SUPPLEMENTARY MATERIAL

New Deoxyisoaustamide Derivatives from the Coral-Derived Fungus *Penicillium dimorphosporum* KMM 4689

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Abstract: Seven new deoxyisoaustamide derivatives (**1–7**) together with known compounds (**8–10**) were isolated from the coral-derived fungus *Penicillium dimorphosporum* KMM 4689. Their structures were established using spectroscopic methods, X-ray diffraction analysis and by comparison with related known compounds. The absolute configurations of some alkaloids were determined based on CD and NOESY data as well as biogenetic considerations. The cytotoxic and neuroprotective activities of some of the isolated compounds were examined and structure-activity relationships were discussed.

Keywords: *Penicillium dimorphosporum*, secondary metabolites, prenylated indole diketopiperazines, deoxyisoaustamide, neuroprotective activity; paraquat.

Content

Experimental Section

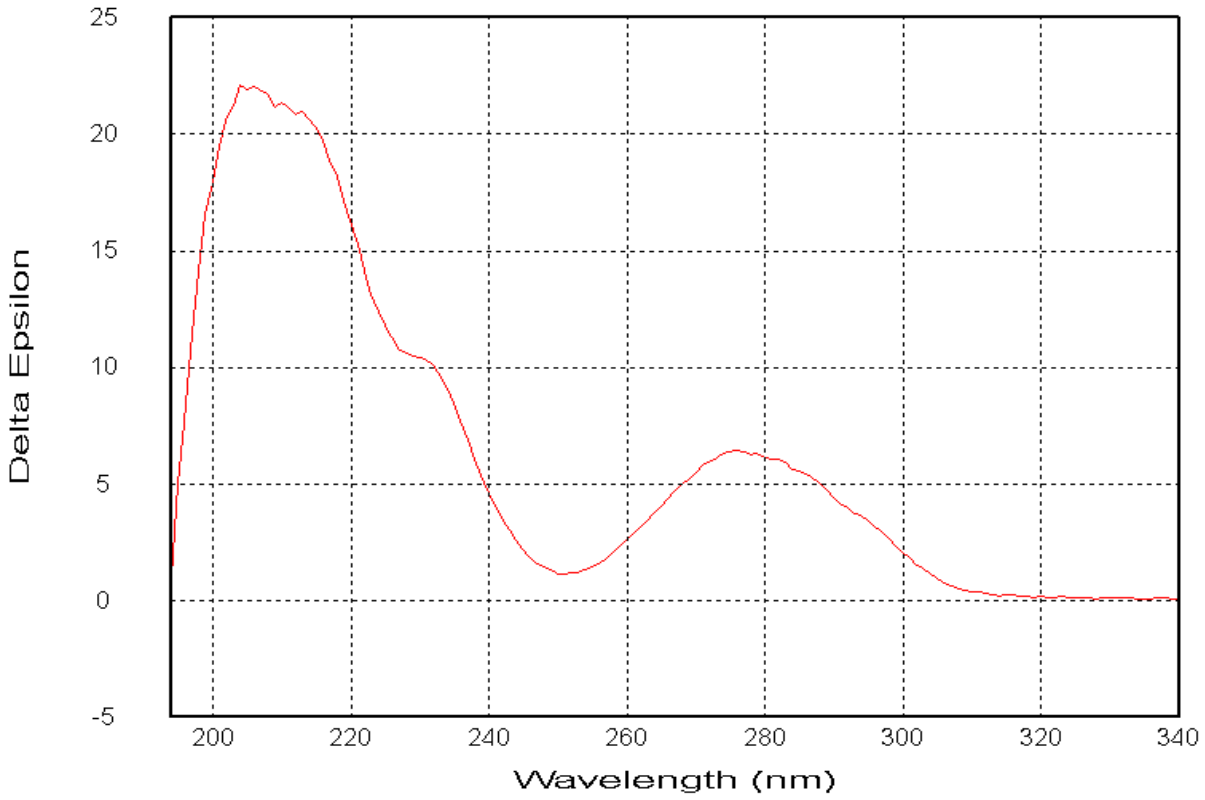


Figure S1. CD spectrum of **1**

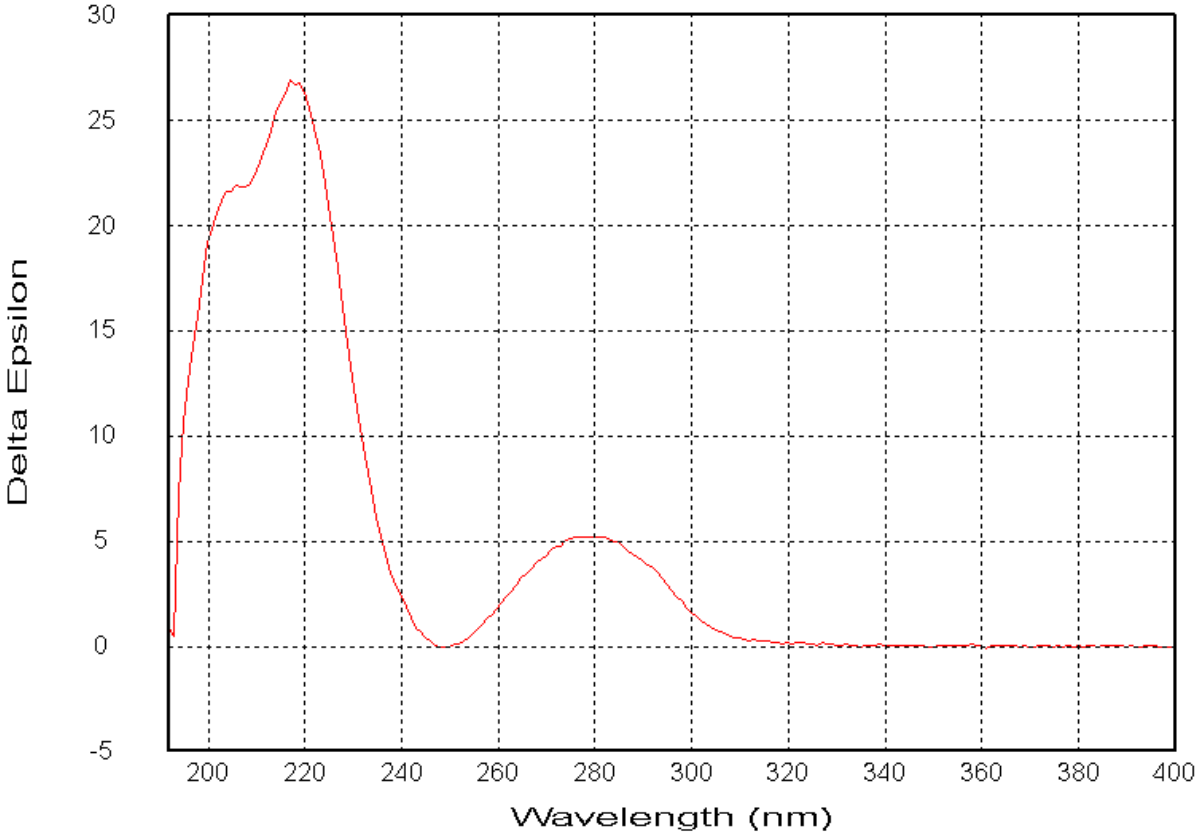


Figure S2. CD spectrum of **2**

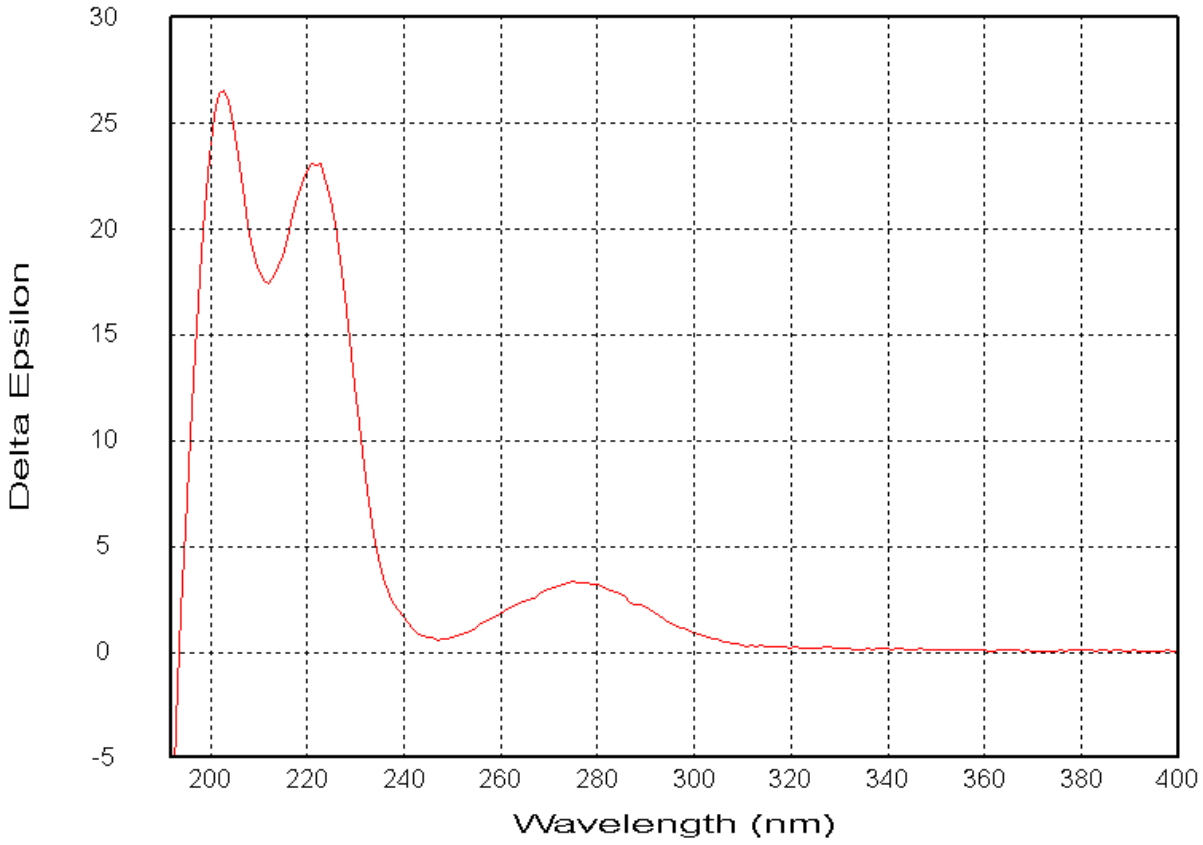


Figure S3.

CD spectrum of **3**

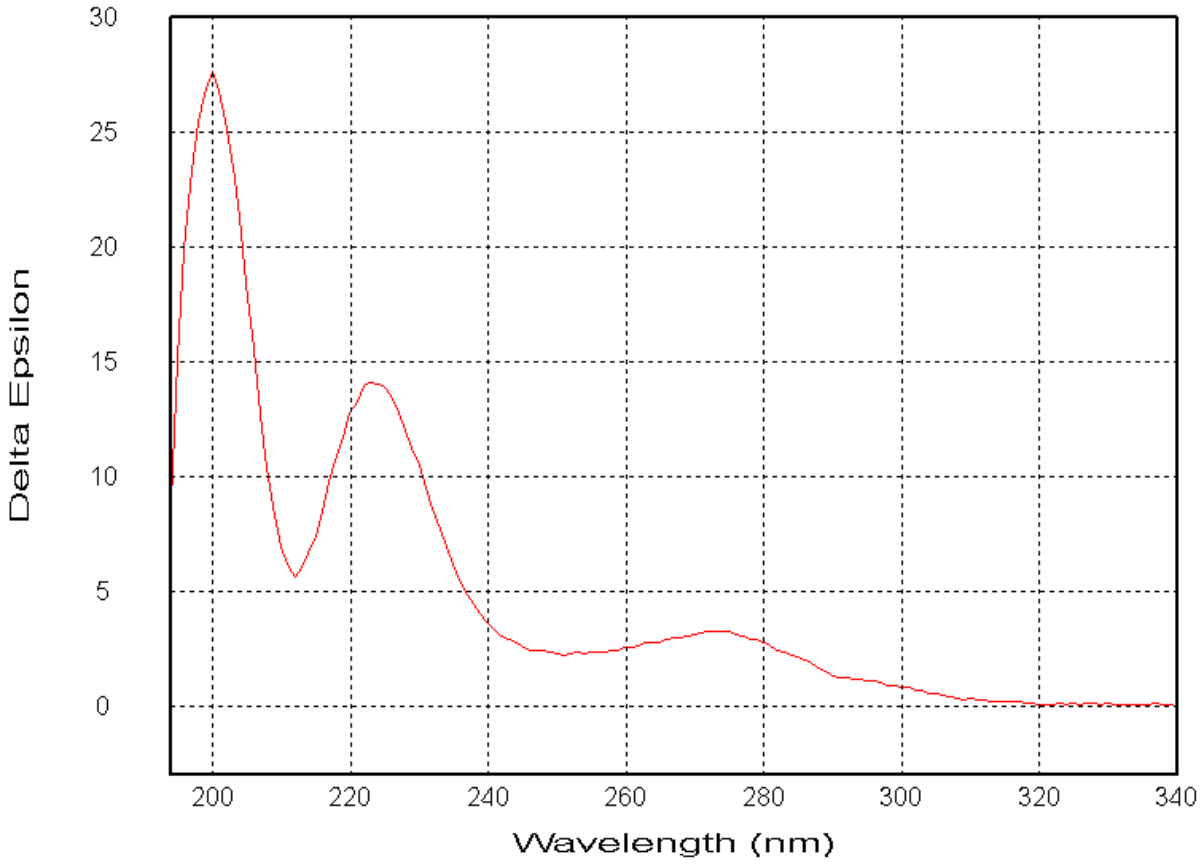


Figure S4. CD spectrum of **4**

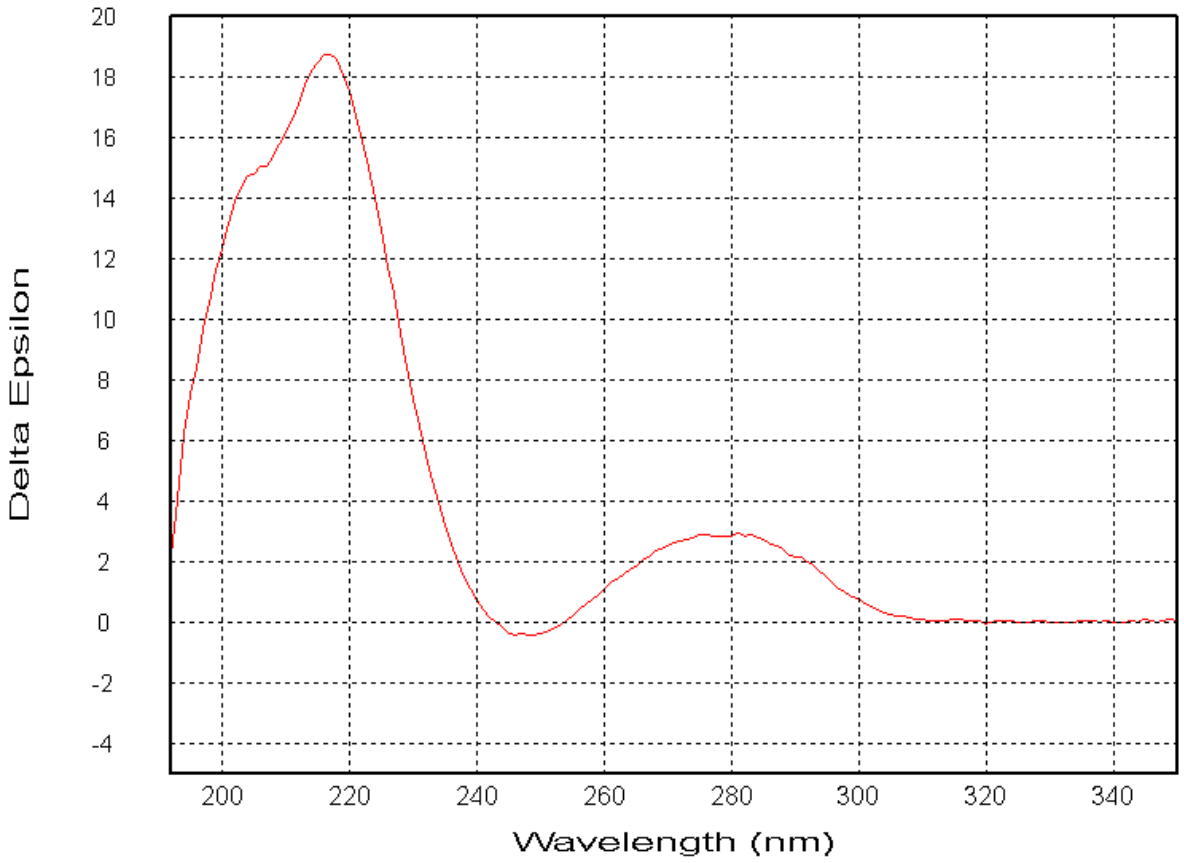


Figure S5. CD spectrum of **5**

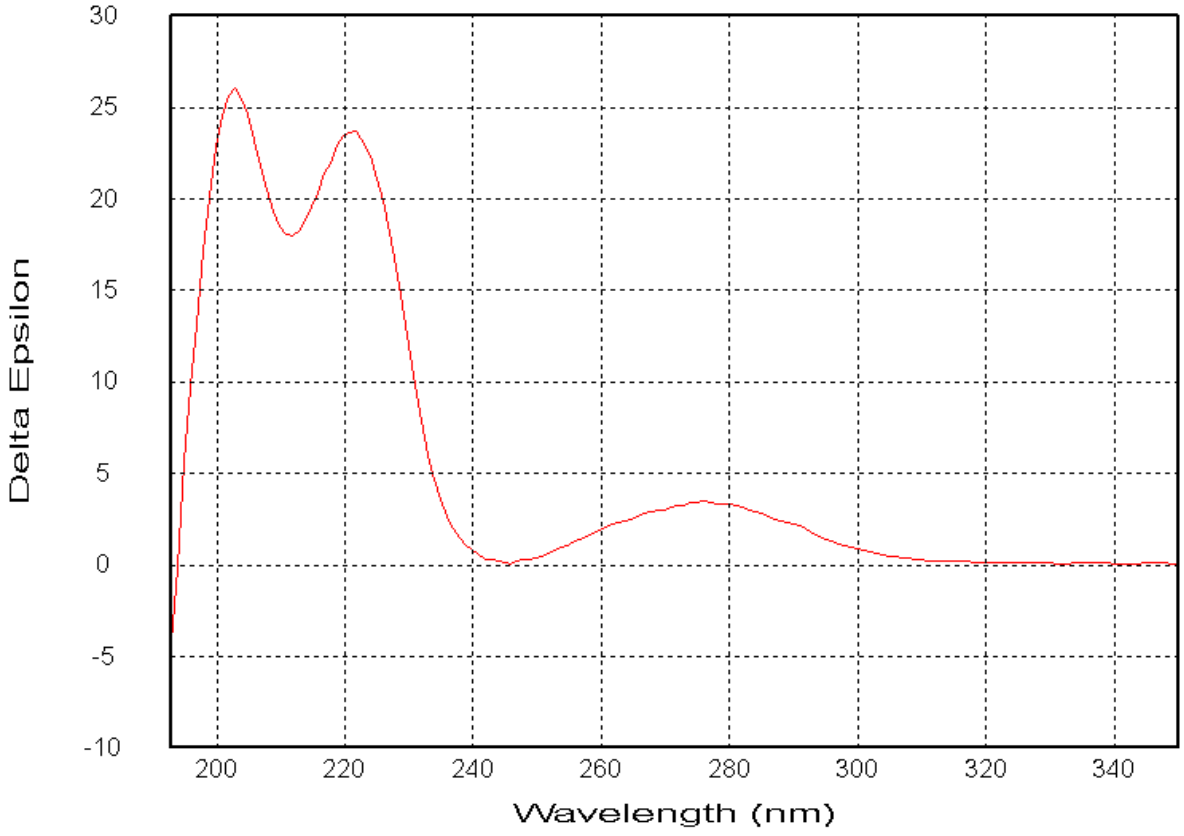


Figure S6. CD spectrum of **6**

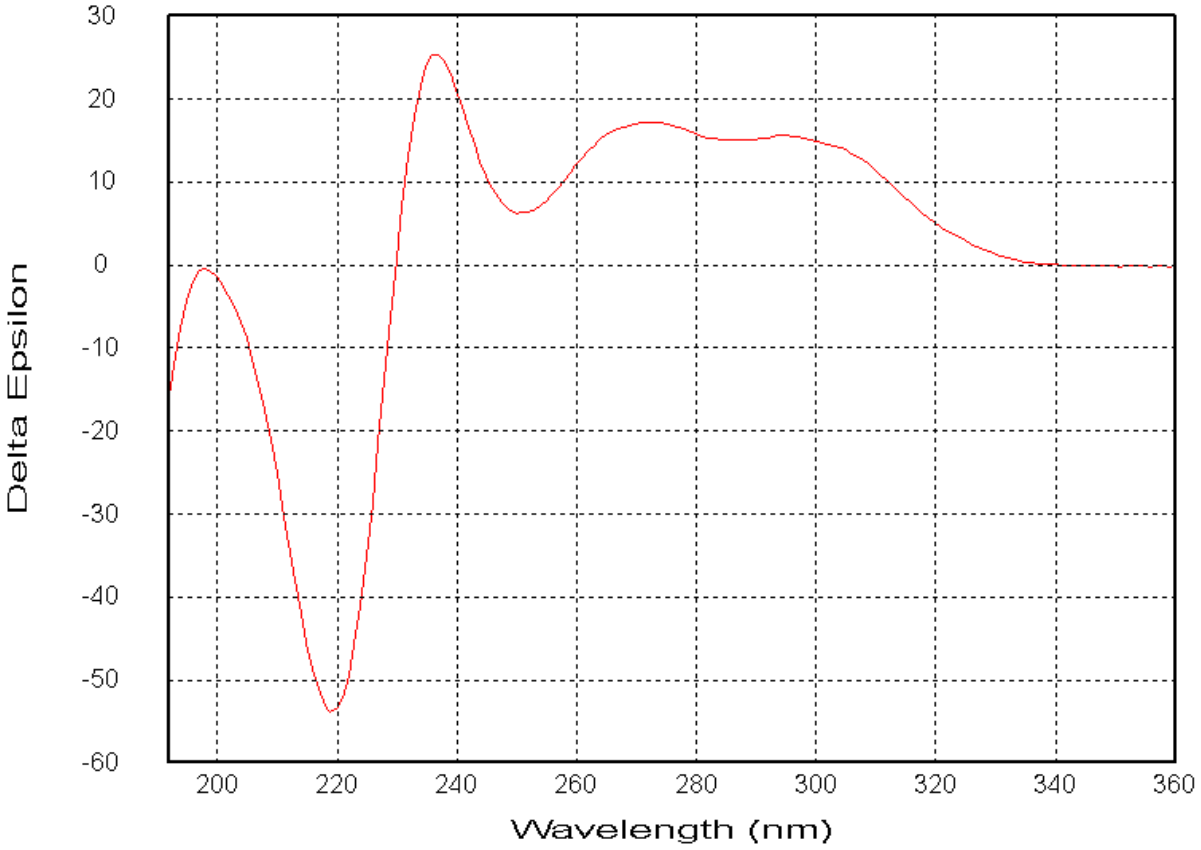


Figure S7. CD spectrum of **7**

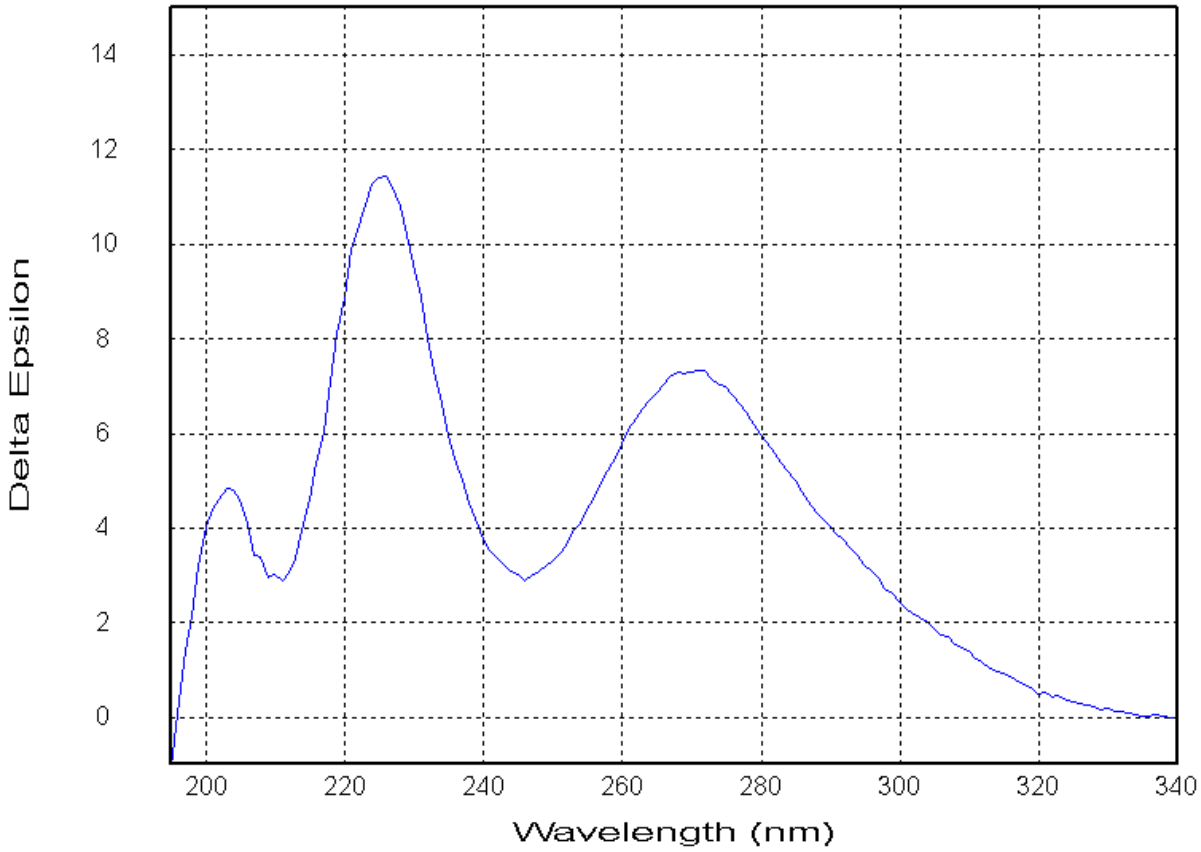


Figure S8.

