Electronic Supplementary Information

Visible-light-induced oxidative difunctionalization of styrenes: synthesis of *α*-trifluoromethylthio-substituted ketones

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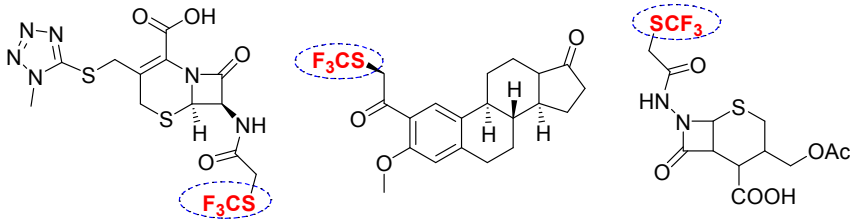
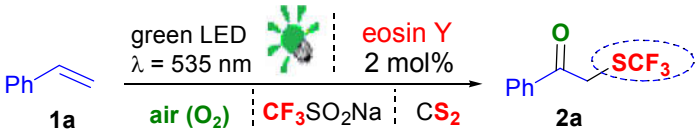
I. Biologically active α-SCF_3-substituted ketones



Cafazaflur | Analogue of estrone | Cephalosporin derivative

II. Control experiments [a]



Entry	Visible light	Eosin Y	Air	CS_2	Yield (%) [b] **2a**
1	–	+	+	+	Zero
2	+	–	+	+	Zero
3	+	+	–	+	Zero [c]
4	+	+	+	–	Zero
5	+	+	+	+	67 [d]
6	+	+	+	+	67 [e]
7	+	+	O_2	+	76 [f]
8	+	+	+	+	Zero [g]
9	+	+	+	+	76 [h]

[a] Reaction conditions: **1** (1.0 mmol), CF_3SO_2Na (3.0 equiv.), CS_2 (3.0 equiv.), eosin Y (2 mol%) in DMSO (3 mL) irradiated using Luxeon Rebel high power green LED [2.50 W, λ = 535 nm] in open air at rt for 10 h, (+) sign indicates the presence & (–) sign indicates the absence. [b] Isolated product yield. [c] Reaction under N_2 atmosphere. [d] Reaction using white LED (7 W). [e] Reaction using green LED (3.0 W). [f] Reaction under O_2 (balloon). [g] Reaction quenched by TEMPO (3.0 equiv.). [h] Reaction conducted with DABCO (3.0 equiv.).

III. **General Information:** All commercially available reagents were used without further purification unless otherwise specified by a reference. Solvents were purified by the usual methods and stored over molecular sieves. All reactions were performed using oven-dried glassware. Organic solutions were concentrated using a Buchi rotary evaporator. Column chromatography was carried out over silica gel (Merck 100–200 mesh) and TLC was performed using silica gel GF254 (Merck) plates. Melting points (m. p.) were determined by open glass capillaries and are uncorrected. ^{1}H (500 MHz), ^{13}C (125.7 MHz) & ^{19}F (470 MHz) NMR spectra were recorded on a Bruker AVII spectrometer in $CDCl_3$ using TMS as internal reference. All chemical shifts are reported in δ/ppm and coupling constants (*J*) in Hertz (Hz). Green LED (2.50 W, λ = 535 nm) Rebel LED, mounted on a 25 mm cool base was purchased from commercial supplier Luxeon Star LEDs Quadica Developments Inc. 47 6th Concession Rd. Brantford, Ontario N 32 5L7 Canada. The quantum yield of the reaction was determined using Shimadzu UV-1601 and Perkin Elmer LS 55 Fluorescence spectrophotometer in EtOH solvent.

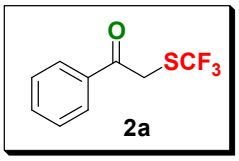
IV. **General procedure for the synthesis of the products 2:** To a mixture of CF_3SO_2Na (3.0 equiv.), CS_2 (3.0 equiv.), eosin Y (2.0 mol %), and styrene **1** (1.0 mmol) in DMSO (3mL) stirred under open air, irradiated with Luxeon Rebel high power green LED [2.50 W, λ = 535 nm] at room temperature for 10-12 h. After the completion of reaction (as indicated by TLC), it was quenched with water (5 mL) and extracted with ethyl acetate (3 × 5 mL). The organic phase was dried over anhydrous magnesium sulfate and concentrated under reduced pressure to yield the crude product, which was purified by silica gel column chromatography using a mixture of EtOAc-Hexane (1:50) to give the pure product **2** in high yields.

The structure of the products was confirmed by the comparison of ^{1}H, ^{13}C & ^{19}F NMR data with those reported in the literature.

Spectral data of compounds **2** are summarised below with relevant references:[1]

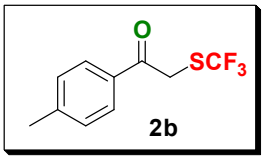
V. Spectral data of the products 2:

(i) 1-Phenyl-2-((trifluoromethyl)thio)ethanone (2a):[1]



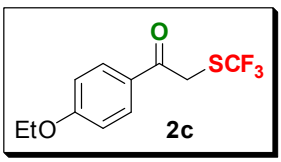
Isolated as a yellow oily liquid. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.95 (d, *J* = 8.5 Hz, 1H), 7.65 (t, *J* = 7.0 Hz, 1H), 7.53 (q, *J* = 8.0 Hz, 3H), 3.83 (q, $^{4}J_{H\text{-}F}$ = 9.5 Hz, 2H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 189.7 (s), 135.8 (s), 134.2 (s), 129.0 (s), 128.4 (s), 127.3 (q, $^{1}J_{C\text{-}F}$ = 276.6 Hz), 42.5 (q, $^{3}J_{C\text{-}F}$ = 27.2 Hz). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.9 (s, 3F).

(ii) 1-(*p*-Tolyl)-2-((trifluoromethyl)thio)ethanone (2b):[1]



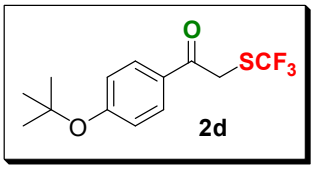
Isolated as a yellow oily liquid. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.84 (d, *J* = 8.2 Hz, 2H), 7.31 (d, *J* = 8.2 Hz, 2H), 3.79 (q, $^{4}J_{H\text{-}F}$ = 9.5 Hz, 2H), 2.43 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 189.3 (s), 143.3 (s), 133.4 (s), 129.6 (s), 129.6 (s), 129.2 (q, $^{1}J_{C\text{-}F}$ = 289.6 Hz), 128.5(s), 42.3 (q, $^{3}J_{C\text{-}F}$ = 28.1 Hz), 21.7 (s). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.9 (s, 3F).

(iii) 1-(4-Ethoxyphenyl)-2-(trifluoromethylthio)ethanone (2c):



Isolated as a yellow solid (m. p. 58–60 °C). ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.90 (d, *J* = 8.2 Hz, 2H), 6.95 (d, *J* = 8.2 Hz, 2H), 4.12 (q, $^{4}J_{H\text{-}F}$ = 9.5 Hz, 2H), 3.76 (q, *J* = 9.5 Hz, 2H), 1.46 (t, *J* = 9.5 Hz, 3H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 190.9 (s), 163.8 (s), 132.0 (s), 130.8 (q, $^{1}J_{C\text{-}F}$ = 276.7 Hz), 120.9, 114.5 (s), 64.0 (s), 42.2 (q, $^{3}J_{C\text{-}F}$ = 27.1 Hz), 14.6 (s). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.9 (s, 3F).

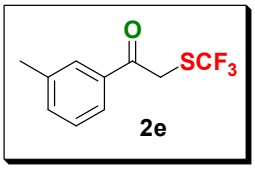
(iv) 1-(4-*tert*-Butylphenyl)-2-(trifluoromethylthio)ethanone (2d):[1]



2d

Isolated as a yellow oily liquid. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.88 (d, *J* = 8.5 Hz, 1H), 7.82 (d, *J* = 8.5 Hz, 1H) 7.55 (d, *J* = 8.5 Hz, 1H), 7.52 (d, *J* = 8.2 Hz, 1H), 3.80 (q, $^{4}J_{H\text{-}F}$ = 9.5 Hz, 2H), 1.34 (s, 9H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 192.1 (s), 158.2 (s), 129.7, 128.4 (s), 127.4 (q, $^{1}J_{C\text{-}F}$ = 276.4 Hz), 125.9(s), 42.3 (q, $^{3}J_{C\text{-}F}$ = 27.9 Hz), 35.3 (s), 31.0 (s). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.8 (s, 3F).

(v) 1-*m*-Tolyl-2-(trifluoromethylthio)ethanone (2e):[1]

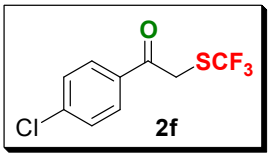


2e

Isolated as a yellow oily liquid. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.67 (s, 1H), 7.33 (dd, *J* = 8.0 Hz, 11.0 Hz, 1H), 7.37 (ddd, *J* = 8.0 Hz, 2.1 Hz, 1.1 Hz, 1H), 7. 33 (t, *J* = 7.9 Hz, 1H), 3.73 (q, $^{4}J_{H\text{-}F}$ = 9.5 Hz, 2H), 2.35 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 193.3 (s), 139.6 (s), 136.0 (s),

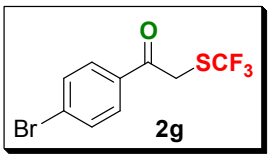
135.7 (s), 134.3 (s), 130.7 (s), 129.6 (s), 129.5 (q, $^{1}J_{C\text{-}F}$ = 276.4 Hz), 43.2 (q, $^{3}J_{C\text{-}F}$ = 27.9 Hz), 22.0 (s). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.9 (s, 3F).

(vi) 1-(4-Chlorophenyl)-2-((trifluoromethyl)thio)ethanone (2f):[1]



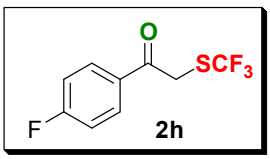
Isolated as a yellow solid (m. p. 56–57 °C). ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.87 (d, *J* = 8.0 Hz, 2H), 7.48 (d, *J* = 7.5 Hz, 2H), 3.81 (q, $^{4}J_{H\text{-}F}$ = 9.5 Hz, 2H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 188.6 (s), 140.9 (s), 134.1 (s), 129.7 (s), 129.3 (s), 127.2 (q, $^{1}J_{C\text{-}F}$ = 276.7 Hz), 42.4 (q, $^{3}J_{C\text{-}F}$ = 29.0 Hz). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.9 (s, 3F).

(vii) 1-(4-Bromophenyl)-2-(trifluoromethylthio)ethanone (2g):[1]



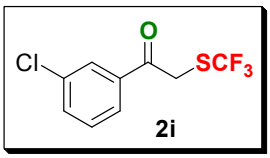
Isolated as a reddish solid (m. p. 80–82 °C). ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.80 (d, *J* = 8.5 Hz, 2H), 7.66 (d, *J* = 8.5 Hz, 2H), 3.79 (q, $^{4}J_{H\text{-}F}$ = 9.4 Hz, 2H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 187.7 (s), 133.4 (s), 131.3 (s), 131.0 (q, $^{1}J_{C\text{-}F}$ = 279.3 Hz), 128.6 (s), 121.6 (s), 41.4 (q, $^{3}J_{C\text{-}F}$ = 29.0 Hz). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.8 (s, 3F).

(viii) 1-(4-Fluorophenyl)-2-((trifluoromethyl)thio)ethanone (2h):[1]



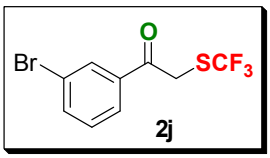
Isolated as yellow oily liquid. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.91 (dd, *J* = 6.0, 5.0 Hz, 2H), 7.19–7.08 (m, 2H), 3.73 (q, $^{4}J_{H\text{-}F}$ = 10.0 Hz, 2H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 188.1 (s), 167.4 (d, $^{1}J_{C\text{-}F}$ = 256.9 Hz), 132.3 (d, $^{3}J_{C\text{-}F}$ = 146.9 Hz), 131.2 (s), 127.2 (q, $^{1}J_{C\text{-}F}$ = 276.7 Hz), 116.3 (d, $^{2}J_{C\text{-}F}$ = 21.8 Hz), 42.5 (q, $^{3}J_{C\text{-}F}$ = 28.6 Hz). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.9 (s, 3F), -102.7 (s, 1F).

(ix) 1-(3-Chlorophenyl)-2-[(trifluoromethyl)sulfanyl]ethan-1-one (3i):[1]



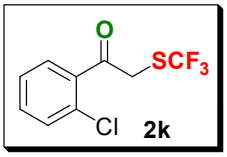
Isolated as a yellow oily liquid. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.84 (s, 1H), 7.74 (dd, *J* = 8.0 Hz, 8.0 Hz, 1H), 7.41 (t, *J* = 8.0 Hz, 1H), 7.19 (s, 1H), 3.73 (q, $^{4}J_{H\text{-}F}$ = 9.5 Hz, 2H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 193.0, 137.3, 135.5, 134.2 (s), 130.5 (q, $^{1}J_{C\text{-}F}$ = 276.8 Hz), 130.3 (s), 127.8 (s), 126.4 (s), 42.7 (q, $^{3}J_{C\text{-}F}$ = 32.6 Hz). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.9 (s, 3F).

(x) 1-(3-Bromophenyl)-2-(trifluoromethylthio)ethanone (3j):[1]



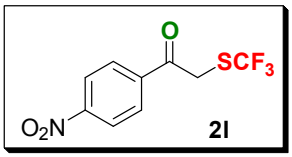
Isolated as a yellow oily liquid. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 8.06 (s, 1H), 7.86 (d, *J* = 8.5 Hz, 1H), 7.60 (d, *J* = 8.0 Hz, 1H), 7.46 (t, *J* = 7.9 Hz, 1H), 3.80 (q, $^{4}J_{H\text{-}F}$ = 9.5 Hz, 2H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 188.5 (s), 137.4 (s), 137.1 (s), 131.4 (s), 130.5 (s), 128.1 (s), 126.9 (s), 126.2 (q, $^{1}J_{C\text{-}F}$ = 283.1 Hz), 42.6 (q, $^{3}J_{C\text{-}F}$ = 27.7 Hz). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.9 (s, 3F).

(xi) 1-(2-Chlorophenyl)-2-(trifluoromethylthio)ethanone (3k):[1]



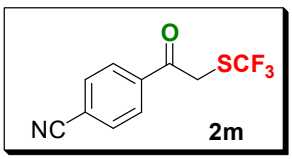
Isolated as a yellow oily liquid. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.55 (t, $^{2}J_{H-H}$ = 2.0 Hz, 1H), 7.46 (dd, $^{2}J_{H-H}$ = 5.0 Hz, 2.0 Hz, 2H), 7.39 (ddd, $^{3}J_{H-H}$ = 1.1 Hz, 2.1 Hz, 8.0 Hz, 1H), 3.89 (q, $^{4}J_{H-F}$ = 9.5 Hz, 2H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 192.4 (s), 137.7 (s), 133.0 (s), 131.2 (s), 138.8 (s), 129.7 (s), 127.3 (s), 126.9 (q, $^{3}J_{C-F}$ = 277.6 Hz), 46.5 (q, $^{1}J_{C-F}$ = 26.7 Hz). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -62.08 (s, 3F).

(xii) 1-(4-Nitrophenyl)-2-(trifluoromethylthio)ethanone (3l):[1]



Isolated as a yellow solid (m. p. 101–102 °C). ^{1}H NMR (500 MHz, $CDCl_3$): δ = 8.38 (d, *J* = 8.5 Hz, 2H), 8.12 (d, *J* = 8.5 Hz, 2H), 3.89 (q, $^{4}J_{H-F}$ = 9.5, 2H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 188.4 (s), 151.0 (s), 140.0 (s), 129.5 (s), 126.8 (q, $^{1}J_{C-F}$ = 277.2 Hz), 124.2 (s), 43.1 (q, $^{3}J_{C-F}$ = 28.6 Hz). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.8 (s).

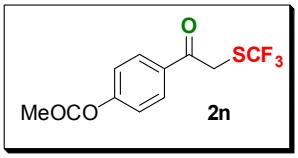
(xiii) 4-(2-(Trifluoromethylthio)acetyl)benzonitrile (2m):[1]



Isolated as a white solid (m. p. 130–132 °C). ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.79 (d, *J* = 8.0 Hz, 2H), 7.82 (d, *J* = 8.5 Hz, 2H), 3.78 (q, $^{4}J_{H-F}$ = 10.0 Hz, 2H). ^{13}C NMR (126 MHz, $CDCl_3$): δ =

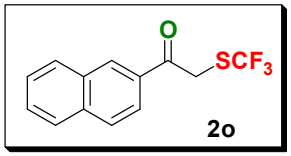
188.6 (s), 138.5 (s), 132.8 (s), 132.5 (s), 128.8 (s), 126.9 (q, $^{1}J_{C\text{-}F}$ = 277.2 Hz), 116.8 (s), 42.8 (q, $^{3}J_{C\text{-}F}$ = 28.9 Hz). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.8 (s, 3F).

(xiv) Acetic acid 4-(2-trifluoromethylsulfanyl-acetyl)-phenyl ester (**2n**):



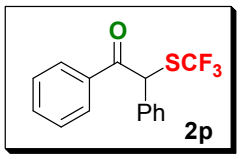
Isolated as a white solid (m. p. 81–82 °C). ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.98 (d, *J* = 8.5 Hz, 2H), 7.25 (d, *J* = 8.0 Hz, 2H), 3.80 (q, $^{4}J_{H\text{-}F}$ = 10.0, 2H), 2.33 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 188.4 (s), 168.6 (s), 155.1 (s), 133.3 (s), 130.0 (s), 127.4 (q, $^{1}J_{C\text{-}F}$ = 276.7 Hz), 122.2 (s), 42.4 (q, $^{3}J_{C\text{-}F}$ = 28.5 Hz), 21.1 (s). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.8 (s).

(xv) 1-(Naphthalen-2-yl)-2-((trifluoromethyl)thio)ethanone (**2o**):[1]



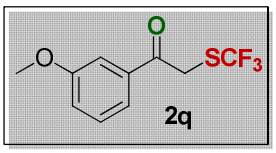
Isolated as a yellow solid (m. p. 87–88 °C). ^{1}H NMR (500 MHz, $CDCl_3$): δ = 8.34 (s, 1H), 7.94-7.90 (m, 2H), 7.86–7.81 (m, 2H), 7.59 (dq, *J* = 1.5 Hz, 1.5 Hz, 7.0 Hz, 2H), 4.67 (q, $^{4}J_{H\text{-}F}$ = 10.0, 2H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 189.6 (s), 136.0 (s), 133.2 (s), 132.3 (s), 130.6 (q, $^{1}J_{C\text{-}F}$ = 276.8 Hz), 127.9 (s), 127.2 (s), 126.7 (s), 125.2 (s), 123.5 (s), 123.2 (s), 123.0 (s), 42.5 (q, $^{3}J_{C\text{-}F}$ = 28.1 Hz). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.8 (s, 3F).

(xvi) 1,2-Diphenyl-2-(trifluoromethylthio)ethanone (**2p**):



Isolated as a yellow solid (m. p. 128–130 °C). ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.90 (s, 1H), 7.42–7.40 (m, 2H), 7.36‑7.32 (m, 5H), 7.17-7.15 (m, 2H), 4.54 (q, $^{4}J_{H\text{-}F}$ = 9.5 Hz, 1H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 197.1 (s), 153.3 (s), 140.7 (s), 131.3 (s), 130.2 (q, $^{1}J_{C\text{-}F}$ = 272.6 Hz), 129.3 (s), 128.8 (s), 128.4 (s), 128.3 (s), 127.7 (s), 56.0 (q, $^{3}J_{C\text{-}F}$ = 27.9 Hz). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -65.4(s, 3F).

(xvii) 1-(3-Methoxyphenyl)-2-((trifluoromethyl)thio)ethanone (**2q**):[1]

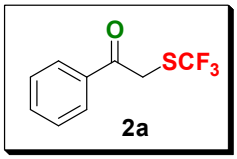


Isolated as a yellow oily liquid. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 7.49 (d, *J* = 7.0 Hz, 2H), 7.43 (t, *J* = 8.0 Hz, 1H), 7.18 (d, *J* = 9.0 Hz, 1H), 3.87 (s, 3H), 3.81 (q, *J* = 10.0 Hz 2H). ^{13}C NMR (126 MHz, $CDCl_3$): δ = 189.5 (s), 160.0 (s), 137.1 (s), 129.9 (q, *J* = 263.2 Hz), 127.1 (s), 120.9 (s), 120.7 (s), 112.4 (s), 55.5 (s), 42.5 (q, *J* = 28.0 Hz). ^{19}F NMR (470 MHz, $CDCl_3$): δ = -61.9 (s, 3F).

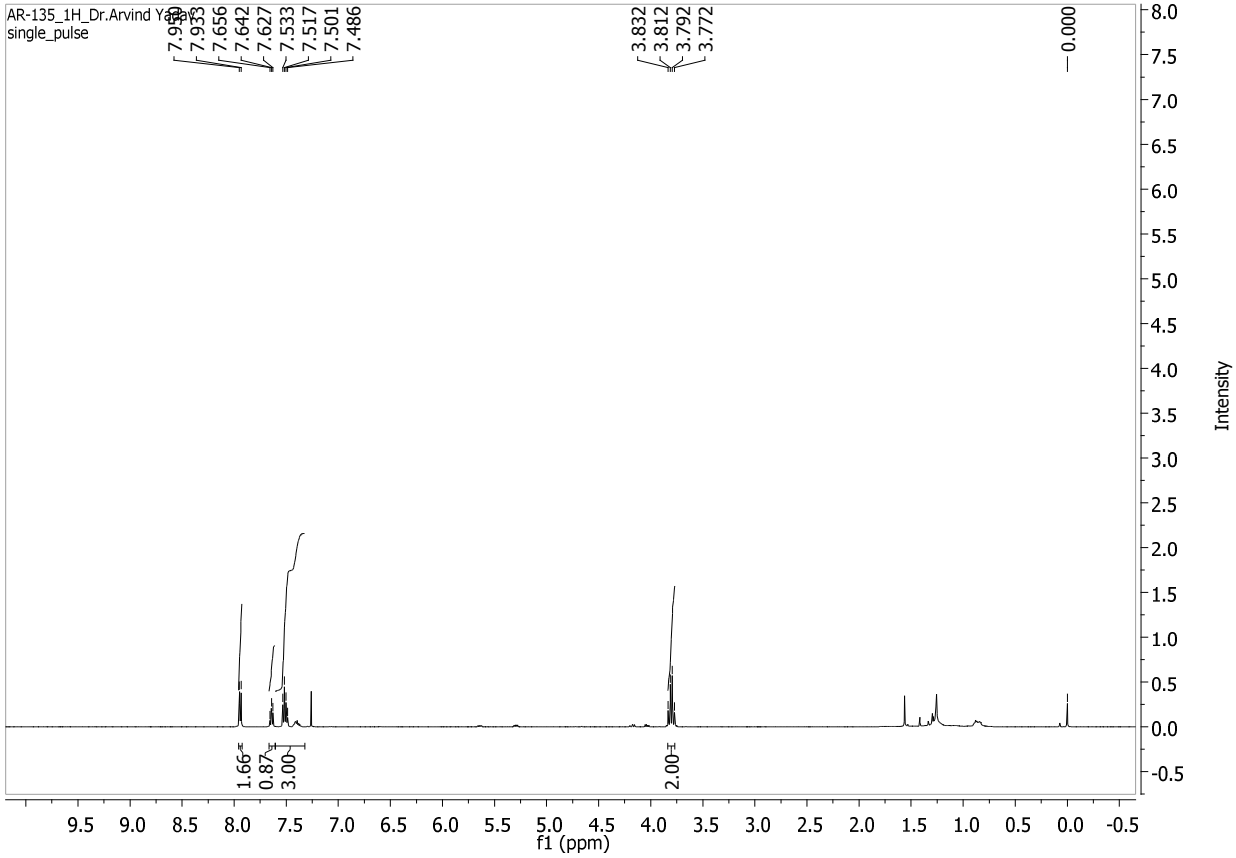
VI. References: 1 (*a*) S. Alazet, E. Ismalaj, Q. Glenadel, D. L. Bars and T. Billard, *Eur. J. Org. Chem*. 2015, 4607; (*b*) Y. Huang, X. He, X. Lin, M. Rong and Z. Weng, *Org. Lett*. 2014, **16**, 3284.

VII. Copies of ^{1}H, ^{13}C & ^{19}F NMR spectra.

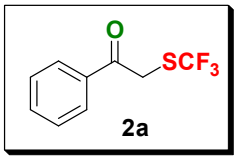
Compound 2a. ^{1}H NMR Spectrum ($CDCl_3$).

