TRABAJO ESPECIAL DE GRADO

DISEÑO DE UN ENLACE DE MICROONDAS Y ESTACION TELEDIFUSORA MECEDORES-AGUA FRIA-CARICUAO PARA LA C.A. VENEZOLANA DE TELEVISION
[ANEXOS]

Presentado ante la ilustre
Universidad Central de Venezuela
Por el Br. Fernandez J. Julian
Para optar al Título de Ingeniero Electricista.

Caracas, 2008

[ANEXO Nº 1]

Standard Parabolic Antenna

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Standard Parabolic Antennas

P, PL, PX and PXL Series Standard Parabolic antennas are unshielded parabolic antennas that provide economical and reliable service where a high degree of back and side radiation suppression is not necessary.

- *Low-VSWR versions minimize echo distortion for less noise on the system*
- *A vertical tower mount is included. Optional mounts and radomes can be ordered separately for versatility of installation*
- *Single and dual-polarized options are available in most applicable frequencies*
- *Spun aluminum reflectors provide long term reliability and minimize environmental distortion to protect system investments*
- *Rugged, high-quality performance at low initial costs*

PXL
PL

Standard Antennas – Dual Polarized
Antenna Inputs: CPR137G, PDR70, and UG-343B/U

7.125 - 7.750 GHz

Antenna Inputs. All antenna VSWR values are specified with CPR and PDR flanges. Other optional flanges may result in equal or slightly higher VSWR. Contact Andrew for details.
Pressurization. Feeds are pressurizable to 10 lb/in^2 (70 kPa).
ValuLine® Antennas. See page 127.

Type Number	Diameter ft (m)	RPE Number(s)	Regulatory Compliance U.S. FCC 101	74	78	ETSI Class	ETSI Gain	Gain, dBi Low	Mid-Band	Top	Beamwidth Degrees	Cross Pol. Disc., dB	F/B Ratio dB	VSWR max. (R.L., dB)
PXL8-70	8 (2.4)	2828	–	–	–	1	2	42.4	42.9	43.2	1.1	30	50	1.06 (30.7)

ANDREW.

[ANEXO Nº 2]

Rectangular Waveguide Components

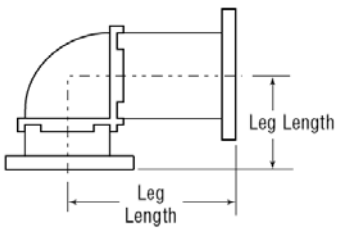
Size and Frequency Codes

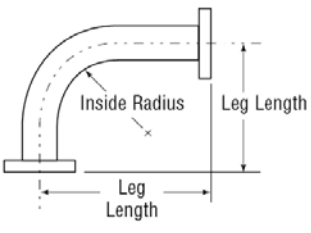
EIA	RCSC	IEC	Waveguide Size Code	Frequency Code	Frequency (GHz)
WR112	WG15	R84	112	S	7.050 - 10.00
				A	7.125 - 7.750
				B	7.725 - 8.500
				C	7.125 - 8.500

Flange Codes

Flange Codes, Descriptions and Availability

Code	Flange Type *	Description	Available for Waveguide Size Codes
A	UG-Choke	Tapped Holes, Gasket Groove, Choke Groove, Square Flange	028, 042, 062, 075, 090, 112





90° E-Plane
Elbow

CPR137G Flanges Shown

90° H-Plane
Elbow

CPR137G Flanges Shown

Straight Sections, H and E Plane Bends and Twists

EIA	RCSC	IEC	Operating Frequency (GHz)	Twists Length	Straight Sections VSWR	Swept H and E Plane Bends Std Leg Length	Radius E	Radius H	VSWR Swept Bends/ Miter Bends	Miter E and H-Plane Bends Min Leg Lengths** E-Plane	H-Plane
WR112	WG15	R84	7.050 - 10.00	10.00 (254)	1.05	1.05	4.0 (102)	2.68 (68)	2.68 (68)	1.05	1.6 (41)	2.00 (52)
			7.125 - 7.750		1.02	1.02				1.02		
			7.750 - 8.500		1.02	1.02				1.02		
			7.125 - 8.500		1.02	1.02				1.02		

Waveguide to Coaxial Adapters

EIA	RCSC	IEC	Size Code	Frequency Code	Frequency (GHz)	Waveguide to Coax Adapters Type N VSWR	SMA VSWR
WR112	WG15	R84	112	S	7.050 - 10.00	1.20	On Request
				A	7.125 - 7.750	1.10	On Request
				B	7.750 - 8.500	1.10	On Request
				C	7.125 - 8.500	1.15	On Request

Rectangular Waveguide Flanges

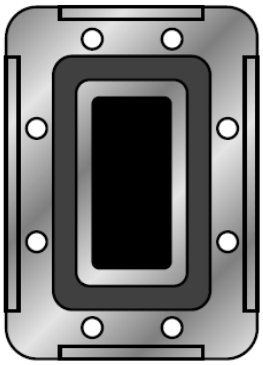


Figure 2

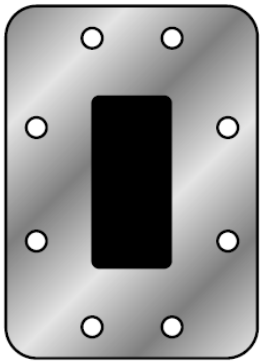


Figure 3

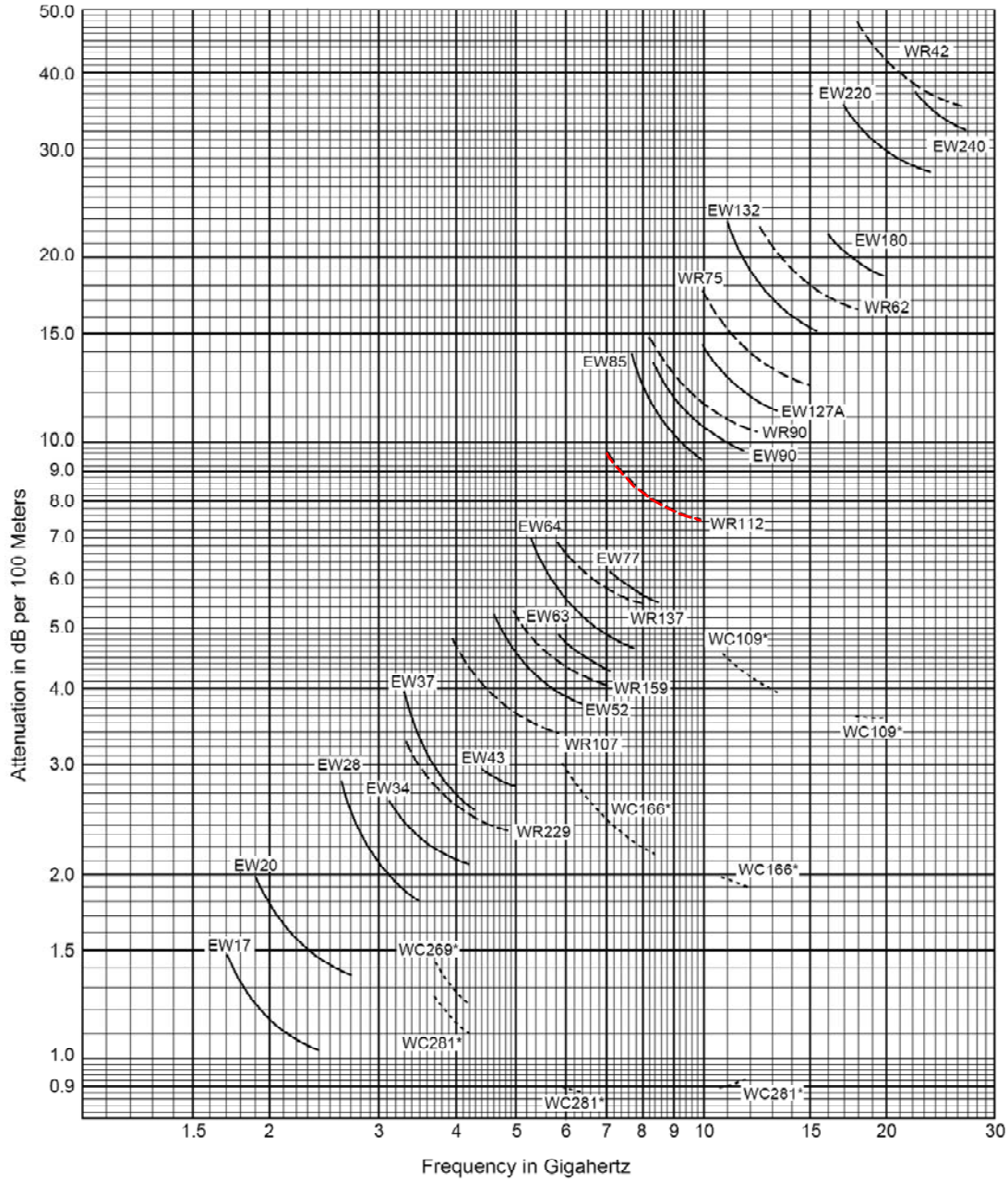
Pressurizable Contact Flanges

Waveguide Type, EIA	With Groove EIA	With Groove MIL Type	With Groove IEC	With Groove Fig. No.	Without Groove EIA	Without Groove MIL Type	Without Groove Fig. No.	Dimensions, Inches (Millimeters)
WR112	CPR112G	UG-1358/U	PDR84*	2	CPR112F	UG-1734/U	3	2.50 x 1.75 (63.5 x 44.5)

Flex-Twist Sections

EIA	RCSC	IEC	Frequency (GHz)	VSWR 12-36" (300-915 mm)	VSWR 36-48" (915-1200 mm)	Attenuation dB/ft (dB/m)	Average Power watts	Peak Power kW	Max Twist deg/ft (deg/m)	Min E-Bend Radius in (mm)	Min H-Bend Radius in (mm)	Pressure lb/in (kPa)
WR112	WG15	R84	7.050 - 10.00	1.10	1.13	0.12 (0.40)	1,260	315	80 (264)	3.0 (76)	6.0 (152)	35 (240)
			7.125 - 7.750	1.03	1.05							
			7.750 - 8.500	1.03	1.05							
			7.125 - 8.500	1.04	1.05							

Waveguide Attenuation
(Metric Units)



Attenuation curves based on:
- VSWR 1.0
- Ambient Temperature 24° C (75° F)
- High Conductivity Copper

The above attenuation curves are guaranteed within ±5%

*Does not include transition or network losses. See page 219.

Ordering Information for Waveguide Assemblies

Frequency* GHz	Waveguide Type	Flange Type††	Connector† Tunable	Fixed-Tuned	Pressure Window	Flex-Twist 2 ft (0.6 m)
Premium Waveguide Assemblies						**VSWR 1.06 (30.7)****
7.125-7.750	**EWP64-71**	UG-344/U†††	**164DCT**	**164SC**	**55000A-137**	**F137PA0240BC**
		CPR137G	**164DET**	**164SE**	**55001-137**	**F137PC0240CC**
		CPR112G	**264DET**	**264SCM**	**55001-112**	**F112PC0240CA**
		PDR70	–	**164SEM**	**223306-70**	**F137MH0600HC**
		PDR84	–	**264SEM**	–	**F112MH0600HA**
6.425-7.125	**EWP64-65**	UG-344/U†††	**164DCT**	**164SC**	**55000A-137**	**F137PA0240BB**
		CPR137G	**164DET**	**164SE**	**55001-137**	**F137PC0240CB**
		PDR70	–	**164SEM**	**223306-70**	**F137MH0600HB**
		PAR70	–	**164SCM**	–	**F137MP0600PB**
6.525-6.875	**EWP64-65N**	UG-344/U†††	**164DCT**	**164SC**	**55000A-137**	**F137PA0240BB**
		CPR137G	**164DET**	**164SE**	**55001-137**	**F137PC0240CB**
		PDR70	–	**164SEM**	**223306-70**	**F137MH0600HB**
		PAR70	–	**164SCM**	–	**F137MP0600PB**
Standard Waveguide Assemblies						**VSWR 1.15 (23.1)****
6.425-7.750	**EW64**	UG-344/U†††	**164DC**	–	**55000A-137**	**F137PA0240BS**
		CPR137G	**164DE**	**164SE**	**55001-137**	**F137PC0240CS**
		PDR70	–	**164SEM**	**223306-70**	**F137MH0600HS**
7.125-7.750	**EW64**	CPR112G	**264DE**	**264SE**	**55001-112**	**F112PC0240CC**
		PDR84	–	**264SEM**	–	**F112MH0600HC**

* Contact Andrew for information on other frequency bands. ** VSWR max., (R.L., dB). Up to 300 ft (90 m). The indicated maximum VSWR characteristics are guaranteed for factory assemblies and are typical for field assemblies. † "Tunable" connectors ordered with factory assemblies are factory tuned. †† For detailed information on mating flanges, refer to pages 214-218. ††† Modified cover flange with gasket groove. Mates with UG choke or cover flanges.

Accessories – Photos and detailed descriptions on pages 194-200

Description	Type No.
Hangers and Adapters	
Hanger Kit of 10, Recommended maximum spacing for outdoor installation is 3.5 ft (1.07 m)*	**42396A-1**
NEW! Snap-In Hanger Kit of 10. Recommended spacing for outdoor installation is 3.5 ft (1.07 m)	**EWSH-64**
Hardware Kit of 10, 3/8" bolts, lock washers, nuts	
3/4" (19 mm) long	**31769-5**
1" (25 mm) long	**31769-1**
Angle Adapter Kit of 10. Stainless steel	**31768A**
Angle Adapter Kit of 10. Galvanized	
3/8" Hardware	**242774**
Metric Hardware	**242774-M**
Round Member Adapter Kit of 10. Stainless steel	
Member Diameter, in (mm)	
1-2 (25-50)	**31670-1**
2-3 (50-75)	**31670-2**
3-4 (75-100)	**31670-3**
4-5 (100-125)	**31670-4**
5-6 (125-150)	**31670-5**
45° Adapter Kit of 10. Galvanized steel	**42334**
Threaded Rod Support, 3/8" rod, nuts, washers, ceiling bracket	
12 in (305 mm) long, kit of 1	**31771**
12 in (305 mm) long, kit of 5	**31771-4**
24 in (610 mm) long, kit of 1	**31771-9**
24 in (610 mm) long, kit of 5	**31771-6**
Tower Standoff Kit of 10. 1 in (25 mm) standoff	
Member Diameter, in (mm)	
0.75-1.5 (20-40)	**30848-5**
1.5-3.0 (40-75)	**30848-4**
3-4 (75-100)	**30848-1**
4-5 (100-125)	**30848-2**
5-6 (125-150)	**30848-3**

* Standard conditions: 125 mph (200 km/h) survival wind velocity, 0.5 in (13 mm) radial ice. For other conditions see page 196.

Description	Type No.
Tower Standoff Kit of 10. 2.5 in (60 mm) standoff	
Member Diameter, in (mm)	
3-4 (75-100)	**41108A-1**
4-5 (100-125)	**41108A-2**
5-6 (125-150)	**41108A-3**
Other Accessories	
Flaring Tool Kit for connector attachment	**202358**
Splice	**164DZ**
Grounding Kit with factory attached, one-hole lug	**204989-3**
Grounding Kit with factory attached, two-hole lug	**241088-3**
Grounding Kit with field attachable crimp-on, one-hole lug	**204989-23**
Grounding Kit with field attachable crimp-on, two-hole lug	**241088-8**
Grounding Kit with field attachable screw-on lug	**204989-33**
Crimping Tool to field attach lug to Grounding Kit	**207270**
Hoisting Grip	**29961**
Bending Tool Kit. One each E and H Plane tool	**EWBTK-2**
Connector Reattachment Kit	**33544-35**
Wall-Roof Feed Thru	**245314-64**
Waveguide Boot for Plates (below),	
4 in (102 mm) dia.	**WGB4-64**
5 in (127 mm) dia	**WGB5-64**

Feed-Thru Plate for Boots (above)

Openings	For 4 in Boots	For 5 in Boots
1	**204673-1**	**48940-1**
1	**204673-2**	–
2	–	**48940-2**
3	–	**48940-3**
4	**204673-4**	**48940-4**
6	–	**48940-6**
8	**204673-8**	–

[ANEXO Nº 3]

Disposición de radiocanales en la banda 7 425-7 725 MHz con una separación de radiocanales de 28 MHz

1 En este Anexo se describe la disposición preferida de radiocanales para los sistemas de relevadores radioeléctricos digitales a 34 Mbit/s y para la coexistencia de sistemas digitales y analógicos de hasta 300 canales que trabajan en la banda de 7 425 a 7 725 MHz. La disposición se representa en la Fig. 2 en la que los valores tienen el significado siguiente:

Sean f_0 la frecuencia del centro de la banda ocupada (MHz),

f_n la frecuencia central de un radiocanal en la mitad inferior de la banda (MHz),

f'_n la frecuencia central de un radiocanal en la mitad superior de la banda (MHz);

entonces las frecuencias en MHz de cada uno de los radiocanales se expresan mediante las relaciones siguientes:

mitad inferior de la banda: $f_n = f_0 - 161 + 28\,n$

mitad superior de la banda: $f'_n = f_0 - 7 + 28\,n$

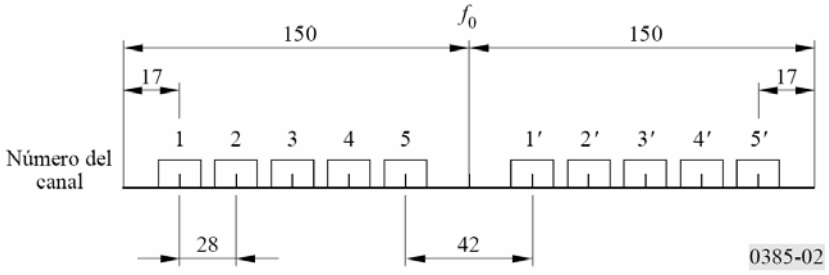
donde:

n = 1, 2, 3, 4 y 5.

FIGURA 2

Disposición de radiocanales para los sistemas de relevadores radioeléctricos analógicos y digitales que trabajan en la banda de 7 GHz

(Todas las frecuencias en MHz)



2 Todos los radiocanales de ida deben estar en una mitad de la banda y todos los radiocanales de retorno en la otra mitad.

3 En cuanto a los radiocanales adyacentes situados en la misma mitad de la banda, se pueden alternar las polarizaciones de los radiocanales sucesivos y, si ello es posible, se pueden utilizar ambas polarizaciones para cada radiocanal digital.

4 Cuando se requieran radiofrecuencias analógicas adicionales, se deberán intercalar entre las del esquema principal de la Fig. 2 y podrán obtenerse con la misma f_0 y la siguiente relación:

mitad inferior de la banda: $f_n = f_0 - 175 + 28\,n$

mitad superior de la banda: $f'_n = f_0 + 7 + 28\,n$

donde:

n = 1, 2, 3, 4 y 5.

5 Cuando se requieran radiofrecuencias digitales adicionales intercaladas entre las de la disposición principal de la Fig. 2, se podrán obtener mediante la misma f_0 y la siguiente relación:

mitad inferior de la banda: $f_n = f_0 - 147 + 28\,n$

mitad superior de la banda: $f'_n = f_0 + 7 + 28\,n$

siendo:

$n = 1, 2, 3$ y 4.

6 La frecuencia central preferida, f_0, es de 7 575 MHz.

7 Los osciladores locales para la mitad inferior de la banda deberían tener una frecuencia de 70 MHz por encima de la frecuencia del radiocanal respectivo, y para la mitad superior de la banda una frecuencia 70 MHz por debajo de la del radiocanal respectivo. Con ello se conseguirá que las frecuencias imagen caigan dentro de la banda. Sin embargo, la utilización de ciertas técnicas, especialmente la de mezcladores con rechazo de la frecuencia imagen, contribuye a soslayar esta limitación.

[ANEXO Nº 4]

Perfil Mecedores - Agua Fría

Nº	Distancia(m)	Altura (m)	Altura Corregida (m)
1	0	1745	1745,0
2	290	1681	1681,8
3	580	1526	1527,5
4	870	1498	1500,3
5	1160	1387	1390,0
6	1450	1220	1223,7
7	1740	1166	1170,4
8	2030	1089	1094,1
9	2320	1071	1076,7
10	2610	952	958,4
11	2900	942	949,1
12	3190	917	924,7
13	3480	909	917,3
14	3770	918	926,9
15	4060	920	929,5
16	4350	924	933,1
17	4640	926	934,7
18	4930	919	937,2
19	5220	907	930,8
20	5510	898	919,3
21	5800	898	910,8
22	6090	894	911,3
23	6380	898	907,8
24	6670	890	912,3
25	6960	891	904,8
26	7250	892	906,2
27	7540	891	907,7
28	7830	891	907,1
29	8120	897	907,5
30	8410	894	913,9
31	8700	895	911,3
32	8990	896	912,7
33	9280	901	914,1
34	9570	907	919,4
35	9860	915	925,8
36	10150	919	934,1
37	10440	915	938,4
38	10730	919	934,7
39	11020	912	939,0
40	11310	914	932,3
41	11600	914	934,5
42	11890	917	934,8
43	12180	916	938,0
44	12470	919	937,2
45	12760	917	938,6
46	13050	921	942,8
47	13340	924	946,0
48	13630	937	959,2
49	13920	940	962,3
50	14210	938	960,4

Nº	Distancia(m)	Altura (m)	Altura Corregida (m)
51	14500	940	962,6
52	14790	950	972,7
53	15080	969	991,8
54	15370	965	987,9
55	15660	985	1007,9
56	15950	1035	1058,0
57	16240	1141	1164,0
58	16530	1185	1208,1
59	16820	1260	1283,1
60	17110	1229	1252,1
61	17400	1273	1296,1
62	17690	1307	1330,1
63	17980	1338	1361,0
64	18270	1382	1405,0
65	18560	1413	1435,9
66	18850	1268	1290,9
67	19140	1251	1273,8
68	19430	1302	1324,7
69	19720	1342	1364,6
70	20010	1230	1252,4
71	20300	1198	1220,3
72	20590	1171	1193,2
73	20880	1084	1106,0
74	21170	1037	1058,8
75	21460	1074	1095,6
76	21750	1086	1107,4
77	22040	1097	1118,2
78	22330	1180	1201,0
79	22620	1200	1220,8
80	22910	1123	1143,5
81	23200	1160	1180,3
82	23490	1189	1209,0
83	23780	1228	1247,7
84	24070	1245	1264,4
85	24360	1189	1208,1
86	24650	1211	1229,8
87	24940	1231	1249,4
88	25230	1297	1315,1
89	25520	1369	1386,7
90	25810	1335	1352,3
91	26100	1276	1292,9
92	26390	1271	1287,5
93	26680	1361	1377,1
94	26970	1331	1346,7
95	27260	1270	1285,2
96	27550	1265	1279,8
97	27840	1258	1272,3
98	28130	1363	1376,8
99	28420	1279	1292,3
100	28710	1326	1338,8

Perfil Mecedores - Agua Fría

Nº	Distancia(m)	Altura (m)	Altura Corregida (m)
101	29000	1406	1418,3
102	29290	1495	1506,8
103	29580	1570	1581,2
104	29870	1638	1648,7
105	30160	1664	1674,1
106	30450	1718	1727,5
107	30740	1650	1658,9
108	31030	1614	1622,3
109	31320	1559	1566,7
110	31610	1541	1548,1
111	31900	1567	1573,4
112	32190	1590	1595,7
113	32480	1610	1615,1
114	32770	1647	1651,4
115	33060	1764	1767,7
116	33350	1843	1846,0
117	33640	1821	1823,3
118	33930	1854	1855,5
119	34220	1940	1940,8
120	34303	1954	1954,0

Perfil Agua Fría - Caricuao

Nº	Distancia(m)	Altura(m)	Altura Corregida(m)
1	0	1954,0	1954,0
2	200	1940,0	1940,3
3	400	1933,0	1933,6
4	600	1854,0	1854,9
5	800	1863,0	1864,1
6	1000	1843,0	1844,4
7	1200	1807,0	1808,7
8	1400	1807,0	1808,9
9	1600	1727,0	1729,2
10	1800	1704,0	1706,4
11	2000	1639,0	1641,7
12	2200	1600,0	1602,9
13	2400	1552,0	1555,1
14	2600	1516,0	1519,3
15	2800	1491,0	1494,6
16	3000	1489,0	1492,8
17	3200	1489,0	1493,0
18	3400	1519,0	1523,2
19	3600	1528,0	1532,4
20	3800	1619,0	1623,5
21	4000	1625,0	1629,7
22	4200	1601,0	1605,9
23	4400	1647,0	1652,1
24	4600	1618,0	1623,2
25	4800	1660,0	1665,4
26	5000	1660,0	1665,5
27	5200	1625,0	1630,7
28	5400	1593,0	1598,8
29	5600	1568,0	1574,0
30	5800	1481,0	1487,1
31	6000	1505,0	1511,2
32	6200	1471,0	1477,3
33	6400	1467,0	1473,4
34	6600	1401,0	1407,5
35	6800	1408,0	1414,6
36	7000	1408,0	1414,7
37	7200	1387,0	1393,8
38	7400	1434,0	1440,9
39	7600	1538,0	1545,0
40	7800	1541,0	1548,0
41	8000	1519,0	1526,1
42	8200	1526,0	1533,1
43	8400	1484,0	1491,2
44	8600	1508,0	1515,2
45	8800	1508,0	1515,3
46	9000	1572,0	1579,3
47	9200	1625,0	1632,3
48	9400	1568,0	1575,4
49	9600	1579,0	1586,4
50	9800	1573,0	1547,4

Nº	Distancia(m)	Altura(m)	Altura Corregida(m)
51	10000	1593,0	1580,4
52	10200	1561,0	1600,4
53	10400	1576,0	1568,4
54	10600	1470,0	1583,4
55	10800	1504,0	1477,3
56	11000	1455,0	1511,3
57	11200	1456,0	1462,3
58	11400	1412,0	1466,2
59	11600	1414,0	1463,2
60	11800	1373,0	1419,1
61	12000	1411,0	1421,1
62	12200	1368,0	1380,0
63	12400	1323,0	1418,0
64	12600	1289,0	1374,9
65	12800	1230,0	1329,8
66	13000	1236,0	1295,7
67	13200	1248,0	1236,6
68	13400	1269,0	1242,5
69	13600	1210,0	1254,4
70	13800	1159,0	1275,3
71	14000	1159,0	1216,2
72	14200	1143,0	1165,1
73	14400	1174,0	1165,0
74	14600	1169,0	1148,8
75	14800	1150,0	1179,7
76	15000	1086,0	1174,5
77	15200	1037,0	1155,4
78	15400	1006,0	1091,2
79	15600	978,0	1042,1
80	15800	970,0	1010,9
81	16000	985,0	982,7
82	16200	969,0	989,4
83	16400	965,0	973,2
84	16600	973,0	969,0
85	16800	1016,0	976,8
86	17000	987,0	1019,6
87	17200	991,0	990,3
88	17400	965,0	994,1
89	17600	970,0	967,9
90	17800	959,0	961,4
91	18000	958,0	959,2
92	18200	951,0	952,7
93	18400	961,0	962,4
94	18600	958,0	959,1
95	18800	993,0	993,9
96	19000	1054,0	1054,6
97	19200	1095,0	1095,3
98	19394	1121,0	1121,0

[ANEXO Nº 5]

Perfiles de Mecedores-Volcán y Volcán-Caricuao

Volcán - Caricuao		
Nº	Distancia	Altura
0	0	1497
1	150	1474
2	300	1464
3	450	1459
4	600	1421
5	750	1402
6	900	1354
7	1050	1301
8	1200	1219
9	1350	1170
10	1500	1130
11	1650	1116
12	1800	1102
13	1950	1084
14	2100	1069
15	2250	1080
16	2400	1114
17	2550	1141
18	2700	1119
19	2850	1072
20	3000	1081
21	3150	1095
22	3300	1129
23	3450	1152
24	3600	1198
25	3750	1233
26	3900	1283
27	4050	1311
28	4200	1310
29	4350	1304
30	4500	1309
31	4650	1292
32	4800	1283
33	4950	1270
34	5100	1278
35	5250	1284
36	5400	1292
37	5550	1301
38	5700	1250
39	5850	1202
40	6000	1165
41	6150	1102
42	6300	1093
43	6450	1060
44	6600	1042
45	6750	1025
46	6900	983
47	7050	976
48	7200	958
49	7350	948
50	7500	940

Volcán - Caricuao		
Nº	Distancia(m)	Altura(m)
51	7650	933
52	7800	920
53	7950	914
54	8100	910
55	8250	914
56	8400	937
57	8550	982
58	8700	1002
59	8850	984
60	9000	963
61	9150	953
62	9300	970
63	9450	970
64	9600	961
65	9750	958
66	9900	961
67	10050	979
68	10200	994
69	10350	1005
70	10500	1024
71	10650	1058
72	10800	1097
73	10950	1138
74	11100	1194
75	11250	1181
76	11400	1133
77	11550	1100
78	11700	1063
79	11850	1054
80	12000	1054
81	12150	1064
82	12300	1065
83	12450	1097
84	12600	1112
85	12750	1138
86	12900	1110
87	13050	1125
88	13200	1147
89	13350	1088
90	13500	1079
91	13650	1059
92	13800	1092
93	13950	1053
94	14100	1071
95	14250	1087
96	14400	1079
97	14550	1095
98	14700	1075
99	14830	1121

Mecedores-Volcán		
Nº	Distancia	Altura
0	0	1745
1	250	1665
2	500	1574
3	750	1440
4	1000	1330
5	1250	1201
6	1500	1085
7	1750	972
8	2000	952
9	2250	937
10	2500	922
11	2750	909
12	3000	902
13	3250	900
14	3500	885
15	3750	890
16	4000	869
17	4250	862
18	4500	855
19	4750	889
20	5000	869
21	5250	882
22	5500	907
23	5750	884
24	6000	882
25	6250	886
26	6500	882
27	6750	886
28	7000	888
29	7250	922
30	7500	917
31	7750	934
32	8000	951
33	8250	1028
34	8500	1082
35	8750	1058
36	9000	1024
37	9250	993
38	9500	968
39	9750	976
40	10000	1000
41	10250	1016
42	10500	1015
43	10750	1010
44	11000	1026
45	11250	1053
46	11500	1103
47	11750	1205
48	12000	1317
49	12250	1320
50	12500	1425
51	12,716	1497

[ANEXO Nº 6]

Método de Calculo del punto de Reflexión

A continuación se expone un método para hallar el punto de reflexión en tierra plana cuando hay irregularidades en el terreno.

h1' y h2' son parámetros que se hallan de la suma de la altura sobre el nivel del mar del sitio de transmisión (h_{sitio1}) y la altura de la torre donde se encuentra la antena transmisora (h_{Tx}) o receptora (h_{Rx}):

$$h1' = h_{sitio1} + h_{Tx}$$
$$h2' = h_{sitio2} + h_{Rx}$$

Paso 1: Se halla la cota de un punto sobre el perfil:

$$h_{itera} = \text{cota de punto}$$

Paso 2: A partir del punto hallado en el *paso 1* se encuentra los parámetros h1 y h2:

$$h1 = h1' - h_{itera}$$
$$h2 = h2' - h_{itera}$$

Posteriormente se sustituye h1 y h2 en las ecuaciones 2.4 y 2.5, con lo cual se obtiene d1.

Paso3: Hallar en el perfil la cota correspondiente a la distancia d1, y sustituir este valor en el parámetro "h_{itera}".

Paso 4: Se repiten los pasos del 2 al 3 hasta que converja la distancia d1 a un valor. Con lo cual se obtiene d2 ya que este depende de d1 y d.

[ANEXO Nº 6.1]

Calculo el Punto de Reflexión

El cálculo del punto de reflexión se realiza a continuación según lo que se expuso en la sección 2.1.6.

Punto de reflexión del vano Mecedores – Volcán:

- Distancia del vano: d = 12,716Km
- Altura sobre el nivel del mar de Mecedores: h_{sitio1} = 1745m
- Altura sobre el nivel del mar de Volcán: h_{sitio2} = 1497m
- Altura de la antena transmisora: h_{Tx} = 15m
- Altura de la antena Receptora: h_{Rx} = 15m

$$h1' = h_{sitio1} + h_{Tx} = 1745\ m + 15\ m = 1760\ m$$
$$h2' = h_{sitio2} + h_{Rx} = 1497\ m + 15\ m = 1512\ m$$

Ahora hallando una altura inicial sobre el perfil para así comenzar a iterar se tiene: $h_{itera(1)}$ = 1081m

$$h1 = h1' - h_{itera(1)} = 1760\ m - 1081 = 679m$$
$$h2 = h2' - h_{itera(1)} = 1512\ m - 1081 = 431m$$
$$d1 = \frac{679}{679 + 431} 12716 = 7778,52m$$
$$d2 = d - d1 = 4937,47\ m$$

Ahora hallando la altura en el perfil para una distancia d1 se tiene: $h_{itera(2)}$ = 925 m

$$h1 = h1' - h_{itera(2)} = 1760\ m - 925 = 820m$$
$$h2 = h2' - h_{itera(2)} = 1512\ m - 925 = 572m$$
$$d1 = \frac{820}{820 + 572} 12716 = 7490,74m$$
$$d2 = d - d1 = 5225,25m$$

Realizando otra iteración se tiene:

$h_{itera(3)} = 921,65$ m

$$h1 = h1' - h_{itera(3)} = 1760 \text{ m} - 921,65 = 823,35\text{m}$$
$$h2 = h2' - h_{itera(3)} = 1512 \text{ m} - 921,65 = 575,35\text{m}$$
$$d1 = \frac{823,35}{823,35 + 575,35} 12716 = 7485,32\text{m}$$
$$d2 = d - d1 = 5230,67 \text{ m}$$

Otra iteración para hallar con precisión el punto de reflexión:

$h_{itera(4)} = 921,88$ m

$$h1 = h1' - h_{itera(4)} = 1760 \text{ m} - 921,88 = 823,12\text{m}$$
$$h2 = h2' - h_{itera(4)} = 1512 \text{ m} - 921,88 = 575,12\text{m}$$

$$d1 = \frac{823,12}{823,12 + 575,12} 12716 = 7485,69\text{m}$$
$$d2 = d - d1 = 5230,3\text{m}$$

Se tiene que el punto de reflexión converge a:

d1 = 7485,67m

d2 = 5230,32m

Punto de reflexión del vano Volcán Caricuao:

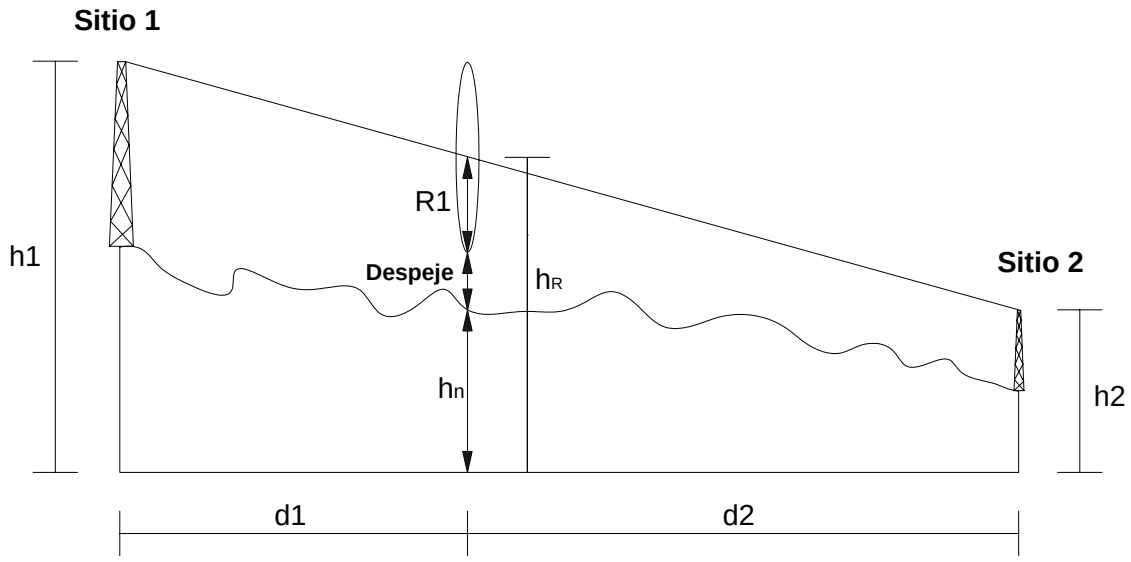
Debido a la topografía no converge el punto de reflexión a ninguna ubicación en el perfil.

[ANEXO Nº 7]

Calculo de las Zonas de Fresnel

Según lo expuesto en el capitulo II en la sección 2.1.7, el radio del primer anillo de Fresnel en las trayectorias de Mecedores – Volcán y Volcán – Caricuao se calcula mediante las siguientes consideraciones:

Si h1>h2:



$$h_R = \frac{(d - d1)\cdot(h1 - h2)}{d} + h2$$

$$\text{Despeje} = h_R - (0{,}6 \cdot R1 + h_n)$$

De donde existe obstrucción si el mismo toma valores negativos.

En donde:

d = Distancia entre el transmisor y el receptor.

R1 = Radio del primer elipsoide de Fresnel.

d1 = Distancia desde el sitio 1 al elipsoide de Fresnel.

d2 = Distancia desde el elipsoide de Fresnel al sitio 2.

h1 = Altura de la antena sobre el nivel del mar en el sitio 1.

h2 = Altura de la antena sobre el nivel del mar en el sitio 1.

h_R = Altura del centro del elipsoide de Fresnel.

h_n = Altura del terreno a una distancia d1 del sitio 1.

Para el análisis del vano Mecedores - Volcán fueron usados los siguientes datos:

- Altura del sitio 1 (Mecedores) sobre el nivel del mar: h_{sitio1} = 1745 m
- Altura de la antena: $h_{antena1}$ = 15 m
- Altura de la estructura sobre el nivel del mar: h1 = h_{sitio1} + $h_{antena1}$ = 1760 m
- Altura del sitio 2 (Volcán) sobre el nivel del mar: h_{sitio2} = 1497 m
- Altura de la antena: $h_{antena2}$ = 15m
- Altura de la estructura sobre el nivel del mar: h2 = h_{sitio2} + $h_{antena2}$ = 1512 m
- Distancia entre los sitios: d = 12,716 Km
- Frecuencia de operación (frecuencia central de la banda): f = 7575 MHz

Se procesan los datos anteriores en una hoja de cálculo para determinar si existe obstrucción de la primera zona de Fresnel:

d(Km)	Altura(m)	h_R(m)	R1(m)	Despeje(m)
0,00	1745	1760,0	0,00	15,0
0,25	1665	1755,1	10,25	84,0
0,50	1574	1750,2	14,36	167,6
0,75	1440	1745,4	17,40	294,9
1,00	1330	1740,5	19,88	398,6
1,25	1201	1735,6	21,99	521,4
1,50	1085	1730,7	23,82	631,5
1,75	972	1725,9	25,44	738,6
2,00	952	1721,0	26,89	752,9
2,25	937	1716,1	28,19	762,2
2,50	922	1711,2	29,35	771,6
2,75	909	1706,4	30,41	779,1
3,00	902	1701,5	31,36	780,7
3,25	900	1696,6	32,22	777,3
3,50	885	1691,7	32,99	786,9
3,75	890	1686,9	33,68	776,7
4,00	869	1682,0	34,30	792,4
4,25	862	1677,1	34,84	794,2
4,50	855	1672,2	35,32	796,0
4,75	889	1667,4	35,73	756,9
5,00	869	1662,5	36,08	771,8
5,25	882	1657,6	36,36	753,8
5,50	907	1652,7	36,59	723,8
5,75	884	1647,9	36,76	741,8
6,00	882	1643,0	36,87	738,9
6,25	886	1638,1	36,92	730,0
6,50	882	1633,2	36,92	729,1
6,75	886	1628,4	36,86	720,2
7,00	888	1623,5	36,74	713,4
7,25	922	1618,6	36,56	674,7

7,50	917	1613,7	36,33	674,9
7,75	934	1608,9	36,03	653,2
8,00	951	1604,0	35,68	631,6
8,25	1028	1599,1	35,26	549,9
8,50	1082	1594,2	34,77	491,4
8,75	1058	1589,3	34,22	510,8
9,00	1024	1584,5	33,59	540,3
9,25	993	1579,6	32,89	566,9
9,50	968	1574,7	32,11	587,5
9,75	976	1569,8	31,24	575,1
10,00	1000	1565,0	30,27	546,8
10,25	1016	1560,1	29,20	526,6
10,50	1015	1555,2	28,02	523,4
10,75	1010	1550,3	26,70	524,3
11,00	1026	1545,5	25,24	504,3
11,25	1053	1540,6	23,59	473,4
11,50	1103	1535,7	21,72	419,7
11,75	1205	1530,8	19,57	314,1
12,00	1317	1526,0	17,03	198,7
12,25	1320	1521,1	13,88	192,8
12,50	1425	1516,2	9,54	85,5
12,716	1497	1512,0	0,00	15,0

Los cálculos realizados en la hoja del calculo indican que en todo el trayecto el valor del despeje es positivo por tanto se determina que no existe obstrucción de la primera zona de Fresnel para este vano.

A continuación se realizara el mismo análisis para el vano Volcán – Caricuao:

- Altura del sitio 1 (Volcán) sobre el nivel del mar: h_{sitio1} = 1497m
- Altura de la antena: $h_{antena1}$ = 15m
- Altura de la estructura sobre el nivel del mar: h1 = h_{sitio1} + $h_{antena1}$ = 1512 m
- Altura del sitio 2 (Caricuao) sobre el nivel del mar: h_{sitio2} = 1121m
- Altura de la antena: $h_{antena2}$ = 15m
- Altura de la estructura sobre el nivel del mar: h2 = h_{sitio2} + $h_{antena2}$ = 1136 m
- Distancia entre los sitios: d = 14,830Km
- Frecuencia de operación (frecuencia central de la banda): f = 7575 MHz

d(Km)	Altura(m)	h_R(m)	R1(m)	Despeje(m)
0,00	1497	1512,0	0,00	15,0
0,15	1474	1508,2	7,98	29,4
0,30	1464	1504,4	11,23	33,7
0,45	1459	1500,6	13,68	33,4
0,60	1421	1496,8	15,72	66,4
0,75	1402	1493,0	17,48	80,5
0,90	1354	1489,2	19,04	123,8
1,05	1301	1485,4	20,46	172,1
1,20	1219	1481,6	21,75	249,5
1,35	1170	1477,8	22,94	294,0
1,50	1130	1474,0	24,05	329,5
1,65	1116	1470,2	25,08	339,1
1,80	1102	1466,4	26,05	348,7
1,95	1084	1462,6	26,95	362,4
2,10	1069	1458,8	27,81	373,1
2,25	1080	1455,0	28,61	357,8
2,40	1114	1451,2	29,38	319,5
2,55	1141	1447,3	30,10	288,3
2,70	1119	1443,5	30,78	306,1
2,85	1072	1439,7	31,43	348,9
3,00	1081	1435,9	32,04	335,7
3,15	1095	1432,1	32,62	317,6
3,30	1129	1428,3	33,18	279,4
3,45	1152	1424,5	33,70	252,3
3,60	1198	1420,7	34,20	202,2
3,75	1233	1416,9	34,67	163,1
3,90	1283	1413,1	35,12	109,0
4,05	1311	1409,3	35,54	77,0
4,20	1310	1405,5	35,94	74,0
4,35	1304	1401,7	36,32	75,9
4,50	1309	1397,9	36,67	66,9
4,65	1292	1394,1	37,01	79,9
4,80	1283	1390,3	37,32	84,9
4,95	1270	1386,5	37,61	93,9
5,10	1278	1382,7	37,89	82,0
5,25	1284	1378,9	38,14	72,0
5,40	1292	1375,1	38,38	60,1
5,55	1301	1371,3	38,60	47,1
5,70	1250	1367,5	38,80	94,2
5,85	1202	1363,7	38,98	138,3
6,00	1165	1359,9	39,15	171,4
6,15	1102	1356,1	39,30	230,5
6,30	1093	1352,3	39,43	235,6
6,45	1060	1348,5	39,54	264,7
6,60	1042	1344,7	39,64	278,9
6,75	1025	1340,9	39,72	292,0
6,90	983	1337,1	39,79	330,2
7,05	976	1333,3	39,83	333,4
7,20	958	1329,5	39,86	347,5
7,35	948	1325,6	39,88	353,7
7,50	940	1321,8	39,88	357,9
7,65	933	1318,0	39,86	361,1

7,80	920	1314,2	39,83	370,3
7,95	914	1310,4	39,78	372,6
8,10	910	1306,6	39,71	372,8
8,25	914	1302,8	39,63	365,1
8,40	937	1299,0	39,53	338,3
8,55	982	1295,2	39,41	289,6
8,70	1002	1291,4	39,28	265,9
8,85	984	1287,6	39,13	280,1
9,00	963	1283,8	38,96	297,4
9,15	953	1280,0	38,77	303,7
9,30	970	1276,2	38,57	283,1
9,45	970	1272,4	38,35	279,4
9,60	961	1268,6	38,11	284,7
9,75	958	1264,8	37,85	284,1
9,90	961	1261,0	37,58	277,5
10,05	979	1257,2	37,28	255,8
10,20	994	1253,4	36,96	237,2
10,35	1005	1249,6	36,62	222,6
10,50	1024	1245,8	36,27	200,0
10,65	1058	1242,0	35,89	162,4
10,80	1097	1238,2	35,48	119,9
10,95	1138	1234,4	35,06	75,3
11,10	1194	1230,6	34,61	15,8
11,25	1181	1226,8	34,13	25,3
11,40	1133	1223,0	33,63	69,8
11,55	1100	1219,2	33,10	99,3
11,70	1063	1215,4	32,55	132,8
11,85	1054	1211,6	31,96	138,4
12,00	1054	1207,8	31,34	134,9
12,15	1064	1203,9	30,69	121,5
12,30	1065	1200,1	30,00	117,1
12,45	1097	1196,3	29,28	81,8
12,60	1112	1192,5	28,51	63,4
12,75	1138	1188,7	27,70	34,1
12,90	1110	1184,9	26,84	58,8
13,05	1125	1181,1	25,92	40,6
13,20	1147	1177,3	24,95	15,4
13,35	1088	1173,5	23,91	71,2
13,50	1079	1169,7	22,79	77,0
13,65	1059	1165,9	21,59	94,0
13,80	1092	1162,1	20,28	57,9
13,95	1053	1158,3	18,84	94,0
14,10	1071	1154,5	17,26	73,2
14,25	1087	1150,7	15,46	54,4
14,40	1079	1146,9	13,38	59,9
14,55	1095	1143,1	10,86	41,6
14,70	1075	1139,3	7,44	59,8
14,83	1121	1136,0	0,00	15,0

Se determina que no existe obstrucción de la primera zona de Fressnel dado que el valor del despeje es positivo en todo el trayecto tal como se observa en la tabla anterior.

[ANEXO Nº 8]

Calculo de la calidad de fidelidad

A continuación se realizara el calculo de la calidad de fidelidad de la ruta conformada por los vanos Mecedores - Volcán y Volcán - Caricuao, según lo planteado en la sección 2.3.8 y 2.3.9.

Calculo de la proporción de segundos con muchos errores del vano Mecedores - Volcán: $P_{TT(MV)}$

- Factor de aparición de desvanecimiento del vano Mecedores - Volcán: $P_{o(MV)}$

Se tiene que para la ruta en estudio el gradiente de refractividad puntual "dN1" tiene el valor de -100, con lo cual se halla el factor geoclimatico "K" según la ecuación 2.31:

$$K = 10^{-4,2 - 0,0029.(-100)}$$

$$K = 1,23.10^{-4}$$

La magnitud de la inclinación del trayecto Mecedores - Volcán "$|\varepsilon_{p(MV)}|$" es:

- Longitud del trayecto d = 12,716Km
- Altura de la antena de transmisión en Mecedores: $h_{t(M)}$ = 1745m + 15m = 1760m
- Altura de la antena de recepción en Volcán: $h_{r(V)}$ = 1497m + 15m = 1512m

$$|\varepsilon_{p(MV)}| = \frac{|1512 - 1760|}{12,716} = 19,5 \text{ mrad}$$

El factor de aparición de desvanecimiento "P_o" para el tramo Mecedores – Volcán viene dado por la ecuación 2.36:

- h_L es el valor mas pequeño entre $h_{t(M)}$ y $h_{r(V)}$: h_L = 1512m.
- La frecuencia de operación: f = 7,575 GHz.
- Distancia del vano: d = 12,716 Km.
- $|\varepsilon_{p(MV)}|$ y K fueron calculados anteriormente.

$$P_{o(MV)} = 1{,}23.10^{-4}.(12{,}716)^{3}.(1+19{,}5)^{-1,2}.10^{0{,}033*7{,}575-0{,}001*1512}\ \%$$

$$P_{o(MV)} = 3{,}68.10^{-4}\ \%$$

- El porcentaje de tiempo para desvanecimiento selectivo requiere para su evaluación conocer los siguientes parámetros:

- El factor de actividad multitrayecto "η":

En la evaluación del factor de actividad multitrayecto para el vano Mecedores - Volcán se necesita conocer el factor de aparición de desvanecimiento "$P_{o(MV)}$" calculado anteriormente y que tiene un valor de $3{,}68.10^{-6}$ (Expresado en forma no porcentual).

$$\eta_{(MV)} = 1- \exp[-0{,}2.(3{,}68.10^{-6})^{3/4}] = 1{,}68.10^{-5}$$

- El valor medio del retardo "τ_m":

La evaluación del valor medio del retardo requiere conocer la distancia del vano Mecedores - Volcán el cual es de 12,716 Km.

$$\tau_{m(MV)} = 0{,}7. \left(\frac{12{,}716}{50}\right)^{1,3}\ \text{ns} = 0.000118\ \mu\text{s}$$

- La constante de signatura k se expresa en forma literal.

- El periodo del símbolo T_s se expresa en forma literal.

$$P_{TS(MV)} = 100.\ 1{,}68.10^{-5}.\ 4{,}32.\ k.\ (0{,}000118 / (\log_2(M)/V_b))^2\ \%$$

$$P_{TS(MV)} = \frac{1{,}011.10^{-10}.k.V_b^{\,2}}{(\log_2(M))^2}\ \%$$

- El margen neto de desvanecimiento depende de tres parámetros que ya han sido hallados los cuales son:

- Margen bruto de desvanecimiento del vano Mecedores - Volcán:

$$M_{3(MV)} = 50{,}38\text{dB}$$

- El porcentaje de tiempo para el desvanecimiento selectivo para el vano Mecedores –Volcán "$P_{TS(MV)}$" es:

$$P_{TS(MV)} = \frac{1{,}011.10^{-10}.k.V_b^{\,2}}{(\log_2(M))^2}\ \%$$

- El factor de aparición de desvanecimiento "P_o": $P_{o(MV)} = 3{,}68.10^{-4}$ %

El margen neto de desvanecimiento para el vano Mecedores - Volcán "$M_{e(MV)}$" es:

$$M_{e(MV)}(\text{dB}) = 50{,}38\ \text{dB} - 10\log\left(1+\frac{3.10^{-2}.k.V_b^{\,2}}{(\log_2(M))^2}\right)$$

La proporción de segundos con muchos errores "P_{TT}" del vano Mecedores – Volcán se halla a partir del factor de aparición de desvanecimiento "$P_{o(MV)}$" y el margen neto de desvanecimiento "$M_{e(MV)}$", mismos que son sustituidos en la ecuación 2.48 y simplificados obteniendo la siguiente expresión:

$$\mathbf{P_{TT(MV)}} = 3{,}37.10^{-9}.\left(1+\frac{3.10^{-2}*k*V_b^{\,2}}{(\log_2(M))^2}\right)\ \mathbf{\%}$$

Calculo de la proporción de segundos con muchos errores del vano Volcán - Caricuao: $P_{TT(VC)}$

- Factor de aparición de desvanecimiento del vano Volcán – Caricuao: $P_{o(VC)}$

Magnitud de la inclinación del trayecto Volcán - Caricuao "$|\varepsilon_{p(MV)}|$" es:

- Longitud del trayecto d = 12,716Km
- Altura de la antena de transmisión en Volcán: $h_{t(V)}$ = 1497m + 15m = 1512m
- Altura de la antena de recepción en Caricuao: $h_{r(C)}$ = 1121m + 15m = 1136m

$$|\ \varepsilon_{p(VC)}\ | = \frac{|1136-1512|}{14{,}830} = 25{,}35\ \text{mrad}$$

El factor de aparición de desvanecimiento "P_o" para el tramo Volcán – Caricuao viene dado por:

- h_L es el valor mas pequeño entre $h_{t(V)}$ y $h_{r(C)}$: h_L = 1136m.
- La frecuencia de operación: f = 7,575 GHz.
- Distancia del vano: d = 14,830 Km.
- $|\varepsilon_{p(MV)}|$ y K fueron calculados anteriormente.

$$P_{o(VC)} = 1{,}23.10^{-4}.(14{,}830)^3.(1+25{,}35)^{-1{,}2}.10^{0{,}033*7{,}575-0{,}001*1136}\ \%$$

$$P_{oVC} = 1{,}02.10^{-3}\ \%$$

- El porcentaje de tiempo para desvanecimiento selectivo requiere para su evaluación conocer los siguientes parámetros:

- El factor de actividad multitrayecto "η":

En la evaluación del factor de actividad multitrayecto para el vano Volcán – Caricuao se necesita conocer el factor de aparición de desvanecimiento "$P_{o(VC)}$" calculado anteriormente y que tiene un valor de $1{,}02.10^{-5}$ (Expresado en forma no porcentual).

$$\eta_{(MV)} = 1 - \exp[-0{,}2.(1{,}02.10^{-5})^{3/4}] = 3{,}61.10^{-5}$$

- El valor medio del retardo "τ_m":

La evaluación del valor medio del retardo requiere conocer la distancia del vano Volcán - Caricuao el cual es de 14,830Km.

$$\tau_{m(MV)} = 0{,}7.\left(\frac{14{,}830}{50}\right)^{1{,}3}\ \text{ns} = 0{,}000144\ \mu\text{s}$$

- La constante de signatura k se expresa en forma literal.

- El periodo del símbolo T_s se expresa en forma literal.

Siendo el porcentaje de tiempo para desvanecimiento selectivo del vano Volcán – Caricuao "$P_{TS(VC)}$":

$$P_{TS(VC)} = 100.\ 3{,}61.10^{-5}.\ 4{,}32.\ k.\ (0{,}000144 / (\log_2(M)/V_b))^2\ \%$$

$$P_{TS(VC)} = \frac{3{,}24.10^{-10}.k.V_b^{\ 2}}{(\log_2(M))^2}\ \%$$

- El margen neto de desvanecimiento depende de tres parámetros que ya han sido hallados los cuales son:

- Margen bruto de desvanecimiento del vano Volcán - Caricuao: $M_{3(VC)} = 49{,}04dB$
- El porcentaje de tiempo para el desvanecimiento selectivo para el vano Volcán – Caricuao "$P_{TS(VC)}$" es:

$$P_{TS(VC)} = \frac{3{,}24.10^{-10}.k.V_b^{\ 2}}{(\log_2(M))^2}\ \%$$

- El factor de aparición de desvanecimiento "P_o": $P_{o(VC)} = 1{,}02.10^{-3}\ \%$

El margen neto de desvanecimiento para el vano Volcán – Caricuao "$M_{e(VC)}$" es:

$$M_{e(VC)}(dB) = 49{,}04dB - 10\log\left(1 + \frac{2{,}54.10^{-2}.k.V_b^{\ 2}}{(\log_2(M))^2}\right)$$

La proporción de segundos con muchos errores "P_{TT}" del vano Volcán - Caricuao se halla a partir del factor de aparición de desvanecimiento "$P_{o(VC)}$" y el margen neto de desvanecimiento "$M_{e(VC)}$", mismos que son sustituidos en la ecuación 2.48 y simplificados obteniendo la siguiente expresión:

$$P_{TT(VC)} = 1{,}27.10^{-8}.\left(1 + \frac{2{,}54.10^{-2} * k * V_b^{\ 2}}{(\log_2(M))^2}\right)\ \%$$

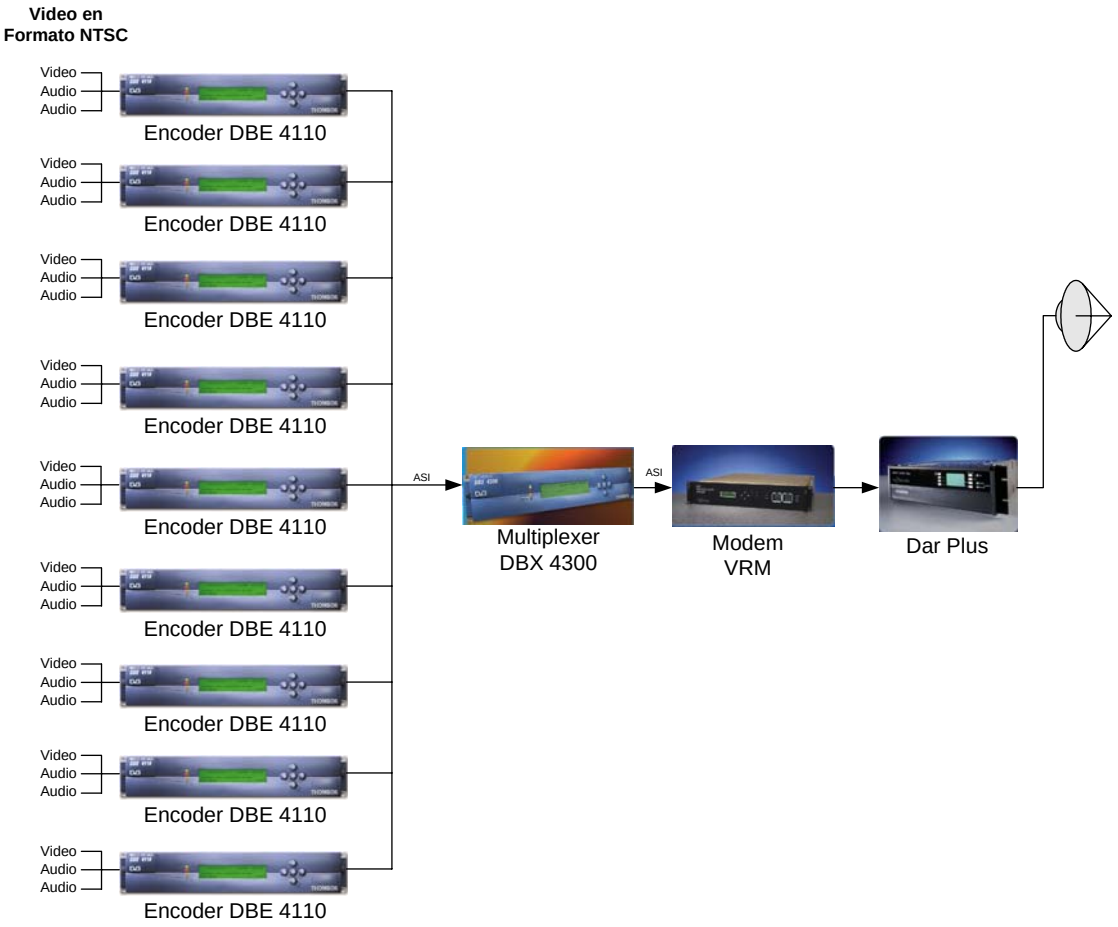
La proporción total de segundos con muchos errores "P_{TT}" de la ruta Mecedores - Volcán - Caricuao viene dada por la suma de $P_{TT(MV)}$ y $P_{TS(VC)}$:

$$P_{TT} = P_{TT(MV)} + P_{TS(VC)}$$

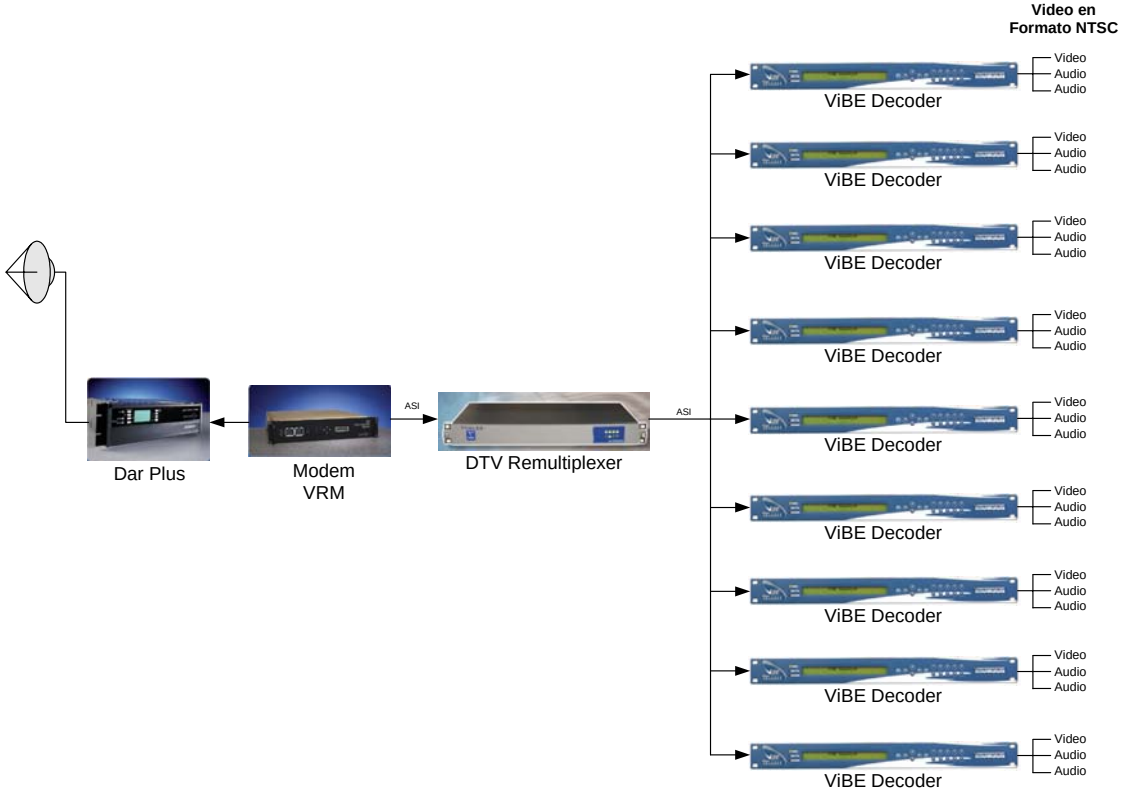
$$P_{TT} = 1{,}607.10^{-8} + \frac{4{,}236.10^{-10} * k * V_b^{\,2}}{\left(\log_2(M)\right)^2}$$

[ANEXO Nº 9]

Sistema de Transmisión Digital



Sistema de Recepción Digital



DSNG Encoder

DBE 4110

As a mobile extension of the MPEG2 DVB 2nd Encoder generation,the Nextream **DBE 4110** Encoder is a high quality, cost effective solution which is used worldwide for Mobile Contribution or DSNG applications.

The DBE 4110 supports various interfaces and specifically, a **QPSK – 8PSK – 16QAM DVB** Modulator.

