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**Test report on laboratory tests for determining the
quality of a
RF security tag
for
Hangzhou Century Co., Ltd., China**

Dortmund, 2009-12-18

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1 Detection test in accordance with VDI 4470 page 1 with an artificial product

1.1 Task and experimental setup

The objective of this test is to determine the detection field factor (DFF) of a RF tag in accordance with VDI 4470 page 1. The test includes an examination in 12 different positions (see Figure 1.1-1), whereby 20 reference points are defined corresponding to a gate width of 1.50 m (see Figure 1.1-2), so that a total of $12 \cdot 20 \cdot 3 = 720$ passages for each test results with 3 attempts per position. For this purpose, 10 tags are selected at random from the security tags made available by the customer for test purposes and tested in each case in a RF standard gate¹.

¹ Checkpoint Evolve P10



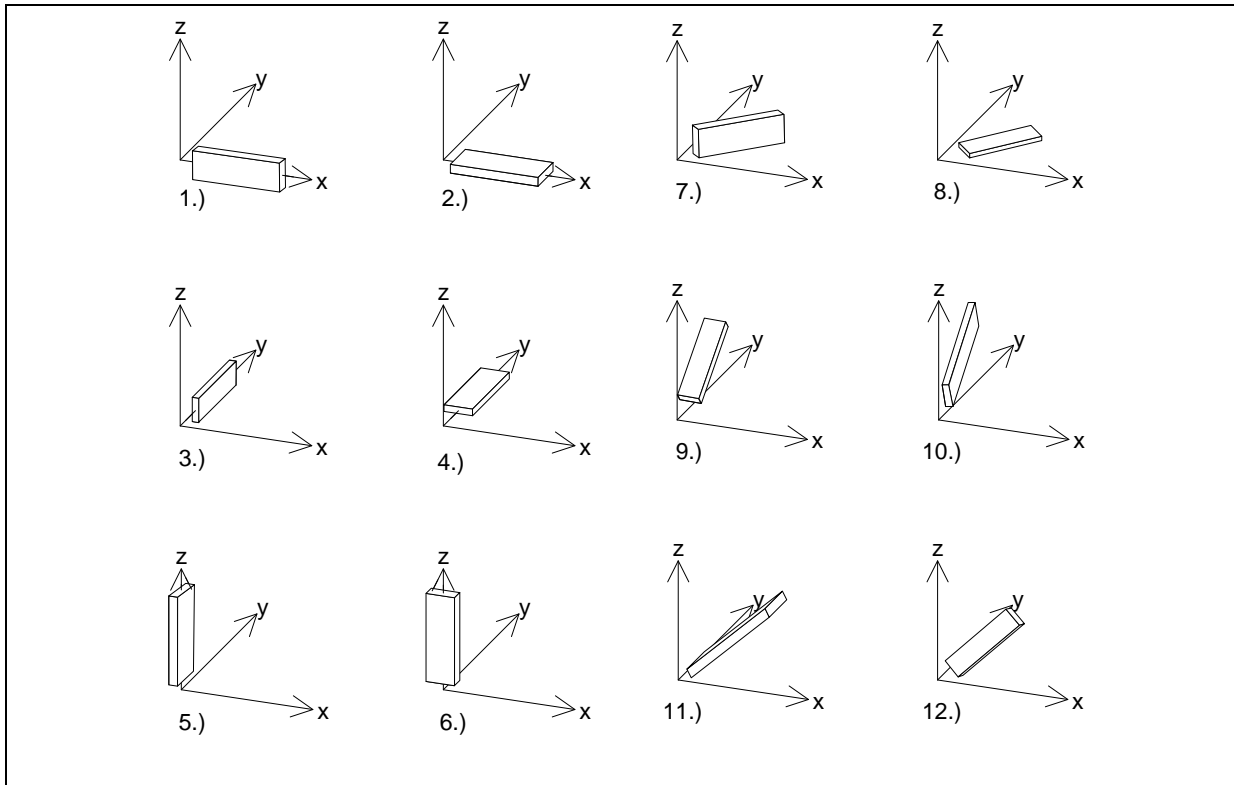


Figure 1.1-1: Parallel and diagonal positions of the artificial product

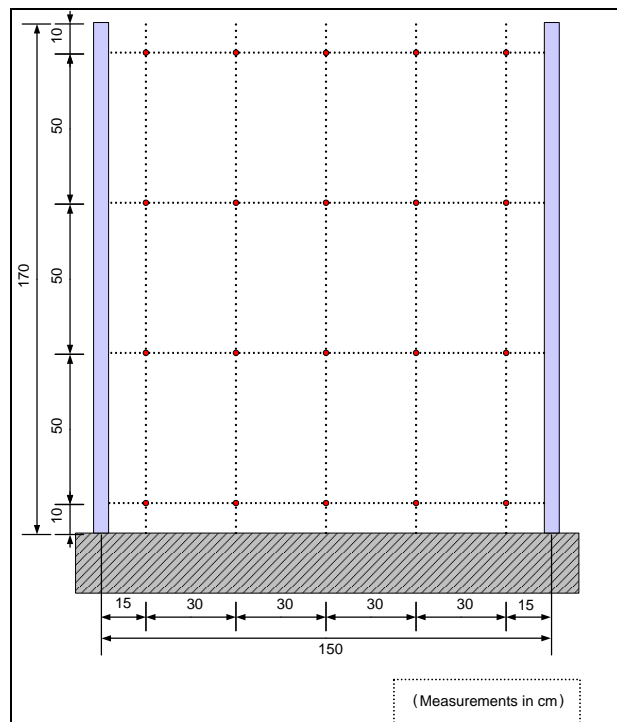


Figure 1.1-2: Reference points for determining the DFF

1.2 Test results

The test results (detection field factors) for the security tags are shown in the following.

