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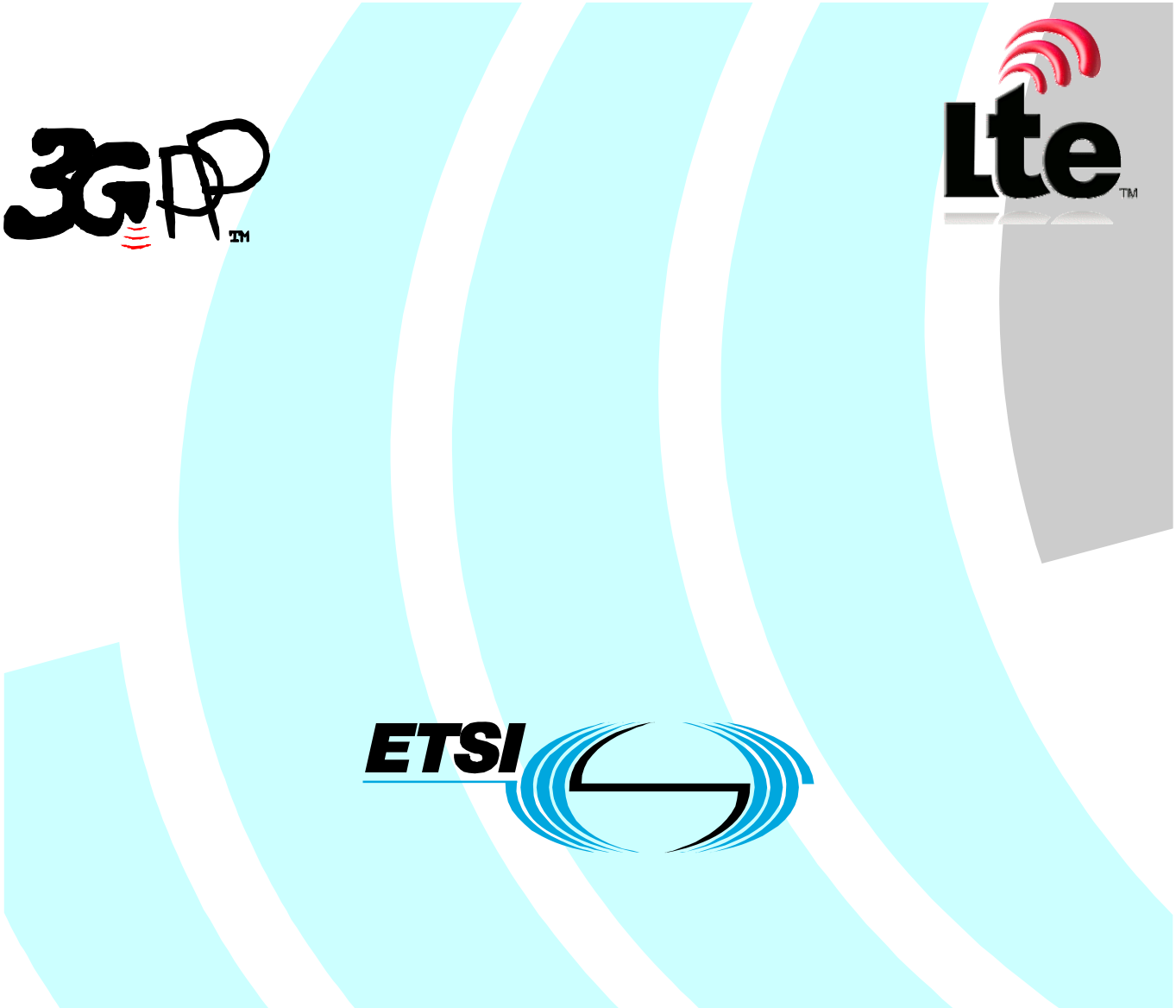
Technical Specification

Universal Mobile Telecommunications System (UMTS);
LTE;
3G Security;
Specification of the MILENAGE algorithm set:
An example algorithm set for the 3GPP authentication and key generation functions f1, f1*, f2, f3, f4, f5 and f5*;
Document 4: Design conformance test data
(3GPP TS 35.208 version 9.0.0 Release 9)



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Foreword

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Contents

Foreword

This Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (3GPP).

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Introduction

This document has been prepared by the 3GPP Task Force, and contains an example set of algorithms which may be used as the authentication and key generation functions ***f1***, ***f1****, ***f2***, ***f3***, ***f4***, ***f5*** and ***f5****. (It is not mandatory that the particular algorithms specified in this document are used — all seven functions are operator-specifiable rather than being fully standardised). This document is one five, which between them form the entire specification of the example algorithms, entitled:

- 3GPP TS 35.205: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 3G Security; Specification of the MILENAGE Algorithm Set: An example algorithm set for the 3GPP authentication and key generation functions f1, f1*, f2, f3, f4, f5 and f5*;
  Document 1: General".

- 3GPP TS 35.206: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 3G Security; Specification of the MILENAGE Algorithm Set: An example algorithm set for the 3GPP authentication and key generation functions f1, f1*, f2, f3, f4, f5 and f5*;
  Document 2: Algorithm Specification".

- 3GPP TS 35.207: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 3G Security; Specification of the MILENAGE Algorithm Set: An example algorithm set for the 3GPP authentication and key generation functions f1, f1*, f2, f3, f4, f5 and f5*;
  Document 3: Implementors' Test Data".

- 3GPP TS 35.208: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 3G Security; Specification of the MILENAGE Algorithm Set: An example algorithm set for the 3GPP authentication and key generation functions f1, f1*, f2, f3, f4, f5 and f5*;
  Document 4: Design Conformance Test Data".

- 3GPP TR 35.909: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 3G Security; Specification of the MILENAGE Algorithm Set: An example algorithm set for the 3GPP authentication and key generation functions f1, f1*, f2, f3, f4, f5 and f5*;
  Document 5: Summary and results of design and evaluation".

1 Outline of the design conformance test data

Section 2 introduces the algorithms and describes the notation used in the subsequent sections.

Section 3 provides test data for the cryptographic kernel function Rijndael.

Section 4 provides test data for the MILENAGE authentication and key generation algorithms *f1, f1*, f2, f3, f4, f5* and *f5**.

1.1 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TS 33.102 v3.5.0: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 3G Security; Security Architecture".

[2] 3GPP TS 33.105 v3.4.0: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 3G Security; Cryptographic Algorithm Requirements".

[3] 3GPP TS 35.206: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 3G Security; Specification of the MILENAGE Algorithm Set: An example algorithm set for the 3GPP authentication and key generation functions f1, f1*, f2, f3, f4, f5 and f5*; Document 2: Algorithm Specification".

[4] 3GPP TS 35.207: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 3G Security; Specification of the MILENAGE Algorithm Set: An example algorithm set for the 3GPP authentication and key generation functions f1, f1*, f2, f3, f4, f5 and f5*; Document 3: Implementors' Test Data".

[5] 3GPP TS 35.208: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; 3G Security; Specification of the MILENAGE Algorithm Set: An example algorithm set for the 3GPP authentication and key generation functions f1, f1*, f2, f3, f4, f5 and f5*; Document 4: Design Conformance Test Data" (this document).

[6] Joan Daemen and Vincent Rijmen: "AES Proposal: Rijndael", available at http://csrc.nist.gov/encryption/aes/round2/AESAlgs/Rijndael/Rijndael.pdf or http://www.esat.kuleuven.ac.be/~rijmen/rijndael/rijndaeldocV2.zip

[7] http://csrc.nist.gov/encryption/aes/

2 Introductory information

2.1 Introduction

Within the security architecture of the 3GPP system there are seven security functions ***f1***, ***f1****, ***f2***, ***f3***, ***f4***, ***f5*** and ***f5****. The operation of these functions falls within the domain of one operator, and the functions are therefore to be specified by each operator rather than being fully standardized. The algorithms specified in this document are examples that may be used by an operator who does not wish to design his own.

The inputs and outputs of all seven algorithms are defined in section 2.5.

This document provides sets of input/output test data for "black box" testing of physical realizations of all algorithms.

2.2 Radix

Unless stated otherwise, all test data values presented in this document are in hexadecimal.

2.3 Bit/Byte ordering

All data variables in this specification are presented with the most significant bit (or byte) on the left hand side and the least significant bit (or byte) on the right hand side. Where a variable is broken down into a number of substrings, the leftmost (most significant) substring is numbered 0, the next most significant is numbered 1, and so on through to the least significant.

2.4 List of Variables

AK	a 48-bit anonymity key that is the output of either of the functions ***f5*** and ***f5****.
AMF	a 16-bit authentication management field that is an input to the functions ***f1*** and ***f1****.
c1,c2,c3,c4,c5	128-bit constants, which are XORed onto intermediate variables.
CK	a 128-bit confidentiality key that is the output of the function ***f3***.
IK	a 128-bit integrity key that is the output of the function ***f4***.
K	a 128-bit subscriber key that is an input to the functions ***f1***, ***f1****, ***f2***, ***f3***, ***f4***, ***f5*** and ***f5****.
MAC-A	a 64-bit network authentication code that is the output of the function ***f1***.
MAC-S	a 64-bit resynchronisation authentication code that is the output of the function ***f1****.
OP	a 128-bit Operator Variant Algorithm Configuration Field that is a component of the functions ***f1***, ***f1****, ***f2***, ***f3***, ***f4***, ***f5*** and ***f5****.
OP_C	a 128-bit value derived from **OP** and **K** and used within the computation of the functions.
r1,r2,r3,r4,r5	integers in the range 0–127 inclusive, which define amounts by which intermediate variables are cyclically rotated.
RAND	a 128-bit random challenge that is an input to the functions ***f1***, ***f1****, ***f2***, ***f3***, ***f4***, ***f5*** and ***f5****.
RES	a 64-bit signed response that is the output of the function ***f2***.
SQN	a 48-bit sequence number that is an input to either of the functions ***f1*** and ***f1****. (For ***f1**** this input is more precisely called SQN_{MS}.)

2.5 Algorithm Inputs and Outputs

The inputs to the algorithms are given in tables 1 and 2, the outputs in tables 3–9 below.

Table 1. inputs to *f1* and *f1**

Parameter	Size (bits)	Comment
K	128	Subscriber key K[0]…K[127]
RAND	128	Random challenge RAND[0]…RAND[127]
SQN	48	Sequence number SQN[0]…SQN[47]. (For ***f1**** this input is more precisely called SQN_{MS}.)
AMF	16	Authentication management field AMF[0]…AMF[15]

Table 2. inputs to *f2*, *f3*, *f4*, *f5* and *f5**

Parameter	Size (bits)	Comment
K	128	Subscriber key K[0]…K[127]
RAND	128	Random challenge RAND[0]…RAND[127]

Table 3. *f1* output

Parameter	Size (bits)	Comment
MAC-A	64	Network authentication code MAC-A[0]…MAC-A[63]

Table 4. *f1 output**

Parameter	Size (bits)	Comment
MAC-S	64	Resynch authentication code MAC-S[0]…MAC-S[63]

Table 5. *f2* output

Parameter	Size (bits)	Comment
RES	64	Response RES[0]…RES[63]

Table 6. *f3* output

Parameter	Size (bits)	Comment
CK	128	Confidentiality key CK[0]…CK[127]

Table 7. *f4* output

Parameter	Size (bits)	Comment
IK	128	Integrity key IK[0]…IK[127]

Table 8. *f5* output

Parameter	Size (bits)	Comment
AK	48	Anonymity key AK[0]…AK[47]

Table 9. *f5 output**

Parameter	Size (bits)	Comment
AK	48	Resynch anonymity key AK[0]…AK[47]

Note: Both f5 and f5* outputs are called AK according to reference [2]. In practice only one of them will be calculated in each instance of the authentication and key agreement procedure.

2.6 Coverage

For each of the algorithms the test data sets have been selected such that, provided the entire set of tests is run:

- Each input bit of the Rijndael kernel function will have been in both the "0" and "1" states.
- Each input bit of the modes (RAND, K, SQN, AMF) will have been in both the "0" and "1" states.
- Every S-Box entry of the Rijndael kernel function will have been used.

3 Conformance test data for Rijndael

3.1 Overview

The test data sets presented here are for the cryptographic kernel function Rijndael. The first 6 test sets are the same as in document 3: implementors" test data.

3.2 Format

The first test set is shown twice, once in binary format, once in hexadecimal format. This is to explicitly show the relationship between the binary data and the hexadecimal representation. The remainder of the test sets are presented in hexadecimal format only. A hexadecimal number will be broken up in two rows of two 32-bit words. For example, the number `ee36f7cf037d37d3692f7f0399e7949a` will be written as

```
ee36f7cf 037d37d3
692f7f03 99e7949a.
```

3.3 Test Sets

3.3.1 Set 1 Binary Format

```
Plaintext:  11101110 00110110 11110111 11001111 00000011 01111101 00110111 11010011 01101001
            00101111 01111111 00000011 10011001 11100111 10010100 10011010
Ciphertext: 10011110 00101001 10000000 11000101 10010111 00111001 11011010 01100111 10110001
            00110110 00110101 01011110 00111100 11101101 11100110 10100010
Key:        01000110 01011011 01011100 11101000 10110001 10011001 10110100 10011111 10101010
            01011111 00001010 00101110 11100010 00111000 10100110 10111100
```

3.3.2 Hexadecimal Format

Set	Plaintext	Ciphertext	Key
1	ee36f7cf 037d37d3 692f7f03 99e7949a	9e2980c5 9739da67 b136355e 3cede6a2	465b5ce8 b199b49f aa5f0a2e e238a6bc
2	93cc3640 c5d6a521 d81235bd 0882bf0a	009a9e09 96561525 f611667b bf79e226	0396eb31 7b6d1c36 f19c1c84 cd6ffd16
3	8f7a8f0d 108b7f2d 97a53eac c1d958d9	5d9bce85 4decaf0d a93d28b7 e35f608c	fec86ba6 eb707ed0 8905757b 1bb44b8f
4	68c98bbf ab628ec1 adf2a3d9 0c34a751	db2944cc e8e683cd 03fff199 31a12135	9e5944ae a94b8116 5c82fbf9 f32db751
5	a840b1dd 60249aa3 22016b4b 31daf3b8	02bffada 7137c492 c00e8452 d8c76eaa	4ab1deb0 5ca6ceb0 51fc98e7 7d026a84
6	d66789ef f5996b9c ffd89e0a 77148657	bdf226fe cf9ff996 1e5c2621 b764efb1	6c38a116 ac280c45 4f59332e e35c8c4f
7	8cbdb88c 620ffe88 f8ce0042 a5052568	fe8d6888 b5a5c146 efea6660 f7b4e699	523ace48 994925ca 0495efd5 0c7c71e2
8	83a4dbcc f3ff12e2 154dbf45 512b5a32	1c3aff64 cd717a6e 959c95c8 b9cd7d3f	e4aee4fa eeb2f93d 43604f5f 2e65ff25
9	d117610c 04f5d3d6 1d8cb6bc 910a918b	21bc0073 cc9aa7a3 81257774 43f8663f	b2c211ec 004d0323 022e49cc d363c8ff
10	9d7cf334 be57ea4d 37f28c8f 8f0a7259	1591d87d 8fa69176 eae9fae9 02cd61a4	443c5a67 59e04dc2 c9c6e465 823dd5b6
11	0f3c382c 488efe2d 8ce7eaa7 7093a486	c59e0669 76d92f8e 567b806f 94fb09d2	23e5c9b1 8034df64 21f22972 c3bd2d93
12	51c0d9dc cb03b860 43d378ea 5f0dd0f8	ff00e5a1 a02f7594 3b4a5a1e 39bf5dc3	d6856512 fd11bf4f 91781e3b 1ea9d8de
13	886f7d2c 6f1dc0cc 851fdd41 82e09d99	3f65bc17 b47b645b 0fbfbfe8 da4269bf	e5e436d4 593ef7cb a221cd07 1ccadfdf
14	dfb0cd05 5b43bd5b 7a31c294 0174b44f	32976e2e d7fb97b2 bcaaba00 80faf1e5	d9c9453e 1b858f22 dab53e20 44e849de
15	7ced704d b8df58f4 4972cecc 0531bc04	53772447 4cf17c9b 105673b5 f37581c8	38fe9997 cbac8d9a c4fc78cc 1fcb1e22
16	878d0fee ad58387e 1b4aaacf b6805e9f	e555cfb7 9663f0ea fdcc9665 55d6498d	8d493a28 f17cfb7d e5be8354 333a66f4
17	29f852ce 631605e3 1722fd87 3bc74208	d78106ad 6fdae41c 95dd2f7b 5b479a79	5d733139 16bde011 c7c26700 0bfe2a9c
18	8995e0d7 0281690a 666070db bd6f0f27	70b059ad f647d183 a18512a3 72ae683c	32448511 c137459f f1d12c17 2cdf7262
19	d1ce62ef b1010adb 2f6eabb2 63e16ee4	ec7fc8b1 10246889 cff7293f e30c8465	93833efa 7bb1316e ebb3dbe3 20a5448d
20	260a7f00 98fe903e 9bb255f6 56840627	91747de6 7effaff8 578381ef 27e497ec	09fa653a cbf5acc8 3e307caa 6e18aa67

4 Conformance test data for MILENAGE

4.1 Overview

The test data sets presented here are for the seven functions *f1*, *f1**, *f2*, *f3*, *f4*, *f5* and *f5**. The first 6 test sets are the same as in document 2: implementors" test data.

4.2 Format

Each Test shows the various inputs to the algorithm. This is followed by the configuration field OP, the value $OP_C = OP \oplus E[OP]_K$ and finally by the function outputs.

The first test set is shown twice, once in binary format, once in hexadecimal format. This is to explicitly show the relationship between the binary data and the hexadecimal representation. The remainder of the test sets are presented in hexadecimal format only.

4.3 Test Sets

4.3.1 Set 1

Binary Format

K: 01000110 01011011 01011100 11101000 10110001 10011001 10110100 10011111 10101010 01011111
00001010 00101110 11100010 00111000 10100110 10111100

RAND: 00100011 01010101 00111100 10111110 10010110 00110111 10101000 10011101 00100001 10001010
11100110 01001101 10101110 01000111 10111111 00110101

SQN: 11111111 10011011 10110100 11010000 10110110 00000111

AMF: 10111001 10111001

OP: 11001101 11000010 00000010 11010101 00010010 00111110 00100000 11110110 00101011 01101101
01100111 01101010 11000111 00101100 10110011 00011000

OP_C: 11001101 01100011 11001011 01110001 10010101 01001010 10011111 01001110 01001000 10100101
10011001 01001110 00110111 10100000 00101011 10101111

f1: 01001010 10011111 11111010 11000011 01010100 11011111 10101111 10110011

f1*: 00000001 11001111 10101111 10011110 11000100 11101000 01110001 11101001

f2: 10100101 01000010 00010001 11010101 11100011 10111010 01010000 10111111

f5: 10101010 01101000 10011100 01100100 10000011 01110000

f3: 10110100 00001011 10101001 10100011 11000101 10001011 00101010 00000101 10111011 11110000
11011001 10000111 10110010 00011011 11111000 11001011

f4: 11110111 01101001 10111100 11010111 01010001 00000100 01000110 00000100 00010010 01110110
01110010 01110001 00011100 01101101 00110100 01000001

f5*: 01000101 00011110 10001011 11101100 10100100 00111011

Hexadecimal Format

Variable	Value
K	465b5ce8 b199b49f aa5f0a2e e238a6bc
RAND	23553cbe 9637a89d 218ae64d ae47bf35
SQN	ff9bb4d0 b607
AMF	b9b9
OP	cdc202d5 123e20f6 2b6d676a c72cb318
OP_C	cd63cb71 954a9f4e 48a5994e 37a02baf
f1	4a9ffac3 54dfafb3
f1*	01cfaf9e c4e871e9
f2	a54211d5 e3ba50bf
f5	aa689c64 8370
f3	b40ba9a3 c58b2a05 bbf0d987 b21bf8cb
f4	f769bcd7 51044604 12767271 1c6d3441
f5*	451e8bec a43b

4.3.2 Test Set 2

Variable	Value
K	465b5ce8 b199b49f aa5f0a2e e238a6bc
RAND	23553cbe 9637a89d 218ae64d ae47bf35
SQN	ff9bb4d0 b607
AMF	b9b9
OP	cdc202d5 123e20f6 2b6d676a c72cb318
OP_C	cd63cb71 954a9f4e 48a5994e 37a02baf
f1	4a9ffac3 54dfafb3
f1*	01cfaf9e c4e871e9
f2	a54211d5 e3ba50bf
f5	aa689c64 8370
f3	b40ba9a3 c58b2a05 bbf0d987 b21bf8cb
f4	f769bcd7 51044604 12767271 1c6d3441
f5*	451e8bec a43b

4.3.3 Test Set 3

Variable	Value
K	fec86ba6 eb707ed0 8905757b 1bb44b8f
RAND	9f7c8d02 1accf4db 213ccff0 c7f71a6a
SQN	9d027759 5ffc
AMF	725c
OP	dbc59adc b6f9a0ef 735477b7 fadf8374
OP_C	1006020f 0a478bf6 b699f15c 062e42b3
f1	9cabc3e9 9baf7281
f1*	95814ba2 b3044324
f2	8011c48c 0c214ed2
f5	33484dc2 136b
f3	5dbdbb29 54e8f3cd e665b046 179a5098
f4	59a92d3b 476a0443 487055cf 88b2307b
f5*	deacdd84 8cc6

4.3.4 Test Set 4

Variable	Value
K	9e5944ae a94b8116 5c82fbf9 f32db751
RAND	ce83dbc5 4ac0274a 157c17f8 0d017bd6
SQN	0b604a81 eca8
AMF	9e09
OP	223014c5 806694c0 07ca1eee f57f004f
OP_C	a64a507a e1a2a98b b88eb421 0135dc87
f1	74a58220 cba84c49
f1*	ac2cc74a 96871837
f2	f365cd68 3cd92e96
f5	f0b9c08a d02e
f3	e203edb3 971574f5 a94b0d61 b816345d
f4	0c4524ad eac041c4 dd830d20 854fc46b
f5*	6085a86c 6f63

4.3.5 Test Set 5

Variable	Value
K	4ab1deb0 5ca6ceb0 51fc98e7 7d026a84
RAND	74b0cd60 31a1c833 9b2b6ce2 b8c4a186
SQN	e880a1b5 80b6
AMF	9f07
OP	2d16c5cd 1fdf6b22 383584e3 bef2a8d8
OP_C	dcf07cbd 51855290 b92a07a9 891e523e
f1	49e785dd 12626ef2
f1*	9e857903 36bb3fa2
f2	5860fc1b ce351e7e
f5	31e11a60 9118
f3	7657766b 373d1c21 38f307e3 de9242f9
f4	1c42e960 d89b8fa9 9f2744e0 708ccb53
f5*	fe2555e5 4aa9

4.3.6 Test Set 6

Variable	Value
K	6c38a116 ac280c45 4f59332e e35c8c4f
RAND	ee6466bc 96202c5a 557abbef f8babf63
SQN	414b9822 2181
AMF	4464
OP	1ba00a1a 7c6700ac 8c3ff3e9 6ad08725
OP_C	3803ef53 63b947c6 aaa225e5 8fae3934
f1	078adfb4 88241a57
f1*	80246b8d 0186bcf1
f2	16c8233f 05a0ac28
f5	45b0f69a b06c
f3	3f8c7587 fe8e4b23 3af676ae de30ba3b
f4	a7466cc1 e6b2a133 7d49d3b6 6e95d7b4
f5*	1f53cd2b 1113

4.3.7 Test Set 7

Variable	Value
K	2d609d4d b0ac5bf0 d2c0de26 7014de0d
RAND	194aa756 013896b7 4b4a2a3b 0af4539e
SQN	6bf69438 c2e4
AMF	5f67
OP	460a4838 5427aa39 264aac8e fc9e73e8
OP_C	c35a0ab0 bcbfc925 2caff15f 24efbde0
f1	bd07d300 3b9e5cc3
f1*	bcb6c2fc ad152250
f2	8c25a16c d918a1df
f5	7e6455f3 4cf3
f3	4cd08460 20f8fa07 31dd47cb dc6be411
f4	88ab80a4 15f15c73 711254a1 d388f696
f5*	dc6dd01e 8f15

4.3.8 Test Set 8

Variable	Value
K	a530a7fe 428fad10 82c45edd fce13884
RAND	3a4c2b32 45c50eb5 c71d0863 9395764d
SQN	f63f5d76 8784
AMF	b90e
OP	511c6c4e 83e38c89 b1c5d8dd e62426fa
OP_C	27953e49 bc8af6dc c6e730eb 80286be3
f1	53761fbd 679b0bad
f1*	21adfd33 4a10e7ce
f2	a63241e1 ffc3e5ab
f5	88196c47 986f
f3	10f05bab 75a99a5f bb98a9c2 87679c3b
f4	f9ec0865 eb32f223 69cade40 c59c3a44
f5*	c987a3d2 3115

4.3.9 Test Set 9

Variable	Value
K	d9151cf0 4896e258 30bf2e08 267b8360
RAND	f761e5e9 3d603feb 730e2755 6cb8a2ca
SQN	47ee0199 820a
AMF	9113
OP	75fc2233 a44294ee 8e6de25c 4353d26b
OP_C	c4c93eff e8a08138 c203d4c2 7ce4e3d9
f1	66cc4be4 4862af1f
f1*	7a4b8d7a 8753f246
f2	4a90b217 1ac83a76
f5	82a0f528 7a71
f3	71236b71 29f9b22a b77ea7a5 4c96da22
f4	90527eba a5588968 db417273 25a04d9e
f5*	527dbf41 f35f

4.3.10 Test Set 10

Variable	Value
K	a0e2971b 6822e8d3 54a18cc2 35624ecb
RAND	08eff828 b13fdb56 2722c65c 7f30a9b2
SQN	db5c0664 81e0
AMF	716b
OP	323792fa ca21fb4d 5d6f13c1 45a9d2c1
OP_C	82a26f22 bba9e948 8f949a10 d98e9cc4
f1	9485fe24 621cb9f6
f1*	bce325ce 03e2e9b9
f2	4bc2212d 8624910a
f5	a2f858aa 9e5d
f3	08cef6d0 04ec6147 1a3c3cda 048137fa
f4	ed0318ca 5deb9206 272f6e8f a64ba411
f5*	74e76fbb ec38

4.3.11 Test Set 11

Variable	Value
K	0da6f7ba 86d5eac8 a19cf563 ac58642d
RAND	679ac4db acd7d233 ff9d6806 f4149ce3
SQN	6e2331d6 92ad
AMF	224a
OP	4b9a26fa 459e3acb ff36f401 5de3bdc1
OP_C	0db1071f 8767562c a43a0a64 c41e8d08
f1	2831d7ae 9088e492
f1*	9b2e1695 1135d523
f2	6fc30fee 6d123523
f5	4c539a26 e1fa
f3	69b1cae7 c7429d97 5e245cac b05a517c
f4	74f24e8c 26df58e1 b38d7dcd 4f1b7fbd
f5*	07861e12 6928

4.3.12 Test Set 12

Variable	Value
K	77b45843 c88e58c1 0d202684 515ed430
RAND	4c47eb30 76dc55fe 5106cb20 34b8cd78
SQN	fe1a8731 005d
AMF	ad25
OP	bf3286c7 a51409ce 95724d50 3bfe6e70
OP_C	d483afae 562409a3 26b5bb0b 20c4d762
f1	08332d7e 9f484570
f1*	ed41b734 489d5207
f2	aefa357b eac2a87a
f5	30ff25cd adf6
f3	908c43f0 569cb8f7 4bc971e7 06c36c5f
f4	c251df0d 888dd932 9bcf4665 5b226e40
f5*	e84ed0d4 677e

4.3.13 Test Set 13

Variable	Value
K	729b1772 9270dd87 ccdf1bfe 29b4e9bb
RAND	311c4c92 9744d675 b720f3b7 e9b1cbd0
SQN	c85c4cf6 5916
AMF	5bb2
OP	d04c9c35 bd2262fa 810d2924 d036fd13
OP_C	228c2f2f 06ac3268 a9e616ee 16db4ba1
f1	ff794fe2 f827ebf8
f1*	24fe4dc6 1e874b52
f2	98dbbd09 9b3b408d
f5	5380d158 cfe3
f3	44c0f23c 5493cfd2 41e48f19 7e1d1012
f4	0c9fb816 13884c25 35dd0eab f3b440d8
f5*	87ac3b55 9fb6

4.3.14 Test Set 14

Variable	Value
K	d32dd23e 89dc6623 54ca12eb 79dd32fa
RAND	cf7d0ab1 d9430695 0bf12018 fbd46887
SQN	484107e5 6a43
AMF	b5e6
OP	fe75905b 9da47d35 6236d031 4e09c32e
OP_C	d22a4b41 80a53257 08a5ff70 d9f67ec7
f1	cf19d62b 6a809866
f1*	5d269537 e45e2ce6
f2	af4a411e 1139f2c2
f5	217af492 72ad
f3	5af86b80 edb70df5 292cc112 1cbad50c
f4	7f4d6ae7 440e1878 9a8b75ad 3f42f03a
f5*	900e101c 677e

4.3.15 Test Set 15

Variable	Value
K	af7c65e1 927221de 591187a2 c5987a53
RAND	1f0f8578 464fd59b 64bed2d0 9436b57a
SQN	3d627b01 418d
AMF	84f6
OP	0c7acb8d 95b7d4a3 1c5aca6d 26345a88
OP_C	a4cf5c81 55c08a7e ff418e54 43b98e55
f1	c37cae78 05642032
f1*	68cd09a4 52d8db7c
f2	7bffa5c2 f41fbc05
f5	837fd7b7 4419
f3	3f8c3f3c cf7625bf 77fc94bc fd22fd26
f4	abcbae8f d46115e9 961a55d0 da5f2078
f5*	56e97a60 90b1

4.3.16 Test Set 16

Variable	Value
K	5bd7ecd3 d3127a41 d12539be d4e7cf71
RAND	59b75f14 251c7503 1d0bcbac 1c2c04c7
SQN	a298ae89 29dc
AMF	d056
OP	f967f760 38b920a9 cd25e10c 08b49924
OP_C	76089d3c 0ff3efdc 6e36721d 4fceb747
f1	c3f25cd9 4309107e
f1*	b0c8ba34 3665afcc
f2	7e3f44c7 591f6f45
f5	5be11495 525d
f3	d42b2d61 5e49a03a c275a5ae f97af892
f4	0b3f8d02 4fe6bfaf aa982b8f 82e319c2
f5*	4d6a34a1 e4eb

4.3.17 Test Set 17

Variable	Value
K	6cd1c6ce b1e01e14 f1b82316 a90b7f3d
RAND	f69b78f3 00a0568b ce9f0cb9 3c4be4c9
SQN	b4fce5fe b059
AMF	e4bb
OP	078bfca9 564659ec d8851e84 e6c59b48
OP_C	a219dc37 f1dc7d66 738b5843 c799f206
f1	69a90869 c268cb7b
f1*	2e0fdcf9 fd1cfa6a
f2	70f6bdb9 ad21525f
f5	1c408a85 8b3e
f3	6edaf99e 5bd9f85d 5f36d91c 1272fb4b
f4	d61c853c 280dd9c4 6f297bae c386de17
f5*	aa4ae52d aa30

4.3.18 Test Set 18

Variable	Value
K	b73a90cb cf3afb62 2dba83c5 8a8415df
RAND	b120f1c1 a0102a2f 507dd543 de68281f
SQN	f1e8a523 a36d
AMF	471b
OP	b672047e 003bb952 dca6cb8a f0e5b779
OP_C	df0c6786 8fa25f74 8b7044c6 e7c245b8
f1	ebd70341 bcd415b0
f1*	12359f5d 82220c14
f2	479dd25c 20792d63
f5	aefdaa5d dd99
f3	66195dbe d0313274 c5ca7766 615fa25e
f4	66bec707 eb2afc47 6d7408a8 f2927b36
f5*	12ec2b87 fbb1

4.3.19 Test Set 19

Variable	Value
K	51222502 14c33e72 3a5dd523 fc145fc0
RAND	81e92b6c 0ee0e12e bceba8d9 2a99dfa5
SQN	16f3b3f7 0fc2
AMF	c3ab
OP	c9e87632 86b5b9ff bdf56e12 97d0887b
OP_C	981d464c 7c52eb6e 50362349 84ad0bcf
f1	2a5c23d1 5ee351d5
f1*	62dae385 3f3af9d2
f2	28d7b0f2 a2ec3de5
f5	ada15aeb 7bb8
f3	5349fbe0 98649f94 8f5d2e97 3a81c00f
f4	9744871a d32bf9bb d1dd5ce5 4e3e2e5a
f5*	d461bc15 475d

4.3.20 Test Set 20

Variable	Value
K	90dca4ed a45b53cf 0f12d7c9 c3bc6a89
RAND	9fddc720 92c6ad03 6b6e4647 89315b78
SQN	20f813bd 4141
AMF	61df
OP	3ffcfe5b 7b111158 9920d352 8e84e655
OP_C	cb9cccc4 b9258e6d ca476037 9fb82581
f1	09db94ea b4f8149e
f1*	a29468aa 9775b527
f2	a95100e2 760952cd
f5	83cfd54d b913
f3	b5f2da03 883b69f9 6bf52e02 9ed9ac45
f4	b4721368 bc16ea67 875c5598 688bb0ef
f5*	4f203939 2ddc

Annex A (informative): Change history

Change history					
TSG SA #	**Version**	**CR**	**Tdoc SA**	**New Version**	**Subject/Comment**
SP-10	SAGE v 1.0	-	SP-010630	3.0.0	Approved as Release 1999
SP-11	3.0.0	-	-	4.0.0	Updated to Release 4
SP-16	4.0.0	-	-	5.0.0	Updated to Release 5
SP-26	5.0.0	-	-	6.0.0	Updated to Release 6
SP-36	6.0.0	-	-	7.0.0	Updated to Release 7
SP-42	7.0.0	-	-	8.0.0	Updated to Release 8
SP-46	8.0.0	-	-	9.0.0	Updated to Release 9

History

Document history		
V9.0.0	February 2010	Publication