



# Full wwPDB NMR Structure Validation Report ⓘ

Apr 26, 2016 – 02:47 PM BST

PDB ID : 1F5G  
Title : The G7(syn)-G4(anti) structure of r(GCAGGCGUGC)2  
Authors : Burkard, M.E.; Turner, D.H.  
Deposited on : 2000-06-14

This is a Full wwPDB NMR Structure Validation Report for a publicly released PDB entry.  
We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)  
A user guide is available at  
<http://wwpdb.org/validation/2016/NMRValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

Cyrange : Kirchner and Güntert (2011)  
NmrClust : Kelley et al. (1996)  
MolProbity : 4.02b-467  
Mogul : unknown  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
RCI : v\_1n\_11\_5\_13\_A (Berjanski et al., 2005)  
PANAV : Wang et al. (2010)  
ShiftChecker : rb-20027457  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : rb-20027457

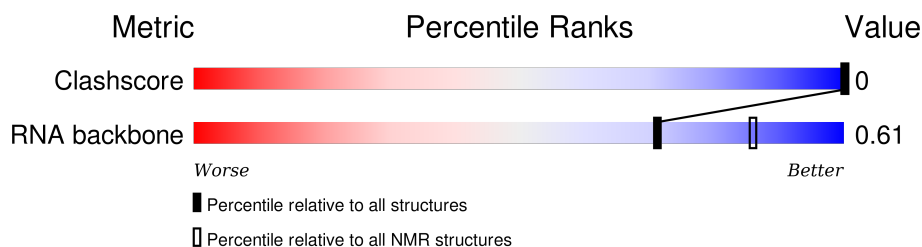
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*SOLUTION NMR*

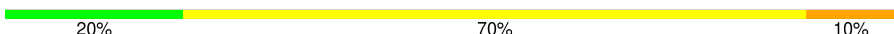

The overall completeness of chemical shifts assignment is 27%.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	NMR archive (#Entries)
Clashscore	114402	11133
RNA backbone	3027	600

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and a grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	10	 20%                      70%                      10%
1	B	10	 10%                      90%

## 2 Ensemble composition and analysis ⓘ

This entry contains 26 models. This entry does not contain protein, therefore identification of well-defined residues and clustering analysis are not possible. All residues are included in the validation scores.

### 3 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 650 atoms, of which 222 are hydrogens and 0 are deuteriums.

- Molecule 1 is a RNA chain called 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'.

Mol	Chain	Residues	Atoms						Trace
1	A	10	Total	C	H	N	O	P	0
			325	96	111	41	68	9	
1	B	10	Total	C	H	N	O	P	0
			325	96	111	41	68	9	

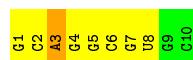
## 4 Residue-property plots [i](#)

### 4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA and DNA chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

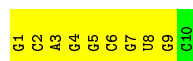
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



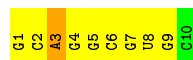
### 4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

#### 4.2.1 Score per residue for model 1

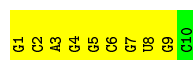
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 




- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



### 4.2.2 Score per residue for model 2

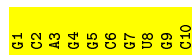
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A:  30% 70%



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

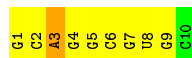
Chain B:  100%



### 4.2.3 Score per residue for model 3

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A:  10% 80% 10%



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B:  20% 80%



### 4.2.4 Score per residue for model 4

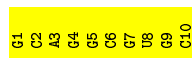
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A:  20% 70% 10%



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B:  100%



### 4.2.5 Score per residue for model 5

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

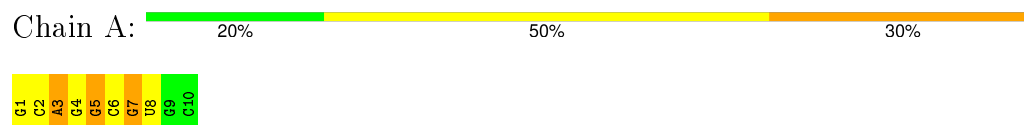


- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'



### 4.2.6 Score per residue for model 6

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'



### 4.2.7 Score per residue for model 7

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'



#### 4.2.8 Score per residue for model 8

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'



#### 4.2.9 Score per residue for model 9

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'



#### 4.2.10 Score per residue for model 10

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'




- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'





#### 4.2.11 Score per residue for model 11

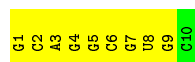
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



#### 4.2.12 Score per residue for model 12

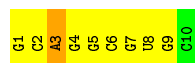
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



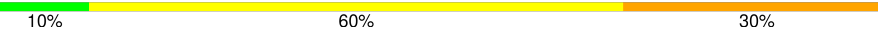
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



