Supplementary Information for:

Transition Metal-Free Cross-Dehydrogenative Coupling Acylation of Coumarins by the $K_2S_2O_8$/Aliquat 336 Catalytic System: A Versatile Strategy towards 4-Aroylcoumarin Derivatives

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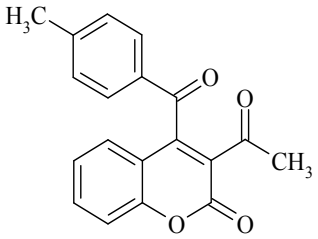
General

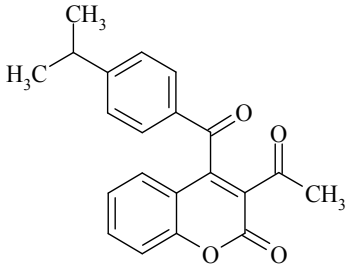
All chemicals were purchased from Merck (Germany) and were used without further purification. Melting points were measured on an Electrothermal 9100 apparatus and are uncorrected. ^{1}H and ^{13}C NMR spectra were measured ($CDCl_3$ solution) with Bruker DRX-500 AVANCE (at 500.1 and 125.8 MHz, resp.), Bruker DRX-400 AVANCE III (at 400.1 and 100.6 MHz, resp.) and Bruker DPX-250 (at 250.1 and 62.8 MHz, resp.) instruments. Chromatography columns were prepared from Merck silica gel 230–240 meshes.

General procedure for synthesis of 3-acetyl-4-(4-methylbenzoyl)-2*H*-chromen-2-one (3a): A 10 mL oven-dried scintillation vial equipped with a magnetic stir bar was charged with a mixture of 3-acetyl coumarin **2a** (0.5 mmol, 0.094 g), 4-methylbenzaldehyde **1a** (1.0 mmol, 0.120 g), $K_2S_2O_8$ (0.6 mmol, 0.162 g), Aliquat 336 (30 mol%, 0.060 g) and CH_3CN (2.0 mL). The vial was capped, and the reaction mixture was stirred at 80 ^{o}C for 2 h. Upon completion, saturated $Na_2S_2O_3$ (3 mL) and distilled H_2O (7 mL) was added, and the mixture was extracted with EtOAc (2 × 10 mL). The combined organic layer was washed with

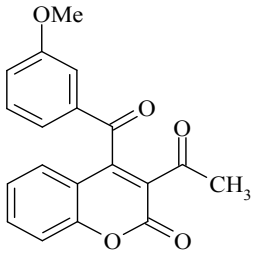
saturated aqueous solution of NaCl, dried over anhydrous Na_2SO_4, and concentrated in vacuo. The crude product was purified by SiO_2 column chromatography to afford 3-acetyl-4-(4-methyl benzoyl)-2*H*-chromen-2-one **3a** as a lemon solid; mp 180–182 °C (recrystallized from 8:1 *n*-hexane-EtOAc); yield: 0.133 g (87%).



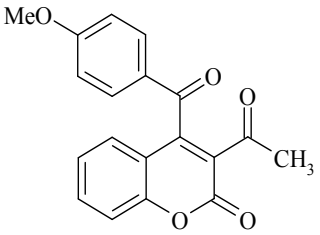
3-Acetyl-4-(4-methylbenzoyl)-2*H*-chromen-2-one (**3a**): yield 0.133 g, 87%; pale yellow solid, m.p. 180–182 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 2.44 (s, 3H), 2.67 (s, 3H), 7.24 (td, *J* = 7.6, 0.8 Hz, 1H), 7.31 (d, *J* = 7.6 Hz, 1H), 7.32 (d, *J* = 8.2 Hz, 2H), 7.45 (d, *J* = 8.0 Hz, 1H), 7.67 (ddd, *J* = 8.6, 7.2, 1.6 Hz, 1H), 7.77 (d, *J* = 8.2 Hz, 2H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 20.8, 29.9, 116.0, 116.1, 120.3, 124.1, 127.4, 127.6, 128.7, 132.1, 133.6, 144.4, 153.5, 156.3, 157.7, 192.1, 195.0.



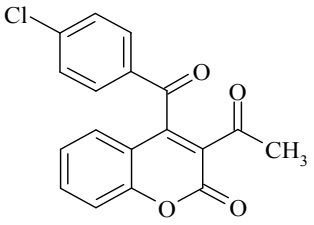
3-Acetyl-4-(4-isopropylbenzoyl)-2*H*-chromen-2-one (**3b**): yield 0.134 g, 80%; pale yellow solid, m.p. 188–190 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 1.29 (d, *J* = 6.9 Hz, 6H), 2.68 (s, 3H), 2.99 (sept, *J* = 6.9 Hz, 1H), 7.25 (td, *J* = 7.3 Hz, 1H), 7.32 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.35 (d, *J* = 8.3 Hz, 2H), 7.46 (d, *J* = 8.3 Hz, 1H), 7.68 (ddd, *J* = 8.6, 7.4, 1.5 Hz, 1H), 7.79 (d, *J* = 8.3 Hz, 2H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 22.5, 30.0, 33.3, 116.0, 116.1, 120.2, 124.2, 126.2, 127.5, 127.7, 132.3, 133.7, 153.5, 155.0, 156.5, 157.8, 192.1, 195.0.



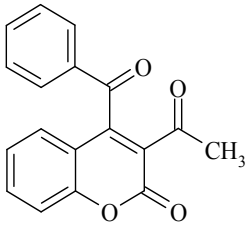
3-Acetyl-4-(3-methoxybenzoyl)-2*H*-chromen-2-one (**3c**): yield 0.137 g, 85%; pale yellow solid, m.p. 120–121 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 2.68 (s, 3H), 3.89 (s, 3H), 7.18 (ddd, *J* = 8.1, 2.2, 0.6 Hz, 1H), 7.23–7.31 (m, 3H), 7.36 (t, *J* = 7.8 Hz, 1H), 7.45 (d, *J* = 8.3 Hz, 1H), 7.53 (s, 1H), 7.68 (ddd, *J* = 8.5, 7.3, 1.6 Hz, 1H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 29.9, 54.4, 111.0, 116.0, 119.7, 120.1, 120.4, 124.2, 127.4, 129.0, 133.8, 135.7, 153.7, 156.4, 157.6, 159.1, 192.2, 194.9.



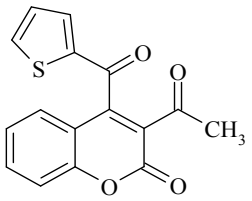
3-Acetyl-4-(4-methoxybenzoyl)-2*H*-chromen-2-one (**3d**): yield 0.137 g, 85%; pale yellow solid, m.p. 150–152 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 2.67 (s, 3H), 3.90 (s, 3H), 6.98 (d, *J* = 9.0 Hz, 2H), 7.24 (td, *J* = 7.6, 0.7 Hz, 1H), 7.32 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.45 (d, *J* = 8.0 Hz, 1H), 7.67 (td, *J* = 8.6, 1.5 Hz, 1H), 7.84 (d, *J* = 8.5 Hz, 2H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 29.9, 54.5, 112.6, 113.3, 116.0, 120.4, 124.1, 127.4, 129.9, 131.2, 133.6, 153.5, 156.1, 157.8, 163.4, 191.0, 195.1.



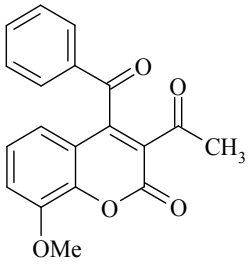
3-Acetyl-4-(4-chlorobenzoyl)-2*H*-chromen-2-one (**3e**): yield 0.129 g, 79%; pale yellow solid, m.p. 204–206 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 2.70 (s, 3H), 7.25–7.28 (m, 3H), 7.47 (d, *J* = 8.0 Hz, 1H), 7.49 (d, *J* = 8.5 Hz, 2H), 7.69–7.73 (m, 1H), 7.81 (d, *J* = 8.5 Hz, 2H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 30.0, 115.8, 116.2, 120.1, 124.3, 127.2, 128.5, 128.7, 132.8, 134.0, 139.7, 153.6, 156.0, 157.5, 191.4, 195.0.



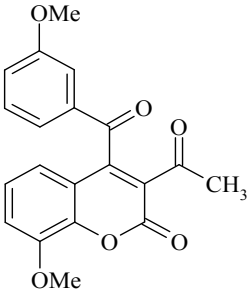
3-Acetyl-4-benzoyl-2*H*-chromen-2-one (**3f**): yield 0.123 g, 84%; pale yellow solid, m.p. 130–132 ºC. ^{1}H NMR (250.1 MHz, $CDCl_3$): δ = 2.88 (s, 3H), 7.15–7.22 (m, 2H), 7.34–7.44 (m, 3H), 7.52–7.62 (m, 2H), 7.78 (d, *J* = 8.0 Hz, 2H). ^{13}C NMR (62.8 MHz, $CDCl_3$): δ = 30.9, 117.0, 117.1, 125.3, 128.4, 128.5, 129.1, 134.2, 134.8, 135.5, 154.6, 157.5, 158.7, 193.5, 196.0.



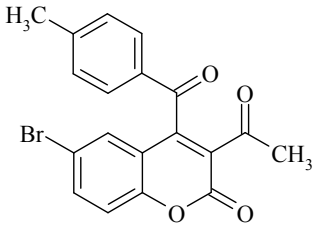
3-Acetyl-4-(thiophene-2-carbonyl)-2*H*-chromen-2-one (**3g**): yield 0.109 g, 73%; pale yellow solid, m.p. 151–153 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 2.69 (s, 3H), 7.14 (dd, *J* = 4.8, 3.9 Hz, 1H), 7.29 (td, *J* = 7.2, 1.0 Hz, 1H), 7.42–7.47 (m, 3H), 7.70 (ddd, *J* = 8.6, 7.3, 1.6 Hz, 1H), 7.82 (dd, *J* = 4.9, 1.0 Hz, 1H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 30.0, 115.7, 116.1, 120.4, 124.3, 127.3, 127.5, 133.0, 133.8, 134.4, 141.3, 153.5, 154.4, 157.7, 184.2, 194.9.



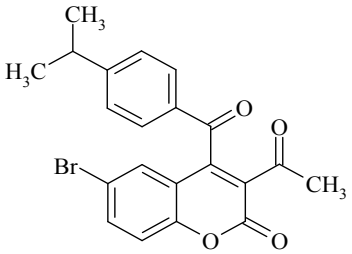
3-Acetyl-4-benzoyl-8-methoxy-2*H*-chromen-2-one (**3h**): yield 0.114 g, 71%; yellow solid, m.p. 188–190 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 2.69 (s, 3H), 4.03 (s, 3H), 6.85 (dd, *J* = 7.7, 1.1 Hz, 1H), 7.17 (t, *J* = 8.0 Hz, 1H), 7.22 (dd, *J* = 8.1, 1.3 Hz, 1H), 7.51 (t, *J* = 7.7 Hz, 2H), 7.64 (t, *J* = 7.4 Hz, 1H), 7.86 (d, *J* = 7.4 Hz, 2H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 30.0, 55.3, 115.0, 116.5, 118.3, 120.3, 124.0, 127.4, 128.0, 133.1, 134.4, 143.4, 146.2, 156.7, 157.2, 192.5, 195.1.



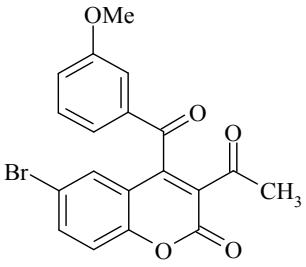
3-Acetyl-8-methoxy-4-(3-methoxybenzoyl)-2*H*-chromen-2-one (**3i**): yield 0.132 g, 75%; pale yellow solid, m.p. 174–176 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 2.68 (s, 3H), 3.88 (s, 3H), 4.01 (s, 3H), 6.85 (dd, *J* = 7.8, 1.4 Hz, 1H), 7.14–7.22 (m, 3H), 7.28 (d, *J* = 7.6 Hz, 1H), 7.35 (t, *J* = 7.9 Hz, 1H), 7.52 (s, 1 H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 29.9, 54.4, 55.3, 110.9, 115.0, 116.6, 118.3, 119.7, 120.3, 120.4, 124.0, 129.0, 135.7, 143.4, 146.2, 156.6, 157.2, 159.0, 192.2, 195.0.



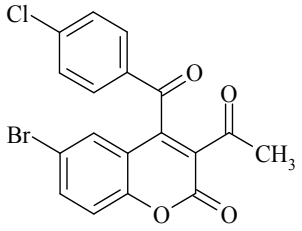
3-Acetyl-6-bromo-4-(4-methylbenzoyl)-2*H*-chromene-2-one (**3j**): yield 0.148 g, 77%; pale yellow solid, m.p. 180–182 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 2.43 (s, 3H), 2.63 (s, 3H), 7.24–7.38 (m, 4H), 7.70–7.80 (m, 3H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 20.8, 29.8, 116.9, 117.5, 117.7, 121.1, 127.6, 128.9, 129.3, 131.6, 136.4, 144.8, 152.3, 154.8, 157.0, 191.3, 194.6.



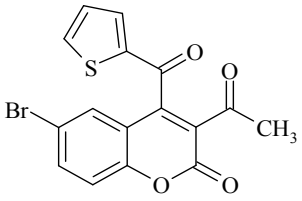
3-Acetyl-6-bromo-4-(4-isopropylbenzoyl)-2*H*-chromen-2-one (**3k**): yield 0.151 g, 73%; white solid, m.p. 188–190 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 1.31 (d, *J* = 6.9 Hz, 6H), 2.67 (s, 3H), 3.01 (sept, *J* = 6.9 Hz, 1H), 7.36 (d, *J* = 8.9 Hz, 2H), 7.38 (d, *J* = 8.4 Hz, 1H), 7.41 (d, *J* = 2.2 Hz, 1H), 7.75–7.79 (m, 3H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 22.5, 29.9, 33.4, 117.0, 117.5, 117.7, 121.0, 126.4, 127.7, 129.4, 131.9, 136.5, 152.4, 155.0, 155.3, 157.1, 191.4, 194.7.



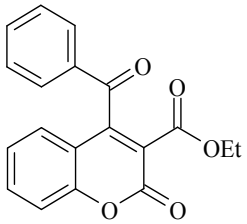
3-Acetyl-6-bromo-4-(3-methoxybenzoyl)-2*H*-chromen-2-one (**3l**): yield 0.154 g, 77%; pale yellow solid, m.p. 162–164 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 2.67 (s, 3H), 3.92 (s, 3H), 7.21 (ddd, *J* = 8.3, 2.6, 0.7 Hz, 1H), 7.26 (d, *J* = 7.7 Hz, 1H), 7.36 (d, *J* = 8.8 Hz, 1H), 7.37–7.41 (m, 2H), 7.53 (t, *J* = 1.9 Hz, 1H), 7.77 (dd, *J* = 8.9, 2.3 Hz, 1H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 29.9, 54.5, 111.1, 117.0, 117.5, 117.8, 120.1, 120.4, 129.2, 129.4, 135.4, 136.6, 152.4, 154.9, 157.0, 159.2, 191.6, 194.6.



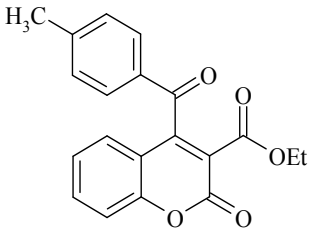
3-Acetyl-6-bromo-4-(4-chlorobenzoyl)-2*H*-chromen-2-one (**3m**): yield 0.152 g, 75%; pale yellow solid, m.p. 197–200 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 2.68 (s, 3H), 7.35–7.37 (m, 2H), 7.51 (d, *J* = 8.7 Hz, 2H), 7.76–7.81 (m, 3H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 29.9, 117.1, 117.2, 117.9, 121.0, 128.6, 128.7, 129.1, 132.5, 136.7, 140.1, 152.5, 154.4, 156.9, 190.6, 194.7.



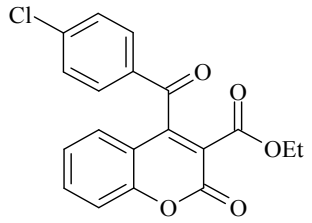
3-Acetyl-6-bromo-4-(thiophene-2-carbonyl)-2*H*-chromen-2-one (**3n**): yield 0.136 g, 72%; pale yellow solid, m.p. 183–185 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 2.67 (s, 3H), 7.17 (dd, *J* = 4.4, 4.4 Hz, 1H), 7.34 (d, *J* = 8.8 Hz, 1H), 7.48 (dd, *J* = 3.8, 0.9 Hz, 1H) 7.52 (d, *J* = 2.2 Hz, 1H), 7.77 (dd, *J* = 8.8, 2.2 Hz, 1H), 7.85 (dd, *J* = 4.8, 0.8 Hz, 1H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 29.9, 117.1, 117.7, 121.5, 127.7, 129.2, 133.1, 133.1, 135.0, 136.5, 141.0, 152.3, 152.7, 157.0, 183.3, 194.6.



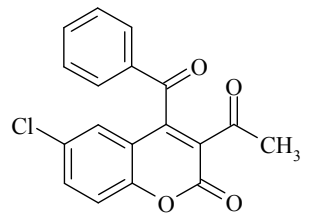
Ethyl-4-benzoyl-2-oxo-2*H*-chromen-3-carboxylate (**3o**): yield 0.132 g, 82%; white solid, m.p. 111–112 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 1.07 (t, *J* = 7.2 Hz, 3H), 4.14 (q, *J* = 7.1 Hz, 2H), 7.24–7.30 (m, 2H), 7.45 (d, *J* = 8.6 Hz, 1H), 7.54 (t, *J* = 8.1 Hz, 2H), 7.65–7.69 (m, 2H), 7.94 (dd, *J* = 8.4, 1.3 Hz, 2H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 12.4, 61.3, 115.3, 116.2, 124.0, 126.6, 128.0, 128.1, 129.0, 133.4, 133.7, 134.1, 153.2, 154.3, 155.4, 161.3, 191.1.



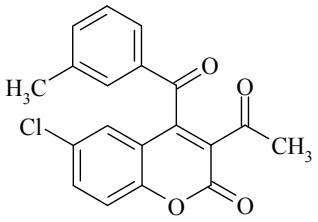
Ethyl-4-(4-methylbenzoyl)-2-oxo-2*H*-chromene-3-carboxylate (**3p**): yield 0.133 g, 79%; white solid, m.p. 121–123 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 1.06 (t, *J* = 7.1 Hz, 3H), 2.44 (s, 3H), 4.12 (q, *J* = 7.1 Hz, 2H), 7.21 (t, *J* = 7.7 Hz, 1H), 7.26 (dd, *J* = 8.6, 1.5 Hz, 1H), 7.31 (d, *J* = 8.0 Hz, 2H), 7.42 (d, *J* = 8.3 Hz, 1H), 7.63 (td, *J* = 8.5, 1.6 Hz, 1H), 7.80 (d, *J* = 8.0 Hz, 2H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 12.4, 20.8, 61.3, 115.3, 115.4, 116.2, 124.0, 126.6, 128.2, 128.8, 131.7, 133.3, 145.1, 153.2, 154.3, 155.5, 161.3, 190.6.



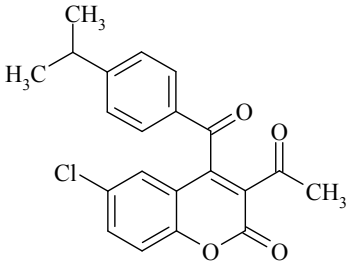
Ethyl-4-(4-chlorobenzoyl)-2-oxo-2*H*-chromene-3-carboxylate (**3q**): yield 0.146 g, 82%; white solid, m.p. 137–139 ºC. ^{1}H NMR (400.1 MHz, $CDCl_3$): δ = 1.10 (t, *J* = 7.1 Hz, 3H), 4.15 (q, *J* = 7.1 Hz, 2H), 7.18–7.26 (m, 2H), 7.42 (d, *J* = 8.5 Hz, 1H), 7.48 (d, *J* = 8.5 Hz, 2H), 7.64 (ddd, *J* = 8.6, 6.2, 2.6 Hz, 1H), 7.84 (d, *J* = 8.5 Hz, 2H). ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 12.5, 61.4, 115.2, 115.4, 116.4, 124.1, 126.4, 128.6, 129.3, 132.6, 133.5, 140.4, 153.3, 154.0, 155.2, 161.3, 189.9.



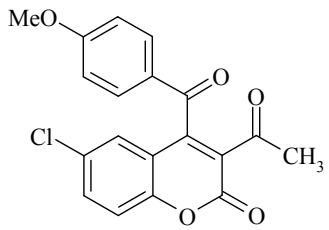
3-Acetyl-4-benzoyl-6-chloro-2*H*-chromen-2-one (**3r**): yield 0.135 g, 83%; white solid; m.p. 186–188 ºC. ^{1}H NMR (500.1 MHz, $CDCl_3$): δ = 2.72 (s, 3H), 7.31 (d, *J* = 2.3 Hz, 1H), 7.47 (d, *J* = 8.8 Hz, 1H), 7.59 (t, *J* = 7.7 Hz, 2H), 7.68 (dd, *J* = 8.8, 2.3 Hz, 1H), 7.72 (t, *J* = 7.1 Hz, 1H), 7.92 (d, *J* = 8.9 Hz, 2H). ^{13}C NMR (125.8 MHz, $CDCl_3$): δ = 31.0, 118.1, 118.7, 122.4, 127.5, 128.6, 129.3, 130.9, 134.7, 134.9, 135.3, 153.1, 156.0, 158.2, 192.9, 195.8.



3-Acetyl-6-chloro-4-(3-methylbenzoyl)-2*H*-chromen-2-one (**3s**): yield 0.136 g, 80%; pale yellow solid; m.p. 192–194 ºC. ^{1}H NMR (500.1 MHz, $CDCl_3$): δ = 2.50 (s, 3H), 2.72 (s, 3H), 7.31 (d, *J* = 2.3 Hz, 1H), 7.45 (t, *J* = 7.6 Hz, 1H), 7.47 (d, *J* = 8.9 Hz, 1H), 7.54 (d, *J* = 7.5 Hz, 1H), 7.65 (d, *J* = 7.7 Hz, 1H), 7.68 (dd, *J* = 8.9, 2.4 Hz, 1H), 7.78 (s, 1H). ^{13}C NMR (125.8 MHz, $CDCl_3$): δ = 21.5, 31.0, 118.2, 118.7, 122.3, 126.0, 127.5, 128.8, 129.2, 130.9, 134.8, 135.3, 135.6, 139.4, 153.1, 156.2, 158.3, 193.1, 195.8.

