10.1071/CH20302_AC

Australian Journal of Chemistry 2021, 74(4), 268-281

Supplementary Material

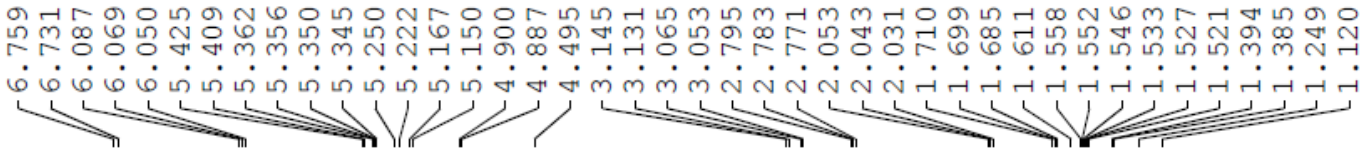
Reduction Chemistry of Natural Pyrethrins and Preliminary Insecticidal Activity of Reduced Pyrethrins

Todd E. Markham,[A,B,C] *Andrew C. Kotze*,[D] *Peter J. Duggan*,[A,C,E] *and Martin R. Johnston*[A,B,E]

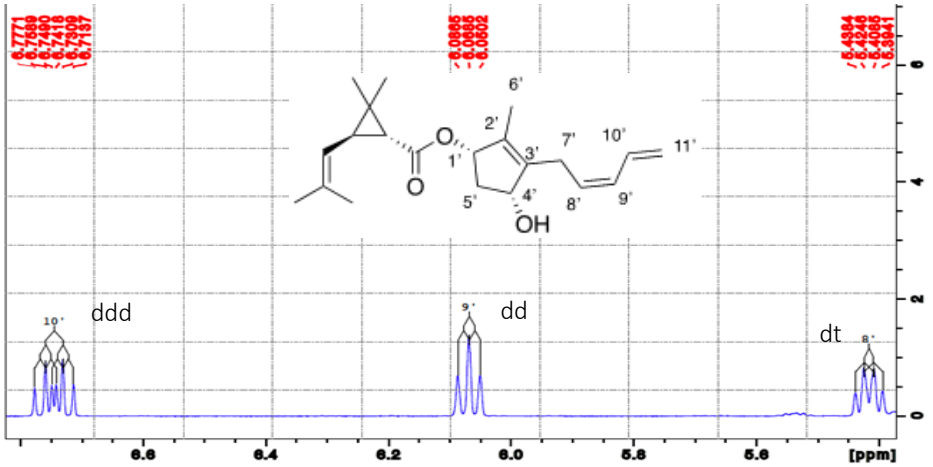
[A]College of Science and Engineering, Flinders University, Adelaide, SA 5042, Australia.
[B]Flinders Institute for Nanoscale Science and Technology, Flinders University, Adelaide, SA 5042, Australia.
[C]CSIRO Manufacturing, Bag 10, Clayton South, Vic. 3169, Australia.
[D]CSIRO Agriculture and Food, St Lucia, Qld 4067, Australia.
[E]Corresponding authors. Email: peter.duggan@csiro.au; Martin.Johnston@flinders.edu.au

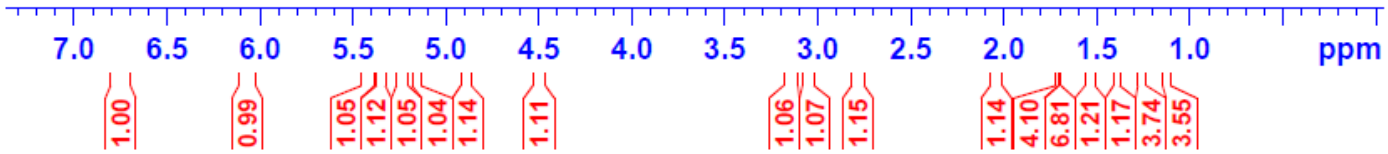
Table of Contents

4R-(4a) NMR Characterisation

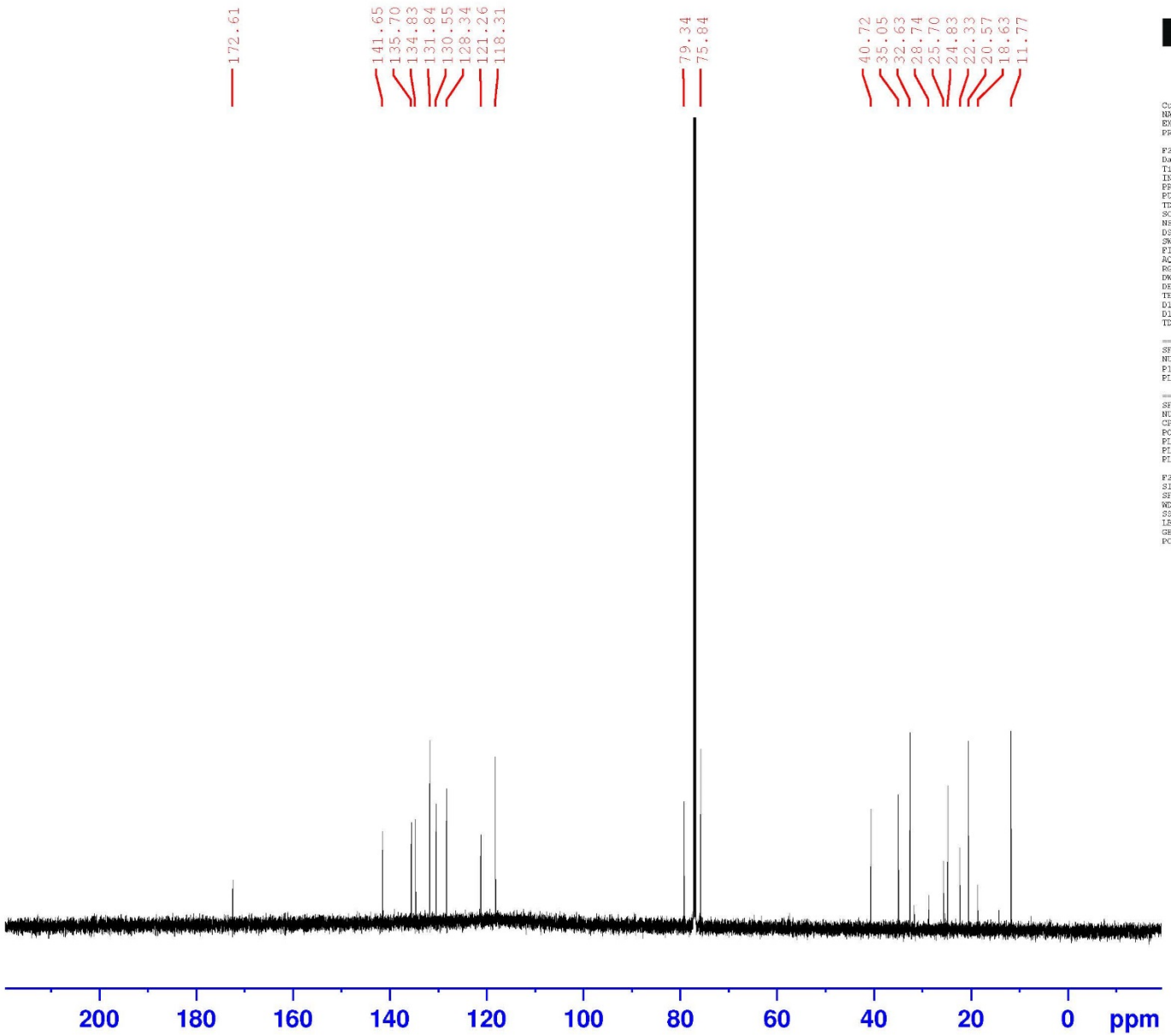


Representative multiplet analysis



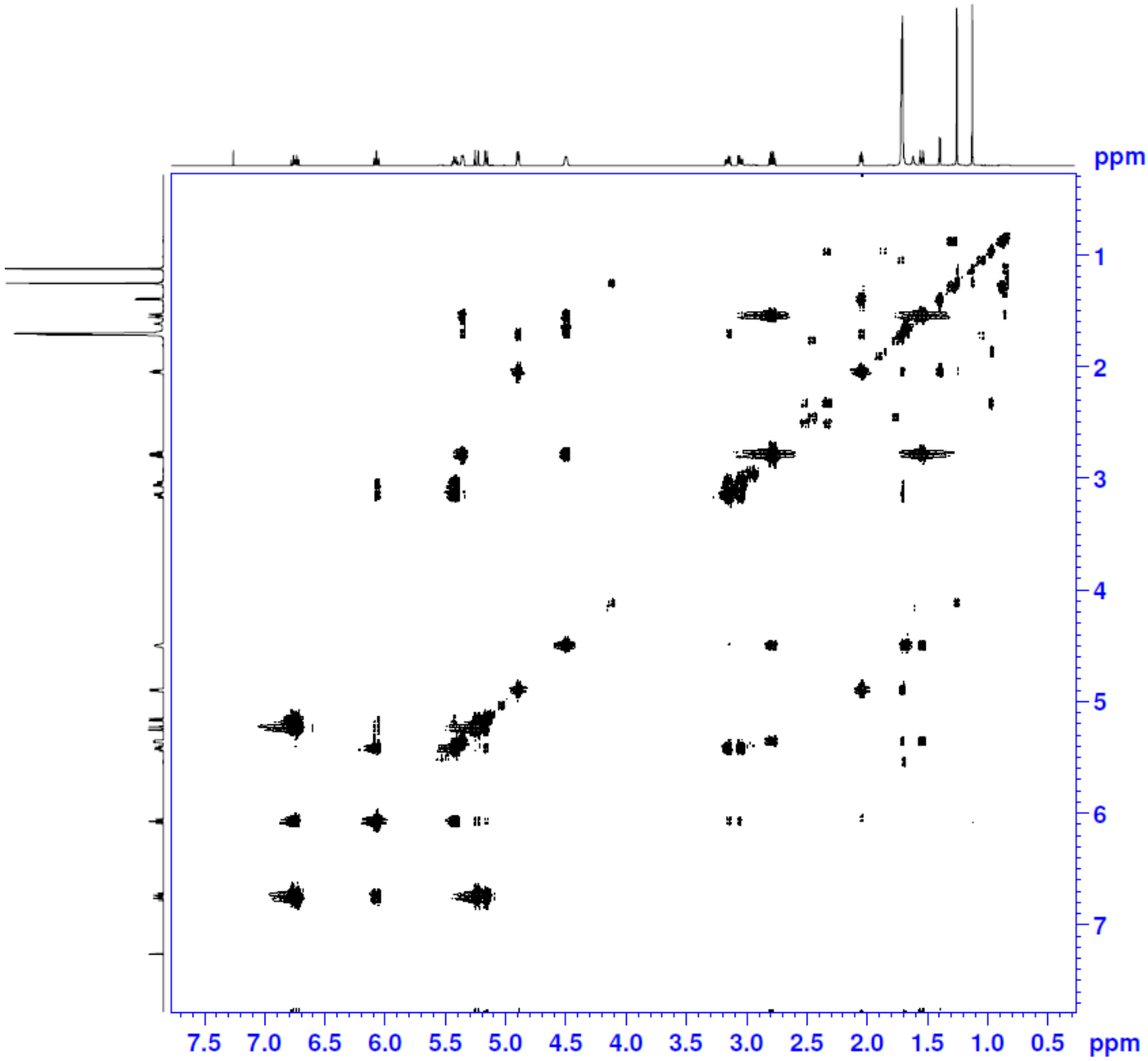



```
Current Data Parameters
NAME      20180914 Pyrethrin I Alcohol
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180914
Time              18.43
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG           zg30
TD               65536
SOLVENT          CDCl3
NS                  16
DS                   2
SWH           12019.230 Hz
FIDRES        0.183399 Hz
AQ            2.7262976 sec
RG                80.6
DW               41.600 usec
DE                6.50 usec
TE               298.2 K
D1            1.00000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1         600.1337060 MHz
NUC1                 1H
P1                8.40 usec
PLW1         12.55000019 W

F2 - Processing parameters
SI               65536
SF           600.1300266 MHz
WDW                  no
SSB       0
LB        0 Hz
GB        0
PC                1.00
```



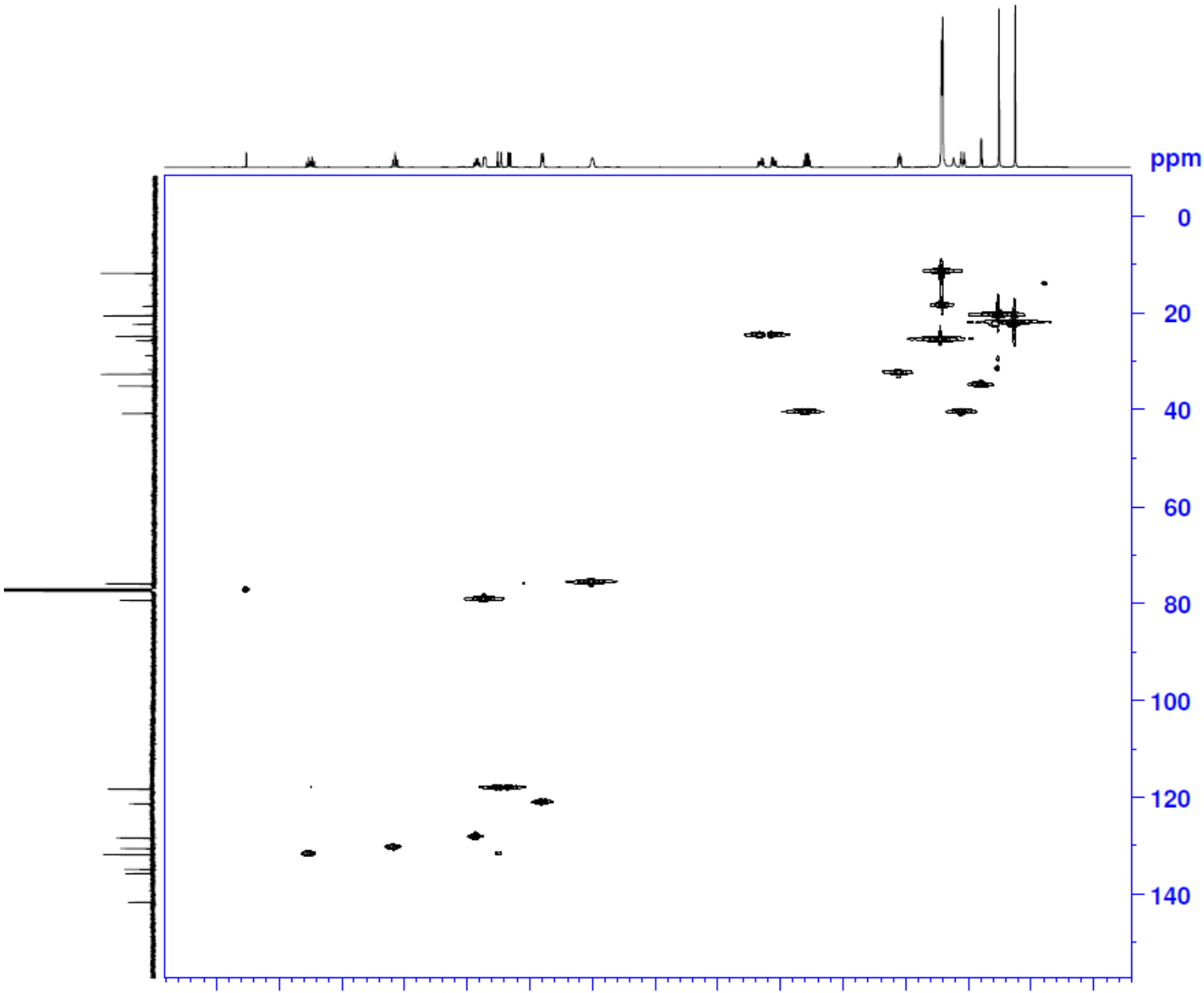
BRUKER

```
Current Data Parameters
NAME        20190118 Pyrethrin I Alcohol Major diastereomer
EXPNO                12
PROCNO                1

F2 - Acquisition Parameters
Date_              20190119
Time                 23.30
INSTRUM              spect
PROBHD    5 mm PABBI 1H/
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  2048
DS                     2
SWH            36057.691 Hz
FIDRES         0.550197 Hz
AQ             0.9087659 sec
RG                  1620
DW                13.867 usec
DE                 6.50 usec
TE                298.2 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1          150.9178988 MHz
NUC1                  13C
P1                  16.00 usec
PLW1         110.76000214 W

======== CHANNEL f2 ========
SFO2          600.1324005 MHz
NUC2                  1H
CPDPRG[2           waltz16
PCPD2               70.00 usec
PLW2          12.55000019 W
PLW12          0.18072000 W
PLW13          0.08855400 W

F2 - Processing parameters
SI                   32768
SF            150.9027905 MHz
WDW                     no
SSB       0
LB        0 Hz
GB        0
PC                   1.40
```

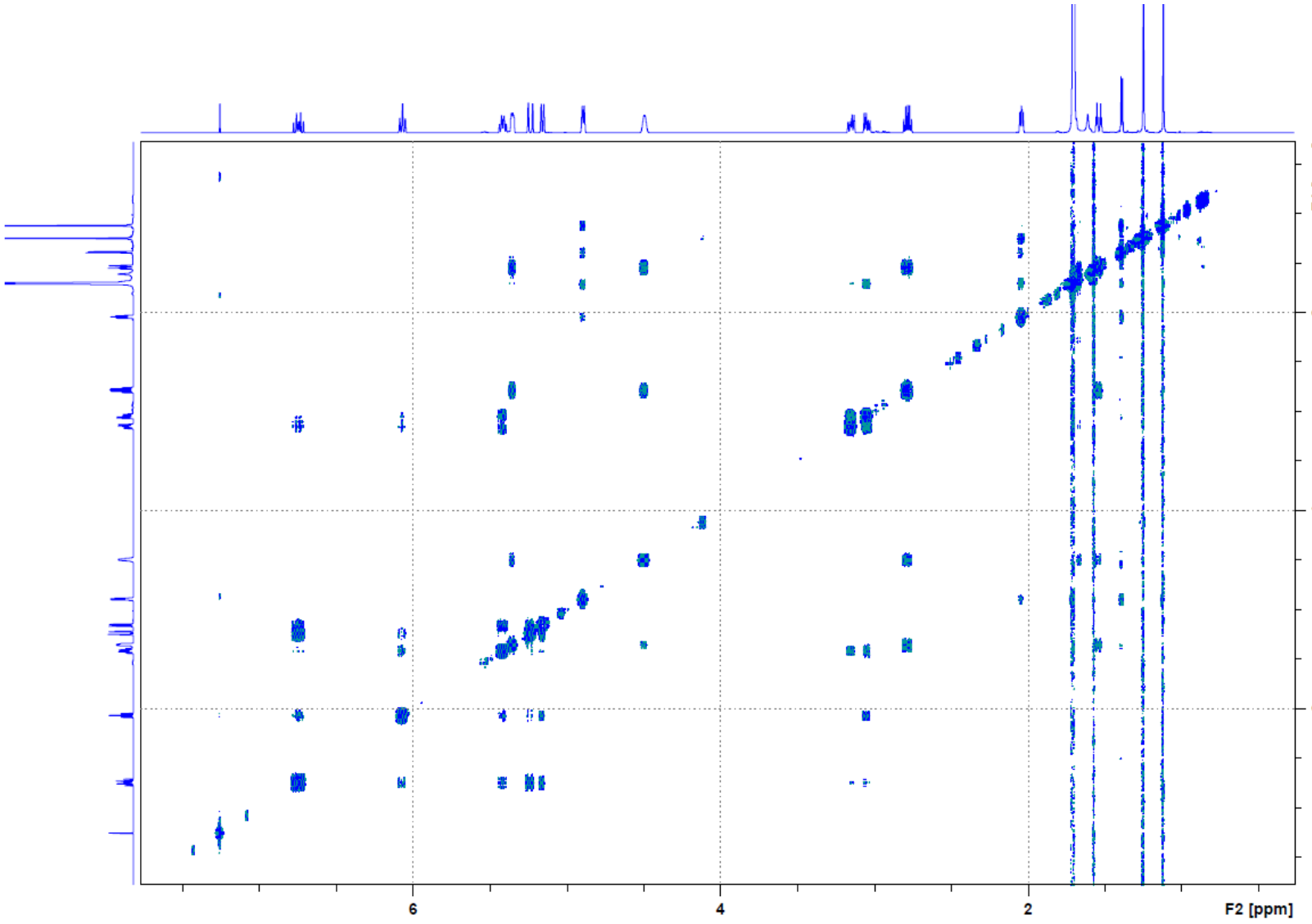


BRUKER

```
Current Data Parameters
NAME      20190118 Pyrethrin I Alcohol Major diastereomer
EXPNO                 11
PROCNO                 1

F2 - Acquisition Parameters
Date_              20190119
Time                 20.13
INSTRUM              spect
PROBHD   5 mm PABBI 1H/
PULPROG    cosygpmfphpp
TD                   2048
SOLVENT              CDCl3
NS                     10
DS                      4
SWH              4504.504 Hz
FIDRES           2.199465 Hz
AQ               0.2273280 sec
RG                   2050
DW                111.000 usec
DE                  6.50 usec
TE                298.2 K
D0               0.00010030 sec
D1               1.91111696 sec
D11              0.03000000 sec
D12              0.00002000 sec
D16              0.00020000 sec
IN0              0.00022200 sec

======== CHANNEL f1 ========
SFO1            600.1324422 MHz
NUC1                     1H
P1                    8.40 usec
P2                   16.80 usec
P17                2500.00 usec
PLW1            12.55000019 W
PLW10            1.30999994 W

======= GRADIENT CHANNEL =====
GPNAM[1]        SMSQ10.100
GPNAM[2]        SMSQ10.100
GPZ1                 10.00 %
GPZ2                 20.00 %
P16                1000.00 usec

F1 - Acquisition parameters
TD                     256
SFO1            600.1324 MHz
FIDRES          17.595720 Hz
SW                  7.506 ppm
FnMODE          States-TPPI

F2 - Processing parameters
SI                    1024
SF              600.1300296 MHz
WDW                   QSINE
SSB                      2
LB          0 Hz
GB          0
PC                    1.40

F1 - Processing parameters
SI                    1024
MC2             States-TPPI
SF              600.1300254 MHz
WDW                   QSINE
SSB                      2
LB          0 Hz
GB          0
```

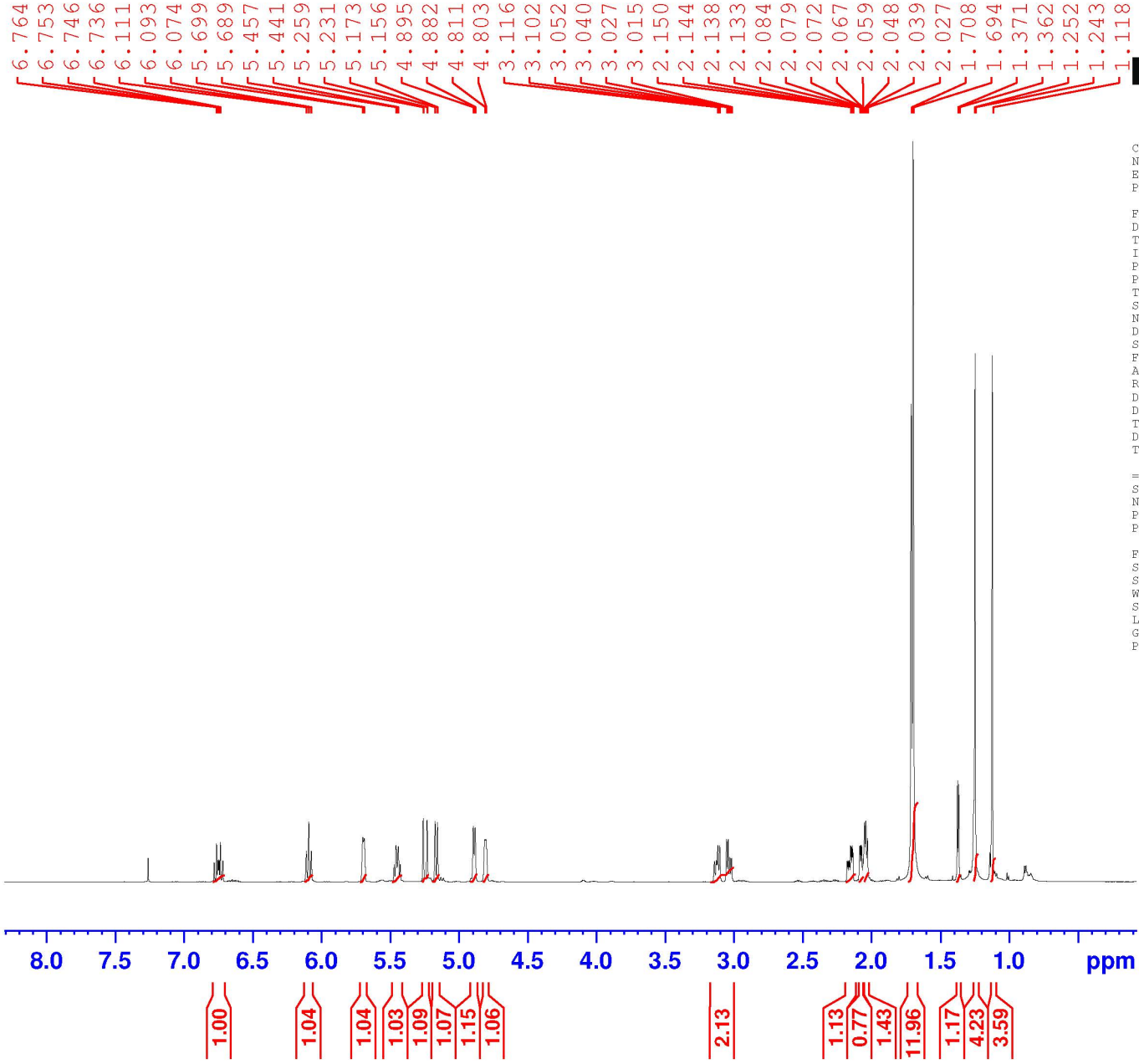



```
Current Data Parameters
NAME      20190118 Pyrethrin I Alcohol Major diastereomer
EXPNO                14
PROCNO                1

F2 - Acquisition Parameters
Date_          20190119
Time              23.35
INSTRUM             spect
PROBHD   5 mm PABBI 1H/
PULPROG        hsqcetgp
TD                 1024
SOLVENT            CDCl3
NS                   50
DS                   16
SWH           4629.629 Hz
FIDRES        4.521122 Hz
AQ            0.1105920 sec
RG                 2050
DW             108.000 usec
DE               6.50 usec
TE               298.3 K
CNST2        145.0000000
D0           0.00000300 sec
D1           1.45494401 sec
D4           0.00172414 sec
D11          0.03000000 sec
D16          0.00020000 sec
IN0          0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1         600.1324577 MHz
NUC1                  1H
P1                 8.40 usec
P2                16.80 usec
P28             1000.00 usec
PLW1        12.55000019 W

======== CHANNEL f2 ========
SFO2         150.9140636 MHz
NUC2                 13C
CPDPRG[2            garp
P3                16.00 usec
P4                32.00 usec
PCPD2             60.00 usec
PLW2        110.76000214 W
PLW12         7.87610006 W

======== GRADIENT CHANNEL ========
GPNAM[1]       SMSQ10.100
GPNAM[2]       SMSQ10.100
GPZ1              80.00 %
GPZ2              20.10 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                  256
SFO1          150.9141 MHz
FIDRES        97.656250 Hz
SW            165.657 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                 1024
SF           600.1300245 MHz
WDW                QSINE
SSB                   2
LB         0 Hz
GB         0
PC                 1.40

F1 - Processing parameters
SI                 1024
MC2        echo-antiecho
SF           150.9028261 MHz
WDW                QSINE
SSB                   2
LB         0 Hz
GB         0
```

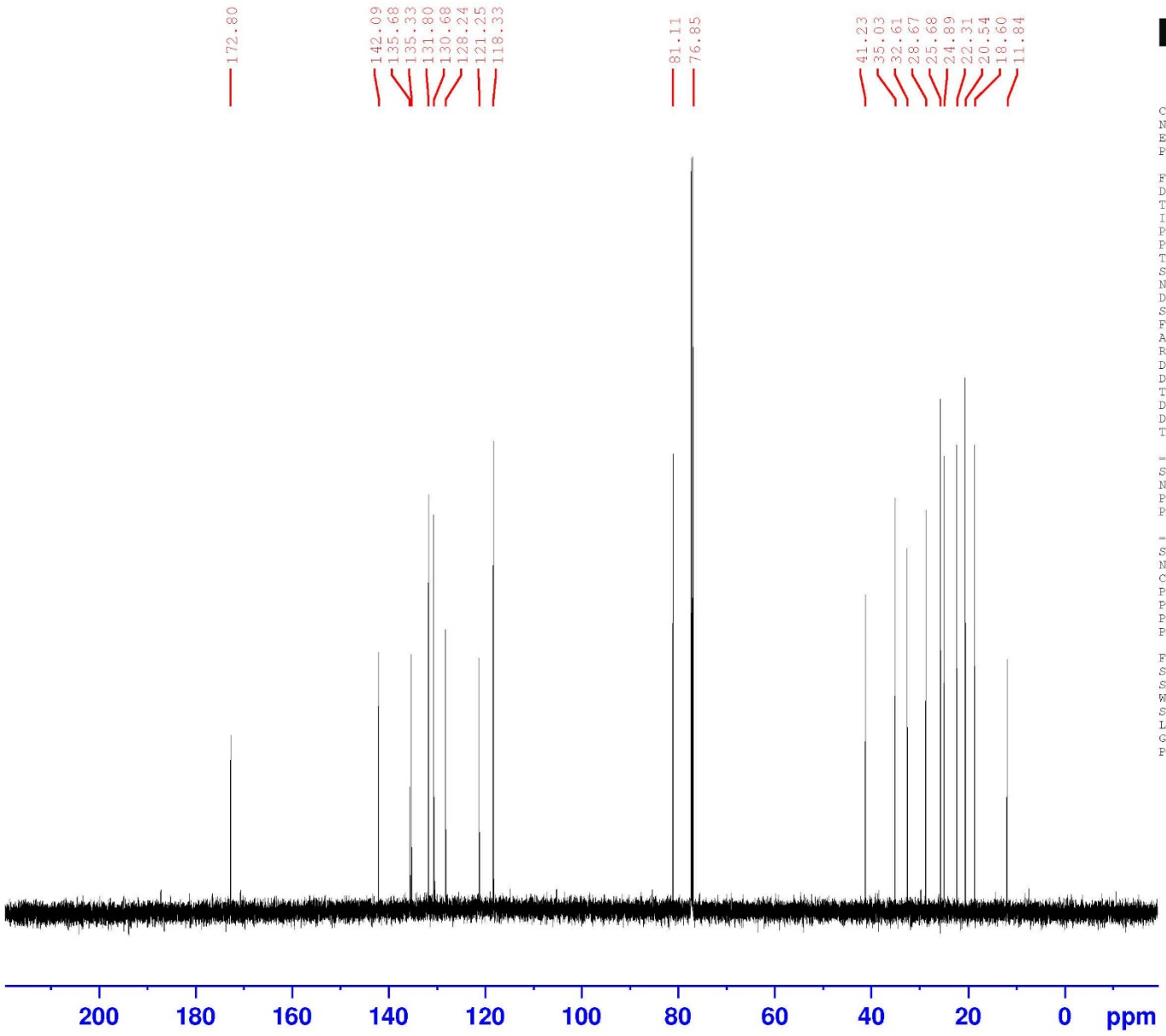



```
Current Data Parameters
NAME      20190122 Pyrethrin I Alcohol MAJOR
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_              20190122
Time                  9.11
INSTRUM              spect
PROBHD    5 mm PABBI 1H/
PULPROG          noesygpph
TD                    4096
SOLVENT              CDCl3
NS                       2
DS                      16
SWH              5411.255 Hz
FIDRES           1.321107 Hz
AQ               0.3784704 sec
RG                     203
DW                92.400 usec
DE                 6.50 usec
TE                298.2 K
D0             0.00008170 sec
D1             3.00000000 sec
D8             0.60000002 sec
D16            0.00020000 sec
IN0            0.00018480 sec

======== CHANNEL f1 ========
SFO1          600.1323960 MHz
NUC1                    1H
P1                   8.40 usec
P2                  16.80 usec
PLW1          12.55000019 W

====== GRADIENT CHANNEL =====
GPNAM[1]       SMSQ10.100
GPZ1                40.00 %
P16               1000.00 usec

F1 - Acquisition parameters
TD                     472
SFO1             600.1324 MHz
FIDRES          11.464524 Hz
SW                  9.017 ppm
FnMODE         States-TPPI

F2 - Processing parameters
SI                    4096
SF            600.1300256 MHz
WDW                  QSINE
SSB          0
LB           0 Hz
GB           0
PC                    1.00

F1 - Processing parameters
SI                    1024
MC2            States-TPPI
SF            600.1300234 MHz
WDW                  QSINE
SSB          0
LB           0 Hz
GB           0
```

4S-(4a) NMR Characterisation

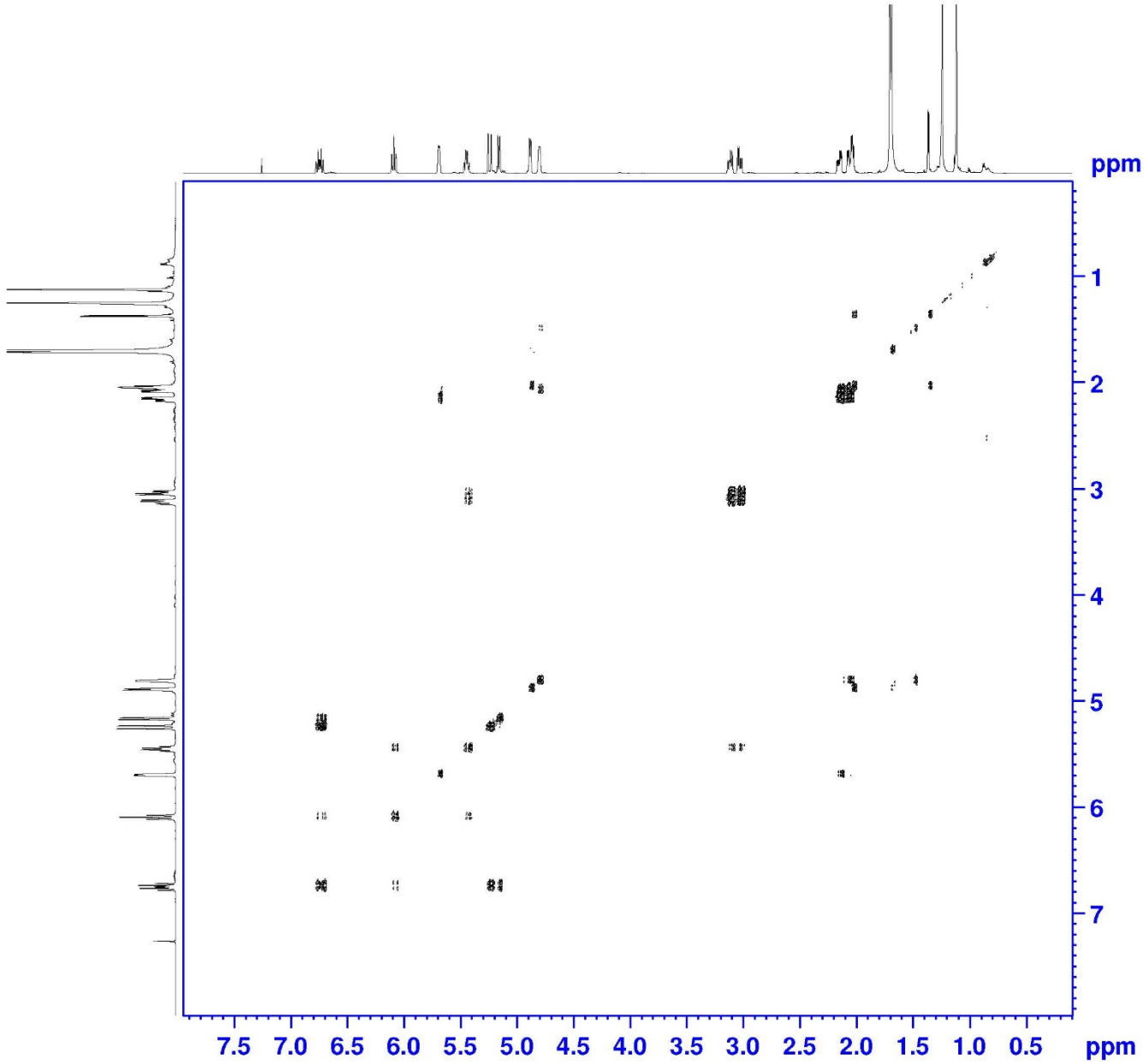



```
Current Data Parameters
NAME      20190123 Pyrethrin I OH MINOR
EXPNO                 20
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190123
Time              18.09
INSTRUM           spect
PROBHD    5 mm PABBI 1H/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           12019.230 Hz
FIDRES         0.183399 Hz
AQ             2.7262976 sec
RG                    32
DW               41.600 usec
DE                6.50 usec
TE               298.2 K
D1            1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         600.1337060 MHz
NUC1                   1H
P1                  8.40 usec
PLW1        12.55000019 W

F2 - Processing parameters
SI                 65536
SF           600.1300240 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



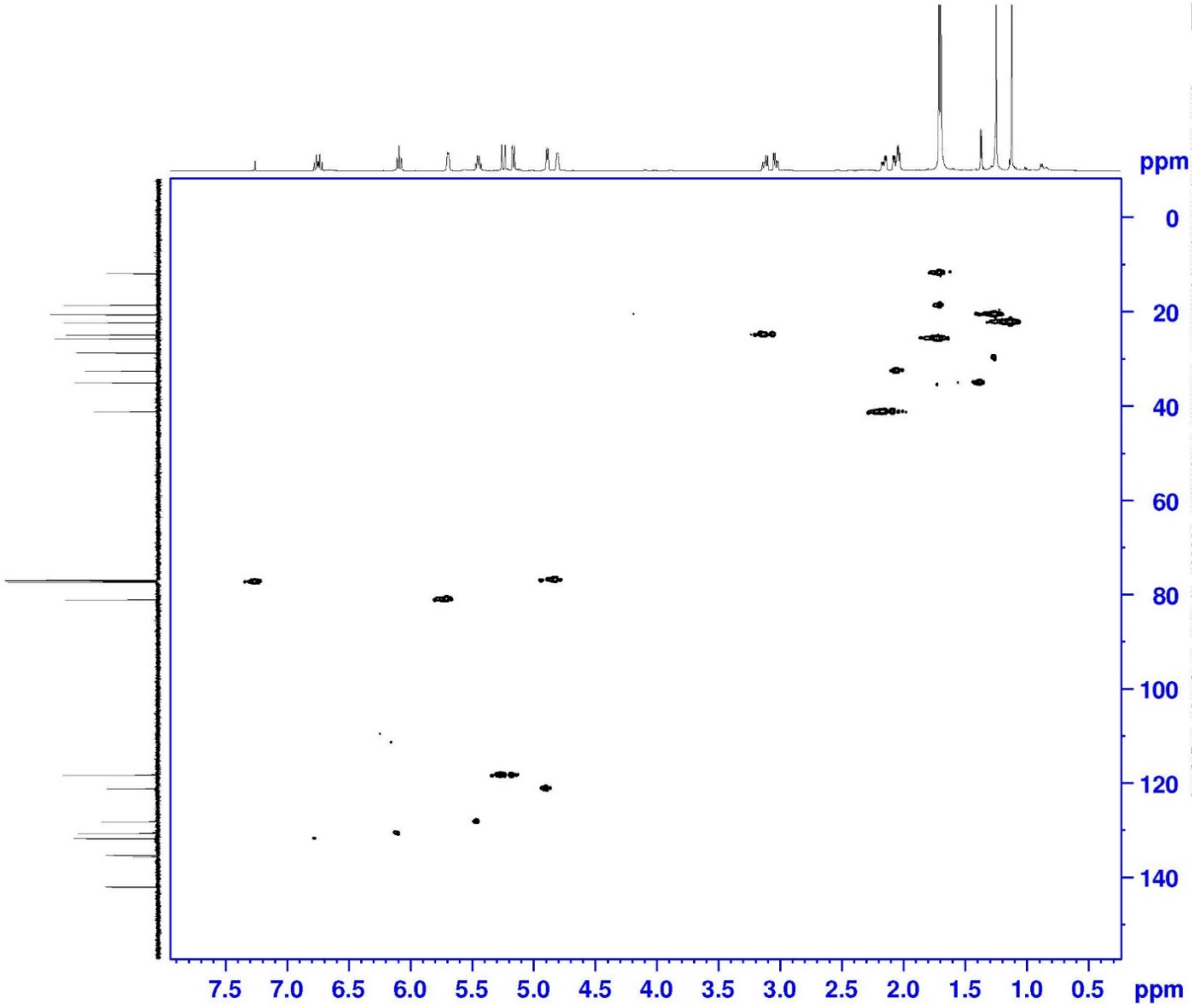
BRUKER

```
Current Data Parameters
NAME      20190122 Pyrethrin I OH MINOR
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190122
Time              16.43
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  215
DS                    2
SWH           36057.691 Hz
FIDRES         0.550197 Hz
AQ             0.9087659 sec
RG                 1440
DW               13.867 usec
DE                6.50 usec
TE              298.2 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1         150.9178988 MHz
NUC1               13C
P1               16.00 usec
PLW1       110.76000214 W

======== CHANNEL f2 ========
SFO2         600.1324005 MHz
NUC2               1H
CPDPRG[2         waltz16
PCPD2             70.00 usec
PLW2         12.55000019 W
PLW12         0.18072000 W
PLW13         0.08855400 W

F2 - Processing parameters
SI                32768
SF           150.9027917 MHz
WDW                  no
SSB       0
LB        0 Hz
GB        0
PC                 1.40
```



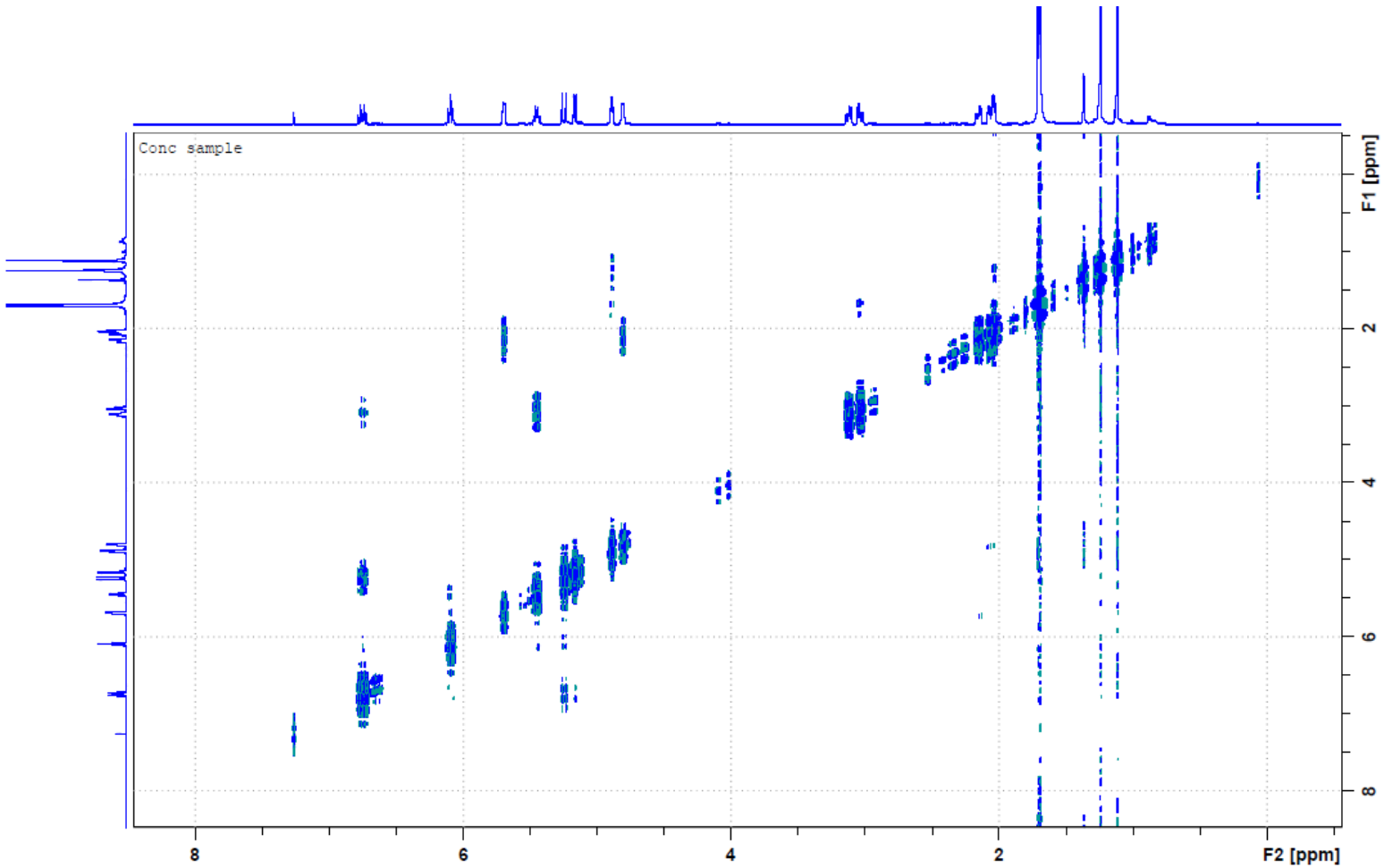
BRUKER

```
Current Data Parameters
NAME      20190118 Pyrethrin I Alcohol Minor diastereomer
EXPNO                11
PROCNO                1

F2 - Acquisition Parameters
Date_              20190120
Time                  7.29
INSTRUM                spect
PROBHD    5 mm PABBI 1H/
PULPROG    cosygpmfphpp
TD                    2048
SOLVENT             CDCl3
NS                      20
DS                       4
SWH               4716.981 Hz
FIDRES            2.303213 Hz
AQ                0.2170880 sec
RG                     2050
DW                 106.000 usec
DE                    6.50 usec
TE                  298.2 K
D0                0.00009530 sec
D1                1.92135704 sec
D11               0.03000000 sec
D12               0.00002000 sec
D16               0.00020000 sec
IN0               0.00021200 sec

======== CHANNEL f1 ========
SFO1            600.1324547 MHz
NUC1                      1H
P1                     8.40 usec
P2                    16.80 usec
P17                2500.00 usec
PLW1         12.55000019 W
PLW10         1.30999994 W

====== GRADIENT CHANNEL =====
GPNAM[1]        SMSQ10.100
GPNAM[2]        SMSQ10.100
GPZ1                 10.00 %
GPZ2                 20.00 %
P16                1000.00 usec

F1 - Acquisition parameters
TD                      256
SFO1            600.1325 MHz
FIDRES          18.425707 Hz
SW                    7.860 ppm
FnMODE          States-TPPI

F2 - Processing parameters
SI                      1024
SF              600.1300392 MHz
WDW                   QSINE
SSB                       2
LB          0 Hz
GB          0
PC                     1.40

F1 - Processing parameters
SI                      1024
MC2             States-TPPI
SF              600.1300236 MHz
WDW                   QSINE
SSB                       2
LB          0 Hz
GB          0
```



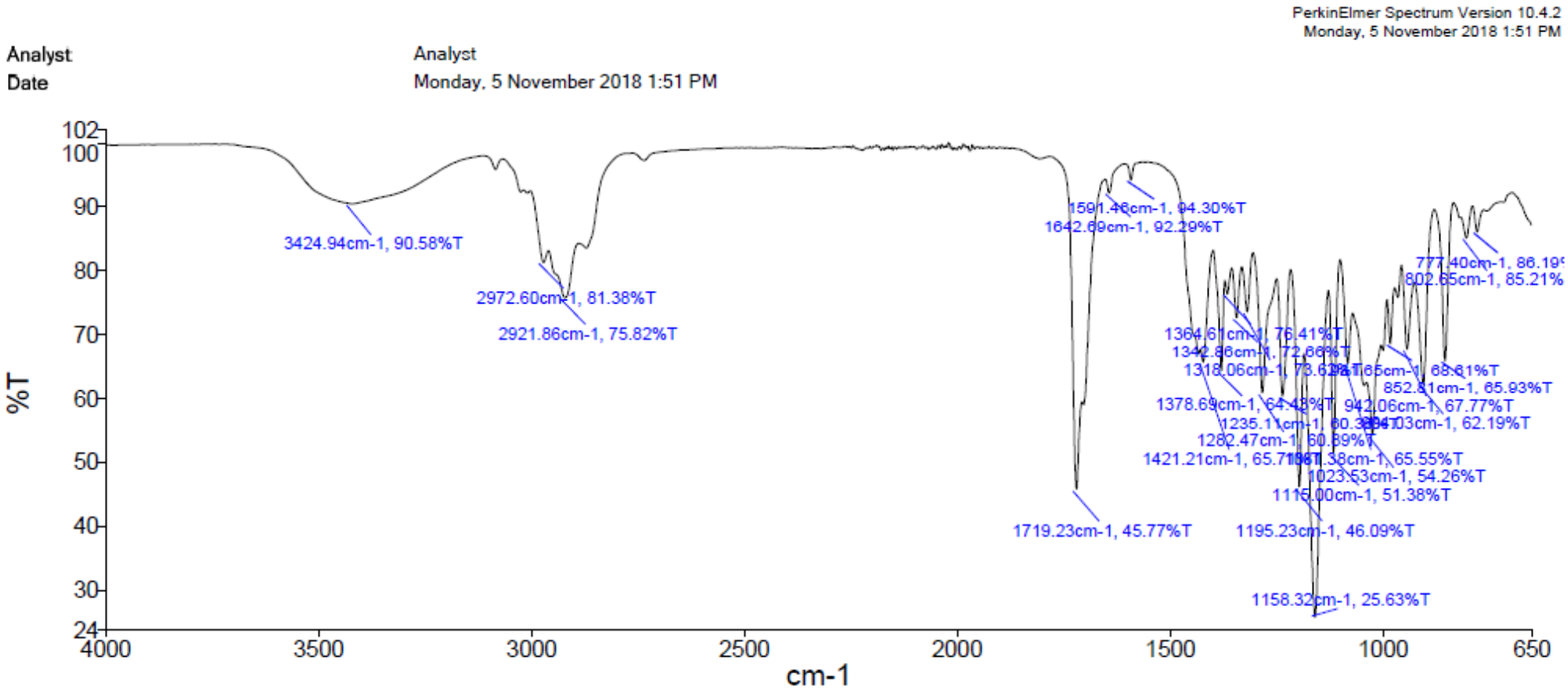
BRUKER

```
Current Data Parameters
NAME      20190118 Pyrethrin I Alcohol Minor diastereomer
EXPNO             14
PROCNO             1

F2 - Acquisition Parameters
Date_          20190120
Time              14.57
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG        hsqcetgp
TD                1024
SOLVENT           CDCl3
NS                  70
DS                  16
SWH           4629.629 Hz
FIDRES        4.521122 Hz
AQ            0.1105920 sec
RG                2050
DW             108.000 usec
DE               6.50 usec
TE              298.3 K
CNST2       145.0000000
D0          0.00000300 sec
D1          1.45494401 sec
D4          0.00172414 sec
D11         0.03000000 sec
D16         0.00020000 sec
IN0         0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1        600.1324815 MHz
NUC1               1H
P1                8.40 usec
P2               16.80 usec
P28            1000.00 usec
PLW1        12.55000019 W

======== CHANNEL f2 ========
SFO2        150.9140636 MHz
NUC2               13C
CPDPRG[2          garp
P3               16.00 usec
P4               32.00 usec
PCPD2            60.00 usec
PLW2       110.76000214 W
PLW12        7.87610006 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1             80.00 %
GPZ2             20.10 %
P16            1000.00 usec

F1 - Acquisition parameters
TD                 256
SFO1        150.9141 MHz
FIDRES       97.656250 Hz
SW           165.657 ppm
FnMODE    Echo-Antiecho

F2 - Processing parameters
SI                1024
SF          600.1300257 MHz
WDW               QSINE
SSB                   2
LB          0 Hz
GB          0
PC                1.40

