Supporting Information

Photoredox-induced three-component oxy-, amino- and carbotrifluoromethylation of enecarbamates

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I- General information

All reactions were carried out under argon atmosphere in oven dried glassware with magnetic stirring. Reagents were obtained from commercial suppliers and used without further purification.

Analytical thin layer chromatography (TLC) was purchased from Merck KGaA (silica gel 60 F254). Visualization was accomplished by irradiation with a UV light at 254 nm. Flash column chromatography was carried out using kieselgel 35-70 µm particle sized silica gel (200-400 mesh).

Chromatography was performed using silica gel 60 (0.040-0.063 mm) from Merck.

Proton chemical shifts are reported in ppm (δ) relative to tetramethylsilane (TMS) with the solvent resonance employed as the internal standard ($CDCl_3$, δ 7.26 ppm). Data are reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet), coupling constants (Hz) and integration. ^{13}C chemical shifts are reported in ppm from tetramethylsilane (TMS) with the solvent resonance as the internal standard ($CDCl_3$, δ 77.0 ppm).

Mass spectra were determined on a Waters XevoQTof spectrometer using an electrospray ionization coupled with a time of flight analyser (ESI-TOF).

Infrared spectra were recorded on an IR spectrometer (Perkin Elmer BX FT-IR), and absorption frequencies were reported in reciprocal centimeters (cm^{-1})

Melting points were recorded on a Reichert apparatus and were uncorrected.

$Ru(bpy)_3(PF_6)_2$ and the hypervalent iodine reagent **4g** were synthesized according to literature procedure[1,2].

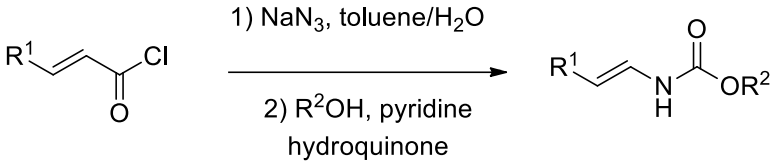
Visible light irradiations were performed with a Flexled INSPIRE LED lamp (3.6 W; λ = 465 nm).

[1] Baghurst, D. R.; Mingos, D. M. P. *J. Chem. Soc., Dalton Trans.* **1992**, 1151.

[2] Li, Y.; Studer, A. *Angew. Chem. Int. Ed.* **2012**, *51*, 8221.

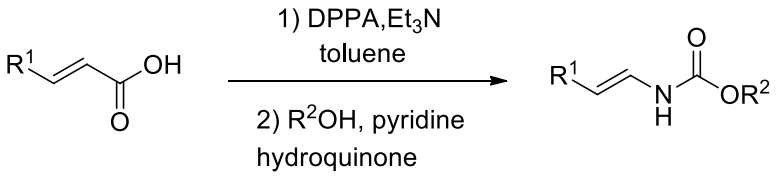
II- Synthesis of enecarbamates

General procedure A starting from the corresponding acyl chloride:



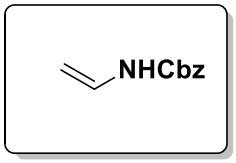
A solution of the corresponding acyl chloride (24.6 mmol) in toluene (6 mL) was added dropwise to a solution of NaN_3 (1.92 g, 29.5 mmol) in H_2O (10 mL) at 0 °C. After stirring the reaction for 5 h at 0 °C, the organic layer was separated and washed with 10% aqueous solution of Na_2CO_3 and water. The organic solution was dried over $MgSO_4$ before use in the following step. Then, the toluene solution of acyl azide was added dropwise to a stirred mixture of hydroquinone (122 mg, 1.1 mmol), pyridine (120 μL, 1.49 mmol), and corresponding alcohol/thiol (29.5 mmol) at 100 °C. The mixture was then stirred for 30 min at 110 °C and the toluene was removed by rotary evaporation. The product was purified by column chromatography on silica gel (Heptane/EtOAc) to afford the desired enecarbamate.

General procedure B starting from the corresponding carboxylic acid:



To a solution of the corresponding carboxylic acid (6 mmol) in toluene (40 mL), was added Et_3N (30 mmol) and diphenylphosphoryl azide (DPPA, 24 mmol). The mixture was stirred at RT overnight. Then the reaction was diluted in CH_2Cl_2 and washed with brine. The organic layer was dried over $MgSO_4$ and concentrated *in vacuo*. The crude acyl azide was purified by column chromatography on silica gel (Heptane/EtOAc). Then, a solution of the acyl azide in toluene (15 mL) was added dropwise to a stirred mixture of hydroquinone (29.8 mg, 0.27 mmol), pyridine (29.3 μL, 0.36 mmol), and corresponding alcohol (7.2 mmol) at 100 °C. The mixture was then stirred for 30 min at 110 °C and the toluene was removed by rotary evaporation. The product was purified by column chromatography on silica gel (Heptane/EtOAc) to afford the desired enecarbamate.

N-Vinyl benzyl carbamate 1a



The product was prepared according to general procedure A.

yield 67%, white solid

m.p. 43-45°C

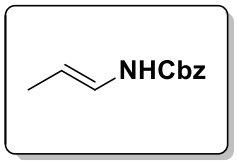
^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.34-7.41 (m, 5H), 6.68-6.80 (m, 1H), 6.51 (br. s, 1H), 5.17 (s, 2H), 4.50 (d, *J* = 15.6 Hz, 1H), 4.32 (d, *J* = 8.4 Hz, 1H).

^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 153.5, 135.9, 129.8, 128.6, 128.4, 128.3, 93.4, 67.3.

IR (neat) ν (cm^{-1}): 3442, 3060, 2948, 1692, 1535, 1250, 689.

EI-HRMS (positive ion) $C_{10}H_{11}NO_2Na$ $[M+Na]^+$: requires 200.0688**;** found 200.0685.

N-(E)-prop-1-enyl benzyl carbamate (*E*)-1e



The product was prepared according to general procedure A.

yield 56%, white solid

m.p. 51-53°C

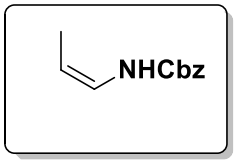
^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.28-7.38 (m, 5H), 6.44-6.52 (m, 1H), 6.30 (br. s, 1H), 5.15 (s, 2H), 4.96-5.07 (m, 1H), 1.66 (d, *J* = 6.6 Hz, 3H).

^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 153.6, 136.2, 128.6, 128.3, 128.2, 124.1, 105.8, 67.0, 14.7.

IR (neat) ν (cm^{-1}): 3277, 3032, 2933, 1678, 1540, 1241, 948, 693.

EI-HRMS (positive ion) $C_{11}H_{13}NO_2Na$ $[M+Na]^+$: requires 214.0844**;** found 214.0838.

***N*-(Z)-prop-1-enyl benzyl carbamate (*Z*)-1e**



A 25 mL round-bottom flask was charged with benzyl carbamate (0.5 g, 3.31 mmol) and benzenesulfinic acid sodium salt (1.09 g, 6.62 mmol) in a mixture of H_2O (6 mL) and methanol (3 mL). Then propionaldehyde (0.48 mL, 6.62 mmol) and formic acid (0.25 mL, 6.62 mmol) were added and the mixture was stirred at RT for 3 days. Methanol was then removed by rotary evaporation and the mixture was extracted with CH_2Cl_2 and the organic layer was washed with water and dried over $MgSO_4$. The solvents were removed and the crude sulfonamide was used without any purification for the next step. It was then dissolved in THF (10 mL) and DBU (0.54 mL, 3.64 mmol) was added. After stirring the reaction for 1 h at RT, THF was removed by rotary evaporation and the crude product was purified by column chromatography on silica gel (Heptane/EtOAc) to afford a mixture of (*Z*) and (*E*) *N*-prop-1-enyl benzyl carbamate in a ratio 85:15 in favor of the (*Z*) diastereomer.

yield 46%, white solid

m.p. 29-31°C

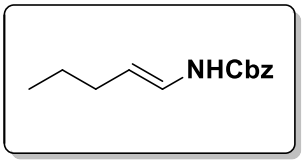
^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.35-7.41 (m, 5H), 6.45-6.53 (m, 1H), 6.34 (br. s, 1H), 5.18 (s, 2H), 4.67-4.77 (m, 1H), 1.58 (d, *J* = 7.0 Hz, 3H).

^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 153.6, 136.0, 128.6, 128.4, 128.2, 123.0, 103.2, 67.2, 10.5.

IR (neat) ν (cm^{-1}): 3255, 3033, 1698, 1399, 1316, 1269, 1076, 1014, 691.

EI-HRMS (positive ion) $C_{11}H_{13}NO_2Na$ $[M+Na]^+$: requires 214.0844**;** found 214.0841.

N-(*E*)-pent-1-enyl benzyl carbamate 1f



The product was prepared according to general procedure B.

yield 45%, colourless oil

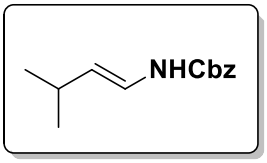
^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.33-7.41 (m, 5H), 6.46-6.51 (m, 1H), 6.34-6.39 (m, 1H), 5.15 (s, 2H), 4.99-5.05 (m, 1H), 1.97-2.01 (m, 2H), 1.35-1.43 (m, 2H), 0.91 (t, *J* = 7.0 Hz, 3H).

^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 153.5, 136.1, 128.6, 128.3, 128.2, 123.4, 111.1, 67.0, 31.7, 23.1, 13.5.

IR (neat) ν (cm^{-1}): 3310, 3030, 2925, 1680, 1523, 1228, 697.

EI-HRMS (positive ion) $C_{13}H_{17}NO_2Na$ $[M+Na]^+$: requires 242.1157**;** found 242.1148.

N-(*E*)-3-methylbut-1-enyl benzyl carbamate 1g



The product was prepared according to general procedure B.

yield 29%, colourless oil

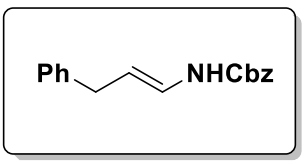
^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.30-7.43 (m, 5H), 6.46 (dd, *J* = 13.8 Hz, *J* = 11.1 Hz, 1H), 6.23-6.31 (m, 1H), 5.15 (s, 2H), 5.00 (dd, *J* = 13.8 Hz, *J* = 6.9 Hz, 1H), 2.25-2.35 (m, 1H), 1.01 (d, *J* = 6.9 Hz, 6H).

^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 153.7, 136.2, 128.6, 128.3, 128.2, 121.4, 118.6, 67.0, 28.8, 23.0.

IR (neat) ν (cm^{-1}): 3325, 2962, 1708, 1532, 1249, 690.

EI-HRMS (positive ion) $C_{13}H_{17}NO_2Na$ $[M+Na]^+$: requires 242.1157**;** found 242.1156.

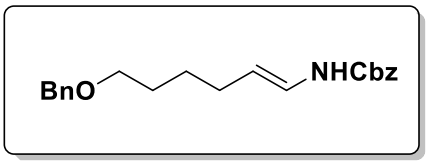
Benzyl (*E*)-3-phenylprop-1-en-1-yl) carbamate 1h



The product was prepared according to previous literature.[3]

[3] Mecozzi, T.; Petrini, M. *Synlett* **2000**, 73.

Benzyl(*E*)-(6-(benzyloxy)hex-1-en-1-yl) carbamate 1i



To a solution of ((hex-5-en-1-yloxy)methyl)benzene (950 mg, 5 mmol, synthesized according to previous literature[4]) and acryloyl chloride (0.62 mL, 7.5 mmol) in toluene (25 mL), was added Hoveyda-Grubbs II catalyst (157 mg, 0.25 mmol). After 16h at RT, the reaction was quenched with addition of sodium azide (975 mg, 15 mmol) and MeCN (25 mL), and the mixture was stirred for 2 h. Then it was diluted with Et_2O, washed with excess water, dried over $MgSO_4$ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (Heptane/EtOAc) to afford the intermediate acyl azide. Then a toluene solution of the acyl azide was added dropwise to a stirred mixture of hydroquinone (25 mg, 0.23 mmol), pyridine (24 μL, 0.30 mmol), and benzyl alcohol (1.6 mL, 15 mmol) at 100 °C. The mixture was then stirred for 30 min at 110 °C and the toluene was removed by rotary evaporation. The product was purified by column chromatography on silica gel (Heptane/EtOAc) to afford the desired benzyl (*E*)-(6-(benzyloxy)hex-1-en-1-yl) carbamate.

yield 65%, white solid

m.p. 39-41°C

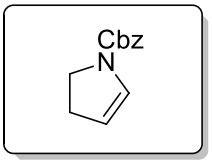
^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.44-7.23 (m, 10H), 6.64-6.44 (m, 2H), 5.16 (s, 2H), 5.07-4.95 (m, 1H), 4.53 (s, 2H), 3.50 (t, *J* = 6.4 Hz, 2H), 2.09-1.97 (m, 2H), 1.71-1.59 (m, 2H), 1.53-1.39 (m, 2H).

^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 153.6, 138.6, 136.2, 128.6, 128.4, 128.3, 128.2, 127.7, 127.5, 123.7, 110.9, 72.9, 70.2, 67.0, 29.5, 29.2, 26.6.

IR (neat) ν (cm^{-1}): 3308, 2937, 2858, 2248, 1711, 1679, 1505, 1216, 906, 695.

EI-HRMS (positive ion) $C_{21}H_{25}NO_3Na$ $[M+Na]^+$: requires 340.1913 **;** found 340.1907.

Benzyl 2,3-dihydro-1H-pyrrole-1-carboxylate 1j

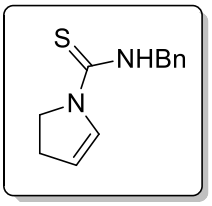


The product was prepared according to previous literature.[5]

[4] Covell, D. J.; White, M.C. *Tetrahedron*, **2013**, *69*, 7771.

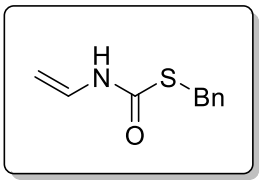
[5] Oliveira, D. F.; Miranda, P. C. M. L.; Correia, C. R. D. *J. Org. Chem.*, **1999**, *64*, 6646.

N-benzyl-2,3-dihydro-1H-pyrrole-1-carbothioamide 1k



Enethiourea **1k** was prepared according to previous literature.[6]

S-Benzyl vinylcarbamothioate 1l



The product was prepared according to general procedure A.

yield 56%, white solid

m.p. 77-79°C

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.39-7.40 (m, 5H), 7.10-6.98 (m, 1H), 6.98-6.83 (m, 1H), 4.58 (d, *J* = 15.6 Hz, 1H), 4.40 (d, *J* = 8.5 Hz, 1H), 4.23 (s, 2H).

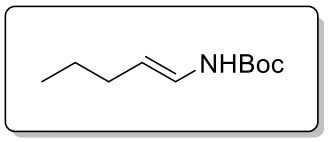
^{13}C NMR (75 MHz, Acetone d^6) δ (ppm): 164.7, 138.7, 129.3, 128.8, 128.5, 127.0, 94.1, 33.2.

IR (neat) ν (cm^{-1}): 3267, 3030, 1739, 1636, 1511, 1217, 972, 857, 698.

EI-HRMS (positive ion) $C_{10}H_{12}NOS$ $[M+H]^+$: requires 194.0640 **;** found 194.0639.

[6] Dagousset, G.; Retailleau,P.; Masson, G.; Zhu, J. *Chem. Eur. J.* **2012**, *18*, 5869.

(E) Tert- butylpent-1-en-1-ylcarbamate 1m



The product was prepared according to general procedure B.

yield 58%, white solid

m.p. 66-68°C

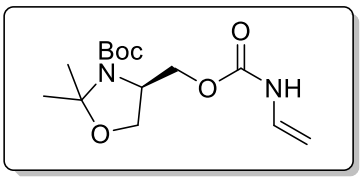
^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 6.50-6.35 (m, 1H), 6.34-6.19 (m, 1H), 5.01-4.86 (m, 1H), 2.00-1.88 (m, 2H), 1.45 (s, 9H), 1.40-1.27 (m, 2H), 0.87 (t, J=7.3 Hz, 1H).

^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 153.0, 123.8, 109.6, 79.8, 31.7, 28.2, 23.1, 13.4.

IR (neat) ν (cm^{-1}): 3314, 2961, 2929, 2873, 1695, 1675, 1512, 1367, 1242, 1161.

EI-HRMS (positive ion) $C_{10}H_{19}NO_2Na$ $[M+Na]^+$: requires 208.1313**;** found 208.1313.

(4*R*)-*Tert*- butyl 2,2-dimethyl-4-(((vinylcarbamoyl)oxy)methyl)oxazolidine-3-carboxylate 1n



The product was prepared according to general procedure B. Garner's alcohol was synthetized according to previous literature.[7]

yield 15%, colourless oil , mixture of rotamers (rot 1/ rot 2).

^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 6.87-6.58 (m, 2H), 4.56-4.41 (m, 1H), 4.33-3.85 (m, 6H), 1.58 (s, 3H, rot 1), 1.54 (s, 3H, rot 2), 1.51-1.39 (m, 12H).

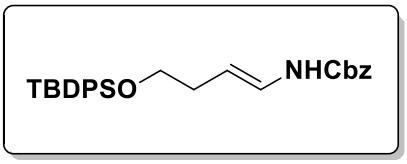
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 153.2 (rot 2), 153.2 (rot 1), 151.6, 129.9 (rot 1), 129.7 (rot 1), 93.6 (rot 2), 93.3 (rot 1), 80.6 (rot 1), 80.3 (rot 2), 65.1 (rot 2), 64.9 (rot 1), 64.0 (rot 2), 63.9 (rot 1), 55.8 (rot 1), 55.6 (rot 2), 28.4, 27.4 (rot 1), 26.7 (rot 2), 24.3 (rot 1), 23.0 (rot 2).

IR (neat) ν (cm^{-1}): 3316, 2981, 2254, 1685, 1650, 1510, 1391, 1244, 1086, 909, 728.

EI-HRMS (positive ion) $C_{14}H_{24}N_2O_5Na$ $[M+Na]^+$: requires 323.1577**;** found 323.1583.

[7] Belanger, D. ; Tong, X. ; Soumare, S. ; Dory, Y.L. ; Zhao, Y. *Chem. Eur. J*. **2012**, 15, 4428.

(*E*)-4-(*Tert*-butyldiphenylsilyloxy)but-1-enyl benzyl carbamate



To a solution of 4-(*tert*-butyldiphenylsilyloxy)but-1-ene (3.1 g, 10 mmol, synthesized according to previous literature[8]) and acryloyl chloride (1.22 mL, 15 mmol) in toluene (50 mL), was added Hoveyda-Grubbs II catalyst (313 mg, 0.5 mmol). After 16h at RT, the reaction was quenched with addition of sodium azide (1.95 g, 30 mmol) and MeCN (50 mL), and the mixture was stirred for 2 h. Then it was diluted with Et_2O, washed with excess water, dried over $MgSO_4$ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (Heptane/EtOAc) to afford the intermediate acyl azide. Then a toluene solution of the acyl azide was added dropwise to a stirred mixture of hydroquinone (49.7 mg, 0.45 mmol), pyridine (48.7 μL, 0.60 mmol), and benzyl alcohol (3.1 mL, 30 mmol) at 100 °C. The mixture was then stirred for 30 min at 110 °C and the toluene was removed by rotary evaporation. The product was purified by column chromatography on silica gel (Heptane/EtOAc) to afford the desired **(*E*)**-4-(*tert*-butyldiphenylsilyloxy)but-1-enyl benzyl carbamate.

yield 63%, white solid

m.p. 50-52 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.66-7.70 (m, 4H), 7.34-7.44 (m, 6H), 6.47-6.55 (m, 1H), 6.34 (d, *J* = 10.5 Hz, 1H), 5.16 (s, 2H), 4.95-5.02 (m, 1H), 3.68 (t, *J* = 6.6 Hz, 2H), 2.21-2.29 (m, 2H), 1.07 (s, 9H).

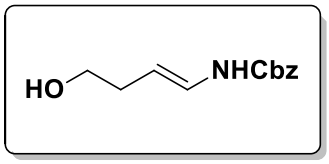
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 153.4, 136.1, 135.6, 133.9, 129.6, 128.6, 128.3, 128.2, 127.6, 124.9, 107.3, 67.1, 64.2, 33.0, 26.9, 19.2.

IR (neat) ν (cm^{-1}): 3315, 3042, 2928, 1694, 1680, 1518, 1231, 1089, 947, 694.

EI-HRMS (positive ion) $C_{28}H_{33}NO_3SiNa$ $[M+Na]^+$: requires 482.2128**;** found 482.2132.

[8] Boeckman Jr., R. K. ; Charette, A. B. ; Asberom , T. ; Johnston, B. H. *J. Am. Chem. Soc.*, **1991**, *113*, 5337.

(*E*)-4-Hydroxy-but-1-enyl benzyl carbamate 1o



To a solution of (*E*)-4-(*tert*-butyldiphenylsilyloxy)but-1-enyl benzyl carbamate (505 mg, 1.1 mmol) in THF (10 mL), was added TBAF (1.2 mL, 1 M in THF, 1.2 mmol) at 0 °C. After stirring for 3 h at 0 °C, THF was removed by rotary evaporation and the residue was purified by column chromatography on silica gel (Heptane/EtOAc) to afford the (*E*)-4-hydroxy-but-1-enyl benzyl carbamate.

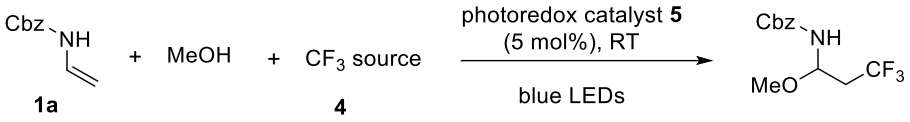
yield 86%, white solid

^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.33-7.41 (m, 5H), 6.46-6.63 (m, 2H), 5.15 (s, 2H), 4.95-5.05 (m, 1H), 3.63 (t, *J* = 6.6 Hz, 2H), 2.23-2.30 (m, 2H).

IR (neat) ν (cm^{-1}): 3310, 3030, 2925, 1680, 1523, 1228, 697.

EI-HRMS (positive ion) $C_{13}H_{17}NO_2Na$ $[M+Na]^+$: requires 244.0950**;** found 244.0940.

III- Optimization of the conditions for oxytrifluoromethylation reactions



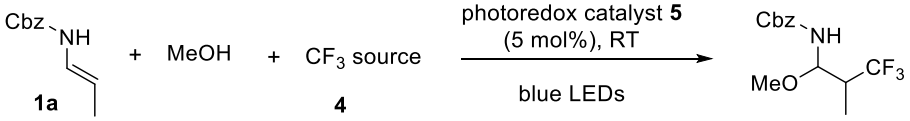
➔ *Stoechiometry*

Entry	Carbamate (eq)	4e (eq)	MeOH	Yield
1	1.2	1	2mL	65
2	1	1.2	2mL	73
3	1	1.2	2mL	83
4	1	2.4	2mL	83

➔ *Solvent optimization*

Entry	Carbamate (eq)	4e (eq)	MeOH	Co-solvent (20 eq)	Yield
3	1	1.2	2mL (= 500eq)	/	65
5	1	1.2	5eq	THF	38
6	1	1.2	20 eq	THF	43
7	1	1.2	20 eq	CH3CN	/
8	1	1.2	20 eq	DCM	
9	1	1.2	20 eq	Acetone	73
10	1	1.2	20 eq	DMF	traces
11	1	1.2	20 eq	Toluene	/

➔ *Catalyst loading*



Entry	Carbamate (eq)	4e (eq)	MeOH	Catalyst (mol %)	Yield
3	1	1.2	2mL	5	83
12	1	1.2	2 mL	1	77
13	1	1.2	2 mL	0,5	20

IV- General procedure

Typical procedure for oxytrifluoromethylation of enecarbamates.

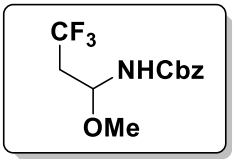
A flame-dried test tube was charged with the corresponding enecarbamate (0.1 mmol), Togni's reagent 4e (37.8 mg, 0.12 mmol, 1.2 equiv), and Ru(bpy)3(PF6)2 5a (4.4 mg, 0.005 mmol, 0.05 equiv). Then, it was dissolved in 2 mL of MeOH, and irradiated with blue LEDs at RT for 3h. The solvent was removed in vacuo. The residue was purified by flash chromatography on silica gel (Hept/AcOEt 7/3) to afford the corresponding pure trifluoromethylated product.

Typical procedure for azido- and cyanotrifluoromethylation of enecarbamates.

A test tube was charged with the corresponding enecarbamate (0.1 mmol), Togni's reagent 4e (37.8 mg, 0.12 mmol, 1.2 equiv), Ru(bpy)3(PF6)2 5a (4.4 mg, 0.005 mmol, 0.05 equiv), triphenylphosphine (2.6 mg, 0.01 mmol), and NaN3 (32.6 mg, 0.5 mmol, 5 equiv) or KCN (32.6 mg, 0.5 mmol, 5 equiv). Then, it was dissolved in 1 mL of THF and 1 mL of H2O, and irradiated with blue LEDs at RT for 12h. The reaction mixture was then diluted into EtOAC and washed with saturated NaHCO3 solution. The organic phase was dried over MgSO4, and solvents were evaporated in vacuo. The residue was purified by flash chromatography on silica gel (Hept/AcOEt) to afford the corresponding pure trifluoromethylated product.

V- Experimental data

Benzyl (3,3,3-trifluoro-1-methoxypropyl) carbamate 6a



m = 23 mg, 83% yield, white solid.

m.p. 38-40°C.

^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.42-7.29 (m, 5H), 5.29-5.19 (m, 1H), 5.19-5.09 (m, 3H), 3.38 (s, 3H), 2.62-2.31 (m, 2H).

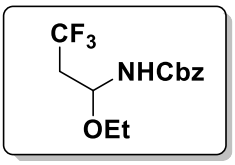
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.5, 135.9, 128.6, 128.4, 128.1, 124.9 (q, *J* = 277.7 Hz), 78.5, 67.3, 55.8, 39.8 (q, *J* = 28.4 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -63.19 (t, *J* = 10.3 Hz).

IR (neat) ν (cm^{-1}): 3319, 2930, 1702, 1531, 1237, 1131, 1051, 697.

EI-HRMS (positive ion) $C_{12}H_{14}F_3NO_3Na$ $[M+Na]^+$: requires 300.0823; found 300.0820.

Benzyl (1-ethoxy-3,3,3-trifluoropropyl) carbamate 6b



m = 21 mg, 71% yield, colourless oil.

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.44-7.28 (m, 5H), 5.41-5.25 (m, 1H), 5.22-5.15 (m, 1H), 5.13 (s, 2H), 3.80-3.46 (m, 2H), 2.64-2.33 (m, 2H), 1.19 (t, *J* = 7.0 Hz, 3H).

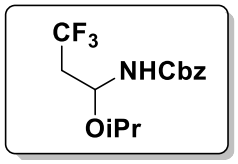
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.5, 136.0, 128.6, 128.4, 128.1, 124.9 (q, *J* = 276.8 Hz), 76.9, 67.2, 63.9, 40.0 (q, *J* = 28.4 Hz), 14.9.

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -63.25 (t, *J* = 10.3 Hz).

IR (neat) ν (cm^{-1}): 3319, 2971, 1736, 1531, 1366, 1217, 1130, 1053, 697.

EI-HRMS (positive ion) $C_{13}H_{16}F_3NO_3Na$ $[M+Na]^+$: requires 314.0995; found 314.0980.

Benzyl (3,3,3-trifluoro-1-isopropoxypropyl) carbamate 6c



m = 15 mg, 50% yield, colourless oil.

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.42-7.30 (m, 5H), 5.48-5.35 (m, 1H), 5.21-5.07 (m, 3H), 3.94-3.80 (m, 1H), 2.57-2.31 (m, 2H), 1.19 (d, *J* = 6.0 Hz, 3H), 1.14 (d, *J* = 6.2 Hz, 3H).

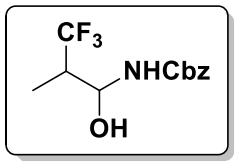
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.4, 136.0, 128.6, 128.4, 128.1, 124.9 (q, *J* = 276.8 Hz), 75.0, 69.6, 67.2, 40.5 (q, *J* = 28.4 Hz), 23.3, 21.2.

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -63.19 (t, *J* = 10.3 Hz).

IR (neat) ν (cm^{-1}): 3319, 2971, 1724, 1528, 1372, 1235, 1111, 1015, 697.

EI-HRMS (positive ion) $C_{14}H_{18}F_3NO_3Na$ $[M+Na]^+$: requires 328.1136; found 328.1136.

Benzyl (3,3,3-trifluoro-1-hydroxy-2-methylpropyl)carbamate 6d



The reaction was performed in a 1:1 mixture of THF/H_2O (2 mL) as solvent.

m = 19 mg, 69% yield, white solid, mixture of diastereomers 52:48 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

m.p. 70-72°C

^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.39-7.34 (m, 5H), 5.66-5.62 (m, 1H), 5.50-5.41 (m, 1H), 5.13 (s, 2H), 4.04-3.99 (m, 1H), 2.60-2.46 (m, 1H), 1.23 (t, *J* = 7.2 Hz, 3H).

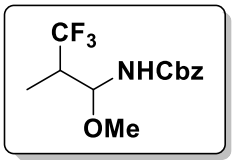
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 156.0 (dia 1), 155.9 (dia 2), 135.6, 128.7, 128.5, 128.2, 126.5 (q, *J* = 278.5 Hz dia 1), 126.5 (q, *J* = 278.5 Hz, dia 2), 74.3, 67.4, 42.8 (q, *J* = 24.7 Hz), 8.5 (dia 1), 8.1 (dia 2).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -69.88 (d, *J* = 10.3 Hz, dia 1), -70.43 (d, *J* = 10.3 Hz, dia 2).

IR (neat) ν (cm^{-1}): 3331, 2953, 1692, 1536, 1240, 1178, 1001, 695.

EI-HRMS (positive ion) $C_{12}H_{14}F_3NO_3Na$ $[M+Na]^+$: requires 300.0834; found 300.0823.

Benzyl (3,3,3-trifluoro-1-methoxy-2-methylpropyl) carbamate 6e



From (Z)-enecarbamate :

m = 21 mg, 73% yield, white solid, mixture of diastereoisomers 45:55 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

m.p. 40-42°C.

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.43-7.30 (m, 5 H), 5.23-5.07 (m, 4H), 3.37 (s, 3H, dia 1), 3.36 (s, 3H, dia 2), 2.64-2.37 (m, 1H), 1.18 (d, *J* = 7.2 Hz, 3H, dia 2), 1.17 (d, *J* = 7.2 Hz, 3H, dia 1).

^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.8 (dia 1), 155.7 (dia 2), 136.0, 128.6, 128.4, 128.1, 126.5 (q, *J* = 280.4 Hz, dia 2), 126.5 (q, *J* = 279.5 Hz, dia 1), 81.9 (dia 2), 81.8 (dia 1), 67.2, 56.0 (dia 2), 55.9 (dia 1), 43.1 (q, *J* = 25.7 Hz, dia 1), 42.8 (q, *J* = 25.7 Hz, dia 2), 8.4.

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -69.01 (d, *J* = 8.2 Hz, dia 2), -69.18 (d, *J* = 8.2 Hz, dia 1).

IR (neat) ν (cm^{-1}): 3299, 2953, 1694, 1534, 1239, 1078, 1013, 695.

EI-HRMS (positive ion) $C_{13}H_{16}F_3NO_3Na$ $[M+Na]^+$: requires 314.0980; found 314.0984.

From (E)-enecarbamate :

m = 22 mg, 76% yield, white solid, mixture of diastereoisomers 55:45 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

m.p. 41-43°C.

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.45-7.30 (m, 5 H), 5.26-5.09 (m, 4H), 3.39 (s, 3H, dia 2), 3.38 (s, 3H, dia 1), 2.64-2.37 (m, 1H), 1.20 (d, *J* = 7.2 Hz, 3H, dia 2), 1.19 (d, *J* = 7.2 Hz, 3H, dia 1).

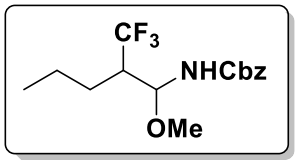
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.8 (dia 1), 155.7 (dia 2), 136.0, 128.6, 128.4, 128.1, 126.5 (q, *J* = 279.5 Hz, dia 1), 126.5 (q, *J* = 281.4 Hz, dia 2), 81.9 (dia 2), 81.8 (dia 1), 67.2, 56.0 (dia 2), 55.9 (dia 1), 43.1 (q, *J* = 24.7 Hz, dia 2), 42.8 (q, *J* = 25.7 Hz, dia 1), 8.4.

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -69.02 (d, *J* = 8.2 Hz, dia 2), -69.20 (d, *J* = 8.2 Hz, dia 1).

IR (neat) ν (cm^{-1}): 3299, 2953, 1694, 1534, 1239, 1078, 1013, 695.

EI-HRMS (positive ion) $C_{13}H_{16}F_3NO_3Na$ $[M+Na]^+$: requires 314.0980; found 314.0984.

Benzyl (1-methoxy-2-(trifluoromethyl)pentyl) carbamate 6f



m = 22 mg, 69% yield, colourless oil, mixture of diastereoisomers 55:45 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.41-7.30 (m, 5H), 5.32-5.08 (m, 4H), 3.36 (s, 3H), 2.47-2. 35 (m, 1H), 1.69-1.57 (m, 2H), 1.55-1.40 (m, 2H), 0.93 (t, *J* = 7.1 Hz, 3H).

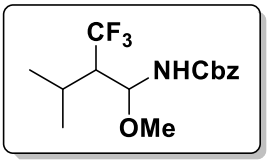
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.9 (dia 2), 155.8 (dia 1), 136.0, 128.6, 128.4, 128.1, 126.9 (q, *J* = 280.4 Hz), 81.7 (dia 2), 81.5 (dia 1), 67.2, 56.1 (dia 1), 56.0 (dia 2), 47.6 (q, *J* = 23.8 Hz, dia 1), 47.6 (q, *J* = 23.8 Hz, dia 2), 26.3, 20.6 (dia 1), 20.6 (dia 2), 14.0 (dia 1), 14.0 (dia 2).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -65.87 (d, *J* = 8.2 Hz, dia 2), -66.02 (d, *J* = 8.2 Hz, dia 1).

IR (neat) ν (cm^{-1}): 3331, 2964, 1705, 1511, 1236, 1089, 697.

EI-HRMS (positive ion) $C_{15}H_{20}F_3NO_3Na$ $[M+Na]^+$: requires 342.1296; found 342.1293.

Benzyl (1-methoxy-3-methyl-2-(trifluoromethyl)butyl) carbamate 6g



m = 19.5 mg, 61% yield, colourless oil, mixture of diastereoisomers 50:50 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.43-7.28 (m, 5H), 5.43-5.34 (m, 1H, dia 1), 5.26-5.09 (m, 3H), 5.26-5.09 (m, 1H, dia 2), 3.35 (s, 3H, dia 1), 3.34 (s, 3H, dia 2), 2.39-2.29 (m, 1H, dia 1), 2.24-2.15 (m, 1H), 2.15-2.09 (m, 1H, dia 2), 1.12-1.06 (m, 6H).

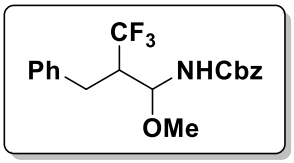
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.8, 136.1 (dia 1), 136.0 (dia 2), 128.6 (dia 1), 128.6 (dia 2), 128.4 (dia 1), 128.3 (dia 2), 128.2 (dia 1), 128.0 (dia 2), 127.1 (q, *J* = 280.4 Hz, dia 1), 126.9 (q, *J* = 279.5 Hz, dia 2), 81.2 (dia 1), 81.0 (dia 2), 67.2, 56.0 (dia 1), 55.5 (dia 2), 54.0 (q, *J* = 22.9 Hz, dia 1), 53.1 (q, *J* = 22.9 Hz, dia 2), 26.2 (dia 1), 26.0 (dia 2), 20.7 (dia 1), 20.7 (dia 2), 20.5 (dia 1), 19.9 (dia 2).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -61.35 (d, *J* = 10.3 Hz, dia 1), -61.49 (d, *J* = 10.3 Hz, dia 2).

IR (neat) ν (cm^{-1}): 3325, 2965, 1704, 1512, 1230, 1082, 697.

