

Executive Summary

The Development of Sharing Criteria for Ka-Band Multi-Purpose Satellite Systems (KAMPSS)

SSE File No. 027ST-360001-3-3617

SSE Contract No. 36001-3-3617/01-ST

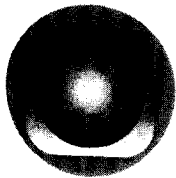
March 31, 1994

CRC SCIENTIFIC AUTHORITY: CARON, M.

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Abstract

The World Administrative Radio Conference (WARC), held in 1992, allocated the frequency bands, 19.7-20.2 GHz and 29.5-30.0 GHz to both Mobile Satellite Services (MSS) and Fixed Satellite Services (FSS) on a co-primary basis for Geostationary Earth Orbit (GEO) satellites. An economic and flexible solution for the provision of both services is to place both MSS and FSS payloads on one multi-purpose satellite. Such a system is currently under study at CRC and is referred to as the Advanced Satcom Program which is intended to demonstrate on-board processing and Ka-band technologies in offering both MSS (land and aeronautical) and FSS to ground terminals equipped with small to very small antennas.

In order to determine the need for detailed interference coordination between satellite communications systems, sharing criteria, in the form of carrier-to-interference (C/I) ratios, are used. If adjacent systems meet the minimum C/I , there is no need for further interference coordination between the two systems. When the minimum C/I is not met, more detailed analysis of the interference between the two systems must be made. Since there are no currently established sharing criteria in the 30/20 GHz band for a mixture of MSS and FSS, there is a need to develop the analytical and software tools to develop such sharing criteria for co-primary operation in this frequency band. Timely development of sharing criteria will facilitate coordination of the Canadian system with its foreign counterparts and it will also develop ITU-R contributions to Working Party 4A. The KAMPSS software is intended to contribute to serving this need.

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1.0 General Overview

The elements in the analysis required in the study of Geostationary Earth Orbit (GEO) satellite communications system interference include

1. Defining the system spatial geometry;
2. Determining transmit power for system links;
3. Computing propagation losses;
4. Defining antenna beam patterns;
5. Defining services;
6. Determining wanted/interfering service frequency bandwidth overlaps;
7. Calculating interference.

The system position geometry is determined by the orbits of the satellites and the location of ground stations on the Earth's surface. Because the GEO orbit is such that, at nominal orbit position, a satellite is stationary with respect to the Earth's surface, the fundamental geometry is static. The angular relationships in the geometry of the system are determined by the angular disposition of antennas as required by each satellite link.

Figure 1.1 illustrates the fundamental geometry of a system of satellites (not necessarily operationally related). Although it shows only two satellites, it captures the essence of the physical configuration; however, note that KAMPSS software does not consider satellite-to-satellite interference or ground-station-to-ground-station interference as depicted in the sketch.

With respect to communications systems requirements, orbit spectrum utilization concerns the relationships amongst system design factors, the communication capacity of the geostationary orbit and some part of the radio frequency spectrum. The number of satellites that can be placed in a given arc, or inversely, the average inter-satellite spacing, $\Delta\theta$, is often used as a measure of the orbit utilization. In general, this measure of orbit utilization is related to system's design factors, as well as to factors related to the environment. A significant factor is interference level. The constraint in orbit utilization is the interference which inevitably results between geostationary satellite networks and which prevents arbitrarily close spacing. The most useful measure of the interference is the C/I ratio. It is defined as the ratio of desired signal power to undesired signal power at the output of the desired signal's receiving antenna.

The KAMPSS Graphical User Interface (GUI) is made up of dialogs, list boxes and windows which prompt the user for input and it displays relevant output. The GUI is the vehicle for defining the building blocks of a wanted and interfering satellite network. Satellite position and other data and the ground stations linked to them are entered. Predefined and stored satellite and ground station data may also be used and modified. In a similar fashion, services, made up of uplink channels and downlink channels, are defined. Finally, all the building blocks of the satellite network are linked together. From the "Link Network" dialog box, the satellite/ground stations are designated as wanted or interfering and the appropriate services are added. Once the network has been established, the C/I for a selected variation in angular spacing between the interfering and wanted satellites are calculated. The C/I for each service may be displayed as a plot or a table of values relative to the angular separation. The user interface offers the user full editing, save, and retrieve facility for the network definitions and their building blocks.

