Uplink (from Mobile to Antenna) :

1) Sensitivity of reception of Antenna = EIRP + (Antenna gain + Antenna Reciver Diversity + Antenna Low Received powerAmplifier - Antenna Cables and connectors loss - Antenna Duplexer) - U_PathLoss - Shadowing - Fading;
2) EIRP = Power of the mobile + Mobil Antenna Gain - Mobil Internal loss = 21 + 0 - 0 = 21dBm;
Then : 1) **U_PathLoss** = 21 + (17 + 5 + 2 - 3 - 2) - 8 - 2 + 120 = 150dB
2) **R_PathLoss** = 21 + (17 + 5 + 2 - 3 - 2) - 4 - 2 + 120 = 154dB

Downlink (from Antenna to Mobile) :

1) Sensitivity of reception of Mobil = EIRP + (Mobil antenna Gain - Mobil internal loss) - U_PathLoss - Shadowing - Fading
2) EIRP = Power of Base Station + Antenna Gain + Antenna Cables and connector loss + Antenna Duplexer) = 46 + 17 - 3 - 2 = 58 dBm
3) Sensitivity of reception 2 = -105dBm = 58dBm + (0 - 0) - U_PathLoss - 8dB - 2 dB
Then : 1) **U_PathLoss** = 58 + 105 - 8 - 2 = 153dB
2) **R_PathLoss** = 58 + 105 - 4 - 2 = 157dB

Loss	Urban 1	Rural 2
Shadowing	8	4
Fading	2	2

	Urban	Rural
Uplink Path-Loss	150	154
Downlink path-loss	153	157

259

EIRP_of_Mobile	141	dBm
Total_Gain1	19	dBm
EIRP_of_Station	163	dBm
Total_Gain2	0	dBm

Radio planning	Base station	Power of the Base station	46	dBm
		Antenna gain 1	17	dB
		Cables and connectors loss	3	dB
		Duplexer	2	dB
		Receiver diversity	5	dB
		Low received power amplifier	2	dB
		Sensisivity of reception 1	-120	dBm
	Mobile	Power of the mobile	21	dBm
		antenna gain 2	0	dB
		Internal loss	0	dB
		Sensitivity of reception 2	-105	dBm

Generated Traffic per Client :

1) Total area (km²) = Rural Zone + Urban Zone = 5176 + 105 = 5281 km²
2) Total ajusted traffic (Erlang) =Total considered area * Propagation coefficient * Ratio Signal/Interference (C/I)= 5281 * 3,5 * 1,14 = 21071,9 Erlang
3) Average trafic (km²) = Total ajusted traffic / Total area = 21071,9 / 5281 = 3,99 Erlang
4) Total trafic in urban area (Erlang) = Average trafic / km² * Urban Zone = 3,99 * 105 = 418,95 Erlang
5) Total trafic in rural area (Erlang) = Average trafic / km² * Rural Zone = 3,99 * 5176 = 20652,24 Erlang

Dimensionning	Demand	Number of clients in urban area	175000	Clients			Total_Gain2
		Number of clients in rural area	1750	Clients			
		Generated traffic per client	0.1	Erlang			Generated Traffic per Client :
		Considered rural area	5176	km2			1) Total area (km²) = Rural Zone + Urban Zone
		Considered urban area	105	km2			2) Total ajusted traffic (Erlang) =Total considerec
		Propagation coefficient	3.5				3) Average trafic (km²) = Total ajusted traffic / T
	Ressources	Ratio of Signal / Interference C/I	1.14	sans unité			4) Total trafic in urban area (Erlang) = Average tı
		Frequency reuse pattern size	1				5) Total trafic in rural area (Erlang) = Average tra
		Bandwidth	5	10	15	20	Then : **Generated traffic per client (in Erlang)** =
		Number of radio resources per cell	25	50	75	100	rural area) = (418,95 + 20652,24) / (175000+175
		Traffic in Erlang per cell	17.51	40.26	63.9	87.97	with table Erlang B with excel it is p
		Traffic per client	0.166667	0.166667	0.166667	0.166667	info in PPT(with 1/6 per hour)
		Number of clients per cell	105.06	241.56	383.4	527.82	
		Blockage probability	2%	2%	2%	2%	info in PPT
Joint Dimensionning & Planning	Urban zones	Number of cells	1666	725	457	332	with excel it is p
		Area of one cell	0.06302521	0.144827586	0.2297593	0.31626506	
		Radius	155.7511306	236.1020202	297.379212	348.8989516	**Area of one cell = (3*(R/1000)² * sqrt(3))/2**
		Urban path-loss	84.73509227	91.05848961	94.56587122	96.99448826	**113 + 35 log10 (Radius/1000)**
		Optimised base station power	-23	-16	-13	-11	
		Optimised mobile power	-45	-38	-35	-33	
	Rural zones	Number of cells	17	8	5	4	with excel it is p
		Area of one cell	304.4705882	647	1035.2	1294	
		Radius	10825.46923	15780.69758	19961.17897	22317.27654	
		Urban path-loss	136.2056355	141.9344169	145.5065166	147.2024418	
		Optimised base station power	26	31	35	37	
		Optimised mobile power	4	9	13	15	105.06

	Costs in k€	5 MHz	10 MHz	15 MHz	20 MHz	with excel it is possible to illustrate the results with a graphic
Fixed cost	2.6 GHz Frequency licence cost	2500	5000	7500	10000	Capex=Number of cells(Urban+Rural)×Installation Cost per Base Station
	23 GHz point-to-point cost	100	100	100	100	
	Capex	25245	10995	6930	5040	

Income/Outcome - 10 years	5MHz-Profitability	k€	Fixed costs	Opex	Income	Profitability	Fixed costs（first year） = Capex+2.6 GHz Frequency License Cost+23 GHz Point-to-Point Cost
		Year 1	27845	8415	3535	-32725	Fixed costs (except first year)= 2.6 GHz Frequency License Cost+23 GHz Point-to-Point Cost
		Year 2	0	8415	3535	-37605	
		Year 3	0	8415	3535	-42485	Opex = Operating Investments (electricity, maintenance, etc.) = 5k€
		Year 4	0	8415	3535	-47365	Income = Price od client suscription × total client = 20× total client
		Year 5	0	8415	3535	-52245	
		Year 6	0	8415	3535	-57125	Profitability(first year) = Income - Fixed Costs - Opex
		Year 7	0	8415	3535	-62005	Profitability(except first year) = Income - Opex + Profitability(last year)
		Year 8	0	8415	3535	-66885	
		Year 9	0	8415	3535	-71765	
		Year 10	0	8415	3535	-76645	