



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 17, 2023 – 03:01 PM EDT

PDB ID : 2E9R  
Title : Foot-and-mouth disease virus RNA-dependent RNA polymerase in complex with a template-primer RNA and with ribavirin  
Authors : Ferrer-Orta, C.; Arias, A.; Perez-Luque, R.; Escarmis, C.; Domingo, E.; Verdaguier, N.  
Deposited on : 2007-01-26  
Resolution : 2.81 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.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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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)  
Xtriage (Phenix) : 1.13  
EDS : 2.36  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

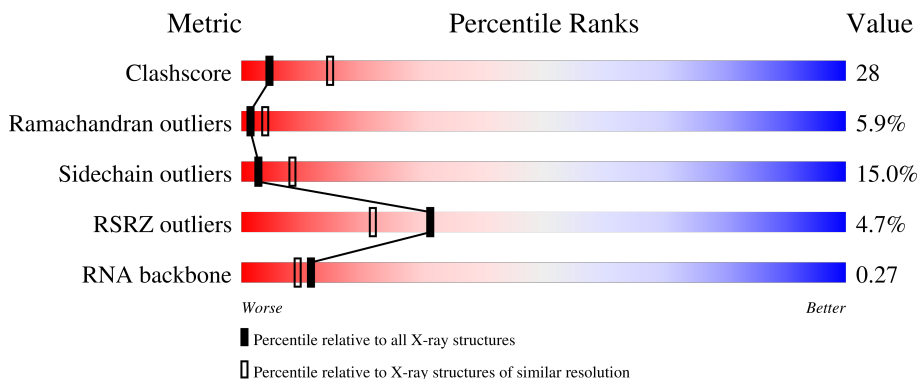
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.81 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	4060 (2.84-2.80)
Ramachandran outliers	138981	3978 (2.84-2.80)
Sidechain outliers	138945	3980 (2.84-2.80)
RSRZ outliers	127900	3552 (2.84-2.80)
RNA backbone	3102	1103 (3.10-2.54)

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  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	9	
2	B	6	
3	X	476	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
5	RTP	X	3832	-	-	X	-

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 4033 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 5'-R(\*CP\*AP\*UP\*GP\*GP\*GP\*CP\*CP\*C)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	A	9	188	85	34	61	8	0	0	0

- Molecule 2 is a RNA chain called 5'-R(\*CP\*CP\*C\*GP\*GP\*GP\*CP\*CP\*C)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	B	6	126	57	24	40	5	0	0	0

- Molecule 3 is a protein called RNA-dependent RNA polymerase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	X	476	3682	2344	639	678	21	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
X	471	ALA	-	cloning artifact	UNP Q0QEE1
X	472	ALA	-	cloning artifact	UNP Q0QEE1
X	473	LEU	-	cloning artifact	UNP Q0QEE1
X	474	GLU	-	cloning artifact	UNP Q0QEE1
X	475	HIS	-	cloning artifact	UNP Q0QEE1
X	476	HIS	-	cloning artifact	UNP Q0QEE1

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
4	X	1	1	1	0	0

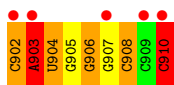
- Molecule 5 is RIBAVIRIN TRIPHOSPHATE (three-letter code: RTP) (formula: C<sub>8</sub>H<sub>15</sub>N<sub>4</sub>O<sub>14</sub>P<sub>3</sub>).



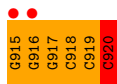
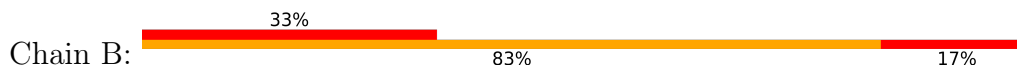
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-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. A red dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

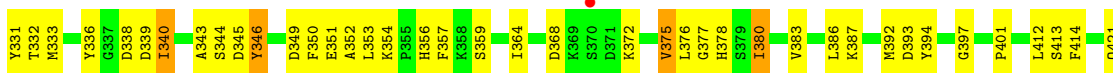
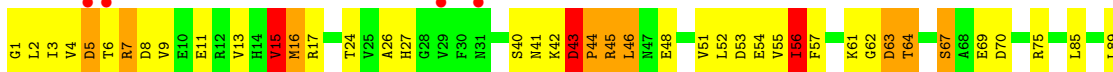
- Molecule 1: 5'-R(\*CP\*AP\*UP\*GP\*GP\*GP\*CP\*CP\*C)-3'



- Molecule 2: 5'-R(\*CP\*CP\*C\*GP\*GP\*GP\*CP\*CP\*C)-3'



- Molecule 3: RNA-dependent RNA polymerase





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	94.09Å 94.09Å 99.28Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.00 – 2.81 29.42 – 2.81	Depositor EDS
% Data completeness (in resolution range)	91.7 (30.00-2.81) 91.8 (29.42-2.81)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	0.09	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.97 (at 2.80Å)	Xtrriage
Refinement program	REFMAC 5.1.24	Depositor
R, $R_{free}$	0.243 , 0.296 0.234 , (Not available)	Depositor DCC
$R_{free}$ test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	64.8	Xtrriage
Anisotropy	0.071	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 49.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.029 for -h,-k,l	Xtrriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	4033	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	51.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.94% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.



