Optus C1 Satellite

The Optus C1 Satellite Will be the Largest Hybrid Commercial / Military Communications Satellite in the World

This document contains information on the Optus C1 Satellite only.

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Optus may change the information in this document from time to time to maintain accuracy and relevance to changes in technology.

The information contained in this document is based on the planned performance of the Optus C1 satellite.

Introduction

In 2002, Optus, in partnership with the Australian Defence Forces, will launch the world's largest hybrid commercial / military communications satellite. The satellite, Optus C1, will share military and commercial functions, delivering next generation direct to home TV and Internet, along with high bandwidth data access throughout Australia and Asia. The commercial payload will operate in the Ku band with coverage for Australia, New Zealand, East Asia and Hawaii.

The launch vehicle for C1 will be an Ariane rocket blasting off from French Guiana.

Optus operates an Australian domestic satellite system which provides coverage over continental Australia, Tasmania and New Zealand. Options are also available for coverage of Papua New Guinea, Norfolk Island, Lord Howe Island, Cocos Island and Christmas Island.

The Optus C1 Satellite

The C1 Satellite is manufactured under contract to Mitsubishi Electric Corporation who sub-contracted Space Systems Loral for the design and manufacture of the space platform or "spacecraft bus".

A diagram of the C1 satellite in the deployed configuration is shown.

Optus C1 Satellite

The C1 satellite consists of a space platform or "spacecraft bus" which provides various support systems that are required to control and maintain the satellite in orbit and operate the on-board communications system. The reliability of the platform itself is designed to be extremely high, and extensive protection from platform failures is provided by built-in redundancy and by emergency operating procedures which have been developed to counter any foreseeable on-station situation. The platform includes the power supply (solar cells and battery) which have been designed with an adequate margin for successful in-orbit operation extending well beyond the satellite design life.

The C1 satellite commercial payload comprises a Ku Band repeater designed to provide Fixed Satellite Services (FSS) to Australia and other specific locations in South East Asia, Asia and the Pacific. A total of twenty-four active linearised transponders are provided. Four beams are possible via the C1 satellite providing connectivity to the National Australia A (NA), National Australia B (NB), National Australia/New Zealand (NANZ) and East Asia (EA). These beams operate in orthogonal polarisations and each uplink beam operates in the polarisation orthogonal to its corresponding downlink beam.

Telemetry and control of the spacecraft is provided by Optus Satellite Operations staff from Sydney Satellite Facility at Belrose, with back up from Perth Satellite Facility at Lockridge.

The main characteristics of the Optus C1 satellite are listed in the table below.

	C-Series
Physical Structure	Rectangular Prism body with solar wings
Dimensions	26 metres across extended solar panels
Dry Weight	2020 kg
Stabilisation Method	3 Axis Body Stabilised
Solar Power Capacity	12000 watts (at end of life) total C1 capacity.
Battery Capacity	Full operation during eclipse
Geostationary Life	15 years
Inclined Life Extension	5yrs (nominal)
Number of Transponders	24 Ku-Band
Transponder Power	110 watts
Transponder Bandwidth	8 Transponders 36 MHz Australia/NZ only 2 Transponders 72 MHz Australia/NZ only 4 Transponders 72MHz EA only 2 Transponder 36 MHz Aust or EA switchable-Splitcast capable. 1 Transponder 72 MHz Aust or EA switchable-Splitcast capable. 6 Transponder 36 MHz Aust only-Simulcast capable. 1 Transponder 72 MHz Aust only-Simulcast capable.
Communications payloads	Ku-Band communications UPC Beacon (Ku-Band)

C1 Satellite Payload Summary

Ku-Band Communications Payload

The Optus C1 satellite can provide twenty-four active 14/12 GHz transponders operating in a dual polarisation frequency re-use scheme with ten transponders on one polarisation and fourteen on the other.

