

Supporting Information for:

Room Temperature Deoxyfluorination of Benzaldehydes and α -Ketoesters with Sulfuryl Fluoride and Tetramethylammonium Fluoride

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1. General Information

NMR spectra were obtained on a Varian MR400 (400.52 MHz for ^1H ; 376.87 MHz for ^{19}F ; 100.71 MHz for ^{13}C) or a Varian vnmrs 500 (500.01 MHz for ^1H ; 125.75 MHz for ^{13}C , and 470.56 MHz for ^{19}F) spectrometer. ^1H and ^{13}C chemical shifts are reported in parts per million (ppm) relative the residual solvent peak (CDCl_3 : ^1H : δ = 7.26 ppm, ^{13}C : δ = 77.16 ppm). ^{19}F NMR spectra are referenced based on the internal standard 4-fluoroanisole, which appears at -125.55 ppm. ^1H and ^{19}F multiplicities are reported as follows: singlet (s), broad singlet (br), doublet (d), triplet (t), quartet (q), pentet (pent) multiplet (m), sextet (sext), septet (sept), doublet of doublets (dd), doublet of triplets (dt), triplet of doublets (td), doublet of doublet of doublets (ddd), doublet of doublet of triplets (ddt). Coupling constants (J) are reported in Hz. GCMS analysis was performed on a Shimadzu GCMSQP2010 gas chromatograph mass spectrometer. The products were separated on a 30 m length by 0.25 mm id RESTEK XTI-5 column coated with a 0.25 μm film. Helium was employed as the carrier gas, with a constant column flow of 1.5 mL/min. The injector temperature was held constant at 250 °C. The GC oven temperature parameters are as follows: 32 °C hold for 5 min, ramp at 15 °C/min to 250 °C. Melting points were determined with a Mel-Temp 3.0 (Laboratory Devices, Inc) and are uncorrected. High-resolution mass spectra were recorded on a Micromass AutoSpec Ultima Magnetic Sector mass spectrometer. All reactions generating sulfuryl fluoride were performed in a well-ventilated fumehood equipped with a wall mounted sulfuryl fluoride specific detector from Spectros Instruments.

2. Materials and Methods

Commercial reagents and solvents were used as received unless otherwise noted. Anhydrous tetramethylammonium fluoride (Me₄NF), 4-bromobenzaldehyde, 4-phenylbenzaldehyde, 4-iodobenzaldehyde, 4-chlorobenzaldehyde, o-tolualdehyde, 4-(1*H*-pyrrol-1-yl)benzaldehyde, 4-(2-pyridinyl)benzaldehyde, 2-pyridinecarboxaldehyde, 5-nitro-2-pyridinecarboxaldehyde, 2-quinolinecarboxaldehyde, 4-quinolinecarboxaldehyde, 4-isoquinolinecarboxaldehyde and Probenecid were purchased from Sigma Aldrich. 2,6-dimethylbenzaldehyde, 4-formylbenzonitrile, 4-formylbenzoate and 3-pyridinecarboxaldehyde were purchased from Acros. 2-phenylbenzaldehyde, 4-(pyrrolidinylcarbonyl)-benzaldehyde, 6-methyl-2-pyridinecarboxaldehyde and 5-bromo-2-pyridinecarboxaldehyde were purchased from Alfa Aesar. 4-(1,1-dimethylethyl)benzaldehyde, 3-methoxy-2-pyridinecarboxaldehyde, 3-chloro-4-pyridinecarboxaldehyde and 2-isopropylbenzoic acid were purchased from TCI America. Adapalene was purchased from Arctom Chemicals. Formic acid was purchased from Sigma-Aldrich and used as is. Dichloromethane, pentane, diethyl ether, ethyl acetate, toluene, acetonitrile and hexanes were obtained from Fisher Scientific and used as received. CDCl₃ was purchased from Cambridge Isotope Laboratories. Anhydrous dimethyl formamide was purchased from Sigma-Aldrich and stored in a glovebox. Tetrahydrofuran (THF, VWR International), toluene (VWR International) and dichloromethane (Fisher) were purified by an Innovative Technologies solvent purification system consisting of a copper catalyst, activated alumina, and molecular sieves.

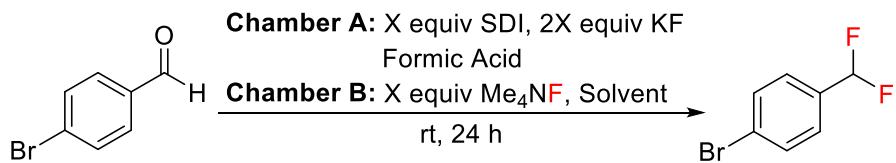
1,1'-sulfonyldiimidazole was synthesized according to literature procedures.¹

Silica gel (6A, 40-63 µm particle size) for flash chromatography was purchased from Silicycle. Diatomaceous earth was purchased from Aqua Solutions. Magnesium sulfate (anhydrous, powder) was purchased from Avantor Performance Materials. Thin layer chromatography (TLC) was performed on Macherey-Nagel GmbH & Co. pre-coated TLC-plates SIL G-25 UV254 (0.25 mm silica gel with fluorescent indicator UV254).

Sulfuryl fluoride was purchased from Synquest Labs, Inc. A solution of sulfuryl fluoride in dimethyl formamide (DMF) was prepared by bubbling sulfuryl fluoride through a premassed sealed bottle of anhydrous DMF (Sigma-Aldrich) for 10 min**. The solution obtained had a concentration of 0.16 M of sulfuryl fluoride.

****During this procedure, great caution was taken due to the toxicity of the sulfuryl fluoride. A specialized sulfuryl fluoride detector (Spectros Instruments) was used to ensure that no sulfuryl fluoride was left in the ventilated fume-hood after the bubbling was complete.**

3. Optimization of two-chamber reaction vessel conditions – Table 1



Entry 1:

In a nitrogen-filled glovebox, 4-bromobenzaldehyde (18.5 mg, 0.1 mmol) and Me_4NF (27.9 mg, 0.3 mmol) were added to a 1 dram vial equipped with a magnetic stir bar. A solution of SO_2F_2 in DMF (0.5 mL, 0.14 M) was added to the vial, which was then sealed and removed from the glovebox. The reaction was allowed to stir for 24 h at room temperature. The reaction mixture was then diluted with dichloromethane (2.0 mL), and 4-fluoroanisole was added as an NMR standard. The reaction mixture was analyzed by ^{19}F NMR spectroscopy. The yield of product in Table 1 represents the average of two runs.

Entries 2 & 3:

In a nitrogen-filled glovebox, 4-bromobenzaldehyde (18.5 mg, 0.1 mmol) and Me_4NF (entry 2: 27.9 mg, 0.3 mmol, 3.0 equiv; entry 3: 37.2 mg, 0.4 mmol, 4.0 equiv) were added to Chamber B of the two-chamber reaction vessel, which was also equipped with a magnetic stir-bar. 1,1'-Sulfonyldiimidazole (entry 2: 29.7 mg, 0.15 mmol; entry 3: 39.6 mg, 0.2 mmol) and KF (entry 2: 17.4 mg, 0.3 mmol; entry 3: 23.2 mg, 0.4 mmol) were added to Chamber A, which was also equipped with a magnetic stir-bar. The vessel was removed from the glovebox, formic acid (0.2 mL) was added to Chamber A, and the mixture was allowed to stir at room temperature for 5 min. Anhydrous *N,N*-dimethylformamide (0.5 mL) was added to Chamber B, and the reaction was allowed to stir for 24 h at room temperature. Chamber B was then diluted with dichloromethane (2.0 mL), and 4-fluoroanisole was added as an NMR standard. The reaction mixture was analyzed by ^{19}F NMR spectroscopy. The yield of product in Table 1 represents the average of two runs.

Entries 4:

In a nitrogen-filled glovebox, 4-bromobenzaldehyde (18.5 mg, 0.1 mmol) and Me_4NF (37.2 mg, 0.4 mmol) were added to Chamber B of the two-chamber reaction vessel, which was also equipped with a magnetic stir-bar. 1,1'-Sulfonyldiimidazole (39.6 mg, 0.2 mmol) and KF (23.2 mg, 0.4 mmol) were added to Chamber A, which was also equipped with a magnetic stir-bar. The vessel was removed from the glovebox, formic acid (0.2 mL) was added to Chamber A, and the mixture was allowed to stir at room temperature for 5 min. Anhydrous *N,N*-dimethylformamide (0.5 mL) was added to Chamber B, and the reaction was allowed to stir for 4 h at room temperature. Chamber B was then diluted with dichloromethane (2.0 mL), and 4-fluoroanisole was added as an NMR standard. The reaction mixture was analyzed by ^{19}F NMR spectroscopy. The yield of product in Table 1 represents the average of two runs.

Entry 5:

In a nitrogen-filled glovebox, 4-bromobenzaldehyde (37.0 mg, 0.2 mmol) and Me₄NF (74.4 mg, 0.8 mmol) were added to Chamber B of the two-chamber reaction vessel, which was also equipped with a magnetic stir-bar. 1,1'-Sulfonyldiimidazole (79.2 mg, 0.4 mmol) and KF (46.4 mg, 0.8 mmol) were added to Chamber A, which was also equipped with a magnetic stir-bar. The vessel was removed from the glovebox, formic acid (0.4 mL) was added to Chamber A, and the mixture was allowed to stir at room temperature for 5 min. Anhydrous *N,N*-dimethylformamide (1.0 mL) was added to Chamber B, and the reaction was allowed to stir for 4 h at room temperature. Diethyl ether (5 mL) was added to Chamber B, and this mixture was then transferred to a separatory funnel. The organic layer was washed with water (5 x 15 mL) and then dried over MgSO₄, and the solvent was removed under reduced pressure. The crude reaction mixture was purified by chromatography of silica gel (100% hexanes; R_F = 0.72) to afford 1-bromo-4-(difluoromethyl)benzene as a colorless oil (35.2 mg, 85% yield). The isolated yield in Table 1 represents the average of two runs.

4. Solvent Screen for Difluoromethylation Using Two-Chamber Set-Up

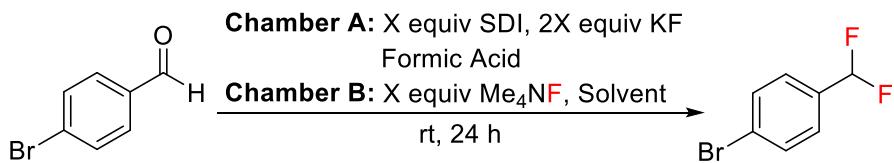
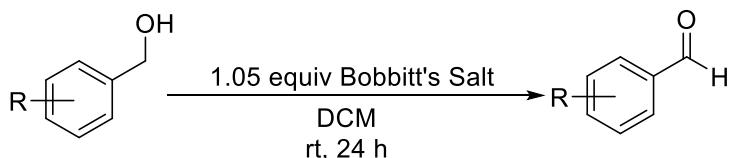


Table S1. Optimization of solvent choice for the difluoromethylation of 4-bromobenzaldehyde.

Entry	Solvent	Yield (%)
1	DMF	68
2	DMA	59
3	THF	34
4	NMP	6
5	DMSO	36
6	Acetonitrile	4
7	DME	47

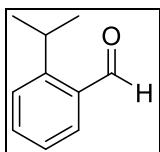
Entries 1–6: In a nitrogen-filled glovebox, 4-bromobenzaldehyde (18.5 mg, 0.1 mmol) and Me₄NF (27.9 mg, 0.3 mmol, 3.0 equiv) were added to Chamber B of the two-chamber reaction vessel, which was also equipped with a magnetic stirbar. 1,1'-Sulfonyldiimidazole (29.7 mg, 0.15 mmol) and KF (17.4 mg, 0.3 mmol) were added to Chamber A, which was also equipped with a magnetic stirbar. The vessel was removed from the glovebox, formic acid (0.2 mL) was added to Chamber A, and the mixture was allowed to stir at room temperature for 5 min. Anhydrous solvent (0.5 mL) was added to Chamber B, and the reaction was allowed to stir for 24 h at room temperature. Chamber B was diluted with dichloromethane (2.0 mL), and 4-fluoroanisole was added as an NMR standard. The reaction mixture was analyzed by ¹⁹F NMR spectroscopy. The yields in Table S1 represent an average of two runs.

5. Synthesis of aldehyde substrates

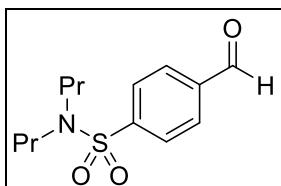


General Procedure:

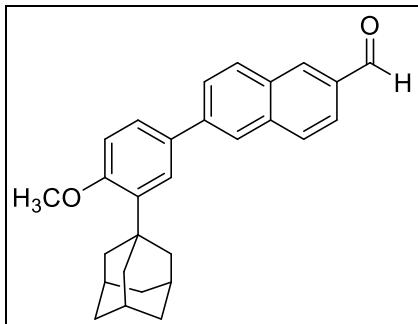
To a 100 mL round bottom flask, benzyl alcohol (0.5 mmol) and 4-acetamido-2,2,6,6-tetramethyl-1-oxopiperidinium tetrafluoroborate (157.5 mg, 0.525 mmol, 1.05 equiv) were added. Dichloromethane (25 mL) was added, and the yellow reaction mixture was stirred for 24 h at room temperature. After several hours, the slurry had become colorless. The crude mixture was filtered through a plug of celite, and then the solvent was removed under reduced pressure. The crude product required no further purification.



The general procedure above was followed using 2-isopropylbenzyl alcohol (75.0 mg, 0.5 mmol) to yield the product, **2-isopropylbenzaldehyde**, as a colorless oil (70.4 mg, 95% yield). ^1H NMR (500 MHz, CDCl_3): 10.37 (s, 1H), 7.82 (d, $J = 6.8$ Hz, 1H), 7.56 (t, $J = 6.8$ Hz, 1H), 7.47 (d, $J = 6.6$ Hz, 1H), 7.35 (t, $J = 6.6$ Hz, 1H), 3.98 (sept, $J = 6.4$ Hz, 1H), 1.32 (d, $J = 6.4$ Hz, 6H). ^{13}C NMR (125 MHz, CDCl_3): 184.2, 137.4, 128.1, 125.8, 125.5, 63.6, 28.3, 24.1.

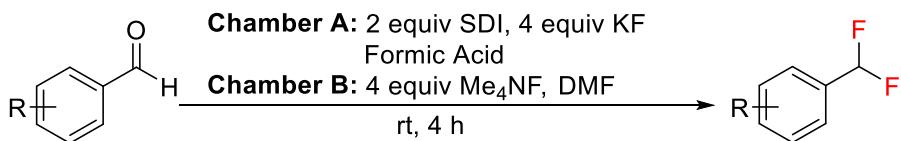


The general procedure above was followed using **probenecid benzyl alcohol** (135.7 mg, 0.5 mmol) to yield the product, **probenecid benzaldehyde**, as a colorless oil (124.8 mg, 92% yield). ^1H NMR (500 MHz, CDCl_3): 10.08 (s, 1H), 7.98 (d, $J = 7.5$ Hz, 2H), 7.96 (d, $J = 7.5$ Hz, 2H), 7.31 (t, $J = 6.7$ Hz, 4H), 1.53 (sept, $J = 6.7$ Hz, 4H), 0.85 (t, $J = 6.7$ Hz, 6H). ^{13}C NMR (125 MHz, CDCl_3): 189.2, 127.4, 126.9, 64.3, 50.3, 21.9, 11.3.



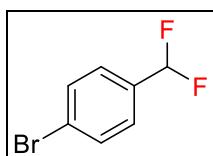
The general procedure above was followed using **adapalene benzyl alcohol** (199.3 mg, 0.5 mmol) to yield the product, **adapalene benzaldehyde**, as a white solid (187.3 mg, 94% yield). ¹H NMR (500 MHz, CDCl₃): 10.12 (s, 1H), 8.31 (s, 1H), 8.00 (t, *J* = 3.2 Hz, 2H), 7.93 (s, 2H), 7.82 (dd, *J* = 7.6 & 3.2 Hz, 1H), 7.58 (d, *J* = 3.2 Hz, 1H), 7.51 (dd, *J* = 7.7 & 3.1 Hz, 1H), 6.96 (d, *J* = 7.6 Hz, 1H), 3.88 (s, 3H), 2.16 (br, 6H), 2.07 (br, 3H), 1.77 (br, 6H). ¹³C NMR (125 MHz, CDCl₃): 192.1, 159.1, 142.3, 139.1, 136.9, 134.3, 133.7, 132.3, 131.3, 129.9, 129.1, 126.8, 126.0, 125.8, 125.0, 123.2, 112.1, 55.2, 40.6, 37.1, 29.1.

6. General Procedure for Difluoromethylation of Aldehydes – Scheme 1

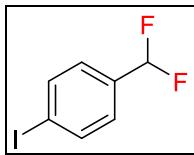


For isolated yields: In a nitrogen-filled glovebox, benzaldehyde (0.2 mmol) and Me_4NF (74.4 mg, 0.8 mmol) were added to Chamber B of the two-chamber reaction vessel, which was equipped with a magnetic stir-bar. 1,1'-Sulfonyldiimidazole (79.2 mg, 0.4 mmol) and KF (46.4 mg, 0.8 mmol) were added to Chamber A, which was also equipped with a magnetic stir-bar. The vessel was removed from the glovebox, formic acid (0.4 mL) was added to Chamber A, and the mixture was allowed to stir at room temperature for 5 min. Anhydrous *N,N*-dimethylformamide (1.0 mL) was added to Chamber B, and the reaction was allowed to stir for 4 h at room temperature. Diethyl ether (5 mL) was added to Chamber B, and the resulting solution was then transferred to a separatory funnel. The organic layer was washed with water (5 x 15 mL) and dried over MgSO_4 , and the solvent was removed under reduced pressure. The crude reaction mixture was purified by chromatography on silica gel.

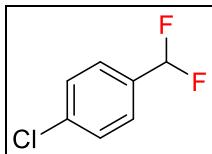
For NMR yields: In a nitrogen-filled glovebox, benzaldehyde (0.2 mmol) and Me_4NF (74.4 mg, 0.8 mmol) were added to Chamber B of the two-chamber reaction vessel, which was equipped with a magnetic stir-bar. 1,1'-Sulfonyldiimidazole (79.2 mg, 0.4 mmol) and KF (46.4 mg, 0.8 mmol) were added to Chamber A, which was also equipped with a magnetic stir-bar. The vessel was removed from the glovebox, formic acid (0.4 mL) was added to Chamber A, and the mixture was allowed to stir at room temperature for 5 min. Anhydrous *N,N*-dimethylformamide (1.0 mL) was added to Chamber B, and the reaction was allowed to stir for 4 h at room temperature. Chamber B was diluted with dichloromethane (2.0 mL), and 4-fluoroanisole was added as an NMR standard. The reaction mixture was analyzed by ^{19}F NMR spectroscopy. The yields in Scheme 1 represent an average of two runs.



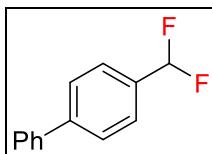
1-bromo-4-(difluoromethyl)benzene (1a**).** The reaction was performed using the standard conditions described above with 4-bromobenzaldehyde (37.0 mg, 0.2 mmol). Following silica gel chromatography using hexanes as the eluent ($R_F = 0.72$), product **1a** was obtained as a colorless oil (36.0 mg, 87% yield). The ^1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the literature.² HRMS EI (m/z): [M]⁺ calcd for $\text{C}_7\text{H}_5\text{BrF}_2$, 205.9543; found 205.9550. The isolated yield reported in the manuscript is the average of two runs (87% and 83% yield).



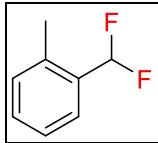
1-iodo-4-(difluoromethyl)benzene (1b). The reaction was performed using the standard conditions described above with 4-iodobenzaldehyde (46.4 mg, 0.2 mmol). Following silica gel chromatography using hexanes as the eluent ($R_F = 0.71$), product **1b** was obtained as a colorless oil (41.6 mg, 81% yield). ^1H NMR (500 MHz, CDCl_3): δ 7.80 (d, $J = 8.4$ Hz, 2H), 7.25 (d, $J = 8.4$ Hz, 2H), 6.60 (t, $J = 56.3$ Hz, 1H). $^{13}\text{C}\{\text{H}\}$ NMR (125 MHz, CDCl_3): 137.89, 133.88, 127.24 (t, $J = 6.0$ Hz), 114.19 (t, $J = 239.1$ Hz), 97.10. ^{19}F NMR (471 MHz, CDCl_3): -111.4 (d, $J = 56.3$ Hz). HRMS EI (m/z): [M]⁺ calcd for $\text{C}_7\text{H}_5\text{IF}_2$, 253.9404; found 253.9400. The isolated yield reported in the manuscript is the average of two runs (71% and 81% yield).



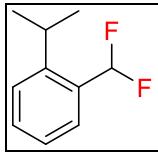
1-chloro-4-(difluoromethyl)benzene (1c). The reaction was performed using the standard conditions described above with 4-chlorobenzaldehyde (28.0 mg, 0.2 mmol). Following silica gel chromatography using hexanes as the eluent ($R_F = 0.73$), product **1c** was obtained as a colorless oil (14.6 mg, 45% yield). The ^1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the literature.³ HRMS EI (m/z): [M]⁺ calcd for $\text{C}_7\text{H}_5\text{ClF}_2$, 162.0048; found 162.0045. The isolated yield reported in the manuscript is the average of two runs (44% and 45% yield).



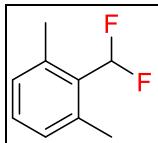
4-(difluoromethyl)-1,1'-biphenyl (1d). The reaction was performed using the standard conditions described above with 4-phenylbenzaldehyde (37.2 mg, 0.2 mmol). Following silica gel chromatography using hexanes as the eluent ($R_F = 0.67$), product **1d** was obtained as a white solid (27.4 mg, 67% yield, mp = 77.8 °C). The ^1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the literature.² HRMS EI (m/z): [M]⁺ calcd for $\text{C}_{13}\text{H}_{10}\text{F}_2$, 204.0751; found 204.0750. The isolated yield reported in the manuscript is the average of two runs (67% and 65% yield).



1-(difluoromethyl)-2-methyl-benzene (1e). The reaction was performed using the standard conditions described above with *o*-tolualdehyde (24.0 mg, 0.2 mmol). Following silica gel chromatography using hexanes as the eluent ($R_F = 0.80$), product **1e** was obtained as a colorless oil (15.7 mg, 56% yield). ^1H NMR (500 MHz, CDCl_3): 7.46 (d, $J = 7.5$ Hz, 1H), 7.33 (t, $J = 7.5$ Hz, 1H), 7.23 (t, $J = 7.6$ Hz, 1H), 7.21 (d, $J = 7.6$ Hz, 1H), 6.72 (t, $J = 55.5$ Hz, 1H), 2.40 (s, 3H). $^{13}\text{C}\{\text{H}\}$ NMR (125 MHz, CDCl_3): 136.20, 132.2, 130.99, 130.54, 125.94, 125.74 (t, $J = 7.4$ Hz), 114.41 (t, $J = 237.8$ Hz), 18.47. ^{19}F NMR (471 MHz, CDCl_3): -113.10 ($J = 55.5$ Hz). HRMS EI (m/z): [M]⁺ calcd for $\text{C}_8\text{H}_8\text{F}_2$, 142.0594; found 142.0593. The isolated yield reported in the manuscript is the average of two runs (56% and 54% yield).

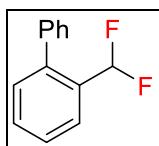


1-(difluoromethyl)-2-isopropyl-benzene (1f). The reaction was performed using the standard conditions described above with 2-isopropylbenzaldehyde (29.8 mg, 0.2 mmol). Following silica gel chromatography using hexanes as the eluent ($R_F = 0.76$), product **1f** was obtained as a colorless oil (21.1 mg, 62% yield). ^1H NMR (500 MHz, CDCl_3): 7.51 (d, $J = 7.8$ Hz, 1H), 7.45 (t, $J = 7.8$ Hz, 1H), 7.41 (d, $J = 7.5$ Hz, 1H), 7.27 (t, $J = 7.5$ Hz, 1H), 6.86 (t, $J = 55.5$ Hz, 1H), 3.27 (sept, $J = 6.8$ Hz, 1H), 1.29 (d, $J = 6.8$ Hz, 6H). $^{13}\text{C}\{\text{H}\}$ NMR (125 MHz, CDCl_3): 147.51, 130.90, 130.85, 126.04, 125.87, 125.74 (t, $J = 7.4$ Hz), 114.06 (t, $J = 55.5$ Hz), 28.64, 24.02. ^{19}F NMR (471 MHz, CDCl_3): -110.32 (d, $J = 55.5$ Hz). HRMS EI (m/z): [M]⁺ calcd for $\text{C}_{10}\text{H}_{12}\text{F}_2$, 170.0907; found 170.0905. The isolated yield reported in the manuscript is the average of two runs (62% and 54% yield).

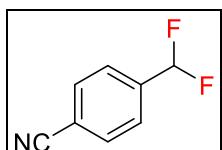


1-(difluoromethyl)-2,6-dimethyl-benzene (1g). The reaction was performed using the standard conditions described above with 2,6-dimethylbenzaldehyde (26.8 mg, 0.2 mmol). Following silica gel chromatography using hexanes as the eluent ($R_F = 0.70$), product **1g** was obtained as a colorless oil (16.3 mg, 52% yield). ^1H NMR (500 MHz, CDCl_3): 7.21 (t, $J = 7.5$ Hz, 1H), 7.05 (d, $J = 7.5$ Hz, 2H), 6.98 (t, $J = 54.3$ Hz, 1H), 2.47 (s, 6H). $^{13}\text{C}\{\text{H}\}$ NMR (125 MHz, CDCl_3): 137.03, 130.29, 129.16, 125.23 (t, $J = 7.0$ Hz), 114.46 (t, $J = 236.1$ Hz), 19.46. ^{19}F NMR (471 MHz, CDCl_3): -111.97

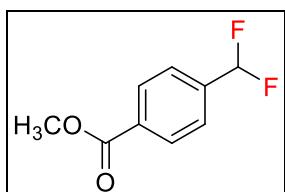
(d, $J = 54.3$ Hz). HRMS EI (m/z): [M]+ calcd for $C_9H_{10}F_2$, 156.0751; found 156.0752. The isolated yield reported in the manuscript is the average of two runs (50% and 52% yield).



