



# Full wwPDB NMR Structure Validation Report ⓘ

May 28, 2020 – 10:52 pm BST

PDB ID : 2KVN  
Title : Phi29 E-loop hairpin  
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Deposited on : 2010-03-19

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

<https://www.wwpdb.org/validation/2017/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  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
RCI : v\_1n\_11\_5\_13\_A (Berjanski et al., 2005)  
PANAV : Wang et al. (2010)  
ShiftChecker : 2.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.11

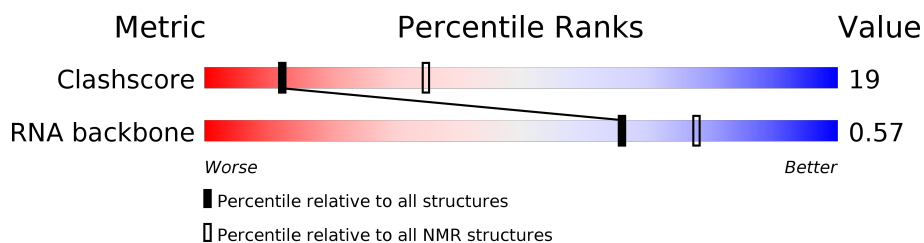
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*SOLUTION NMR*

The overall completeness of chemical shifts assignment was not calculated.

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	158937	12864
RNA backbone	4643	676

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	17	

## 2 Ensemble composition and analysis

This entry contains 30 models. This entry does not contain polypeptide chains, therefore identification of well-defined residues and clustering analysis are not possible. All residues are included in the validation scores.

### 3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 544 atoms, of which 184 are hydrogens and 0 are deuteriums.

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

Mol	Chain	Residues	Atoms					Trace	
			Total	C	H	N	O		P
1	A	17	544	162	184	64	118	16	0

## 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: RNA (5'-R(\*GP\*GP\*UP\*GP\*AP\*UP\*UP\*GP\*AP\*GP\*UP\*UP\*CP\*AP\*CP\*CP\*A)-3')

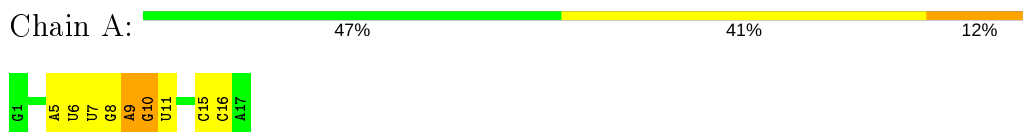


### 4.2 Scores per residue for each member of the ensemble

Colouring as in section [4.1](#) above.

#### 4.2.1 Score per residue for model 1

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




#### 4.2.2 Score per residue for model 2

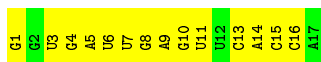
- Molecule 1: RNA (5'-R(\*GP\*GP\*UP\*GP\*AP\*UP\*UP\*GP\*AP\*GP\*UP\*UP\*CP\*AP\*CP\*CP\*A)-3')



### 4.2.3 Score per residue for model 3

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

Chain A:  18% 82%



### 4.2.4 Score per residue for model 4

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

Chain A:  18% 71% 12%



### 4.2.5 Score per residue for model 5

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

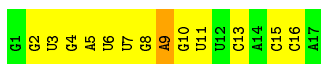
Chain A:  47% 47% 6%



### 4.2.6 Score per residue for model 6

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

Chain A:  24% 71% 6%



### 4.2.7 Score per residue for model 7

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



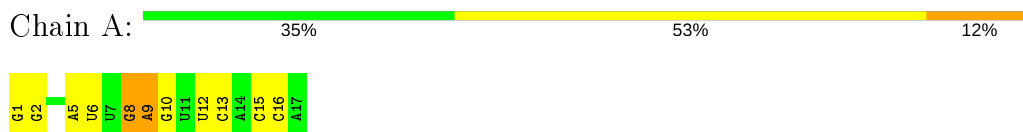
#### 4.2.8 Score per residue for model 8