Frequency Plan

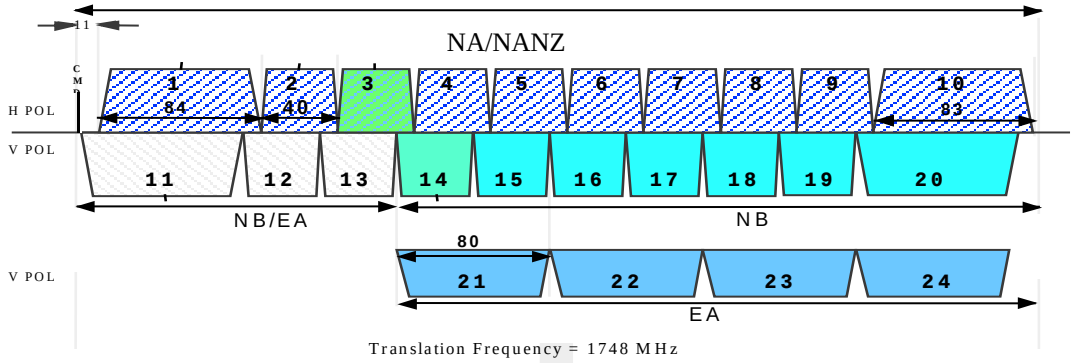
The C1 satellite will receive and transmit at the following Ku-Band frequencies:

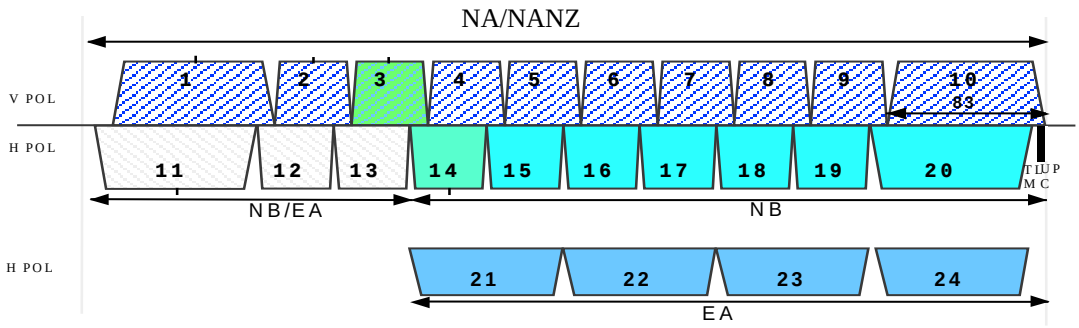
Receive	14,000-14,500 MHz	(14.00-14.50 GHz)
Transmit	12,250-12,750 MHz	(12.25-12.75 GHz)

The frequency plan uses the following spacing of transponder centre frequencies.

Adjacent transponder separation	40 MHz
Frequency offset (Repeater A to Repeater B)	9 MHz

UPLINK (RECEIVE)





DOWNLINK (TRANSMIT)

Uplink channel	Centre frequency	Downlink channel	Centre frequency
CMD1	14000.50		
CMD2	14002.50		
1	14053.00	1	12305.00
2	14115.00	2	12367.00
3	14155.00	3	12407.00
4	14195.00	4	12447.00
5	14235.00	5	12487.00
6	14275.00	6	12527.00
7	14315.00	7	12567.00
8	14355.00	8	12607.00
9	14395.00	9	12647.00
10	14457.00	10	12709.00
11	14044.00	11	12296.00
12	14106.00	12	12358.00
13	14146.00	13	12398.00
14	14186.00	14	12438.00
15	14226.00	15	12478.00
16	14266.00	16	12518.00
17	14306.00	17	12558.00
18	14346.00	18	12598.00
19	14386.00	19	12638.00
20	14448.00	20	12700.00
TLM1			12747.75
TLM2			12748.75
UPC			12750.00
21	14206.00	21	12458.00
22	14286.00	22	12538.00
23	14366.00	23	12618.00
24	14448.00	24	12700.00

Satellite Beam Information

Each Optus satellite has several receive and transmit beams on both horizontal and vertical polarisation.

