Deloitte LLP
Bay Adelaide Centre, East Tower
22 Adelaide Street West
Suite 200
Toronto, ON M5H 0A9
Canada

Tel: +1 416 601 6150
Fax: +1 416 601 6400
www.deloitte.ca

INDEPENDENT ASSURANCE REPORT

To the management of Entrust Ltd. doing business as AffirmTrust ("AffirmTrust"):

Scope

We have been engaged, in a reasonable assurance engagement, to report on AffirmTrust management's assertion that for its Certification Authority (CA) operations in Ottawa, Ontario, Canada and Toronto, Ontario, Canada throughout the period 1 March 2018 to 28 February 2019 (the "Period") for its CAs as enumerated in Attachment A, AffirmTrust has:

- disclosed its SSL certificate lifecycle management business practices in its Certification Practice Statements as enumerated on Attachment B, including its commitment to provide SSL certificates in conformity with the CA/Browser Forum Requirements on the AffirmTrust website, and provided such services in accordance with its disclosed practices

- maintained effective controls to provide reasonable assurance that:
  - the integrity of keys and SSL certificates it manages is established and protected throughout their lifecycles; and
  - SSL subscriber information is properly authenticated (for the registration activities performed by AffirmTrust)

- maintained effective controls to provide reasonable assurance that:
  - logical and physical access to CA systems and data is restricted to authorized individuals;
  - the continuity of key and certificate management operations is maintained; and
  - CA systems development, maintenance, and operations are properly authorized and performed to maintain CA systems integrity

- maintained effective controls to provide reasonable assurance that it meets the Network and Certificate System Security Requirements as set forth by the CA/Browser Forum

in accordance with the WebTrust Principles and Criteria for Certification Authorities – SSL Baseline with Network Security v2.3.

The information included in Attachment C, '*Other information provided by the CA'* is presented by the management of AffirmTrust to provide additional information to users of this report. This information has not been subjected to our procedures, and, accordingly, we express no opinion on it.

Certification authority's responsibilities

AffirmTrust's management is responsible for its assertion, including the fairness of its presentation, and the provision of its described services in accordance with the WebTrust Principles and Criteria for Certification Authorities – SSL Baseline with Network Security v2.3.

Our independence and quality control

We have complied with the relevant rules of professional conduct / code of ethics applicable to the practice of public accounting and related to assurance engagements, issued by various professional accounting bodies, which are founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behaviour.

The firm applies Canadian Standard on Quality Control 1, and accordingly maintains a comprehensive system of quality control including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

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Auditor's responsibilities

Our responsibility is to express an opinion on management's assertion based on our procedures. We conducted our procedures in accordance with Canadian Standard on Assurance Engagements 3000, *Attestation Engagements Other than Audits or Reviews of Historical Financial Information,* set out in the CPA Canada Handbook – Assurance. This standard requires that we plan and perform our procedures to obtain reasonable assurance about whether, in all material respects, management's assertion is fairly stated, and, accordingly, included:

(1) obtaining an understanding of AffirmTrust's SSL certificate lifecycle management business practices, including its relevant controls over the issuance, renewal, and revocation of SSL certificates, and obtaining an understanding of AffirmTrust's network and certificate system security to meet the requirements set forth by the CA/Browser Forum;
(2) selectively testing transactions executed in accordance with disclosed SSL certificate lifecycle management practices;
(3) testing and evaluating the operating effectiveness of the controls; and
(4) performing such other procedures as we considered necessary in the circumstances.

We believe that the evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Relative effectiveness of controls

The relative effectiveness and significance of specific controls at AffirmTrust and their effect on assessments of control risk for subscribers and relying parties are dependent on their interaction with the controls, and other factors present at individual subscriber and relying party locations. We have performed no procedures to evaluate the effectiveness of controls at individual subscriber and relying party locations.

Inherent limitations

Because of the nature and inherent limitations of controls, AffirmTrust's ability to meet the aforementioned criteria may be affected. For example, controls may not prevent, or detect and correct, error, fraud, unauthorised access to systems and information, or failure to comply with internal and external policies or requirements. Also, the projection of any conclusions based on our findings to future periods is subject to the risk that changes may alter the validity of such conclusions.

