

Summary report of e-MRTD InterFest Testing Session 4

Date : 3 February 2005
Venue : Paya Lebar Kovan Community Club , Room Hillside
Hougang Street 21

Coordinators: Mr Lin Yih, Digital Applied Research and Technology Pte Ltd
Mr Sunny Ho, NEC Asia Pacific

Companies participated:

ACG (Asia Pacific) Pte Ltd	Mr Vernon Heng
Digital Applied Research and Technology Pte Ltd (Moderator)	Mr Derek Chan Hsien Wei Mr Joseph Ng Hon Keong Ms Loo Foong Ling
Gemplus	Mr Ng Poh Chang
Infineon Technologies Asia Pacific Pte Ltd	Mr Chung Wei-Ho
IRIS Corporation Berhad	Mr Chew Hoong Wei Mr Ryan Koo Boon Chong
Oberthur Card Systems Asia Pacific Pte Ltd	Mr Samnoeuk Khim
PCS Security	Mr David Goh Ms Wendy Soh
Philips Electronics (S) Pte Ltd	Ms Kam Bee Peng
SCM Microsystems	Mr Anthony Yeap
Sharp Electronics (S) Pte Ltd	Mr Vincent Kua Soon Huat

Timeline of activities:

02 Dec 2004	First round of InterFest testing concluded.
10 Dec 2004	Release of standard test application version 1.0.
16 Dec 2004	Second round of InterFest testing concluded.
06 Jan 2005	Release of standard test application version 1.1.
20 Jan 2005	Third round of InterFest testing (BAC) concluded.
01 Feb 2005	Release of standard test application version 1.2.
03 Feb 2005	Fourth round of InterFest testing concluded.

Test Objectives:

1. Basic Access Control (BAC) testing of cards/books with InterFest test application.
 - ❖ Read EF.COM, EF.DG1, EG.DG2 under Secure Messaging.

Special note : IRIS Corporation Berhad used their own application (“ICAO test program”) for testing, as the current InterFest test application only supports PC/SC readers.

2. Investigative tests for issues identified from the four test sessions.

Equipment tested:

Readers

1. ACG ISO14443 Contactless Reader
2. E Passport Reader 100U (IRIS Corp)
3. Sentinel Duo Passport Scanner (PCS Security)
4. SCR331/DI Rev 2.0 (SCM)

Cards/Books/Inlays:

	Type A	Type B
BAC	1. IRIS book (Philips MTCOS)	1. Infineon Inlay 2. Gemplus (Lague Helga) 3. Sharp book
no BAC	1. Philips Eval OS card 2. Oberthur card (Cosmopolie LDS)	1. Gemplus book (Lane Rita) 2. Sharp book 3. IRIS book (ST Micro)

Conduct of Tests:

A moderator follows the card company representative as he goes through the various reader company stations. Tests were performed according to the steps in the checklist.

Although the InterFest does not compare performance, timings were taken for certain tests for investigative purposes.

The moderators were Mr Derek Chan Hsien Wei, Mr Joseph Ng Hon Keong, Ms Loo Foong Ling and Mr Sunny Ho.

At each reader station, the standard InterFest test application was used to test BAC.

Testing is considered successful when the MRZ and photo are successfully retrieved and displayed.

Key Findings:

1. Testing of past issues

Please see attached tables for results of the testing.

Calculations and observations from readings:

- a. Approximate average distance of book to reader before failure = 1.5 cm
- b. Average time taken to read DG1 and DG2 at different baud rates (silver data set with IRIS application, non PC/SC):

	DG1 (no BAC)	DG2 (no BAC)	DG1 (BAC)	DG2 (BAC)
106	0.29s	4.07s	0.38s	8.10s
212	0.28s	3.27s	0.35s	7.07s
424	0.27s	2.88s	0.34s	6.43s

- c. Cards are able to respond to both Le byte values of 0 and 28h, for mutual authentication.

- d. Average time taken to read DG1 and DG2 (all cards with silver data set using InterFest test application):

	DG1 (no BAC)	DG2 (no BAC)	DG1 (BAC)	DG2 (BAC)
Time (secs)	0.17	3.28	0.80	11.30

- e. Average time to read DG1 and DG2 for *Infineon inlay* supporting both BAC and non-BAC (silver data set with InterFest test application):

	DG1 (no BAC)	DG2 (no BAC)	DG1 (BAC)	DG2 (BAC)
Time (secs)	0.81	10.97	1.91	19.43

- DG1 : BAC takes 2.36 times longer.
DG2 : BAC takes 1.77 times longer.