F1 - Processing parameters
SI                1024
MC2       echo-antiecho
SF          150.9028140 MHz
WDW               QSINE
SSB                   2
LB          0 Hz
GB          0
```

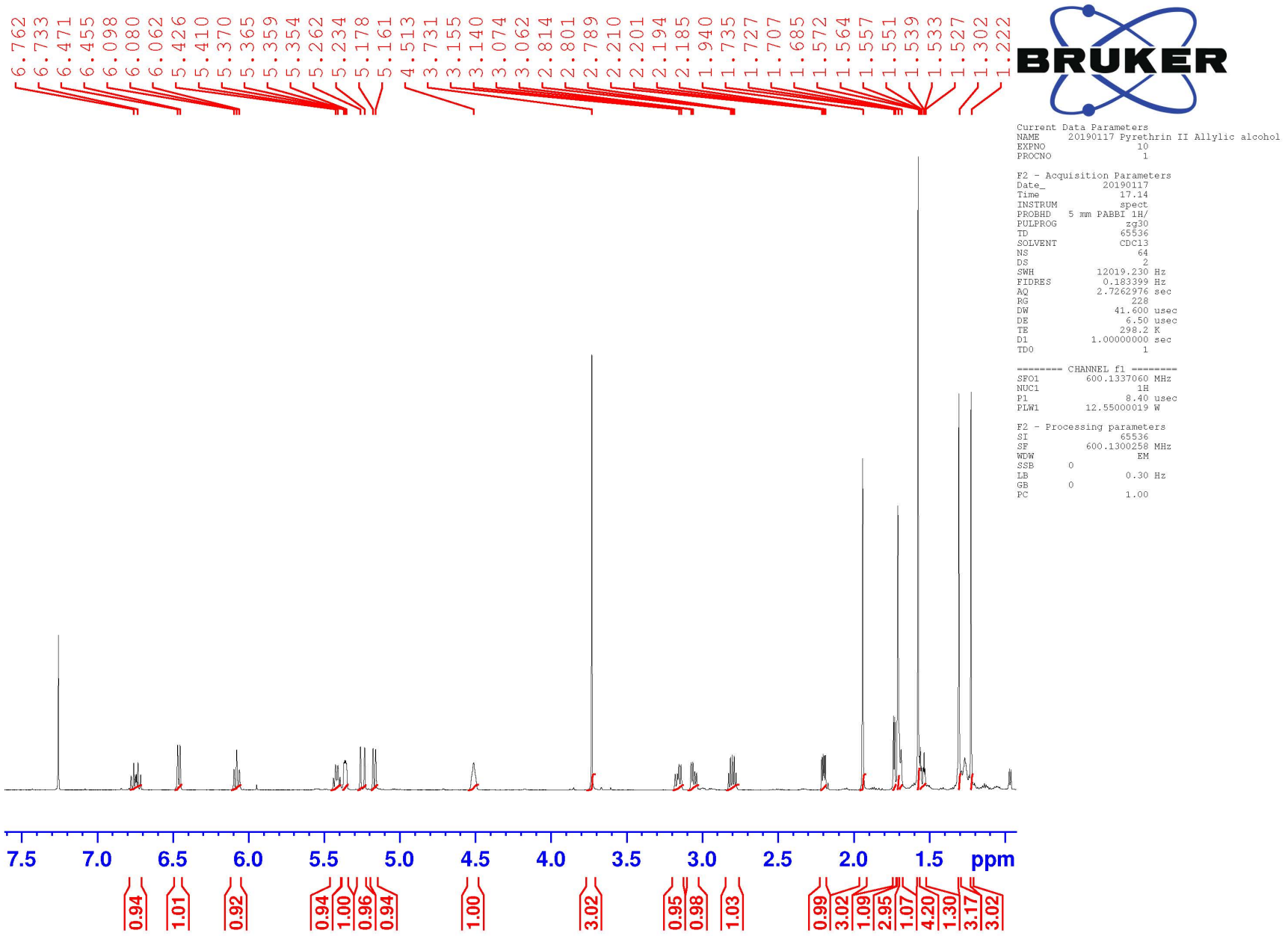


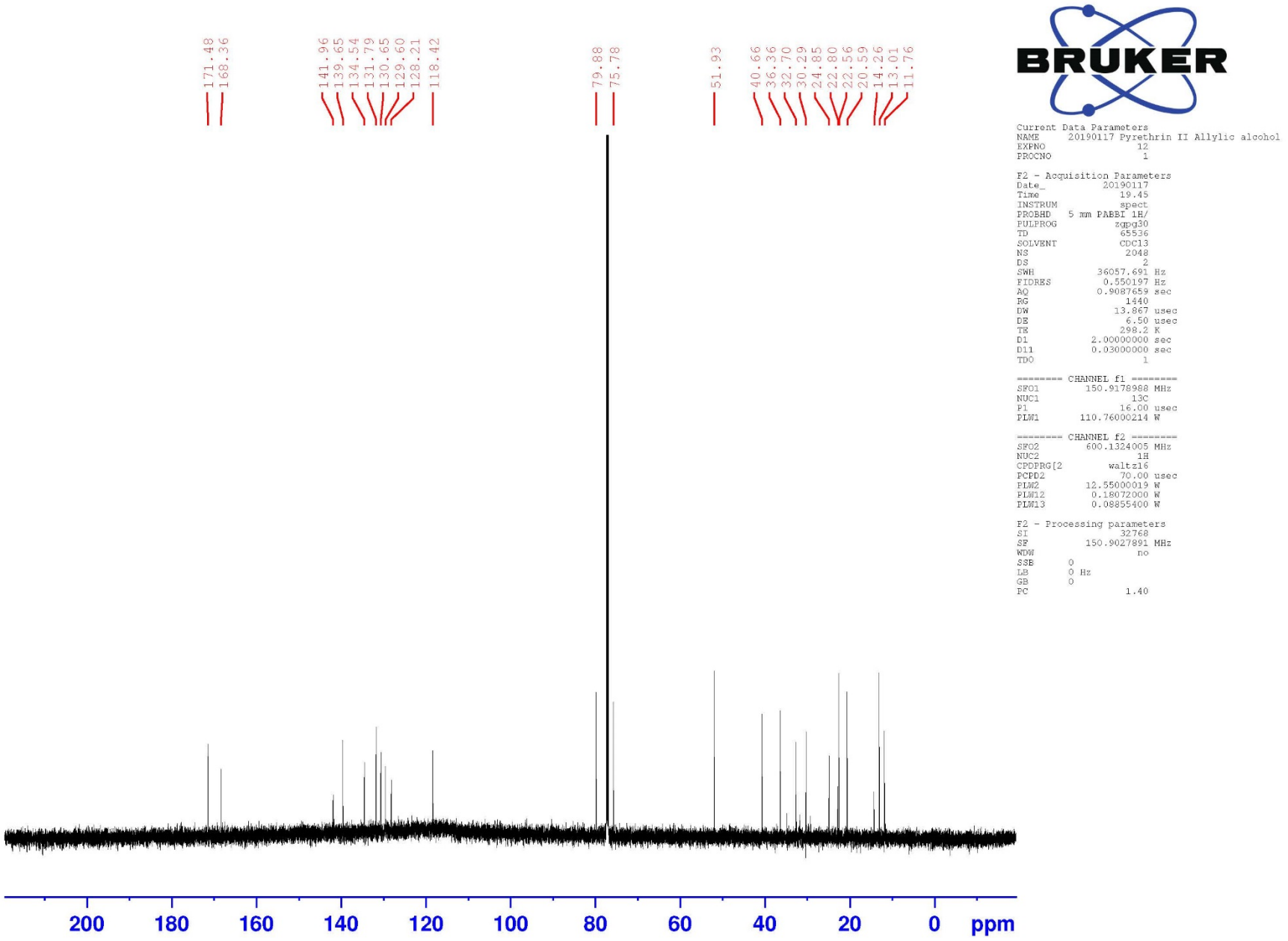

```
Current Data Parameters
NAME      20190122 Pyrethrin I OH MINOR
EXPNO                 11
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190122
Time              16.54
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG        noesygpph
TD                 4096
SOLVENT            CDCl3
NS                    2
DS                   16
SWH           5411.255 Hz
FIDRES        1.321107 Hz
AQ            0.3784704 sec
RG                 50.8
DW               92.400 usec
DE                6.50 usec
TE                298.2 K
D0            0.00008170 sec
D1            3.00000000 sec
D8            0.60000002 sec
D16           0.00020000 sec
IN0           0.00018480 sec

======== CHANNEL f1 ========
SFO1         600.1323960 MHz
NUC1                 1H
P1                8.40 usec
P2               16.80 usec
PLW1         12.55000019 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPZ1               40.00 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                  127
SFO1          600.1324 MHz
FIDRES       42.608311 Hz
SW                9.017 ppm
FnMODE       States-TPPI

F2 - Processing parameters
SI                 4096
SF           600.1300253 MHz
WDW                QSINE
SSB       0
LB        0 Hz
GB        0
PC                 1.00

F1 - Processing parameters
SI                 1024
MC2          States-TPPI
SF           600.1300135 MHz
WDW                QSINE
SSB       0
LB        0 Hz
GB        0
```

(4a) IR Spectrum



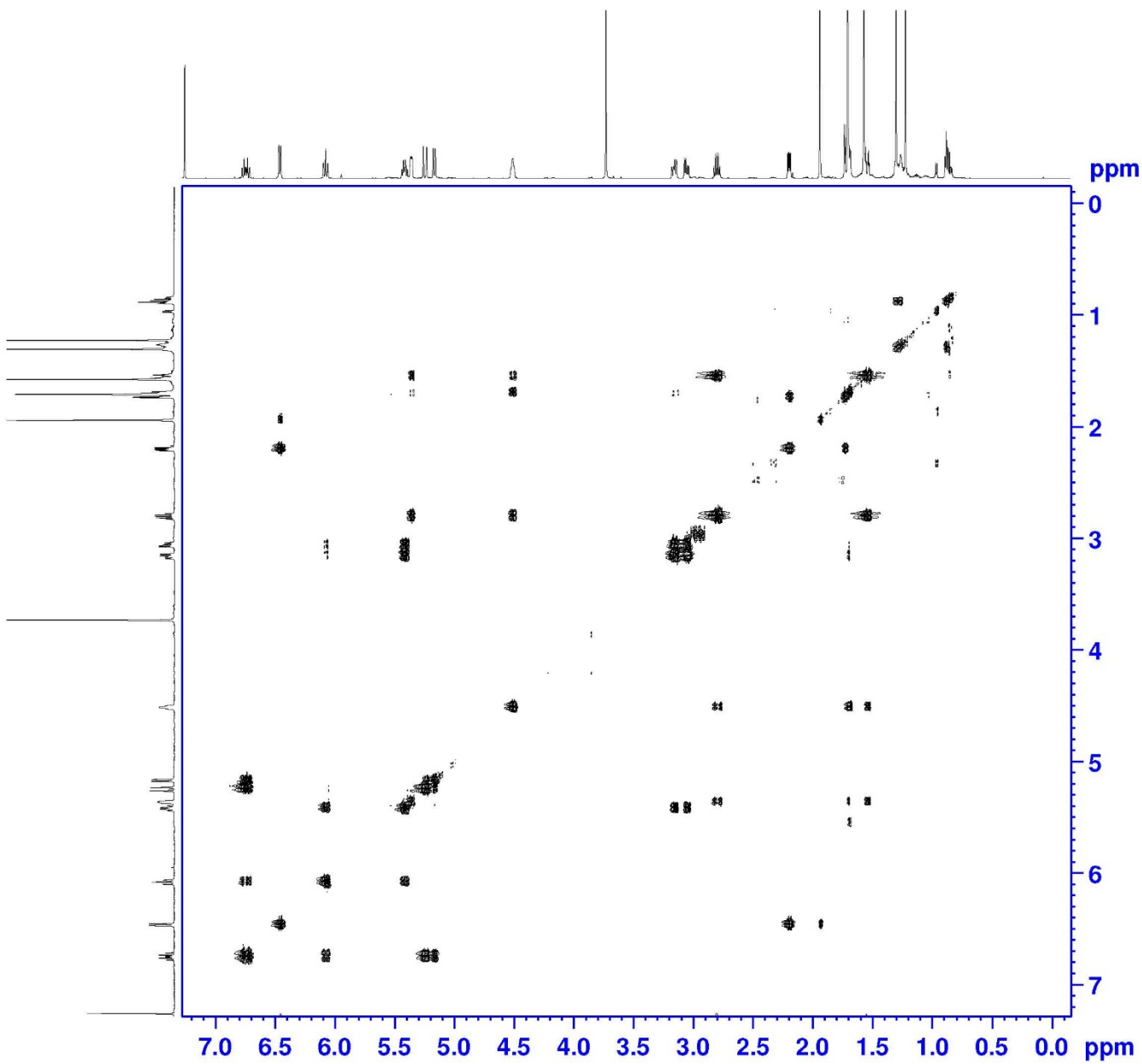
4R-(4b) NMR Characterisation





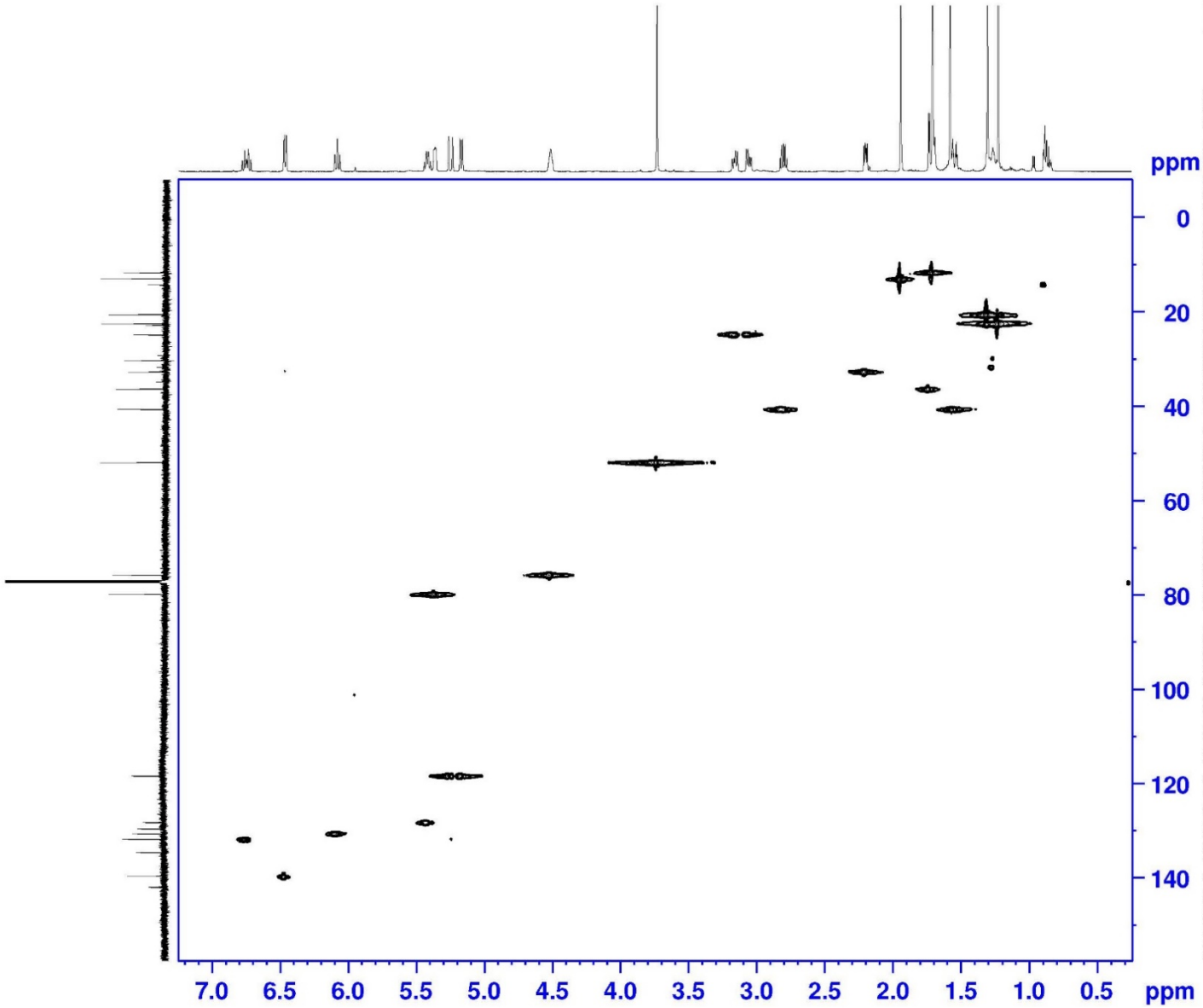
BRUKER

```
Current Data Parameters
NAME      20190117 Pyrethrin II Allylic alcohol
EXPNO                 12
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190117
Time                19.45
INSTRUM             spect
PROBHD   5 mm PABBI 1H/
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  2048
DS                     2
SWH            36057.691 Hz
FIDRES          0.550197 Hz
AQ              0.9087659 sec
RG                  1440
DW                13.867 usec
DE                 6.50 usec
TE                298.2 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         150.9178988 MHz
NUC1                 13C
P1                 16.00 usec
PLW1        110.76000214 W

======== CHANNEL f2 ========
SFO2         600.1324005 MHz
NUC2                 1H
CPDPRG[2          waltz16
PCPD2              70.00 usec
PLW2          12.55000019 W
PLW12          0.18072000 W
PLW13          0.08855400 W

F2 - Processing parameters
SI                 32768
SF           150.9027891 MHz
WDW                   no
SSB       0
LB        0 Hz
GB        0
PC                  1.40
```



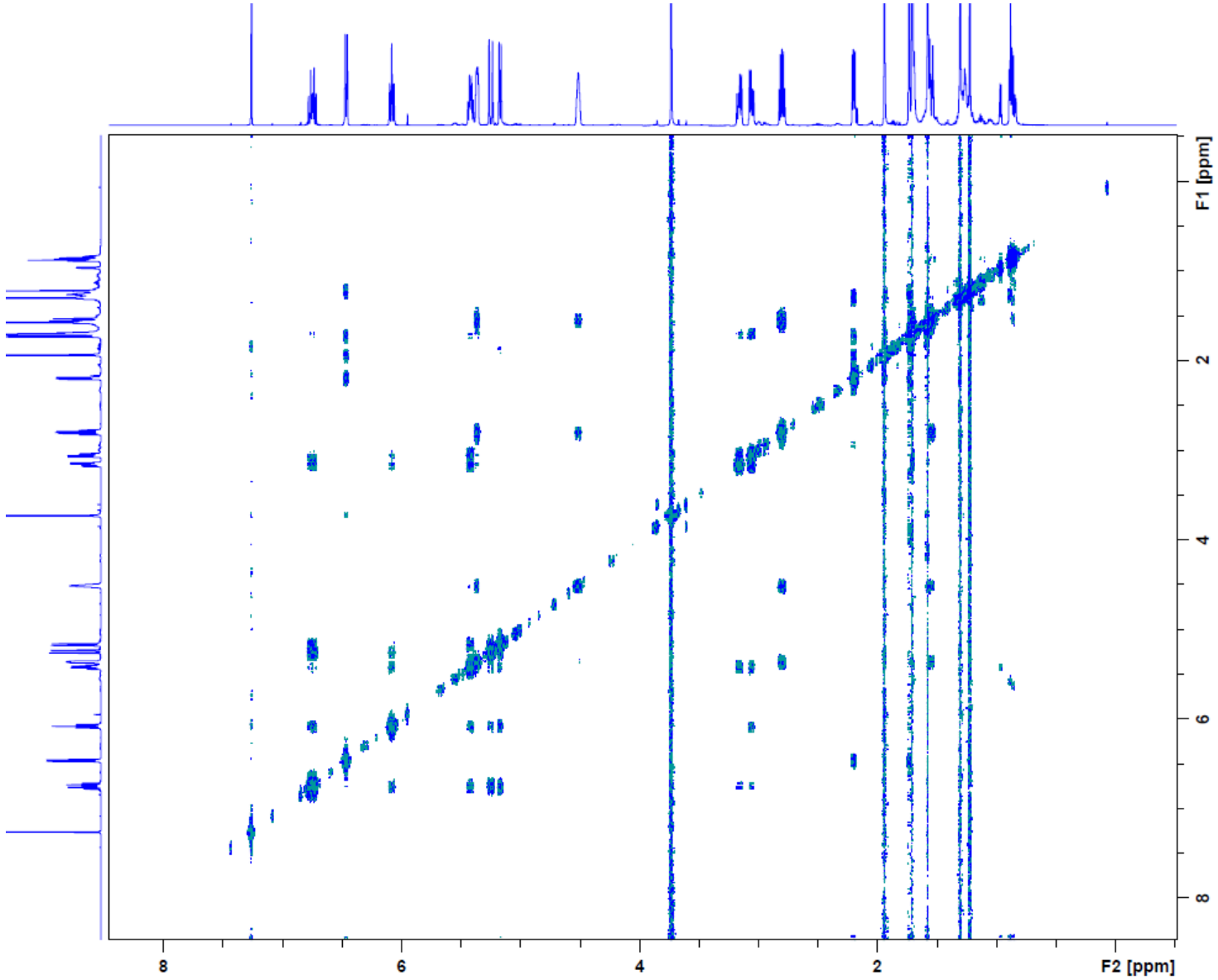
BRUKER

```
Current Data Parameters
NAME      20190117 Pyrethrin II Allylic alcohol
EXPNO                 11
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190117
Time              17.16
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG    cosygpmfphpp
TD                 2048
SOLVENT            CDCl3
NS                    5
DS                    4
SWH            4464.286 Hz
FIDRES         2.179827 Hz
AQ             0.2293760 sec
RG                 2050
DW               112.000 usec
DE                 6.50 usec
TE               298.2 K
D0             0.00010130 sec
D1             1.90906894 sec
D11            0.03000000 sec
D12            0.00002000 sec
D16            0.00020000 sec
INO            0.00022400 sec

======== CHANNEL f1 ========
SFO1          600.1321673 MHz
NUC1                  1H
P1                  8.40 usec
P2                 16.80 usec
P17              2500.00 usec
PLW1          12.55000019 W
PLW10          1.30999994 W

====== GRADIENT CHANNEL =====
GPNAM[1]       SMSQ10.100
GPNAM[2]       SMSQ10.100
GPZ1                10.00 %
GPZ2                20.00 %
P16               1000.00 usec

F1 - Acquisition parameters
TD                   256
SFO1            600.1322 MHz
FIDRES         17.438616 Hz
SW                 7.439 ppm
FnMODE       States-TPPI

F2 - Processing parameters
SI                  1024
SF            600.1300296 MHz
WDW                 QSINE
SSB                    2
LB         0 Hz
GB         0
PC                  1.40

F1 - Processing parameters
SI                  1024
MC2          States-TPPI
SF            600.1300274 MHz
WDW                 QSINE
SSB                    2
LB         0 Hz
GB         0
```



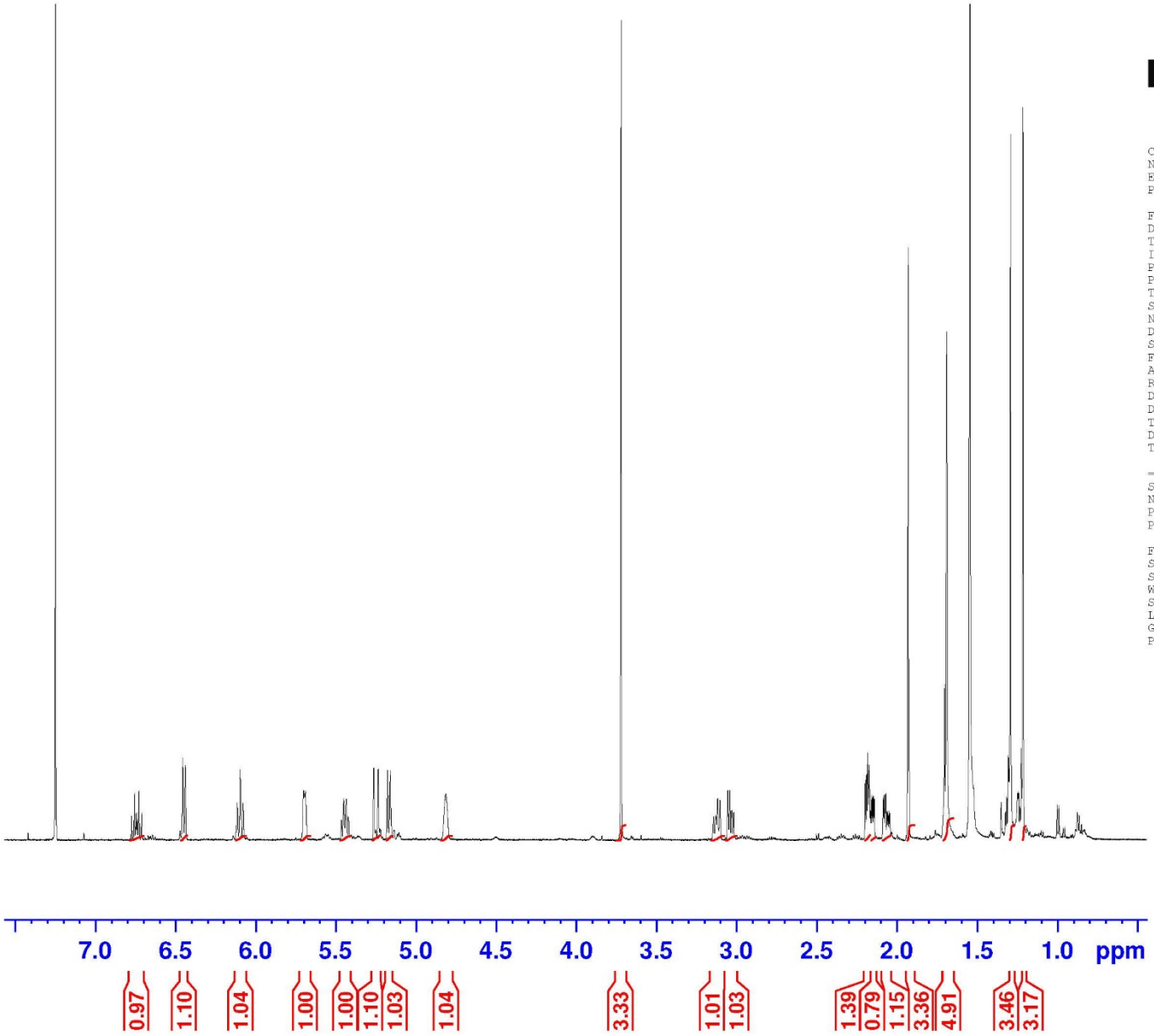
BRUKER

```
Current Data Parameters
NAME      20190117 Pyrethrin II Allylic alcohol
EXPNO                14
PROCNO                1

F2 - Acquisition Parameters
Date_              20190117
Time                 19.51
INSTRUM              spect
PROBHD   5 mm PABBI 1H/
PULPROG          hsqcetgp
TD                   1024
SOLVENT             CDCl3
NS                     45
DS                     16
SWH               4201.681 Hz
FIDRES            4.103204 Hz
AQ                0.1218560 sec
RG                    2050
DW                 119.000 usec
DE                   6.50 usec
TE                  298.2 K
CNST2          145.0000000
D0               0.00000300 sec
D1               1.44368005 sec
D4               0.00172414 sec
D11              0.03000000 sec
D16              0.00020000 sec
IN0              0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1          600.1322686 MHz
NUC1                    1H
P1                    8.40 usec
P2                   16.80 usec
P28                1000.00 usec
PLW1          12.55000019 W

======== CHANNEL f2 ========
SFO2          150.9140636 MHz
NUC2                   13C
CPDPRG[2               garp
P3                   16.00 usec
P4                   32.00 usec
PCPD2                60.00 usec
PLW2          110.76000214 W
PLW12           7.87610006 W

====== GRADIENT CHANNEL =====
GPNAM[1]       SMSQ10.100
GPNAM[2]       SMSQ10.100
GPZ1                80.00 %
GPZ2                20.10 %
P16               1000.00 usec

F1 - Acquisition parameters
TD                     256
SFO1            150.9141 MHz
FIDRES          97.656250 Hz
SW                165.657 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                    1024
SF            600.1300209 MHz
WDW                   QSINE
SSB                       2
LB         0 Hz
GB         0
PC                     1.40

F1 - Processing parameters
SI                    1024
MC2         echo-antiecho
SF            150.9027813 MHz
WDW                   QSINE
SSB                       2
LB         0 Hz
GB         0
```



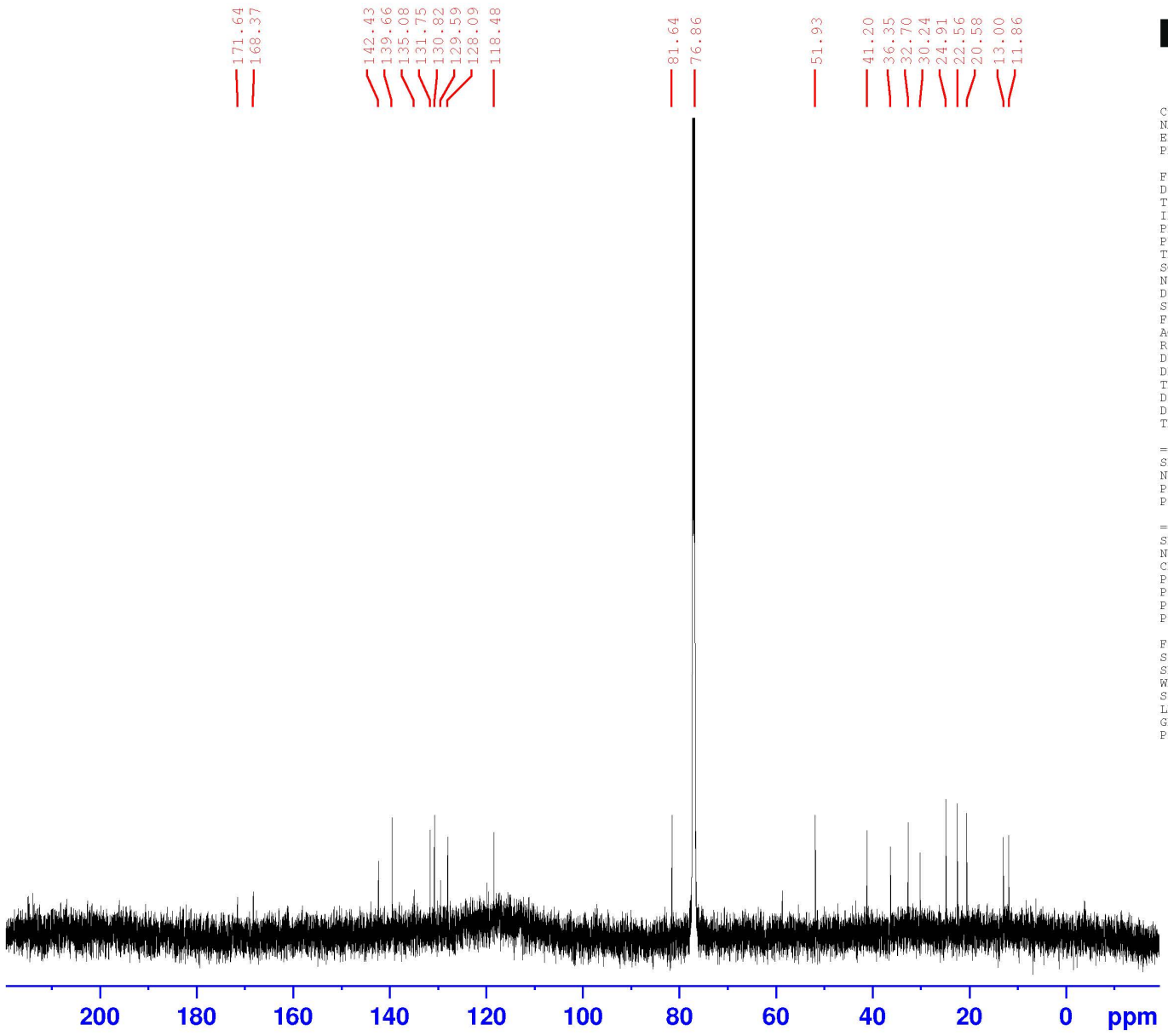

```
Current Data Parameters
NAME      20190121 Pyrethrin II OH MAJOR
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190121
Time               8.41
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG        noesygpph
TD                 4096
SOLVENT            CDC13
NS                     2
DS                    16
SWH           5411.255 Hz
FIDRES        1.321107 Hz
AQ            0.3784704 sec
RG                   203
DW                92.400 usec
DE                 6.50 usec
TE                298.2 K
D0           0.00008170 sec
D1           3.00000000 sec
D8           0.60000002 sec
D16          0.00020000 sec
IN0          0.00018480 sec

======== CHANNEL f1 ========
SFO1         600.1323960 MHz
NUC1                   1H
P1                  8.40 usec
P2                 16.80 usec
PLW1         12.55000019 W

======= GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPZ1               40.00 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                   397
SFO1           600.1324 MHz
FIDRES        13.630366 Hz
SW                 9.017 ppm
FnMODE       States-TPPI

F2 - Processing parameters
SI                  4096
SF           600.1300252 MHz
WDW                 QSINE
SSB       0
LB        0 Hz
GB        0
PC                  1.00

F1 - Processing parameters
SI                  1024
MC2          States-TPPI
SF           600.1300210 MHz
WDW                 QSINE
SSB       0
LB        0 Hz
GB        0
```

4S-(4b) NMR Characterisation

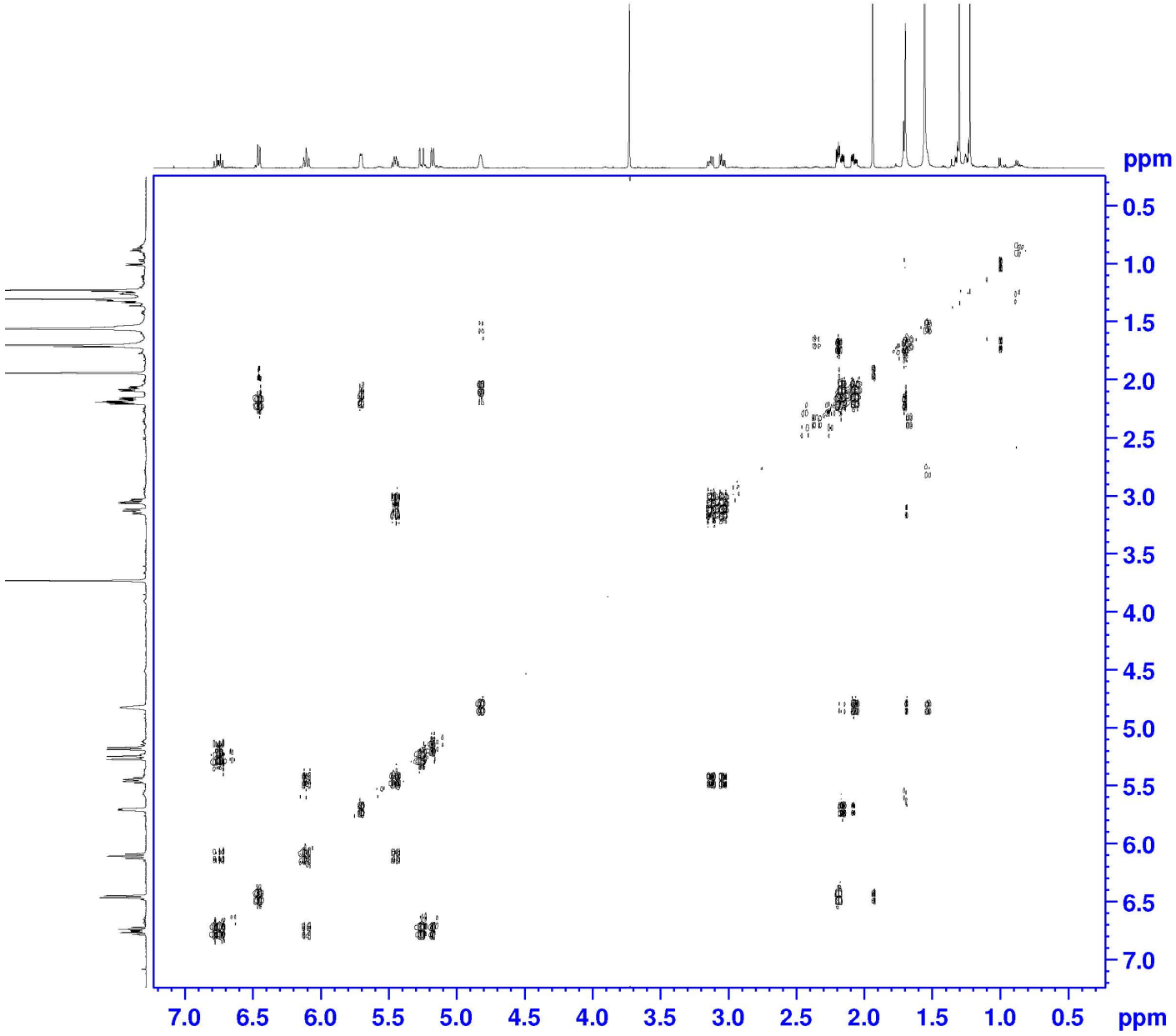


BRUKER

```
Current Data Parameters
NAME      20190123 Pyrethrin II OH MINOR
EXPNO                 20
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190123
Time              18.28
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG             zg30
TD                65536
SOLVENT           CDCl3
NS                   64
DS                    2
SWH           12019.230 Hz
FIDRES         0.183399 Hz
AQ             2.7262976 sec
RG                  362
DW               41.600 usec
DE                6.50 usec
TE                298.2 K
D1           1.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1         600.1337060 MHz
NUC1                 1H
P1                8.40 usec
PLW1        12.55000019 W

F2 - Processing parameters
SI                65536
SF           600.1300305 MHz
WDW                  no
SSB       0
LB        0 Hz
GB        0
PC                1.00
```

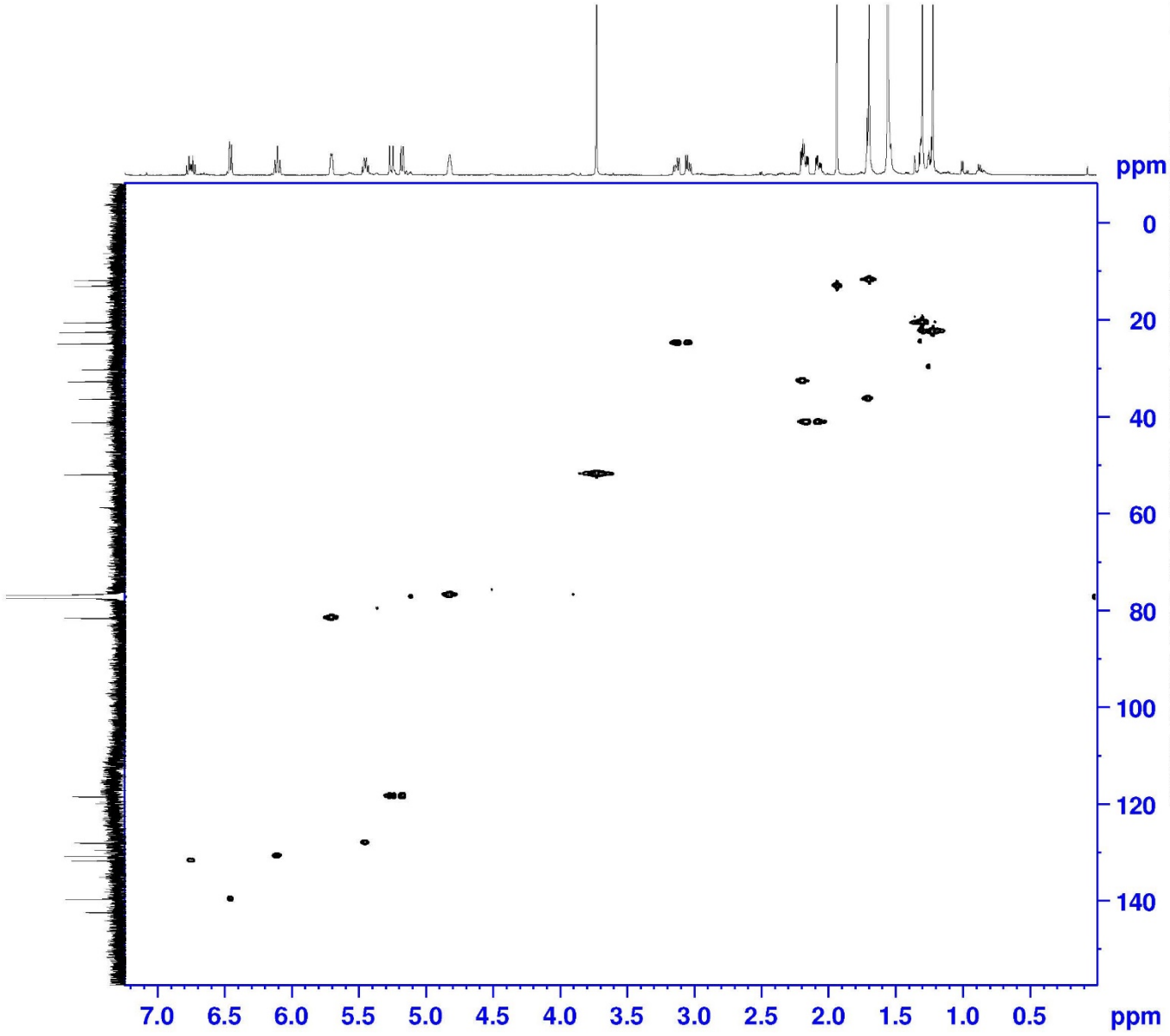



```
Current Data Parameters
NAME      20190121 Pyrethrin II Minor OH
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190121
Time              22.33
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                 6144
DS                    2
SWH           36057.691 Hz
FIDRES         0.550197 Hz
AQ            0.9087659 sec
RG                 1440
DW               13.867 usec
DE                6.50 usec
TE                298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1         150.9178988 MHz
NUC1                 13C
P1                16.00 usec
PLW1        110.76000214 W

======== CHANNEL f2 ========
SFO2         600.1324005 MHz
NUC2                 1H
CPDPRG[2          waltz16
PCPD2             70.00 usec
PLW2         12.55000019 W
PLW12         0.18072000 W
PLW13         0.08855400 W

F2 - Processing parameters
SI                32768
SF           150.9027895 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



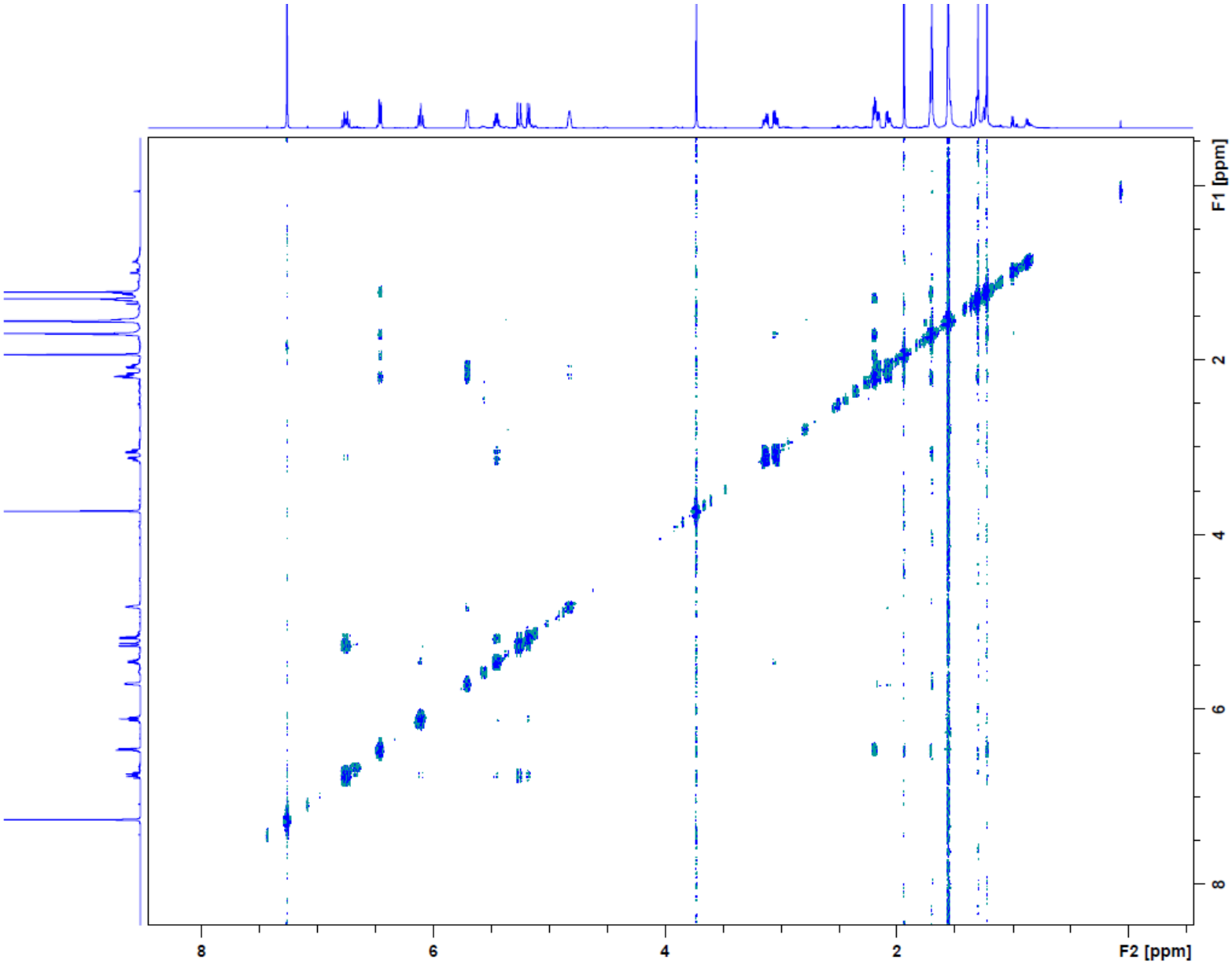
BRUKER

```
Current Data Parameters
NAME      20190125 Pyrethrin II OH MINOR
EXPNO                 11
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190125
Time               10.54
INSTRUM            spect
PROBHD   5 mm PABBI 1H/
PULPROG    cosygpmfphpp
TD                 2048
SOLVENT            CDCl3
NS                    6
DS                    4
SWH             4201.681 Hz
FIDRES          2.051602 Hz
AQ              0.2437120 sec
RG                 2050
DW               119.000 usec
DE                 6.50 usec
TE                298.2 K
D0             0.00010830 sec
D1             1.89473295 sec
D11            0.03000000 sec
D12            0.00002000 sec
D16            0.00020000 sec
IN0            0.00023800 sec

======== CHANNEL f1 ========
SFO1         600.1322665 MHz
NUC1                 1H
P1                 8.40 usec
P2                16.80 usec
P17             2500.00 usec
PLW1         12.55000019 W
PLW10         1.30999994 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1               10.00 %
GPZ2               20.00 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                  124
SFO1            600.1323 MHz
FIDRES         33.884521 Hz
SW                7.001 ppm
FnMODE       States-TPPI

F2 - Processing parameters
SI                 1024
SF           600.1300272 MHz
WDW                QSINE
SSB                   2
LB        0 Hz
GB        0
PC                 1.40

F1 - Processing parameters
SI                 1024
MC2          States-TPPI
SF           600.1300209 MHz
WDW                QSINE
SSB                   2
LB        0 Hz
GB        0
```



BRUKER

```
Current Data Parameters
NAME      20190118 Pyrethrin II Alcohol Minor diastereomer
EXPNO                 12
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190119
Time                8.26
INSTRUM            spect
PROBHD   5 mm PABBI 1H/
PULPROG          hsqcetgp
TD                 1024
SOLVENT            CDCl3
NS                   70
DS                   16
SWH           4347.826 Hz
FIDRES        4.248924 Hz
AQ            0.1177600 sec
RG                 2050
DW             115.000 usec
DE                6.50 usec
TE               298.3 K
CNST2         145.0000000
D0            0.00000300 sec
D1            1.44077596 sec
D4            0.00172414 sec
D11           0.03000000 sec
D16           0.00020000 sec
IN0           0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1         600.1322032 MHz
NUC1                 1H
P1                  8.40 usec
P2                 16.80 usec
P28              1000.00 usec
PLW1         12.55000019 W

======== CHANNEL f2 ========
SFO2         150.9140636 MHz
NUC2                 13C
CPDPRG[2             garp
P3                 16.00 usec
P4                 32.00 usec
PCPD2              60.00 usec
PLW2         110.76000214 W
PLW12          7.87610006 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1               80.00 %
GPZ2               20.10 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                  256
SFO1          150.9141 MHz
FIDRES        97.656250 Hz
SW              165.657 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                 1024
SF           600.1300289 MHz
WDW                QSINE
SSB                    2
LB         0 Hz
GB         0
PC                 1.40

F1 - Processing parameters
SI                 1024
MC2         echo-antiecho
SF           150.9028985 MHz
WDW                QSINE
SSB                    2
LB         0 Hz
GB         0
```




```
Current Data Parameters
NAME      20190121 Pyrethrin II OH MINOR
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190121
Time              13.10
INSTRUM             spect
PROBHD   5 mm PABBI 1H/
PULPROG         noesygpph
TD                  4096
SOLVENT             CDC13
NS                      2
DS                     16
SWH             5411.255 Hz
FIDRES          1.321107 Hz
AQ              0.3784704 sec
RG                    575
DW                 92.400 usec
DE                  6.50 usec
TE                298.2 K
D0              0.00008170 sec
D1              3.00000000 sec
D8              0.60000002 sec
D16             0.00020000 sec
IN0             0.00018480 sec

======== CHANNEL f1 ========
SFO1          600.1323960 MHz
NUC1                    1H
P1                   8.40 usec
P2                  16.80 usec
PLW1          12.55000019 W

====== GRADIENT CHANNEL =====
GPNAM[1]       SMSQ10.100
GPZ1                40.00 %
P16               1000.00 usec

F1 - Acquisition parameters
TD                    384
SFO1            600.1324 MHz
FIDRES          14.091811 Hz
SW                 9.017 ppm
FnMODE        States-TPPI

F2 - Processing parameters
SI                   4096
SF              600.1300256 MHz
WDW                  QSINE
SSB         0
LB          0 Hz
GB          0
PC                    1.00

F1 - Processing parameters
SI                   1024
MC2           States-TPPI
SF              600.1300184 MHz
WDW                  QSINE
SSB         0
LB          0 Hz
GB          0
```

(4b) IR Spectrum

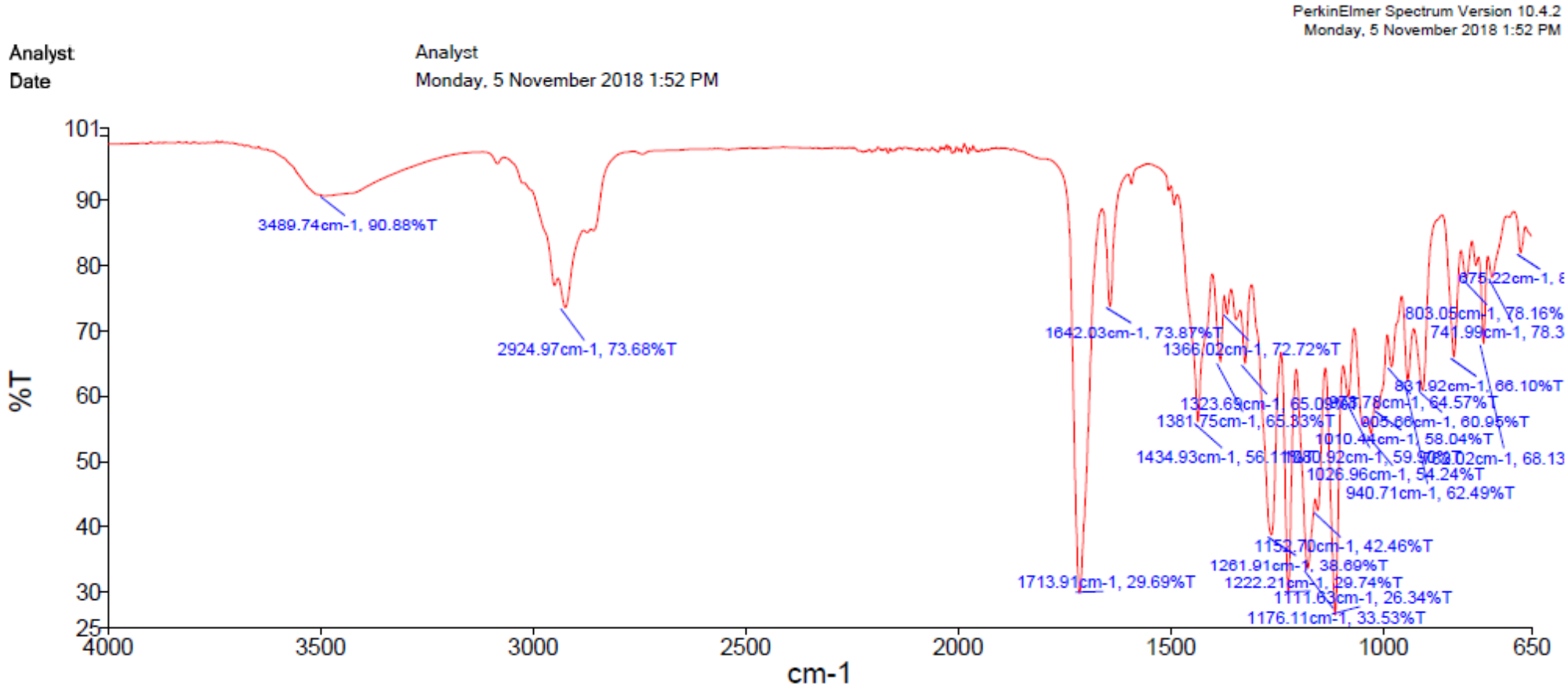
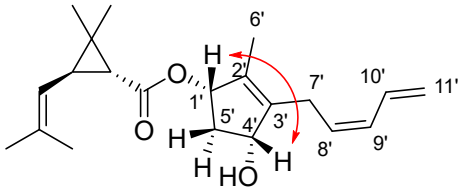
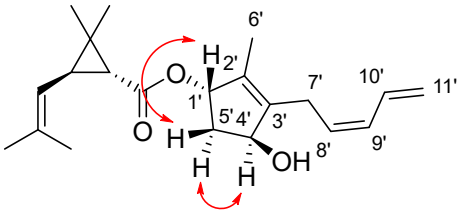


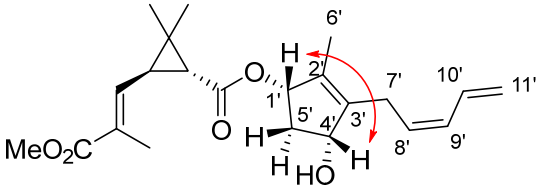
Figure showing nOe correlations for **4a** and **4b** epimers



