



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 16, 2024 – 11:18 PM EDT

PDB ID : 5LKQ  
Title : Protease domain of RadA  
Authors : Rapisarda, C.; Fronzes, R.  
Deposited on : 2016-07-22  
Resolution : 2.50 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  
Xtriage (Phenix) : 1.13  
EDS : 2.37.1  
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) : 2.37.1

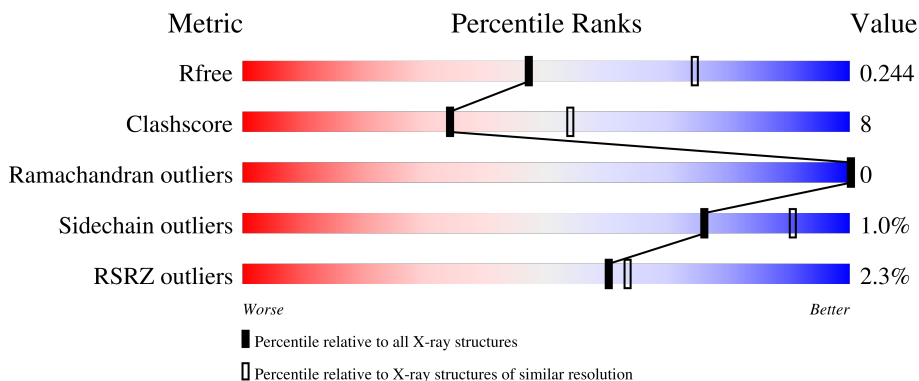
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 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)

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	198	 3% 69% 20% 11%
1	B	198	 2% 74% 16% 11%

## 2 Entry composition i

There are 2 unique types of molecules in this entry. The entry contains 2782 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 DNA repair protein RadA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	176	1338	849	230	255	4	0	0	0
1	B	177	1342	851	231	256	4	0	0	0

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	255	MET	-	initiating methionine	UNP A0A0T7K9X0
A	256	ALA	-	expression tag	UNP A0A0T7K9X0
A	257	SER	-	expression tag	UNP A0A0T7K9X0
A	258	TRP	-	expression tag	UNP A0A0T7K9X0
A	259	SER	-	expression tag	UNP A0A0T7K9X0
A	260	HIS	-	expression tag	UNP A0A0T7K9X0
A	261	PRO	-	expression tag	UNP A0A0T7K9X0
A	262	GLN	-	expression tag	UNP A0A0T7K9X0
A	265	LYS	MET	conflict	UNP A0A0T7K9X0
A	266	SER	GLN	conflict	UNP A0A0T7K9X0
A	267	GLY	SER	conflict	UNP A0A0T7K9X0
A	270	GLY	LEU	conflict	UNP A0A0T7K9X0
A	271	GLY	VAL	conflict	UNP A0A0T7K9X0
A	272	LEU	GLU	conflict	UNP A0A0T7K9X0
A	274	PRO	LEU	conflict	UNP A0A0T7K9X0
A	275	ARG	ASN	conflict	UNP A0A0T7K9X0
A	276	GLY	PRO	conflict	UNP A0A0T7K9X0
A	432	LEU	PRO	conflict	UNP A0A0T7K9X0
B	255	MET	-	initiating methionine	UNP A0A0T7K9X0
B	256	ALA	-	expression tag	UNP A0A0T7K9X0
B	257	SER	-	expression tag	UNP A0A0T7K9X0
B	258	TRP	-	expression tag	UNP A0A0T7K9X0
B	259	SER	-	expression tag	UNP A0A0T7K9X0
B	260	HIS	-	expression tag	UNP A0A0T7K9X0
B	261	PRO	-	expression tag	UNP A0A0T7K9X0

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Chain	Residue	Modelled	Actual	Comment	Reference
B	262	GLN	-	expression tag	UNP A0A0T7K9X0
B	265	LYS	MET	conflict	UNP A0A0T7K9X0
B	266	SER	GLN	conflict	UNP A0A0T7K9X0
B	267	GLY	SER	conflict	UNP A0A0T7K9X0
B	270	GLY	LEU	conflict	UNP A0A0T7K9X0
B	271	GLY	VAL	conflict	UNP A0A0T7K9X0
B	272	LEU	GLU	conflict	UNP A0A0T7K9X0
B	274	PRO	LEU	conflict	UNP A0A0T7K9X0
B	275	ARG	ASN	conflict	UNP A0A0T7K9X0
B	276	GLY	PRO	conflict	UNP A0A0T7K9X0
B	432	LEU	PRO	conflict	UNP A0A0T7K9X0

