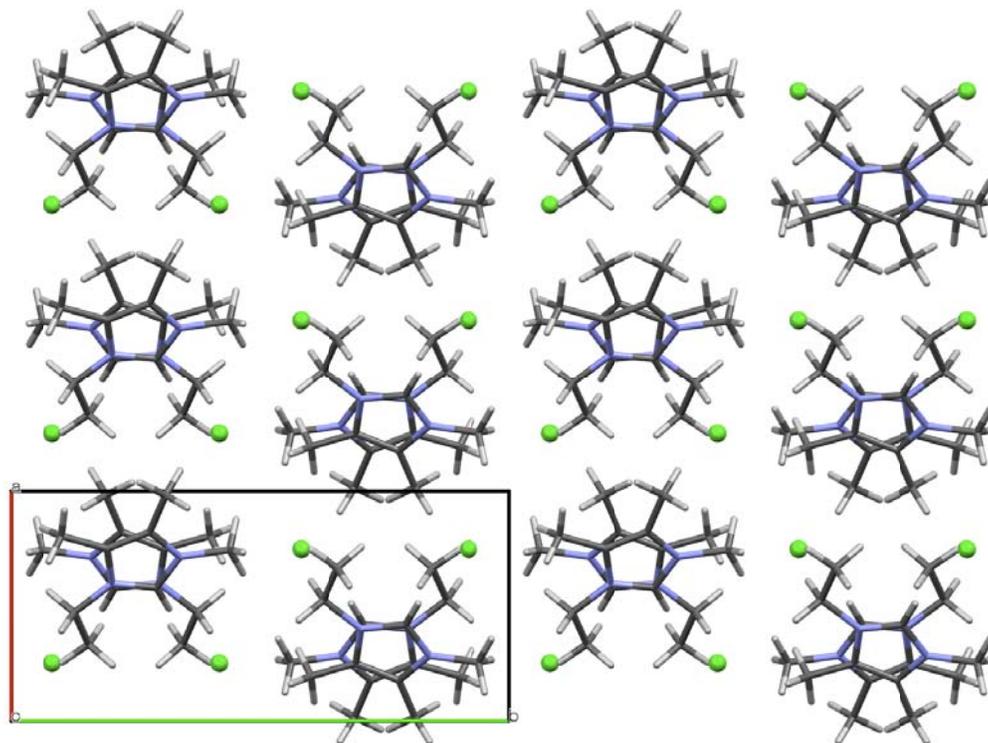
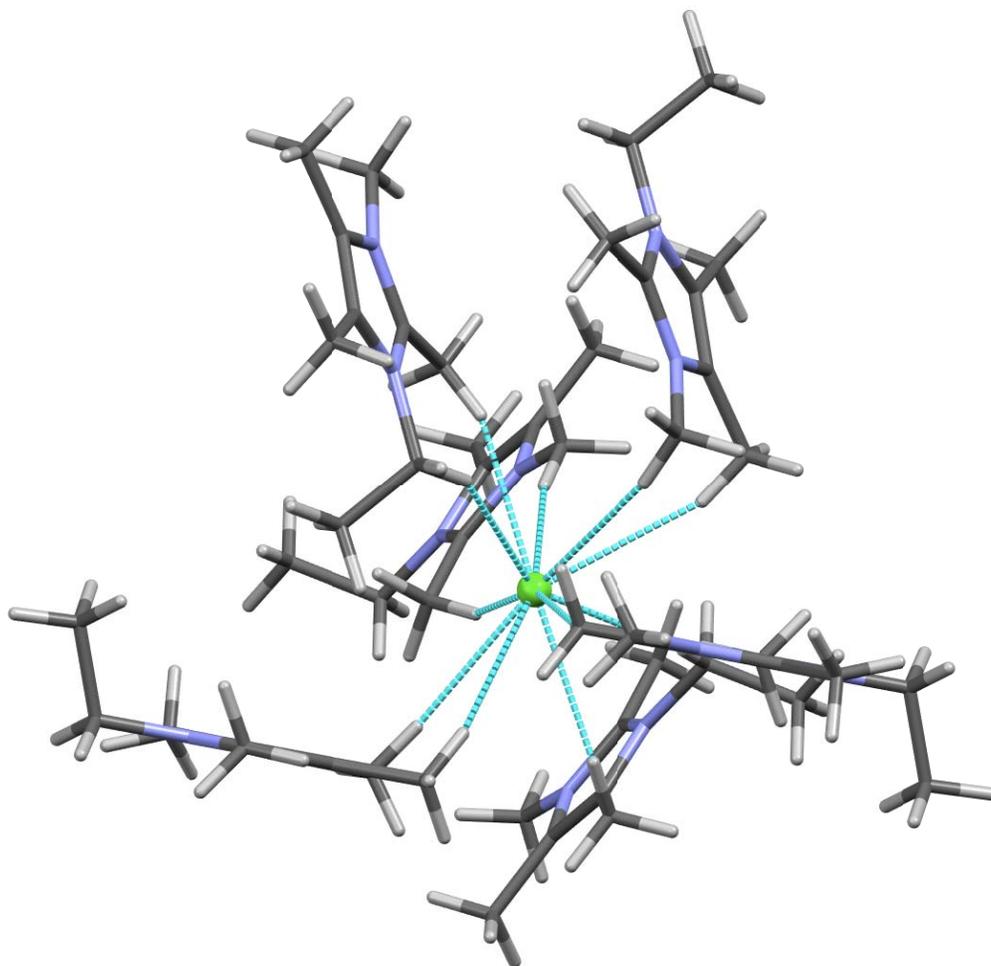


Figure S6. Packing diagram in the crystal structure of **18c**, along the crystallographic $[001]$ direction.

c) Compound **18a**

Hydrogen bonding around each $[\text{Cl}]^-$ anion includes interactions with six $[\text{C}_2\text{C}_1\text{m}_3\text{im}]^+$ cations: $\text{C4-H4B}\cdots\text{Cl1} = 2.920(12) \text{ \AA}$; $\text{C4-H4C}\cdots\text{Cl1} = 2.764(16) \text{ \AA}$; $\text{C5-H5A}\cdots\text{Cl1} = 2.922(14) \text{ \AA}$; $\text{C5-H5B}\cdots\text{Cl1} = 2.746(10) \text{ \AA}$, $\text{C5-H5C}\cdots\text{Cl1} = 2.884(12) \text{ \AA}$; $\text{C6-H6A}\cdots\text{Cl1} = 2.818(12) \text{ \AA}$; $\text{C6-H6B}\cdots\text{Cl1} = 2.786(12) \text{ \AA}$; $\text{C6-H6C}\cdots\text{Cl1} = 2.913(12) \text{ \AA}$; $\text{C7-H7A}\cdots\text{Cl1} = 2.767(13) \text{ \AA}$; $\text{C8-H8A}\cdots\text{Cl1} = 2.793(11) \text{ \AA}$; $\text{C8-H8B}\cdots\text{Cl1} = 2.822(10) \text{ \AA}$. Hydrogen bonding around each $[\text{C}_2\text{C}_1\text{m}_3\text{im}]^+$ cation includes the same interactions with six $[\text{Cl}]^-$ anions (Figure S7, S8).



*Figure S7. Hydrogen-bond interactions between each $[\text{Cl}]^-$ anion and $[\text{C}_2\text{C}_1\text{m}_3\text{im}]^+$ cations in the crystal structure of **18a**.*

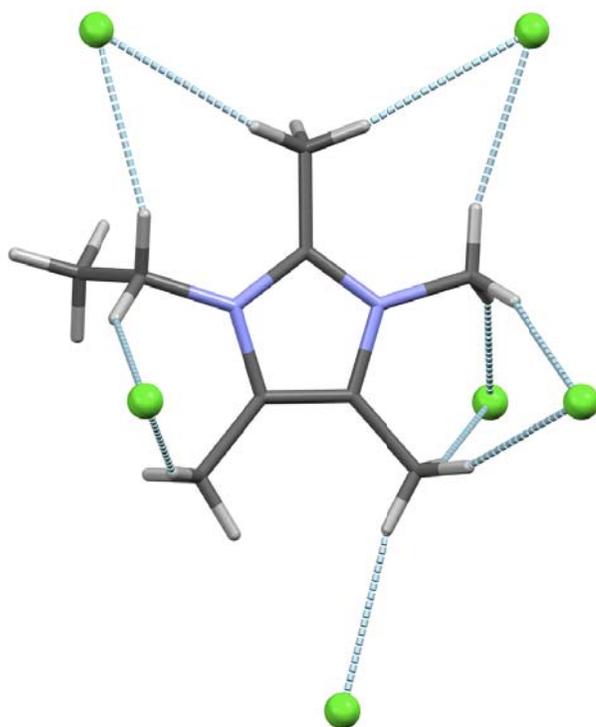


Figure S8. Hydrogen-bond interactions between each $[C_2C_1m_3im]^+$ cation and $[Cl]^-$ anions in the crystal structure of **18a**.

In the crystal packing, short ring-interactions are observed between two $[C_2C_1m_3im]^+$ cation imidazolium rings (ring centroid-centroid distance of 4.9241(11) Å). A typical packing pattern around the three-fold axes and inversion centers is observed along the [001] direction, clustering the $[C_2C_1m_3im]^+$ cation together in a cyclic columnar manner, surrounded by the $[Cl]^-$ anions (Figure S9).