2-(difluoromethyl)-1,1'-biphenyl (1h). The reaction was performed using the standard conditions described above with 2-phenylbenzaldehyde (36.4 mg, 0.2 mmol). Following silica gel chromatography using hexanes as the eluent ($R_F = 0.64$), product **1h** was obtained as a colorless oil (30.1 mg, 74% yield). The 1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the literature.⁴ HRMS EI (m/z): [M]+ calcd for $C_{13}H_{10}F_2$, 204.0751, found 204.0759. The isolated yield reported in the manuscript is the average of two runs (70% and 74% yield).

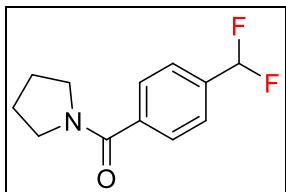


4-(difluoromethyl)-benzonitrile (1i). The reaction was performed using the standard conditions described above with 4-formylbenzonitrile (26.2 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-30% EtOAc; $R_F = 0.21$ in 90:10 hexane: EtOAc), product **1i** was obtained as a colorless oil (25.8 mg, 84% yield). The 1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the literature.² HRMS EI (m/z): [M]+ calcd for $C_8H_5NF_2$, 153.0390; found 153.0396. The isolated yield reported in the manuscript is the average of two runs (80% and 84% yield).

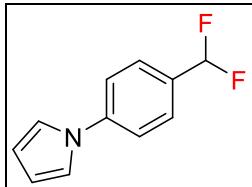


Methyl 4-(difluoromethyl)benzoate (1j). The reaction was performed using the standard conditions described above with methyl 4-formylbenzoate (32.8 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-30% EtOAc; $R_F = 0.20$ in 90:10 hexane: EtOAc), product **1j** was obtained as a white solid (36.0 mg, 97% yield, mp = 89.2 °C). The 1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the

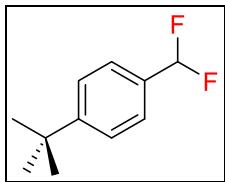
literature.⁵ HRMS EI (m/z): [M]⁺ calcd for C₉H₈O₂F₂, 186.0492; found 186.0490. The isolated yield reported in the manuscript is the average of two runs (97% and 97% yield).



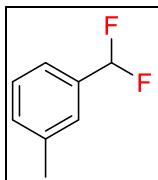
4-(difluoromethyl)-phenyl-1-pyrrolidinyl methanone (1k). The reaction was performed using the standard conditions described above with 4-(pyrrolidinylcarbonyl)-benzaldehyde (40.6 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-30% EtOAc; R_F = 0.15 in 90:10 hexane: EtOAc), product **1k** was obtained as a colorless oil (39.1 mg, 87% yield). ¹H NMR (500 MHz, CDCl₃): 7.57 (d, *J* = 8.3 Hz, 2H), 7.53 (d, *J* = 8.3 Hz, 2H), 6.64 (t, *J* = 56.3 Hz, 1H), 3.63 (t, *J* = 6.9 Hz, 2H), 3.37 (t, *J* = 6.9 Hz, 2H), 1.95 (pent, *J* = 6.6 Hz, 2H), 1.87 (pent, *J* = 6.6 Hz, 2H). ¹³C{¹H} NMR (125 MHz, CDCl₃): 168.65, 139.59, 135.54 (t, *J* = 22.4 Hz), 127.41, 125.58 (t, *J* = 6.1 Hz), 114.18 (t, *J* = 239.4 Hz), 49.50, 46.20, 26.36, 24.41. ¹⁹F NMR (471 MHz, CDCl₃): -111.59 (t, *J* = 56.3 Hz). HRMS EI (m/z): [M]⁺ calcd for C₁₂H₁₃NOF₂, 225.0965; found 225.0965. The isolated yield reported in the manuscript is the average of two runs (85% and 87% yield).



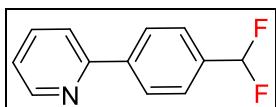
1-[4-(difluoromethyl)phenyl]-1H-pyrrole (1l). The reaction was performed using the standard conditions described above with 4-(1H-pyrrol-1-yl)benzaldehyde (34.2 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-30% EtOAc; R_F = 0.11 in 90:10 hexane: EtOAc), product **1l** was obtained as a colorless oil (11.6 mg, 30% yield). ¹H NMR (500 MHz, CDCl₃): 7.97 (d, *J* = 4.5 Hz, 2H), 7.80 (d, *J* = 8.3 Hz, 2H), 7.61 (d, *J* = 8.3 Hz, 2H), 7.27 (t, *J* = 4.5 Hz, 2H), 6.68 (t, *J* = 56.4 Hz, 1H), 6.50 (s, 1H). ¹³C{¹H} NMR (125 MHz, CDCl₃): 141.65, 126.93 (t, *J* = 6.1 Hz), 126.76, 118.99, 114.25 (t, *J* = 238.8 Hz), 108.21. ¹⁹F NMR (471 MHz, CDCl₃): -110.39 (d, *J* = 56.5 Hz). HRMS EI (m/z): [M]⁺ calcd for C₁₁H₉NF₂, 193.0703; found 193.0705. The isolated yield reported in the manuscript is the average of two runs (25% and 30%).



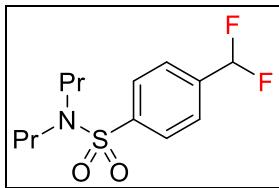
1-(difluoromethyl)-4-(1,1-dimethylethyl)benzene (1m). The reaction was performed using the standard conditions described above with 4-(1,1-dimethylethyl)benzaldehyde (32.4 mg, 0.2 mmol). Following silica gel chromatography using hexanes as the eluent ($R_F = 0.65$), product **1m** was obtained as a colorless oil (17.3 mg, 47% yield). The ^1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the literature.⁵ HRMS EI (m/z): [M]⁺ calcd for $\text{C}_{11}\text{H}_{14}\text{F}_2$, 184.1064; found 184.1061. The isolated yield reported in the manuscript is the average of two runs (47% and 45% yield).



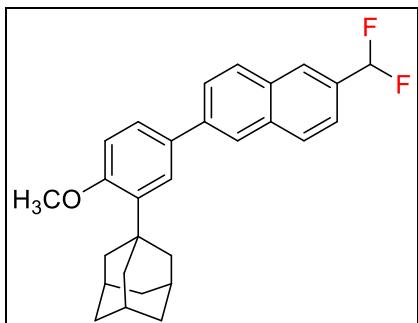
1-(difluoromethyl)-3-methylbenzene (1n). The reaction was performed using the standard conditions described above with *m*-tolualdehyde (24.0 mg, 0.2 mmol). Following silica gel chromatography using hexanes as the eluent ($R_F = 0.80$), product **1n** was obtained as a colorless oil (13.1 mg, 48% yield). The ^1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the literature.⁵ HRMS EI (m/z): [M]⁺ calcd for $\text{C}_8\text{H}_8\text{F}_2$, 142.0594; found 142.0591. The isolated yield reported in the manuscript is the average of two runs (48% and 44% yield).



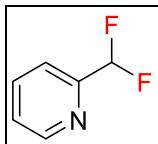
2-[4-(difluoromethyl)phenyl]-pyridine (1o). The reaction was performed using the standard conditions described above with 4-(2-pyridinyl)benzaldehyde (36.6 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-30% EtOAc, $R_F = 0.34$ in 90:10 hexane: EtOAc), product **1o** was obtained as a colorless oil (33.2 mg, 81% yield). ^1H NMR (500 MHz, CDCl_3): 8.70 (dt, $J = 4.5, 1.3$ Hz, 1H), 8.06 (d, $J = 7.8$ Hz, 2H), 7.73-7.79 (m, 2H), 7.62 (d, $J = 7.8$ Hz, 2H), 7.26-7.30 (m, 1H), 6.69 (t, $J = 56.5$ Hz, 1H). $^{13}\text{C}\{\text{H}\}$ NMR (125 MHz, CDCl_3): 156.32, 149.83, 141.68, 136.88, 134.69 (t, $J = 22.4$ Hz), 127.17, 125.97 (t, $J = 6.1$ Hz), 122.67, 120.75, 114.59 (t, $J = 238.9$ Hz). ^{19}F NMR (471 MHz, CDCl_3): -110.89 (d, $J = 56.5$ Hz). HRMS EI (m/z): [M]⁺ calcd for $\text{C}_{12}\text{H}_9\text{NF}_2$, 205.0703; found 205.0700. The isolated yield reported in the manuscript is the average of two runs (77% and 81% yield).



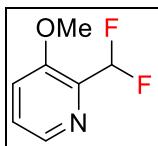
1-[(dipropylamino)sulfonyl]-4-(difluoromethyl)benzene (1p). The reaction was performed using the standard conditions described above with **probenecid benzaldehyde** (53.8 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-40% EtOAc, R_F = 0.36 in 90:10 hexane: EtOAc), product **1p** was obtained as a colorless oil (48.4 mg, 84% yield). ^1H NMR (500 MHz, CDCl_3): 7.89 (d, J = 8.0 Hz, 2H), 7.65 (d, J = 8.0 Hz, 2H), 6.69 (t, J = 56.0 Hz, 1H), 3.09 (t, J = 7.6 Hz, 4H), 1.56 (sext, J = 7.6 Hz, 4H), 0.87 (t, J = 7.6 Hz, 6H). $^{13}\text{C}\{\text{H}\}$ NMR (125 MHz, CDCl_3): 142.59, 137.91, 127.42, 126.31 (t, J = 6.1 Hz), 113.59 (t, J = 240.2 Hz), 50.00, 21.99, 11.14. ^{19}F NMR (471 MHz, CDCl_3): -112.54 (d, J = 56.0 Hz). HRMS EI (m/z): [M]⁺ calcd for $\text{C}_{13}\text{H}_{19}\text{NO}_2\text{SF}_2$, 291.1105; found 291.1104. The isolated yield reported in the manuscript is the average of two runs (84% and 80% yield).



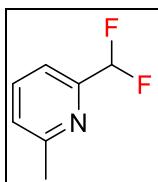
6-(4-methoxy-3-tricyclo[3.3.1.1]dec-1-ylphenyl)-2-(difluoromethyl)naphthalene (1q). The reaction was performed using the standard conditions described above with **adapalene benzaldehyde** (80.0 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-25% EtOAc, R_F = 0.21 in 70:30 hexane: EtOAc), product **1q** was obtained as a white solid (38.0 mg, 47% yield, mp = 301 °C). ^1H NMR (500 MHz, CDCl_3): 7.98 (t, J = 8.8 Hz, 3H), 7.94 (d, J = 8.8 Hz, 1H), 7.80 (d, J = 8.3 Hz, 1H), 7.60 (d, J = 8.3 Hz, 2H), 7.53 (d, J = 8.4 Hz, 1H), 6.99 (d, J = 8.4 Hz, 1H), 6.81 (t, J = 56.5 Hz, 1H), 3.91 (s, 3H), 2.19 (s, 6H), 2.11 (br, 3H), 1.81 (s, 6H). $^{13}\text{C}\{\text{H}\}$ NMR (125 MHz, CDCl_3): 158.80, 140.53, 138.97, 134.70, 132.60, 131.28, 128.96, 128.83, 126.62, 125.92, 125.67, 124.86, 122.32 (t, J = 4.8 Hz), 115.10 (t, J = 238.3 Hz), 112.08, 55.16, 40.60, 37.19, 37.12, 29.10. ^{19}F NMR (471 MHz, CDCl_3): -109.65 (d, J = 56.5 Hz). HRMS EI (m/z): [M]⁺ calcd for $\text{C}_{28}\text{H}_{28}\text{OF}_2$, 418.2108; found 418.2101. The isolated yield reported in the manuscript is the average of two runs (37% and 47% yield).



2-(difluoromethyl)pyridine (1r). The reaction was performed using the standard conditions described above with 2-pyridinecarboxaldehyde (21.4 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-30% EtOAc, R_F = 0.12 in 90:10 hexane: EtOAc), product **1r** was obtained as a colorless oil (15.5 mg, 60% yield). The ^1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the literature.³ HRMS EI (m/z): [M]⁺ calcd for $\text{C}_6\text{H}_5\text{NF}_2$, 129.0390; found 129.0387. The isolated yield reported in the manuscript is the average of two runs (50% and 60% yield).

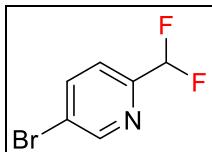


2-(difluoromethyl)-3-methoxypyridine (1s). The reaction was performed using the standard conditions described above with 3-methoxy-2-pyridinecarboxaldehyde (27.4 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-30% EtOAc, R_F = 0.19 in 90:10 hexane: EtOAc), product **1s** was obtained as a colorless oil (28.5 mg, 90% yield). ^1H NMR (500 MHz, CDCl_3): 8.25 (d, J = 4.5 Hz, 1H), 7.36-7.38 (m, 1H), 7.31 (d, J = 8.5 Hz, 1H), 6.89 (t, J = 54.4 Hz, 1H), 3.89 (s, 3H). $^{13}\text{C}\{\text{H}\}$ NMR (125 MHz, CDCl_3): 154.19, 141.10 (d, J = 4.7 Hz), 126.52 (t J = 28.8 Hz), 118.90 (t, J = 27.1 Hz), 113.33, 111.47 (t, J = 234.6 Hz), 55.60. ^{19}F NMR (471 MHz, CDCl_3): -119.46 (d, J = 54.4 Hz). HRMS EI (m/z): [M]⁺ calcd for $\text{C}_7\text{H}_7\text{NOF}_2$, 159.0496; found 159.0499. The isolated yield reported in the manuscript is the average of two runs (90% and 90% yield).

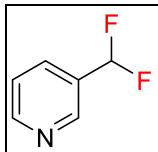


2-(difluoromethyl)-6-methylpyridine (1t). The reaction was performed using the standard conditions described above with 6-methyl-2-pyridinecarboxaldehyde (24.2 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-30% EtOAc, R_F = 0.21 in 90:10 hexane: EtOAc), product **1t** was obtained as a colorless oil (24.5 mg, 82% yield). ^1H NMR (500 MHz, CDCl_3): 7.71 (t, J = 7.7 Hz, 1H), 7.44 (d, J = 7.7 Hz, 1H), 7.26 (d, J = 6.4 Hz, 1H), 6.59 (t, J = 55.6 Hz, 1H), 2.59 (s, 3H). $^{13}\text{C}\{\text{H}\}$ NMR (125 MHz, CDCl_3): 158.60, 152.20, 137.35, 125.05, 117.02 (t, J = 3.3 Hz), 114.03 (t, J = 240.4 Hz), 24.23. ^{19}F NMR (471 MHz, CDCl_3): -115.79 (d, J = 55.6 Hz). HRMS EI (m/z): [M]⁺ calcd for $\text{C}_7\text{H}_7\text{NF}_2$, 143.0547; found 143.0547. The isolated yield reported in the manuscript is the average of two runs (78% and 82% yield). Due to

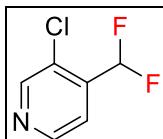
the high volatility of **1q** (bp = 150 °C), the isolated product could not be separated completely from ethyl acetate (<3%).



5-bromo-2-(difluoromethyl)pyridine (1u). The reaction was performed using the standard conditions described above with 5-bromo-2-pyridinecarboxaldehyde (37.2 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-30% EtOAc, R_F = 0.23 in 90:10 hexane: EtOAc), product **1u** was obtained as a colorless oil (35.6 mg, 86% yield). ^1H NMR (500 MHz, CDCl_3): 8.38 (s, 1H), 7.96 (d, J = 8.5 Hz, 1H), 7.05 (d, J = 8.5 Hz), 6.72 (t, J = 55.6 Hz, 1H). $^{13}\text{C}\{\text{H}\}$ NMR (125 MHz, CDCl_3): 145.90 (t J = 16.2 Hz), 138.69 (t J = 8.7 Hz), 128.21, 112.70 (t, J = 239.5 Hz), 110.22, 109.92. ^{19}F NMR (471 MHz, CDCl_3): -115.62 (d, J = 55.6 Hz). HRMS EI (m/z): [M]+ calcd for $\text{C}_6\text{H}_4\text{BrNF}_2$, 206.9495; found 206.9494. The isolated yield reported in the manuscript is the average of two runs (78% and 86% yield).

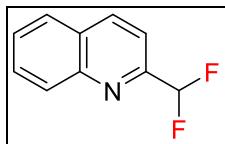


3-(difluoromethyl)pyridine (1v). The reaction was performed using the standard conditions described above with 3-pyridinecarboxaldehyde (21.4 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate (0-30% EtOAc, R_F = 0.21 in 90:10 hexane: EtOAc), product **1v** was obtained as a colorless oil (17.6 mg, 68% yield). The ^1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the literature.³ HRMS EI (m/z): [M]+ calcd for $\text{C}_6\text{H}_5\text{NF}_2$, 129.0390; found 129.0392. The isolated yield reported in the manuscript is the average of two runs (64% and 68% yield). Due to the high volatility of **1t** (bp = 165 °C), the isolated product could not be separated completely from ethyl acetate (<10%).

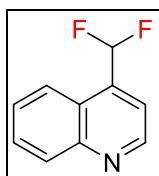


3-chloro-4-(difluoromethyl)pyridine (1w). The reaction was performed using the standard conditions described above with 3-chloro-4-pyridinecarboxaldehyde (28.3 mg, 0.2 mmol), providing **1w** in 35% yield as determined by ^{19}F NMR spectroscopic analysis of the crude reaction

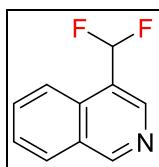
mixture. The identity of the product was further confirmed by GCMS analysis (m/z = 163). The yield reported in the manuscript is the average of two runs (33% and 35% yield).



2-(difluoromethyl)quinoline (1x). The reaction was performed using the standard conditions described above with 2-quinolinecarboxaldehyde (31.4 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-40% EtOAc, R_F = 0.28 in 90:10 hexane: EtOAc), product **1x** was obtained as a white solid (32.1 mg, 90% yield). The ^1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the literature.² HRMS EI (m/z): [M]⁺ calcd for $\text{C}_{10}\text{H}_7\text{NF}_2$, 179.0547; found 179.0549. The isolated yield reported in the manuscript is the average of two runs (90% and 90% yield).

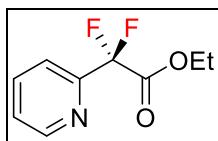


4-(difluoromethyl)quinoline (1y). The reaction was performed using the standard conditions described above with 4-quinolinecarboxaldehyde (31.4 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-40% EtOAc, R_F = 0.25 in 90:10 hexane: EtOAc), product **1y** was obtained as a white solid (34.8 mg, 97% yield). ^1H NMR (500 MHz, CDCl_3): 9.00 (d, J = 4.3 Hz, 1H), 8.20 (d, J = 8.4 Hz, 1H), 8.08 (d, J = 8.4 Hz, 1H), 7.77 (t, J = 8.3 Hz, 1H), 7.64 (t, J = 8.3 Hz, 1H), 7.57 (d, J = 4.3 Hz, 1H), 7.14 (t, J = 54.6 Hz, 1H). $^{13}\text{C}\{^1\text{H}\}$ NMR (125 MHz, CDCl_3): 149.96, 148.59, 137.76, 130.40, 129.89, 127.78, 124.10, 123.25, 117.91 (t, J = 7.6 Hz), 113.26 (t, J = 240.3 Hz). ^{19}F NMR (471 MHz, CDCl_3): -115.06 (d, J = 54.6 Hz). HRMS EI (m/z): [M]⁺ calcd for $\text{C}_{10}\text{H}_7\text{NF}_2$, 179.0547; found 179.0545. The isolated yield reported in the manuscript is the average of two runs (95% and 97% yield).

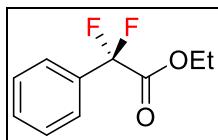


4-(difluoromethyl)isoquinoline (1z). The reaction was performed using the standard conditions described above with 4-isoquinolinecarboxaldehyde (31.4 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-40% EtOAc, R_F = 0.27 in 90:10 hexane: EtOAc), product **1z** was obtained as a white solid (32.0 mg, 90% yield). ^1H NMR (500 MHz, CDCl_3): 9.32 (s, 1H), 8.63 (s, 1H), 8.17 (d, J = 8.4 Hz, 1H), 8.03 (d, J = 8.4 Hz, 1H), 7.79 (t, J = 7.9 Hz, 1H), 7.67 (t, J = 7.9 Hz, 1H), 7.04 (t, J = 54.4 Hz, 1H). $^{13}\text{C}\{^1\text{H}\}$ NMR (125 MHz,

CDCl_3): 156.00, 141.64 (t, J = 9.4 Hz), 132.14, 131.66, 128.41, 127.91, 123.42, 123.25, 123.14, 115.05 (t, J = 238.5 Hz). ^{19}F NMR (471 MHz, CDCl_3): -111.03 (d, J = 54.4 Hz). HRMS EI (m/z): [M]⁺ calcd for $\text{C}_{10}\text{H}_7\text{NF}_2$, 179.0547; found 179.0544. The isolated yield reported in the manuscript is the average of two runs (90% and 88% yield).



Ethyl 2-pyridyldifluoroacetate (1aa). The reaction was performed using the standard conditions described above with ethyl 2-pyridylglyoxylate (35.6 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-40% EtOAc, R_F = 0.28 in 90:10 hexane: EtOAc), product **1aa** was obtained as a white solid (33.2 mg, 84% yield). The ^1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the literature.⁶ HRMS EI (m/z): [M]⁺ calcd for $\text{C}_{10}\text{H}_7\text{NF}_2$, 201.0601; found 201.0605. The isolated yield reported in the manuscript is the average of two runs (84% and 80% yield).



Ethyl phenyldifluoroacetate (1bb). The reaction was performed using the standard conditions described above with ethyl benzoylformate (35.4 mg, 0.2 mmol). Following silica gel chromatography using a gradient of hexanes and ethyl acetate as the eluent (0-40% EtOAc, R_F = 0.28 in 90:10 hexane: EtOAc), product **1bb** was obtained as a white solid (28.6 mg, 73% yield). The ^1H , ^{13}C and ^{19}F NMR spectra were consistent with those published in the literature.⁶ HRMS EI (m/z): [M]⁺ calcd for $\text{C}_{10}\text{H}_{10}\text{O}_2\text{F}_2$, 200.0649; found 200.0651. The isolated yield reported in the manuscript is the average of two runs (73% and 69% yield).

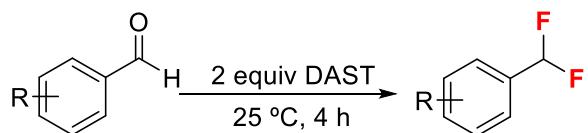
7. Procedure for 1 mmol scale of difluoromethylation of 4-bromobenzaldehyde

In a nitrogen-filled glovebox, 4-bromobenzaldehyde (185.0 mg, 1.0 mmol) and Me₄NF (372.0 mg, 4.0 mmol) were added to Chamber B of the two-chamber reaction vessel, which was also equipped with a magnetic stir-bar. 1,1'-Sulfonyldiimidazole (396.0 mg, 2.0 mmol) and KF (232.0 mg, 4.0 mmol) were added to Chamber A, which was also equipped with a magnetic stir-bar. The vessel was removed from the glovebox, formic acid (2.0 mL) was added to Chamber A, and the mixture was allowed to stir at room temperature for 5 min. Anhydrous *N,N*-dimethylformamide (3.0 mL) was added to Chamber B, and the reaction was allowed to stir for 4 h at room temperature. Diethyl ether (25 mL) was added to Chamber B, and this mixture was then transferred to a separatory funnel. The organic layer was washed with water (5 x 50 mL) and then dried over MgSO₄, and the solvent was removed under reduced pressure. The crude reaction mixture was purified by chromatography of silica gel (100% hexanes; R_F = 0.72) to afford 1-bromo-4-(difluoromethyl)benzene as a colorless oil (165.6 mg, 80% yield).

8. Procedure for 5 mmol scale of difluoromethylation of 4-bromobenzaldehyde

In a nitrogen-filled glovebox, 4-bromobenzaldehyde (925.0 mg, 5.0 mmol) and Me₄NF (186 g, 20.0 mmol) were added to a 250 mL round bottom flask equipped with a magnetic stir-bar. A SO₂F₂ / DMF solution (62.5 mL, 0.16 M) was added by syringe and reaction was allowed to stir for 4 hours at room temperature. At this time, diethyl ether (150 mL) was added, and this mixture was then transferred to a separatory funnel. The organic layer was washed with water (10 x 100 mL) and then dried over MgSO₄, and the solvent was removed under reduced pressure. The crude reaction mixture was purified by chromatography of silica gel (100% hexanes; R_F = 0.72) to afford 1-bromo-4-(difluoromethyl)benzene as a colorless oil (817.7 mg, 79% yield).

