# Supporting Information

**Environmentally Benign Synthesis of Tetra-Substituted Imidazoles through 4-Components Strategy Mediated by (*S*)-3-Methyl-1, 1-Diphenylbutane-1, 2-Diamine**

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## 1. General Methods and Experimental Procedures:

All of the reagents and solvents are commercially available and were used as purchased without any further purification. Some solvents except laboratory reagent grade were dried and purified, when necessary. Reactions were monitored by thin layer chromatographic (TLC) plates over silica gel (60 GF$_{254,}$ E. Merck). The melting points of the compounds were recorded on electro thermal melting point apparatus (Gallenkamp). NMR ($^1$H & $^{13}$C) spectra were recorded in d- CDCl$_3$ & d$_6$-DMSO using an AC-Bruker 500 MHz spectrometer. Chemical shift ($\delta$) and coupling constant (*J*) are given in ppm and Hz units with respect to TMS as an internal standard.
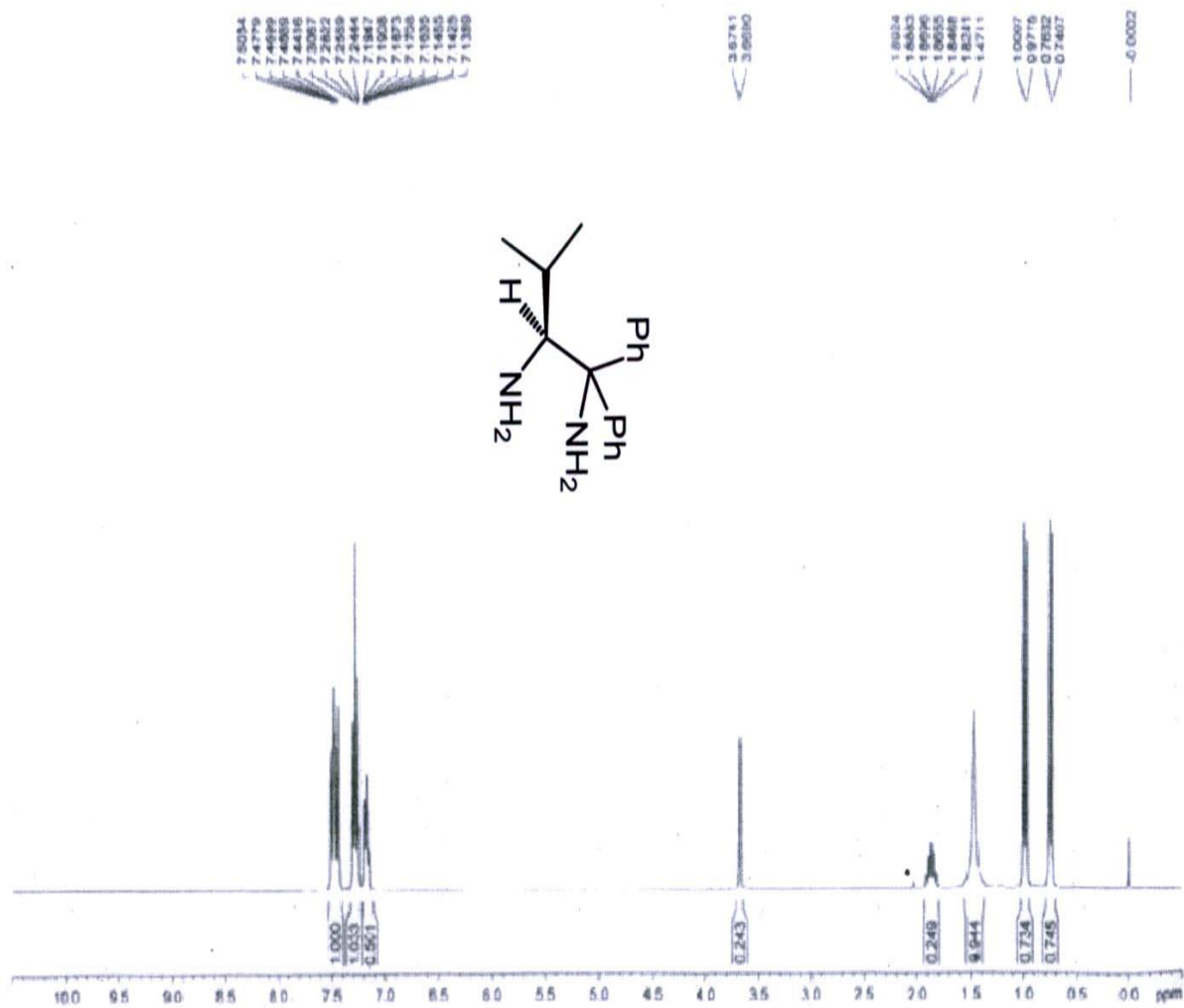
## General procedure for the preparation of tetra-substituted imidazoles (5)