EI-HRMS (positive ion) $C_{15}H_{20}F_3NO_3Na$ $[M+Na]^+$: requires 342.1295; found 342.1293.

Benzyl (2-benzyl-3,3,3-trifluoro-1-methoxypropyl) carbamate 6h



m = 28.5 mg, 77% yield, colourless oil, mixture of diastereoisomers 55/45. Diastereomeric ratio was determined by ^{19}F NMR analysis. Each diastereomer is a mixture of rotamers.

^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.47-7.14 (m, 5H), 5.45-4.76 (m, 4H), 3.37 (s, 3H, dia 1), 3.35 (s, 3H, dia 2), 3.08-2.90 (m, 2H), 2.83-2.66 (m, 1H).

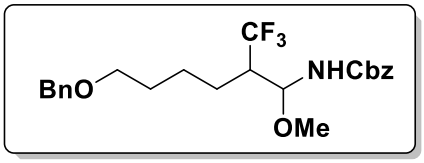
^{13}C NMR (125 MHz, DMSO d^6) δ (ppm): 156.6 (dia 1), 156.3 (dia 2), 139.0 (dia 1), 138.9 (dia 2), 137.2, 129.3, 129.2, 128.9, 128.8, 128.4, 128.2, 126.8, 127.2 (q, J=283.2 Hz), 81.5 (dia 1), 81.3 (dia 2), 66.2 (dia 1), 66.1 (dia 2), 55.3, 49.4 (q, J=22.9 Hz, dia 2), 48.7 (q, J=22.9 Hz, dia 1), 30.1 (dia 1), 29.6 (dia 2).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -65.45 (d, J= 8.2 Hz, dia 1, rot 1), -65.59 (d, J= 8.2 Hz, dia 1, rot 2), -67.12 (d, J= 8.2 Hz, dia 2, rot 1), -67.20 (d, J= 8.2 Hz, dia 2, rot 2).

IR (neat) ν (cm^{-1}): 3327, 2937, 1708, 1498, 1233, 1118, 1057, 741, 697.

EI-HRMS (positive ion) $C_{15}H_{20}F_3NO_3Na$ [M+Na]+ : requires 390.1302 found 342.1301.

Benzyl (6-(benzyloxy)-1-methoxy-2-(trifluoromethyl)hexyl) carbamate 6i



m = 40 mg, 92% yield, colourless oil, mixture of diastereoisomers 50:50 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.43-7.28 (m, 10H), 5.38-5.24 (m, 1H), 5.22-5.15 (m, 1H), 5.14 (s, 2H), 4.49 (s, 2H), 3.47 (t, *J* = 6.0 Hz, 2H), 3.35 (s, 3H), 2.50-2.30 (m, 1H), 1.73-1.50 (m, 6H).

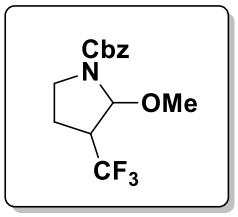
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.9, 138.5 (dia 1), 138.4 (dia 2), 136.0 (dia 1), 135.9 (dia 2), 128.6, 128.4, 128.1, 127.7, 127.7, 127.6, 126.8 (q, *J* = 280.4 Hz), 81.6 (dia 1), 81.4 (dia 2), 73.0 (dia 1), 73.0 (dia 2), 69.9 (dia 1), 69.8 (dia 2), 67.2, 56.0, 47.9 (q, *J* = 23.8 Hz, dia 1), 47.8 (q *J* = 23.8 Hz, dia 2), 29.6 (dia 1), 29.5 (dia 2), 24.3 (dia 1), 24.3 (dia 2), 24.2 (dia 1), 24.0 (dia 2).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -66.15 (d, *J* = 8.2 Hz, dia 1), -66.21 (d, *J* = 8.2 Hz, dia 2).

IR (neat) ν (cm^{-1}): 3324, 2935, 1725, 1498, 1229, 1099, 736, 697.

EI-HRMS (positive ion) $C_{23}H_{28}F_3NO_4Na$ $[M+Na]^+$: requires 462.1868; found 462.1871.

Benzyl 2-methoxy-3-(trifluoromethyl)pyrrolidine-1-carboxylate 6j



m = 18 mg, 60% yield, colourless oil, mixture of diastereoisomers 60/40. Diastereomeric ratio was determined by ^{19}F NMR analysis. The first diastereomer is a mixture of 2 rotamers.

^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.42-7.27 (m, 5H), 5.48-5.09 (m, 3H), 3.82-3.22 (m, 5H), 2.88-2.77 (m, 1H, dia 1), 2.73-2.61 (m, 1H, dia 2), 2.39-2.24 (m, 1H), 2.17-2.02 (m, 1H).

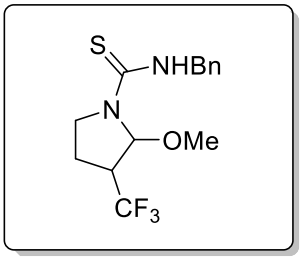
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.3 (dia 1), 154.3 (dia 2), 136.3 (dia 1), 136.1 (dia 2), 128.6 & 128.5 & 128.4 & 128.2 & 128.0 & 127.8 (dia 1 + dia 2), 126.3 (q, *J* = 278.3 Hz), 88.7 (dia 2), 88.1 (dia 1, rot 1), 87.1 (dia 1, rot 2), 67.6 (dia 2), 67.3 (dia 1), 57.4 (dia 1, rot 1), 56.4 (dia 1, rot 2), 55.6 (dia 2), 49.9 (q, *J* = 26.9Hz, dia 1, rot 1), 49.0 (q, *J* = 26.9 Hz, dia 2), 47.5 (q, *J* = 26.9 Hz, dia 1, rot 2), 44.9 (dia 1, rot 1), 44.7 (dia 2), 44.7 (dia 1, rot 2), 23.2 (dia 1), 22.5 (dia 2).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -65.65 (d, *J* = 8.2 Hz, dia 1, rot 1), -70.71 (d, *J* = 8.2 Hz, dia 2), -70.77 (d, *J* = 8.2 Hz, dia 1, rot 2).

IR (neat) ν (cm^{-1}): 2953, 1712, 1408, 1275, 1127, 772, 698.

EI-HRMS (positive ion) $C_{14}H_{16}F_3NO_4Na$ [M+Na]+ : requires 326.0988, found 326.0980.

***N*-benzyl-2-methoxy-3-(trifluoromethyl)pyrrolidine-1-carbothioamide 6k**



m = 23.5 mg, 74% yield, yellow oil, mixture of diastereoisomers 85:15 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

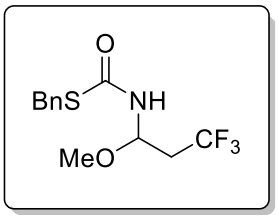
^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.42-7.30 (m, 5H), 6.58-6.42 (br. s, 1H), 5.57 (s, 1H), 4.90 (dd, *J* = 14.6, 4.9 Hz, 1H), 4.81 (dd, *J* = 14.7, 5.1 Hz, 1H), 4.07-3.93 (m, 1H), 3.89-3.73 (m, 1H), 3.33 (s, 3H), 3.07-2.90 (m, 1H), 2.44-2.27 (m, 1H), 2.24-2.11 (m, 1H).

^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 182.1 (dia 1), 181.6 (dia 2), 137.6 (dia 1), 137.4 (dia 2), 128.9 (dia 2), 128.9 (dia 1), 128.0 (dia 2), 127.9 (dia 2), 127.8 (dia 1), 127.8 (dia 1), 126.1 (q, *J* = 278.6 Hz, dia 1), 124.9 (q, *J* = 277.7 Hz, dia 2), 89.1 (dia 1), 88.7 (dia 2), 52.6, 49.8 (dia 2), 49.8 (dia 1), 49.3, 47.5 (q, *J* = 27.5 Hz, dia 1), 46.8 (q, *J* = 29.3 Hz, dia 2), 22.8 (dia 2), 22.5 (dia 1).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -65.74 (d, *J* = 8.2 Hz, dia 2), -70.33 (d, *J* = 8.2 Hz, dia 1).

IR (neat) ν (cm^{-1}): 3318, 2936, 1739, 1526, 1340, 1271, 1121, 965, 697.

S-benzyl (3, 3,3-trifluoro-1-methoxypropyl) carbamothioate 6l



m = 20.5 mg, 70% yield, colourless oil, mixture of rotamers.

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.29-7.20 (m, 5H), 5.54 (d, *J* = 8.8 Hz, 1H), 5.41-5.29 (m, 1H), 4.12 (s, 2H, rot 1), 4.09 (s, 2H, rot 2), 3.30 (s, 3H), 2.56-2.28 (m, 2H).

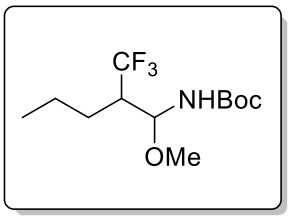
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 138.0 (rot 1), 137.6 (rot 2), 128.8, 128.7 (rot 1), 128.6 (rot 2), 127.4 (rot 1), 127.3 (rot 2), 124.8 (q, *J* = 277.7 Hz), 77.5, 56.2, 39.7 (q, *J* = 28.4 Hz), 34.5 (rot 1), 34.3 (rot 2).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -63.18 (t, *J* = 10.3 Hz).

IR (neat) ν (cm^{-1}): 3300, 2937, 1652, 1496, 1255, 1112, 843, 699.

EI-HRMS (positive ion) $C_{12}H_{14}F_3NO_2SNa$ $[M+Na]^+$: requires 316.0590 found; 316.0595.

Tert-butyl (1-methoxy-2-(trifluoromethyl)pentyl) carbamate 6m



m = 24 mg, 84% yield, yellow oil, mixture of diasteromers 45:55 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 5.15-4.86 (m, 2H), 3.34 (s, 3H), 5.15-4.86 (m, 1H), 1.67-1.52 (m, 2H), 1.52-1.37 (m, 11H), 0.93 (t, *J* = 7.3 Hz, 3H).

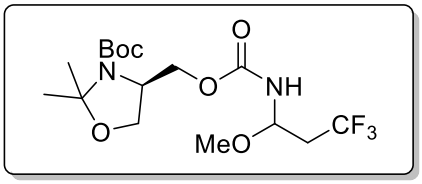
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.2, 126.9 (q, *J* = 281.4 Hz), 81.1 (dia 1), 80.9 (dia 2), 80.3 (dia 1), 80.3 (dia 2), 55.8 (dia 1), 55.8 (dia 2), 47.6 (q, *J* = 28.4 Hz, dia 1), 47.5 (q, *J* = 28.4 Hz, dia 2), 28.2, 26.7 (dia 2), 26.6 (dia 1), 20.6 (dia 2), 20.6 (dia 1), 14.0.

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm) : -65.93 (d, *J* = 8.2 Hz, dia 1), -66.03 (d, *J* = 8.2 Hz, dia 2).

IR (neat) ν (cm^{-1}): 3339, 2967, 1704, 1498, 1367, 1238, 1130, 962, 735.

EI-HRMS (positive ion) $C_{12}H_{22}F_3NO_3Na$ $[M+Na]^+$: requires 308.1459; found 308.1449.

(4*R*)- (*Tert*-butyl-2,2-dimethyl-4-((((3,3,3-trifluoro-1-methoxypropyl)carbamoyl)oxy) methyl)oxazolidine-3-carboxylate 6n



m = 29 mg, 72% yield, colourless oil, mixture of diastereoisomers 50:50 dr. Diastereomeric ratio was determined by ^{1}H NMR analysis.

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 5.22-5.02 (m, 2H), 4.26-4.13 (m, 1H), 4.13-3.77 (m, 4H), 3.31 (s, 3H, dia 1), 3.30 (s, 3H, dia 2), 2.57-2.26 (m, 2H), 1.52 (s, 3H, dia 1), 1.48 (s, 3H, dia 2), 1.45-1.38 (m, 12H).

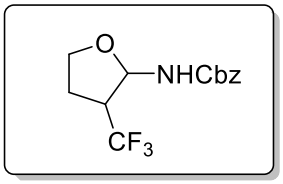
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.3 (dia 1), 155.2 (dia 2), 152.2 (dia 1), 151.6 (dia 2), 124.9 (q, *J* = 277.7 Hz), 94.1 (dia 1), 93.7 (dia 2), 80.7 (dia 1), 80.4 (dia 2), 78.5, 65.3 (dia 1), 65.0 (dia 2), 64.1 (dia 1), 64.0 (dia 2), 55.9, 55.9 (dia 1), 55.8 (dia 2), 39.8 (q, *J* = 28.4 Hz), 28.4, 27.5 (dia 1), 26.6 (dia 2), 24.3 (dia 1), 23.1 (dia 2).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -63.21 (t, *J* = 10.3 Hz).

IR (neat) ν (cm^{-1}): 3318, 2981, 1683, 1529, 1390, 1235, 1169, 843, 733.

EI-HRMS (positive ion) $C_{16}H_{27}F_3N_2O_6Na$ $[M+Na]^+$: requires 423.1714; found 423.1719.

Benzyl (3-(trifluoromethyl)tetrahydrofuran-2-yl)carbamate 6o



m = 15 mg, 52% yield, white solid, mixture of diastereoisomers 94:6 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

m.p. 102-104°C.

^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.42-7.31 (m, 5H), 7.65-7.51 (m, 2H), 5.14 (s, 2H), 4.07-3.79 (m, 2H), 3.03-2.79 (m, 1H), 2.37-2.21 (m, 1H), 2.18- 2.05 (m, 1H).

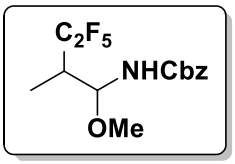
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.1, 135.8, 128.6, 128.4, 128.2, 126.4 (q, *J* = 277.7 Hz), 82.9, 67.3, 66.7, 48.7 (q, *J* = 24.7 Hz), 26.0.

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm) : -65.67 (d, *J* = 8.2 Hz, dia 2), -77.10 (d, *J* = 8.2 Hz, dia 1).

IR (neat) ν (cm^{-1}): 3330, 2948, 1693, 1531, 1390, 1246, 1166, 1026, 970, 761, 695.

EI-HRMS (positive ion) $C_{13}H_{15}F_3NO_3$ [M+H]+ : requires 290.1010 found 290.1004.

Benzyl (3,3,4,4,4-pentafluoro-1-methoxy-2-methylbutyl)carbamate 6p



m = 22 mg, 65% yield, colourless oil, mixture of diastereomers 58:42 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

^{1}H NMR (500 MHz, $CDCl_3$) δ (ppm): 7.40-7.32 (m, 5H), 5.28-5.19 (m, 2H), 5.16-5.15 (m, 2H), 3.37 (s, 3H), 2.71-2.44 (m, 1H), 1.22-1.18 (m, 3H).

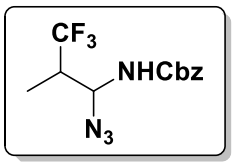
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.7 (dia 1), 155.6 (dia 2), 136.0 (dia 1), 135.9 (dia 2), 128.6, 128.4, 128.2 (dia 1), 128.1 (dia 2), 119.2 (qtd, *J* = 286.9, 36.7, 11.9 Hz), 116.5 (tqd, *J* = 255.7, 36.7, 10.1 Hz), 81.3 (dia 1), 81.2 (dia 2), 67.3, 55.9 (dia 1), 55.7 (dia 2), 41.1 (t, *J* = 20.2 Hz, dia 1), 40.1 (t, *J* = 19.2 Hz, dia 2), 7.5 (dia1), 7.0 (dia 2).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -82.68 (CF_3, dia 1), -82.77 (CF_3, dia 2), -117.22 (d, *J* = 10.3 Hz), -117.74 (d, *J* = 10.3 Hz), -118.18 (d, *J* = 10.3 Hz), -118.71 (d, *J* = 10.3 Hz), -119.24 (d, *J* = 10.3 Hz), -120.20 (d, *J* = 10.3 Hz), -120.61 (d, *J* = 10.3 Hz), -121.58 (d, *J* = 10.3 Hz).

IR (neat) ν (cm^{-1}): 3330, 2955, 1702, 1520, 1191, 1178, 1076, 1014, 696.

EI-HRMS (positive ion) $C_{14}H_{16}F_5NO_3Na$ $[M+Na]^+$: requires 364.0950; found 364.0948.

Benzyl (1-azido-3,3,3-trifluoro-2-methylpropyl)carbamate 8a



m = 19.5 mg, 65% yield, colourless oil, mixture of diastereomers 50:50 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.40-7.35 (m, 5H), 5.74-5.45 (m, 2H), 5.19 (s, 2H), 2.54-2.46 (m, 1H), 1.22 (d, *J* = 7.0 Hz, 3H, dia 1), 1.21 (d, *J* = 7.0 Hz, 3H, dia 2).

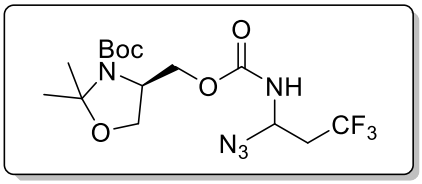
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.5 (dia 1), 155.4 (dia 2), 135.5 (dia 1), 135.3 (dia 2), 128.7, 128.6, 128.3, 126.1 (q, *J* = 280.8 Hz), 67.9, 67.1, 42.3 (q, *J* = 26.6 Hz, dia 1), 42.0 (q, *J* = 25.7Hz, dia 2), 9.2 (dia 1), 8.2 (dia 2).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -69.02 (d, *J* = 8.2 Hz, dia 1), -69.38 (d, *J* = 8.2 Hz, dia 2).

IR (neat) ν (cm^{-1}): 3317, 2957, 2101, 1698, 1515, 1227, 1137, 1018, 738, 696.

EI-HRMS (positive ion) $C_{12}H_{13}F_3N_4O_2$ $[M+Na]^+$: requires 325.0891; found 325.0888.

(4*R*)-*Tert*-butyl-4-((((1-azido-3,3,3-trifluoropropyl)carbamoyl)oxy)methyl)-2,2-dimethyl oxazolidine-3-carboxylate 8b



m = 30.5 mg, 75% yield, coloUrless oil, mixture of diastereomers 72:28 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 5.88-5.61 (m, 2H), 4.34-4.25 (m, 1H), 4.21-4.13 (m, 1H), 4.10-4.00 (m, 1H), 3.98-3.90 (m, 2H), 2.52-2.42 (m, 2H), 1.59 (s, 3H, dia 1), 1.55 (s, 3H, dia 2), 1.50 (s, 3H, dia 1), 1.49 (s, 3H, dia 2), 1.49 (s, 9H).

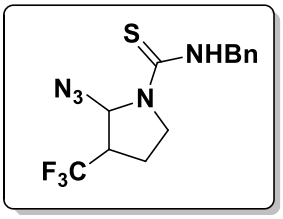
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.2 (dia 1), 155.1 (dia 2), 152.3 (dia 1), 151.5 (dia 2), 125.8 (q, *J* = 266.8 Hz, dia 1), 124.5 (q, *J* = 277.7 Hz, dia 2), 94.2 (dia 1), 93.7 (dia 2), 80.8 (dia 2), 80.4 (dia 1), 65.2 (dia 1), 64.9 (dia 2), 64.5, 63.7, 55.8 (dia 1), 55.7 (dia 2), 38.6 (q, *J* = 29.3 Hz), 28.4, 27.5 (dia 1), 26.6 (dia 2), 24.3 (dia 1), 23.0 (dia 2).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -63.47 (t, *J* = 10.3 Hz, dia 1), -63.55 (d, *J* = 10.3 Hz, dia 2).

IR (neat) ν (cm^{-1}): 3306, 2978, 2933, 2113, 1703, 1679, 1528, 1391, 1240, 1142, 1078, 846, 770.

EI-HRMS (positive ion) $C_{15}H_{24}F_3N_5O_5Na$ $[M+Na]^+$: requires 434.1627; found 434.1634.

2-Azido-*N*-benzyl-3-(trifluoromethyl)pyrrolidine-1-carbothioamide 8c



m = 26 mg, 79% yield, 55:45 dr. The two diastereomers could be separated on silica gel.

Diastereomer 1: 14.2 mg, white solid.

m.p. 86-88°C

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.39-7.34 (m, 5H), 6.46 (s, 1H), 5.87 (br s, 1H), 4.89 (dd, *J* = 14.5, 5.0 Hz, 1H), 4.86 (dd, *J* = 14.5, 5.0 Hz, 1H), 3.68-3.62 (m, 2H), 2.95-2.90 (m, 1H), 2.54-2.46 (m, 1H), 2.35-2.29 (m, 1H).

^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 181.2, 137.2, 128.9, 128.1, 128.0, 125.8 (q, *J* = 278.6 Hz), 76.5, 50.1, 49.1 (q, *J* = 27.5 Hz), 46.3, 23.5.

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -72.76 (d, *J* = 10.3 Hz).

IR (neat) ν (cm^{-1}): 3303, 2967, 1697, 1532, 1241, 1133, 1047, 738, 696.

EI-HRMS (positive ion) $C_{13}H_{15}F_3N_5S$ $[M+H]^+$: requires 330.0992; found 330.0998.

Diastereomer 2: 11.8 mg, white solid, mixture of rotamers.

m.p. 96-98°C

^{1}H NMR (300 MHz, MeOD) δ (ppm): 7.37-7.23 (m, 5H), 6.39 (d, *J* = 5.7 Hz, 1H, rot 1), 5.97 (s, 1H, rot 2), 4.92 (d, *J* = 5.7 Hz, 2H, rot 1), 4.87 (d, *J* = 3.9 Hz, 2H, rot 2), 3.81-3.74 (m, 1H), 3.71-3.66 (m, 1H, rot 2), 3.57-3.51 (m, 1H, rot 1), 3.26-3.20 (m, 1H, rot 1), 3.06-2.97 (m, 1H, rot 2), 2.50-2.43 (m, 1H, rot 2), 2.36-2.32 (m, 2H, rot 1), 2.19-2.14 (m, 2H, rot 2).

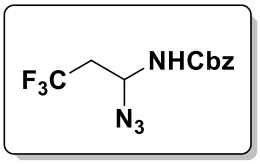
^{13}C NMR (125 MHz, MeOD) δ (ppm): 182.6 (rot 1), 181.7 (rot 2), 140.2 (rot 2), 140.1 (rot 1), 129.4, 128.6, 128.1, 128.0 (q, *J* = 277.7 Hz), 84.8, 77.4, 51.3 (q, J=27.5 Hz), 49.5, 24.0 (rot 1), 23.7 (rot 2).

^{19}F NMR (282 MHz, MeOD) δ (ppm): -67.24 (d, *J* = 10.3 Hz), -72.18 (d, *J* = 10.3 Hz).

IR (neat) ν (cm^{-1}): 3293, 2967, 1692, 1540, 1244, 1129, 1046, 756, 696.

EI-HRMS (positive ion) $C_{13}H_{15}F_3N_5S$ $[M+H]^+$: requires 330.0992; found 330.1000.

Benzyl (1-azido-3,3,3-trifluoropropyl)carbamate 8d



m = 20 mg, 70% yield, white solid.

m.p. 56-58°C

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.42-7.37 (m, 5H), 5.67 (br. s, 1H), 5.50-5.48 (m, 1H), 5.20 (s, 2H), 2.50-2.45 (m, 2H).

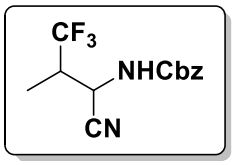
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 155.3, 135.5, 128.7, 128.6, 128.3, 124.5 (q, *J* = 276.8 Hz), 67.8, 63.7, 38.6 (q, *J* = 29.3 Hz).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -63.41 (t, *J* = 10.3 Hz).

IR (neat) ν (cm^{-1}): 3293, 2966, 1692, 541, 1262, 1129, 1046, 757, 696.

EI-HRMS (positive ion) $C_{11}H_{11}F_3N_4O_2Na$ $[M+Na]^+$: requires 311.0732; found 311.0738.

Benzyl (1-cyano-3,3,3-trifluoro-2-methylpropyl)carbamate 9a



m = 17 mg, 60% yield, white solid, mixture of diastereomers 78:22 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

m.p. 45-47°C.

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.42-7.38 (m, 5H), 5.41-5.36 (m, 1H), 5.18 (s, 2H), 5.08-5.03 (m, 1H), 2.78-2.71 (m, 1H), 1.37 (d, *J* = 7.2 Hz, 3H).

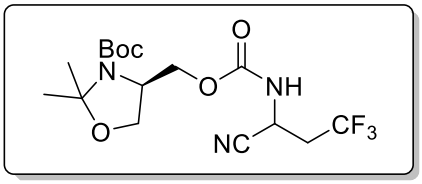
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 154.9, 135.2, 128.7, 128.7, 128.4, 128.2 (q, *J* = 280.8 Hz), 115.7 (dia 1), 115.5 (dia 2), 68.2, 42.9 (dia 2), 42.8 (dia 1), 41.2 (q, *J* = 27.5 Hz), 10.0.

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -69.27 (d, *J* = 8.2 Hz, dia 1), -70.08 (d, *J* = 8.2 Hz, dia 2).

IR (neat) ν (cm^{-1}): 3306, 2955, 1701, 1527, 1241, 1136, 696.

EI-HRMS (positive ion) $C_{13}H_{13}F_3N_2O_2$ $[M+Na]^+$: requires 309.0827; found 309.0825.

(4R)-Tert-butyl4-((((1-cyano-3,3,3-trifluoropropyl)carbamoyl)oxy)methyl)-2,2-dimethyl oxazolidine-3-carboxylate 9b



m = 21.5 mg, 55% yield, colourless oil, mixture of diastereomers 65:35 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 6.02-5.89 (m, 1H, dia 1), 5.62 (d, *J* = 29.3 Hz, 1H, dia 2), 4.99-4.92 (m, 1H), 4.32-4.16 (m, 2H), 4.03-3.87 (m, 3H), 2.82-2.70 (m, 2H), 1.60 (s, 3H, dia 2), 1.56 (s, 3H, dia 1), 1.50-1.49 (m, 12H).

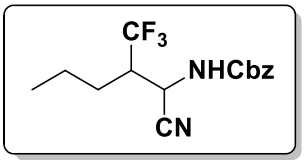
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 154.6 (dia 1), 154.4 (dia 2), 152.4 (dia 1), 151.5 (dia 2), 124.3 (q, *J* = 277.7 Hz), 116.2 (dia 1), 116.1 (dia 2), 94.2 (dia 1), 93.8 (dia 2), 80.9 (dia 2), 80.5 (dia 1), 65.1 64.9, 55.7 (dia 1), 55.6 (dia 2), 37.5, 37.1 (q, *J* = 30.2 Hz), 28.4, 27.5 (dia 1), 26.6 (dia 2), 24.2 (dia 1), 23.0 (dia 2).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -63.74 (t, *J* = 8.2 Hz, dia 1), -63.87 (d, *J* = 8.2 Hz, dia 2).

IR (neat) ν (cm^{-1}): 3304, 2980, 3939, 1730, 1672, 1526, 1367, 1243, 1145, 1078, 844, 769.

EI-HRMS (positive ion) $C_{16}H_{24}F_3N_3O_5Na$ $[M+Na]^+$: requires 418.1566; found 418.1572.

Benzyl (1-cyano-2-(trifluoromethyl)pentyl)carbamate 9c



m = 18 mg, 58% yield, colourless oil, mixture of diastereomers 74:26 dr. Diastereomeric ratio was determined by ^{19}F NMR analysis.

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.42-7.37 (m, 5H), 5.44-5.42 (m, 1H, dia 1), 5.28-5.26 (m, 1H, dia 2), 5.21-5.15 (m, 2H), 5.12-5.06 (m, 1H), 2.62-2.55 (m, 1H), 1.85-1.77 (m, 1H), 1.70-1.50 (m, 3H), 1.02 (t, *J* = 7.3 Hz, 3H, dia 1), 0.99 (t, *J* = 7.3 Hz, 3H, dia 2).

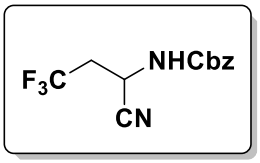
^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 154.9, 135.3, 128.7, 128.7, 128.4, 126.3 (q, *J* = 280.8 Hz, dia 1), 126.0 (q, *J* = 280.8 Hz, dia 2), 116.0 (dia 2), 115.4 (dia 1), 68.2, 46.0 (q, *J* = 25.7 Hz, dia 1), 45.9 (q, *J* = 24.7 Hz, dia 2), 41.6 (dia 1), 41.3 (dia 2), 27.4 (dia 1), 27.2 (dia 2), 20.1 (dia 2), 20.0 (dia 1), 13.8 (dia 2), 13.6 (dia 1).

^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -66.82 (d, *J* = 8.2 Hz, dia 1), -66.95 (d, *J* = 8.2 Hz, dia 2).

IR (neat) ν (cm^{-1}): 3303, 2967, 1697, 1532, 1241, 1133, 696.

EI-HRMS (positive ion) $C_{15}H_{18}F_3N_2O_2$ $[M+H]^+$: requires 315.1320; found 315.1328.

Benzyl (1-cyano-3,3,3-trifluoropropyl)carbamate 9d



m = 17 mg, 62% yield, white solid.

m.p. 77-79°C

^{1}H NMR (300 MHz, $CDCl_3$) δ (ppm): 7.43-7.35 (m, 5H), 5.45-5.41 (m, 1H), 5.19 (s, 2H), 4.98-4.95 (m, 1H), 2.80-2.68 (m, 2H).

^{13}C NMR (125 MHz, $CDCl_3$) δ (ppm): 154.7, 135.2, 128.7, 128.7, 128.4, 124.3 (q, *J* = 276.8 Hz), 116.1, 68.2, 37.5, 37.1 (q, *J* = 29.3 Hz).

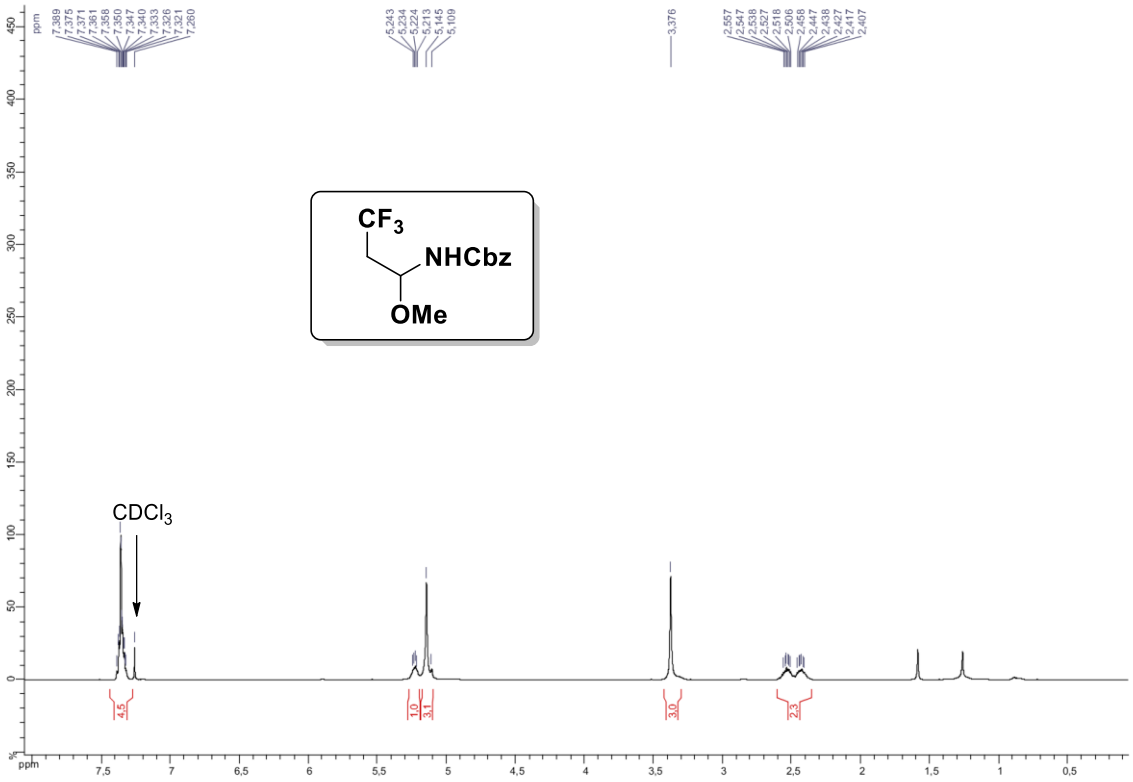
^{19}F NMR (282 MHz, $CDCl_3$) δ (ppm): -63.70 (t, *J* = 10.3 Hz).

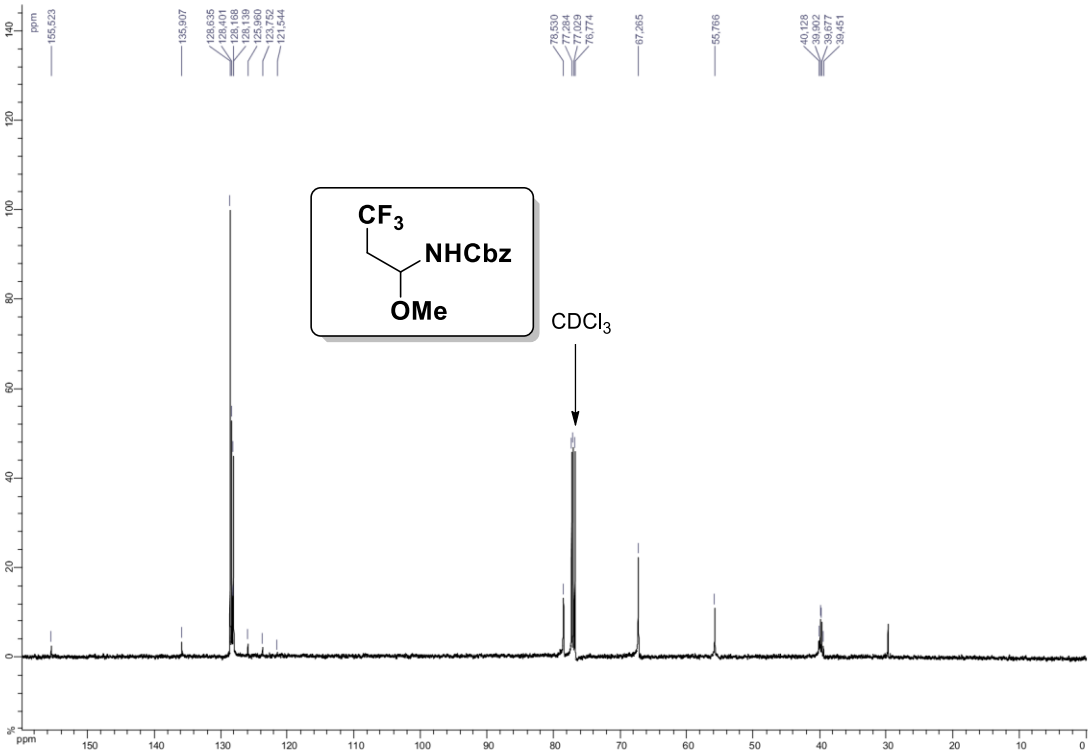
IR (neat) ν (cm^{-1}): 3291, 2967, 1692, 1542, 1262, 1129, 1046, 757, 696.