Other matters

Without modifying our opinion, we noted the following other matters during our procedures:

	Matter topic	Matter description
1	**Serial numbers contain only 63 bits of entropy**	In February 2019, it was discovered that an open-source CA software used by some of the in-scope CAs had a bug where only 63 bits of entropy was used to generate certificate serial numbers despite the configuration specifying to use 64 bits. This impacted 7 Intermediate CA certificates and 1 end-entity certificate. 4 of the Intermediate CA certificates and 1 end-entity certificate were revoked as of 22 March 2019. 3 of the Intermediate CA certificates could not be revoked as they are in active production use. 6 of the Intermediate CA certificates were re-signed with serial numbers containing 127 bits of entropy on 21 March 2019.

Basis for qualified opinion

During our procedures, we noted the following which caused a qualification of our opinion:

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	Observation	Relevant WebTrust Criteria

1	During the Period, there were instances where upon the discovery of a Critical Vulnerability any of the following did not occur within 96 hours:
	
	• Remediation of the vulnerability;
	• Creation and implementation of a plan to mitigate the vulnerability; or
	• Documentation of the factual basis for AffirmTrust's determination that the vulnerability does not require remediation.
	
	This caused WebTrust Principles and Criteria for Certification Authorities – SSL Baseline with Network Security v2.2, Principle 4, Criterion 4.6 to not be met.
	
	This observation was remediated as of 30 June 2018.
		P4, 4.6: The CA maintains controls to provide reasonable assurance that it performs one of the following within 96 hours of discovery of a Critical Vulnerability not previously addressed by the CA's vulnerability correction process:
		
		• Remediate the Critical Vulnerability;
		• If remediation of the Critical Vulnerability within 96 hours is not possible, create and implement a plan to mitigate the Critical Vulnerability, giving priority to the following:
		  ○ Vulnerabilities with high CVSS scores, starting with the vulnerabilities the CA determines are the most critical (such as those with a CVSS score of 10.0); and
		  ○ Systems that lack sufficient compensating controls that, if the vulnerability were left unmitigated, would allow external system control, code execution, privilege escalation, or system compromise; OR
		• Document the factual basis for the CA's determination that the vulnerability does not require remediation because of one of the following:
		  ○ The CA disagrees with the NVD rating;
		  ○ The identification is a false positive;
		  ○ The exploit of the vulnerability is prevented by compensating controls or an absence of threats; or
		  ○ Other similar reasons.

2	During the Period, there were instances of some Certificate Systems not undergoing a Vulnerability Scan at least every three (3) months. This caused WebTrust Principles and Criteria for Certification Authorities – SSL Baseline with Network Security v2.3, Principle 4, Criterion 4.3 to not be met.	**P4, 4.3:** The CA maintains controls to provide reasonable assurance that a Vulnerability Scan is performed on public and private IP addresses identified by the CA or Delegated Third Party as the CA's or Delegated Third Party's Certificate Systems based on the following: • Within one (1) week of receiving a request from the CA/Browser Forum; • After any system or network changes that the CA determines are significant; • and • At least every three (3) months
3	During the Period, there were instances where a technical control to restrict remote access to only those devices owned or	**P4, 2.15:** The CA maintains controls to provide reasonable assurance that it restricts remote administration or access to an Issuing System, Certificate Management

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Observation	Relevant WebTrust Criteria

controlled by AffirmTrust did not operate effectively.
 	
This caused WebTrust Principles and Criteria for Certification Authorities – SSL Baseline with Network Security v2.3, Principle 4, Criterion 2.15 to not be met.
	System, or Security Support System except when:
	
	• The remote connection originates from a device owned or controlled by the CA or Delegated Third Party;
	• The remote connection is through a temporary, non-persistent encrypted channel that is supported by multifactor authentication; and
	• The remote connection is made to a designated intermediary device meeting the following:
	
	  • Located within the CA's network;
	  • Secured in accordance with the Network and Certificate System Security Requirements; and
	  • Mediates the remote connection to the Issuing System.

Qualified opinion

In our opinion, except for the matters described in the preceding section entitled 'Basis for qualified opinion', throughout the period 1 March 2018 to 28 February 2019, AffirmTrust management's assertion, as referred to above, is fairly stated, in all material respects, in accordance with the WebTrust Principles and Criteria for Certification Authorities – SSL Baseline with Network Security v2.3.

This report does not include any representation as to the quality of AffirmTrust's services beyond those covered by the WebTrust Principles and Criteria for Certification Authorities – SSL Baseline with Network Security v2.3, nor the suitability of any of AffirmTrust's services for any customer's intended purpose.