A mixture of benzil or benzoin (2 mmol), aldehyde (2 mmol), ammonium acetate (5 mmol), aryl amine (2 mmol) and (S)-3-methyl-1, 1-diphenylbutane-1, 2-diamine (10 mol %) in ethanol (2 ml) was stirred at reflux temperature for 2~3 hours. The progress of the reaction was monitored by TLC. After completion of reaction, the mixture was cooled to room temperature, diluted with water and poured on crushed ice. The obtained crude solid product was filtered, dried and finally recrystallized from ethanol to obtain sufficiently pure product **5**.
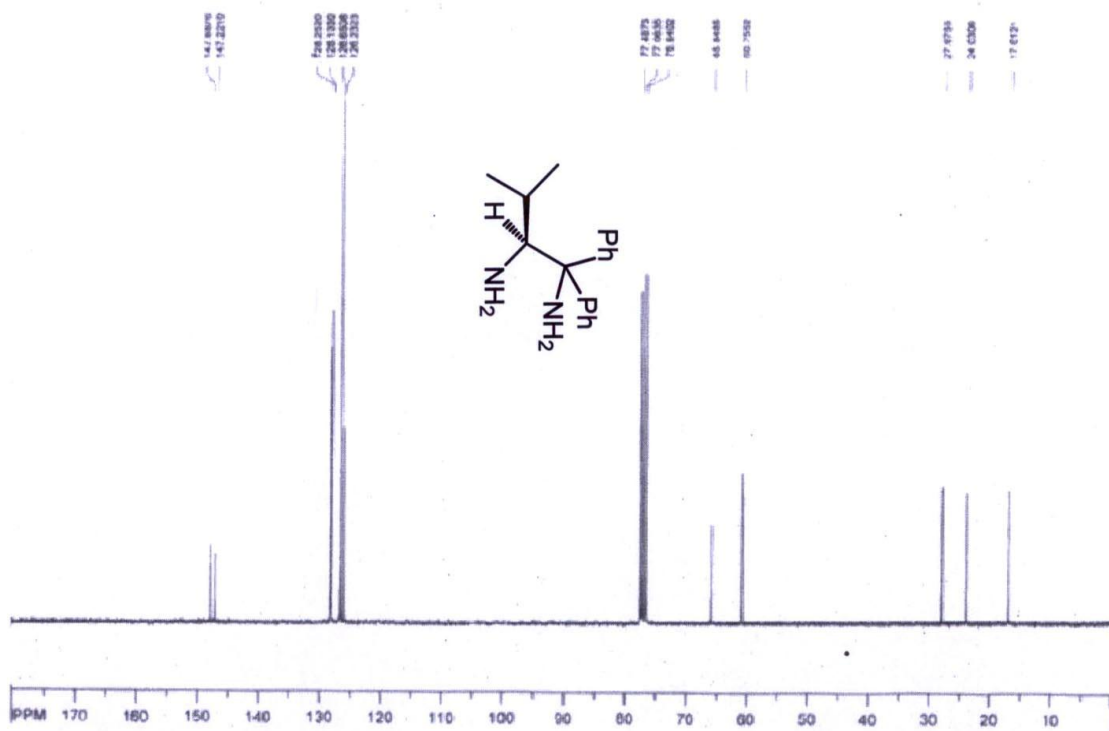
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## 2. Copies of NMR ($^1$H & $^{13}$C) spectra:

### $^1$H NMR: for Catalyst.

# $^{1}$C NMR: for Catalyst.

# $^1$**H NMR:** for compound **1**

# $^{13}$C NMR: for compound 1



LKR_OCT_N4
LKR_OCT_N4

154.7834
140.7364
133.9506
128.4043
128.3665
124.5048
83.0855
82.6277
82.5689
45.2854
45.1180
44.9589
44.7839
44.6166
44.4495
44.2830