Transmission security is achieved thanks to **BISS DSNG-CA.**

Applications

- Digital Satellite News Gathering
- SCPC application and Remux for MCPC
- Private Networks

Key Features

- MPEG2 DVB
  4:2:0 Main Profile @ Main Level
  4:2:2 Professional Profile @ Main Level
- High Quality PAL/NTSC Decoding with SYNC.
- Configurable output bit rate between 0.5 – 54 Mbps
- Low Delay Modes down to 100 ms end-to-end
- Ebu Fixed Key Scrambling: BISS modes 1 & E
- Built-in Modulator (IF & L-Band outputs)
- Encoder Cascading in Multi-Video Environment
- Full Control from Encoder Front Panel
- 8 User Predefined Configurations plus three DVB or ISOG Profiles

NEXTREAM
A JOINT VENTURE OF ALCATEL AND THOMSON

DBE 4110

General Purpose Encoder

Encoding features

Video input

- PAL/NTSC, High Quality with SYNC mode
- Accepts degraded video input signals
- SECAM (option)
- SDI 4:2:2 270 Mbps (625 / 525)
- Composite acc.to ITU-R 470-2 rep 624-4
- S/N : > 61 dB (ramp filtered weighted)
- Frequency response: 0.15 - 5.7 MHz (PAL)

Pre-processing

- Noise reduction: Adaptive pre-filtering
- Sub-sampling: H 720 to 352 pxls
  V 576 (50Hz) 480 (60Hz)
- Motion Estimation 127/256 pixels - half pixel resolution
- Scene Cut Detection
- Test pattern generation

Video encoding

- 420 Main Profile @ Main Level
- 422 Professional Profile @ Main Level (option)
- Bit rates : 0.5 to 15 or 50Mbps
- Adaptive GOP
- Low delay modes (down to 100ms end-to-end)

Audio input

- 2 stereo analog - or 4 mono - channels
- 18bits, 48kHz sampling
- SDI embedded
- 2 Digital AES / EBU (option)
- Modes : Stereo, Joint Stereo, Mono, Dual Mono
- MPEG1 Layer II, 64 to 384 kbps
- Test tone generation

VBI

- CEEFAX B, WSS, VPS, AFD, D/VITC, Closed Captioning, transparent lines
- DVB subtitling insertion

Auxiliary Data

- Ethernet 10BaseT (up to 2 Mbps)
- RS232 asynchronous up to 38400 bauds (option)
- ASI Transport stream input up to 54Mbps (option)

Outputs

Transport Stream

- 3 DVB ASI O/P ports - Data Burst Mode
- Bit rate : 1 to 54 Mbps
- Re-multiplexing capability
- Signalling: compliance to SI/PSI generation Per, EN 300 468 Standard incl. TSDT

Modulated Output (option)

- QPSK, 8PSK, 16QAM acc. To EN 300 421 & EN 301 210 Standards
- IF : 50 - 180MHz, 125kHz step size
- L-Band : 950 - 1750MHz, 1kHz step size (IESS 308 compliant)
- Local Oscillator Output at 100MHz
- I/P rate : up to 28Mbps
- O/P : to 16 Msps
- Adjustable levels
- Roll-Off : 35% and 26%

Scrambling (option)

- DSNG CA BISS modes 1 & Encrypted

Control and Monitoring

- Exhaustive MMI through encoder Front Panel
- 11 Pre-Set configurations
- Alarm monitoring, Voltage free contacts (option)
- WIN NT® PC-based applet (Ethernet 10BaseT)

Upgrade

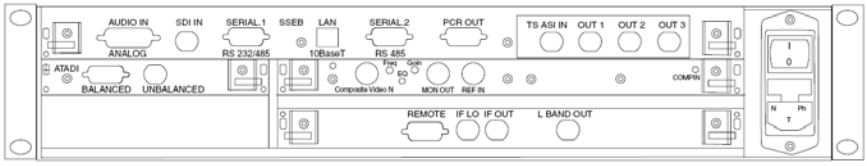
- Ethernet 10BaseT
- Licensed SW Keys for Option setting

General

- 484 (19'') x 600 x 88 (2RU) mm
- Weight : 15kg max.
- Power: AC 100 / 230V,
  Consump.: 150W max.
- Temp.: Op. 0° to 45°C,
  Storage -10° to +70°C
- Certification : CE and UL

Options

- Re-Multiplexing for Multi-Video Operation
- Control and Command of external modulator
- 4 additional stereo audio (AES/EBU, SDI embedded or Dolby pass trough)



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NEXTREAM
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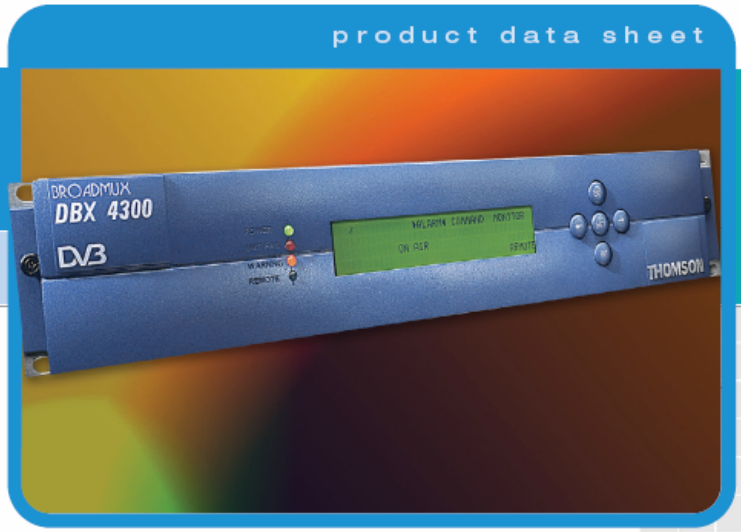
NEXTREAM

A THOMSON PRODUCT

product data sheet

Broadmux DBX 4300

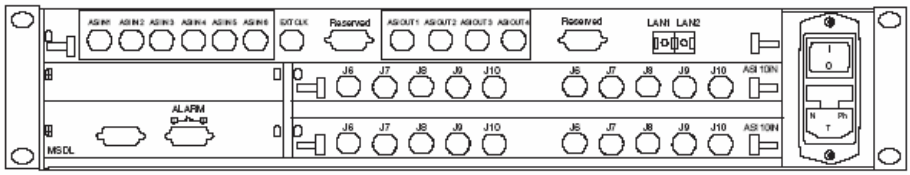
Channel Multiplexer



With the DBX 4300, Nextream provides operators with a leading re-multiplexing solution for composing a set of services for a digital television system. The DBX 4300 can handle up to 26 transport streams, ensuring full DVB of output streams. Broadmux also provides operators with a cost-effective solution for MPEG-2 local program insertions by using its integrated near seamless splicing.

Applications

- *Primary Distribution*
- *Satellite Digital Broadcasting*
- *Splicing and Regional Opt-outs*



key features

- Multiplexes up to 26 single and/or multi-programs MPEG-2 ASI transport streams
- High density of features concentrated in a 2 RU rack
- Signaling or trans-signaling of the MPEG-2 TS
- Implements DVB common scrambling functions and interfaces to most CA systems
- Data injection
- Opportunistic data injection: high speed data insertion and “no null packets”
- Performs near seamless splicing for MPEG-2 Program switching
- Allows bit rate management between several content providers sharing the same multiplex

Specifications

Inputs

Transport Stream
- From 6 to 26 inputs, serial DVB ASI
- Connector: BNC (female)

Data Injection
- One Ethernet channel (typically 2 Mb/s) DVB simulcrypt protocol supported
- Any ASI input

Outputs

Transport Stream
- Four identical outputs: serial DVB ASI
- Connector: BNC (female)
- Max. bit rate: 130 Mb/s

Features

Scrambling Access Control Versions
- Built-in DVB Common Scrambling interface with major conditional access systems providers
- BISS mode capability

Multiplexing and Re-multiplexing of TS
- Services and components management (add/drop of services or components)
- Automatic PSI/SI management
- Input bit rate control
- Facilities for interfacing to various SI injector

Opportunistic Data Injection (SW option)
Optimum use of the allocated bandwidth

Near Seamless Spicing (SW option)
Cost-effective solution for MPEG-2 program switching

Control and Monitoring
- Ethernet remote C&C, local control with front panel keypad & LCD
- Alarms: voltage-free contact

Electrical and Mechanical

Power Supply
AC 110/230V ±10% – 50/60 Hz
DC 48V

Consumption
50W max. depending on configuration

Temperature Range
484 (19") x 620 x 89 (2 RU) mm

Dimensions and Weight
- 0° to +40°C (operation),
- –20° to 70°C (storage)
- 15 kg

Compliance
CE & UL compliant

Nextream Customer Service Commitment

The Thomson Broadcast and Media Solutions Support Team delivers complete service solutions that enhance Nextream line of products. With years of experience designing and installing turnkey systems, we are able to offer flexible service contracts covering customer's first and second line support requirements for our products, as well as, integrated third party products, with graduated response times (up to 24/7 support). Our four choices of service level agreements, Topaz, Ruby, Emerald, and Diamond, along with DSNG dedicated Comet and Comet Plus agreements, satisfy market demands and meet customers needs.

Thomson Broadcast and Media Solutions Nextream customer support is specifically for Nextream products, and includes:

- Contract management:
  - — Service Level Agreements (SLA) - front line customer support contracts (Topaz, Ruby, Emerald, Diamond)
  - — 2nd Level Support Contracts (SLC) for distributors and partners
  - — Dedicated contracts: software upgrades, product coverage, help desk (Token), DSNG (Comet and Comet plus)
- Product repairs and customer logistic management
- Spare parts and hardware upgrades
- Onsite and factory operational, technical and maintenance training courses

For more information, contact Service Sales in your region.

Headquarters

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Fax	+33 (0) 1 34 20 75 75

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Fax	+1 305 477 5385

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Fax	+1 530 478 3347

Pacific

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upport	+852 2531 3056
Fax	+852 2802 2996

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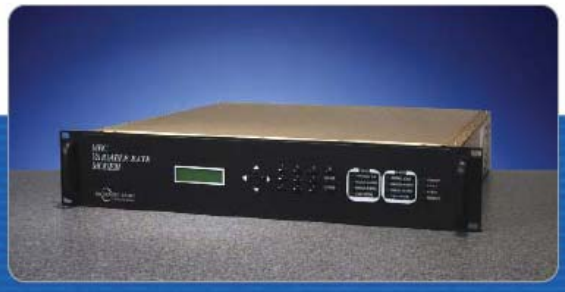

VRM Modem

Variable Rate Modem for High Speed Data

Overview

This innovative and highly flexible platform can be configured for data rates between 1 and 200 Mbps. The unit allows complete control over the modulation density and channel bandwidth for efficiencies up to 6 Bps/Hz. The unique architecture of the modem's IF allows large improvements to fading and multipath via multiple digital equalizers.

The MRC Modem is an ideal solution for both new and retrofit microwave link installations. Maximum flexibility is achieved by an internal data multiplexer that combines up to four user selectable data paths into a single data stream. Interface choices for each include DS3, E3, STS-1, and DVB-ASI, SMPTE 310M, Parallel, Overhead and T1/E1(Wayside). The IF can be configured with 1 to 4 channels, each with 12 tap equalizer providing total flexibility. Each multiplexed channel can operate up to 7 Mbaud.

System Benefits

MRC's Variable Rate Modem combined with MRC's DAR Plus Radio platform allows the user an efficient utilization of channel bandwidth with maximum overall system link budget characteristics while still maintaining application flexibility. The user can configure the application by choosing from a variety of interface cards and complex modulation schemes to match his microwave system link budget requirements. Such applications include digital electronic newsgathering back haul links and single to multiple DS3/E3/T1/E1 distribution/contribution links.

Applications

- High capacity data carrier for Studio-to-Transmitter Links and Transmitter-to-Studio Links
- Satellite Backhauls

Features

- Internal One to Four Channel Multiplexer
- Up to Four User-Selectable Data/Overhead Interfaces
- Data Rates from 1 to 200 Mbps
- 4, 16, 32, 64, and 128 QAM Operation
- Space Diversity Option
- Ideal for New Microwave Links, Upgrades or Retrofits
- High Resistance to Fading
- Wayside and/or Overhead Options
- Simplex or Duplex Configurations
- Bandwidth efficiency using 1 to 4 IF carriers

The built in packet based multiplexer of the Variable Rate Modem is ideal for applications that require drop and insert of signals within a microwave network.

As a complete system, the MRC DAR Plus Radio and MRC Variable Rate Modem can be configured for multihop, repeating, simplex, duplex and space diversity applications.

RELIABILITY

The MRC Variable Rate Modem is rich with features designed to maximize the integrity of your data service. The Reed-Solomon decoder provides superior error correction while the adaptive equalizers provide superior protection from frequency selective fading and multipath.

Optional space diversity switching can provide higher than normal protection via the units ability to predict and switch before data errors occur.

Additional features include the choice of remotely interfacing through one of three on board connections: Ethernet (SNMP), RS485 or an externally-controlled RS232 terminal. The front panel offers push-button control of all features and a backlit LCD display. Menus are specifically designed for ease of use and quick on line operation as well as changes in configuration.

SPECIFICATIONS:

Front panel selectable.

Total Data Rate: ..... Variable from 1-200 Mbps total in 1 bps steps*

Note: Interface selection may limit maximum data rate.

Total Baud Rate: .....up to 28 Mbaud depending upon number of IF channels installed

IF Channels: .....1 to 4

IF Channel Baud Rate: .3.5 to 7 Mbaud Per Channel

IF Channel Spacing: 1.15 to 1.4 times channel baud rate. 1.25 nominal*

Mux/Demux: One to four* data channel DVB compliant

Modulation: .....4, 16, 32, 64, 128 QAM*

FEC: .....204/188 Reed Solomon

FEC/Mux Overhead: .....204/184 (204/188 for DVB Framed Interface)

Adaptive Equalizer: .....12 tap DFE and 8 tap FFE (One per IF Channel)

IF Range: .....50 to 90 MHz*

IF Return Loss: .....20 dB

Tx Output Power: .....0 to –25 dBm in 0.1 dB steps*

Spurious Output: ..... –55 dBc in band

Rx Input Power: .....0 to –25 dBm.

Frequency Stability: ..... 10 ppm

Carrier Acquisition: .....±400 KHz or ±10% of channel baud rate, whichever is less

Rx Data Buffer: .....0 to ±2 Mbits

Remote Control: .....SNMP - RS485/232 Modem Drives External Terminal

Chassis Size: .....2 RU (3.5")

Power: .....85–264 Vac, 50/60 Hz

Environmental: .....0 to 50 o C

Compliance: .....CE mark

OPTIONS:

- –48 Vdc, +24 Vdc
- Simplex Configuration: Modulator Only
- Simplex Configuration: Demodulator Only
- Space Diversity: Demodulator Only
- Additional Modulator IF Channels: Up to 4 per Chassis
- Additional Demodulator IF Channels: Up to 4 per Chassis

OPTIONAL DATA INTERFACES:

- G.703, DS3, E3 or STS-1*
- DVB ASI (normal or advanced)
- RS422 Parallel, DVB–SPI Parallel, M2P*
- LVDS Parallel, DVB–SPI Parallel, M2P*
- Other interfaces available upon request

Note: Up to 4 interfaces per chassis. Any combination can be installed and operated by front panel control. Only one interface can be configured for DVB framed data.

OPTIONAL WAYSIDE CHANNEL INTERFACES:

- Orderwire—can be configured for eight DS0s or seven DS0s plus one Audio*
- T1 or E1 (Wayside)*

HOW TO CALCULATE 3 DB BANDWIDTH OF THE MRC VARIABLE RATE MODEM MODULATED CARRIER

1. Find combined Interface data rate:
DR C = Interface 1 Data Rate + Interface 2 Data Rate + Interface 3 Data Rate + Interface 4 Data Rate
2. Find Total Data Rate plus R/S and mux overhead:
DR T = DR C x (204/184)
3. Find Channel Baud Rate:
BR C = DR T /(QAM X N C)
Where Nc = number of channels (one to four)
And QAM = 2 for 4 QAM
4 for 16 QAM
5 for 32 QAM
6 for 64 QAM
7 for 128 QAM
4. Select Channel Spacing:
C S = from 1.15 to 1.4 times channel baud rate.
This number is normally 1.25 but can be set to any number between 1.15 and 1.4.
5. Total 3 dB bandwidth = BR C x C S x (N C – 1) + BR C

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DAR Plus

Analog or Digital Microwave System

Overview

The DAR Plus radio is a versatile solution for carrying conventional video and audio, or a digital transport with rates up to 120 Mbps. The DAR Plus is field switchable between analog to digital requiring only to change a few switch settings in the RF shelf, and is easily reconfigured using the DAR Plus Menu System. The DAR Plus Menu System provides full control of the radio with alarm reporting and status.

The DAR Plus provides both video and audio modulation for NTSC and PAL formats with four audio channels. The analog video and audio components are all contained on two plug-in modules for easy swap out and service.

Perhaps DAR Plus's greatest feature is the variety of digital transport options:

- The radio can be configured for ATSC using MRC's QV2 internal modem.
- When used with MRC's Variable Rate Modem, four user selectable IF carriers can can multiplexed into one datastream with data rates up to 120 Mbps
- The SCM4000 Single Carries provides data rate capacities up 105 Mbps

To protect your signal path. DAR Plus can be configured for hot standby on both the transmit and receive ends. In addition, the MRC Hot Standby Diversity Shelf provides "errorless" switching on the receive end for maintaining data integrity.

Applications

- Studio-to-Transmitter Links and Transmitter-to-Studio Links
- Satellite backhauls
- Analog news gathering backhauls
- Intercity Relays (ICR)
- Cable Headend Feeds
- Multi-Hop Networks

Features

- High Capacity up to 120 Mbps
- Architecture supports FCC and ITU channel plans from 1.9 to 15.4 GHz
- Proprietary implementation of MRC Broadcast's extremely stable, low-noise YiG oscillator technology
- Built-in diagnostics through front panel controls and display
- Analog or digital-ready
- AC or DC Versions
- Options
- Analog: FMT/FMR 70 MHz, IF, 4 audio subcarriers, high-power output options
- Digital:
  - QV2 19.39 Mbps Internal modulator or demodulator
  - VRM - Variable Rate Modem modulator or demodulator for data rates of 20 to 120 Mbps
  - SCM4000 - Single Carrier Modem at data rates up 105 Mbps

GENERAL
Standard Frequency Bands:
6.8 to 7.1 GHz, 12.7 to 13.2 GHz
Optional Frequency Bands:.....Contact MRC on other bands from 1.99 to 15.4 GHz
Capacity, Analog: .....525 or 625 line video up to 4 audio channels pilot carrier or video signal plus data above video
Capacity, Digital:.....70 MHz modem interface

TRANSMITTER
Type: .....Single conversion
Local Oscillators:.....Ultra-low phase noise, phase-locked sources
Frequency Stability: .....±0.0005%
Power Output: .....See Operating Summary

RECEIVER
Type: .....Single conversion
Local Oscillators:.....Ultra-low phase noise phase-locked sources
Noise Figure: .....See Specifications Summary
IF Bandwidth: .....30 MHz
Threshold: .....See Operating Summary

VIDEO PERFORMANCE (OPTIONAL FMT)
(Back-to-Back with CCIR Emphasis)
Frequency Response
10 kHz to 4.5 MHz (525 line): .....±0.25 dB
10 kHz to 5.0 MHz (625 line): .....±0.25 dB
5 MHz to 8 MHz (Baseband Output):.....±0.5 dB
Field Tilt:.....3 IRE max
Line Tilt: .....0.5 IRE max
Baseband Chroma Delay:.....±20 nS max
Baseband Chroma Gain: .....±2 IRE max
Differential Phase: .....±0.5° max
Differential Gain: .....2% max
Signal-to-Noise Ratio:
Meets / exceeds RS-250C; 67 dB (See Analog Summary)
Signal-to-Hum (p-p/RMS):.....60 dB min
Video Input Level:.....1 Vp-p
Video Input Return Loss:.....+26 dB min reference to 75 Ω

ANALOG RADIO PERFORMANCE
Signal to Noise:...Meets or exceeds RS-250C; 67 dB
Signal to Hum: .....60 dB min
Signal to Discrete Tones:.....65 dB min
Differential Gain:.....1% max
Differential Phase: .....±0.2° max

Note: One-hop, 525 or 625 line video per CCIR; -40 dBm receiver carrier level; excludes modem.

DIGITAL SPECIFICATIONS (OPTIONAL QM2 MODEM)
Digital Video Channel
Data Rate:.....19.39 Mbps (ATSC transport stream)
Interface: .....SMPTE 310M, typical

WAYSIDE DATA CHANNEL
Data Rate (DS1):.....1.544 Mbps
Interface:.....G.703

ASYNCHRONOUS SERVICE CHANNEL
Data Rate: .....9.6 kbps
Interface:.....RS-232
Modulation: .....16 QAM
FEC: .....Reed-Solomon (204/188) and depth 12 interleaving

ELECTRICAL
Power Consumption
Transmitter, unprotected terminal: ....75 Watts typical
Receiver, unprotected terminal: .....55 Watts typical
Power Supply Voltages:.....110/240 Vac

ENVIRONMENTAL
Operating Temperature Range:.....0° to +50°C
Relative Humidity: .....0 to 95%, non condensing

PHYSICAL
Height:.....3 rack units: 5.25" (13.34 cm)
Depth:.....15.0" (38.1 cm)
Weight:.....22 lbs (10 kg)

INTERCONNECTION
RF Connections
1.71 to 4.90 GHz: .....Type "N" female connector
5.925 to 7.125 GHz:Type WR137; CPR @ top of rack
7.10 to 8.50 GHz: ..Type WR112; CPR @ top of rack
10.70 to 13.25 GHz .....Type WR75
14.4 to 15.35 GHz: .....Type WR62
IF/Baseband Connectors: .....BNC

POWER, AUDIO & ALARM CONNECTIONS:
Audio.....Barrier strip, screw terminals
Network Management Control:.....9-pin D connector

DIGITAL Specifications Summary

Model	Frequency Range (GHz)	TX	RX		
		Output Power (dBm) (Note 1)	Noise Figure (dB) (Note 2)	BER3 (10^{-6}) (dBm) (Note 3)	System Gain (dB) (Note 2)
DAR 2	1.7 to 2.7	+31	2.5	–85	117
DAR 4	3.3 to 4.9	+28	3.5	–84	113
DAR 6	5.9 to 7.1	+28	3.5	–85	113
DAR 6HP	5.9 to 7.1	+31	3.5	–85	116
DAR 7	7.1 to 8.5	+28	3.5	–84	109
DAR 7HP	7.1 to 8.5	+31	3.5	–84	112
DAR 12	10.5 to 13.2	+24	4.0	–84	108
DAR 12HP	10.5 to 13.2	+27	4.0	–84	111

Analog Specifications Summary

Model	Frequency Range (GHz)	TX	RX			
		Output Power (dBm) (Note 1)	Noise Figure (dB) (Note 2)	Thresh-hold (dBm) (Note 3)	System Gain (dB) (Note 2)	Signal/ Noise (dBm) (Note 3)
DAR 2	1.7 to 2.7	+37	2.5	–88	123	–75
DAR 4	3.3 to 4.9	+33	3.5	–84	118	–73
DAR 6	5.9 to 7.1	+33	3.5	–85	118	–73
DAR 6HP	5.9 to 7.1	+37	3.5	–85	122	–73
DAR 7	7.1 to 8.5	+30	3.5	–84	115	–73
DAR 7HP	7.1 to 8.5	+34	3.5	–84	119	–70
DAR 12	10.5 to 13.2	+30	4.0	–84	114	–70
DAR 12HP	10.5 to 13.2	+33	4.0	–84	117	–70
DAR 15	14.4 to 15.35	+30	4.0	–84	114	–70

Notes:
1 Transmitter output values calculated prior to branching.
Digital operation assumes 3 dB back-off QPSK, 6dB @ 16QAM
2 Does not include branching filter.
3 For one-hop, NTSC video; EIA/CCIR weighting.
4 Contact factory for other modulation power output
5 "HP" suffix indicates high power option.

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Analog NTSC/PAL Modulation

70 MHz FM Modulator (FMT): The 70 MHz FM Modulator provides a full-performance video/baseband interface, with three possible inputs. The video-in can be lowpass filtered before modulation. The baseband input is wideband (15 MHz) for composite signal insertion. The subcarrier input allows the independent insertion of subcarriers carrying alarm, telephone and orderwire information.

Audio Subcarrier Modulators: When the FMT is ordered, a 4-channel audio motherboard can be installed as a slide-in board within the DAR chassis. The motherboard can accommodate up to 4 optional audio subcarrier generators. Each generator features a 600 ohm balanced audio input and a selection of subcarrier frequencies at either 75 or 50 microsecond pre-emphasis (Figure 1).

Baseband Demodulator (FMR): The second 70 MHz signal from the IF module is routed through an independent group delay equalizer to the optional baseband demodulator. The demodulator contains the limiter-discriminator, de-emphasis, video amplifier and provides two baseband outputs (one squelched and one unsquelched) and a squelched video output. This configuration is commonly referred to as a heterodyne receiver with baseband drop or a remodulating receiver (Figure 1).

Audio Subcarrier Demodulators: A 4-channel audio motherboard can be installed as a slide-in board within the receiver chassis. The motherboard can accommodate up to 4 optional audio subcarrier demodulators. Each demodulator features a 600 ohm balanced audio output and a selection of subcarrier frequencies at either 75 or 50 microsecond pre-emphasis.

Analog Options

PAC-10/PAC-12 Audio Subcarrier System: The PAC-10/PAC-12 system inserts additional FM audio subcarriers above the video channel. In addition to transmitting and receiving program audio sources, it can carry telephone channels, engineering orderwire, remote control and alarm signals. Each single-rack unit chassis can accommodate up to four subcarriers.

DigiPro™ Digital Audio System: The DigiPro System conveys high-quality program material over video microwave radios. The DigiPro Encoder and DigiPro Decoder comprise a digital audio codec (coder/decoder) which converts audio material into a shaped digital signal suitable for transmission over the PAC-10WB wideband subcarrier modulator and PAC-12WB wideband subcarrier demodulator. The complete DigiPro System is supplied with the Encoder, Decoder, PAC-10WB and PAC-12WB; it can be configured for two program audio channels, or left and right discrete stereo channels and one data channel.

The DataQ Modem adds E1/T1 capability above the video signal. This features lets you multiplex engineering orderwire, alarm and status monitoring with up to 24 FDM telephony channels. (Figure 3)

Backup Protection

The MRC Hot Standby Shelf provides complete redundancy for the system for one to three analog audio/video channels. MRC also offers baseband and IF space diversity protection with the DS-2 IF Diversity Switch.

For "errorless" switching, the MRC Diversity Shelf provides an uninterupted datastream for digital ATSC paths.

High Power Options

High-Power Amplifier: High-power amplifiers are available in many frequency bands. These amplifiers are mounted internally and powered from the standard transmitter power supply. These GaAs FET amplifiers use microstrip transmission line techniques to provide broadband high-power outputs.

Front Panel Controls and Display

The DAR Plus Menu System provides full control over all radio functions. Setup menus allow easy transition of the radio between analog and digital operation. System parameters are set using the Learn menus.

Modulator menus auto detect installation of internal or external modulators or demodulators. Alarms are displayed on the Main Menu and the system module affected.

Transmitter Menu Configurations

Setup and Configuration	Transmitter/Receiver Select, Analog/Digital Power Level
Main Menu	Output Power (dBm)
Power Supply (+15,–15,+5 Vdc)	Current, minimum, and maximum voltage levels
Radio menu	Current, Minimum, and Maximum readings for: Threshold, Phase Lock Loop, Transmit power (dBm)
Analog Alarm	FMT Phase Lock Loop, Sub-Carrier Status, Carrier Insert Status
Digital Modem Status (Internal)	All 1s Inserted, Carrier Level, Phase Lock Loop Status, Loss of Signal Status, T1/All 1s Inserted Status ,T1/Loss of Signal Status
Digital Modem Status (External)	Summary Alarm

Receiver Menu Features

Setup and Configuration	Transmitter/Receiver Select, Analog/Digital Threshold, Analog/Digital, Receive Carrier Level
Main Menu	Receive Signal Level, Fade Margin, Scrolling Alarm Window
Power Supply (+15,–15,+5 Vdc)	Current, minimum, and maximum voltage levels
Radio menu	Current, minimum, and maximum readings for: Phase Lock Loop Status, Receive Signal Level (Current, minimum, and maximum), Fade Margin
Analog Channel	Sub Carrier Status IF Squelch Status
Digital Modem Status (Internal)	IF Level, Synchronization, Phase Lock Loop, Bit Error Rate, T1 Status
Digital Modem Status (External)	Summary Alarm

DAR Plus Front Panel Display (Transmitter & Receiver)

SCM4000

The SCM4000 is a robust, variable rate, single carrier modem that provides a variety of modulation and data rate settings to allow aggregate data rates up to 105 Mbps. The choice of a single carrier system provides a simple, flexible architecture that allows a greater variety of interface options, with no sacrifice in performance at the supported data rates.

As an modulator/encoder, the SCM4000 accepts a wide variety of inputs and multiplexes up to four of them into the output stream.

As a demodulator/decoder, the SCM4000 recovers the individual streams and connects them to the selected interface connectors.

The SCM4000 can be configured for simplex, duplex, or diversity applications. The figure below shows a typical simplex application using both the IF Modem and MPEG Encoder modules.

SCM4000 Single Carrier Modem

Features

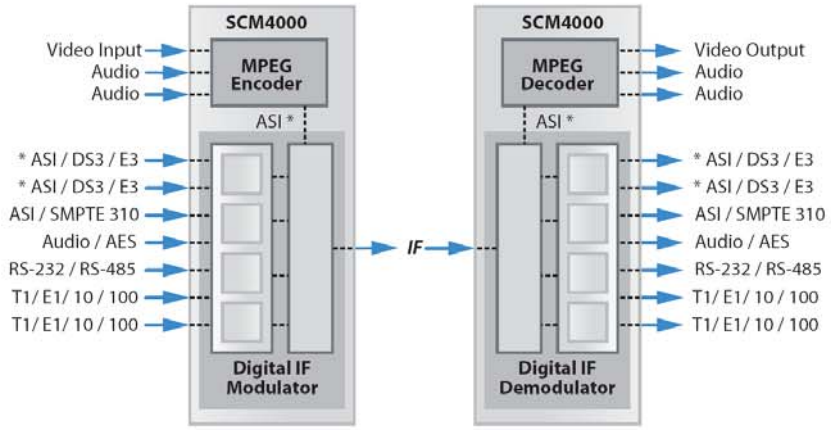
- Single carrier for optimizing data rate and spectrum efficiency for use in 25 or 12 MHz bandwidths
- Data rates up to 105 Mbps
- Adaptive Modulation Formats
- PRBS/BER & S/N
- Flexible system design using building block modules:
  - IF Modulator / Demodulator
  - MPEG Encoder / Decoder
- Simplex, Duplex, and Diversity applications
- Seamless integration with MRC's heterodyne radio
- Four individual programmable channels supporting the following interfaces:
  - T1
  - E1
  - DS3
  - E3
  - DVB-ASI SMPTE310M
  - RS-232
  - RS-485
  - 10/100Base-T

Modulator / Demodulator Module

- DS3/ASI (2 ports)
- SMPTE310M/ASI
- T1, E1, 10/100 Base-T
- RS-232
- Summary Alarm

MPEG Encoder / Decoder Module

- Video
- Analog Audio
- AES/EBU Audio



TSC DTV Transport

or the DTV transition, use the DAR Plus dio as a single carrier solution to transport TSC digital data. MRC offers the QV2 odulator and QV2 Demodulator in as a lug-in internal version, easily accessed om the front panel.

QV2 Modem Plug-in Module

Variable Rate Multiplexing

The MRC Variable Rate Modem (Figure 4) provides a flexible solution for current and future requirements. Rated at a carrier load of 120 Mbps, the VRM can multiplex four data IF channels:

- DS3, E3, STS–1
- DVB-ASI
- RS422 Parallel, DVB–SPI Parallel, M2P
- LVDS Parallel, DVB-SPE Parallel, M2P
- T1/E1 Wayside
- SMPTE 310M
- Reed Solomon Forward Error Correction

The VRM can be configured for 4, 16, 32, 64, or 128 QAM modulation with these additional options:

- Adaptive Equalizer
- Space Diversity Option
- Remote Control from Network or Serial Interface

MRC Variable Rate Modem

THALES

AMBER Starter

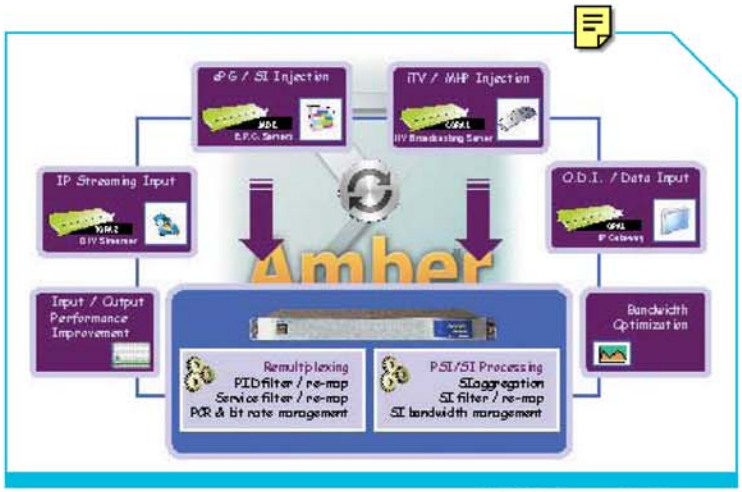
DTV Remultiplexer

Based on the third generation of Thales Broadcast & Multimedia's Remultiplexer and Processor, AMBER Starter brings powerful remultiplexing and PSI/SI processing features in a compact and reliable 1RU platform.

Key Benefits

- Most compact and efficient MPEG-2 remultiplexer in the industry
- Remultiplexing of up to 8 ASI transport streams
- Input/Output bit rates up to 50 Mbps with 1 bps accuracy
- Superior management of PSI/PSIP tables
- Service/PI /Table filtering
- Service/PID/Table re-mapping
- Full PCR re-stamping to preserve program synchronization
- Easy configuration via Ethernet interface
- Powerful Web-based GUI for Control and Supervision
- Fits into Thales' Web Network Management System, LAZULITE

>> DTV REMULTIPLEXER



AMBER Starter Environment

Overview

AMBER Starter is the new cost-effective re-multiplexer by Thales. AMBER combines a powerful multiplexing engine with advanced DVB-SI processing capabilities.

Among other features, AMBER Starter provides the ability to filter, insert, and re-map identifiers at service, component and signaling table levels. AMBER Starter ensures the output of a fully MPEG-2/DVB compliant transport stream by internally managing DVB SI tables repetition rates and re-stamping on-the-fly all necessary program clock references.

AMBER Starter also provides a vast range of options, including optimized connections with all Thales' servers (see AMBER Starter Environment).

Advanced PSI and SI Processing

The AMBER Starter DTV Remultiplexer supports all MPEG-2/DVB tables, enabling operators to fully customize their streams.

Various management modes allow full signal control: automatic generation, filtering, re-mapping, extraction of incoming transport stream tables or injection from section files. Section files can be created using the Thales syntax and table editors.

AMBER Starter also performs the multiplexing of MHP applications into audio/video services, with the appropriate signaling.

Optionally AMBER Starter can interface with Thales' JADE SI Server for more advanced DVB SI processing.

Superior Configuration & Supervision

Configuration and supervision can be easily accessed by any standard Web browser. Configuration is straightforward, using the simple drag & drop concept. The AMBER supervision displays graphical views of the incoming streams content and the generated output multiplex, along with the bandwidth allocation for each service.

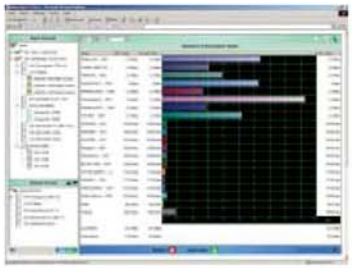
An embedded SNMP Agent is available for centralized management of configuration and monitoring.

Additionally, AMBER fits into Thales' Web Network Management Solution, LAZULITE.

Dynamic Configuration Changes

The current configuration parameters may be changed at any time (e.g. Adding a new service) without disturbing the rest of the multiplex. New configuration parameters may be predefined and stored on the equipment for deferred activation, allowing simultaneous and automatic network program map update.

The embedded configuration scheduler manages seamless configuration switching without an external device.



AMBER Starter Configuration and Supervision Software

Future-proof Investment

From bit rate performance improvement to bandwidth management or opportunistic data insertion, a full range of optional features are available to boost your AMBER Starter platform.

AMBER Starter preserves the customer's initial investment by providing a complete extension range to manage future applications.

Easy Maintenance

As all other Thales' AMBER product family, AMBER Starter is equipped as standard with a Compact Flash storage. Just slip the card into another platform, turn the power on and you are finished: equipment replacement made simple and easy.

Physical Characteristics

- 19" rack, 1U high
- 7 LEDs for quick status detection
- Power and alarm LEDs on front panel
- Free voltage contacts

Ordering Information

Ordering number	Description
TNM-4052-D	2 ASI inputs
TNM-4054-D	4 ASI inputs
TNM-4058-D	8 ASI inputs

Please contact Thales at the numbers below for further details on AMBER Starter's available options.

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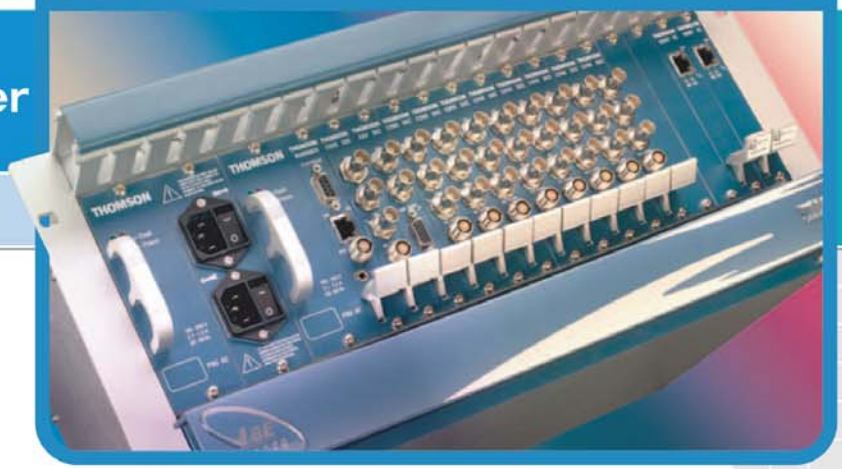
grass valley

product data sheet

ViBE Decoder



ViBE Video Broadband Evolution™

The Nextream ViBE Decoder is a unique professional receiver decoder perfectly suited to multi-services contribution applications and high-grade monitoring. The ViBE Decoder module is part of the brand new ViBE product range.

Thanks its versatility, ViBE offers several decoding modules, as well as range of interface boards, which can be fitted into a ViBE 1 RU or 5 RU chassis providing cost-effective migration to meet operators' ever-evolving needs.

The high density architecture means that up to five channels can be decoded in a single, 1 RU chassis.

The ViBE Decoder offers connectivity through a wide range of front-ends, such as DVB ASI, IP, PDH 34 Mb/s, and PDH 45 Mb/s.

Applications

- *Contribution and distribution over IP and MPLS backbones*
- *Contribution and distribution over PDH and SONET/SDH backbones*
- *High-confidence monitoring*

ViBE Decoder 1 RU Front View

ViBE Decoder 1 RU Rear View

key features

- Best in class for multi-decoding solutions
- Performs decoding according to MPEG-2 4:2:0 MP@ML or 4:2:2 P@ML standard
- Available slots for extension boards giving access to telecom or IP networks
- Offers compactness for high level decoding and cost-effectiveness
- Easy Control & Command through XMS™ 3500 management system
- Board redundancy management (including PSU for the 5 RU chassis)
- Reduced wiring thanks to bus interconnection
- Six slots for hot-pluggable boards in the 1 RU chassis
- 15 slots for hot-pluggable boards in the 5 RU chassis

Specifications

Inputs

Transport Stream

- DVB ASI
- Connector: BNC (female)
- Max. bit rate: 160 Mb/s

Front-End (option) – Multiple Front-Ends Per Chassis

IP Front-End:

- 100Base-T 802.3
- Line rate transmission
- IP V4 de-capsulation
- Connector: RJ-45
- Optional FEC, MPEG Software Mux

PDH Front-End:

- 34/45 Mb/s bi-directional G703 interfaces
- Optional PDH framing/FEC
- Connectors: BNC (female)
- Optional MPEG Software Mux

ASI In/Out Interface:

- Optional MPEG Software Mux

Outputs

Video

Digital:

- 4:2:2 Serial Digital 270 Mb/s (two identical outputs) with embedded audios
- Connector: BNC (female)

Composite (option):

- Analog composite PAL/NTSC (two identical outputs) PAL B, G , H, I, N, M, and NTSC-M
- Connector: BNC (female)

Video Decoding

MPEG-2 MP@ML – up to 15 Mb/s

MPEG-2 422P@ML – up to 50 Mb/s

Audio

Decoding of one or two audio stereo channels

Digital:

- Connector: 6-pin LEMO

Analog (option):

- Connector: DSUB-15
- Audio XLR expander (option)

Audio Processing

- MPEG-1 audio streams according to ISO/IEC 13818-3 layer 2
- Linear audio SMPTE 302M (Option)
- Dolby® Digital AC-3 passthrough
- Dolby® Digital E passthrough

VBI Processing

Teletext System-B, Closed caption, D/VITC, WSS, VPS, VITS, AFD, transparent lines

Conditional Access Control

DVB BISS Mode 1 – Mode E

Control and Monitoring

- XMS 3500 Management Software (Ethernet 10/100Base-T)
- Local monitoring with LCD front panel and keypad
- Alarm relay closure and GPI/O

Upgrade

- Software download (Ethernet 10/100Base-T)
- Licensed software keys for option setting
- Hot pluggable boards

Physical Characteristics and Power Supply

1 RU Chassis

- Dimensions (WxHxD): 484 (19") x 44 (1 RU) x 385 (15") mm
- Weight: <8 kg (fully equipped)
- Power supply: 100 to 240 VAC or –40 to –60 VDC
- Power consumption: 140W max.
- Five slots plus manager module

5 RU Chassis

- Dimensions with fan unit (WxHxD): 484 (19") x 220 (5 RU) x 250 (10") mm
- Weight: <20 kg (fully equipped)
- Two redundant power supplies: 100 to 240 VAC or –40 to –60 VDC
- Power consumption: 280W max.
- 14 slots plus manager module

Environment

Temperature:

- Operating: 5° to 40°C
- Storage: –5° to 45°C

Compliance

- CE marked in accordance with the 93/68/EEC (22/07/93) Directive
- Safety: IEC 60950 and EN 60950, UL 60950 and CSA C22.2 No. 60950
- EMC: EN 55022, EN 55024, EN 61000-3-2, FCC Part 15 Class A

Customer Service Commitment

The Thomson Broadcast and Media Solutions Support Team delivers complete service solutions that enhance the Nextream line of products. With years of experience designing and installing turnkey systems, we are able to offer flexible service contracts covering customers' first and second line support requirements for our products, as well as integrated third party products with graduated response times (up to 24/7 support). Our four choices of service level agreements, Topaz, Ruby, Emerald, and Diamond, along with DSNG dedicated Comet and Comet Plus agreements, satisfy market demands and meet customers needs.

Thomson Broadcast and Media Solutions Nextream customer support is specifically for Nextream products and includes:

- Contract management:
  - — Service Level Agreements (SLA) – front line customer support contracts (Topaz, Ruby, Emerald, Diamond)
  - — 2nd Level Support Contracts (SLC) for distributors and partners
  - — Dedicated contracts – software upgrades, product coverage, help desk (Token), DSNG (Comet and Comet plus)
- Product repairs and customer logistic management
- Spare parts and hardware upgrades
- Onsite and factory operational, technical and maintenance training courses

For more information, contact Service Sales in your region.

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VCN-1020D

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[ANEXO Nº 10]

Método de la FCC para el cálculo de cobertura

El método de la FCC requiere la utilización de algunos conceptos que se detallan a continuación, para el desarrollo adecuado de los cálculos de cobertura e interferencia.

Los siguientes conceptos pertenecen a las regulaciones y recomendaciones de la FCC, y fueron extraídos del Trabajo de Grado titulado "Automatización del Método Propuesto por la FCC para el Análisis de Cobertura e Interferencia en VHF y UHF", presentado ante la U.C.V por Luís Aponte Reyes en mayo del 2004:

Definición de Términos Básicos del Método de la FCC

Area de Servicio

Es una porción de territorio dentro de una zona geográfica, que recibe un nivel de señal superior al mínimo recomendado, relativo a una estación en particular.

Contorno de Servicio

Es el lugar geométrico de todos los puntos pertenecientes al área de servicio que tienen un determinado nivel de señal.

Trayecto de Propagación

Es la trayectoria seguida por una determinada señal radioeléctrica desde la antena de la estación de transmisión hasta la antena de recepción.

Perfil del Terreno

Es el lugar geométrico de todos los puntos pertenecientes a la superficie del terreno en una dirección determinada llamada radial que especifica para cada distancia a partir del transmisor la altura del terreno sobre el nivel del mar.

Condición de Línea de Vista

Es la condición bajo la cual el perfil del terreno permite "ver" radioeléctricamente,

desde la antena transmisora.

Altura promedio del Terreno (APT)

En un radial dado, es el promedio de las cotas de altura. El parámetro APT se calcula de la siguiente manera:

El Método de la FCC exige que los puntos sobre un perfil estén a la misma distancia unos de otros, por ello se puede calcular:

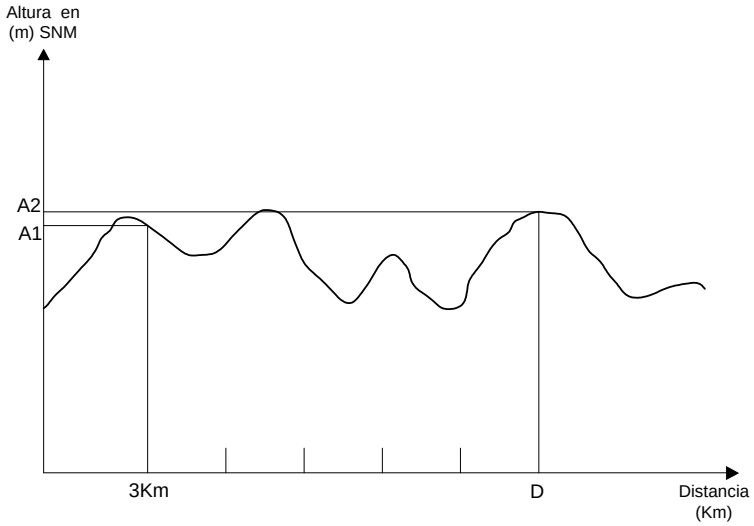


Figura 1. Cálculo de APT(a)

$$\text{APT} = \frac{\sum_{n} An}{Nh}$$

Donde Nh es el número de cotas de altura tomadas y An las distintas alturas desde 3km hasta "D". Cuando las distancias están separadas a distancias de 1km, aparece la expresión utilizada en Venezuela por CONATEL:

$$\text{APT} = \frac{\sum_{i=3}^{15} Ai}{13}$$

Donde *Ai* es la altura tomada del perfil en análisis en muestras con espaciamientos de 1 Km.

Una forma de hacer general este método, donde no necesariamente los puntos estén a

la misma distancia unos de otros, consiste en el siguiente procedimiento:

Se puede calcular el área total encerrada bajo la curva del perfil entre los 3km y la distancia "D" punto a punto utilizando la siguiente expresión:

$$AreaN = 0.5 * (D_{N+1} - D_N) * (A_{N+1} + A_N)$$

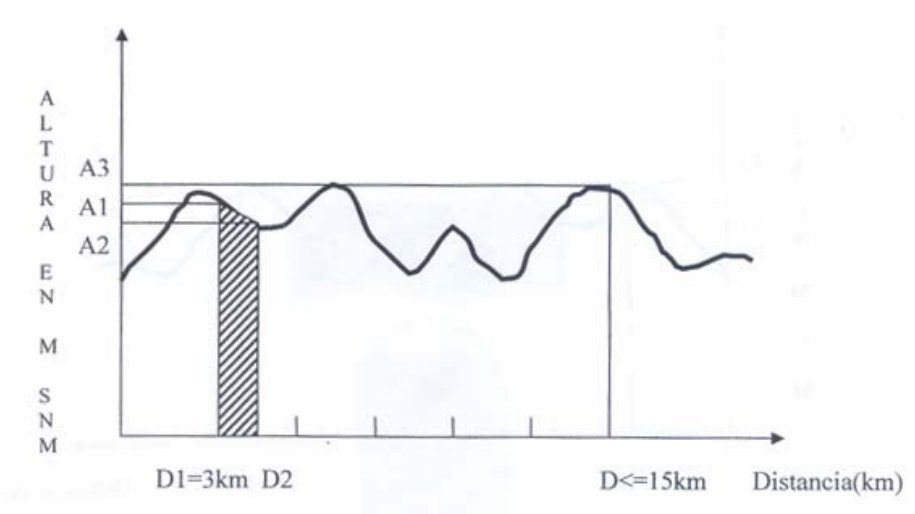


Figura 2 . Cálculo de APT(b)

El área total será la suma de todas las áreas calculadas:

$$AreaTotal = Areal + Area2 + Area3 ..... + AreaN$$

Entonces APT será:

$$APT = AreaTotal / (D - 3km)$$

Donde "D" es la distancia del punto "X" del perfil, donde se desea calcular el nivel de señal.

Centro de Radiación

Es el punto donde estaría ubicada una fuente puntual de radiación equivalente a la antena transmisora. Para fines prácticos, se asume que el centro de radiación coincide con el centro estructural de la antena.

Altura Sobre el Promedio del Terreno (ASPT)

En una dirección dada, es la diferencia de cota de altura entre el centro de radiación y la APT.

Esta medida permite tener un promedio de la topografía del terreno y la influencia de las condiciones de propagación, dichas condiciones implícitas en las curvas F(50,50) y F(50,10).

Para calcular la Altura Sobre el Promedio del Terreno (ASPT), es imprescindible contar con las alturas y distancias del trayecto. Por eso, la información de la topografía se expresa en forma de Radial, que no es más que el perfil topográfico tomado en una dirección. Tal dirección es tomada en sentido horario con respecto al norte geográfico.

La expresión general para su cálculo es:

$$ASPT = ht - APT$$

Donde "ht" es la altura total a la que se encuentra el centro de radiación con respecto al nivel del mar, y es el resultado de la suma de la altura del sitio de transmisión sobre el nivel del mar con la altura de la antena sobre el sitio de transmisión.

Para calcular la ASPT hay que tomar en cuenta los cuatro casos posibles:

- **Terreno Plano:** cuando la antena se encuentra directamente sobre el terreno a cubrir, la APT es igual a cero y la ASPT es igual a la altura del origen de la radiación.
- **Distancias menores a 3 Kilómetros:** se toma como ASPT la diferencia de altura entre el origen de la radiación y la altura del sitio o antena de recepción.

$$ASPT = TRANS + ANT – A$$

Donde:

TRANS = Altura del transmisor sobre el nivel del mar en metros

ANT = Altura del centro de radiación de la antena sobre el sitio de transmisión en metros

A = Altura del punto X

- **Distancias entre 3 y 15 kilómetros:** se calcula la ASPT restándole a la altura de origen la APT calculada entre 3km y la distancia máxima menor o igual a 15km.

$$ASPT = TRANS + ANT - APT$$

Donde:

APT = Promedio de alturas entre los 3km y el punto X del perfil.

- **Distancias mayores de 15 kilómetros:** la ASPT se calcula restándole a la altura de origen la APT calculada entre los 3 y 15 kilómetros.

$$ASPT = TRANS + ANT - APT$$

APT = Promedio de alturas entre los 3km y 15Km.

En este método no se toma en cuenta la topografía del terreno por debajo de los 3km y por encima de los 15km.

Angulo Horizontal de Radiación

Es el ángulo formado por la dirección de propagación de cada trayecto en particular con la dirección hacia el norte verdadero. Este valor del ángulo se expresa en grados positivos en sentido horario.

Fracción de Radiación Horizontal

Es la relación entre la intensidad de señal emitida en una dirección dada sobre el plano horizontal y la intensidad de señal emitida en la dirección de máxima radiación. Se abrevia como ($^{0}/_{1}$H).

Patrón de Radiación Horizontal Normalizado

Es la gráfica característica que establece la relación entre la ganancia de la antena y el ángulo horizontal de radiación cuyos valores están normalizados por el valor máximo.

Angulo Vertical de Radiación

Es el ángulo que forma línea recta entre el centro de radiación y el sitio de recepción referenciado a la horizontal que pasa por dicho centro de radiación.

Fracción de Radiación Vertical

Es la relación entre la intensidad de señal emitida en una dirección dada sobre el plano vertical y la intensidad de señal emitida en la dirección de máxima radiación. Se abrevia como ($^0/_1$V). Para determinarla, hay que calcular previamente el ángulo existente entre el sitio de origen y el punto de recepción mediante la ecuación:

$$\alpha = arctg(ht / d)$$

Donde ht es la diferencia de altura entre el origen de la radiación y el punto de recepción y d la distancia a la que se quiere calcular el ángulo.

Con el ángulo entre los dos puntos se halla la distribución de potencia en la gráfica representativa del patrón de radiación vertical según la polarización implementada.

Patrón de Radiación Vertical Normalizado

Es la gráfica característica que establece la relación entre la ganancia de la antena y el ángulo vertical de radiación cuyos valores están normalizados por el valor máximo del patrón.

Ganancia (Gant)

La ganancia de la antena en la dirección de interés, está determinada por la siguiente expresión:

$$Gant = 10 * \log [g * (^0/_1V)^2 * (^0/_1H)^2]$$

Donde g es la ganancia de la antena en veces, $^0/_1$H representa la fracción de radiación horizontal que corresponde con la dirección azimutal. $^0/_1$V representa la fracción de radiación vertical.

Potencia Efectiva Radiada (PER)

Es la potencia que podría ser necesaria en los terminales de entrada de un dipolo de media onda para producir la misma cantidad de campo que la antena utilizada en el sistema.

La potencia efectiva radiada para un trayecto en particular es el resultado de multiplicar la potencia medida en el punto de entrada del sistema irradiante (antena), por la ganancia de potencia de la antena en la dirección del trayecto especificado, dividido entre las

perdidas de alimentación.

En decibeles, la expresión que permite calcular la potencia efectiva radiada viene dada de la siguiente manera:

$$PER = P_{Tx} + Gant - Pa$$

Donde, P_{Tx} es la potencia de transmisión en dBk, Gant es la ganancia de la antena en una dirección especifica en dBi y Pa es la pérdida en los alimentadores en dB.

Rugosidad del Terreno (Δh)

Para definir el grado de irregularidad el terreno, se utiliza el parámetro Δh, que es la diferencia entre las alturas del terreno excedidas por el 10% y el 90% del trayecto de propagación comprendido entre 10km Y 50 km de distancia.

Este factor de rugosidad del terreno (Δh) es expresado en metros, y se determina por el método estadístico de la desviación estándar de una muestra, tomando medidas entre el kilómetro 10 y el kilómetro 50 de cada radial. Se calcula de la siguiente manera:

$$\Delta h = h_{10\%} - h_{90\%}$$

Donde:

$$h_{10\%} = Prom + [\sigma * 1.28]$$

$$h_{90\%} = Prom + [\sigma * 1.28]$$

Con:

$$\sigma = \sqrt{\frac{n\sum_{i=1}^{n} Xi^2 - \left(\sum_{i=1}^{n} Xi\right)^2}{n(n-1)}}$$

Se puede simplificar como:

$$\Delta h = h_{10\%} - h_{90\%} = Prom + [\sigma * 1.28] - (Prom + [\sigma * 1.28]) = 2{,}56 * \sigma$$

El valor Prom es el promedio de alturas entre 10km y 50km, y de manera general se puede calcular como la división del área bajo la curva que forman las alturas sobre el nivel del mar entre los 10km y los 50km, Y la distancia existente entre los 10km y los 50km. De manera general, se pueden presentar tres casos:

a) La distancia D del punto X del perfil es menor o igual a los l0km:

$$\Delta h = 0$$

b) La distancia D del punto X del perfil es mayor a los l0km y menor o igual a los 50km: en este caso, se toma el factor de rugosidad entre los 10km y la distancia "D". Para ello, se calcula "σ" considerando las alturas del perfil que van desde los 10km hasta la distancia "D".

c) La distancia D del punto X del perfil sobrepasa los 50km: en este caso, se toma el factor de rugosidad entre los 10km y los 50km.

Se calcula "σ" considerando las alturas del perfil que van desde los 10km hasta la distancia 50km.

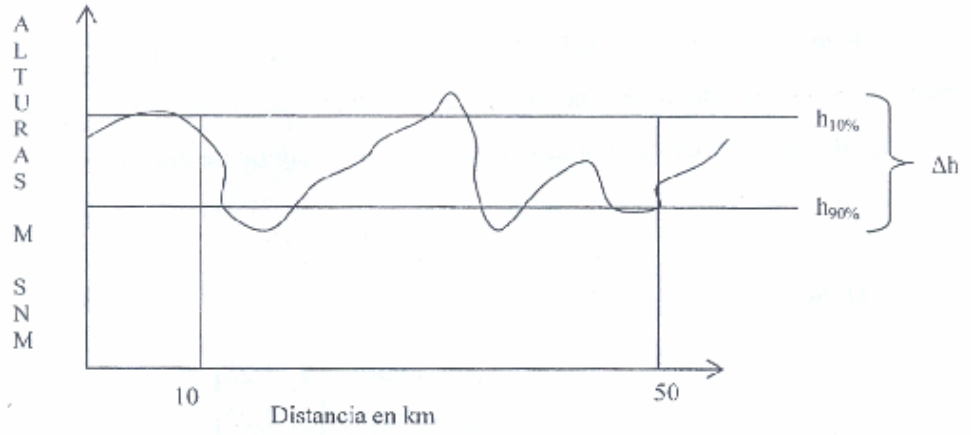


Figura 3. Factor de rugosidad Δh

Factor de Corrección de Rugosidad del Terreno

El factor de corrección de rugosidad del terreno (Δf) es el factor que da el valor en decibeles correspondientes a un grado de irregularidad del terreno (Δh), el cual depende de la frecuencia de operación [3]. El factor Δf sigue la siguiente ecuación:

$$\Delta f = C - [0{,}03 * (\Delta h) * (1 + f/300)] \text{ [dB]}$$

f: frecuencia de la señal en MHz

Donde C es una constante de valor específico para usar con cada una de las bandas de frecuencia, de donde se tiene que:

C = 1,9 para los canales de TV de la banda baja de VHF (2-6) *y* FM.

C = 2,5 para los canales de TV de la banda alta de VHF (7-13)

C = 4.8 para los canales de TV de la banda UHF (14-69)

Estos valores son utilizados tanto en cálculos de cobertura como de interferencia.

Curvas F(50,50) y F(50,10)

Las reglas de la FCC contienen un conjuntos de curvas para VHF *y* UHF desarrolladas a finales de 1940, como resultado de los estudios realizados por un comité para la evaluación de los factores de la radio propagación concernientes a los servicios de broadcasting de radio FM *y* TV en el rango de frecuencias de 50 a 250 MHz. Estas curvas fueron desarrolladas para alturas de antena de transmisión entre 100 y 5000 pies (30 y 1600 m) sobre el promedio del terreno y una antena de recepción de 30 pies (10m). Desde entonces, datos adicionales de intensidad de campo, han estado disponibles para la comisión, *y* otros estudios han sido realizados para probar la veracidad de las curvas existentes.

La notación general empleada para referirse a estas curvas es F(L,T), donde "L" indica el porcentaje de localidades donde las intensidades de campo son excedidas en un "T" porcentaje de tiempo. Estas curvas sólo se refieren al 50 % de las localidades donde es excedido el campo en un 50% o 10% del tiempo [F(50,50) y F(50,10)].

Los valores F(50,50) y F(50,10) se obtienen de la familia de curvas de Magnitud del campo en dB normalizado a 1μV/m para lKw de Potencia Efectiva Radiada, recibida a 10 metros de altura.

Estas curvas reflejan la influencia de todos los factores que modifican las condiciones de propagación por su obtención experimental.

Las curvas utilizadas en el presente trabajo son extraídas de la recomendación 73.333 del tomo 47 de la FCC, año 1994 y presentadas en el anexo Nº 10.

.

Nivel de Señal Esperado (NSE)

Es el nivel de intensidad de campo eléctrico estimado para el punto de recepción para una altura sobre el terreno en un trayecto dado expresado en dBu.

El nivel de señal esperado NSE para una determinada distancia se calcula mediante la siguiente expresión:

$$NSE = PER + F(50,50) + \Delta f$$ para cálculos de Cobertura

$$NSE = PER + F(50,l0) + \Delta f \qquad \text{para cálculos de Interferencia}$$

Las magnitudes de campo están referidas en una potencia efectiva de 1 kW radiada desde un dipolo de media onda en espacio libre.

APLICACIÓN DEL MÉTODO DE LA FCC

El Método de la FCC basa sus cálculos de intensidad de campo en el uso de las curvas de la FCC F(50,50) y F(50,10). Es un método utilizado para servicios de broadcasting tanto de radio como de televisión en las bandas de VHF y UHF, donde este es empleado para predecir cuáles son los contornos de servicio que puede prestar una estación transmisora y hasta que punto se podrían causar problemas de interferencia a otros sistemas. Por tal motivo, el método exige el levantamiento topográfico de la zona donde se presta o se prestará el servicio.

La forma como se divide el terreno es en radiales, que no son más que los perfiles topográficos en distintas direcciones tomadas con referencia al norte geográfico (0°) y en sentido horario. Dependiendo del servicio, el ente regulador exige una cantidad específica de radiales para definir un área geográfica. Estos radiales deben contener la máxima información posible del terreno donde se indiquen las irregularidades más notables. Deben describir para cada punto de distancia al transmisor, la altura sobre el nivel del mar del terreno. La FCC y CONATEL, exige que los puntos en los radiales sean equidistantes, sin embargo, se puede realizar mediante otro procedimiento obteniendo los mismos resultados en el cálculo de la APT.

Luego de haber definido la zona geográfica en radiales (18 según CONATEL), se deben de conocer una serie de detalles técnicos de la estación de transmisión. Para ello, se deben de revisar los distintos manuales de los equipos:

Los parámetros necesarios para poder aplicar el método son los siguientes:

- Frecuencia de Operación.
- Ganancia de la antena de transmisión.
- Potencia del transmisor.
- Patrón horizontal de la antena de transmisión.
- Patrón(es) vertical(es) de la antena de transmisión.
- Altura del sitio donde se ubica el transmisor sobre el nivel del mar.

- Altura de la antena de transmisión sobre el sitio de transmisión.
- Coordenadas de ubicación del transmisor.
- Perfiles Topográficos de la zona (radiales).
- Pérdidas en los alimentadores.

Para realizar los cálculos de cobertura, el método parte de la necesidad de conseguir el N.S.E que se representa de la siguiente manera:

$$NSE = PER + F(50,50) + \Delta f$$

Los parámetros PER, F(50,50) y Δf se calculan como:

Calculo de la PER.

Según se definió en el punto 3.3.16 la PER viene dada por:

$$PER = P_{Tx} + Gant - Pa$$

De donde se requiere que la PER esté en unidades de dBk, para ello la potencia del transmisor Ptx debe estar también expresada en dBk.

La Gant viene dada según el punto 3.3.15 como:

$$Gant = 10*\log [g * ({}^{0}/_{1}V)^2 * ({}^{0}/_{1}H)^2]$$

Donde la ganancia de la antena (g) generalmente es dada en dB y es requerida en veces en la ecuación anterior, pudiéndose hacer esto mediante la siguiente conversión:

$$g = 10^{G(dB)/10}$$

Los Parámetros ${}^{0}/_{1}V$ y ${}^{0}/_{1}H$ son calculados con los patrones normalizados de la antena de transmisión, vertical y horizontal respectivamente.

Para calcular el ${}^{0}/_{1}H$, hay que conocer el patrón normalizado horizontal de la antena y la rotación que esta tiene con respecto al norte geográfico que representa 0°. Es igual para todos los valores de un radial y gráficamente se puede entender como la intersección de la dirección del radial con el patrón de radiación horizontal. Esta intersección se mide en el patrón de radiación normalizado y el valor obtenido es ${}^{0}/_{1}H$. En la figura siguiente se puede

observar lo antes mencionado.

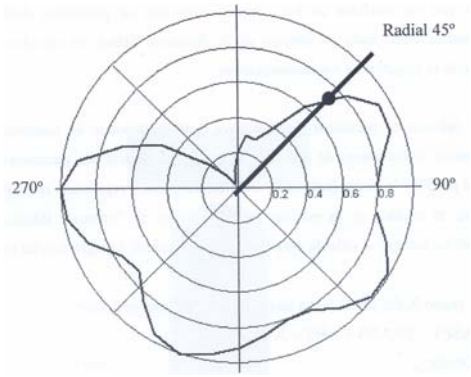


Figura 4. Patrón horizontal normalizado para hallar el parámetro $^{0}/_{1}H$

El parámetro $^{0}/_{1}V$ es variable a lo largo del radial ya que depende del ángulo formado por la altura del sitio de transmisión y la altura de cada punto del radial (Suele considerarse $^{0}/_{1}V=1$ por motivos de simplicidad en los cálculos). En la siguiente figura se puede observar lo antes señalado:

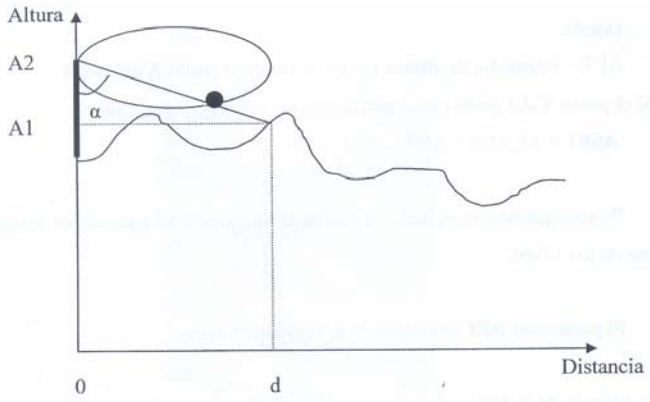


Figura 5. Cálculo de $^{0}/_{1}V$

En cuanto a las pérdidas en los alimentadores (Pa) son un parámetro dado por el fabricante y generalmente viene dado en función de la distancia, deben ser calculadas en dB tomando en cuenta toda la longitud de los alimentadores.

Calculo del parámetro F(50,50)

Para calcular el parámetro F(50,50), el cual es el valor de intensidad de campo medido directamente en las curvas de la FCC, se requieren conocer dos parámetros que son la

distancia desde el transmisor al punto donde se desea conocer el NSE y la ASPT correspondiente.

Como se explica en el punto 3.3.8, se halla la altura sobre el promedio del terreno (ASPT).

Una vez calculada la ASPT, según la frecuencia de operación del sistema de transmisión, se ubica la carta apropiada (ver anexo 4) según los siguientes requerimientos:

- Estudio de Cobertura, se utilizan las cartas F(50,50)
- Estudio de Interferencia, se utilizan las cartas F(50,10)
- Según la frecuencia se utilizan las cartas para VHF en los canales del 2 al 6 ó canales del 7 al 13.

Al ubicar la carta necesaria, se ubica en la misma la curva para la distancia "D" del punto "X" del perfil Topográfico donde se quiere hallar el NSE. Las cartas tienen graficadas algunas curvas para algunas distancias.