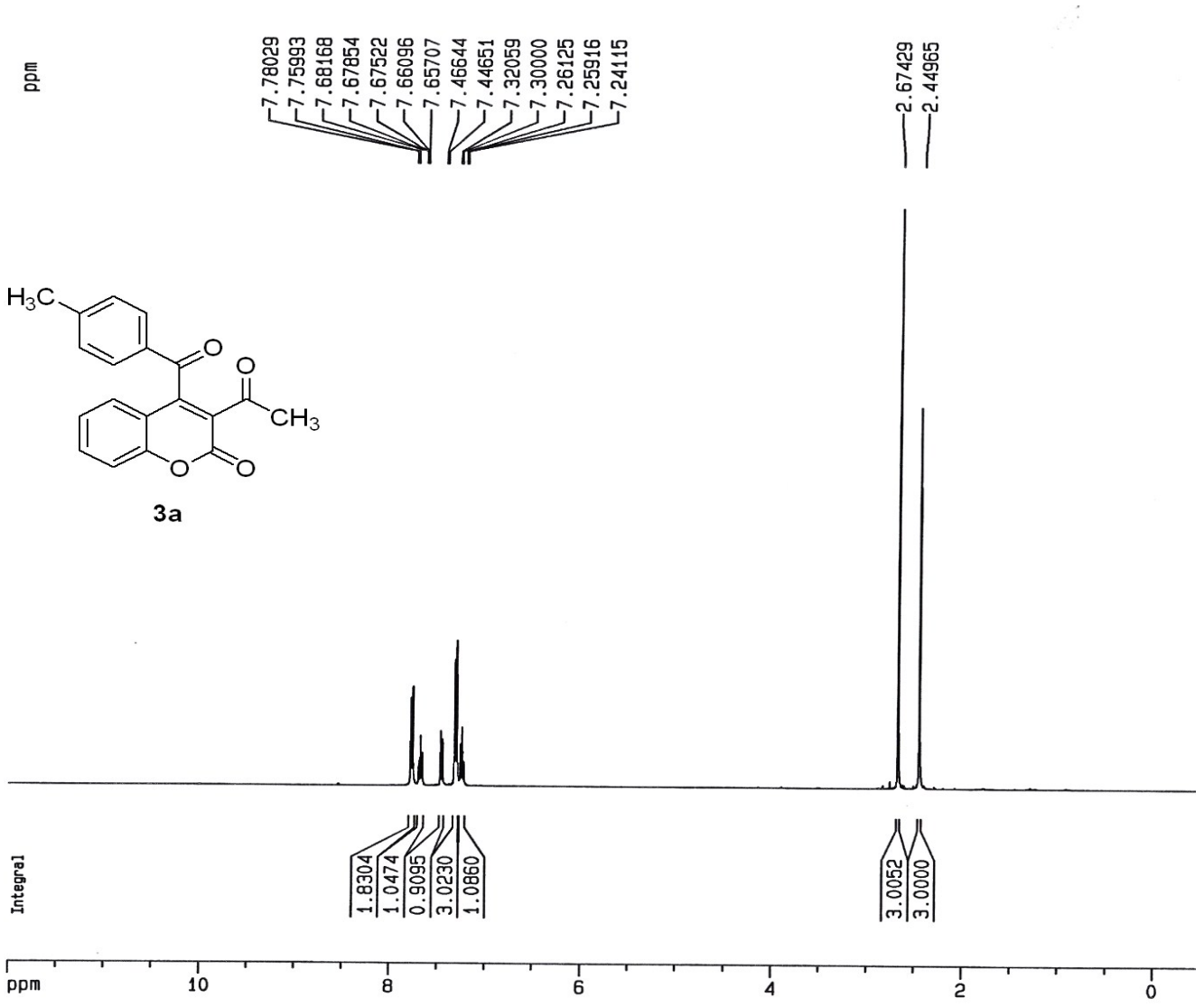


3-Acetyl-6-chloro-4-(4-isopropylbenzoyl)-2*H*-chromen-2-one (**3t**): yield 0.143 g, 78%; pale yellow solid; m.p. 162–164 ºC. ^{1}H NMR (500.1 MHz, $CDCl_3$): δ = 1.36 (d, *J* = 6.9 Hz, 6H), 2.72 (s, 3H), 3.07 (sept, *J* = 6.9 Hz, 1H), 7.32 (d, *J* = 2.3 Hz, 1H), 7.43 (d, *J* = 8.4 Hz, 2H), 7.46 (d, *J* = 8.9 Hz, 1H), 7.67 (dd, *J* = 8.8, 2.3 Hz, 1H), 7.84 (d, *J* = 8.2 Hz, 2H). ^{13}C NMR (125.8 MHz, $CDCl_3$): δ = 23.6, 31.0, 34.6, 118.2, 118.6, 122.3, 127.5, 127.6, 128.9, 130.8, 133.2, 134.8, 153.1, 156.1, 156.5, 158.3, 192.5, 195.9.

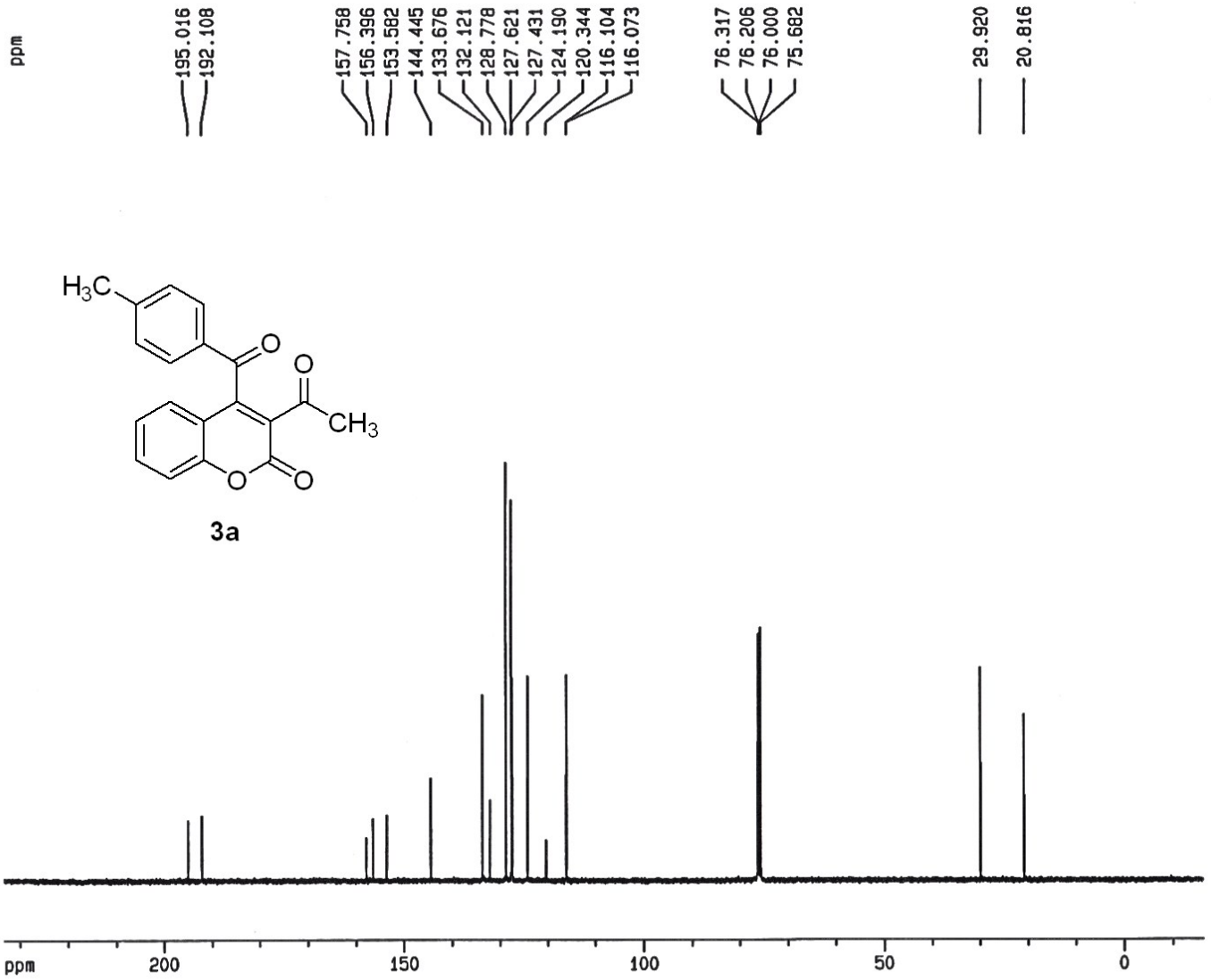


3-Acetyl-6-chloro-4-(4-methoxybenzoyl)-2*H*-chromen-2-one (**3u**): yield 0.137 g, 77%; yellow solid; m.p. 199–201 ºC. ^{1}H NMR (500.1 MHz, $CDCl_3$): δ = 2.71 (s, 3H), 3.97 (s, 3H), 7.05 (d, *J* = 8.9 Hz, 2H), 7.32 (d, *J* = 2.3 Hz, 1H), 7.46 (d, *J* = 8.9 Hz, 1H), 7.66 (dd, *J* = 8.9, 2.4 Hz, 1H), 7.89 (d, *J* = 8.4 Hz, 2H). ^{13}C NMR (125.8 MHz, $CDCl_3$): δ = 31.0, 55.8, 114.7, 118.2, 118.6, 122.6, 127.5, 128.5, 130.8, 131.2, 134.6, 153.0, 155.7, 158.3, 164.9, 191.3, 196.0.

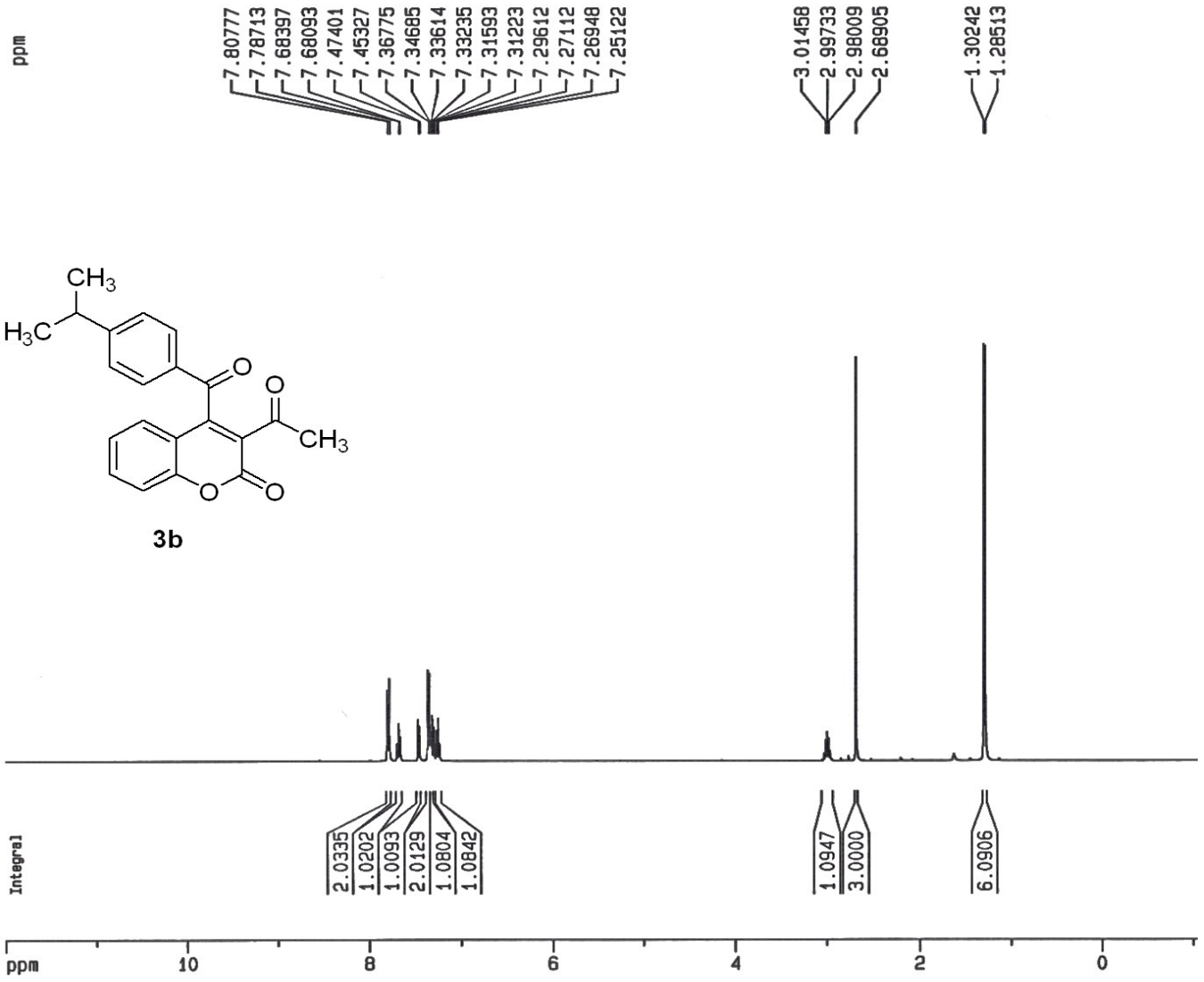
^{1}H NMR spectrum of 3-acetyl-4-(4-methylbenzoyl)-2*H*-chromen-2-one (**3a**)



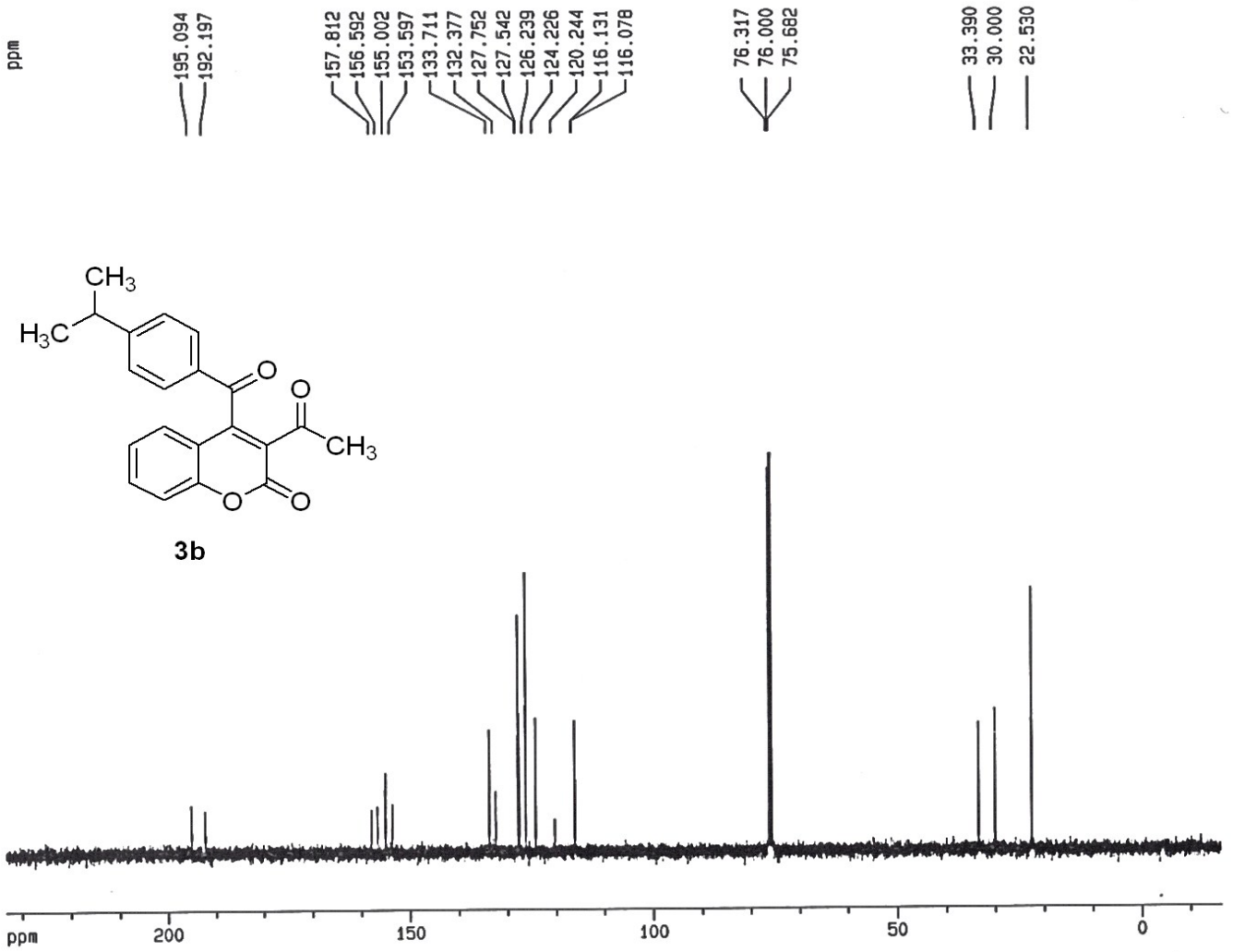
^{13}C NMR spectrum of 3-acetyl-4-(4-methylbenzoyl)-2*H*-chromen-2-one (**3a**)



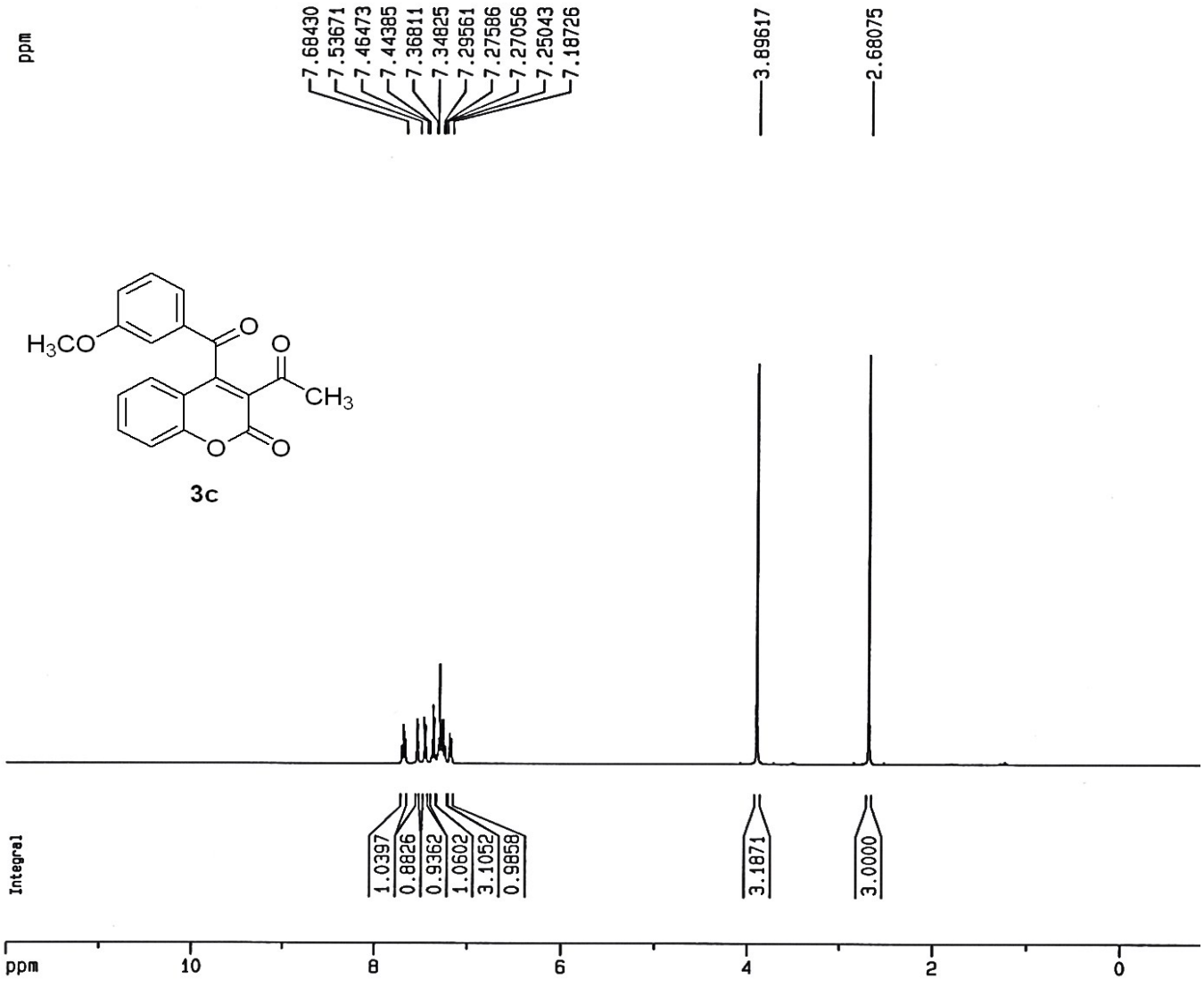
^{1}H NMR spectrum of 3-acetyl-4-(4-isopropylbenzoyl)-2*H*-chromen-2-one (**3b**)



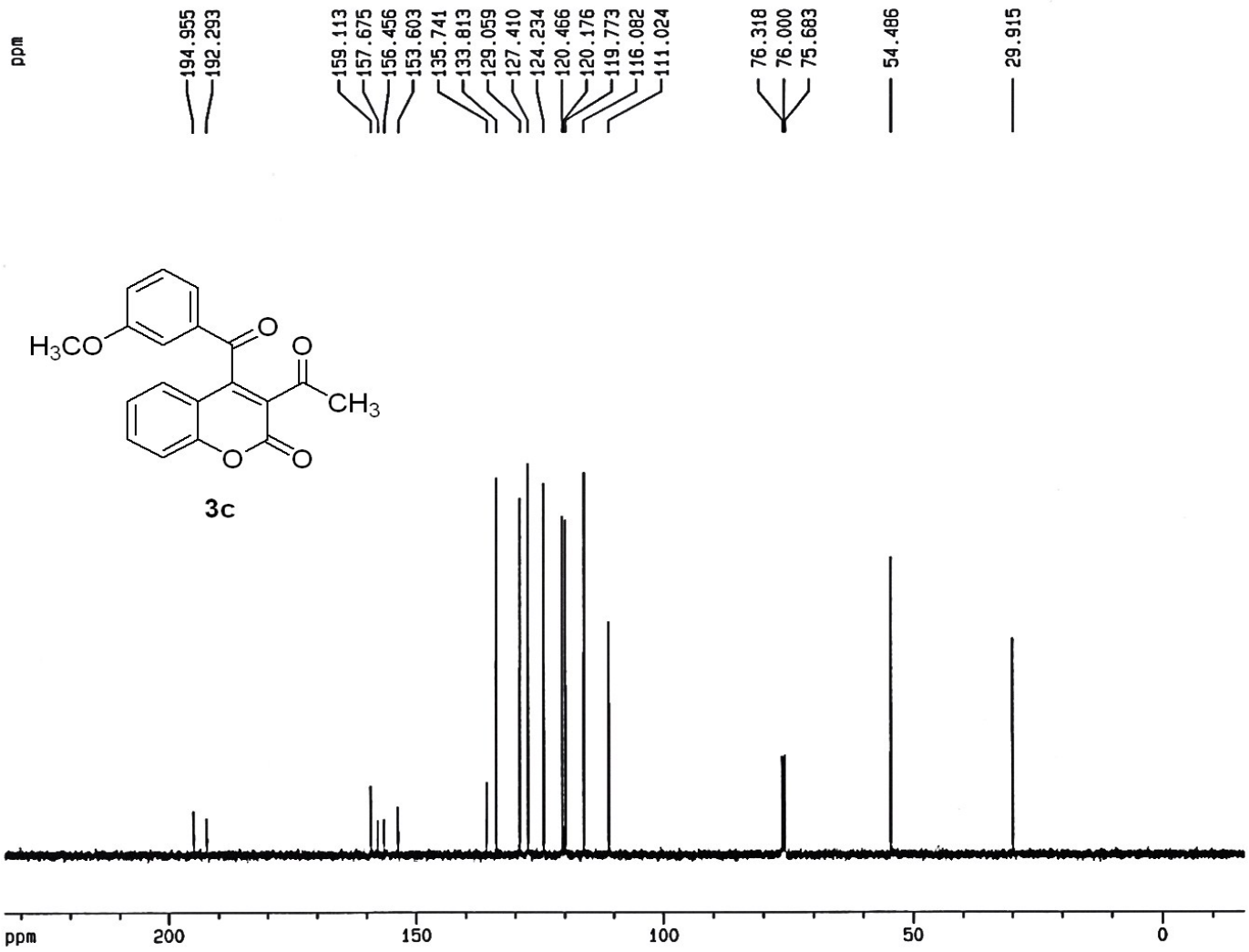
^{13}C NMR spectrum of 3-acetyl-4-(4-isopropylbenzoyl)-2*H*-chromen-2-one (**3b**)



