Supplementary Table S1. Detailed information of SARS-CoV-2 genomes used for multiple alignment

Accession	Pangolin lineage	WHO classification	Category	Length (bp)	Location
MN908947	B			29903	China
MW913362	B.1.1.7	Alpha	variant of concern	29763	Austria: Upper Austria, Voecklabruck
OU514166	B.1.1.7	Alpha	variant of concern	29810	Germany:Europe/Germany/Baden-Wurttemberg
OU514176	B.1.1.7	Alpha	variant of concern	29813	Germany:Europe/Germany/Baden-Wurttemberg
MZ350105	B.1.1.7	Alpha	variant of concern	29756	Ghana
MZ350109	B.1.1.7	Alpha	variant of concern	29773	Ghana
MZ266365	B.1.1.7	Alpha	variant of concern	29763	Hong Kong
BS001137	B.1.1.7	Alpha	variant of concern	29863	Japan: Tochigi
BS001138	B.1.1.7	Alpha	variant of concern	29862	Japan: Tochigi
BS001139	B.1.1.7	Alpha	variant of concern	29877	Japan: Tochigi
BS001140	B.1.1.7	Alpha	variant of concern	29862	Japan: Tochigi
OU538849	B.1.1.7	Alpha	variant of concern	29884	Switzerland:SO
OU538851	B.1.1.7	Alpha	variant of concern	29884	Switzerland:BE
MZ888516	B.1.1.7	Alpha	variant of concern	29882	Thailand: Kamphaeng Phet
OU562607	B.1.1.7	Alpha	variant of concern	29884	United Kingdom:Scotland
OU562608	B.1.1.7	Alpha	variant of concern	29884	United Kingdom:Scotland
MZ895877	B.1.1.7	Alpha	variant of concern	29521	USA: Washington
MZ298839	B.1.351	Beta	variant of concern	29764	Hong Kong
MZ298840	B.1.351	Beta	variant of concern	29764	Hong Kong
MW981442	B.1.351	Beta	variant of concern	29848	South Africa
MZ202314	B.1.351	Beta	variant of concern	29783	South Africa
MZ376663	B.1.351	Beta	variant of concern	29848	South Africa
OU539352	B.1.351	Beta	variant of concern	29885	Switzerland:AG

OU525106	B.1.351	Beta	variant of concern	29885	United Kingdom:England
MZ879365	B.1.351	Beta	variant of concern	29782	USA: Colorado
MZ913100	B.1.351	Beta	variant of concern	29712	USA: New Mexico
LC643036	B.1.617.2	Delta	variant of concern	29875	Japan: Tokyo
LC643044	B.1.617.2	Delta	variant of concern	29878	Japan: Tokyo
MZ854386	B.1.617.2	Delta	variant of concern	29830	Sierra Leone
MZ854387	B.1.617.2	Delta	variant of concern	29831	Sierra Leone
MZ854389	B.1.617.2	Delta	variant of concern	29830	Sierra Leone
MZ853946	B.1.617.2	Delta	variant of concern	29890	South Korea
OU539261	B.1.617.2	Delta	variant of concern	29893	Switzerland:TG
OU539690	B.1.617.2	Delta	variant of concern	29890	Switzerland:ZH
MZ888532	B.1.617.2	Delta	variant of concern	29835	Thailand: Kamphaeng Phet
MZ888533	B.1.617.2	Delta	variant of concern	29809	Thailand: Kamphaeng Phet
OU562629	B.1.617.2	Delta	variant of concern	29890	United Kingdom:England
MZ896136	B.1.617.2	Delta	variant of concern	29516	USA: Oregon
MZ477746	P.1	Gamma	variant of concern	29741	Brazil: Parana
MZ477748	P.1	Gamma	variant of concern	29738	Brazil: Parana
MW938104	P.1	Gamma	variant of concern	29874	Peru
OU539784	P.1	Gamma	variant of concern	29894	Switzerland:AG
OU539830	P.1	Gamma	variant of concern	29894	Switzerland:GR
OU539894	P.1	Gamma	variant of concern	29894	Switzerland:ZH
OU492255	P.1	Gamma	variant of concern	29898	United Kingdom:England
OU565182	P.1	Gamma	variant of concern	29898	United Kingdom:Scotland
MZ896179	P.1	Gamma	variant of concern	29531	USA: Oregon
MZ896359	P.1	Gamma	variant of concern	29827	USA: Minnesota

MZ896669	P.1	Gamma	variant of concern	29808	USA: California
MZ911221	B.1.427	Epsilon	variant of interest	29864	USA: Arizona, Pima
MZ375854	B.1.427	Epsilon	variant of interest	29870	Mexico: B.C.
MZ375858	B.1.427	Epsilon	variant of interest	29833	Mexico: B.C.
MZ943834	B.1.429	Epsilon	variant of interest	29780	USA: California
MZ687447	B.1.429	Epsilon	variant of interest	29838	USA: Tennessee, Davidson county
OU282717	B.1.429	Epsilon	variant of interest	29903	United Kingdom:Wales
OU235436	B.1.429	Epsilon	variant of interest	29903	United Kingdom:England
MZ277390	B.1.429	Epsilon	variant of interest	29891	Taiwan
MZ746235	B.1.617.1	Kappa	variant of interest	29791	USA: Utah
MZ724425	B.1.617.1	Kappa	variant of interest	29788	India
MZ571142	B.1.617.1	Kappa	variant of interest	29818	Morocco
MZ562746	B.1.617.1	Kappa	variant of interest	29837	India: Madhya Pradesh
MZ538882	B.1.617.1	Kappa	variant of interest	29823	USA: FL
OU322235	B.1.617.1	Kappa	variant of interest	29559	Germany:Europe/Germany/Berlin
OU290035	B.1.617.1	Kappa	variant of interest	29893	United Kingdom:England
MZ487800	B.1.617.1	Kappa	variant of interest	29809	USA: DC
OU265178	B.1.617.1	Kappa	variant of interest	29902	United Kingdom:Wales
OU247018	B.1.617.1	Kappa	variant of interest	29902	United Kingdom:England
OU254949	B.1.617.1	Kappa	variant of interest	29902	United Kingdom:Wales
MZ397173	B.1.617.1	Kappa	variant of interest	29830	Myanmar
MZ397175	B.1.617.1	Kappa	variant of interest	29812	Myanmar
MZ397176	B.1.617.1	Kappa	variant of interest	29822	Myanmar
MZ397177	B.1.617.1	Kappa	variant of interest	29823	Myanmar
OU168413	B.1.617.1	Kappa	variant of interest	29795	Germany:Europe/Germany/Saxony

OU172184	B.1.617.1	Kappa	variant of interest	29835	Switzerland:SO
OU182966	B.1.617.1	Kappa	variant of interest	29850	Switzerland:BL
MZ363839	B.1.617.1	Kappa	variant of interest	29801	India
MZ332524	B.1.617.1	Kappa	variant of interest	29801	India
MZ332527	B.1.617.1	Kappa	variant of interest	29801	India
OU061269	B.1.617.1	Kappa	variant of interest	29902	United Kingdom:Scotland
LC633761	B.1.617.1	Kappa	variant of interest	29890	Japan
MZ026886	B.1.617.1	Kappa	variant of interest	29525	Bahrain
MZ953185	C.37	Lambda	variant of interest	29805	USA: California
MZ953277	C.37	Lambda	variant of interest	29801	USA: Massachusetts
MZ937666	C.37	Lambda	variant of interest	29379	USA: Illinois
MZ942542	C.37	Lambda	variant of interest	29653	USA: Kentucky
MZ908711	C.37	Lambda	variant of interest	29785	USA: Virginia
MZ857990	C.37	Lambda	variant of interest	29750	USA: Tennessee
OU517038	C.37	Lambda	variant of interest	29795	Germany:Europe/Germany/Hesse
OU356036	C.37	Lambda	variant of interest	29873	United Kingdom:England
OU351967	C.37	Lambda	variant of interest	29873	Switzerland:GE
MZ496613	C.37	Lambda	variant of interest	29794	Peru
OU268528	C.37	Lambda	variant of interest	29873	Switzerland:GE
OU100999	C.37	Lambda	variant of interest	29752	Germany:Europe/Germany/Berlin
OU053018	C.37	Lambda	variant of interest	29873	United Kingdom:England
MZ275295	C.37	Lambda	variant of interest	29781	Peru
MZ275301	C.37	Lambda	variant of interest	29798	Peru

Supplementary Table S2. Summary of DNA target sequences used for plasmid construction

Gene fragments	Length (bp)	Sequence (5'→3')
Wild-type S gene	3822	ATGTTTGTTTTTTTTGTTTTATTGCCACTAGTCTCTAGTCAGTGTGTTAATCTTACAACCAGAACTCAATTACCCCCTGCATACACTAATTCTTTCACACGTGGTGTTTATTACCCTGACAAAGTTTTCAGATCCTCAGTTTTACATTCAACTCAGGACTTGTTCTTACCTTTCTTTTCCAATGTTACTTGGTTCCATGCTATACATGTCTCTGGGACCAATGGTACTAAGAGGTTTGCTAACCCTGTCCTACCATTTAATGATGGTGTTTATTTTGCTTCCACTGAGAAGTCTAACATAATAAGAGGCTGGATTTTTGGTACTACTTTAGATTCGAAGACCCAGTCCCTACTTATTGTTAATAACGCTACTAATGTTGTTATTAAAGTCTGTGAATTTCAATTTTGTAATGATCCATTTTTGGGTGTTTATTACCACAAAAACAACAAAAGTTGGATGGAAAGTGAGTTCAGAGTTTATTCTAGTGCGAATAATTGCACTTTTGAATATGTCTCTCAGCCTTTTCTTATGGACCTTGAAGGAAAACAGGGTAATTTCAAAAATCTTAGGGAATTTGTGTTTAAGAATATTGATGGTTATTTTAAAATATATTCTAAGCACACGCCTATTAATTTAGTGCGTGGTCTCCCTCAGGGTTTTTCGGCTTTAGAACCATTGGTAGATTTGCCAATAGGTATTAACATCACTAGGTTTCAAACTTTACTTGCTTTACATATAAGTTATTTGACTCCTGGTGATTCTTCTTCAGGTTGGACAGCTGGTGCTGCAGCTTATTATGTGGGTTATCTTCAACCTAGGACTTTTCTATTAAAATATAATGAAAATGGAACCATTACAGATGCTGTAGACTGTGCACTTGACCCTCTCTCAGAAACAAAGTGTACGTTGAAATCCTTCACTGTAGAAAAAGGAATCTATCAAACTTCTAACTTTAGAGTCCAACCAACAGAATCTATTGTTAGATTTCCTAATATTACAAACTTGTGCCCTTTTGGTGAAGTTTTTAACGCCACCAGATTTGCATCTGTTTATGCTTGGAACAGGAAGAGAATCAGCAACTGTGTTGCTGATTATTCTGTCCTATATAATTCCGCATCATTTTCCACTTTTAAGTGTTATGGAGTGTCTCCTACTAAATTAAATGATCTCTGCTTTACTAATGTCTATGCAGATTCATTTGTAATTAGAGGTGATGAAGTCAGACAAATCGCTCCAGGGCAAACTGGAAACATTGCTGATTATAATTATAAATTACCAGATGATTTTACAGGCTGCGTTATAGCTTGGAATTCTAACAATCTTGATTCTAAGGTTGGTGGTAATTATAATTACCTGTTTAGATTGTTTAGGAAGTCTAATCTCAAACCTTTTGAGAGAGATATTTCAACTGAAATCTATCAGGCCGGTAGCACACCTTGTAATGGTGTTAAAGGTTTTAATTGTTACTTTCCTTTACAATCATATGGTTTCCAACCCACTTATGGTGTTGGTTACCAACCATACAGAGTAGTAGTACTTTCTTTTGAACTTCTACATGCACCAGCAACTGTTTGTGGACCTAAAAAGTCTACTAATTTGGTTAAAAACAAATGTGTCAATTTCAACTTCAATGGTTTAACAGGCACAGGTGTTCTTACTGAGTCTAACAAAAAGTTTCTGCCTTTCCAACAATTTGGCAGAG