Si la distancia no está especificada en la carta, se interpola un valor aproximado entre ellas. Sin embargo, estas cartas tienen límites que no permiten establecer conclusiones fuera de esos rangos. Las cartas F(50,50) admiten distancias entre 1.5km y 300km, mientras que las cartas F(50,10) admiten distancias entre 15 y 500 km.

Luego de ubicar la curva de distancia correspondiente al punto X del perfil topográfico, se ubica en la escala horizontal el valor de la ASPT calculada. Si la ASPT es menor a 30m, se toma la ASPT de 30m.

La intersección de estos dos valores da como resultado en la escala vertical de la gráfica, el valor de intensidad de campo normalizado para 1kW de PER.

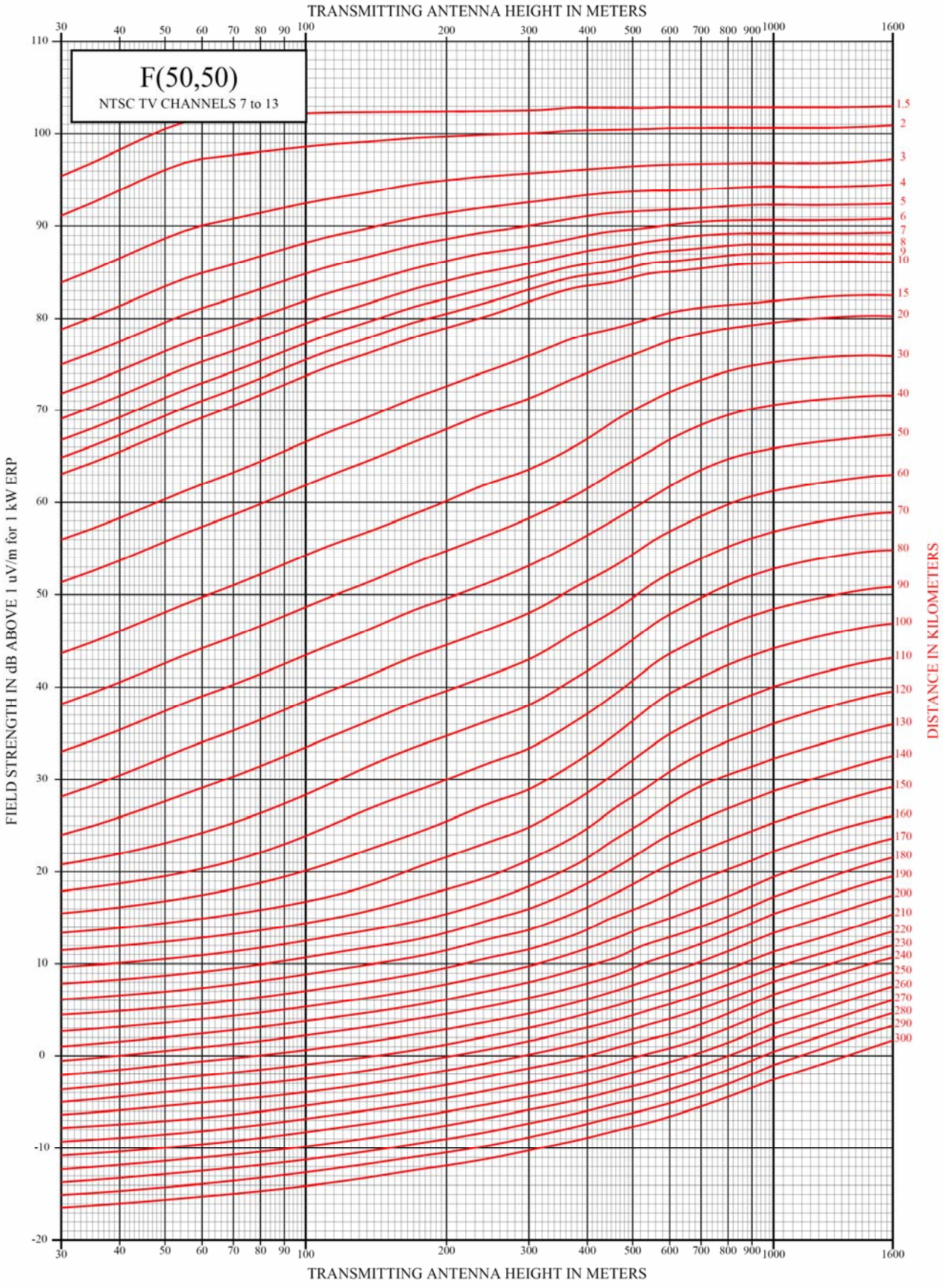
Calculo del parámetro Δf

Para calcular el parámetro Δf se debe primero obtener el parámetro Δh tal como se especifica en ítems anteriormente.

[ANEXO Nº 11]

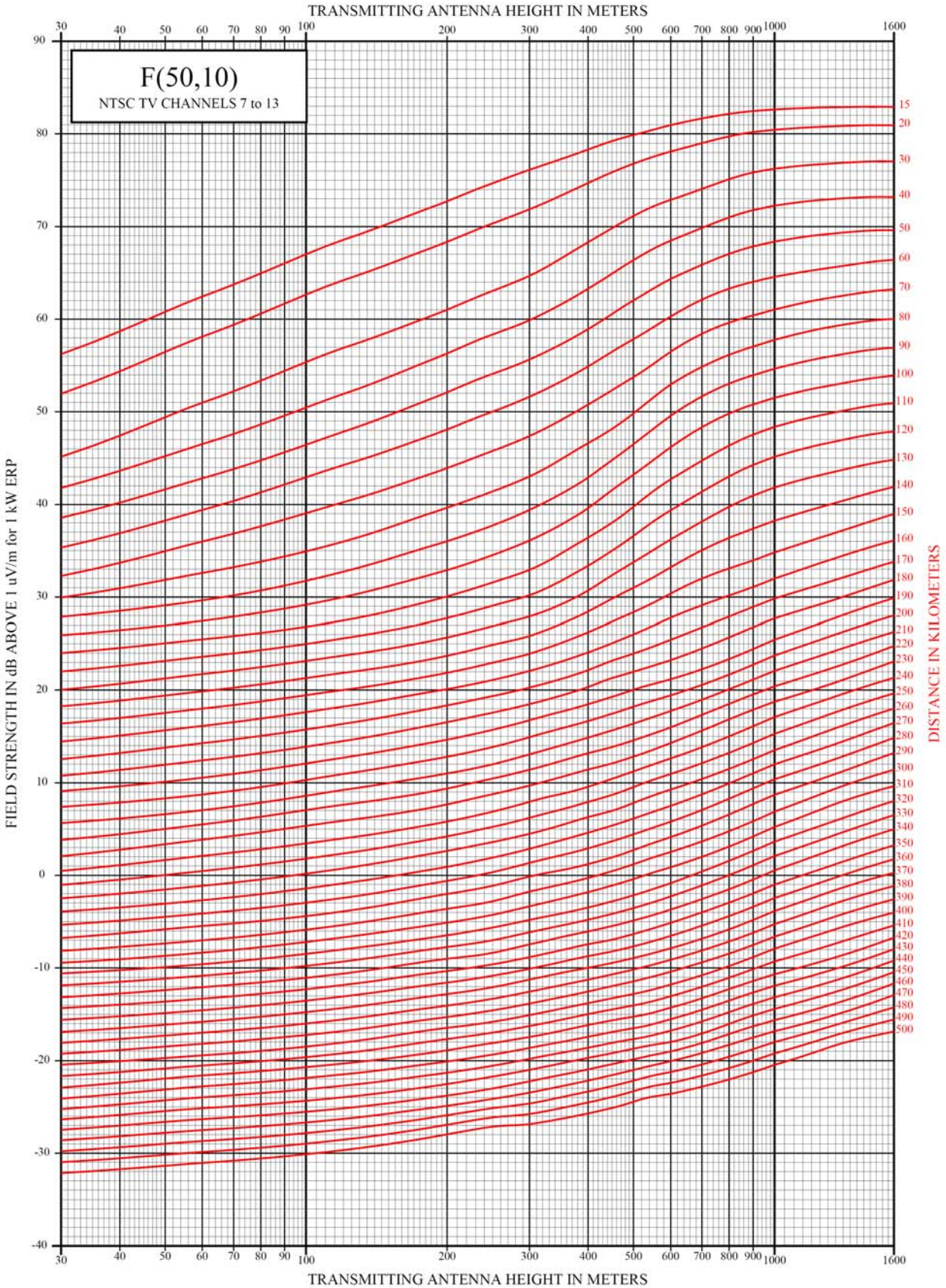
47 CFR Section 73.699, Figure 10

Estimated Field Strength Exceeded at 50 percent of the potential receiver locations 50 percent of the time, at a receiving antenna height of 9 meters



47 CFR Section 73.699, Figure 10a

Estimated Field Strength Exceeded at 50 percent of the potential receiver locations 10 percent of the time, at a receiving antenna height of 9 meters



[ANEXO Nº 12]

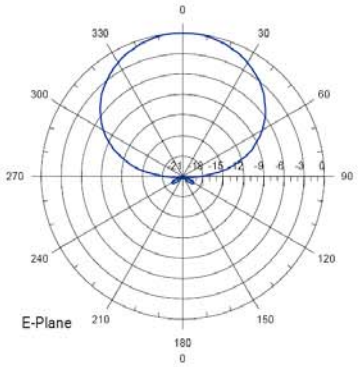
Band III 4 Dipoles Panel
Especially suitable for triangular & round masts
Model: AT13-243

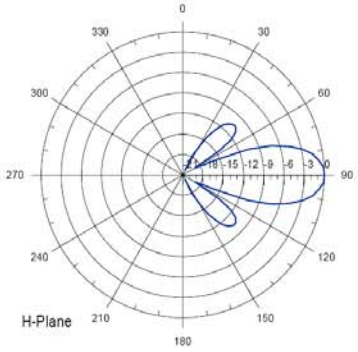
Electrical Specifications

Frequency range	174 – 230 MHz	
Peak gain	10 dB (ref. λ/2 dipole)	
3 dB beam width	E-plane: 78º	H-plane: 26º
Polarization	Horizontal	
Impedance	50 Ohm	
VSWR	≤ 1.1:1	
Maximum power	2 kW (7/16 connector)	
Connector	DIN 7/16 female (other type on request)	

Mechanical & Environmental Specifications

Materials : Reflector & dipoles Feed points radome	 Hot dip galvanized steel Fiberglass
Dimensions (WxDxH)	1000 x 530 x 2900 mm
Max. wind speed	200 km/h
Windload (front)	1465 N (@ 160 km/h)
Windload (lateral)	976 N (@ 160 km/h)
Weight (kg)	65
Typical mounting	Triangular arrangement tower
Clamp type	To Ø 80 – 115 mm pipe
Vertical spacing	3200 mm
Grounding	DC grounded
Temperature range	-40° to +80° C
Humidity	100 %





Antenna System Characteristics

Number of bays	Number ant. (per bay)	Peak gain (dBd)	Weight (kg)	Wind load 160 km/h	System height (mm)
1	2	7.00	130	3.2 kN	2900
	3	5,23	195	4.6 kN	
2	2	10.00	260	6.3 kN	6100
	3	8.23	390	9.2 kN	
4	2	13.00	520	12.6 kN	12500
	3	11.23	780	18.5 kN	
6	2	14.78	780	18.9 kN	18900
	3	13.02	1170	27.7 kN	
8	2	16.00	1040	25.2 kN	25300
	3	14.23	1560	37.0 kN	

NOTES:
-Null fill, beam tilt, harness & feeder losses NOT INCLUDED.
-Wind load & weight figures without considering cables, splitters & hardware.

RYMSA will reserve the right to make any changes without notice.

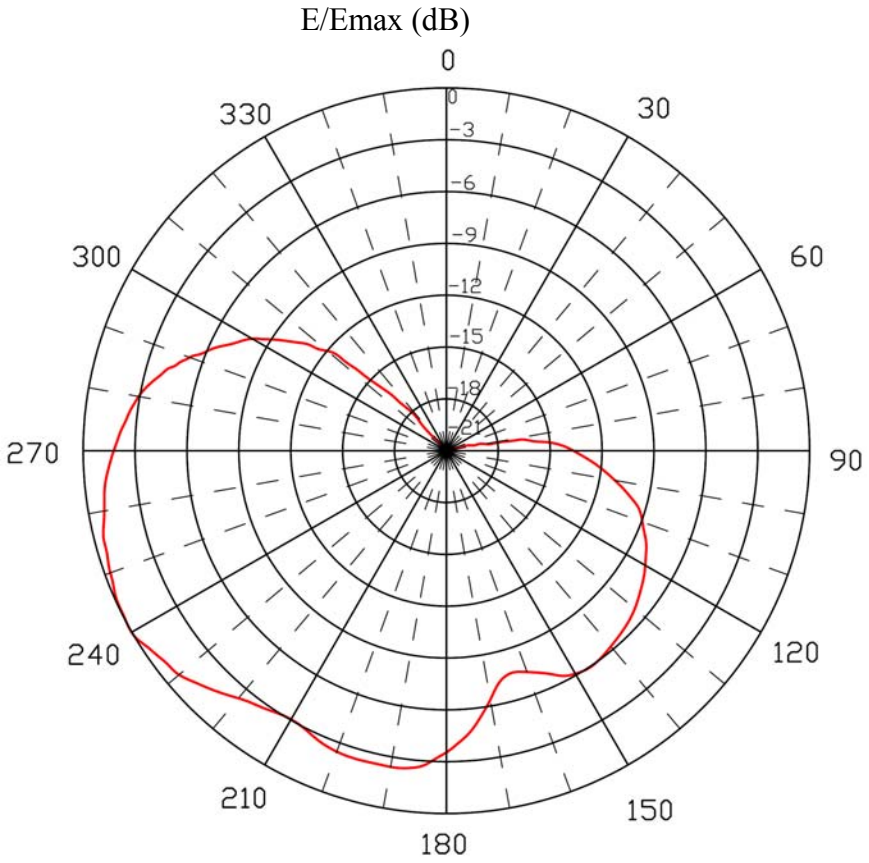
Ctra Campo Real, km 2,100
28500 Arganda del Rey
Madrid-Spain

Phone : 34 91 876 06 81
Fax: 34 91 876 07 09
E_mail : broadcast.commercial@rymsa.com
Web site : www.rymsa.com

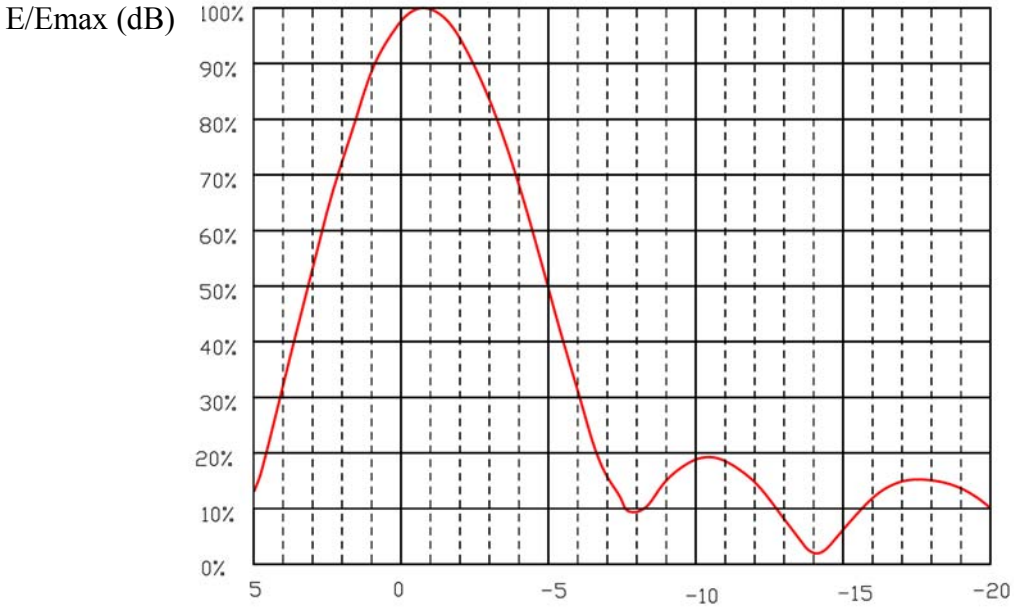
index

[ANEXO Nº 13]

Patrón de Radiación Horizontal

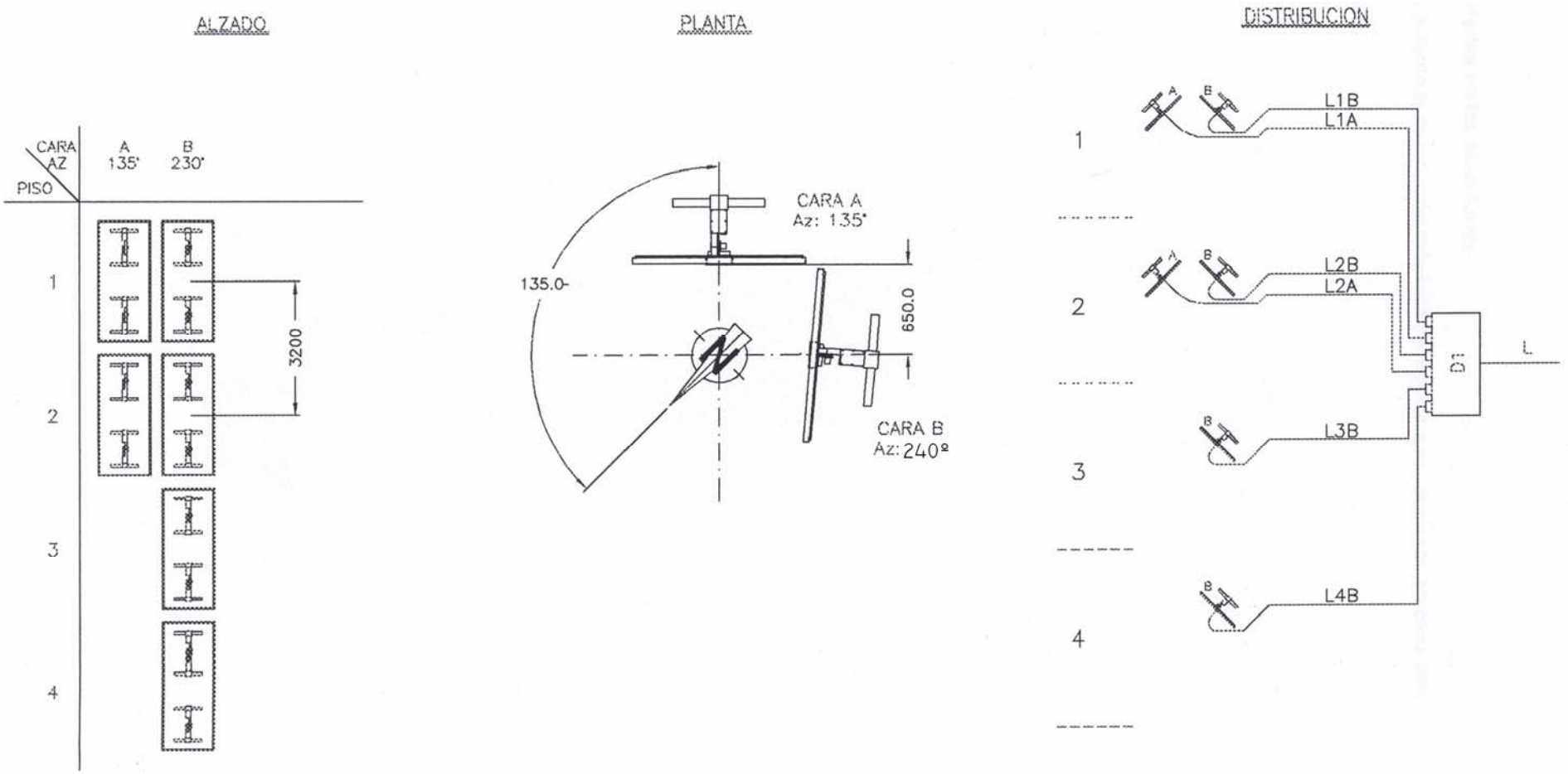


Patrón de Radiación Vertical



[ANEXO Nº 14]

Alineación de los Paneles Radiantes



[ANEXO Nº 15]

7/8" Foam Dielectric, LDF Series – *50-ohm*

LDF5-50A

Description	Type No.
Cable Ordering Information	
Standard Cable	
7/8" Standard Cable, Standard Jacket	**LDF5-50A**
Fire Retardant Cable	
7/8" Fire Retardant Jacket (CATVR)	**LDF5RN-50A**
Low VSWR and Specialized Cables	
7/8" Low VSWR, specify operating band	**LDF5P-50A-(**)**

** Insert suffix number from "Low VSWR Specifications" table, page 508.

Characteristics

Electrical	
Impedance, ohms	50 ± 1
Maximum Frequency, GHz	5.0
Velocity, percent	89
Peak Power Rating, kW	91
dc Resistance, ohms/1000 ft (1000 m)	
Inner	0.32 (1.05)
Outer	0.36 (1.18)
dc Breakdown, volts	6000
Jacket Spark, volts RMS	8000
Capacitance, pF/ft (m)	22.8 (75.0)
Inductance, µH/ft (m)	0.057 (0.187)
Mechanical	
Outer Conductor	Copper
Inner Conductor	Copper
Diameter over Jacket, in (mm)	1.09 (28)
Diameter over Copper Outer Conductor, in (mm)	0.98 (24.9)
Diameter Inner Conductor, in (mm)	0.355 (9.0)
Nominal Inside Transverse Dimensions, cm	2.11
Minimum Bending Radius, in (mm)	10 (250)
Number of Bends, minimum (typical)	15 (50)
Bending Moment, lb-ft (N•m)	12 (16.3)
Cable Weight, lb/ft (kg/m)	0.33 (0.49)
Tensile Strength, lb (kg)	325 (147)
Flat Plate Crush Strength, lb/in (kg/mm)	80 (1.4)

* A 75-ohm 7/8" diameter cable is available. Contact Andrew for further information.

Attenuation and Average Power

Frequency MHz	Attenuation dB/100 ft	Attenuation dB/100 m	Average Power, kW
0.5	0.025	0.081	91.0
1	0.035	0.115	78.6
1.5	0.043	0.141	64.1
2	0.050	0.163	55.5
10	0.112	0.366	24.6
20	0.159	0.521	17.3
30	0.195	0.641	14.1
50	0.254	0.833	10.8
88	0.340	1.12	8.08
100	0.364	1.19	7.56
108	0.378	1.24	7.26
150	0.449	1.47	6.12
174	0.486	1.59	5.66
200	0.523	1.72	5.26
300	0.649	2.13	4.24
400	0.758	2.49	3.63
450	0.808	2.65	3.41
500	0.855	2.81	3.22
512	0.866	2.84	3.17
600	0.945	3.10	2.91
700	1.03	3.37	2.67
800	1.11	3.63	2.48
824	1.13	3.69	2.44
894	1.18	3.87	2.34
960	1.23	4.02	2.24
1000	1.25	4.12	2.19
1250	1.42	4.67	1.93
1500	1.58	5.18	1.74
1700	1.70	5.56	1.62
1800	1.75	5.75	1.57
2000	1.86	6.11	1.48
2100	1.92	6.29	1.44
2200	1.97	6.46	1.40
2300	2.02	6.63	1.36
3000	2.37	7.76	1.16
3400	2.55	8.37	1.08
4000	2.81	9.23	0.978
5000	3.23	10.6	0.853

Standard Conditons:
For Attenuation. VSWR 1.0, ambient temperature 20°C (68°F).
For Average Power. VSWR 1.0, ambient temperature 40°C (104°F), inner conductor temperature 100°C (212°F); no solar loading.

ANDREW

Customer Service Center - Call toll-free from: • U.S.A., Canada and Mexico 1-800-255-1479

[ANEXO Nº 16]

500W TV-VHF TRANSMITTER

Band III Type T-V-05/C-S

GENERAL DESCRIPTION

Introduction

The 500W TV-VHF Transmitter Type T-V-05/C-S in description is realised in fully solid state.

All the RF coaxial connection have an impedance of 50Ω.

The RF power amplifier and related power supply are the result of two interchangeable modules in parallel system by means of 3dB couplers.

The substitution of these modules do not produce Tx operation inerruption, as also the print-board substitution do not require special tuning.

The cooling system is inside the transmitter and the hot air output is located on Tx top.

Protection

The transmitter is protected against;

- overloads, short circuits and over heating
- inefficiency of the cooling system;
- incorrect operation or adjustment;
- missing power supply
- RF circuit mismatching.
- Current Limiter with rapid intervention, independent for each base board
- Limitation of RF output power in real time in relation to VSWR increase

Composition of Tx

- No. 1 Driver
- No. 1 RF final amplifier e relative power supply module.
- No. 1 Air Cooling System (inside) with internal air-duct distribution.

(total 10 cubic mt/min)

- General distribution power supply.
- No. 1 Control Logic programmable for apparatus operation.

Control available in AUTOMATIC or MANUAL (local or remote)

- Band-Pass Filter (in RF output 716 female EIA flange)

- No. 2 Directional coupler

Dimensions and weight

width	544	mm
height	1395	mm
depth	800	mm
weight	~280	kg

Mains AC

220/230V ± 2% single-phase - 50/60Hz - cos φ 0.9

Total adsorption at black level (including cooling system) ~ 2,5 kW

All subsystem of equipment including the RF amplifier modules are electrically supplied through thoroidal transformer with the following characteristics:

* electric isolation between primary and secondary
* electrostatic isolation referred to ground to avoid transient transfer from primary to secondary.

The transmitter is protected against;

- overloads, short circuits and over heating
- inefficiency of the cooling system;
- incorrect operation or adjustment;
- missing power supply
- RF circuit mismatching.
- Current Limiter with rapid intervention, independent for each base board
- Limitation of RF output power in real time in relation to VSWR increase

Composition of Tx

- No. 1 Driver
- No. 1 RF final amplifier e relative power supply module.
- No. 1 Air Cooling System (inside) with internal air-duct distribution.

(total 10 cubic mt/min)

- General distribution power supply.
- No. 1 Control Logic programmable for apparatus operation.

Control available in AUTOMATIC or MANUAL (local or remote)

- Band-Pass Filter (in RF output 716 female EIA flange)

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Aquila Broadcasting Sets S.p.A.
Via Colle San Giovanni – 67063 Oricola (AQ)

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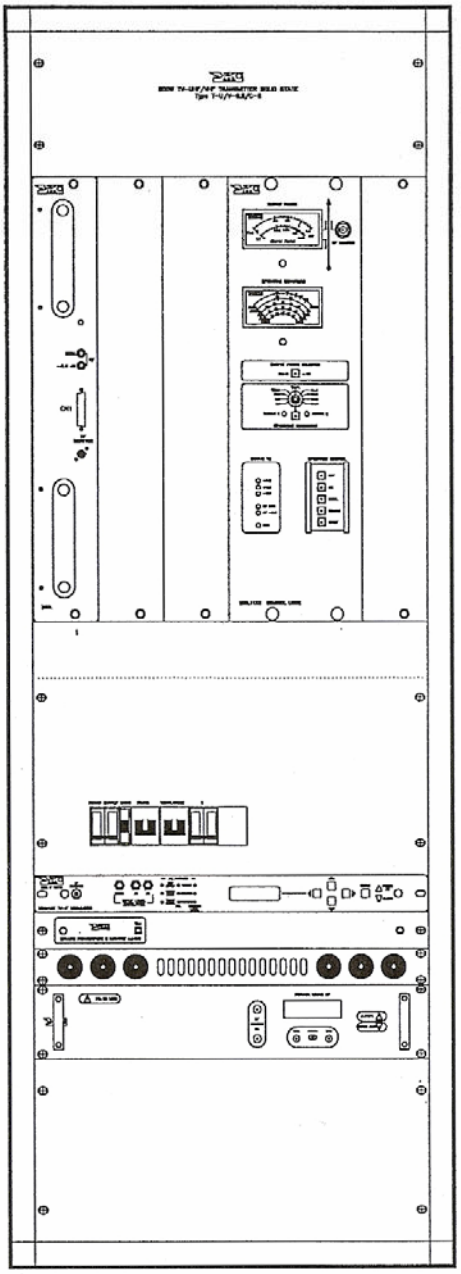

SCALA/SCALE	FORMATO/SIZE	PAGINA/PAGE
☒ FUORI SCALA/OUT OF SCALE ☐ 1:5 ☐ 1:2 ☐ 1:1 ☐ 2:1 ☐ ALTRA SCALA/OTHER SCALE: _	A4	1 / 1

A.B.S.

FIRME/SIGNATURES		DATA/DATE
DIS./DRAW.	AMICI E.	11-02-2002
APPROV.	ROSSI M.	11-02-2002

DESCRIZIONE/DESCRIPTION

TRASMETTITORE TV-UHF/VHF 500W Stato Solido

500W TV-UHF/VHF TRANSMITTER Solid State

Technical specification for all power class TV transmitter

RF characteristics

Frequency ranges:	band I: (41) 46 to 68 MHz band III: 174 to 230 MHz band IV-V: 470 to 860 MHz
Vision & sound carrier amplification	Combined or separate
Vision/sound power ratio:	-10 dB or -13 & -20 dB
Intermodulation distortion (v.c.-8 dB,s.c.-10 dB,s.b.-16 dB):	≤ -60 dB ref. to peak sync. (w/precorrection)
Permissible VSWR at the output flange	≤ 1.5
TV standard:	B/G , D, K, K', I, M/N (all negative video modulation)
Type of emission:	vision C3F (A5C) neg. sound 1 F3E (F3) sound 2 F3E (IRT) or NICAM 728
Sound FM carrier deviation:	± 50 kHz or ± 25 kHz
Harmonic emission:	≤ -60 dB (ref. to peak sync.)
Spurious emission:	≤ -60 dB (ref. to peak sync.) not >1 mW in VHF not >20 mW in UHF
Variation of output power with black/white transition:	≤ ± 0.25 dB
Frequency stability:	≤ ± 7 ppm/year (± 0.5 ppm/ year as option)
External drive frequency:	5 MHz, 1 Vrms/50 Ohm (10 MHz on request)
Line offset:	25 Hz steps (option)
Output impedance	50 Ohms
Output connector	Eia Flange (normally)

Video characteristics

Video input	BNC female, with automatic switchover
Nominal input level:	1 Vpp ±6 dB control range, 75 Ohm
Return loss (up to 5 MHz):	≤ -34 dB
DC restoration	clamped to the blanking level w/o affecting the burst
White level limiter:	at 90 % of the modulation depth w/o affecting the
Group delay variation (0.2 to 4.8 MHz):	≤ ±35 ns without receiver precorrector and without sound trap in the TV demodulator
Differential gain (at 4.43 MHz):	≤ ±2 %
Differential phase (at 4.43 MHz):	≤ ±3 deg.
Incidental phase	±2 deg.
Luminance non linearity	2 %
Luminance /crominance delay	±20 ns

Sideband spectrum (D/K std) MHz	Sideband spectrum (I std) MHz	Sideband spectrum (M/N std) MHz	Sideband spectrum (B/G std) MHz	Upper limit (dB)	Lower limit (dB)
-4.43 ± 0.2	-4.43 ± 0.2	-3.58 ± 0.2	-4.43 ± 0.2	-36	
>-1.25	>-1.25	>-1.25	>-1.25	-20	
-1.25 to -0.75	-1.25 to -0.75	-1.25 to -0.75	-1.25 to -0.75	+0.5	
-1.25 to -0.75	-1.25 to -0.75	-1.25 to -0.75	-1.25 to -0.75	+0.5	-4
-0.5	-0.5	-0.5	-0.5	+0.5	-1.0
-0.25	-0.25	-0.25	-0.25	+0.5	-0.5
0	0	0	0	+0.5	-0.5
+0.2	+0.2	+0.2	+0.2	Ref. value	
+4.0 to +5.5	+3.5 to +5.0	+2 to +3.5	+3 to +4.5	+0.5	-1.0
+6.0	+5.5	+4	+5	+0.5	-2.5
>6.5	>6.0	>4.5	>5.5	-20	

K factor	2T=2%, 20 T=2%
Static linearity	< 10 %
Non linearity distortion (mod. 10 to 75 %):	≤ 5 %
Signal to hum (peak value) ratio (f <1 kHz):	≥ 48 dB
Signal to periodic noise (peak value) ratio (10 kHz to 5 MHz)	≥ 50 dB unweighted
Signal to random noise (rms value) ratio (100 kHz to 5 MHz)	≥ 56 dB unweighted ≥ 63 dB weighted

Audio characteristics

Audio input	XLR-31 connector
Nominal input level (for dev. = ± 50 kHz):	0 dBm ±10 dB
Input impedance:	600 Ohm balanced
Pre-emphasis:	50 µs ±0.5 µs. or 75 µs ±0.7 µs (disconn)
Amplitude vs. frequency response:	40 Hz to 15 kHz = ±0.2dB 15 kHz to 100 kHz = ±0.5dB
Total harmonic distortion:	≤ 0.3 %, d2 <0.35%, d3 < 0.5 %
FM signal to noise (rms value) ratio (at dev. = ± 50 kHz):	< -60 dB unweighted < -70 dB weighted
AM signal to noise (rms value) ratio:	< - 50 dB
AM sinchronous	< - 40 dB

Multisound characteristics

IRT stereo system	
Stereo separation	-40 dB
Cross-talk	-60 dB
BTSC stereo	
Stereo separation	-36 dB

Cross-talk	-50 dB
NICAM 728 system	
Cross-talk	-70 dB
Group-delay	± 20 ns
Eye high (for B - G)	85 %

Enviromental data

Ambient temperature operating range	0 to +45 °C (storage -20 to 60 °C)
Maximum permissible rel. humidity	95% not condensing (temp. ≤ 25°C)
Maximum installation altitude	2000 m a.s.l. (higher altitudes on request)
Acustic noise	65 dB(A)

Metering and indications

Metering

- peak sync output power
- reflected power
- driving power
- exciter output power
- visual c. modulation percentage
- aural c. modulation percentage
- local oscillator voltage

Protection circuits

- high reflected power
- driver amplifier overcurrent
- driver amplifier overheating
- driver amplifier overdrive
- air cooling flow low
- mains voltage out range

- phase lack
- external interlock
- Indications
- working conditions
- alarms

Remote controls

- parallel interface according to IEC 864-1 serial interface RS 232 or RS 485 (option IEC 864-2)

"STABILITY OF THE EMISSION CHARACTERISTICS IS ASSURED FOR LONGER THAN 12 MONTHS"

All figures are typical values and are subject to modification without notice.
The information contained in this leaflet does not bind ABS to any contractual obligations which may arise therefrom.

ABS Aquila Broadcasting Sets
Via Colle S. Giovanni 67063 Oricola (AQ) Italia
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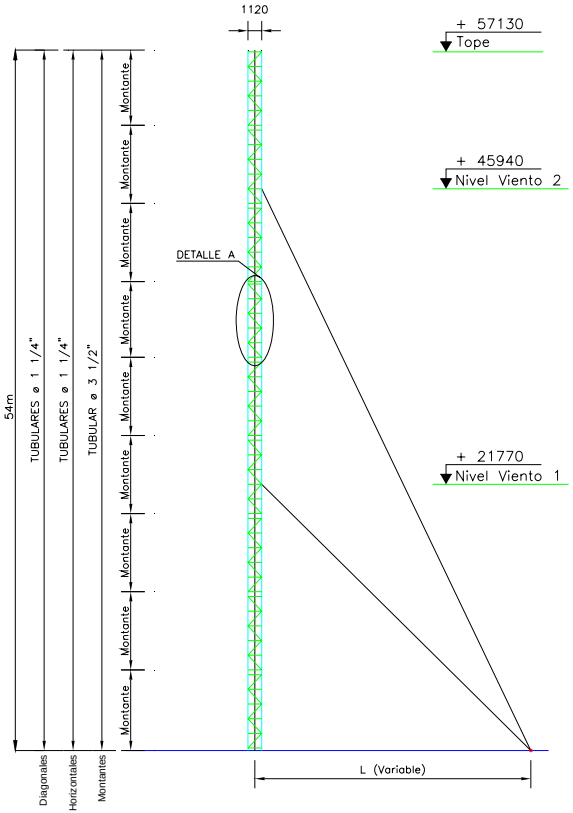
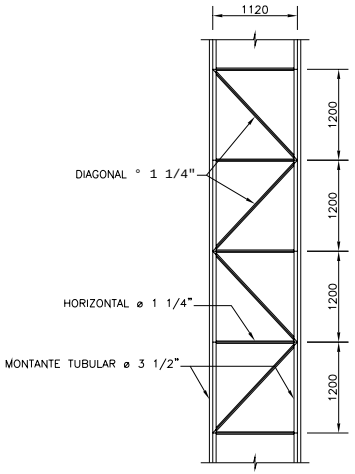
Fax 0863-995215 *Fax +39-0863-995215*
Technical e-mail : abstec@ermes.it *Commercial e-mail : abscom@ermes.it*
Web : www.abs-spa.com

[ANEXO Nº 17]

Torre Triangular

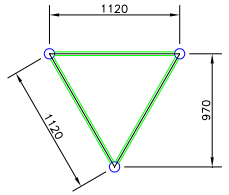


ESQUEMA DE LA ESTRUCTURA

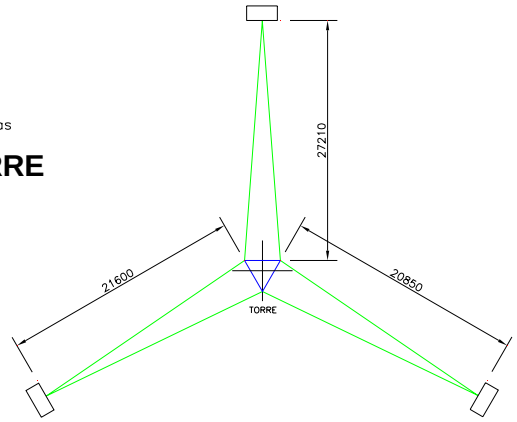


NOTA: Todas las uniones son soldadas

SECCION TÍPICA DE TORRE (DETALLE A)



PLANTA DE LA TORRE



ESQUEMA DE LOS VIENTOS

CALIDAD DE LOS MATERIALES	
ACERO ESTRUCTURAL	A-572 (GRADO 50)
PERNOS	A-325

LOCACIÓN: ESTACIÓN CARICUAO		ESQUEMA DE LA ESTRUCTURA	
Dibujo: JULIAN FERNANDEZ		DESCRIPCIÓN: UBICACION DE LOS DIAFRAGMAS	
ESCALA: 1:100	FECHA: 20-JUL-07	UNIDADES: SIN ESCALA	Plano Nº: 2

[ANEXO Nº 18]

Sistema de Monitoreo

En la siguiente tabla se presenta los equipos que componen el sistema de monitoreo que opera en las diferentes estaciones de radiodifusión de televisión que posee la empresa CAVTV.

A continuación se detallan las especificaciones técnicas de los elementos que componen dicho sistema de monitoreo.

SISTEMA DE MONITOREO
VIDEO / STEREO AUDIO SWITCHER RS 12-A
DISTRIBUTION SYSTEM LEITCH FR-684AV
2 VIDEO DISTRIBUTION AMPLIFIER MOUNTING FRAME LEITCH FR-684
2 COMPOSITE VIDEO DISTRIBUTION AMPLIFIER LEITCH VDA 683
2 STEREO AUDIO DA (I/P SELECTOR OUTPUT) LEITCH ASD-880-600
VIDEO PROCESOR LEITCH VPA 331N
BTSC STEREO GENERATOR A CRL TVS 3003 BTSC STEREO GENERATOR B CRL TVS 3003
DEMODULADOR VIDEOTEK DM 154
WAVEFORM VECTORSCOPE LEADER 5872ª
AUDIO AMP AND PPM UNIT WOHLER AMP1A-LP2S
VIDEO SIGNAL GENERATOR TEKTRONIX TG700+ATG7
PICTURE MONITOR JVC TM-H150CG
AC DISTRIBUTION PANEL A MID ATLANTIC PD920-NS AC DISTRIBUTION PANEL B MID ATLANTIC PD920-NS

[ANEXO Nº 18.1]

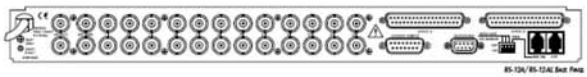
12x1 Video/Stereo Audio Switcher

RS-12A

DESCRIPTION

The RS-12A 12x1 Routing Switcher is designed for the switching of analog video and stereo audio signals. Stringent specifications assure minimal loss or degradation of input signals. A remote control panel (RSP-12) can be used with either the RS-12A or the RS-12AL.

Serial interface as well as contact closure control is standard with all units. All switchers in the series have audio follow video with breakaway for independent switching of audio or video signals.



FEATURES

- **12 loop through inputs**
- **Two audio channels per input**
- **Changeable legend buttons**
- **Vertical interval switching (Line 10 - NTSC, Line 6 - PAL)**
- **Configurations available for component (RGB/YUV), Y/C, and 12x2 operation**
- **Optional remote control panel (up to 300 meters using four conductor wire)**
- **Accepts external reference (composite video)**
- **GPI port standard**
- **RS-232 or RS-422 interface standard (field selectable)**
- **More than 3 days source memory in case of power failure**
- **Standards available:**
  - **NTSC and PAL**

RoHS Compliant

SPECIFICATIONS

Specifications and designs are subject to change without notice.

VIDEO

Inputs:	12
Connectors:	BNC Hi-Z looping female
Return Loss:	≤-40 dB to 5 MHz
Maximum Input Level:	2V (DC + peak AC)
Crosstalk:	-60 dB to 4.43 MHz
Frequency Response:	±0.15 dB, 10 Hz to 5 MHz, relative to 200 kHz +0.3 dB, -3 dB to 30 MHz, relative to 200 kHz
Output Level:	Two video outputs with common front panel adjustment. Video output gain is unity with ± 2.5 dB adjustment range
Output Impedance:	75 ohms, 1% source terminated
Tilt:	<0.5%
Differential Phase:	≤0.1° at 3.58 MHz or 4.43 MHz
Differential Gain:	≤0.1% at 3.58 MHz or 4.43 MHz
Input Matching:	±1.0% at 1 MHz
Hum And Noise:	70 dB (minimum) below 1V p-p
Overshoot And Ringing:	<0.5% at 1V p-p
Throughput Delay:	33 ns typical

SYNC REFERENCE

Input:	BNC, Hi-Z looping
Signal:	Blackburst, composite video, composite sync
Signal Level:	150 mV to 4.0V
Return Loss:	≤-40 dB to 5 MHz
Vertical Interval Switching:	Switching derived from common video bus or from external synchronizing input (EXT.REF.) with automatic priority given to external input. It can be blackburst, composite sync, or any other video signal conforming to PAL or NTSC standards with an amplitude of 0.5V to 4V p-p.

AUDIO

Inputs:	Two audio inputs (left and right) per video input
Connectors:	37-pin D-sub connector for each audio channel (2 total)
Input Level:	+24 dBm maximum
Input Impedance:	>10 k ohms balanced or unbalanced
Output Levels:	Independent left and right output level adjustments accessible from the front panel
Output Gain:	Unity, adjustable ± 2.5 dB of input level
Maximum Output Level:	+24 dBm balanced
Output Impedance:	<50 ohms The output can be connected in either balanced or unbalanced configuration
Crosstalk:	>70 dB at 20 kHz
Frequency Response:	30 Hz to 20 kHz ± 0.5 dB (referenced to 1 kHz)
Hum And Noise:	-70 dBm, maximum
Harmonic Distortion:	<0.5%, 30 Hz to 20 kHz
Common Mode Rejection:	40 dB minimum from 50 Hz to 10 kHz

INTERFACE

Remote Control:	Two 4-pin modular jacks (type RJ-11) are provided on back panel for loop thru connections to other RS-12A switchers and remote control panel (RSP-12)
RS-232/RS-422 Interface:	9-pin D-sub connector provided Internally selectable (Emulates Grass Valley protocol)
GPI Remote Control:	15-pin D-sub connector provided for hardware switch remote

POWER

Power Input:	90 to 132/180 to 264 VAC, 50/60 Hz, nominal
Power Consumption:	14 VA, typical

ENVIRONMENTAL

Operating Temperature:	0° to 50°C
Storage Temperature:	-50° to 70°C
Humidity:	90% maximum (non-condensing)

12x1 Video/Stereo Audio Switcher RS-12A

MECHANICAL

Dimensions:

Height:	1.75" (4.5 cm)
Width:	19.0" (48.3 cm)
Depth:	7.4" (18.8 cm)
Weight:	7.1 lb (3.23 kg)

STANDARD ACCESSORIES

Two mating 37-pin D-sub audio connectors
One mating 15-pin D-sub GPI connector
Operation & Service Manual
Rack Extension Kit
Power cord

OPTIONS

RSP-12:	Remote control panel
ABP-12:	Audio Breakout panel (adapts 37-pin D-sub connectors to terminal strips)

CONFIGURATIONS

RS-12A:	12x1 Vertical Interval Video and Stereo Routing Switcher
RS-12AL:	Same as RS-12A without push buttons

[ANEXO Nº 18.2]

Series Audio/Video Distribution Amplifier Mounting Frame FR-684AV

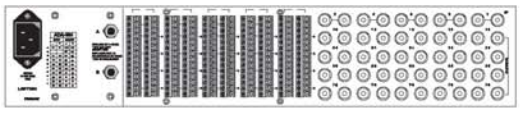
DESCRIPTION

The 2RU FR-684AV mounting frame provides distribution of any combination of up to five 680 series video amplifiers with looping inputs and 8 outputs and any combination of five of the ASD-880, AMD-880 and APD-880 audio amplifiers (stereo, mono, summing). It comes complete with one 684PS power supply and room for a redundant power supply, if required. It accepts line input voltages of either 90-135 or 190-265 VAC.

Isolation between modules in these mounting frames is better than 100dB over the entire audio frequency band and interchannel crosstalk.

FEATURES

- **Both video and audio distribution**
- **Ideal where space is a limitation**
- **Stereo/mono audio**
- **High/low impedance outputs**



SPECIFICATIONS

Specifications and designs are subject to change without notice.

ELECTRICAL

682PSVoltage	90-135 VAC/190-265 VAC
Frequency	50/60 Hz
Power	50 VA max.

MECHANICAL

Height	88 mm (3.5 ")
Width	483 mm (19")
Depth	280 mm (11")

ORDERING INFORMATION

For more information visit www.leitch.com

FR-684AV	5 video, 5 audio frame with power supply
FR-683AV	2 Video, 2 Audio 1RU frame with power supply - offered as mixed format replacement for Mix Box
684PS	Redundant 85-270 V Power Supply

[ANEXO Nº 18.3]

Video Distribution Amplifier Mounting Frame

FR-683, FR-684

DESCRIPTION

The FR-683/684 mounting frames accept any type of 680 series video distribution amplifiers in any slot. Outputs are provided with BNC connectors, simplifying solutions to signal distribution and processing such as clamping, equalization, clipping, remote gain, and delay. This equipment is renowned for its high quality and reliability. Design considerations ensure compatibility with both earlier and future developments.

Frame Styles and Sizes

The mounting frames have fold-down front panels. Each frame is pre-wired with a full set of BNC connectors mounted to the rear. This ensures superior performance, simplicity of ordering, and easy installation.

The 1RU FR-683 mounting frame comes complete with one 684PS power supply and accepts any mix of up to four 680 series amplifiers with looping inputs and eight outputs.

The 2RU FR-684 mounting frame accepts any mix of up to ten 680 series amplifiers with looping inputs and eight outputs. It comes complete with one 684PS plug-in power supply and is pre-wired for an optional second 684PS when total power back-up is desired.

Inter-frame DC power connectors allow the sharing of power supply redundancy between frames. A single power supply is required per frame, while only one extra power supply is required when several frames are interconnected.

To combine both audio and video DAs in a single frame, see FR-684AV.

Power Supply

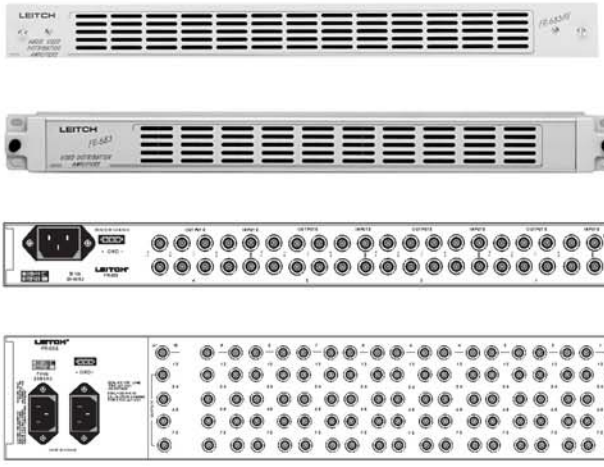
The high-efficiency, switchable 684PS plug-in power supply accepts line input voltages of 90-135 and 190-265 VAC. The supply easily handles any mix of ten 680 series amplifiers under worst-case load conditions. Also available is the 684PS-48 48VDC plug-in power supply for telecom and cable applications.

FEATURES

- **Four 8-out video DAs in 1RU**
- **Ten 8-out video DAs in 2RU**
- **Accepts any 600 series DA**
- **Redundant power supply available for 2RU frames**
- **Switchable 90-135/190-265 VAC or 48VDC power supplies available**
- **Inter-frame power supply redundancy**

Distribution Amplifiers

The 680 series video distribution amplifiers include models for composite or non-composite video, subcarrier and pulse distribution, cable equalization, clamping, clipping, remote gain, and delay. Descriptions and specifications of the various amplifiers are contained in separate data sheets.



SPECIFICATIONS

Specifications and designs are subject to change without notice.

ELECTRICAL

684PS (120V)

Input Voltage	90-135 VAC
Frequency	50/60 Hz
Power	50 VA max.

684PS (240V)

Input Voltage	190-265 VAC
Frequency	50/60 Hz
Power	50 VA max.

MECHANICAL

FR-683

Height	44 mm (1.75 inches)
Width	483 mm (19")
Depth	280 mm (11")
Nominal weight with modules	5.5 kg (12 lbs)

FR-684

Height	88 mm (3.5")
Width	483 mm (19")
Depth	280 mm (11")
Nominal weight with modules	7.3 kg (16 lbs)

Video Distribution Amplifier Mounting Frame

FR-683, FR-684

ORDERING INFORMATION

For more information visit www.leitch.com

FR-683	4 DA frame with power supply
FR-684	10 DA frame with power supply
684PS	Redundant power supply (120-240 V switchable)
FR-683-48	4 DA frame with 48VDC power supply
FR-684-48	10 DA frame with 48VDC power supply
684PS-48	Redundant power supply (48 VDC)
101ME	Module extender

[ANEXO Nº 18.4]

Composite Video Distribution Amplifier

VDA-683

DESCRIPTION

The VDA-683 is a general-purpose distribution amplifier with excellent linearity and gain stability for solving common mode errors. It can handle anything from nominally 0.7Vp-p non-composite video to 2Vp-p subcarrier. Low power consumption and high temperature stability make this a very reliable, inexpensive distribution amplifier for analog composite/component and analog HDTV installations.

The VDA-683 provides a differential input when equalization and clamping are not required. Although normally used as a unity gain amplifier, a variable gain control on the module front edge with a range from -3dB to +3dB allows compensation for non-standard input levels or line losses.

FEATURES

- **Differential looping input**
- **Composite/non-composite video or subcarrier distribution**
- **Eight outputs**
- **>30MHz bandwidth**
- **Gain range -3 to +3 dB**

SPECIFICATIONS

Specifications and designs are subject to change without notice.

INPUT (DC COUPLED)

Video Input Level	1Vp-p nominal
Subcarrier Input level	1 to 2Vp-p
Input Impedance	750hms bridging
Input Return Loss	>40dB to 10MHz, 30dB to 30MHz
Coupling	D.C.
Max. Common Mode Signal	10Vp-p
CMR	>60dB to 10KHz

PERFORMANCE

Gain Range	-3dB to +3dB
Gain Stability	<0.02dB per 10°C
Frequency Response	<±0.05dB to 10MHz; 0 to -0.5dB to 20MHz; -3dB bandwidth, 35MHz typ.
Line Rate Window Tilt	<0.25%
Field Rate Window Tilt	<0.25%
50/60 Hz Square Wave Tilt	<0.5%
Differential Gain	<0.15% (10 - 90% APL)
Differential Phase	<0.1° (10 - 90% APL)
S/N Ratio	65dB to 20MHz unweighted (RMS noise/0.714V)
Hum	1mVp-p
Propagation Delay	20 ± 1ns @5 MHz
Stability with ±10% Line Voltage Change	0.05%

OUTPUT

Number of Outputs	8
Output Impedance	75W
Output Return Loss	>37dB to 10MHz
Output Isolation	>30dB to 10MHz
Response Variation	<0.1dB, 1 to 8 loads, to 10 MHz

TEMPERATURE

Performance	5° to 40°C
Operating	0° to 50°C

POWER REQUIREMENTS

Power Dissipation	2 W

ORDERING INFORMATION

For more information visit www.leitch.com

VDA-683	Video Distribution Amplifier
FR-683	4 DA frame with 85-270V power supply
FR-683-48	4 DA frame with 48VDC power supply
FR-684	10 DA frame with 85-270V power supply
FR-684-48	10 DA frame with 48VDC power supply
FR-684AV	5-video, 5-audio frame with power supply
684PS	Redundant 85-270V power supply
684PS-48	Redundant 48VDC power supply
101ME	Module extender

[ANEXO Nº 18.5]

Stereo Audio Distribution Amplifier — ASD-880

DESCRIPTION

The ASD-880 stereo audio distribution amplifier is designed to meet the most demanding requirements of broadcast facilities, television post-production, and recording studios. This excellent amplifier provides two high-performance channels with four balanced outputs per channel. Outputs can be customized to low (66 ohms), or 600 ohms impedance. Excellent output isolation and interchannel crosstalk are ensured by the use of individual drivers for each output.

The input is over-voltage protected up to 120 Volts AC or DC. The transformerless, balanced input is normally bridging, but can be terminated by installing a suitable resistor. Unbalanced input is converted to balanced output.

The ASD-880's exceptional performance features include 100 dB S/N ratio, flat frequency response, carefully controlled roll-off and very low distortion, thus ensuring a virtually transparent transmission path.

FEATURES

- **1-in, 4-out stereo**
- **Available in 66 ohms, or 600 ohms output impedance**
- **Very low noise (100 dB S/N)**
- **Excellent interchannel crosstalk (>95 dB)**
- **Gain range of -6 to +33 dB**

SPECIFICATIONS

Specifications and designs are subject to change without notice.

INPUT

Impedance	>30 K ohms, balanced
Max. level	+30dBu (66 ohms), +24dBm (600 ohms)
Common mode range	±20V
CMR	>90dB @ 60Hz, >60dB @ 20KHz

OUTPUT

Channels	2
Outputs per channel	4
Impedance	66 ohms, 600 ohms balanced
Max. level	+30dBu (66 ohms), +24dBm (600 ohms)
Output to output isolation	>70dB, 20Hz to 20kHz

PERFORMANCE

Gain range	-6 to +33dB, (±6dB on 18-turn pot, 0, +9, +18, +27 dB on jumper)
S/N ratio	>100dB @ unity gain 20Hz -20 kHz, relative to +8dBu signal, unweighted
Frequency response	<±0.05dB, 20Hz - 20 kHz, rel. to 1kHz, any level up to +30dBu (66 ohms), +24dBm (600 ohms)
Total harmonic distortion	<0.05%, 20Hz - 20 kHz @ +30dBu (66 ohms), +24dBm (600 ohms)
Isolation between modules	>100dB, 20Hz - 20 kHz
Intermodulation distortion	<0.02%, SMPTE @ +18dBu (66 ohms), +18dBm (600 ohms)
Interchannel crosstalk	>95dB, 20Hz -20kHz

ORDERING INFORMATION

For more information visit www.leitch.com

ASD-880	Stereo Audio Distribution Amplifier, 66 ohms
ASD-880-600	Stereo Audio Distribution Amplifier, 600 ohms
FR-883	4 DA frame with 85-270V power supply
FR-883-48	4 DA frame with 48VDC power supply
FR-884	12 DA frame with 85-270V power supply
FR-884-48	12 DA frame with 48VDC power supply
FR-684AV	5-video, 5-audio frame with power supply
884PS	Redundant 85-270V power supply
884PS-48	Redundant 48VDC power supply
101ME	Module extender

[ANEXO Nº 18.6]

NTSC Video Processing Amplifier

VPA-331N

DESCRIPTION

The VPA-331N is a complete, broadcast quality Video Processing Amplifier, requiring only one unit of rack space. The VPA-331N features front panel controls for video and chroma levels, burst phase, set-up and fade-to-black. An auxiliary video input has been added for a stand-by signal. The VPA-331N automatically switches to this signal if this function is enabled and the main program input fails.

The VPA incorporates a high-stability color sync pulse generator capable of maintaining the EIA RS170A pulse and SC/H phase specifications. In order to allow a wide range of operational flexibility, the VPA has independent adjustments for the various signal parameters. Horizontal and vertical blanking, for instance, can be adjusted to suit specific in-plant applications. Once established, the settings are accurately maintained. The H sync to subcarrier phase relationship (SC/H) is established relative to the selected lock signal. The VPA front panel and the optional 330RP-2 Auxiliary Remote Control Panel have Correct SC/H indicators as a convenience for setting and monitoring.

LOCK MODES

The VPAs internal sync generator may be locked to the input video or to an external reference signal. Lock mode selection is manual or automatic. In the automatic mode, the timing of the input video sync is compared to that of the external reference. If the timing is within a preset (selectable) window, the VPA locks to the external reference. Automatic transfer to input video lock occurs when the timing is outside the preset window or when the signals are non-synchronous.

SIGNAL PROCESSING

The video signal processing functions include replacement of the blanking interval, video and chroma gain controls, selectable soft or hard back porch clamping, adjustable black and white clipping. The luminance black clip can be set to prevent the intrusion of signal components into the set-up.

AUTOMATIC GAIN CONTROL

The VPA provides independently selectable chroma and video AGC. The chroma AGC is referenced to the burst amplitude of the input video, while video AGC is referenced to the input sync amplitude. The preset AGC function can be locally or remotely activated.

FADE-TO-BLACK

A front panel 3-position toggle switch is used to assign the linear, synchronous fade-to-black function to local or remote control. Deselection restores unity gain. Local and remote tallies show when the fade control is active.

VITS

Vertical interval test signals on lines 10 to 21 of either field 1 or field 2 may be retained or deleted, as desired. It is also possible to select a mode in which the fade-to-black function does not affect the retained VIT signals.

BYPASS FUNCTIONS

Processing may be turned on or off by front panel switches. When processing is switched off, the blanking interval is not replaced. All other functions remain operational. When the front panel BYPASS switch is pressed, the video input is routed directly to the program output connector and the preview output is inactive. Bypass is automatic when power is lost.

FEATURES

- **RS170A front panel SC/H indication**
- **H & V blanking width adjustable**
- **Selectable VIT retention**
- **Video gain control**
- **Setup control**
- **Chroma gain control**
- **Burst phase control**
- **Fade to black control**
- **Soft white clip**
- **Hard white clip**
- **Soft black clip**
- **Hard or soft clamping**
- **Input video lock**
- **External reference lock (standard)**
- **Video and/or chroma AGC (standard)**
- **Total bypass**
- **Auxiliary video input (VPA-331N)**
- **Differential input (optional)**
- **Equalizing (optional)**

OUTPUT CONTINUITY

In the processing mode, sync, burst and set-up appear on the program and preview outputs at all times.

AUXILIARY VIDEO INPUT

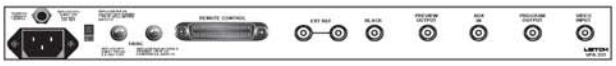
The auxiliary video input is intended for a dedicated stand-by signal in case the main signal fails. The signal is routed to the program output connector via relay contacts after a delay of 3 seconds. The feature is enabled by internal jumper selection.

OPTIONS

Remote control of the VPA-331N is possible with the optional 330RP-1 Remote

Control Panel which provides the following:

- Video gain control 2.5 dB
- Chroma gain control 2.5 dB.
- Synchronous, linear fade-to-black with tally when active.
- Burst phase control 6.
- Normal, Processing Bypass and Total Bypass mode selection with tally.



LEITCH

NTSC Video Processing Amplifier — VPA-331N

SPECIFICATIONS

Specifications and designs are subject to change without notice.

POWER

Voltage	115/230 VAC ±10%
Frequency	50/60 Hz
Power consumption	25 VA max.

TEMPERATURE RANGE

Performance	5-40°C ambient
Operating	0-50°C ambient

VIDEO INPUT

Level	1 Vp-p ±6 dB composite video
Impedance	75 Ohm, terminating
Return loss	>40 dB to 4.2 MHz
Auxiliary Video Input	
(VPA-331N) Level	1 Vp-p ±6 dB composite video
External Reference Level	composite video with 40 IRE units sync & burst ±6 dB
Impedance	75 Ohm, bridging
Return loss	>40 dB to 4.2 MHz

BLACK OUTPUT

Number of outputs	1
Level	40 IRE units sync & burst, 7.5 IRE units set-up
Timing	synchronous with program output
Impedance	75 Ohm
Return loss	>37 dB to 4.2 MHz
Video Path Video gain range	±2.5 dB
Chroma gain range	± 2.5 dB
Frequency response	± 0.1 dB to 5 MHz
Line tilt	< 0.5%
Field tilt	< 0.5%
Differential phase	< 0.2°
Differential gain	< 0.5%
S/N ratio	> 60 dB to 4.2 MHz (p-p signal to rms noise)
Hum	>54 dB below 1 Vp-p

VIDEO OUTPUTS

Number of outputs	2 (program & preview)
Total bypass input to program output	
Impedance	75 Ohm
Return loss	>34 dB to 4.2 MHz
Output isolation	>40 dB to 4.2 MHz
Blanking Interval Regeneration Sync level	40 IRE units, adjustable
Burst level	40 IRE units, adjustable
Set-up	7.5 IRE units, adjustable
H timing range	+3.5 us (delay) -0.6 us (advance)
H timing resolution	< 10 ns
H lock jitter	< 5 ns
Pulse width per RS170A, adjustable H	
blanking start	nominal ± 0.5 us
H blanking finish	nominal -1.0 +0.5 us
V blanking	lines 10-21 on either field may be blanked or retained.
Burst phase Range	360°
Resolution	< 0.1°
Jitter	< 0.2°
Burst lock frequency	3.579545 MHz ±30 Hz

MOUNTING FRAME

Height	44 mm (1.75 inches)
Width	483 mm (19 inches)
Depth from mounting surface	445 mm (17.5 inches)
Net weight	8.6 kg (19 lbs)

ORDERING INFORMATION

For more information visit www.leitch.com

VPA-331N NTSC Video Processing Amplifier complete with detachable power cord and instruction manual.

OPTIONS

330RP-1	Remote Control Panel
101ME	Module Extender

[ANEXO Nº 18.7]

TVS-3003

MTS GENERATOR LIMITER SYSTEM

ADVANCED MTS GENERATOR / AUDIO LIMITER

Our TVS-3003 is a combination MTS generator and audio limiter that combines advanced AGC and limiting audio processing with a state-of-the-art digitally synthesized generator. It provides a single package stand-alone stereo television audio system.

Through the use of time tested circuit technology and innovative packaging, the TVS-3003 lets you convert to stereo both quickly and easily. In addition, it includes a long list of "must have" features that will make your station's audio quality stand out.

INPUT AGC LEVELING

The TVS-3003 input circuitry consists of a wideband AGC circuit with over 20 dB of range control that satisfies most all on-air AGC needs without additional level control.

When used with our deluxe TVS-3001 studio processing unit, this AGC is used lightly as a level safety net between the two units or any microwave link which may be connecting them.

TRUE STEREOPHONIC ENHANCEMENT

The received stereo effect perceived by your viewers is usually poor and is caused by their television's speaker spacing being too close together.

Our TVS-3003 provides a method to overcome this and allows you to stand out from your competition. We provide an exclusive stereo image enhancer which dramatically improves your station's received stereo effect on both small and large television sets.

With our special enhancement system, you can automatically increase program separation within a defined range to cause dramatic stereo separation improvements.

You decide "HOW MUCH" maximum enhancement should be allowed by the automatic circuitry and the system takes care of the rest.

Further control is provided by allowing enhancement to ONLY begin above your defined minimum separation level, (selectable at 6 dB or 12 dB) so that mono sources remain unaffected.

INTELLIGENT LIMITER SYSTEM

To preserve transmitted stereo audio fidelity, a specialized pre-emphasis limiting system has been designed by CRL especially for stereo television broadcasts.

The variable transfer function system we use modifies the transmitted pre-emphasis curve into two parts, allowing the independent attenuation of the 1 kHz to 6 kHz (band-pass) and the 6 kHz to 15 kHz (high-pass) segment of the frequency spectrum. This technique allows full fidelity transmission of the high frequency spectrum when the mid-range frequencies must be limited to prevent overmodulation.

The final limiter used in the TVS-3003 is a unique intelligent feedback controlled design that automatically sets itself to offer instantaneous peak protection without generating the undesirable distortion products associated with simpler designs. This technique allows for extremely transparent absolute output control.

ADVANCED AUDIO LOW-PASS FILTERING

Our MTS generator uses a distributed 11th order filtering system rather than the standard BTSC 11th order topology.

Our low pass filtering consists first of one pair of 7th order filters in left and right channels and another pair of 7th order filters in the L+R/L-R generator paths.