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



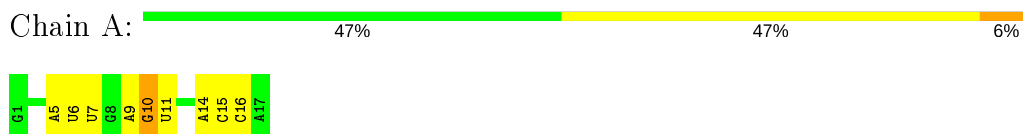
#### 4.2.9 Score per residue for model 9

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



#### 4.2.10 Score per residue for model 10

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



#### 4.2.11 Score per residue for model 11

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



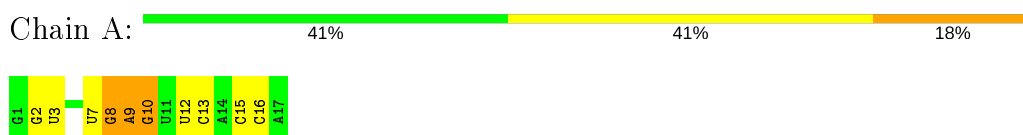
#### 4.2.12 Score per residue for model 12

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



#### 4.2.13 Score per residue for model 13

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



#### 4.2.14 Score per residue for model 14

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



#### 4.2.15 Score per residue for model 15

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



#### 4.2.16 Score per residue for model 16

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





#### 4.2.17 Score per residue for model 17

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



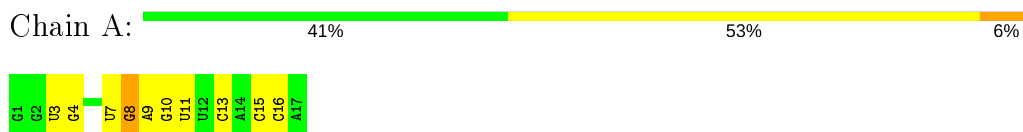
#### 4.2.18 Score per residue for model 18

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



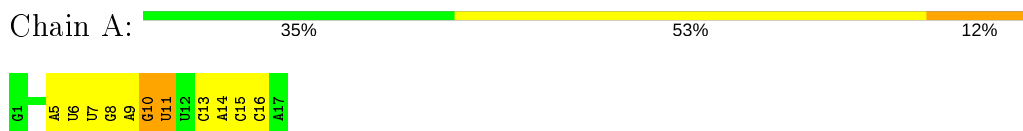
#### 4.2.19 Score per residue for model 19

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



#### 4.2.20 Score per residue for model 20

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



#### 4.2.21 Score per residue for model 21

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



#### 4.2.22 Score per residue for model 22

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



#### 4.2.23 Score per residue for model 23

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



#### 4.2.24 Score per residue for model 24

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



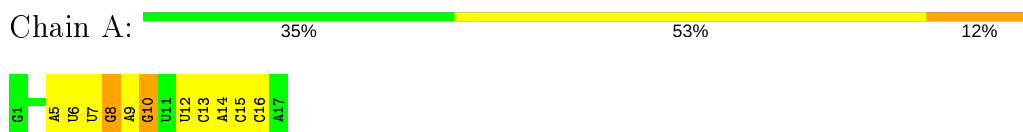
#### 4.2.25 Score per residue for model 25

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



#### 4.2.26 Score per residue for model 26

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



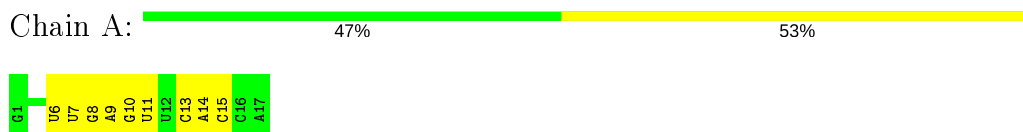
#### 4.2.27 Score per residue for model 27