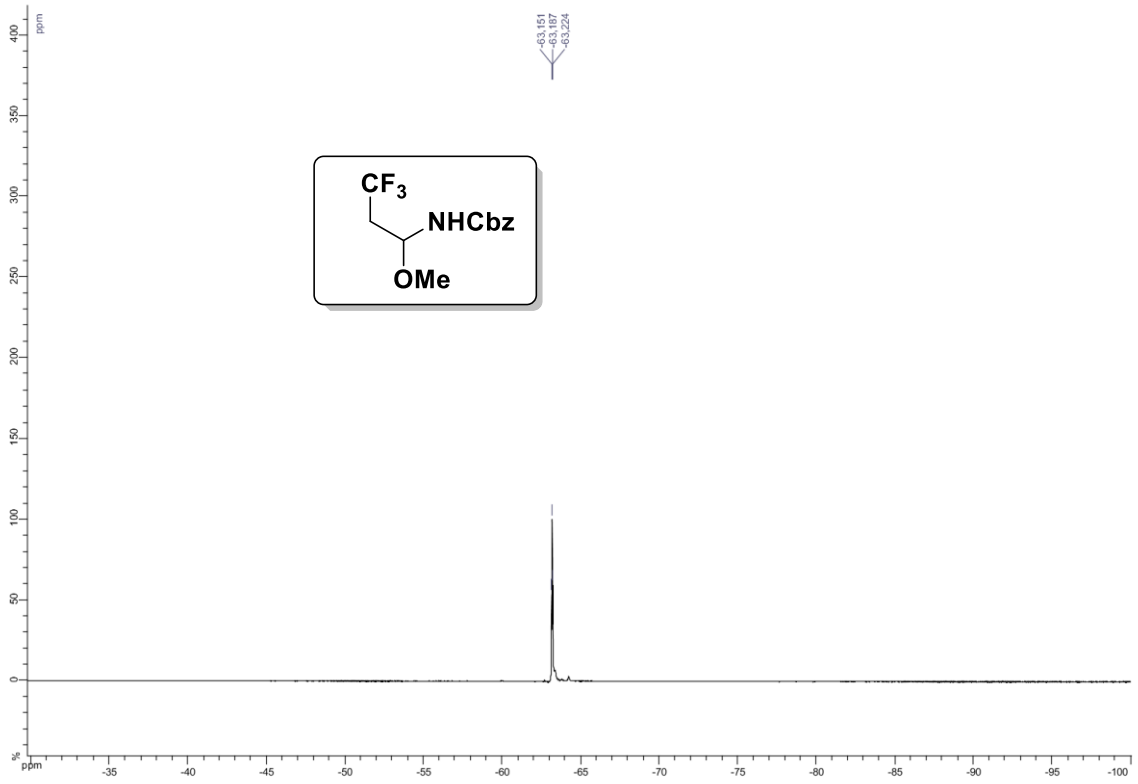
EI-HRMS (positive ion) $C_{12}H_{11}F_3N_2O_2Na$ $[M+Na]^+$: requires 295.0670; found 295.0675.

VI-^{1}H, ^{13}C and ^{19}F NMR spectra.

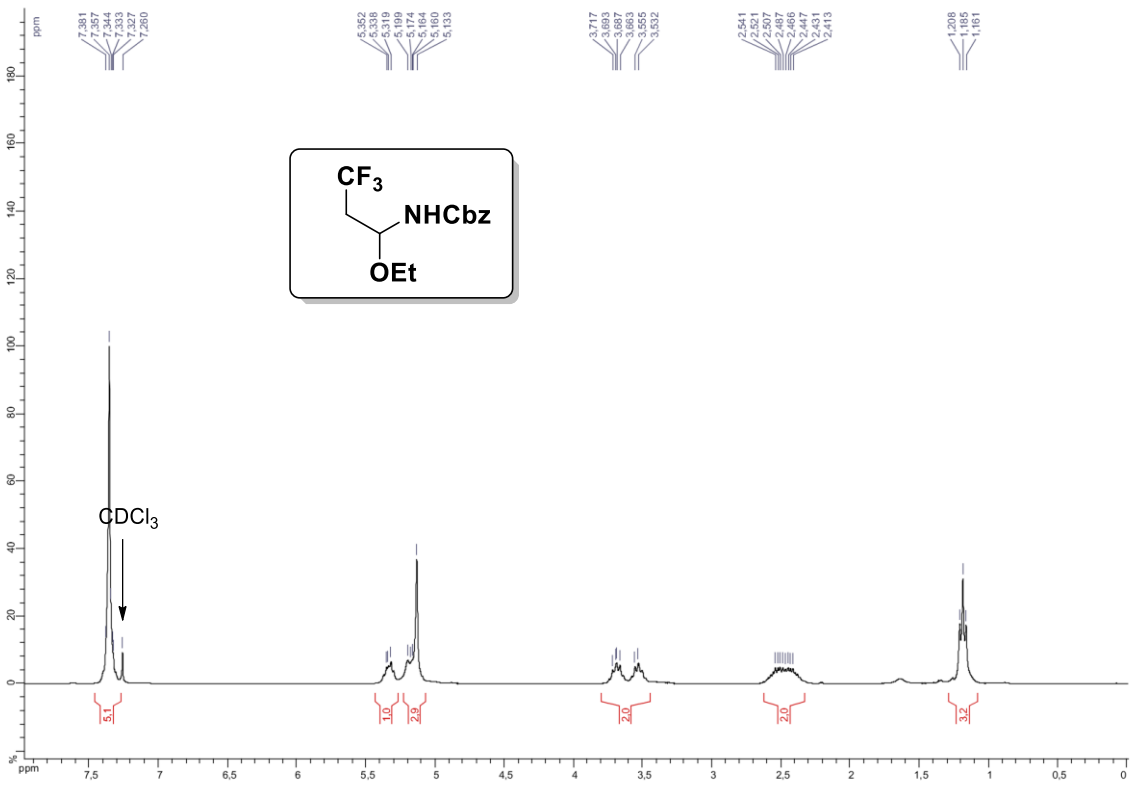
Benzyl (3,3,3-trifluoro-1-methoxypropyl) carbamate 6a

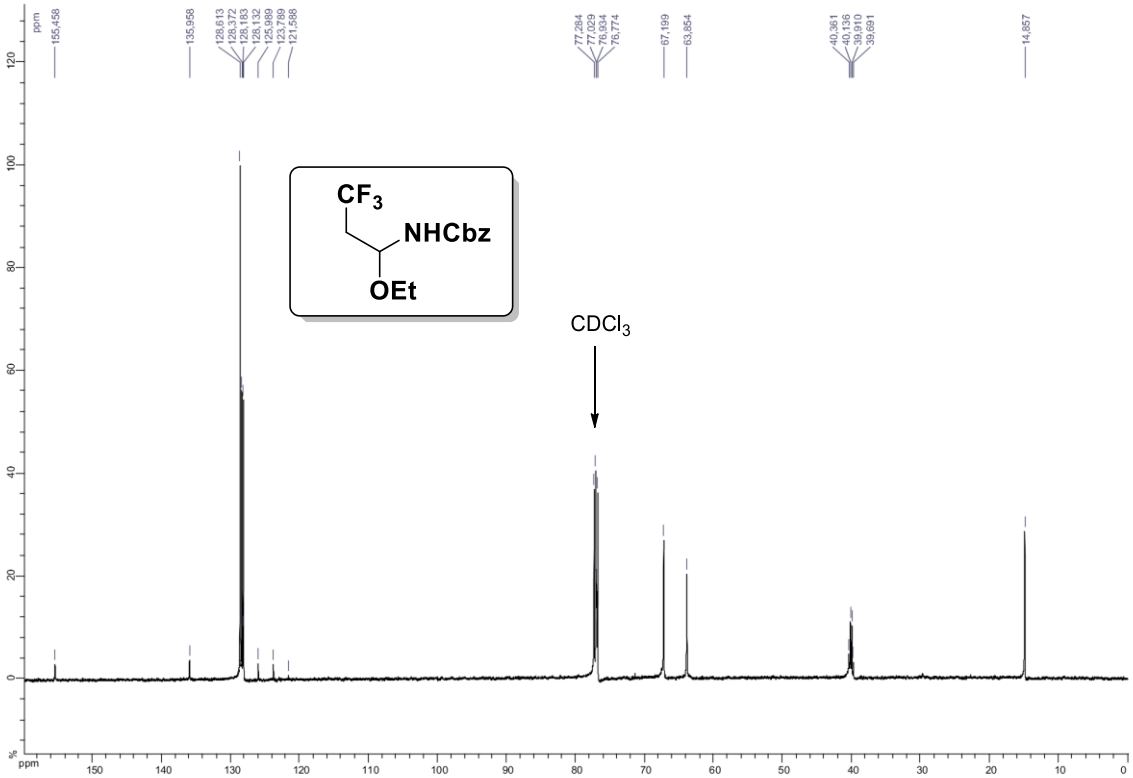


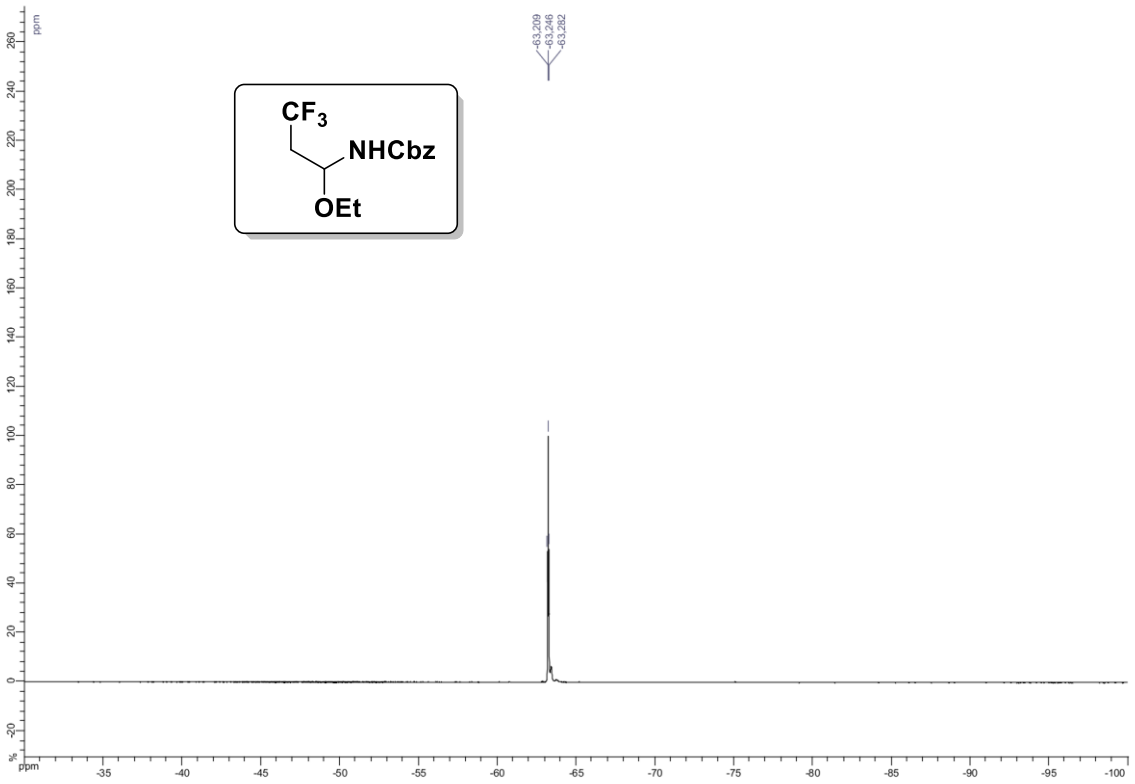



-63.151
-63.187
-63.224
CF3
NHCbz
OMe
ppm
400
350
300
250
200
150
100
50
0
%
ppm
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

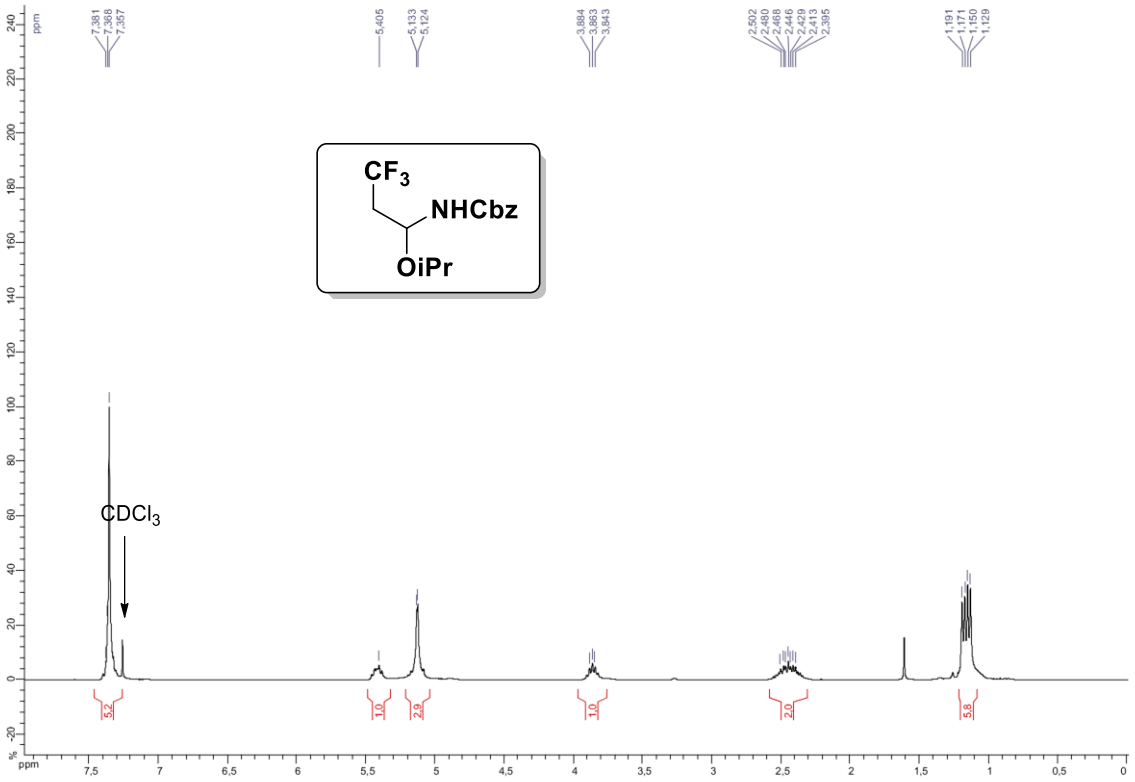
Benzyl (1-ethoxy-3,3,3-trifluoropropyl) carbamate 6b

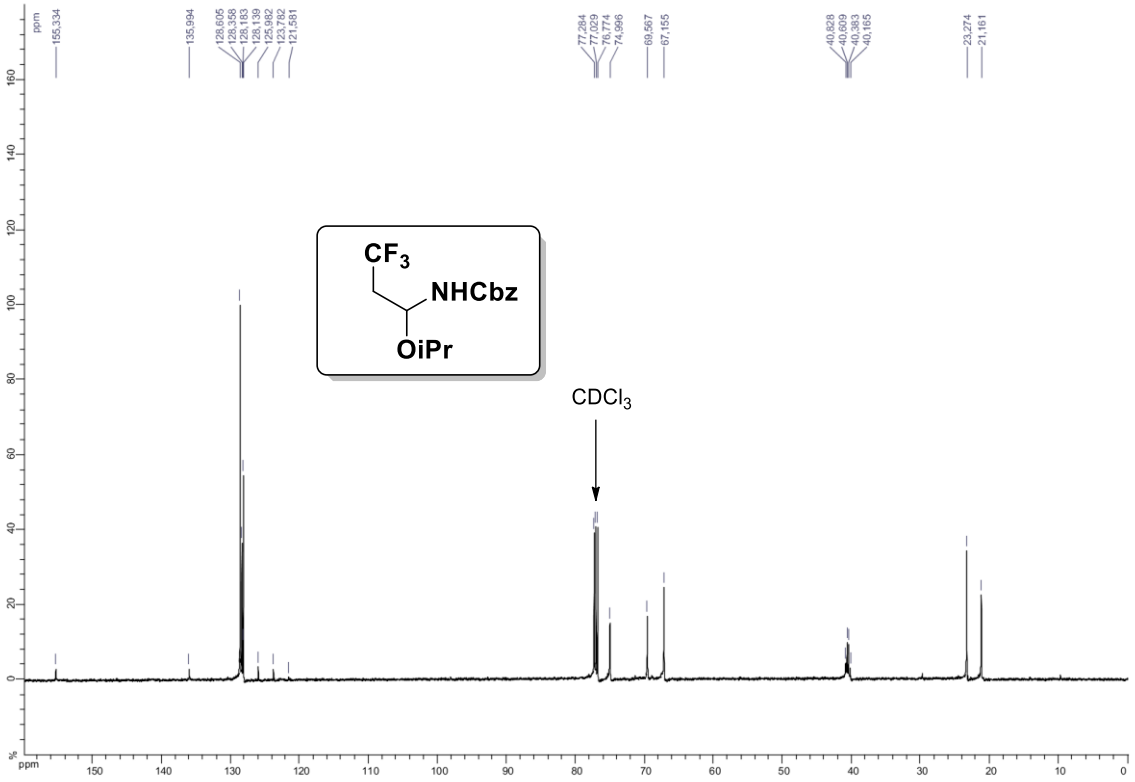


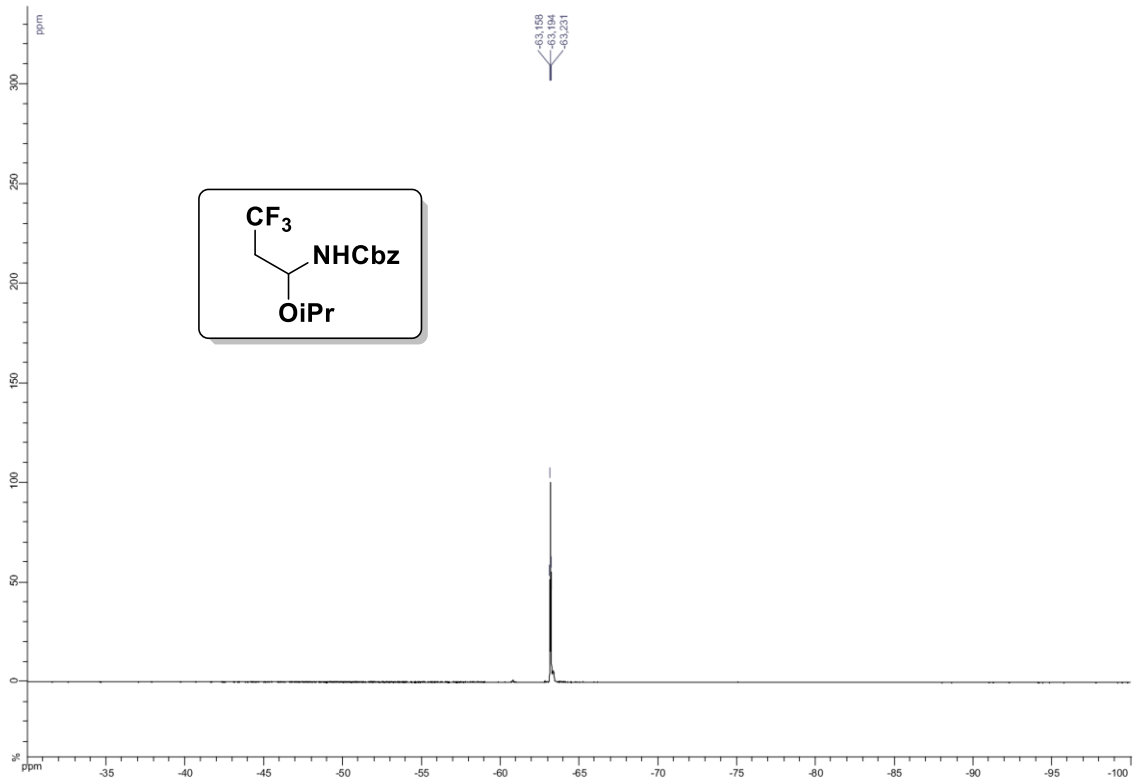



-63.209
-63.246
-63.282
CF3
NHCbz
OEt
ppm
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
%
ppm
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

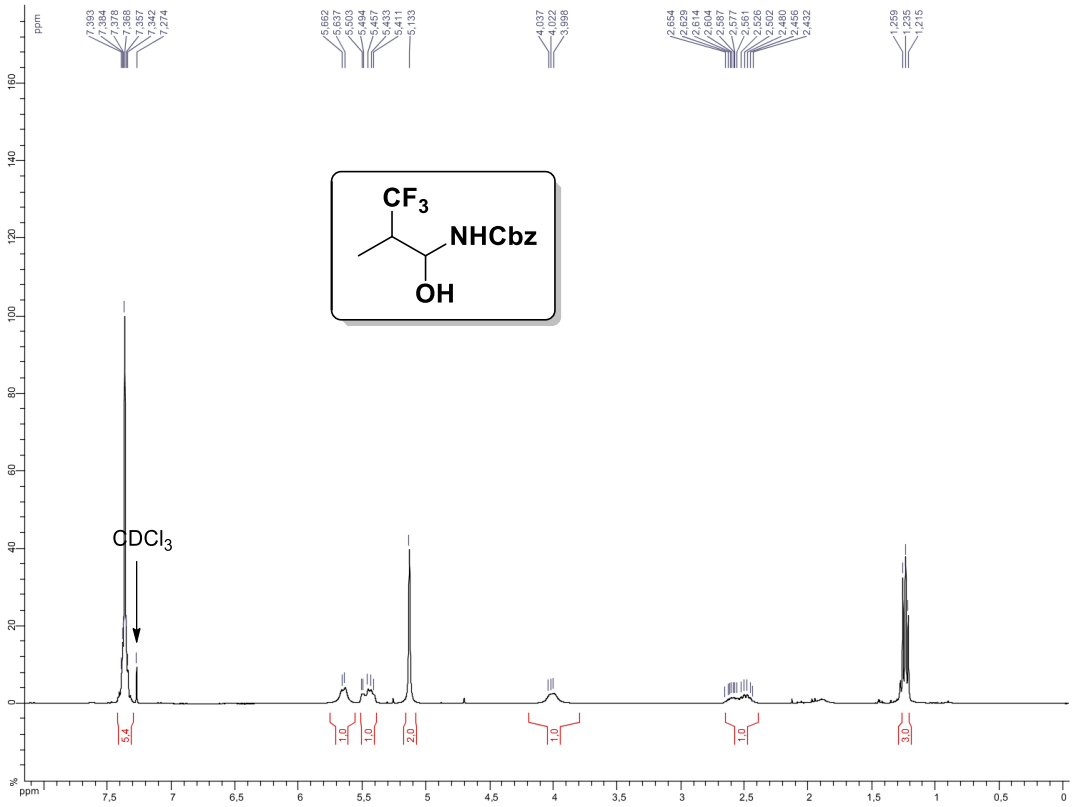
Benzyl (3,3,3-trifluoro-1-isopropoxypropyl) carbamate 6c

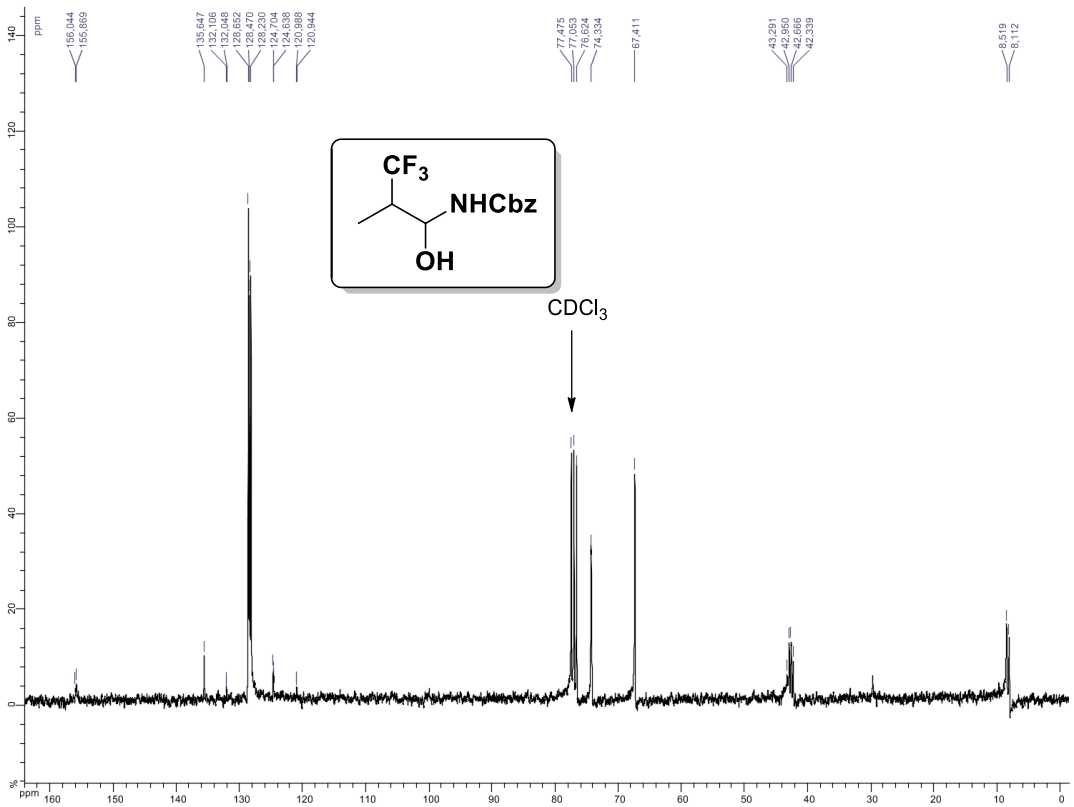


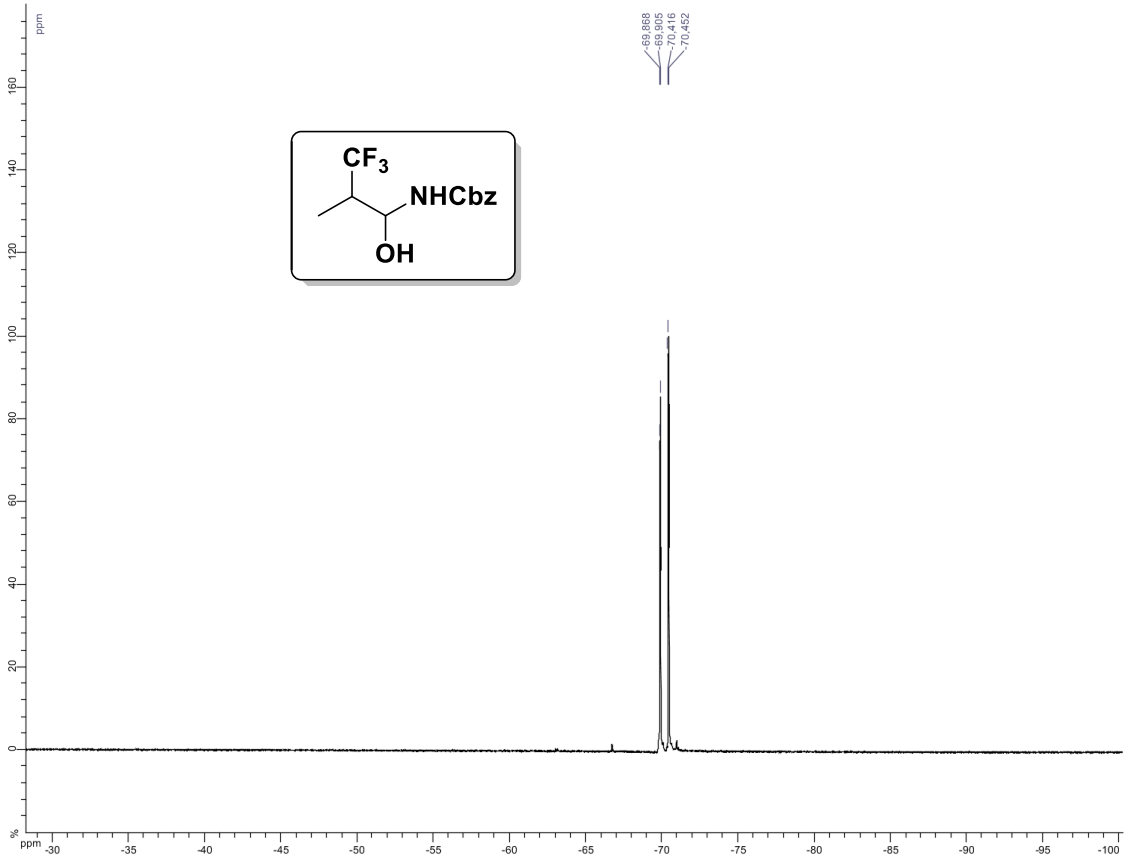



-63.158
-63.194
-63.231
CF3
NHCbz
OiPr
ppm
300
250
200
150
100
50
0
%
ppm
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

Benzyl (3,3,3-trifluoro-1-hydroxy-2-methylpropyl)carbamate 6d

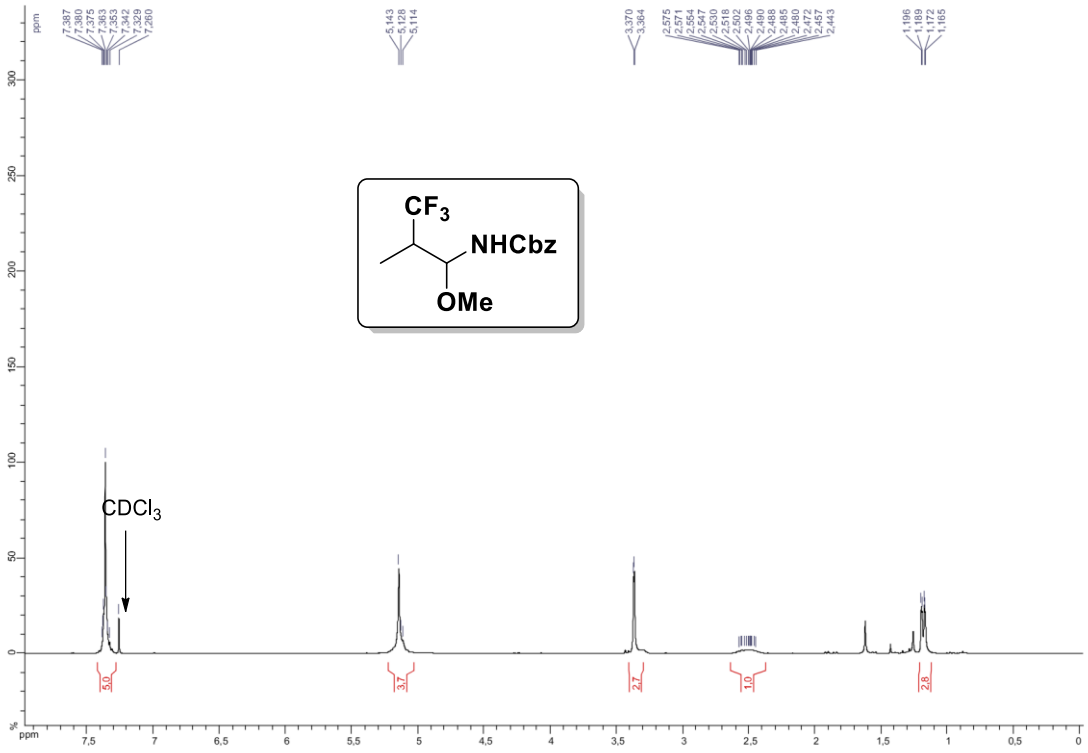


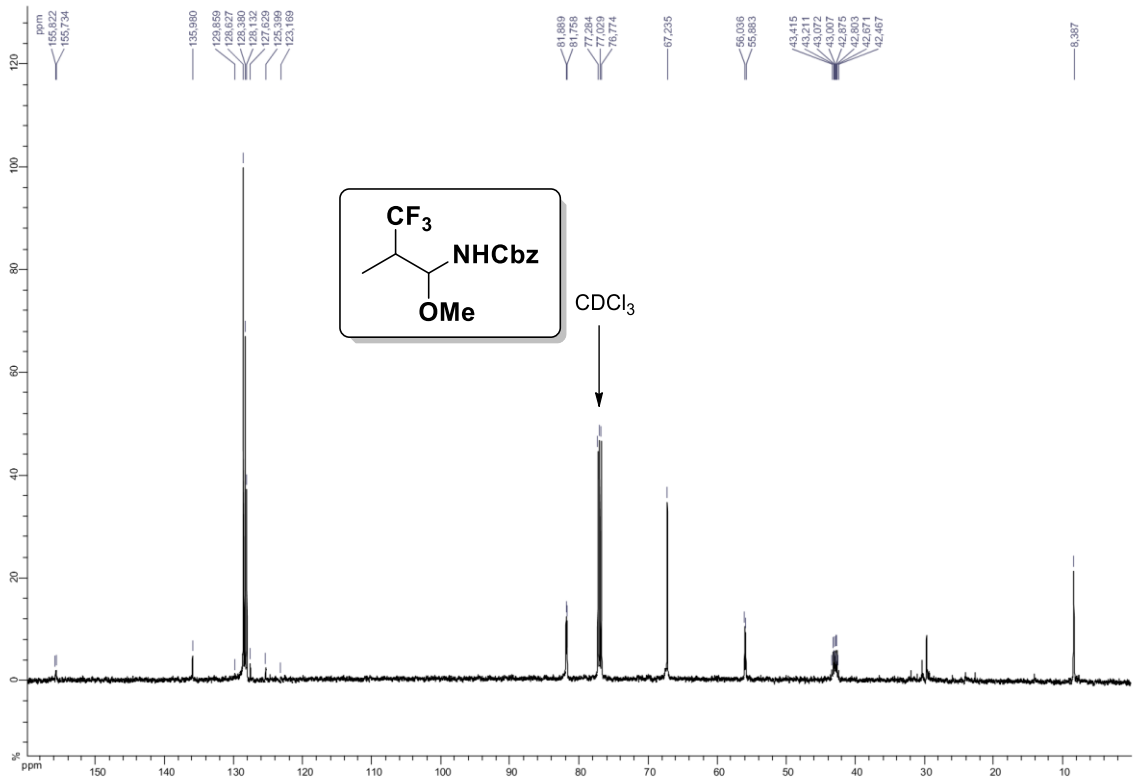


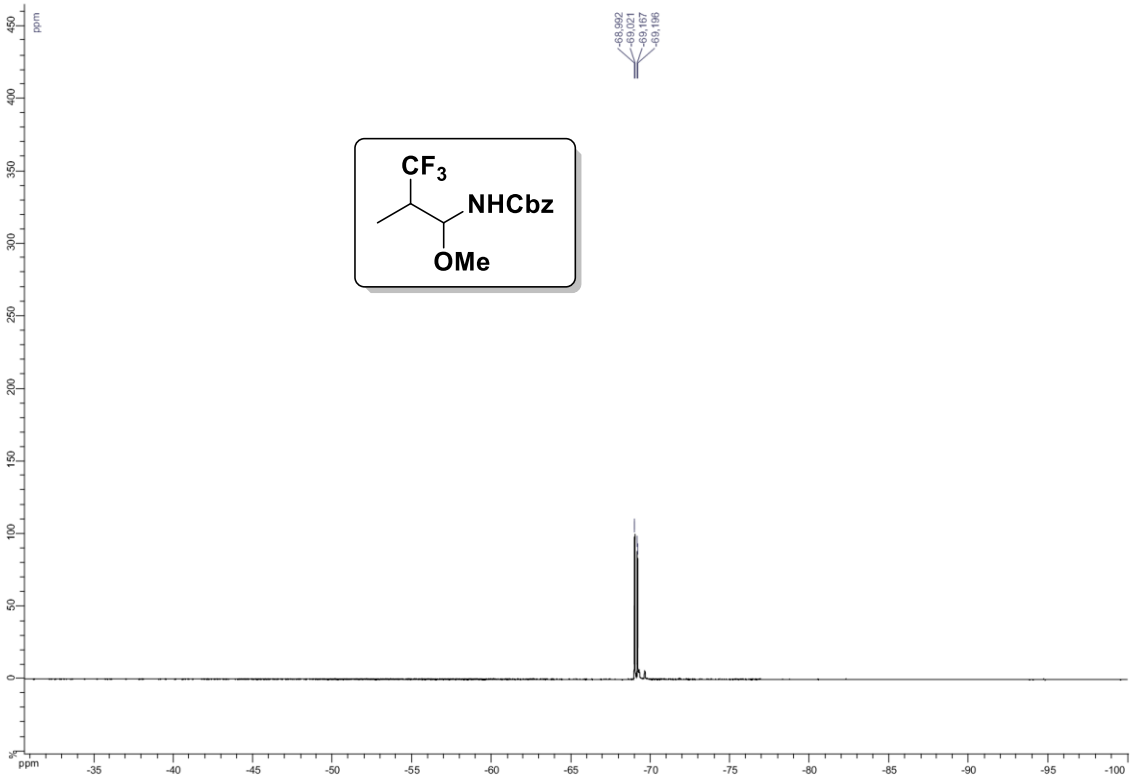

ppm
-69.868
-69.905
-70.416
-70.452
CF3
NHCbz
OH
160
140
120
100
80
60
40
20
0
%
ppm
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

