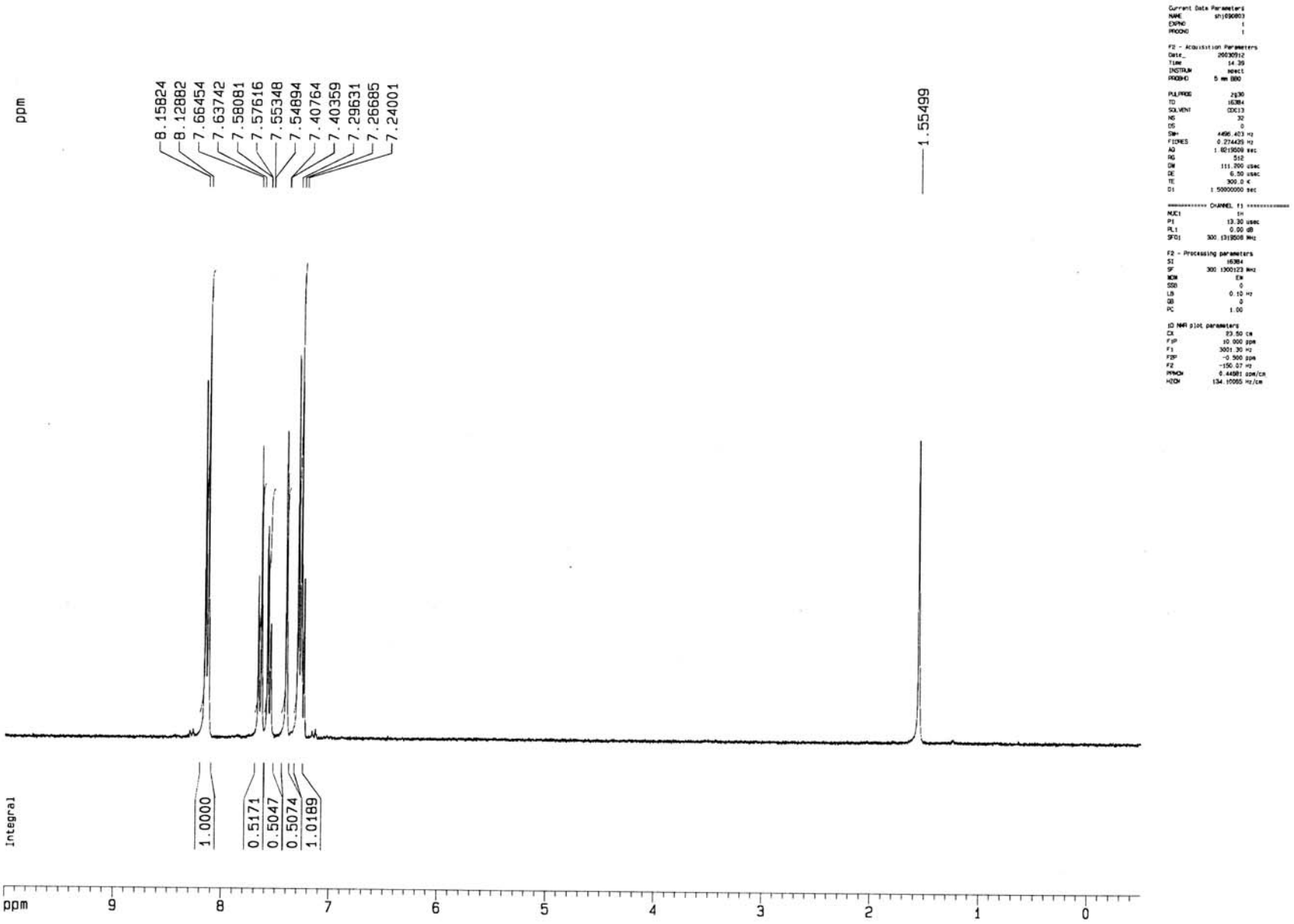
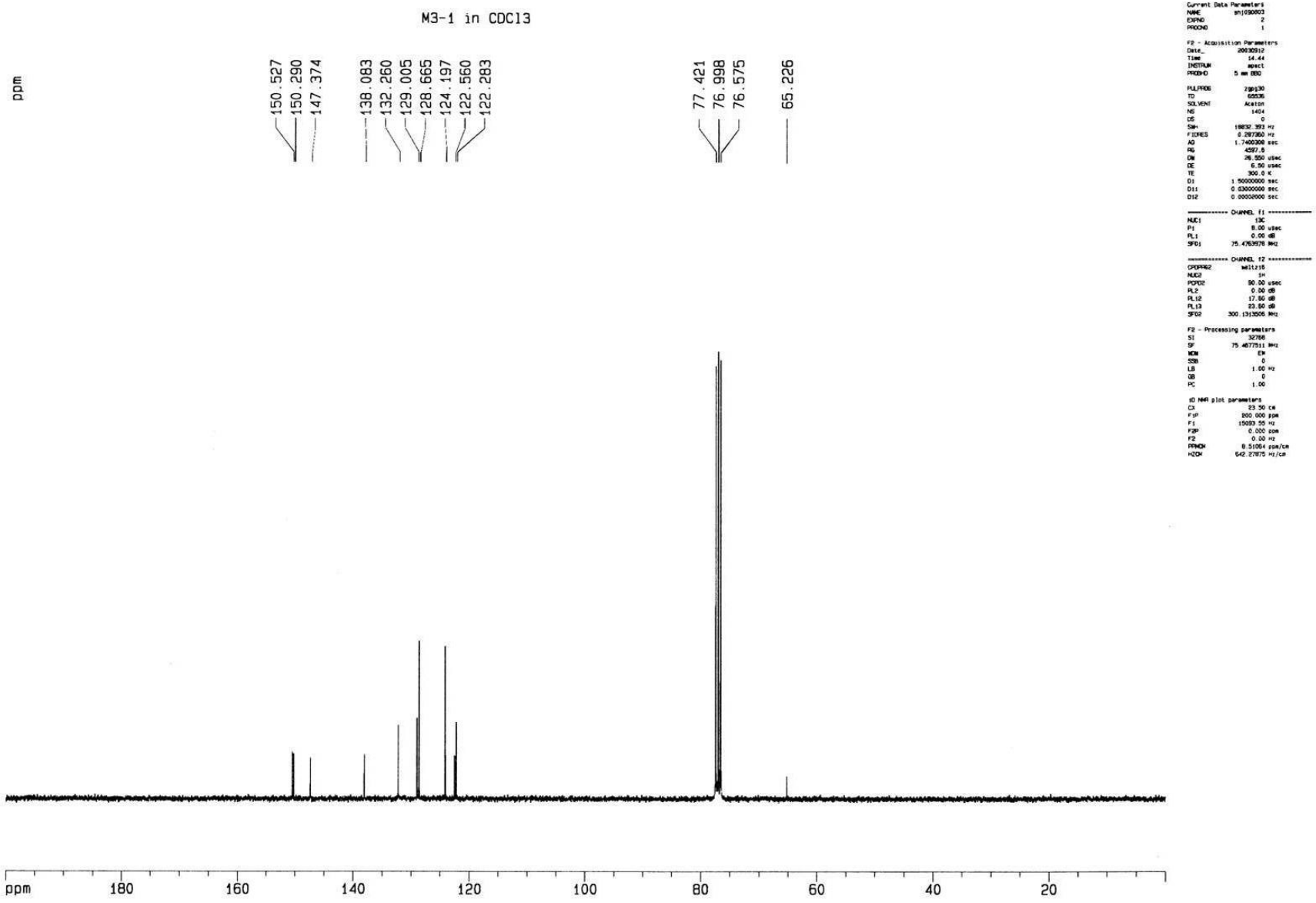
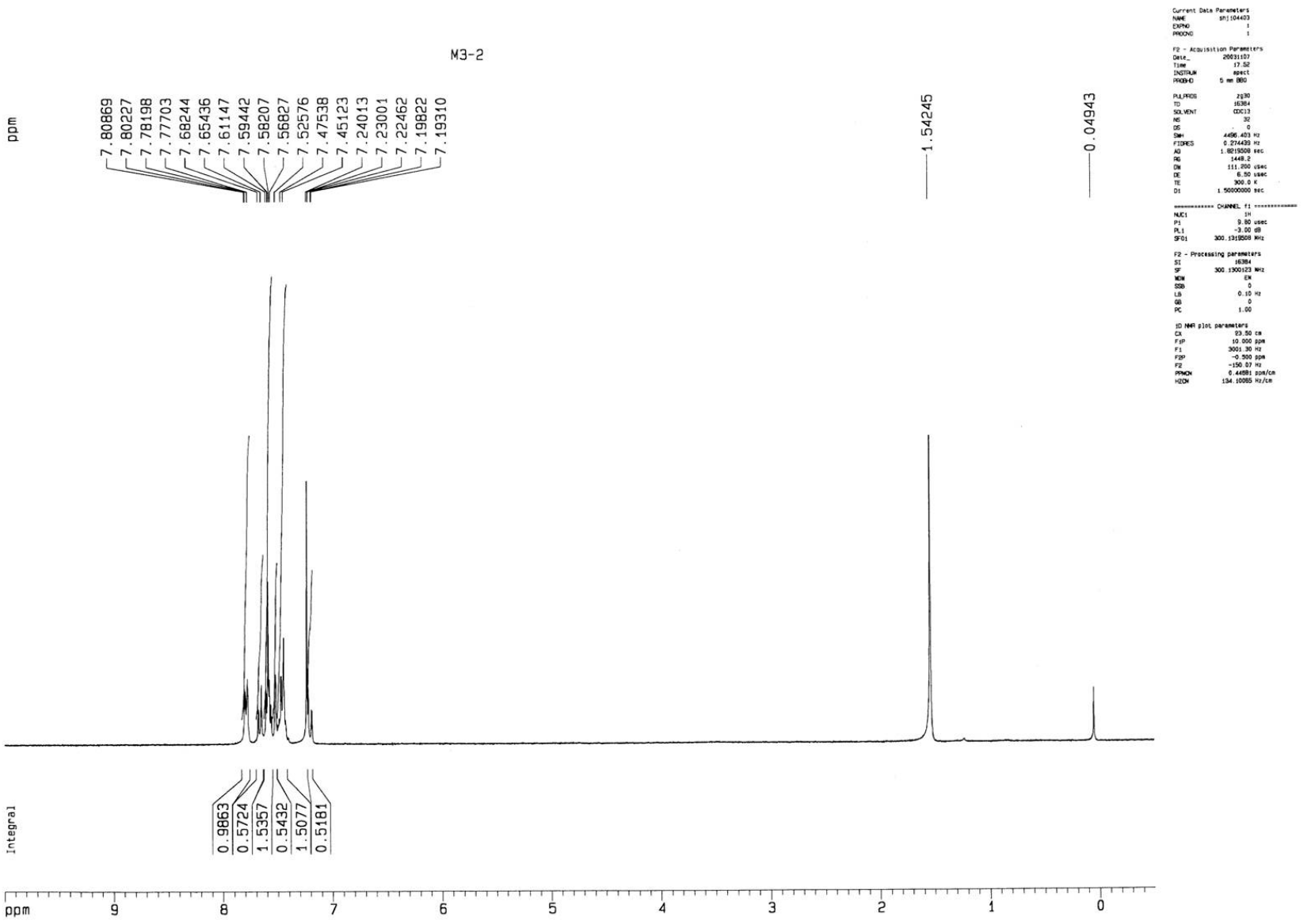