CD spectrum of **8**

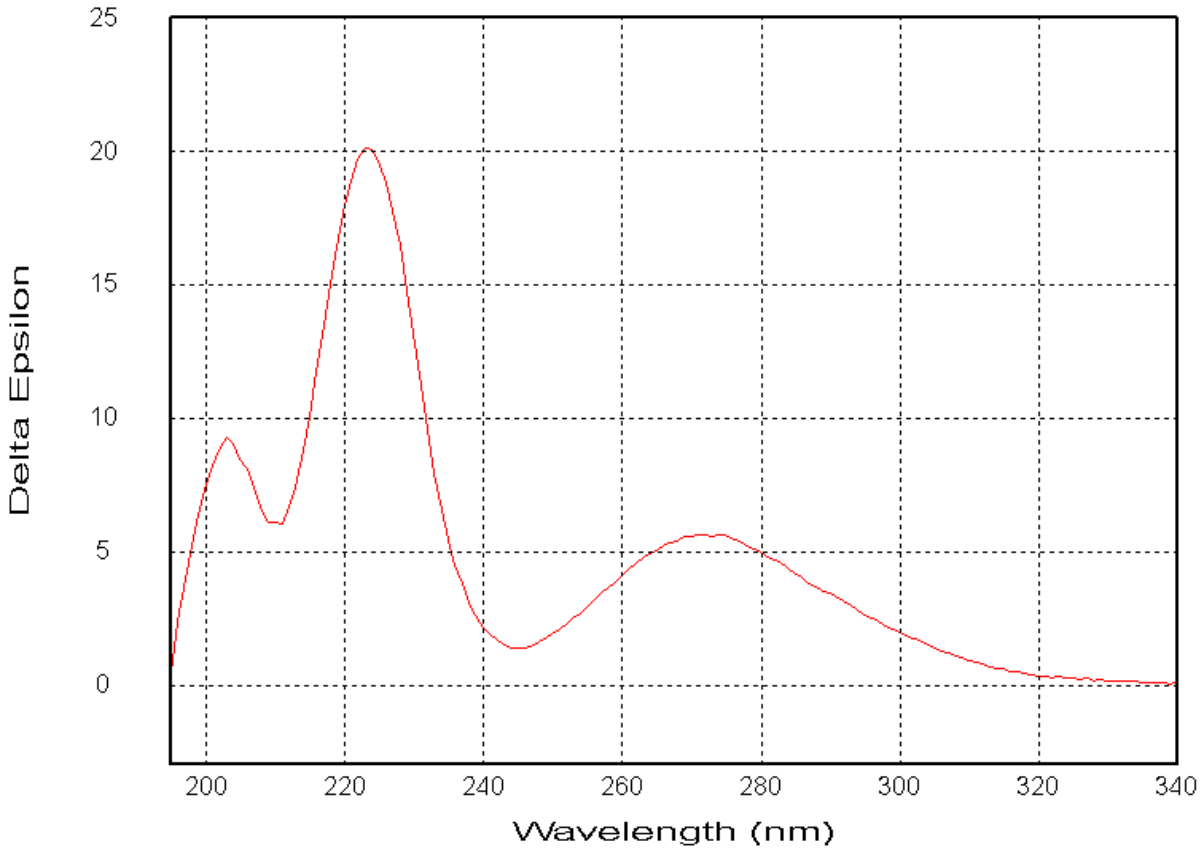


Figure S9. CD spectrum of **9**

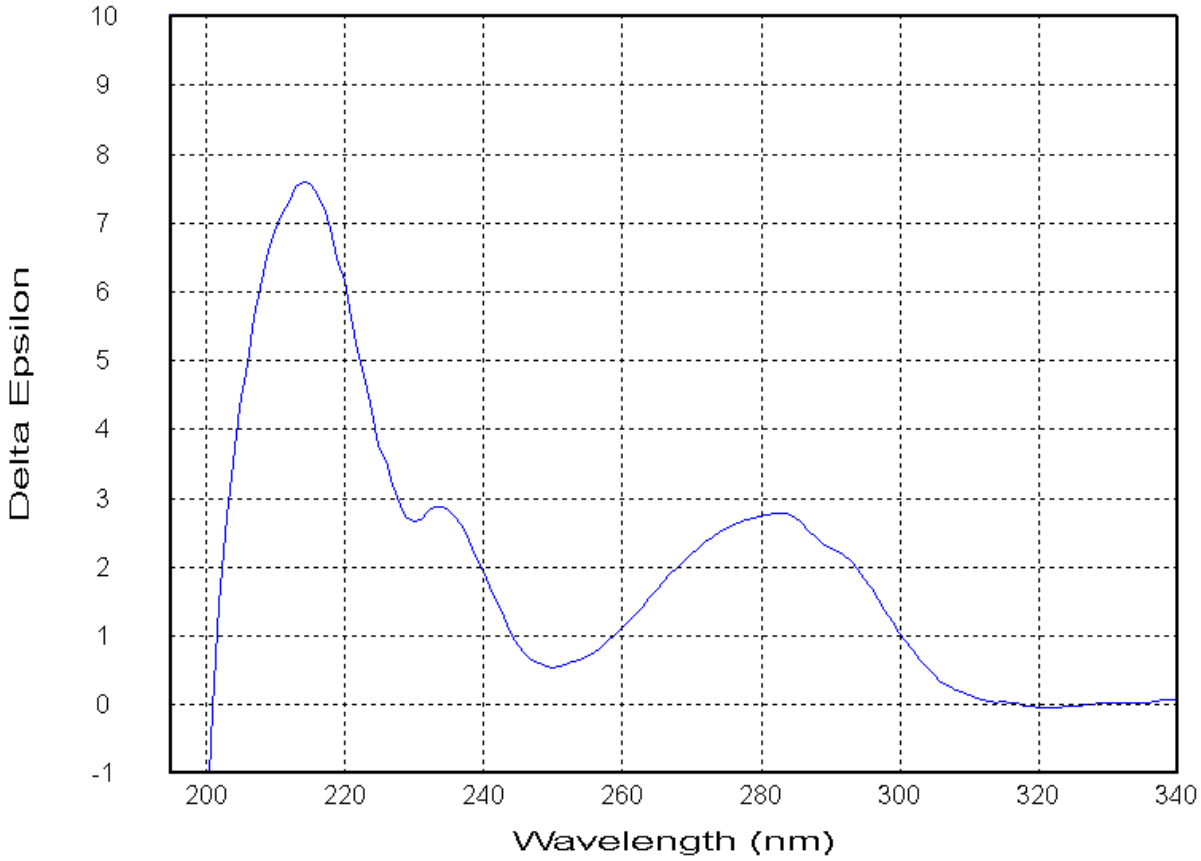


Figure S10. CD spectrum of **10**

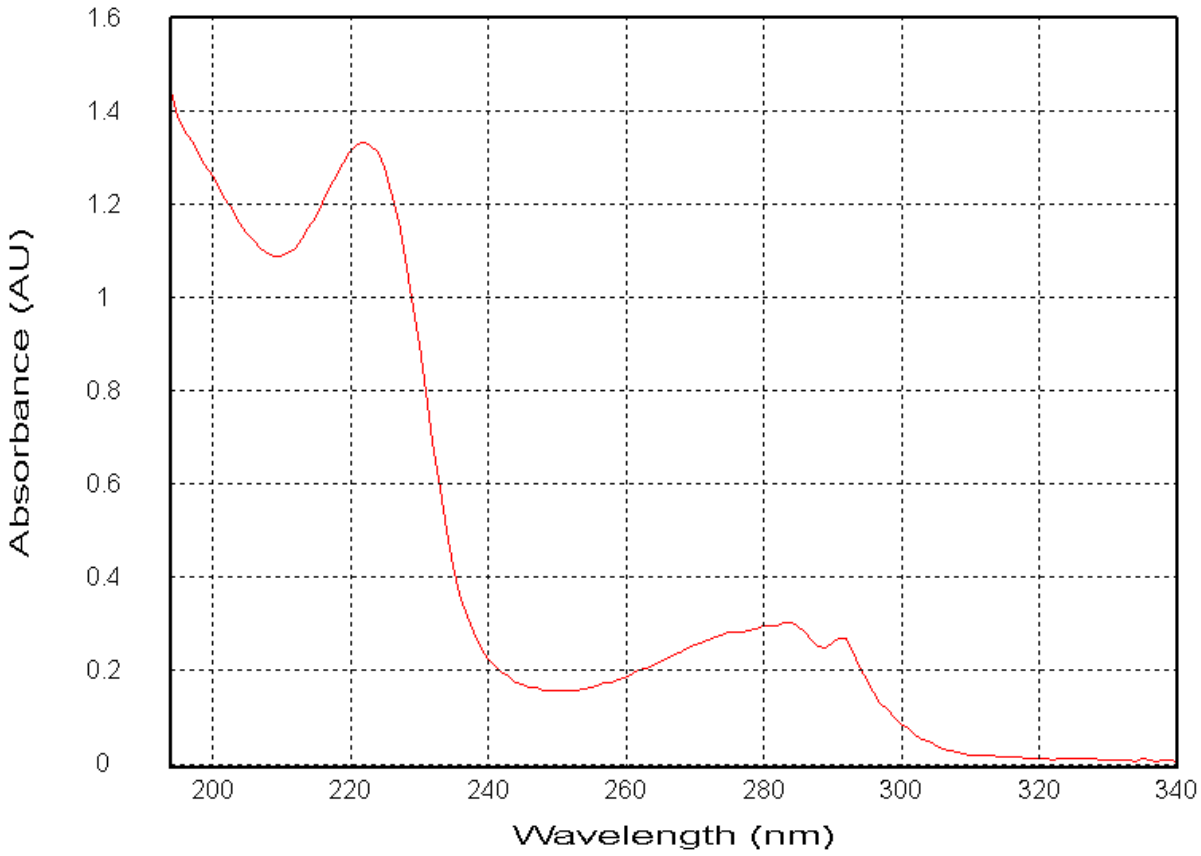


Figure S11. UV spectrum of **1**

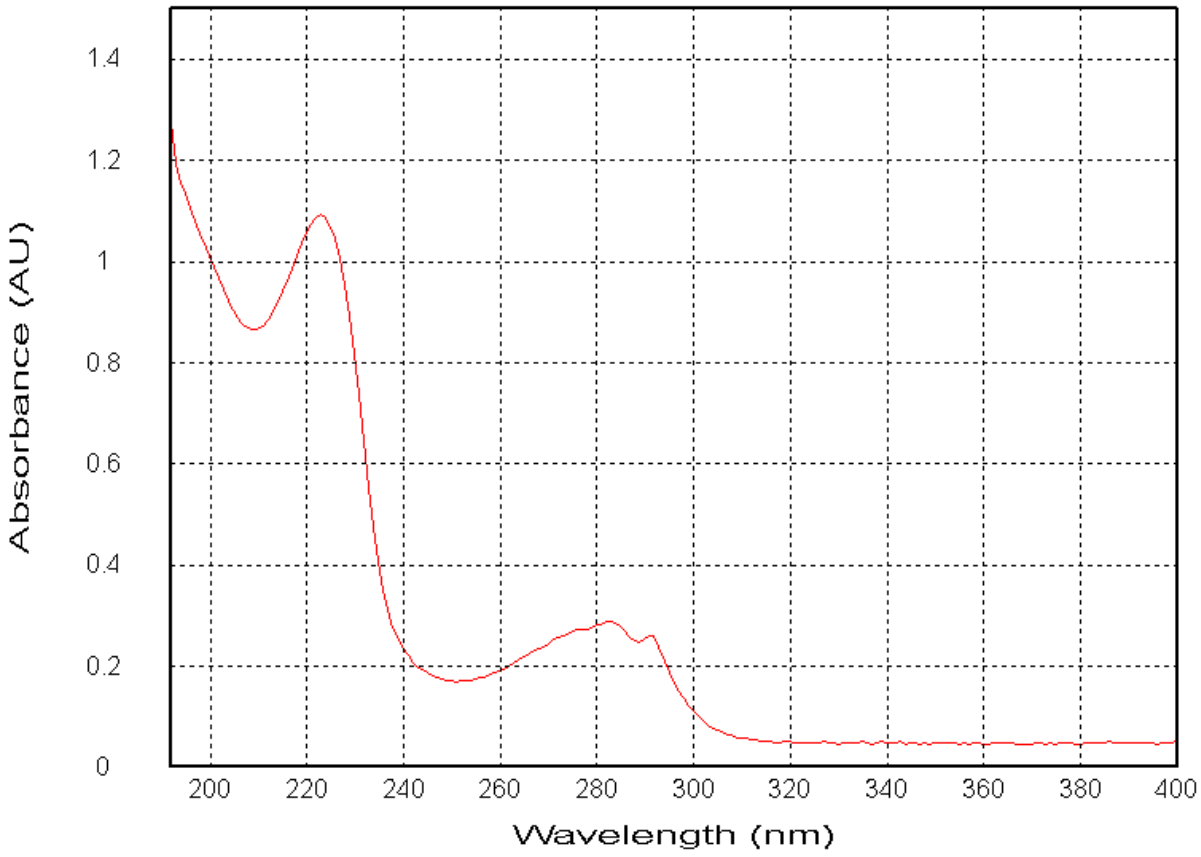


Figure S12. UV spectrum of **2**

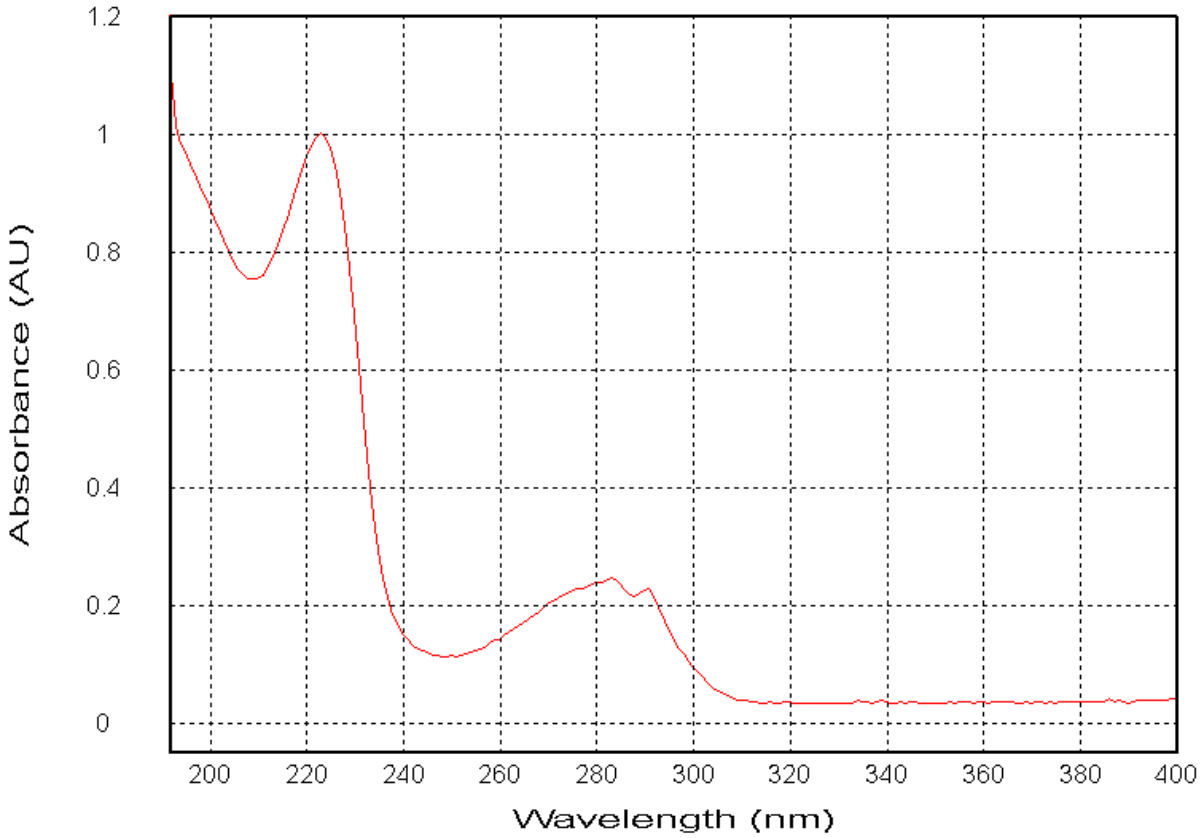


Figure S13. UV spectrum of **3**

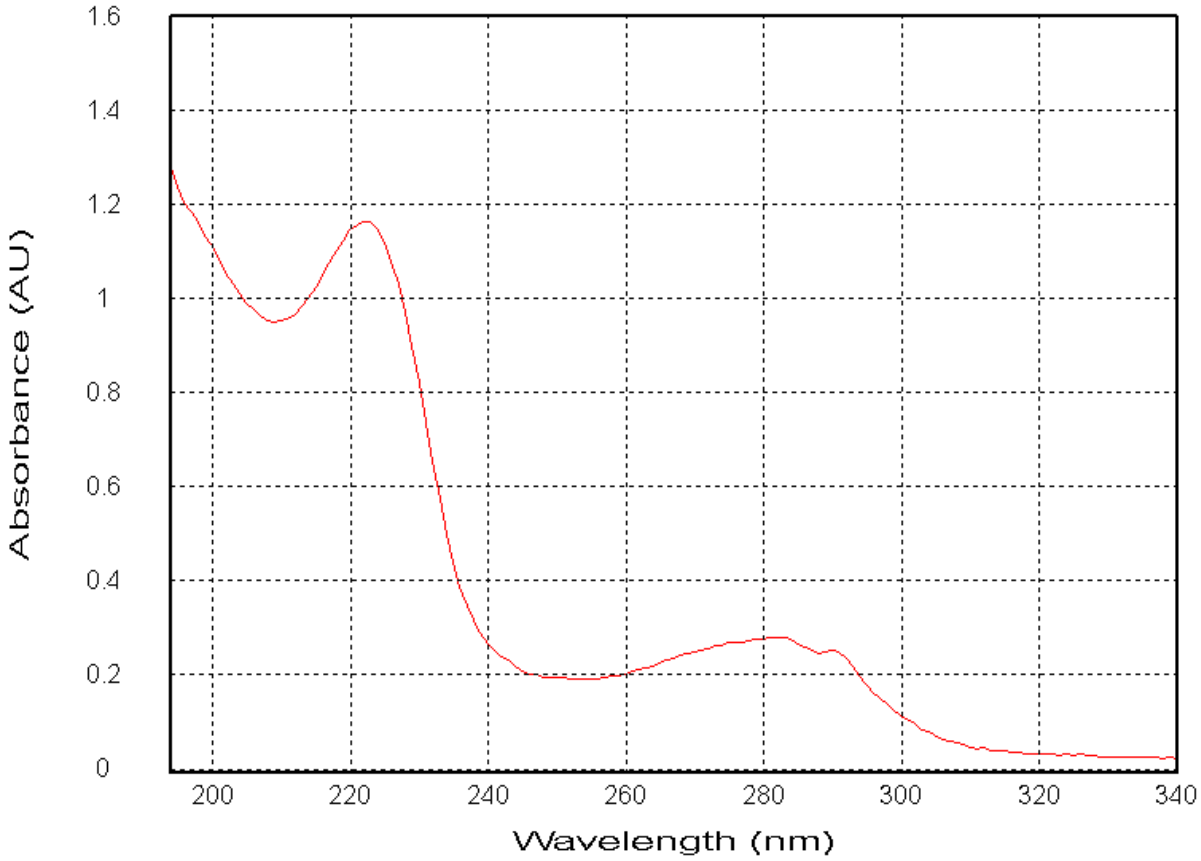


Figure S14. UV spectrum of **4**

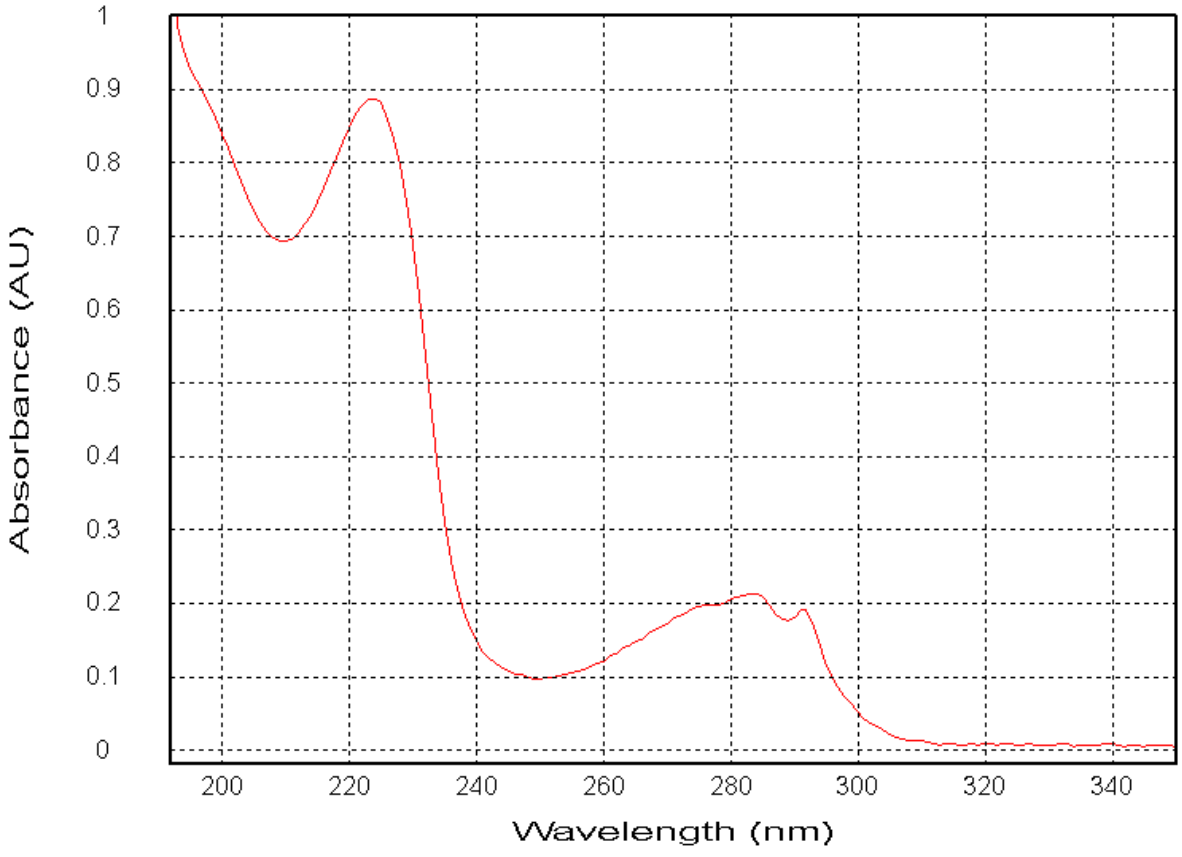


Figure S15. UV spectrum of **5**

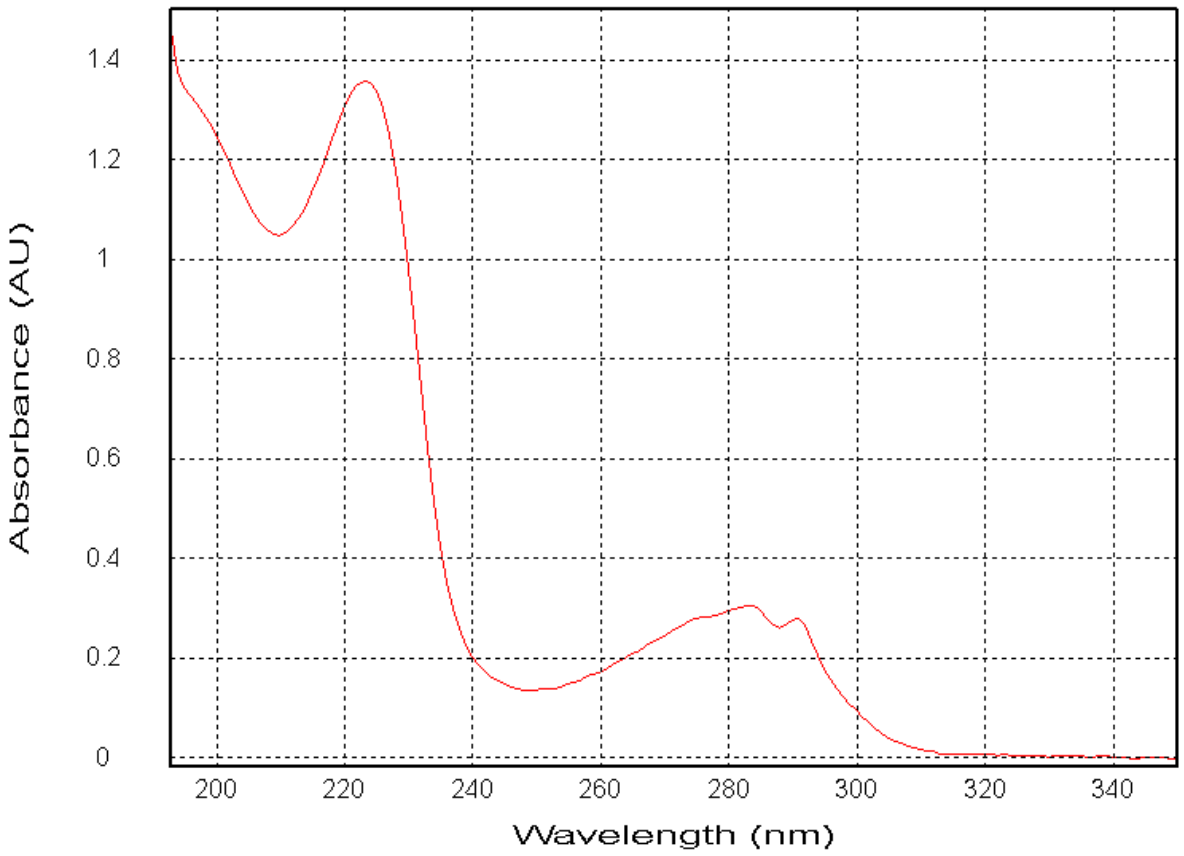


Figure S16. UV spectrum of **6**

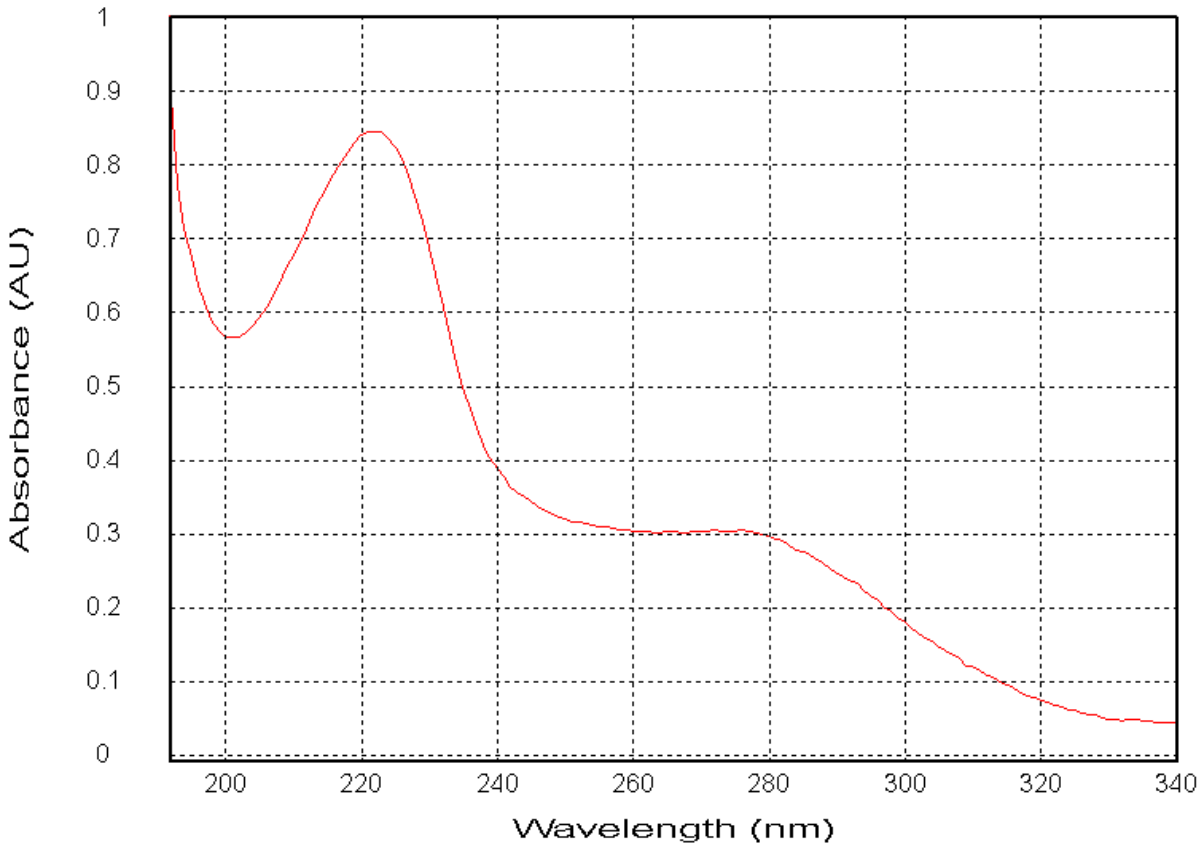


Figure S17. UV spectrum of **7**

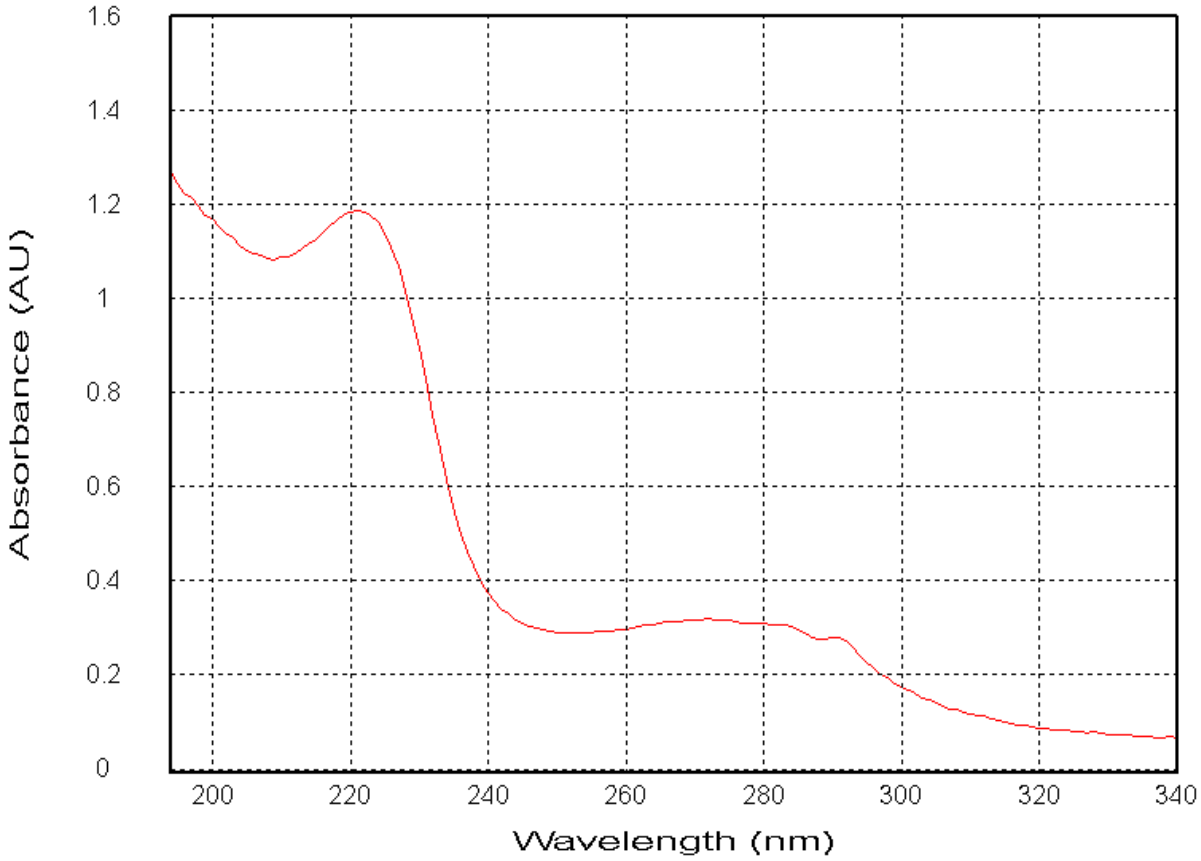


Figure S18. UV spectrum of **8**

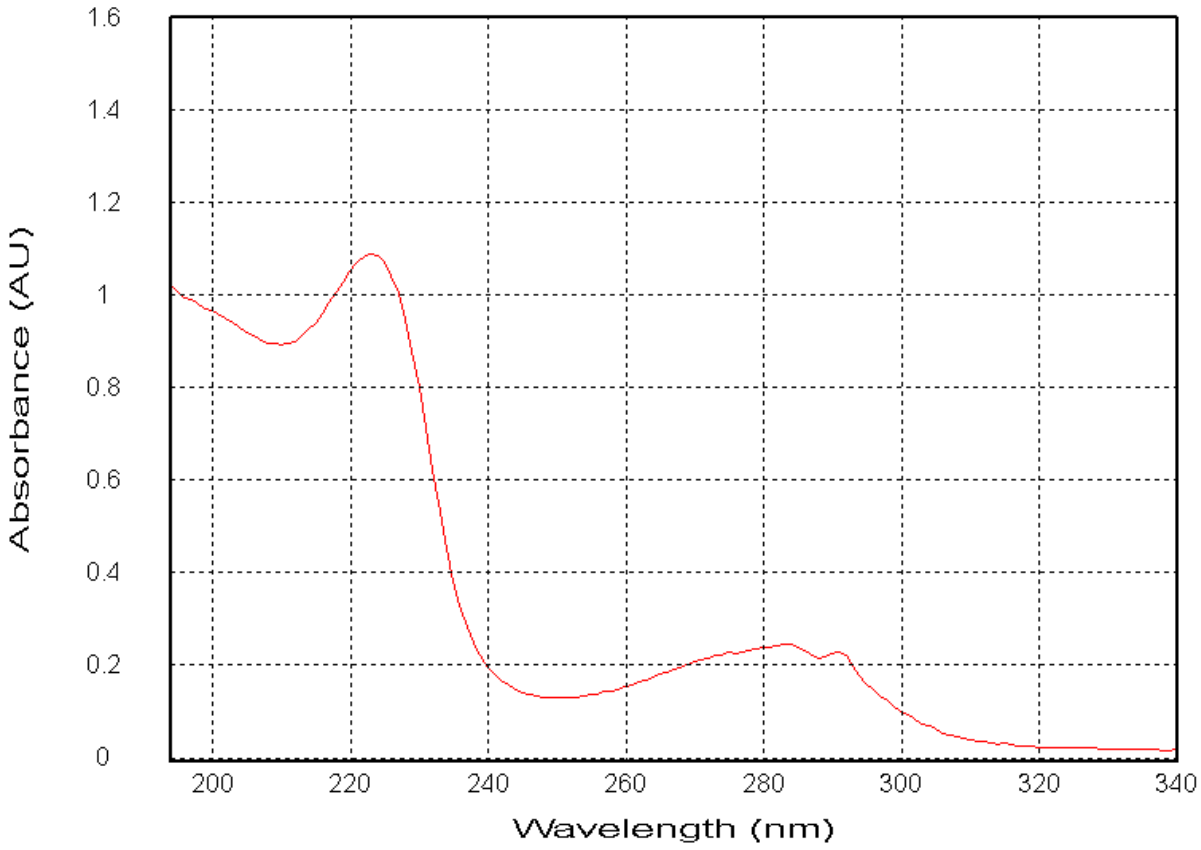


Figure S19. UV spectrum of **9**

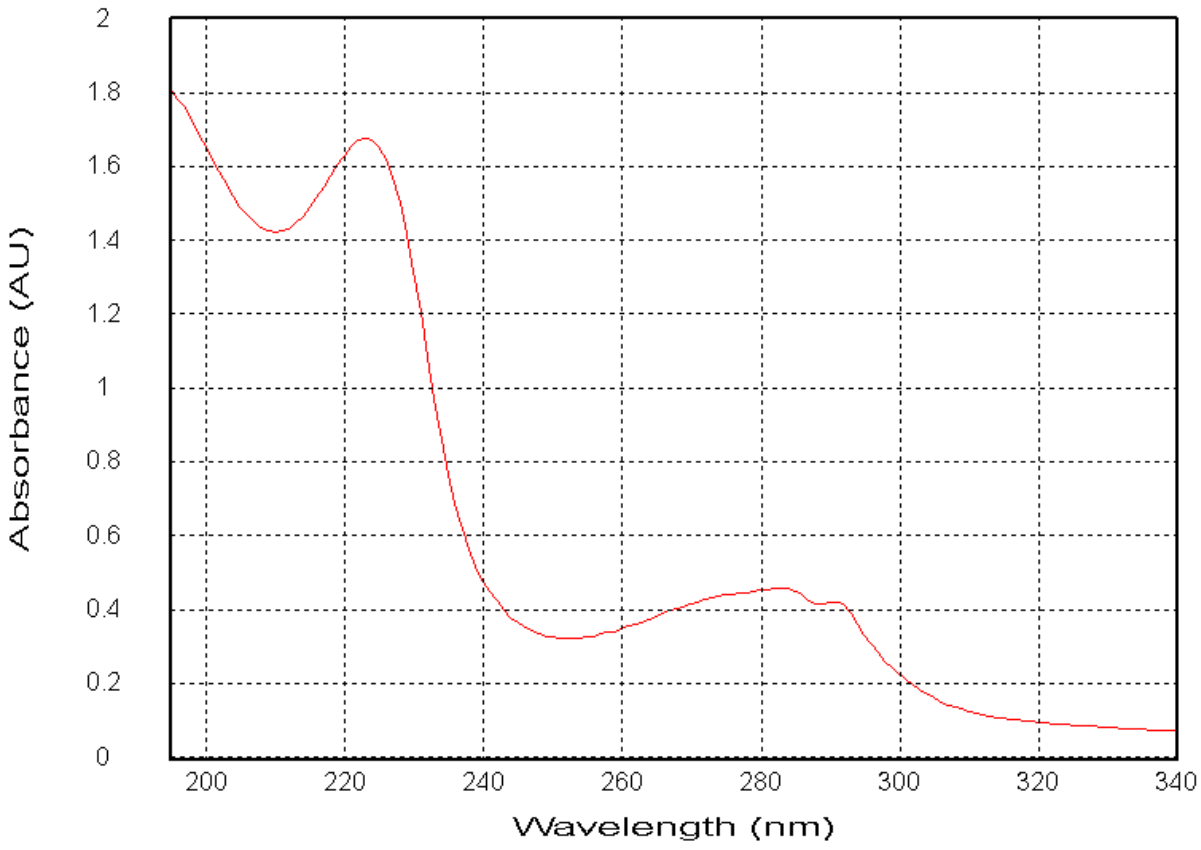


Figure S20. UV spectrum of **10**

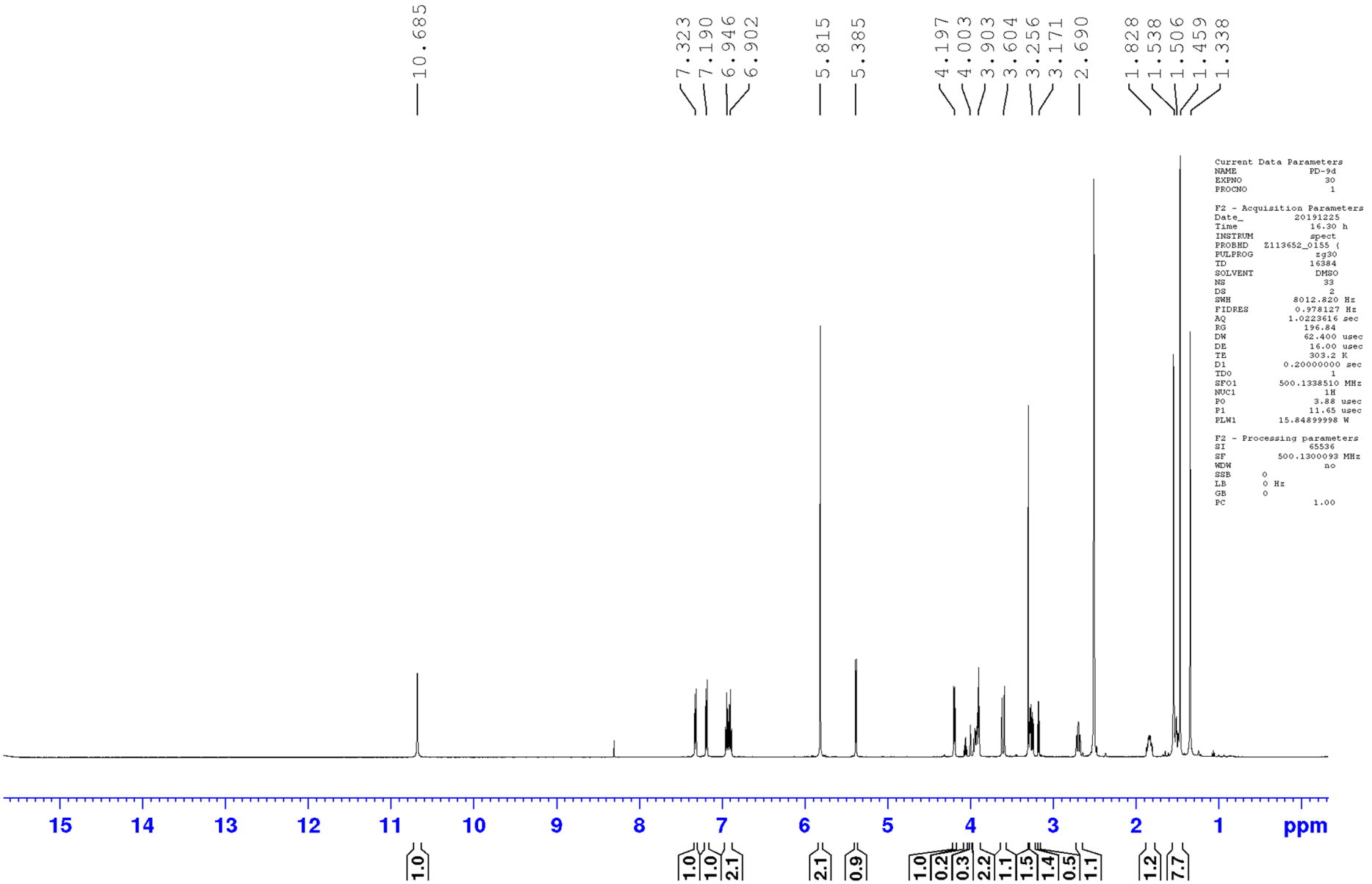


Figure S21. [1]H NMR spectrum (500 MHz, DMSO-d6) of **1**

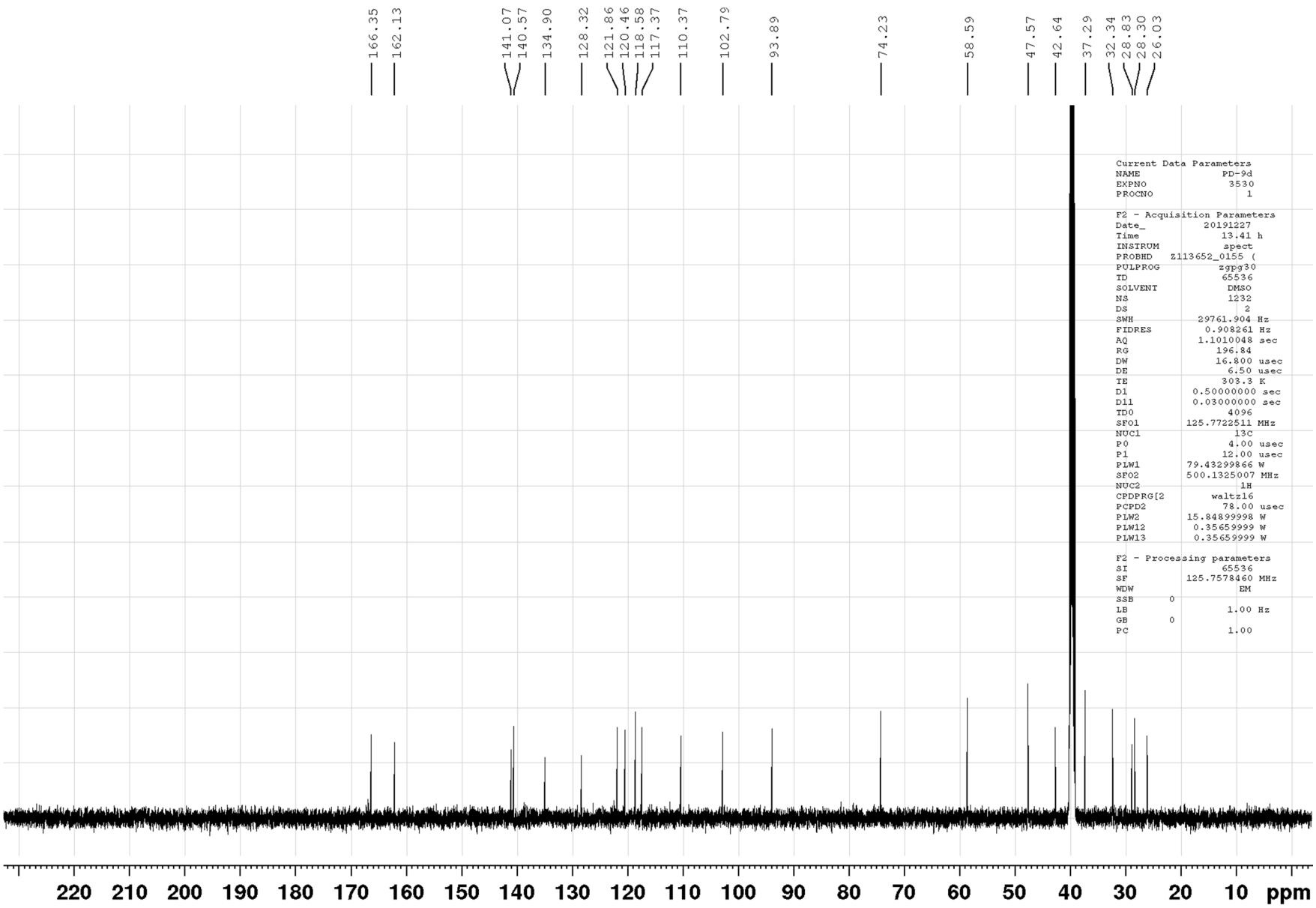


Figure S22. ^{13}C NMR spectrum (125 MHz, DMSO-d6) of **1**

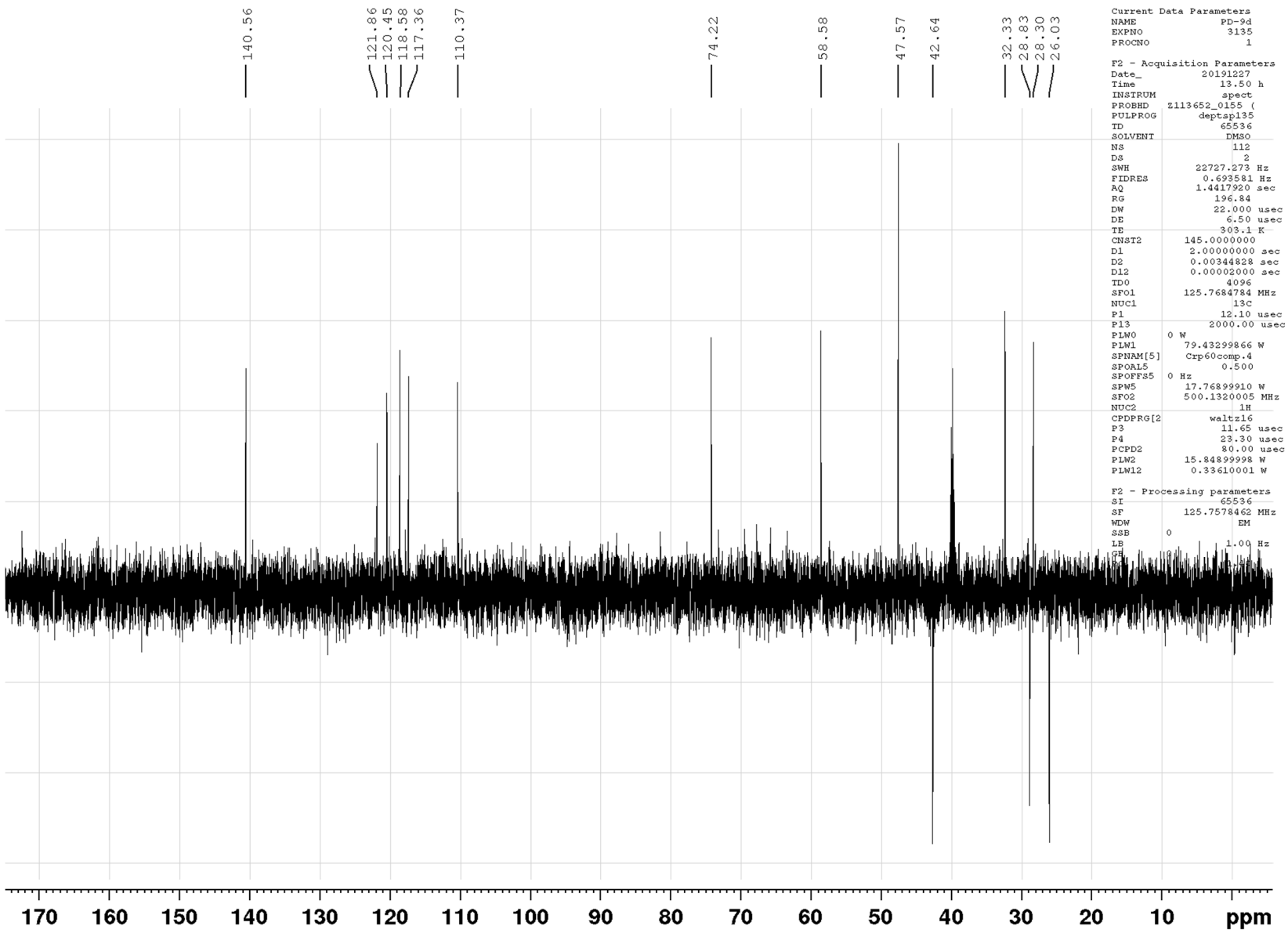
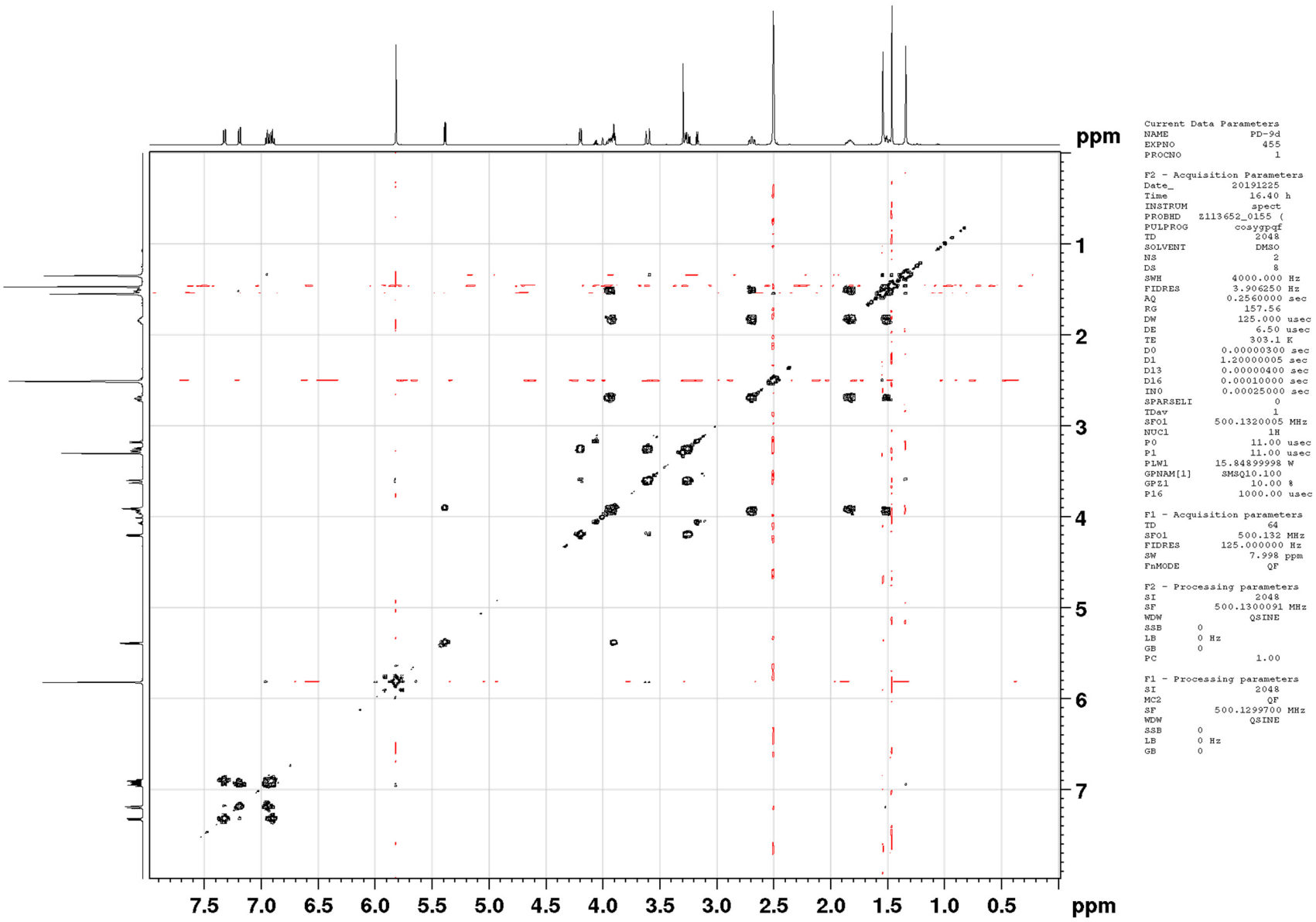


Figure S23. DEPT-135 NMR spectrum (125 MHz, DMSO-d6) of **1**

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PROCNO                    1

F2 - Acquisition Parameters
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Time                 16.40 h
INSTRUM               spect
PROBHD    Z113652_0155 (
PULPROG           cosygpqf
TD                    2048
SOLVENT               DMSO
NS                       2
DS                       8
SWH               4000.000 Hz
FIDRES            3.906250 Hz
AQ                0.2560000 sec
RG                   157.56
DW                  125.000 usec
DE                    6.50 usec
TE                  303.1 K
D0                0.00000300 sec
D1                1.20000005 sec
D13               0.00000400 sec
D16               0.00010000 sec
IN0               0.00025000 sec
SPARSELI                 0
TDav                     1
SFO1           500.1320005 MHz
NUC1                    1H
P0                   11.00 usec
P1                   11.00 usec
PLW1          15.84899998 W
GPNAM[1]       SMSQ10.100
GPZ1                 10.00 %
P16                1000.00 usec

F1 - Acquisition parameters
TD                       64
SFO1              500.132 MHz
FIDRES          125.000000 Hz
SW                  7.998 ppm
FnMODE                   QF

F2 - Processing parameters
SI                    2048
SF           500.1300091 MHz
WDW                  QSINE
SSB          0
LB           0 Hz
GB           0
PC                    1.00

F1 - Processing parameters
SI                    2048
MC2                      QF
SF           500.1299700 MHz
WDW                  QSINE
SSB          0
LB           0 Hz
GB           0
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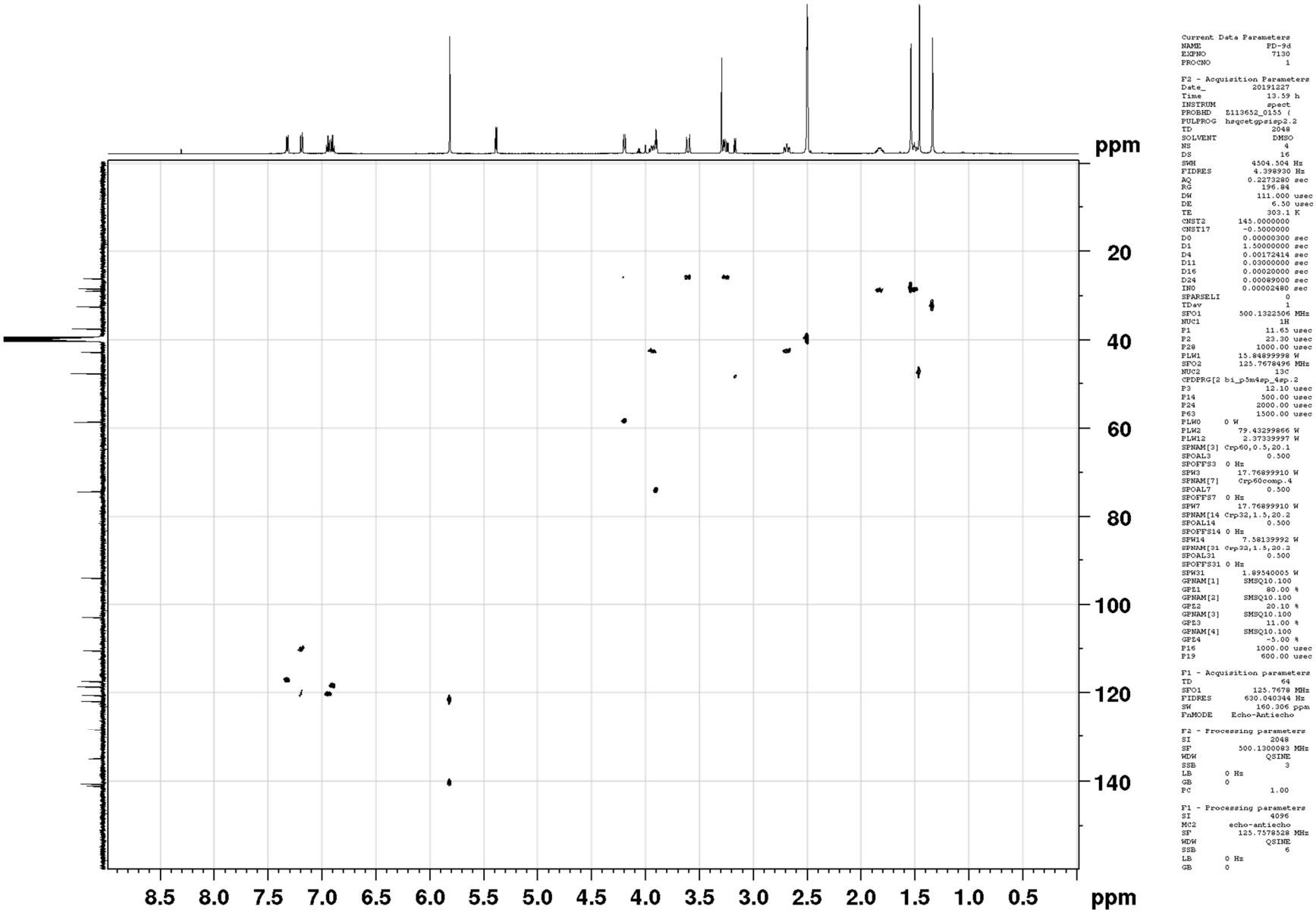
Figure S24. COSY-45 spectrum (500 MHz, DMSO-d6) of **1**

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EXPNO                  7130
PROCNO                    1

F2 - Acquisition Parameters
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PROBHD    Z113652_0155 (
PULPROG   hsqcetgpsisp2.2
TD                     2048
SOLVENT                DMSO
NS                        4
DS                       16
SWH                4504.504 Hz
FIDRES             4.398930 Hz
AQ                 0.2273280 sec
RG                    196.84
DW                   111.000 usec
DE                     6.50 usec
TE                    303.1 K
CNST2             145.0000000
CNST17             -0.5000000
D0                 0.00000300 sec
D1                 1.50000000 sec
D4                 0.00172414 sec
D11                0.03000000 sec
D16                0.00020000 sec
D24                0.00089000 sec
IN0                0.00002480 sec
SPARSELI                  0
TDav                      1
SFO1              500.1322506 MHz
NUC1                      1H
P1                     11.65 usec
P2                     23.30 usec
P28                 1000.00 usec
PLW1              15.84899998 W
SFO2              125.7678496 MHz
NUC2                      13C
CPDPRG[2 bi_p5m4sp_4sp.2
P3                     12.10 usec
P14                   500.00 usec
P24                  2000.00 usec
P63                  1500.00 usec
PLW0      0 W
PLW2               79.43299866 W
PLW12               2.37339997 W
SPNAM[3] Crp60,0.5,20.1
SPOAL3                 0.500
SPOFFS3   0 Hz
SPW3               17.76899910 W
SPNAM[7]    Crp60comp.4
SPOAL7                 0.500
SPOFFS7   0 Hz
SPW7               17.76899910 W
SPNAM[14 Crp32,1.5,20.2
SPOAL14                0.500
SPOFFS14 0 Hz
SPW14               7.58139992 W
SPNAM[31 Crp32,1.5,20.2
SPOAL31                0.500
SPOFFS31 0 Hz
SPW31               1.89540005 W