## 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: RTP, MG

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	A	1.33	0/209	2.28	12/324 (3.7%)
2	B	1.66	2/140 (1.4%)	2.52	13/217 (6.0%)
3	X	0.97	2/3771 (0.1%)	1.06	14/5118 (0.3%)
All	All	1.02	4/4120 (0.1%)	1.25	39/5659 (0.7%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	X	259	GLU	CD-OE2	-6.35	1.18	1.25
2	B	918	C	C1'-N1	5.72	1.57	1.48
3	X	264	GLU	CG-CD	5.10	1.59	1.51
2	B	915	G	C3'-O3'	5.00	1.49	1.42

All (39) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	915	G	O4'-C1'-N9	12.67	118.34	108.20
1	A	906	G	O4'-C1'-N9	11.23	117.19	108.20
3	X	349	ASP	CB-CG-OD2	8.72	126.14	118.30
3	X	182	ASP	CB-CG-OD2	8.43	125.89	118.30
1	A	906	G	N9-C1'-C2'	-8.01	103.19	112.00
3	X	321	ARG	NE-CZ-NH1	7.96	124.28	120.30
3	X	222	ASP	CB-CG-OD2	7.75	125.28	118.30
2	B	915	G	N9-C1'-C2'	-7.71	103.52	112.00
1	A	903	A	P-O3'-C3'	-7.63	110.54	119.70
1	A	902	C	N1-C2-O2	7.40	123.34	118.90
3	X	240	ASP	CB-CG-OD2	6.84	124.45	118.30
1	A	910	C	C3'-C2'-C1'	-6.60	96.22	101.50
2	B	918	C	P-O3'-C3'	6.54	127.54	119.70
2	B	920	C	N1-C1'-C2'	-6.52	104.83	112.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	902	C	C5'-C4'-O4'	6.21	116.55	109.10
1	A	908	C	O4'-C1'-N1	6.08	113.07	108.20
2	B	919	C	C6-N1-C2	6.07	122.73	120.30
2	B	919	C	N3-C2-O2	5.98	126.08	121.90
1	A	910	C	O4'-C1'-N1	5.82	112.85	108.20
2	B	915	G	C4'-C3'-C2'	-5.78	96.82	102.60
3	X	106	ASP	CB-CG-OD2	5.73	123.45	118.30
2	B	920	C	O4'-C1'-N1	5.70	112.76	108.20
2	B	916	G	C5-C6-O6	-5.67	125.19	128.60
1	A	904	U	C3'-C2'-C1'	-5.65	96.98	101.50
3	X	43	ASP	CB-CG-OD2	5.56	123.31	118.30
2	B	916	G	N1-C6-O6	5.52	123.21	119.90
1	A	902	C	C2'-C3'-O3'	5.50	122.49	113.70
3	X	198	ARG	NE-CZ-NH1	5.41	123.00	120.30
3	X	329	ASP	CB-CG-OD2	5.38	123.14	118.30
2	B	917	G	C5-C6-O6	-5.29	125.42	128.60
1	A	903	A	N3-C4-N9	-5.29	123.17	127.40
1	A	903	A	C3'-C2'-C1'	-5.19	97.35	101.50
2	B	919	C	C2-N1-C1'	-5.15	113.14	118.80
3	X	70	ASP	CB-CG-OD2	5.13	122.92	118.30
3	X	432	VAL	CB-CA-C	-5.12	101.67	111.40
3	X	8	ASP	CB-CG-OD2	5.08	122.87	118.30
3	X	198	ARG	NE-CZ-NH2	-5.08	117.76	120.30
2	B	915	G	P-O3'-C3'	5.06	125.78	119.70
3	X	165	ASP	CB-CG-OD2	5.04	122.83	118.30

There are no chirality outliers.

There are no planarity outliers.

## 5.2 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 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	A	188	0	100	26	0
2	B	126	0	68	10	0
3	X	3682	0	3551	207	0
4	X	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	X	29	0	11	13	0
6	A	1	0	0	0	0
6	B	3	0	0	1	0
6	X	3	0	0	0	0
All	All	4033	0	3730	218	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 28.