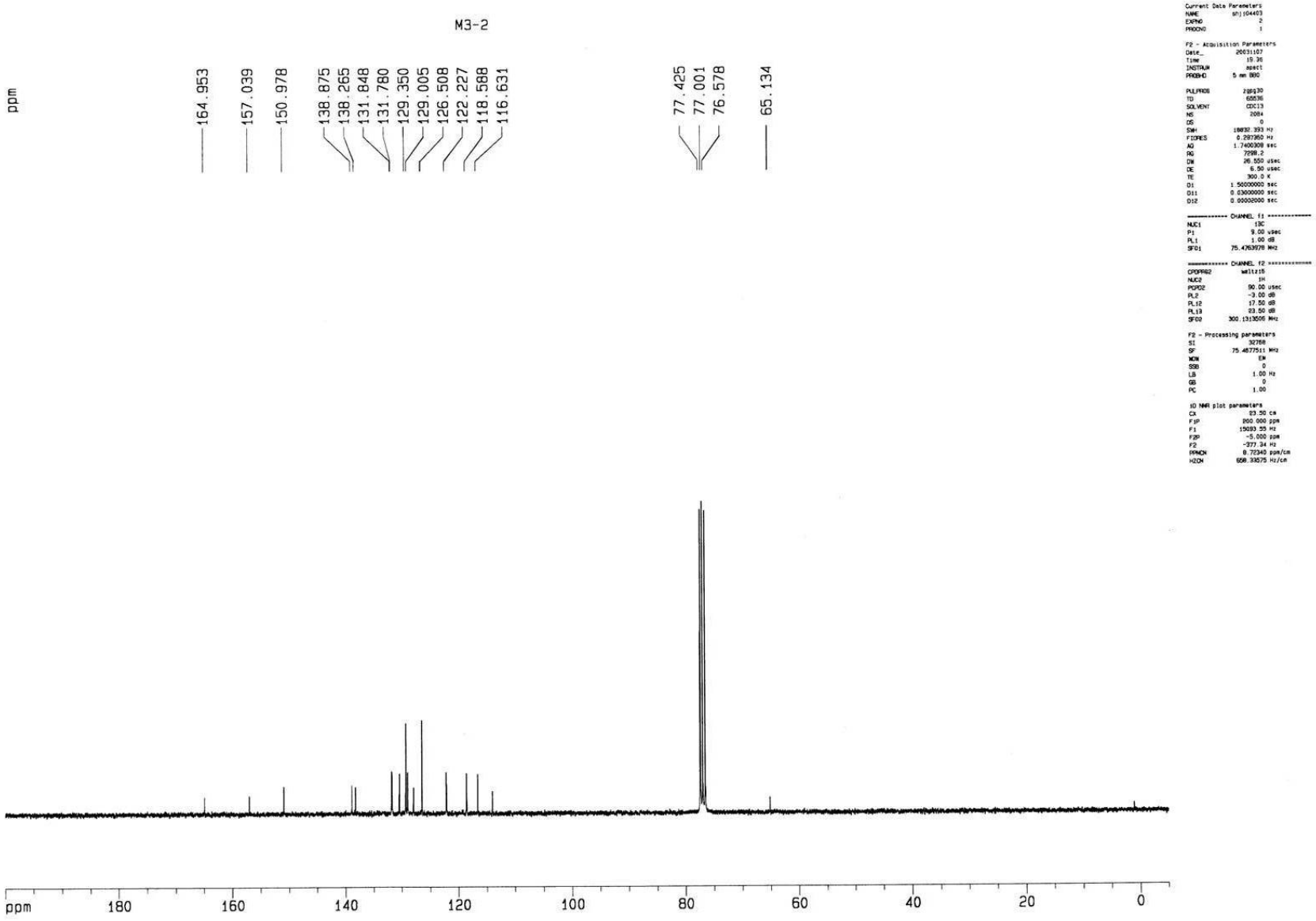

**附圖 1. 2,7-Dibromo-9,9-di(4-nitrophenyl)fluorine，化合物 A1 的 $^{1}$H-NMR 光譜圖**



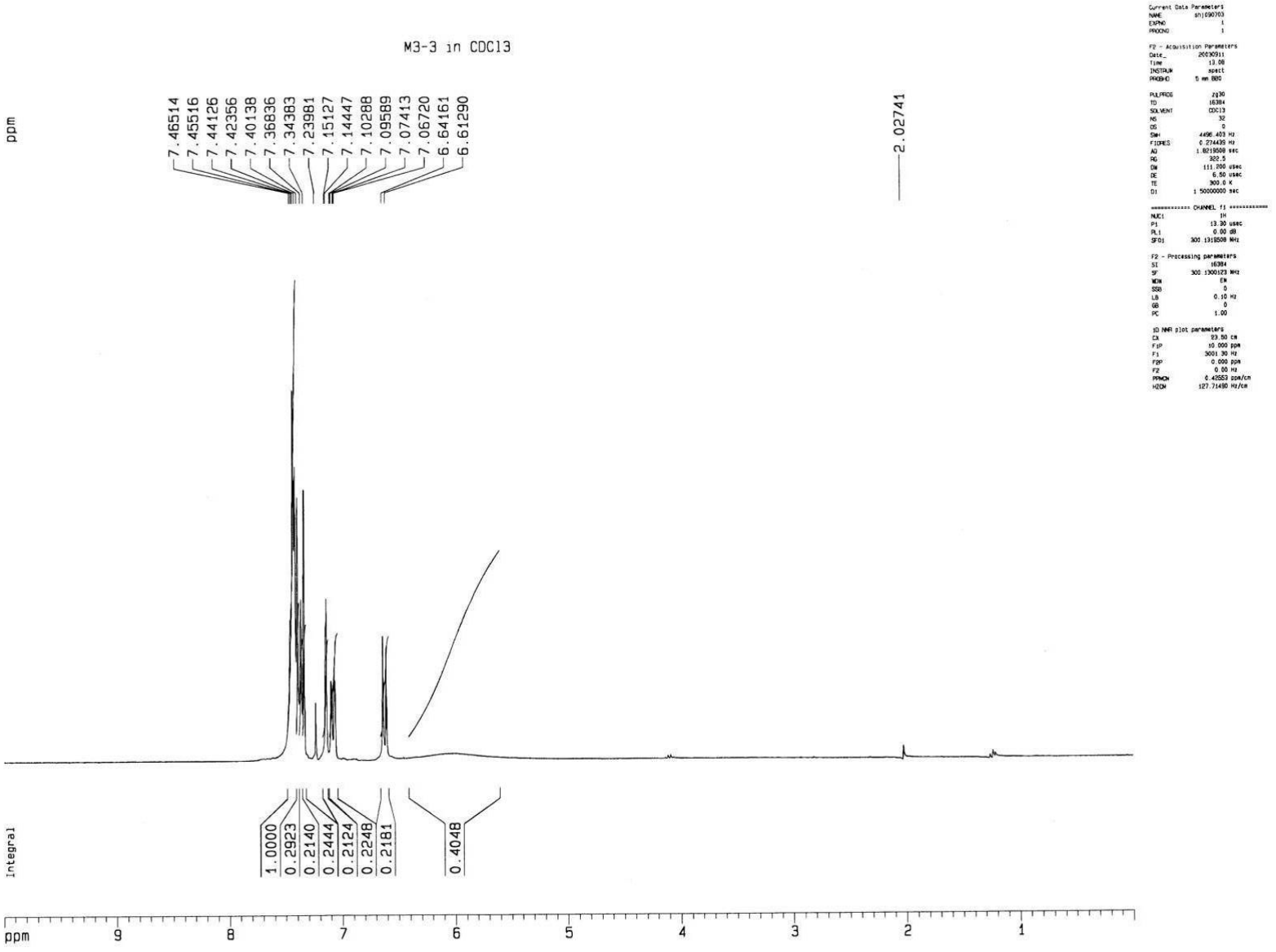

**附圖 2. 2,7-Dibromo-9,9-di(4-nitrophenyl)fluorene 的，化合物 A1 的 $^{13}$C-NMR 光譜圖**



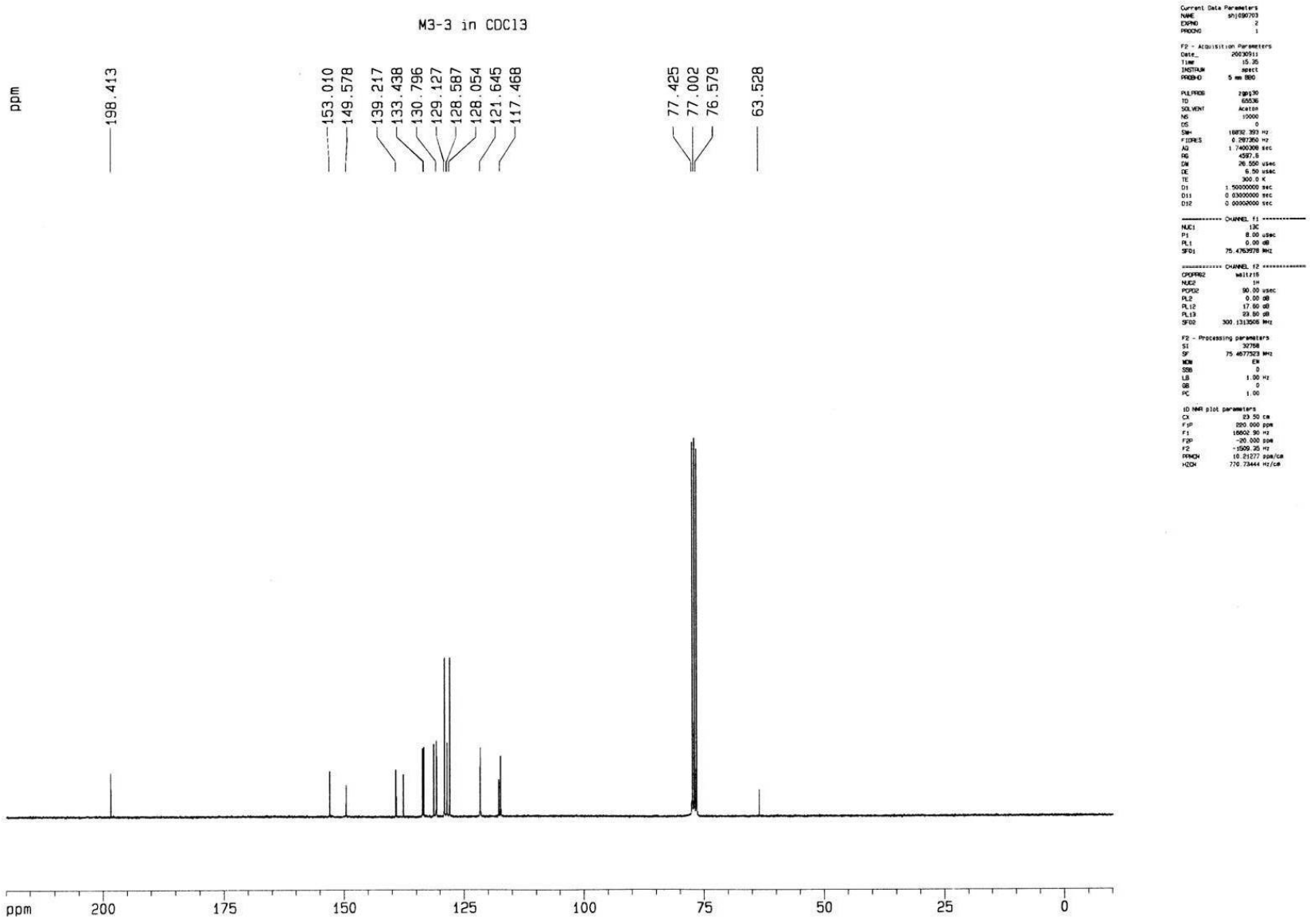

**附圖 3. 2,7-Dibromo-9,9-bis[5-(3-phenyl-2,1-benzisoxazolyl)]fluorine，化合物 A2 的 $^{1}$H-NMR 光譜圖**




**附圖 4. 2,7-Dibromo-9,9-bis[5-(3-phenyl-2,1-benzisoxazolyl)]fluorine，化合物 A2 的 $^{13}$C-NMR 光譜圖**

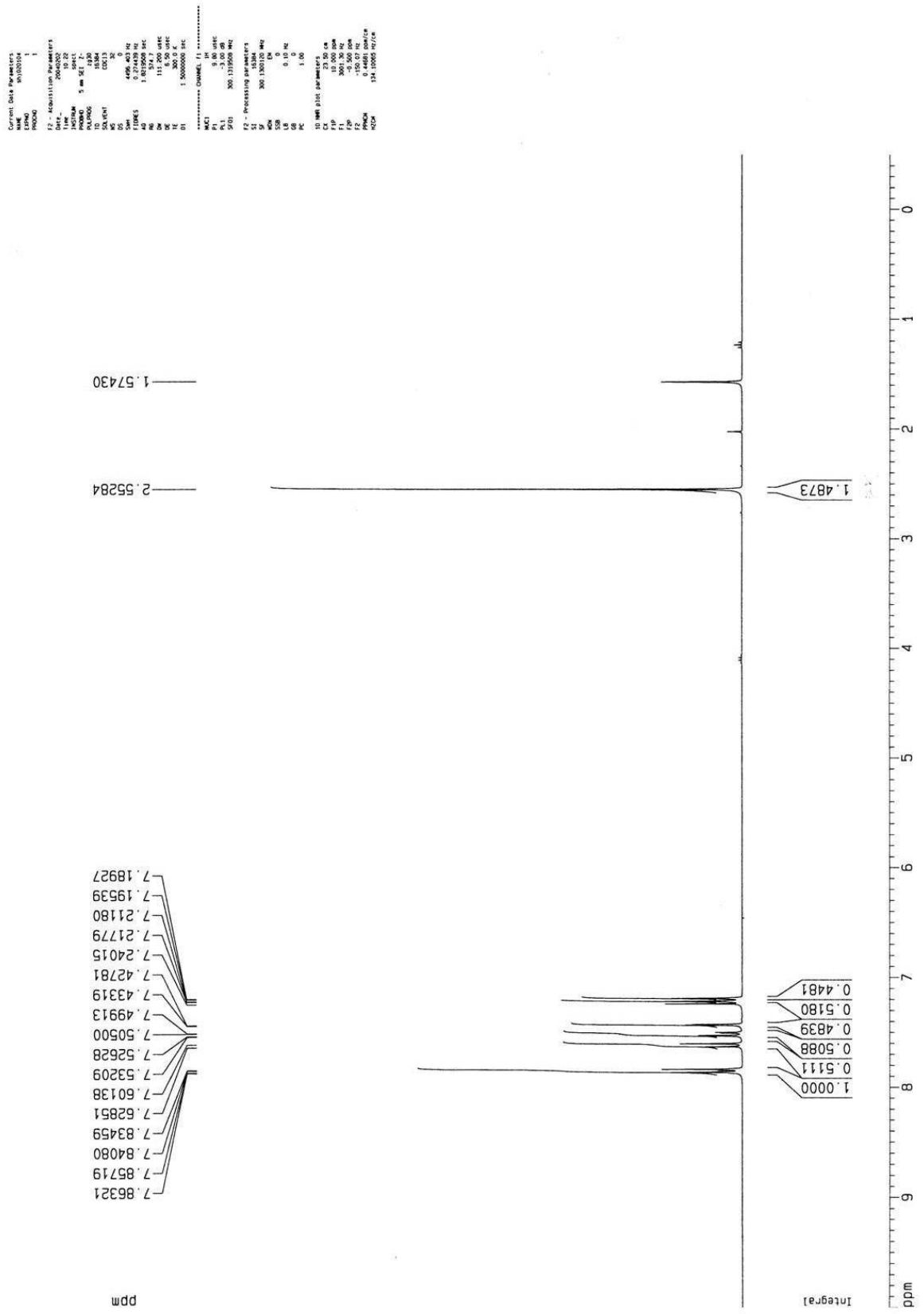



**附圖 5. 2,7-Dibromo-9,9-bis(4-amino-3-benzoylphenyl)fluorene，化合物 A3 的 $^{1}$H-NMR 光譜圖**

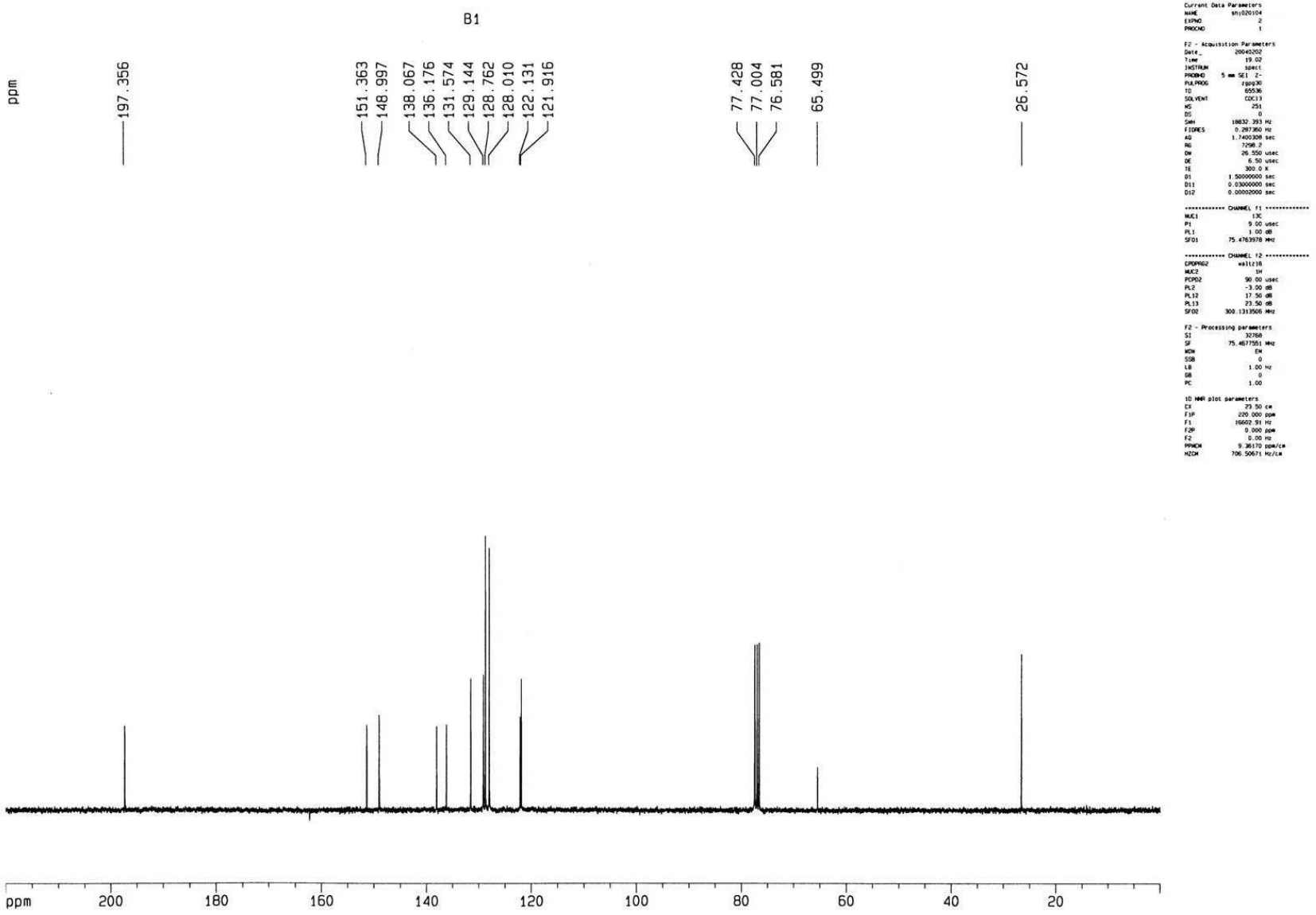




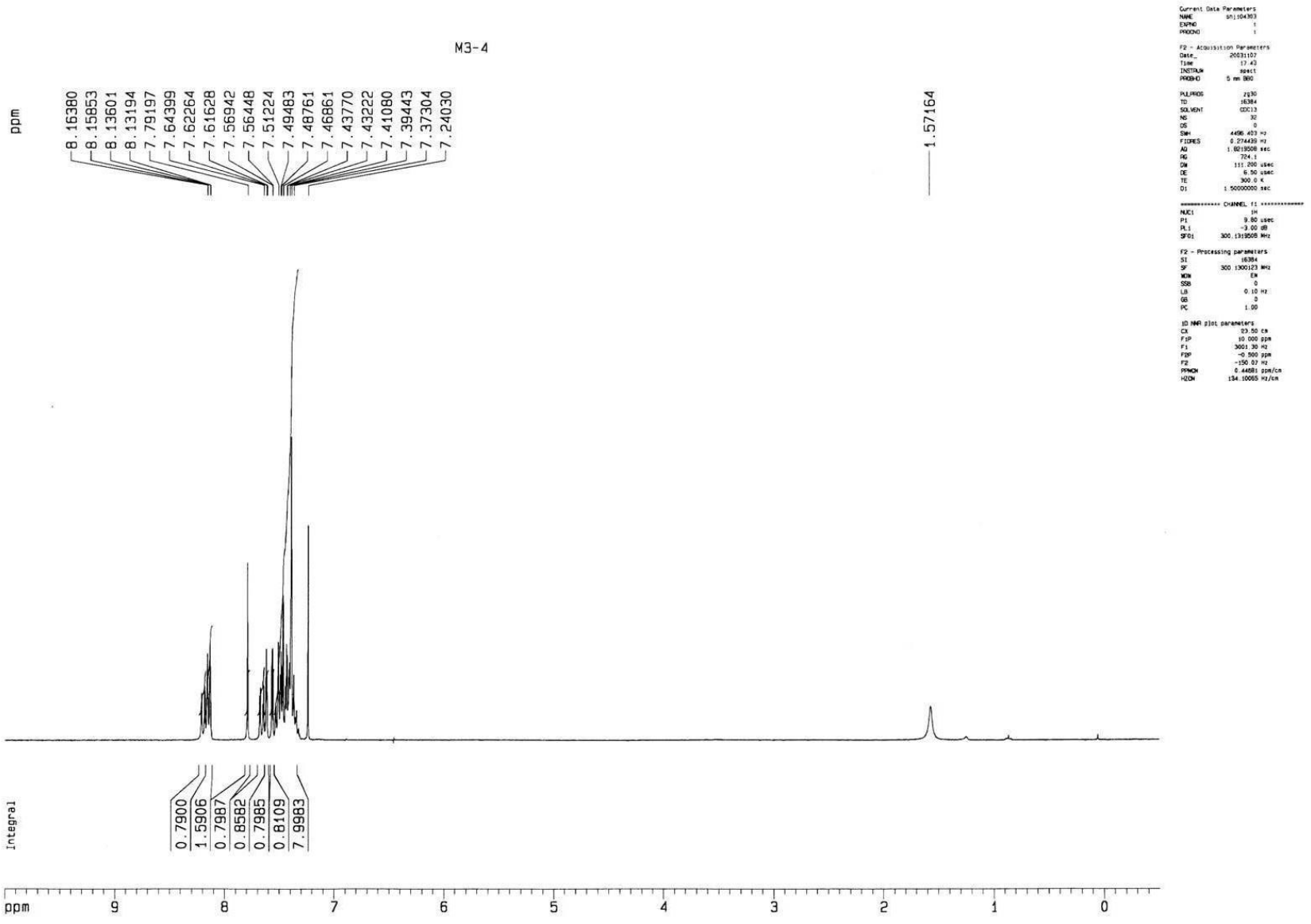

**附圖 6. 2,7-Dibromo-9,9-bis(4-amino-3-benzoylphenyl)fluorene，化合物 A3 的 $^{13}$C-NMR 光譜圖**



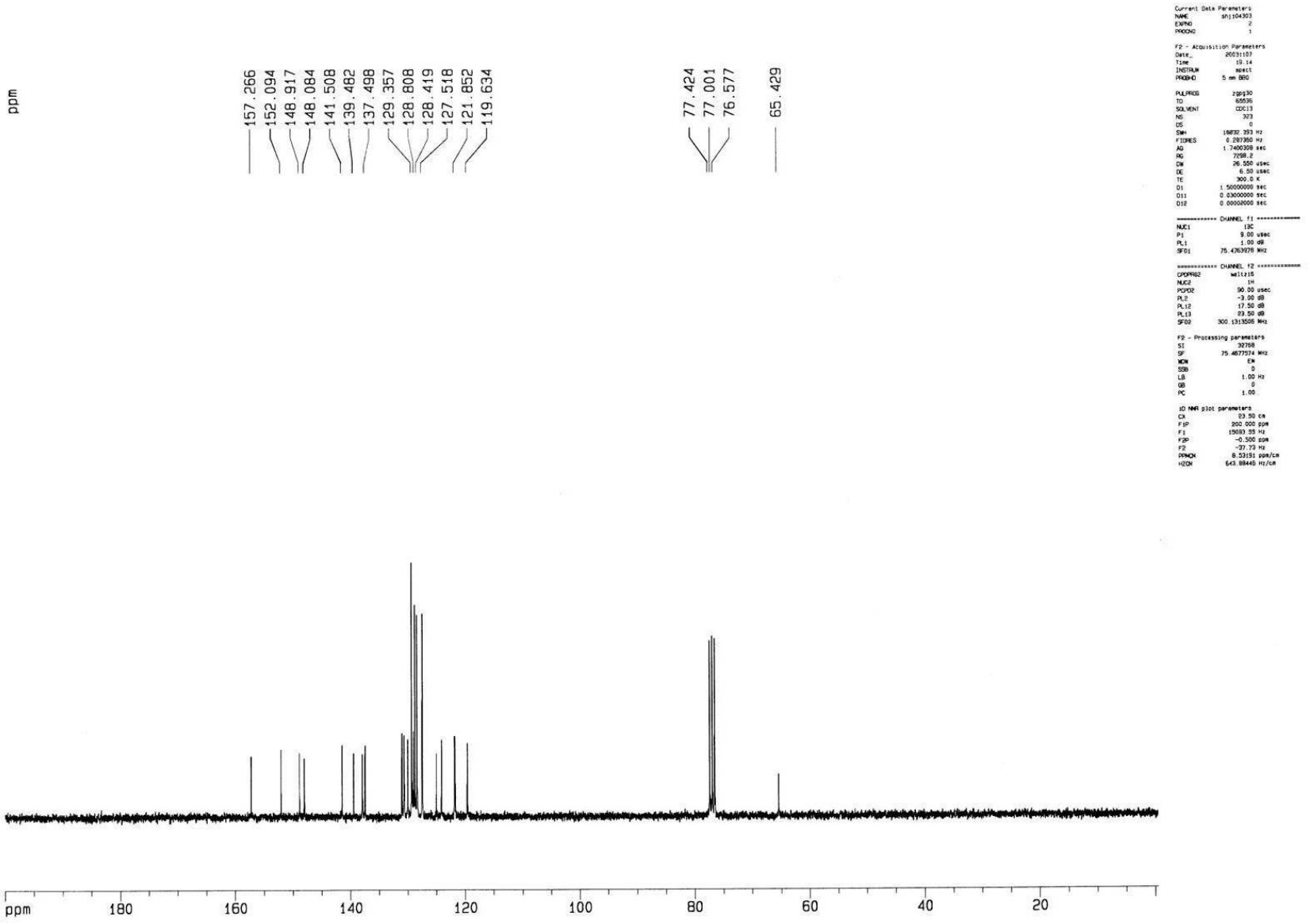

**附圖 7. 2,7-Dibromo-9,9-bis(4-acetylphenyl)fluorene，化合物 A4 的 $^{1}$H-NMR 光譜圖**



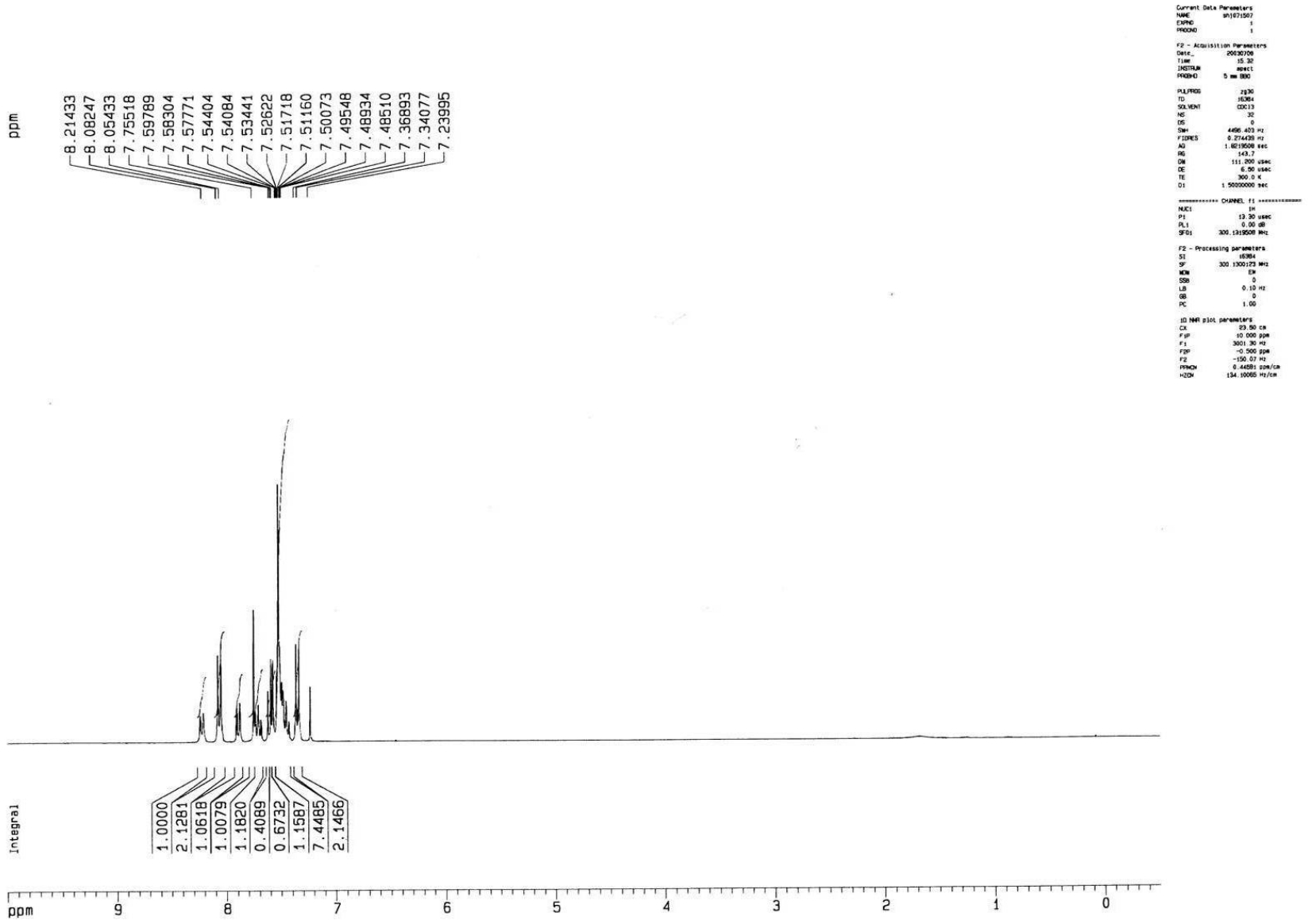

**附圖 8. 2,7-Dibromo-9,9-bis(4-acetylphenyl)fluorene，化合物 A4 的 $^{13}$C-NMR 光譜圖**



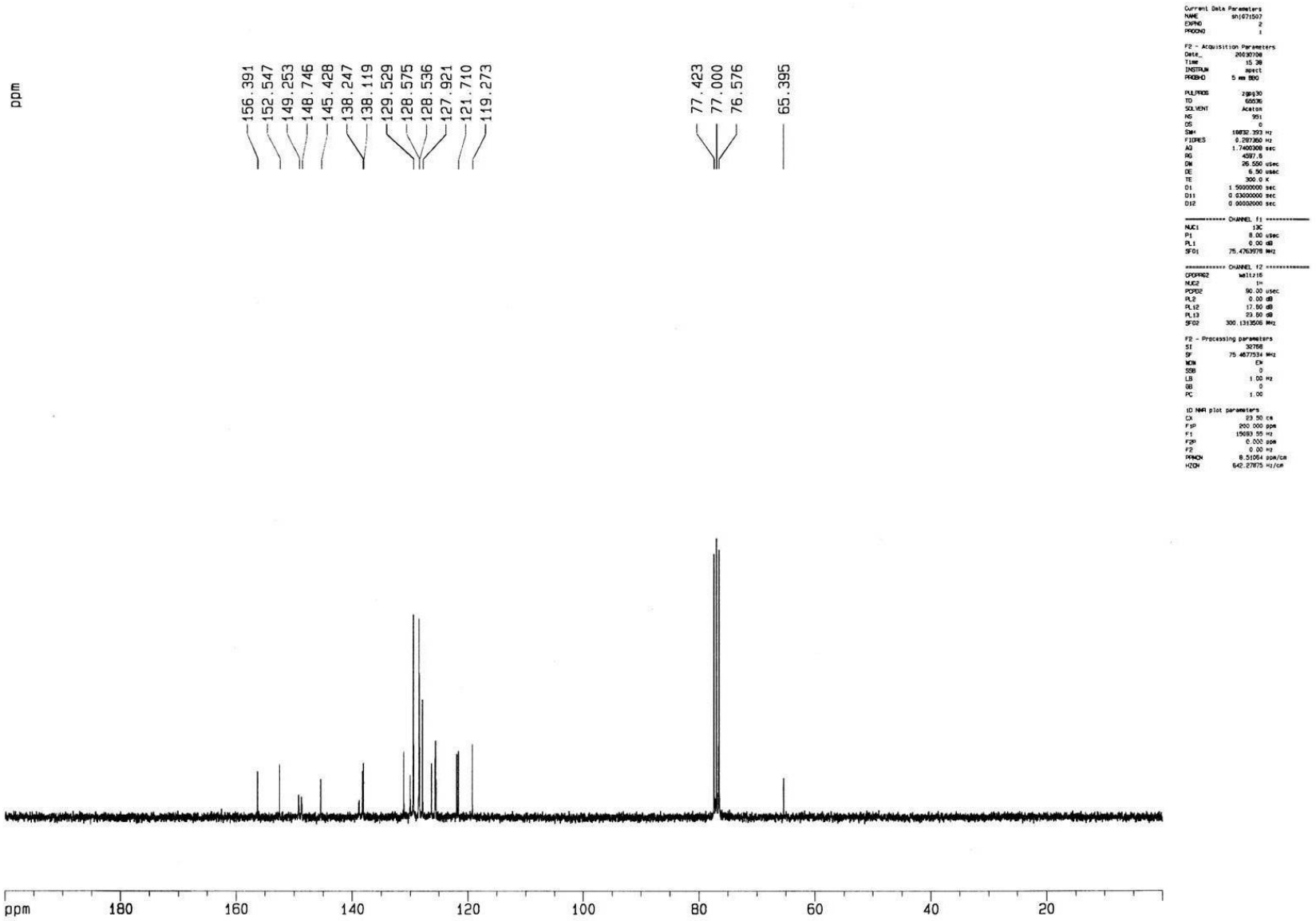

**附圖 9. 單體 Q1 的 $^{1}$H-NMR 光譜圖**




**附圖 10. 單體 Q1 的 $^{13}$C-NMR 光譜圖**

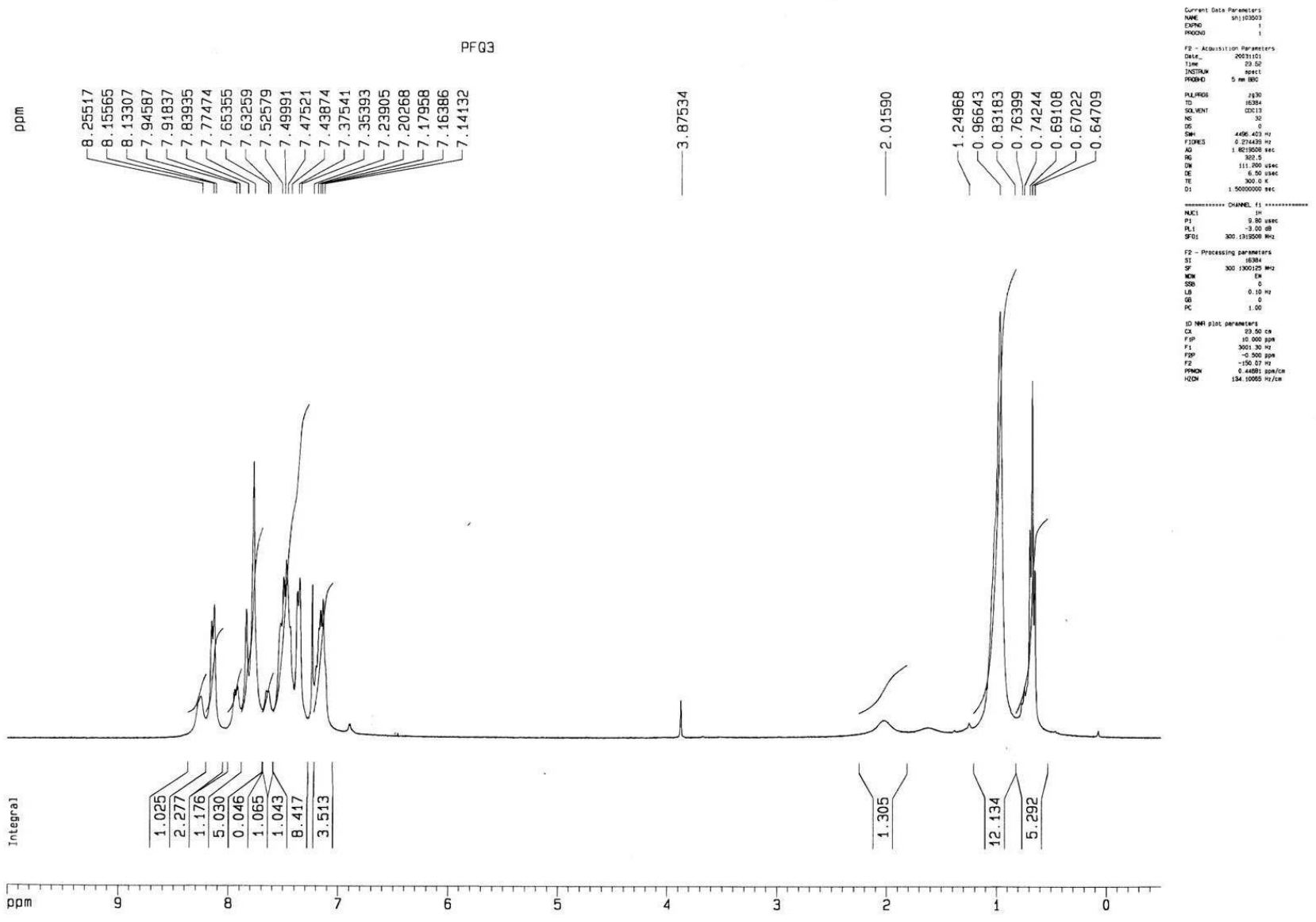



**附圖 11. 單體 Q2 的 $^{1}$H-NMR 光譜圖**

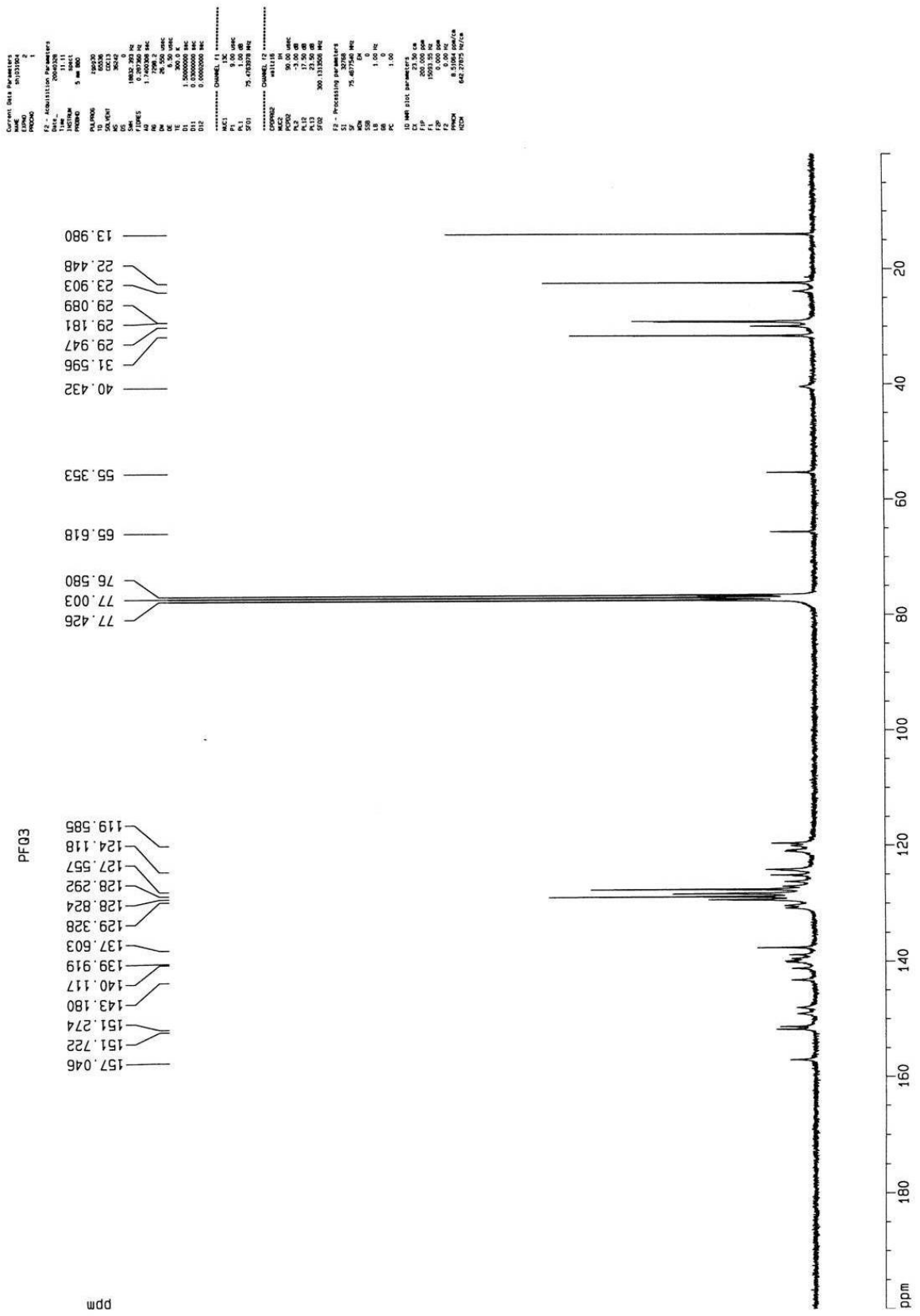




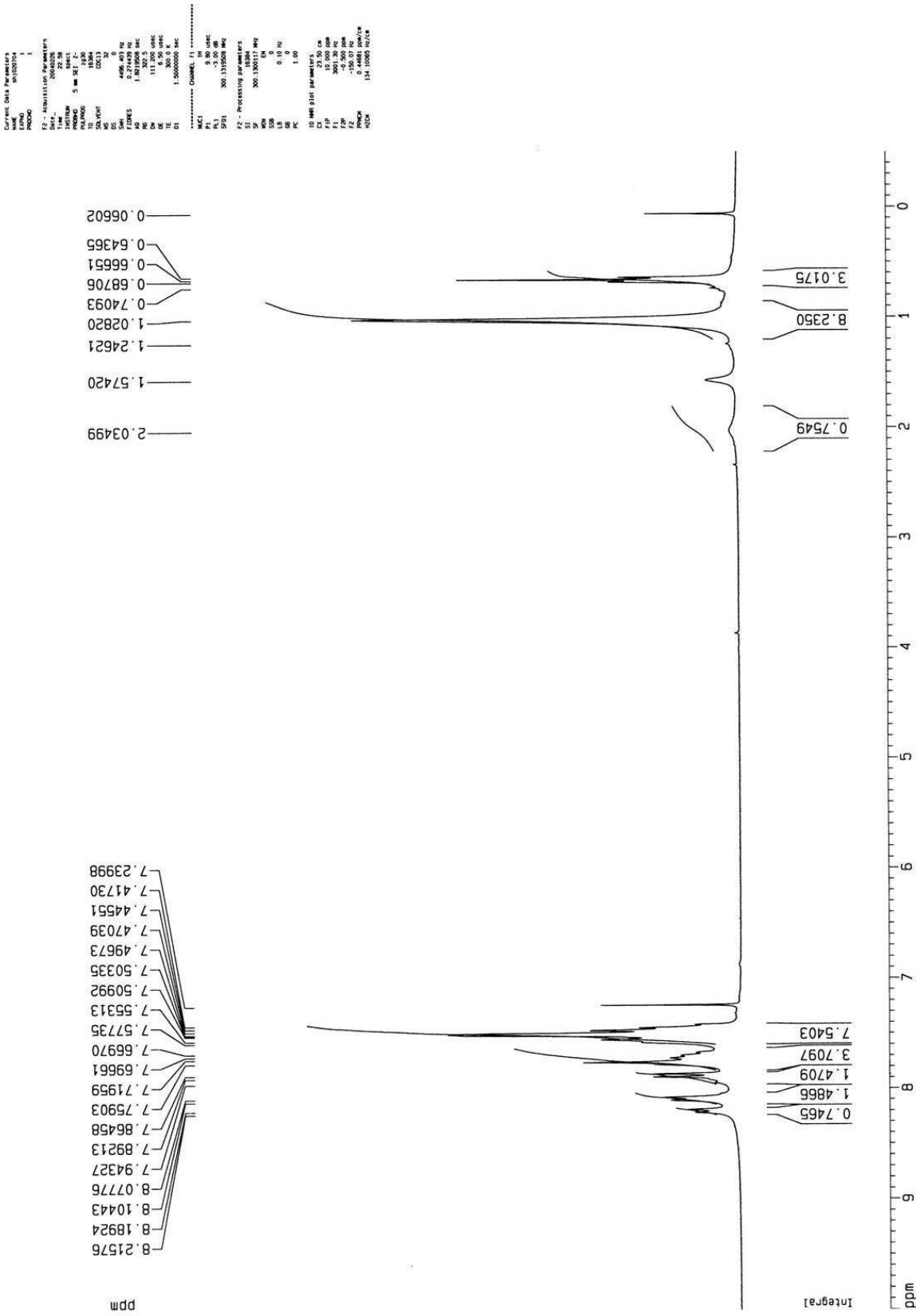