Table 1.2-1: Evaluation according to the vertical area

	DFF
Top	95 %
Centre 1	99 %
Centre 2	100 %
Bottom	95 %
Average	97 %

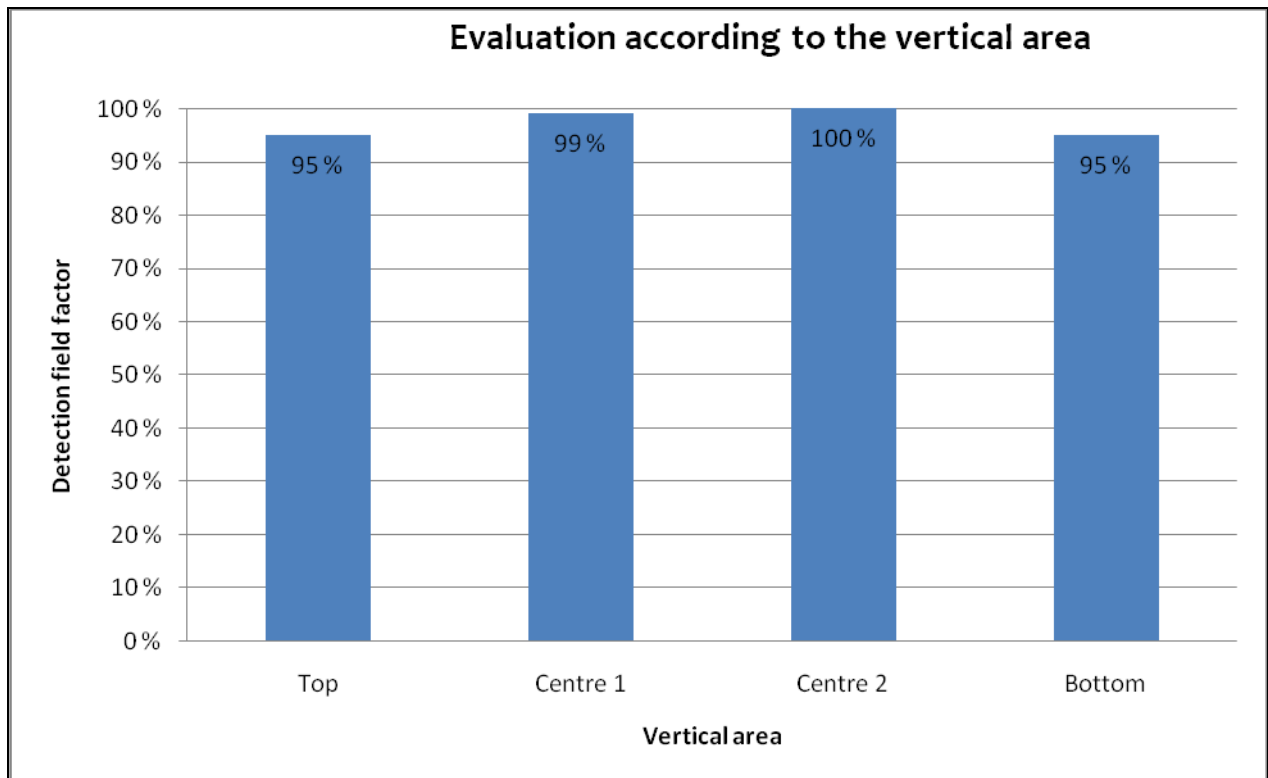


Figure 1.2-1: Evaluation according to the vertical area

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Table 1.2-2: Evaluation according to the horizontal area

