

[ANEXO 1]

GUÍA PARA LA OBTENCIÓN DE LAS HABILITACIONES DE RADIODIFUSIÓN SONORA Y TELEVISIÓN ABIERTA, SUS ATRIBUTOS Y LAS CONCESIONES DE RADIODIFUSIÓN

RECAUDOS TÉCNICOS

Los interesados deberán presentar en la sección técnica de la solicitud un proyecto técnico acerca de la actividad de telecomunicaciones a realizar, el cual deberá contener, como mínimo, los siguientes aspectos:

Los interesados en prestar los servicios de **RADIODIFUSIÓN SONORA EN AMPLITUD MODULADA, RADIODIFUSIÓN SONORA EN FRECUENCIA MODULADA, TELEVISIÓN ABIERTA VHF O TELEVISIÓN ABIERTA UHF**, deberán consignar lo siguiente:

Descripción del servicio

1. Actividad de telecomunicaciones a realizar: prestación de servicios de telecomunicaciones, con indicación expresa del nombre del atributo que solicita para realizar tal actividad.
2. Zona de cobertura del servicio, en función de los estados y/o municipios a cubrir.
3. Ubicación de la planta transmisora y de los estudios: dirección exacta especificando el estado, municipio y parroquia, además de sus coordenadas geográficas (latitud y longitud) en grados, minutos y segundos, así como la altura sobre el nivel del mar (ASNM) de ambos sitios.
4. Mapa orográfico, a escala 1:100.000, donde se visualice en conjunto los siguientes aspectos:
 - a. Lugar donde se instalarán los estudios, indicando las coordenadas geográficas.
 - b. Lugar donde se instalará la planta transmisora, indicando las coordenadas geográficas.
 - c. Ruta a seguir por el enlace Estudio – Planta, en caso de emplearlo.

- d. Ubicación de los aeropuertos dentro del área a servir, si los hubiere.
 - e. Contornos de intensidad de campo eléctrico estimado de la estación propuesta de acuerdo con el servicio solicitado, en caso de tratarse de los servicios de Radiodifusión Sonora FM y Televisión Abierta VHF y UHF (**Tabla No. 1**).
 - f. Contornos de intensidad de campo eléctrico estimado de la estación propuesta de acuerdo con el tipo de estación, en caso de tratarse del servicio de radiodifusión sonora AM (**Tabla No. 2**).
5. Altura física de la torre de transmisión, desde el nivel del suelo, incluyendo luces de balizaje.
6. Características técnicas del equipo transmisor principal y auxiliar:
- a. Marca y modelo del equipo, así como el país de fabricación.
 - b. Tipo (si es de estado sólido o con tubos de vacío).
 - c. Sintonizabilidad del transmisor (frecuencia fija, conmutable en pasos, sintonización continua).
 - d. Frecuencia mínima y máxima en las que opera el equipo (MHz).
 - e. Ancho de banda con el que opera el equipo (MHz).
 - f. Clase de emisión del transmisor (código alfa-numérico suministrado por el fabricante).
 - g. Tipo de modulación.
 - h. Potencia de sintonizabilidad del transmisor (en caso que el equipo posea esta característica).
 - i. Potencia asociada a la portadora.
 - j. Potencia máxima radiada (KW).
 - k. Potencia sintonizable inferior (KW).
 - l. Potencia sintonizable superior (KW).
 - m. Atenuación de la segunda armónica (dB).
 - n. Potencia entregada a la antena (KW y dBK).
 - o. Indicar si el equipo se encuentra homologado y la institución, organismo o empresa que lo certifica.
 - p. Número de serie del equipo.

7. Características técnicas de la antena, indicando:

- a. Marca y modelo del equipo, así como el país de fabricación.
- b. Tipo de antena.
- c. Número de bays que la componen.
- d. Polarización.
- e. Frecuencia inferior en la cual trabaja (MHz).
- f. Frecuencia superior en la cual trabaja (MHz).
- g. Altura del Centro de Radiación (ACR) en metros (altura de la antena sobre la torre desde el nivel del suelo).
- h. Ganancia máxima de potencia en el plano horizontal, en dBi, o en su defecto la ganancia del arreglo de antenas en caso de utilizarlo.
- i. En caso de que la antena sea directiva, indicar el acimut del lóbulo principal de la antena medido con respecto al norte magnético y en sentido horario (°).
- j. Elevación del lóbulo principal en grados medido con respecto al eje horizontal con sentido antihorario (ángulo de inclinación vertical o beam-tilt, eléctrico o mecánico).
- k. Altura efectiva (altura total del centro de radiación sobre el nivel del mar) (m).
- l. Potencia efectiva (W): máximo rango de potencia que puede radiar la antena.
- m. Apertura del haz horizontal en grados.
- n. Apertura del haz vertical en grados.
- o. Patrones de radiación horizontal y vertical.
- p. Si es necesario modificar el patrón de radiación dado por el fabricante, se debe suministrar el nuevo patrón de radiación esperado.
- q. Indicar si el equipo se encuentra homologado y la institución, organismo o empresa que lo certifica.
- r. Número de serie del equipo

8. Características de la línea de transmisión:

- a. Marca y modelo del equipo, así como el país de fabricación.

- b. Tipo de alimentación (cable de conductor paralelo, cable coaxial, guía de onda rectangular).
 - c. Atenuación en la línea de transmisión (dB).
 - d. Longitud del alimentador (m) (largo de la línea de transmisión).
9. Marca y modelo de los equipos utilizados para monitorear y para procesar la señal.
10. Marca y modelo del equipo receptor de la señal correspondiente a la transmisión de los mensajes o alocuciones oficiales.
11. Catálogos con las especificaciones de todos los equipos, incluyendo los certificados de homologación.
12. Descripción de la planta de emergencia a emplear en los estudios y en la planta transmisora.
13. Descripción del sistema de aterramiento en los estudios y en la planta transmisora.
14. Cronograma de ejecución, que detalle las actividades de implementación a realizar, indicando los lapsos de tiempo para la instalación y prestación del servicio de telecomunicaciones, tomando como punto de inicio la fecha de otorgamiento de la habilitación.

Descripción de la utilización del espectro radioeléctrico

Adicionalmente a los recaudos arriba indicados, los interesados en prestar servicios de **RADIODIFUSIÓN SONORA EN FRECUENCIA MODULADA, TELEVISIÓN ABIERTA VHF O TELEVISIÓN ABIERTA UHF**, deberán consignar lo siguiente:

1. Estudio de cobertura, que contenga:
 - a. Frecuencia de operación (MHz) y clase de la estación, según el Reglamento sobre la Operación de Estaciones de Radiodifusión Sonora vigente, en el caso de Radiodifusión Sonora en FM y canal de operación en el caso del servicio de Televisión Abierta.
 - b. Pérdida en los alimentadores (dB).

- c. Trazar como mínimo 18 radiales espaciados cada 20°, tomando como referencia de 0° el norte verdadero, y determinar para cada uno de ellos:
- Potencia Efectiva Radiada (PER) (dBK).
 - Ganancia de antena por radial (dB).
 - Acimut en grados.
 - Tabla indicando cotas, en metros, contra distancias (igualmente espaciadas), en kilómetros, a lo largo de cada radial; tomadas cada kilómetro (como máximo), entre cero y cincuenta kilómetros.
 - Gráfico del perfil.
 - Altura sobre el nivel promedio del terreno (ASPT) en metros.
 - Factor de rugosidad del terreno (Δh) en metros y factor de atenuación por rugosidad del terreno (ΔF) en dB.
 - Distancia a los contornos de intensidad de campo eléctrico de acuerdo al servicio, según la **Tabla No. 1**.
- d. Promedio de ASPT de todos los radiales.

SERVICIO	CONTORNO 1	CONTORNO 2	CONTORNO 3
Radio FM	70 dB μ V/m	60 dB μ V/m	-----
TV VHF (Canales 2 al 6)	74 dB μ V/m	68 dB μ V/m	47 dB μ V/m
TV VHF (Canales 7 al 13)	77 dB μ V/m	71 dB μ V/m	56 dB μ V/m
TV UHF (Canales 21 al 69)	86 dB μ V/m	74 dB μ V/m	64 dB μ V/m

Tabla No. 1

Los interesados en prestar el servicio de **RADIODIFUSIÓN SONORA EN FRECUENCIA MODULADA** deberán consignar:

1. Cálculos de los contornos de cobertura.

Se debe tomar en cuenta lo siguiente:

- a. La PER real calculada por radial, en ningún caso deberá exceder el valor máximo permitido según la clase de la estación.
- b. El promedio de las ASPT de los diversos radiales trazados no deberá exceder

el máximo valor permitido según la clase de la estación.

En ambos casos, el valor máximo permitido será el determinado en los artículos 94, 95 y 96 del Reglamento sobre la Operación de Estaciones de Radiodifusión Sonora vigente.

En el caso en que el promedio de las ASPT fuera excedido, debe reducirse la Potencia Efectiva Radiada (PER) de conformidad al artículo 97 del Reglamento sobre la Operación de Estaciones de Radiodifusión Sonora vigente, a través de las gráficas de ASPT vs. PER según la clase de la estación correspondiente (**ANEXOS 10, 11 Y 12**).

En caso de emplear un método de predicción de cobertura distinto al propuesto por la FCC, se deben especificar detalladamente fórmulas, cálculos y descripción del mismo.

2. Estudio de interferencias, considerando:

- a. Cocanales.
- b. Canales adyacentes de primero, segundo y tercer orden.
- c. Frecuencia intermedia.
- d. Productos de intermodulación hasta el tercer orden.
- e. Interferencia a canales de T.V., por segundas armónicas.
- f. Canal 6 de T.V.

En caso que no sea posible cumplir las relaciones de distancia establecidas en el artículo 108 del Reglamento sobre la Operación de Estaciones de Radiodifusión Sonora vigente, para las estaciones cocanales o canales adyacentes de primero, segundo y tercer orden deberán demostrar el cumplimiento de las relaciones de protección, según el método establecido en el **ANEXO 13**.

Adicionalmente a los recaudos arriba indicados, los interesados en prestar el servicio de **RADIODIFUSIÓN SONORA EN AMPLITUD MODULADA** deberán consignar lo siguiente:

1. Descripción del sistema de aterramiento, indicando el número de radiales que componen el sistema de tierra así como la longitud de los mismos.
2. Patrón de radiación de la antena.
3. Estudio de cobertura en el cual se debe incluir los siguientes datos:
 - a. Frecuencia de operación (KHz).
 - b. Tipo de estación (de canal despejado, regional, local, local restringido).
 - c. Potencia diurna y potencia nocturna del transmisor (KW).
 - d. Indicar el valor de la intensidad del campo característico (E_c), en mV/m, a una distancia de 1 Km con relación a 1 KW, tanto para la estación propuesta como para cada una de las estaciones interferidas.
 - e. Trazar como mínimo 18 radiales igualmente espaciados tomando como referencia el norte verdadero, determinando para cada uno de ellos, las distancias a los contornos de intensidad de campo eléctrico estimado de acuerdo con el tipo de estación, según la **Tabla No. 2**, indicando en detalle todos los cálculos que se realicen y las expresiones utilizadas con el fin de determinar la intensidad de campo de la onda de superficie y la ionosférica.

TIPO DE ESTACIÓN	CONTORNO PRIMARIO	CONTORNO SECUNDARIO	CONTORNO NOCTURNO
Canal despejado	0,75 mV/m	1,25 mV/m	
Regional	1,25 mV/m diurno		6,5 mV/m
Local	1,25 mV/m diurno		10 mV/m
Local restringida	Será señalado en el título de concesión		

Tabla No. 2

4. Estudio de interferencias considerando:
 - a. Todas las estaciones cocanales.
 - b. Todos los canales adyacentes de primero, segundo y tercer orden.
 - c. Las relaciones entre señales para los contornos protegidos establecidos que se deben cumplir se especifican en la **Tabla No. 3**.

SEPARACIÓN DE FRECUENCIA	RELACIONES DE PROTECCIÓN
0 kHz	26 dB (20:1)
10 kHz	0 dB (1:1)
20 kHz	-30 dB (1:32)
30 KHz	-39 dB (1:90)

Tabla No. 3

En caso de emplear un método para el cálculo de las intensidades de campo de la onda superficial y de la onda ionosférica distinto al propuesto por la FCC, deben especificarse detalladamente fórmulas, cálculos y descripción del mismo.

5. Mapa Orográfico a escala adecuada, donde se visualice en conjunto los siguientes aspectos:
 - a. Contornos de intensidad de campo eléctrico de la estación propuesta.
 - b. Contornos de intensidad de campo eléctrico de las estaciones cocanales y adyacentes de primero, segundo y tercer orden.
 - c. Todas las estaciones y sus respectivos contornos indicados en el mapa deben estar debidamente identificados.

6. Mapa de conductividades a escala donde se visualice, en conjunto, la estación propuesta y las estaciones cocanales y adyacentes de primero, segundo y tercer orden debidamente identificadas.

Descripción de Enlaces Estudio – Planta

Los interesados en prestar los servicios de **RADIODIFUSIÓN SONORA EN AMPLITUD MODULADA, RADIODIFUSIÓN SONORA EN FRECUENCIA MODULADA, TELEVISIÓN ABIERTA VHF O TELEVISIÓN ABIERTA UHF**, que requieran utilizar enlaces entre los estudios y la planta transmisora, deberán indicar lo siguiente:

1. Ubicación de la planta transmisora y de los estudios: dirección exacta especificando el estado, municipio y parroquia, además de sus coordenadas geográficas (latitud y

longitud) en grados, minutos y segundos, así como la altura sobre el nivel del mar (ASNM) de ambos sitios.

2. Banda de frecuencias según el servicio solicitado y de acuerdo al Cuadro Nacional de Atribución de Frecuencias (CUNABAF).
3. Longitud del enlace (Km).
4. Cálculo del enlace.
5. Perfil del enlace.
6. Potencia recibida (dBm).
7. Potencia umbral (dBm).
8. Despeje de la primera zona de Fresnel o en su defecto el 60% de ésta.
9. Disponibilidad y confiabilidad del enlace.
10. Tablas de cotas contra distancia.
11. Si el enlace entre los estudios y la planta es satelital, mencionarlo e indicar que empresa se encargará de realizar el transporte.
12. Características técnicas del equipo transmisor:
 - a. Marca y modelo del equipo, así como el país de fabricación.
 - b. Sintonizabilidad del transmisor (frecuencia fija, conmutable en pasos, sintonización continua).
 - c. Frecuencia mínima y máxima en las que opera el equipo (MHz).
 - d. Ancho de banda con el que opera el equipo (MHz).
 - e. Clase de emisión del transmisor (código alfa-numérico suministrado por el fabricante).
 - f. Tipo de modulación.
 - g. Potencia de sintonizabilidad del transmisor (en caso que el equipo posea esta característica).
 - h. Potencia asociada a la portadora.
 - i. Potencia máxima radiada (W).
 - j. Potencia sintonizable inferior (W).
 - k. Potencia sintonizable superior (W).
 - l. Atenuación de la segunda armónica (dB).

- m. Potencia entregada a la antena (W).
- n. Indicar si el equipo se encuentra homologado y la institución, organismo o empresa que lo certifica.
- o. Número de serie del equipo.

13. Características técnicas del equipo receptor:

- a. Marca y modelo del equipo, así como el país de fabricación.
- b. Sintonizabilidad del Receptor (Frecuencia fija, Conmutable en pasos, Sintonización continua).
- c. Frecuencia mínima y máxima en las que opera el equipo (MHz).
- d. Ancho de banda con el que opera el equipo (MHz).
- e. Clase de emisión (código alfa-numérico suministrado por el fabricante).
- f. Nivel de sensibilidad del equipo a las interferencias (dB).
- g. Frecuencia intermedia (MHz).
- h. Relación señal / ruido (dB).
- i. Sensibilidad del receptor (dBm).
- j. Selectividad del receptor (dB).
- k. Indicar si el equipo se encuentra homologado y la institución, organismo o empresa que lo certifica.
- l. Número de serie del equipo.

14. Características técnicas de las antenas:

- a. Marca y modelo del equipo, así como el país de fabricación.
- b. Equipo (transmisor o receptor) al cual está relacionada.
- c. Tipo de antena.
- d. Frecuencia inferior de funcionamiento (MHz).
- e. Frecuencia superior de funcionamiento (MHz).
- f. Altura del centro de radiación desde el nivel del suelo (m).
- g. Ganancia de la antena (dBi).

- h. Acimut del lóbulo principal de la antena con respecto al norte magnético y en sentido horario ($^{\circ}$).
- i. Polarización.
- j. Elevación del lóbulo principal en grados utilizando el eje horizontal con sentido antihorario ($^{\circ}$) (ángulo de inclinación eléctrico o mecánico).
- k. Altura efectiva (altura total del centro de radiación sobre el nivel del mar) (m).
- l. Potencia efectiva (W): máximo rango de potencia que puede radiar la antena (en caso de antenas transmisoras).
- m. Apertura del haz horizontal en grados.
- n. Apertura del haz vertical en grados.
- o. Angulo de potencia mitad.
- p. Indicar si el equipo se encuentra homologado y la institución, organismo o empresa que lo certifica.
- q. Número de serie del equipo.

15. Características de la línea de transmisión: Atenuación en la línea de transmisión (dB).

- a. Tipo de alimentación (cable de conductor paralelo, cable coaxial, guía de onda rectangular).
- b. Longitud del alimentador (m) (largo de la línea de transmisión).

16. Catálogos con las especificaciones de todos los equipos, incluyendo los certificados de homologación.

[ANEXO 2]

CANALES DE TELEVISIÓN UHF EN CARACAS

ESTADO	CIUDAD	CANAL	DIRECCION PLANTA	Latitud XX°, YY'ZZ"	Longitud XX°, YY'ZZ"
DISTRITO FEDERAL	CARACAS AVILA 5	39	SECTOR AVILA 5, PARQUE NACIONAL EL AVILA, CARACAS - D.F.	10,3402	66,5442
DISTRITO FEDERAL	CARACAS CARICUAO	29	VEREDA 5, FILA CARICUAO, INSTALACIONES DE VENEZOLANA DE TELEVISION (VTV) CARICUAO, DTTO. FEDERAL	10,2633	66,5909
DISTRITO FEDERAL	CARACAS	69	TOPO CONEJO BLANCO, CAMINO DE LOS ESPAÑOLES, PUERTA DE CARACAS, CARACAS, DTTO. FEDERAL.	10,3229	66,5542
DISTRITO FEDERAL	CARACAS	51	AVILA 5, LOS MECEDORES	10,3354	66,5438
DISTRITO FEDERAL	CARACAS	33	SECTOR LOS MECEDORES II PARQUE NACIONAL EL AVILA	10,3354	66,5438
DISTRITO FEDERAL	CARACAS	43		10,3354	66,5438
DISTRITO FEDERAL	CARACAS	63	CERRO PAPELÓN A MECEDORES	10,3144	66,5258
DISTRITO FEDERAL	CARACAS	45		10,3358	66,5446
DISTRITO FEDERAL	CARACAS EL AVILA	27	EL VOLCÁN, BARUTA	10,3231	66,5240
DISTRITO FEDERAL	CARACAS EL AVILA	57	CASETA AVILA 5 - FILA DEL AVILA - ESTACIÓN TELEFERICO, HUMBOLDT, CARACAS - D.F.	10,2510	66,5053
DISTRITO FEDERAL	CARACAS EL VOLCAN	55	ORIPOTO - SITIO DENOMINADO "EL VOLCAN" - MUNICIPIO BARUTA.	10,3231	66,5240
DISTRITO FEDERAL	CARACAS EL VOLCAN	49	ORIPOTO - SITIO DENOMINADO "EL VOLCAN" - MUNICIPIO BARUTA	10,2605	66,5230
DISTRITO FEDERAL	CARACAS EL VOLCAN	21	EL VOLCAN, ORIPOTO EL HATHILO DTTO SUCRE ESTADO MIRANDA	10,2605	66,5230
DISTRITO FEDERAL	CARACAS EL VOLCAN	29	EL VOLCÁN, BARUTA, CARACAS	10,3231	66,5240
DISTRITO FEDERAL	CARACAS EL VOLCAN	37	CERRO EL VOLCÁN, ORITOPPO, MUNICIPIO BARUTA, EDO. MIRANDA.	10,2605	66,5230
DISTRITO FEDERAL	CARACAS EL VOLCAN	31	EL VOLCÁN, BARUTA, ESTADO MIRANDA	10,2605	66,5240
DISTRITO FEDERAL	CARICUAO	35	FILA CARICUAO, PARROQUIA CARICUAO, (TORRE DE VENEZOLANA DE TELEVISIÓN) CARACAS-DTTO. FEDERAL.	10,2635	66,5915
DISTRITO FEDERAL	CARACAS	27	UNIVERSIDAD SIMÓN BOLÍVAR	10,3118	66,525
DISTRITO FEDERAL	CARACAS	29	UNIVERSIDAD SIMÓN BOLÍVAR	10,2528	66,5321
DISTRITO FEDERAL	CARACAS	24	MUNICIPIO CHACAO	10,3151	66,5234
DISTRITO FEDERAL	CARACAS	21	PARROQUIA CARICUAO	10,2648	66,585
DISTRITO FEDERAL	CARACAS EL AVILA	25	SECTOR LOS MECEDORES, PARQUE NACIONAL EL AVILA	10,2512	66,5115