Deloitte LLP

Deloitte LLP
Chartered Professional Accountants
Toronto, Ontario, Canada
24 May 2019

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ATTACHMENT A

LIST OF IN SCOPE CAs

Root CAs
1. AffirmTrust Commercial 2. AffirmTrust Networking 3. AffirmTrust Premium 4. AffirmTrust Premium ECC
DV SSL Issuing CAs
5. AffirmTrust Certificate Authority - DV1
OV SSL Issuing CAs
6. AffirmTrust Certificate Authority - OV1
EV SSL Issuing CAs
7. AffirmTrust Extended Validation CA - EV1 8. AffirmTrust Extended Validation CA - EV2 9. AffirmTrust Extended Validation CA - EV3 10. AffirmTrust Extended Validation CA - EVEC1

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CA IDENTIFYING INFORMATION

CA #	Cert #	Subject	Issuer	Serial Number	Key Type	Hash Type	Not Before	Not After	Extended Key Usage	Subject Key Identifier	SHA256 Fingerprint
1	1	CN=AffirmTrust Commercial O=AffirmTrust C=US	CN=AffirmTrust Commercial O=AffirmTrust C=US	7777062726a9b17c	RSA 2048-bits	RSA SHA-256	2010-01-29 14:06:06 UTC	2030-12-31 14:06:06 UTC		9d93c6538b5ecaaf3f9f1e0fe59995bc24f6948f	0376ab1d54c5f9803ce4b2e201a0ee7eef7b57b636e8a93c9b8d4860c96f5fa7
2	1	CN=AffirmTrust Networking O=AffirmTrust C=US	CN=AffirmTrust Networking O=AffirmTrust C=US	7c4f04391cd4992d	RSA 2048-bits	RSA SHA-1	2010-01-29 14:08:24 UTC	2030-12-31 14:08:24 UTC		071fd2e79cdac26ea240b4b07a50105074c4c8bd	0a81ec5a929777f145904af38d5d509f66b5e2c58fcdb531058b0e17f3f0b41b
3	1	CN=AffirmTrust Premium O=AffirmTrust C=US	CN=AffirmTrust Premium O=AffirmTrust C=US	6d8c1446b1a60aee	RSA 4096-bits	RSA SHA-384	2010-01-29 14:10:36 UTC	2040-12-31 14:10:36 UTC		9dc067a60c22d926f545aba665521127d845ac63	70a73f7f376b60074248904534b11482d5bf0e698ecc498df52577ebf2e93b9a
4	1	CN=AffirmTrust Premium ECC O=AffirmTrust C=US	CN=AffirmTrust Premium ECC O=AffirmTrust C=US	7497258ac73f7a54	EC 384-bits	ECDSA SHA-384	2010-01-29 14:20:24 UTC	2040-12-31 14:20:24 UTC		9aaf297ac01135352651 3000c36afe40d5aed63c	bd71fdf6da97e4cf62d1647add2581b07d79adf8397eb4ecba9c5e84888214 23
5	1	CN=AffirmTrust Certificate Authority - DV1 OU=See www.affirmtrust.com/repository O=AffirmTrust C=CA	CN=AffirmTrust Commercial O=AffirmTrust C=US	2c07cff96ce8689a	RSA 2048-bits	RSA SHA-256	2017-01-06 17:55:17 UTC	2030-12-02 04:00:00 UTC	TLS Web Server Authentication, TLS Web Client Authentication	33df7a3e027996ebb60cc063fa75bf9222cd91fa	ed8be0e7f03bb876b42e4aaf437bf03a759885f9cc5bae36ded8a8bd8e14e47f
5	2	CN=AffirmTrust Certificate Authority - DV1 OU=See www.affirmtrust.com/repository O=AffirmTrust C=CA	CN=AffirmTrust Commercial O=AffirmTrust C=US	580e00b14e86ce35	RSA 2048-bits	RSA SHA-256	2017-04-07 15:10:56 UTC	2030-12-02 04:00:00 UTC	TLS Web Server Authentication, TLS Web Client Authentication	33df7a3e027996ebb60cc063fa75bf9222cd91fa	ca4389c89ddfc31bec26c74b44a8498c58b2d838516fa01b14f1393629e58a40
6	1	CN=AffirmTrust Certificate Authority - OV1 OU=See www.affirmtrust.com/repository O=AffirmTrust C=CA	CN=AffirmTrust Commercial O=AffirmTrust C=US	0caaf8102e1d992e	RSA 2048-bits	RSA SHA-256	2016-11-28 21:25:58 UTC	2030-12-02 04:00:00 UTC	TLS Web Server Authentication, TLS Web Client Authentication	fe60c30da4a29d214f7a784c62c5db14fc3978c4	7026ccd913001646e6adad954fae435e1369b6567532a0bd94449ed2df088b63
