



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 24, 2020 – 05:47 am BST

PDB ID : 3K49  
Title : Puf3 RNA binding domain bound to Cox17 RNA 3' UTR recognition sequence site B  
Authors : Zhu, D.; Stumpf, C.R.; Krahn, J.M.; Wickens, M.; Hall, T.M.T.  
Deposited on : 2009-10-05  
Resolution : 2.50 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
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)	:	2.11

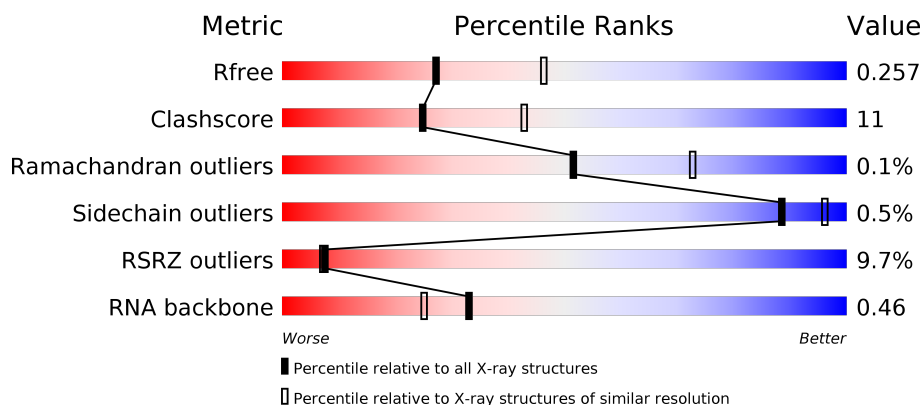
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*


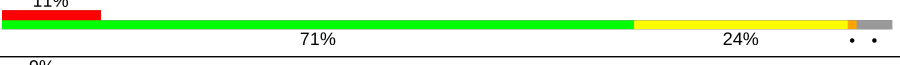
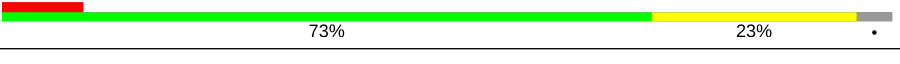

The reported resolution of this entry is 2.50 Å.

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))
$R_{free}$	130704	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (2.50-2.50)
RNA backbone	3102	1008 (2.84-2.16)

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 on 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	369	
1	C	369	
1	E	369	
2	B	10	

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Mol	Chain	Length	Quality of chain
2	D	10	 70%30%
2	F	10	 70%30%

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 9635 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 protein called mRNA-binding protein PUF3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	353	Total	C	N	O	S	0	0	0
			2847	1808	482	547	10			
1	C	353	Total	C	N	O	S	0	0	0
			2847	1808	482	547	10			
1	E	353	Total	C	N	O	S	0	0	0
			2847	1808	482	547	10			

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	10	Total	C	N	O	P	0	0	0
			208	95	37	67	9			
2	D	10	Total	C	N	O	P	0	0	0
			208	95	37	67	9			
2	F	10	Total	C	N	O	P	0	0	0
			208	95	37	67	9			

- Molecule 3 is CITRIC ACID (three-letter code: CIT) (formula: C<sub>6</sub>H<sub>8</sub>O<sub>7</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			13	6	7		
3	C	1	Total	C	O	0	0
			13	6	7		
3	E	1	Total	C	O	0	0
			13	6	7		

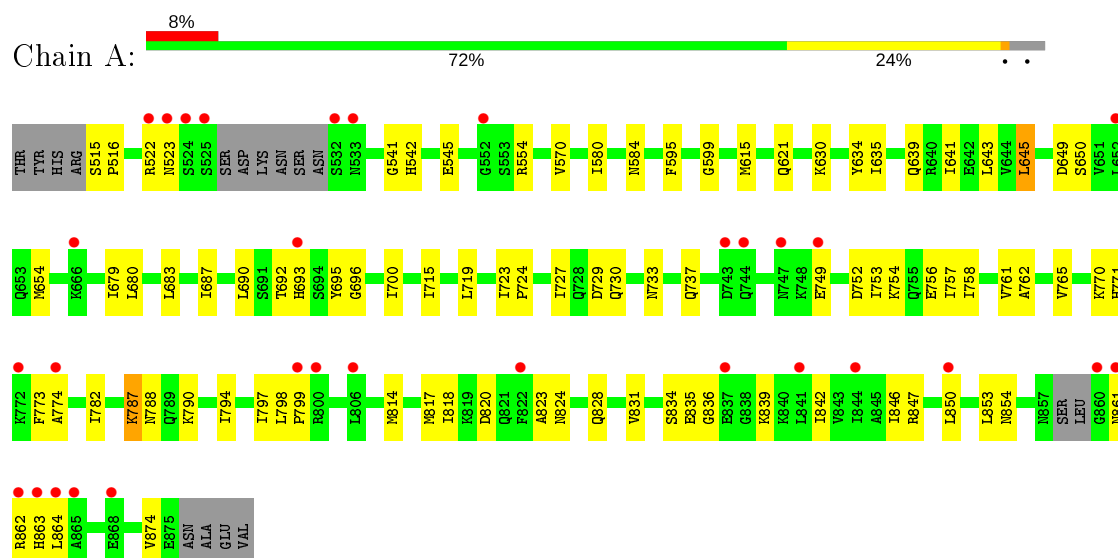
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	132	Total	O	0	0
			132	132		
4	B	10	Total	O	0	0
			10	10		
4	C	120	Total	O	0	0
			120	120		
4	D	9	Total	O	0	0
			9	9		
4	E	154	Total	O	0	0
			154	154		
4	F	6	Total	O	0	0
			6	6		