NOMBRE	ESTADO	CIUDAD	NOMBRE COMERCIAL	SERVICIO	DIRECCION
CMT TELEVISORA METROPOLITANA	DISTRITO FEDERAL	CARACAS	CMT TELEVISORA METROPOLITANA	UHF	CALLE VARGAS C/C SANTA CLARA, EDIF. C.M.T. BOLEITA NORTE CARACAS
CORPOMEDIOS GV INVERSIONES, C.A. (GLOBOVISION).	DISTRITO FEDERAL	CARACAS	CORPOMEDIO GV INVERSIONES, C.A.	UHF	PROLONGACION AV. LOS PINOS, CRUCE C/C ALAMEDA, QTA. GLOBOVISIÓN, ALTA FLORIDA CARACAS
NIÑOS CANTORES DEL ZULIA	DISTRITO FEDERAL	CARACAS	NIÑOS CANTORES DEL ZULIA	UHF (R)	URB. LA PAZ, AV. 45-B ENTRE CALLE 87 Y 98 MARACAIBO.
NUEVO MILENIO DE MEDIOS AUDIOVISUALES, C.A.	DISTRITO FEDERAL	CARACAS		UHF	
TELEEXITO (RESTITUTO CALVO)	DISTRITO FEDERAL	CARACAS	TELEEXITO	UHF (R)	AV. LA ESTANCIA, QTA. CARMEN, URB. LA CAMPIÑA, CARACAS.
TV FAMILIA AC	DISTRITO FEDERAL	CARACAS	TV FAMILIA	UHF (I)	AV. 1 CONJUNTO RESD. EL PATIO, N° 1-5. LA BOYERA, MUNCIPIO EL HATILLO, EDO. MIRANDA
ARMANDO DE ARMAS	DISTRITO FEDERAL	CARACAS - AVILA 5	MERIDIANO TELEVISION	UHF	FINAL AV. SAN MARTIN, CRUCE CON FINAL AV. LA PAZ, EDIF. BLOQUE DE ARMAS CARACAS, DISTRITO FEDERAL.
CORPOMEDIOS GV INVERSIONES, C.A. (GLOBOVISION)	DISTRITO FEDERAL	CARACAS - CARICUAO	GLOBOVISION	UHF (I)	PROLONGACION AV. LOS PINOS, CRUCE C/C ALAMEDA, QTA. WEYCE ALTA FLORIDA CARACAS 1061, DTTO. FEDERAL
EL PAIS TELEVISION, C.A.	DISTRITO FEDERAL	CARACAS - EL AVILA	BRAVO	UHF	CALLE SANATORIO DEL AVILA, EDIF. BRAVO, MUNCIPIO. SUCRE, ESTADO MIRANDA.
U. S. B.	DISTRITO FEDERAL	CARACAS - EL AVILA	U. S. B.	UHF (I)	EDIF. DE COMUNICACIONES DE LA U.S.B., SARTENEJAS, BARUTA.
EL PAIS TELEVISION C.A.	DISTRITO FEDERAL	CARACAS - EL VOLCAN	PUMA TV	UHF	CALLE SANATORIO DEL AVILA, EDIF. PUMA T.V., C.A., BOLEITA NORTE, CARACAS.
TELEVEN	DISTRITO FEDERAL	CARACAS - EL VOLCAN	TELEVEN	UHF	CENTRO COMERCIAL CHAGUARAMOS, CARACAS
ARMANDO DE ARMAS	DISTRITO FEDERAL	CARACAS EL VOLCAN	MERIDIANO TELEVISION	UHF	AV. SAN MARTIN, CRUCE CON FINAL AV. LA PAZ, EDIF. BLOQUE DE ARMAS CARACAS.

[ANEXO 3]

RADIALES DE COBERTURA

RADIAL 0°		RADIAL 20°		RADIAL 40°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	1841	3	1785	3	2045
4	1350	4	1437	4	1436
5	1003	5	1277	5	832
6	684	6	991	6	785
7	545	7	608	7	1118
8	231	8	171	8	880
9	104	9	111	9	511
10	61	10	12	10	317
11	23	11	5	11	251
12	8	12	2	12	65
13	3	13	3	13	14
14	1	14	5	14	2
15	1	15	1	15	0
16	6	16	0	16	1
17	3	17	2	17	1
18	5	18	3	18	1
19	2	19	5	19	1
20	2	20	1	20	3
21	4	21	0	21	3
22	1	22	0	22	1
23	0	23	4	23	1
24	3	24	1	24	1
25	2	25	3	25	5
26	1	26	4	26	6
27	3	27	1	27	1
28	3	28	5	28	0
29	5	29	3	29	3
30	2	30	6	30	3
31	1	31	6	31	2
32	4	32	4	32	1
33	4	33	4	33	2
34	5	34	1	34	2
35	2	35	3	35	0
36	9	36	4	36	2
37	2	37	6	37	1
38	6	38	1	38	2
39	3	39	1	39	0
40	7	40	5	40	1
41	3	41	4	41	1
42	3	42	4	42	2
43	2	43	5	43	2
44	3	44	0	44	1
45	3	45	3	45	2
46	4	46	3	46	3
47	3	47	4	47	1
48	6	48	5	48	1
49	3	49	4	49	0
50	2	50	4	50	2

RADIAL 60°		RADIAL 80°		RADIAL 100°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	2233	3	2205	3	1681
4	1920	4	2571	4	1642
5	1782	5	1992	5	1696
6	1500	6	1837	6	1475
7	1501	7	2129	7	1561
8	1513	8	2388	8	1767
9	1232	9	2229	9	1687
10	1373	10	2342	10	1676
11	1189	11	2476	11	1716
12	778	12	2102	12	1486
13	467	13	1639	13	1320
14	706	14	1642	14	1310
15	579	15	1648	15	1239
16	186	16	1666	16	1050
17	66	17	1455	17	985
18	179	18	1261	18	899
19	114	19	1043	19	675
20	19	20	1447	20	609
21	4	21	1173	21	658
22	3	22	1251	22	898
23	2	23	1092	23	793
24	2	24	1112	24	840
25	1	25	1042	25	714
26	2	26	758	26	414
27	1	27	881	27	394
28	7	28	901	28	698
29	4	29	805	29	626
30	0	30	485	30	497
31	3	31	491	31	406
32	6	32	683	32	387
33	1	33	486	33	380
34	2	34	415	34	348
35	0	35	730	35	317
36	4	36	636	36	309
37	3	37	794	37	333
38	5	38	686	38	310
39	0	39	509	39	368
40	0	40	667	40	405
41	1	41	421	41	488
42	1	42	418	42	436
43	3	43	577	43	529
44	1	44	560	44	504
45	1	45	274	45	425
46	1	46	146	46	605
47	4	47	247	47	575
48	1	48	512	48	568
49	1	49	484	49	569
50	3	50	570	50	526

RADIAL 120°		RADIAL 140°		RADIAL 160°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	1131	3	965	3	932
4	1045	4	908	4	897
5	950	5	897	5	860
6	920	6	857	6	856
7	910	7	832	7	966
8	897	8	876	8	1086
9	865	9	906	9	930
10	887	10	913	10	1121
11	991	11	872	11	1168
12	1076	12	1015	12	1109
13	1031	13	1065	13	1184
14	1105	14	983	14	1211
15	1081	15	984	15	969
16	1170	16	908	16	893
17	1039	17	931	17	932
18	1096	18	804	18	1113
19	1089	19	559	19	897
20	932	20	826	20	1077
21	913	21	649	21	890
22	919	22	936	22	621
23	783	23	987	23	637
24	876	24	699	24	494
25	860	25	856	25	420
26	915	26	649	26	365
27	1023	27	578	27	450
28	994	28	563	28	610
29	799	29	367	29	406
30	623	30	403	30	307
31	566	31	334	31	303
32	677	32	243	32	259
33	526	33	200	33	268
34	539	34	180	34	313
35	394	35	179	35	252
36	318	36	143	36	208
37	280	37	174	37	192
38	289	38	167	38	220
39	325	39	148	39	174
40	454	40	130	40	160
41	512	41	155	41	170
42	585	42	187	42	160
43	801	43	262	43	159
44	748	44	254	44	155
45	635	45	124	45	165
46	715	46	179	46	210
47	695	47	330	47	228
48	503	48	469	48	268
49	615	49	530	49	309
50	627	50	315	50	328

RADIAL 180°		RADIAL 200°		RADIAL 220°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	906	3	926	3	946
4	885	4	868	4	898
5	876	5	872	5	875
6	1059	6	876	6	928
7	957	7	875	7	897
8	953	8	891	8	969
9	933	9	936	9	1176
10	991	10	927	10	1131
11	1035	11	1005	11	1131
12	1092	12	972	12	1196
13	1262	13	1075	13	1193
14	1207	14	1184	14	1075
15	914	15	1037	15	1038
16	990	16	1024	16	1105
17	1063	17	1168	17	1298
18	1187	18	1205	18	1550
19	888	19	1239	19	1554
20	1055	20	1319	20	1685
21	1213	21	1307	21	1574
22	887	22	1315	22	1401
23	1019	23	1084	23	1344
24	780	24	965	24	1278
25	700	25	815	25	1300
26	735	26	748	26	1189
27	589	27	871	27	1191
28	495	28	990	28	1191
29	445	29	653	29	1272
30	605	30	669	30	1306
31	481	31	679	31	1097
32	526	32	515	32	867
33	430	33	720	33	922
34	406	34	624	34	787
35	361	35	623	35	775
36	329	36	630	36	708
37	328	37	594	37	806
38	305	38	488	38	653
39	283	39	314	39	547
40	275	40	501	40	730
41	243	41	476	41	628
42	223	42	430	42	456
43	210	43	484	43	526
44	234	44	491	44	528
45	257	45	491	45	739
46	416	46	449	46	691
47	404	47	481	47	875
48	597	48	549	48	1004
49	648	49	495	49	1078
50	600	50	513	50	1278

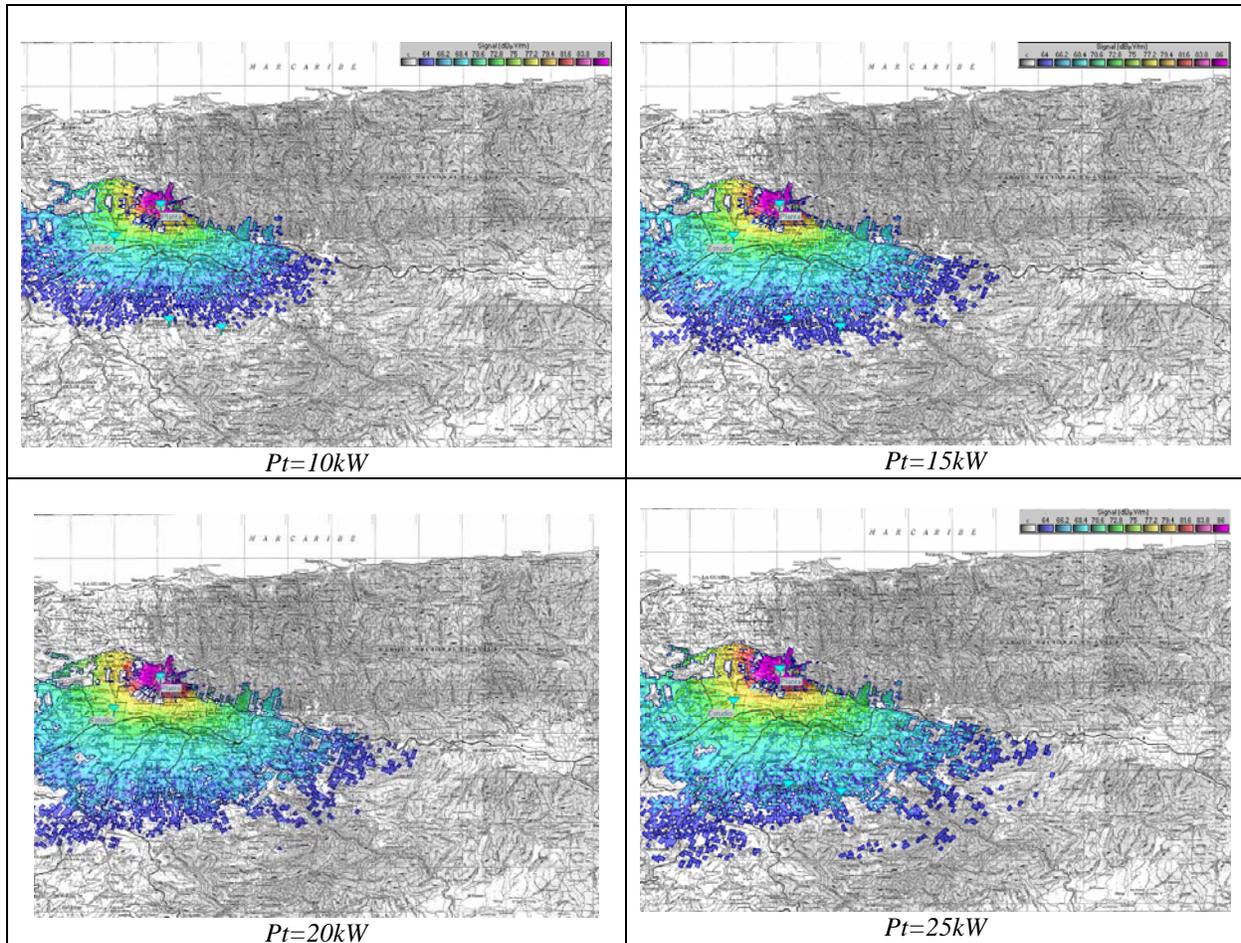
RADIAL 240°		RADIAL 260°		RADIAL 280°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	953	3	1116	3	1457
4	935	4	1075	4	1359
5	939	5	1041	5	1260
6	941	6	1011	6	1477
7	922	7	976	7	1432
8	896	8	974	8	1465
9	915	9	1000	9	1347
10	996	10	977	10	1253
11	943	11	932	11	1226
12	949	12	670	12	1029
13	992	13	962	13	728
14	1013	14	1071	14	492
15	1128	15	1130	15	493
16	1103	16	903	16	733
17	1073	17	966	17	821
18	1219	18	887	18	763
19	1523	19	1069	19	517
20	1402	20	1280	20	199
21	1305	21	1078	21	351
22	1099	22	1244	22	504
23	1226	23	1354	23	459
24	1173	24	1509	24	177
25	1197	25	1607	25	104
26	1159	26	1432	26	166
27	1246	27	1369	27	14
28	1170	28	1243	28	7
29	1237	29	1241	29	2
30	1383	30	1462	30	6
31	1415	31	1603	31	2
32	1572	32	1262	32	0
33	1761	33	1278	33	2
34	1837	34	1330	34	2
35	1902	35	1397	35	3
36	1526	36	1409	36	3
37	1487	37	1175	37	2
38	1551	38	1158	38	2
39	1600	39	757	39	1
40	1612	40	814	40	1
41	1570	41	1095	41	3
42	1229	42	1377	42	3
43	824	43	1284	43	2
44	1197	44	924	44	3
45	1036	45	916	45	3
46	1279	46	932	46	2
47	997	47	860	47	5
48	989	48	833	48	3
49	894	49	1208	49	1
50	1103	50	785	50	1

RADIAL 300°		RADIAL 320°		RADIAL 340°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	1783	3	1826	3	1420
4	1758	4	1438	4	1278
5	1868	5	1325	5	1112
6	1422	6	1236	6	687
7	1186	7	762	7	473
8	973	8	524	8	164
9	596	9	251	9	85
10	270	10	11	10	32
11	546	11	3	11	12
12	447	12	5	12	6
13	140	13	4	13	4
14	129	14	3	14	4
15	65	15	4	15	4
16	69	16	0	16	2
17	86	17	3	17	3
18	29	18	1	18	2
19	10	19	3	19	3
20	4	20	1	20	2
21	1	21	1	21	4
22	2	22	3	22	3
23	1	23	2	23	4
24	3	24	0	24	3
25	6	25	2	25	2
26	3	26	0	26	4
27	2	27	3	27	4
28	1	28	2	28	2
29	4	29	3	29	3
30	2	30	1	30	2
31	2	31	2	31	5
32	2	32	2	32	6
33	2	33	3	33	8
34	3	34	3	34	5
35	2	35	4	35	2
36	3	36	4	36	4
37	2	37	4	37	3
38	2	38	3	38	2
39	2	39	3	39	2
40	4	40	2	40	2
41	2	41	5	41	3
42	1	42	3	42	5
43	2	43	4	43	3
44	3	44	4	44	5
45	3	45	3	45	4
46	3	46	5	46	4
47	3	47	3	47	5
48	3	48	3	48	4
49	3	49	5	49	4
50	3	50	3	50	3

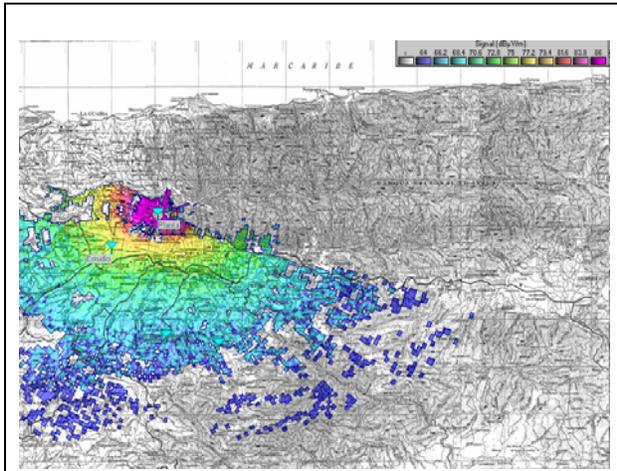
[ANEXO 4]

DIAGRAMAS DE COBERTURA CON VARIACIÓN DE POTENCIA

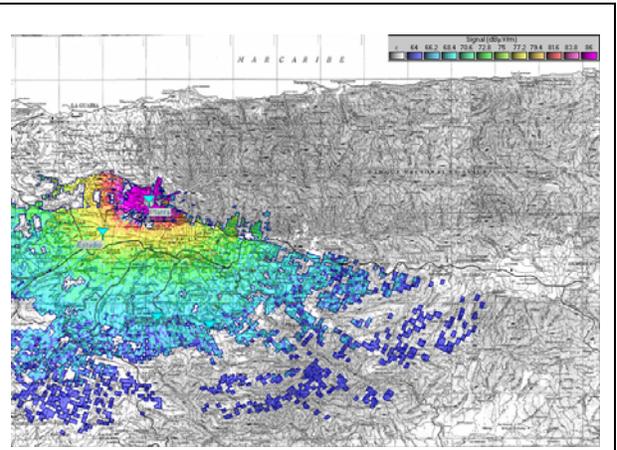
A continuación se presentan los diagramas de cobertura levantados en *Radio Mobile*, productos de variar la potencia de operación del transmisor (P_t)



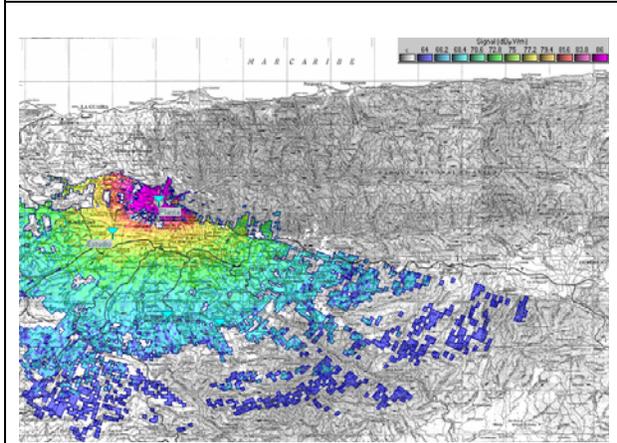
Cuando la potencia del transmisor esta fijada entre 0,2 y 20kW, aun no se obtiene una cobertura satisfactoria.