ACATTGATGACACTACTGATGCTGTCCGTGATCCACAGACACTTGAGATTCTTGACATTACACCATGTTCTTTTGGTGGTGTCAG
TGTTATAACACCAGGAACAAATACTTCTAACCAGGTTGCTGTTCTTTATCAGGGTGTTAACTGCACAGAAGTCCCTGTTGCTATT
CATGCAGATCAACTTACTCCTACTTGGCGTGTTTATTCTACAGGTTCTAATGTTTTTCAAACACGTGCAGGCTGTTTAATAGGGG
CTGAACATGTCAACAACTCATATGAGTGTGACATACCCATTGGTGCAGGTATATGCGCTAGTTATCAGACTCAGACTAATTCTC
ATCGGCGGGCACGTAGTGTAGCTAGTCAATCCATCATTGCCTACACTATGTCACTTGGTGTAGAAAATTCAGTTGCTTACTCTAA
TAACTCTATTGCCATACCCATAAATTTTACTATTAGTGTTACCACAGAAATTCTACCAGTGTCTATGACCAAGACATCAGTAGAT
TGTACAATGTACATTTGTGGTGATTCAACTGAATGCAGCAATCTTTTGTTGCAATATGGCAGTTTTTGTACACAATTAAACCGTG
CTTTAACTGGAATAGCTGTTGAACAAGACAAAAACACCCAAGAAGTTTTTGCACAAGTCAAACAAATTTACAAAACACCACCA
ATTAAAGATTTTGGTGGTTTTAATTTTTCACAAATATTACCAGATCCATCAAAACCAAGCAAGAGGTCATTTATTGAAGATCTAC
TTTTCAACAAAGTGACACTTGCAGATGCTGGCTTCATCAAACAATATGGTGATTGCCTTGGTGATATTGCTGCTAGAGACCTCAT
TTGTGCACAAAAGTTTAACGGCCTTACTGTTTTGCCACCTTTGCTCACAGATGAAATGATTGCTCAATACACTTCTGCACTGTTA
GCGGGTACAATCACTTCTGGTTGGACCTTTGGTGCAGGTGCTGCATTACAAATACCATTTGCTATGCAAATGGCTTATAGGTTTA
ATGGTATTGGAGTTACACAGAATGTTCTCTATGAGAACCAAAAATTGATTGCCAACCAATTTAATAGTGCTATTGGCAAAATTC
AAGACTCACTTTCTTCCACAGCAAGTGCACTTGGAAAACTTCAAGATGTGGTCAACCAAAATGCACAAGCTTTAAACACGCTTG
TTAAACAACTTAGCTCCAATTTTGGTGCAATTTCAAGTGTTTTAAATGATATCCTTGCACGTCTTGACAAAGTTGAGGCTGAAGT
GCAAATTGATAGGTTGATCACAGGCAGACTTCAAAGTTTGCAGACATATGTGACTCAACAATTAATTAGAGCTGCAGAAATCA
GAGCTTCTGCTAATCTTGCTGCTACTAAAATGTCAGAGTGTGTACTTGGACAATCAAAAGAGTTGATTTTTGTGGAAAGGGCT
ATCATCTTATGTCCTTCCCTCAGTCAGCACCTCATGGTGTAGTCTTCTTGCATGTGACTTATGTCCCTGCACAAGAAAAGAACTT
CACAACTGCTCCTGCCATTTGTCATGATGGAAAAGCACACTTTCCTCGTGAAGGTGTCTTTGTTTCAAATGGCACACACTGGTTT
GTAACACAAAGGAATTTTTATGAACCACAAATCATTACTACACAACACATTTGTGTCTGGTAACTGTGATGTTGTAATAGGA
ATTGTCAACAACACAGTTTATGATCCTTTGCAACCTGAATTAGACTCATTCAAGGAGGAGTTAGATAAATATTTTAAGAATCAT
ACATCACCAGATGTTGATTTAGGTGACATCTCTGGCATTAATGCTTCAGTTGTAAACATTCAAAAAGAAATTGACCGCCTCAAT
GAGGTTGCCAAGAATTTAAATGAATCTCTCATCGATCTCCAAGAACTTGGAAAGTATGAGCAGTATATAAAATGGCCATGGTAC
ATTTGGCTAGGTTTTATAGCTGGCTTGATTGCCATAGTAATGGTGACAATTATGCTTTGCTGTATGACCAGTTGCTGTAGTTGTC
TCAAGGGCTGTTGTTCTTGTGGATCCTGCTGCAAATTTGATGAAGACGACTCTGAGCTAGTGCTCAAAGGAGTCAAATTACATT
ACACATAA

| Mutant S gene | 3822 | ATGTTTGTTTTTTTTGTTTTATTGCCACTAGTCTCTAGTCAGTGTGTTAATCTTACAACCAGAACTCAATTACCCCCTGCATACAC
TAATTCTTTCACACGTGGTGTTTATTACCCTGACAAAGTTTTCAGATCCTCAGTTTTACATTCAACTCAGGACTTGTTCTTACCTT
TCTTTTCCAATGTTACTTGGTTCCATGCTATACATGTCTCTGGGACCAATGGTACTAAGAGGTTTGCTAACCCTGTCCTACCATTT
AATGATGGTGTTTATTTTGCTTCCACTGAGAAGTCTAACATAATAAGAGGCTGGATTTTTGGTACTACTTTAGATTCGAAGACCCC
AGTCCCTACTTATTGTTAATAACGCTACTAATGTTGTTATTAAAGTCTGTGAATTTCAATTTTGTAATGATCCATTTTTGGGTGTT
TATTACCACAAAAACAACAAAAGTTGGATGGAAAGTGAGTTCAGAGTTTATTCTAGTGCGAATAATTGCACTTTTGAATATGTC
TCTCAGCCTTTTCTTATGGACCTTGAAGGAAAACAGGGTAATTTCAAAAATCTTAGGGAATTTGTGTTTAAGAATATTGATGGTT
ATTTTAAAATATATTCTAAGCACACGCCTATTAATTTAGTGCGTGGTCTCCCTCAGGGTTTTTCGGCTTTAGAACCATTGGTAGA
TTTGCCAATAGGTATTAACATCACTAGGTTTCAAACTTTACTTGCTTTACATATAAGTTATTTGACTCCTGGTGATTCTTCTTCAG
GTTGGACAGCTGGTGCTGCAGCTTATTATGTGGGTTATCTTCAACCTAGGACTTTTCTATTAAAATATAATGAAAATGGAACCAT
TACAGATGCTGTAGACTGTGCACTTGACCCTCTCTCAGAAACAAAGTGTACGTTGAAATCCTTCACTGTAGAAAAAGGAATCTA
TCAAACTTCTAACTTTAGAGTCCAACCAACAGAATCTATTGTTAGATTTCCTAATATTACAAACTTGTGCCCTTTTGGTGAAGTT
TTTAACGCCACCAGATTTGCATCTGTTTATGCTTGGAACAGGAAGAGAATCAGCAACTGTGTTGCTGATTATTCTGTCCTATATA
ATTCCGCATCATTTTCCACTTTTAAGTGTTATGGAGTGTCTCCTACTAAATTAAATGATCTCTGCTTTACTAATGTCTATGCAGAT
TCATTTGTAATTAGAGGTGATGAAGTCAGACAAATCGCTCCAGGGCAAACTGGAAATATTGCTGATTATAATTATAAATTACCA
GATGATTTTACAGGCTGCGTTATAGCTTGGAATTCTAACAATCTTGATTCTAAGGTTGGTGGTAATTATAATTACCGGTTTAGAT
TGTTTAGGAAGTCTAATCTCAAACCTTTTGAGAGAGATATTTCAACTGAAATCTATCAGGCCGGTAGCAAACCTTGTAATGGTG
TTCAAGGTTTTAATTGTTACTTTCCTTTACAATCATATGGTTTCCAACCCACTTATGGTGTTGGTTACCAACCATACAGAGTAGT
AGTACTTTCTTTTGAACTTCTACATGCACCAGCAACTGTTTGTGGACCTAAAAAGTCTACTAATTTGGTTAAAAACAAATGTGTC
AATTTCAACTTCAATGGTTTAACAGGCACAGGTGTTCTTACTGAGTCTAACAAAAAGTTTCTGCCTTTCCAACAATTTGGCAGAG
ACATTGATGACACTACTGATGCTGTCCGTGATCCACAGACACTTGAGATTCTTGACATTACACCATGTTCTTTTGGTGGTGTCAG
TGTTATAACACCAGGAACAAATACTTCTAACCAGGTTGCTGTTCTTTATCAGGGTGTTAACTGCACAGAAGTCCCTGTTGCTATT
CATGCAGATCAACTTACTCCTACTTGGCGTGTTTATTCTACAGGTTCTAATGTTTTTCAAACACGTGCAGGCTGTTTAATAGGGG
CTGAACATGTCAACAACTCATATGAGTGTGACATACCCATTGGTGCAGGTATATGCGCTAGTTATCAGACTCAGACTAATTCTC
ATCGGCGGGCACGTAGTGTAGCTAGTCAATCCATCATTGCCTACACTATGTCACTTGGTGTAGAAAATTCAGTTGCTTACTCTAA
TAACTCTATTGCCATACCCATAAATTTTACTATTAGTGTTACCACAGAAATTCTACCAGTGTCTATGACCAAGACATCAGTAGAT |

