

CERTIFICATE

P3 communications GmbH

Am Kraftversorgungsturm 3, D-52070 Aachen, Germany

hereby certifies that



vodafone

Vodafone Romania

Piața Charles de Gaulle nr.15, Sector 1, 011857 București, Romania

achieved „**Best in Test**“ with a

Total Score of **899 of 1000**

in the **Mobile Benchmark Romania 01/2016.**

(Score 353 of 400 in Telephony, Score 546 of 600 in Data Services)



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Measurement Setup

	Voice	Data
Device	Samsung Galaxy S5 LTE cat4 (SM-G900F) LTE / HSPA+ DC / HSUPA 5.76 Attenuation book	4G Preferred CA Samsung Galaxy Note4 LTE cat6 (SM-N910F) LTE / HSPA+ DC / HSUPA 5.76 Attenuation book
Test Cases	Mobile-to-Mobile Set1 4Gpref (MRAB) to 3G pref (MRAB) Set2 3Gpref to 4G pref 70 sec call duration 115 sec call window multiRAB 1:1 traffic injection	HTTP File DL 3MB HTTP File UL 1MB HTTP DL stress test 10s HTTP UL stress test 10s Web Browsing-ETSI Ref. Page, 3 live websites YouTube SD Video-30s clip YouTube HD Video-30s clip One car 4G pref. and one 3G pref.
Mobility and Route Types	100% Drivetest ~51% in Big Cities ~19% in Small Cites ~30% in Transfers	
Samples	M2ISDN: ~ 1600 per Operator M2M: ~ 2700 per Operator	Data 3G ~ 640 per Operator Data 4G ~ 660 per Operator Data 4G CA ~ 1300 per Operator
QoS DL/UL	4Gpref Vodafone 224000/50000, Orange 300000/50000, Telekom 150000/50000, RCS-RDS 200000/50000 [kbit/s] 3Gpref Vodafone 32000/8437, Orange 21000/5312, Telekom 42000/5625, RCS-RDS 21000/8000 [kbit/s]	
Dates	20 measurement days, November 20th - December 22nd, 2015	

Testing Route



Score Points and Breakdown

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

Module	Infrastructure	Max.	Vodafone	Operator 2	Operator 3	Operator 4
Voice	Total	400	353	333	312	289
	big cities	260	234	215	201	186
	small cities and connecting roads	140	119	118	111	103
Data	Total	600	546	532	333	235
	big cities	390	375	358	266	162
	small cities	90	80	81	29	26
	connecting roads	120	91	92	38	47
TOTAL		1.000	899	864	645	524

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.	Vodafone	Operator 2	Operator 3	Operator 4
big cities	Web Browsing	136,5	97%	92%	80%	44%
	File Download	78,0	97%	91%	82%	62%
	File Upload	78,0	93%	90%	75%	31%
	YouTube	97,5	97%	93%	36%	30%
small cities	Web Browsing	31,5	93%	91%	36%	24%
	File Download	18,0	86%	89%	46%	48%
	File Upload	18,0	79%	89%	24%	30%
	YouTube	22,5	91%	92%	20%	18%
connecting roads	Web Browsing	42,0	81%	79%	30%	36%
	File Download	24,0	82%	83%	44%	59%
	File Upload	24,0	69%	70%	30%	32%
	YouTube	30,0	69%	74%	26%	34%

Voice KPI Overview

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

Voice M2M	Kpi Name	Unit	Vodafone	Operator 2	Operator 3	Operator 4
big cities	Qualified	[%]	99,1	98,0	97,1	95,7
	Call Setup Time	[s]	5,8	6,8	7,4	5,5
	AVG Speech Quality	[MOS-LQO]	3,7	3,7	3,8	3,0
small cities and connecting roads	Qualified	[%]	96,3	96,1	94,7	92,9
	Call Setup Time	[s]	5,7	6,5	7,1	5,3
	AVG Speech Quality	[MOS-LQO]	3,5	3,6	3,6	3,0

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 “Big Cities” and “Connecting Roads”.

Data big cities	Kpi Name	Unit	Vodafone	Operator 2	Operator 3	Operator 4
http Live Page DL	Qualified	[%]	99,9	98,8	96,5	88,6
	AVG Session Time	[s]	2,6	2,7	3,4	4,1
http Static Page DL	Qualified	[%]	99,9	98,8	97,8	90,9
	AVG Session Time	[s]	0,9	1,3	1,8	2,8
http file DL 3MB	Qualified	[%]	99,7	99,3	98,7	97,0
	AVG Session Time	[s]	0,9	1,2	2,0	6,4
	90% faster than	[kbit/s]	20566	15564	7044	1624
	10% faster than	[kbit/s]	56738	61856	44037	24794
http file UL 1MB	Qualified	[%]	99,7	99,0	98,1	83,6
	AVG Session Time	[s]	0,9	1,0	2,7	5,4
	90% faster than	[kbit/s]	4692	4316	1478	674
	10% faster than	[kbit/s]	15444	19560	10270	5835
http DL FDTT 10s	Qualified	[%]	100	99,3	98,7	97,6
	AVG throughput	[kbit/s]	60715	46489	34658	12955
	90% faster than	[kbit/s]	26129	16379	7921	1595
	10% faster than	[kbit/s]	101219	83403	66802	27736
http UL FDTT 10s	Qualified	[%]	99,9	99,3	98,4	96,1
	AVG throughput	[kbit/s]	28392	27106	16809	2661
	90% faster than	[kbit/s]	12663	6553	1439	334
	10% faster than	[kbit/s]	38513	40338	38268	6468
Youtube SD	Qualified	[%]	100	99,1	96,2	93,7
	Start Time	[s]	1,1	1,2	1,9	2,0
	Playouts w/o interruptions	[%]	100,0	100,0	98,3	97,9
Youtube HD	Qualified	[%]	100	99,1	77,4	82,4
	Start Time	[s]	1,1	1,2	2,1	2,6
	Playouts w/o interruptions	[%]	99,7	99,4	90,9	90,9