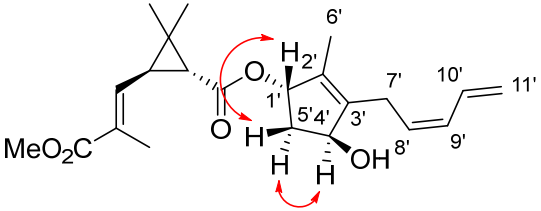
4R-**4a**



4S-**4a**

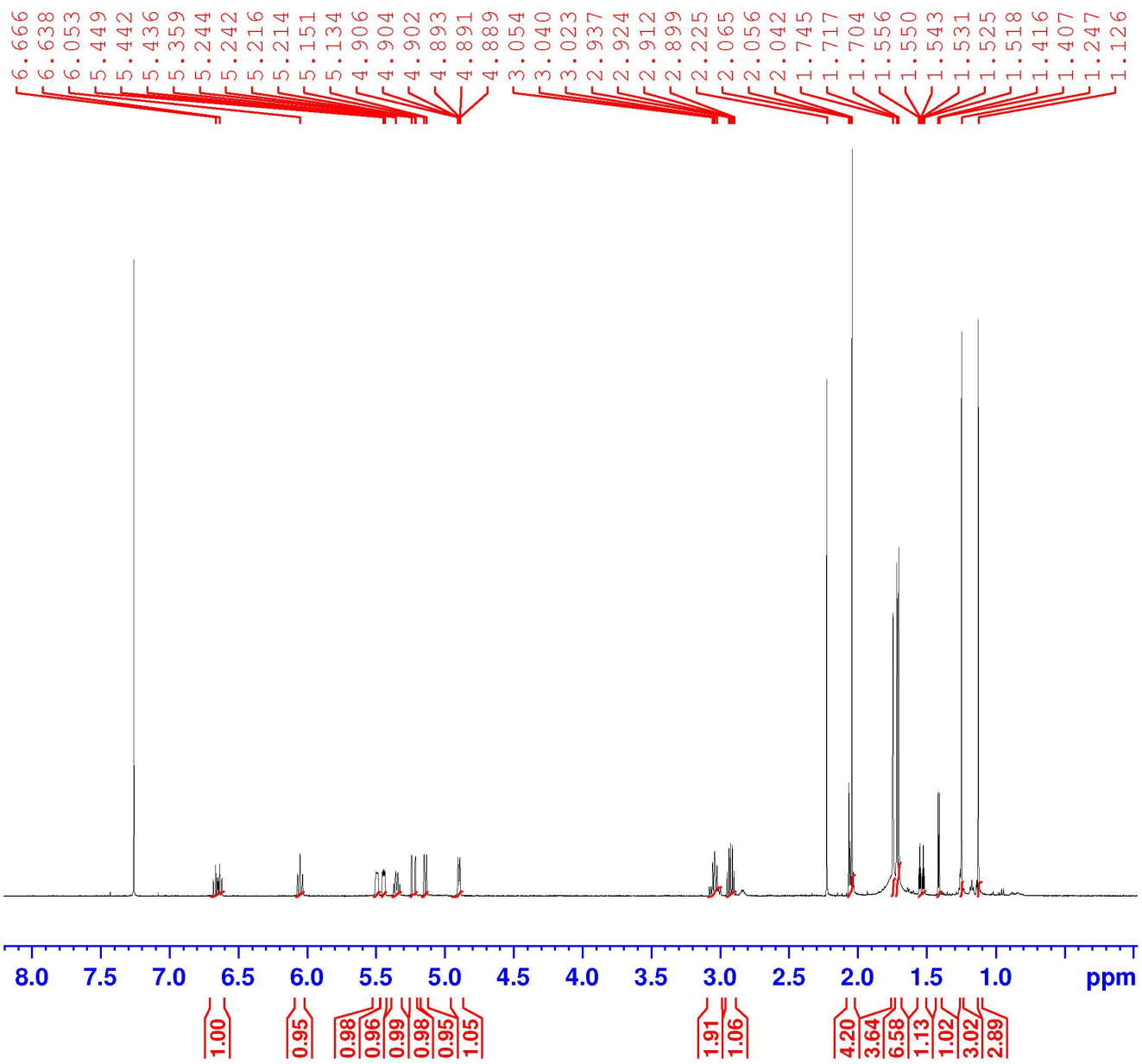


4R-**4b**



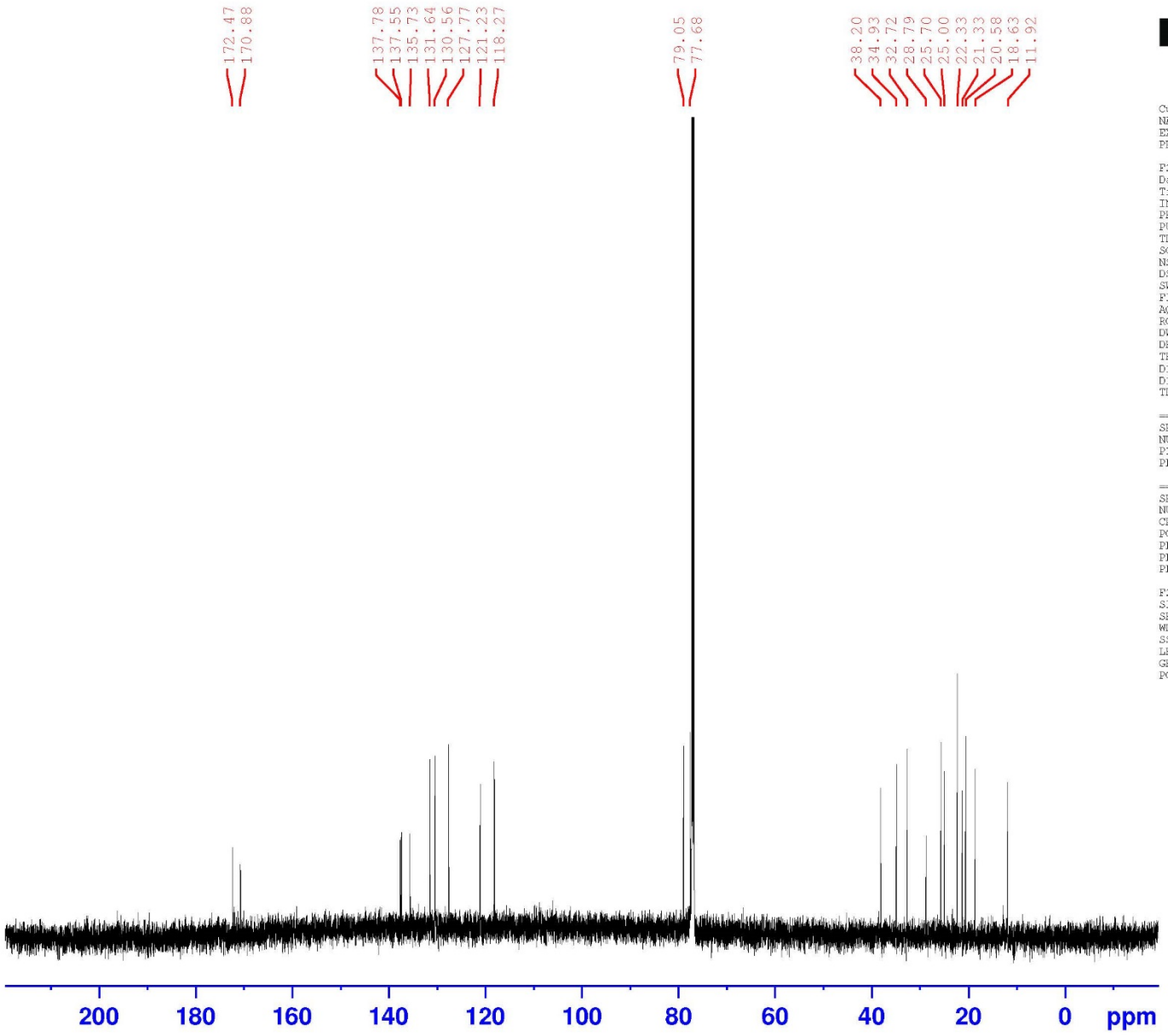
4S-**4b**

4R-(5a) NMR Characterisation



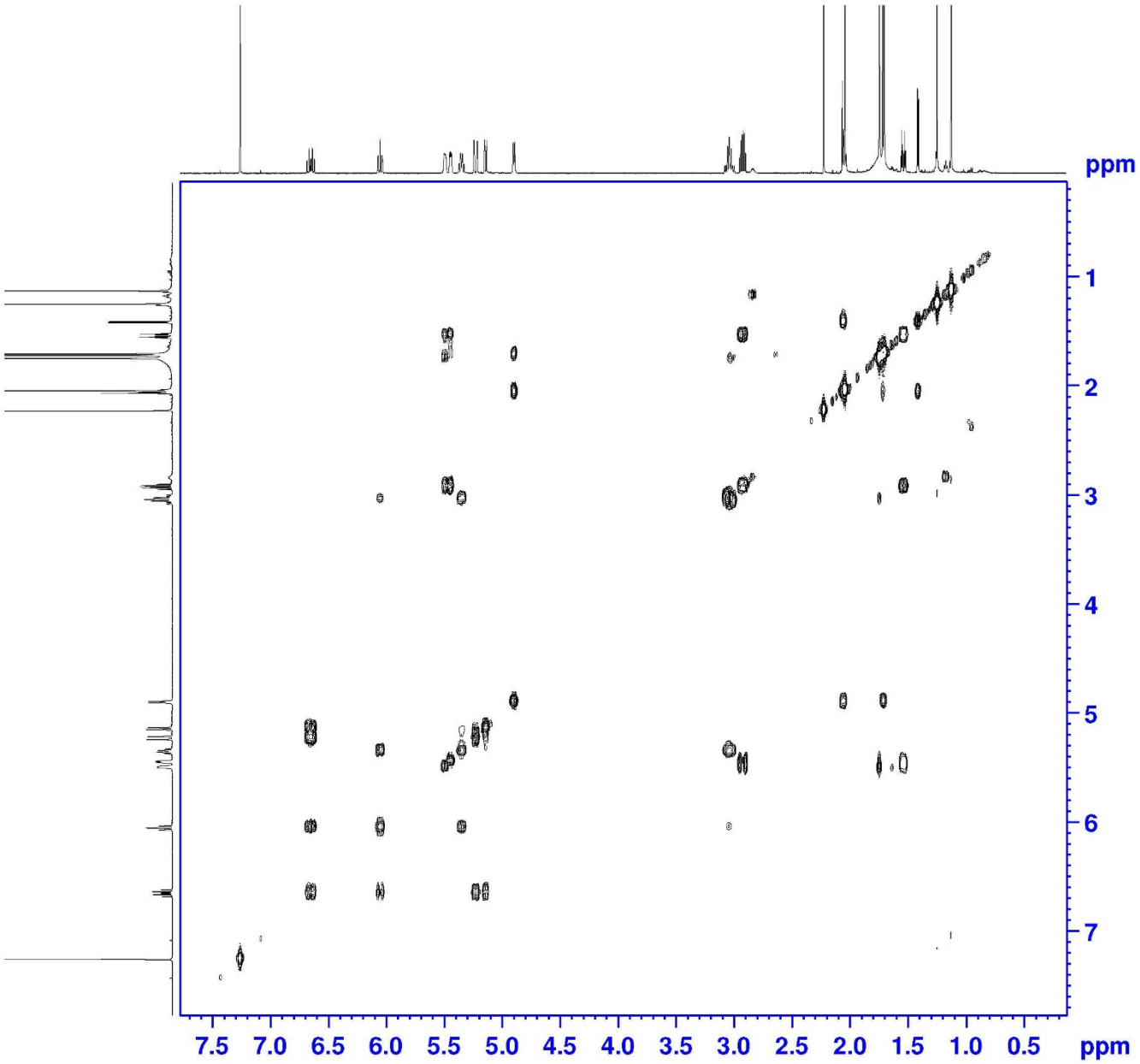
BRUKER

```
Current Data Parameters
NAME      20190218 Pyrethrin I Acetate MAJOR
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190218
Time              18.32
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG           zg30
TD               65536
SOLVENT          CDCl3
NS                  32
DS                   2
SWH          12019.230 Hz
FIDRES        0.183399 Hz
AQ            2.7262976 sec
RG                 322
DW              41.600 usec
DE               6.50 usec
TE              298.1 K
D1           1.00000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1        600.1337061 MHz
NUC1               1H
P1                13.50 usec
PLW1        17.00000000 W

F2 - Processing parameters
SI                65536
SF          600.1300256 MHz
WDW                  no
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



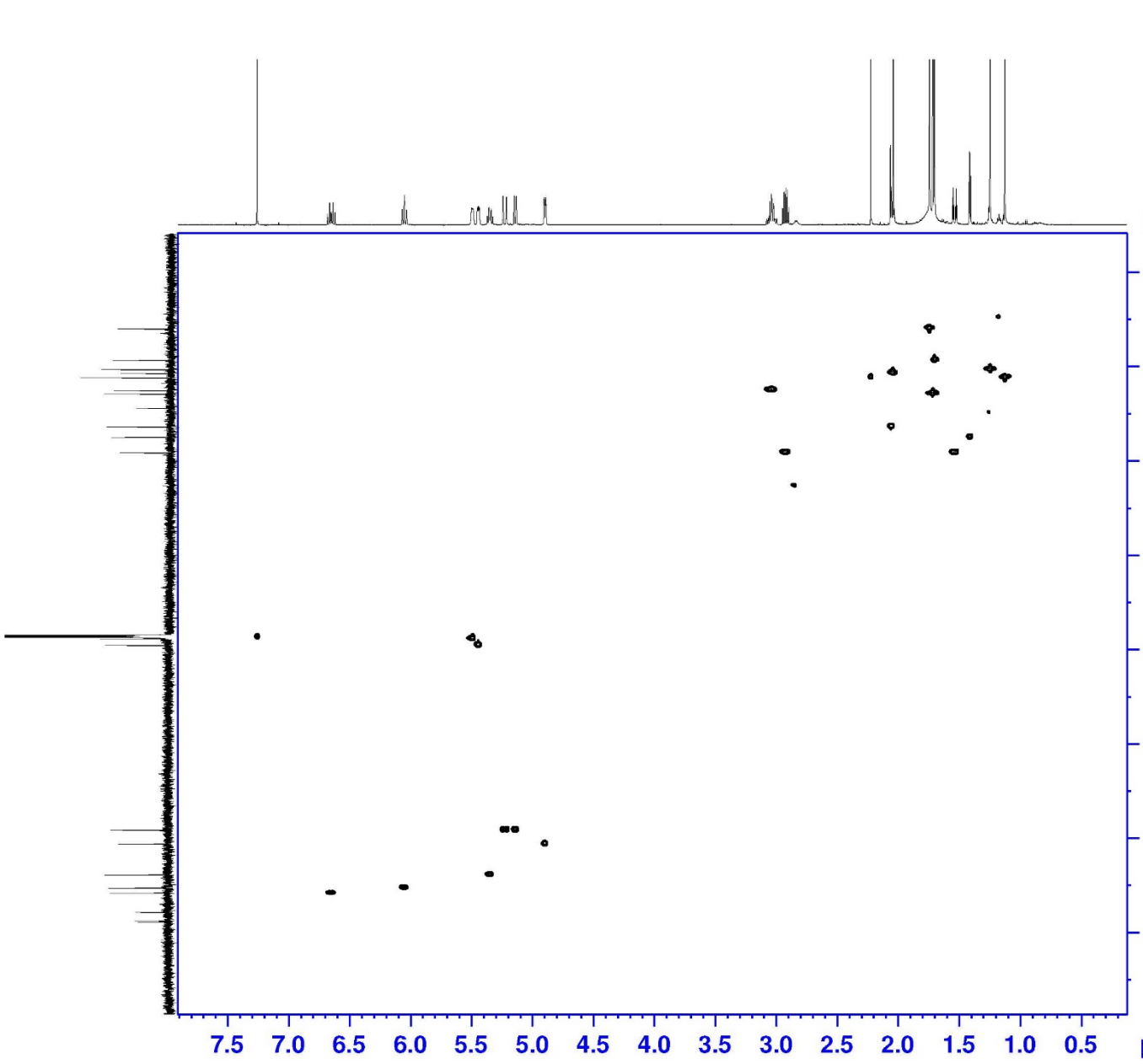
BRUKER

```
Current Data Parameters
NAME      20190218 Pyrethrin I Acetate MAJOR
EXPNO                22
PROCNO                1

F2 - Acquisition Parameters
Date_          20190218
Time              21.23
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD               65536
SOLVENT          CDCl3
NS                2048
DS                   2
SWH          36057.691 Hz
FIDRES        0.550197 Hz
AQ           0.9087659 sec
RG                2050
DW              13.867 usec
DE                6.50 usec
TE               298.2 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1       150.9178988 MHz
NUC1               13C
P1               12.00 usec
PLW1       80.00000000 W

======== CHANNEL f2 ========
SFO2       600.1324005 MHz
NUC2               1H
CPDPRG[2        waltz16
PCPD2            70.00 usec
PLW2       17.00000000 W
PLW12       0.63230002 W
PLW13       0.30983001 W

F2 - Processing parameters
SI               32768
SF         150.9027902 MHz
WDW                EM
SSB       0
LB               1.00 Hz
GB        0
PC               1.40
```



BRUKER

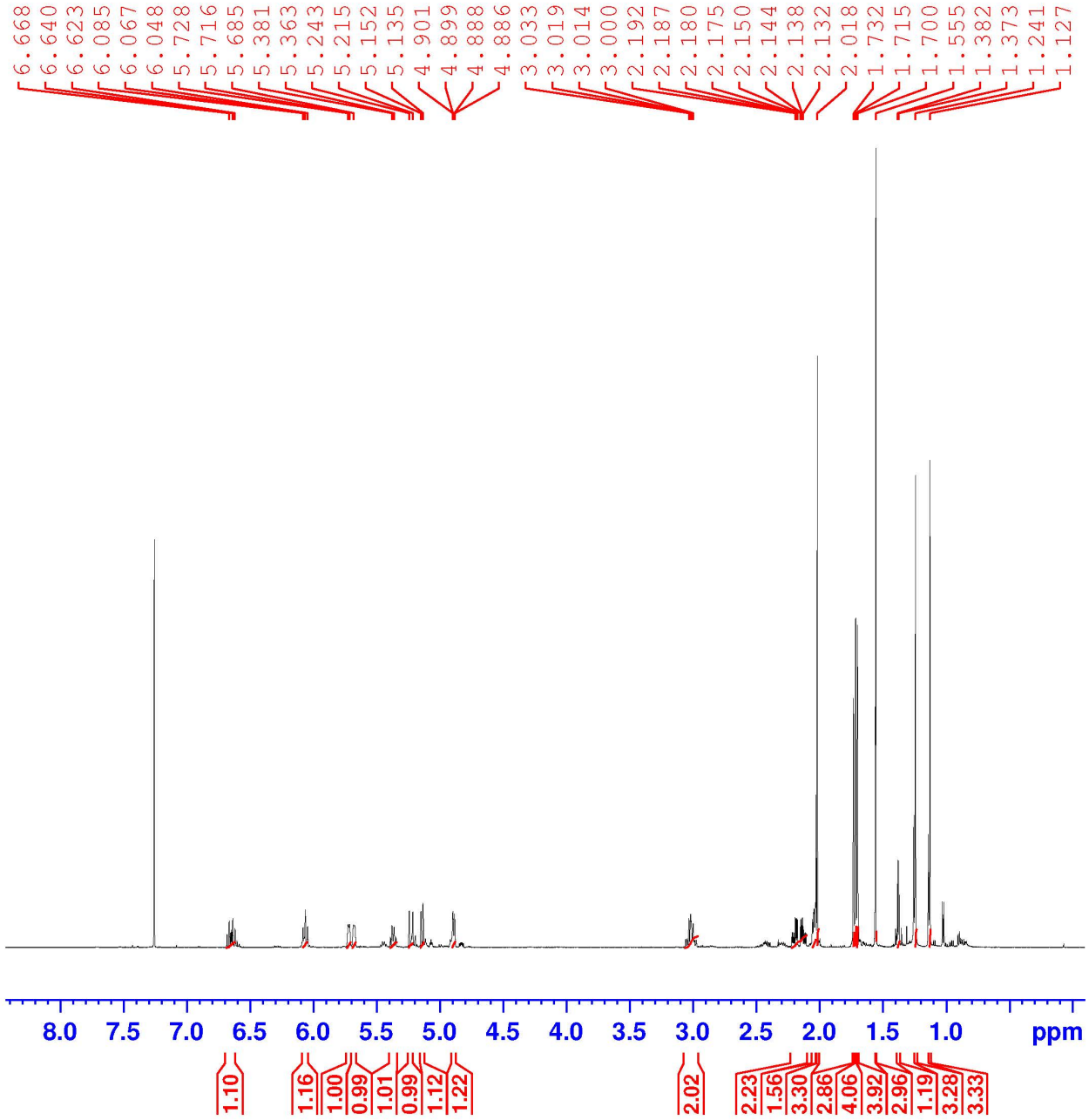
```
Current Data Parameters
NAME      20190218 Pyrethrin I Acetate MAJOR
EXPNO                21
PROCNO                1

F2 - Acquisition Parameters
Date_          20190218
Time              18.54
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG      cosygpppqf
TD                 2048
SOLVENT            CDCl3
NS                   10
DS                    8
SWH             4587.156 Hz
FIDRES          2.239822 Hz
AQ              0.2232320 sec
RG                   161
DW                109.000 usec
DE                  6.50 usec
TE                298.2 K
D0             0.00000300 sec
D1             1.90456295 sec
D11            0.03000000 sec
D12            0.00002000 sec
D13            0.00000400 sec
D16            0.00020000 sec
IN0            0.00021800 sec

======== CHANNEL f1 ========
SFO1         600.1323992 MHz
NUC1                   1H
P0                  13.50 usec
P1                  13.50 usec
P17               2500.00 usec
PLW1         17.00000000 W
PLW10         4.58319998 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPZ1               10.00 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                   128
SFO1           600.1324 MHz
FIDRES         35.837154 Hz
SW                7.644 ppm
FnMODE                QF

F2 - Processing parameters
SI                  1024
SF           600.1300252 MHz
WDW                 QSINE
SSB       0
LB        0 Hz
GB        0
PC                  1.40

F1 - Processing parameters
SI                  1024
MC2                   QF
SF           600.1300274 MHz
WDW                 QSINE
SSB       0
LB        0 Hz
GB        0
```



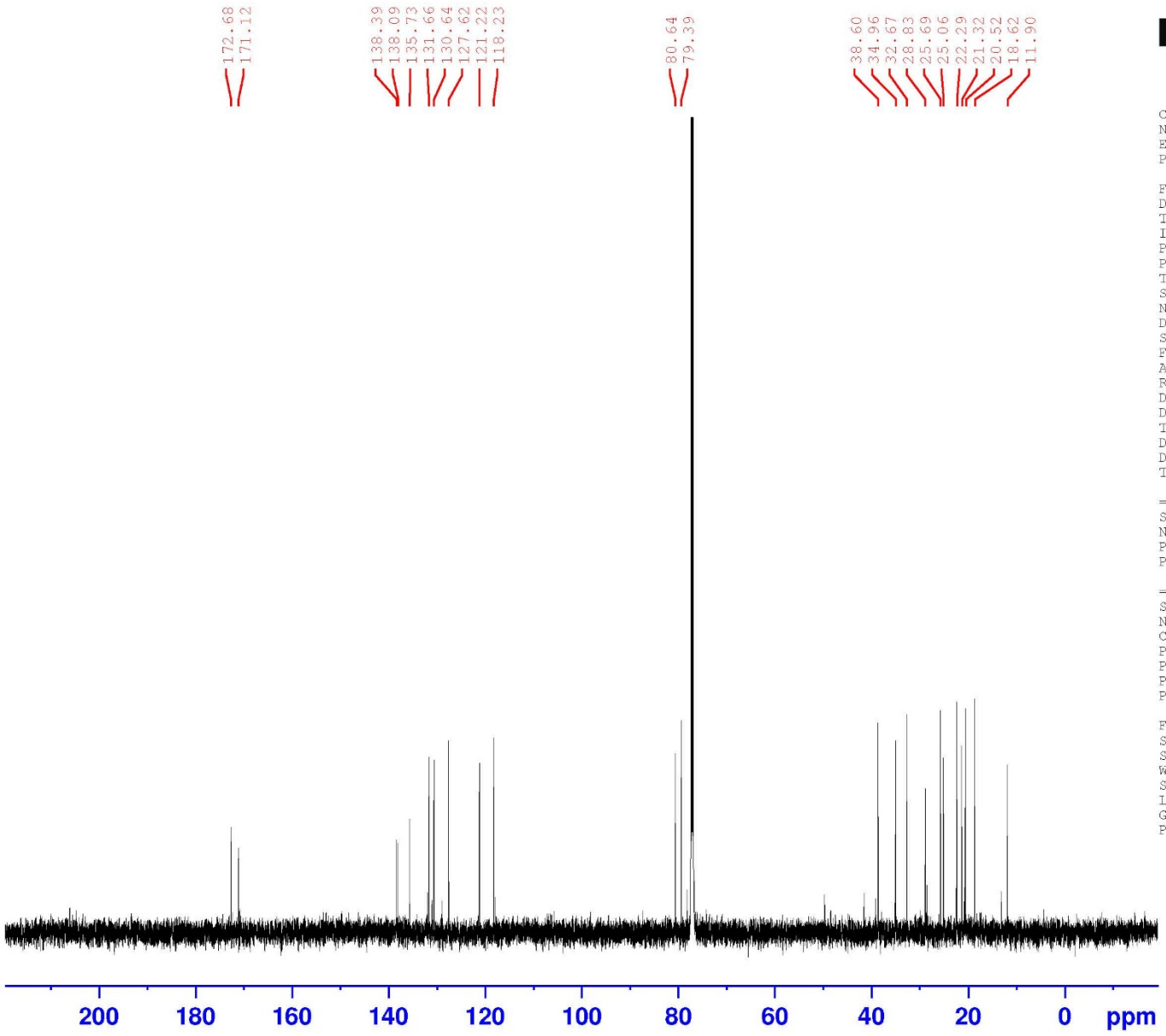
BRUKER

```
Current Data Parameters
NAME      20190218 Pyrethrin I Acetate MAJOR
EXPNO              24
PROCNO              1

F2 - Acquisition Parameters
Date_          20190218
Time             21.31
INSTRUM          spect
PROBHD   5 mm PABBO BB/
PULPROG       hsqcetgp
TD                1024
SOLVENT           CDCl3
NS                  50
DS                  16
SWH           4672.897 Hz
FIDRES        4.563376 Hz
AQ            0.1095680 sec
RG                2050
DW             107.000 usec
DE               6.50 usec
TE             298.3 K
CNST2       145.0000000
D0           0.00000300 sec
D1           1.45596802 sec
D4           0.00172414 sec
D11          0.03000000 sec
D16          0.00020000 sec
IN0          0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1        600.1324365 MHz
NUC1               1H
P1               13.50 usec
P2               27.00 usec
P28            1000.00 usec
PLW1        17.00000000 W

======== CHANNEL f2 ========
SFO2        150.9140636 MHz
NUC2               13C
CPDPRG[2          garp
P3               12.00 usec
P4               24.00 usec
PCPD2            60.00 usec
PLW2        80.00000000 W
PLW12        3.20000005 W

====== GRADIENT CHANNEL =====
GPNAM[1]     SMSQ10.100
GPNAM[2]     SMSQ10.100
GPZ1             80.00 %
GPZ2             20.10 %
P16            1000.00 usec

F1 - Acquisition parameters
TD                 256
SFO1          150.9141 MHz
FIDRES        97.656250 Hz
SW              165.657 ppm
FnMODE    Echo-Antiecho

F2 - Processing parameters
SI                1024
SF          600.1300252 MHz
WDW               QSINE
SSB                   2
LB        0 Hz
GB        0
PC                1.40

F1 - Processing parameters
SI                1024
MC2        echo-antiecho
SF          150.9028159 MHz
WDW               QSINE
SSB                   2
LB        0 Hz
GB        0
```

4S-(5a) NMR Characterisation

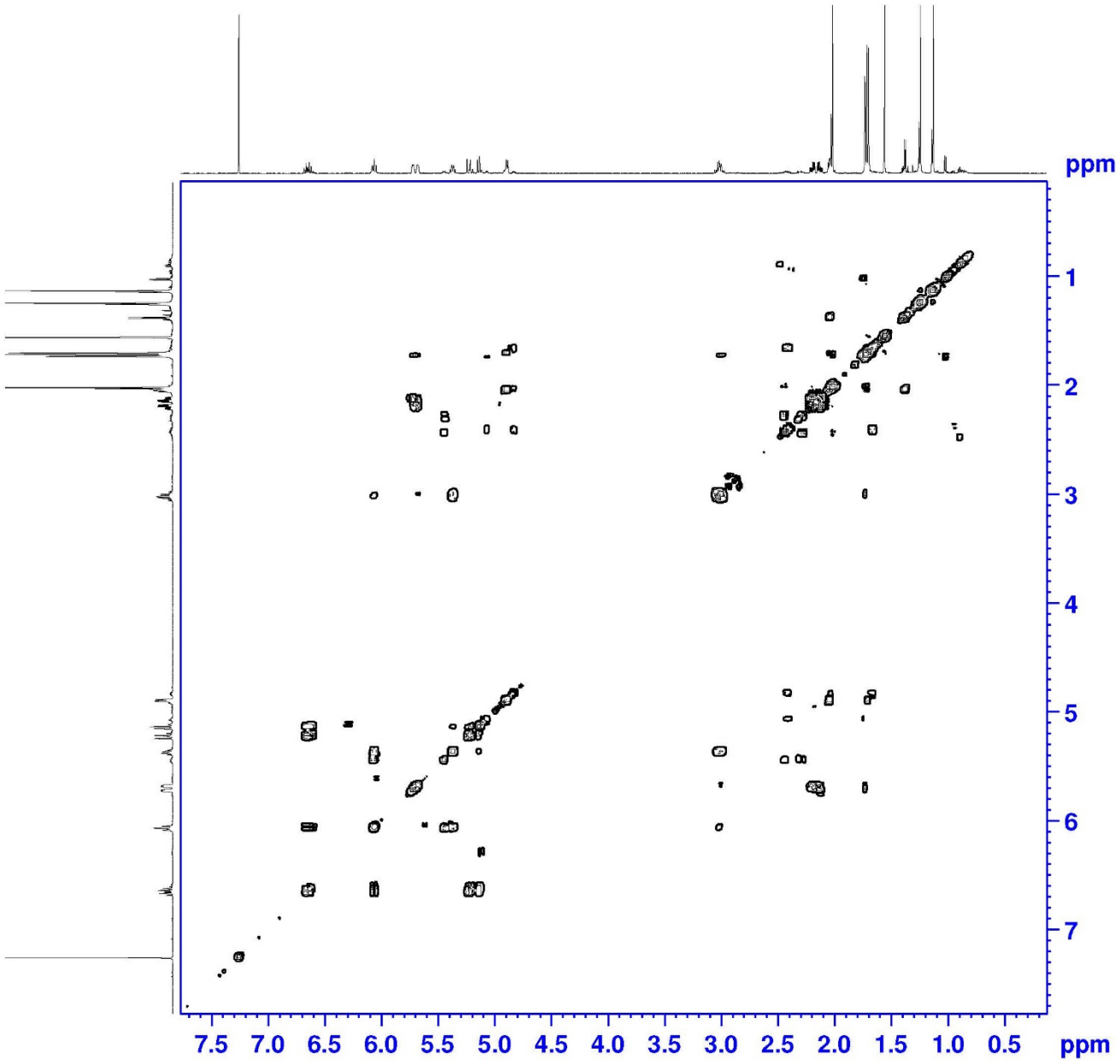



```
Current Data Parameters
NAME      20190225 PI Acetate Minor
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190225
Time              18.41
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                   32
DS                    2
SWH           12019.230 Hz
FIDRES        0.183399 Hz
AQ            2.7262976 sec
RG                  256
DW               41.600 usec
DE                6.50 usec
TE                298.2 K
D1           1.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        600.1337061 MHz
NUC1                1H
P1                13.50 usec
PLW1        17.00000000 W

F2 - Processing parameters
SI                65536
SF          600.1300258 MHz
WDW                  no
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



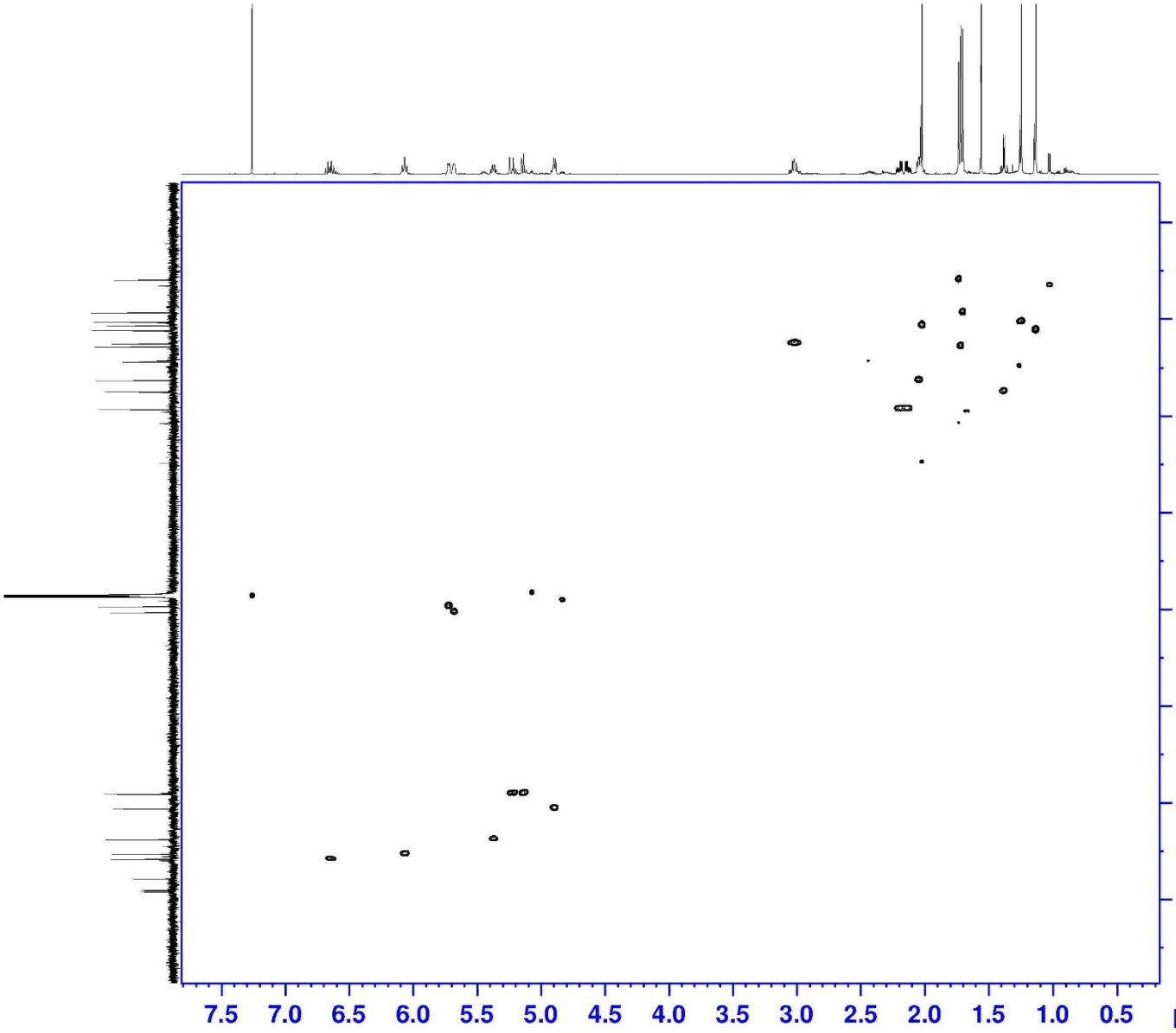
BRUKER

```
Current Data Parameters
NAME      20190225 PI Acetate Minor
EXPNO                22
PROCNO                1

F2 - Acquisition Parameters
Date_          20190225
Time              21.28
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD                65536
SOLVENT           CDCl3
NS                 2048
DS                    2
SWH           36057.691 Hz
FIDRES         0.550197 Hz
AQ             0.9087659 sec
RG                 2050
DW               13.867 usec
DE                6.50 usec
TE                298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        150.9178988 MHz
NUC1                13C
P1                12.00 usec
PLW1        80.00000000 W

======== CHANNEL f2 ========
SFO2        600.1324005 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             70.00 usec
PLW2        17.00000000 W
PLW12        0.63230002 W
PLW13        0.30983001 W

F2 - Processing parameters
SI                 32768
SF          150.9027908 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```



BRUKER

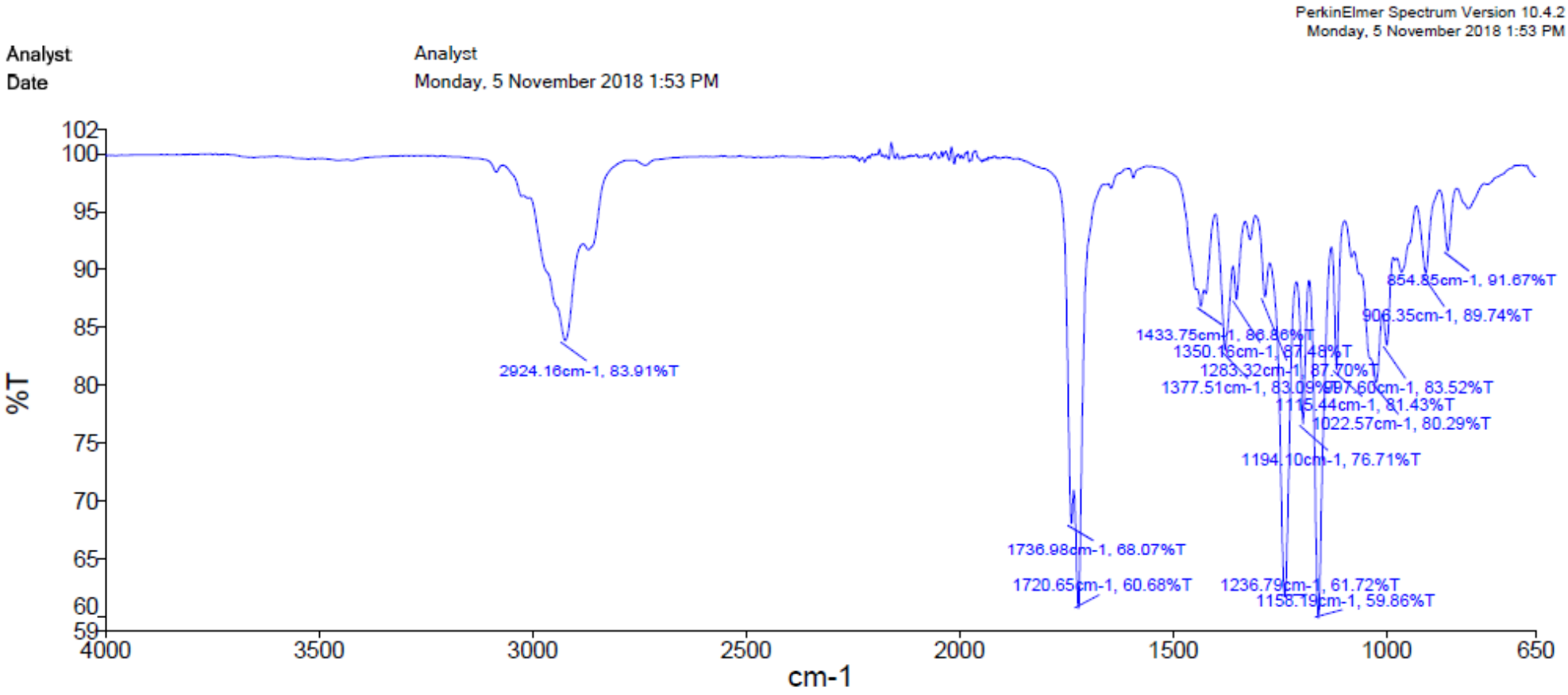
```
Current Data Parameters
NAME      20190225 PI Acetate Minor
EXPNO                21
PROCNO                1

F2 - Acquisition Parameters
Date_          20190225
Time             18.59
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG      cosygpppqf
TD                2048
SOLVENT           CDCl3
NS                  10
DS                   8
SWH           4587.156 Hz
FIDRES        2.239822 Hz
AQ            0.2232320 sec
RG                 144
DW              109.000 usec
DE                6.50 usec
TE                298.2 K
D0          0.00000300 sec
D1          1.90456295 sec
D11         0.03000000 sec
D12         0.00002000 sec
D13         0.00000400 sec
D16         0.00020000 sec
IN0         0.00021800 sec

======== CHANNEL f1 ========
SFO1        600.1323978 MHz
NUC1                1H
P0                13.50 usec
P1                13.50 usec
P17             2500.00 usec
PLW1         17.00000000 W
PLW10         4.58319998 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPZ1               10.00 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                  128
SFO1           600.1324 MHz
FIDRES        35.837154 Hz
SW                7.644 ppm
FnMODE               QF

F2 - Processing parameters
SI                 1024
SF          600.1300256 MHz
WDW               QSINE
SSB       0
LB        0 Hz
GB        0
PC                1.40

F1 - Processing parameters
SI                 1024
MC2                  QF
SF          600.1300261 MHz
WDW               QSINE
SSB       0
LB        0 Hz
GB        0
```



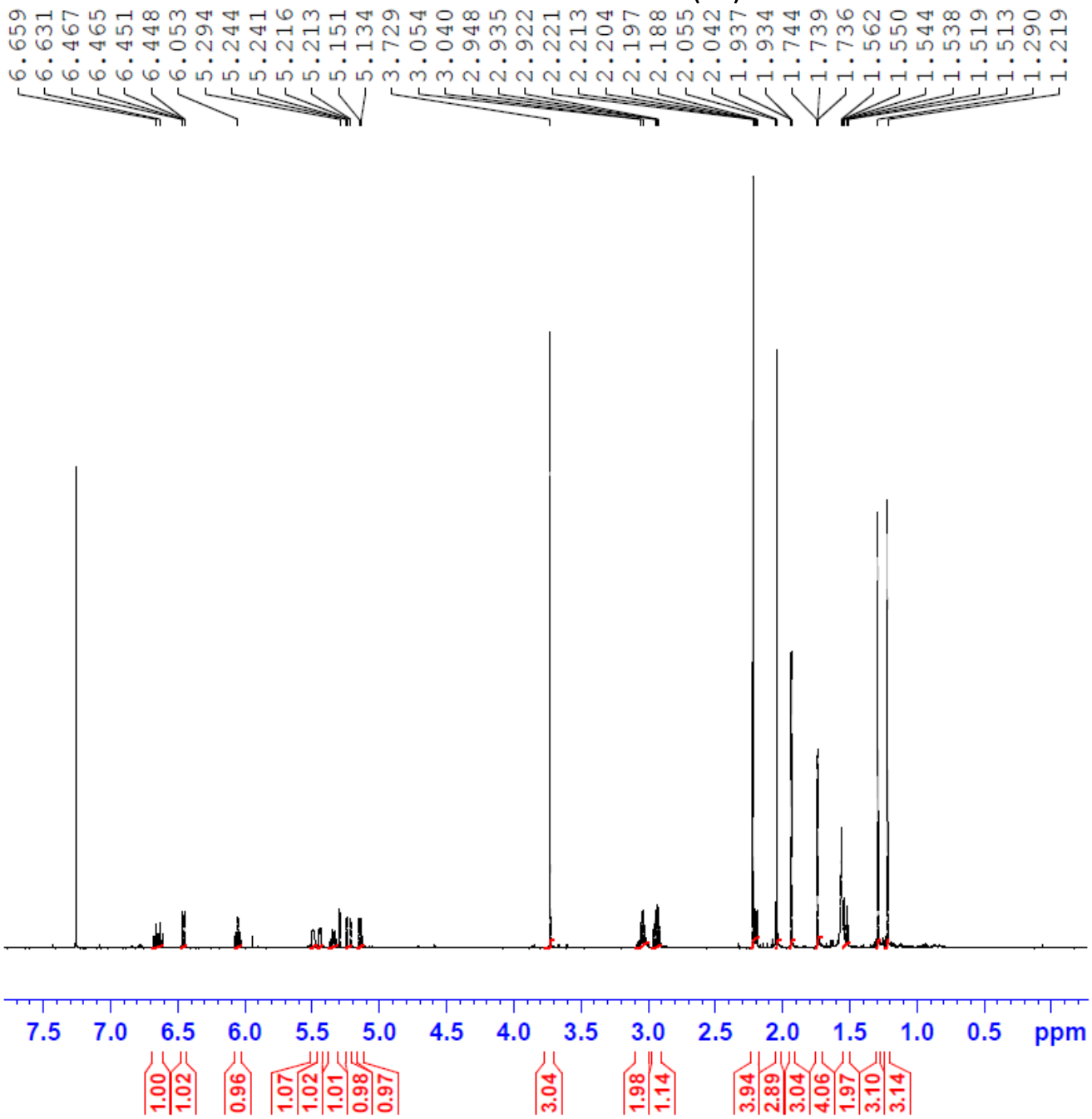
BRUKER

```
Current Data Parameters
NAME      20190225 PI Acetate Minor
EXPNO                24
PROCNO                1

F2 - Acquisition Parameters
Date_          20190225
Time             21.37
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG         hsqcetgp
TD                 1024
SOLVENT            CDCl3
NS                   50
DS                   16
SWH             4587.156 Hz
FIDRES          4.479644 Hz
AQ             0.1116160 sec
RG                 2050
DW              109.000 usec
DE                6.50 usec
TE                298.3 K
CNST2         145.0000000
D0             0.00000300 sec
D1             1.45392001 sec
D4             0.00172414 sec
D11            0.03000000 sec
D16            0.00020000 sec
IN0            0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1          600.1324175 MHz
NUC1                  1H
P1                 13.50 usec
P2                 27.00 usec
P28              1000.00 usec
PLW1          17.00000000 W

======== CHANNEL f2 ========
SFO2          150.9140636 MHz
NUC2                 13C
CPDPRG[2             garp
P3                 12.00 usec
P4                 24.00 usec
PCPD2              60.00 usec
PLW2          80.00000000 W
PLW12          3.20000005 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1               80.00 %
GPZ2               20.10 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                   256
SFO1            150.9141 MHz
FIDRES          97.656250 Hz
SW                165.657 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                  1024
SF           600.1300234 MHz
WDW                 QSINE
SSB                     2
LB         0 Hz
GB         0
PC                   1.40

F1 - Processing parameters
SI                  1024
MC2         echo-antiecho
SF           150.9028227 MHz
WDW                 QSINE
SSB                     2
LB         0 Hz
GB         0
```

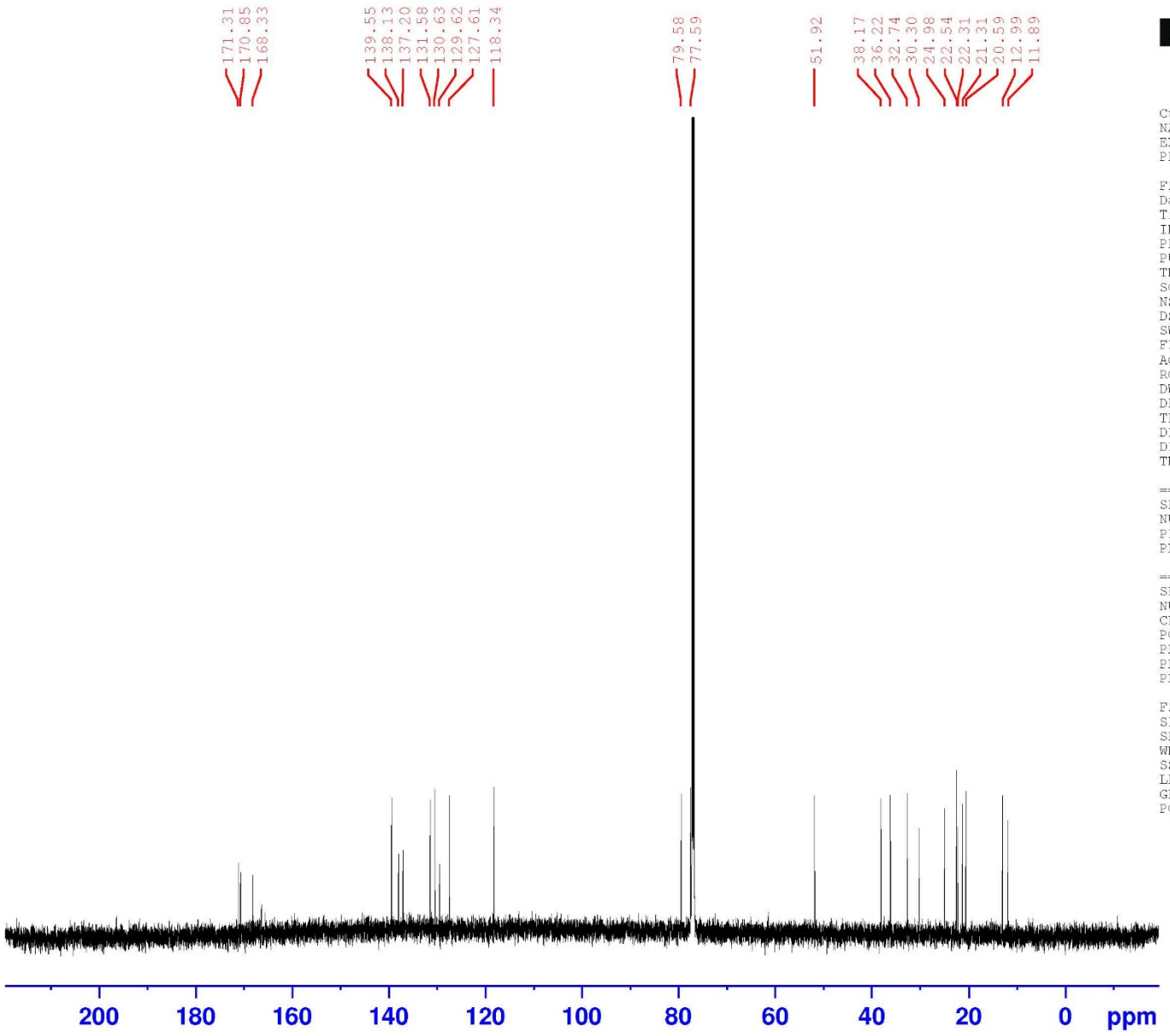
(5a) IR Spectrum



4R-(5b) NMR Characterisation

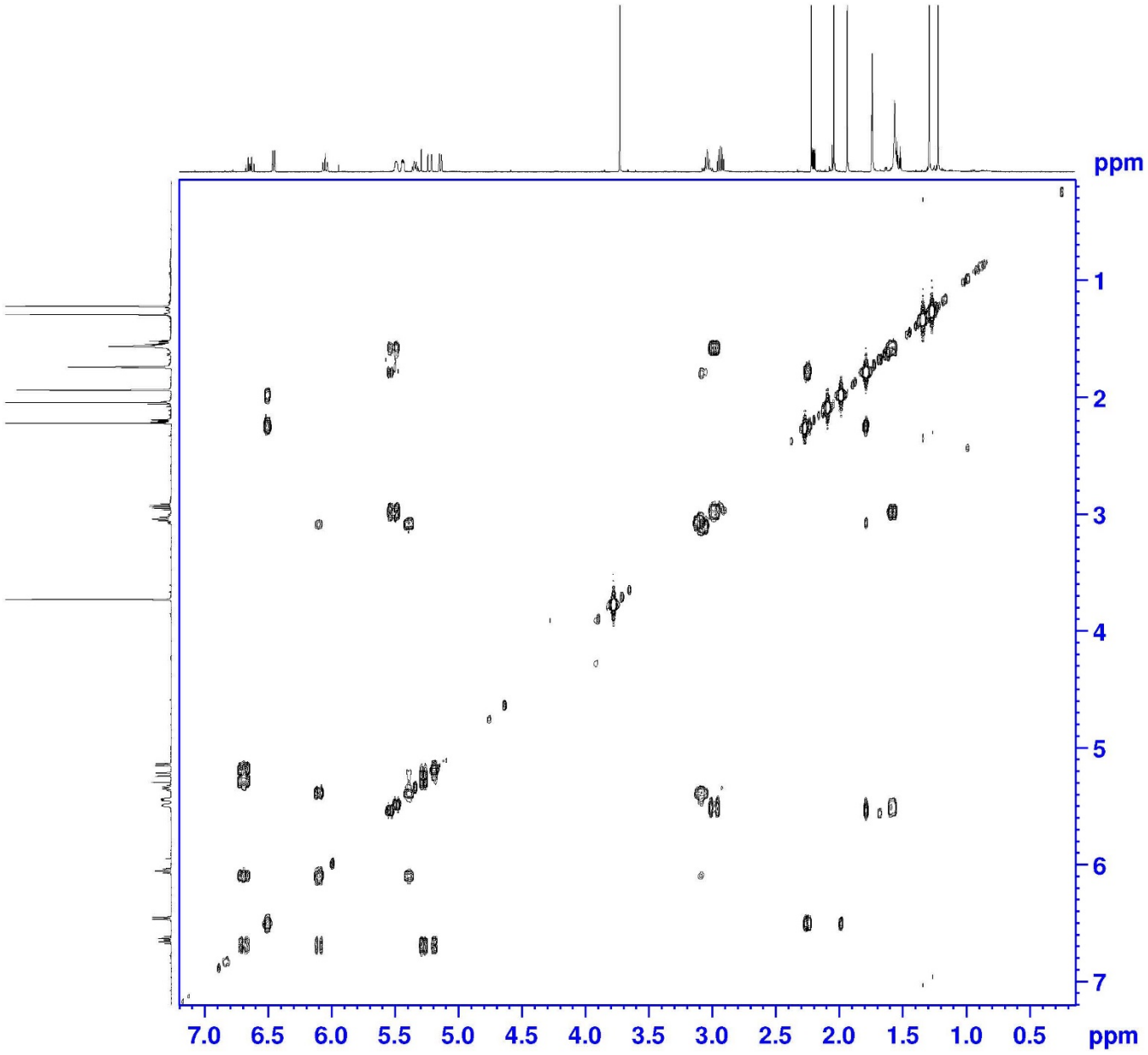



