



illumina NextSeq 550Dx Local Run Manager Germline Variant Analysis User Guide

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NextSeq 550Dx Local Run Manager Germline Variant Analysis User Guide FOR IN VITRO DIAGNOSTIC USE

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NextSeq 550Dx Local Run Manager Germline Variant Analysis

Local Run Manager Germline Variant Analysis Module Workflow Guide for NextSeq 550Dx

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Overview

The Local Run Manager Germline Variant Module is for use with the Illumina TruSeq Custom Amplicon Kit Dx assay and the NextSeq 550Dx. When used with the Germline Variant Module, the assay is intended for preparing libraries used for the sequencing of DNA from peripheral whole blood specimens. The analysis module evaluates short regions of amplified DNA, or amplicons, for variants. Focused sequencing of amplicons enables high coverage of particular regions. See the package insert TruSeq Custom Amplicon Kit Dx (document # 1000000029772). The Germline Variant analysis module requires 300-cycle sequencing consumables. For more information, see the NextSeq 550Dx High Output Reagent Kit v2 or NextSeq 550Dx High Output Reagent Kit v2.5 package insert.

About This Guide

This guide provides instructions for setting up run parameters for sequencing and analysis for the Germline Variant analysis module. For information about the Local Run Manager dashboard and system settings, see the NextSeq 550Dx Instrument Reference Guide (document # 1000000009513).

Viewing Local Run Manager

The Local Run Manager interface is viewed within NextSeq 550Dx Operating Software (NOS) or through a web browser. The supported web browser is Chromium.



NOTE

If you use an unsupported browser, download the supported browser when prompted on the “Confirm Unsupported Browser” message. Select “here” to download the supported version of Chromium.

View on the Instrument Monitor

1. To view the Local Run Manager interface on the instrument monitor, select one of the following options:
 - u From the NOS Home Screen, select Local Run Manager. Click the X in the upper right corner to return to NOS when done.
 - u Select the Minimize NOS icon, open the Chromium web browser that is on the instrument, and enter <https://localhost> in the address bar.
- Only admin users can minimize NOS.

View from a Networked Computer

Open a Chromium web browser on a computer with access to the same network as the instrument and connect using the instrument IP address or instrument name. For example, <https://www.myinstrument>.

Enter Run Information

Set Parameters

1. Log in to Local Run Manager.
2. Select Create Run, and select Germline Variant.
3. Enter a run name that identifies the run from sequencing through analysis.
Use alphanumeric characters, spaces, underscores, or dashes.
4. [Optional] Enter a run description to help identify the run.
Use alphanumeric characters, spaces, underscores, or dashes.
5. Select the number of samples and index set from the drop-down list.
Consider the following information when you make a selection.
 - The drop-down list contains numbers of samples with an index set. For example, 24-Set 1 indicates 24 samples to be tested, with indexes from index set 1.
 - Index set numbers refer to different sets of i5 indexes. Set 1 and Set 2 both provide index diversity.
Two index sets are offered to help prevent depletion of a single set.
 - Choose the number of samples that is nearest to the number of samples you are testing. If the exact number of samples is not in the list, select the number nearest, but less than the number you are testing. For example, if you want to test 18 samples, select 16 samples.
 - Sample wells and index combinations that meet index diversity requirements are highlighted in green.
If you select other wells and index combinations, when you save the run you receive notification if index diversity requirements are not met.

Import Manifest Files for the Run

1. Make sure that the manifests you want to import are available in an accessible network location or on a USB drive.
2. Select Import Manifests.
3. Navigate to the manifest file and select the manifests that you want to add.



NOTE

To make manifest files available for all runs using the Germline Variant analysis module, add manifests using the Module Settings feature. This feature requires admin user level permissions. For more information, see the NextSeq 550Dx Instrument Reference Guide (document # 1000000009513).


Specify Samples for the Run

Specify samples for the run using one of the options and the directions that follow.


- Enter samples manually—Use the blank table on the Create Run screen.
- Import samples—Navigate to an external file in a comma-separated values (*.csv) format. A template is available for download on the Create Run screen.

After you have populated the samples table, you can export the sample information to an external file. Use the file as a reference when you prepare libraries or import the file for another run.