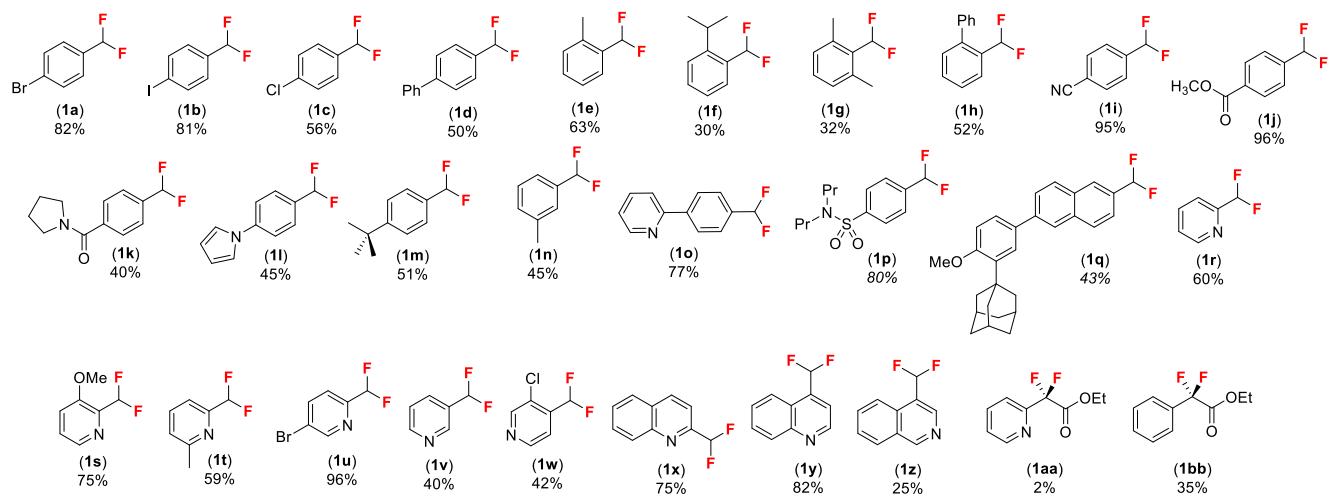
9. General Procedure for Deoxyfluorination with DAST



General Procedure B:

In a glovebox, to a 4 mL vial was added the appropriate substrate (0.2 mmol, 1 equiv), Diethylaminosulfur trifluoride (64.5 mg, 0.4 mmol, 2 equiv), and CH_2Cl_2 (1.0 mL, 0.2 M). The mixture was stirred vigorously at room temperature for 4 hours. The vial was opened and diluted with dichloromethane (2.0 mL), and 4-fluoroanisole was added as an NMR standard. The reaction mixture was analyzed by ^{19}F NMR spectroscopy. The yields in Scheme S1 represent an average of two runs.

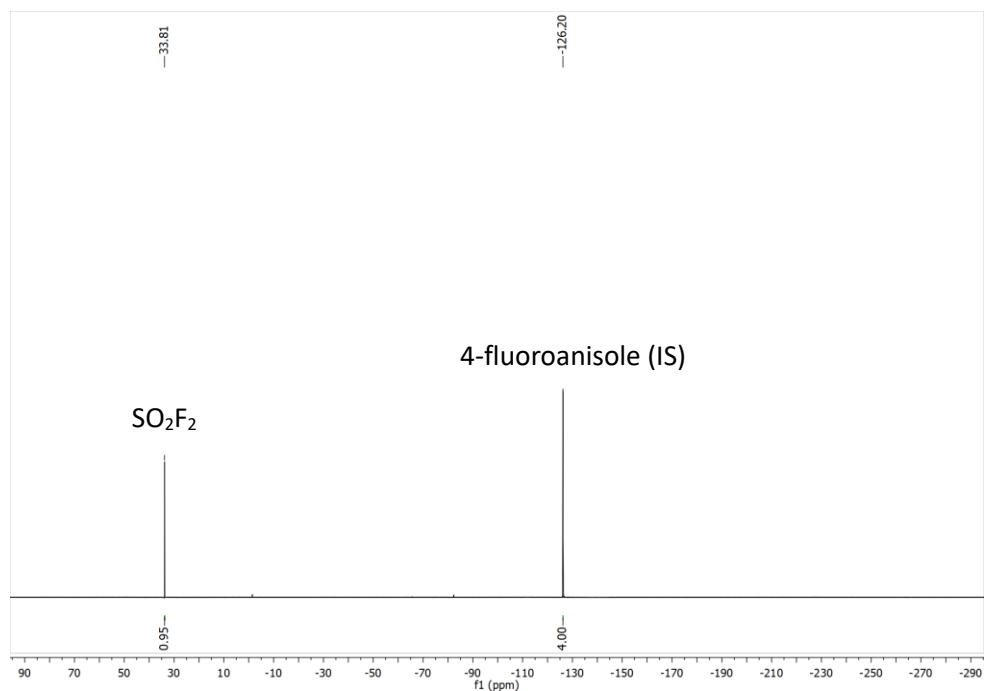
Scheme SI. ^{19}F Yields of difluoromethylation of aldehyde substrates using DAST.



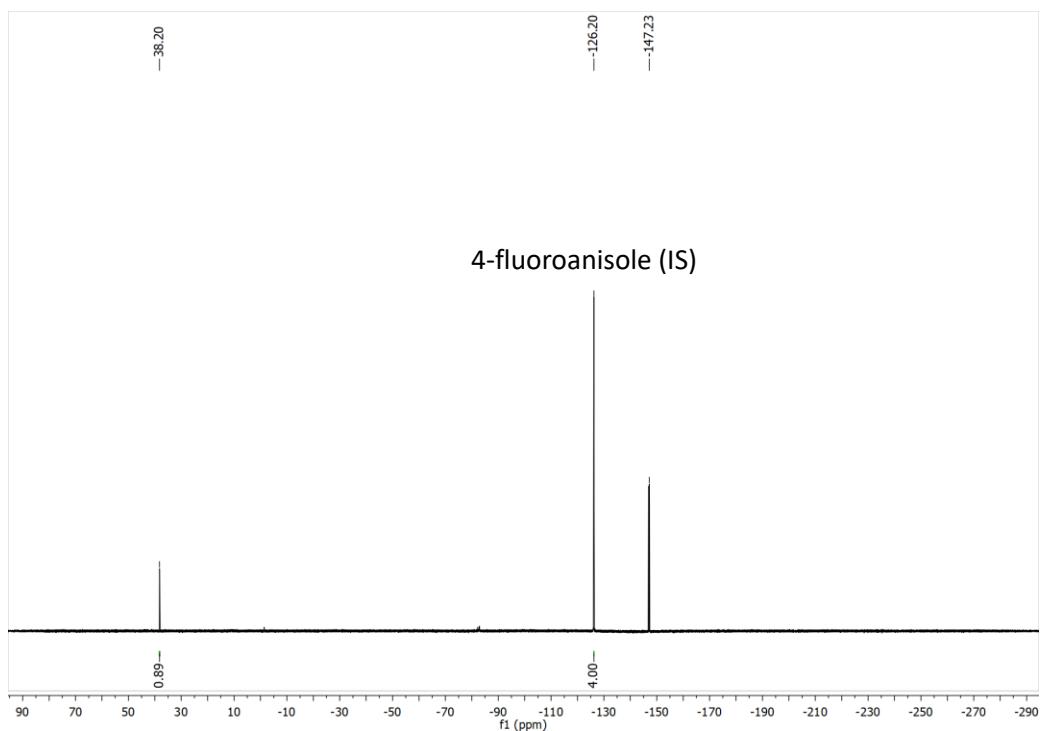
10. Experiment into Speciation of SO_2F_2 and Me_4NF in DMF

In a dry glovebox, 4-fluoroanisole (40.4 mg, 0.32 mmol, 4 equiv) was weighed into a vial. SO_2F_2 in DMF (0.5 mL, 0.16 M, 0.08 mmol, 1 equiv) was added to the vial via syringe. The contents of the vial was transferred to a screw-cap NMR tube and the ^{19}F NMR spectrum was recorded (SO_2F_2 singlet peak at 33.81 ppm, see below). The NMR tube was returned to the glovebox where Me_4NF (29.8 mg, 0.32 mmol, 4 equiv) was added to the NMR tube. The NMR tube was once again removed from the glovebox and sonicated at room temperature for 4 h. After this time, the ^{19}F NMR spectrum was recorded (new peak generated at 38.20 ppm, see below).

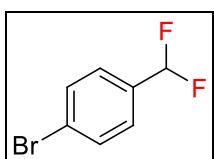
Initial ^{19}F NMR (before addition of Me_4NF):



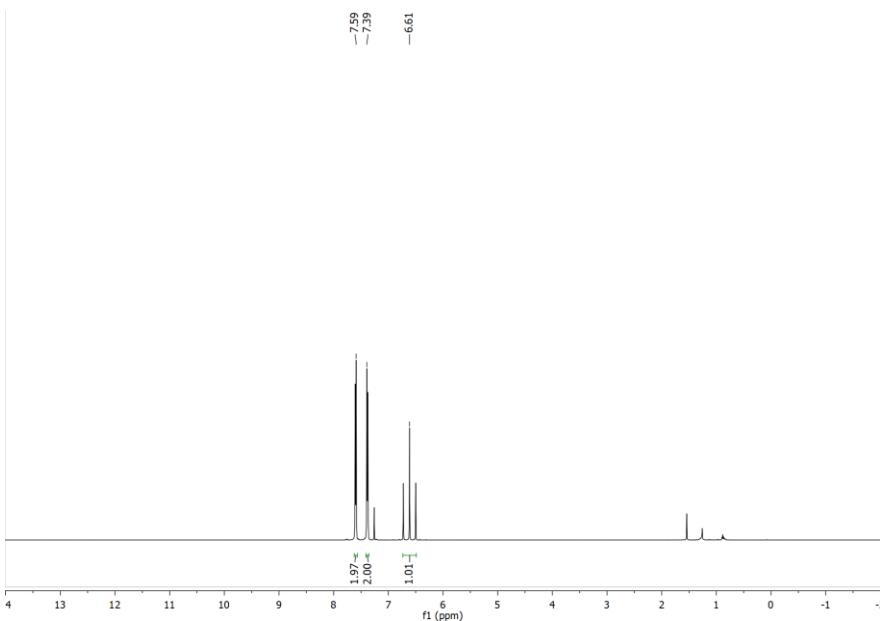
^{19}F NMR after addition of Me_4NF :



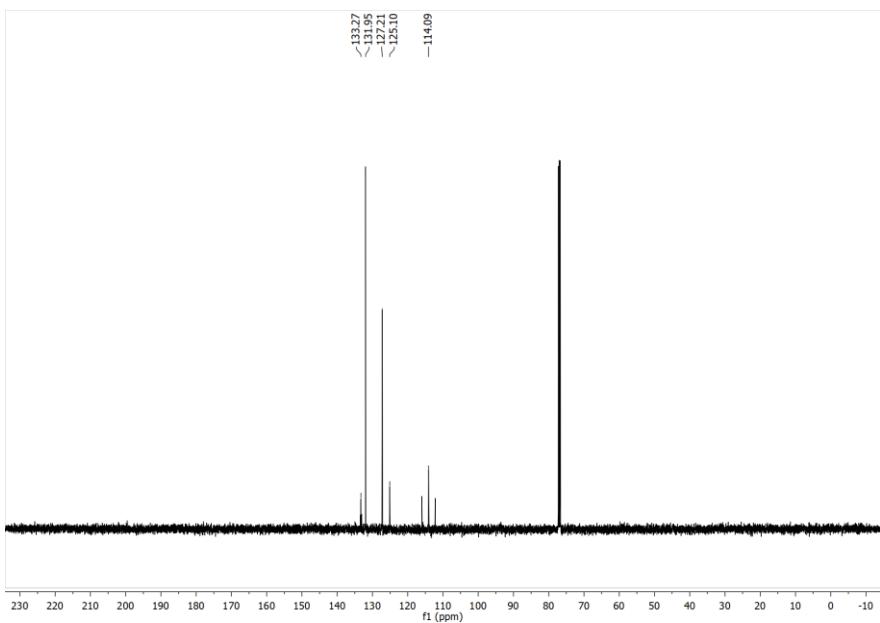
11. NMR Spectral Data



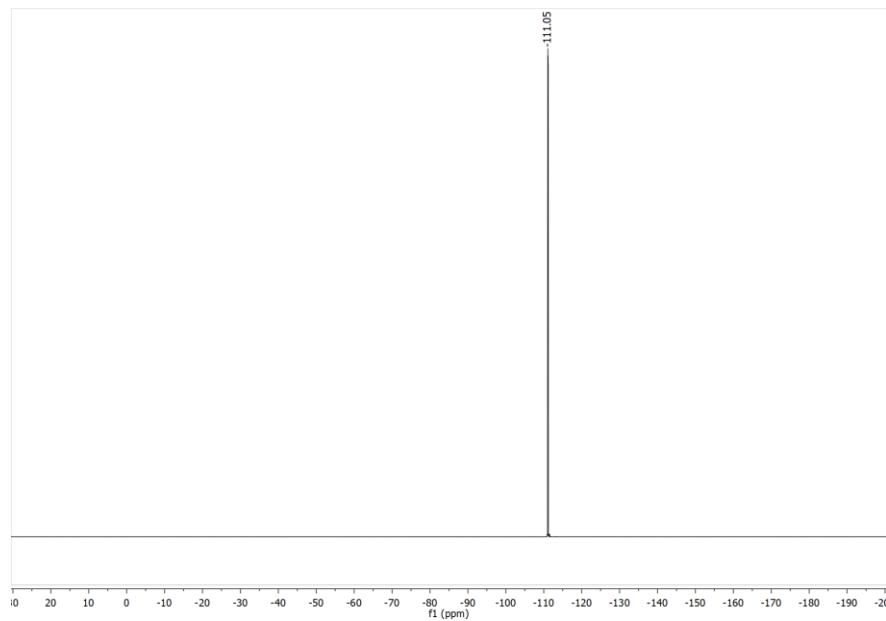
¹H NMR spectra of **1a**:

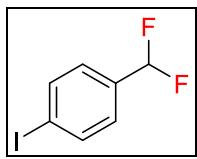


¹³C NMR spectra of **1a**:

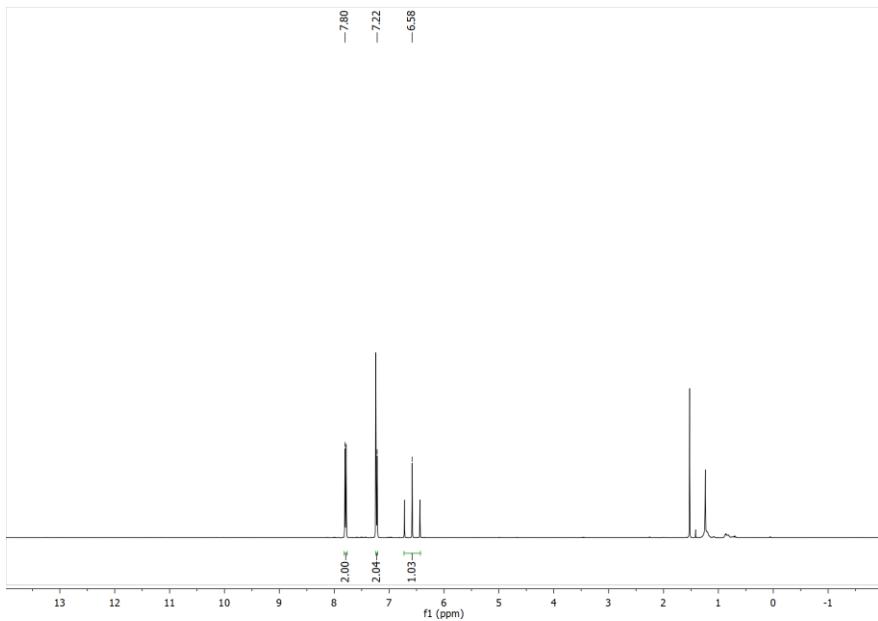


¹⁹F NMR spectra of **1a**:

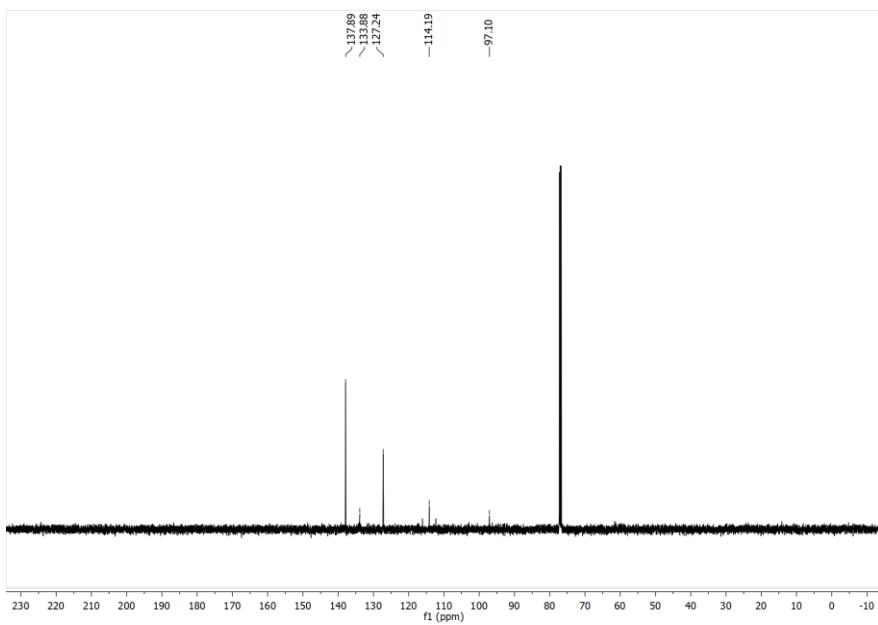




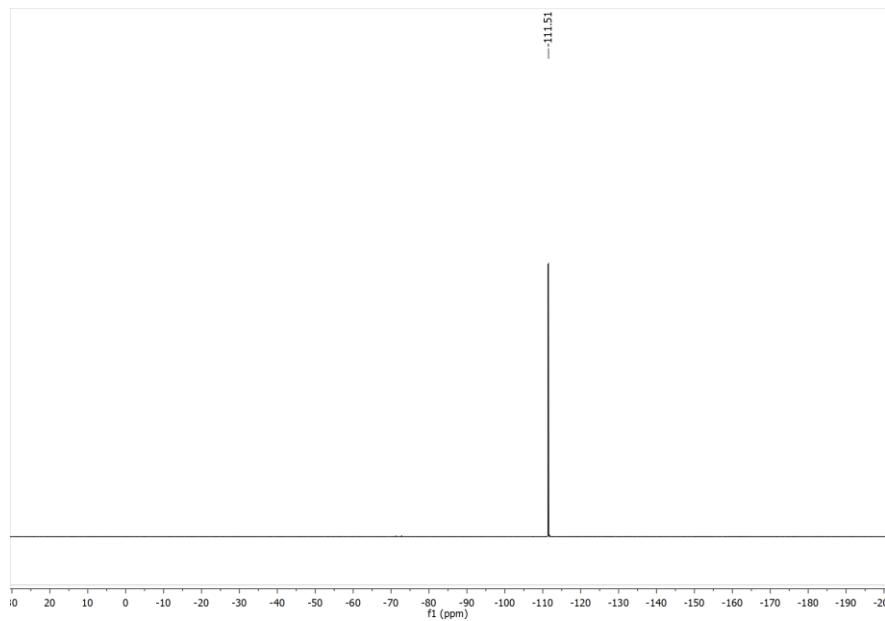
¹H NMR spectra of **1b**:

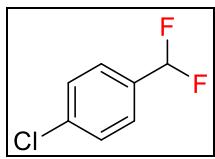


¹³C NMR spectra of **1b**:

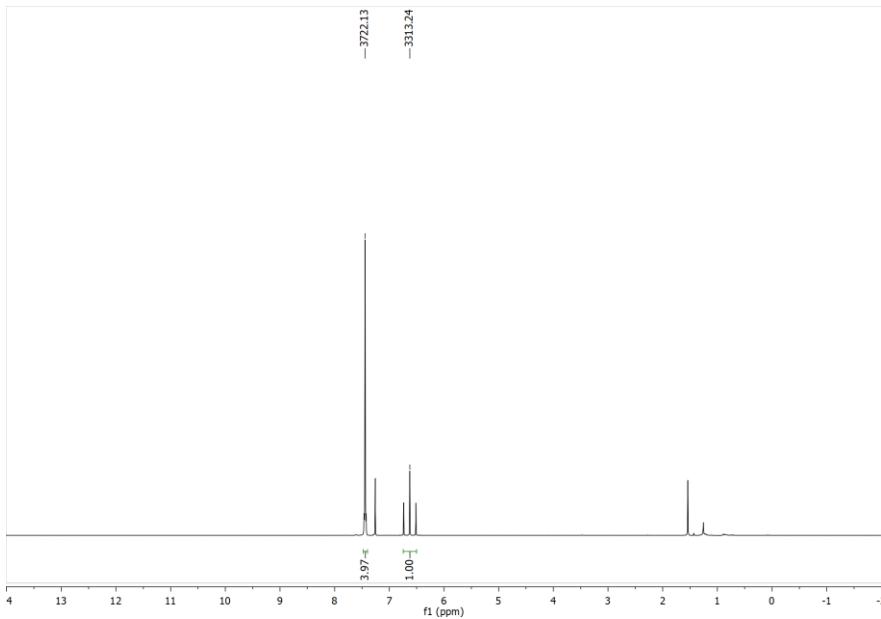


¹⁹F NMR spectra of **1b**:

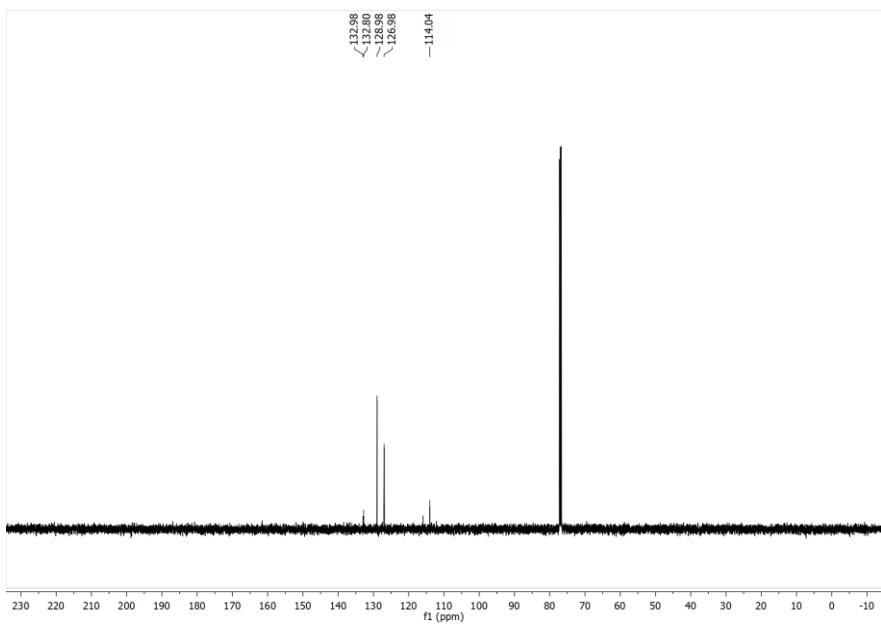




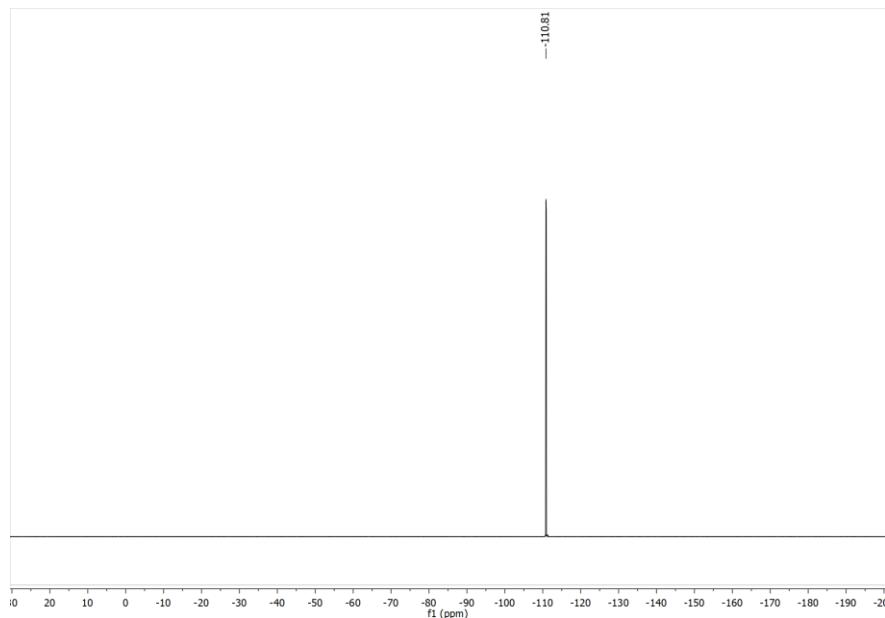
¹H NMR spectra of **1c**:

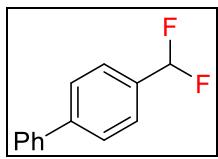


¹³C NMR spectra of **1c**:

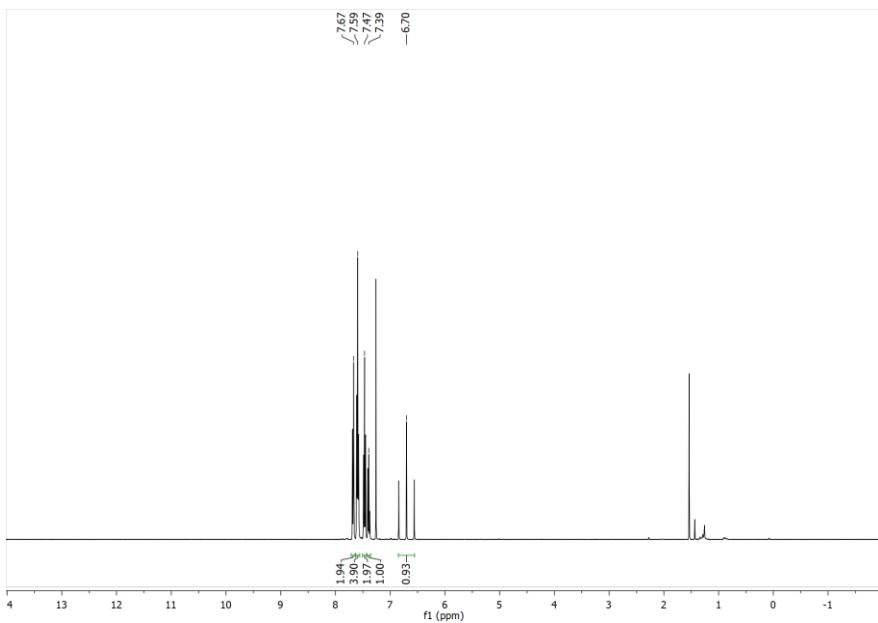


¹⁹F NMR spectra of **1c**:

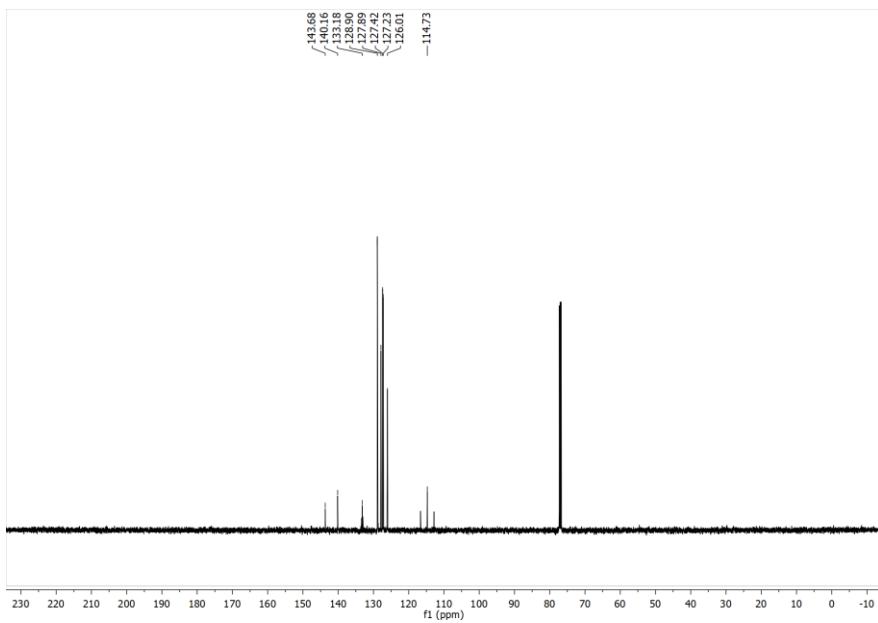




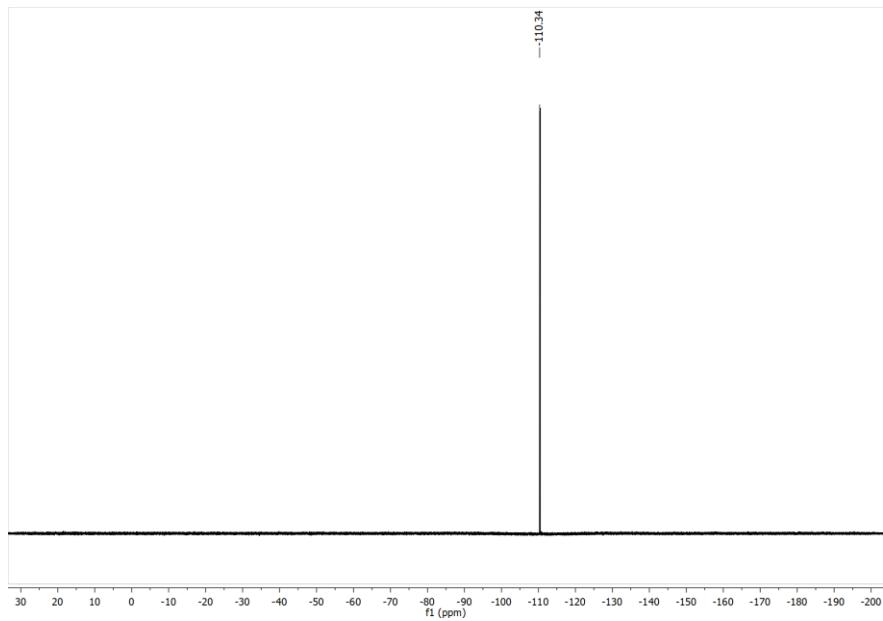
¹H NMR spectra of **1d**:

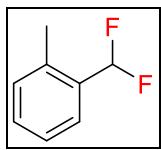


¹³C NMR spectra of **1d**:

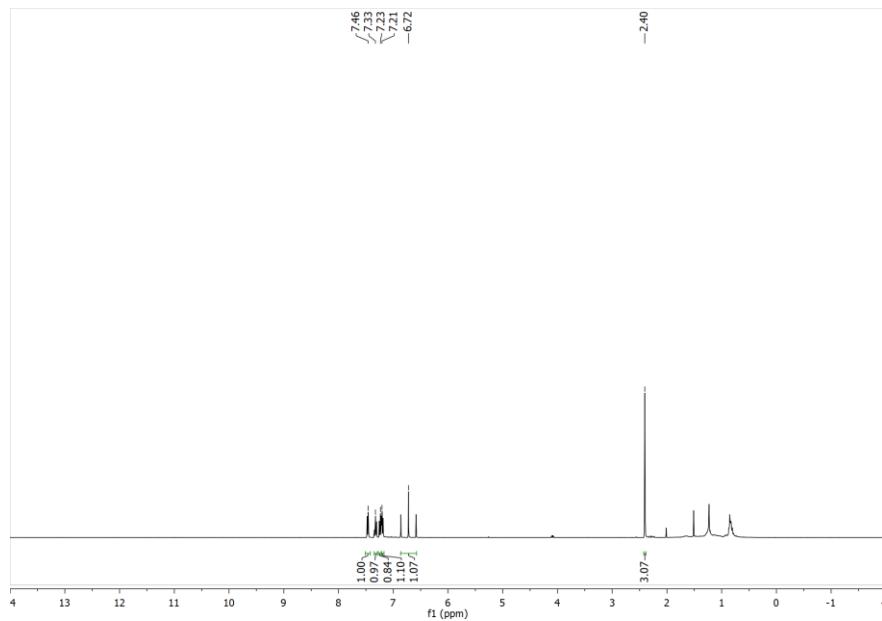


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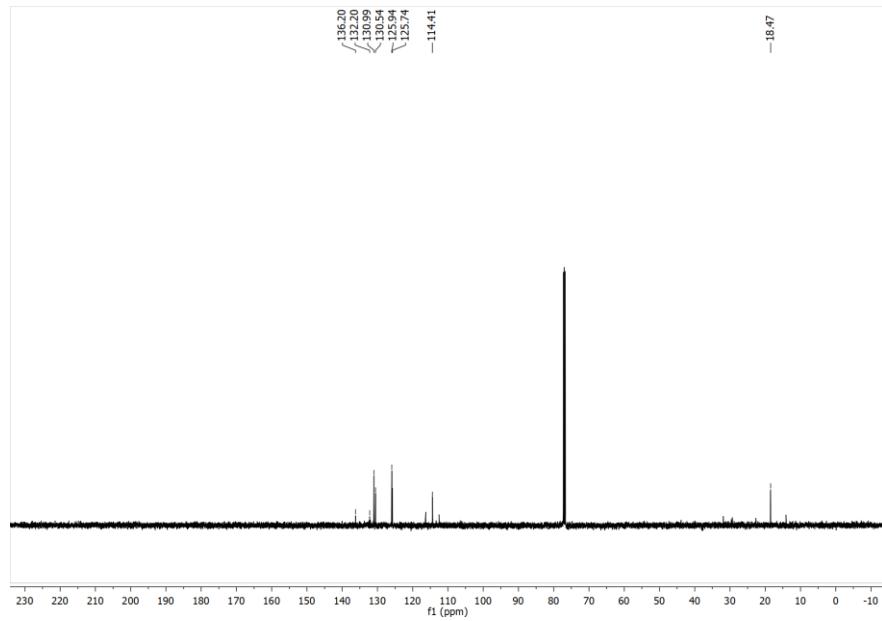




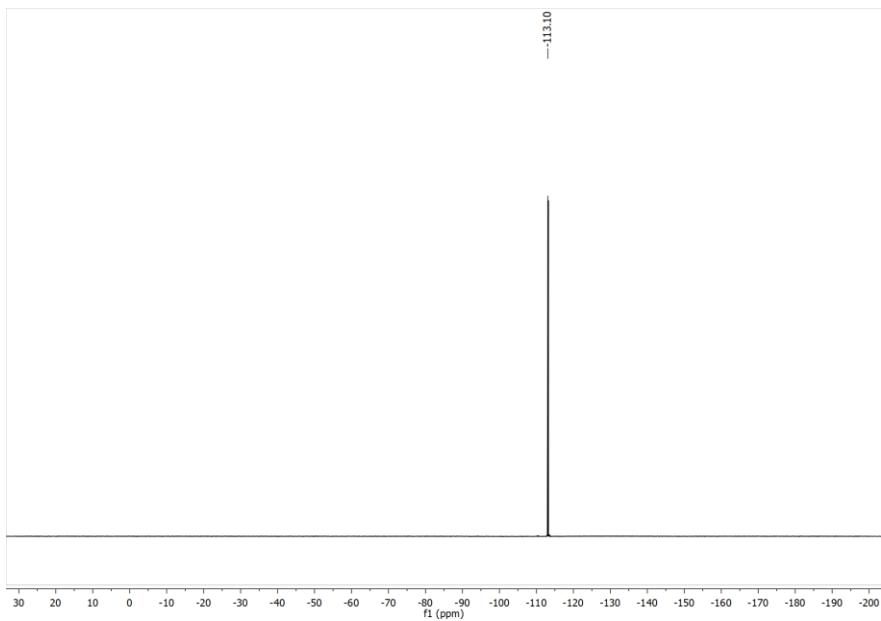
¹H NMR spectra of **1e**:

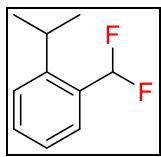


¹³C NMR spectra of **1e**:

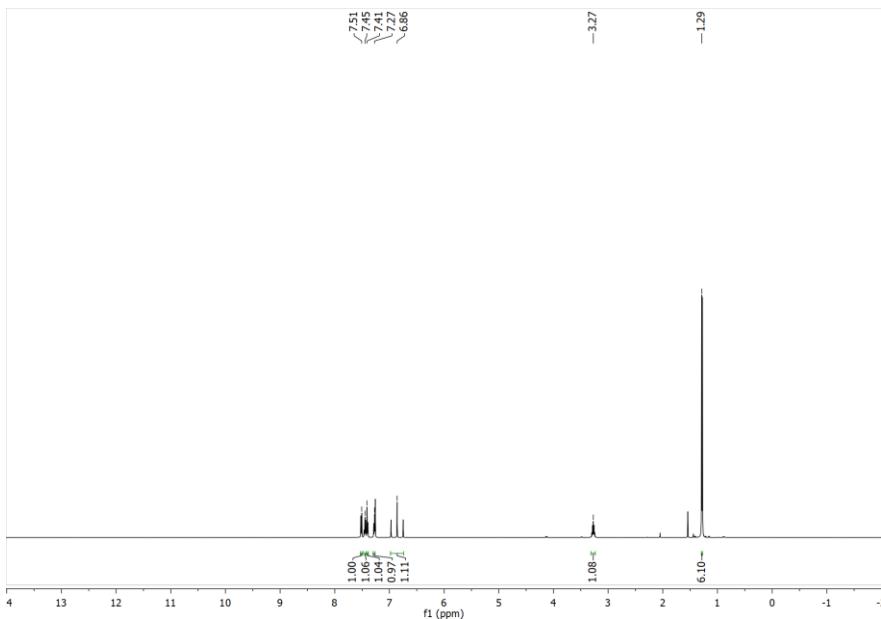


¹⁹F NMR spectra of **1e**:

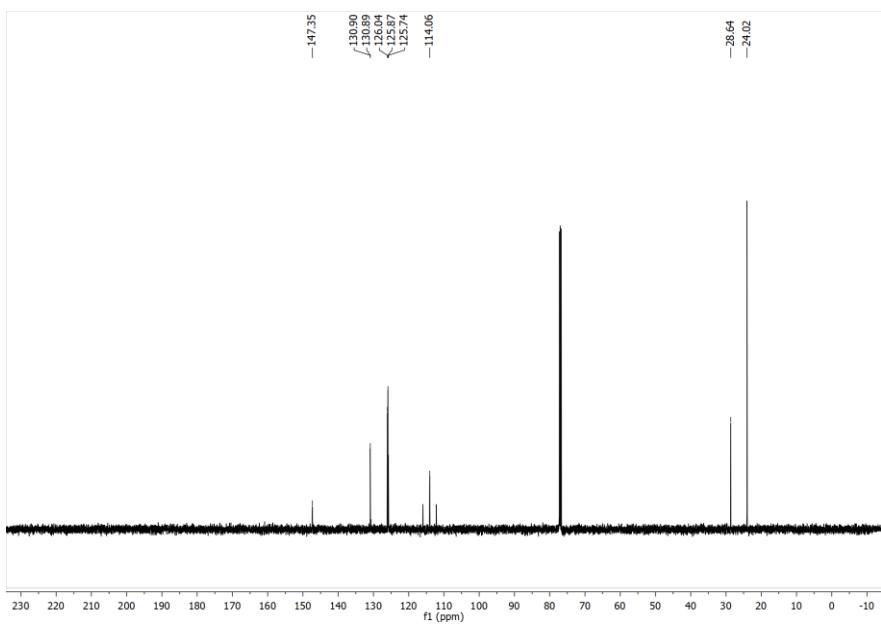




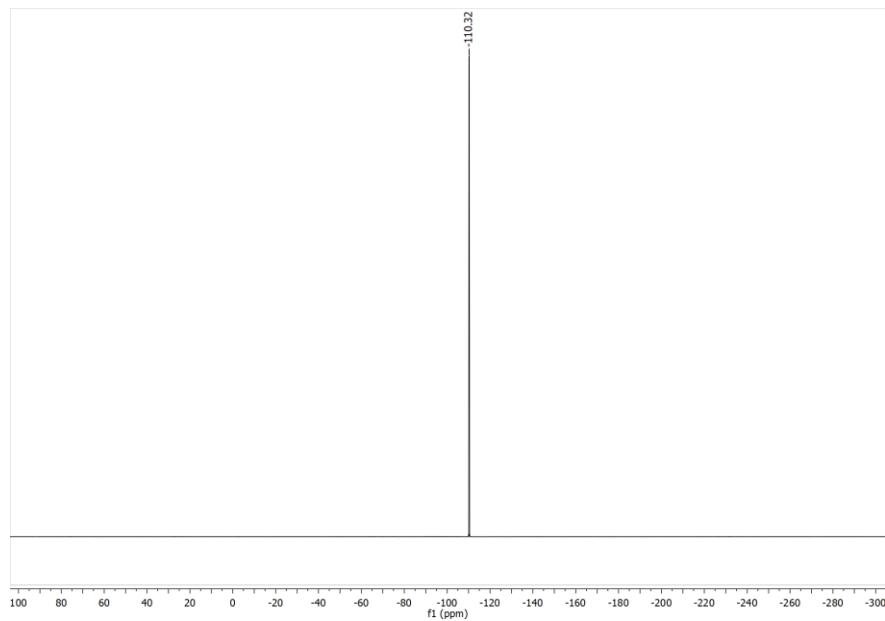
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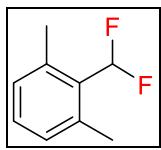


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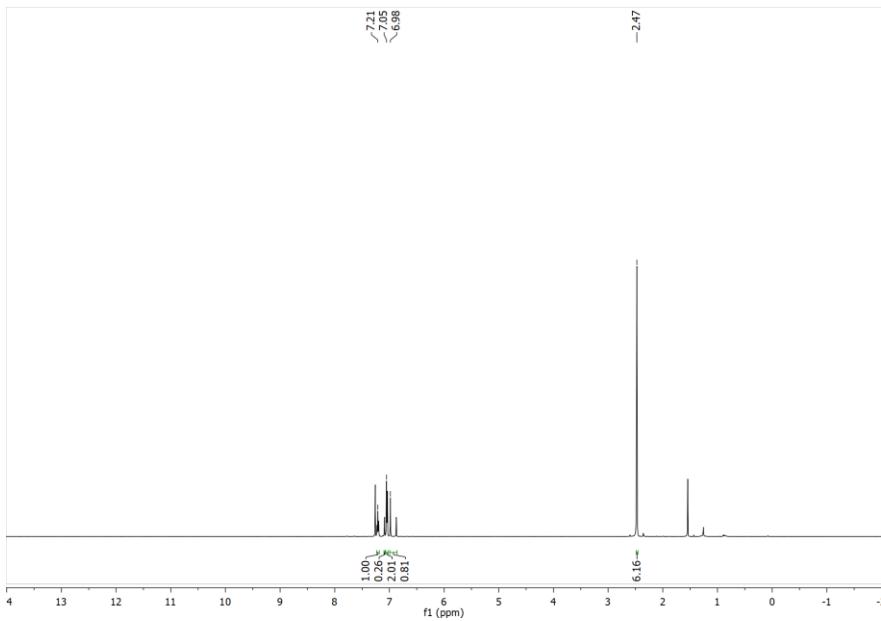


¹⁹F NMR spectra of **1f**:

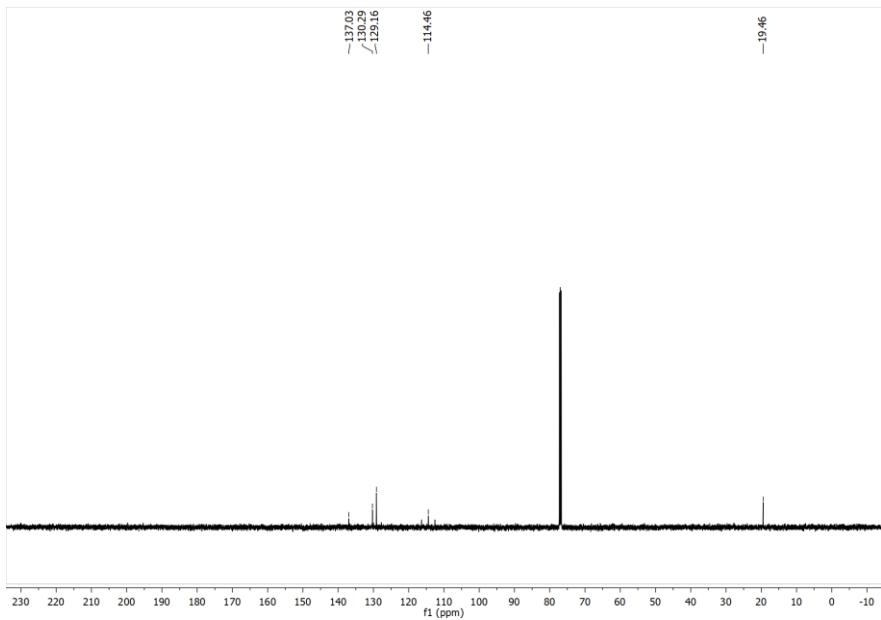




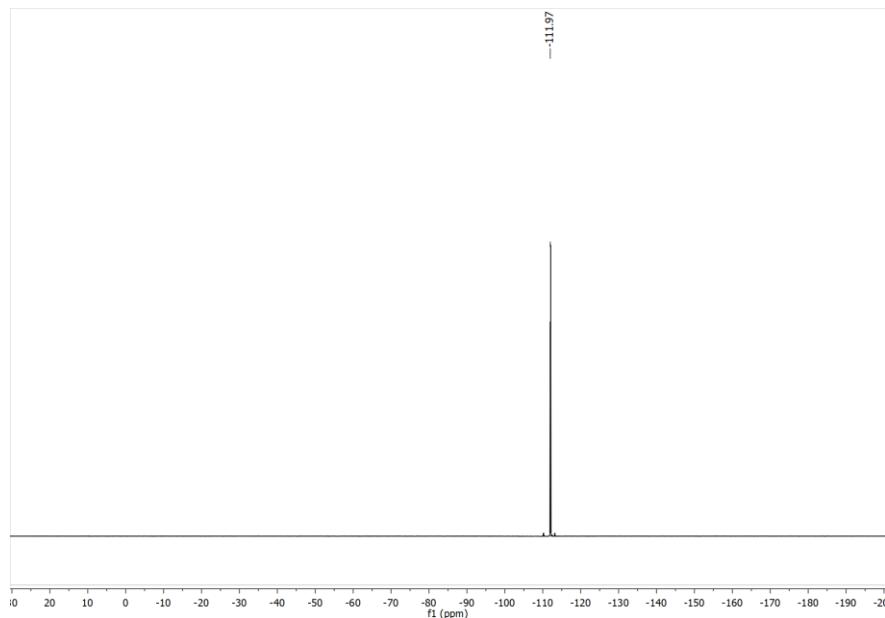
¹H NMR spectra of **1g**:

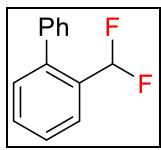


¹³C NMR spectra of **1g**:

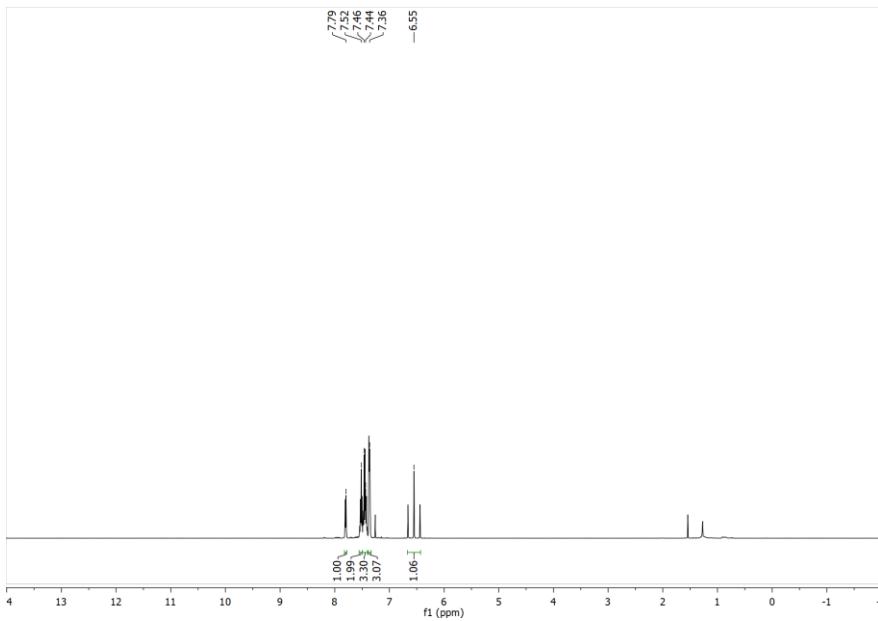


¹⁹F NMR spectra of **1g**:

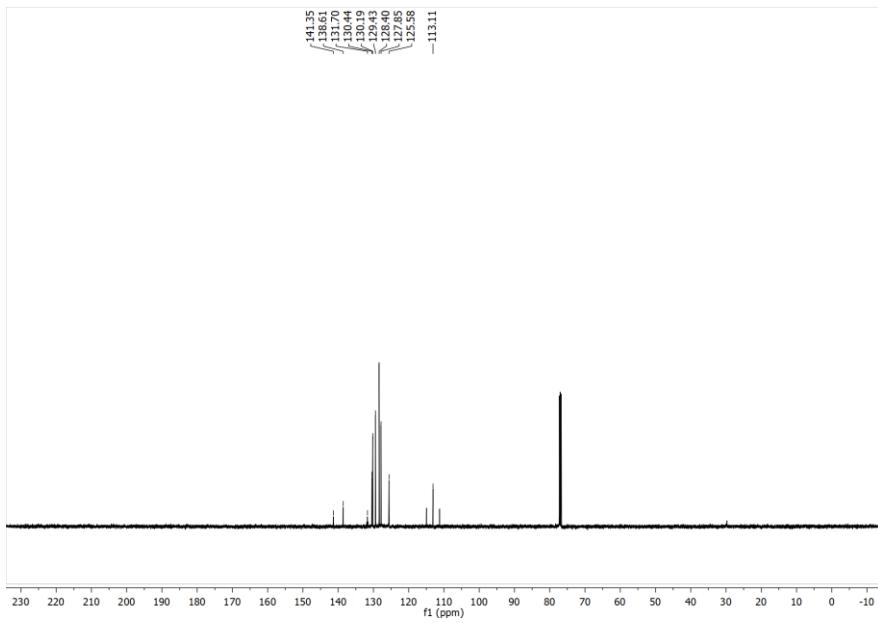




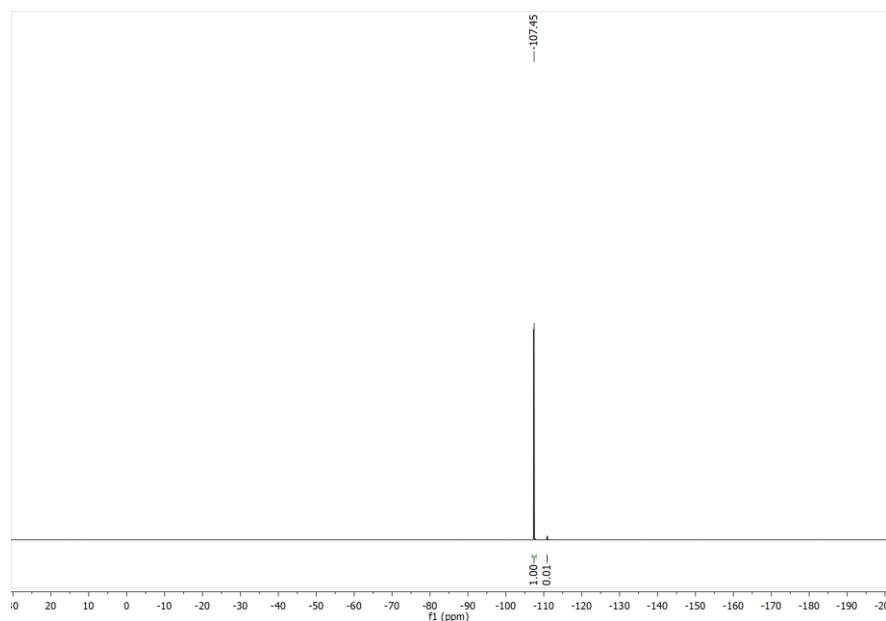
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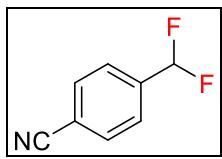