```
Current Data Parameters
NAME      20190220 PII Acetate MAJOR
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190220
Time              17.35
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG           zg30
TD               65536
SOLVENT          CDCl3
NS                  16
DS                   2
SWH           12019.230 Hz
FIDRES         0.183399 Hz
AQ            2.7262976 sec
RG                 322
DW               41.600 usec
DE                6.50 usec
TE               298.2 K
D1            1.00000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1         600.1337061 MHz
NUC1               1H
P1                13.50 usec
PLW1         17.00000000 W

F2 - Processing parameters
SI                65536
SF           600.1300283 MHz
WDW                  no
SSB       0
LB        0 Hz
GB        0
PC                 1.00
```



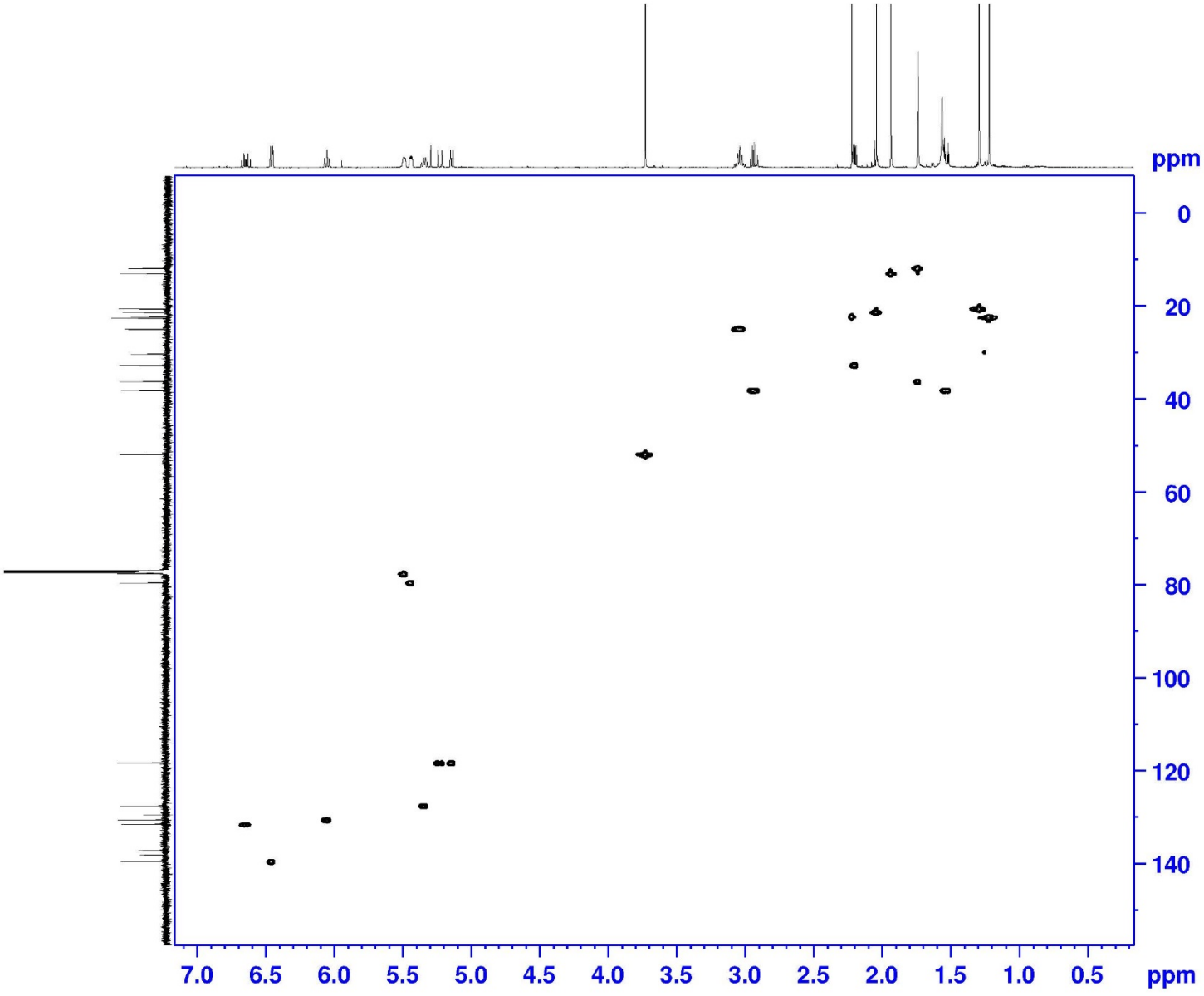
BRUKER

```
Current Data Parameters
NAME      20190220 PII Acetate MAJOR
EXPNO                22
PROCNO                1

F2 - Acquisition Parameters
Date_          20190220
Time              20.14
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD                65536
SOLVENT           CDCl3
NS                 2048
DS                    2
SWH           36057.691 Hz
FIDRES         0.550197 Hz
AQ            0.9087659 sec
RG                 2050
DW               13.867 usec
DE                6.50 usec
TE                298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        150.9178988 MHz
NUC1               13C
P1               12.00 usec
PLW1        80.00000000 W

======== CHANNEL f2 ========
SFO2        600.1324005 MHz
NUC2               1H
CPDPRG[2         waltz16
PCPD2             70.00 usec
PLW2        17.00000000 W
PLW12        0.63230002 W
PLW13        0.30983001 W

F2 - Processing parameters
SI                32768
SF          150.9027925 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



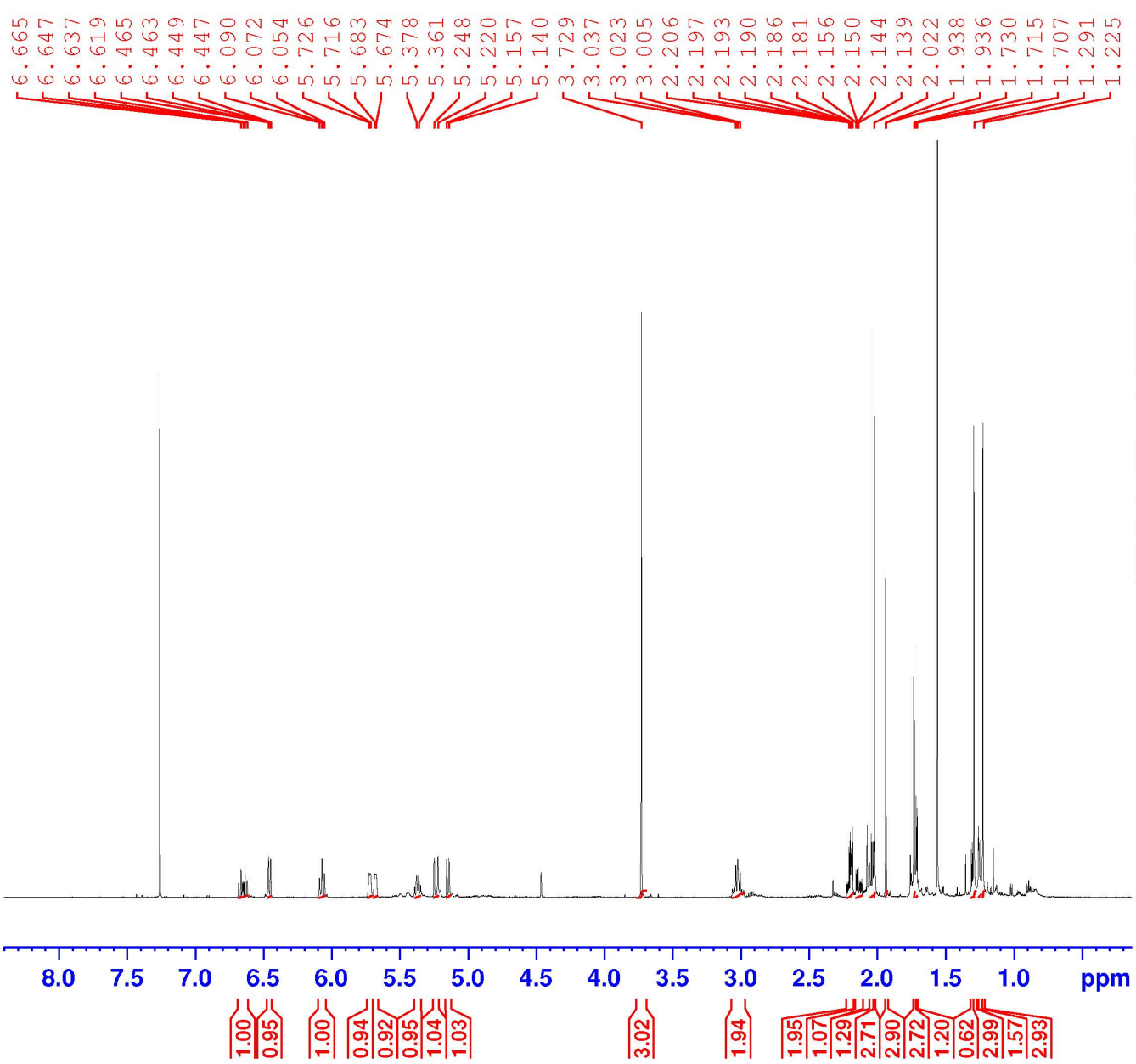
BRUKER

```
Current Data Parameters
NAME      20190220 PII Acetate MAJOR
EXPNO                 21
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190220
Time              17.45
INSTRUM           spect
PROBHD    5 mm PABBO BB/
PULPROG       cosygpppqf
TD                  2048
SOLVENT             CDCl3
NS                    10
DS                     8
SWH             4237.288 Hz
FIDRES          2.068988 Hz
AQ              0.2416640 sec
RG                   161
DW                118.000 usec
DE                  6.50 usec
TE                298.2 K
D0             0.00000300 sec
D1             1.88613105 sec
D11            0.03000000 sec
D12            0.00002000 sec
D13            0.00000400 sec
D16            0.00020000 sec
IN0            0.00023600 sec

======== CHANNEL f1 ========
SFO1         600.1322008 MHz
NUC1                 1H
P0                13.50 usec
P1                13.50 usec
P17             2500.00 usec
PLW1         17.00000000 W
PLW10         4.58319998 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPZ1               10.00 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                   128
SFO1            600.1322 MHz
FIDRES         33.103813 Hz
SW                7.061 ppm
FnMODE               QF

F2 - Processing parameters
SI                  1024
SF           600.1299971 MHz
WDW                QSINE
SSB       0
LB        0 Hz
GB        0
PC                 1.40

F1 - Processing parameters
SI                  1024
MC2                   QF
SF           600.1299966 MHz
WDW                QSINE
SSB       0
LB        0 Hz
GB        0
```

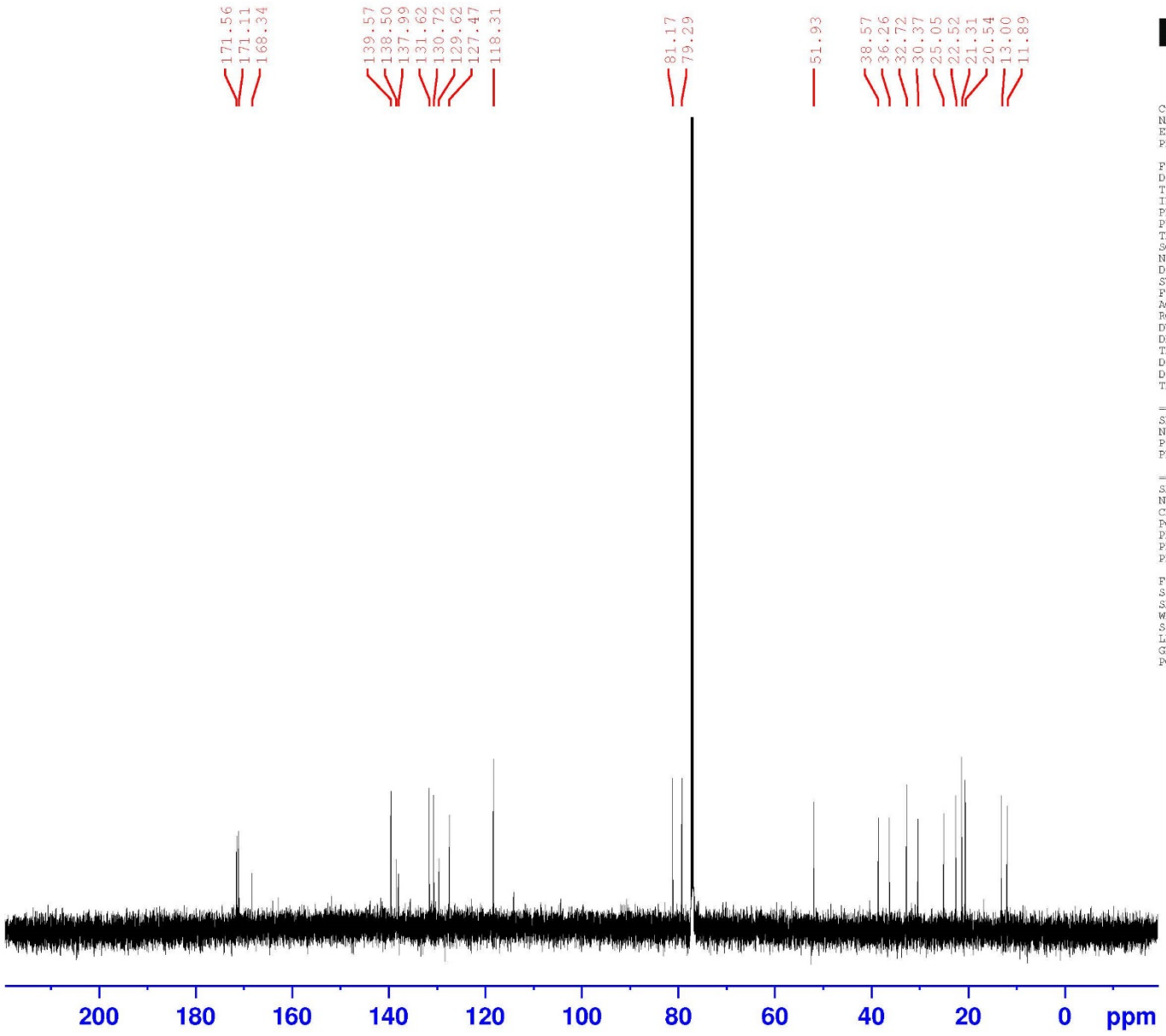



```
Current Data Parameters
NAME      20190220 PII Acetate MAJOR
EXPNO                24
PROCNO                1

F2 - Acquisition Parameters
Date_           20190220
Time              20.22
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG        hsqcetgp
TD                1024
SOLVENT           CDCl3
NS                  50
DS                  16
SWH            4201.681 Hz
FIDRES         4.103204 Hz
AQ             0.1218560 sec
RG                2050
DW              119.000 usec
DE                6.50 usec
TE              298.3 K
CNST2        145.0000000
D0             0.00000300 sec
D1             1.44368005 sec
D4             0.00172414 sec
D11            0.03000000 sec
D16            0.00020000 sec
IN0            0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1         600.1322258 MHz
NUC1                1H
P1                13.50 usec
P2                27.00 usec
P28             1000.00 usec
PLW1        17.00000000 W

======== CHANNEL f2 ========
SFO2         150.9140636 MHz
NUC2                13C
CPDPRG[2           garp
P3                12.00 usec
P4                24.00 usec
PCPD2             60.00 usec
PLW2        80.00000000 W
PLW12        3.20000005 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1              80.00 %
GPZ2              20.10 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                 256
SFO1          150.9141 MHz
FIDRES         97.656250 Hz
SW               165.657 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                1024
SF           600.1300260 MHz
WDW               QSINE
SSB                   2
LB        0 Hz
GB        0
PC                 1.40

F1 - Processing parameters
SI                1024
MC2        echo-antiecho
SF           150.9027807 MHz
WDW               QSINE
SSB                   2
LB        0 Hz
GB        0
```

4S-(5b) NMR Characterisation

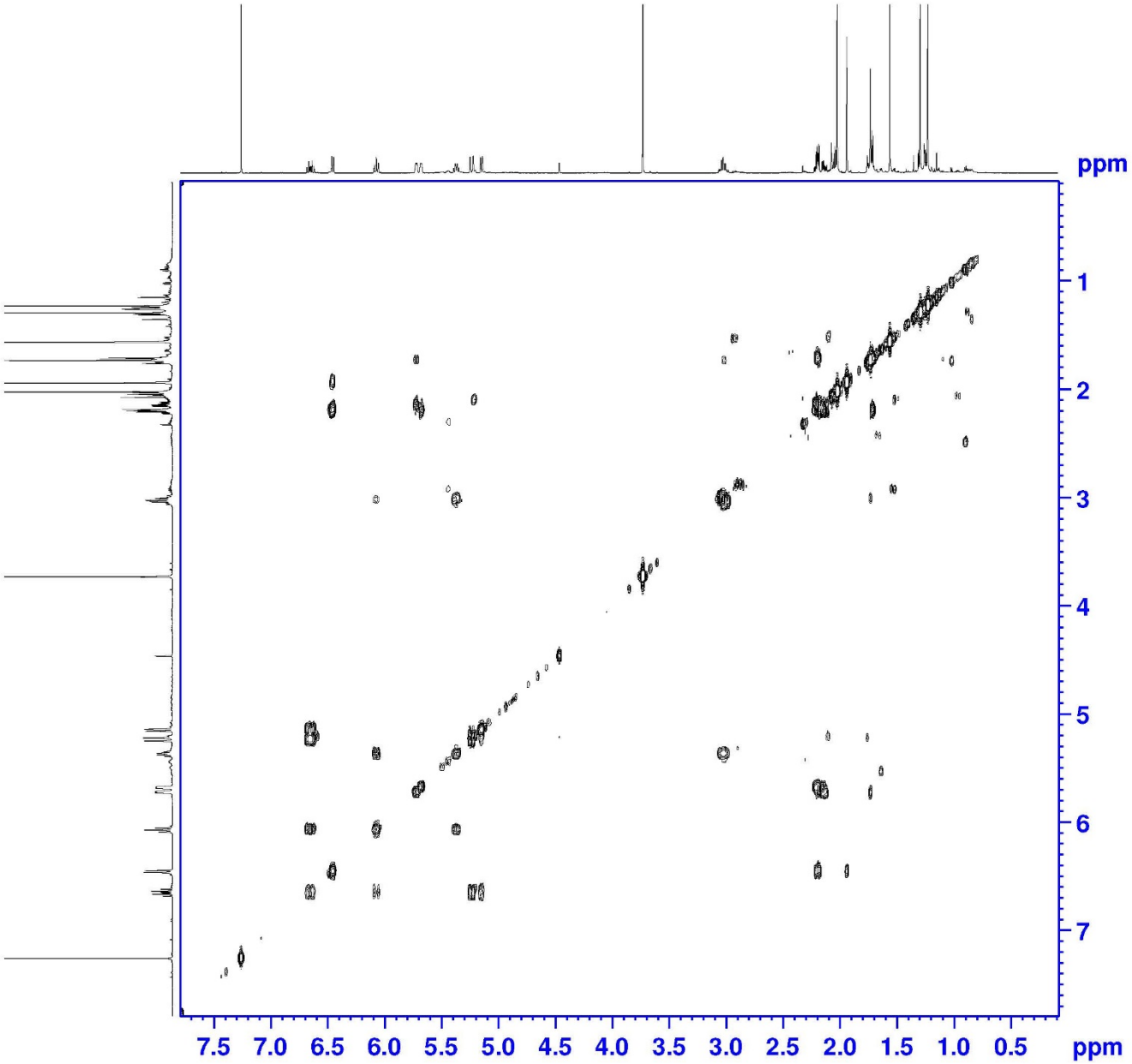



```
Current Data Parameters
NAME      20190226 Pyrethrin II Acetate Minor
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190226
Time              17.31
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG           zg30
TD               65536
SOLVENT          CDCl3
NS                  64
DS                   2
SWH           12019.230 Hz
FIDRES         0.183399 Hz
AQ            2.7262976 sec
RG                 287
DW              41.600 usec
DE               6.50 usec
TE              298.2 K
D1           1.00000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1         600.1337061 MHz
NUC1               1H
P1              13.50 usec
PLW1        17.00000000 W

F2 - Processing parameters
SI                 65536
SF           600.1300261 MHz
WDW                  no
SSB       0
LB        0 Hz
GB        0
PC                1.00
```



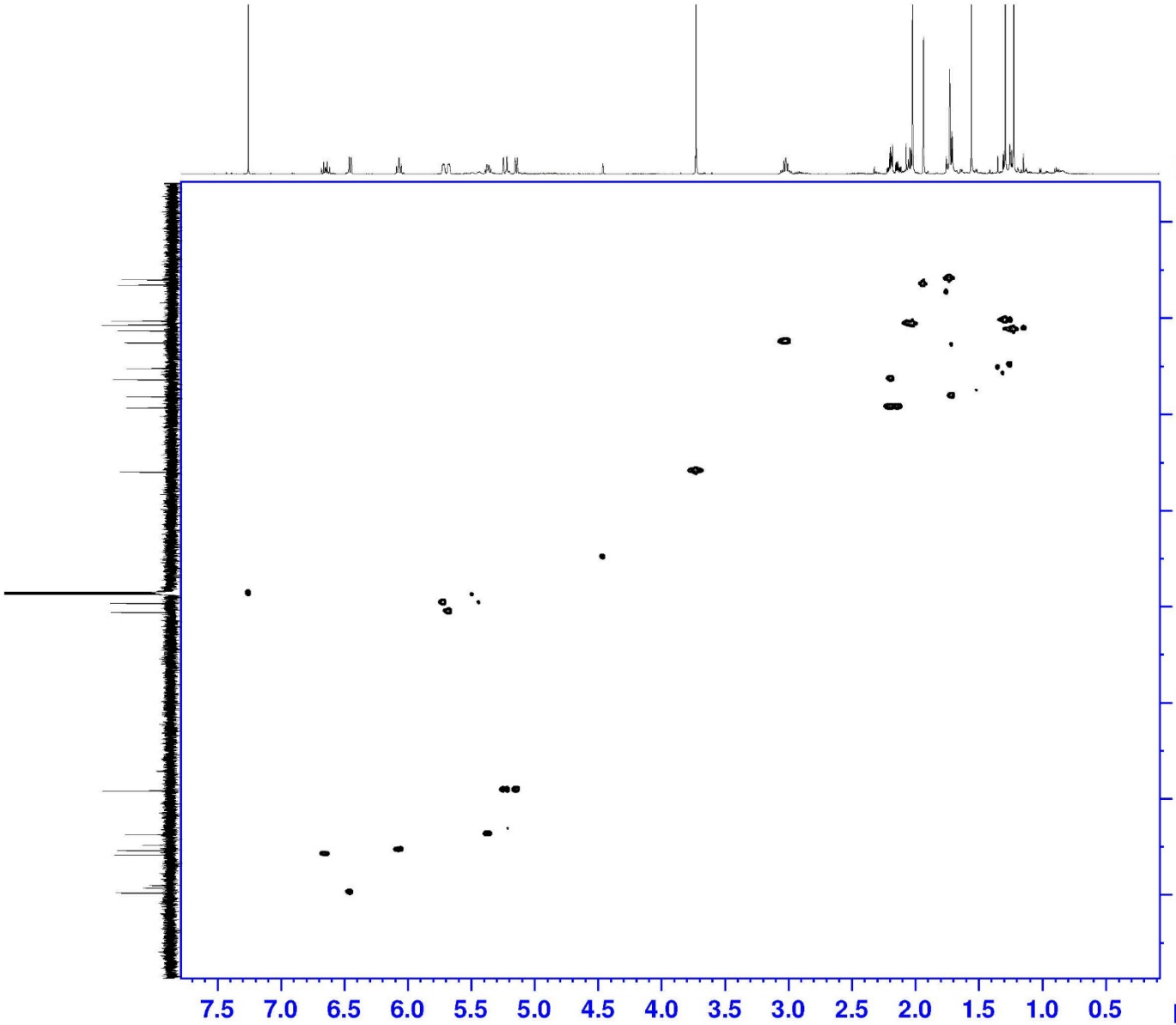
BRUKER

```
Current Data Parameters
NAME      20190226 Pyrethrin II Acetate Minor
EXPNO                22
PROCNO                1

F2 - Acquisition Parameters
Date_          20190226
Time             21.20
INSTRUM          spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD               65536
SOLVENT          CDCl3
NS                3096
DS                   2
SWH          36057.691 Hz
FIDRES        0.550197 Hz
AQ           0.9087659 sec
RG                2050
DW              13.867 usec
DE                6.50 usec
TE               298.2 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1       150.9178988 MHz
NUC1               13C
P1               12.00 usec
PLW1       80.00000000 W

======== CHANNEL f2 ========
SFO2       600.1324005 MHz
NUC2               1H
CPDPRG[2        waltz16
PCPD2            70.00 usec
PLW2       17.00000000 W
PLW12       0.63230002 W
PLW13       0.30983001 W

F2 - Processing parameters
SI               32768
SF         150.9027906 MHz
WDW                 no
SSB       0
LB        0 Hz
GB        0
PC              1.40
```



BRUKER

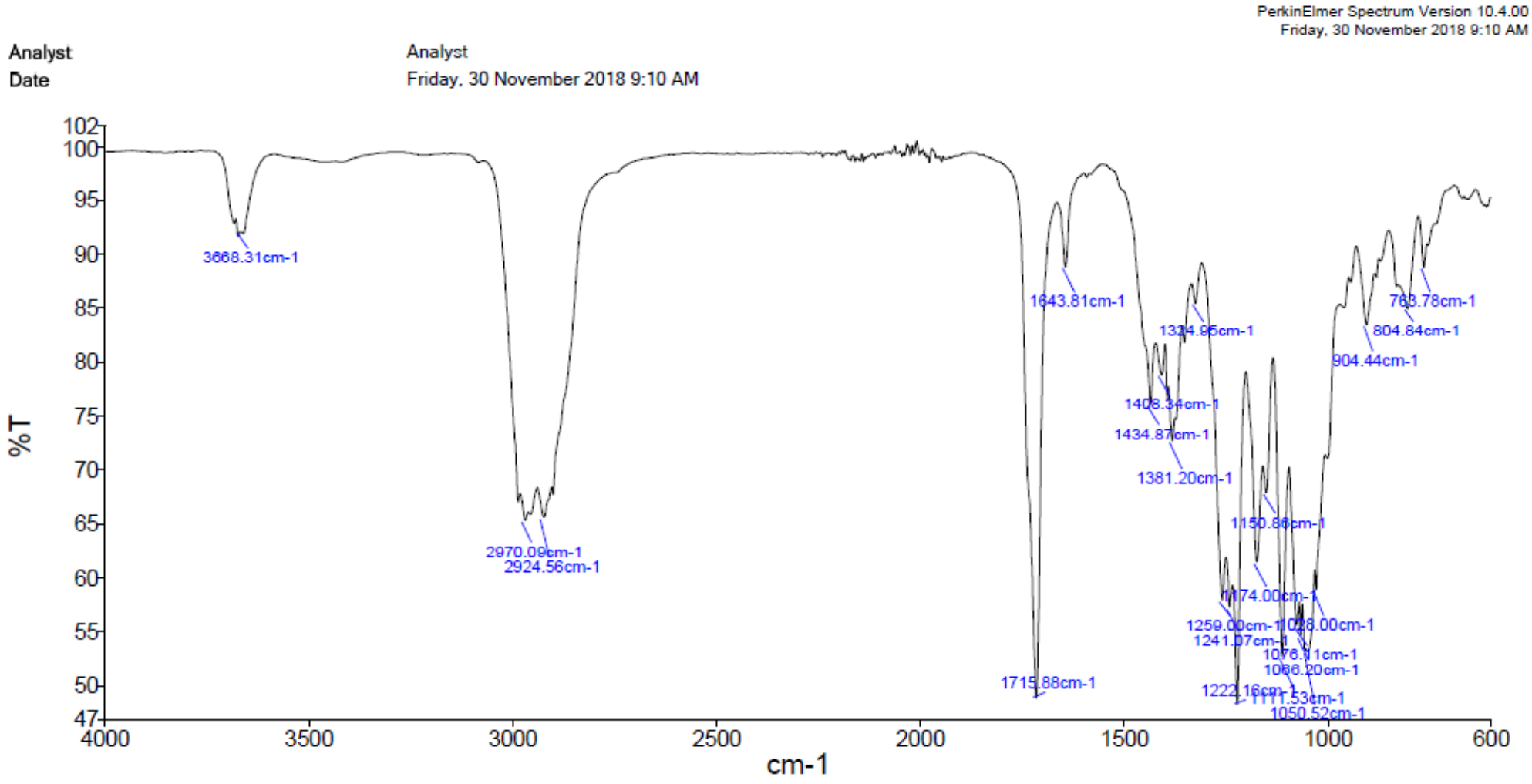
```
Current Data Parameters
NAME      20190226 Pyrethrin II Acetate Minor
EXPNO                 21
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190226
Time              17.59
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG       cosygpppqf
TD                  2048
SOLVENT             CDCl3
NS                    10
DS                     8
SWH              4629.629 Hz
FIDRES           2.260561 Hz
AQ               0.2211840 sec
RG                   144
DW                108.000 usec
DE                  6.50 usec
TE                298.2 K
D0              0.00000300 sec
D1              1.90661097 sec
D11             0.03000000 sec
D12             0.00002000 sec
D13             0.00000400 sec
D16             0.00020000 sec
IN0             0.00021600 sec

======== CHANNEL f1 ========
SFO1          600.1323879 MHz
NUC1                  1H
P0                 13.50 usec
P1                 13.50 usec
P17              2500.00 usec
PLW1          17.00000000 W
PLW10          4.58319998 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPZ1              10.00 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                   128
SFO1            600.1324 MHz
FIDRES          36.168980 Hz
SW                7.714 ppm
FnMODE                QF

F2 - Processing parameters
SI                   1024
SF            600.1300249 MHz
WDW                 QSINE
SSB       0
LB        0 Hz
GB        0
PC                  1.40

F1 - Processing parameters
SI                   1024
MC2                   QF
SF            600.1300256 MHz
WDW                 QSINE
SSB       0
LB        0 Hz
GB        0
```



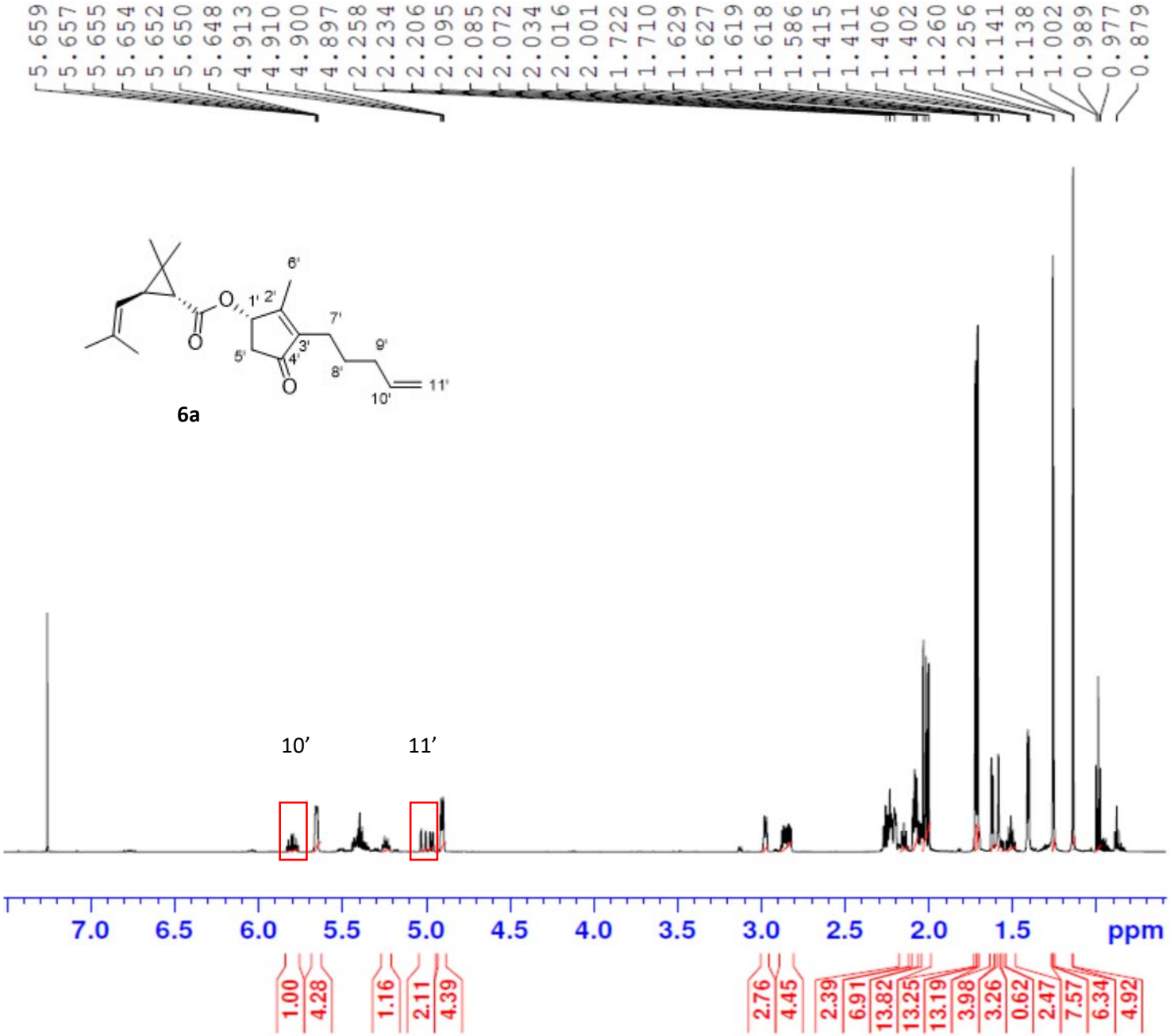
BRUKER

```
Current Data Parameters
NAME      20190226 Pyrethrin II Acetate Minor
EXPNO                 24
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190226
Time              21.28
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG         hsqcetgp
TD                 1024
SOLVENT            CDCl3
NS                   50
DS                   16
SWH             4629.629 Hz
FIDRES          4.521122 Hz
AQ              0.1105920 sec
RG                 2050
DW               108.000 usec
DE                 6.50 usec
TE                298.3 K
CNST2         145.0000000
D0             0.00000300 sec
D1             1.45494401 sec
D4             0.00172414 sec
D11            0.03000000 sec
D16            0.00020000 sec
IN0            0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1          600.1323855 MHz
NUC1                  1H
P1                 13.50 usec
P2                 27.00 usec
P28              1000.00 usec
PLW1          17.00000000 W

======== CHANNEL f2 ========
SFO2          150.9140636 MHz
NUC2                 13C
CPDPRG[2             garp
P3                 12.00 usec
P4                 24.00 usec
PCPD2              60.00 usec
PLW2          80.00000000 W
PLW12          3.20000005 W

====== GRADIENT CHANNEL =====
GPNAM[1]       SMSQ10.100
GPNAM[2]       SMSQ10.100
GPZ1               80.00 %
GPZ2               20.10 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                   256
SFO1            150.9141 MHz
FIDRES          97.656250 Hz
SW                165.657 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                  1024
SF            600.1300250 MHz
WDW                 QSINE
SSB                     2
LB          0 Hz
GB          0
PC                   1.40

F1 - Processing parameters
SI                  1024
MC2          echo-antiecho
SF            150.9028175 MHz
WDW                 QSINE
SSB                     2
LB          0 Hz
GB          0
```

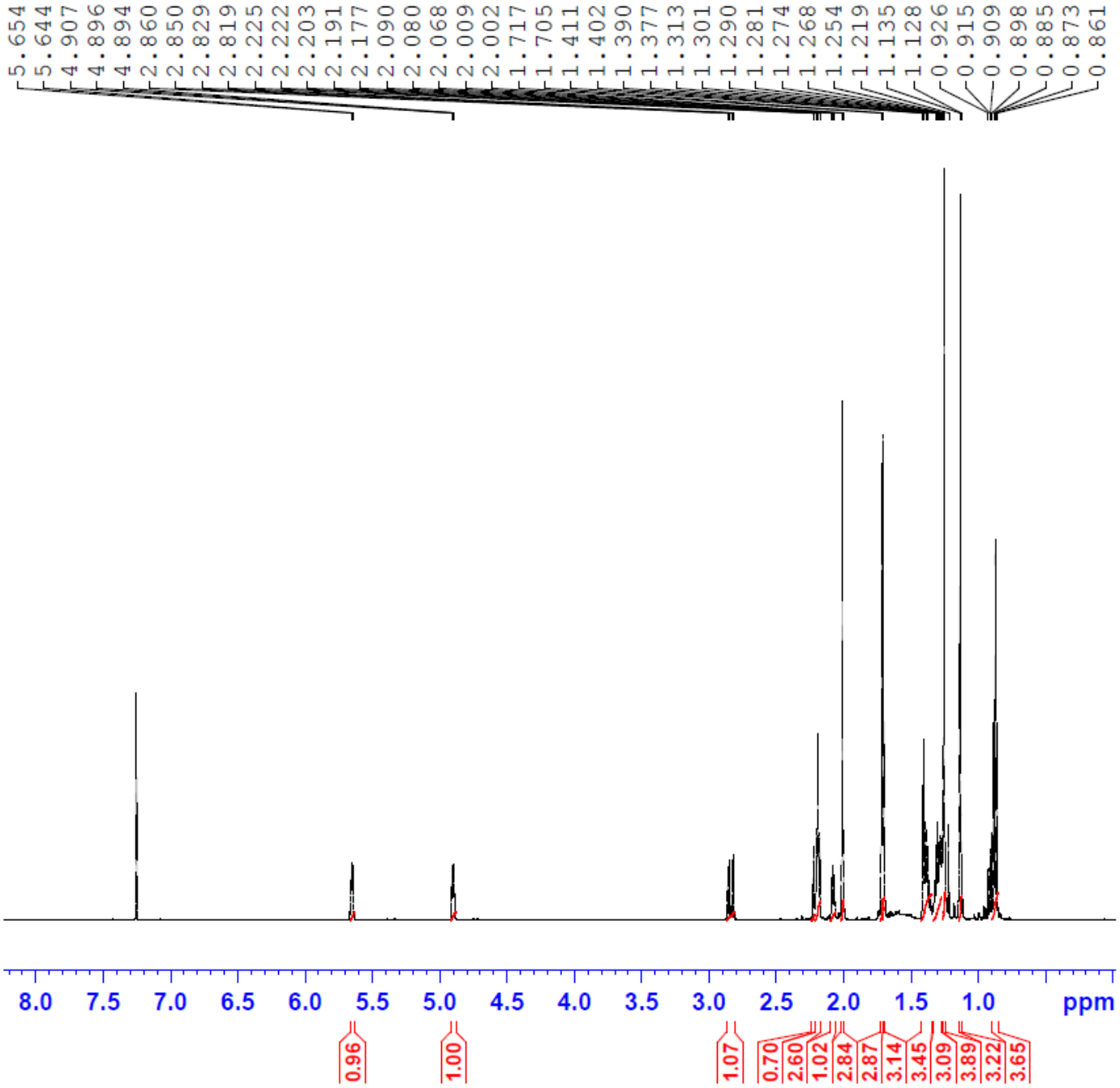
(5b) IR Spectrum



Representative ^{1}H NMR spectrum of partially hydrogenated pyrethrin I (**1a**) showing characteristic peaks for compound **6a**

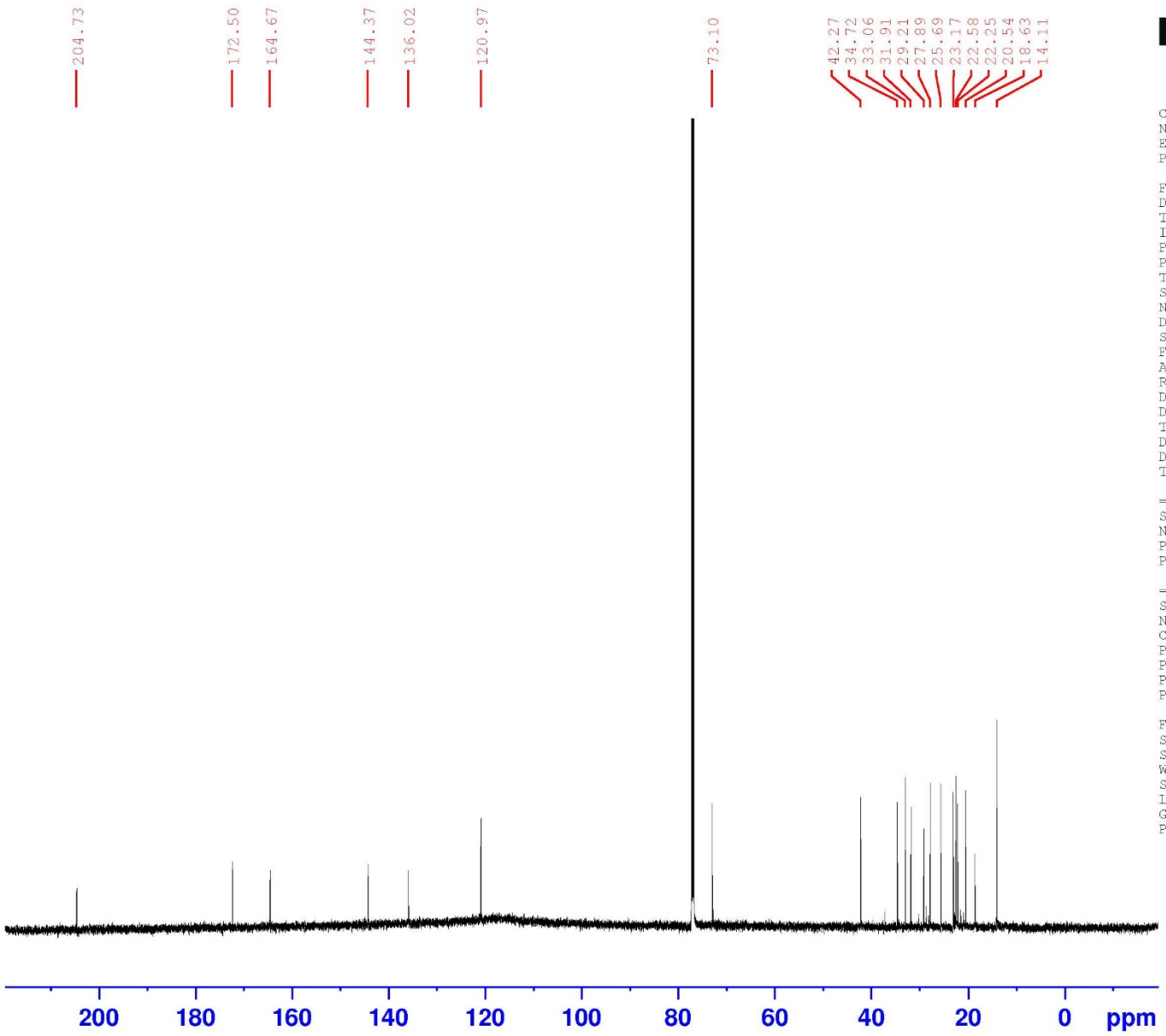


(7a) NMR Characterisation



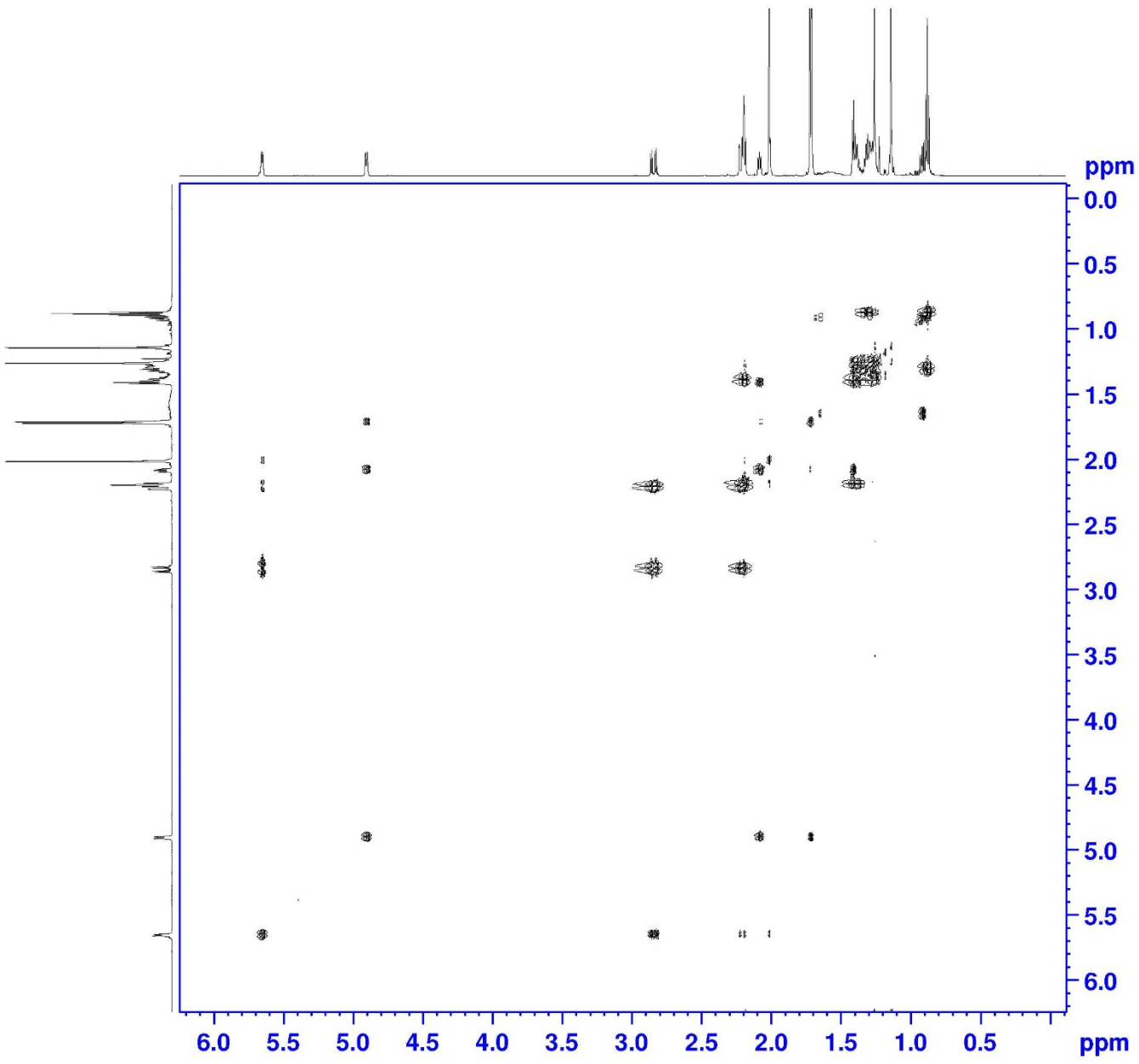
BRUKER

```
Current Data Parameters
NAME      20180904 Hydrogenation PI
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180904
Time              18.28
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG             zg30
TD                65536
SOLVENT           CDCl3
NS                   64
DS                    2
SWH           12019.230 Hz
FIDRES         0.183399 Hz
AQ            2.7262976 sec
RG                  161
DW               41.600 usec
DE                6.50 usec
TE                298.2 K
D1           1.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1         600.1337060 MHz
NUC1                 1H
P1                8.40 usec
PLW1        12.55000019 W

F2 - Processing parameters
SI                65536
SF           600.1300297 MHz
WDW                  EM
SSB       0
LB                0.30 Hz
GB        0
PC                1.00
```



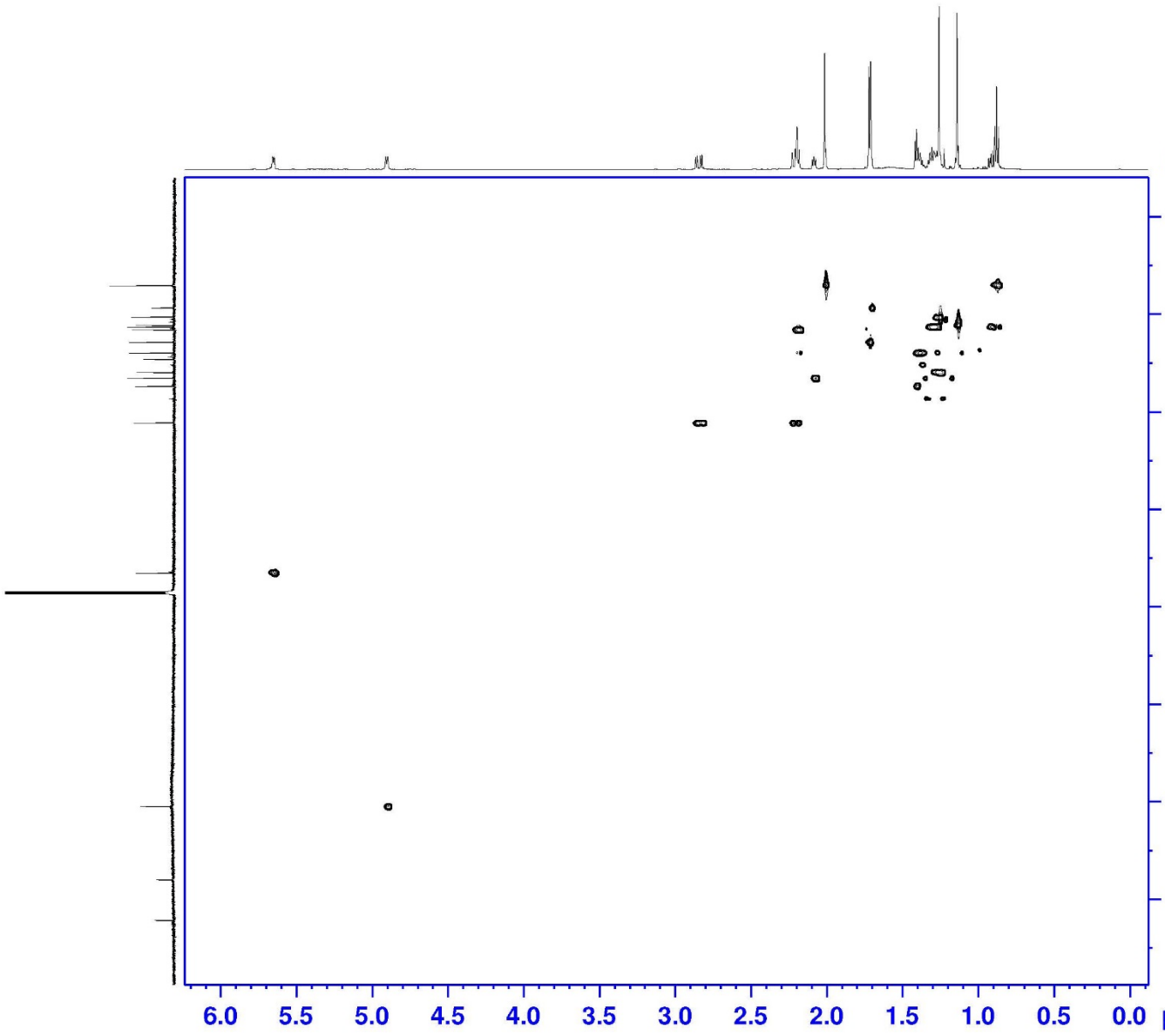
BRUKER

```
Current Data Parameters
NAME      20180904 Hydrogenation PI
EXPNO                 11
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180904
Time              20.13
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG         zgpg30
TD               65536
SOLVENT          CDCl3
NS                2048
DS                   2
SWH           36057.691 Hz
FIDRES         0.550197 Hz
AQ             0.9087659 sec
RG                1820
DW              13.867 usec
DE                6.50 usec
TE                298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1        150.9178988 MHz
NUC1                13C
P1                16.00 usec
PLW1       110.76000214 W

======== CHANNEL f2 ========
SFO2        600.1324005 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             70.00 usec
PLW2         12.55000019 W
PLW12         0.18072000 W
PLW13         0.08855400 W

F2 - Processing parameters
SI                32768
SF          150.9027920 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



BRUKER

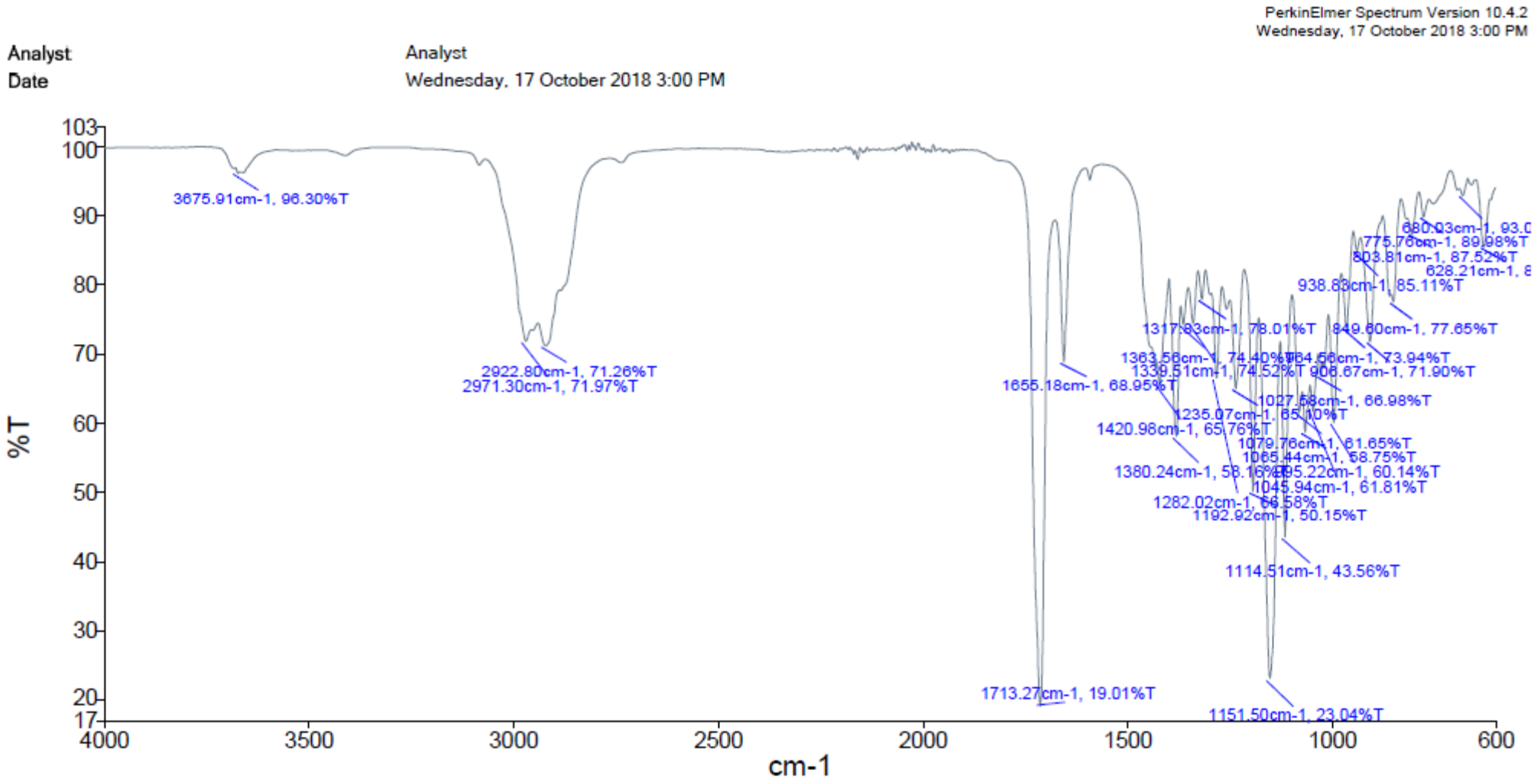
```
Current Data Parameters
NAME      20180904 Hydrogenation PI
EXPNO                 13
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180904
Time              20.20
INSTRUM           spect
PROBHD    5 mm PABBI 1H/
PULPROG    cosygpmfphpp
TD                 2048
SOLVENT           CDCl3
NS                    5
DS                    4
SWH            3816.794 Hz
FIDRES         1.863669 Hz
AQ             0.2682880 sec
RG                 2050
DW              131.000 usec
DE                6.50 usec
TE                298.2 K
D0           0.00012030 sec
D1           1.87015700 sec
D11          0.03000000 sec
D12          0.00002000 sec
D16          0.00020000 sec
IN0          0.00026200 sec

