

ANEXOS

Anexo 1: Coeficientes de polarización lineal y circular

Tabla A1.1: Coeficientes de polarización lineal y circular

Frecuencia	$K_h$	$\alpha_h$	$K_v$	$\alpha_v$	$K_c$	$\alpha_c$
4.0	0.0001070	1.6009	0.0002461	1.2475	0.000176560	1.35465686
4.5	0.0001340	1.6948	0.0002347	1.3987	0.000184345	1.50624702
5.0	0.0002159	1.6969	0.0002428	1.5317	0.000229323	1.60948798
5.5	0.0003897	1.6499	0.0003115	1.5882	0.000350613	1.62252335
6.0	0.0007024	1.5900	0.0004878	1.5728	0.000595104	1.58295927
6.5	0.0011965	1.5328	0.0008370	1.5254	0.001016708	1.52976513
7.0	0.0019060	1.4810	0.0014248	1.4745	0.001665385	1.47823102
7.5	0.0028635	1.4339	0.0022911	1.4265	0.002577272	1.43060467
8.0	0.0041028	1.3905	0.0034498	1.3797	0.003776303	1.38558968
8.5	0.0056521	1.3510	0.0049105	1.3335	0.005281282	1.34282613
9.0	0.0075227	1.3155	0.0066908	1.2895	0.007106729	1.30324445
9.5	0.0097025	1.2842	0.0088128	1.2499	0.009257619	1.26788083
10.0	0.0121582	1.2571	0.0112919	1.2156	0.011725047	1.23713664
10.5	0.0148443	1.2339	0.0141289	1.1865	0.014486587	1.2107643
11.0	0.0177135	1.2140	0.0173073	1.1617	0.017510408	1.1881603
11.5	0.0207262	1.1971	0.0207949	1.1403	0.020760580	1.16864079
12.0	0.0238549	1.1825	0.0245483	1.1216	0.024201635	1.15159738
12.5	0.0270848	1.1698	0.0285185	1.1050	0.027801620	1.13654965
13.0	0.0304115	1.1586	0.0326560	1.0901	0.031533755	1.12313943
13.5	0.0338386	1.1486	0.0369155	1.0767	0.035377058	1.11110284
14.0	0.0373744	1.1396	0.0412583	1.0646	0.039316336	1.10024064
14.5	0.0410292	1.1312	0.0456544	1.0538	0.043341789	1.09039479
15.0	0.0448143	1.1233	0.0500825	1.0440	0.047448398	1.08143293
15.5	0.0487404	1.1158	0.0545300	1.0352	0.051635207	1.07323922
16.0	0.0528172	1.1086	0.0589919	1.0273	0.055904565	1.06570965
16.5	0.0570533	1.1017	0.0634695	1.0202	0.060261380	1.05874987
17.0	0.0614559	1.0949	0.0679690	1.0137	0.064712429	1.05227443
17.5	0.0660311	1.0883	0.0725004	1.0079	0.069265742	1.04620653
18.0	0.0707840	1.0818	0.0770761	1.0025	0.073930082	1.04047795
18.5	0.0757187	1.0754	0.0817103	0.9976	0.078714514	1.03502884
19.0	0.0808385	1.0691	0.0864176	0.9930	0.083628065	1.02980742
19.5	0.0861458	1.0629	0.0912131	0.9887	0.088679461	1.02476944
20.0	0.0916427	1.0568	0.0961112	0.9847	0.093876935	1.01987763
20.5	0.0973303	1.0507	0.1011259	0.9808	0.099228094	1.01510101
21.0	0.1032095	1.0447	0.1062702	0.9771	0.104739823	1.0104142
21.5	0.1092806	1.0388	0.1115559	0.9735	0.110418233	1.0057967
22.0	0.1155435	1.0329	0.1169938	0.9700	0.116268631	1.00123226
22.5	0.1219976	1.0271	0.1225934	0.9665	0.122295514	0.99670821
23.0	0.1286420	1.0214	0.1283632	0.9630	0.128502572	0.99221495
23.5	0.1354753	1.0157	0.1343101	0.9595	0.134892709	0.98774543
24.0	0.1424958	1.0101	0.1404403	0.9561	0.141468064	0.98329468
24.5	0.1497016	1.0046	0.1467585	0.9526	0.148230041	0.97885946
25.0	0.1570902	0.9991	0.1532685	0.9491	0.155179343	0.97443792
25.5	0.1646589	0.9937	0.1599731	0.9456	0.162316005	0.97002931
26.0	0.1724048	0.9884	0.1668741	0.9421	0.169639431	0.96563377
26.5	0.1803246	0.9832	0.1739722	0.9385	0.177148429	0.9612521
27.0	0.1884149	0.9780	0.1812676	0.9349	0.184841249	0.95688563
27.5	0.1966718	0.9729	0.1887595	0.9313	0.192715620	0.95253606
28.0	0.2050913	0.9679	0.1964463	0.9277	0.200768786	0.94820533
28.5	0.2136692	0.9629	0.2043259	0.9240	0.208997539	0.9438956
29.0	0.2224010	0.9580	0.2123955	0.9203	0.217398259	0.9396091
29.5	0.2312823	0.9532	0.2206516	0.9166	0.225966946	0.9353481
30.0	0.2403082	0.9485	0.2290903	0.9129	0.234699254	0.93111488

**Anexo 2: Atenuación específica para polarización circular en las capitales  
del Perú**

Tabla A2.1: Atenuación específica para polarización circular en las ciudades de Moquegua, Tacna, Arequipa, Ica, Lima, Piura, Chiclayo y Trujillo

Frecuencia	Moquegua	Tacna	Arequipa	Ica	Lima	Piura	Chiclayo	Trujillo
4	0.0036	0.0051	0.0057	0.0076	0.0085	0.0138	0.0143	0.0173
4.5	0.0052	0.0078	0.0088	0.0121	0.0137	0.0234	0.0244	0.0302
5	0.0082	0.0125	0.0142	0.0200	0.0229	0.0406	0.0425	0.0533
5.5	0.0129	0.0197	0.0225	0.0317	0.0363	0.0648	0.0677	0.0852
6	0.0200	0.0303	0.0345	0.0483	0.0550	0.0968	0.1011	0.1265
6.5	0.0304	0.0454	0.0515	0.0711	0.0808	0.1394	0.1454	0.1805
7	0.0444	0.0655	0.0739	0.1010	0.1141	0.1934	0.2015	0.2484
7.5	0.0619	0.0900	0.1012	0.1369	0.1542	0.2568	0.2672	0.3271
8	0.0820	0.1179	0.1321	0.1771	0.1986	0.3256	0.3383	0.4115
8.5	0.1043	0.1483	0.1655	0.2199	0.2458	0.3968	0.4118	0.4980
9	0.1285	0.1809	0.2012	0.2651	0.2953	0.4701	0.4874	0.5861
9.5	0.1548	0.2158	0.2394	0.3131	0.3477	0.5466	0.5661	0.6773
10	0.1831	0.2532	0.2802	0.3640	0.4033	0.6271	0.6489	0.7730
10.5	0.2133	0.2931	0.3235	0.4180	0.4621	0.7118	0.7360	0.8735
11	0.2452	0.3349	0.3690	0.4745	0.5236	0.8000	0.8267	0.9780
11.5	0.2784	0.3783	0.4162	0.5329	0.5871	0.8908	0.9200	1.0854
12	0.3125	0.4227	0.4644	0.5925	0.6518	0.9830	1.0148	1.1944
12.5	0.3472	0.4677	0.5133	0.6528	0.7172	1.0759	1.1102	1.3039
13	0.3823	0.5131	0.5625	0.7134	0.7829	1.1688	1.2057	1.4132
13.5	0.4175	0.5587	0.6119	0.7740	0.8486	1.2615	1.3008	1.5222
14	0.4530	0.6044	0.6613	0.8347	0.9143	1.3538	1.3956	1.6306
14.5	0.4885	0.6502	0.7108	0.8953	0.9799	1.4459	1.4901	1.7386
15	0.5243	0.6961	0.7605	0.9560	1.0456	1.5379	1.5846	1.8465
15.5	0.5603	0.7423	0.8104	1.0170	1.1115	1.6301	1.6791	1.9544
16	0.5965	0.7888	0.8606	1.0783	1.1777	1.7226	1.7741	2.0627
16.5	0.6331	0.8357	0.9113	1.1401	1.2445	1.8158	1.8697	2.1717
17	0.6702	0.8831	0.9624	1.2025	1.3119	1.9097	1.9660	2.2816
17.5	0.7077	0.9311	1.0142	1.2656	1.3801	2.0045	2.0634	2.3924
18	0.7458	0.9798	1.0668	1.3295	1.4491	2.1005	2.1617	2.5045
18.5	0.7846	1.0291	1.1200	1.3943	1.5190	2.1975	2.2613	2.6178
19	0.8239	1.0793	1.1741	1.4600	1.5899	2.2958	2.3621	2.7325
19.5	0.8640	1.1303	1.2290	1.5266	1.6618	2.3954	2.4642	2.8486
20	0.9047	1.1821	1.2848	1.5943	1.7348	2.4962	2.5675	2.9660
20.5	0.9462	1.2347	1.3415	1.6630	1.8088	2.5982	2.6722	3.0848
21	0.9884	1.2882	1.3991	1.7327	1.8838	2.7015	2.7780	3.2048
21.5	1.0314	1.3426	1.4576	1.8033	1.9599	2.8060	2.8851	3.3262
22	1.0751	1.3978	1.5170	1.8750	2.0370	2.9116	2.9933	3.4487
22.5	1.1195	1.4538	1.5772	1.9475	2.1150	3.0183	3.1026	3.5723
23	1.1646	1.5106	1.6383	2.0210	2.1940	3.1260	3.2129	3.6970
23.5	1.2104	1.5682	1.7001	2.0953	2.2739	3.2346	3.3241	3.8225
24	1.2570	1.6266	1.7627	2.1705	2.3545	3.3440	3.4362	3.9489
24.5	1.3041	1.6857	1.8261	2.2464	2.4360	3.4542	3.5490	4.0760
25	1.3519	1.7454	1.8902	2.3230	2.5181	3.5651	3.6624	4.2037
25.5	1.4003	1.8058	1.9548	2.4003	2.6010	3.6766	3.7765	4.3319
26	1.4493	1.8668	2.0201	2.4781	2.6843	3.7885	3.8910	4.4604
26.5	1.4988	1.9283	2.0860	2.5565	2.7683	3.9008	4.0059	4.5893
27	1.5487	1.9904	2.1523	2.6354	2.8526	4.0135	4.1210	4.7183
27.5	1.5992	2.0529	2.2191	2.7147	2.9374	4.1263	4.2364	4.8474
28	1.6501	2.1158	2.2863	2.7943	3.0225	4.2393	4.3518	4.9764
28.5	1.7013	2.1790	2.3538	2.8742	3.1078	4.3523	4.4673	5.1054
29	1.7530	2.2426	2.4217	2.9544	3.1933	4.4652	4.5827	5.2341
29.5	1.8049	2.3065	2.4898	3.0347	3.2790	4.5780	4.6979	5.3624
30	1.8571	2.3705	2.5580	3.1151	3.3647	4.6906	4.8129	5.4904

Tabla A2.2: Atenuación específica para polarización circular en las ciudades de Puno, Tumbes, Abancay, Huancavelica, Pasco, Huaraz, Cusco y Ayacucho