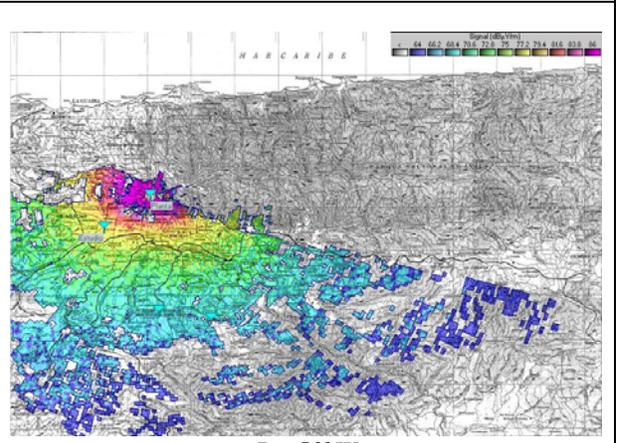
Pt=30kW



Pt=35kW



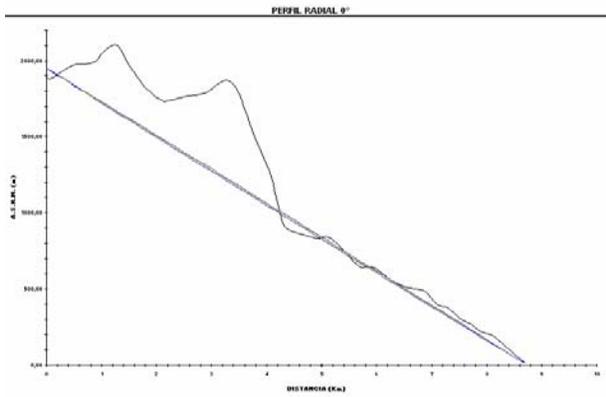
Pt=40kW



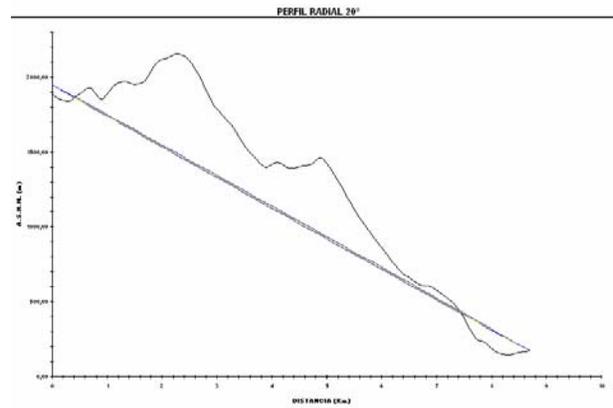
Pt=50kW

[ANEXO 5]
PERFILES CON OBSTRUCCIÓN FILO DE CUCHILLO

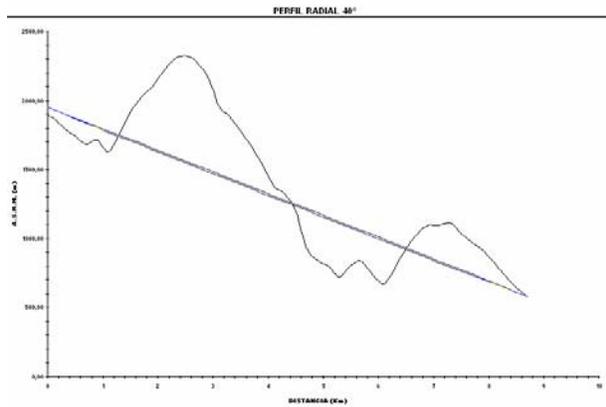
A continuación se presentan los perfiles de los radiales que presentan la obstrucción tipo filo de cuchillo, los cuales fueron trazados para un trayecto de 8,7Km:



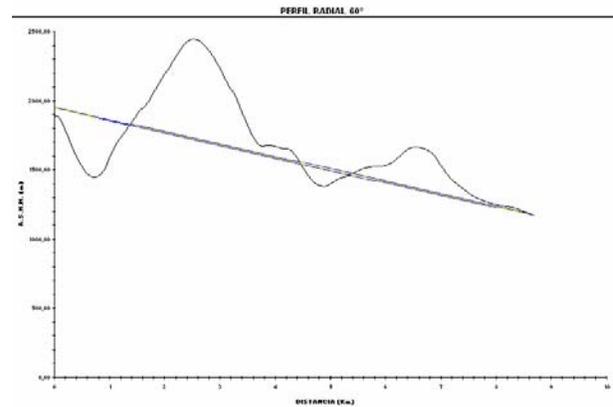
Radial 0°



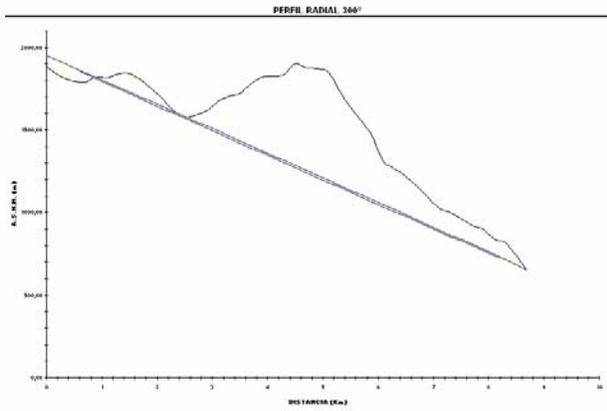
Radial 20°



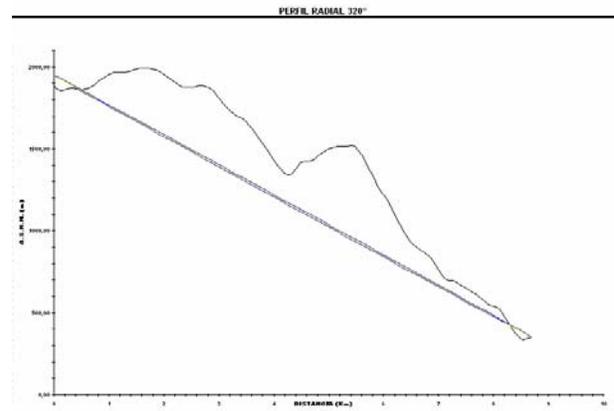
Radial 40°



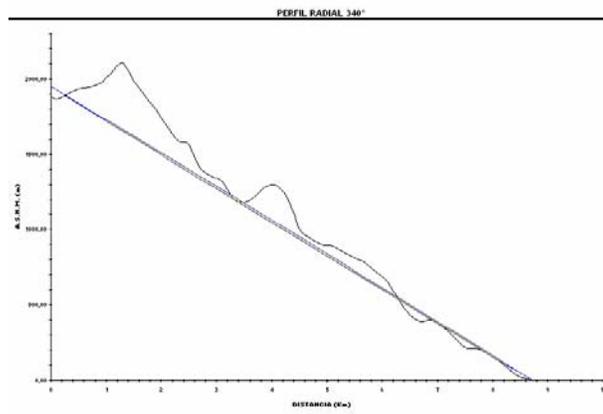
Radial 60°



Radial 300°



Radial 320°



Radial 340°

[ANEXO 6]

CÁLCULOS DE LOS CONTORNOS DE SERVICIO

<p>Nombre de la estación: ANTV CANAL 62 UHF CARACAS</p>	<p>Coordenadas del Tx: Latitud: 10° 31' 51" N Longitud: 66° 52' 34" O Pt(dBk): 14,77 Pal (dB): 0,53</p>	<p>Canal: 62 UHF G(max.): 13dB Angulo Horizontal (max. Rad): 110° Angulo Vertical (max. Rad): 0</p>	<p>A.C.R.S.N.M: 1888m</p>
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Azimut	E/Emax Horizontal dB			G (dB)			ASPT (m)	PER (fsw)	ΔH(m)			ΔF (dB)			Cont 86 dBu			Cont 74 dBu			Cont 64 dBu			F(50,50) dBu		
	Cont 1	Cont 2	Cont 3	Cont 1	Cont 2	Cont 3			Cont 1	Cont 2	Cont 3	Cont 1	Cont 2	Cont 3	Cont 1	Cont 2	Cont 3	Cont 1	Cont 2	Cont 3	Cont 1	Cont 2	Cont 3	Cont 1	Cont 2	Cont 3
0°	-8,5	-8,5	-8,5	4,5	4,5	4,5	1555,5	74,8	-	-	-	-	-	-	-	2,576	2,67	2,67	2,853	99	98,5	98				
20°	-17	-17	-17	-4,0	-4,0	-4,0	1395,1	10,6	-	-	-	-	-	-	-	2,576	2,67	2,853	99	98,5	98					
40°	-30	-30	-30	-17,0	-17,0	-17,0	1290,6	0,52	-	-	-	-	-	-	-	2,576	2,67	2,853	99	98,5	98					
60°	-12	-12	-12	1,0	1,0	1,0	745,5	33,4	-	-	-	-	-	-	-	2,576	2,67	2,853	99	98,5	98					
80°	-6	-6	-6	7,0	7,0	7,0	-78,0	133,0	400,0	400,0	400,0	-37,6	-37,6	-37,6	0,88	1,75	3,2	64,8	52,8	42,8	64,8	52,8	42,8			
100°	-2,5	-2,5	-2,5	10,5	10,5	10,5	329,8	295,1	400,0	400,0	400,0	-37,6	-37,6	-37,6	2,2	6,0	11,6	61,3	49,3	39,3	61,3	49,3	39,3			
120°	-0,5	-0,5	-0,5	12,5	12,5	12,5	896,5	467,7	400,0	400,0	400,0	-37,6	-37,6	-37,6	3,2	9,7	19,1	59,3	47,3	37,3	59,3	47,3	37,3			
140°	-1,5	-1,5	-1,5	11,5	11,5	11,5	999,3	374,9	400,0	400,0	400,0	-37,6	-37,6	-37,6	2,8	9,1	17,9	60,3	48,3	38,3	60,3	48,3	38,3			
160°	-2,8	-2,8	-2,8	10,5	10,5	10,5	865,8	295,1	400,0	400,0	400,0	-37,6	-37,6	-37,6	2,5	8,5	16,6	61,3	49,3	39,3	61,3	49,3	39,3			
180°	-1,5	-1,5	-1,5	11,5	11,5	11,5	882,6	374,9	400,0	400,0	400,0	-37,6	-37,6	-37,6	2,8	9,1	17,9	60,3	48,3	38,3	60,3	48,3	38,3			
200°	-1,5	-1,5	-1,5	11,5	11,5	11,5	930,8	374,9	400,0	400,0	400,0	-37,6	-37,6	-37,6	2,8	9,1	17,9	60,3	48,3	38,3	60,3	48,3	38,3			
220°	-0,5	-0,5	-0,5	12,5	12,5	12,5	833,1	467,7	400,0	400,0	400,0	-37,6	-37,6	-37,6	3,2	9,7	18,5	59,3	47,3	37,3	59,3	47,3	37,3			
240°	-5,8	-5,8	-5,8	7,2	7,2	7,2	924,8	139,3	400,0	400,0	400,0	-37,6	-37,6	-37,6	1,7	6,0	14,1	64,6	52,6	42,6	64,6	52,6	42,6			
260°	0	0	0	13,0	13,0	13,0	893,0	528,8	400,0	400,0	400,0	-37,6	-37,6	-37,6	3,2	10,4	19,1	58,8	46,8	36,8	58,8	46,8	36,8			
280°	-5,8	-5,8	-5,8	7,2	7,2	7,2	732,8	139,3	400,0	400,0	400,0	-37,6	-37,6	-37,6	1,7	6,0	12,9	64,6	52,6	42,6	64,6	52,6	42,6			
300°	-0,5	-0,5	-0,5	12,5	12,5	12,5	1027,8	467,7	-	-	-	-	-	-	-	2,576	2,67	2,853	99	98,5	98					
320°	-1,5	-1,5	-1,5	11,5	11,5	11,5	1421,8	374,9	-	-	-	-	-	-	-	2,576	2,67	2,853	99	98,5	98					
340°	-4,0	-4,0	-4,0	9,0	9,0	9,0	1528,0	210,9	-	-	-	-	-	-	-	2,576	2,67	2,853	99	98,5	98					

NOTA: Pt = Potencia de Transmisión = 30 KW = 14,77 dBK, G = Ganancia de la Antena Transmisora = 13,05 dB

G = G (dB) + 20 log %H + 20 log %V, Pal = Perdidas por la línea = 0,53 dB, PER = Pt + G - Pal = 529,8 KW = 27,24 dB

[ANEXO 7.1]

RADIALES DE LAS ESTACIONES INTERFERENTES

a) Canal 62 Maracay

RADIAL 0°		RADIAL 20°		RADIAL 40°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	463	3	702	3	477
4	487	4	666	4	499
5	711	5	897	5	598
6	1000	6	893	6	563
7	1057	7	869	7	592
8	1210	8	719	8	684
9	1477	9	925	9	941
10	1156	10	924	10	1047
11	920	11	1316	11	1269
12	1207	12	1735	12	1738
13	914	13	1917	13	1837
14	755	14	1545	14	1671
15	624	15	1462	15	1809
16	634	16	1475	16	1552
17	572	17	1298	17	1573
18	421	18	1507	18	1663
19	357	19	1343	19	1658
20	278	20	1270	20	1285
21	260	21	1140	21	1297
22	192	22	859	22	1374
23	160	23	608	23	1027
24	207	24	261	24	725
25	301	25	115	25	435
26	286	26	280	26	623
27	25	27	471	27	840
28	7	28	466	28	1232
29	4	29	266	29	1322
30	6	30	133	30	895
31	4	31	385	31	700
32	5	32	27	32	927
33	6	33	4	33	685
34	4	34	4	34	340
35	4	35	3	35	385
36	4	36	3	36	440
37	5	37	3	37	643
38	5	38	3	38	360
39	3	39	4	39	350
40	4	40	3	40	214
41	4	41	4	41	5
42	2	42	4	42	4
43	4	43	4	43	4
44	4	44	5	44	1
45	4	45	3	45	2
46	2	46	2	46	4
47	3	47	2	47	3
48	2	48	2	48	2
49	2	49	2	49	2
50	2	50	3	50	3

RADIAL 60°		RADIAL 80°		RADIAL 100°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	476	3	464	3	454
4	509	4	446	4	440
5	637	5	448	5	434
6	756	6	458	6	435
7	581	7	555	7	454
8	710	8	689	8	521
9	679	9	637	9	593
10	1118	10	778	10	669
11	954	11	556	11	672
12	1004	12	751	12	592
13	1287	13	548	13	484
14	1389	14	591	14	476
15	1045	15	814	15	619
16	918	16	818	16	737
17	1206	17	611	17	695
18	1532	18	610	18	616
19	1879	19	680	19	773
20	1855	20	630	20	731
21	1738	21	1039	21	589
22	1757	22	1073	22	698
23	1925	23	1133	23	612
24	2027	24	895	24	607
25	1734	25	712	25	568
26	1734	26	1141	26	543
27	1966	27	1329	27	539
28	1883	28	1175	28	555
29	2087	29	963	29	599
30	2226	30	879	30	582
31	1891	31	819	31	690
32	1852	32	1083	32	591
33	2237	33	1501	33	594
34	1957	34	1461	34	623
35	1759	35	1258	35	685
36	1959	36	1295	36	902
37	1814	37	1095	37	751
38	1851	38	848	38	895
39	1851	39	1101	39	1268
40	1410	40	1333	40	1193
41	1434	41	1032	41	1144
42	1221	42	873	42	1065
43	1302	43	844	43	982
44	1355	44	992	44	976
45	1052	45	927	45	1238
46	759	46	1044	46	1295
47	877	47	1103	47	1347
48	1058	48	1035	48	1309
49	1035	49	1267	49	1215
50	1401	50	1539	50	1049

RADIAL 120°		RADIAL 140°		RADIAL 160°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	452	3	446	3	442
4	443	4	440	4	435
5	438	5	437	5	421
6	438	6	430	6	423
7	442	7	437	7	423
8	446	8	437	8	425
9	449	9	436	9	426
10	451	10	433	10	429
11	454	11	438	11	431
12	455	12	443	12	432
13	455	13	444	13	430
14	457	14	440	14	434
15	460	15	442	15	431
16	461	16	443	16	609
17	463	17	454	17	481
18	461	18	450	18	452
19	461	19	443	19	490
20	455	20	448	20	625
21	450	21	448	21	787
22	595	22	452	22	686
23	612	23	468	23	549
24	618	24	691	24	533
25	700	25	690	25	529
26	951	26	625	26	534
27	1093	27	577	27	559
28	1056	28	599	28	666
29	1084	29	846	29	863
30	1050	30	920	30	671
31	1048	31	720	31	745
32	1057	32	930	32	749
33	1091	33	685	33	793
34	967	34	634	34	589
35	923	35	643	35	728
36	811	36	547	36	730
37	825	37	612	37	798
38	886	38	785	38	715
39	894	39	704	39	772
40	668	40	771	40	821
41	637	41	659	41	924
42	721	42	527	42	752
43	688	43	516	43	823
44	902	44	508	44	761
45	847	45	451	45	945
46	731	46	415	46	726
47	511	47	401	47	784
48	482	48	418	48	1199
49	609	49	435	49	785
50	592	50	427	50	635

RADIAL 180°		RADIAL 200°		RADIAL 220°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	439	3	438	3	436
4	432	4	428	4	429
5	414	5	412	5	422
6	414	6	414	6	413
7	411	7	416	7	419
8	411	8	412	8	417
9	415	9	410	9	414
10	420	10	414	10	412
11	425	11	413	11	411
12	421	12	412	12	411
13	420	13	408	13	412
14	427	14	410	14	411
15	425	15	410	15	409
16	429	16	448	16	412
17	434	17	626	17	410
18	440	18	452	18	569
19	474	19	552	19	469
20	603	20	693	20	450
21	821	21	816	21	435
22	651	22	855	22	423
23	604	23	821	23	415
24	756	24	655	24	432
25	786	25	687	25	442
26	744	26	693	26	466
27	811	27	739	27	534
28	773	28	756	28	506
29	878	29	747	29	480
30	753	30	715	30	460
31	690	31	705	31	460
32	667	32	739	32	562
33	662	33	839	33	624
34	857	34	856	34	727
35	987	35	821	35	775
36	1088	36	997	36	757
37	1312	37	894	37	936
38	992	38	682	38	981
39	708	39	597	39	1166
40	888	40	555	40	800
41	879	41	690	41	772
42	786	42	904	42	720
43	813	43	1150	43	763
44	775	44	1013	44	991
45	854	45	878	45	877
46	879	46	778	46	811
47	702	47	660	47	606
48	650	48	550	48	550
49	450	49	634	49	542
50	500	50	760	50	555

RADIAL 240°		RADIAL 260°		RADIAL 280°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	438	3	440	3	447
4	434	4	439	4	447
5	433	5	441	5	444
6	415	6	432	6	435
7	412	7	424	7	433
8	405	8	414	8	415
9	410	9	390	9	426
10	404	10	372	10	426
11	410	11	385	11	427
12	408	12	402	12	428
13	410	13	411	13	436
14	404	14	414	14	435
15	405	15	412	15	430
16	410	16	413	16	436
17	411	17	410	17	452
18	411	18	411	18	459
19	411	19	409	19	460
20	411	20	410	20	533
21	411	21	430	21	555
22	410	22	380	22	497
23	405	23	412	23	503
24	408	24	425	24	496
25	408	25	408	25	556
26	407	26	415	26	602
27	412	27	427	27	687
28	409	28	431	28	958
29	409	29	432	29	632
30	410	30	435	30	531
31	410	31	439	31	493
32	412	32	438	32	498
33	415	33	437	33	575
34	411	34	436	34	783
35	415	35	436	35	1004
36	419	36	439	36	839
37	423	37	457	37	694
38	424	38	447	38	1080
39	424	39	447	39	907
40	425	40	448	40	1051
41	425	41	448	41	1323
42	427	42	470	42	1259
43	430	43	643	43	1044
44	435	44	489	44	1212
45	442	45	474	45	1319
46	442	46	542	46	1231
47	448	47	648	47	1328
48	451	48	671	48	1119
49	456	49	573	49	1146
50	463	50	547	50	1322

RADIAL 300°		RADIAL 320°		RADIAL 340°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	452	3	452	3	457
4	451	4	456	4	486
5	570	5	464	5	721
6	504	6	475	6	797
7	691	7	485	7	665
8	494	8	509	8	673
9	449	9	583	9	873
10	460	10	613	10	1087
11	505	11	758	11	1350
12	501	12	919	12	1745
13	747	13	1291	13	1914
14	1087	14	1315	14	2102
15	1226	15	1187	15	1650
16	1176	16	866	16	1151
17	1274	17	982	17	870
18	1685	18	890	18	1285
19	1484	19	953	19	957
20	1480	20	1029	20	799
21	1285	21	811	21	588
22	1221	22	568	22	538
23	618	23	638	23	416
24	771	24	321	24	765
25	582	25	422	25	555
26	298	26	359	26	391
27	575	27	235	27	211
28	794	28	136	28	37
29	1106	29	20	29	3
30	1281	30	14	30	6
31	754	31	169	31	4
32	264	32	254	32	5
33	175	33	6	33	5
34	446	34	6	34	4
35	676	35	5	35	4
36	622	36	4	36	3
37	451	37	5	37	3
38	239	38	7	38	5
39	12	39	4	39	4
40	10	40	7	40	3
41	8	41	2	41	3
42	8	42	4	42	3
43	41	43	5	43	2
44	11	44	3	44	5
45	39	45	3	45	1
46	12	46	2	46	2
47	8	47	3	47	0
48	4	48	2	48	4
49	6	49	2	49	3
50	3	50	5	50	4

b) Canal 61 Villa de Cura

RADIAL 0°		RADIAL 20°		RADIAL 40°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	734	3	547	3	657
4	609	4	563	4	545
5	501	5	638	5	579
6	485	6	789	6	615
7	465	7	648	7	620
8	457	8	512	8	642
9	451	9	469	9	778
10	447	10	452	10	879
11	446	11	459	11	910
12	445	12	575	12	1020
13	467	13	457	13	979
14	453	14	454	14	1011
15	453	15	452	15	940
16	457	16	453	16	934
17	459	17	560	17	791
18	458	18	530	18	797
19	460	19	579	19	669
20	461	20	528	20	814
21	468	21	492	21	716
22	507	22	520	22	598
23	488	23	691	23	709
24	488	24	632	24	611
25	506	25	701	25	590
26	554	26	687	26	575
27	550	27	862	27	623
28	875	28	792	28	579
29	869	29	923	29	602
30	785	30	863	30	792
31	1136	31	972	31	861
32	1209	32	1023	32	1007
33	1207	33	876	33	1051
34	1338	34	935	34	895
35	1482	35	1187	35	662
36	1524	36	1297	36	677
37	1775	37	1532	37	670
38	2105	38	1892	38	748
39	1781	39	1873	39	1053
40	1337	40	1868	40	1187
41	1119	41	2037	41	1441
42	738	42	2231	42	1116
43	571	43	1871	43	1118
44	699	44	1912	44	966
45	399	45	2081	45	1064
46	366	46	1630	46	1207
47	697	47	1274	47	1559
48	717	48	934	48	1847
49	396	49	800	49	1938
50	400	50	689	50	1756