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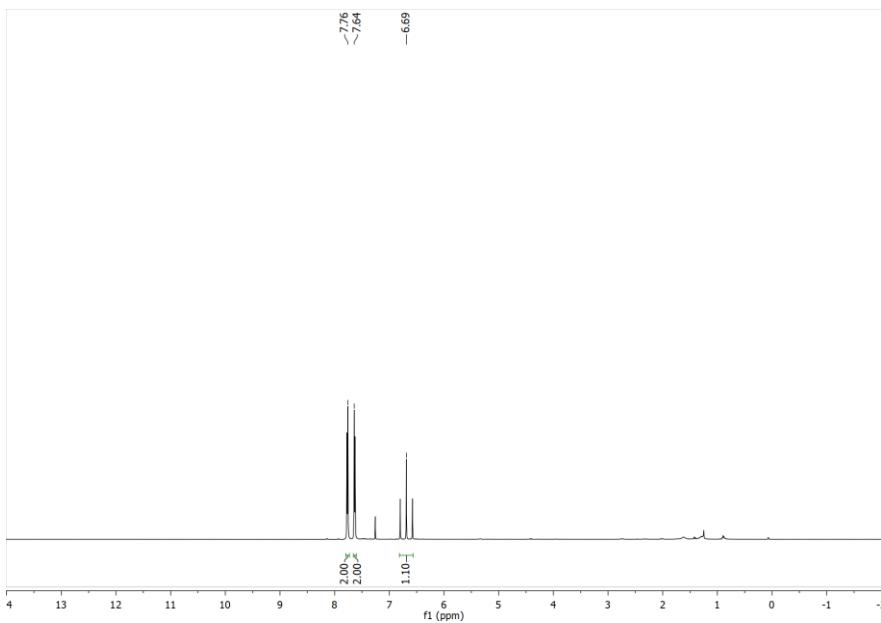


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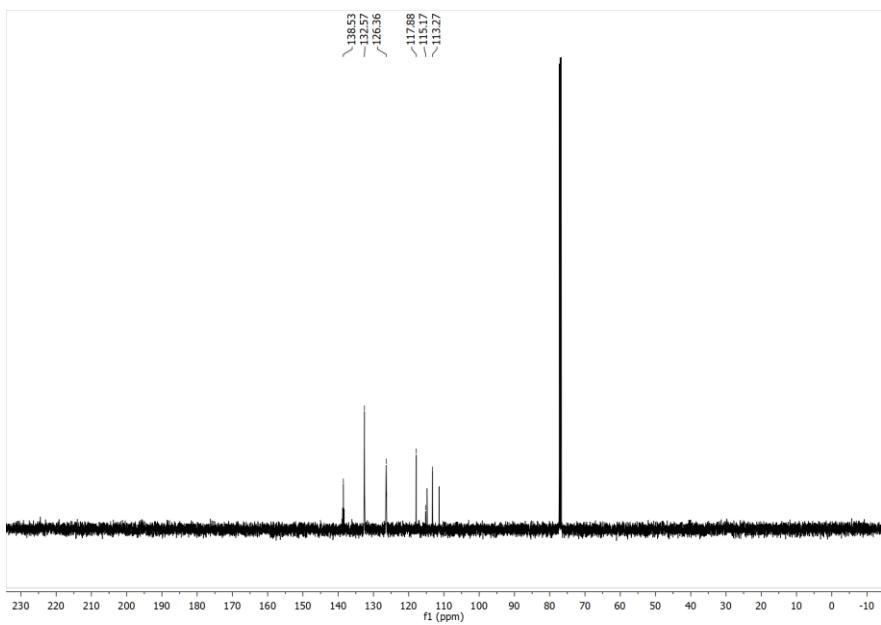




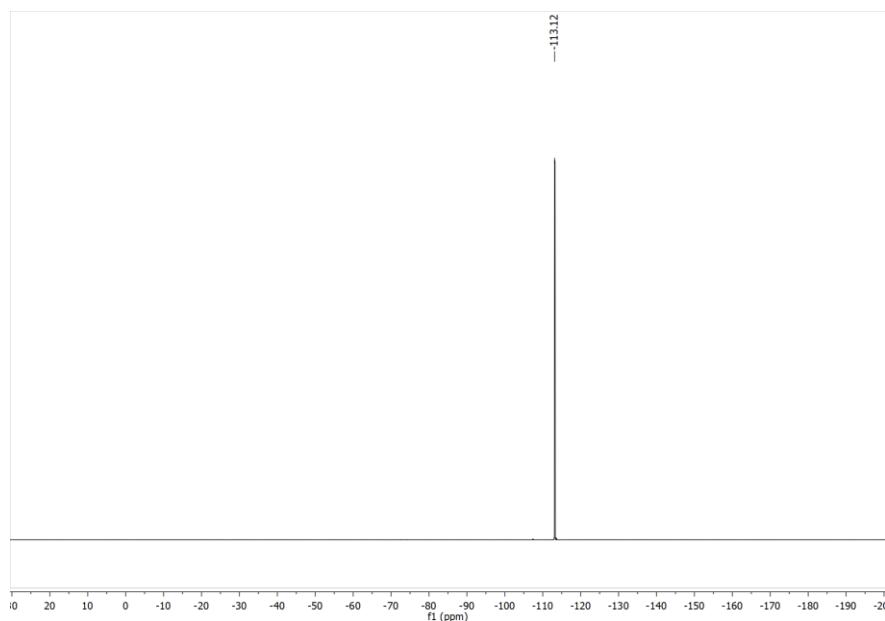
¹H NMR spectra of **1i**:

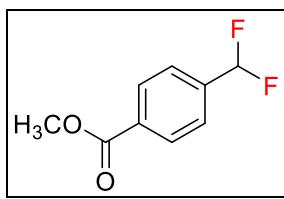


¹³C NMR spectra of **1i**:

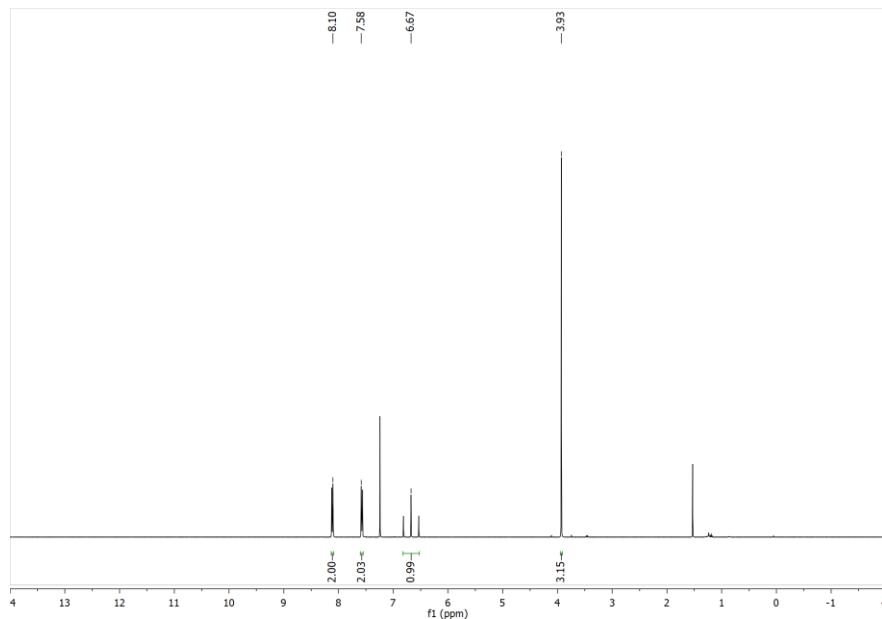


¹⁹F NMR spectra of **1i**:

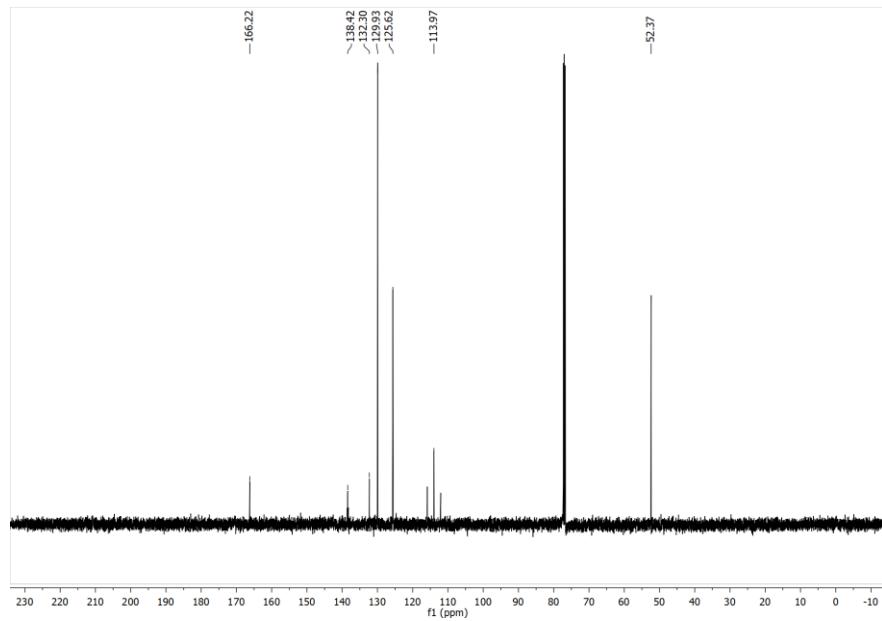




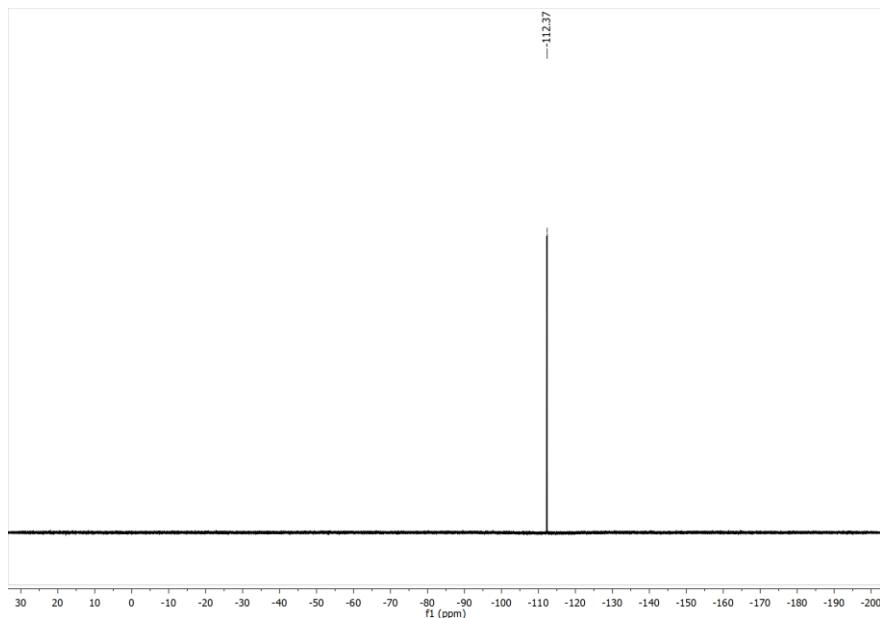
¹H NMR spectra of **1J**:

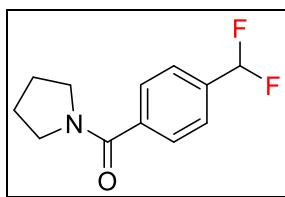


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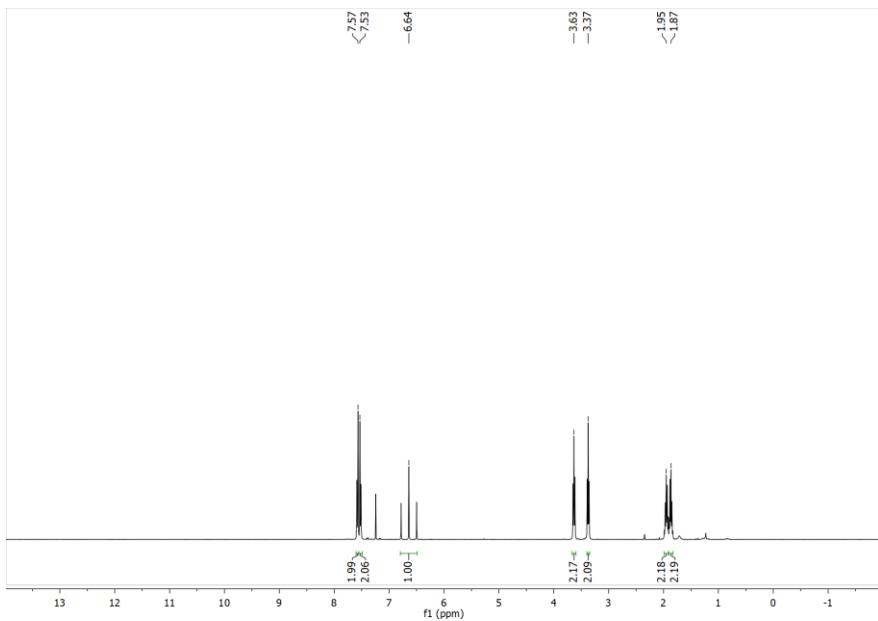


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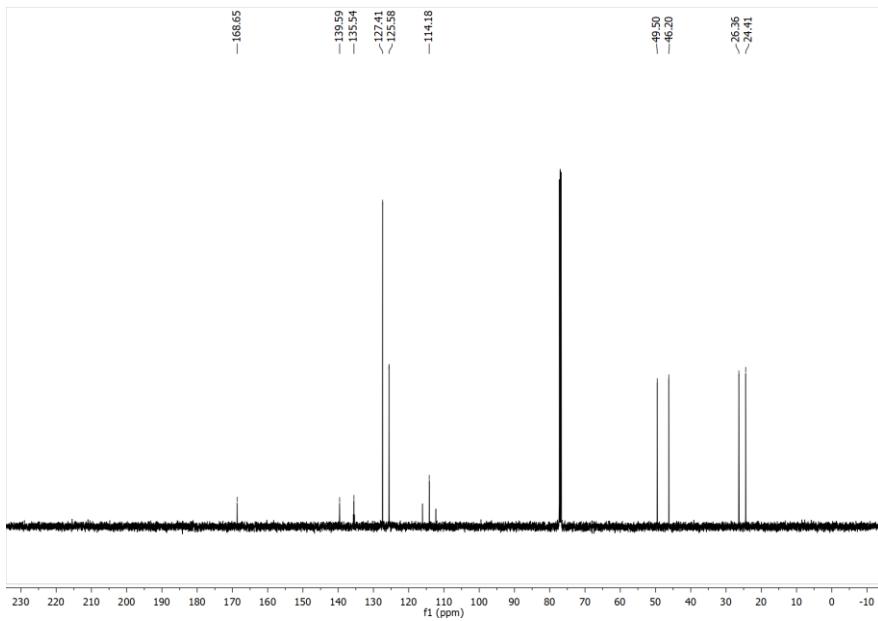




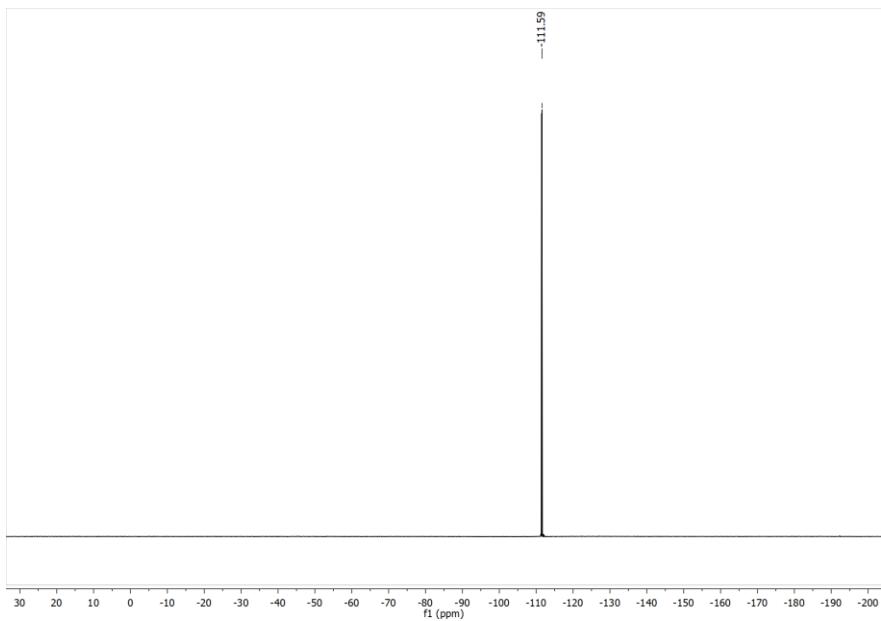
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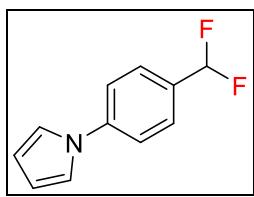


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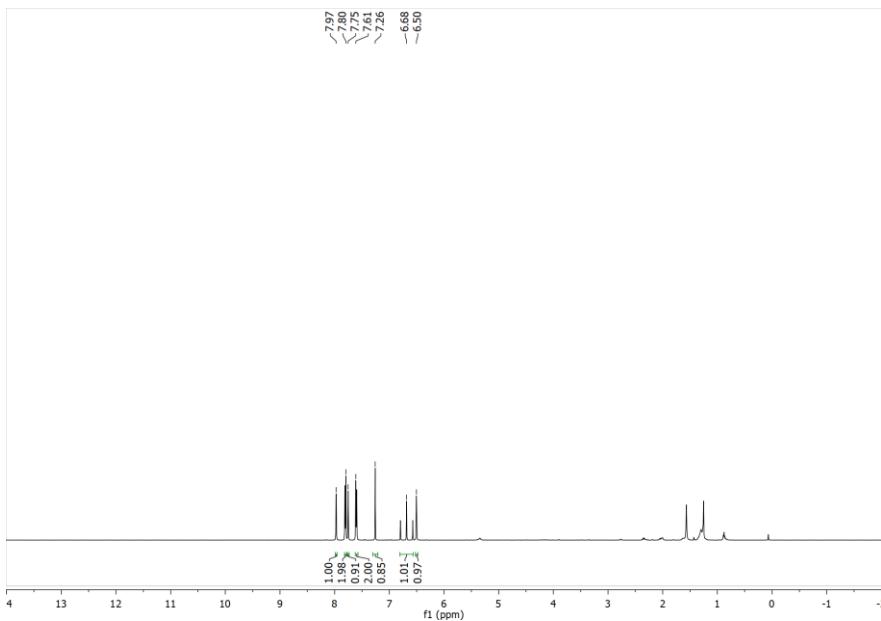


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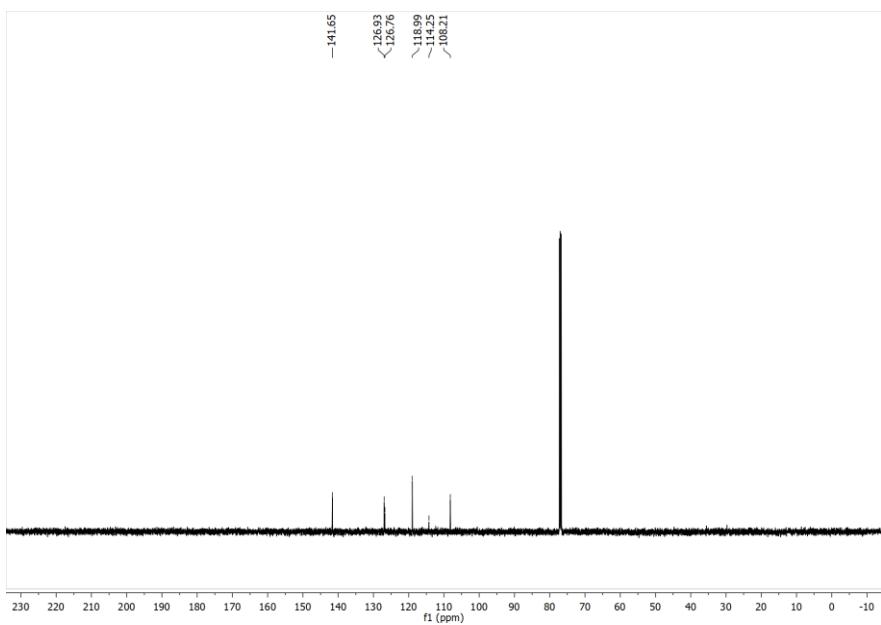




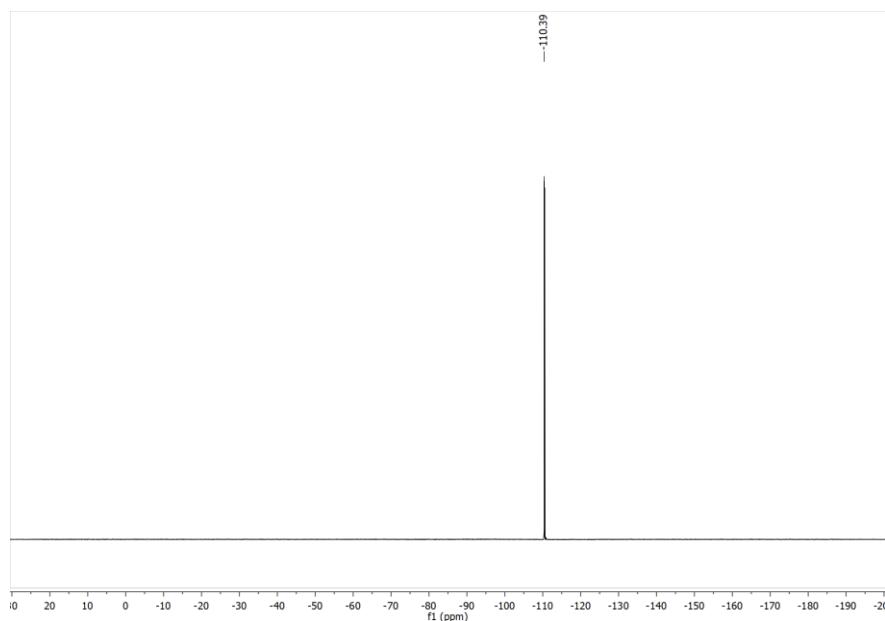
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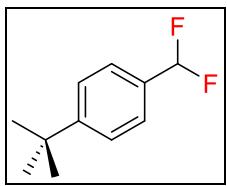


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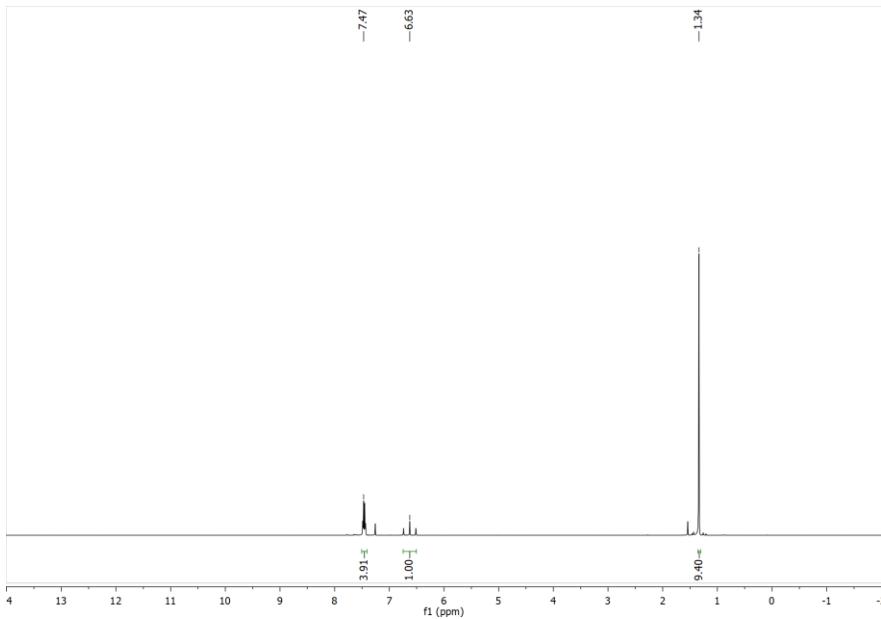


¹⁹F NMR spectra of **1I**:

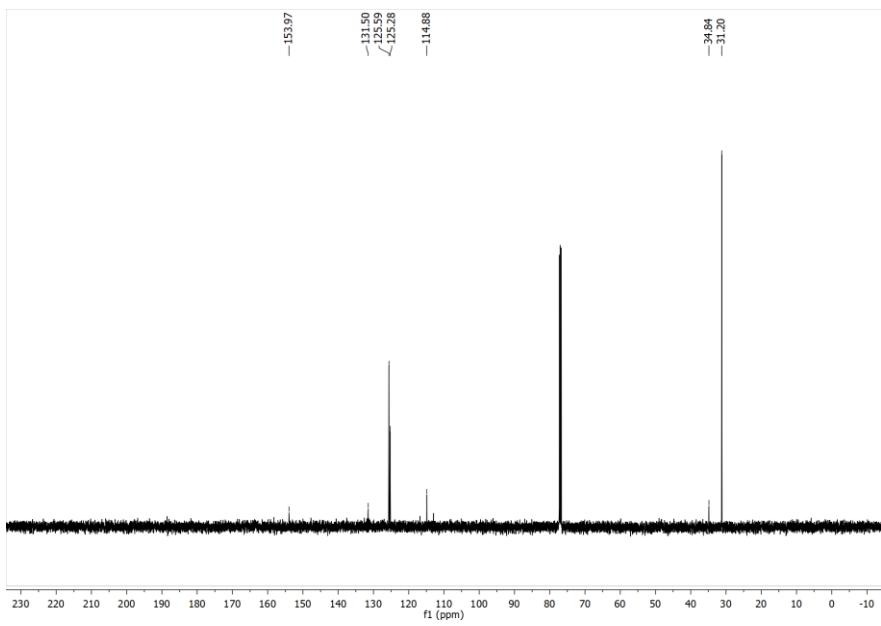




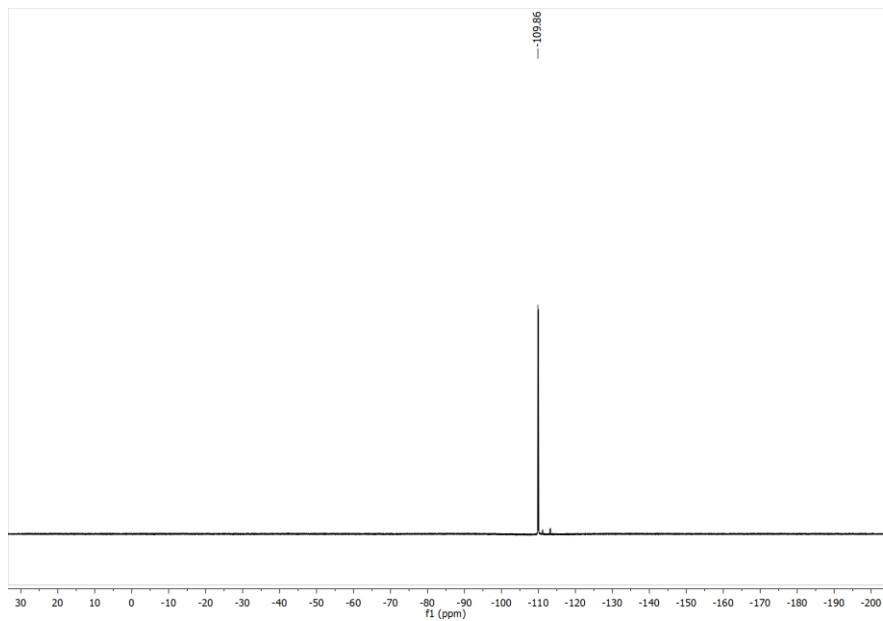
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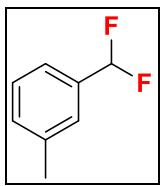