======== CHANNEL f1 ========
SFO1        600.1318677 MHz
NUC1                  1H
P1                 8.40 usec
P2                16.80 usec
P17             2500.00 usec
PLW1         12.55000019 W
PLW10         1.30999994 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1              10.00 %
GPZ2              20.00 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                   256
SFO1            600.1319 MHz
FIDRES         14.909351 Hz
SW                6.360 ppm
FnMODE       States-TPPI

F2 - Processing parameters
SI                  1024
SF            600.1300271 MHz
WDW                 QSINE
SSB                     2
LB        0 Hz
GB        0
PC                   1.40

F1 - Processing parameters
SI                  1024
MC2          States-TPPI
SF            600.1300277 MHz
WDW                 QSINE
SSB                     2
LB        0 Hz
GB        0
```

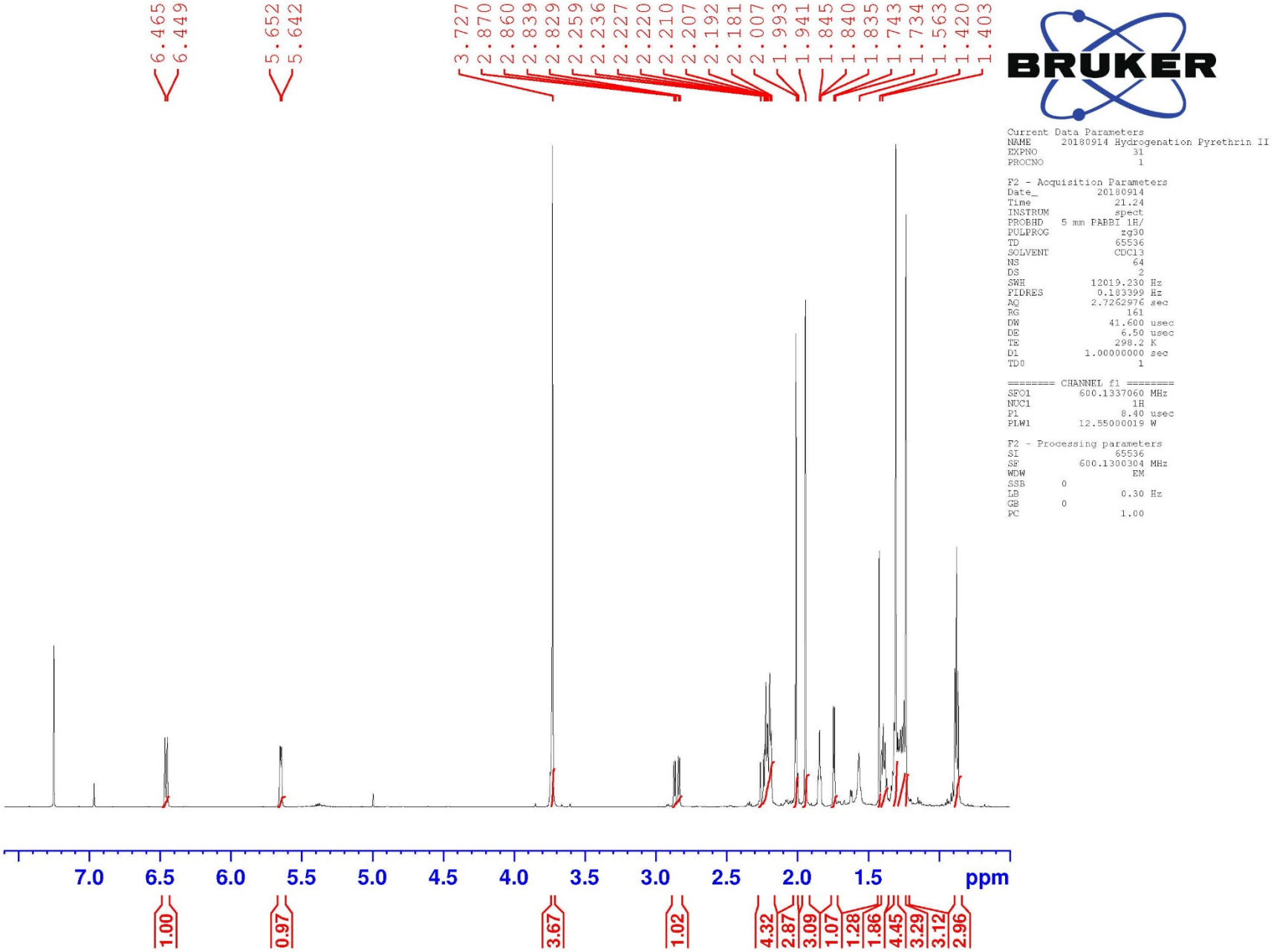


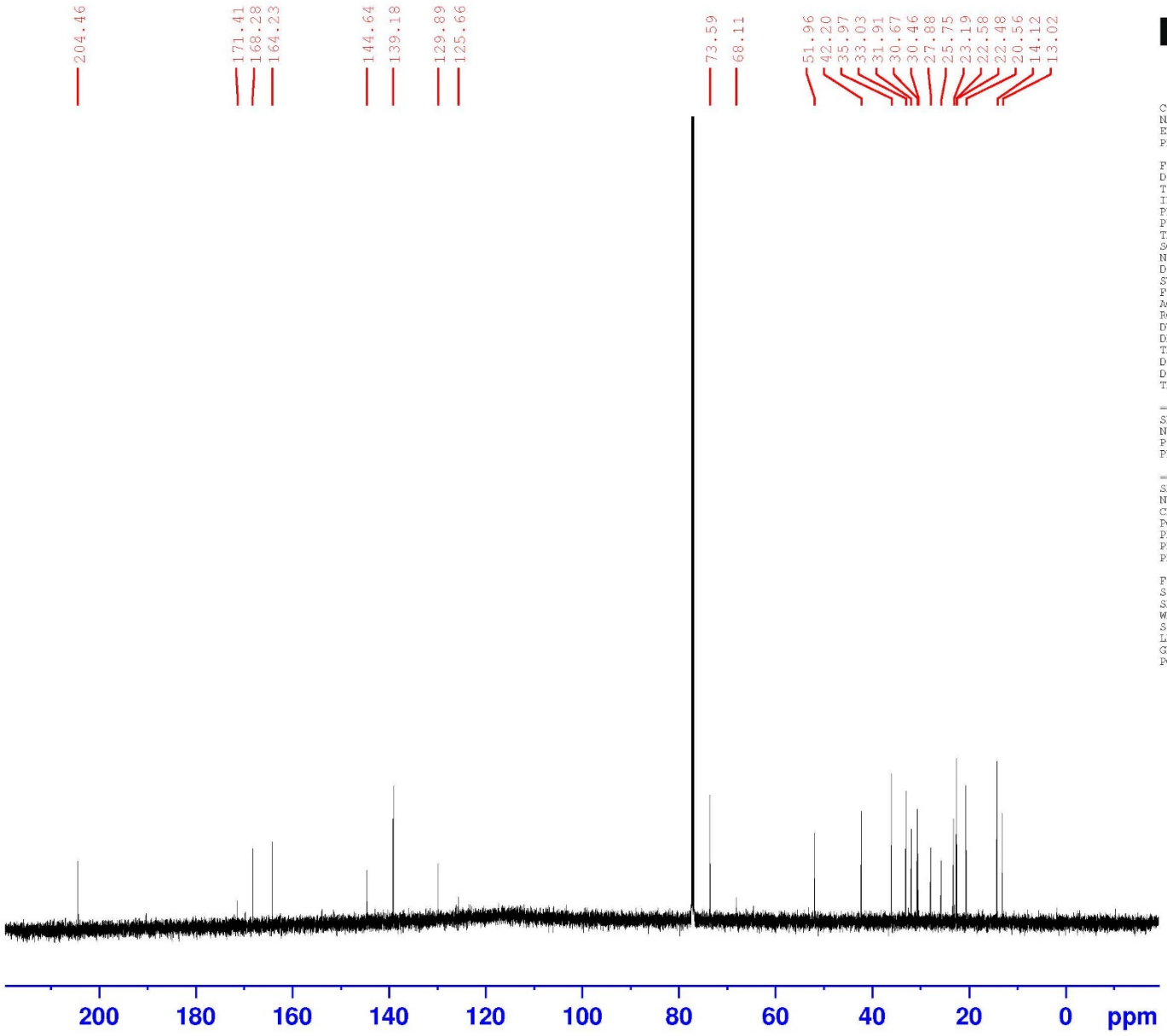
BRUKER

```
Current Data Parameters
NAME      20180904 Hydrogenation PI
EXPNO                14
PROCNO                1

F2 - Acquisition Parameters
Date_          20180904
Time             21.10
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG        hsqcetgp
TD                1024
SOLVENT           CDCl3
NS                  50
DS                  16
SWH           3816.794 Hz
FIDRES        3.727338 Hz
AQ            0.1341440 sec
RG                2050
DW             131.000 usec
DE               6.50 usec
TE              298.0 K
CNST2        145.0000000
D0            0.00000300 sec
D1            1.43139195 sec
D4            0.00172414 sec
D11           0.03000000 sec
D16           0.00020000 sec
IN0           0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1         600.1318677 MHz
NUC1                1H
P1                 8.40 usec
P2                16.80 usec
P28             1000.00 usec
PLW1        12.55000019 W

======== CHANNEL f2 ========
SFO2         150.9140636 MHz
NUC2                13C
CPDPRG[2           garp
P3                16.00 usec
P4                32.00 usec
PCPD2             60.00 usec
PLW2        110.76000214 W
PLW12         7.87610006 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1              80.00 %
GPZ2              20.10 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                 256
SFO1          150.9141 MHz
FIDRES        97.656250 Hz
SW              165.657 ppm
FnMODE    Echo-Antiecho

F2 - Processing parameters
SI                1024
SF           600.1300315 MHz
WDW               QSINE
SSB                   2
LB        0 Hz
GB        0
PC                 1.40

F1 - Processing parameters
SI                1024
MC2        echo-antiecho
SF           150.9027851 MHz
WDW               QSINE
SSB                   2
LB        0 Hz
GB        0
```

(7a) IR Spectrum

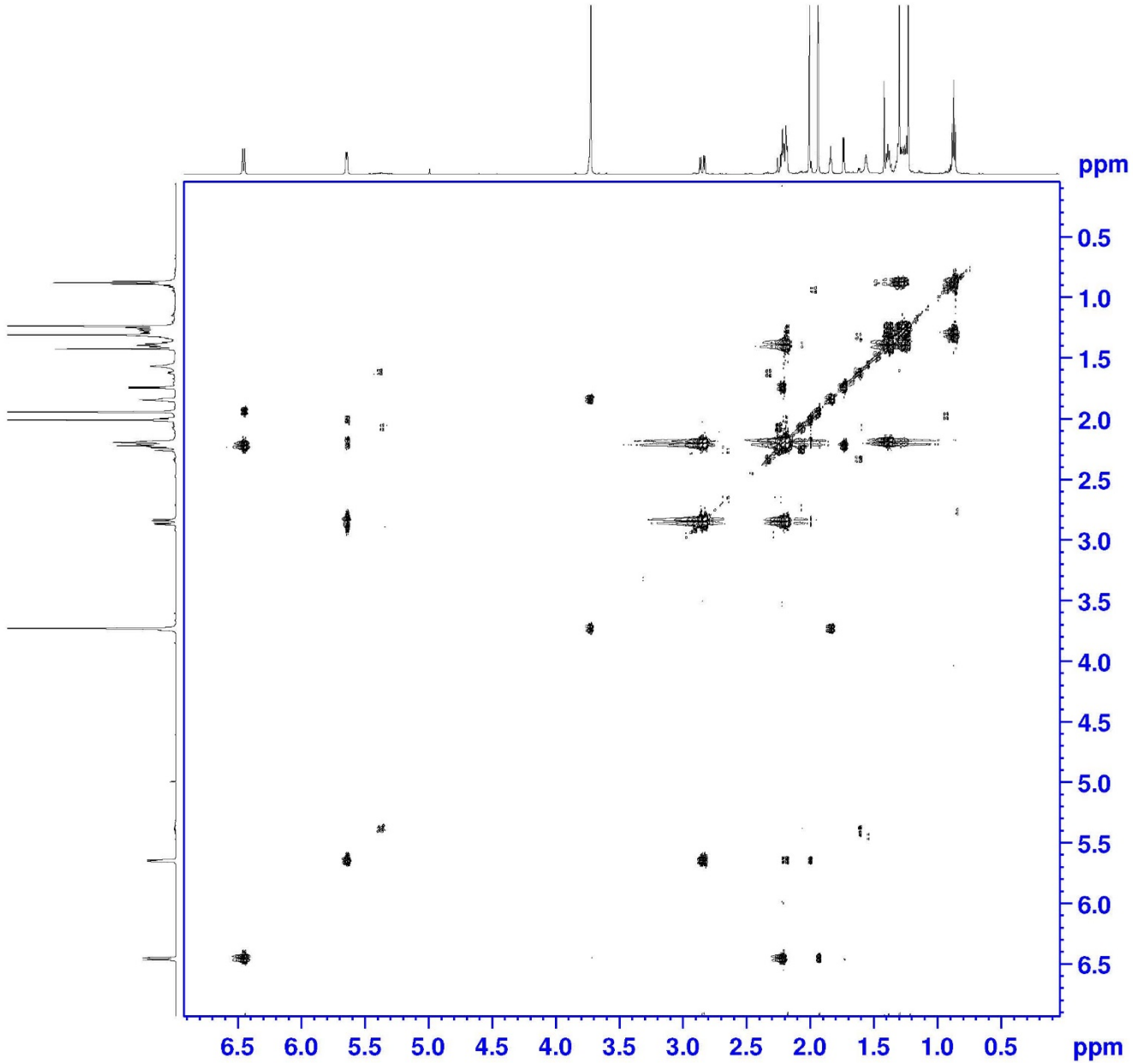



6.465
6.449
5.652
5.642
3.727
2.870
2.860
2.839
2.829
2.259
2.236
2.227
2.220
2.210
2.207
2.192
2.181
2.007
1.993
1.941
1.845
1.840
1.835
1.743
1.734
1.563
1.420
1.403
BRUKER
Current Data Parameters
NAME 20180914 Hydrogenation Pyrethrin II
EXPNO 31
PROCNO 1
F2 - Acquisition Parameters
Date_ 20180914
Time 21.24
INSTRUM spect
PROBHD 5 mm PABBI 1H/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 64
DS 2
SWH 12019.230 Hz
FIDRES 0.183399 Hz
AQ 2.7262976 sec
RG 161
DW 41.600 usec
DE 6.50 usec
TE 298.2 K
D1 1.00000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 600.1337060 MHz
NUC1 1H
P1 8.40 usec
PLW1 12.55000019 W
F2 - Processing parameters
SI 65536
SF 600.1300304 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm
1.00
0.97
3.67
1.02
4.32
2.87
3.09
1.07
1.28
1.86
4.45
3.29
3.12
2.96



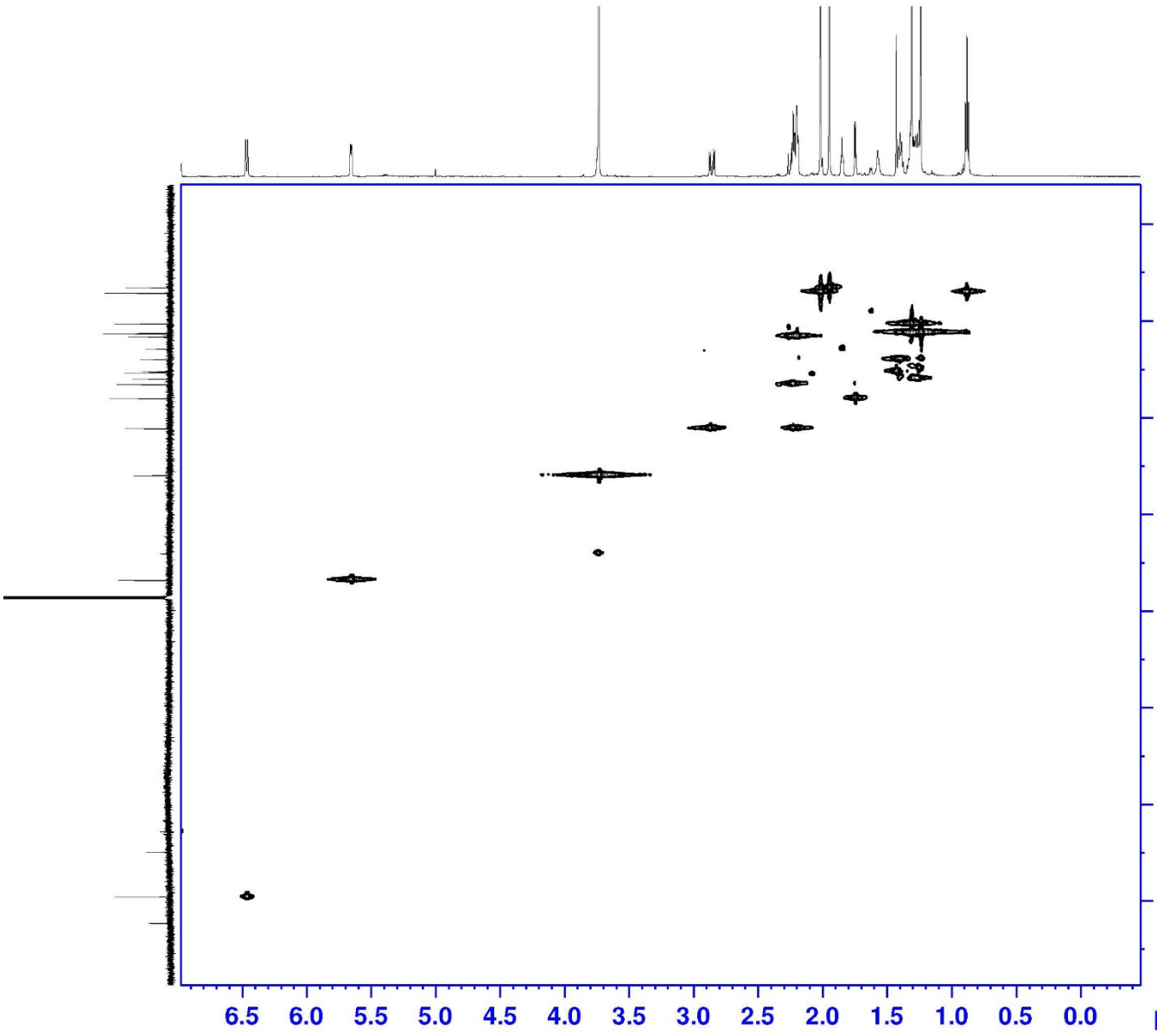
BRUKER

```
Current Data Parameters
NAME      20180914 Hydrogenation Pyrethrin II
EXPNO                 30
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180914
Time              21.08
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                 2048
DS                    2
SWH           36057.691 Hz
FIDRES         0.550197 Hz
AQ            0.9087659 sec
RG                 1440
DW               13.867 usec
DE                6.50 usec
TE                298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        150.9178988 MHz
NUC1                13C
P1                16.00 usec
PLW1       110.76000214 W

======== CHANNEL f2 ========
SFO2        600.1324005 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             70.00 usec
PLW2        12.55000019 W
PLW12        0.18072000 W
PLW13        0.08855400 W

F2 - Processing parameters
SI                32768
SF          150.9027904 MHz
WDW                 no
SSB       0
LB        0 Hz
GB        0
PC                1.40
```



BRUKER

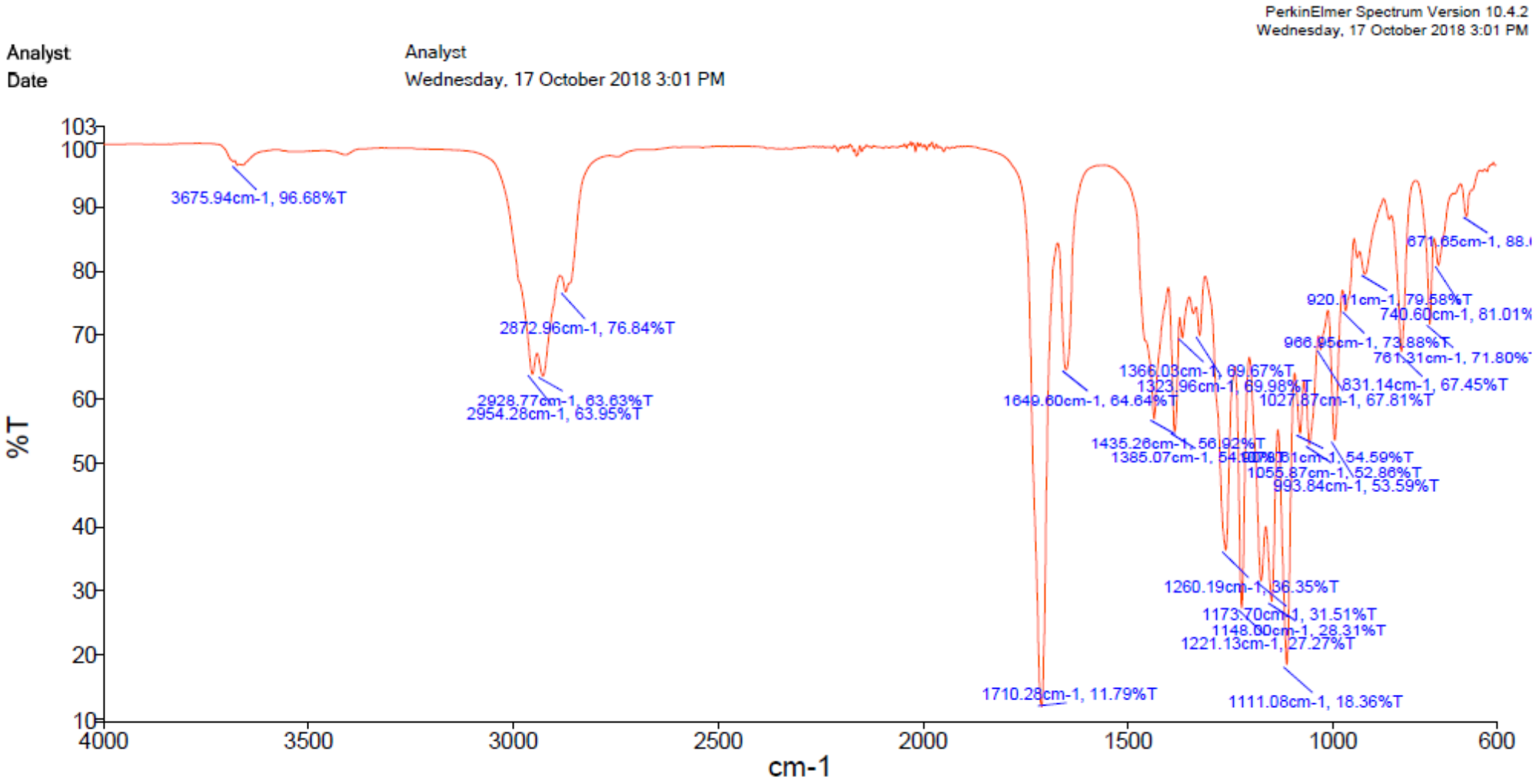
```
Current Data Parameters
NAME      20180914 Hydrogenation Pyrethrin II
EXPNO                 32
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180914
Time              21.35
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG    cosygpmfphpp
TD                 2048
SOLVENT            CDCl3
NS                   10
DS                    4
SWH            4132.231 Hz
FIDRES         2.017691 Hz
AQ             0.2478080 sec
RG                  2050
DW               121.000 usec
DE                 6.50 usec
TE                298.2 K
D0             0.00011030 sec
D1             1.89063704 sec
D11            0.03000000 sec
D12            0.00002000 sec
D16            0.00020000 sec
IN0            0.00024200 sec

======== CHANNEL f1 ========
SFO1         600.1321235 MHz
NUC1                 1H
P1                 8.40 usec
P2                16.80 usec
P17             2500.00 usec
PLW1         12.55000019 W
PLW10         1.30999994 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1              10.00 %
GPZ2              20.00 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                  256
SFO1          600.1321 MHz
FIDRES       16.141529 Hz
SW                6.886 ppm
FnMODE       States-TPPI

F2 - Processing parameters
SI                 1024
SF           600.1300327 MHz
WDW                QSINE
SSB                   2
LB        0 Hz
GB        0
PC                 1.40

F1 - Processing parameters
SI                 1024
MC2          States-TPPI
SF           600.1300295 MHz
WDW                QSINE
SSB                   2
LB        0 Hz
GB        0
```

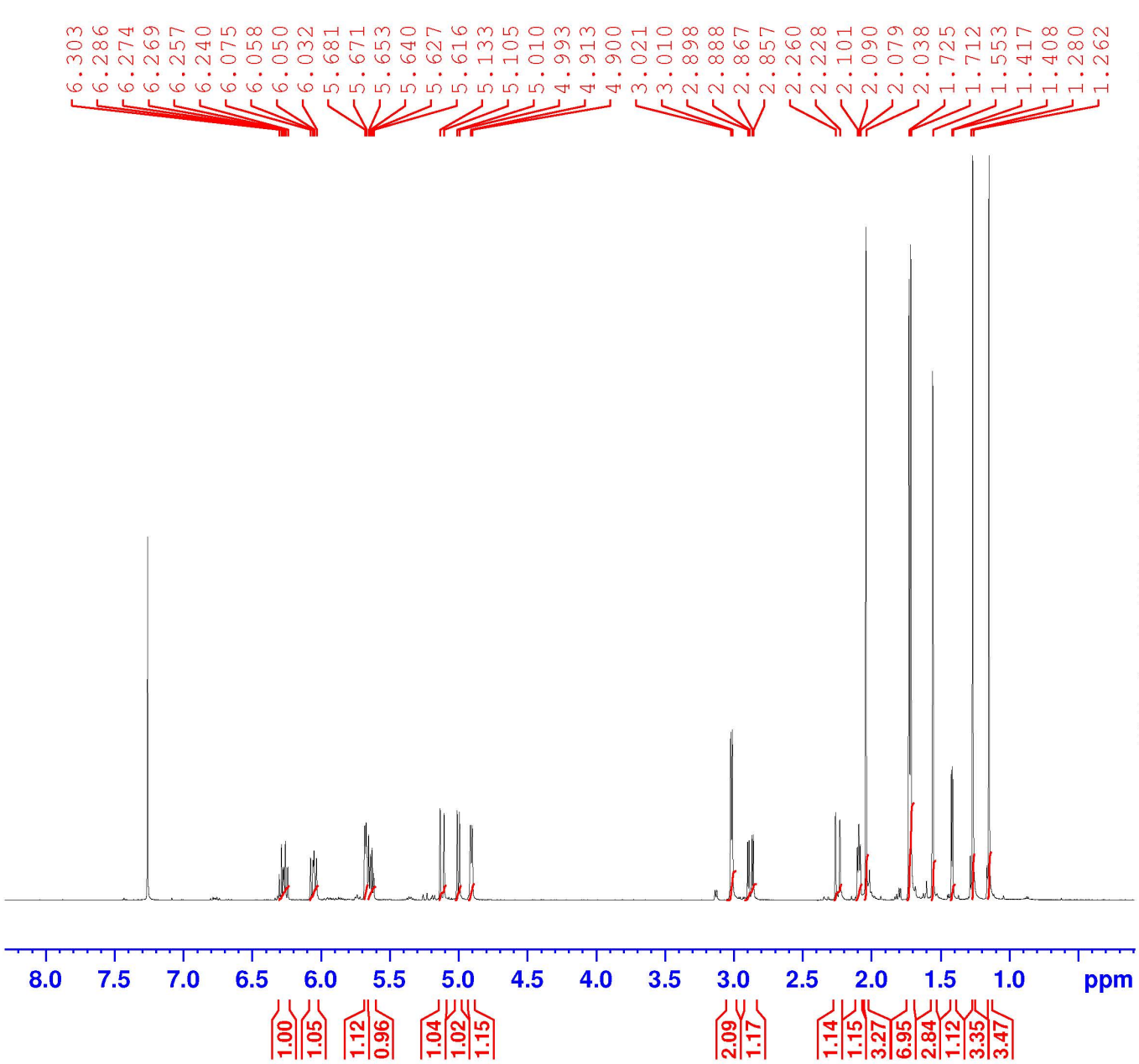


BRUKER

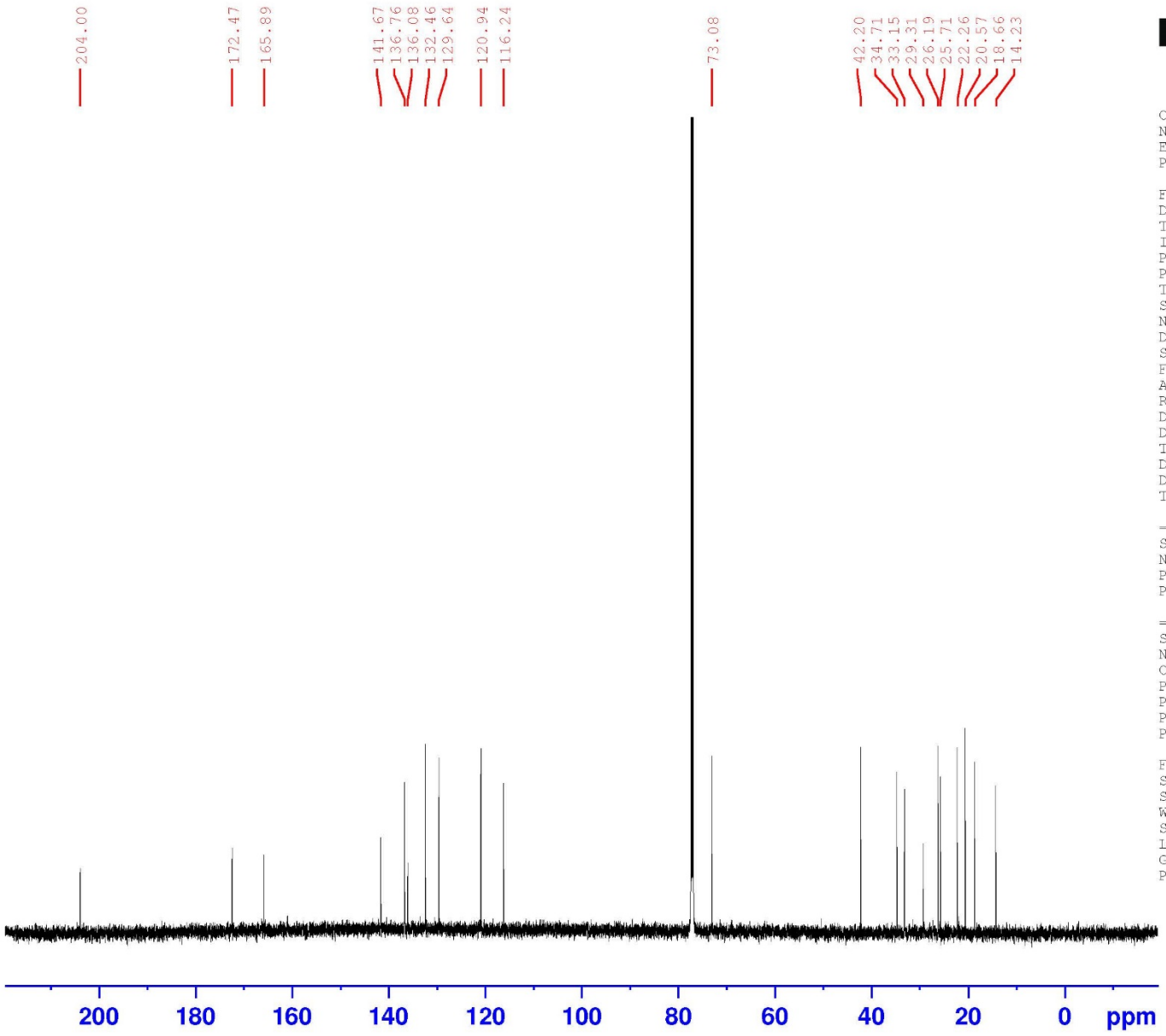
```
Current Data Parameters
NAME      20180914 Hydrogenation Pyrethrin II
EXPNO                34
PROCNO                1

F2 - Acquisition Parameters
Date_          20180914
Time              23.37
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG        hsqcetgp
TD                1024
SOLVENT           CDCl3
NS                  50
DS                  16
SWH            4464.286 Hz
FIDRES         4.359654 Hz
AQ             0.1146880 sec
RG                2050
DW              112.000 usec
DE                6.50 usec
TE                298.0 K
CNST2         145.0000000
D0             0.00000300 sec
D1             1.45084798 sec
D4             0.00172414 sec
D11            0.03000000 sec
D16            0.00020000 sec
IN0            0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1          600.1319837 MHz
NUC1                  1H
P1                  8.40 usec
P2                 16.80 usec
P28              1000.00 usec
PLW1         12.55000019 W

======== CHANNEL f2 ========
SFO2          150.9140636 MHz
NUC2                 13C
CPDPRG[2            garp
P3                 16.00 usec
P4                 32.00 usec
PCPD2              60.00 usec
PLW2        110.76000214 W
PLW12         7.87610006 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1              80.00 %
GPZ2              20.10 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                   256
SFO1            150.9141 MHz
FIDRES         97.656250 Hz
SW               165.657 ppm
FnMODE    Echo-Antiecho

F2 - Processing parameters
SI                  1024
SF            600.1300288 MHz
WDW                 QSINE
SSB                     2
LB         0 Hz
GB         0
PC                   1.40

F1 - Processing parameters
SI                  1024
MC2         echo-antiecho
SF            150.9028085 MHz
WDW                 QSINE
SSB                     2
LB         0 Hz
GB         0
```

(7b) IR Spectrum



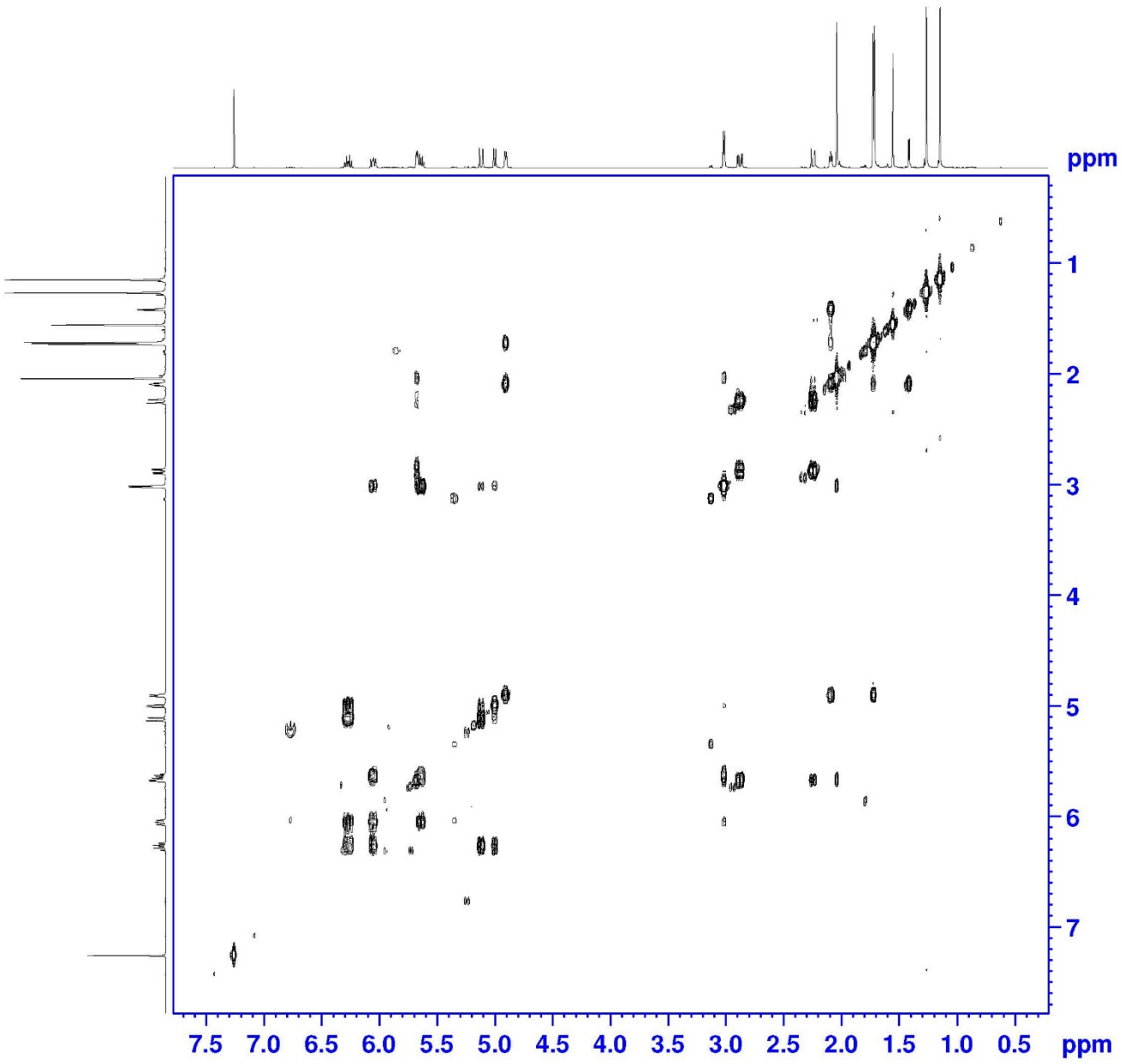



```
Current Data Parameters
NAME      20190404 Trans PI CLEAN
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190405
Time                3.28
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    64
DS                     2
SWH            12019.230 Hz
FIDRES          0.183399 Hz
AQ             2.7262976 sec
RG                   287
DW                41.600 usec
DE                 6.50 usec
TE                298.2 K
D1           1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         600.1337060 MHz
NUC1                1H
P1                 13.50 usec
PLW1         17.00000000 W

F2 - Processing parameters
SI                 65536
SF           600.1300263 MHz
WDW                   EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```

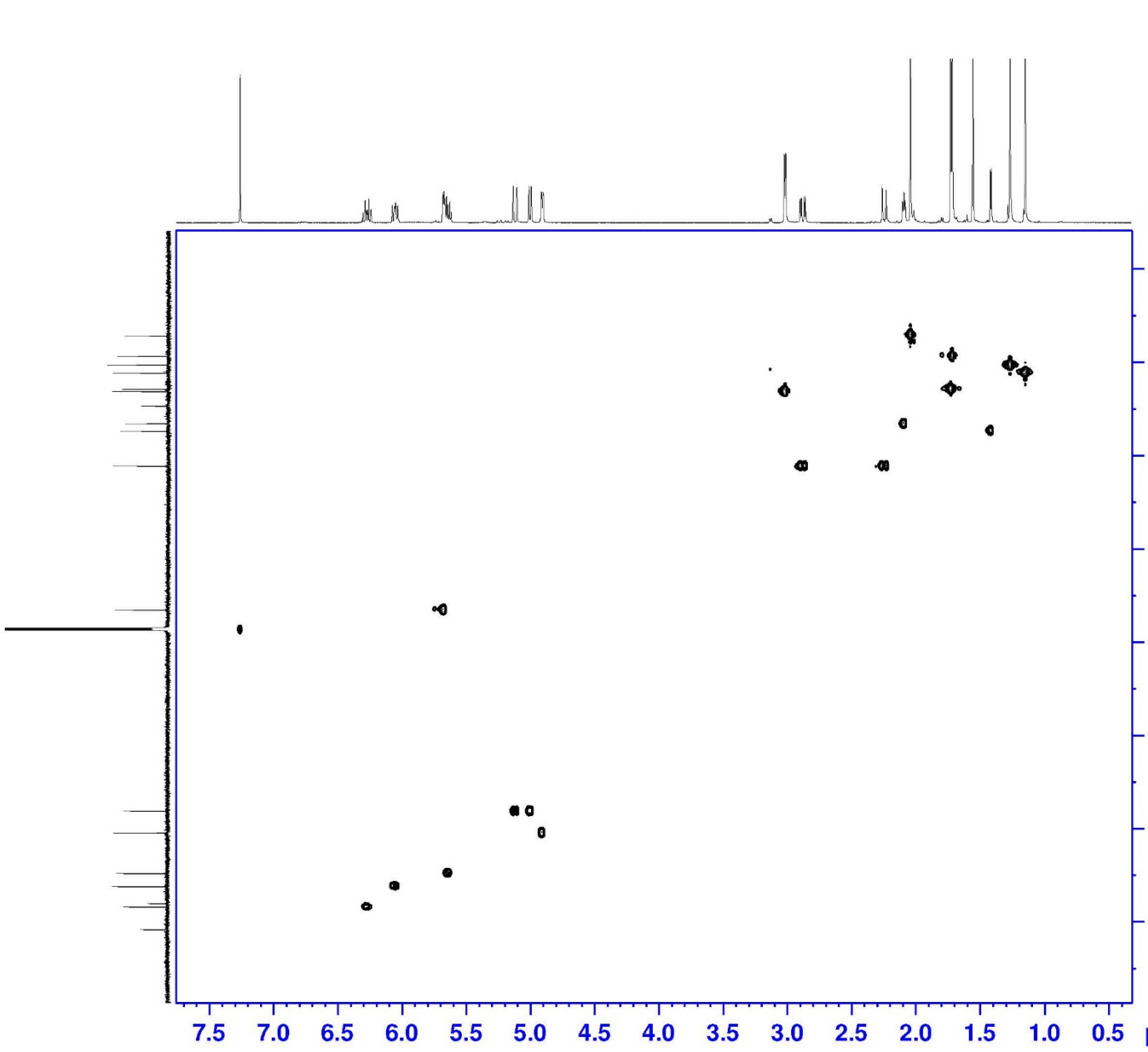


BRUKER

```
Current Data Parameters
NAME      20190404 Trans PI CLEAN
EXPNO                 12
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190405
Time                5.59
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                 2048
DS                    2
SWH           36057.691 Hz
FIDRES         0.550197 Hz
AQ            0.9087659 sec
RG                 2050
DW               13.867 usec
DE                6.50 usec
TE                298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1         150.9178988 MHz
NUC1                13C
P1                12.00 usec
PLW1         80.00000000 W

======== CHANNEL f2 ========
SFO2         600.1324005 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             70.00 usec
PLW2         17.00000000 W
PLW12         0.63230002 W
PLW13         0.30983001 W

F2 - Processing parameters
SI                 32768
SF           150.9027893 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```



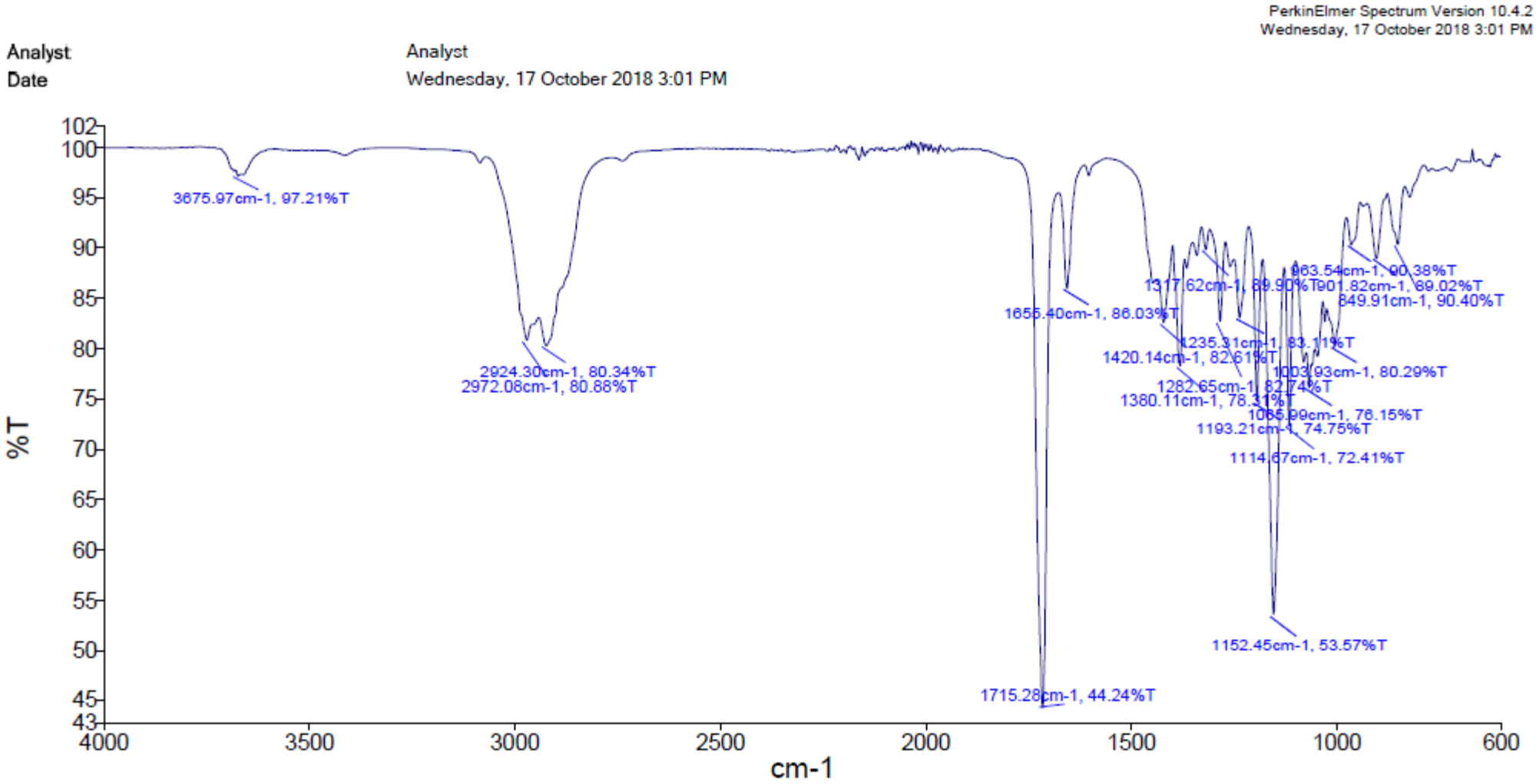

```
Current Data Parameters
NAME      20190404 Trans PI CLEAN
EXPNO                 11
PROCNO                 1

F2 - Acquisition Parameters
Date_           20190405
Time               3.30
INSTRUM           spect
PROBHD    5 mm PABBO BB/
PULPROG      cosygpppqf
TD                 2048
SOLVENT            CDCl3
NS                   10
DS                    8
SWH             4545.455 Hz
FIDRES          2.219460 Hz
AQ              0.2252800 sec
RG                   144
DW                110.000 usec
DE                  6.50 usec
TE                 298.2 K
D0            0.00000300 sec
D1            1.90251505 sec
D11           0.03000000 sec
D12           0.00002000 sec
D13           0.00000400 sec
D16           0.00020000 sec
IN0           0.00022000 sec

======== CHANNEL f1 ========
SFO1         600.1324241 MHz
NUC1                  1H
P0                 13.50 usec
P1                 13.50 usec
P17              2500.00 usec
PLW1          17.00000000 W
PLW10          4.58319998 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPZ1               10.00 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                   128
SFO1            600.1324 MHz
FIDRES         35.511364 Hz
SW                 7.574 ppm
FnMODE                QF

F2 - Processing parameters
SI                  1024
SF           600.1300250 MHz
WDW                 QSINE
SSB       0
LB        0 Hz
GB        0
PC                  1.40

F1 - Processing parameters
SI                  1024
MC2                   QF
SF           600.1300264 MHz
WDW                 QSINE
SSB       0
LB        0 Hz
GB        0
```

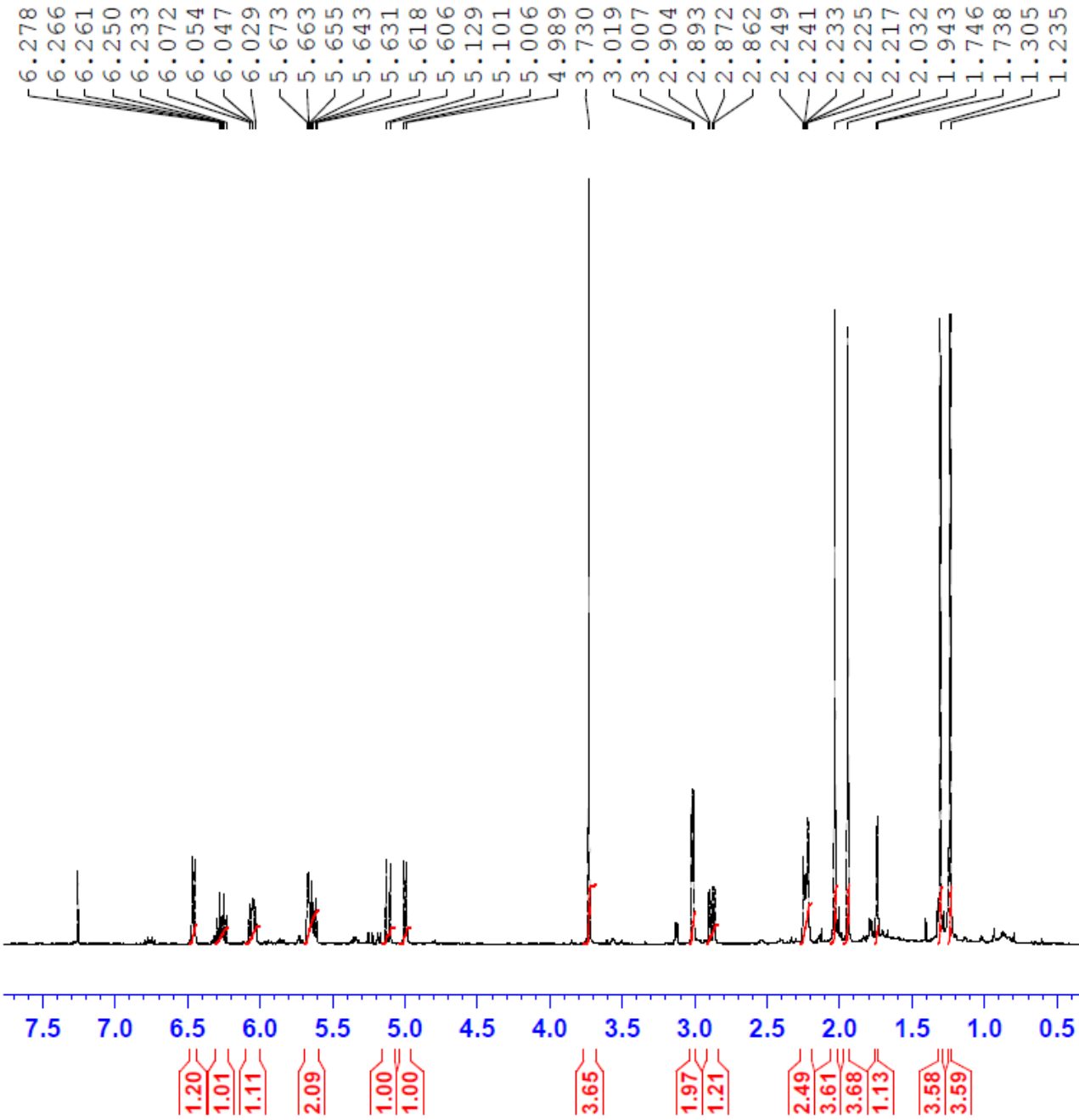


BRUKER