**附圖 12. 單體 Q2 的 $^{13}$C-NMR 光譜圖**



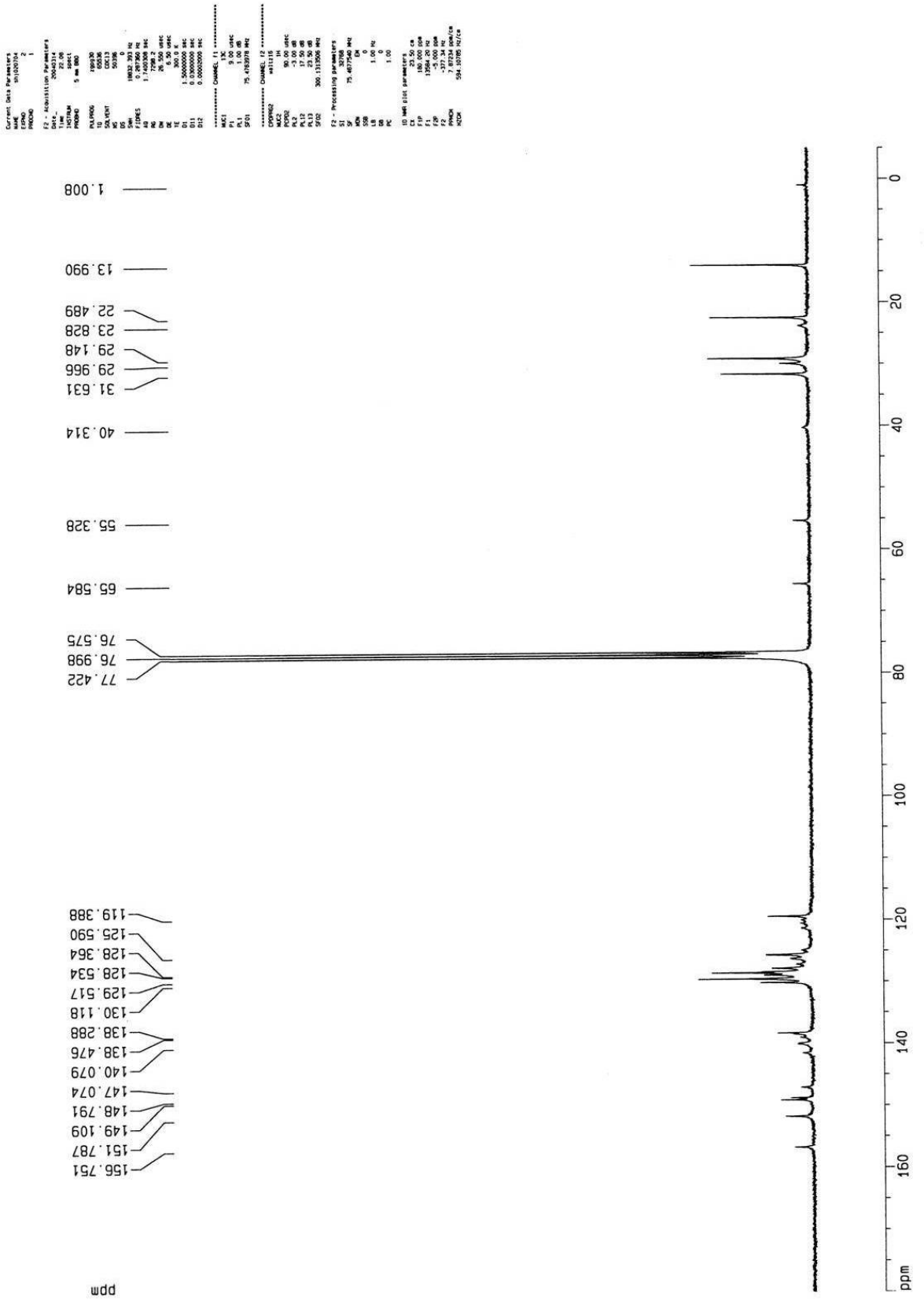

**附圖 13. 高分子 PF-Q1 的 $^{1}$H-NMR 光譜圖**



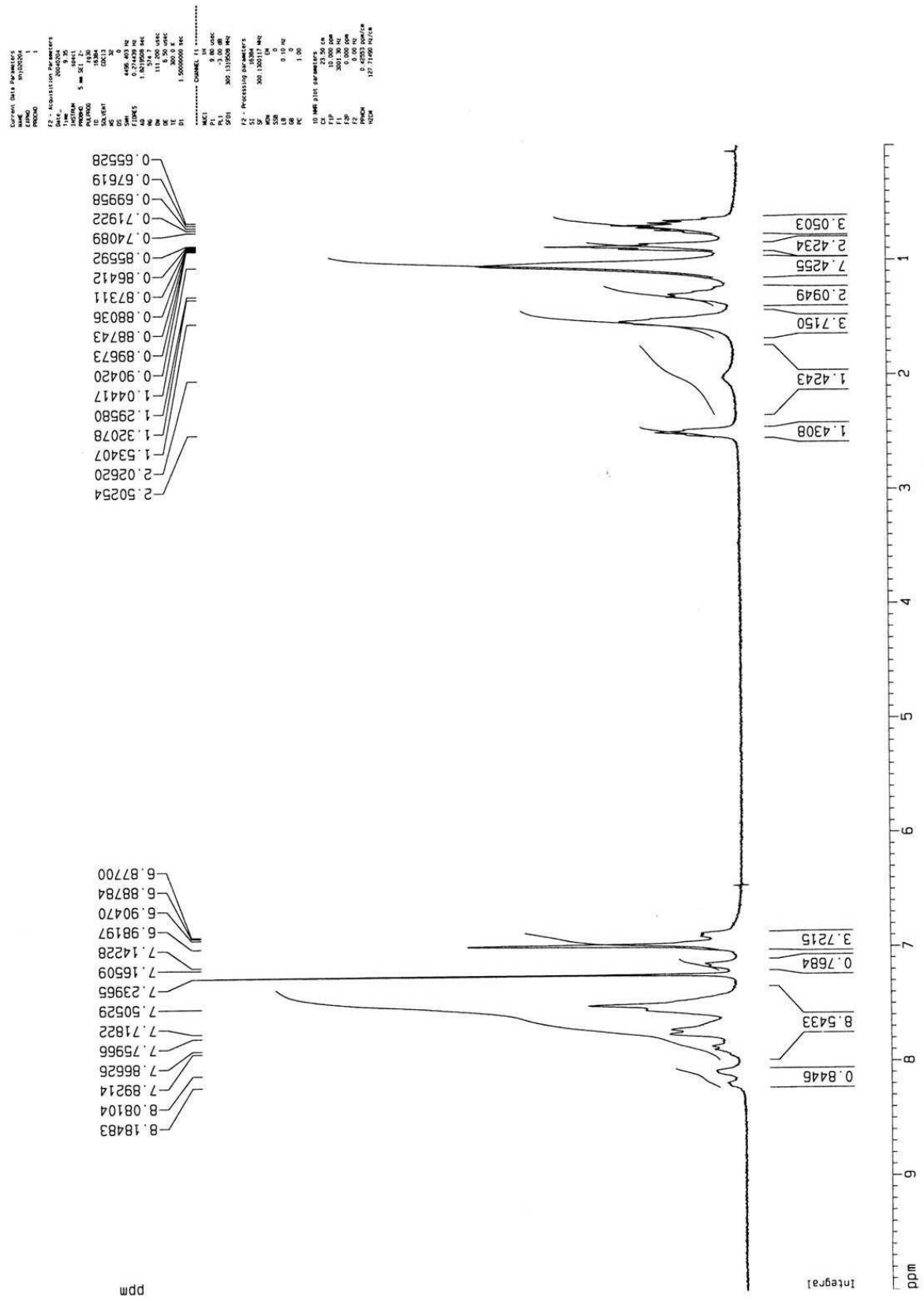

**附圖 14. 高分子 PF-Q1 的 $^{13}$C-NMR 光譜圖**



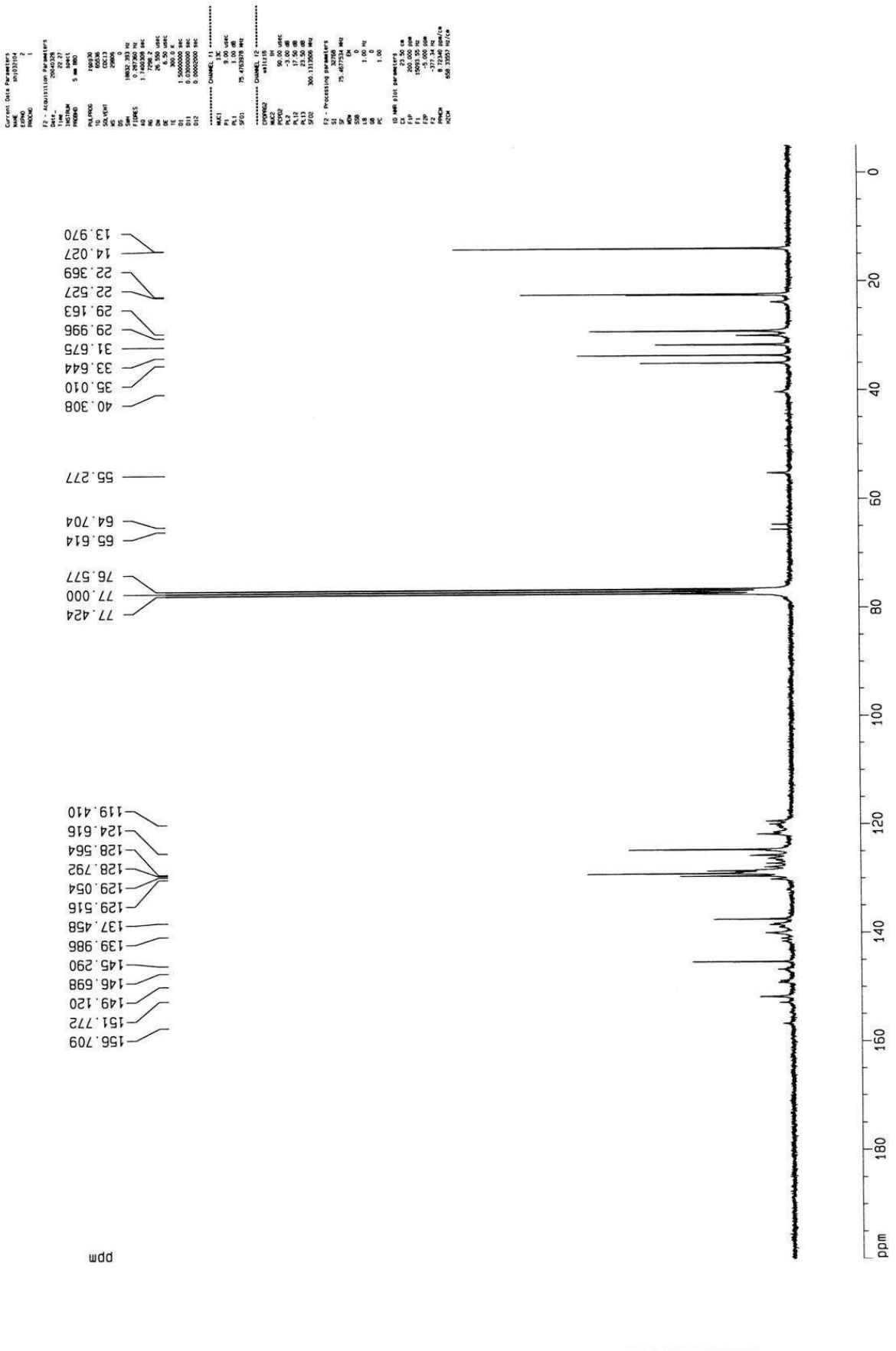

**附圖 15. 高分子 PF-Q2 的 $^{1}$H-NMR 光譜圖**



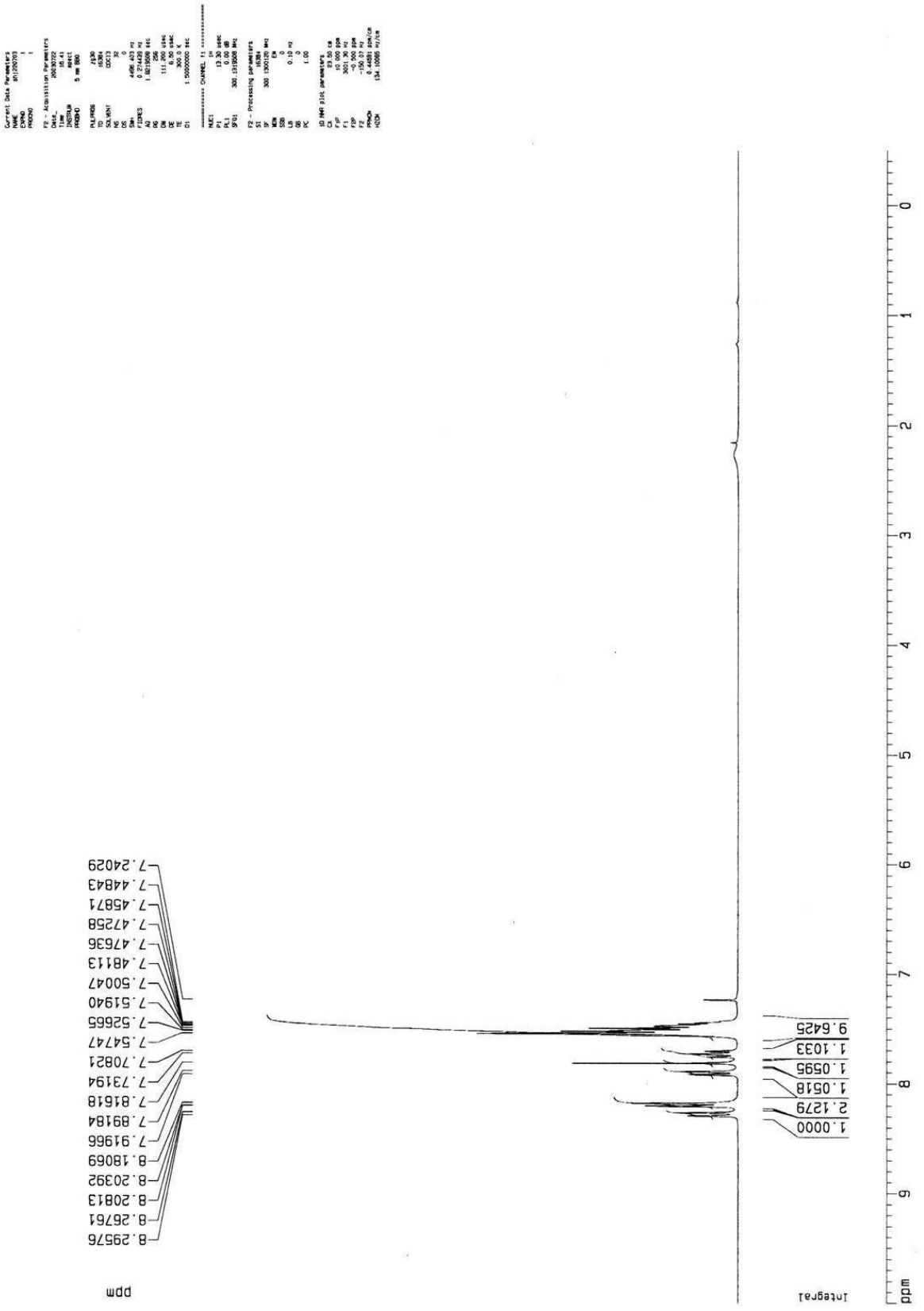

**附圖 16. 高分子 PF-Q2 的 $^{13}$C-NMR 光譜圖**



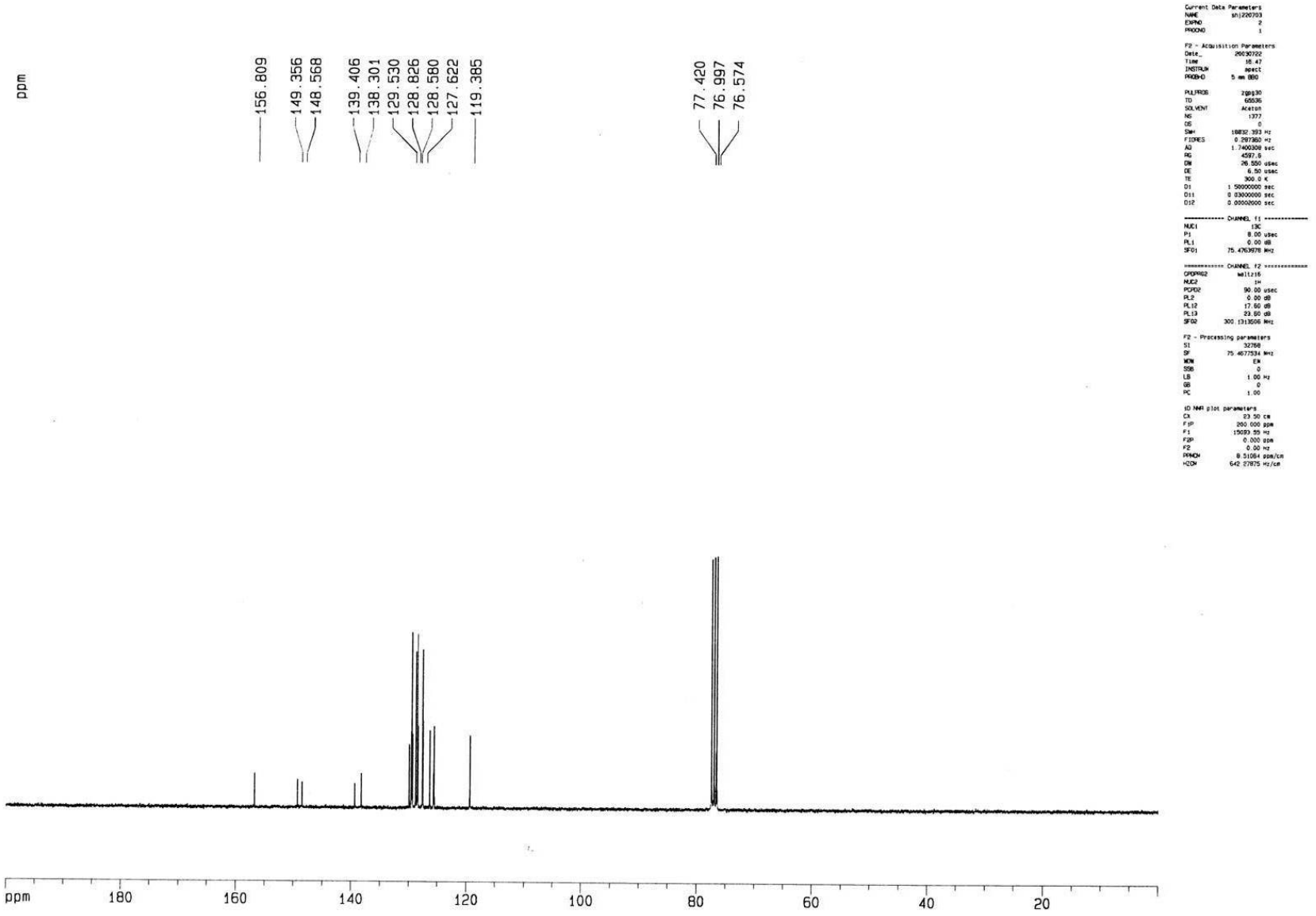

**附圖 17. 高分子 PF-QA 的 $^{1}$H-NMR 光譜圖**



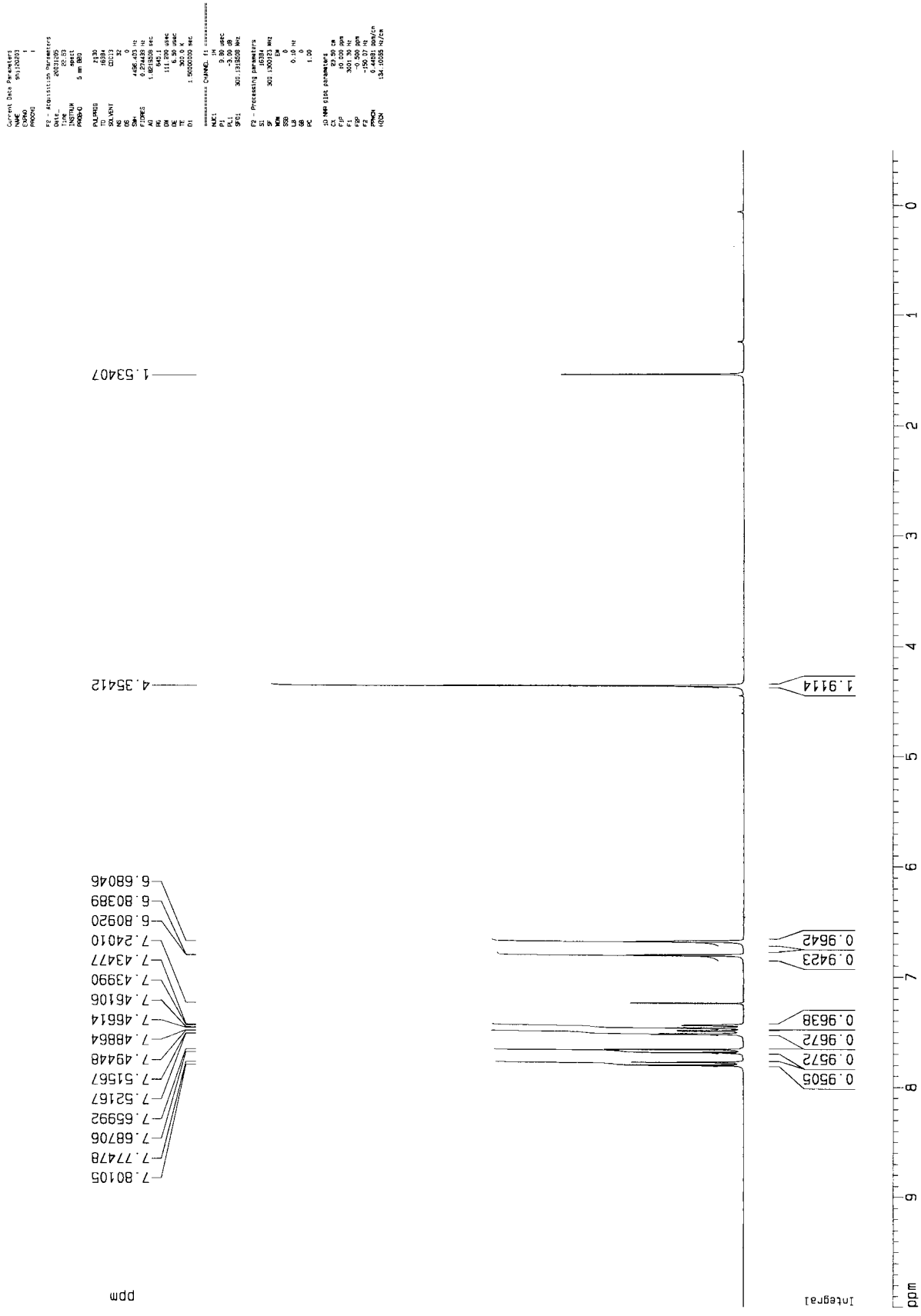

**附圖 18. 高分子 PF-QA 的 $^{13}$C-NMR 光譜圖**



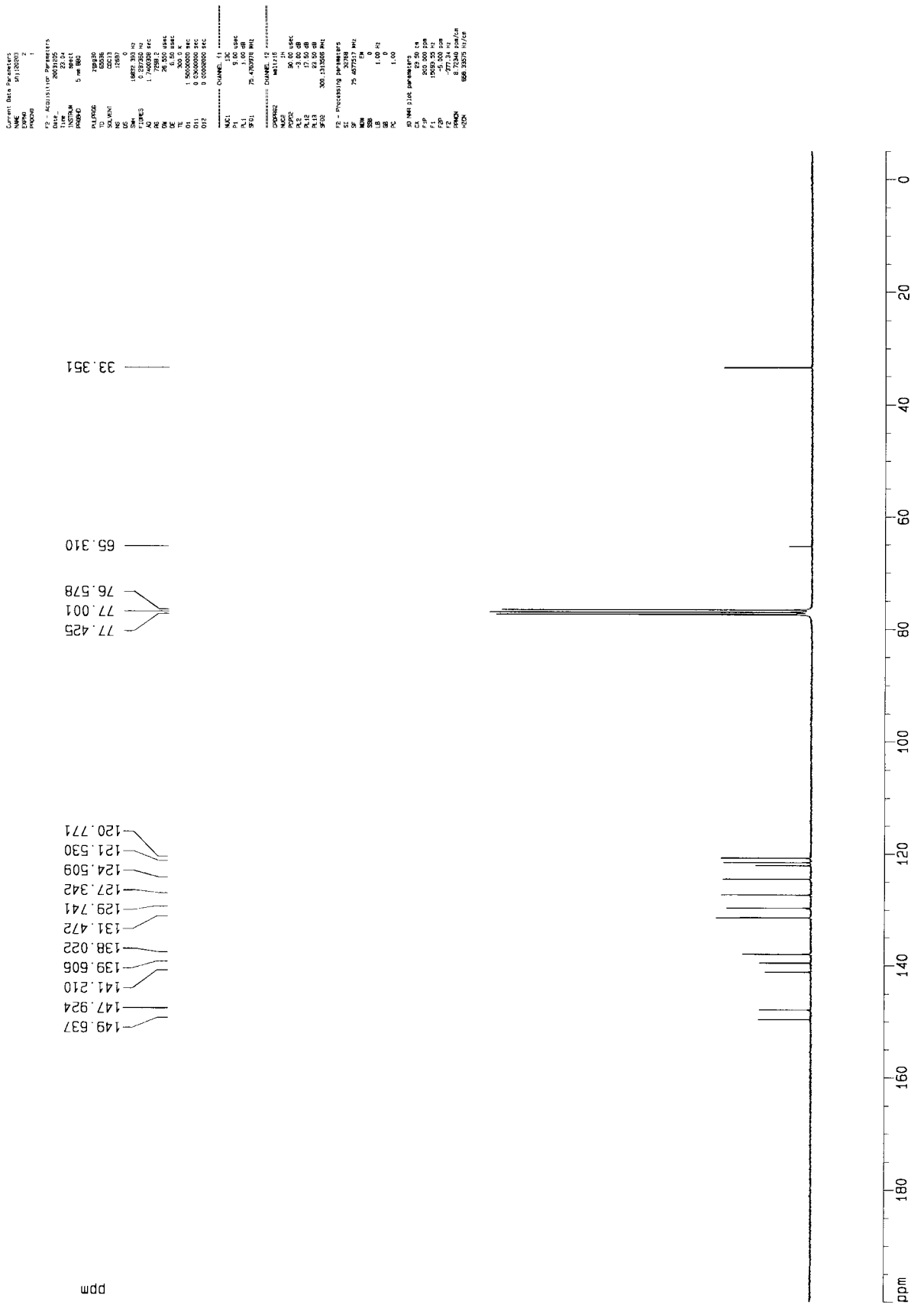

**附圖 19. 2,4-Diphenylquinoline 的 $^{1}$H-NMR 光譜圖**



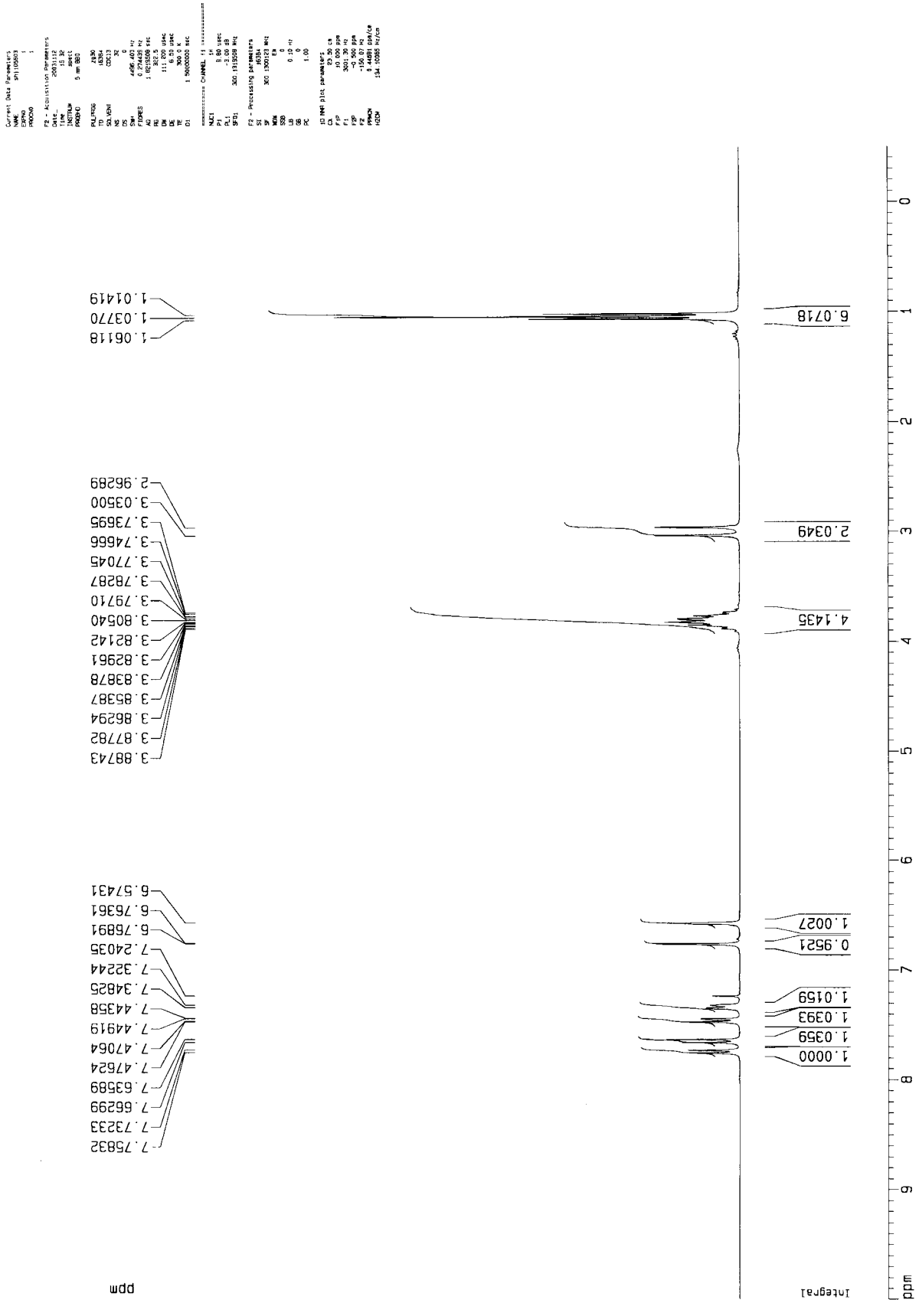

**附圖 20. 2,4-Diphenylquinoline 的 $^{13}$C-NMR 光譜圖**



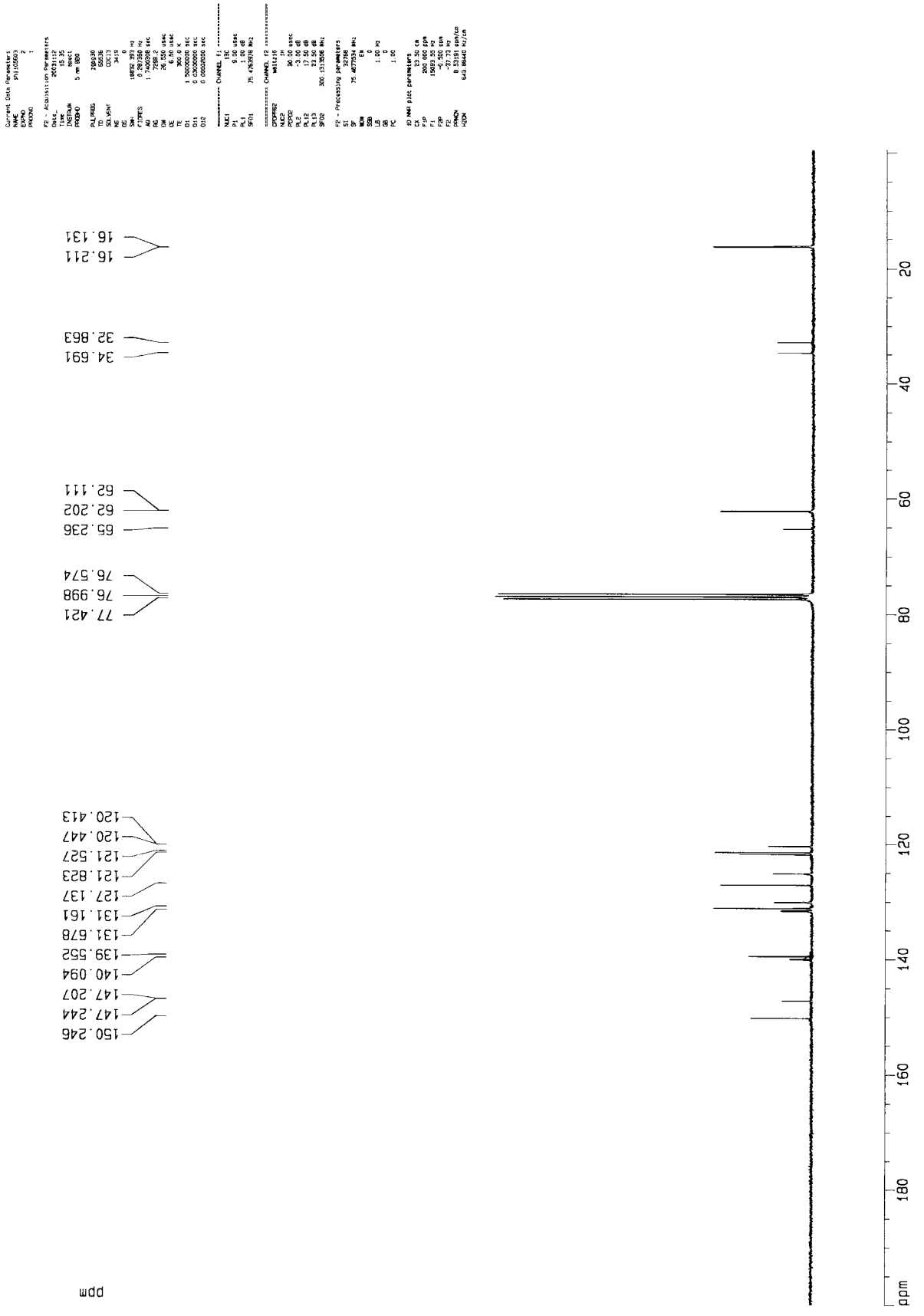

**附圖 21. 2,7- Dibromo -2',7'- bis(bromomethyl) -9,9'-spirobifluorene，化合物 B1 的 $^{1}$H-NMR 光譜圖**



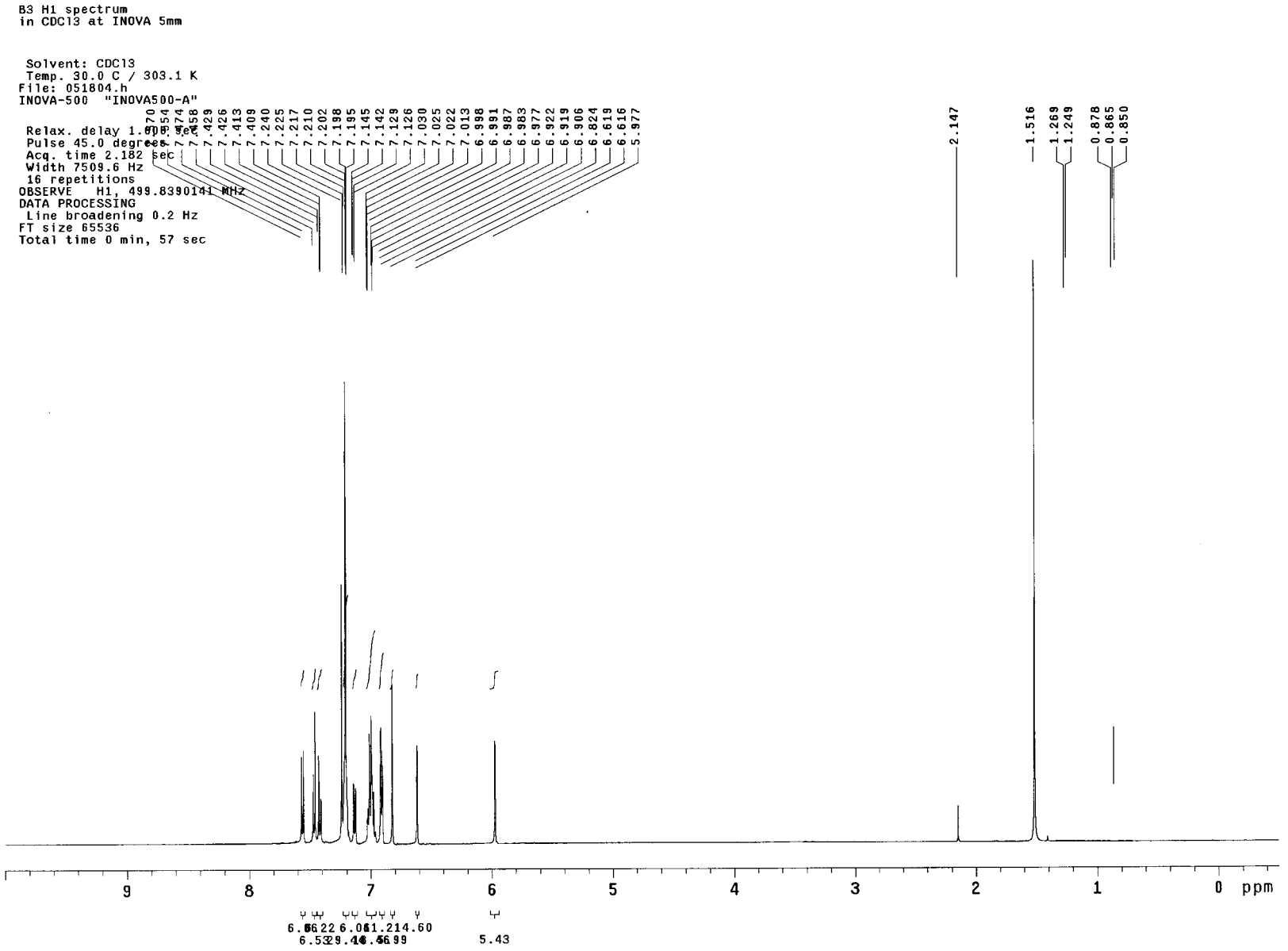

**附圖 22. 2,7- Dibromo -2',7'- bis(bromomethyl) -9,9'-spirobifluorene，化合物 B1 的 $^{13}$C-NMR 光譜圖**



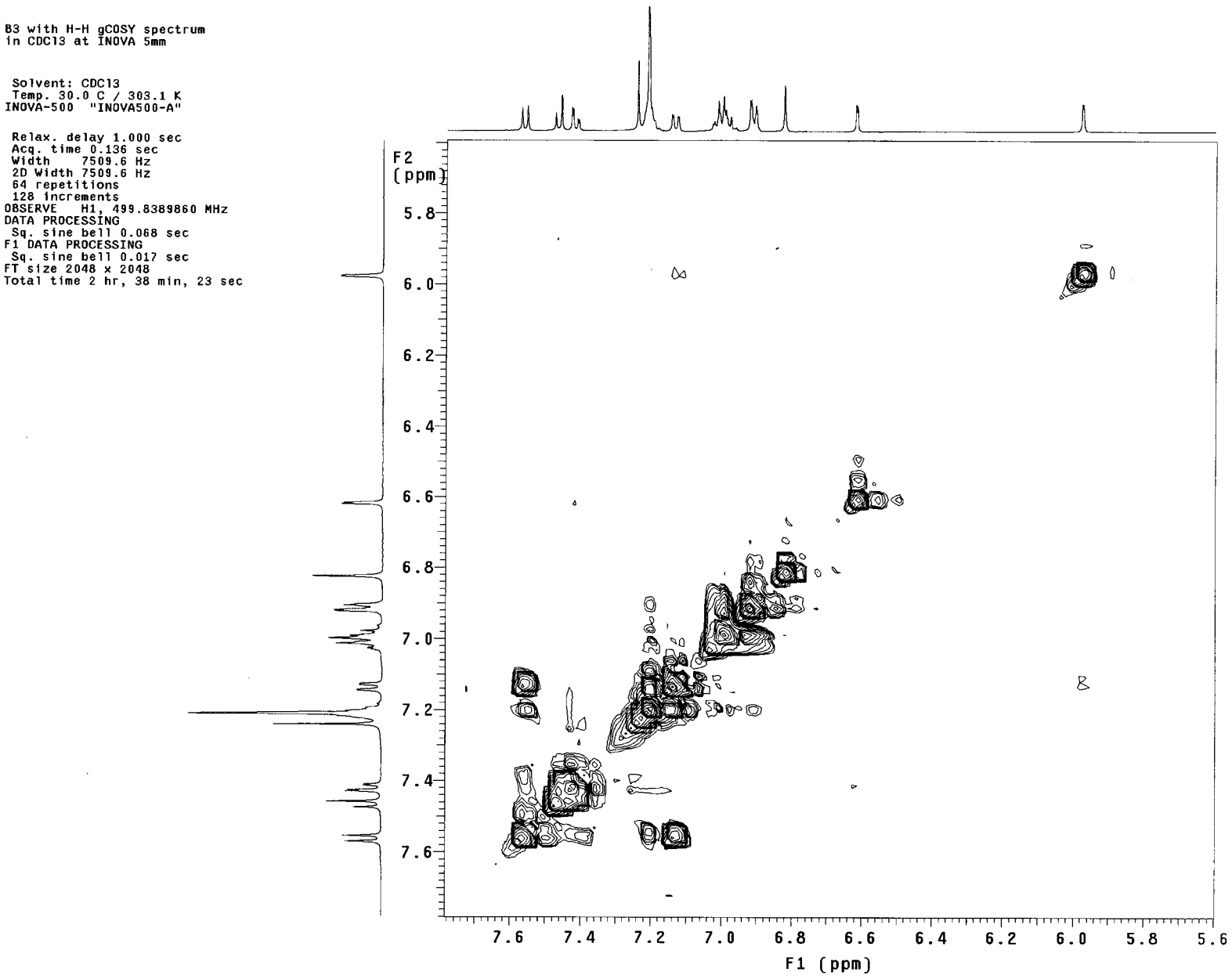

**附圖 23. 2, 7-Dibromo-2', 7'-bis(diethoxyphosphorylmethyl)-9, 9'- spirobifluorene，化合物 B2 的 $^{1}$H-NMR 光譜圖**



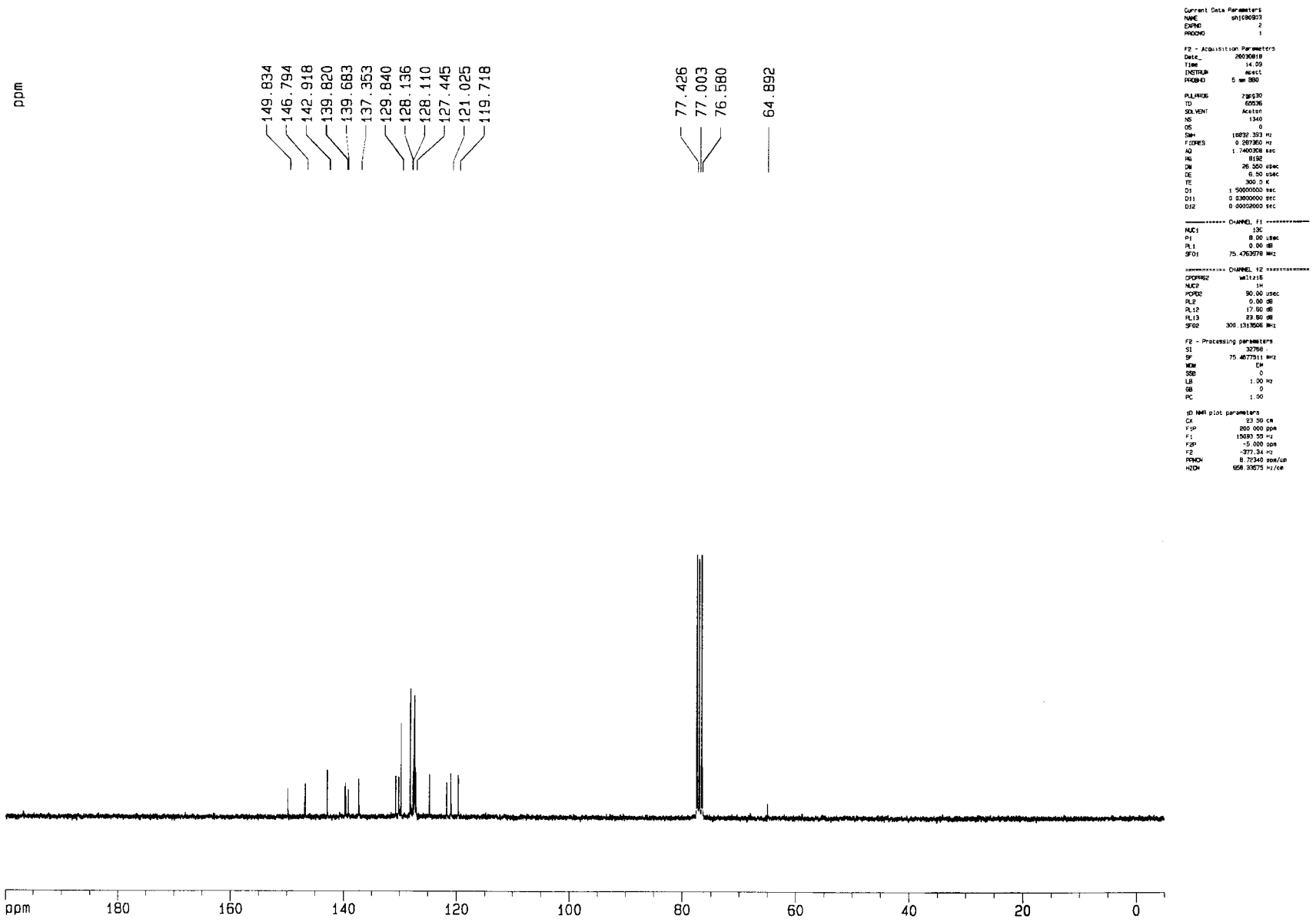

**附圖 24. 2, 7-Dibromo-2',7'-bis(diethoxyphosphorylmethyl)-9,9'- spirobifluorene，化合物 B2 的 $^{13}$C-NMR 光譜圖**




**附圖 25. 2,7-Dibromo-2',7'-bis(2,2-diphenylvinyl)- 9,9'-spirobifluorene，化合物 B3 的 $^{1}$H-NMR 光譜圖**

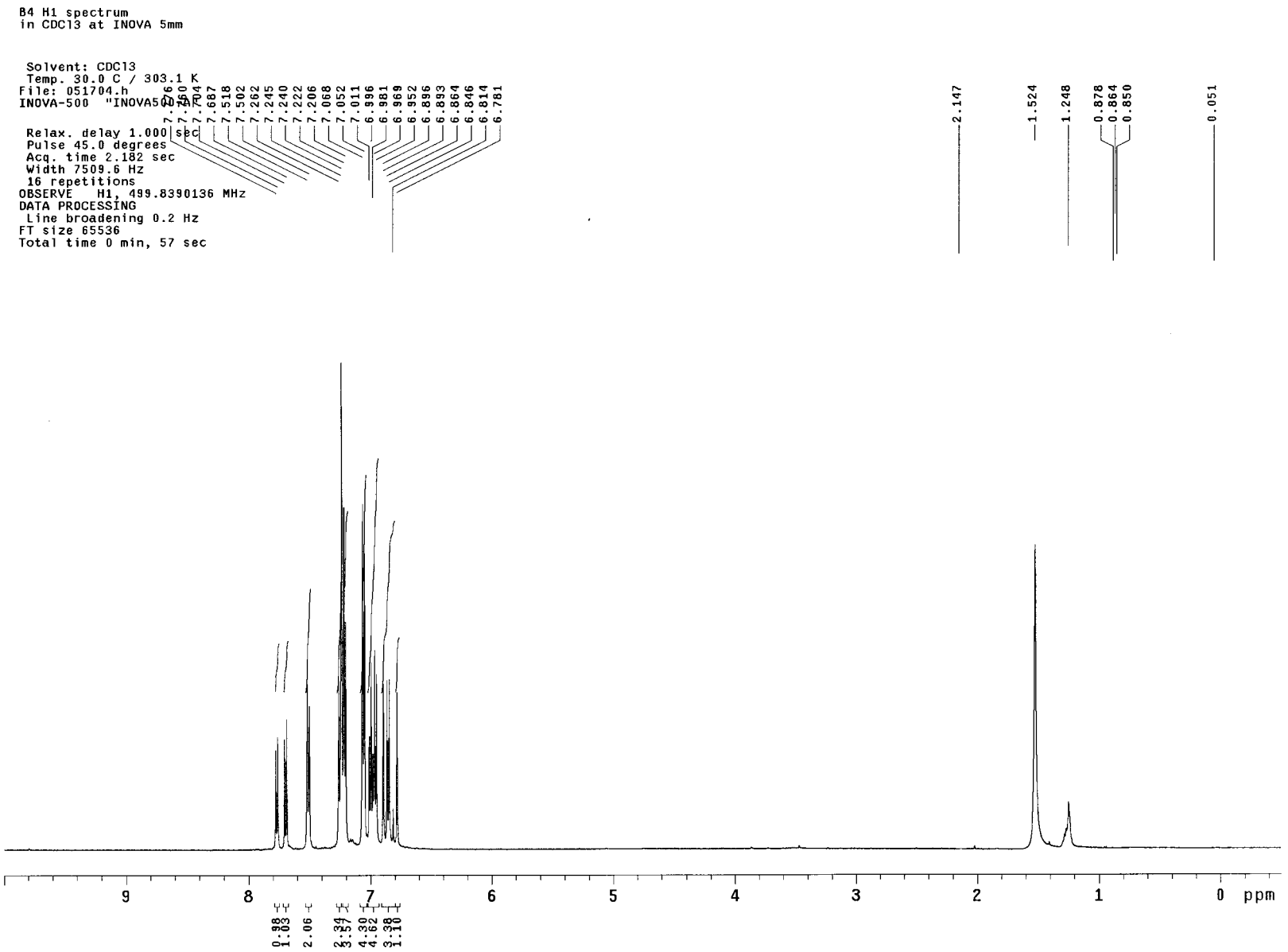