- f. The average timings in the report were based on a very small sample size, so may not be very accurate

- g. In order to be consistent, the timing from those books that were not using the silver data set were not used.

- h. The timings from the InterFest test application were calculated as such:

- i) Time taken to read up to DG1 (time taken from Select AID, EF.COM to EF.DG1 displayed)

- ii) Time taken to read up to DG2 (time taken from Select AID, EF.COM, EF.DG1 to EF.DG2 displayed)

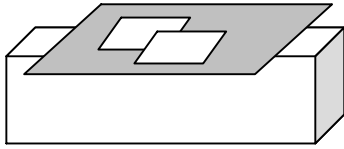
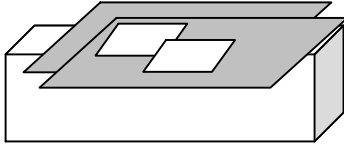
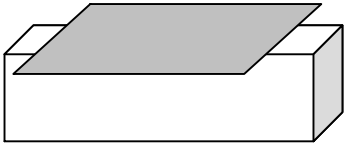
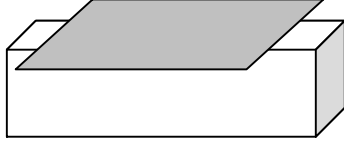
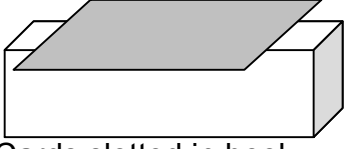
2. MRZ Font

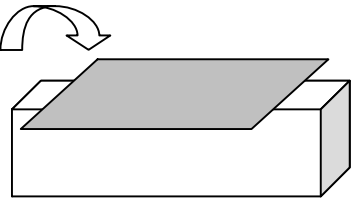
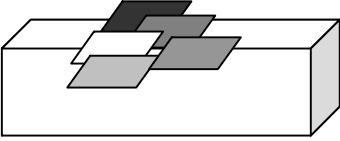
One book failed the test because the MRZ scanner could not successfully read its MRZ. It was found that the font used for the MRZ is not the standard OCR-B font.

3. Anti-collision




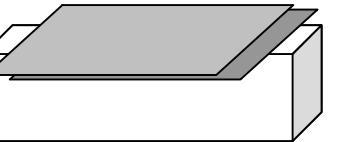
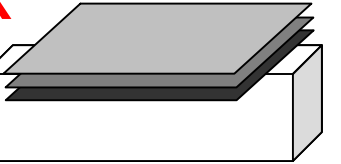
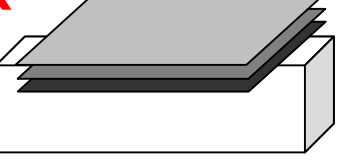
Anti-collision tests were performed using a combination of Type A and Type B cards, with IRIS reader and application.

Type A:

Cards/Books/Inlays	Test position	Findings
1. Philip card (JCOP41) 2. Oberthur card (Cosmopolie) 3. IRIS book (Philips chip, MTCOS O/S)	✓  2 cards over book.	Application is able to detect all three cards/book.
1. Philip card (JCOP41) 2. Oberthur card (Cosmopolie) 3. IRIS book (Philips chip, MTCOS O/S) 4. IRIS book (JCOP41)	✗  2 cards over 2 books.	Application cannot detect the cards. Possible distance factor.
1. Philip card (JCOP41) 2. Oberthur card (Cosmopolie) 3. IRIS book (Philips chip, MTCOS O/S)	✗  Book over 2 cards.	Application cannot detect the cards.
1. Philip card (JCOP41) 2. IRIS book (Philips chip, MTCOS O/S)	✓  Book over card.	Application is able to detect both card and book.
1. Philip card (JCOP41) 2. Oberthur card (Cosmopolie) 3. IRIS book (Philips chip, MTCOS O/S)	✓  Cards slotted in book.	Application is able to detect all three cards/book.