Data small cities	Kpi Name	Unit	Vodafone	Operator 2	Operator 3	Operator 4
http Live Page DL	Qualified	[%]	99,1	98,7	80,0	86,5
	AVG Session Time	[s]	2,8	2,8	4,2	4,9
http Static Page DL	Qualified	[%]	99,8	98,8	95,0	82,2
	AVG Session Time	[s]	1,1	1,4	2,9	5,0
http file DL 3MB	Qualified	[%]	99,6	97,5	92,0	96,2
	AVG Session Time	[s]	1,5	1,2	3,2	12,6
	90% faster than	[kbit/s]	8756	14925	4843	979
	10% faster than	[kbit/s]	53333	61069	36036	5021
http file UL 1MB	Qualified	[%]	98,0	99,2	81,2	68,7
	AVG Session Time	[s]	1,6	1,1	5,2	7,2
	90% faster than	[kbit/s]	2377	4692	784	605
	10% faster than	[kbit/s]	12618	17167	8013	2583
http DL FDTT 10s	Qualified	[%]	98,8	100	89,7	96,3
	AVG throughput	[kbit/s]	40199	44062	20352	3545
	90% faster than	[kbit/s]	9047	17047	5101	751
	10% faster than	[kbit/s]	77439	78462	55570	7263
http UL FDTT 10s	Qualified	[%]	99,2	99,2	90,0	96,8
	AVG throughput	[kbit/s]	19964	23466	6447	1151
	90% faster than	[kbit/s]	1381	5383	554	105
	10% faster than	[kbit/s]	37043	39228	27255	2408
Youtube SD	Qualified	[%]	99,6	100	75,1	91,0
	Start Time	[s]	1,3	1,2	2,4	2,9
	Playouts w/o interruptions	[%]	99,6	100,0	99,4	96,5
Youtube HD	Qualified	[%]	98,0	99,6	71,4	65,6
	Start Time	[s]	1,3	1,2	2,8	4,4
	Playouts w/o interruptions	[%]	100	97,6	92,9	74,5

Data connecting routes	Kpi Name	Unit	Vodafone	Operator 2	Operator 3	Operator 4
http Live Page DL	Qualified	[%]	94,4	94,5	72,6	83,3
	AVG Session Time	[s]	3,4	3,5	4,1	5,7
http Static Page DL	Qualified	[%]	95,1	94,5	77,9	80,5
	AVG Session Time	[s]	1,9	2,4	3,2	5,7
http file DL 3MB	Qualified	[%]	96,8	96,5	82,9	93,3
	AVG Session Time	[s]	4,7	4,6	6,5	10,7
	90% faster than	[kbit/s]	2612	2223	2068	1241
	10% faster than	[kbit/s]	42553	49485	18045	6873
http file UL 1MB	Qualified	[%]	90,8	89,7	72,4	22,7
	AVG Session Time	[s]	3,4	3,4	6,1	5,3
	90% faster than	[kbit/s]	1173	1000	627	863
	10% faster than	[kbit/s]	12140	15968	7692	4191
http DL FDTT 10s	Qualified	[%]	97,8	99,3	87,4	96,8
	AVG throughput	[kbit/s]	20413	21506	12285	4577
	90% faster than	[kbit/s]	2384	2128	954	1184
	10% faster than	[kbit/s]	63459	54542	24788	7662
http UL FDTT 10s	Qualified	[%]	96,1	97,5	87,4	92,0
	AVG throughput	[kbit/s]	9088	10753	4308	952
	90% faster than	[kbit/s]	356	476	99	192
	10% faster than	[kbit/s]	30871	31233	12155	2682
Youtube SD	Qualified	[%]	94,8	96,5	70,3	92,5
	Start Time	[s]	1,8	1,9	2,6	3,1
	Playouts w/o interruptions	[%]	99,2	99,0	97,7	98,0
Youtube HD	Qualified	[%]	89,6%	93,8	65,6	77,6
	Start Time	[s]	2,4	2,2	3,1	5,2
	Playouts w/o interruptions	[%]	91,7	88,9	92,6	81,4