	1	2	3	4	5	Average
DFF	100 %	100 %	86 %	100 %	100 %	97 %

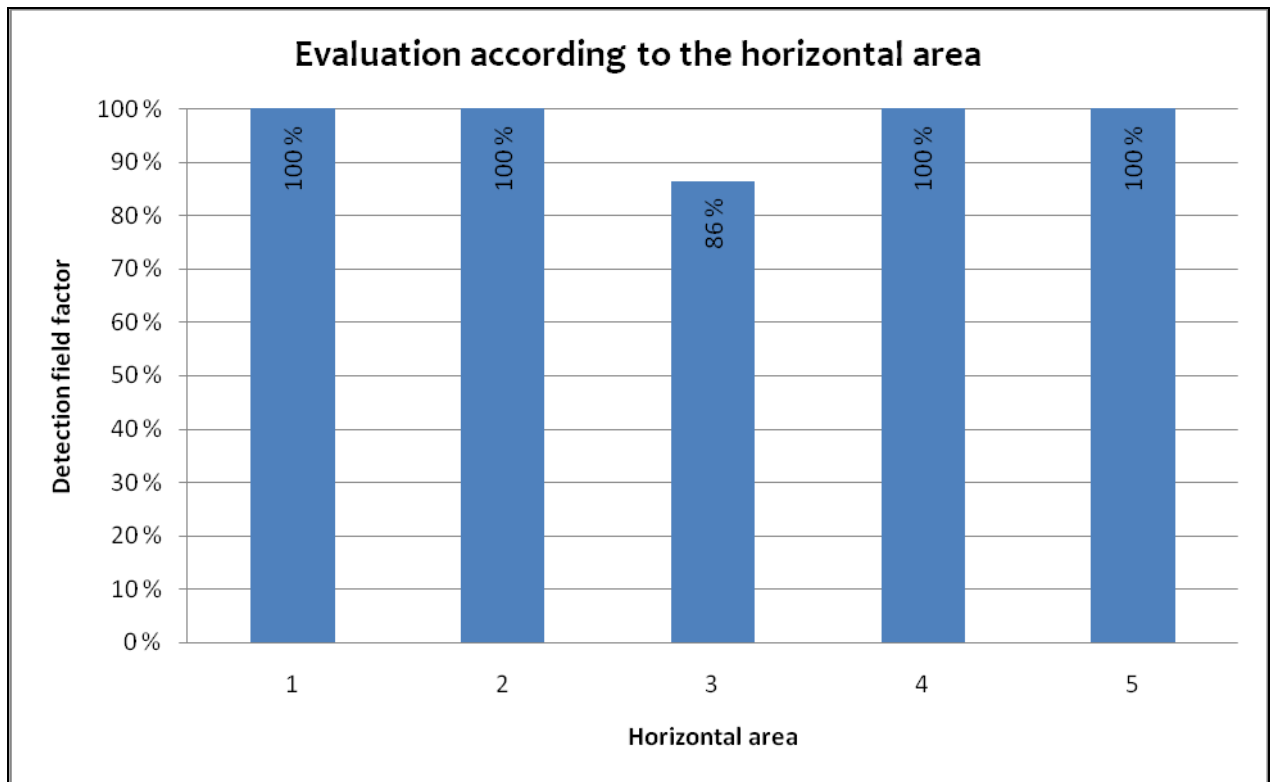


Figure 1.2-2: Evaluation according to the horizontal area

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Table 1.2-3: Evaluation according to the reference points

		1	2	3	4	5	Average
DFF	Top	100 %	100 %	75 %	100 %	100 %	95 %
	Centre 1	100 %	100 %	95 %	100 %	100 %	99 %
	Centre 2	100 %	100 %	100 %	100 %	100 %	100 %
	Bottom	100 %	100 %	75 %	100 %	100 %	95 %
	Average	100 %	100 %	86 %	100 %	100 %	97 %

Table 1.2-4: Evaluation according to the parallel and diagonal positions

Parallel	DFF	Diagonal	DFF
1	98 %	7	100 %
2	90 %	8	90 %
3	100 %	9	100 %
4	90 %	10	100 %
5	100 %	11	100 %
6	100 %	12	100 %
Average	96 %	Average	98 %

In all instances, the detection field factors are above the detection rate required by commerce of 85 % in accordance with VDI 4471 page 1. The average is 97 %.

2 Deactivation test in accordance with VDI 4470 page 2

2.1 Task and experimental setup

The objective of this test is the examination of the correct deactivation and the deactivation height in accordance with VDI 4470 page 2. The deactivator² is fitted on the underside of the table board of a cash desk. As the deactivation height is measured above the table board, the height of the table board must be added to the following results for a correct deactivation height. The table board has a thickness of 28 mm. For the