This method maintains superior stereo separation specifications, excellent pilot and subcarrier protection that cannot be obtained with the "ALL-IN-ONE" 11th order filtering system. It also produces less group delay in the L-R filter section which is important since this filter is in the dbx compressor loop.

FACTORY dbx ENCODING WITH CRL L-R NOISE REDUCTION

Only the latest generation of factory dbx encoders is used in our TVS-3003 and is computer checked by us to ensure full range BTSC operation.

- L/R or L+R/L–R Audio Input
- 20 dB Input AGC Range
- Program Controlled Stereo Enhancement
- Variable Transfer Function Pre-emphasis Limiting
- Sync Input / Video Sync Separator
- Digitally Synthesized Stereo Generation
- Advanced 15.734 kHz Input Filtering
- CRL Improved dbx Noise Reduction
- Full Function Diagnostic Metering
- On-Board Bessel Tone Calibration Generator

Early in our design stage, we found that dbx encoders increase their gain by as much as 60 dB during quiet passages! This is the NORMAL characteristic of dbx encoders and results in their L-R noise floor rising substantially.

We also determined that some television receivers could detect this noise. CRL therefore developed a unique gating technique that prevents the excessive dbx gain from taking place when L-R approaches low levels (no separation).

The result of this intelligent gating action is up to a 20 dB lower L-R noise floor than ALL other MTS generators currently on the market.

DIGITAL STEREO GENERATION

Our MTS L-R subchannel modulator is a CRL-pioneered and time-proven design. Its digitally synthesized circuitry provides totally transparent and drift-free L-R subchannel generation.

Configured as a unique PAM (pulse amplitude modulator), our design takes advantage of being a digital modulator while acting as an apparent "ANALOG" balanced modulator. This produces the high stability and precision found in digital modulators and provides the high linearity found in balanced modulators.

Ultimately, our modulator provides both a drift-free and spectrum-pure design which resists aging effects that occur with either of the previous modulator designs. This means you never have to worry about whether your CRL generator is aligned.

METERING AND CONTROLS

Our TVS-3003 quick and easy setup is enhanced by the inclusion of a metering system that allows selection of virtually all vital operating parameters on a high resolution LED display panel.

Metering functions and input ranges are selected either by a front panel push button or by configuration switches mounted behind the front panel access door.

Multi-color status indicators continuously monitor generator performance. All normally used level and control functions are mounted behind the front panel access door. Many additional options, (which are rarely used) are available on internal circuit board jumpers.

Audio input levels and composite output levels are controlled by high quality 20 turn potentiometers.

Our internal Bessel tone calibration signal allows easy level alignment of proper ON AIR modulation levels.

Specifications

LIMITER SECTION

Pre-emphasis
50 uS or 75 uS jumper selectable

Frequency Response
+/- 0.5 dBm (from 75 uS pre-emphasis, while below limiting threshold). 50 Hz to 15 kHz.

Harmonic Distortion
< 0.05% bypass. < 0.25% operate at limit threshold, 50 Hz to 15 kHz

IM Distortion
< 0.25%, SMPTE method, 4:1 ratio

S + N/N ratio
> 80 dBm bypass, > 70 dBm operate (de-emphasized)

Limiting Method
Input AGC followed by dual band variable transfer function pre-emphasis limiter and final peak controller

Input AGC
Provides greater than 20 dBm of gated wideband G/R range. Strapped control circuit provides perfect stereo tracking

Control Elements
Voltage controlled resistor (VCR) for input AGC & peak controller. Voltage controlled amplifier (VCA) for pre-emphasis limiters.

Pre-emphasis Limiter Crossover Frequencies
1 kHz, 6 kHz

Limiting Range
Up to 20 dBm for 75 uS pre-emphasis limiting

Peak Mod. Control
Within 1% for all program material

Output Filtering
Seventh-order, elliptical function

Stereo Enhance
User adjustable program dependent stereo enhancement. Enhances audio with at least 6 dBm separation to levels set by user.

GENERATOR SECTION

Frequency Response
+/- 0.5 dBm, 50 Hz to 15 kHz, +/- 0.25 dBm 50 Hz 12.5 kHz

Harmonic Distortion
Equivalent mode; < 0.08% 50 Hz to 15 kHz with 75 uS de-emphasis
BTSC mode: < 0.1% 50 Hz to 15 kHz with 75 uS de-emphasis

S+ N/N
> 75 dBm (BTSC operation, ref. 50 kHz deviation decoded and de-emphasized)

Stereo Separation
BTSC operate mode with N/R:
> 40 dBm 50 Hz to 10 kHz
> 35 dBm 10 kHz to 12.5 kHz

Equivalent Mode
> 60 dBm 50 kHz to 12 kHz, 65 dBm typical
> 50 dBm 12 kHz to 14 kHz, 55 dBm typical

Crosstalk
Non-Linear— > 75 dBm down 50 to 15 kHz (Ref. 50 kHz deviation)
Linear— > 60 dBm down 50 to 15 kHz (Ref. 50 kHz deviation)

Pilot Phasing / Frequency
Digitally locked to Fh of 15.734 kHz

Pilot Protection
> 40 dBm dynamically measured with 1 kHz BW centered at 15.734 kHz

2 Fh Suppression
Locked to station Fh of 15.734 kHz
31.468 kHz Suppression > 60 dBm or less than +/- 50 Hz deviation of main carrier

GENERAL

Input Audio
Type — Active balanced, (differential) EMI suppressed. Accepts L&R inputs or L+R & L-R inputs
Bridging Impedance — > 10k ohms balanced bridging; > 5k ohms unbalanced
Terminated Impedance — 600 ohms (selectable)
Level — Adjustable from - 20 to +20 dBmmm referenced to input AGC threshold

Input SAP/PRO Subcarrier
Type — BNC, unbalanced
Impedance — 1000 ohms
Termination — 75 ohms (selectable)

Output Main Composite
Type — BNC, unbalanced
Impedance — 75 ohms or < 10 ohms resistive (selectable)
Level — Adjustable to > 5 volts p-p into 75 ohms

Output Auxiliary Composite
Type — Active balanced or unbalanced
Impedance — 75 ohms unbalanced, 150 ohms balanced
Level — Adjustable to > 10 volts p-p balanced into 75 ohms

Video/Sync Loop Thru
Impedance — 100k ohms (75 ohm termination provided)
Level required — 1v p-p or greater

Metering
Two channel level indication with 43 dBm of metering range (-40 dBm to +3 dBm).
Input level range selection allows for selectable full-scale reading of -10, 0 +10 or +20 dBmmm.

Metered Functions
Input audio L/R; Limiter input L/R; Stereo generator input L/R; PLL lock level; Aux. output level; L+R/L-R dbx levels; Composite output level (relative); Pilot injection level; L-R input level; Subcarrier injection; Input AGC gain reduction; Stereo enhance activity.

Status Indicators
Stereo On; Test Mode selected; Sync Input/Failure; Pilot Lock/Failure.

Remote Control Input
Stereo / Mono selected by Opto-isolated switching

Remote Status Indicators
Stereo on / off; Audio phase reversal; Sync loss.

Remote Outputs
Opto-isolated current source (25 mA max.)

Internal Controls
Automatic Mono / Stereo switching — AUTO / MANUAL;
Final safety limiter threshold adjust 90%–110%;
Final safety limiter defeat — IN / OUT;
Remote control mode MOMENTARY / TOGGLE;
Low level modified noise reduction defeat.

Operating Temperature Range — -32 to 122 degrees F (0 to 50 degrees C)

Power Requirements — 100–130 or 200–250 VAC; 50 / 60 Hz, 50 VA max. EMI suppressed, IEC connector standard

Operating Humidity — 0–95% RH, non-condensing

Operating Altitude — 0–15,000 Feet AMSL

Shipping Weight — 32 lbs. (including standard accessories)

Dimensions — 19" x 3.5" x 17.25" (w/handles) or 15.75" (without)
48.3 cm x 8.9 cm x 43.8 cm (w/handles) or 40 cm (without)

ORDERING INFORMATION

MTS Stereo Television Systems
TVS-3003
MTS Audio Limiter/Generator
Stand alone system with audio peak limiting, unique stereo enhancement, a superior digitally synthesized generator and factory dbx encoding.
TVS-3001
Studio Audio Controller
Precision Multiband audio processor with CRL loudness control. Automatic phase reversal correction and audio asymmetry removal.
OPTIONS
TVS-FPNL Filler Panel
Black anodized 1.75" blank panel machined to match TVS units.
TVS-SLR
Rack Slide Mounting Kit
High quality roller bearing for easy chassis/rear panel access.

1330 W. Auto Dr. | Tempe AZ 85284
602.438.0888 | 480.785.1031 fax

www.crlsystems.com

[ANEXO Nº 18.8]

DM-141A, DM-145, DM-145GCR, DM-154, DM-192
Frequency Agile Demodulators

DM-192

For more than two decades, the Videotek family of demodulators has provided the highest performance at the best value in the industry. By offering the greatest selection of demodulators, with the widest range of features, Videotek has become the largest supplier of agile demodulators in North America. All models provide video and BTSC stereo signal demodulation for Broadcast, CATV and closed circuit monitoring applications. From basic receiving and monitoring applications to full FCC proof of performance testing, Videotek offers an agile demodulator that will fit your needs and your budget.

Demodulator Series Features

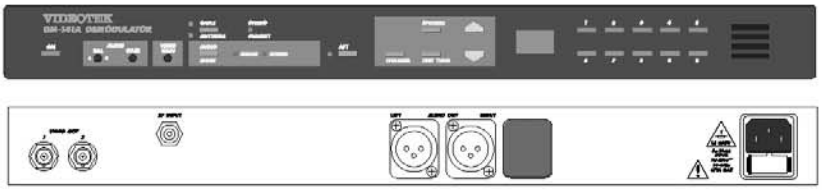
- Multi-band tuning (VHF/UHF/Cable)
- HRC/IRC tuning capability
- Random access, search or up/down channel selection
- Front panel Cable/Antenna selection
- Frequency synthesized channel selection
- Front panel audio presence indicators
- Synchronous detection
- Envelope and synchronous detection on DM-192
- Up to 4 MHz bandwidth for FCC testing
- Audio output configurations for every requirement
- Front panel LED channel display
- Controls for video gain, audio gain and balance on front panel
- Front panel memory retained for one week in event of power loss
- All models receive and process PAL-M
- Standards available: NTSC and PAL-M

NTSC Demodulator Selection Chart

Model	Cable Chan: (All tune VHF/UHF)	Remote	Video Out	Video SNR	Audio Out	QUAD Out	4.5MHz/ Comp	IF Loop	Zero Carr Pulse	Detection	Diff Gain	Diff Phase	Size
DM-200	1-134	RS-232/422	2	≥58dB	Stereo/ SAP	Y	Y	Y	Y	Synchronous	≤1.0%	≤1.0°	½ x 1 RU
DM-200A	1-134	RS-232/422	2	≥58dB	Stereo/ SAP	N	Y	Y	Y	Synchronous	≤1.0%	≤1.0°	½ x 1 RU
DM-192	2-125	RS-232/422	2	>55dB	Stereo/ SAP/ PRO	Y	Y	Y	Y	Synchronous /Envelope	≤4.0%	≤4.0°	1 RU
DM-154	2-99	RS-232	2	>55dB	Stereo/ SAP	Y	Y	Y	Y	Synchronous	≤4.0%	≤4.0°	1 RU
DM-145GCR	2-99	N	2*	>49 dB	Stereo/ SAP	N	N	N	N	Synchronous	≤5.0%	≤5.0°	1 RU
DM-145	2-99	N	2	>49dB	Stereo/ SAP	N	N	N	N	Synchronous	≤5.0%	≤5.0°	1 RU
DM-141A	2-99	N	2	>49dB	Stereo	N	N	N	N	Synchronous	≤5.0%	≤5.0°	1 RU
DM-100	2-99	N	1	–	Stereo	N	N	N	N	Synchronous	–	–	⅓ x 1 RU

* Only 1 video output is corrected with GCR signal

DM-141A

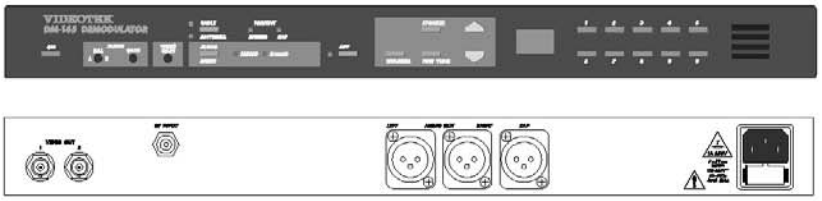


The most affordable model in our family, the **DM-141A** *receives "off air" or CATV signals, processes these signals and provides two buffered composite baseband video outputs. Additionally the DM-141A provides balanced stereo audio outputs which may be monitored via the front panel speaker. Ideal for uses where quality video and stereo audio reception is required. The DM-141A is used in headends, studios and remotes for monitoring and retransmission applications.*

FEATURES:

- *154 channel tuning (VHF/UHF/Cable)*
- *HRC/IRC tuning capability via wide range fine tuning*
- *Random access, search or up/down channel selection*
- *Front panel Cable/Antenna selection*
- *Frequency synthesized channel selection*
- *Synchronous detection*
- *Stereo presence indicator*
- *Front panel LED channel display*
- *Controls for video gain, audio gain and balance on front panel*
- *Front panel memory retained for one week in event of power loss*

DM-145

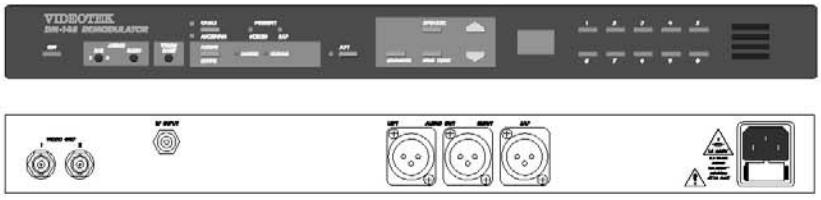


Like the DM-141A, the next model in the Videotek demodulator series, the **DM-145**, *is perfect for broadcast and cable applications and adds the capability of providing both stereo audio and SAP (Second Audio Program) outputs. Second language programming, emergency alert, or radio simulcasting are a few of the applications that require full time SAP audio.*

FEATURES:

- *154 channel tuning (VHF/UHF/Cable)*
- *Simultaneous stereo and SAP audio outputs*
- *HRC/IRC tuning capability via wide range fine tuning*
- *Random access, search or up/down channel selection*
- *Front panel Cable/Antenna selection*
- *Frequency synthesized channel selection*
- *Synchronous detection*
- *SAP and Stereo presence indicators*
- *Front panel LED channel display*
- *Controls for video gain, audio gain and balance on front panel*
- *Front panel memory retained for one week in event of power loss*

DM-145GCR

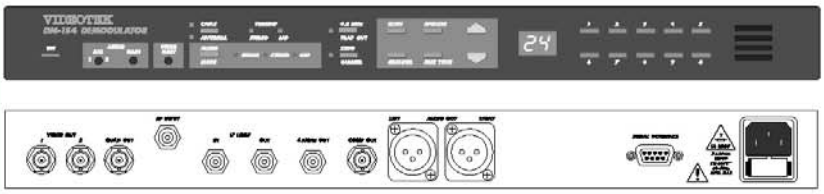


Like the DM-145, the next model in the Videotek demodulator series, the **DM-145GCR**, *is perfect for broadcast applications where the added capability of Ghost Cancellation Reference (GCR) correction to the Video output is needed. Correcting for ghosts from +3 to -42 µsec.*

FEATURES:

- *One GCR corrected output (video out #2)*
- *154 channel tuning (VHF/UHF/Cable)*
- *Simultaneous stereo and SAP audio outputs*
- *HRC/IRC tuning capability via wide range fine tuning*
- *Random access, search or up/down channel selection*
- *Front panel Cable/Antenna selection*
- *Frequency synthesized channel selection*
- *Synchronous detection*
- *SAP and Stereo presence indicators*
- *Front panel LED channel display*
- *Controls for video gain, audio gain and balance on front panel*
- *Front panel memory retained for one week in event of power loss*

DM-154



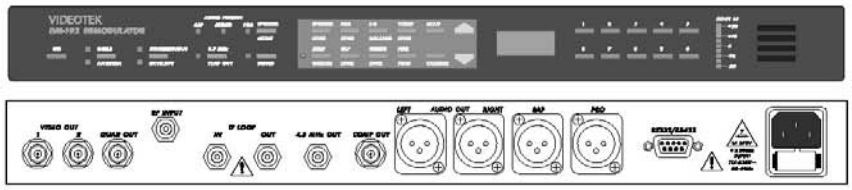
The **DM-154** demodulator is a high performance television tuner/demodulator which, in addition to being at home in basic broadcast, cable and closed circuit monitoring applications, can also be used for FCC compliance testing. It contains features beyond standard tuners, including forced mono mode, a Zero Carrier Pulse (chopper), 4.5 MHz aural carrier output, external IF loop and remote control via an RS-232 port. The DM-154 may be used in testing applications and in locations where computer control is required.

FEATURES

All features of the DM-141A PLUS

- Full 4 MHz bandwidth video for compliance testing
- Quadrature output for ICPM measurements
- SAP presence indicator
- Front panel selection of Stereo, Mono or SAP outputs
- Zero Carrier Pulse control on front panel
- Remote control via an RS-232 port
- IF (45.75 MHz) loop enabled by an internal jumper
- Suitable for full FCC proof of performance testing

DM-192



The **DM-192** is a 192 channel high performance agile demodulator that provides features and performance found on demodulators over twice its price! It shares all of the features of the DM-154 plus front panel selectable synchronous or envelope detection and three types of full time audio outputs plus composite audio out. Like all Videotek agile demodulators, the DM-192's front panel provides convenient control of all standard operations. The DM-192 is ideal for high quality reception and testing applications and in any application where all audio signals are required all the time.

FEATURES

All high performance features of the DM-154 PLUS

- 192 channel tuning (up to cable channel 125)
- Envelope or synchronous detection (front panel selectable)
- Full time Stereo, SAP, PRO, 4.5 MHz and composite audio outputs
- User selectable RS-232/RS-422 port
- Designed for full FCC proof of performance testing

DM-141A/145/145GCR/154/192 Common Specifications

VIDEOTEK®
A Zero Defects Company

TUNER

TUNING RANGE:
55.25 to 801.25 MHz

CONNECTOR:
75Ω F connector, female

INPUT RANGE:
- 15 to +15 dBmV

MAXIMUM RF INPUT LEVEL:
+30 dBmV

CROSS MODULATION:
< -50 dB nominal

FINE TUNING RANGE:
±2 MHz in 64 steps (62.5 kHz per step)

FREQUENCY STABILITY:
±15 kHz typical

CHANNEL COVERAGE:
VHF Channels 2-13
UHF Channels 14-69
Cable Channels 2-99

BAND COVERAGE:
Low, Mid, High, Super, UHF

DETECTOR: Synchronous

VIDEO

VIDEO OUTPUTS:
2 NTSC video outputs, sync negative 75Ω source terminated

CONNECTORS: 75Ω BNC, female

LEVEL:
1V p-p, typical into 75Ω load

ADJUSTMENT RANGE:
±3 dB typical (front panel control)

CHROMA/LUMA DELAY:
Within 30 ns typical (ref -170)

AUDIO

AUDIO LINE OUTPUTS:
Balanced stereo (left and right)

CONNECTORS: XLR (male)

LEVEL: 0 dBm, typical across 600Ω

ADJUSTMENT RANGE:
-16 dBm to +4 dBm

FREQUENCY RESPONSE:
50 Hz to 12 kHz (stereo mode)

SIGNAL TO NOISE RATIO:
50 dB at 0 dBm

STEREO SEPARATION:
>20 dB @ 1 kHz

DISTORTION:
2% maximum, 1 kHz to 12 kHz

AUDIO SPEAKER:
Internal 1" speaker, front panel level control

POWER

INPUT:
90 - 264 VAC,
50/60 Hz

CONSUMPTION:
35 VA, typical

CONNECTION:
Detachable 3 wire power cord, per IEC 320

ENVIRONMENTAL

OPERATING TEMPERATURE:
0° to 50°C

STORAGE TEMPERATURE:
-40° to 75°C

HUMIDITY:
90% maximum (non-condensing)

MECHANICAL

DIMENSIONS:
Height: 1.75" (4.5cm)
Width: 19" (48.3cm)
Depth: 10.75" (27.3cm)

WEIGHT:
9.25 lbs. (4.2kg)

STANDARD ACCESSORIES

Operation & Service Manual
Power Cord
Rackmount Kit

DM-141A/145/145GCR/154/192 Unique Specifications

DM-141A/145

VIDEO

DIFFERENTIAL GAIN: <5%

DIFFERENTIAL PHASE: <5°

SIGNAL TO NOISE RATIO:
>49 dB at 0 dBmV
>55 dB at 10 dBmV

FREQUENCY RESPONSE:
0.5 MHz to 3.6 MHz ±1 dB

DM-145

ALL SPECIFICATIONS COMMON WITH DM-141A PLUS

AUDIO LINE OUTPUTS:
Balanced stereo (left and right)
SAP Output

DM-145GCR

ALL SPECIFICATIONS COMMON WITH DM-145 PLUS

VIDEO OUTPUTS:
2 NTSC video outputs, 1 GCR corrected

GCR VIDEO OUTPUT

FREQUENCY RESPONSE:
± 1 dB to 3.6 MHz added

DIFFERENTIAL PHASE: <2° added

DIFFERENTIAL GAIN: <3% added

SIGNAL TO NOISE RATIO: <3 dB added

ADJUSTMENT RANGE:
None (auto corrected with GCR signal)

D.C. OFSET:
< 50 mV with active GCR signal correction
< 150 mV without GCR signal correction

GHOST CANCELLATION OUTPUT:
Ghost Reduction: 35 dB, typical
Operating Range:
Leading Ghost to +3 µsec
Trailing Ghost to -42 µsec

DM-154

ALL SPECIFICATIONS COMMON WITH DM-141A PLUS

TUNER

IF LOOP:
+20 dBmV typical, internally enabled

CONNECTORS:
75Ω F, female

VIDEO

DIFFERENTIAL GAIN:
<4%

DIFFERENTIAL PHASE:
<4°

BANDWIDTH:
0.5 MHz to 4.0 MHz ±1 dB (Trap out)

SIGNAL TO NOISE RATIO:
>50 dB at 0 dBmV
>55 dB at 10 dBmV

ZERO CARRIER OUTPUT:
User selection ON/OFF; Location of Zero Carrier Pulse selectable from line 10 through line 25 via front panel

QUADRATURE OUTPUT:
within 7°

CONNECTOR: 75Ω BNC, female

AUDIO

4.5 MHz AURAL OUTPUT:
+10 dBmV or +34 ±2dBmV selectable

CONNECTOR:
75Ω F, female

COMPOSITE AUDIO OUTPUT:
110 kHz bandwidth, 0.5V p-p

CONNECTOR:
75Ω BNC connector, female

REMOTE CONTROL

- RS-232 connector: (Type DB 9, Female)
- Cable or Antenna selection
- Channel selection select/scan up or down
- Audio mode selection
- Speaker volume control
- Zero Carrier enable and line location
- Fine tuning
- 4.5 MHz trap ensible/disable
- All commands return status of controlled feature

DM-192

ALL SPECIFICATIONS COMMON WITH DM-154 PLUS

TUNER

CHANNEL COVERAGE:
VHF Channels 2-13
UHF Channels 14-69
Cable Channels 2-125

DETECTOR:
Synchronous or Envelope detection
Front panel selectable

SIGNAL STRENGTH METER:
Front panel indication of input RF level

AUDIO

AUDIO LINE OUTPUTS:
Balanced Stereo Left and Right
SAP, PRO channel

ADJUSTMENT RANGE: -16 to +8 dBm

CONNECTORS: XLR (male)

4.5 MHz AURAL OUTPUT: +10 dBmV

CONNECTOR:
75Ω F connector, female

COMPOSITE AUDIO OUTPUT:
110 kHz bandwidth, 1V p-p

CONNECTOR: 75Ω BNC, female

DEMODS & MONITORING

Specifications subject to change without notice.

[ANEXO Nº 18.9]

5870(NTSC, SCH) / 5872A(NTSC)* / 5873(PAL)**

LEADER

Simultaneous Display of Vector and Waveform

The 5870 and 5872A are combination NTSC signal measurement monitors that integrate a waveform monitor with a vectorscope in one half rack chassis. The 5870 has a SCH phase measurement circuit.
Waveforms and vectors can be independently or simultaneously displayed on a single CRT. For example, both Channel A and B waveform and vectorscope displays can be shown at the same time.
In addition, the 5870 has a SCH phase measuring function for video editing. The SCH phase can be displayed on the CRT with a numerical readout. Phase variations of jitter are also displayed with the waveform.
Furthermore, a full-line selector function is installed for reading the field and line number on the CRT. As a result, the 5870 and 5872A are very useful not only in observing the blanking time intervals for VITS, VIR, character broadcasting and ITS, but also in checking the various characteristics of video camera resolution.

*The 5872A model does not have the SCH phase measuring capability.
**The 5873 model is the PAL equivalent to the 5872A NTSC

FEATURES

- 150 mm rectangular CRT with internal graticule. The 16.5 kV high-accelerating potential facilitates legible, clearly defined display.
- CRT displays of SCH measurements enable correct monitoring without reading errors. (only 5870)
- The full-line selector function used to select optional lines, also vertical interval test signals can be monitored (VITS).
- Stores/recalls up to 9 panel settings.
- Field and line numbers selected by the full line selector are displayed on the CRT for confirmation during waveform observation.
- Dual-channel display shows A and B inputs concurrently.
- Power supply circuit enables operation using supply voltages of 90 to 250 VAC without switching. The standard DC operation function (11 to 20 VDC) enables instrument use in vehicles.
- All front-panel switches can be externally remote-controlled.
- Differential gain (DG) and differential phase (DP) can be displayed through single key operations.
- RGB/YRGB with parade display function.

● 5872A FRONT PANEL

● 5872A REAR PANEL

5873 / 5870 / 5872A SPECIFICATIONS

Model	5873	5870/5872A
CRT		
Type	150 mm rectangular	
Accelerating Potential	16.5 kV	
Effective Display Area	100 (H) × 80 (V) mm	
Scale	Internal graticule (for waveform and vector display) with scale illumination	
Waveform Monitor		
Vertical Axis		
Deflection Sensitivity	1 Vp-p full scale, 1.0 scale: ±1%, x5 MAG: ±3%	1 Vp-p full scale, 140 IRE: ±1% x5 MAG: ±3%
Gain Variable Range	x1 full scale: 0.7 to 2 Vp-p, x5: 0.14 to 0.4 Vp-p	
Maximum Input Voltage	±2V (DC+peak AC), AC coupled	
Frequency Response		
FLAT	25 Hz to 6 MHz±2%, 6 MHz to 8 MHz +2%, -5% at 50 kHz reference	
LUM	Attenuation: 35 dB or more at 4.43 MHz Flatness between FLAT and LUM:1% or less at 15 kHz	〈5872A〉 Attenuation: 35 dB or more at 3.58 MHz Flatness between FLAT and LUM: 1% or less at 15 kHz
IRE	——	〈5870〉 Conforms to IEEE STD 205 of 1972 Flatness between FLAT and IRE: 1% or less at 15 kHz
CHROMA	4.43 MHz bandpass filter, Bandwidth: 2 MHz ±500 kHz Flatness between FLAT and CHROMA: 1% or less at 4.43 MHz	3.58 MHz bandpass filter, Bandwidth: 2 MHz±500 kHz Flatness between FLAT and CHROMA: 1% or less at 3.58 MHz
Transient Response	1V full scale (2 T pulse and 2 T bar for FLAT)	
Overshoot	±2%	±2 IRE
Preshoot	±2%	±2 IRE
Ringing	±2%	±2 IRE
Pulse to bar Ratio	Within ±1%	
Vertical Window Signal Tilting	Within ±2%	
Input Impedance	15 kΩ or more	
Return Loss	40 dB or more at 50 kHz to 6 MHz	
Video Output	1 Vp-p ±5% at 1.0 scale deflection	1 Vp-p ±5% at 140 IRE scale deflection
Frequency Response	25 Hz to 6 MHz ±5%	
Output Impedance	75 Ω	
DC Restoration	Clamped on the back porch	
Horizontal Axis		
1H Sweep	Displays 1H waveform	
2H Sweep	Displays 2H waveform	
1 µs/div	10 times of 2H sweep	
0.2 µs/div	25 times of 1H sweep	
1V Sweep	Displays 1V waveform	
2V Sweep	Displays 2V waveform	
V. MAG	20 ±3 times 1V and 2V sweeps	
Sweep Time Accuracy	1 µs/div: ±3% 0.2 µs/div: ±3%	
Sweep Length	12.5 div	
Linearity	Within ±3%	
RGB/YRGB	Selectable (RGB at shipment)	
Staircase Input	10 Vp-p ±15% for 9 div display	
Maximum Input	±12V (DC+peak AC)	
Timebase	RGB: 30% or standard length (1H sweep) YRGB: 22% or standard length (1H sweep)	
Control Signal	Apply TTL LOW active signal to rear panel remote connector.	
CAL	Amplitude: 1 Vp-p ±1% Frequency: 100 kHz ±0.1 kHz	
DG and DP Display		
DG Measurement	Range: ±10% Accuracy: ±1%	
DP Measurement	Range: ±10° Accuracy: ±1°	

Model	5873	5870/5872A
Vectorscope Section		
Chrominance Processing		
Bandwidth	Fsc=4.43361875 MHz High Frequency=Fsc+500 kHz Low Frequency=Fsc-500 kHz	Fsc=3.579545 MHz High Frequency=Fsc+500 kHz Low Frequency=Fsc-500 kHz
Phase Accuracy	±2°	
Amplitude Accuracy	±3%	
Differential Phase	±1°	
Differential Gain	±1%	
Subcarrier Regenerator	Sync capture range: ±50 Hz	
Phase Adjustment Range	360°	
Display		
GAIN Variable Range	x1 MAG input: 210 mVp-p to 1.05 Vp-p x5 MAG input: 43.2 to 210 mVp-p	
SCH Mode (5870 only)		
Absolute Accuracy	–	±5° at ambient of 25°C
Relative Accuracy	–	±2°
Display Range	–	External reference: 360° Internal reference: ±80°
CRT Readout	–	SCH+80° to SCH-80°
Required Input		
SCH Mode (5870 only)	–	Sync and burst of composite video or black burst signal: 286 mVp-p ±3 dB
Other Mode	Sync and burst of composite video or black burst signal: 300 mVp-p ±6 dB	Sync and burst of composite video or black burst signal: 286 mVp-p ±6 dB
EXT REF		
Sync Amplitude	Synchronization with 143 mVp-p to 4 Vp-p	
Input Impedance	15 kΩ or more	
Return Loss	40 dB or more at 50 kHz to 6 MHz	
Maximum Input Voltage	±12V (DC+peak AC)	
Line Selector	Field 1, 3: 1 to 313 lines Field 2, 4: 314 to 625 lines Field selection: FD 1, 3, FD 2, 4 or FD 1, 2, 3, 4 Preset: 1 to 9, 9 points	Field 1, 3: 1 to 263 lines Field 2, 4: 1 to 262 lines Field selection: FD 1, 3, FD 2, 4 or FD 1, 2, 3, 4 Preset: 1 to 9, 9 points
CRT Readout	Preset No.: P1 to P9 Field: FD 1, 3, FD 2, 4 or FD 1, 2, 3, 4 Line Number: 1 to 313 or 314 to 625	Preset No.: P1 to P2 Field: FD 1, 3 FD 2, 4 or FD 1, 2, 3, 4 Line Number: 1 to 262 or 1 to 263
Remote Control		
Controllable Section	All front panel functions	
Control Signal	TTL (active low)	
Control Input Connector	Rear panel D-sub 25-pin (REMOTE A) D-sub 9-pin (REMOTE B)	
Power Requirements	90 to 250 VAC, 48 to 440 Hz, 44 W 11 to 20 VDC, 2. 8 A at 12V	
Dimensions and Weight	215 (W) x 132 (H) x 429 (D) mm, 7.1kg (5873, 5870), 7kg (5872A) 8 1/2(W) x 5 1/4(H) x 16 3/4(D) in., 15.6 / 15.4 lbs.	
Supplied Accessories	D-sub 25-pin connector ····· 1 D-sub 9-pin connector ····· 1 Cannon connector ····· 1 Screw (inch size) ····· 2 Illumination lamp ····· 5 Cover, inlet stopper ····· 1 Screw lock ····· 2 E-ring ····· 1 AC power cord ····· 1 Instruction manual ····· 1	

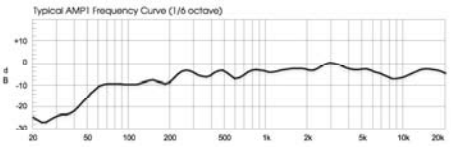
[ANEXO Nº 18.10]

February 4, 2004

World Leader • In-Rack • Audio & Video Monitoring

WOHLER AMP1A-LP2S

Compact, High Quality Analog Self-Powered Speaker System - 2 Stereo Channels



Features:

Full Fidelity Audio Monitoring in only 1U of rack space
4 Balanced Analog Inputs (2 Stereo, Select 1)
Balanced Analog Output of Selected Stereo Source
Powerful 98dB SPL at 2 feet (0.6m)
Two 10 Segment Tri-Color Level Meters Displaying VU or PPM
Premium Quality Drivers & Power Amplifiers
Extended Frequency Response and Low Distortion
Focused Sound, Reduces Adjacent Bay Crosstalk
Audible Indication of Phase/Polarity Problems
Innovative LED Display of Phase/Polarity Relationships
Thorough Magnetic Shielding for Placement next to Video Monitors
Headphone Jack, Mutes Speakers
Blowout Proof Speakers
Quick and Simple Installation

The AMP1A-LP2S provides self-powered, full-fidelity stereo audio monitoring in the smallest rack space possible. A front panel switch allows the operator to select one stereo source for monitoring & output from up to 2 stereo analog inputs (4 channels). The AMP1A-LP2S features two 10 segment LED level meters showing VU or PPM for accurate level-metering. This unit contains four high performance transducers driven by three power amplifiers: one amplifier/driver combination handles midrange and high frequency information in stereo, while the second handles summed low frequency information below the 500 Hz crossover point.

The unique design provides optimally focused sound for operators in an Ultra Near Field (1 to 3 ft.) working environment and offers performance comparable to that of many separate monitor pairs, yet does so without the installation hassles, awkward speaker placements and "added-on" look. This provides for a higher SPL for the operator while reducing overall ambient sound and adjacent bay crosstalk.

Extended HF response reveals potential problems with audio whine or hiss and electronic rather than acoustic cancellation of bass frequencies provides positive audible detection of out-of-phase (reversed polarity) audio feeds. A headphone jack is provided on the front panel, usage automatically mutes the speakers. The front panel features an innovative LED Display of Phase/Polarity Relationships. Output limiter circuits are incorporated to protect the speakers, and extensive magnetic shielding allows placement immediately adjacent to video monitors with no color impurities.

The AMP1A-LP2S is ideally suited for use in VTR bays, mobile production vehicles, teleconferencing installations, multimedia systems, satellite link and cable TV facilities, and on-air radio studios. Built and rigorously tested in the USA, the AMP1A-LP2S is backed by a strong warranty and a "Satisfaction Guaranteed" return policy.

Wohler

Audio Monitoring | Level Metering | Alarm Systems | Video Monitoring

Toll Free (US): 1-888-5-WOHLER Tel: (650) 589-5676 Fax: (650) 589-1355 • 713 Grandview Drive, South San Francisco, California 94080, USA

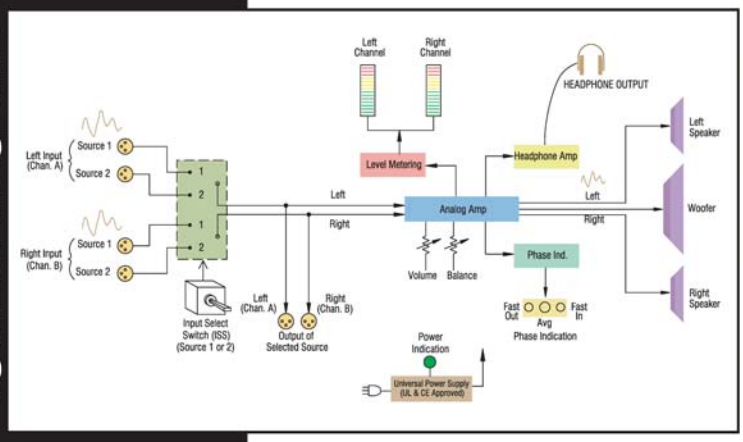
www.wohler.com sales@wohler.com

WOHLER AMP1A-LP2S

Compact, High Quality Analog Self-Powered Speaker System - 2 Stereo Channels

Rear Panel:

System Diagram:



Specifications:

Input	2 stereo balanced analog - XLR
Output	balanced analog output of selected pair - XLR
Level meters	2 x 10 segment bargraphs
Level meter scale	+3 to -20 dB
Level meter threshold	-6, 0, +4, +8 dBv: DIP switch selectable
Level meter dynamics	VU or PPM: DIP switch selectable
Midscale resolution	1 dB
Analog input impedance	>40 kOhms balanced
Peak acoustic output @ 2 feet	98dB SPL
Frequency response (1/6 octave)	80Hz - 20kHz (±5dB) (-10dB @ 50Hz, 22kHz)
Power output	RMS each side (2 Ohms) - 5W, 7W peak RMS dual WOOFER (4 Ohms) - 11W, 16W peak
Electrical distortion	<0.15% at any level below limit threshold
Acoustic distortion	8% or less worst case frequencies above 180Hz including cabinet resonance, typically <2%
Hum and noise	better than -68dB below full output
Magnetic shielding	<0.5 gauss any adjacent surface
Power consumption (AVG. MAX.)	30W
Dimensions (HxWxD)	1.75 x 19 x 12" (44.5 x 483 x 305mm)
Weight (approx.)	9.5lbs (4.3kg)
Power supply	100 to 240VAC, 50/60Hz universal input CE and UL approved

All specifications are subject to improvement

Wohler

Toll Free (US): 1-888-5-WOHLER Tel: (650) 589-5676 Fax: (650) 589-1355
713 Grandview Drive, South San Francisco, California 94080, USA
www.wohler.com • sales@wohler.com

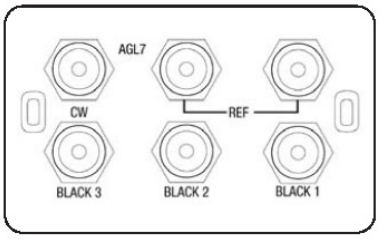
[ANEXO Nº 18.11]

Test Equipment Depot
1-800-517-8431

Multiformat Video Generator

▶ TG700

The TG700 is a multiformat, analog and digital precision signal generation platform. Designed with the changing needs of the video industry in mind, the TG700 offers sync pulse generation and test signal generation for a wide array of analog, serial digital and digital high definition formats. The TG700 Multiformat Video Generator has a modular architecture that offers the flexibility to meet the single format and growing multiformat needs of the video professional. The TG700 mainframe allows up to four of the following modules to be fitted in the mainframe.



The TG700 has a high stability reference. The AGL7 Analog Genlock Module adds the capacity to lock to a variety of signals, which makes the TG700 an ideal solution as the master house reference or slave reference for broadcast and production/ post-production applications. Three black outputs are available and are selectable for HDTV tri-level or NTSC or PAL. Additionally, the AGL7 can lock to a variety of formats to include NTSC/PAL black and HDTV tri-level as well as 1, 3.58, 4.43, 5 and 10 MHz CW. When the AGL7 is configured for Stay GenLock mode, a momentary loss of synchronization at the genlock reference input will not cause a disturbance in the TG700's test signal and black outputs. When the genlock signal is reapplied, the AGL7 will gradually re-acquire lock, causing little disruption to devices synchronized to the TG700 reference.

▶ Features & Benefits

Multiformat Analog and Digital Test Signal Generation

Ideal Channel Configuration and Performance to Support Reference Generator Needs

Modular Expandable Platform

Stay GenLock™ – Unique, Robust Genlock Mode Provides Stable Synchronization Signals for Digital and Traditional Broadcast Facilities

▶ Applications

Reference Generator and Test Signal Generator for Post-production and Broadcast Facilities

Test Signal Generator for Research and Development

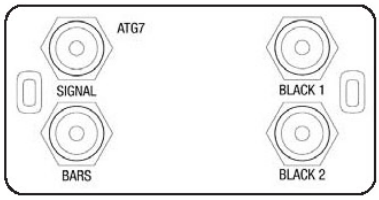
Equipment Design and Maintenance

Test Equipment Depot - 800.517.8431 - 99 Washington Street Melrose, MA 02176
FAX 781.665.0780 - TestEquipmentDepot.com

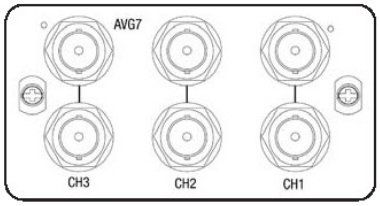
Tektronix
Enabling Innovation

Multiformat Video Generator

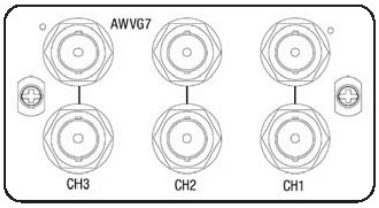
► TG700



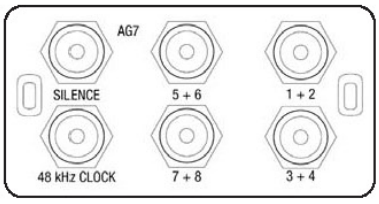
The ATG7 Composite Analog Test Generator supports PAL, NTSC and NTSC NoSetup. It provides one test signal output, one color bar test signal output and two black outputs. The black outputs can independently generate H, V, Blackburst and subcarrier.



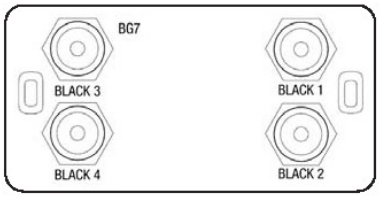
The AVG7 is an Analog Video Generator for 525/625 interlace formats supporting component (Y'P'bP'r, G,B,R, Y/C), 525 Beta, and composite (PAL, NTSC, NTSC NoSetup). It provides two identical component outputs, two identical Y/C and Composite or six identical composite outputs.



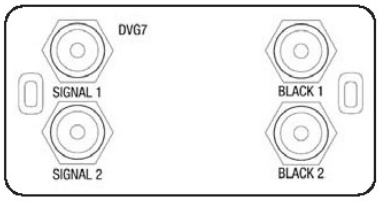
The AWVG7 is an Analog Wideband Video Generator that supports a variety of HD analog component formats (Y'P'bP'r or GBR). The module provides two identical component outputs with a bandwidth of 30 MHz. Up to two AWVG7 Analog Wideband Video Generators can be placed in a single TG700 mainframe.



The AG7 provides eight channels (four AES/EBU pairs) of audio signal generation. It also provides two channels (1 AES/EBU pair) of silence as well as a 48 kHz clock output.

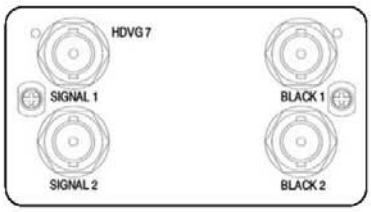


The BG7 is an analog black generator with four independently selectable outputs. The BG7 Black Generator supports NTSC and PAL black burst as well as HDTV tri-level sync. With Option CB, two of the outputs can also generate various analog NTSC and PAL color bar test signals.



► DVG7 (shown with Option BK).

The DVG7 is a multiformat test signal generator. The DVG7 Digital Video Generator supports 525 and 625 component digital at 270 Mb/s and NTSC composite digital at 143.181818 Mb/s. The DVG7 Digital Video Generator has two identical test signal outputs. With Option BK, two additional identical serial digital black signal outputs are available.

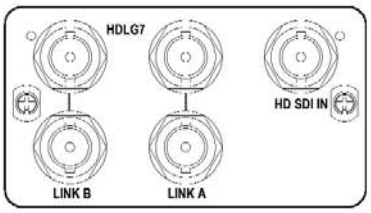


▶ HDVG7 (shown with Option BK).

The HDVG7 is a high-accuracy, multi-format, high-definition test signal module that provides up to two identical 1.485 Gb/s serial digital video test signal outputs in a broad variety of formats. With Option BK, two additional identical serial black signal outputs are available. Up to two HDVG7 HDTV Digital Video Generators can be placed in a single TG700 mainframe.

The digital modules DVG7 and HDVG7 support AV timing mode and up to 16 channels of 20- or 24-Bit audio sampled at 48 kHz embedded on the test signal outputs. The user can independently set frequency and level for each channel.

Option FP allows generation of full frame test and custom patterns for the AVG7, AWVG7, DVG7 and HDVG7 modules. Simple full frame patterns are available on V3.1 (or higher than V3.1) CD-ROM.



The HDLG7 is a test signal generator that provides two identical dual-link high-definition serial digital interface (HD SDI) outputs. The module supports video formats that require the use of a dual-link interface, such as 4:4:4 RGB at rates up to 1080i/60 Hz or 1080p/30 Hz or 4:2:2: YCbCr at rates up to 1080p/60 Hz. The HDLG7 supports several standard test signals and also has the unique ability to up-convert an arbitrary single-link HD SDI input signal to a dual-link format for the outputs.

▶ Characteristics

TG700, Mainframe

Internal Reference Frequency – 13.5 MHz.
Long Term Stability – Less than 1 ppm/year.
Number of Slots for Modules – 4.
Power Supply Slot – 1.
Network Interface – 10Base-T Ethernet.

AGL7, Analog Genlock Module

PAL-M and PAL-N are not supported by AGL7.

Reference Input

Loopthrough Input –
Input connector: 75 Ω x2.
Input signal: NTSC/PAL black burst or HDTV tri-level sync.
Amplitude range: Standard ±6 dB.
S/N ratio: >40 dB.
SCH phase: 0 ±40°.
Return Loss – ≥30 dB 5 MHz to 30 MHz.
Burst Lock/Sync Lock Stability –
±3 dB amplitude change: <1 ns.
Jitter with burst lock: <0.5°.
Jitter with sync lock: <1 ns.

CW Input

Input Impedance – 75 Ω, internal term.
Input signal: CW (continuous wave).
Amplitude: 2 V (1 to 2.25) $V_{pk\text{-}pk}$.
Frequency: NTSC/PAL FSC, 1/5/10 MHz.
Return loss: >30 dB to 30 MHz.
CW Lock Stability –
Over the amplitude range: <1 ns.
Jitter: <1 ns (typ. 1°) with CW input S/N >50 dB.
Genlock Time Adjustment –
Range: Anywhere in the color frame.
Resolution: <0.5° of NTSC/PAL subcarrier.
1 ns with tri-level sync input.
Color Framing –
Keeps accuracy even with ±45° SCH error of input reference input.
Black Input Signal –
Black 1: NTSC/PAL black burst output.
Black 2,3: NTSC/PAL black burst output or tri-level HDTV sync.
Output Format – Combination of the following:
1. NTSC/PAL black burst x3 (1 black burst is an independent, black burst x2 are distributed outputs).
2. NTSC/PAL black burst x2, HDTV tri-level sync x1 (all black burst and HDTV tri-level sync are independent).
3. NTSC/PAL black burst x1, HDTV tri-level sync x2 (HDTV tri-level sync x2 are distributed from the same source).

NTSC/PAL Black Burst Output

Output Standard – EBU N14, SMPTE RP 154.
Amplitude Accuracy – Black burst std. ±2%.
Burst Frequency – NTSC/PAL FSC ±1 Hz.
SCH Phase – <±5°.

HDTV Tri-level Sync Output

Matching Standard –
SMPTE 240M, 274M, 296M, RP211.
Amplitude Accuracy – Std. HDTV tri-level ±2%.

Output Signal Timing Adjustment

NTSC/PAL Black Burst Output –
Range: Anywhere in the color frame.
Resolution: <0.5° of NTSC/PAL subcarrier.
HDTV Tri-level Sync –
Range: Anywhere in the frame.
Resolution: <1 ns.
Output Impedance – 75 Ω.
Return Loss – >30 dB to 30 MHz.

AG7, Audio Generator

Audio Test Signal Output

Standard – ANSI S4.40 (AES3), AES3-ID.
Output Channels – 8 channels (4 AES/EBU pairs).
Output Impedance – 75 Ω, unbalanced.
Output Connector – BNC x4.
Output Amplitude – 1 V ±0.2 V.
Frequency (Hz):
50, 100, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1500, 1600, 2000, 2400, 3000, 3200, 4000, 4800, 5000, 6000, 8000, 9600, 10000, 12000, 15000, 18000, 20000.
Level: –60 to 0 dBFS, 1 dB step.
Sampling Frequency – 48 kHz (lock on video signal).
Quantization –
Linear PCM, 20- or 24-Bits (2's complement).
Transfer Coding – Bi-phase mark.

Silence Output

Standard – ANSI S4.40 (AES3), AES3-ID.
Channel – 2 channels (one AES/EBU pair).
Output Impedance – 75 Ω, unbalanced.
Output Connector – BNC x1.
Output Amplitude – 1 ±0.2 V.
Frequency, Level – No signal.
Sampling Frequency – 48 kHz (lock on video signal).
Quantization –
Linear PCM, 20- or 24-Bits (2's complement).
Transfer Coding – Bi-phase mark.

ATG7, Analog Test Signal Generator

Signal Output

NTSC/NTSC No Setup Test Signals –
100%/75% Color Bars.
SMPTE Color Bars.
0% (NTSC only)/10%/40%/50%/100% Flat Field.
Black Burst.
Black Burst with Field Reference.
Field Square Wave.
10/5 Step, Ramp.
Modulated 5 step.
Modulated Ramp.
Modulated Pedestal.
Shallow Ramp.
Convergence.
2/4 Level Pedestal and Pluge.
100%/75% Red Field.
Gray/White Window.
Safe Area.
Monitor Setup.
100%/60% Multiburst.
Multipulse.
100%/60% Sweep
Chroma Frequency Response.
Window 2T Pulse and Bar.
Sin(x)/x.
FCC Composite/Multiburst.
NTC7 Composite/Combination.
Test Matrix SNG Color Bars and 0% to 100% Bounce.
APL High/Low, APL Bounce.

Test Equipment Depot - 800.517.8431 - 99 Washington Street Melrose, MA 02176
FAX 781.665.0780 - TestEquipmentDepot.com

PAL Test Signals –
PAL-M and PAL-N are not supported by ATG7.
100%/75% Color Bars.
100%/75% Color Bars Over Red.
40%/50%/100% Flat Field.
Black Burst.
Black Burst with No Field Reference.
Field Square Wave.
5/10 Step.
Ramp.
Modulated 5/10 Step.
Modulated Ramp.
Modulated Pedestal.
Shallow Ramp.
Convergence.
2/4 Level Pedestal and Pluge.
100%/75% Red Field.
Gray/White Window.
Safe Area.
Monitor Setup Matrix.
100% Multiburst.
Multipulse.
100%/75% Sweep.
Window 2T Pulse and Bar.
Sin(x)/x.
CCIR 17/18/330/331.
UK ITS 1/2.
UK 1 Line ITS.
ITS Matrix and 0%-100% Bounce.
APL High/Low, APL Bounce.
ID Text –
Max 18 characters. One Row (character 14x11 pixels).
Text and Position is embedded to each signal.
Luminance amplitude –
±1% (Measured at 700 mV).
Chrominance-to-Luminance Gain – ±1%.
Frequency Response – ±1% to 5.5 MHz.
Chrominance-to-Luminance Delay – ≤10 ns.
Linearity – ≤1% (Measured at 5 Step Signal).
Differential Gain Error – ≤0.5%.
Differential Phase Error – ≤0.5°.

BARS Output

NTSC/NTSC No Setup Signals –
100%/75% Color Bars.
SMPTE Color Bars.
40% Flat Field.
Black Burst.
Black Burst with Field REF.
Monitor setup, SNG Color Bar.
PAL Signals –
100%/75% Color Bars.
100%/75% Color Bars Over RED.
40% Flat Field.
Black Burst.
Black Burst with No Field REF.
Monitor setup, SNG color bars.
ID Text –
Max 18 characters. One Row (character 14x11 pixels).
Text and Position is embedded to each signal.
Luminance amplitude –
±1% (Measured at 700 mV).
Chrominance-to-Luminance Gain – ±2%.

BLACK 1/2 Outputs

NTSC/NTSC No Setup Signals –
Black Burst.
Black Burst with Field Reference.
Timing Pulse (Subcarrier, Composite Sync, H Drive, V Drive, Composite Blanking and Color Frame ID).
PAL Signals –
Black Burst.
Black Burst with Field Reference.
Timing Pulse (Subcarrier, Composite Sync, H Drive, V Drive, Composite Blanking, Color Frame ID and PAL Pulse).
Timing Pulse Amplitude – –0.5 to 0.5 V (1 $V_{pk\text{-}pk}$).

Signal, Bars and Black 1/2 (Common)

Standards –
ITU-R BT, 470-6.
SMPTE 170M.
Output Impedance – 75 Ω.
Return Loss – ≥36 dB to 6 MHz.
Burst Amplitude – ±2%.
Sync Amplitude – ±2%.
Blanking Level – 0 mV ±50 mV.
SC/H Phase Accuracy – 0° ±5°.
Timing Offset Range – Full Color Frame.
Timing Offset Resolution – 54 MHz Clock Resolution.

AVG7, Analog Video Generator

Analog Signal Output

Test Signals –
Output signal (preinstalled for all formats): 100%, 75% and SMPTE Color Bars, Linearity, Flat Field, Multiburst, Sweep, Monitor, Pulse and Bar and other major test signals.
Formats Supported –
NTSC, NTSC No Setup, PAL, 525 R'G'B', 525 Y'P'bP'r, 525 Beta, 625 R'G'B', 625 Y'P'bP'r.
Outputs –
6 identical analog composite outputs, 2 identical component video outs, or 2 identical Y/C and composite out.
Output Impedance – 75 Ω.
Luminance Linearity Error – ≤0.5%.
Luminance Amplitude –
±1% (Measured at 700 mV).
Chrominance-to-Luminance Gain Error –
≤1% (Relative to 100 kHz).
Chrominance-to-Luminance Delay –
≤2.5 ns on a composite output (typical).
Channel-to-Channel Delay –
≤1 ns (Relative to CH1).
Frequency Response –
≤0.5% to 8 MHz at 700 mV (typical).
Differential Gain Error – ≤0.5%.
Differential Phase Error – ≤0.5°.
Timing Adjustment for the Output Signal –
Range: Anywhere in the frame.
Resolution: 0.1 ns.
Return Loss – ≥40 dB to 6 MHz.

AWVG7, Analog Wideband Video Generator

Analog Signal Output

Test Signals –
(Preinstalled for all formats.) 100%, 75% and SMPTE Color Bars, Linearity, Multiburst, Sweep, Monitor and other major test signals.
Formats Supported –
(All formats are factory preinstalled.)
Y'P'bP'r or R'G'B' 1080i/50 Hz, 59.94 Hz, 60 Hz.
1080 p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz.
1080 psF/23.98 Hz, 24 Hz.
720 p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz, 50 Hz, 59.94 Hz, 60 Hz.
Outputs –
2 identical analog component video outputs.
Output Impedance – 75 Ω.
Output Amplitude – ≤1% at 700 mV.
Channel-to-Channel Delay – ≤1 ns relative to CH 1.
Frequency Response –
±1% to 20 MHz.
±2% to 28 MHz.
±3% to 30 MHz.
Timing Adjustment for the Output Signal –
Range: Anywhere in the frame.
Resolution: 0.1 ns.
Return Loss – ≥35 dB to 30 MHz.

BG7, Black Generator

PAL-M and PAL-N are not supported by BG7.

Black Output 1/2/3/4

NTSC/PAL black burst and independently selectable HDTV tri-level analog sync.

Black Burst Output

Output Standard –
EBU N14, SMPTE RP 154, RP318M-B.
Amplitude Accuracy – Std. Black burst ±2%.
SCH Phase – <±5°.

HDTV Tri-level Sync Output

Standard – SMPTE 240M, 274M, 296M, RP211.
Amplitude Accuracy – Std. HDTV tri-level ±2%.
Timing Adjustment – Each output is independent.
NTSC/PAL Black Burst –
Range: Anywhere in the color frame.
Resolution: Clock resolution 18.5 ns (1/54 µs).
HDTV Tri-level Sync –
Range: Anywhere in the frame.
Resolution: Clock resolution 13.5 ns (1/74.25 µs).

Analog Test Signal (Opt. CB)

Test Signals (black 3/4 output) –
NTSC, NTSC No Setup:
100% Color Bars, 75% Color Bars, SMPTE Color Bars, 40% flat field, SNG Color Bars, Monitor Setup Matrix, 10 field ID.
PAL:
100% Color Bars, 75% Color Bars, 100% Color Bars Over Red, 75% Color Bars Over Red, 40% Flat Field, SNG Color Bars, 4 Level Pluge, Monitor Setup Matrix.
Luminance amplitude accuracy: ±1% (video at 100%).
Chroma amplitude accuracy: ±2%.
Output Impedance – 75 Ω.
Return Loss – ≥30 dB to 30 MHz.
Jitter – ≤1 ns.

DVG7, Digital Video Generator

Serial Digital Signal Output

Test Signals – (Pre-installed for all formats): 100%, 75% and SMPTE Color Bars, Linearity, Multiburst, Sweep, Monitor, SDI pathological, Timing and other major test signals.
Standards –
ITU-R BT 601, 656, EBU Tech 3267, SMPTE 125M, 244M, 259M, 272M, RP165, RP178.
Bit Rate – 143 Mb/s, 270 Mb/s.
Resolution – 8- or 10-Bits.
Output Impedance – 75 Ω.
Output Amplitude – 800 mV_{p-p} ±10%.
Overshoot – ≤10%.
Rise/Fall Time – 0.4 to 1.5 ns (20-80%).
DC Offset (AC couple) – 0 ±0.5 V.
Jitter – ≤0.2 UI, above 10 Hz jitter frequency.
Timing Adjustment for the Output Signal –
Range: Anywhere in the frame.
Resolution: Clock resolution (37 or 70 ns).
Return Loss – >15 dB 5 to 270 MHz.

Embedded Audio Signal

Active Channels – 1 to 16 channels.
Sample Frequency – 48 kHz.
Digital Coding – 20- or 24-Bits.
Signal Alignment –
Async. and Sync. (no frame #), Synchronous (frame #).
Audio Tone – Frequency (Hz):
50, 100, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1500, 1600, 2000, 2400, 3000, 3200, 4000, 4800, 5000, 6000, 8000, 9600, 10000, 12000, 15000, 16000, 20000.
Level – –60 to 0 dBFS, 1 dB steps.

HDVG7, HDTV Digital Video Generator

Serial Digital Signal Output

Test Signals – (Preinstalled for all formats.)
100%, 75% and SMPTE Color Bars, Linearity, Multiburst, Sweep, Monitor, SDI pathological, Timing and other major test signals.
Standards – SMPTE 240M, 272M, 292M, 296M.
Bit Rate – 1.485 Gb/s, 1.485/1.001 Gb/s.
Output Format –
1035i/59.94 Hz, 60 Hz.
1080i/50 Hz, 59.94 Hz, 60 Hz.
1080p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz.
1080psF/23.98 Hz, 24 Hz.
720p/23.98 Hz, 24 Hz, 50 Hz, 59.94 Hz, 60 Hz.
Output Impedance – 75 Ω.
Output Amplitude – 800 $mV_{pk\text{-}pk}$ ±10% (typical).
Overshoot – ≤10% (typ.).
Rise/Fall Time – ≤270 ps (20-80%) (typical).
DC Offset (AC coupling) – 0 V ±0.5 V (typ.).
Jitter – ≤135 ps (typical).
Timing Adjustment for the Output –
Range: Anywhere in the frame.
Resolution: Clock resolution 13.5 ns (1/74.25 MHz).
Return Loss –
≥15 dB from 5 MHz to 750 MHz.
≥10 dB from 750 MHz to 1.485 GHz (typ.).

Embedded Audio Signal

Active channels – 1 to 16 channels.
Sample frequency – 48 kHz.
Digital coding – 20- or 24-Bits.
Signal alignment –
Async. and Sync. (no frame #), Synchronous (frame #).
Audio Tone – Frequency (Hz):
50, 100, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1500, 1600, 2000, 2400, 3000, 3200, 4000, 4800, 5000, 6000, 8000, 9600, 10000, 12000, 15000, 16000, 20000.
Level – –60 to 0 dBFS, 1 dB steps.

HDLG7 HD Dual Link Video Generator

Serial Digital Signal Output

Test Signals –
100%, 75% and SMPTE Color Bars, Flat Field (0% to 100% in 10% steps), 100% and 75% Red/Green/Blue, Convergence, Ramp, Valid Ramp, 5 Step Staircase, 2T30 Pulse and Bar.
HD-SDI Converter –
Input signal up-converted to dual-link format for output signal.
Standards – SMPTE 372M, 292M, 352M.
Bit Rate –
1.485 Gb/s, 1.485/1.001 Gb/s for each link.
Output Format –
1080i/50 Hz, 59.94 Hz, 60 Hz.
1080p/23.98 Hz, 24 Hz, 25 Hz, 29.97 Hz, 30 Hz, 50 Hz, 59.94 Hz, 60 Hz.
1080psF/23.98 Hz, 24 Hz.
Sampling Format –
4:2:2 YCbCr, 4:4:4 YCbCr, 4:4:4 GBR.
Word Size – 10- or 12-Bits.
Alpha Channel –
Same as Y/G channel or Flat Field (0% to 100% in 10% steps).
Embedded Audio –
16 channels copied from input signal to Link A in converter mode. No embedded audio in generator mode.
Payload Identifier –
Link A and Link B identified as per SMPTE 352M.
Link Timing Offset –
Adjustable timing offset between Link A and Link B, ±200 ns in single clock increments.
Output Impedance – 75 Ω.
Output Amplitude – 800 $mV_{pk\text{-}pk}$ ±10%.
Overshoot – ≤10% (typical).
Rise/Fall Time – ≤270 ps (20% to 80%).
DC Offset (AC coupling) – 0 V ±0.5 V (typical).
Jitter – ≤135 ps (typical).
Timing Adjustment for the Output –
Range: Anywhere in the frame.
Resolution: Clock resolution 13.5 ns (1/74.25 MHz).
Return Loss –
≥15 dB from 5 MHz to 750 MHz.
≥10 dB from 750 MHz to 1.485 GHz.

Environmental

Power Consumption – 100 W (max.).
Temperature – 0 °C to +50 °C.
Altitude – 4500 meters (15,000 ft.).
Source Voltage – 100 to 240 V, 48 to 63 Hz.

Physical Characteristics

Dimensions	mm	in.
Height	44	1.73
Width	483	19
Length	559	22
Weight	**kg**	**lbs.**
Net	8.2	18

► Ordering Information

TG700

Mainframe.*1 Up to four modules can be fitted in the frame. Please specify power cord when ordering.

Opt. FP – Frame picture function (available only for AVG7, AWVG7, DVG7 and HDVG7 modules).

Modules

AGL7

Analog Genlock.

AG7

Audio Generator.

ATG7

Analog Test Generator Module.

AVG7

Component and Composite Analog Video Generator Module.

AWVG7

Analog Wideband Video Generator Module.

BG7

Black Generator.

Opt. CB – Add NTSC/PAL color bar. Option must be added at time of order. Option cannot be added later.

*1 Order requires one of the modules.

Multiformat Video Generator

▶ TG700

DVG7

Digital Video Generator.

Opt. BK – Add SDI black outputs. Option must be added at time of order. Option cannot be added later.

HDVG7

HDTV Digital Video Generator.

Opt. BK – Add black outputs. Option must be added at time of order. Option cannot be added later.

HDLG7

HD Dual-link Video Generator.

Module Limitations

Only one AGL7 module may be installed in one TG700 mainframe.

Up to two HDVG7, two AWVG7 or two AVG7 modules in any combination may be installed in one TG700 mainframe.

Warranty

1 year parts and labor.

Common Options for All Models

Opt. 88 – Module installation.*2

Opt. D1 – Calibration data report in English/Japanese.

Standard Accessories

User Manual, CD-ROM (Containing ARIB STD-B28 standard Multiformat Color Bar library, SMPTE RP219 HD/SD Compatible Color Bar library, TG7 Communication SW, TG7 Setup SW, Logo Gen, Frame Picture Gen, Signal Viewer, Signal DNL, Sample Frame Pictures and Logos), Rackmount Kit and Power Cord.

Please specify power cord when ordering.

Power Cord Options

International Power Plugs

Opt. A0 – North America power.

Opt. A1 – Universal Euro power.

Opt. A2 – United Kingdom power.

Opt. A3 – Australia power.

Opt. A4 – 240 V, North America power.

Opt. A5 – Switzerland power.

Service

Opt. C3 – Calibration service 3 years.

Opt. C5 – Calibration service 5 years.

Opt. D1 – Calibration Data Report.

Opt. D3 – Calibration Data Report 3 years (with Opt. C3).

Opt. D5 – Calibration Data Report 5 years (with Opt. C5).

Opt. R3 – Repair service 3 years (including warranty).

Opt. R5 – Repair service 5 years (including warranty).