```
Current Data Parameters
NAME      20190404 Trans PI CLEAN
EXPNO                14
PROCNO                1

F2 - Acquisition Parameters
Date_          20190405
Time               6.04
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG        hsqcetgp
TD                 1024
SOLVENT            CDCl3
NS                   50
DS                   16
SWH             4464.286 Hz
FIDRES          4.359654 Hz
AQ              0.1146880 sec
RG                 2050
DW               112.000 usec
DE                 6.50 usec
TE                298.2 K
CNST2         145.0000000
D0              0.00000300 sec
D1              1.45084798 sec
D4              0.00172414 sec
D11             0.03000000 sec
D16             0.00020000 sec
IN0             0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1          600.1324484 MHz
NUC1                  1H
P1                 13.50 usec
P2                 27.00 usec
P28              1000.00 usec
PLW1          17.00000000 W

======== CHANNEL f2 ========
SFO2          150.9140636 MHz
NUC2                 13C
CPDPRG[2              garp
P3                 12.00 usec
P4                 24.00 usec
PCPD2              60.00 usec
PLW2          80.00000000 W
PLW12          3.20000005 W

====== GRADIENT CHANNEL =====
GPNAM[1]       SMSQ10.100
GPNAM[2]       SMSQ10.100
GPZ1               80.00 %
GPZ2               20.10 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                  137
SFO1            150.9141 MHz
FIDRES        182.481750 Hz
SW              165.657 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                 1024
SF            600.1300246 MHz
WDW                QSINE
SSB                    2
LB         0 Hz
GB         0
PC                  1.40

F1 - Processing parameters
SI                 1024
MC2         echo-antiecho
SF            150.9028116 MHz
WDW                QSINE
SSB                    2
LB         0 Hz
GB         0
```

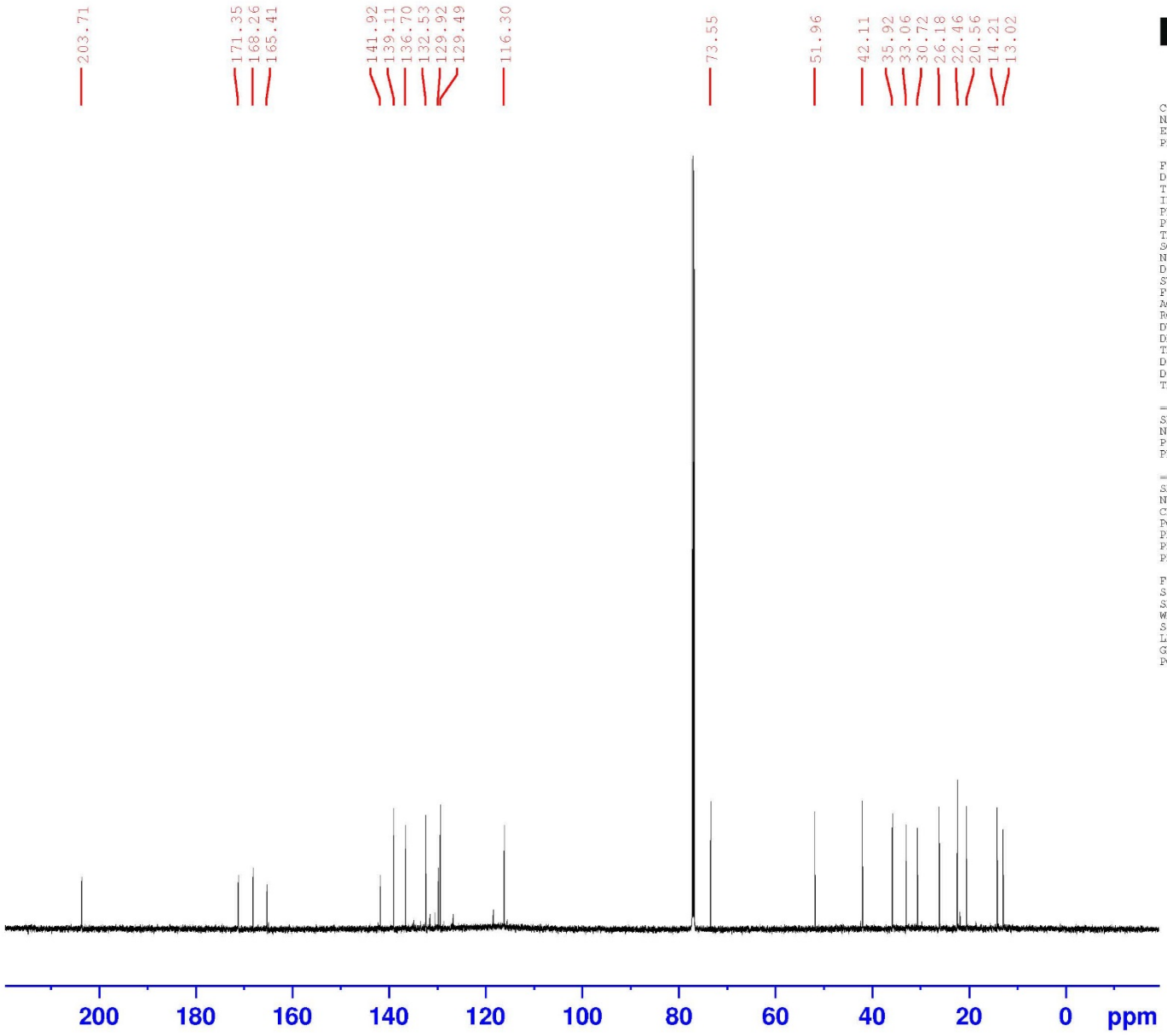
(8a) IR Spectrum





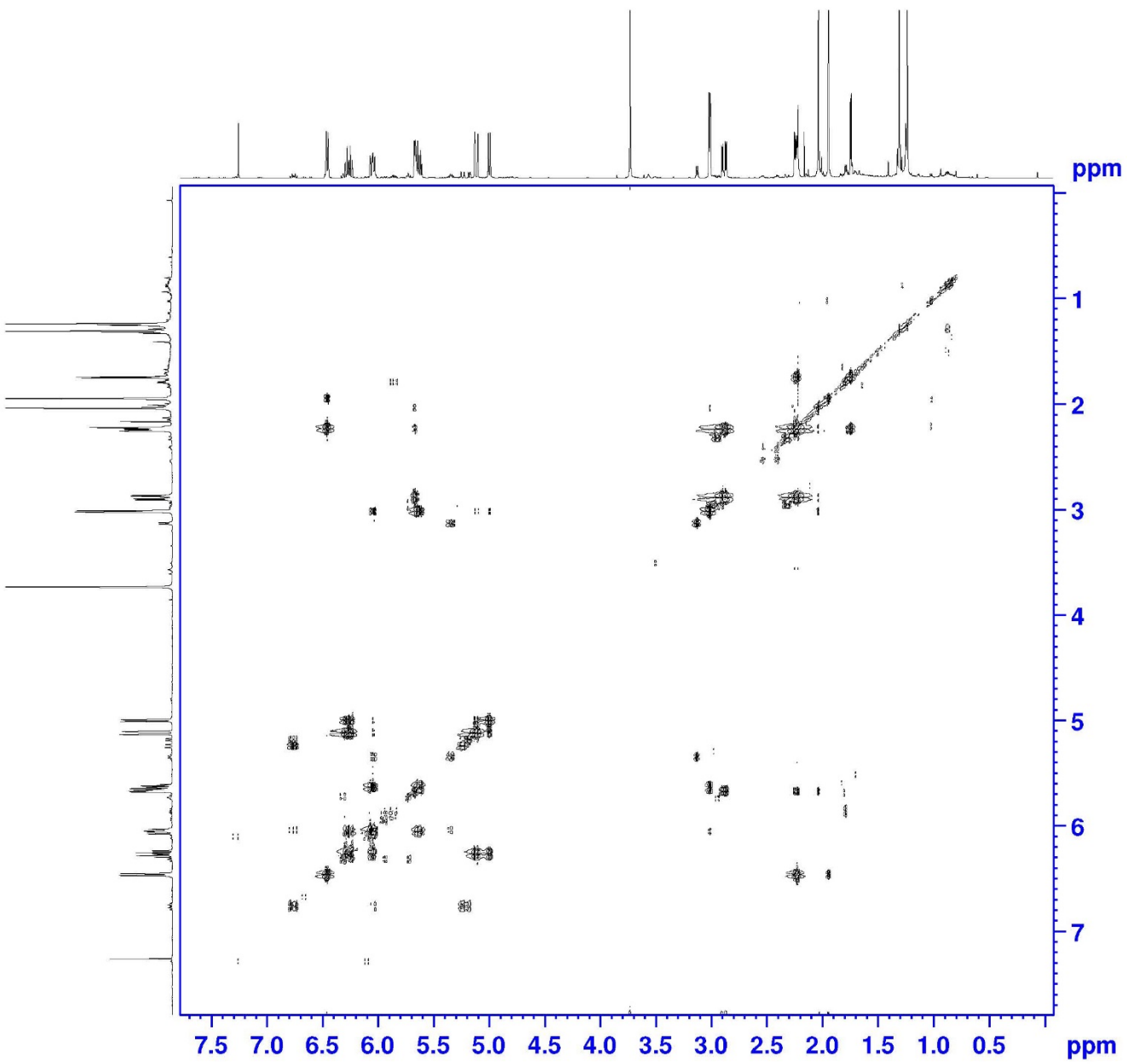
BRUKER

```
Current Data Parameters
NAME      20181008 Transfer Hydrogenation PII
EXPNO                20
PROCNO                1

F2 - Acquisition Parameters
Date_              20181008
Time               17.10
INSTRUM            spect
PROBHD   5 mm PABBI 1H/
PULPROG            zg30
TD                 65536
SOLVENT            CDCl3
NS                 64
DS                 2
SWH            12019.230 Hz
FIDRES         0.183399 Hz
AQ             2.7262976 sec
RG                 90.5
DW               41.600 usec
DE                6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                1

======== CHANNEL f1 ========
SFO1          600.1337060 MHz
NUC1                  1H
P1                 8.40 usec
PLW1          12.55000019 W

F2 - Processing parameters
SI                 65536
SF            600.1300270 MHz
WDW                EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



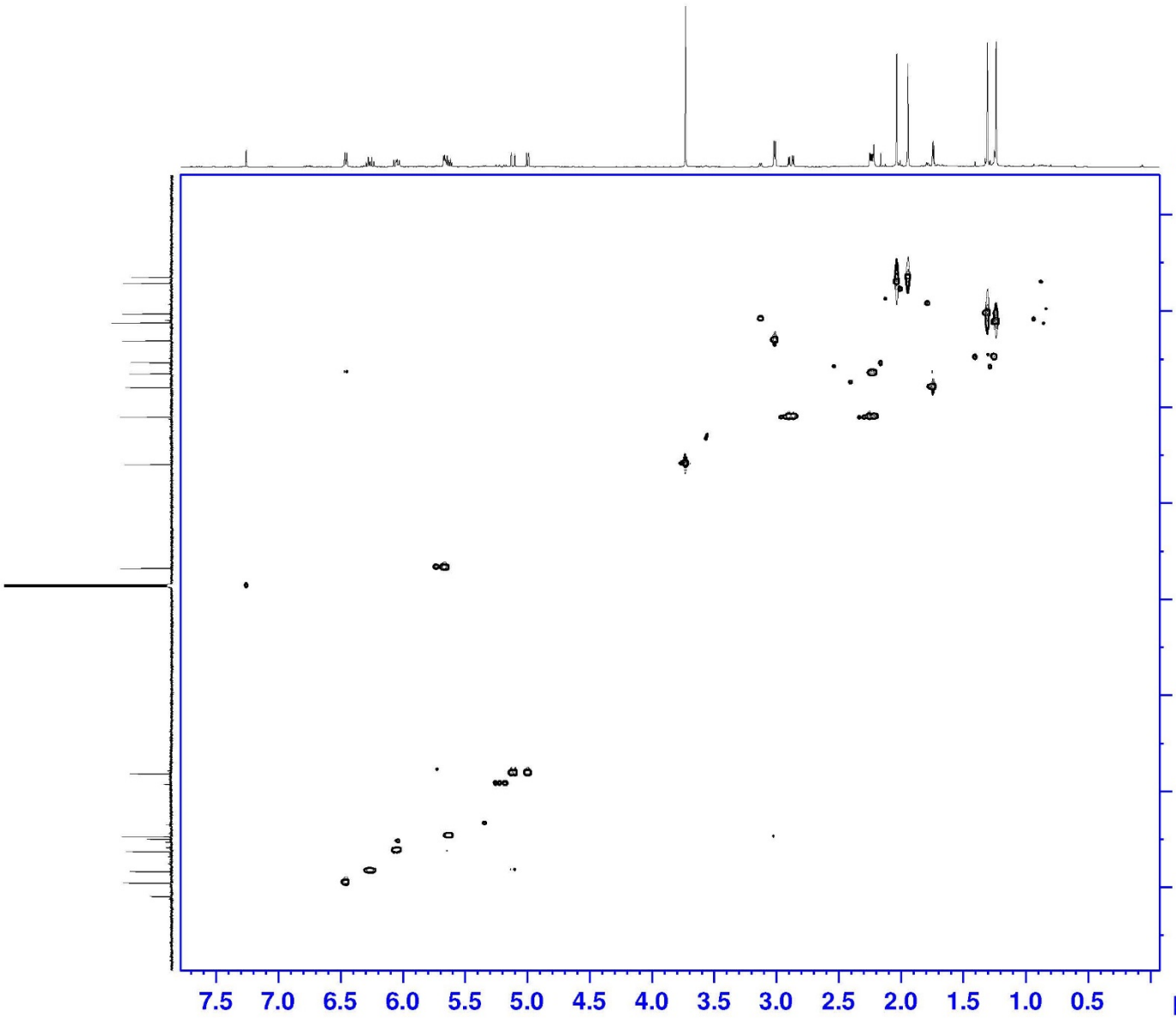
BRUKER

```
Current Data Parameters
NAME      20181008 Transfer Hydrogenation PII
EXPNO                21
PROCNO                1

F2 - Acquisition Parameters
Date_          20181008
Time              18.16
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                 1024
DS                    2
SWH           36057.691 Hz
FIDRES        0.550197 Hz
AQ            0.9087659 sec
RG                 1620
DW               13.867 usec
DE                6.50 usec
TE               298.2 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        150.9178988 MHz
NUC1                13C
P1                16.00 usec
PLW1       110.76000214 W

======== CHANNEL f2 ========
SFO2        600.1324005 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             70.00 usec
PLW2         12.55000019 W
PLW12         0.18072000 W
PLW13         0.08855400 W

F2 - Processing parameters
SI                32768
SF          150.9027908 MHz
WDW                 EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



BRUKER

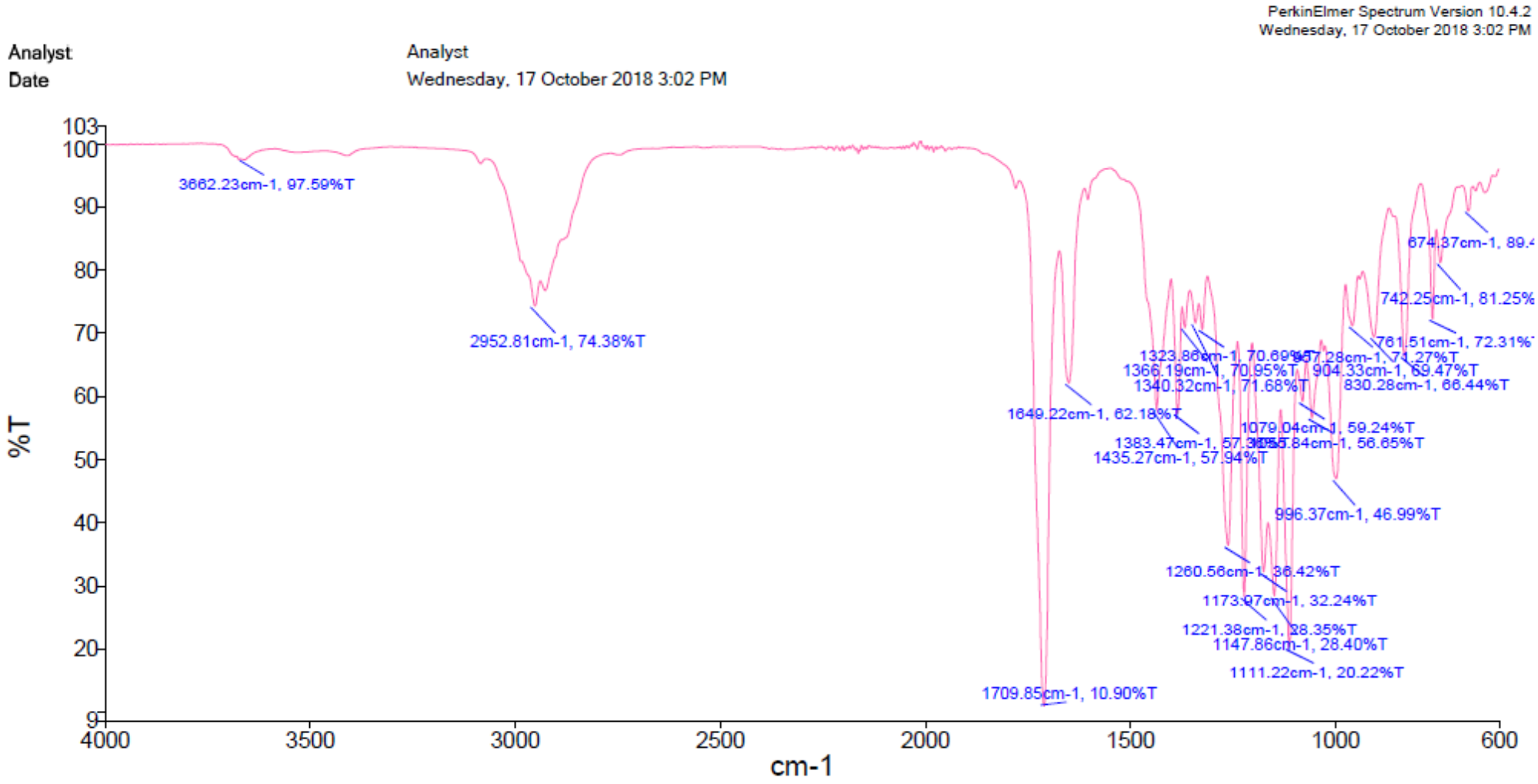
```
Current Data Parameters
NAME      20181008 Transfer Hydrogenation PII
EXPNO              23
PROCNO              1

F2 - Acquisition Parameters
Date_          20181008
Time             18.23
INSTRUM          spect
PROBHD    5 mm PABBI 1H/
PULPROG    cosygpmfphpp
TD               2048
SOLVENT          CDCl3
NS                  5
DS                  4
SWH          4716.981 Hz
FIDRES       2.303213 Hz
AQ           0.2170880 sec
RG                2050
DW             106.000 usec
DE               6.50 usec
TE              298.2 K
D0          0.00009530 sec
D1          1.92135704 sec
D11         0.03000000 sec
D12         0.00002000 sec
D16         0.00020000 sec
IN0         0.00021200 sec

======== CHANNEL f1 ========
SFO1       600.1323382 MHz
NUC1              1H
P1                8.40 usec
P2               16.80 usec
P17            2500.00 usec
PLW1       12.55000019 W
PLW10       1.30999994 W

====== GRADIENT CHANNEL =====
GPNAM[1]     SMSQ10.100
GPNAM[2]     SMSQ10.100
GPZ1             10.00 %
GPZ2             20.00 %
P16            1000.00 usec

F1 - Acquisition parameters
TD                256
SFO1         600.1323 MHz
FIDRES      18.425707 Hz
SW           7.860 ppm
FnMODE     States-TPPI

F2 - Processing parameters
SI               1024
SF         600.1300250 MHz
WDW              QSINE
SSB                 2
LB       0 Hz
GB       0
PC              1.40

F1 - Processing parameters
SI               1024
MC2        States-TPPI
SF         600.1300203 MHz
WDW              QSINE
SSB                 2
LB       0 Hz
GB       0
```

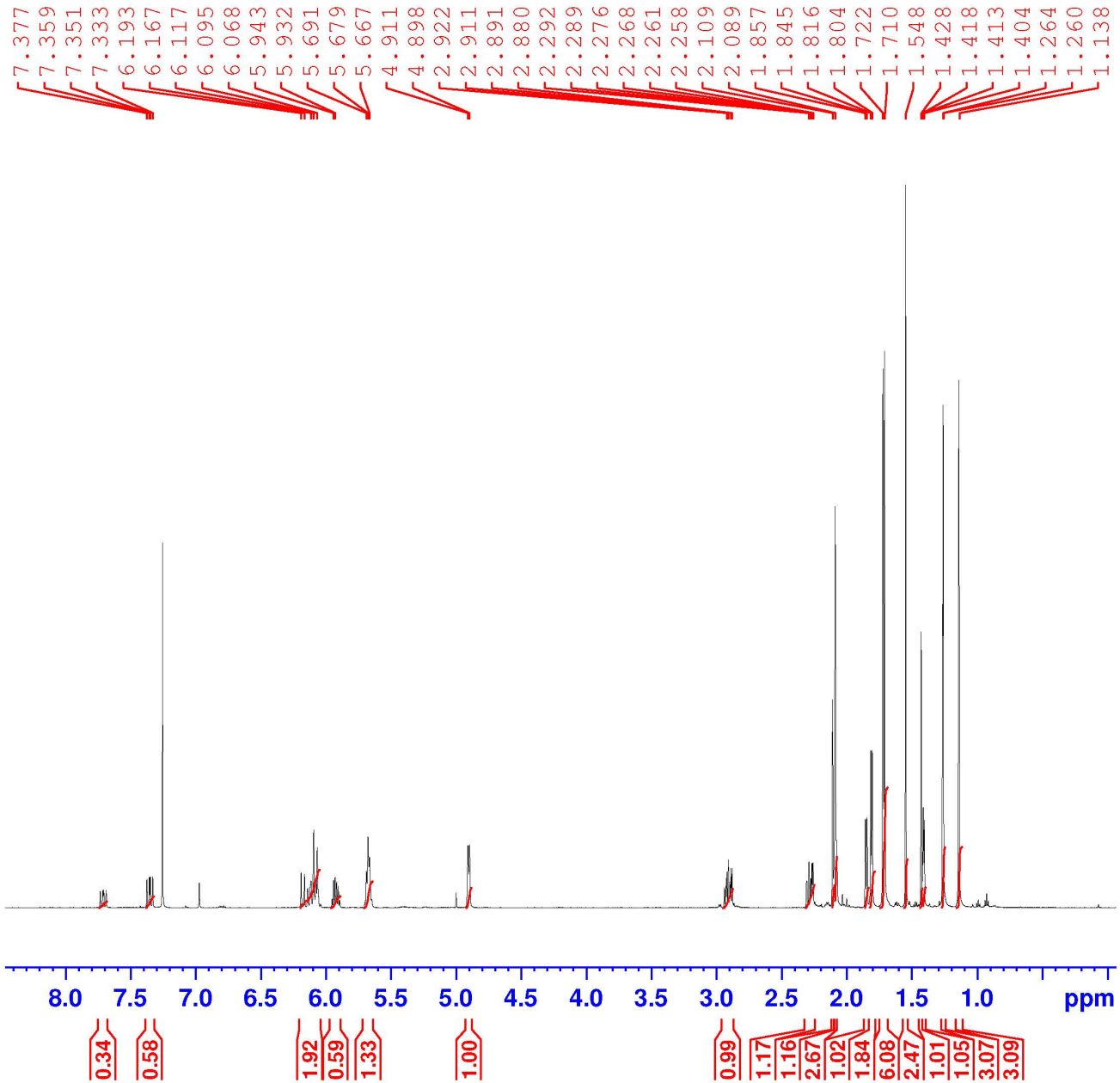


BRUKER

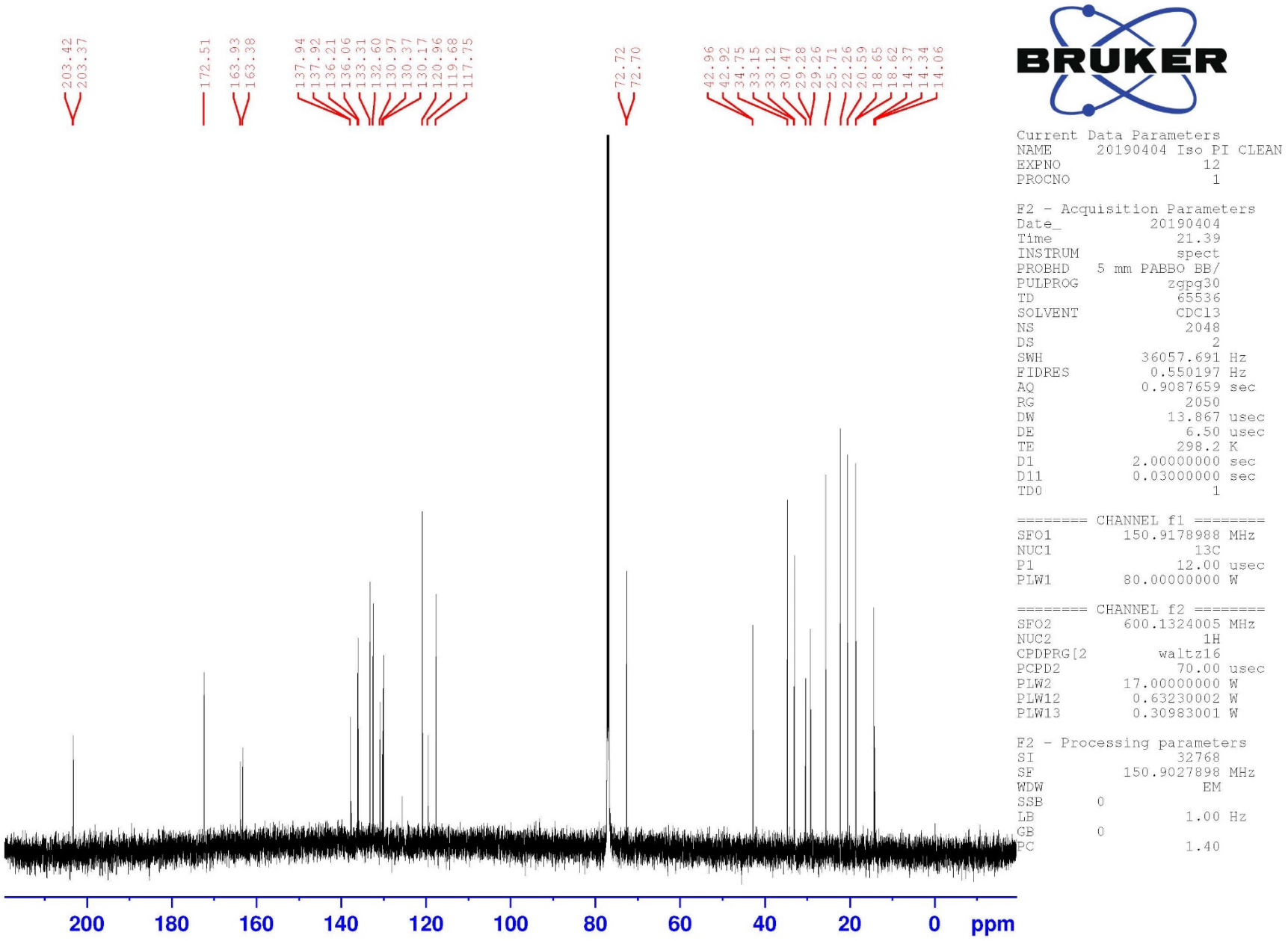
```
Current Data Parameters
NAME      20181008 Transfer Hydrogenation PII
EXPNO              24
PROCNO              1

F2 - Acquisition Parameters
Date_          20181008
Time             19.12
INSTRUM          spect
PROBHD   5 mm PABBI 1H/
PULPROG      hsqcetgp
TD               1024
SOLVENT          CDCl3
NS                 35
DS                 16
SWH          4716.981 Hz
FIDRES       4.606427 Hz
AQ           0.1085440 sec
RG              2050
DW            106.000 usec
DE              6.50 usec
TE             298.1 K
CNST2       145.0000000
D0           0.00000300 sec
D1           1.45699203 sec
D4           0.00172414 sec
D11          0.03000000 sec
D16          0.00020000 sec
IN0          0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1       600.1323382 MHz
NUC1              1H
P1                8.40 usec
P2               16.80 usec
P28            1000.00 usec
PLW1        12.55000019 W

======== CHANNEL f2 ========
SFO2       150.9140636 MHz
NUC2              13C
CPDPRG[2          garp
P3               16.00 usec
P4               32.00 usec
PCPD2            60.00 usec
PLW2       110.76000214 W
PLW12        7.87610006 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1             80.00 %
GPZ2             20.10 %
P16            1000.00 usec

F1 - Acquisition parameters
TD                256
SFO1         150.9141 MHz
FIDRES       97.656250 Hz
SW           165.657 ppm
FnMODE    Echo-Antiecho

F2 - Processing parameters
SI               1024
SF         600.1300239 MHz
WDW              QSINE
SSB                 2
LB        0 Hz
GB        0
PC               1.40

F1 - Processing parameters
SI               1024
MC2       echo-antiecho
SF         150.9028240 MHz
WDW              QSINE
SSB                 2
LB        0 Hz
GB        0
```

(8b) IR Spectrum



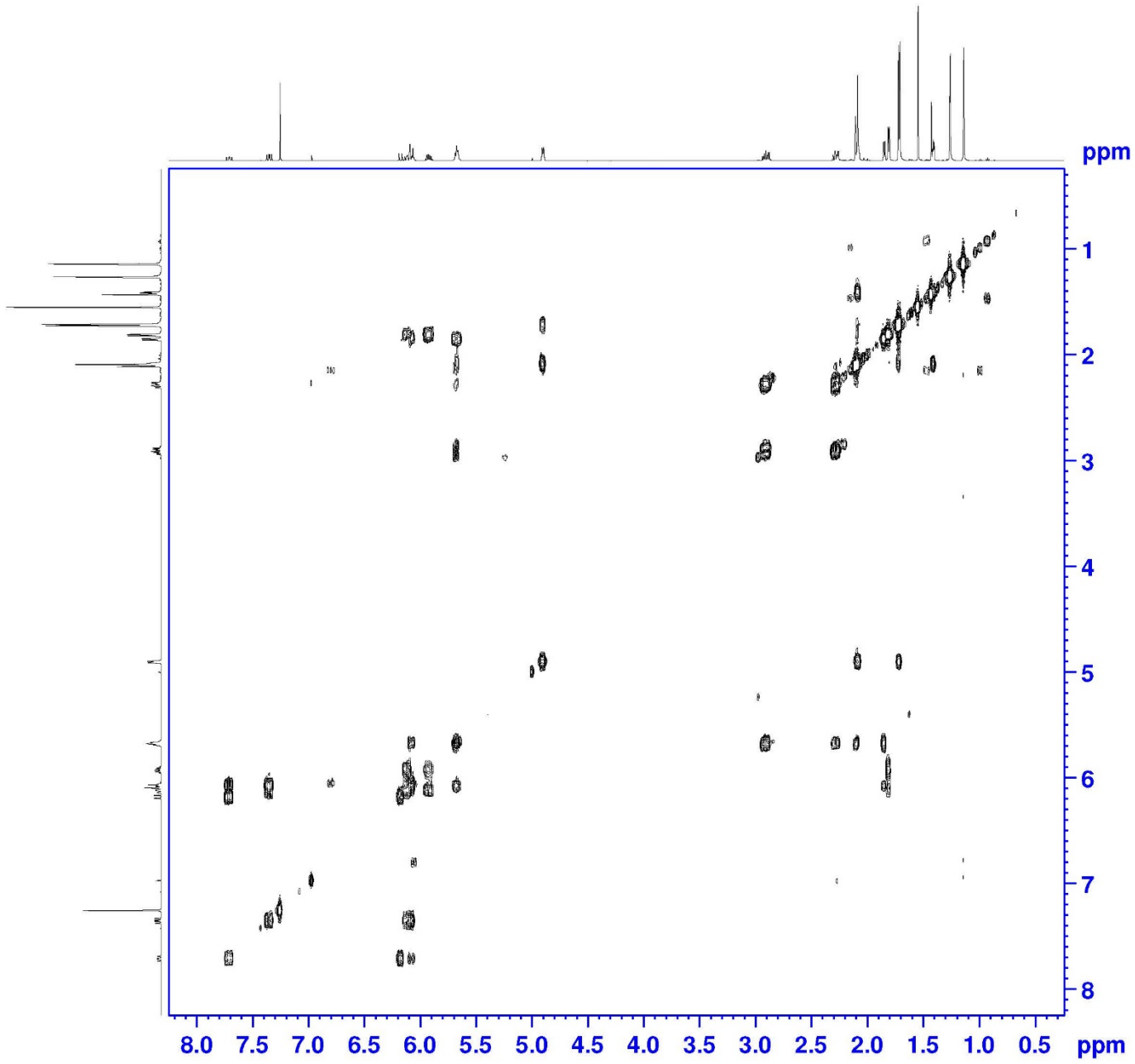



```
Current Data Parameters
NAME      20190404 Iso PI CLEAN
EXPNO                   10
PROCNO                   1

F2 - Acquisition Parameters
Date_           20190404
Time              19.08
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG           zg30
TD               65536
SOLVENT          CDCl3
NS                  64
DS                   2
SWH           12019.230 Hz
FIDRES         0.183399 Hz
AQ            2.7262976 sec
RG                 287
DW                41.600 usec
DE                 6.50 usec
TE                298.2 K
D1           1.00000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1         600.1337060 MHz
NUC1               1H
P1                13.50 usec
PLW1         17.00000000 W

F2 - Processing parameters
SI                65536
SF           600.1300277 MHz
WDW                EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



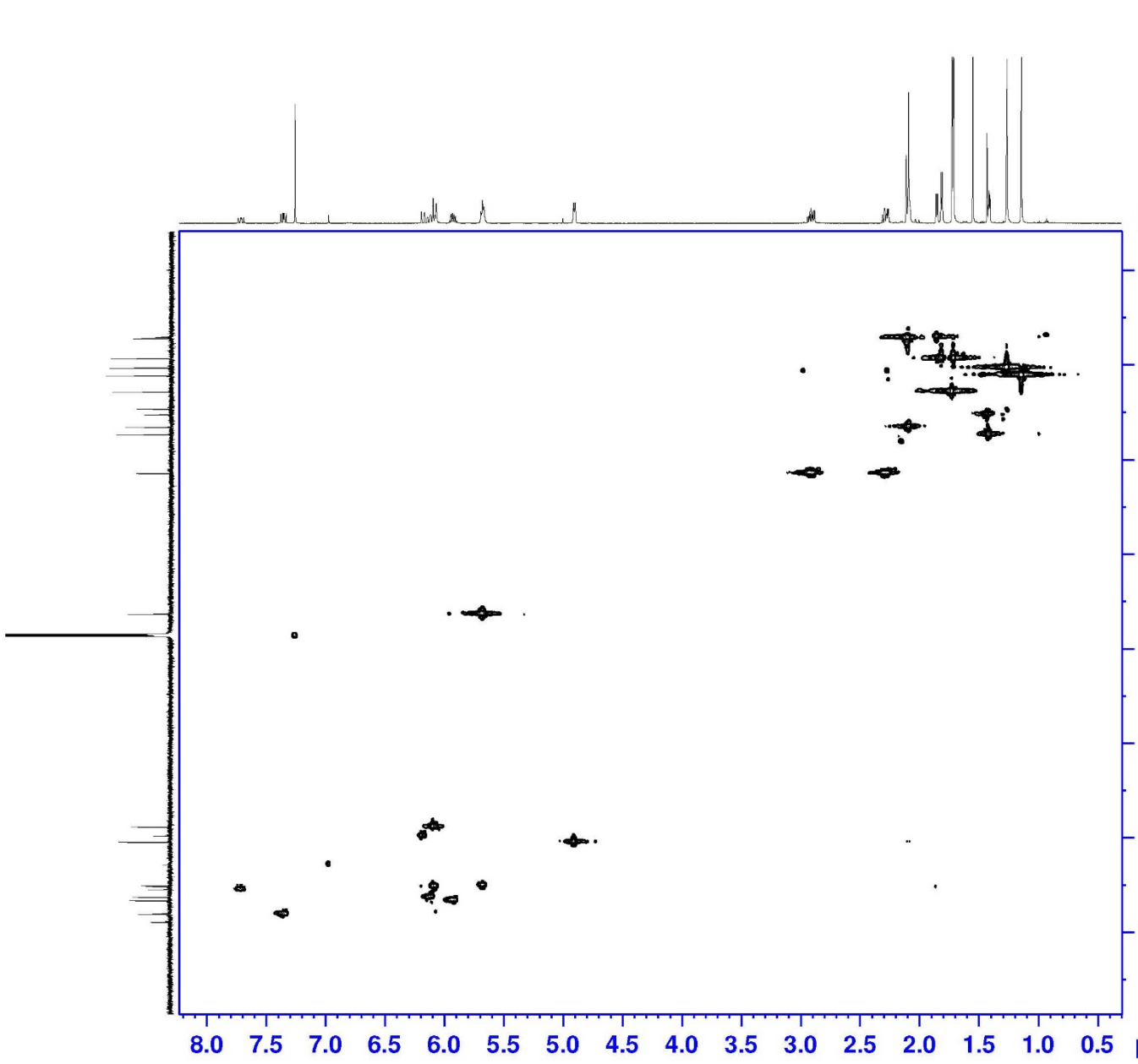
BRUKER

```
Current Data Parameters
NAME      20190404 Iso PI CLEAN
EXPNO                12
PROCNO                1

F2 - Acquisition Parameters
Date_          20190404
Time              21.39
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD               65536
SOLVENT          CDCl3
NS                2048
DS                   2
SWH          36057.691 Hz
FIDRES        0.550197 Hz
AQ           0.9087659 sec
RG                2050
DW              13.867 usec
DE               6.50 usec
TE              298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1        150.9178988 MHz
NUC1               13C
P1               12.00 usec
PLW1        80.00000000 W

======== CHANNEL f2 ========
SFO2        600.1324005 MHz
NUC2               1H
CPDPRG[2        waltz16
PCPD2            70.00 usec
PLW2        17.00000000 W
PLW12        0.63230002 W
PLW13        0.30983001 W

F2 - Processing parameters
SI                32768
SF          150.9027898 MHz
WDW                EM
SSB       0
LB               1.00 Hz
GB        0
PC               1.40
```



BRUKER

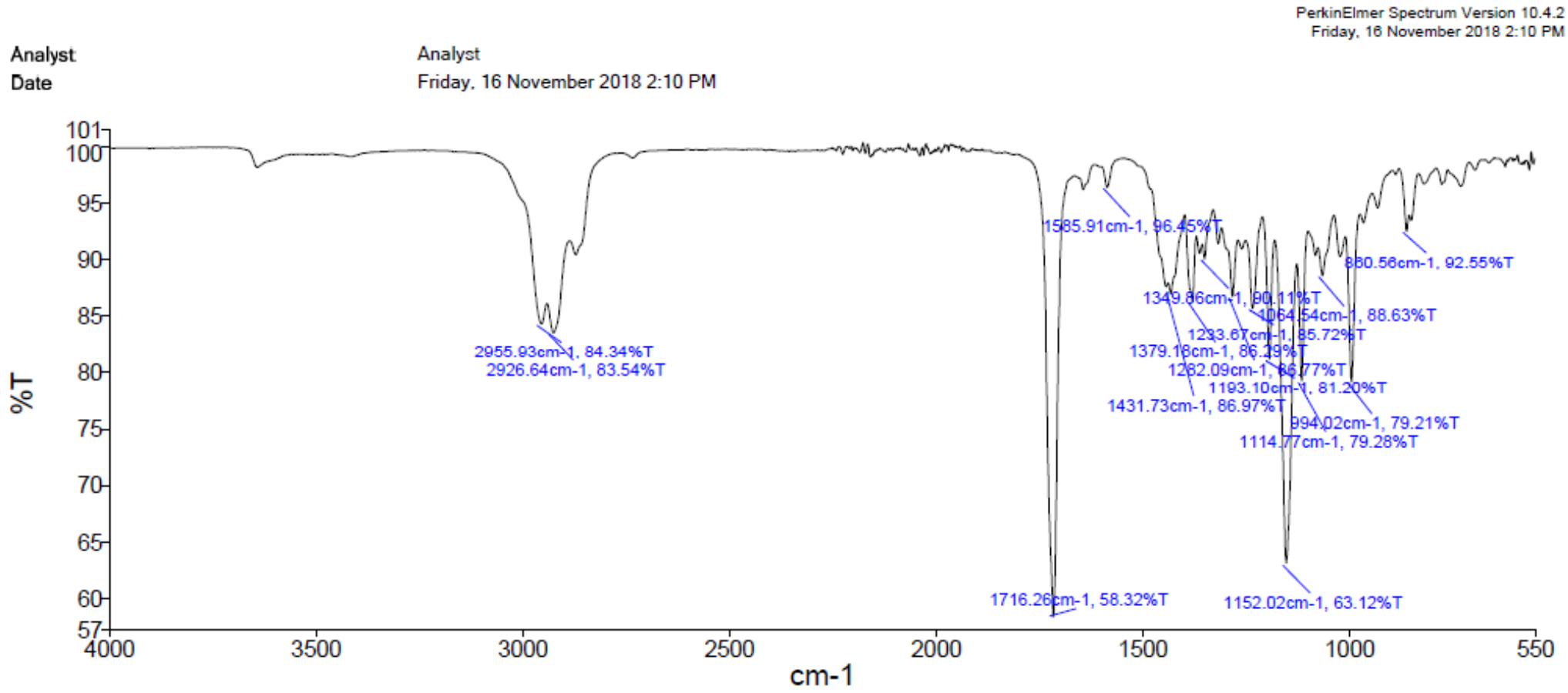
```
Current Data Parameters
NAME      20190404 Iso PI CLEAN
EXPNO                11
PROCNO                1

F2 - Acquisition Parameters
Date_          20190404
Time             19.10
INSTRUM          spect
PROBHD   5 mm PABBO BB/
PULPROG      cosygpppqf
TD                2048
SOLVENT           CDCl3
NS                  10
DS                   8
SWH           4807.692 Hz
FIDRES        2.347506 Hz
AQ            0.2129920 sec
RG                 144
DW              104.000 usec
DE                6.50 usec
TE               298.2 K
D0          0.00000300 sec
D1          1.91480303 sec
D11         0.03000000 sec
D12         0.00002000 sec
D13         0.00000400 sec
D16         0.00020000 sec
IN0         0.00020800 sec

======== CHANNEL f1 ========
SFO1        600.1325742 MHz
NUC1                1H
P0                13.50 usec
P1                13.50 usec
P17             2500.00 usec
PLW1         17.00000000 W
PLW10         4.58319998 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPZ1              10.00 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                  128
SFO1          600.1326 MHz
FIDRES       37.560097 Hz
SW                8.011 ppm
FnMODE               QF

F2 - Processing parameters
SI                 1024
SF          600.1300254 MHz
WDW                QSINE
SSB       0
LB        0 Hz
GB        0
PC                 1.40

F1 - Processing parameters
SI                 1024
MC2                  QF
SF          600.1300271 MHz
WDW                QSINE
SSB       0
LB        0 Hz
GB        0
```



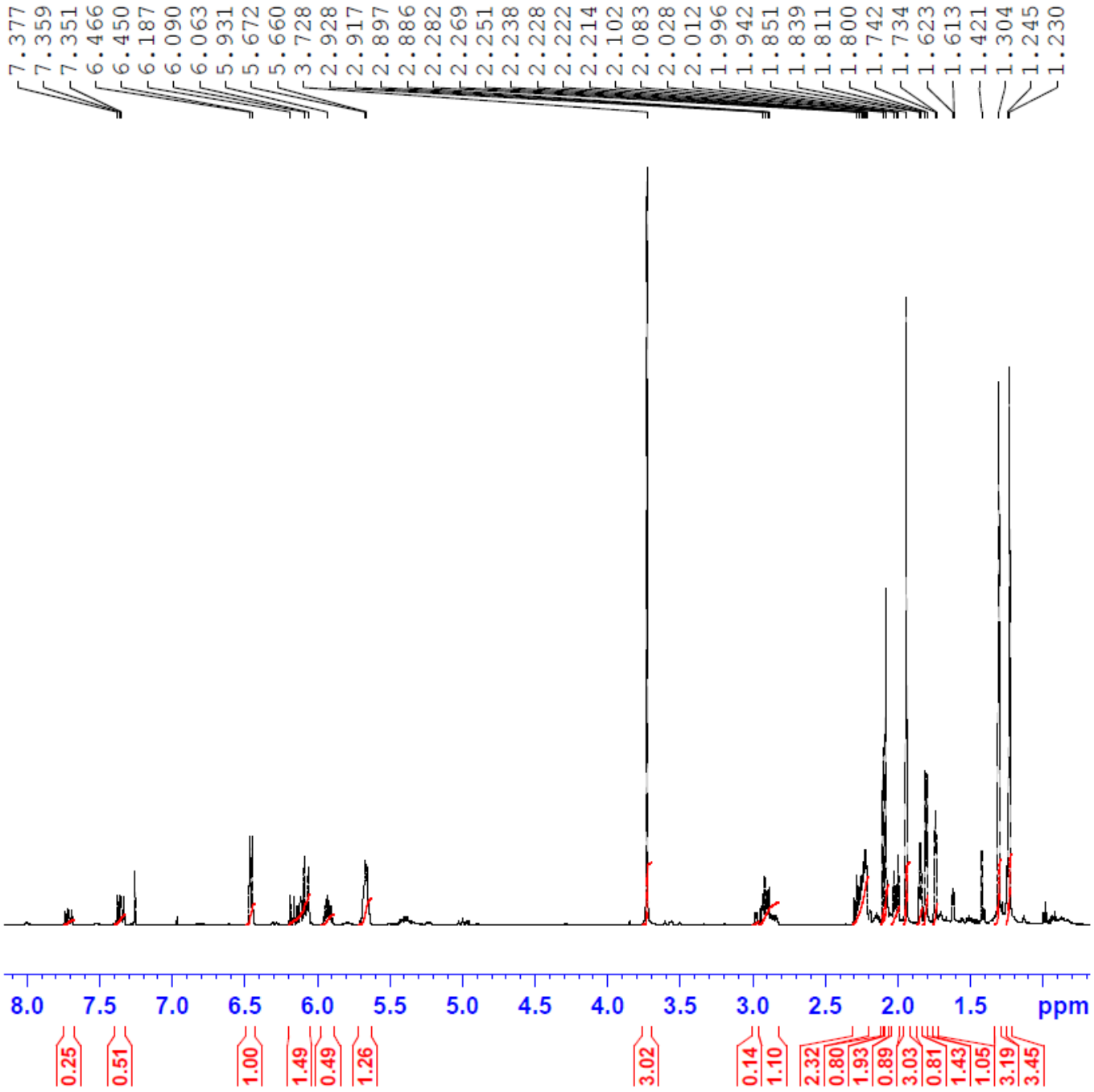
BRUKER

```
Current Data Parameters
NAME      20190404 Iso PI CLEAN
EXPNO                   14
PROCNO                   1

F2 - Acquisition Parameters
Date_           20190404
Time              21.44
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         hsqcetgp
TD                 1024
SOLVENT            CDCl3
NS                   50
DS                   16
SWH             4761.905 Hz
FIDRES          4.650298 Hz
AQ              0.1075200 sec
RG                 2050
DW               105.000 usec
DE                 6.50 usec
TE                298.3 K
CNST2         145.0000000
D0              0.00000300 sec
D1              1.45801604 sec
D4              0.00172414 sec
D11             0.03000000 sec
D16             0.00020000 sec
IN0             0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1          600.1325854 MHz
NUC1                  1H
P1                 13.50 usec
P2                 27.00 usec
P28              1000.00 usec
PLW1         17.00000000 W

======== CHANNEL f2 ========
SFO2          150.9140636 MHz
NUC2                 13C
CPDPRG[2             garp
P3                 12.00 usec
P4                 24.00 usec
PCPD2              60.00 usec
PLW2         80.00000000 W
PLW12         3.20000005 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1               80.00 %
GPZ2               20.10 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                  256
SFO1            150.9141 MHz
FIDRES          97.656250 Hz
SW                165.657 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                 1024
SF            600.1300256 MHz
WDW                QSINE
SSB                    2
LB         0 Hz
GB         0
PC                  1.40

F1 - Processing parameters
SI                 1024
MC2         echo-antiecho
SF            150.9028185 MHz
WDW                QSINE
SSB                    2
LB         0 Hz
GB         0
```

(9a) IR Spectrum

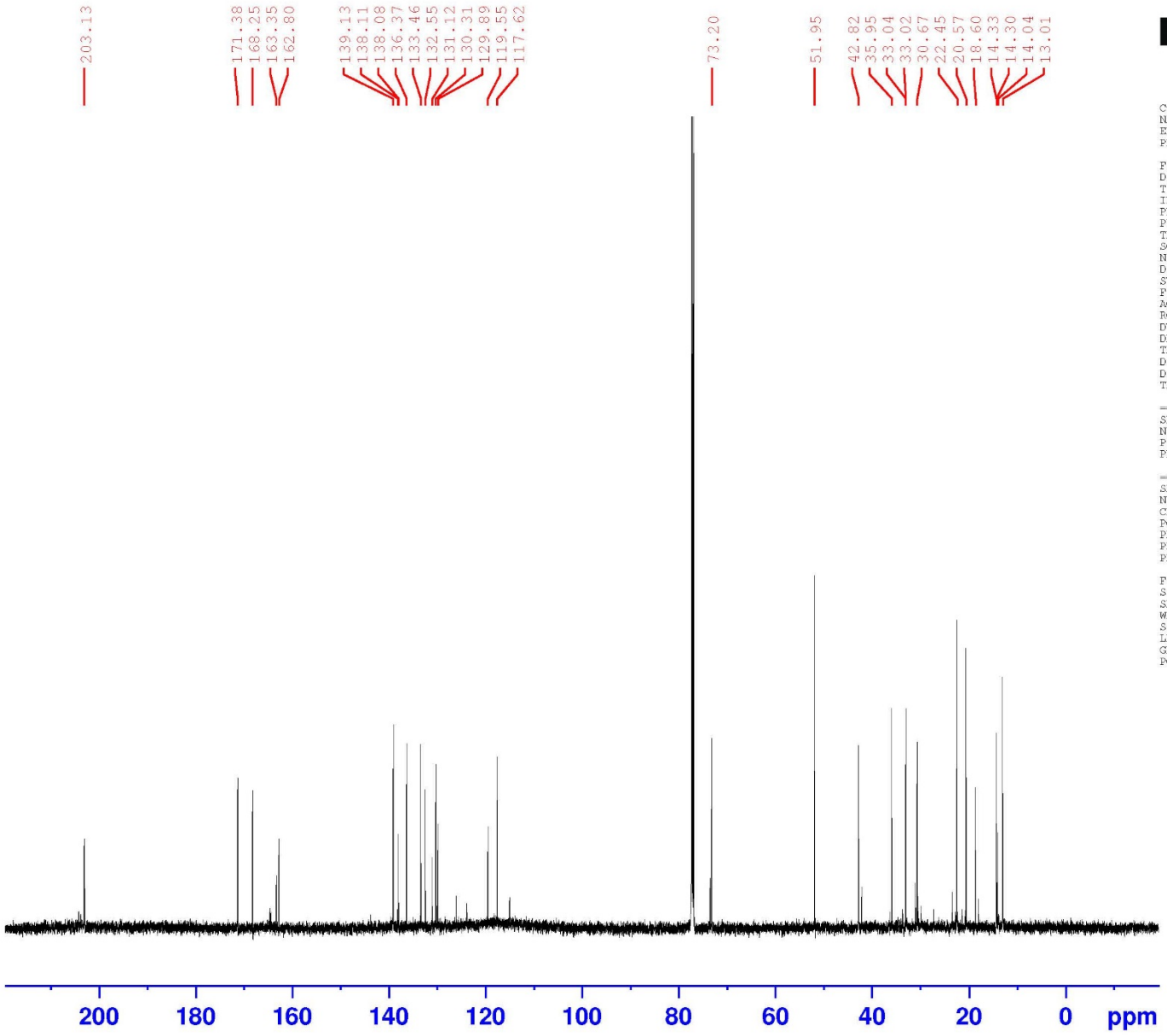


(9b) NMR Characterisation



BRUKER

```
Current Data Parameters
NAME      20181008 Transfer Hydrogenation PII
EXPNO             10
PROCNO             1

F2 - Acquisition Parameters
Date_          20181008
Time_             17.03
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG           zg30
TD               65536
SOLVENT          CDCl3
NS                  64
DS                   2
SWH           12019.230 Hz
FIDRES            0.183399 Hz
AQ             2.7262976 sec
RG                  71.8
DW                41.600 usec
DE                 6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1         600.1337060 MHz
NUC1               1H
P1                 8.40 usec
PLW1         12.55000019 W

F2 - Processing parameters
SI                65536
SF           600.1300267 MHz
WDW                EM
SSB       0
LB                 0.30 Hz
GB        0
PC                 1.00
```