Benzyl (3,3,3-trifluoro-1-methoxy-2-methylpropyl) carbamate : 6e

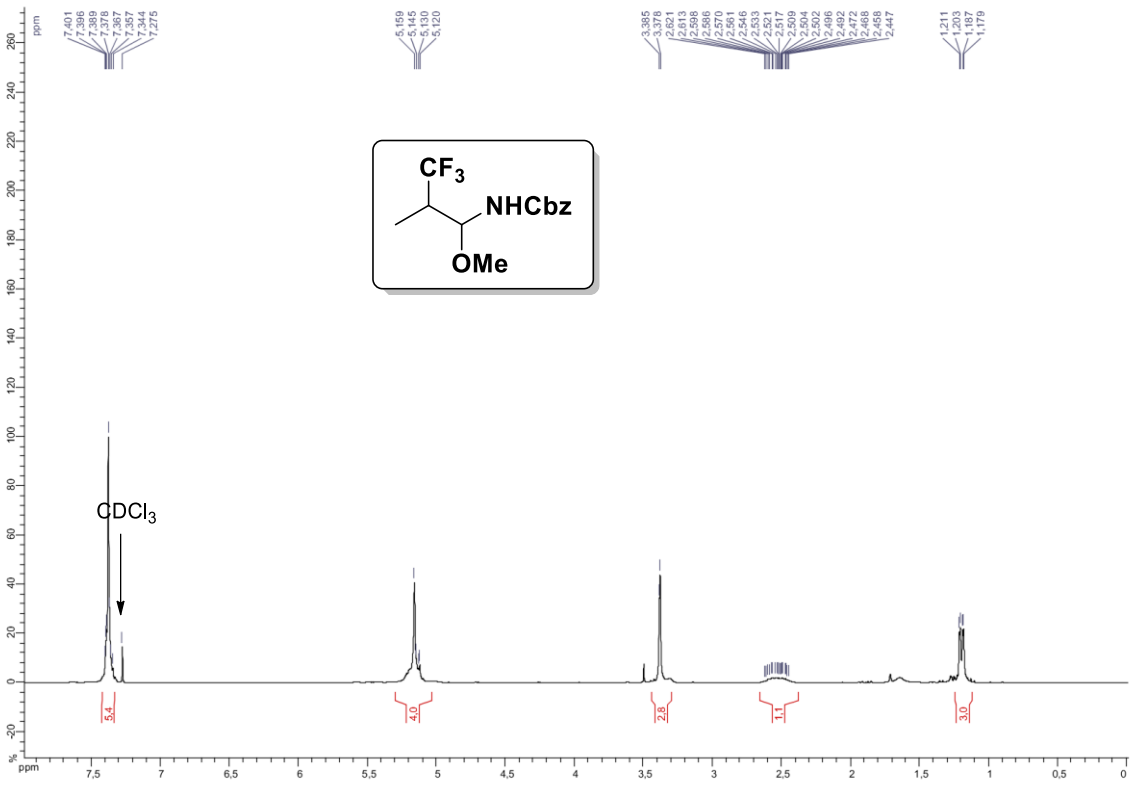
From (Z) carbamate :

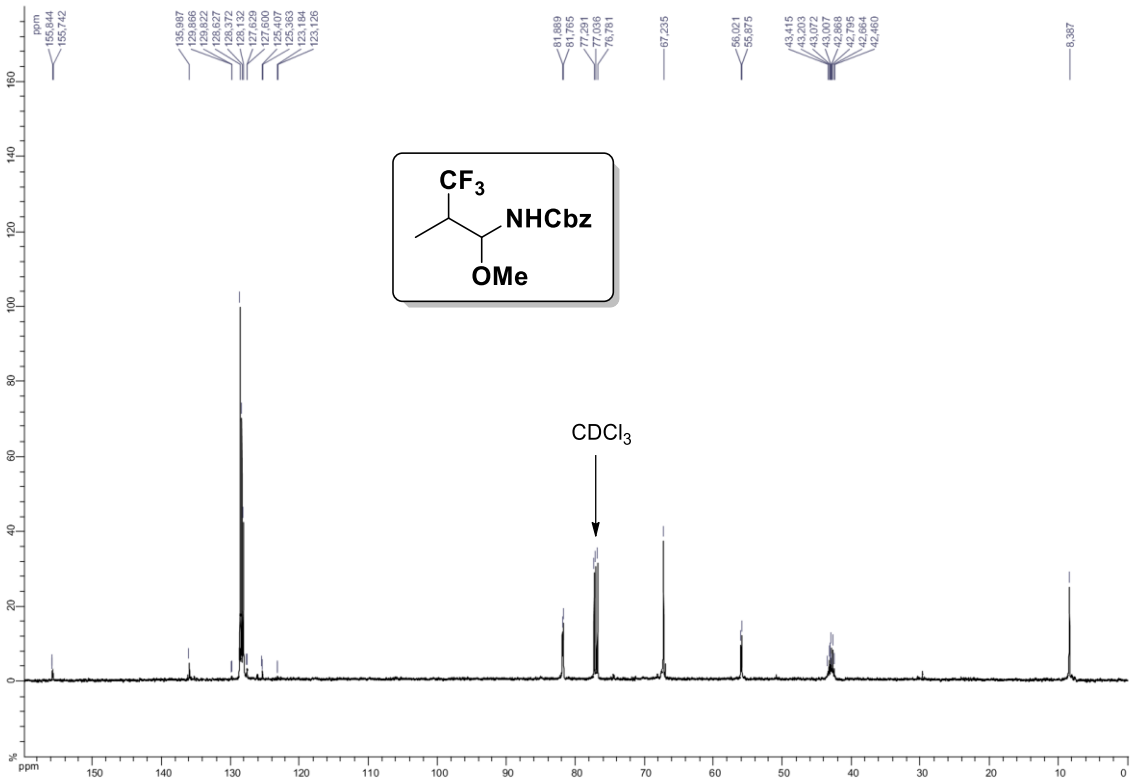


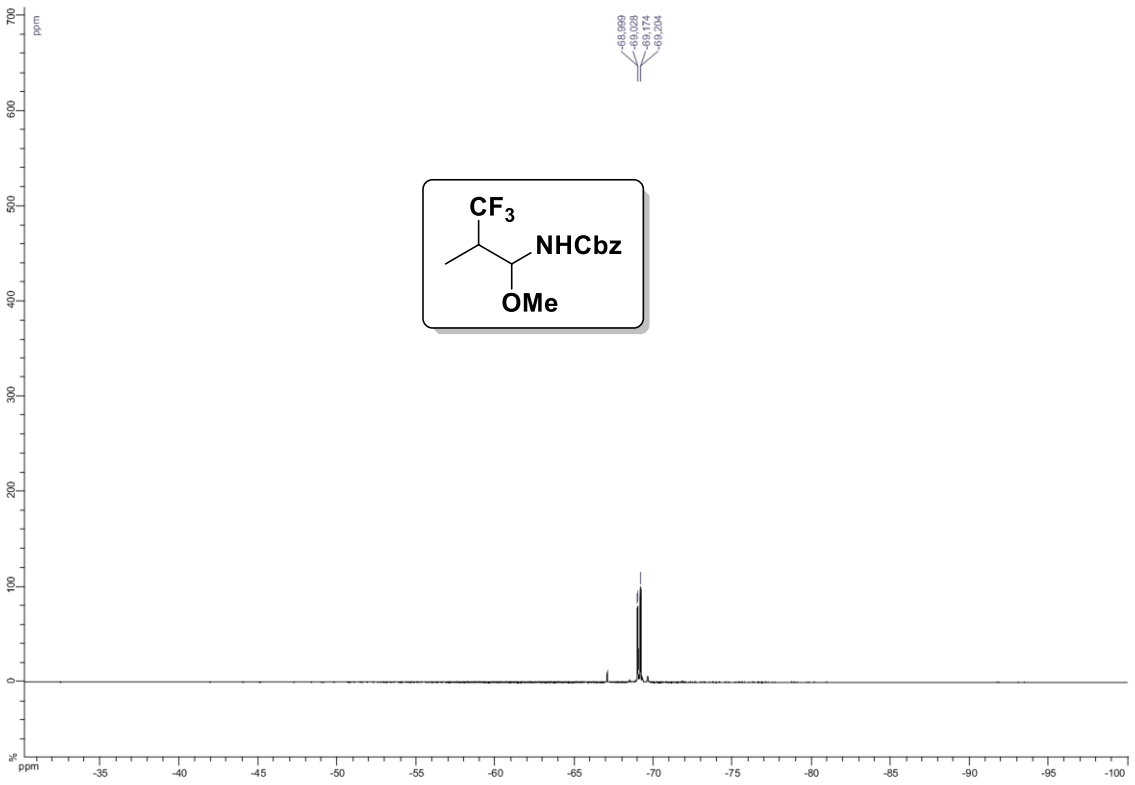




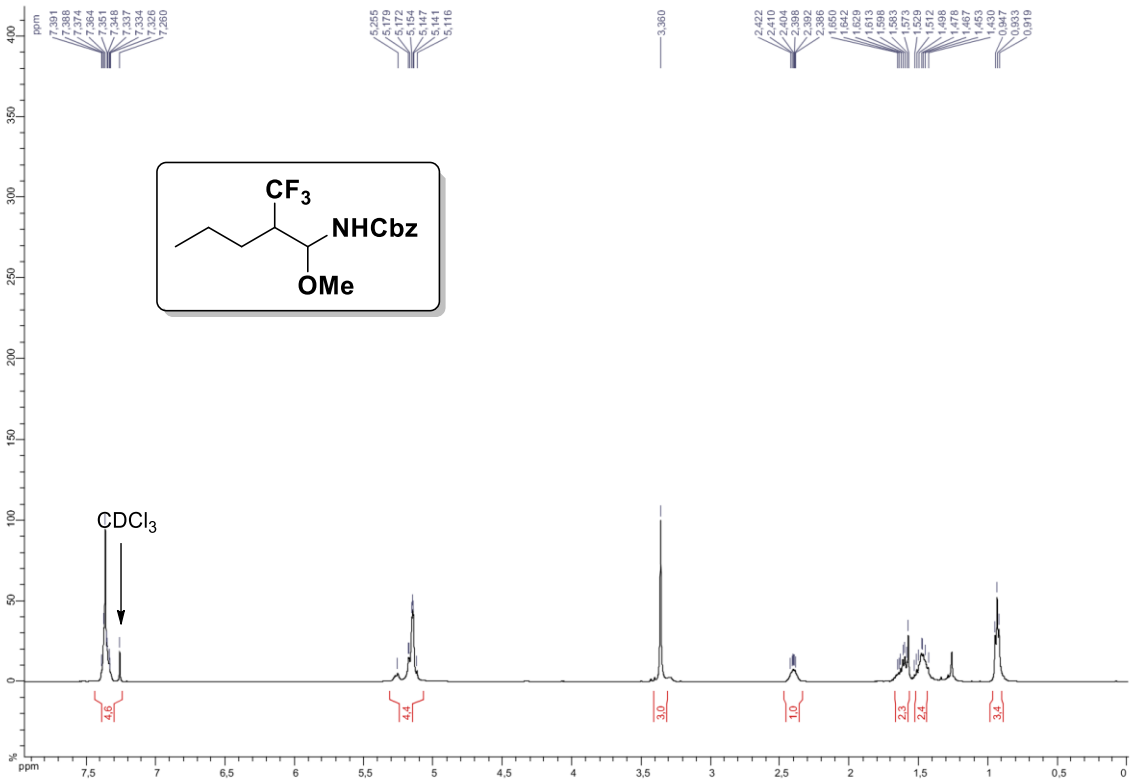
From (E) carbamate :

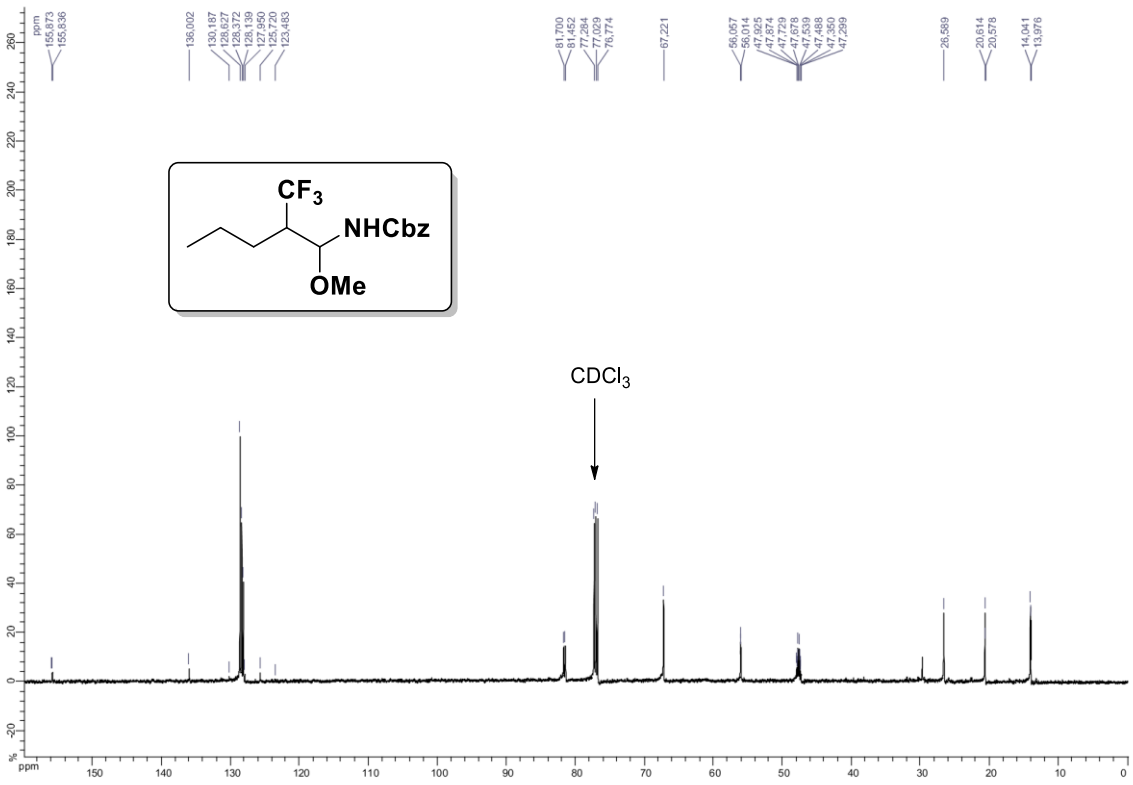


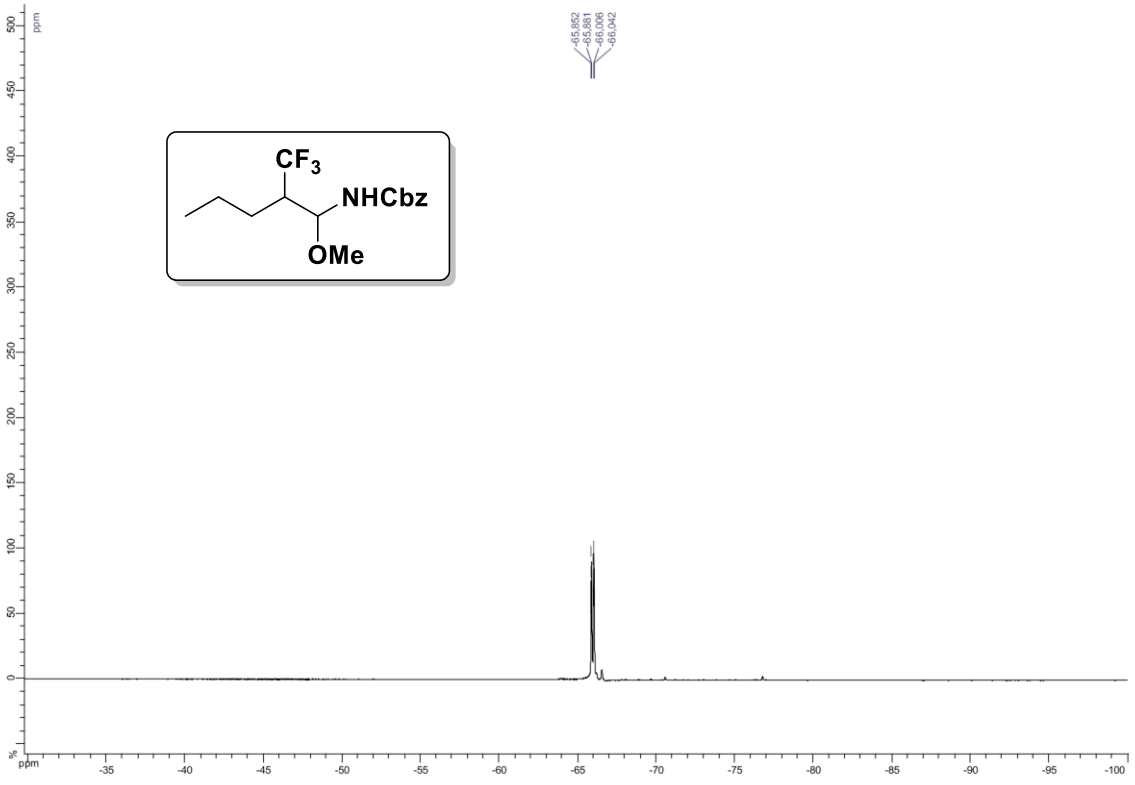

CF3
NHCbz
OMe
CDCl3


CF3
NHCbz
OMe

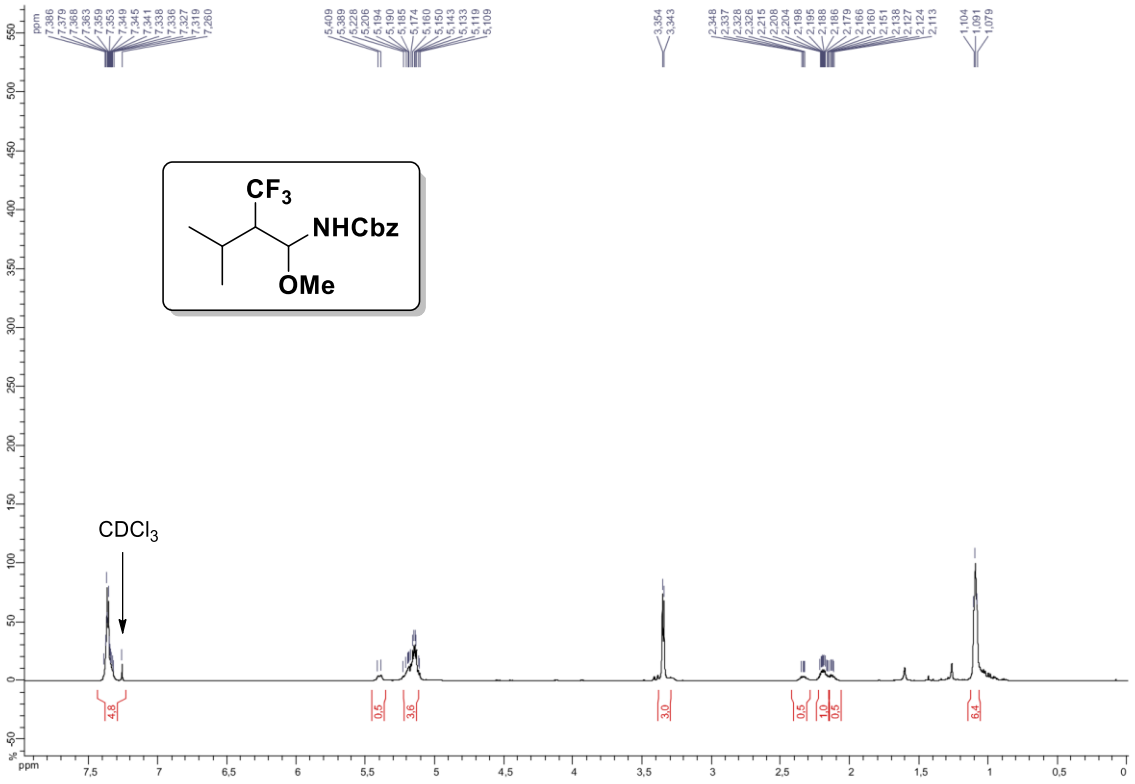
Benzyl (1-methoxy-2-(trifluoromethyl)pentyl) carbamate : 6f

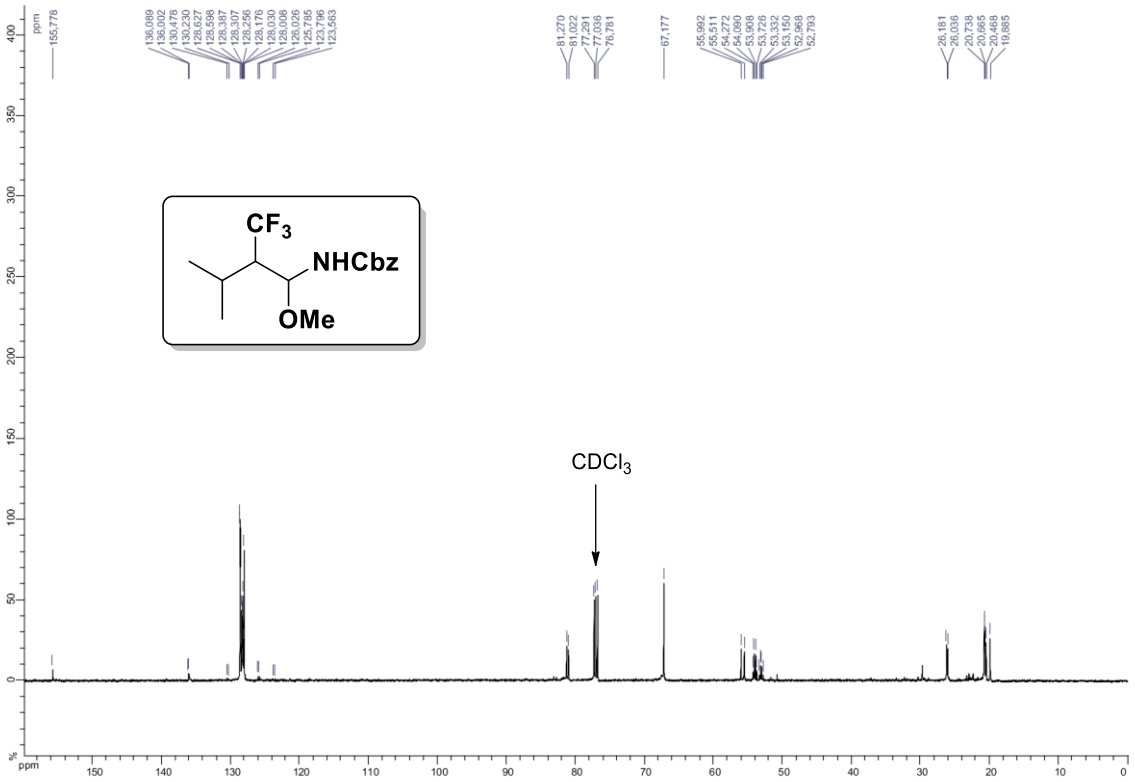


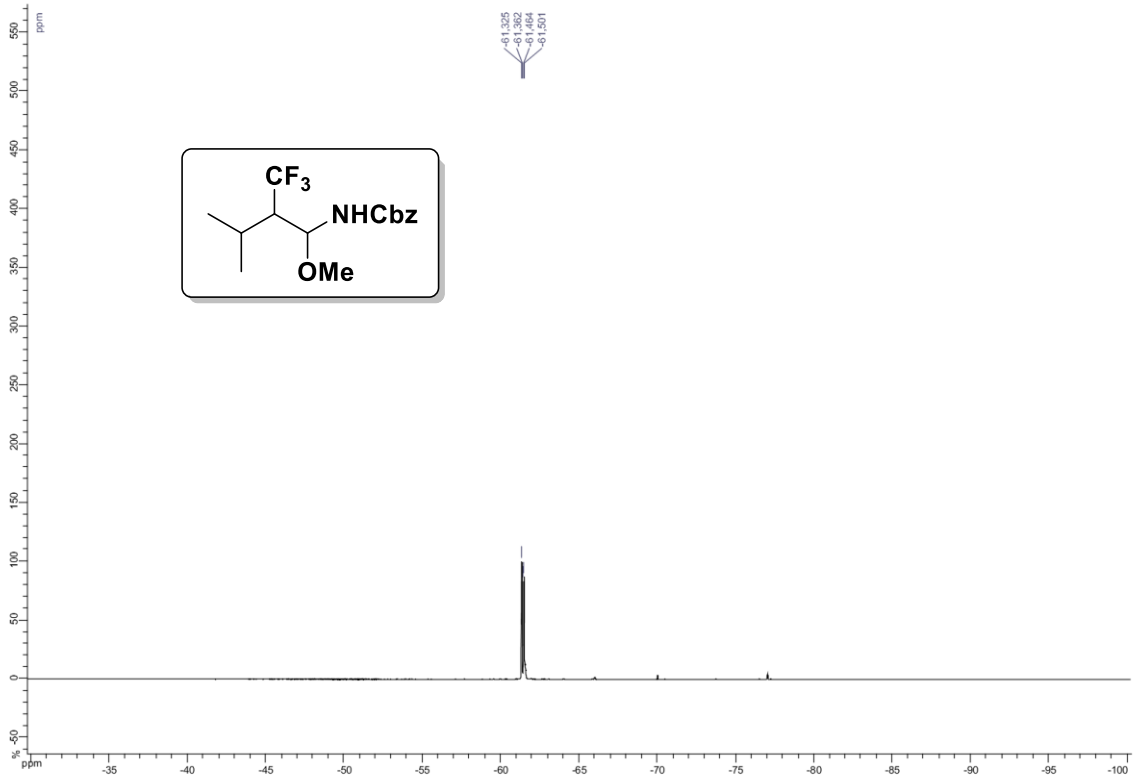



-65,652
-65,681
-66,006
-66,042
CF3
NHCbz
OMe
ppm
500
450
400
350
300
250
200
150
100
50
0
%
ppm
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

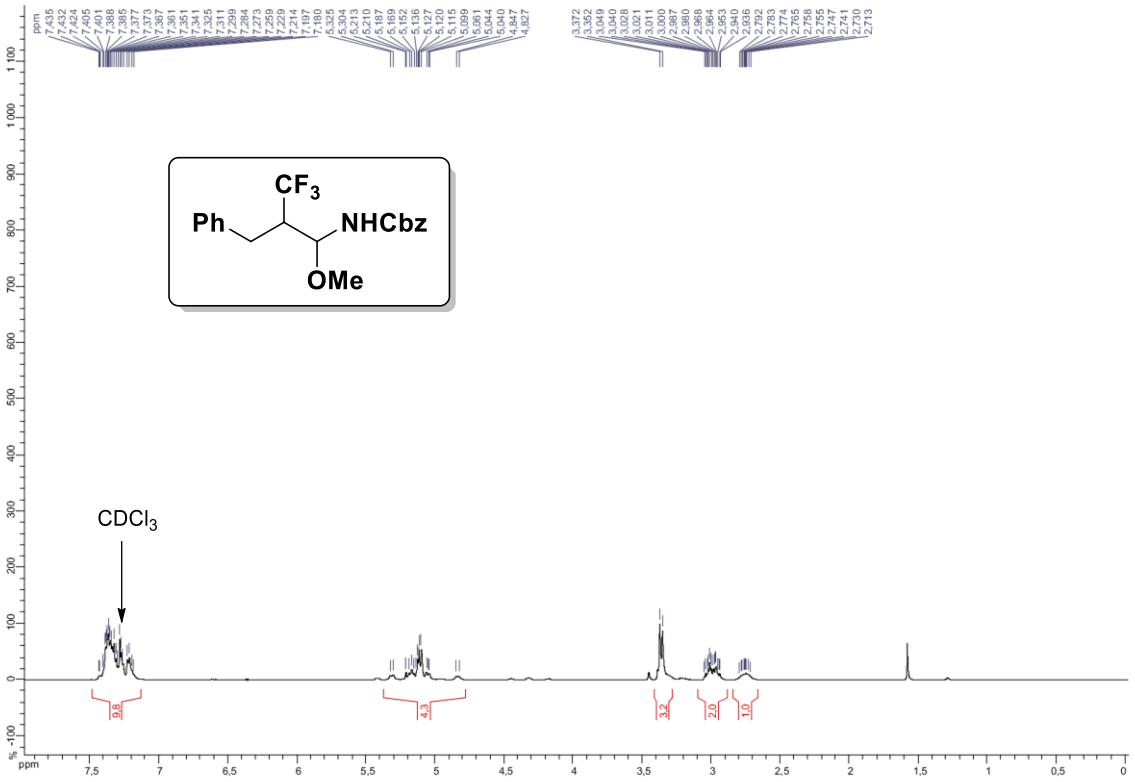
Benzyl (1-methoxy-3-methyl-2-(trifluoromethyl)butyl) carbamate 6g

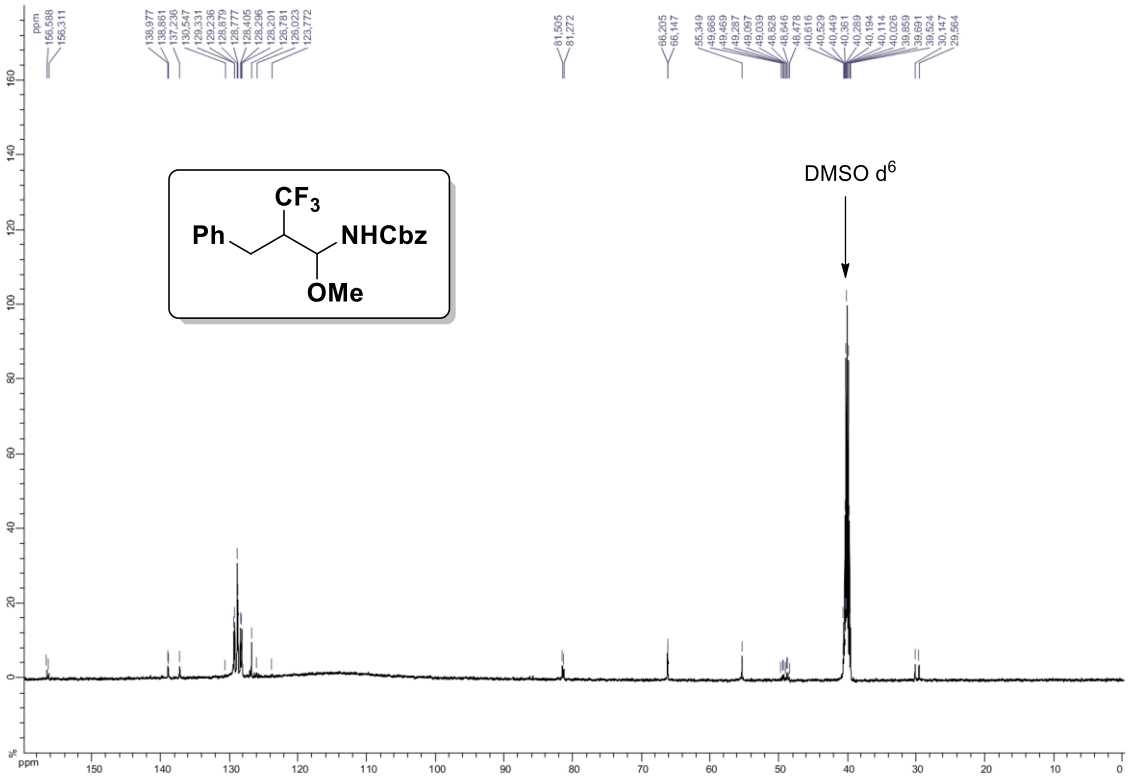


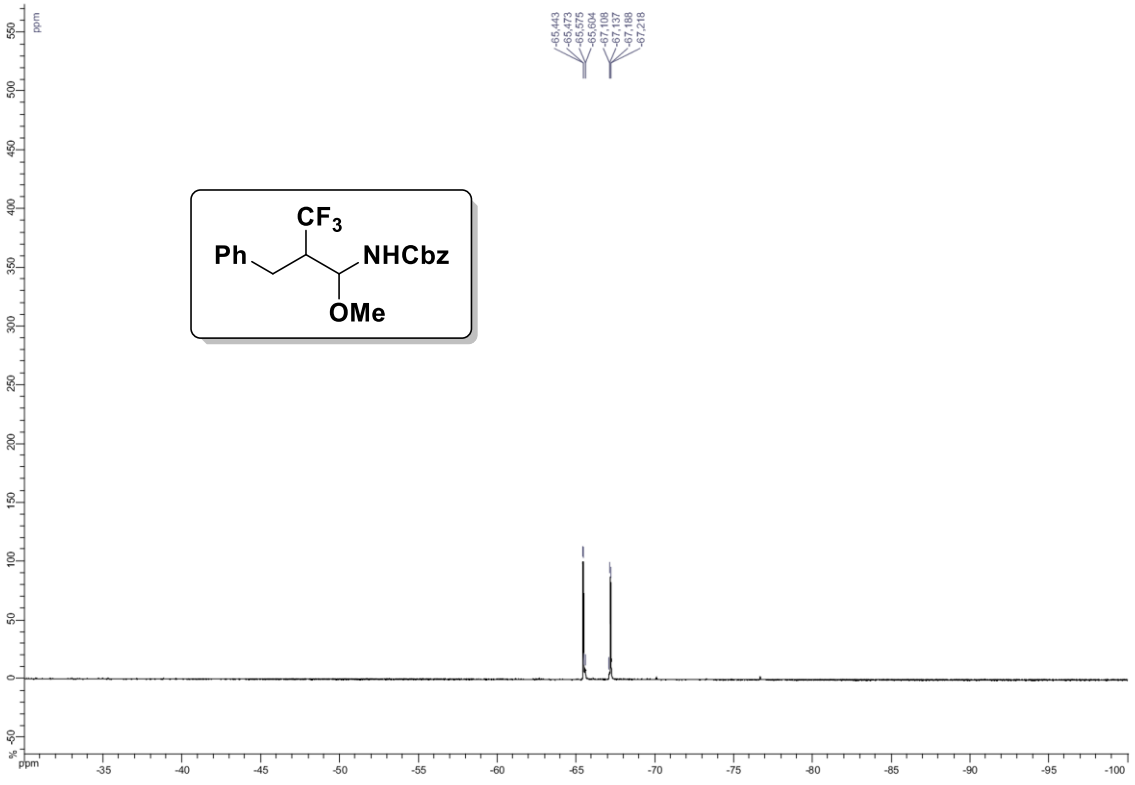



-61.325
-61.382
-61.464
-61.501
CF3
NHCbz
OMe
ppm
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

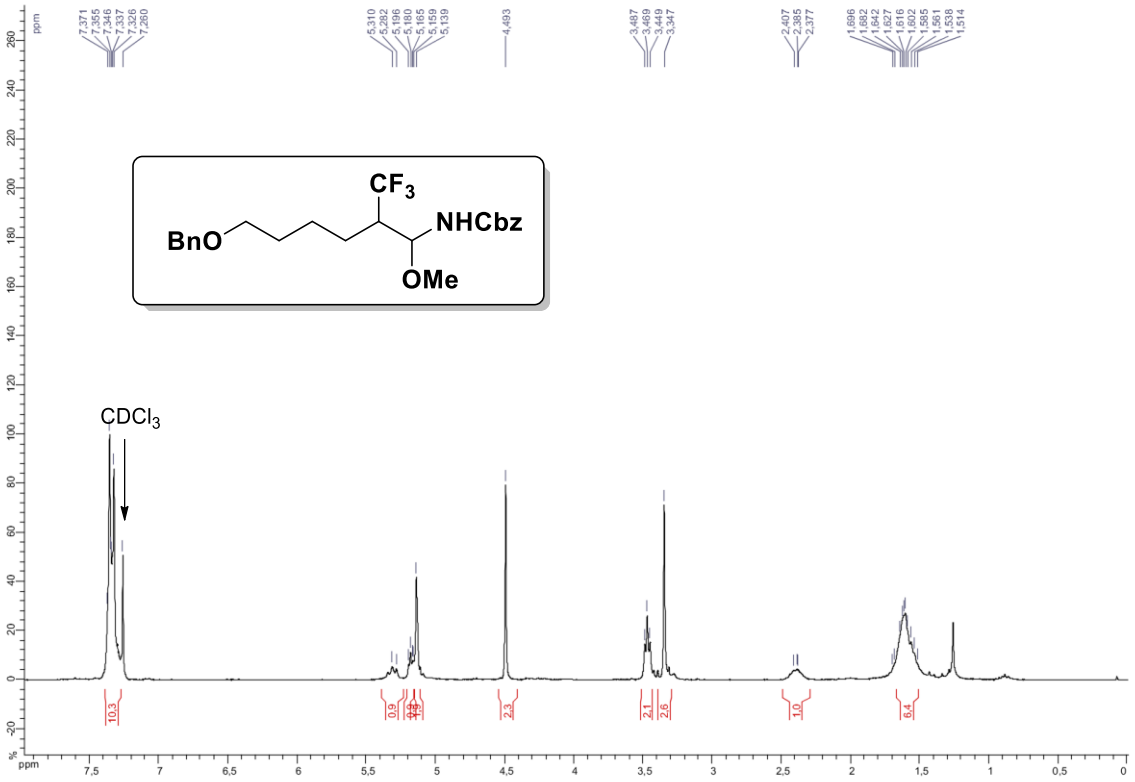
Benzyl (2-benzyl-3,3,3-trifluoro-1-methoxypropyl) carbamate 6h