6	2	CN=AffirmTrust Certificate Authority - OV1 OU=See www.affirmtrust.com/repository O=AffirmTrust C=CA	CN=AffirmTrust Commercial O=AffirmTrust C=US	187e7f3bf66f23cd	RSA 2048-bits	RSA SHA-256	2016-11-29 16:49:28 UTC	2030-12-02 04:00:00 UTC	TLS Web Server Authentication, TLS Web Client Authentication	fe60c30da4a29d214f7a784c62c5db14fc3978c4	ea4ee2faa57ae4b539b63977fe5bb205b6afb32f7a73b2b363e4be02cd8a91e9
7	1	CN=AffirmTrust Extended Validation CA - EV1 OU=See www.affirmtrust.com/repository O=AffirmTrust C=CA	CN=AffirmTrust Commercial O=AffirmTrust C=US	0bcc5321d219ce0c	RSA 2048-bits	RSA SHA-256	2016-11-28 21:17:29 UTC	2030-12-02 04:00:00 UTC	TLS Web Server Authentication, TLS Web Client Authentication	dbef65370be547cb35d1901f03c1bc88c7a7ea80	1e4ad482c8f9b6157bd8aeac27e5a0f02b06a2cb373dfae889fe798bf523f3ec
7	2	CN=AffirmTrust Extended Validation CA - EV1 OU=See www.affirmtrust.com/repository O=AffirmTrust C=CA	CN=AffirmTrust Commercial O=AffirmTrust C=US	40f0bbaa8ae0c098	RSA 2048-bits	RSA SHA-256	2016-11-29 16:42:17 UTC	2030-12-02 04:00:00 UTC	TLS Web Server Authentication, TLS Web Client Authentication	dbef65370be547cb35d1901f03c1bc88c7a7ea80	cf88915cf996932c2b4cbe3039076d119bb728b4f31e49b63a5022fe65489a12
8	1	CN=AffirmTrust Extended Validation CA - EV2 OU=See www.affirmtrust.com/repository O=AffirmTrust C=CA	CN=AffirmTrust Premium O=AffirmTrust C=US	72c3c67f9b2c457b	RSA 2048-bits	RSA SHA-256	2017-05-30 20:15:21 UTC	2030-12-02 04:00:00 UTC	TLS Web Server Authentication, TLS Web Client Authentication	737c9a38683c517c4108fea11f2a1eb461dbcd3c	a9ebcfba0299a10436c4c41a2bd75933cb2c7960cf780267ecbe3d5229c19c76
9	1	CN=AffirmTrust Extended Validation CA - EV3 OU=See www.affirmtrust.com/repository O=AffirmTrust C=CA	CN=AffirmTrust Networking O=AffirmTrust C=US	532092e1e00a15b5	RSA 2048-bits	RSA SHA-256	2017-05-30 20:29:49 UTC	2030-12-02 04:00:00 UTC	TLS Web Server Authentication, TLS Web Client Authentication	791eb1c917c71eacb1c714d7c3e87fbcb9509b15	6b63ec3becdecf9f9127235c0995f578d66f77b14d1c7f0fdc2dc060f3c78dd6
10	1	CN=AffirmTrust Extended Validation CA - EVEC1 OU=See www.affirmtrust.com/repository O=AffirmTrust C=CA	CN=AffirmTrust Premium ECC O=AffirmTrust C=US	0ad0428f14541475	EC 384-bits	ECDSA SHA-384	2017-05-30 20:40:17 UTC	2030-12-02 04:00:00 UTC	TLS Web Server Authentication, TLS Web Client Authentication	c6908c0283d75de3be3b9c2ed5657d2a1060eee5	59518fc1ef1c337ef34f601e30e623df4d07d3a7b6e402bca2be6e027385c7b8

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ATTACHMENT B

LIST OF AFFIRMTRUST CERTIFICATION PRACTICE STATEMENTS

CPS Name	Version	Date
AffirmTrust Certification Practice Statement	3.2	08-Dec-2017
AffirmTrust Certification Practice Statement	3.3	31-May-2018
AffirmTrust Certification Practice Statement	3.4	10-Sep-2018
AffirmTrust Certification Practice Statement	3.5	12-Oct-2018

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ATTACHMENT C

Other information provided by the CA

The information included herein is presented by the management of AffirmTrust to provide additional information to users of this report. This information has not been subjected to the procedures of this engagement, and, accordingly, Deloitte LLP express no opinion on it.