GPNAM[1]      SMSQ10.100
GPZ1                  80.00 %
GPNAM[2]      SMSQ10.100
GPZ2                  20.10 %
GPNAM[3]      SMSQ10.100
GPZ3                  11.00 %
GPNAM[4]      SMSQ10.100
GPZ4                  -5.00 %
P16                 1000.00 usec
P19                  600.00 usec

F1 - Acquisition parameters
TD                       64
SFO1              125.7678 MHz
FIDRES            630.040344 Hz
SW                160.306 ppm
FnMODE    Echo-Antiecho

F2 - Processing parameters
SI                     2048
SF                500.1300083 MHz
WDW                    QSINE
SSB                       3
LB        0 Hz
GB        0
PC                     1.00

F1 - Processing parameters
SI                     4096
MC2          echo-antiecho
SF                125.7578528 MHz
WDW                    QSINE
SSB                       6
LB        0 Hz
GB        0
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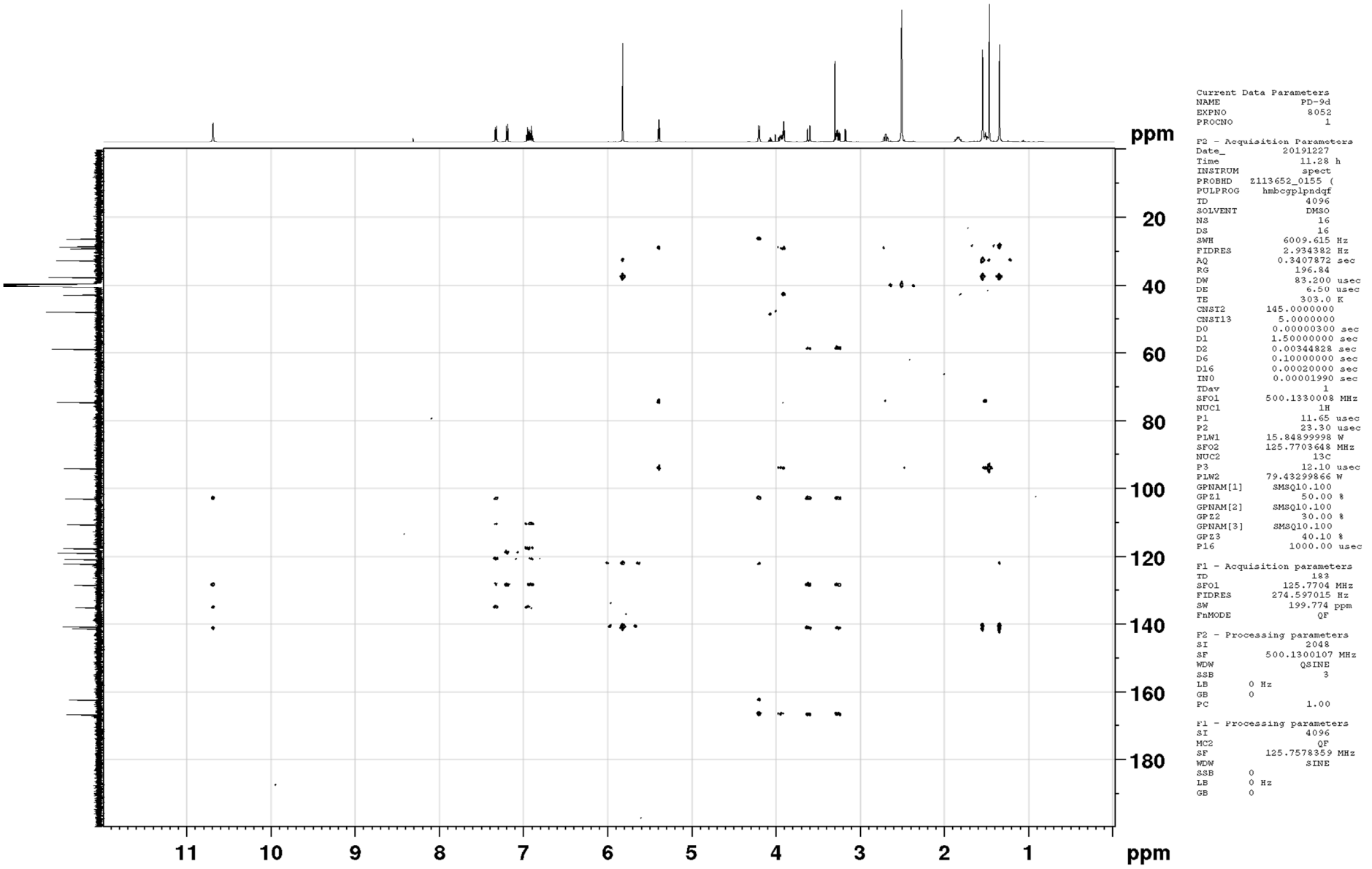
Figure S25. HSQC spectrum (500 MHz, DMSO-d6) of **1**

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EXPNO                  8052
PROCNO                    1

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PROBHD    Z113652_0155 (
PULPROG     hmbcgplpndqf
TD                    4096
SOLVENT               DMSO
NS                      16
DS                      16
SWH                6009.615 Hz
FIDRES             2.934382 Hz
AQ                 0.3407872 sec
RG                    196.84
DW                   83.200 usec
DE                    6.50 usec
TE                   303.0 K
CNST2             145.0000000
CNST13              5.0000000
D0                 0.00000300 sec
D1                 1.50000000 sec
D2                 0.00344828 sec
D6                 0.10000000 sec
D16                0.00020000 sec
IN0                0.00001990 sec
TDav                        1
SFO1              500.1330008 MHz
NUC1                       1H
P1                    11.65 usec
P2                    23.30 usec
PLW1              15.84899998 W
SFO2              125.7703648 MHz
NUC2                      13C
P3                    12.10 usec
PLW2              79.43299866 W
GPNAM[1]           SMSQ10.100
GPZ1                  50.00 %
GPNAM[2]           SMSQ10.100
GPZ2                  30.00 %
GPNAM[3]           SMSQ10.100
GPZ3                  40.10 %
P16                 1000.00 usec

F1 - Acquisition parameters
TD                        183
SFO1              125.7704 MHz
FIDRES            274.597015 Hz
SW                  199.774 ppm
FnMODE                    QF

F2 - Processing parameters
SI                      2048
SF                500.1300107 MHz
WDW                     QSINE
SSB                         3
LB              0 Hz
GB              0
PC                       1.00

F1 - Processing parameters
SI                      4096
MC2                       QF
SF                125.7578359 MHz
WDW                     SINE
SSB             0
LB              0 Hz
GB              0
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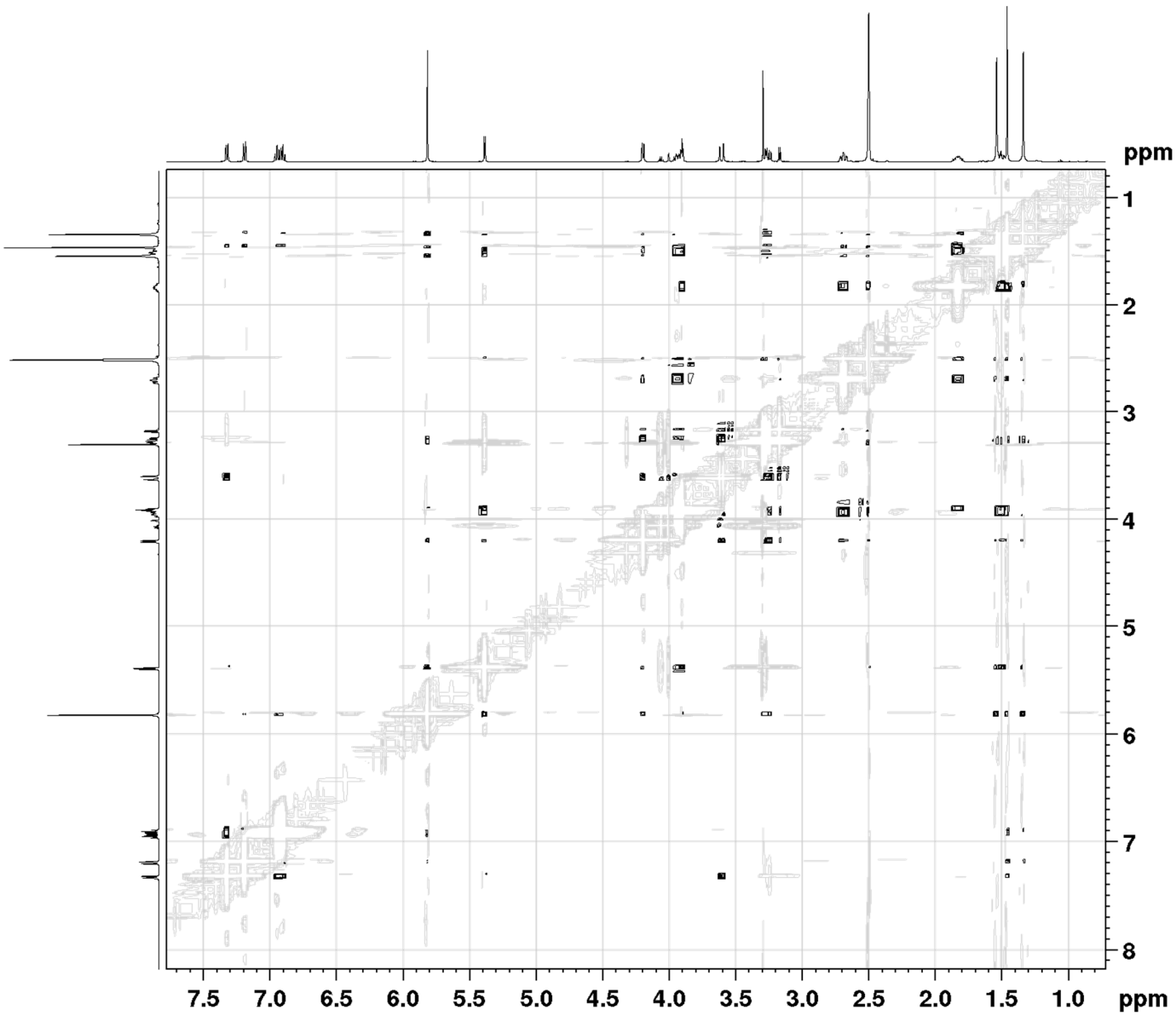
Figure S26. HMBC spectrum (500 MHz, DMSO-d6) of **1**

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Current Data Parameters
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EXPNO                  6030
PROCNO                    2

F2 - Acquisition Parameters
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INSTRUM                spect
PROBHD    Z113652_0155 (
PULPROG          noesygpph
TD                     2048
SOLVENT                DMSO
NS                       16
DS                       16
SWH                6009.615 Hz
FIDRES             5.868765 Hz
AQ                 0.1703936 sec
RG                    106.06
DW                    83.200 use
DE                     6.50 use
TE                    303.0 K
D0              0.00006837 sec
D1              1.00000000 sec
D8              1.00000000 sec
D16             0.00020000 sec
IN0             0.00016640 sec
TDav                      1
SFO1           500.1330008 MHz
NUC1                   1H
P1                    11.65 usec
P2                    23.30 use
PLW1           15.84899998 W
GPNAM[1]        SMSQ10.100
GPZ1                  40.00 %
P16                 1000.00 usec

F1 - Acquisition parameters
TD                       70
SFO1              500.133 MHz
FIDRES         171.703293 Hz
SW                 12.016 ppm
FnMODE                TPPI

F2 - Processing parameters
SI                     2048
SF             500.1300093 MHz
WDW                   QSINE
SSB                       2
LB          0 Hz
GB          0
PC                     1.00

F1 - Processing parameters
SI                     2048
MC2                    TPPI
SF             500.1300084 MHz
WDW                   QSINE
SSB                       2
LB          0 Hz
GB          0
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Figure S27. NOESY spectrum (500 MHz, DMSO-d6) of **1**