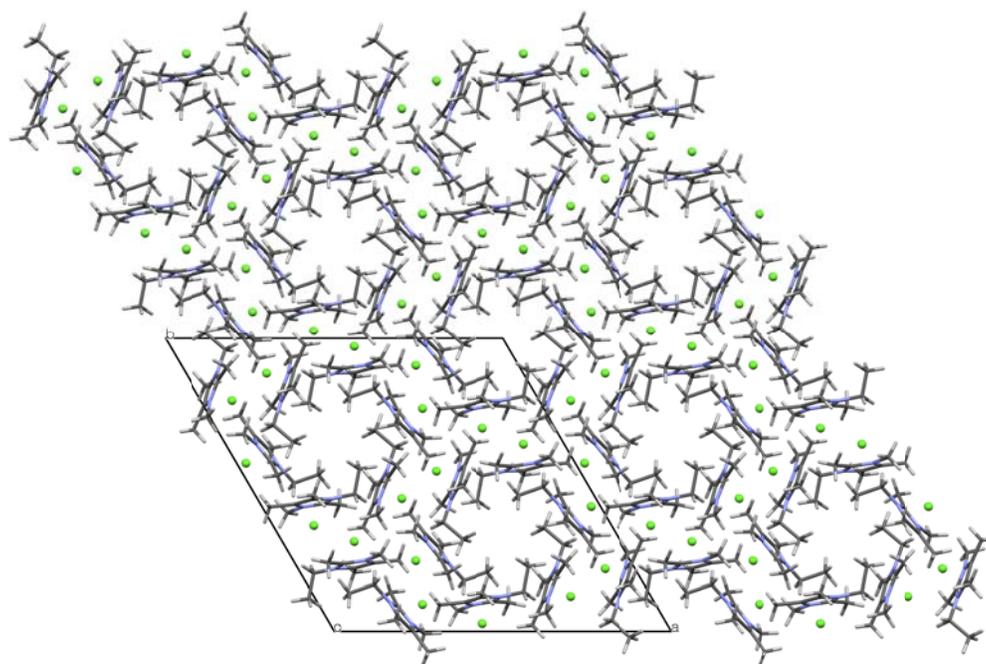
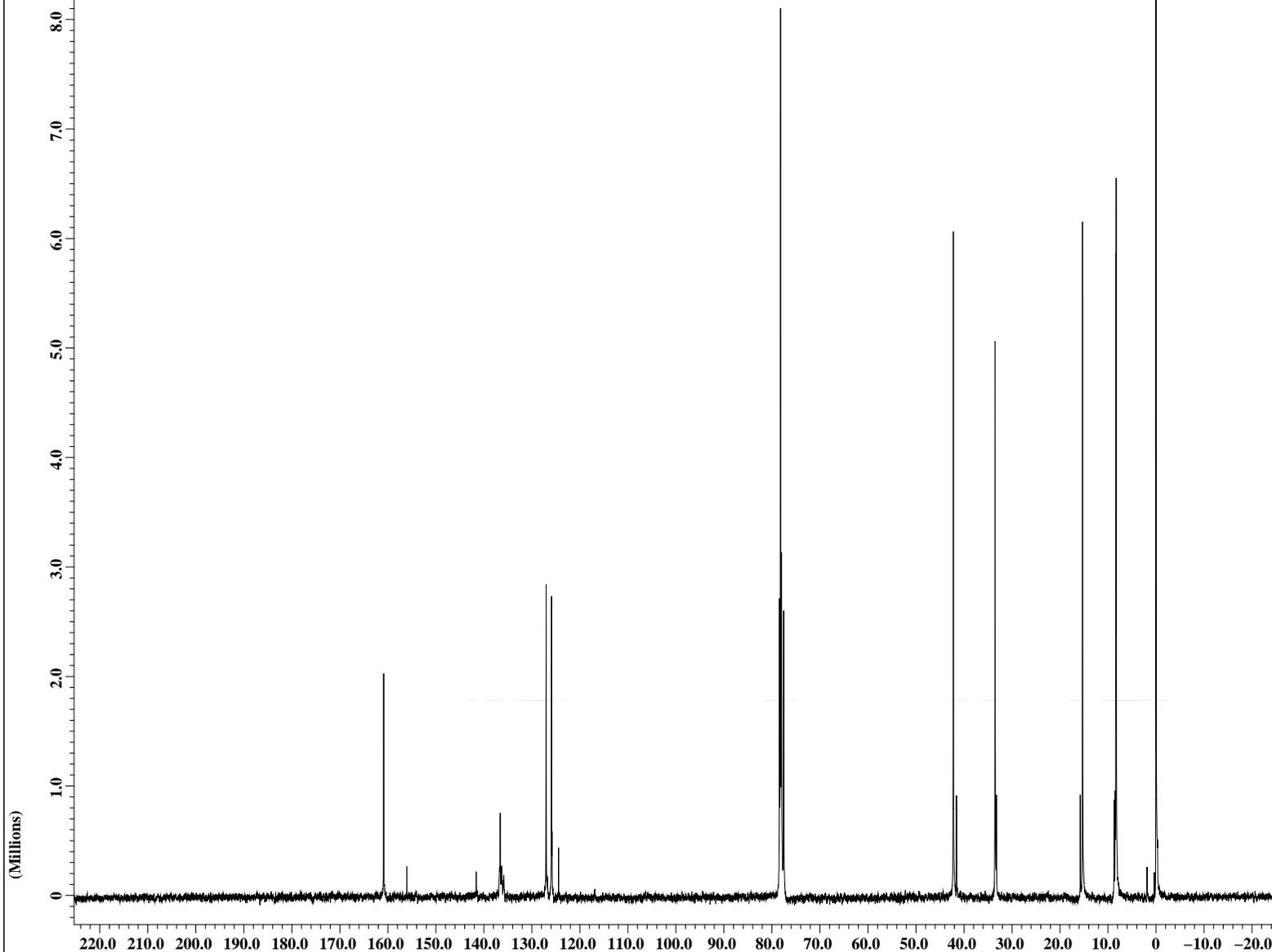


Figure S9. Packing diagram in the crystal structure of **18a**, along the crystallographic [001] direction.



