



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 23, 2021 – 03:28 PM EDT

PDB ID : 1DK1  
Title : DETAILED VIEW OF A KEY ELEMENT OF THE RIBOSOME ASSEMBLY: CRYSTAL STRUCTURE OF THE S15-RRNA COMPLEX  
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Deposited on : 1999-12-06  
Resolution : 2.80 Å(reported)

This is a Full wwPDB X-ray 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/XrayValidationReportHelp>

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:

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.23.2

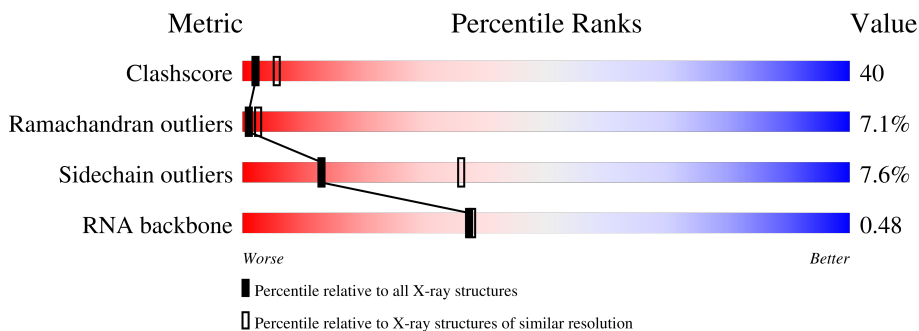
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.80 Å.

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)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RNA backbone	3102	1227 (3.10-2.50)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. 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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	B	57	 21%                      51%                      25%                      .
2	A	86	 28%                      59%                      13%

## 2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 2047 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a RNA chain called RRNA FRAGMENT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	B	57	1288	573	236	420	59	0	3	0

- Molecule 2 is a protein called 30S RIBOSOMAL PROTEIN S15.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	Se			
2	A	86	722	452	142	124	4	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	111	MSE	ILE	engineered mutation	UNP P80378
A	179	MSE	ALA	engineered mutation	UNP P80378
A	157	MSE	MET	engineered mutation	UNP P80378
A	158	MSE	MET	engineered mutation	UNP P80378

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	9	Total	Mg	0	0
			9	9		

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	2	Total	Na	0	0
			2	2		

- Molecule 5 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total K 1 1	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	B	17	Total O 17 17	0	0
6	A	8	Total O 8 8	0	0



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 64 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	128.80Å 128.80Å 65.10Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	8.00 – 2.80	Depositor
% Data completeness (in resolution range)	98.1 (8.00-2.80)	Depositor
$R_{merge}$	0.04	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	CNS	Depositor
R, $R_{free}$	0.213 , 0.291	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	2047	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	60.0	wwPDB-VP

## 5 Model quality i

### 5.1 Standard geometry i

Bond lengths and bond angles in the following residue types are not validated in this section: MG, K, NA

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 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	B	1.90	4/1440 (0.3%)	0.90	8/2247 (0.4%)
2	A	0.53	0/729	0.69	1/963 (0.1%)
All	All	1.58	4/2169 (0.2%)	0.84	9/3210 (0.3%)

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 outliers	#Planarity outliers
1	B	2	4

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	29[A]	A	O3'-P	48.53	2.19	1.61
1	B	29[B]	A	O3'-P	48.53	2.19	1.61
1	B	28[A]	G	O3'-P	-5.72	1.54	1.61
1	B	28[B]	G	O3'-P	-5.72	1.54	1.61

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	52	A	C2'-C3'-O3'	9.33	130.03	109.50
1	B	5	G	C2'-C3'-O3'	7.85	126.77	109.50
1	B	29[A]	A	O3'-P-O5'	7.01	117.32	104.00
1	B	29[B]	A	O3'-P-O5'	7.01	117.32	104.00
1	B	5	G	C4'-C3'-O3'	6.43	125.86	113.00
1	B	16	U	N1-C1'-C2'	6.34	122.24	114.00
1	B	57	C	C2'-C3'-O3'	-5.15	98.18	109.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	123	SER	N-CA-C	5.12	124.82	111.00
1	B	52	A	C4'-C3'-O3'	5.07	123.15	113.00

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	B	5	G	C3'
1	B	52	A	C3'

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	16	U	Sidechain
1	B	24	G	Sidechain
1	B	49	G	Sidechain
1	B	9	U	Sidechain

## 5.2 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 the 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 within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	1288	0	653	65	0
2	A	722	0	757	76	0
3	B	9	0	0	0	0
4	B	2	0	0	0	0
5	A	1	0	0	0	0
6	A	8	0	0	1	0
6	B	17	0	0	2	0
All	All	2047	0	1410	133	0

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 40.