1 Title      N4
2 Solvent  CDCl3 with few
            drops of DMSO
3 Nucleus  13C

# <sup>1</sup>H NMR: for compound 2

# <sup>1</sup>C NMR: for compound 2

# $^1$H NMR: for compound 3

# <sup>1</sup>C NMR: for compound 3

1 Title    N3
2 Solvent  CDCl3 with
          Few drops of
          DMSO
3 Nucleus  13C

**<sup>1</sup>H NMR:** for compound **4**

**¹C NMR:** for compound **4**



Peak labels: 150.7694, 148.5368, 147.0099, 129.6483, 128.5504, 127.7695, 127.1963, 126.4240, 123.8655, 118.9768, 117.8049, 112.1429, 77.2915, 76.7835, 40.3245, -0.0185

| Parameter | Value |
|---|---|
| 3 Origin | Bruker BioSpin GmbH |
| 4 Owner | Administrator |
| 5 Solvent | CDCl3 |
| 6 Pulse Sequence | zgpg30 |
| 7 Acquisition Date | 2016-03-18T 14:57:02 |
| 8 Modification Date | |
| 9 Temperature | 295.5 |
| 10 Number of Scans | 1000 |
| 11 Spectrometer Frequency | 125.77 |
| 12 Spectral Width | 30303.0 |
| 13 Lowest Frequency | -2574.5 |
| 14 Nucleus | 13C |
| 15 Acquired Size | 16364 |
| 16 Spectral Size | 32768 |