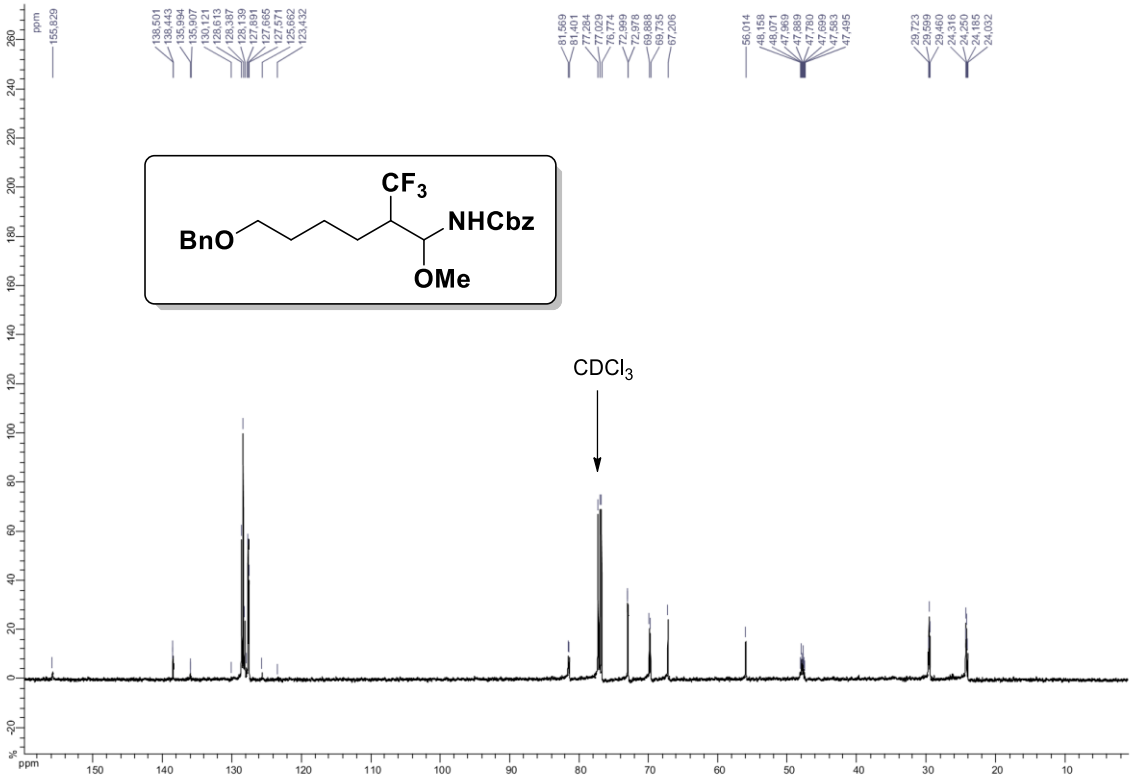


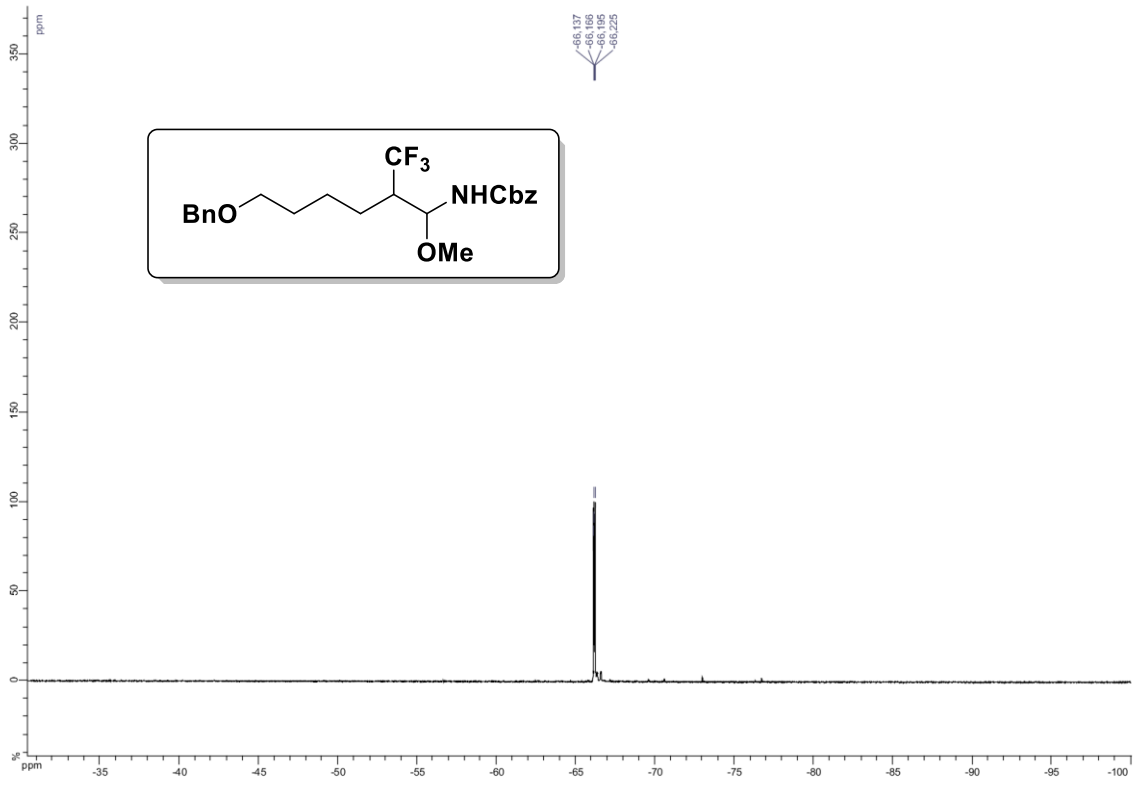



-65.443
-65.473
-65.575
-65.604
-67.108
-67.137
-67.188
-67.218
CF3
Ph
NHCbz
OMe
ppm
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

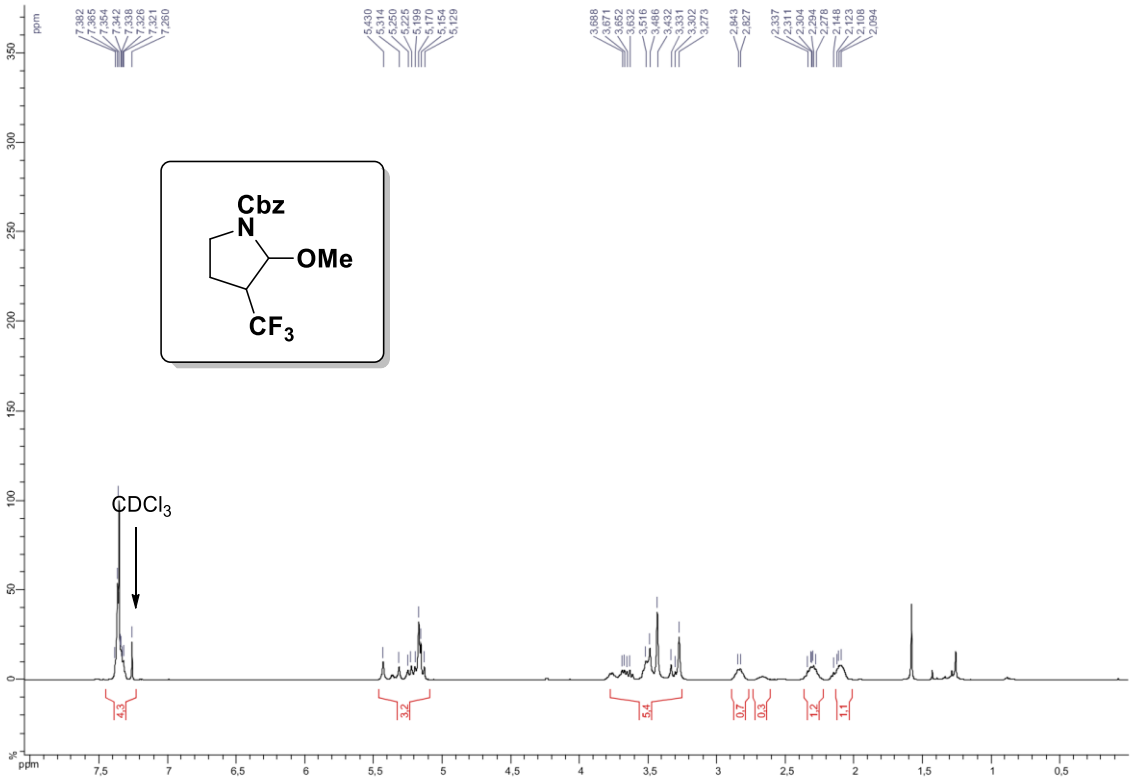
Benzyl (6-(benzyloxy)-1-methoxy-2-(trifluoromethyl)hexyl) carbamate 6i

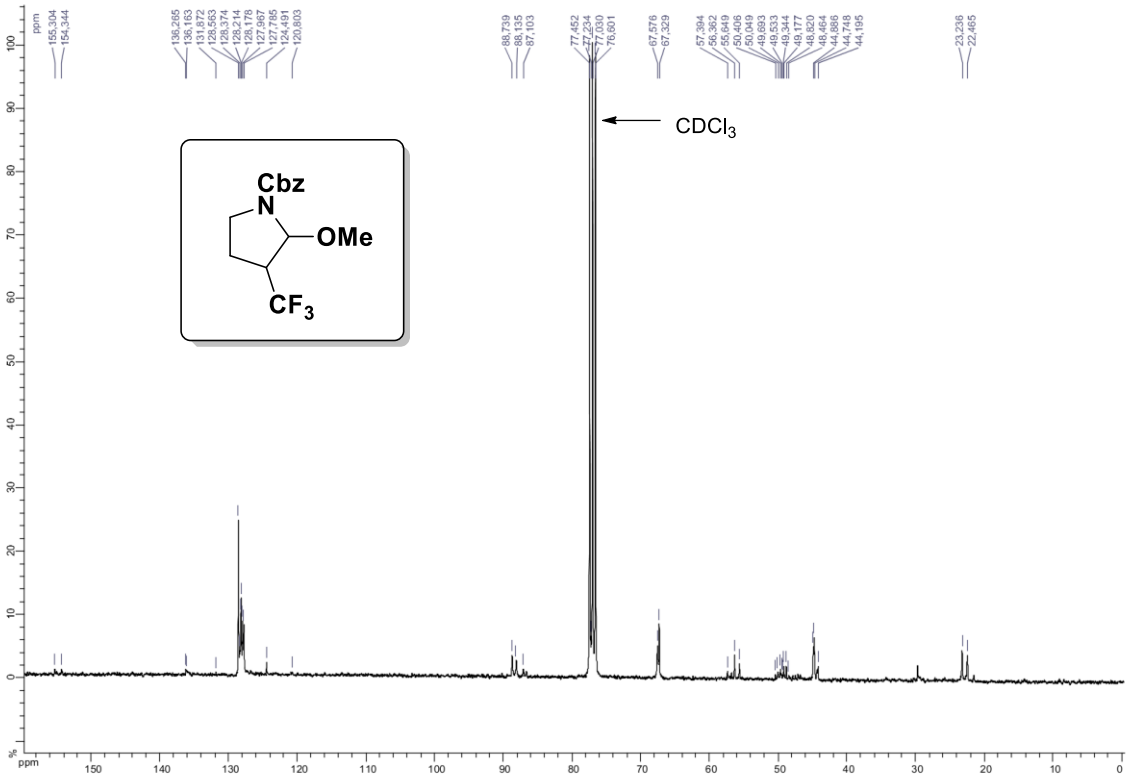


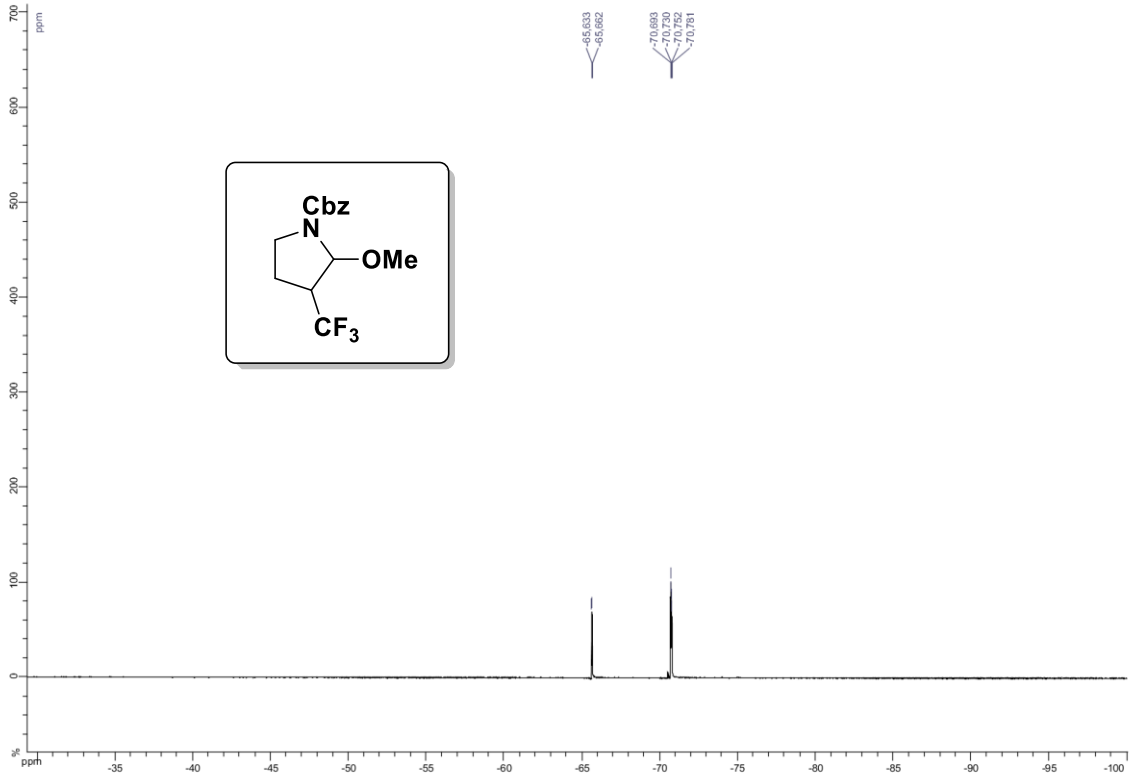



-66.137
-66.166
-66.195
-66.225
CF3
NHCbz
BnO
OMe
ppm
350
300
250
200
150
100
50
0
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

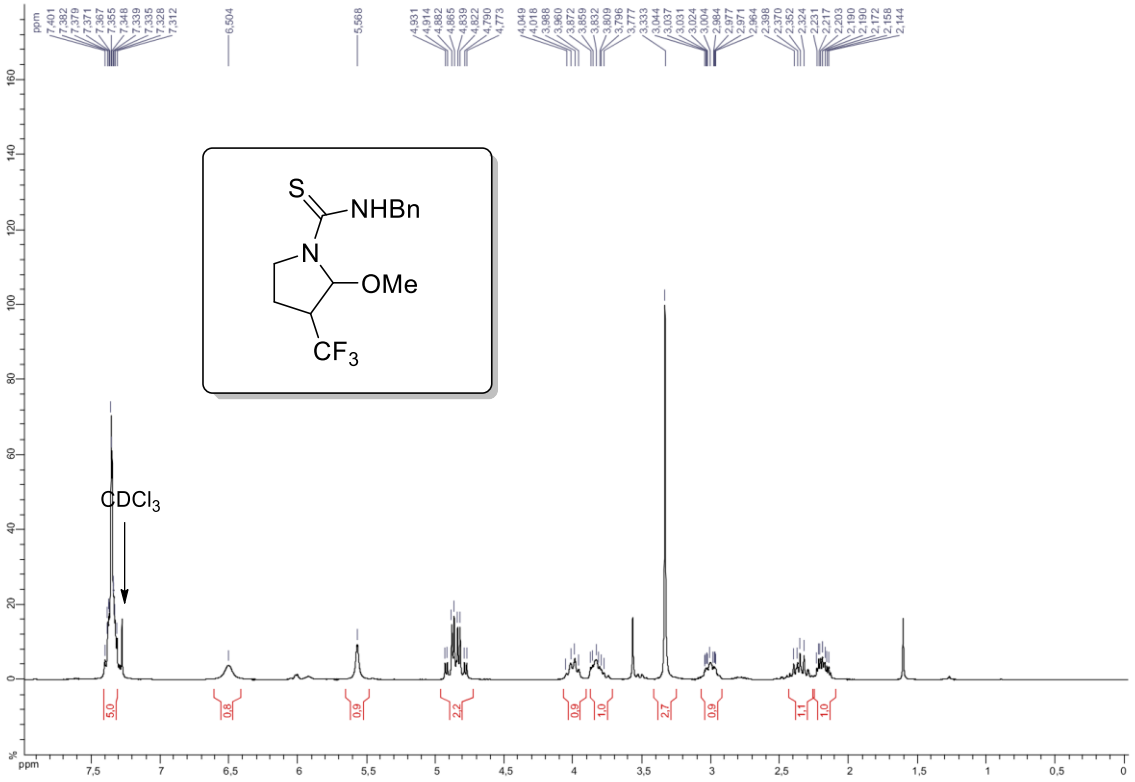
Benzyl 2-methoxy-3-(trifluoromethyl)pyrrolidine-1-carboxylate 6j

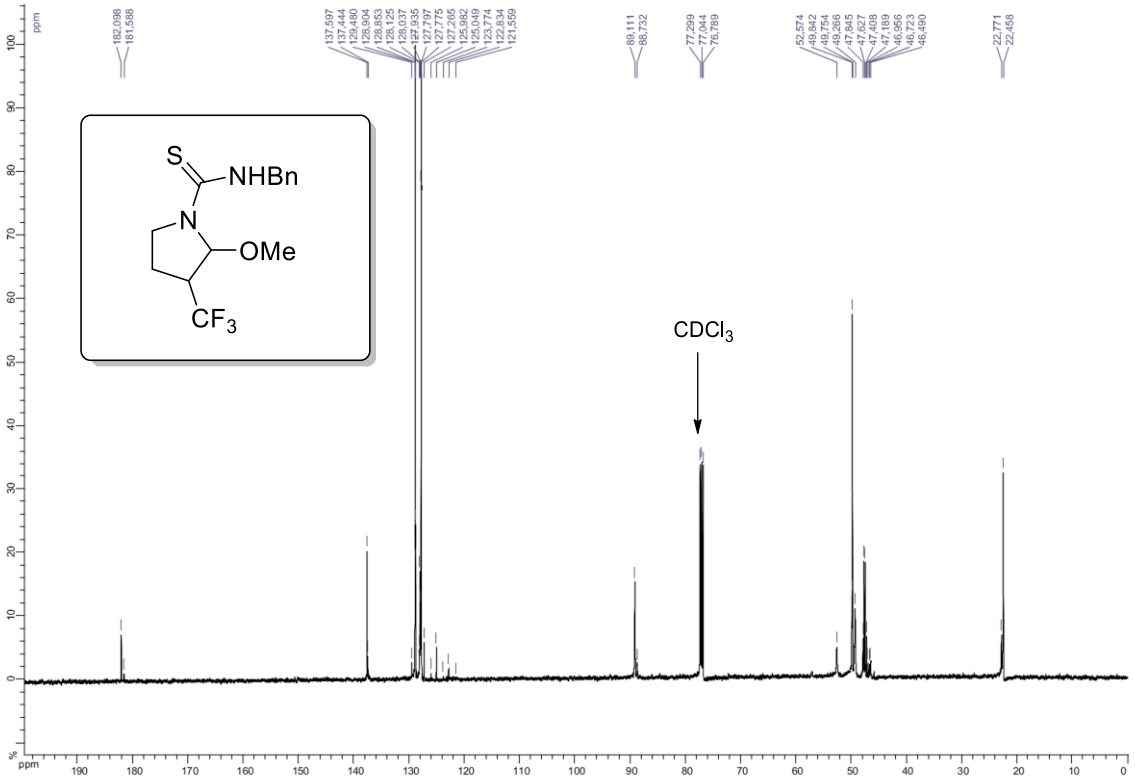


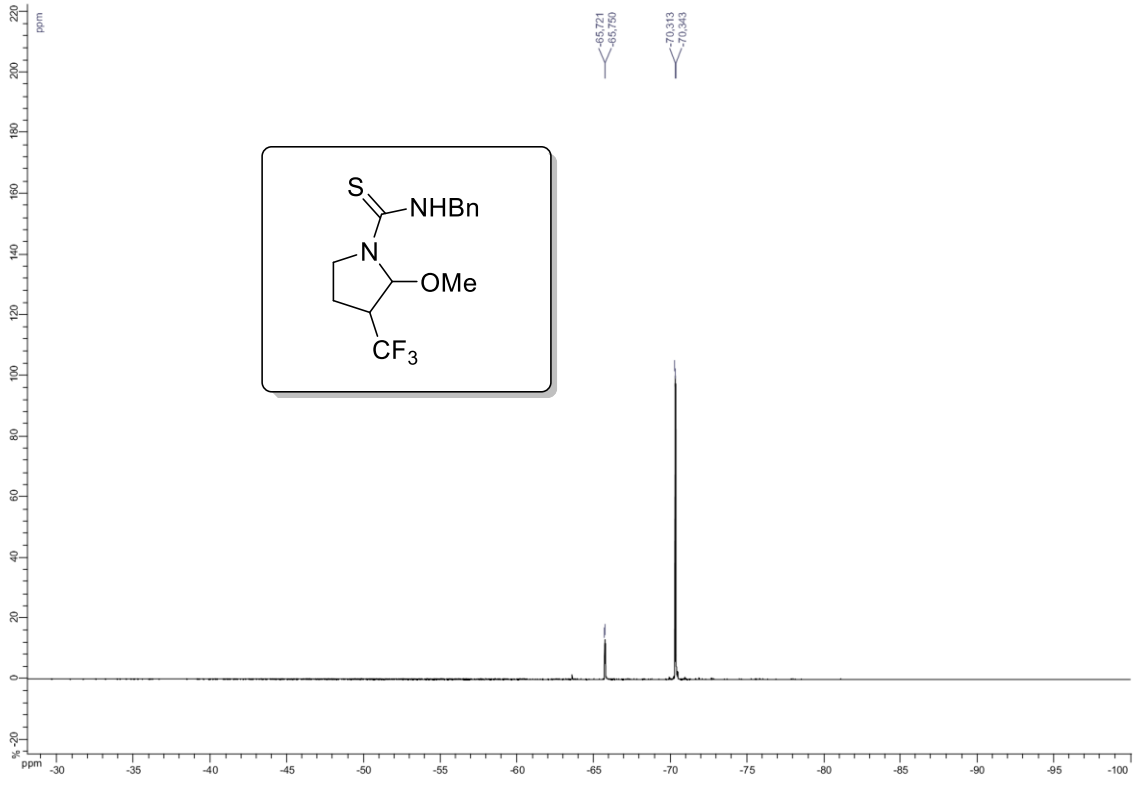



-65,633
-65,662
-70,693
-70,730
-70,752
-70,781
Cbz
N
OMe
CF3
ppm
700
600
500
400
300
200
100
0
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

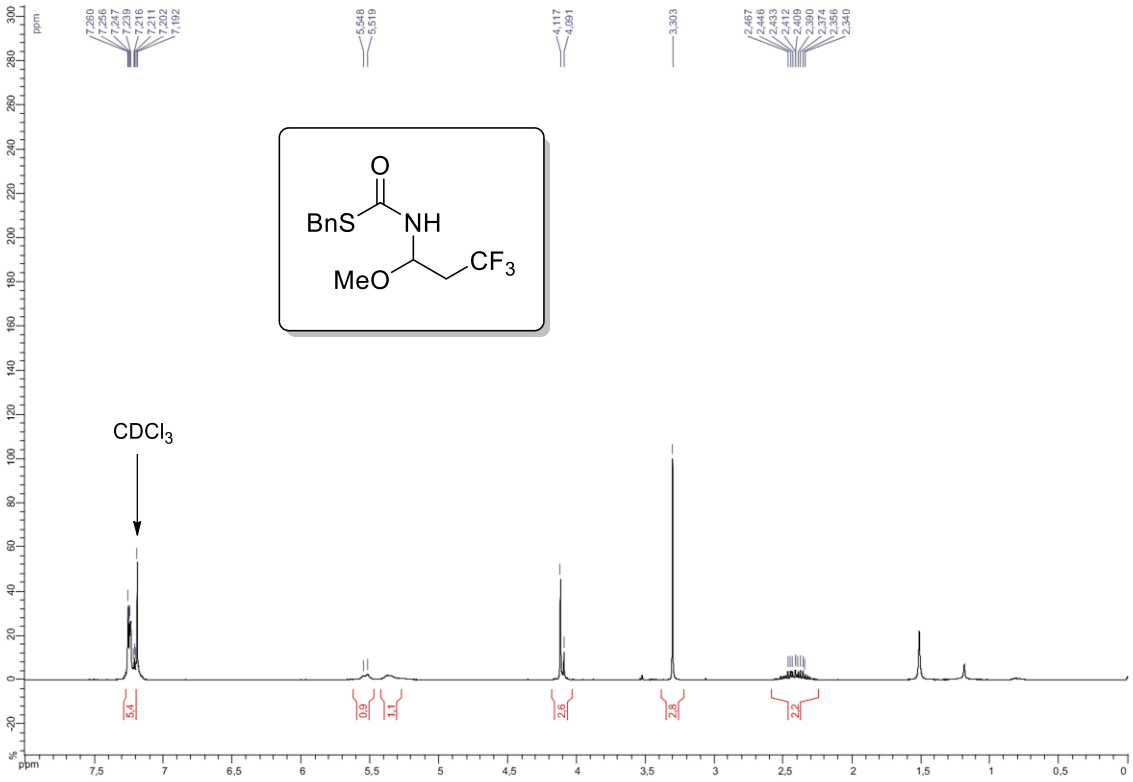
N-benzyl-2-methoxy-3-trifluoromethyl)pyrrolidine-1-carbothioamide 6k

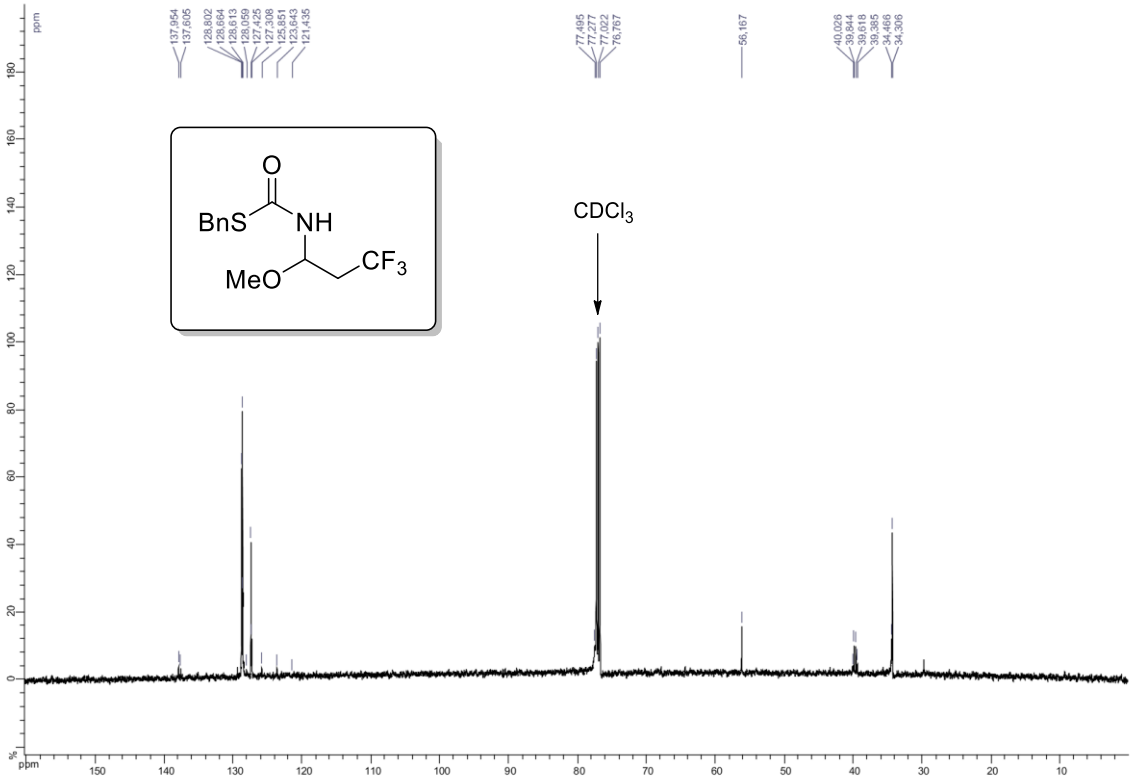


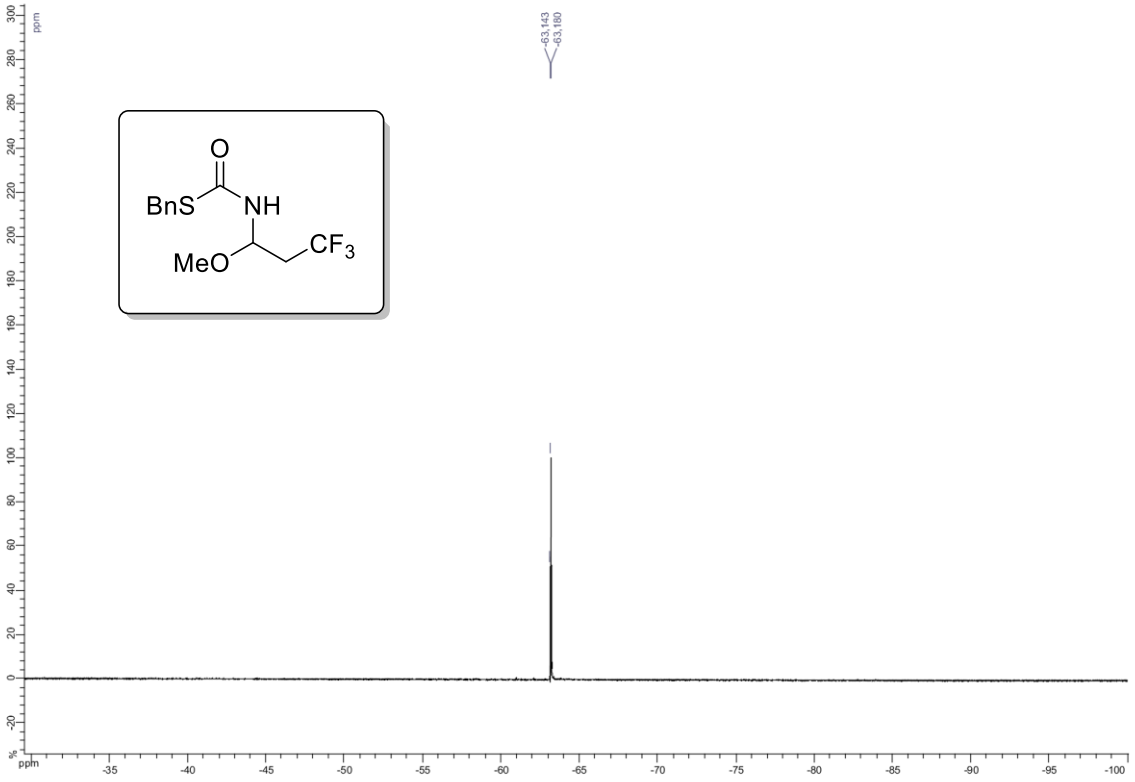



-65.721
-65.750
-70.313
-70.343
S
NHBn
N
OMe
CF3
ppm
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

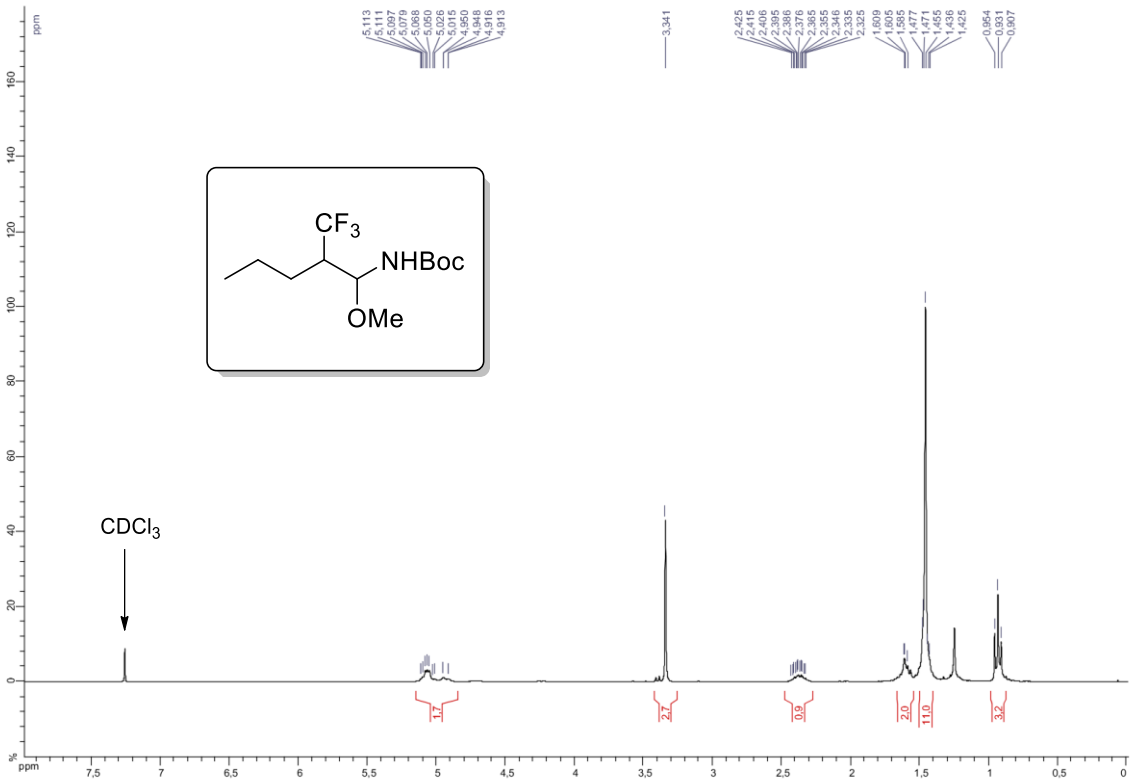
S-Benzyl (3,3,3-trifluoro-1-methoxypropyl) carbamothioate 6l