¹³C NMR spectra of **1m**:

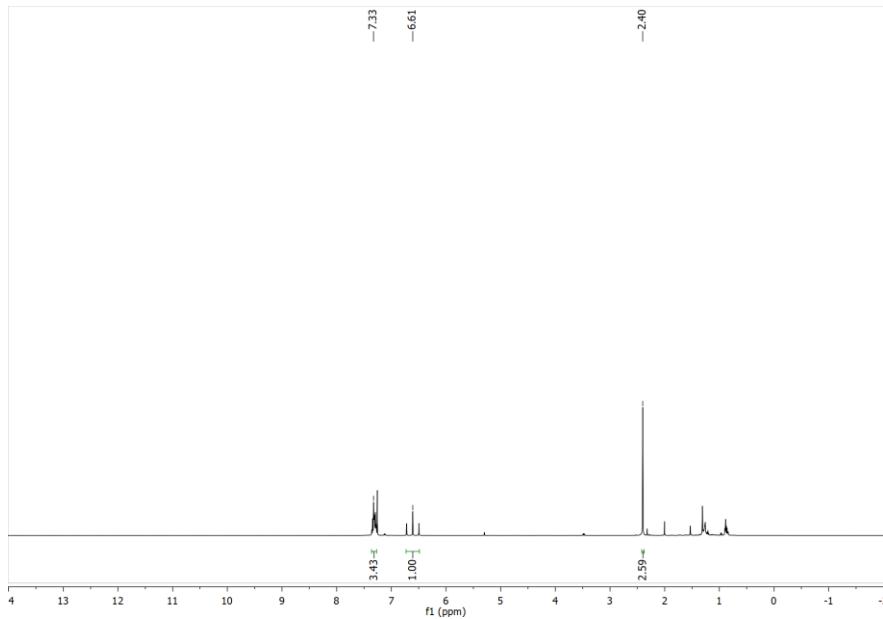


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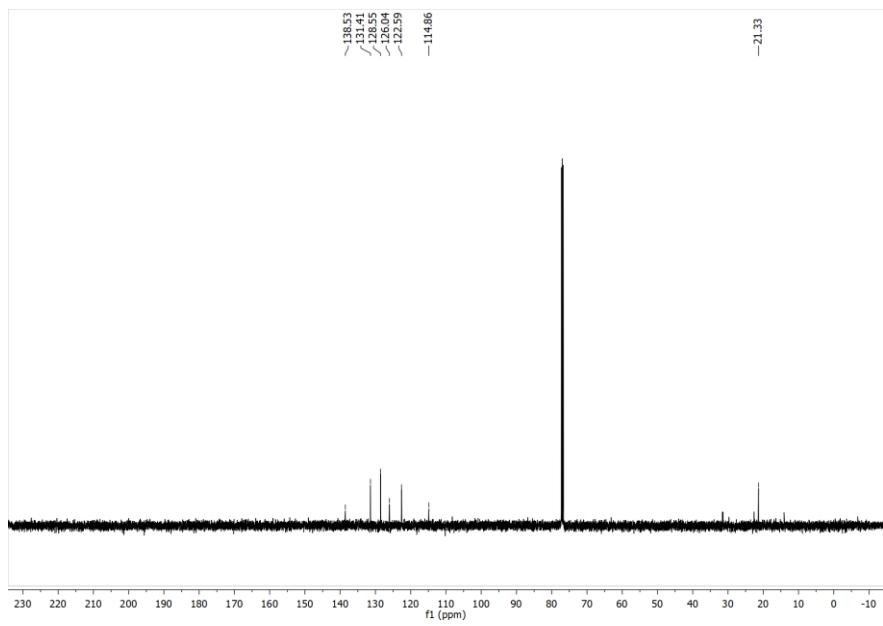




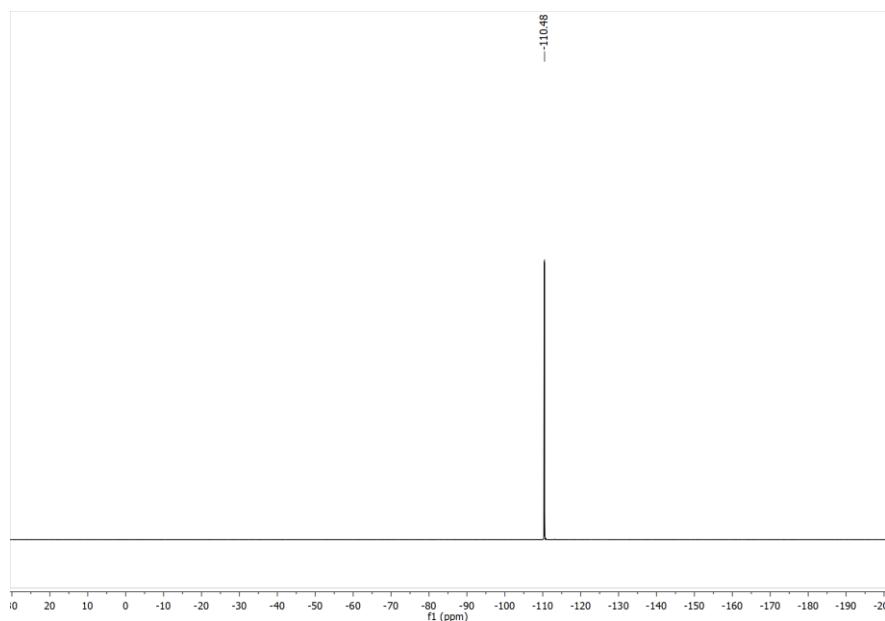
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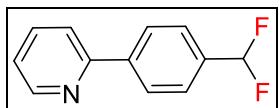


¹³C NMR spectra of **1n**:

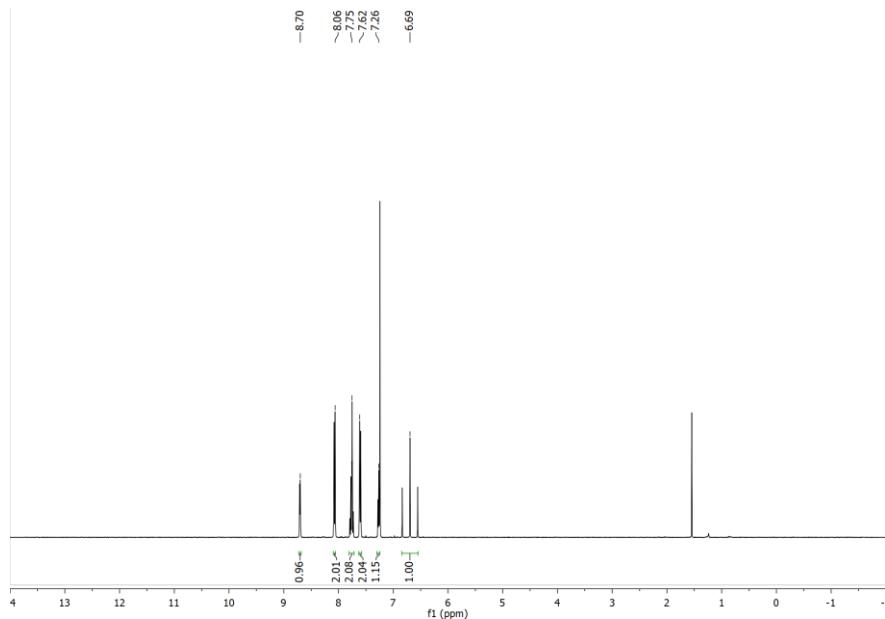


¹⁹F NMR spectra of **1n**:

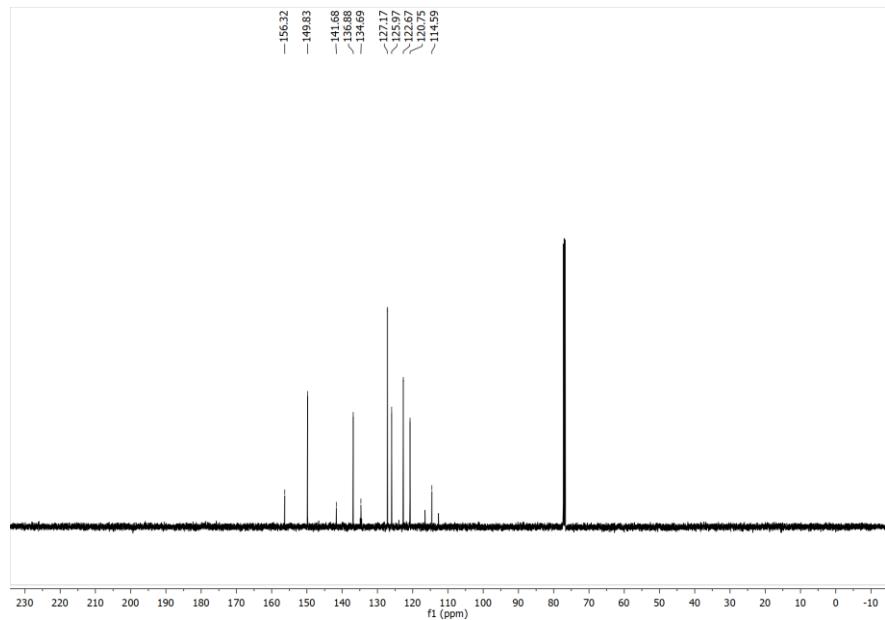




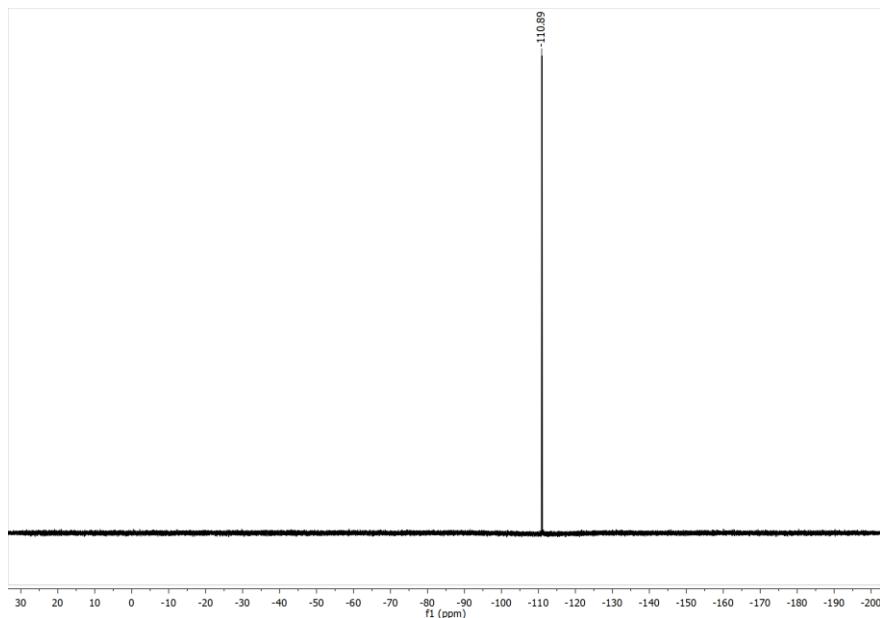
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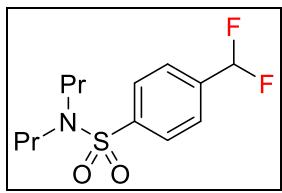


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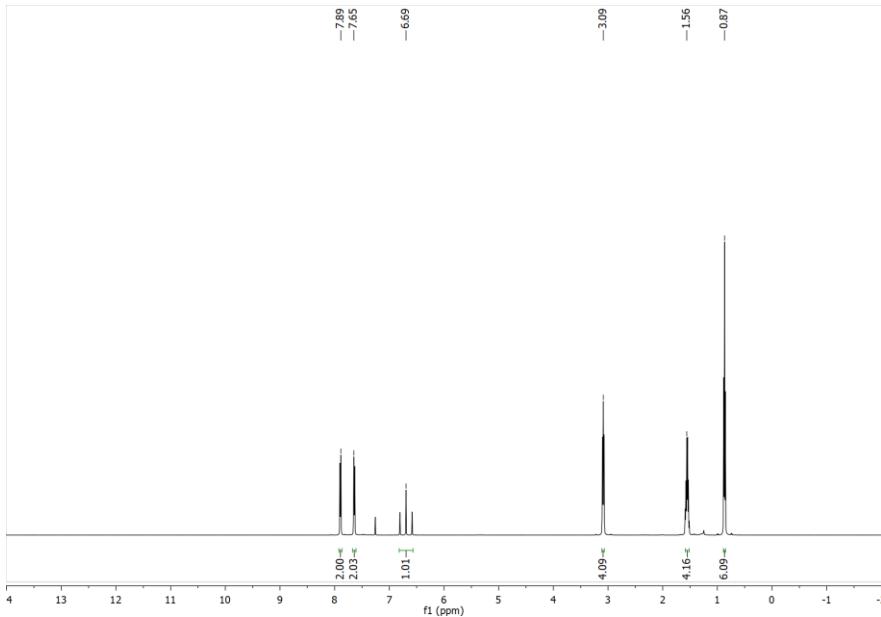


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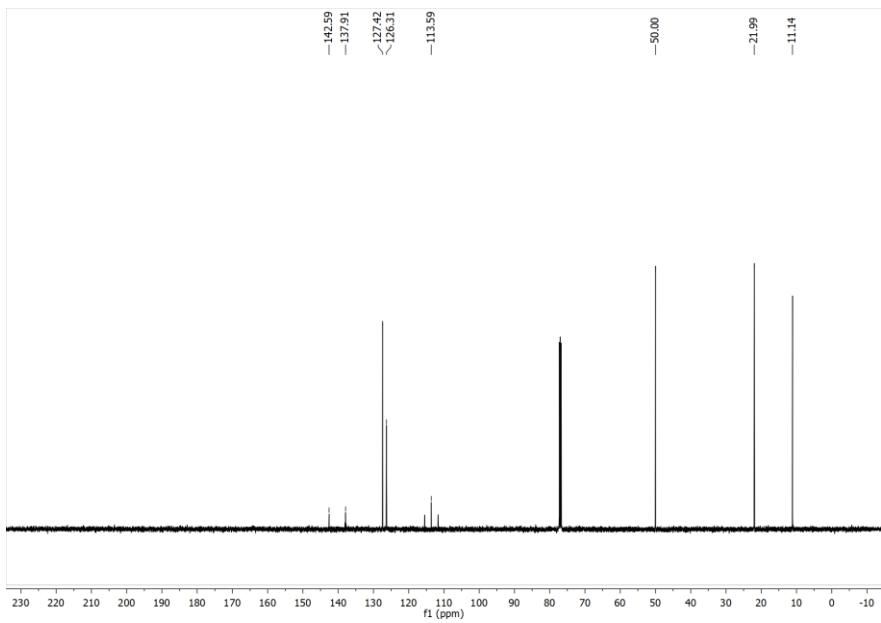




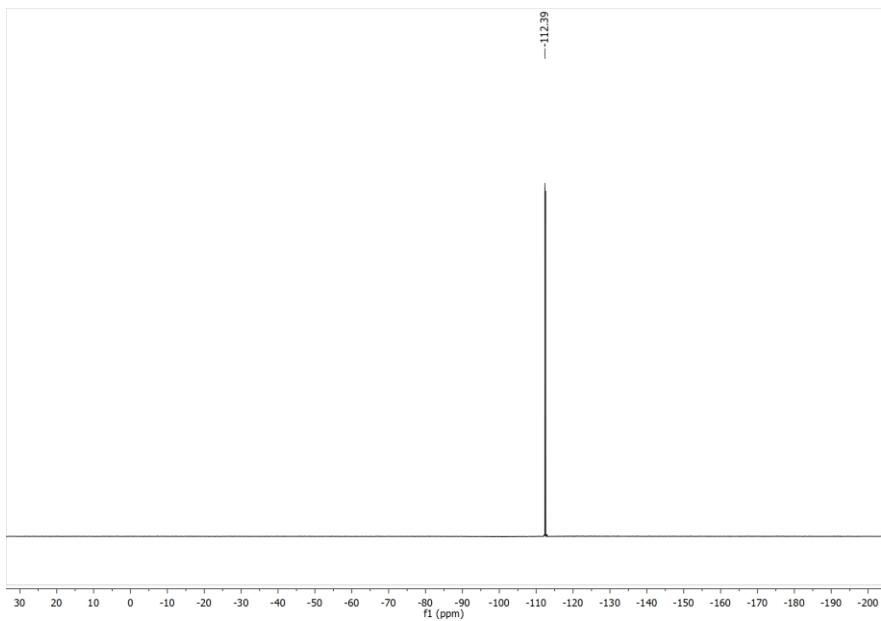
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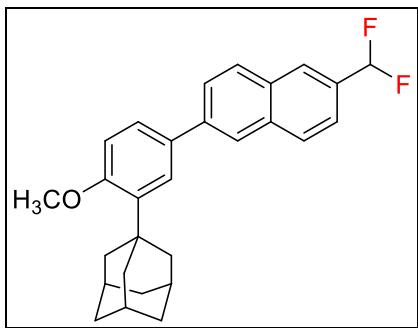


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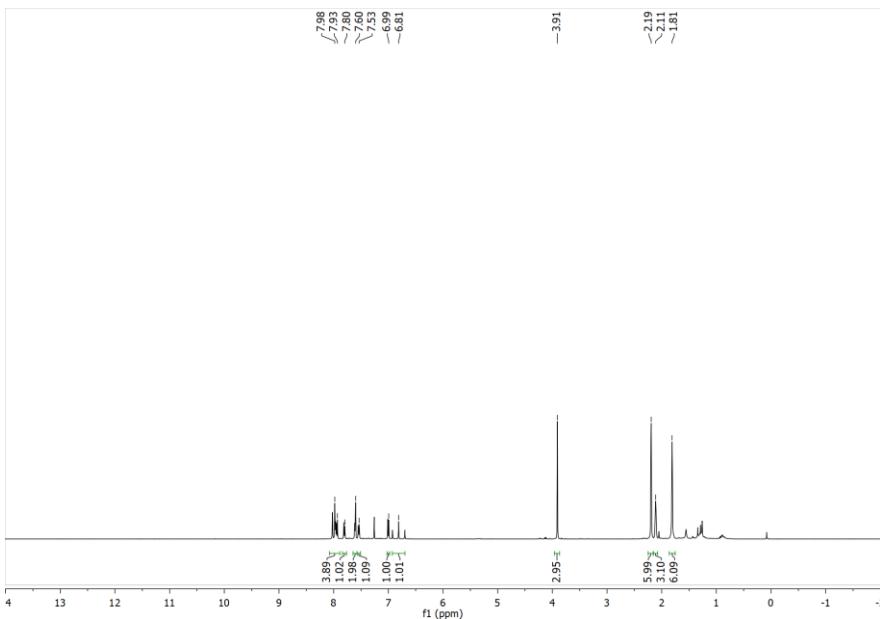


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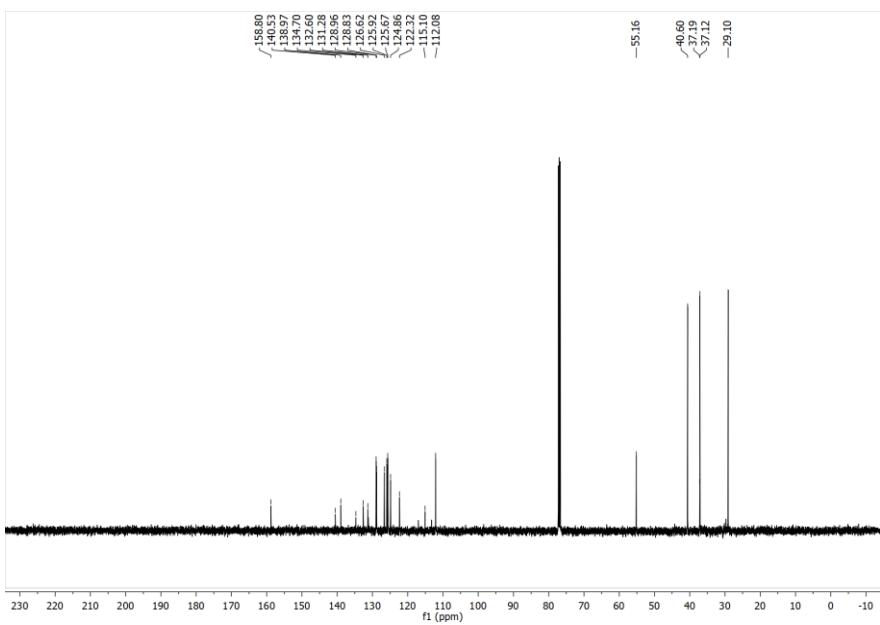




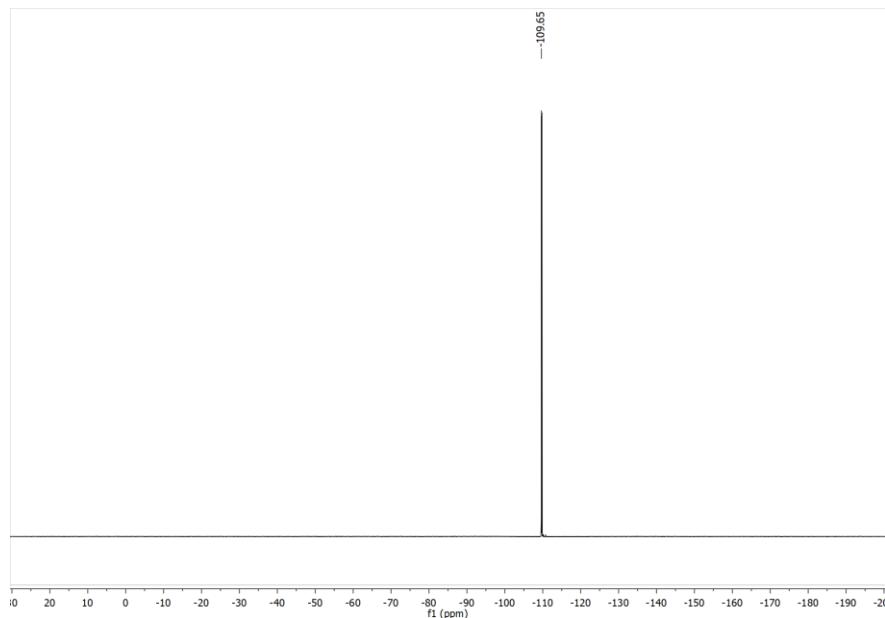
¹H NMR spectra of **1q**:

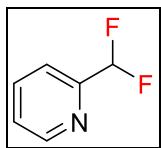


¹³C NMR spectra of **1q**:

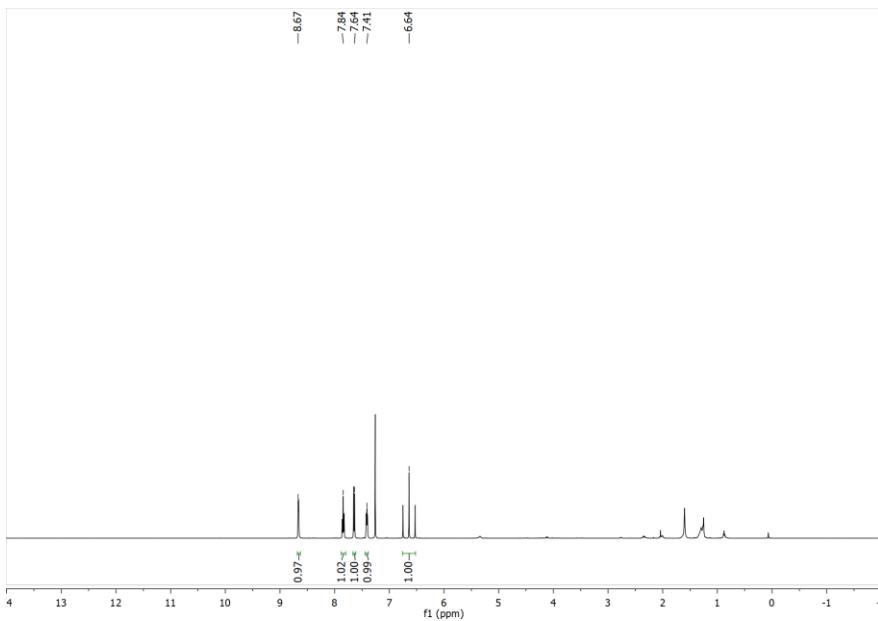


¹⁹F NMR spectra of **1q**:

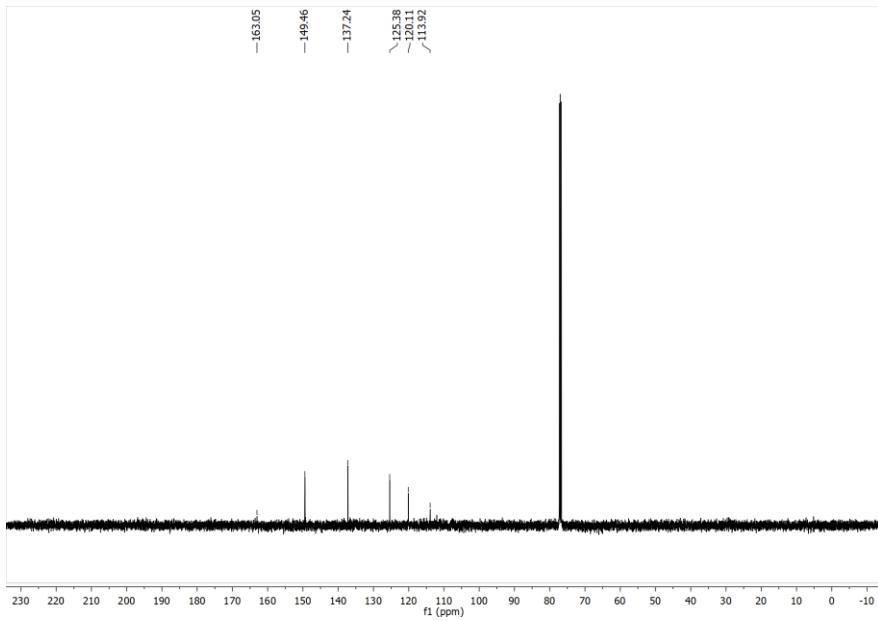




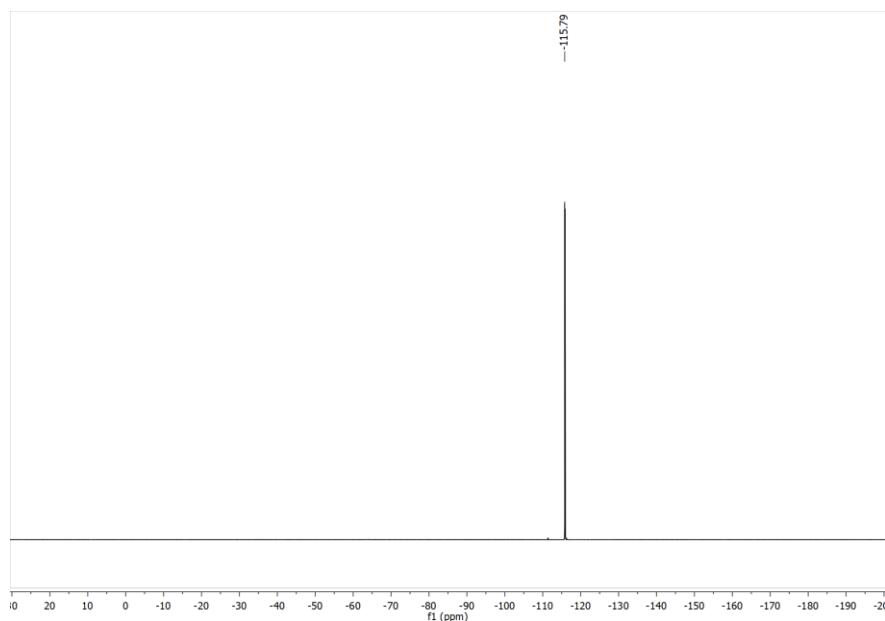
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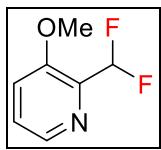


¹³C NMR spectra of **1r**:

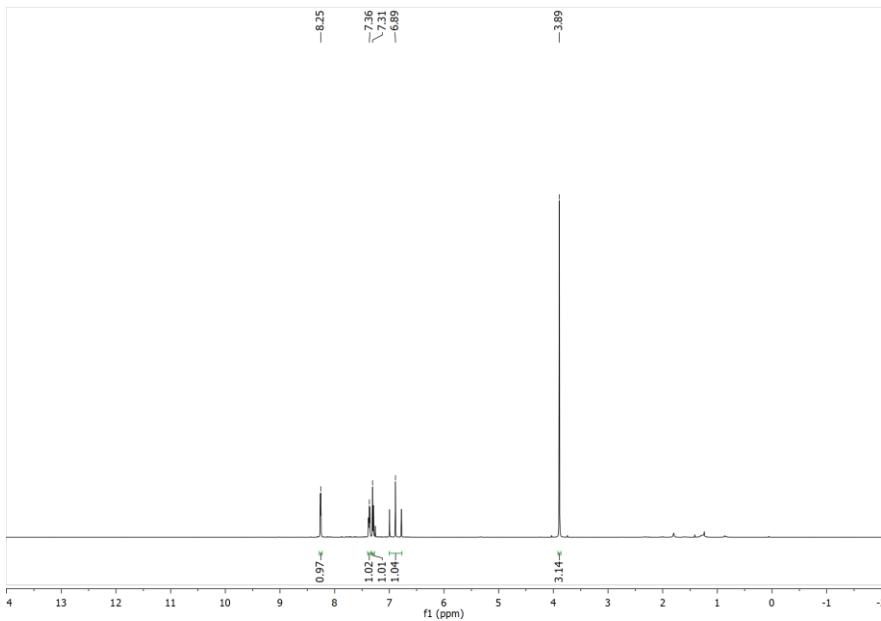


¹⁹F NMR spectra of **1r**:

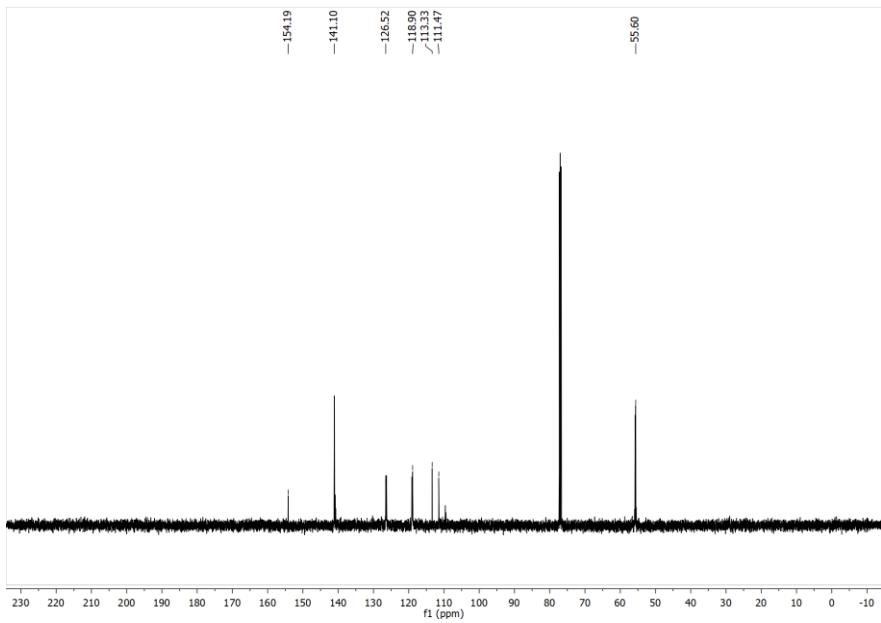




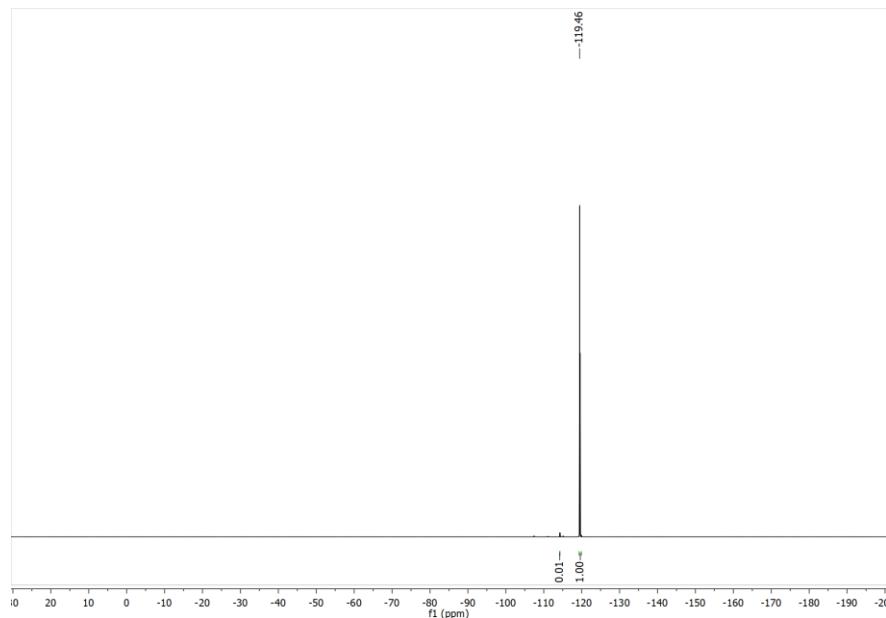
¹H NMR spectra of **1s**:

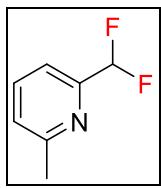


¹³C NMR spectra of **1s**:

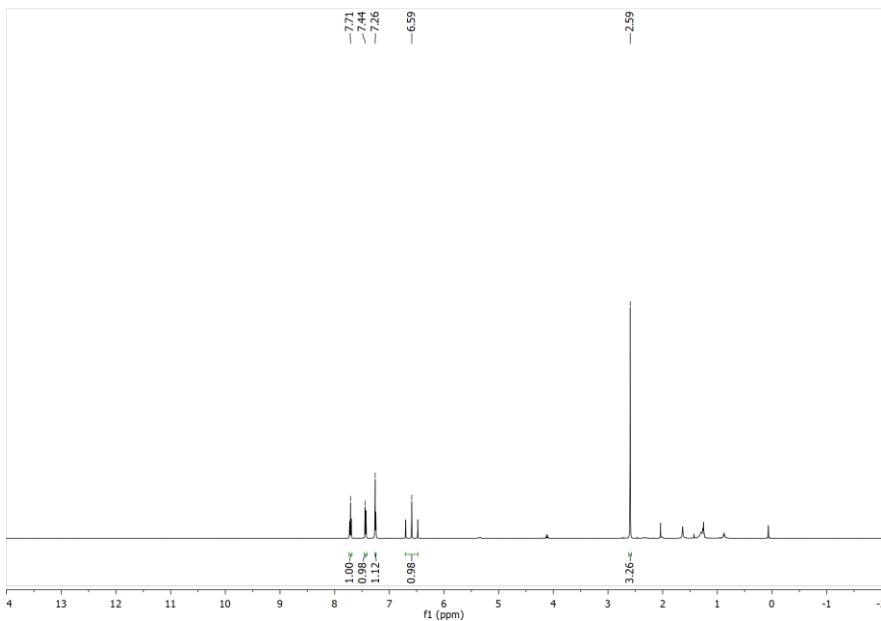


¹⁹F NMR spectra of **1s**:

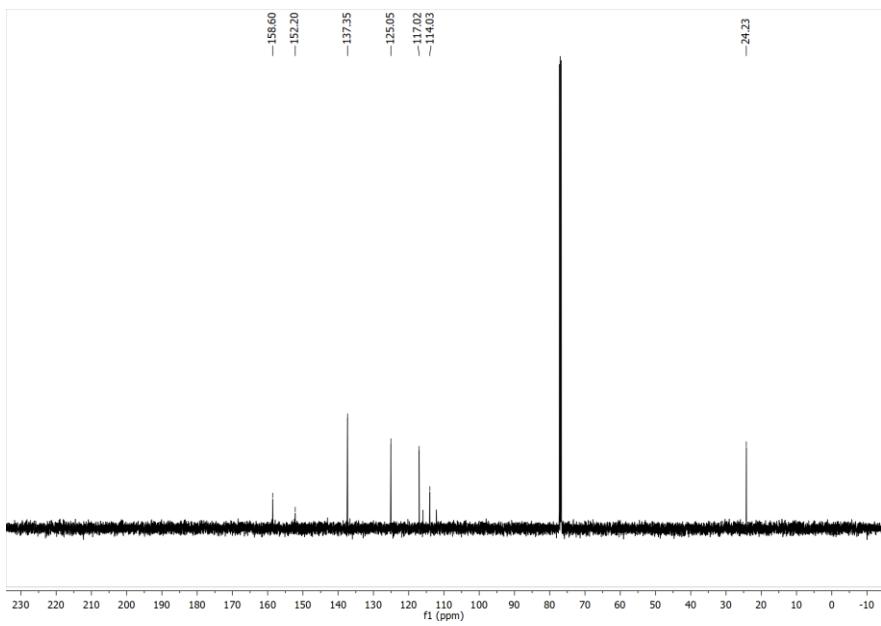




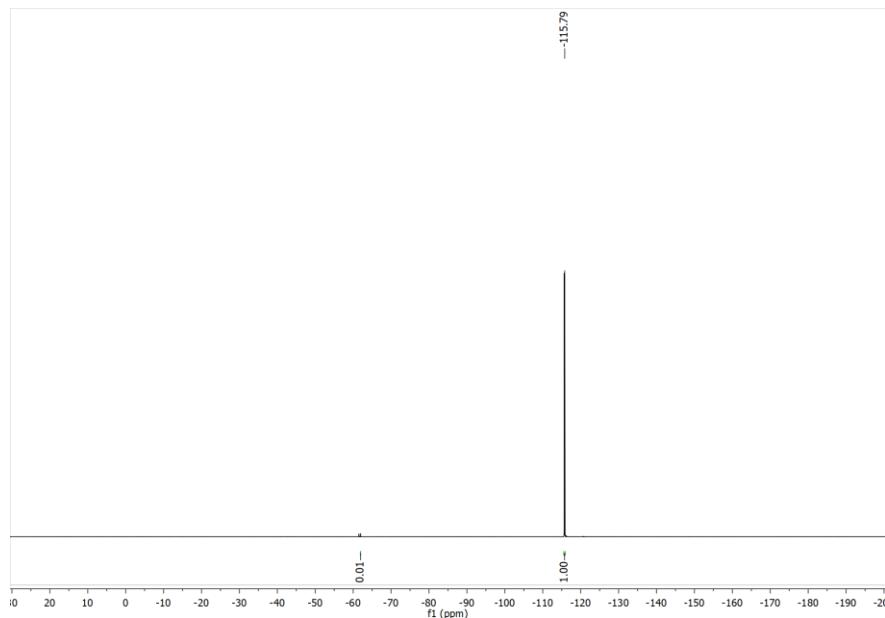
¹H NMR spectra of **1t**:

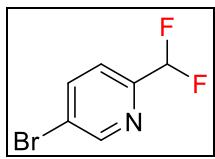


¹³C NMR spectra of **1t**:

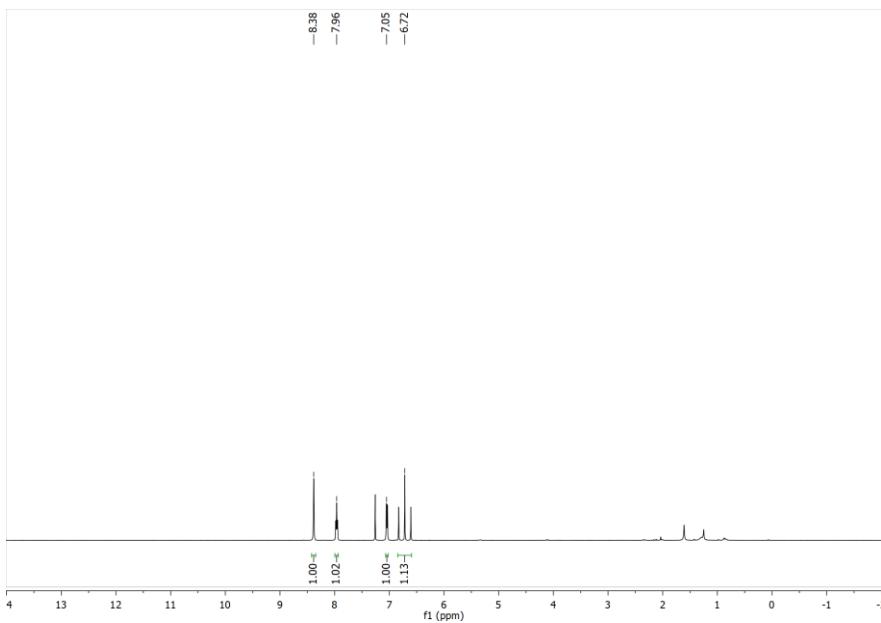


¹⁹F NMR spectra of **1t**:

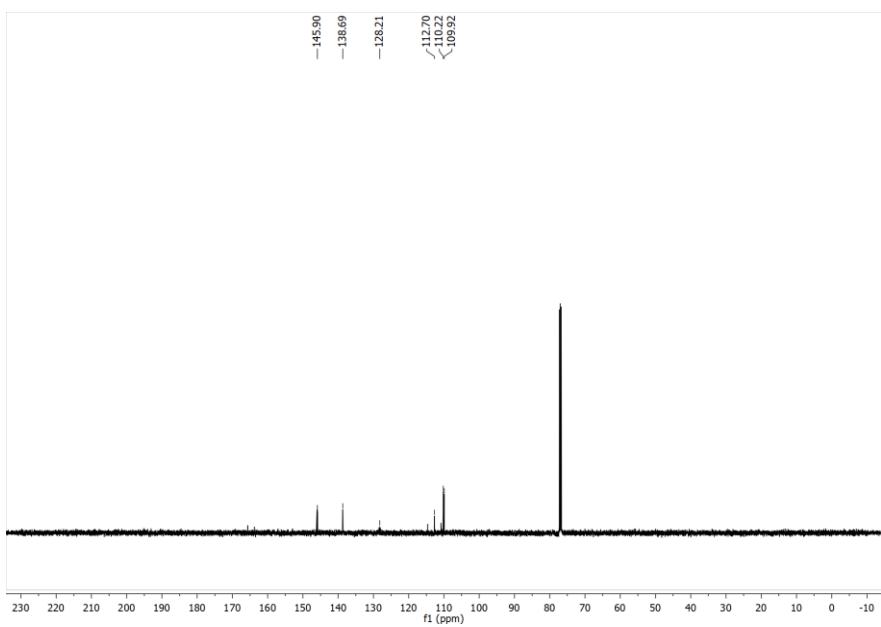




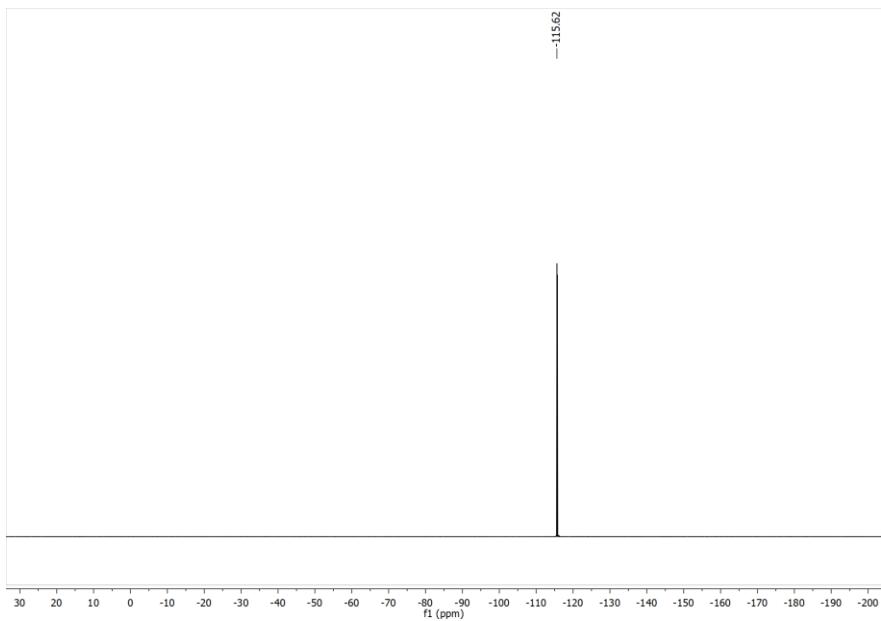
¹H NMR spectra of **1u**:

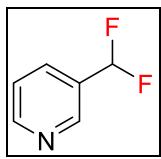


¹³C NMR spectra of **1u**:

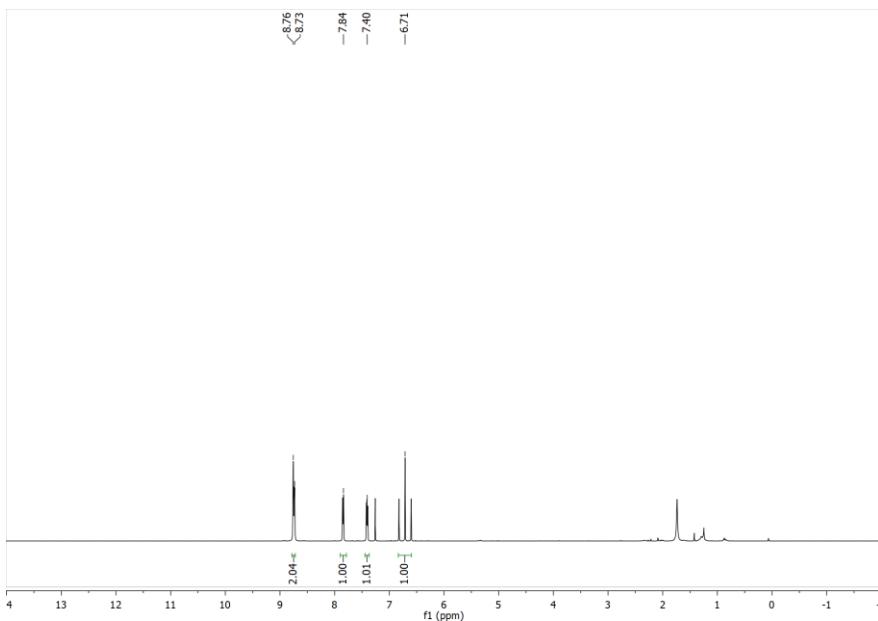


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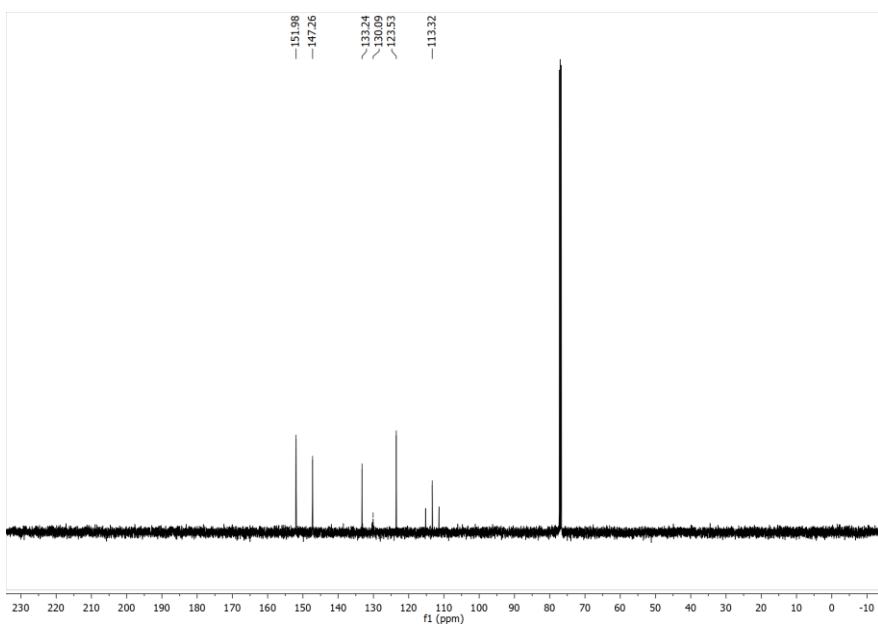




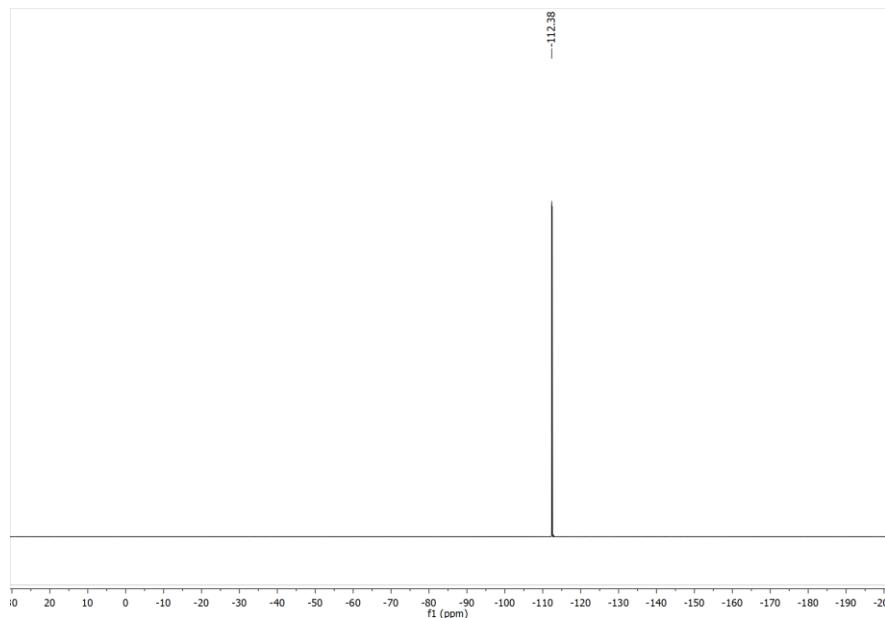
¹H NMR spectra of **1v**:

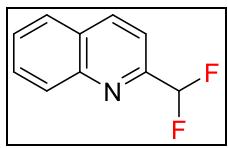


¹³C NMR spectra of **1v**:

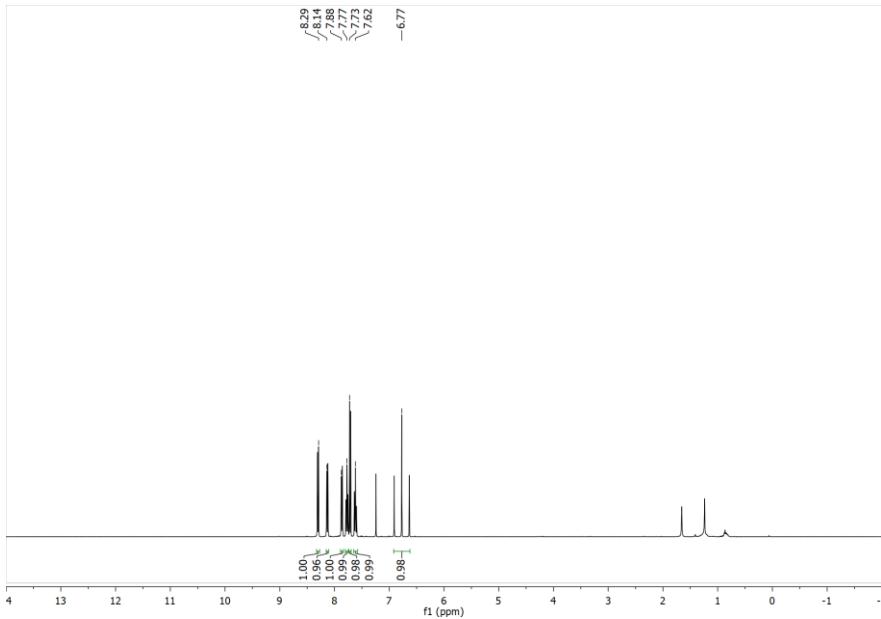


¹⁹F NMR spectra of **1v**:

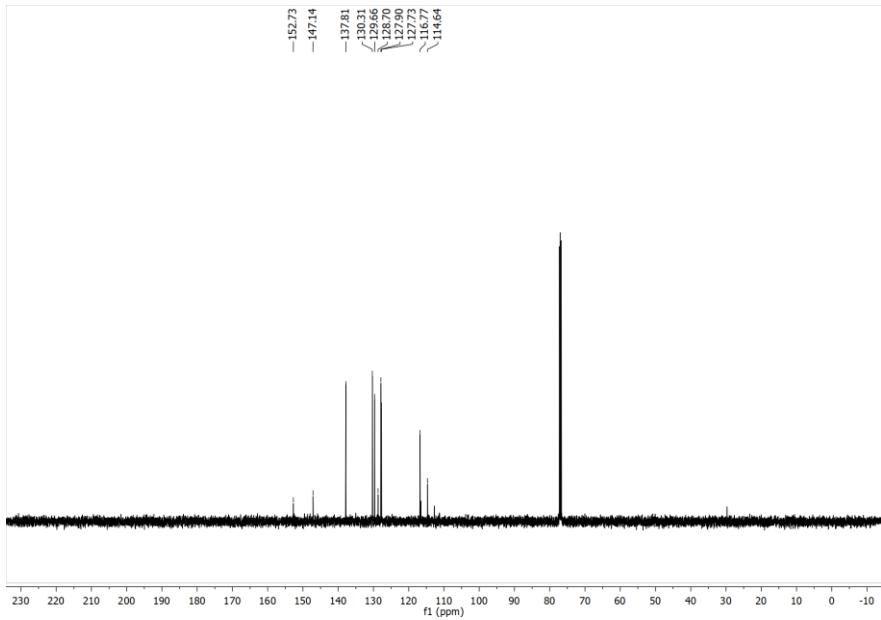




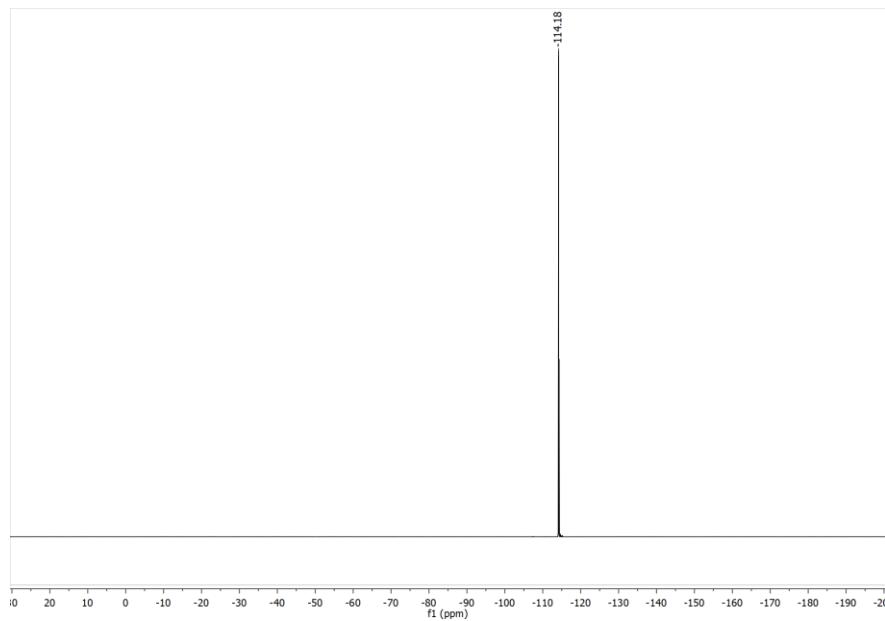
¹H NMR spectra of **1x**:

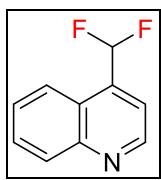


¹³C NMR spectra of **1x**:

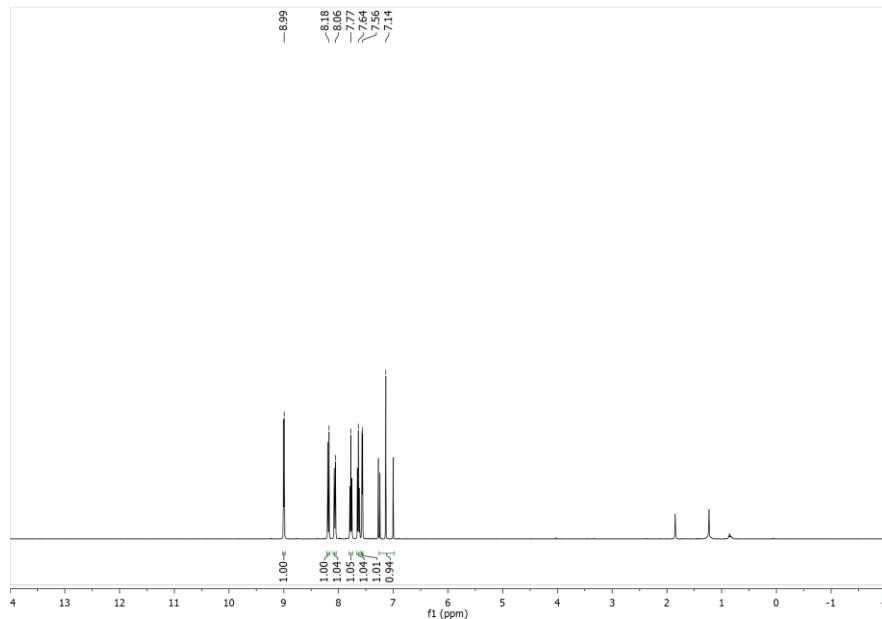


¹⁹F NMR spectra of **1x**:

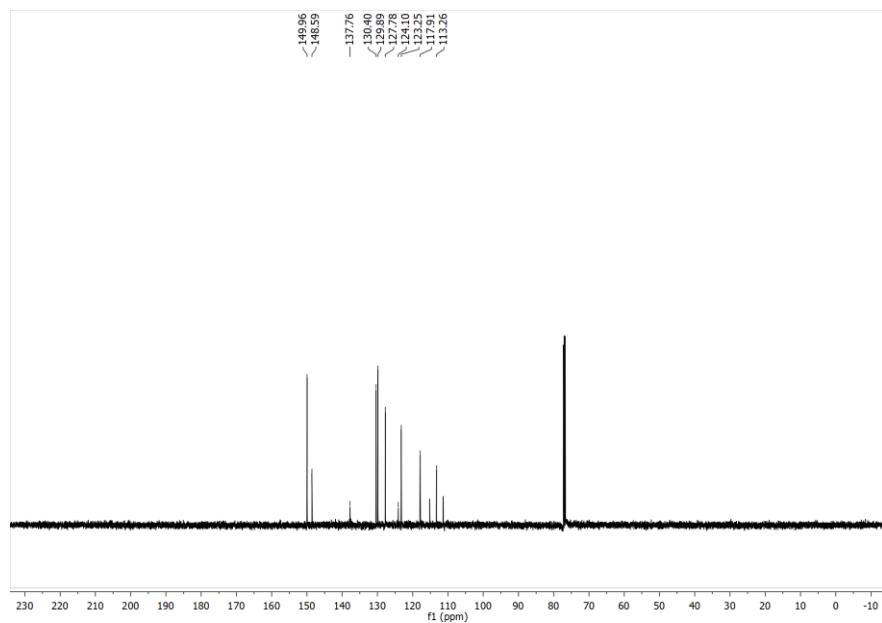




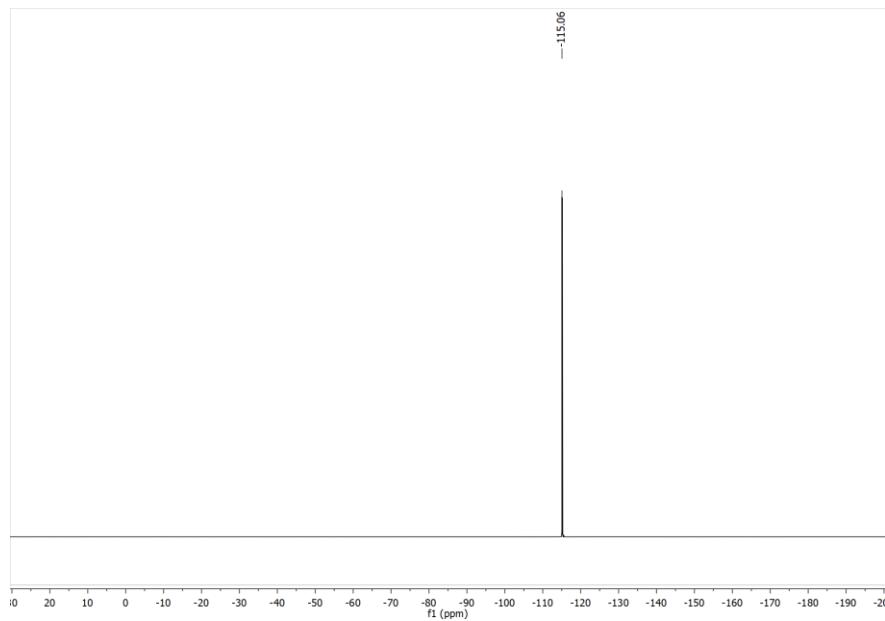
¹H NMR spectra of **1y**:

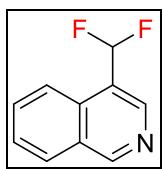


¹³C NMR spectra of **1y**:

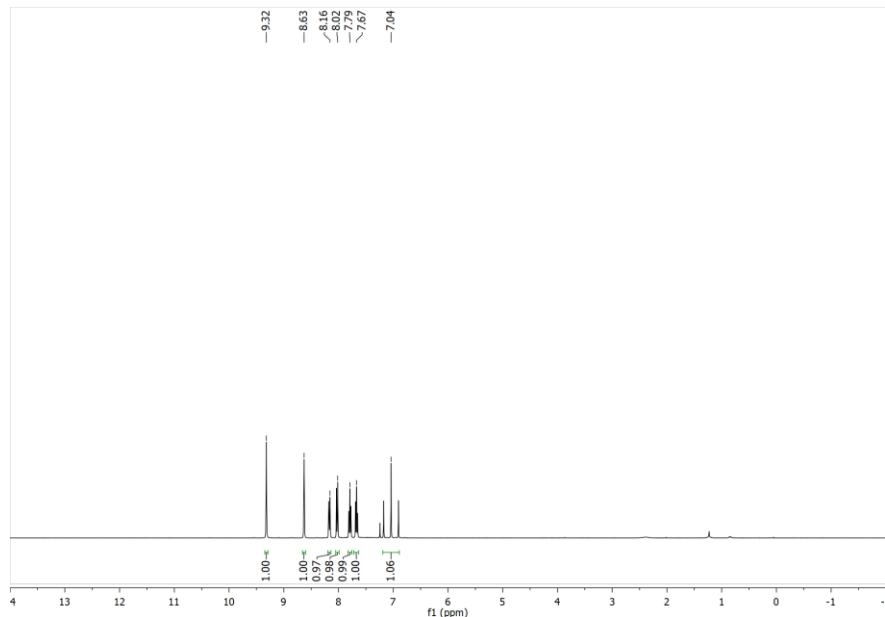


¹⁹F NMR spectra of **1y**:

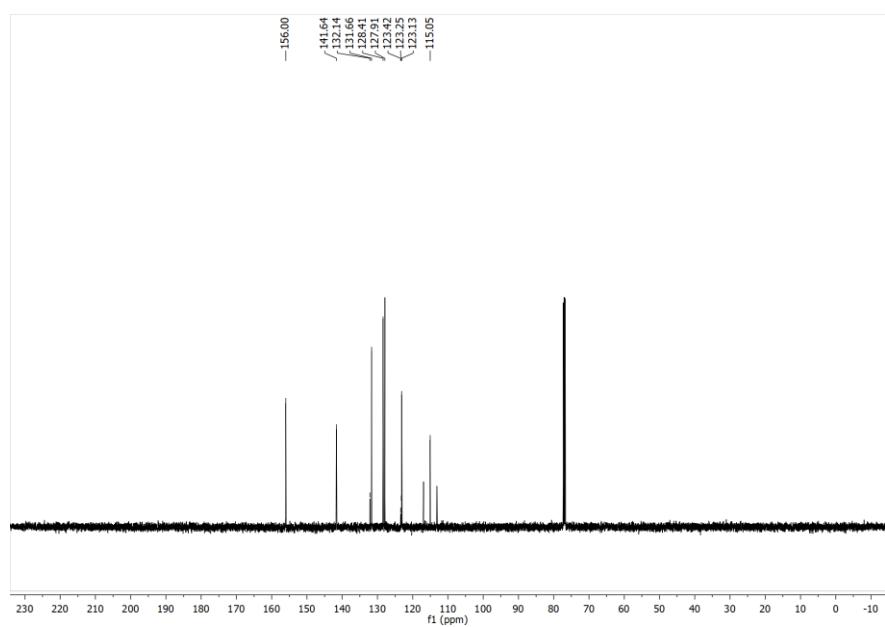




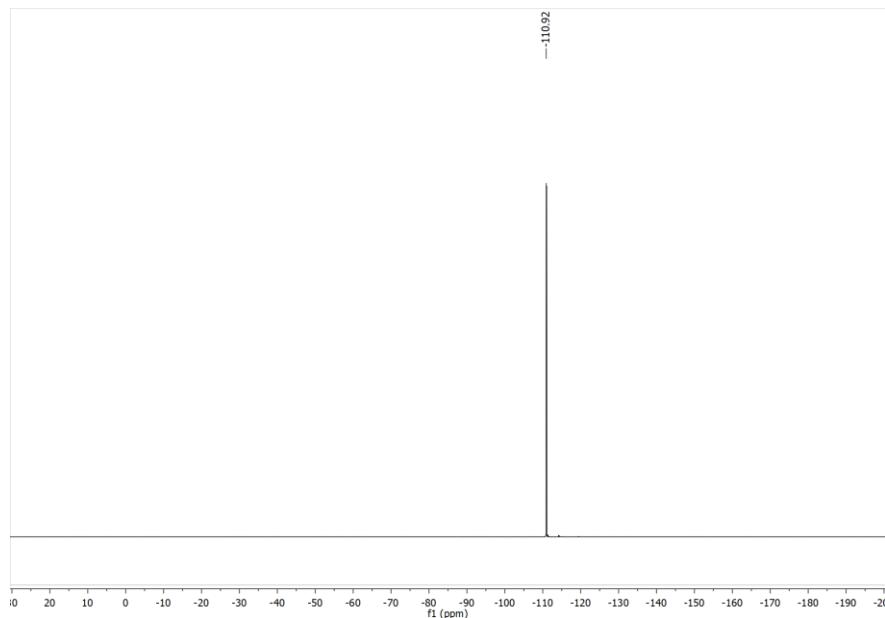
¹H NMR spectra of **1z**:

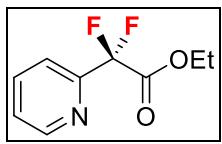


¹³C NMR spectra of **1z**:

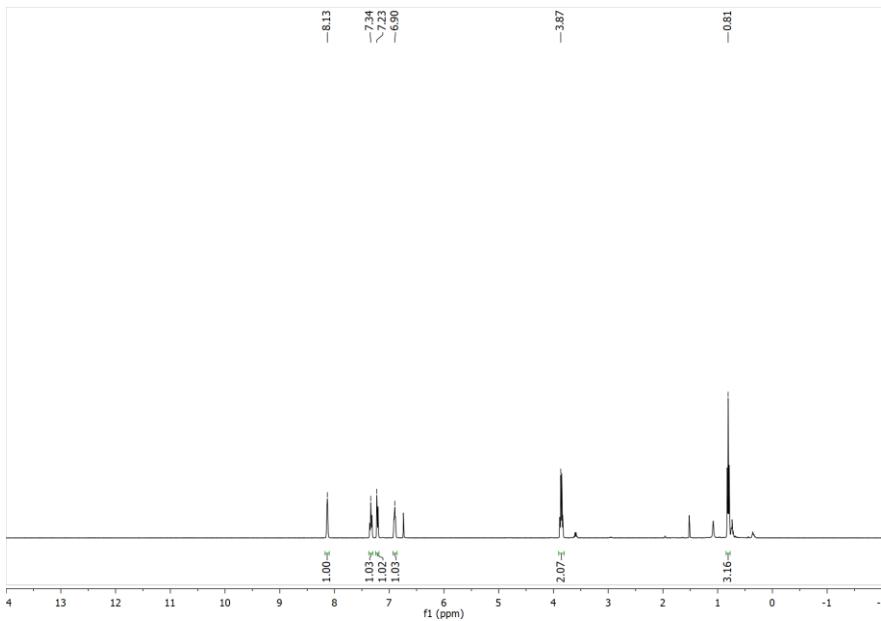


¹⁹F NMR spectra of **1z**:



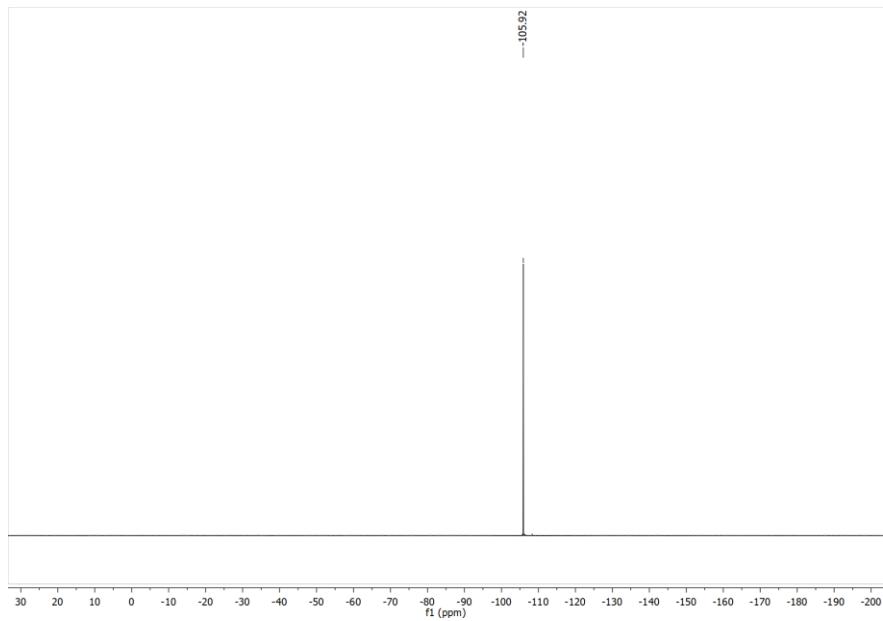


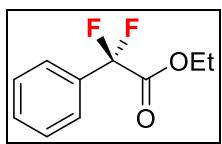
¹H NMR spectra of **1aa**:



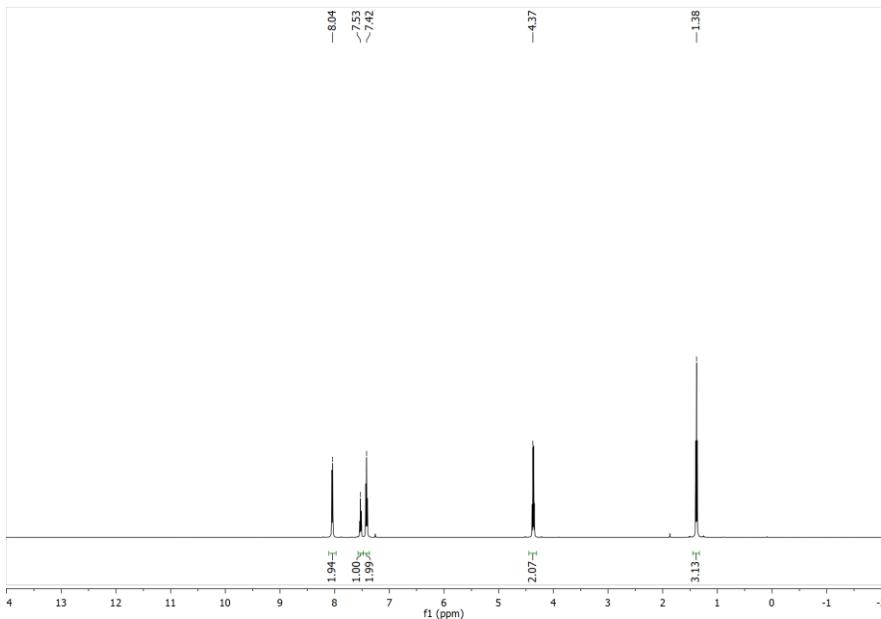
¹³C NMR spectra of **1aa**:

¹⁹F NMR spectra of **1aa**:

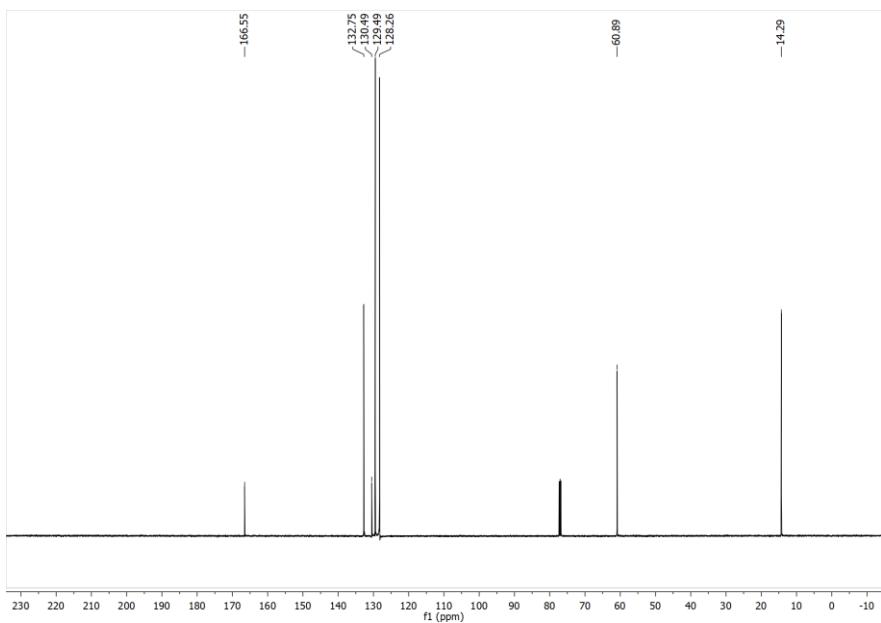




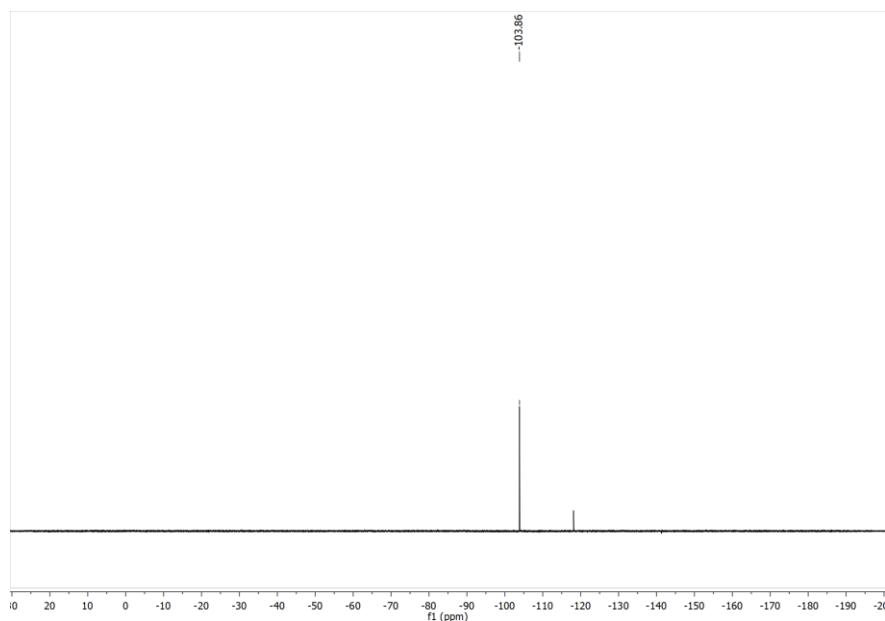
¹H NMR spectra of **1bb**:



¹³C NMR spectra of **1bb**:



¹⁹F NMR spectra of **1bb**:



12. References

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