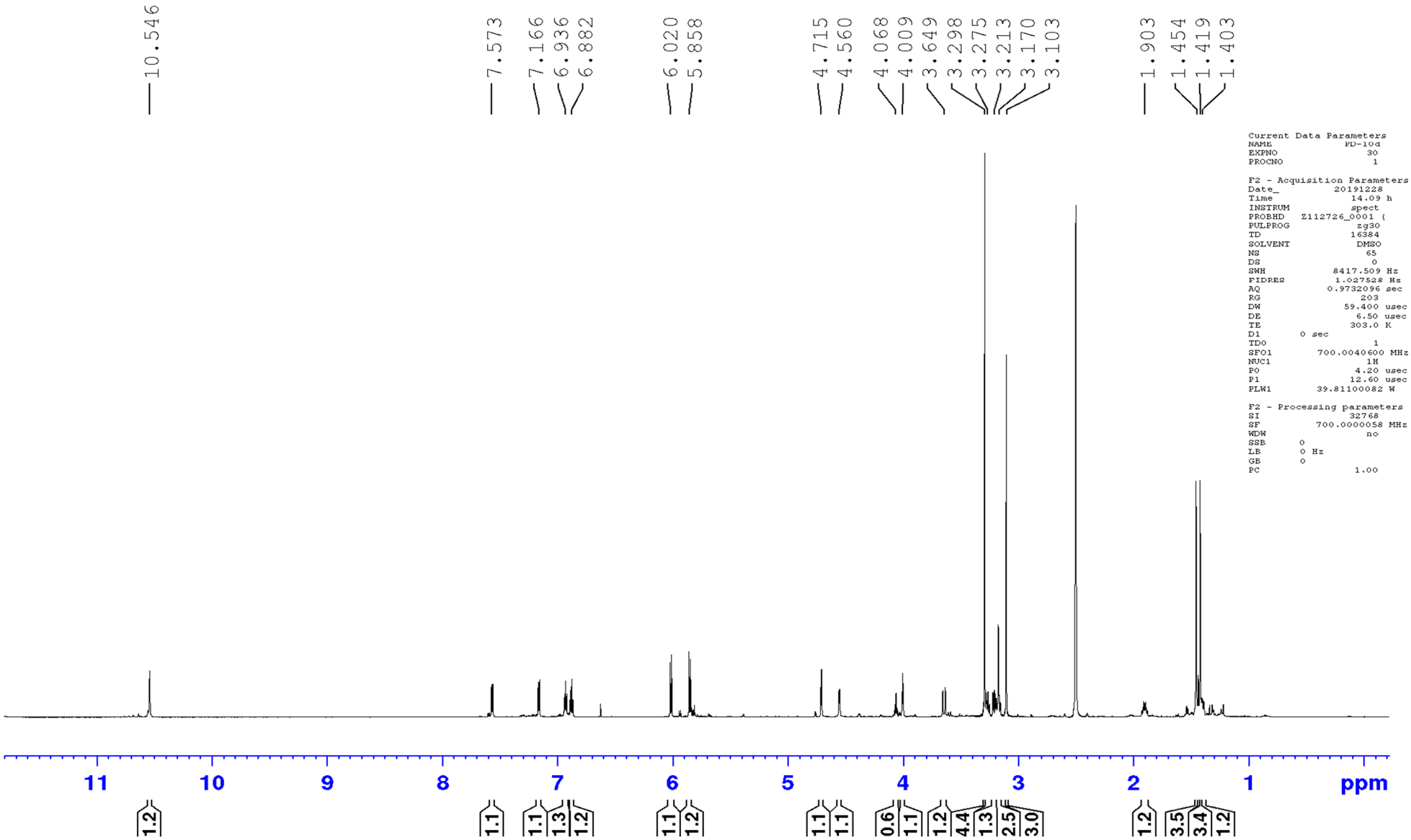


Figure S28. ^{1}H NMR spectrum (700 MHz, DMSO-d6) of **2**

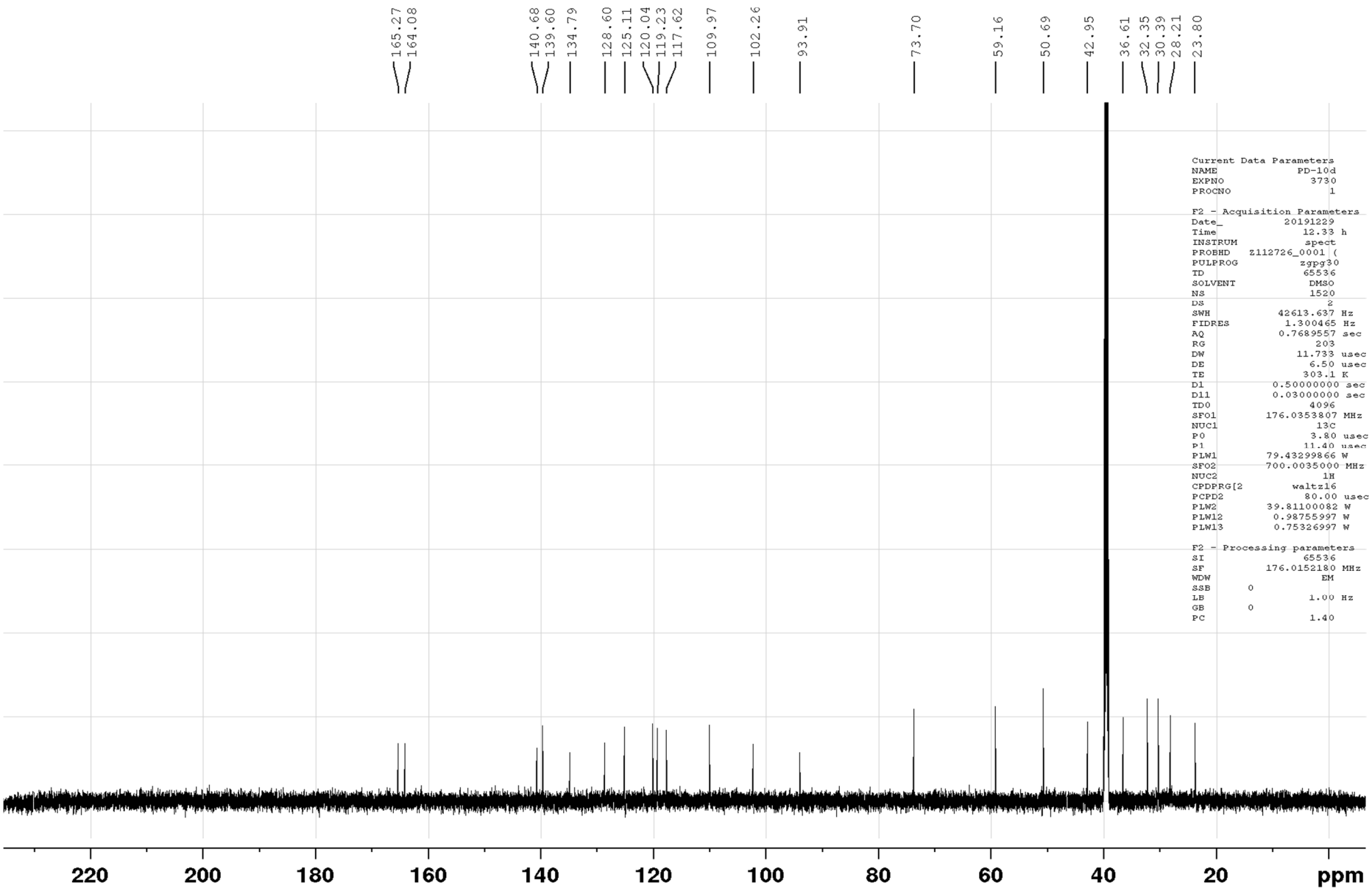


Figure S29. ^{13}C NMR spectrum (176 MHz, DMSO-d6) of **2**

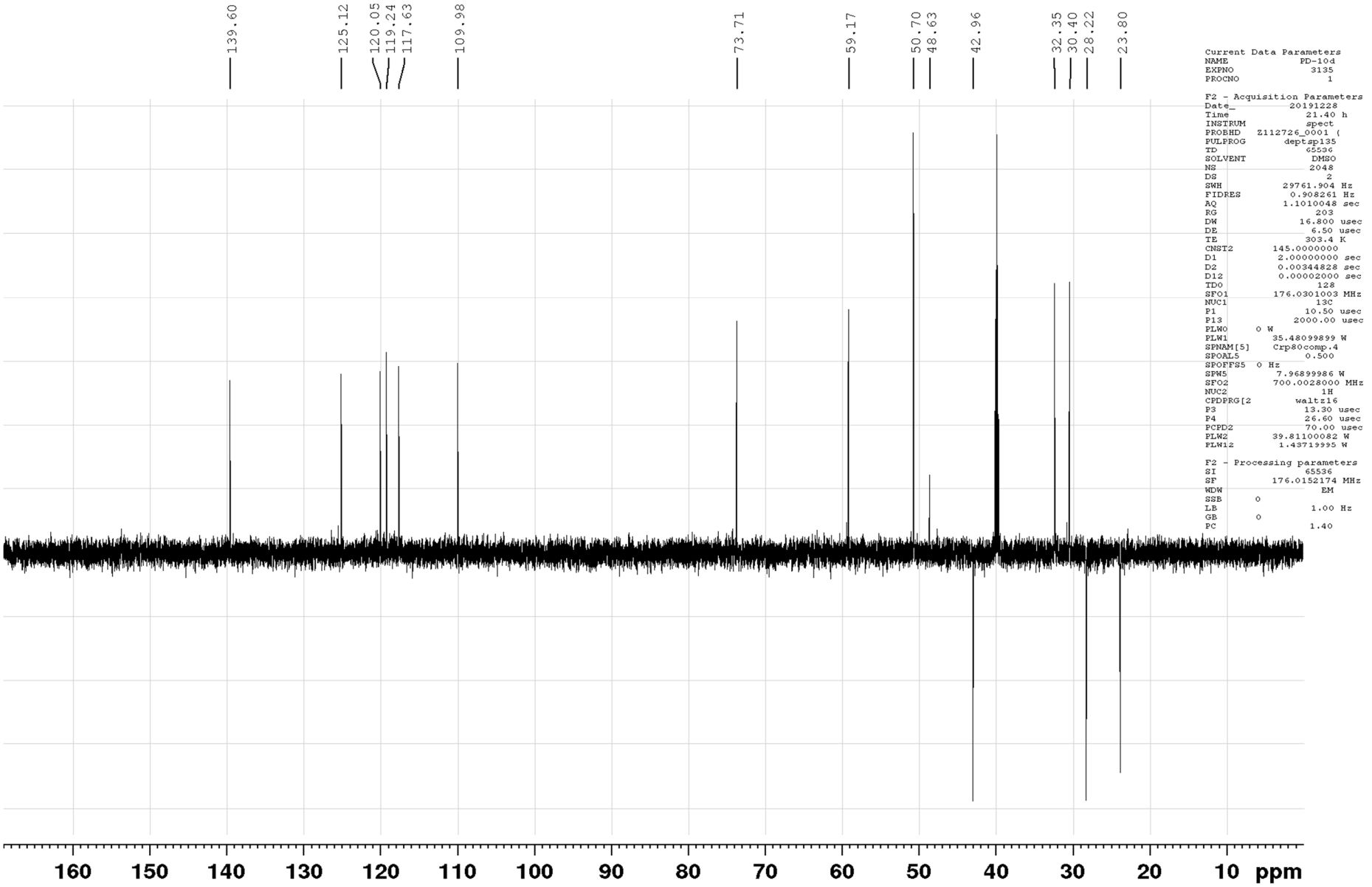


Figure S30. DEPT-135 NMR spectrum (176 MHz, DMSO-d6) of **2**

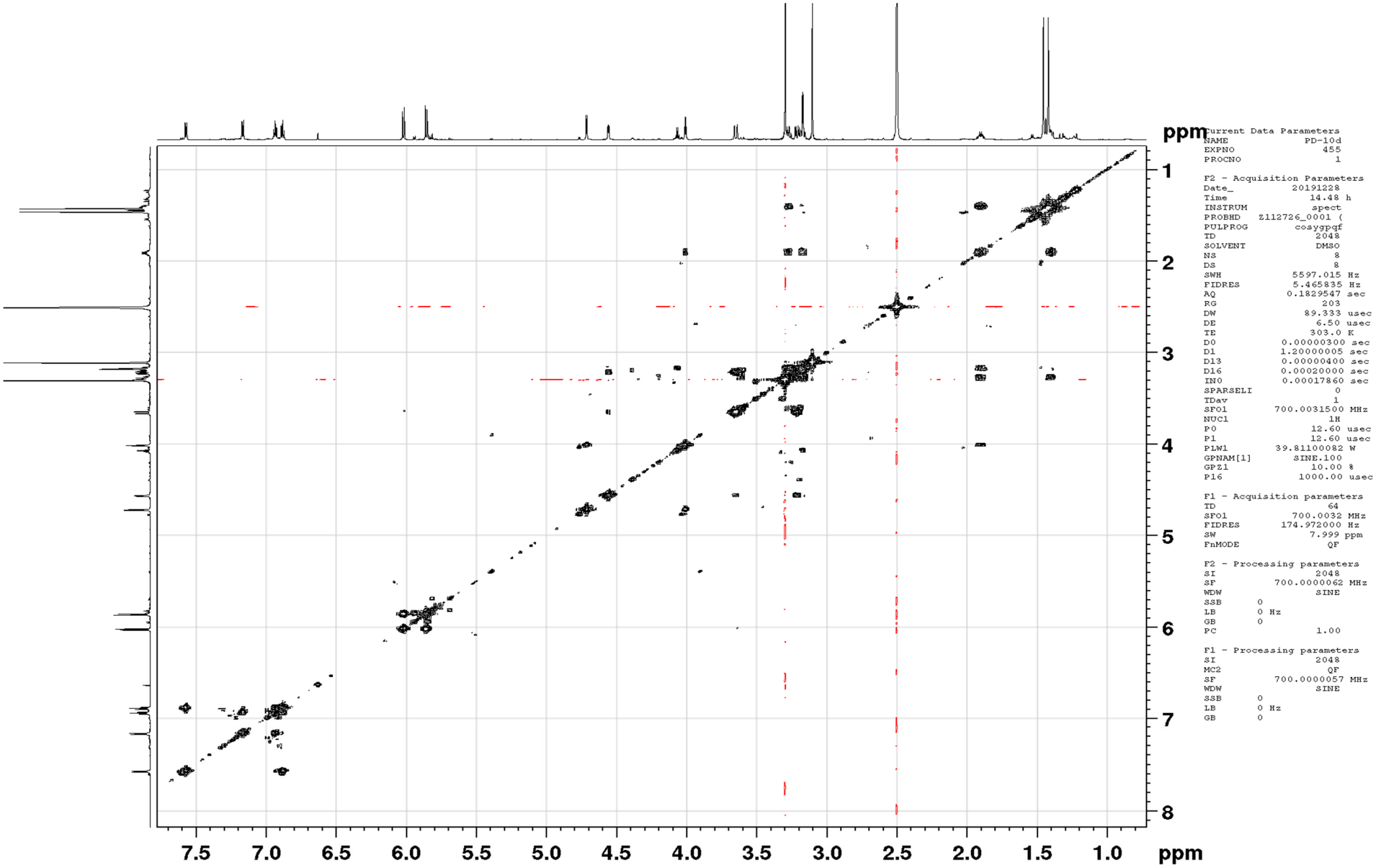
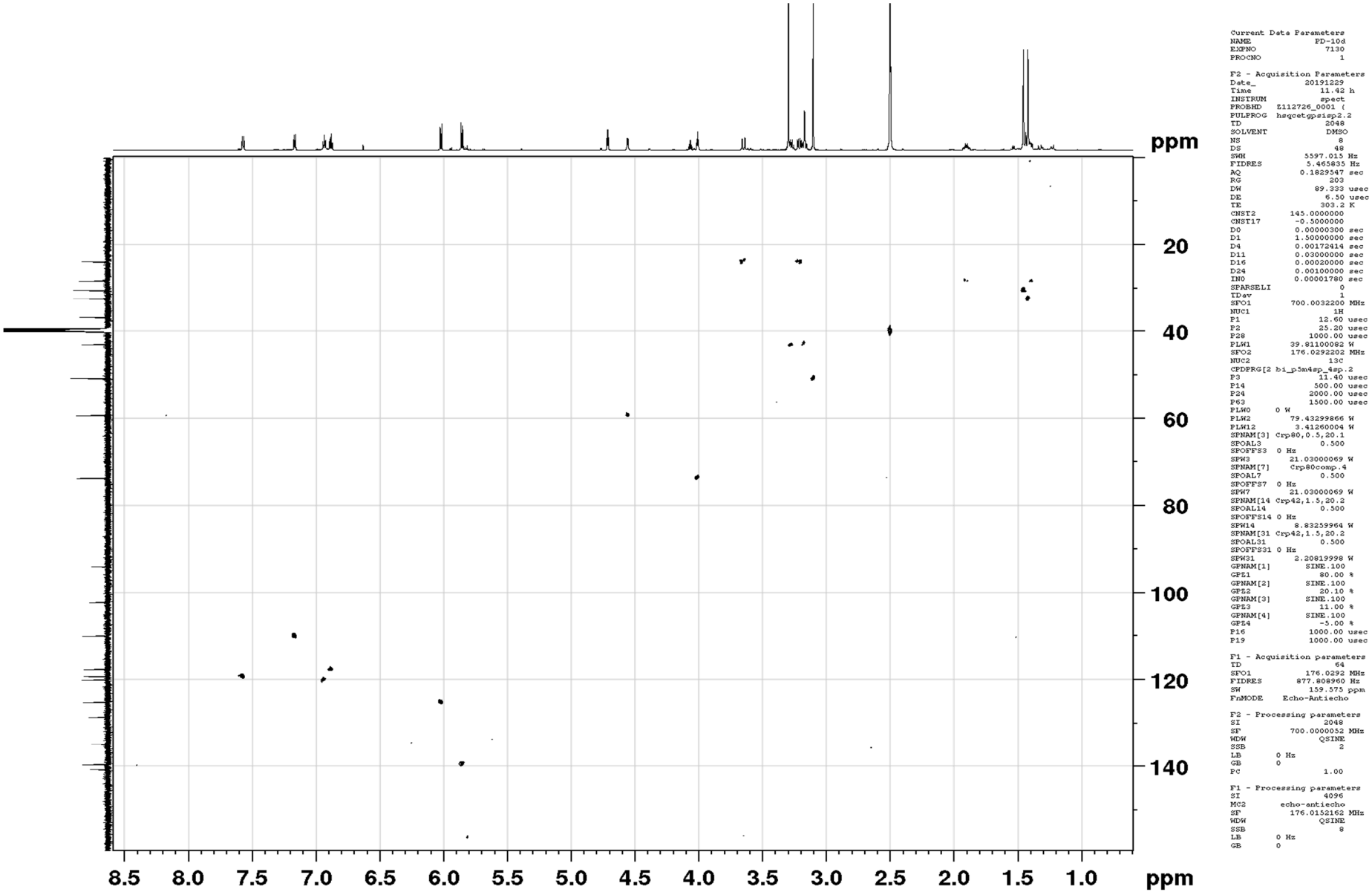


Figure S31. COSY-45 spectrum (700 MHz, DMSO-d6) of **2**

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EXPNO                   7130
PROCNO                     1

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INSTRUM                spect
PROBHD    I112726_0001 (
PULPROG   hsqcetgpsisp2.2
TD                      2048
SOLVENT                 DMSO
NS                         8
DS                        48
SWH                 5597.015 Hz
FIDRES                5.465835 Hz
AQ                  0.1829547 sec
RG                        203
DW                     89.333 usec
DE                      6.50 usec
TE                     303.2 K
CNST2              145.0000000
CNST17              -0.5000000
D0                  0.00000300 sec
D1                  1.50000000 sec
D4                  0.00172414 sec
D11                 0.03000000 sec
D16                 0.00020000 sec
D24                 0.00100000 sec
IN0                 0.00001780 sec
SPARSELI                   0
TDav                       1
SFO1               700.0032200 MHz
NUC1                      1H
P1                      12.60 usec
P2                      25.20 usec
P28                   1000.00 usec
PLW1              39.81100082 W
SFO2              176.0292202 MHz
NUC2                      13C
CPDPRG[2 bi_p5m4sp_4sp.2
P3                      11.40 usec
P14                    500.00 usec
P24                   2000.00 usec
P63                   1500.00 usec
PLW0       0 W
PLW2              79.43299866 W
PLW12              3.41260004 W
SPNAM[3] Crp80,0.5,20.1
SPOAL3                   0.500
SPOFFS3    0 Hz
SPW3              21.03000069 W
SPNAM[7]    Crp80comp.4
SPOAL7                   0.500
SPOFFS7    0 Hz
SPW7              21.03000069 W
SPNAM[14 Crp42,1.5,20.2
SPOAL14                  0.500
SPOFFS14 0 Hz
SPW14              8.83259964 W
SPNAM[31 Crp42,1.5,20.2
SPOAL31                  0.500
SPOFFS31 0 Hz
SPW31             2.20819998 W
GPNAM[1]            SINE.100
GPZ1                    80.00 %
GPNAM[2]            SINE.100
GPZ2                    20.10 %
GPNAM[3]            SINE.100
GPZ3                    11.00 %
GPNAM[4]            SINE.100
GPZ4                    -5.00 %
P16                   1000.00 usec
P19                   1000.00 usec

F1 - Acquisition parameters
TD                         64
SFO1               176.0292 MHz
FIDRES            877.808960 Hz
SW                  159.575 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                      2048
SF                700.0000052 MHz
WDW                     QSINE
SSB                        2
LB         0 Hz
GB         0
PC                      1.00

F1 - Processing parameters
SI                      4096
MC2          echo-antiecho
SF                176.0152162 MHz
WDW                     QSINE
SSB                        8
LB         0 Hz
GB         0
```

Figure S32. HSQC spectrum (700 MHz, DMSO-d6) of **2**

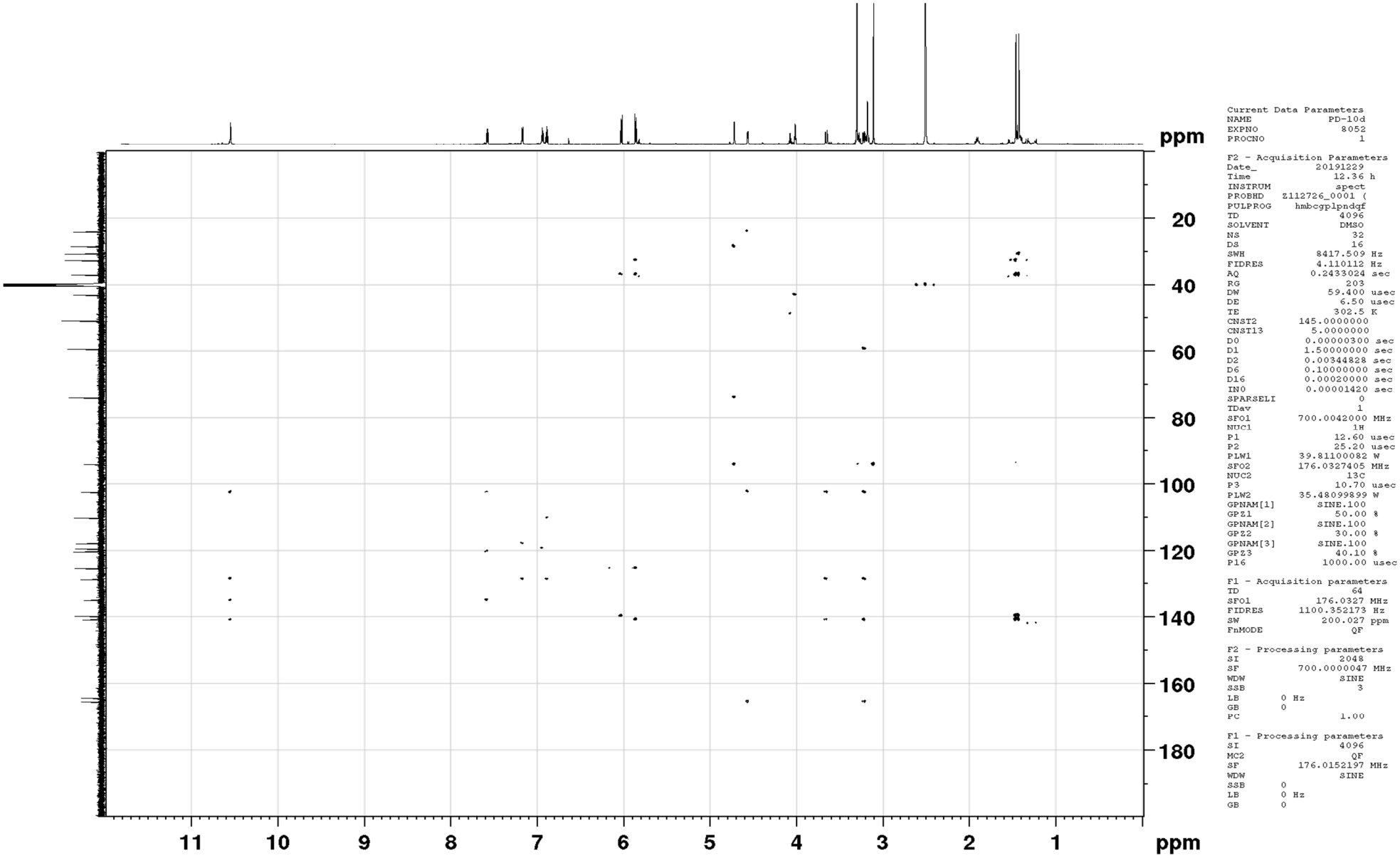
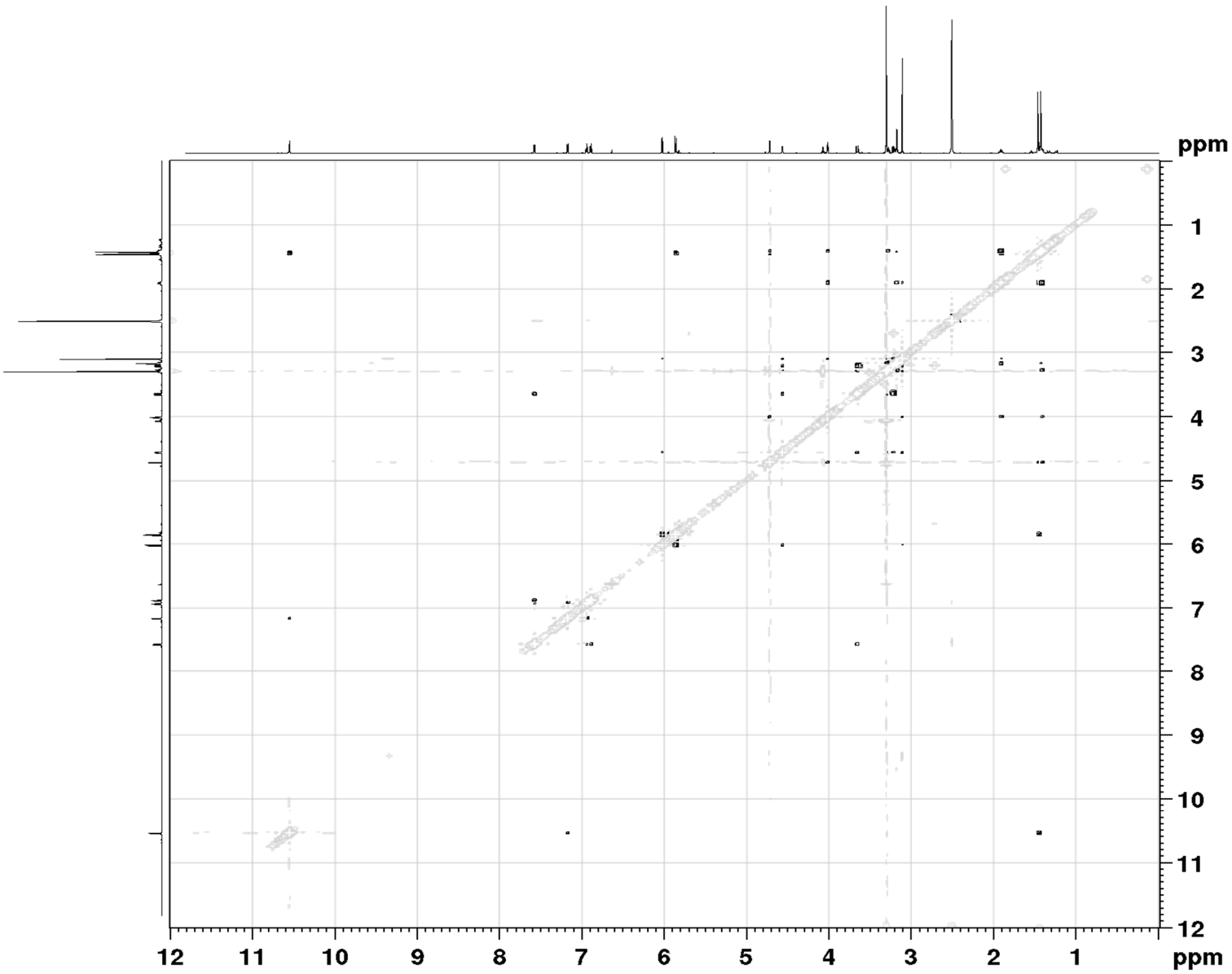


Figure S33. HMBC spectrum (700 MHz, DMSO-d6) of **2**




```
Current Data Parameters
NAME                  PD-10d
EXPNO                   6030
PROCNO                     2

F2 - Acquisition Parameters
Date_              20191228
Time                  15.03 h
INSTRUM               spect
PROBHD    Z112726_0001 (
PULPROG          noesygpph
TD                      2048
SOLVENT                 DMSO
NS                        32
DS                        16
SWH                 8417.509 Hz
FIDRES              8.220223 Hz
AQ                  0.1216512 sec
RG                        203
DW                     59.400 usec
DE                      6.50 usec
TE                     303.0 K
D0                0.00004336 sec
D1                1.00000000 sec
D8                1.00000000 sec
D16               0.00020000 sec
IN0               0.00011880 sec
TDav                       1
SFO1            700.0042000 MHz
NUC1                      1H
P1                     12.60 usec
P2                     25.20 usec
PLW1           39.81100082 W
GPNAM[1]          SINE.100
GPZ1                   20.00 %
P16                  1000.00 usec

F1 - Acquisition parameters
TD                       256
SFO1                700.0042 MHz
FIDRES             65.761787 Hz
SW                    12.025 ppm
FnMODE                 TPPI

F2 - Processing parameters
SI                      2048
SF              700.0000055 MHz
WDW                    QSINE
SSB                        2
LB          0 Hz
GB          0
PC                      1.00

F1 - Processing parameters
SI                      2048
MC2                     TPPI
SF              700.0000053 MHz
WDW                    QSINE
SSB                        2
LB          0 Hz
GB          0
```

Figure S34. NOESY spectrum (700 MHz, DMSO-d6) of **2**

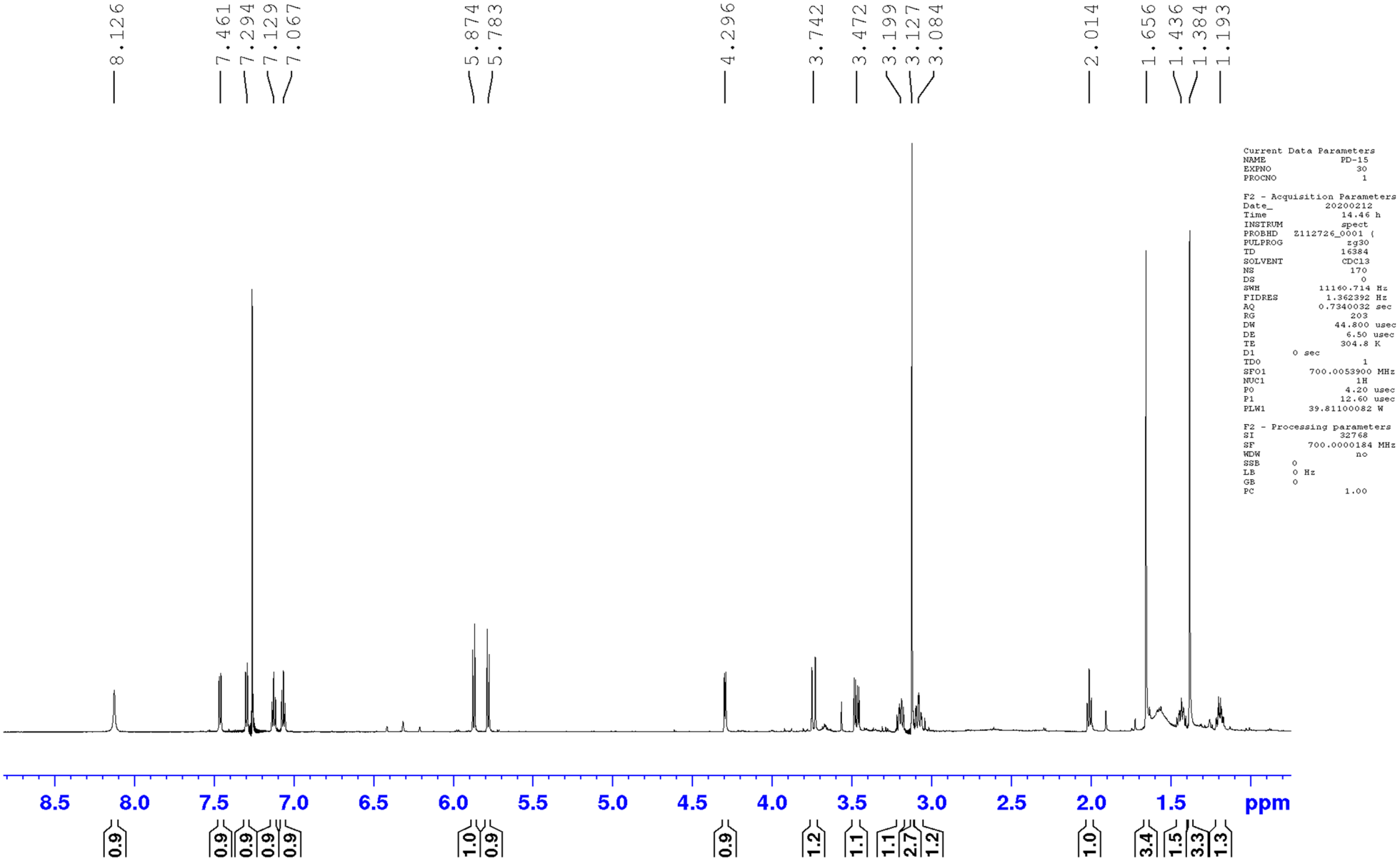


Figure S35. ^{1}H NMR spectrum (700 MHz, CD_3OD) of **3**

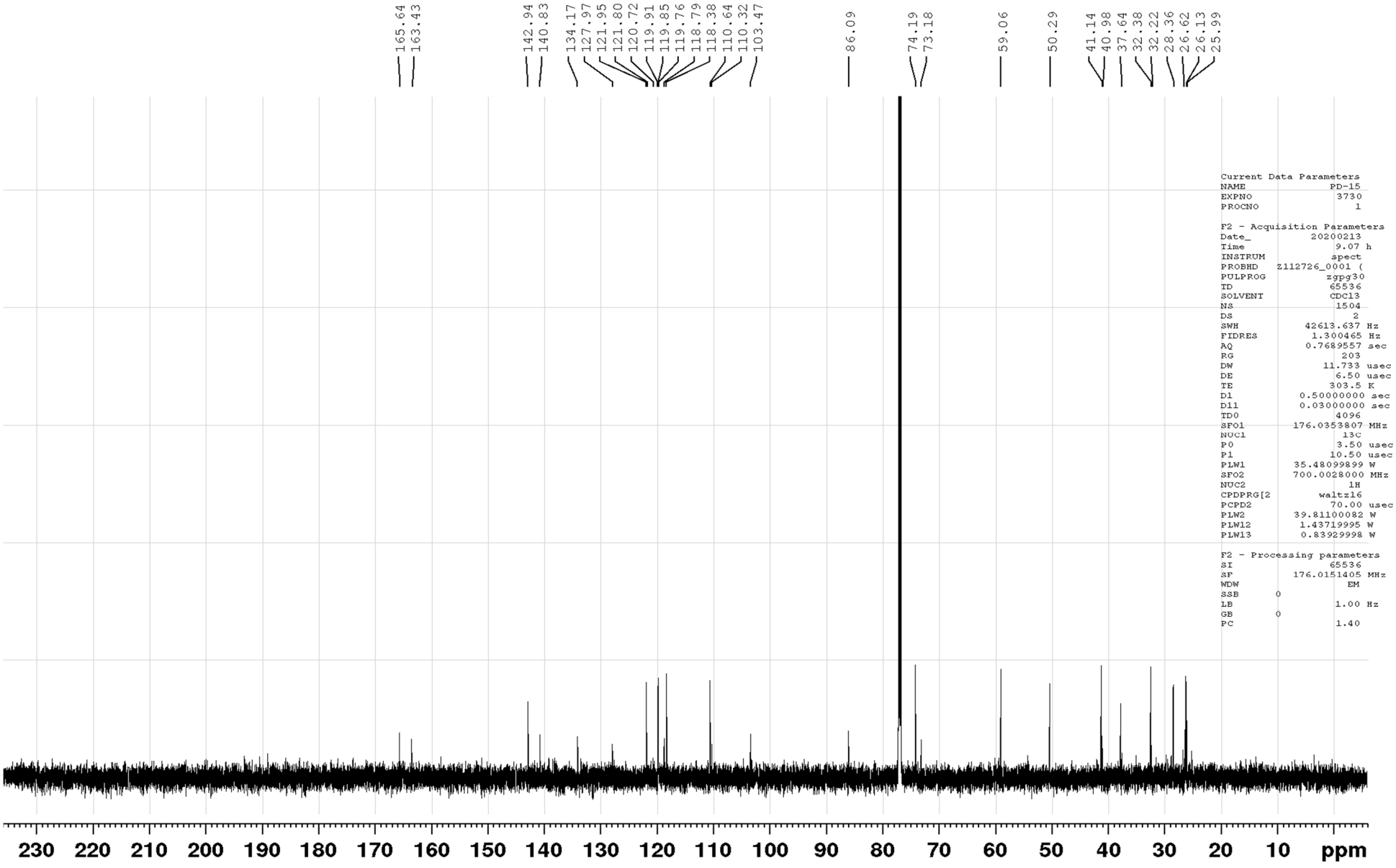


Figure S36. ^{13}C NMR spectrum (176 MHz, CD_3OD) of **3**

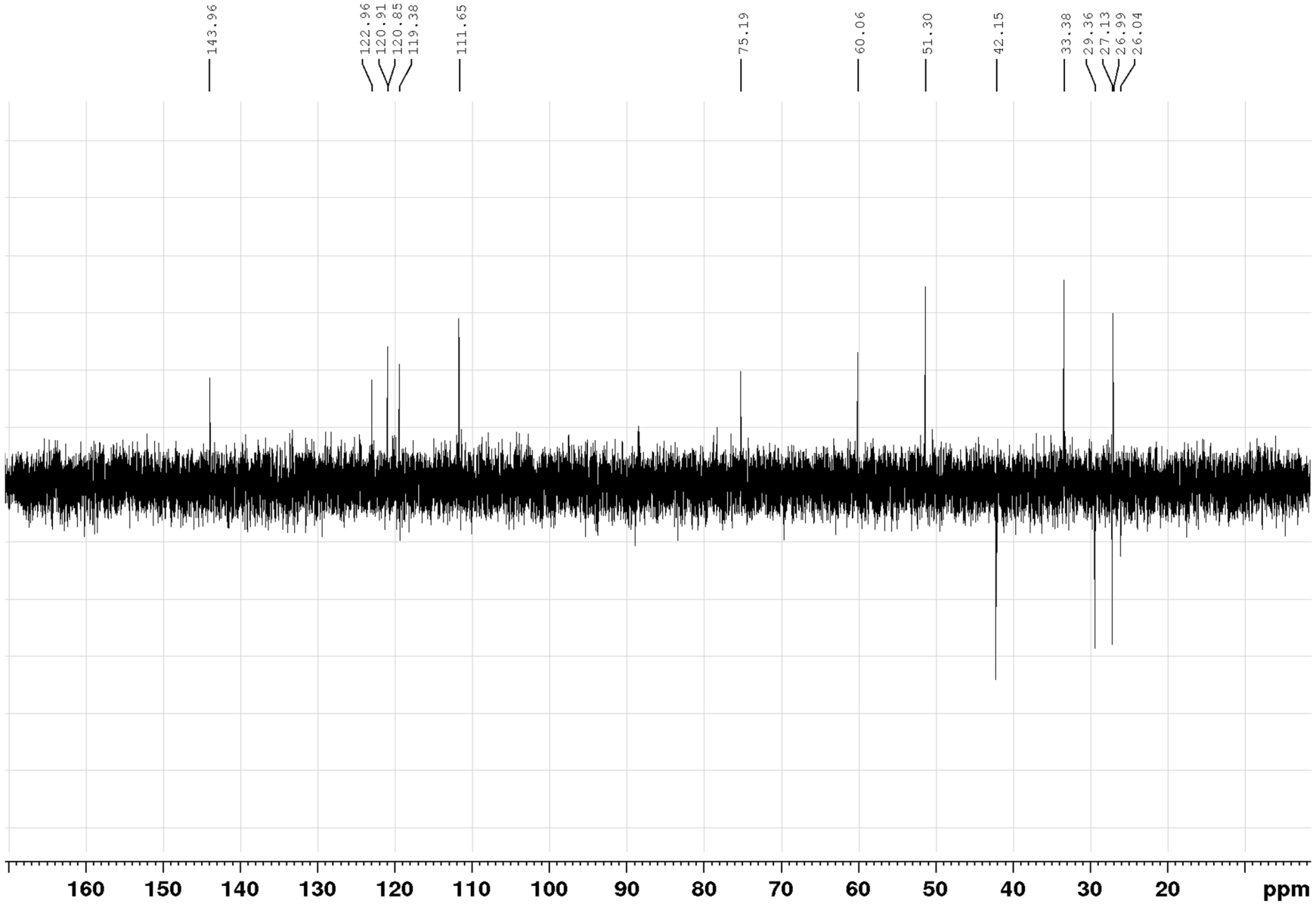
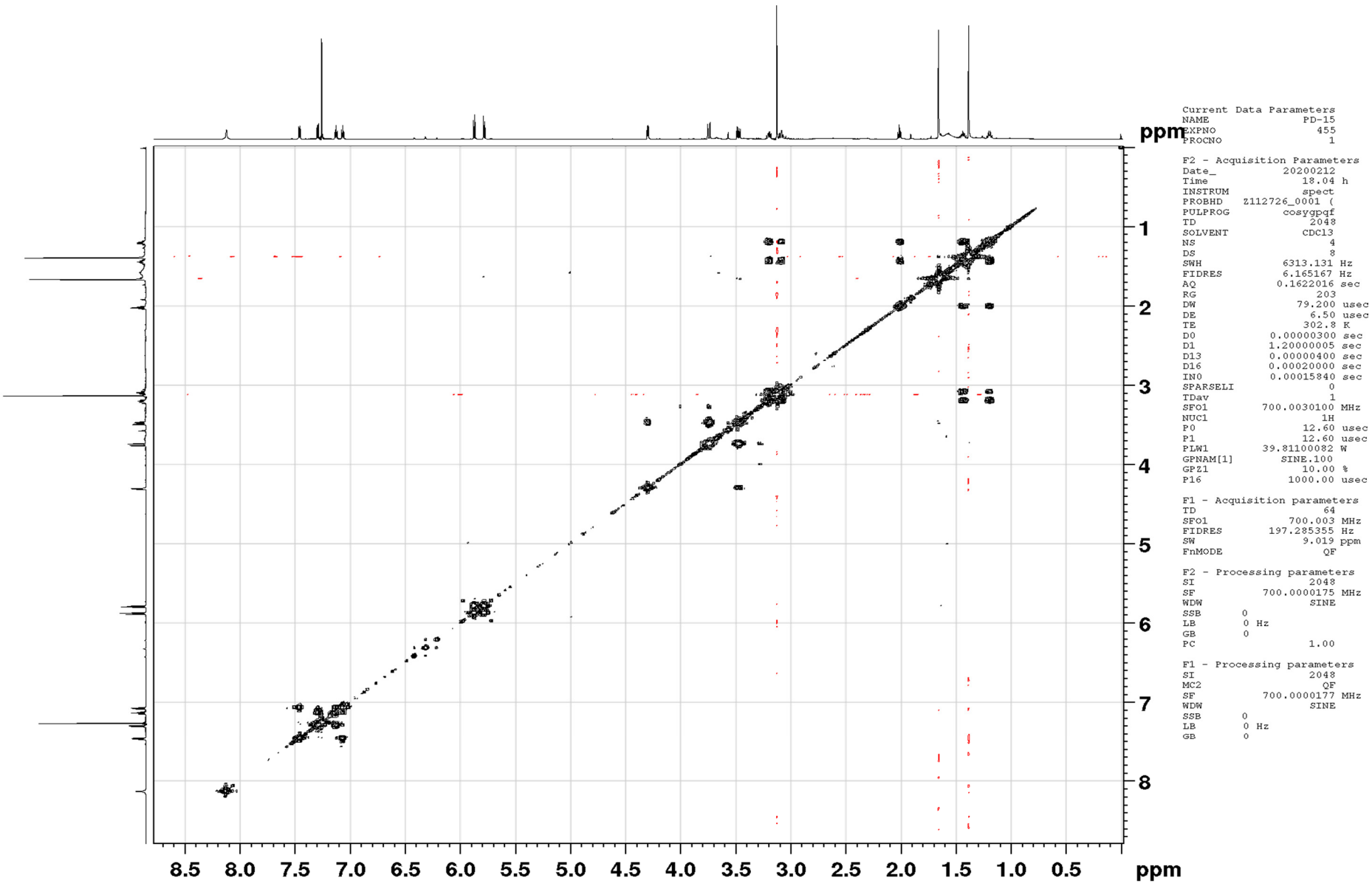


Figure S37. DEPT-135 NMR spectrum (176 MHz, CD_3OD) of **3**




```
Current Data Parameters
NAME                  PD-15
EXPNO                   455
PROCNO                    1

F2 - Acquisition Parameters
Date_              20200212
Time                 18.04 h
INSTRUM                spect
PROBHD    Z112726_0001 (
PULPROG            cosygpqf
TD                     2048
SOLVENT               CDCl3
NS                        4
DS                        8
SWH                6313.131 Hz
FIDRES             6.165167 Hz
AQ                 0.1622016 sec
RG                      203
DW                   79.200 usec
DE                    6.50 usec
TE                   302.8 K
D0                 0.00000300 sec
D1                 1.20000005 sec
D13                0.00000400 sec
D16                0.00020000 sec
IN0                0.00015840 sec
SPARSELI                  0
TDav                      1
SFO1           700.0030100 MHz
NUC1                    1H
P0                   12.60 usec
P1                   12.60 usec
PLW1              39.81100082 W
GPNAM[1]           SINE.100
GPZ1                 10.00 %
P16                1000.00 usec

F1 - Acquisition parameters
TD                       64
SFO1              700.003 MHz
FIDRES         197.285355 Hz
SW                   9.019 ppm
FnMODE                  QF

F2 - Processing parameters
SI                     2048
SF             700.0000175 MHz
WDW                    SINE
SSB                       0
LB                        0 Hz
GB                        0
PC                     1.00