160.8648
156.0401

141.5812
136.5885
136.2984
127.0306
125.9008
125.7939
124.4351

78.4170
78.2032
77.9895

42.2163
41.5598
33.5288
33.2387

15.7567
15.3139
8.7333
8.5196
8.3822
8.2906
-0.0000

X : parts per Million : 13C

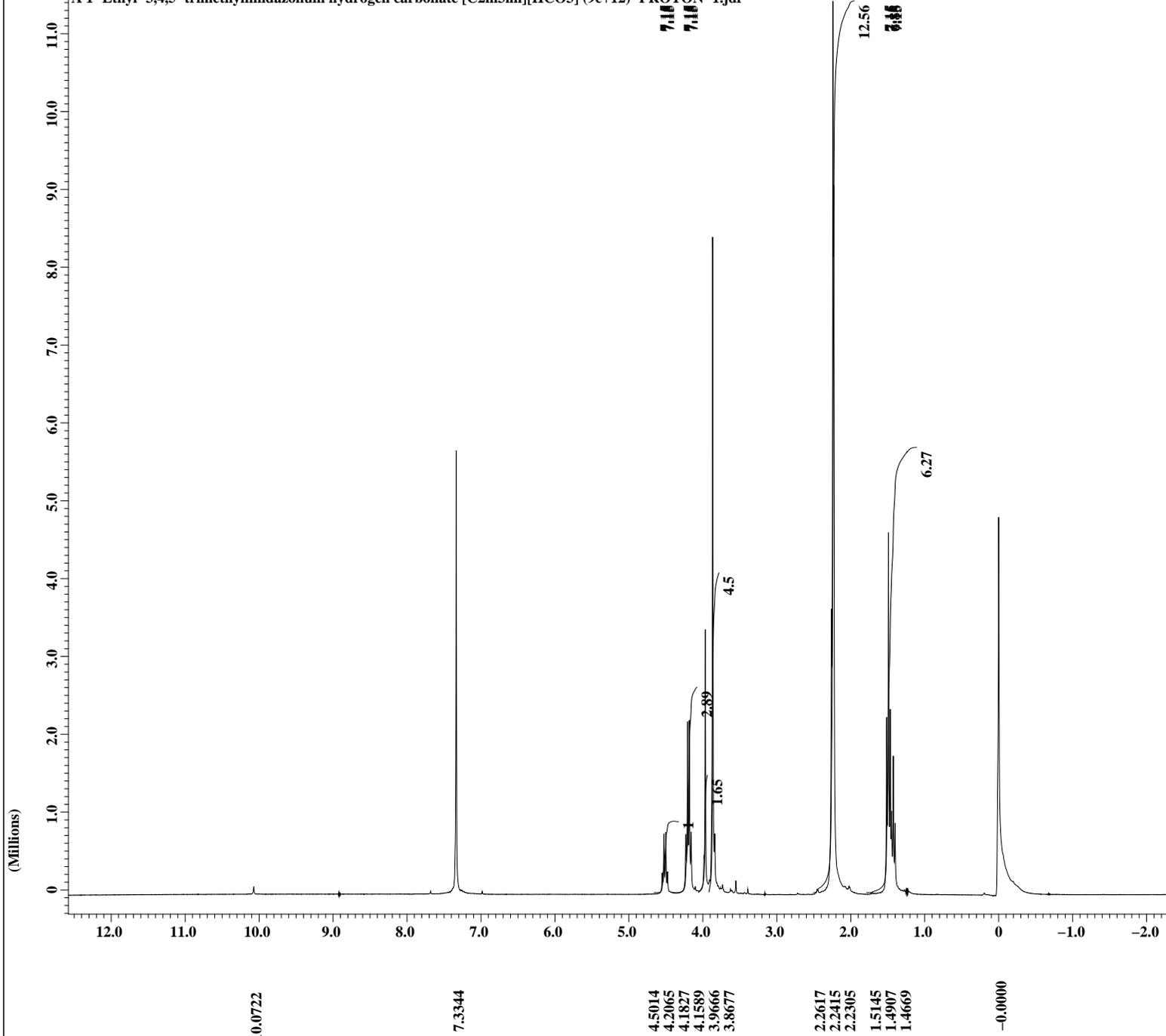
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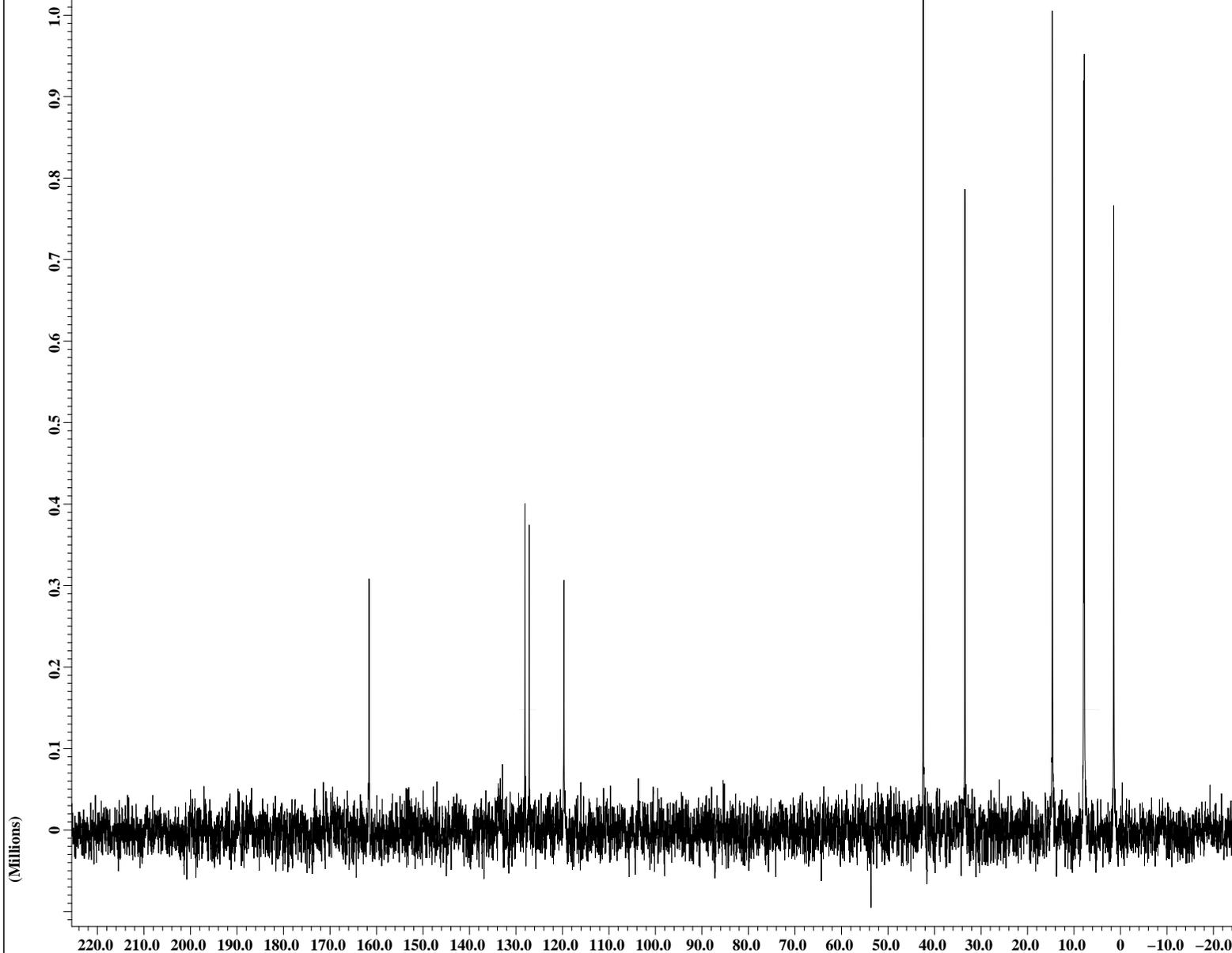
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X : parts per Million : 1H



161.6059
 132.9171
 128.0618
 127.1610
 119.6796

 42.4077
 33.4606

 14.6503
 7.9171
 7.7796
 1.4586

X : parts per Million : 13C

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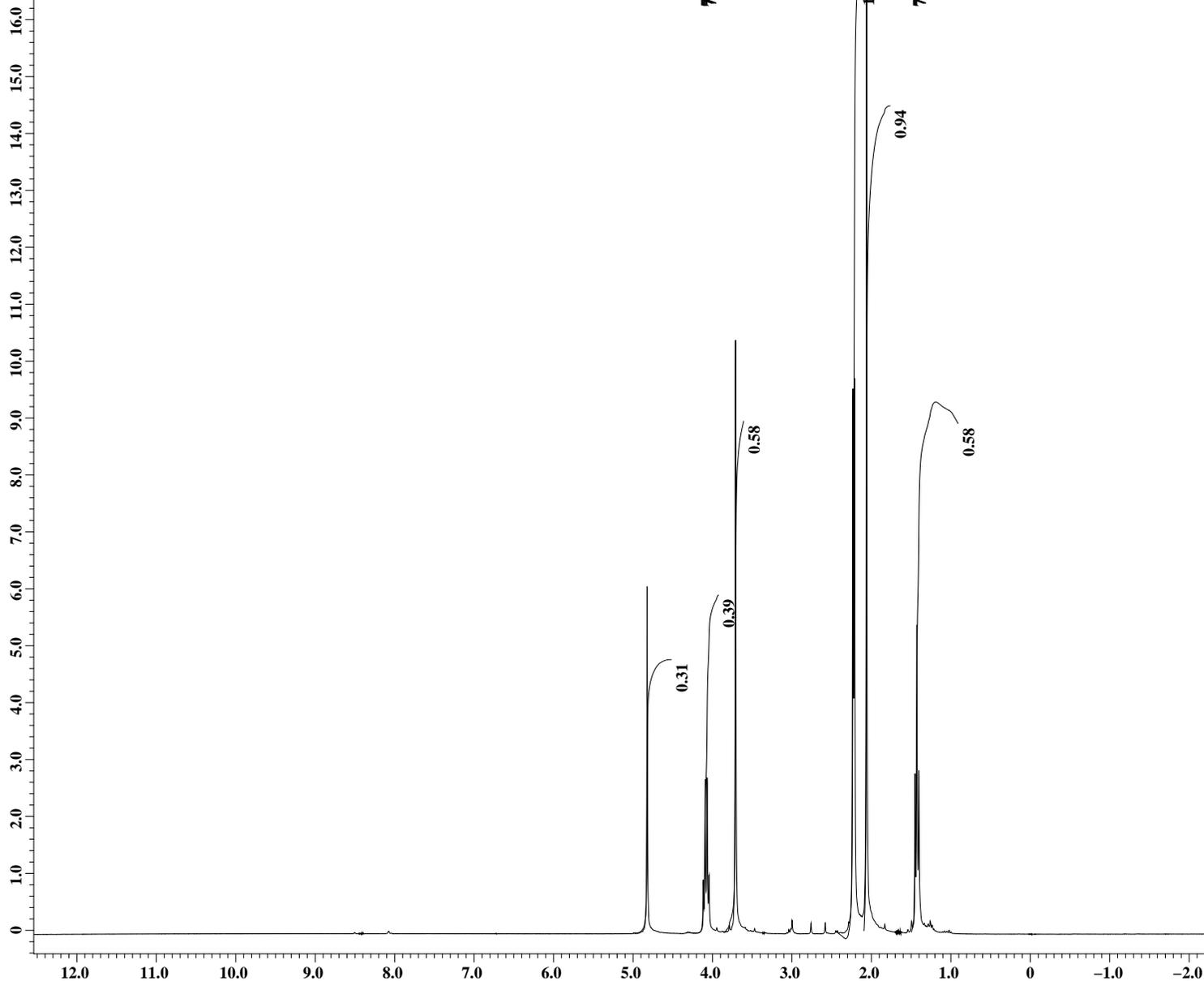
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B 1-Ethyl-3,4,5-trimethylimidazolium hydrogen carbonate [C2m3im][HCO3] (9c)-PROTON-4.jdf



(Millions)