RADIAL 60°		RADIAL 80°		RADIAL 100°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	808	3	573	3	614
4	793	4	655	4	698
5	766	5	608	5	738
6	664	6	643	6	737
7	773	7	707	7	687
8	726	8	930	8	709
9	646	9	1041	9	601
10	599	10	1058	10	671
11	593	11	1084	11	653
12	599	12	1000	12	640
13	609	13	1045	13	965
14	629	14	1052	14	1200
15	657	15	1188	15	1114
16	818	16	1082	16	987
17	966	17	946	17	795
18	1130	18	1069	18	741
19	961	19	957	19	699
20	1030	20	742	20	622
21	1098	21	748	21	629
22	826	22	966	22	868
23	712	23	692	23	781
24	838	24	748	24	802
25	959	25	973	25	601
26	732	26	768	26	719
27	846	27	546	27	697
28	869	28	634	28	641
29	1087	29	669	29	432
30	1419	30	915	30	417
31	1445	31	1120	31	514
32	1373	32	912	32	440
33	1251	33	669	33	411
34	1036	34	639	34	453
35	928	35	700	35	422
36	1123	36	618	36	470
37	1142	37	678	37	661
38	924	38	673	38	563
39	902	39	812	39	484
40	977	40	975	40	538
41	933	41	1020	41	771
42	750	42	1074	42	882
43	508	43	851	43	1016
44	507	44	652	44	651
45	476	45	577	45	621
46	458	46	545	46	774
47	523	47	578	47	654
48	584	48	583	48	574
49	617	49	565	49	404
50	599	50	523	50	510

RADIAL 120°		RADIAL 140°		RADIAL 160°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	515	3	537	3	643
4	504	4	558	4	812
5	501	5	765	5	727
6	500	6	706	6	589
7	580	7	502	7	596
8	629	8	804	8	731
9	608	9	544	9	710
10	501	10	761	10	656
11	499	11	666	11	825
12	756	12	536	12	748
13	534	13	682	13	888
14	488	14	812	14	720
15	500	15	561	15	716
16	547	16	477	16	647
17	496	17	452	17	748
18	476	18	443	18	984
19	450	19	505	19	578
20	428	20	473	20	666
21	420	21	485	21	755
22	451	22	458	22	657
23	409	23	418	23	465
24	461	24	452	24	439
25	441	25	494	25	367
26	375	26	410	26	363
27	399	27	388	27	372
28	423	28	361	28	359
29	529	29	386	29	310
30	409	30	329	30	332
31	439	31	428	31	328
32	425	32	381	32	345
33	440	33	368	33	314
34	368	34	385	34	362
35	393	35	345	35	432
36	380	36	315	36	255
37	385	37	295	37	247
38	365	38	239	38	275
39	355	39	254	39	239
40	451	40	242	40	229
41	489	41	307	41	228
42	394	42	242	42	226
43	411	43	239	43	214
44	382	44	245	44	217
45	426	45	264	45	225
46	494	46	242	46	237
47	542	47	225	47	294
48	473	48	249	48	289
49	429	49	264	49	252
50	329	50	266	50	262

RADIAL 180°		RADIAL 200°		RADIAL 220°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	624	3	596	3	672
4	770	4	707	4	703
5	911	5	893	5	826
6	848	6	704	6	766
7	712	7	681	7	836
8	610	8	627	8	712
9	670	9	650	9	931
10	786	10	696	10	775
11	766	11	728	11	634
12	884	12	749	12	660
13	973	13	1075	13	720
14	905	14	1200	14	844
15	1085	15	946	15	846
16	840	16	959	16	961
17	1062	17	1081	17	947
18	1243	18	1226	18	1007
19	935	19	883	19	795
20	891	20	706	20	936
21	1036	21	718	21	954
22	985	22	672	22	651
23	666	23	550	23	680
24	542	24	440	24	726
25	484	25	400	25	1108
26	408	26	435	26	917
27	391	27	407	27	696
28	462	28	341	28	885
29	362	29	343	29	769
30	364	30	316	30	524
31	353	31	302	31	481
32	331	32	285	32	392
33	348	33	276	33	458
34	390	34	284	34	584
35	357	35	271	35	386
36	323	36	281	36	334
37	323	37	309	37	371
38	246	38	329	38	335
39	253	39	238	39	374
40	266	40	222	40	332
41	275	41	437	41	345
42	288	42	302	42	346
43	264	43	419	43	327
44	239	44	434	44	314
45	236	45	410	45	316
46	237	46	291	46	338
47	206	47	253	47	303
48	204	48	295	48	320
49	197	49	226	49	349
50	200	50	213	50	313

RADIAL 240°		RADIAL 260°		RADIAL 280°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	783	3	556	3	537
4	709	4	575	4	531
5	767	5	682	5	551
6	950	6	585	6	690
7	870	7	610	7	713
8	1064	8	746	8	639
9	989	9	632	9	526
10	935	10	657	10	520
11	965	11	678	11	539
12	763	12	675	12	571
13	922	13	847	13	623
14	774	14	921	14	624
15	663	15	966	15	608
16	659	16	870	16	518
17	697	17	815	17	626
18	731	18	804	18	590
19	806	19	730	19	620
20	855	20	793	20	739
21	910	21	749	21	863
22	910	22	716	22	1019
23	814	23	699	23	938
24	732	24	709	24	791
25	586	25	723	25	734
26	566	26	752	26	784
27	525	27	835	27	671
28	555	28	914	28	582
29	641	29	1137	29	519
30	808	30	1003	30	455
31	1029	31	925	31	441
32	1092	32	880	32	443
33	836	33	1056	33	443
34	787	34	1088	34	442
35	714	35	911	35	437
36	677	36	835	36	434
37	682	37	776	37	431
38	820	38	717	38	425
39	841	39	734	39	425
40	817	40	712	40	412
41	847	41	742	41	417
42	682	42	858	42	436
43	563	43	640	43	414
44	555	44	591	44	414
45	529	45	578	45	425
46	560	46	568	46	436
47	491	47	574	47	471
48	479	48	600	48	424
49	447	49	642	49	477
50	444	50	853	50	426

RADIAL 300°		RADIAL 320°		RADIAL 340°	
D (Km)	Altura (m)	D (Km)	Altura (m)	D (Km)	Altura (m)
3	513	3	505	3	554
4	538	4	547	4	500
5	535	5	733	5	502
6	525	6	794	6	696
7	557	7	872	7	580
8	549	8	732	8	530
9	475	9	619	9	590
10	466	10	454	10	518
11	464	11	467	11	476
12	447	12	527	12	438
13	449	13	510	13	439
14	442	14	430	14	439
15	436	15	428	15	439
16	426	16	431	16	440
17	418	17	427	17	440
18	413	18	429	18	437
19	417	19	422	19	436
20	407	20	417	20	440
21	465	21	417	21	438
22	481	22	415	22	437
23	411	23	416	23	436
24	416	24	415	24	437
25	413	25	416	25	439
26	408	26	417	26	440
27	415	27	417	27	432
28	410	28	418	28	593
29	411	29	418	29	485
30	409	30	424	30	499
31	409	31	417	31	724
32	409	32	411	32	981
33	409	33	416	33	827
34	411	34	422	34	1094
35	409	35	427	35	1218
36	414	36	433	36	1357
37	415	37	439	37	1203
38	423	38	483	38	1339
39	402	39	858	39	1553
40	411	40	802	40	1050
41	416	41	934	41	1146
42	407	42	1010	42	821
43	415	43	1267	43	905
44	421	44	1654	44	854
45	429	45	1565	45	1372
46	432	46	1370	46	1538
47	439	47	1313	47	1329
48	463	48	1193	48	1050
49	527	49	845	49	813
50	515	50	451	50	589

[ANEXO 7.2]

CONTORNO DE 42dBu DE LA ESTACIÓN CANAL 62 MARACAY

CONTORNO DE 42dBu PARA EL CANAL 62 UHF, MARACAY					
RADIAL	ASPT (m)	Δh (m)	ΔF (dB)	F(50,50)	D(Km)
0°	-333,8	400	-37,6	54,49	12,86
20°	-603,8	400	-37,6	54,49	12,86
40°	-538,8	400	-37,6	54,49	12,86
60°	-340,3	400	-37,6	54,49	12,86
80°	-78,0	400	-37,6	54,49	12,86
100°	-9,4	400	-37,6	54,49	15,36
120°	67,8	400	-37,6	54,49	22,87
140°	78,3	333,8	-30,5	47,39	31,62
160°	87,6	400	-37,6	53,59	24,12
180°	95,9	400	-37,6	53,59	25,37
200°	197,4	400	-37,6	53,59	30,37
220°	228,3	400	-37,6	53,59	32,87
240°	196,9	-	-	16,89	106,67
260°	222,6	154,8	-11,6	28,49	79,15
280°	84,0	400	-37,6	54,49	24,12
300°	-108,9	400	-37,6	54,49	12,86
320°	-214,3	400	-37,6	54,49	12,86
340°	-361,8	400	-37,6	54,49	12,86

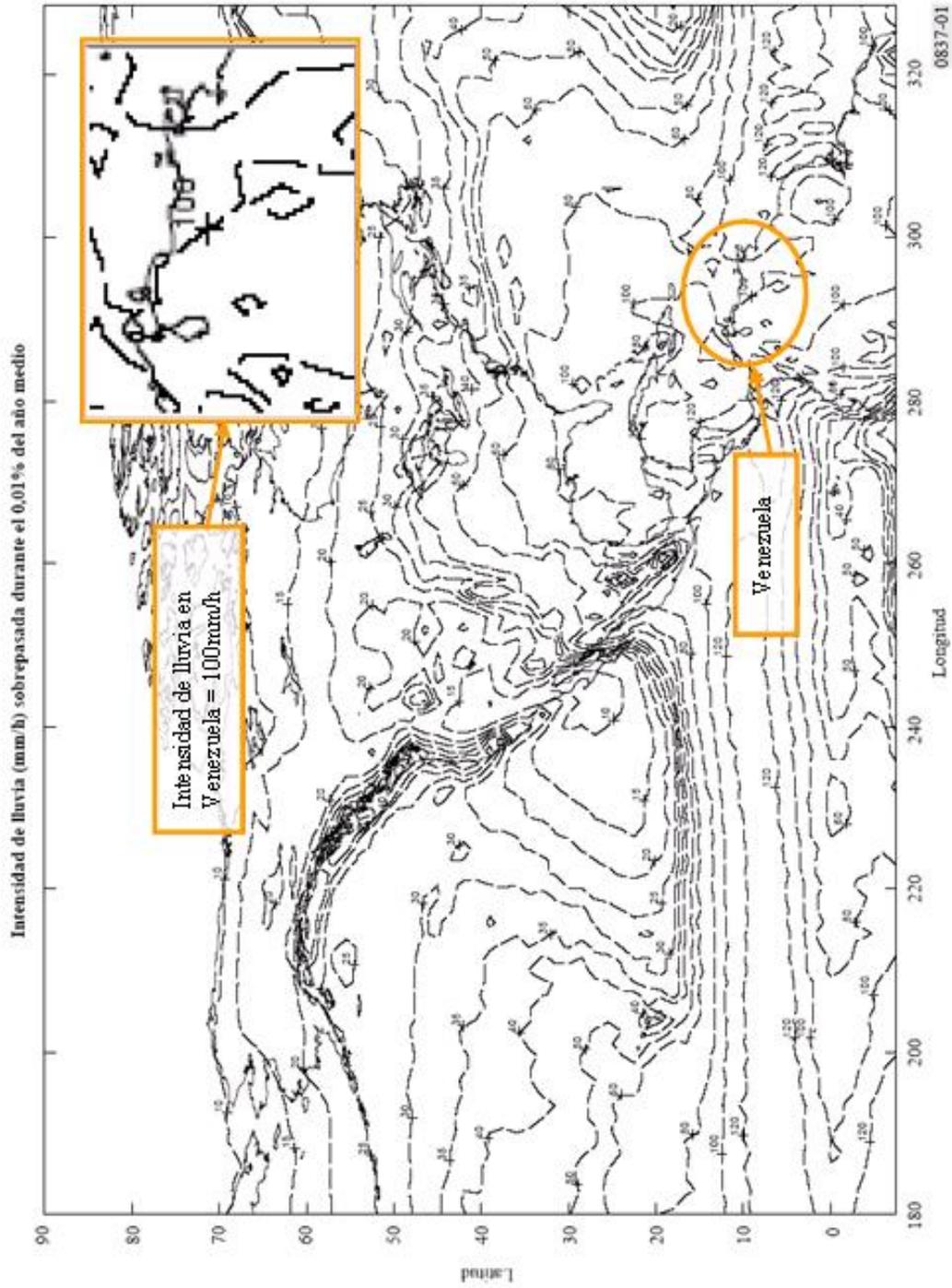
[ANEXO 8]

TABLA DE COTAS Vs DISTANCIA DEL PERFIL ESTUDIO-PLANTA

ESTUDIO - PLANTA	
D (Km)	Altura (m)
0	931
0,11	924,7
0,22	924
0,329	928,5
0,439	926,9
0,549	924,7
0,659	922,8
0,769	922,3
0,879	923,3
0,988	921,6
1,098	920,6
1,208	918,6
1,318	910,8
1,428	906
1,537	908,3
1,647	913,2
1,757	922,5
1,867	935,2
1,977	943,2
2,087	949,2
2,196	953,6
2,306	956,8
2,416	963,3
2,526	979
2,636	1021,8
2,745	1078,2
2,855	1124
2,965	1155,3
3,075	1178
3,185	1206,1
3,294	1233,1
3,404	1257,9
3,514	1292,7
3,624	1349,3
3,734	1415,6
3,844	1472,5
3,953	1515,1
4,063	1552,6
4,173	1566,6
4,283	1597,1
4,393	1628,5
4,502	1673,3
4,612	1699,7
4,722	1727,9
4,832	1749,2
4,942	1763,2
5,052	1786,5
5,161	1812,3
5,249	1837

[ANEXO 9]

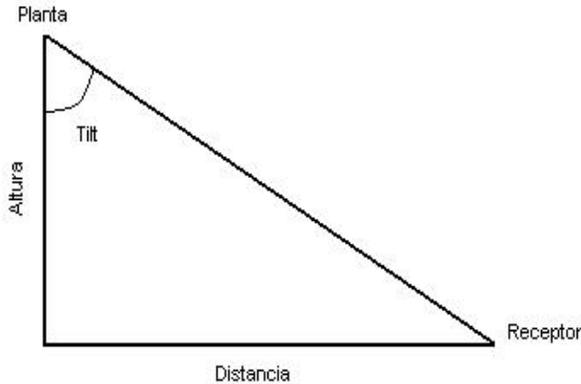
INTENSIDAD DE LLUVIA, RECOMENDACIÓN UIT-R P-837-3



[ANEXO 10]

TILT DE LA ANTENA TRANSMISORA UHF

Luego de escoger varias zonas de recepción, con la distancia y la diferencia de altura entre la planta transmisora y la zona de prueba realizamos el cálculo siguiente:



$$Tilt = \arctg\left(\frac{D(m)}{A(m)}\right)$$

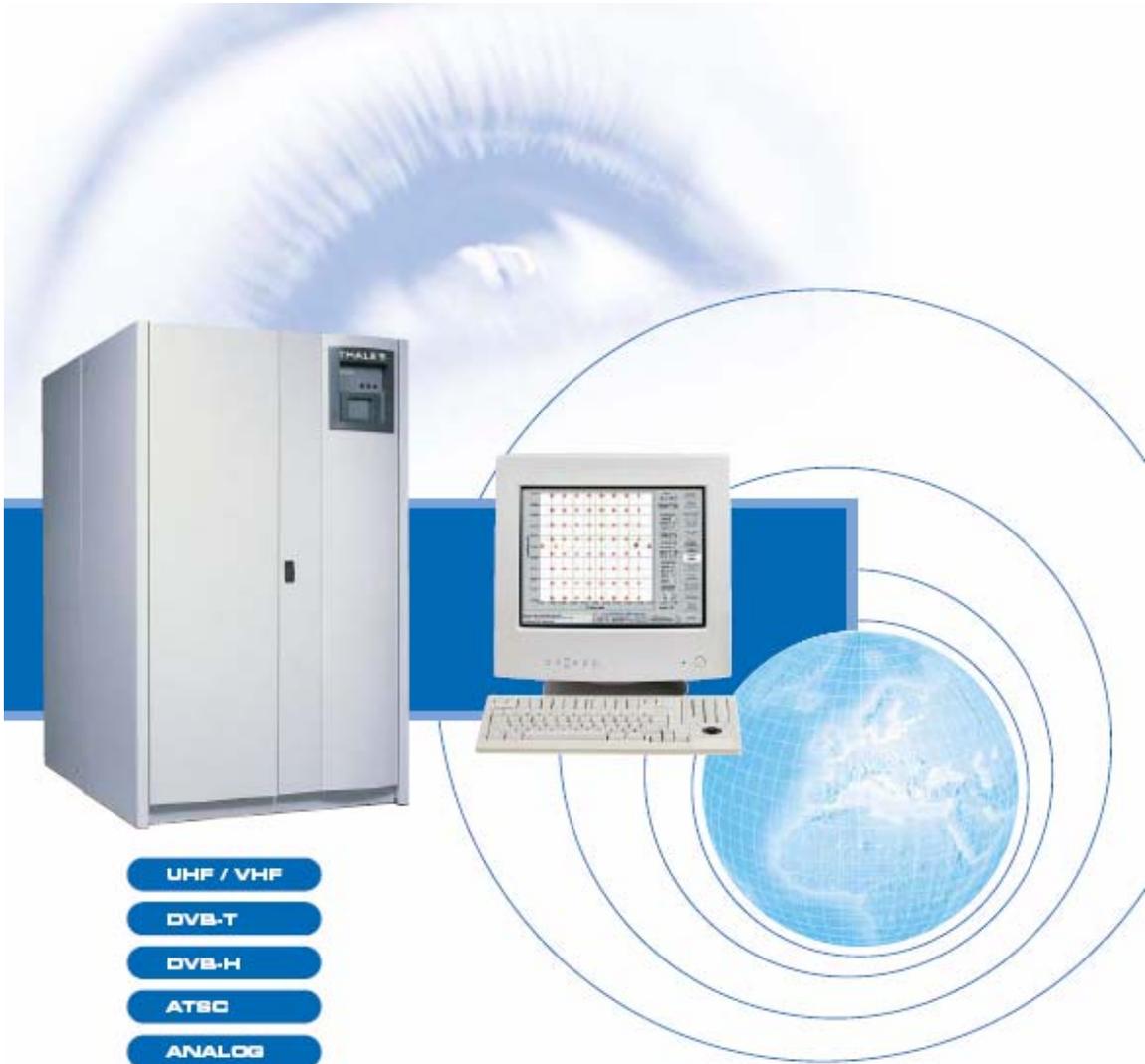
D = Distancia entre planta y el sitio de recepción

A = Altura entre planta y sitio de recepción

POBLACION	ALTURA TORRE (Km)	ALTURA SITIO (m)	DISTANCIA (Km)	TILT(°)
PALO VERDE	1888	925	12,5	4,405
EL MARQUES	1888	843	9,5	6,277
LA CALIFORNIA	1888	830	11,6	5,211
CAFETAL	1888	974	10	5,222
ALTO HATILLO	1888	1200	14,8	2,661
LOS NARANJOS	1888	1100	14,4	3,132
CHACAITO	1888	806	6,9	8,474
ALTO PRADO	1888	1100	12	3,757
BELLO MONTE	1888	860	7	8,354
EL VALLE	1888	945	10,4	5,181
PRADO DE MARIA	1888	883	8,5	6,743
LA VEGA	1888	800	11,5	5,404
EL SILENCIO	1888	866	6,9	8,425
EL PARAISO	1888	850	8,5	6,962
PROPATRIA	1888	976	10,2	5,109
CATIA	1888	1018	8	6,206
PROMEDIO				5,72° ≈ 6°

El promedio de todos los ángulos será entonces el tilt a fijar en la antena transmisora, que como se puede observar en la tabla presentada supra, este grado de inclinación es de 6°.

[ANEXO 11]
TRANSMISOR UHF



→ **ANALOG
AND DIGITAL
TV TRANSMITTERS**

➔ Analog and Digital TV Trans

UHF ULTIMATE

VHF OPTIMUM



Digital adaptive

Today and tomorrow

Pioneering solid state broadcasting technology for more than 20 years, Thales is pleased to present its third generation of TV Solid State Transmitters.

Thales transmitters answer the new UHF/VHF market requirements, and address the promising opportunities of the digital area.