test, 100 of the tags made available by the customer are selected at random and checked for their functional reliability prior to deactivation. Subsequently, the tags are moved individually towards the deactivator and their deactivation height is documented. A successful deactivation is indicated by a visual signal. Subsequently, the tags are checked for any reactivation after 5 minutes, 30 minutes and 60 minutes. Here the tags are not, however, mechanically loaded.

2.2 Test results

The test results are shown in the following.

Table 2.2-1: Ascertained deactivation height

	Deactivation height in cm
Average	25.03
Standard deviation	6.34

Table 2.2-2: Reactivation properties

Reactive after		
5 min.	30 min.	60 min.
0 %	0 %	0 %

All 100 tested tags were deactivated successfully.

² Checkpoint CP IX

3 Appendix

3.1 Individual results of the detection test in accordance with VDI 4470 page 1

Table 3.1-1: Evaluation according to the vertical area

	Tag									
	1	2	3	4	5	6	7	8	9	10
	DFF									
Top	95 %	95 %	95 %	95 %	95 %	95 %	95 %	95 %	95 %	95 %
Centre 1	100 %	100 %	100 %	100 %	98 %	98 %	98 %	100 %	97 %	98 %
Centre 2	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Bottom	95 %	95 %	95 %	95 %	95 %	95 %	95 %	95 %	95 %	95 %
Average	98 %	98 %	98 %	98 %	97 %	97 %	97 %	98 %	97 %	97 %

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Table 3.1-2: Evaluation according to the horizontal area