4.8220
4.1151
4.1032
4.0913
4.0675
4.0546
4.0418
3.7085

2.2325
2.2124
2.0604
1.4505
1.4267
1.4029

7.15

1.09

7.15

0.31

0.39

0.58

0.94

0.58

X : parts per Million : 1H

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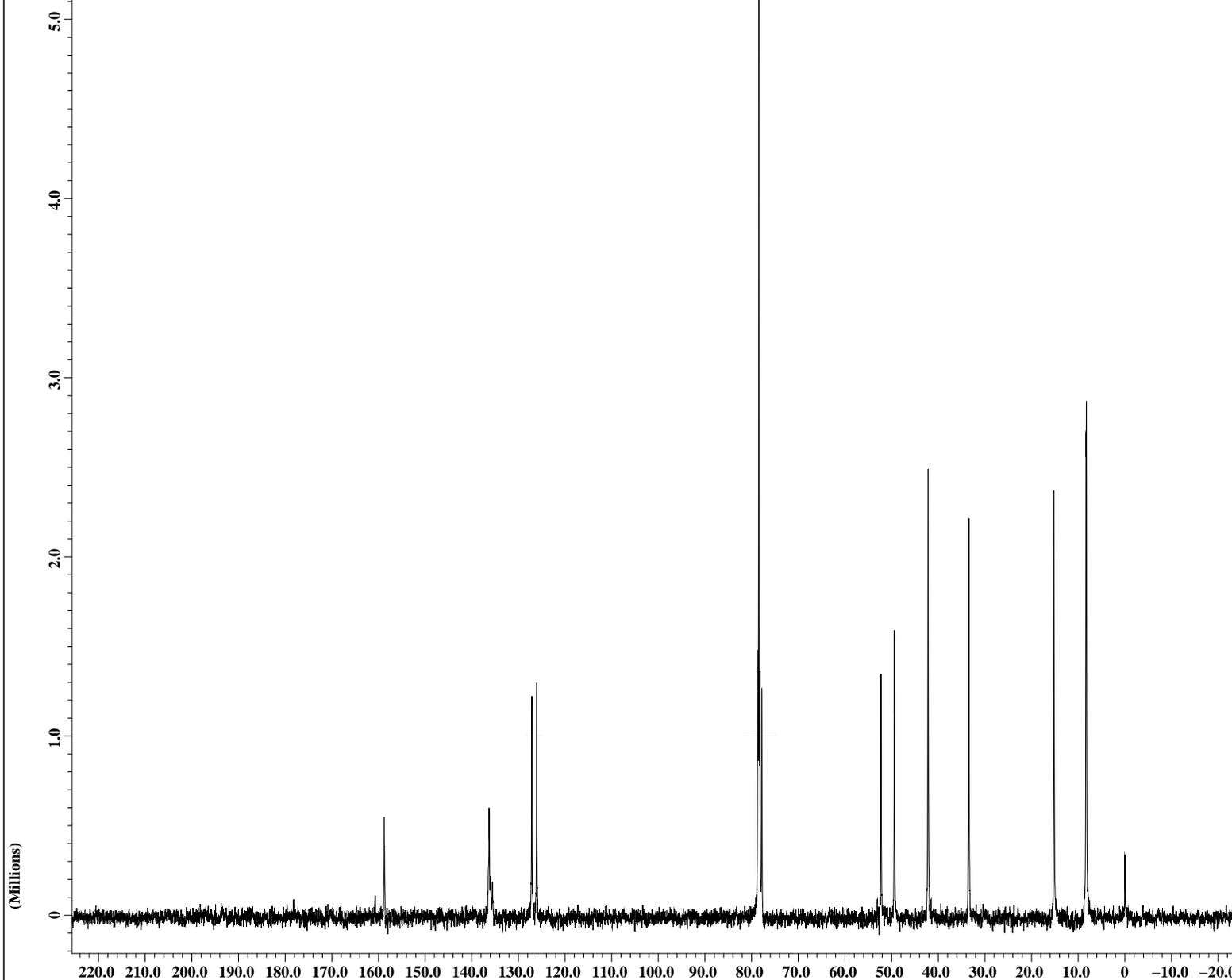
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C 1-Ethyl-3,4,5-trimethylimidazolium methyl carbonate [C2m3im][CH3CO3] (8c)-CARBON-1.jdf



158.7578

136.2832

127.1070
126.0535

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52.2780
49.4076

42.1858

33.4371

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-0.0000

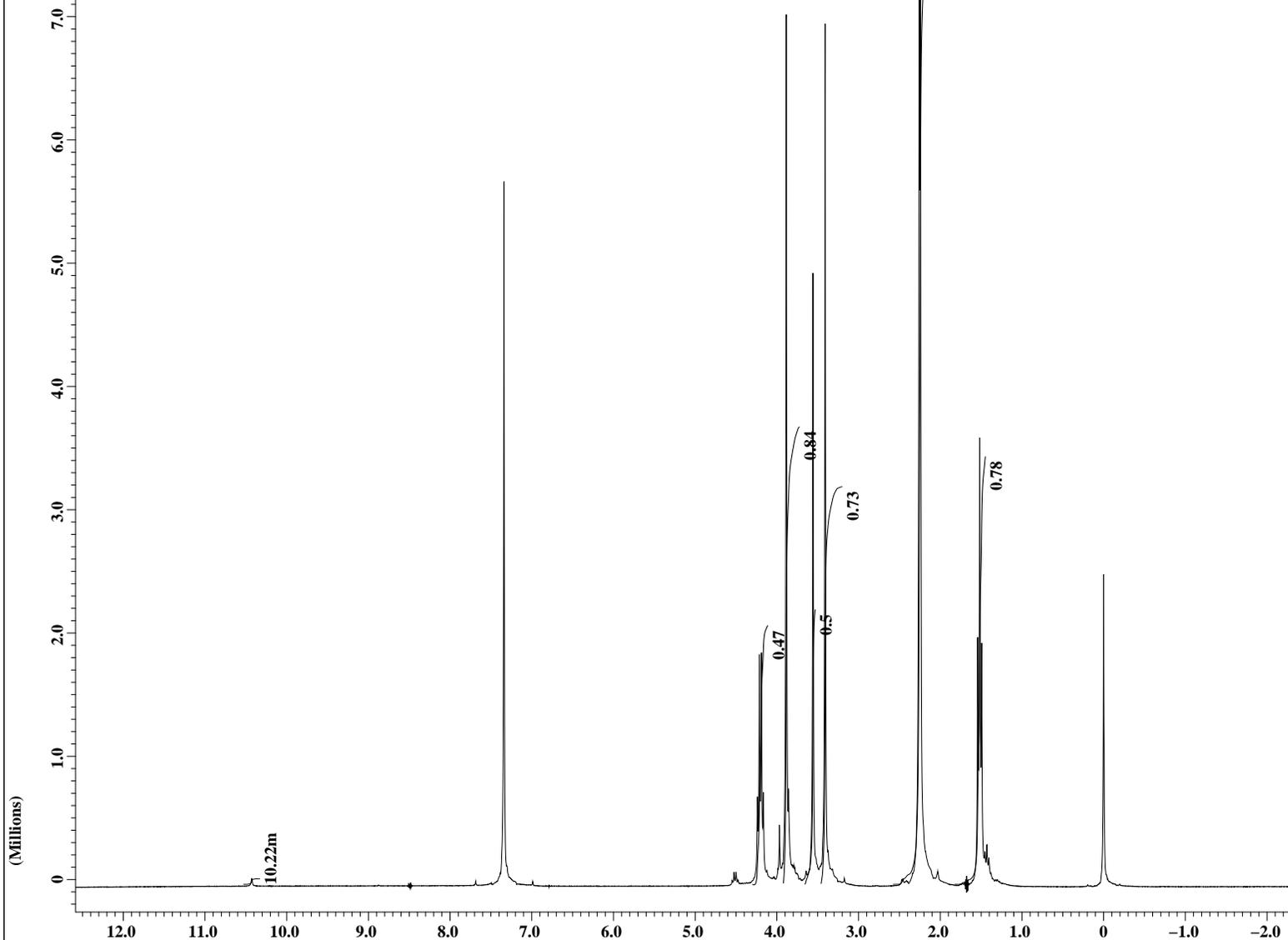
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7.3399

4.2138
4.1882
4.1644
3.8842
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3.4081

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1.5182
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0.0000

