



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 20, 2023 – 02:43 PM EDT

PDB ID : 5I57  
Title : Glutamate- and glycine-bound GluN1/GluN2A agonist binding domains  
Authors : Mou, T.-C.; Sprang, S.R.; Hansen, K.B.  
Deposited on : 2016-02-14  
Resolution : 1.70 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)  
Xtrriage (Phenix) : 1.13  
EDS : 2.35.1  
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) : 2.35.1

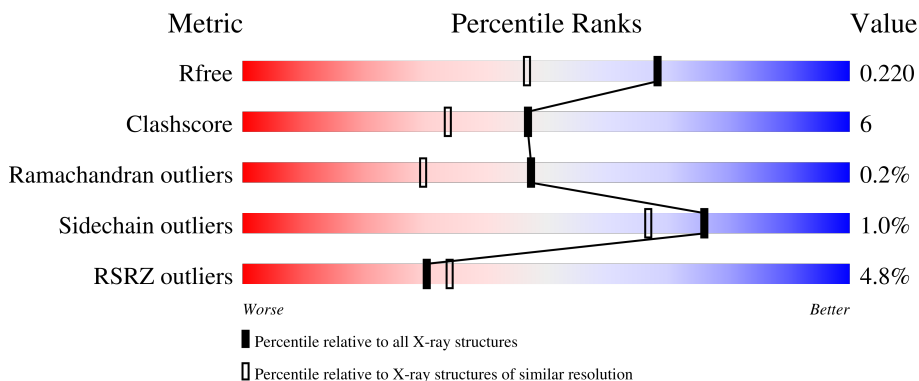
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.70 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	4298 (1.70-1.70)
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)
RSRZ outliers	127900	4222 (1.70-1.70)

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	292	
2	B	281	

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 4953 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 Glutamate receptor ionotropic, NMDA 1, Glutamate receptor ionotropic, NMDA 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	281	2269	1444	390	418	17	0	4	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	expression tag	UNP P35439
A	153	GLY	-	linker	UNP P35439
A	154	THR	-	linker	UNP P35439

- Molecule 2 is a protein called Glutamate receptor ionotropic, NMDA 2A, Glutamate receptor ionotropic, NMDA 2A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	277	2184	1387	374	409	14	0	1	0

There are 4 discrepancies between the modelled and reference sequences:

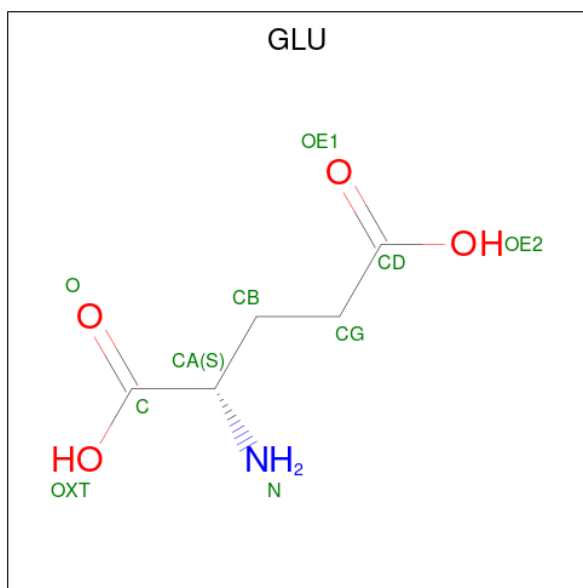
Chain	Residue	Modelled	Actual	Comment	Reference
B	4	SER	-	expression tag	UNP Q00959
B	143	GLY	-	linker	UNP Q00959
B	144	THR	-	linker	UNP Q00959
B	242	THR	SER	see remark 999	UNP Q00959

- Molecule 3 is GLYCINE (three-letter code: GLY) (formula: C<sub>2</sub>H<sub>5</sub>NO<sub>2</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
3	A	1	5	2	1	2	0	0

- Molecule 4 is GLUTAMIC ACID (three-letter code: GLU) (formula: C<sub>5</sub>H<sub>9</sub>NO<sub>4</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
4	B	1	10	5	1	4	0	0


- Molecule 5 is water.

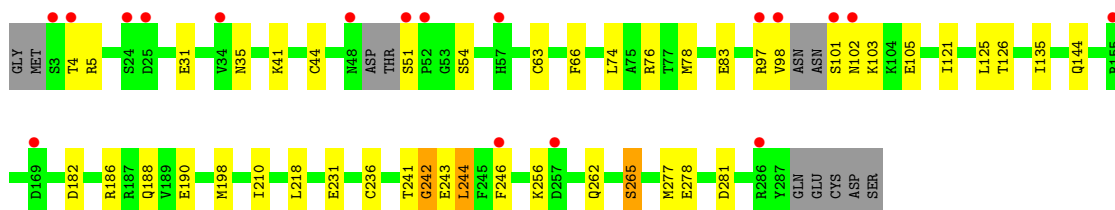
<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
5	A	216	Total 216	O 216	0	0
5	B	269	Total 269	O 269	0	0