All (218) 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)
3:X:245:ASP:OD2	5:X:3832:RTP:H2'	1.53	1.05
1:A:904:U:O2	3:X:299:GLY:HA3	1.67	0.95
3:X:238:ASP:HB2	3:X:383:VAL:HG12	1.48	0.93
3:X:345:ASP:O	3:X:346:TYR:C	2.07	0.90
3:X:245:ASP:OD2	5:X:3832:RTP:C2'	2.22	0.88
3:X:56:ILE:HD12	3:X:180:ILE:HG23	1.55	0.86
3:X:192:THR:HG23	3:X:274:ILE:HD11	1.58	0.83
3:X:245:ASP:HB2	5:X:3832:RTP:O3'	1.80	0.81
3:X:392:MET:SD	3:X:397:GLY:C	2.60	0.80
3:X:338:ASP:HB2	5:X:3832:RTP:H4'	1.62	0.80
2:B:920:C:H2'	5:X:3832:RTP:H5	1.65	0.79
3:X:297:PRO:HD2	3:X:300:CYS:SG	2.23	0.77
3:X:133:ASP:HB2	3:X:138:THR:HB	1.66	0.76
2:B:920:C:OP2	6:B:503:HOH:O	2.05	0.74
3:X:351:GLU:OE2	3:X:354:LYS:NZ	2.19	0.71
3:X:145:ALA:O	3:X:149:LEU:HG	1.89	0.71
3:X:152:LYS:HB2	3:X:152:LYS:NZ	2.06	0.70
3:X:105:VAL:HG22	3:X:106:ASP:H	1.58	0.69
1:A:906:G:H5'	3:X:302:ALA:H	1.57	0.69
1:A:904:U:OP1	3:X:115:THR:HA	1.93	0.69
3:X:51:VAL:HB	3:X:54:GLU:HG3	1.76	0.68
1:A:907:G:H5'	3:X:204:HIS:CE1	2.29	0.68
3:X:195:MET:HG3	3:X:274:ILE:HG21	1.76	0.68
1:A:910:C:C6	1:A:910:C:H3'	2.29	0.67
3:X:89:LEU:HD11	3:X:203:MET:HE3	1.76	0.67
1:A:905:G:H2'	1:A:906:G:C8	2.30	0.67
3:X:218:ASN:O	3:X:220:ASP:N	2.28	0.67
3:X:345:ASP:O	3:X:346:TYR:O	2.13	0.66
3:X:230:PHE:HB2	3:X:380:ILE:HD12	1.77	0.66