F1 - Processing parameters
SI                     2048
MC2                     QF
SF             700.0000177 MHz
WDW                    SINE
SSB                       0
LB                        0 Hz
GB                        0
```

Figure S38. COSY-45 spectrum (700 MHz, CD_3OD) of **3**

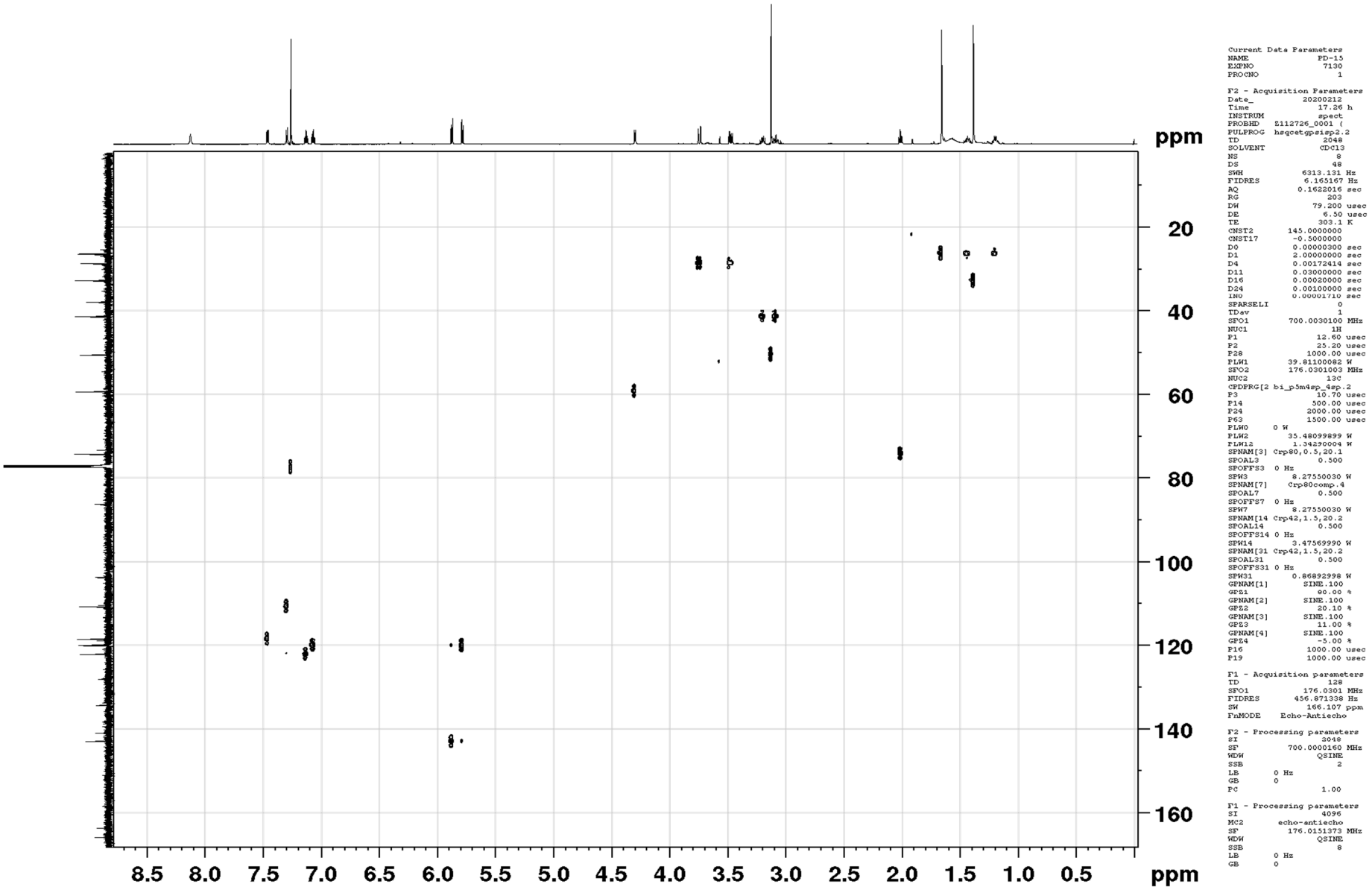
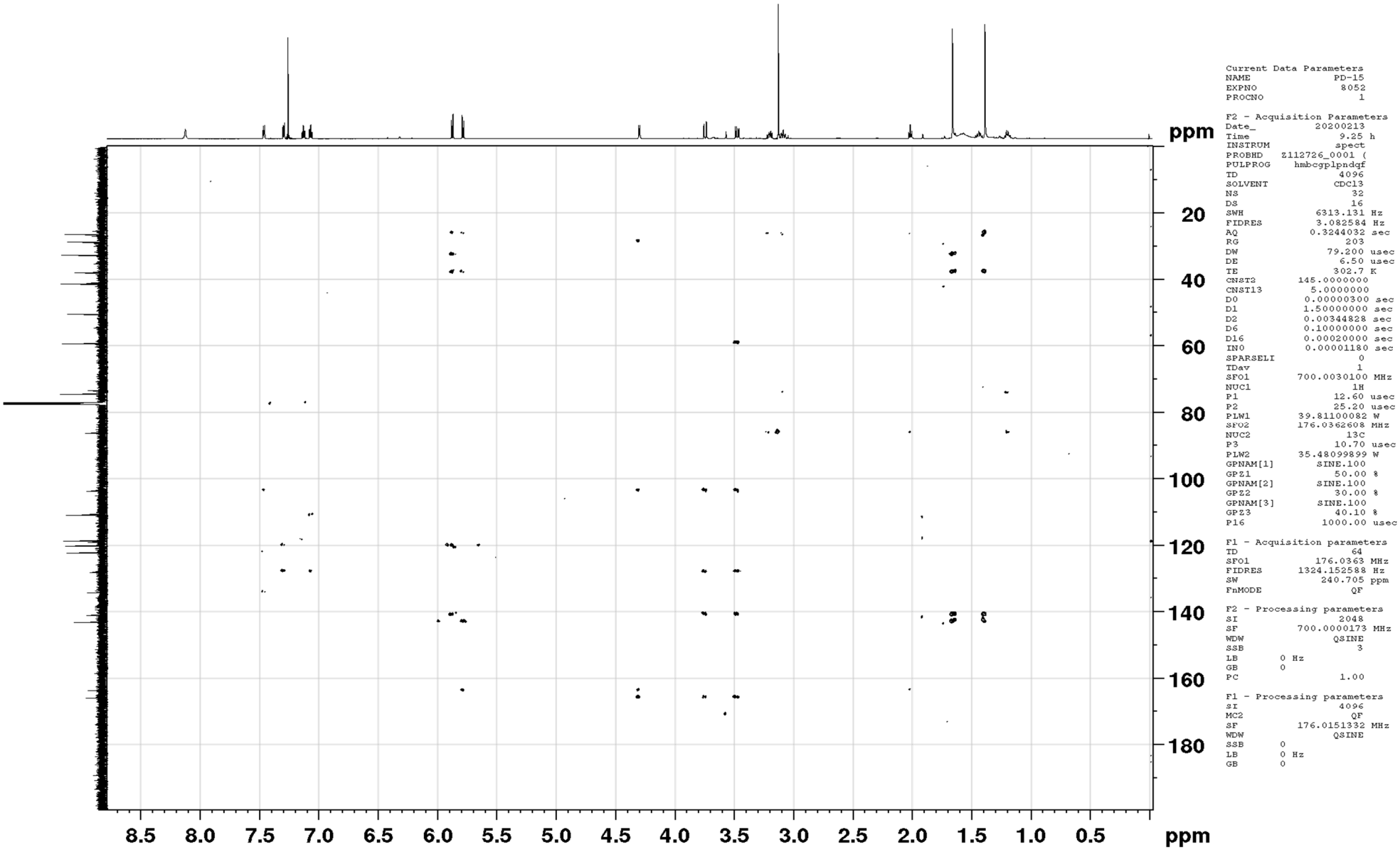


Figure S39. HSQC spectrum (700 MHz, CD_3OD) of **3**




```
Current Data Parameters
NAME                  PD-15
EXPNO                  8052
PROCNO                    1

F2 - Acquisition Parameters
Date_              20200213
Time                  9.25 h
INSTRUM               spect
PROBHD    Z112726_0001 (
PULPROG     hmbcgplpndqf
TD                     4096
SOLVENT               CDCl3
NS                       32
DS                       16
SWH                6313.131 Hz
FIDRES             3.082584 Hz
AQ                 0.3244032 sec
RG                       203
DW                  79.200 usec
DE                   6.50 usec
TE                   302.7 K
CNST2             145.0000000
CNST13              5.0000000
D0                  0.00000300 sec
D1                  1.50000000 sec
D2                  0.00344828 sec
D6                  0.10000000 sec
D16                 0.00020000 sec
IN0                 0.00001180 sec
SPARSELI                 0
TDav                     1
SFO1              700.0030100 MHz
NUC1                    1H
P1                   12.60 usec
P2                   25.20 usec
PLW1              39.81100082 W
SFO2              176.0362608 MHz
NUC2                    13C
P3                   10.70 usec
PLW2              35.48099899 W
GPNAM[1]             SINE.100
GPZ1                  50.00 %
GPNAM[2]             SINE.100
GPZ2                  30.00 %
GPNAM[3]             SINE.100
GPZ3                  40.10 %
P16                 1000.00 usec

F1 - Acquisition parameters
TD                       64
SFO1              176.0363 MHz
FIDRES           1324.152588 Hz
SW                 240.705 ppm
FnMODE                   QF

F2 - Processing parameters
SI                     2048
SF              700.0000173 MHz
WDW                   QSINE
SSB                      3
LB          0 Hz
GB          0
PC                    1.00

F1 - Processing parameters
SI                     4096
MC2                      QF
SF              176.0151332 MHz
WDW                   QSINE
SSB         0
LB          0 Hz
GB          0
```

Figure S40. HMBC spectrum (700 MHz, CD_3OD) of **3**

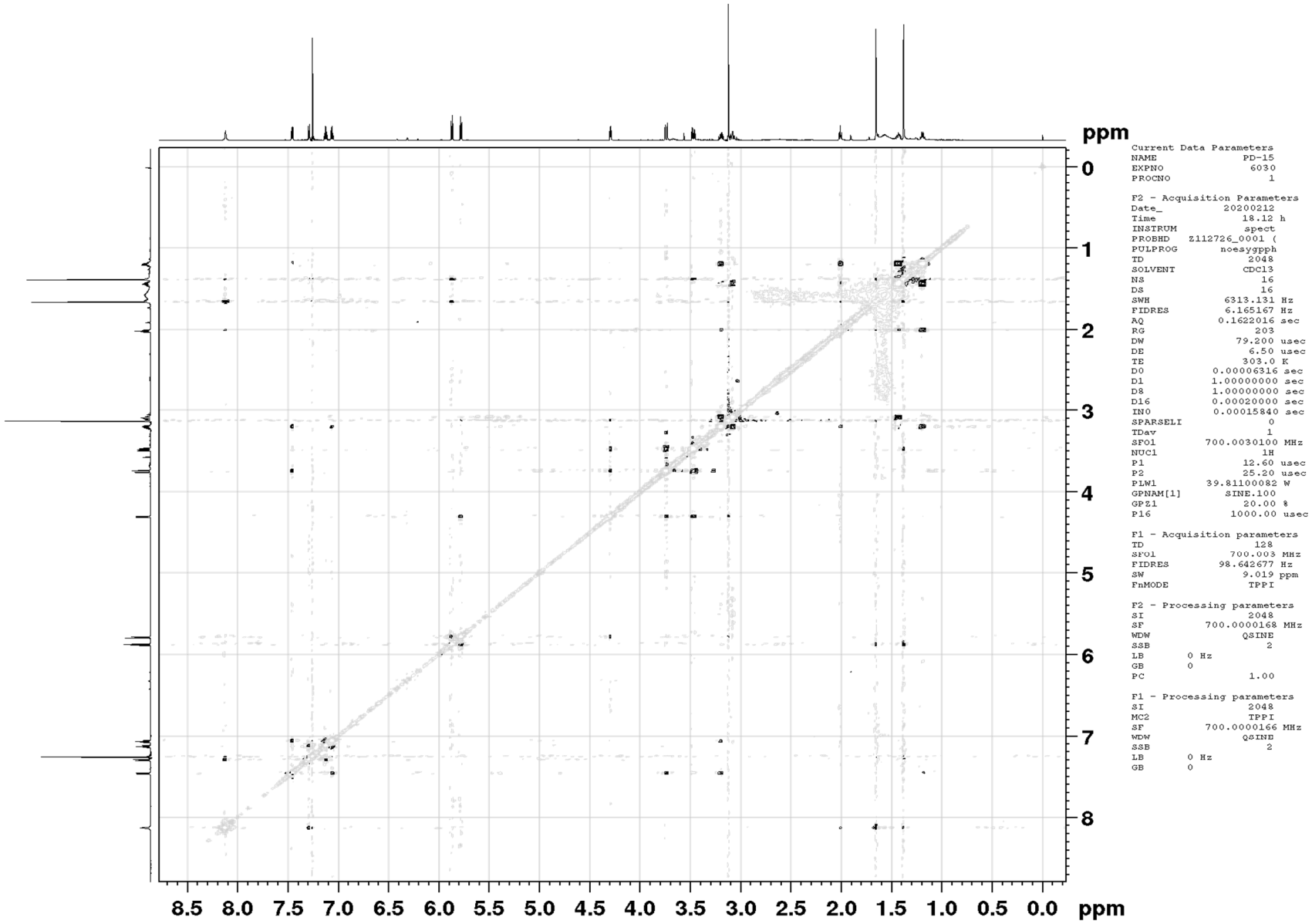


Figure S41. NOESY spectrum (700 MHz, CD_3OD) of **3**

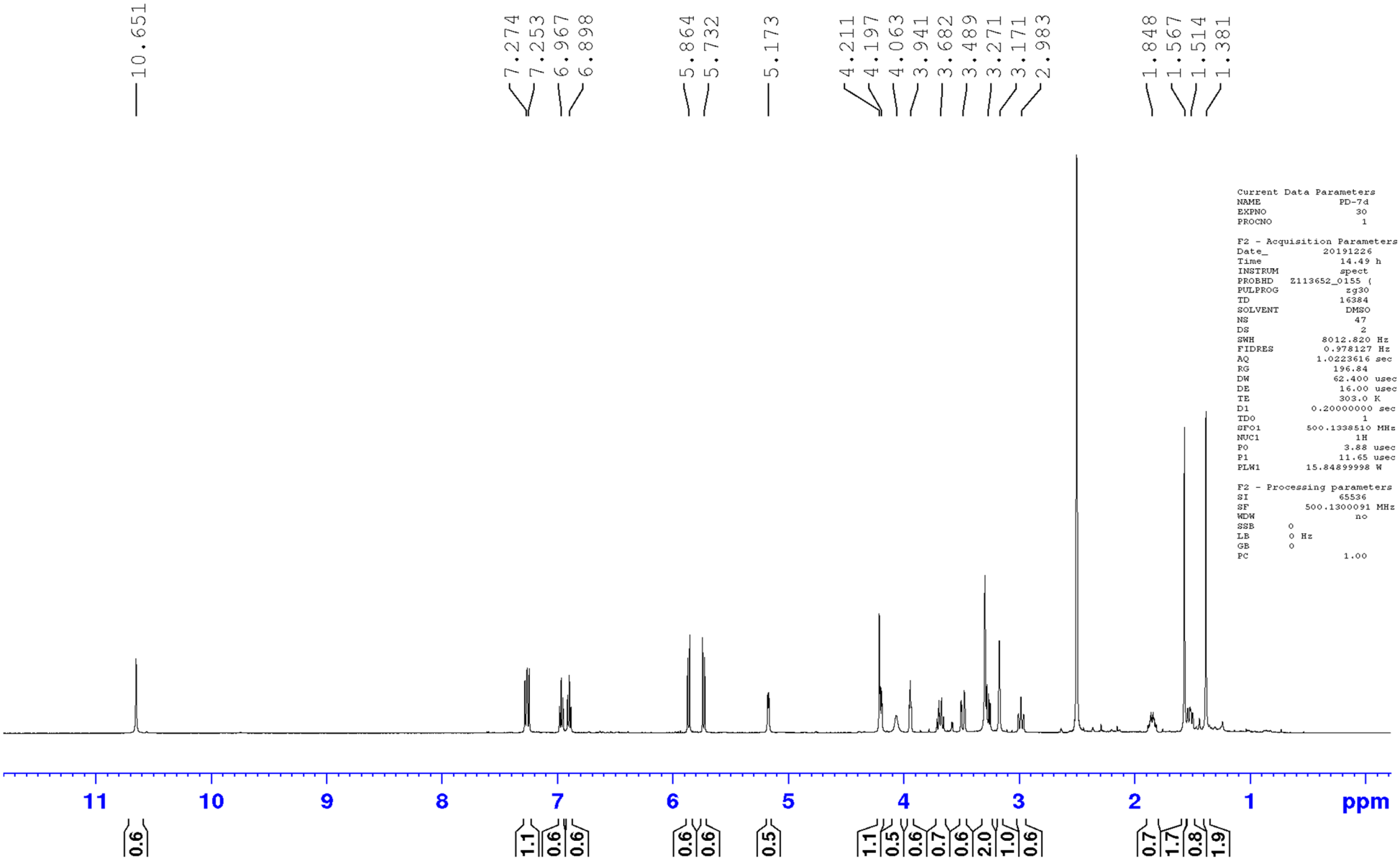


Figure S42. ^{1}H NMR spectrum (500 MHz, DMSO-d_6) of **4**

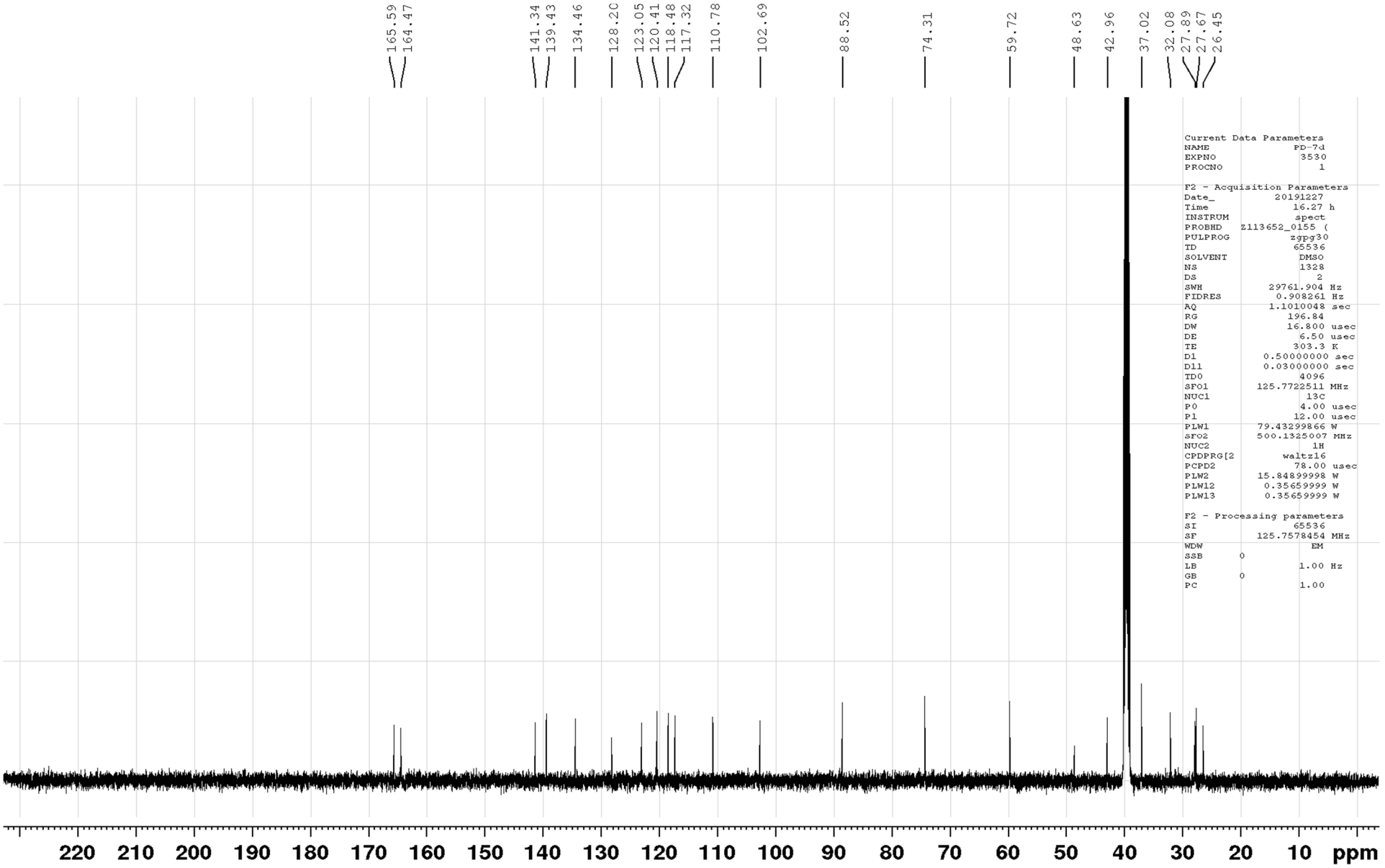


Figure S43. ^{13}C NMR spectrum (125 MHz, DMSO-d_6) of **4**

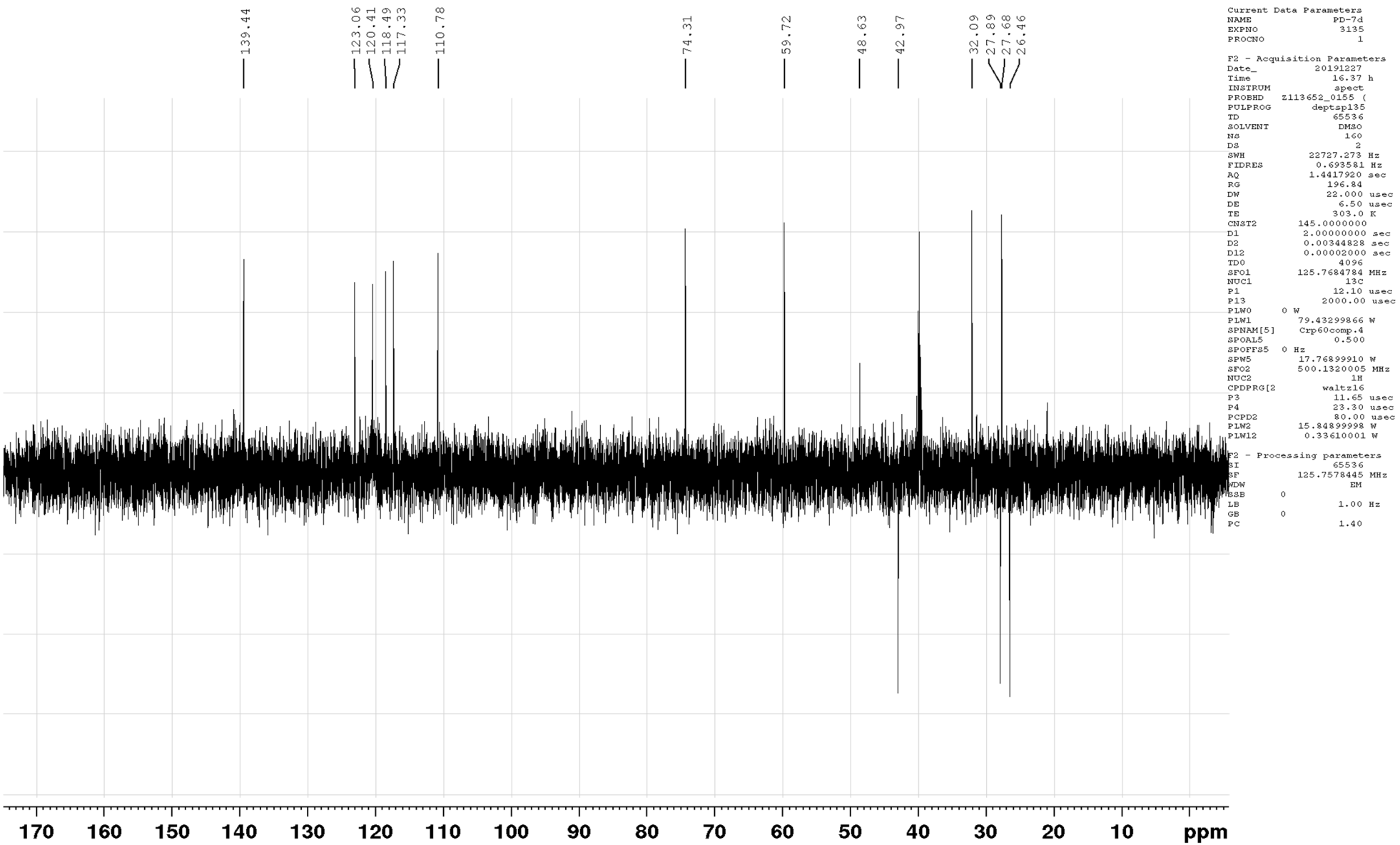


Figure S44. DEPT-135 NMR spectrum (125 MHz, DMSO-d_6) of **4**

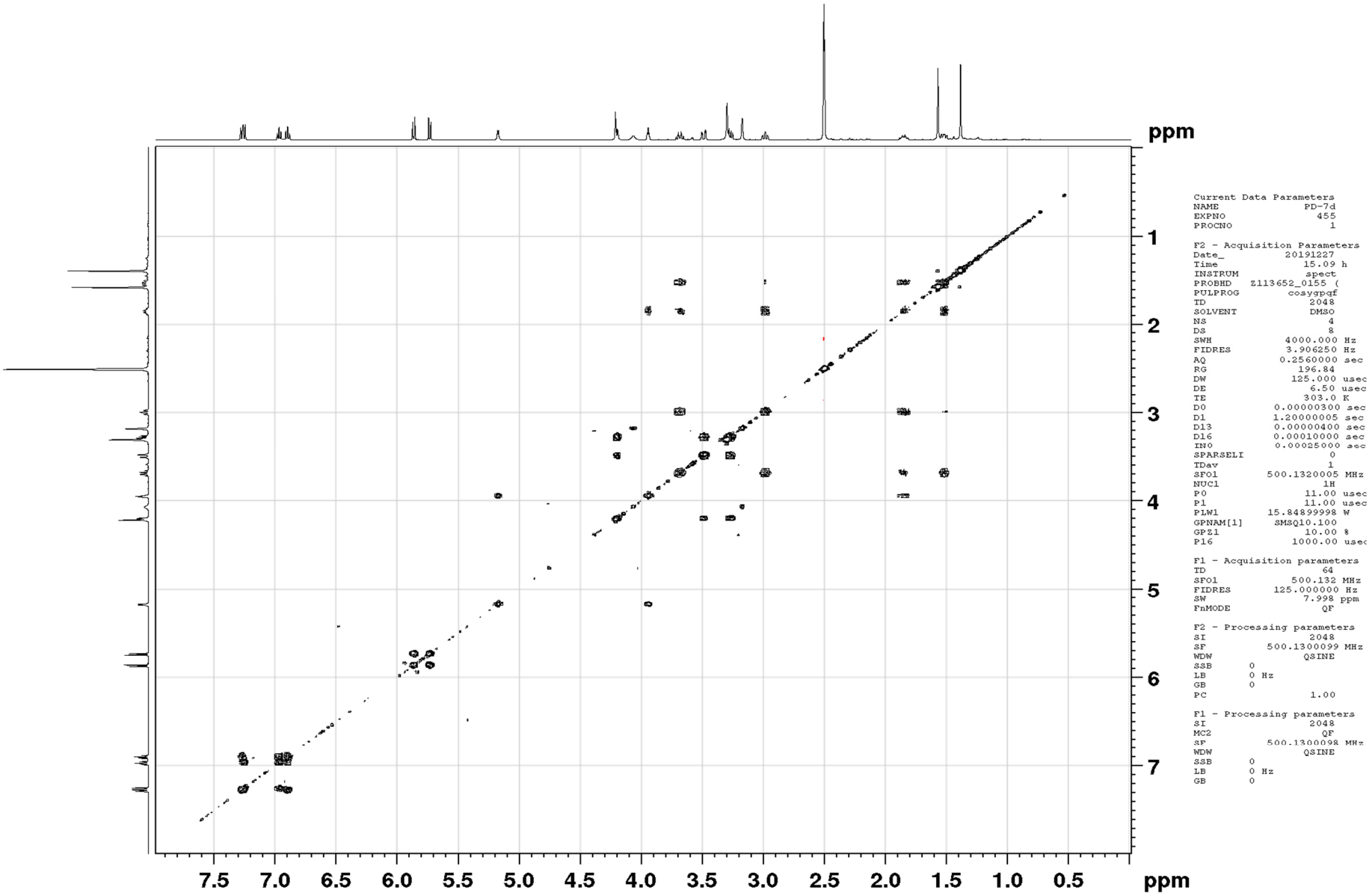
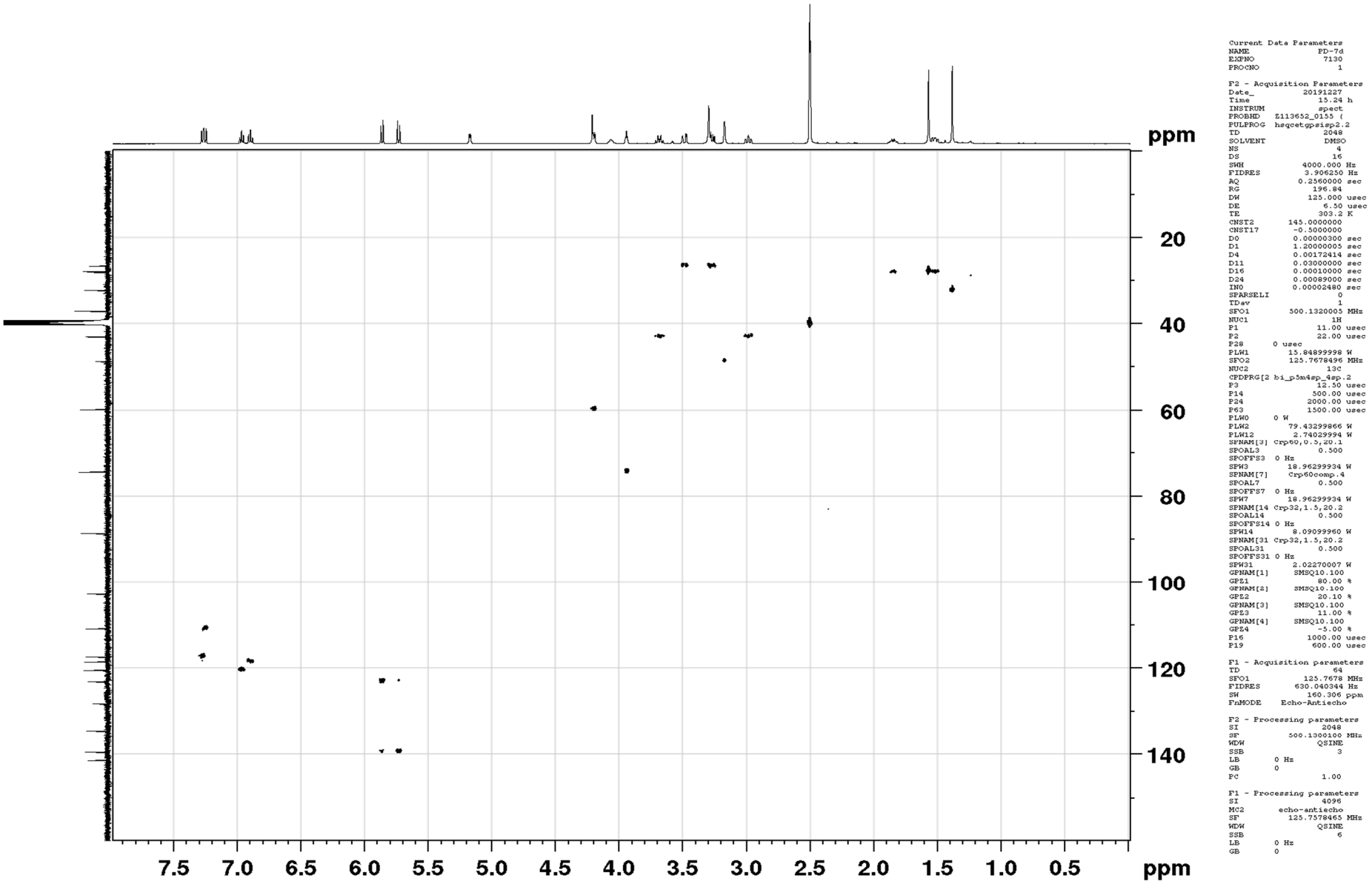


Figure S45. COSY-45 spectrum (500 MHz, DMSO-d_6) of **4**




```
Current Data Parameters
NAME                  PD-7d
EXPNO                  7130
PROCNO                    1

F2 - Acquisition Parameters
Date_               20191227
Time                   15.24 h
INSTRUM                spect
PROBHD    Z113652_0155 (
PULPROG   hsqcetgpsisp2.2
TD                     2048
SOLVENT                DMSO
NS                        4
DS                       16
SWH              4000.000 Hz
FIDRES              3.906250 Hz
AQ                0.2560000 sec
RG                   196.84
DW                 125.000 usec
DE                   6.50 usec
TE                  303.2 K
CNST2           145.0000000
CNST17           -0.5000000
D0                0.00000300 sec
D1                1.20000005 sec
D4                0.00172414 sec
D11               0.03000000 sec
D16               0.00010000 sec
D24               0.00089000 sec
IN0               0.00002480 sec
SFARSELI                  0
TDav                      1
SFO1           500.1320005 MHz
NUC1                    1H
P1                   11.00 usec
P2                   22.00 usec
P28         0 usec
PLW1          15.84899998 W
SFO2          125.7678496 MHz
NUC2                   13C
CPDPRG[2 bi_p5m4sp_4sp.2
P3                   12.50 usec
P14                 500.00 usec
P24                2000.00 usec
P63                1500.00 usec
PLW0        0 W
PLW2          79.43299866 W
PLW12          2.74029994 W
SPNAM[3] Crp60,0.5,20.1
SPOAL3                0.500
SPOFFS3     0 Hz
SPW3          18.96299934 W
SPNAM[7]     Crp60comp.4
SPOAL7                0.500
SPOFFS7     0 Hz
SPW7          18.96299934 W
SPNAM[14 Crp32,1.5,20.2
SPOAL14               0.500
SPOFFS14    0 Hz
SPW14          8.09099960 W
SPNAM[31 Crp32,1.5,20.2
SPOAL31               0.500
SPOFFS31    0 Hz
SPW31          2.02270007 W
GPNAM[1]      SMSQ10.100
GPZ1                 80.00 %
GPNAM[2]      SMSQ10.100
GPZ2                 20.10 %
GPNAM[3]      SMSQ10.100
GPZ3                 11.00 %
GPNAM[4]      SMSQ10.100
GPZ4                 -5.00 %
P16                1000.00 usec
P19                 600.00 usec

F1 - Acquisition parameters
TD                       64
SFO1            125.7678 MHz
FIDRES          630.040344 Hz
SW                160.306 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                     2048
SF            500.1300100 MHz
WDW                   QSINE
SSB                       3
LB          0 Hz
GB          0
PC                     1.00