Thales introduced the **ULTIMATE** and **OPTIMUM** after close collaboration with our customers. The results combine state of the art technology, broadcasting security, and a new standard for maintenance.

The result is a comprehensive range of transmitters addressing both the analog and digital markets. The analog units range in power from 2kW to 60kW, digital units range is 800Wrms to 22kWrms.

Among the major benefits : ULTIMATE and OPTIMUM have been designed to adhere to the digital standards (DVB-T, DVB-H and ATSC). When buying ULTIMATE or OPTIMUM analog range, you are sure to make the right choice : all ULTIMATE and OPTIMUM analog transmitters are fitted and easily upgradeable for digital transmission.

The Thales philosophy was to develop common modules for digital and analog transmitters : amplifiers, power supplies, control unit. Now you simply switch the analog exciter with the digital one.

Today, Thales is proud to be the leader in automatic correction with the digital adaptive precorrection. This automatic precorrection is changing the concept of transmission : you are now sure to have an intelligent transmitter! The aging of the transmitter, the environmental variations, the reduction of output power, will be taken into account by the digital adaptive precorrection and will be corrected accordingly. The transmitted signals will always have the same high performance so that you will no longer have to intervene : digital adaptive precorrection works for you !

Consequently, you can imagine how your maintenance will be easier! No adjustments, no special electronic devices, etc. to refresh the transmitter's performances, all you need is ULTIMATE or OPTIMUM !

We know the choice you're making today has to remain the best one for the next 20 years. So with Thales TV technology, you get the most advanced features available on the market in terms of :

● Structure

ULTIMATE and OPTIMUM feature a cableless structure, which provides the advantages of :

- the highest level of reliability
- simplification of maintenance operations

● Amplification

Thales uses proven broadband amplifier technology.

Based on LDMos, Dmos and Mosfet technologies, Thales's transmitters offer high efficiency, high reliability and excellent thermal characteristics.

In addition, no visual or audio adjustment is required for transmission in digital or analog.

mitters :

These transmitters are also available in common amplification :

- for a fast and easy change of frequency,
- for an rapid and cost effective migration to digital.

These major advantages lead to a drastic reduction of spare part cost.

● Control & monitoring

A microprocessor supervises the status of the transmitter and provides all the useful information of each subassembly. Thanks to the LCD Display, ULTIMATE and OPTIMUM offer a complete guide for the control and maintenance. The control unit software allows a complete status check of the transmitter from one transistor inside an amplifier module, up to the position of the power supply breaker. This precise and usefull information enables broadcasters to identify the failure and reduce considerably intervention times.

All monitoring informations are available through Web server or SNMP agent. Thales is proud to be leader in SNMP deployments, with real complete network supervision experiences.



● Cooling system

In order to satisfy all our customer requirements, Thales has developed two kinds of efficient cooling systems, liquid and air.

A new innovative liquid solution integrates proven technology from AM Radio. More than, 1000 transmitters operate using this technology throughout the world. The cooling system is based on aeronautics technology which ensures liquid tightness and operational safety.



The security of broadcasting

ULTIMATE/OPTIMUM provide the highest level of service availability, thanks to an optimized architecture which avoids broadcast interruption in the event of failure. With Thales transmitters, you select the level of security you need :

- dual exciter with automatic switch-over
- active reserve configuration supervised by microprocessor
- passive reserve configuration supervised by microprocessor
- N+R configuration for digital supervised by microprocessor.

Each Thales transmitter offers an unrivaled level of internal redundancy, with multiple Solid State amplifiers and power supplies operating in parallel.

Each power sub-assembly of the Thales range has integrated protection against VSWR, overdrive, temperature, current, voltage.

ANALOG AND DIGITAL TV TRANSMITTERS

Analog

- General specifications

Power levels peak sync.	2kW to 60kW					
Frequency range	44 – 86MHz ; 170 – 230 MHz ; 470 –862 MHz					
TV standard	PAL, SECAM, NTSC					
Vision standard	All standards					
Sound standard	Mono, BTSC, IRT, NICAM					
Load impedance	50 Ohms					
Power stability	± 0.3dB					
Frequency carrier stability	1.10 ⁻⁷					
Frequency step	50 kHz / 1Hz					
Harmonics	< 60 dB and/or < 20 mW In UHF – 1 mW In VHF					
Spurious emissions	< 60 dB and/or < 20 mW In UHF – 1 mW In VHF					
Input signals						
Inputs	Type	Connector	Frequency	Level	Impedance	VSWR
Video	Video	BNC female	0 to 6MHz	1Vpp ± 6dB	75Ω	>30dB
Audio	Mono	XLR female	40Hz to 15kHz	1,5 Vrms ± 6dB	600Ω ±10% bal Or > 10 k Ω bal	
	IRT*	XLR female	40Hz to 56kHz	1,5 Vrms ± 6dB	600Ω ±10% bal Or > 10 k Ω bal	
	NICAM*	BNC female	Stand. B/G/D/I	300mV ± 1dB	50Ω	>14dB
	BTSC composite	BNC female	30Hz to 120kHz	3Vpp ± 1dB (exc. 75kHz)	75Ω	>35dB
	BTSC subcarrier	BNC female	16Hz to 120kHz	2Vpp ± 1dB (exc. 50kHz)	75Ω	>35dB
	External Pilote	BNC female	10MHz	0dBm ± 2dB	50Ω	>20dB
	External Synth.	BNC female		13dBm ± 2dB	50Ω	>14dB
*Encoders optional						
Visual Performance						
RF amplitude / freq response	according to the standard					
Differential phase	< 3°					
Differential gain	< 5%					
Luminance non-linearity	< 5%					
Envelope delay	according to the standard					
Incidental phase carrier	< 3°					
Luminance bar tilt	< 2%					
Field time bar tilt	< 2%					
Line time bar tilt	< 2%					
2T pulse	< 2%					
Signal to noise	< -34 dB unweighted 0.2 – 5 MHz < -61 dB weighted					
Aural Performance						
	Frequency	Amplitude	Phase	Delay		
Monoson	30Hz to 15kHz	± 0.2 dB	-	-		
IRT	30Hz to 56kHz	± 0.2 dB	-	-		
BTSC composite	30Hz to 50kHz	± 0.05 dB	± 0.5°	-		
	50Hz to 120kHz	± 1 dB	± 10°	-		
BTSC subcarrier	16Hz to 120kHz	± 1 dB	-	-		
NICAM B/G	Fs 2 to 260kHz	± 0.5 dB	-	± 50 ns		
NICAM I	Fs 2 to 360kHz	± 0.5 dB	-	± 70 ns		
Pre-emphasis	50 or 75 µs					
Modulation capability	± 100 kHz (BTSC Excluded)					
Harmonic distortions	< 0.5% (30 Hz to 15 kHz)					
FM Noise	< -60dB					
AM synchronous noise	< -40dB					
AM asynchronous noise	< -50dB					
Channel crosstalk	< -70 dB (IRT)					
Stereo separation	< -40 dB (IRT) (100Hz to 15kHz)					
SAP-PRO to Stereo crosstalk	< -60 dB (BTSC)					
Main to Stereo crosstalk	< -40 dB (BTSC)					
Service conditions						
Temperature range	0°C to 45°C guaranteed specifications / -10°C to 50°C guaranteed operation					
Humidity	< 95% non condensing					
Altitude	up to 1500m , > 1500m on request					
AC power	3 phases, 4 wires + ground, 50 Hz – 60 Hz 208V to 400V ± 15%, 480 + 10% -15%					
CE Marking	Compliant					

The information contained herein is subject to confirmation at time of ordering

SOLID STATE TV TRANSMITTERS

[ANEXO 12]

CATALOGO DE ANTENAS UHF RYMSA



Band IV/V Horizontal Polarization Panel
Especially suitable for square masts
Model: AT15-250

Electrical Specifications

Frequency range	470 – 860 MHz
Peak gain	11.35 dB (ref. $\lambda/2$ dipole)
3 dB beam width	E-plane: 61° H-plane: 26°
Polarization	Horizontal
Impedance	50 Ohms
VSWR	1.10:1 typical (1.15:1 maximum)
Maximum power	1 kW (7/16 connector)
Connector	DIN 7/16 female (other type on request)

Mechanical & Environmental Specifications

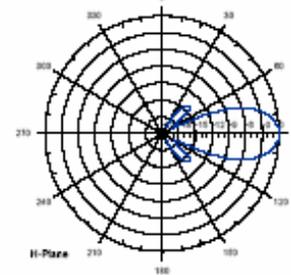
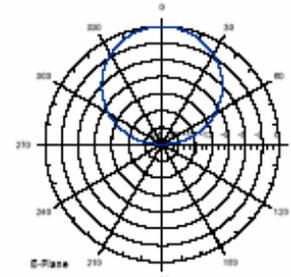
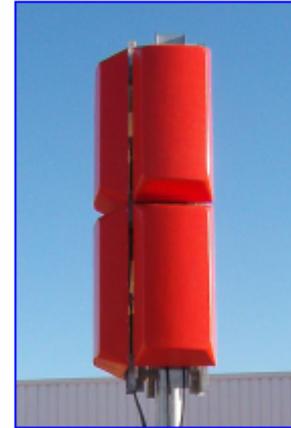
Materials : Reflector & radiating element	Aluminium
Radome	Fiberglass
Dimensions (WxDxH)	483 x 264 x 983 mm
Max. wind speed	200 km/h
Windload (front)	743 N (@ 160 km/h)
Windload (lateral)	258 N (@ 160 km/h)
Weight (kg)	10
Typical mounting	Several combinations depending on the radiation pattern required (typically square)
Vertical spacing	1000 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	8.4	20	1.1 kN	1000
	3	6.6	30	1.6 kN	
	4	5.3	40	1.5 kN	
2	2	11.4	40	2.2 kN	2000
	3	9.6	60	3.2 kN	
	4	8.3	80	3.1 kN	
4	2	14.4	80	4.4 kN	4000
	3	12.6	120	6.4 kN	
	4	11.4	160	6.2 kN	
6	2	16.1	120	6.6 kN	6000
	3	14.4	180	9.6 kN	
	4	13.1	240	8.3 kN	
8	2	17.4	160	8.8 kN	8000
	3	15.6	240	12.8 kN	
	4	14.4	320	12.4 kN	

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

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



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

Phone : 34 91 876 06 81
 Fax: 34 91 876 07 09

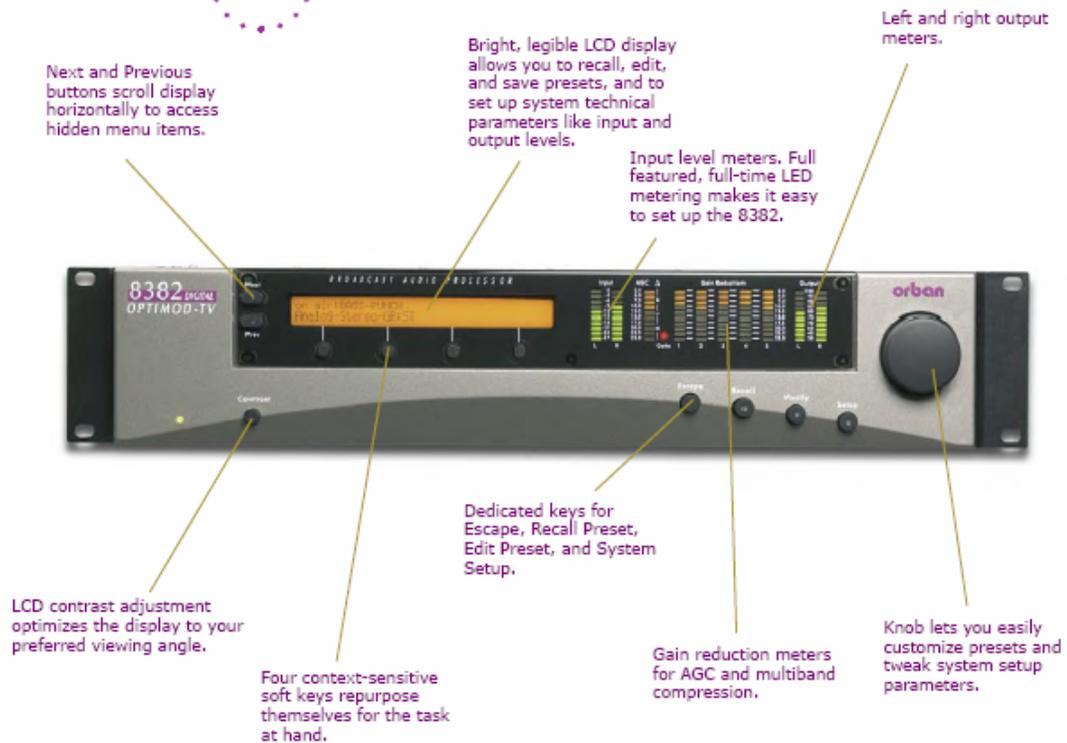
E_mail : broadcast.commercial@rymsa.com
 Web site : www.rymsa.com

[ANEXO 13]
EQUIPO PROCESADOR DE AUDIO



OPTIMOD-TV
8382

details



The 8382 is remote controllable via eight programmable GPI ports, which can be used to recall presets and change operating modes. It is also equipped for remote control via RS232 serial or Ethernet ports and it comes with a full-featured remote control application that runs on Windows 2000 or XP. Finally, the 8382 features the ability to have its input AES3 "channel mode" bits determine its operating mode (stereo or dual-mono), and it can send this information to downstream equipment via the AES3 connection.

The 8382 can also be controlled via its built-in clock-based automation, which can be programmed to change presets and operating modes at preset times. The internal clock can automatically be set via the Internet. It can also be reset to the hour via GPI contact closure to ensure that it remains accurately synchronized with the facility's master clock.

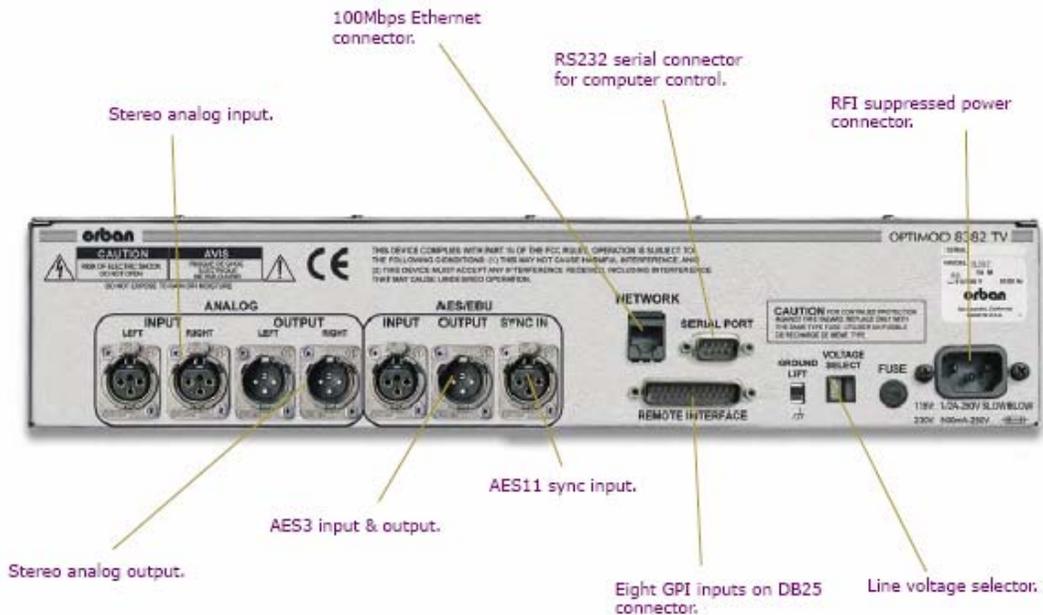
unmatched
cleanliness,
quality

and
stability

If you wish to place level protection prior to your studio / transmitter link (STL), use an Orban studio level control system expressly designed for this purpose. At the time of this writing, these are OPTIMOD-PC 1100V2 (a PCI card that works in Windows XP computers) and OPTIMOD 6300 (a stand-alone processor). Either can be adjusted so that it substitutes for the broadband AGC circuitry in OPTIMOD-TV, which is then defeated.

excellent audio quality...
and loudness consistency

8382TV



features & benefits

USER-FRIENDLY INTERFACE	
LCD and full-time LED meters	Makes setup, adjustment and programming of OPTIMOD-TV easy — you can always see the metering while you're adjusting the processor. Navigation is by dedicated buttons, soft buttons (whose function is context-sensitive), and a large rotary knob. The LEDs show all metering functions of the processing structure (Two-Band or Five-Band) in use.
ABSOLUTE CONTROL OF PEAK MODULATION	
Universal transmitter protection & audio processing for TV broadcast	Can be configured to interface ideally with any commonly found transmission system in the world, including EIAJ stereo, BTSC stereo, and dual-carrier.
Pre-emphasis limiting for the two standard pre-emphasis curves of 50µs & 75µs	Its pre-emphasis control is seldom audibly apparent, producing a clean, open sound with subjective brightness matching the original program. (For AM aural carriers without pre-emphasis, we recommend Orban's OPTIMOD 6300 processor, which also includes a CBS Loudness Controller.)
Tight peak control at all its outputs	Analog left/right and AES/EBU left/right.
Bandwidth limiting & overshoot compensation	By providing 15 kHz low-pass filters ahead of the 8382's audio outputs and stereo encoder, the 8382 prevents aliasing distortion in subsequent stereo encoders or transmission links.
Anti-aliased clippers	Running at 256 kHz sample rate, they prevent any trace of "digital clipper" sound.
FLEXIBLE CONFIGURATION	
Analog & AES/EBU digital inputs & outputs	Both digital input and digital output are equipped with sample rate converters and can operate at 32 kHz, 44.1 kHz, 48, 88.2 and 96 kHz sample rates. The pre-emphasis status and output levels are separately adjustable for the analog and digital outputs. The analog inputs are transformerless, balanced 10 kΩ instrumentation-amplifier circuits , and the analog outputs are transformerless balanced, and floating to ensure highest transparency and accurate pulse response.
Precise control of audio bandwidth to 15 kHz	Prevents overshoots in uncompressed digital links operating at a 32 kHz-sample rate and helps avoid interference to the pilot tone and any subcarriers. Because the stopband of these filters begins at 16 kHz, they are well matched to BTSC stereo generators — the stereo generator will need to remove very little energy to protect the pilot tone, minimizing peak modulation overshoot.
Dual-mono mode	Allows entirely separate mono programs to be processed, facilitating dual-language operation.
Rigorously RFI-suppressed input, output & power connections	Orban's traditional exacting standards ensure trouble-free installation.
Certified	Meets all applicable international safety and emissions standards.

outstandingly

clean speech reproduction

features & benefits

ADAPTABILITY THROUGH MULTIPLE AUDIO PROCESSING STRUCTURES	
Rides gain over an adjustable range of up to 25 dB	Compresses dynamic range and compensates for both operator gain-riding errors and gain inconsistencies in automated systems.
Two processing structures	A processing structure is a program that operates as a complete audio processing system. Only one processing structure can be on-air at a time. OPTIMOD-TV realizes its processing structures as a series of high-speed mathematical computations made by Digital Signal Processing (DSP) chips. Use the Five-Band for a spectrally consistent sound with good loudness control. Use Two-Band with CBS Loudness Controller for a transparent sound that preserves the frequency balance of the original program material while also effectively controlling subjective loudness. (The CBS Loudness Controller is not needed with the Five-Band processing because its spectral consistency creates consistent loudness as a desirable byproduct.) A special Two-Band preset creates a no-compromise "Protect" function that is functionally similar to the "Protect" structures in earlier Orban digital processors. The Five-Band and Two-Band structures can be switched via a mute-free crossfade. The 8382's Two-Band processing structure is phase-linear to maximize audible transparency.
Orban's next generation look-ahead technology	Achieves outstandingly clean speech reproduction.
CONTROLLABLE	
Eight programmable, optically isolated "general-purpose interface" (GPI) ports	Allows the 8382 to be remote-controlled by 5-12 V pulses applied to these ports.
8382 PC Remote software	A graphical application that runs under Windows 2000 and XP. It communicates with a given 8382 via TCP/IP over modem, direct serial, and Ethernet connections. You can configure PC Remote to switch between many 8382s via a convenient organizer that supports giving any 8382 an alias and grouping multiple 8382s into folders. Clicking an 8382's icon causes PC Remote to connect to that 8382 through an Ethernet network, or initiates a Windows Dial-Up or Direct Cable Connection if appropriate. The PC Remote software allows the user to access all 8382 features (including advanced controls not available from the 8382's front panel), and allows the user to archive and restore presets, automation lists, and system setups (containing I/O levels, digital word lengths, GPI functional assignments, etc.).
Bypass Test Mode	Can be invoked locally, by remote control (from either the 8382's GPI port or the 8382 PC Remote application), or by automation to permit broadcast system test and alignment or "proof of performance" tests.
Built-in line-up tone generator	Facilitates quick and accurate level setting in any system.
Upgrade software	OPTIMOD-TV's software can be upgraded by running Orban-supplied downloadable upgrade software on a PC. The upgrade can occur remotely through the 8382's Ethernet port or serial port (connected to an external modem), or locally (by connecting a Windows® computer to the 8382's serial port through the supplied null modem cable).
Versatile real-time clock	Allows automation of various events (including recalling presets) at pre-programmed times.

specifications



It is impossible to characterize the listening quality of even the simplest limiter or compressor based on specifications, because such specifications cannot adequately describe the crucial dynamic processes that occur under program conditions. Therefore, the only way to evaluate the sound of an audio processor meaningfully is by subjective listening tests.