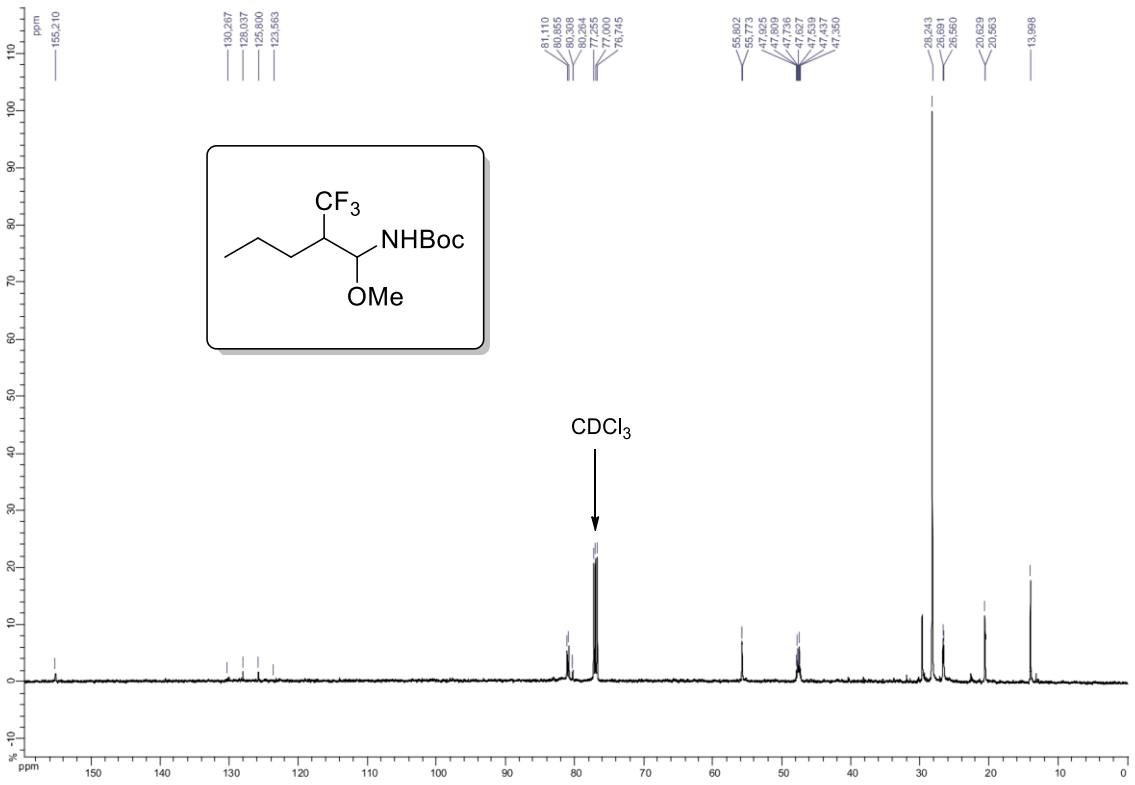


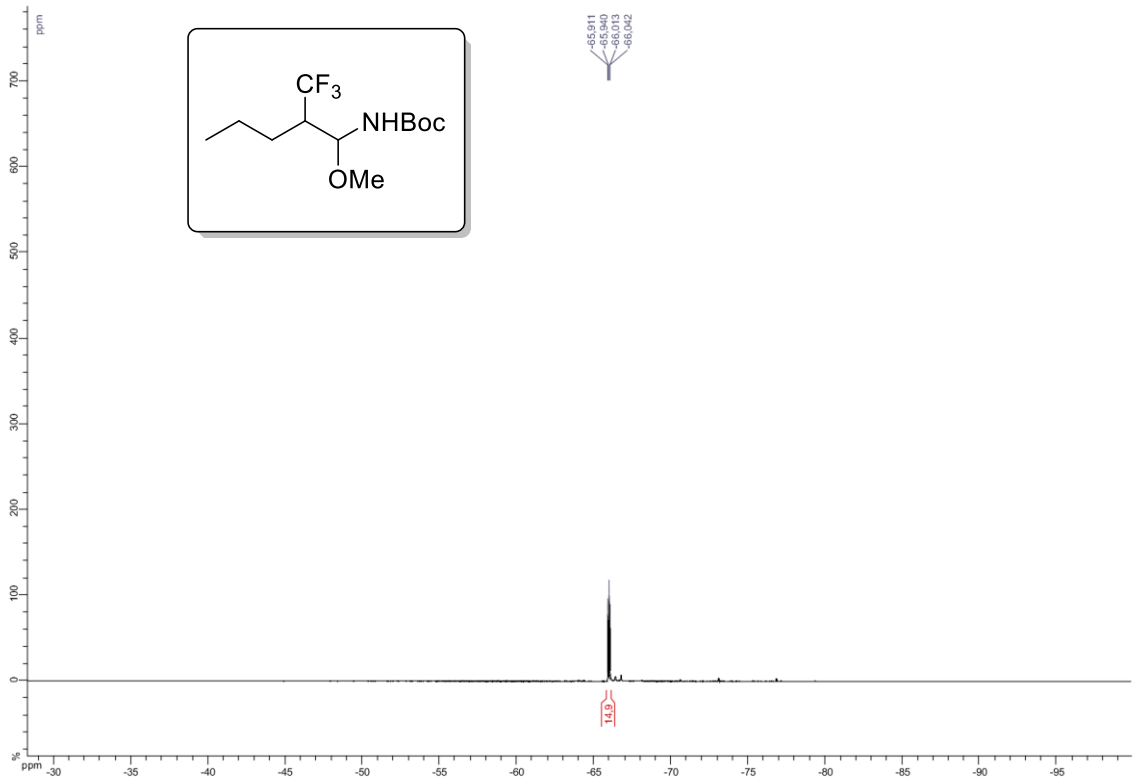



-63,143
-63,180
O
BnS
NH
MeO
CF3
ppm
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
ppm
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

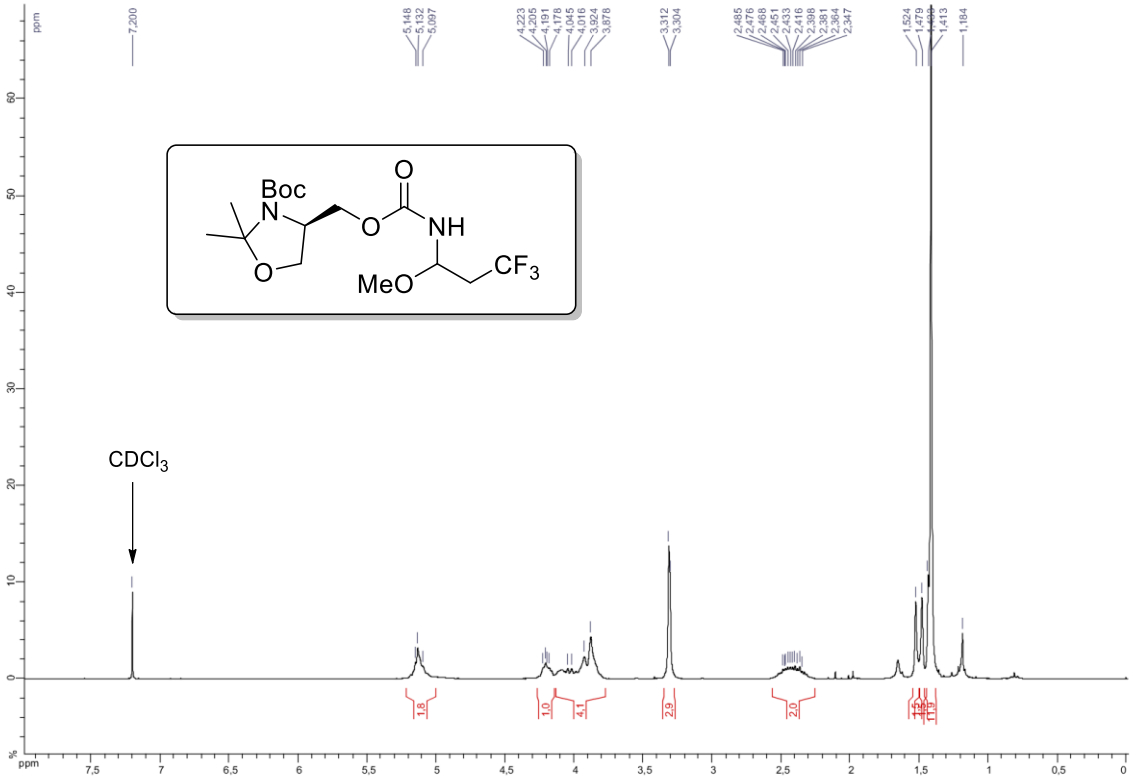
Tert-butyl (1-methoxy-2-(trifluoromethyl)pentyl) carbamate 6m

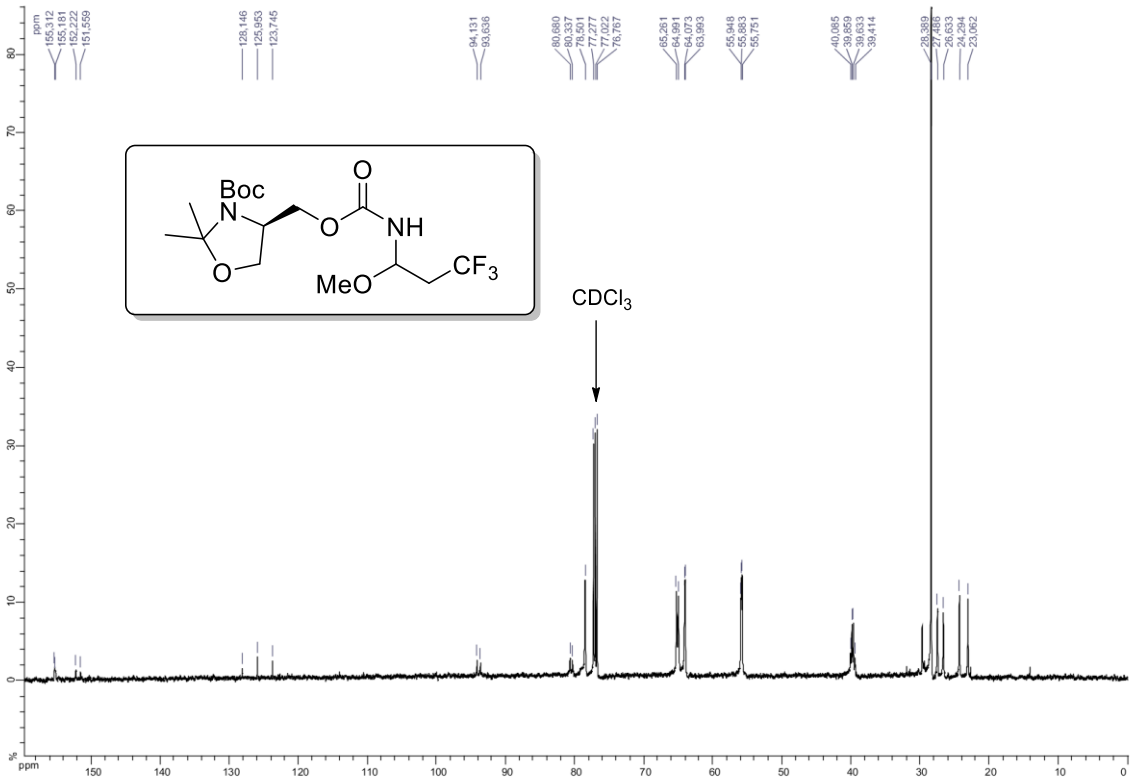


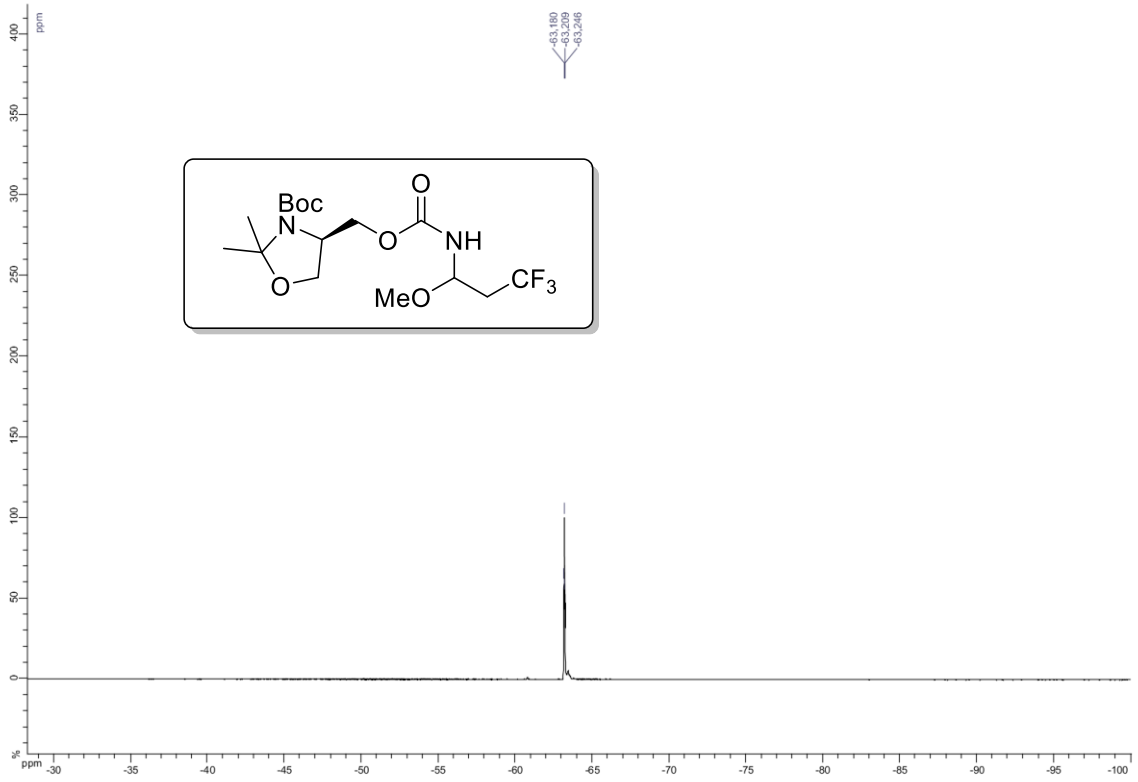



CF3
NHBoc
OMe
-65.911
-65.940
-66.013
-66.042
14.9
ppm
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95

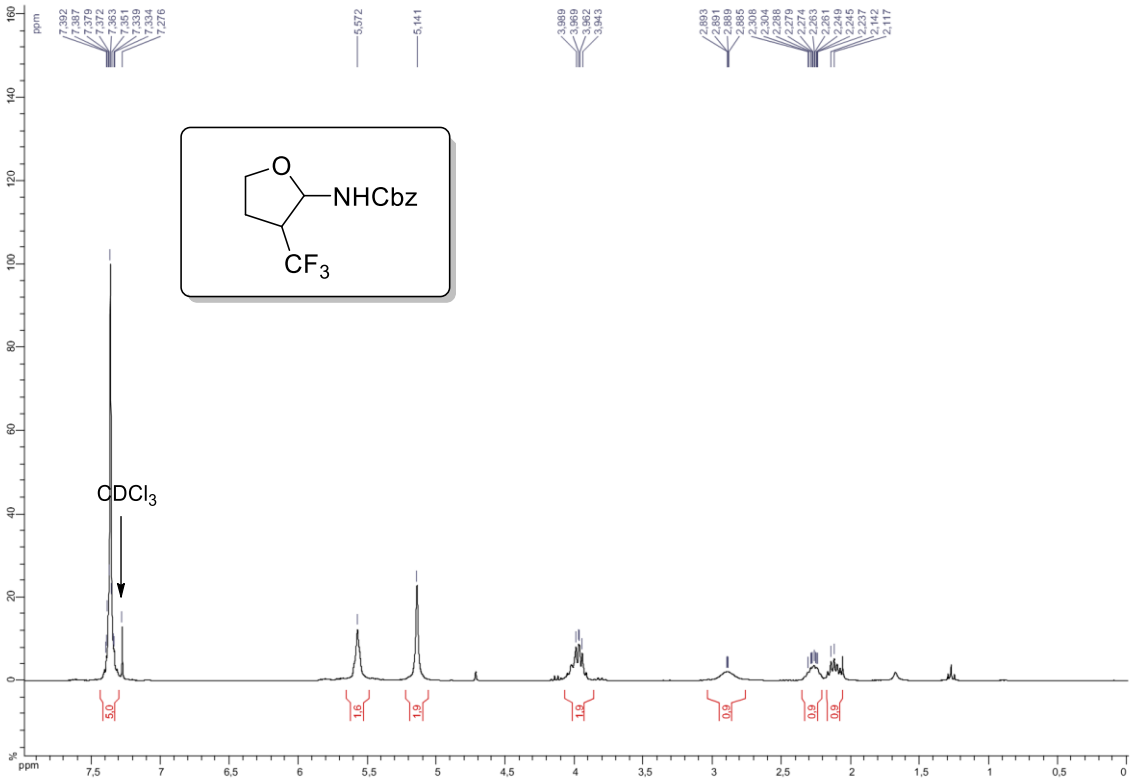
(4R)-Tert-butyl-2,2-dimethyl-4-((((3,3,3-trifluoro-1-methoxypropyl)carbamoyl)oxy) methyl)oxazolidine-3-carboxylate 6n

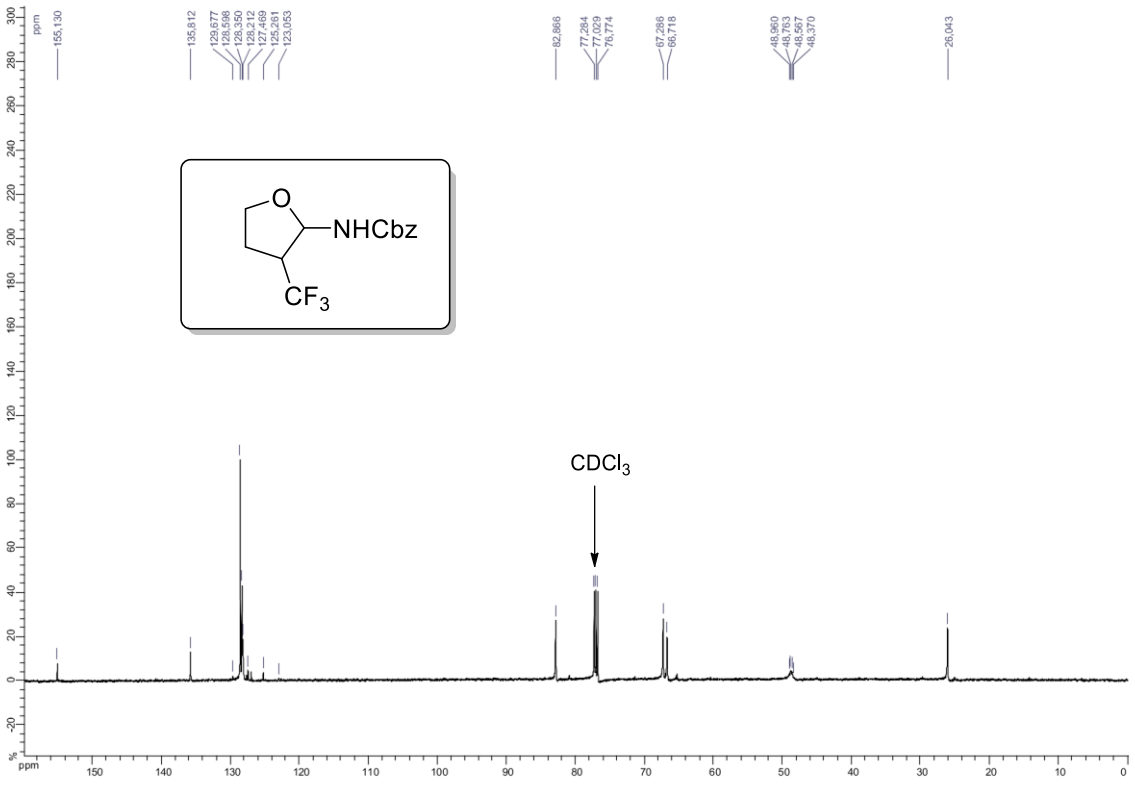


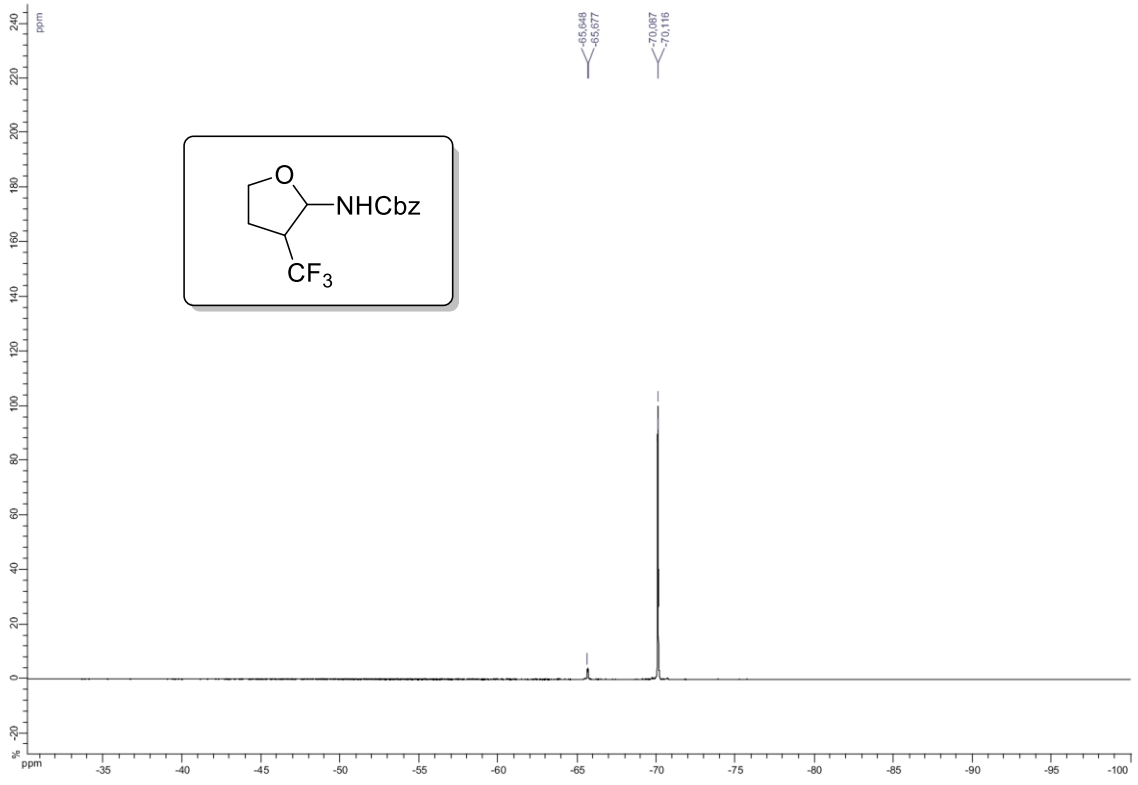



-63.180
-63.209
-63.246
Boc
N
O
O
O
NH
MeO
CF3
ppm
400
350
300
250
200
150
100
50
0
%
ppm
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

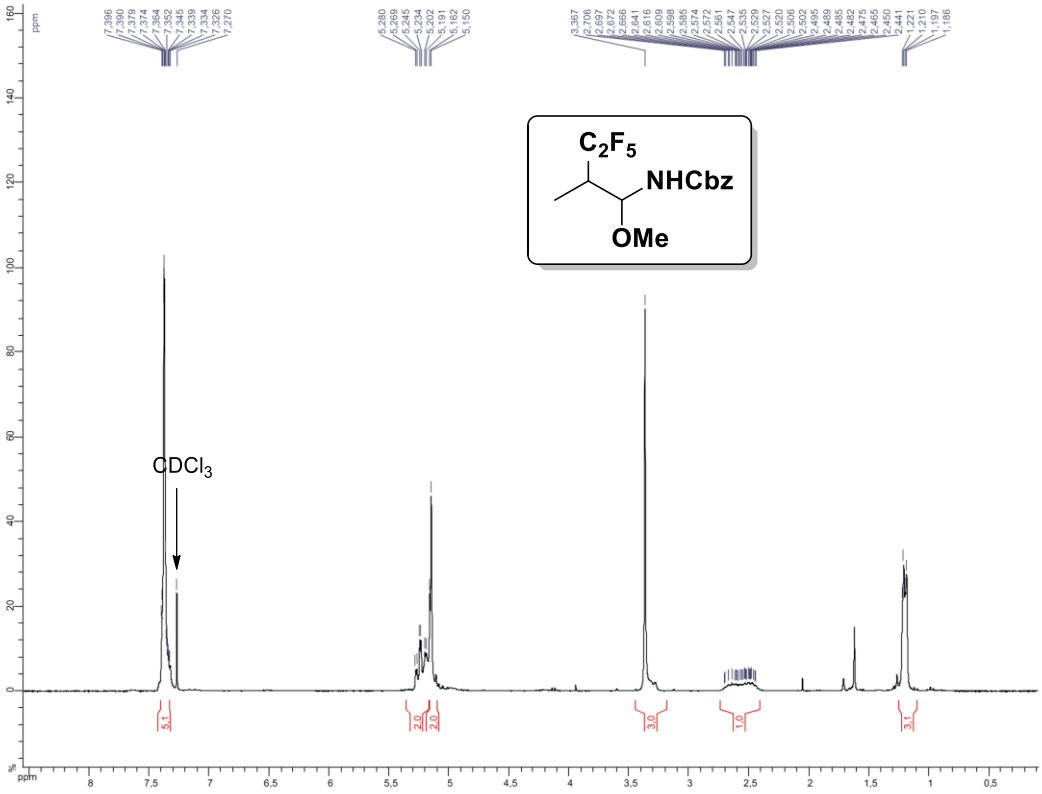
Benzyl (3-(trifluoromethyl)tetrahydrofuran-2-yl)carbamate 6o

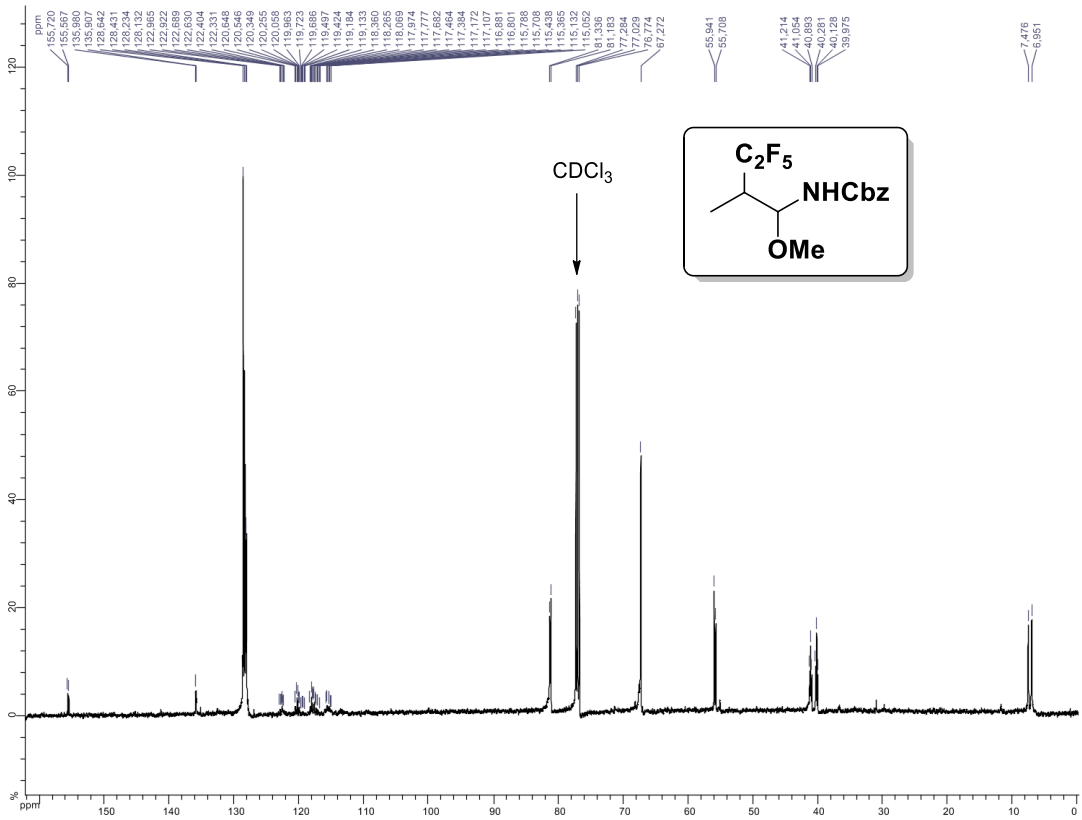


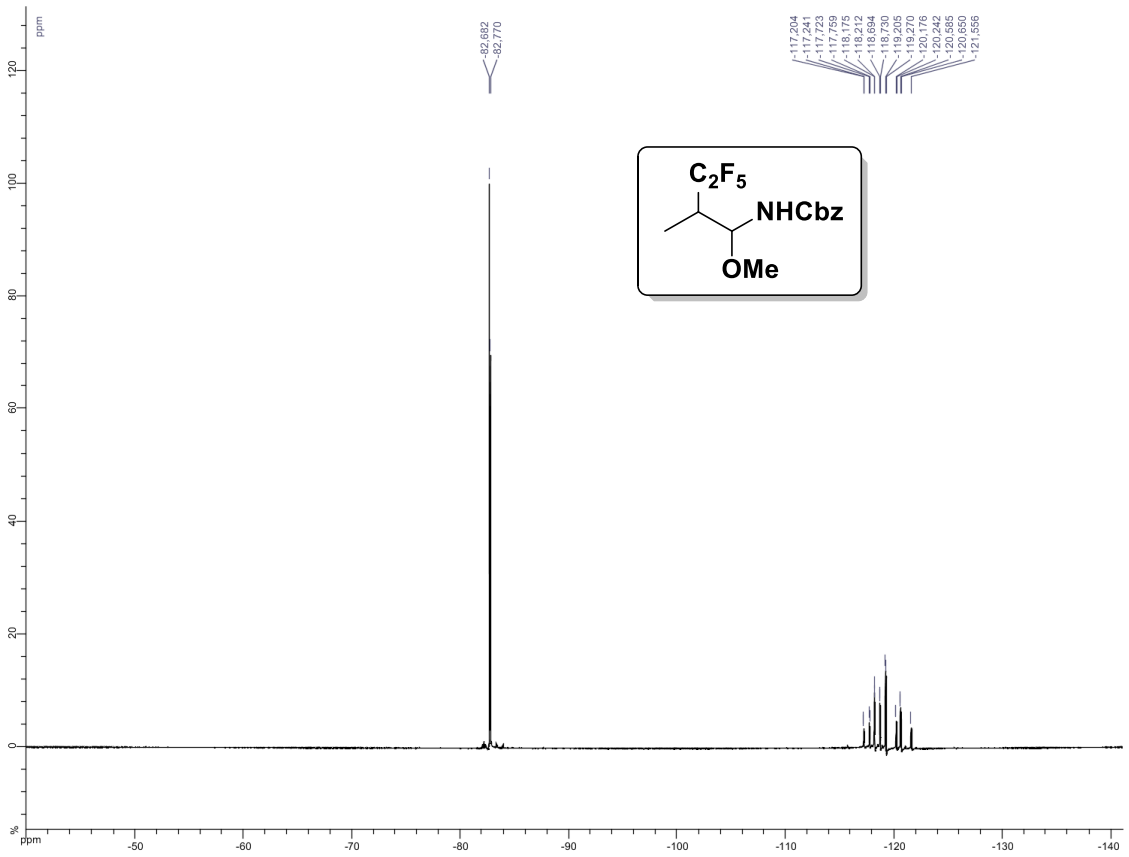



-65.648
-65.677
-70.087
-70.116
O
NHCbz
CF3
ppm
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

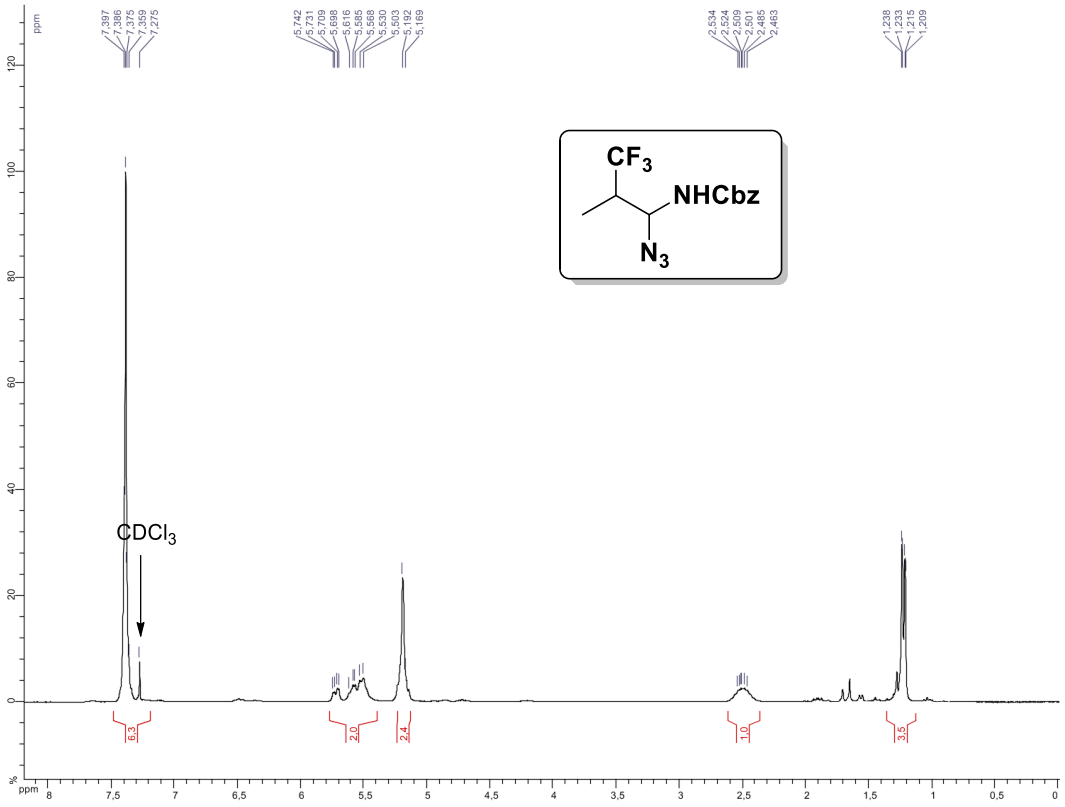
Benzyl (3,3,4,4,4-pentafluoro-1-methoxy-2-methylbutyl)carbamate 6p