F1 - Processing parameters
SI                     4096
MC2         echo-antiecho
SF            125.7578465 MHz
WDW                   QSINE
SSB                       6
LB          0 Hz
GB          0
```

Figure S46. HSQC spectrum (500 MHz, DMSO-d_6) of **4**

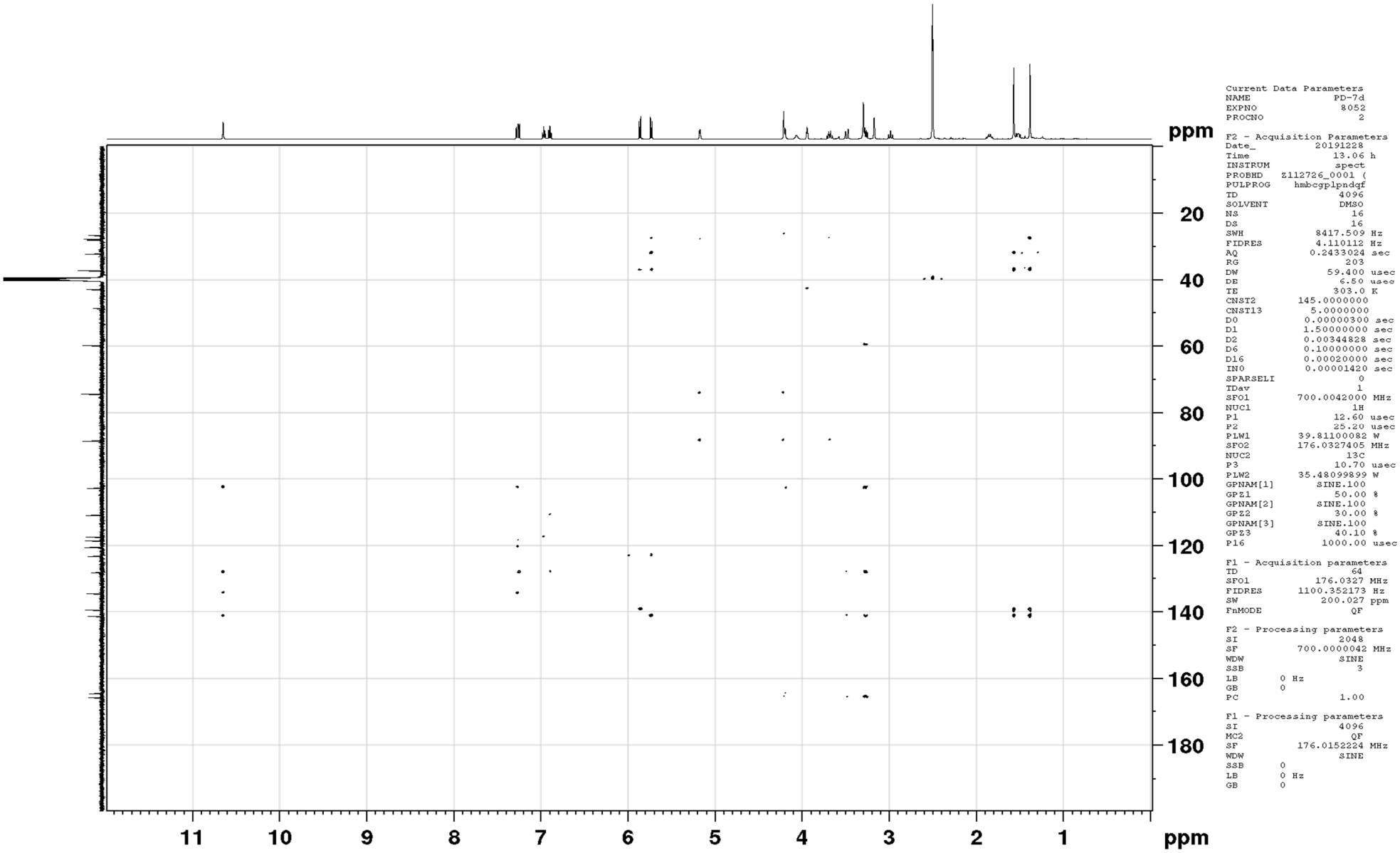
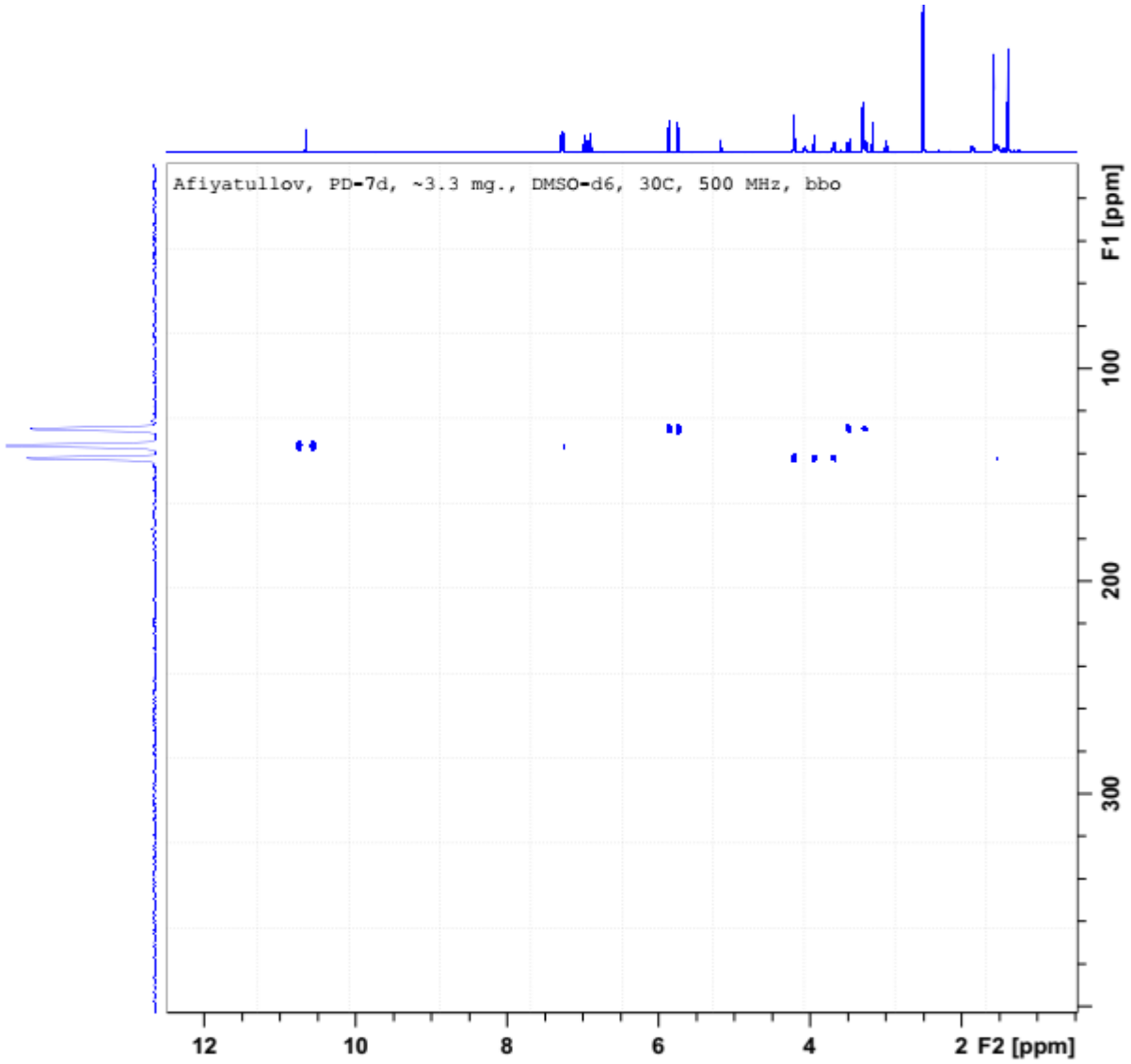


Figure S47. ^{1}H-^{13}C HMBC spectrum (700 MHz, DMSO-d_6) of **4**




```
Current Data Parameters
NAME                  PD-7d
EXPNO                  8552
PROCNO                    1

F2 - Acquisition Parameters
Date_              20191229
Time                 17.40 h
INSTRUM               spect
PROBHD    Z113652_0155 (
PULPROG         hmbcgpndqf
TD                      4096
SOLVENT                 DMSO
NS                      1024
DS                        16
SWH                6009.615 Hz
FIDRES             2.934382 Hz
AQ                 0.3407872 sec
RG                    196.84
DW                    83.200 usec
DE                     6.50 usec
TE                    303.0 K
CNST13             5.0000000
D0                 0.00000300 sec
D1                 1.79999995 sec
D6                 0.10000000 sec
D16                0.00020000 sec
IN0                0.00002470 sec
SPARSELI                  0
TDav                      1
SFO1            500.1332508 MHz
NUC1                     1H
P1                    11.65 usec
P2                    23.30 usec
PLW1           15.84899998 W
SFO2            50.6878685 MHz
NUC2                    15N
P3                    16.00 usec
PLW2          158.49000549 W
GPNAM[1]        SMSQ10.100
GPZ1                  70.00 %
GPNAM[2]        SMSQ10.100
GPZ2                  30.00 %
GPNAM[3]        SMSQ10.100
GPZ3                  50.10 %
P16                 1000.00 usec

F1 - Acquisition parameters
TD                        24
SFO1              50.68787 MHz
FIDRES         1686.909546 Hz
SW                399.364 ppm
FnMODE                   QF

F2 - Processing parameters
SI                      4096
SF              500.1300108 MHz
WDW                    QSINE
SSB                        3
LB          0 Hz
GB          0
PC                      1.00

F1 - Processing parameters
SI                      4096
MC2                      QF
SF              50.6775627 MHz
WDW                    QSINE
SSB         0
LB          0 Hz
GB          0
```

Figure S48. ^{1}H-^{15}N GHMBC spectrum (50 MHz, DMSO-d_6) of **4**

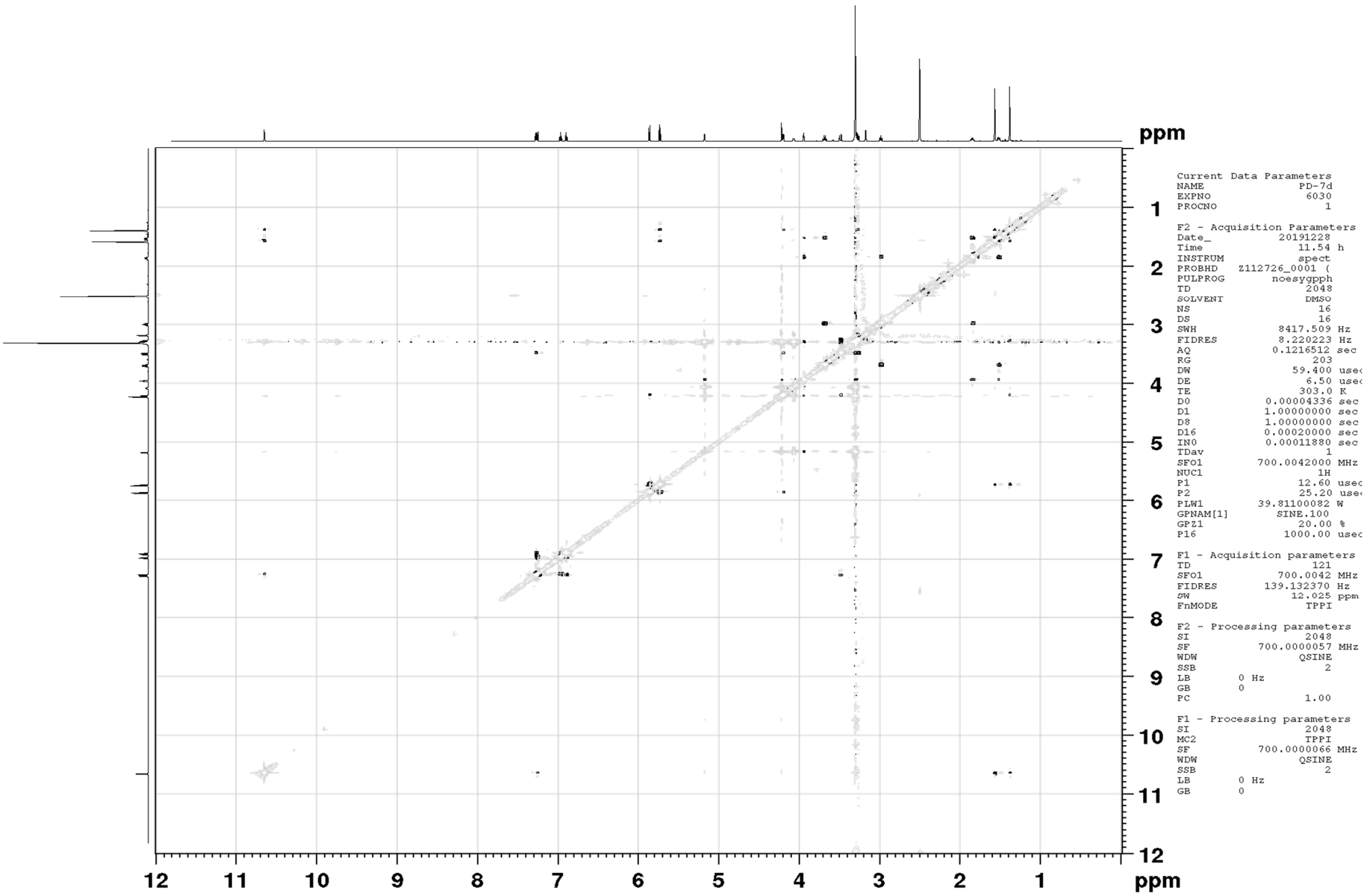


Figure S49. NOESY spectrum (700 MHz, DMSO-d_6) of **4**

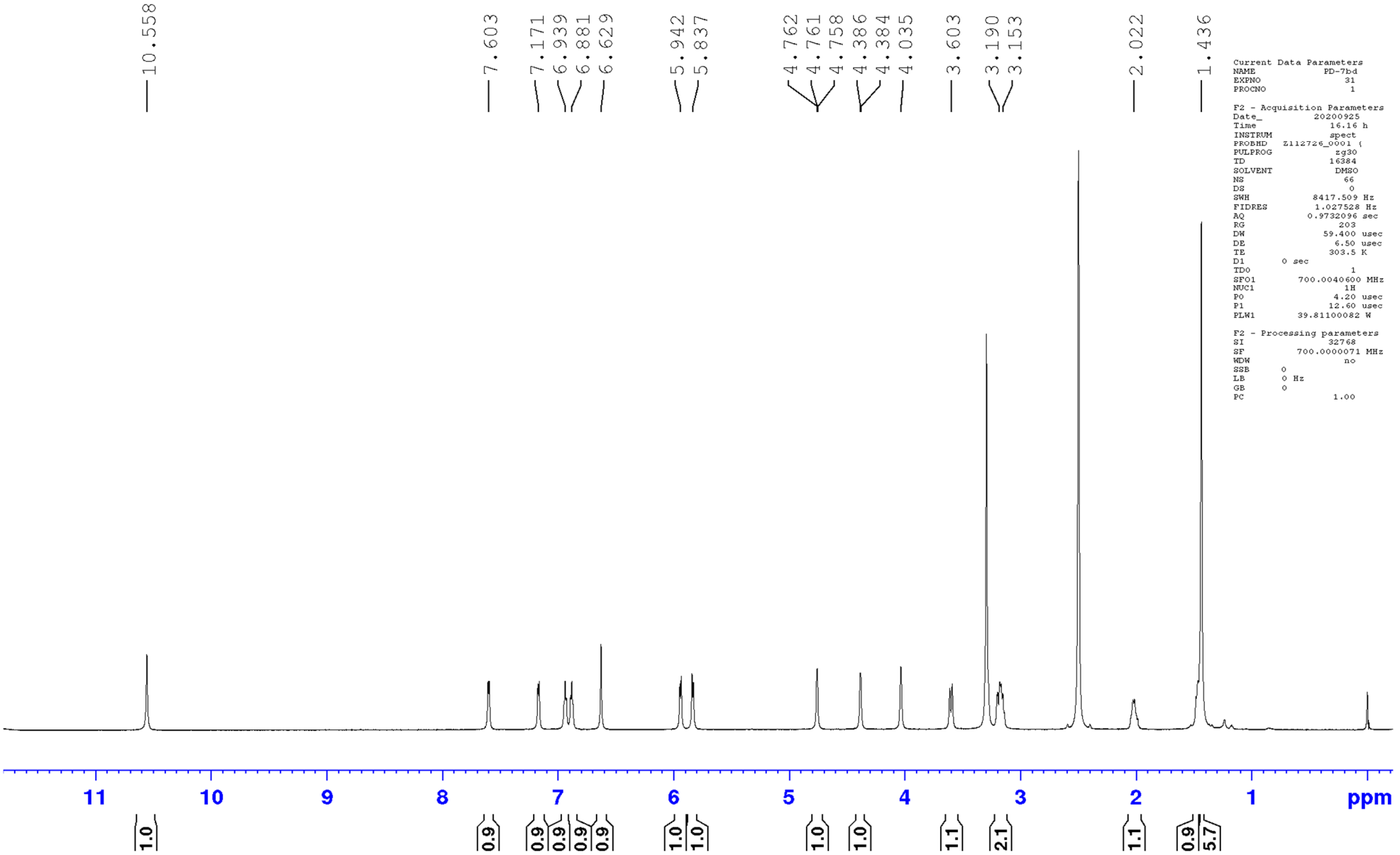


Figure S50. ^{1}H NMR spectrum (700 MHz, DMSO-d6) of **5**

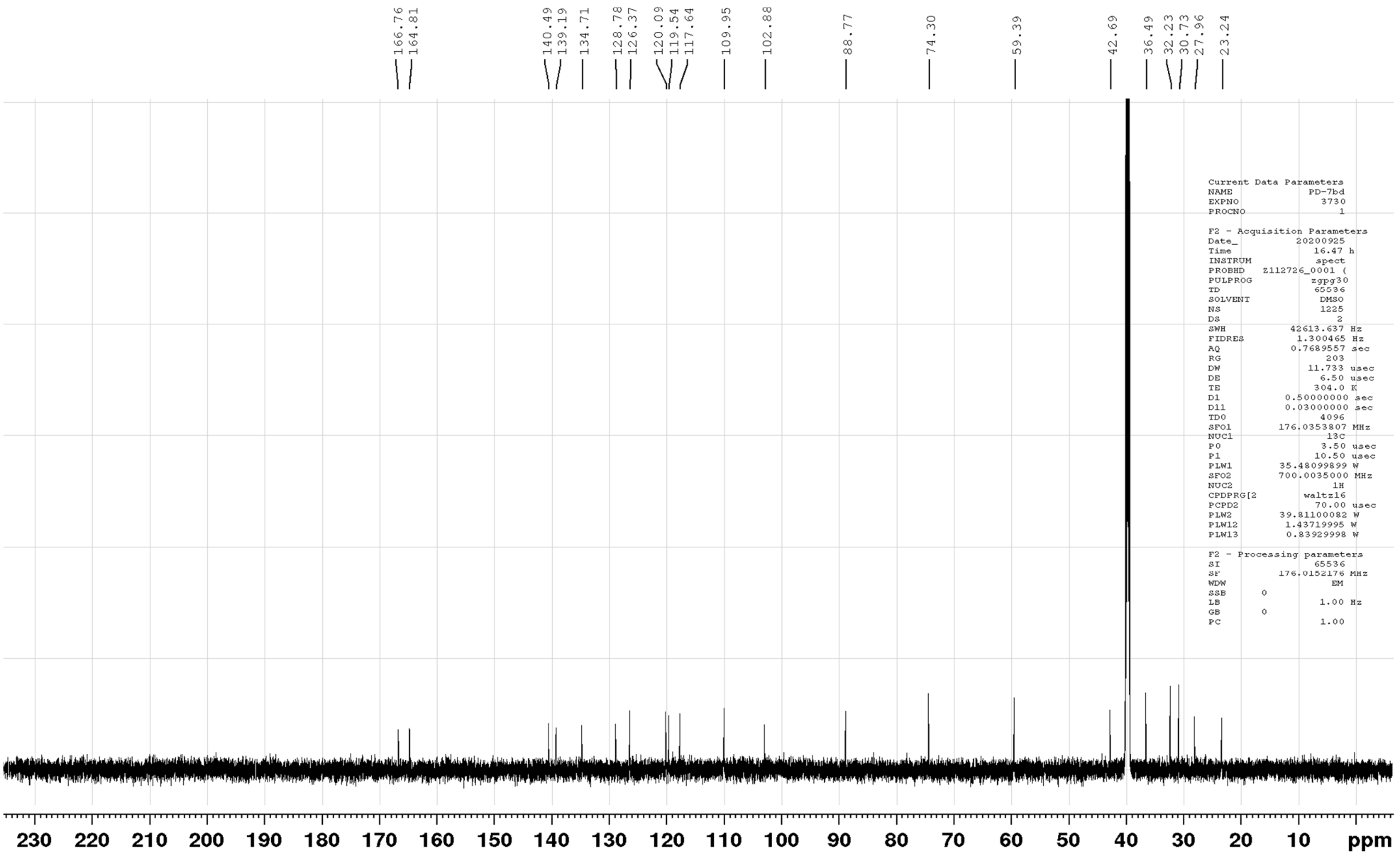


Figure S51. ^{13}C NMR spectrum (176 MHz, DMSO-d6) of **5**

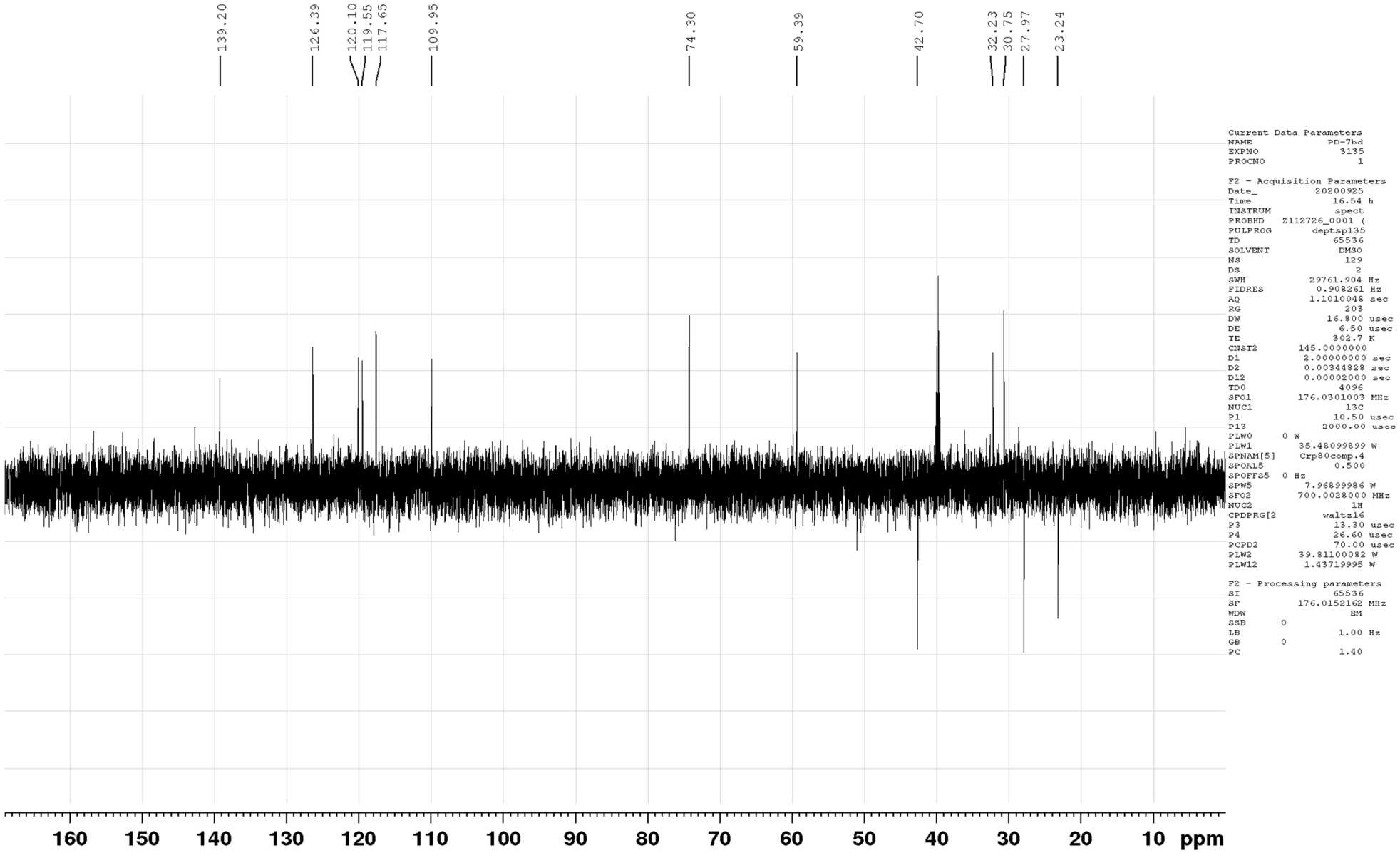
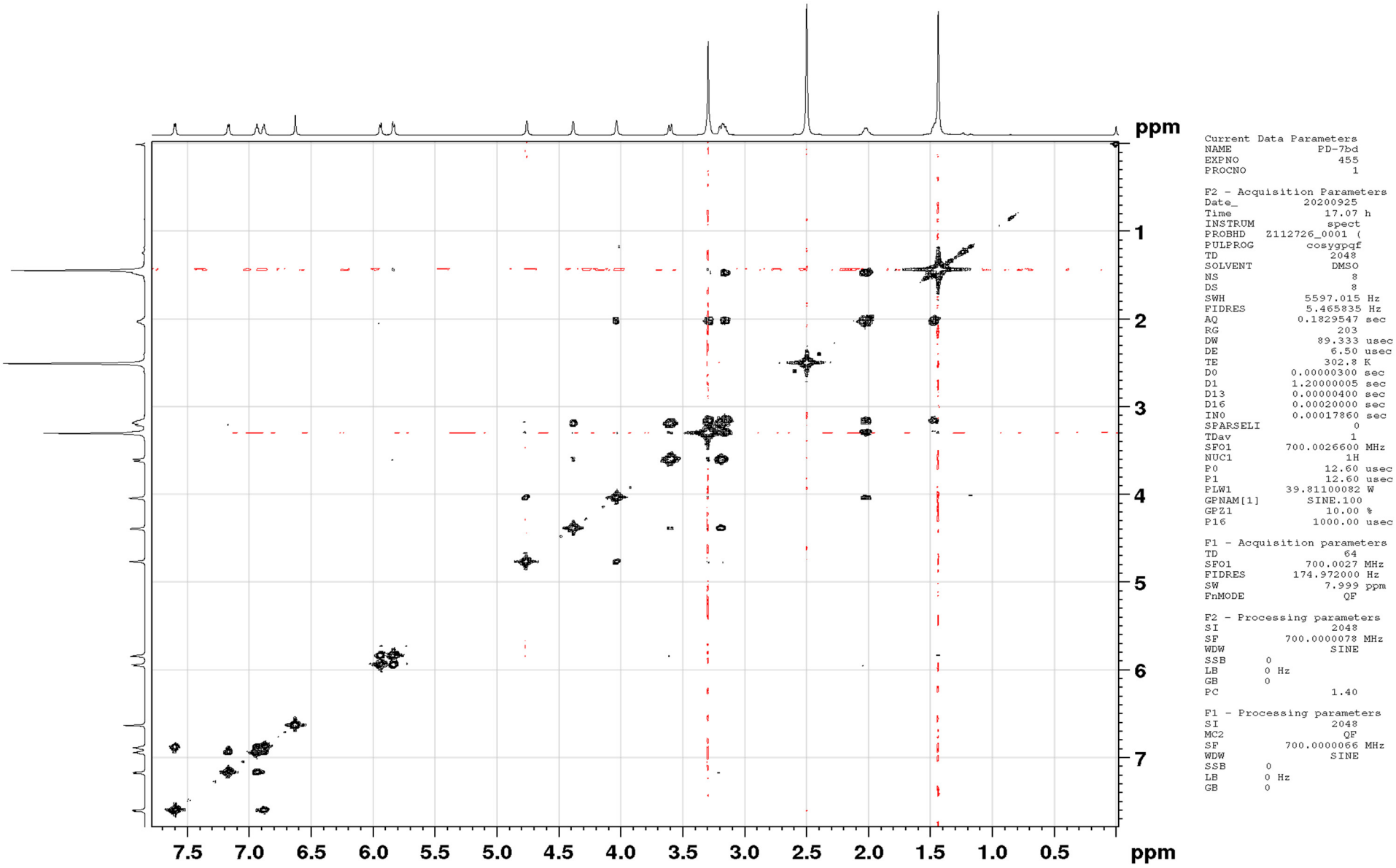


Figure S52. DEPT-135 NMR spectrum (176 MHz, DMSO-d6) of **5**




```
Current Data Parameters
NAME                  PD-7bd
EXPNO                    455
PROCNO                     1

F2 - Acquisition Parameters
Date_              20200925
Time                 17.07 h
INSTRUM               spect
PROBHD    Z112726_0001 (
PULPROG           cosygpqf
TD                     2048
SOLVENT                DMSO
NS                        8
DS                        8
SWH                5597.015 Hz
FIDRES             5.465835 Hz
AQ                 0.1829547 sec
RG                       203
DW                    89.333 usec
DE                     6.50 usec
TE                    302.8 K
D0                 0.00000300 sec
D1                 1.20000005 sec
D13                0.00000400 sec
D16                0.00020000 sec
IN0                0.00017860 sec
SPARSELI                  0
TDav                      1
SFO1           700.0026600 MHz
NUC1                     1H
P0                    12.60 usec
P1                    12.60 usec
PLW1           39.81100082 W
GPNAM[1]          SINE.100
GPZ1                 10.00 %
P16                1000.00 usec

F1 - Acquisition parameters
TD                        64
SFO1               700.0027 MHz
FIDRES             174.972000 Hz
SW                   7.999 ppm
FnMODE                   QF

F2 - Processing parameters
SI                     2048
SF             700.0000078 MHz
WDW                    SINE
SSB          0
LB           0 Hz
GB           0
PC                     1.40

F1 - Processing parameters
SI                     2048
MC2                      QF
SF             700.0000066 MHz
WDW                    SINE
SSB          0
LB           0 Hz
GB           0
```

Figure S53. COSY-45 spectrum (700 MHz, DMSO-d6) of **5**

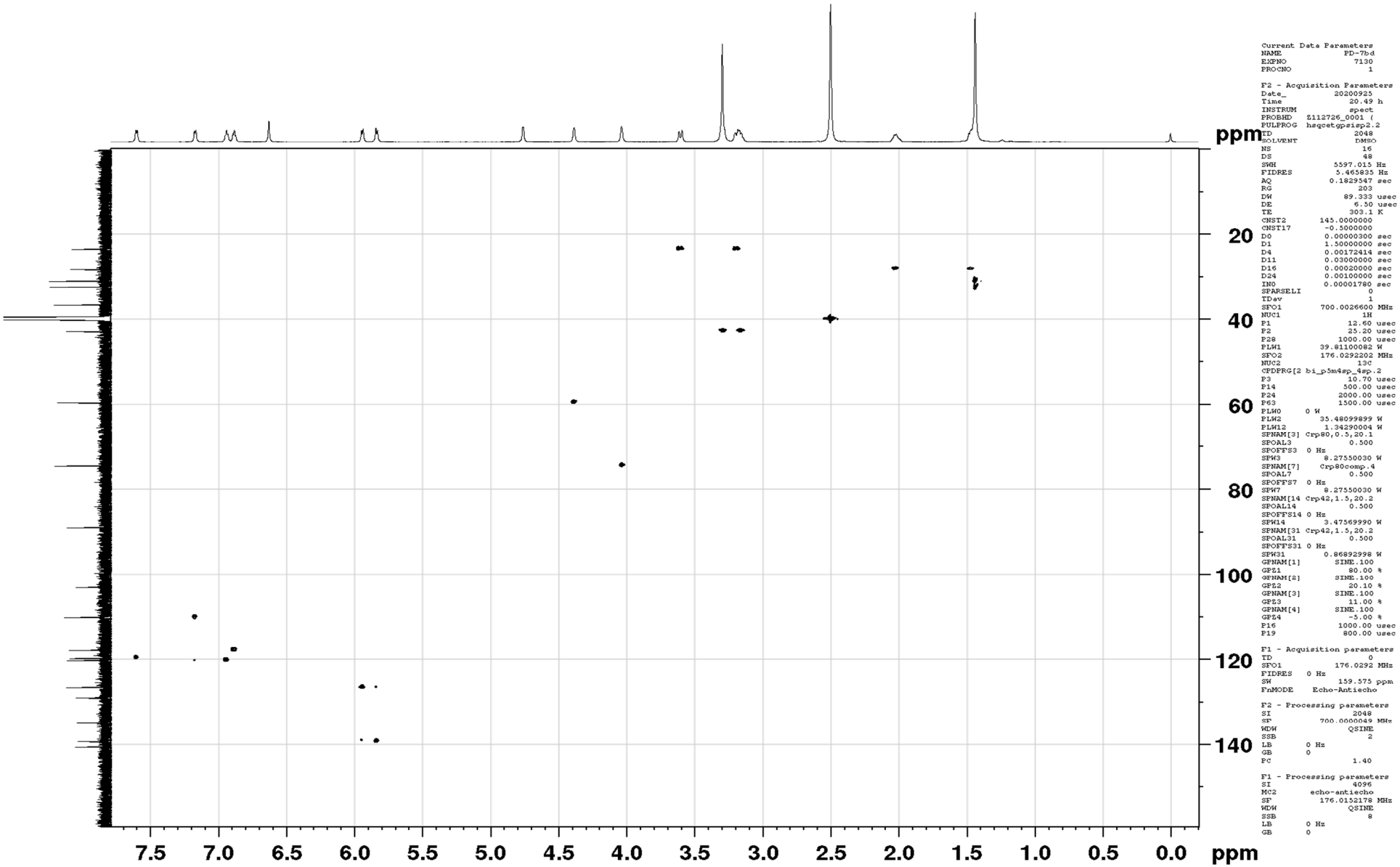
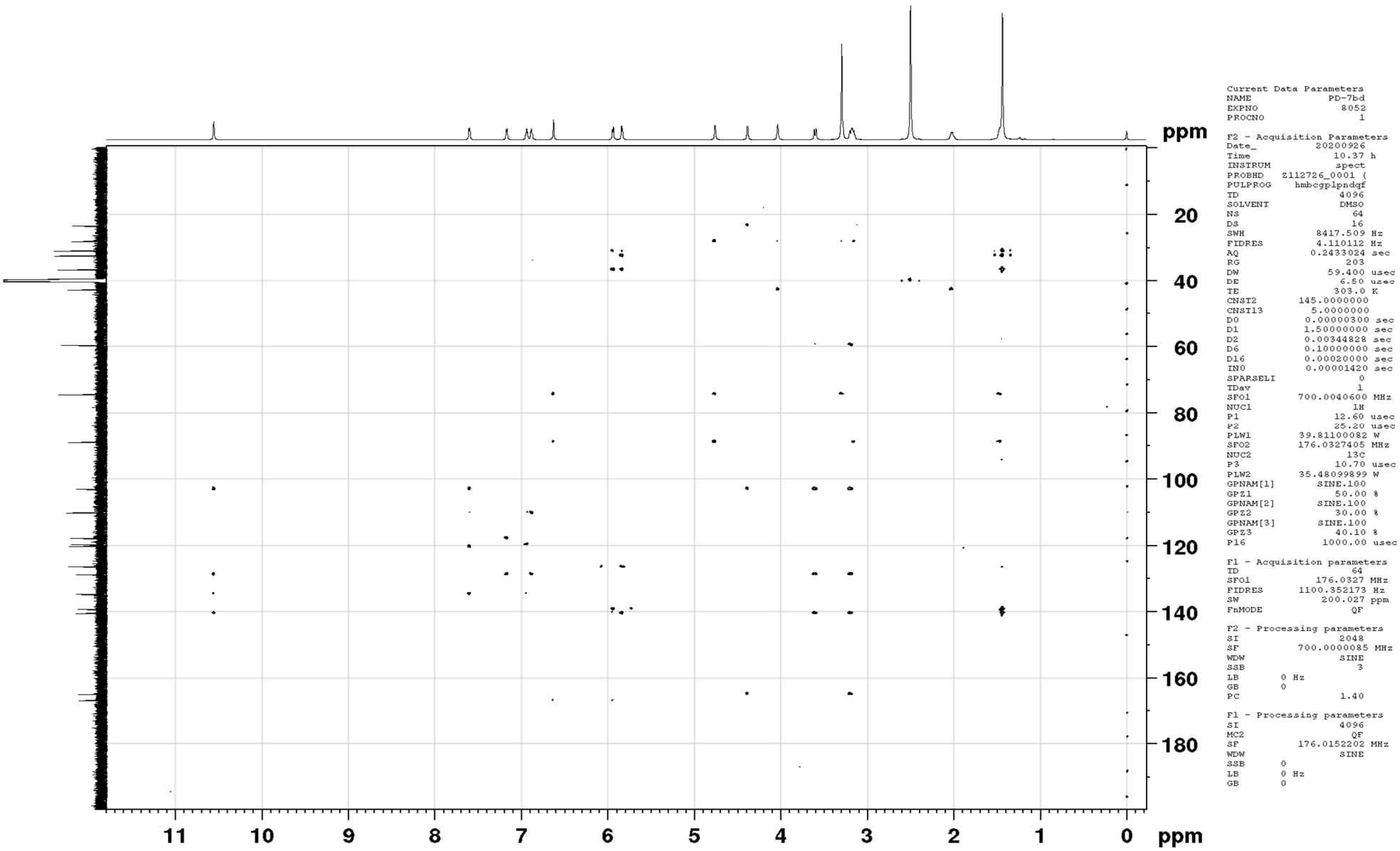


Figure S54. HSQC spectrum (700 MHz, DMSO-d6) of **5**




```
Current Data Parameters
NAME                  PD-7bd
EXPNO                   8052
PROCNO                     1

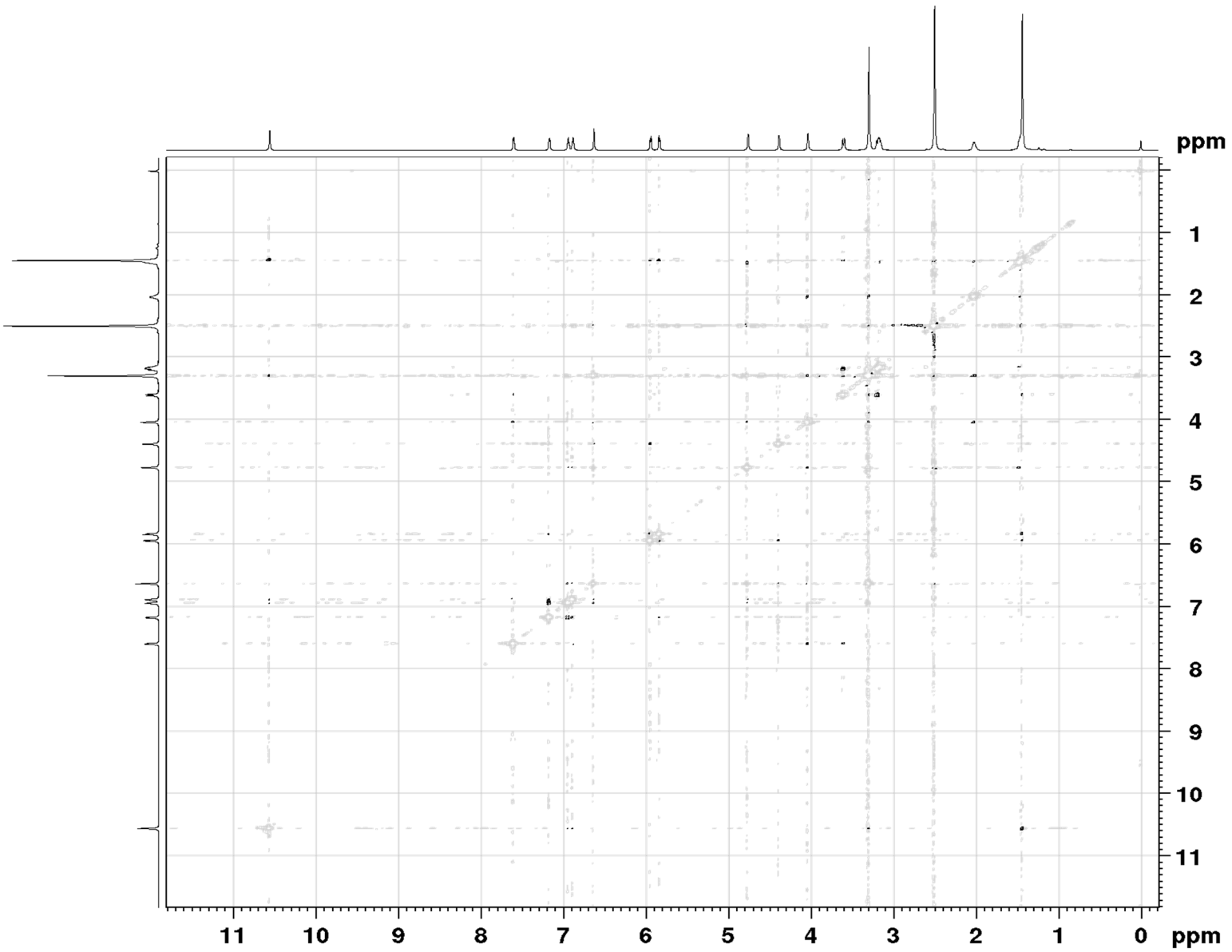
F2 - Acquisition Parameters
Date_               20200926
Time                  10.37 h
INSTRUM                spect
PROBHD    Z112726_0001 (
PULPROG     hmbcgplpndqf
TD                      4096
SOLVENT                 DMSO
NS                        64
DS                        16
SWH                 8417.509 Hz
FIDRES              4.110112 Hz
AQ                  0.2433024 sec
RG                        203
DW                   59.400 usec
DE                    6.50 usec
TE                    303.0 K
CNST2              145.0000000
CNST13               5.0000000
D0                  0.00000300 sec
D1                  1.50000000 sec
D2                  0.00344828 sec
D6                  0.10000000 sec
D16                 0.00020000 sec
IN0                 0.00001420 sec
SPARSELI                   0
TDav                       1
SF01              700.0040600 MHz
NUC1                      1H
P1                    12.60 usec
P2                    25.20 usec
PLW1              39.81100082 W
SFO2              176.0327405 MHz
NUC2                      13C
P3                    10.70 usec
PLW2              35.48099899 W
GPNAM[1]             SINE.100
GPZ1                  50.00 %
GPNAM[2]             SINE.100
GPZ2                  30.00 %
GPNAM[3]             SINE.100
GPZ3                  40.10 %
P16                 1000.00 usec