Certain specifications are presented here to assure the engineer that they are reasonable, to help plan the installation, and make certain comparisons with other processing equipment.

PERFORMANCE	
Specifications apply for measurements from analog left/right input to stereo composite output and to TV analog left/right output.	
Frequency Response (Bypass Mode)	Follows standard 50 μ s or 75 μ s pre-emphasis curve ± 0.10 dB, 2.0 Hz – 15 kHz. Analog left/right output and Digital output can be user configured for flat or pre-emphasized output.
Noise	Output noise floor will depend upon how much gain the processor is set for (Limit Drive, AGC Drive, Two-Band Drive, and/or Multi-Band Drive), gating level, equalization, noise reduction, etc. The dynamic range of the A/D converter, which has a specified overload-to-noise ratio of 110 dB, primarily governs it. The dynamic range of the digital signal processing is 144 dB.
Total System Distortion (de-emphasized, 100% modulation)	$< 0.01\%$ THD, 20 Hz – 1 kHz, rising to $< 0.05\%$ at 15 kHz. $< 0.02\%$ SMPTE IM Distortion.
Total System L/R Channel Separation	> 80 dB, 20 Hz – 15 kHz; 90 dB typical.
Polarity (Two-Band and Bypass Modes)	Absolute polarity maintained. Positive-going signal on input will result in positive-going signal on output.
Processing Sample Rate	The 8382 is a "multirate" system, using internal rates from 32 kHz to 256 kHz as appropriate for the processing being performed. Audio clippers operate at 256 kHz.
Processing Resolution	Internal processing has 24 bit (fixed point) or higher resolution; uses Motorola DSP56362 DSP chips.
Delay	The minimum available input / output delay is approximately 20 ms, as determined by the advanced "look-ahead" processing algorithms employed. This can be padded to exactly one frame of 24, 25, 29.97 or 30 frames / second video.
Operating Mode	Stereo or dual-mono. In dual-mono mode, both processing channels have the same subjective adjustments (as determined by the active preset) but are otherwise independent, making this mode appropriate for dual-language transmissions.
INSTALLATION	
Analog Audio Input	
Configuration	Stereo / Dual-Mono.
Impedance	> 10 k Ω load impedance, electronically balanced. (No jumper selection available for 600 Ω . Through-hole pads are available on I/O module for user-installed 600 Ω termination.)
Nominal Input Level	Software adjustable from -4.0 to $+13.0$ dBu (VU).
Maximum Input Level	$+27$ dBu.
Connectors	Two XLR-type, female, EMI-suppressed. Pin 1 chassis ground, Pins 2 (+) and 3 electronically balanced, floating and symmetrical.
A/D Conversion	24 bit 128x oversampled delta sigma converter with linear-phase anti-aliasing filter. Converter outputs 64 kHz sample rate, which the 8382 then decimates to 32 kHz in DSP using an ultra-high-quality image-free synchronous sample rate converter.
Filtering	RFI filtered, with high-pass filter at 0.15 Hz (-3 dB).
Analog Audio Output	
Configuration	Stereo. Flat or pre-emphasized (at 50 μ s or 75 μ s), software-selectable.
Source Impedance	50 Ω , electronically balanced and floating.
Load Impedance	600 Ω or greater, balanced or unbalanced. Termination not required or recommended.
Output Level (100% peak modulation)	Adjustable from -5 dBu to $+24$ dBu peak, into 600 Ω or greater load, software-adjustable.
Signal-to-Noise	≥ 90 dB unweighted (Bypass mode, de-emphasized, 20 Hz – 15 kHz bandwidth, referenced to 100% modulation).
L/R Crosstalk	≤ -70 dB, 20 Hz – 15 kHz.
Distortion	$\leq 0.01\%$ THD (Bypass mode, de-emphasized) 20 Hz – 15 kHz bandwidth.
Connectors	Two XLR-type, male, EMI-suppressed. Pin 1 chassis ground, Pins 2 (+) and 3 electronically balanced, floating and symmetrical.
D/A Conversion	24 bit 128x oversampled.
Filtering	RFI filtered.

INSTALLATION	Digital Audio Input	
	Configuration	Stereo or Two-Channel (dual-mono) per AES3 standard, 24-bit resolution, software selection of stereo or dual-mono. Unit can detect Stereo or Two-Channel status bits and switch modes appropriately.
	Sampling Rate	32, 44.1, 48 or 88.1 kHz, automatically selected.
	Connector	XLR-type, female, EMI-suppressed. Pin 1 chassis ground, pins 2 and 3 transformer balanced and floating, 110 Ω impedance.
	Input Reference Level	Variable within the range of -30 dBFS to -10 dBFS.
	J.17 De-emphasis	Software-selectable.
	Filtering	RFI filtered.
	Digital Audio Output	
	Configuration	Stereo or Two-Channel per AES3 standard. Output configured in software as flat or pre-emphasized to the chosen processing pre-emphasis (50 μs or 75 μs), with or without J.17 pre-emphasis.
	Sample Rate	Internal free running at 32, 44.1, 48, 88.1 or 96 kHz, selected in software. Can also be synced to the AES/EBU digital input at 32, 44.1, 48, 88.1 or 96 kHz, as configured in software.
	Word Length	Software selected for 24, 20, 18, 16 or 14-bit resolution. First-order highpass noise-shaped dither can be optionally added; dither level automatically adjusted appropriately for the word length.
	Connector	XLR-type, male, EMI-suppressed. Pin 1 chassis ground, pins 2 and 3 transformer balanced and floating, 110 Ω impedance.
	Output Level (100% peak modulation)	-20.0 to 0.0 dBFS, software controlled.
	Filtering	RFI filtered.
	Remote Computer Interface	
	Configuration	TCP/IP protocol via direct cable connect, modem, or Ethernet interface. Suitable null modem cable for direct connect is supplied. Modem is not supplied.
	Serial Port	115 kbps RS-232 port DB-9 male, EMI-suppressed.
	Ethernet Port	100 Mbit/sec on RJ45 female connector.
	Remote Control (GPI) Interface	
	Configuration	Eight (8) inputs, opto-isolated and floating.
	Voltage	6 - 15 V AC or DC, momentary or continuous. 9 V DC provided to facilitate use with contact closure.
	Connector	DB-25 male, EMI-suppressed.
	Control	User-programmable for any eight of user presets, factory presets, bypass, test tone, stereo or mono modes, analog input, digital input.
	Filtering	RFI filtered.
	Power	
	Voltage	100 - 132 V AC or 200 - 264 V AC, switch-selected on the rear panel, 50 - 60 Hz, 40 VA.
Connector	IEC, EMI-suppressed. Detachable 3-wire power cord supplied.	
Grounding	Circuit ground is independent of chassis ground, and can be isolated or connected with a rear panel switch.	
Safety Standards	ETL listed to UL standards, CE marked.	
Environmental		
Operating Temperature	32 to 122 °F / 0 to 50 °C for all operating voltage ranges.	
Humidity	0 - 95% RH, non-condensing.	
Dimensions (W x H x D)	19" x 3.5" x 14.25" / 48.3 cm x 8.9 cm x 36.2 cm. Two rack units high.	
RFI / EMI	Tested according to Cerniec procedures. FCC Part 15 Class A device.	
Shipping Weight	19 lbs. / 8.7 kg	
Warranty		
Two Years, Parts & Service	Subject to the limitations set forth in Orban/CRL's Standard Warranty Agreement.	

Because engineering improvements are ongoing, specifications are subject to change without notice.

[ANEXO 14] MONITOR DE MODULACIÓN



BTSC TV Stereo Aural Modulation Monitor and Test System

FEATURES AND BENEFITS

- BTSC measurement capability for complete stereo Proof-of-Performance and operational monitoring.
- Multiple inputs for RF, IF and composite measurements to monitor, analyze, and test each phase of BTSC operation.
- Peak flashers with exclusive Peak Modulation Duration Differentiation (P.M.D.D.) circuit for Stereo and Mono to assure compliance and proper audio processing.
- Built-in modulation calibrator for daily assurance of accuracy.
- Single unit offers complete measurement package without requirement for separate precision demodulator.
- Can be combined with optional Model 850 Distortion Analyzer/Voltmeter and Model 855 SAP and Pro Monitor.

- Large, front panel meters for easy comprehension of all BTSC components.
- Microprocessor controlled display and measurement selection for versatile configuration.
- Complete set of outputs for external measurement and monitoring of stereo and mono.

GENERAL DESCRIPTION

The Model 850 BTSC TV stereo Aural Modulation Monitor/Analyzer is specifically designed to measure, analyze, and monitor all the performance characteristics of a BTSC composite signal.

The Model 850's measurement capabilities include: Total Modulation, Stereo Channel Modulation, individual Left and Right Channel Modulation, Positive and Negative Modulation, Main Channel (L+R) Modulation, Stereo Channel (L-R) Modulation, Stereo Phase, and Stereo Pilot.

A full complement of outputs for external instrumentation and audio monitoring are provided so that proper BTSC stereo operation can be confirmed.

COMPLETE BTSC MEASUREMENT CAPABILITY

Because the Model 850 contains a complete RF preselector and demodulator, it is not necessary to use an external equipment for monitoring and measurements. In addition to a low level RF input, the Model 850 also has a high level RF input for connection to a directional coupler and IF inputs to facilitate measuring and trouble shooting transmitters for proper BTSC operation.

BUILT-IN MODULATION CALIBRATOR

The Model 850 has a built-in calibration circuit which injects a precise, digitally generated RF signal to insure modulation accuracy to $\pm 0.5\%$. This CAL signal can be used without an external RF generator that would be required for a Bessel Null calibration technique.

EXCLUSIVE PEAK-MODULATION-DURATION-DIFFERENTIATION (P.M.D.D.) CIRCUIT

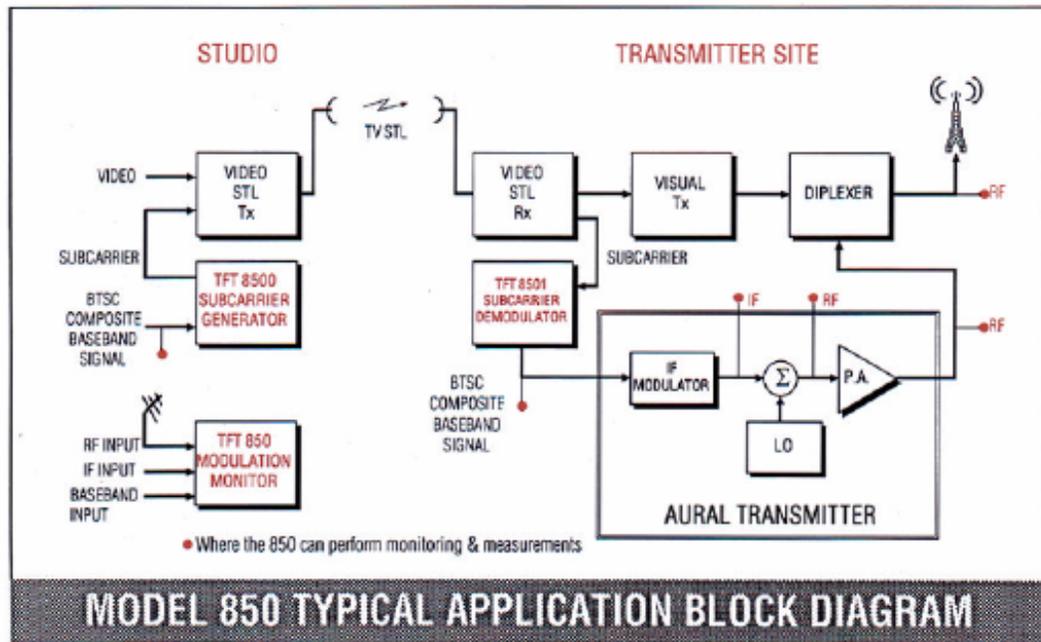
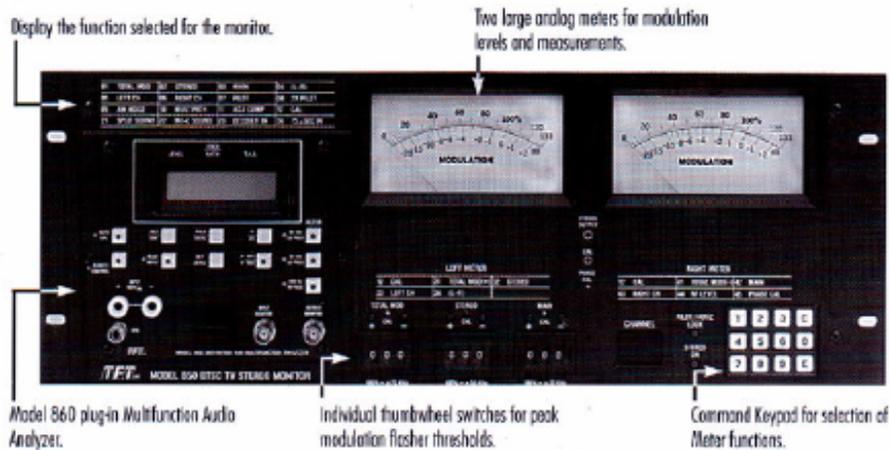
The peak flashers for Total, Stereo, and Main use TFT's P.M.D.D. circuitry to eliminate erroneous peak readings caused by multipath and transients. Thus the modulation of the transmitter can be set to the maximum allowable limits.

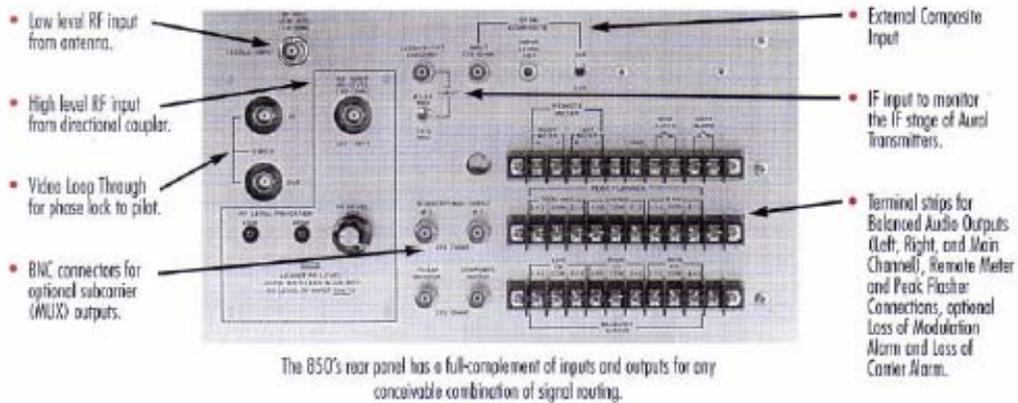
OPTIONAL 860 DISTORTION ANALYZER/VOLTMETER

The Model 860 Distortion Analyzer/Voltmeter plugs into the Model 850 and displays three parameters simultaneously: level, frequency and ratio or T.H.D. of the audio signal. With this plug-in, complete proof of performance measurements are fast and easy. The voltmeter is autoranging and self-calibrating.

OPTIONAL 850 SAP AND PRO

A rear panel output on the Model 850 provides a direct feed to the Model 855 SAP and Pro Monitor used as a part of the BTSC signal.





ACCESSORIES and OPTIONS

- **Model 860 Plug-in Digital Distortion Analyzer/AC Level Meter/Radio Meter for Models 850/851 or 852.** Separate detailed data sheets are available.
- **Remote Metering and Peak Flasher Panel.** TFT part number: 7100-4020. This meter panel duplicates the front panel meters of the 850/851 as well as the peak

flashers for remote meter readings. A 50 foot cable is provided.

- **Alarm and MUX board.** TFT part number: 7100-4110. This plugging card consists of circuitry to detect the loss of carrier and modulation and also provides relay contact closures for activating an external alarm. Additionally, one or two

band-pass filters can be provided for multiplex subcarriers (39 kHz and 102.27kHz). These subcarriers are then available at the rear panel outputs of the 850/851.

Other Related Units:

851

The Model 851 is for use in conjunction with a precision TV demodulator. It requires a BTSC composite signal at its input. The 851 is a lower cost version of the 850. The RF preselector and demodulator are not available in this unit.

852

The Model 852 is specifically designed for use CATV applications. It has a built-in, frequency-agile preselector and demodulator and is keyboard tunable across all IS-6 Cable Television Channels. It will also accept an IF of 4.5 MHz or 41.25 MHz signal. Special applications information and data sheet are available by contacting TFT.

855

Separate SAP/Pro Channel Monitor deriving its signal from the 850 or 851. Contact TFT for a separate data sheet.

CATV



SAP/Pro Monitor



Specifications

RF INPUT (except Model 851)

Frequency Range	Preset Channel 2 through 83 (NTSC Standard): visual and aural carrier or aural carrier only
Input Signal Level	
Low Level	Approximately 200 μ V to 5 mV
High Level	Approximately 2 V to 10 V
Image Rejection	- 60 dB (low level input via channel filter)
Input Impedance	50 ohms
Input Connector	BNC

COMPOSITE INPUT

Level	Minimum, 200 mVrms, \pm 73 kHz deviation, 75 ohms
-------	--

IF INPUT (except Model 851)

Level	200 mV - 1 Vrms, 41.25 and 32.5 MHz, switch selectable, 50 ohms
Video Loop-Through	1 Vp-p, unbalanced bridging input/output

OUTPUTS

Left, Right, Main Channel	Balanced audio outputs, 1.5 Vrms each, 600 ohms
Composite Output	1.5 Vrms, 75 ohms
To SAP Monitor	Composite signal feed to TFT SAP/Pro Monitor 1.5 Vrms, 75 ohms
Remote Meter Peak Flasher	Barrier strip terminals for option, TFT P/N 7100-4020
Modulation and Carrier Alarm	Relay contact closures for external alarm; (requires optional Alarm and MUX board)
Function Output/Level to Built-in Analyzer	730 mV \pm 73 kHz deviation

MODULATION PEAK FLASHERS

Six peak flasher lights indicate plus and minus peaks simultaneously for Total, Stereo, and Main Channel modulation. Peak levels are digitally set by thumbwheel switches in 1% increments from 0% to 199% peaks. LEDs illuminate for approximately 2 seconds after triggering by modulation peaks.

MODULATION CALIBRATOR

Built-in frequency synthesized calibrator for meter and peak flasher calibration (100% modulation) from the front panel. Accuracy \pm 0.5%.

LEFT METER FUNCTION

CAL	100% = \pm 73 kHz deviation
Total Modulation (+)	100% = \pm 73 kHz deviation
Stereo	100% = \pm 55 kHz deviation
Left CH	100% = full left channel modulation (\pm 12.5 kHz deviation)
(L - R)	100% = \pm 50 kHz deviation

RIGHT METER FUNCTION

CAL	100% = \pm 73 kHz deviation
Total Modulation (-)	100% = \pm 73 kHz deviation
Main (L + R)	100% = \pm 25 kHz deviation
Right Channel	100% = full right channel modulation (\pm 12.5 kHz deviation)
RF Level	Greater than 20% reading indicates adequate RF level for full limiting
Phase CAL	Minimum reading indicates best calibration of internal P.L.L. circuitry

MEASUREMENT CAPABILITIES

(With Distortion Analyzer/AC Level Meter TFT Model 860 or equivalent)	
Total Modulation	\pm 0.1 dB, 50 Hz to 50 kHz \pm 0.5 dB, 30 Hz to 120 kHz
Stereo Channel	\pm 0.1 dB, 50 Hz to 47 kHz
Main Channel	\pm 0.1 dB, 50 Hz to 15 kHz
L - R Channel	\pm 0.1 dB, 16 Hz to 47 kHz
Left Channel	\pm 0.1 dB, 50 Hz to 15 kHz
Right Channel	\pm 0.1 dB, 50 Hz to 15 kHz
Signal/Noise Ratio	50 dB wideband, 70 dB de-emphasized, ref. 5 mV input RF
Stereo Separation (without companding)	40 dB (below 8 kHz), 45 dB (8 kHz or higher)
Pilot Injection Level	- 23.3 dB (\pm 0.2 dB) from 100% Total Modulation
Stereo Subcarrier Suppression, 31.468 kHz	- 55 dB ref. 100% Total Modulation
Inter-Carrier Noise	- 65 dB ref. 100% Total Modulation
Pilot Interference Ratio	- 40 dB ref. normal pilot level
AM Noise	Measures AM modulation on the aural carrier read out in mV
Multipath	To minimize multipath distortion when using Low Level RF input
MECHANICAL AND ENVIRONMENTAL	
Input Power	117/230 VAC \pm 10%, 50/60 Hz, 70 watts maximum
Operating Temperature	0°C to + 50°C (32°F to 122°F)
Size	7" (17.78 cm) H x 19" (48.26 cm) W x 15 5/8" (39.7 cm) D
Net Weight	23 lbs. (10.4 kg) add 5 lbs. (2.3 kg) for Analyzer
Shipping Weight	38 lbs. (17.2 kg) add 5 lbs. (2.3 kg) for Analyzer



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[ANEXO 15]

RADIO TRANSMISOR-RECEPTOR DE MICROONDAS

NULINX
Digital/Analog Microwave Link
1.3 GHz to 15.4 GHz

HIGHLIGHTS:

Nucomm is pleased to introduce the Nulinx series fixed link heterodyne radios just in time for the 2 GHz relocation process. The Nulinx is a significant move forward over existing systems available today and brings new meaning to the word flexibility. The new LCD front panel menu with control and monitoring software is a powerful feature that greatly enhances control and visibility of system parameters and diagnostics. Other new features include frequency agility, remote control and monitoring via Ethernet or RS232 interfaces.