# $^1$H NMR: for compound 5



LKR_OCT_N5
LKR_OCT_N5

1 Title     N5
2 Solvent  CDCl3 with few drops
            of DMSO
3 Nucleus  1H

# <sup>1</sup>C NMR: for compound 5

# <sup>1</sup>H NMR: for compound 6

# $^1$C NMR: for compound 6

1 Title      N6
2 Solvent  CDCl3 with few drops of DMSO
3 Nucleus  13C

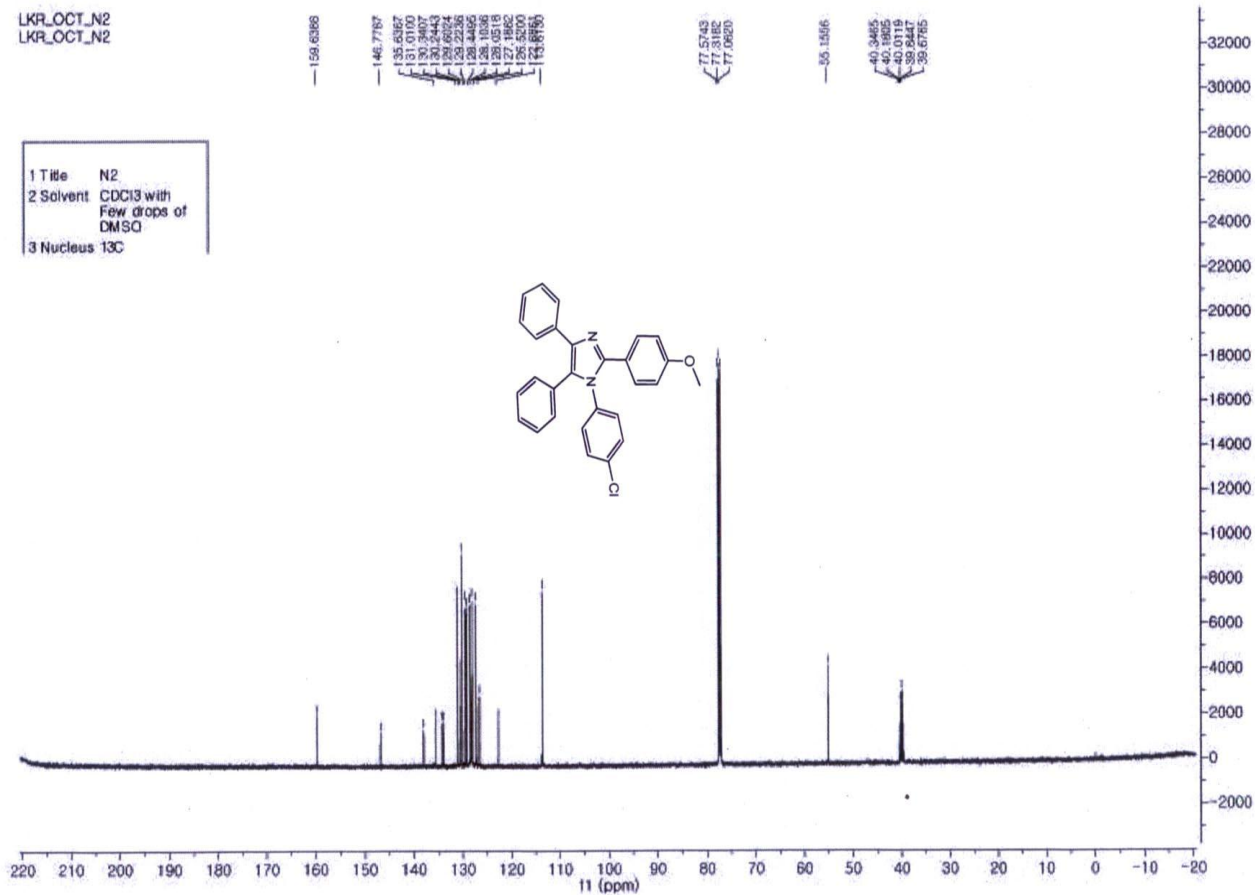# <sup>1</sup>H NMR: for compound 7

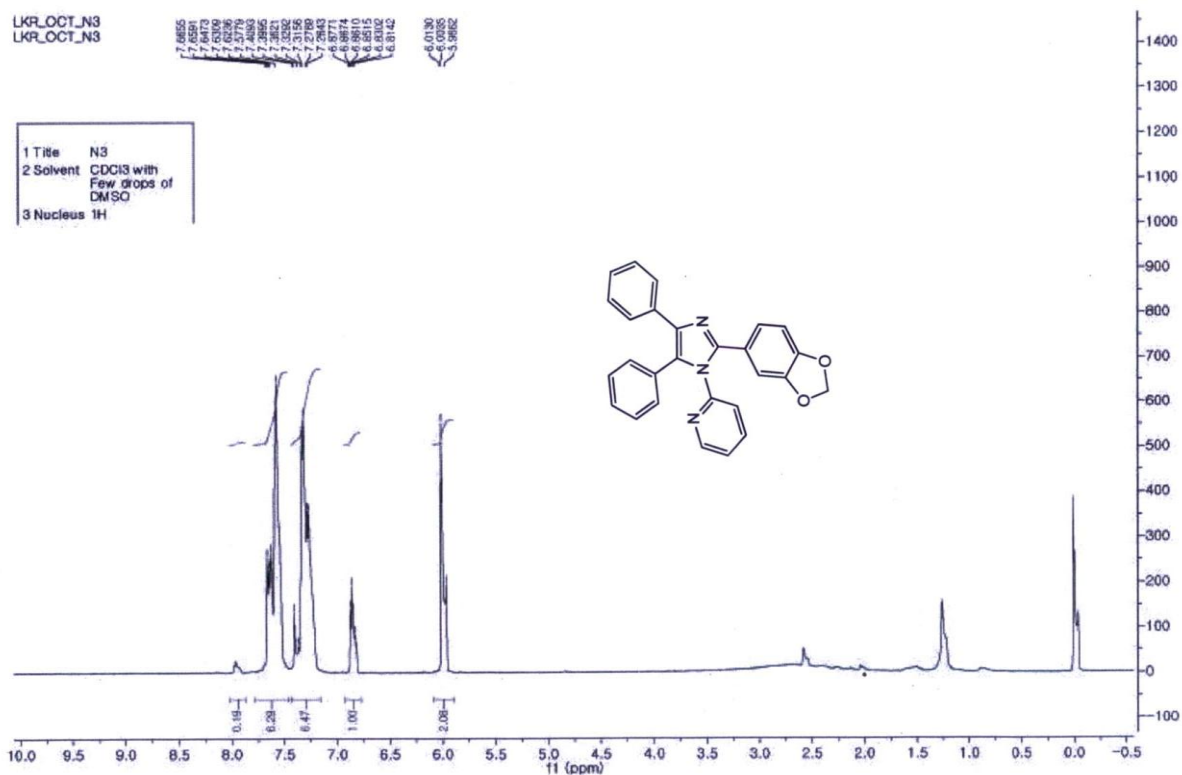**<sup>1</sup>C NMR:** for compound **7**