Frecuencia	Puno	Tumbes	Abancay	Huancavelica	Pasco	Huaraz	Cusco	Ayacucho
4	0.0181	0.0231	0.0284	0.0295	0.0316	0.0325	0.0327	0.0343
4.5	0.0318	0.0417	0.0523	0.0546	0.0590	0.0608	0.0611	0.0646
5	0.0562	0.0752	0.0959	0.1003	0.1090	0.1126	0.1132	0.1201
5.5	0.0899	0.1205	0.1539	0.1611	0.1752	0.1811	0.1820	0.1932
6	0.1333	0.1774	0.2252	0.2355	0.2556	0.2639	0.2653	0.2812
6.5	0.1899	0.2503	0.3152	0.3291	0.3561	0.3674	0.3692	0.3906
7	0.2608	0.3405	0.4256	0.4437	0.4789	0.4935	0.4959	0.5236
7.5	0.3430	0.4440	0.5508	0.5735	0.6175	0.6357	0.6387	0.6733
8	0.4308	0.5532	0.6818	0.7089	0.7615	0.7833	0.7869	0.8280
8.5	0.5206	0.6633	0.8122	0.8436	0.9041	0.9291	0.9333	0.9805
9	0.6119	0.7741	0.9422	0.9775	1.0455	1.0735	1.0782	1.1311
9.5	0.7063	0.8879	1.0749	1.1140	1.1894	1.2205	1.2256	1.2841
10	0.8053	1.0067	1.2131	1.2562	1.3391	1.3732	1.3788	1.4430
10.5	0.9092	1.1312	1.3577	1.4049	1.4955	1.5328	1.5390	1.6090
11	1.0172	1.2604	1.5077	1.5591	1.6578	1.6983	1.7050	1.7812
11.5	1.1282	1.3930	1.6614	1.7171	1.8239	1.8678	1.8750	1.9574
12	1.2407	1.5273	1.8169	1.8769	1.9919	2.0391	2.0468	2.1354
12.5	1.3538	1.6620	1.9726	2.0369	2.1600	2.2105	2.2189	2.3136
13	1.4667	1.7963	2.1277	2.1962	2.3273	2.3811	2.3900	2.4908
13.5	1.5791	1.9298	2.2817	2.3544	2.4933	2.5503	2.5597	2.6665
14	1.6910	2.0624	2.4345	2.5113	2.6581	2.7182	2.7281	2.8408
14.5	1.8024	2.1944	2.5865	2.6674	2.8218	2.8851	2.8955	3.0140
15	1.9137	2.3261	2.7380	2.8229	2.9849	3.0513	3.0622	3.1865
15.5	2.0250	2.4578	2.8895	2.9783	3.1480	3.2174	3.2289	3.3589
16	2.1367	2.5898	3.0413	3.1341	3.3114	3.3839	3.3959	3.5317
16.5	2.2491	2.7226	3.1938	3.2907	3.4755	3.5512	3.5637	3.7052
17	2.3623	2.8564	3.3475	3.4483	3.6408	3.7196	3.7326	3.8799
17.5	2.4766	2.9913	3.5024	3.6073	3.8075	3.8894	3.9029	4.0560
18	2.5922	3.1276	3.6588	3.7678	3.9757	4.0607	4.0747	4.2337
18.5	2.7090	3.2653	3.8168	3.9299	4.1456	4.2337	4.2483	4.4132
19	2.8272	3.4045	3.9764	4.0936	4.3171	4.4085	4.4236	4.5944
19.5	2.9467	3.5453	4.1377	4.2591	4.4904	4.5850	4.6006	4.7773
20	3.0677	3.6876	4.3006	4.4261	4.6654	4.7631	4.7793	4.9620
20.5	3.1900	3.8314	4.4650	4.5948	4.8419	4.9429	4.9596	5.1483
21	3.3137	3.9765	4.6309	4.7648	5.0200	5.1242	5.1414	5.3360
21.5	3.4387	4.1230	4.7982	4.9363	5.1994	5.3068	5.3245	5.5252
22	3.5648	4.2707	4.9666	5.1090	5.3800	5.4906	5.5089	5.7155
22.5	3.6920	4.4196	5.1362	5.2827	5.5616	5.6755	5.6943	5.9069
23	3.8203	4.5694	5.3067	5.4574	5.7442	5.8613	5.8806	6.0992
23.5	3.9494	4.7200	5.4780	5.6329	5.9275	6.0478	6.0676	6.2921
24	4.0794	4.8715	5.6500	5.8089	6.1114	6.2348	6.2552	6.4856
24.5	4.2101	5.0235	5.8224	5.9854	6.2957	6.4222	6.4431	6.6793
25	4.3413	5.1760	5.9951	6.1623	6.4801	6.6098	6.6312	6.8732
25.5	4.4730	5.3288	6.1680	6.3392	6.6647	6.7974	6.8193	7.0671
26	4.6051	5.4818	6.3409	6.5161	6.8491	6.9849	7.0073	7.2607
26.5	4.7375	5.6349	6.5137	6.6928	7.0333	7.1721	7.1950	7.4539
27	4.8700	5.7879	6.6862	6.8692	7.2170	7.3588	7.3821	7.6466
27.5	5.0025	5.9407	6.8582	7.0451	7.4001	7.5448	7.5687	7.8386
28	5.1349	6.0932	7.0297	7.2203	7.5825	7.7302	7.7545	8.0297
28.5	5.2672	6.2453	7.2005	7.3949	7.7641	7.9146	7.9394	8.2199
29	5.3992	6.3969	7.3705	7.5686	7.9447	8.0979	8.1232	8.4089
29.5	5.5309	6.5479	7.5396	7.7412	8.1242	8.2802	8.3059	8.5966
30	5.6621	6.6981	7.7076	7.9128	8.3024	8.4611	8.4872	8.7830

Tabla A2.3: Atenuación específica para polarización Circular en las ciudades de Huancayo, Cajamarca, Huánuco, Puerto Maldonado, Moyobamba, Chachapoyas, Pucallpa e Iquitos.

Frecuencia	Huanca yo	Cajamarc a	Huánuc o	Puerto Maldonado	Moyobamba	Chachapo yas	Pucallp a	Iquitos
4	0.0344	0.0413	0.0472	0.0561	0.0600	0.0602	0.0819	0.1052
4.5	0.0648	0.0793	0.0920	0.1115	0.1204	0.1208	0.1699	0.2245
5	0.1205	0.1495	0.1753	0.2152	0.2335	0.2344	0.3375	0.4544
5.5	0.1939	0.2408	0.2828	0.3477	0.3776	0.3791	0.5474	0.7388
6	0.2821	0.3486	0.4078	0.4988	0.5405	0.5427	0.7766	1.0405
6.5	0.3918	0.4807	0.5594	0.6797	0.7345	0.7374	1.0425	1.3832
7	0.5251	0.6399	0.7408	0.8943	0.9639	0.9675	1.3520	1.7768
7.5	0.6752	0.8175	0.9420	1.1302	1.2152	1.2196	1.6861	2.1964
8	0.8303	0.9993	1.1463	1.3675	1.4670	1.4722	2.0146	2.6026
8.5	0.9831	1.1765	1.3439	1.5946	1.7068	1.7127	2.3211	2.9750
9	1.1341	1.3500	1.5360	1.8133	1.9371	1.9435	2.6105	3.3215
9.5	1.2873	1.5252	1.7293	2.0323	2.1672	2.1742	2.8970	3.6620
10	1.4466	1.7068	1.9293	2.2585	2.4047	2.4122	3.1919	4.0119
10.5	1.6129	1.8964	2.1380	2.4945	2.6523	2.6605	3.4994	4.3771
11	1.7854	2.0928	2.3542	2.7388	2.9088	2.9176	3.8180	4.7557
11.5	1.9619	2.2937	2.5753	2.9885	3.1709	3.1803	4.1434	5.1424
12	2.1403	2.4966	2.7983	3.2403	3.4351	3.4451	4.4712	5.5317
12.5	2.3188	2.6994	3.0211	3.4916	3.6986	3.7093	4.7977	5.9192
13	2.4963	2.9008	3.2422	3.7408	3.9599	3.9712	5.1208	6.3023
13.5	2.6724	3.1004	3.4612	3.9873	4.2183	4.2302	5.4400	6.6801
14	2.8470	3.2982	3.6780	4.2313	4.4739	4.4864	5.7553	7.0532
14.5	3.0205	3.4946	3.8932	4.4732	4.7274	4.7405	6.0677	7.4225
15	3.1934	3.6902	4.1074	4.7140	4.9795	4.9932	6.3782	7.7895
15.5	3.3661	3.8855	4.3213	4.9543	5.2312	5.2455	6.6880	8.1554
16	3.5391	4.0811	4.5356	5.1949	5.4831	5.4980	6.9981	8.5217
16.5	3.7130	4.2776	4.7507	5.4364	5.7361	5.7515	7.3093	8.8891
17	3.8880	4.4754	4.9671	5.6794	5.9905	6.0065	7.6221	9.2586
17.5	4.0644	4.6747	5.1852	5.9242	6.2467	6.2634	7.9372	9.6304
18	4.2425	4.8757	5.4051	6.1709	6.5051	6.5223	8.2545	10.0049
18.5	4.4222	5.0786	5.6270	6.4198	6.7655	6.7833	8.5744	10.3821
19	4.6037	5.2834	5.8508	6.6708	7.0282	7.0466	8.8966	10.7618
19.5	4.7870	5.4900	6.0766	6.9238	7.2928	7.3119	9.2210	11.1439
20	4.9720	5.6985	6.3043	7.1787	7.5595	7.5791	9.5474	11.5279
20.5	5.1586	5.9086	6.5336	7.4353	7.8278	7.8480	9.8755	11.9136
21	5.3467	6.1202	6.7645	7.6934	8.0977	8.1185	10.2050	12.3004
21.5	5.5362	6.3332	6.9967	7.9528	8.3687	8.3901	10.5354	12.6879
22	5.7269	6.5473	7.2300	8.2132	8.6407	8.6627	10.8665	13.0755
22.5	5.9186	6.7624	7.4641	8.4744	8.9134	8.9360	11.1978	13.4630
23	6.1112	6.9782	7.6989	8.7360	9.1865	9.2097	11.5290	13.8496
23.5	6.3044	7.1946	7.9342	8.9977	9.4596	9.4834	11.8596	14.2350
24	6.4982	7.4113	8.1695	9.2594	9.7325	9.7569	12.1894	14.6188
24.5	6.6923	7.6281	8.4048	9.5207	10.0049	10.0298	12.5179	15.0004
25	6.8865	7.8448	8.6399	9.7814	10.2766	10.3021	12.8447	15.3795
25.5	7.0806	8.0613	8.8743	10.0413	10.5472	10.5732	13.1697	15.7558
26	7.2746	8.2772	9.1081	10.3000	10.8166	10.8431	13.4924	16.1288
26.5	7.4681	8.4924	9.3409	10.5573	11.0844	11.1115	13.8126	16.4982
27	7.6611	8.7068	9.5725	10.8132	11.3504	11.3781	14.1301	16.8637
27.5	7.8534	8.9202	9.8029	11.0672	11.6146	11.6427	14.4444	17.2251
28	8.0448	9.1323	10.0317	11.3193	11.8765	11.9051	14.7556	17.5820
28.5	8.2353	9.3431	10.2588	11.5692	12.1361	12.1652	15.0633	17.9344
29	8.4245	9.5523	10.4842	11.8169	12.3932	12.4228	15.3673	18.2818
29.5	8.6126	9.7600	10.7075	12.0621	12.6477	12.6777	15.6675	18.6243
30	8.7992	9.9658	10.9288	12.3047	12.8993	12.9298	15.9637	18.9616

**Anexo 3: Atenuación por lluvia para las Bandas C, Ku y Ka para 0.01%, 0.1%, 0.5% y 1% de Probabilidad**

Tabla A3.1: Datos de atenuación para las Bandas C, Ku y Ka, con tasa de probabilidad de 0.01%.