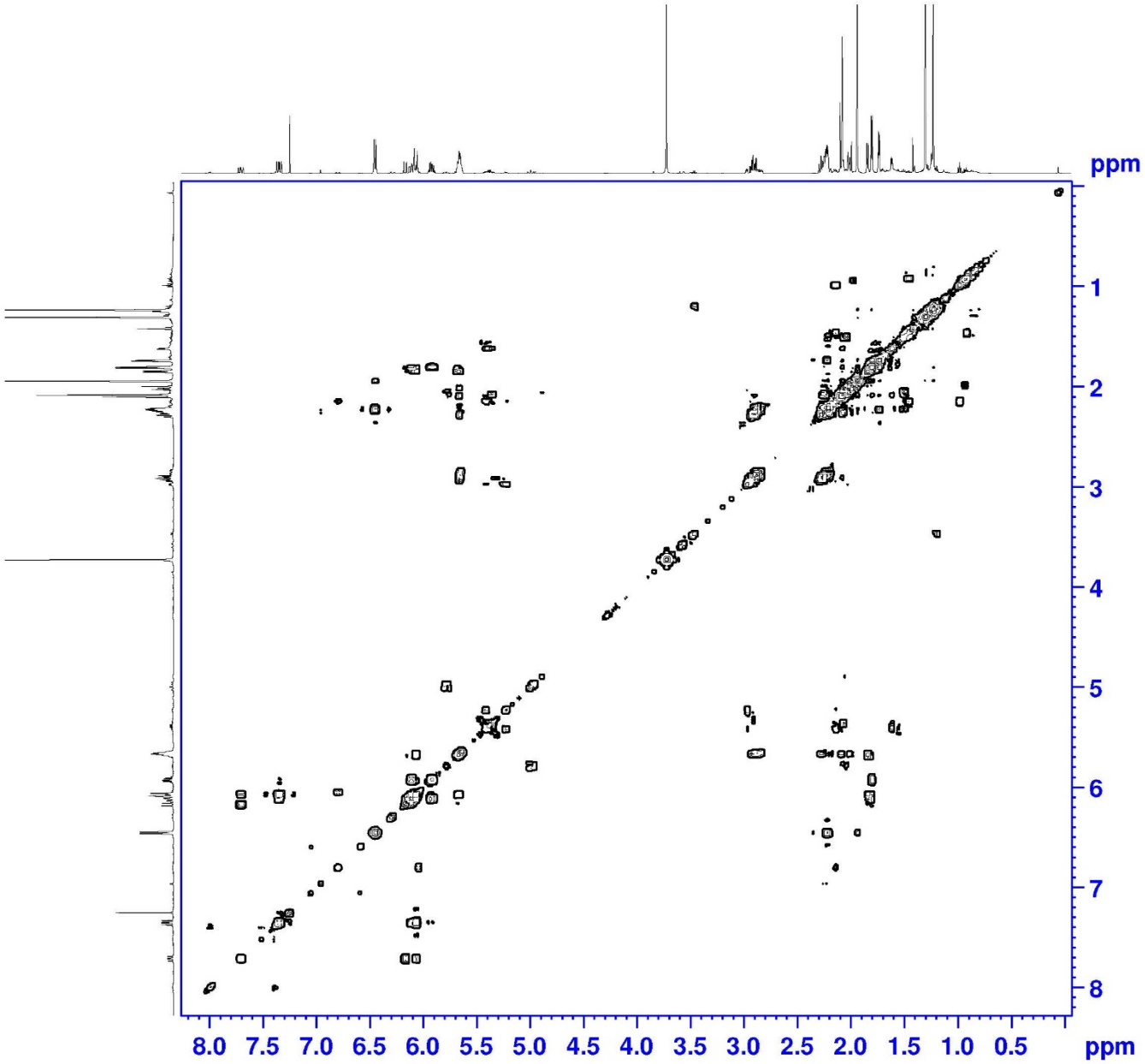
Current Data Parameters
NAME 20181008 Transfer Hydrogenation PII
EXPNO 11
PROCNO 1

F2 - Acquisition Parameters
Date_ 20181009
Time 3.59
INSTRUM spect
PROBHD 5 mm PABBI 1H/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 1024
DS 2
SWH 36057.691 Hz
FIDRES 0.550197 Hz
AQ 0.9087659 sec
RG 1820
DW 13.867 usec
DE 6.50 usec
TE 298.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1

======== CHANNEL f1 ========
SFO1 150.9178988 MHz
NUC1 13C
P1 16.00 usec
PLW1 110.76000214 W

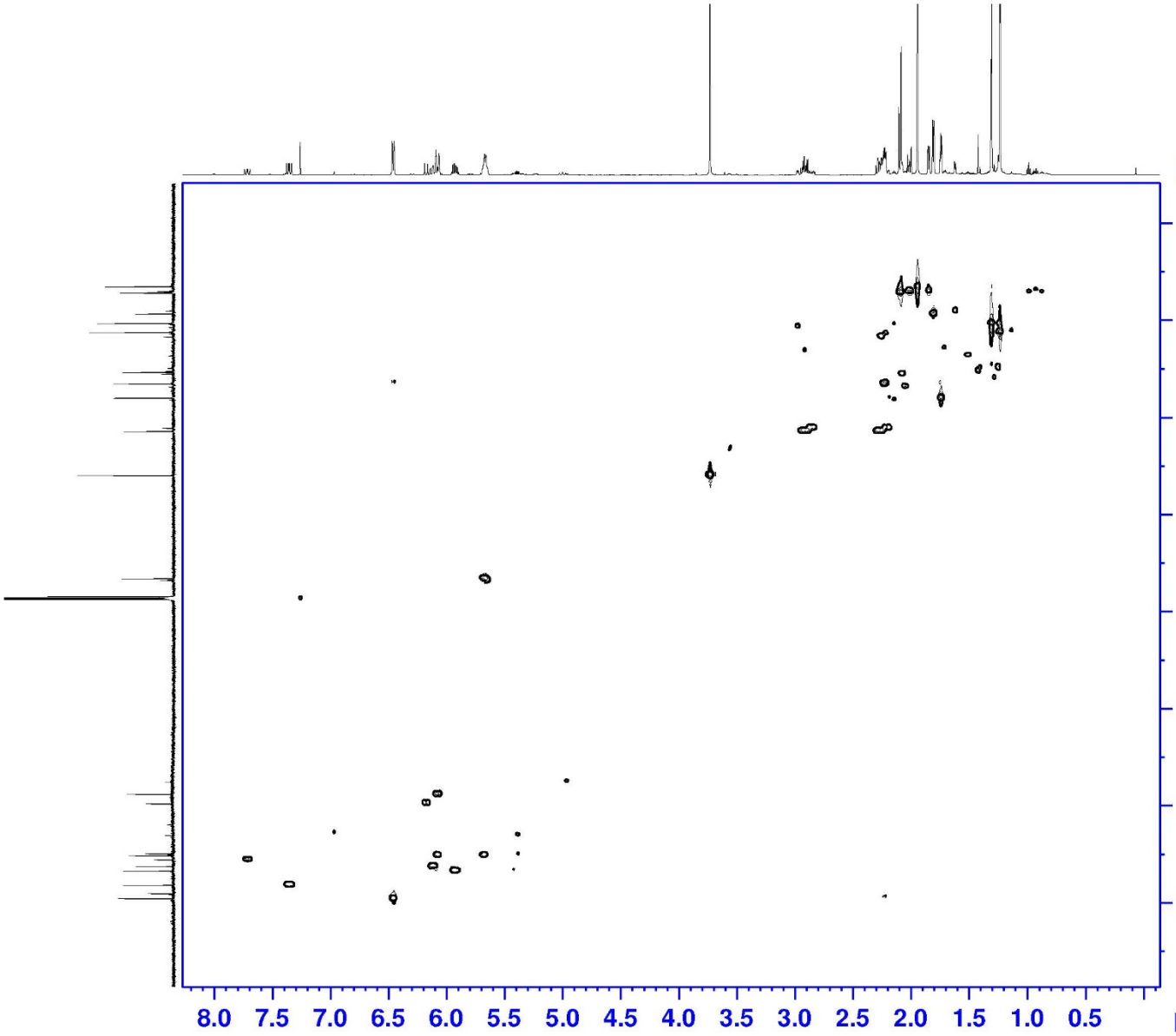
======== CHANNEL f2 ========
SFO2 600.1324005 MHz
NUC2 1H
CPDPRG[2 waltz16
PCPD2 70.00 usec
PLW2 12.55000019 W
PLW12 0.18072000 W
PLW13 0.08855400 W

F2 - Processing parameters
SI 32768
SF 150.9027924 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



BRUKER

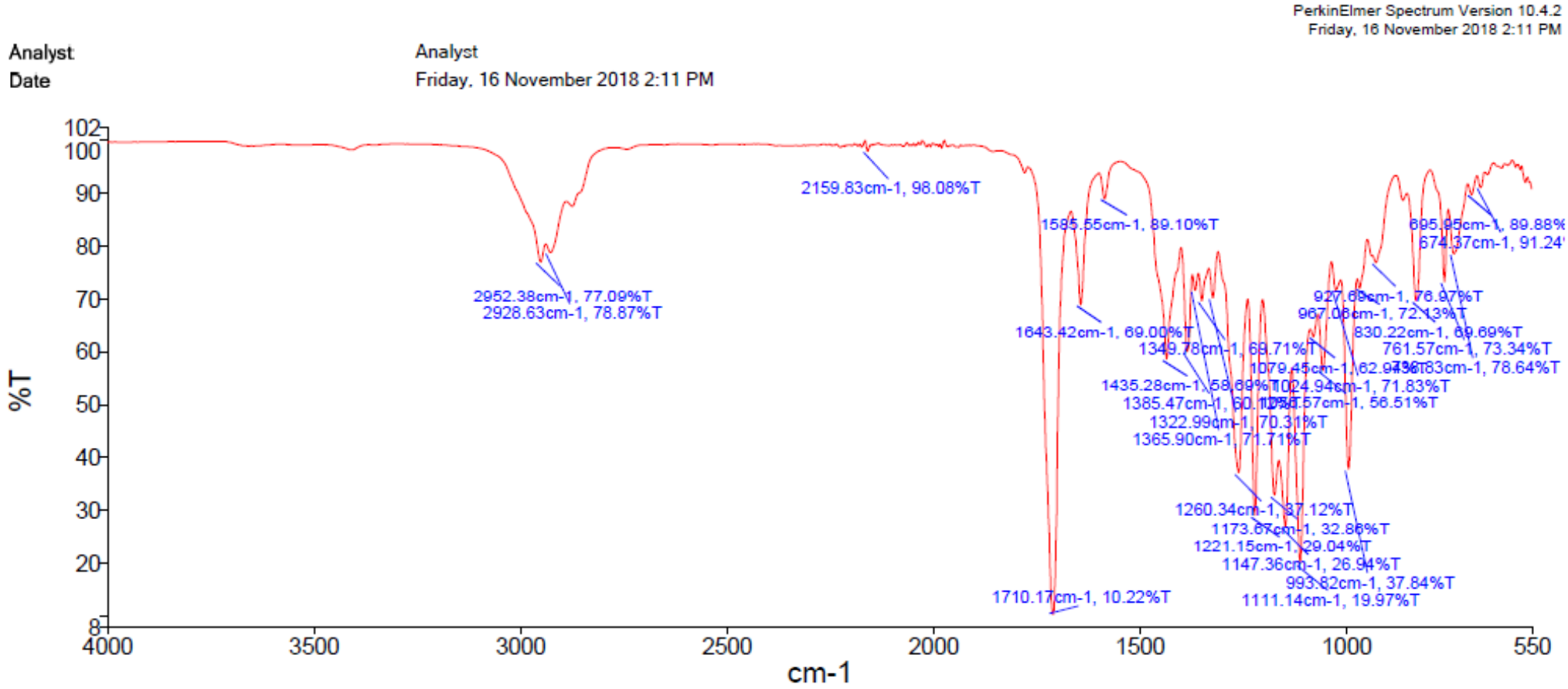
```
Current Data Parameters
NAME      20181107 Isopyrethrin II
EXPNO                 11
PROCNO                 1

F2 - Acquisition Parameters
Date_           20181107
Time               9.58
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG      cosygpppqf
TD                 2048
SOLVENT            CDCl3
NS                    5
DS                    8
SWH             5000.000 Hz
FIDRES          2.441406 Hz
AQ             0.2048000 sec
RG                   64
DW               100.000 usec
DE                 6.50 usec
TE                298.2 K
D0             0.00000300 sec
D1             1.92299497 sec
D11            0.03000000 sec
D12            0.00002000 sec
D13            0.00000400 sec
D16            0.00020000 sec
IN0            0.00020000 sec

======== CHANNEL f1 ========
SFO1         600.1324960 MHz
NUC1                 1H
P0                 8.40 usec
P1                 8.40 usec
P17             2500.00 usec
PLW1         12.55000019 W
PLW10         1.30999994 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPZ1              10.00 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                  128
SFO1            600.1325 MHz
FIDRES        39.062500 Hz
SW                8.331 ppm
FnMODE               QF

F2 - Processing parameters
SI                 1024
SF           600.1300342 MHz
WDW                QSINE
SSB       0
LB        0 Hz
GB        0
PC                 1.40

F1 - Processing parameters
SI                 1024
MC2                  QF
SF           600.1300265 MHz
WDW                QSINE
SSB       0
LB        0 Hz
GB        0
```



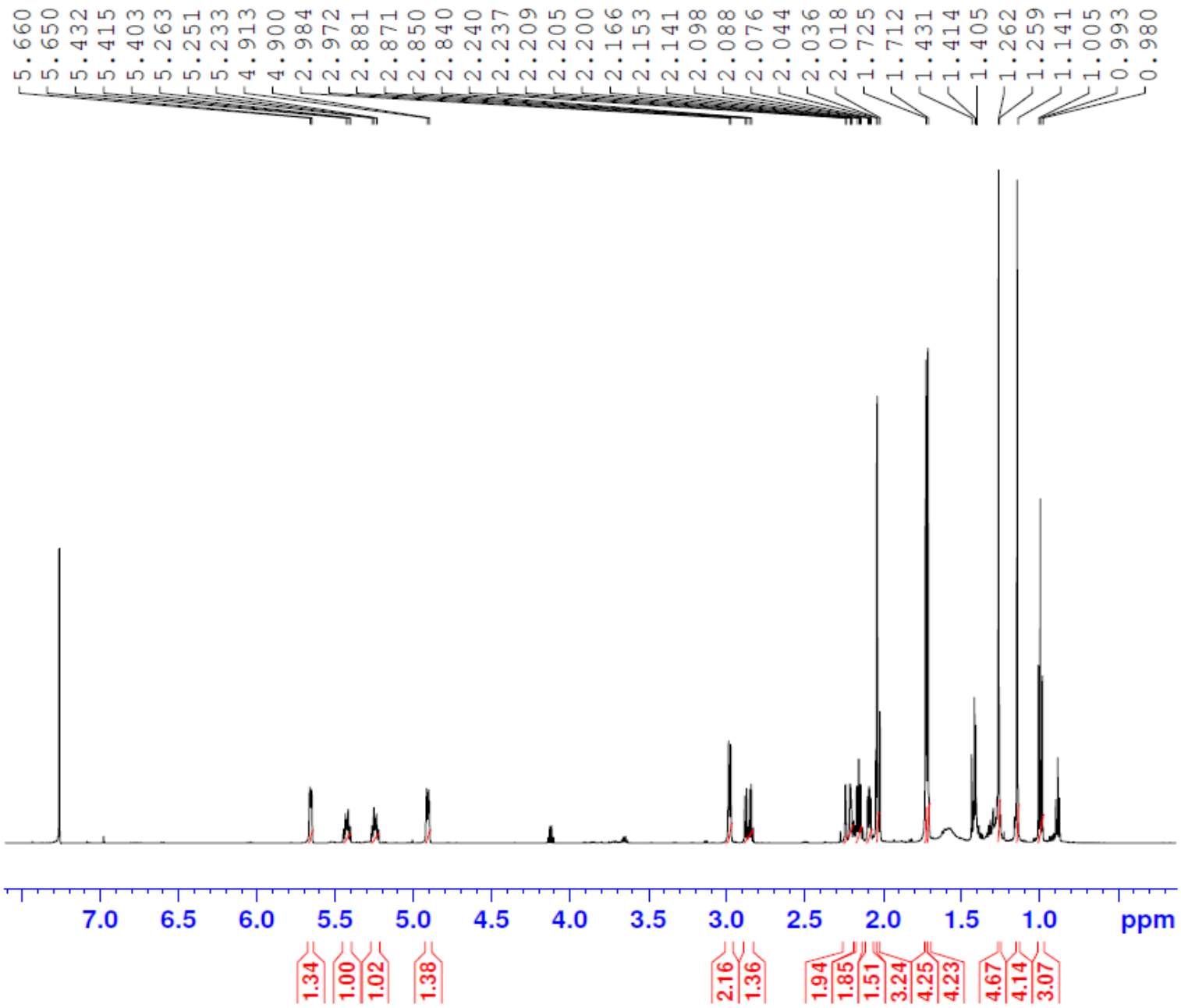
BRUKER

```
Current Data Parameters
NAME      20181008 Transfer Hydrogenation PII
EXPNO                14
PROCNO                1

F2 - Acquisition Parameters
Date_          20181009
Time               4.55
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG        hsqcetgp
TD                 1024
SOLVENT            CDCl3
NS                   35
DS                   16
SWH           5050.505 Hz
FIDRES        4.932134 Hz
AQ            0.1013760 sec
RG                 2050
DW               99.000 usec
DE                6.50 usec
TE                298.1 K
CNST2        145.0000000
D0            0.00000300 sec
D1            1.46415997 sec
D4            0.00172414 sec
D11           0.03000000 sec
D16           0.00020000 sec
IN0           0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1         600.1324643 MHz
NUC1                 1H
P1                 8.40 usec
P2                16.80 usec
P28             1000.00 usec
PLW1        12.55000019 W

======== CHANNEL f2 ========
SFO2         150.9140636 MHz
NUC2                13C
CPDPRG[2           garp
P3                16.00 usec
P4                32.00 usec
PCPD2             60.00 usec
PLW2       110.76000214 W
PLW12        7.87610006 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1              80.00 %
GPZ2              20.10 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                  256
SFO1           150.9141 MHz
FIDRES        97.656250 Hz
SW              165.657 ppm
FnMODE    Echo-Antiecho

F2 - Processing parameters
SI                 1024
SF          600.1300237 MHz
WDW                QSINE
SSB                    2
LB        0 Hz
GB        0
PC                 1.40

F1 - Processing parameters
SI                 1024
MC2        echo-antiecho
SF          150.9028198 MHz
WDW                QSINE
SSB                    2
LB        0 Hz
GB        0
```

(9b) IR Spectrum



Semi-synthetic (2a) + (7a) mixture NMR Characterisation

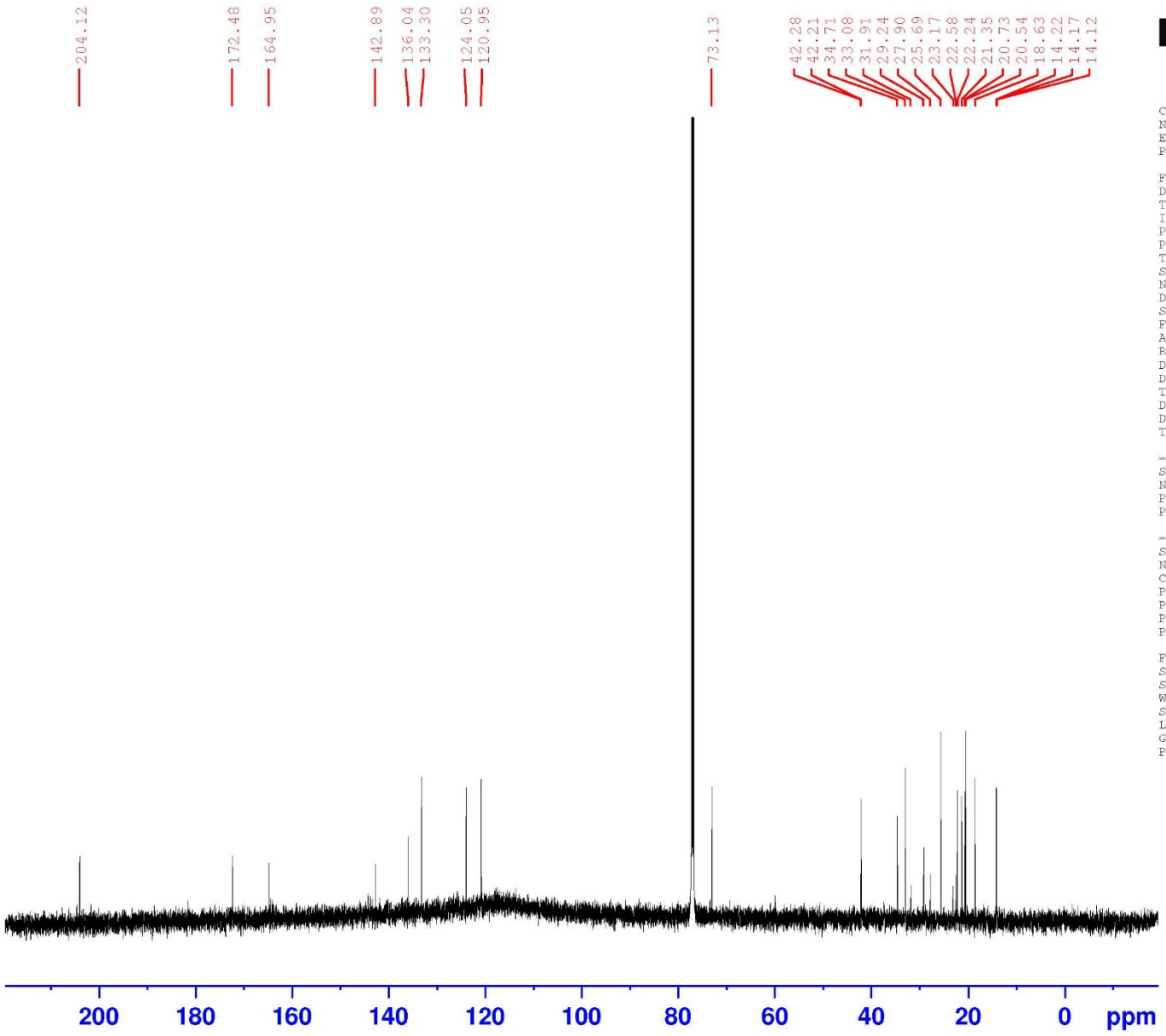


Current Data Parameters
NAME 20180704 Diimide Reduction PI
EXPNO 10
PROCNO 1

F2 - Acquisition Parameters
Date_ 20180704
Time 18.13
INSTRUM spect
PROBHD 5 mm PABBI 1H/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 64
DS 2
SWH 12019.230 Hz
FIDRES 0.183399 Hz
AQ 2.7262976 sec
RG 181
DW 41.600 usec
DE 6.50 usec
TE 298.2 K
D1 1.00000000 sec
TD0 1

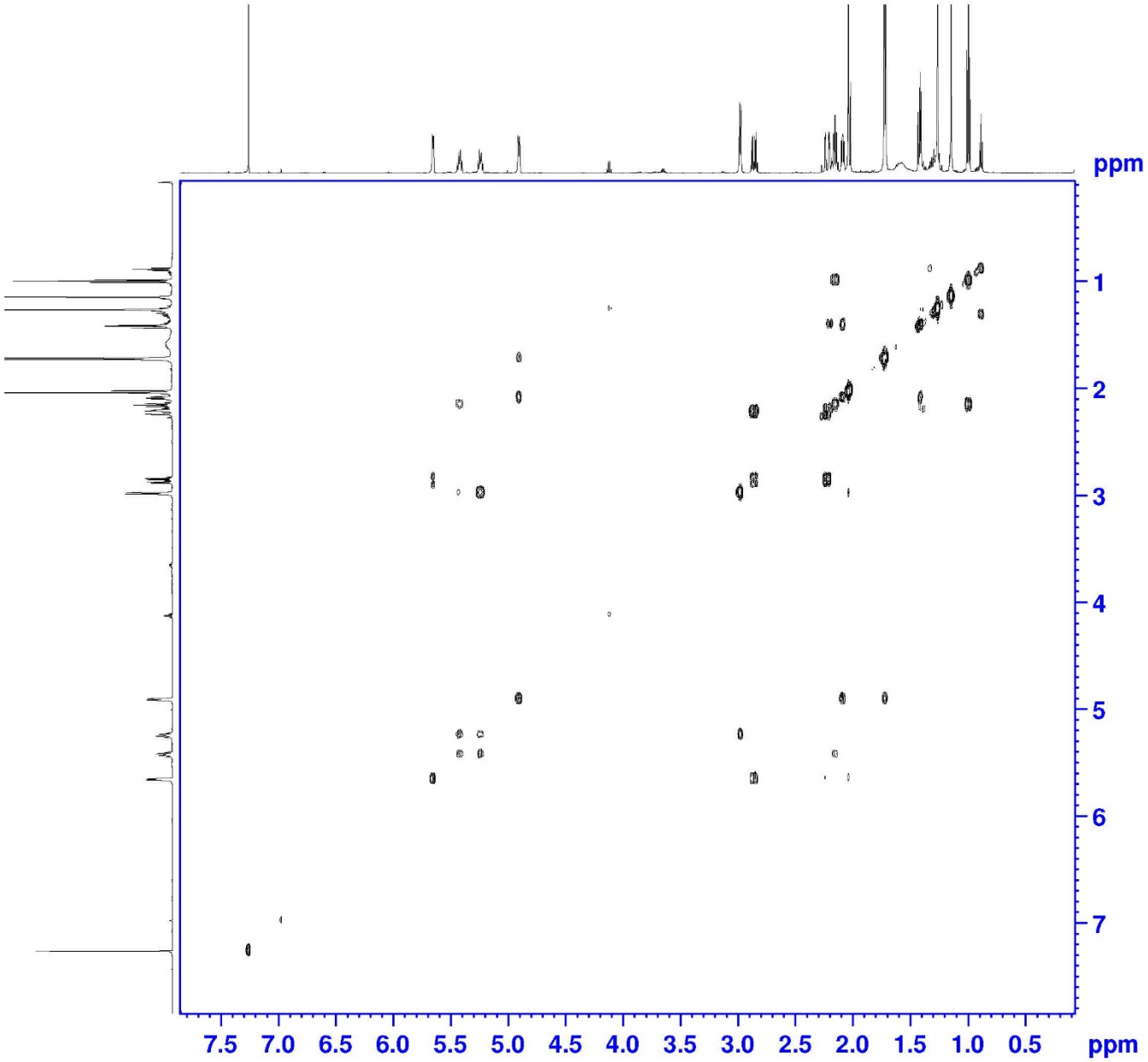
======== CHANNEL f1 ========
SFO1 600.1337060 MHz
NUC1 1H
P1 8.40 usec
PLW1 12.55000019 W

F2 - Processing parameters
SI 65536
SF 600.1300237 MHz
WDW no
SSB 0
LB 0 Hz
GB 0
PC 1.00



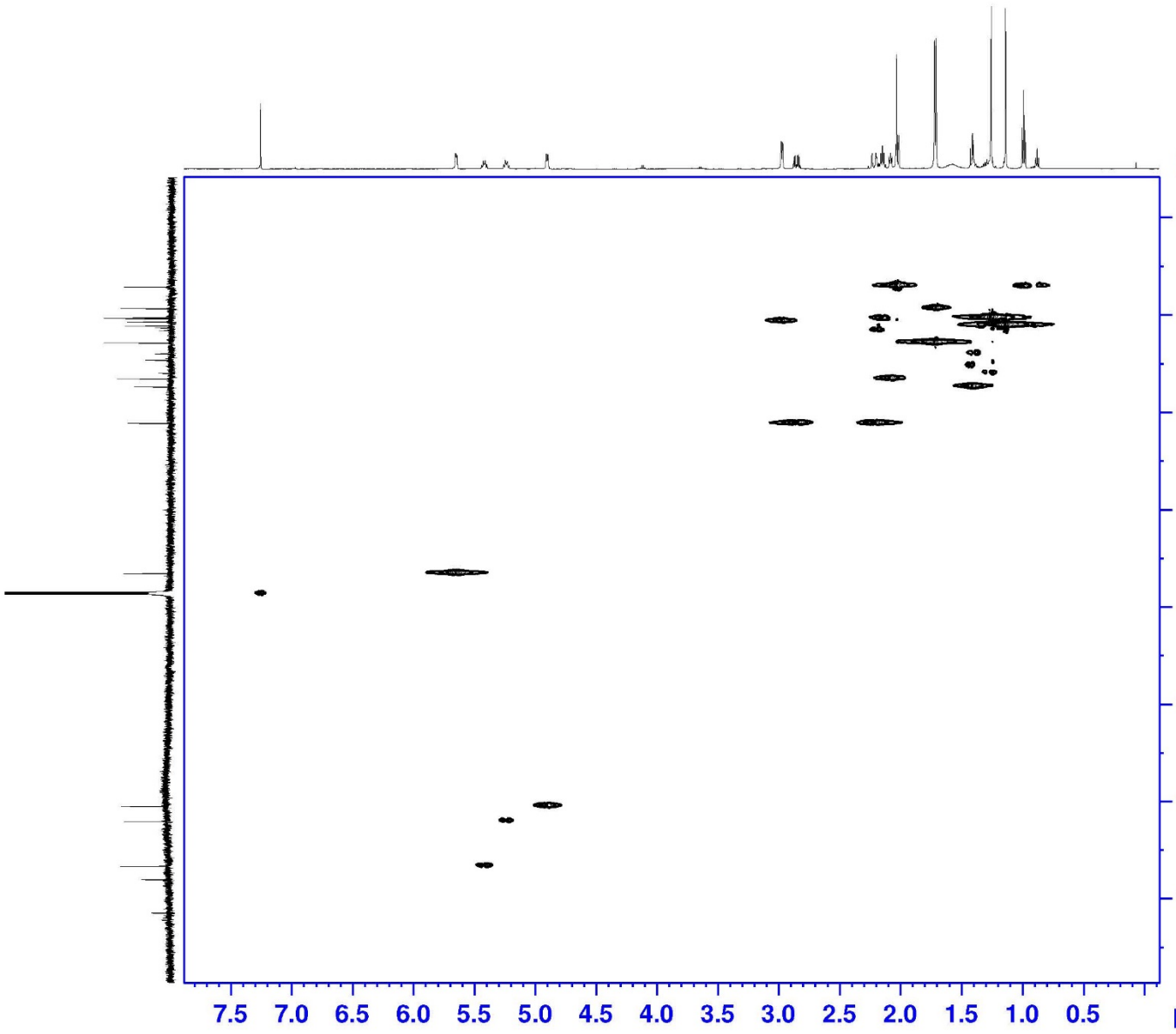
BRUKER

```
Current Data Parameters
NAME      20180704 Diimide Reduction PI
EXPNO                 12
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180704
Time              19.12
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                 1024
DS                    2
SWH           36057.691 Hz
FIDRES         0.550197 Hz
AQ             0.9087659 sec
RG                 1820
DW               13.867 usec
DE                6.50 usec
TE              298.2 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1         150.9178988 MHz
NUC1               13C
P1                16.00 usec
PLW1       110.76000214 W

======== CHANNEL f2 ========
SFO2         600.1324005 MHz
NUC2               1H
CPDPRG[2          waltz16
PCPD2             70.00 usec
PLW2         12.55000019 W
PLW12         0.18072000 W
PLW13         0.08855400 W

F2 - Processing parameters
SI                32768
SF           150.9027915 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



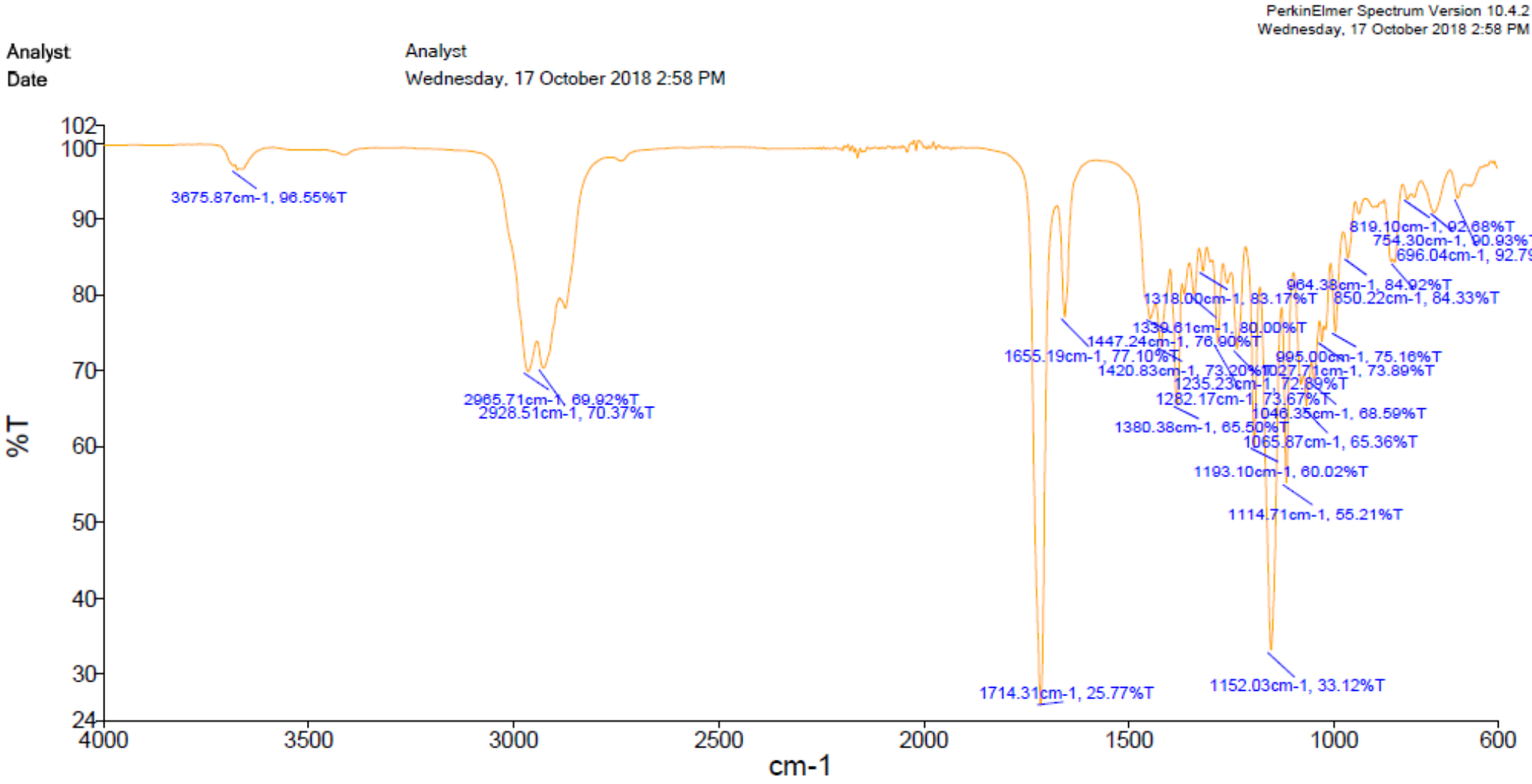
BRUKER

```
Current Data Parameters
NAME      20180704 Diimide Reduction PI
EXPNO                 11
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180704
Time              18.15
INSTRUM           spect
PROBHD    5 mm PABBI 1H/
PULPROG       cosygpppqf
TD                  2048
SOLVENT           CDCl3
NS                     1
DS                     8
SWH             4672.897 Hz
FIDRES          2.281688 Hz
AQ             0.2191360 sec
RG                    64
DW              107.000 usec
DE                6.50 usec
TE               298.2 K
D0            0.00000300 sec
D1            1.90865898 sec
D11           0.03000000 sec
D12           0.00002000 sec
D13           0.00000400 sec
D16           0.00020000 sec
IN0           0.00021400 sec

======== CHANNEL f1 ========
SFO1         600.1323996 MHz
NUC1                1H
P0                8.40 usec
P1                8.40 usec
P17            2500.00 usec
PLW1         12.55000019 W
PLW10         1.30999994 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPZ1               10.00 %
P16              1000.00 usec

F1 - Acquisition parameters
TD                  128
SFO1            600.1324 MHz
FIDRES         36.507008 Hz
SW                7.786 ppm
FnMODE              QF

F2 - Processing parameters
SI                 1024
SF           600.1300204 MHz
WDW                QSINE
SSB       0
LB        0 Hz
GB        0
PC                 1.40

F1 - Processing parameters
SI                 1024
MC2                QF
SF           600.1300260 MHz
WDW                QSINE
SSB       0
LB        0 Hz
GB        0
```

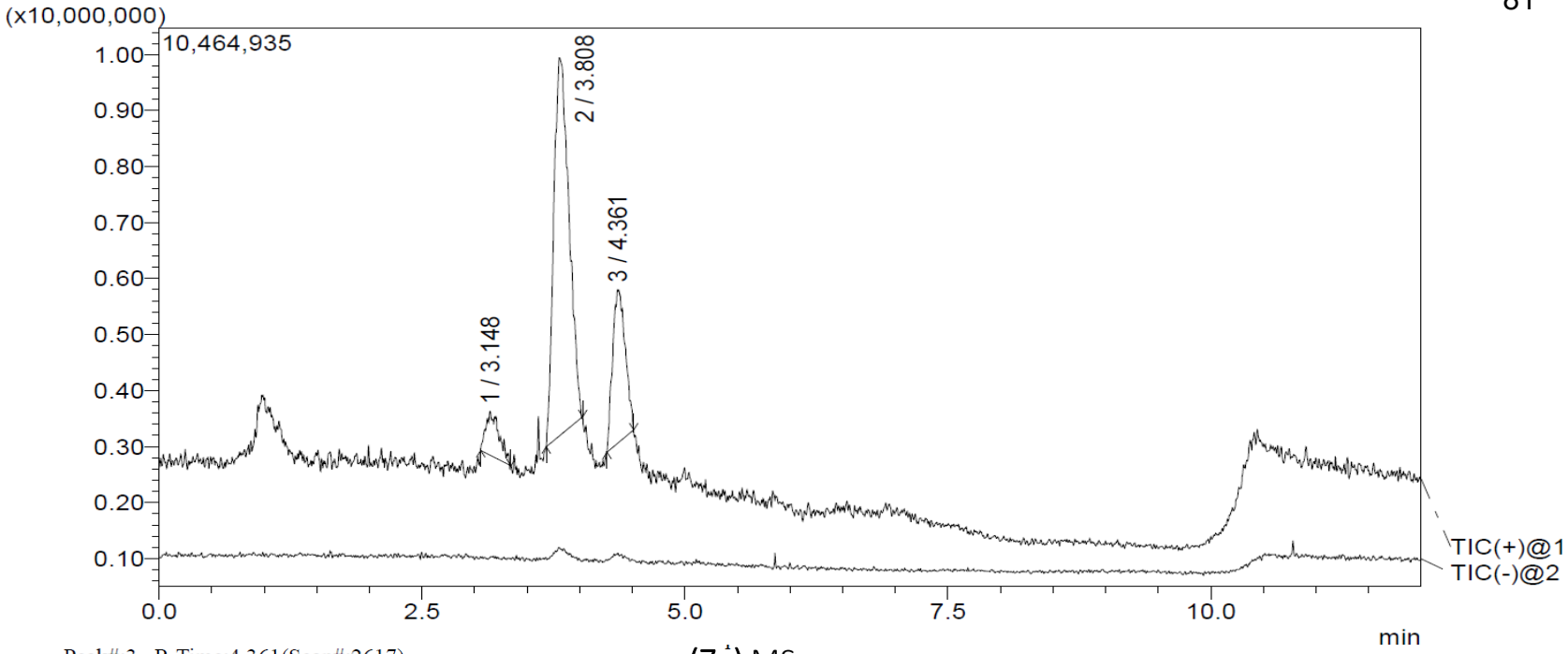



```
Current Data Parameters
NAME      20180704 Diimide Reduction PI
EXPNO                14
PROCNO                1

F2 - Acquisition Parameters
Date_          20180704
Time             19.18
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG        hsqcetgp
TD                1024
SOLVENT           CDCl3
NS                  50
DS                  16
SWH           4807.692 Hz
FIDRES        4.695012 Hz
AQ            0.1064960 sec
RG                2050
DW             104.000 usec
DE               6.50 usec
TE              298.0 K
CNST2       145.0000000
D0           0.00000300 sec
D1           1.45904005 sec
D4           0.00172414 sec
D11          0.03000000 sec
D16          0.00020000 sec
IN0          0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1         600.1323536 MHz
NUC1                1H
P1                 8.40 usec
P2                16.80 usec
P28             1000.00 usec
PLW1        12.55000019 W

======== CHANNEL f2 ========
SFO2         150.9140636 MHz
NUC2                13C
CPDPRG[2           garp
P3                16.00 usec
P4                32.00 usec
PCPD2             60.00 usec
PLW2        110.76000214 W
PLW12         7.87610006 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1              80.00 %
GPZ2              20.10 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                 256
SFO1          150.9141 MHz
FIDRES        97.656250 Hz
SW              165.657 ppm
FnMODE    Echo-Antiecho

F2 - Processing parameters
SI                1024
SF          600.1300242 MHz
WDW               QSINE
SSB                   2
LB        0 Hz
GB        0
PC                 1.40

F1 - Processing parameters
SI                1024
MC2        echo-antiecho
SF          150.9028278 MHz
WDW               QSINE
SSB                   2
LB        0 Hz
GB        0
```

Semi-synthetic **(2a) + (7a)** mixture IR Spectrum

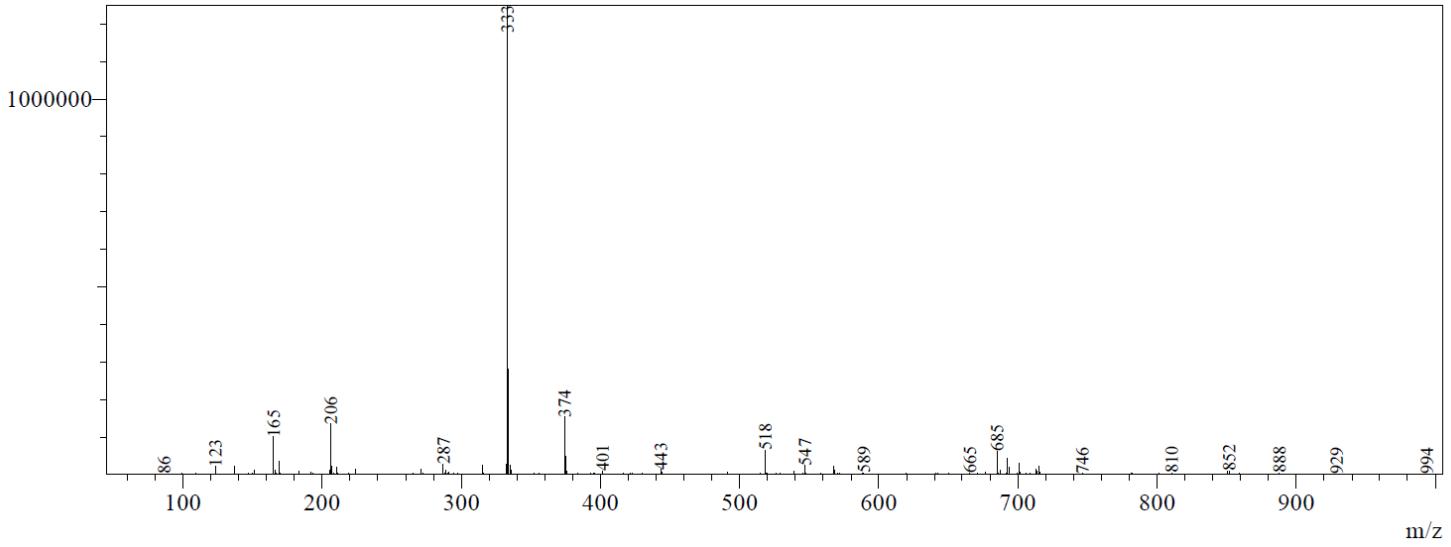


Semi-synthetic **(2a) + (7a)** mixture LC-MS

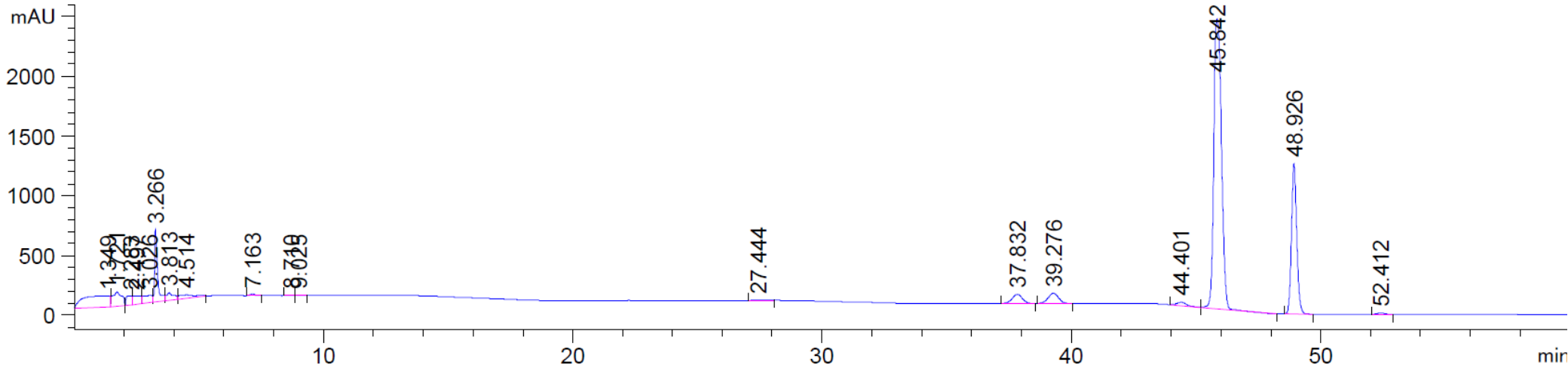


(7a) MS

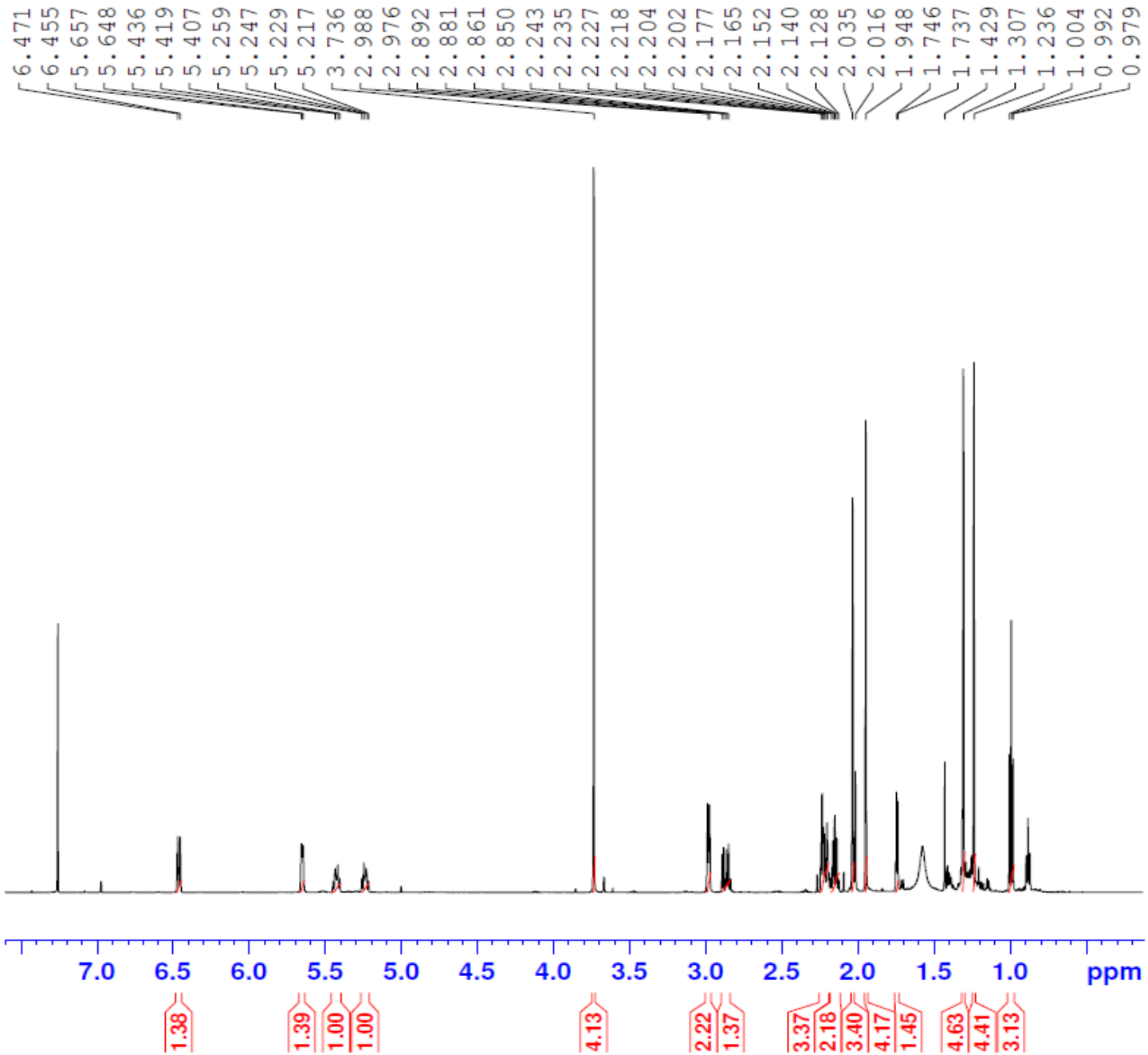
Peak#:3 R.Time:4.361(Scan#:2617)
MassPeaks:557
Spectrum Mode:Averaged 4.357-4.363(2615-2619)
BG Mode:Calc Segment 1 - Event 1



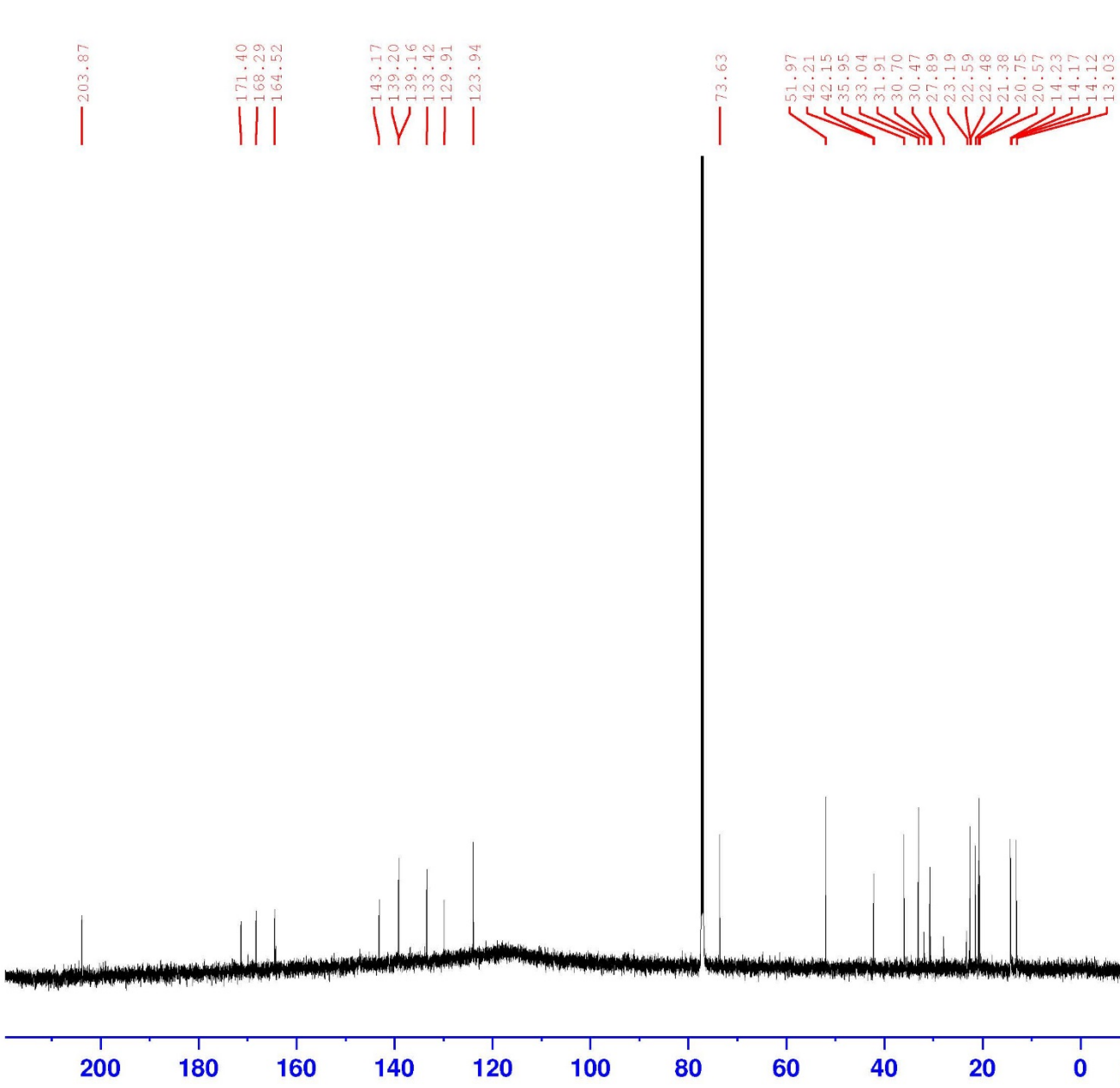
HPLC analysis Semi-synthetic **(2a) + (7a)** mixture



Retention time (min)	Compound (#)	Area (mAU)	% Area
45.842	**2a**	51507.4	68.0
48.926	**7a**	18624.9	24.7

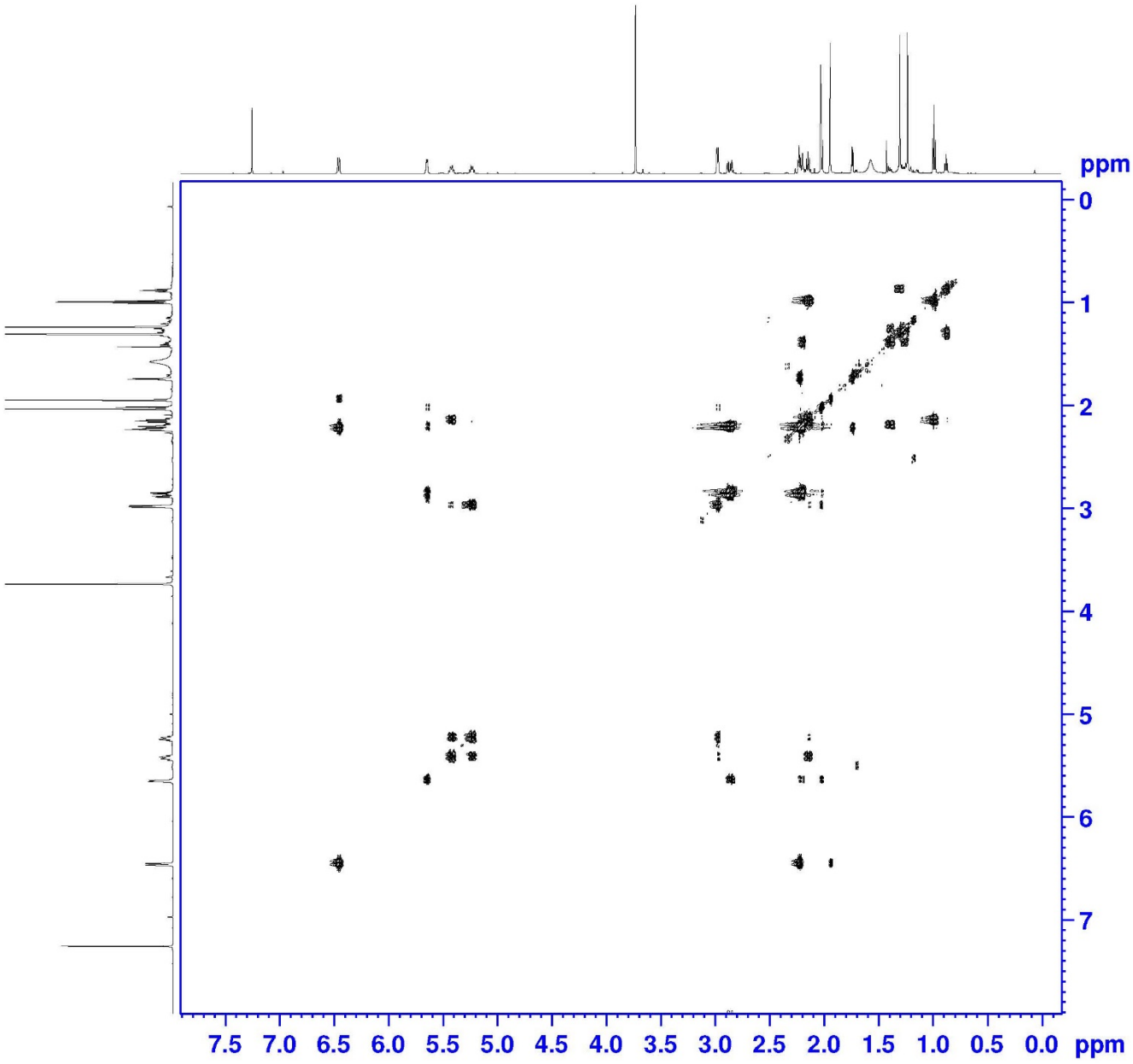