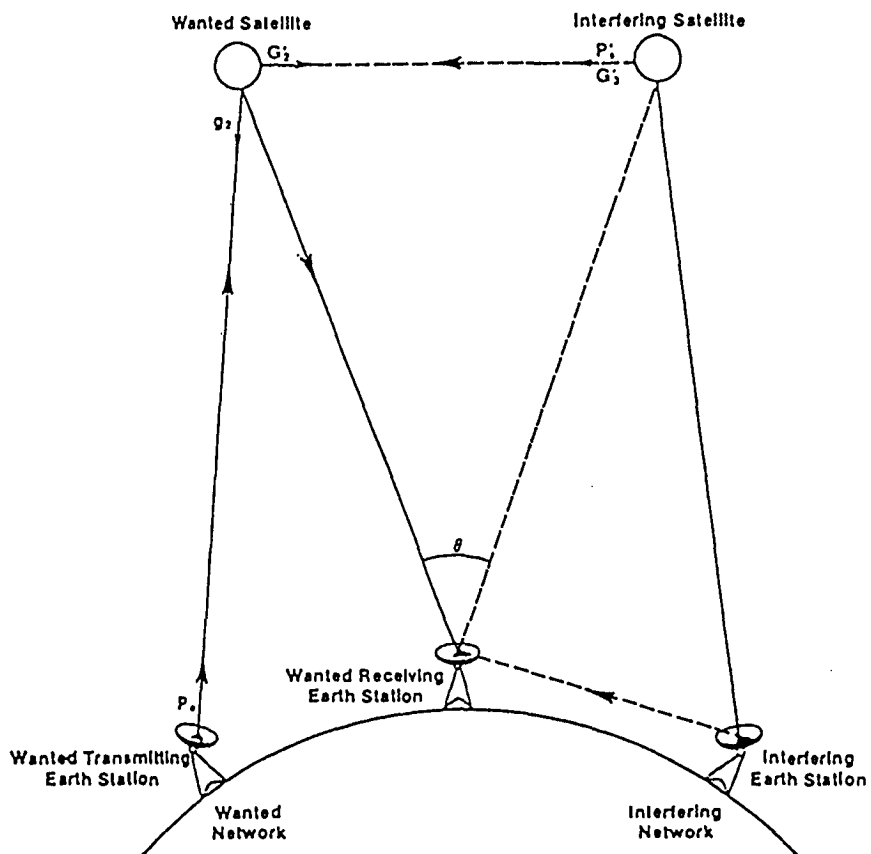


Figure 1.1 Interference Geometry

2.0 Objectives of the Work

The overall general objective of this work is to develop sharing criteria between multi-purpose satellite systems operating in the 30/20 GHz band to allow the introduction of MSS and FSS in an orderly manner resulting in an efficient use of the geostationary orbit and frequency spectrum.

To meet this goal the technical objectives for the work adopted for the KAMPSS development were:

1. To develop software tools to analyze the impact of satellite orbit spacing on the C/I ratio and conversely the impact of the C/I ratio on the satellite orbit spacing;
2. To generate system curves showing the impact of system parameters on satellite spacing, given objective C/I ratios, and conversely the impact of system parameters on C/I ratios given satellite spacing,
3. To develop a stand-alone program operating on a Macintosh personal computer, designed to allow the user to study downlink and uplink interference under different scenarios through a minimum set of user-definable parameters, namely,
 - i) Choice of repeater type or fully regenerative payload for both the interfering and wanted satellite for downlink interference,
 - ii) Choice of repeater type or fully regenerative payload for the satellite in uplink interference calculations,
 - iii) Modulation and demodulation type,
 - iv) Error correction coding,
 - v) Satellite access scheme,
 - vi) Bit error rate objectives,
 - vii) Antenna gain patterns and sizes,
 - viii) Satellite frequency re-use patterns;
 - ix) Propagation losses;
 - x) RF characteristics of transmitters and receivers,
 - xi) Antenna pointing angle accuracy,
 - xii) Availability,
 - xiii) Impact of fade countermeasures;
4. To develop the program as a highly interactive tool and to allow the user to save/retrieve scenarios to/from files once defined.

3.0 Problem Statement

The problem involves interaction of GEO satellite communications networks and the orbit spacing relationships necessary to obtain optimum use of this resource while yielding acceptable levels of interference.

The systems of interest are those systems communicating in the 20-30GHz band. Realistic evaluation of the interference scenario requires an adequate simulation of the geometry and proper determination of the propagation losses to be able to establish transmit power requirements of the networks selected for study. In addition, adequate models of beam patterns are essential for good accuracy. Realism in the types of service, their access schemes and

modulation schemes, their bandwidths are necessary in the determination of the interference situation.

