

CERTIFICATE

P3 communications GmbH

Am Kraftversorgungsturm 3, D-52070 Aachen, Germany

hereby certifies that



Crnogorski Telekom A.D.

Moskovska 29, Podgorica, Montenegro

achieved „**Best in Test**“ with a

Total Score of 525 of 1000

in the **Mobile Benchmark Montenegro 06/2016.**

(Score 266 of 400 in Telephony, Score 259 of 600 in Data Services)



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*Head of Network Testing
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Measurement Setup

	Voice	Data
Device	Sony Xperia Z5 (E6653) P3 attenuator	Samsung Galaxy Note4 LTE cat6 (SM-N910F) LTE/HSPA+ DC/HSUPA 5.76 Carrier Aggregation capable P3 attenuator
Test Cases	Mobile-to-Mobile (M2M) Side1 (4G preferred) to Side2 (3G preferred) Side1 (4G preferred) to Side2 (4G preferred) 115 sec call window 70 sec call duration 15 sec call setup timeout Email traffic injection on both sides (100KB) (1 email per call window)	Data 4G preferred HTTP DL data stream 10s HTTP UL data stream 10s HTTP 3MB DL fixed file transfer HTTP 1MB UL fixed file transfer Web browsing - Kepler ETSI ref. page (50% http, 50% https) 10 Live web pages (50% http, 50% https) YouTube HD/ SD video - 45s
Mobility and Route Types	100% Drivetest 52.18% in cities, 17.33% in towns and 30.5% on roads	
Samples	~ 3060 per Operator	~ 1200 per Operator/Service
Dates	7 measurement days May 27th – June 4th, 2016	

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”.

Module	Infrastructure	Max.	Telekom	Operator 2	Operator 3
Voice	Total	400	266	251	249
	Overall	400	66%	63%	62%
Data	Total	600	259	241	201
	Overall	600	43%	40%	34%
TOTAL		1.000	525	492	450

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 Service Group

Data	Service Group	Max.	Telekom	Operator 2	Operator 3
Overall	Web Browsing	210	36%	30%	30%
	File Download	120	50%	48%	41%
	File Upload	120	39%	37%	28%
	YouTube	150	50%	51%	37%

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).

Voice M2M	Kpi Name	Unit	Telekom	Operator 2	Operator 3
Overall	Qualifier	[%]	95,0	94,8	95,1
	Call Setup Time	[s]	5,5	6,0	7,0
	AVG Speech Quality	[MOS-LQO]	3,6	3,3	3,4

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).

Data Overall	Kpi Name	Unit	Telekom	Operator 2	Operator 3
HTTP live page DL	Qualifier	[%]	86,7	83,7	64,2
	AVG Session Time	[s]	4,6	4,9	5,7
HTTP static page DL	Qualifier	[%]	92,5	90,9	93,1
	AVG Session Time	[s]	2,2	3,3	3,3
HTTP file DL 3MB	Qualifier	[%]	93,8	92,6	92,9
	AVG Session Time	[s]	4,0	3,3	5,1
	90% faster than	[kbit/s]	2980	4766	3205
	10% faster than	[kbit/s]	46243	34582	11927

Data Overall	Kpi Name	Unit	Telekom	Operator 2	Operator 3
HTTP file UL 1MB	Qualifier	[%]	90,3	89,8	88,5
	AVG Session Time	[s]	3,1	3,4	6,4
	90% faster than	[kbit/s]	1034	1375	716
	10% faster than	[kbit/s]	9716	7759	2831
HTTP DL FDTT 10s	Qualifier	[%]	93,2	93,6	93,7
	AVG throughput	[kbit/s]	38563	25979	9470
	90% faster than	[kbit/s]	3685	5674	3260
	10% faster than	[kbit/s]	82728	48807	16822
HTTP UL FDTT 10s	Qualifier	[%]	92,5	92,0	94,1
	AVG throughput	[kbit/s]	18475	13623	1649
	90% faster than	[kbit/s]	791	1217	492
	10% faster than	[kbit/s]	43521	36681	2982
YouTube	Qualifier	[%]	90,4	90,7	90,9
	Start Time	[s]	2,4	2,7	2,9
	Playouts w/o interruptions	[%]	99,5	99,4	98,7
	AVG Resolution	[p]	605,2	591,7	360,0
	HD Share	[%]	68,1	64,4	0,0