LKR_OCT_N7
LKR_OCT_N7

1 Title    N7
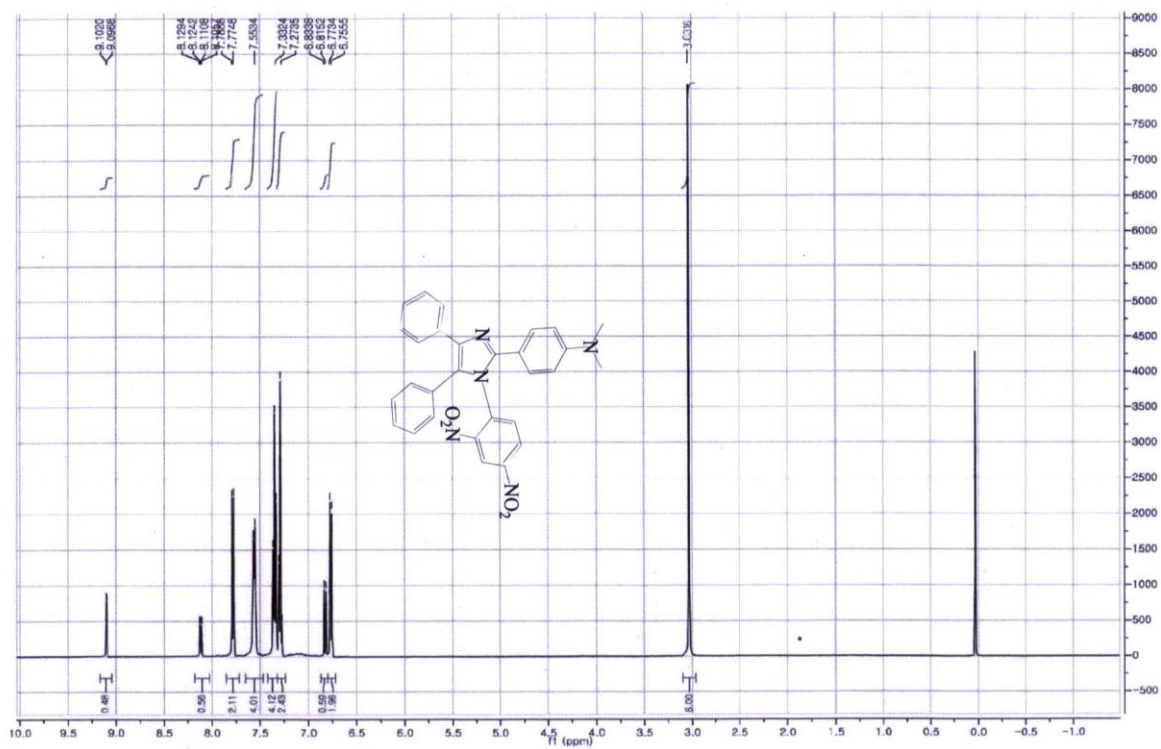2 Solvent  CDCl3 with few
         drops of DMSO
3 Nucleus  13C

**<sup>1</sup>H NMR:** for compound **8**



| Parameter | Value |
|---|---|
| 3 Origin | Bruker BioSpin GmbH |
| 4 Owner | Administrator |
| 5 Solvent | CDCl3 |
| 6 Pulse Sequence | zg30 |
| 7 Acquisition Date | 2016-03-18T17:36:25 |
| 8 Modification Date | |
| 9 Temperature | 295.0 |
| 10 Number of Scans | 16 |
| 11 Spectrometer Frequency | 500.13 |
| 12 Spectral Width | 10000.0 |
| 13 Lowest Frequency | -2499.4 |
| 14 Nucleus | 1H |
| 15 Acquired Size | 16384 |
| 16 Spectral Size | 32768 |

**$^1$C NMR:** for compound **8**



| | Parameter | Value |
|---|---|---|
| 3 | Origin | Bruker BioSpin GmbH |
| 4 | Owner | Administrator |
| 5 | Solvent | CDCl3 |
| 6 | Pulse Sequence | zgpg30 |
| 7 | Acquisition Date | 2016-03-18T 18:20:43 |
| 8 | Modification Date | |
| 9 | Temperature | 295.2 |
| 10 | Number of Scans | 1000 |
| 11 | Spectrometer Frequency | 125.77 |
| 12 | Spectral Width | 30303.0 |
| 13 | Lowest Frequency | -2574.5 |
| 14 | Nucleus | 13C |
| 15 | Acquired Size | 16384 |
| 16 | Spectral Size | 32768 |

Peaks: 150.7568, 146.9018, 128.5340, 127.7713, 127.1650, 126.4233, 117.8182, 112.1433, 77.2314, 77.0099, 76.7734, 40.3365, 0.0146