Optional Accessories

TG700 Opt. FP Upgrade Kit – Order 040-1698-00.

This kit upgrades any TG700 to 64 MB Flash Memory.

Service Manual – Order 070-A800-xx.

Power Supply Module – Order 650-A810-00.

Blank Panel for TG700 – Order 614-A021-00.

*2 Applies to mainframe and all modules.

Tektronix

Enabling Innovation

Test Equipment Depot - 800.517.8431 - 99 Washington Street Melrose, MA 02176

FAX 781.665.0780 - TestEquipmentDepot.com

[ANEXO Nº 18.12]

15-INCH HIGH RESOLUTION COLOR MONITOR TM-H150CGU

- Product Overview
- Technical Description
- Specifications
- Accessories
- Press Releases
- Instruction Manuals
- Bid Specifications
- Suggested List Price
- Contacts & Dealers

Color System		NTSC and PAL H:15.734kHz (NTSC)/15.625kHz (PAL)
Scanning Frequency		V:59.94Hz (NTSC)/50Hz (PAL) 15"(14"V) diagonally measured
CRT		0.27mm dot pitch
Horizontal Resolution		More than 750 TV lines (Y/C input mode)
Power Requirement		120V AC,220-240V AC, 50/60Hz
Power Consumption		1.2A/120V,0.8A/220-240V
Color Temperature		6500° and 9300°selectable
INPUT Terminals		
Input A	Composite	1 line,BNC connector x 2,1.0V (p-p), 75 ohms,negative sync,auto-termination, bridged output possible
	Composite	1 line,BNC connector x 2,1.0V (p-p), 75 ohms,negative sync,auto-termination, bridged output possible
Input B		
	Y/C Signal	1 line,mini-DIN 4-pin x 2 Y:1.0V (p-p),75 ohms,negative sync C:0.286V (p-p),75 ohms (NTSC Burst) 0.3V (p-p),75 ohms (PAL Burst) auto-termination,bridged output possible
Input Slot		1 slot port for 1 input card for Component or SDI card RCA pin x 4 for input A and B,0.5V (rms),
Audio Terminals		
Remote Terminal		high-impedance,bridged output possible D-sub 15-pin x1
Audio Speaker		3-1/4"(8cm) round x 1,1W output (monaural)
Dimensions (WxHxD)		14-1/4"x 12-1/4"x 16-1/2"(360 x 310 x 418mm)
Weight		35.2lbs.(16kg)

[ANEXO Nº 18.13]

Middle Atlantic Products, Inc.
middleatlantic.com

115 Volt Rackmount Power Strips

EIA/TIA Compliant | c UL us LISTED

Rackmount units provide economical 15 and 20 amp power distribution

PD-915R / PD-920R-NS

front view

PD-815R-PL

front view

PD-815RA-PL

front view

PD-815RC-PL

front view

rear view

rear view (PD-920R-NS only)

Features

- UL Listed (file # E204950)
- Available in 15 and 20 amp Models
- 8 circuit-breaker protected rear outlets
- Enhanced surge protection does not introduce potentially damaging ground contamination and noise (PD-915 and PD-815 Series only)
- Two models available with front outlet and illuminated power switch or pilot light for status indication
- Choice of finishes available: Black Brushed and Anodized, Silver Brushed and Anodized, Black Powdercoat

Architects' and Engineers' Specifications

Rackmount power strip shall be Middle Atlantic Products model # _ (refer to chart), with a _ amp capacity (refer to chart), differential and common mode surge and spike protection (surge and spike protection available on 15 amp power only) and EMI filtering. Enhanced surge protection shall not introduce potentially damaging ground contamination and noise (PD-915 and PD-815 Series only). Rackmount power strip shall operate on 115 volt AC/60Hz current. Rackmount power strip shall include 9' 14/3 power cord with _ (refer to chart) plug, 8 rear outlets (refer to chart), _ front outlet(s) (NEMA 5-15R), and _ amp circuit breaker located on the power strip's _ (refer to chart). Rackmount power strip shall occupy one rackspace and be constructed of 18-gauge phosphate pre-treated steel with a _ finish (refer to chart). Rackmount power strip shall be warrantied to be free from defects in materials and workmanship under normal use and conditions for a period of 3 years. Rackmount power strip shall be UL listed in the US and Canada.

customizable specification clips available at middleatlantic.com

Engineered Mounting Solutions

US: New Jersey • California • Illinois • Voice: 973-839-1011 Fax: 973-839-1976 • middleatlantic.com
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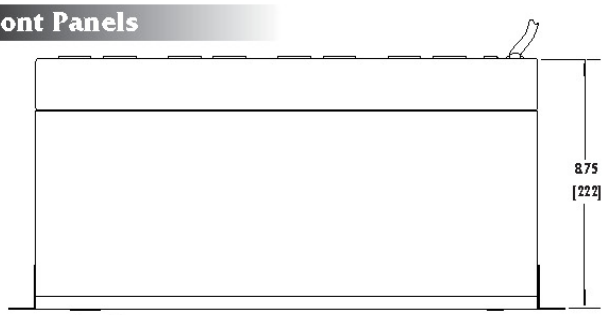
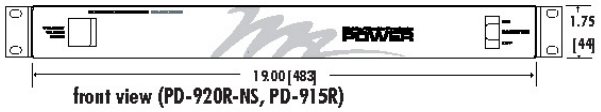
Rackmount Power Strips basic dimensions

Front Panels

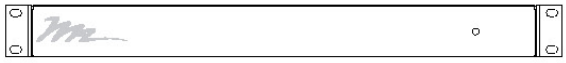
All dimensions in inches [Bracketed dimensions are in millimeters]



top view



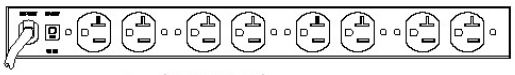
front view (PD-920R-NS, PD-915R)



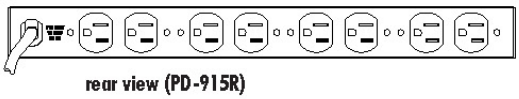
front view (PD-815RA-PL / PD815RC-PL)

front view (PD-815R-PL)

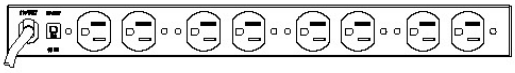
Rear Panels



rear view (PD-920R-NS)



rear view (PD-915R)



rear view (PD-815R-PL / PD-815RA-PL / PD815RC-PL)

Part #	Amps	Power Cord Type	# Front Outlets	# Rear Outlets	Circuit Breaker Location	Rear Outlet Type	Finish
PD-815R-PL	15	NEMA 5-15P	0	8	Rear	NEMA 5-15R	Black Powdercoat
PD-815RA-PL	15	NEMA 5-15P	0	8	Rear	NEMA 5-15R	Black Brushed and Anodized
PD-815RC-PL	15	NEMA 5-15P	0	8	Rear	NEMA 5-15R	Silver Brushed and Anodized
PD-915R	15	NEMA 5-15P	1	8	Front	NEMA 5-15R	Black Powdercoat
PD-920R-NS	20	NEMA 5-20P	1	8	Rear	NEMA 5-20R	Black Powdercoat

Surge Suppression & EMI Filter Specifications (PD-815R-PL / PD-815RA-PL / PD-815RC-PL / PD-915R)

- Nominal line voltage: 120 VAC
- Maximum line current: 15 Amps
- Maximum allowable voltage: 125 VAC (RMS)
  - Maximum continuous voltage differential applied between line and neutral
  - Maximum clamping voltage: 395 volts@100 amps
- Peak impulse current (8/20 micro seconds):
  - 30,000 amps, one time
  - 21,000 amps, two times within 5 minutes
  - 9,000 amps, ten times within 2 minutes
  - Maximum peak impulse current pulse as defined between line and neutral
  - Maximum multiple impulse current derated per spec
- Response time: Instantaneous (Less than 1 nanosecond)
- EMI/ RF Suppression: More than 20 db
  - Calculated line to neutral, 100 KHz to 1 MHz suppression based upon nominal impedance

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[ANEXO Nº 19]

Perfil de 0º

Distancia(Km)	Altura(m)
0	1121
0,2	1140
0,4	1161
0,6	1111
0,8	1104
1	1104
1,2	1168
1,4	1212
1,6	1108
1,8	1038
2	949
2,2	932
2,4	949
2,6	971
2,8	981
3	1037
3,2	1079
3,4	1118
3,6	1148
3,8	1148
4	1163
4,2	1173
4,4	1195
4,6	1238
4,8	1281
5	1211
5,2	1225
5,4	1279
5,6	1289
5,8	1238
6	1164
6,2	1126
6,4	1076
6,6	1016
6,8	1016
7	951
7,2	875
7,4	802
7,6	714
7,8	672
8	688
8,2	674
8,4	680
8,6	675
8,8	667
9	612
9,2	584
9,4	566
9,6	566
9,8	615
10	659
10,2	704
10,4	724
10,6	672
10,8	660
11	762
11,2	864
11,4	956
11,6	1064
11,8	1136
12	1056
12,2	980
12,4	1009

Distancia(Km)	Altura(m)
12,6	1009
12,8	1111
13	1087
13,2	995
13,4	885
13,6	802
13,8	739
14	692
14,2	652
14,4	620
14,6	574
14,8	505
15	462
15,2	382
15,4	266
15,6	266
15,8	287
16	314
16,2	274
16,4	261
16,6	261
16,8	188
17	129
17,2	82
17,4	59
17,6	47
17,8	41
18	41
18,2	37
18,4	37
18,6	7
18,8	0
19	0
19,2	0
19,4	0
19,6	0
19,8	0
20	0
20,2	0
20,4	0
20,6	0
20,8	0
21	0
21,2	0
21,4	0
21,6	0
21,8	0
22	0
22,2	0
22,4	0
22,6	0
22,8	0
23	0
23,2	0
23,4	0
23,6	0
23,8	0
24	0
24,2	0
24,4	0
24,6	0
24,8	0
25	0

Distancia(Km)	Altura(m)
25,2	0
25,4	0
25,6	0
25,8	0
26	0
26,2	0
26,4	0
26,6	0
26,8	0
27	0
27,2	0
27,4	0
27,6	0
27,8	0
28	0
28,2	0
28,4	0
28,6	0
28,8	0
29	0
29,2	0
29,4	0
29,6	0
29,8	0
30	0
30,2	0
30,4	0
30,6	0
30,8	0
31	0
31,2	0
31,4	0
31,6	0
31,8	0
32	0
32,2	0
32,4	0
32,6	0
32,8	0
33	0
33,2	0
33,4	0
33,6	0
33,8	0
34	0
34,2	0
34,4	0
34,6	0
34,8	0
35	0
35,2	0
35,4	0
35,6	0
35,8	0
36	0
36,2	0
36,4	0
36,6	0
36,8	0
37	0
37,2	0
37,4	0
37,6	0

Distancia(Km	Altura(m)
37,8	0
38	0
38,2	0
38,4	0
38,6	0
38,8	0
39	0
39,2	0
39,4	0
39,6	0
39,8	0
40	0
40,2	0
40,4	0
40,6	0
40,8	0
41	0
41,2	0
41,4	0
41,6	0
41,8	0
42	0
42,2	0
42,4	0
42,6	0
42,8	0
43	0
43,2	0
43,4	0
43,6	0
43,8	0
44	0
44,2	0
44,4	0
44,6	0
44,8	0
45	0
45,2	0
45,4	0
45,6	0
45,8	0
46	0
46,2	0
46,4	0
46,6	0
46,8	0
47	0
47,2	0
47,4	0
47,6	0
47,8	0
48	0
48,2	0
48,4	0
48,6	0
48,8	0
49	0
49,2	0
49,4	0
49,6	0
49,8	0
50	0

Perfil de 20º:

Distancia(Km)	Altura(m)
0	1121
0,2	1172
0,4	1231
0,6	1231
0,8	1214
1	1172
1,2	1165
1,4	1248
1,6	1255
1,8	1188
2	1093
2,2	1081
2,4	999
2,6	944
2,8	925
3	920
3,2	925
3,4	933
3,6	963
3,8	963
4	1163
4,2	1173
4,4	1195
4,6	1238
4,8	1281
5	1211
5,2	1225
5,4	1279
5,6	1289
5,8	1238
6	1164
6,2	1126
6,4	1076
6,6	1016
6,8	1016
7	951
7,2	875
7,4	802
7,6	714
7,8	672
8	688
8,2	674
8,4	680
8,6	675
8,8	667
9	612
9,2	584
9,4	566
9,6	566
9,8	615
10	659
10,2	704
10,4	724
10,6	672
10,8	660
11	762
11,2	864
11,4	956
11,6	1064
11,8	1136
12	1056
12,2	980
12,4	1009

Distancia(Km)	Altura(m)
12,6	1009
12,8	1111
13	1087
13,2	995
13,4	885
13,6	802
13,8	739
14	692
14,2	652
14,4	620
14,6	574
14,8	505
15	462
15,2	382
15,4	266
15,6	266
15,8	287
16	314
16,2	274
16,4	261
16,6	261
16,8	188
17	129
17,2	82
17,4	59
17,6	47
17,8	41
18	41
18,2	37
18,4	37
18,6	7
18,8	0
19	0
19,2	0
19,4	0
19,6	0
19,8	0
20	0
20,2	0
20,4	0
20,6	0
20,8	0
21	0
21,2	0
21,4	0
21,6	0
21,8	0
22	0
22,2	0
22,4	0
22,6	0
22,8	0
23	0
23,2	0
23,4	0
23,6	0
23,8	0
24	0
24,2	0
24,4	0
24,6	0
24,8	0
25	0

Distancia(Km)	Altura(m)
25,2	0
25,4	0
25,6	0
25,8	0
26	0
26,2	0
26,4	0
26,6	0
26,8	0
27	0
27,2	0
27,4	0
27,6	0
27,8	0
28	0
28,2	0
28,4	0
28,6	0
28,8	0
29	0
29,2	0
29,4	0
29,6	0
29,8	0
30	0
30,2	0
30,4	0
30,6	0
30,8	0
31	0
31,2	0
31,4	0
31,6	0
31,8	0
32	0
32,2	0
32,4	0
32,6	0
32,8	0
33	0
33,2	0
33,4	0
33,6	0
33,8	0
34	0
34,2	0
34,4	0
34,6	0
34,8	0
35	0
35,2	0
35,4	0
35,6	0
35,8	0
36	0
36,2	0
36,4	0
36,6	0
36,8	0
37	0
37,2	0
37,4	0
37,6	0

Distancia(Km)	Altura(m)
37,8	0
38	0
38,2	0
38,4	0
38,6	0
38,8	0
39	0
39,2	0
39,4	0
39,6	0
39,8	0
40	0
40,2	0
40,4	0
40,6	0
40,8	0
41	0
41,2	0
41,4	0
41,6	0
41,8	0
42	0
42,2	0
42,4	0
42,6	0
42,8	0
43	0
43,2	0
43,4	0
43,6	0
43,8	0
44	0
44,2	0
44,4	0
44,6	0
44,8	0
45	0
45,2	0
45,4	0
45,6	0
45,8	0
46	0
46,2	0
46,4	0
46,6	0
46,8	0
47	0
47,2	0
47,4	0
47,6	0
47,8	0
48	0
48,2	0
48,4	0
48,6	0
48,8	0
49	0
49,2	0
49,4	0
49,6	0
49,8	0
50	0

Perfil de 40º:

Distancia(Km)	Altura(m)
0	1121
0,2	1108
0,4	1172
0,6	1266
0,8	1266
1	1266
1,2	1270
1,4	1218
1,6	1260
1,8	1330
2	1320
2,2	1290
2,4	1290
2,6	1297
2,8	1209
3	1209
3,2	1140
3,4	1058
3,6	1022
3,8	1011
4	964
4,2	913
4,4	913
4,6	917
4,8	915
5	908
5,2	903
5,4	904
5,6	904
5,8	902
6	900
6,2	897
6,4	900
6,6	897
6,8	896
7	903
7,2	898
7,4	896
7,6	895
7,8	901
8	901
8,2	903
8,4	936
8,6	936
8,8	978
9	1020
9,2	983
9,4	971
9,6	979
9,8	955
10	955
10,2	930
10,4	969
10,6	986
10,8	984
11	996
11,2	1006
11,4	1002
11,6	1017
11,8	1037
12	1123
12,2	1082
12,4	1045

Distancia(Km)	Altura(m)
12,6	1089
12,8	1125
13	1134
13,2	1279
13,4	1399
13,6	1399
13,8	1521
14	1532
14,2	1499
14,4	1543
14,6	1637
14,8	1649
15	1649
15,2	1832
15,4	1918
15,6	1918
15,8	1761
16	1701
16,2	1584
16,4	1523
16,6	1443
16,8	1406
17	1406
17,2	1573
17,4	1738
17,6	1698
17,8	1678
18	1472
18,2	0
18,4	0
18,6	1339
18,8	1296
19	1250
19,2	1183
19,4	1052
19,6	1057
19,8	967
20	960
20,2	910
20,4	818
20,6	818
20,8	934
21	763
21,2	800
21,4	725
21,6	636
21,8	573
22	455
22,2	376
22,4	205
22,6	205
22,8	186
23	286
23,2	286
23,4	328
23,6	232
23,8	135
24	137
24,2	68
24,4	35
24,6	35
24,8	26
25	14

Distancia(Km)	Altura(m)
25,2	1
25,4	0
25,6	0
25,8	0
26	0
26,2	0
26,4	0
26,6	0
26,8	0
27	0
27,2	0
27,4	0
27,6	0
27,8	0
28	0
28,2	0
28,4	0
28,6	0
28,8	0
29	0
29,2	0
29,4	0
29,6	0
29,8	0
30	0
30,2	0
30,4	0
30,6	0
30,8	0
31	0
31,2	0
31,4	0
31,6	0
31,8	0
32	0
32,2	0
32,4	0
32,6	0
32,8	0
33	0
33,2	0
33,4	0
33,6	0
33,8	0
34	0
34,2	0
34,4	0
34,6	0
34,8	0
35	0
35,2	0
35,4	0
35,6	0
35,8	0
36	0
36,2	0
36,4	0
36,6	0
36,8	0
37	0
37,2	0
37,4	0
37,6	0

Distancia(Km)	Altura(m)
37,8	0
38	0
38,2	0
38,4	0
38,6	0
38,8	0
39	0
39,2	0
39,4	0
39,6	0
39,8	0
40	0
40,2	0
40,4	0
40,6	0
40,8	0
41	0
41,2	0
41,4	0
41,6	0
41,8	0
42	0
42,2	0
42,4	0
42,6	0
42,8	0
43	0
43,2	0
43,4	0
43,6	0
43,8	0
44	0
44,2	0
44,4	0
44,6	0
44,8	0
45	0
45,2	0
45,4	0
45,6	0
45,8	0
46	0
46,2	0
46,4	0
46,6	0
46,8	0
47	0
47,2	0
47,4	0
47,6	0
47,8	0
48	0
48,2	0
48,4	0
48,6	0
48,8	0
49	0
49,2	0
49,4	0
49,6	0
49,8	0
50	0

Perfil de 60º:

Distancia(Km)	Altura(m)
0	1121
0,2	1108
0,4	1189
0,6	1174
0,8	1251
1	1266
1,2	1293
1,4	1297
1,6	1287
1,8	1343
2	1335
2,2	1283
2,4	1249
2,6	1211
2,8	1216
3	1227
3,2	1170
3,4	1146
3,6	1148
3,8	1061
4	1061
4,2	976
4,4	1001
4,6	1015
4,8	938
5	938
5,2	956
5,4	975
5,6	1078
5,8	1063
6	1121
6,2	1094
6,4	1164
6,6	1185
6,8	1142
7	1095
7,2	1095
7,4	1074
7,6	1000
7,8	929
8	912
8,2	903
8,4	900
8,6	893
8,8	892
9	885
9,2	885
9,4	885
9,6	883
9,8	881
10	888
10,2	888
10,4	905
10,6	916
10,8	912
11	894
11,2	924
11,4	893
11,6	911
11,8	898
12	869
12,2	866
12,4	866

Distancia(Km)	Altura(m)
12,6	897
12,8	886
13	896
13,2	897
13,4	900
13,6	903
13,8	914
14	916
14,2	924
14,4	924
14,6	942
14,8	948
15	950
15,2	968
15,4	968
15,6	986
15,8	976
16	1012
16,2	1013
16,4	1064
16,6	1064
16,8	1208
17	1224
17,2	1357
17,4	1280
17,6	1280
17,8	1372
18	1448
18,2	1549
18,4	1562
18,6	1640
18,8	1728
19	1915
19,2	1960
19,4	0
19,6	0
19,8	1884
20	1836
20,2	1756
20,4	1627
20,6	1627
20,8	1647
21	1738
21,2	1911
21,4	2007
21,6	2061
21,8	2061
22	2184
22,2	2270
22,4	2404
22,6	2444
22,8	2264
23	2270
23,2	2290
23,4	2170
23,6	2114
23,8	1938
24	1938
24,2	1877
24,4	1951
24,6	2106
24,8	2106
25	2119

Distancia(Km)	Altura(m)
25,2	2215
25,4	2208
25,6	2114
25,8	2064
26	1964
26,2	1921
26,4	1844
26,6	1909
26,8	1824
27	1824
27,2	1643
27,4	1585
27,6	1460
27,8	1376
28	1314
28,2	1179
28,4	1102
28,6	1035
28,8	0
29	863
29,2	733
29,4	714
29,6	659
29,8	606
30	654
30,2	673
30,4	775
30,6	960
30,8	892
31	893
31,2	933
31,4	995
31,6	1002
31,8	943
32	846
32,2	846
32,4	690
32,6	679
32,8	534
33	460
33,2	379
33,4	321
33,6	303
33,8	236
34	309
34,2	411
34,4	411
34,6	362
34,8	257
35	389
35,2	440
35,4	329
35,6	380
35,8	517
36	582
36,2	575
36,4	483
36,6	372
36,8	252
37	257
37,2	171
37,4	171
37,6	139

Distancia(Km)	Altura(m)
37,8	115
38	255
38,2	263
38,4	273
38,6	256
38,8	255
39	332
39,2	348
39,4	257
39,6	257
39,8	107
40	155
40,2	25
40,4	34
40,6	0
40,8	0
41	0
41,2	0
41,4	0
41,6	0
41,8	0
42	0
42,2	0
42,4	0
42,6	0
42,8	0
43	0
43,2	0
43,4	0
43,6	0
43,8	0
44	0
44,2	0
44,4	0
44,6	0
44,8	0
45	0
45,2	0
45,4	0
45,6	0
45,8	0
46	0
46,2	0
46,4	0
46,6	0
46,8	0
47	0
47,2	0
47,4	0
47,6	0
47,8	0
48	0
48,2	0
48,4	0
48,6	0
48,8	0
49	0
49,2	0
49,4	0
49,6	0
49,8	0
50	0

Perfil de 80º:

Distancia(Km)	Altura(m)
0	1142
0,2	1108
0,4	1123
0,6	1132
0,8	1120
1	1191
1,2	1252
1,4	1214
1,6	1254
1,8	1254
2	1221
2,2	1276
2,4	1295
2,6	1252
2,8	1235
3	1221
3,2	1216
3,4	1185
3,6	1200
3,8	1174
4	1209
4,2	1209
4,4	1189
4,6	1196
4,8	1176
5	1141
5,2	1095
5,4	1011
5,6	962
5,8	940
6	938
6,2	928
6,4	914
6,6	914
6,8	910
7	909
7,2	907
7,4	903
7,6	896
7,8	894
8	894
8,2	896
8,4	898
8,6	901
8,8	930
9	930
9,2	937
9,4	939
9,6	985
9,8	999
10	1025
10,2	1073
10,4	1067
10,6	1056
10,8	1040
11	1023
11,2	1021
11,4	1014
11,6	1014
11,8	984
12	941
12,2	983
12,4	1011

Distancia(Km)	Altura(m)
12,6	970
12,8	940
13	917
13,2	894
13,4	914
13,6	929
13,8	949
14	949
14,2	981
14,4	984
14,6	1033
14,8	1032
15	1004
15,2	1007
15,4	998
15,6	999
15,8	1000
16	935
16,2	919
16,4	919
16,6	900
16,8	903
17	924
17,2	933
17,4	983
17,6	957
17,8	904
18	890
18,2	869
18,4	870
18,6	902
18,8	902
19	905
19,2	885
19,4	885
19,6	882
19,8	837
20	864
20,2	893
20,4	906
20,6	922
20,8	942
21	937
21,2	937
21,4	982
21,6	997
21,8	1033
22	1083
22,2	1104
22,4	1090
22,6	1075
22,8	1095
23	1088
23,2	1051
23,4	1033
23,6	1014
23,8	1002
24	962
24,2	853
24,4	890
24,6	968
24,8	1010
25	945

Distancia(Km)	Altura(m)
25,2	929
25,4	921
25,6	947
25,8	902
26	902
26,2	797
26,4	725
26,6	715
26,8	712
27	705
27,2	702
27,4	763
27,6	697
27,8	601
28	626
28,2	644
28,4	644
28,6	762
28,8	801
29	831
29,2	799
29,4	741
29,6	814
29,8	853
30	898
30,2	885
30,4	813
30,6	792
30,8	819
31	819
31,2	911
31,4	847
31,6	835
31,8	736
32	666
32,2	612
32,4	577
32,6	638
32,8	709
33	792
33,2	826
33,4	826
33,6	841
33,8	902
34	858
34,2	804
34,4	711
34,6	648
34,8	723
35	817
35,2	841
35,4	835
35,6	809
35,8	809
36	799
36,2	715
36,4	665
36,6	626
36,8	588
37	514
37,2	460
37,4	462
37,6	456

Distancia(Km)	Altura(m)
37,8	445
38	466
38,2	466
38,4	516
38,6	510
38,8	552
39	570
39,2	551
39,4	552
39,6	585
39,8	590
40	614
40,2	605
40,4	612
40,6	612
40,8	620
41	634
41,2	652
41,4	667
41,6	704
41,8	757
42	795
42,2	816
42,4	836
42,6	797
42,8	723
43	723
43,2	671
43,4	608
43,6	563
43,8	579
44	554
44,2	548
44,4	576
44,6	504
44,8	498
45	598
45,2	609
45,4	591
45,6	591
45,8	498
46	513
46,2	494
46,4	529
46,6	601
46,8	670
47	746
47,2	808
47,4	844
47,6	852
47,8	905
48	905
48,2	878
48,4	887
48,6	838
48,8	880
49	1006
49,2	1024
49,4	988
49,6	936
49,8	833
50	837

Perfil de 100º:

Distancia(Km)	Altura(m)
0	1142
0,2	1108
0,4	1068
0,6	1088
0,8	1058
1	1119
1,2	1096
1,4	1139
1,6	1129
1,8	1129
2	1131
2,2	1140
2,4	1130
2,6	1106
2,8	1053
3	1055
3,2	1069
3,4	1123
3,6	1186
3,8	1193
4	1090
4,2	1033
4,4	1033
4,6	1000
4,8	982
5	953
5,2	959
5,4	962
5,6	946
5,8	942
6	950
6,2	949
6,4	931
6,6	910
6,8	910
7	914
7,2	922
7,4	950
7,6	955
7,8	977
8	989
8,2	1009
8,4	1053
8,6	1115
8,8	1182
9	1237
9,2	1237
9,4	1299
9,6	1232
9,8	1286
10	1277
10,2	1282
10,4	1275
10,6	1258
10,8	1285
11	1221
11,2	1158
11,4	1111
11,6	1111
11,8	1096
12	1091
12,2	1141
12,4	1100

Distancia(Km)	Altura(m)
12,6	1064
12,8	1114
13	1126
13,2	1157
13,4	1205
13,6	1301
13,8	1361
14	1361
14,2	1356
14,4	1409
14,6	1474
14,8	1498
15	1448
15,2	1421
15,4	1398
15,6	1366
15,8	1348
16	1314
16,2	1285
16,4	1257
16,6	1257
16,8	1233
17	1191
17,2	1186
17,4	1166
17,6	1154
17,8	1152
18	1130
18,2	1139
18,4	1128
18,6	1141
18,8	1123
19	1123
19,2	1088
19,4	1058
19,6	1052
19,8	1027
20	1011
20,2	997
20,4	1013
20,6	1009
20,8	1028
21	992
21,2	971
21,4	971
21,6	911
21,8	902
22	810
22,2	722
22,4	698
22,6	713
22,8	646
23	662
23,2	627
23,4	623
23,6	678
23,8	678
24	685
24,2	710
24,4	646
24,6	660
24,8	645
25	672

Distancia(Km)	Altura(m)
25,2	558
25,4	557
25,6	547
25,8	538
26	516
26,2	514
26,4	611
26,6	622
26,8	619
27	589
27,2	667
27,4	764
27,6	851
27,8	746
28	687
28,2	560
28,4	554
28,6	509
28,8	611
29	588
29,2	478
29,4	603
29,6	613
29,8	520
30	470
30,2	396
30,4	354
30,6	350
30,8	346
31	348
31,2	349
31,4	428
31,6	507
31,8	570
32	593
32,2	427
32,4	433
32,6	488
32,8	482
33	525
33,2	494
33,4	331
33,6	331
33,8	355
34	343
34,2	305
34,4	302
34,6	357
34,8	308
35	298
35,2	318
35,4	327
35,6	434
35,8	403
36	403
36,2	407
36,4	526
36,6	644
36,8	743
37	619
37,2	514
37,4	432
37,6	415

Distancia(Km)	Altura(m)
37,8	395
38	447
38,2	596
38,4	621
38,6	621
38,8	621
39	652
39,2	649
39,4	644
39,6	718
39,8	783
40	743
40,2	699
40,4	663
40,6	588
40,8	511
41	511
41,2	438
41,4	532
41,6	503
41,8	442
42	454
42,2	412
42,4	357
42,6	367
42,8	417
43	401
43,2	415
43,4	415
43,6	408
43,8	352
44	301
44,2	318
44,4	292
44,6	302
44,8	297
45	300
45,2	322
45,4	305
45,6	317
45,8	317
46	363
46,2	388
46,4	398
46,6	449
46,8	535
47	598
47,2	650
47,4	663
47,6	667
47,8	663
48	684
48,2	684
48,4	746
48,6	816
48,8	785
49	830
49,2	870
49,4	867
49,6	867
49,8	819
50	820

Perfil de 120º:

Distancia(Km)	Altura(m)
0	1121
0,2	1054
0,4	1068
0,6	1029
0,8	1029
1	998
1,2	1005
1,4	996
1,6	1007
1,8	1007
2	1015
2,2	1012
2,4	1043
2,6	1070
2,8	1062
3	1094
3,2	1091
3,4	1142
3,6	1171
3,8	1171
4	1241
4,2	1204
4,4	1105
4,6	1073
4,8	1017
5	1027
5,2	1037
5,4	1010
5,6	1009
5,8	1098
6	1114
6,2	1118
6,4	1134
6,6	1073
6,8	1073
7	1011
7,2	982
7,4	1018
7,6	1053
7,8	1003
8	1003
8,2	1034
8,4	992
8,6	1073
8,8	1048
9	1113
9,2	1082
9,4	1077
9,6	1159
9,8	1183
10	1255
10,2	1264
10,4	1254
10,6	1201
10,8	1181
11	1181
11,2	1272
11,4	1335
11,6	1293
11,8	1213
12	1222
12,2	1191
12,4	1149

Distancia(Km)	Altura(m)
12,6	1091
12,8	1173
13	1173
13,2	1138
13,4	1161
13,6	1131
13,8	1057
14	1057
14,2	1064
14,4	1016
14,6	1028
14,8	1010
15	1080
15,2	1047
15,4	1045
15,6	959
15,8	980
16	980
16,2	983
16,4	964
16,6	920
16,8	900
17	900
17,2	881
17,4	809
17,6	746
17,8	698
18	685
18,2	777
18,4	906
18,6	976
18,8	918
19	918
19,2	876
19,4	837
19,6	741
19,8	858
20	881
20,2	882
20,4	891
20,6	774
20,8	724
21	645
21,2	591
21,4	530
21,6	594
21,8	698
22	698
22,2	678
22,4	582
22,6	653
22,8	593
23	648
23,2	646
23,4	682
23,6	718
23,8	704
24	704
24,2	688
24,4	618
24,6	685
24,8	661
25	661

Distancia(Km)	Altura(m)
25,2	535
25,4	488
25,6	456
25,8	429
26	402
26,2	427
26,4	486
26,6	517
26,8	576
27	576
27,2	448
27,4	421
27,6	428
27,8	396
28	457
28,2	401
28,4	485
28,6	444
28,8	387
29	352
29,2	352
29,4	320
29,6	337
29,8	314
30	291
30,2	303
30,4	275
30,6	255
30,8	256
31	240
31,2	240
31,4	232
31,6	230
31,8	226
32	221
32,2	221
32,4	222
32,6	215
32,8	211
33	209
33,2	208
33,4	208
33,6	202
33,8	200
34	195
34,2	195
34,4	191
34,6	192
34,8	187
35	188
35,2	182
35,4	182
35,6	182
35,8	178
36	176
36,2	175
36,4	172
36,6	168
36,8	164
37	163
37,2	163
37,4	174
37,6	161

Distancia(Km)	Altura(m)
37,8	179
38	170
38,2	176
38,4	164
38,6	163
38,8	153
39	161
39,2	161
39,4	163
39,6	154
39,8	147
40	168
40,2	168
40,4	141
40,6	127
40,8	122
41	122
41,2	125
41,4	122
41,6	126
41,8	122
42	122
42,2	122
42,4	123
42,6	124
42,8	125
43	128
43,2	136
43,4	126
43,6	142
43,8	140
44	151
44,2	128
44,4	135
44,6	209
44,8	185
45	244
45,2	244
45,4	266
45,6	234
45,8	270
46	284
46,2	314
46,4	314
46,6	280
46,8	260
47	245
47,2	245
47,4	214
47,6	147
47,8	127
48	145
48,2	145
48,4	191
48,6	170
48,8	206
49	226
49,2	285
49,4	272
49,6	277
49,8	205
50	172

Perfil de 140º:

Distancia(Km)	Altura(m)
0	1121
0,2	1054
0,4	1015
0,6	1035
0,8	991
1	976
1,2	1025
1,4	1025
1,6	1058
1,8	1033
2	1033
2,2	1100
2,4	1142
2,6	1081
2,8	1096
3	1131
3,2	1135
3,4	1135
3,6	1210
3,8	1257
4	1368
4,2	1337
4,4	1252
4,6	1133
4,8	1129
5	1182
5,2	1305
5,4	1367
5,6	1310
5,8	1365
6	1460
6,2	1383
6,4	1383
6,6	1310
6,8	1269
7	1275
7,2	1211
7,4	1183
7,6	1231
7,8	1231
8	1298
8,2	1255
8,4	1255
8,6	1320
8,8	1272
9	1204
9,2	1226
9,4	1244
9,6	1198
9,8	1224
10	1174
10,2	1160
10,4	1103
10,6	1205
10,8	1177
11	1191
11,2	1234
11,4	1221
11,6	1277
11,8	1268
12	1275
12,2	1221
12,4	1239

Distancia(Km)	Altura(m)
12,6	1225
12,8	1225
13	1282
13,2	1250
13,4	1114
13,6	1065
13,8	1005
14	888
14,2	888
14,4	948
14,6	1045
14,8	1129
15	1164
15,2	1089
15,4	1097
15,6	1097
15,8	1092
16	1193
16,2	1183
16,4	1183
16,6	1135
16,8	1134
17	1131
17,2	1135
17,4	1006
17,6	949
17,8	870
18	873
18,2	839
18,4	827
18,6	827
18,8	856
19	733
19,2	733
19,4	621
19,6	574
19,8	550
20	575
20,2	569
20,4	544
20,6	544
20,8	602
21	533
21,2	537
21,4	564
21,6	503
21,8	544
22	585
22,2	601
22,4	589
22,6	542
22,8	526
23	460
23,2	427
23,4	405
23,6	405
23,8	424
24	400
24,2	399
24,4	413
24,6	412
24,8	416
25	416

Distancia(Km)	Altura(m)
25,2	392
25,4	357
25,6	357
25,8	384
26	375
26,2	376
26,4	376
26,6	372
26,8	342
27	330
27,2	326
27,4	354
27,6	317
27,8	341
28	316
28,2	331
28,4	308
28,6	325
28,8	306
29	346
29,2	331
29,4	326
29,6	303
29,8	299
30	299
30,2	332
30,4	325
30,6	305
30,8	320
31	332
31,2	303
31,4	303
31,6	301
31,8	304
32	258
32,2	260
32,4	237
32,6	248
32,8	248
33	220
33,2	253
33,4	216
33,6	223
33,8	240
34	256
34,2	226
34,4	226
34,6	214
34,8	202
35	221
35,2	241
35,4	236
35,6	201
35,8	201
36	210
36,2	182
36,4	182
36,6	176
36,8	184
37	177
37,2	177
37,4	175
37,6	170

Distancia(Km)	Altura(m)
37,8	170
38	186
38,2	188
38,4	171
38,6	183
38,8	173
39	168
39,2	162
39,4	165
39,6	161
39,8	163
40	172
40,2	170
40,4	180
40,6	168
40,8	168
41	161
41,2	165
41,4	166
41,6	154
41,8	162
42	151
42,2	151
42,4	159
42,6	161
42,8	187
43	198
43,2	197
43,4	212
43,6	212
43,8	227
44	254
44,2	239
44,4	242
44,6	250
44,8	292
45	295
45,2	290
45,4	312
45,6	322
45,8	327
46	354
46,2	357
46,4	361
46,6	361
46,8	347
47	360
47,2	370
47,4	373
47,6	360
47,8	398
48	398
48,2	487
48,4	455
48,6	455
48,8	345
49	310
49,2	261
49,4	255
49,6	236
49,8	231
50	231

Perfil de 160º:

Distancia(Km)	Altura(m)
0	1121
0,2	1054
0,4	1015
0,6	998
0,8	969
1	1005
1,2	1005
1,4	1029
1,6	1100
1,8	1094
2	1130
2,2	1201
2,4	1287
2,6	1289
2,8	1188
3	1188
3,2	1220
3,4	1355
3,6	1411
3,8	1470
4	1515
4,2	1493
4,4	1500
4,6	1500
4,8	1438
5	1442
5,2	1453
5,4	1439
5,6	1403
5,8	1413
6	1377
6,2	1377
6,4	1410
6,6	1384
6,8	1381
7	1384
7,2	1425
7,4	1401
7,6	1403
7,8	1403
8	1395
8,2	1420
8,4	1428
8,6	1438
8,8	1482
9	1436
9,2	1481
9,4	1481
9,6	1452
9,8	1494
10	1450
10,2	1384
10,4	1340
10,6	1306
10,8	1283
11	1287
11,2	1270
11,4	1303
11,6	1318
11,8	1321
12	1258
12,2	1177
12,4	1227

Distancia(Km)	Altura(m)
12,6	1187
12,8	1187
13	1155
13,2	1037
13,4	999
13,6	983
13,8	938
14	929
14,2	925
14,4	1033
14,6	964
14,8	875
15	803
15,2	844
15,4	903
15,6	960
15,8	880
16	880
16,2	794
16,4	679
16,6	659
16,8	686
17	647
17,2	631
17,4	637
17,6	692
17,8	637
18	615
18,2	708
18,4	671
18,6	698
18,8	704
19	620
19,2	581
19,4	581
19,6	584
19,8	550
20	506
20,2	493
20,4	525
20,6	578
20,8	537
21	537
21,2	538
21,4	620
21,6	623
21,8	554
22	603
22,2	640
22,4	684
22,6	684
22,8	626
23	659
23,2	710
23,4	773
23,6	824
23,8	875
24	928
24,2	928
24,4	970
24,6	961
24,8	881
25	817

Distancia(Km)	Altura(m)
25,2	794
25,4	715
25,6	688
25,8	688
26	633
26,2	679
26,4	658
26,6	616
26,8	586
27	573
27,2	573
27,4	587
27,6	587
27,8	549
28	508
28,2	445
28,4	401
28,6	361
28,8	337
29	315
29,2	323
29,4	312
29,6	309
29,8	308
30	300
30,2	311
30,4	302
30,6	300
30,8	300
31	295
31,2	273
31,4	267
31,6	255
31,8	256
32	249
32,2	247
32,4	252
32,6	244
32,8	249
33	251
33,2	241
33,4	239
33,6	237
33,8	237
34	238
34,2	238
34,4	227
34,6	220
34,8	214
35	212
35,2	210
35,4	210
35,6	217
35,8	217
36	224
36,2	218
36,4	218
36,6	219
36,8	241
37	272
37,2	329
37,4	329
37,6	410

Distancia(Km)	Altura(m)
37,8	475
38	537
38,2	457
38,4	492
38,6	562
38,8	517
39	517
39,2	463
39,4	430
39,6	403
39,8	470
40	492
40,2	474
40,4	546
40,6	546
40,8	577
41	685
41,2	642
41,4	565
41,6	539
41,8	481
42	448
42,2	418
42,4	418
42,6	426
42,8	416
43	439
43,2	469
43,4	506
43,6	561
43,8	620
44	669
44,2	675
44,4	622
44,6	531
44,8	497
45	472
45,2	443
45,4	392
45,6	392
45,8	378
46	431
46,2	469
46,4	491
46,6	539
46,8	577
47	613
47,2	640
47,4	616
47,6	553
47,8	554
48	611
48,2	676
48,4	782
48,6	953
48,8	953
49	966
49,2	992
49,4	909
49,6	884
49,8	775
50	795

Perfil de 180º:

Distancia(Km)	Altura(m)
0	1121
0,2	1085
0,4	1037
0,6	986
0,8	973
1	1009
1,2	1044
1,4	1094
1,6	1092
1,8	1152
2	1210
2,2	1210
2,4	1288
2,6	1352
2,8	1432
3	1509
3,2	1525
3,4	1485
3,6	1471
3,8	1487
4	1554
4,2	1540
4,4	1564
4,6	1655
4,8	1721
5	1683
5,2	1683
5,4	1659
5,6	1633
5,8	1587
6	1568
6,2	1562
6,4	1503
6,6	1473
6,8	1462
7	1446
7,2	1484
7,4	1496
7,6	1472
7,8	1427
8	1419
8,2	1419
8,4	1467
8,6	1470
8,8	1413
9	1354
9,2	1357
9,4	1404
9,6	1370
9,8	1329
10	1319
10,2	1319
10,4	1318
10,6	1335
10,8	1302
11	1302
11,2	1231
11,4	1199
11,6	1156
11,8	1094
12	1012
12,2	867
12,4	797

Distancia(Km)	Altura(m)
12,6	815
12,8	790
13	721
13,2	745
13,4	730
13,6	704
13,8	788
14	788
14,2	856
14,4	906
14,6	966
14,8	1006
15	980
15,2	898
15,4	776
15,6	803
15,8	860
16	907
16,2	962
16,4	1004
16,6	935
16,8	865
17	865
17,2	779
17,4	699
17,6	700
17,8	634
18	607
18,2	598
18,4	563
18,6	563
18,8	598
19	638
19,2	667
19,4	592
19,6	543
19,8	599
20	599
20,2	563
20,4	495
20,6	488
20,8	536
21	623
21,2	706
21,4	771
21,6	776
21,8	687
22	602
22,2	531
22,4	553
22,6	520
22,8	575
23	575
23,2	676
23,4	721
23,6	638
23,8	598
24	648
24,2	661
24,4	726
24,6	814
24,8	723
25	573

Distancia(Km)	Altura(m)
25,2	586
25,4	664
25,6	639
25,8	639
26	610
26,2	600
26,4	593
26,6	524
26,8	492
27	471
27,2	381
27,4	329
27,6	323
27,8	280
28	282
28,2	340
28,4	431
28,6	384
28,8	384
29	318
29,2	309
29,4	394
29,6	450
29,8	485
30	460
30,2	529
30,4	559
30,6	562
30,8	597
31	608
31,2	543
31,4	512
31,6	514
31,8	514
32	536
32,2	563
32,4	608
32,6	678
32,8	721
33	684
33,2	674
33,4	667
33,6	655
33,8	592
34	538
34,2	546
34,4	572
34,6	528
34,8	528
35	534
35,2	554
35,4	585
35,6	627
35,8	636
36	662
36,2	660
36,4	685
36,6	729
36,8	764
37	709
37,2	658
37,4	675
37,6	593

Distancia(Km)	Altura(m)
37,8	593
38	622
38,2	599
38,4	632
38,6	639
38,8	626
39	635
39,2	631
39,4	641
39,6	672
39,8	655
40	718
40,2	831
40,4	893
40,6	893
40,8	984
41	1101
41,2	1195
41,4	1267
41,6	1200
41,8	1074
42	987
42,2	934
42,4	878
42,6	831
42,8	814
43	885
43,2	925
43,4	956
43,6	956
43,8	981
44	944
44,2	881
44,4	891
44,6	884
44,8	833
45	781
45,2	772
45,4	743
45,6	684
45,8	631
46	652
46,2	694
46,4	594
46,6	594
46,8	611
47	606
47,2	601
47,4	559
47,6	518
47,8	556
48	631
48,2	544
48,4	550
48,6	643
48,8	695
49	790
49,2	961
49,4	993
49,6	993
49,8	897
50	881

Perfil de 200º:

Distancia(Km)	Altura(m)
0	1142
0,2	1085
0,4	1037
0,6	959
0,8	985
1	1037
1,2	1015
1,4	1033
1,6	1055
1,8	1152
2	1192
2,2	1256
2,4	1339
2,6	1352
2,8	1352
3	1298
3,2	1235
3,4	1287
3,6	1235
3,8	1242
4	1279
4,2	1331
4,4	1331
4,6	1385
4,8	1466
5	1538
5,2	1558
5,4	1511
5,6	1429
5,8	1413
6	1413
6,2	1349
6,4	1446
6,6	1558
6,8	1551
7	1466
7,2	1398
7,4	1411
7,6	1411
7,8	1362
8	1445
8,2	1421
8,4	1371
8,6	1272
8,8	1235
9	1240
9,2	1242
9,4	1284
9,6	1283
9,8	1255
10	1261
10,2	1315
10,4	1276
10,6	1225
10,8	1225
11	1238
11,2	1271
11,4	1252
11,6	1217
11,8	1226
12	1167
12,2	1078
12,4	1105

Distancia(Km)	Altura(m)
12,6	1080
12,8	959
13	849
13,2	870
13,4	914
13,6	1051
13,8	1147
14	1147
14,2	1146
14,4	1049
14,6	1004
14,8	1010
15	897
15,2	805
15,4	895
15,6	895
15,8	934
16	1026
16,2	1060
16,4	1111
16,6	1015
16,8	943
17	883
17,2	883
17,4	751
17,6	698
17,8	771
18	753
18,2	701
18,4	600
18,6	617
18,8	617
19	631
19,2	725
19,4	777
19,6	727
19,8	649
20	570
20,2	493
20,4	512
20,6	497
20,8	542
21	574
21,2	540
21,4	483
21,6	478
21,8	443
22	443
22,2	450
22,4	549
22,6	573
22,8	517
23	450
23,2	452
23,4	445
23,6	530
23,8	428
24	390
24,2	496
24,4	560
24,6	596
24,8	479
25	479

Distancia(Km)	Altura(m)
25,2	446
25,4	546
25,6	612
25,8	729
26	803
26,2	852
26,4	824
26,6	873
26,8	879
27	867
27,2	951
27,4	898
27,6	878
27,8	816
28	736
28,2	736
28,4	712
28,6	635
28,8	576
29	530
29,2	594
29,4	555
29,6	540
29,8	559
30	586
30,2	627
30,4	639
30,6	677
30,8	779
31	979
31,2	966
31,4	966
31,6	926
31,8	895
32	840
32,2	770
32,4	721
32,6	694
32,8	703
33	703
33,2	717
33,4	692
33,6	696
33,8	731
34	801
34,2	873
34,4	914
34,6	914
34,8	974
35	988
35,2	910
35,4	880
35,6	829
35,8	777
36	718
36,2	718
36,4	667
36,6	657
36,8	628
37	606
37,2	612
37,4	644
37,6	679

Distancia(Km)	Altura(m)
37,8	711
38	757
38,2	779
38,4	729
38,6	763
38,8	795
39	897
39,2	927
39,4	927
39,6	1059
39,8	1023
40	1025
40,2	1005
40,4	990
40,6	1026
40,8	1102
41	1038
41,2	1094
41,4	1105
41,6	1197
41,8	1278
42	1213
42,2	1192
42,4	1140
42,6	1140
42,8	1049
43	964
43,2	901
43,4	817
43,6	771
43,8	758
44	725
44,2	725
44,4	707
44,6	704
44,8	744
45	715
45,2	709
45,4	711
45,6	732
45,8	732
46	740
46,2	772
46,4	778
46,6	784
46,8	811
47	873
47,2	833
47,4	833
47,6	744
47,8	709
48	753
48,2	808
48,4	905
48,6	895
48,8	834
49	765
49,2	718
49,4	648
49,6	561
49,8	555
50	587

Perfil de 220º:

Distancia(Km)	Altura(m)
0	1121
0,2	1085
0,4	984
0,6	965
0,8	969
1	1011
1,2	1011
1,4	1049
1,6	1075
1,8	1087
2	1027
2,2	1070
2,4	1145
2,6	1157
2,8	1224
3	1249
3,2	1201
3,4	1137
3,6	1040
3,8	1126
4	1130
4,2	1204
4,4	1143
4,6	1134
4,8	1134
5	1068
5,2	1051
5,4	1026
5,6	1025
5,8	1042
6	1034
6,2	1034
6,4	1028
6,6	1076
6,8	1076
7	1166
7,2	1145
7,4	1218
7,6	1324
7,8	1224
8	1241
8,2	1241
8,4	1276
8,6	1364
8,8	1383
9	1441
9,2	1425
9,4	1423
9,6	1437
9,8	1420
10	1343
10,2	1313
10,4	1275
10,6	1214
10,8	1201
11	1220
11,2	1248
11,4	1264
11,6	1231
11,8	1231
12	1239
12,2	1243
12,4	1243

Distancia(Km)	Altura(m)
12,6	1196
12,8	1171
13	1196
13,2	1177
13,4	1211
13,6	1252
13,8	1252
14	1248
14,2	1220
14,4	1226
14,6	1244
14,8	1262
15	1337
15,2	1317
15,4	1354
15,6	1315
15,8	1342
16	1338
16,2	1373
16,4	1320
16,6	1355
16,8	1292
17	1201
17,2	1234
17,4	1234
17,6	1300
17,8	1364
18	1368
18,2	1381
18,4	1305
18,6	1329
18,8	1329
19	1397
19,2	1363
19,4	1363
19,6	1264
19,8	1136
20	1016
20,2	1015
20,4	922
20,6	791
20,8	791
21	739
21,2	812
21,4	881
21,6	986
21,8	992
22	986
22,2	915
22,4	903
22,6	766
22,8	786
23	712
23,2	639
23,4	620
23,6	722
23,8	714
24	672
24,2	694
24,4	694
24,6	640
24,8	554
25	545

Distancia(Km)	Altura(m)
25,2	615
25,4	653
25,6	752
25,8	752
26	678
26,2	633
26,4	633
26,6	551
26,8	482
27	491
27,2	564
27,4	503
27,6	453
27,8	453
28	459
28,2	470
28,4	496
28,6	472
28,8	491
29	511
29,2	583
29,4	601
29,6	721
29,8	735
30	777
30,2	787
30,4	748
30,6	771
30,8	769
31	827
31,2	897
31,4	897
31,6	887
31,8	888
32	921
32,2	933
32,4	910
32,6	925
32,8	933
33	905
33,2	900
33,4	900
33,6	876
33,8	861
34	927
34,2	938
34,4	985
34,6	1096
34,8	1113
35	1203
35,2	1224
35,4	1194
35,6	1211
35,8	1120
36	1155
36,2	1098
36,4	1095
36,6	1001
36,8	1021
37	1021
37,2	1093
37,4	1176
37,6	1167

Distancia(Km)	Altura(m)
37,8	1220
38	1277
38,2	1338
38,4	1338
38,6	1392
38,8	1397
39	1397
39,2	1311
39,4	1299
39,6	1195
39,8	1119
40	1099
40,2	1085
40,4	1085
40,6	1101
40,8	973
41	890
41,2	903
41,4	889
41,6	995
41,8	1056
42	1006
42,2	1021
42,4	954
42,6	1043
42,8	970
43	935
43,2	952
43,4	902
43,6	931
43,8	864
44	864
44,2	786
44,4	764
44,6	719
44,8	673
45	612
45,2	563
45,4	563
45,6	628
45,8	717
46	717
46,2	702
46,4	636
46,6	614
46,8	689
47	611
47,2	640
47,4	640
47,6	714
47,8	812
48	812
48,2	779
48,4	696
48,6	680
48,8	714
49	692
49,2	680
49,4	680
49,6	649
49,8	628
50	668

Perfil de 240º:

Distancia(Km)	Altura(m)
0	1142
0,2	1030
0,4	1030
0,6	965
0,8	952
1	971
1,2	956
1,4	956
1,6	977
1,8	960
2	979
2,2	976
2,4	1026
2,6	1023
2,8	1051
3	1027
3,2	1054
3,4	1002
3,6	1020
3,8	971
4	978
4,2	1061
4,4	1092
4,6	1119
4,8	1108
5	1168
5,2	1241
5,4	1320
5,6	1320
5,8	1345
6	1297
6,2	1359
6,4	1385
6,6	1385
6,8	1421
7	1393
7,2	1443
7,4	1445
7,6	1532
7,8	1532
8	1611
8,2	1606
8,4	1647
8,6	1674
8,8	1631
9	1670
9,2	1666
9,4	1666
9,6	1698
9,8	1645
10	1682
10,2	1618
10,4	1613
10,6	1647
10,8	1647
11	1642
11,2	1622
11,4	1552
11,6	1556
11,8	1512
12	1544
12,2	1581
12,4	1661

Distancia(Km)	Altura(m)
12,6	1651
12,8	1555
13	1555
13,2	1494
13,4	1527
13,6	1517
13,8	1520
14	1512
14,2	1498
14,4	1470
14,6	1413
14,8	1449
15	1387
15,2	1367
15,4	1332
15,6	1337
15,8	1301
16	1301
16,2	1313
16,4	1324
16,6	1350
16,8	1407
17	1379
17,2	1450
17,4	1507
17,6	1559
17,8	1578
18	1606
18,2	1606
18,4	1626
18,6	1654
18,8	1731
19	1784
19,2	1789
19,4	1819
19,6	1780
19,8	1847
20	1895
20,2	1895
20,4	1928
20,6	1861
20,8	1752
21	1669
21,2	1669
21,4	1587
21,6	1478
21,8	1427
22	1349
22,2	1302
22,4	1253
22,6	1120
22,8	1046
23	1178
23,2	1280
23,4	1280
23,6	1217
23,8	1299
24	1218
24,2	1200
24,4	1101
24,6	1053
24,8	1012
25	1029

Distancia(Km)	Altura(m)
25,2	962
25,4	962
25,6	843
25,8	848
26	834
26,2	825
26,4	825
26,6	909
26,8	914
27	975
27,2	895
27,4	978
27,6	911
27,8	1018
28	1077
28,2	1178
28,4	0
28,6	0
28,8	0
29	0
29,2	709
29,4	762
29,6	736
29,8	796
30	726
30,2	752
30,4	855
30,6	855
30,8	962
31	992
31,2	1067
31,4	1105
31,6	1105
31,8	967
32	962
32,2	894
32,4	895
32,6	846
32,8	846
33	851
33,2	959
33,4	870
33,6	903
33,8	857
34	901
34,2	933
34,4	863
34,6	771
34,8	703
35	625
35,2	650
35,4	724
35,6	708
35,8	708
36	642
36,2	660
36,4	640
36,6	658
36,8	658
37	658
37,2	702
37,4	689
37,6	699

Distancia(Km)	Altura(m)
37,8	745
38	745
38,2	808
38,4	782
38,6	895
38,8	901
39	984
39,2	1014
39,4	1158
39,6	1185
39,8	1115
40	1155
40,2	1087
40,4	1033
40,6	1031
40,8	933
41	933
41,2	794
41,4	783
41,6	703
41,8	812
42	843
42,2	935
42,4	934
42,6	1015
42,8	1035
43	1063
43,2	1084
43,4	964
43,6	890
43,8	830
44	917
44,2	872
44,4	956
44,6	884
44,8	820
45	866
45,2	771
45,4	832
45,6	726
45,8	636
46	566
46,2	566
46,4	605
46,6	651
46,8	736
47	699
47,2	632
47,4	687
47,6	619
47,8	593
48	588
48,2	578
48,4	610
48,6	615
48,8	627
49	603
49,2	662
49,4	622
49,6	617
49,8	579
50	547

Perfil de 260º:

Distancia(Km)	Altura(m)
0	1121
0,2	1091
0,4	1028
0,6	948
0,8	948
1	953
1,2	990
1,4	1043
1,6	1046
1,8	1021
2	1027
2,2	1065
2,4	1091
2,6	1134
2,8	1166
3	1111
3,2	1111
3,4	1156
3,6	1219
3,8	1276
4	1306
4,2	1221
4,4	1253
4,6	1124
4,8	1173
5	1265
5,2	1313
5,4	1264
5,6	1179
5,8	1181
6	1251
6,2	1250
6,4	1114
6,6	1204
6,8	1159
7	1222
7,2	1187
7,4	1093
7,6	1183
7,8	1253
8	1253
8,2	1279
8,4	1307
8,6	1293
8,8	1342
9	1383
9,2	1277
9,4	1133
9,6	1135
9,8	1185
10	1234
10,2	1278
10,4	1278
10,6	1418
10,8	1476
11	1499
11,2	1524
11,4	1518
11,6	1495
11,8	1523
12	1585
12,2	1565
12,4	1546

Distancia(Km)	Altura(m)
12,6	1543
12,8	1543
13	1609
13,2	1655
13,4	1629
13,6	1575
13,8	1528
14	1532
14,2	1485
14,4	1364
14,6	1294
14,8	1260
15	1275
15,2	1275
15,4	1340
15,6	1388
15,8	1395
16	1489
16,2	1501
16,4	1561
16,6	1572
16,8	1649
17	1638
17,2	1663
17,4	1726
17,6	1726
17,8	1746
18	1734
18,2	1747
18,4	1599
18,6	1620
18,8	1712
19	1751
19,2	1801
19,4	1890
19,6	1977
19,8	2047
20	2047
20,2	2008
20,4	2034
20,6	2028
20,8	1978
21	1968
21,2	1889
21,4	1796
21,6	1778
21,8	1792
22	1862
22,2	1827
22,4	1827
22,6	1855
22,8	1832
23	1824
23,2	1876
23,4	1909
23,6	1933
23,8	1920
24	1984
24,2	1996
24,4	1967
24,6	1950
24,8	1950
25	2003

Distancia(Km)	Altura(m)
25,2	2027
25,4	2145
25,6	2222
25,8	2271
26	2295
26,2	2261
26,4	2195
26,6	2098
26,8	1991
27	1916
27,2	1843
27,4	1747
27,6	1656
27,8	1574
28	1475
28,2	1453
28,4	1349
28,6	1345
28,8	1340
29	1439
29,2	1563
29,4	1637
29,6	1637
29,8	1545
30	1479
30,2	1383
30,4	1341
30,6	1490
30,8	1432
31	1292
31,2	1364
31,4	1462
31,6	1583
31,8	1691
32	1691
32,2	1727
32,4	1798
32,6	1843
32,8	1878
33	1875
33,2	1849
33,4	1822
33,6	1710
33,8	1753
34	1839
34,2	1957
34,4	1957
34,6	2067
34,8	2109
35	2122
35,2	2040
35,4	1952
35,6	1854
35,8	1827
36	1758
36,2	1769
36,4	1667
36,6	1542
36,8	1542
37	1526
37,2	1590
37,4	1627
37,6	1714

Distancia(Km)	Altura(m)
37,8	1812
38	1913
38,2	1973
38,4	2048
38,6	1951
38,8	1900
39	1842
39,2	1842
39,4	1835
39,6	1828
39,8	1802
40	1914
40,2	1986
40,4	2032
40,6	2027
40,8	1971
41	2018
41,2	2023
41,4	2036
41,6	2036
41,8	2121
42	2126
42,2	2064
42,4	1973
42,6	1903
42,8	1815
43	1719
43,2	1644
43,4	1661
43,6	1622
43,8	1731
44	1731
44,2	1757
44,4	1759
44,6	1729
44,8	1675
45	1633
45,2	1573
45,4	1664
45,6	1715
45,8	1720
46	1684
46,2	1734
46,4	1734
46,6	1814
46,8	1888
47	1952
47,2	1993
47,4	2060
47,6	2115
47,8	2177
48	2154
48,2	2117
48,4	2096
48,6	2120
48,8	2051
49	2029
49,2	2021
49,4	2013
49,6	2036
49,8	2078
50	2042

Perfil de 280º:

Distancia(Km)	Altura(m)
0	1142
0,2	1091
0,4	997
0,6	948
0,8	948
1	1036
1,2	1107
1,4	1164
1,6	1184
1,8	1183
2	1195
2,2	1261
2,4	1301
2,6	1308
2,8	1293
3	1286
3,2	1286
3,4	1291
3,6	1332
3,8	1295
4	1283
4,2	1296
4,4	1345
4,6	1369
4,8	1474
5	1551
5,2	1572
5,4	1572
5,6	1486
5,8	1491
6	1488
6,2	1524
6,4	1545
6,6	1588
6,8	1562
7	1634
7,2	1652
7,4	1602
7,6	1526
7,8	1526
8	1535
8,2	1535
8,4	1535
8,6	1557
8,8	1634
9	1713
9,2	1833
9,4	1879
9,6	1860
9,8	1876
10	1861
10,2	1861
10,4	1901
10,6	1909
10,8	1909
11	1877
11,2	1897
11,4	1941
11,6	1977
11,8	1995
12	2017
12,2	2029
12,4	2044

Distancia(Km)	Altura(m)
12,6	2044
12,8	2007
13	2079
13,2	2131
13,4	2072
13,6	2026
13,8	2031
14	1936
14,2	1884
14,4	1842
14,6	1904
14,8	1904
15	1843
15,2	1703
15,4	1743
15,6	1756
15,8	1745
16	1712
16,2	1619
16,4	1552
16,6	1487
16,8	1405
17	1393
17,2	1393
17,4	1441
17,6	1468
17,8	1468
18	1468
18,2	1396
18,4	1307
18,6	1294
18,8	1395
19	1469
19,2	1535
19,4	1504
19,6	1504
19,8	1572
20	1541
20,2	1493
20,4	1470
20,6	1435
20,8	1418
21	1409
21,2	1350
21,4	1350
21,6	1363
21,8	1400
22	1400
22,2	1371
22,4	1251
22,6	1199
22,8	1216
23	1274
23,2	1326
23,4	1398
23,6	1467
23,8	1530
24	1460
24,2	1404
24,4	1404
24,6	1310
24,8	1243
25	1171

Distancia(Km)	Altura(m)
25,2	1094
25,4	1021
25,6	961
25,8	911
26	857
26,2	810
26,4	731
26,6	731
26,8	669
27	611
27,2	661
27,4	632
27,6	579
27,8	553
28	497
28,2	436
28,4	419
28,6	388
28,8	408
29	408
29,2	494
29,4	555
29,6	514
29,8	539
30	597
30,2	650
30,4	647
30,6	690
30,8	723
31	785
31,2	845
31,4	845
31,6	933
31,8	1023
32	1129
32,2	1169
32,4	1269
32,6	1267
32,8	1212
33	1143
33,2	1102
33,4	1136
33,6	1183
33,8	1183
34	1128
34,2	992
34,4	975
34,6	996
34,8	946
35	1052
35,2	1158
35,4	1113
35,6	1139
35,8	1170
36	1151
36,2	1151
36,4	1185
36,6	1041
36,8	1046
37	1056
37,2	1005
37,4	933
37,6	875

Distancia(Km)	Altura(m)
37,8	817
38	772
38,2	712
38,4	712
38,6	652
38,8	609
39	605
39,2	512
39,4	404
39,6	309
39,8	197
40	177
40,2	0
40,4	0
40,6	492
40,8	492
41	460
41,2	440
41,4	588
41,6	652
41,8	774
42	848
42,2	809
42,4	734
42,6	652
42,8	589
43	636
43,2	636
43,4	644
43,6	668
43,8	703
44	710
44,2	634
44,4	586
44,6	546
44,8	487
45	459
45,2	370
45,4	305
45,6	305
45,8	285
46	179
46,2	183
46,4	124
46,6	116
46,8	110
47	59
47,2	74
47,4	141
47,6	260
47,8	301
48	301
48,2	351
48,4	355
48,6	418
48,8	355
49	312
49,2	354
49,4	425
49,6	371
49,8	233
50	282

Perfil de 300º:

Distancia(Km)	Altura(m)
0	1142
0,2	1091
0,4	1100
0,6	972
0,8	982
1	1054
1,2	1154
1,4	1154
1,6	1163
1,8	1165
2	1085
2,2	1088
2,4	1088
2,6	1004
2,8	1026
3	1058
3,2	1026
3,4	1081
3,6	1112
3,8	1063
4	1071
4,2	1106
4,4	1106
4,6	1156
4,8	1146
5	1251
5,2	1324
5,4	1306
5,6	1359
5,8	1420
6	1425
6,2	1442
6,4	1495
6,6	1537
6,8	1683
7	1646
7,2	1538
7,4	1538
7,6	1465
7,8	1475
8	1455
8,2	1516
8,4	1457
8,6	1435
8,8	1371
9	1447
9,2	1461
9,4	1473
9,6	1431
9,8	1517
10	1483
10,2	1365
10,4	1339
10,6	1322
10,8	1254
11	1172
11,2	1182
11,4	1138
11,6	1138
11,8	1241
12	1240
12,2	1368
12,4	1416