The principal interest is in providing the means to determine characteristic curves for the C/I ratios for the services specified by the user as a function of orbital separation of the interfering systems, with the interest being focused on a "wanted" system.

4.0 Problem Solution

4.1 Geometry

In order to establish the basis for the analytical framework, the general geometry for the interference analyses is based on a static, three dimensional (and 4π steradian) geometry, with the origin of the reference frame coincident with the centre of the Earth. This permits the specification of ground station positions and the GEO satellite positions to be provided as geodetic coordinates.

In the case of ground stations, a transformation provided to transform position data into the ground station local reference frame from which range, azimuth angle and elevation angle is calculated. Position data may be subsequently transformed to each antenna local reference frame referred to the boresight axis. This permits computation of the antenna gains in the direction of relevant transmitters and/or receivers, which are functions of the antenna off-axis angles.

In the case of satellites, a transformation is provided to transform all position data into a satellite body-fixed reference frame with origin at the position (centre of mass) of the satellite; that is, the axes are respectively coincident with the direction of the spacecraft velocity vector, the normal (south) direction of the orbit plane and the inverse-direction of the satellite's Earth radius vector. A transformation is provided to transform data from the satellite body-fixed reference frame to the reference frame referred to the boresight axis. As in the case of ground stations, this permits computation of the antenna gains in the direction of relevant transmitters and/or receivers, which are functions of the antenna off-axis angles.

This overall geometry provides a straightforward basis for all study configurations.

4.2 Transmit Power

Each uplink and downlink transmit power for each network is computed based upon the the carrier-to-noise density ratio required for particular access schemes (FDMA/TDMA, CDMA), modulation schemes (MSK, BPSK, QPSK, M-ary PSK) and bit error rate specified, the transmitter gain, the propagation path losses (see below) and the properties of the receiver.

4.3 Propagation Losses

Propagation losses included are the free space loss, losses due to atmospheric gases, rain fading, tropospheric scintillation fading and angular pointing error of the transmitter/receiver. These losses are applied directly in the determination of the transmit power and wanted received power, although in the case of the fading losses these are applied as root-sum-squares. In the case of interfering signals, fading losses are not applied. In addition, the pointing error is assumed to always worsen the interference problem; that is, it is applied as a "negative" loss to interfering source signals.

4.4 Antenna Beam Patterns

All beam patterns are assumed to be rotationally symmetric about the boresight axis. Options include the FCC/CCIR specification, the modified CCIR specification, the Krauss model

and a data array from which straight-line interpolations are made.

4.5 Services

The current implementation of KAMPSS allows the storage of 100 service definitions, with a maximum of 20 active services.

4.6 Frequency Bandwidth Overlap

It is assumed that if there is no frequency band overlap of the service bandwidth by a potential interfering signal that the interference is negligible (zero). If an overlap occurs, the frequency band defined by the overlap represents the frequency limits over which the interfering signal power spectral density function is integrated to determine the interference power. For TDMA/FDMA services the received power spectral density function is assumed to have a Gaussian distribution. For CDMA services, the power spectral density function is assumed to have a uniform distribution.

4.7 Interference

The C/I ratios for each uplink service and each downlink service are computed as well as the total uplink/downlink power for each service. The angular separation of the satellites can be varied in discrete steps to provide a variation of the separation and thus yield characteristic variation of C/I accordingly.

5.0 Results

Appendices A and B demonstrate some results generated by the KAMPSS software. Appendix A shows the variation of the C/I versus angular separation between a wanted and an interfering satellite, both of which are considered to be regenerative repeaters. These results are shown alternatively as a plot and as a table of values. Note the presence of the desired C/I which shows as a straight line on the C/I plot and which is provided as an entry in the results table. Included also is a print-out of the text file which functions as a supporting information source to the user and which stores the GUI input for each run. Appendix B is a case where both satellites are considered to be conventional repeaters and similar output is provided. It should be noted that negative angular separations should be interpreted as the interfering satellite being west of the wanted satellite. Also, it should be appreciated that the results illustrated do not necessarily precisely represent an actual system but rather typifies the interference situation.