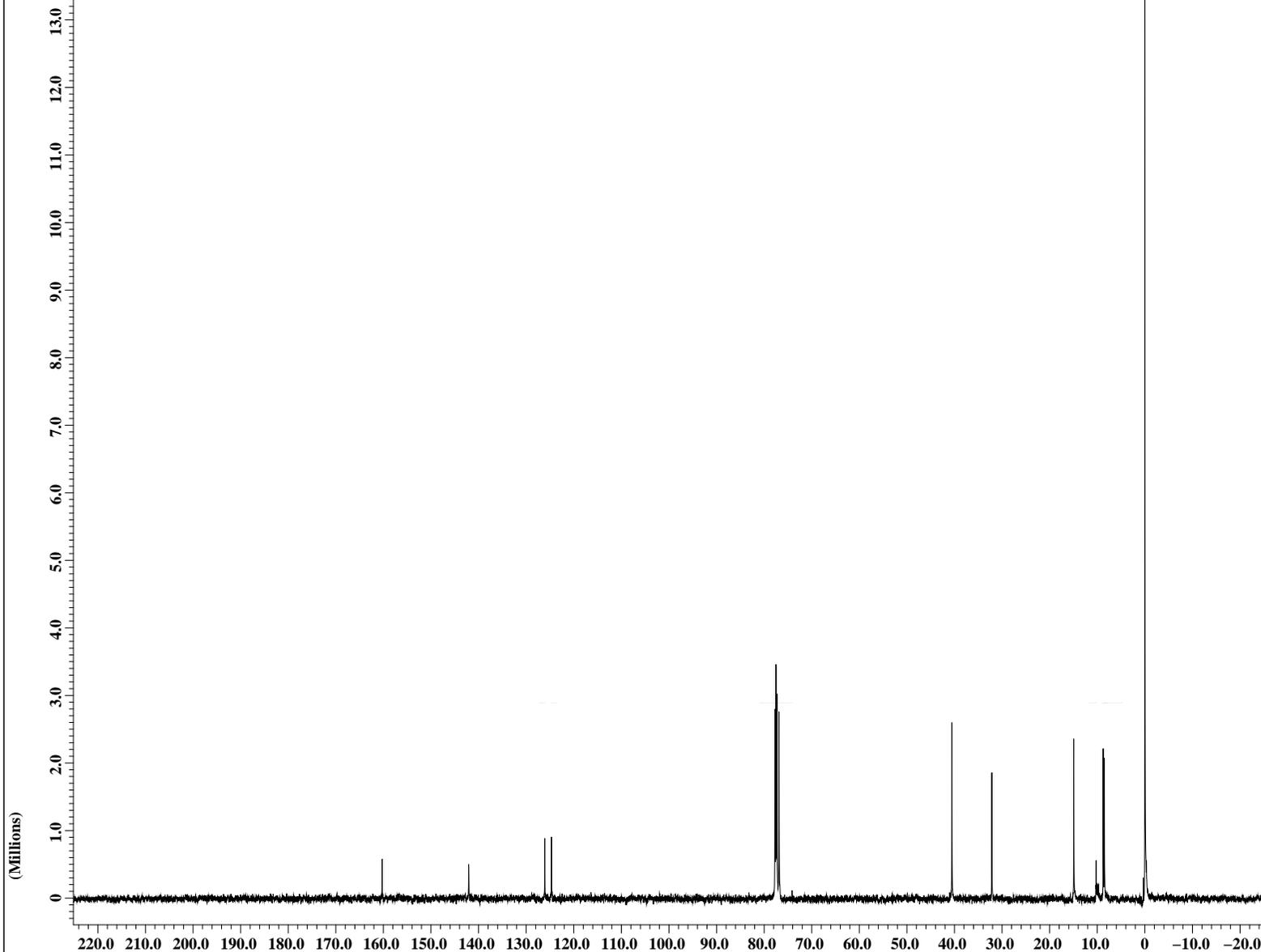


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160.2693

142.0697

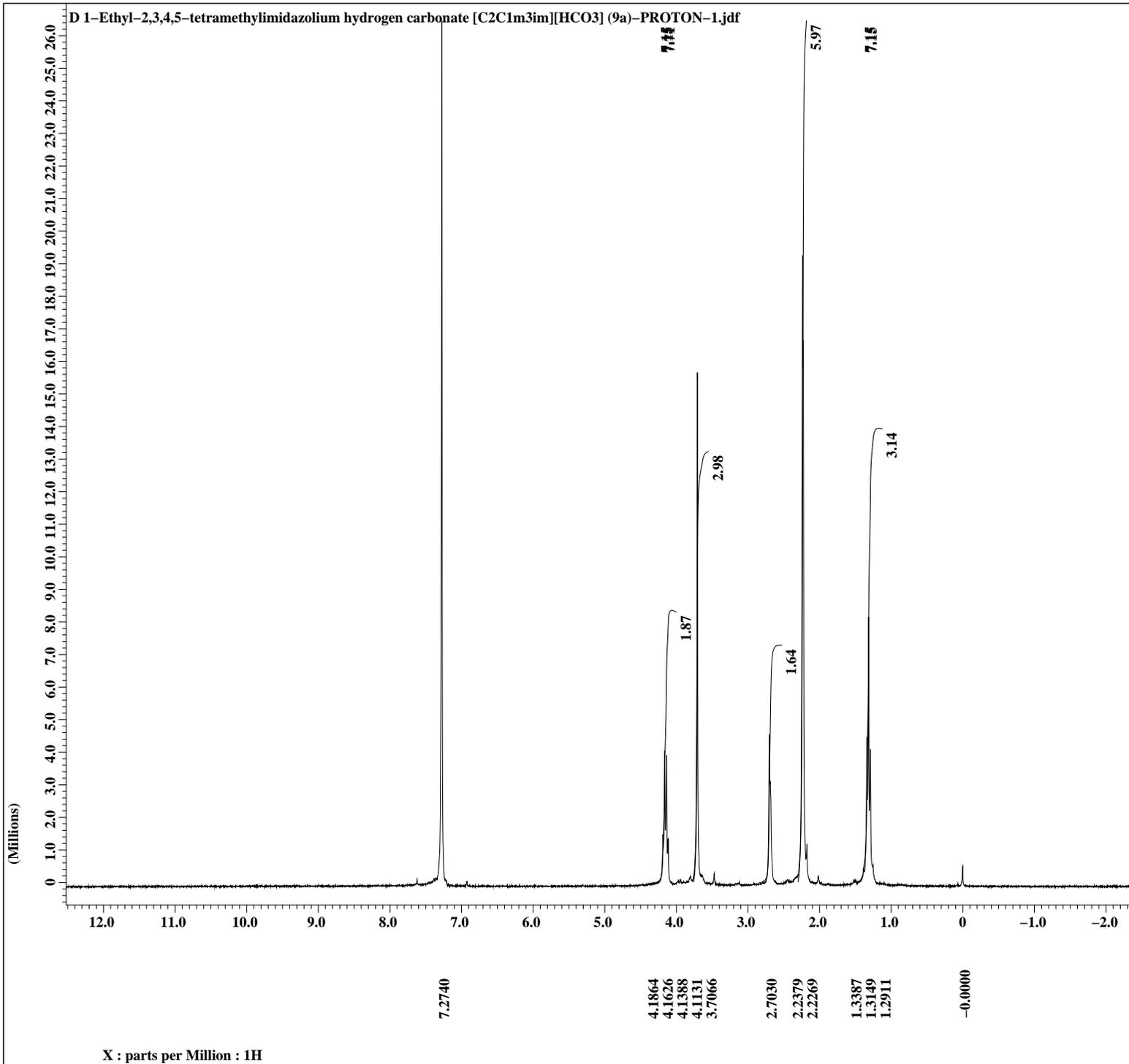
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77.7299
77.5162
77.3024

40.5521
32.1546

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0.0000

X : parts per Million : 13C

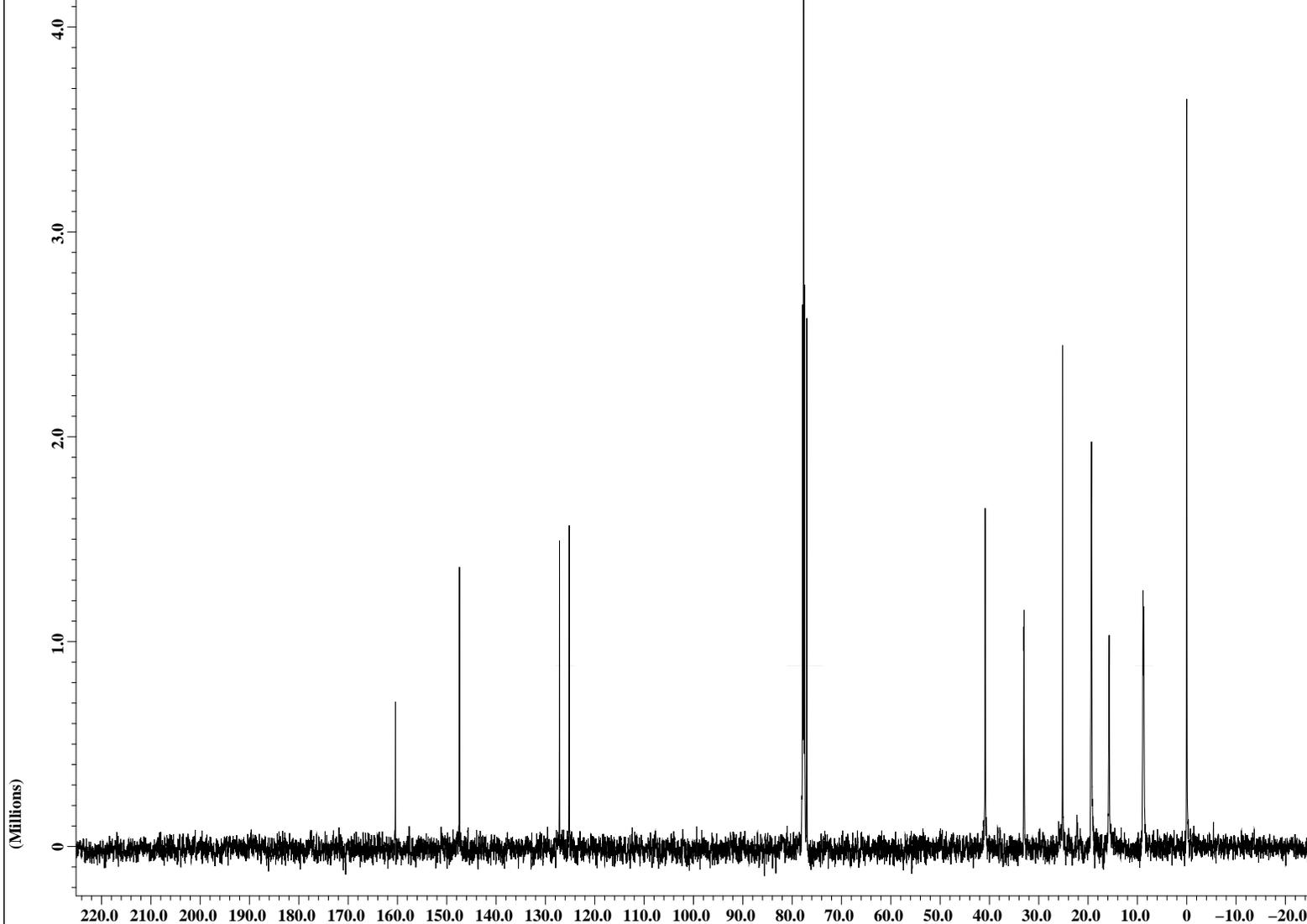


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 X_prescans = 0
 X_resolution = 0.55036209[Hz]
 X_sweep = 4.50856628[kHz]
 Clipped = FALSE
 Mod_return = 1
 Scans = 8
 Total_scans = 8

X_90_width = 14.5[us]
 X_acq_time = 1.8169856[s]
 X_angle = 90[deg]
 X_pulse = 14.5[us]
 Initial_wait = 1[s]
 Phase_preset = 3[us]
 Recvr_gain = 19
 Relaxation_delay = 5[s]
 Temp_get = 20.8[dC]
 Unblank_time = 2[us]