Receive and transmit connectivity may be configured by ground command from the Optus Satellite Control Centre to match system operational requirements as they evolve throughout the life of each satellite.

Receive Beams

The receive beams for the C1 satellite are as follows:

Transponders	**C1 Satellite Receive Beams**
Transponders 1-10	Switchable NA or NANZ
Transponders 11-13	Switchable NB or EA
Transponders 14-20	NB
Transponders 21-24	EA

Transmit Beams

The transmit beams for the C1 satellite are as follows:

Transponders	**C1 Satellite Transmit Beams**
Transponders 1-10	Switchable NA or NANZ
Transponders 11-13	Switchable NB or EA
Transponders 14-20	NB
Transponders 21-24	EA

Transponder Gain Control

Each satellite transponder contains a Channel Control Unit, which provides a means of controlling the transponder gain. This gives the transponder a range of operating C/T values to suit the characteristics of the systems operating on it at a given time.

On the C1 satellite two methods are used to provide transponder gain control for a range of C/Ts. Fixed Gain Mode (FGM) and Variable Gain Mode (VGM) are selectable by ground command

Uplink Power Control

All Optus satellites transmit beacon signals which are used by Optus to monitor the condition of the spacecraft and which may be used by customer earth stations for antenna tracking and uplink power control (UPC). The C1 satellite transmits two telemetry beacons which are used to monitor the condition of the spacecraft , and uplink power control beacon which is used for tracking and Uplink Power Control (UPC).

Customers may use uplink power control systems (UPC) to compensate for uplink rain attenuation. Since a malfunctioning UPC system can interfere with other services and even damage a satellite TWTA, UPC systems must be approved by Optus before use and are strictly limited in the amount of uplink compensation permitted. Details of the amount of UPC permitted under various operating conditions may be obtained from Optus.
The UPC beacon is appropriate for tracking by customer earth stations.

C1 Satellite Coverage Maps

The contour diagrams below show the General Design Levels for geostationary Optus satellites.
This information contains predicted C1 Ku-band patterns. The patterns are composites of three frequencies and therefore represent the worst-case over frequency. They also include worst-case beam pointing errors.

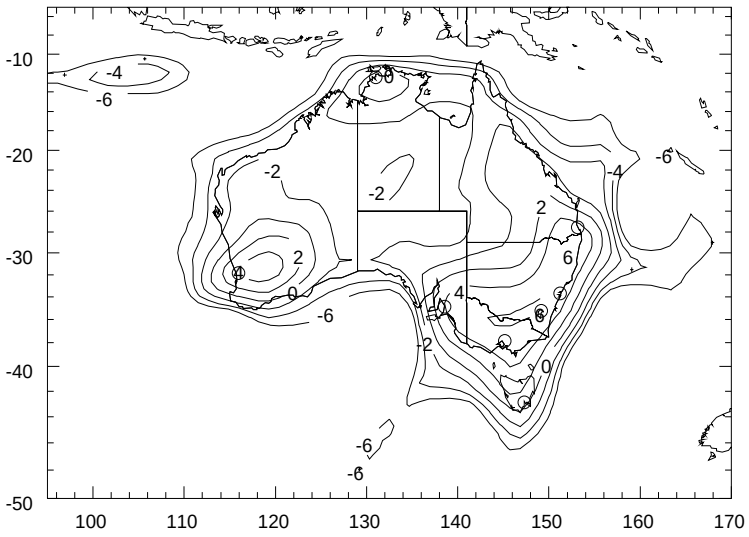


Figure A1-1 - NA Beam Receive Gain on Temperature (G/T)