Enter Samples Manually

1. Enter a unique sample ID in the Sample ID field.
Use alphanumeric characters, dashes, or underscores.
2. [Optional] For positive or negative control samples, right-click and select the control type.
3. [Optional] Enter a sample description in the Sample Description field.
Use alphanumeric characters, dashes, or underscores.
Sample descriptions are associated with a sample name. Sample descriptions are overwritten if the same sample name is used again in a later run.
4. Select an Index 1 adapter from the Index 1 (i7) drop-down list.
When you use suggested sample wells, the software auto-populates i7 and i5 index adapters that meet diversity index requirements. If the exact number of samples you are testing is not in the list, make sure to select index adapters for extra wells. If you need to select indexes for extra wells, or you do not use the recommended index adapter combinations, before you choose indexes make sure to read Base Calling and Index Diversity on page 13.
5. Select an Index 2 adapter from the Index 2 (i5) drop-down list.
6. Select a manifest file from the Manifest drop-down list.
7. Choose an option to view, print, or save the plate layout as a reference for preparing libraries:
 - Select the  Print icon to display the plate layout. Select Print to print the plate layout.
 - Select Export to export sample information to an external file.Make sure that manifest and sample information is correct. Incorrect information can impact results.
8. Select Save Run.

Import Samples

1. Select Import Samples and browse to the location of the sample information file. There are two types of files you can import.
 - Select Template on the Create Run screen to make a new plate layout. The template file contains the correct column headings for import. Enter sample information in each column for the samples in the run. Delete example information in unused cells, and then save the file.
 - Use a file of sample information that was exported from the Germline Variant module using the Export feature.
2. Select the  Print icon to display the plate layout.
3. Select Print to print the plate layout as a reference for preparing libraries.
4. [Optional] Select Export to export sample information to an external file.
Make sure that manifest and sample information is correct. Incorrect information can impact results.
5. Select Save Run.

Edit a Run

For instructions on editing the information in your run before sequencing, see NextSeq 550Dx Instrument Reference Guide (document # 1000000009513).

Analysis Methods

The Germline Variant analysis module performs the following analysis steps and then writes analysis output files to the Alignment folder.

- Demultiplexes index reads
- Generates FASTQ files
- Aligns to a reference
- Identifies variants

Demultiplexing

Demultiplexing compares each Index Read sequence to the index sequences specified for the run. No quality values are considered in this step.

Index reads are identified using the following steps:

- Samples are numbered starting from 1 based on the order they are listed for the run.
- Sample number 0 is reserved for clusters that were not assigned to a sample.
- Clusters are assigned to a sample when the index sequence matches exactly or when there is up to a single mismatch per Index Read.

FASTQ File Generation

After demultiplexing, the software generates intermediate analysis files in the FASTQ format, which is a text format used to represent sequences. FASTQ files contain reads for each sample and the associated quality scores. Clusters that did not pass filter are excluded.

Each FASTQ file contains reads for only one sample, and the name of that sample is included in the FASTQ file name. FASTQ files are the primary input for alignment. Eight FASTQ files are generated per sample, four from Read 1 and four from Read 2.

Alignment

During the alignment step, the banded Smith-Waterman algorithm aligns clusters from each sample against amplicon sequences specified in the manifest file.

The banded Smith-Waterman algorithm performs semiglobal sequence alignments to determine similar regions between two sequences. Instead of comparing the total sequence, the Smith-Waterman algorithm compares segments of all possible lengths.

Each paired-end read is evaluated in terms of its alignment to the relevant probe sequences for that read.

- Read 1 is evaluated against the reverse complement of the Downstream Locus-Specific Oligos (DLSO).
- Read 2 is evaluated against the Upstream Locus-Specific Oligos (ULSO).
- If the start of a read matches a probe sequence with no more than three differences (mismatches or shifts due to leading indels), the full length of the read is aligned against the amplicon target for that sequence.
- Indels within the DLSO and ULSO are not observed given the assay chemistry.

Alignments are filtered from alignment results based on mismatch rates over either the region of interest or the full amplicon, depending on the amplicon length. Filtered alignments are written in alignment files as unaligned and are not used in variant calling.

Variant Calling

Developed by Illumina, the Pisces Variant Caller identifies variants present in the DNA sample.



The Pisces variant caller identifies SNVs, MNVs, and small indels in 3 steps:

- Considers each position in the reference genome separately
- Counts bases at the given position for aligned reads that overlap the position
- Computes a variant score that measures the quality of the call using Poisson model. Variants with a quality

score below Q20 are excluded.

If a variant passes all filters, the variant is marked as PASS in VCF.
For more information, see github.com/Illumina/Pisces/wiki.