Filename = E 1-Ethyl-2-isopropyl
 Author = synthese
 Experiment = single_pulse_dec
 Sample_id = CM/CMCIL2.47
 Solvent = CHLOROFORM-D
 Creation_time = 19-SEP-2012 08:44:43
 Revision_time = 16-MAY-2013 15:02:25
 Current_time = 31-OCT-2013 15:09:41

Data_format = 1D_COMPLEX
 Dim_size = 16384
 Dim_title = 13C
 Dim_units = [ppm]
 Dimensions = X
 Site = Eclipse+ 300
 Spectrometer = DELTA_NMR

Field_strength = 7.0586013[T] (300[MHz])
 X_acq_duration = 0.8667136[s]
 X_domain = 13C
 X_freq = 75.56823426[MHz]
 X_offset = 100[ppm]
 X_points = 16384
 X_prescans = 0
 X_resolution = 1.15378367[Hz]
 X_sweep = 18.90359168[kHz]
 Irr_domain = 1H
 Irr_freq = 300.52965592[MHz]
 Irr_offset = 5[ppm]
 Clipped = FALSE
 Mod_return = 4
 Scans = 300
 Total_scans = 300

X_90_width = 10[us]
 X_acq_time = 0.8667136[s]
 X_angle = 30[deg]
 X_pulse = 3.33333333[us]
 Initial_wait = 1[s]
 Phase_preset = 3[us]
 Recvr_gain = 28
 Relaxation_delay = 1[s]
 Temp_get = 19.1[dC]
 Unblank_time = 2[us]

160.4067

147.4288

127.1528
125.1832

77.8826
77.4551
77.0276

40.8727

32.9791

25.1618

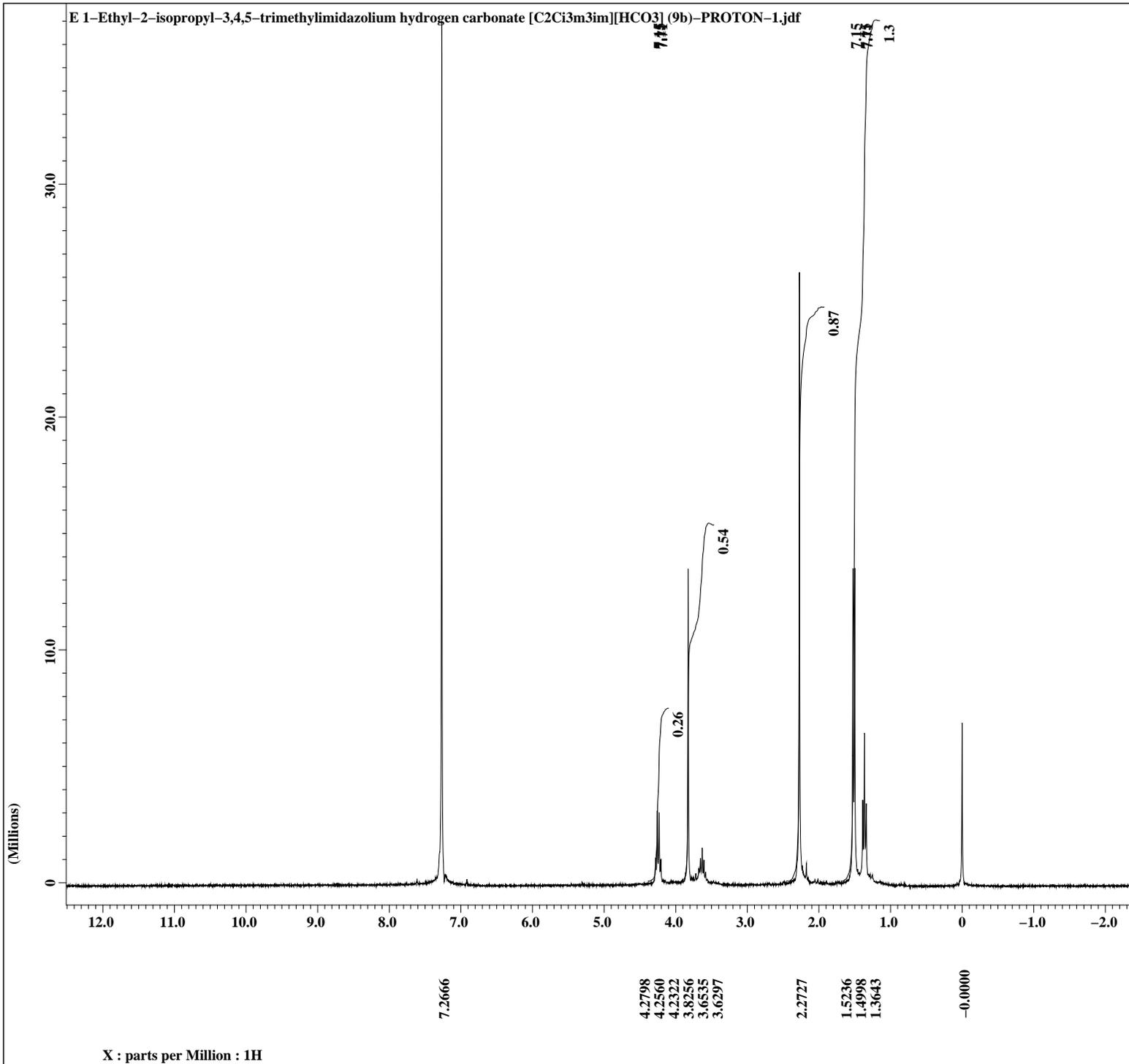
19.2989

15.7261

8.8555

8.6875

-0.0000

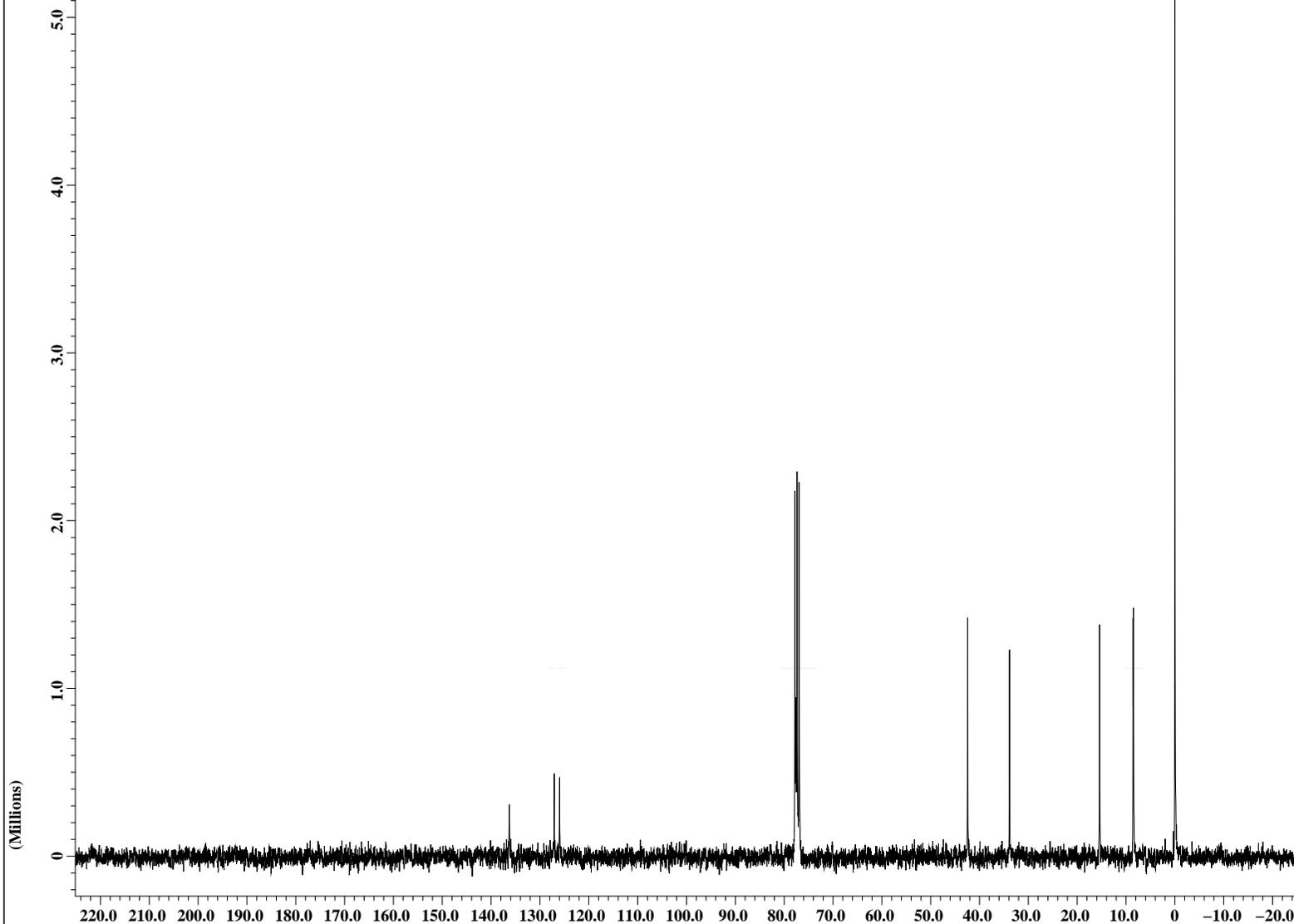


Filename = E 1-Ethyl-2-isopropyl
 Author = synthese
 Experiment = single_pulse.exp
 Sample_id = CM/CMCIL2.56-lyoc
 Solvent = CHLOROFORM-D
 Creation_time = 16-MAY-2013 02:15:03
 Revision_time = 16-JUN-2013 11:01:34
 Current_time = 31-OCT-2013 15:10:05