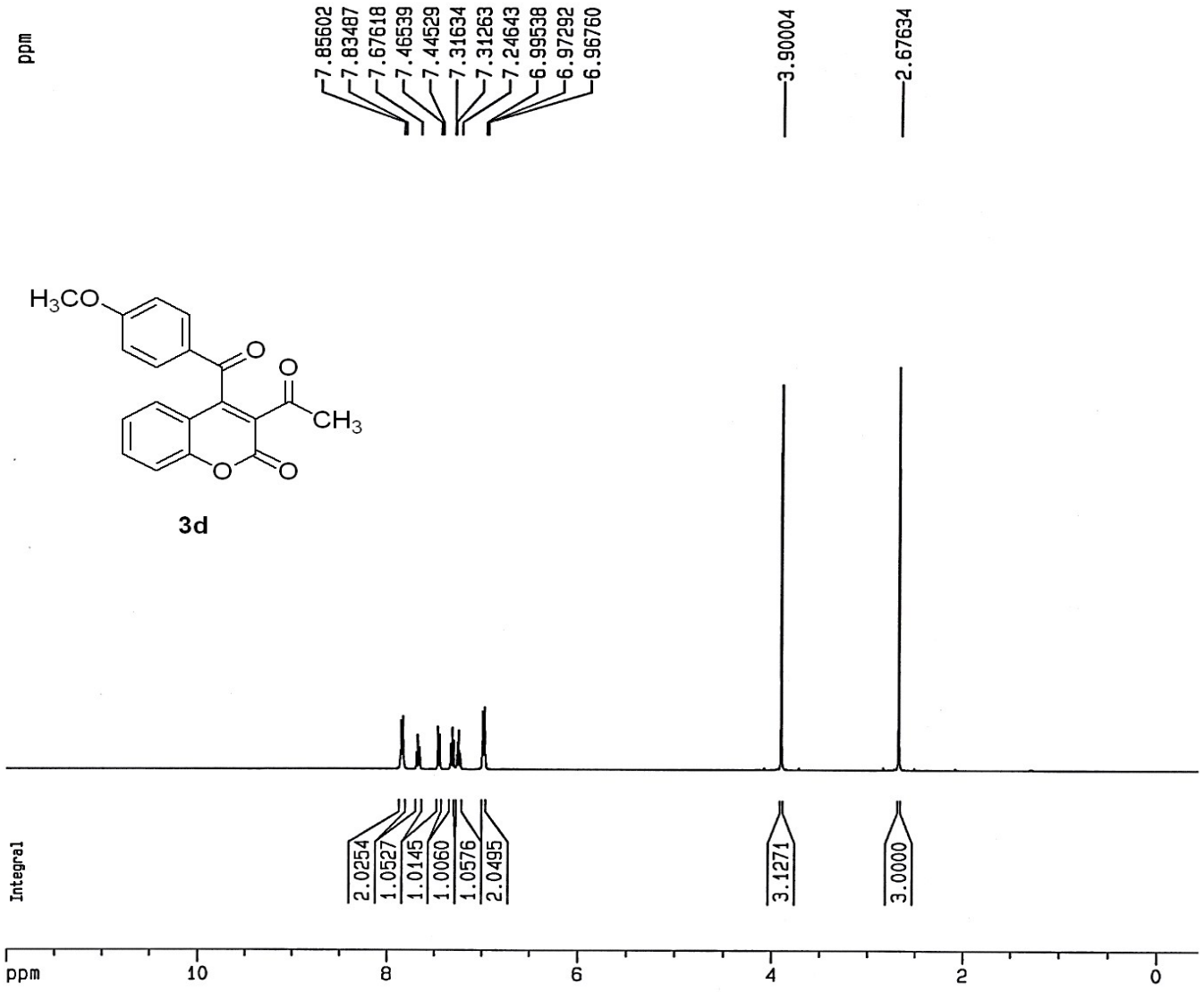
^{1}H NMR spectrum of 3-acetyl-4-(3-methoxybenzoyl)-2*H*-chromen-2-one (**3c**)



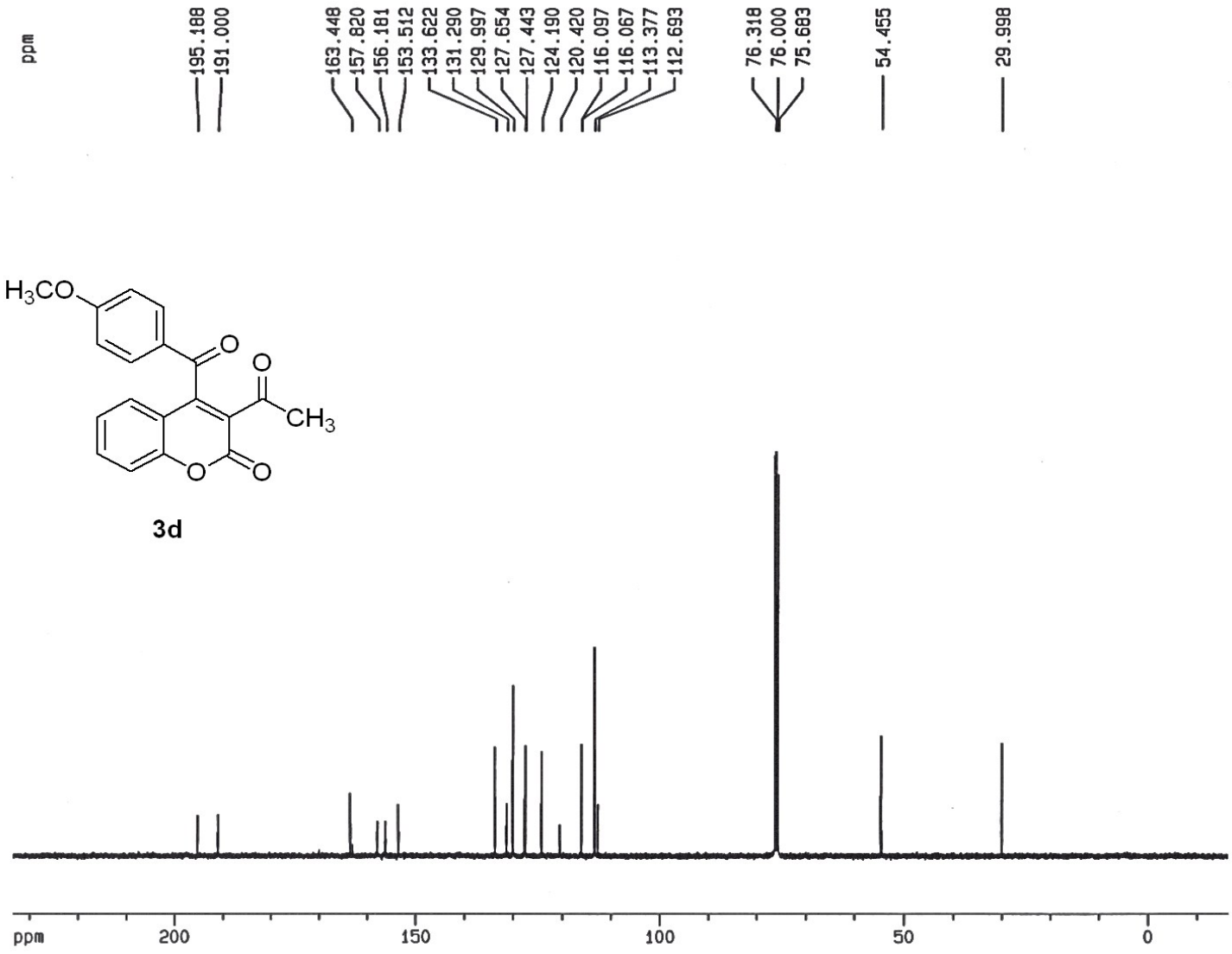
^{13}C NMR spectrum of 3-acetyl-4-(3-methoxybenzoyl)-2*H*-chromen-2-one (**3c**)



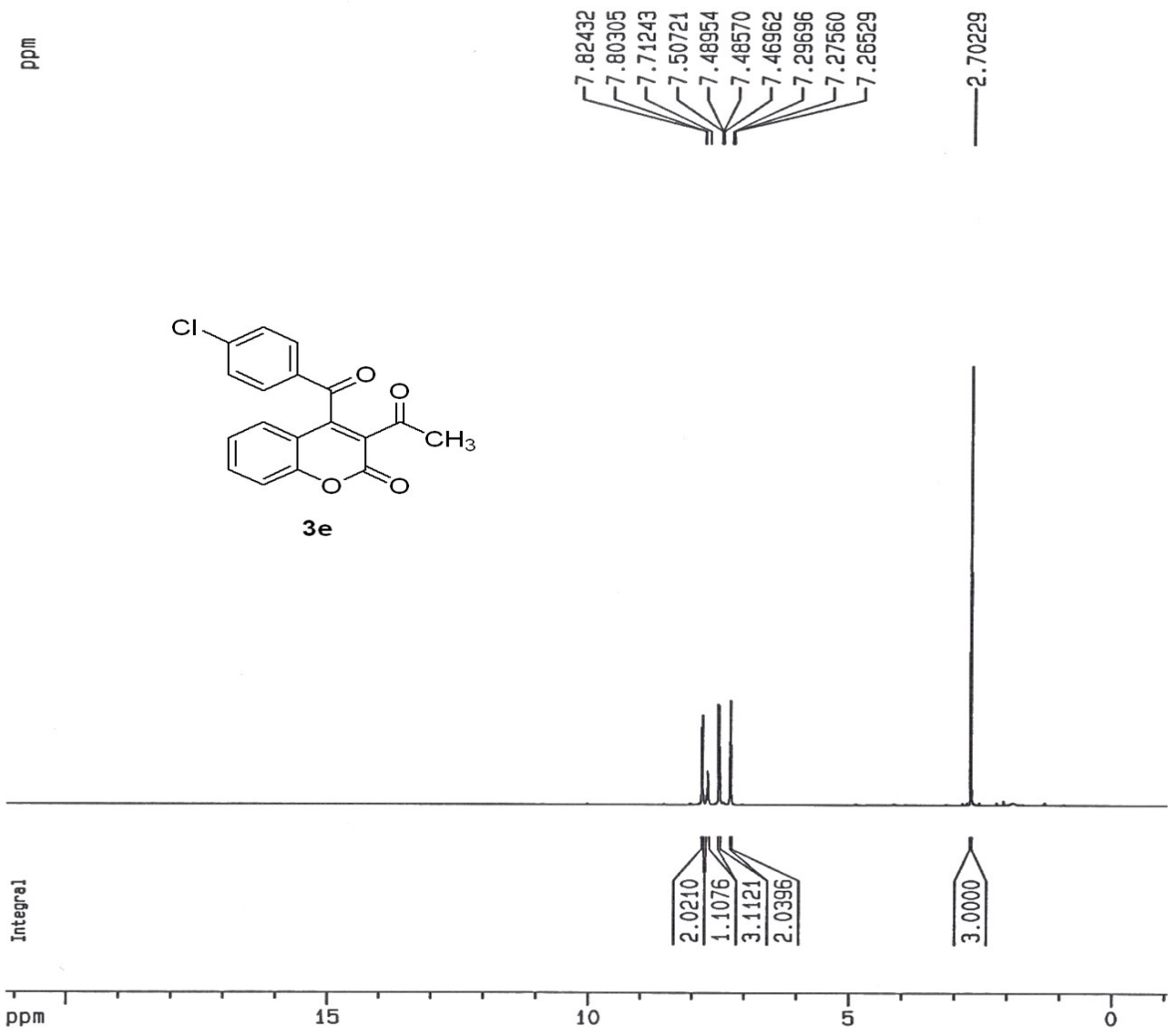
^{1}H NMR spectrum of 3-acetyl-4-(4-methoxybenzoyl)-2*H*-chromen-2-one (**3d**)



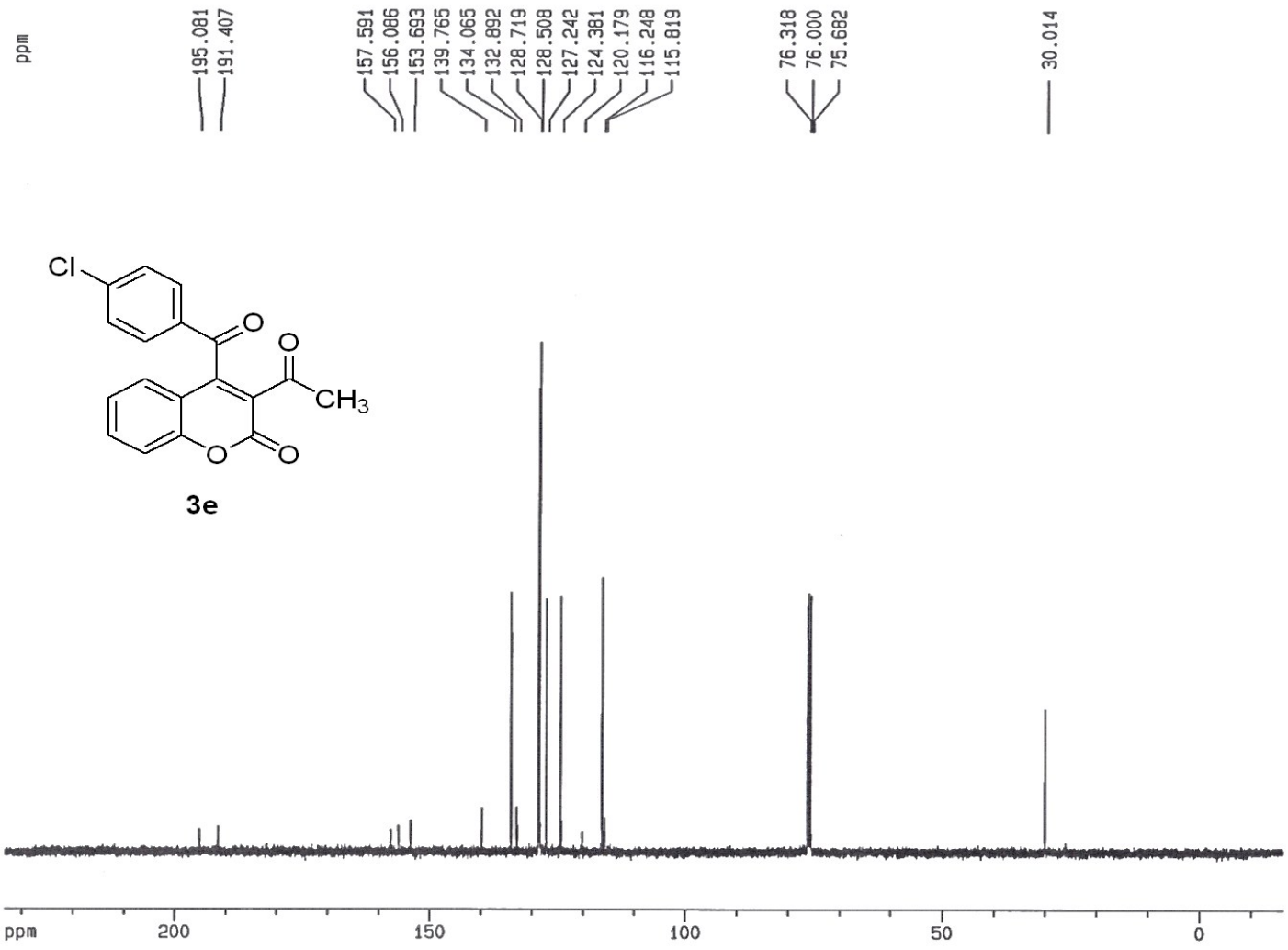
^{13}C NMR spectrum of 3-acetyl-4-(4-methoxybenzoyl)-2*H*-chromen-2-one (**3d**)



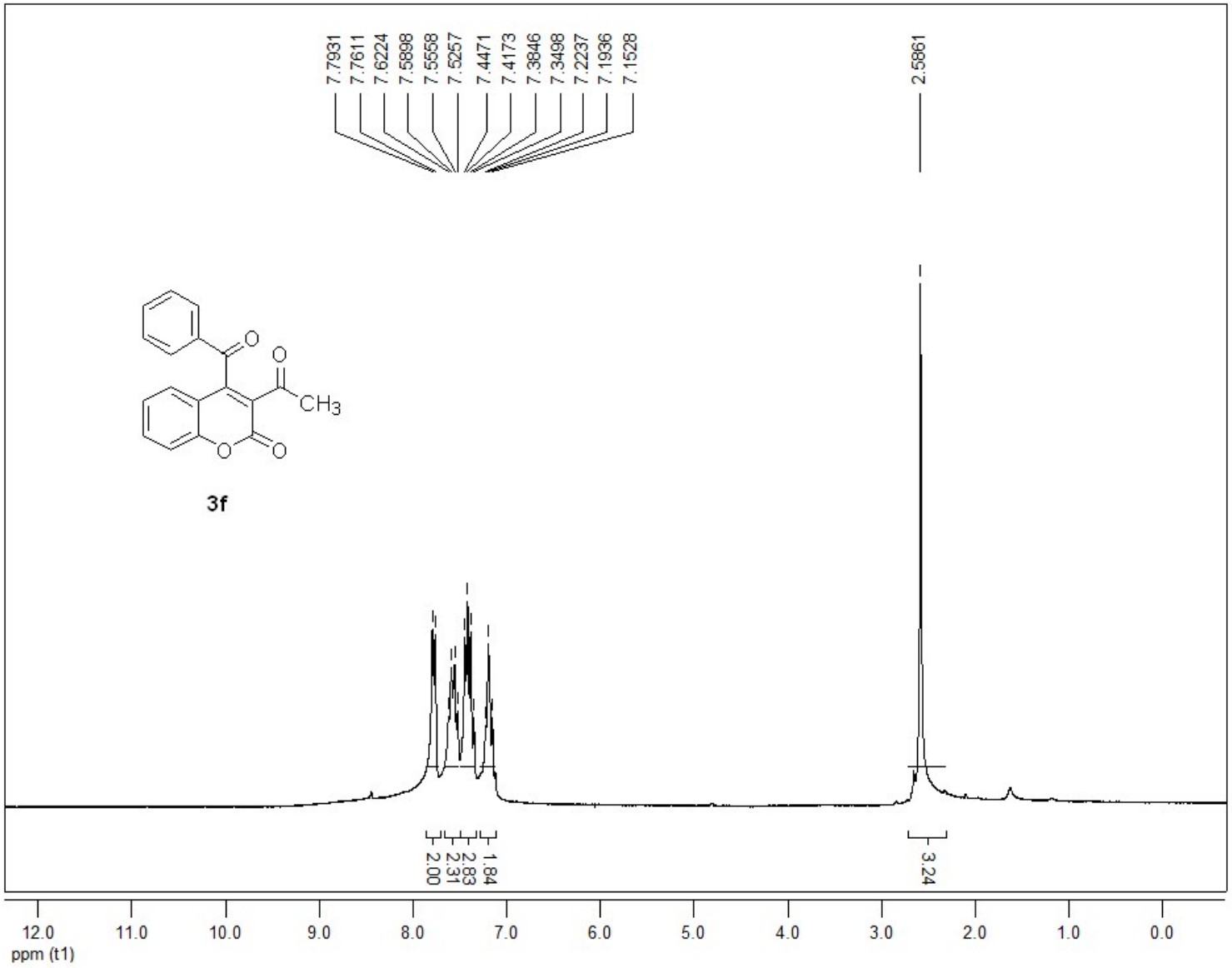
^{1}H NMR spectrum of 3-acetyl-4-(4-chlorobenzoyl)-2*H*-chromen-2-one (**3e**)