Designed with high performance RF components including YIG oscillators and ultra linearized RF power amplifiers, the Nulinx system is ideal for virtually any digital or analog transport requirement. The basic digital radio interfaces to a companion digital modem via a 70 MHz IF signal. Nucomm carries a full line of digital modems that can be configured to transport data rates to 120 Mbs with single or multiple interfaces (multiplexed) as required. Available modulation formats include VSB, QPSK, QAM (16 to 128) or COFDM (DVB-T). Available digital interfaces include DVB ASI, SMPTE-310M, DS3/E3, T1/E1 and RS422 data channels. For FM analog transport requirements an analog modulator/demodulator with up to six audio subcarriers can be integrated inside the TX/RX units respectively.

The system is designed for easy integration and service with Nucomm's popular split chassis design that provides easy access to all internal modules, no extender cards required. The system can be configured for simplex, duplex, fully redundant hot standby and frequency or space diversity. Seamless diversity switching of the received digital transport stream is also available.

The Nulinx is available in bands from 1.3 GHz to 15.4 GHz.

APPLICATIONS:

- STL/TSL
- ENG backhaul
- Satellite backhaul
- Multi-hop systems

FEATURES:

- Supports FM, VSB, QPSK, COFDM and 16 to 128QAM
- Transport data rates to 120 Mbs
- *Smart display* system using backlit, multi-line LCD for all system control and alarm functions
- Ultra low noise proprietary design YIG oscillators
- Broadband linearized RF power amplifiers
- Low noise high dynamic gain LNA with AGC
- RS232 and Ethernet control and monitoring interfaces
- Split chassis design, no extender cards necessary
- Available in simplex, duplex and various hot standby protection configurations
- 2RU

OPTIONS:

- Two broadband high power options available
- Simplex, duplex and hot standby
- System design, integration and commissioning

Nucomm
Innovation Inside™

NU LINX

Digital/Analog Microwave Link

Specifications:

Analog/Digital Mode Transmitter/Receiver:

RF Specs:	See table below
Type:	Single conversion, 70 MHz heterodyne
Local Oscillator:	Ultra low noise YIG oscillator
Frequency Stability:	±0.0005% (others available)
IF Input/output Frequency:	70 MHz
IF Input/output Level:	+5 dB min. ±1 dB
IF Input/output Return Loss:	26 dB min. ±15 MHz @ 75 Ohms
Receiver IF Bandwidth:	7 GHz selectable 30 MHz and 45 MHz 2 GHz - 12 MHz (others available)

Analog RF 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:	±1% max.

Note: For one-hop, signal-link radio system @ -40 dBm received signal level, 525 or 625 line video per CCIR. Excludes modulator/demodulator.

70 MHz Modulator/Demodulator, Analog Video Performance:

(Back-to-Back with CCIR Emphasis)

Frequency Response:	
10 kHz to 4.75 MHz (525 line):	±0.25 dB
10 kHz to 5.6 MHz (625 line):	±0.25 dB
Field Tilt:	1% max.
Line Tilt:	1% max.
Baseband Chroma Delay:	±20 nsec max.
Baseband Chroma Gain:	±2 IRE (typical ±1 IRE)
Differential Phase:	±1% max.
Differential Gain:	1% max.
Signal-to-Noise Ratio:	Meets or exceeds RS-250C; 67 dB
Signal-to-HUM (P-P/RMS):	60 dB min.
Video Input Level:	1 Volt P-P (8 MHz P-P @ 70 MHz)
Video Input Return Loss:	26 dB min. @ 75 Ohms

70 MHz Modulator/Demodulator, Analog Audio Performance:

No. of Subcarriers:	Up to six channels, field tunable 5 kHz increments
Frequency Response:	
40 kHz to 12 kHz:	±0.5 dB max.
12 kHz to 15 kHz:	±1.0 dB max.
Signal-to-Noise Ratio:	@ 75 kHz peak deviation: Meets or exceeds RS-250C; 66 dB
Distortion:	1.0% max. at 75 kHz or 100 kHz peak deviation (typ. 5%)
Input Level at Peak Deviation:	0 to +9 dBm adjustable, set +8 dBm
Output Level at Peak Deviation:	0 to +9 dBm adjustable, set +8 dBm
Input Impedance:	600 Ohms balanced
Output Impedance:	600 Ohms balanced; others optional
Prime Power:	
Standard:	AC 90 to 260 VAC, 50 to 60 Hz
Optional:	DC 11 to 32 VDC or 30 to 72 VDC
Optional Universal Power Supply:	AC and DC
Input Power Required:	All receivers: 30 watts, transmitter 75 Watts typical (90 watts max.)

Environmental:

Ambient Temperature Range:	
Full Specifications:	-10° to +60°C
Humidity:	98% (0° to 40°C) non-condensing

Physical Characteristics:

Size:	3.5" H x 9" W x 16.0" D (8.89 x 48.26 x 40.64 cm)
Weight:	26 lbs (11.79 kg)

Connectors:

Video/Baseband/IF:	Type BNC-F
Audio:	
Modulator:	Terminal strip connection
Demodulator:	Terminal strip connection
Alarms and Monitor:	RS232 or 37 Pin "D" (F)
Summary Alarm:	Barrier strip, screw terminals
Power:	
AC:	IED-320-C13 recessed power receptacle
DC:	Barrier strip, screw terminals

Model No. ¹		Frequency Range ¹ (MHz)	Power Output ² (dBm)		Analog/Digital (BER10 ⁴) Threshold ⁴ (-dBm)	RX Noise Figure	RF Output Connector
Xmit	Rec		Analog Mode	Digital Mode			
23FT6	23FR6	1,990 - 2,700	33/37	30/34	87/87	2.0	Type N
36FT6	36FR6	3,400 - 3,800	33/37	30/34	87/87	2.0	Type N
70FT6	70FR6	6,475 - 7,125	33/37	30/34	86/86	3.0	WR137
75FT6	75FR6	7,125 - 7,750	33/37	30/34	86/86	3.5	WR112
80FT6	80FR6	7,750 - 8,400	33/37	30/34	86/86	3.5	WR112
110FT6	110FR6	10,700 - 11,200	30/35	27/32	84/84	4.0	WR90
115FT6	115FR6	11,200 - 11,700	30/35	27/32	84/84	4.0	WR90
130FT6	130FR6	12,700 - 13,250	30/35	27/32	84/84	4.0	WR75
150FT6	150FR6	14,500 - 15,350	30	27	84/84	4.0	WR62

Consult the factory for complete part number and frequency code.

Notes: 1 - Other frequencies available. Consult Nucomm.

2 - Power at connector, excluding branching network. Operating in Linear Mode.

3 - All transmitters and receivers include channel filters.

4 - For one-hop, NTSC video, BIA/CCIR weighting (For reduced threshold by 1 dB). Does not include branching network filter.

Nucomm reserves the right to make changes to specifications of products described in this datasheet at any time without notice and without obligation to notify any person of such changes.

004_04_06



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[ANEXO 16]

ANTENA PARABÓLICA PARA MICROONDAS

Product Specifications



PX4-144-DXA

4 ft Standard Parabolic Unshielded Antenna, dual-polarized, 14.4–15.35 GHz, PDR flange, gray antenna, molded gray radome with flash, standard pack—one-piece reflector



CHARACTERISTICS

General Specifications

Diameter, Nominal	1.2 m 4 ft
Antenna Input	PDR140
Antenna Type	PX - Standard Parabolic Unshielded Antenna, dual-polarized
Polarization	Dual
Reflector Construction	One-piece reflector
Antenna Color	Gray
Radome Color	Gray
Radome Material Description	Molded
Flash Included	Yes
Packing	Standard pack

Electrical Specifications

Operating Frequency Band	14.400 – 15.350 GHz
Gain, Top Band	42.8 dBi
Gain, Mid Band	42.5 dBi
Gain, Low Band	42.3 dBi
Front-to-Back Ratio	48 dB
Cross Polarization Discrimination (XPD)	30 dB
Beamwidth, Horizontal	1.2°
Beamwidth, Vertical	1.2°
VSWR	1.10
Return Loss	26.4 dB
Radiation Pattern Envelope Reference (RPE)	1565C
Electrical Compliance	ETSI Class 1

Mechanical Specifications

Product Specifications



Wind Velocity Operational	70 mph 113 km/h
Wind Velocity Survival Rating	125 mph 201 km/h
Fine Azimuth Adjustment	$\pm 5^\circ$
Fine Elevation Adjustment	$\pm 5^\circ$
Mounting Pipe Diameter	115 mm 4.5 in
Side Struts, Included	1 Inboard
Side Struts, Optional	1 Inboard
Net Weight	54 kg 119 lb

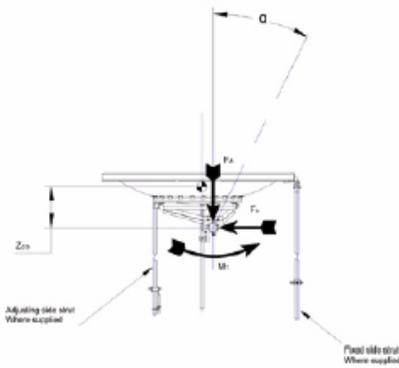
Wind Forces At Wind Velocity Survival Rating

Axial Force (FA)	1930 N 434 lbf
Side Force (FS)	1188 N 267 lbf
Twisting Moment (MT)	774 N•m
Angle α for MT Max	90°
Zcg without Ice	254 mm 10 in
Zcg with 1/2" (12 mm) Radial Ice	371 mm 15 in
Weight with 1/2" (12 mm) Radial Ice	86 kg 190 lb

Product Specifications



Wind Forces At Wind Velocity Survival Rating Image



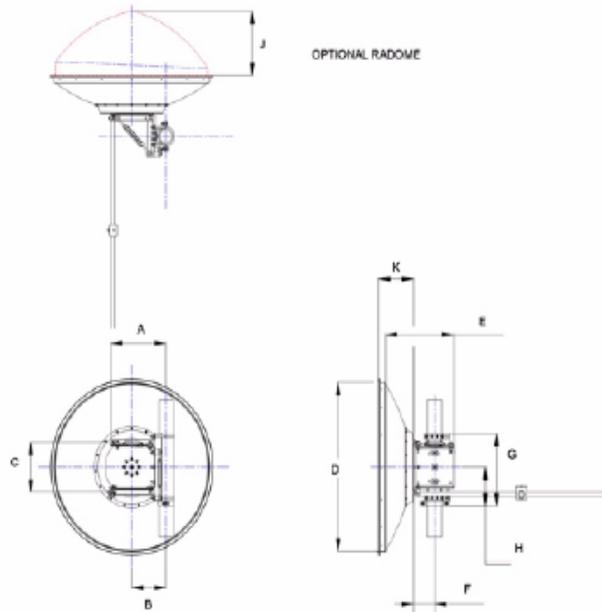
Packed Dimensions

Gross Weight, Packed Antenna	168.0 kg 370.4 lb
Length	1430.0 mm 56.3 in
Width	1430.0 mm 56.3 in
Height	840.0 mm 33.1 in
Volume	1.7 m ³

Product Specifications



Antenna Dimensions And Mounting Information



ANTENNA DIMENSIONS			
All dimensions in mm (inches)			
A	411 (16.2)	F	165 (6.5)
B	264 (10.4)	G	528(20.8)
C	361 (14.2)	H	288 (11.1)
D	1247 (49.1)	J	470 (18.5)
E	544 (21.4)	K	280 (11.0)

* Footnotes

Axial Force (FA)

Maximum forces exerted on a supporting structure as a result of wind from the most critical direction

Product Specifications



	for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.
Cross Polarization Discrimination (XPD)	The difference between the peak of the co-polarized main beam and the maximum cross-polarized signal over an angle twice the 3 dB beamwidth of the co-polarized main beam.
Front-to-Back Ratio	Denotes highest radiation relative to the main beam, at $180^\circ \pm 40^\circ$, across the band. Production antennas do not exceed rated values by more than 2 dB unless stated otherwise.
Gain, Mid Band	For a given frequency band, gain is primarily a function of antenna size. The gain of Andrew antennas is determined by either gain by comparison or by computer integration of the measured antenna patterns.
Operating Frequency Band	Bands correspond with CCIR recommendations or common allocations used throughout the world. Other ranges can be accommodated on special order.
Packing	Andrew standard packing is suitable for export. Antennas are shipped as standard in totally recyclable cardboard or wire-bound crates (dependent on product). For your convenience, Andrew offers heavy duty export packing options.
Radiation Pattern Envelope Reference (RPE)	Radiation patterns determine an antenna's ability to discriminate against unwanted signals under conditions of radio congestion. Radiation patterns are dependent on antenna series, size, and frequency.
Return Loss	The figure that indicates the proportion of radio waves incident upon the antenna that are rejected as a ratio of those that are accepted.
Side Force (FS)	Maximum axial forces exerted on support structures by side struts as a result of a 200 km/h (125 mph) wind from the most critical direction and extreme angle permitted. The forces are a component of, not in addition to, the maximum forces specified above.
Twisting Moment (MT)	Maximum forces exerted on a supporting structure as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.
VSWR	Maximum; is the guaranteed Peak Voltage-Standing-Wave-Ratio within the operating band.
Wind Velocity Operational	The wind speed where the antenna deflection is equal to or less than 0.1 degrees.
Wind Velocity Survival Rating	Microwave antennas, including mounts and radomes, where applicable, will withstand the simultaneous wind and ice conditions as specified.

[ANEXO 17]
CABLE COAXIAL ANDREW



HELIX® Coaxial Cables



5" Air Dielectric, High Power
HJ()HP Series – 50-ohm

HJ9HP-50

Description	Type No.
Cable Ordering Information	
High Power Cable	
5" Standard High Power Cable	HJ9HP-50
45 – 70 MHz, 1.06 VSWR, max.	
87 – 108 MHz, 1.06 VSWR, max. over broadcast channel	
170 – 230 MHz, 1.06 VSWR, max. over broadcast channel	
470 – 960 MHz, 1.10 VSWR, max. over broadcast channel	
* For broadcast applications, specify channel and frequency.	
Characteristics	
Electrical	
Impedance, ohms	50 ± 0.5
Maximum Frequency, GHz	0.96
Velocity, percent	96.4
Peak Power Rating, kW	1690
dc Resistance, ohms/1000 ft. (1000 m)	
Inner	0.1 (0.33)
Outer	0.04 (0.13)
dc Breakdown, volts	26000
Jacket Spark, volts RMS	12000
Capacitance, pF/ft (m)	20.8 (68.1)
Inductance, µH/ft (m)	0.054 (0.176)
Mechanical	
Outer Conductor	Copper
Inner Conductor	Copper
Diameter over Jacket, in (mm)	5.20 (132)
Diameter over Outer Conductor, in (mm)	5.00 (127)
Diameter Inner Conductor, in (mm)	2.07 (52.7)
Nominal Inside Transverse Dimensions, (cm)	11.3
Minimum Bending Radius, in (mm)	50 (1270)
Number of Bends, minimum (typical)	15 (30)
Bending Moment, lb-ft (N-m)	200 (271)
Cable Weight, lb/ft (kg/m)	3.4 (4.9)
Tensile Strength, lb (kg)	1000 (454)
Flare Plate Crush Strength, lb/in (kg/mm)	240 (4.29)

Attenuation and Average Power Ratings

Frequency MHz	Attenuation dB/100 ft	Attenuation dB/100 m	Average Power, kW
0.5	0.0045	0.0148	1690
1	0.0064	0.0211	1690
1.6	0.0081	0.0267	1540
2	0.0092	0.0300	1375
10	0.0211	0.0693	599
20	0.0306	0.100	416
30	0.0381	0.125	335
50	0.0505	0.166	254
88	0.0695	0.228	185
100	0.0748	0.245	172
108	0.0782	0.257	165
150	0.0948	0.311	137
174	0.104	0.340	125
200	0.113	0.369	116
300	0.144	0.474	90.8
400	0.173	0.568	76.2
450	0.186	0.612	70.8
500	0.200	0.655	66.3
512	0.203	0.665	65.3
600	0.225	0.737	59.1
700	0.249	0.816	53.6
800	0.272	0.893	49.1
824	0.278	0.910	48.2
860	0.286	0.937	48.9
894	0.293	0.962	45.7
960	0.308	1.010	43.6

Standard Conditions:
For Attenuation: VSWR 1.0 ambient temperature 20°C (68°F), atmospheric pressure, dry air.
For Average Power, VSWR 1.0, inner temperature 150°C (302°F), ambient temperature 40°C (104°F), atmospheric pressure, dry air, no solar loading.

United States Patent No. 5,742,002



Coaxial Cable



PRODUCT SPECIFICATION

HJ9HP-50

High power coaxial cable, 5", 50 ohm air HELIAX (Wideband from 0.5-960 MHz)

CHARACTERISTICS

Jacket Color:	Black
Jacket Description:	Polyethylene
Jacket Material:	Polyethylene
Outer Conductor Material:	Corrugated Copper
Inner Conductor Material:	N/A

Dimensions

Diameter Over Jacket (inches):	5.20
Diameter Over Jacket (millimeters):	132.10
Outer Conductor Outside Diameter (inches):	5.00
Outer Conductor Outside Diameter (millimeters):	127.00
Outer Conductor Inside Diameter (inches):	4.95
Outer Conductor Inside Diameter (millimeters):	125.70
Inner Conductor Outside Diameter (inches):	2.07
Inner Conductor Outside Diameter (millimeters):	52.60
Inner Conductor Inside Diameter (inches):	2.02
Inner Conductor Inside Diameter (millimeters):	51.30

General Specifications

Cable Grade:	Standard
NEC Classification Type:	N/A
Nominal Size (inches):	5
Short Description:	5" 50 ohm HELIAX air coaxial cable

Connectors

Part Number	Connector Type	Special Characteristics	Inner Contact	Grade
H9FB-602	6-1/8 EIA Flange	Gas Block, No Inner Connect	Tab-Flare	Standard
H9FB-M408	4-1/2 IEC Flange	Gas Block, No Inner Connect	Tab-Flare	Standard
H9FP-602	6-1/8 EIA Flange	Gas Pass, No Inner Connect	Tab-Flare	Standard
H9FP-M408	4-1/2 IEC Flange	Gas Pass, No Inner Connect	Tab-Flare	Standard
H9MB-602	6-1/8 EIA Flange	Gas Block, Inner Connector	Tab-Flare	Standard
H9MB-M408	4-1/2 IEC Flange	Gas Block, Inner Connector	Tab-Flare	Standard
H9MP-602	6-1/8 EIA Flange	Gas Pass, Inner Connector	Tab-Flare	Standard
H9MP-M408	4-1/2 IEC Flange	Gas Pass, Inner Connector	Tab-Flare	Standard

Accessories

Part Number	Description
33598-5	Standard Hanger kit of 10
31769-4	Hardware Kit

Customer Support Center:

From North America: 1-800-255-1479
International: +1-708-873-2307

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Coaxial Cable



PRODUCT SPECIFICATION

HJ9HP-50

High power coaxial cable, 5", 50 ohm air HELIX (Wideband from 0.5-960 MHz)

CHARACTERISTICS

Accessories

Part Number	Description
31031-1	Standard Hoisting Grip
204989-7	Standard Grounding kit with factory attached one hole lug, 24" (600mm)
204989-27	Standard Grounding kit with field attachable crimp-on one hole lug, 36" (914mm)
204989-37	Standard Grounding kit with field attachable screw-on one hole lug, 36" (914mm)
33938-5	Wall/Roof Feed Thru Assembly, Single Entrance
244338	Round Pole Adapter
12395-1	Stainless Steel Wraplock
244495	Connector Grounding Kit
244458	Universal Grounding Lugs
UGBKIT	19-1/2" Universal Ground Bar
UGBKIT-2	12-1/2" Universal Ground Bar
UGBA-DIN-36	Universal Ground Bar Assembly, three 6-position ground bars, for APTL and APT series 7-16 DIF
UGBA-DINU-36	Universal Ground Bar Assembly, three 6-position ground bars, for APG and APM series 7-16 DIN
UGBA-N-36	Universal Ground Bar Assembly, three 6-position ground bars, for Type N bulkhead or bolt-ground
UGBA-DIN-34	Universal Ground Bar Assembly, three 4-position ground bars, for APTL and APT series 7-16 DIF
UGBA-DINU-34	Universal Ground Bar Assembly, three 4-position ground bars, for APG and APM series 7-16 DIN
UGBA-N-34	Universal Ground Bar Assembly, three 4-position ground bars, for Type N bulkhead or bolt-ground
221213	Connector/Splice weatherproofing kit
APOINT-13-4	ArrestorPort II Integrated Wall / Entry Grounding System (Type DIN)
APOINT-26N-4	ArrestorPort II Integrated Wall / Entry Grounding System (Type N)
EBKIT-CAB-6	Cabinet EntryBlox System
EBKIT-BLD-6	Building EntryBlox System
CEBKIT-CAB-4	Compact EntryBlox System
EBWEDGE	Compression Wedge Kit
224351	Tool Box
224352	Safety Knife
224353	Wire Snips
224354	Inch/Millimeter Rule
224355	Greasing Brush
224356	Point File
224390	Leather Buffing Strap
224391	Emery Cloth - 1ft (30cm)
224392	Flare Hammer
224393	Flat Hammer