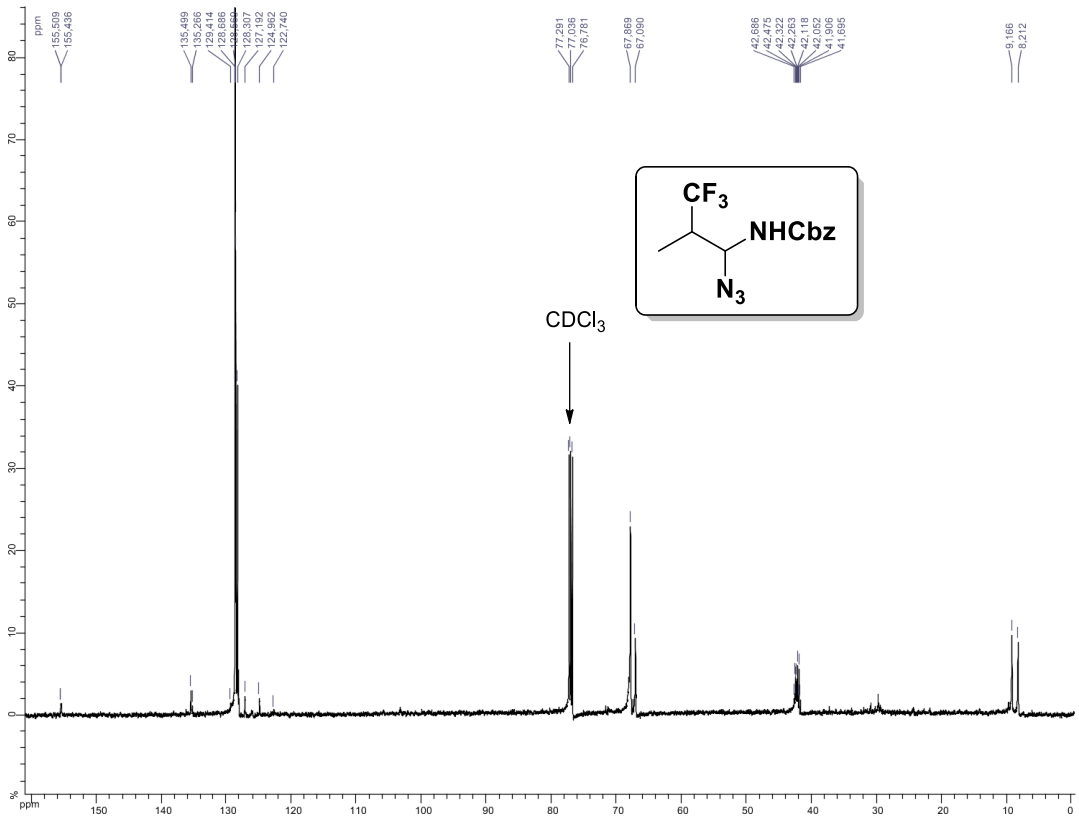


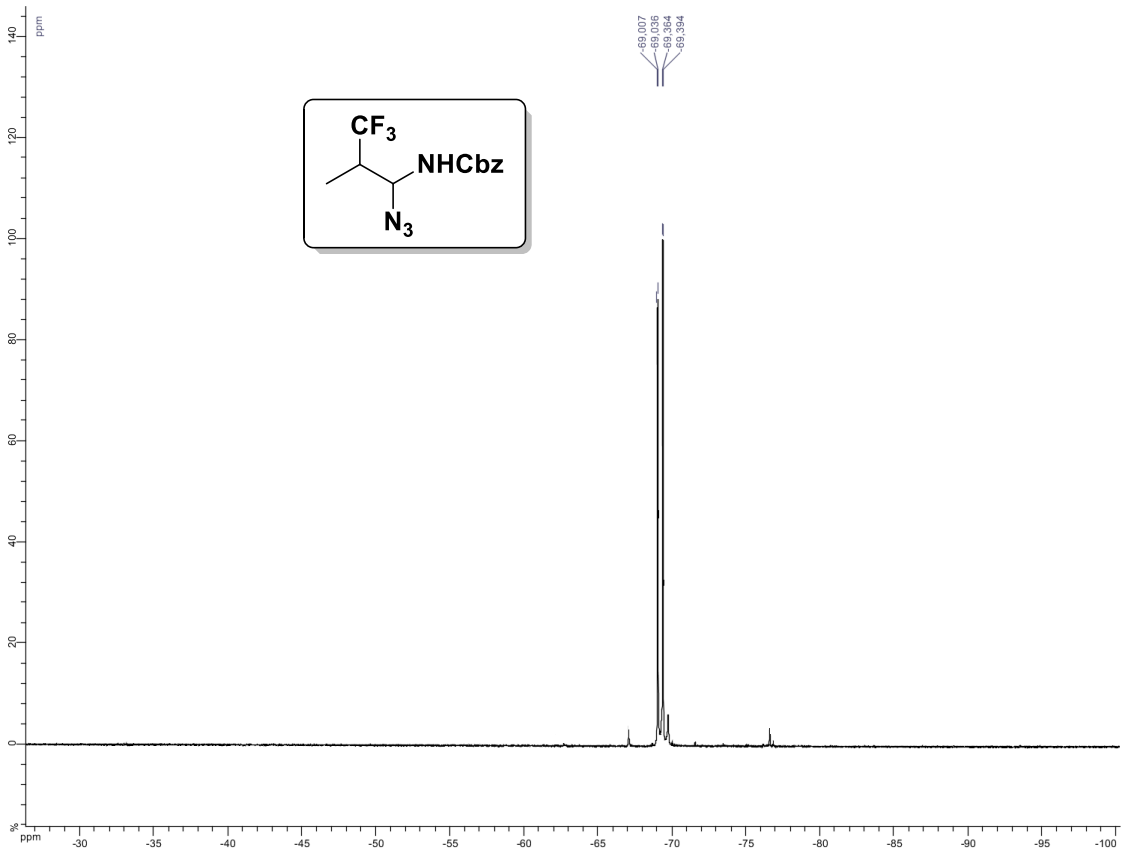



ppm
120
100
80
60
40
20
0
%
-82.682
-82.770
-117.204
-117.241
-117.723
-117.759
-118.175
-118.212
-118.694
-118.730
-119.205
-119.270
-120.176
-120.242
-120.585
-120.650
-121.556
C2F5
NHCbz
OMe
ppm
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140

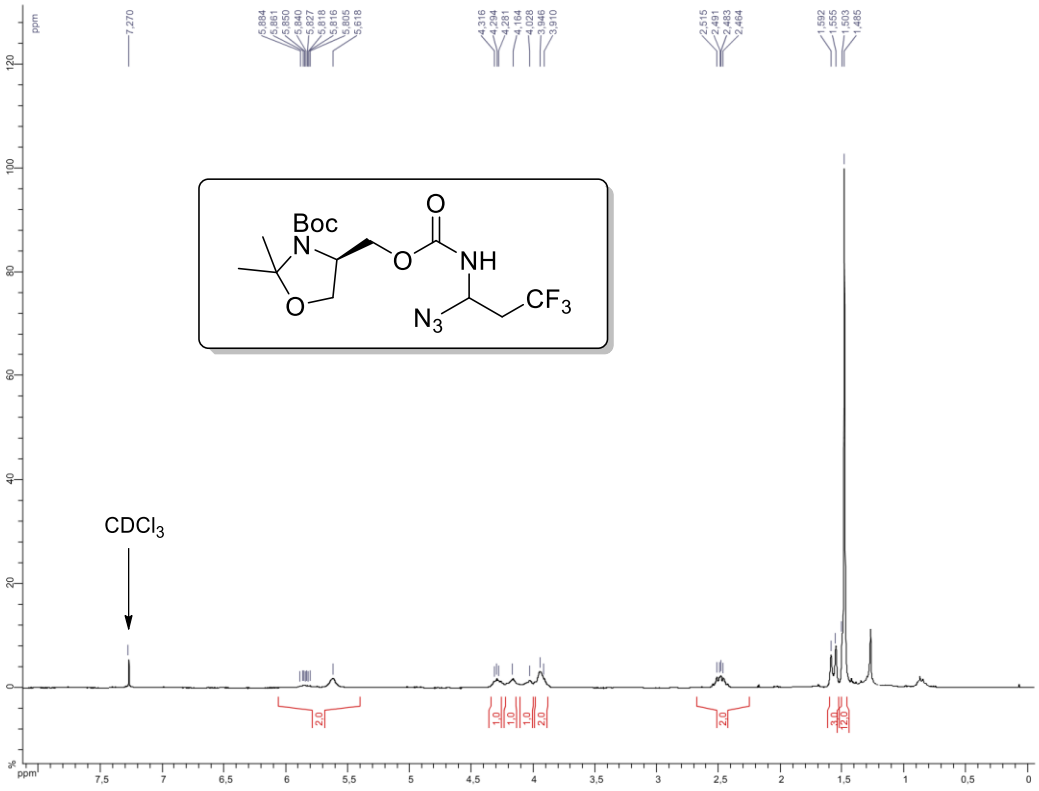
Benzyl (1-azido-3,3,3-trifluoro-2-methylpropyl)carbamate 8a

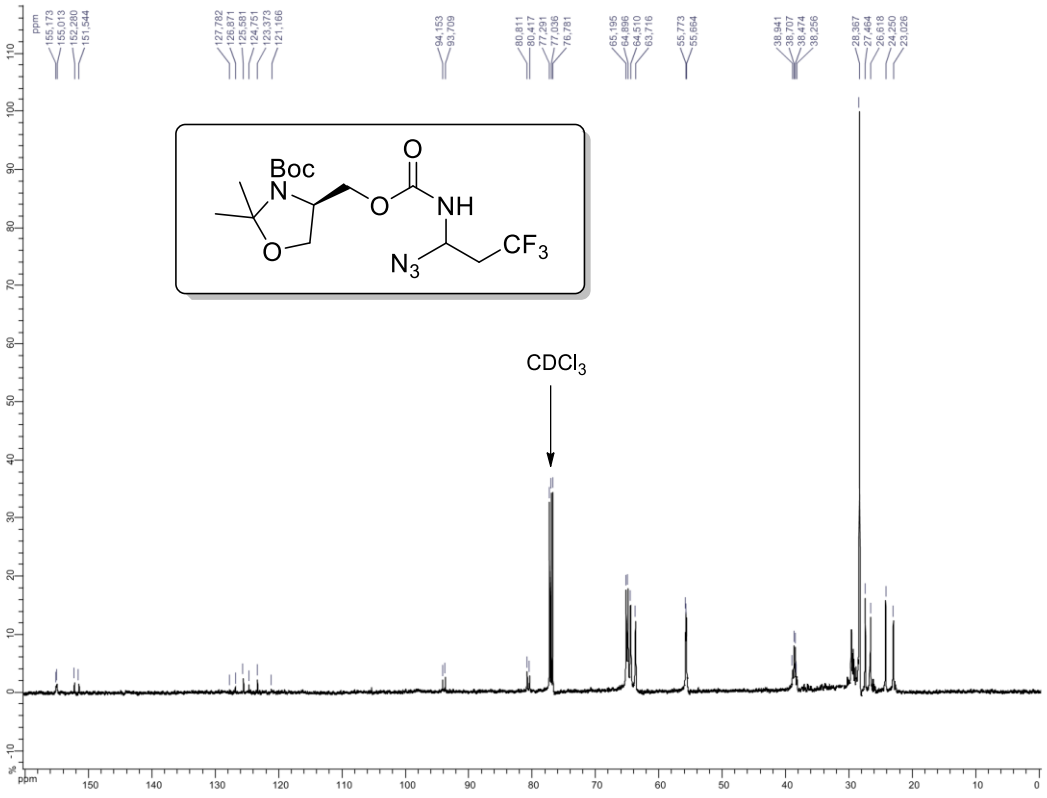


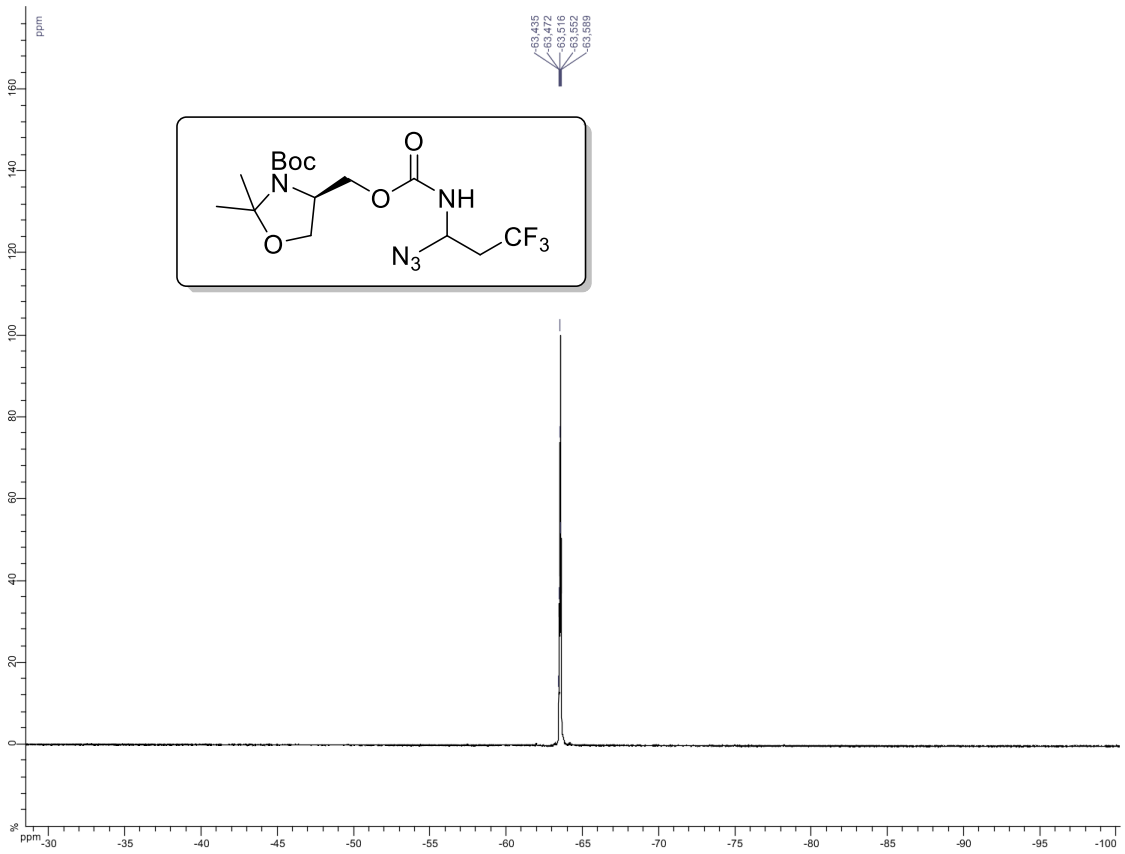



-69,007
-69,036
-69,364
-69,394
CF3
NHCbz
N3
ppm
%
140
120
100
80
60
40
20
0
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

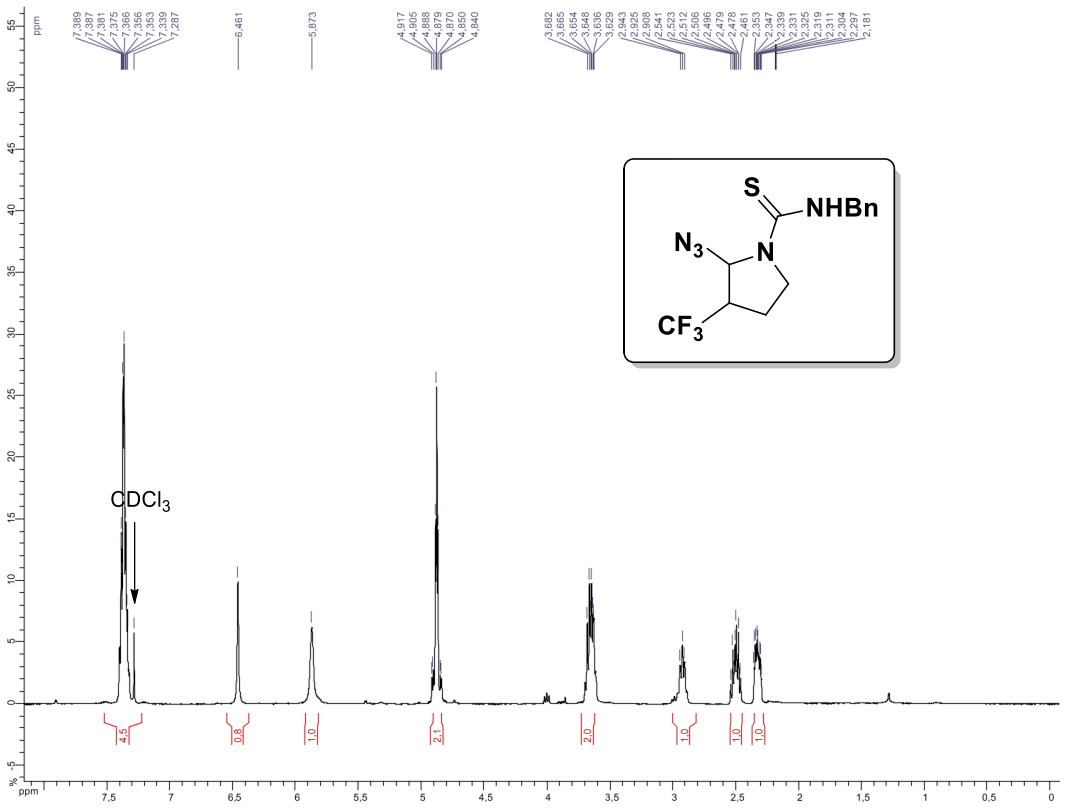
(4R)-*Tert*-butyl4-((((1-azido-3,3,3-trifluoropropyl)carbamoyl)oxy)methyl)-2,2-dimethyl oxazolidine-3-carboxylate 8b

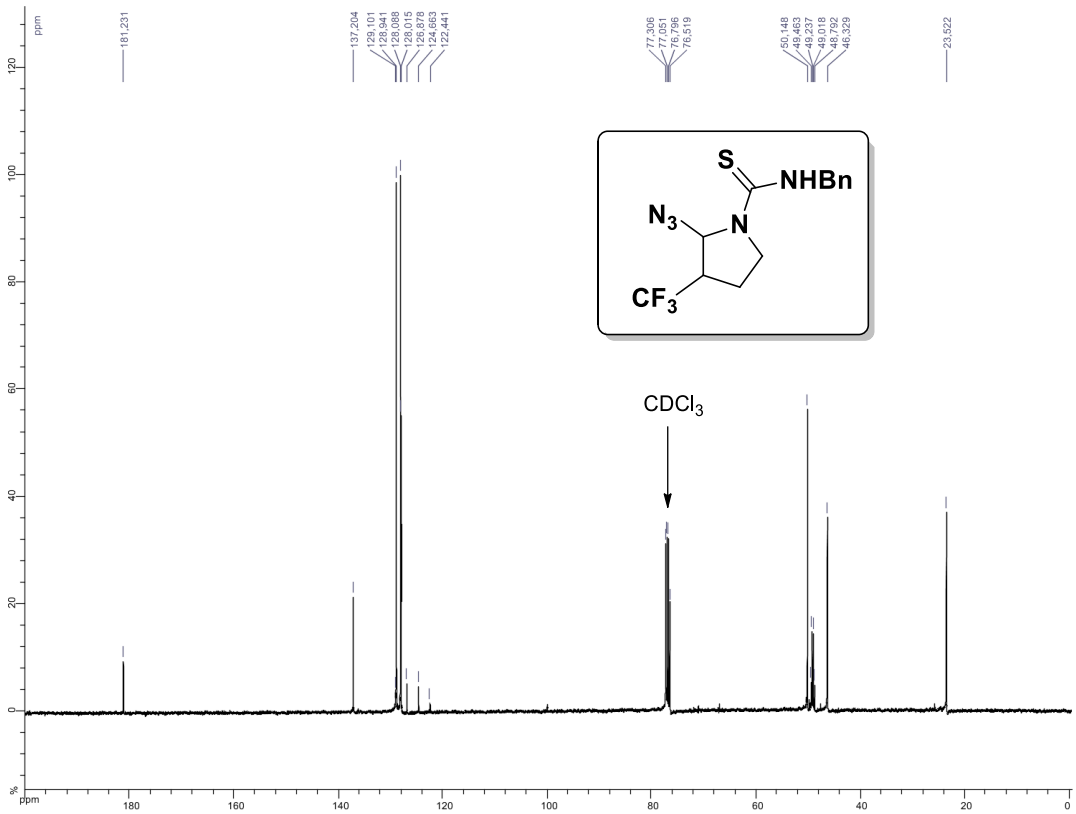


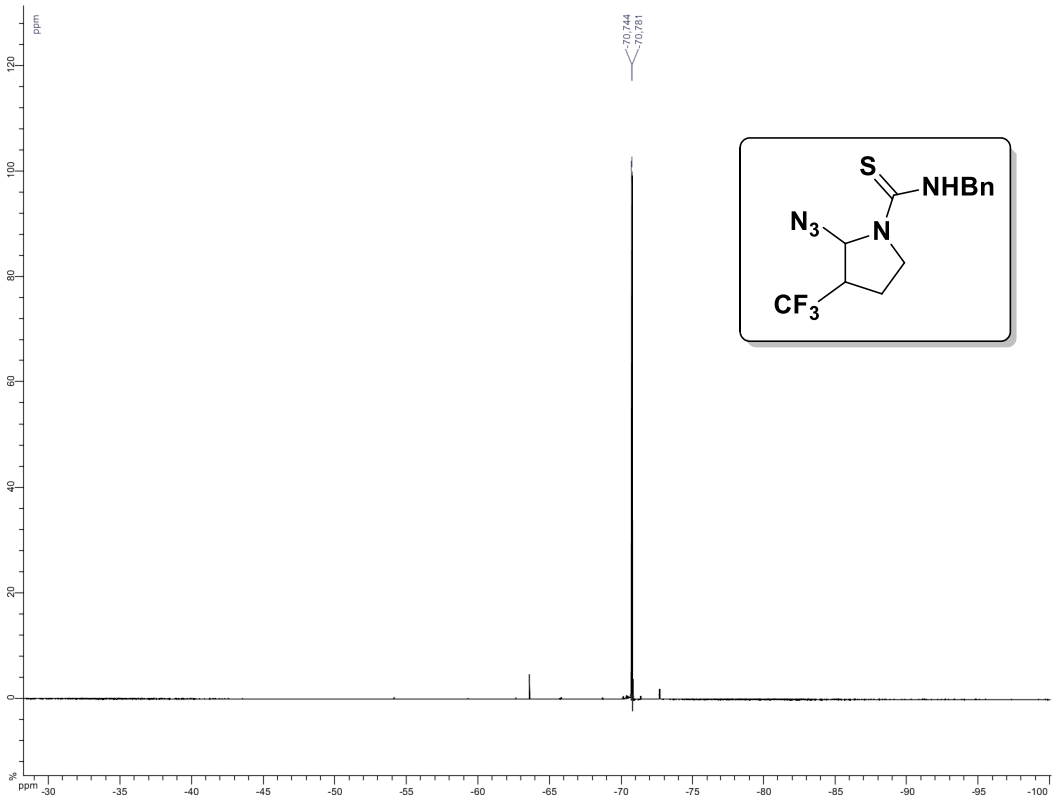



-63.435
-63.472
-63.516
-63.552
-63.589
Boc
N
O
O
O
NH
N3
CF3
ppm
%
160
140
120
100
80
60
40
20
0
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

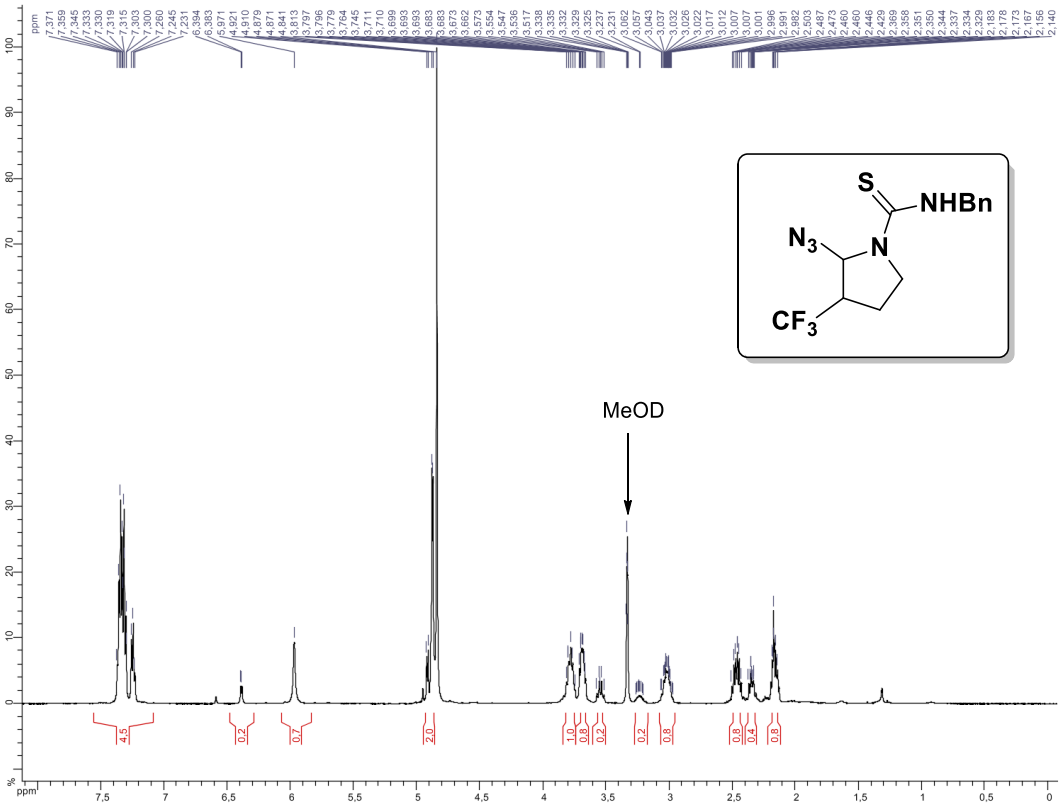
2-Azido-*N*-benzyl-3-(trifluoromethyl)pyrrolidine-1-carbothioamide 8c; diastereomer 1

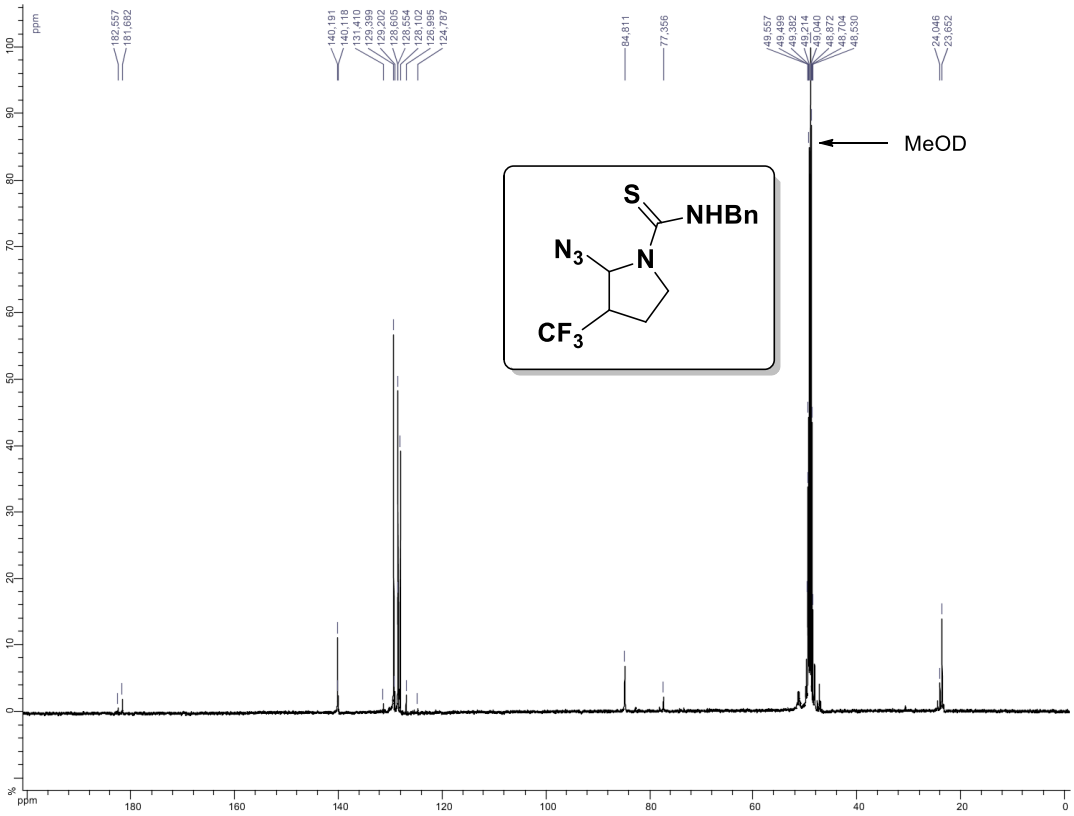


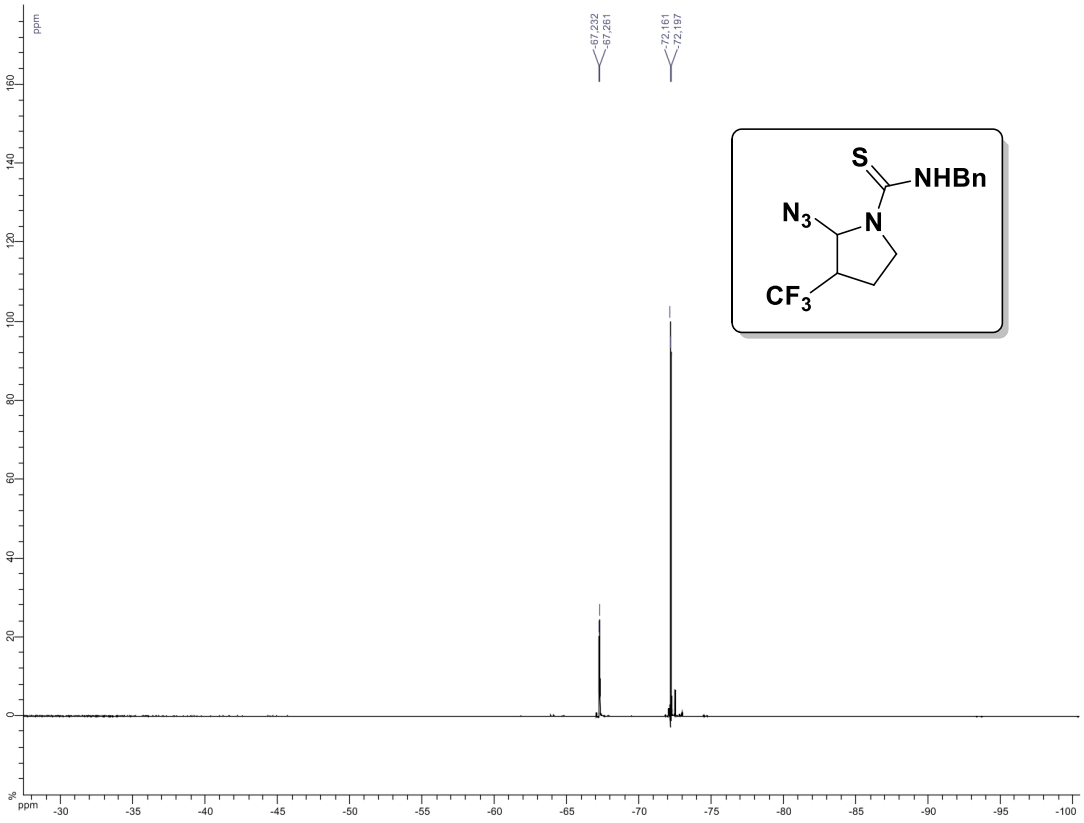



ppm
-70,744
-70,781
S
NHBn
N3
N
CF3
120
100
80
60
40
20
0
%
ppm
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

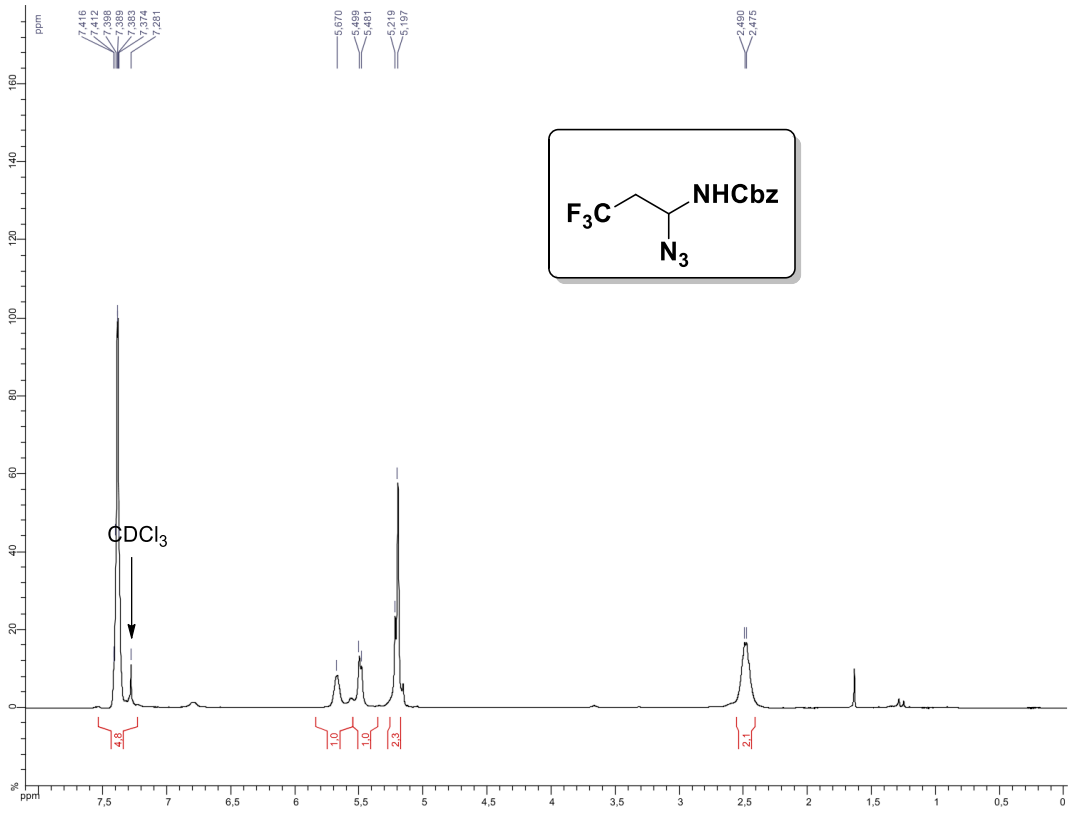
2-Azido-*N*-benzyl-3-(trifluoromethyl)pyrrolidine-1-carbothioamide 8c; diastereomer 2

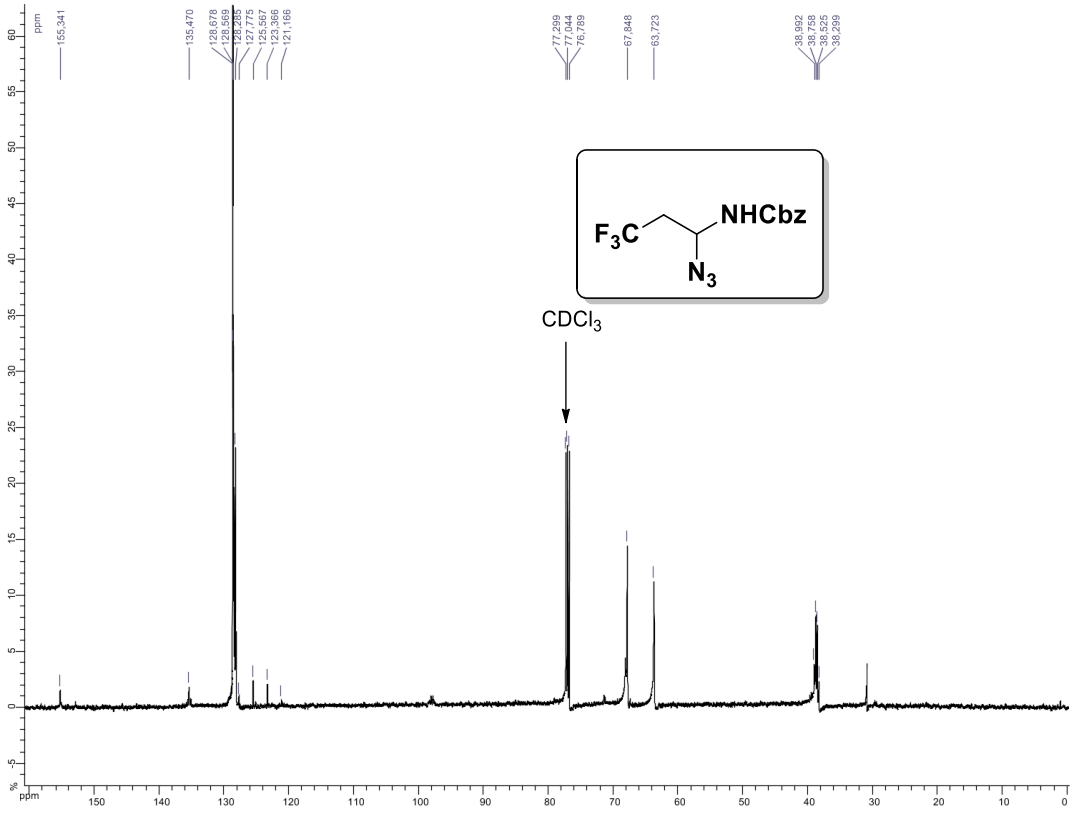


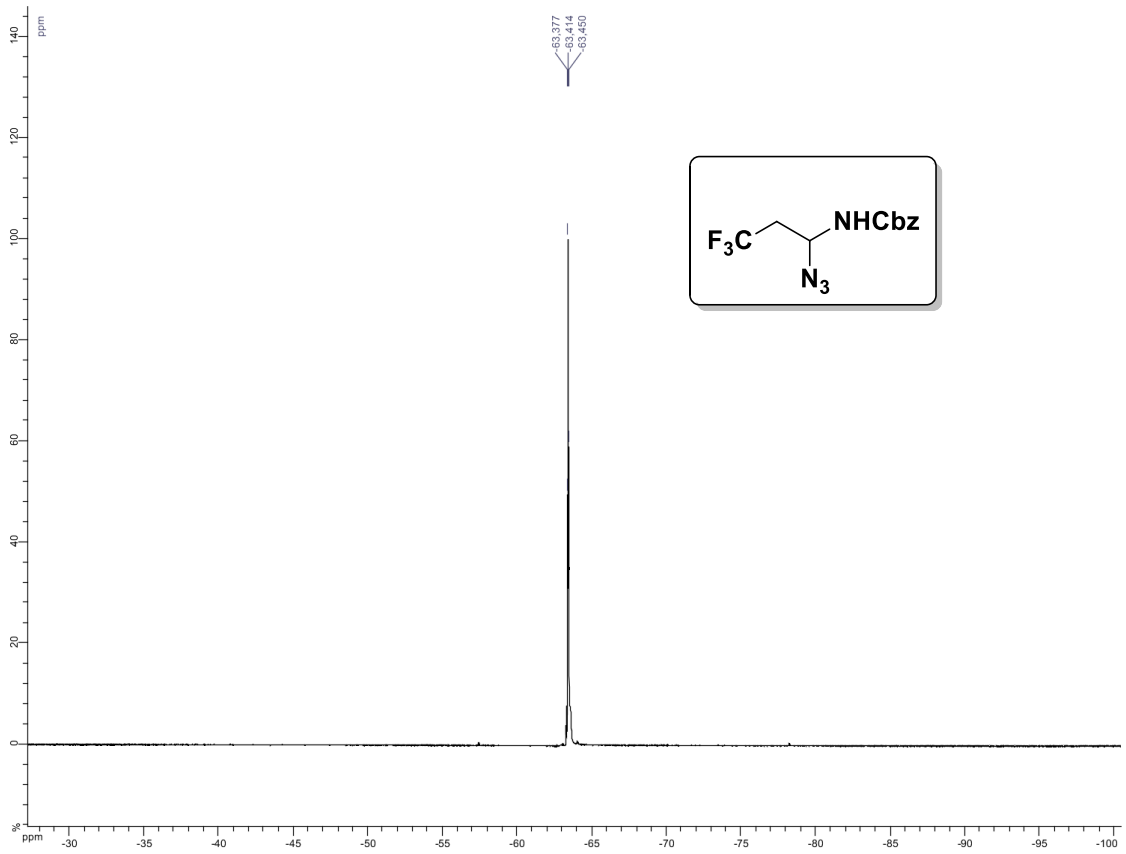



-67.232
-67.261
-72.161
-72.197
S
NHBn
N3
N
CF3
ppm
%
160
140
120
100
80
60
40
20
0
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