n°	Capital	30 GHz	20 GHz	14 GHz	12 GHz	6 GHz	4 GHz
1	Moquegua	12.3687	5.5857	2.4995	1.7927	0.1093	0.0198
2	Tacna	18.8602	8.5589	3.8064	2.7764	0.1847	0.0320
3	Arequipa	12.9747	6.0131	2.7201	2.0159	0.1381	0.0235
4	Ica	23.4561	10.8135	4.8254	3.6033	0.2631	0.0433
5	Lima	27.0146	12.6662	5.6357	4.2258	0.3160	0.0514
6	Piura	33.2354	16.3300	7.5122	5.7943	0.4818	0.0739
7	Chiclayo	34.7051	17.0168	7.8609	6.0619	0.5071	0.0776
8	Trujillo	38.2932	18.8280	8.8291	6.8561	0.5990	0.0900
9	Puno	14.9616	7.3737	3.4175	2.7369	0.2465	0.0360
10	Tumbes	43.2173	21.5081	10.1472	7.9846	0.7648	0.1113
11	Abancay	30.2760	15.2406	7.1418	5.7560	0.5576	0.0787
12	Huancavelica	17.3951	8.9753	4.2561	3.5093	0.3512	0.0485
13	Cerro De Pasco	12.9656	6.7842	3.2954	2.7514	0.2838	0.0384
14	Huaraz	22.9375	11.8050	5.6270	4.6336	0.4691	0.0644
15	Cusco	21.4931	11.0312	5.2369	4.3108	0.4365	0.0600
16	Ayacucho	29.7586	15.1385	7.2040	5.8337	0.5960	0.0823
17	Huancayo	23.2572	11.9631	5.7192	4.6984	0.4820	0.0659
18	Cajamarca	31.7490	16.3317	7.8248	6.4041	0.6937	0.0938
19	Huánuco	43.3580	22.0159	10.4229	8.4533	0.9555	0.1292
20	Puerto Maldonado	62.4984	31.0514	14.4114	11.5552	1.3677	0.1852
21	Moyobamba	56.5831	28.6594	13.5061	10.9645	1.3381	0.1783
22	Chachapoyas	40.8665	21.1042	10.0861	8.3226	1.0035	0.1317
23	Pucallpa	73.9094	37.0865	17.2922	14.0138	1.8729	0.2458
24	Iquitos	84.6907	42.5046	19.7306	16.0964	2.2177	0.2882

Tabla A3.2: Datos de atenuación para las Bandas C, Ku y Ka, con tasa de probabilidad de 0.1%.

n°	Capital	30 GHz	20 GHz	14 GHz	12 GHz	6 GHz	4 GHz
1	Moquegua	5.0615	2.1050	0.8666	0.6006	0.0274	0.0042
2	Tacna	7.9946	3.3429	1.3670	0.9650	0.0485	0.0070
3	Arequipa	5.3793	2.3021	0.9592	0.6891	0.0358	0.0051
4	Ica	10.5570	4.4917	1.8436	1.3356	0.0744	0.0102
5	Lima	12.5846	5.4551	2.2318	1.6243	0.0929	0.0125
6	Piura	16.8683	7.6998	3.2683	2.4540	0.1577	0.0199
7	Chiclayo	17.4453	7.9450	3.3879	2.5432	0.1645	0.0207
8	Trujillo	19.2123	8.7763	3.8049	2.8783	0.1953	0.0241
9	Puno	6.3419	2.9046	1.2431	0.9729	0.0683	0.0082
10	Tumbes	22.9229	10.6124	4.6318	3.5553	0.2671	0.0318
11	Abancay	14.1076	6.6141	2.8653	2.2582	0.1718	0.0198
12	Huancavelica	7.7042	3.7117	1.6291	1.3167	0.1038	0.0117
13	Cerro De Pasco	5.6865	2.7823	1.2541	1.0277	0.0838	0.0092
14	Huaraz	10.7822	5.1801	2.2867	1.8454	0.1474	0.0165
15	Cusco	9.6857	4.6392	2.0388	1.6447	0.1314	0.0147
16	Ayacucho	13.8899	6.5881	2.9029	2.2999	0.1855	0.0209
17	Huancayo	10.6939	5.1346	2.2740	1.8305	0.1483	0.0165
18	Cajamarca	15.7964	7.5848	3.3672	2.6993	0.2322	0.0255
19	Huánuco	21.7260	10.2837	4.5056	3.5757	0.3224	0.0354
20	Puerto Maldonado	31.8672	14.7258	6.3119	4.9464	0.4693	0.0517
21	Moyobamba	30.3387	14.3208	6.2427	4.9596	0.4868	0.0526
22	Chachapoyas	21.1009	10.1757	4.5050	3.6440	0.3529	0.0375
23	Pucallpa	39.9052	18.6429	8.0318	6.3688	0.6910	0.0735
24	Iquitos	48.8304	22.8175	9.7822	7.8138	0.8767	0.0922

Tabla A3.3: Datos de atenuación para las Bandas C, Ku y Ka, con tasa de probabilidad de 0.5%.

n°	Capital	30 GHz	20 GHz	14 GHz	12 GHz	6 GHz	4 GHz
1	Moquegua	1.9234	0.7552	0.2933	0.1984	0.0074	0.0010
2	Tacna	3.1338	1.2375	0.4772	0.3292	0.0136	0.0017
3	Arequipa	2.0503	0.8299	0.3265	0.2295	0.0098	0.0012
4	Ica	4.1953	1.6876	0.6534	0.4634	0.0213	0.0026
5	Lima	5.0469	2.0709	0.7990	0.5695	0.0270	0.0032
6	Piura	6.8424	2.9666	1.1904	0.8771	0.0471	0.0052
7	Chiclayo	7.1042	3.0727	1.2390	0.9127	0.0493	0.0054
8	Trujillo	7.8851	3.4215	1.4042	1.0429	0.0593	0.0064
9	Puno	2.4413	1.0623	0.4300	0.3312	0.0195	0.0020
10	Tumbes	9.4679	4.1672	1.7225	1.2994	0.0824	0.0085
11	Abancay	5.7082	2.5464	1.0442	0.8102	0.0520	0.0052
12	Huancavelica	2.9935	1.3747	0.5717	0.4556	0.0304	0.0030
13	Cerro De Pasco	2.1605	1.0086	0.4315	0.3490	0.0241	0.0023
14	Huaraz	4.2669	1.9536	0.8174	0.6504	0.0440	0.0043
15	Cusco	3.8226	1.7445	0.7264	0.5778	0.0391	0.0038
16	Ayacucho	5.6121	2.5347	1.0584	0.8258	0.0565	0.0055
17	Huancayo	4.2418	1.9409	0.8149	0.6466	0.0444	0.0043
18	Cajamarca	6.3918	2.9248	1.2311	0.9726	0.0712	0.0068
19	Huánuco	9.0045	4.0580	1.6842	1.3165	0.1014	0.0096
20	Puerto Maldonado	13.5777	5.9643	2.4182	1.8650	0.1516	0.0144
21	Moyobamba	12.7901	5.7471	2.3724	1.8566	0.1565	0.0146
22	Chachapoyas	8.6904	3.9950	1.6766	1.3374	0.1111	0.0102
23	Pucallpa	17.1717	7.6315	3.1111	2.4297	0.2278	0.0209
24	Iquitos	21.1592	9.4058	3.8144	3.0023	0.2918	0.0265

Tabla A3.4: Datos de atenuación para las Bandas C, Ku y Ka, con tasa de probabilidad de 1%.

n°	Capital	30 GHz	20 GHz	14 GHz	12 GHz	6 GHz	4 GHz
1	Moquegua	1.0202	0.3907	0.1480	0.0991	0.0034	0.0004
2	Tacna	1.6978	0.6541	0.2459	0.1680	0.0064	0.0008
3	Arequipa	1.0809	0.4271	0.1639	0.1142	0.0045	0.0005
4	Ica	2.2091	0.8674	0.3275	0.2302	0.0098	0.0011
5	Lima	2.6198	1.0499	0.3950	0.2790	0.0122	0.0014
6	Piura	3.3645	1.4268	0.5588	0.4084	0.0203	0.0021
7	Chiclayo	3.5450	1.4995	0.5903	0.4313	0.0216	0.0022
8	Trujillo	3.9921	1.6943	0.6791	0.5004	0.0264	0.0027
9	Puno	1.2837	0.5464	0.2159	0.1651	0.0090	0.0009
10	Tumbes	4.6198	1.9896	0.8033	0.6015	0.0354	0.0035
11	Abancay	3.0063	1.3127	0.5257	0.4052	0.0242	0.0023
12	Huancavelica	1.5399	0.6927	0.2814	0.2230	0.0138	0.0013
13	Cerro De Pasco	1.0799	0.4941	0.2066	0.1662	0.0107	0.0010
14	Huaraz	2.1503	0.9643	0.3942	0.3118	0.0196	0.0018
15	Cusco	1.9879	0.8886	0.3615	0.2858	0.0180	0.0016
16	Ayacucho	2.9444	1.3021	0.5312	0.4118	0.0262	0.0024
17	Huancayo	2.1865	0.9800	0.4020	0.3171	0.0203	0.0018
18	Cajamarca	3.1837	1.4270	0.5870	0.4609	0.0315	0.0028
19	Huánuco	4.6379	2.0464	0.8298	0.6444	0.0464	0.0041
20	Puerto Maldonado	7.2116	3.0995	1.2269	0.9398	0.0715	0.0064
21	Moyobamba	6.3959	2.8136	1.1345	0.8821	0.0696	0.0061
22	Chachapoyas	4.3181	1.9446	0.7975	0.6324	0.0492	0.0042
23	Pucallpa	8.8299	3.8407	1.5289	1.1862	0.1045	0.0090
24	Iquitos	10.4075	4.5279	1.7928	1.4022	0.1281	0.0109

Anexo 4: Especificaciones técnicas de antena de 0.74m – Satcom

# 0.74M Ka-Band Rx/Tx Antenna

## Series 3740

### Technical Specifications

Electrical		Ka-Band Circular	Ka-Band Circular	Ka-Band Linear
Antenna Size		0.74M	0.74M	0.74M
Operating Frequency (GHz)	Receive	20.20 - 21.20 GHz	18.30 - 21.20 GHz	18.70 - 21.20 GHz
	Transmit	30.00 - 31.00 GHz	29.20 - 31.00 GHz	27.00 - 31.00 GHz
Midband Gain (± .5dB)	Receive	42.10 dBi	41.60 dBi	41.90 dBi
	Transmit	45.30 dBi	45.20 dBi	45.00 dBi
VSWR		1.25:1 Max	1.3:1 Max	Rx: 1.5:1 Max Tx: 1.3:1 Max
Pattern Beamwidth (in degrees at midband)	-3 dB	Rx: 1.20° Tx: 0.80°	Rx: 1.20° Tx: 0.80°	Rx: 1.20° Tx: 0.80°
	-15 dB	Rx: 2.60° Tx: 1.80°	Rx: 2.60° Tx: 1.80°	Rx: 2.60° Tx: 1.80°
Sidelobe Envelope, Co-Pol (dBi) 100λ / D < θ ≤ 20° 20° < θ ≤ 26.3° 26.3° < θ ≤ 48° θ > 48°		29 - 25 Logθ dBi -3.5 dBi 32 - 25 Logθ dBi -10 dBi (averaged)	29 - 25 Logθ dBi -3.5 dBi 32 - 25 Logθ dBi -10 dBi (averaged)	29 - 25 Logθ dBi -3.5 dBi 32 - 25 Logθ dBi -10 dBi (averaged)
Antenna Noise Temperature				
5° Elevation		194 K	194 K	196 K
10° Elevation		144 K	144 K	147 K
20° Elevation		100 K	100 K	113 K
40° Elevation		90 K	90 K	93 K
Cross Polarization Isolation	On Axis	24.80 dB	Rx: 17.70 dB Tx: 21.30 dB	Rx: 30.00 dB Tx: 35.00 dB
	Within 1.0 dB Beamwidth	24.80 dB	Rx: 17.70 dB Tx: 21.30 dB	26 dB
Power Handling		100 W	100 W	100 W
Output Waveguide Interface Flange		Rx: WR42 Tx: WR28	Rx: WR42 Tx: WR28	Rx: WR42 Tx: WR28