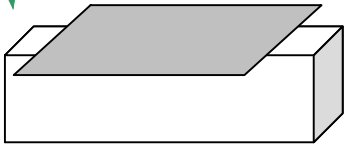
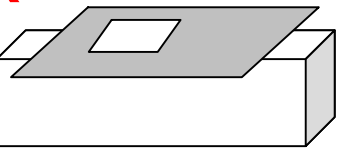
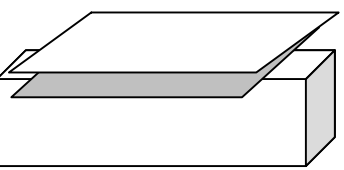

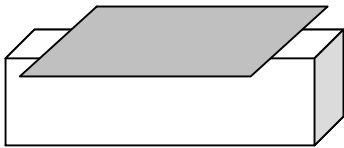
<p>1. Philip card (JCOP41) 2. Oberthur card (Cosmopolie) 3. IRIS book (Philips chip, MTCOS O/S)</p>	<p>✓</p>  <p>Flip over book slotted with cards.</p>	<p>Application is able to detect all three cards/book.</p>
<p>1. Philip card (JCOP41) X 4 2. Oberthur card (Cosmopolie)</p>	<p>✗</p>  <p>5 cards</p>	<p>Application cannot detect all the cards.</p>

Type B:

Cards/Books/Inlays	Test position	Findings
1. Gemplus book (Infineon chip, GemBorder O/S) 2. IRIS book (ST Micro chip)	<p>X</p>  <p>2 books.</p>	<p>Application cannot detect top book.</p> <p>Possible distance or different chip issue.</p>
1. Gemplus book (Infineon chip, GemBorder O/S) 2. Infineon Inlay (Eval O/S)	<p>✓</p>  <p>Inlay over book.</p>	<p>Application is able to detect both book and inlay of same chip but different O/S.</p>
1. Gemplus book (Infineon chip, GemBorder O/S) 2. Infineon Inlay (Eval O/S)	<p>✓</p>  <p>Book over inlay.</p>	<p>Application is able to detect both book and inlay of same chip but different O/S.</p>
1. Infineon inlays (Eval O/S) x 2	<p>✓</p>  <p>2 inlays.</p>	<p>Application is able to detect both books of same chip and O/S.</p>
1. Infineon inlay (Eval O/S) x 2 2. Gemplus book (Infineon chip, GemBorder O/S)	<p>X</p>  <p>2 inlays over book.</p>	<p>Application cannot detect all three inlays/book.</p>
1. Infineon inlay (Eval O/S) x 2 2. Gemplus book (Infineon chip, GemBorder O/S)	<p>X</p>  <p>2 inlays slotted in book.</p>	<p>Application cannot detect all three inlays/book.</p>

Type A and Type B:

It is noted that the application polls for Type A before Type B cards.

Cards/Books/Inlays	Test position	Findings
1. Philips card (Type A, JCOP41) 2. Sharp inlay (Type B)	 <p>Philips card under Sharp inlay.</p>	Application is able to detect both card and inlay.
1. Philips card (Type A, JCOP41) x 2 2. Sharp inlay (Type B)	 <p>Sharp inlay between 2 Philips cards.</p>	Only both Philips cards (Type A) can be detected.
1. Philips card (Type A, JCOP41) x 2 2. Sharp inlay (Type B) 3. Infineon Inlay (Type B, Eval O/S)	 <p>Infineon inlay over Sharp inlay over Philips card.</p>	Philips card (Type A) cannot be detected.
1. Philips card (Type A, JCOP41) x 2 2. Infineon inlay (Type B)	 <p>Infineon inlay over 2 Philips cards.</p>	Application is able to detect all inlay and cards.
1. Philips card (Type A, JCOP41) x 2 2. IRIS book (Type B, ST Micro chip)	 <p>IRIS book over Philips cards.</p>	Only Philips cards (Type A) can be detected.

Issues and observations:

- a. Type B cards can generally only be detected up to two cards in the field.
- b. Readers may have problems detecting different chips within the same field.

- c. When both Type A and Type B cards are in the same field, Type A cards are usually detected over Type B.
- d. Relative size/thickness of books/cards in the same field may pose a problem to readers.

Other Matters:

Certificates of Participation will be issued to all companies involved in the InterFest.

There was a briefing on the Japan Passport Interoperability Testing from March 8 to 10 at Tsukubu, Tokyo, Japan. Companies can refer to <http://www.epassport-test.org> for details of registration.