		TGTACAATGTACATTTGTGGTGATTCAACTGAATGCAGCAATCTTTTGTTGCAATATGGCAGTTTTTGTACACAATTAAACCGTG CTTTAACTGGAATAGCTGTTGAACAAGACAAAAACACCCAAGAAGTTTTTGCACAAGTCAAACAAATTTACAAAACACCACCA ATTAAAGATTTTGGTGGTTTTAATTTTTCACAAATATTACCAGATCCATCAAAACCAAGCAAGAGGTCATTTATTGAAGATCTAC TTTTCAACAAAGTGACACTTGCAGATGCTGGCTTCATCAAACAATATGGTGATTGCCTTGGTGATATTGCTGCTAGAGACCTCAT TTGTGCACAAAAGTTTAACGGCCTTACTGTTTTGCCACCTTTGCTCACAGATGAAATGATTGCTCAATACACTTCTGCACTGTTA GCGGGTACAATCACTTCTGGTTGGACCTTTGGTGCAGGTGCTGCATTACAAATACCATTTGCTATGCAAATGGCTTATAGGTTTA ATGGTATTGGAGTTACACAGAATGTTCTCTATGAGAACCAAAAATTGATTGCCAACCAATTTAATAGTGCTATTGGCAAAATTC AAGACTCACTTTCTTCCACAGCAAGTGCACTTGGAAAACTTCAAGATGTGGTCAACCAAAATGCACAAGCTTTAAACACGCTTG TTAAACAACTTAGCTCCAATTTTGGTGCAATTTCAAGTGTTTTAAATGATATCCTTGCACGTCTTGACAAAGTTGAGGCTGAAGT GCAAATTGATAGGTTGATCACAGGCAGACTTCAAAGTTTGCAGACATATGTGACTCAACAATTAATTAGAGCTGCAGAAATCA GAGCTTCTGCTAATCTTGCTGCTACTAAAATGTCAGAGTGTGTACTTGGACAATCAAAAAGAGTTGATTTTTGTGGAAAGGGCT ATCATCTTATGTCCTTCCCTCAGTCAGCACCTCATGGTGTAGTCTTCTTGCATGTGACTTATGTCCCTGCACAAGAAAAGAACTT CACAACTGCTCCTGCCATTTGTCATGATGGAAAAGCACACTTTCCTCGTGAAGGTGTCTTTGTTTCAAATGGCACACACTGGTTT GTAACACAAAGGAATTTTTATGAACCACAAATCATTACTACACACAACACATTTGTGTCTGGTAACTGTGATGTTGTAATAGGA ATTGTCAACAACACAGTTTATGATCCTTTGCAACCTGAATTAGACTCATTCAAGGAGGAGTTAGATAAATATTTTAAGAATCAT ACATCACCAGATGTTGATTTAGGTGACATCTCTGGCATTAATGCTTCAGTTGTAAACATTCAAAAAGAAATTGACCGCCTCAAT GAGGTTGCCAAGAATTTAAATGAATCTCTCATCGATCTCCAAGAACTTGGAAAGTATGAGCAGTATATAAAATGGCCATGGTAC ATTTGGCTAGGTTTTATAGCTGGCTTGATTGCCATAGTAATGGTGACAATTATGCTTTGCTGTATGACCAGTTGCTGTAGTTGTC TCAAGGGCTGTTGTTCTTGTGGATCCTGCTGCAAATTTGATGAAGACGACTCTGAGCTAGTGCTCAAAGGAGTCAAATTACATT ACACATAA
S- Orf 8 gen e	36 6	ATGAAATTTCTTGTTTTCTTAGGAATCATCACAACTGTAGCTGCATTTCACCAAGAATGTAGTTTACAGTCATGTACTCAACATC AACCATATGTAGTTGATGACCCGTGTCCTATTCACTTCTATTCTAAATGGTATATTAGAGTAGGAGCTAGAAAATCAGCACCTTT AATTGAATTGTGCGTGGATGAGGCTGGTTCTAAATCACCCATTCAGTACATCGATATCGGTAATTATACAGTTTCCTGTTCACCT TTTACAATTAATTGCCAGGAACCTAAATTGGGTAGTCTTGTAGTGCGTTGTTCGTTCTATGAAGACTTTTTAGAGTATCATGACG TTCGTGTTGTTTTAGATTTCATCTAA

L-Orf8 gene	**366**	ATGAAATTTCTTGTTTTCTTAGGAATCATCACAACTGTAGCTGCATTTCACCAAGAATGTAGTTTACAGTCATGTACTCAACATC AACCATATGTAGTTGATGACCCGTGTCCTATTCACTTCTATTCTAAATGGTATATTAGAGTAGGAGCTAGAAAATCAGCACCTTT AATTGAATTGTGCGTGGATGAGGCTGGTTCTAAATCACCCATTCAGTACATCGATATCGGTAATTATACAGTTTCCTGTTTACCT TTTACAATTAATTGCCAGGAACCTAAATTGGGTAGTCTTGTAGTGCGTTGTTCGTTCTATGAAGACTTTTTAGAGTATCATGACG TTCGTGTTGTTTTAGATTTCATCTAA
NP gene	**1260**	ATGTCTGATAATGGACCCCAAAATCAGCGAAATGCACCCCGCATTACGTTTGGTGGACCCTCAGATTCAACTGGCAGTAACCAG AATGGAGAACGCAGTGGGGCGCGATCAAAACAACGTCGGCCCCAAGGTTTACCCAATAATACTGCGTCTTGGTTCACCGCTCTC ACTCAACATGGCAAGGAAGACCTTAAATTCCCTCGAGGACAAGGCGTTCCAATTAACACCAATAGCAGTCCAGATGACCAAAT TGGCTACTACCGAAGAGCTACCAGACGAATTCGTGGTGGTGACGGTAAAATGAAAGATCTCAGTCCAAGATGGTATTTCTACTA CCTAGGAACTGGGCCAGAAGCTGGACTTCCCTATGGTGCTAACAAAGACGGCATCATATGGGTTGCAACTGAGGGAGCCTTGA ATACACCAAAAGATCACATTGGCACCCGCAATCCTGCTAACAATGCTGCAATCGTGCTACAACTTCCTCAAGGAACAACATTGC CAAAAGGCTTCTACGCAGAAGGGAGCAGAGGCGGCAGTCAAGCCTCTTCTCGTTCCTCATCACGTAGTCGCAACAGTTCAAGA AATTCAACTCCAGGCAGCAGTAGGGGAACTTCTCCTGCTAGAATGGCTGGCAATGGCGGTGATGCTGCTCTTGCTTTGCTGCTG CTTGACAGATTGAACCAGCTTGAGAGCAAAATGTCTGGTAAAGGCCAACAACAACAAGGCCAAACTGTCACTAAGAAATCTGC TGCTGAGGCTTCTAAGAAGCCTCGGCAAAAACGTACTGCCACTAAAGCATACAATGTAACACAAGCTTTCGGCAGACGTGGTC CAGAACAAACCCAAGGAAATTTTGGGGACCAGGAACTAATCAGACAAGGAACTGATTACAAACATTGGCCGCAAATTGCACA ATTTGCCCCCAGCGCTTCAGCGTTCTTCGGAATGTCGCGCATTGGCATGGAAGTCACACCTTCGGGAACGTGGTTGACCTACAC AGGTGCCATCAAATTGGATGACAAAGATCCAAATTTCAAAGATCAAGTCATTTTGCTGAATAAGCATATTGACGCATACAAAA CATTCCCACCAACAGAGCCTAAAAAGGACAAAAAGAAGAAGGCTGATGAAACTCAAGCCTTACCGCAGAGACAGAAGAAACA GCAAACTGTGACTCTTCTTCCTGCTGCAGATTTGGATGATTTCTCCAAACAATTGCAACAATCCATGAGCAGTGCTGACTCAACT CAGGCCTAA

Note: NP gene, the gene encoding the nucleoprotein of SARS-CoV-2 (nt 28,274-29,533, NCBI accession number MN908947);   Wild-type S gene, gene fragment of SARS-CoV-2 spike protein (nt 21,563-25,384, NCBI accession number MN908947); Mutant S gene, gene fragments of SARS-CoV-2 spike protein including mutations: L5F, D80A, D215G, R246I, K417N, L452R/Q, Y453F, E484Q, N501Y, A570D, D614G, P681H, A701V, T716I, S982A, D1118H, P1263L; S-Orf8 gene, S lineage gene fragment of open reading frame 8 (ORF8, nt 27,894-28,259, NCBI accession number MN908947); L-Orf8 gene, L lineage fragment of SARS-CoV-2 ORF8 with mutation of S84L.

