



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 10:50 AM UTC

PDB ID : 8A2K / pdb\_00008a2k  
Title : human STING in complex with 2'-3'-cyclic-GMP-7-deaza(4-[(2-naphthyloxy)methyl]phenyl)-AMP  
Authors : Vavrina, Z.; Brynda, J.; Rezacova, P.  
Deposited on : 2022-06-03  
Resolution : 1.89 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 : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 2.0  
EDS : 3.0  
Buster-report : wwPDB partial adaption of 1.1.7 (2018)  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

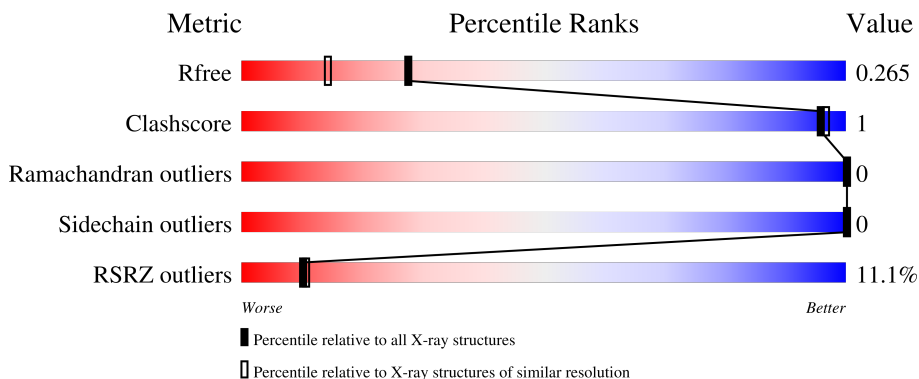
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.89 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))
$R_{free}$	180053	7789 (1.90-1.90)
Clashscore	190562	8410 (1.90-1.90)
Ramachandran outliers	187476	8333 (1.90-1.90)
Sidechain outliers	187428	8333 (1.90-1.90)
RSRZ outliers	180081	7790 (1.90-1.90)

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	241	
1	B	241	

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2969 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 Stimulator of interferon genes protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	189	1436	911	250	267	8	0	1	0
1	B	172	1320	837	225	252	6	0	1	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	139	SER	-	expression tag	UNP Q86WV6
A	232	ARG	HIS	variant	UNP Q86WV6
B	139	SER	-	expression tag	UNP Q86WV6
B	232	ARG	HIS	variant	UNP Q86WV6

- Molecule 2 is 2-azanyl-9-[(1 {R},6 {R},8 {R},9 {R},10 {S},15 {R},17 {R},18 {R})-8-[4-azanyl-5-[4-(naphthalen-1-yloxymethyl)phenyl]pyrrolo[2,3-d]pyrimidin-7-yl]-3,9,12,18-tetrakis(oxidanyl)-3,12-bis(oxidanylidene)-2,4,7,11,13,16-hexaoxa-3<sup>1</sup>{5},12<sup>1</sup>{5}-diphosphatricyclo[13.2.1.0<sup>6,10</sup>]octadecan-17-yl]-3 {H}-purin-6-one (CCD ID: KXD) (formula: C<sub>38</sub>H<sub>37</sub>N<sub>9</sub>O<sub>14</sub>P<sub>2</sub>) (labeled as "Ligand of Interest" by depositor).





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	93.90Å 117.26Å 35.88Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.73 – 1.89 49.73 – 1.89	Depositor EDS
% Data completeness (in resolution range)	99.9 (49.73-1.89) 99.9 (49.73-1.89)	Depositor EDS
$R_{merge}$	0.14	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.46 (at 1.90Å)	Xtrriage
Refinement program	REFMAC 5.8.0267	Depositor
R, $R_{free}$	0.215 , 0.260 0.220 , 0.265	Depositor DCC
$R_{free}$ test set	1632 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	31.4	Xtrriage
Anisotropy	0.161	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 41.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	2969	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	36.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.39% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: KXD

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	0.21	0/1463	0.45	0/1991
1	B	0.21	0/1343	0.44	0/1823
All	All	0.21	0/2806	0.45	0/3814

There are no bond length outliers.

There are no bond angle outliers.

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	1436	0	1352	3	0
1	B	1320	0	1237	5	0
2	B	63	0	0	0	0
3	A	82	0	0	0	0
3	B	68	0	0	0	0
All	All	2969	0	2589	6	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 1.