```
Current Data Parameters
NAME      20180831 JII (Diimide reduction)
EXPNO                 10
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180831
Time              18.02
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG           zg30
TD               65536
SOLVENT          CDCl3
NS                  64
DS                   2
SWH           12019.230 Hz
FIDRES         0.183399 Hz
AQ             2.7262976 sec
RG                 203
DW              41.600 usec
DE               6.50 usec
TE              298.2 K
D1           1.00000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1         600.1337060 MHz
NUC1               1H
P1                8.40 usec
PLW1        12.55000019 W

F2 - Processing parameters
SI                65536
SF           600.1300252 MHz
WDW                  no
SSB       0
LB        0 Hz
GB        0
PC                1.00
```



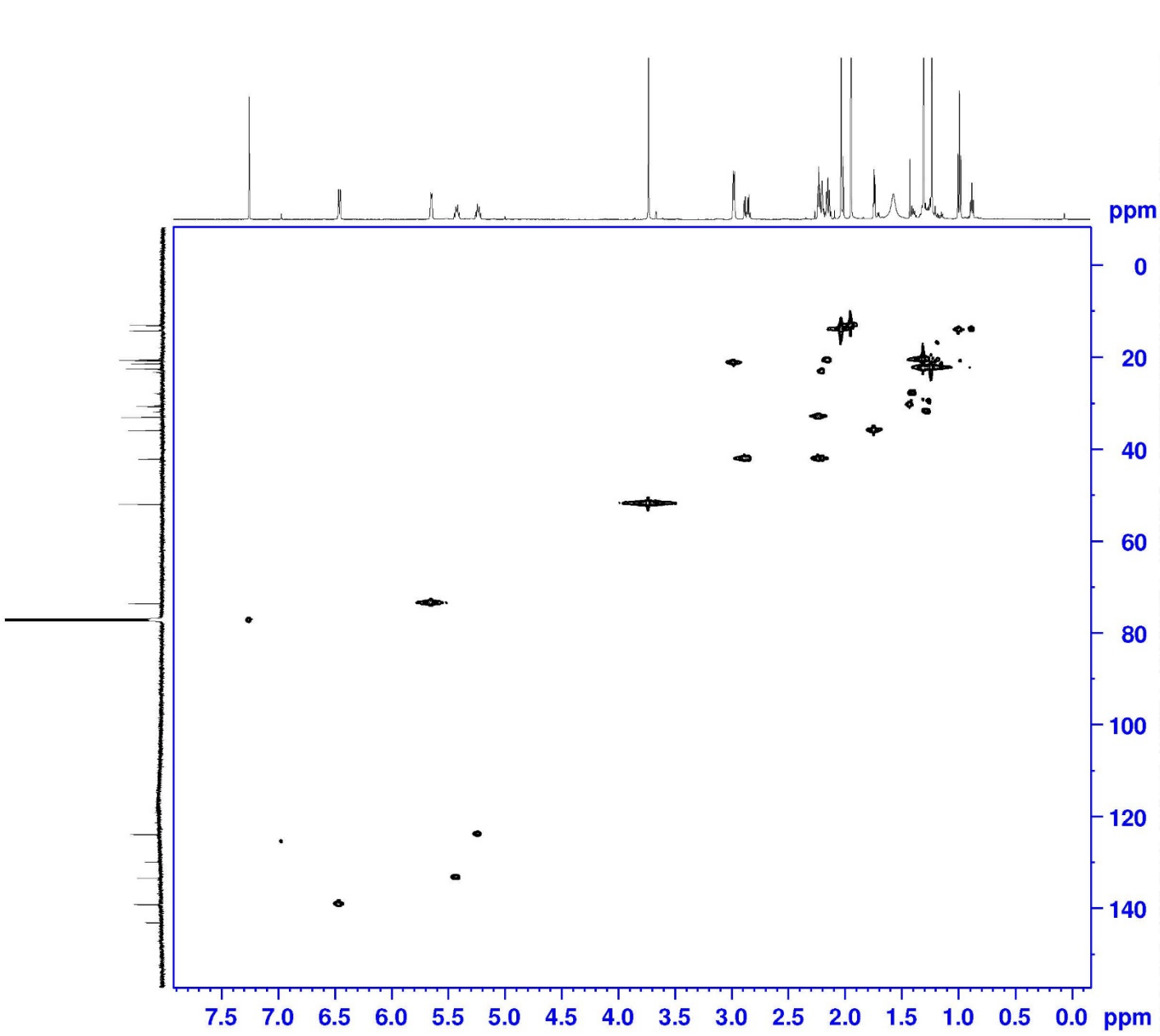
BRUKER

```
Current Data Parameters
NAME      20180831 JII (Diimide reduction)
EXPNO                 11
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180831
Time              19.55
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                 2048
DS                    2
SWH           36057.691 Hz
FIDRES         0.550197 Hz
AQ             0.9087659 sec
RG                 1820
DW               13.867 usec
DE                6.50 usec
TE                298.2 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1         150.9178988 MHz
NUC1                13C
P1                16.00 usec
PLW1       110.76000214 W

======== CHANNEL f2 ========
SFO2         600.1324005 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             70.00 usec
PLW2         12.55000019 W
PLW12         0.18072000 W
PLW13         0.08855400 W

F2 - Processing parameters
SI                32768
SF           150.9027891 MHz
WDW                 EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



BRUKER

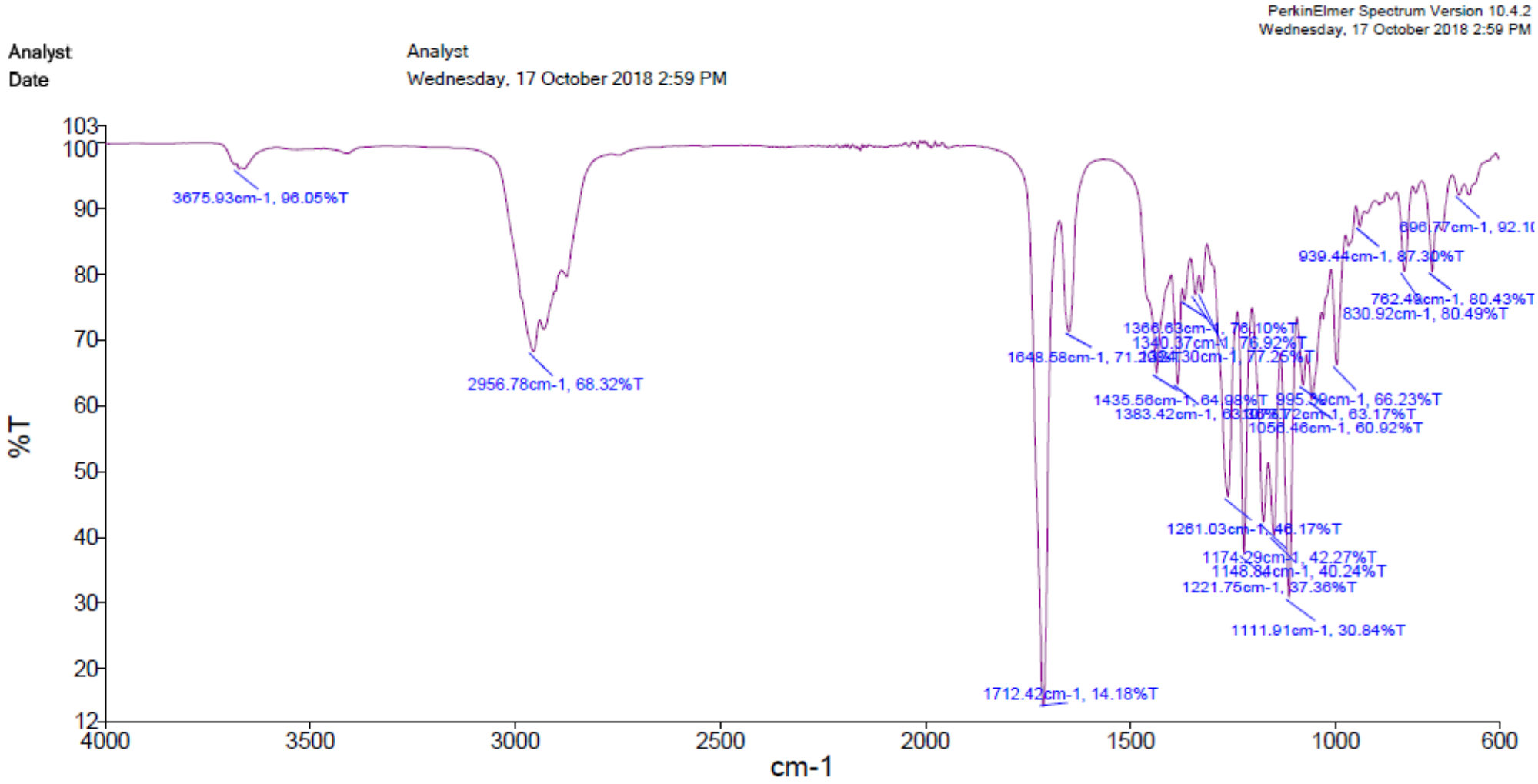
```
Current Data Parameters
NAME      20180831 JII (Diimide reduction)
EXPNO                 13
PROCNO                 1

F2 - Acquisition Parameters
Date_           20180831
Time              20.19
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG    cosygpmfphpp
TD                 2048
SOLVENT           CDCl3
NS                   15
DS                    4
SWH            4854.369 Hz
FIDRES         2.370297 Hz
AQ             0.2109440 sec
RG                 2050
DW              103.000 usec
DE                6.50 usec
TE                298.2 K
D0           0.00009230 sec
D1           1.92750096 sec
D11          0.03000000 sec
D12          0.00002000 sec
D16          0.00020000 sec
IN0          0.00020600 sec

======== CHANNEL f1 ========
SFO1         600.1323522 MHz
NUC1                 1H
P1                8.40 usec
P2               16.80 usec
P17            2500.00 usec
PLW1        12.55000019 W
PLW10        1.30999994 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1              10.00 %
GPZ2              20.00 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                  256
SFO1          600.1324 MHz
FIDRES       18.962379 Hz
SW                8.089 ppm
FnMODE      States-TPPI

F2 - Processing parameters
SI                 1024
SF          600.1300312 MHz
WDW                QSINE
SSB                    2
LB        0 Hz
GB        0
PC                 1.40

F1 - Processing parameters
SI                 1024
MC2         States-TPPI
SF          600.1300305 MHz
WDW                QSINE
SSB                    2
LB        0 Hz
GB        0
```



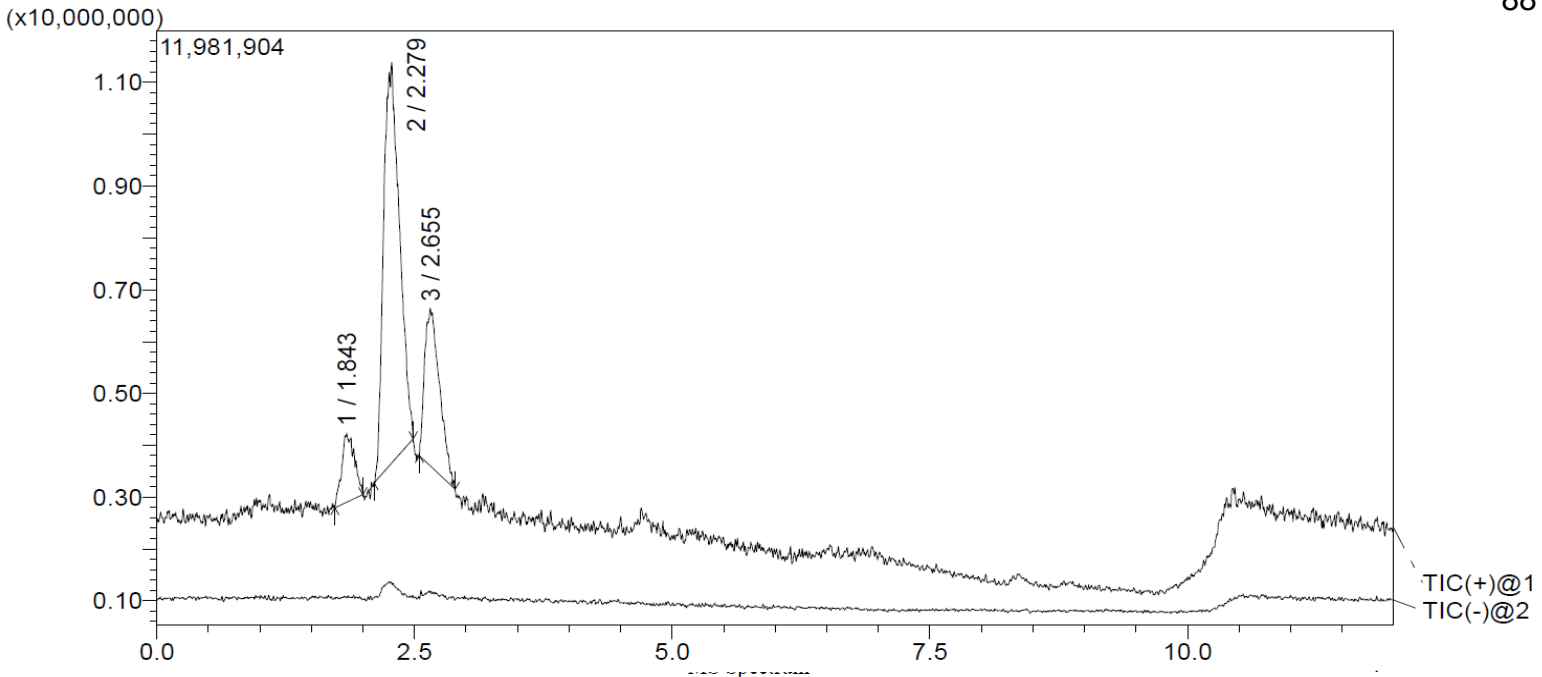
BRUKER

```
Current Data Parameters
NAME      20180831 JII (Diimide reduction)
EXPNO                14
PROCNO                1

F2 - Acquisition Parameters
Date_          20180831
Time              22.52
INSTRUM           spect
PROBHD   5 mm PABBI 1H/
PULPROG        hsqcetgp
TD                1024
SOLVENT           CDCl3
NS                  50
DS                  16
SWH            4854.369 Hz
FIDRES         4.740595 Hz
AQ             0.1054720 sec
RG                2050
DW              103.000 usec
DE                6.50 usec
TE              298.0 K
CNST2        145.0000000
D0             0.00000300 sec
D1             1.46006405 sec
D4             0.00172414 sec
D11            0.03000000 sec
D16            0.00020000 sec
IN0            0.00002000 sec
ZGOPTNS

======== CHANNEL f1 ========
SFO1          600.1323522 MHz
NUC1                  1H
P1                 8.40 usec
P2                16.80 usec
P28             1000.00 usec
PLW1         12.55000019 W

======== CHANNEL f2 ========
SFO2          150.9140636 MHz
NUC2                 13C
CPDPRG[2             garp
P3                16.00 usec
P4                32.00 usec
PCPD2             60.00 usec
PLW2        110.76000214 W
PLW12         7.87610006 W

====== GRADIENT CHANNEL =====
GPNAM[1]      SMSQ10.100
GPNAM[2]      SMSQ10.100
GPZ1              80.00 %
GPZ2              20.10 %
P16             1000.00 usec

F1 - Acquisition parameters
TD                 256
SFO1          150.9141 MHz
FIDRES         97.656250 Hz
SW               165.657 ppm
FnMODE     Echo-Antiecho

F2 - Processing parameters
SI                1024
SF          600.1300246 MHz
WDW               QSINE
SSB                   2
LB        0 Hz
GB        0
PC                 1.40

F1 - Processing parameters
SI                1024
MC2        echo-antiecho
SF          150.9028264 MHz
WDW               QSINE
SSB                   2
LB        0 Hz
GB        0
```

Semi-synthetic **(2b) + (7b)** mixture IR Spectrum

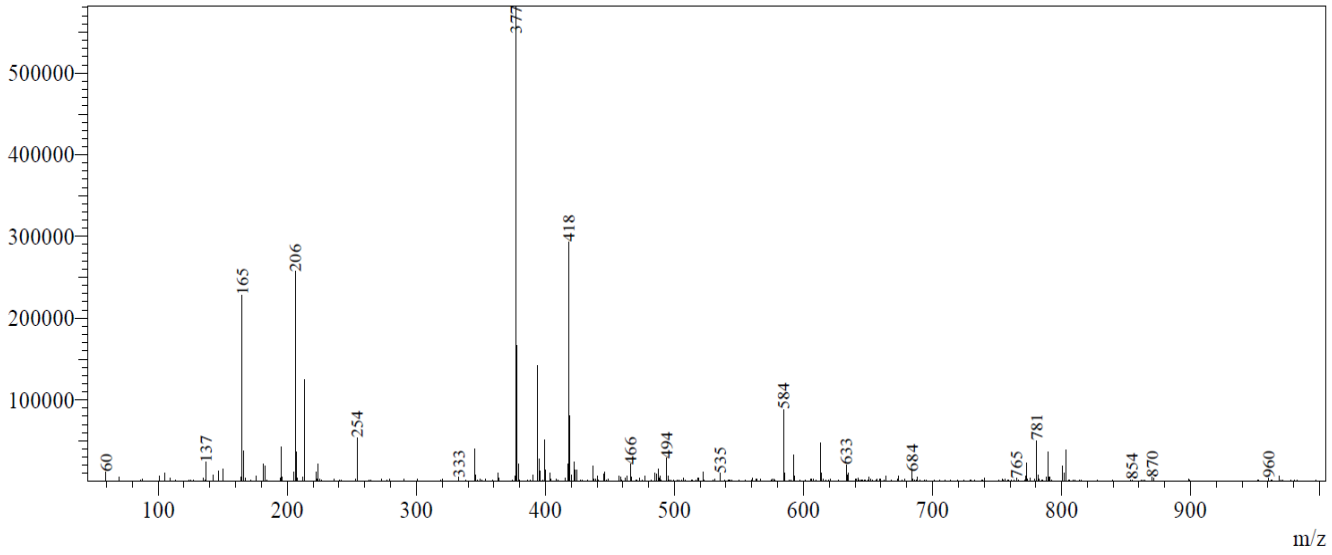


Semi-synthetic **(2b) + (7b)** mixture LC-MS

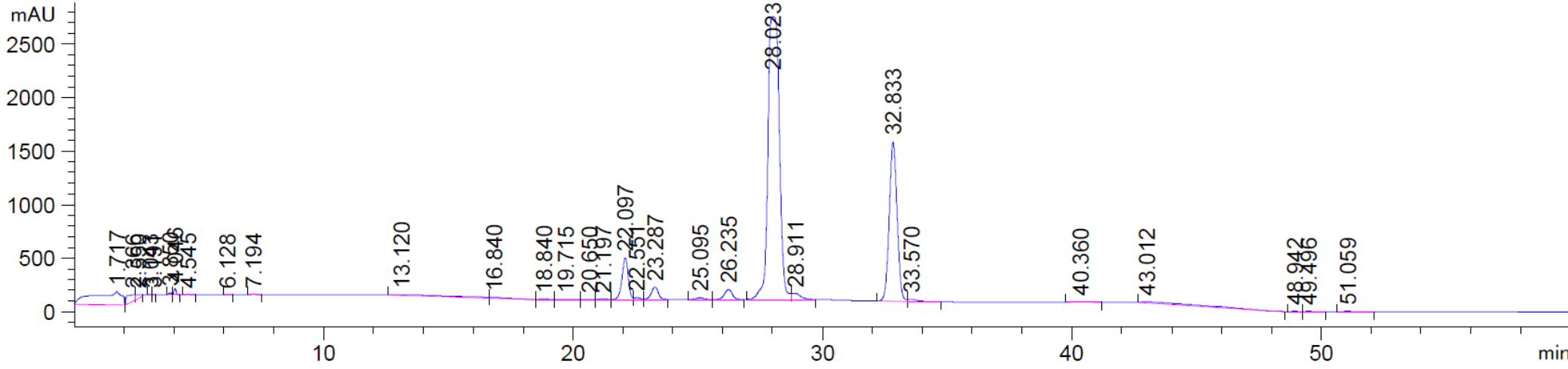


Peak#:3 R.Time:2.655(Scan#:1593)
MassPeaks:607
Spectrum Mode:Averaged 2.650-2.657(1591-1595)
BG Mode:Calc Segment 1 - Event 1

(7b) MS

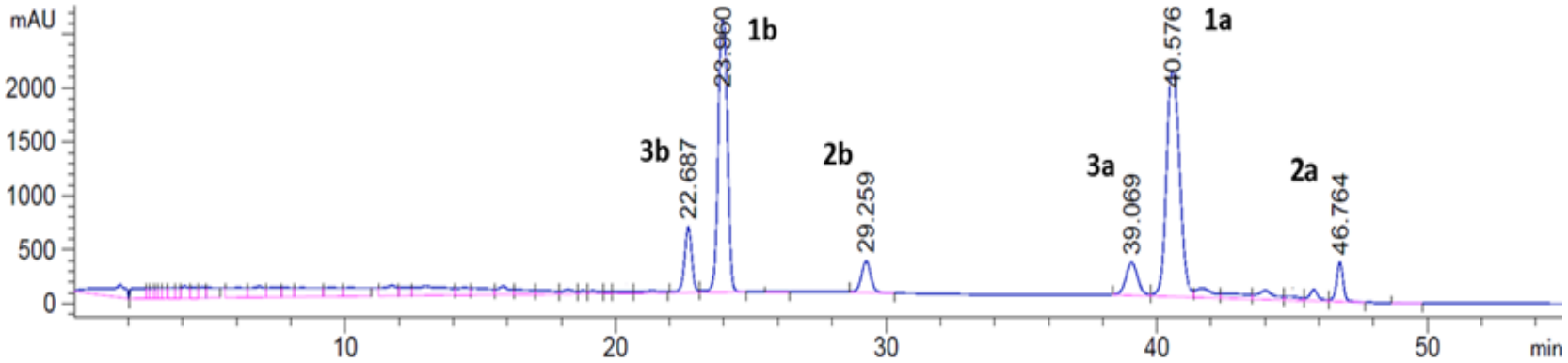


HPLC analysis Semi-synthetic **(2b) + (7b)** mixture



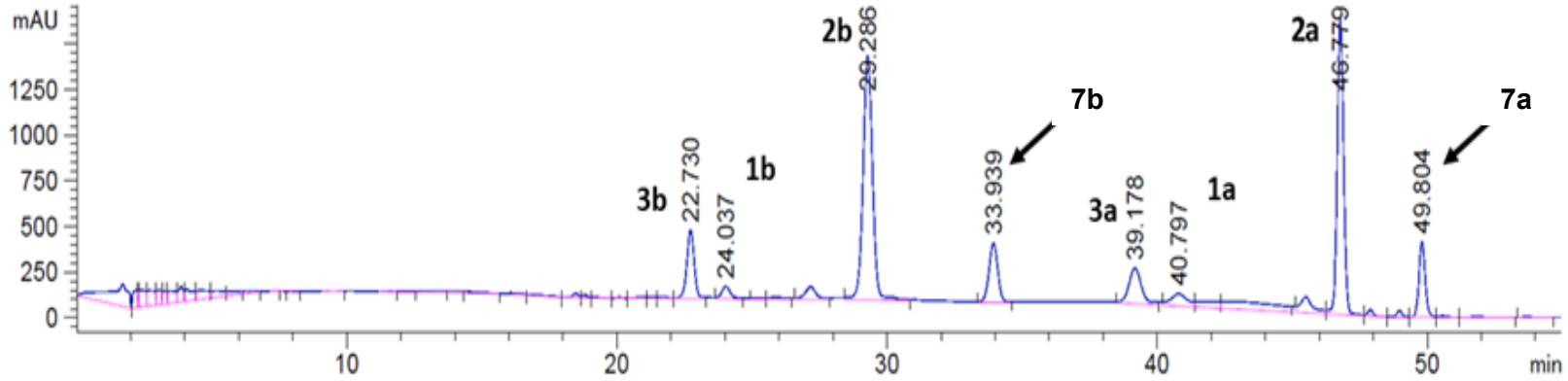
Retention time (min)	Compound (#)	Area (mAU)	% Area
28.023	**2b**	83793.2	65.8
32.833	**7b**	32642.4	25.6

HPLC analysis Pyrethrum



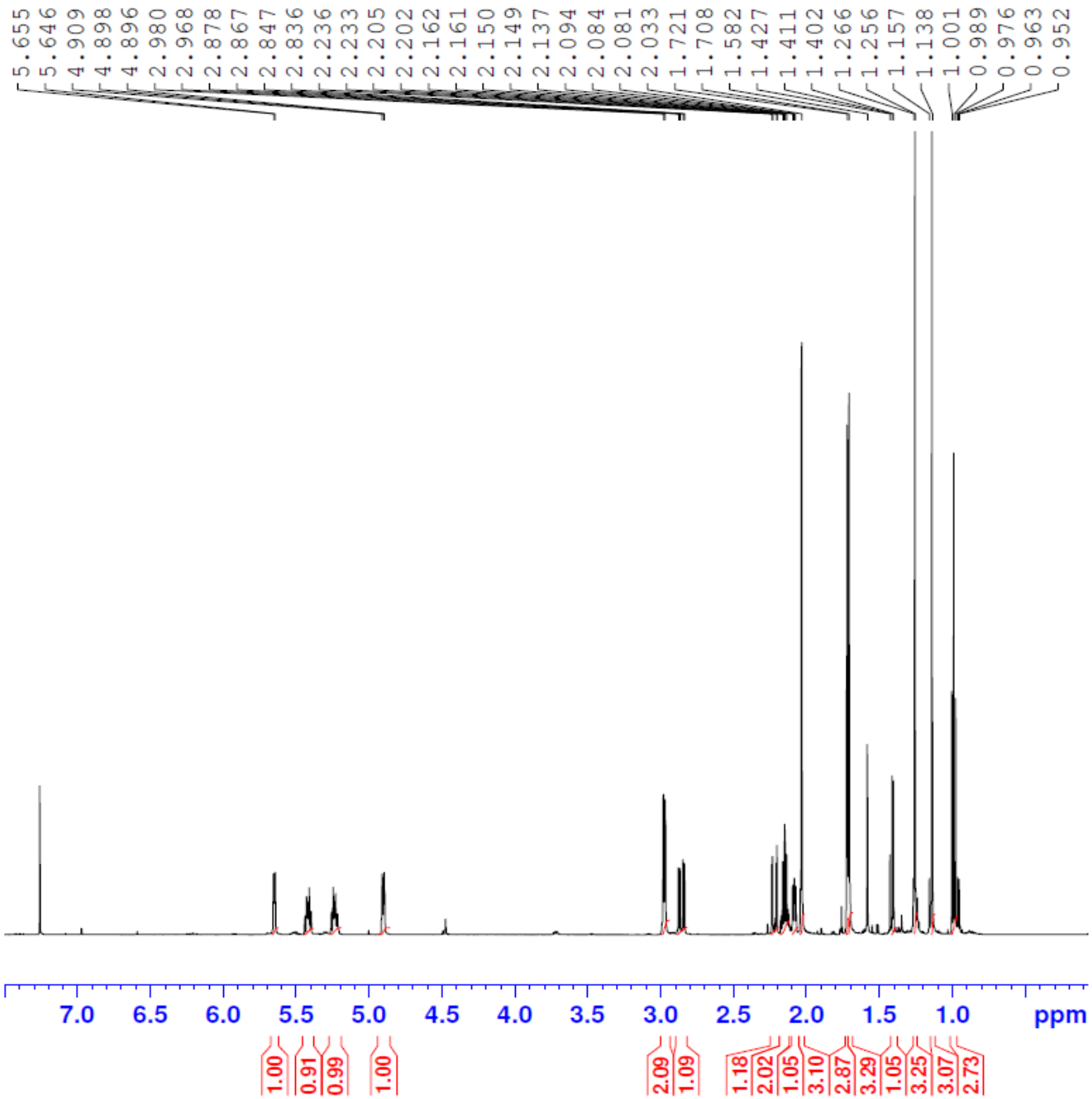
Retention time (min)	Compound (#)	Area (mAU)	% Area
23.960	**1b**	60141.1	36.2
29.259	**2b**	7049.85	4.3
40.576	**1a**	71498.3	43.1
46.764	**2a**	6303.67	3.8

Constituents	Peaks (min)	% Concentrate
Pyrethrins **1**	23.960, 40.576	79.3
Jasmolins **2**	29.259, 46.764	8.1



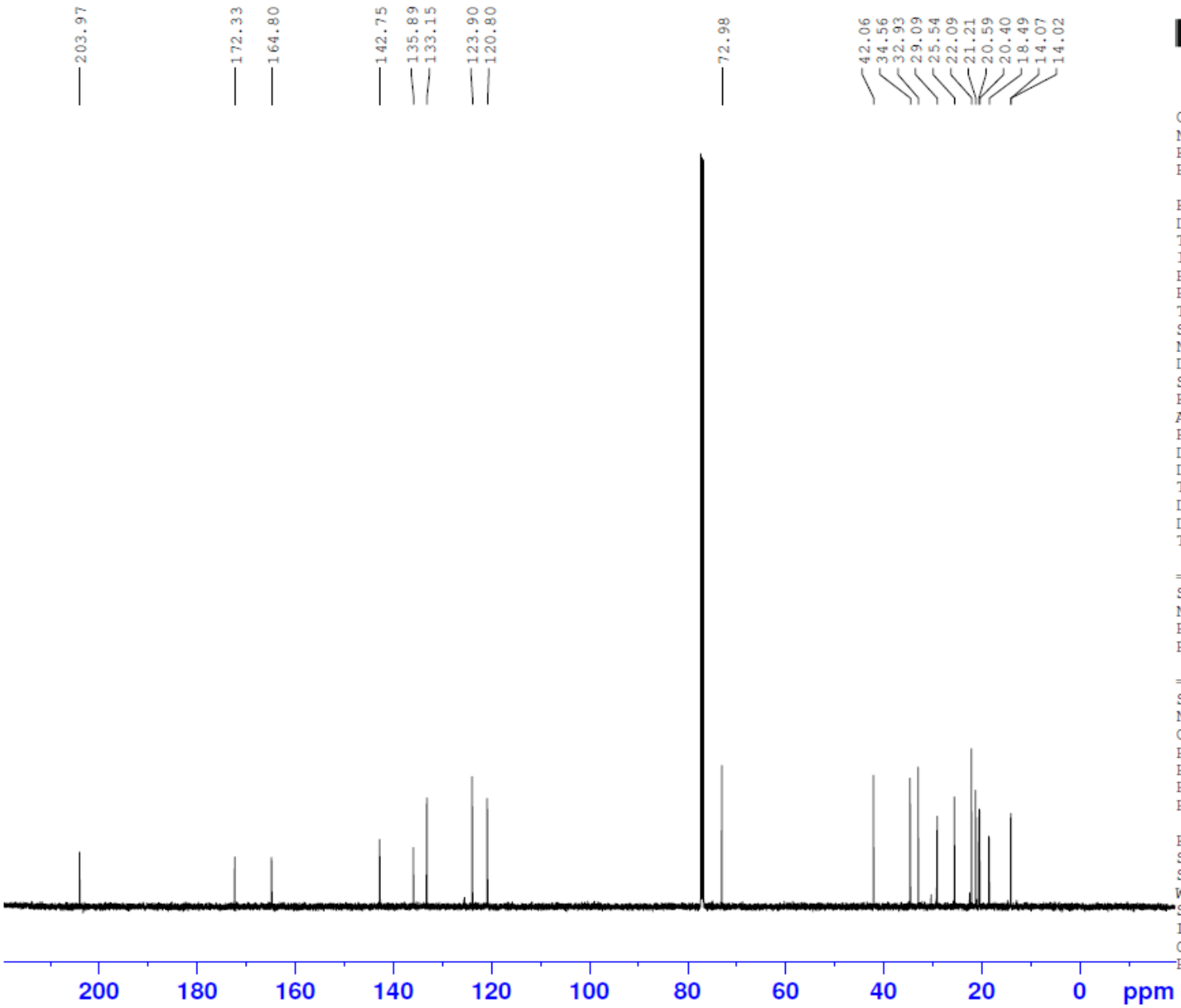
Retention time (min)	Compound (#)	Area (mAU)	% Area
24.037	**1b**	1587.85	1.8
29.286	**2b**	32595.5	35.7
40.797	**1a**	2928.08	3.2
46.779	**2a**	26629.8	29.2
33.939	**7b**	7251.37	8.0
49.804	**7a**	6641.69	7.3

Constituents	Peaks (min)	% Concentrate
Pyrethrins **1**	24.037, 40.797	5.0
Jasmolins **2**	29.286, 46.779	64.9
Tetrahydropyrethrins **7**	33.939, 49.804	15.3



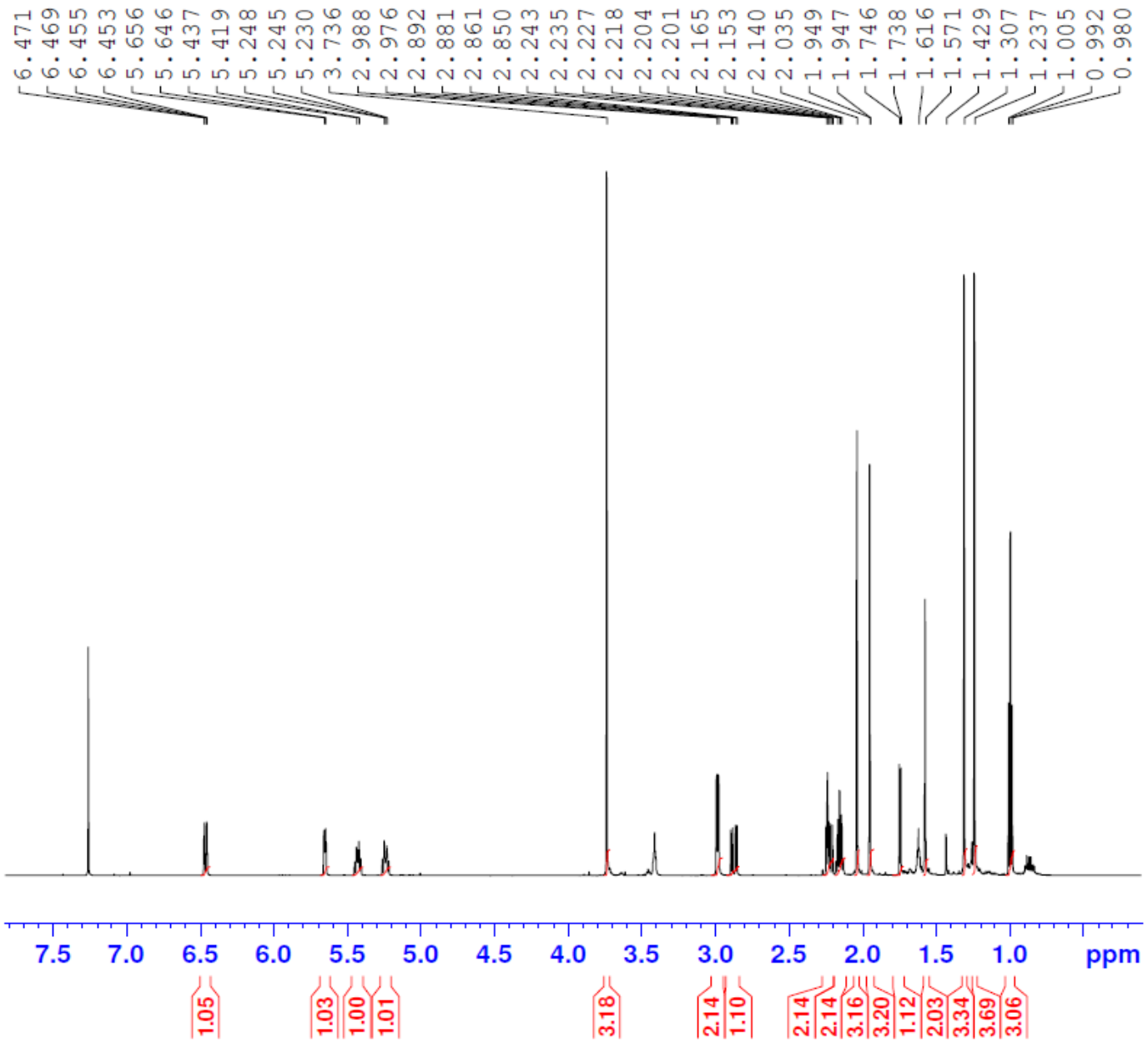
BRUKER

```
Current Data Parameters
NAME      Natural Jasmolin I
EXPNO                   10
PROCNO                   1

F2 - Acquisition Parameters
Date_           20191022
Time               17.17
INSTRUM            spect
PROBHD    5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    32
DS                     2
SWH            12019.230 Hz
FIDRES          0.183399 Hz
AQ             2.7262976 sec
RG                   161
DW                41.600 usec
DE                 6.50 usec
TE                298.2 K
D1             1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         600.1337060 MHz
NUC1                 1H
P1                13.50 usec
PLW1         17.00000000 W

F2 - Processing parameters
SI                 65536
SF           600.1300262 MHz
WDW                  EM
SSB       0
LB                0.30 Hz
GB        0
PC                1.00
```

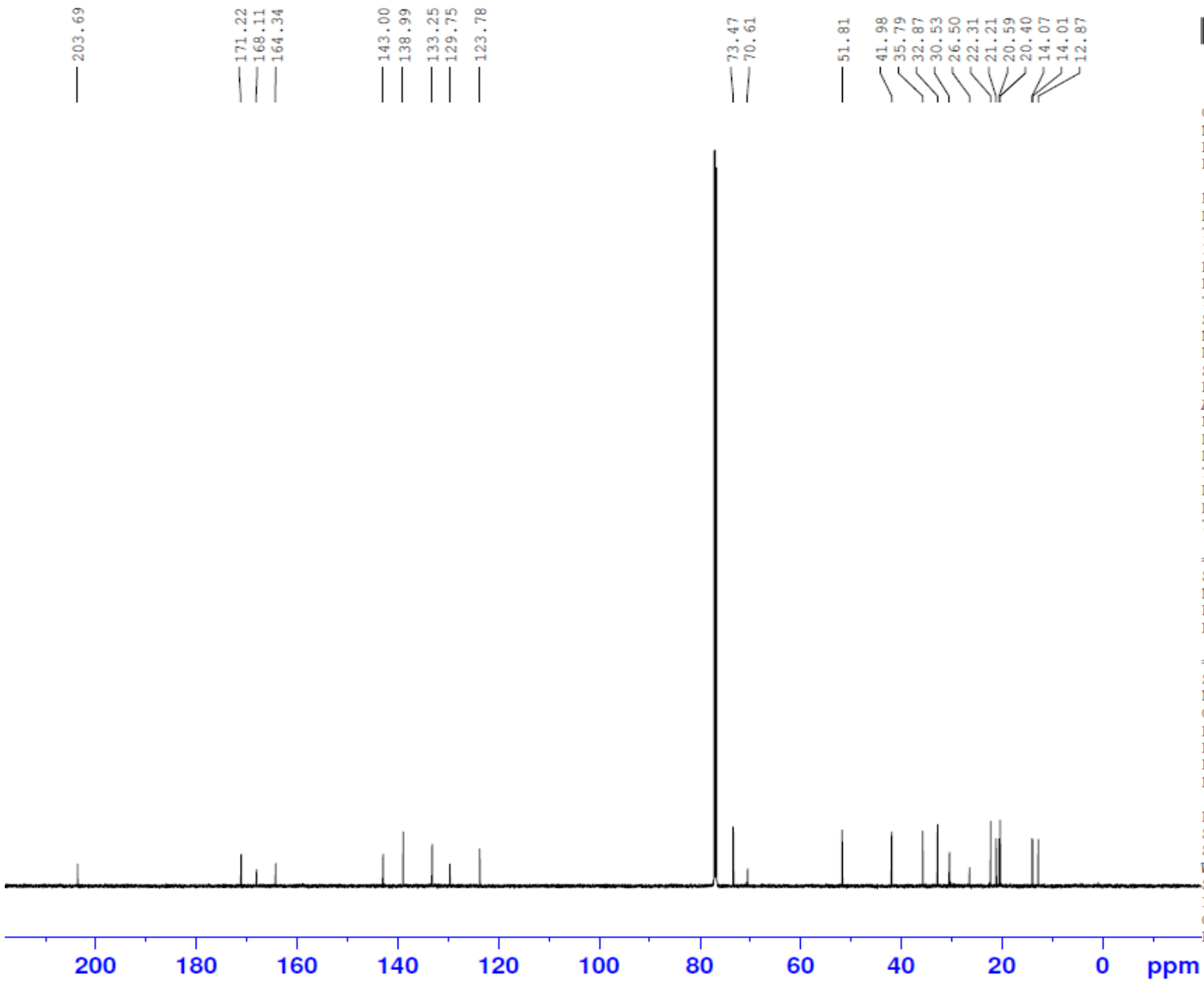


BRUKER

```
Current Data Parameters
NAME      Natural Jasmolin I
EXPNO                    11
PROCNO                    1

F2 - Acquisition Parameters
Date_              20191022
Time                  17.48
INSTRUM               spect
PROBHD    5 mm PABBO BB/
PULPROG             zgpg30
TD                   65536
SOLVENT              CDC13
NS                     603
DS                       2
SWH             36057.691 Hz
FIDRES           0.550197 Hz
AQ               0.9087659 sec
RG                    2050
DW                  13.867 usec
DE                    6.50 usec
TE                   298.2 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          150.9178988 MHz
NUC1                   13C
P1                   12.00 usec
PLW1          80.00000000 W

======== CHANNEL f2 ========
SFO2          600.1324005 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2                70.00 usec
PLW2          17.00000000 W
PLW12          0.63230002 W
PLW13          0.30983001 W

F2 - Processing parameters
SI                   32768
SF            150.9028135 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```

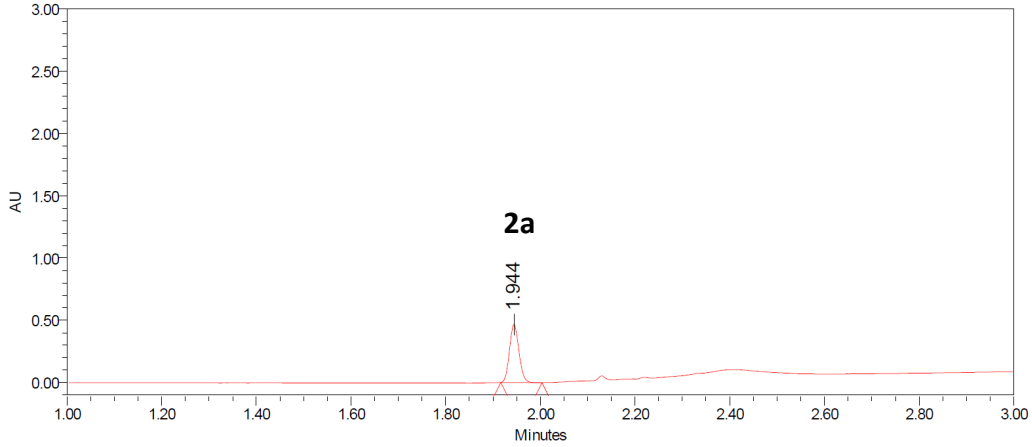



```
Current Data Parameters
NAME      Natural Jasmolin II
EXPNO                  10
PROCNO                  1

F2 - Acquisition Parameters
Date_           20191022
Time              17.55
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                65536
SOLVENT           CDCl3
NS                   32
DS                    2
SWH           12019.230 Hz
FIDRES         0.183399 Hz
AQ            2.7262976 sec
RG                  228
DW               41.600 usec
DE                6.50 usec
TE               298.3 K
D1          1.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        600.1337060 MHz
NUC1                1H
P1                13.50 usec
PLW1        17.00000000 W

F2 - Processing parameters
SI                 65536
SF          600.1300260 MHz
WDW                EM
SSB       0
LB                0.30 Hz
GB        0
PC                1.00
```

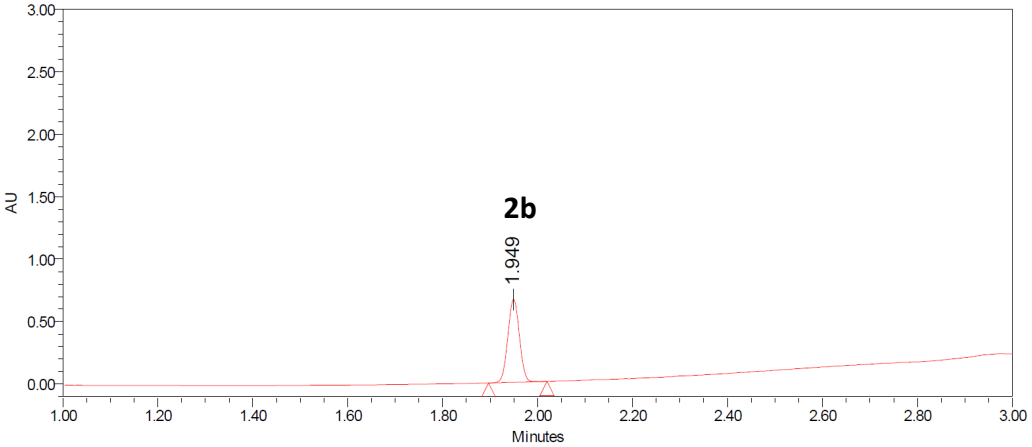


BRUKER

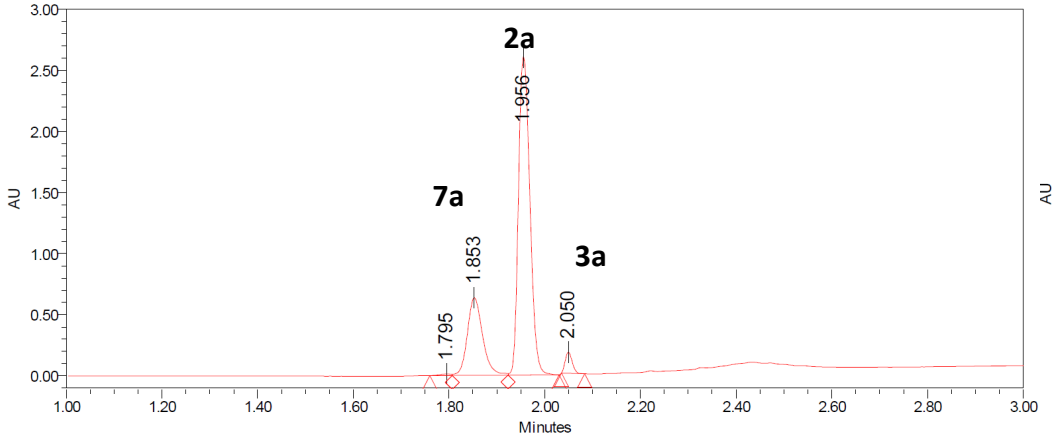
```
Current Data Parameters
NAME      Natural Jasmolin II
EXPNO                      11
PROCNO                      1

F2 - Acquisition Parameters
Date_               20191022
Time                   19.38
INSTRUM                spect
PROBHD    5 mm PABBO BB/
PULPROG              zgpg30
TD                     65536
SOLVENT                CDCl3
NS                      2048
DS                         2
SWH                36057.691 Hz
FIDRES              0.550197 Hz
AQ                 0.9087659 sec
RG                      2050
DW                    13.867 usec
DE                      6.50 usec
TE                     298.2 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
SFO1            150.9178988 MHz
NUC1                     13C
P1                     12.00 usec
PLW1           80.00000000 W

======== CHANNEL f2 ========
SFO2            600.1324005 MHz
NUC2                     1H
CPDPRG[2              waltz16
PCPD2                  70.00 usec
PLW2           17.00000000 W
PLW12           0.63230002 W
PLW13           0.30983001 W

F2 - Processing parameters
SI                       32768
SF              150.9028144 MHz
WDW                         EM
SSB          0
LB                      1.00 Hz
GB           0
PC                      1.40
```



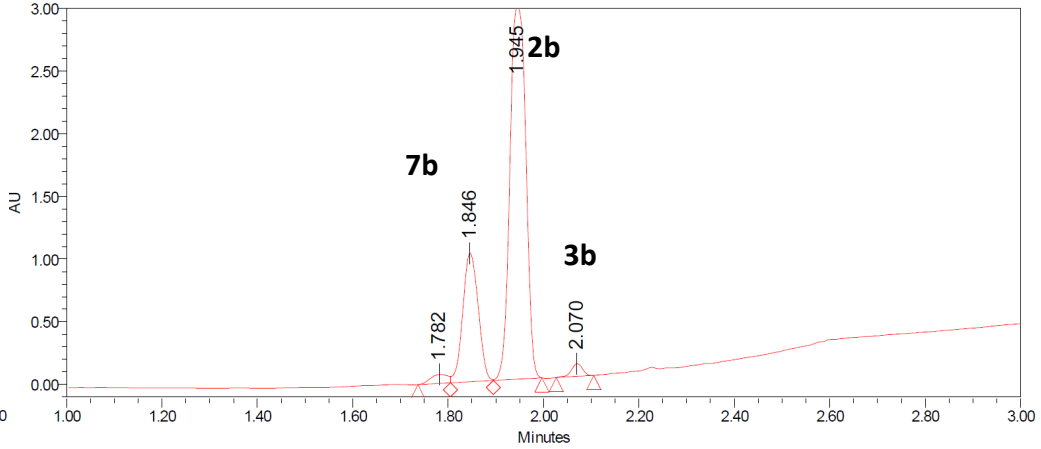
Representative chromatogram natural jasmolin I **2a**



Representative chromatogram natural jasmolin II **2b**



Representative chromatogram of diimide-reduced **1a**



Representative chromatogram of diimide-reduced **1b**