6.0 Conclusion

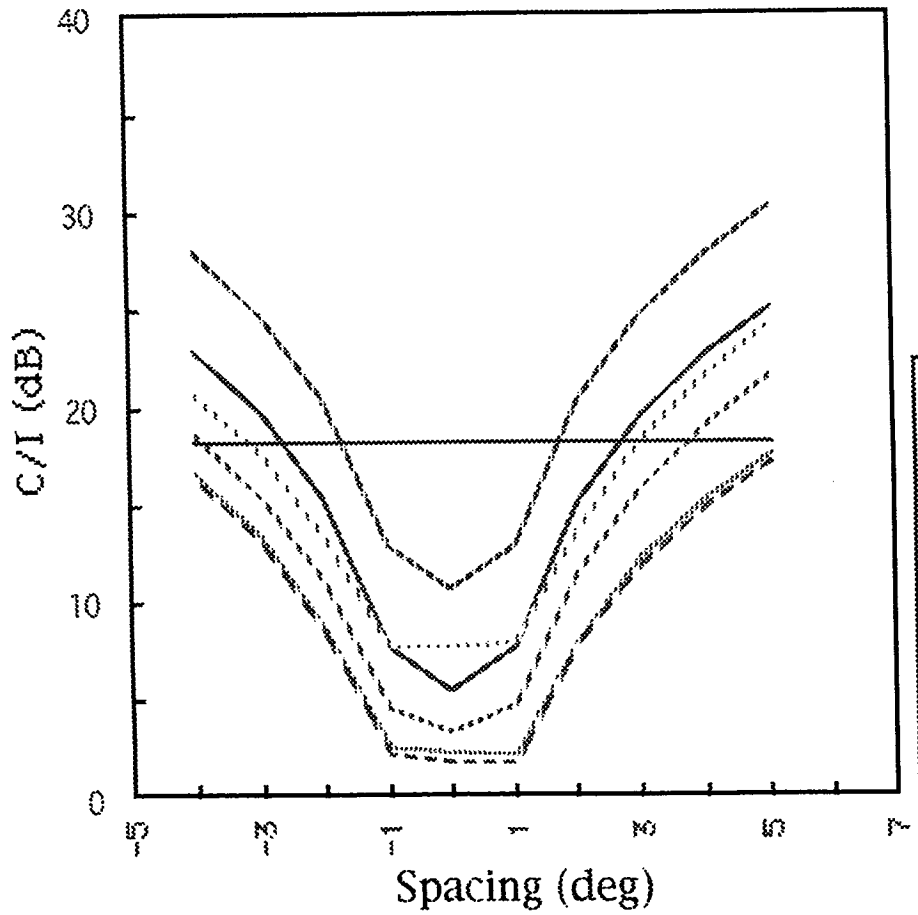
KAMPSS software provides the user the utility to study a number of situations relevant to the development of sharing criteria in the 20/30 GHz band relative to GEO satellites, in particular the relationship of the C/I and orbit angular separation. It permits this to be accomplished in a user-friendly fashion through a typical, modern graphical user interface.

SSE utilized third-party commercial development and support tools to aid in the development and control of the software implementation, including the Language System FORTRAN Compiler, the AppMaker application generator. All software was developed, maintained and managed within the Macintosh Programmer's Workshop (MPW) software development system, which provides, through Projector, source management facility control and audit trails for all developed source code across the complete project development cycle and programming staff. The graphical user interface (GUI) was developed in accordance with and adheres to Apple's Human Interface Guidelines.

Appendix A

Regenerative Repeater

C/I vs Spacing



- 64 kbps TDMA/TDM Up Link A
- 64 kbps TDMA/TDM Down Link A
- ... 64 kbps TDMA/TDM Total A
- - - 64 kbps TDMA/TDM Up Link B
- · · 64 kbps TDMA/TDM Down Link B
- · - 64 kbps TDMA/TDM Total B
- 64 kbps TDMA/TDM C/I Req Up
- 64 kbps TDMA/TDM C/I Req Down

KAMPSS Satellite Network Information

Network name = Con Net1 May2/94

Wanted satellite information

Wanted Sat ident = Wanted Conventional Sat
Wanted Sat Loc Latitude = 0.0000000000000000
Wanted Sat Loc Longitude = 245.0000000000000000
Wanted Sat Height = 35786.020000000000
Wanted Sat Repeater Type = Conventional

Wanted Sat Tx Loc Azimuth = 147.90300000000000
Wanted Sat Tx Loc Elevation = 82.15510000000000
Wanted Sat Tx Loc Latitude = 45.35000000000000
Wanted Sat Tx Loc Longitude = 284.10000000000000
Wanted Sat Tx Max O/P Power = 50.00000000000000
Wanted Sat Tx Pattern Type = Modified CCIR
Wanted Sat Tx Pattern Gain = 45.00000000000000
Wanted Sat Tx FieldX1 = 0.0000000000000000
Wanted Sat Tx FieldX2 = 0.3000000000000000
Wanted Sat Tx FieldA1 = 45.00000000000000
Wanted Sat Tx FieldB1 = 0.0000000000000000
Wanted Sat Tx FieldA2 = 32.00000000000000
Wanted Sat Tx FieldB2 = 25.00000000000000
Wanted Sat Tx File name user for defined pattern = untitled file name