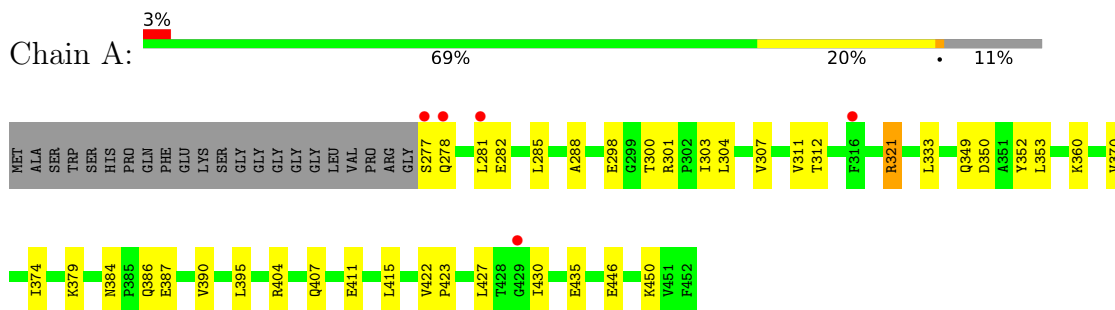
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	48	Total O 48 48	0	0
2	B	54	Total O 54 54	0	0

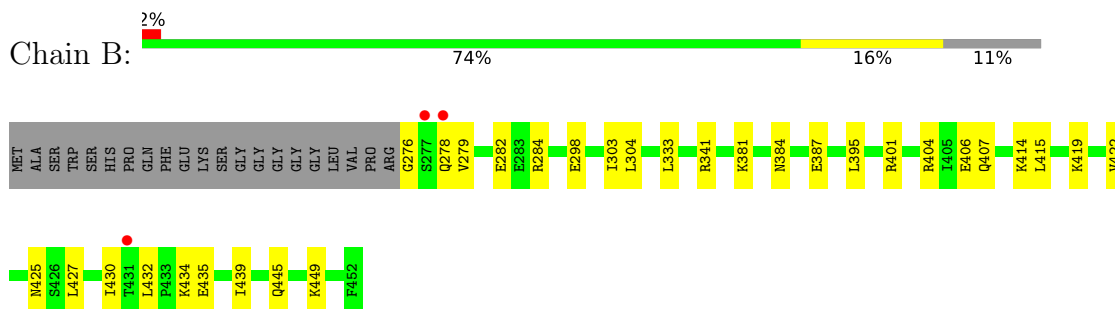
### 3 Residue-property plots [i](#)

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: DNA repair protein Rada



- Molecule 1: DNA repair protein Rada



## 4 Data and refinement statistics

Property	Value	Source
Space group	H 3	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	88.46Å 88.46Å 127.51Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	49.00 – 2.50 49.00 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.8 (49.00-2.50) 99.9 (49.00-2.50)	Depositor EDS
$R_{merge}$	0.19	Depositor
$R_{sym}$	0.06	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.19 (at 2.51Å)	Xtrriage
Refinement program	PHENIX (dev_2474: ???)	Depositor
R, $R_{free}$	0.186 , 0.244 0.186 , 0.244	Depositor DCC
$R_{free}$ test set	655 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	46.1	Xtrriage
Anisotropy	0.395	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 46.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.037 for h,-h-k,-l	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	2782	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	55.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.87% 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	0.32	0/1353	0.63	1/1830 (0.1%)
1	B	0.32	0/1357	0.60	2/1835 (0.1%)
All	All	0.32	0/2710	0.62	3/3665 (0.1%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	360	LYS	CA-CB-CG	6.97	128.74	113.40
1	B	414	LYS	CA-CB-CG	5.86	126.30	113.40
1	B	414	LYS	CG-CD-CE	-5.42	95.63	111.90

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	1338	0	1405	29	0
1	B	1342	0	1408	18	0
2	A	48	0	0	2	1
2	B	54	0	0	2	1
All	All	2782	0	2813	46	1

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 8.