All (6) 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:224:LYS:HE3	1:B:236:LYS:HD3	1.94	0.48
1:A:224:LYS:HE2	1:B:236:LYS:O	2.13	0.48
1:B:161:TRP:O	1:B:165:ILE:HG12	2.15	0.46
1:B:299:LEU:HD12	1:B:311:LEU:HD11	1.98	0.45
1:A:153:PHE:HA	1:A:290:LEU:HD13	2.04	0.40
1:B:197:ARG:HD3	1:B:310:ARG:NH1	2.36	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	186/241 (77%)	180 (97%)	6 (3%)	0	100	100
1	B	165/241 (68%)	162 (98%)	3 (2%)	0	100	100
All	All	351/482 (73%)	342 (97%)	9 (3%)	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	142/210 (68%)	142 (100%)	0	100	100
1	B	132/210 (63%)	132 (100%)	0	100	100
All	All	274/420 (65%)	274 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	218	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 oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

1 ligand is 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	$\# Z  > 2$
2	KXD	B	401	-	72,72,72	2.36	25 (34%)	98,110,110	1.96	23 (23%)

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
2	KXD	B	401	-	-	10/39/71/71	0/9/10/10

All (25) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	401	KXD	C52-N53	6.63	1.48	1.37
2	B	401	KXD	C17-C16	5.74	1.57	1.49
2	B	401	KXD	C54-N55	5.30	1.46	1.34
2	B	401	KXD	C54-N56	4.88	1.45	1.33
2	B	401	KXD	C52-N48	-4.68	1.32	1.37
2	B	401	KXD	C40-N41	4.44	1.45	1.34
2	B	401	KXD	O22-C23	3.99	1.48	1.36
2	B	401	KXD	O46-C03	3.83	1.53	1.45
2	B	401	KXD	C08-C09	-3.80	1.43	1.52
2	B	401	KXD	C54-N53	3.74	1.46	1.37
2	B	401	KXD	C57-N56	3.73	1.44	1.38
2	B	401	KXD	C02-C59	-3.69	1.44	1.53
2	B	401	KXD	P06-O07	3.62	1.70	1.59
2	B	401	KXD	O58-C57	-3.48	1.17	1.23
2	B	401	KXD	C02-C03	-3.20	1.44	1.53
2	B	401	KXD	C57-C51	3.05	1.53	1.45
2	B	401	KXD	C15-N14	-3.00	1.33	1.38
2	B	401	KXD	P61-O60	2.98	1.68	1.59
2	B	401	KXD	C42-C08	-2.45	1.47	1.53
2	B	401	KXD	P61-O11	2.35	1.68	1.59
2	B	401	KXD	C51-N50	-2.32	1.34	1.39
2	B	401	KXD	C49-N48	-2.21	1.32	1.37
2	B	401	KXD	C21-C20	2.12	1.55	1.50
2	B	401	KXD	C28-C27	-2.04	1.39	1.43
2	B	401	KXD	C15-C16	2.00	1.39	1.37

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	401	KXD	C21-O22-C23	8.59	129.21	117.49
2	B	401	KXD	C35-C36-N37	-5.34	121.31	126.97
2	B	401	KXD	C36-N14-C15	5.25	110.25	108.08
2	B	401	KXD	N39-C38-N37	-5.19	120.73	128.58
2	B	401	KXD	O22-C23-C28	3.87	125.83	115.11
2	B	401	KXD	C16-C15-N14	-3.86	108.92	110.54
2	B	401	KXD	O22-C23-C24	-3.53	116.68	124.45
2	B	401	KXD	C38-N37-C36	3.52	120.42	111.83
2	B	401	KXD	C59-C47-N48	-2.97	108.60	114.24
2	B	401	KXD	O12-C13-N14	2.75	113.37	108.09
2	B	401	KXD	C51-C52-N48	2.72	107.50	106.25
2	B	401	KXD	C42-C13-N14	-2.72	106.56	113.30
2	B	401	KXD	C34-C17-C16	-2.70	117.59	120.98

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	401	KXD	O22-C21-C20	2.51	116.53	109.16
2	B	401	KXD	C49-N48-C52	2.38	108.67	106.67
2	B	401	KXD	N48-C49-N50	-2.33	109.09	113.40
2	B	401	KXD	C32-C27-C26	-2.24	117.89	123.01
2	B	401	KXD	C38-N39-C40	2.17	122.29	118.73
2	B	401	KXD	C24-C23-C28	-2.16	117.37	121.10
2	B	401	KXD	N53-C54-N56	-2.08	119.52	123.32
2	B	401	KXD	C02-C59-C47	2.06	106.76	102.81
2	B	401	KXD	O60-C59-C02	-2.05	104.32	111.68
2	B	401	KXD	C59-C02-C03	2.03	106.37	101.99

There are no chirality outliers.