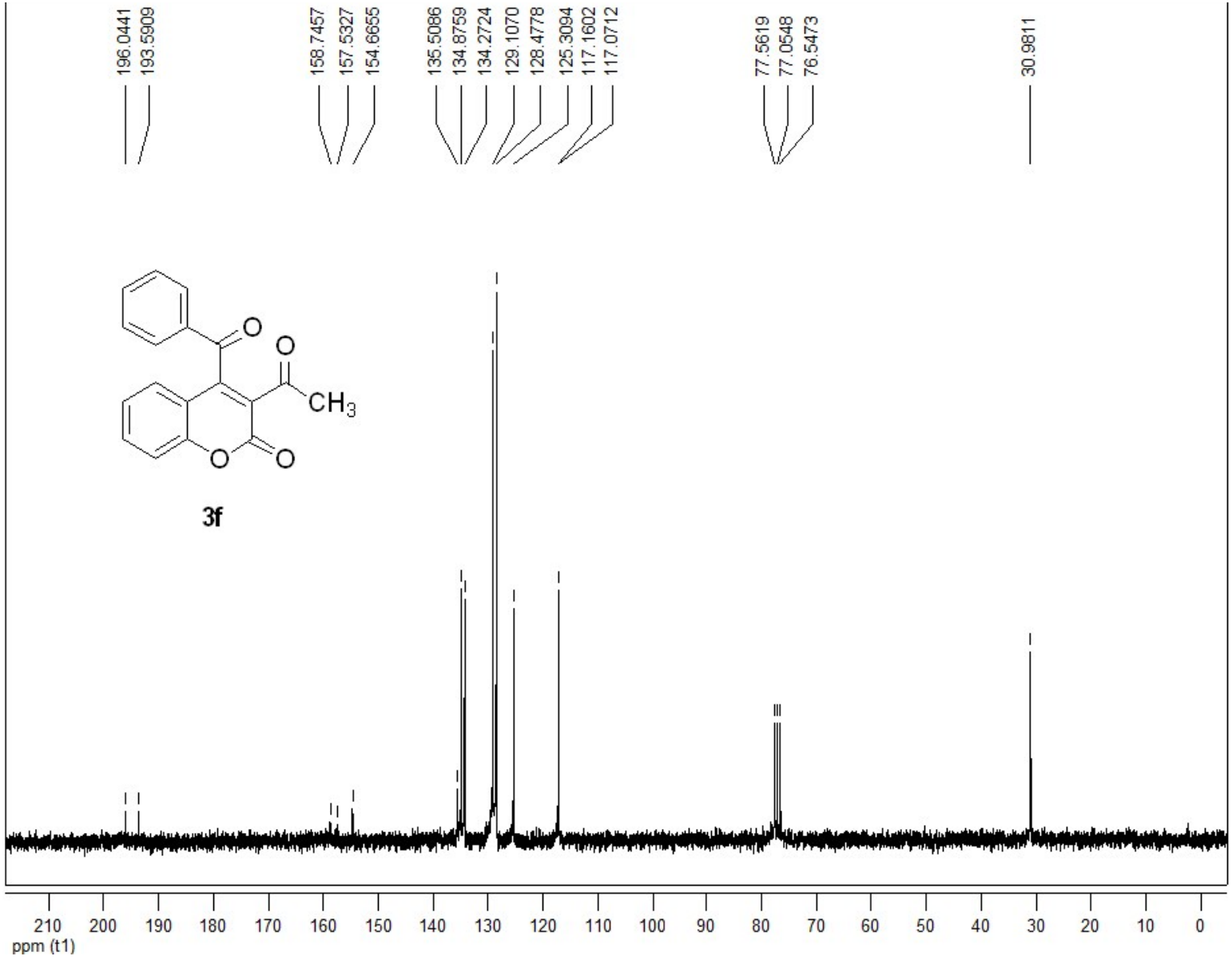
^{13}C NMR spectrum of 3-acetyl-4-(4-chlorobenzoyl)-2*H*-chromen-2-one (**3e**)



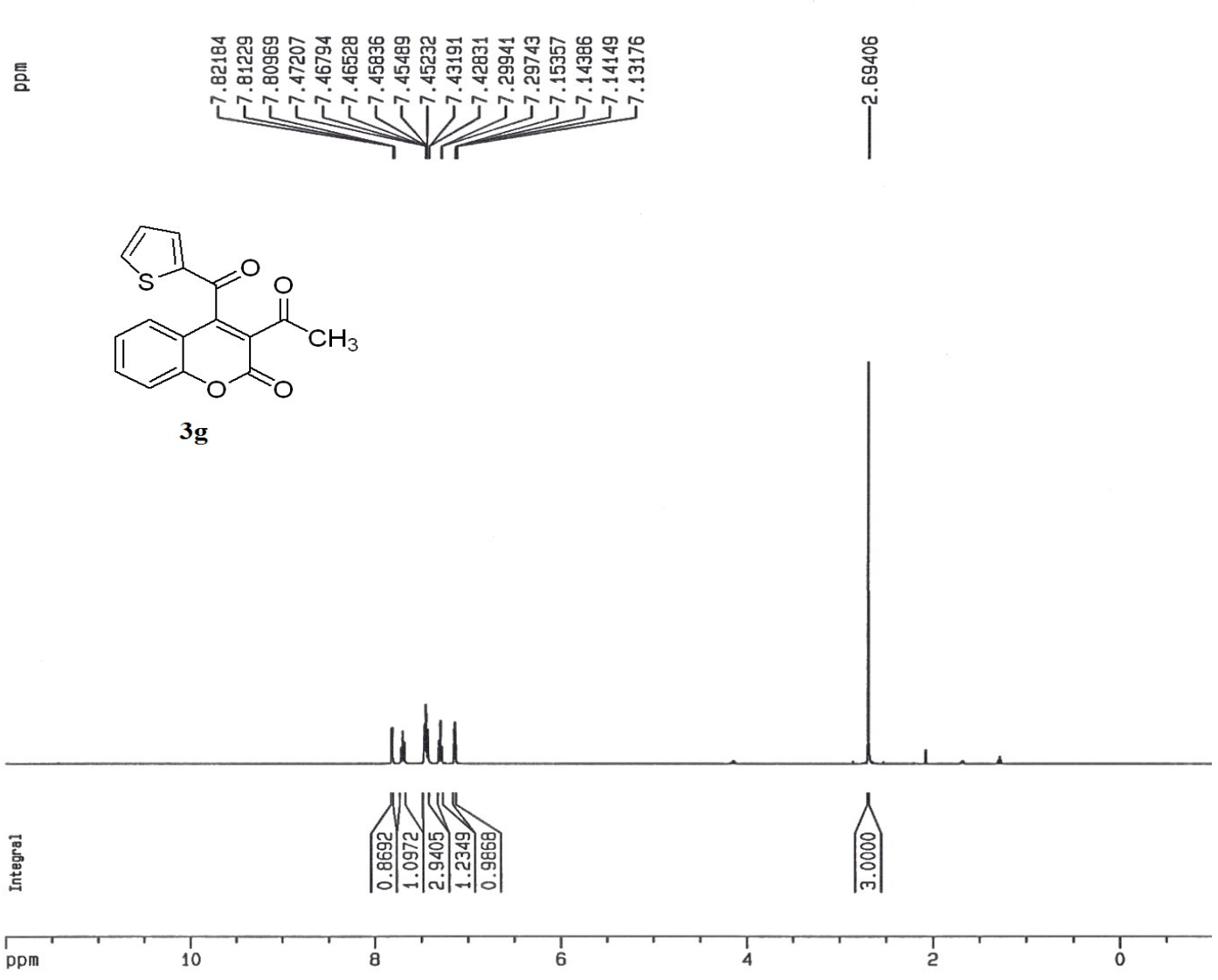
^{1}H NMR spectrum of 3-acetyl-4-benzoyl-2*H*-chromen-2-one (**3f**)



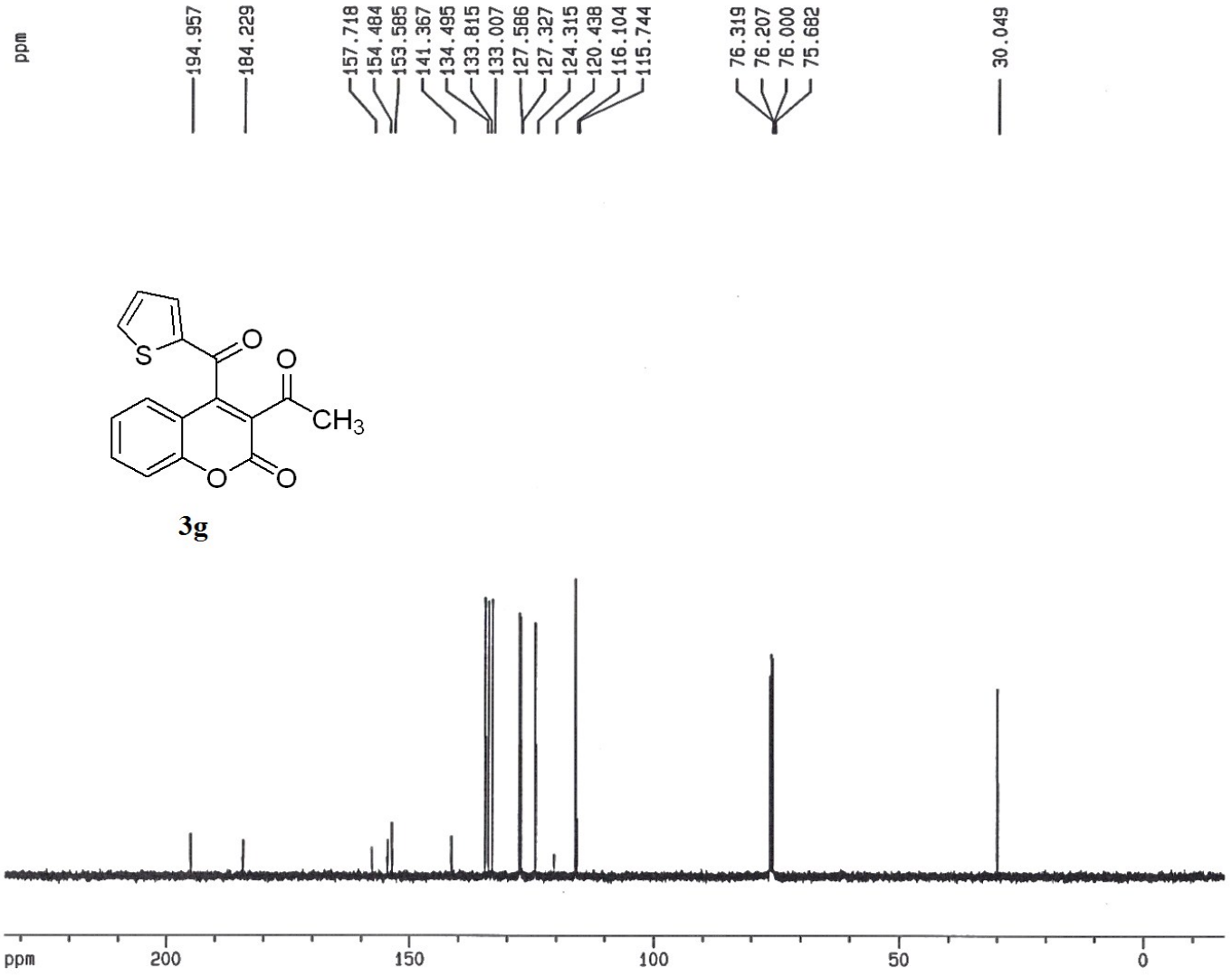
^{13}C NMR spectrum of 3-acetyl-4-benzoyl-2*H*-chromen-2-one (**3f**)



^{1}H NMR spectrum of 3-acetyl-4-(thiophene-2-carbonyl)-2*H*-chromen-2-one (**3g**)

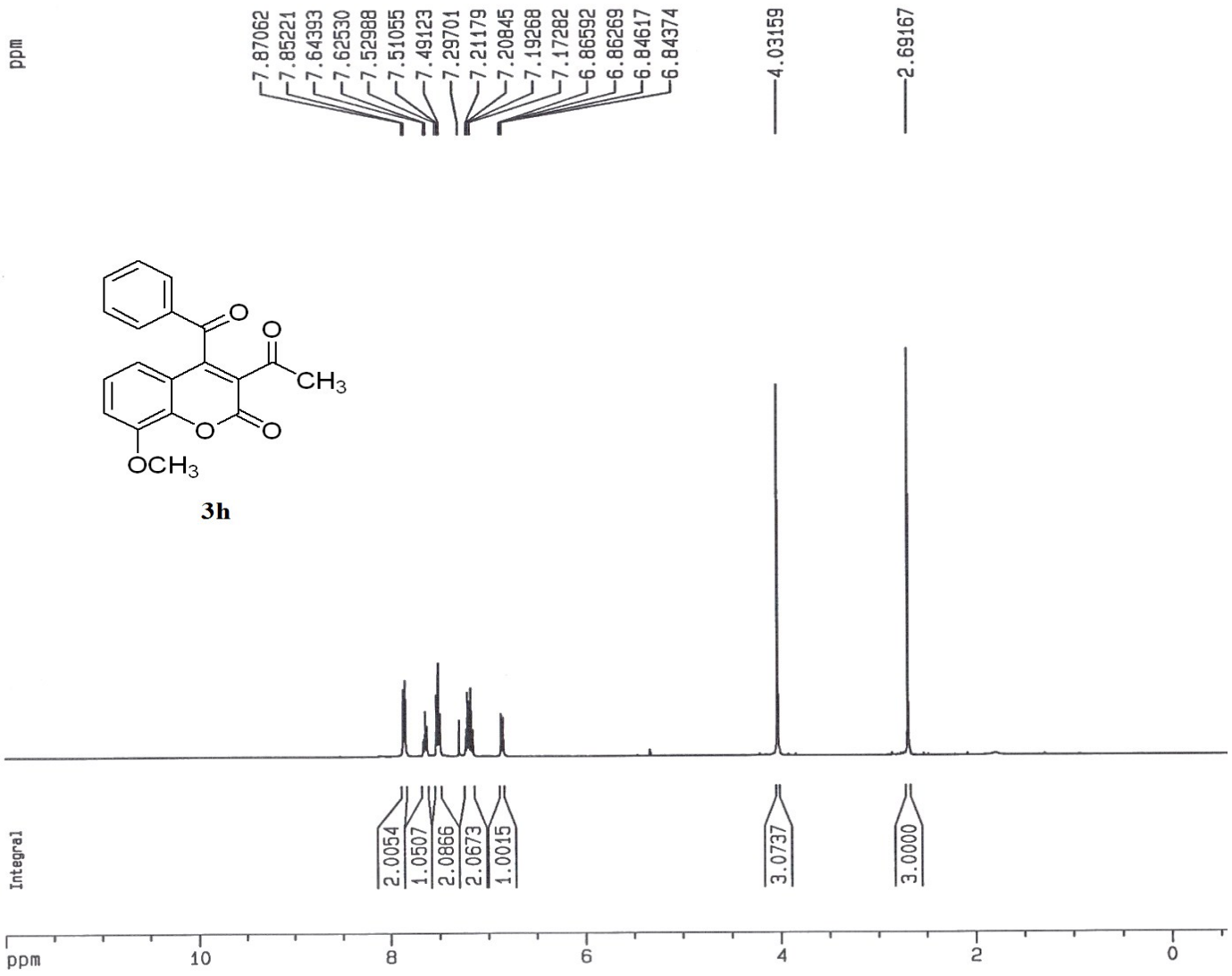


^{13}C NMR spectrum of 3-acetyl-4-(thiophene-2-carbonyl)-2*H*-chromen-2-one (**3g**)

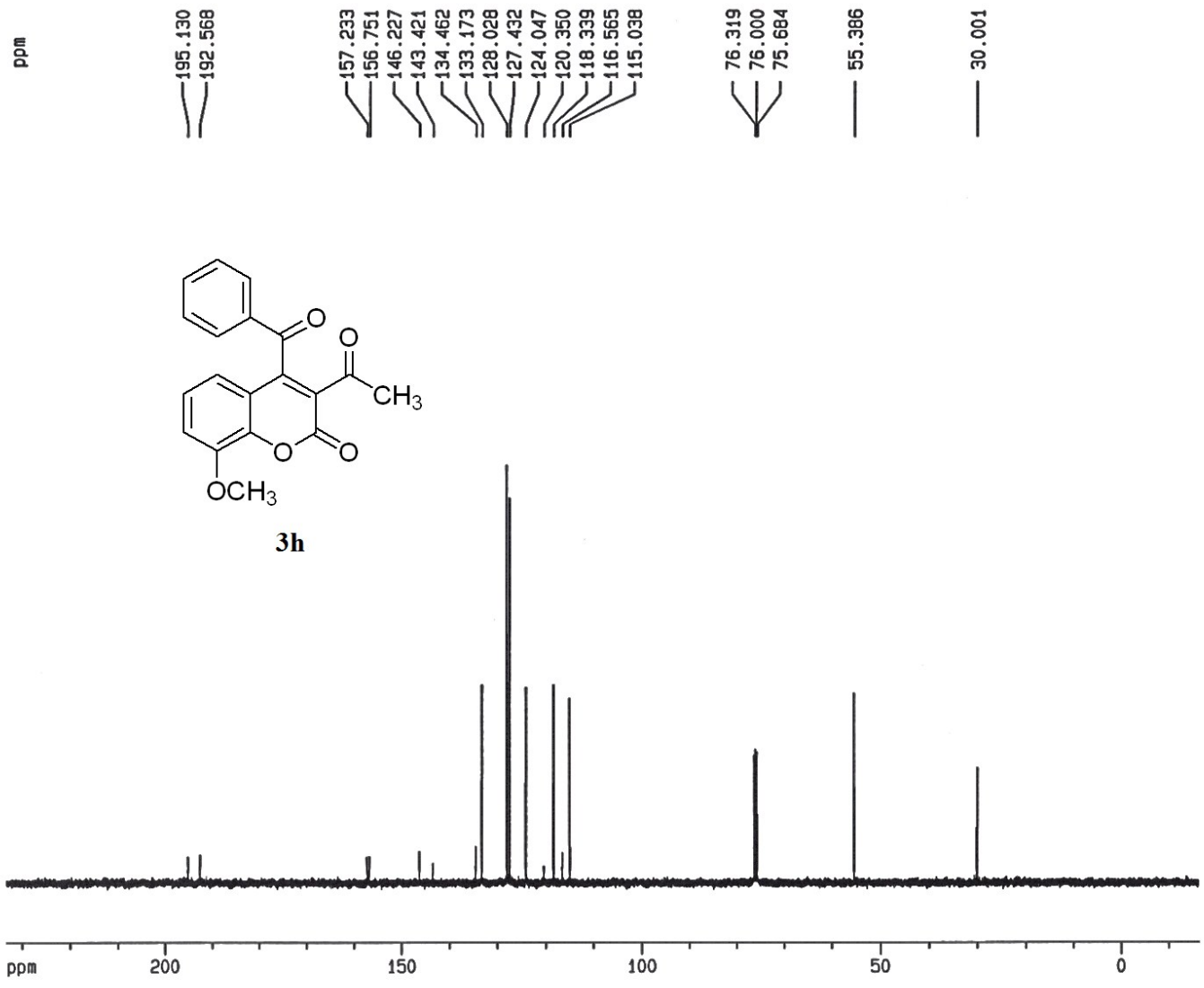


3g

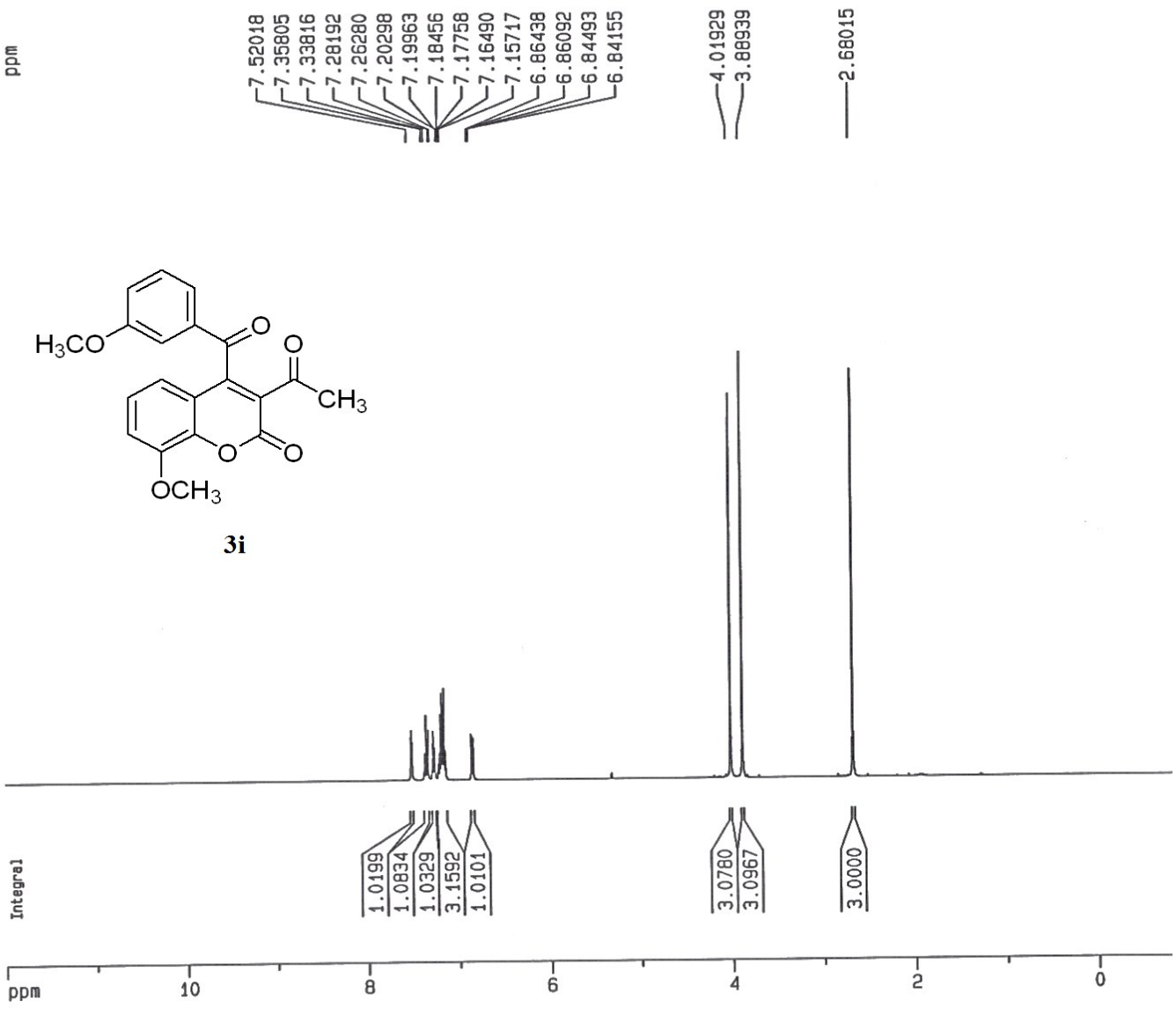
^{1}H NMR spectrum of 3-acetyl-4-benzoyl-8-methoxy-2*H*-chromen-2-one (**3h**)



^{13}C NMR spectrum of 3-acetyl-4-benzoyl-8-methoxy-2*H*-chromen-2-one (**3h**)