Singapore will have a booth at the venue as a showcase for the InterFest sessions. All companies involved are invited to participate, or to send their equipment over for testing. Companies should register on their own and inform the Head of Delegation on the details of personnel going.

Conclusion

This session concludes the BAC testing. The investigative test results will be analysed and presented at the Japan Interoperability tests in March.

Prepared by:

Derek Chan Hsien Wei
Engineer
Digital Applied Research and Technology Pte Ltd

	ACG	IRIS	PCS Security (tested without BAC)	SCM
1. Place book/card/inlay on reader and 1,2,3,4,5 cm over reader. Read data.				
On reader	√	√	√	√
1 cm	√	√	√	√
2 cm	√	X	√	√
3 cm	X	X	X (connect ok)	X
4 cm	X	X	X (connect ok)	X
5 cm	X	X	X (connect ok)	X
Max distance before failure	2cm	1cm	2cm	2cm
2. Place book/card/inlay at optimal distance. Orientate at 0/45/90 degrees in both planes. Read data.				
Vertical plane				
45 degrees	√	X	√	√
90 degrees (perpendicular)	X	X	X	X
Horizontal plane				
45 degrees	√	√	√	√
90 degrees (perpendicular)	√	√	√	√
3. (For IRIS only) Place book/card/inlay at optimal distance. Set reader's application to bit rate of 106/212/424/847 kbits/s. Read data.	n.a.		n.a.	n.a.
106				
DG1		0.35		
DG2		8.58		
212				
DG1		0.32		
DG2		7.58		
424				
DG1		0.31		
DG2		6.83		
847				
DG1		-		
DG2		-		
4. Flip over book/card/inlay at optimal distance. Read data.	√	√	√	√
5. Place book/card/inlay at optimal distance. Set test application Le byte value to 00/28h. Read data (BAC)				
0	√	√	n.a.	√
28h	√	√	n.a.	√
6. Place book/card/inlay at optimal distance. Read EF.COM / EF.DG1 / EF.DG2. Record timing. Repeat with/without BAC (if supported)			(non BAC)	
Time taken to read and display up to DG1 (secs)	0.751	0.31	0.187	0.691
Time taken to read and display up to DG2 (secs)	10.395	7.16	2.344	9.123

	ACG	IRIS	PCS Security	SCM
1. Place book/card/inlay on reader and 1,2,3,4,5 cm over reader. Read data.				
On reader	√	√	X (only DG1 ok)	√
1 cm	√	√	X	√
2 cm	√	√	X	√
3 cm	X	X	X	X
4 cm	X	X	X	X
5 cm	X	X	X	X
Max distance before failure	2cm	2cm	-	2cm
2. Place book/card/inlay at optimal distance. Orientate at 0/45/90 degrees in both planes. Read data.				
Vertical plane				
45 degrees	X	√	X	X
90 degrees (perpendicular)	X	X	X	X
Horizontal plane				
45 degrees	√	√	X	√
90 degrees (perpendicular)	√	√	X	√
3. (For IRIS only) Place book/card/inlay at optimal distance. Set reader's application to bit rate of 106/212/424/847 kbits/s. Read data.	n.a.		n.a.	n.a.
106				
DG1 (no BAC)		0.88		
DG2 (no BAC)		7.24		
212				
DG1 (no BAC)		0.88		
DG2 (no BAC)		6.34		
424				
DG1 (no BAC)		0.86		
DG2 (no BAC)		5.94		
DG1 (BAC)		1.17		
DG2 (BAC)		12.73		
847				
DG1 (no BAC)		0.86		
DG2 (no BAC)		5.68		
4. Flip over book/card/inlay at optimal distance. Read data.	√	√	X (only DG1 ok)	√
5. Place book/card/inlay at optimal distance. Set test application Le byte value to 00/28h. Read data (BAC)				
0	√	√	-	√
28h	√	√	-	√
6. Place book/card/inlay at optimal distance. Read EF.COM / EF.DG1 / EF.DG2. Record timing. Repeat with/without BAC (if supported)				
Time taken to read and display up to DG1 (secs) BAC	2.314	1.17	1.328	2.083
Time taken to read and display up to DG2 (secs) BAC	20.74	12.73	-	18.126
Time taken to read and display up to DG1 (secs) no BAC	0.55	-	0.906	0.972
Time taken to read and display up to DG2 (secs) no BAC	11.847	-	-	10.085