Supplementary Table S3. Information of clinical samples

SARS-CoV-2 variants	Sample ID	Cycle threshold value (ORF1a/b)	Cycle threshold value (N)
Wild-type	20SF5770	37	36
	20SF5783	28	28
	20SF5774	21	21
	20SF5787	21	22
	20SF5788	28	28
Aplha	XG01774	21	20
	XG02064	24	23
	XG03594	17	16
	XG03595	26	26
	XG03596	15	15
	XG03607	18	16
	XG03623	16	15
	XG04704	18	17
	XG04850	21	22
	XG08145	24	22
	XG08337	17	16
Beta	XG02289	23	23
	XG03246	18	18
	XG03255	19	19
	XG03240	14	13
	XG05824	18	17
	XG07753	27	26
	XG07933	22	22

	XG08741	31	31
Delta	XG08547	20	19
	XG08859	18	19
	XG09082	16	17
	XG08688	21	21
	XG08689	15	15
	XG08692	16	16
	XG08693	16	16
	XG08694	18	16

Supplementary Table S4. Summary of guide RNA (crRNA) sequences

crRNA	Mutations detected	On-target	Off-target	Sequence (5'→3')
crRNA-N1	NA	NP gene	NA	UAAUUUCUACUAAGUGUAGACCCCCAGCGCUUCAGCGUUC
crRNA-N2	NA	NP gene	NA	UAAUUUCUACUAAGUGUAGAGUGGACCCUCAGAUUCAACU
crRNA-N3	NA	NP gene	NA	UAAUUUCUACUAAGUGUAGACCCAAUAAUACUGCGUCUUG
crRNA-N4	NA	NP gene	NA	UAAUUUCUACUAAGUGUAGAUACUACCUAGGAACUGGGCC
crRNA-N5	NA	NP gene	NA	UAAUUUCUACUAAGUGUAGACUGCUGCUUGACAGAUUGAA
crRNA-S	NA	Both wild-type and mutant S gene	NA	UAAUUUCUACUAAGUGUAGAAUAGGGGCUGAACAUGUCAA
crRNA-S-5F	L5F (Spike protein)	Mutant S gene (5F)	Wild-type S gene (5l)	UAAUUUCUACUAAGUGUAGAUUUUAUUGCCACUAGUCUCU
crRNA-S-80A	D80A (Spike protein)	Mutant S gene (80A)	Wild-type S gene (80D)	UAAUUUCUACUAAGUGUAGACUAACCCUGUCCUACCAUUU
crRNA-S-215G	D215G (Spike protein)	Mutant S gene (215G)	Wild-type S gene (215D)	UAAUUUCUACUAAGUGUAGAGUGCGUGGUCUCCCUCAGGG
crRNA-S-246I	R246I (Spike protein)	Mutant S gene (246I)	Wild-type S gene (246R)	UAAUUUCUACUAAGUGUAGACAUAUAAGUUAUUUGACUCC
crRNA-S-417K	K417N (Spike protein)	Wild-type S gene (417K)	Mutant S gene (417N)	UAAUUUCUACUAAGUGUAGAAACGAUUGCUGAUUAUAAUU
crRNA-S-417N	K417N (Spike protein)	Mutant S gene (417N)	Wild-type S gene (417K)	UAAUUUCUACUAAGUGUAGAAACUAUUGCUGAUUAUAAUU
crRNA-S-452R	L452R (Spike protein)	Mutant S gene (452R)	Wild-type S gene (452L)	UAAUUUCUACUAAGUGUAGACCGAUAUAGAUUGUUUAGGA
crRNA-S-452Q	L452Q (Spike protein)	Mutant S gene (452Q)	Wild-type S gene (452L)	UAAUUUCUACUAAGUGUAGACCAAUAUAGAUUGUUUAGGA

crRNA	Mutation	Target 1	Target 2	Sequence
crRNA-S-453F	Y453F (Spike protein)	Mutant S gene (453F)	Wild-type S gene (453Y)	UAAUUUCUACUAAGUGUAGAGAUUGUUUAGGAAGUCUAAU
crRNA-S-478T	T478K (Spike protein)	Wild-type S gene (478T)	Mutant S gene (478K)	UAAUUUCUACUAAGUGUAGAAAGGGGUGCUACCGGCCUGA
crRNA-S-478K	T478K (Spike protein)	Mutant S gene (478K)	Wild-type S gene (478T)	UAAUUUCUACUAAGUGUAGAAAGGGUUGCUACCGGCCUGA
crRNA-S-484K	E484K (Spike protein)	Mutant S gene (484K)	Wild-type S gene (484E)	UAAUUUCUACUAAGUGUAGAACACCAUUACAAGGUGUGCU
crRNA-S-484Q	E484Q (Spike protein)	Mutant S gene (484Q)	Wild-type S gene (484E)	UAAUUUCUACUAAGUGUAGAAAUGGUGUACAAGGUUUUAA
crRNA-S-501N	N501Y (Spike protein)	Wild-type S gene (501N)	Mutant S gene (501Y)	UAAUUUCUACUAAGUGUAGACAACCCACUAAUGGUGUUGG
crRNA-S-570D	A570D (Spike protein)	Mutant S gene (570D)	Wild-type S gene (570A)	UAAUUUCUACUAAGUGUAGAGCAGAGACAUUGAUGACACU
crRNA-S-614D	D614G (Spike protein)	Wild-type S gene (614D)	Mutant S gene (614G)	UAAUUUCUACUAAGUGUAGAUCAGGACGUUAACUGCACAG
crRNA-S-701V	A701V (Spike protein)	Mutant S gene (701V)	Wild-type S gene (701A)	UAAUUUCUACUAAGUGUAGAUACACCAAGUGACAUAGUGU
crRNA-S-716I	T716I (Spike protein)	Mutant S gene (716I)	Wild-type S gene (716T)	UAAUUUCUACUAAGUGUAGAAUGGGUAUGGCAAUAGAGUU
crRNA-S-982S	S982A (Spike protein)	Wild-type S gene (982S)	Mutant S gene (982A)	UAAUUUCUACUAAGUGUAGAACGUCUUGACAAAGUUGAGG
crRNA-S-1263L	P1263L (Spike protein)	Mutant S gene (1263L)	Wild-type S gene (1263P)	UAAUUUCUACUAAGUGUAGAAGCACUAGCUCAGAGUCGUC
crRNA-Orf8	S84L (ORF8 protein)	L-Orf8 gene (84L)	S-Orf8 gene (84S)	UAAUUUCUACUAAGUGUAGACCUUUUACAAUUAAUUGCCA

Note: NA, not available; NP gene, the gene encoding the nucleoprotein of SARS-CoV-2 (nt 28,274-29,533, NCBI accession number MN908947);   Wild-type S gene, gene fragment of SARS-CoV-2 spike protein (nt 21,563-25,384, NCBI accession number MN908947); Mutant S gene, gene fragments of SARS-CoV-2 spike protein including mutations: L5F, D80A, D215G, R246I, K417N, L452R/Q, Y453F, T478K, E484K/Q, N501Y, A570D, D614G, P681H, A701V, T716I, S982A, D1118H, P1263L; S-Orf8 gene, S lineage gene fragment of open reading frame 8 (ORF8, nt 27,894-28,259, NCBI accession number MN908947); L-Orf8 gene, L lineage fragment of SARS-CoV-2 ORF8 with mutation of S84L.

Supplementary Table S5. Summary of primer sequences

Primer	Sequence (5'→3')
N-gene_F	ATGTCTGATAATGGACC
N-gene_R	GGTGTGACTTCCATGCC
S-gene_F1	CTAGTGATGTTCTTGTT
S-gene_R1	TGCACAGTCTACAGCATC
S-gene_F2	ACTTGTGCCCTTTTGGTGAAG
S-gene_R2	GCTATTCCAGTTAAAGCACGGT
S-gene_F3	AGACTCACTTTCTTCCACAGCAA
S-gene_R3	GTATCGTTGCAGTAGCGCGA
Orf8-gene_F	AGGAATCATCACAACTGTAGC
Orf8-gene_R	AACGAACAACGCACTACAAGAC
K417N_F	ATCGCTCCAGGGCAAATTTGAAA
K417N_R	GCTATTCCAGTTAAAGCACGGT
L452R_F	AGGTTGGTGGTAATTATATTTAC
L452R_R	AGTACTACTACTCTGTATGGTTGGT
T478K-R	AACACCATTTCAAGGT
E484Q_F	AGCACACCTTTTAATGGTGTT
E484Q_R	AGTACTACTACTCTGTATGGTTGGT
HCoV 229E NP gene_F	CTACAGTCAAATGGGCTGATGCATCT
HCoV 229E NP gene_R	TGACTTCATCAATTATGTCAG
HCoV OC43 NP gene_F	TCCAGTAGTAGAGCGTCCTCTGGA
HCoV OC43 NP gene_R	GCTGATGTCCTCTGCAGTCAACTCTA
HCoV HKU1 NP gene_F	ATACTCCCGGTCATTATGCTGGAA
HCoV HKU1 NP gene_R	ACATAAGGATCATCAAGAGTAGC

HCoV 229E S gene outer_F	TTGTTGCATATGCCTTGTTGCATATTGC
HCoV 229E S gene outer__R	ATCTTTTCAACGTCGTAATAAGGAAGTTTAG
HCoV 229E S gene inner_F	ACTCTGTTTGCAACGGCTGTGTTGGT
HCoV 229E S gene inner__R	ACTCACCACAAAGATGAGCACGACTG
HCoV OC43 S gene outer_F	TATAAGTATTGATACTGTTGATGTTACTA
HCoV OC43 S gene outer__R	GTCCTTGAGATTGATGTAGCTATGA
HCoV OC43 S gene inner_F	CAGGTTCCACATATCGTAATAT
HCoV OC43 S gene inner__R	AGCTATACCTCTATTACCAGCAATGCA
HCoV HKU1 S gene outer_F	GCCTACAACATTAGCTGTTATA
HCoV HKU1 S gene outer__R	ACACACTCATTAACCTTCTC
HCoV HKU1 S gene inner_F	GTTAAGAATACTAAGTTGTATGT
HCoV HKU1 S gene inner__R	AGCCTATCAATCTGAACCTGA
HCoV 229E Orf3 gene_F	CTCTAGGTTTGTTCACATTGCA
HCoV 229E Orf3 gene_R	TCTGTGTTGACTATTCCAACAGC
HCoV OC43 Orf5 gene_F	ACTTCACATGACGACTAAGTT
HCoV OC43 Orf5 gene_R	ACAATCCACCATCACATGA
HCoV HKU1 Orf4 gene_F	ATGGACGTTTGGAGACCTAGC
HCoV HKU1 Orf4 gene_R	TCAACCATACTTATTAAGTGC

Supplementary Table S6. Comparison of CRISPR-Cas12a, RT-PCR and whole genome sequencing in detecting SARS-CoV-2 variants

Characteristics	CRISPR-Cas12a	RT-PCR(1, 2)	Whole genome sequencing[§]
Procedure	1. Amplification plus Cas12 cleavage (1.0-2h) 2. Amplification-free Cas12 system (20-30 min)	1. Amplification of target gene (1.5-2h) 2. Detection (0-30min) depending on different assays	1. Library preparations (5-7 h) 2. Sequencing (17-32 h) 3. Bioinformatic analysis (1-2 h)
Assay results	Qualitative/Semi-quantitative / diagnosis / genotyping	Quantitative / diagnosis / genotyping	Qualitative / genotyping / characterizing mutations
Limits of detection	1-10 copies per µL or higher	~1 copies per µL	Not applicable
Estimated cost	$4 per sample	$3 per sample	$87 per sample
Benefits	1. Isothermal amplification and reaction at room temperature. 2. Easily to find conserved primer sequences to ensure sensitivity. 3. Specificity relies on crRNA or gRNA.	1. Matured technology and products. 2. PCR equipment and facilities available.	1. Identify novel mutations and variants. 2. Provide complete genome sequence information.
Challenges	1. Limited to known mutations or variants with signature mutations. 2. Multiple readouts and mixed mutations need an integrated testing system and algorithm.	1. PCR equipment and facility needed; 2. Limited to known mutations or variants with signature mutations. 3. Difficult to find appropriate primers for specific mutations. 4. Not suitable for point-of-care testing.	1. Time-consuming for sequencing. 2. Complex bioinformatics pipeline. 3. High-end facilities and trained specialists.