Distancia(Km)	Altura(m)
12,6	1462
12,8	1467
13	1305
13,2	1276
13,4	1350
13,6	1238
13,8	1241
14	1208
14,2	1241
14,4	1174
14,6	1174
14,8	1103
15	1059
15,2	1017
15,4	938
15,6	848
15,8	801
16	800
16,2	848
16,4	833
16,6	833
16,8	713
17	785
17,2	887
17,4	896
17,6	896
17,8	880
18	906
18,2	909
18,4	957
18,6	1002
18,8	999
19	923
19,2	943
19,4	841
19,6	841
19,8	771
20	760
20,2	644
20,4	543
20,6	535
20,8	454
21	400
21,2	370
21,4	346
21,6	321
21,8	307
22	350
22,2	322
22,4	240
22,6	240
22,8	154
23	115
23,2	136
23,4	140
23,6	67
23,8	67
24	219
24,2	253
24,4	220
24,6	165
24,8	165
25	145

Distancia(Km)	Altura(m)
25,2	86
25,4	0
25,6	0
25,8	0
26	0
26,2	0
26,4	0
26,6	0
26,8	0
27	0
27,2	0
27,4	0
27,6	0
27,8	0
28	0
28,2	0
28,4	0
28,6	0
28,8	0
29	0
29,2	0
29,4	0
29,6	0
29,8	0
30	0
30,2	0
30,4	0
30,6	0
30,8	0
31	0
31,2	0
31,4	0
31,6	0
31,8	0
32	0
32,2	0
32,4	0
32,6	0
32,8	0
33	0
33,2	0
33,4	0
33,6	0
33,8	0
34	0
34,2	0
34,4	0
34,6	0
34,8	0
35	0
35,2	0
35,4	0
35,6	0
35,8	0
36	0
36,2	0
36,4	0
36,6	0
36,8	0
37	0
37,2	0
37,4	0
37,6	0

Distancia(Km)	Altura(m)
37,8	0
38	0
38,2	0
38,4	0
38,6	0
38,8	0
39	0
39,2	0
39,4	0
39,6	0
39,8	0
40	0
40,2	0
40,4	0
40,6	0
40,8	0
41	0
41,2	0
41,4	0
41,6	0
41,8	0
42	0
42,2	0
42,4	0
42,6	0
42,8	0
43	0
43,2	0
43,4	0
43,6	0
43,8	0
44	0
44,2	0
44,4	0
44,6	0
44,8	0
45	0
45,2	0
45,4	0
45,6	0
45,8	0
46	0
46,2	0
46,4	0
46,6	0
46,8	0
47	0
47,2	0
47,4	0
47,6	0
47,8	0
48	0
48,2	0
48,4	0
48,6	0
48,8	0
49	0
49,2	0
49,4	0
49,6	0
49,8	0
50	0

Perfil de 320º:

Distancia(Km)	Altura(m)
0	1142
0,2	1140
0,4	1100
0,6	950
0,8	950
1	1019
1,2	966
1,4	982
1,6	984
1,8	984
2	977
2,2	1035
2,4	1030
2,6	1106
2,8	1139
3	1185
3,2	1185
3,4	1196
3,6	1261
3,8	1249
4	1315
4,2	1320
4,4	1404
4,6	1404
4,8	1489
5	1583
5,2	1541
5,4	1561
5,6	1516
5,8	1502
6	1523
6,2	1505
6,4	1460
6,6	1397
6,8	1395
7	1456
7,2	1460
7,4	1442
7,6	1377
7,8	1254
8	1169
8,2	1169
8,4	1100
8,6	1076
8,8	1095
9	1093
9,2	1007
9,4	886
9,6	886
9,8	760
10	746
10,2	867
10,4	896
10,6	790
10,8	824
11	824
11,2	918
11,4	996
11,6	1053
11,8	1039
12	999
12,2	936
12,4	908

Distancia(Km)	Altura(m)
12,6	857
12,8	761
13	708
13,2	648
13,4	556
13,6	497
13,8	493
14	433
14,2	373
14,4	317
14,6	317
14,8	267
15	211
15,2	209
15,4	276
15,6	419
15,8	567
16	567
16,2	496
16,4	399
16,6	426
16,8	499
17	445
17,2	511
17,4	511
17,6	483
17,8	372
18	396
18,2	322
18,4	333
18,6	280
18,8	200
19	147
19,2	33
19,4	65
19,6	125
19,8	63
20	0
20,2	1
20,4	0
20,6	0
20,8	0
21	0
21,2	0
21,4	0
21,6	0
21,8	0
22	0
22,2	0
22,4	0
22,6	0
22,8	0
23	0
23,2	0
23,4	0
23,6	0
23,8	0
24	0
24,2	0
24,4	0
24,6	0
24,8	0
25	0

Distancia(Km)	Altura(m)
25,2	0
25,4	0
25,6	0
25,8	0
26	0
26,2	0
26,4	0
26,6	0
26,8	0
27	0
27,2	0
27,4	0
27,6	0
27,8	0
28	0
28,2	0
28,4	0
28,6	0
28,8	0
29	0
29,2	0
29,4	0
29,6	0
29,8	0
30	0
30,2	0
30,4	0
30,6	0
30,8	0
31	0
31,2	0
31,4	0
31,6	0
31,8	0
32	0
32,2	0
32,4	0
32,6	0
32,8	0
33	0
33,2	0
33,4	0
33,6	0
33,8	0
34	0
34,2	0
34,4	0
34,6	0
34,8	0
35	0
35,2	0
35,4	0
35,6	0
35,8	0
36	0
36,2	0
36,4	0
36,6	0
36,8	0
37	0
37,2	0
37,4	0
37,6	0

Distancia(Km)	Altura(m)
37,8	0
38	0
38,2	0
38,4	0
38,6	0
38,8	0
39	0
39,2	0
39,4	0
39,6	0
39,8	0
40	0
40,2	0
40,4	0
40,6	0
40,8	0
41	0
41,2	0
41,4	0
41,6	0
41,8	0
42	0
42,2	0
42,4	0
42,6	0
42,8	0
43	0
43,2	0
43,4	0
43,6	0
43,8	0
44	0
44,2	0
44,4	0
44,6	0
44,8	0
45	0
45,2	0
45,4	0
45,6	0
45,8	0
46	0
46,2	0
46,4	0
46,6	0
46,8	0
47	0
47,2	0
47,4	0
47,6	0
47,8	0
48	0
48,2	0
48,4	0
48,6	0
48,8	0
49	0
49,2	0
49,4	0
49,6	0
49,8	0
50	0

Perfil de 340º:

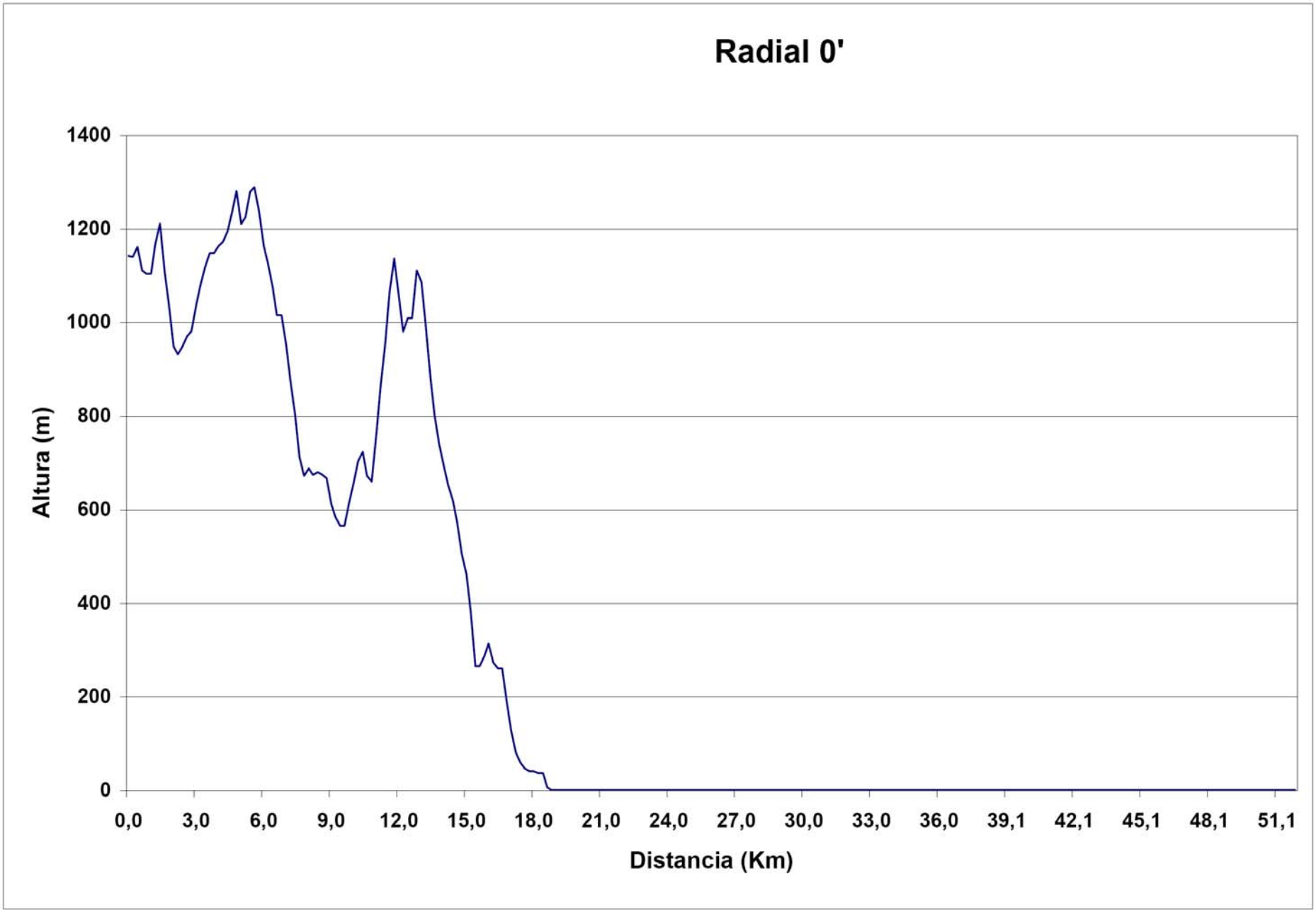
Distancia(Km)	Altura(m)
0	1121
0,2	1140
0,4	1161
0,6	1076
0,8	1016
1	1021
1,2	1032
1,4	1070
1,6	1007
1,8	939
2	944
2,2	944
2,4	1033
2,6	1096
2,8	1112
3	1078
3,2	1135
3,4	1139
3,6	1149
3,8	1203
4	1202
4,2	1250
4,4	1333
4,6	1389
4,8	1461
5	1497
5,2	1424
5,4	1424
5,6	1354
5,8	1271
6	1208
6,2	1147
6,4	1095
6,6	1024
6,8	991
7	1102
7,2	1102
7,4	1154
7,6	1158
7,8	1091
8	1059
8,2	957
8,4	929
8,6	885
8,8	885
9	878
9,2	858
9,4	841
9,6	781
9,8	739
10	722
10,2	708
10,4	708
10,6	599
10,8	551
11	597
11,2	678
11,4	746
11,6	775
11,8	794
12	794
12,2	794
12,4	873

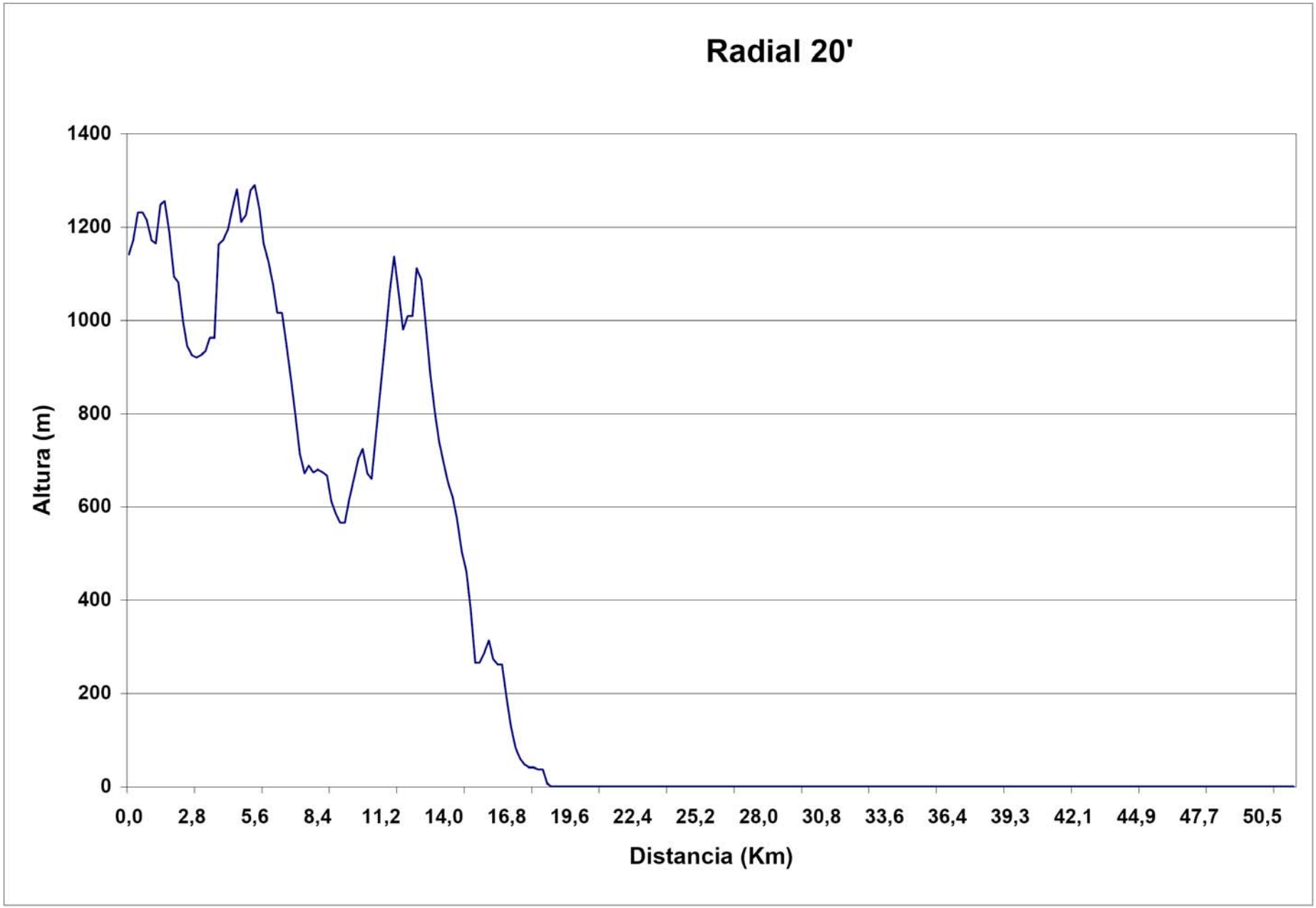
Distancia(Km)	Altura(m)
12,6	866
12,8	867
13	825
13,2	842
13,4	885
13,6	817
13,8	817
14	708
14,2	618
14,4	544
14,6	530
14,8	498
15	516
15,2	409
15,4	365
15,6	275
15,8	248
16	271
16,2	226
16,4	210
16,6	152
16,8	182
17	182
17,2	129
17,4	152
17,6	119
17,8	78
18	42
18,2	32
18,4	27
18,6	30
18,8	11
19	2
19,2	0
19,4	0
19,6	0
19,8	0
20	0
20,2	0
20,4	0
20,6	0
20,8	0
21	0
21,2	0
21,4	0
21,6	0
21,8	0
22	0
22,2	0
22,4	0
22,6	0
22,8	0
23	0
23,2	0
23,4	0
23,6	0
23,8	0
24	0
24,2	0
24,4	0
24,6	0
24,8	0
25	0

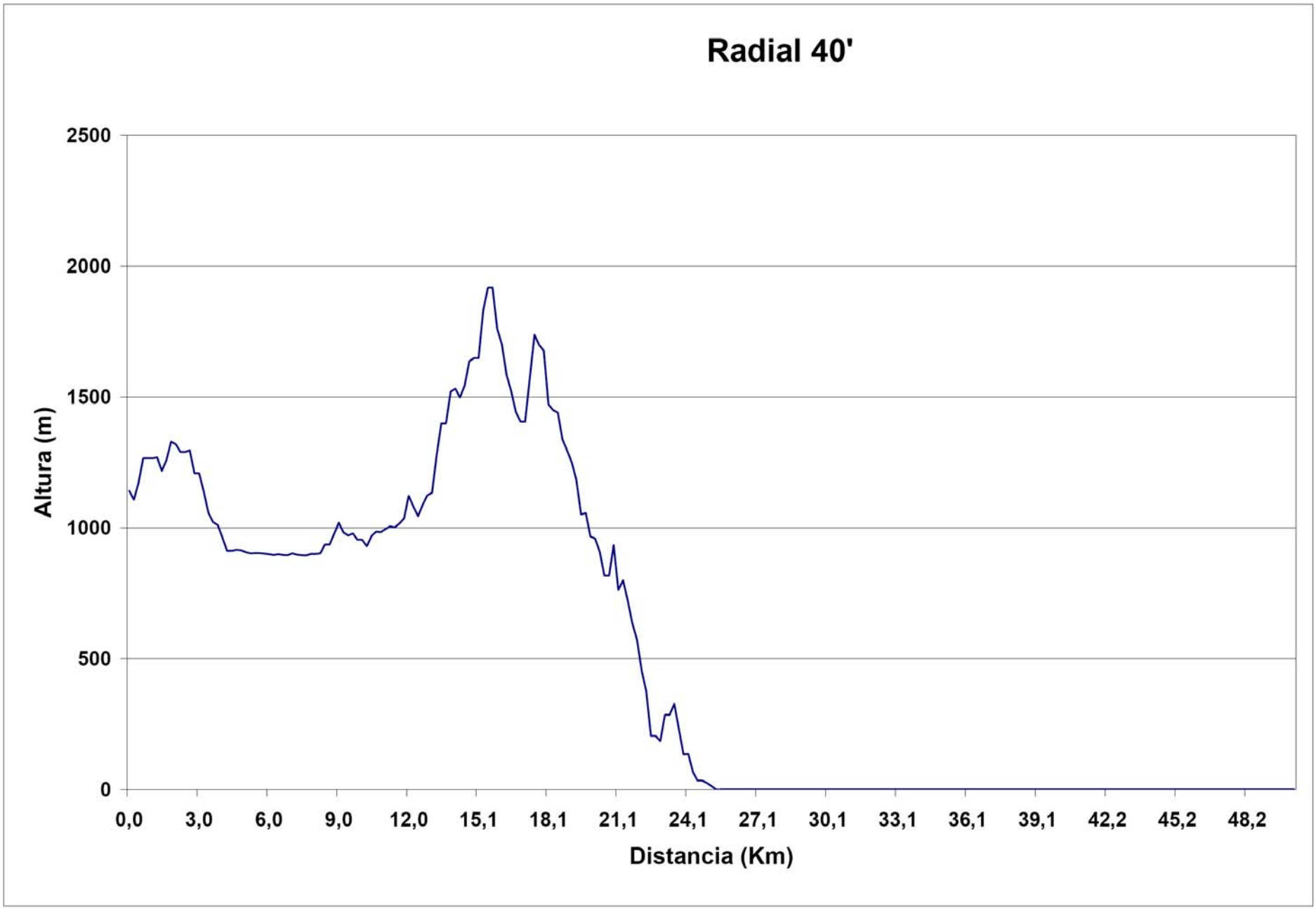
Distancia(Km)	Altura(m)
25,2	0
25,4	0
25,6	0
25,8	0
26	0
26,2	0
26,4	0
26,6	0
26,8	0
27	0
27,2	0
27,4	0
27,6	0
27,8	0
28	0
28,2	0
28,4	0
28,6	0
28,8	0
29	0
29,2	0
29,4	0
29,6	0
29,8	0
30	0
30,2	0
30,4	0
30,6	0
30,8	0
31	0
31,2	0
31,4	0
31,6	0
31,8	0
32	0
32,2	0
32,4	0
32,6	0
32,8	0
33	0
33,2	0
33,4	0
33,6	0
33,8	0
34	0
34,2	0
34,4	0
34,6	0
34,8	0
35	0
35,2	0
35,4	0
35,6	0
35,8	0
36	0
36,2	0
36,4	0
36,6	0
36,8	0
37	0
37,2	0
37,4	0
37,6	0

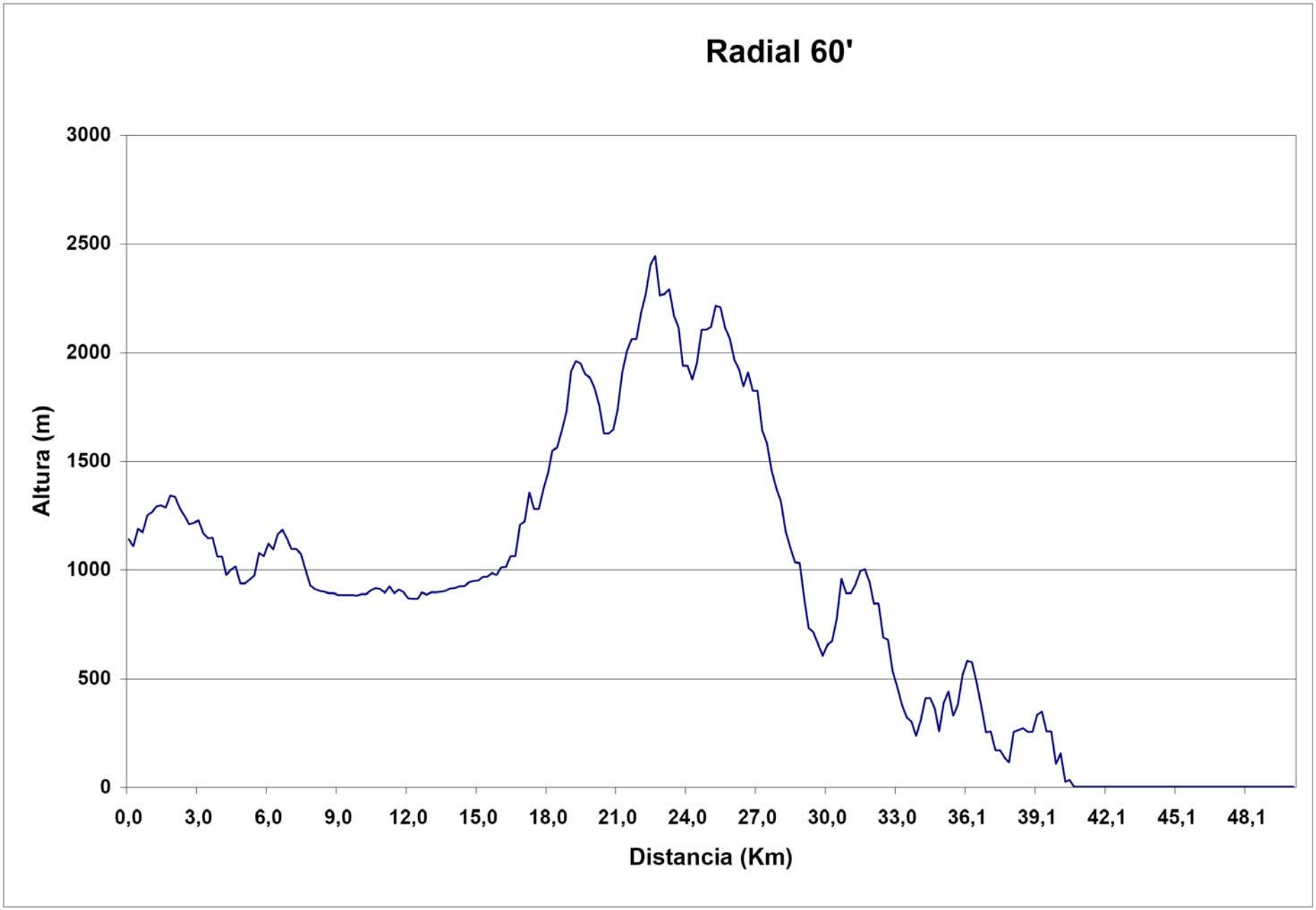
Distancia(Km)	Altura(m)
37,8	0
38	0
38,2	0
38,4	0
38,6	0
38,8	0
39	0
39,2	0
39,4	0
39,6	0
39,8	0
40	0
40,2	0
40,4	0
40,6	0
40,8	0
41	0
41,2	0
41,4	0
41,6	0
41,8	0
42	0
42,2	0
42,4	0
42,6	0
42,8	0
43	0
43,2	0
43,4	0
43,6	0
43,8	0
44	0
44,2	0
44,4	0
44,6	0
44,8	0
45	0
45,2	0
45,4	0
45,6	0
45,8	0
46	0
46,2	0
46,4	0
46,6	0
46,8	0
47	0
47,2	0
47,4	0
47,6	0
47,8	0
48	0
48,2	0
48,4	0
48,6	0
48,8	0
49	0
49,2	0
49,4	0
49,6	0
49,8	0
50	0

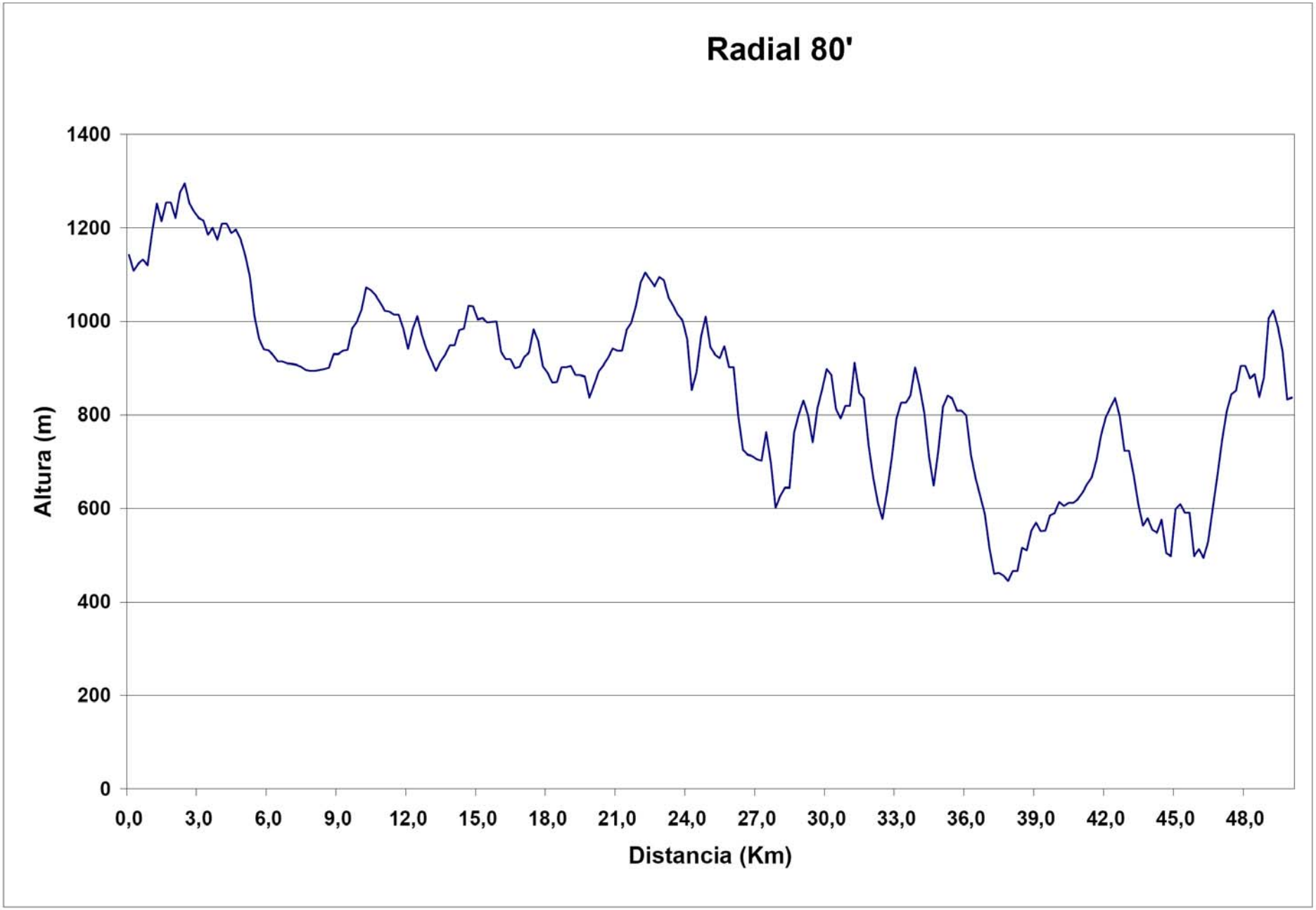
[ANEXO Nº 20]

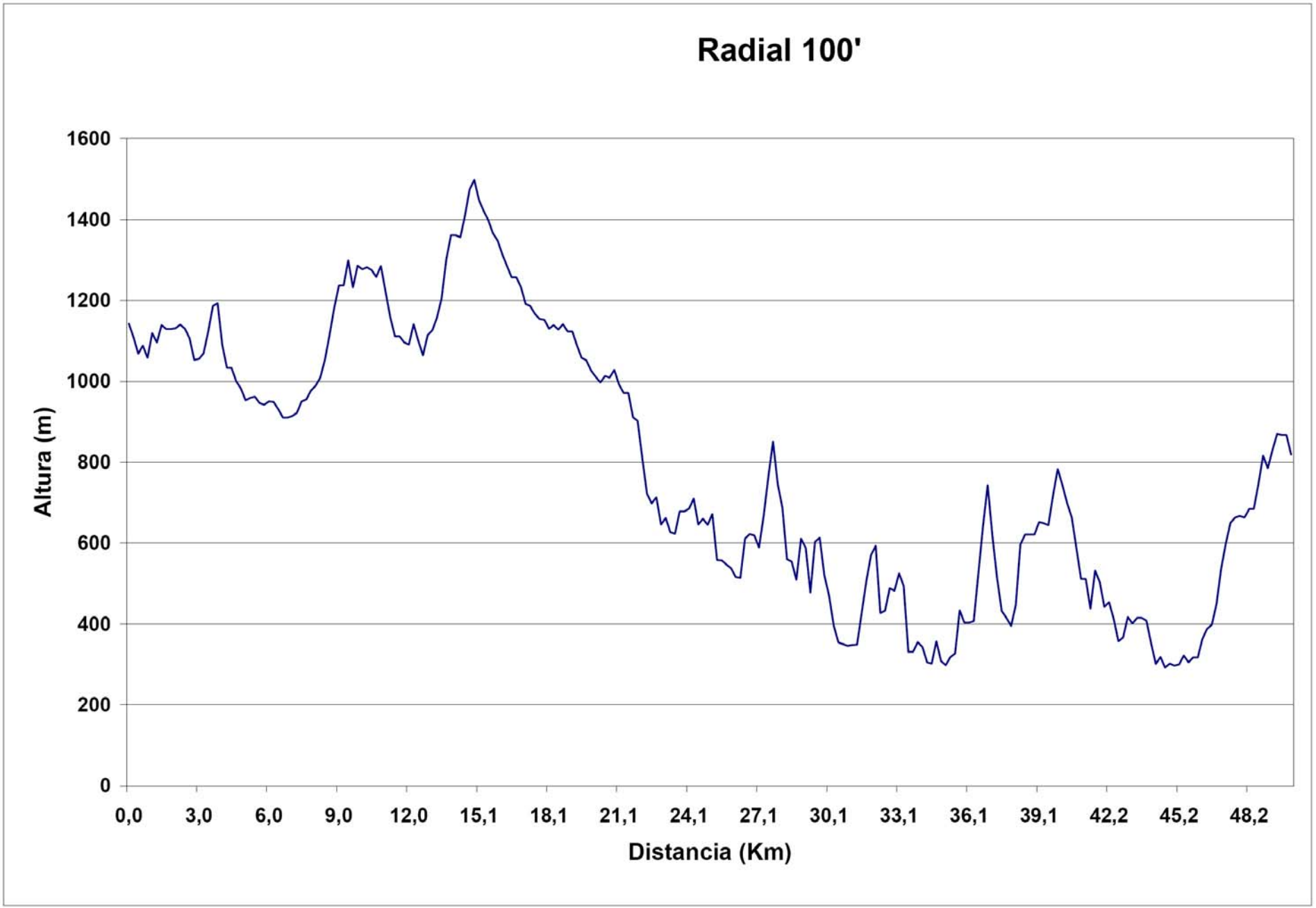

Radial 0'
Altura (m)
1400
1200
1000
800
600
400
200
0
0,0
3,0
6,0
9,0
12,0
15,0
18,0
21,0
24,0
27,0
30,0
33,0
36,0
39,1
42,1
45,1
48,1
51,1
Distancia (Km)

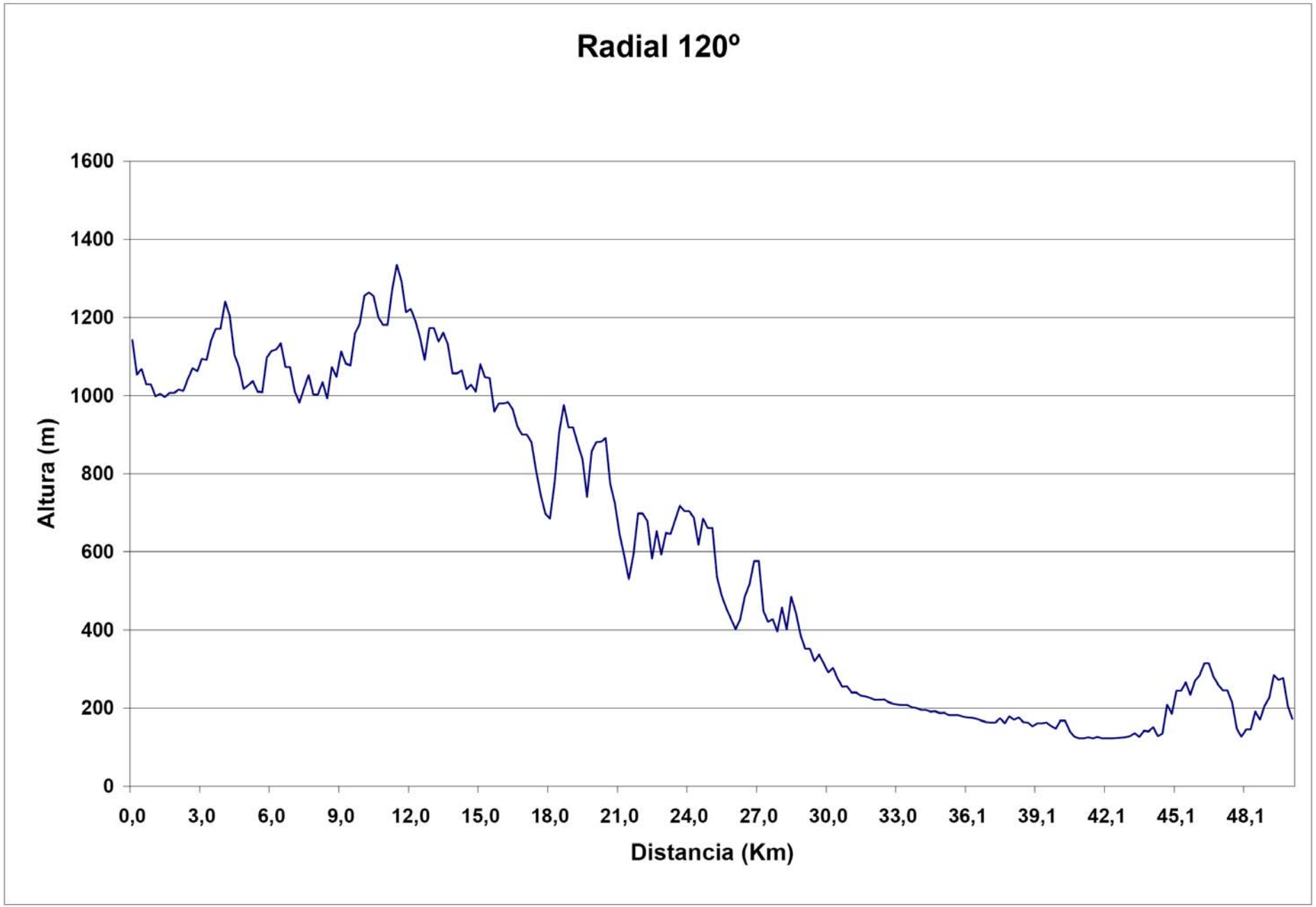

Radial 20'
1400
1200
1000
800
600
400
200
0
Altura (m)
0,0
2,8
5,6
8,4
11,2
14,0
16,8
19,6
22,4
25,2
28,0
30,8
33,6
36,4
39,3
42,1
44,9
47,7
50,5
Distancia (Km)

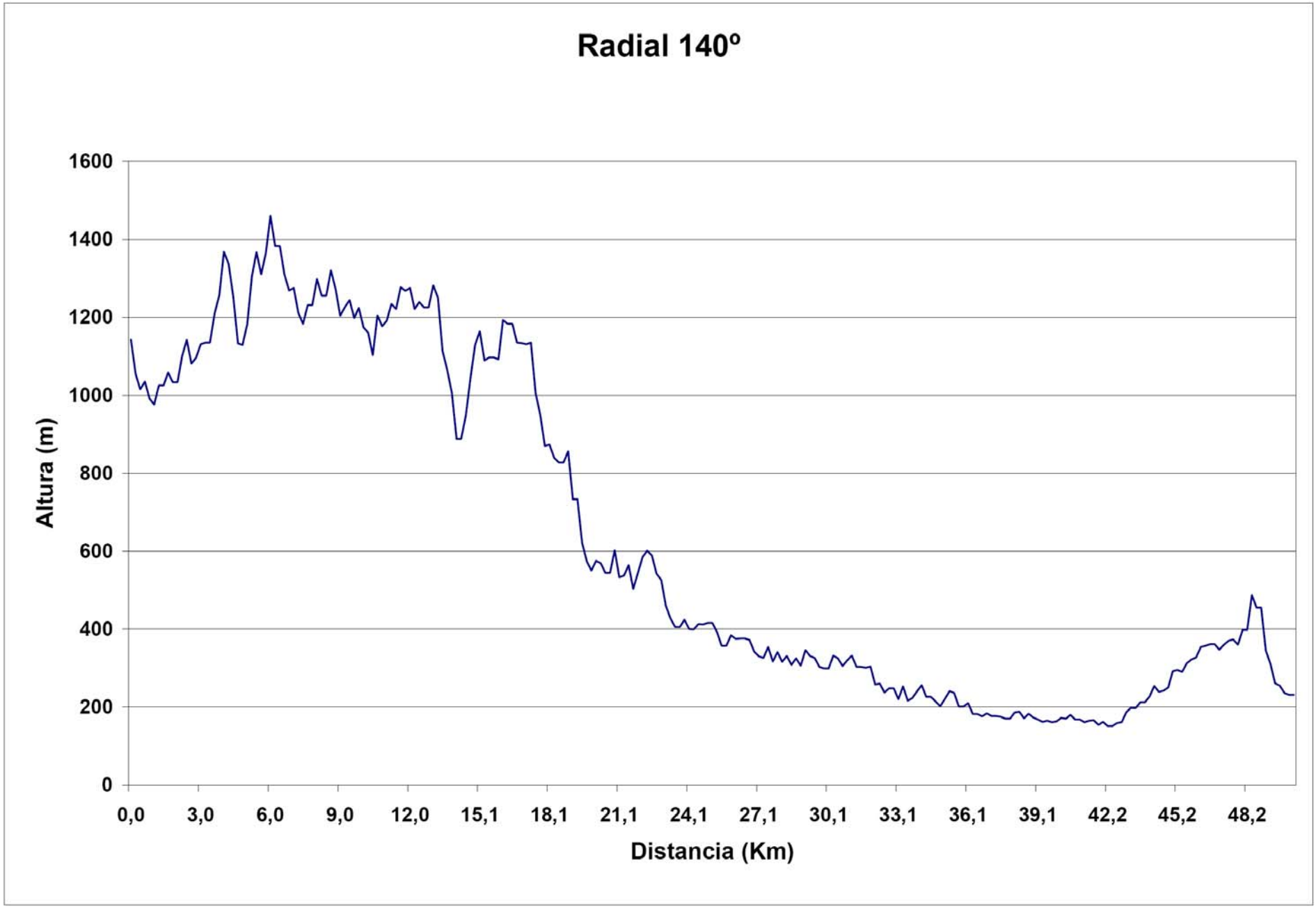

Radial 40'
2500
2000
1500
1000
500
0
Altura (m)
0,0
3,0
6,0
9,0
12,0
15,1
18,1
21,1
24,1
27,1
30,1
33,1
36,1
39,1
42,2
45,2
48,2
Distancia (Km)

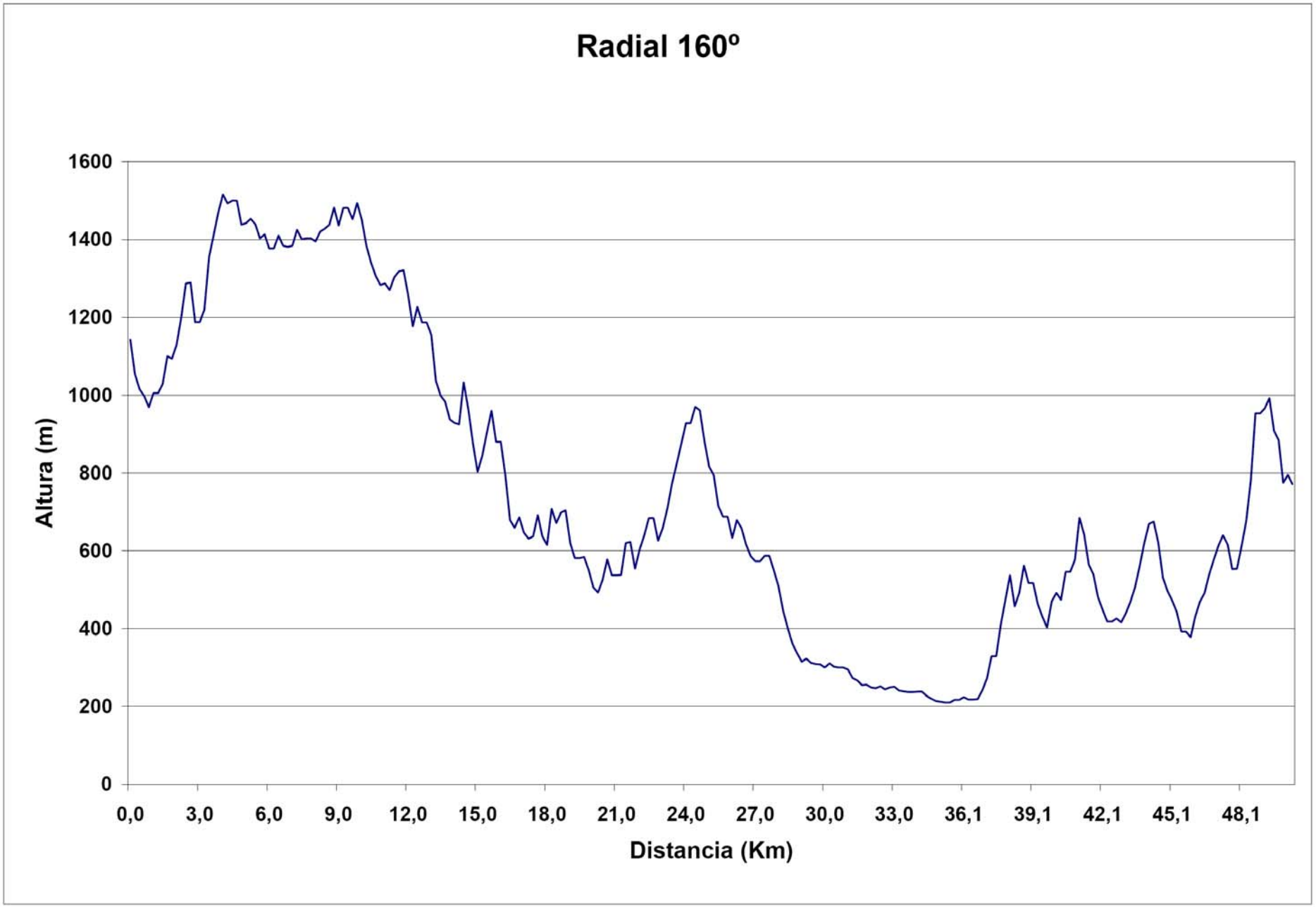

Radial 60'
3000
2500
2000
1500
1000
500
0
Altura (m)
0,0
3,0
6,0
9,0
12,0
15,0
18,0
21,0
24,0
27,0
30,0
33,0
36,1
39,1
42,1
45,1
48,1
Distancia (Km)

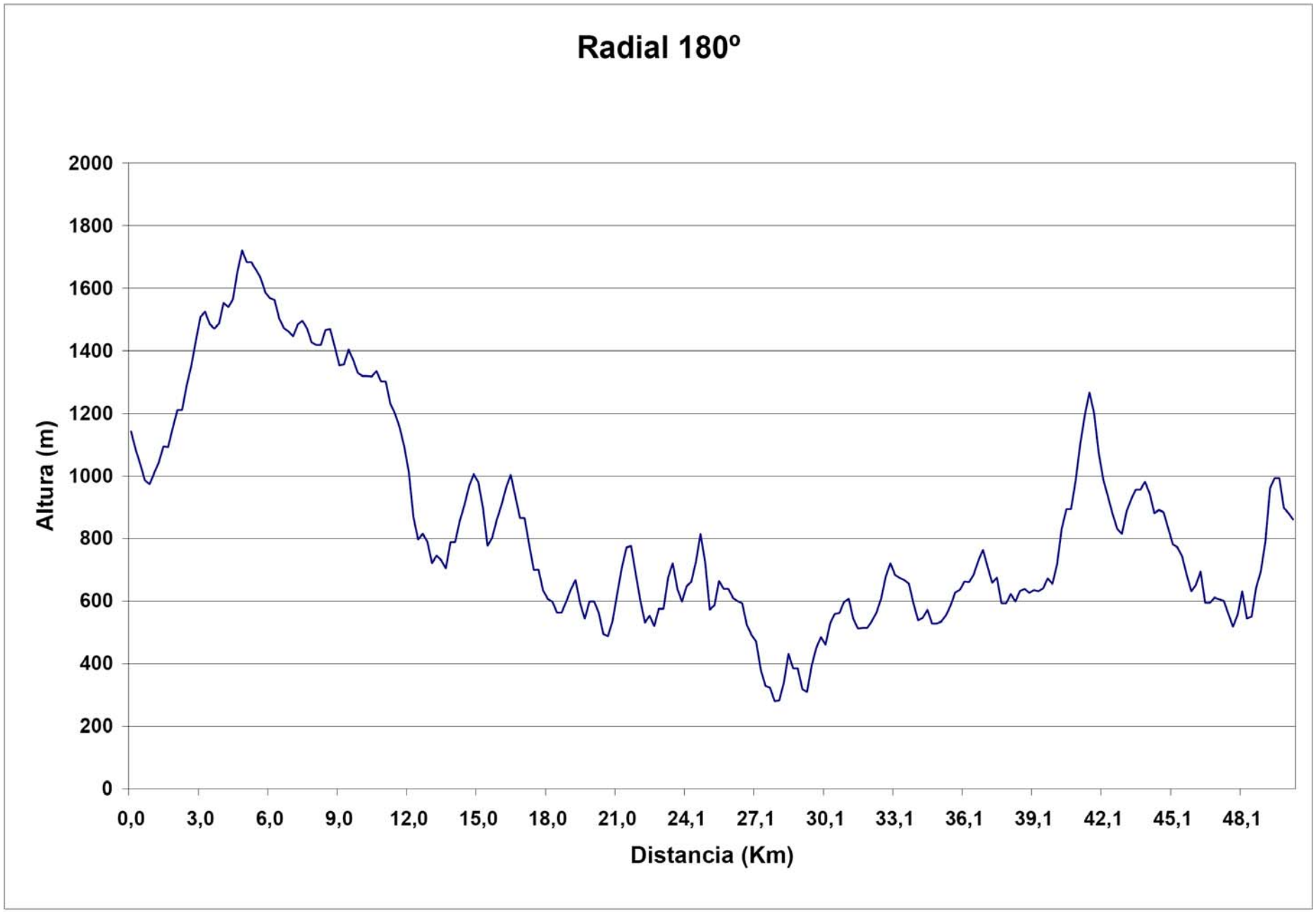

Radial 80'
1400
1200
1000
800
600
400
200
0
Altura (m)
0,0
3,0
6,0
9,0
12,0
15,0
18,0
21,0
24,0
27,0
30,0
33,0
36,0
39,0
42,0
45,0
48,0
Distancia (Km)

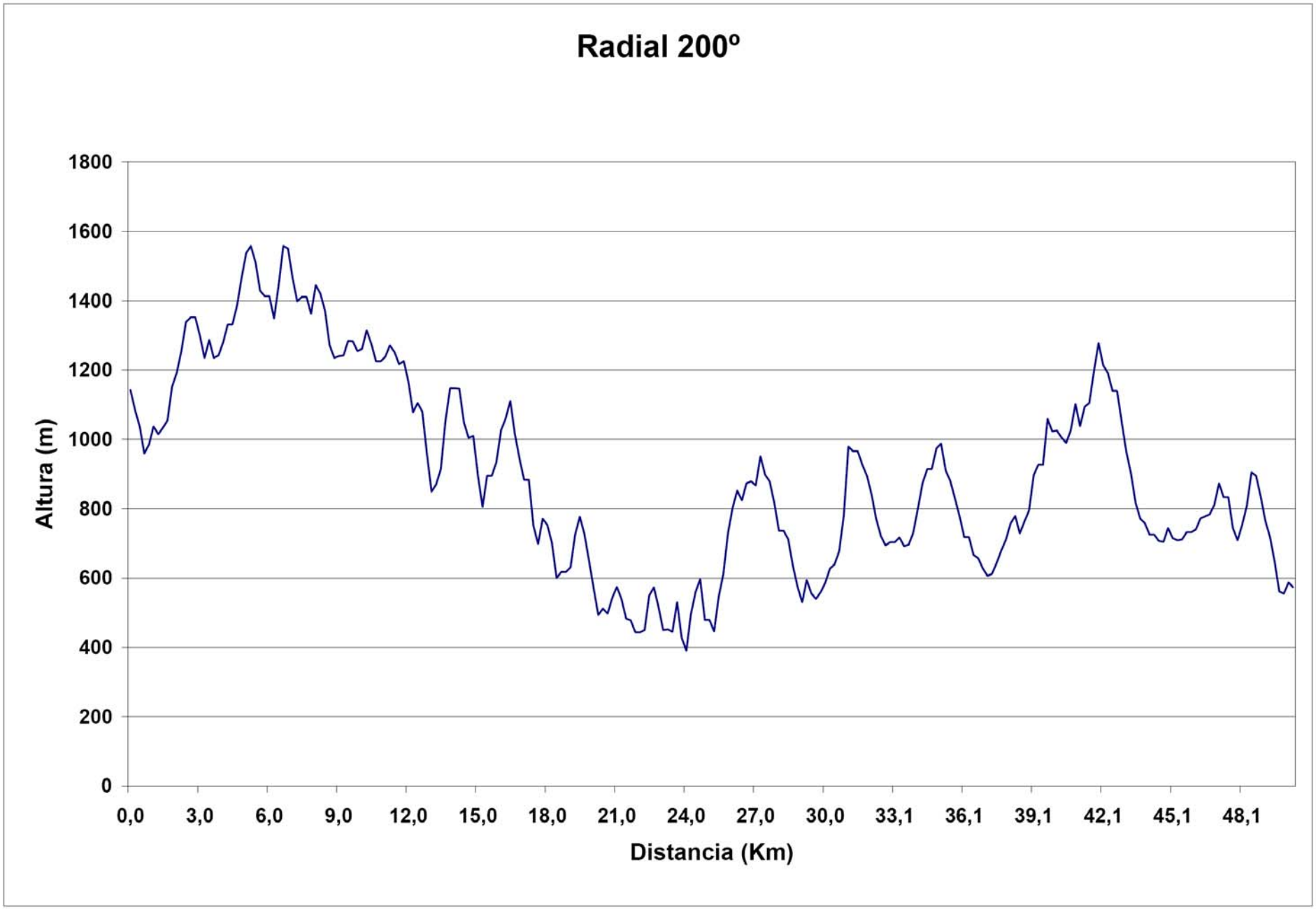

Radial 100'
1600
1400
1200
1000
800
600
400
200
0
Altura (m)
0,0
3,0
6,0
9,0
12,0
15,1
18,1
21,1
24,1
27,1
30,1
33,1
36,1
39,1
42,2
45,2
48,2
Distancia (Km)

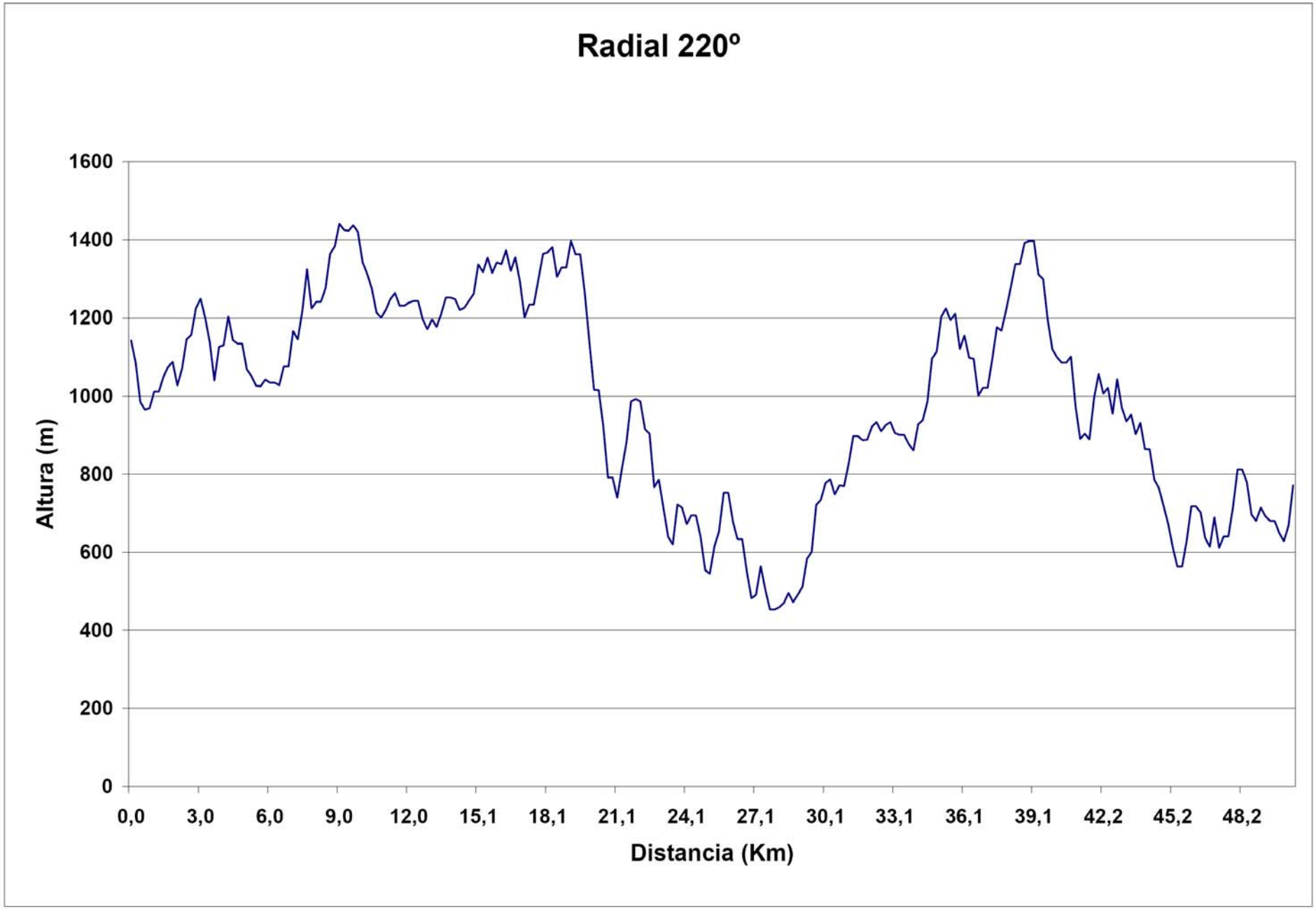

Radial 120º
Altura (m)
1600
1400
1200
1000
800
600
400
200
0
0,0
3,0
6,0
9,0
12,0
15,0
18,0
21,0
24,0
27,0
30,0
33,0
36,1
39,1
42,1
45,1
48,1
Distancia (Km)

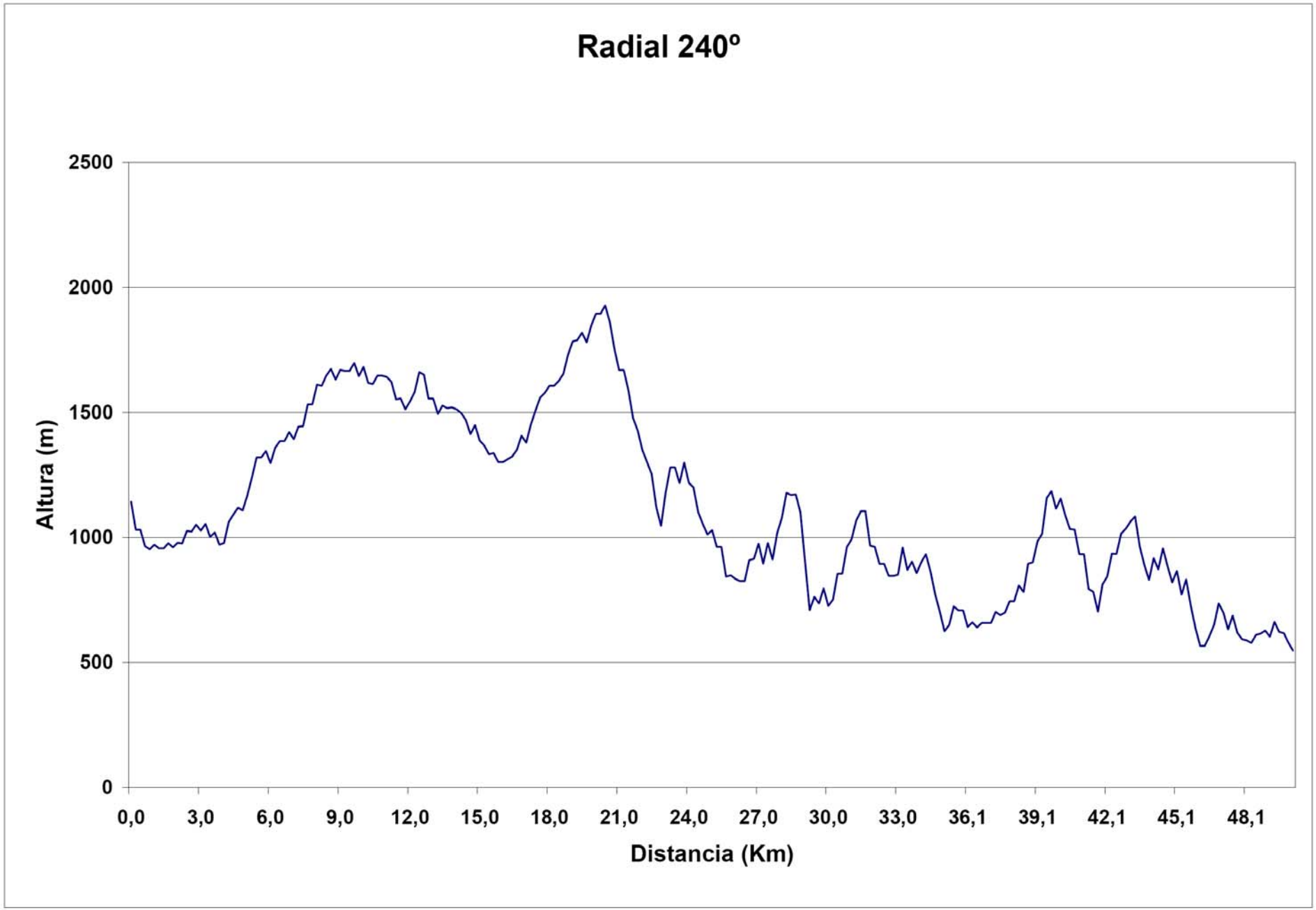

Radial 140º
Altura (m)
1600
1400
1200
1000
800
600
400
200
0
0,0
3,0
6,0
9,0
12,0
15,1
18,1
21,1
24,1
27,1
30,1
33,1
36,1
39,1
42,2
45,2
48,2
Distancia (Km)

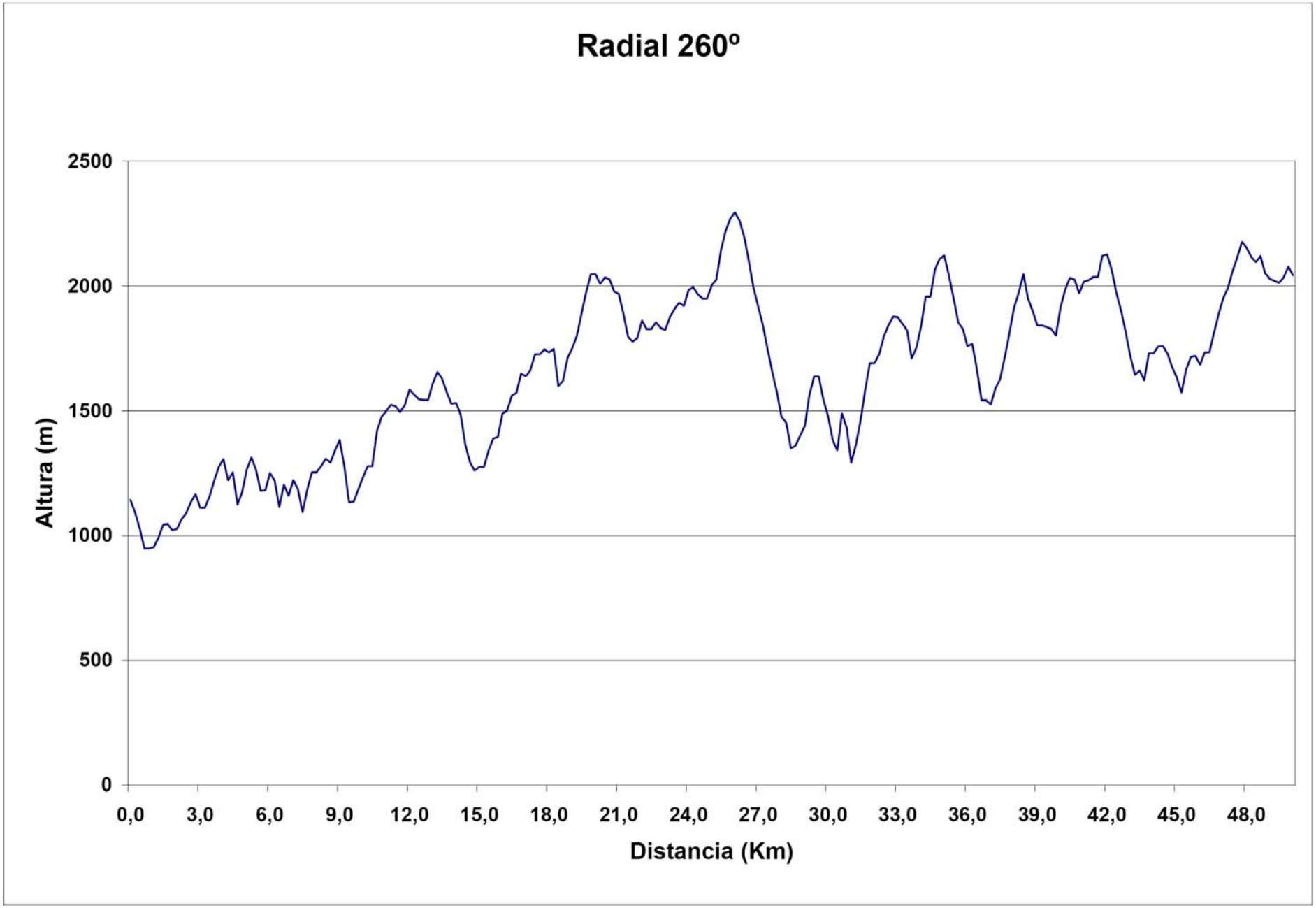

Radial 160º
Altura (m)
1600
1400
1200
1000
800
600
400
200
0
0,0
3,0
6,0
9,0
12,0
15,0
18,0
21,0
24,0
27,0
30,0
33,0
36,1
39,1
42,1
45,1
48,1
Distancia (Km)