Data_format = 1D_COMPLEX
 Dim_size = 8192
 Dim_title = 1H
 Dim_units = [ppm]
 Dimensions = X
 Site = Eclipse+ 300
 Spectrometer = DELTA_NMR

Field_strength = 7.0586013[T] (300[MHz])
 X_acq_duration = 1.8169856[s]
 X_domain = 1H
 X_freq = 300.52965592[MHz]
 X_offset = 5[ppm]
 X_points = 8192
 X_prescans = 0
 X_resolution = 0.55036209[Hz]
 X_sweep = 4.50856628[kHz]
 Clipped = FALSE
 Mod_return = 1
 Scans = 8
 Total_scans = 8

X_90_width = 14.5[us]
 X_acq_time = 1.8169856[s]
 X_angle = 90[deg]
 X_pulse = 14.5[us]
 Initial_wait = 1[s]
 Phase_preset = 3[us]
 Recvr_gain = 22
 Relaxation_delay = 5[s]
 Temp_get = 21[dC]
 Unblank_time = 2[us]



136.2678
127.0764
125.9771

77.7910
77.3635
76.9360

42.4453
33.8494

15.4208
8.5501
8.4738
-0.0000

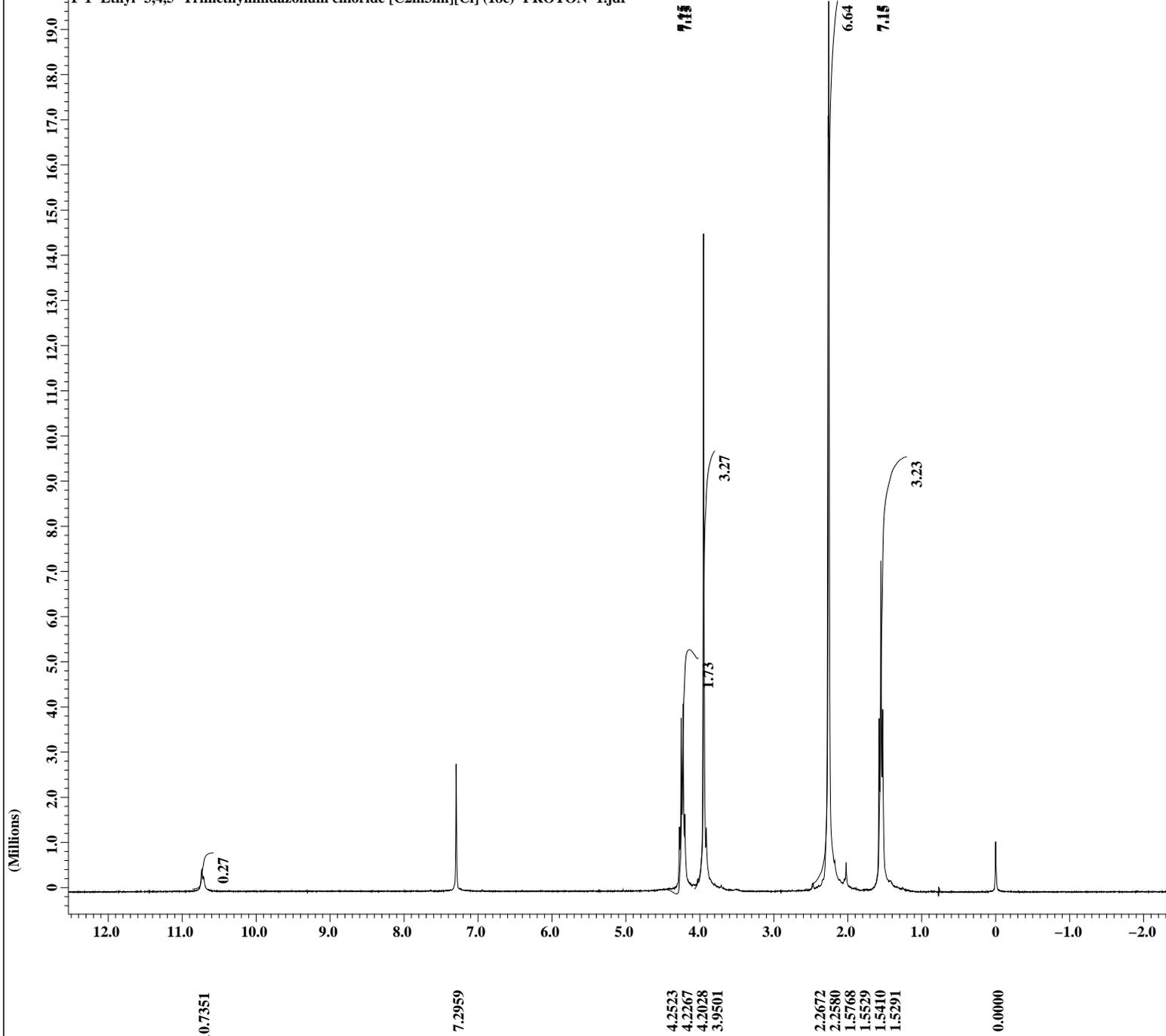
X : parts per Million : 13C

Filename = F 1-Ethyl-3,4,5-Trime
Author = synthese
Experiment = single_pulse_dec
Sample_id = CM/CMCIL6.20-ow-air-c
Solvent = CHLOROFORM-D
Creation_time = 28-APR-2013 00:34:48
Revision_time = 9-JUL-2013 19:40:52
Current_time = 31-OCT-2013 15:10:45

Data_format = 1D COMPLEX
Dim_size = 16384
Dim_title = 13C
Dim_units = [ppm]
Dimensions = X
Site = Eclipse+ 300
Spectrometer = DELTA_NMR

Field_strength = 7.0586013[T] (300[MHz]
X_acq_duration = 0.8667136[s]
X_domain = 13C
X_freq = 75.56823426[MHz]
X_offset = 100[ppm]
X_points = 16384
X_prescans = 0
X_resolution = 1.15378367[Hz]
X_sweep = 18.90359168[kHz]
Irr_domain = 1H
Irr_freq = 300.52965592[MHz]
Irr_offset = 5[ppm]
Clipped = FALSE
Mod_return = 4
Scans = 300
Total_scans = 300

X_90_width = 10[us]
X_acq_time = 0.8667136[s]
X_angle = 30[deg]
X_pulse = 3.33333333[us]
Initial_wait = 1[s]
Phase_preset = 3[us]
Recvr_gain = 28
Relaxation_delay = 1[s]
Temp_get = 21.5[dC]
Unblank_time = 2[us]



Filename = F 1-Ethyl-3,4,5-Trime
 Author = synthese
 Experiment = single_pulse.exp
 Sample_id = CM/CMCIL6.20-oh
 Solvent = CHLOROFORM-D
 Creation_time = 28-APR-2013 04:02:47
 Revision_time = 9-JUL-2013 19:43:27
 Current_time = 31-OCT-2013 15:11:25

Comment = spectr v ow: [OH]- pr
 Data_format = 1D COMPLEX
 Dim_size = 8192
 Dim_title = 1H
 Dim_units = [ppm]
 Dimensions = X
 Site = Eclipse+ 300
 Spectrometer = DELTA_NMR

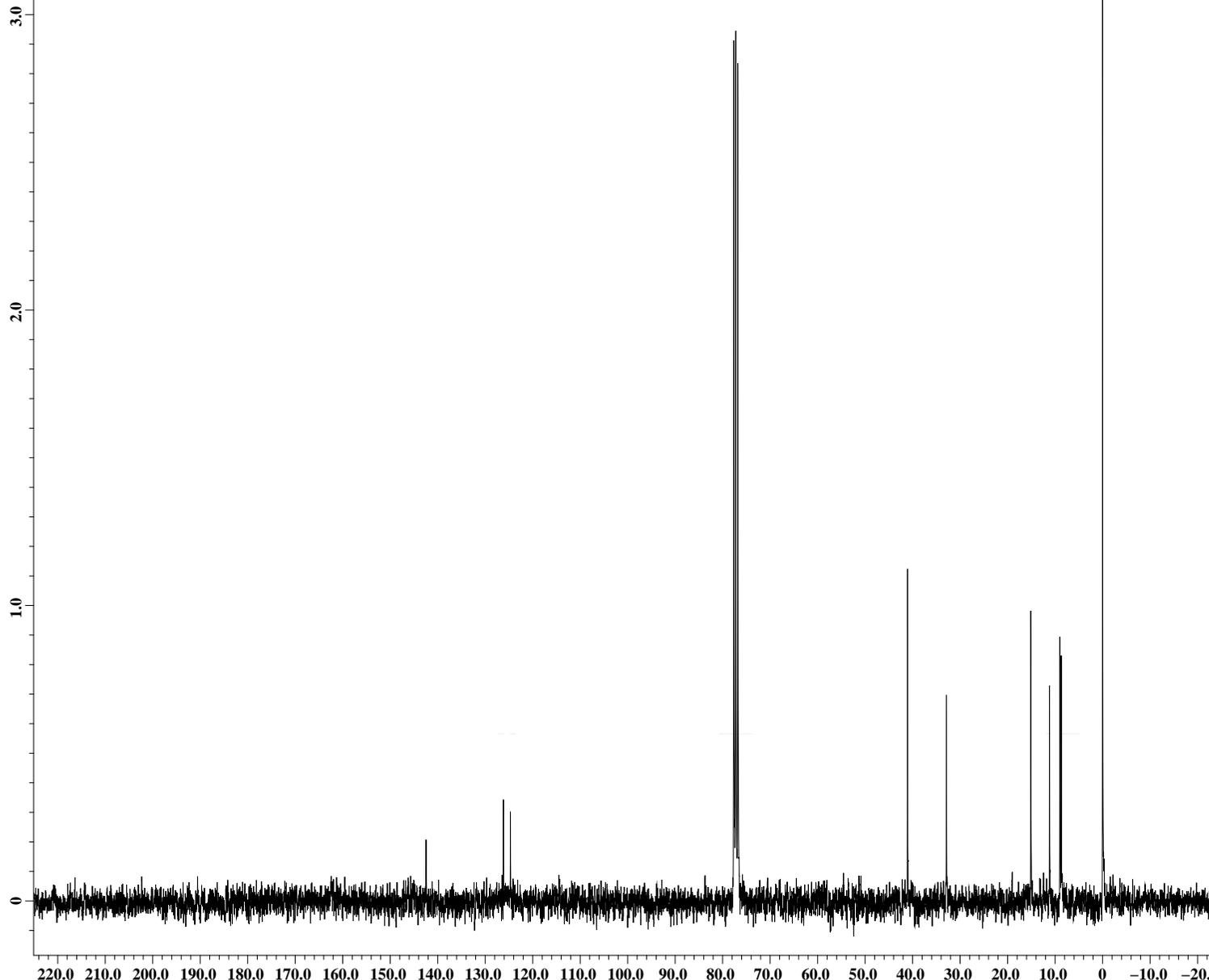
Field_strength = 7.0586013[T] (300[MHz]
 X_acq_duration = 1.8169856[s]
 X_domain = 1H
 X_freq = 300.52965592[MHz]
 X_offset = 5[ppm]
 X_points = 8192
 X_prescans = 0
 X_resolution = 0.55036209[Hz]
 X_sweep = 4.50856628[kHz]
 Clipped = FALSE
 Mod_return = 1
 Scans = 8
 Total_scans = 8