Mechanical	
Reflector Material	Galvanized Steel with Powder Paint
Antenna Optics	1-piece Offset, Prime Focus
Mast Pipe Size	2.0" SCH 40 Pipe (2.375" OD) 60.3 mm
Elevation Adjustment Range	5° to 90° Continuous Fine Adjustment
Azimuth Adjustment Range	360° Continuous Coarse Adjustment, 10° Fine Adjustment
Polarization Adjustment Range	± 180° Continuous Coarse Adjustment
Shipping Specifications	
Approximate Net Weight:	20 Pounds (9kg)
Approximate Packaged Weight:	28 Pounds (12.7kg)

Environmental Performance		
Wind Loading	Operational	50 mph (80 km/h) (0.5dB Tx Loss)
	Survival	125 mph (201 km/h) with no permanent damage; 150mph (240 km/h) no breakaway.
Temperature Range	Operational	- 40° to 140° F (- 40° to 60° C)
	Survival	- 58° to 176° F (- 50° to 80° C)
Rain (operational)		1/2" (13mm) / hr
Atmospheric Conditions		Salt, Pollutants and Contaminants as Encountered in Coastal and Industrial Areas
Relative Humidity		0 to 100% With Condensation
Solar Radiation		360 BTU/h/ft²

Anexo 5: Especificaciones técnicas de antena para ET de 8.1m – Satcom

Technical Specifications

Model 8.1m Ka-Band Antenna

Electrical <sup>(1)</sup>	Ka-Band 4-Port Circular Polarized		Ka-Band 4-Port Linear Polarized	
	Receive	Transmit	Receive	Transmit
Frequency (GHz)	17.70 - 21.20	27.50 - 31.00	17.70 - 21.20	27.50 - 31.00
Antenna Gain, Midband (dBi)	62.10	64.70	62.10	64.80
VSWR	1.30:1	1.30:1	1.30:1	1.30:1
Pattern Beamwidth -3 dB, at midband	0.12°	0.09°	0.12°	0.09°
Antenna Noise Temperature (K)				
5° Elevation	213		207	
10° Elevation	171		164	
20° Elevation	136		128	
40° Elevation	111		104	
Typical G/T (dB/K) <sup>(2)</sup>				
19.45 GHz, 120 K LNA	38.0		38.2	
Axial Ratio (dB)	0.75	0.50		
Power Handling (total)	400 Watts		400 Watts	
Cross Polarization Isolation (dB)				
On Axis	27.3	27.3	30.0	30.0
Within 1.0 dB beamwidth	27.3	27.3	30.0	30.0
Port to Port Isolation (dB)				
Rx/Tx (Rx frequency)	0	-85	0	-85
Tx/Rx (Tx frequency)	-85	0	-85	0
Sidelobe Performance	ITU, EUTELSAT, WGS, FCC			
RF Specification	975-3862		975-3532	

(1) All values are at rear feed flange. (2) Typical G/T at 20° elevation with clear horizon using single bolt-on LNA to feed.

Mechanical/Environmental <sup>(1)</sup>	Kingpost Pedestal (KP120)	Kingpost Pedestal (KX200)
Antenna Diameter	8.1 meters (26.67 feet)	
Antenna Type	Cassegrain design	
Reflector Construction	16 precision-formed aluminum panels with heat-diffusing white paint Cleaned and brightened aluminum back-up structure	
Hub Dimensions	70 in (178 cm) OD, 36 in (91 cm) depth	
Mount Configuration	Elevation over azimuth pedestal, constructed of galvanized A36 steel	
Drive Type	Manual jack screws	
Azimuth Travel	120° continuous	200° (2 segments @ 120°)
Elevation Travel	5 to 90° continuous	0 to 90° continuous
Foundation (L x W x D)	22.0 x 22.0 x 2.0 ft (6.7 x 6.7 x 0.61 m)	22.0 x 22.0 x 1.5 ft (6.7 x 6.7 x 0.46 m)
Concrete	36.0 yds <sup>3</sup> (27.5 m <sup>3</sup> )	27.0 yds <sup>3</sup> (20.6 m <sup>3</sup> )
Reinforcing Steel	6,100 lbs. (2,767 kg)	3,560 lbs. (1,615 kg)
Shipping Containers	One 40 ft standard	
Operational Wind Loading	45 mph (72 km/h) gusting to 60 mph (97 km/h)	
Survival Wind Loading	125 mph (200 km/h) @ 58° F (15° C), any position	
Operational Temperature	+5° to +122° F (-15° to +50° C)	
Survival Temperature	-22° to +140° F (-30° to +60° C), low temperature options available	
Rain	Up to 4 in/h (10 cm/h)	
Relative Humidity	0 to 100% with condensation	
Solar Radiation	360 BTU/h/ft <sup>2</sup> (1,000 Kcal/h/m <sup>2</sup> )	
Ice (survival)	1 in (2.5 cm) on all surfaces or 1/2 in (1.3 cm) on all surfaces with 80 mph (130 km/h) wind gusts	
Atmospheric Conditions	As encountered in coastal regions and/or heavily industrialized areas	
Shock and Vibration	As encountered during shipment by airplane, ship or truck	



**Anexo 6: Resultados de C/N ascendente**

Tabla A6.1: Relación de C/N ascendente para una portadora de 4096 Kbps

		Outbound = 120000 Kbps / Inbound = 4096 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
N°	Ubicación	ET-Sat	Vsat-Sat	ET-Sat	Vsat-Sat	ET - Sat	Vsat-Sat	ET - Sat	Vsat-Sat
1	Moquegua	17.74	15.24	17.13	15.24	17.77	14.19	16.69	14.19
2	Tacna	17.74	15.24	17.13	15.24	17.67	13.43	16.11	13.12
3	Arequipa	17.74	15.25	17.13	15.25	17.69	14.12	16.54	14.12
4	Ica	17.69	14.15	17.47	14.15	17.48	10.80	16.93	10.38
5	Lima	17.74	14.72	17.93	14.72	17.48	10.92	17.70	10.50
6	Piura	17.74	15.24	17.93	15.24	17.48	9.83	17.68	9.83
7	Chiclayo	17.69	14.15	17.92	14.15	17.48	11.33	17.70	11.33
8	Trujillo	17.74	15.24	17.93	15.24	17.40	8.23	17.59	8.23
9	Puno	17.69	14.16	17.47	14.16	17.64	12.19	17.04	12.19
10	Tumbes	17.74	15.24	17.93	15.24	17.22	6.78	17.41	6.36
11	Abancay	17.74	15.25	17.93	15.25	17.48	11.21	17.70	11.21
12	Huancavelica	17.74	14.73	17.57	14.73	17.64	12.85	17.04	12.52
13	Cerro De Pasco	17.74	15.25	17.13	15.25	17.67	14.06	16.54	14.06
14	Huaraz	17.69	14.15	17.92	14.15	17.40	10.33	17.65	10.33
15	Cusco	17.74	14.74	17.57	14.74	17.58	11.91	16.72	11.91
16	Ayacucho	17.74	15.25	17.93	15.25	17.48	11.29	17.70	11.29
17	Huancayo	17.74	14.73	17.57	14.73	17.58	11.58	16.72	11.58
18	Cajamarca	17.74	15.25	17.93	15.25	17.48	10.23	17.68	10.23
19	Huánuco	17.74	15.25	17.93	15.25	17.22	7.22	17.41	7.22
20	Puerto Maldonado	17.74	14.75	17.92	14.75	17.26	7.97	17.59	7.97
21	Moyobamba	17.69	14.17	17.92	14.17	17.22	7.79	17.41	7.79
22	Chachapoyas	17.74	14.74	17.47	14.74	17.48	11.52	16.82	11.52
23	Pucallpa	17.74	15.26	17.93	15.26	17.26	7.40	17.59	7.40
24	Iquitos	17.74	15.27	17.93	15.27	17.17	3.85	17.41	3.85

Tabla A6.2: Relación de C/N ascendente para una portadora de 6144 Kbps

		Outbound = 120000 Kbps / Inbound = 6144 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
N°	Ubicación	ET-Sat	Vsat-Sat	ET-Sat	Vsat-Sat	ET - Sat	Vsat-Sat	ET - Sat	Vsat-Sat
1	Moquegua	17.74	14.29	17.13	14.29	17.77	12.73	16.69	12.73
2	Tacna	17.74	14.29	17.13	14.29	17.67	11.83	16.11	11.83
3	Arequipa	17.74	14.29	17.13	14.29	17.69	12.97	16.54	12.65
4	Ica	17.69	13.00	17.47	12.68	17.48	9.71	16.93	8.16
5	Lima	17.74	13.67	17.93	13.67	17.48	8.30	17.70	8.30
6	Piura	17.74	14.29	17.93	14.29	17.48	7.57	17.68	7.57
7	Chiclayo	17.69	13.00	17.92	13.00	17.48	9.44	17.70	9.44
8	Trujillo	17.74	14.29	17.93	14.29	17.40	5.71	17.59	6.19
9	Puno	17.69	13.01	17.47	13.01	17.64	10.81	17.04	10.39
10	Tumbes	17.74	14.29	17.93	14.29	17.52	10.23	17.77	10.23
11	Abancay	17.74	14.30	17.93	14.30	17.48	8.62	17.70	8.62
12	Huancavelica	17.74	13.68	17.57	13.68	17.64	11.17	17.04	10.76
13	Cerro De Pasco	17.74	14.30	17.13	14.30	17.67	12.90	16.54	12.57
14	Huaraz	17.69	13.01	17.92	13.01	17.40	8.11	17.65	8.11
15	Cusco	17.74	13.69	17.57	13.69	17.58	10.08	16.72	10.08
16	Ayacucho	17.74	14.30	17.93	14.30	17.48	9.83	17.70	8.70
17	Huancayo	17.74	13.68	17.57	13.68	17.58	9.71	16.72	9.02
18	Cajamarca	17.74	14.30	17.93	14.30	17.48	8.00	17.68	8.00
19	Huánuco	17.74	14.30	17.93	14.30	17.22	3.46	17.41	3.46
20	Puerto Maldonado	17.74	13.70	17.92	13.70	17.26	5.92	17.59	5.92
21	Moyobamba	17.69	13.02	17.92	13.02	17.22	5.73	17.41	5.73
22	Chachapoyas	17.74	13.69	17.47	13.69	17.48	9.65	16.82	8.96
23	Pucallpa	17.74	14.31	17.93	14.31	17.48	7.61	17.68	7.61
24	Iquitos	17.74	14.33	17.93	14.33	17.40	7.74	17.65	7.74

Tabla A6.3: Relación de C/N ascendente para una portadora de 8192 Kbps

N°	Ubicación	Outbound = 120000 Kbps / Inbound = 8192 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
		ET-Sat	Vsat-Sat	ET-Sat	Vsat-Sat	ET - Sat	Vsat-Sat	ET - Sat	Vsat-Sat
1	Moquegua	17.74	13.51	17.13	13.20	17.77	11.81	16.69	11.41
2	Tacna	17.74	13.51	17.13	13.20	17.67	10.84	16.11	9.75
3	Arequipa	17.74	13.51	17.13	13.21	17.69	11.71	16.54	11.31
4	Ica	17.69	11.74	17.47	11.74	17.48	7.02	16.93	6.59
5	Lima	17.74	12.83	17.93	12.83	17.48	7.16	17.70	7.16
6	Piura	17.74	13.51	17.93	13.51	17.48	5.99	17.68	5.99
7	Chiclayo	17.69	11.75	17.92	11.75	17.48	7.62	17.70	7.62
8	Trujillo	17.74	13.51	17.93	13.51	17.40	3.32	17.59	3.32
9	Puno	17.69	11.76	17.47	11.76	17.64	8.63	17.04	8.63
10	Tumbes	17.74	13.51	17.93	13.51	17.52	8.46	17.77	8.46
11	Abancay	17.74	13.52	17.93	13.52	17.48	7.49	17.70	7.49
12	Huancavelica	17.74	12.83	17.57	12.51	17.64	9.71	17.04	9.02
13	Cerro De Pasco	17.74	13.52	17.13	13.21	17.67	11.63	16.54	11.23
14	Huaraz	17.69	11.75	17.92	11.75	17.40	6.97	17.65	6.97
15	Cusco	17.74	12.84	17.57	12.52	17.58	8.30	16.72	8.30
16	Ayacucho	17.74	13.52	17.93	13.52	17.48	7.57	17.70	7.57
17	Huancayo	17.74	12.84	17.57	12.51	17.58	7.91	16.72	7.91
18	Cajamarca	17.74	13.52	17.93	13.52	17.48	6.43	17.68	6.43
19	Huánuco	17.74	13.52	17.93	13.52	17.54	8.45	17.77	8.45
20	Puerto Maldonado	17.74	12.86	17.92	12.86	17.26	3.05	17.59	3.05
21	Moyobamba	17.69	11.77	17.92	11.77	17.40	5.93	17.65	5.93
22	Chachapoyas	17.74	12.84	17.47	12.51	17.48	7.84	16.82	7.84
23	Pucallpa	17.74	13.54	17.93	13.54	17.48	6.02	17.68	5.54
24	Iquitos	17.74	13.55	17.93	13.55	17.40	6.16	17.65	6.16