1. **Wang H, Miller JA, Verghese M, Sibai M, Solis D, Mfuh KO, Jiang B, Iwai N, Mar M, Huang C, Yamamoto F, Sahoo MK, Zehnder J, Pinsky BA.** 2021. Multiplex SARS-CoV-2 Genotyping RT-PCR for Population-Level Variant Screening and Epidemiologic Surveillance. Journal of clinical microbiology**:**Jcm0085921.
2. **Zelyas N, Pabbaraju K, Croxen MA, Lynch T, Buss E, Murphy SA, Shokoples S, Wong A, Kanji JN, Tipples G.** 2021. Precision Response to the Rise of the SARS-CoV-2 B.1.1.7 Variant of Concern by Combining Novel PCR Assays and Genome Sequencing for Rapid Variant Detection and Surveillance. Microbiology spectrum **9:**e0031521.

§**Based on Illumina MiSeq sequencing platforms.**

Multiple sequence alignment (positions 1–60):

```
                              1        10        20        30        40        50        60
                              |         |         |         |         |         |         |
MN908947/Wuhan-Hu-1          MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
BS001137/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
BS001138/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
BS001139/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
BS001140/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MW913362/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ266365/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ350105/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGV.YPDKVFRSSVLHSTQDLFLPFFS
MZ350109/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ888516/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
OU562607/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
OU514166/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
OU538851/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
OU538849/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ895877/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
OU514176/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
OU562608/B.1.1.7/Alpha       MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MW981442/B.1.351/Beta        MFVFLVLLPLVSSQCVNFTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ298839/B.1.351/Beta        MFVFLVLLPLVSSQCVNLTTRTQLPPSYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ913100/B.1.351/Beta        MFVFLVLLPLVSSQCVNFTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ879365/B.1.351/Beta        MFVFLVLLPLVSSQCVNFTTRTQLLPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
OU525106/B.1.351/Beta        MFVFLVLLPLVSSQCVNLTTRTQLPPSYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
OU539352/B.1.351/Beta        MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ202314/B.1.351/Beta        MFVFLVLLPLVSSQCVNFTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ298840/B.1.351/Beta        MFVFLVLLPLVSSQCVNLTTRTQLPPSYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ376663/B.1.351/Beta        MFVFLVLLPLVSSQCVNFTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
LC643036/B.1.617.2/Delta     MFVFLVLLPLVSSQCVNLRTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
LC643044/B.1.617.2/Delta     MFVFLVLLPLVSSQCVNLRTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ853946/B.1.617.2/Delta     MFVFLVLLPLVSSQCVNLRTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
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MZ888532/B.1.617.2/Delta     MFVFLVLLPLVSSQCVNLRTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ888533/B.1.617.2/Delta     MFVFLVLLPLVSSQCVNLRTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ896136/B.1.617.2/Delta     MFVFLVLLPLVSSQCVNLRTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
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OU562629/B.1.617.2/Delta     MFVFLVLLPLVSSQCVNLRTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
OU539690/B.1.617.2/Delta     MFVFLVLLPLVSSQCVNLRTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ854387/B.1.617.2/Delta     MFVFLVLLPLVSSQCVNLRTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
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MZ477748/P.1/Gamma           MFVFLVLLPLVSSQCVNFTNRTQLPSAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
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MZ397177/B.1.617.1/Kappa     MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
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OU061269/B.1.617.1/Kappa     MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
OU182966/B.1.617.1/Kappa     MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ746235/B.1.617.1/Kappa     MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ487800/B.1.617.1/Kappa     MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
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OU351967/C.37/Lambda         MFVFLVLLPLVSSQCVNLTTRIQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
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MZ496613/C.37/Lambda         MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
OU517038/C.37/Lambda         MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ953277/C.37/Lambda         MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ942542/C.37/Lambda         MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
MZ857990/C.37/Lambda         MFVFLVLLPLVSSQCVNLTTRTQLPPAYTNSFTRGVYYPDKVFRSSVLHSTQDLFLPFFS
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                                  70        80        90        100       110       120
MN908947/Wuhan-Hu-1      NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
BS001137/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
BS001138/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
BS001139/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
BS001140/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MW913362/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ266365/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ350105/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ350109/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ888516/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU562607/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU514166/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU538851/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU538849/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFAFTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ895877/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKFNIIRGWIFGTTLDSKTQSLLIV
OU514176/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU562608/B.1.1.7/Alpha   NVTWFHAI..SGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MW981442/B.1.351/Beta    NVTWFHAIHVSGTNGTKRFANPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ298839/B.1.351/Beta    NVTWFHAIHVSGTNGTKRFANPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ913100/B.1.351/Beta    NVTWFHAIHVSGTNGTKRFANPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ879365/B.1.351/Beta    NVTWFHAIHVSGTNGTKRFANPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU525106/B.1.351/Beta    NVTWFHAIHVSGTNGTKRFANPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU539352/B.1.351/Beta    NVTWFHAIHVSGTNGTKRFANPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ202314/B.1.351/Beta    NVTWFHAIHVSGTNGTKRFANPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ298840/B.1.351/Beta    NVTWFHAIHVSGTNGTKRFANPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ376663/B.1.351/Beta    NVTWFHAIHVSGTNGTKRFANPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
LC643036/B.1.617.2/Delta NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
LC643044/B.1.617.2/Delta NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASIEKSNIIRGWIFGTTLDSKTQSLLIV
MZ853946/B.1.617.2/Delta NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ854386/B.1.617.2/Delta NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ888532/B.1.617.2/Delta NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ888533/B.1.617.2/Delta NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ896136/B.1.617.2/Delta NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU539261/B.1.617.2/Delta NVTWFHAIHVSGTNGTTRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ854389/B.1.617.2/Delta NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU562629/B.1.617.2/Delta NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU539690/B.1.617.2/Delta NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ854387/B.1.617.2/Delta NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU539784/P.1/Gamma       NVTWFHAIHVSGTNVTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU539830/P.1/Gamma       NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU539894/P.1/Gamma       NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ477748/P.1/Gamma       NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ477746/P.1/Gamma       NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MW938104/P.1/Gamma       NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ896179/P.1/Gamma       NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ896359/P.1/Gamma       NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ896669/P.1/Gamma       NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU565182/P.1/Gamma       NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU492255/P.1/Gamma       NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ911221/B.1.427/Epsilon NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ375854/B.1.427/Epsilon NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ375858/B.1.427/Epsilon NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
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OU235436/B.1.429/Epsilon NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ687447/B.1.429/Epsilon NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
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MZ724425/B.1.617.1/Kappa NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASIEKSNIIRGWIFGTTLDSKTQSLLIV
MZ363839/B.1.617.1/Kappa NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASIEKSNIIRGWIFGTTLDSKTQSLLIV
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MZ332527/B.1.617.1/Kappa NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASIEKSNIIRGWIFGTTLDSKTQSLLIV
LC633761/B.1.617.1/Kappa NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASIEKSNIIRGWIFGTTLDSKTQSLLIV
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MZ487800/B.1.617.1/Kappa NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU322235/B.1.617.1/Kappa NVTWFHAIHVSGTNGTKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ953185/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ937666/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU356036/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU351967/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU053018/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU268528/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU100999/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ275295/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ275301/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ908711/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ496613/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
OU517038/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ953277/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ942542/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
MZ857990/C.37/Lambda     NVTWFHAIHVSGTNVIKRFDNPVLPFNDGVYFASTEKSNIIRGWIFGTTLDSKTQSLLIV
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                                    130       140       150       160       170       180
MN908947/Wuhan-Hu-1      NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
BS001137/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
BS001138/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
BS001139/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
BS001140/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MW913362/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ266365/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ350105/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ350109/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ888516/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU562607/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFFMDLE
OU514166/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU538851/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU538849/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ895877/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNHPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU514176/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU562608/B.1.1.7/Alpha   NNATNVVIKVCEFQFCNDPFLG..YHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MW981442/B.1.351/Beta    NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ298839/B.1.351/Beta    NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ913100/B.1.351/Beta    NNATNVVIKVCEFQFCNYPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
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MZ298840/B.1.351/Beta    NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
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MZ888533/B.1.617.2/Delta NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMES...VYSSANNCTFEYVSQPFLMDLE
MZ896136/B.1.617.2/Delta NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMES...VYSSANNCTFEYVSQPFLMDLE
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OU539690/B.1.617.2/Delta NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMES...VYSSANNCTFEYVSQPFLMDLE
MZ854387/B.1.617.2/Delta NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMESE.RVYSSANNCTFEYVSQPFLMDLE
OU539784/P.1/Gamma       NNATNVVIKVCEFQFCNYPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
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OU539894/P.1/Gamma       NNATNVVIKVCEFQFCNYPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ477748/P.1/Gamma       NNATNVVIKVCEFQFCNYPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ477746/P.1/Gamma       NNATNVVIKVCEFQFCNYPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
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MZ896179/P.1/Gamma       NNATNVVIKVCEFQFCNYPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ896359/P.1/Gamma       NNATNVVIKVCEFQFCNYPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ896669/P.1/Gamma       NNATNVVIKVCEFQFCNYPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU565182/P.1/Gamma       NNATNVVIKVCEFQFCNYPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU492255/P.1/Gamma       NNATNVVIKVCEFQFCNYPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
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MZ375854/B.1.427/Epsilon NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSCMESEFRVYSSANNCTFEYVSQPFLMDLE
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MZ332527/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
LC633761/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
MZ562746/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
MZ571142/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
OU168413/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
MZ026886/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
OU172184/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ397173/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
MZ397176/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
MZ397175/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
MZ397177/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
OU290035/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
OU265178/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
OU254949/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
OU247018/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
OU061269/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
OU182966/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
MZ746235/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
MZ487800/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
OU322235/B.1.617.1/Kappa NNATNVVIKVCEFQFCNDPFLDVYYHKNNKSWMKSEFRVYSSANNCTFEYVSQPFLMDLE