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:904:U:C2	3:X:181:VAL:HG13	2.31	0.66
3:X:447:GLN:HE22	3:X:452:ILE:HG12	1.61	0.65
3:X:146:ALA:HA	3:X:149:LEU:HD12	1.80	0.64
3:X:353:LEU:O	3:X:354:LYS:C	2.35	0.64
3:X:392:MET:SD	3:X:397:GLY:O	2.56	0.64
3:X:307:ASN:ND2	5:X:3832:RTP:O2'	2.30	0.64
3:X:218:ASN:C	3:X:220:ASP:H	2.00	0.63
1:A:903:A:H2	3:X:165:ASP:HB3	1.64	0.62
3:X:357:PHE:CD1	3:X:364:ILE:HD13	2.35	0.62
3:X:146:ALA:HA	3:X:149:LEU:CG	2.29	0.62
1:A:904:U:H3	5:X:3832:RTP:HN31	1.49	0.61
3:X:270:ASN:O	3:X:274:ILE:HG22	2.01	0.61
3:X:146:ALA:HA	3:X:149:LEU:HG	1.82	0.60
3:X:245:ASP:CG	5:X:3832:RTP:O2'	2.40	0.60
3:X:213:SER:OG	3:X:215:VAL:HG22	2.01	0.60
3:X:196:ILE:HD12	3:X:200:CYS:SG	2.42	0.59
3:X:412:LEU:HD21	3:X:427:VAL:HG11	1.83	0.59
1:A:906:G:N2	3:X:336:TYR:OH	2.36	0.59
3:X:242:SER:O	3:X:243:ALA:HB3	2.03	0.59
3:X:297:PRO:HB2	3:X:300:CYS:HB3	1.85	0.59
3:X:146:ALA:HA	3:X:149:LEU:CD1	2.33	0.59
3:X:41:ASN:HB3	3:X:52:LEU:HB3	1.85	0.58
3:X:133:ASP:O	3:X:134:PHE:C	2.41	0.58
2:B:918:C:H2'	2:B:919:C:C6	2.39	0.58
3:X:150:MET:SD	3:X:155:TYR:CD2	2.96	0.58
3:X:167:ILE:HD11	3:X:414:PHE:HB2	1.86	0.57
3:X:133:ASP:CB	3:X:138:THR:HB	2.32	0.57
3:X:333:MET:HE3	3:X:340:ILE:CD1	2.35	0.57
3:X:152:LYS:HB2	3:X:152:LYS:HZ2	1.67	0.57
3:X:241:TYR:OH	3:X:311:ASN:ND2	2.38	0.57
3:X:111:MET:SD	3:X:190:LEU:HD23	2.45	0.57
1:A:904:U:OP1	3:X:115:THR:CA	2.53	0.56
3:X:274:ILE:HD13	3:X:275:LEU:N	2.21	0.56
3:X:132:ILE:HA	3:X:138:THR:O	2.05	0.56
3:X:97:SER:O	3:X:98:ILE:C	2.41	0.56
3:X:321:ARG:HD3	3:X:356:HIS:HD2	1.71	0.56
1:A:910:C:C6	1:A:910:C:C3'	2.89	0.56
3:X:150:MET:CG	3:X:155:TYR:CD2	2.88	0.56
3:X:6:THR:HG21	3:X:288:LYS:HB3	1.88	0.55
3:X:180:ILE:HD13	3:X:180:ILE:H	1.71	0.55
3:X:97:SER:O	3:X:100:GLU:N	2.39	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:X:192:THR:HG23	3:X:274:ILE:CD1	2.34	0.54
3:X:299:GLY:CA	5:X:3832:RTP:O3	2.56	0.54
3:X:5:ASP:O	3:X:7:ARG:CZ	2.56	0.53
3:X:6:THR:OG1	3:X:290:ILE:HG13	2.08	0.53
3:X:4:VAL:CG2	3:X:5:ASP:N	2.71	0.53
3:X:27:HIS:C	3:X:27:HIS:ND1	2.61	0.53
3:X:322:HIS:CE1	3:X:352:ALA:HB1	2.44	0.53
3:X:245:ASP:CG	5:X:3832:RTP:C2'	2.76	0.53
3:X:317:TYR:CD1	3:X:317:TYR:C	2.82	0.53
3:X:235:ASN:HB2	3:X:344:SER:O	2.08	0.53
3:X:322:HIS:ND1	3:X:356:HIS:CE1	2.76	0.53
3:X:350:PHE:HA	3:X:353:LEU:HG	1.90	0.53
2:B:920:C:H2'	5:X:3832:RTP:C5	2.39	0.52
3:X:124:GLN:HE21	3:X:126:LYS:HE3	1.75	0.52
3:X:218:ASN:C	3:X:220:ASP:N	2.62	0.52
1:A:904:U:H5'	3:X:116:ALA:HB3	1.91	0.52
3:X:297:PRO:O	3:X:298:SER:C	2.48	0.52
3:X:152:LYS:O	3:X:153:ARG:HB2	2.10	0.52
3:X:299:GLY:N	5:X:3832:RTP:O3	2.42	0.51
1:A:907:G:H1'	3:X:336:TYR:OH	2.10	0.51
3:X:124:GLN:O	3:X:125:GLY:O	2.29	0.51
3:X:97:SER:O	3:X:99:TYR:N	2.44	0.51
3:X:392:MET:SD	3:X:397:GLY:HA2	2.51	0.51
3:X:473:LEU:C	3:X:475:HIS:H	2.14	0.51
2:B:919:C:C4	2:B:920:C:C4	3.00	0.50
1:A:905:G:H4'	3:X:301:SER:HA	1.93	0.50
3:X:9:VAL:HG13	3:X:11:GLU:O	2.10	0.50
3:X:131:LEU:HB3	3:X:143:VAL:HG23	1.93	0.50
3:X:150:MET:HG3	3:X:155:TYR:CG	2.47	0.50
3:X:273:TRP:O	3:X:277:THR:HG23	2.12	0.50
3:X:2:LEU:HD13	3:X:62:GLY:HA2	1.94	0.49
3:X:94:ALA:HB3	3:X:198:ARG:NH2	2.27	0.49
1:A:904:U:O2	3:X:181:VAL:HG13	2.11	0.49
1:A:905:G:O4'	3:X:299:GLY:O	2.30	0.49
3:X:215:VAL:HG21	3:X:305:ILE:HD13	1.94	0.49
3:X:45:ARG:O	3:X:46:LEU:C	2.50	0.49
3:X:101:ALA:HB1	3:X:190:LEU:HD22	1.95	0.49
1:A:904:U:O4'	3:X:183:VAL:HG22	2.13	0.49
3:X:96:LEU:HG	3:X:100:GLU:HB2	1.95	0.49
3:X:102:ILE:HD13	3:X:132:ILE:HG23	1.95	0.48
3:X:429:GLY:HA2	3:X:432:VAL:HG22	1.95	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:907:G:O5'	3:X:109:ASP:OD2	2.31	0.48
3:X:207:ASN:HA	3:X:211:ILE:HD11	1.95	0.48
3:X:474:GLU:O	3:X:474:GLU:HG3	2.13	0.48
3:X:124:GLN:HE21	3:X:126:LYS:CE	2.26	0.48
3:X:169:PRO:HG2	3:X:172:LYS:HG3	1.94	0.48
3:X:375:VAL:HG22	3:X:378:HIS:CE1	2.49	0.48
3:X:333:MET:HE3	3:X:340:ILE:HD12	1.95	0.47
3:X:133:ASP:CG	3:X:138:THR:HB	2.35	0.47
3:X:444:GLU:N	3:X:445:PRO:HD2	2.29	0.47
2:B:919:C:N4	2:B:920:C:N4	2.63	0.47
3:X:75:ARG:HG3	3:X:259:GLU:OE2	2.13	0.47
3:X:98:ILE:O	3:X:102:ILE:HG13	2.14	0.47
3:X:392:MET:SD	3:X:397:GLY:CA	3.02	0.47