Wanted Sat Rx Loc Azimuth = 159.86800000000000
Wanted Sat Rx Loc Elevation = 81.60210000000000
Wanted Sat Rx Loc Latitude = 60.00000000000000
Wanted Sat Rx Loc Longitude = 284.10000000000000
Wanted Sat Rx G/Ts = 18.30000000000000

Wanted Sat Rx Pattern Type = Modified CCIR
Wanted Sat Rx Pattern Gain = 45.00000000000000
Wanted Sat Rx X1or3dBd = 0.0000000000000000
Wanted Sat Rx FieldX2 = 0.3000000000000000
Wanted Sat Rx FieldA1 = 45.00000000000000
Wanted Sat Rx FieldB1 = 0.0000000000000000
Wanted Sat Rx FieldA2 = 32.00000000000000
Wanted Sat Rx FieldB2 = 25.00000000000000
Wanted Sat Rx File name user for defined pattern = untitled file name

Interfering Satellite Information

Interfering Sat Ident = Interf Conventional Sat
Interfering Sat Loc Latitude = 0.0000000000000000
Interfering Sat Loc Longitude = 240.00000000000000
Interfering Sat Height = 35786.020000000000
Interfering Sat Repeater Type = Conventional
Interfering Sat Number of GSt/TxRx = 1

Interfering Sat Tx Loc Azimuth = 149.99600000000000
Interfering Sat Tx Loc Elevation = 82.32740000000000
Interfering Sat Tx Loc Longitude = 45.00000000000000
Interfering Sat Tx Loc Latitude = 275.00000000000000
Interfering Sat Tx MaxO/P Power = 50.00000000000000
Interfering Sat Tx Pattern Type = Modified CCIR
Interfering Sat Tx Pattern Gain = 45.00000000000000
Interfering Sat Tx Pattern FieldX1 = 0.0000000000000000
Interfering Sat Tx Pattern FieldX2 = 0.3000000000000000
Interfering Sat Tx Pattern FieldA1 = 45.00000000000000
Interfering Sat Tx Pattern FieldB1 = 0.0000000000000000
Interfering Sat Tx Pattern FieldA2 = 32.00000000000000
Interfering Sat Tx Pattern FieldB2 = 25.00000000000000
Interfering Sat Tx File name user for defined pattern = untitled file name

Interfering Sat Rx Loc Azimuth = 128.92200000000000
Interfering Sat Rx Loc Elevation = 83.49990000000000
Interfering Sat Rx Loc Longitude = 25.00000000000000
Interfering Sat Rx Loc Latitude = 275.00000000000000
Interfering Sat Rx G/Ts = 18.30000000000000
Interfering Sat Rx Pattern Type = Modified CCIR
Interfering Sat Rx Pattern Gain = 45.00000000000000
Interfering Sat Rx Pattern FieldX1 = 0.0000000000000000
Interfering Sat Rx Pattern FieldX2 = 0.3000000000000000
Interfering Sat Rx Pattern FieldA1 = 45.00000000000000
Interfering Sat Rx Pattern FieldB1 = 0.0000000000000000
Interfering Sat Rx Pattern FieldA2 = 32.00000000000000
Interfering Sat Rx Pattern FieldB2 = 25.00000000000000
Interfering Sat Rx File name user for defined pattern = untitled file name

Wanted Ground Station Information

Number of wanted Ground Stations = 2
Wanted Ground Station Ident = Wanted GS1-2-A
Wanted Ground Station Loc Type = 1

Wanted Ground Station Loc Azimuth = 147.903000000000
 Wanted Ground Station Loc Elevation = 82.155100000000
 Wanted Ground Station Loc Latitude = 45.350000000000
 Wanted Ground Station Loc Longitude = 284.100000000000
 Wanted Ground Station Height(m) = 126.000000000000