All (46) 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:401:ARG:HH11	1:B:425:ASN:HB3	1.47	0.79
1:A:379:LYS:NZ	2:A:501:HOH:O	2.19	0.76
1:A:278:GLN:O	1:A:282:GLU:HG3	1.87	0.74
1:B:278:GLN:O	1:B:282:GLU:HG3	1.88	0.73
1:A:333:LEU:HD12	1:A:395:LEU:HD21	1.75	0.68
1:B:404:ARG:NH2	1:B:407:GLN:OE1	2.30	0.65
1:B:276:GLY:N	2:B:502:HOH:O	2.35	0.59
1:B:333:LEU:HD12	1:B:395:LEU:HD21	1.88	0.56
1:B:445:GLN:O	1:B:449:LYS:HD3	2.07	0.54
1:A:386:GLN:NE2	2:A:504:HOH:O	2.40	0.54
1:A:281:LEU:HD11	1:A:386:GLN:HG3	1.88	0.54
1:B:435:GLU:OE2	1:B:435:GLU:N	2.31	0.52
1:B:419:LYS:HD3	1:B:439:ILE:HD12	1.92	0.52
1:A:285:LEU:HB2	1:A:288:ALA:HB2	1.92	0.51
1:A:301:ARG:HH11	1:A:303:ILE:HG13	1.76	0.51
1:A:352:TYR:HB3	1:B:333:LEU:HD13	1.91	0.51
1:B:434:LYS:N	1:B:434:LYS:HD2	2.25	0.51
1:A:411:GLU:O	1:A:415:LEU:HG	2.11	0.50
1:B:276:GLY:O	1:B:279:VAL:HG22	2.12	0.50
1:A:301:ARG:HH11	1:A:303:ILE:CG1	2.24	0.49
1:A:384:ASN:HB3	1:A:387:GLU:HG3	1.95	0.49
1:B:304:LEU:HG	1:B:415:LEU:HD12	1.95	0.49
1:B:298:GLU:HB3	1:B:303:ILE:CD1	2.44	0.48
1:A:422:VAL:HG21	1:A:427:LEU:HD21	1.96	0.47
1:A:301:ARG:HD3	1:A:303:ILE:HD11	1.95	0.47
1:A:300:THR:HG22	1:A:404:ARG:HH12	1.79	0.47
1:B:381:LYS:HB3	1:B:381:LYS:HE2	1.62	0.46
1:B:406:GLU:CG	1:B:430:ILE:HD11	2.45	0.46
1:A:304:LEU:HD23	1:A:415:LEU:HD12	1.98	0.46
1:A:298:GLU:HB3	1:A:303:ILE:CD1	2.45	0.45
1:B:384:ASN:HB3	1:B:387:GLU:HG3	1.98	0.45
1:A:312:THR:O	1:A:350:ASP:N	2.45	0.44
1:A:321:ARG:NH1	1:A:349:GLN:O	2.44	0.44
1:A:307:VAL:HG11	1:A:370:VAL:HA	2.00	0.44
1:A:301:ARG:O	1:A:303:ILE:HD12	2.18	0.44
1:B:284:ARG:NH2	2:B:501:HOH:O	2.34	0.43
1:A:435:GLU:OE1	1:A:435:GLU:N	2.40	0.43
1:A:430:ILE:HD12	1:A:430:ILE:HA	1.77	0.43
1:A:404:ARG:HE	1:A:407:GLN:NE2	2.18	0.42
1:A:353:LEU:HD21	1:A:374:ILE:HD11	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:277:SER:N	1:A:415:LEU:O	2.53	0.41
1:A:298:GLU:CB	1:A:303:ILE:HD13	2.49	0.41
1:A:390:VAL:O	1:A:423:PRO:HD3	2.20	0.41
1:B:422:VAL:HG21	1:B:427:LEU:HD21	2.03	0.40
1:A:311:VAL:HA	1:A:350:ASP:O	2.21	0.40
1:A:446:GLU:O	1:A:450:LYS:HG3	2.21	0.40

All (1) 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)
2:A:507:HOH:O	2:B:522:HOH:O[2_655]	2.13	0.07

## 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	174/198 (88%)	172 (99%)	2 (1%)	0	100	100
1	B	175/198 (88%)	174 (99%)	1 (1%)	0	100	100
All	All	349/396 (88%)	346 (99%)	3 (1%)	0	100	100

There are no Ramachandran outliers to report.

### 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	146/161 (91%)	145 (99%)	1 (1%)	84	94
1	B	146/161 (91%)	144 (99%)	2 (1%)	67	86
All	All	292/322 (91%)	289 (99%)	3 (1%)	76	90

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	321	ARG
1	B	341	ARG
1	B	432	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	407	GLN
1	A	410	ASN

### 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](#)

There are no ligands in this entry.

## 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 [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	176/198 (88%)	0.13	5 (2%) 53 56	33, 53, 88, 101	0
1	B	177/198 (89%)	-0.01	3 (1%) 70 72	30, 49, 79, 95	0
All	All	353/396 (89%)	0.06	8 (2%) 60 63	30, 51, 84, 101	0

All (8) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	278	GLN	4.4
1	A	281	LEU	4.0
1	A	316	PHE	3.5
1	A	277	SER	3.2
1	B	277	SER	2.8
1	A	278	GLN	2.2
1	A	429	GLY	2.2
1	B	431	THR	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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.