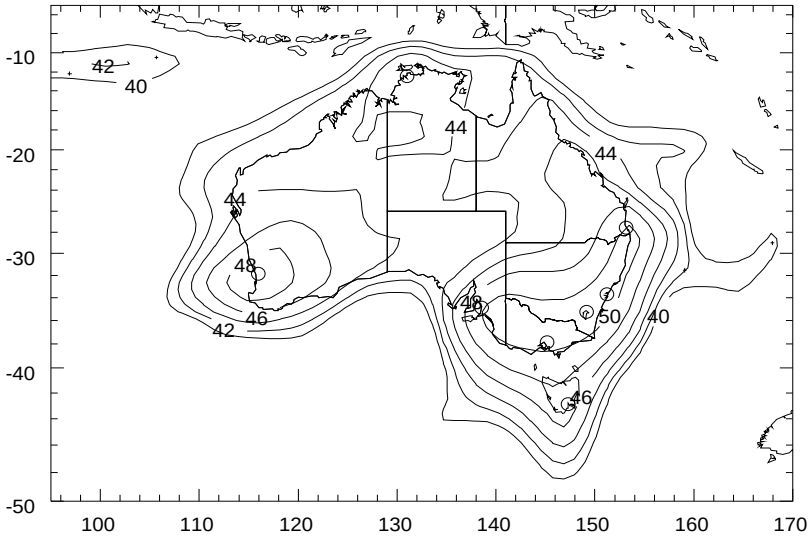


Figure A1-2 - NA Beam Effective Isotropic Radiated Power (EIRP)

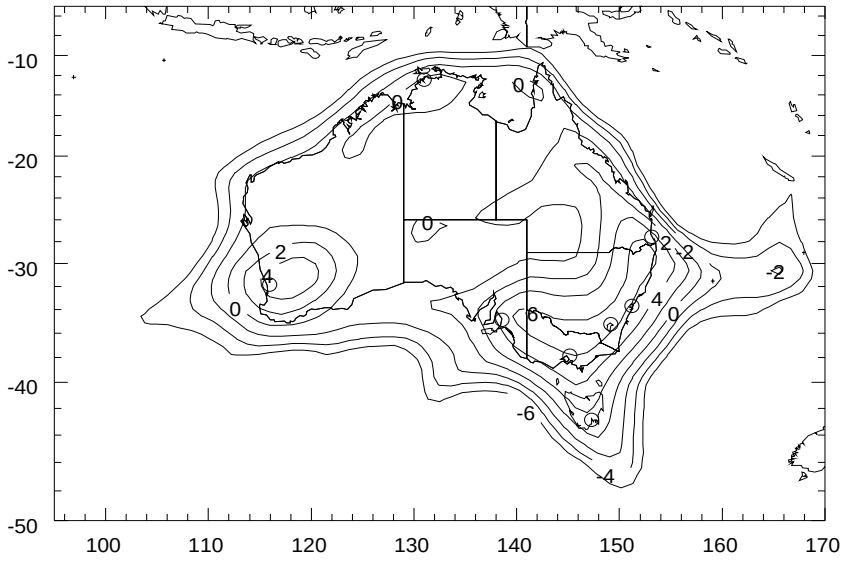


Figure A1-3 - NB Beam Receive Gain on Temperature (G/T)

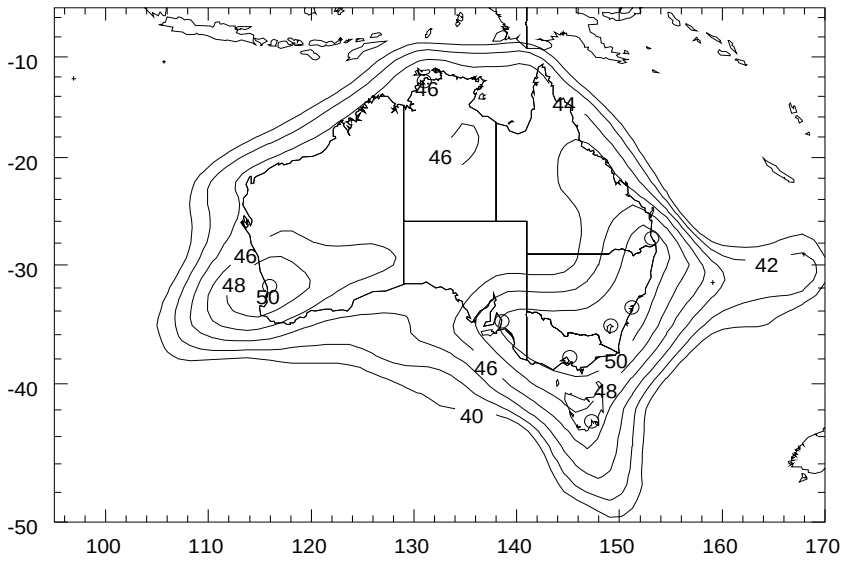


Figure A1-4 - NB Beam Effective Isotropic Radiated Power (EIRP)

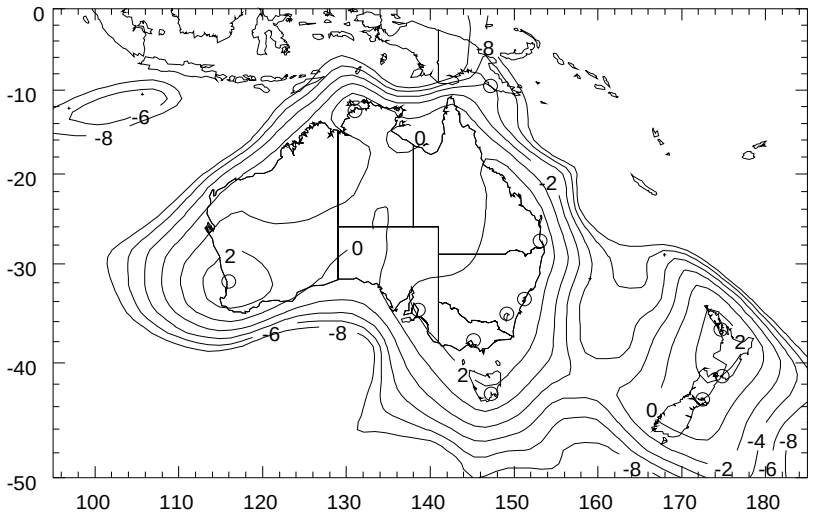


Figure A1-5 - NANZ Beam Receive Gain on Temperature (G/T)

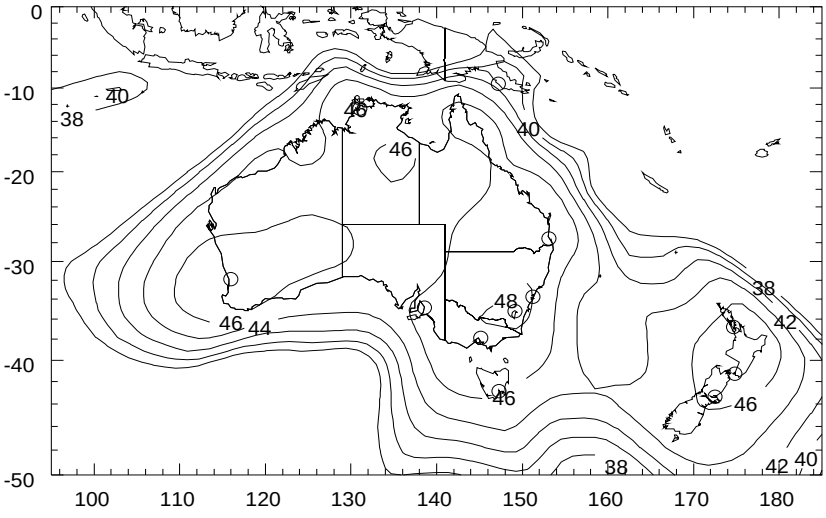


Figure A1-6 - NANZ Beam Effective Isotropic Radiated Power (EIRP)

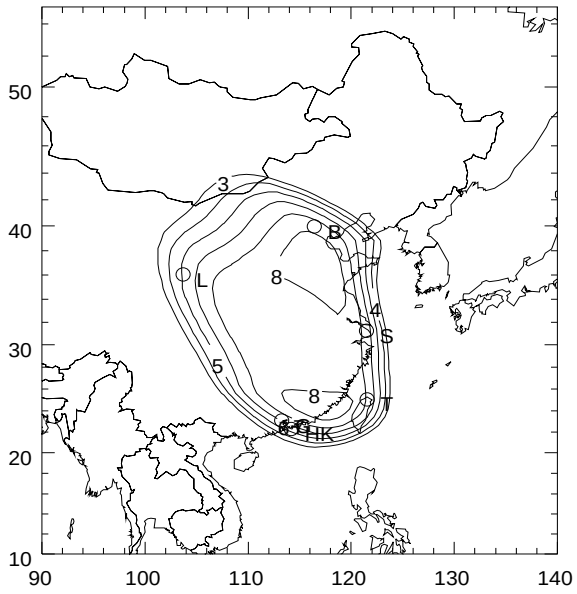


Figure A1-7 - EA Beam East Asia Receive Gain on Temperature (G/T)

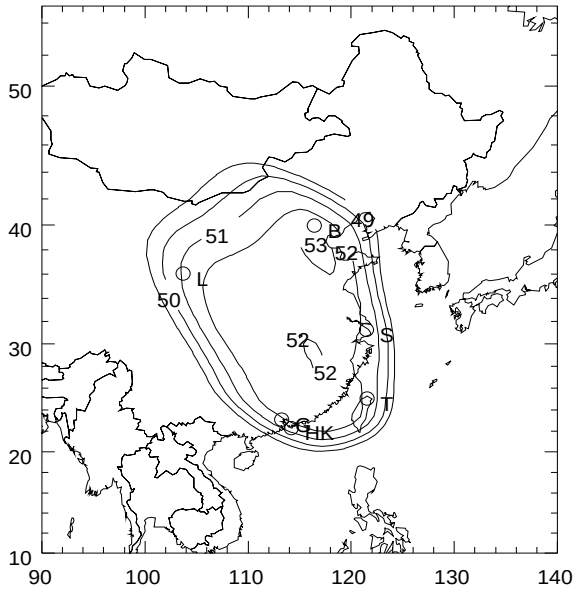


Figure A1-8 - EA Beam East Asia Effective Isotropic Radiated Power (EIRP)

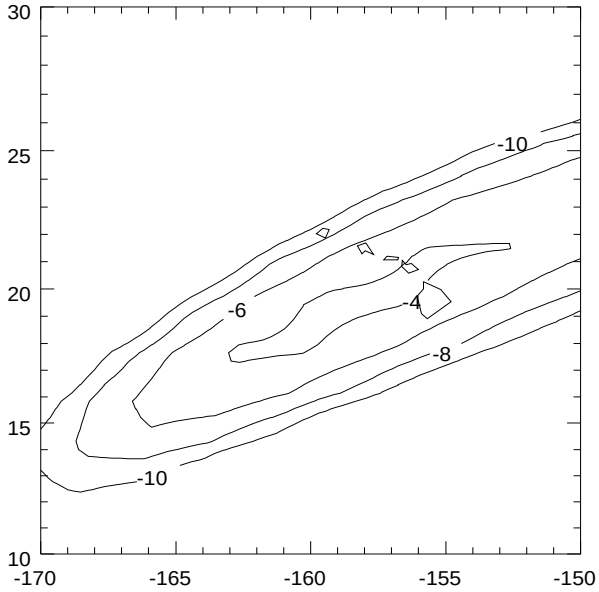


Figure A1-9 - NA Beam Hawaii Spot Receive Gain on Temperature (G/T)

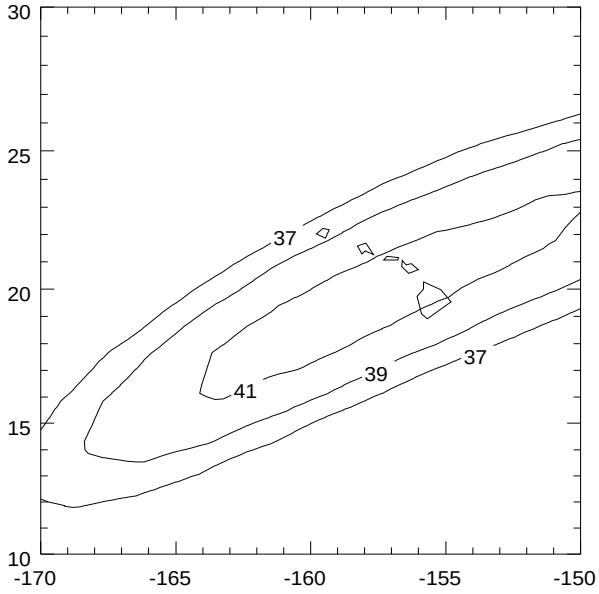


Figure A1-10 - NA Beam Hawaii Spot Effective Isotropic Radiated Power (EIRP)

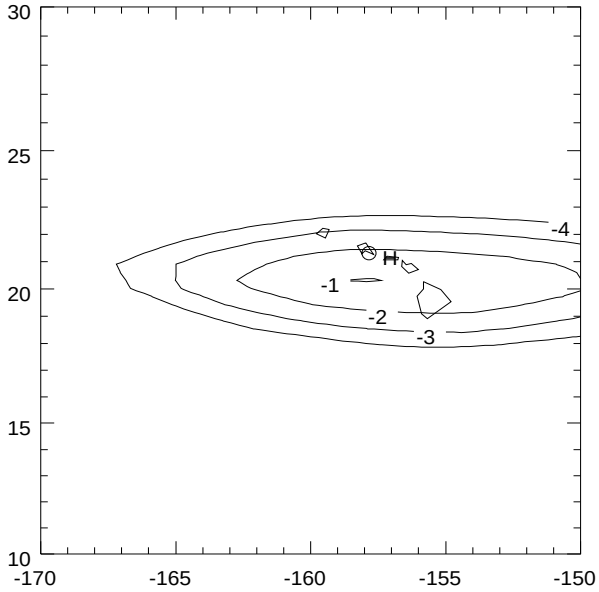


Figure A1-11 - EA Beam Hawaii Spot Receive Gain on Temperature (G/T)

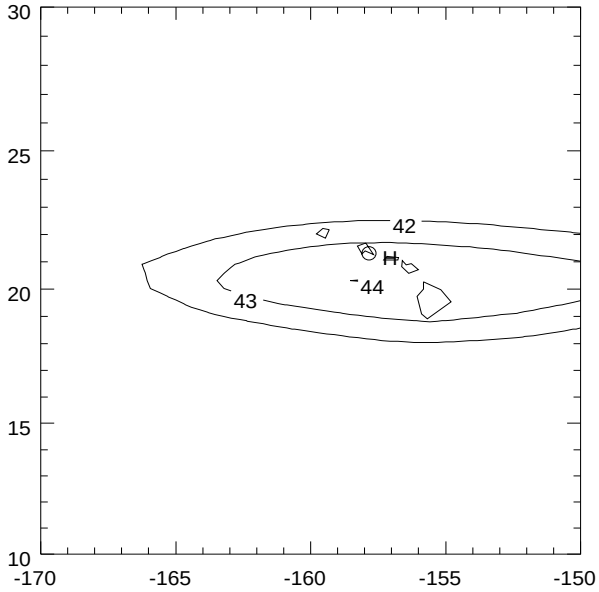


Figure A1-12 - EA Beam Hawaii Spot Effective Isotropic Radiated Power (EIRP)

Further Information

Optus Satellite Services is part of a range of integrated communications solutions provided by Optus to help your business grow. For further details about our latest range of satellite products and services, please visit our web site at **optusbusiness.com.au**

For more specific enquiries about our C1 Satellite, please call Mark Harwood on (02) 9027 0084 or by email on mark.harwood@optus.com.au