MZ953185/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ937666/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU356036/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU351967/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU053018/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU268528/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU100999/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ275295/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ275301/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ908711/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ496613/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
OU517038/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESELRVYSSANNCTFEYVSQPFLMDLE
MZ953277/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ942542/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
MZ857990/C.37/Lambda     NNATNVVIKVCEFQFCNDPFLGVYYHKNNKSWMESEFRVYSSANNCTFEYVSQPFLMDLE
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                              190       200       210       220       230       240
MN908947/Wuhan-Hu-1        GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
BS001137/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
BS001138/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
BS001139/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
BS001140/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MW913362/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ266365/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ350105/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ350109/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ888516/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU562607/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU514166/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU538851/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU538849/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ895877/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU514176/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU562608/B.1.1.7/Alpha     GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MW981442/B.1.351/Beta      GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRGLPQGFSALEPLVDLPIGINITRFQT
MZ298839/B.1.351/Beta      GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRGLPQGFSALEPLVDLPIGINITRFQT
MZ913100/B.1.351/Beta      GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRGLPQGFSALEPLVDLPIGINITRFQT
MZ879365/B.1.351/Beta      GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRGLPQGFSALEPLVDLPIGINITRFQT
OU525106/B.1.351/Beta      GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRGLPQGFSALEPLVDLPIGINITRFQT
OU539352/B.1.351/Beta      GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRGLPQGFSALEPLVDLPIGINITRFQT
MZ202314/B.1.351/Beta      GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRGLPQGFSALEPLVDLPIGINITRFQT
MZ298840/B.1.351/Beta      GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRGLPQGFSALEPLVDLPIGINITRFQT
MZ376663/B.1.351/Beta      GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRGLPQGFSALEPLVDLPIGINITRFQT
LC643036/B.1.617.2/Delta   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPHGFSALEPLVDLPIGINITRFQT
LC643044/B.1.617.2/Delta   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPHGFSALEPLVDLPIGINITRFQT
MZ853946/B.1.617.2/Delta   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ854386/B.1.617.2/Delta   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ888532/B.1.617.2/Delta   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ888533/B.1.617.2/Delta   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ896136/B.1.617.2/Delta   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSVLEPLVDLPIGINITRFQT
OU539261/B.1.617.2/Delta   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ854389/B.1.617.2/Delta   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU562629/B.1.617.2/Delta   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU539690/B.1.617.2/Delta   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ854387/B.1.617.2/Delta   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU539784/P.1/Gamma         GKQGNFKNLSEFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU539830/P.1/Gamma         GKQGNFKNLSEFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU539894/P.1/Gamma         GKQGNFKNLSEFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ477748/P.1/Gamma         GKQGNFKNLSEFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ477746/P.1/Gamma         GKQGNFKNLSEFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MW938104/P.1/Gamma         GKQGNFKNLSEFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ896179/P.1/Gamma         GKQGNFKNLSEFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ896359/P.1/Gamma         GKQGNFKNLSEFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ896669/P.1/Gamma         GKQGNFKNLSEFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU565182/P.1/Gamma         GKQGNFKNLSEFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU492255/P.1/Gamma         GKQGNFKNLSEFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ911221/B.1.427/Epsilon   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ375854/B.1.427/Epsilon   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ375858/B.1.427/Epsilon   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ943834/B.1.429/Epsilon   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ277390/B.1.429/Epsilon   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU282717/B.1.429/Epsilon   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU235436/B.1.429/Epsilon   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ687447/B.1.429/Epsilon   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ538882/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ724425/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ363839/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ332524/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ332527/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
LC633761/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ562746/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ571142/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU168413/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ026886/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU172184/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ397173/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ397176/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPICINITRFQT
MZ397175/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPICINITRFQT
MZ397177/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPICINITRFQT
OU290035/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPHGFSALEPLVDLPIGINITRFQT
OU265178/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPHGFSALEPLVDLPIGINITRFQT
OU254949/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPHGFSALEPLVDLPIGINITRFQT
OU247018/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU061269/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU182966/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ746235/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ487800/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU322235/B.1.617.1/Kappa   GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ953185/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ937666/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU356036/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU351967/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU053018/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU268528/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU100999/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ275295/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ275301/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ908711/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ496613/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
OU517038/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ953277/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ942542/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
MZ857990/C.37/Lambda       GKQGNFKNLREFVFKNIDGYFKIYSKHTPINLVRDLPQGFSALEPLVDLPIGINITRFQT
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Multiple sequence alignment (positions ~245–300):

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                                250        260        270        280        290        300
MN908947/Wuhan-Hu-1      LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
BS001137/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
BS001138/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
BS001139/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
BS001140/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MW913362/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ266365/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ350105/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ350109/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ888516/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
OU562607/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
OU514166/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
OU538851/B.1.1.7/Alpha   LLALH SSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
OU538849/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ895877/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
OU514176/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
OU562608/B.1.1.7/Alpha   LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MW981442/B.1.351/Beta    L...HRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ298839/B.1.351/Beta    L...HRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ913100/B.1.351/Beta    L...HRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ879365/B.1.351/Beta    L...HRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
OU525106/B.1.351/Beta    L...HRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
OU539352/B.1.351/Beta    L...HRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ202314/B.1.351/Beta    L...HRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ298840/B.1.351/Beta    L...HRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ376663/B.1.351/Beta    L...HRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
LC643036/B.1.617.2/Delta LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
LC643044/B.1.617.2/Delta LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ853946/B.1.617.2/Delta LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ854386/B.1.617.2/Delta LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ888532/B.1.617.2/Delta LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ888533/B.1.617.2/Delta LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAVDCALDPLSETK
MZ896136/B.1.617.2/Delta LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAIDCALDPLSETK
OU539261/B.1.617.2/Delta LLALHRSYLTPGDSSSGWTAGAAAYYVGYLQPRTFLLKYNENGTITDAIDCALDPLSETK
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MN908947/Wuhan-Hu-1       CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
BS001137/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
BS001138/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
BS001139/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
BS001140/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MW913362/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ266365/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ350105/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ350109/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ888516/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU562607/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU514166/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU538851/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU538849/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ895877/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU514176/B.1.1.7/Alpha    CVADYSVLYNSVSFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU562608/B.1.1.7/Alpha    CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MW981442/B.1.351/Beta     CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ298839/B.1.351/Beta     CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGNIAD
MZ913100/B.1.351/Beta     CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGNIAD
MZ879365/B.1.351/Beta     CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGNIAD
OU525106/B.1.351/Beta     CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGNIAD
OU539352/B.1.351/Beta     CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGNIAD
MZ202314/B.1.351/Beta     CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGNIAD
MZ298840/B.1.351/Beta     CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGNIAD
MZ376663/B.1.351/Beta     CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
LC643036/B.1.617.2/Delta  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
LC643044/B.1.617.2/Delta  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ853946/B.1.617.2/Delta  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ854386/B.1.617.2/Delta  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ888532/B.1.617.2/Delta  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ888533/B.1.617.2/Delta  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ896136/B.1.617.2/Delta  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU539261/B.1.617.2/Delta  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ854389/B.1.617.2/Delta  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU562629/B.1.617.2/Delta  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU539690/B.1.617.2/Delta  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ854387/B.1.617.2/Delta  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU539784/P.1/Gamma        CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGTIAD
OU539830/P.1/Gamma        CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGTIAD
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MZ477748/P.1/Gamma        CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGTIAD
MZ477746/P.1/Gamma        CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGTIAD
MW938104/P.1/Gamma        CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGTIAD
MZ896179/P.1/Gamma        CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGTIAD
MZ896359/P.1/Gamma        CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGTIAD
MZ896669/P.1/Gamma        CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGTIAD
OU565182/P.1/Gamma        CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGTIAD
OU492255/P.1/Gamma        CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGTIAD
MZ911221/B.1.427/Epsilon  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ375854/B.1.427/Epsilon  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
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MZ943834/B.1.429/Epsilon  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ277390/B.1.429/Epsilon  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU282717/B.1.429/Epsilon  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU235436/B.1.429/Epsilon  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ687447/B.1.429/Epsilon  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ538882/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ724425/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ363839/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ332524/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ332527/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
LC633761/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ562746/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ571142/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
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MZ026886/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU172184/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ397173/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