**附圖 26. 2,7-Dibromo-2',7'-bis(2,2-diphenylvinyl)- 9,9'-spirobifluorene，化合物 B3 的 $^{1}$H-$^{1}$H COSY 光譜圖**

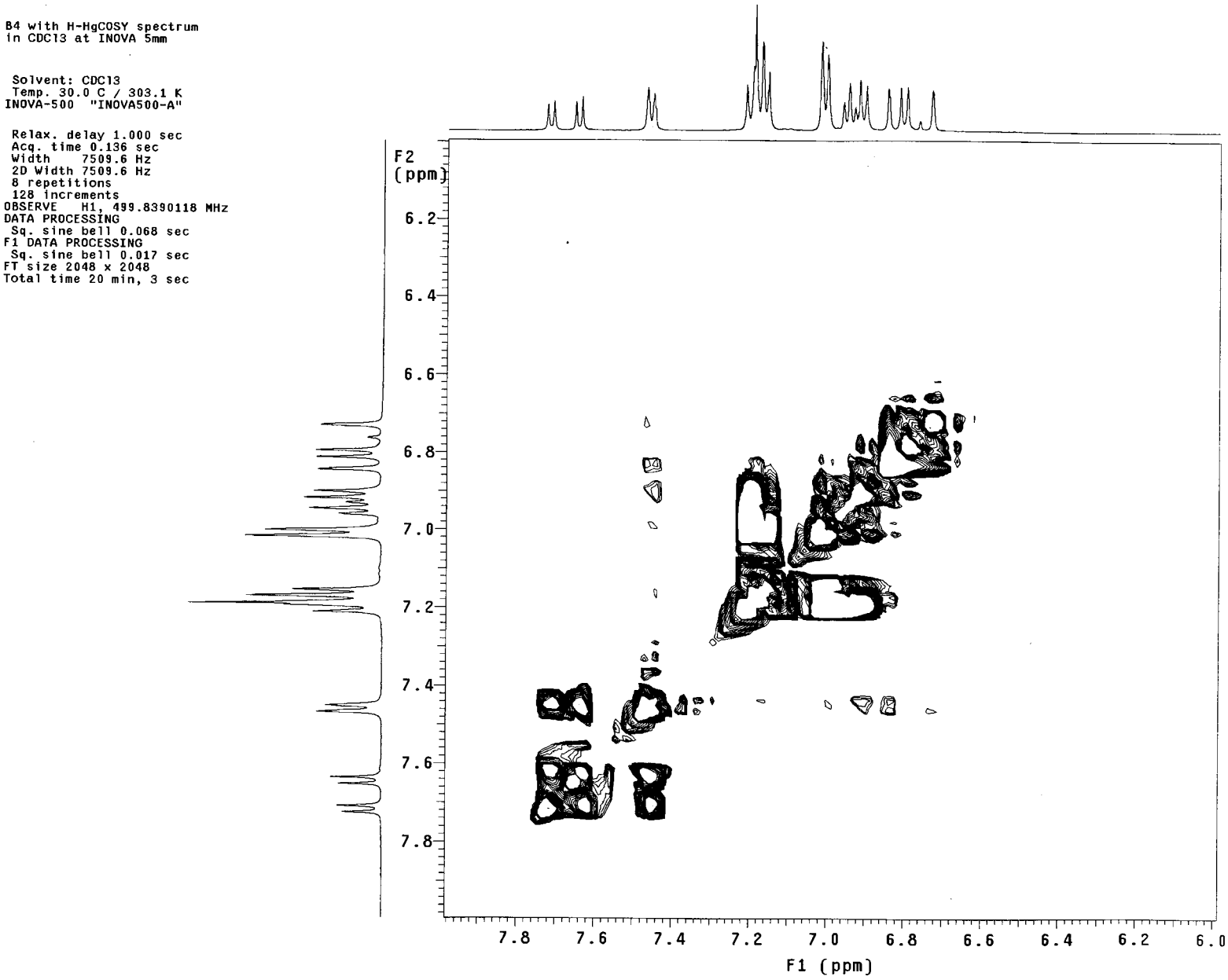





**附圖 27. 2,7-Dibromo-2',7'-bis(2,2-diphenylvinyl)- 9,9'-spirobifluorene，化合物 B3 的 $^{13}$C-NMR 光譜圖**

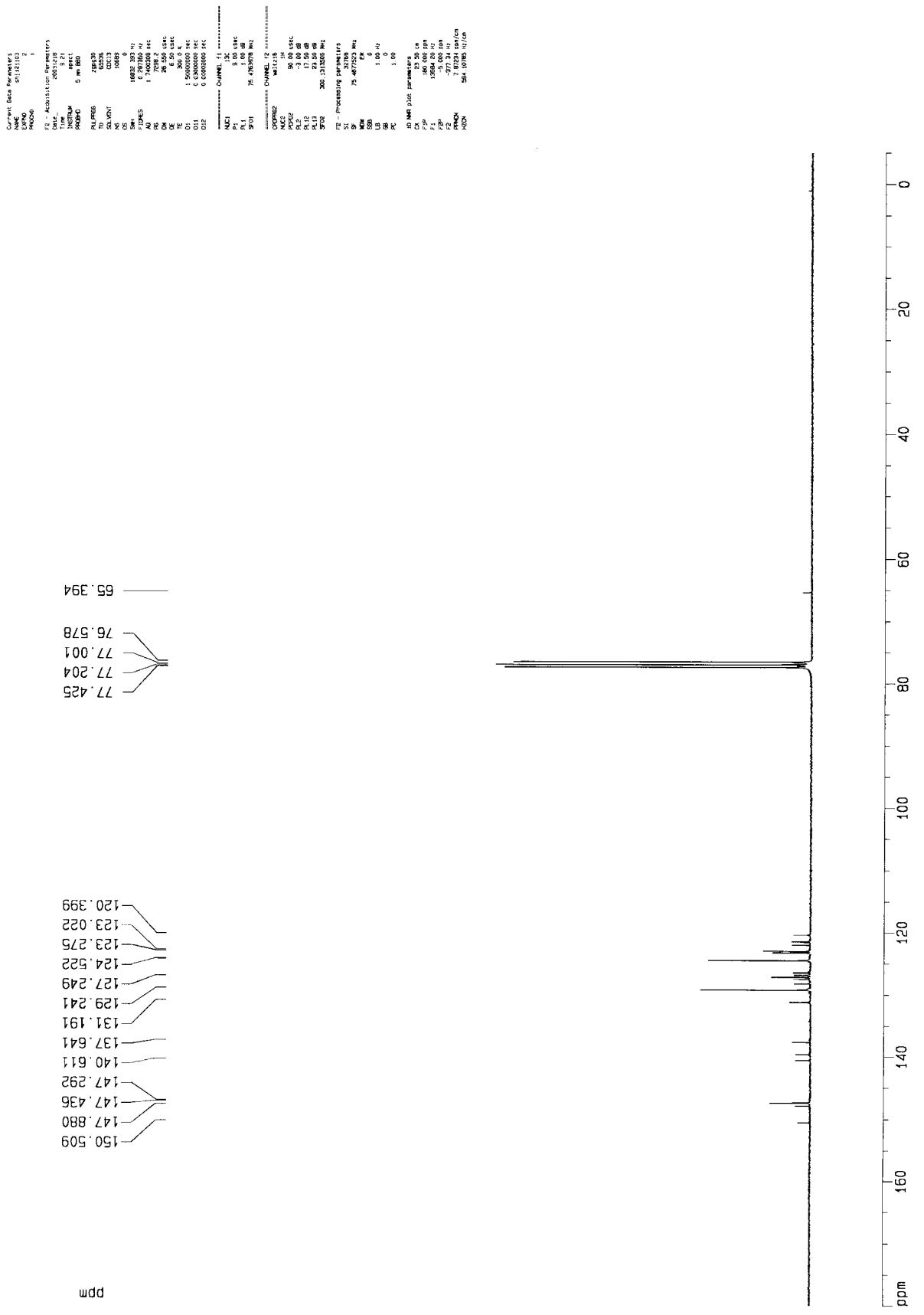



**附圖 28. 2,7-Dibromo-2',7'- bis[4'-(diphenylamino)styryl]- 9,9'-spirobifluorene，化合物 B4 的 $^{1}$H-NMR 光譜圖**

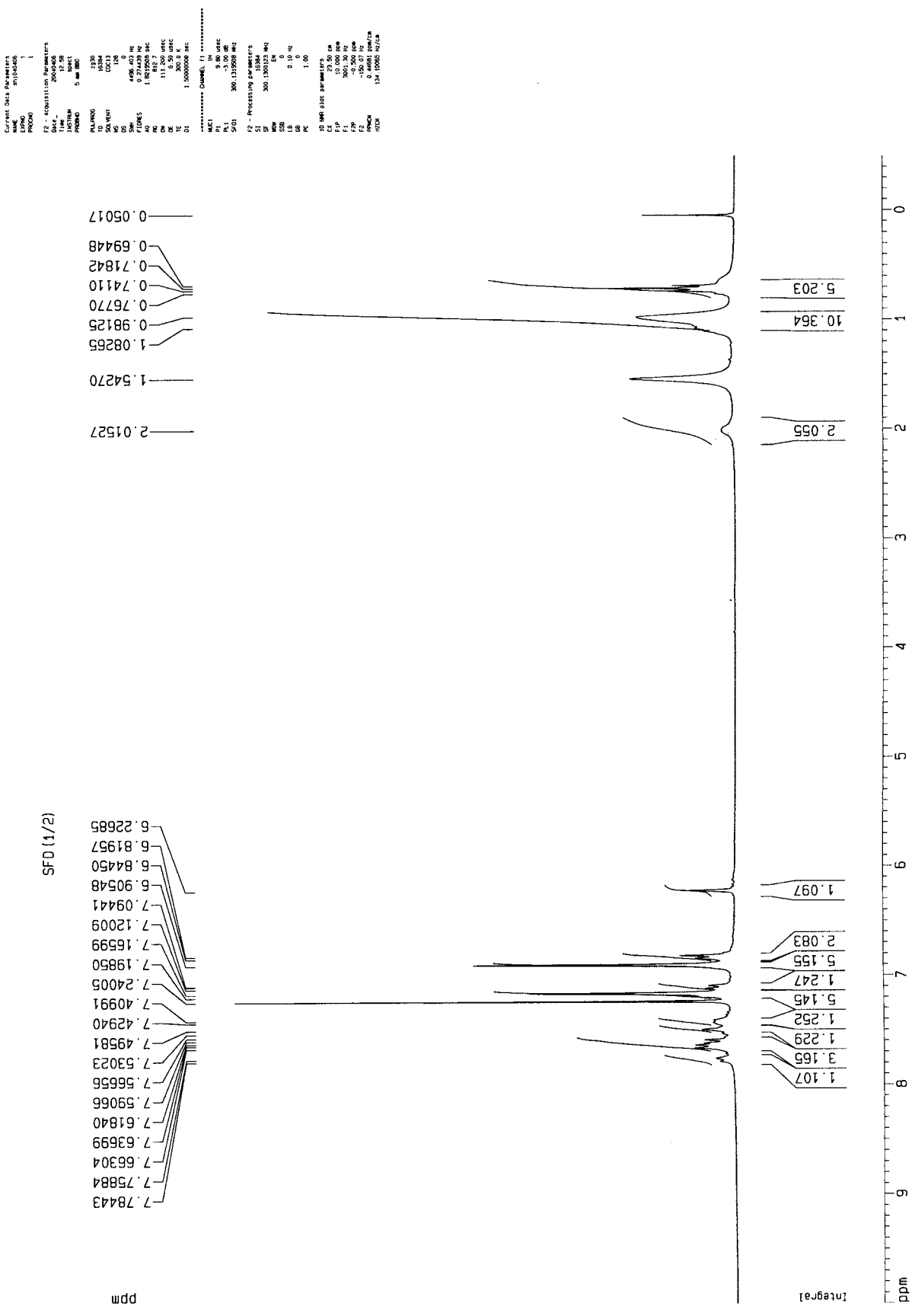




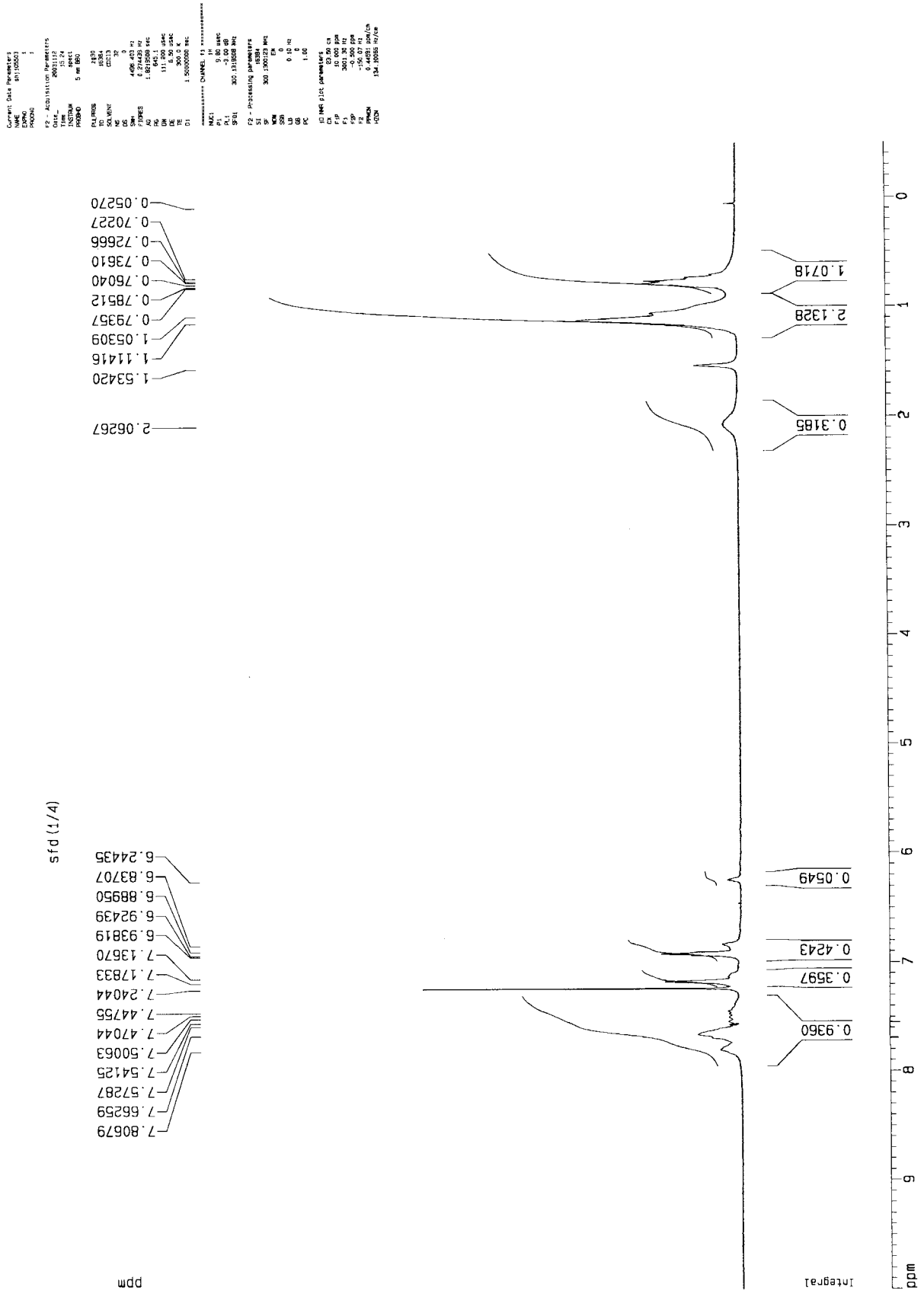

**附圖 29. 2,7-Dibromo-2',7'- bis[4'-(diphenylamino)styryl]- 9,9'-spirobifluorene，化合物 B4 的 $^{1}$H-$^{1}$H COSY 光譜圖**



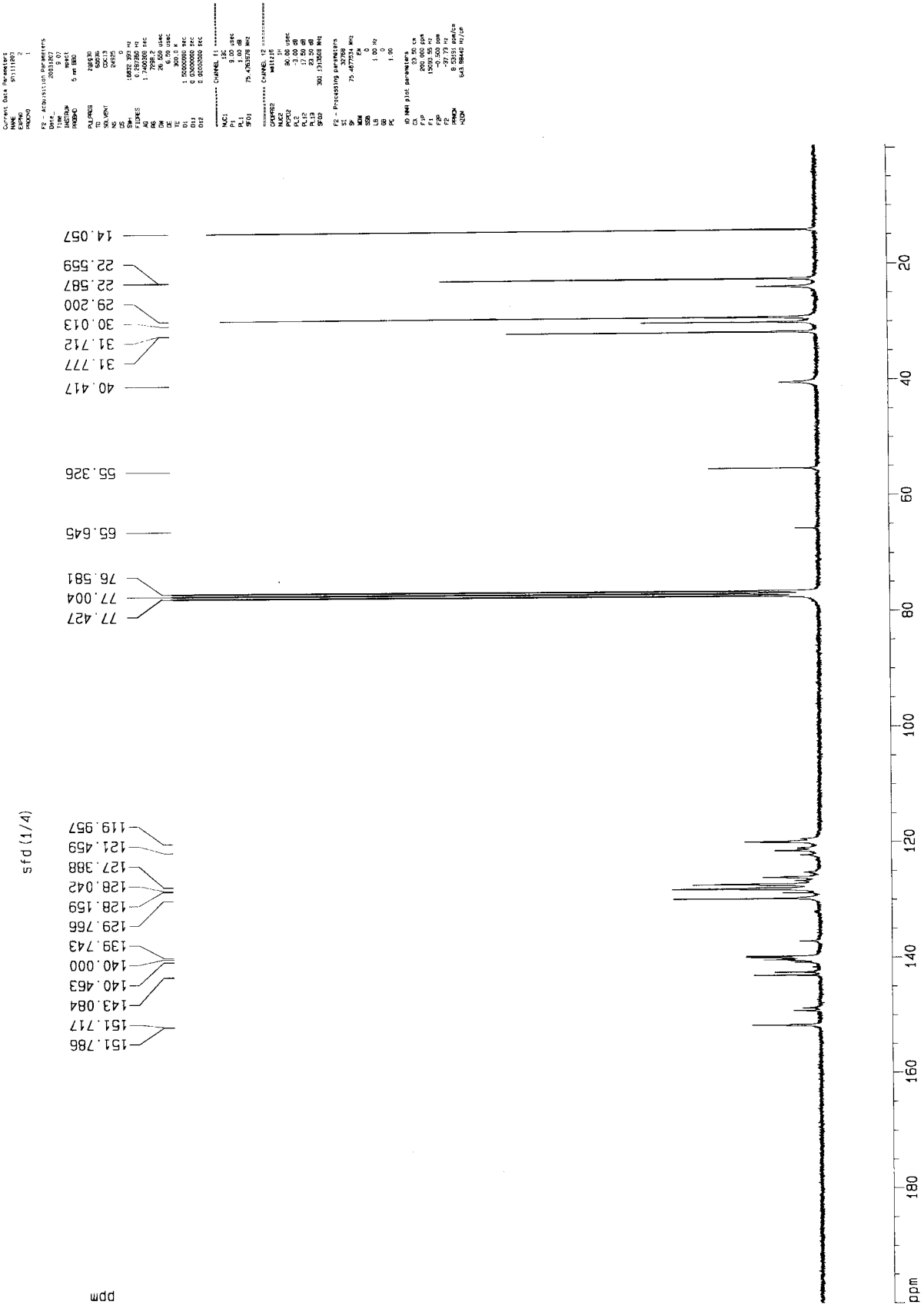

**附圖 30. 2,7-Dibromo-2',7'- bis[4'-(diphenylamino)styryl]- 9,9'-spirobifluorene，化合物 B4 的 $^{13}$C-NMR 光譜圖**



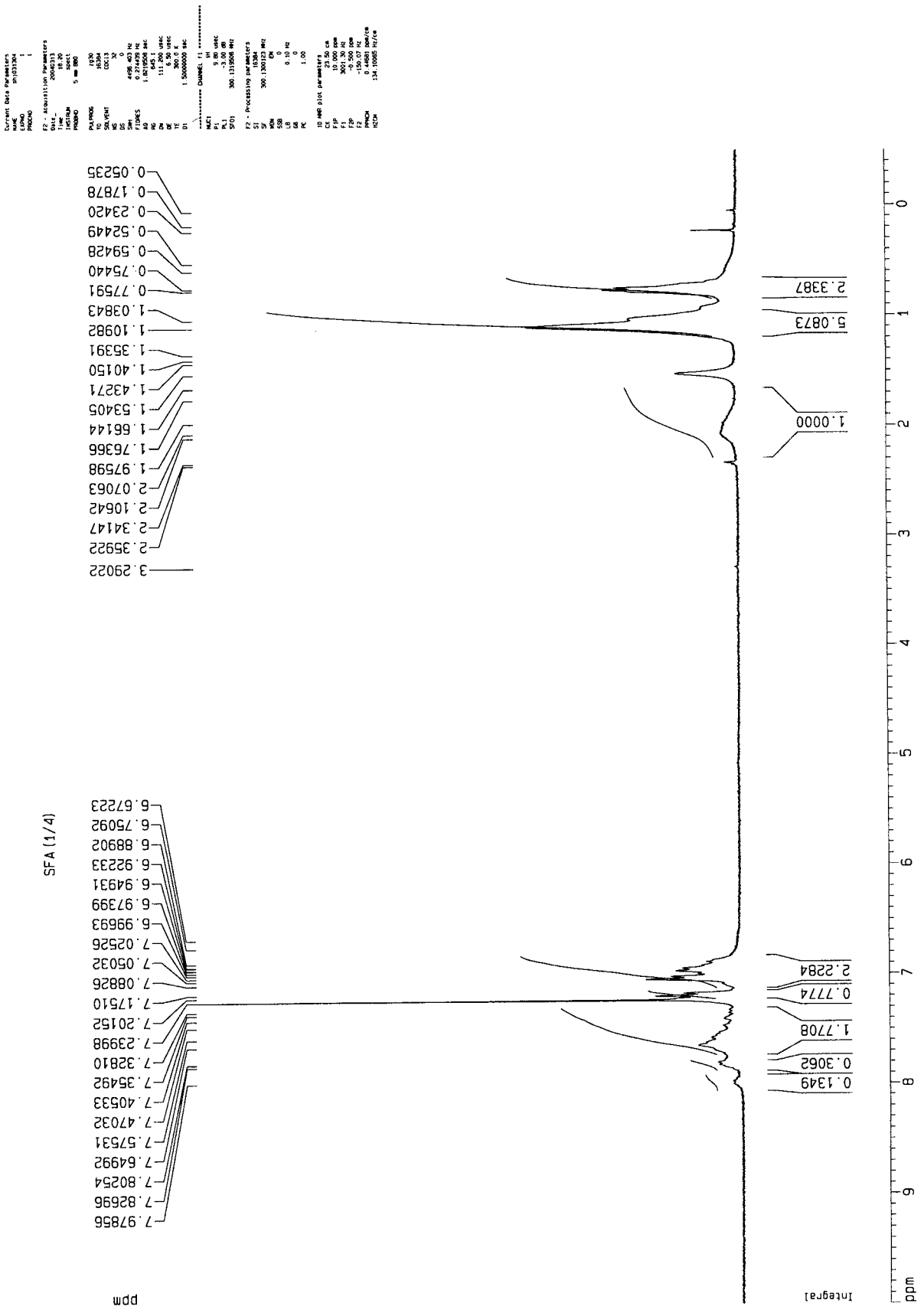

**附圖 31. 高分子 SFD(1/2)的 $^{1}$H-NMR 光譜圖**



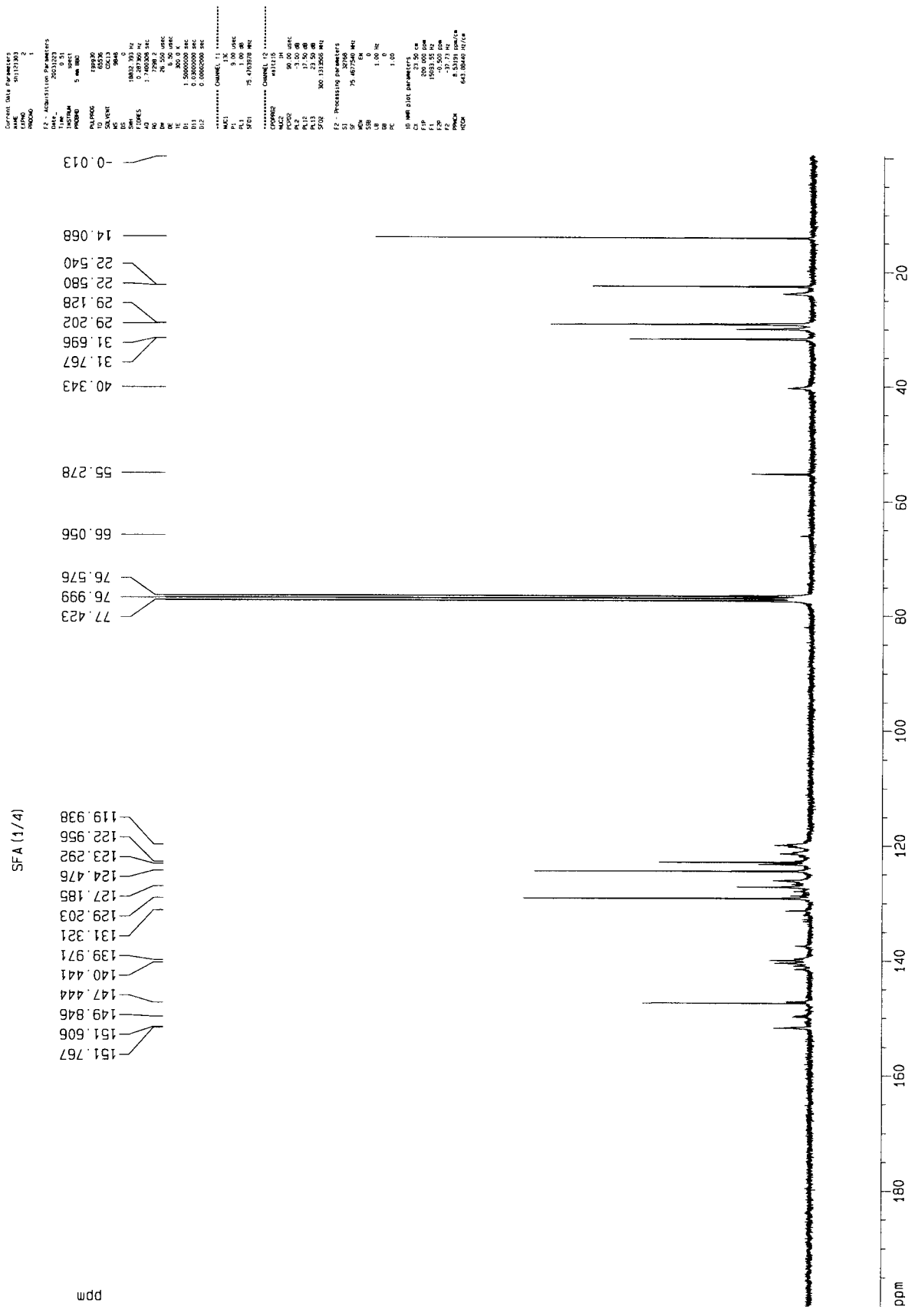

**附圖 32. 高分子 SFD(1/4)的 $^{1}$H-NMR 光譜圖**



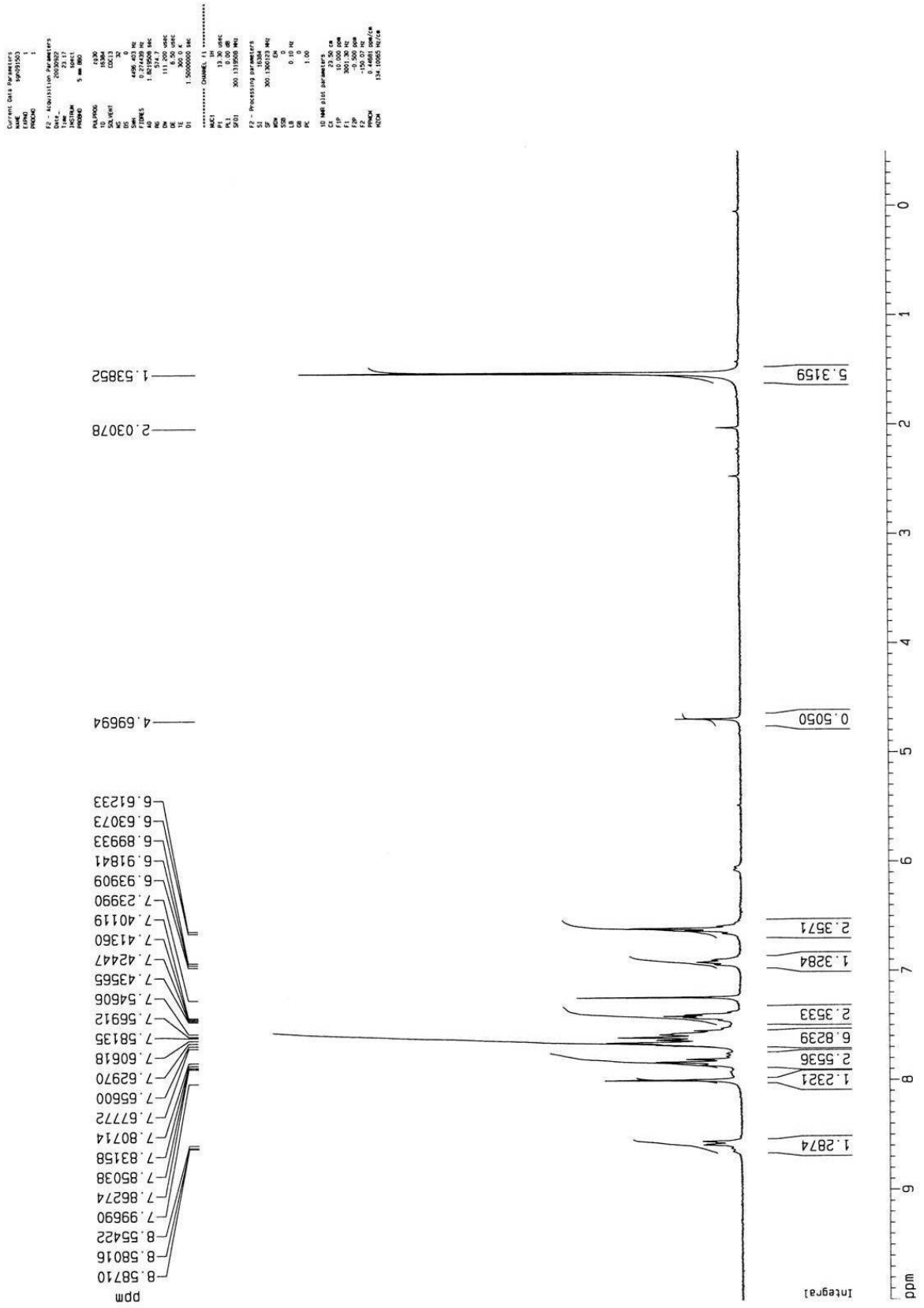

**附圖 33. 高分子 SFD(1/4)的 $^{13}$C-NMR 光譜圖**



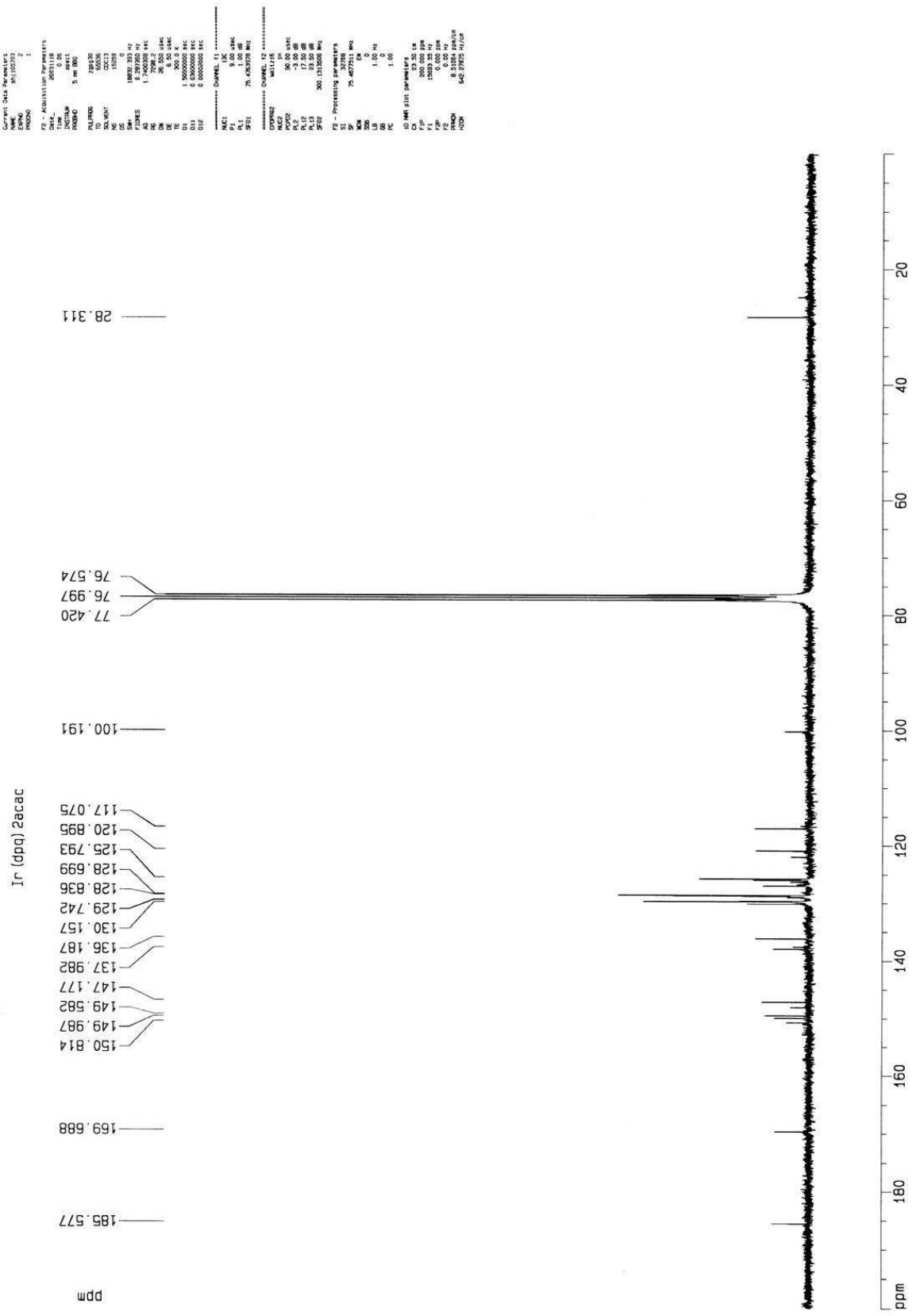

**附圖 34. 高分子 SFA(1/4)的 $^{1}$H-NMR 光譜圖**



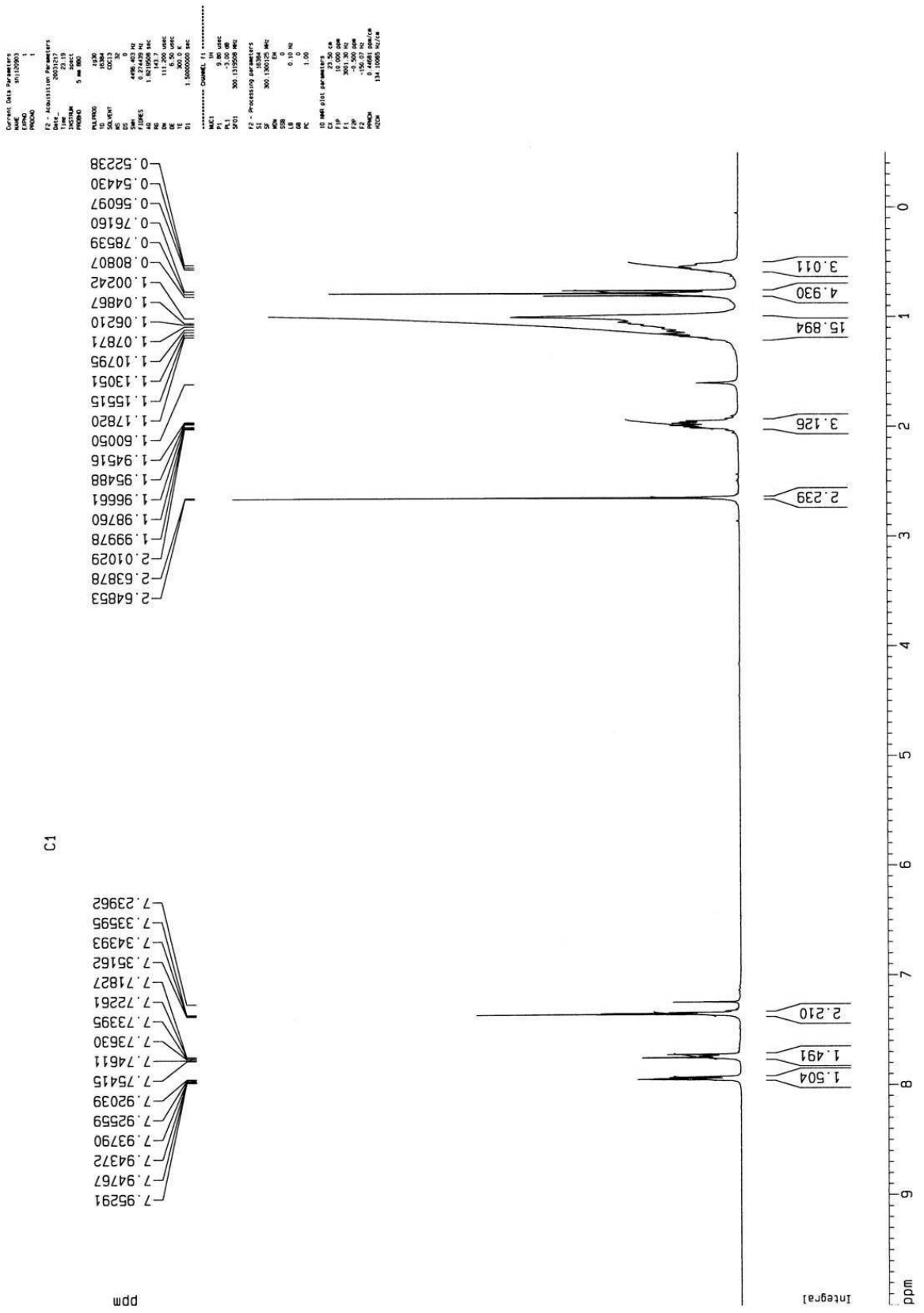

**附圖 35. 高分子 SFA(1/4)的 $^{13}$C-NMR 光譜圖**



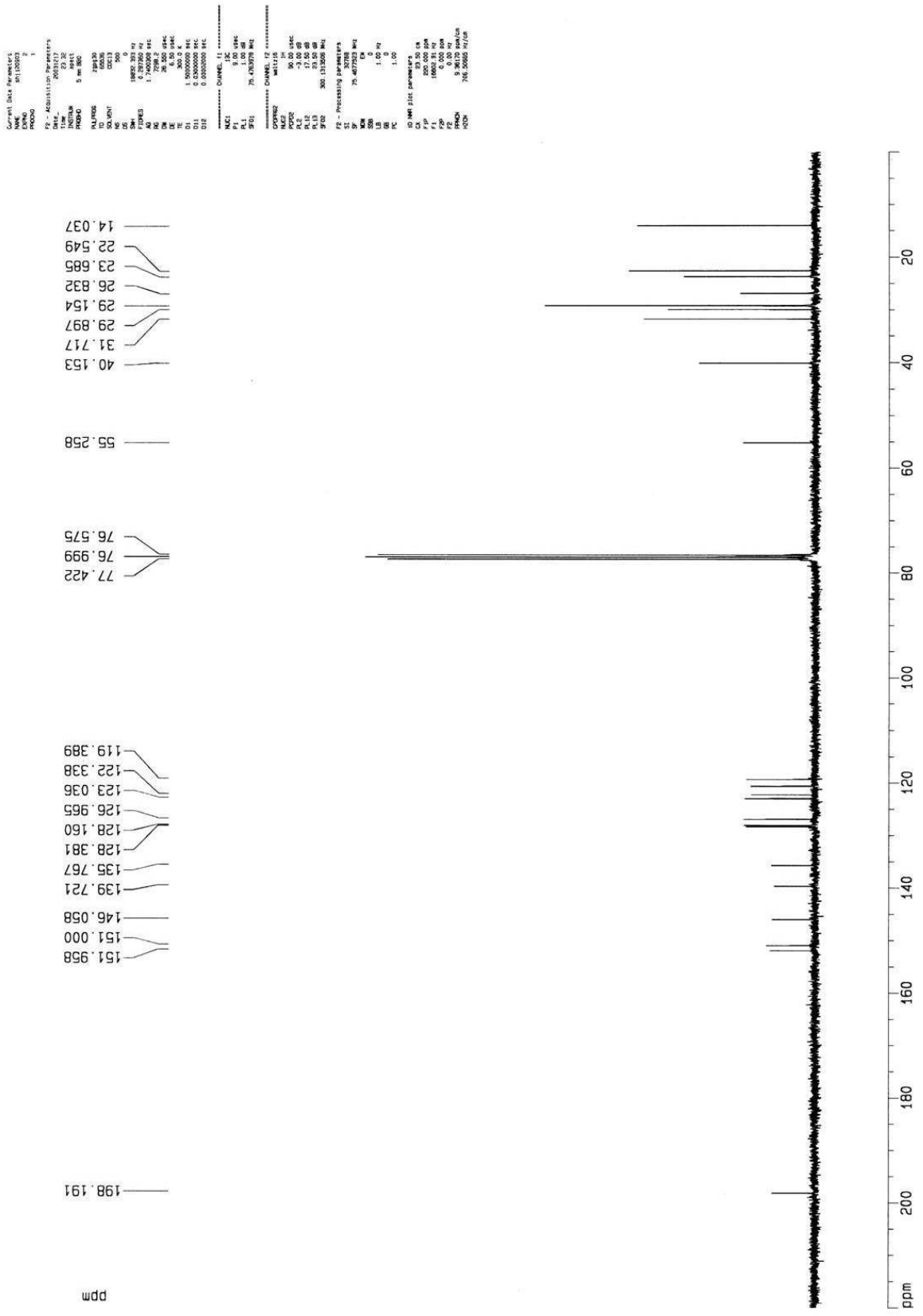

**附圖 36. Ir(dpq)$_2$acac 的 $^1$H-NMR 光譜圖**



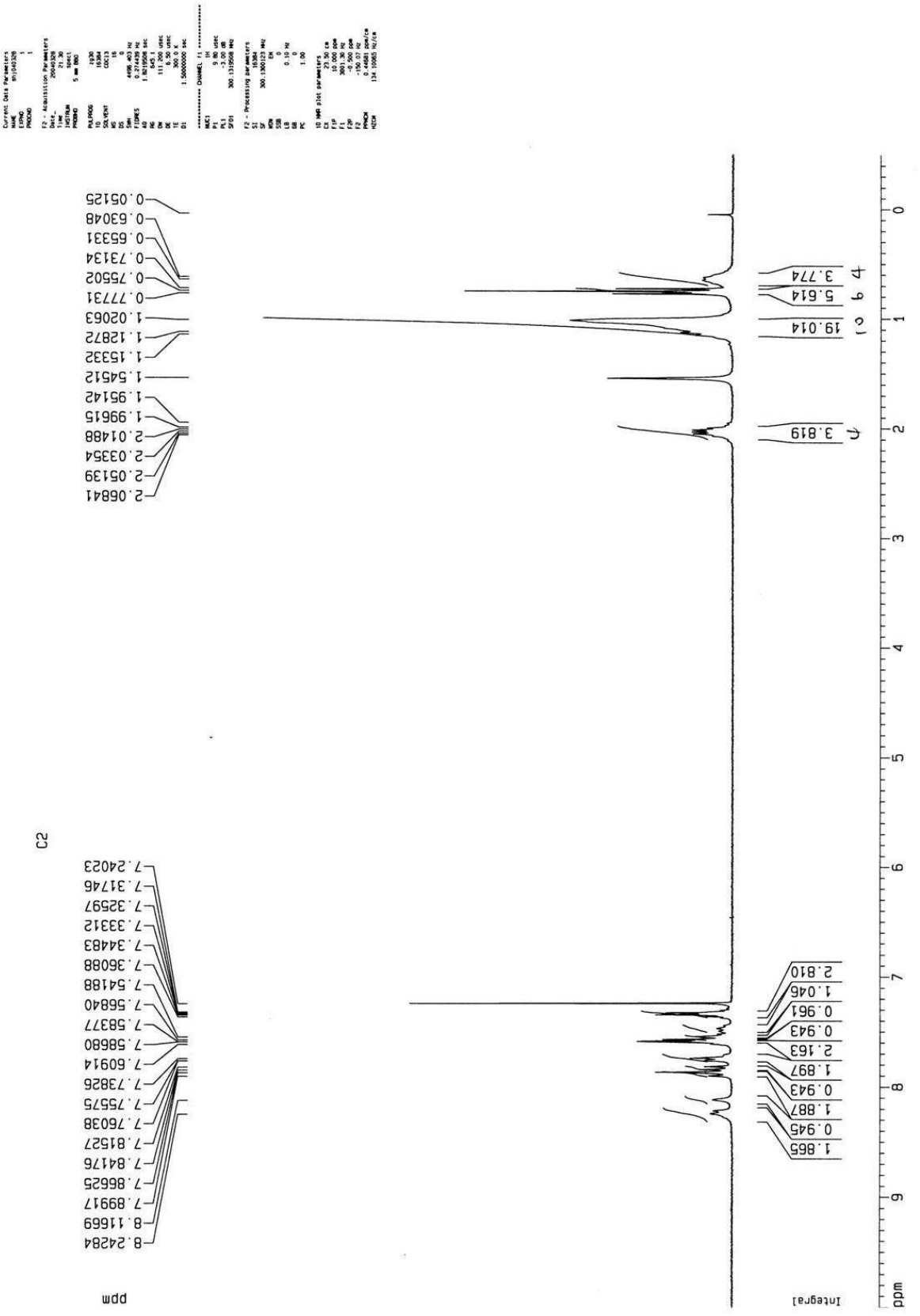