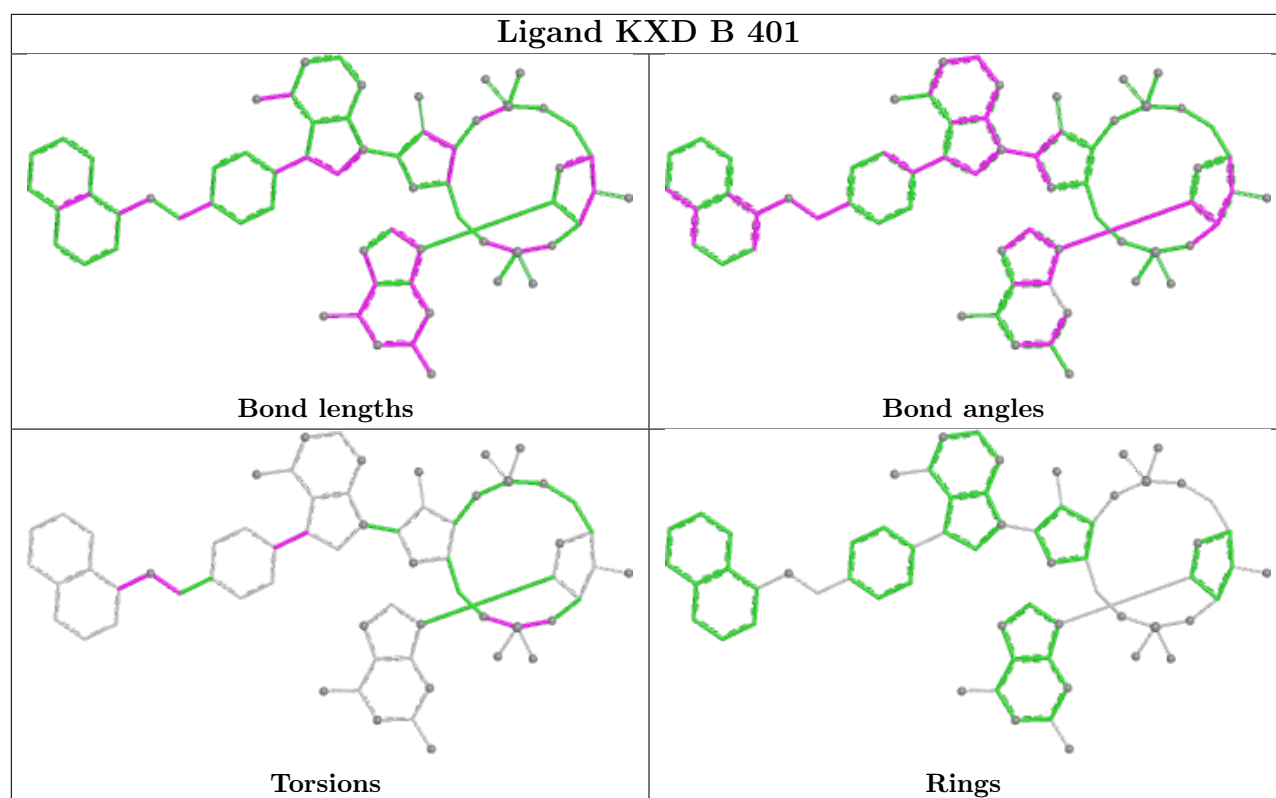
All (10) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	401	KXD	C10-O11-P61-O62
2	B	401	KXD	C10-O11-P61-O63
2	B	401	KXD	C59-O60-P61-O11
2	B	401	KXD	C20-C21-O22-C23
2	B	401	KXD	C28-C23-O22-C21
2	B	401	KXD	C24-C23-O22-C21
2	B	401	KXD	C59-O60-P61-O62
2	B	401	KXD	C59-O60-P61-O63
2	B	401	KXD	C10-O11-P61-O60
2	B	401	KXD	C35-C16-C17-C18

There are no ring outliers.

No monomer is involved in short contacts.

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 [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	189/241 (78%)	0.65	20 (10%) <b>11</b> <b>12</b>	13, 33, 60, 87	1 (0%)
1	B	172/241 (71%)	0.75	20 (11%) <b>9</b> <b>10</b>	15, 35, 57, 69	1 (0%)
All	All	361/482 (74%)	0.70	40 (11%) <b>10</b> <b>11</b>	13, 34, 57, 87	2 (0%)

All (40) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	320	ASP	5.4
1	B	153	PHE	4.2
1	A	147	VAL	4.2
1	A	235	ILE	3.9
1	B	303	PRO	3.8
1	A	317	PRO	3.7
1	B	319	ASP	3.3
1	B	232	ARG	3.3
1	B	183	ASN	3.2
1	A	279	PHE	3.1
1	A	322	SER	3.1
1	A	148	CYS	3.1
1	A	274	TYR	3.0
1	B	307	ASN	3.0
1	A	214	MET	2.9
1	A	278	GLY	2.9
1	B	240	TYR	2.7
1	B	177	ALA	2.7
1	B	316	GLU	2.7
1	B	338	LYS	2.7
1	B	170	LEU	2.6
1	B	181	THR	2.6
1	A	321	SER	2.5
1	B	180	ARG	2.5

