

# CERTIFICATE

## **P3 communications GmbH**

Am Kraftversorgungsturm 3, D-52070 Aachen, Germany

hereby certifies that



**TDC A/S**

Teglholmegade 1, 0900 København C, Denmark

achieved „**Best in Test**“ with a

Total Score of **903 of 1000**

in the **Mobile Benchmark Denmark 05/2016**.

(Score 345 of 400 in Telephony, Score 558 of 600 in Data Services)



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## Measurement Setup

	Voice	Data
<b>Device</b>	Samsung Galaxy S5 LTE cat4 (SM-G900F) LTE/HSPA+ DC/HSUPA 5.76 P3 attenuator	Samsung Galaxy Note4 LTE cat6 (SM-N910F) LTE/HSPA+ DC/HSUPA 5.76 P3 attenuator
<b>Test Cases</b>	<b>Mobile-to-Mobile</b> Side1 (4G preferred) to Side2 (3G preferred) 115 sec call window 70 sec call duration 15 sec call setup timeout Email traffic injection on both sides (1 email per call window)	<b>Data 4G preferred CA</b> HTTP DL datastream 10s HTTP UL datastream 10s HTTP 3MB DL fixed file transfer HTTP 1MB UL fixed file transfer Web Browsing - Kepler ETSI Ref. Page 10 Live web pages YouTube HD/ SD video - 45s
<b>Mobility and Route Types</b>	100% Drivetest 55% in Cities, 22% in Towns and 23% on Roads Cities, towns and roads	
<b>Samples</b>	~ 5200 per Operator	~ 1150 per Operator
<b>Dates</b>	<b>14 measurement days</b> <b>May 17th - June 3rd, 2016</b>	

## Testing Route



## Score Points and Breakdown

The following table indicates the score points achieved by the networks under test in the modules “Voice” and “Data Services” as well as the breakdown of achieved points in the geographical categories “Cities”, “Towns” and “Roads”.

Module	Infrastructure	Max.	TDC	Operator 2	Operator 3	Operator 4
<b>Voice</b>	<b>Total</b>	<b>400</b>	<b>345</b>	<b>288</b>	<b>251</b>	<b>284</b>
	Cities	240	86%	71%	64%	68%
	Towns	80	86%	79%	64%	81%
	Roads	80	85%	67%	58%	69%
<b>Data</b>	<b>Total</b>	<b>600</b>	<b>558</b>	<b>498</b>	<b>486</b>	<b>428</b>
	Cities	360	93%	86%	83%	72%
	Towns	120	93%	84%	83%	78%
	Roads	120	94%	74%	74%	64%
<b>TOTAL</b>		<b>1.000</b>	<b>903</b>	<b>786</b>	<b>738</b>	<b>712</b>

Shown voice, data and total scores are rounded

The following table indicates the achieved percentage of the maximum score in each of the different data services.

Data	Service Group	Max.	TDC	Operator 2	Operator 3	Operator 4
Cities	Web Browsing	126	89%	85%	84%	71%
	File Download	72	92%	83%	82%	70%
	File Upload	72	97%	82%	79%	74%
	YouTube	90	94%	92%	86%	72%
Towns	Web Browsing	42	90%	86%	81%	76%
	File Download	24	91%	84%	85%	76%
	File Upload	24	97%	77%	79%	73%
	YouTube	30	96%	87%	85%	86%
Roads	Web Browsing	42	89%	73%	72%	59%
	File Download	24	100%	81%	84%	76%
	File Upload	24	96%	68%	69%	54%
	YouTube	30	96%	74%	71%	69%

## Voice KPI Overview

The following table indicates the achieved values of all networks under test in each of the relevant Voice Key Performance Indicators (KPIs) for the geographical categories “Cities”, “Towns” and “Roads”.

Voice M2M	KPI Name	Unit	TDC	Operator 2	Operator 3	Operator 4
Cities	Qualifier	[%]	99,2	96,8	95,6	96,1
	Call Setup Time	[s]	7,0	7,6	8,0	7,6
	AVG Speech Quality	[MOS-LQO]	3,8	3,6	3,6	3,7
Towns	Qualifier	[%]	99,0	98,1	95,3	98,4
	Call Setup Time	[s]	6,6	7,2	7,5	7,1
	AVG Speech Quality	[MOS-LQO]	3,8	3,7	3,7	3,7
Roads	Qualifier	[%]	98,3	94,0	91,5	94,2
	Call Setup Time	[s]	6,7	7,9	8,1	7,3
	AVG Speech Quality	[MOS-LQO]	3,7	3,6	3,6	3,6

## Data KPI Overview

The following table indicates the achieved values of all networks under test in each of the relevant Data Key Performance Indicators (KPIs) for the geographical categories “Cities”, “Towns” and “Roads”.