View Run and Sample Data

1. From the Local Run Manager dashboard, click the run name.
 2. From the Run Overview tab, review the sequencing run metrics.
 3. [Optional] Click the Copy to Clipboard  icon to copy the output run folder path.
 4. Click the Sequencing Information tab to review run parameters and consumables information.
 5. Click the Samples and Results tab to view the analysis report location.
 - If analysis was repeated, expand the Select Analysis drop-down list and select the appropriate analysis.
 6. Click the Copy to Clipboard  icon to copy the Analysis folder path.
- For more information on the Run Overview and Sequencing Information tabs, and how to requeue analysis, see the NextSeq 550Dx Instrument Reference Guide (document # 1000000009513).

Analysis Report

Analysis results are summarized on the Samples and Results tab, and as an aggregate report in the Alignment folder. A report for each sample is also available in a PDF file format for each sample.

Samples and Results Tab Information

- 1 Click a sample in the list to see the sample report.

Table 1 Run and Sample Information

Column Heading	Description
Run Status	States whether the sequencing run passed or failed.
Total Yield (GB)	Number of bases called in the sequencing run. Shows passing threshold, and pass or fail status.
% ≥ Q30	The percentage of reads in the sequencing run with a quality score of 30(Q30) or greater. Shows passing threshold, and pass or fail status.
Sample ID	The sample ID provided when the run was created.
Total PF Reads	The total number of reads passing filter.
Read 1% ≥ Q30	The percentage of reads in Read 1 with a quality score of 30(Q30) or greater for the sample.
Read 2% ≥ Q30	The percentage of reads in Read 2 with a quality score of 30(Q30) or greater for the sample.
Autosome Call Rate	The number of genomic positions across the autosomes (chromosomes 1 through 22) that meet a predefined confidence value threshold, divided by the total number of autosomal genomic positions interrogated. Call rate is described on a per-sample basis and reported as a percentage that is calculated as 1 minus (number of autosomal positions with incomplete calls divided by the total number of autosomal positions sequenced).

Table 2 Sample Report Information

Column Heading	Description
Sample	The sample ID provided when the run was created.
Report Date	Date the report was generated.
Sample Information	The sample ID that was provided when the run was created, total reads that passed filter in the sample, the percentage of reads for the sample with a quality score of 30 (Q30) or greater, and the autosomal call rate.
Amplicon Summary	Total number of amplicon regions sequenced, and the total length in base pairs of sequenced amplicons in the target regions, for the sample and the manifest file. The manifest file specifies the reference genome and targeted reference regions used in the alignment step.
Read Level Statistics	Number and percent of reads for the sample that cover each position in the reference, for Read 1 and Read 2.
Variants Summary	Number of SNVs, insertions, and deletions detected for the sample that passed suggested values to determine if quality results are within an acceptable range,
Coverage Summary	The total number of aligned bases divided by the targeted region size, and the percentage of amplicon regions with coverage values greater than the low coverage threshold of 0.2 * amplicon mean coverage, for the sample.
Coverage Plots	The Coverage by Amplicon Region plot show the coverage across amplicon regions for the sample. Regions with coverage values lower than the coverage threshold are highlighted in red. The average of all values is indicated by an orange line.
Software Versions	Software versions when the sample was sequenced. Includes NextSeq 550Dx Operating Software (NOS), Local Run Manager Software, RTA Software, and the Germline Variant Module version.

Analysis Output Files

The following analysis output files are generated for the Germline Variant analysis module and provide analysis results for alignment and variant calling. Analysis output files are located in the Alignment folder.

File Name	Description
Demultiplexing (*.txt)	Intermediate files containing demultiplexing summary results.
FASTQ (*.fastq.gz)	Intermediate files containing quality scored base calls. FASTQ files are the primary input for the alignment step.
Alignment files in the BAM format (*.bam)	Contains aligned reads for a given sample.
Variant call files in the genome VCF format (*.genome.vcf.gz)	Contains the genotype for each position, whether called as a variant or called as a reference.
Variant call files in the VCF format (*.vcf.gz)	Contains all variants called across the target region.
AmpliconCoverage_M1.tsv	Contains information about coverage per amplicon per sample for each manifest provided. M# represents the manifest number.

Demultiplexing File Format

The process of demultiplexing reads the index sequence attached to each cluster to determine from which sample the cluster originated. The mapping between clusters and sample number is written to a demultiplexing (*.demux) file for each tile of the flow cell.

The demultiplexing file naming format is [s_1_X.demux](#), where X is the tile number.