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



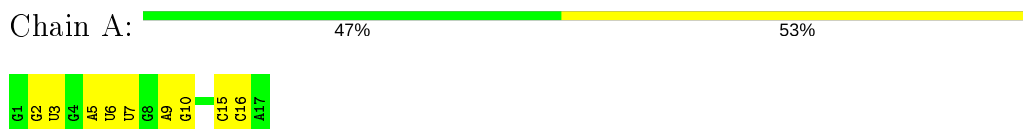
#### 4.2.28 Score per residue for model 28

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



#### 4.2.29 Score per residue for model 29

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



#### 4.2.30 Score per residue for model 30

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

Chain A:  41% 41% 18%



## 5 Refinement protocol and experimental data overview

The models were refined using the following method: *DGSA-distance geometry simulated annealing*.

Of the 132 calculated structures, 30 were deposited, based on the following criterion: *structures with no restraint violations*.

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

Software name	Classification	Version
CNS	geometry optimization	1.2
CNS	refinement	1.2

No chemical shift data was provided. No validations of the models with respect to experimental NMR restraints is performed at this time.

## 6 Model quality [i](#)

### 6.1 Standard geometry [i](#)

There are no covalent bond-length or bond-angle outliers.

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 6.2 Too-close contacts [i](#)

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
1	A	360	184	184	10±3
All	All	10800	5520	5520	311

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 19.

All unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:7:U:H2'	1:A:9:A:N7	0.99	1.71	4	23
1:A:10:G:HO2'	1:A:11:U:H6	0.92	0.99	20	2
1:A:1:G:HO5'	1:A:1:G:H8	0.86	1.07	22	1
1:A:9:A:O2'	1:A:10:G:H2'	0.79	1.77	13	18
1:A:9:A:O3'	1:A:10:G:H2'	0.74	1.82	17	2
1:A:6:U:H2'	1:A:7:U:O4'	0.73	1.83	22	16
1:A:10:G:O2'	1:A:11:U:H5'	0.71	1.84	1	12
1:A:8:G:H2'	1:A:9:A:O4'	0.67	1.90	4	7
1:A:8:G:H2'	1:A:9:A:O5'	0.64	1.92	1	1
1:A:4:G:H2'	1:A:5:A:O4'	0.63	1.94	18	6
1:A:11:U:H2'	1:A:12:U:O4'	0.61	1.95	4	13
1:A:13:C:O5'	1:A:13:C:H6	0.60	1.79	20	11
1:A:5:A:H2'	1:A:6:U:O4'	0.60	1.96	9	2
1:A:8:G:H2'	1:A:9:A:C5'	0.60	2.26	1	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:16:C:H2'	1:A:17:A:O4'	0.59	1.96	2	1
1:A:9:A:O5'	1:A:9:A:H8	0.59	1.79	6	2
1:A:13:C:H6	1:A:13:C:O5'	0.57	1.83	3	11
1:A:4:G:O2'	1:A:5:A:H5'	0.57	2.00	21	4
1:A:15:C:O5'	1:A:15:C:H6	0.55	1.85	24	10
1:A:5:A:H2'	1:A:6:U:C6	0.55	2.37	12	18
1:A:16:C:O5'	1:A:16:C:H6	0.53	1.86	17	16
1:A:15:C:H6	1:A:15:C:O5'	0.52	1.87	5	10
1:A:6:U:C4	1:A:7:U:C4	0.52	2.97	1	3
1:A:8:G:C2'	1:A:9:A:O5'	0.52	2.57	1	1
1:A:16:C:H6	1:A:16:C:O5'	0.52	1.86	27	9
1:A:8:G:O3'	1:A:9:A:H8	0.51	1.87	9	1
1:A:12:U:H2'	1:A:13:C:C6	0.51	2.41	30	8
1:A:7:U:C2'	1:A:9:A:N7	0.50	2.71	21	4
1:A:1:G:H2'	1:A:2:G:O4'	0.49	2.06	16	5
1:A:14:A:O5'	1:A:14:A:H8	0.49	1.91	11	2
1:A:2:G:O2'	1:A:3:U:H5'	0.48	2.08	23	7
1:A:14:A:H2'	1:A:15:C:C6	0.48	2.44	8	5
1:A:13:C:H2'	1:A:14:A:C8	0.48	2.44	14	4
1:A:15:C:H2'	1:A:16:C:C6	0.47	2.44	26	16
1:A:1:G:O2'	1:A:2:G:H5'	0.47	2.10	9	2
1:A:14:A:H8	1:A:14:A:O5'	0.47	1.93	21	4
1:A:8:G:H2'	1:A:9:A:H5'	0.46	1.86	1	1
1:A:9:A:HO2'	1:A:10:G:H8	0.46	1.51	2	1
1:A:9:A:H8	1:A:9:A:O5'	0.46	1.94	24	2
1:A:7:U:C5	1:A:9:A:OP2	0.46	2.69	1	1
1:A:10:G:O2'	1:A:11:U:C5'	0.46	2.64	20	2
1:A:10:G:H1'	1:A:11:U:OP1	0.46	2.11	30	2
1:A:9:A:H2'	1:A:11:U:C6	0.45	2.46	17	2
1:A:3:U:H2'	1:A:4:G:C8	0.45	2.46	5	11
1:A:6:U:H2'	1:A:7:U:C6	0.45	2.47	28	5
1:A:9:A:O2'	1:A:10:G:C8	0.45	2.68	2	2
1:A:8:G:N7	1:A:9:A:N3	0.45	2.65	22	1
1:A:8:G:O3'	1:A:9:A:C8	0.45	2.69	9	1
1:A:8:G:H5''	1:A:9:A:C8	0.45	2.47	19	1
1:A:10:G:C1'	1:A:11:U:OP1	0.44	2.65	30	1
1:A:9:A:H2'	1:A:11:U:C5	0.44	2.47	15	1
1:A:6:U:H6	1:A:6:U:O5'	0.44	1.94	3	2
1:A:12:U:O5'	1:A:12:U:H6	0.44	1.96	9	1
1:A:12:U:O2'	1:A:13:C:H5'	0.43	2.13	4	3
1:A:5:A:O2'	1:A:6:U:H5'	0.43	2.14	21	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:8:G:C6	1:A:9:A:C6	0.42	3.08	12	1
1:A:8:G:N2	1:A:10:G:N7	0.42	2.66	13	2
1:A:9:A:O2'	1:A:10:G:N9	0.42	2.53	1	1
1:A:9:A:O2'	1:A:10:G:C2'	0.41	2.61	13	2
1:A:5:A:C2	1:A:6:U:C2	0.41	3.08	29	1
1:A:8:G:O5'	1:A:8:G:H8	0.41	1.99	18	1
1:A:1:G:O5'	1:A:1:G:H8	0.41	1.99	3	1
1:A:8:G:H4'	1:A:9:A:OP1	0.41	2.14	18	1
1:A:9:A:H2'	1:A:10:G:H2'	0.40	1.93	30	1
1:A:9:A:O2'	1:A:10:G:C4	0.40	2.74	1	1

## 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	16/17 (94%)	2±1 (9±5%)	0±0 (1±2%)	0.57±0.05
All	All	480/510 (94%)	45 (9%)	4 (1%)	0.57

The overall RNA backbone suiteness is 0.57.

All unique RNA backbone outliers are listed below:

Mol	Chain	Res	Type	Models (Total)
1	A	8	G	20
1	A	10	G	18
1	A	9	A	5
1	A	11	U	2

All unique RNA pucker outliers are listed below:



Mol	Chain	Res	Type	Models (Total)
1	A	8	G	2
1	A	10	G	2

#### 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

No chemical shift data were provided