All (133) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.



Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:27[A]:A:H2'	1:B:28[A]:G:H5''	1.39	1.00
1:B:29[A]:A:O3'	1:B:30:G:P	2.19	1.00
1:B:43:C:H2'	1:B:44:C:H5''	1.45	0.97
2:A:132:THR:HG23	2:A:162:ARG:HH12	1.30	0.96
1:B:45:A:O2'	1:B:46:C:H5'	1.65	0.95
1:B:27[A]:A:C2'	1:B:28[A]:G:H5''	2.00	0.90
1:B:27[A]:A:H2'	1:B:28[A]:G:C5'	2.09	0.81
1:B:43:C:C2'	1:B:44:C:H5''	2.11	0.80
1:B:7:C:H1'	1:B:17:A:H61	1.46	0.80
1:B:44:C:H5'	1:B:44:C:H6	1.52	0.74
1:B:9:U:H2'	1:B:11:C:C5	2.23	0.72
2:A:104:LYS:C	2:A:106:GLU:H	1.94	0.71
1:B:27[A]:A:C3'	1:B:28[A]:G:H5''	2.22	0.69
2:A:173:ASP:OD2	2:A:175:GLU:HG3	1.95	0.67
1:B:28[A]:G:C2'	1:B:29[A]:A:H5''	2.25	0.67
2:A:167:ARG:HH21	2:A:171:ARG:HH11	1.42	0.65
2:A:152:HIS:CE1	2:A:156:LEU:HD11	2.31	0.64
1:B:28[A]:G:O2'	1:B:29[A]:A:H5''	1.96	0.63
2:A:175:GLU:HG3	2:A:176:ARG:H	1.63	0.63
1:B:45:A:C2'	1:B:46:C:H5'	2.29	0.62
2:A:108:GLN:HE21	2:A:112:GLN:NE2	1.96	0.62
1:B:23:U:O2'	1:B:24:G:H5'	1.98	0.62
2:A:123:SER:O	2:A:124:THR:HB	1.99	0.62
1:B:28[A]:G:C3'	1:B:29[A]:A:H5''	2.30	0.61
2:A:182:GLU:HG2	2:A:183:LYS:H	1.66	0.61
1:B:38:C:O2	2:A:141:HIS:HE1	1.85	0.60
2:A:169:LEU:HG	2:A:169:LEU:O	2.02	0.60
2:A:115:ALA:HB1	2:A:120:ASP:HB3	1.85	0.58
1:B:33:U:O2	1:B:36:G:O6	2.21	0.58
2:A:103:THR:HG22	2:A:104:LYS:N	2.18	0.58
2:A:127:GLN:O	2:A:131:LEU:HB2	2.03	0.58
1:B:27[A]:A:H2'	1:B:28[A]:G:C4'	2.33	0.58
1:B:27[A]:A:C2'	1:B:28[A]:G:C5'	2.75	0.58
1:B:20:C:O2'	2:A:127:GLN:NE2	2.38	0.57
1:B:36:G:C8	1:B:36:G:H3'	2.41	0.56
1:B:44:C:H5'	1:B:44:C:C6	2.39	0.56
2:A:128:VAL:HG11	2:A:166:LEU:HD11	1.87	0.56
2:A:149:HIS:ND1	2:A:150:HIS:N	2.54	0.56
2:A:177:TYR:O	2:A:181:ILE:HG23	2.06	0.56
1:B:16:U:O2'	1:B:17:A:H5''	2.06	0.55
2:A:173:ASP:CG	2:A:176:ARG:HD3	2.26	0.55
1:B:38:C:H2'	1:B:39:U:O4'	2.05	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:132:THR:HG23	2:A:162:ARG:NH1	2.11	0.55
2:A:127:GLN:HE21	2:A:165:LEU:HD11	1.72	0.55
2:A:181:ILE:C	2:A:181:ILE:HD12	2.28	0.54
1:B:40:G:H2'	1:B:41:G:O4'	2.06	0.54
2:A:149:HIS:HB2	6:A:320:HOH:O	2.07	0.54
1:B:47:C:H5''	6:B:324:HOH:O	2.08	0.54
1:B:39:U:O3'	2:A:138:LEU:HD13	2.07	0.54
2:A:178:ARG:O	2:A:181:ILE:HG13	2.08	0.54
2:A:110:VAL:HG23	2:A:111:MSE:N	2.23	0.54
2:A:177:TYR:CZ	2:A:181:ILE:HG21	2.43	0.53
2:A:173:ASP:OD2	2:A:176:ARG:HD3	2.08	0.53
2:A:132:THR:CG2	2:A:162:ARG:HH12	2.13	0.52
1:B:26:G:O2'	1:B:27[A]:A:H5'	2.09	0.52
1:B:14:G:C2'	1:B:15:C:H5'	2.40	0.52
2:A:119:GLY:O	2:A:121:THR:HG23	2.10	0.51