Demultiplexing files start with a header:

- Version (4 byte integer), currently 1
- Cluster count (4 byte integer)

The remainder of the file consists of sample numbers for each cluster from the tile.

When the demultiplexing step is complete, the software generates a demultiplexing file named [DemultiplexSummaryF1L1.txt](#).

- In the file name, F1 represents the flow cell number.
- In the file name, L1 represents the lane number.
- Demultiplexing results in a table with 1 row per tile and 1 column per sample, including sample 0.
- The most commonly occurring sequences in index reads.

FASTQ File Format

FASTQ is a text-based file format that contains base calls and quality values per read. Each record contains 4 lines:

- The identifier
- The sequence
- A plus sign (+)
- The Phred quality scores in an ASCII + 33 encoded format

The identifier is formatted as:

@Instrument:RunID:FlowCellID:Lane:Tile:X:Y ReadNum:FilterFlag:0:SampleNumber

Example:

@SIM:1:FCX:1:15:6329:1045 1:N:0:2

TCGCACTCAACGCCCTGCATATGACAAGACAGAATC

+

<>;##=><9=AAAAAAAAA9#:<#<;<<<????#=#

BAM File Format

A BAM file (*.bam) is the compressed binary version of a SAM file that is used to represent aligned sequences up to 128 Mb. SAM and BAM formats are described in detail at samtools.github.io/hts-specs/SAMv1.pdf.

BAM files use the file naming format of SampleName_S#.bam, where # is the sample number determined by the order that samples are listed for the run.

BAM files contain a header section and an alignment section:

- Header—Contains information about the entire file, such as sample name, sample length, and alignment method. Alignments in the alignments section are associated with specific information in the header section.
- Alignments—Contains read name, read sequence, read quality, alignment information, and custom tags. The read name includes the chromosome, start coordinate, alignment quality, and the match descriptor string.

The alignments section includes the following information for each read or read pair:

- **AS:** Paired-end alignment quality
- **RG:** Read group, which indicates the number of reads for a specific sample.
- **BC:** Barcode tag, which indicates the demultiplexed sample ID associated with the read.
- **SM:** Single-end alignment quality.
- **XC:** Match descriptor string
- **XN:** Amplicon name tag, which records the amplicon ID associated with the read BAM index files (*. [bam.bai](#)) provide an index of the corresponding BAM file.

VCF File Format

Variant Call Format (VCF) is a common file format developed by the genomics scientific community. It contains information about variants found at specific positions in a reference genome. VCF files end with the .vcf suffix

The VCF file header includes the VCF file format version and the variant caller version and lists the annotations used in the remainder of the file. The VCF header also includes the reference genome file and BAM file. The last line in the header contains the column headings for the data lines. Each of the VCF file data lines contains information about one variant.

VCF File Headings

Heading	Description
CHROM	The chromosome of the reference genome. Chromosomes appear in the same order as the reference FASTQ file.
POS	The single-base position of the variant in the reference chromosome. For SNPs, this position is the reference base with the variant; for indels or deletions, this position is the reference base immediately before the variant.
ID	The rs number for the variant obtained from dbSNP.txt, if applicable. If there are multiple rs numbers at this location, the list is semi-colon delimited. If no dbSNP entry exists at this position, a missing value marker ('.') is used.
REF	The reference genotype. For example, a deletion of a single T is represented as reference TT and alternate T. An A to T single nucleotide variant is represented as reference A and alternate T.
ALT	The alleles that differ from the reference read. For example, an insertion of a single T is represented as reference A and alternate AT. An A to T single nucleotide variant is represented as reference A and alternate T.
QUAL	A Phred-scaled quality score assigned by the variant caller. Higher scores indicate higher confidence in the variant and lower probability of errors. For a quality score of Q, the estimated probability of an error is $10^{-(Q/10)}$. For example, the set of Q30 calls has a 0.1% error rate. Many variant callers assign quality scores based on their statistical models, which are high in relation to the error rate observed.

VCF File Annotations

Heading	Description
FILTER	<p>If all filters are passed, PASS is written in the filter column.</p> <ul style="list-style-type: none"> • LowDP— Applied to sites with depth of coverage below 150x. For amplicon positions covered by both the forward and reverse read, this is equivalent to 300 overlapping paired-end reads. • q20—Quality score < 20. • MultiAllelicSite—Variant does not conform to diploid model. • R5x9—The number of adjacent repeats (of length 1 to 5 bp) to the variant calls ≥ 9. • SB—The strand bias is more than the given threshold.

INFO	<p>Possible entries in the INFO column include:</p> <ul style="list-style-type: none"> • AC—Allele count in genotypes for each ALT allele, in the same order as listed. • AF—Allele Frequency for each ALT allele, in the same order as listed. • AN—The total number of alleles in called genotypes. • CD—A flag indicating that the SNP occurs within the coding region of at least 1 RefGene entry. • DP—The depth (number of base calls aligned to a position and used in variant calling). • Exon—A comma-separated list of exon regions read from RefGene. • FC—Functional Consequence. • GI—A comma-separated list of gene IDs read from RefGene. • QD—Variant Confidence/Quality by Depth. • TI—A comma-separated list of transcript IDs read from RefGene.
FORMAT	<p>The format column lists fields separated by colons. For example, GT:GQ. The list of fields provided depends on the variant caller used. Available fields include:</p> <ul style="list-style-type: none"> • AD—Entry of the form X,Y, where X is the number of reference calls, and Y is the number of alternate calls. • DP—Approximate read depth; reads with MQ=255 or with bad mates are filtered. • GQ—Genotype quality. • GT—Genotype. 0 corresponds to the reference base, 1 corresponds to the first entry in the ALT column, and so on. The forward slash (/) indicates that no phasing information is available. • NC—Fraction of bases which were uncalled, or with base call quality below the minimum threshold. • NL—Noise level; an estimate of base calling noise at this position. • SB—Strand bias at this position. Larger negative values indicate less bias; values near 0 indicate more bias. • VF—Variant frequency; the percentage of reads supporting the alternate allele.
SAMPLE	<p>The sample column gives the values specified in the FORMAT column.</p>

Genome VCF Files

Genome VCF (gVCF) files are VCF v4.1 files that follow a set of conventions for representing all sites within the genome in a reasonably compact format. The gVCF (*.[genome.vcf.gz](https://sites.google.com/site/gvcftools/home/about-gvcf)) files include all sites within the region of interest in a single file for each sample.

The gVCF file shows no-calls at positions that do not pass all filters. A genotype (GT) tag of ./ indicates a no-call. For more information, see sites.google.com/site/gvcftools/home/about-gvcf.

Amplicon Coverage File

An amplicon coverage file is generated for each manifest file. The M# in the file name represents the manifest number.

Each file includes a header row that contains the sample IDs associated with the manifest. The file contains the following information.

- The Target ID as it is listed in the manifest.
- The coverage depth of reads passing filter.

Supplementary Output Files

The following output files provide supplementary information, or summarize run results and analysis errors. Although these files are not required for assessing analysis results, they can be used for troubleshooting purposes. All files are located in the Alignment folder unless otherwise specified.

File Name	Description
AnalysisLog.txt	Processing log that describes every step that occurred during analysis of the current run folder. This file does not contain error messages. Located in the Alignment folder.
AnalysisError.txt	Processing log that lists any errors that occurred during analysis. This file will be empty if no errors occurred. Located in the Alignment folder.
DemultiplexSummaryF1L1#.txt	Reports demultiplexing results in a table with 1 row per tile and 1 column per sample. The # represents lane 1, 2, 3, or 4 of the flow cell. Located in the Alignment folder.
AmpliconRunStatistics.xml	Contains summary statistics specific to the run. Located in the Alignment folder.

Analysis Folder

The analysis folder holds the files generated by the Local Run Manager software.

The relationship between the output folder and analysis folder is summarized as follows:

- During sequencing, Real-Time Analysis (RTA) populates the output folder with files generated during image analysis, base calling, and quality scoring.
- RTA copies files to the analysis folder in real time. After RTA assigns a quality score to each base for each cycle, the software writes the file RTAComplete.txt to both folders.
- When the file RTAComplete.txt is present, analysis begins.
- As analysis continues, Local Run Manager writes output files to the analysis folder, and then copies the files back to the output folder.

Alignment Folders

Each time that analysis is requeued, the Local Run Manager creates an Alignment folder named Alignment_N, where N is a sequential number.

Folder Structure



Alignment—Contains *.bam, *.vcf, FASTQ files, and files specific to the analysis module.