X_90_width = 14.5[us]
 X_acq_time = 1.8169856[s]
 X_angle = 90[deg]
 X_pulse = 14.5[us]
 Initial_wait = 1[s]
 Phase_preset = 3[us]
 Recvr_gain = 16
 Relaxation_delay = 5[s]
 Temp_get = 20.8[dC]
 Unblank_time = 2[us]

G 1-Ethyl-2,3,4,5-Tetramethylimidazolium chloride [C2C1m3im][Cl] (18a) CARBON-1.jdf



(Millions)



Filename = G 1-Ethyl-2,3,4,5-Tet
Author = synthese
Experiment = single_pulse_dec
Sample_id = CM/CMCIL5.9-cl-carbon
Solvent = CHLOROFORM-D
Creation_time = 9-APR-2013 22:39:25
Revision_time = 9-MAY-2013 18:07:25
Current_time = 31-OCT-2013 15:11:59

Data_format = 1D_COMPLEX
Dim_size = 16384
Dim_title = 13C
Dim_units = [ppm]
Dimensions = X
Site = Eclipse+ 300
Spectrometer = DELTA_NMR

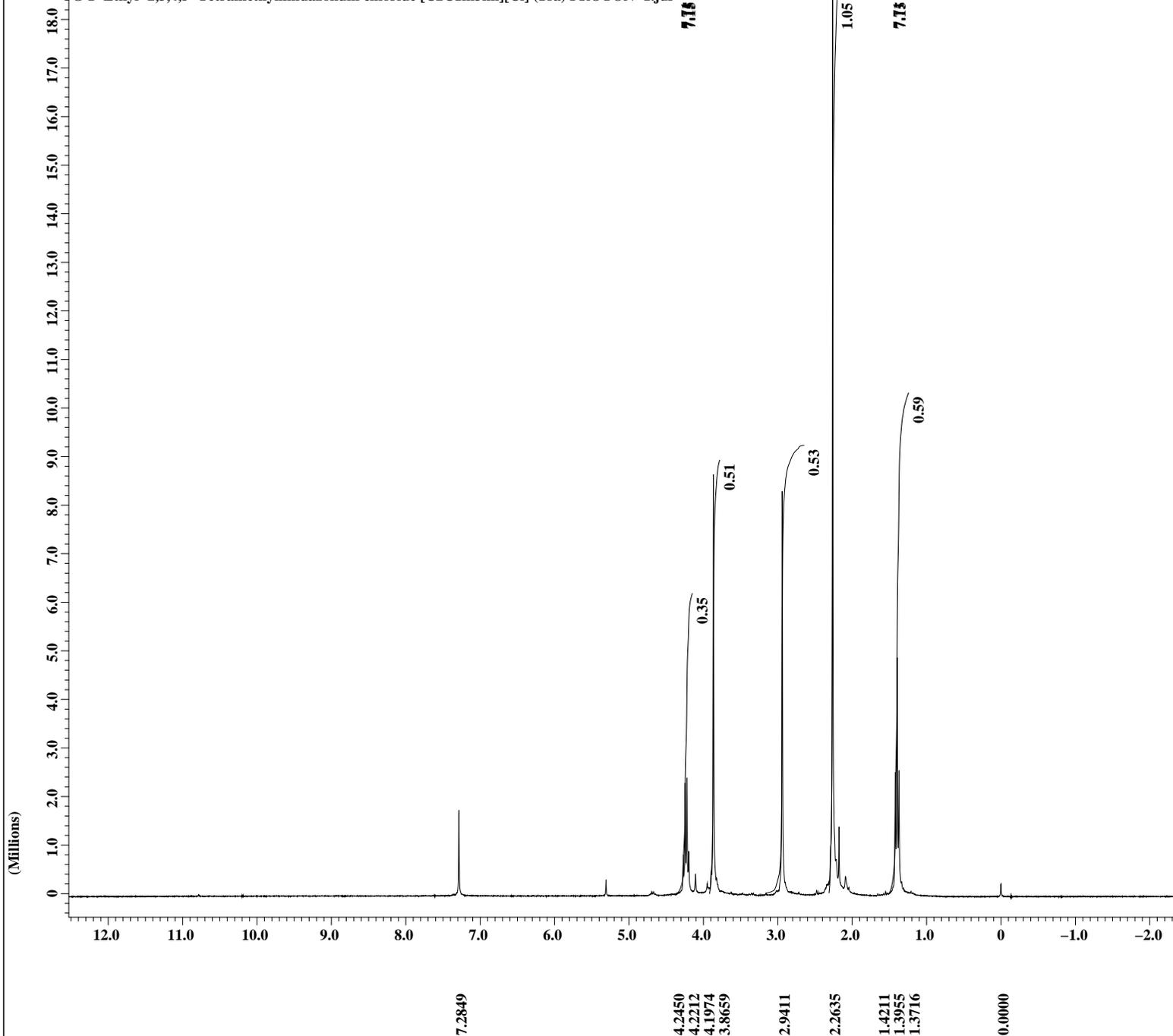
Field_strength = 7.0586013[T] (300[MHz])
X_acq_duration = 0.8667136[s]
X_domain = 13C
X_freq = 75.56823426[MHz]
X_offset = 100[ppm]
X_points = 16384
X_prescans = 0
X_resolution = 1.15378367[Hz]
X_sweep = 18.90359168[kHz]
Irr_domain = 1H
Irr_freq = 300.52965592[MHz]
Irr_offset = 5[ppm]
Clipped = FALSE
Mod_return = 4
Scans = 320
Total_scans = 320

X_90_width = 10[us]
X_acq_time = 0.8667136[s]
X_angle = 30[deg]
X_pulse = 3.33333333[us]
Initial_wait = 1[s]
Phase_preset = 3[us]
Recvr_gain = 28
Relaxation_delay = 1[s]
Temp_get = 23.5[dC]
Unblank_time = 2[us]

142.4514
126.1604
124.6946
77.6536
77.2261
76.8138
41.0712
32.8875
15.1154
11.1763
8.9929
8.7028
0.0000

X : parts per Million : 13C

G 1-Ethyl-2,3,4,5-Tetramethylimidazolium chloride [C2C1m3im][Cl] (18a) PROTON-1.jdf



```

Filename      = G 1-Ethyl-2,3,4,5-Tet
Author       = synthese
Experiment    = single_pulse.exp
Sample_id    = CM/CMCIL5.9
Solvent      = CHLOROFORM-D
Creation_time = 9-APR-2013 08:50:41
Revision_time = 9-MAY-2013 19:06:36
Current_time  = 31-OCT-2013 15:12:34
    
```

```

Comment      = precip et20 uit warme
Data_format  = 1D COMPLEX
Dim_size     = 8192
Dim_title    = 1H
Dim_units    = [ppm]
Dimensions   = X
Site         = Eclipse+ 300
Spectrometer = DELTA_NMR
    
```

```

Field_strength = 7.0586013[T] (300[MHz]
X_acq_duration = 1.8169856[s]
X_domain       = 1H
X_freq         = 300.52965592[MHz]
X_offset       = 5[ppm]
X_points       = 8192
X_prescans     = 0
X_resolution   = 0.55036209[Hz]
X_sweep        = 4.50856628[kHz]
Clipped        = FALSE
Mod_return     = 1
Scans          = 8
Total_scans    = 8
    
```

```

X_90_width    = 14.5[us]
X_acq_time     = 1.8169856[s]
X_angle        = 90[deg]
X_pulse        = 14.5[us]
Initial_wait   = 1[s]
Phase_preset   = 3[us]
Recvr_gain     = 16
Relaxation_delay = 5[s]
Temp_get       = 20.4[dC]
Unblank_time   = 2[us]
    
```

X : parts per Million : 1H