3:X:438:GLU:OE1	3:X:441:ARG:NE	2.48	0.47
3:X:124:GLN:O	3:X:125:GLY:C	2.53	0.47
2:B:920:C:O3'	3:X:338:ASP:HB3	2.15	0.47
3:X:297:PRO:CD	3:X:300:CYS:SG	3.00	0.47
3:X:133:ASP:O	3:X:136:ASN:N	2.46	0.47
3:X:43:ASP:HA	3:X:44:PRO:HD2	1.83	0.47
3:X:152:LYS:O	3:X:153:ARG:CB	2.63	0.46
1:A:905:G:H2'	1:A:906:G:H8	1.79	0.46
3:X:13:VAL:H	3:X:286:GLU:HA	1.80	0.46
3:X:230:PHE:CB	3:X:380:ILE:HD12	2.44	0.46
3:X:428:ALA:HB1	3:X:458:LEU:HD11	1.98	0.46
3:X:55:VAL:HG11	3:X:177:LYS:HD3	1.97	0.46
3:X:42:LYS:O	3:X:43:ASP:C	2.54	0.46
3:X:248:HIS:CD2	3:X:310:LEU:HD12	2.52	0.45
3:X:57:PHE:CZ	3:X:290:ILE:HD13	2.51	0.45
3:X:96:LEU:HD22	3:X:197:GLY:HA3	1.97	0.45
3:X:102:ILE:HG21	3:X:137:GLY:HA2	1.99	0.45
3:X:121:TRP:O	3:X:126:LYS:HG3	2.17	0.45
3:X:167:ILE:HG22	3:X:168:ARG:N	2.30	0.45
3:X:332:THR:HG22	3:X:343:ALA:HB3	1.98	0.45
1:A:905:G:P	3:X:128:ARG:HH22	2.40	0.45
3:X:96:LEU:HB3	3:X:194:MET:HA	1.97	0.45
3:X:132:ILE:HD11	3:X:143:VAL:HG21	1.99	0.45
3:X:180:ILE:H	3:X:180:ILE:CD1	2.29	0.44
1:A:905:G:N3	3:X:303:THR:CG2	2.80	0.44
3:X:63:ASP:O	3:X:64:THR:C	2.56	0.44
3:X:215:VAL:HG21	3:X:305:ILE:CD1	2.47	0.44
2:B:919:C:O2'	3:X:386:LEU:HB3	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:906:G:OP1	3:X:193:ARG:NH1	2.51	0.44
3:X:219:PRO:O	3:X:401:PRO:HG3	2.18	0.44
3:X:235:ASN:ND2	3:X:377:GLY:H	2.14	0.44
3:X:322:HIS:ND1	3:X:356:HIS:HE1	2.16	0.44
3:X:375:VAL:HG23	3:X:376:LEU:O	2.18	0.44
3:X:26:ALA:HB2	3:X:446:PHE:CZ	2.52	0.44
2:B:917:G:H5''	3:X:423:LYS:NZ	2.32	0.44
1:A:903:A:N1	3:X:165:ASP:O	2.51	0.43
3:X:468:GLY:O	3:X:471:ALA:HB3	2.18	0.43
3:X:470:ALA:C	3:X:473:LEU:H	2.21	0.43
3:X:393:ASP:OD2	3:X:459:TYR:OH	2.34	0.43
3:X:153:ARG:HG2	3:X:270:ASN:HD21	1.83	0.43
3:X:196:ILE:HD12	3:X:200:CYS:HG	1.83	0.43
3:X:155:TYR:CE2	3:X:157:PHE:HD2	2.37	0.43
1:A:904:U:C2	3:X:181:VAL:CG1	3.01	0.43
3:X:427:VAL:O	3:X:427:VAL:HG12	2.18	0.43
3:X:85:LEU:HD11	3:X:203:MET:CE	2.48	0.42
3:X:445:PRO:HB2	3:X:446:PHE:CD1	2.54	0.42
3:X:424:LEU:HD22	3:X:443:PHE:CE2	2.54	0.42
3:X:446:PHE:O	3:X:449:LEU:HB2	2.19	0.42
3:X:386:LEU:O	3:X:387:LYS:HB2	2.19	0.42
3:X:438:GLU:O	3:X:439:TYR:C	2.55	0.42
3:X:164:LYS:HG3	3:X:181:VAL:HG23	2.01	0.42
3:X:182:ASP:OD2	3:X:283:HIS:ND1	2.47	0.42
3:X:43:ASP:O	3:X:46:LEU:HB2	2.20	0.42
3:X:286:GLU:HG2	3:X:287:ASN:H	1.85	0.42
3:X:300:CYS:O	3:X:301:SER:O	2.37	0.42
3:X:421:GLN:O	3:X:425:ILE:HG12	2.20	0.42
3:X:242:SER:HA	5:X:3832:RTP:O2G	2.20	0.42
3:X:121:TRP:CH2	3:X:142:GLU:HG2	2.55	0.42
3:X:167:ILE:CG2	3:X:168:ARG:N	2.82	0.42
1:A:904:U:OP1	3:X:115:THR:CB	2.67	0.42
3:X:24:THR:H	3:X:27:HIS:HB2	1.85	0.42
3:X:150:MET:SD	3:X:155:TYR:CE2	3.12	0.42
3:X:331:TYR:CD1	3:X:331:TYR:N	2.87	0.42
3:X:413:SER:HB2	3:X:414:PHE:CD1	2.54	0.42
3:X:105:VAL:HG22	3:X:106:ASP:N	2.30	0.42
3:X:447:GLN:OE1	3:X:447:GLN:HA	2.19	0.42
3:X:473:LEU:C	3:X:475:HIS:N	2.74	0.42
3:X:243:ALA:O	3:X:244:PHE:C	2.58	0.42
3:X:412:LEU:CD2	3:X:427:VAL:HG11	2.48	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:X:241:TYR:O	3:X:242:SER:HB3	2.19	0.41
3:X:259:GLU:HA	3:X:259:GLU:OE1	2.21	0.41
3:X:3:ILE:HG22	3:X:5:ASP:N	2.34	0.41
3:X:15:VAL:O	3:X:16:MET:C	2.58	0.41
2:B:919:C:O3'	3:X:387:LYS:HG2	2.19	0.41
3:X:4:VAL:HG23	3:X:5:ASP:N	2.36	0.41
3:X:251:ASP:OD1	3:X:251:ASP:N	2.52	0.41
3:X:45:ARG:O	3:X:46:LEU:O	2.39	0.41
3:X:56:ILE:CD1	3:X:180:ILE:HG23	2.38	0.41
3:X:91:THR:O	3:X:91:THR:OG1	2.31	0.41
3:X:377:GLY:O	3:X:378:HIS:C	2.59	0.41
3:X:300:CYS:O	3:X:303:THR:HB	2.21	0.41
3:X:427:VAL:O	3:X:427:VAL:CG1	2.69	0.41
3:X:150:MET:HG2	3:X:155:TYR:CD2	2.56	0.41
3:X:152:LYS:HB2	3:X:152:LYS:HZ3	1.83	0.41
3:X:1:GLY:N	3:X:246:ALA:O	2.46	0.41
3:X:297:PRO:O	3:X:300:CYS:SG	2.78	0.41
3:X:100:GLU:O	3:X:104:GLY:N	2.54	0.40
3:X:180:ILE:HD13	3:X:180:ILE:N	2.34	0.40
3:X:193:ARG:O	3:X:197:GLY:HA3	2.21	0.40
3:X:150:MET:HG3	3:X:155:TYR:CB	2.52	0.40
3:X:100:GLU:O	3:X:101:ALA:C	2.60	0.40
3:X:272:GLU:O	3:X:276:LYS:HG3	2.21	0.40
3:X:75:ARG:CG	3:X:259:GLU:OE2	2.69	0.40
3:X:193:ARG:HG2	3:X:193:ARG:HH11	1.85	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
3	X	474/476 (100%)	398 (84%)	48 (10%)	28 (6%)	<b>1</b> <b>4</b>