Tag		1	2	3	4	5	Average
1	DFF	100 %	100 %	88 %	100 %	100 %	98 %
2		100 %	100 %	88 %	100 %	100 %	98 %
3		100 %	100 %	88 %	100 %	100 %	98 %
4		100 %	100 %	88 %	100 %	100 %	98 %
5		100 %	100 %	85 %	100 %	100 %	97 %
6		100 %	100 %	85 %	100 %	100 %	97 %
7		100 %	100 %	85 %	100 %	100 %	97 %
8		100 %	100 %	88 %	100 %	100 %	98 %
9		100 %	100 %	83 %	100 %	100 %	97 %
10		100 %	100 %	85 %	100 %	100 %	97 %

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Table 3.1-3: Evaluation according to the reference points

Tag			1	2	3	4	5	Average
1	DFF	Top	100 %	100 %	75 %	100 %	100 %	95 %
		Centre 1	100 %	100 %	100 %	100 %	100 %	100 %
		Centre 2	100 %	100 %	100 %	100 %	100 %	100 %
		Bottom	100 %	100 %	75 %	100 %	100 %	95 %
2	DFF	Top	100 %	100 %	75 %	100 %	100 %	95 %
		Centre 1	100 %	100 %	100 %	100 %	100 %	100 %
		Centre 2	100 %	100 %	100 %	100 %	100 %	100 %
		Bottom	100 %	100 %	75 %	100 %	100 %	95 %
3	DFF	Top	100 %	100 %	75 %	100 %	100 %	95 %
		Centre 1	100 %	100 %	100 %	100 %	100 %	100 %
		Centre 2	100 %	100 %	100 %	100 %	100 %	100 %
		Bottom	100 %	100 %	75 %	100 %	100 %	95 %
4	DFF	Top	100 %	100 %	75 %	100 %	100 %	95 %
		Centre 1	100 %	100 %	100 %	100 %	100 %	100 %
		Centre 2	100 %	100 %	100 %	100 %	100 %	100 %
		Bottom	100 %	100 %	75 %	100 %	100 %	95 %
5	DFF	Top	100 %	100 %	75 %	100 %	100 %	95 %
		Centre 1	100 %	100 %	92 %	100 %	100 %	98 %
		Centre 2	100 %	100 %	100 %	100 %	100 %	100 %
		Bottom	100 %	100 %	75 %	100 %	100 %	95 %
6	DFF	Top	100 %	100 %	75 %	100 %	100 %	95 %
		Centre 1	100 %	100 %	92 %	100 %	100 %	98 %
		Centre 2	100 %	100 %	100 %	100 %	100 %	100 %
		Bottom	100 %	100 %	75 %	100 %	100 %	95 %
7	DFF	Top	100 %	100 %	75 %	100 %	100 %	95 %
		Centre 1	100 %	100 %	92 %	100 %	100 %	98 %
		Centre 2	100 %	100 %	100 %	100 %	100 %	100 %
		Bottom	100 %	100 %	75 %	100 %	100 %	95 %
8	DFF	Top	100 %	100 %	75 %	100 %	100 %	95 %
		Centre 1	100 %	100 %	100 %	100 %	100 %	100 %
		Centre 2	100 %	100 %	100 %	100 %	100 %	100 %
		Bottom	100 %	100 %	75 %	100 %	100 %	95 %
9	DFF	Top	100 %	100 %	75 %	100 %	100 %	95 %
		Centre 1	100 %	100 %	83 %	100 %	100 %	97 %
		Centre 2	100 %	100 %	100 %	100 %	100 %	100 %
		Bottom	100 %	100 %	75 %	100 %	100 %	95 %
10	DFF	Top	100 %	100 %	75 %	100 %	100 %	95 %
		Centre 1	100 %	100 %	92 %	100 %	100 %	98 %
		Centre 2	100 %	100 %	100 %	100 %	100 %	100 %
		Bottom	100 %	100 %	75 %	100 %	100 %	95 %

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Table 3.1-4: Evaluation according to the parallel and diagonal positions