### 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.

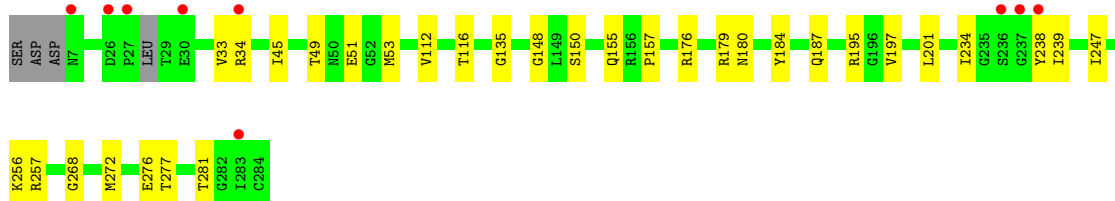
- Molecule 1: Glutamate receptor ionotropic, NMDA 1,Glutamate receptor ionotropic, NMDA 1

Chain A: 



- Molecule 2: Glutamate receptor ionotropic, NMDA 2A,Glutamate receptor ionotropic, NMDA 2A

Chain B: 



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	54.34Å 89.64Å 125.69Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	9.98 – 1.70 14.98 – 1.70	Depositor EDS
% Data completeness (in resolution range)	93.2 (9.98-1.70) 91.9 (14.98-1.70)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.08	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.73 (at 1.70Å)	Xtrriage
Refinement program	PHENIX (1.10.1_2155: ???)	Depositor
R, $R_{free}$	0.185 , 0.222 0.185 , 0.220	Depositor DCC
$R_{free}$ test set	2000 reflections (3.15%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	20.7	Xtrriage
Anisotropy	0.113	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.38 , 48.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	4953	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.87% 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](#)

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	0.59	0/2330	0.71	2/3141 (0.1%)
2	B	0.61	0/2229	0.73	0/3013
All	All	0.60	0/4559	0.72	2/6154 (0.0%)

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	A	0	1

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	A	242	GLY	N-CA-C	6.92	130.41	113.10
1	A	198	MET	CG-SD-CE	-5.07	92.08	100.20

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	241	THR	Peptide

### 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	2269	0	2262	34	0
2	B	2184	0	2180	25	0
3	A	5	0	2	1	0
4	B	10	0	5	1	0
5	A	216	0	0	11	0
5	B	269	0	0	2	0
All	All	4953	0	4449	55	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 6.

All (55) 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)
2:B:33:VAL:HG13	2:B:34:ARG:HG2	1.40	0.99
2:B:49:THR:HG22	2:B:51:GLU:H	1.32	0.93
1:A:97:ARG:HH22	1:A:102:ASN:HA	1.44	0.80
1:A:35:ASN:ND2	5:A:1102:HOH:O	2.14	0.75
1:A:236:CYS:SG	5:A:1285:HOH:O	2.49	0.70
1:A:4:THR:O	5:A:1101:HOH:O	2.09	0.69
1:A:101:SER:N	5:A:1106:HOH:O	2.28	0.67
2:B:176:ARG:HH21	2:B:179:ARG:HD2	1.59	0.67
1:A:76:ARG:NH1	5:A:1110:HOH:O	2.30	0.64
2:B:116:THR:HG1	4:B:301:GLU:N	2.00	0.60
2:B:176:ARG:NH1	2:B:180:ASN:OD1	2.36	0.59
1:A:242:GLY:HA3	1:A:243:GLU:HG2	1.86	0.57
1:A:188:GLN:NE2	2:B:268:GLY:O	2.38	0.56
1:A:190:GLU:H	1:A:190:GLU:CD	2.10	0.55
2:B:112:VAL:HG22	2:B:247:ILE:HD12	1.88	0.55
1:A:74:LEU:HD22	1:A:78:MET:HE2	1.91	0.53
1:A:44:CYS:SG	1:A:63[B]:CYS:HB3	2.48	0.52
1:A:265:SER:HB3	5:A:1288:HOH:O	2.11	0.51
1:A:98:VAL:HG23	1:A:101:SER:HB3	1.93	0.51
2:B:176:ARG:NH2	2:B:179:ARG:HD2	2.26	0.50
1:A:262:GLN:NE2	5:A:1115:HOH:O	2.43	0.50
1:A:121:ILE:HG21	1:A:125:LEU:HD22	1.94	0.50
2:B:45:ILE:HD11	2:B:53:MET:HG2	1.94	0.50
1:A:278:GLU:OE1	2:B:238:TYR:OH	2.24	0.49
1:A:51:SER:O	1:A:54:SER:OG	2.29	0.49
1:A:126:THR:HG1	3:A:1001:GLY:N	2.11	0.49
1:A:243:GLU:O	1:A:244:LEU:C	2.51	0.49
1:A:5:ARG:HA	5:A:1101:HOH:O	2.14	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:210:ILE:HD13	1:A:231:GLU:HG3	1.96	0.47
1:A:98:VAL:HG22	1:A:103:LYS:O	2.15	0.47
2:B:272:MET:O	2:B:276:GLU:HG3	2.16	0.46
1:A:97:ARG:NH2	1:A:102:ASN:HA	2.21	0.46
1:A:242:GLY:CA	1:A:243:GLU:HG2	2.45	0.46
1:A:103:LYS:HD2	5:A:1210:HOH:O	2.16	0.45
2:B:184:TYR:O	2:B:187:GLN:HG3	2.17	0.45
2:B:49:THR:HG22	2:B:51:GLU:N	2.14	0.45
2:B:148:GLY:HA2	2:B:234:ILE:HD11	1.99	0.44
1:A:66:PHE:CZ	1:A:277:MET:HE3	2.53	0.44
1:A:246:PHE:HE2	5:A:1303:HOH:O	2.00	0.44
2:B:157:PRO:HD2	2:B:184:TYR:CE2	2.53	0.43
1:A:182:ASP:OD2	1:A:186:ARG:NH2	2.52	0.43
1:A:256:LYS:HE3	2:B:257:ARG:NH1	2.33	0.43
2:B:256:LYS:HE3	5:B:608:HOH:O	2.18	0.43
2:B:277:THR:HA	2:B:281:THR:HG23	2.00	0.43
1:A:256:LYS:HE3	2:B:257:ARG:CZ	2.49	0.43
1:A:281:ASP:HB2	5:A:1148:HOH:O	2.19	0.43
2:B:33:VAL:HG22	2:B:34:ARG:H	1.83	0.43
2:B:135:GLY:HA3	2:B:239:ILE:CG2	2.49	0.43
1:A:31:GLU:HG3	1:A:41:LYS:NZ	2.34	0.43
2:B:150:SER:HA	2:B:155:GLN:OE1	2.20	0.42
2:B:34:ARG:HH11	2:B:34:ARG:HG3	1.83	0.42
2:B:33:VAL:HG12	5:B:403:HOH:O	2.18	0.41
1:A:135:ILE:C	1:A:256:LYS:HZ3	2.23	0.41
2:B:197:VAL:O	2:B:201:LEU:HG	2.20	0.41
1:A:5:ARG:HD3	1:A:83:GLU:OE1	2.21	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	
1	A	279/292 (96%)	271 (97%)	7 (2%)	1 (0%)	34	18
2	B	274/281 (98%)	264 (96%)	10 (4%)	0	100	100
All	All	553/573 (96%)	535 (97%)	17 (3%)	1 (0%)	47	30