Comments on other matters

	Matter topic	Additional AffirmTrust comments
1	**Serial numbers contain only 63 bits of entropy**	Problem has been addressed and disclosed per https://bugzilla.mozilla.org/show_bug.cgi?id=1536287.

Comments on qualified opinion

	Observation
1	During the Period, there were instances where upon the discovery of a Critical Vulnerability any of the following did not occur within 96 hours: • Remediation of the vulnerability; • Creation and implementation of a plan to mitigate the vulnerability; or • Documentation of the factual basis for AffirmTrust's determination that the vulnerability does not require remediation. This caused WebTrust Principles and Criteria for Certification Authorities – SSL Baseline with Network Security v2.2, Principle 4, Criterion 4.6 to not be met. This observation was remediated as of 30 June 2018.
2	During the Period, there were instances of some Certificate Systems not undergoing a Vulnerability Scan at least every three (3) months. This caused WebTrust Principles and Criteria for Certification Authorities – SSL Baseline with Network Security v2.3, Principle 4, Criterion 4.3 to not be met.
3	During the Period, there were instances where a technical control to restrict remote access to only those devices owned or controlled by AffirmTrust did not operate effectively. This caused WebTrust Principles and Criteria for Certification Authorities – SSL Baseline with Network Security v2.3, Principle 4, Criterion 2.15 to not be met.

AFFIRMTRUST MANAGEMENT'S ASSERTION

Entrust Ltd. doing business as AffirmTrust ("AffirmTrust") operates the Certification Authority (CA) services as enumerated in Attachment A, and provides SSL CA services.

The management of AffirmTrust is responsible for establishing and maintaining effective controls over its SSL CA operations, including its network and certificate system controls, its SSL CA business practices disclosure on its website, SSL key lifecycle management controls, and SSL certificate lifecycle management controls. These controls contain monitoring mechanisms, and actions are taken to correct deficiencies identified.

There are inherent limitations in any controls, including the possibility of human error, and the circumvention or overriding of controls. Accordingly, even effective controls can only provide reasonable assurance with respect to AffirmTrust's Certification Authority operations. Furthermore, because of changes in conditions, the effectiveness of controls may vary over time.

AffirmTrust management has assessed its disclosures of its certificate practices and controls over its CA services. Based on that assessment, in AffirmTrust management's opinion, in providing its SSL and non-SSL Certification Authority (CA) services at Ottawa, Ontario, and Toronto, Ontario, throughout the period 1 March 2018 to 28 February 2019, AffirmTrust has:

- disclosed its SSL certificate lifecycle management business practices in its Certification Practice Statements as enumerated on Attachment B, including its commitment to provide SSL certificates in conformity with the CA/Browser Forum Requirements on the AffirmTrust website, and provided such services in accordance with its disclosed practices

- maintained effective controls to provide reasonable assurance that:
    - the integrity of keys and SSL certificates it manages is established and protected throughout their lifecycles; and
    - SSL subscriber information is properly authenticated (for the registration activities performed by AffirmTrust)

- maintained effective controls to provide reasonable assurance that:
    - logical and physical access to CA systems and data is restricted to authorized individuals;
    - the continuity of key and certificate management operations is maintained; and
    - CA systems development, maintenance, and operations are properly authorized and performed to maintain CA systems integrity

- maintained effective controls to provide reasonable assurance that it meets the Network and Certificate System Security Requirements as set forth by the CA/Browser Forum

in accordance with the WebTrust Principles and Criteria for Certification Authorities – SSL Baseline with Network Security v2.3.

Bruce Morton
CA Operations Manager
24 May 2019

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LIST OF IN SCOPE CAs

Root CAs
1. AffirmTrust Commercial 2. AffirmTrust Networking 3. AffirmTrust Premium 4. AffirmTrust Premium ECC
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5. AffirmTrust Certificate Authority - DV1
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AffirmTrust Certification Practice Statement	3.5	12-Oct-2018