	ACG	IRIS	PCS Security	SCM
1. Place book/card/inlay on reader and 1,2,3,4,5 cm over reader. Read data.				
On reader	√	√	√	√
1 cm	√	√	√	√
2 cm	√	X (connect ok)	X (connect ok)	√
3 cm	X (connect ok)	X	X (connect ok)	√
4 cm	X (connect ok)	X	X (connect ok)	X (connect ok)
5 cm	X (connect ok)	X	X	X (connect ok)
Max distance before failure	2cm	2cm	2cm	3cm
2. Place book/card/inlay at optimal distance. Orientate at 0/45/90 degrees in both planes. Read data.				
Vertical plane				
45 degrees	√	X (ok at approx 40degs)	X	√
90 degrees (perpendicular)	X	X	X	X
Horizontal plane				
45 degrees	√	√	√	√
90 degrees (perpendicular)	√	√	√	√
3. (For IRIS only) Place book/card/inlay at optimal distance. Set reader's application to bit rate of 106/212/424/847 kbits/s. Read data.	n.a.		n.a.	n.a.
106				
DG1		0.09		
DG2		2.98		
212				
DG1		0.07		
DG2		2.46		
424				
DG1		0.06		
DG2		2.23		
847				
DG1		-		
DG2		-		
4. Flip over book/card/inlay at optimal distance. Read data.	√	√	√	√
5. Place book/card/inlay at optimal distance. Set test application Le byte value to 00/28h. Read data (BAC)				
0	-	-	-	-
28h	-	-	-	-
6. Place book/card/inlay at optimal distance. Read EF.COM / EF.DG1 / EF.DG2. Record timing. Repeat with/without BAC (if supported)				
Time taken to read and display up to DG1 (secs) no BAC	0.201	0.06	0.563	0.14
Time taken to read and display up to DG2 (secs) no BAC	3.586	2.17	2.578	2.143

	ACG	IRIS	PCS Security	SCM
1. Place book/card/inlay on reader and 1,2,3,4,5 cm over reader. Read data.				
On reader	√	√	X (only up to DG1 ok)	√
1 cm	√	√	X	√
2 cm	X	√	X	X (only up to DG1 ok)
3 cm	X	X	X	X (only connect ok)
4 cm	X	X	X	X
5 cm	X	X	X	X
Max distance before failure	1cm	2cm	-	1cm
2. Place book/card/inlay at optimal distance. Orientate at 0/45/90 degrees in both planes. Read data.				
Vertical plane				
45 degrees	X (ok at approx 15degs)	√	X (only up to DG1 ok)	√
90 degrees (perpendicular)	X	X	X	X
Horizontal plane				
45 degrees	√	√	X (only up to DG1 ok)	√
90 degrees (perpendicular)	√	√	X (only up to DG1 ok)	√
3. (For IRIS only) Place book/card/inlay at optimal distance. Set reader's application to bit rate of 106/212/424/847 kbits/s. Read data.	n.a.		n.a.	n.a.
106				
DG1		0.17		
DG2		4.53		
212				
DG1		0.15		
DG2		3.57		
424				
DG1		0.14		
DG2		3.06		
847				
DG1		-		
DG2		-		
4. Flip over book/card/inlay at optimal distance. Read data.	√	√	X (only up to DG1 ok)	√
5. Place book/card/inlay at optimal distance. Set test application Le byte value to 00/28h. Read data (BAC)				
0	-	-	-	-
28h	-	-	-	-
6. Place book/card/inlay at optimal distance. Read EF.COM / EF.DG1 / EF.DG2. Record timing. Repeat with/without BAC (if supported)				
Time taken to read and display up to DG1 (secs) no BAC	0.16	0.14	0.766	0.14
Time taken to read and display up to DG2 (secs) no BAC	5.518	3.06	-	3.515

