

CERTIFICATE

P3 communications GmbH

Am Kraftversorgungsturm 3, D-52070 Aachen, Germany

hereby certifies that



vodafone

Vodafone Romania

Globalworth Tower,

Str. Barbu Vacarescu, nr.201, sector 2, Bucuresti 020276, Romania

achieved „**Best in Test**“ with a

Total Score of **826 of 1000**

in the **Mobile Benchmark Romania 12/2016.**

(Score 332 of 400 in Telephony, Score 493 of 600 in Data Services)



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Head of Network Testing
& Benchmarking
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Measurement Setup

	Voice	Data
Device	Samsung Galaxy S5 LTE cat4	Samsung Galaxy Note4 LTE cat6
Test Cases	Mobile-to-Mobile (M2M) Side1 (4G preferred) to Side2 (4G preferred) Side1 (4G preferred) to Side2 (3G preferred) 115 sec call window 70 sec call duration 15 sec call setup timeout Multi-RAB traffic injection on both sides	Data 4G preferred CA 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 (50% http / 50% https) YouTube HD/SD video - 45s
Mobility and Route Types	100% Drivetest 60% in Cities, 21% in Towns and 19% on Roads	
Samples	~ 2800 per Operator	~ 1200 per Operator
Dates	26 measurement days November 5th - December 12th, 2016	

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

Data	Service Group	Max.	Vodafone	Operator 2	Operator 3	Operator 4
Cities	Web Browsing	126	86%	86%	51%	81%
	File Download	72	92%	91%	66%	79%
	File Upload	72	96%	96%	34%	80%
	YouTube	90	96%	93%	74%	86%
Towns	Web Browsing	42	61%	67%	22%	55%
	File Download	24	70%	73%	54%	68%
	File Upload	24	49%	61%	32%	42%
	YouTube	30	80%	79%	63%	73%
Roads	Web Browsing	42	66%	64%	18%	52%
	File Download	24	77%	75%	54%	63%
	File Upload	24	62%	62%	30%	44%
	YouTube	30	79%	75%	54%	65%

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	Vodafone	Operator 2	Operator 3	Operator 4
Cities	Qualifier	[%]	99,0	98,8	95,4	98,3
	Call Setup Time	[s]	5,6	6,0	7,3	6,5
	AVG Speech Quality	[MOS-LQO]	3,7	3,5	2,9	3,7
Towns	Qualifier	[%]	97,0	97,5	97,0	94,9
	Call Setup Time	[s]	5,8	6,8	6,0	7,6
	AVG Speech Quality	[MOS-LQO]	3,7	3,5	2,8	3,7
Roads	Qualifier	[%]	94,9	96,9	90,6	92,0
	Call Setup Time	[s]	6,1	6,7	6,2	7,5
	AVG Speech Quality	[MOS-LQO]	3,7	3,5	2,9	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	Vodafone	Operator 2	Operator 3	Operator 4
HTTP Live Page DL	Qualifier	[%]	98,9	99,0	91,7	98,0
	AVG Session Time	[s]	4,0	3,9	4,7	4,2
HTTP Static Page DL	Qualifier	[%]	99,8	99,9	95,2	99,5
	AVG Session Time	[s]	1,3	1,3	2,3	1,5
HTTP file DL 3MB	Qualifier	[%]	99,9	99,9	98,6	99,1
	AVG Session Time	[s]	1,1	1,1	4,9	1,6
	90% faster than	[kbit/s]	15286	14524	2293	7890
	10% faster than	[kbit/s]	56471	67989	27491	50526
HTTP file UL 1MB	Qualifier	[%]	99,7	99,8	88,0	99,0
	AVG Session Time	[s]	0,9	0,9	4,1	1,8
	90% faster than	[kbit/s]	8377	6932	893	2377
	10% faster than	[kbit/s]	16985	19802	6748	12424
HTTP DL FDTT 10s	Qualifier	[%]	99,9	99,8	97,8	98,1
	AVG throughput	[kbit/s]	57946	53842	15679	40785
	90% faster than	[kbit/s]	21662	17976	2268	9099
	10% faster than	[kbit/s]	105356	99926	35616	76769
HTTP UL FDTT 10s	Qualifier	[%]	99,7	99,7	96,6	98,3
	AVG throughput	[kbit/s]	31387	29869	3649	23932
	90% faster than	[kbit/s]	13584	9347	346	2602
	10% faster than	[kbit/s]	42514	43705	7353	43807
YouTube	Qualifier	[%]	99,9	99,7	98,3	98,2
	Start Time	[s]	1,7	1,8	2,3	1,9
	Playouts w/o interruptions	[%]	100,0	100,0	99,5	100,0
	AVG Resolution	[p]	660,8	631,0	460,9	601,2