# <sup>1</sup>H NMR: for compound 9

**¹H NMR:** for compound **9**



| Parameter | Value |
| --- | --- |
| 3 Origin | Bruker BioSpin GmbH |
| 4 Owner | Administrator |
| 5 Solvent | CDCl3 |
| 6 Pulse Sequence | zg30 |
| 7 Acquisition Date | 2016-03-18T15:53:34 |
| 8 Modification Date | |
| 9 Temperature | 295.0 |
| 10 Number of Scans | 16 |
| 11 Spectrometer Frequency | 500.13 |
| 12 Spectral Width | 10000.0 |
| 13 Lowest Frequency | -2499.4 |
| 14 Nucleus | 1H |
| 15 Acquired Size | 16384 |
| 16 Spectral Size | 32768 |

# $^1$C NMR: for compound 9



| | Parameter | Value |
|---|---|---|
| 3 | Origin | Bruker BioSpin GmbH |
| 4 | Owner | Administrator |
| 5 | Solvent | CDCl3 |
| 6 | Pulse Sequence | zgpg30 |
| 7 | Acquisition Date | 2016-03-16T16:37:53 |
| 8 | Modification Date | |
| 9 | Temperature | 295.5 |
| 10 | Number of Scans | 1000 |
| 11 | Spectrometer Frequency | 125.77 |
| 12 | Spectral Width | 30303.0 |
| 13 | Lowest Frequency | -2574.5 |
| 14 | Nucleus | 13C |
| 15 | Acquired Size | 16384 |
| 16 | Spectral Size | 32768 |

Peaks: 150.2057, 147.6961, 136.0546, 135.4093, 134.5125, 133.7752, 129.7819, 129.4471, 126.4471, 127.9454, 126.4965, 117.8782, 111.6022, 77.9855, 77.0320, 76.7774, 40.2215, -0.0186

**¹H NMR:** for compound **10**

LKR_OCT_N1
LKR_OCT_N1

1 Title N1
2 Solvent CDCl3
3 Nucleus 13C

**$^1$H NMR:** for compound **11**

# <sup>1</sup>C NMR: for compound 11



| Parameter | Value |
|-----------|-------|
| 3 Origin | Bruker BioSpin GmbH |
| 4 Owner | Administrator |
| 5 Solvent | DMSO |
| 6 Pulse Sequence | zgpg30 |
| 7 Acquisition Date | 2016-03-18T 21:41:20 |
| 8 Modification Date | |
| 9 Temperature | 295.7 |
| 10 Number of Scans | 1000 |
| 11 Spectrometer Frequency | 125.77 |
| 12 Spectral Width | 30303.0 |
| 13 Lowest Frequency | -2574.5 |
| 14 Nucleus | 13C |
| 15 Acquired Size | 16384 |
| 16 Spectral Size | 32768 |

# <sup>1</sup>H NMR: for compound 12



| Parameter | Value |
|---|---|
| 3 Origin | Bruker BioSpin GmbH |
| 4 Owner | Administrator |
| 5 Solvent | CDCl3 |
| 6 Pulse Sequence | zg30 |
| 7 Acquisition Date | 2016-03-18T13:20:41 |
| 8 Modification Date | |
| 9 Temperature | 295.2 |
| 10 Number of Scans | 16 |
| 11 Spectrometer Frequency | 500.13 |
| 12 Spectral Width | 10000.0 |
| 13 Lowest Frequency | -2499.4 |
| 14 Nucleus | 1H |
| 15 Acquired Size | 16384 |
| 16 Spectral Size | 32768 |

# $^1$C NMR: for compound 12



| | Parameter | Value |
|---|---|---|
| 3 | Origin | Bruker BioSpin GmbH |
| 4 | Owner | Administrator |
| 5 | Solvent | CDCl3 |
| 6 | Pulse Sequence | zgpg30 |
| 7 | Acquisition Date | 2016-03-18T 14:04:54 |
| 8 | Modification Date | |
| 9 | Temperature | 295.6 |
| 10 | Number of Scans | 1000 |
| 11 | Spectrometer Frequency | 125.77 |
| 12 | Spectral Width | 30303.0 |
| 13 | Lowest Frequency | -2574.5 |
| 14 | Nucleus | 13C |
| 15 | Acquired Size | 16384 |
| 16 | Spectral Size | 32768 |