Customer Support Center:

From North America: 1-800-255-1479
International: +1-708-873-2307

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Coaxial Cable



PRODUCT SPECIFICATION

HJ9HP-50

High power coaxial cable, 5", 50 ohm air HELIAX (Wideband from 0.5-960 MHz)

CHARACTERISTICS

Accessories

Part Number	Description
224394	Beveled Hammer Tip
224358	Tapered Drill Punch
224360	Pin Alignment Tool
224362	Cutoff Guide 8/32" (6.3mm)
224377	Soldering Pliers
TB-COMP-KIT	Complete Tool Box
TB-BASIC-KIT	Basic Tool Box
207270	Crimping Tool to field-attach lugs to grounding kits
GPS-KIT12	GPS Antenna Kit - LDF4 1/2" HELIAX Cable
GPS-KITF4	GPS Antenna Kit - FSJ4 1/2" HELIAX Cable
GPS-KIT78	GPS Antenna Kit - LDF5 7/8" HELIAX Cable
GPS-KITV5	GPS Antenna Kit - VXL5 7/8" HELIAX Cable
TB-DIN-KIT	DIN Tool Box
TB-N-KIT	N Tool Box
244377	DIN Connector Coupling Torque Wrench
244379	N Connector Coupling Torque Wrench
TB-AW-KIT	Air & Waveguide Toolkit
224380	Pin Depth Gauge N Male
224395	Pin Depth Gauge N Female
114468	Pin Depth Gauge DIN Male
114469	Pin Depth Gauge DIN Female

Attenuation and Average Power Ratings

Frequency (MHz)	Attenuation (dB/100ft)	Attenuation (dB/100m)	Average Power (kW)
0.5	0.004	0.015	1481.63
1	0.006	0.021	1042.01
1.5	0.008	0.026	847.29
2	0.009	0.030	731.23
10	0.021	0.069	316.88
20	0.030	0.100	218.98
30	0.038	0.124	175.73
50	0.050	0.165	132.52
88	0.069	0.227	96.21
100	0.075	0.245	89.37
108	0.078	0.256	85.46

Customer Support Center:
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 International: +1-708-873-2307

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HELIAX[®]

Coaxial Cable



PRODUCT SPECIFICATION

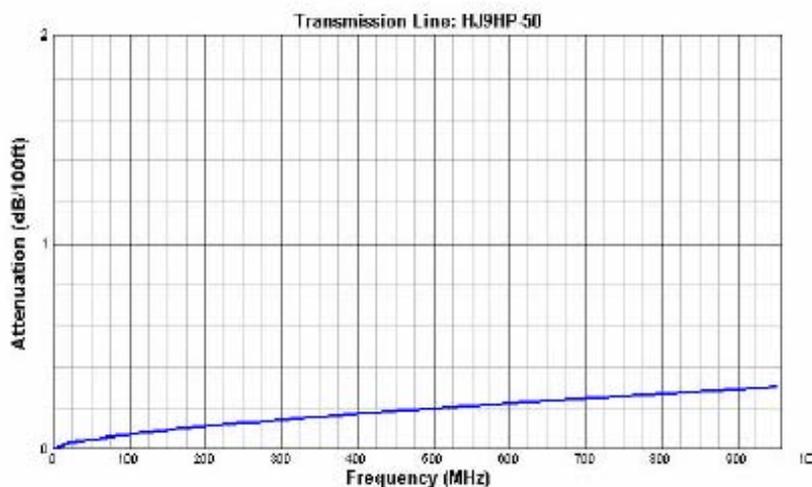
HJ9HP-50

High power coaxial cable, 5", 50 ohm air HELIAX (Wideband from 0.5-960 MHz)

CHARACTERISTICS

Attenuation and Average Power Ratings

Frequency (MHz)	Attenuation (dB/100ft)	Attenuation (dB/100m)	Average Power (kW)
150	0.095	0.310	70.46
174	0.103	0.339	64.49
200	0.112	0.369	59.31
300	0.144	0.473	46.24
400	0.173	0.567	38.58
450	0.186	0.611	35.78
500	0.199	0.654	33.43
512	0.203	0.664	32.92
600	0.225	0.737	29.68
700	0.249	0.816	26.80
800	0.272	0.892	24.51
824	0.278	0.910	24.02
860	0.286	0.937	23.34
894	0.293	0.962	22.73
960	0.308	1.010	21.66



Customer Support Center:
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International: +1-708-873-2307

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[ANEXO 18] GUÍA DE ONDA ELÍPTICA



Elliptical Waveguide Types EWP132 and EW132



Terrestrial Microwave Antenna System Products

Characteristics

Type Numbers	
Premium Waveguide, Standard Jacket	EWP132
Standard Waveguide, Standard Jacket	EW132
Premium Waveguide Type CATVP	222040-7
Standard Waveguide, Fire Retardant, Non-Halogenated Jacket	35409-14*
Electrical	
Max. Frequency Range, GHz	11.0-15.35
TE ₁₁ Mode Cutoff Frequency, GHz	9.22
Group Delay at 14.7 GHz, ns/100 ft (ns/100 m)	130 (425)
Peak Power Rating at 14.7 GHz, KW	
with 1132 series connectors	22.8
with 2132 series connectors	36.6
Mechanical	
Minimum Bending Radii, without rebending, inches (mm)	
E Plane	5 (130)
H Plane	14 (360)
Minimum Bending Radii, with rebending, inches (mm)	
E Plane	5 (130)
H Plane	14 (360)
Maximum Twist, degrees/foot (m)	2 (6)
Dimensions over Jacket, in (mm)	0.95 x 0.59 (24.1 x 15.0)
Weight, pounds per foot (kg/m)	0.22 (0.33)

* UL* listed Type CATVR.

Attenuation, Average Power, Group Velocity

Frequency GHz	Attenuation dB/100 ft (dB/100 m)	Average Power Rating, kW	Group Velocity of Propagation, %
11.0	7.05 (23.20)	0.58	54.4
11.5	6.35 (20.80)	0.65	59.8
12.0	5.89 (19.30)	0.70	64.0
12.5	5.56 (18.30)	0.74	70.5
13.0	5.32 (17.40)	0.73	70.5
13.5	5.13 (16.80)	0.80	73.0
14.0	4.98 (16.34)	0.83	75.9
14.2	4.93 (16.17)	0.83	76.6
14.4	4.88 (16.02)	0.84	77.4
14.6	4.84 (15.87)	0.85	78.1
14.8	4.80 (15.74)	0.86	78.8
15.0	4.76 (15.62)	0.87	79.4
15.2	4.72 (15.50)	0.87	80.0
15.35	4.70 (15.42)	0.88	80.4

Attenuation values based on VSWR 1.0, ambient temperature 24°C (75°F) and are guaranteed within ±5%. Average power ratings based on VSWR 1.0 and 42°C (76°F) temperature rise over 40°C (104°F) ambient.

Connectors – Flange dimensions on pages 216-217

	L In (mm)	W In (mm)	A In (mm)	Weight lb (kg)
--	--------------	--------------	--------------	-------------------

Type No. 1132DC, 1132DCT, 1132DCMT

Figure 1	4.5 (114)	2.1 (53)	2.5 (64)	2.0 (0.9)
----------	--------------	-------------	-------------	--------------

Type No. 1132DBM, 1132DBMT

Figure 1	4.4 (112)	2.1 (53)	2.5 (64)	1.5 (0.7)
----------	--------------	-------------	-------------	--------------

Type No. 1132SC, 1132SCM

Figure 1	3.67 (93.2)	1.89 (48)	1.89 (48)	1.5 (0.67)
----------	----------------	--------------	--------------	---------------

Type No. 2132DC, 2132DCT, 2132DCMT

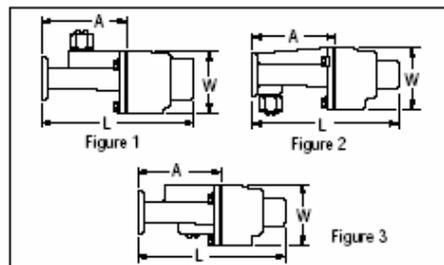
Figure 2	4.1 (104)	2.0 (51)	2.2 (56)	1.5 (0.7)
----------	--------------	-------------	-------------	--------------

Type No. 2132DBMT

Figure 3	4.1 (104)	2.1 (53)	2.2 (56)	1.5 (0.7)
----------	--------------	-------------	-------------	--------------

Type No. 2132DK, 2132DKT

Figure 1	4.6 (117)	2.1 (53)	2.7 (69)	1.6 (0.7)
----------	--------------	-------------	-------------	--------------



Connector Material: Brass

[ANEXO 19]

PLANTA ELÉCTRICA CUMMINS DE 80Kw



Diesel Generator Set Model DGCG 60 Hz

80 kW, 100 kVA Standby
72 kW, 90 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 Level 1 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 enclosures and coolant heaters shield the generator set from extreme operating conditions. Environmental concerns are addressed by low exhaust emission engines, sound-attenuated enclosures, 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 UL 2200.

Low Exhaust Emissions - Engine meets former U.S. EPA Nonroad Source Emission Standards, 40 CFR 89, Tier 1.

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 Level 1 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. Optional cooling system is available for higher ambient temperatures.

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.

Enclosures - Optional weather-protective and sound-attenuated enclosures 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.

Generator Set

The general specifications provide representative configuration details. Consult the outline drawing for installation design.

Specifications – General

See outline drawing 500-3839 for installation design specifications.

Unit Width, in (mm)	40.0 (1016)
Unit Height, in (mm)	48.5 (1232)
Unit Length, in (mm)	82.8 (2104)
Unit Dry Weight, lb (kg)	1883 (854)
Unit Wet Weight, lb (kg)	2018 (915)
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)	4.7 (17.7)	4.7 (17.7)
Coolant Flow Rate, Gal/min (L/min)	45.0 (170.3)	45.0 (170.3)
Heat Rejection To Coolant, Btu/min (MJ/min)	2860.0 (3.0)	2600.0 (2.8)
Heat Radiated To Room, Btu/min (MJ/min)	1402.0 (1.5)	1335.0 (1.4)
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)	248.0 (7.0)	234.0 (6.6)
Alternator Cooling Air, scfm (m ³ /min)	1308.0 (37.0)	1308.0 (37.0)
Radiator Cooling Air, scfm (m ³ /min)	4900.0 (138.7)	4900.0 (138.7)
Max. Static Restriction, in H ₂ O (Pa)	0.50 (124.50)	0.50 (124.50)

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

Nominal engine power available up to 5831 ft (1777 m) at ambient temperatures up to 104°F (40°C). Above 5831 ft (1777 m) derate at 4% per 1000 ft (305 m), and 1% per 10°F (2% per 11°C) above 104°F (40°C).

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 4BTA3.9-G3, Turbocharged and Jacket Water Aftercooled, diesel-fueled
Displacement in³ (L)	239.0 (3.9)
Overspeed Limit, rpm	2100 ±50
Regenerative Power, kW	11.90
Cylinder Block Configuration	Cast iron, In-line 4 cylinder
Battery Capacity	480 amps minimum at ambient temperature of 32°F (0°C)
Battery Charging Alternator	65 amps
Starting Voltage	12-volt, negative ground
Lube Oil Filter Types	Single spin-on canister, full flow
Standard Cooling System	104° F (40°C) ambient radiator

Power Output		Standby	Prime						
Gross Engine Power Output, bhp (kWm)		130.0 (97.0)	117.0 (87.3)						
BMEP at Rated Load, psi (kPa)		230.0 (1585.8)	207.0 (1427.2)						
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		16.5:1	16.5:1						
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)		14.3 (54.1)	13.6 (51.5)						
Maximum Inlet Restriction, in. Hg (mm Hg)		4.0 (101.6)	4.0 (101.6)						
Maximum Return Restriction, in. Hg (mm Hg)		10.0 (254.0)	10.0 (254.0)						
Air Cleaner									
Maximum Air Cleaner Restriction, in. H ₂ O (kPa)		25.0 (6.2)	25.0 (6.2)						
Exhaust									
Exhaust Flow at Rated Load, cfm (m ³ /min)		637.0 (18.0)	588.0 (16.6)						
Exhaust Temperature, °F (°C)		815.0 (435.0)	770.0 (410.0)						
Max Back Pressure, in. H ₂ O (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)		80 (100)				72 (90)			
	Load	1/4	1/2	3/4	Full	1/4	1/2	3/4	Full
	US Gal/hr	1.9	3.1	4.6	6.3	1.8	2.8	4.1	5.6
	L/hr	7	12	17	24	7	11	16	21

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 MG1-1.85
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	125° C	150° C	150° C	150° C	150° C
Feature Code	B418	B415	B268	B304	B417	B414	B267	B303	B416	B413	B419		
Alternator Data Sheet Number	206	207	208	206	205	206	208	205	205	205	205		
Voltage Ranges	110/190 Thru 120/208 120/208 220/380 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	82	82	83	82	81	81	83	82	81	81	82		
Motor Starting kVA (at 90% sustained voltage)	Shunt	313	360	422	313	260	313	422	260	260	260	260	
	PMG	368	423	497	368	306	368	497	306	306	306	306	
Full Load Current - Amps at Standby Rating	120/208 278	127/220 262	139/240 241	240/416 139	254/440 131	277/480 120	347/600 95						

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	206	207	207	208	205	206	206	208				
Voltage Ranges	120/240 ¹	120/240 ¹	120/240 ¹	120/240 ¹	120/240 ¹	120/240 ¹	120/240 ¹	120/240 ¹				
Surge kW	80	81	81	81	79	80	80	81				
Motor Starting kVA (at 90% sustained voltage)	Shunt	185	215	215	250	155	185	185	250			
	PMG	220	250	250	290	183	220	220	290			
Full Load Current - Amps at Standby Rating	120/240 ¹ 222	120/240 ¹ 333										

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.

Control System

	<p>PowerCommand Control with AmpSentry™ Protection</p> <ul style="list-style-type: none"> 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. Standard PCCNet interface. 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. 	
<p>AmpSentry AC Protection</p> <ul style="list-style-type: none"> 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 	<p>Engine Protection</p> <ul style="list-style-type: none"> 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 	<p>Operator Interface</p> <ul style="list-style-type: none"> 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)
<p>Alternator Data</p> <ul style="list-style-type: none"> Line-to-line and line-to-neutral AC volts 3-phase AC current Frequency Total and individual phase kW and kVA 	<p>Engine Data</p> <ul style="list-style-type: none"> DC voltage Lube oil pressure Coolant temperature Lube oil temperature (optional) 	<p>Other Data</p> <ul style="list-style-type: none"> 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)
<p>Governing</p> <ul style="list-style-type: none"> Integrated digital electronic isochronous governor Temperature dynamic governing Smart Idle speed mode Glow plug control (some models) 	<p>Voltage Regulation</p> <ul style="list-style-type: none"> Integrated digital electronic voltage regulator 3-phase line to neutral sensing PMG (Optional) Single and three phase fault regulation Configurable torque matching 	<p>Control Functions</p> <ul style="list-style-type: none"> Data logging on faults Fault simulation (requires InPower) Time delay start and cooldown Cycle cranking PCCNet Interface (4) Configurable customer inputs (4) Configurable customer outputs (8) Configurable network inputs and (16) outputs (with optional network)
<p>Options</p>		
<ul style="list-style-type: none"> <input type="checkbox"/> Analog AC Meter Display <input type="checkbox"/> Thermostatically Controlled Space Heater 	<ul style="list-style-type: none"> <input type="checkbox"/> Key-type mode switch <input type="checkbox"/> Ground fault module <input type="checkbox"/> Engine oil temperature <input type="checkbox"/> Auxiliary Relays (3) 	<ul style="list-style-type: none"> <input type="checkbox"/> Echelon LonWorks Interface <input type="checkbox"/> Digital input and output module(s) (loose) <input type="checkbox"/> Remote annunciator (loose)

[ANEXO 20]

PLANTA ELÉCTRICA CUMMINS DE 40Kw



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 Level 1 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 enclosures and coolant heaters shield the generator set from extreme operating conditions. Environmental concerns are addressed by low exhaust emission engines, sound-attenuated enclosures, 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 UL 2200.

Low Exhaust Emissions - Engine meets former U.S. EPA Nonroad Source Emission Standards, 40 CFR 89, Tier 1.

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 Level 1 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.

Enclosures - Optional weather-protective and sound-attenuated enclosures 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.

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 ₂ O (Pa)	0.50 (124.50)	0.50 (124.50)

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% .

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 in³ (L)	239.0 (3.9)
Overspeed Limit, rpm	2100 ±50
Regenerative Power, kW	11.90
Cylinder Block Configuration	Cast iron, In-line 4 cylinder
Battery Capacity	480 amps minimum at ambient temperature of 32°F (0°C)
Battery Charging Alternator	65 amps
Starting Voltage	12-volt, negative ground
Lube Oil Filter Types	Single spin-on canister, full flow
Standard Cooling System	104°F (40°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 (101.8)	4.0 (101.8)							
Maximum Return Restriction, in. Hg (mm Hg)	10.0 (254.0)	10.0 (254.0)							
Air Cleaner									
Maximum Air Cleaner Restriction, in. H ₂ O (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 ₂ O (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

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 MG1-1.85
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	110/150 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	110/150 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	110/150 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
	PMG	191	191	272	191	155	155	221	155	155	155
Full Load Current - Amps at Standby Rating	<u>120/208</u> 139	<u>127/220</u> 131	<u>139/240</u> 120	<u>220/380</u> 76	<u>240/416</u> 69	<u>277/480</u> 60	<u>247/500</u> 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 ¹	120/240 ¹	120/240 ¹	120/240 ¹	120/240 ¹	120/240 ¹	
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	<u>120/240¹</u> 111	<u>120/240¹</u> 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.

Control System

	<p>PowerCommand Control with AmpSentry™ Protection</p> <ul style="list-style-type: none"> 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. Standard PCCNet interface. 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. 										
<p>AmpSentry AC Protection</p> <ul style="list-style-type: none"> 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 	<p>Engine Protection</p> <ul style="list-style-type: none"> 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 	<p>Operator Interface</p> <ul style="list-style-type: none"> 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) 									
<p>Alternator Data</p> <ul style="list-style-type: none"> Line-to-line and line-to-neutral AC volts 3-phase AC current Frequency Total and individual phase kW and KVA 	<p>Engine Data</p> <ul style="list-style-type: none"> DC voltage Lube oil pressure Coolant temperature Lube oil temperature (optional) 	<p>Other Data</p> <ul style="list-style-type: none"> 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) 									
<p>Governing</p> <ul style="list-style-type: none"> Integrated digital electronic isochronous governor Temperature dynamic governing Smart Idle speed mode Glow plug control (some models) 	<p>Voltage Regulation</p> <ul style="list-style-type: none"> Integrated digital electronic voltage regulator 3-phase line to neutral sensing PMG (Optional) Single and three phase fault regulation Configurable torque matching 	<p>Control Functions</p> <ul style="list-style-type: none"> Data logging on faults Fault simulation (requires InPower) Time delay start and cooldown Cycle cranking PCCNet Interface (4) Configurable customer inputs (4) Configurable customer outputs (8) Configurable network inputs and (16) outputs (with optional network) 									
<p>Options</p> <table border="0"> <tr> <td data-bbox="267 1493 641 1520"> <input type="checkbox"/> Analog AC Meter Display </td> <td data-bbox="641 1493 1047 1520"> <input type="checkbox"/> Ground fault module </td> <td data-bbox="1047 1493 1451 1520"> <input type="checkbox"/> Echelon LonWorks Interface </td> </tr> <tr> <td data-bbox="267 1520 641 1560"> <input type="checkbox"/> Thermostatically Controlled Space Heater </td> <td data-bbox="641 1520 1047 1547"> <input type="checkbox"/> Engine oil temperature </td> <td data-bbox="1047 1520 1451 1547"> <input type="checkbox"/> Digital input and output module(s) (loose) </td> </tr> <tr> <td data-bbox="267 1560 641 1585"> <input type="checkbox"/> Key-type mode switch </td> <td data-bbox="641 1547 1047 1575"> <input type="checkbox"/> Auxiliary Relays (3) </td> <td data-bbox="1047 1547 1451 1575"> <input type="checkbox"/> Remote annunciator (loose) </td> </tr> </table>			<input type="checkbox"/> Analog AC Meter Display	<input type="checkbox"/> Ground fault module	<input type="checkbox"/> Echelon LonWorks Interface	<input type="checkbox"/> Thermostatically Controlled Space Heater	<input type="checkbox"/> Engine oil temperature	<input type="checkbox"/> Digital input and output module(s) (loose)	<input type="checkbox"/> Key-type mode switch	<input type="checkbox"/> Auxiliary Relays (3)	<input type="checkbox"/> Remote annunciator (loose)
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