F1 - Acquisition parameters
TD                        64
SFO1               176.0327 MHz
FIDRES            1100.352173 Hz
SW                  200.027 ppm
FnMODE                    QF

F2 - Processing parameters
SI                      2048
SF                700.0000085 MHz
WDW                     SINE
SSB                        3
LB                0 Hz
GB                0
PC                      1.40

F1 - Processing parameters
SI                      4096
MC2                       QF
SF                176.0152202 MHz
WDW                     SINE
SSB               0
LB                0 Hz
GB                0
```

Figure S55. HMBC spectrum (700 MHz, DMSO-d6) of **5**




```
Current Data Parameters
NAME                  PD-7bd
EXPNO                   6030
PROCNO                     1

F2 - Acquisition Parameters
Date_               20200925
Time                  17.21 h
INSTRUM                 spect
PROBHD    Z112726_0001 (
PULPROG           noesygpph
TD                      2048
SOLVENT                 DMSO
NS                        32
DS                        16
SWH                 8417.509 Hz
FIDRES              8.220223 Hz
AQ                  0.1216512 sec
RG                        203
DW                     59.400 usec
DE                      6.50 usec
TE                     303.0 K
D0                  0.00004336 sec
D1                  1.00000000 sec
D8                  1.00000000 sec
D16                 0.00020000 sec
IN0                 0.00011880 sec
SPARSELI                   0
TDav                       1
SFO1              700.0040600 MHz
NUC1                      1H
P1                     12.60 usec
P2                     25.20 usec
PLW1             39.81100082 W
GPNAM[1]            SINE.100
GPZ1                   20.00 %
P16                  1000.00 usec

F1 - Acquisition parameters
TD                        128
SFO1               700.0041 MHz
FIDRES             131.523575 Hz
SW                     12.025 ppm
FnMODE                   TPPI

F2 - Processing parameters
SI                      2048
SF              700.0000000 MHz
WDW                     QSINE
SSB                        2
LB          0 Hz
GB          0
PC                      1.40

F1 - Processing parameters
SI                      2048
MC2                     TPPI
SF              700.0000000 MHz
WDW                     QSINE
SSB                        2
LB          0 Hz
GB          0
```

Figure S56. NOESY spectrum (700 MHz, DMSO-d6) of **5**

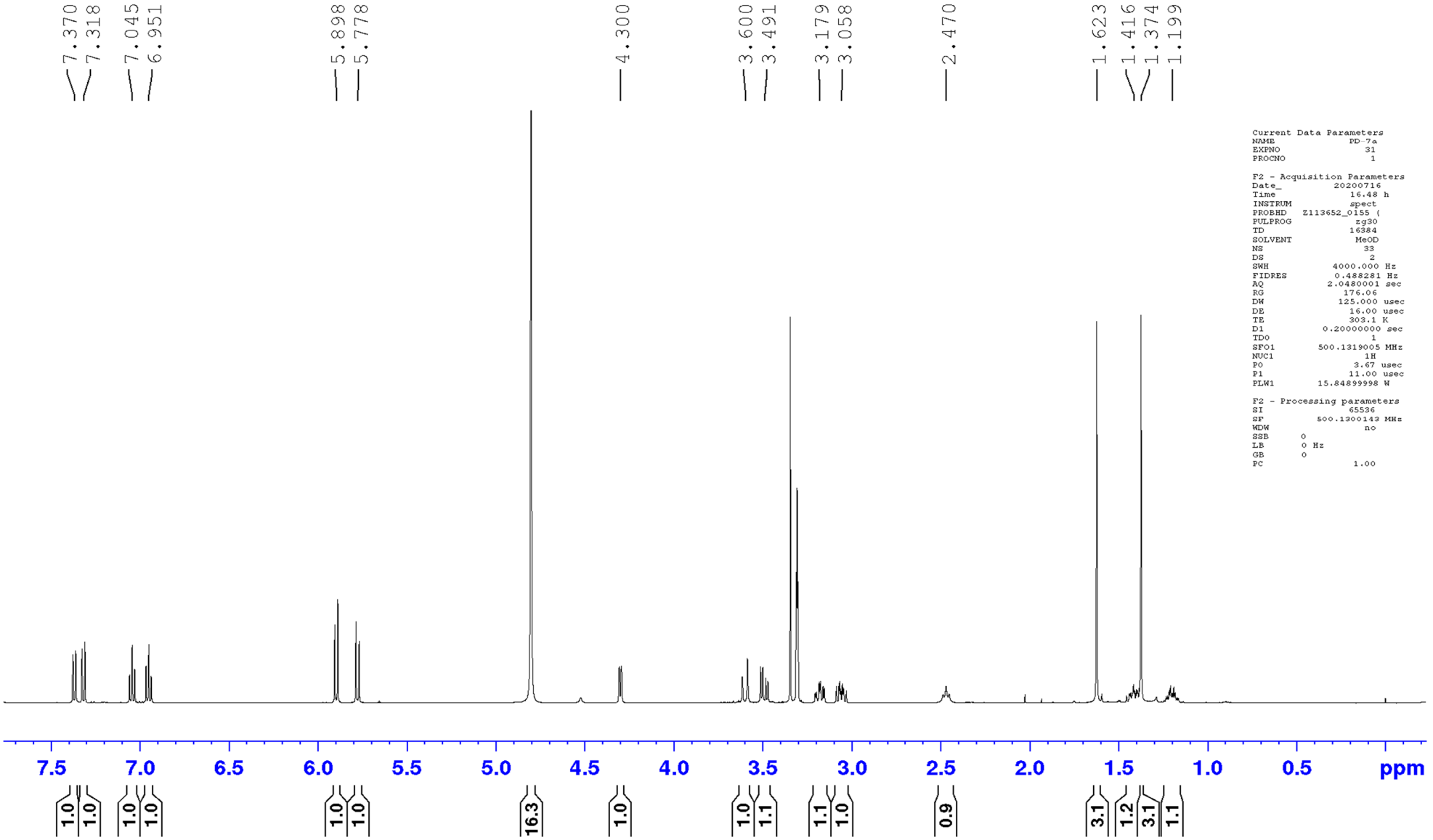


Figure S57. ^{1}H NMR spectrum (500 MHz, CD_3OD) of **6**

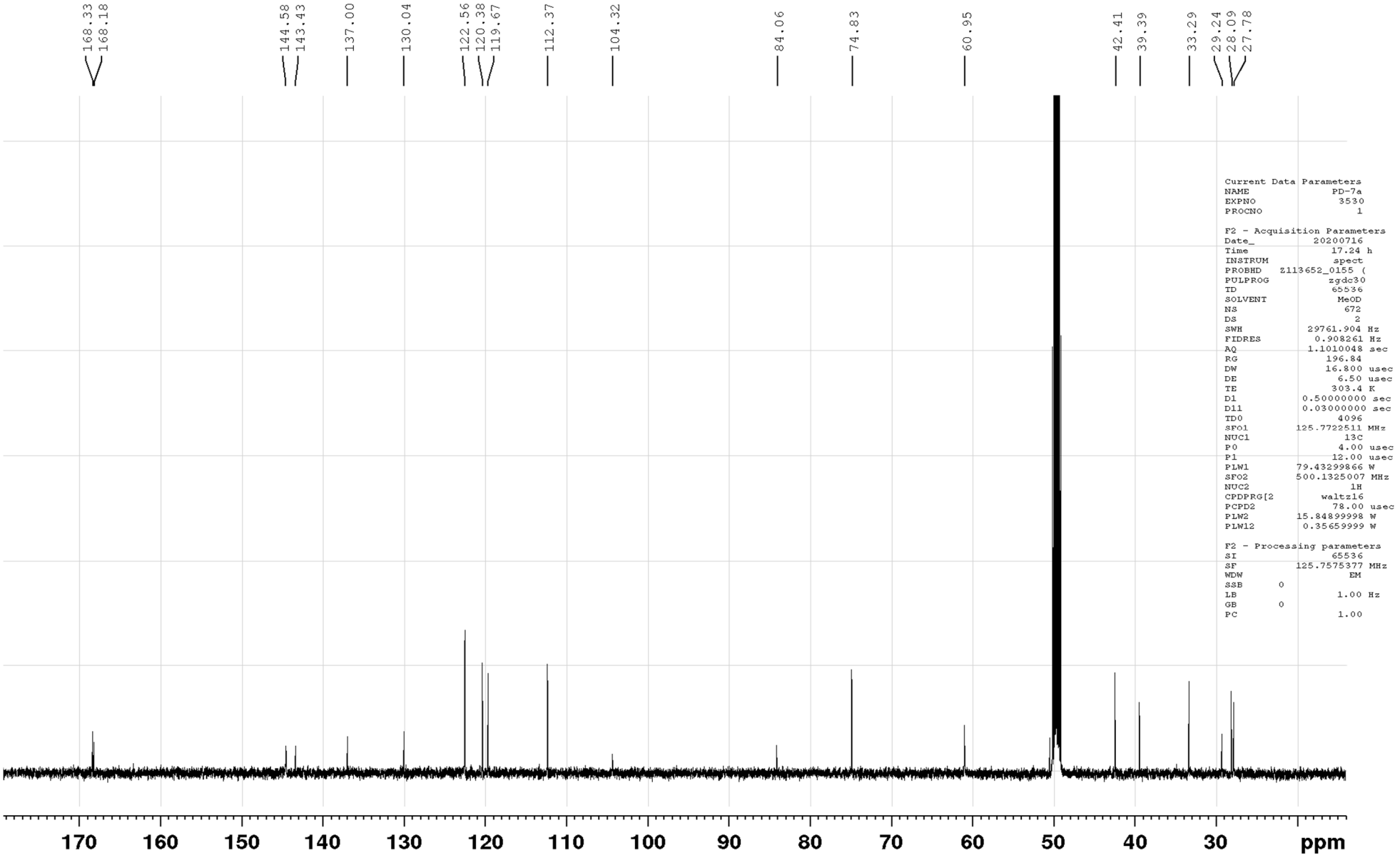


Figure S58. ^{13}C NMR spectrum (125 MHz, CD_3OD) of **6**

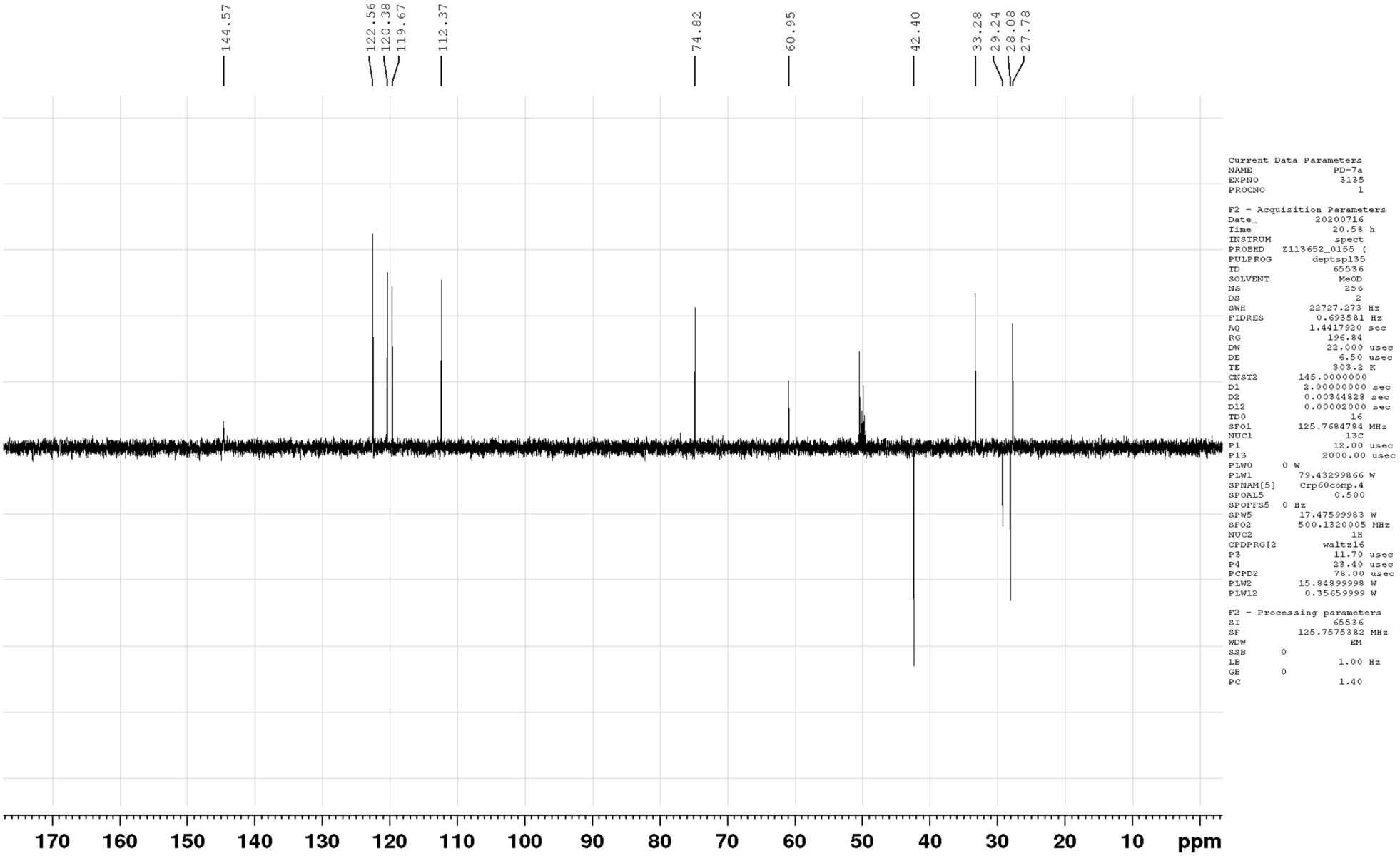
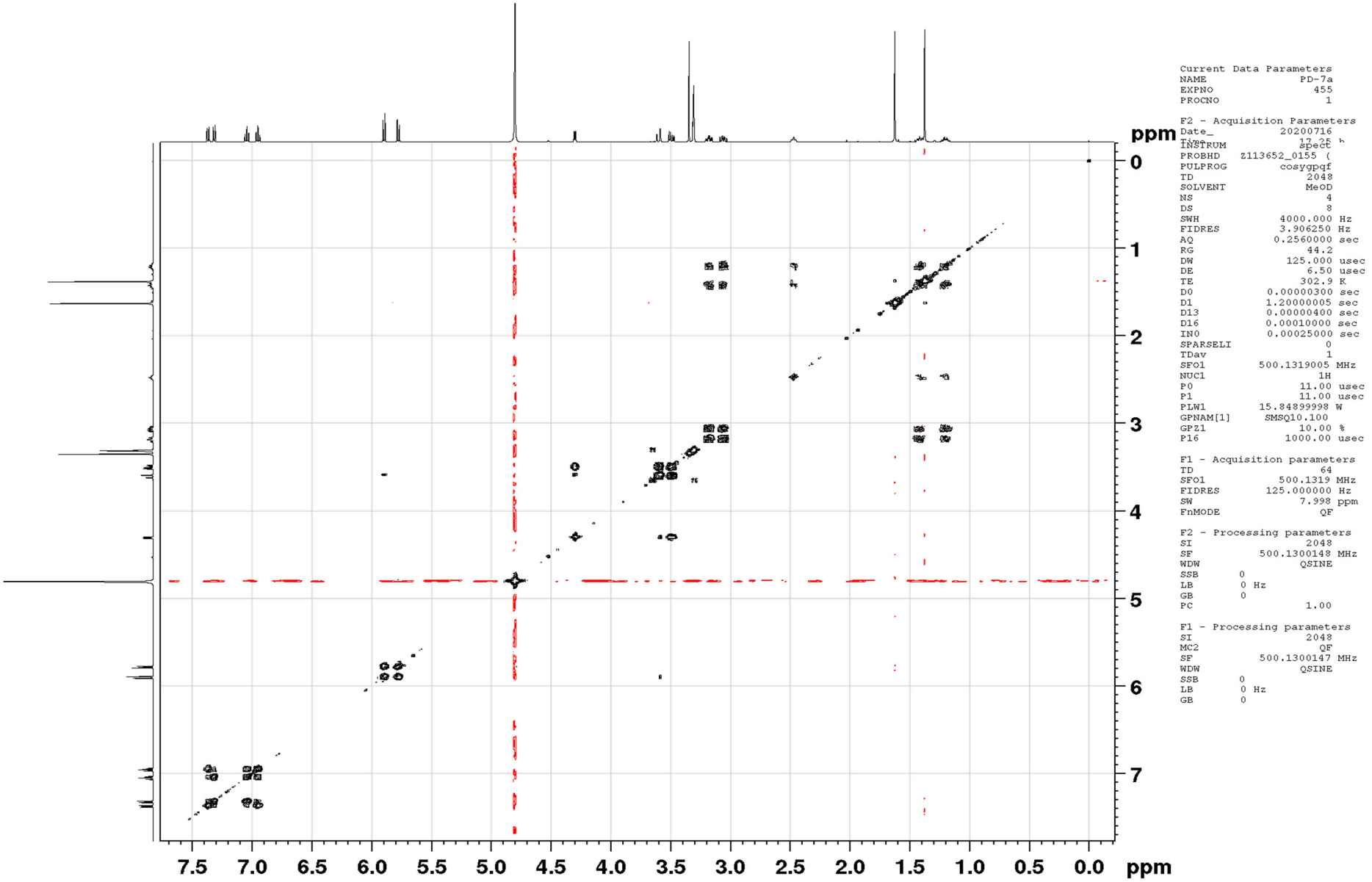


Figure S59. DEPT-135 NMR spectrum (125 MHz, CD_3OD) of **6**




```
Current Data Parameters
NAME                  PD-7a
EXPNO                   455
PROCNO                    1

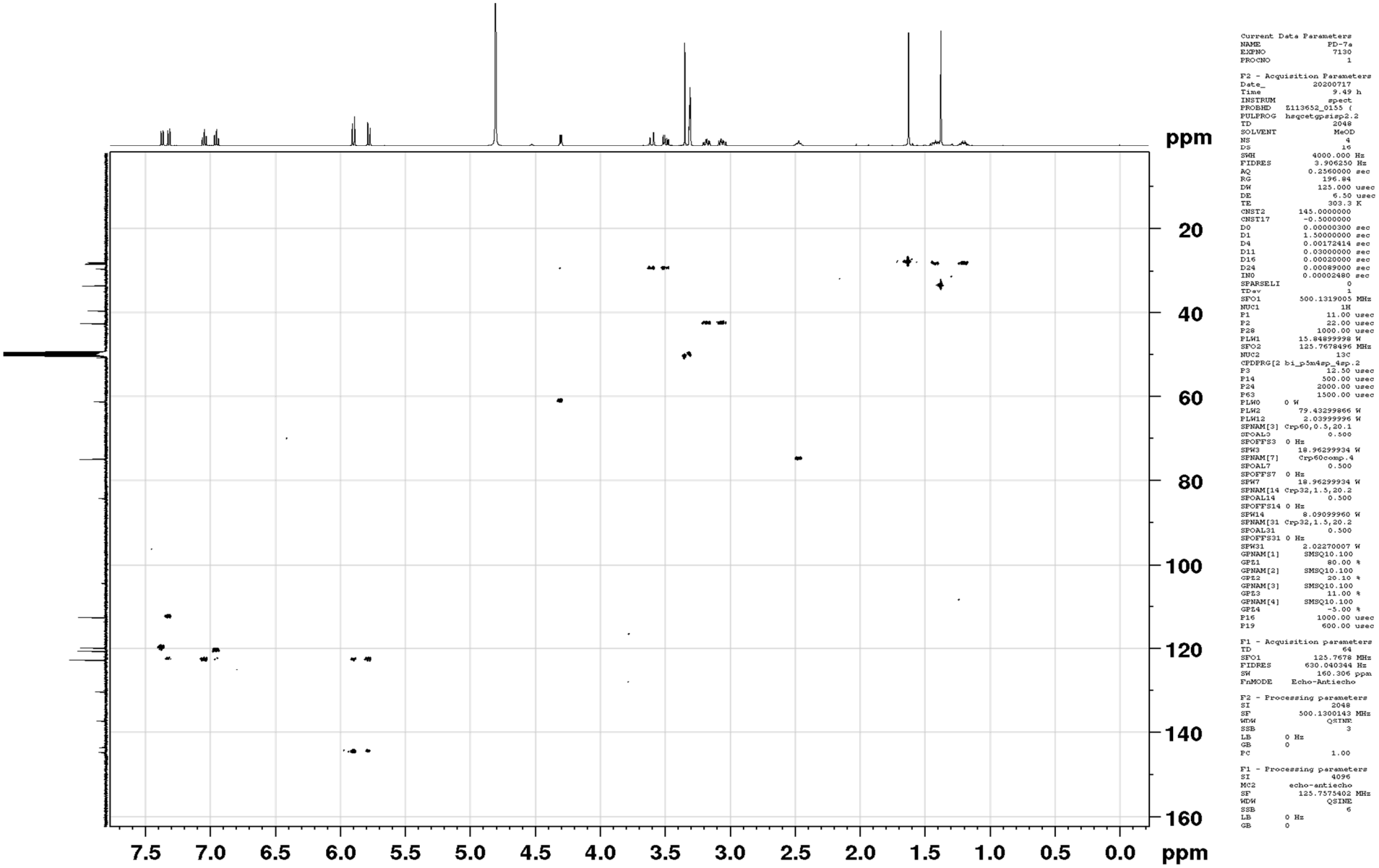
F2 - Acquisition Parameters
Date_              20200716
TIME                  17.25 h
INSTRUM                spect
PROBHD    Z113652_0155 (
PULPROG            cosygpqf
TD                     2048
SOLVENT                MeOD
NS                        4
DS                        8
SWH                4000.000 Hz
FIDRES                3.906250 Hz
AQ                 0.2560000 sec
RG                     44.2
DW                  125.000 usec
DE                    6.50 usec
TE                   302.9 K
D0                 0.00000300 sec
D1                 1.20000005 sec
D13                0.00000400 sec
D16                0.00010000 sec
IN0                0.00025000 sec
SPARSELI                  0
TDav                      1
SFO1           500.1319005 MHz
NUC1                    1H
P0                   11.00 usec
P1                   11.00 usec
PLW1          15.84899998 W
GPNAM[1]       SMSQ10.100
GPZ1                 10.00 %
P16                1000.00 usec

F1 - Acquisition parameters
TD                       64
SFO1              500.1319 MHz
FIDRES          125.000000 Hz
SW                    7.998 ppm
FnMODE                   QF

F2 - Processing parameters
SI                     2048
SF             500.1300148 MHz
WDW                   QSINE
SSB          0
LB           0 Hz
GB           0
PC                     1.00

F1 - Processing parameters
SI                     2048
MC2                      QF
SF             500.1300147 MHz
WDW                   QSINE
SSB          0
LB           0 Hz
GB           0
```

Figure S60. COSY-45 spectrum (500 MHz, CD_3OD) of **6**




```
Current Data Parameters
NAME                  PD-7a
EXPNO                  7130
PROCNO                    1

F2 - Acquisition Parameters
Date_              20200717
Time                   9.49 h
INSTRUM               spect
PROBHD    Z113652_0155 (
PULPROG   hsqcetgpsisp2.2
TD                     2048
SOLVENT                MeOD
NS                        4
DS                       16
SWH                4000.000 Hz
FIDRES                3.906250 Hz
AQ                 0.2560000 sec
RG                     196.84
DW                   125.000 usec
DE                     6.50 usec
TE                     303.3 K
CNST2              145.0000000
CNST17              -0.5000000
D0                 0.00000300 sec
D1                 1.50000000 sec
D4                 0.00172414 sec
D11                0.03000000 sec
D16                0.00020000 sec
D24                0.00089000 sec
IN0                0.00002480 sec
SPARSELI                  0
TDsv                      1
SFO1               500.1319005 MHz
NUC1                      1H
P1                     11.00 usec
P2                     22.00 usec
P28                  1000.00 usec
PLW1              15.84899998 W
SFO2               125.7678496 MHz
NUC2                      13C
CPDPRG[2 bi_p5m4sp_4sp.2
P3                     12.50 usec
P14                   500.00 usec
P24                  2000.00 usec
P63                  1500.00 usec
PLW0      0 W
PLW2               79.43299866 W
PLW12              2.03999996 W
SPNAM[3] Crp60,0.5,20.1
SPOAL3                0.500
SPOFFS3   0 Hz
SPW3               18.96299934 W
SPNAM[7]    Crp60comp.4
SPOAL7                0.500
SPOFFS7   0 Hz
SPW7               18.96299934 W
SPNAM[14 Crp32,1.5,20.2
SPOAL14               0.500
SPOFFS14 0 Hz
SPW14              8.09099960 W
SPNAM[31 Crp32,1.5,20.2
SPOAL31               0.500
SPOFFS31 0 Hz
SPW31              2.02270007 W
GPNAM[1]      SMSQ10.100
GPZ1                 80.00 %
GPNAM[2]      SMSQ10.100
GPZ2                 20.10 %
GPNAM[3]      SMSQ10.100
GPZ3                 11.00 %
GPNAM[4]      SMSQ10.100
GPZ4                 -5.00 %
P16                  1000.00 usec
P19                   600.00 usec

F1 - Acquisition parameters
TD                       64
SFO1               125.7678 MHz
FIDRES            630.040344 Hz
SW                 160.306 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                     2048
SF                500.1300143 MHz
WDW                    QSINE
SSB                       3
LB        0 Hz
GB        0
PC                     1.00

F1 - Processing parameters
SI                     4096
MC2          echo-antiecho
SF                125.7575402 MHz
WDW                    QSINE
SSB                       6
LB        0 Hz
GB        0
```

Figure S61. HSQC spectrum (500 MHz, CD_3OD) of **6**

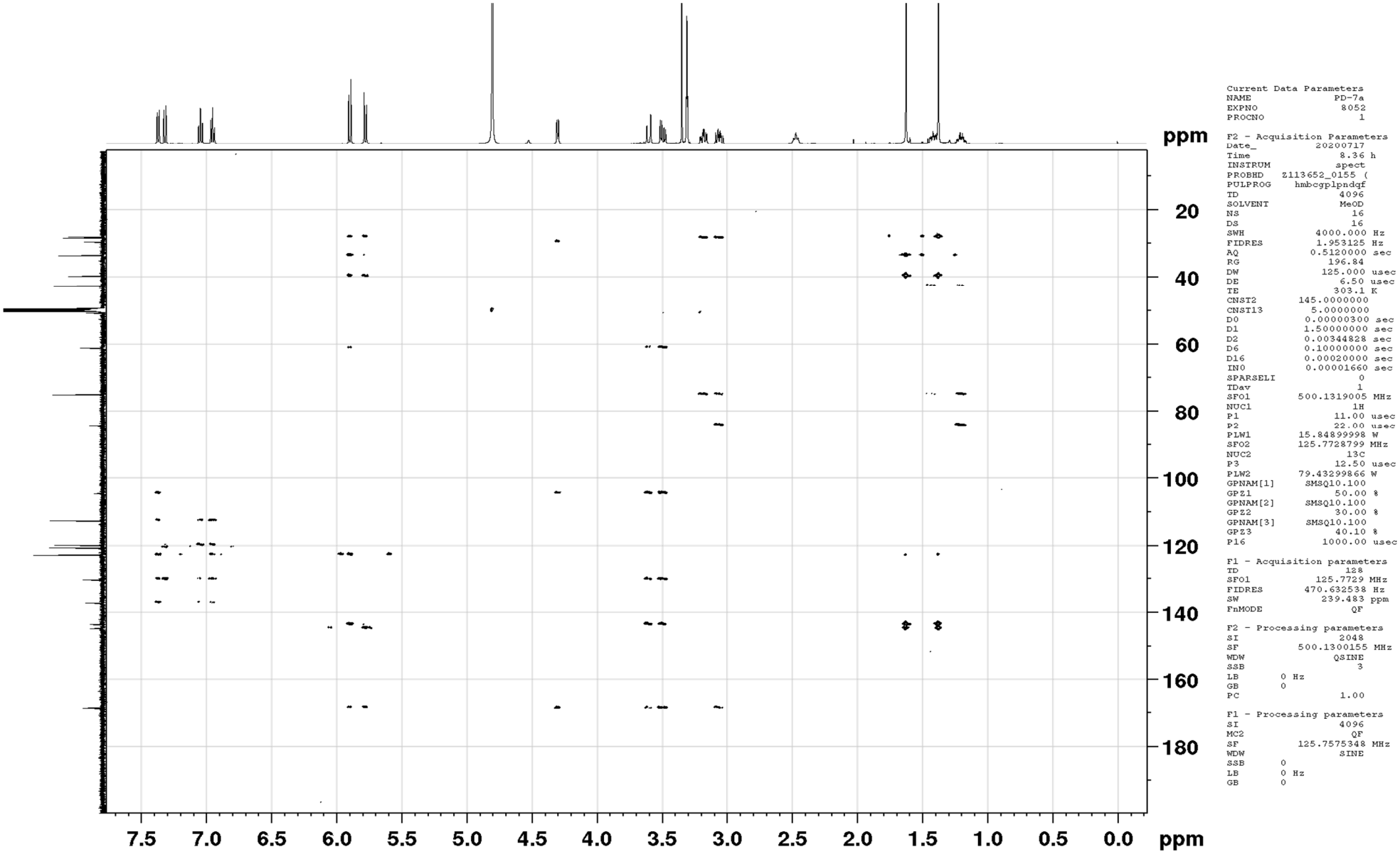
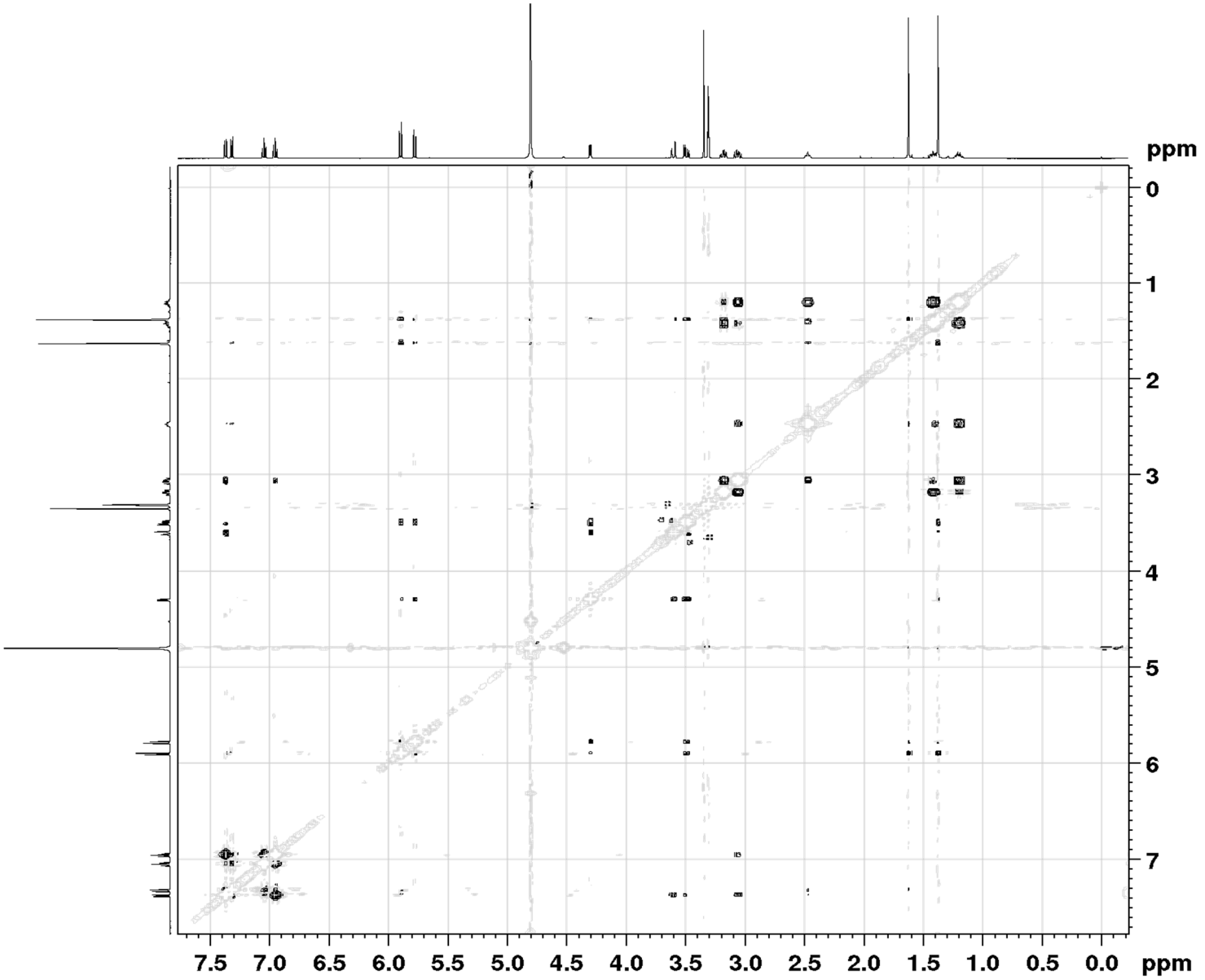


Figure S62. HMBC spectrum (500 MHz, CD_3OD) of **6**




```
Current Data Parameters
NAME                  PD-7a
EXPNO                  6030
PROCNO                    1

F2 - Acquisition Parameters
Date_              20200716
Time                 17.34 h
INSTRUM                spect
PROBHD    Z113652_0155 (
PULPROG          noesygpph
TD                     2048
SOLVENT                MeOD
NS                       16
DS                       16
SWH               4000.000 Hz
FIDRES               3.906250 Hz
AQ                0.2560000 sec
RG                   106.06
DW                  125.000 usec
DE                    6.50 usec
TE                   303.1 K
D0              0.00011099 sec
D1              1.50000000 sec
D8              1.00000000 sec
D16             0.00010000 sec
IN0             0.00025000 sec
TDav                     1
SFO1           500.1319005 MHz
NUC1                    1H
P1                   11.00 usec
P2                   22.00 usec
PLW1           15.84899998 W
GPNAM[1]        SMSQ10.100
GPZ1                 40.00 %
P16                1000.00 usec

F1 - Acquisition parameters
TD                     256
SFO1              500.1319 MHz
FIDRES           31.250000 Hz
SW                   7.998 ppm
FnMODE                TPPI

F2 - Processing parameters
SI                     2048
SF             500.1300139 MHz
WDW                   QSINE
SSB                       2
LB          0 Hz
GB          0
PC                     1.00