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MZ397177/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU290035/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU265178/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU254949/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU247018/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU061269/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU182966/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ746235/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ487800/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU322235/B.1.617.1/Kappa  CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ953185/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ937666/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU356036/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU351967/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU053018/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU268528/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
OU100999/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ275295/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ275301/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ908711/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ496613/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
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MZ953277/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ942542/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
MZ857990/C.37/Lambda      CVADYSVLYNSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIAD
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                                   430       440       450       460       470       480
MN908947/Wuhan-Hu-1       YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
BS001137/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
BS001138/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
BS001139/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
BS001140/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
MW913362/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ266365/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ350105/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ350109/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ888516/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
OU562607/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
OU514166/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
OU538851/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
OU538849/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ895877/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
OU514176/B.1.1.7/Alpha    YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
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MW981442/B.1.351/Beta     YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ298839/B.1.351/Beta     YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ913100/B.1.351/Beta     YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
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OU525106/B.1.351/Beta     YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
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OU539261/B.1.617.2/Delta  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSKPC
MZ854389/B.1.617.2/Delta  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSKPC
OU562629/B.1.617.2/Delta  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSKPC
OU539690/B.1.617.2/Delta  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSKPC
MZ854387/B.1.617.2/Delta  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSKPC
OU539784/P.1/Gamma        YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
OU539830/P.1/Gamma        YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
OU539894/P.1/Gamma        YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
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MZ477746/P.1/Gamma        YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
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MZ896179/P.1/Gamma        YNYKLPNDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ896359/P.1/Gamma        YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
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OU565182/P.1/Gamma        YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
OU492255/P.1/Gamma        YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPC
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OU235436/B.1.429/Epsilon  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ687447/B.1.429/Epsilon  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ538882/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ724425/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ363839/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ332524/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ332527/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
LC633761/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ562746/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ571142/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
OU168413/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ026886/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
OU172184/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ397173/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ397176/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ397175/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ397177/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
OU290035/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
OU265178/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
OU254949/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
OU247018/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
OU061269/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
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MZ746235/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ487800/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
OU322235/B.1.617.1/Kappa  YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYRYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ953185/C.37/Lambda      YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYQYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ937666/C.37/Lambda      YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYQYRLFRKSNLKPFERDISTEIYQAGSTPC
OU356036/C.37/Lambda      YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYQYRLFRKSNLKPFERDISTEIYQAGSTPC
OU351967/C.37/Lambda      YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYQYRLFRKSNLKPFERDISTEIYQAGSTPC
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OU100999/C.37/Lambda      YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYQYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ275295/C.37/Lambda      YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYQYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ275301/C.37/Lambda      YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYQYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ908711/C.37/Lambda      YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYQYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ496613/C.37/Lambda      YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYQYRLFRKSNLKPFERDISTEIYQAGSTPC
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MZ953277/C.37/Lambda      YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYQYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ942542/C.37/Lambda      YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYQYRLFRKSNLKPFERDISTEIYQAGSTPC
MZ857990/C.37/Lambda      YNYKLPDDFTGCVIAWNSNNLDSKVGGNYNYQYRLFRKSNLKPFERDISTEIYQAGSTPC
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                                        490       500       510       520       530       540
MN908947/Wuhan-Hu-1        NGVEGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
BS001137/B.1.1.7/Alpha     NGVEGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
BS001138/B.1.1.7/Alpha     NGVEGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
BS001139/B.1.1.7/Alpha     NGVEGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
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MZ266365/B.1.1.7/Alpha     NGVEGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ350105/B.1.1.7/Alpha     NGVEGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
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MZ895877/B.1.1.7/Alpha     NGVEGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
OU514176/B.1.1.7/Alpha     NGVEGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
OU562608/B.1.1.7/Alpha     NGVEGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MW981442/B.1.351/Beta      NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ298839/B.1.351/Beta      NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ913100/B.1.351/Beta      NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ879365/B.1.351/Beta      NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
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MZ376663/B.1.351/Beta      NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
LC643036/B.1.617.2/Delta   NGVEGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
LC643044/B.1.617.2/Delta   NGVEGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
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OU539690/B.1.617.2/Delta   NGVEGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ854387/B.1.617.2/Delta   NGVEGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
OU539784/P.1/Gamma         NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
OU539830/P.1/Gamma         NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
OU539894/P.1/Gamma         NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ477748/P.1/Gamma         NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ477746/P.1/Gamma         NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MW938104/P.1/Gamma         NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ896179/P.1/Gamma         NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ896359/P.1/Gamma         NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ896669/P.1/Gamma         NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
OU565182/P.1/Gamma         NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
OU492255/P.1/Gamma         NGVKGFNCYFPLQSYGFQPTYGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ911221/B.1.427/Epsilon   NGVEGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ375854/B.1.427/Epsilon   NGVEGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
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MZ724425/B.1.617.1/Kappa   NGVQGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ363839/B.1.617.1/Kappa   NGVQGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ332524/B.1.617.1/Kappa   NGVQGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
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LC633761/B.1.617.1/Kappa   NGVQGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
MZ562746/B.1.617.1/Kappa   NGVQGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPVTVCGPKKSTNLVKNKCVN
MZ571142/B.1.617.1/Kappa   NGVQGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
OU168413/B.1.617.1/Kappa   NGVQGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
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MZ487800/B.1.617.1/Kappa   NGVQGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
OU322235/B.1.617.1/Kappa   NGVQGFNCYFPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
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MZ937666/C.37/Lambda       NGVEGFNCYSPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
OU356036/C.37/Lambda       NGVEGFNCYSPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
OU351967/C.37/Lambda       NGVEGFNCYSPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
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MZ857990/C.37/Lambda       NGVEGFNCYSPLQSYGFQPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSTNLVKNKCVN
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                                  610       620       630       640       650       660
                                   .         .         .         .         .         .
MN908947/Wuhan-Hu-1        GTNTSNQVAVLYQDVNCTEVPVAIHADQLTPTWRVYSTGSNVFQTRAGCLIGAEHVNNSY
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BS001138/B.1.1.7/Alpha     GTNTSNQVAVLYQGVNCTEVPVAIHADQLTPTWRVYSTGSNVFQTRAGCLIGAEHVNNSY
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MZ275301/C.37/Lambda      ECDIPIGAGICASYQTQTNSPRRARSVASQSIIAYTMSLGAENSVAYSNNSIAIPTNFTI
MZ908711/C.37/Lambda      ECDIPIGAGICASYQTQTNSPRRARSVASQSIIAYTMSLGAENSVAYSNNSIAIPTNFTI
MZ496613/C.37/Lambda      ECDIPIGAGICASYQTQTNSPRRARSVASQSIIAYTMSLGAENSVAYSNNSIAIPTNFTI
OU517038/C.37/Lambda      ECDIPIGAGICASYQTQTNSPRRARSVASQSIIAYTMSLGAENSVAYSNNSIAIPTNFTI
MZ953277/C.37/Lambda      ECDIPIGAGICASYQTQTNSPRRARSVASQSIIAYTMSLGAENSVAYSNNSIAIPTNFTI
MZ942542/C.37/Lambda      ECDIPIGAGICASYQTQTNSPRRARSVASQSIIAYTMSLGAENSVAYSNNSIAIPTNFTI
MZ857990/C.37/Lambda      ECDIPIGAGICASYQTQTNSPRRARSVASQSIIAYTMSLGAENSVAYSNNSIAIPTNFTI
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                                      730       740       750       760       770       780
MN908947/Wuhan-Hu-1        SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
BS001137/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
BS001138/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
BS001139/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
BS001140/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MW913362/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ266365/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ350105/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ350109/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ888516/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
OU562607/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
OU514166/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
OU538851/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
OU538849/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ895877/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
OU514176/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
OU562608/B.1.1.7/Alpha     SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MW981442/B.1.351/Beta      SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ298839/B.1.351/Beta      SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ913100/B.1.351/Beta      SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ879365/B.1.351/Beta      SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
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LC643036/B.1.617.2/Delta   SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
LC643044/B.1.617.2/Delta   SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
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OU562629/B.1.617.2/Delta   SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
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MZ854387/B.1.617.2/Delta   SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
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OU539830/P.1/Gamma         SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
OU539894/P.1/Gamma         SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ477748/P.1/Gamma         SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ477746/P.1/Gamma         SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MW938104/P.1/Gamma         SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
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OU492255/P.1/Gamma         SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ911221/B.1.427/Epsilon   SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
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MZ538882/B.1.617.1/Kappa   SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
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MZ937666/C.37/Lambda       SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
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OU351967/C.37/Lambda       SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
OU053018/C.37/Lambda       SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
OU268528/C.37/Lambda       SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
OU100999/C.37/Lambda       SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ275295/C.37/Lambda       SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ275301/C.37/Lambda       SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