**附圖 37. Ir(dpq)$_2$acac 的 $^{13}$C-NMR 光譜圖**



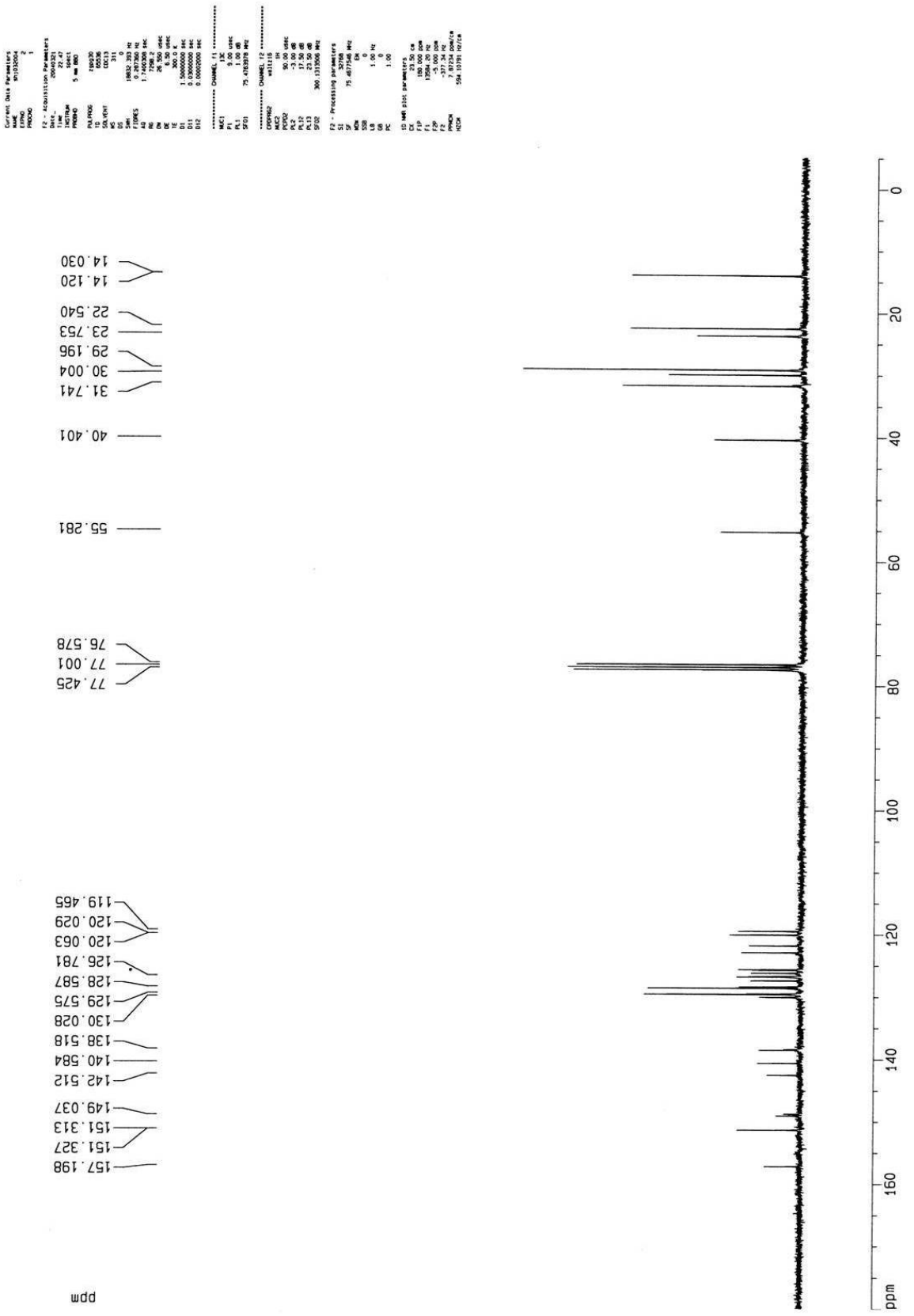

**附圖 38. 2-Acetyl-9,9-dioctylfluorene，化合物 C1 的 $^{1}$H-NMR 光譜圖**



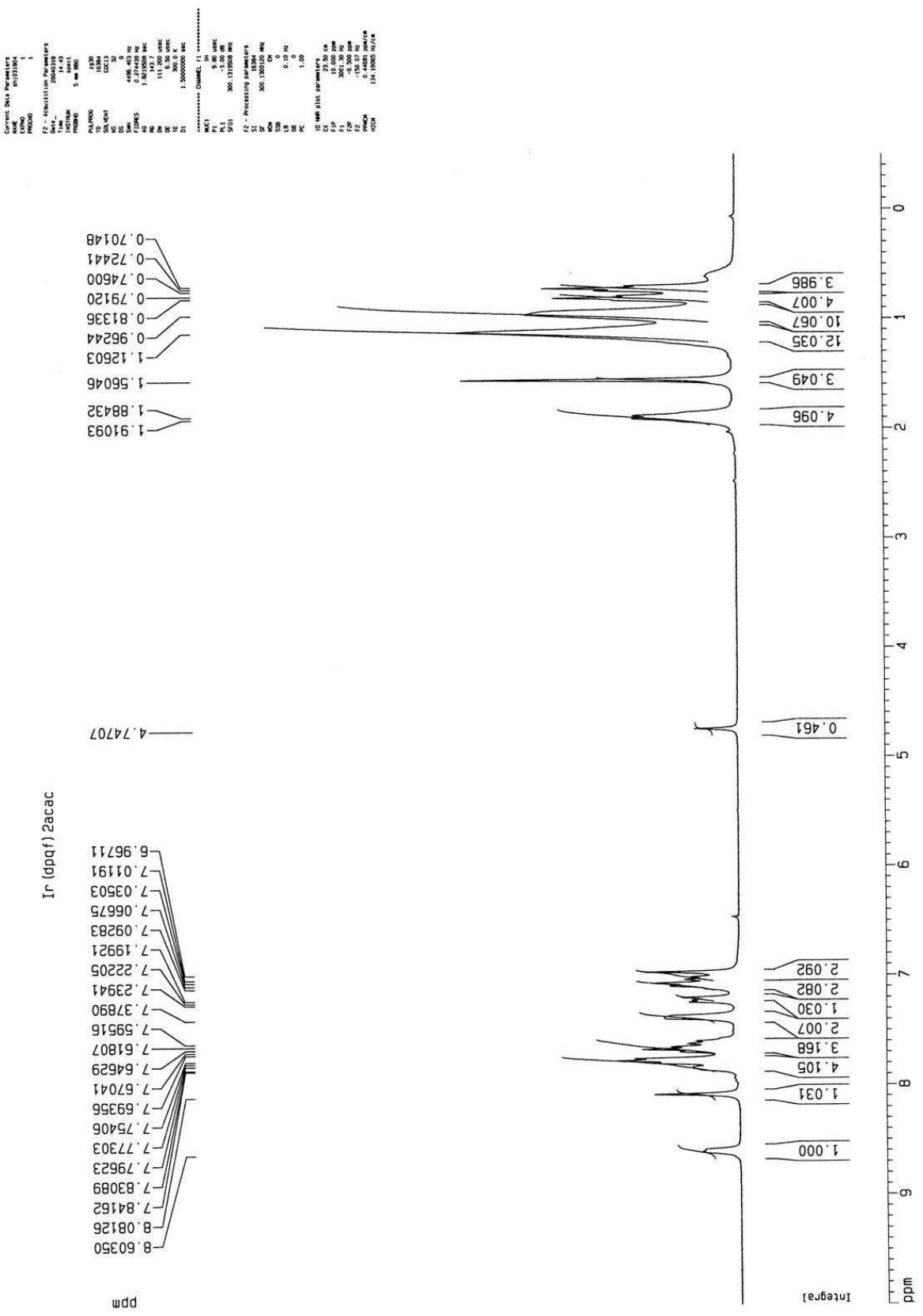

**附圖 39. 2-Acetyl-9,9-dioctylfluorene，化合物 C1 的 $^{13}$C-NMR 光譜圖**



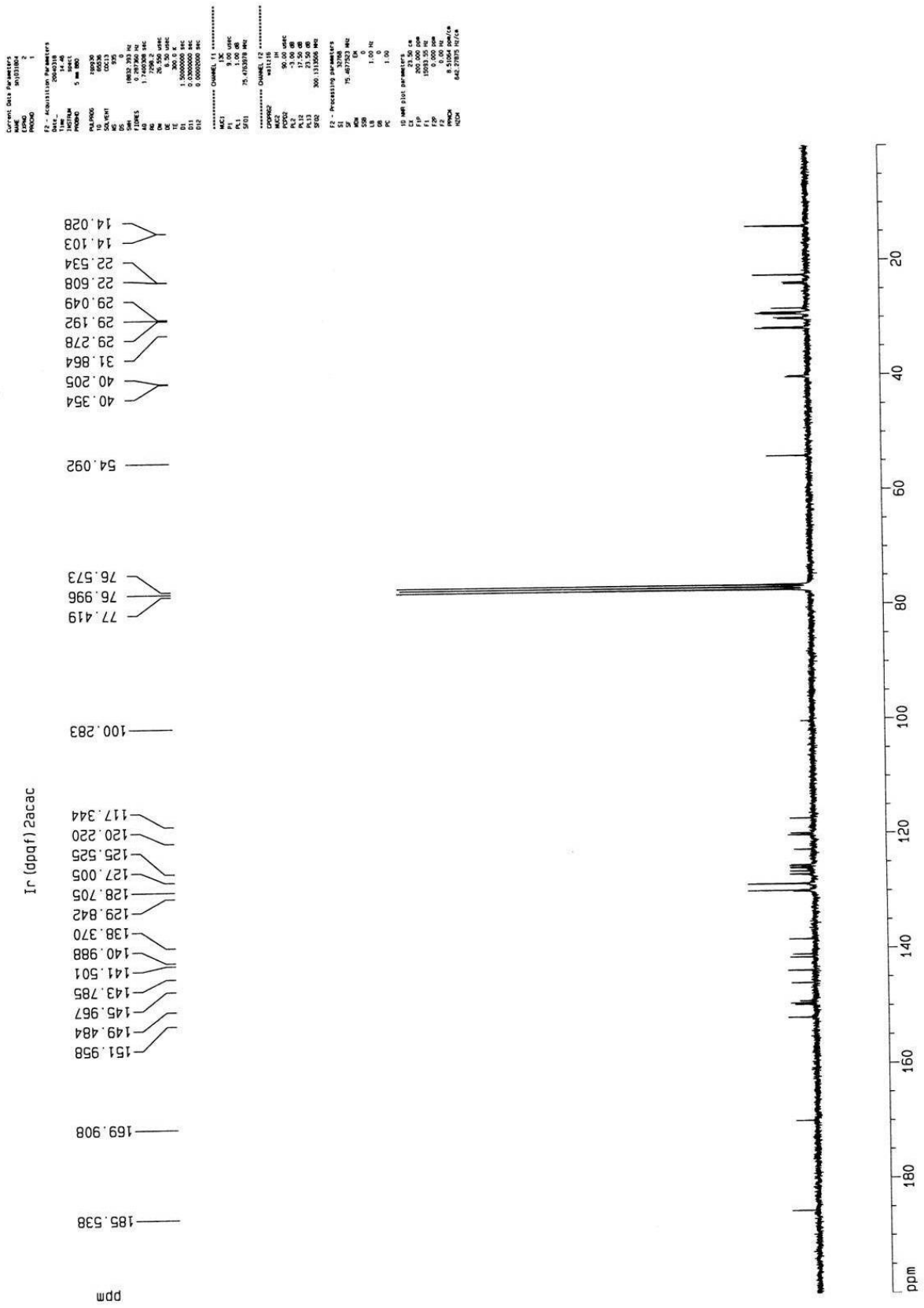

**附圖 40. 2-(9,9-dioctyl-9H-2-fluorenyl)-4-phenylquinoline，化合物 C2 的 $^{1}$H-NMR 光譜圖**




**附圖 41. 2-(9,9-dioctyl-9H-2-fluorenyl)-4-phenylquinoline，化合物 C2 的 $^{13}$C-NMR 光譜圖**




**附圖 42. Ir(pfq)$_2$acac 的 $^1$H-NMR 光譜圖**




**附圖 43. Ir(pfq)$_2$acac 的 $^{13}$C-NMR 光譜圖**

# 附表 一 $Ir(dpq)_2acac$ X-ary 晶格繞射數據

Table 2. Bond lengths [Å] and angles [°] for ic10619.

| | | | |
|---|---|---|---|
| Ir-C(1) | 1.963(4) | Ir-C(22) | 1.973(4) |
| Ir-N(2) | 2.066(3) | Ir-N(1) | 2.072(3) |
| Ir-O(2) | 2.170(3) | Ir-O(1) | 2.176(3) |
| O(1)-C(44) | 1.264(6) | O(2)-C(46) | 1.279(6) |
| N(1)-C(7) | 1.344(5) | N(1)-C(15) | 1.399(5) |
| N(2)-C(28) | 1.355(5) | N(2)-C(36) | 1.386(5) |
| C(1)-C(2) | 1.409(6) | C(1)-C(6) | 1.414(5) |
| C(2)-C(3) | 1.376(6) | C(3)-C(4) | 1.382(7) |
| C(4)-C(5) | 1.374(6) | C(5)-C(6) | 1.396(6) |
| C(6)-C(7) | 1.458(6) | C(7)-C(8) | 1.403(6) |
| C(8)-C(9) | 1.356(6) | C(9)-C(10) | 1.435(6) |
| C(9)-C(16) | 1.495(6) | C(10)-C(11) | 1.411(6) |
| C(10)-C(15) | 1.423(6) | C(11)-C(12) | 1.360(7) |