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Mol	Chain	Res	Type	RSRZ
1	B	176	GLN	2.5
1	B	237	ASP	2.4
1	B	239	VAL	2.4
1	A	230	GLY	2.4
1	B	182	TYR	2.4
1	B	235	ILE	2.4
1	B	337	GLU	2.3
1	A	307	ASN	2.3
1	A	215	ALA	2.3
1	A	335	GLN	2.3
1	A	231	ASP	2.2
1	A	228	GLN	2.2
1	A	229	THR	2.2
1	B	305	SER	2.2
1	A	177	ALA	2.2
1	A	337	GLU	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](#)

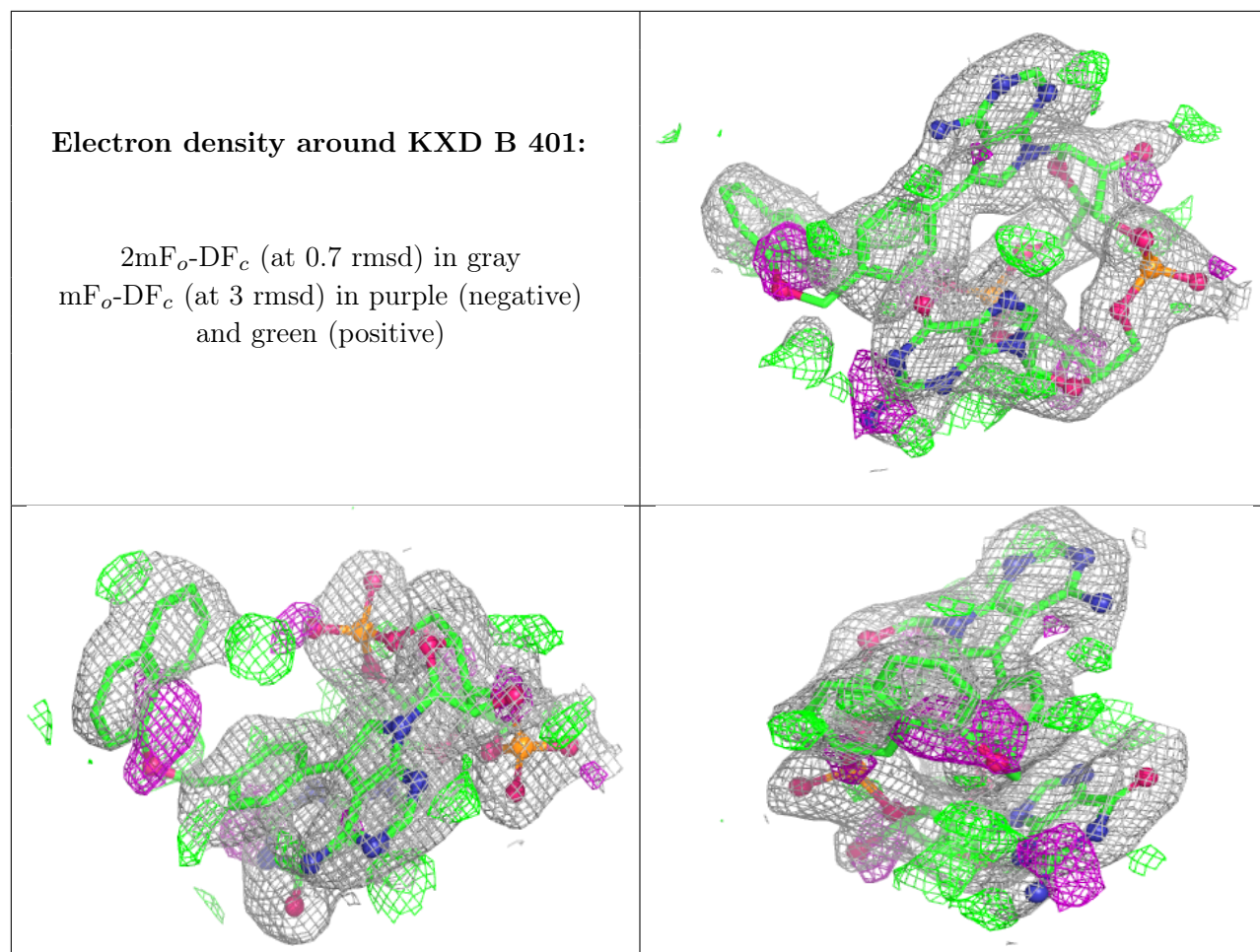
There are no oligosaccharides in this entry.

## 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
2	KXD	B	401	63/63	0.93	0.14	20,32,70,75	0

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.