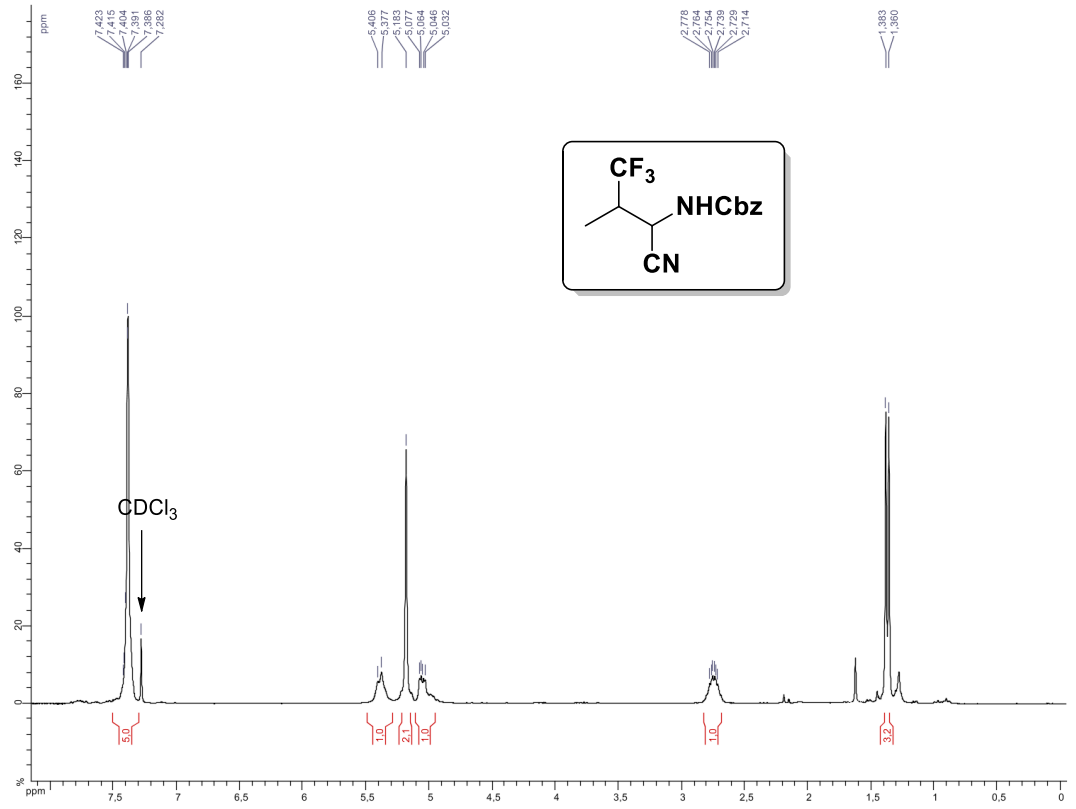
Benzyl (1-azido-3,3,3-trifluoropropyl)carbamate 8d

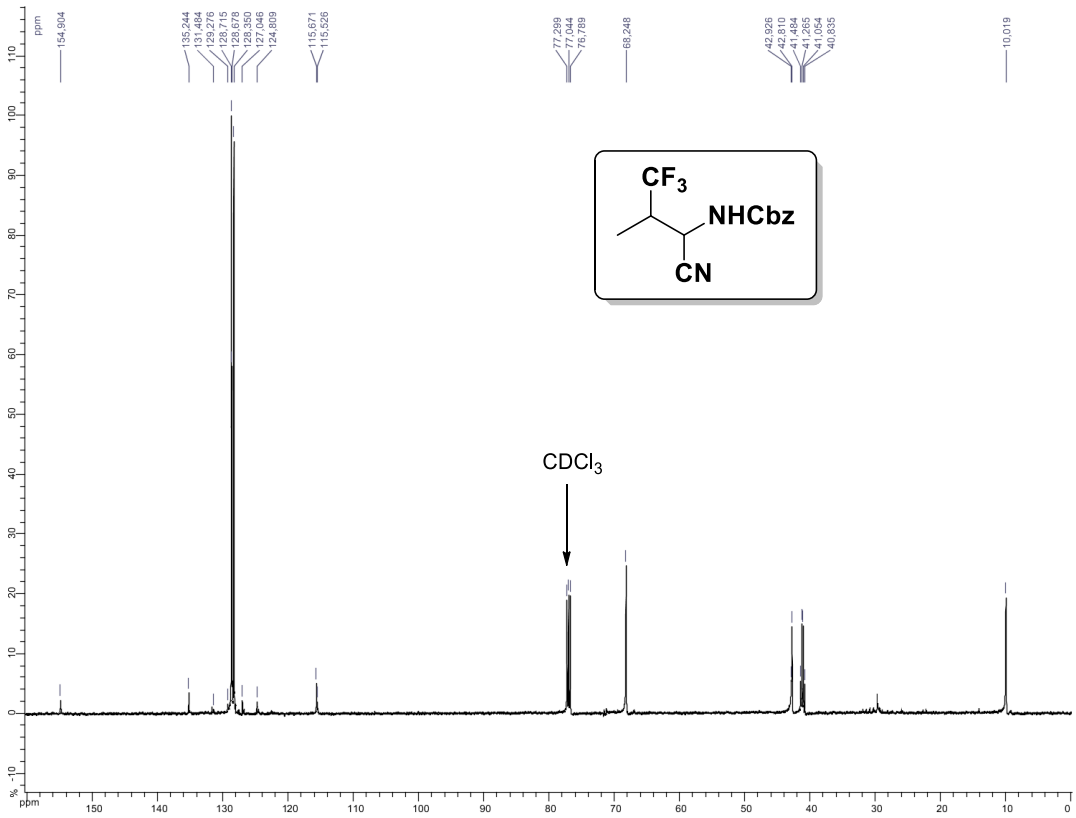


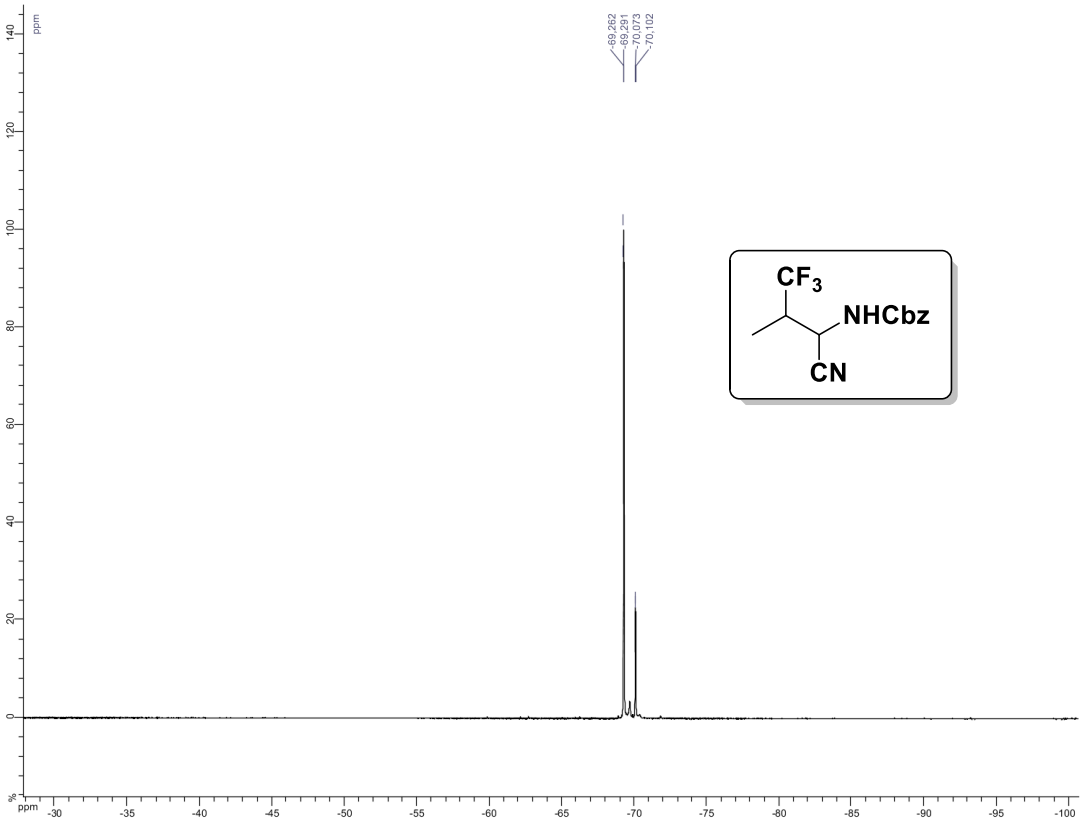



-63,377
-63,414
-63,450
F3C
NHCbz
N3
ppm
140
120
100
80
60
40
20
0
%
ppm
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

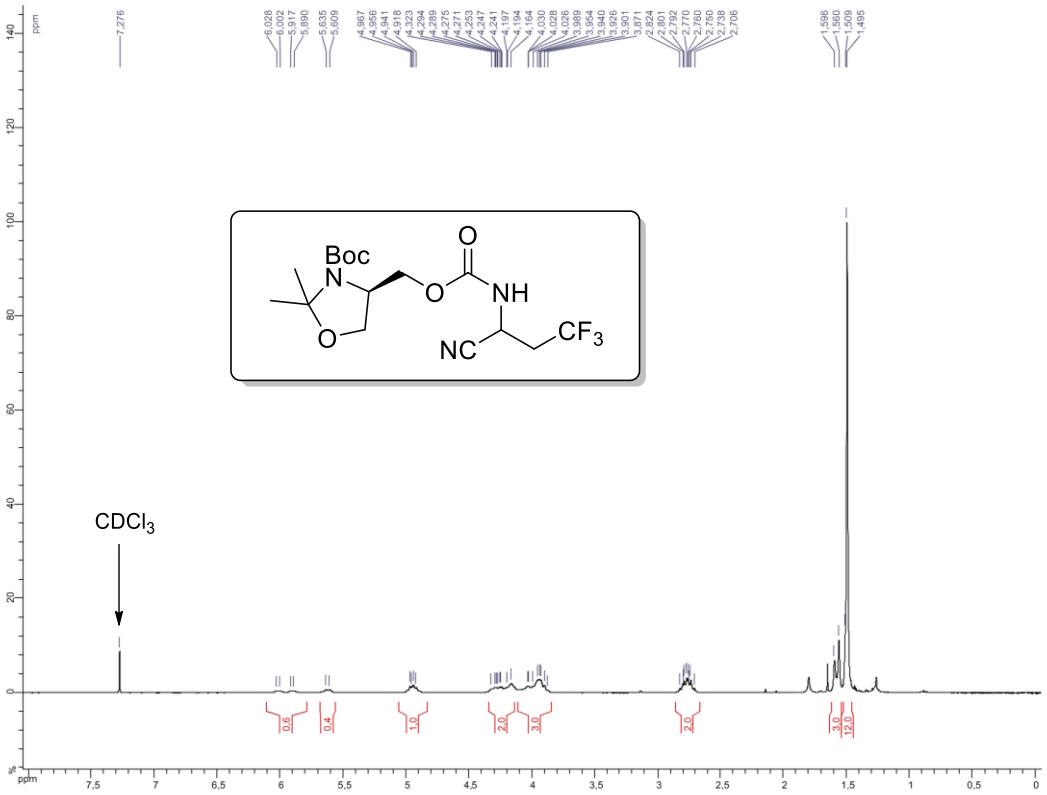
Benzyl (1-cyano-3,3,3-trifluoro-2-methylpropyl)carbamate 9a

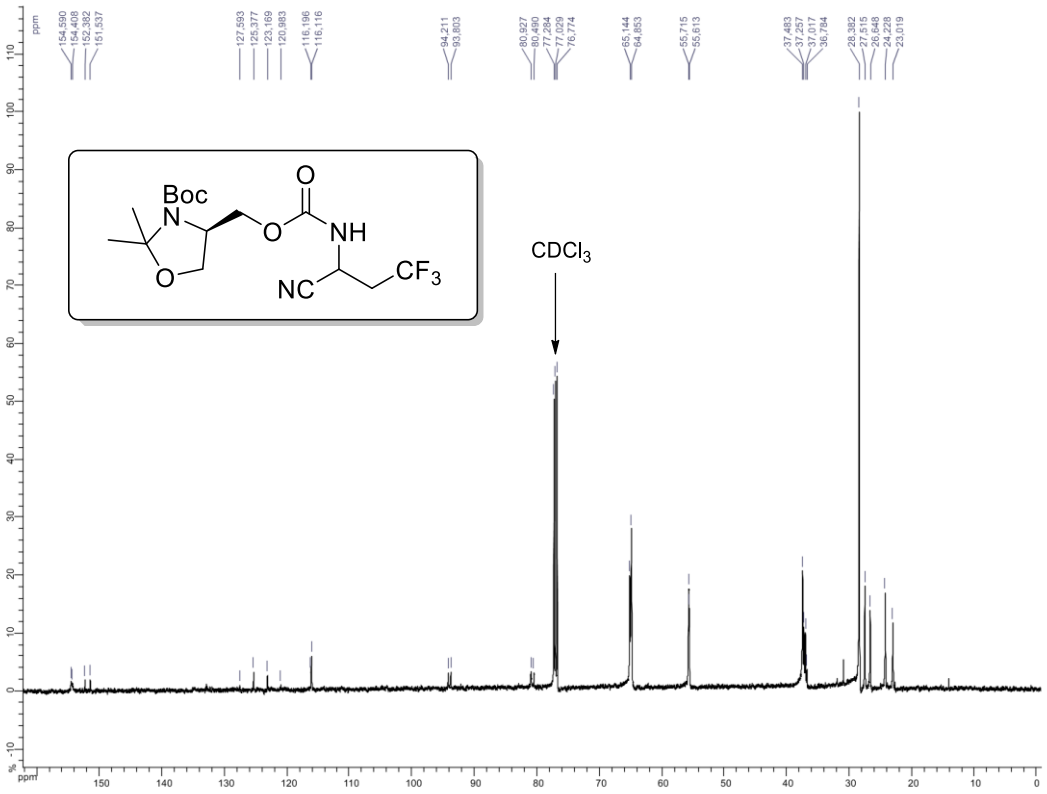


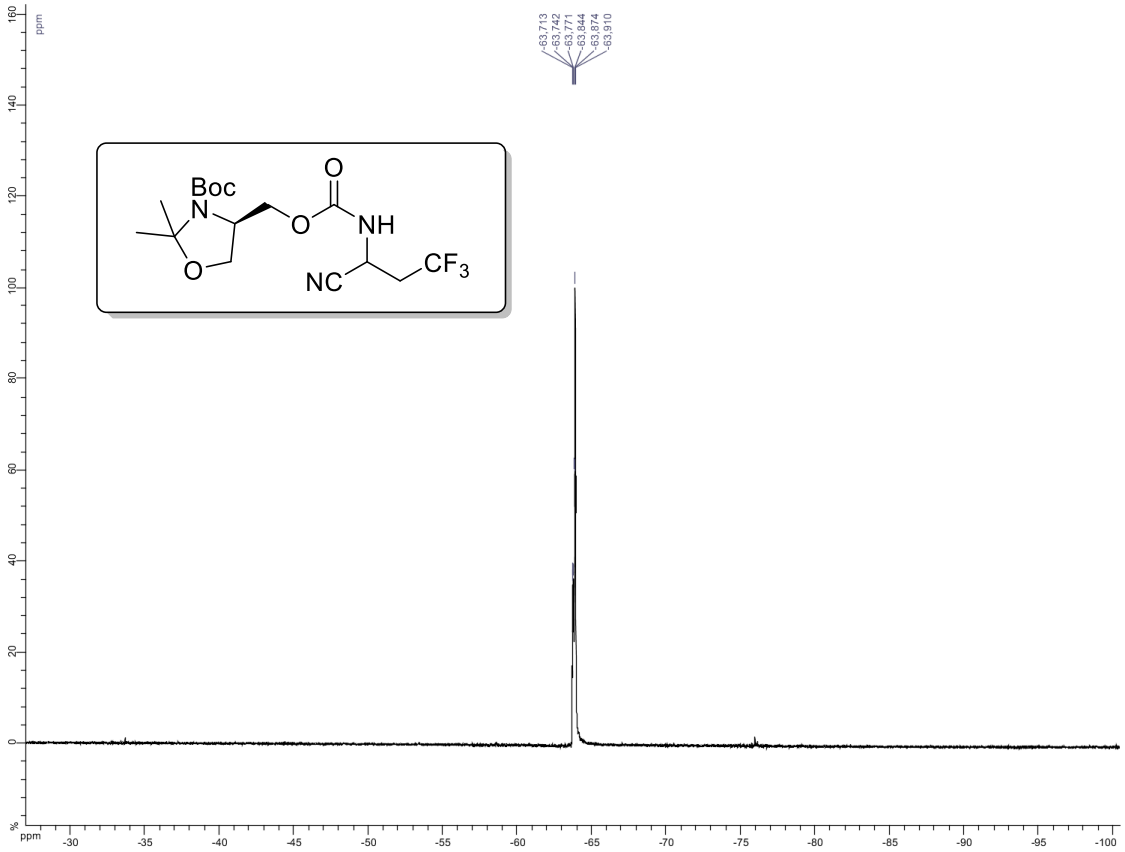



-69.262
-69.291
-70.073
-70.102
CF3
NHCbz
CN
ppm
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

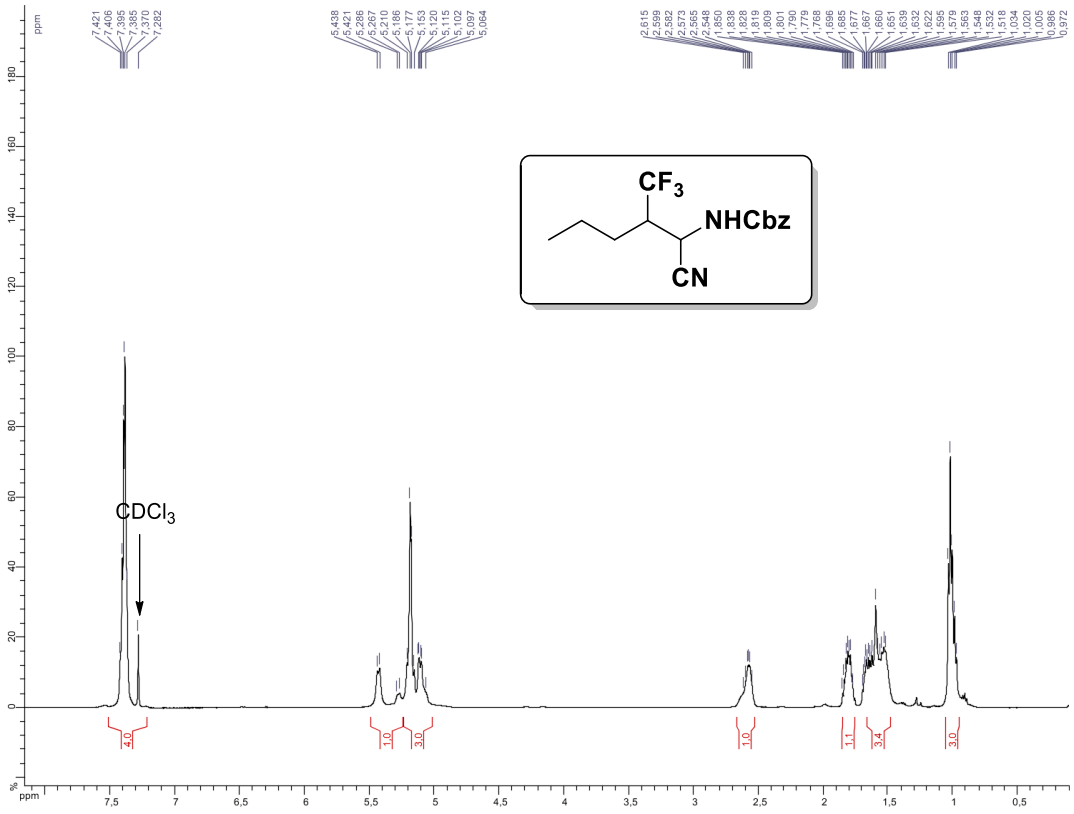
(4R)-Tert-butyl 4-((((1-cyano-3,3,3-trifluoropropyl)carbamoyl)oxy)methyl)-2,2-dimethyloxazolidine-3-carboxylate 9b

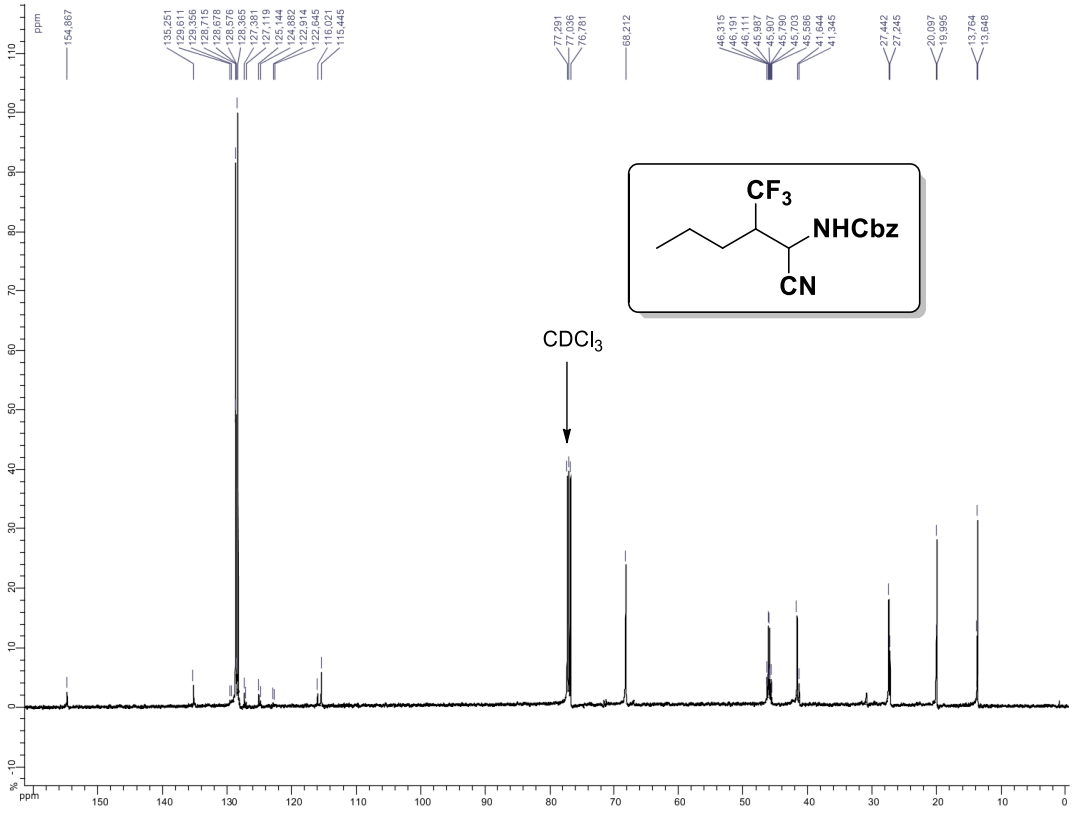


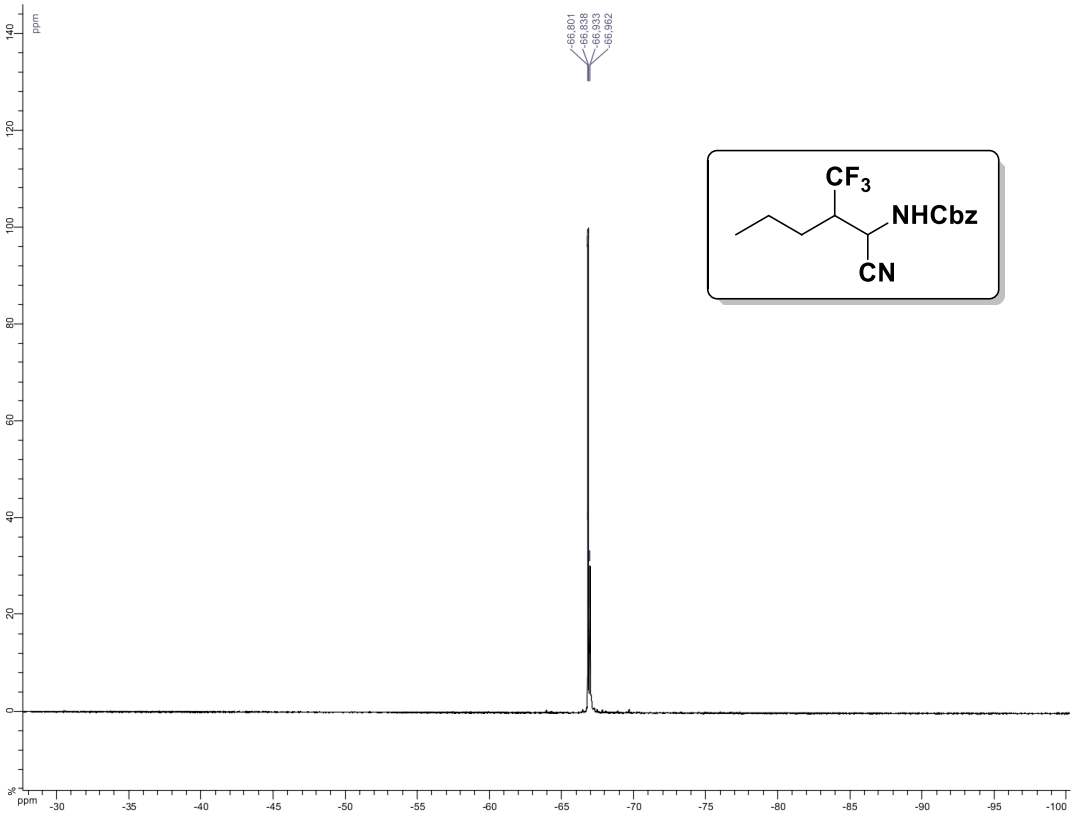



-63,713
-63,742
-63,771
-63,844
-63,874
-63,910
Boc
N
O
O
O
NH
NC
CF3
ppm
%
160
140
120
100
80
60
40
20
0
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

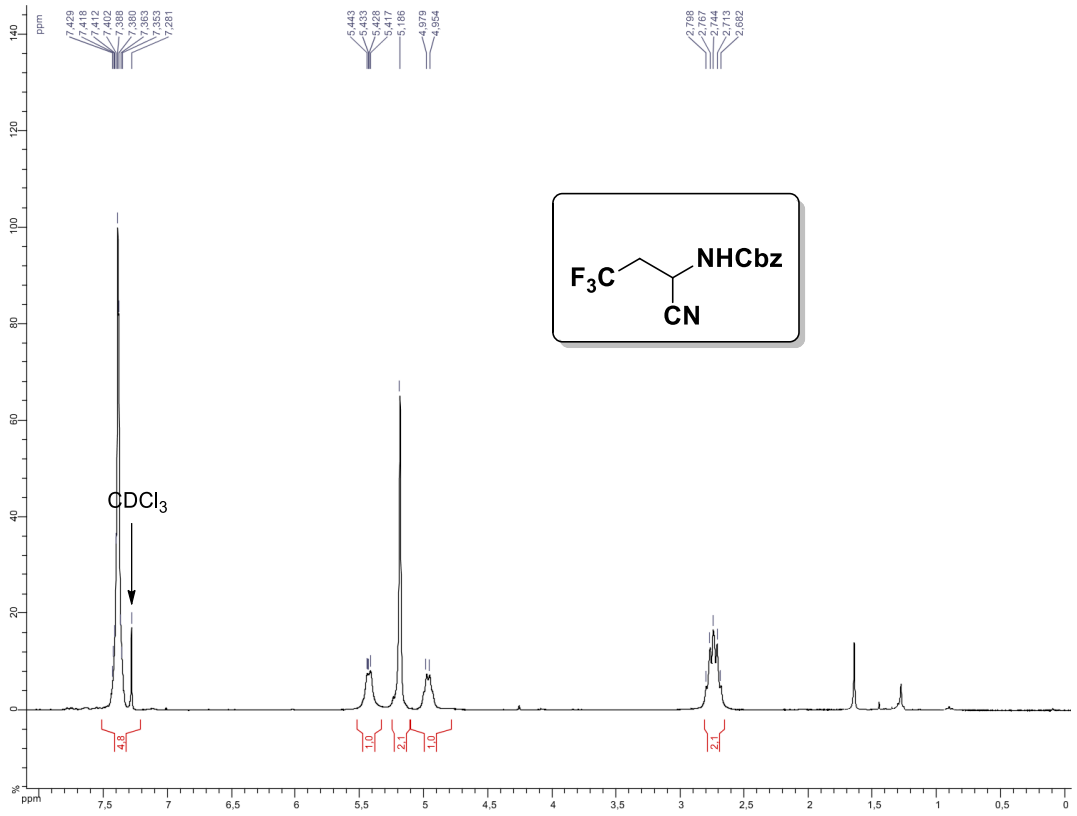
Benzyl (1-cyano-2-(trifluoromethyl)pentyl)carbamate 9c

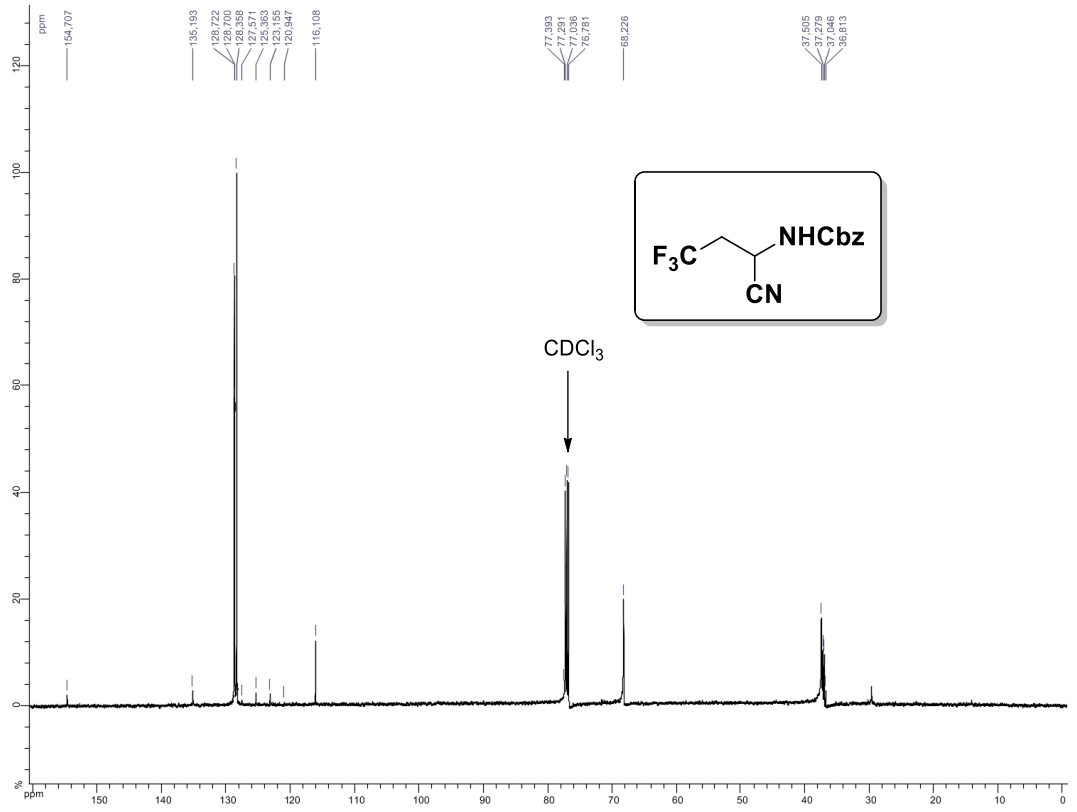


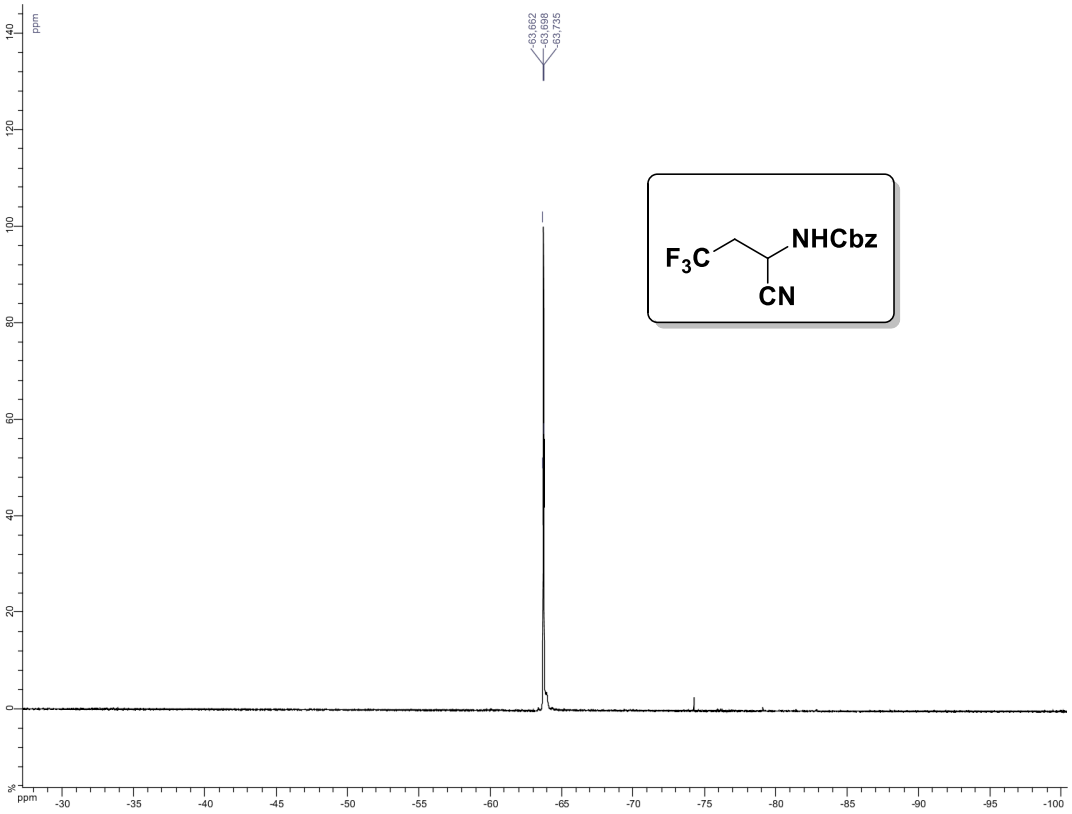



-66.801
-66.838
-66.933
-66.952
CF3
NHCbz
CN
ppm
%
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100

Benzyl (1-cyano-3,3,3-trifluoropropyl)carbamate 9d






-63,662
-63,698
-63,735
ppm
140
120
100
80
60
40
20
0
%
ppm
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100
F3C
NHCbz
CN