| C(12)-C(13) | 1.393(7) | C(13)-C(14) | 1.344(7) |
| C(14)-C(15) | 1.406(6) | C(16)-C(21) | 1.376(7) |
| C(16)-C(17) | 1.392(7) | C(17)-C(18) | 1.385(7) |
| C(18)-C(19) | 1.373(8) | C(19)-C(20) | 1.376(8) |
| C(20)-C(21) | 1.388(7) | C(22)-C(23) | 1.406(6) |
| C(22)-C(27) | 1.410(6) | C(23)-C(24) | 1.375(7) |
| C(24)-C(25) | 1.386(7) | C(25)-C(26) | 1.372(6) |
| C(26)-C(27) | 1.397(6) | C(27)-C(28) | 1.453(6) |
| C(28)-C(29) | 1.407(6) | C(29)-C(30) | 1.361(6) |
| C(30)-C(31) | 1.434(6) | C(30)-C(37) | 1.488(6) |
| C(31)-C(32) | 1.402(6) | C(31)-C(36) | 1.421(6) |
| C(32)-C(33) | 1.360(7) | C(33)-C(34) | 1.399(7) |
| C(34)-C(35) | 1.351(6) | C(35)-C(36) | 1.404(6) |
| C(37)-C(38) | 1.383(6) | C(37)-C(42) | 1.395(6) |
| C(38)-C(39) | 1.399(6) | C(39)-C(40) | 1.361(7) |
| C(40)-C(41) | 1.375(8) | C(41)-C(42) | 1.384(6) |
| C(43)-C(44) | 1.520(8) | C(44)-C(45) | 1.388(8) |
| C(45)-C(46) | 1.379(8) | C(46)-C(47) | 1.513(8) |

| | | | |
|---|---|---|---|
| C(1)-Ir-C(22) | 93.29(17) | C(1)-Ir-N(2) | 95.74(15) |
| C(22)-Ir-N(2) | 80.10(15) | C(1)-Ir-N(1) | 79.74(15) |
| C(22)-Ir-N(1) | 96.44(15) | N(2)-Ir-N(1) | 174.19(13) |
| C(1)-Ir-O(2) | 175.81(14) | C(22)-Ir-O(2) | 90.33(15) |
| N(2)-Ir-O(2) | 82.79(13) | N(1)-Ir-O(2) | 101.97(13) |
| C(1)-Ir-O(1) | 91.14(15) | C(22)-Ir-O(1) | 175.37(14) |
| N(2)-Ir-O(1) | 100.82(13) | N(1)-Ir-O(1) | 83.01(13) |