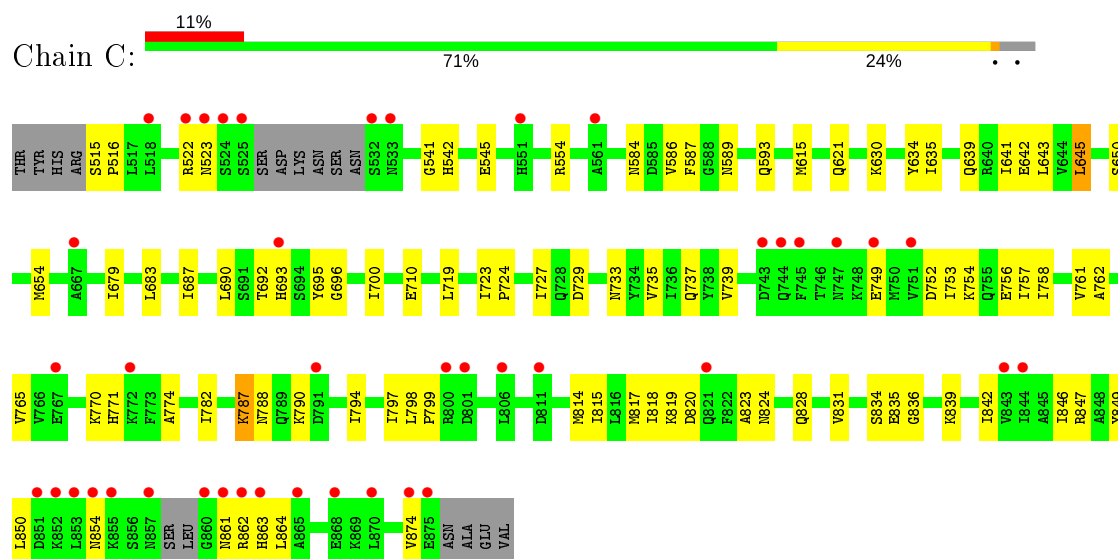
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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 ( $\text{RSRZ} > 2$ ). 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: mRNA-binding protein PUF3



#### • Molecule 1: mRNA-binding protein PUF3



#### • Molecule 1: mRNA-binding protein PUF3



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	151.13 Å   87.07 Å   125.18 Å 90.00°   116.48°   90.00°	Depositor
Resolution (Å)	36.61 – 2.50 36.61 – 2.48	Depositor EDS
% Data completeness (in resolution range)	94.3 (36.61-2.50) 93.4 (36.61-2.48)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	0.10	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.88 (at 2.48 Å)	Xtriage
Refinement program	PHENIX	Depositor
R, $R_{free}$	0.228 , 0.263 0.224 , 0.257	Depositor DCC
$R_{free}$ test set	2429 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	41.3	Xtriage
Anisotropy	0.931	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 65.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.46$ , $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	0.074 for $1/2^*h-3/2^*k,-1/2^*h-1/2^*k,-1/2^*h+1/2^*k-l$ 0.087 for $1/2^*h+3/2^*k,1/2^*h-1/2^*k,-1/2^*h-1/2^*k-l$	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	9635	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	62.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.00% 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: CIT

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	0.38	0/2888	0.49	0/3885
1	C	0.39	0/2888	0.49	0/3885
1	E	0.40	0/2888	0.51	0/3885
2	B	0.58	0/232	1.10	1/359 (0.3%)
2	D	0.52	0/232	0.89	0/359
2	F	0.59	0/232	1.08	1/359 (0.3%)
All	All	0.41	0/9360	0.56	2/12732 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
2	B	1	C	C5-C6-N1	6.49	124.25	121.00
2	F	1	C	C6-N1-C1'	-5.01	114.79	120.80

There are no chirality outliers.

There are no planarity outliers.