Tabla A6.4: Relación de C/N ascendente para una portadora de 10240 Kbps

N°	Ubicación	Outbound = 120000 Kbps / Inbound = 10240 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
		ET-Sat	Vsat-Sat	ET-Sat	Vsat-Sat	ET - Sat	Vsat-Sat	ET - Sat	Vsat-Sat
1	Moquegua	17.74	12.85	17.13	12.52	17.77	10.63	16.69	9.96
2	Tacna	17.74	12.85	17.13	12.52	17.67	9.60	16.11	8.91
3	Arequipa	17.74	12.85	17.13	12.52	17.69	10.94	16.54	9.86
4	Ica	17.69	10.56	17.47	10.56	17.48	5.69	16.93	5.20
5	Lima	17.74	11.77	17.93	11.77	17.48	5.83	17.70	5.35
6	Piura	17.74	12.85	17.93	12.52	17.48	4.59	17.68	3.38
7	Chiclayo	17.69	10.98	17.92	10.98	17.48	6.73	17.70	6.30
8	Trujillo	17.74	12.85	17.93	12.52	17.48	8.15	17.77	8.15
9	Puno	17.69	10.99	17.47	10.58	17.64	7.76	17.04	7.76
10	Tumbes	17.74	12.85	17.93	12.52	17.52	7.58	17.77	7.58
11	Abancay	17.74	12.86	17.93	12.53	17.48	6.17	17.70	6.17
12	Huancavelica	17.74	11.78	17.57	11.78	17.64	8.16	17.04	8.16
13	Cerro De Pasco	17.74	12.86	17.13	12.53	17.67	10.44	16.54	9.77
14	Huaraz	17.69	10.57	17.92	10.57	17.40	5.15	17.65	5.15
15	Cusco	17.74	11.79	17.57	11.79	17.58	7.42	16.72	7.00
16	Ayacucho	17.74	12.86	17.93	12.53	17.48	6.25	17.70	6.25
17	Huancayo	17.74	11.78	17.57	11.78	17.58	7.02	16.72	6.60
18	Cajamarca	17.74	12.86	17.93	12.53	17.48	3.83	17.68	3.83
19	Huánuco	17.74	12.86	17.93	12.53	17.54	7.58	17.77	7.58
20	Puerto Maldonado	17.74	11.81	17.92	11.81	17.26	3.69	17.65	3.69
21	Moyobamba	17.69	10.58	17.92	10.58	17.40	3.32	17.65	3.32
22	Chachapoyas	17.74	11.79	17.47	11.79	17.48	6.96	16.82	6.53
23	Pucallpa	17.74	12.88	17.93	12.55	17.48	3.42	17.68	3.42
24	Iquitos	17.74	12.89	17.93	12.57	17.40	3.56	17.65	3.56

**Anexo 7: Resultados de C/N descendente**

Tabla A7.1: Relación de C/N descendente para una portadora de 4096 Kbps

		Outbound = 120000 Kbps / Inbound = 4096 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
Nº	Ubicación	ET-Sat	Vsat-Sat	ET-Sat	Vsat-Sat	ET - Sat	Vsat-Sat	ET - Sat	Vsat-Sat
1	Moquegua	15.14	17.74	8.49	16.54	13.90	17.52	4.55	15.84
2	Tacna	15.14	17.74	8.49	16.54	12.41	17.33	1.68	15.07
3	Arequipa	15.14	17.74	8.50	16.54	13.25	17.50	3.87	15.79
4	Ica	13.70	17.74	8.36	16.93	8.72	17.02	1.36	14.98
5	Lima	14.61	17.74	13.08	17.48	8.94	16.81	6.00	15.89
6	Piura	15.14	17.74	13.74	17.48	8.45	16.05	5.30	15.06
7	Chiclayo	13.70	17.74	12.24	17.48	9.07	17.16	6.13	16.61
8	Trujillo	15.14	17.74	13.75	17.48	7.34	15.25	3.87	14.04
9	Puno	13.71	17.75	8.38	16.94	10.98	17.38	3.18	16.03
10	Tumbes	15.14	17.74	13.75	17.48	5.42	14.41	1.60	12.67
11	Abancay	15.15	17.75	13.76	17.49	9.09	16.63	6.15	15.85
12	Huancavelica	14.61	17.75	9.90	16.94	11.20	17.36	3.44	15.80
13	Cerro De Pasco	15.15	17.75	8.51	16.55	12.82	17.49	3.44	15.75
14	Huaraz	13.70	17.75	12.24	17.48	7.80	16.88	4.84	16.20
15	Cusco	14.62	17.75	9.91	16.95	10.15	17.12	1.48	15.45
16	Ayacucho	15.15	17.75	13.76	17.49	9.10	16.65	6.17	15.88
17	Huancayo	14.62	17.75	9.90	16.94	9.81	17.02	1.09	15.23
18	Cajamarca	15.15	17.75	13.75	17.48	8.52	16.23	5.38	15.30
19	Huánuco	15.15	17.75	13.76	17.49	5.58	14.69	1.77	13.34
20	Puerto Maldonado	14.63	17.75	12.99	17.49	6.19	15.61	3.43	14.49
21	Moyobamba	13.72	17.75	12.26	17.49	5.50	15.94	1.67	14.92
22	Chachapoyas	14.62	17.75	9.27	16.94	9.17	17.00	1.46	15.20
23	Pucallpa	15.16	17.75	13.77	17.49	6.06	14.80	3.30	13.48
24	Iquitos	15.17	17.75	13.79	17.50	4.74	12.40	1.17	10.68

Tabla A7.2: Relación de C/N descendente para una portadora de 6144 Kbps

		Outbound = 120000 Kbps / Inbound = 6144 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
Nº	Ubicación	ET-Sat	Vsat-Sat	ET-Sat	Vsat-Sat	ET - Sat	Vsat-Sat	ET - Sat	Vsat-Sat
1	Moquegua	15.14	17.54	8.49	15.91	13.90	17.14	4.55	14.78
2	Tacna	15.14	17.54	8.49	15.91	12.41	16.85	1.68	14.08
3	Arequipa	15.14	17.54	8.50	15.91	13.25	17.20	3.87	14.72
4	Ica	13.70	17.54	8.36	16.27	8.72	16.68	1.36	13.47
5	Lima	14.61	17.54	13.08	17.17	8.94	15.75	6.00	14.66
6	Piura	15.14	17.54	13.74	17.17	8.45	14.88	5.30	13.57
7	Chiclayo	13.70	17.54	12.24	17.17	9.07	16.58	6.13	15.78
8	Trujillo	15.14	17.54	13.75	17.17	7.34	13.71	3.87	12.55
9	Puno	13.71	17.55	8.38	16.44	10.98	17.03	3.18	15.00
10	Tumbes	15.14	17.54	13.75	17.17	10.18	16.23	7.80	15.30
11	Abancay	15.15	17.55	13.76	17.18	9.09	15.47	6.15	14.31
12	Huancavelica	14.61	17.55	9.90	16.43	11.20	16.89	3.44	14.70
13	Cerro De Pasco	15.15	17.55	8.51	15.92	12.82	17.19	3.44	14.67
14	Huaraz	13.70	17.55	12.24	17.18	7.80	16.07	4.84	15.09
15	Cusco	14.62	17.55	9.91	16.44	10.15	16.51	1.48	14.24
16	Ayacucho	15.15	17.55	13.76	17.18	9.10	16.06	6.17	14.36
17	Huancayo	14.62	17.55	9.90	16.44	9.81	16.37	1.09	13.46
18	Cajamarca	15.15	17.55	13.75	17.18	8.52	15.13	5.38	13.88
19	Huánuco	15.15	17.55	13.76	17.18	5.58	12.07	1.77	10.31
20	Puerto Maldonado	14.63	17.56	12.99	17.19	6.19	14.48	3.43	13.09
21	Moyobamba	13.72	17.55	12.26	17.18	5.50	14.91	1.67	13.61
22	Chachapoyas	14.62	17.55	9.27	16.44	9.17	16.35	1.46	13.42
23	Pucallpa	15.16	17.55	13.77	17.19	8.52	14.92	5.38	13.63
24	Iquitos	15.17	17.56	13.79	17.20	8.20	15.01	5.26	13.74

Tabla A7.3: Relación de C/N descendente para una portadora de 8192 Kbps

		Outbound = 120000 Kbps / Inbound = 8192 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
N°	Ubicación	ET-Sat	Vsat-Sat	ET-Sat	Vsat-Sat	ET - Sat	Vsat-Sat	ET - Sat	Vsat-Sat
1	Moquegua	15.14	17.35	8.49	15.13	13.90	16.84	4.55	13.74
2	Tacna	15.14	17.35	8.49	15.13	12.41	16.48	1.68	12.35
3	Arequipa	15.14	17.35	8.50	15.14	13.25	16.81	3.87	13.66
4	Ica	13.70	17.27	8.36	15.78	8.72	15.57	1.36	12.27
5	Lima	14.61	17.35	13.08	16.88	8.94	15.17	6.00	13.93
6	Piura	15.14	17.35	13.74	16.88	8.45	13.89	5.30	12.39
7	Chiclayo	13.70	17.27	12.24	16.76	9.07	15.85	6.13	14.80
8	Trujillo	15.14	17.35	13.75	16.88	7.34	11.95	3.87	10.18
9	Puno	13.71	17.28	8.38	15.80	10.98	16.29	3.18	13.82
10	Tumbes	15.14	17.35	13.75	16.88	10.18	15.38	7.80	14.19
11	Abancay	15.15	17.36	13.76	16.89	9.09	14.84	6.15	13.53
12	Huancavelica	14.61	17.36	9.90	15.79	11.20	16.37	3.44	13.46
13	Cerro De Pasco	15.15	17.36	8.51	15.15	12.82	16.78	3.44	13.60
14	Huaraz	13.70	17.27	12.24	16.77	7.80	15.55	4.84	14.41
15	Cusco	14.62	17.36	9.91	15.81	10.15	15.76	1.48	12.91
16	Ayacucho	15.15	17.36	13.76	16.89	9.10	14.89	6.17	13.58
17	Huancayo	14.62	17.36	9.90	15.80	9.81	15.56	1.09	12.60
18	Cajamarca	15.15	17.36	13.75	16.89	8.52	14.19	5.38	12.74
19	Huánuco	15.15	17.36	13.76	16.89	10.25	15.38	7.71	14.20
20	Puerto Maldonado	14.63	17.37	12.99	16.91	6.19	12.51	3.43	10.81
21	Moyobamba	13.72	17.28	12.26	16.78	7.49	15.02	4.51	13.74
22	Chachapoyas	14.62	17.36	9.27	15.80	9.17	15.53	1.46	12.55
23	Pucallpa	15.16	17.37	13.77	16.90	8.52	13.94	5.38	12.06
24	Iquitos	15.17	17.37	13.79	16.92	8.20	14.05	5.26	12.57