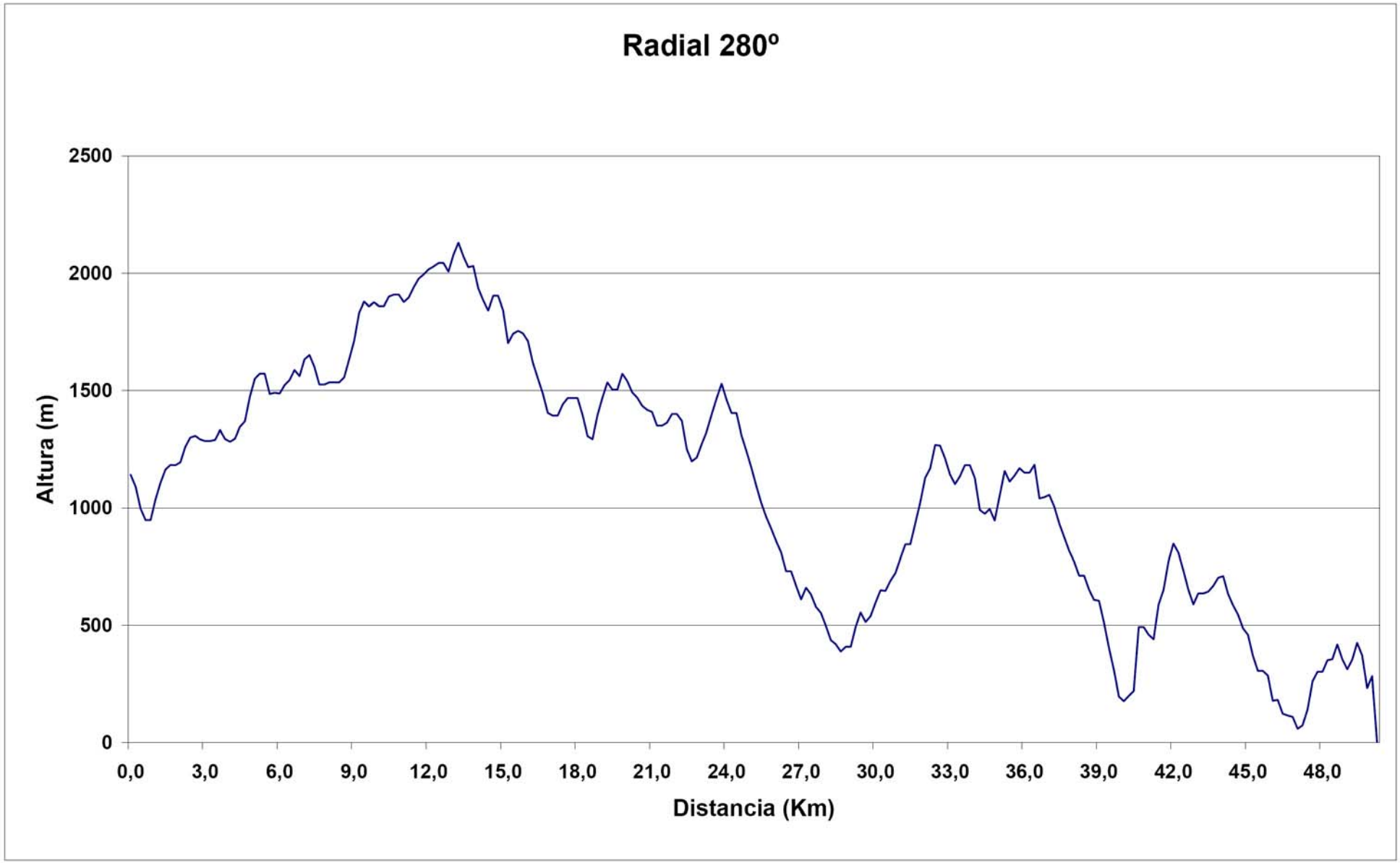

Radial 180º
Altura (m)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0,0
3,0
6,0
9,0
12,0
15,0
18,0
21,0
24,1
27,1
30,1
33,1
36,1
39,1
42,1
45,1
48,1
Distancia (Km)

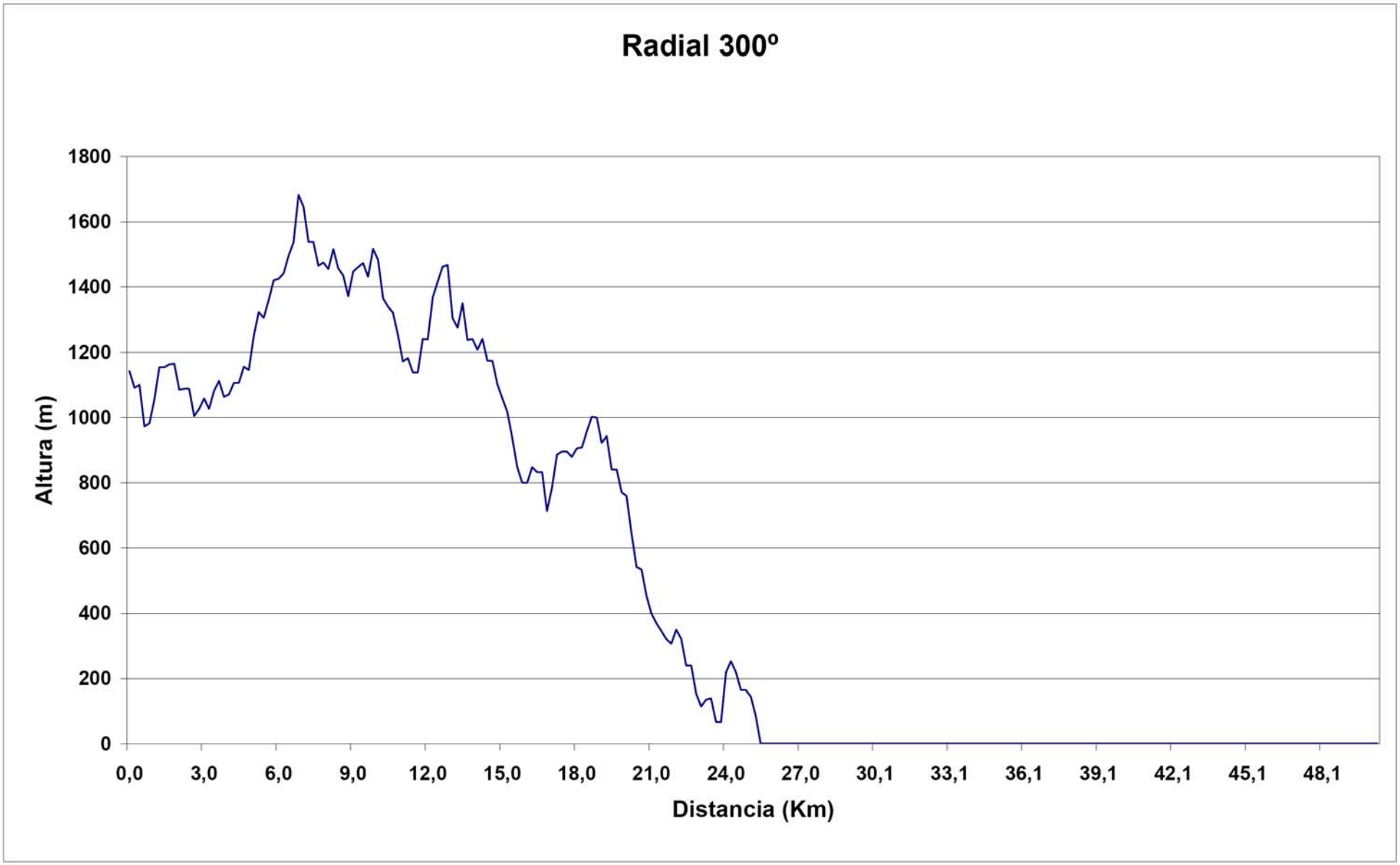

Radial 200º
Altura (m)
1800
1600
1400
1200
1000
800
600
400
200
0
0,0
3,0
6,0
9,0
12,0
15,0
18,0
21,0
24,0
27,0
30,0
33,1
36,1
39,1
42,1
45,1
48,1
Distancia (Km)

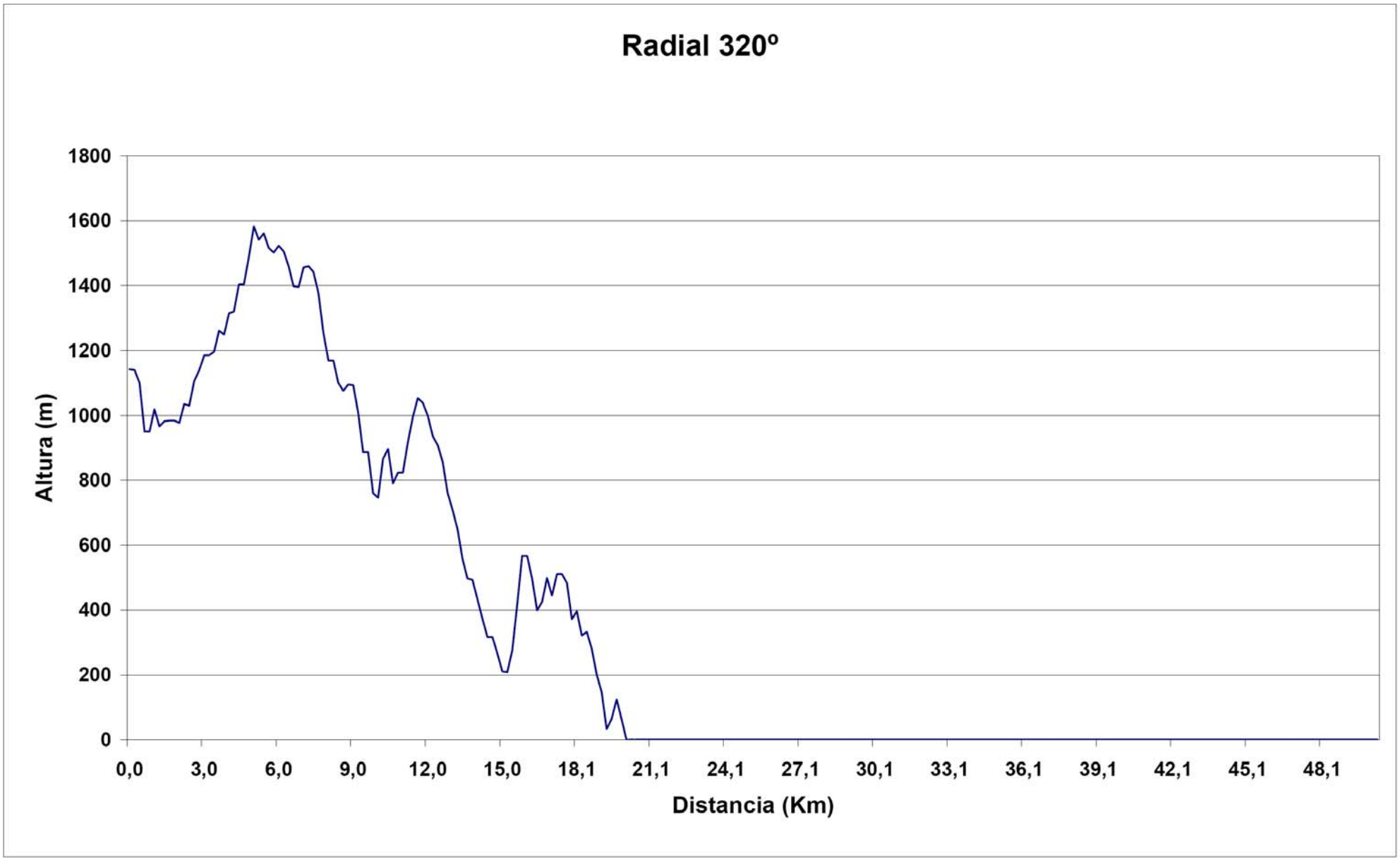

Radial 220º
Altura (m)
1600
1400
1200
1000
800
600
400
200
0
0,0
3,0
6,0
9,0
12,0
15,1
18,1
21,1
24,1
27,1
30,1
33,1
36,1
39,1
42,2
45,2
48,2
Distancia (Km)

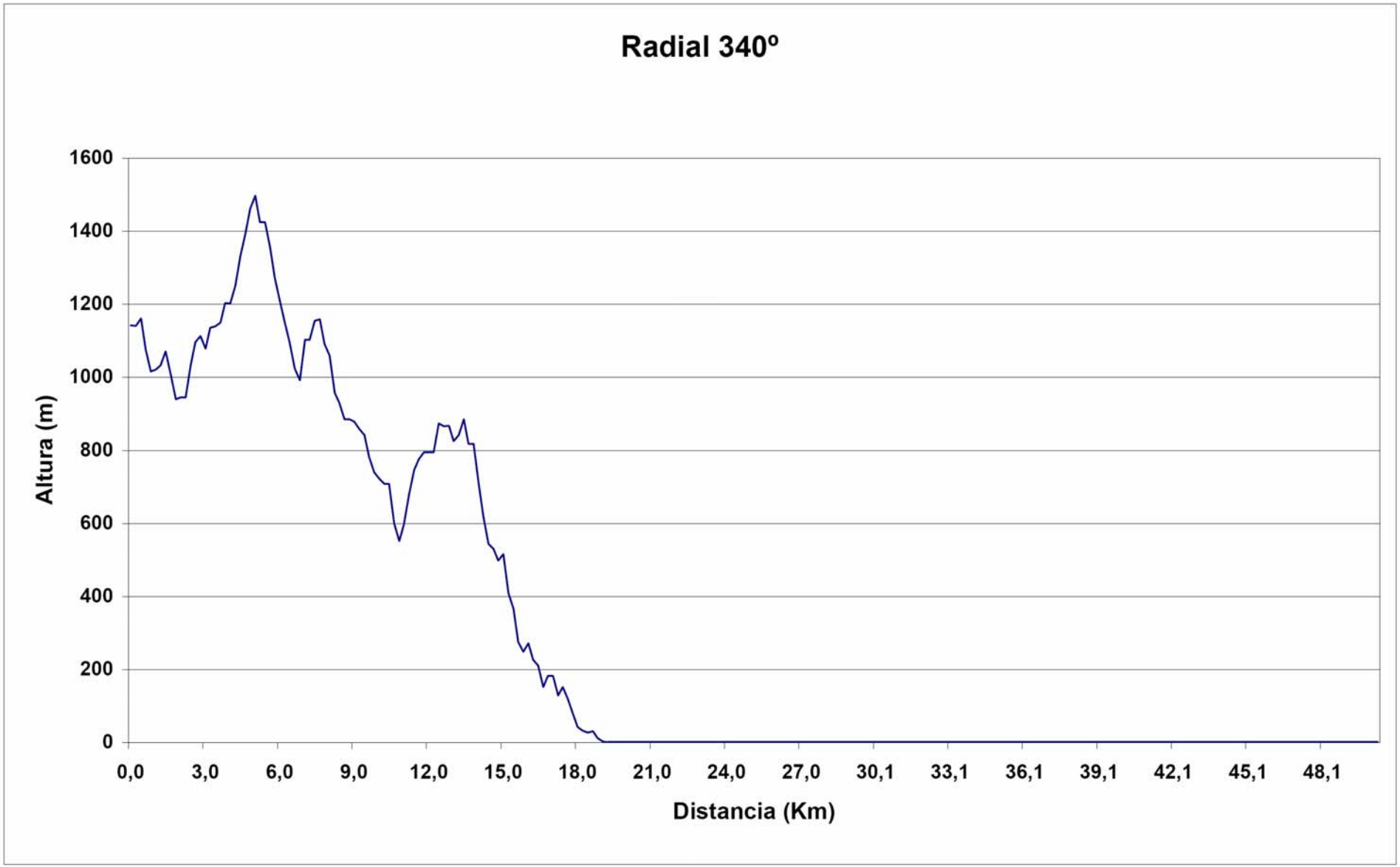

Radial 240º
Altura (m)
2500
2000
1500
1000
500
0
0,0
3,0
6,0
9,0
12,0
15,0
18,0
21,0
24,0
27,0
30,0
33,0
36,1
39,1
42,1
45,1
48,1
Distancia (Km)


Radial 260º
2500
2000
1500
1000
500
0
Altura (m)
0,0
3,0
6,0
9,0
12,0
15,0
18,0
21,0
24,0
27,0
30,0
33,0
36,0
39,0
42,0
45,0
48,0
Distancia (Km)


Radial 280º
2500
2000
1500
1000
500
0
Altura (m)
0,0
3,0
6,0
9,0
12,0
15,0
18,0
21,0
24,0
27,0
30,0
33,0
36,0
39,0
42,0
45,0
48,0
Distancia (Km)


Radial 300º
Altura (m)
1800
1600
1400
1200
1000
800
600
400
200
0
0,0
3,0
6,0
9,0
12,0
15,0
18,0
21,0
24,0
27,0
30,1
33,1
36,1
39,1
42,1
45,1
48,1
Distancia (Km)


Radial 320º
Altura (m)
1800
1600
1400
1200
1000
800
600
400
200
0
0,0
3,0
6,0
9,0
12,0
15,0
18,1
21,1
24,1
27,1
30,1
33,1
36,1
39,1
42,1
45,1
48,1
Distancia (Km)


Radial 340º
Altura (m)
1600
1400
1200
1000
800
600
400
200
0
0,0
3,0
6,0
9,0
12,0
15,0
18,0
21,0
24,0
27,0
30,1
33,1
36,1
39,1
42,1
45,1
48,1
Distancia (Km)

[ANEXO Nº 21]

Cálculos de los Contornos de Cobertura

Las ecuaciones a continuación, especificadas en el anexo Nº 10, y serán usadas para hallar los niveles de intensidad de campo correspondientes al primer, segundo y tercer contorno de cobertura:

a) $Gant = 10 * \log [g * ({}^{0}/_{1}V)^2 * ({}^{0}/_{1}H)^2]$

b) $P_{Tx} = 10 * \log [P/1Kw]$

c) $PER = P_{Tx} + Gant - Pa$

d) $\Delta f = C - [0,03 * (\Delta h) * (1 + f/300)]$ [dB]

e) $NSE = PER + F(50,50) + \Delta f$

A continuación se especifican una serie de variables que serán requeridas en todos los cálculos posteriores:

- Perdida de los alimentadores: Pa = 1,032dB
- Altura de la antena: ANT = 47m
- Altura del Terreno: TRANS = 1121m
- Potencia del Transmisor: $P_{Tx} = 500W = 10 \cdot \log(\frac{500W}{1kW}) = -3,01dBk$
- Altura del sistema radiante sobre el nivel del mar:

A = ANT + TRANS = 47m + 1121m = 1168m

- Portadora de video: f = 199.25MHz

Al operar las ecuaciones mencionadas anteriormente y sustituyendo las constantes respectivas se obtiene:

$$F(50,50) = NSE - Gant + 0,05 \cdot \Delta h + 1.54dB$$

El calculo de los niveles de intensidad de campo en las curvas F(50,50) se halla a partir de una ASPT que depende del radial en estudio y la distancia al punto donde se desea conocer dicho nivel de intensidad de campo. Usando la ecuación anterior y el método de calculo de la FCC se hallan los contornos de cobertura exigidos por CONATEL.

Radial: 0º

	Gant(dB) = -10,79dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 89,33dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 83,3dBu	
Tercer Contorno	60	0
Ecuación Resultante	F(50,50) = 72,3dBu	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50)[dBu] Grafico	
1037	0,0	3,0	1168,0		
1079	1058,0	3,2	110,0	92	
1118	1078,3	3,4	89,7	**90,2**	**Primer Contorno**
1148	1096,5	3,6	71,5	**88**	
1148	1109,4	4,0	49,4	**83,3**	**Segundo Contorno**
1163	1118,6	4,2	41,2		
1173	1126,8	5,0	30,0	74,9	
1195	1135,0	5,4	30,0	73,7	
1238	1145,2	5,8	30,0	**72,4**	**Tercer Contorno**
1281	1157,9	6,0	30,0	**71,8**	

Primer Contorno de Cobertura: d = 3,5 Km
Segundo Contorno de Cobertura: d = 4 Km
Tercer Contorno de Cobertura: d = 5,9 Km

Radial: 20º

	Gant(dB) = -10,79dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 89,33dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 83,3dBu	
Tercer Contorno	60	0
Ecuación Resultante	F(50,50) = 72,3dBu	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	
920		3,0			
925	922,50	3,2	245,5	94,5	
933	925,75	3,4	242,3	94	
963	933,16	3,6	234,8	93,5	
1163	964,99	4,0	203,0		
1173	998,85	4,2	169,1	**90,3**	**Primer Contorno**
1195	1025,31	4,4	142,7	**88,79**	
1211	1089,94	5,0	78,1	**83**	**Segundo Contorno**
1225	1101,59	5,2	66,4	**81**	
1289	1127,20	5,6	40,8	75,6	
1238	1136,94	5,8	31,1	**72,7**	**Tercer Contorno**
1164	1141,21	6,0	30,0	**72**	

Primer Contorno de Cobertura: d = 4,3 Km
Segundo Contorno de Cobertura: d = 5,1 Km
Tercer Contorno de Cobertura: d = 5,9 Km

Radial: 40º

	Gant(dB) = -10,79dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 89,33dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 83,3dBu	
Tercer Contorno	60	0
Ecuación Resultante	F(50,50) = 72,33dBu	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

d(Km)	Altura(m)	ASPT(m)	F(50,50) [dBu] Grafico	
0,0	1121	0		
1,0	1266	30		
2,0	1320	30		
2,2	1290	30	**89,3**	**Primer Contorno**

d(Km)	Altura(m)	APT(m)	ASPT(m)	F(50,50) [dBu] Grafico	
3,0	1209				
3,2	1140	1174,5	30,0		
3,4	1058	1136,8	31,3	**83,9**	**Segundo Contorno**
3,6	1022	1104,5	63,5	87,25	
3,8	1011	1082,5	85,5	88,05	
4,0	964	1063,5	104,5	88,43	
4,2	913	1042,7	125,3	88,79	
4,4	913	1024,1	143,9	79,3	
4,6	917	1010,5	157,5	88,74	
4,8	915	1000,0	168,0	78	
5,0	908	991,1	176,9		
5,2	903	983,4	184,6	**72,7**	**Tercer Contorno**
5,4	903	980	190,0	**73**	
6,0	900	961,9	206,1		

Primer Contorno de Cobertura: d = 2,2 Km
Segundo Contorno de Cobertura: d = 3,4 Km
Tercer Contorno de Cobertura: d = 5,5 Km

Radial: 60º

	Gant(dB) = -10,79dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 89,33dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 83,33dBu	
Tercer Contorno	60	0
Ecuación Resultante	F(50,50) = 72,33dBu	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

d	ASPT	F(50,50) Grafico	
2,2	30,0	**89,6**	**Primer Contorno**
2,6	30,0	86,7	

d	ASPT	F(50,50) Grafico	
3,0	30,0	**83,8**	**Segundo Contorno**
3,2	30,0	**82,9**	
3,6	30,0	80,8	
4,0	34,2	79,9	
4,2	53,4		
4,4	71,4		
5,0	108,2		
5,2	110,2	**72,7**	**Tercer Contorno**
6,0	121,3		
7,0	98,4		
8,0	108,2		
9,0	135,3		
9,8	152,8		

Primer Contorno de Cobertura: d = 2,2 Km
Segundo Contorno de Cobertura: d = 3,1 Km
Tercer Contorno de Cobertura: d = 5,2 Km

Radial: 80º

	Gant(dB) = -10,79dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 89,33dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 83,33dBu	
Tercer Contorno	60	0
Ecuación Resultante	F(50,50) = 72,33dBu	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	
1142	0,0	26		
1108	0,2	60		
1123	0,4	45		
1132	0,6	36		
1120	0,8	48		
1191	1,0	30		
1252	1,2	30		
1214	1,4	30		
1254	1,6	30		
1254	1,8	30		
1221	2,0	30		
1276	2,2	30	**89,6**	**Primer Contorno**
1295	2,4	30		
1252	2,6	30		

Altura(m)	APT(m)	d(m)	ASPT(m)	F(50,50) [dBu] Grafico	
1221		3,0	30	**84**	**Segundo Contorno**
1216	1218,5	3,2	30	**82,9**	
1185	1209,5	3,4	30		
1200	1203,8	3,6	30		
1174	1199,6	3,8	30		
1209	1198,0	4,0	30		
1209	1199,8	4,2	30		
1189	1199,7	4,4	30		
1196	1198,8	4,6	30		
1176	1197,4	4,8	30		
1141	1193,5	5,0	30		
1095	1186,6	5,2	30		

1011	1175,5	5,4	30		
962	1161,0	5,6	30,0		
940	1146,0	5,8	30,0	**72,4**	**Tercer Contorno**
938	1132,2	6,0	35,8		
928	1119,7	6,2	48,3		
914	1108,0	6,4	60,0		
914	1097,3	6,6	70,7		
910	1087,5	6,8	80,5		

Primer Contorno de Cobertura: d = 2,2 Km
Segundo Contorno de Cobertura: d = 3,1 Km
Tercer Contorno de Cobertura: d = 5,8 Km

Radial: 100º

	Gant(dB) = -0,89dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 79,43dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 73,43dBu + 0,05·Δh	
Tercer Contorno	60	No determinado
Ecuación Resultante	F(50,50) = 62,43dBu + 0,05·Δh	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

d(Km)	Altura(m)	APT(m)	ASPT(m)	F(50,50) [dBu] Grafico	
3,0	1055	0,0	1168,0		
3,2	1069	1062,0	106,0		
3,4	1123	1079,0	89,0		
3,6	1186	1104,2	63,8		
3,8	1193	1125,5	42,5		
4,0	1090	1128,7	39,3	81,1	
4,2	1033	1117,5	50,5	82,7	
4,4	1033	1105,4	62,6		
4,6	1000	1094,3	73,7	84,0	
4,8	982	1082,8	85,2		
5,0	953	1071,3	96,7	84,5	
5,2	959	1060,8	107,2		
5,4	962	1052,5	115,5		
5,6	946	1044,9	123,1		
5,8	942	1037,7	130,3		
6,0	950	1031,6	136,4	84,0	
6,2	949	1026,4	141,6		
6,4	931	1021,4	146,6		
6,6	910	1015,7	152,3		
6,8	910	1010,2	157,8		
7,0	914	1005,3	162,7	82,9	
7,2	922	1001,1	166,9		
7,4	950	998,2	169,8		
7,6	955	996,2	171,8		
7,8	977	994,9	173,1		
8,0	989	994,4	173,6	81,4	
8,2	1009	994,6	173,4		
8,4	1053	996,0	172,0		
8,6	1115	999,1	168,9		
8,8	1182	1004,3	163,7	**79,5**	**Primer Contorno**
9,0	1237	1011,1	156,9	**78,9**	

							NSE 71dBu	NSE 60dBu			NSE 60dBu			NSE 71dBu		
Altura(m)	APT(m)	n	Xi	xi^2	σ	Δh	F(50,50)	F(50,50)	d(Km)	ASPT(m)	F(50,50) [dBu]	F(50,50) [dBu] Grafico		F(50,50) [dBu] Grafico	F(50,50) [dBu]	
1277	1047,0	1	1277	1630729					10,0	121,0						
1282	1053,4	2	1282	1643524	3,53553391	9,0509668	73,9	62,9	10,2	114,6		62,9		74,6	73,9	
1275	1059,5	3	1275	1625625	3,60555128	9,23021127	73,9	62,9	10,4	108,5		62,9		**73,9**	**73,9**	**Segundo Contorno**
1258	1065,0	4	1258	1582564	10,4243305	26,6862861	74,8	63,8	10,6	103,0		63,8			74,8	
1285	1070,3	5	1285	1651225	10,5023807	26,8860945	74,8	63,8	10,8	97,7		63,8			74,8	
1221	1074,8	6	1221	1490841	24,1136199	61,730867	76,5	65,5	11,0	93,2	71,64	65,5			76,5	
1158	1077,6	7	1158	1340964	46,4880937	119,00952	79,4	68,4	11,2	90,4		68,4			79,4	
1111	1079,0	8	1111	1234321	65,5546392	167,819876	81,8	70,8	11,4	89,0	**70,66**	**70,8**	**Tercer Contorno**		81,8	
1111	1079,7	9	1111	1234321	73,6491306	188,541774	82,9	71,9	11,6	88,3		71,9			82,9	
1096	1080,3	10	1096	1201216	79,7094725	204,056249	83,6	72,6	11,8	87,7		72,6			83,6	

Primer Contorno de Cobertura: d = 8,8 Km
Segundo Contorno de Cobertura: d = 10,4 Km
Tercer Contorno de Cobertura: d = 11,4 Km

Radial: 120º

	Gant(dB) = 2,49dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 76,05dBu	
Segundo Contorno	71	No determinado
Ecuación Resultante	F(50,50) = 70,05dBu + 0,05·Δh	
Tercer Contorno	60	No determinado
Ecuación Resultante	F(50,50) = 59,05dBu + 0,05·Δh	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	
1094	0,0	3,0	1168,0		
1091	1092,5	3,2	75,5		
1142	1104,5	3,4	63,5		
1171	1121,8	3,6	46,2		
1171	1134,1	3,8	33,9		
1241	1148,5	4,0	30,0		
1204	1160,8	4,2	30,0		
1105	1159,9	4,4	30,0		
1073	1151,1	4,6	30,0	**76,5**	**Primer Contorno**
1017	1139,3	4,8	30,0	**75,7**	
1027	1127,6	5,0	40,4		

							NSE 71dBu	NSE 60dBu			NSE 71dBu			NSE 60dBu		
Altura(m)	APT(m)	n	Xi	xi^2	σ	Δh	F(50,50)	F(50,50)	d(Km)	ASPT(Km)	F(50,50) [dBu] Grafico	F(50,50) [dBu]		F(50,50) [dBu] Grafico	F(50,50) [dBu]	
1255	1083,2	1	1255	1575025					10,0	84,8						
1264	1088,1	2	1264	1597696	6,36396103	16,2917402	70,9	59,9	10,2	79,9	71,45	70,9			59,9	
1254	1092,8	3	1254	1572516	5,50757055	14,0993806	70,8	59,8	10,4	75,2	70,5	**70,8**	**Segundo**		59,8	
1201	1096,3	4	1201	1442401	28,6879766	73,44122	73,7	62,7	10,6	71,7		**73,7**	**Contorno**		62,7	
1181	1098,7	5	1181	1394761	37,3965239	95,7351012	74,8	63,8	10,8	69,3		74,8			63,8	
1181	1100,8	6	1181	1394761	39,1850312	100,31368	75,1	64,1	11,0	67,2		75,1			64,1	
1272	1103,9	7	1272	1617984	40,3390393	103,267941	75,2	64,2	11,2	64,1		75,2			64,2	
1335	1108,6	8	1335	1782225	52,7296	134,987776	76,8	65,8	11,4	59,4		76,8		65,4	65,8	**Tercer Contorno**
1293	1113,4	9	1293	1671849	52,077133	133,31746	76,7	65,7	11,6	54,6		76,7			65,7	
1213	1116,6	10	1213	1471369	50,3619124	128,926496	76,5	65,5	11,8	51,4		76,5			65,5	
1222	1118,8	11	1222	1493284	48,2738401	123,581031	76,2	65,2	12,0	49,2		76,2		64,5	65,2	
1191	1120,7	12	1191	1418481	48,3970322	123,896402	76,2	65,2	12,2	47,3		76,2			65,2	

Primer Contorno de Cobertura: d = 4,7 Km
Segundo Contorno de Cobertura: d = 10,4 Km
Tercer Contorno de Cobertura: d = 11,4 Km

Radial: 140º

	Gant(dB) = 4,01dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 74,53dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 68,53	
Tercer Contorno	60	No determinado
Ecuación Resultante	F(50,50) = 57,53dBu + 0,05·Δh	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50)	
1131	0,0	3,0	1168,0		
1135	1133,0	3,2	35,0		
1135	1134,0	3,4	34,0		
1210	1146,8	3,6	21,2		
1257	1168,5	3,8	30,0		
1368	1197,3	4,0	30,0		
1337	1223,2	4,2	30,0		
1252	1233,4	4,4	30,0		
1133	1228,2	4,6	30,0		
1129	1217,4	4,8	30,0		
1182	1211,3	5,0	30,0		
1305	1214,2	5,2	30,0	**74,3**	**Primer Contorno**
1367	1224,3	5,4	30,0		
1310	1233,1	5,6	30,0		
1365	1240,6	5,8	30,0		
1460	1252,0	6,0	30,0		
1383	1262,6	6,2	30,0		
1383	1269,7	6,4	30,0		
1310	1274,0	6,6	30,0		
1269	1274,8	6,8	30,0		
1275	1274,7	7,0	30,0		
1211	1273,1	7,2	30,0	**68,6**	**Segundo Contorno**
1183	1269,7	7,4	30,0		
1231	1267,0	7,6	30,0		
1231	1265,5	7,8	30,0		
1298	1265,4	8,0	30,0		

Altura(m)	APT(m)	n	Xi	xi^2	σ	Δh	NSE 60dBu F(50,50) [dBu]	d(Km)	ASPT(m)	NSE 60dBu F(50,50) [dBu] Grafico	NSE 60dBu F(50,50) [dBu]	
1174	1259,1	1	1174	1378276				10,0	30			
1160	1256,6	2	1160	1345600	9,89949494	25,342707	58,80	10,2	30		58,8	
1103	1253,2	3	1103	1216609	37,6076233	96,2755158	62,34	10,4	30	**62,5**	**62,3**	**Tercer Contorno**
1205	1250,6	4	1205	1452025	42,6966041	109,303306	63,00	10,6	30		63,0	
1177	1249,1	5	1177	1385329	37,7054373	96,5259194	62,36	10,8	30		62,4	
1191	1247,4	6	1191	1418481	35,5058681	90,8950222	62,07	11,0	30	61,6	62,1	

Primer Contorno de Cobertura: d = 5,2 Km
Segundo Contorno de Cobertura: d = 7,2 Km
Tercer Contorno de Cobertura: d = 10,4 Km

Radial: 160º

	Gant(dB) = 2,85dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 75,7dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 69,7 dBu	
Tercer Contorno	60	No determinado
Ecuación Resultante	F(50,50) = 58,7dBu + 0,05·Δh	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	
1188	0,0	3,0	1168		
1220	1204,0	3,2	30		
1355	1245,8	3,4	30		
1411	1291,5	3,6	30		
1470	1328,8	3,8	30		
1515	1361,5	4,0	30		
1493	1385,3	4,2	30		
1500	1401,1	4,4	30		
1500	1413,5	4,6	30		
1438	1419,7	4,8	30	**75,7**	**Primer Contorno**
1442	1421,7	5,0	30		
1453	1424,0	5,2	30		
1439	1425,9	5,4	30		
1403	1425,5	5,6	30		
1413	1424,3	5,8	30		
1377	1422,3	6,0	30		
1377	1419,5	6,2	30		
1410	1417,9	6,4	30		
1384	1416,8	6,6	30		
1381	1415,0	6,8	30	**69,7**	**Segundo Contorno**
1384	1413,4	7,0	30		
1425	1412,9	7,2	30		
1401	1412,9	7,4	30		
1403	1412,5	7,6	30		
1403	1412,1	7,8	30		
1395	1411,5	8,0	30		

							NSE 60dBu			NSE 60dBu		
Altura(m)	APT(m)	n	Xi	xi^2	σ	Δh	F(50,50)	d	ASPT	F(50,50) Grafico	F(50,50)	
1450,0	1423,5	1	1450	2102500				10,0	30	63	63,00	Tercer Contorno
1384,0	1423,3	2	1384	1915456	46,6690476	119,472762	64,674	10,2	30		64,67	
1340,0	1421,7	3	1340	1795600	55,3654525	141,735558	65,787	10,4	30		65,79	
1306,0	1419,1	4	1306	1705636	62,1610811	159,132368	66,657	10,6	30		66,66	

Primer Contorno de Cobertura: d = 4,8 Km
Segundo Contorno de Cobertura: d = 6,8 Km
Tercer Contorno de Cobertura: d = 10 Km

Radial: 180º

	Gant(dB) = 6,68dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 71,86dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 65,86 dBu	
Tercer Contorno	60	No determinado
Ecuación Resultante	F(50,50) = 54,86 dBu + 0,05·Δh	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	
1509	0,0	3,0	1168		
1525	1517,0	3,2	30		
1485	1511,0	3,4	30		
1471	1500,0	3,6	30		
1487	1494,8	3,8	30		
1554	1499,9	4,0	30		
1540	1507,7	4,2	30		
1564	1514,1	4,4	30		
1655	1526,0	4,6	30		
1721	1544,0	4,8	30		
1683	1559,8	5,0	30		
1683	1571,0	5,2	30		
1659	1579,3	5,4	30		
1633	1584,5	5,6	30		
1587	1586,3	5,8	30		
1568	1585,7	6,0	30	**71,8**	**Primer Contorno**
1562	1584,4	6,2	30		
1503	1581,4	6,4	30		
1473	1576,2	6,6	30		
1462	1570,4	6,8	30		
1446	1564,6	7,0	30		
1484	1559,9	7,2	30		
1496	1556,7	7,4	30		
1472	1553,5	7,6	30		
1427	1549,2	7,8	30		
1419	1544,2	8,0	30		
1419	1539,3	8,2	30		
1467	1535,8	8,4	30	**66**	**Segundo Contorno**
1470	1533,4	8,6	30		
1413	1530,2	8,8	30		

							NSE 60dBu			NSE 60dBu		
Altura(m)	APT(m)	n	Xi	xi^2	σ	Δh	F(50,50)	d	ASPT	F(50,50) Grafico	F(50,50)	
1450,0	1423,5	1	1450	2102500				10,0	30	63	63,00	Tercer Contorno
1384,0	1423,3	2	1384	1915456	46,6690476	119,472762	64,674	10,2	30		64,67	
1340,0	1421,7	3	1340	1795600	55,3654525	141,735558	65,787	10,4	30		65,79	
1306,0	1419,1	4	1306	1705636	62,1610811	159,132368	66,657	10,6	30		66,66	

Primer Contorno de Cobertura: d = 6 Km
Segundo Contorno de Cobertura: d = 8,4 Km
Tercer Contorno de Cobertura: d = 11,4 Km

Radial: 200º

	Gant(dB) = 7,75dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 70,8 dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 64,8 dBu	
Tercer Contorno	60	No determinado
Ecuación Resultante	F(50,50) = 53,8 dBu + 0,05·Δh	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	
1298	0,0	3,0	1168		
1235	1266,5	3,2	30		
1287	1263,8	3,4	30		
1235	1262,8	3,6	30		
1242	1256,8	3,8	30		
1279	1257,5	4,0	30		
1331	1265,4	4,2	30		
1331	1274,8	4,4	30		
1385	1285,2	4,6	30		
1466	1300,8	4,8	30		
1538	1320,9	5,0	30		
1558	1341,5	5,2	30		
1511	1357,6	5,4	30		
1429	1366,3	5,6	30		
1413	1370,2	5,8	30		
1413	1373,0	6,0	30		
1349	1373,5	6,2	30		
1446	1374,9	6,4	30	70,7	Primer Contorno
1558	1382,0	6,6	30		
1551	1391,1	6,8	30		
1466	1396,9	7,0	30		
1398	1398,6	7,2	30		
1411	1398,9	7,4	30		
1411	1399,4	7,6	30		
1362	1398,9	7,8	30		
1445	1399,1	8,0	30		
1421	1400,4	8,2	30		
1371	1400,2	8,4	30		
1272	1397,4	8,6	30		
1235	1392,4	8,8	30		
1240	1387,3	9,0	30	64,8	Segundo Contorno
1242	1382,5	9,2	30		
1284	1378,8	9,4	30		

Altura(m)	APT(m)	n	Xi	xi^2	σ	Δh	NSE 60dBu F(50,50) [dBu]	d(Km)	ASPT(m)	NSE 60dBu F(50,50) [dBu] Grafico	NSE 60dBu F(50,50) [dBu]	
1261	1369,5	1	1261	1590121								
1315	1367,2	2	1315	1729225	38,1837662	97,7504414	58,69	10,0	30			
1276	1365,3	3	1276	1628176	27,8747197	71,3592825	57,37	10,2	30		58,69	
1225	1362,3	4	1225	1500625	37,259227	95,3836212	58,57	10,4	30		57,37	
1225	1358,8	5	1225	1500625	37,8523447	96,9020025	58,65	10,6	30		58,57	
1238	1355,6	6	1238	1532644	35,0694549	89,7778045	58,29	10,8	30		58,65	
1271	1353,1	7	1271	1615441	32,4690329	83,1207241	57,96	11,0	30	61,6	58,29	
1252	1350,9	8	1252	1567504	30,1540687	77,1944158	57,66	11,2	30		57,96	
1217	1348,2	9	1217	1481089	31,3249102	80,1917702	57,81	11,4	30		57,66	
1226	1345,3	10	1226	1503076	30,7722819	78,7770417	57,74	11,6	30		57,81	
1167	1342,0	11	1167	1361889	38,5694179	98,7377099	58,74	11,8	30		57,74	
1078	1337,3	12	1078	1162084	60,1756897	154,049766	61,50	12,0	30	60,2	58,74	
1105	1332,0	13	1105	1221025	67,1334301	171,861581	62,39	12,2	30	**60**	**61,50**	**Tercer Contorno**
1080	1327,0	14	1080	1166400	74,5256059	190,785551	63,34	12,4	30		62,39	
959	1320,8	15	959	919681	96,6843169	247,511851	66,18	12,6	30		63,34	

Primer Contorno de Cobertura: d = 6,4 Km
Segundo Contorno de Cobertura: d = 9 Km
Tercer Contorno de Cobertura: d = 12,2 Km

Radial: 220º

	Gant(dB) = 7,92dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 70,62 dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 64,62 dBu	
Tercer Contorno	60	No determinado
Ecuación Resultante	F(50,50) = 53,62 dBu + 0,05·Δh	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	APT(m)	d(m)	ASPT(m)	F(50,50) [dBu] Grafico	
1249	0,0	3,0	1168,0		
1201	1225,0	3,2	30,0		
1137	1197,0	3,4	30,0		
1040	1160,8	3,6	30,0		
1126	1141,4	3,8	30,0		
1130	1138,7	4,0	30,0		
1204	1143,4	4,2	30,0		
1143	1147,7	4,4	30,0		
1134	1146,6	4,6	30,0		
1134	1145,2	4,8	30,0		
1068	1140,7	5,0	30,0		
1051	1133,4	5,2	34,6		
1026	1125,5	5,4	42,5		
1025	1117,8	5,6	50,2		
1042	1111,7	5,8	56,3		
1034	1106,8	6,0	61,2	78,1	
1034	1102,3	6,2	65,7		
1028	1098,1	6,4	69,9		
1076	1095,5	6,6	72,5		
1076	1094,5	6,8	73,5		
1166	1095,8	7,0	72,2	76,7	
1145	1098,7	7,2	69,3		
1218	1102,4	7,4	65,6		
1324	1109,8	7,6	58,2		
1224	1116,6	7,8	51,4		
1241	1121,2	8,0	46,8	**70,8**	**Primer Contorno**
1241	1125,8	8,2	42,2		
1276	1130,8	8,4	37,2		
1364	1137,5	8,6	30,5		
1383	1145,7	8,8	30,0		
1441	1154,5	9,0	30,0		
1425	1163,5	9,2	30,0	**64,52**	**Segundo Contorno**
1423	1171,7	9,4	30,0		

Altura(m)	APT(m)	n	Xi	xi^2	σ	Δh	NSE 60dBu F(50,50) [dBu]	d(Km)	ASPT(m)	NSE 60dBu F(50,50) [dBu] Grafico	NSE 60dBu F(50,50) [dBu]	
1343	1192,4	1	1343	1803649				10,0369	30			
1313	1196,1	2	1313	1723969	21,2132034	54,3058008	56,34	10,2376	30		56,34	
1275	1198,8	3	1275	1625625	34,0783411	87,2405533	57,98	10,4383	30		57,98	
1214	1200,0	4	1214	1473796	55,6259831	142,402517	60,74	10,6391	30		60,74	
1201	1200,2	5	1201	1442401	61,434518	157,272366	61,48	10,8398	30	61,9	61,48	
1220	1200,4	6	1220	1488400	58,5047007	149,772034	61,11	11,0405	30	**61,6**	**61,11**	**Tercer Contorno**
1248	1201,3	7	1248	1557504	53,6327903	137,299943	60,48	11,2413	30		60,48	
1264	1202,6	8	1264	1597696	49,6840014	127,191044	59,98	11,442	30		59,98	
1231	1203,6	9	1231	1515361	47,4529006	121,479426	59,69	11,6428	30		59,69	

Primer Contorno de Cobertura: d = 8 Km
Segundo Contorno de Cobertura: d = 9,2 Km
Tercer Contorno de Cobertura: d = 11 Km

Radial: 240º

	Gant(dB) = 10,21dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 68,33 dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 62,33 dBu	
Tercer Contorno	60	No determinado
Ecuación Resultante	F(50,50) = 51,33 dBu + 0,05·Δh	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

d(Km)	Altura(m)	APT(m)	ASPT(m)	F(50,50) [dBu] Grafico	
3,0	1027	0,0	1168,0		
4,0	978	1009,9	158,1		
5,0	1168	1050,2	117,8		
6,0	1297	1130,7	37,3	73,6	
7,0	1393	1192,8	30,0	69	
7,2	1443	1203,5	30,0	**68,6**	**Primer Contorno**
7,4	1445	1214,5	30,0	**68,1**	
8,0	1611	1252,4	30,0		
9,0	1670	1317,0	30,0		
9,4	1666	1338,8	30,0	64,16	
9,8	1645	1358,7	30,0	63,44	
10,0	1682	1367,4	30,0	**63**	**Segundo Contorno**

Altura(m)	APT(m)	n	Xi	xi^2	σ	Δh	F(50,50) [dBu]	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	F(50,50) [dBu]	
1682	1367,4	1	1682,00	2829124,00	0,00			10,0	30,00			
1618	1375,3	2	1618,00	2617924,00	45,25	115,85	57,12	10,2	30,00		57,12	
1613	1381,8	3	1613,00	2601769,00	38,48	98,50	56,25	10,4	30,00		56,25	
1647	1388,3	4	1647,00	2712609,00	31,76	81,30	55,40	10,6	30,00		55,40	
1647	1394,9	5	1647,00	2712609,00	27,68	70,87	54,87	10,8	30,00		54,87	
1642	1401,2	6	1642,00	2696164,00	24,76	63,39	54,50	11,0	30,00	61,70	54,50	
1622	1406,8	7	1622,00	2630884,00	23,77	60,86	54,37	11,2	30,00		54,37	
1552	1411,1	8	1552,00	2408704,00	37,74	96,62	56,16	11,4	30,00		56,16	
1556	1414,4	9	1556,00	2421136,00	42,67	109,22	56,79	11,6	30,00		56,79	
1512	1417,1	10	1512,00	2286144,00	52,75	135,03	58,08	11,8	30,00		58,08	
1544	1419,6	11	1544,00	2383936,00	53,75	137,60	58,21	12,0	30,00	60,20	58,21	
1581	1422,7	12	1581,00	2499561,00	51,65	132,22	57,94	12,2	30,00		57,94	
1661	1426,9	13	1661,00	2758921,00	52,14	133,49	58,00	12,4	30,00		58,00	
1651	1431,7	14	1651,00	2725801,00	51,53	131,91	57,93	12,6	30,00		57,93	
1555	1435,2	15	1555,00	2418025,00	51,58	132,05	57,93	12,8	30,00		57,93	
1555	1437,6	16	1555,00	2418025,00	51,41	131,61	57,91	13,0	30,00	58,80	57,91	
1494	1439,3	17	1494,00	2232036,00	56,29	144,11	58,54	13,2	30,00	**58,60**	**58,54**	**Tercer**
1527	1440,7	18	1527,00	2331729,00	56,98	145,87	58,62	13,4	30,00	**58,30**	**58,62**	**Contorno**

Primer Contorno de Cobertura: d = 7,1 Km
Segundo Contorno de Cobertura: d = 10 Km
Tercer Contorno de Cobertura: d = 13,3 Km

Radial: 260º

	Gant(dB) = 9,3dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 69,2 dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 63,2 dBu	
Tercer Contorno	60	No determinado
Ecuación Resultante	F(50,50) = 52,2 dBu + 0,05·Δh	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	
1111	0,0	3,0	1168,0		
1111	1111,0	3,2	57,0		
1156	1122,2	3,4	45,8		
1219	1144,0	3,6	30,0		
1276	1169,9	3,8	30,0		
1306	1194,1	4,0	30,0		
1221	1205,7	4,2	30,0		
1253	1210,1	4,4	30,0		
1124	1207,4	4,6	30,0		
1173	1200,9	4,8	30,0		
1265	1202,7	5,0	30,0		
1313	1210,5	5,2	30,0		
1264	1217,0	5,4	30,0		
1179	1217,4	5,6	30,0		
1181	1214,7	5,8	30,0		
1251	1214,8	6,0	30,0		
0	1178,0	6,2	30,0		
1114	1141,4	6,4	30,0		
1204	1142,4	6,6	30,0		
1159	1144,5	6,8	30,0		
1222	1146,8	7,0	30,0	**69,1**	**Primer Contorno**
1187	1149,5	7,2	30,0		
1093	1149,1	7,4	30,0		
1183	1148,6	7,6	30,0		
1253	1151,5	7,8	30,0		
1253	1155,6	8,0	30,0		
1279	1159,8	8,2	30,0		
1307	1164,7	8,4	30,0		
1293	1169,6	8,6	30,0		
1342	1174,7	8,8	30,0		
1383	1180,9	9,0	30,0		
1277	1185,7	9,2	30,0		
1133	1186,3	9,4	30,0		
1135	1184,8	9,6	30,0		
1185	1184,0	9,8	30,0	**63,4**	**Segundo Contorno**
1234	1184,8	10,0	30,0		

Altura(m)	APT(m)	n	Xi	xi^2	σ	Δh	NSE 60dBu F(50,50) [dBu]	d(Km)	ASPT(m)	NSE 60dBu F(50,50) [dBu] Grafico	NSE 60dBu F(50,50) [dBu]	
1234	1184,8	1	1234	1522756				10,003	30			
1278	1186,7	2	1278	1633284	31,1126984	79,6485078	56,182	10,2031	30		56,18	
1278	1189,2	3	1278	1633284	25,4034118	65,0327343	55,452	10,4031	30		55,45	
1418	1193,4	4	1418	2010724	80,0666389	204,970596	62,449	10,6032	30	**62,2**	**62,45**	**Tercer Contorno**
1476	1199,9	5	1476	2178576	104,226676	266,820291	65,541	10,8033	30		65,54	
1499	1207,1	6	1499	2247001	114,34757	292,729778	66,836	11,0033	30		66,84	
1524	1214,5	7	1524	2322576	120,668574	308,91155	67,646	11,2034	30		67,65	

Primer Contorno de Cobertura: d = 7 Km
Segundo Contorno de Cobertura: d = 9,8 Km
Tercer Contorno de Cobertura: d = 10,6 Km

Radial: 280º

	Gant(dB) = 7,28dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 71,26 dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 65,26 dBu	
Tercer Contorno	60	No determinado
Ecuación Resultante	F(50,50) = 54,26 dBu + 0,05·Δh	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	
1286	0,0	3,0	1168		
1286	1286,0	3,2	30		
1291	1287,2	3,4	30		
1332	1295,3	3,6	30		
1295	1299,9	3,8	30		
1283	1297,7	4,0	30		
1296	1296,3	4,2	30		
1345	1299,8	4,4	30		
1369	1306,9	4,6	30		
1474	1319,7	4,8	30		
1551	1338,9	5,0	30		
1572	1359,2	5,2	30		
1572	1376,9	5,4	30		
1486	1388,6	5,6	30		
1491	1395,7	5,8	30		
1488	1402,0	6,0	30		
1524	1408,5	6,2	30	**71,2**	**Primer Contorno**
1545	1415,9	6,4	30	**70,73**	
1588	1424,3	6,6	30		
1562	1432,2	6,8	30		
1634	1440,5	7,0	30		
1652	1450,1	7,2	30		
1602	1458,2	7,4	30		
1526	1462,8	7,6	30		
1526	1465,4	7,8	30	**67,2**	**Segundo Contorno**
1535	1468,0	8,0	30	**66,7**	

Altura(m)	APT(m)	n	Xi	xi^2	σ	Δh	NSE 60dBu F(50,50) [dBu]	d(Km)	ASPT(m)	NSE 60dBu F(50,50) [dBu] Grafico	NSE 60dBu F(50,50) [dBu]	
1861	1537,7	1	1861	3463321				10,0	30			
1861	1546,7	2	1861	3463321	0	0	54,26	10,2	30		54,26	
1901	1555,7	3	1901	3613801	23,0940108	59,1206676	57,22	10,4	30		57,22	
1909	1564,9	4	1909	3644281	25,6124969	65,5679922	57,54	10,6	30		57,54	
1909	1573,8	5	1909	3644281	25,0439613	64,1125411	57,47	10,8	30		57,47	
1877	1581,7	6	1877	3523129	22,8619043	58,5264749	57,19	11,0	30		57,19	
1897	1589,2	7	1897	3598609	21,2558115	54,4148775	56,98	11,2	30		56,98	
1941	1597,0	8	1941	3767481	27,208192	69,6529716	57,74	11,4	30		57,74	
1977	1605,5	9	1977	3908529	37,469988	95,9231693	59,06	11,6	30		59,06	
1995	1614,1	10	1995	3980025	45,6308862	116,815069	60,10	11,8	30	**60,5**	**60,10**	**Tercer Contorno**
2017	1622,8	11	2017	4068289	53,4884864	136,930525	61,11	12,0	30	60,2	61,11	
2029	1631,5	12	2029	4116841	59,5831479	152,532859	61,89	12,2	30	60	61,89	

Primer Contorno de Cobertura: d = 6,2 Km
Segundo Contorno de Cobertura: d = 7,8 Km
Tercer Contorno de Cobertura: d = 11,8 Km

Radial: 300º

	Gant(dB) = 2,18 dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 76,36 dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 70,36 dBu	
Tercer Contorno	60	No determinado
Ecuación Resultante	F(50,50) = 59,36 dBu + 0,05·Δh	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	
1058	0,0	3,0042	1168,0		
1026	1042,0	3,2056	126,0		
1081	1047,7	3,4059	120,3		
1112	1064,0	3,6063	104,0		
1063	1069,9	3,8066	98,1		
1071	1069,3	4,007	98,7	88,15	
1106	1072,5	4,2073	95,5		
1106	1077,3	4,4077	90,7		
1156	1084,0	4,608	84,0		
1146	1091,4	4,8084	76,6		
1251	1102,1	5,0087	65,9	81,82	
1324	1119,0	5,2091	49,0	**78,7**	**Primer Contorno**
1306	1135,3	5,4094	32,7	**74,5**	
1359	1150,5	5,6098	30,0	73,1	
1420	1167,6	5,8101	30,0		
1425	1184,6	6,0105	30,0	71,8	
1442	1200,1	6,2108	30,0		
1495	1215,9	6,4112	30,0		
1537	1232,6	6,6115	30,0	**70,2**	**Segundo Contorno**
1683	1252,4	6,8119	30,0		
1646	1273,0	7,0122	30,0		

Altura(m)	APT(m)	n	Xi	xi^2	σ	Δh	NSE 60dBu F(50,50) [dBu]	d(Km)	ASPT(m)	NSE 60dBu F(50,50) [dBu] Grafico	NSE 60dBu F(50,50) [dBu]	
1483	1360,1	1	1483	2199289				10,0	30	**63**	**63,00**	**Tercer Contorno**
1365	1361,9	2	1365	1863225	83,4386002	213,602816	70,04	10,2	30		70,04	
1339	1361,6	3	1339	1792921	76,741992	196,459499	69,18	10,4	30		69,18	
1322	1360,8	4	1322	1747684	72,6836754	186,070209	68,66	10,6	30		68,66	
1254	1358,9	5	1254	1572516	83,6677955	214,189556	70,07	10,8	30		70,07	
1172	1355,3	6	1172	1373584	105,053796	268,937717	72,81	11,0	30		72,81	
1182	1350,9	7	1182	1397124	109,621861	280,631964	73,39	11,2	30		73,39	
1138	1346,4	8	1138	1295044	116,960845	299,419763	74,33	11,4	30		74,33	
1138	1341,6	9	1138	1295044	119,456524	305,808701	74,65	11,6	30		74,65	
1241	1338,1	10	1241	1540081	112,899365	289,022375	73,81	11,8	30		73,81	

Primer Contorno de Cobertura: d = 5,3 Km
Segundo Contorno de Cobertura: d = 6,6 Km
Tercer Contorno de Cobertura: d = 10 Km

Radial: 320º

	Gant(dB) = -10,79 dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 89,33 dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 83,33 dBu	
Tercer Contorno	60	0
Ecuación Resultante	F(50,50) = 72,33 dBu	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	
1142	0,0	26		
1140	0,2	28		
1100	0,4	68		
950	0,6	218		
950	0,8	218		
1019	1,0	149		
966	1,2	202		
982	1,4	186		
984	1,6	184		
984	1,8	184		
977	2,0	191	99,62	
1035	2,2	133	98	
1030	2,4	138	96,9	
1106	2,6	62	**93**	**Primer Contorno**
1139	2,8	30	**85,32**	

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	
1185	0,0	3,0	30	**83,8**	**Segundo Contorno**
1185	1185,0	3,2	30	**82,9**	
1196	1187,8	3,4	30		
1261	1201,3	3,6	30		
1249	1214,8	3,8	30		
1315	1228,2	4,0	30		
1320	1243,1	4,2	30		
1404	1260,1	4,4	30		
1404	1278,1	4,6	30		
1489	1296,8	4,8	30		
1583	1320,7	5,0	30		
1541	1342,6	5,2	30		

1561	1360,0	5,4	30		
1516	1373,7	5,6	30		
1502	1383,4	5,8	30	**72,4**	**Tercer Contorno**
1523	1392,0	6,0	30		
1505	1399,6	6,2	30		
1460	1404,5	6,4	30		
1397	1405,8	6,6	30		
1395	1405,3	6,8	30		
1456	1406,3	7,0	30		

Primer Contorno de Cobertura: d = 2,7 Km
Segundo Contorno de Cobertura: d = 3 Km
Tercer Contorno de Cobertura: d = 5,8 Km

Radial: 340º

	Gant(dB) = -10,79 dB	
	NSE(dBu)	Δh
Primer Contorno	77	0
Ecuación Resultante	F(50,50) = 89,33 dBu	
Segundo Contorno	71	0
Ecuación Resultante	F(50,50) = 83,33 dBu	
Tercer Contorno	60	0
Ecuación Resultante	F(50,50) = 72,33 dBu	

Iteraciones realizadas en una hoja de cálculo para hallar las distancias a las cuales se encuentran los contornos de cobertura primario, secundario y terciario.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	
1078	0,0	3,0	90,0	**91,9**	**Primer Contorno**
1135	1106,5	3,2	61,5	**90**	
1139	1121,7	3,4	46,3	85,8	
1149	1129,2	3,6	38,8	**83,2**	**Segundo Contorno**
1203	1140,9	3,8	30,0		
1202	1153,2	4,0	30,0		
1250	1165,3	4,2	30,0		
1333	1183,4	4,4	30,0		
1389	1205,6	4,6	30,0		
1461	1229,9	4,8	30,0		
1497	1254,8	5,0	30,0		
1424	1273,5	5,2	30,0		
1424	1286,1	5,4	30,0		
1354	1294,0	5,6	30,0		
1271	1295,3	5,8	30,0	**72,4**	**Tercer Contorno**
1208	1291,6	6,0	30,0		
1147	1284,5	6,2	30,0		
1095	1274,9	6,4	30,0		
1024	1262,9	6,6	30,0		

Primer Contorno de Cobertura: d = 3 Km
Segundo Contorno de Cobertura: d = 3,6 Km
Tercer Contorno de Cobertura: d = 5,8 Km

[ANEXO Nº 22]

PROCEDIMIENTO A SEGUIR PARA DEMOSTRAR EL CUMPLIMIENTO DE LAS RELACIONES DE PROTECCION ENTRE ESTACIONES DE TV ABIERTA DE VHF

Determinar el contorno establecido en la tabla Nº 1 para la estación de televisión interferida (estados circunvecinos), empleando las curvas F(50,50) de la FCC.

Servicio	**Contorno 2**
TV VHF (Canales del 2 al 6)	68 dBμV/m
TV VHF (Canales del 7 al 13)	71 dBμV/m

Tabla Nº 1

Posteriormente y usando las curvas F(50,50) de la FCC, para la estación de televisión interferente, el contorno correspondiente, de acuerdo con la tabla Nº 2.

Separación	**Contorno a calcular para la Estación Interferente (dBμV/m)**
X+1	81
X	40
X-1	71

Tabla Nº 2

En donde X es el canal propuesto de la estación de televisión abierta VHF.

Se considera que se cumplen las relaciones de protección si no se solapa el contorno de la estación de televisión abierta propuesta con los contornos de las estaciones de televisión interferidas calculadas.

[ANEXO Nº 23]

Cálculos del Estudio de Interferencia

Los parámetros necesarios para poder analizar lass estaciones interferentes se especifican a continuación:

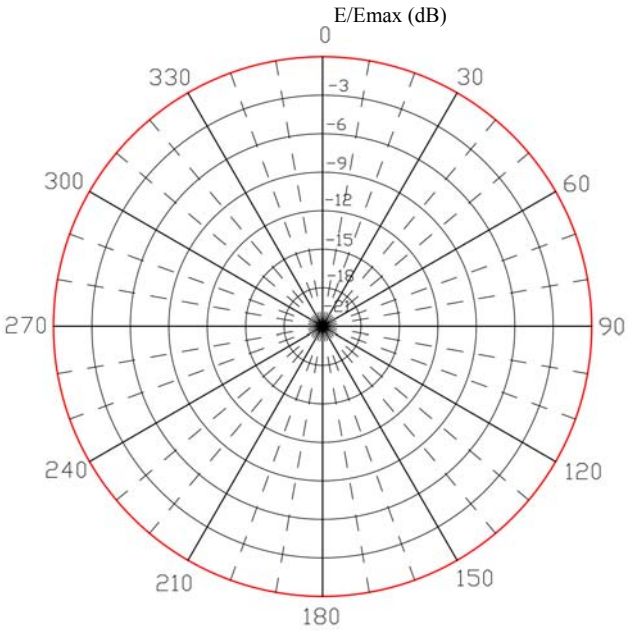
Coordenadas:

Las mismas corresponden a la ubicación de las estaciones interferentes las cuales corresponden al canal 10 y el 12 que pertenecen a Televen y LaTele, que fueron precisadas con el software EarthGoogle Pro.

Sitio de Tx de Televen y la LaTele	Datum WGS84	
	Latitud	Longitud
	10º 30’ 58,6’’	66º 52’ 52,8’’
Altura de la Estación		

Patrón de Radiación:

El patrón de radiación usado en los cálculos es omnidireccional ya que no fue posible que ambas televisoras proporcionaran el mismo. Se muestra a continuación el patrón de radiación horizontal:



Ganancia del Arreglo:

La ganancia del arreglo típica para dar señal a la zona de Caracas es de alrededor de 10dB.

Potencia del Transmisor:

La potencia del transmisor es de 500W.

Altura del Sistema de Radiación:

El sistema de radiación se ubica en una torre a una altura de 50m aproximadamente.

Perdidas de a Línea de Transmisión:

Las perdidas del sistema de transmisión se estiman en alrededor de 1,5 dB.

Calculo de los Contornos de Protección para las Estaciones Interferentes:

Al igual que en el estudio de cobertura de la estación que proporcionara el servicio de televisión en la zona de Caricuao, se hará uso de las siguientes ecuaciones descritas anteriormente:

a) $Gant = 10 * \log [g * ({}^{0}/_{1}V)^2 * ({}^{0}/_{1}H)^2]$
b) $P_{Tx} = 10 * \log [P/1Kw]$
c) $PER = P_{Tx} + Gant - Pa$
d) $\Delta f = C - [0,03 * (\Delta h) * (1 + f/300)]$ [dB]
e) $NSE = PER + F(50,50) + \Delta f$

A continuación se especifican una serie de variables que serán requeridas en todos los cálculos posteriores:
- Perdida de los alimentadores: Pa = 1,5dB
- Altura de la antena: ANT = 50m
- Altura del Terreno: TRANS = 1030m

- Potencia del Transmisor: P_{Tx} = 500W = $10.\log(\frac{500W}{1kW})$ = -3,01dBk

- Altura del sistema radiante sobre el nivel del mar:

A = ANT + TRANS = 50m + 1030m = 1080m

- Portadora de video del canal 10 de VHF: f = 193,25 MHz

- Portadora de video del canal 12 de VHF: f = 205,25 MHz

Al operar las ecuaciones mencionadas anteriormente y sustituyendo las constantes respectivas se obtiene:

$$F(50,50) = NSE - P_{Tx} - Gant + Pa – 2,5 + 0,03 * (\Delta h) * (1 + f/300)$$

Al usar la ecuación anterior y las condiciones del método de la FCC se obtuvieron los contornos de 81dBu y 71dbu pertenecientes a los canales 11 (LaTele) y al canal 10 (Televen) correspondientemente, y se resumen en las siguientes tablas:

Contorno de Protección Canal adyacente Superior NSE = 81dBu					
radiales	**D(m)**	**radiales**	**D(m)**	**Radiales**	**D(m)**
0º	5,6	**120º**	10,8	**240º**	10,6
20º	5,6	**140º**	10,4	**260º**	9,4
40º	5,6	**160º**	10,2	**280º**	10,4
60º	5,6	**180º**	8,8	**300º**	5,6
80º	5,6	**200º**	10,4	**320º**	5,6
100º	11	**220º**	9,2	**340º**	5,6

Contorno de Protección Canal adyacente Inferior NSE = 71dBu					
radiales	**D(m)**	**radiales**	**D(m)**	**Radiales**	**D(m)**
0º	10	**120º**	14,2	**240º**	13
20º	10	**140º**	11	**260º**	10,4
40º	10	**160º**	10,8	**280º**	16
60º	10	**180º**	10,4	**300º**	10
80º	10	**200º**	12,2	**320º**	10
100º	13,4	**220º**	10,2	**340º**	10

A continuación se expondrán los cálculos que permiten hallar los niveles de señal esperada de 81dBu y 71dBu correspondientes a los contornos de protección de canal adyacente superior e inferior correspondientemente.