All (28) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	X	5	ASP
3	X	15	VAL
3	X	46	LEU
3	X	56	ILE
3	X	134	PHE
3	X	242	SER
3	X	301	SER
3	X	16	MET
3	X	125	GLY
3	X	372	LYS
3	X	40	SER
3	X	45	ARG
3	X	63	ASP
3	X	64	THR
3	X	124	GLN
3	X	137	GLY
3	X	467	CYS
3	X	474	GLU
3	X	44	PRO
3	X	67	SER
3	X	219	PRO
3	X	241	TYR
3	X	346	TYR
3	X	113	PRO
3	X	141	PRO
3	X	43	ASP
3	X	394	TYR
3	X	105	VAL

### 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
3	X	379/399 (95%)	322 (85%)	57 (15%)	<b>3</b> <b>8</b>

All (57) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	X	7	ARG
3	X	15	VAL
3	X	17	ARG
3	X	48	GLU
3	X	53	ASP
3	X	56	ILE
3	X	61	LYS
3	X	67	SER
3	X	69	GLU
3	X	91	THR
3	X	100	GLU
3	X	123	LEU
3	X	126	LYS
3	X	147	LEU
3	X	152	LYS
3	X	154	GLU
3	X	162	PHE
3	X	170	MET
3	X	180	ILE
3	X	182	ASP
3	X	186	VAL
3	X	198	ARG
3	X	202	GLN
3	X	211	ILE
3	X	217	CYS
3	X	223	TRP
3	X	228	THR
3	X	240	ASP
3	X	245	ASP
3	X	250	SER
3	X	251	ASP
3	X	264	GLU
3	X	274	ILE
3	X	289	ARG
3	X	298	SER
3	X	310	LEU
3	X	311	ASN
3	X	317	TYR
3	X	323	TYR
3	X	329	ASP
3	X	339	ASP
3	X	340	ILE
3	X	359	SER

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Mol	Chain	Res	Type
3	X	368	ASP
3	X	375	VAL
3	X	380	ILE
3	X	423	LYS
3	X	426	SER
3	X	432	VAL
3	X	437	ASP
3	X	445	PRO
3	X	449	LEU
3	X	452	ILE
3	X	461	ARG
3	X	467	CYS
3	X	469	ASP
3	X	474	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
3	X	31	ASN
3	X	124	GLN
3	X	188	HIS
3	X	235	ASN
3	X	247	ASN
3	X	248	HIS
3	X	254	ASN
3	X	280	ASN
3	X	307	ASN
3	X	311	ASN
3	X	356	HIS
3	X	362	GLN

### 5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	A	9/9 (100%)	3 (33%)	1 (11%)
2	B	6/6 (100%)	2 (33%)	1 (16%)
All	All	15/15 (100%)	5 (33%)	2 (13%)

All (5) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	A	903	A
1	A	908	C
1	A	910	C
2	B	916	G
2	B	920	C

All (2) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	A	902	C
2	B	915	G

## 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 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
5	RTP	X	3832	-	23,30,30	1.97	4 (17%)	29,47,47	2.07	10 (34%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	RTP	X	3832	-	-	5/18/42/42	0/2/2/2

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	X	3832	RTP	C3-C6	-7.12	1.47	1.53
5	X	3832	RTP	C3-N2	3.70	1.37	1.34
5	X	3832	RTP	C6-N3	2.32	1.37	1.33
5	X	3832	RTP	PA-O1A	2.13	1.58	1.50