	Tag									
	1	2	3	4	5	6	7	8	9	10
Parallel	DFF									
1	100 %	100 %	100 %	100 %	95 %	95 %	95 %	100 %	95 %	95 %
2	90 %	90 %	90 %	90 %	90 %	90 %	90 %	90 %	90 %	90 %
3	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
4	90 %	90 %	90 %	90 %	90 %	90 %	90 %	90 %	90 %	90 %
5	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
6	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	95 %	100 %
Average	97 %	97 %	97 %	97 %	96 %	96 %	96 %	97 %	95 %	96 %
Diagonal	DFF									
7	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
8	90 %	90 %	90 %	90 %	90 %	90 %	90 %	90 %	90 %	90 %
9	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
10	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
11	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
12	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Average	98 %	98 %	98 %	98 %	98 %	98 %	98 %	98 %	98 %	98 %



3.2 Individual results of the deactivation test in accordance with VDI 4470 page 2

Table 3.2-1: Deactivation height and reactivation properties (1 = reactive, 0 = inactive)

No.	Deactivation height [cm]	Reactive after		
		5 min.	30 min.	60 min.
1	34	0	0	0
2	34.5	0	0	0
3	33	0	0	0
4	27	0	0	0
5	32	0	0	0
6	32	0	0	0
7	32	0	0	0
8	32.5	0	0	0
9	23	0	0	0
10	27.5	0	0	0
11	23	0	0	0
12	31	0	0	0
13	17	0	0	0
14	23.5	0	0	0
15	33	0	0	0
16	14.5	0	0	0
17	14.5	0	0	0
18	12.5	0	0	0
19	22	0	0	0
20	28	0	0	0
21	26.5	0	0	0
22	26	0	0	0
23	19	0	0	0
24	28.5	0	0	0
25	28	0	0	0
26	21.5	0	0	0
27	20	0	0	0
28	19.5	0	0	0
29	34	0	0	0
30	29.5	0	0	0
31	33	0	0	0
32	17	0	0	0
33	30.5	0	0	0
34	24	0	0	0
35	31	0	0	0

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No.	Deactivation height [cm]	Reactive after		
		5 min.	30 min.	60 min.
36	27	0	0	0
37	27	0	0	0
38	32	0	0	0
39	19.5	0	0	0
40	33	0	0	0
41	31	0	0	0
42	29.5	0	0	0
43	30	0	0	0
44	23	0	0	0
45	13	0	0	0
46	15	0	0	0
47	21.5	0	0	0
48	30	0	0	0
49	34	0	0	0
50	24	0	0	0
51	30	0	0	0
52	35	0	0	0
53	27.5	0	0	0
54	21	0	0	0
55	18	0	0	0
56	22.5	0	0	0
57	24	0	0	0
58	29	0	0	0
59	32.5	0	0	0
60	14	0	0	0
61	24.5	0	0	0
62	18	0	0	0
63	30	0	0	0
64	23	0	0	0
65	21	0	0	0
66	27.5	0	0	0
67	30	0	0	0
68	25	0	0	0
69	34	0	0	0
70	30	0	0	0

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No.	Deactivation height [cm]	Reactive after		
		5 min.	30 min.	60 min.
71	19	0	0	0
72	23	0	0	0
73	16.5	0	0	0
74	14	0	0	0
75	10	0	0	0
76	22	0	0	0
77	25.5	0	0	0
78	25.5	0	0	0
79	20.5	0	0	0
80	25	0	0	0
81	19.5	0	0	0
82	24	0	0	0
83	29	0	0	0
84	32	0	0	0
85	28	0	0	0
86	32	0	0	0
87	13.5	0	0	0
88	13	0	0	0
89	27	0	0	0
90	28.5	0	0	0
91	16	0	0	0
92	33.5	0	0	0
93	29	0	0	0
94	20.5	0	0	0
95	13	0	0	0
96	24	0	0	0
97	21.5	0	0	0
98	22.5	0	0	0
99	29.5	0	0	0
100	25	0	0	0