Date and Time Stamp—Date_time stamp of analysis as YYYYMMDD_HHMMSS



[AnalysisError.txt](#)



[AnalysisLog.txt](#)



[aggregate.report.html](#)



[aggregate.report.pdf](#)



[aggregate.summary.csv](#)







AmpliconCoverage_M#.tsv





[AmpliconRunStatistics.xml](#)





[Sample1.genome.vcf.gz](#)









 [Sample1.coverage.csv](#)
 [Sample1.report.pdf](#)
 [Sample1.summary.csv](#)
 [Sample1.vcf.gz](#)
 [Sample1.bam](#)




 FASTQ
 Sample1

 [Sample1_L001_R1_001_fastq.gz](#)

 Stats

 [DemuxSummaryF1L1.txt](#)
 [FastqSummaryF1L1.txt](#)

 Data
 Intensities
 BaseCalls
 L001—Contains *.bcl files.
 L001—Contains *.locs files.
 RTA Logs—Contains log files from RTA software analysis.
 InterOp—Contains binary files used to report sequencing run metrics.
 Logs—Contains log files describing steps performed during sequencing.

 [RTACComplete.txt](#)
 [RunInfo.xml](#)
 [RunParameters.xml](#)

Base Calling and Index Diversity

When samples are sequenced on the NextSeq 550Dx instrument, base calling determines a base (A, C, G, or T) for every cluster of a given tile, or imaging area on the flow cell, at a specific cycle. The NextSeq 550Dx instrument uses two-channel sequencing, which requires only two images to encode the data for four DNA bases, one from the red channel and one from the green channel.

The process for base calling index reads differs from base calling during other reads.

Index reads must begin with at least one base other than G in either of the first two cycles. If an Index Read begins with two base calls of G, no signal intensity is generated. Signal must be present in either of the first two cycles to ensure demultiplexing performance.

When selecting indexes during run creation a low diversity warning will appear if the indexes do not meet diversity requirements. To prevent the low diversity warning, select index sequences that provide signal in both channels for every cycle.

- Red channel—A or C
- Green channel—A or T

This base calling process ensures accuracy when analyzing low-plex samples. For more information about the sequences of your indexes, see the package insert TruSeq Custom Amplicon Kit Dx (document # 1000000029772).

During run creation in Local Run Manager you will choose the number of samples to be tested. Suggested index combinations that meet index diversity requirements are auto populated by the software. Although you are not required to use the suggested index combinations, it is recommended.

Revision History

Document	Date	Description of Change
Document # 1000000030329 v0 4	August 2021	Updated EU Authorized Representative address.
Document # 1000000030329 v0 3	December 20 19	Updated EU Authorized Representative address. Updated Australian Sponsor address.
Document # 1000000030329 v0 2	January 2019	Added information about v2.5 reagent kits.
Document # 1000000030329 v0 1	August 2018	Updated regulatory markings.
Document # 1000000030329 v0 0	November 20 17	Initial release.

Technical Assistance

For technical assistance, contact Illumina Technical Support.

Website: www.illumina.com

Email: techsupport@illumina.com

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China	400.066.5835	
Denmark	+45 80820183	+45 89871156
Finland	+358 800918363	+358 974790110
France	+33 805102193	+33 170770446
Germany	+49 8001014940	+49 8938035677
Hong Kong	800960230	
Ireland	+353 1800936608	+353 016950506
Italy	+39 800985513	+39 236003759
Japan	0800.111.5011	
Netherlands	+31 8000222493	+31 207132960
New Zealand	0800.451.650	
Norway	+47 800 16836	+47 21939693
Singapore	+1.800.579.2745	
Spain	+34 911899417	+34 800300143
Sweden	+46 850619671	+46 200883979
Switzerland	+41 565800000	+41 800200442
Taiwan	806651752	
United Kingdom	+44 8000126019	+44 2073057197
Other countries	+44.1799.534000	

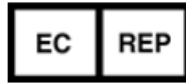
Safety data sheets (SDSs)—Available on the Illumina website at support.illumina.com/sds.html.

Product documentation—Available for download in PDF from the Illumina website. Go to support.illumina.com, select a product, then select Documentation & Literature.



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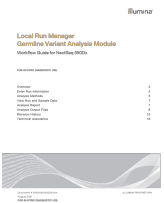
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Documents / Resources

	illumina NextSeq 550Dx Local Run Manager Germline Variant Analysis [pdf] User Guide NextSeq 550Dx Local Run Manager Germline Variant Analysis, NextSeq 550Dx, Local Run Manager Germline Variant Analysis, Germline Variant Analysis
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References

- [Home · Illumina/Pisces Wiki · GitHub](#)
- [Support Center](#)
- [Safety Data Sheets \(SDS\)](#)
- [Illumina | Sequencing and array-based solutions for genetic research](#)
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