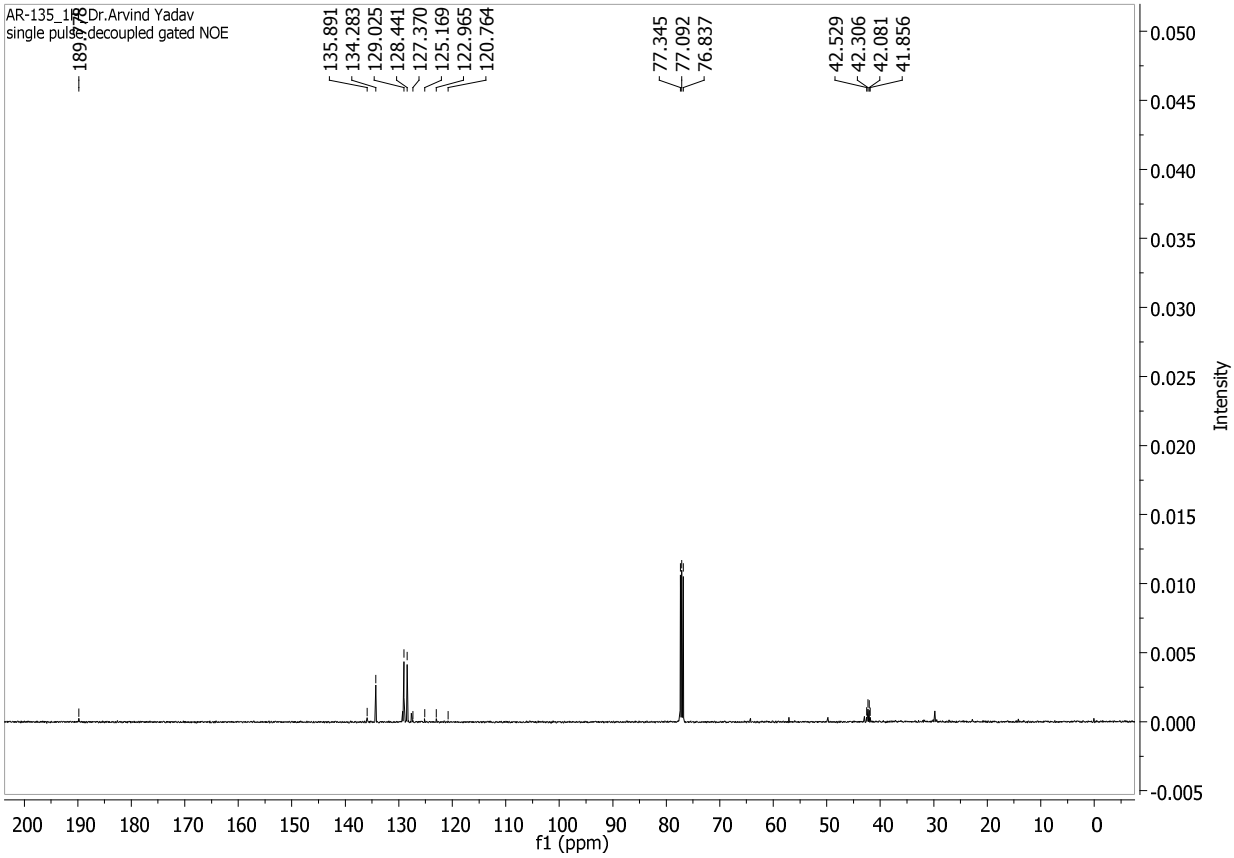


2a

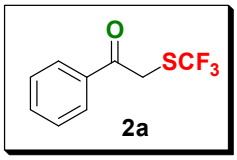


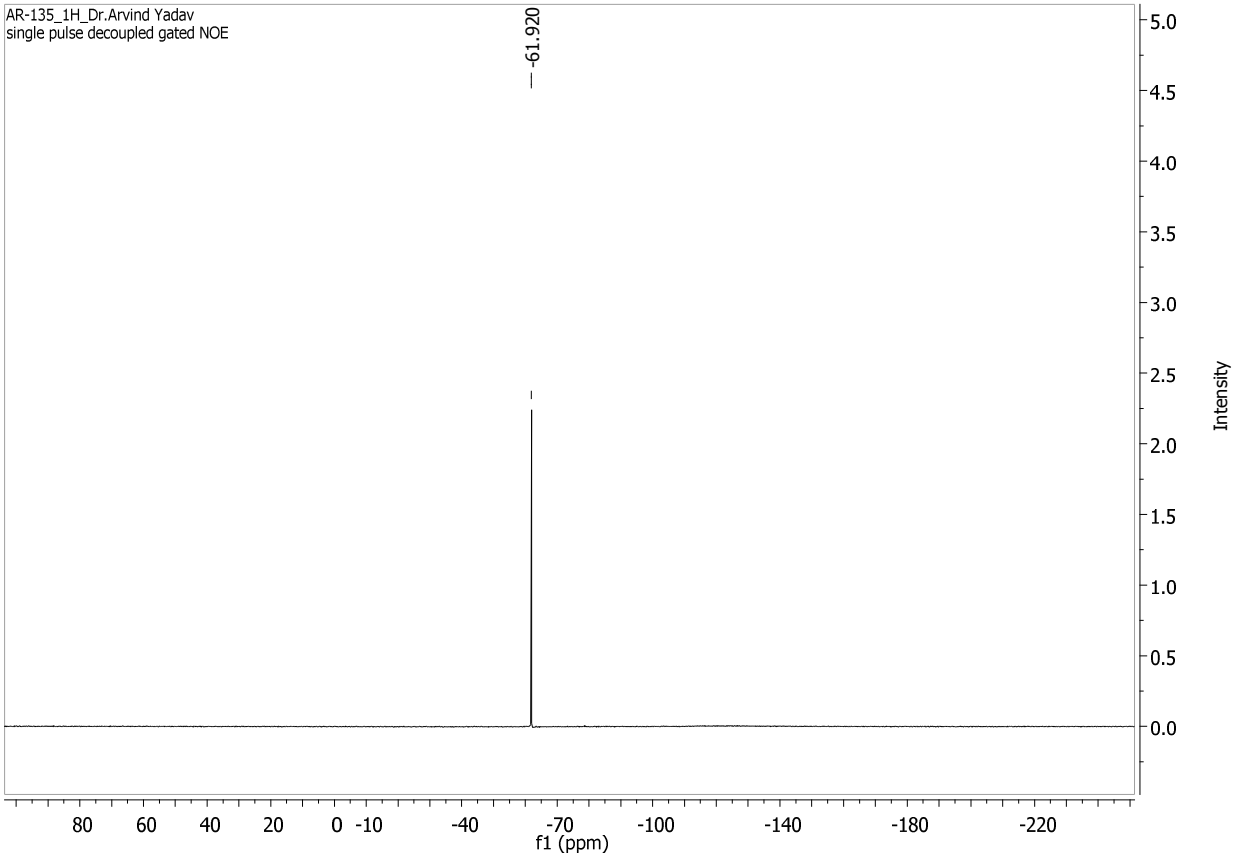
Compound 2a. ^{13}C NMR Spectrum ($CDCl_3$).



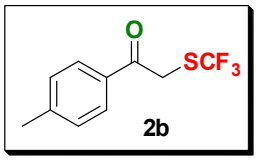


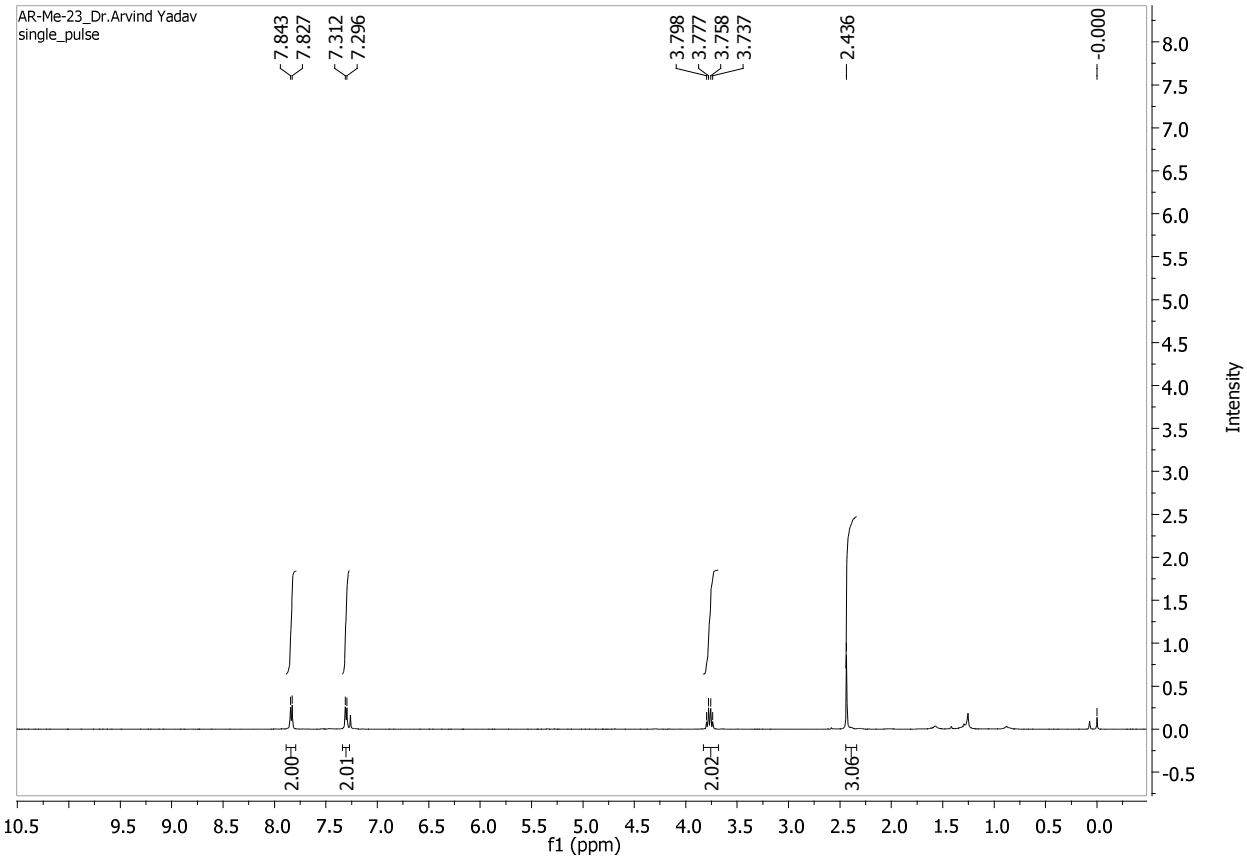
Compound 2a. ^{19}F NMR Spectrum ($CDCl_3$).



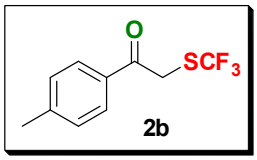


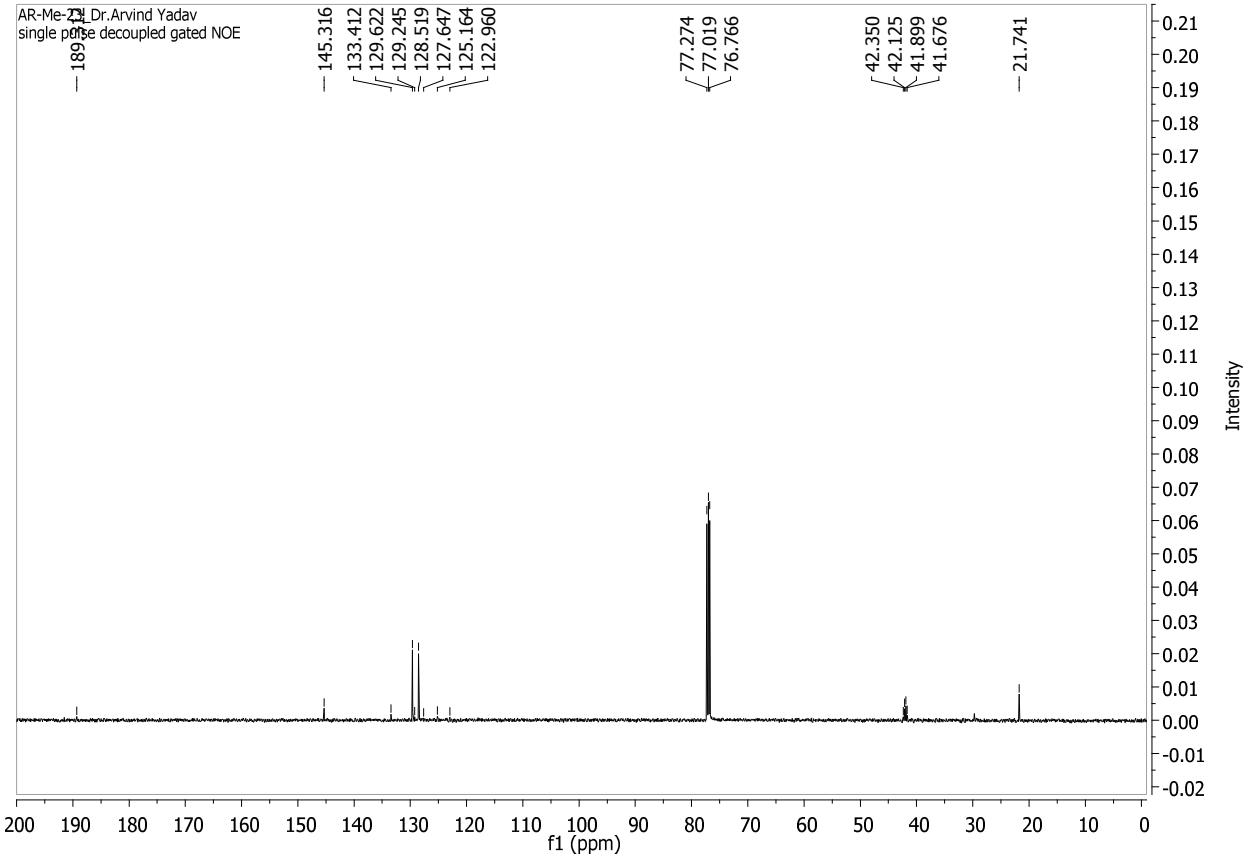
Compound 2b. ^{1}H NMR Spectrum ($CDCl_3$).



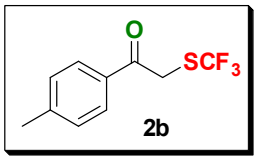


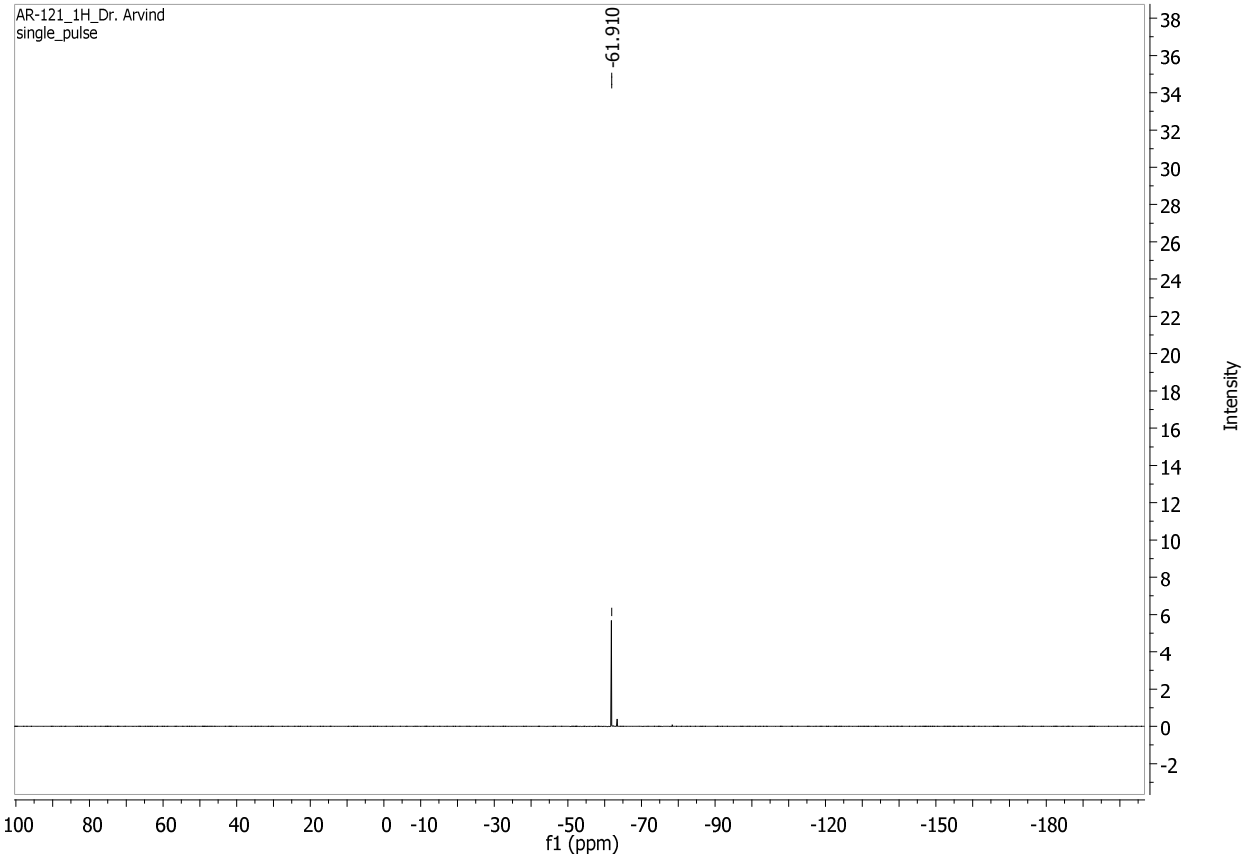
Compound 2b. ^{13}C NMR Spectrum ($CDCl_3$).



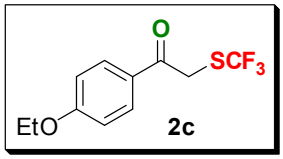


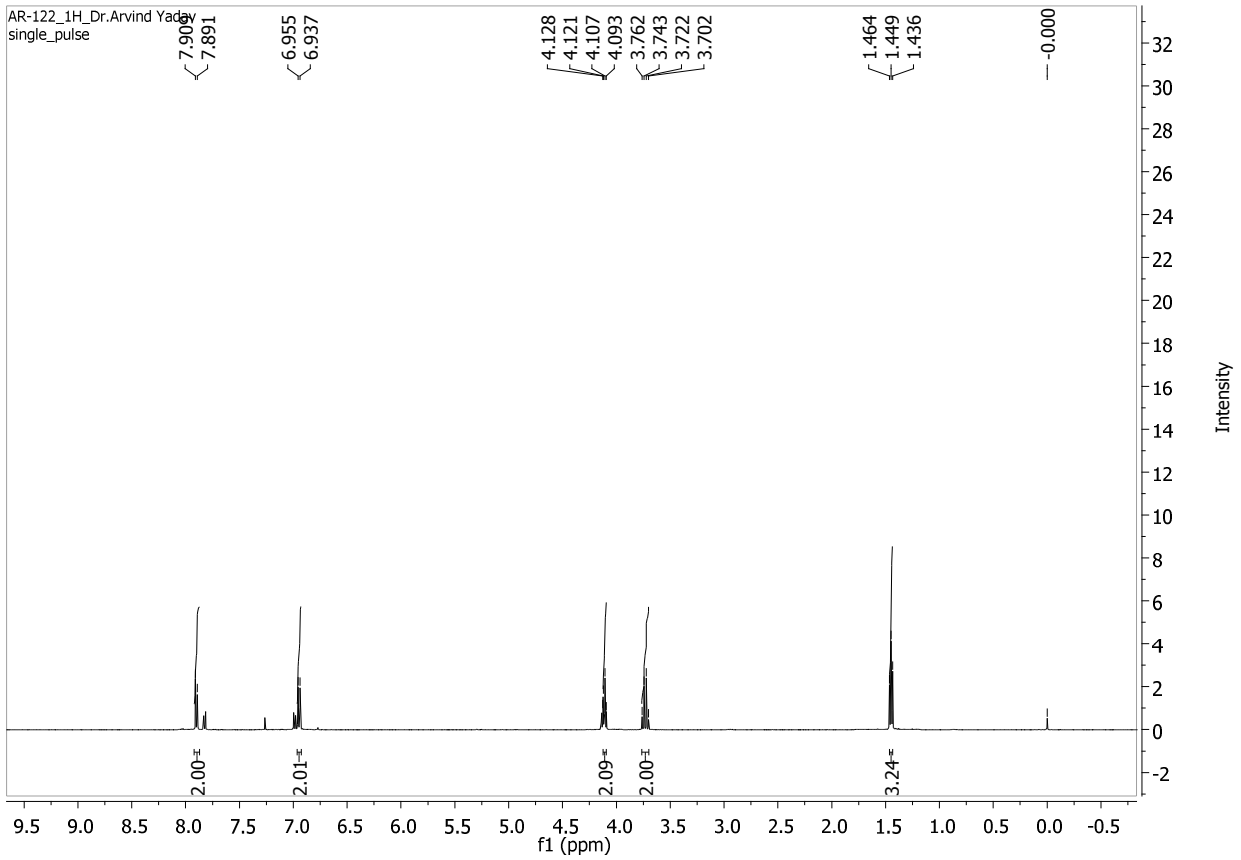
Compound 2b. ^{13}F NMR Spectrum ($CDCl_3$).



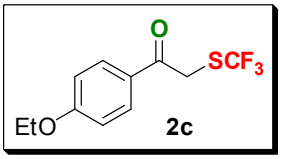


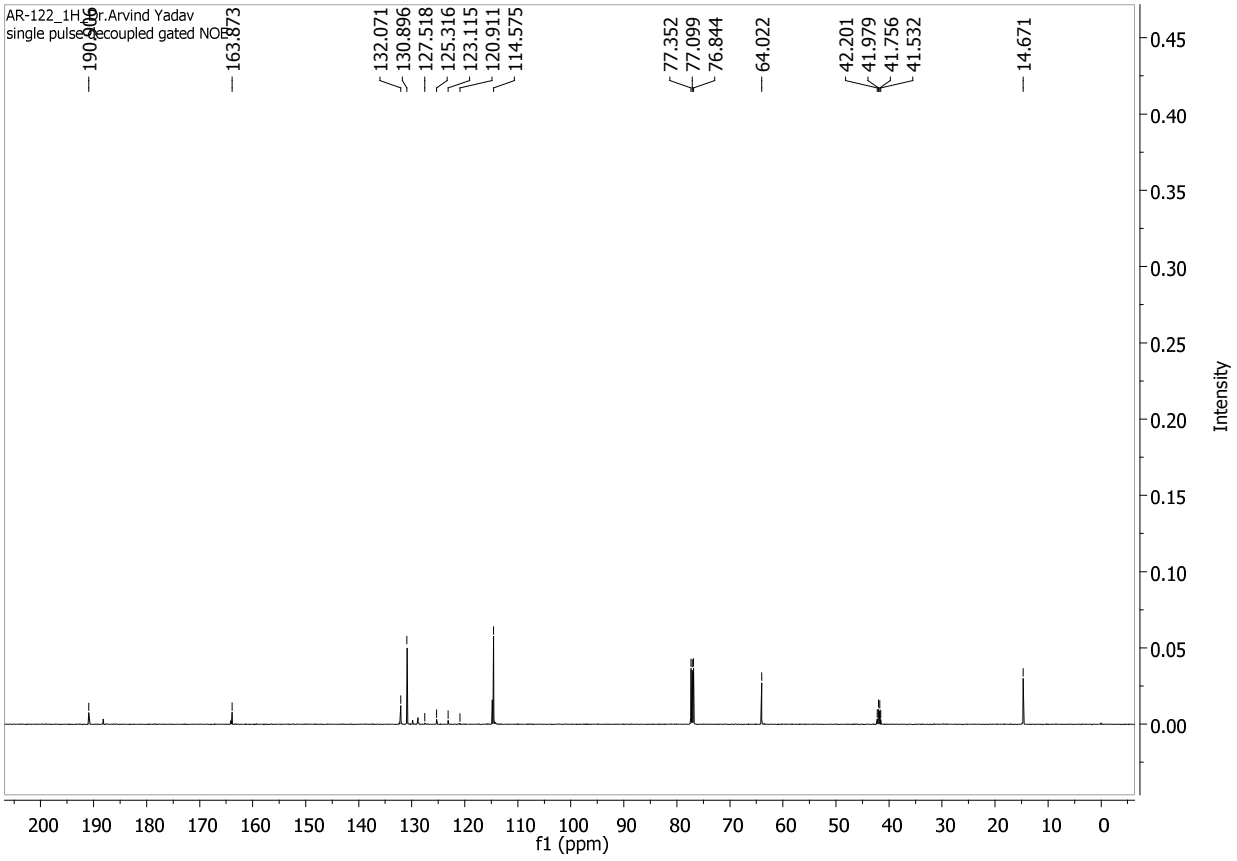
Compound 2c. ^{1}H NMR Spectrum ($CDCl_3$).



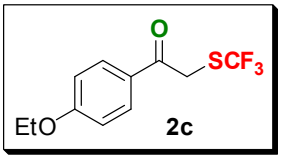


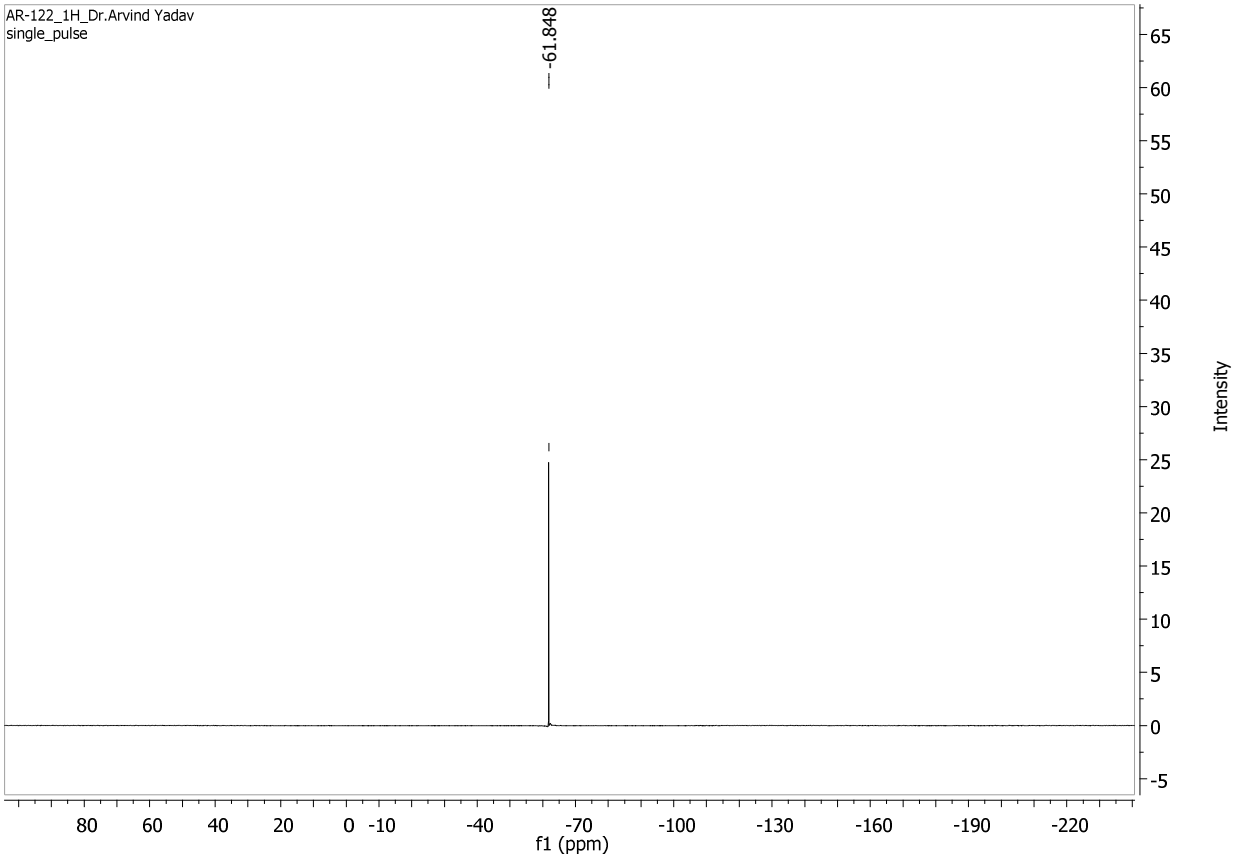
Compound 2c. ^{13}C NMR Spectrum ($CDCl_3$).