Radial: 0º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

Altura(m)	d(Km)	APT(m)	ASPT(m)	F(50,50) [dBu] Grafico
2112	3,0	0,0	1080	
2112	3,2	2112,0	30,0	
1928	3,4	2066,0	30,0	
1777	3,6	1994,8	30,0	
1668	3,8	1926,7	30,0	
1668	4,0	1875,0	30,0	
1575	4,2	1832,7	30,0	
1622	4,4	1799,3	30,0	
1622	4,6	1777,1	30,0	
1595	4,8	1758,4	30,0	
1661	5,0	1745,4	30,0	
1661	5,2	1737,7	30,0	
1768	5,4	1735,8	30,0	
1567	5,6	1730,5	30,0	**73**
1311	5,8	1709,7	30,0	
1311	6,0	1683,1	30,0	
1091	6,2	1653,0	30,0	
976	6,4	1616,5	30,0	
976	6,6	1580,9	30,0	
868	6,8	1546,3	30,0	
782	7,0	1510,2	30,0	
782	7,2	1475,5	30,0	
750	7,4	1426,2	30,0	

609	7,6	1377,5	30,0	
523	7,8	1343,6	30,0	
523	8,0	1310,8	30,0	
451	8,2	1279,1	30,0	
369	8,4	1246,9	30,0	
369	8,6	1215,6	30,0	
303	8,8	1185,3	30,0	
338	9,0	1156,4	30,0	
338	9,2	1130,0	38,0	
264	9,4	1104,1	63,9	
298	9,6	1079,2	88,8	
224	9,8	1055,1	112,9	
224	10,0	1031,4	136,6	**63**

Distancia del Contorno del Protección del Canal Adyacente Superior: 5,6 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 10 Km

Radial: 20º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

Altura(m)	d(Km)	APT(m)	ASPT(m)	F(50,50) [dBu] Grafico
1839	3,0	0,0	1080,0	
1820	3,2	1829,5	30,0	
1816	3,4	1823,8	30,0	
1968	3,6	1846,5	30,0	
2101	3,8	1893,5	30,0	
2101	4,0	1935,0	30,0	
2253	4,2	1975,3	30,0	
2119	4,4	2005,4	30,0	
2119	4,6	2019,6	30,0	
1901	4,8	2018,6	30,0	
1846	5,0	2004,1	30,0	
1846	5,2	1989,7	30,0	
1634	5,4	1968,9	30,0	
1483	5,6	1937,3	30,0	**73**
1618	5,8	1909,7	30,0	
1475	6,0	1885,5	30,0	
1398	6,2	1857,4	30,0	
1398	6,4	1830,4	30,0	
1247	6,6	1802,2	30,0	
1296	6,8	1774,2	30,0	
1296	7,0	1750,3	30,0	
1171	7,2	1725,7	30,0	
1120	7,4	1699,3	30,0	
1120	7,6	1674,2	30,0	
982	7,8	1648,2	30,0	
909	8,0	1620,1	30,0	
909	8,2	1592,7	30,0	

692	8,4	1563,4	30,0	
692	8,6	1532,3	30,0	
669	8,8	1502,9	30,0	
541	9,0	1473,0	30,0	
367	9,2	1440,1	30,0	
351	9,4	1406,3	30,0	
218	9,6	1372,3	30,0	
218	9,8	1338,4	30,0	
215	10,0	1306,3	30,0	**63**

Distancia del Contorno del Protección del Canal Adyacente Superior: 5,6 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 10 Km

Radial: 40º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

Altura(m)	d(Km)	APT(m)	ASPT(m)	F(50,50) [dBu]
1782	3,0	0,0	1080,0	
1991	3,2	1886,5	30,0	
1991	3,4	1938,7	30,0	
2258	3,6	2000,6	30,0	
2258	3,8	2065,0	30,0	
2436	4,0	2121,4	30,0	
2436	4,2	2173,8	30,0	
2372	4,4	2206,7	30,0	
2277	4,6	2221,4	30,0	
2117	4,8	2218,7	30,0	
1842	5,0	2194,8	30,0	
1842	5,2	2162,7	30,0	
1485	5,4	2121,1	30,0	
1485	5,6	2072,2	30,0	**73**
1480	5,8	1977,2	30,0	
1450	6,0	1845,4	30,0	
1452	6,2	1730,1	30,0	
1425	6,4	1628,3	30,0	
1400	6,6	1537,8	30,0	
1350	6,8	1492,4	30,0	
1300	7,0	1451,5	30,0	
1207	7,2	1411,1	30,0	
1095	7,4	1399,3	30,0	
1100	7,6	1386,2	30,0	
1115	7,8	1371,3	30,0	
1100	8,0	1335,5	30,0	
1220	8,2	1284,2	30,0	

1330	8,4	1236,6	30,0	
1367	8,6	1216,9	30,0	
1332	8,8	1221,4	30,0	
1342	9,0	1225,3	30,0	
1213	9,2	1227,0	30,0	
1187	9,4	1226,1	30,0	
1030	9,6	1222,6	30,0	
1013	9,8	1216,6	30,0	
903	10,0	1209,3	30,0	**63**

Distancia del Contorno del Protección del Canal Adyacente Superior: 5,6 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 10 Km

Radial: 60º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

Altura(m)	d(Km)	APT(m)	ASPT(m)	F(50,50) [dBu]
1711	3,0	0,0	1080,0	
1775	3,2	1743,0	30,0	
1866	3,4	1781,8	30,0	
1997	3,6	1831,7	30,0	
1955	3,8	1867,8	30,0	
1917	4,0	1881,4	30,0	
2112	4,2	1903,6	30,0	
2219	4,4	1941,0	30,0	
2282	4,6	1979,7	30,0	
2434	4,8	2021,7	30,0	
2540	5,0	2068,3	30,0	
2540	5,2	2111,1	30,0	
2445	5,4	2142,9	30,0	
2355	5,6	2072,1	30,0	**73**
2220	5,8	1924,1	30,0	
2188	6,0	1868,7	30,0	
2188	6,2	1888,7	30,0	
2204	6,4	1906,8	30,0	
2241	6,6	1924,3	30,0	
2241	6,8	1941,0	30,0	
2125	7,0	1953,1	30,0	
2239	7,2	1964,0	30,0	
2272	7,4	1977,2	30,0	
2267	7,6	1989,9	30,0	
2198	7,8	2000,0	30,0	
2194	8,0	2007,9	30,0	
2015	8,2	2011,6	30,0	
2035	8,4	2012,1	30,0	

2014	8,6	2012,5	30,0	
1911	8,8	2010,8	30,0	
1855	9,0	2006,6	30,0	
1855	9,2	2001,7	30,0	
1687	9,4	1994,5	30,0	
1599	9,6	1983,8	30,0	
1599	9,8	1972,5	30,0	
1463	10,0	1959,9	30,0	**63**

Distancia del Contorno del Protección del Canal Adyacente Superior: 5,6 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 10 Km

Radial: 80º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

Altura(m)	d(Km)	APT(m)	ASPT(m)	F(50,50) [dBu]
1246	3,0	0,0	1080,0	
1252	3,2	1249,0	30,0	
1252	3,4	1250,5	30,0	
1308	3,6	1260,3	30,0	
1418	3,8	1286,0	30,0	
1418	4,0	1312,4	30,0	
1372	4,2	1326,2	30,0	
1468	4,4	1339,6	30,0	
1468	4,6	1355,6	30,0	
1468	4,8	1368,1	30,0	
1561	5,0	1382,7	30,0	
1574	5,2	1399,5	30,0	
1574	5,4	1414,1	30,0	
1757	5,6	1433,4	30,0	**73**
1759	5,8	1456,6	30,0	
1759	6,0	1476,8	30,0	
1701	6,2	1492,6	30,0	
1605	6,4	1502,0	30,0	
1605	6,6	1507,7	30,0	
1504	6,8	1510,2	30,0	
1491	7,0	1509,6	30,0	
1575	7,2	1510,7	30,0	
1710	7,4	1516,7	30,0	
1845	7,6	1528,0	30,0	
1845	7,8	1541,2	30,0	
1973	8,0	1555,9	30,0	
2071	8,2	1573,9	30,0	
2106	8,4	1592,9	30,0	

2106	8,6	1611,2	30,0	
2054	8,8	1627,4	30,0	
2061	9,0	1641,7	30,0	
2061	9,2	1655,3	30,0	
2093	9,4	1668,5	30,0	
2191	9,6	1682,8	30,0	
2191	9,8	1697,8	30,0	
2061	10,0	1710,0	30,0	**63**

Distancia del Contorno del Protección del Canal Adyacente Superior: 5,6 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 10 Km

Radial: 100º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu + 0,05· Δh		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu + 0,05· Δh		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

									NSE 81dBu		NSE 71dBu	
APT(m)	Altura(m)	n	Xi	xi^2	σ	Δh	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	F(50,50) [dBu]	F(50,50) [dBu] Grafico	F(50,50) [dBu]
940,0	946	1	946	894916			10,0	140,0				
940,3	958	2	958	917764	8,4852814	21,72232	10,2	139,7		74,09		64,09
940,8	958	3	958	917764	6,9282032	17,7362	10,4	139,2		73,89		63,89
941,6	982	4	982	964324	15,099669	38,655152	10,6	138,4		74,93		64,93
942,6	980	5	980	960400	15,594871	39,92287	10,8	137,4		75,00		65,00
943,5	980	6	980	960400	15,266521	39,082294	11,0	136,5	**74,8**	**74,95**		64,95
944,7	1001	7	1001	1002001	18,871748	48,311674	11,2	135,3		75,42		65,42
946,3	1030	8	1030	1060900	26,901606	68,868112	11,4	133,7		76,44		66,44
948,3	1030	9	1030	1060900	30,298515	77,564198	11,6	131,7		76,88		66,88
949,8	1003	10	1003	1006009	29,127307	74,565905	11,8	130,2		76,73		66,73
950,7	970	11	970	940900	28,093027	71,91815	12,0	129,3		76,60	73,7	66,60
951,1	970	12	970	940900	27,14607	69,493938	12,2	128,9		76,47		66,47
951,8	1000	13	1000	1000000	26,3665	67,498239	12,4	128,2		76,37		66,37
952,3	947	14	947	896809	27,315113	69,926689	12,6	127,7		76,50		66,50
951,7	907	15	907	822649	32,754207	83,850771	12,8	128,3		77,19		67,19
950,8	907	16	907	822649	36,216881	92,715216	13,0	129,2		77,64	71,6	67,64
949,1	822	17	822	675684	50,715179	129,83086	13,2	130,9		79,49		69,49
946,0	746	18	746	556516	71,170443	182,19634	13,4	134,0		82,11	**71,9**	**72,11**
942,2	746	19	746	556516	83,776541	214,46794	13,6	137,8		83,72	71,4	73,72

Distancia del Contorno del Protección del Canal Adyacente Superior: 11 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 13,4 Km

Radial: 120º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu + 0,05· Δh		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu + 0,05· Δh		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

									NSE 81dBu		NSE 71dBu	
APT(m)	Altura(m)	n	Xi	xi^2	σ	Δh	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	F(50,50) [dBu]	F(50,50) [dBu] Grafico	F(50,50) [dBu]
861,6	916	1	916	839056			10,0	218,4				
862,7	886	2	886	784996	21,2132	54,3058	10,2	217,3		75,72		65,72
863,8	919	3	919	844561	18,24829	46,71562	10,4	216,2		75,34		65,34
865,9	968	4	968	937024	33,94481	86,89871	10,6	214,1	78,6	77,34		67,34
869,1	1014	5	1014	1028196	50,47574	129,2179	10,8	210,9	**78,9**	**79,46**		69,46
873,2	1053	6	1053	1108809	64,37287	164,7946	11,0	206,8	77,8	81,24		71,24
876,9	994	7	994	988036	60,20718	154,1304	11,2	203,1		80,71		70,71
879,1	943	8	943	889249	56,24675	143,9917	11,4	200,9		80,20		70,20
880,5	943	9	943	889249	52,97903	135,6263	11,6	199,5		79,78		69,78
881,6	914	10	914	835396	51,98504	133,0817	11,8	198,4		79,65		69,65
882,5	929	11	929	863041	49,93651	127,8375	12,0	197,5	76,4	79,39		69,39
883,5	929	12	929	863041	48,09901	123,1335	12,2	196,5		79,16		69,16
883,7	855	13	855	731025	53,1482	136,0594	12,4	196,3		79,80		69,80
883,1	855	14	855	731025	56,25355	144,0091	12,6	196,9		80,20		70,20
883,2	915	15	915	837225	54,50408	139,5305	12,8	196,8		79,98		69,98
882,8	817	16	817	667489	60,42171	154,6796	13,0	197,2		80,73	75	70,73
881,5	817	17	817	667489	64,41279	164,8967	13,2	198,5		81,24		71,24
881,6	953	18	953	908209	62,92666	161,0923	13,4	198,4		81,05		71,05
882,9	953	19	953	908209	61,53129	157,5201	13,6	197,1		80,88		70,88
885,0	1036	20	1036	1073296	64,83865	165,9869	13,8	195,0		81,30		71,30
888,3	1095	21	1095	1199025	72,68572	186,0755	14,0	191,7		82,30	73,5	72,30
892,0	1095	22	1095	1199025	78,40898	200,727	14,2	188,0		83,04	**73,1**	**73,04**
895,4	1079	23	1079	1164241	81,5135	208,6746	14,4	184,6		83,43		73,43

Distancia del Contorno del Protección del Canal Adyacente Superior: 10,8 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 14,2 Km

Radial: 140º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu + 0,05· Δh		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu + 0,05· Δh		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

									NSE 81dBu		NSE 71dBu	
APT(m)	Altura(m)	n	Xi	xi^2	σ	Δh	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	F(50,50) [dBu]	F(50,50) [dBu] Grafico	F(50,50) [dBu]
924,1	1010	1	1010	1020100			10,0	155,9				
926,3	1000	2	1000	1000000	7,071068	18,10193	10,2	153,7	76,7	73,91		63,91
929,2	1068	3	1068	1140624	36,71512	93,99071	10,4	150,8	**77,9**	**77,70**		67,70
932,9	1068	4	1068	1140624	36,60146	93,69973	10,6	147,1		77,68		67,68
937,9	1192	5	1192	1420864	76,42513	195,6483	10,8	142,1		82,78		72,78
944,3	1192	6	1192	1420864	85,15789	218,0042	11,0	135,7	74,7	83,90	**74,9**	**74,20**
951,0	1246	7	1246	1552516	97,9514	250,7556	11,2	129,0		85,54	74,1	75,54

Distancia del Contorno del Protección del Canal Adyacente Superior: 10,4 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 11 Km

Radial: 160º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu + 0,05·Δh		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu + 0,05· Δh		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

									NSE 81dBu		NSE 71dBu	
APT(m)	Altura(m)	n	Xi	xi^2	σ	Δh	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	F(50,50) [dBu]	F(50,50) [dBu] Grafico	F(50,50) [dBu]
965,9	1149	1	1149	1320201			10,0	114,1				
971,0	1149	2	1149	1320201	0	0	10,2	109,0	**73,8**	**73,00**		63,00
977,1	1247	3	1247	1555009	56,580326	144,84564	10,4	102,9		80,24		70,24
984,7	1282	4	1282	1643524	68,197629	174,58593	10,6	90,1		81,73		71,73
992,3	1282	5	1282	1643524	67,975731	174,01787	10,8	87,7		81,70	**71,4**	**71,70**
1000,3	1344	6	1344	1806336	78,647102	201,33658	11,0	79,7	70,2	83,07	70,2	74,20
1008,9	1365	7	1365	1863225	85,497981	218,87483	11,2	71,1		83,94		73,94

Distancia del Contorno del Protección del Canal Adyacente Superior: 10,2 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 10,8 Km

Radial: 180º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu + 0,05· Δh		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

Altura(m)	d(Km)	ASPT(m)	APT(m)	F(50,50) Grafico
882,0	3,0	1080,0	0,0	
920,0	3,2	179,0	901,0	
952,0	3,4	161,5	918,5	
952,0	3,6	150,3	929,7	
955,0	3,8	144,4	935,6	
1009,0	4,0	135,1	944,9	
1009,0	4,2	124,4	955,6	
1071,0	4,4	112,4	967,6	
1110,0	4,6	97,0	983,0	
1110,0	4,8	82,9	997,1	
1107,0	5,0	71,8	1008,2	
1087,0	5,2	63,7	1016,3	
1055,0	5,4	59,1	1020,9	
1055,0	5,6	56,5	1023,5	
1029,0	5,8	55,2	1024,8	
1021,0	6,0	55,2	1024,8	
1021,0	6,2	55,4	1024,6	
1037,0	6,4	55,1	1024,9	
954,0	6,6	56,8	1023,2	
954,0	6,8	60,4	1019,6	
929,0	7,0	64,3	1015,7	
920,0	7,2	68,7	1011,3	
958,0	7,4	72,0	1008,0	
958,0	7,6	74,1	1005,9	
954,0	7,8	76,2	1003,8	
972,0	8,0	77,8	1002,2	75,1
972,0	8,2	79,0	1001,0	
1019,0	8,4	79,2	1000,8	
1072,0	8,6	77,6	1002,4	
1072,0	8,8	75,2	1004,8	**73,2**
1026,0	9,0	73,7	1006,3	72,6

									NSE 71dBu	
APT(m)	Altura(m)	n	Xi	xi^2	σ	Δh	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	F(50,50) [dBu]
1023,1	1166	1	1166	1359556			10,0	56,9		
1027,1	1166	2	1166	1359556	0	0	10,2	52,9		63,00
1031,2	1193	3	1193	1423249	15,588457	39,906451	10,4	48,8	**65,9**	**65,00**
1036,7	1288	4	1288	1658944	57,915887	148,26467	10,6	43,3		70,41
1043,2	1288	5	1288	1658944	62,866525	160,9383	10,8	36,8		71,05

Distancia del Contorno del Protección del Canal Adyacente Superior: 8,8 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 10,4 Km

Radial: 200º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu + 0,05·Δh		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu + 0,05· Δh		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

									NSE 81dBu		NSE 71dBu	
APT(m)	Altura(m)	n	Xi	xi^2	σ	Δh	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	F(50,50) [dBu]	F(50,50) [dBu] Grafico	F(50,50) [dBu]
931,0	1007	1	1007	1014049			10,0	149,0				
932,7	977	2	977	954529	21,2132	54,3058	10,2	147,3		75,72		65,72
934,2	1003	3	1003	1006009	16,28906	41,69998	10,4	145,8	**75,9**	**75,08**		65,08
936,0	1003	4	1003	1006009	13,79613	35,3181	10,6	144,0		74,77		64,77
937,6	993	5	993	986049	12,1161	31,01723	10,8	142,4	75,5	74,55		64,55
940,0	1075	6	1075	1155625	33,79152	86,50629	11,0	140,0	75,1	77,33	75	74,20
943,3	1075	7	1075	1155625	39,51371	101,1551	11,2	136,7		78,06		68,06
945,8	1020	8	1020	1040400	36,5843	93,6558	11,4	134,2		77,68		67,68
948,0	1058	9	1058	1119364	36,59273	93,67738	11,6	132,0		77,68		67,68
950,2	1038	10	1038	1077444	34,80565	89,10247	11,8	129,8		77,46		67,46
953,6	1165	11	1165	1357225	53,6158	137,2565	12,0	126,4		79,86	73,2	69,86
959,2	1258	12	1258	1582564	81,60882	208,9186	12,2	120,8		83,45	**73**	**73,45**
965,6	1258	13	1258	1582564	96,14452	246,13	12,4	114,4		85,31		75,31
970,2	1122	14	1122	1258884	93,35199	238,9811	12,6	109,8		84,95		74,95
972,1	1003	15	1003	1006009	91,86455	235,1732	12,8	107,9		84,76		74,76
972,7	1003	16	1003	1006009	90,33189	231,2496	13,0	107,3		84,56	70	74,56
974,3	1097	17	1097	1203409	87,78345	224,7256	13,2	105,7		84,24		74,24
976,7	1104	18	1104	1218816	85,58551	219,0989	13,4	103,3		83,95		73,95
979,1	1104	19	1104	1218816	83,5403	213,8632	13,6	100,9		83,69		73,69

Distancia del Contorno del Protección del Canal Adyacente Superior: 10,4 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 12,2 Km

Radial: 220º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu + 0,05· Δh		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50) Grafico
941	0,0	3,0	1080,0	
950	945,5	3,2	134,5	
952	948,3	3,4	131,8	
949	949,0	3,6	131,0	
896	942,4	3,8	137,6	
896	933,1	4,0	146,9	
883	925,8	4,2	154,2	
883	919,7	4,4	160,3	
882	915,1	4,6	164,9	
885	911,6	4,8	168,4	
887	909,0	5,0	171,0	
893	907,3	5,2	172,7	
897	906,3	5,4	173,8	
920	906,4	5,6	173,6	
921	907,4	5,8	172,6	
971	910,0	6,0	170,0	
971	913,8	6,2	166,2	
1060	919,8	6,4	160,2	
1060	927,6	6,6	152,4	
1151	936,9	6,8	143,1	
1151	947,7	7,0	132,3	
1177	958,0	7,2	122,0	
1177	967,9	7,4	112,1	
1119	975,7	7,6	104,3	
1035	980,0	7,8	100,0	
1114	983,7	8,0	96,3	77,0
1051	987,5	8,2	92,5	
1051	989,9	8,4	90,1	
1021	991,5	8,6	88,5	75,1
1021	992,6	8,8	87,4	74,6
1033	993,7	9,0	86,3	74,1
1033	995,0	9,2	85,0	**73,6**
1083	996,9	9,4	83,1	

									NSE 71dBu	
APT(m)	Altura(m)	n	Xi	xi^2	σ	Δh	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	F(50,50) [dBu]
1007,0	1146	1	1146	1313316			10,0	73,0		
1009,6	1054	2	1054	1110916	65,05382	166,5378	10,2	70,4	**71**	**71,33**
1010,0	998	3	998	996004	74,72617	191,299	10,4	70,0	69,9	72,56
1009,7	998	4	998	996004	69,84745	178,8095	10,6	70,3		71,94
1010,2	1058	5	1058	1119364	60,62343	155,196	10,8	69,8		70,76
1011,4	1058	6	1058	1119364	54,30285	139,0153	11,0	68,6	68,6	74,20
1013,6	1145	7	1145	1311025	60,76927	155,5693	11,2	66,4		70,78
1016,7	1145	8	1145	1311025	62,92569	161,0898	11,4	63,3		71,05

Distancia del Contorno del Protección del Canal Adyacente Superior: 9,2 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 10,2 Km

Radial: 240º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu + 0,05·Δh		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu + 0,05· Δh		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

									NSE 81dBu		NSE 71dBu	
APT(m)	Altura(m)	n	Xi	xi^2	σ	Δh	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	F(50,50) [dBu]	F(50,50) [dBu] Grafico	F(50,50) [dBu]
904,3	942	1	942	887364			10,0	175,7				
905,3	942	2	942	887364	0	0	10,2	174,7		73,00		63,00
907,3	1014	3	1014	1028196	41,56922	106,4172	10,4	172,7		78,32		68,32
909,7	983	4	983	966289	34,98928	89,57257	10,6	170,3	**77,1**	**77,48**		67,48
911,6	983	5	983	966289	30,83342	78,93356	10,8	168,4		76,95		66,95
914,3	1056	6	1056	1115136	43,75233	112,006	11,0	165,7	76,5	78,60		74,20
917,7	1056	7	1056	1115136	47,76979	122,2907	11,2	162,3		79,11		69,11
920,3	993	8	993	986049	44,24425	113,2653	11,4	159,7		78,66		68,66
922,4	1031	9	1031	1062961	42,98837	110,0502	11,6	157,6		78,50		68,50
924,9	1031	10	1031	1062961	41,69852	106,7482	11,8	155,1		78,34		68,34
927,8	1081	11	1081	1168561	46,00613	117,7757	12,0	152,2		78,89	71,9	68,89
931,1	1081	12	1081	1168561	48,39508	123,8914	12,2	148,9		79,19		69,19
934,1	1066	13	1066	1136356	48,35884	123,7986	12,4	145,9		79,19		69,19
937,9	1163	14	1163	1352569	60,17392	154,0452	12,6	142,1		80,70		70,70
942,5	1163	15	1163	1352569	67,3721	172,4726	12,8	137,5		81,62		71,62
945,9	1062	16	1062	1127844	65,34112	167,2733	13,0	134,1		81,36	**71,9**	**71,36**
949,4	1184	17	1184	1401856	72,21486	184,87	13,2	130,6		82,24		72,24

Distancia del Contorno del Protección del Canal Adyacente Superior: 10,6 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 13 Km

Radial: 260º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu + 0,05· Δh		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50)
938	0,0	3,0	1080,0	
923	930,5	3,2	149,5	
924	927,0	3,4	153,0	
944	929,3	3,6	150,7	
942	932,7	3,8	147,3	
942	934,6	4,0	145,4	
936	935,3	4,2	144,7	
927	934,8	4,4	145,2	
927	933,8	4,6	146,2	
935	933,5	4,8	146,5	
957	934,7	5,0	145,3	
957	936,8	5,2	143,2	
983	939,5	5,4	140,5	
987	943,0	5,6	137,0	
987	946,2	5,8	133,8	
1001	949,4	6,0	130,6	
1020	953,2	6,2	126,8	
1020	957,1	6,4	122,9	
1049	961,4	6,6	118,6	
1086	967,0	6,8	113,0	
1049	972,0	7,0	108,0	
1049	975,7	7,2	104,3	
991	977,7	7,4	102,3	
1008	978,7	7,6	101,3	
1008	979,9	7,8	100,1	
987	980,6	8,0	99,4	77,4
992	980,9	8,2	99,1	
1006	981,6	8,4	98,4	
1031	982,9	8,6	97,1	
1035	984,6	8,8	95,4	
1035	986,3	9,0	93,7	74,9
1119	989,2	9,2	90,8	
1226	995,0	9,4	85,0	**73,2**
1226	1002,0	9,6	78,0	
1233	1008,7	9,8	71,3	71,0
1264	1015,5	10,0	64,5	

									NSE 71dBu	
APT(m)	Altura(m)	n	Xi	xi^2	σ	Δh	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	F(50,50) [dBu]
1015,5	1264	1	1264	1597696			10,0	64,5		
1021,3	1184	2	1184	1401856	56,56854	144,8155	10,2	58,7	68,7	70,24
1025,7	1184	3	1184	1401856	46,18802	118,2413	10,4	54,3	**68,1**	**68,91**
1029,2	1134	4	1134	1285956	53,77422	137,662	10,6	50,8		69,88
1032,3	1163	5	1163	1352569	48,2825	123,6032	10,8	47,7		69,18

Distancia del Contorno del Protección del Canal Adyacente Superior: 9,4 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 10,4 Km

Radial: 280º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu + 0,05·Δh		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu + 0,05· Δh		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

									NSE 81dBu		NSE 71dBu	
APT(m)	Altura(m)	n	Xi	xi^2	σ	Δh	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	F(50,50) [dBu]	F(50,50) [dBu] Grafico	F(50,50) [dBu]
939,1	764	1	764	583696			10,0	140,9				
934,3	764	2	764	583696	0	0	10,2	145,7		73,00		63,00
929,0	715	3	715	511225	28,29016	72,42282	10,4	151,0	**76**	**76,62**		66,62
923,1	693	4	693	480249	35,7864	91,61319	10,6	156,9	76,5	77,58		67,58
916,9	672	5	672	451584	41,58485	106,4572	10,8	163,1		78,32		68,32
910,8	672	6	672	451584	42,34934	108,4143	11,0	169,2	76,6	78,42		74,20
905,1	682	7	682	465124	40,43278	103,5079	11,2	174,9		78,18		68,18
899,5	659	8	659	434281	41,37611	105,9228	11,4	180,5		78,30		68,30
893,9	659	9	659	434281	41,34543	105,8443	11,6	186,1		78,29		68,29
888,0	606	10	606	367236	48,59858	124,4124	11,8	192,0		79,22		69,22
880,7	519	11	519	269361	68,85175	176,2605	12,0	199,3		81,81	76,4	71,81
872,9	519	12	519	269361	79,31334	203,0422	12,2	207,1		83,15		73,15
866,0	577	13	577	332929	79,37617	203,203	12,4	214,0		83,16		73,16
861,0	678	14	678	459684	76,53316	195,9249	12,6	219,0		82,80		72,80
857,3	678	15	678	459684	73,97477	189,3754	12,8	222,7		82,47		72,47
852,8	595	16	595	354025	73,13503	187,2257	13,0	227,2		82,36	76	72,36

									NSE 81dBu		NSE 71dBu	
APT(m)	Altura(m)	n	Xi	xi^2	σ	Δh	d(Km)	ASPT(m)	F(50,50) [dBu] Grafico	F(50,50) [dBu]	F(50,50) [dBu] Grafico	F(50,50) [dBu]
847,1	526	17	526	276676	77,24598	197,7497	13,2	232,9		82,89		72,89
840,9	526	18	526	276676	80,08003	205,0049	13,4	239,1		83,25		73,25
834,7	500	19	500	250000	84,1134	215,3303	13,6	245,3		83,77		73,77
829,0	550	20	550	302500	83,88783	214,7529	13,8	251,0		83,74		73,74
823,9	550	21	550	302500	83,50329	213,7684	14,0	256,1		83,69	75,6	73,69
819,6	615	22	615	378225	81,51346	208,6745	14,2	260,4		83,43		73,43
816,4	659	23	659	434281	79,98085	204,751	14,4	263,6		83,24		73,24
813,9	687	24	687	471969	79,23574	202,8435	14,6	266,1		83,14		73,14
811,8	687	25	687	471969	78,46863	200,8797	14,8	268,2		83,04		73,04
809,9	714	26	714	509796	78,62507	201,2802	15,0	270,1		83,06	75	73,06
808,7	749	27	749	561001	80,24878	205,4369	15,2	270,1		83,27		73,27
807,7	749	28	749	561001	81,51457	208,6773	15,4	270,1		83,43		73,43
806,6	734	29	734	538756	81,86516	209,5748	15,6	270,1		83,48		73,48
805,6	752	30	752	565504	82,78986	211,942	15,8	270,1		83,60		73,60
804,8	752	31	752	565504	83,50065	213,7617	16,0	270,1		83,69	**73,9**	**73,69**
803,7	705	32	705	497025	82,6819	211,6657	16,2	270,1		83,58		73,58

Distancia del Contorno del Protección del Canal Adyacente Superior: 10,4 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 16 Km

Radial: 300º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

Altura(m)	APT(m)	d(Km)	ASPT(m)	F(50,50)
1197	0,0	3,0	1080,0	
1209	1203,0	3,2	30,0	
1094	1177,3	3,4	30,0	
1125	1154,7	3,6	30,0	
1166	1152,4	3,8	30,0	
1166	1155,1	4,0	30,0	
1293	1167,5	4,2	30,0	
1391	1192,4	4,4	30,0	
1391	1217,2	4,6	30,0	
1310	1232,1	4,8	30,0	
1310	1239,8	5,0	30,0	
1283	1245,0	5,2	30,0	
1329	1250,1	5,4	30,0	
1329	1256,2	5,6	30,0	**73**
1532	1268,6	5,8	30,0	
1532	1286,2	6,0	30,0	
1551	1302,1	6,2	30,0	
1461	1314,1	6,4	30,0	
1461	1322,3	6,6	30,0	
1474	1329,9	6,8	30,0	
1588	1340,0	7,0	30,0	
1588	1351,8	7,2	30,0	
1460	1359,6	7,4	30,0	
1415	1363,0	7,6	30,0	
1324	1363,3	7,8	30,0	
1270	1360,6	8,0	30,0	
1257	1356,9	8,2	30,0	

1122	1350,7	8,4	30,0	
1012	1340,6	8,6	30,0	
1004	1329,1	8,8	30,0	
1127	1320,3	9,0	30,0	
987	1311,8	9,2	30,0	
1057	1302,8	9,4	30,0	
1057	1295,3	9,6	30,0	
955	1286,8	9,8	30,0	
1017	1278,2	10,0	30,0	**63**

Distancia del Contorno del Protección del Canal Adyacente Superior: 5,6 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 10 Km

Radial: 320º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

Altura(m)	d(Km)	APT(m)	ASPT(m)	F(50,50)
1412	3,0	0,0	1080,0	
1474	3,2	1443,0	30,0	
1474	3,4	1458,5	30,0	
1544	3,6	1475,3	30,0	
1597	3,8	1499,1	30,0	
1597	4,0	1518,7	30,0	
1666	4,2	1537,5	30,0	
1666	4,4	1555,9	30,0	
1680	4,6	1570,5	30,0	
1680	4,8	1582,7	30,0	
1821	5,0	1599,5	30,0	
1821	5,2	1619,6	30,0	
1896	5,4	1639,5	30,0	
1875	5,6	1658,4	30,0	**73**
1826	5,8	1672,1	30,0	
1606	6,0	1675,1	30,0	
1606	6,2	1670,8	30,0	
1496	6,4	1663,7	30,0	
1496	6,6	1654,4	30,0	
1465	6,8	1645,2	30,0	
1465	7,0	1636,2	30,0	
1568	7,2	1630,5	30,0	
1484	7,4	1625,8	30,0	
1383	7,6	1617,4	30,0	
1461	7,8	1609,3	30,0	
1193	8,0	1598,0	30,0	
1252	8,2	1583,5	30,0	
1037	8,4	1567,3	30,0	
1005	8,6	1547,8	30,0	

1005	8,8	1529,0	30,0	
821	9,0	1508,5	30,0	
910	9,2	1487,8	30,0	
731	9,4	1466,9	30,0	
767	9,6	1445,2	30,0	
640	9,8	1423,4	30,0	
628	10,0	1400,8	30,0	**63**

Distancia del Contorno del Protección del Canal Adyacente Superior: 5,6 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 10 Km

Radial: 340º

	Gant(dB) = 10dBd		
	NSE(dBu)	Δh	f(MHz)
Contorno de canal adyacente superior	81	0	193,25
Ecuación Resultante	F(50,50) = 73dBu		
Contorno canal adyacente inferior	71	0	205,25
Ecuación Resultante	F(50,50) = 63dBu		

Iteraciones realizadas en una hoja de cálculo para hallar la distancia a la cual se encuentran los contornos de protección de la estación interferente.

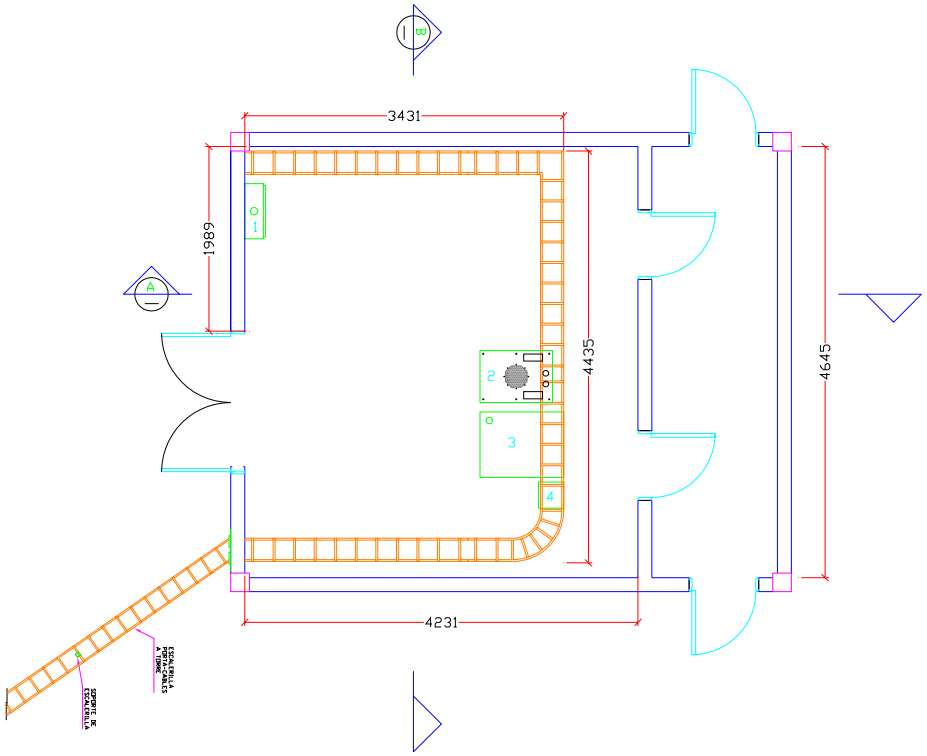
Altura(m)	d(Km)	APT(m)	ASPT(m)	F(50,50)
1805	3,0	0,0	1080,0	
1825	3,2	1815,0	30,0	
1825	3,4	1820,0	30,0	
1915	3,6	1836,7	30,0	
1903	3,8	1854,8	30,0	
1903	4,0	1864,4	30,0	
1893	4,2	1870,0	30,0	
1784	4,4	1865,5	30,0	
1784	4,6	1855,3	30,0	
1673	4,8	1841,2	30,0	
1578	5,0	1819,7	30,0	
1578	5,2	1797,7	30,0	
1529	5,4	1777,3	30,0	
1342	5,6	1751,0	30,0	**73**
1342	5,8	1721,8	30,0	
1308	6,0	1695,4	30,0	
1308	6,2	1671,1	30,0	
1206	6,4	1646,8	30,0	
1001	6,6	1616,6	30,0	
1001	6,8	1584,2	30,0	
923	7,0	1553,1	30,0	
879	7,2	1522,1	30,0	
879	7,4	1492,8	30,0	
907	7,6	1466,7	30,0	
759	7,8	1440,3	30,0	
759	8,0	1413,1	30,0	
636	8,2	1385,6	30,0	
609	8,4	1357,3	30,0	

609	8,6	1330,6	30,0	
553	8,8	1304,7	30,0	
424	9,0	1277,5	30,0	
424	9,2	1250,0	30,0	
367	9,4	1223,3	30,0	
254	9,6	1195,6	30,0	
254	9,8	1167,9	30,0	
191	10,0	1140,9	30,0	**63**

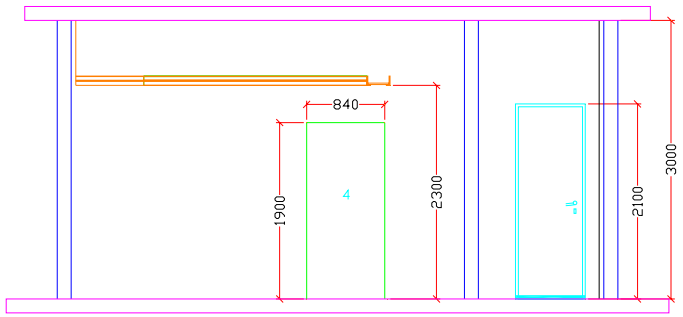
Distancia del Contorno del Protección del Canal Adyacente Superior: 5,6 Km

Distancia del Contorno de Protección del Canal Adyacente Inferior: 10 Km

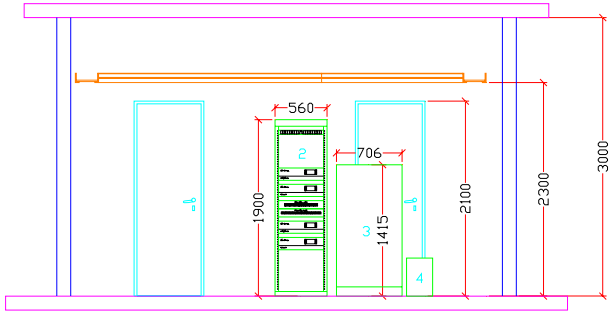
[ANEXO Nº 24]



1-TABLERO PRINCIPAL
2-RACK DE MONITOREO CERRADO VTV
3-TRANSMISOR DE 500W TIPO T-V-05/C-S
4-TRANSFORMADOR DEL TRANSMISOR

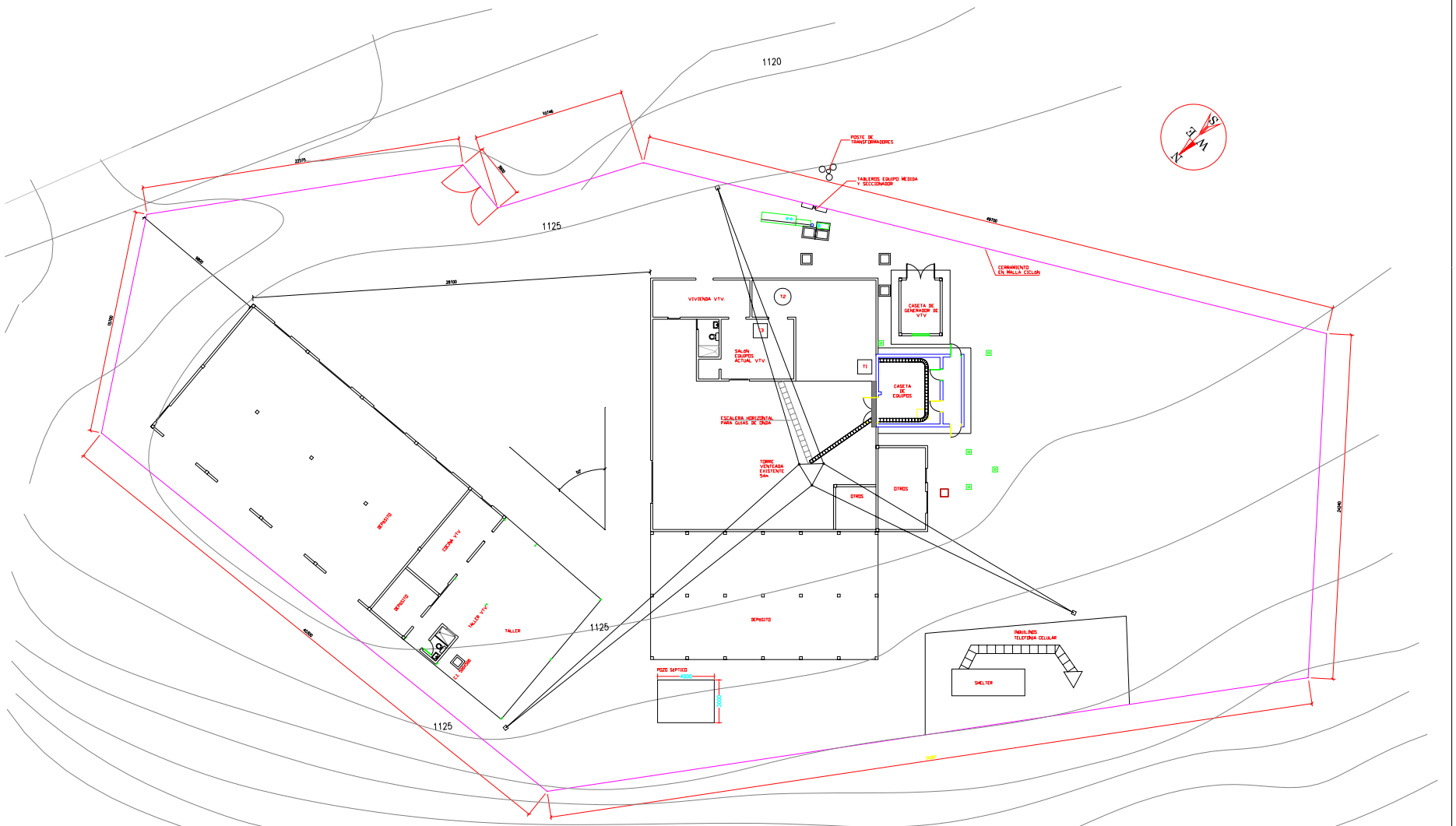


CORTE A-A



CORTE B-B

LOCACIÓN: ESTACIÓN CARICUAO		TITULO: NUEVO SALÓN DE EQUIPOS	
Dibujo: JULIAN FERNANDEZ		DESCRIPCION: CORTES - PROPUESTA	
ESCALA: 1:25	FECHA: 20-JUL-07	UNIDADES: milimetros	Plano Nº: 1



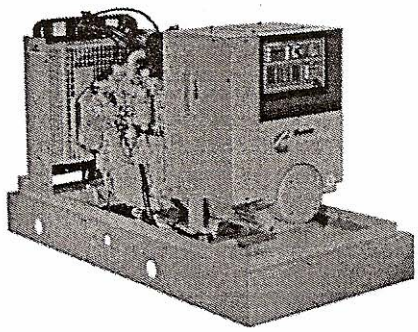
LOCACIÓN: ESTACIÓN CARICUAO		TITULO: PLANTA LOCALIZACIÓN GENERAL	
Dibujo: JULIAN FERNANDEZ		DESCRIPCION: EMPLAZAMIENTO	
ESCALA: 1:100	FECHA: 20-JUL-07	UNIDADES: milimetros	Plano Nº: 2

[ANEXO Nº 25]

Power Generation

Diesel Generator Set
Model DGBC 60 Hz

40 kW, 50 kVA Standby
35 kW, 44 kVA Prime



Description

The Cummins Power Generation DG-series commercial generator set is a fully integrated power generation system providing optimum performance, reliability, and versatility for stationary standby or prime power applications.

A primary feature of the DG GenSet is strong motor-starting capability and fast recovery from transient load changes. The torque-matched system includes a heavy-duty Cummins 4-cycle diesel engine, an AC alternator with high motor-starting kVA capacity, and an electronic voltage regulator with three phase sensing for precise regulation under steady-state or transient loads. The DG GenSet accepts 100% of the nameplate standby rating in one step, in compliance with NFPA 110 requirements.

The standard PowerCommand® digital electronic control is an integrated system that combines engine and alternator controls for high reliability and optimum GenSet performance.

Optional weather-protective housings and coolant heaters shield the generator set from extreme operating conditions. Environmental concerns are addressed by low exhaust emission engines, sound-attenuated housings, exhaust silencers, and dual-wall fuel tanks. A wide range of options, accessories, and services are available, allowing configuration to your specific power generation needs.

Every production unit is factory tested at rated load and power factor. This testing includes demonstration of rated power and single-step rated load pickup. Cummins Power Generation manufacturing facilities are registered to ISO9001 quality standards, emphasizing our commitment to high quality in the design, manufacture, and support of our products. The generator set is CSA certified and is available as UL2200 Listed. The PowerCommand control is UL508 Listed.

All Cummins Power Generation systems are backed by a comprehensive warranty program and supported by a worldwide network of 170 distributors and service branches to assist with warranty, service, parts, and planned maintenance support.

Features

UL Listed Generator Set - The complete generator set assembly is available Listed to UL2200.

Low Exhaust Emissions - Engine certified to U.S. EPA Nonroad Source Emission Standards, CFR 40.

Cummins Heavy-Duty Engine - Rugged 4-cycle industrial diesel engine delivers reliable power, low emissions, and fast response to load changes.

Alternator - Several alternator sizes offer selectable motor-starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads, fault-clearing short-circuit capability, and class H insulation. The alternator electrical insulation system is UL1446 Recognized.

Control Systems - The PowerCommand electronic control is standard equipment and provides total genset system integration, including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection, and NFPA 110 compliance. PowerCommand control is Listed to UL508.

Cooling System - Standard cooling package provides reliable running at the rated power level, at up to 50°C ambient temperature.

Integral Vibration Isolation - Robust skid base supports the engine, alternator, and radiator on isolators, minimizing transmitted vibration.

E-Coat Finish - Dual electro-deposition paint system provides high resistance to scratching, corrosion, and fading.

Housings - Optional weather-protective housings are available.

Fuel Tanks - Dual wall sub-base fuel tanks and in-skid day tanks are also offered.

Certifications - Generator sets are designed, manufactured, tested, and certified to relevant UL, NFPA, ISO, IEC, and CSA standards.

Warranty and Service - Backed by a comprehensive warranty and worldwide distributor service network.

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Generator Set

The general specifications provide representative configuration details. Consult the outline drawing for installation design.

Specifications – General

See outline drawing 500-3304 for installation design specifications.

Unit Width, in (mm)	40.0 (1016)
Unit Height, in (mm)	47.5 (1207)
Unit Length, in (mm)	82.8 (2104)
Unit Dry Weight, lb (kg)	1538 (698)
Unit Wet Weight, lb (kg)	1668 (757)
Rated Speed, rpm	1800
Voltage Regulation, No Load to Full Load	±1.0%
Random Voltage Variation	±1.0%
Frequency Regulation	5%
Random Frequency Variation	±0.5%, Isochronous optional ± 0.25%
Radio Frequency Interference	Optional PMG excitation operates in compliance with BS800 and VDE level G and N. Addition of RFI protection kit allows operation per MIL-STD-461 and VDE level K.

Cooling	**Standby**	**Prime**
Fan Load, HP (kW)	4.6 (3.4)	4.6 (3.4)
Coolant Capacity with radiator, US Gal (L)	4.5 (16.9)	4.5 (16.9)
Coolant Flow Rate, Gal/min (L/min)	45.0 (170.3)	45.0 (170.3)
Heat Rejection To Coolant, Btu/min (MJ/min)	2380.0 (2.5)	2100.0 (2.2)
Heat Radiated To Room, Btu/min (MJ/min)	846.0 (0.9)	719.0 (0.8)
Maximum Coolant Friction Head, psi (kPa)	5.0 (34.5)	5.0 (34.5)
Maximum Coolant Static Head, ft (m)	46.0 (14.0)	46.0 (14.0)

Air		
Combustion Air, scfm (m^3/min)	105.0 (3.0)	105.0 (3.0)
Alternator Cooling Air, scfm (m^3/min)	635.0 (18.0)	635.0 (18.0)
Radiator Cooling Air, scfm (m^3/min)	4900.0 (138.7)	4900.0 (138.7)
Max. Static Restriction, in H_2O (Pa)	0.5 (124.5)	0.5 (124.5)

Rating Definitions

Standby Rating based on: Applicable for supplying emergency power for the duration of normal power interruption. No sustained overload capability is available for this rating. (Equivalent to Fuel Stop Power in accordance with ISO3046, AS2789, DIN6271 and BS5514). Nominally rated.

Prime (Unlimited Running Time) Rating based on: Applicable for supplying power in lieu of commercially purchased power. Prime power is the maximum power available at a variable load for an unlimited number of hours. A 10% overload capability is available for limited time. (Equivalent to Prime Power in accordance with ISO8528 and Overload Power in accordance with ISO3046, AS2789, DIN6271, and BS5514). This rating is not applicable to all generator set models.

Base Load (Continuous) Rating based on: Applicable for supplying power continuously to a constant load up to the full output rating for unlimited hours. No sustained overload capability is available for this rating. Consult authorized distributor for rating. (Equivalent to Continuous Power in accordance with ISO8528, ISO3046, AS2789, DIN6271, and BS5514). This rating is not applicable to all generator set models.

Site Derating Factors

Engine power available up to 810 ft (250 m) at ambient temperatures up to 77°F (25°C) at 30% relative humidity. Above 810 ft (250 m) derate at 3% per 1000 ft (305 m), and 1% per 10°F (2% per 11°C) above 77°F (25°C), and 1.5% per 10% relative humidity above 30% .

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Engine

Cummins heavy-duty diesel engines use advanced combustion technology for reliable and stable power, low emissions, and fast response to sudden load changes.

Mechanical governing is standard. Electronic governing is available for applications requiring constant (isochronous) frequency regulation such as Uninterruptible Power Supply (UPS) systems, non-linear loads, or sensitive electronic loads. Optional coolant heaters are recommended for all emergency standby installations or for any application requiring fast load acceptance after start-up.

Specifications – Engine

Base Engine	Cummins Model 4B3.9-G2, naturally aspirated, diesel-fueled
Displacement in^3 (L)	239.0 (3.9)
Overspeed Limit, rpm	2100 ±50
Regenerative Power, kW	11.90
Cylinder Block Configuration	Cast iron, In-line 4 cylinder
Cranking Current	460 amps at ambient temperature of 32°F (0°C)
Battery Charging Alternator	37 amps
Starting Voltage	12-volt, negative ground
Lube Oil Filter Types	Single spin-on canister, full flow
Standard Cooling System	122°F (50°C) ambient radiator

Power Output	**Standby**	**Prime**
Gross Engine Power Output, bhp (kWm)	68.0 (50.7)	60.0 (44.8)
BMEP at Rated Load, psi (kPa)	116.9 (806.0)	103.3 (712.2)
Bore, in. (mm)	4.02 (102.1)	4.02 (102.1)
Stroke, in. (mm)	4.72 (119.9)	4.72 (119.9)
Piston Speed, ft/min (m/s)	1416.0 (7.2)	1416.0 (7.2)
Compression Ratio	17.3:1	17.3:1
Lube Oil Capacity, qt. (L)	11.5 (10.9)	11.5 (10.9)
Fuel Flow		
Fuel Flow at Rated Load, US Gal/hr (L/hr)	11.4 (43.1)	10.9 (41.3)
Maximum Inlet Restriction, in. Hg (mm Hg)	4.0 (101.6)	4.0 (101.6)
Maximum Return Restriction, in. Hg (mm Hg)	20.0 (508.0)	20.0 (508.0)
Air Cleaner		
Maximum Air Cleaner Restriction, in. H_2O (kPa)	20.0 (5.0)	20.0 (5.0)
Exhaust		
Exhaust Flow at Rated Load, cfm (m^3/min)	306.0 (8.7)	285.0 (8.1)
Exhaust Temperature, °F (°C)	1204.0 (651.1)	1071.0 (577.2)
Max Back Pressure, in. H_2O (kPa)	41.0 (10.2)	41.0 (10.2)

Fuel System	Direct injection, number 2 diesel fuel, fuel filter; water separator; automatic electric fuel shutoff

Fuel Consumption		**Standby**				**Prime**			
60 Hz Ratings, kW (kVA)		**40 (50)**				**35 (44)**			
	Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full
	US Gal/hr	1.3	2.0	2.6	3.4	1.2	1.8	2.4	2.9
	L/hr	5	8	10	13	5	7	9	11

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Alternator

Several alternators are available for application flexibility based on the required motor-starting kVA and other requirements. Larger alternator sizes have lower temperature rise for longer life of the alternator insulation system. In addition, larger alternator sizes can provide a cost-effective use of engine power in across-the-line motor-starting applications and can be used to minimize voltage waveform distortion caused by non-linear loads.

Single-bearing alternators couple directly to the engine flywheel with flexible discs for drivetrain reliability and durability. No gear reducers or speed changers are used. Two-thirds pitch windings eliminate third-order harmonic content of the AC voltage waveform and provide the standardization desired for paralleling of generator sets. The standard excitation system is a self (shunt) excited system with the voltage regulator powered directly from the generator set output.

Alternator Application Notes

Separately Excited Permanent Magnet Generator (PMG) System - This option uses an integral PMG to supply power to the voltage regulator. A PMG system generally has better motor-starting performance, lower voltage dip upon load application, and better immunity from problems with harmonics in the main alternator output induced by non-linear loads. This option is recommended for use in applications that have large transient loads, sensitive electronic loads (especially UPS applications), harmonic content, or that require sustained short-circuit current (sustained 3-phase short circuit current at approximately 3 times rated for 10 seconds).

Alternator Sizes - On any given model, various alternator sizes are available to meet individual application needs. Alternator sizes are differentiated by maximum winding temperature rise, at the generator set standby or prime rating, when operated in a 40°C ambient environment. Available temperature rises range from 80°C to 150°C. Not all temperature rise selections are available on all models. Lower temperature rise is accomplished using larger alternators at lower current density. Lower temperature rise alternators have higher motor-starting kVA, lower voltage dip upon load application, and they are generally recommended to limit voltage distortion and heating due to harmonics induced by non-linear loads.

Alternator Space Heater - is recommended to inhibit condensation.

Available Output Voltages

Three Phase Reconnectable

[ ] 120/208
[ ] 127/220
[ ] 139/240
[ ] 120/240
[ ] 240/416
[ ] 254/440
[ ] 277/480

Single Phase Non-Reconnectable

[ ] 120/240

Three Phase Non-Reconnectable

[ ] 220/380
[ ] 347/600

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Specifications – Alternator

Design	Brushless, 4 pole, drip proof revolving field
Stator	2/3 pitch
Rotor	Direct coupled by flexible disc
Insulation System	Class H per NEMA MG1-1.65
Standard Temperature Rise	150°C Standby
Exciter Type	Shunt
Phase Rotation	A (U), B (V), C (W)
Alternator Cooling	Direct drive centrifugal blower
AC Waveform Total Harmonic Distortion	<5% total no load to full linear load <3% for any single harmonic
Telephone Influence Factor (TIF)	<50 per NEMA MG1-22.43
Telephone Harmonic Factor (THF)	<3

Three Phase Table[1]		105° C	105° C	105° C	105° C	125° C	125° C	125° C	125° C	150° C	150° C	150° C	
Feature Code		B418	B415	B268	B304	B417	B414	B267	B303	B416	B413	B419	
Alternator Data Sheet Number		202	202	204	202	201	201	203	201	201	201	201	
Voltage Ranges		110/190 Thru 120/208 220/380 Thru 240/416	120/208 Thru 139/240 240/416 Thru 277/480	120/208 Thru 139/240 240/416 Thru 277/480	347/600	110/190 Thru 120/208 220/380 Thru 240/416	120/208 Thru 139/240 240/416 Thru 277/480	120/208 Thru 139/240 240/416 Thru 277/480	347/600	110/190 Thru 120/208 220/380 Thru 240/416	120/208 Thru 139/240 240/416 Thru 277/480	347/600	
Surge kW		42	42	43	42	41	41	43	42	41	41	42	
Motor Starting kVA (at 90% sustained voltage)	Shunt	163	163	231	163	131	131	188	131	131	131	131	
	PMG	191	191	272	191	155	155	221	155	155	155	155	

Full Load Current - Amps at Standby Rating	120/208	127/220	139/240	220/380	240/416	277/480	347/600
	139	131	120	76	69	60	48

Notes:

1. Single phase power can be taken from a three phase generator set at up to 2/3 set rated 3-phase kW at 1.0 power factor. Also see Note 2 below.

Single Phase Table		105° C	105° C	105° C	105° C	125° C	125° C	125° C	125° C				
Feature Code		B418	B415	B274	B268	B417	B414	B273	B267				
Alternator Data Sheet Number		202	202	203	204	201	201	202	203				
Voltage Ranges		120/240[1]	120/240[1]	120/240[2]	120/240[2]	120/240[1]	120/240[1]	120/240[2]	120/240[2]				
Surge kW		40	40	42	42	39	39	41	41				
Motor Starting kVA (at 90% sustained voltage)	Shunt	95	95	113	130	72	72	95	113				
	PMG	112	112	133	153	85	85	112	133				

Full Load Current - Amps at Standby Rating	120/240[1]	120/240[2]
	111	167

Notes:

1. The broad range alternators can supply single phase output up to 2/3 set rated 3-phase kW at 1.0 power factor.
2. The extended stack (full single phase output) and 4 lead alternators can supply single phase output up to full set rated 3-phase kW at 1.0 power factor.

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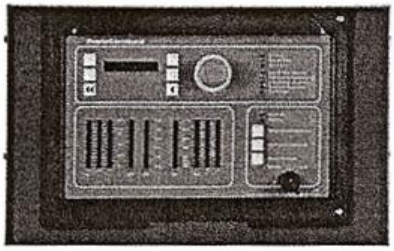
Control System



PowerCommand Control with AmpSentry™ Protection

- The PowerCommand Control is an integrated generator set control system providing governing, voltage regulation, engine protection, and operator interface functions.
- PowerCommand Controls include integral AmpSentry protection. AmpSentry provides a full range of alternator protection functions that are matched to the alternator provided.
- Controls provided include Battery monitoring and testing features, and Smart-Starting control system.
- InPower PC-based service tool available for detailed diagnostics.
- Available with Echelon LonWorks™ network interface.
- NEMA 3R enclosure.
- Suitable for operation in ambient temperatures from -40C to +70C, and altitudes to 13,000 feet (5000 meters).
- Prototype tested; UL, CSA, and CE compliant.

AmpSentry AC Protection	Engine Protection	Operator Interface
• Overcurrent and short circuit shutdown • Overcurrent warning • Single & 3-phase fault regulation • Over and under voltage shutdown • Over and under frequency shutdown • Overload warning with alarm contact • Reverse power and reverse Var shutdown • Excitation fault	• Overspeed shutdown • Low oil pressure warning and shutdown • High coolant temperature warning and shutdown • High oil temperature warning (optional) • Low coolant level warning or shutdown • Low coolant temperature warning • High and low battery voltage warning • Weak battery warning • Dead battery shutdown • Fail to start (overcrank) shutdown • Fail to crank shutdown • Redundant start disconnect • Cranking lockout • Sensor failure indication	• OFF/MANUAL/AUTO mode switch • MANUAL RUN/STOP switch • Panel lamp test switch • Emergency Stop switch • Alpha-numeric display with pushbutton access, for viewing engine and alternator data and providing setup, controls, and adjustments • LED lamps indicating genset running, not in auto, common warning, common shutdown • (5) configurable LED lamps • LED Bargraph AC data display (optional)
Alternator Data	**Engine Data**	**Other Data**
• Line-to-line and line-to-neutral AC volts • 3-phase AC current • Frequency • Total and individual phase kW and kVA	• DC voltage • Lube oil pressure • Coolant temperature • Lube oil temperature (optional)	• Genset model data • Start attempts, starts, running hours • KW hours (total and since reset) • Fault history • Load profile (hours less than 30% and hours more than 90% load) • System data display (optional with network and other PowerCommand gensets or transfer switches
Governing	**Voltage Regulation**	**Control Functions**
• Integrated digital electronic isochronous governor • Temperature dynamic governing • Smart idle speed mode • Glow plug control (some models)	• Integrated digital electronic voltage regulator • 3-phase line to neutral sensing • PMG (Optional) • Single and three phase fault regulation • Configurable torque matching	• Data logging on faults • Fault simulation (requires InPower) • Time delay start and cooldown • Cycle cranking • (4) Configurable customer inputs • (4) Configurable customer outputs • (8) Configurable network inputs and (16) outputs (with optional network)

Options

[ ] Power Transfer Control	[ ] Key-type mode switch	[ ] Echelon LonWorks interface
[ ] Analog AC Meter Display	[ ] Ground fault module	[ ] Digital input and output module(s) (loose)
[ ] Thermostatically Controlled Space Heater	[ ] Engine oil temperature	[ ] Remote annunciator (loose)
	[ ] Auxiliary Relays (3)	

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Generator Set Options

Engine

[ ] 120/240 V, 1000 W coolant heaters
[ ] 120/240 V, 150 W lube oil heater
[ ] Electronic governor

Cooling System

[ ] 125°F (50°C) ambient cooling
[ ] Remote radiator cooling

Fuel System

[ ] 12 hour dual wall sub-base tank
[ ] 24 hour dual wall sub-base tank
[ ] Single wall sub-base tank, 80 gal
[ ] In-skid tank, 44 gal

Alternator

[ ] 105°C rise alternator
[ ] 125°C rise alternator
[ ] 120/240 V, 100 W anti-condensation heater
[ ] Extended stack (full single phase output)
[ ] PMG excitation
[ ] Single phase

Exhaust System

[ ] GenSet mounted muffler
[ ] Heavy duty exhaust elbow
[ ] Slip on exhaust connection

Generator Set

[ ] AC entrance box
[ ] Batteries
[ ] Battery charger
[ ] Export box packaging
[ ] UL2200 Listed
[ ] Main line circuit breaker
[ ] PowerCommand Network Communication Module (NCM)
[ ] QuietSite Stage I housing w/silencer
[ ] QuietSite Stage II housing w/silencer
[ ] Remote annunciator panel
[ ] Spring isolators
[ ] Weather protective enclosure with silencer
[ ] 2 year prime power warranty
[ ] 2 year standby warranty
[ ] 5 year basic power warranty

Available Products and Services

A wide range of products and services is available to match your power generation system requirements. Cummins Power Generation products and services include:

- Diesel and Spark-Ignited Generator Sets
- Transfer Switches
- Bypass Switches
- Parallel Load Transfer Equipment
- Digital Paralleling Switchgear
- PowerCommand Network and Software
- Distributor Application Support
- Planned Maintenance Agreements

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Warranty

All components and subsystems are covered by an express limited one-year warranty. Other optional and extended factory warranties and local distributor maintenance agreements are available. Contact your distributor/dealer for more information.

Certifications

ISO9001 - This generator set was designed and manufactured in facilities certified to ISO9001.

CSA - This generator set is CSA certified to product class 4215-01.

PTS - The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Products bearing the PTS symbol have been subjected to demanding tests in accordance to NFPA 110 to verify the design integrity and performance under both normal and abnormal operating conditions including short circuit, endurance, temperature rise, torsional vibration, and transient response, including full load pickup.

UL - The generator set is available Listed to UL2200, Stationary Engine Generator Assemblies. The PowerCommand control is Listed to UL508 - Category NITW7 for U.S. and Canadian usage.

See your distributor for more information

Power Generation

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LonWorks is a registered trademark of Echelon

Important: Backfeed to a utility system can cause electrocution and/or property damage. Do not connect generator sets to any building electrical system except through an approved device or after building main switch is open.