#### 4.2.13 Score per residue for model 13

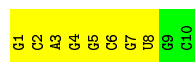
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

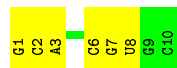
Chain B: 



#### 4.2.14 Score per residue for model 14

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



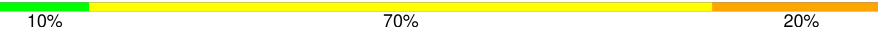
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



#### 4.2.15 Score per residue for model 15

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



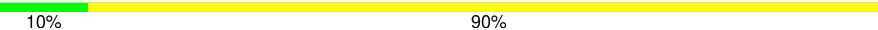
#### 4.2.16 Score per residue for model 16

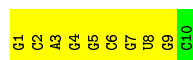
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



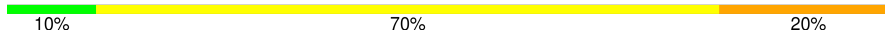
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



#### 4.2.17 Score per residue for model 17

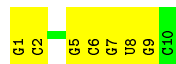
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A:  10% 70% 20%



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

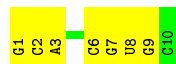
Chain B:  30% 70%



#### 4.2.18 Score per residue for model 18

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A:  30% 70%



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

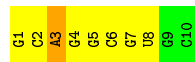
Chain B:  20% 80%



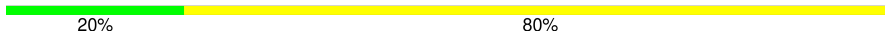
#### 4.2.19 Score per residue for model 19

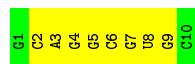
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A:  20% 70% 10%



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

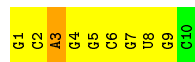
Chain B:  20% 80%



#### 4.2.20 Score per residue for model 20

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



#### 4.2.21 Score per residue for model 21

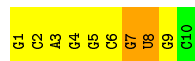
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



#### 4.2.22 Score per residue for model 22

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



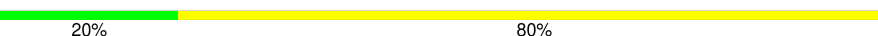
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



#### 4.2.23 Score per residue for model 23

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



#### 4.2.24 Score per residue for model 24

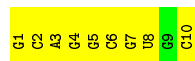
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



#### 4.2.25 Score per residue for model 25

- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A: 



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B: 



#### 4.2.26 Score per residue for model 26

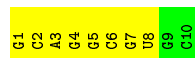
- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain A:  20% 50% 30%



- Molecule 1: 5'-R(\*GP\*CP\*AP\*GP\*GP\*CP\*GP\*UP\*GP\*C)-3'

Chain B:  20% 80%



## 5 Refinement protocol and experimental data overview

The models were refined using the following method: *Simulated annealing, Energy minimization*.

Of the 40 calculated structures, 26 were deposited, based on the following criterion: *structures with the lowest energy. First model represents the minimized averaged structure*.

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
DISCOVER	structure solution	95.0
DISCOVER	refinement	95.0

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 7 of this report.

Chemical shift file(s)	BMRB entry 4614
Number of chemical shift lists	1
Total number of shifts	108
Number of shifts mapped to atoms	108
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	27%

No validations of the models with respect to experimental NMR restraints is performed at this time.

## 6 Model quality

### 6.1 Standard geometry

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the (average) root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#Z>5	RMSZ	#Z>5
1	A	1.11±0.01	0±0/239 (0.0±0.0%)	1.88±0.03	7±1/372 (1.9±0.3%)
1	B	1.12±0.01	0±0/239 (0.0±0.0%)	1.85±0.03	6±1/372 (1.6±0.2%)
All	All	1.11	0/12428 (0.0%)	1.87	341/19344 (1.8%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	Chirality	Planarity
1	A	0.0±0.0	3.0±1.0
1	B	0.0±0.0	3.7±0.5
All	All	0	172

There are no bond-length outliers.

All unique angle outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	B	7	G	O4'-C1'-N9	10.85	116.88	108.20	21	26
1	A	7	G	O4'-C1'-N9	10.33	116.46	108.20	15	26
1	A	6	C	O4'-C1'-N1	8.02	114.62	108.20	20	26
1	B	6	C	O4'-C1'-N1	7.79	114.43	108.20	14	23
1	A	4	G	O4'-C1'-N9	7.76	114.41	108.20	26	16
1	A	2	C	O4'-C1'-N1	6.96	113.77	108.20	24	26
1	B	8	U	O4'-C1'-N1	6.74	113.59	108.20	17	26
1	A	8	U	O4'-C1'-N1	6.59	113.47	108.20	25	26
1	B	4	G	O4'-C1'-N9	6.54	113.44	108.20	13	20
1	B	2	C	O4'-C1'-N1	6.36	113.29	108.20	6	26
1	A	4	G	P-O3'-C3'	5.99	126.89	119.70	26	1
1	A	7	G	N3-C4-C5	-5.92	125.64	128.60	18	26
1	B	7	G	N3-C4-C5	-5.90	125.65	128.60	14	26