Tabla A7.4: Relación de C/N descendente para una portadora de 10240 Kbps

		Outbound = 120000 Kbps / Inbound = 10240 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
N°	Ubicación	ET-Sat	Vsat-Sat	ET-Sat	Vsat-Sat	ET - Sat	Vsat-Sat	ET - Sat	Vsat-Sat
1	Moquegua	15.14	17.17	8.49	14.62	13.90	16.39	4.55	12.54
2	Tacna	15.14	17.17	8.49	14.61	12.41	15.94	1.68	11.62
3	Arequipa	15.14	17.17	8.50	14.62	13.25	16.52	3.87	12.45
4	Ica	13.70	16.95	8.36	15.09	8.72	14.87	1.36	11.12
5	Lima	14.61	17.07	13.08	16.47	8.94	14.39	6.00	12.62
6	Piura	15.14	17.17	13.74	16.47	8.45	12.91	5.30	10.23
7	Chiclayo	13.70	17.07	12.24	16.47	9.07	15.42	6.13	13.97
8	Trujillo	15.14	17.17	13.75	16.47	10.43	15.21	8.32	13.98
9	Puno	13.71	17.08	8.38	15.11	10.98	15.92	3.18	13.19
10	Tumbes	15.14	17.17	13.75	16.47	10.18	14.89	7.80	13.58
11	Abancay	15.15	17.18	13.76	16.48	9.09	14.02	6.15	12.54
12	Huancavelica	14.61	17.08	9.90	15.36	11.20	15.68	3.44	12.79
13	Cerro De Pasco	15.15	17.17	8.51	14.63	12.82	16.32	3.44	12.38
14	Huaraz	13.70	16.95	12.24	16.30	7.80	14.56	4.84	13.18
15	Cusco	14.62	17.08	9.91	15.37	10.15	15.32	1.48	11.86
16	Ayacucho	15.15	17.17	13.76	16.48	9.10	14.07	6.17	12.60
17	Huancayo	14.62	17.08	9.90	15.36	9.81	15.10	1.09	11.52
18	Cajamarca	15.15	17.17	13.75	16.48	8.52	12.35	5.38	10.63
19	Huánuco	15.15	17.18	13.76	16.48	10.25	14.90	7.71	13.59
20	Puerto Maldonado	14.63	17.09	12.99	16.50	7.33	12.99	5.10	11.34
21	Moyobamba	13.72	16.96	12.26	16.32	7.49	13.40	4.51	11.81
22	Chachapoyas	14.62	17.08	9.27	15.37	9.17	15.06	1.46	11.47
23	Pucallpa	15.16	17.18	13.77	16.49	8.52	12.05	5.38	10.29
24	Iquitos	15.17	17.19	13.79	16.51	8.20	12.18	5.26	10.44

**Anexo 8: Relación de C/N total del sistema**

Tabla A8.1: Relación de C/N total del sistema para una portadora de 4096 Kbps

		Outbound = 120000 Kbps / Inbound = 4096 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
N°	Ubicación	ET-Sat	Vsat-Sat	ET-Sat	Vsat-Sat	ET - Sat	Vsat-Sat	ET - Sat	Vsat-Sat
1	Moquegua	13.24	13.31	7.94	12.83	12.40	12.54	4.30	11.93
2	Tacna	13.24	13.30	7.93	12.83	11.28	11.94	1.52	10.97
3	Arequipa	13.24	13.31	7.94	12.84	11.92	12.48	3.65	11.87
4	Ica	12.24	12.57	7.86	12.31	8.18	9.87	1.24	9.09
5	Lima	12.89	12.97	11.85	12.88	8.37	9.93	5.71	9.40
6	Piura	13.24	13.30	12.34	13.21	7.94	8.90	5.06	8.69
7	Chiclayo	12.24	12.57	11.20	12.49	8.48	10.32	5.84	10.20
8	Trujillo	13.24	13.31	12.34	13.21	6.94	7.44	3.69	7.22
9	Puno	12.25	12.58	7.88	12.32	10.13	11.04	3.01	10.69
10	Tumbes	13.24	13.31	12.34	13.21	5.14	6.09	1.49	5.44
11	Abancay	13.24	13.31	12.35	13.22	8.50	10.12	5.86	9.93
12	Huancavelica	12.89	12.97	9.21	12.69	10.31	11.53	3.25	10.85
13	Cerro De Pasco	13.24	13.31	7.95	12.84	11.59	12.43	3.23	11.81
14	Huaraz	12.24	12.58	11.20	12.50	7.35	9.46	4.61	9.33
15	Cusco	12.90	12.98	9.22	12.69	9.43	10.77	1.35	10.32
16	Ayacucho	13.24	13.31	12.35	13.22	8.51	10.18	5.87	9.99
17	Huancayo	12.89	12.97	9.21	12.69	9.14	10.49	0.97	10.02
18	Cajamarca	13.24	13.31	12.35	13.21	8.00	9.25	5.13	9.05
19	Huánuco	13.24	13.31	12.35	13.22	5.30	6.51	1.65	6.27
20	Puerto Maldonado	12.91	12.99	11.78	12.90	5.86	7.28	3.27	7.10
21	Moyobamba	12.25	12.59	11.21	12.51	5.21	7.17	1.56	7.02
22	Chachapoyas	12.90	12.97	8.66	12.69	8.57	10.44	1.33	9.97
23	Pucallpa	13.25	13.32	12.36	13.23	5.75	6.68	3.14	6.45
24	Iquitos	13.26	13.33	12.37	13.24	4.50	3.28	1.07	3.03

Tabla A8.2: Relación de C/N total del sistema para una portadora de 6144 Kbps

		Outbound = 120000 Kbps / Inbound = 6144 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
N°	Ubicación	ET-Sat	Vsat-Sat	ET-Sat	Vsat-Sat	ET - Sat	Vsat-Sat	ET - Sat	Vsat-Sat
1	Moquegua	13.24	12.61	7.94	12.02	12.40	11.39	4.30	10.63
2	Tacna	13.24	12.61	7.93	12.01	11.28	10.64	1.52	9.80
3	Arequipa	13.24	12.61	7.94	12.02	11.92	11.58	3.65	10.55
4	Ica	12.24	11.69	7.86	11.10	8.18	8.91	1.24	7.04
5	Lima	12.89	12.18	11.85	12.07	8.37	7.58	5.71	7.39
6	Piura	13.24	12.61	12.34	12.48	7.94	6.83	5.06	6.60
7	Chiclayo	12.24	11.69	11.20	11.59	8.48	8.67	5.84	8.53
8	Trujillo	13.24	12.61	12.34	12.49	6.94	5.07	3.69	5.29
9	Puno	12.25	11.70	7.88	11.39	10.13	9.88	3.01	9.10
10	Tumbes	13.24	12.61	12.34	12.49	9.44	9.25	7.38	9.05
11	Abancay	13.24	12.62	12.35	12.50	8.50	7.80	5.86	7.58
12	Huancavelica	12.89	12.19	9.21	11.83	10.31	10.14	3.25	9.28
13	Cerro De Pasco	13.24	12.62	7.95	12.02	11.59	11.52	3.23	10.48
14	Huaraz	12.24	11.70	11.20	11.60	7.35	7.46	4.61	7.31
15	Cusco	12.90	12.19	9.22	11.84	9.43	9.19	1.35	8.67
16	Ayacucho	13.24	12.62	12.35	12.49	8.51	8.90	5.87	7.65
17	Huancayo	12.89	12.19	9.21	11.83	9.14	8.86	0.97	7.69
18	Cajamarca	13.24	12.61	12.35	12.49	8.00	7.23	5.13	7.00
19	Huánuco	13.24	12.62	12.35	12.50	5.30	2.90	1.65	2.64
20	Puerto Maldonado	12.91	12.20	11.78	12.10	5.86	5.36	3.27	5.16
21	Moyobamba	12.25	11.71	11.21	11.61	5.21	5.24	1.56	5.08
22	Chachapoyas	12.90	12.19	8.66	11.84	8.57	8.81	1.33	7.63
23	Pucallpa	13.25	12.63	12.36	12.51	8.00	6.87	5.13	6.64
24	Iquitos	13.26	12.64	12.37	12.52	7.71	6.99	5.01	6.77

Tabla A8.3: Relación de C/N total del sistema para una portadora de 8192 Kbps

		Outbound = 120000 Kbps / Inbound = 8192 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
Nº	Ubicación	ET-Sat	Vsat-Sat	ET-Sat	Vsat-Sat	ET - Sat	Vsat-Sat	ET - Sat	Vsat-Sat
1	Moquegua	13.24	12.01	7.94	11.05	12.40	10.62	4.30	9.41
2	Tacna	13.24	12.01	7.93	11.05	11.28	9.79	1.52	7.85
3	Arequipa	13.24	12.01	7.94	11.06	11.92	10.54	3.65	9.32
4	Ica	12.24	10.67	7.86	10.30	8.18	6.45	1.24	5.55
5	Lima	12.89	11.51	11.85	11.39	8.37	6.52	5.71	6.33
6	Piura	13.24	12.01	12.34	11.86	7.94	5.34	5.06	5.09
7	Chiclayo	12.24	10.67	11.20	10.56	8.48	7.01	5.84	6.86
8	Trujillo	13.24	12.01	12.34	11.87	6.94	2.76	3.69	2.50
9	Puno	12.25	10.69	7.88	10.32	10.13	7.94	3.01	7.48
10	Tumbes	13.24	12.01	12.34	11.87	9.44	7.65	7.38	7.43
11	Abancay	13.24	12.02	12.35	11.88	8.50	6.76	5.86	6.52
12	Huancavelica	12.89	11.52	9.21	10.84	10.31	8.86	3.25	7.68
13	Cerro De Pasco	13.24	12.02	7.95	11.06	11.59	10.47	3.23	9.25
14	Huaraz	12.24	10.68	11.20	10.56	7.35	6.40	4.61	6.25
15	Cusco	12.90	11.53	9.22	10.85	9.43	7.58	1.35	7.01
16	Ayacucho	13.24	12.02	12.35	11.88	8.51	6.83	5.87	6.60
17	Huancayo	12.89	11.52	9.21	10.84	9.14	7.22	0.97	6.64
18	Cajamarca	13.24	12.02	12.35	11.87	8.00	5.75	5.13	5.51
19	Huánuco	13.24	12.02	12.35	11.88	9.51	7.65	7.31	7.43
20	Puerto Maldonado	12.91	11.54	11.78	11.42	5.86	2.58	3.27	2.37
21	Moyobamba	12.25	10.69	11.21	10.58	7.06	5.43	4.30	5.27
22	Chachapoyas	12.90	11.53	8.66	10.84	8.57	7.16	1.33	6.58
23	Pucallpa	13.25	12.03	12.36	11.89	8.00	5.37	5.13	4.67
24	Iquitos	13.26	12.04	12.37	11.90	7.71	5.51	5.01	5.27