Wanted Grnd Stion Tx Loc Azimuth = 228.827402357817
 Wanted Grnd Stion Tx Loc Elevation = 25.2059701304724
 Wanted Grnd Stion Tx Loc Az Pointing error = 0.000000000000
 Wanted Grnd Stion Tx Loc El Pointing error = 0.000000000000
 Wanted Grnd Stion Tx Max O/P Power = 5.000000000000
 Wanted Grnd Stion Tx Pattern Type = Modified CCIR
 Wanted Grnd Stion Tx Pattern Gain = 37.300000000000
 Wanted Grnd Stion Tx Pattern FieldX1 = 0.000000000000
 Wanted Grnd Stion Tx Pattern FieldX2 = 0.950000000000
 Wanted Grnd Stion Tx Pattern FieldA1 = 37.300000000000
 Wanted Grnd Stion Tx Pattern FieldB1 = 0.000000000000
 Wanted Grnd Stion Tx Pattern FieldA2 = 34.000000000000
 Wanted Grnd Stion Tx Pattern FieldB2 = 25.000000000000
 Wanted Grnd Stion Tx File name user for defined pattern = untitled file name

Wanted Grnd Stion Rx Loc Azimuth = 228.827402357817
 Wanted Grnd Stion Rx Loc Elevation = 25.2059701304724
 Wanted Grnd Stion Rx Az Pointing error = 0.000000000000
 Wanted Grnd Stion Rx El Pointing error = 0.000000000000
 Wanted Grnd Stion Rx G/Ts = 13.000000000000
 Wanted Grnd Stion Rx Pattern Type = Modified CCIR
 Wanted Grnd Stion Rx Pattern Gain = 33.700000000000
 Wanted Grnd Stion Rx Pattern FieldX1 = 0.000000000000
 Wanted Grnd Stion Rx Pattern FieldX2 = 1.780000000000
 Wanted Grnd Stion Rx Pattern FieldA1 = 33.700000000000
 Wanted Grnd Stion Rx Pattern FieldB1 = 0.000000000000
 Wanted Grnd Stion Rx Pattern FieldA2 = 36.000000000000
 Wanted Grnd Stion Rx Pattern FieldB2 = 25.000000000000
 Wanted Grnd Stion Rx File name user for defined pattern = untitled file name

Wanted Ground Station Ident = Wanted GS1-2-B
 Wanted Ground Station Loc Type = 1
 Wanted Ground Station Loc Azimuth = 159.868000000000
 Wanted Ground Station Loc Elevation = 81.602100000000
 Wanted Ground Station Loc Latitude = 60.000000000000
 Wanted Ground Station Loc Longitude = 284.100000000000
 Wanted Ground Station Height(m) = 126.000000000000

Wanted Grnd Stion Tx Loc Azimuth = 223.198519632786
 Wanted Grnd Stion Tx Loc Elevation = 14.4334899913064
 Wanted Grnd Stion Tx Loc Az Pointing error = 0.000000000000
 Wanted Grnd Stion Tx Loc El Pointing error = 0.000000000000
 Wanted Grnd Stion Tx Max O/P Power = 5.000000000000
 Wanted Grnd Stion Tx Pattern Type = Modified CCIR
 Wanted Grnd Stion Tx Pattern Gain = 37.300000000000
 Wanted Grnd Stion Tx Pattern FieldX1 = 0.000000000000
 Wanted Grnd Stion Tx Pattern FieldX2 = 0.950000000000
 Wanted Grnd Stion Tx Pattern FieldA1 = 37.300000000000
 Wanted Grnd Stion Tx Pattern FieldB1 = 0.000000000000
 Wanted Grnd Stion Tx Pattern FieldA2 = 34.000000000000
 Wanted Grnd Stion Tx Pattern FieldB2 = 25.000000000000
 Wanted Grnd Stion Tx File name user for defined pattern = untitled file name

Wanted Grnd Stion Rx Loc Azimuth = 223.198519632786
 Wanted Grnd Stion Rx Loc Elevation = 14.4334899913064
 Wanted Grnd Stion Rx Az Pointing error = 0.000000000000
 Wanted Grnd Stion Rx El Pointing error = 0.000000000000
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 Wanted Grnd Stion Rx Pattern Type = Modified CCIR
 Wanted Grnd Stion Rx Pattern Gain = 33.700000000000
 Wanted Grnd Stion Rx Pattern FieldX1 = 0.000000000000
 Wanted Grnd Stion Rx Pattern FieldX2 = 1.780000000000
 Wanted Grnd Stion Rx Pattern FieldA1 = 33.700000000000
 Wanted Grnd Stion Rx Pattern FieldB1 = 0.000000000000
 Wanted Grnd Stion Rx Pattern FieldA2 = 36.000000000000
 Wanted Grnd Stion Rx Pattern FieldB2 = 25.000000000000
 Wanted Grnd Stion Rx File name user for defined pattern = untitled file name

Interfering Ground Station Information

Number of interfering ground stations = 2
 Interfering ground station ident = Interf GS2-2-A
 Interfering ground station Loc Type = 1
 Interfering ground station Loc Azimuth = 149.996000000000
 Interfering ground station Loc Elevation = 82.327400000000
 Interfering ground station Loc Latitude = 45.000000000000
 Interfering ground station Loc Longitude = 275.000000000000
 Interfering ground station Loc Height(m) = 126.000000000000
 Interfering Grnd Stion Tx Loc Azimuth = 224.744209195366
 Interfering Grnd Stion Tx Loc Elevation = 27.7235211589311

Interfering Grnd Stion Tx Loc Az Pointing error = 0.0000000000000000
 Interfering Grnd Stion Tx Loc El Pointing error = 0.0000000000000000
 Interfering Grnd Stion TxMax O/P Power = 5.0000000000000000
 Interfering Grnd Stion Tx Pattern Type = Modified CCIR
 Interfering Grnd Stion Tx Pattern Gain = 37.3000000000000000
 Interfering Grnd Stion Tx Pattern X1or3dBbw = 0.0000000000000000
 Interfering Grnd Stion Tx Pattern FieldX2 = 0.9500000000000000
 Interfering Grnd Stion Tx Pattern FieldA1 = 37.3000000000000000
 Interfering Grnd Stion Tx Pattern FieldB1 = 0.0000000000000000
 Interfering Grnd Stion Tx Pattern FieldA2 = 36.0000000000000000
 Interfering Grnd Stion Tx Pattern FieldB2 = 25.0000000000000000
 Interfering Grnd Stion Tx File name user for defined pattern =
 untitled file name

Interfering Grnd Stion Rx Loc Azimuth = 224.744209195366
 Interfering Grnd Stion Rx Loc Elevation = 27.7235211589311
 Interfering Grnd Stion Rx Loc Az Pointing error = 0.0000000000000000
 Interfering Grnd Stion Rx Loc El Pointing error = 0.0000000000000000
 Interfering Grnd Stion RX G/Ts = 13.0000000000000000
 Interfering Grnd Stion Rx Pattern Type = FCC/CCIR
 Interfering Grnd Stion Rx Pattern Gain = 37.0000000000000000
 Interfering Grnd Stion Rx Pattern FieldX1 = 0.5000000000000000
 Interfering Grnd Stion Rx Pattern FieldX2 = 0.0000000000000000
 Interfering Grnd Stion Rx Pattern FieldA1 = 32.0000000000000000
 Interfering Grnd Stion Rx Pattern FieldB1 = 25.0000000000000000
 Interfering Grnd Stion Rx Pattern FieldA2 = 0.0000000000000000
 Interfering Grnd Stion Rx Pattern FieldB2 = 0.0000000000000000
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Interfering ground station ident = Interf GS2-2-B
 Interfering ground station Loc Type = 1
 Interfering ground station Loc Azimuth = 128.9220000000000000
 Interfering ground station Loc Elevation = 83.4999000000000000
 Interfering ground station Loc Latitude = 25.0000000000000000
 Interfering ground station Loc Longitude = 275.0000000000000000
 Interfering ground station Loc Height(m) = 126.0000000000000000
 Interfering Grnd Stion Tx Loc Azimuth = 238.914864579886
 Interfering Grnd Stion Tx Loc Elevation = 41.4363787460988
 Interfering Grnd Stion Tx Loc Az Pointing error = 0.0000000000000000
 Interfering Grnd Stion Tx Loc El Pointing error = 0.0000000000000000
 Interfering Grnd Stion TxMax O/P Power = 5.0000000000000000
 Interfering Grnd Stion Tx Pattern Type = Modified CCIR
 Interfering Grnd Stion Tx Pattern Gain = 37.3000000000000000
 Interfering Grnd Stion Tx Pattern X1or3dBbw = 0.0000000000000000
 Interfering Grnd Stion Tx Pattern FieldX2 = 0.9500000000000000
 Interfering Grnd Stion Tx Pattern FieldA1 = 37.3000000000000000
 Interfering Grnd Stion Tx Pattern FieldB1 = 0.0000000000000000
 Interfering Grnd Stion Tx Pattern FieldA2 = 36.0000000000000000
 Interfering Grnd Stion Tx Pattern FieldB2 = 25.0000000000000000
 Interfering Grnd Stion Tx File name user for defined pattern =
 untitled file name