| O(2)-Ir-O(1) | 85.29(12) | C(44)-O(1)-Ir | 126.6(3) |
| C(46)-O(2)-Ir | 126.8(3) | C(7)-N(1)-C(15) | 118.2(3) |
| C(7)-N(1)-Ir | 113.9(3) | C(15)-N(1)-Ir | 127.9(3) |
| C(28)-N(2)-C(36) | 118.5(3) | C(28)-N(2)-Ir | 113.3(3) |
| C(36)-N(2)-Ir | 128.2(3) | C(2)-C(1)-C(6) | 116.2(4) |
| C(2)-C(1)-Ir | 128.1(3) | C(6)-C(1)-Ir | 115.5(3) |
| C(3)-C(2)-C(1) | 121.5(4) | C(2)-C(3)-C(4) | 120.9(4) |
| C(5)-C(4)-C(3) | 119.9(4) | C(4)-C(5)-C(6) | 119.8(4) |
| C(5)-C(6)-C(1) | 121.7(4) | C(5)-C(6)-C(7) | 124.5(4) |
| C(1)-C(6)-C(7) | 113.6(4) | N(1)-C(7)-C(8) | 121.2(4) |
| N(1)-C(7)-C(6) | 114.7(4) | C(8)-C(7)-C(6) | 124.0(4) |
| C(9)-C(8)-C(7) | 122.8(4) | C(8)-C(9)-C(10) | 117.6(4) |
| C(8)-C(9)-C(16) | 120.3(4) | C(10)-C(9)-C(16) | 122.1(4) |
| C(11)-C(10)-C(15) | 118.5(4) | C(11)-C(10)-C(9) | 123.3(4) |
| C(15)-C(10)-C(9) | 118.2(4) | C(12)-C(11)-C(10) | 121.1(5) |
| C(11)-C(12)-C(13) | 119.3(5) | C(14)-C(13)-C(12) | 121.9(5) |

| | | | |
|---|---|---|---|
| C(13)-C(14)-C(15) | 120.4(5) | N(1)-C(15)-C(14) | 119.8(4) |
| N(1)-C(15)-C(10) | 121.6(4) | C(14)-C(15)-C(10) | 118.6(4) |
| C(21)-C(16)-C(17) | 119.0(4) | C(21)-C(16)-C(9) | 121.8(4) |
| C(17)-C(16)-C(9) | 119.1(4) | C(18)-C(17)-C(16) | 120.2(5) |
| C(19)-C(18)-C(17) | 120.1(5) | C(18)-C(19)-C(20) | 120.2(5) |
| C(19)-C(20)-C(21) | 119.7(5) | C(16)-C(21)-C(20) | 120.8(5) |