Tabla A8.4: Relación de C/N total del sistema para una portadora de 10240 Kbps

		Outbound = 120000 Kbps / Inbound = 10240 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
Nº	Ubicación	ET-Sat	Vsat-Sat	ET-Sat	Vsat-Sat	ET - Sat	Vsat-Sat	ET - Sat	Vsat-Sat
1	Moquegua	13.24	11.48	7.94	10.43	12.40	9.60	4.30	8.05
2	Tacna	13.24	11.48	7.93	10.43	11.28	8.69	1.52	7.05
3	Arequipa	13.24	11.48	7.94	10.44	11.92	9.88	3.65	7.95
4	Ica	12.24	9.66	7.86	9.25	8.18	5.19	1.24	4.21
5	Lima	12.89	10.65	11.85	10.50	8.37	5.26	5.71	4.60
6	Piura	13.24	11.48	12.34	11.05	7.94	3.99	5.06	2.57
7	Chiclayo	12.24	10.02	11.20	9.90	8.48	6.18	5.84	5.62
8	Trujillo	13.24	11.48	12.34	11.05	9.65	7.37	7.86	7.14
9	Puno	12.25	10.04	7.88	9.27	10.13	7.14	3.01	6.66
10	Tumbes	13.24	11.48	12.34	11.05	9.44	6.84	7.38	6.61
11	Abancay	13.24	11.49	12.35	11.06	8.50	5.51	5.86	5.27
12	Huancavelica	12.89	10.65	9.21	10.20	10.31	7.45	3.25	6.87
13	Cerro De Pasco	13.24	11.49	7.95	10.45	11.59	9.44	3.23	7.87
14	Huaraz	12.24	9.67	11.20	9.54	7.35	4.68	4.61	4.51
15	Cusco	12.90	10.66	9.22	10.21	9.43	6.76	1.35	5.77
16	Ayacucho	13.24	11.49	12.35	11.06	8.51	5.59	5.87	5.35
17	Huancayo	12.89	10.66	9.21	10.20	9.14	6.39	0.97	5.38
18	Cajamarca	13.24	11.49	12.35	11.06	8.00	3.26	5.13	3.01
19	Huánuco	13.24	11.49	12.35	11.06	9.51	6.84	7.31	6.61
20	Puerto Maldonado	12.91	10.68	11.78	10.54	6.91	3.21	4.86	3.00
21	Moyobamba	12.25	9.68	11.21	9.56	7.06	2.92	4.30	2.75
22	Chachapoyas	12.90	10.66	8.66	10.21	8.57	6.33	1.33	5.32
23	Pucallpa	13.25	11.51	12.36	11.08	8.00	2.86	5.13	2.61
24	Iquitos	13.26	11.52	12.37	11.09	7.71	3.00	5.01	2.75

**Anexo 9: Márgenes de enlace para portadoras Inbound de 4096, 6144, 8192 y 10240 Kbps**

Tabla A9.1: Margen de enlace y ModCod alcanzado en la portadora Inbound de 4096 Kbps (Elaboración propia)

N°	Ubicación	Inbound = 4096 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
		Margen	ModCod	Margen	ModCod	Margen	ModCod	Margen	ModCod
1	Moquegua	2.02	8PSK 5/6	1.55	8PSK 5/6	1.25	8PSK 5/6	0.64	8PSK 5/6
2	Tacna	2.02	8PSK 5/6	1.54	8PSK 5/6	0.66	8PSK 5/6	1.41	8PSK 3/4
3	Arequipa	2.02	8PSK 5/6	1.55	8PSK 5/6	1.19	8PSK 5/6	0.58	8PSK 5/6
4	Ica	1.28	8PSK 5/6	1.02	8PSK 5/6	0.31	8PSK 3/4	0.60	8PSK 2/3
5	Lima	1.68	8PSK 5/6	1.59	8PSK 5/6	0.37	8PSK 3/4	0.91	8PSK 2/3
6	Piura	2.02	8PSK 5/6	1.92	8PSK 5/6	0.41	8PSK 2/3	0.20	8PSK 2/3
7	Chiclayo	1.29	8PSK 5/6	1.20	8PSK 5/6	0.76	8PSK 3/4	0.64	8PSK 3/4
8	Trujillo	2.02	8PSK 5/6	1.92	8PSK 5/6	1.57	QPSK 5/6	1.34	QPSK 5/6
9	Puno	1.29	8PSK 5/6	1.03	8PSK 5/6	1.48	8PSK 3/4	1.13	8PSK 3/4
10	Tumbes	2.02	8PSK 5/6	1.92	8PSK 5/6	0.21	QPSK 5/6	0.65	QPSK 3/4
11	Abancay	2.03	8PSK 5/6	1.93	8PSK 5/6	0.56	8PSK 3/4	0.37	8PSK 3/4
12	Huancavelica	1.68	8PSK 5/6	1.40	8PSK 5/6	0.24	8PSK 5/6	1.29	8PSK 3/4
13	Cerro De Pasco	2.02	8PSK 5/6	1.55	8PSK 5/6	1.15	8PSK 5/6	0.53	8PSK 5/6
14	Huaraz	1.29	8PSK 5/6	1.21	8PSK 5/6	0.97	8PSK 2/3	0.84	8PSK 2/3
15	Cusco	1.69	8PSK 5/6	1.41	8PSK 5/6	1.21	8PSK 3/4	0.76	8PSK 3/4
16	Ayacucho	2.02	8PSK 5/6	1.93	8PSK 5/6	0.62	8PSK 3/4	0.43	8PSK 3/4
17	Huancayo	1.68	8PSK 5/6	1.40	8PSK 5/6	0.93	8PSK 3/4	0.46	8PSK 3/4
18	Cajamarca	2.02	8PSK 5/6	1.93	8PSK 5/6	0.77	8PSK 2/3	0.56	8PSK 2/3
19	Huánuco	2.03	8PSK 5/6	1.93	8PSK 5/6	0.63	QPSK 5/6	0.40	QPSK 5/6
20	Puerto Maldonado	1.70	8PSK 5/6	1.61	8PSK 5/6	1.41	QPSK 5/6	1.22	QPSK 5/6
21	Moyobamba	1.30	8PSK 5/6	1.22	8PSK 5/6	1.30	QPSK 5/6	1.14	QPSK 5/6
22	Chachapoyas	1.69	8PSK 5/6	1.40	8PSK 5/6	0.88	8PSK 3/4	0.41	8PSK 3/4
23	Pucallpa	2.03	8PSK 5/6	1.94	8PSK 5/6	0.80	QPSK 5/6	0.57	QPSK 5/6
24	Iquitos	2.04	8PSK 5/6	1.95	8PSK 5/6	0.95	QPSK 1/2	0.70	QPSK 1/2

Tabla A9.2: Margen de enlace y ModCod alcanzado en la portadora Inbound de 6144 Kbps (Elaboración propia)

		Inbound = 6144 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
N°	Ubicación	Margen	ModCod	Margen	ModCod	Margen	ModCod	Margen	ModCod
1	Moquegua	1.32	8PSK 5/6	0.73	8PSK 5/6	1.83	8PSK 3/4	1.07	8PSK 3/4
2	Tacna	1.32	8PSK 5/6	0.72	8PSK 5/6	1.08	8PSK 3/4	0.24	8PSK 3/4
3	Arequipa	1.32	8PSK 5/6	0.73	8PSK 5/6	0.29	8PSK 5/6	0.99	8PSK 3/4
4	Ica	0.40	8PSK 5/6	1.54	8PSK 3/4	1.28	QPSK 5/6	1.16	QPSK 5/6
5	Lima	0.89	8PSK 5/6	0.78	8PSK 5/6	1.70	QPSK 5/6	1.52	QPSK 5/6
6	Piura	1.32	8PSK 5/6	1.20	8PSK 5/6	0.96	QPSK 5/6	0.72	QPSK 5/6
7	Chiclayo	0.41	8PSK 5/6	0.31	8PSK 5/6	0.18	8PSK 2/3	0.04	QPSK 2/3
8	Trujillo	1.32	8PSK 5/6	1.20	8PSK 5/6	1.35	QPSK 2/3	0.49	QPSK 3/4
9	Puno	0.42	8PSK 5/6	0.10	8PSK 5/6	0.32	8PSK 3/4	0.61	8PSK 2/3
10	Tumbes	1.32	8PSK 5/6	1.20	8PSK 5/6	0.77	8PSK 2/3	0.56	8PSK 2/3
11	Abancay	1.33	8PSK 5/6	1.21	8PSK 5/6	1.92	QPSK 5/6	1.70	QPSK 5/6
12	Huancavelica	0.90	8PSK 5/6	0.54	8PSK 5/6	0.58	8PSK 3/4	0.79	8PSK 2/3
13	Cerro De Pasco	1.33	8PSK 5/6	0.74	8PSK 5/6	0.24	8PSK 5/6	0.92	8PSK 3/4
14	Huaraz	0.41	8PSK 5/6	0.31	8PSK 5/6	1.59	QPSK 5/6	1.44	QPSK 5/6
15	Cusco	0.91	8PSK 5/6	0.55	8PSK 5/6	0.70	8PSK 2/3	0.18	8PSK 2/3
16	Ayacucho	1.33	8PSK 5/6	1.21	8PSK 5/6	1.72	8PSK 3/4	1.78	QPSK 5/6
17	Huancayo	0.90	8PSK 5/6	0.55	8PSK 5/6	0.37	8PSK 2/3	1.81	QPSK 5/6
18	Cajamarca	1.33	8PSK 5/6	1.20	8PSK 5/6	1.35	QPSK 5/6	1.12	QPSK 5/6
19	Huánuco	1.33	8PSK 5/6	1.21	8PSK 5/6	0.57	QPSK 1/2	0.32	QPSK 1/2
20	Puerto Maldonado	0.92	8PSK 5/6	0.81	8PSK 5/6	0.56	QPSK 3/4	0.36	QPSK 3/4
21	Moyobamba	0.42	8PSK 5/6	0.32	8PSK 5/6	0.44	QPSK 3/4	0.28	QPSK 3/4
22	Chachapoyas	0.90	8PSK 5/6	0.55	8PSK 5/6	0.32	8PSK 2/3	1.75	QPSK 5/6
23	Pucallpa	1.34	8PSK 5/6	1.22	8PSK 5/6	0.99	QPSK 5/6	0.76	QPSK 5/6
24	Iquitos	1.35	8PSK 5/6	1.23	8PSK 5/6	1.12	QPSK 5/6	0.89	QPSK 5/6



Tabla A9.3: Margen de enlace y ModCod alcanzado en la portadora Inbound de 8192Kbps (Elaboración propia)

		Inbound = 8192 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
N°	Ubicación	Margen	ModCod	Margen	ModCod	Margen	ModCod	Margen	ModCod
1	Moquegua	0.72	8PSK 5/6	1.49	8PSK 3/4	1.06	8PSK 3/4	0.92	8PSK 2/3
2	Tacna	0.72	8PSK 5/6	1.49	8PSK 3/4	0.23	8PSK 3/4	1.97	QPSK 5/6
3	Arequipa	0.72	8PSK 5/6	1.50	8PSK 3/4	0.98	8PSK 3/4	0.83	8PSK 2/3
4	Ica	1.11	8PSK 3/4	0.74	8PSK 3/4	0.57	QPSK 5/6	0.75	QPSK 3/4
5	Lima	0.23	8PSK 5/6	0.10	8PSK 5/6	0.64	QPSK 5/6	0.45	QPSK 5/6
6	Piura	0.72	8PSK 5/6	0.58	8PSK 5/6	0.54	QPSK 3/4	0.29	QPSK 3/4
7	Chiclayo	1.11	8PSK 3/4	1.00	8PSK 3/4	1.13	QPSK 5/6	0.98	QPSK 5/6
8	Trujillo	0.72	8PSK 5/6	0.58	8PSK 5/6	0.43	QPSK 1/2	0.18	QPSK 1/2
9	Puno	1.13	8PSK 3/4	0.76	8PSK 3/4	2.07	QPSK 5/6	1.61	QPSK 5/6
10	Tumbes	0.72	8PSK 5/6	0.58	8PSK 5/6	1.78	QPSK 5/6	1.55	QPSK 5/6
11	Abancay	0.73	8PSK 5/6	0.59	8PSK 5/6	0.88	QPSK 5/6	0.65	QPSK 5/6
12	Huancavelica	0.23	8PSK 5/6	1.28	8PSK 3/4	0.37	8PSK 2/3	1.81	QPSK 5/6
13	Cerro De Pasco	0.73	8PSK 5/6	1.50	8PSK 3/4	0.91	8PSK 3/4	0.76	8PSK 2/3
14	Huaraz	1.12	8PSK 3/4	1.00	8PSK 3/4	0.52	QPSK 5/6	0.37	QPSK 5/6
15	Cusco	0.24	8PSK 5/6	1.29	8PSK 3/4	1.70	QPSK 5/6	1.13	QPSK 5/6
16	Ayacucho	0.73	8PSK 5/6	0.59	8PSK 5/6	0.96	QPSK 5/6	0.72	QPSK 5/6
17	Huancayo	0.24	8PSK 5/6	1.28	8PSK 3/4	1.34	QPSK 5/6	0.76	QPSK 5/6
18	Cajamarca	0.73	8PSK 5/6	0.59	8PSK 5/6	0.95	QPSK 3/4	0.71	QPSK 3/4
19	Huánuco	0.73	8PSK 5/6	0.59	8PSK 5/6	1.78	QPSK 5/6	1.55	QPSK 5/6
20	Puerto Maldonado	0.25	8PSK 5/6	0.13	8PSK 5/6	0.25	QPSK 1/2	0.04	QPSK 1/2
21	Moyobamba	1.13	8PSK 3/4	1.02	8PSK 3/4	0.63	QPSK 3/4	0.47	QPSK 3/4
22	Chachapoyas	0.24	8PSK 5/6	1.28	8PSK 3/4	1.28	QPSK 5/6	0.70	QPSK 5/6
23	Pucallpa	0.74	8PSK 5/6	0.60	8PSK 5/6	0.57	QPSK 3/4	0.95	QPSK 2/3
24	Iquitos	0.76	8PSK 5/6	0.62	8PSK 5/6	0.71	QPSK 3/4	0.47	QPSK 3/4