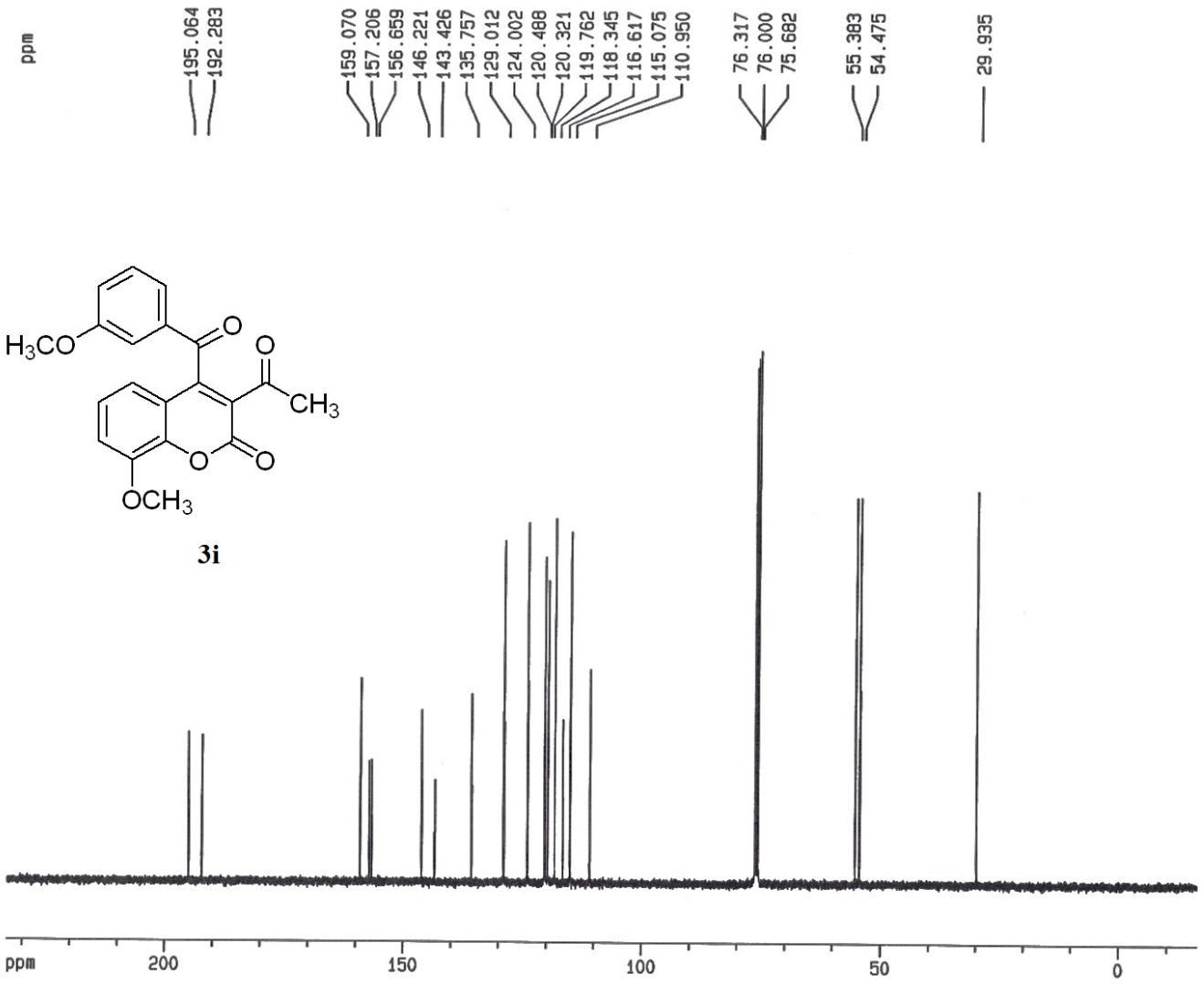


^{1}H NMR spectrum of 3-acetyl-8-methoxy-4-(3-methoxybenzoyl)-2*H*-chromen-2-one (**3i**)

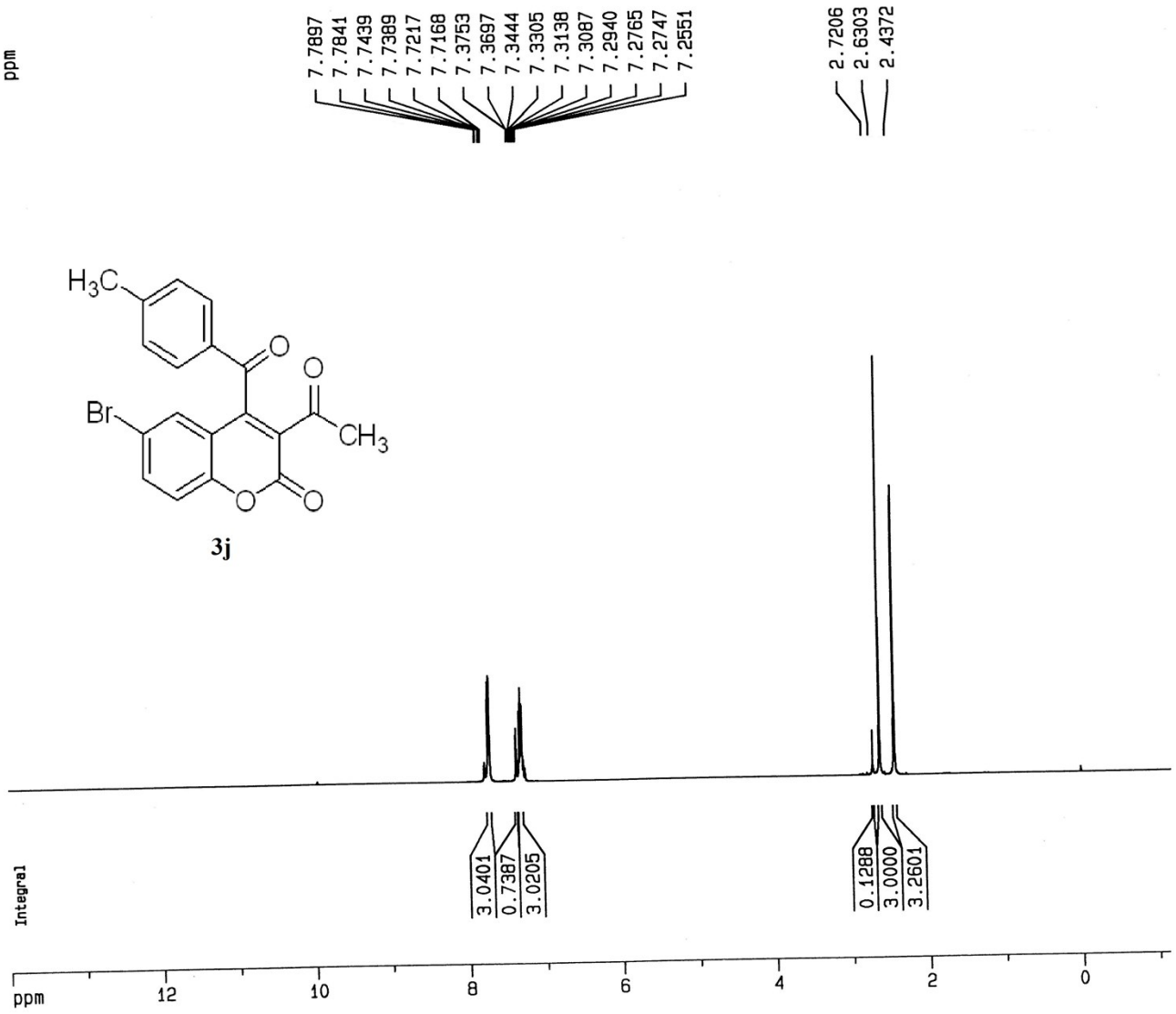


3i

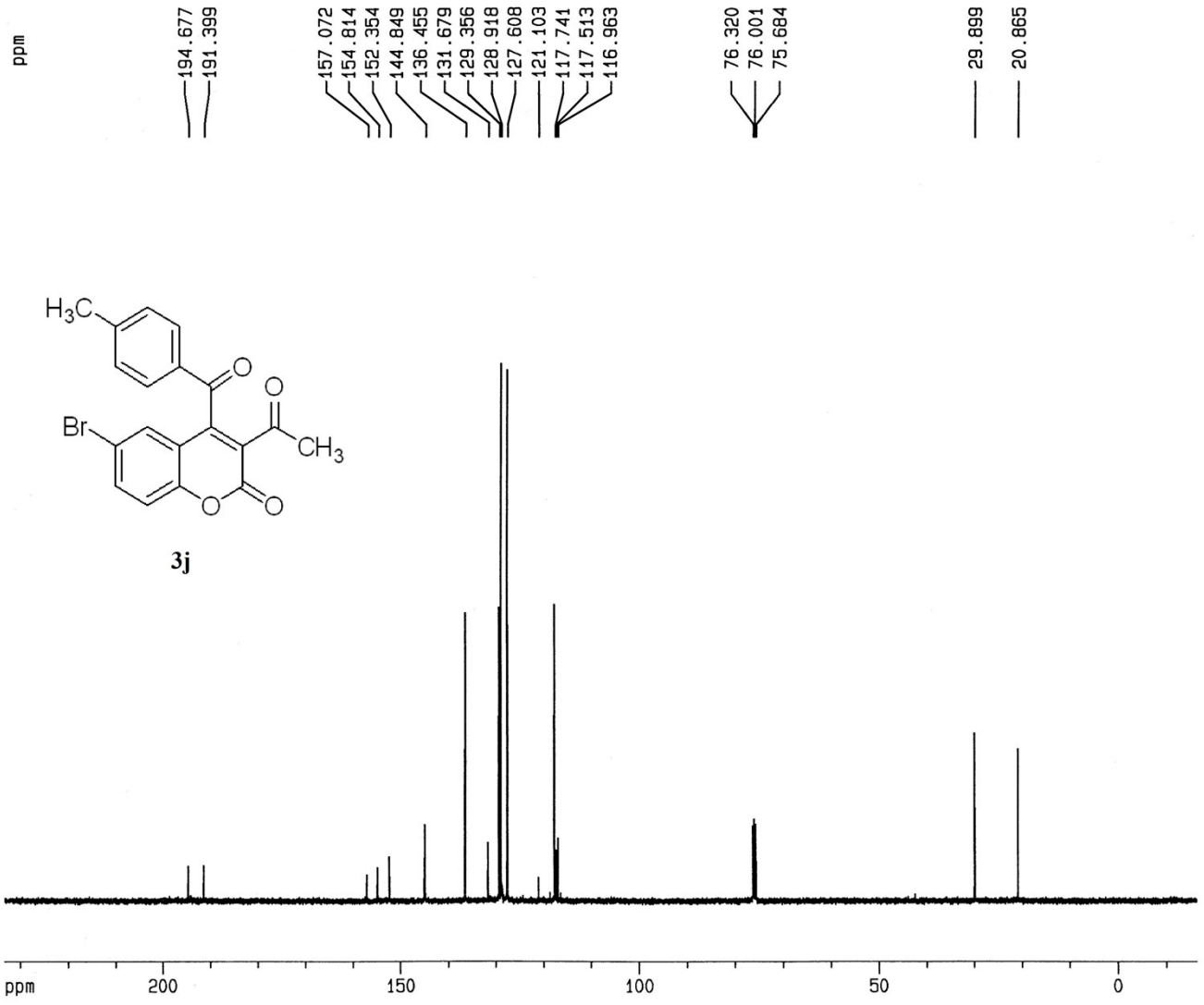
^{13}C NMR spectrum of 3-acetyl-8-methoxy-4-(3-methoxybenzoyl)-2*H*-chromen-2-one (**3i**)



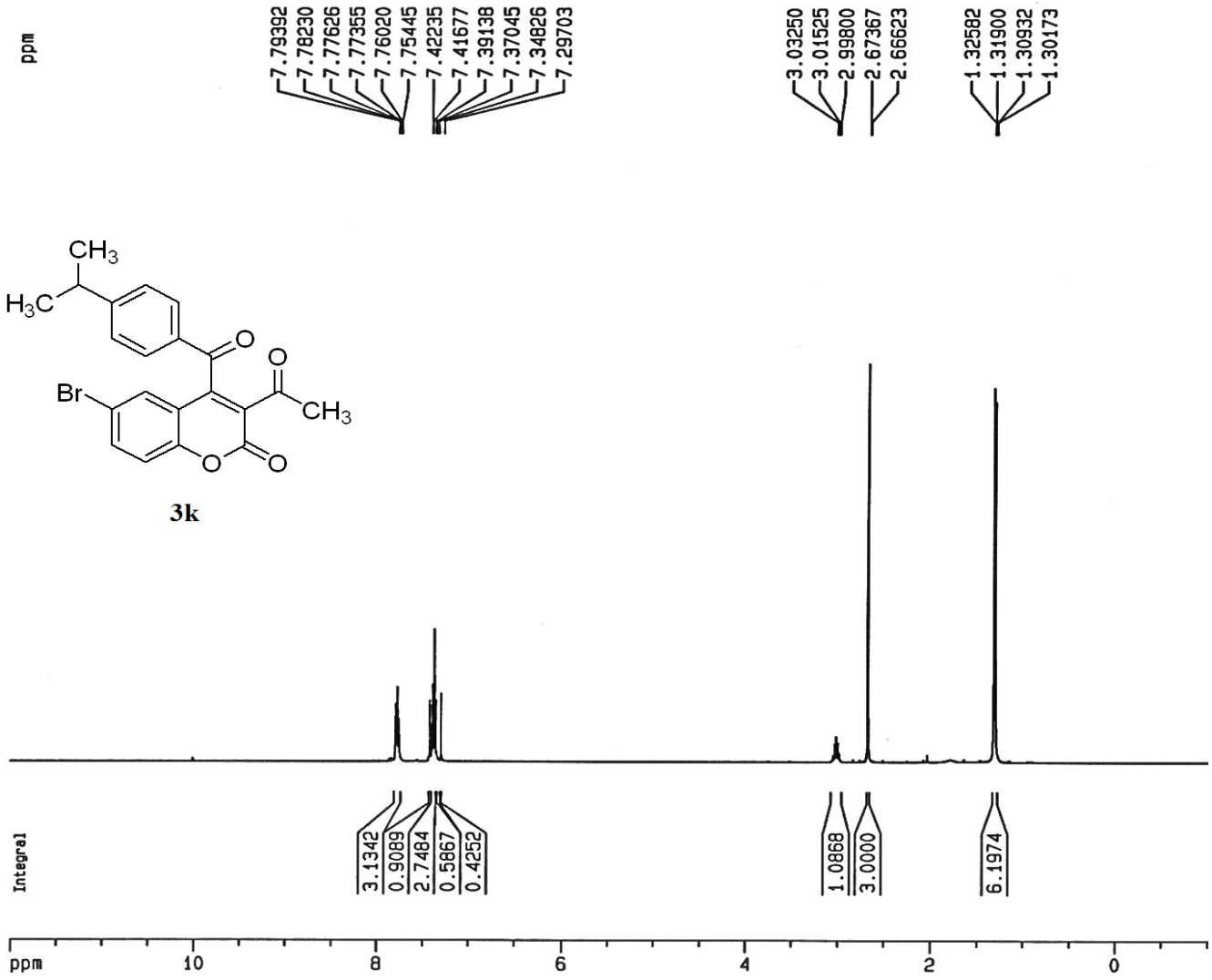
^{1}H NMR spectrum of 3-acetyl-6-bromo-4-(4-methylbenzoyl)-2*H*-chromene-2-one (**3j**)



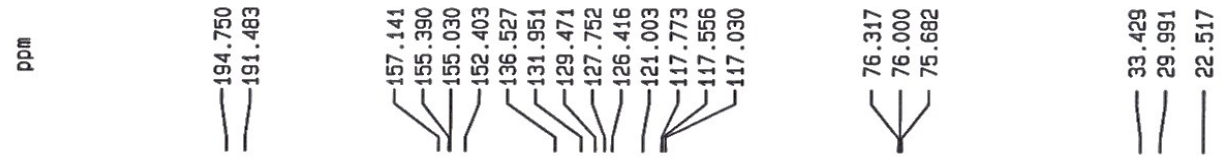
^{13}C NMR spectrum of 3-acetyl-6-bromo-4-(4-methylbenzoyl)-2*H*-chromene-2-one (**3j**)

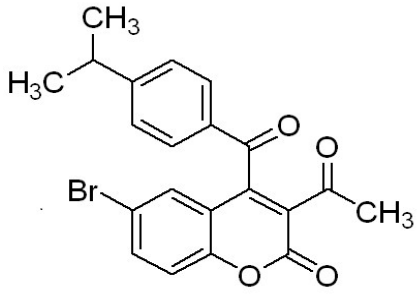


^{1}H NMR spectrum of 3-acetyl-6-bromo-4-(4-isopropylbenzoyl)-2*H*-chromen-2-one (**3k**)

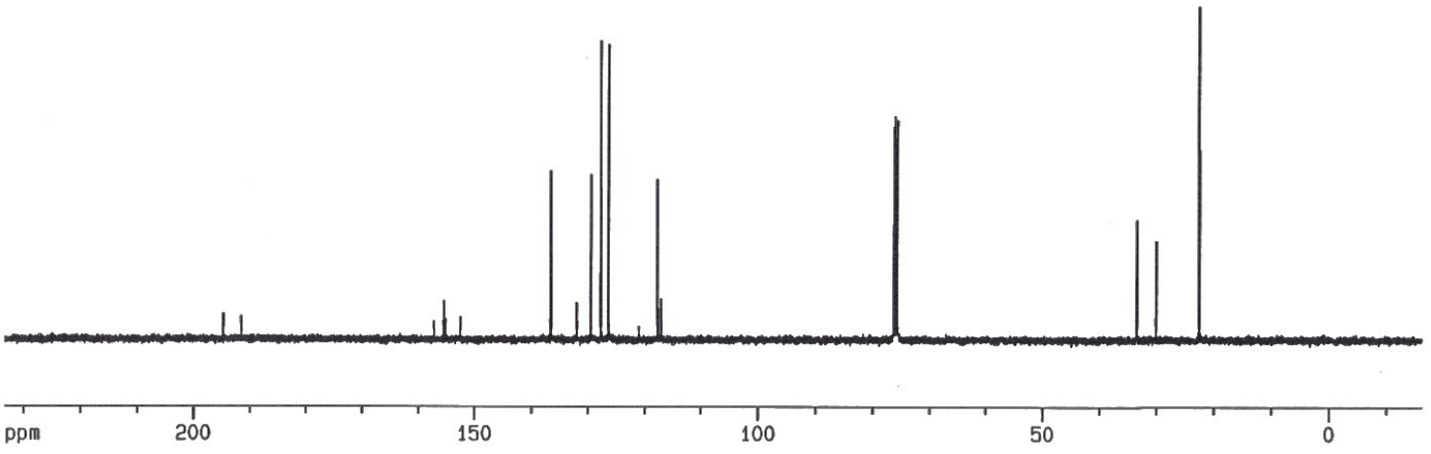


^{13}C NMR spectrum of 3-acetyl-6-bromo-4-(4-isopropylbenzoyl)-2*H*-chromen-2-one (**3k**)

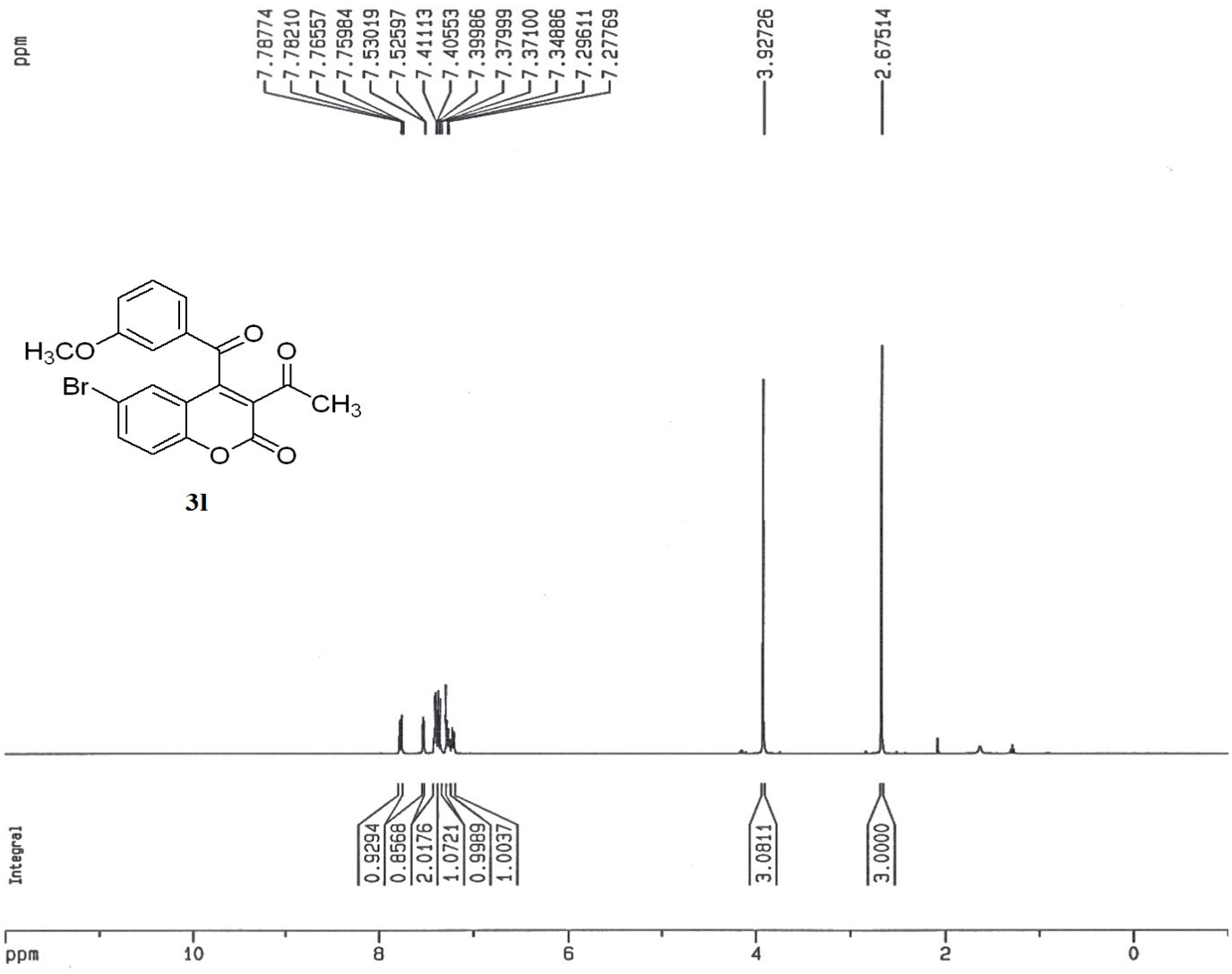




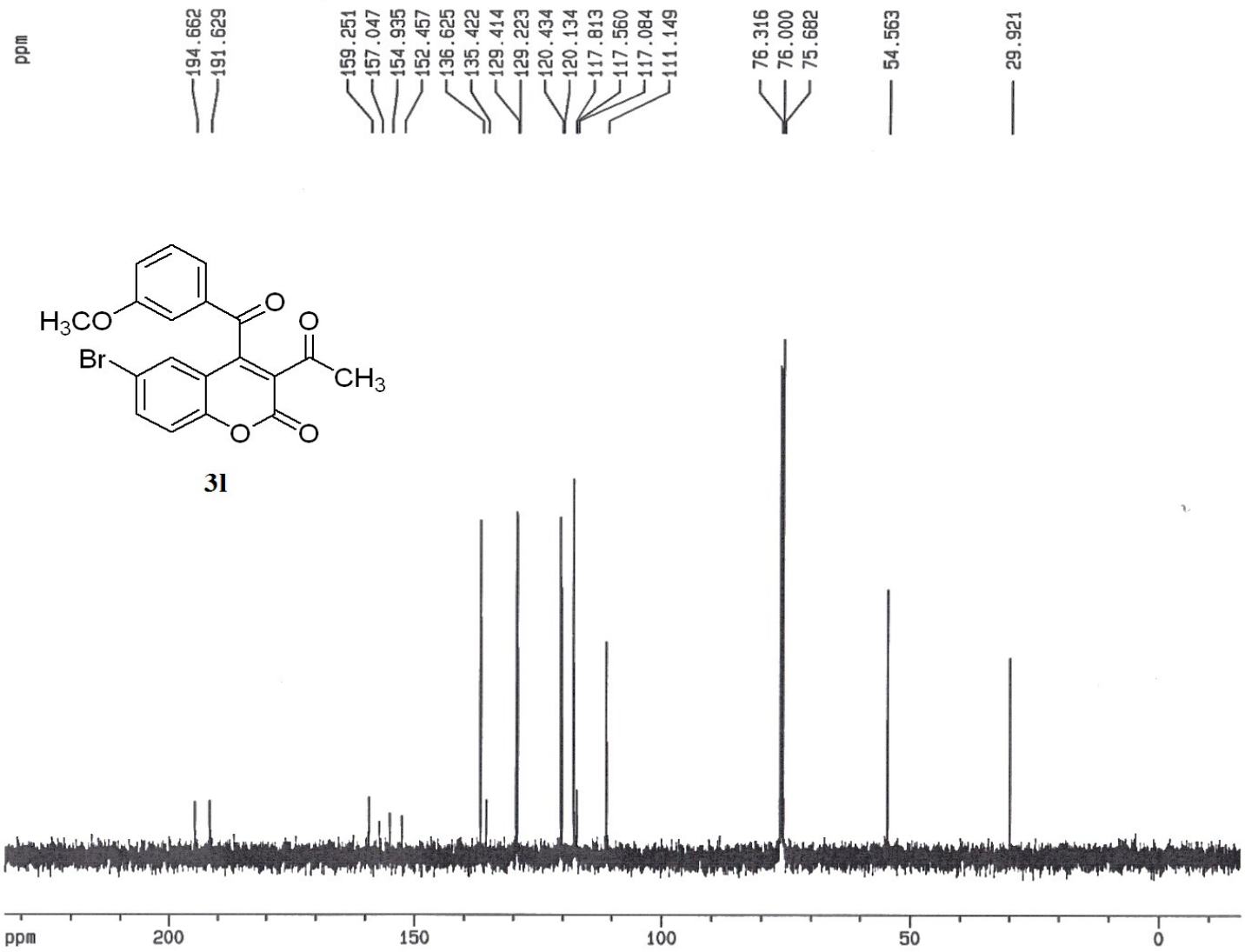
3k



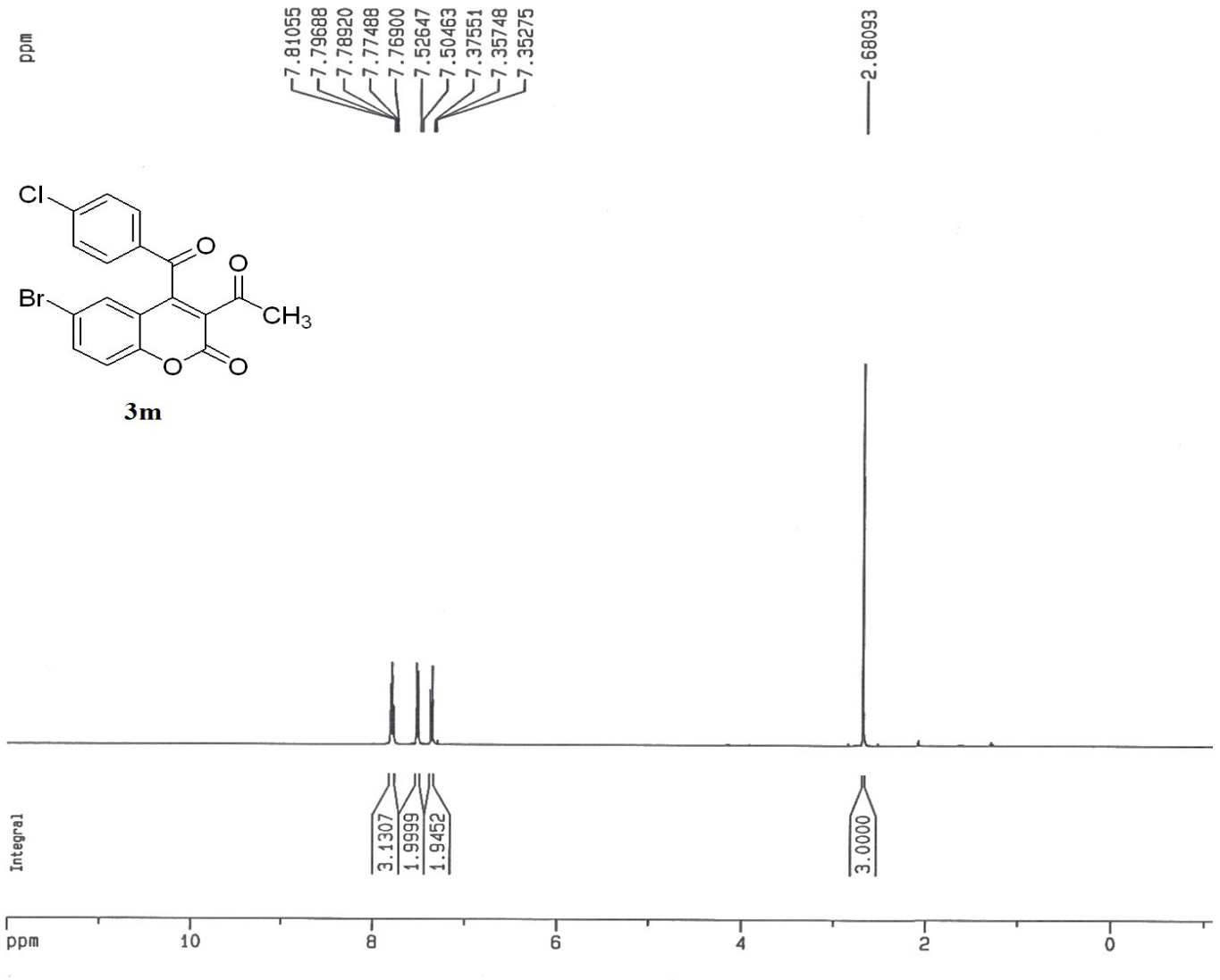
^{1}H NMR spectrum of 3-acetyl-6-bromo-4-(3-methoxybenzoyl)-2*H*-chromen-2-one (**3l**)



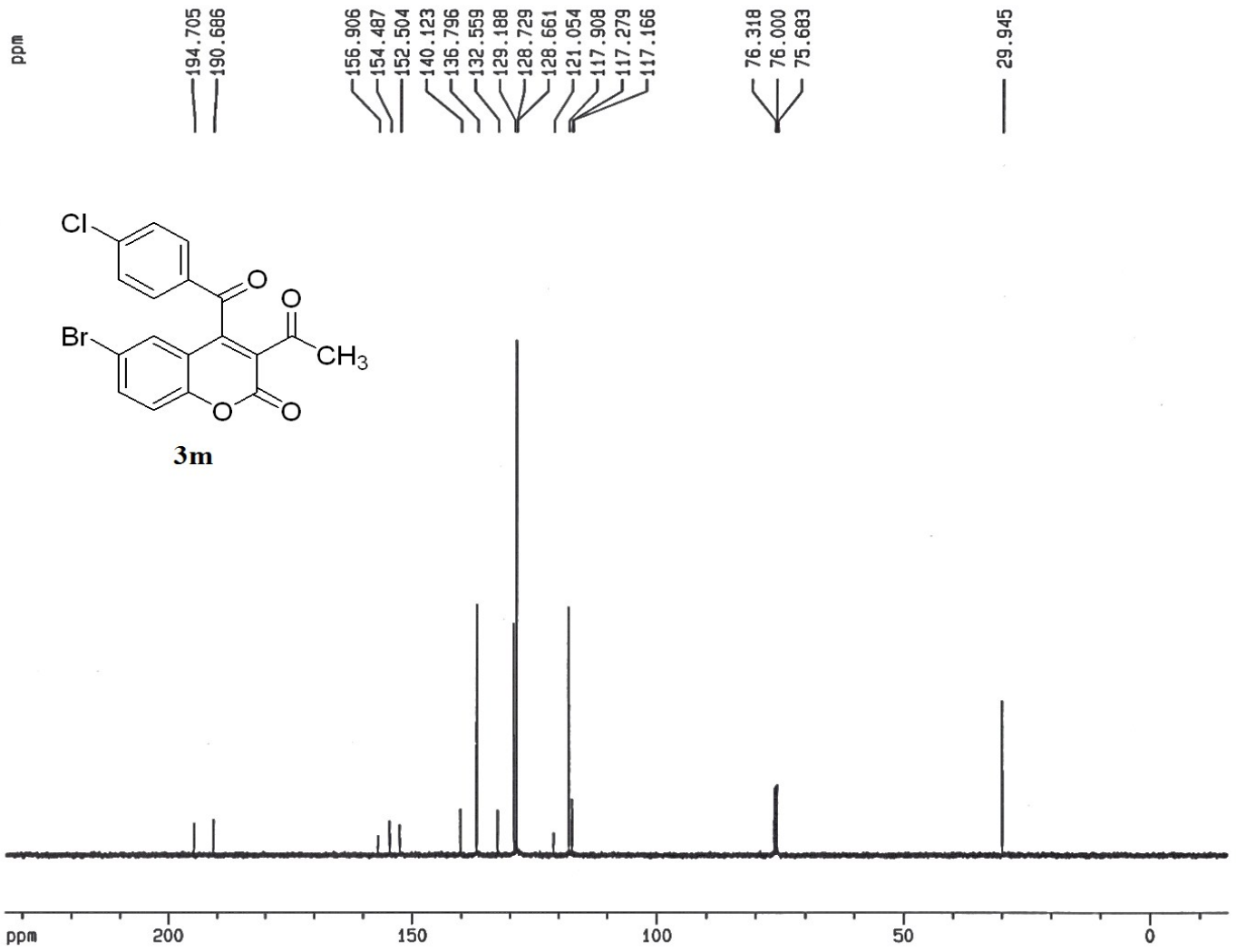
^{13}C NMR spectrum of 3-acetyl-6-bromo-4-(3-methoxybenzoyl)-2*H*-chromen-2-one (**3l**)



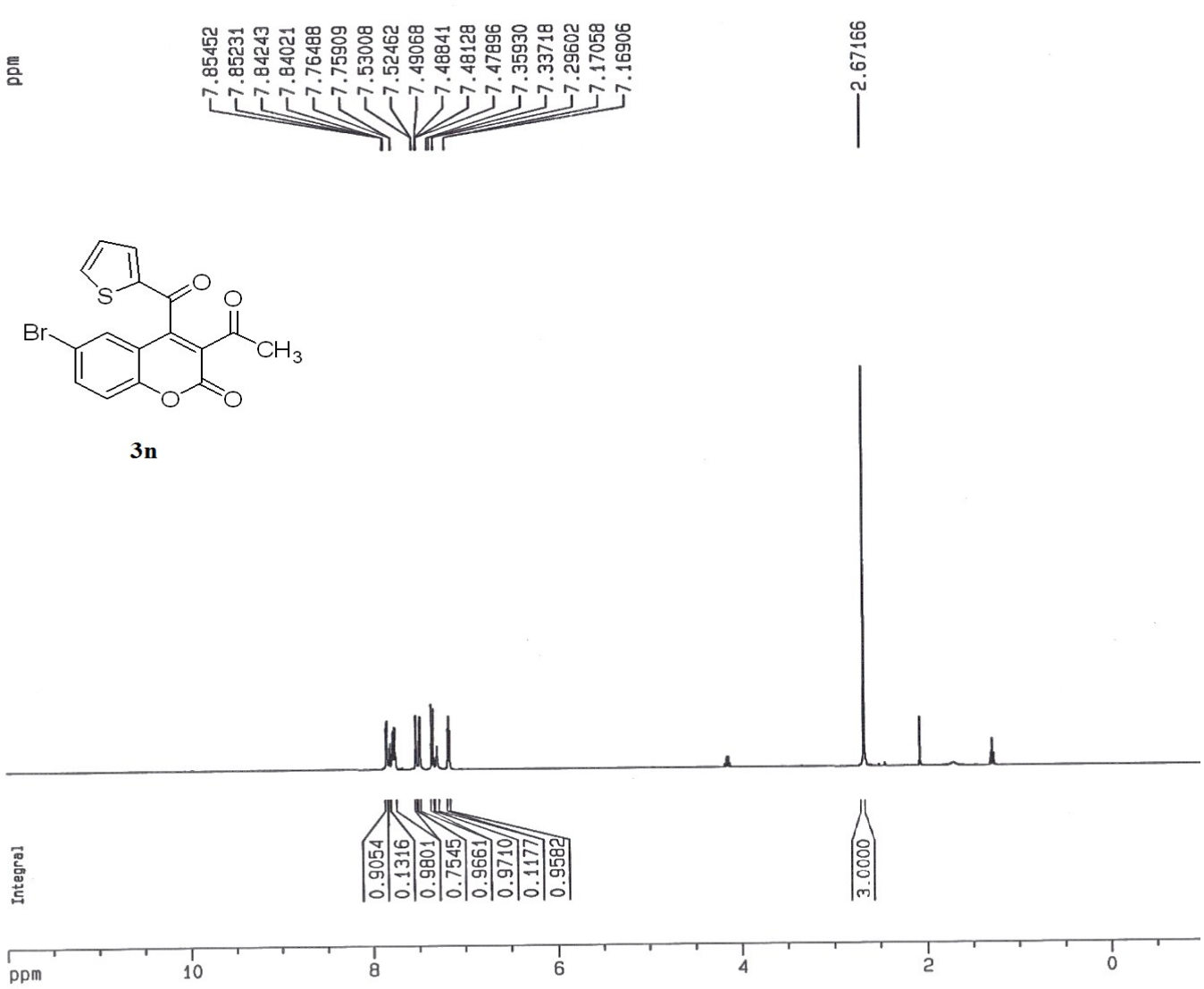
^{1}H NMR spectrum of 3-acetyl-6-bromo-4-(4-chlorobenzoyl)-2*H*-chromen-2-one (**3m**)



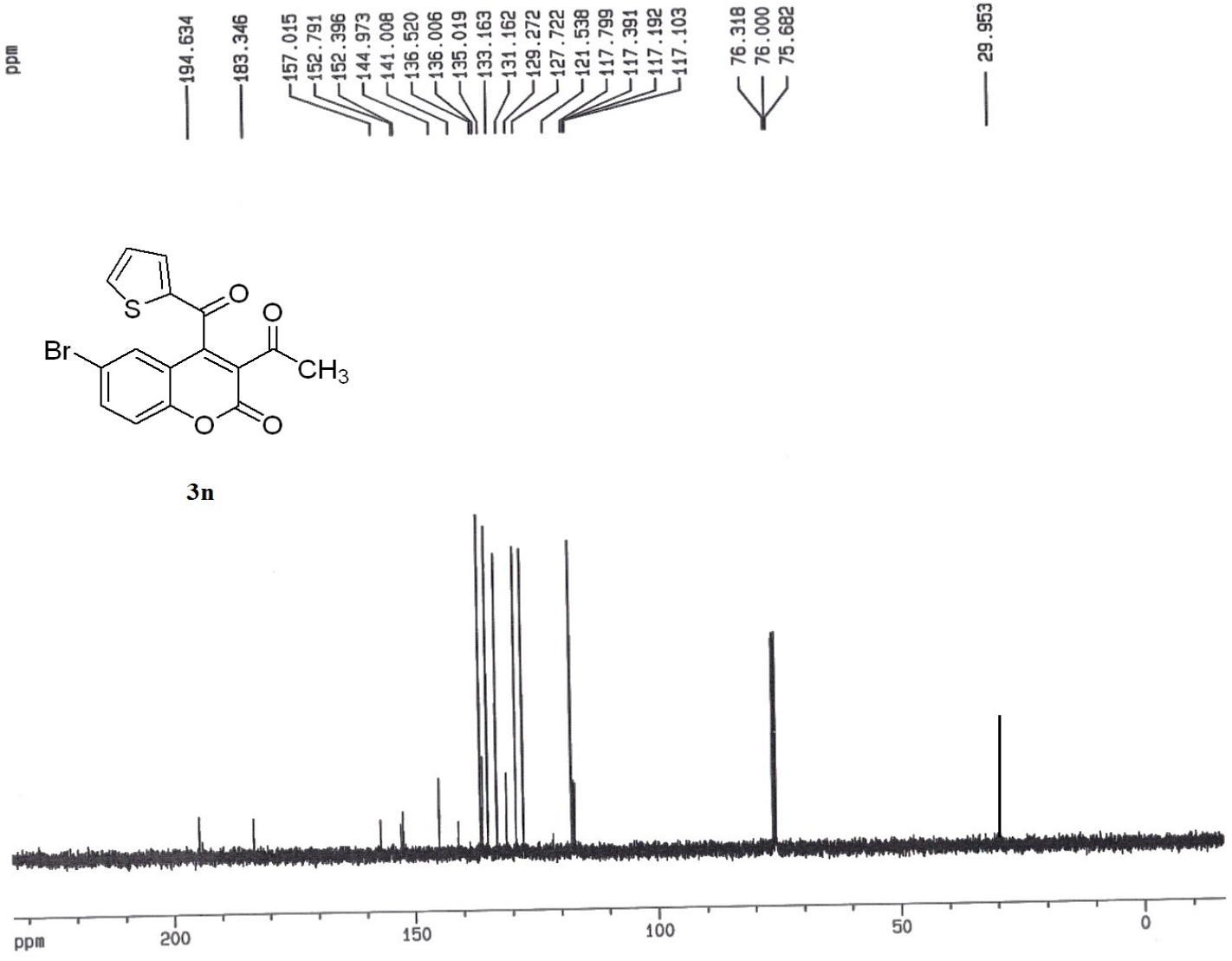
^{13}C NMR spectrum of 3-acetyl-6-bromo-4-(4-chlorobenzoyl)-2*H*-chromen-2-one (**3m**)



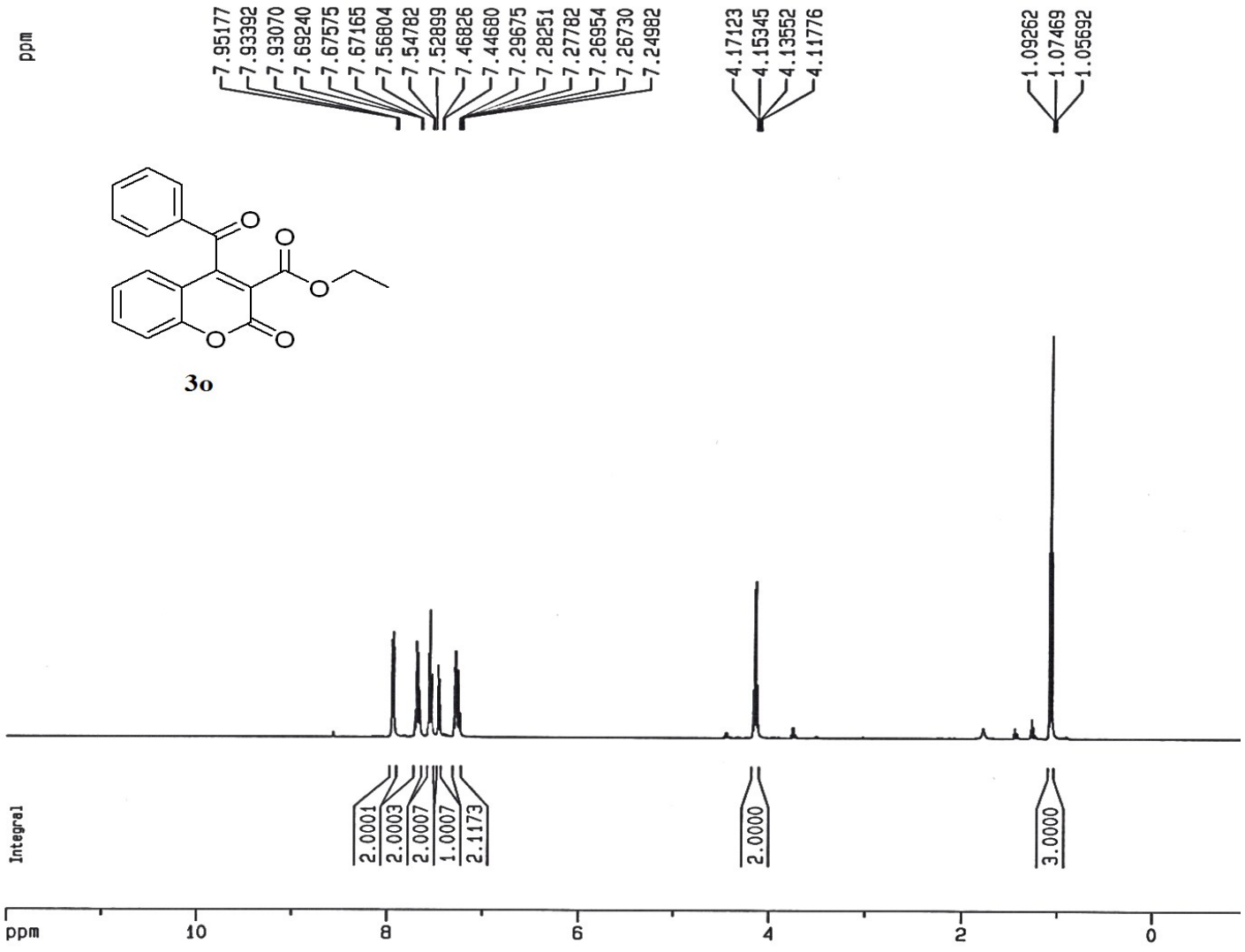
^{1}H NMR spectrum of 3-acetyl-6-bromo-4-(thiophene-2-carbonyl)-2*H*-chromen-2-one (**3n**)



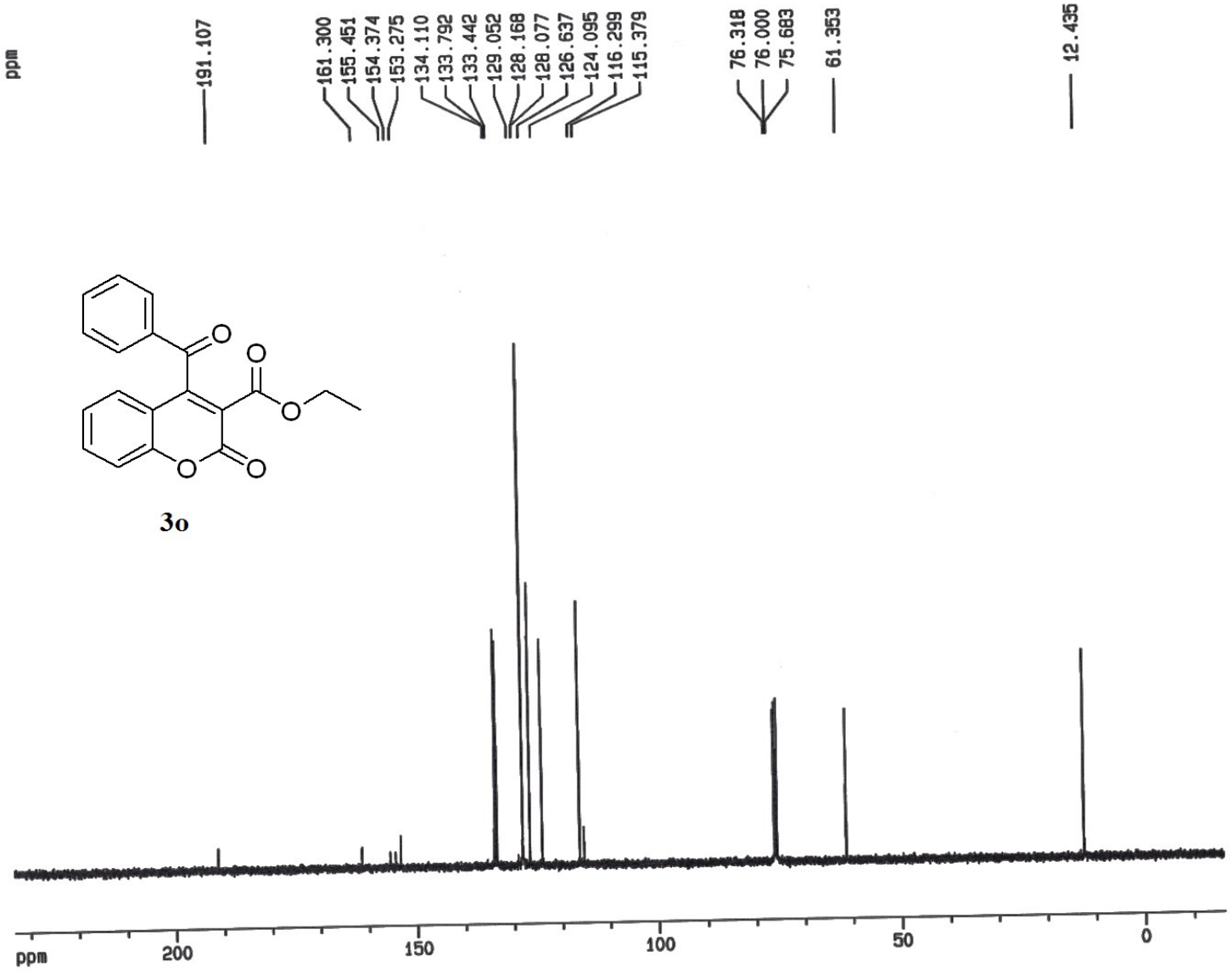
^{13}C NMR spectrum of 3-acetyl-6-bromo-4-(thiophene-2-carbonyl)-2*H*-chromen-2-one (**3n**)



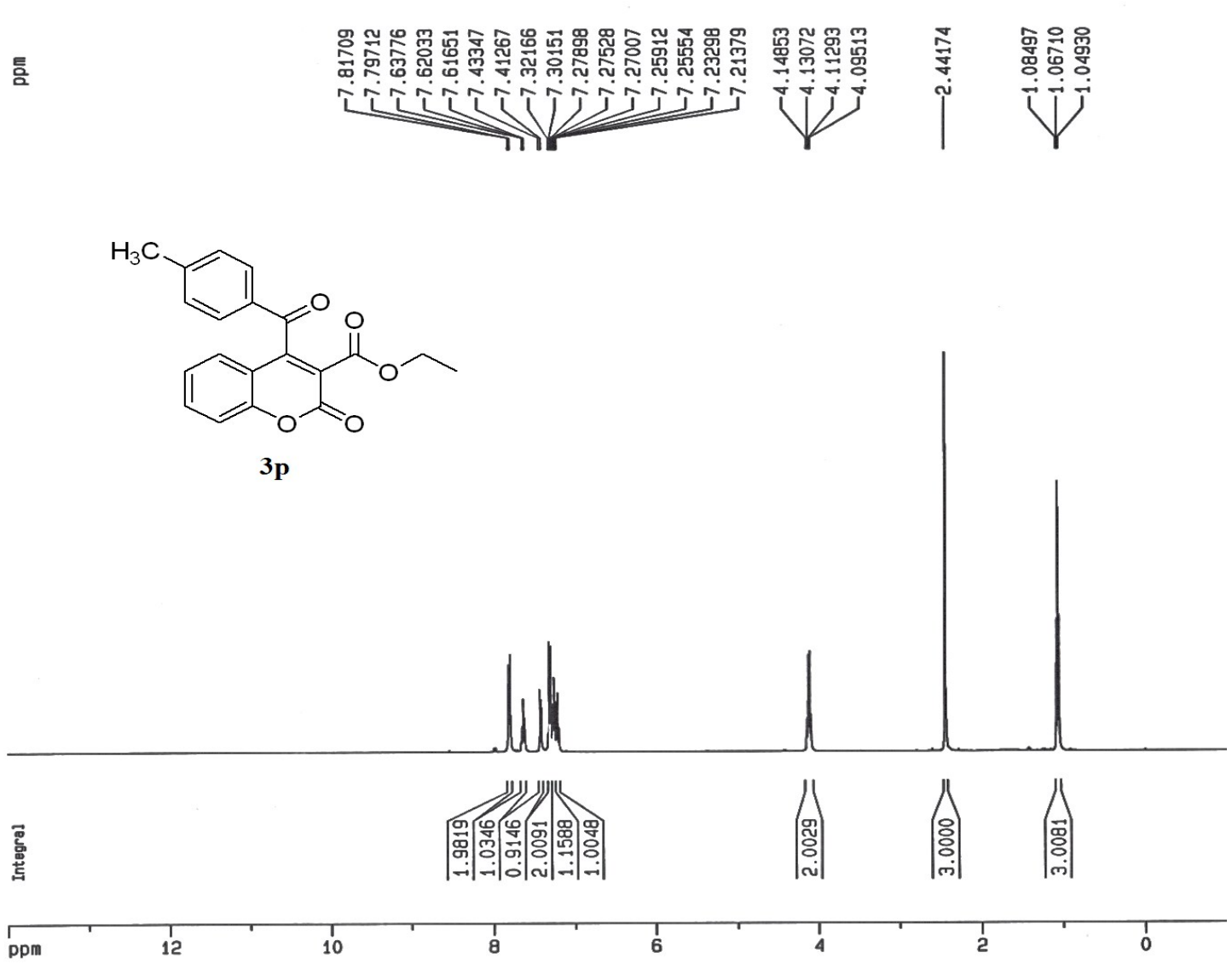
^{1}H NMR spectrum of ethyl-4-benzoyl-2-oxo-2*H*-chromene-3-carboxylate (**3o**)



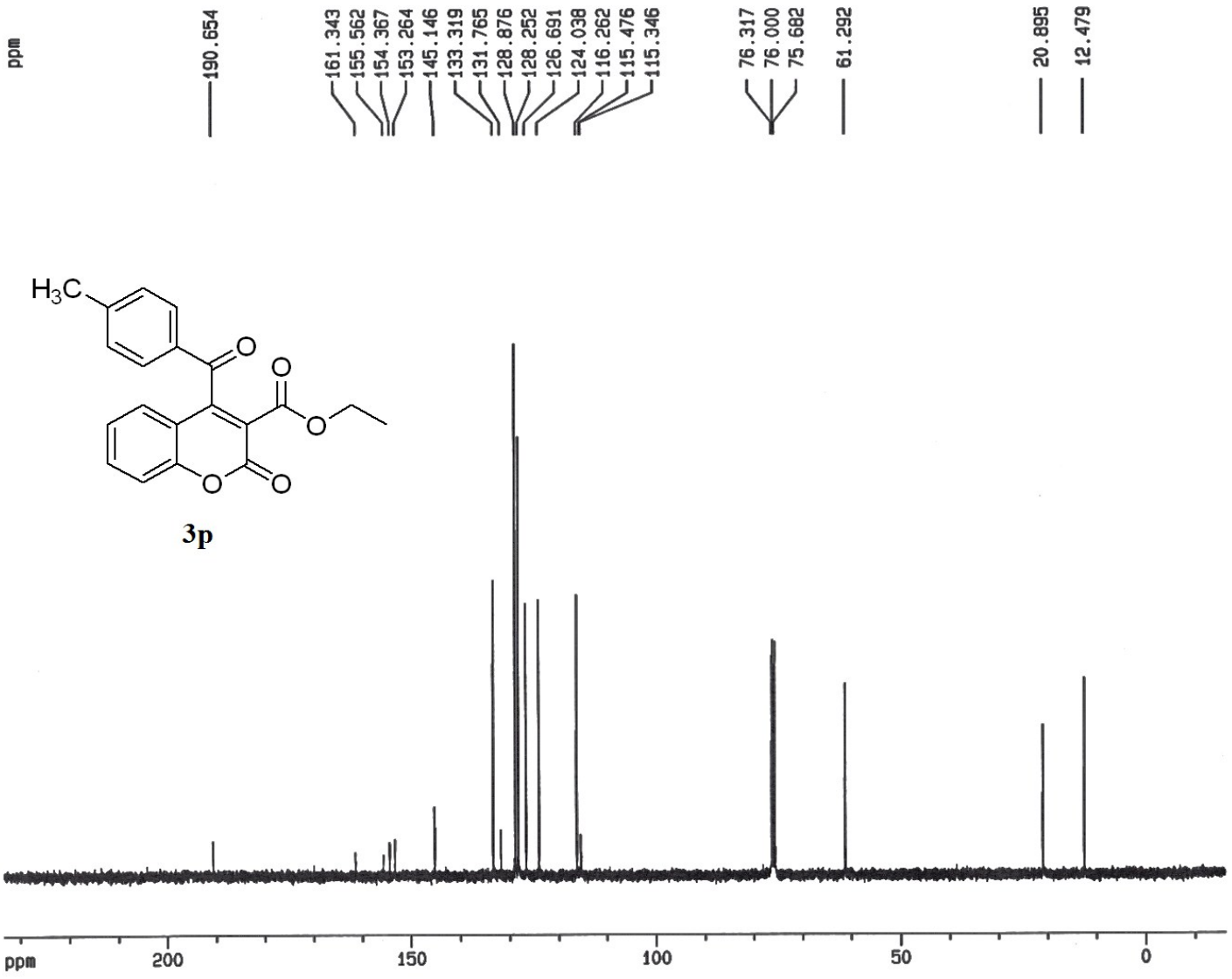
^{13}C NMR spectrum of ethyl-4-benzoyl-2-oxo-2*H*-chromene-3-carboxylate (**3o**)



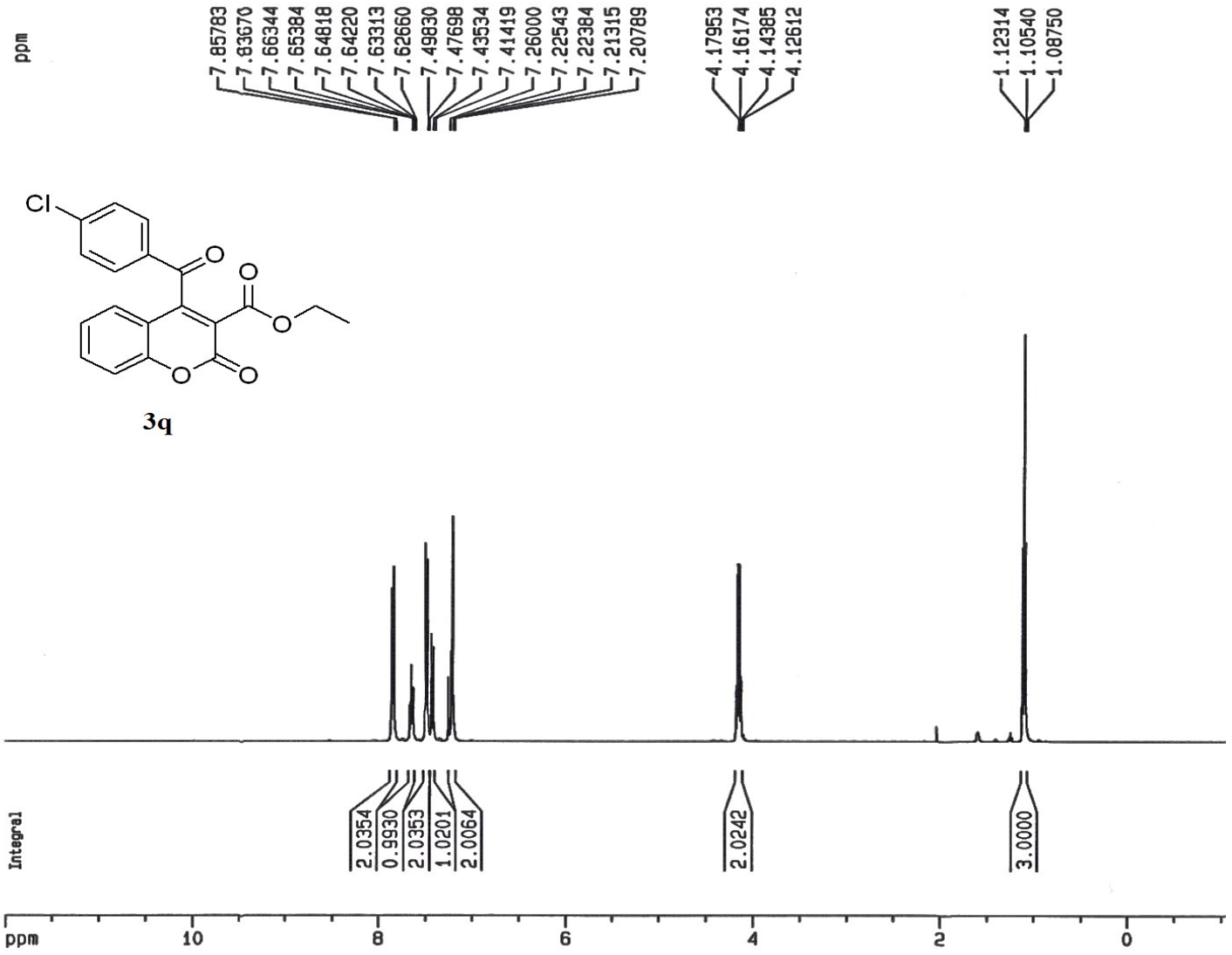
[1]H NMR spectrum of ethyl-4-(4-methylbenzoyl)-2-oxo-2*H*-chromene-3-carboxylate (**3p**)



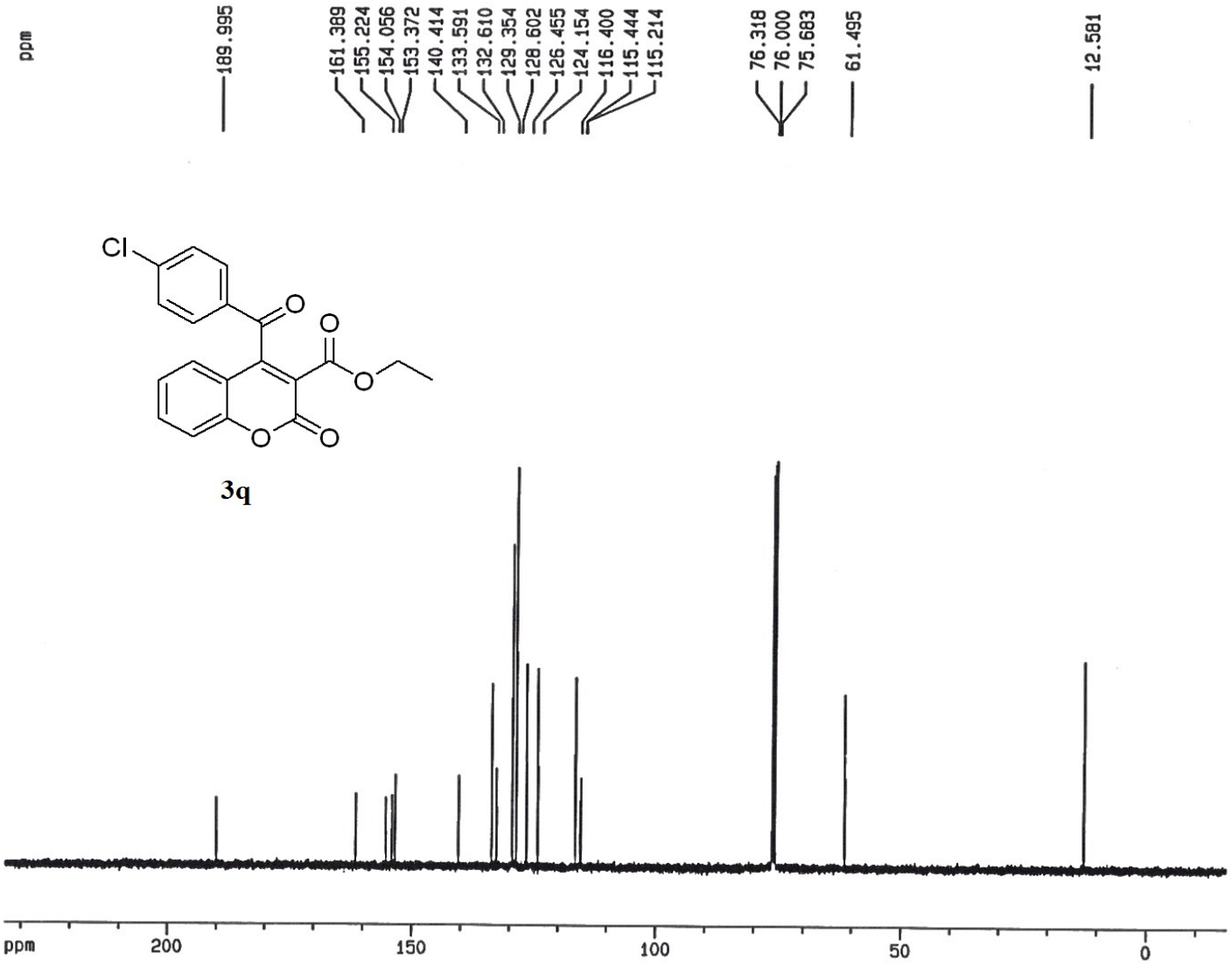
^{13}C NMR spectrum of ethyl-4-(4-methylbenzoyl)-2-oxo-2*H*-chromene-3-carboxylate (**3p**)



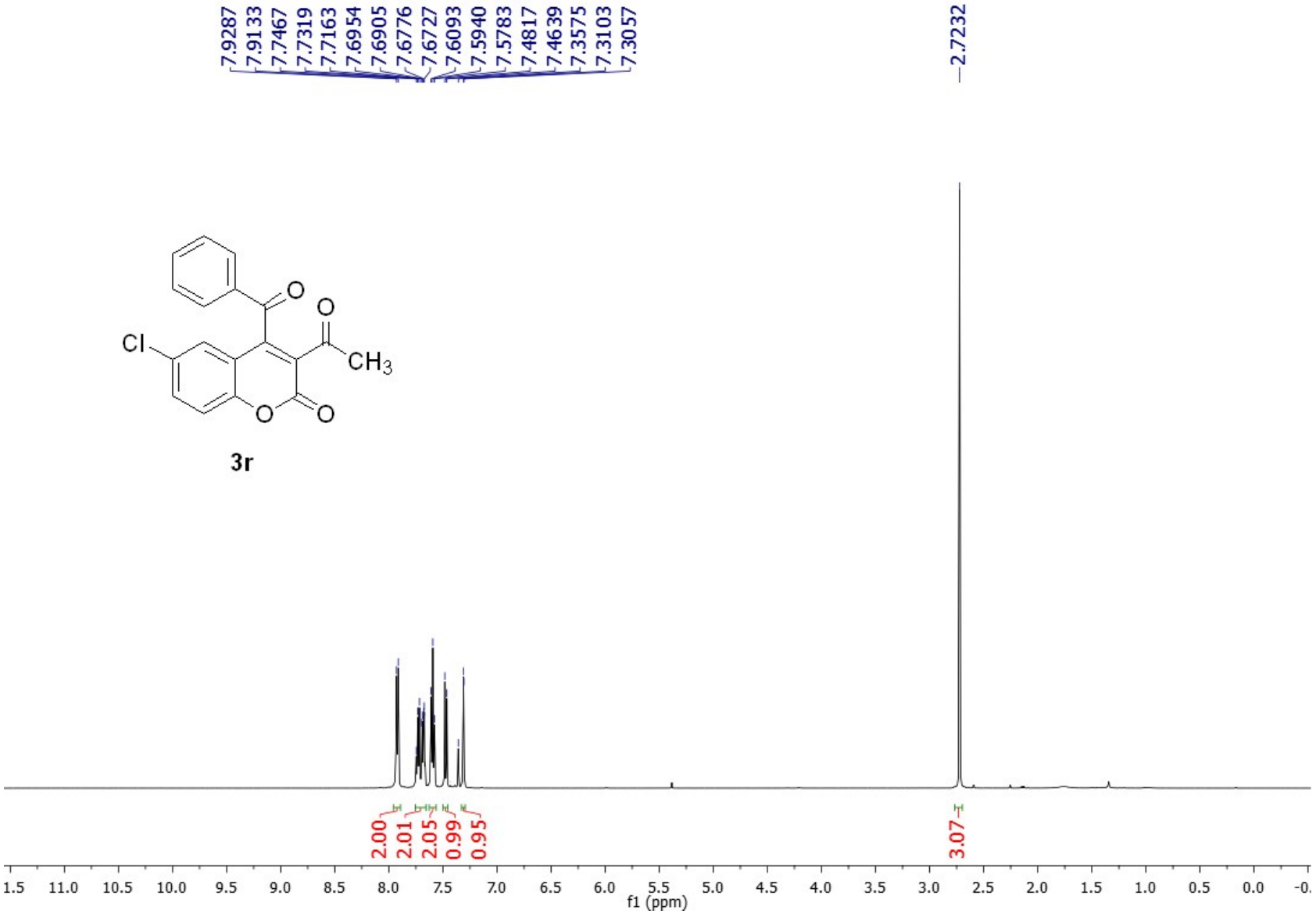
^{1}H NMR spectrum of ethyl-4-(4-chlorobenzoyl)-2-oxo-2*H*-chromene-3-carboxylate (**3q**)