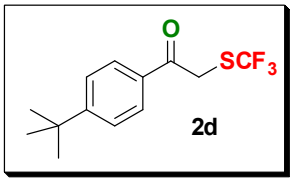


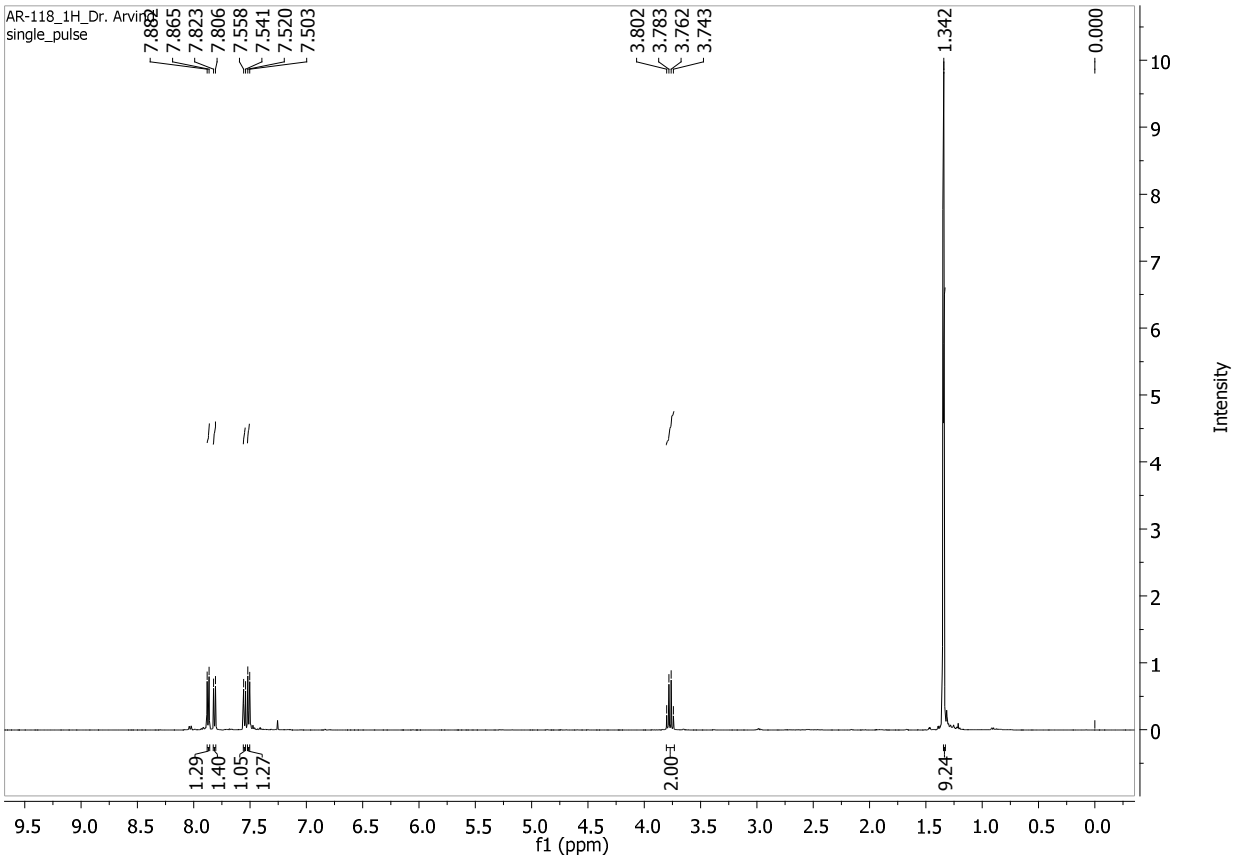
Compound 2c. ^{19}F NMR Spectrum ($CDCl_3$).



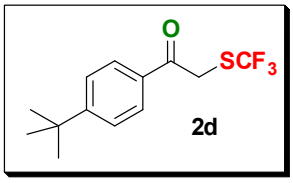


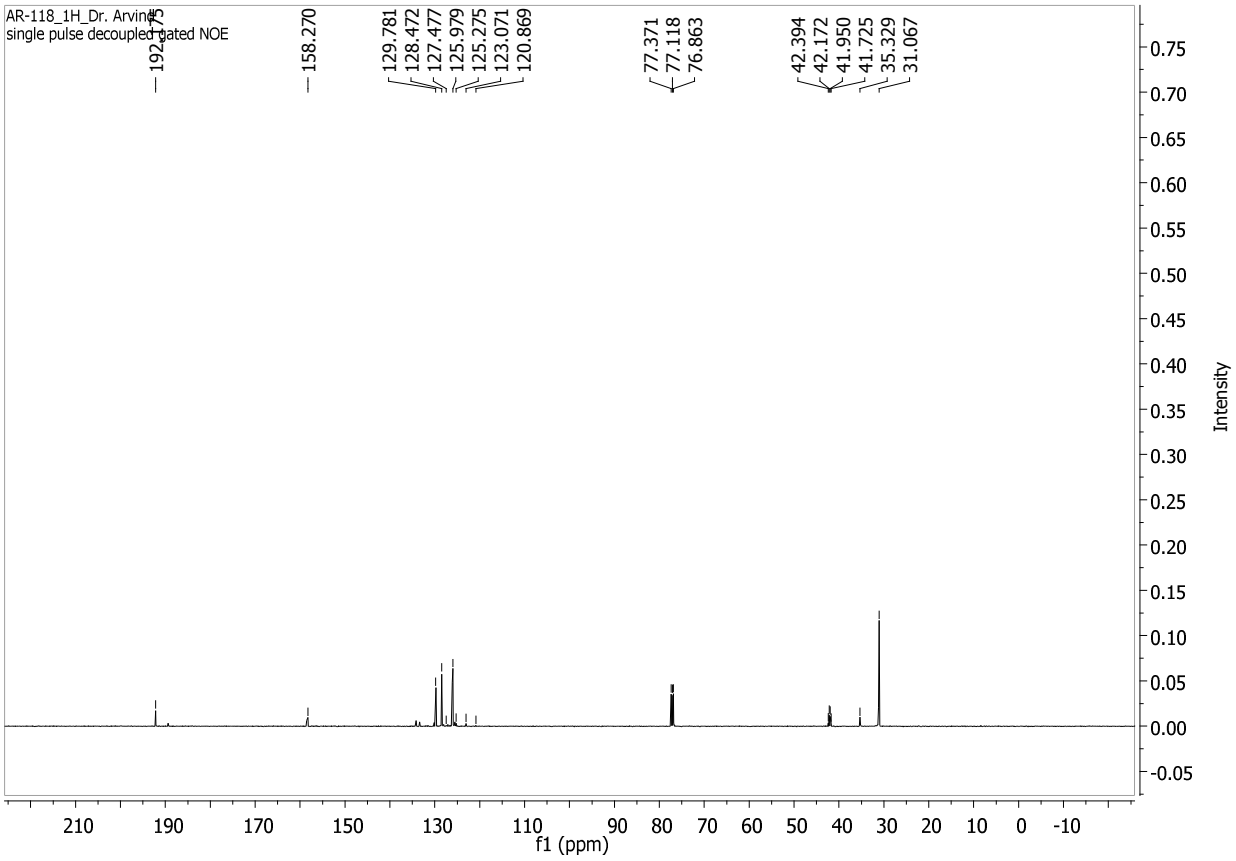
Compound 2d. ^{1}H NMR Spectrum ($CDCl_3$).



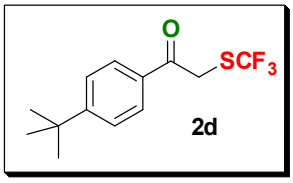


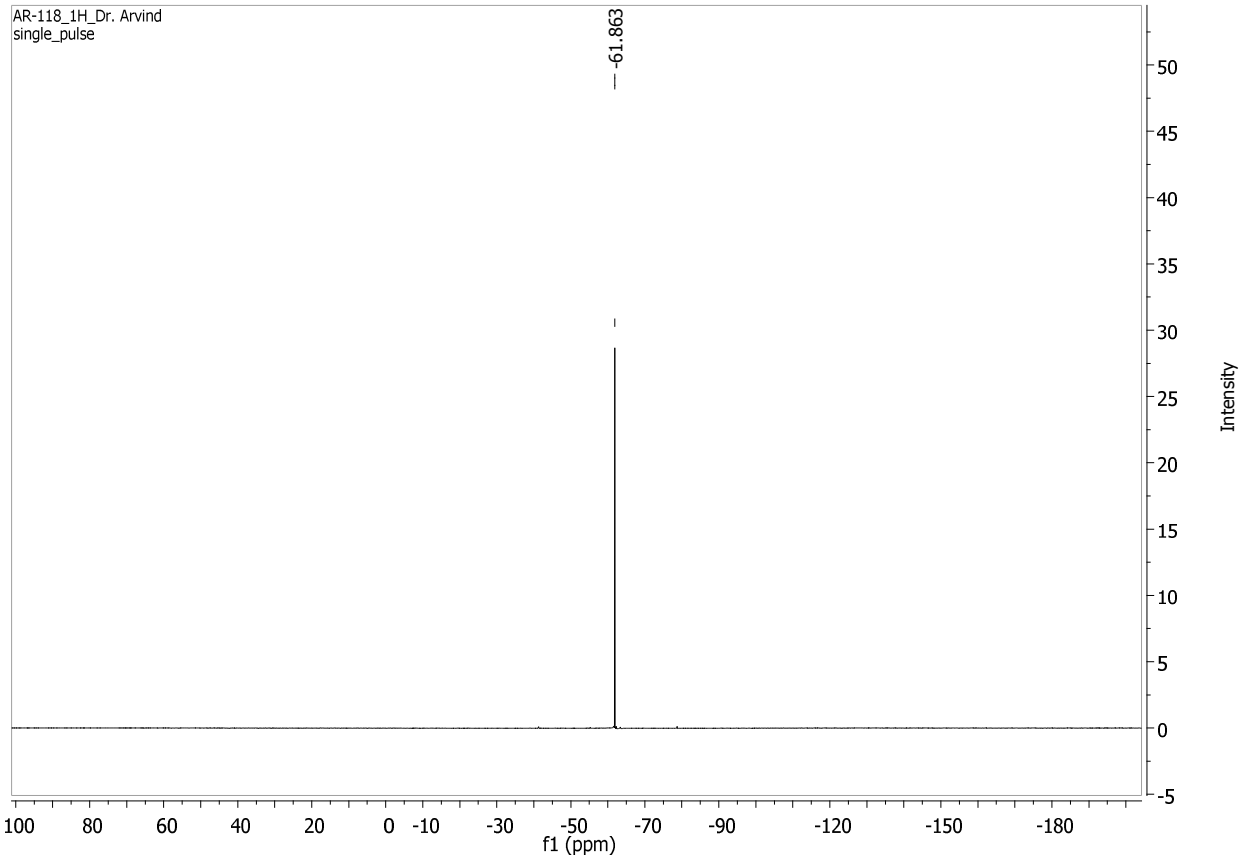
Compound 2d. ^{13}C NMR Spectrum ($CDCl_3$).



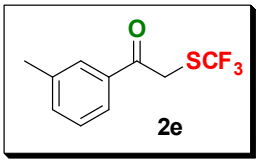


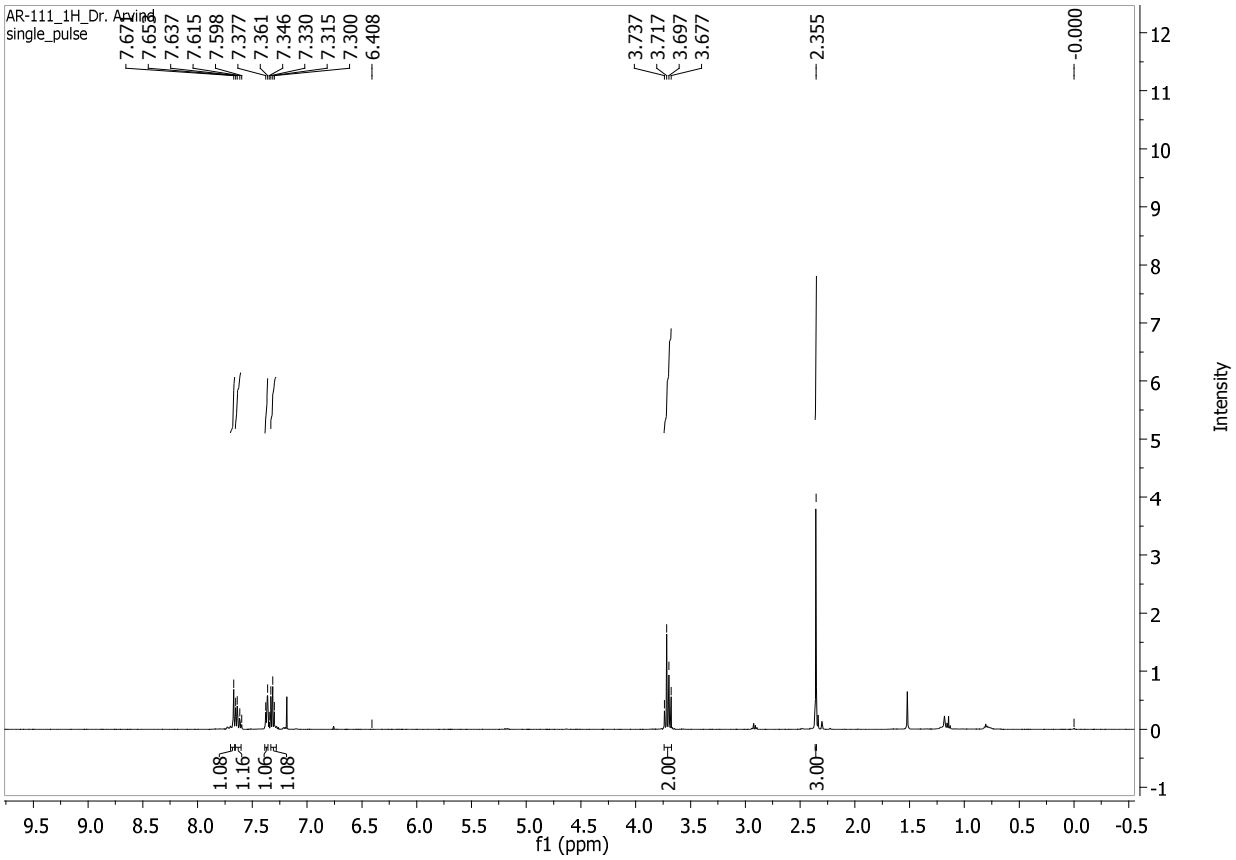
Compound 2d. ^{19}F NMR Spectrum ($CDCl_3$).



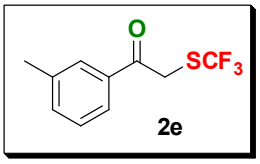


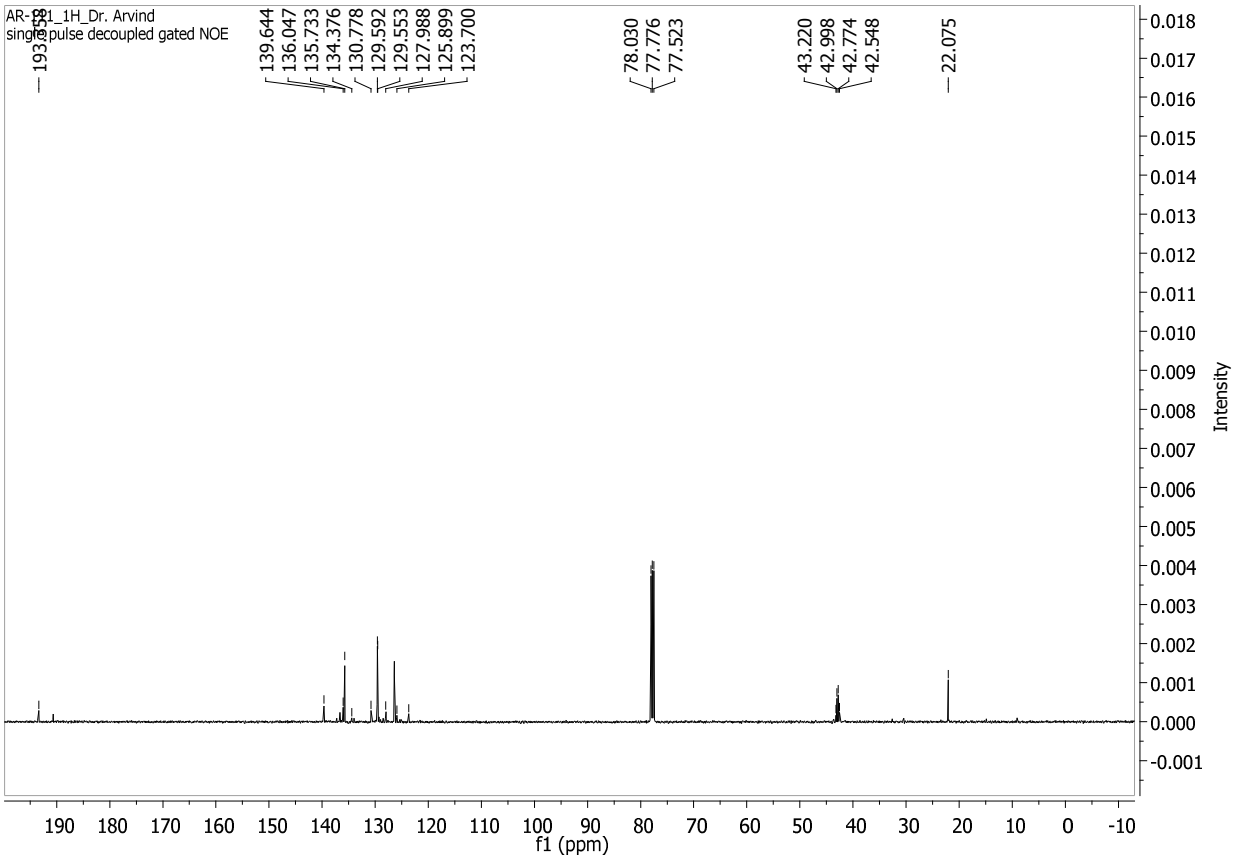
Compound 2e. ^{1}H NMR Spectrum ($CDCl_3$).



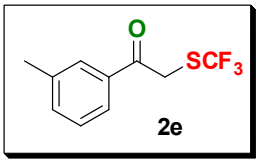


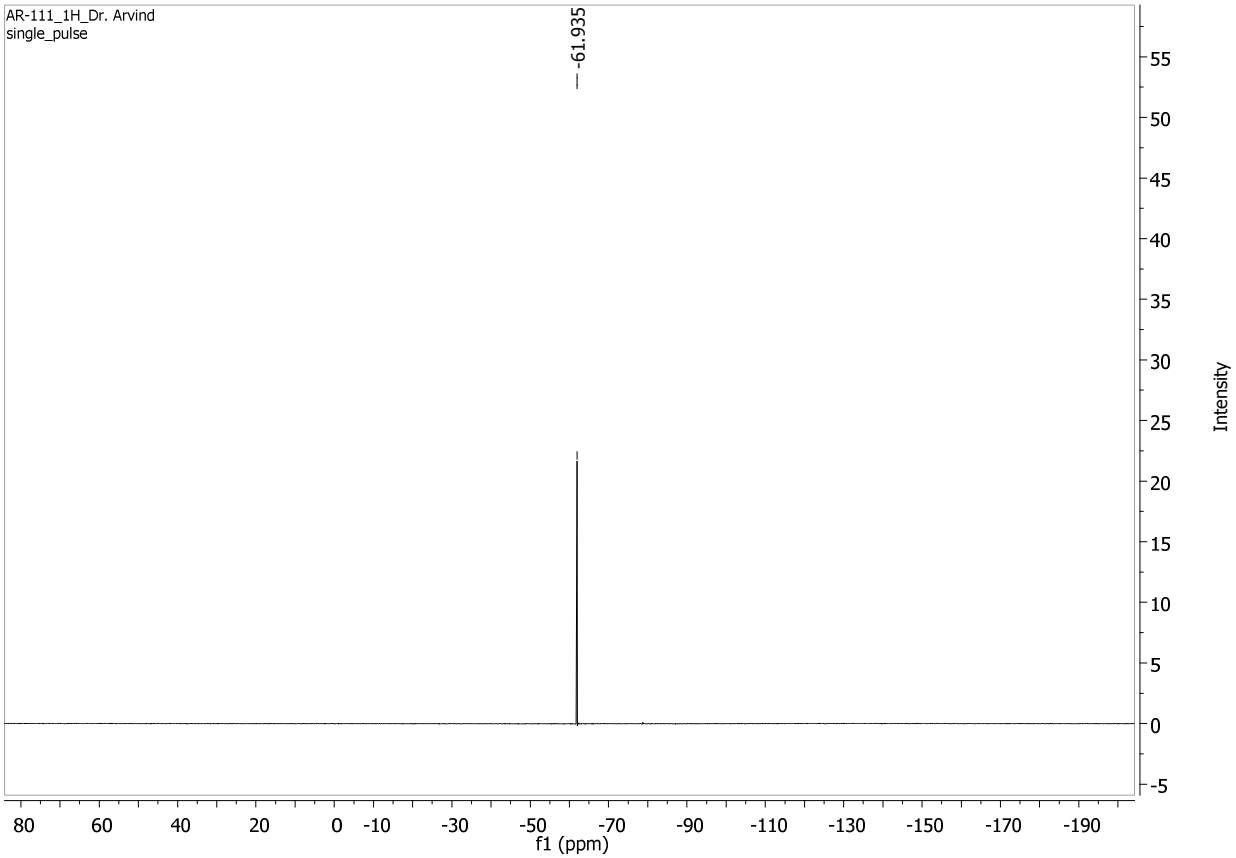
Compound 2e. ^{13}C NMR Spectrum ($CDCl_3$).



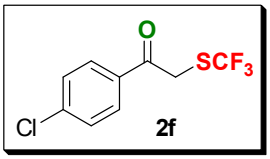


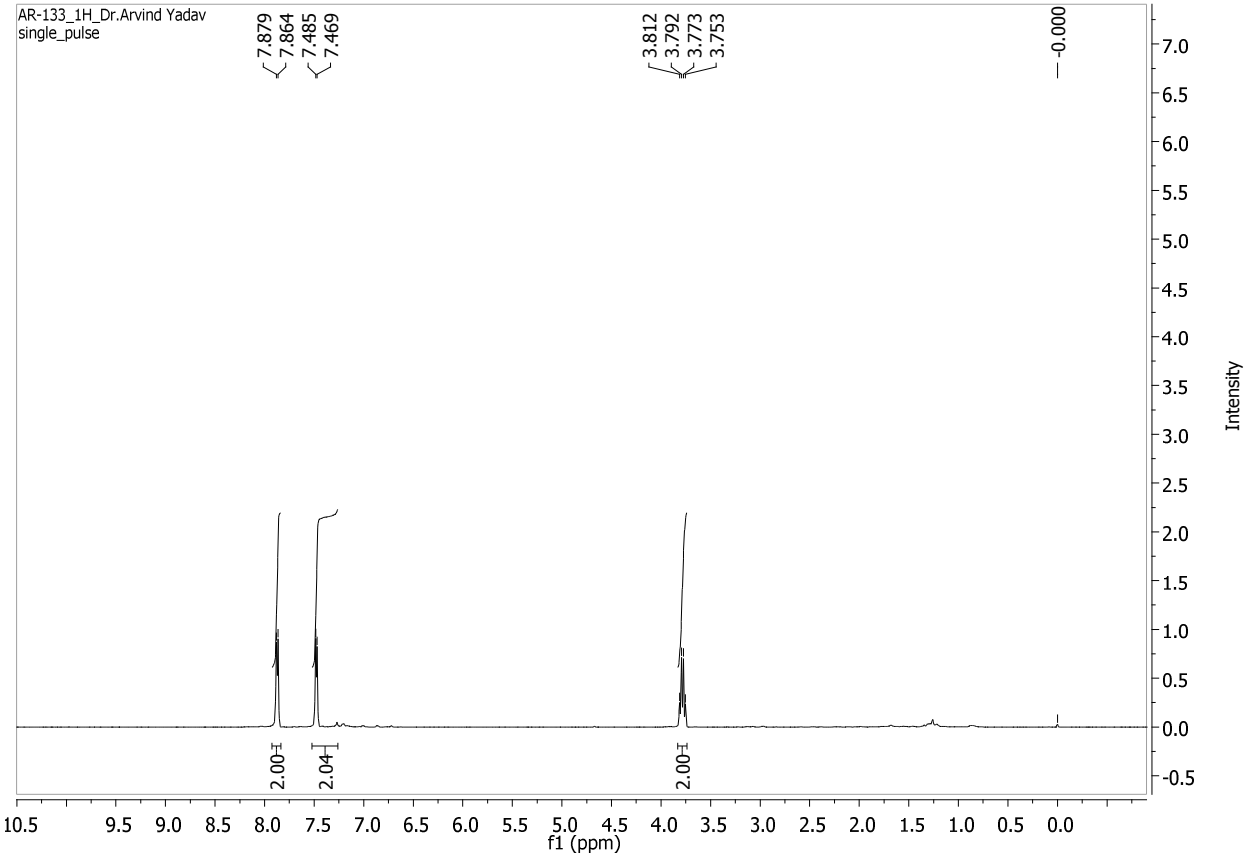
Compound 2e. ^{19}F NMR Spectrum ($CDCl_3$).