Tabla A9.4: Margen de enlace y ModCod alcanzado en la portadora Inbound de 10240 Kbps (Elaboración propia)

N°	Ubicación	Inbound = 10240 Kbps							
		Cielo Despejado		Lluvia ET-Sat		Lluvia Sat - Vsat		Lluvia ambos lados	
		Margen	ModCod	Margen	ModCod	Margen	ModCod	Margen	ModCod
1	Moquegua	0.20	8PSK 5/6	0.87	8PSK 3/4	1.12	8PSK 2/3	2.17	QPSK 5/6
2	Tacna	0.19	8PSK 5/6	0.87	8PSK 3/4	0.21	8PSK 2/3	1.17	QPSK 5/6
3	Arequipa	0.20	8PSK 5/6	0.88	8PSK 3/4	0.32	8PSK 3/4	2.08	QPSK 5/6
4	Ica	1.17	8PSK 2/3	0.76	8PSK 2/3	0.39	QPSK 3/4	0.50	QPSK 2/3
5	Lima	1.09	8PSK 3/4	0.94	8PSK 3/4	0.46	QPSK 3/4	0.88	QPSK 2/3
6	Piura	0.19	8PSK 5/6	1.49	8PSK 3/4	0.27	QPSK 2/3	0.24	QPSK 1/2
7	Chiclayo	0.46	8PSK 3/4	0.34	8PSK 3/4	0.30	QPSK 5/6	0.82	QPSK 3/4
8	Trujillo	0.20	8PSK 5/6	1.49	8PSK 3/4	1.49	QPSK 5/6	1.27	QPSK 5/6
9	Puno	0.48	8PSK 3/4	0.78	8PSK 2/3	1.26	QPSK 5/6	0.79	QPSK 5/6
10	Tumbes	0.20	8PSK 5/6	1.49	8PSK 3/4	0.96	QPSK 5/6	0.73	QPSK 5/6
11	Abancay	0.21	8PSK 5/6	1.50	8PSK 3/4	0.71	QPSK 3/4	0.47	QPSK 3/4
12	Huancavelica	1.09	8PSK 3/4	0.64	8PSK 3/4	1.57	QPSK 5/6	1.00	QPSK 5/6
13	Cerro De Pasco	0.20	8PSK 5/6	0.92	8PSK 3/4	0.95	8PSK 2/3	2.00	QPSK 5/6
14	Huaraz	1.18	8PSK 2/3	1.05	8PSK 2/3	0.96	QPSK 2/3	0.80	QPSK 2/3
15	Cusco	1.10	8PSK 3/4	0.65	8PSK 3/4	0.89	QPSK 5/6	0.97	QPSK 3/4
16	Ayacucho	0.20	8PSK 5/6	1.50	8PSK 3/4	0.79	QPSK 3/4	0.55	QPSK 3/4
17	Huancayo	1.10	8PSK 3/4	0.64	8PSK 3/4	0.52	QPSK 5/6	0.59	QPSK 3/4
18	Cajamarca	0.20	8PSK 5/6	1.50	8PSK 3/4	0.93	QPSK 1/2	0.68	QPSK 1/2
19	Huánuco	0.21	8PSK 5/6	1.50	8PSK 3/4	0.96	QPSK 5/6	0.73	QPSK 5/6
20	Puerto Maldonado	1.12	8PSK 3/4	0.98	8PSK 3/4	0.88	QPSK 1/2	0.67	QPSK 1/2
21	Moyobamba	1.20	8PSK 2/3	1.07	8PSK 2/3	0.59	QPSK 1/2	0.42	QPSK 1/2
22	Chachapoyas	1.10	8PSK 3/4	0.65	8PSK 3/4	0.76	QPSK 5/6	0.52	QPSK 3/4
23	Pucallpa	0.22	8PSK 5/6	1.52	8PSK 3/4	0.53	QPSK 1/2	0.28	QPSK 1/2
24	Iquitos	0.23	8PSK 5/6	1.53	8PSK 3/4	0.67	QPSK 1/2	0.42	QPSK 1/2

### Anexo 10: Calculo de enlace para la ciudad de Arequipa

**DATOS DEL SATELITE**

Longitud	-61 °E		
Banda de Operación:	Ka		
Frecuencia Ascendente	29.23	29.88	GHZ
Frecuencia Descendente	19.54	20.08	GHZ
Polarización:	Circular		
Ancho de banda del Beam	237.00		MHZ
Atenuador de Posición (ATP):	9.0		dB
IBO	4.00		dB
OBO	3.00		dB
Densidad de Flujo de Potencia (SFD)	-92.00		dBW/m2
Figura de Merito Satélite (G/T)	19.00		dB/K
PIRE de saturación Beam:	62.00		dBW
Relación C/I Satélite Adyacente	24.00		dB
Relación C/I Intermodulación	22.50		dB
Relación C/I por Polarización Cruzada	22.50		dB

**DATOS DE ESTACION TERRENA Y TERMINALES**

	ET	Arequipa	
Localidad Tx., Rx.	99.95	99.50	%
Disponibilidad del enlace ascendente	99.95	99.50	%
Disponibilidad del enlace descendente	99.95	99.50	%
Diámetro de Antena:	8.1	0.74	metros
Potencia del HPA	100.0	2.0	W
Pérdidas Antena - HPA	1.0	0.5	dB
Ganancia de Antena Tx:	64.70	45.30	dB
ganancia de Antena Rx:	62.10	42.10	dB
Temperatura. Total del Sistema	111	90	K
Temperatura. Total del Sistema	20.45	19.54	dBK
G/T de la Estación Terrena y Terminal	41.65	22.56	dB/K
Latitud	-17.19	-16.40	°
Longitud	-70.93	-71.52	°
Elevación	66.80	67.20	°
Distancia Centro Tierra - Satélite	42164	42164	Km
Radio Tierra	6378	6378	Km
Distancia al Satélite	36226.6	36211.6	Km
Atenuación por Lluvia Tx	6.92	2.05	dB
Atenuación por Lluvia Rx	2.95	0.83	dB
Ventaja Geográfica en Tx (Sobre el G/T del Satélite)	0.00	0.00	dB
Ventaja Geográfica en Rx (Sobre el PIRE del Satélite)	0.00	0.00	dB

**DATOS DE LA PORTADORA**

	Cielo Despejado		Lluvia ET-Sat		Lluvia Sat-Vsat		Lluvia Ambos lados		
Velocidad de Información	120000	2048	120000	2048	120000	2048	120000	2048	Kbps
Modulación	32APSK	8PSK	8PSK	8PSK	16APSK	8PSK	QPSK	8PSK	
Índice de Modulación	5	3	3	3	4	3	2	3	
FEC	3/4	5/6	3/4	5/6	5/6	5/6	2/3	5/6	
Rolloff	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	%
Eb/No	7.04	7.60	4.43	7.60	6.42	7.60	1.89	7.60	dB
BER	10^-7	10^-5	10^-7	10^-5	10^-7	10^-5	10^-7	10^-5	
Ancho de Banda Ocupado	38400	983	64000	983	43200	983	108000	983	KHz

**ENLACE ASCENDENTE**

	Cielo Despejado		Lluvia ET-Sat		Lluvia Sat-Vsat		Lluvia Ambos lados		
	ET - Sat	Vsat - Sat	ET - Sat	Vsat - Sat	ET - Sat	Vsat - Sat	ET - Sat	Vsat - Sat	
Pérdidas por Dispersión	162.17	162.17	162.17	162.17	162.17	162.17	162.17	162.17	dBm2
Pérdidas por Espacio Libre	212.95	213.13	212.95	213.13	212.95	213.13	212.95	213.13	dB
PIRE/Portadora desde la ET	70.17	47.81	70.17	47.81	70.17	47.81	70.17	47.81	dBW
Pérdidas por Apuntamiento	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	dB
Pérdidas por Polarizador	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	dB
Constante de Boltzman	-228.60	-228.60	-228.60	-228.60	-228.60	-228.60	-228.60	-228.60	dBJ/K
Atenuación por lluvia	0.00	0.00	6.92	2.05	0.00	2.05	6.92	2.05	dB
Pérdidas por Absorción Atmosférica	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	dB
Control Automático de Potencia ET	0.00	0.00	5.00	0.00	0.00	0.00	5.00	0.00	dB
Figura de Merito Satélite (G/T)	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	dB/K
Relación C/No Ascendente	103.82	81.28	101.90	81.28	103.82	79.23	101.90	79.23	dB-Hz
Relación C/N Ascendente	27.98	21.35	23.84	21.35	27.47	19.30	21.57	19.30	dB
Relación C/I Intermodulación	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	dB
Relación C/I por Polarización Cruzada	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	dB
Relación C/I Satélite Adyacente	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	dB
Relación C/N Ascendente del Sistema	17.74	16.47	17.13	16.47	17.69	15.69	16.54	15.69	dB

**ENLACE DESCENDENTE**

	Cielo Despejado		Lluvia ET-Sat		Lluvia Sat-Vsat		Lluvia Ambos lados		
	Sat - Vsat	Sat - ET	Sat - Vsat	Sat - ET	Sat - Vsat	Sat - ET	Sat - Vsat	Sat - ET	
PIRE en la ET	62.00	62.00	62.00	62.00	62.00	62.00	62.00	62.00	dBW
PIRE requerida del Satélite	53.50	31.14	46.58	31.14	53.50	29.09	46.58	29.09	dBW
Pérdidas por Espacio Libre	209.68	209.45	209.68	209.45	209.68	209.45	209.68	209.45	dB
Pérdidas por Apuntamiento	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	dB
Pérdidas por Polarizador	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	dB
Atenuación por lluvia	0.00	0.00	0.00	2.95	0.83	0.00	0.83	2.95	dB
Pérdidas por Absorción Atmosférica	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	dB
G/T de la Estación Terrena	22.56	41.65	22.56	38.18	20.71	41.65	20.71	38.18	dB/K
Relación C/No Descendente	93.97	90.94	87.05	84.52	91.29	88.89	84.37	82.47	dB-Hz
Relación C/N Descendente	18.13	31.01	8.99	24.60	14.94	28.96	4.04	22.55	dB
Relación C/I Intermodulación	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	dB
Relación C/I por Polarización Cruzada	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	dB
Relación C/I Satélite Adyacente	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	dB
Relación C/N Descendente del Sistema	15.14	17.95	8.50	17.28	13.25	17.83	3.87	16.82	dB

Relación C/N Total del Sistema	13.24	14.14	7.94	13.85	11.92	13.62	3.65	13.21	dB
Provisión por degradaciones adicionales	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	dB
Relación C/N Requerida	11.99	10.79	7.16	10.79	10.86	10.79	2.35	10.79	dB
<b>MARGEN DEL ENLACE</b>	0.75	2.85	0.28	2.56	0.56	2.33	0.80	1.92	dB