

TABLE OF CONTENTS

2.3.S DRUG SUBSTANCE {CX-038839}	3
2.3.S.1 General Information.....	3
2.3.S.1.1 Nomenclature.....	3
2.3.S.1.2 Structure.....	3
2.3.S.1.3 General Properties	6
2.3.S.2 Manufacture.....	7
2.3.S.2.1 Manufacturer(s)	7
2.3.S.2.2 Description of Manufacturing Process and Process Controls.....	9
2.3.S.2.3 Control of Materials.....	11
2.3.S.2.4 Controls of Critical Steps and Intermediates	14
2.3.S.2.5 Process Validation and/or Evaluation.....	14
2.3.S.2.6 Manufacturing Process Development.....	15
2.3.S.3 Characterisation	15
2.3.S.3.1 Elucidation of Structure and Other Characteristics	15
2.3.S.3.2 Impurities.....	16
2.3.S.4 Control of the Drug Substance.....	17
2.3.S.4.1 Specification	17
2.3.S.4.2 Analytical Procedures.....	17
2.3.S.4.3 Validation of Analytical Procedures.....	18
2.3.S.4.4 Batch Analyses	18
2.3.S.4.5 Justification of Specification	18
2.3.S.5 Reference Standards or Materials	18
2.3.S.6 Container Closure System	19
2.3.S.7 Stability.....	19
2.3.S.7.1 Stability Summary and Conclusions.....	19
2.3.S.7.2 Post-Approval Stability Protocol and Stability Commitment.....	21
2.3.S.7.3 Stability Data	21

LIST OF TABLES

Table 1:	Structural Overview of CX-038839	4
Table 2:	Features of CX-038839 Molecular Sequence	6
Table 3:	General Properties of CX-038839 mRNA	7
Table 4:	European Facilities and Responsibilities for Manufacture and Testing of CX-038839.....	7
Table 5:	US Facilities and Responsibilities for Manufacture and Testing of CX-038839.....	7
Table 6:	CX-038839 mRNA Item Numbers	9
Table 7:	Specification for CX-038839	17
Table 8:	CX-038839 mRNA Stability Lots.....	21

TABLE OF FIGURES

Figure 1:	Full mRNA Sequence of CX-038839	4
Figure 2:	Cap Structure of CX-038839	6
Figure 3:	Overview of the RNA Manufacturing Process.....	10
Figure 4:	Raw Material Control Process Overview.....	12
Figure 5:	Lineage of the Host Cell Line	13
Figure 6:	Overview of Plasmid Cell Banking	14

2.3.S DRUG SUBSTANCE {CX-038839}

2.3.S.1 General Information

CX-038839 is the mRNA that encodes for the pre-fusion stabilized Spike protein for 2023-novel Coronavirus (SARS-CoV-2) XBB.1.5 variant.

2.3.S.1.1 Nomenclature

International Non-proprietary Name (INN):	Andusomeran
Proprietary name:	N/A
Company product codes:	CX-038839
Drug Product name:	mRNA-1273
Synonymous name:	N/A

2.3.S.1.2 Structure

The XBB.1.5 subvariant is a sub-lineage of the Omicron variants. XBB.1.5 is a recombinant of two BA.2 sub-lineages, with an additional spike receptor-binding domain (RBD) change, S486P. The CX-038839 mRNA sequence encodes the pre-fusion stabilized Spike protein of 2019-novel Coronavirus (SARS-CoV-2) XBB.1.5 variant. The S protein is stabilized in the so-called pre-fusion conformation by two amino acid mutations, K982P and V983P.

CX-038839 mRNA is chemically identical to naturally occurring mammalian mRNA with the exception that the uridine nucleoside normally present in mammalian mRNA is fully replaced with N1-methylpseudouridine, a naturally occurring pyrimidine base present in mammalian tRNAs. This nucleoside is included in the CX-038839 mRNA in place of the normal uridine base to minimize the indiscriminate recognition of CX-038839 mRNA by pathogen associated molecular pattern (PAMP) receptors (e.g., Toll-like receptors). The molecular sequence of CX-038839, including the 5' cap, the 5' untranslated region (UTR), the Open Reading Frame (ORF), the 3' UTR, and the 3' polyA tail, is provided in [Figure 1](#), with the structural overview and sequence features in [Table 1](#) and [Table 2](#) respectively. This is the same cap structure previously used for mRNA-1273 prototype and variants. The cap structure to be used in the mRNA is identical to the natural mammalian Cap 1 structure consisting of a guanosine residue methylated in the 7-position linked through a 5'-5' triphosphate linkage to the first residue of the mRNA at the 5' end, and methylation of the 2'-position of the ribose sugar of the penultimate nucleotide. Both the cap structure at the 5' end and the polyA tail at the 3' end are required for the CX-038839 mRNA to be translated by the cellular translational machinery. The 3'UTR for CX-038839 mRNA has been modified with a 24 nt substitution of an 11 nt sequence in the original 3'UTR used in CX-024414

mRNA. This sequence is referred to as the identity and ratio (IDR) sequence. The IDR sequence corresponds to position 3943-3966 in the CX-038839 mRNA sequence.

Table 1: Structural Overview of CX-038839

mRNA Sequence Molecular Weight (free acid)	CCI	
mRNA Sequence Molecule Length		
mRNA Sequence Elements	ORF:	CCI
	5' UTR:	
	3' UTR:	
	PolyA tail:	

Abbreviations: ORF = open reading frame; UTR = untranslated region

Figure 1: Full mRNA Sequence of CX-038839

Nucleotide Sequence (50 nucleotides per line, blocks of 10 with numbering at the end of each line):

CCI	

CCI



Where: A, C, G and U = AMP, CMP, GMP and & N1-Me-ΨMP, respectively;
Me = methyl; p = inorganic phosphate.

Figure 2: Cap Structure of CX-038839

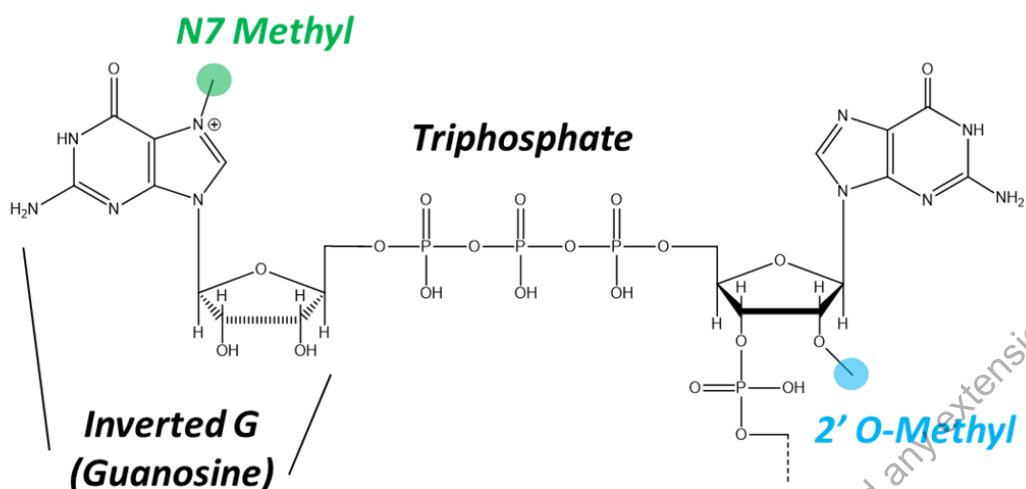


Table 2: Features of CX-038839 Molecular Sequence

Element	Description	Position
Cap	CCI	
5' UTR		
ORF		
3' UTR		
polyA tail		

Abbreviations: ORF = open reading frame; UTR = untranslated region

2.3.S.1.3 General Properties

CX-038839 mRNA is intended for further processing into mRNA-1273.815 LNP-B, an mRNA/lipid-based product. CX-038839 is not intended for direct injection. The general properties of CX-038839 are summarized in [Table 3](#), and are consistent with previous mRNA-1273 variants.

Table 3: General Properties of CX-038839 mRNA

Attribute	Summary
Appearance	Clear, colorless solution, essentially free of visible particulates
pH	Formulated at a target pH of CCI
Partition coefficient	Due to the high aqueous solubility and charge density, the partition coefficient is negligible for mRNAs like CX-038839 mRNA
Aqueous solubility	Readily soluble in water and salts, demonstrated solubility up to at least CCI
Extinction coefficient	A sequence specific coefficient is calculated using the formula as described in The SSC for CX-038839 mRNA is CCI

Abbreviations: SSC = sequence specific coefficient

2.3.S.2 Manufacture

2.3.S.2.1 Manufacturer(s)

The facilities and responsibilities for the manufacture and quality control testing of CX-038839 are summarized in Table 4 and Table 5.

Table 4: European Facilities and Responsibilities for Manufacture and Testing of CX-038839

Facility	Address	Responsibility
Lonza AG	Lonzastrasse 3930 Visp Switzerland	<ul style="list-style-type: none"> Manufacture of CX-038839 Quality control testing (excluding Identity testing)
Microsynth AG	Schützenstrasse 15 9436 Balgach Switzerland	<ul style="list-style-type: none"> Quality control testing for Identity of CX-038839
Moderna Biotech Spain S.L.	C/ Julian Camarillo n°31 28037 Madrid Spain	<ul style="list-style-type: none"> Release and stability testing (all methods excluding Bioburden)

Table 5: US Facilities and Responsibilities for Manufacture and Testing of CX-038839

Manufacturers	Location	Responsibility
ModernaTX, Inc.	One Moderna Way Norwood, MA, 02062 USA	<ul style="list-style-type: none"> Manufacturer of CX-038839
ModernaTX, Inc.	One Moderna Way Norwood, MA, 02062 USA	<ul style="list-style-type: none"> Quality control, in-process testing of CX-038839
ModernaTX, Inc. (Quality Control Laboratory Annex)	210 Rustcraft Road Dedham, MA, 02026 USA	

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ema.europa.eu
Data up to date as of 12 June 2025

2.3.S.2.2 Description of Manufacturing Process and Process Controls

ModernaTX utilizes part numbers to distinguish different processes and different process scales. A summary of process part numbers and manufacturing sites for CX-038839 mRNA is shown in [Table 6](#).

Table 6: CX-038839 mRNA Item Numbers

CX mRNA	Part Number	Nominal Batch Size	Manufacturing Site
CX-038839 mRNA	40168	75 L	ModernaTX, Inc. (Norwood, MA, USA)
CX-038839 mRNA	40163	75 L	Lonza AG (Visp, Switzerland)

The nominal manufacturing batch size for CX-034476 mRNA at Lonza AG (Lonza Visp) (Visp, Switzerland) and at ModernaTX (Norwood, United States) is 75 L (Scale B) in vitro transcription (IVT) reaction volume. The manufacturing process for CX-034476 is identical to the manufacturing process presented for CX-024414 at the 75 L scale at Lonza Visp and at ModernaTX Norwood. Please refer to

for Lonza Visp, and to [Section 3.2.S.2.2](#) for ModernaTX Norwood.

Flow Diagram

A flow diagram of the manufacturing process is provided in [Figure 3](#).

Figure 3: Overview of the RNA Manufacturing Process

Materials	Unit Operation	In Process Controls
[Redacted Content]		

[Redacted Content]		
[Redacted Content]		
[Redacted Content]		
[Redacted Content]		
[Redacted Content]		

Manufacturing Process Summary

In the first manufacturing step, uncapped RNA is synthesized enzymatically by an in vitro transcription (IVT) reaction using the linearized plasmid template specific for CX-038839 to

produce the desired full-length RNA with a polyadenylated tail. Tangential flow filtration (TFF) is performed to exchange buffer and concentrate the RNA prior to loading of the custom affinity (oligonucleotide deoxythymidine [Oligo dT]) chromatography column. The RNA is captured by dT chromatography, washed to reduce process-related impurities, and eluted.

A second TFF is performed to adjust RNA concentration, followed by an enzymatic capping reaction to produce mRNA. A third TFF is performed for buffer exchange and to adjust mRNA concentration for the second Oligo dT chromatography to capture the mRNA and remove process-related impurities from the capping reaction. A final TFF is performed to concentrate the mRNA and for buffer exchange into Final Storage Buffer, followed by a bioburden reduction clarification step. The resulting CX-038839 mRNA is dispensed in containers as described in [REDACTED] and stored at the long term storage temperature of -90°C to -60°C.

Detailed description of the manufacturing process is provided in [REDACTED].

2.3.S.2.3 Control of Materials

The raw materials used in the manufacture of CX-038839 are identical to the raw materials used for manufacture of CX-024414. Refer to [REDACTED]

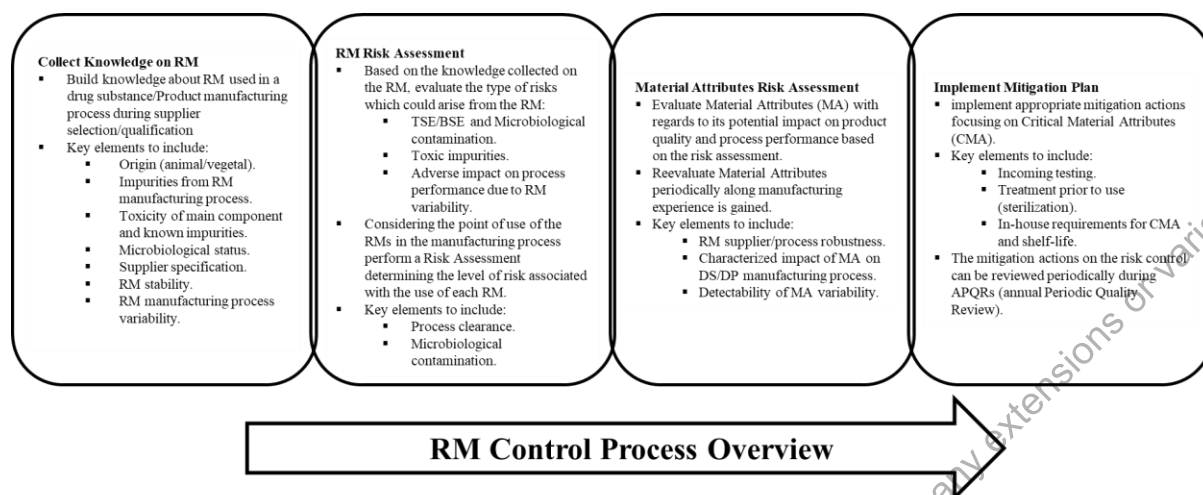
and to [REDACTED] for the control of raw materials used in the manufacturing process of CX-038839 manufactured at the European manufacturing site (Lonza Visp AG) and US manufacturing site (ModernaTX Norwood), respectively.

Raw Materials

Raw materials are received from qualified suppliers. The supplier qualification process demonstrates the supplier has an effective and acceptable Quality Management System in place and can meet the minimum quality requirements of the process. Qualified suppliers have been assessed and qualified using a supplier risk level review and audit requirements based on the materials to be sourced from the supplier. Qualification includes verification of release assay performance. Supplier performance is maintained and monitored through routine surveillance audits, periodic re-verification of release assay performance, quality agreements, and change notification agreements based on supplier risk level.

An overview of the Raw Material control process is provided in [Figure 4](#). In instances of material transfer within the global manufacturing network, raw materials initially received at a manufacturing site and released may be transferred to another manufacturing site and received as released goods for manufacturing based on a risk-based approach that will be managed through the Quality Management System accordingly.

Figure 4: Raw Material Control Process Overview



Adapted from Concept Paper: Management and control of raw materials. Version 1 Nov 29th 2017

Materials of Biological Origin

There are no starting materials of animal or human origin used in the manufacture of CX-038839.

Starting Materials

The starting materials in the manufacture of CX-038839 are the linearized plasmid template and the nucleotides ATP, CTP, GTP, N1-Me-ΨTP. The nucleotides are the same nucleotides as used for manufacture of CX-024414 mRNA. For more information refer to

– [Starting Materials – Lonza Visp](#) and

This Section will focus on the plasmid and its cell banking system.

Linearized Plasmid Template

A unique linearized DNA plasmid template specific for CX-038839 mRNA was manufactured at ModernaTX, Inc. (Norwood, MA, USA). The features of the plasmid template specific for CX-038839 mRNA are consistent with CX-024414 mRNA described in

and [Section 3.2.S.2.3 {CX-024414 – Starting Materials – US](#)

, with the exception of the specific sequence of the coding region and the 3'UTR, which was also introduced for previous variant CX-034476 mRNA (Omicron BA.4-5). In addition to the elements described for the 3'UTR of CX-024414, the 3'UTR for CX-038839 mRNA has been modified with a 24 nt substitution in an 11 nt region of the original 3'UTR used in CX-024414 mRNA. This sequence is referred to as the identity and ratio (IDR) sequence, to enable identification and relative ratio determination of individual RNA components in a bivalent Drug

Product. Introduction of the IDR in the 3'UTR enables analytical control using RNase H guides specifically targeting to the IDR for each RNA and offers the flexibility and efficiency for analytical control of future variant vaccines. These proposed sequences are non-coding and would therefore not be translated into peptides.

The full plasmid DNA sequence and the plasmid map are provided in

Generation of Host Cell Line

The lineage of the host cell line is illustrated in [Figure 5](#).

Figure 5: Lineage of the Host Cell Line

CCI



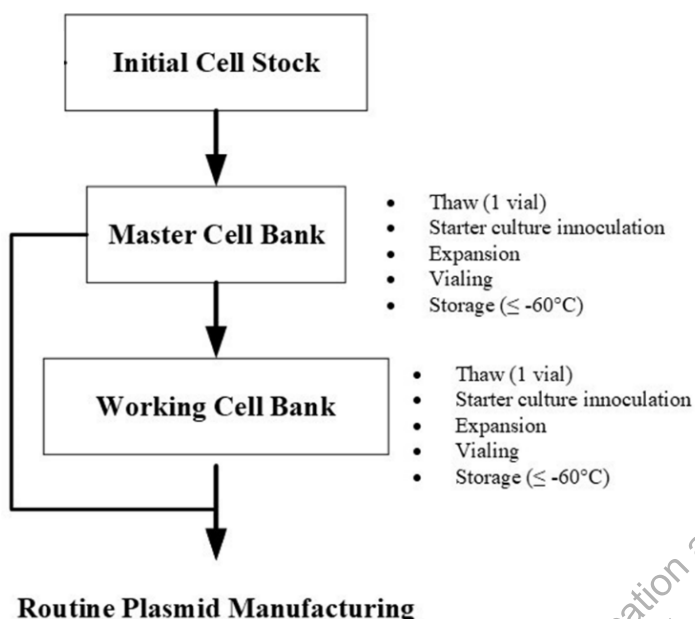
The host strain used for manufacture of PL-034023 for CX-038839 mRNA is the same as described for CX-024414 mRNA in and }.

Plasmid Cell Banking System

The cell banking system is two-tiered, including a master cell bank (MCB) and a working cell bank (WCB).

An overview of the cell banking process is provided in [Figure 6](#).

Figure 6: Overview of Plasmid Cell Banking



Further details of the manufacturing of the cell banks, their release results, stability testing and qualifications are provided in

2.3.S.2.4 Controls of Critical Steps and Intermediates

The process control strategy and methods for critical in-process controls testing for the CX-038839 mRNA manufacturing process are identical to the ones in place for the CX-024414. Please refer to and to

2.3.S.2.5 Process Validation and/or Evaluation

Process validation for CX-038839 mRNA is performed in compliance with European Medicines Agency, United States Food and Drug Administration, International Conference on Harmonization, and international regulatory expectations. Process validation comprises Process Design (Phase 1), Process Performance Qualification (PPQ; Phase 2), and Continued Process Verification (CPV; Phase 3). The elements of Process Design (Phase 1) are described in } for control strategy and . PPQ (Phase 2) and CPV (Phase 3) are discussed in .

discusses the process verification used to support the introduction

of CX-038839 mRNA.

Moderna has successfully completed process verification of the CX-038839 mRNA manufacturing process as a means of demonstrating that the commercial-scale manufacturing process platform is capable of consistently delivering quality product. The PPQ verification has generated data at commercial scale to support and complement concurrent laboratory-scale studies. One confirmatory PPQ verification lot was performed to demonstrate process consistency per site per the requirements specified in the Process Validation Master Plan.

The commercial control strategy ([Section 3.2.S.2.4 {CX-024414}](#)) defines critical quality attributes (CQAs) and identifies critical process parameters (CPPs) and critical in-process controls (CIPCs) for the manufacturing process. The commercial control strategy is the basis of the defined acceptance criteria for PPQ verification.

More complete information on process validation is provided in [Section 3.2.S.2.5 {CX-038839}](#).

2.3.S.2.6 Manufacturing Process Development

The development of additional mRNA-1273 vaccines was initiated in response to the emergence of SARS-CoV-2 variants of concern. Sequences for mRNA-1273 vaccines are designed based upon the S-2P encoding sequence for CX-024414 mRNA. Changes relative to this sequence are made only to incorporate the specific mutations of the variant S protein sequence encoded by the sequence of the specific mRNA-1273 RNA. The manufacturing process and process and analytical control strategies established for the CX-024414 mRNA are applied directly to CX-038839 mRNA. .

Subsequent process characterization beyond that described in [Section 3.2.S.2.6 {CX-024414}](#) was performed for CX-038839 mRNA (XBB.1.5), with the intent of verifying the applicability of the process description and process control strategy defined in [Section 3.2.S.2.2 {CX-024414}](#) and [Section 3.2.S.2.4 {CX-024414}](#).

The process characterization and comparability demonstration, including evaluation of process change impact on critical quality attributes, are included in [Section 3.2.S.2.6 {CX-038839}](#).

2.3.S.3 Characterisation

2.3.S.3.1 Elucidation of Structure and Other Characteristics

The structure, physicochemical properties of CX-038839 mRNA, were studied using a variety of techniques applicable to mRNAs. Unless otherwise indicated, data were generated from development lot DH-77209.1. The data generated from these analyses confirm the physicochemical structure of CX-038839 mRNA, as described in more detail in [Section 3.2.S.3.1 {CX-038839}](#).

2.3.S.3.2 Impurities

The CX-038839 mRNA is comprised of the same nucleotide components as the original prototype CX-024414 mRNA, including the 5' Cap and polyA tail and the nucleotide components used to manufacture the mRNA. In addition, the manufacturing process for CX-038839 mRNA is consistent with the manufacturing process for the original prototype, CX-024414 at the 75 L scale. The product- and process-related impurities for CX-038839 are therefore consistent with what is described in Section [3.2.S.3.2 Impurities {CX-024414}](#), as the changes made to the mRNA sequence to target XBB.1.5 would not result in any changes in the types of impurities present in the final product.

For more information on impurities, please refer to [Section 3.2.S.3.2 {CX-024414}](#).

2.3.S.4 Control of the Drug Substance

2.3.S.4.1 Specification

Testing of CX-038839 is performed in accordance with the specification listed in [Table 7](#).

Table 7: Specification for CX-038839

Test	Analytical Method (SOP Reference)	Acceptance Criteria
Appearance	Visual Ph. Eur. 2.2.1, 2.2.2, 2.9.20 USP<631>, USP<790> (SOP-0278 ModernaTX, Inc.) (CHVI-101557 Lonza AG)	Clear, colorless solution, essentially free of visible particulates
Identity	Reverse Transcription/Sanger Sequencing (SOP-1019 ModernaTX, Inc.) (SOP 3.37.51.007 Microsynth AG)	Sequence matches description
Total RNA content	UV (SOP-0995 ModernaTX, Inc.) (GROUP-107939 Lonza AG)	CCI
Purity	RP-IP-HPLC (SOP-1142 ModernaTX, Inc.) (GROUP-116855 Lonza AG)	
Product-related impurities		
% 5' Capped	RP-HPLC (SOP-0997 ModernaTX, Inc.) (GROUP-107938 Lonza AG)	
% PolyA tailed RNA (% Tailless RNA)	RP-HPLC (SOP-0994 ModernaTX, Inc.) (GROUP-107934 Lonza AG)	
pH	USP <791>, Ph. Eur. 2.2.3 (SOP-0288 ModernaTX, Inc.) (CHVI-82391 Lonza AG)	
Bacterial endotoxin	USP <85>, Ph. Eur. 2.6.14 (SOP-0352 Moderna TX, Inc.) (CHVI-6303 Lonza AG)	
Bioburden	USP <61>, Ph. Eur. 2.6.12 (SOP-0480 Moderna TX, Inc.) (CHVI-8889 Lonza AG)	

Abbreviations: UV= Ultraviolet; RP-IP-HPLC= Reverse-phase ion-pair high-performance liquid chromatography; RP-HPLC= Reversed Phase High Performance Liquid Chromatography; CFU= Colony forming unit; TAMC = Total aerobic microbial count; TYMC = Total combined yeasts/molds count

2.3.S.4.2 Analytical Procedures

The analytical methods used for release testing of CX-038839 and prototype CX-024414 are identical with the exception of the identity method, since this is the only method that is sequence-specific. For descriptions of the common methods please refer to [Section 3.2.S.4.1](#).

A full description of the identity method is provided in [Section 3.2.S.4.2 {CX-038839}](#).

2.3.S.4.3 Validation of Analytical Procedures

The analytical procedures used for testing CX-038839 and the prototype CX-024414 are identical with the exception of the identity method, since this is the only method that is sequence specific. For information on validation of common methods please refer to [Section 3.2.S.4.3 {CX-024414}](#). For a validation summary of the CX-038839 identity testing method, please refer to [Section 3.2.S.4.3 {CX-038839}](#).

2.3.S.4.4 Batch Analyses

CX-038839 GMP lots are intended for further manufacturing into mRNA-1273.815 Drug Product GMP lots. Batch analysis data generated for CX-038839 according to specifications approved at time of release are presented in [Section 3.2.S.4.4 {CX-038839}](#).

2.3.S.4.5 Justification of Specification

The specifications for CX-038839 and CX-024414 are identical, except for the specification for identity by reverse transcription / Sanger sequencing.

For justification of specifications, please refer to [Section 3.2.S.4.5 {CX-024414}](#). For identity more details are provided in [Section 3.2.S.4.5 {CX-038839}](#).

2.3.S.5 Reference Standards or Materials

The reference material as described in [Section 3.2.S.5 {CX-024414}](#) will serve as the reference material for CX-038839.

The CX-024414 reference material is used as a reference standard for measurement of total RNA content of variant mRNA-1273 LNP and DP materials including mRNA-1273.815 LNP and DP. It is also used as a system suitability standard for several release tests.

Sanger sequencing test methods are used to confirm identity for both mRNA-1273 RNA and LNP. These test methods can experimentally measure the nucleotide sequence of specific regions of the RNA. Test results are compared against the theoretical mRNA sequence to confirm identity of the test sample. Since the data reporting is using a theoretical mRNA sequence and not compared against the reference material sequence, a product-specific reference standard is not utilized for these test methods. In this case, the mRNA reference material is used as a positive control for the test method and serves as a system suitability standard.

Similarly, the total RNA content for CX-038839 mRNA is measured using NaOH digestion which calculates content via UV absorbance of the digested nucleotides and a sequence-corrected

coefficient. No reference material is used in the calculation of total RNA content.

Assays such as %PolyA tailed variants, use a relative measurement of a specific peak of interest (such as a PolyA tail peak) relative to a total peak area within the same test sample to report results. The measurement of purity and product-related impurities by ion pairing reversed-phase chromatography uses a similar approach, where the purity and impurity peaks are measured in relation to the total peak area within a sample chromatogram. In both cases, a product-specific reference standard is not needed to measure the attributes of interest. To assess the system performance parameters such as peak area or retention time consistency within the run as system suitability, any standard that chromatographs similarly to the analyte of interest can be used, and a product-specific reference standard is not required for testing. In the case of the RP-IP HPLC purity method, a single mRNA standard (CX-024414) is used to assess system suitability.

Therefore, the use of the CX-024414 mRNA established reference material, is justified for use for testing of CX-038839 mRNA samples.

2.3.S.6 Container Closure System

The container closure system for CX-038839 mRNA is the same as for the original prototype, CX-024414 mRNA.

For information regarding the container closure system, please refer to [Section 3.2.S.6 {CX-024414}](#).

2.3.S.7 Stability

2.3.S.7.1 Stability Summary and Conclusions

The CX-038839 registration stability program was executed according to ICH Q1A (R2), *Stability Testing of new Drug Substances and Products*, and ICH Q5C, *Stability Testing of Biotechnological/Biological Products*. The CX-038839 mRNA is stored at -60 to -90°C, after an optional interim storage at -15 to -25°C of maximum 3 months. A shelf-life of 36 months is approved as from the time of freezing for CX-038839 mRNA material stored in the commercial container closure system, defined in [Section 3.2.S.6 {CX-038839}](#), when stored at the recommended long-term storage condition of -60°C to -90°C.

The properties of CX-038839 mRNA with respect to the attributes that affect product potency have been systematically and thoroughly assessed. These attributes include fidelity of the RNA sequence, including cap, tail, and open reading frame; and integrity of the RNA. Direct measurements of those attributes have been established and are included in the routine release panel for CX-038839 mRNA.