2:A:104:LYS:O	2:A:106:GLU:N	2.44	0.51
2:A:117:PHE:HB2	2:A:118:PRO:HD2	1.91	0.51
1:B:28[A]:G:C5'	1:B:28[A]:G:H8	2.24	0.51
2:A:103:THR:HG22	2:A:104:LYS:H	1.75	0.51
2:A:148:ASP:O	2:A:150:HIS:N	2.43	0.50
2:A:123:SER:O	2:A:124:THR:CB	2.59	0.50
1:B:27[A]:A:O2'	1:B:28[A]:G:OP1	2.26	0.50
2:A:138:LEU:O	2:A:138:LEU:HG	2.11	0.50
2:A:182:GLU:C	2:A:184:LEU:H	2.15	0.49
1:B:44:C:H6	1:B:44:C:C5'	2.20	0.49
2:A:123:SER:OG	2:A:125:GLU:HG2	2.11	0.49
2:A:136:ASN:O	2:A:138:LEU:N	2.45	0.49
1:B:9:U:H2'	1:B:11:C:H5	1.71	0.49
1:B:36:G:C8	1:B:36:G:C3'	2.96	0.49
1:B:44:C:H2'	1:B:45:A:C8	2.48	0.48
2:A:134:ARG:HH21	2:A:158:MSE:SE	2.46	0.48
2:A:182:GLU:HG2	2:A:183:LYS:N	2.28	0.48
1:B:34:U:O2	1:B:34:U:O4'	2.31	0.48
1:B:14:G:H2'	1:B:15:C:H5'	1.96	0.48
1:B:36:G:H3'	1:B:36:G:H8	1.78	0.48
1:B:33:U:H2'	1:B:35:C:C5	2.49	0.47
2:A:182:GLU:C	2:A:184:LEU:N	2.68	0.47
2:A:125:GLU:N	2:A:125:GLU:OE1	2.48	0.47
2:A:104:LYS:H	2:A:104:LYS:HD2	1.79	0.47
2:A:135:ILE:CG2	2:A:136:ASN:N	2.77	0.47
1:B:35:C:O4'	1:B:36:G:C5	2.67	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:120:ASP:OD2	2:A:123:SER:HB3	2.15	0.47
2:A:107:LYS:HG2	2:A:111:MSE:CE	2.45	0.46
1:B:30:G:H2'	1:B:31:G:O4'	2.15	0.46
1:B:26:G:O3'	1:B:27[B]:A:H5'	2.17	0.45
1:B:27[A]:A:H2'	1:B:28[A]:G:O4'	2.16	0.45
1:B:33:U:P	2:A:147:LYS:HZ3	2.39	0.45
2:A:180:LEU:C	2:A:182:GLU:H	2.20	0.45
1:B:18:G:H1'	6:B:309:HOH:O	2.16	0.45
2:A:155:LEU:O	2:A:159:VAL:HG23	2.16	0.45
2:A:101:PRO:C	2:A:102:ILE:HG13	2.37	0.45
1:B:39:U:OP1	2:A:101:PRO:HD2	2.17	0.44
2:A:132:THR:OG1	2:A:162:ARG:NH1	2.50	0.44
1:B:52:A:H4'	1:B:53:C:O5'	2.18	0.44
2:A:181:ILE:HG21	2:A:186:ILE:HD13	1.99	0.44
1:B:16:U:C2'	1:B:17:A:H5''	2.48	0.44
1:B:27[B]:A:N1	1:B:41:G:N1	2.57	0.44
1:B:54:G:H2'	1:B:55:C:C6	2.53	0.44
2:A:155:LEU:C	2:A:155:LEU:HD13	2.38	0.43
1:B:33:U:OP1	2:A:147:LYS:NZ	2.50	0.43
2:A:138:LEU:HD22	2:A:158:MSE:HE1	2.00	0.43
1:B:47:C:O4'	1:B:47:C:OP2	2.37	0.43
2:A:135:ILE:HG22	2:A:136:ASN:N	2.34	0.43
2:A:163:ARG:HA	2:A:163:ARG:HD3	1.87	0.43
2:A:143:LYS:HD3	2:A:143:LYS:HA	1.73	0.43
2:A:155:LEU:O	2:A:155:LEU:HD13	2.19	0.43
2:A:104:LYS:N	2:A:104:LYS:HD2	2.33	0.43
2:A:104:LYS:C	2:A:106:GLU:N	2.63	0.42
2:A:136:ASN:O	2:A:139:SER:N	2.50	0.42
2:A:105:GLU:HG3	2:A:109:LYS:NZ	2.34	0.42
2:A:136:ASN:C	2:A:138:LEU:N	2.71	0.42
2:A:124:THR:HB	2:A:125:GLU:OE1	2.18	0.42
2:A:163:ARG:NH1	2:A:166:LEU:HD23	2.34	0.42
1:B:3:G:H2'	1:B:4:C:H6	1.85	0.42
2:A:107:LYS:CG	2:A:111:MSE:CE	2.97	0.42
1:B:41:G:P	2:A:134:ARG:HH22	2.42	0.42