F1 - Processing parameters
SI                     2048
MC2                    TPPI
SF             500.1300138 MHz
WDW                   QSINE
SSB                       2
LB          0 Hz
GB          0
```

Figure S63. NOESY spectrum (500 MHz, CD_3OD) of **6**

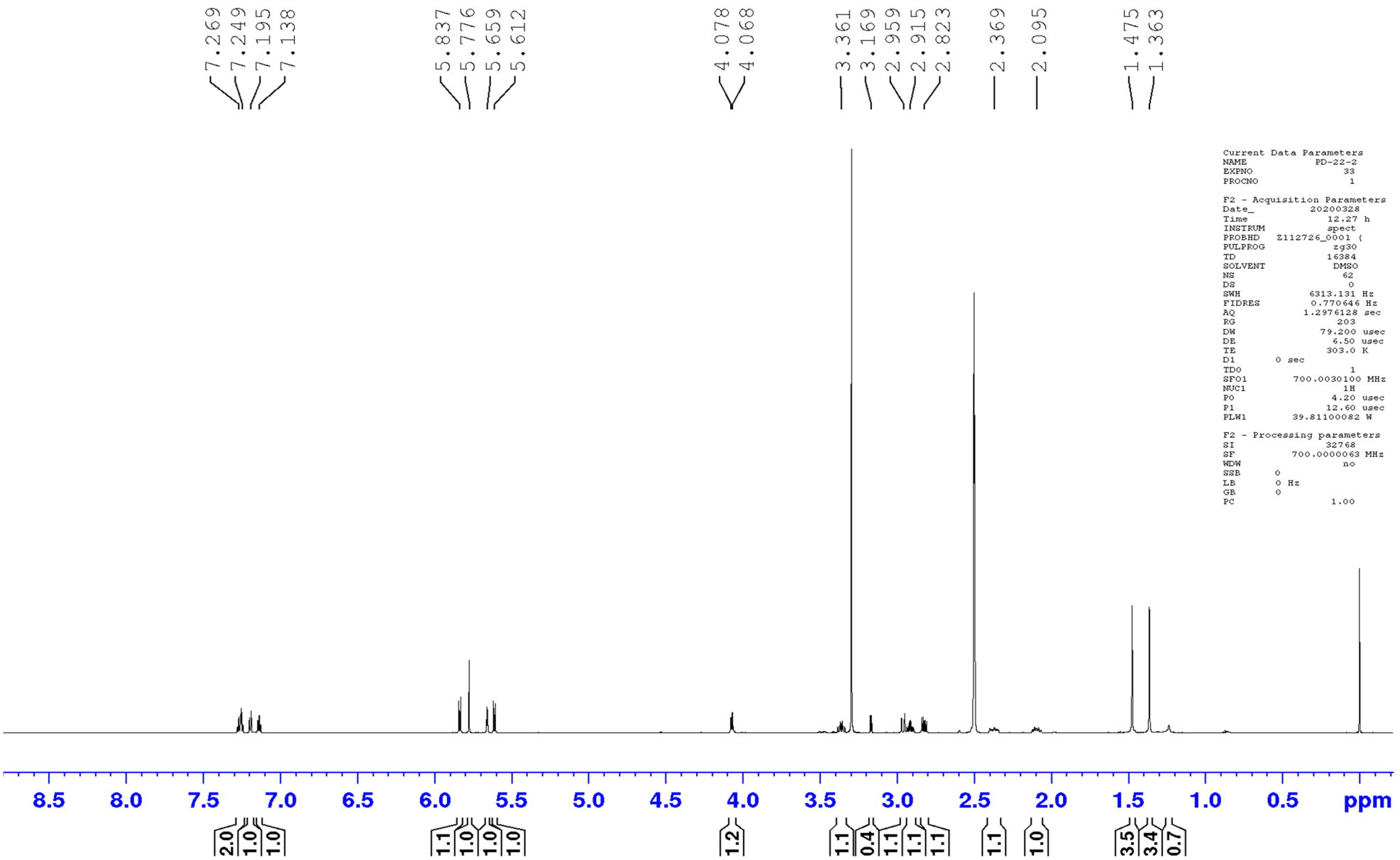


Figure S64. ^{1}H NMR spectrum (700 MHz, DMSO-d_6) of **7**

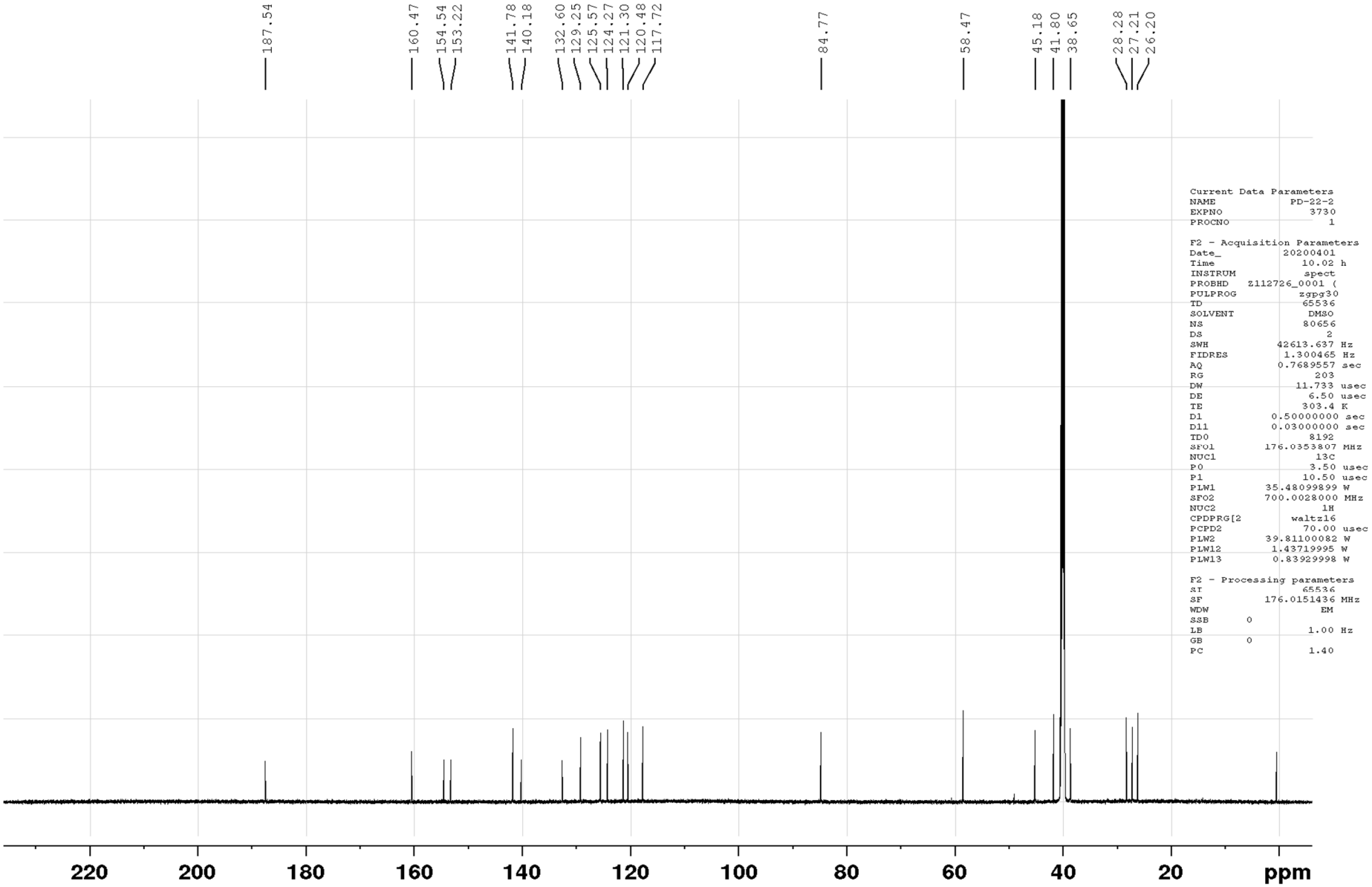


Figure S65. ^{13}C NMR spectrum (176 MHz, DMSO-d_6) of **7**

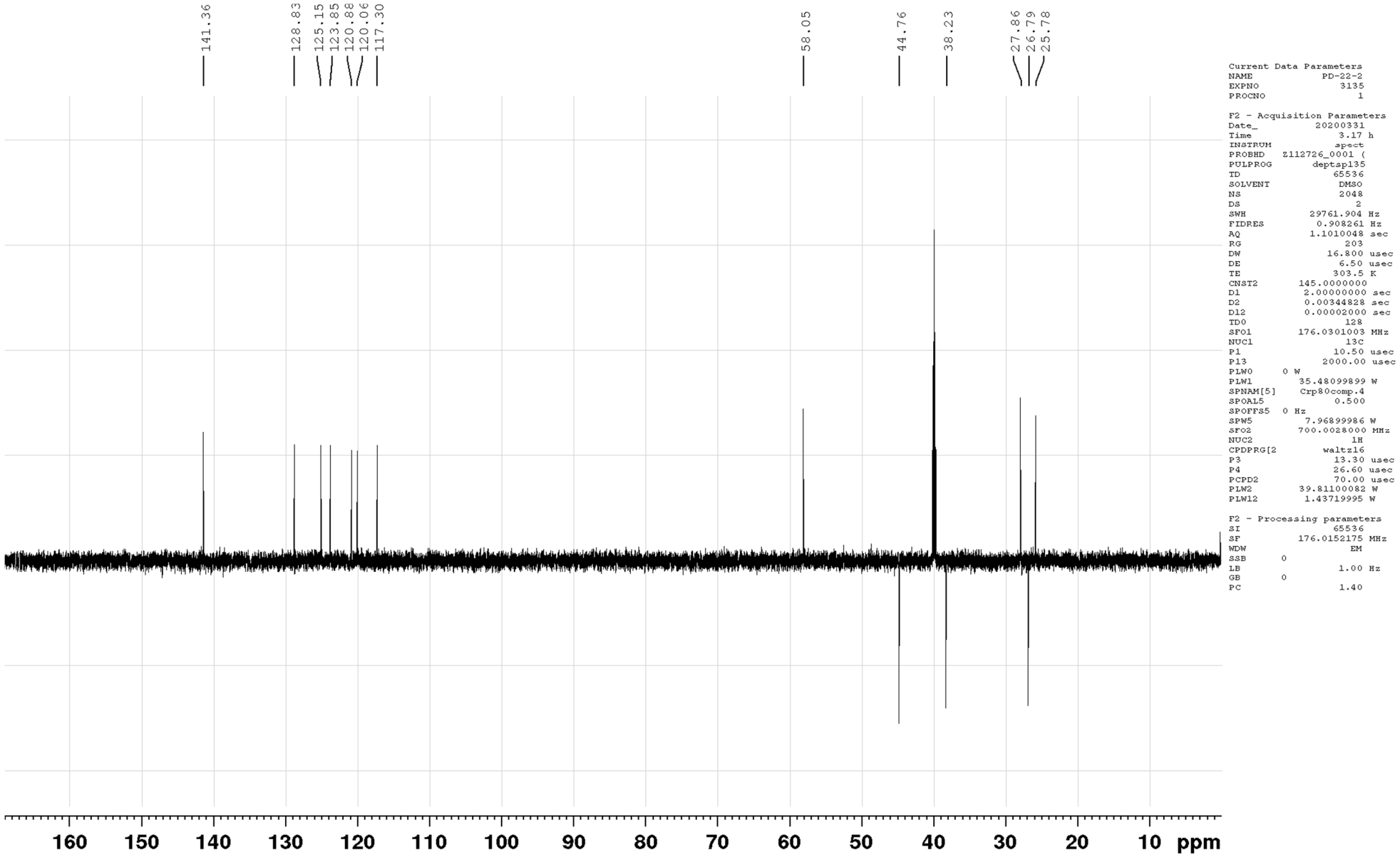
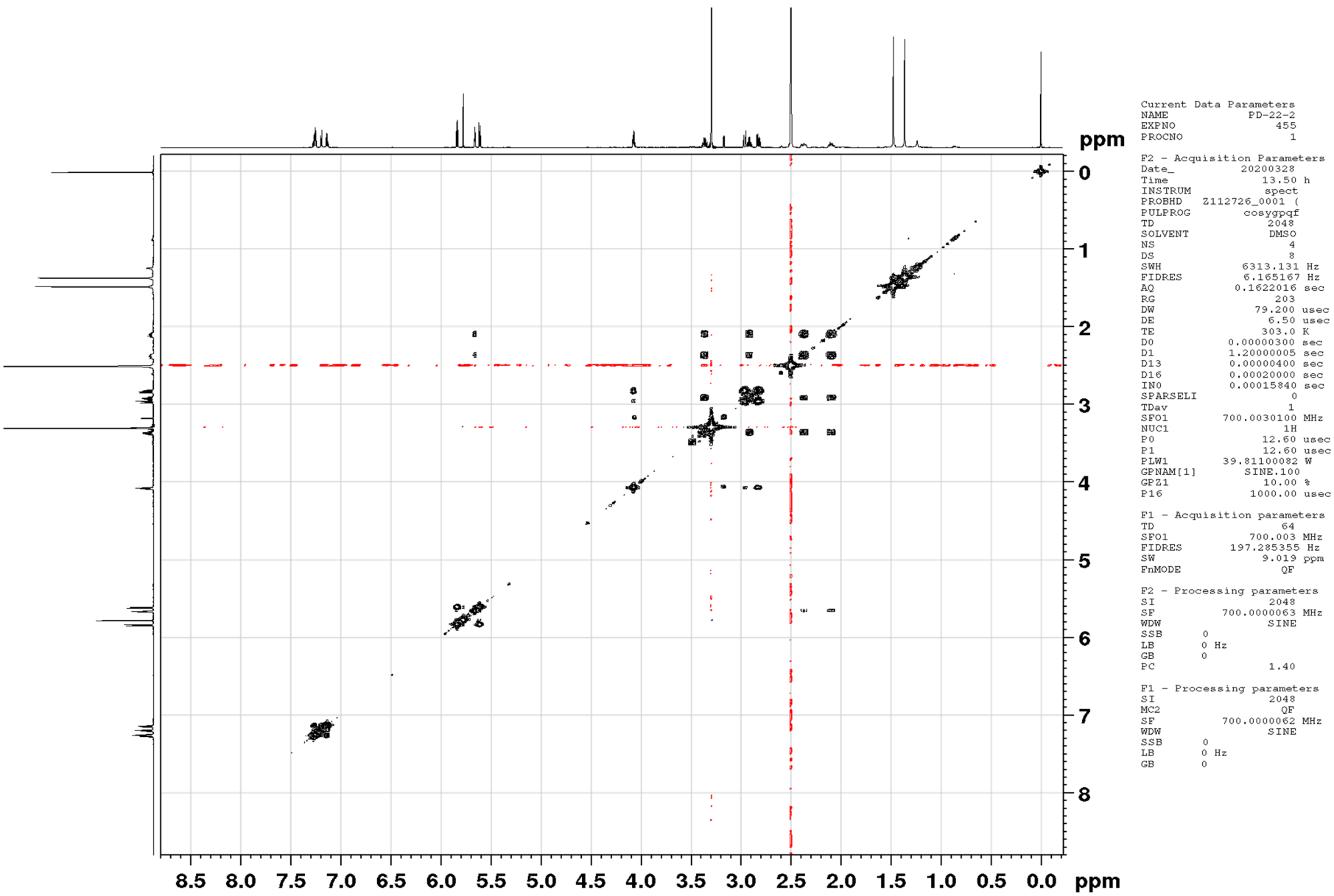


Figure S66. DEPT-135 NMR spectrum (176 MHz, DMSO-d_6) of **7**




```
Current Data Parameters
NAME                  PD-22-2
EXPNO                     455
PROCNO                      1

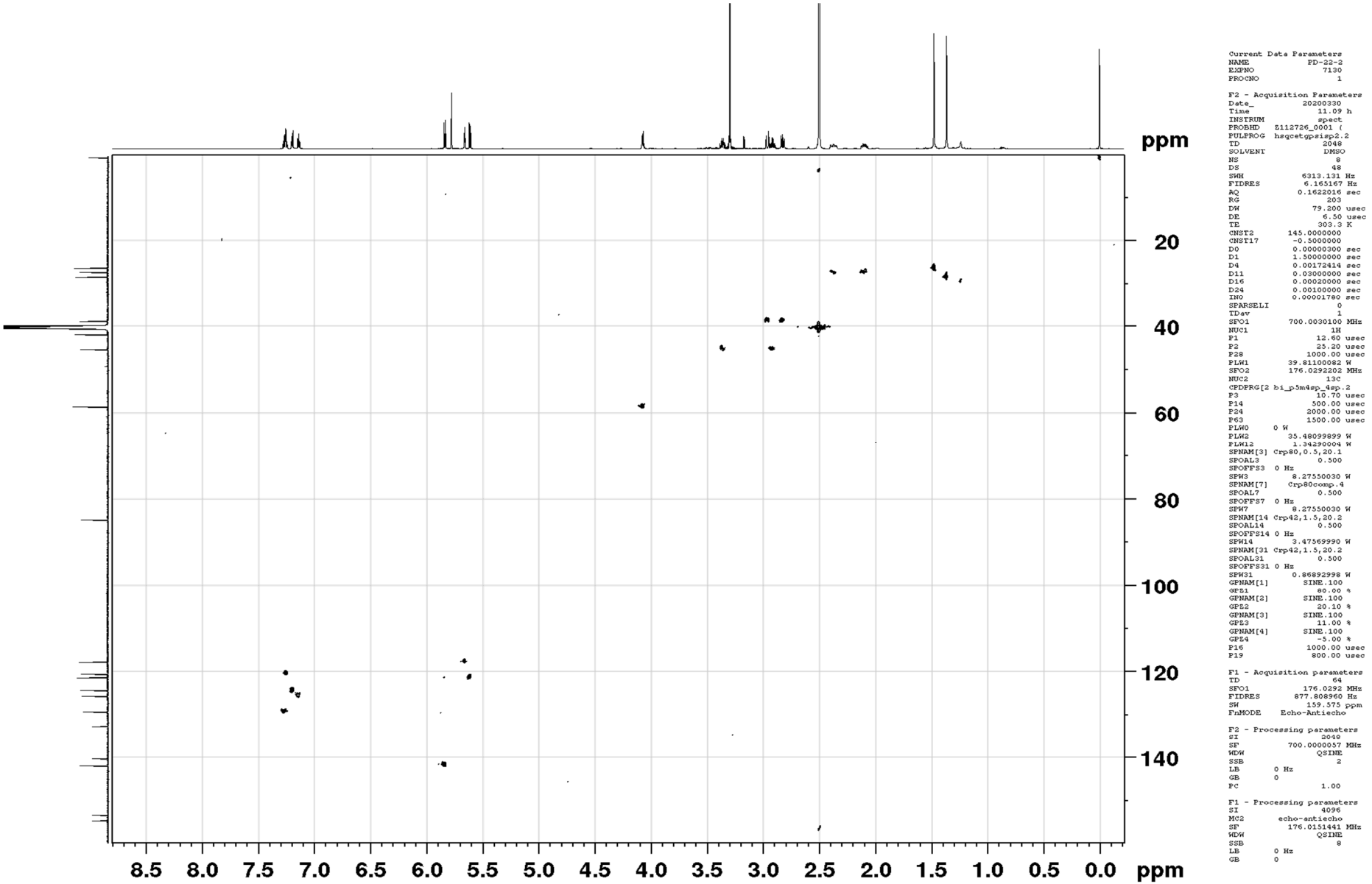
F2 - Acquisition Parameters
Date_              20200328
Time                  13.50 h
INSTRUM                 spect
PROBHD    Z112726_0001 (
PULPROG             cosygpqf
TD                      2048
SOLVENT                 DMSO
NS                         4
DS                         8
SWH                6313.131 Hz
FIDRES             6.165167 Hz
AQ                 0.1622016 sec
RG                       203
DW                    79.200 usec
DE                     6.50 usec
TE                    303.0 K
D0                 0.00000300 sec
D1                 1.20000005 sec
D13                0.00000400 sec
D16                0.00020000 sec
IN0                0.00015840 sec
SPARSELI                   0
TDav                       1
SFO1           700.0030100 MHz
NUC1                      1H
P0                    12.60 usec
P1                    12.60 usec
PLW1           39.81100082 W
GPNAM[1]           SINE.100
GPZ1                  10.00 %
P16                 1000.00 usec

F1 - Acquisition parameters
TD                        64
SFO1                700.003 MHz
FIDRES             197.285355 Hz
SW                    9.019 ppm
FnMODE                   QF

F2 - Processing parameters
SI                      2048
SF             700.0000063 MHz
WDW                     SINE
SSB         0
LB          0 Hz
GB          0
PC                    1.40

F1 - Processing parameters
SI                      2048
MC2                       QF
SF             700.0000062 MHz
WDW                     SINE
SSB         0
LB          0 Hz
GB          0
```

Figure S67. COSY-45 spectrum (700 MHz, DMSO-d6) of **4**




```
Current Data Parameters
NAME                  PD-22-2
EXPNO                    7130
PROCNO                      1

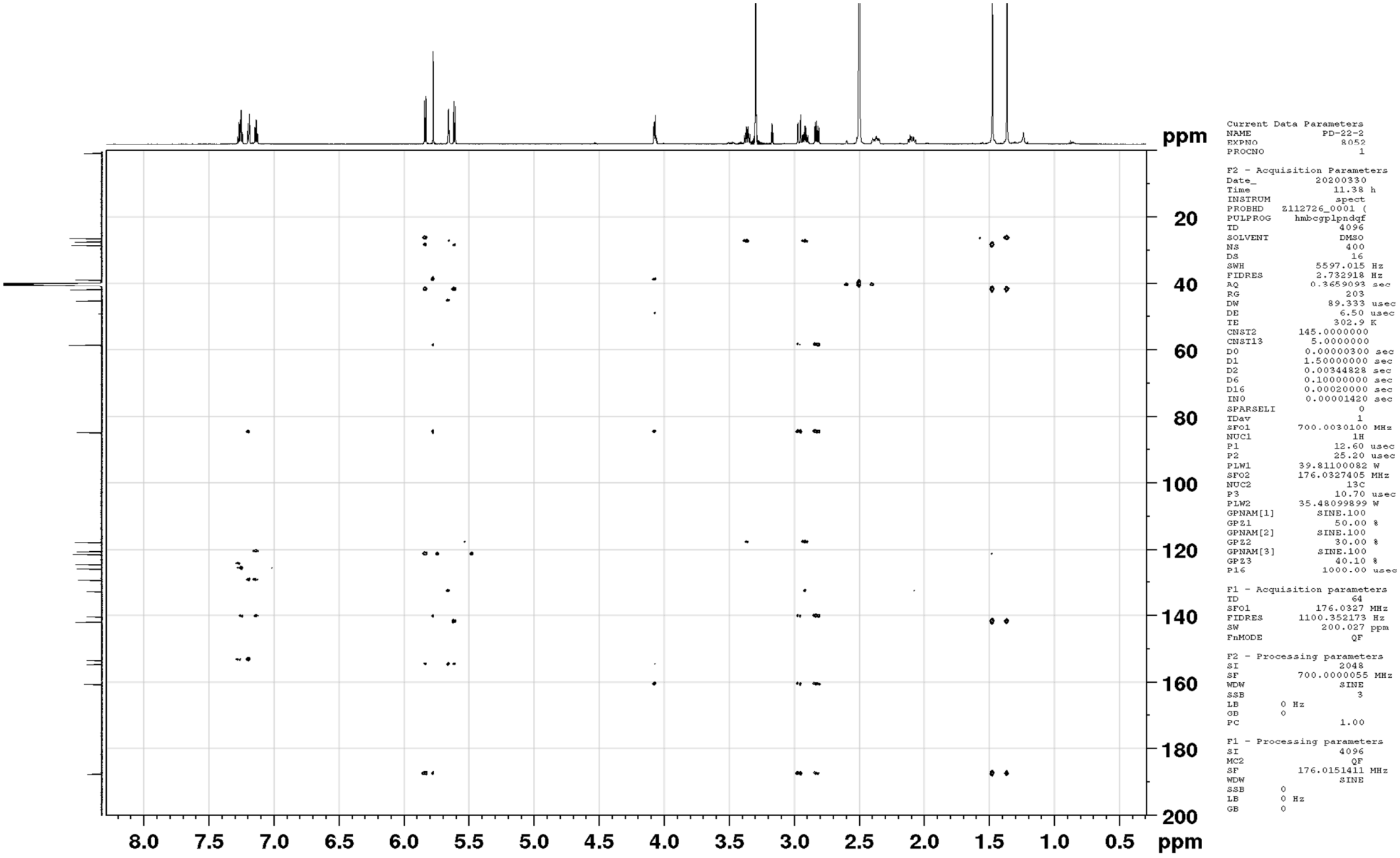
F2 - Acquisition Parameters
Date_              20200330
Time                    11.09 h
INSTRUM                 spect
PROBHD     Z112726_0001 (
PULPROG    hsqcetgpsisp2.2
TD                        2048
SOLVENT                   DMSO
NS                           8
DS                          48
SWH                   6313.131 Hz
FIDRES                6.165167 Hz
AQ                    0.16222016 sec
RG                          203
DW                     79.200 usec
DE                      6.50 usec
TE                      303.3 K
CNST2              145.00000000
CNST17              -0.5000000
D0                  0.00000300 sec
D1                  1.50000000 sec
D4                  0.00172414 sec
D11                 0.03000000 sec
D16                 0.00020000 sec
D24                 0.00100000 sec
IN0                 0.00001780 sec
SPARSELI                     0
TDav                         1
SFO1               700.0030100 MHz
NUC1                        1H
P1                       12.60 usec
P2                       25.20 usec
P28                    1000.00 usec
PLW1               39.81100082 W
SFO2               176.0292202 MHz
NUC2                        13C
CPDPRG[2 bi_p5m4sp_4sp.2
P3                       10.70 usec
P14                     500.00 usec
P24                    2000.00 usec
P63                    1500.00 usec
PLW0      0 W
PLW2                35.48099899 W
PLW12                1.34290004 W
SPNAM[3] Crp80,0.5,20.1
SPOAL3                    0.500
SPOFFS3   0 Hz
SPW3                 8.27550030 W
SPNAM[7]     Crp80comp.4
SPOAL7                    0.500
SPOFFS7   0 Hz
SPW7                 8.27550030 W
SPNAM[14 Crp42,1.5,20.2
SPOAL14                   0.500
SPOFFS14 0 Hz
SPW14                3.47569990 W
SPNAM[31 Crp42,1.5,20.2
SPOAL31                   0.500
SPOFFS31 0 Hz
SPW31                0.86892998 W
GPNAM[1]          SINE.100
GPZ1                     80.00 %
GPNAM[2]          SINE.100
GPZ2                     20.10 %
GPNAM[3]          SINE.100
GPZ3                     11.00 %
GPNAM[4]          SINE.100
GPZ4                     -5.00 %
P16                    1000.00 usec
P19                     800.00 usec

F1 - Acquisition parameters
TD                          64
SFO1               176.0292 MHz
FIDRES            877.808960 Hz
SW                  159.575 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                        2048
SF                 700.0000057 MHz
WDW                       QSINE
SSB                          2
LB          0 Hz
GB          0
PC                        1.00

F1 - Processing parameters
SI                        4096
MC2          echo-antiecho
SF                 176.0151441 MHz
WDW                       QSINE
SSB                          8
LB          0 Hz
GB          0
```

Figure S68. HSQC spectrum (700 MHz, DMSO-d_6) of **7**




```
Current Data Parameters
NAME                  PD-22-2
EXPNO                    8052
PROCNO                      1

F2 - Acquisition Parameters
Date_              20200330
Time                  11.38 h
INSTRUM                 spect
PROBHD    Z112726_0001 (
PULPROG     hmbcgplpndqf
TD                      4096
SOLVENT                 DMSO
NS                       400
DS                        16
SWH                 5597.015 Hz
FIDRES              2.732918 Hz
AQ                 0.3659093 sec
RG                        203
DW                   89.333 usec
DE                     6.50 usec
TE                    302.9 K
CNST2             145.0000000
CNST13              5.0000000
D0                 0.00000300 sec
D1                 1.50000000 sec
D2                 0.00344828 sec
D6                 0.10000000 sec
D16                0.00020000 sec
IN0                0.00001420 sec
SPARSELI                    0
TDav                        1
SFO1           700.0030100 MHz
NUC1                       1H
P1                      12.60 usec
P2                      25.20 usec
PLW1           39.81100082 W
SFO2           176.0327405 MHz
NUC2                       13C
P3                      10.70 usec
PLW2           35.48099899 W
GPNAM[1]            SINE.100
GPZ1                   50.00 %
GPNAM[2]            SINE.100
GPZ2                   30.00 %
GPNAM[3]            SINE.100
GPZ3                   40.10 %
P16                  1000.00 usec

F1 - Acquisition parameters
TD                          64
SFO1             176.0327 MHz
FIDRES         1100.352173 Hz
SW                200.027 ppm
FnMODE                     QF

F2 - Processing parameters
SI                        2048
SF             700.0000055 MHz
WDW                       SINE
SSB                          3
LB          0 Hz
GB          0
PC                        1.00

F1 - Processing parameters
SI                        4096
MC2                        QF
SF             176.0151411 MHz
WDW                       SINE
SSB         0
LB          0 Hz
GB          0
```

Figure S69. HMBC spectrum (700 MHz, DMSO-d_6) of **7**

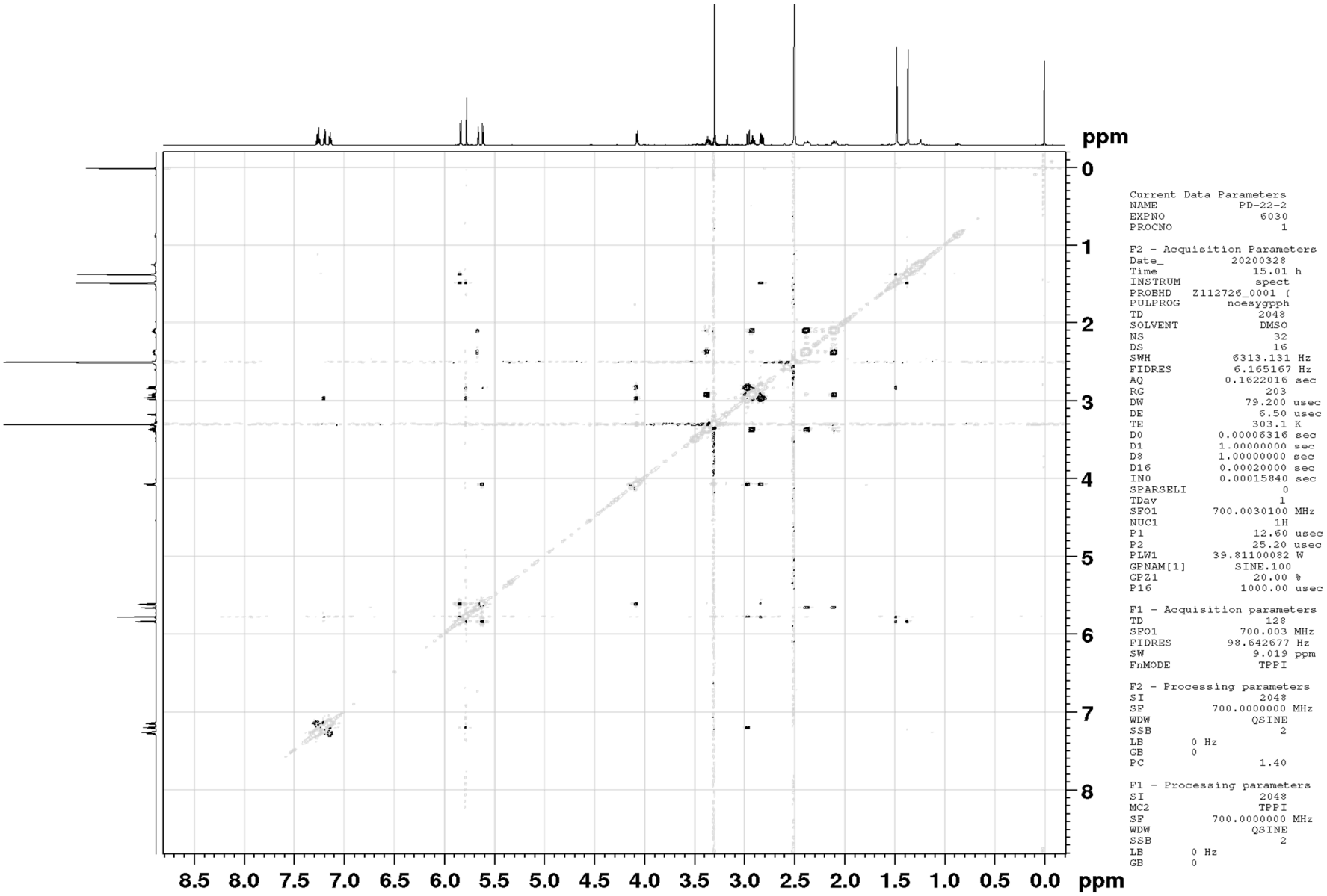


Figure S70. NOESY spectrum (700 MHz, DMSO-d_6) of **7**

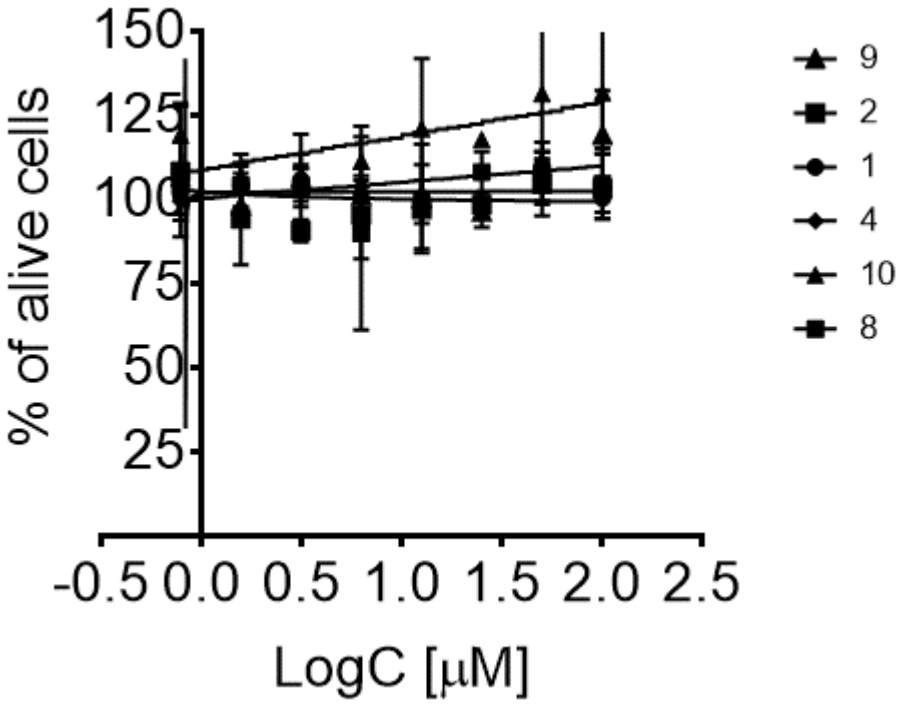


Figure 71. Viability of human prostate PNT2 cells treated with the investigated compounds for 48 h. No significant cytotoxicity was observed for the concentrations of the drugs up to 100 μM.

Table S1 Selected crystal data and refinement parameters for structure **1.**

Formula weight	395.45
Temperature (K)	298(2)
Radiationtype	Mo K_α
Space group	$P2_12_12_1$
Unit cell dimensions (Å)	a = 7.5507(3), b = 12.1354(6), c = 21.985(1)
V (Å^3) / Z	2014.5(2), 4
D_{calc}(g/cm^3)	1.304
μ, mm^{-1}	0.091
F(000)	840
Crystal size (mm)	0.45 × 0.41 × 0.28
θ range (°)	1.853 - 32.041
Range of *h*, *k* and *l*	-11<=h<=7, -16<=k<=18, -32<=l<=32
Reflections measured/ unique / with $I>2\sigma(I)$	35597/6978/6055 R_{int} = 0.0205
GooF	1.030
Final R indices [I>2sigma(I)]	R1 = 0.0406, wR2 = 0.1116
R indices (all data)	R1 = 0.0484, wR2 = 0.1179
$\Delta\varrho_{min}$, $\Delta\varrho_{max}$ (e/Å^3)	-0.207, 0.208

Table S2 Selected bond lengths (d, Å) in the structures **1**.

O(1)—C(4)	1.224(2)
O(2)—C(9)	1.231(2)
O(3)—C(6)	1.415(2)
O(4)—C(5)	1.402(2)
O(4)—C(22)	1.417(2)
N(1)—C(4)	1.344(2)
N(1)—C(3)	1.437(2)
N(1)—C(10)	1.464(2)
N(2)—C(9)	1.335(2)
N(2)—C(5)	1.456(2)
N(2)—C(8)	1.476(2)
N(3)—C(18)	1.373(2)
N(3)—C(19)	1.379(2)
C(1)—C(2)	1.504(3)
C(1)—C(19)	1.515(2)
C(1)—C(20)	1.534(3)
C(1)—C(21)	1.555(3)
C(2)—C(3)	1.323(3)
C(4)—C(5)	1.525(2)
C(5)—C(6)	1.531(2)
C(6)—C(7)	1.529(3)
C(7)—C(8)	1.535(3)
C(9)—C(10)	1.518(2)
C(10)—C(11)	1.539(2)
C(11)—C(12)	1.491(2)
C(12)—C(19)	1.373(2)
C(12)—C(13)	1.429(3)
C(13)—C(14)	1.405(3)
C(13)—C(18)	1.406(3)
C(14)—C(15)	1.382(5)
C(15)—C(16)	1.387(6)
C(16)—C(17)	1.369(5)
C(17)—C(18)	1.391(3)

Table S3 Hydrogen bonds for structure **1**.

D—H...A	d(D—H)	d(H...A)	d(D...A)	<(DHA)
N(3)—H(3A)···O(1)^{i}	0.94(3)	2.01(3)	2.909(2)	159(2)
O(3)—H(3)···O(2)^{ii}	0.87(3)	1.97(3)	2.825(2)	170(3)

Symmetry transformations used to generate equivalent atoms:
(ii)–x,y–1/2,–z+1/2;(iii) x–1/2,–y+3/2,–z