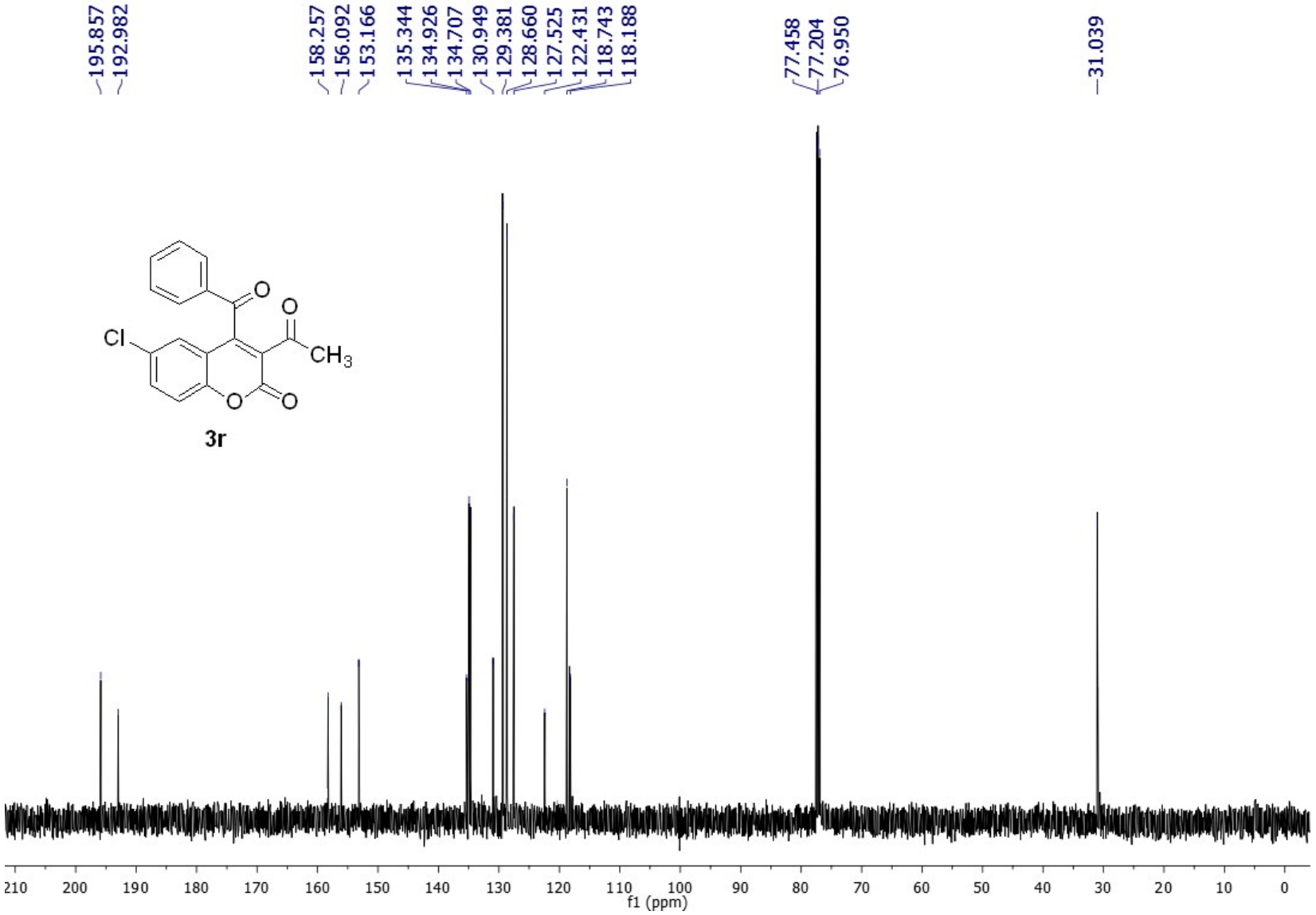
^{13}C NMR spectrum of ethyl-4-(4-chlorobenzoyl)-2-oxo-2*H*-chromene-3-carboxylate (**3q**)



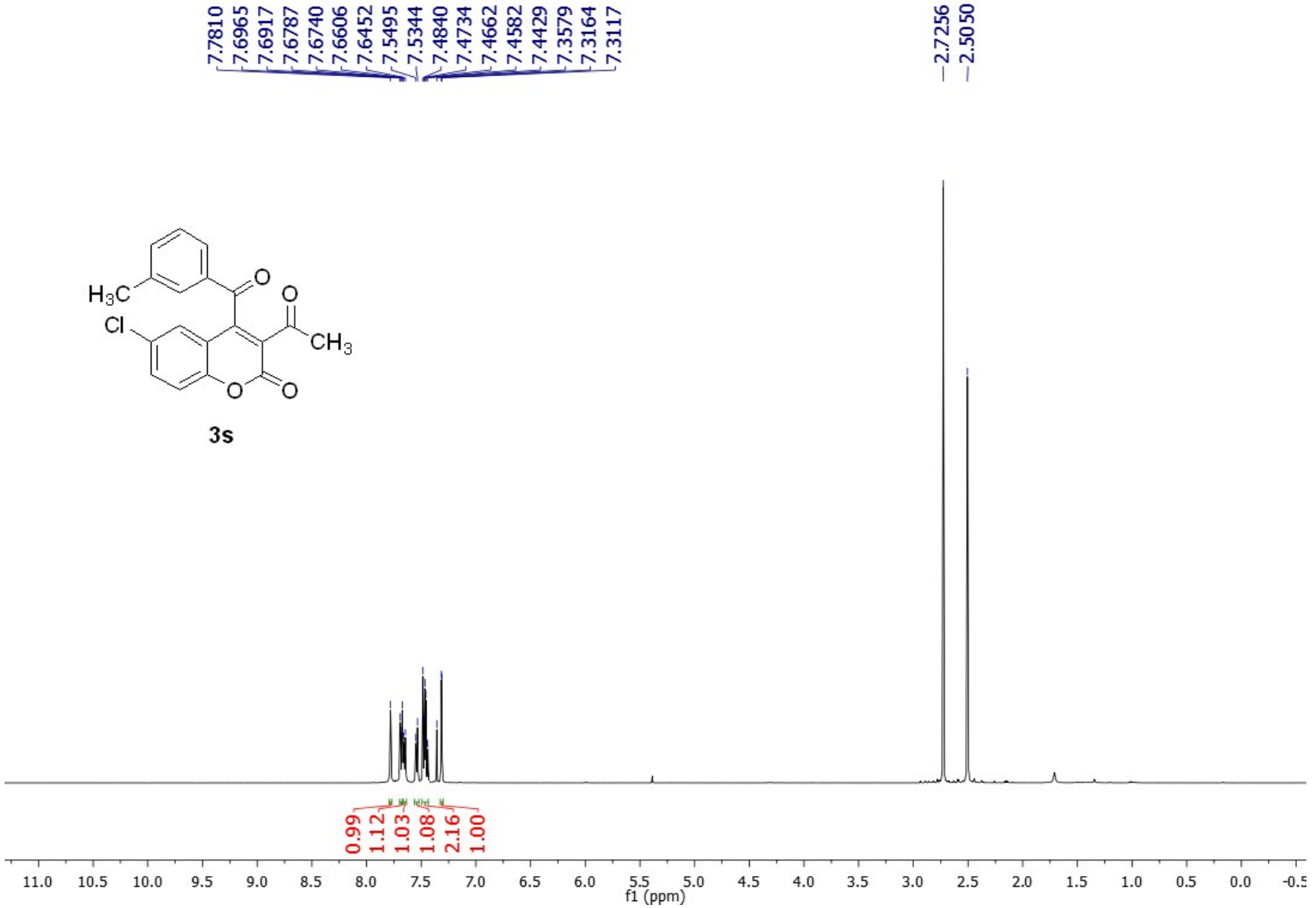
[1]H NMR spectrum of 3-acetyl-6-chloro-4-benzoyl-2*H*-chromen-2-one (**3r**)



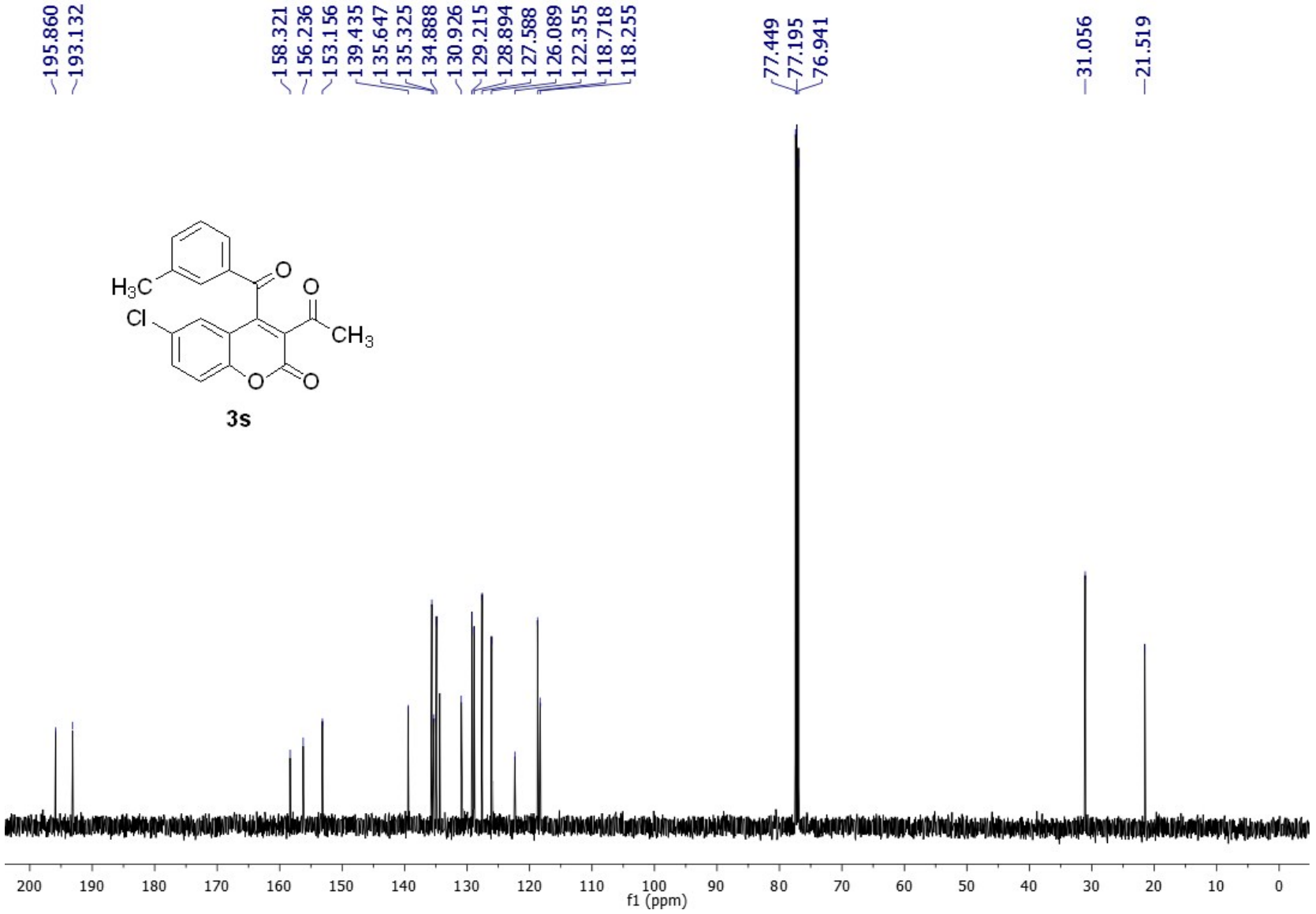
^{13}C NMR spectrum of 3-acetyl-6-chloro-4-benzoyl-2*H*-chromen-2-one (**3r**)



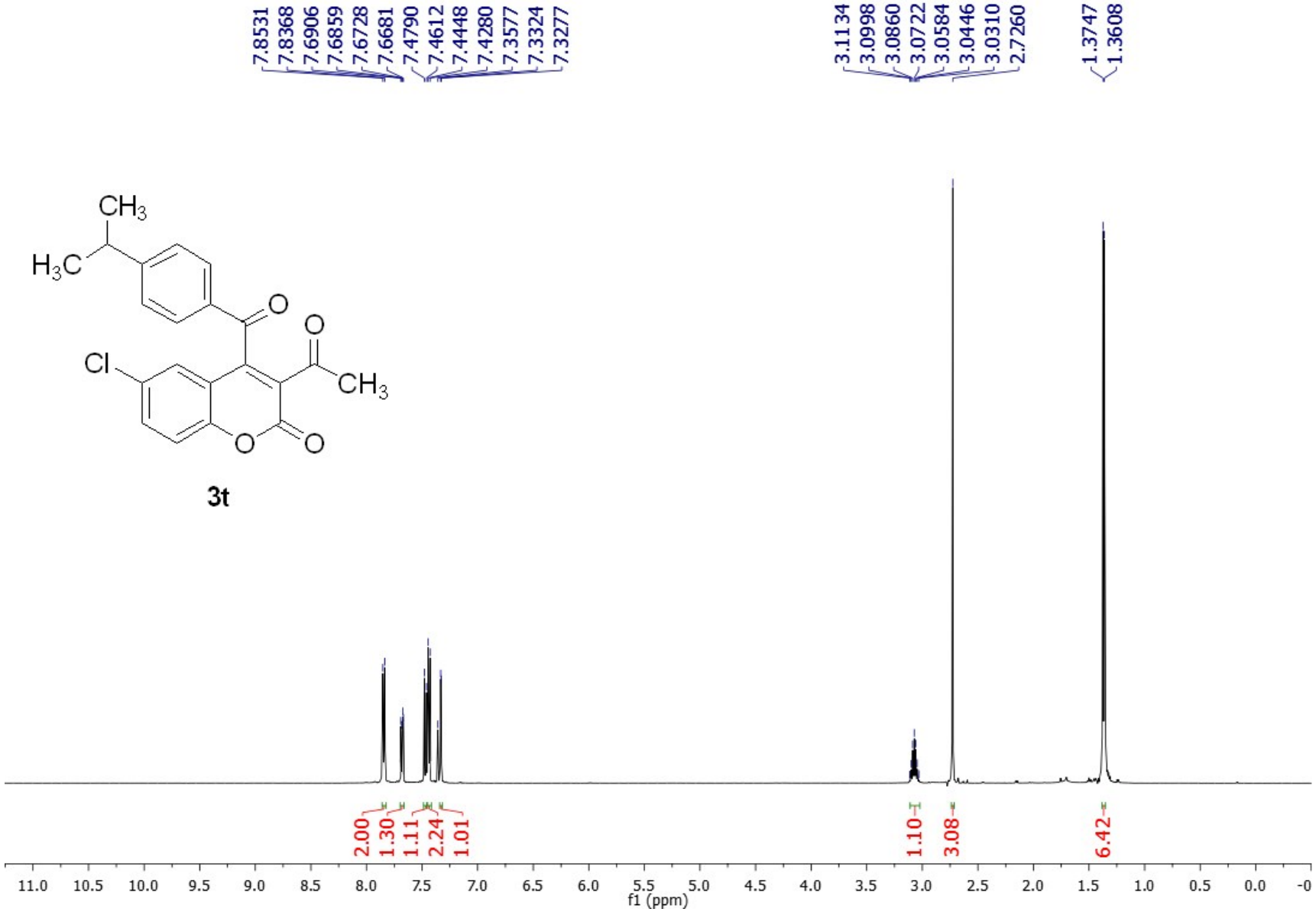
^{1}H NMR spectrum of 3-acetyl-6-chloro-4-(3-methylbenzoyl)-2*H*-chromen-2-one (**3s**)



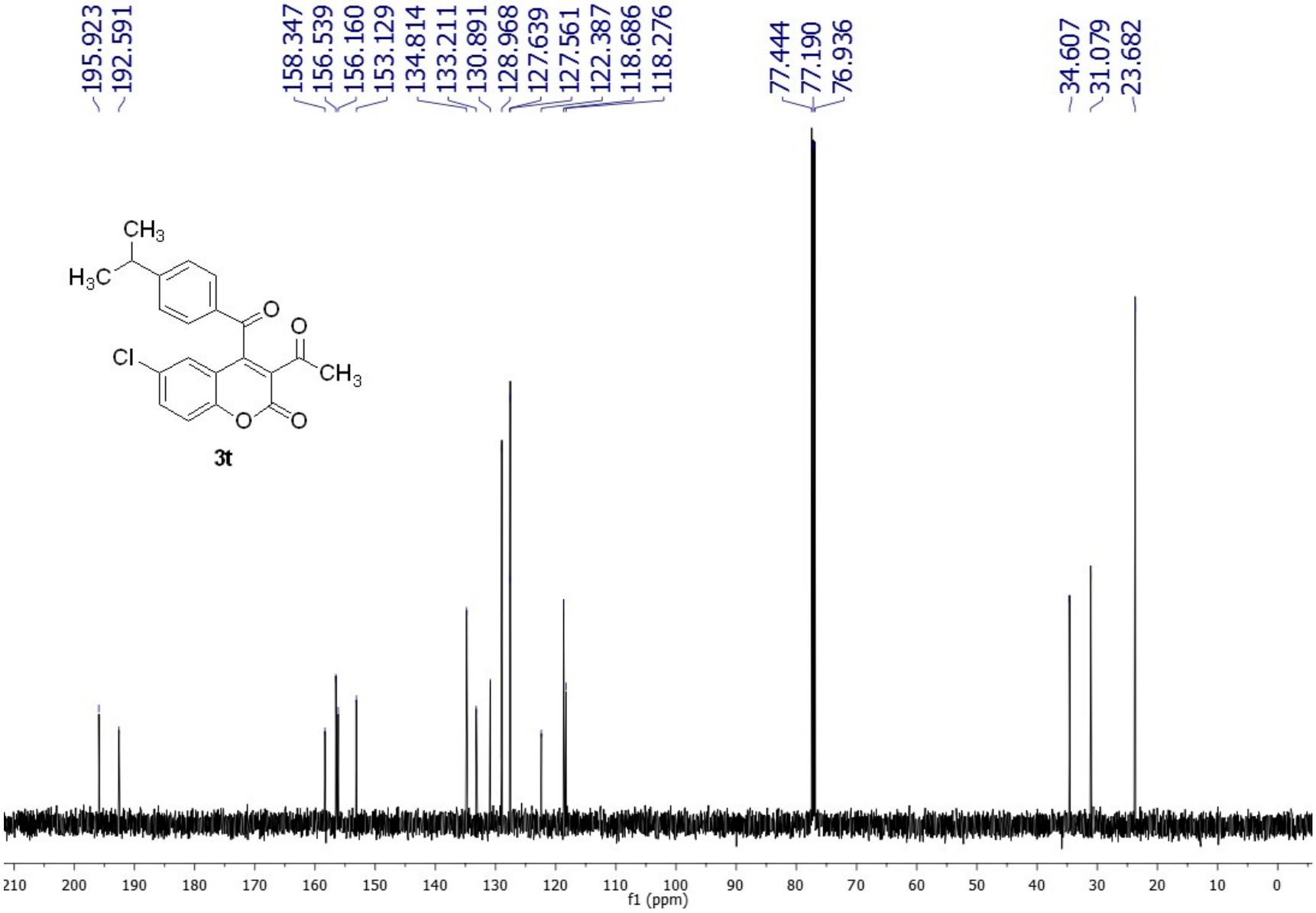
^{13}C NMR spectrum of 3-acetyl-6-chloro-4-(3-methylbenzoyl)-2*H*-chromen-2-one (**3s**)



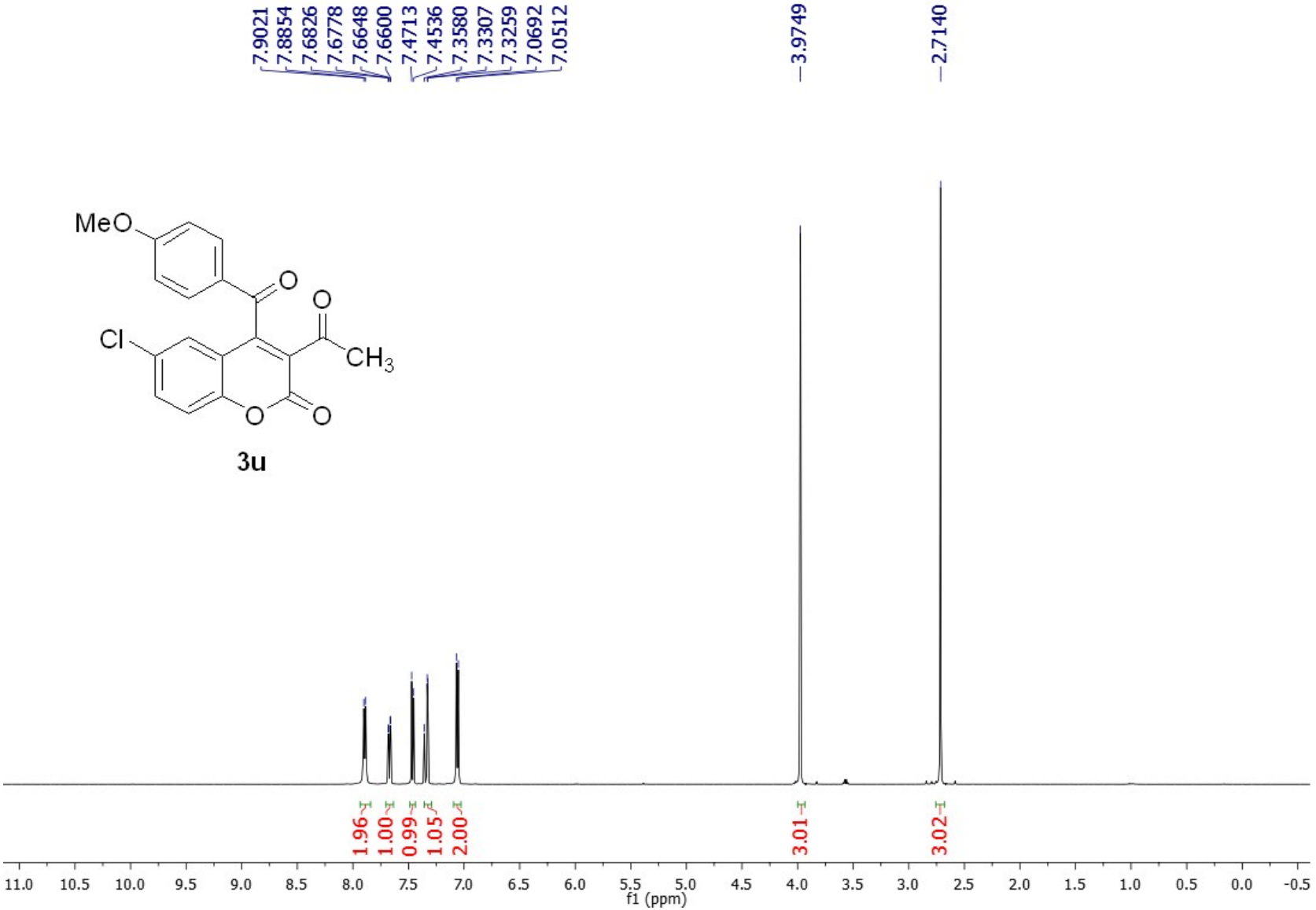
^{1}H NMR spectrum of 3-acetyl-6-chloro-4-(4-isopropylbenzoyl)-2*H*-chromen-2-one (**3t**)



^{13}C NMR spectrum of 3-acetyl-6-chloro-4-(4-isopropylbenzoyl)-2*H*-chromen-2-one (**3t**)



^{1}H NMR spectrum of 3-acetyl-6-bromo-4-(4-methoxybenzoyl)-2*H*-chromen-2-one (**3u**)



^{13}C NMR spectrum of 3-acetyl-6-bromo-4-(4-methoxybenzoyl)-2*H*-chromen-2-one (**3u**)