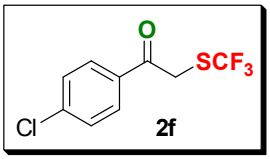


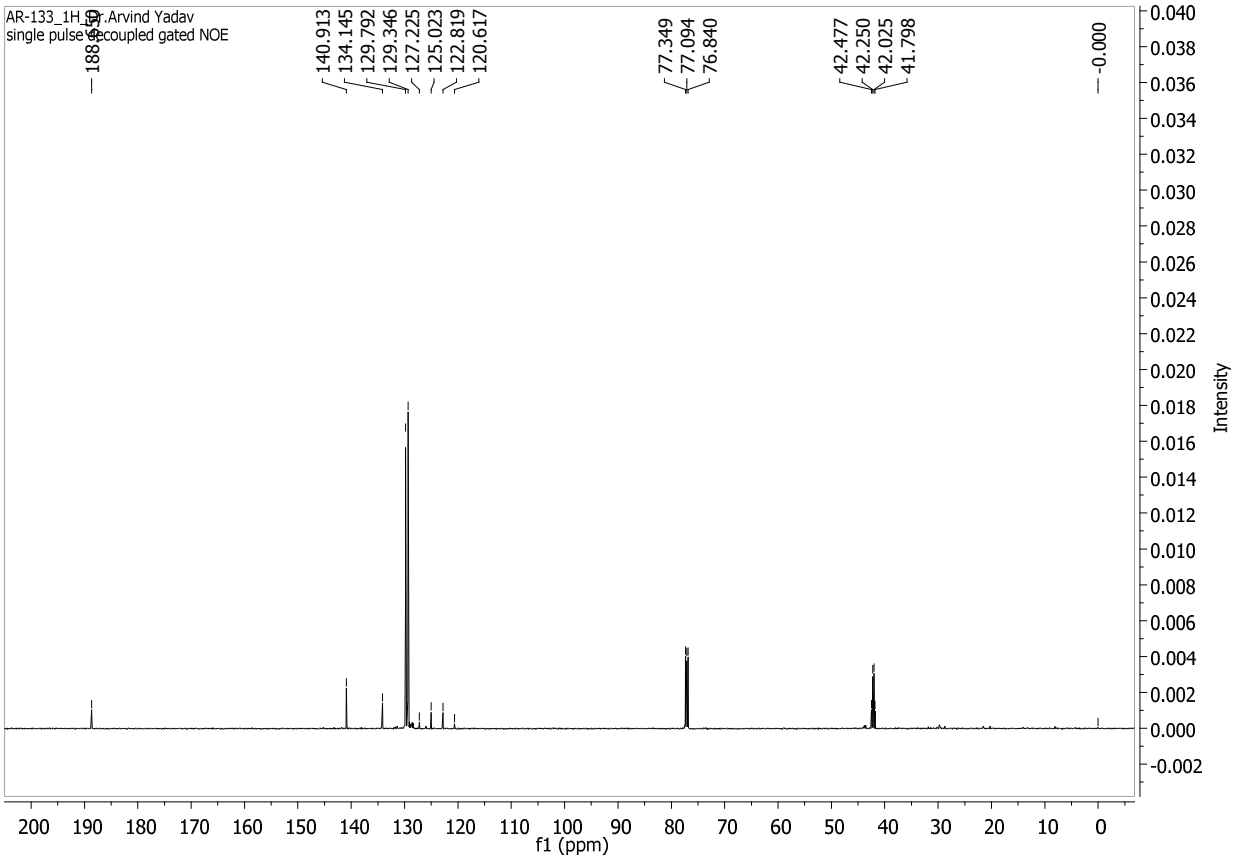
Compound 2f. ^{1}H NMR Spectrum ($CDCl_3$).



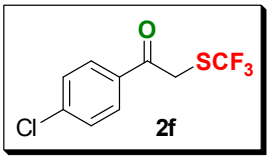


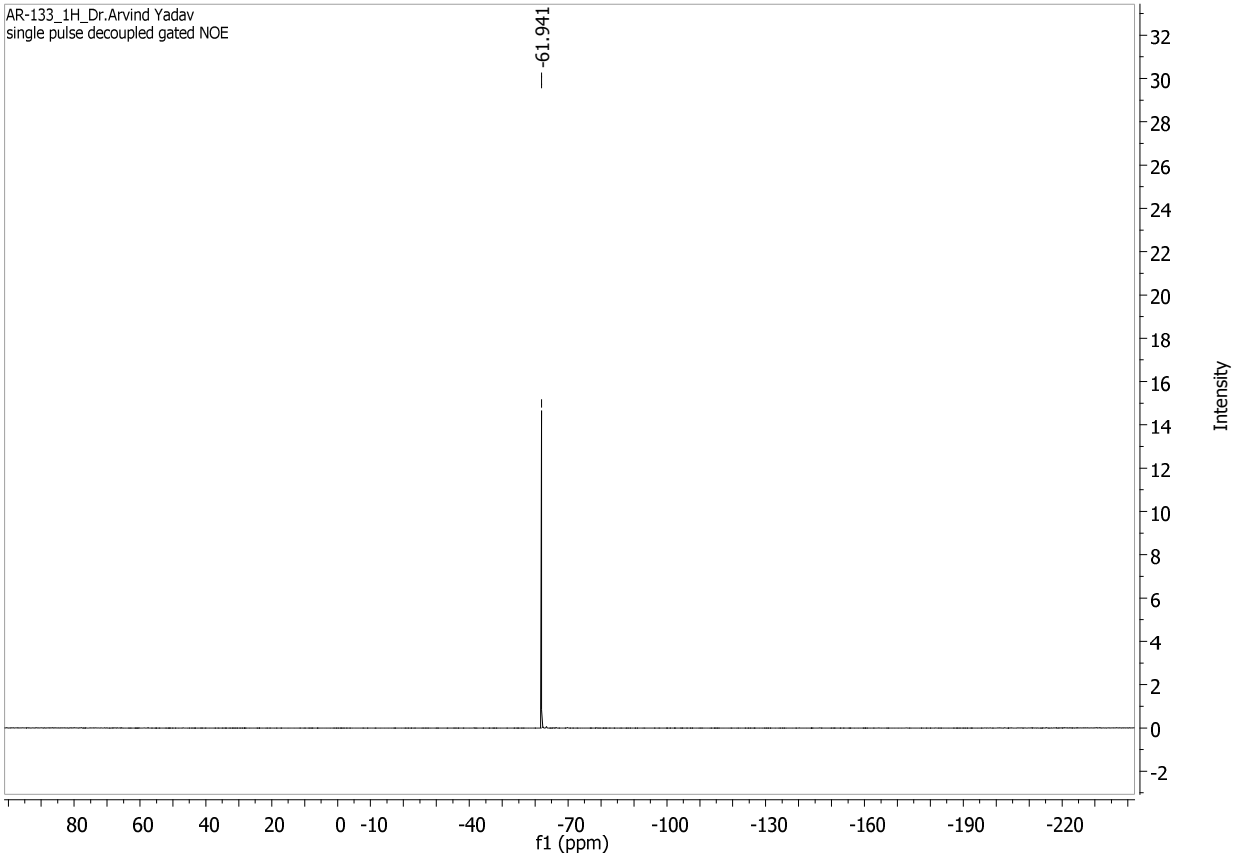
Compound 2f. ^{13}C NMR Spectrum ($CDCl_3$).



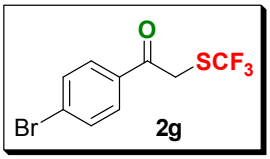


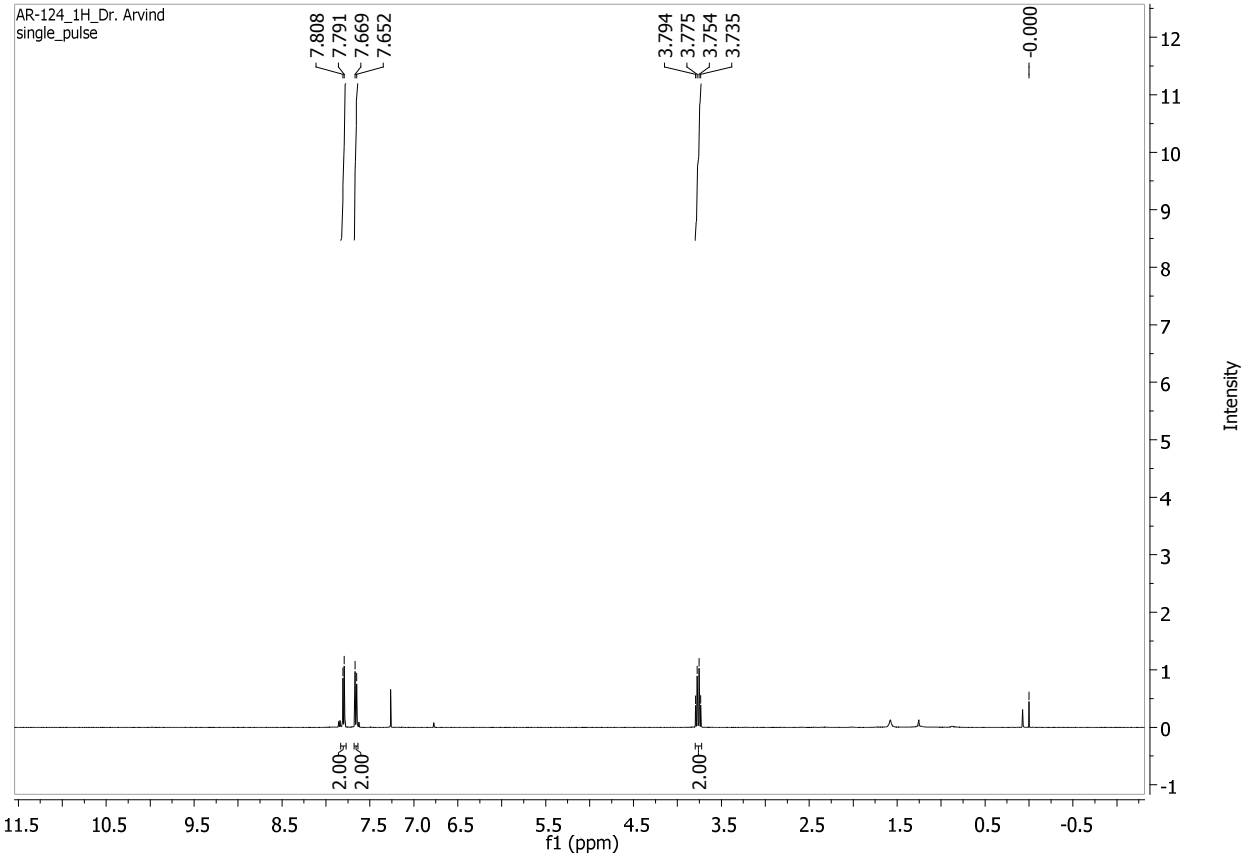
Compound 2f. ^{19}F NMR Spectrum ($CDCl_3$).



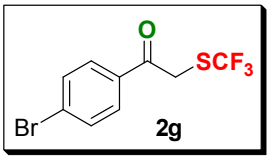


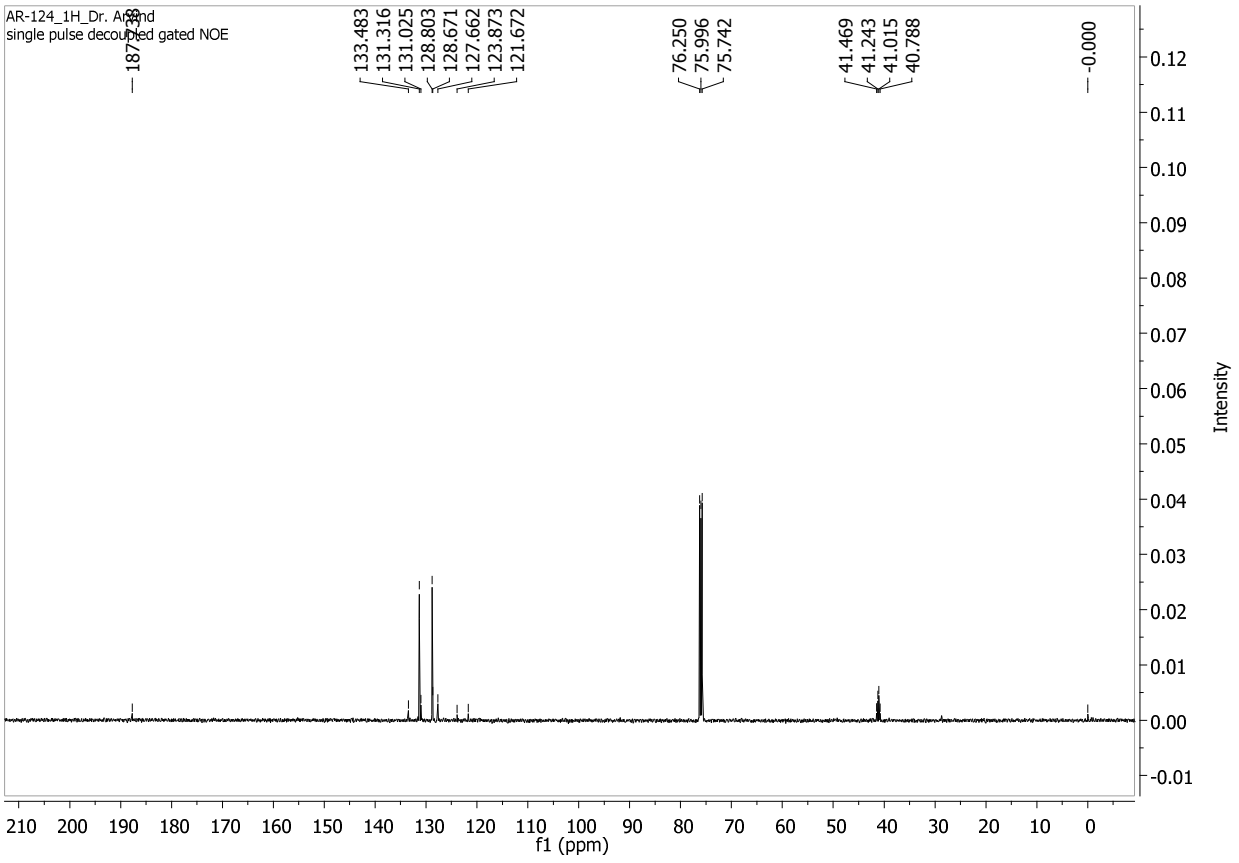
Compound 2g. ^{1}H NMR Spectrum ($CDCl_3$).



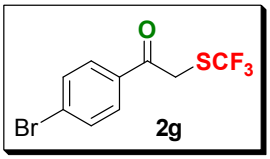


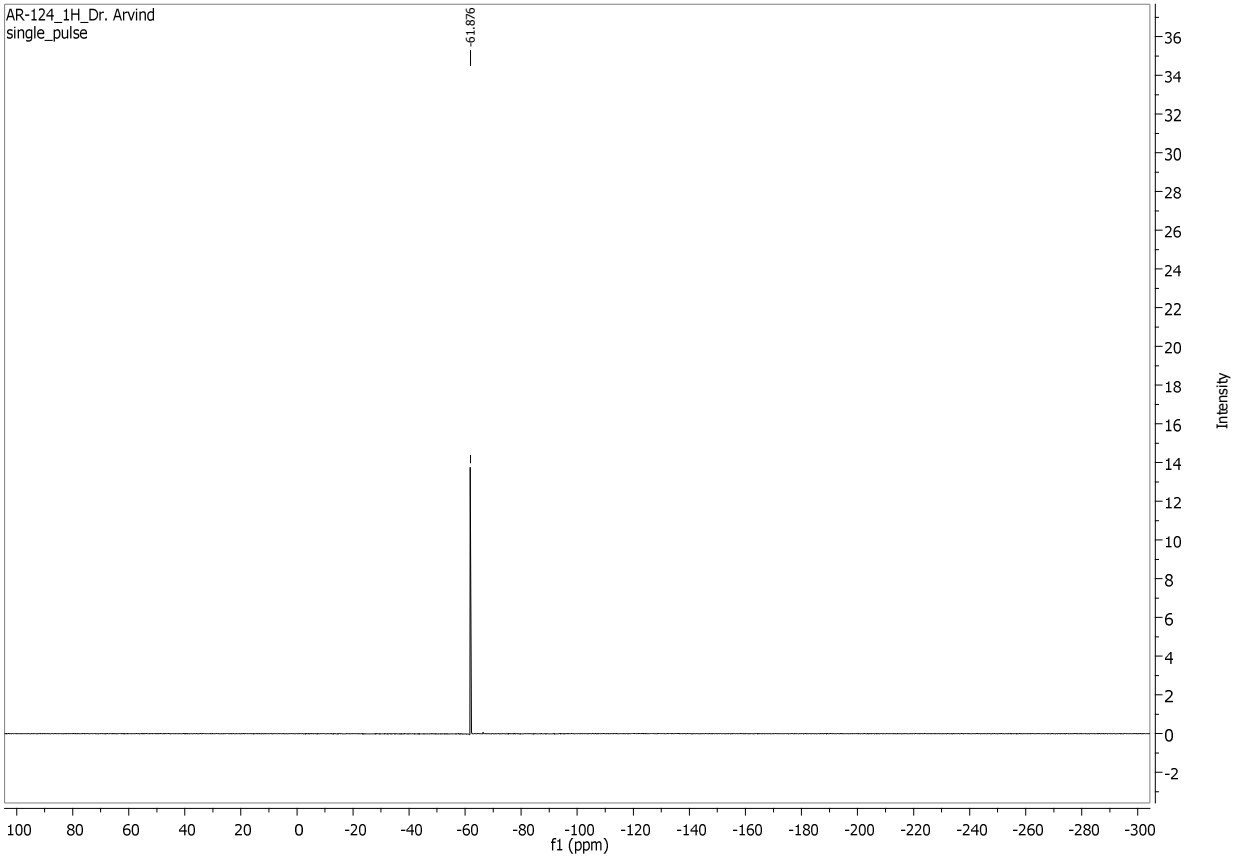
Compound 2g. ^{13}C NMR Spectrum ($CDCl_3$).



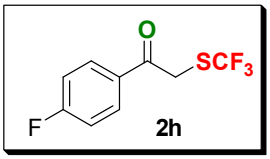


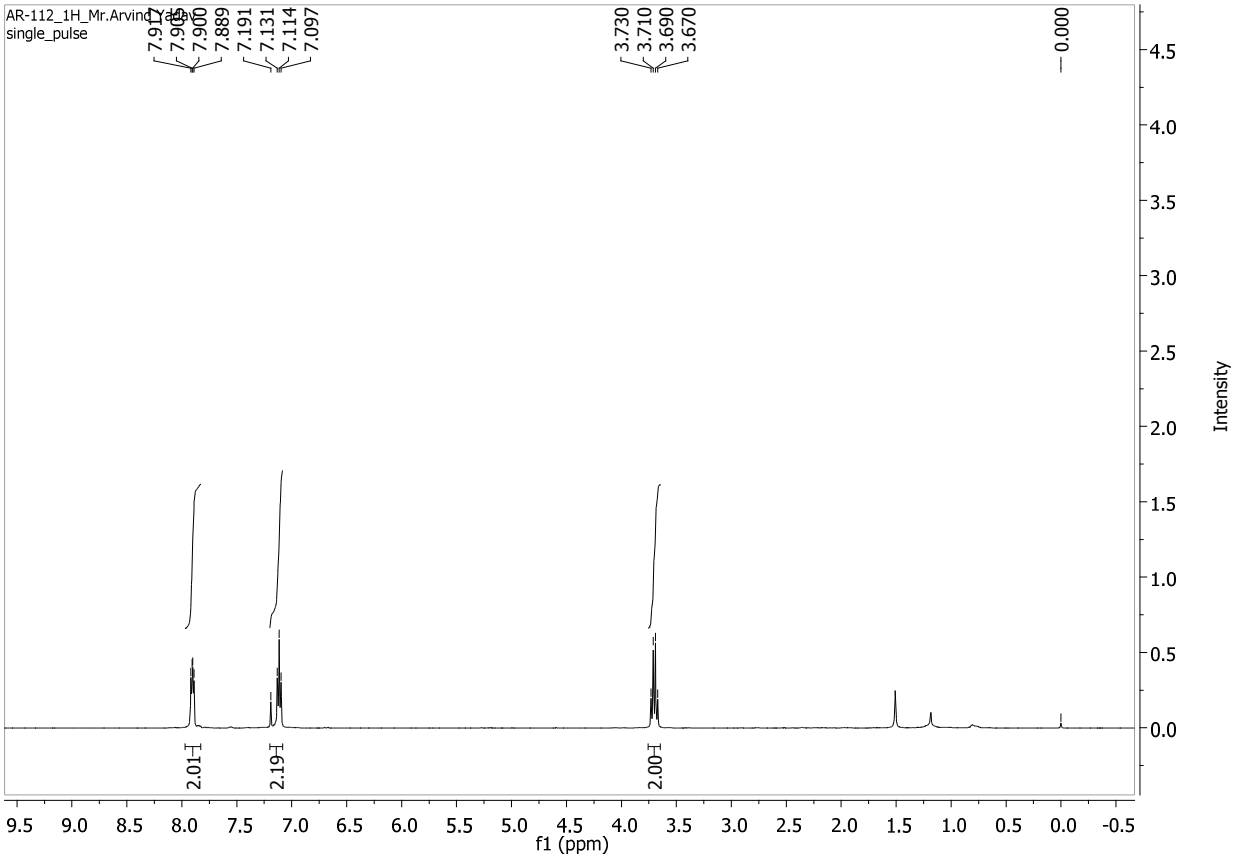
Compound 2g. ^{19}F NMR Spectrum ($CDCl_3$).



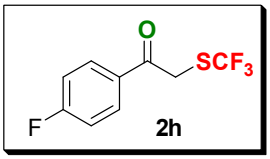


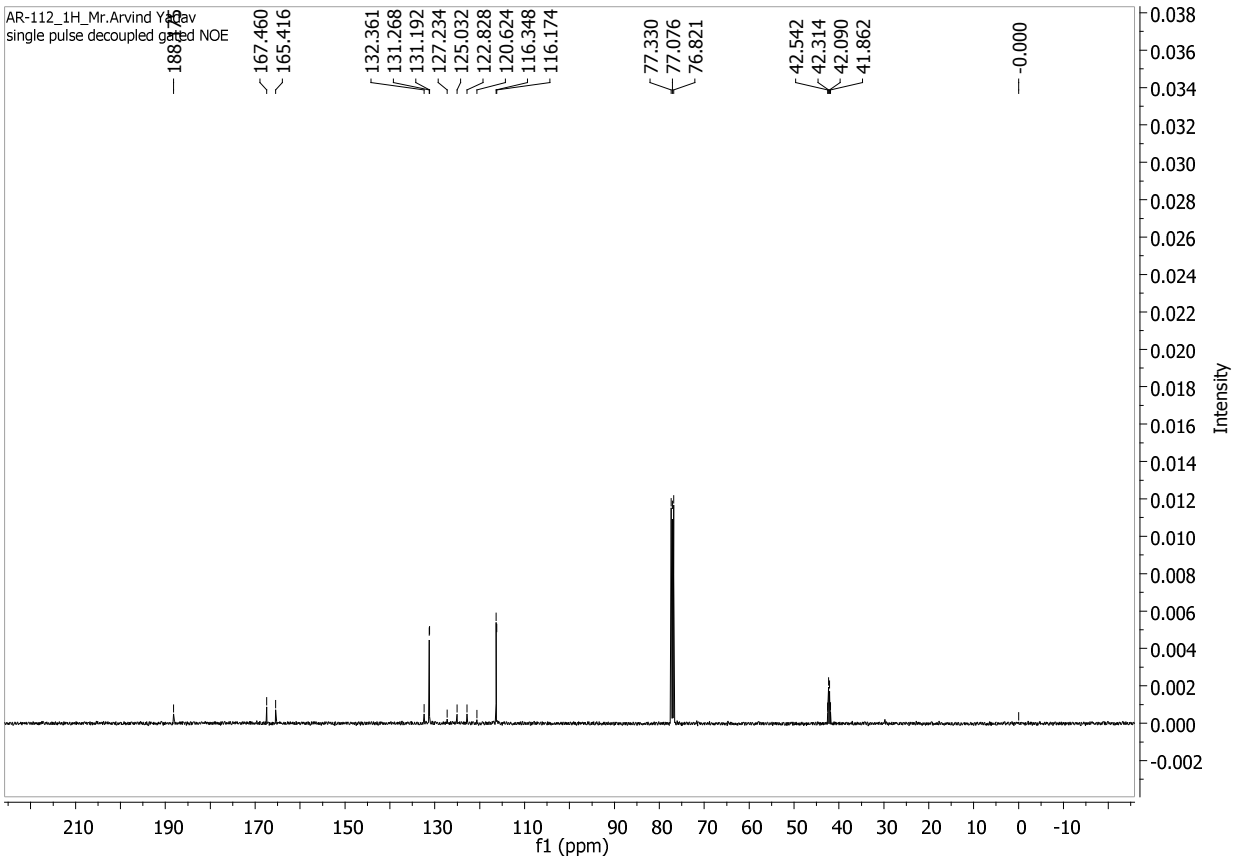
Compound 2h. ^{1}H NMR Spectrum ($CDCl_3$).



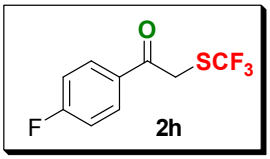


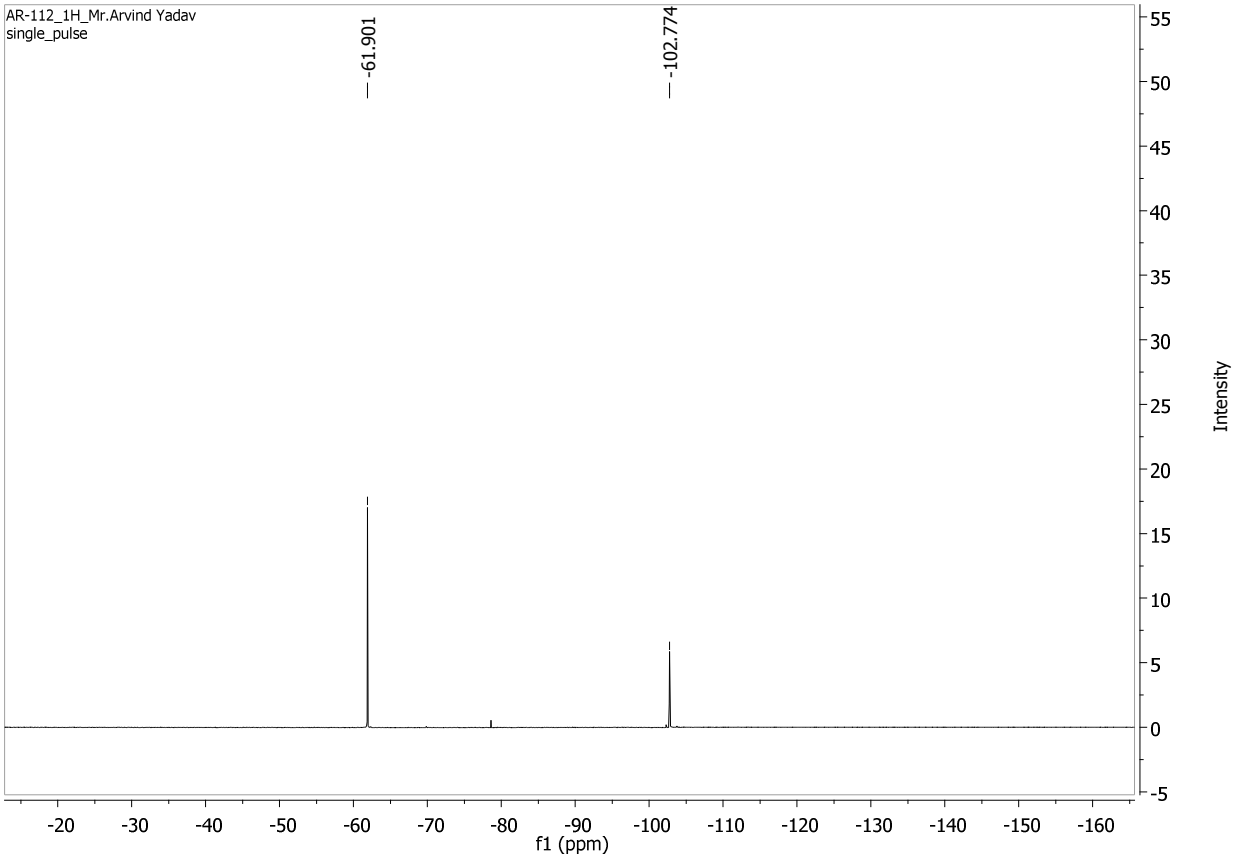
Compound 2h. ^{13}C NMR Spectrum ($CDCl_3$).



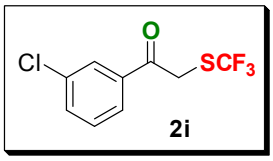


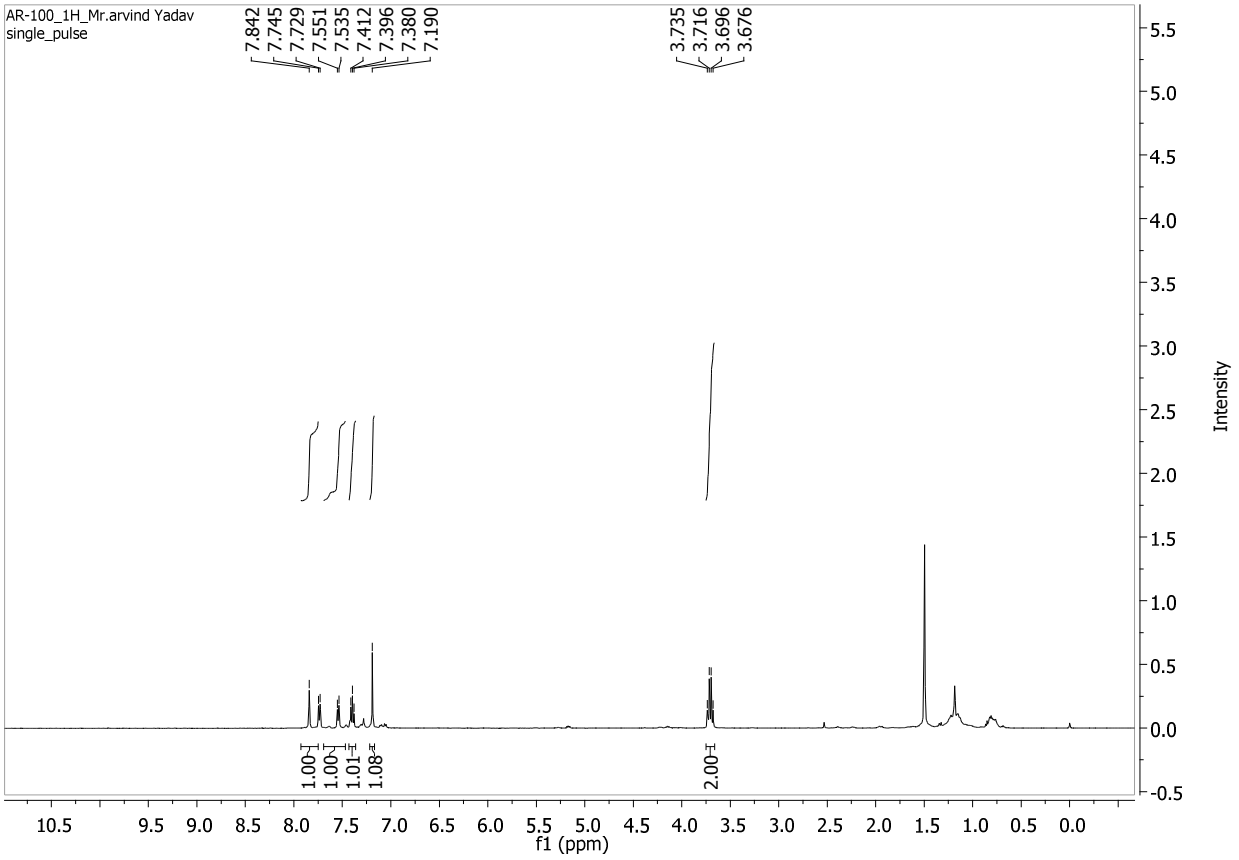
Compound 2h. ^{19}F NMR Spectrum ($CDCl_3$).



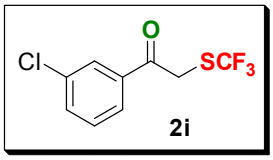


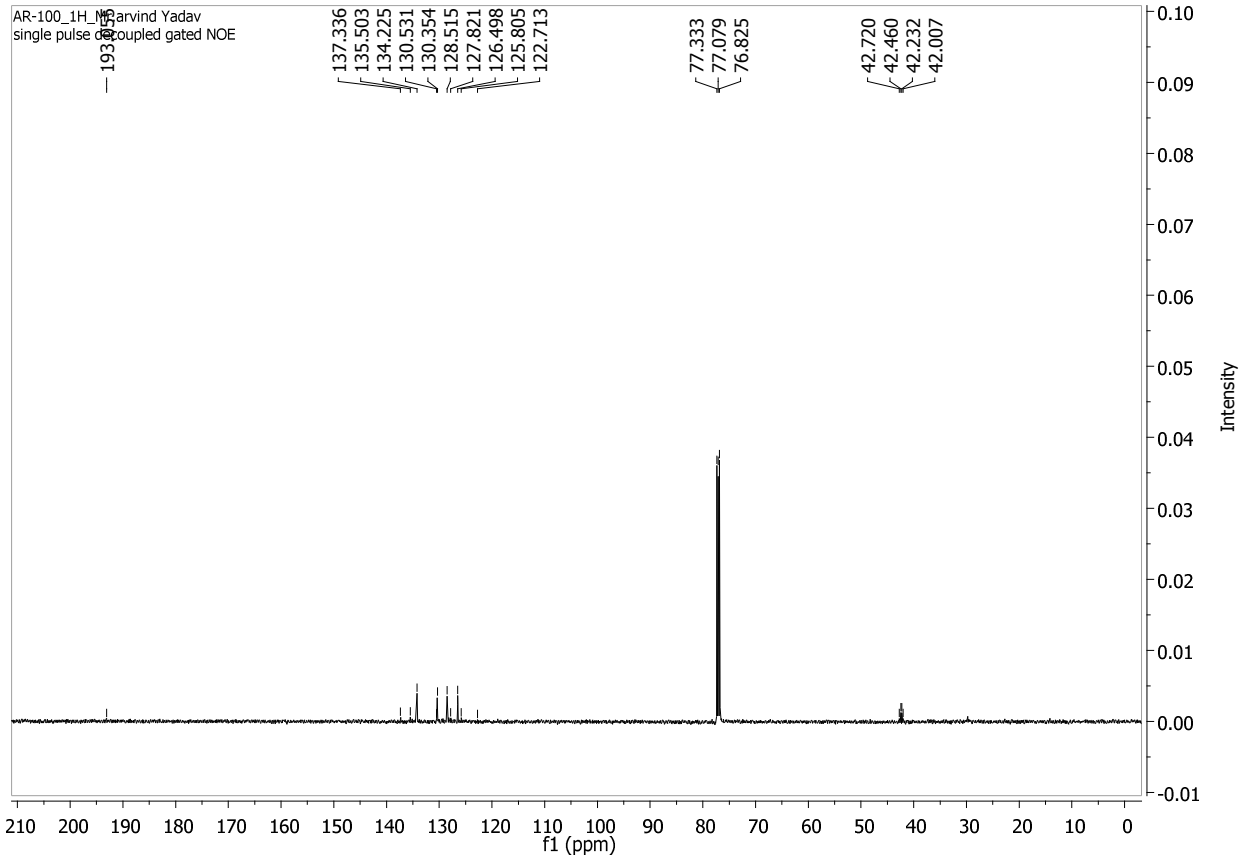
Compound 2i. ^{13}C NMR Spectrum ($CDCl_3$).



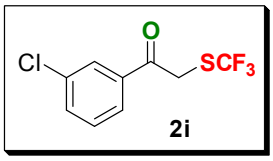


Compound 2i. ^{13}C NMR Spectrum ($CDCl_3$).

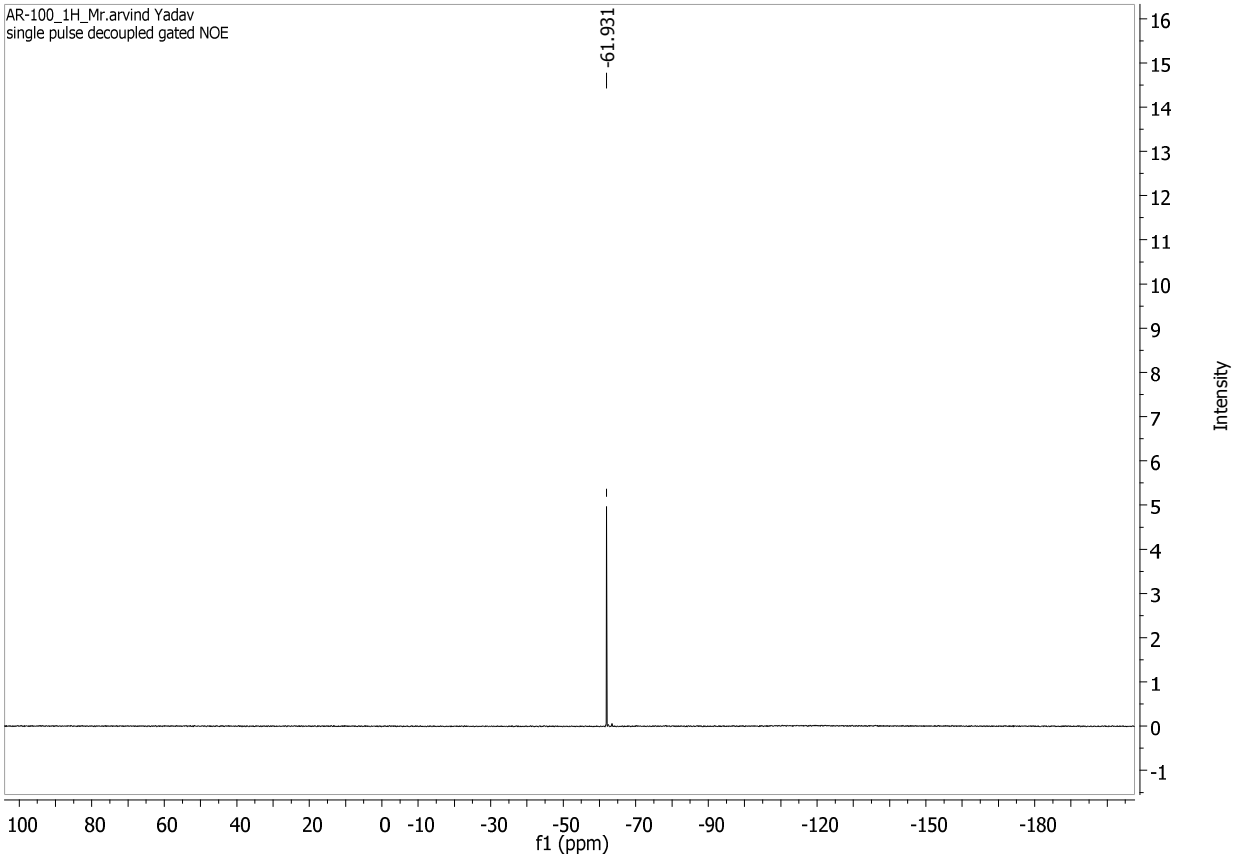




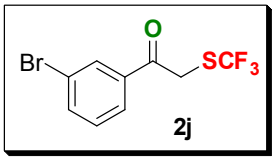
Compound 2i. ^{19}F NMR Spectrum ($CDCl_3$).

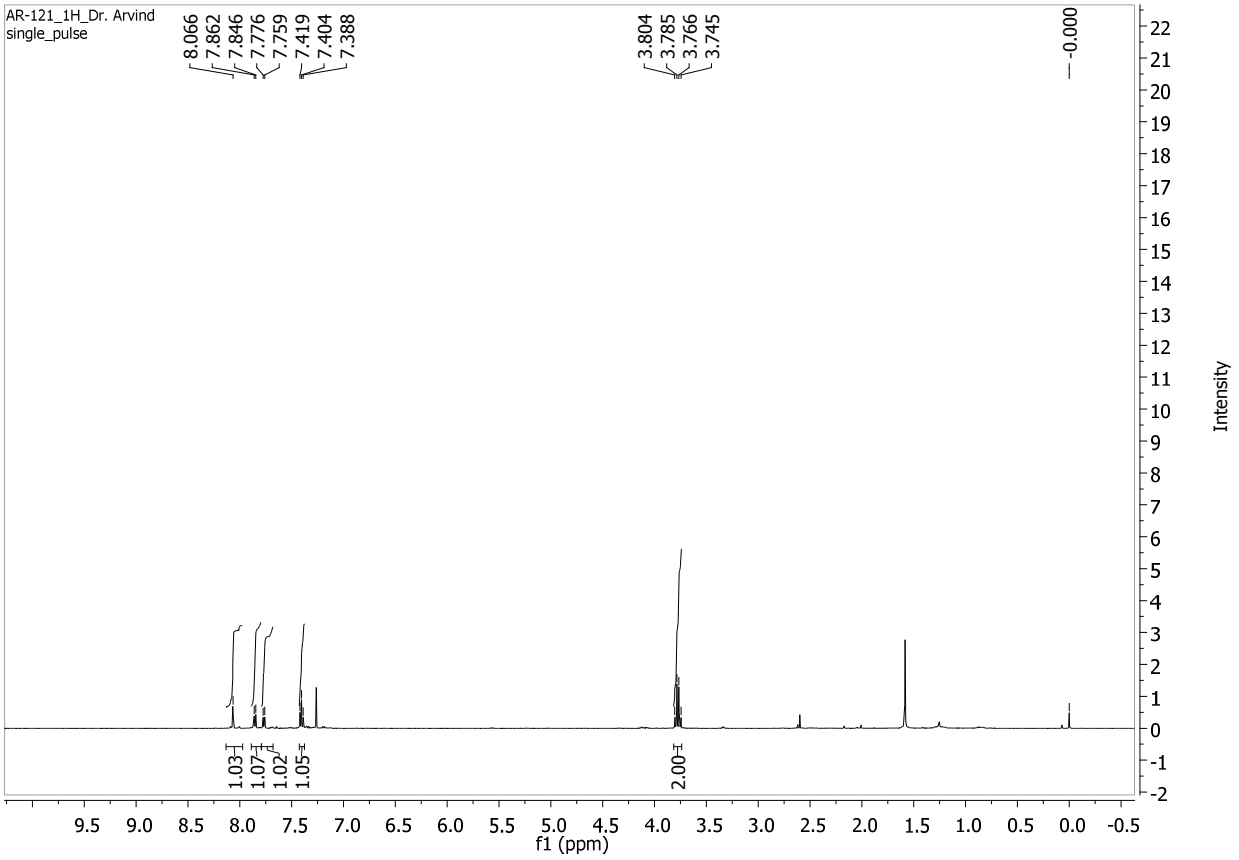


2i

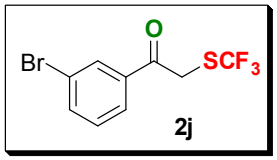


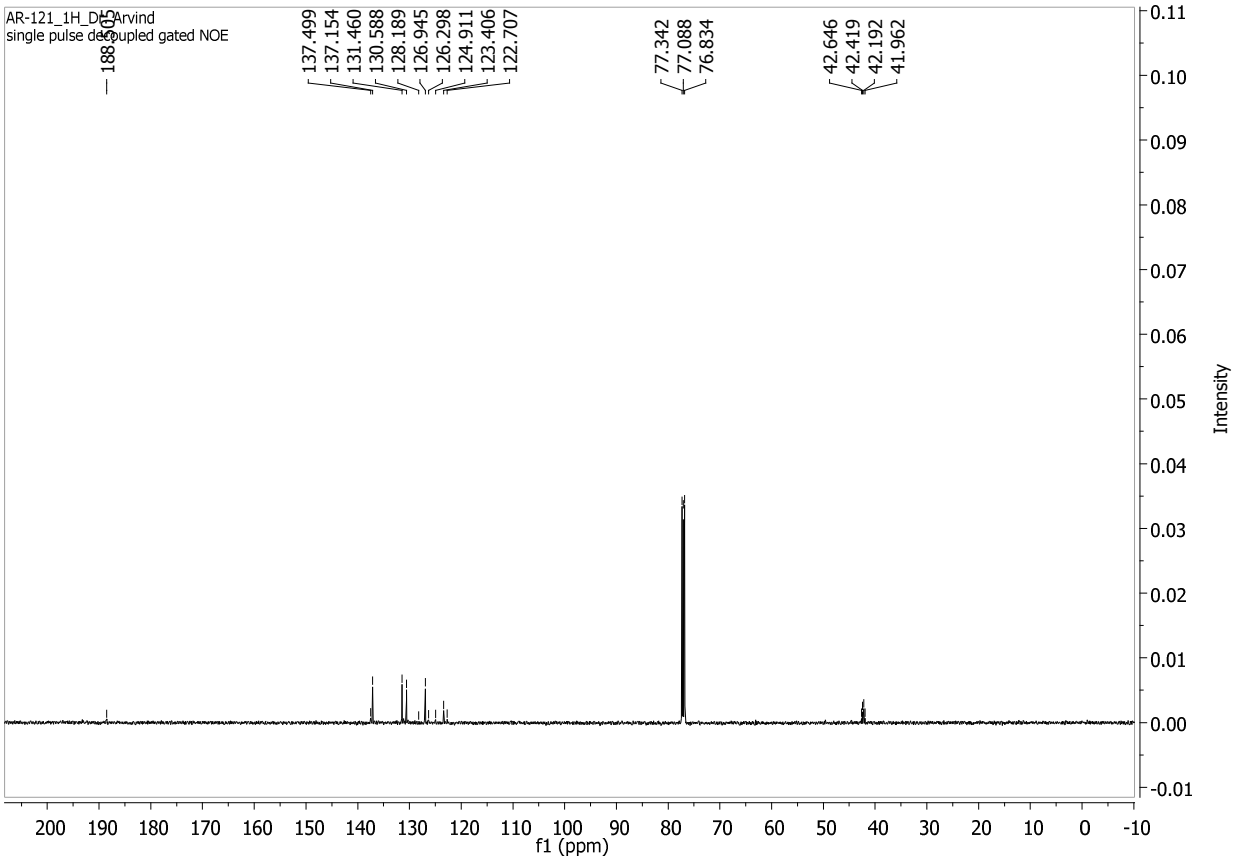
Compound 2j. ^{1}H NMR Spectrum ($CDCl_3$).



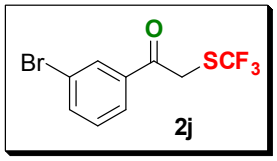


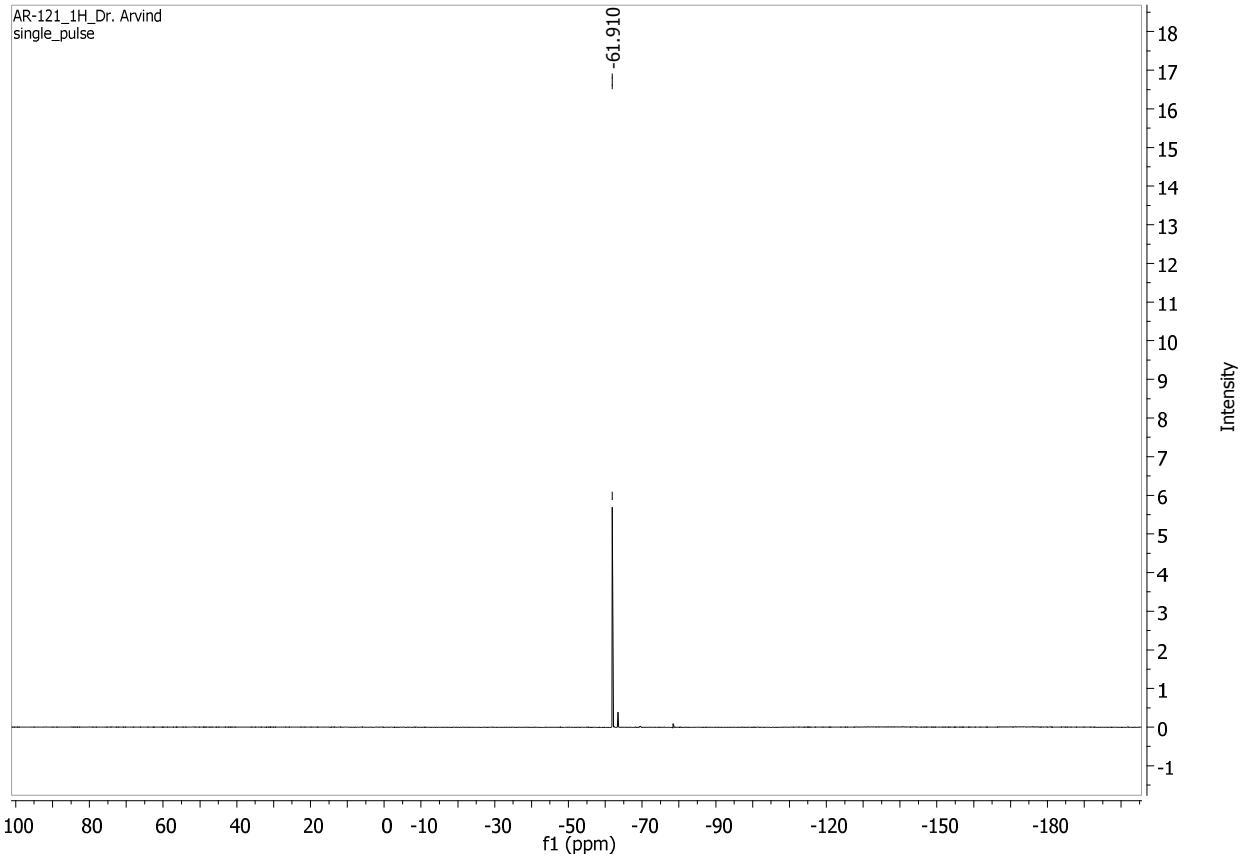
Compound 2j. ^{13}C NMR Spectrum ($CDCl_3$).



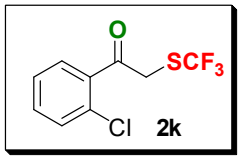


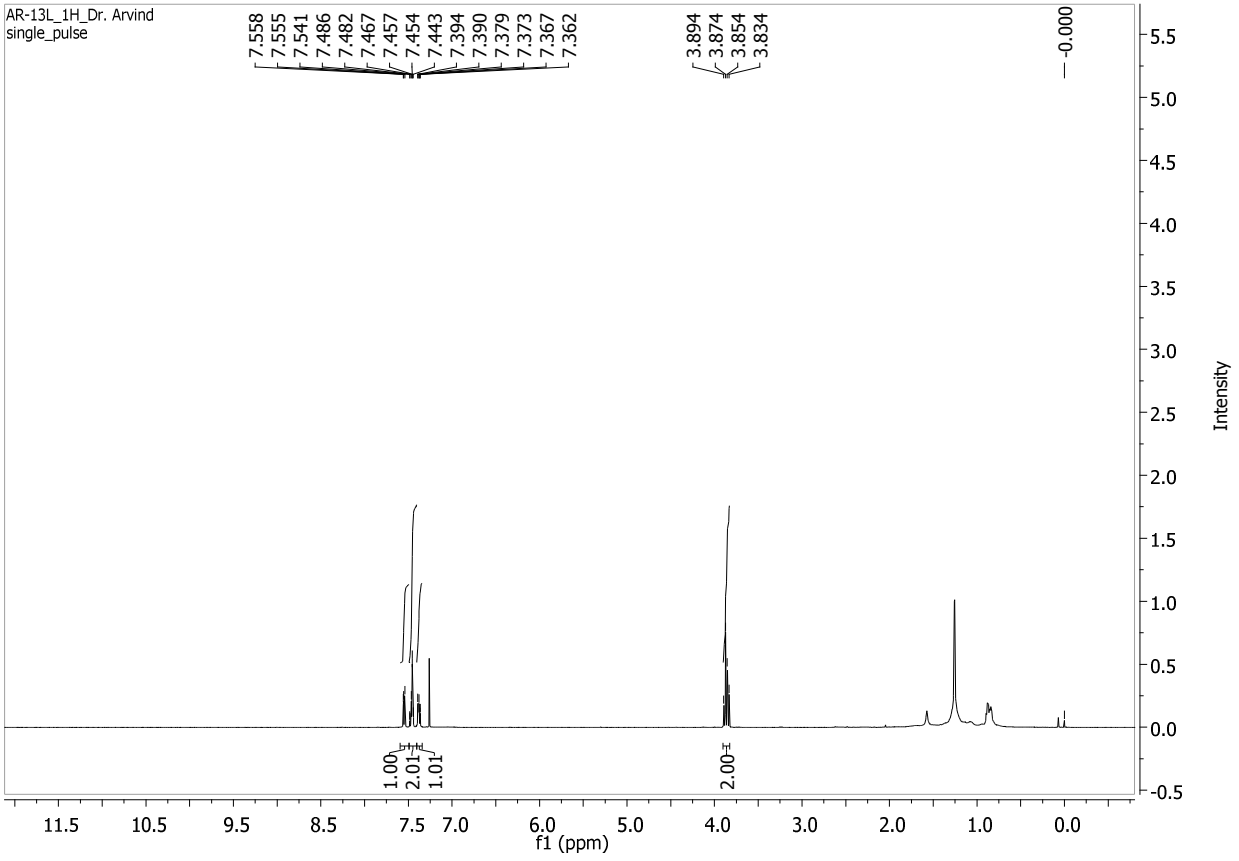
Compound 2j. ^{19}F NMR Spectrum ($CDCl_3$).



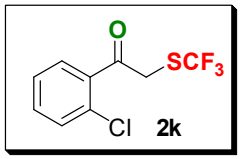


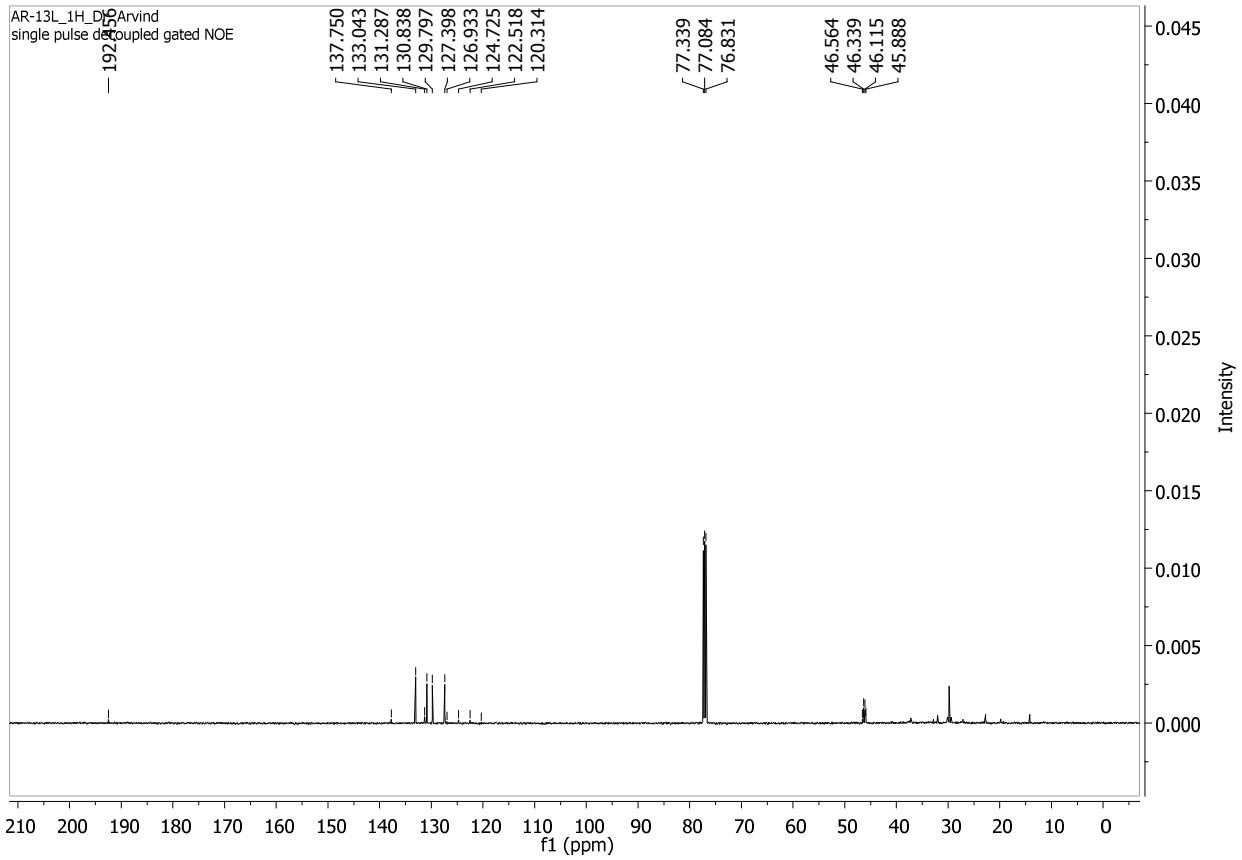
Compound 2k. ^{1}H NMR Spectrum ($CDCl_3$).



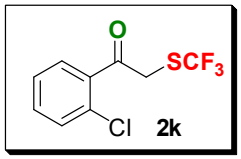


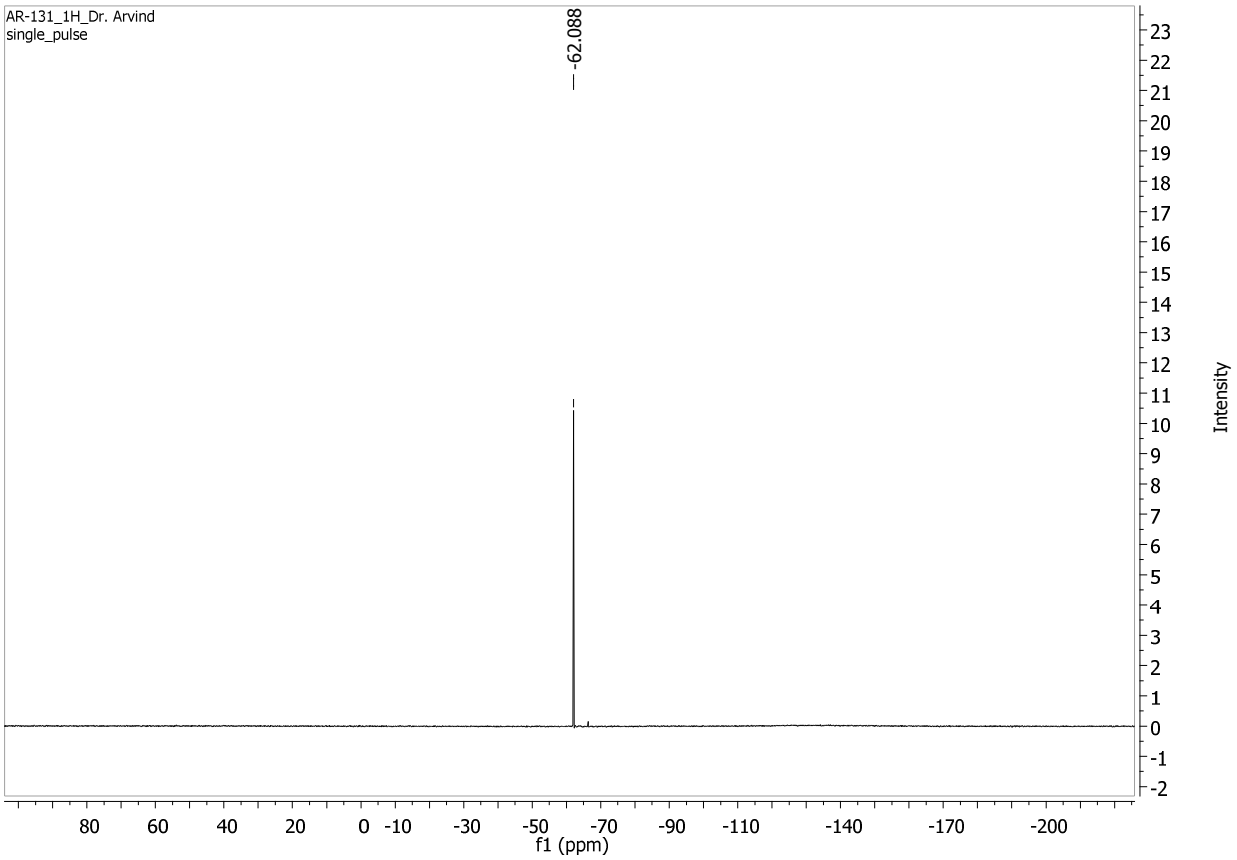
Compound 2k. ^{13}C NMR Spectrum ($CDCl_3$).



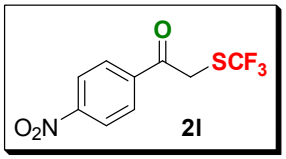


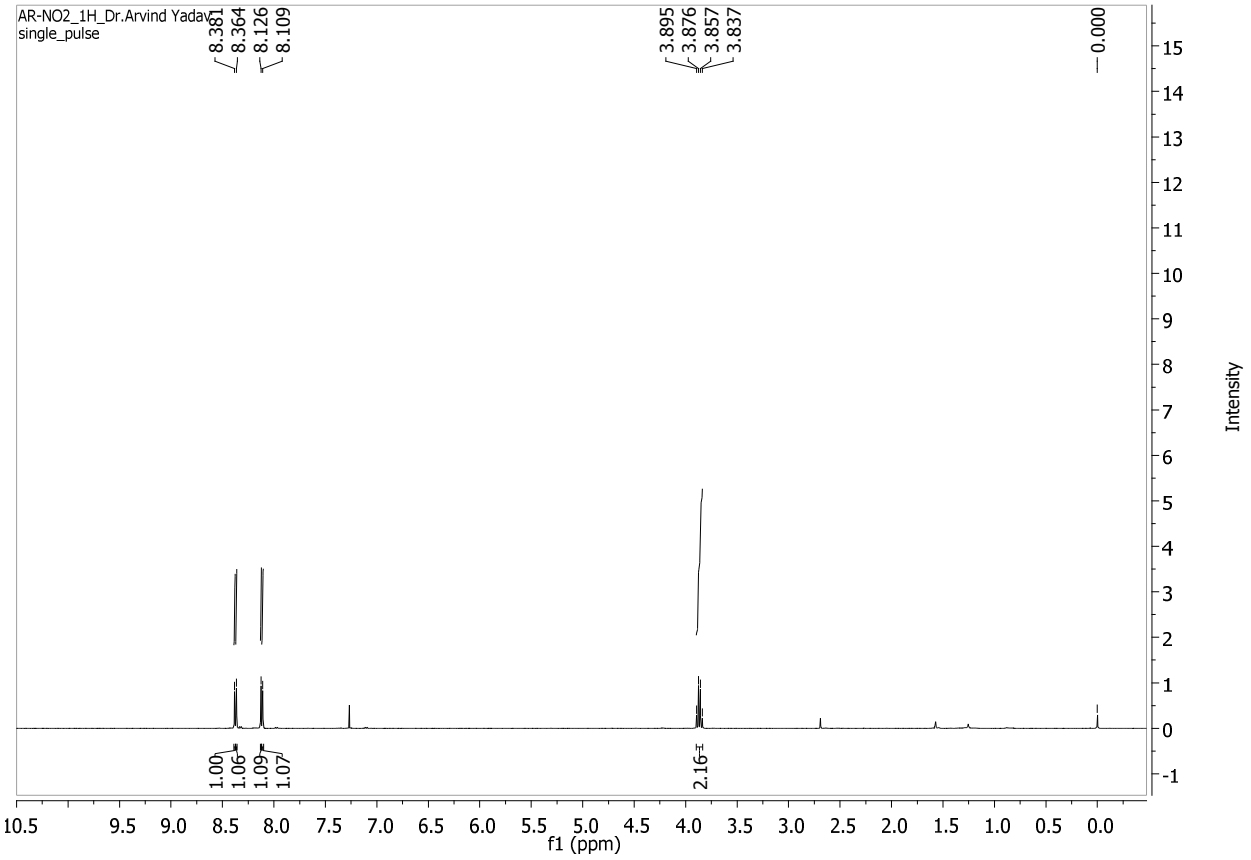
Compound 2k. ^{19}F NMR Spectrum ($CDCl_3$).



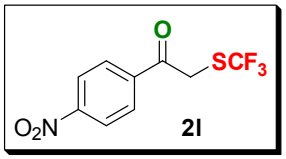


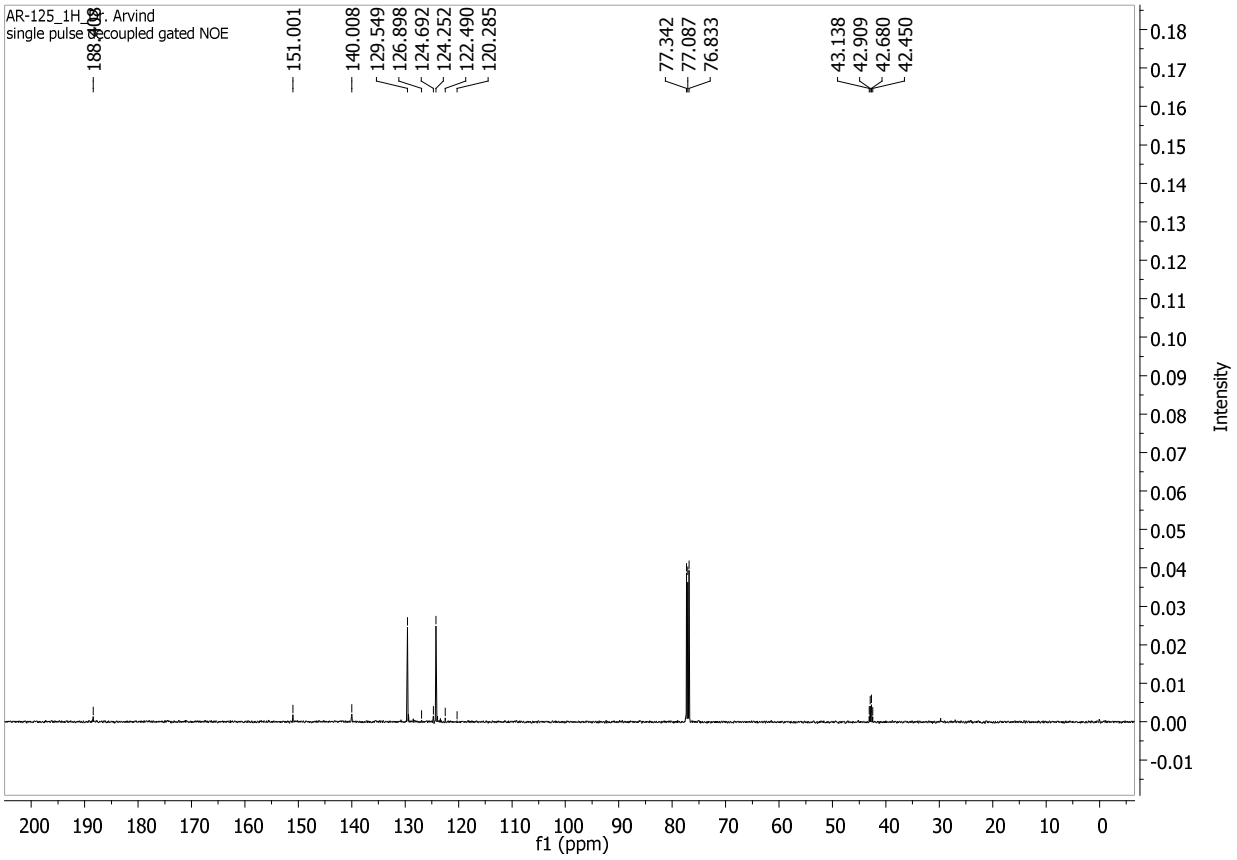
Compound 2l. ^{1}H NMR Spectrum ($CDCl_3$).



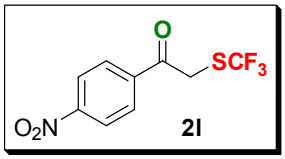


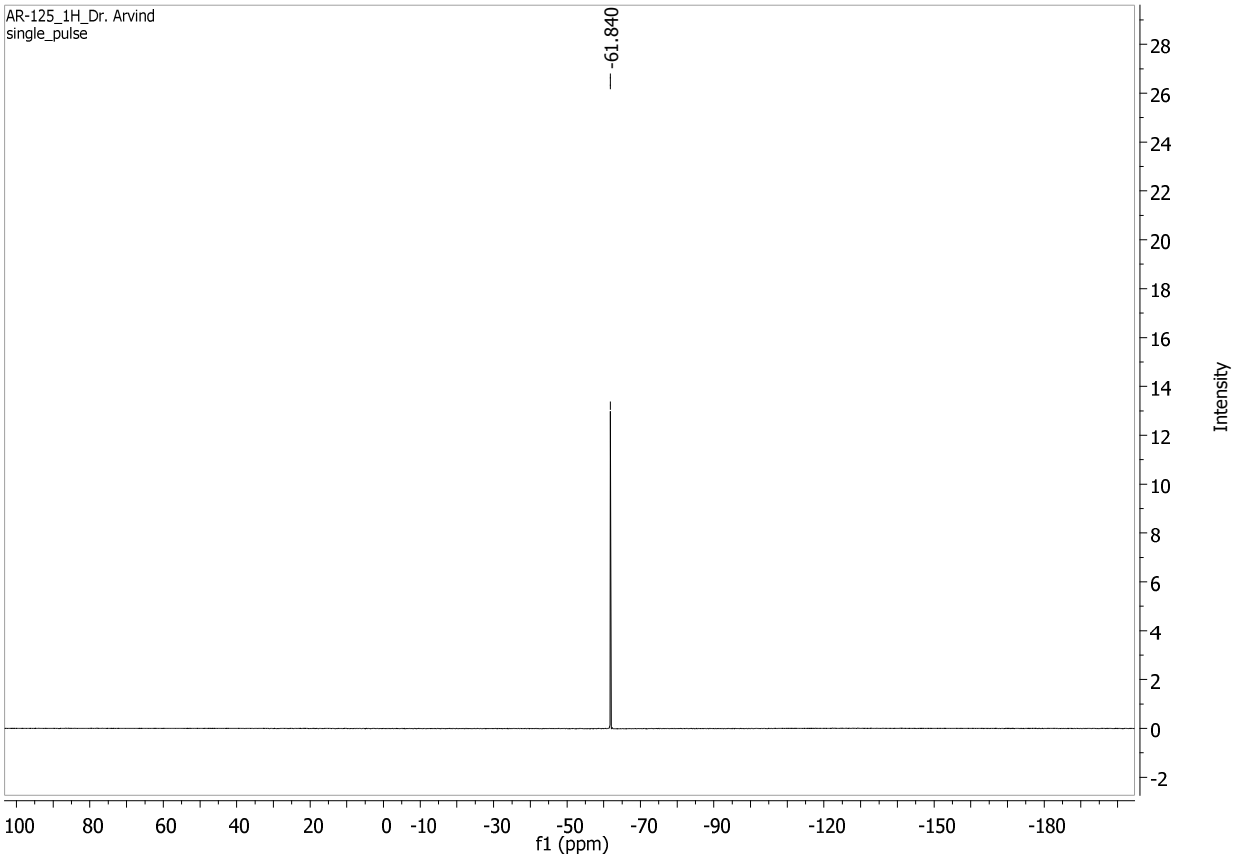
Compound 2l. ^{13}C NMR Spectrum ($CDCl_3$).



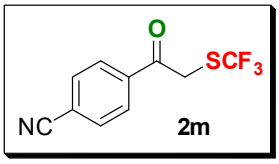


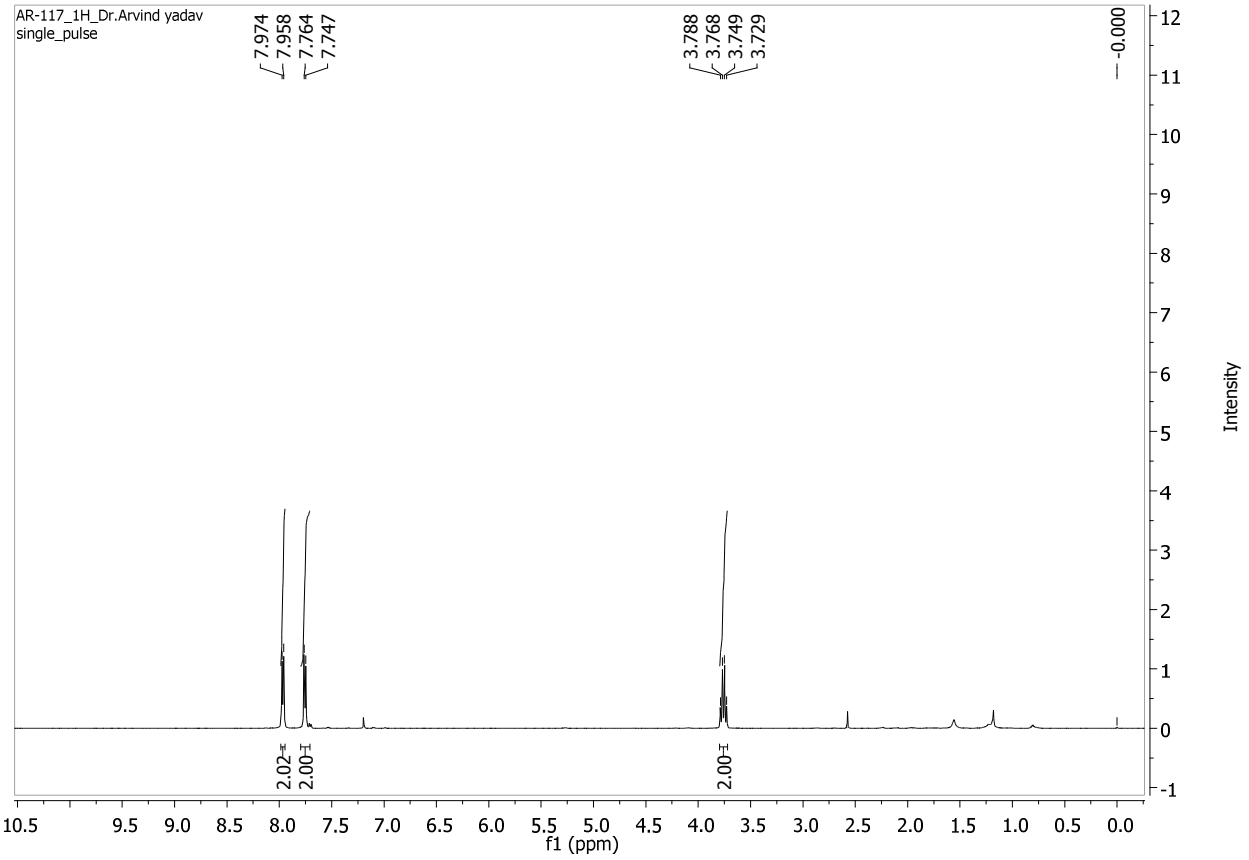
Compound 2l. ^{19}F NMR Spectrum ($CDCl_3$).



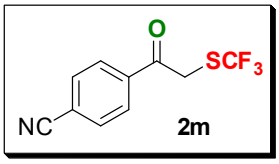


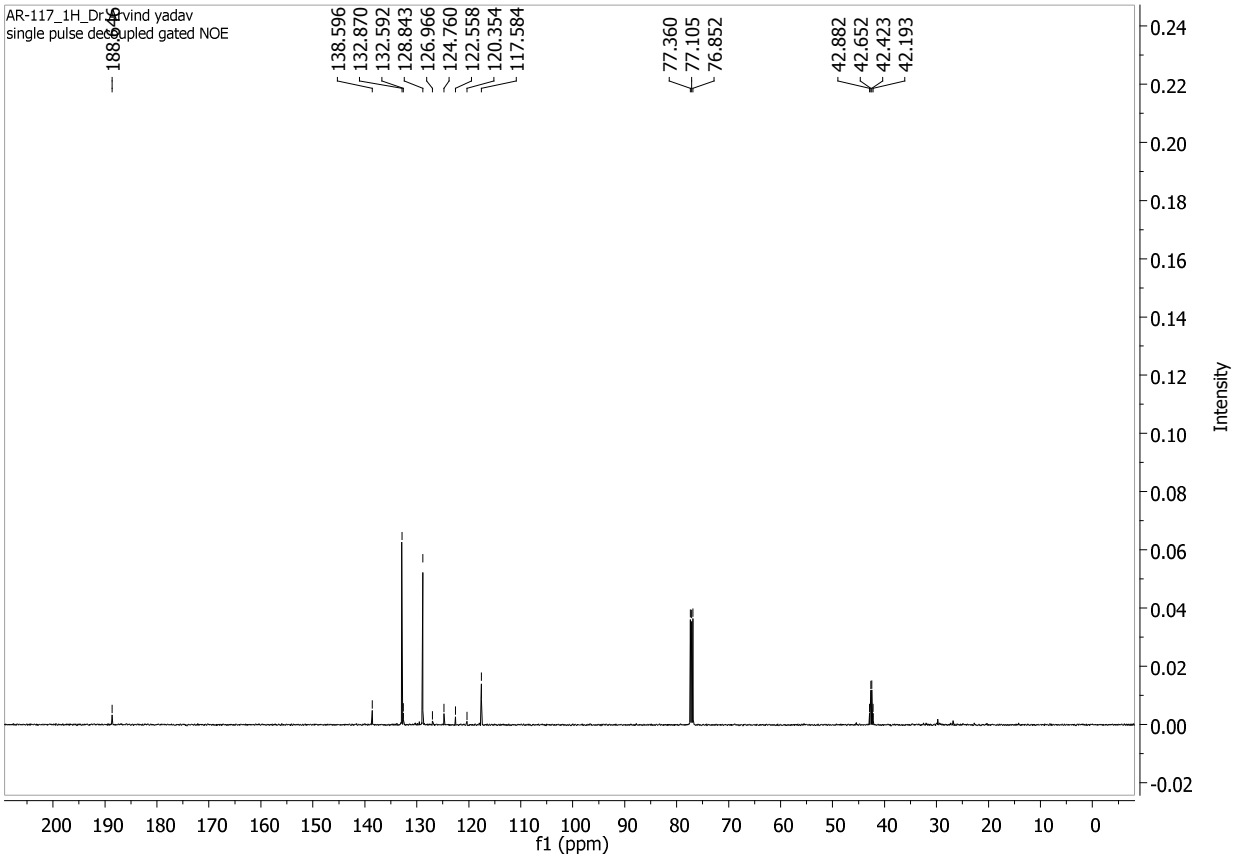
Compound 2m. ^{1}H NMR Spectrum ($CDCl_3$).



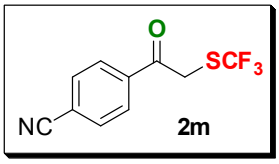


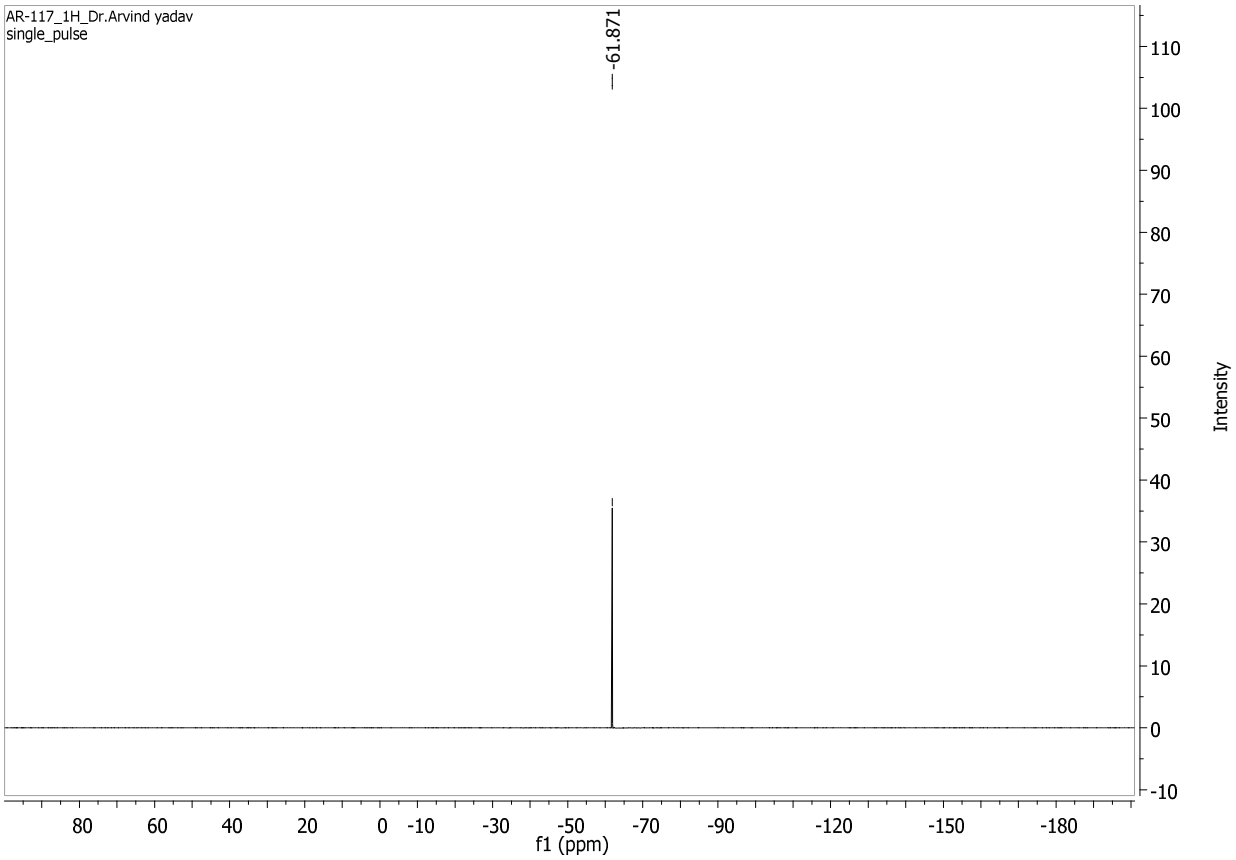
Compound 2m. ^{13}C NMR Spectrum ($CDCl_3$).



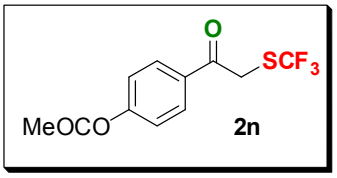


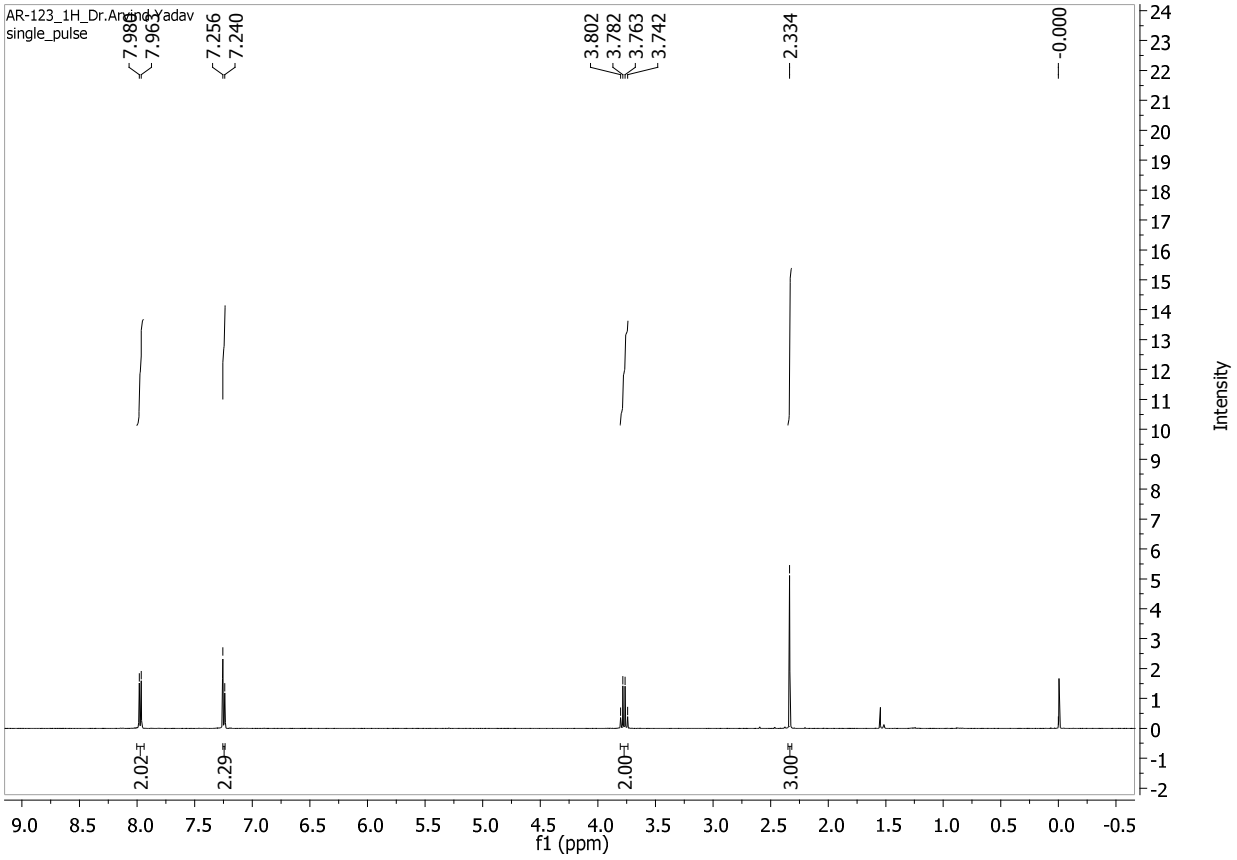
Compound 2m. ^{19}F NMR Spectrum ($CDCl_3$).



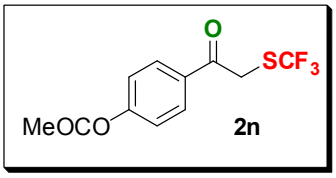


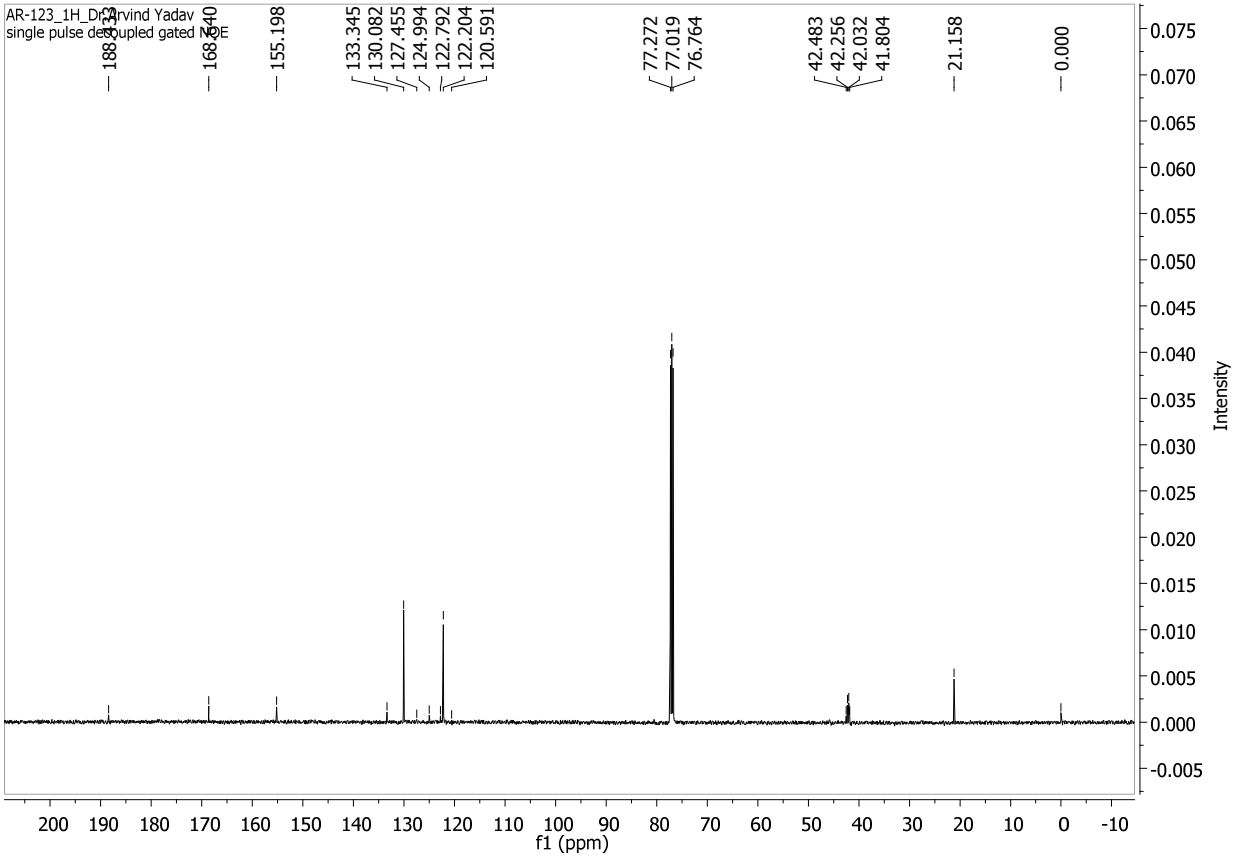
Compound 2n. ^{1}H NMR Spectrum ($CDCl_3$).



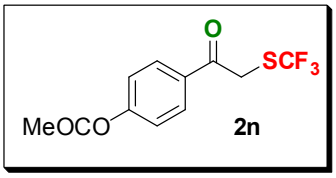


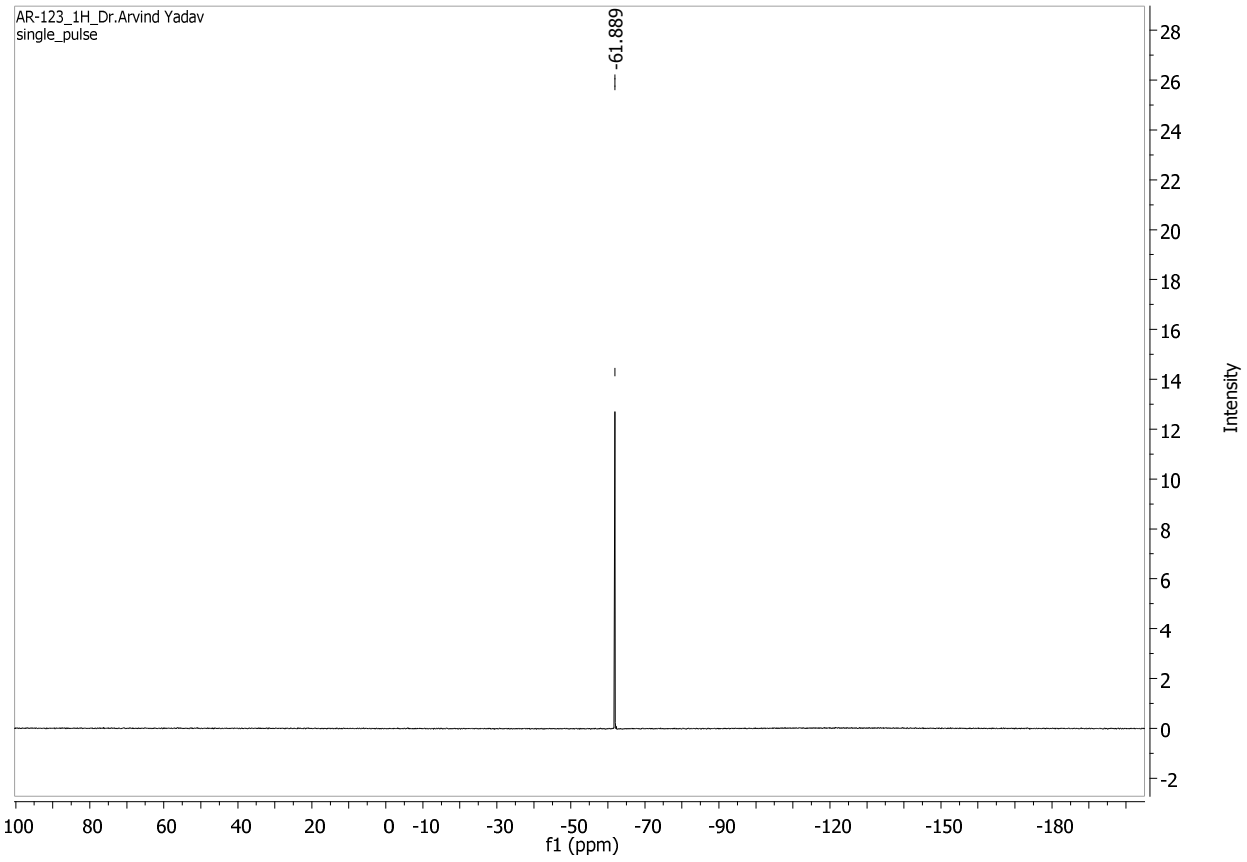
Compound 2n. ^{13}C NMR Spectrum ($CDCl_3$).



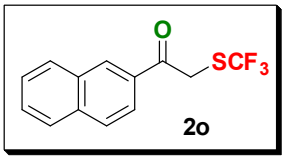


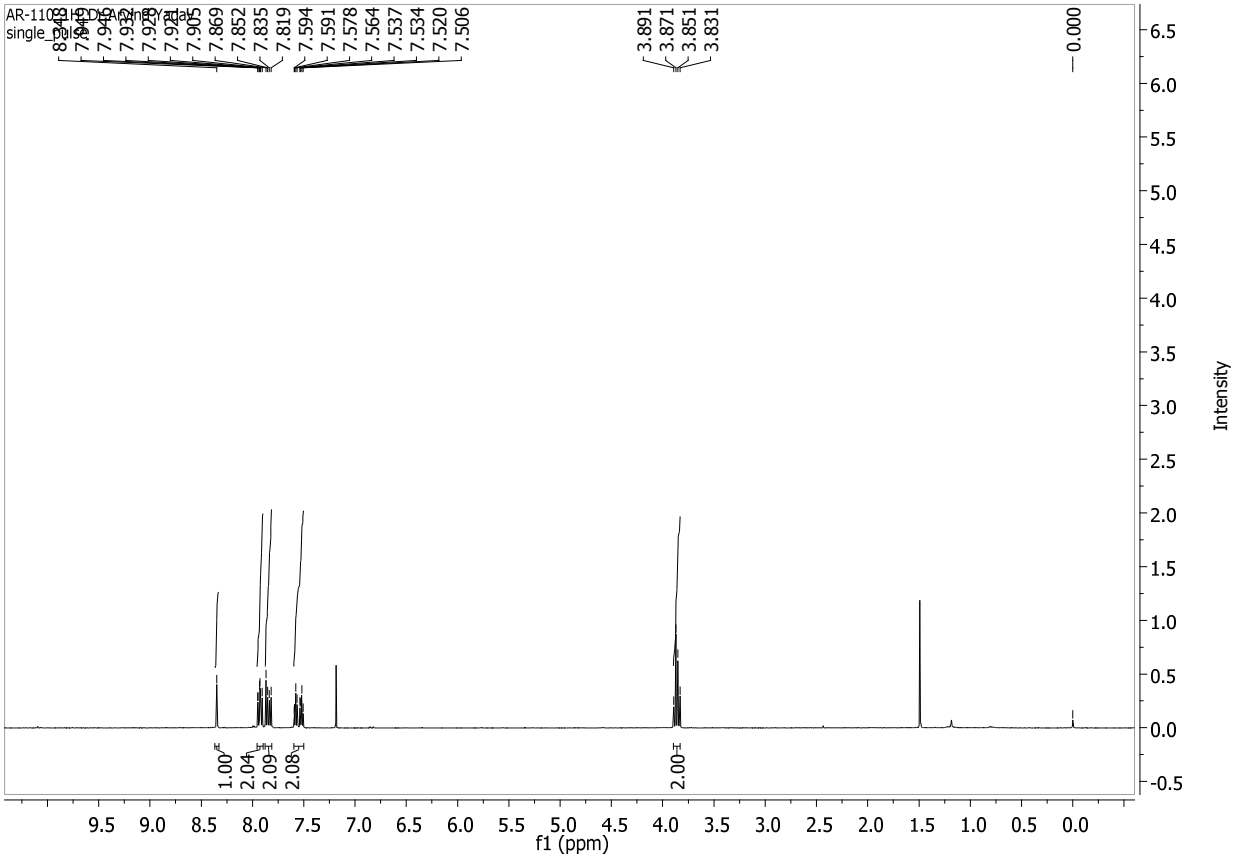
Compound 2n. ^{19}F NMR Spectrum ($CDCl_3$).



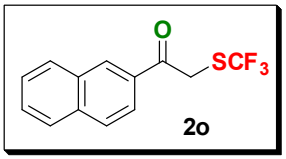


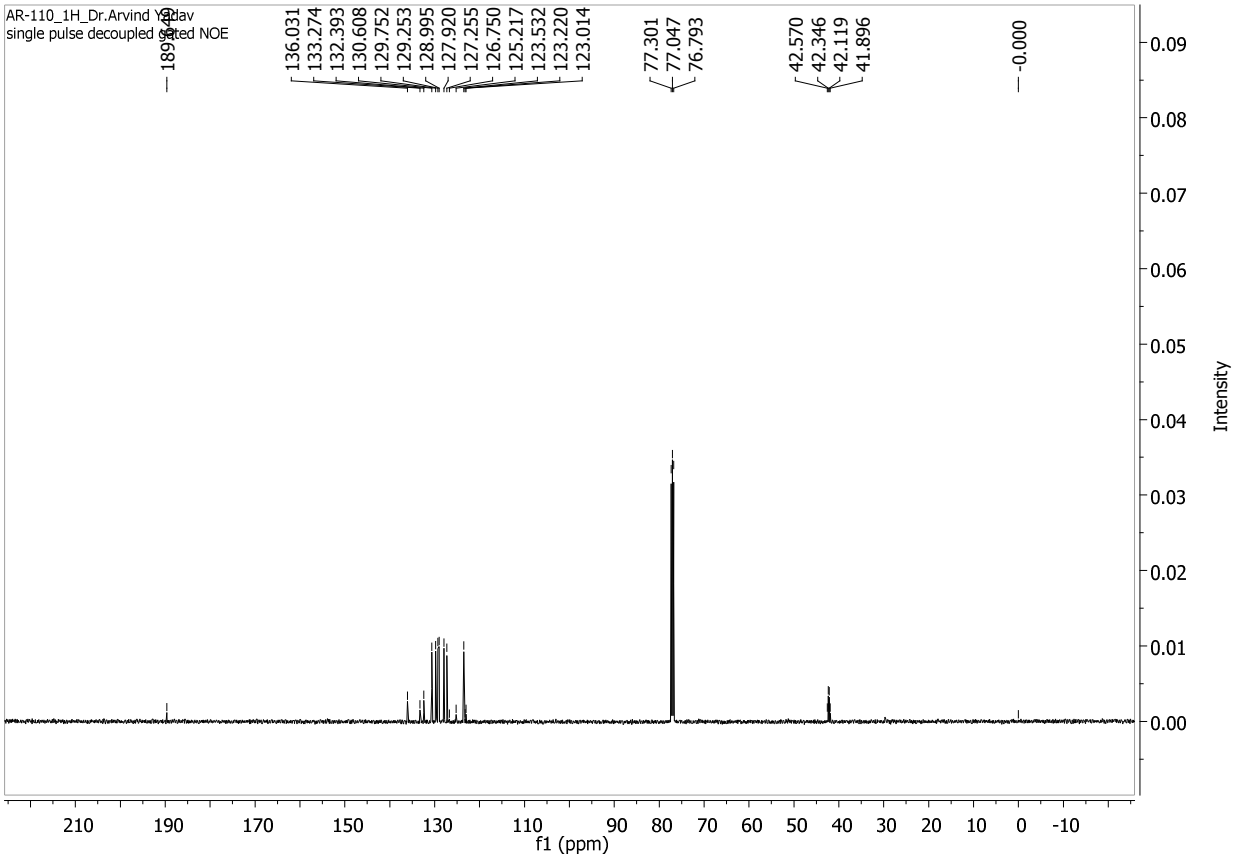
Compound 2o. ^{1}H NMR Spectrum ($CDCl_3$).



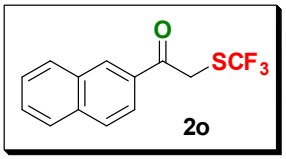


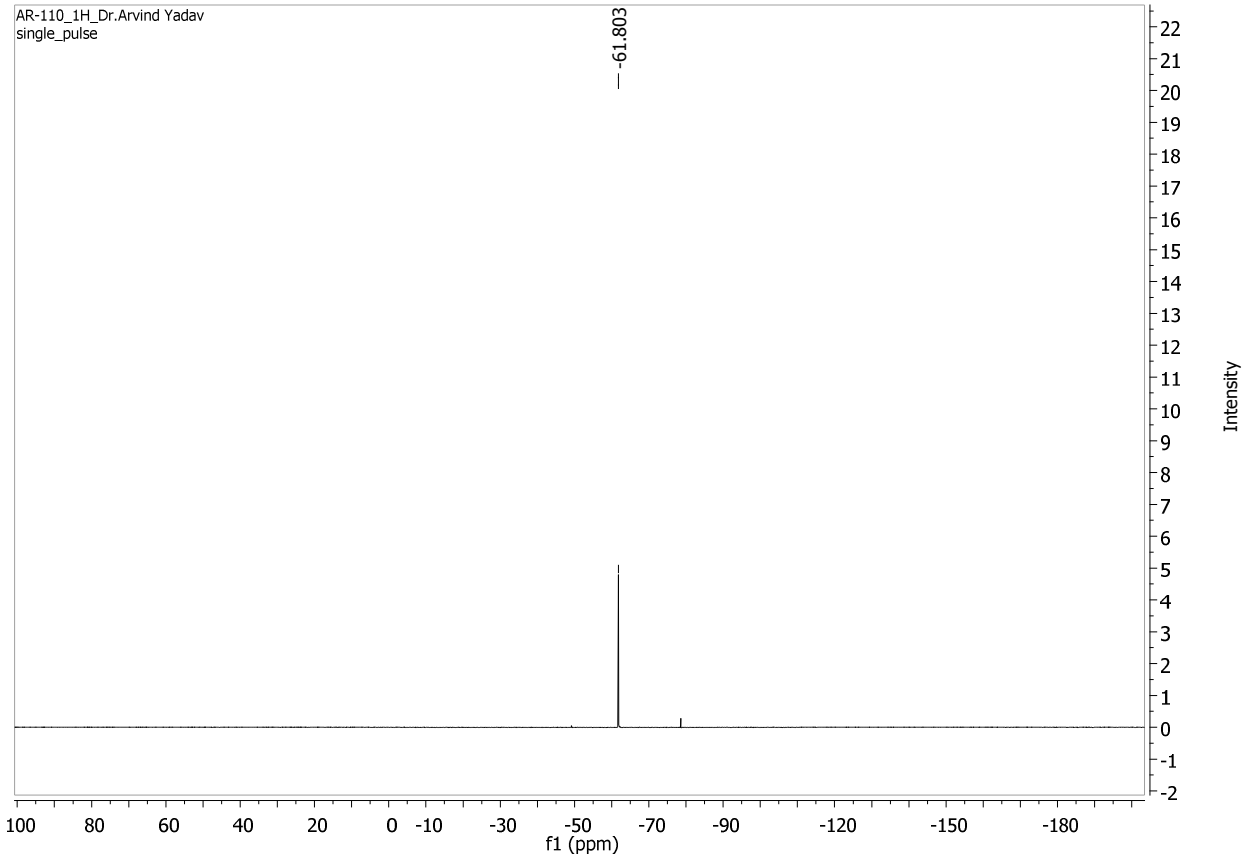
Compound 2o. ^{13}C NMR Spectrum ($CDCl_3$).



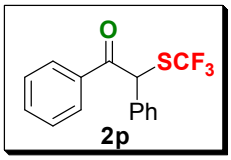


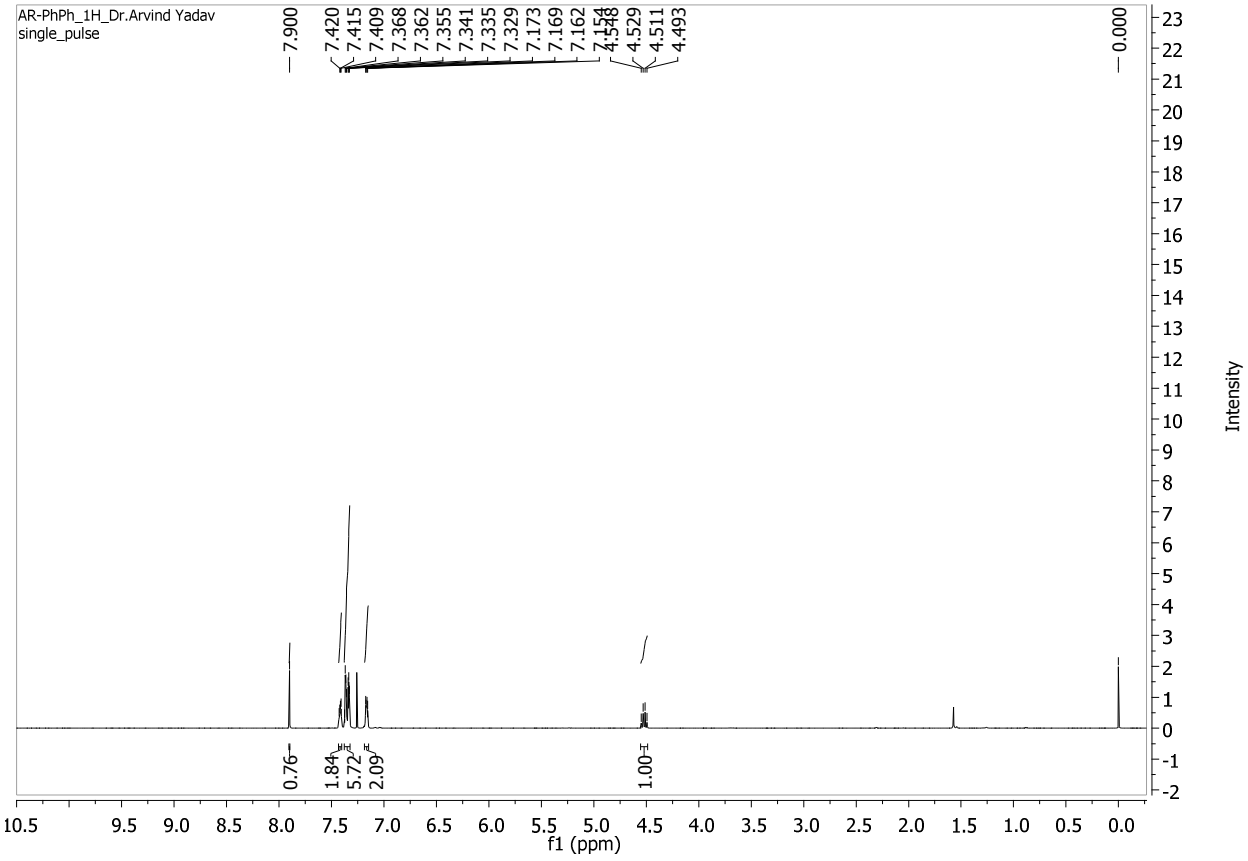
Compound 2o. ^{19}F NMR Spectrum ($CDCl_3$).



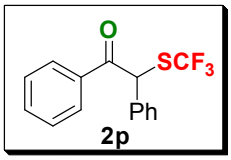


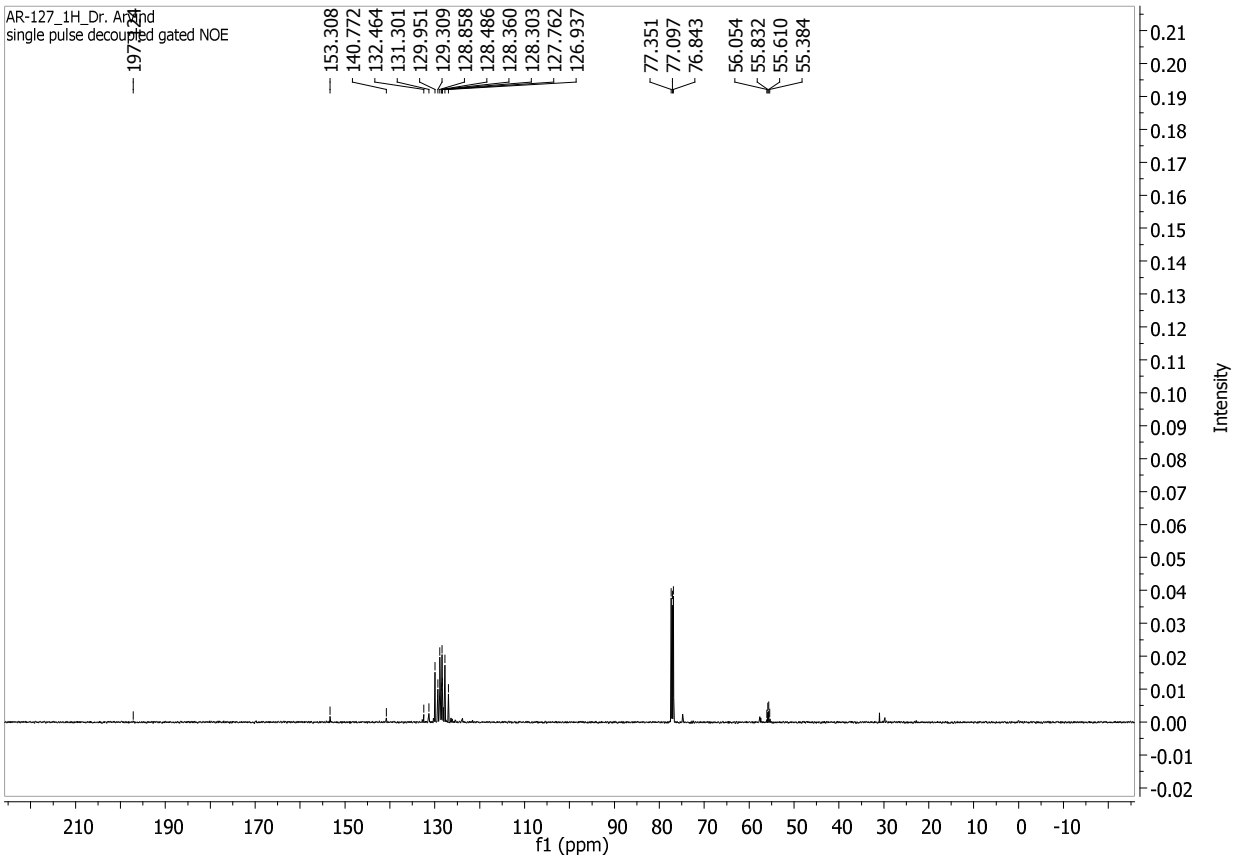
Compound 2p. ^{1}H NMR Spectrum ($CDCl_3$).



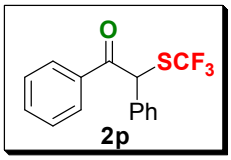


Compound 2p. ^{13}C NMR Spectrum ($CDCl_3$).

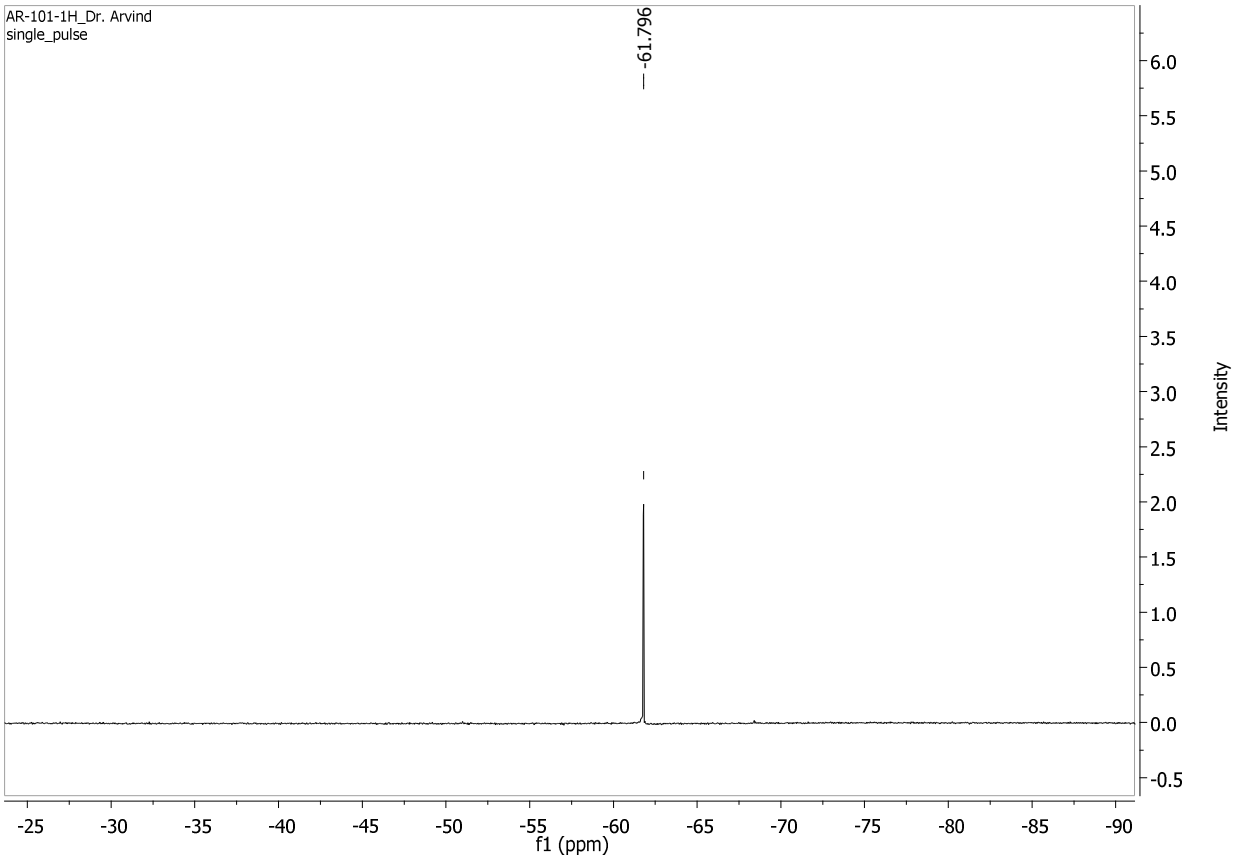




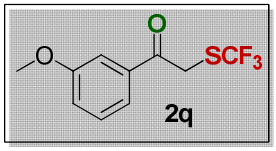
Compound 2p. ^{19}F NMR Spectrum ($CDCl_3$).

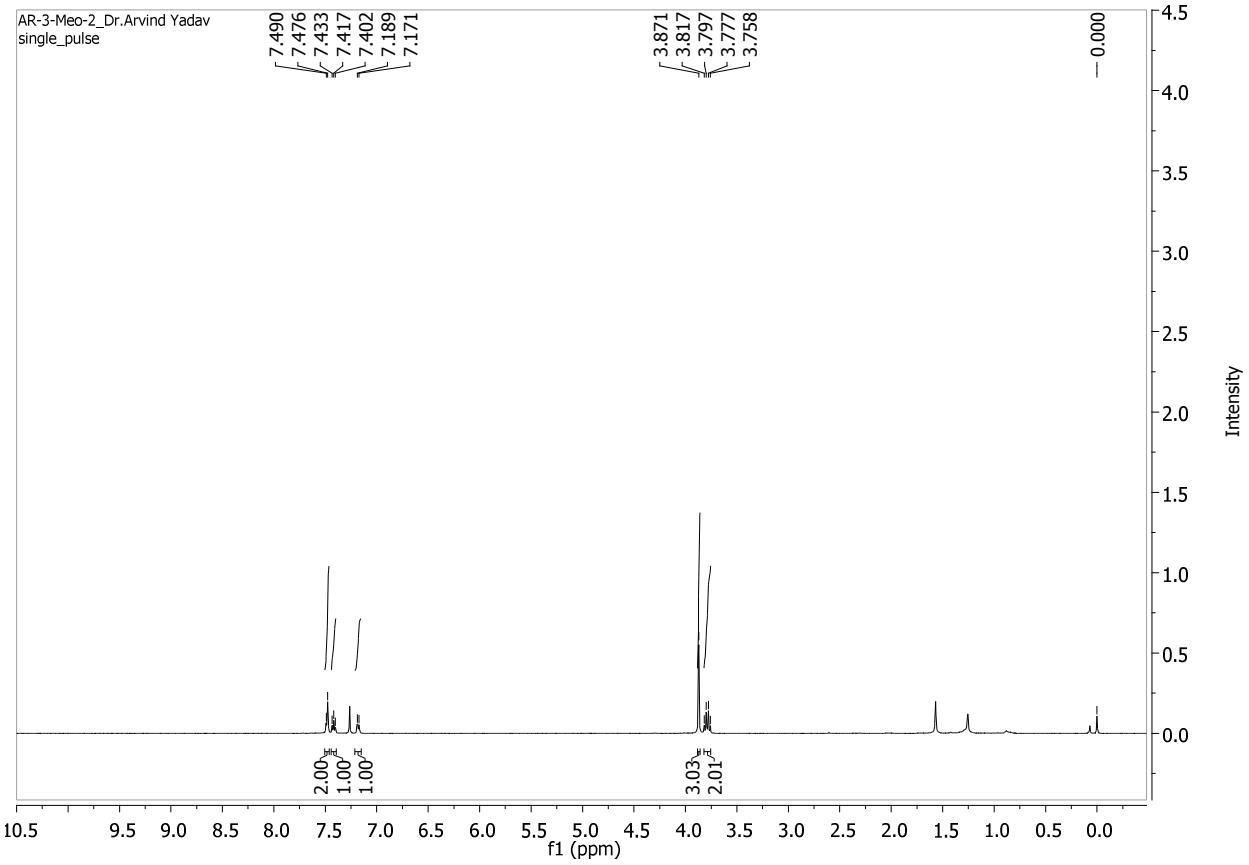


2p

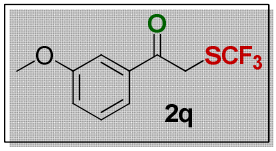


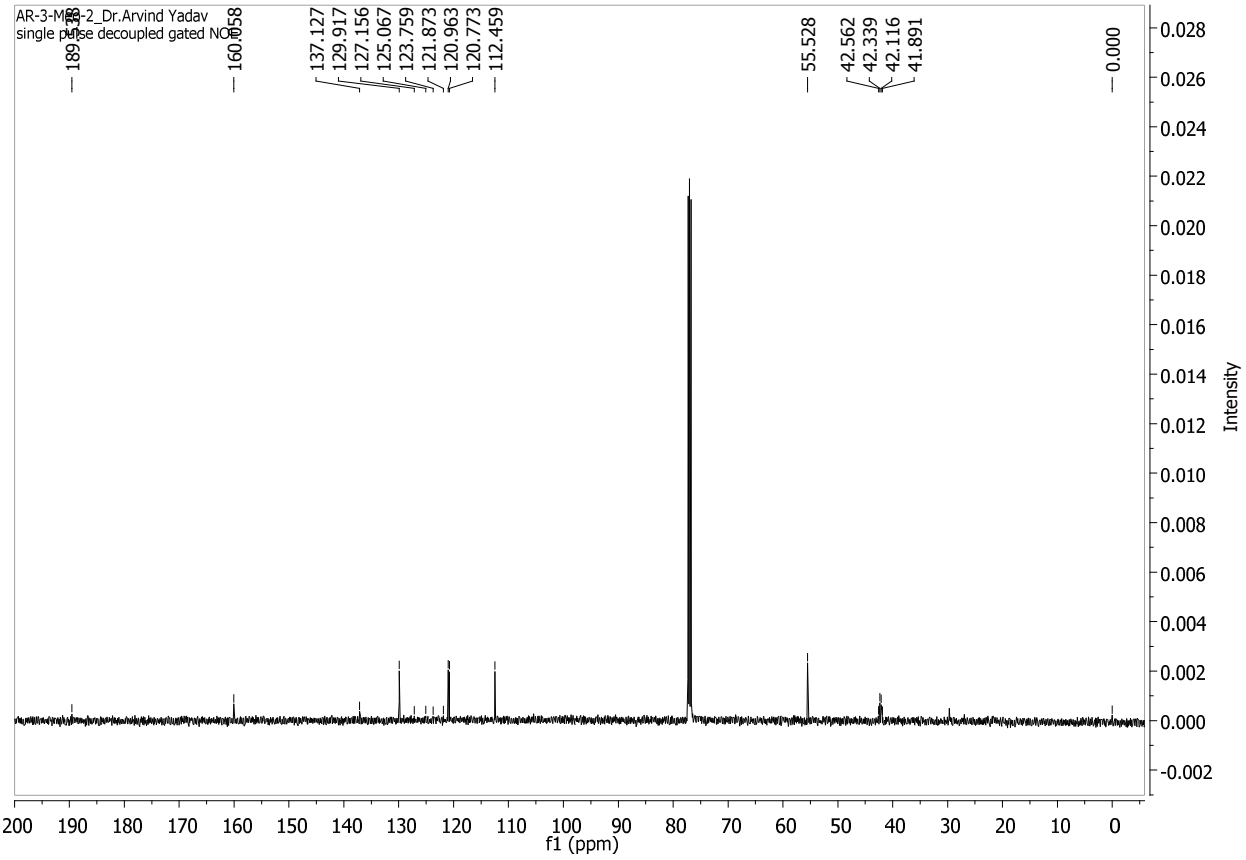
Compound 2q. ^{1}H NMR Spectrum ($CDCl_3$).



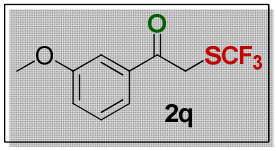


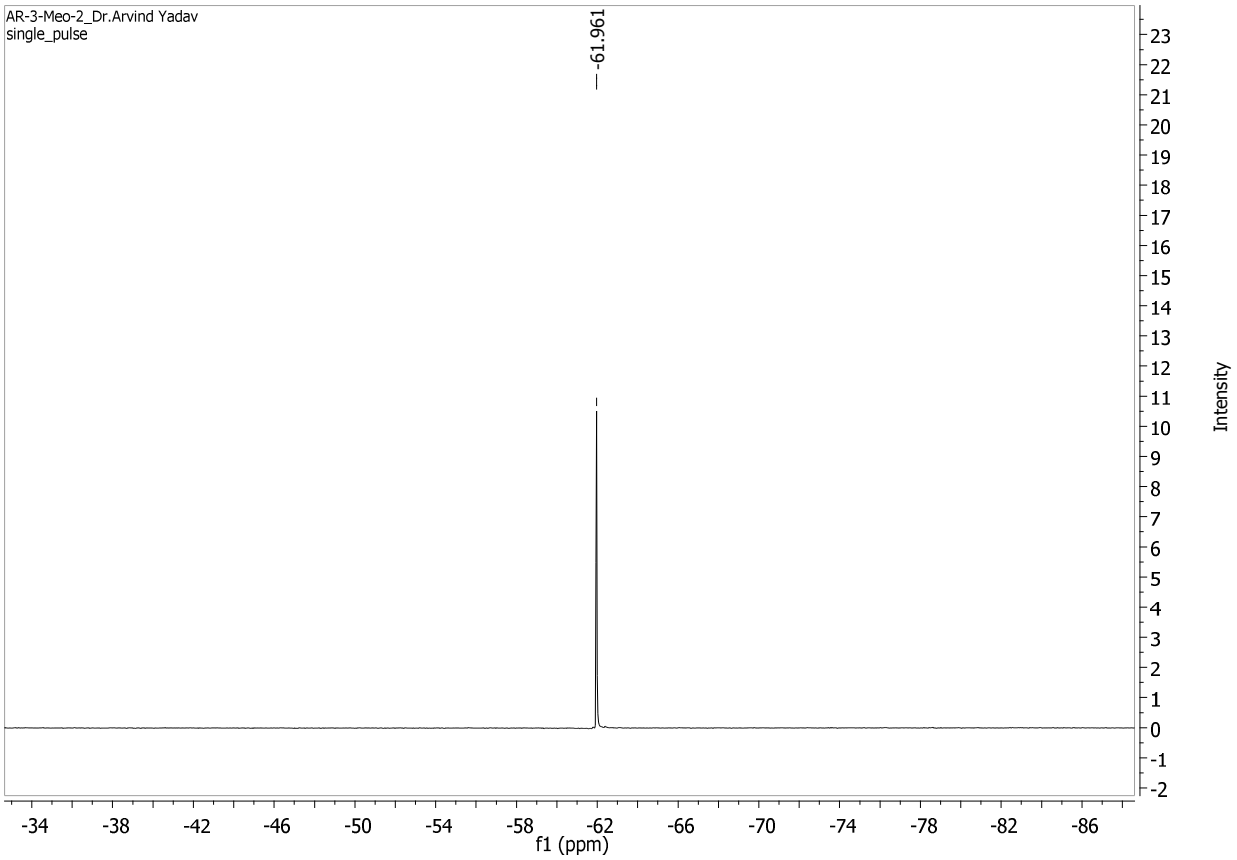
Compound 2q. ^{13}C NMR Spectrum ($CDCl_3$).



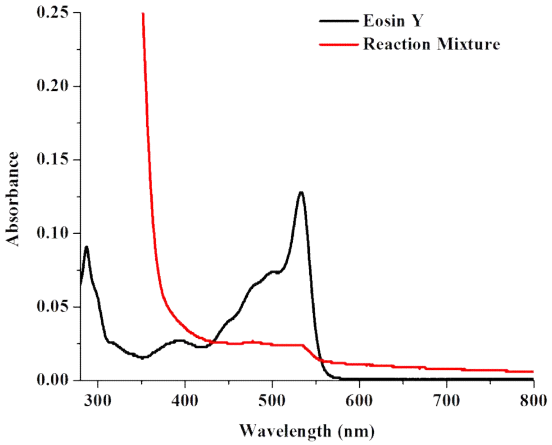


Compound 2q. ^{19}F NMR Spectrum ($CDCl_3$).

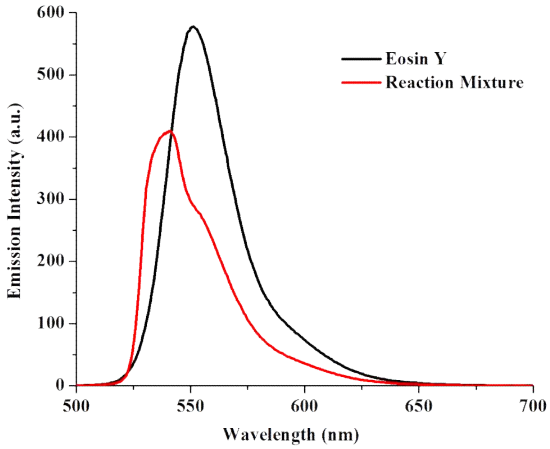




VIII. UV-Vis and Fluorescence spectra of the representative reaction 1a to 2a:



(UV-Vis spectra)



(Fluorescence spectra)

$\emptyset_S = \emptyset_L \times \frac{F_S}{F_L} \times \frac{A_L}{A_S} \left(\frac{n_L}{n_S}\right)^2$ Where $\emptyset_s$ = quantum yield, F_S = fluorescence of sample, F_L = Fluorescence of reference, A_L = Absorbance of reference, A_S = Absorbance of sample, n_L = Refractive index of reference and n_S = Refractive index of sample

$$\emptyset_s = 0.67 \times \frac{15776.89}{22552.88} \times \frac{105.85}{429.04} \left(\frac{1.35}{1.32}\right)^2$$

= 0.115