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	X	3832	RTP	C3'-C2'-C1'	4.26	107.40	100.98
5	X	3832	RTP	N2-C3-N4	-3.84	111.53	114.72
5	X	3832	RTP	O3'-C3'-C2'	3.71	123.83	111.82
5	X	3832	RTP	PA-O3A-PB	-3.41	121.14	132.83
5	X	3832	RTP	O4'-C4'-C3'	3.33	111.70	105.11
5	X	3832	RTP	O3-C6-N3	2.88	126.67	122.58
5	X	3832	RTP	O2A-PA-O1A	2.83	126.25	112.24
5	X	3832	RTP	O3G-PG-O2G	2.78	118.25	107.64
5	X	3832	RTP	O4'-C4'-C5'	2.43	117.36	109.37
5	X	3832	RTP	C3-C6-N3	-2.35	111.94	115.85

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	X	3832	RTP	C5'-O5'-PA-O1A
5	X	3832	RTP	PB-O3A-PA-O5'
5	X	3832	RTP	O4'-C4'-C5'-O5'
5	X	3832	RTP	C5'-O5'-PA-O3A
5	X	3832	RTP	PA-O3A-PB-O2B

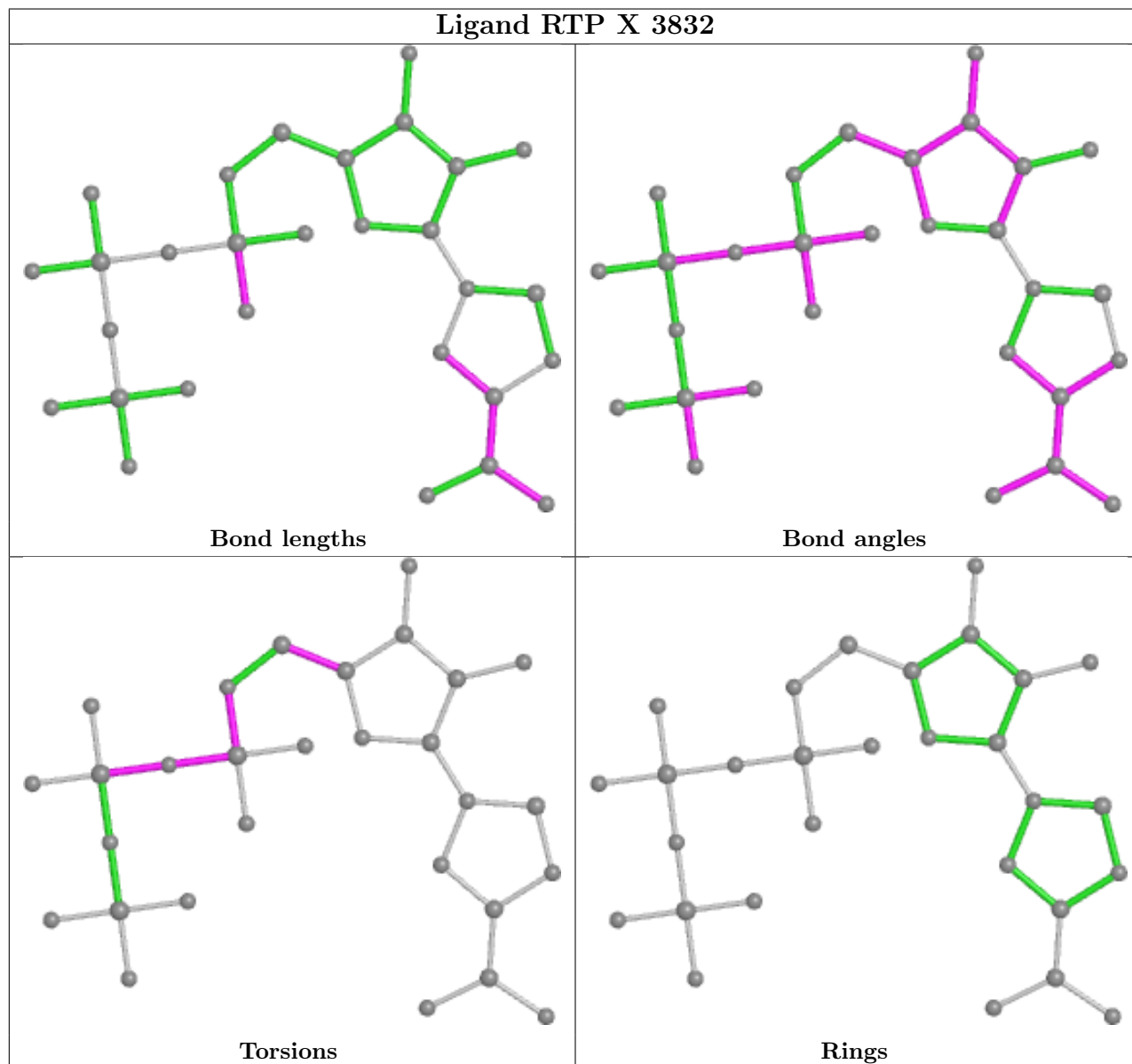
There are no ring outliers.