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	244	LEU

### 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	
1	A	254/260 (98%)	250 (98%)	4 (2%)	62	48
2	B	243/246 (99%)	242 (100%)	1 (0%)	91	87
All	All	497/506 (98%)	492 (99%)	5 (1%)	76	67

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

Mol	Chain	Res	Type
1	A	105	GLU
1	A	144	GLN
1	A	218	LEU
1	A	265	SER
2	B	195	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

## 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](#)

2 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
4	GLU	B	301	-	8,9,9	1.32	1 (12%)	10,11,11	1.40	2 (20%)
3	GLY	A	1001	-	4,4,4	0.83	0	3,4,4	1.75	2 (66%)

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
4	GLU	B	301	-	-	3/9/9/9	-
3	GLY	A	1001	-	-	0/2/2/2	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	301	GLU	OXT-C	-2.03	1.23	1.30

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	301	GLU	OE2-CD-CG	2.54	122.20	114.03

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	301	GLU	OE1-CD-CG	-2.16	116.13	123.08
3	A	1001	GLY	OXT-C-O	-2.12	118.01	123.30
3	A	1001	GLY	OXT-C-CA	2.11	121.84	113.45

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	B	301	GLU	OE1-CD-CG-CB
4	B	301	GLU	OE2-CD-CG-CB
4	B	301	GLU	C-CA-CB-CG

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	301	GLU	1	0
3	A	1001	GLY	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

### 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	281/292 (96%)	0.23	18 (6%) 19 21	16, 28, 46, 58	0
2	B	277/281 (98%)	0.15	9 (3%) 47 52	14, 25, 43, 59	0
All	All	558/573 (97%)	0.19	27 (4%) 30 34	14, 26, 45, 59	0

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	283	ILE	5.6
2	B	236	SER	4.3
1	A	34	VAL	4.2
1	A	3	SER	3.6
1	A	52	PRO	3.6
2	B	30	GLU	3.4
1	A	286	ARG	3.3
2	B	238	TYR	3.3
1	A	101	SER	3.3
1	A	98	VAL	3.1
2	B	237	GLY	3.0
1	A	155	ARG	3.0
1	A	257	ASP	2.9
1	A	24	SER	2.8
1	A	4	THR	2.8
1	A	57	HIS	2.7
1	A	169	ASP	2.6
2	B	27	PRO	2.6
2	B	26	ASP	2.5
1	A	102	ASN	2.4
2	B	34	ARG	2.4
1	A	246	PHE	2.4
1	A	25	ASP	2.3
2	B	7	ASN	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	48	ASN	2.1
1	A	51	SER	2.1
1	A	97	ARG	2.0

## 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
3	GLY	A	1001	5/5	0.98	0.06	13,16,17,17	0
4	GLU	B	301	10/10	0.98	0.06	13,16,21,23	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.