*Continued on next page...*



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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	3	A	O4'-C1'-N9	5.53	112.63	108.20	3	24
1	B	7	G	C2-N3-C4	5.40	114.60	111.90	14	1
1	A	7	G	C2-N3-C4	5.38	114.59	111.90	20	2
1	B	10	C	O4'-C1'-N1	5.21	112.37	108.20	2	5
1	A	3	A	N1-C6-N6	-5.19	115.48	118.60	22	1
1	A	5	G	O4'-C1'-N9	5.17	112.34	108.20	19	11
1	B	3	A	N1-C6-N6	-5.13	115.52	118.60	12	1
1	B	7	G	P-O3'-C3'	5.11	125.83	119.70	21	1
1	B	4	G	P-O3'-C3'	5.07	125.78	119.70	23	1

There are no chirality outliers.

All unique planar outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Group	Models (Total)
1	B	1	G	Sidechain	25
1	B	3	A	Sidechain	24
1	A	1	G	Sidechain	23
1	B	9	G	Sidechain	23
1	B	5	G	Sidechain	23
1	A	3	A	Sidechain	21
1	A	5	G	Sidechain	18
1	A	9	G	Sidechain	13
1	A	7	G	Sidechain	2

## 6.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in each chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
All	All	11128	5772	5772	-

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is -.

There are no clashes.

## 6.3 Torsion angles [i](#)

### 6.3.1 Protein backbone [i](#)

There are no protein molecules in this entry.

### 6.3.2 Protein sidechains [i](#)

There are no protein molecules in this entry.

### 6.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers	Suiteness
1	A	9/10 (90%)	0±0 (2±4%)	0±0 (0±2%)	0.59±0.03
1	B	9/10 (90%)	0±0 (2±4%)	0±0 (1±3%)	0.63±0.04
All	All	468/520 (90%)	9 (2%)	3 (1%)	0.61

The overall RNA backbone suiteness is 0.61.

All unique RNA backbone outliers are listed below:

Mol	Chain	Res	Type	Models (Total)
1	A	7	G	2
1	B	4	G	2
1	A	4	G	1
1	B	7	G	1
1	B	8	U	1
1	A	5	G	1
1	B	5	G	1

All unique RNA pucker outliers are listed below:

Mol	Chain	Res	Type	Models (Total)
1	A	4	G	1
1	B	4	G	1
1	B	7	G	1

## 6.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

## 6.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

## 6.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 6.7 Other polymers [i](#)

There are no such molecules in this entry.

## 6.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 7 Chemical shift validation

The completeness of assignment taking into account all chemical shift lists is 27% for the well-defined parts and 27% for the entire structure.

### 7.1 Chemical shift list 1

File name: BMRB entry 4614

Chemical shift list name: *assigned\_chem\_shift\_list\_1*

#### 7.1.1 Bookkeeping

The following table shows the results of parsing the chemical shift list and reports the number of nuclei with statistically unusual chemical shifts.

Total number of shifts	108
Number of shifts mapped to atoms	108
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	0

#### 7.1.2 Chemical shift referencing

No chemical shift referencing corrections were calculated (not enough data).

#### 7.1.3 Completeness of resonance assignments

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 27%, i.e. 106 atoms were assigned a chemical shift out of a possible 386. 0 out of 0 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	<sup>1</sup> H	<sup>13</sup> C	<sup>15</sup> N
Backbone	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Sidechain	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Aromatic	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Overall	106/386 (27%)	106/226 (47%)	0/130 (0%)	0/30 (0%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 27%, i.e. 106 atoms were assigned a chemical shift out of a possible 386. 0 out of 0 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	<b>Total</b>	<b><sup>1</sup>H</b>	<b><sup>13</sup>C</b>	<b><sup>15</sup>N</b>
Backbone	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Sidechain	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Aromatic	0/0 (—%)	0/0 (—%)	0/0 (—%)	0/0 (—%)
Overall	106/386 (27%)	106/226 (47%)	0/130 (0%)	0/30 (0%)

#### 7.1.4 Statistically unusual chemical shifts ⓘ

There are no statistically unusual chemical shifts.

#### 7.1.5 Random Coil Index (RCI) plots ⓘ

No *random coil index* (RCI) plot could be generated from the current chemical shift list (assigned\_chem\_shift\_list\_1). RCI is only applicable to proteins.