| C(23)-C(22)-C(27) | 116.9(4) | C(23)-C(22)-Ir | 128.0(3) |
| C(27)-C(22)-Ir | 115.0(3) | C(24)-C(23)-C(22) | 121.1(4) |
| C(23)-C(24)-C(25) | 120.9(4) | C(26)-C(25)-C(24) | 119.8(4) |
| C(25)-C(26)-C(27) | 119.8(4) | C(26)-C(27)-C(22) | 121.4(4) |
| C(26)-C(27)-C(28) | 124.4(4) | C(22)-C(27)-C(28) | 114.0(4) |
| N(2)-C(28)-C(29) | 120.7(4) | N(2)-C(28)-C(27) | 114.9(4) |
| C(29)-C(28)-C(27) | 124.2(4) | C(30)-C(29)-C(28) | 122.5(4) |
| C(29)-C(30)-C(31) | 117.6(4) | C(29)-C(30)-C(37) | 120.3(4) |
| C(31)-C(30)-C(37) | 122.1(4) | C(32)-C(31)-C(36) | 118.5(4) |
| C(32)-C(31)-C(30) | 123.1(4) | C(36)-C(31)-C(30) | 118.4(4) |
| C(33)-C(32)-C(31) | 121.5(4) | C(32)-C(33)-C(34) | 119.5(4) |
| C(35)-C(34)-C(33) | 121.0(5) | C(34)-C(35)-C(36) | 120.9(4) |
| N(2)-C(36)-C(35) | 119.7(4) | N(2)-C(36)-C(31) | 121.6(4) |
| C(35)-C(36)-C(31) | 118.7(4) | C(38)-C(37)-C(42) | 118.7(4) |
| C(38)-C(37)-C(30) | 119.5(4) | C(42)-C(37)-C(30) | 121.8(4) |
| C(37)-C(38)-C(39) | 120.5(5) | C(40)-C(39)-C(38) | 119.9(5) |
| C(39)-C(40)-C(41) | 120.3(5) | C(40)-C(41)-C(42) | 120.5(5) |
| C(41)-C(42)-C(37) | 120.1(5) | O(1)-C(44)-C(45) | 126.8(5) |
| O(1)-C(44)-C(43) | 115.0(5) | C(45)-C(44)-C(43) | 118.2(5) |
| C(46)-C(45)-C(44) | 127.6(5) | O(2)-C(46)-C(45) | 126.4(5) |
| O(2)-C(46)-C(47) | 114.4(5) | C(45)-C(46)-C(47) | 119.1(5) |

Symmetry transformations used to generate equivalent atoms: