FIPS 140-2 Non-Proprietary Security Policy

BlackBerry Cryptographic Java Module Versions 2.9

Document version 1.18

BlackBerry Security Certifications, BlackBerry

Table of Contents

TABLE OF CONTENTS 2
LIST OF FIGURES..... 4
LIST OF TABLES 5
INTRODUCTION..... 6
1 CRYPTOGRAPHIC MODULE SPECIFICATION..... 8
1.1 PHYSICAL SPECIFICATIONS..... 8
1.2 COMPUTER HARDWARE, OS, AND JVM..... 10
1.3 SOFTWARE SPECIFICATIONS 10
2 CRYPTOGRAPHIC MODULE PORTS AND INTERFACES 12
3 ROLES, SERVICES, AND AUTHENTICATION 13
3.1 ROLES AND SERVICES..... 13
3.2 SECURITY FUNCTION..... 14
3.3 OPERATOR AUTHENTICATION 19
4 FINITE STATE MODEL 20
5 PHYSICAL SECURITY 21
6 OPERATIONAL ENVIRONMENT 22
7 CRYPTOGRAPHIC KEY MANAGEMENT..... 23
7.1 KEY GENERATION 23
7.2 KEY ESTABLISHMENT 23
7.3 KEY ENTRY AND OUTPUT 23
7.4 KEY STORAGE..... 24
7.5 KEY ZEROIZATION..... 24
8 SELF-TESTS..... 25
8.1 POWER-UP TESTS 25
8.2 ON-DEMAND SELF-TESTS..... 25
8.3 CONDITIONAL TESTS 25
8.4 FAILURE OF SELF-TESTS..... 25
9 DESIGN ASSURANCE..... 26
9.1 CONFIGURATION MANAGEMENT 26
9.2 DELIVERY AND OPERATION..... 26
9.3 DEVELOPMENT 26

9.4 GUIDANCE DOCUMENTS 26

10 MITIGATION OF OTHER ATTACKS 27

10.1 TIMING ATTACK ON RSA 27

10.2 ATTACK ON BIASED PRIVATE KEY OF DSA 27

DOCUMENT AND CONTACT INFORMATION 34

List of Figures

Figure 1. BlackBerry Enterprise Service 10 architecture 6
Figure 2. Cryptographic module hardware block diagram 9
Figure 3: Cryptographic module software block diagram 11

List of Tables

Table 1. Summary of achieved security levels per FIPS 140-2 section 7
Table 2. Implementation of FIPS 140-2 interfaces 12
Table 3. Roles and services 13
Table 4. Supported cryptographic algorithms 14
Table 5. Key and CSP, key size, security strength, and access 17
Table 6. Module self-tests 25

Introduction

BlackBerry® is the leading wireless solution that allows users to stay connected to a full suite of applications, including email, phone, enterprise applications, the Internet, Short Message Service (SMS), and organizer information. BlackBerry is a totally integrated package that includes innovative software, advanced BlackBerry wireless devices and wireless network service, providing a seamless solution. The BlackBerry® Enterprise Service 12 architecture is shown in the following figure.

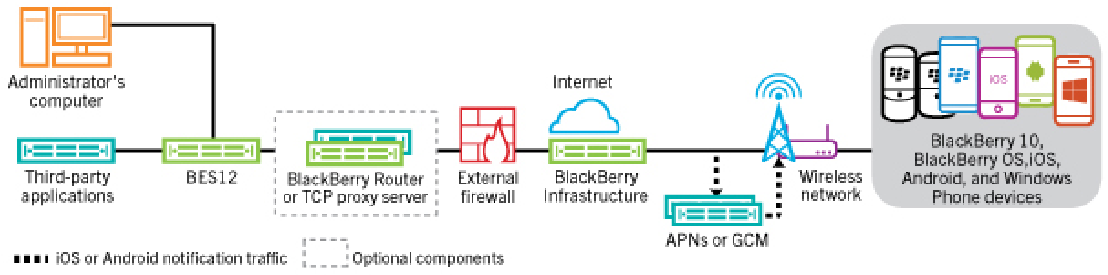

Administrator's computer
Internet
Third-party applications
BES12
BlackBerry Router or TCP proxy server
External firewall
BlackBerry Infrastructure
Wireless network
BlackBerry 10, BlackBerry OS,iOS, Android, and Windows Phone devices
APNs or GCM
iOS or Android notification traffic
Optional components

Figure 1. BlackBerry Enterprise Service 12 architecture

BlackBerry® smartphones are built on industry-leading wireless technology and, combined with BlackBerry Enterprise Service, provide users with an industry leading, end to end security solution. With the use of BlackBerry Enterprise Service 12, you can manage BlackBerry smartphones, as well as iOS® devices, Android™ devices, and Windows phones® all from a unified interface.

BlackBerry 10 smartphones contain the BlackBerry OS Cryptographic Library, a software module that provides the cryptographic functionality required for basic operation of the device. The BlackBerry Cryptographic Java Module expands the secure capabilities and features BlackBerry is known for, to devices running operating systems other than the BlackBerry OS.

The BlackBerry Cryptographic Java Module, hereafter referred to as cryptographic module or module, is a software module that provides the following cryptographic services to the BlackBerry Enterprise Service 12 and other BlackBerry device management components:

- Data encryption and decryption
- Message digest and authentication code generation
- Random data generation
- Elliptic curve key pair generation
- Elliptic curve digital signature generation and verification
- Elliptic curve key agreement

More information on the BlackBerry solution is available from http://ca.blackberry.com/.

The BlackBerry Cryptographic Java Module meets the requirements applicable to FIPS 140-2 Security Level 1 as shown in Table 1.

Table 1. Summary of achieved security levels per FIPS 140-2 section

Section	Level
Cryptographic Module Specification	1
Cryptographic Module Ports and Interfaces	1
Roles, Services, and Authentication	1
Finite State Model	1
Physical Security	N/A
Operational Environment	1
Cryptographic Key Management	1
EMI/EMC	1
Self-Tests	1
Design Assurance	1
Mitigation of Other Attacks	1
Cryptographic Module Security Policy	1

1 Cryptographic module specification

The BlackBerry Cryptographic Java Module is a multiple-chip, stand-alone software cryptographic module that operates with the following components:

- Commercially available general-purpose computer hardware
- Commercially available Operating System (OS) that runs on the computer hardware
- A commercially available Java Virtual Machine (JVM) that runs on the computer hardware and OS

1.1 Physical specifications

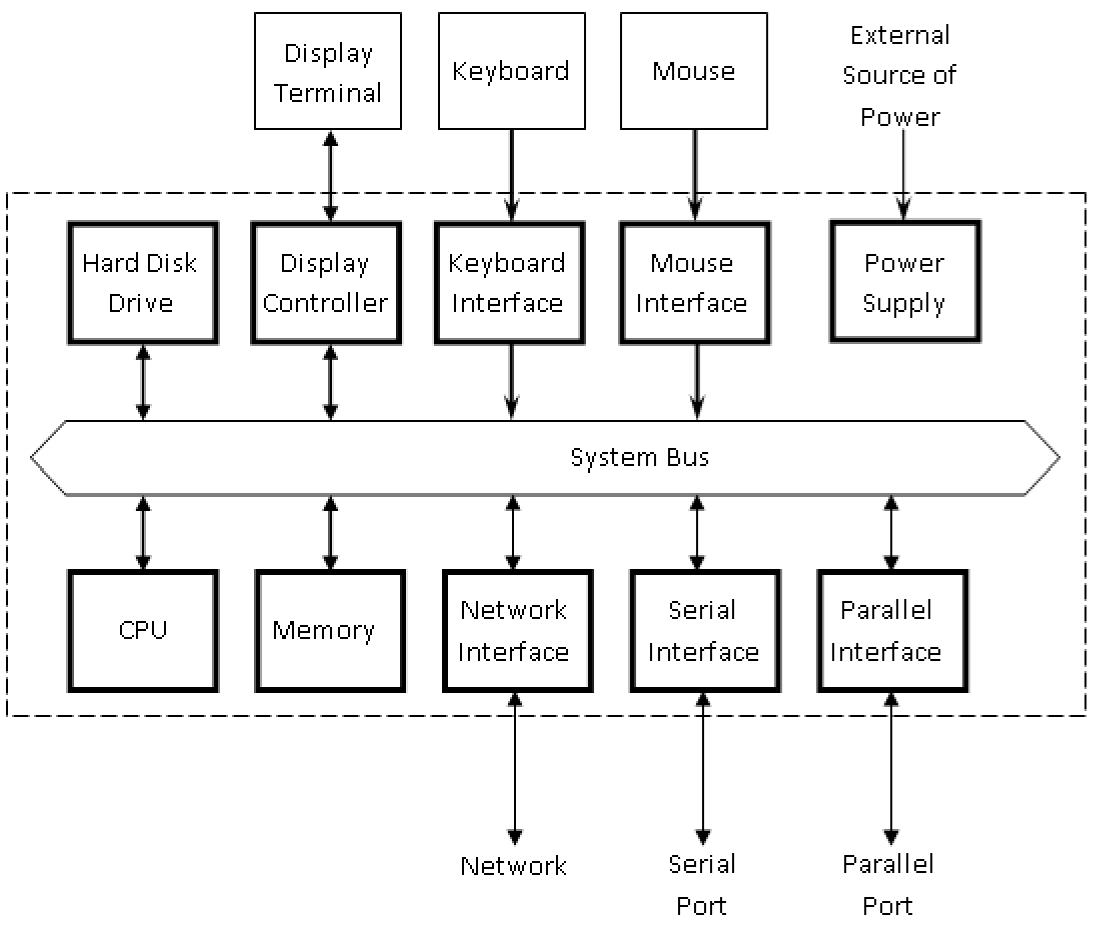
The general, computer hardware component consists of the following devices:

- CPU (microprocessor)
- Working memory located on the RAM and contains the following spaces:
    - Input/Output buffer
    - Plaintext/ciphertext buffer
    - Control buffer

Note: Key storage is not deployed in this module.

- Program memory is also located on the RAM
- Hard disk (or disks), including flash memory
- Display controller, including the touch screen controller
- Keyboard interface
- Mouse interface, including the trackball interface
- Audio controller
- Network interface
- Serial port
- Parallel port
- USB interface
- Power supply

Figure 2 illustrates the configuration of this component.



Key:

⬚	Physical Cryptographic Boundary
↕	Flow of data, control input, and status output
↓	Flow of control input
↑	Flow of status output

Figure 2. Cryptographic module hardware block diagram

1.2 Computer hardware, OS, and JVM

The BlackBerry Cryptographic Java Module version 2.9 has been tested on the following representative combinations of computer hardware and OS:

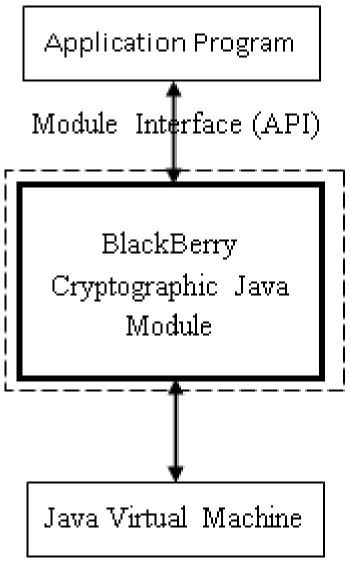
1. 1. CentOS Linux 7.0 64-bit x86 running JRE 1.8.0 by Oracle, running on a Dell PowerEdge 2950
2. BlackBerry Priv with a Qualcomm 8992 Snapdragon processor, running Android OS version 6.0.1
3. Ricoh MP C3004 with a NXP ARM Cortex-A9 processor, running Android OS API level 17

The module will run on other Android platforms while maintaining its compliance to the FIPS 140-2 Level 1 requirements.

1.3 Software specifications

The BlackBerry Cryptographic Java Module provides services to the Java computer language users in the form of a Java archive (JAR). The same binary is used for all identified computer hardware and OS because the JVM underneath the BlackBerry Cryptographic Java Module will absorb the differences of the computer hardware and OS.

The interface into the BlackBerry Cryptographic Java Module is through Application Programmer's Interface (API) method calls. These method calls provide the interface to the cryptographic services, for which the parameters and return codes provide the control input and status output (see Figure 3).



Key:

⬚	Cryptographic boundary
↕	Data flows

Figure 3: Cryptographic module software block diagram

2 Cryptographic module ports and interfaces

The cryptographic module ports correspond to the physical ports of the GPC that is executing the module, and the module interfaces correspond to the module's logical interfaces. The following table describes the module ports and interfaces.

Table 2. Implementation of FIPS 140-2 interfaces

FIPS 140-2 interface	Module ports	Module interfaces
Data Input	API	Ethernet Port
Data Output	API	Ethernet Port
Control Input	API	Keyboard and Mouse
Status Output	Return Code	Display
Power Input	Initialization Function	The Power Supply is the power interface.
Maintenance	Not supported	Not supported

3 Roles, services, and authentication

3.1 Roles and services

The module supports User and Crypto Officer roles. The module does not support a maintenance role. The module does not support multiple or concurrent operators and is intended for use by a single operator, thus it always operates in a single-user mode.

Table 3. Roles and services

Service*[1]	Crypto Officer	User
Initialization, etc.		
Initialization	×	×
Deinitialization	×	×
Self-tests	×	×
Show status	×	×
Symmetric Ciphers (AES and TRIPLE-DES)		
Key generation (Triple-DES only)	×	×
Encrypt	×	×
Decrypt	×	×
Key zeroization	×	×
Hash Algorithms and Message Authentication (SHA, HMAC)		
Hashing	×	×
Message authentication	×	×
Random Bit Generation		
Instantiation	×	×
Request	×	×

[1] These services are non-Approved when using one of the non-Approved algorithms as specified in table 4

Service*[1]	Crypto Officer	User
CSP/key zeroization	×	×
Digital Signature (DSA, ECDSA, RSA)		
Key pair generation	×	×
Sign	×	×
Verify	×	×
Key Zeroization	×	×
Key Agreement (Diffie-Hellman, Elliptic Curve Diffie-Hellman, ECMQV)		
Key pair generation	×	×
Shared secret generation	×	×
Key Zeroization	×	×
KeyWrapping (RSA)		
Key pair generation	×	×
Wrap	×	×
Unwrap	×	×
Key Zeroization	×	×

To operate the module securely, the Crypto Officer and User are responsible for confining those methods that have been FIPS 140-2 Approved. Thus, in the Approved mode of operation, all roles shall confine themselves to calling FIPS Approved algorithms, as shown in Table 4.

3.2 Security functions

The BlackBerry Cryptographic Java Module supports many cryptographic algorithms. Table 4 shows the set of cryptographic algorithms supported by the BlackBerry Cryptographic Java Module.

Table 4. Supported cryptographic algorithms

Type	Algorithm	FIPS approved or allowed	Certificate number
Block Ciphers	DES (ECB, CBC, CFB64, OFB64)		

Type	Algorithm	FIPS approved or allowed	Certificate number
	TRIPLE-DES (TECB, TCBC, TCFB64, TOFB64) [SP800-67]	×	# 2188, #2320, #2321
	DESX (ECB, CBC, CFB64, OFB64)		
	AES (ECB, CBC, CFB128, OFB128, CTR, CCM, CMAC, GCM) [FIPS 197]	×	# 3988
	AES (ECB, CBC, CFB128, OFB128, CTR) [FIPS 197]	×	#4299, #4300
	ARC2 (ECB, CBC, CFB64, OFB64) [RFC 2268]		
Stream Cipher	ARC4		
Hash Functions	SHA-1 [FIPS 180-4]	×	# 3292, #3537, #3538
	SHA-224 [FIPS 180-4]	×	# 3292, #3537, #3538
	SHA-256 [FIPS 180-4]	×	# 3292, #3537, #3538
	SHA-384 [FIPS 180-4]	×	# 3292, #3537, #3538
	SHA-512 [FIPS 180-4]	×	# 3292, #3537, #3538
	MD5 [RFC 1321]		
	MD2 [RFC 1115]		
	RIPEMD		

Type	Algorithm	FIPS approved or allowed	Certificate number
Message Authenticatio n	HMAC-SHA-1 [FIPS 198-1]	×	# 2603, #2835, #2836
	HMAC-SHA-224 [FIPS 198-1]	×	# 2603, #2835, #2836
	HMAC-SHA-256 [FIPS 198-1]	×	# 2603, #2835, #2836
	HMAC-SHA-384 [FIPS 198-1]	×	# 2603, #2835, #2836
	HMAC-SHA-512 [FIPS 198-1]	×	# 2603, #2835, #2836
	HMAC-MD5 [RFC 2104]		
Random Bit Generation	ANSI X9.62 RNG [ANSI X9.62]		
	DRBG [NIST SP 800-90A Rev. 1]	×	# 1180, #1359, #1360
	NDRBG (GenerateSeed())	×	
Digital Signature	DSA [FIPS 186-4]	×	#1084, #1142, #1143
	ECDSA [FIPS 186-4]	×	# 884, #1009, #1010
	ECDSA [ANSI X9.62]		
	RSA PKCS1 v1.5 Signature [PKCS #1 v2.1]	×	# 2046, #2320, #2321

Type	Algorithm	FIPS approved or allowed	Certificate number
	RSA PSS [PKCS #1 v2.1]	×	# 2046, #2320
	ECQV		
Key Agreement	Diffie-Hellman [NIST SP 800-56A]	×	# 83, #98, #99
	Elliptic Curve Diffie-Hellman [NIST SP 800-56A]	×	#83, #98, #99
	ECMQV [NIST SP 800-56A]	×	83, #98, #99
Key Wrapping	RSA PKCS1 v1.5 Encryption [PKCS #1 v2.1]	×	
	RSA OAEP [KTS, vendor affirmed]	×	
	ECIES [ANSI X9.63]		

The DES, DESX, AES CCM* (CCM star) mode, random bit generation (ANSI X9.62), ARC2, ARC4, RIPEMD, MD4, MD2, and HMAC-MD5, ECQV, ECIES, RSA PKCS #1 v1.5 Encryption algorithm, and Diffie-Hellman with strength < 112 bits are supported as non FIPS Approved algorithms. In order to operate the module in a FIPS Approved mode of operation these algorithms must not be used.

Note: *2-Key Triple-DES decryption is permitted for legacy purposes. 2-Key Triple-DES encryption is considered a non FIPS Approved algorithm as of January 1st, 2016. Please consult NIST SP 800-131A for additional details on algorithm transitions.*

Table 5 summarizes the keys and CSPs used in the FIPS mode.

Table 5. Key and CSP, key size, security strength, and access

Algorithm	Key and CSP	Key size	Security strength	Access
AES	Key	128 to 256 bits	128 to 256 bits	Use
TRIPLE-DES	Key	192 bits	112 bits	Create, Read, Use
HMAC	Key	160 to 512 bits	160-512 bits	Use
DRBG	seed	160-512 bits	160-256 bits	Use
DSA	Key pair	2048 to 15360 bits	112 to 256 bits	Create, Read, Use

Algorithm	Key and CSP	Key size	Security strength	Access
ECDSA	Key pair	224 to 521 bits	112 to 256 bits	Create, Read, Use
RSA	Key pair	2048 to 15360 bits	112 to 256 bits	Create, Read, Use
DH	Static/ephemeral key pair	Public key 2048-15360 bits/ Private key 224-512 bits	112 to 256 bits	Create, Read, Use
ECDH	Static/ephemeral key pair	224 to 521 bits	112 to 256 bits	Create, Read, Use
ECMQV	Static/ephemeral key pair	224 to 521 bits	112 to 256 bits	Create, Read, Use
RSA key wrapping	Key pair	2048 to 15360 bits	112 to 256 bits	Create, Read, Use

Note:

- Diffie-Hellman (key agreement; key establishment methodology provides between 112 and 256 bits of encryption strength (public key between 2048 and 15360 bits, private key between 224 and 512 bits); non-compliant less than 112-bits of encryption strength (public key less than 2048 bits, private key less than 224 bits)).
- EC Diffie-Hellman (key agreement; key establishment methodology provides between 112 and 256 bits of encryption strength; non-compliant less than 112-bits of encryption strength).
- ECMQV (key agreement; key establishment methodology provides between 112 and 256 bits of encryption strength; non-compliant less than 112-bits of encryption strength).
- RSA (key wrapping; key establishment methodology provides between 112 and 256 bits of encryption strength; non-compliant less than 112-bits of encryption strength).
- Digital signature generation that provides less than 112 bits of security (using RSA, DSA or ECDSA) is disallowed beginning January 1st, 2014.
- Digital signature generation using SHA-1 as its underlying hash function is disallowed beginning January 1st, 2014.
- HMAC-SHA-1 shall have a key size of at least 112 bits.
- In FIPS approved mode only the curves P-224, P-256, P-384, P-521, K-233, K-283, K-409, K-571, B-233, B-283, B-409 and B-571 can be used.

- The BlackBerry Cryptographic Java Module supports the elliptic curves K-163, B-163, P-192, secp160r1, sect239k1 and wTLS5 that are not FIPS approved. They can be used with the ECDSA, ECDH, ECMQV and ECIES algorithms, but not in FIPS approved mode.
- The operator shall use an Approved DRBG internal to the module to generate the IV when using AES GCM

3.3 Operator authentication

The BlackBerry Cryptographic Java Module does not deploy an authentication mechanism. The operator implicitly selects the Crypto Officer and User roles.

4 Finite State Model

The Finite State Model contains the following states:

- Installed/Uninitialized
- Initialized
- Self-Test
- Idle
- Crypto Officer/User
- Error

The following list provides the important features of the state transitions:

1. When the Crypto Officer installs the module, the module is in the Installed/Uninitialized state.
2. When the initialization command is applied to the module, the module is loaded into memory and transitions to the Initialized state. Then, the module transitions to the Self-Test state and automatically runs the power-up tests. While in the Self-Test state, all data output through the data output interface is prohibited. On success, the module enters the Idle state; on failure, the module enters the Error state and the module is disabled. From the Error state, the Crypto Officer might need to reinstall the module to attempt correction.
3. From the Idle state, which is entered only if the self-test has succeeded, the module can transition to the Crypto Officer/User state when an API function is called.
4. When the API function has completed successfully, the state transitions back to the Idle state.
5. If the conditional test (continuous RNG test or Pair-wise consistency Test) fails, the state transitions to the Error state and the module is disabled.
6. When the on-demand self-test is executed, the module enters the Self-Test state. On success, the module enters the Idle state; on failure, the module enters the Error state and the module is disabled.
7. When the de-initialization command is executed, the module returns to the Installed/Uninitialized state.

5 Physical security

The BlackBerry device that executes this module is manufactured using industry standard integrated circuits and meets the FIPS 140-2 Level 1 physical security requirements.

6 Operational environment

The BlackBerry Cryptographic Java Module runs on a single-user operational environment where each user application runs in a virtually separated, independent space.

Note: Android provides such an operational environment.

7 Cryptographic key management

The BlackBerry Cryptographic Java Module provides the underlying functions to support FIPS 140-2 Level 1 key management. The user will select FIPS Approved algorithms and will handle keys with appropriate care to build up a system that complies with FIPS 140-2. The Crypto Officer and User are responsible for selecting FIPS 140-2 validated algorithms. For more information, see Table 4.

7.1 Key generation

The BlackBerry Cryptographic Java Module provides FIPS 140-2 compliant key generation. The underlying random number generation uses a FIPS Approved method, DRBG.

The module also supports Dual_EC DRBG; however, the use of Dual_EC DRBG is non-approved for key generation. No keys generated using this version of the DRBG can be used to protect sensitive data in the Approved mode. Any random output in Approved mode using the DUAL_EC DRBG is equivalent to plaintext.

7.2 Key establishment

The BlackBerry Cryptographic Java Module provides the following FIPS Approved or Allowed key establishment techniques [5]:

- Diffie Hellman (DH): The DH key agreement technique implementation supports modulus sizes from 512 bits to 15360 bits that provides between 56 and 256 bits of security strength, where 2048 bits and above must be used to provide a minimum of 112 bits of security in the FIPS mode.
- EC Diffie-Hellman (ECDH) & ECMQV : The ECDH and ECMQV key agreement technique implementations support elliptic curve sizes from 160 bits to 571 bits that provide between 80 and 256 bits of security strength, where 224 bits and above must be used to provide a minimum of 112 bits of security in the FIPS mode.
- RSA OAEP: The RSA OAEP key wrapping implementation supports modulus sizes from 512 bits to 15360 bits that provides between 56 and 256 bits of security, where 2048 bits and above must be used to provide minimum of 112 bits of security in the FIPS mode.

It is the responsibility of the calling application to make sure that the appropriate key establishment techniques are applied to the appropriate keys.

7.3 Key entry and output

Secret (security sensitive) keys must be imported to and exported from the cryptographic boundary in encrypted form using a FIPS Approved algorithm.

7.4 Key storage

The BlackBerry Cryptographic Java Module is a low-level cryptographic toolkit; therefore, it does not provide key storage.

7.5 Key zeroization

The BlackBerry Cryptographic Java Module provides zeroizable interfaces which implement zeroization methods. Zeroization of all keys and CSPs are performed in the finalizing methods of the objects; JVM executes the finalizing methods every time it operates garbage collection.

8 Self-tests

8.1 Power-up tests

Self-tests are initiated automatically by the module at start-up. The following tests are applied.

Table 6. Module self-tests

Test	Description
Known Answer Tests (KATs)	KATs are performed on Triple-DES encrypt, Triple-DES decrypt, AES encrypt, and AES decrypt, AES GCM, SHS (using HMAC-SHS), HMAC-SHS, DRBG Hash, DRBG HMAC, DRBG counter, RNG, RSA sign and RSA verify, and KDF. For DSA and ECDSA, a Pair-wise Consistency Test is used. For DH, ECDH, ECMQV, the underlying arithmetic implementations are tested using DSA and ECDSA tests.
Software integrity test	The software integrity test deploys ECDSA signature validation to verify the integrity of the module.
DRBG Health tests	DRBG Instantiate, DRBG Generate, DRBG Reseed, DRBG Un-instantiate

8.2 On-demand self-tests

The Crypto Officer or User can invoke on-demand self-tests by invoking a function, which is described in *Appendix C Crypto Officer and User Guide* in this document.

8.3 Conditional tests

The continuous RNG test is executed on all RNG generated data, examining the first 160 bits of each requested random generator for repetition. This examination makes sure that the RNG is not stuck at any constant value. In addition, upon each generation of a DSA, ECDSA, or RSA key pair, the generated key pair is tested for its correctness by generating a signature and verifying the signature on a given message as a Pair-wise Consistency Test. Upon generation or reception of a DH, ECDH, or ECMQV key pair, the key pair is tested of their correctness by checking shared secret matching of two key agreement parties as a Pair-wise Consistency Test.

8.4 Failure of self-tests

Self-test failure places the cryptographic module in the Error state, wherein no cryptographic operations can be performed. The module is disabled. Additionally, the cryptographic module will throw a Java exception to the caller.

9 Design assurance

9.1 Configuration management

A configuration management system for the cryptographic module is employed and has been described in documentation submitted to the testing laboratory. The module uses Subversion (SVN) to track the configurations.

9.2 Delivery and operation

Please refer to Section A.1 of Crypto Officer And User Guide in Appendix A to review the steps necessary for the secure installation and initialization of the cryptographic module.

9.3 Development

Detailed design information and procedures have been described in documentation that was submitted to the testing laboratory. The source code is fully annotated with comments, and it was also submitted to the testing laboratory.

9.4 Guidance documents

The *Crypto Officer Guide and User Guide* outlines the operations for the Crypto Officer and User to ensure the security of the module.

10 Mitigation of other attacks

The BlackBerry Cryptographic Java Module implements mitigation of the following attacks:

- Timing attack on RSA
- Attack on biased private key of DSA

10.1 Timing attack on RSA

When employing Montgomery computations, timing effects allow an attacker to tell when the base of exponentiation is near the secret modulus. This attack leaks information concerning the secret modulus.

In order to mitigate this attack, the bases of exponentiation are randomized by a novel technique that requires no inversion to remove (unlike other blinding methods, for example, see *BSAFE Crypto-C User Manual v4.2*).

Note: Remote timing attacks are practical. For more information, see *Remote Timing Attacks are Practical* [9].

10.2 Attack on biased private key of DSA

The standards for choosing ephemeral values in El-Gamal type signatures introduce a slight bias. Daniel Bleichenbacher presented the means to exploit these biases to ANSI.

In order to mitigate this attack, this bias in RNG is reduced to levels that are far below the Bleichenbacher attack threshold.

To mitigate this attack, NIST published Change Notice 1 of FIPS 186-2.

Appendix A Acronyms

Introduction

This appendix lists the acronyms used in this document.

Acronyms

Acronym	Full term
AES	Advanced Encryption Standard
ANSI	American National Standards Institute
ARC	Alleged Rivest's Cipher
CBC	cipher block chaining
CCM	Counter with CBC-MAC
CFB	cipher feedback
CMAC	Cipher-based MAC
CSP	critical security parameter
CTR	counter
CVS	Concurrent Versioning System
DES	Data Encryption Standard
DH	Diffie-Hellman
DRBG	deterministic random bit generator
DSA	Digital Signature Algorithm
EC	Elliptic Curve
ECB	electronic codebook
ECC	Elliptic Curve Cryptography
ECDH	Elliptic Curve Diffie-Hellman
ECDSA	Elliptic Curve Digital Signature Algorithm

Acronym	Full term
ECIES	Elliptic Curve Integrated Encryption Standard
ECMQV	Elliptic Curve Menezes-Qu-Vanstone
ECNR	Elliptic Curve Nyburg Rueppel
ECQV	Elliptic Curve Qu-Vanstone
FIPS	Federal Information Processing Standards
GCM	Galois/Counter Mode
HMAC	Hash-based Message Authentication code
IEEE	Institute of Electrical and Electronics Engineers
KAT	known answer test
LCD	liquid crystal display
LED	light-emitting diode
MD	Message Digest Algorithm
NIST	National Institute of Standards and Technology
OAEP	Optimal Asymmetric Encryption Padding
OFB	output feedback
PIM	personal information management
PIN	personal identification number
PKCS	Public-Key Cryptography Standard
PSS	Probabilistic Signature Scheme
pRNG	pseudorandom number generator
RFC	Recursive Flow Classification
RNG	random number generator
RSA	Rivest Shamir Adleman
SHA	Secure Hash Algorithm
SHS	Secure Hash Service

Acronym	Full term
SMS	Short Message Service
SVN	Subversion
TRIPLE-DES	Triple Data Encryption Standard
USB	Universal Serial Bus

Appendix B References

Introduction

This appendix lists the references that were used for this project.

References

1. *NIST Security Requirements For Cryptographic Modules, FIPS PUB 140-2, December 3, 2002*
2. *NIST Security Requirements For Cryptographic Modules, Annex A: Approved Security Functions for FIPS PUB 140-2, Draft, July 26, 2011*
3. *NIST Security Requirements For Cryptographic Modules, Annex B: Approved Protection Profiles for FIPS PUB 140-2, Draft, August 12, 2011*
4. *NIST Security Requirements For Cryptographic Modules, Annex C: Approved Random Number Generators for FIPS PUB 140-2, Draft, July 26, 2011.*
5. *NIST Security Requirements For Cryptographic Modules, Annex D: Approved Key Establishment Techniques for FIPS PUB 140-2, Draft, July 26, 2011.*
6. *NIST Security Requirements For Cryptographic Modules Derived Test Requirements for FIPS PUB 140-2, Draft, January 4, 2011.*
7. *NIST Implementation Guidance for FIPS PUB 140-2 and the Cryptographic Module Validation Program, July 15, 2011.*
8. *NIST Frequently Asked Questions for the Cryptographic Module Validation Program, December 4, 2007.*
9. David Brumley, Dan Boneh, “Remote Timing Attacks are Practical”*, Stanford University* http://crypto.stanford.edu/~dabo/papers/ssl-timing.pdf

Appendix C Crypto Office and User Guide

C.1 Installation

In order to carry out a secure installation of the BlackBerry Cryptographic Java Module, the Crypto Officer must follow the procedure described in this section.