Data Cities	KPI Name	Unit	TDC	Operator 2	Operator 3	Operator 4
HTTP Live Page DL	Qualifier	[%]	99,1	98,3	98,1	95,7
	AVG Session Time	[s]	3,5	3,5	3,7	4,5
HTTP Static Page DL	Qualifier	[%]	100,0	99,8	99,7	99,0
	AVG Session Time	[s]	1,0	1,2	1,4	1,9
HTTP file DL 3MB	Qualifier	[%]	100,0	99,7	99,7	99,7
	AVG Session Time	[s]	1,1	1,9	1,9	3,7
	90% faster than	[kbit/s]	13277	7572	7686	3935
	10% faster than	[kbit/s]	56075	41309	38703	21263
HTTP file UL 1MB	Qualifier	[%]	100,0	99,1	99,1	98,9
	AVG Session Time	[s]	0,8	1,7	2,0	2,1
	90% faster than	[kbit/s]	9206	2571	1635	2139
	10% faster than	[kbit/s]	15943	11901	12767	9761
HTTP DL FDTT 10s	Qualifier	[%]	100,0	99,5	99,4	97,3
	AVG throughput	[kbit/s]	62879	35127	34454	23522
	90% faster than	[kbit/s]	16951	12864	10331	5488
	10% faster than	[kbit/s]	128166	60024	64455	47469
HTTP UL FDTT 10s	Qualifier	[%]	100,0	99,7	99,8	98,7
	AVG throughput	[kbit/s]	30047	18152	15289	12437
	90% faster than	[kbit/s]	13849	2865	1605	1860
	10% faster than	[kbit/s]	45012	31349	31720	20363
YouTube	Qualifier	[%]	99,2	99,2	99,2	95,8
	Start Time	[s]	2,2	2,3	2,3	3,4
	Playouts w/o interruptions	[%]	99,1	99,2	98,9	97,5
	AVG Resolution	[p]	720,0	699,0	655,9	678,4
	HD Share	[%]	100,0	94,2	82,2	88,4

Data Towns	KPI Name	Unit	TDC	Operator 2	Operator 3	Operator 4
HTTP Live Page DL	Qualifier	[%]	99,5	98,8	97,6	97,2
	AVG Session Time	[s]	3,5	3,7	3,7	4,4
HTTP Static Page DL	Qualifier	[%]	100,0	99,6	99,4	98,7
	AVG Session Time	[s]	1,0	1,4	1,4	1,7
HTTP file DL 3MB	Qualifier	[%]	99,6	100,0	100,0	99,6
	AVG Session Time	[s]	1,1	1,9	1,7	3,7
	90% faster than	[kbit/s]	15763	7606	8987	4207
	10% faster than	[kbit/s]	51993	39947	48029	24773
HTTP file UL 1MB	Qualifier	[%]	100,0	98,9	99,2	97,0
	AVG Session Time	[s]	0,8	2,2	2,2	1,7
	90% faster than	[kbit/s]	8589	1523	1494	3331
	10% faster than	[kbit/s]	15285	11230	11499	9308
HTTP DL FDTT 10s	Qualifier	[%]	100,0	100,0	100,0	99,6
	AVG throughput	[kbit/s]	61037	31175	35364	22472
	90% faster than	[kbit/s]	19024	8904	9655	7625
	10% faster than	[kbit/s]	122702	58504	72430	41957
HTTP UL FDTT 10s	Qualifier	[%]	100,0	98,9	100,0	98,9
	AVG throughput	[kbit/s]	28014	17966	15596	12517
	90% faster than	[kbit/s]	16069	2007	1476	3675
	10% faster than	[kbit/s]	42381	32918	33543	20032
YouTube	Qualifier	[%]	99,6	99,3	99,2	98,5
	Start Time	[s]	2,2	2,2	2,0	3,2
	Playouts w/o interruptions	[%]	99,6	99,6	99,6	98,5
	AVG Resolution	[p]	718,7	657,6	635,3	697,8
	HD Share	[%]	99,6	82,7	76,5	93,8

Data Roads	KPI Name	Unit	TDC	Operator 2	Operator 3	Operator 4
HTTP Live Page DL	Qualifier	[%]	98,5	93,7	93,6	89,5
	AVG Session Time	[s]	3,5	3,9	3,9	4,5
HTTP Static Page DL	Qualifier	[%]	99,4	96,2	95,5	93,6
	AVG Session Time	[s]	1,1	1,7	1,8	2,0
HTTP file DL 3MB	Qualifier	[%]	100,0	97,5	98,8	97,0
	AVG Session Time	[s]	1,4	3,6	3,3	5,3
	90% faster than	[kbit/s]	10044	3522	4159	2915
	10% faster than	[kbit/s]	55287	37659	44082	24233
HTTP file UL 1MB	Qualifier	[%]	99,2	95,9	96,0	91,9
	AVG Session Time	[s]	1,0	3,4	4,0	3,4
	90% faster than	[kbit/s]	7562	1056	911	1055
	10% faster than	[kbit/s]	14843	10862	10888	8497
HTTP DL FDTT 10s	Qualifier	[%]	100,0	98,4	98,0	97,0
	AVG throughput	[kbit/s]	51183	24163	23635	20365
	90% faster than	[kbit/s]	16085	4538	5843	6120
	10% faster than	[kbit/s]	103502	48136	49557	41255
HTTP UL FDTT 10s	Qualifier	[%]	99,2	95,0	96,4	90,5
	AVG throughput	[kbit/s]	27474	10064	8645	9201
	90% faster than	[kbit/s]	9040	929	753	749
	10% faster than	[kbit/s]	44122	27254	22907	18509
YouTube	Qualifier	[%]	98,9	95,1	95,1	91,9
	Start Time	[s]	2,2	2,7	2,6	3,0
	Playouts w/o interruptions	[%]	99,6	98,3	97,0	97,7
	AVG Resolution	[p]	713,1	586,6	559,3	625,0
	HD Share	[%]	98,1	62,9	55,4	73,6