1 monomer is involved in 13 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	X	3832	RTP	13	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In

addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



## 5.7 Other polymers [\(i\)](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues

There are no chain breaks in this entry.

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	9/9 (100%)	2.57	5 (55%) <b>0</b> <b>0</b>	72, 76, 84, 86	9 (100%)
2	B	6/6 (100%)	2.91	2 (33%) <b>0</b> <b>0</b>	55, 72, 79, 83	6 (100%)
3	X	476/476 (100%)	-0.05	16 (3%) 45 35	27, 49, 68, 78	0
All	All	491/491 (100%)	0.03	23 (4%) 31 22	27, 49, 70, 86	15 (3%)

All (23) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	915	G	7.8
1	A	907	G	4.5
1	A	902	C	3.8
1	A	910	C	3.7
2	B	916	G	3.5
1	A	909	C	3.0
3	X	6	THR	2.8
3	X	31	ASN	2.8
3	X	134	PHE	2.8
3	X	370	SER	2.8
3	X	5	ASP	2.8
3	X	474	GLU	2.8
3	X	106	ASP	2.7
3	X	475	HIS	2.7
3	X	114	ASP	2.5
3	X	287	ASN	2.5
3	X	304	SER	2.4
1	A	903	A	2.2
3	X	182	ASP	2.2
3	X	298	SER	2.2
3	X	303	THR	2.2
3	X	307	ASN	2.1
3	X	29	VAL	2.1



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

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

## 6.3 Carbohydrates [i](#)

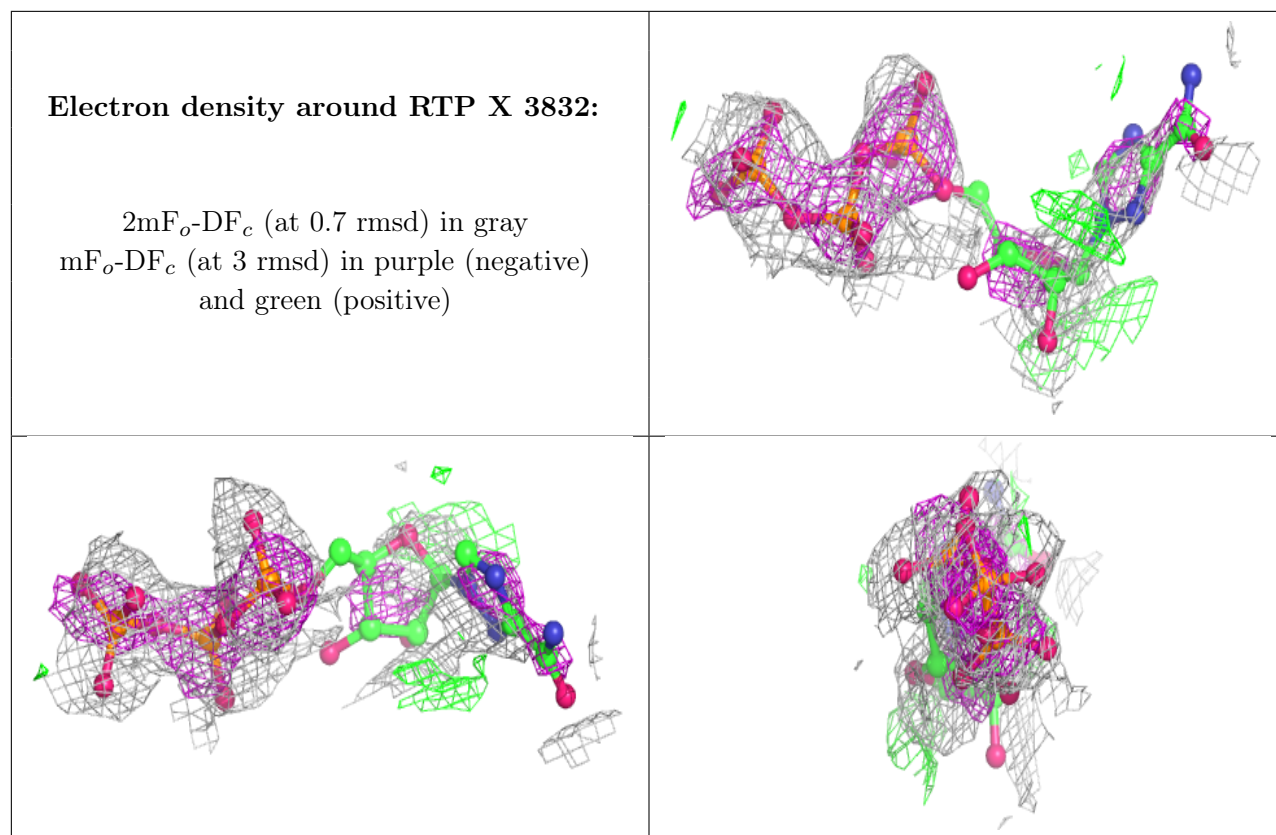
There are no monosaccharides in this entry.

## 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
4	MG	X	665	1/1	0.70	0.37	34,34,34,34	1
5	RTP	X	3832	29/29	0.78	0.35	34,37,44,48	29

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



## 6.5 Other polymers [i](#)

There are no such residues in this entry.