Data Towns	KPI Name	Unit	Vodafone	Operator 2	Operator 3	Operator 4
HTTP Live Page DL	Qualifier	[%]	94,6	95,6	82,5	93,2
	AVG Session Time	[s]	4,9	4,6	6,0	4,7
HTTP Static Page DL	Qualifier	[%]	96,8	97,2	90,0	94,7
	AVG Session Time	[s]	2,6	2,2	4,7	2,4
HTTP file DL 3MB	Qualifier	[%]	98,4	99,0	97,1	97,4
	AVG Session Time	[s]	4,7	4,1	9,8	3,8
	90% faster than	[kbit/s]	2746	2925	1269	3852
	10% faster than	[kbit/s]	35636	39056	8153	39669
HTTP file UL 1MB	Qualifier	[%]	90,7	94,7	55,2	91,1
	AVG Session Time	[s]	3,5	2,8	5,3	3,5
	90% faster than	[kbit/s]	1237	1330	844	1150
	10% faster than	[kbit/s]	11765	12294	3475	8212
HTTP DL FDTT 10s	Qualifier	[%]	98,9	99,4	97,6	97,8
	AVG throughput	[kbit/s]	16632	19827	5728	22240
	90% faster than	[kbit/s]	2679	2828	1310	4628
	10% faster than	[kbit/s]	45314	46430	8826	61704
HTTP UL FDTT 10s	Qualifier	[%]	97,3	97,8	96,6	94,5
	AVG throughput	[kbit/s]	9347	9797	1435	8445
	90% faster than	[kbit/s]	523	1078	265	819
	10% faster than	[kbit/s]	27587	22583	3387	24571
YouTube	Qualifier	[%]	99,3	98,8	98,1	97,2
	Start Time	[s]	2,3	2,2	3,4	2,3
	Playouts w/o interruptions	[%]	100,0	99,7	98,9	100,0
	AVG Resolution	[p]	488,4	493,3	310,1	500,3

Data Roads	KPI Name	Unit	Vodafone	Operator 2	Operator 3	Operator 4
HTTP Live Page DL	Qualifier	[%]	93,5	92,2	73,7	88,7
	AVG Session Time	[s]	4,9	4,8	6,2	4,8
HTTP Static Page DL	Qualifier	[%]	95,7	95,8	82,3	90,1
	AVG Session Time	[s]	2,6	2,5	5,0	2,6
HTTP file DL 3MB	Qualifier	[%]	98,0	97,6	95,0	93,8
	AVG Session Time	[s]	4,5	5,0	9,7	4,4
	90% faster than	[kbit/s]	2852	2146	1308	3181
	10% faster than	[kbit/s]	35078	38932	8182	24901
HTTP file UL 1MB	Qualifier	[%]	90,0	91,1	37,3	86,5
	AVG Session Time	[s]	3,4	3,2	5,0	4,0
	90% faster than	[kbit/s]	1167	1263	829	1031
	10% faster than	[kbit/s]	12012	13212	4350	7306
HTTP DL FDTT 10s	Qualifier	[%]	98,1	97,6	93,7	92,9
	AVG throughput	[kbit/s]	16320	17909	5706	16424
	90% faster than	[kbit/s]	2760	2541	1238	3255
	10% faster than	[kbit/s]	41848	44140	8327	34800
HTTP UL FDTT 10s	Qualifier	[%]	97,2	95,1	91,9	90,0
	AVG throughput	[kbit/s]	8790	9760	2135	6495
	90% faster than	[kbit/s]	608	802	220	812
	10% faster than	[kbit/s]	22555	27528	3360	18295
YouTube	Qualifier	[%]	97,9	97,1	91,9	92,5
	Start Time	[s]	2,3	2,3	3,5	2,5
	Playouts w/o interruptions	[%]	100,0	99,7	99,8	99,1
	AVG Resolution	[p]	486,0	467,2	303,0	475,2