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MZ953277/C.37/Lambda       SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ942542/C.37/Lambda       SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
MZ857990/C.37/Lambda       SVTTEILPVSMTKTSVDCTMYICGDSTECSNLLLQYGSFCTQLNRALTGIAVEQDKNTQE
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                              790        800        810        820        830        840

MN908947/Wuhan-Hu-1      VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
BS001137/B.1.1.7/Alpha   VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
BS001138/B.1.1.7/Alpha   VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
BS001139/B.1.1.7/Alpha   VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
BS001140/B.1.1.7/Alpha   VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
MW913362/B.1.1.7/Alpha   VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
MZ266365/B.1.1.7/Alpha   VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
MZ350105/B.1.1.7/Alpha   VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
MZ350109/B.1.1.7/Alpha   VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
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MZ854387/B.1.617.2/Delta VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
OU539784/P.1/Gamma       VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
OU539830/P.1/Gamma       VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
OU539894/P.1/Gamma       VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
MZ477748/P.1/Gamma       VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
MZ477746/P.1/Gamma       VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
MW938104/P.1/Gamma       VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
MZ896179/P.1/Gamma       VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
MZ896359/P.1/Gamma       VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
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OU565182/P.1/Gamma       VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
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MZ911221/B.1.427/Epsilon VFAQVKQIYKTPPIKDFGGFNFSQILPDPSKPSKRSFIEDLLFNKVTLADAGFIKQYGDC
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BS001137/B.1.1.7/Alpha   TLVKQLSSNFGAISSVLNDILARLDKVEAEVQIDRLITGRLQSLQTYVTQQLIRAAEIRA
BS001138/B.1.1.7/Alpha   TLVKQLSSNFGAISSVLNDILARLDKVEAEVQIDRLITGRLQSLQTYVTQQLIRAAEIRA
BS001139/B.1.1.7/Alpha   TLVKQLSSNFGAISSVLNDILARLDKVEAEVQIDRLITGRLQSLQTYVTQQLIRAAEIRA
BS001140/B.1.1.7/Alpha   TLVKQLSSNFGAISSVLNDILARLDKVEAEVQIDRLITGRLQSLQTYVTQQLIRAAEIRA
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MZ937666/C.37/Lambda     TLVKQLSSNFGAISSVLNDILSRLDKVEAEVQIDRLITGRLQSLQTYVTQQLIRAAEIRA
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OU100999/C.37/Lambda     TLVKQLSSNFGAISSVLNDILSRLDKVEAEVQIDRLITGRLQSLQTYVTQQLIRAAEIRA
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MZ275301/C.37/Lambda     TLVKQLSSNFGAISSVLNDILSRLDKVEAEVQIDRLITGRLQSLQTYVTQQLIRAAEIRA
MZ908711/C.37/Lambda     TLVKQLSSNFGAISSVLNDILSRLDKVEAEVQIDRLITGRLQSLQTYVTQQLIRAAEIRA
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MZ953277/C.37/Lambda     TLVKQLSSNFGAISSVLNDILSRLDKVEAEVQIDRLITGRLQSLQTYVTQQLIRAAEIRA
MZ942542/C.37/Lambda     TLVKQLSSNFGAISSVLNDILSRLDKVEAEVQIDRLITGRLQSLQTYVTQQLIRAAEIRA
MZ857990/C.37/Lambda     TLVKQLSSNFGAISSVLNDILSRLDKVEAEVQIDRLITGRLQSLQTYVTQQLIRAAEIRA
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OU565182/P.1/Gamma       ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU492255/P.1/Gamma       ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ911221/B.1.427/Epsilon ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ375854/B.1.427/Epsilon ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ375858/B.1.427/Epsilon ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ943834/B.1.429/Epsilon ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ277390/B.1.429/Epsilon ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU282717/B.1.429/Epsilon ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU235436/B.1.429/Epsilon ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ687447/B.1.429/Epsilon ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ538882/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ724425/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ363839/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ332524/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ332527/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
LC633761/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ562746/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ571142/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU168413/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ026886/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU172184/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ397173/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ397176/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
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OU290035/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTDWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU265178/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTDWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU254949/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTDWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU247018/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTDWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU061269/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTDWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU182966/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTDWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ746235/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ487800/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTDWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU322235/B.1.617.1/Kappa ICHDGKAHFPREGVFVSNGTDWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ953185/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ937666/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU356036/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU351967/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU053018/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU268528/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU100999/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ275295/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ275301/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ908711/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ496613/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
OU517038/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ953277/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ942542/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
MZ857990/C.37/Lambda     ICHDGKAHFPREGVFVSNGTHWFVTQRNFYEPQIITTDNTFVSGNCDVVIGIVNNTVYDP
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BS001137/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
BS001138/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
BS001139/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
BS001140/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MW913362/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ266365/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ350105/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ350109/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ888516/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU562607/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU514166/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU538851/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU538849/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ895877/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU514176/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU562608/B.1.1.7/Alpha      LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MW981442/B.1.351/Beta       LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ298839/B.1.351/Beta       LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ913100/B.1.351/Beta       LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ879365/B.1.351/Beta       LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU525106/B.1.351/Beta       LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU539352/B.1.351/Beta       LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ202314/B.1.351/Beta       LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ298840/B.1.351/Beta       LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ376663/B.1.351/Beta       LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
LC643036/B.1.617.2/Delta    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
LC643044/B.1.617.2/Delta    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ853946/B.1.617.2/Delta    WQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ854386/B.1.617.2/Delta    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ888532/B.1.617.2/Delta    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ888533/B.1.617.2/Delta    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ896136/B.1.617.2/Delta    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU539261/B.1.617.2/Delta    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ854389/B.1.617.2/Delta    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU562629/B.1.617.2/Delta    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU539690/B.1.617.2/Delta    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
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OU539784/P.1/Gamma          LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASFVNIQKEIDRLNEVAKNLNESLIDL
OU539830/P.1/Gamma          LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASFVNIQKEIDRLNEVAKNLNESLIDL
OU539894/P.1/Gamma          LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASFVNIQKEIDRLNEVAKNLNESLIDL
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MZ477746/P.1/Gamma          LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASFVNIQKEIDRLNEVAKNLNESLIDL
MW938104/P.1/Gamma          LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASFVNIQKEIDRLNEVAKNLNESLIDL
MZ896179/P.1/Gamma          LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASFVNIQKEIDRLNEVAKNLNESLIDL
MZ896359/P.1/Gamma          LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASFVNIQKEIDRLNEVAKNLNESLIDL
MZ896669/P.1/Gamma          LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASFVNIQKEIDRLNEVAKNLNESLIDL
OU565182/P.1/Gamma          LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASFVNIQKEIDRLNEVAKNLNESLIDL
OU492255/P.1/Gamma          LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASFVNIQKEIDRLNEVAKNLNESLIDL
MZ911221/B.1.427/Epsilon    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ375854/B.1.427/Epsilon    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ375858/B.1.427/Epsilon    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ943834/B.1.429/Epsilon    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ277390/B.1.429/Epsilon    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU282717/B.1.429/Epsilon    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU235436/B.1.429/Epsilon    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ687447/B.1.429/Epsilon    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ538882/B.1.617.1/Kappa    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ724425/B.1.617.1/Kappa    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
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MZ332524/B.1.617.1/Kappa    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ332527/B.1.617.1/Kappa    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
LC633761/B.1.617.1/Kappa    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ562746/B.1.617.1/Kappa    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ571142/B.1.617.1/Kappa    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU168413/B.1.617.1/Kappa    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ026886/B.1.617.1/Kappa    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU172184/B.1.617.1/Kappa    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ397173/B.1.617.1/Kappa    LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
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OU356036/C.37/Lambda        LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
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MZ908711/C.37/Lambda        LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ496613/C.37/Lambda        LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
OU517038/C.37/Lambda        LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ953277/C.37/Lambda        LQPELDSFKEELDKYFKNHTSPDVDLGDFSGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ942542/C.37/Lambda        LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
MZ857990/C.37/Lambda        LQPELDSFKEELDKYFKNHTSPDVDLGDISGINASVVNIQKEIDRLNEVAKNLNESLIDL
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                                 1210      1220      1230      1240      1250      1260
MN908947/Wuhan-Hu-1        QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
BS001137/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
BS001138/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
BS001139/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
BS001140/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
MW913362/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
MZ266365/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
MZ350105/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVIVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
MZ350109/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
MZ888516/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
OU562607/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
OU514166/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
OU538851/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
OU538849/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
MZ895877/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
OU514176/B.1.1.7/Alpha     QELGKYEQYIKWPWYIWLGFIAGLIAIVMVTIMLCCMTSCCSCLKGCCSCGSCCKFDEDD
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Supplementary Figure S1. Multiple alignment of amino acid sequences of spike protein from different variants of concern or variants of interest from different regions, and compared with wild-type SARS-CoV-2 strain isolated from Wuhan, China (accession number MN908947). SARS-CoV-2 genomes used for alignment were download from NCBI GenBank database and its detailed information was listed in Supplementary Table S1. Multiple alignment was performed and visualized using MAFFT version 7 and ESPript 3.0 respectively. The accession number, pangolin lineage and WHO classification are shown on the left side of the sequences. The red boxes represent identical residues while similar residues are indicated by red letters.
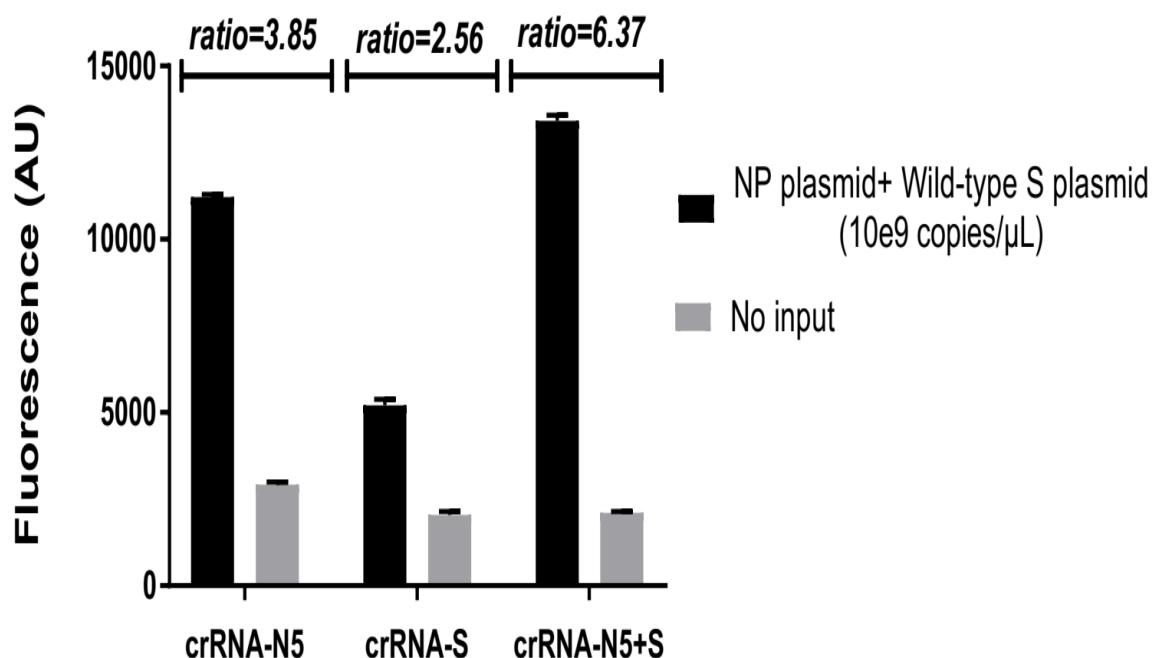
Supplementary Figure S2. Enhanced detection sensitivity for the combination of different guide RNAs in CRISPR-Cas12a-based detection. 10^9 copies/μL of plasmid DNA for SARS-CoV-2 nucleoprotein (NP) and wild-type spike (S) gene were detected by CRISPR-Cas12a-based assay using crRNA-N5, crRNA-S and the mixture of crRNA-N5 and crRNA-S, respectively. The ration of fluorescence signal for SARS-CoV-2 plasmid DNA over no input control was presented at the top of the figure.

crRNA-N5

Legend:
- Wild-type
- Alpha
- Beta
- Delta
- SARS-CoV-2 NP plasmid (10e9 copies/µL)
- No input
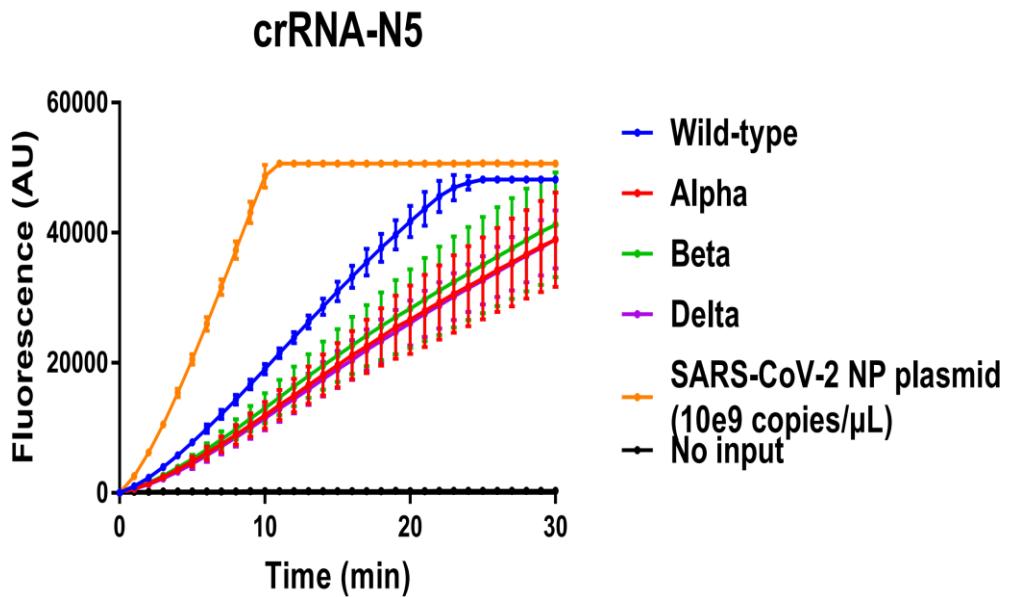
Supplementary Figure S3. CRISPR-Cas12a-based detection of SARS-CoV-2 NP gene. Viral RNA templates were extracted from SARS-CoV-2 wild-type strain as well as Alpha, Beta and Delta SARS-CoV-2 variants of concern and amplified by RT-PCR followed by CRISPR-Cas12a-mediated detection by using crRNA-N5. The SARS-CovV-2 NP plasmid DNA (10^9 copies/µL) was used as positive control. The fluorescence was measured at different time points and presented as the mean $\pm$ standard deviation (SD) from 3 replicates. No input, negative control with no plasmid DNA.