### 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	A	2847	0	2876	66	1
1	C	2847	0	2876	69	1
1	E	2847	0	2876	59	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	208	0	109	1	0
2	D	208	0	109	3	0
2	F	208	0	109	1	0
3	A	13	0	5	0	0
3	C	13	0	5	0	0
3	E	13	0	5	1	0
4	A	132	0	0	1	0
4	B	10	0	0	0	0
4	C	120	0	0	0	1
4	D	9	0	0	0	0
4	E	154	0	0	0	1
4	F	6	0	0	0	0
All	All	9635	0	8970	196	2

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 11.

The worst 5 of 196 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:A:584:ASN:ND2	1:A:621:GLN:HE22	1.80	0.79
1:E:584:ASN:ND2	1:E:621:GLN:HE22	1.85	0.74
1:A:753:ILE:HD13	1:A:756:GLU:OE2	1.89	0.72
1:C:584:ASN:ND2	1:C:621:GLN:HE22	1.86	0.71
1:E:753:ILE:HD13	1:E:756:GLU:OE2	1.91	0.69

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:C:103:HOH:O	4:E:410:HOH:O[2_555]	2.13	0.07
1:A:649:ASP:OD2	1:C:642:GLU:OE1[4_444]	2.14	0.06

## 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	
1	A	347/369 (94%)	335 (96%)	12 (4%)	0	100	100
1	C	347/369 (94%)	335 (96%)	12 (4%)	0	100	100
1	E	347/369 (94%)	335 (96%)	11 (3%)	1 (0%)	41	61
All	All	1041/1107 (94%)	1005 (96%)	35 (3%)	1 (0%)	51	73

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	746	THR

### 5.3.2 Protein sidechains ⓘ

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	
1	A	324/339 (96%)	322 (99%)	2 (1%)	86	95
1	C	324/339 (96%)	322 (99%)	2 (1%)	86	95
1	E	324/339 (96%)	323 (100%)	1 (0%)	92	97
All	All	972/1017 (96%)	967 (100%)	5 (0%)	88	96

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	645	LEU
1	A	787	LYS
1	C	645	LEU
1	C	787	LYS
1	E	645	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	542	HIS
1	E	621	GLN
1	C	621	GLN
1	A	863	HIS
1	C	550	GLN

### 5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	B	9/10 (90%)	0	0
2	D	9/10 (90%)	0	0
2	F	9/10 (90%)	0	0
All	All	27/30 (90%)	0	0

There are no RNA backbone outliers to report.

There are no RNA pucker outliers to report.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

## 5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

3 ligands are modelled in this entry.

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	$\# Z  > 2$
3	CIT	E	3	-	3,12,12	1.51	0	3,17,17	2.76	2 (66%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
3	CIT	C	2	-	3,12,12	1.38	0	3,17,17	1.59	1 (33%)
3	CIT	A	1	-	3,12,12	1.25	0	3,17,17	1.83	1 (33%)

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. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	CIT	E	3	-	-	4/6/16/16	-
3	CIT	C	2	-	-	3/6/16/16	-
3	CIT	A	1	-	-	3/6/16/16	-

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	E	3	CIT	C3-C2-C1	-3.88	108.77	114.98
3	E	3	CIT	C3-C4-C5	-2.67	110.71	114.98
3	A	1	CIT	C3-C2-C1	-2.57	110.87	114.98
3	C	2	CIT	C3-C4-C5	-2.30	111.31	114.98

There are no chirality outliers.

5 of 10 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	E	3	CIT	C1-C2-C3-C6
3	A	1	CIT	C2-C3-C4-C5
3	A	1	CIT	O7-C3-C4-C5
3	A	1	CIT	C6-C3-C4-C5
3	E	3	CIT	C1-C2-C3-O7

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	E	3	CIT	1	0

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

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

There are no chain breaks in this entry.

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

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

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	353/369 (95%)	0.54	31 (8%) 10 10	28, 54, 112, 127	0
1	C	353/369 (95%)	0.68	42 (11%) 4 4	28, 55, 113, 137	0
1	E	353/369 (95%)	0.58	33 (9%) 8 8	29, 54, 113, 132	0
2	B	10/10 (100%)	-0.42	0 100 100	43, 57, 96, 106	0
2	D	10/10 (100%)	-0.47	0 100 100	45, 57, 96, 105	0
2	F	10/10 (100%)	-0.55	0 100 100	43, 56, 96, 105	0
All	All	1089/1137 (95%)	0.57	106 (9%) 7 7	28, 54, 113, 137	0

The worst 5 of 106 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	860	GLY	15.0
1	E	861	ASN	9.7
1	E	525	SER	9.5
1	C	853	LEU	8.8
1	C	861	ASN	8.4

### 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 carbohydrates 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(Å <sup>2</sup> )	Q<0.9
3	CIT	A	1	13/13	0.48	0.36	95,118,128,132	0
3	CIT	C	2	13/13	0.67	0.28	86,100,108,110	0
3	CIT	E	3	13/13	0.85	0.18	70,87,95,97	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.