	ACG	IRIS	PCS Security	SCM
1. Place book/card/inlay on reader and 1,2,3,4,5 cm over reader. Read data.				
On reader	√	√	√	√
1 cm	√	√	X (only connect ok)	√
2 cm	X	X (only connect ok)	X	√
3 cm	X	X	X	√
4 cm	X	X	X	X
5 cm	X	X	X	X
Max distance before failure	1cm	1cm	0cm	3cm
2. Place book/card/inlay at optimal distance. Orientate at 0/45/90 degrees in both planes. Read data.				
Vertical plane				
45 degrees	X	X	X	√
90 degrees (perpendicular)	X	X	X	X
Horizontal plane				
45 degrees	√	√	√	√
90 degrees (perpendicular)	√	√	√	√
3. (For IRIS only) Place book/card/inlay at optimal distance. Set reader's application to bit rate of 106/212/424/847 kbits/s. Read data.	n.a.		n.a.	n.a.
106				
DG1		0.09		
DG2		2.78		
212				
DG1		0.09		
DG2		1.93		
424				
DG1		0.08		
DG2		1.46		
847				
DG1		-		
DG2		-		
4. Flip over book/card/inlay at optimal distance. Read data.	√	√	√	√
5. Place book/card/inlay at optimal distance. Set test application Le byte value to 00/28h. Read data (BAC)				
0	-	-	-	-
28h	-	-	-	-
6. Place book/card/inlay at optimal distance. Read EF.COM / EF.DG1 / EF.DG2. Record timing. Repeat with/without BAC (if supported)				
Time taken to read and display up to DG1 (secs) no BAC	0.14	0.07	0.078	0.1
Time taken to read and display up to DG2 (secs) no BAC	3.485	1.44	1.735	1.783

	ACG	IRIS	PCS Security	SCM
1. Place book/card/inlay on reader and 1,2,3,4,5 cm over reader. Read data.				
On reader	√	√	√	√
1 cm	√	√	√	√
2 cm	√	√	X (only connect ok)	√
3 cm	X (only up to DG1 ok)	X (only connect ok)	X	√
4 cm	X (only connect ok)	X	X	X (only connect ok)
5 cm	X	X	X	X
Max distance before failure	2cm	2cm	1cm	3cm
2. Place book/card/inlay at optimal distance. Orientate at 0/45/90 degrees in both planes. Read data.				
Vertical plane				
45 degrees	√	√	X	√
90 degrees (perpendicular)	X	X	X	X
Horizontal plane				
45 degrees	√	√	√	√
90 degrees (perpendicular)	√	√	√	√
3. (For IRIS only) Place book/card/inlay at optimal distance. Set reader's application to bit rate of 106/212/424/847 kbits/s. Read data.	n.a.		n.a.	n.a.
106				
DG1		0.18		
DG2		1.74		
212				
DG1		0.19		
DG2		1.33		
424				
DG1		0.15		
DG2		1.2		
847				
DG1		-		
DG2		-		
4. Flip over book/card/inlay at optimal distance. Read data.	√	√	√	√
5. Place book/card/inlay at optimal distance. Set test application Le byte value to 00/28h. Read data (BAC)				
0	-	-	-	-
28h	-	-	-	-
6. Place book/card/inlay at optimal distance. Read EF.COM / EF.DG1 / EF.DG2. Record timing. Repeat with/without BAC (if supported)				
Time taken to read and display up to DG1 (secs) no BAC	0.17	0.15	0.14	0.161
Time taken to read and display up to DG2 (secs) no BAC	2.273	1.2	1.687	1.643

	ACG	IRIS	PCS Security	SCM
1. Place book/card/inlay on reader and 1,2,3,4,5 cm over reader. Read data.				
On reader	√	√	√	√
1 cm	√	√	X (only up to DG1 ok)	√
2 cm	X (only connect ok)	√	X (only up to DG1 ok)	√
3 cm	X	X	X (only connect ok)	X
4 cm	X	X	X	X
5 cm	X	X	X	X
Max distance before failure	1cm	2cm	0cm	2cm
2. Place book/card/inlay at optimal distance. Orientate at 0/45/90 degrees in both planes. Read data.				
Vertical plane				
45 degrees	√	√	X	√
90 degrees (perpendicular)	X	X	X	X
Horizontal plane				
45 degrees	√	√	√	√
90 degrees (perpendicular)	√	√	√	√
3. (For IRIS only) Place book/card/inlay at optimal distance. Set reader's application to bit rate of 106/212/424/847 kbits/s. Read data.	n.a.		n.a.	n.a.
106				
DG1		0.1		
DG2		3.29		
212				
DG1		0.09		
DG2		2.33		
424				
DG1		0.08		
DG2		1.9		
847				
DG1		-		
DG2		-		
4. Flip over book/card/inlay at optimal distance. Read data.	√	√	√	√
5. Place book/card/inlay at optimal distance. Set test application Le byte value to 00/28h. Read data (BAC)				
0	-	-	-	-
28h	-	-	-	-
6. Place book/card/inlay at optimal distance. Read EF.COM / EF.DG1 / EF.DG2. Record timing. Repeat with/without BAC (if supported)				
Time taken to read and display up to DG1 (secs) no BAC	0.14	0.08	0.079	0.1
Time taken to read and display up to DG2 (secs) no BAC	4.376	1.9	2.282	8.463