2:A:174:PRO:O	2:A:175:GLU:C	2.57	0.42
1:B:42:U:H2'	1:B:43:C:C6	2.55	0.42
1:B:32:C:H2'	1:B:33:U:O4'	2.20	0.41
1:B:36:G:H2'	1:B:37:G:O5'	2.19	0.41
1:B:43:C:H2'	1:B:44:C:C5'	2.33	0.41
1:B:28[A]:G:H3'	1:B:29[A]:A:H5''	2.00	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:105:GLU:O	2:A:109:LYS:HD2	2.21	0.41
1:B:23:U:P	2:A:107:LYS:HE3	2.61	0.41
1:B:37:G:N2	1:B:38:C:C2	2.89	0.41
2:A:178:ARG:HA	2:A:181:ILE:CG1	2.50	0.41
1:B:1:G:H2'	1:B:2:G:O4'	2.21	0.40
1:B:3:G:H2'	1:B:4:C:C6	2.57	0.40
1:B:28[A]:G:C3'	1:B:29[A]:A:C5'	2.99	0.40
2:A:136:ASN:C	2:A:138:LEU:H	2.24	0.40
2:A:149:HIS:O	2:A:152:HIS:N	2.44	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles [i](#)

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

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
2	A	84/86 (98%)	59 (70%)	19 (23%)	6 (7%)	<b>1</b> <b>2</b>

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	A	118	PRO
2	A	137	ARG
2	A	105	GLU
2	A	149	HIS
2	A	142	LEU
2	A	119	GLY

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

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar

resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
2	A	79/75 (105%)	73 (92%)	6 (8%)	13 36

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	A	125	GLU
2	A	131	LEU
2	A	135	ILE
2	A	150	HIS
2	A	166	LEU
2	A	178	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
2	A	112	GLN
2	A	127	GLN
2	A	152	HIS

### 5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	B	53/57 (92%)	11 (20%)	2 (3%)

All (11) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	B	6	G
1	B	16	U
1	B	17	A
1	B	26	G
1	B	35	C
1	B	38	C
1	B	44	C
1	B	47	C
1	B	53	C

*Continued on next page...*

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Mol	Chain	Res	Type
1	B	54	G
1	B	57	C

All (2) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	B	37	G
1	B	52	A

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

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

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 12 ligands modelled in this entry, 12 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

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

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	B	2

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	26:G	O3'	27[B]:A	P	2.96
1	B	29[A]:A	O3'	30:G	P	2.19

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

### 6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.