C.1.1 Installing the cryptographic module

The Crypto Officer is responsible for the installation of the BlackBerry Cryptographic Java Module. Only the Crypto Officer is allowed to install the product.

Note: Place the cryptographic module, EccpressoFIPS.jar in CLASSPATH or as in installed extension.

C.1.2 Uninstalling the cryptographic module

Remove the jar file, EccpressoFIPS.jar, from the computer hardware.

C.2 Commands

C.2.1 Initialization

FIPSManage.getInstance().activateFIPSMode()
This method runs a series of Self-Tests on the module. These tests examine the integrity of the shared object, and the correct operation of the cryptographic algorithms. If these tests are successful, the module will be enabled.

The Self-Tests are automatically run whenever a CryptoTransform or DRBG object is created. Therefore, there is no need to invoke this method to initialize the module explicitly.

If the module has been de-initialized by a previous call to *FIPSManage.getInstance().deactivateFIPSMode()*, it can be re-initialized by calling this method.

C.2.2 Deinitialization

FIPSManage.getInstance().deactivateFIPSMode()
This method de-initializes the module.

C.2.3 Self-tests

FIPSManage.getInstance().runSelfTests()
This method runs a series of Self-Tests, and returns if the tests are successful, otherwise, and exception is thrown. These tests examine the integrity of the shared object, and the correct operation of the cryptographic algorithms. If these tests fail, the module will be disabled. Section C.3 of this document describes how to recover from the disabled state.

C.2.4 Show Status

Status can be found by calling FIPSManager.getInstance().isFIPSMode() and FIPSManager.getInstance().requestCryptoOperation(). If both methods return true, the module is in the Idle state.

C.3 When the cryptographic module is disabled

When BlackBerry Cryptographic Java Module becomes disabled, attempt to bring the module back to the Installed state by calling the deinitialization method, and then to initialize the module using the initialization method. If the initialization is successful, the module is recovered. If this attempt fails, uninstall the module and re-install it. If the module is initialized successfully by this re-installation, the recovery is successful. If this recovery attempt fails, it indicates a fatal error. Contact BlackBerry Support immediately.

C.1.2 FIPS Mode

In order to operate in FIPS 140-2 mode, it is the user’s responsibility to use FIPS Approved algorithms, as marked in Table 4.

Document and contact information

Version	Date	Author	Reason for revision
1.0	January 06, 2012	Randy Eyamie	Document creation
1.1	June 1, 2012	Randy Eyamie	Updates based on Lab Comments
1.2	June 14, 2012	Randy Eyamie	Added reference to version 2.8.7
1.3	May 29, 2015	Randy Eyamie	Added reference to version 2.8.8
1.4	July 29, 2015	Randy Eyamie	Updates based on Lab Comments
1.5	November 12, 2015	Randy Eyamie	Updates based on Lab Comments
1.6	November 25, 2015	Randy Eyamie	Updates based on Lab Comments
1.7	December 16, 2015	Randy Eyamie	Updates based on Lab Comments
1.8	January 11, 2016	Randy Eyamie	Updates required for NIST SP 800-131A transitions
1.9	June 13, 2016	Randy Eyamie	Addition of version 2.9
1.10	June 14, 2016	Randy Eyamie	Updates based on Lab Comments
1.11	September 1, 2016	Randy Eyamie	Updates based on Lab Comments
1.12	September 1, 2016	Randy Eyamie	Updates based on Lab Comments
1.13	October 4, 2016	Randy Eyamie	Updates based on Lab Comments
1.14	October 5, 2016	Randy Eyamie	Update to Table 4
1.15	February 21, 2017	Randy Eyamie	Added Android Platforms
1.16	June 20, 2017	Randy Eyamie	Removed references to previous versions
1.17	July 14, 2017	Lyndon Levett	Updates based on Lab Comments
1.18	July 25, 2017	Lyndon Levett	Updates based on Lab Comments

Contact	**Corporate office**
Security Certifications Team certifications@blackberry.com (519) 888-7465 ext. 72921	BlackBerry B 2200 University Ave. E Waterloo, ON, Canada N2K 0A7 www.blackberry.com