The product quality attribute expected to change most during the manufacturing and distribution of the product is mRNA purity, which represents the fraction of intact mRNA. The degradation of RNA in the product has been extensively studied by applying a sensitive chromatographic assay to assess the formation of RNA degradants. The principal route of degradation for the RNA is hydrolytic chain scission to species that elute prior to the main peak (RNA fragments). mRNA purity correlates with protein levels measured in the in vitro relative protein expression assay. Direct measurement of RNA degradation utilizing the RNA purity assay by RP-HPLC is precise, accurate, and the most stability-indicating measure of product activity.

The degradation rates can be determined from the purity analysis over different stability timepoints. Based on the stochastic nature of the degradation mechanism, there is a dependence on the rate of degradation on RNA size (length). Since CX-024414 and CX-038839 mRNAs have approximately the same overall length (~4,000 nt), a similar rate of degradation is expected across these different sequences.

The stability profiles for all the stability-indicating attributes are evaluated and monitored, but purity is the primary determinant of shelf-life, since it is the most stability-indicating attribute. Degradation rates for purity at each temperature of interest are reported in [Section 3.2.S.7.1.1 {CX-031302}](#).

The shelf-life is justified from the purity statistical model described in [Section 3.2.S.7.1.1 {CX-031302}](#). The lots used in the purity modeling analysis were manufactured using a development process, PVU scale process, the initial Scale B process and the Scale B process. Modeling included data from development lots from additional variant RNAs to incorporate sequence differences in the statistical model. The modeling results are provided in [Section 3.2.S.7.1.1 {CX-031302}](#) and the purity data from these studies are presented in [Section 3.2.S.7.3 {CX-031302}](#).

Stability and characterization studies were designed to evaluate product stability under various stressed and long-term storage conditions. All lots were manufactured using the manufacturing process described in [Section 3.2.S.2.2 {CX-024414}](#). Stability samples were stored in containers made of the same materials as the commercial closure system.

Size-based RNA purity and polyA tailed RNA, as determined by reverse-phase high-performance liquid chromatography (RP-HPLC), were demonstrated to be stability indicating (refer to for analytical procedures).

Stability studies have been initiated for CX-038839 mRNA manufactured at ModernaTX, Inc. (Norwood, MA) and at Lonza (Visp, Switzerland) (see [Table 8](#)). These studies are currently ongoing and the data from these studies will be presented in [Section 3.2.S.7.3 {CX-038839}](#).

Table 8: CX-038839 mRNA Stability Lots

Lot	Product	Manufacturing Site	Lot Size	Fill Volume	Scale	Process Train	Container Closure	Conditions	
								Temperature	Duration
4016823001	CX-038839 mRNA	ModernaTX, Inc. Norwood, MA,	75 L IVT	15 mL	B	3	50-mL Mobius bag	CCI	
4016323001 (Lonza lot 1313001)	CX-038839 mRNA	Lonza Visp, Switzerland	75 L IVT	30 mL	B	13	50-mL CCI bag		

Abbreviation: IVT = in vitro transcription

The stability protocols are described in [Section 3.2.S.7.1 {CX-038839}](#).

Stability conclusion and stability data are provided in [Section 3.2.S.7.1 {CX-038839}](#) and [Section 3.2.S.7.3 {CX-038839}](#), respectively.

Freeze-Thaw Cycling Stability Study

Freeze-thaw cycling studies were performed on CX-024414 material and are applicable to CX-038839. Refer to [Section 3.2.S.7.1 Stability Summary and Conclusion {CX-024414}](#).

Stability Conclusions

Based on all the available stability data for RNAs of similar length as CX-038839, the use period for GMP CX-038839 stored at -60°C to -90°C is 36 months, as from the time of freezing, including an optional interim storage at -15 to -25°C of maximum 3 months prior to -60°C to -90°C long-term storage. Use period extensions will be evaluated as additional stability data is obtained. The use period cannot exceed the duration of the stability protocol.

2.3.S.7.2 Post-Approval Stability Protocol and Stability Commitment

For information regarding the post-approval stability, please refer to [Section 3.2.S.7.2 Post-Approval Stability Protocol and Commitment {CX-038839}](#).

2.3.S.7.3 Stability Data

Stability data are provided in [Section 3.2.S.7.3 {CX-038839}](#).