

## INDOOR COVERAGE SOLUTION FOR THURAYA GMPCS

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+30 dBm band-selective repeater set

### Summary

This type of repeater has been designed to solve the problems of Thuraya GMPCS network coverage extension to difficult areas or “Dead Spots” such as underground car parks, shopping malls, tunnels, buildings, etc., as well as outdoor shaded zones where there is no direct line of sight from Thuraya mobile terminal to satellite transponder. Dropped calls and dead spots can be eliminated thus increasing revenue and customer satisfaction. Designed model covers the entire Thuraya frequency band and can be used to operate within any satellite transponder beam. Repeater system is low cost and is easily installed and maintained. The Repeater can use 120/240VAC or alternatively external batteries can be connected thus ensuring continual “no-break” operation, in the event of a mains power failure. Low power consumption makes it possible to work continuously by using a solar panel of small dimensions, including the antenna and the accumulator.

### Features

- “Full-duplex” configuration based on “heterodyne” structures.
- Full bandwidth used for up-link and down-link.
- Gain greater than 85 dB.
- Output power of +30 dBm.
- Dynamic margins between 65 and 85 dB.
- ALC loops to suppress unwanted disturbing radio signals.
- Parametric digital control of the gain, ALC loops, bandwidth function, in / out levels by interface RS-232 (9600 baud) throughout computer or by using a modem.
- Small dimensions and weight. Easy to install and operate.
- Specifications meet ETSI Standard

### Brief technical description

The signal from Thuraya satellite transponder appears at 16 dBi donor antenna and goes to the repeater unit through N-type Male connector.

Duplexer is a filter designed to separate the up-link and downlink signals to their respective paths. This duplexer is normally tuned to the full Thuraya bandwidth. That is 824-849 and 869-894MHz for AMPS and CDMA. For GSM systems it is usually 880-915 and 935- 960MHz. The down-link output from the duplexer goes to the low noise amplifier LNA1. This is a two stage amplifier with a gain of 35dB and a noise figure of <1.5dB. The LNA output is applied to a mixer. Also applied to the mixer is the signal from the local oscillator, a synthesiser. The synthesiser generates a signal, which is 70Mhz below the centre of the input signal. The synthesiser output is then applied to a power divider to give two separate signal of the same frequency, That is 70MHz below the centre of the desired channel. One of these signals is applied to the first mixer the output of the mixer is thus a 70Mhz IF frequency. The 70MHz IF signal is first amplified by a single stage amplifier with a nominal gain of 10B. It is then applied to a Surface

Acoustic Wave Filter with very sharp rejection characteristics. The SAW filter is selected to customer's specifications. For example, for a single GSM Channel repeater a 200KHz SAW filter is selected. If a number of channels are required to be repeated the customer can select an appropriate filter, which will pass only the wanted channels. All other frequencies are attenuated by at least 60dB. The IF signal (now at 70 MHz) is amplified and then passes to an attenuator with a range of 54dB in 2dB steps. This is controlled by the user by toggle switches on the IF amplifier assembly.

Repeater has a maximum gain of 85dB, however 95dB gain is available, The attenuator allows the user to easily control the repeater gain from 31dB to 85dB or 41dB to 95dB. The IF and the second output of the synthesiser is applied to the second mixer. The resultant difference frequency is exactly as the original signal but with all unwanted signals removed. A pre-amplifier amplifies this signal to a level sufficient to drive the RF output amplifier. This pre-amplifier also contains filters to remove any residual local oscillator signal and the image frequency. This signal is applied to a power amplifier, which amplifies the signal to a high level of RF power.

## **Installation procedure**

The following steps are to be taken before switching on the repeater:

2. Choice of best site for the external donor antenna installation
3. Choice of external donor antenna type pointing the BTS
4. Choice of antenna cable type
5. Choice of the repeater attachment location and system
6. Repeater individual power supply attachment
7. Operating check

External donor antenna installation: It is better to install the external donor antenna pointing towards the satellite as high as possible (on the roof) and in direct sight line of Thuraya satellite. Correct external donor antenna installation is very important so as to take full advantage of its gain.

Depending on the volume to be covered by the Repeater, the best is usually to fix indoor (service) antenna either in top corners or in the top middle part of walls facing the area to cover.

Depending of the type of environment (walls, structures) and depending on the type of service antenna the optimum repeater operating zone is between 100 and 400 meters.

Both vertical and horizontal spacing is necessary between donor and service antennas to ensure correct 110 dB isolation. Walls and floors can be useful by separating antennas from each other.

Repeater attachment: depending on the nature of the walls or the support, fixing clamps are the best way of attaching the picorepeater on the wall with screws.

Individual power supply attachment: the individual power supply can be plugged in any 220 VAC socket.

## Electrical specifications

DownLink gain	not less than 85 dB
UpLink gain	not less than 85 dB
Gain Uplink & Downlink Adjustment	50 – 85 dB
Automatic Gain Control	35 dB
AGC speed (uplink)	10-20 mkS
AGC speed (downlink)	100 mkS
Maximum output power at downlink	+30 dBm (1 W)
Maximum output power at uplink	+27 dBm (0.5 W)
Noise Figure	better than 4 dB
Group delay	2 mkS
Supported channels	THURAYA GMPCS 1.5 - 1.6 ГГц
Bandwidth	37 MHz within 1523-1560 MHz range and 37 MHz within 1623-1660 MHz range
IM 3	+49 dBm

## Mechanical

Weight	3.1 kg
Power consumption	24 VA
Dimensions	290 x 170 x 90 mm
Case	water-proof, IP30
Operating temperature	-25 deg C.....+45 deg C

## Link budget

EIRP from the satellite transponder	56 dBm
Path loss (miles)	-107 dB
Antenna gain	20 dBi
Feeder loss (1/2 inch coax)	-3.7 dB
Repeater input	-34.7 dBm
Repeater downlink gain setting	67 dB
Repeater output power	32.3 dBm
Feeder loss	-4.6 dB
Antenna gain	20 dBi
EIRP repeater downlink	47.7 dBm
Path loss (.....m)	-107 dB
MS input level	-59.3 dBm
Fading margin	-15 dB
Received at the MS	-74.3 dBm

## Downlink

## Link budget

MS output power	30 dBm
-Antenna gain (cell phone)	0 dBi
-Path loss	-107 dB
-Fading margin	-15 dB
-Antenna gain	20 dBi
-Feeder loss	-4.6 dB
-Repeater input	-76.6 dBm
Repeater uplink gain	84 dB
Repeater output power	7.4 dBm
Feeder loss	-3.7 dB
Antenna gain	20 dBi
EIRP repeater Uplink	23.7 dBm
Path loss	-107 dB
Received at the satellite transponder	-83.3 dBm

## Uplink