	ACG	IRIS	PCS Security	SCM
1. Place book/card/inlay on reader and 1,2,3,4,5 cm over reader. Read data.				
On reader	√	√	X (only up to DG1 ok)	√
1 cm	√	√	X (only up to DG1 ok)	√
2 cm	X	√	X (only connect ok)	√
3 cm	X	X	X (only connect ok)	X (only connect ok)
4 cm	X	X	X (only connect ok)	X (only connect ok)
5 cm	X	X	X (only connect ok)	X
Max distance before failure	1cm	2cm	0cm	2cm
2. Place book/card/inlay at optimal distance. Orientate at 0/45/90 degrees in both planes. Read data.				
Vertical plane				
45 degrees	X (about 30degs ok)	√	X	√
90 degrees (perpendicular)	X	X	X	X
Horizontal plane				
45 degrees	√	√	√	√
90 degrees (perpendicular)	√	√	√	√
3. (For IRIS only) Place book/card/inlay at optimal distance. Set reader's application to bit rate of 106/212/424/847 kbits/s. Read data.	n.a.		n.a.	n.a.
106				
DG1		-		
DG2		-		
212				
DG1		-		
DG2		-		
424				
DG1		-		
DG2		-		
847				
DG1		-		
DG2		-		
4. Flip over book/card/inlay at optimal distance. Read data.	√	√	X (only up to DG1 ok)	√
5. Place book/card/inlay at optimal distance. Set test application Le byte value to 00/28h. Read data (BAC)				
0	√	√	-	√
28h	√	√	-	√
6. Place book/card/inlay at optimal distance. Read EF.COM / EF.DG1 / EF.DG2. Record timing. Repeat with/without BAC (if supported)				
Time taken to read and display up to DG1 (secs) with BAC	1.081	0.77	1.281	1.011
Time taken to read and display up to DG2 (secs) with BAC	17.425	11.68	-	15.752

	ACG	IRIS	PCS Security	SCM
1. Place book/card/inlay on reader and 1,2,3,4,5 cm over reader. Read data.				
On reader	√	√	√	√
1 cm	√	√	X	√
2 cm	X	X	X	√
3 cm	X	X	X	√
4 cm	X	X	X	X
5 cm	X	X	X	X
Max distance before failure	1cm	1cm	0cm	3cm
2. Place book/card/inlay at optimal distance. Orientate at 0/45/90 degrees in both planes. Read data.				
Vertical plane				
45 degrees	X	X	X	√
90 degrees (perpendicular)	X	X	X	X
Horizontal plane				
45 degrees	√	√	√	√
90 degrees (perpendicular)	√	√	√	√
3. (For IRIS only) Place book/card/inlay at optimal distance. Set reader's application to bit rate of 106/212/424/847 kbits/s. Read data.	n.a.		n.a.	n.a.
106				
DG1		0.41		
DG2		7.61		
212				
DG1		0.38		
DG2		6.56		
424				
DG1		0.36		
DG2		6.02		
847				
DG1		-		
DG2		-		
4. Flip over book/card/inlay at optimal distance. Read data.	√	√	X (only up to DG1 ok)	√
5. Place book/card/inlay at optimal distance. Set test application Le byte value to 00/28h. Read data (BAC)				
0	√	√	√	√
28h	√	√	√	√
6. Place book/card/inlay at optimal distance. Read EF.COM / EF.DG1 / EF.DG2. Record timing. Repeat with/without BAC (if supported)				
Time taken to read and display up to DG1 (secs) with BAC	0.801	0.36	0.359	0.581
Time taken to read and display up to DG2 (secs) with BAC	11.256	6.02	6.031	8.402