Interfering Grnd Stion Rx Loc Azimuth = 238.914864579886
 Interfering Grnd Stion Rx Loc Elevation = 41.4363787460988
 Interfering Grnd Stion Rx Loc Az Pointing error = 0.0000000000000000
 Interfering Grnd Stion Rx Loc El Pointing error = 0.0000000000000000
 Interfering Grnd Stion RX G/Ts = 13.0000000000000000
 Interfering Grnd Stion Rx Pattern Type = FCC/CCIR
 Interfering Grnd Stion Rx Pattern Gain = 37.0000000000000000
 Interfering Grnd Stion Rx Pattern FieldX1 = 0.5000000000000000
 Interfering Grnd Stion Rx Pattern FieldX2 = 0.0000000000000000
 Interfering Grnd Stion Rx Pattern FieldA1 = 32.0000000000000000
 Interfering Grnd Stion Rx Pattern FieldB1 = 25.0000000000000000
 Interfering Grnd Stion Rx Pattern FieldA2 = 0.0000000000000000
 Interfering Grnd Stion Rx Pattern FieldB2 = 0.0000000000000000
 Interfering Grnd Stion Rx File name user for defined pattern =
 untitled file name

Wanted Services Information

Number of wanted services for Wanted GS 1 = 1
 Wanted service ident = 64 kbps TDMA/TDM
 Wanted uplink BER = 1.0000000000000000D-05
 Wanted uplink Data Bit Rate = 385.5000000000000000
 Wanted uplink Error Correction gain = 5.5000000000000000
 Wanted uplink Availability = 90.5000000000000000
 Wanted uplink Centre Frequency = 29.7000000000000000
 Wanted uplink Required Bandwidth = 540.0000000000000000
 Wanted uplink C/I Required = 18.2000000000000000
 Wanted uplink Miscellaneous Losses = 2.0000000000000000
 Wanted uplink Modulation - Coherent or Differential = Coherent
 Wanted uplink Modulation Type = QPSK
 Wanted uplink M or Eb/No if PSK or User Defined = 0.0000000000000000
 Wanted uplink Access Scheme Type = FDMA/TDMA
 Wanted uplink CDMA Spreading Factor = 0.0000000000000000

Wanted uplink CDMA Loading Factor = 0.0000000000000000
Wanted uplink FadeCountermeasures Off(1) or On(2) = 2
Wanted uplink Fade On Threshold = 1.0000000000000000
Wanted uplink Fade On Max Gain = 3.0000000000000000

Wanted downlink BER = 1.0000000000000000D-05
Wanted downlink Data Bit Rate = 2560.000000000000
Wanted downlink Error Correction gain = 5.5000000000000000
Wanted downlink Availability = 99.5000000000000000
Wanted downlink Centre Frequency = 19.7000000000000000
Wanted downlink Required Bandwidth = 3584.000000000000
Wanted downlink C/I Required = 18.2000000000000000
Wanted downlink Miscellaneous Losses = 2.0000000000000000
Wanted downlink Modulation - Coherent or Differential = Coherent
Wanted downlink Modulation Type = QPSK
Wanted downlink M or Eb/No if PSK or User Defined = 0.0000000000000000
Wanted downlink Access Scheme Type = FDMA/TDMA
Wanted downlink CDMA Spreading Factor = 0.0000000000000000
Wanted downlink CDMA Loading Factor = 0.0000000000000000
Wanted downlink FadeCountermeasures Off(1) or On(0) = 1
Wanted downlink Fade On Threshold = 0.0000000000000000
Wanted downlink Fade On Max Gain = 0.0000000000000000

Number of wanted services for Wanted GS 2 = 1
Wanted service ident = 64 kbps TDMA/TDM
Wanted uplink BER = 1.0000000000000000D-05
Wanted uplink Data Bit Rate = 385.500000000000
Wanted uplink Error Correction gain = 5.5000000000000000
Wanted uplink Availability = 90.5000000000000000
Wanted uplink Centre Frequency = 29.7000000000000000
Wanted uplink Required Bandwidth = 540.000000000000
Wanted uplink C/I Required = 18.2000000000000000
Wanted uplink Miscellaneous Losses = 2.0000000000000000
Wanted uplink Modulation - Coherent or Differential = Coherent
Wanted uplink Modulation Type = QPSK
Wanted uplink M or Eb/No if PSK or User Defined = 0.0000000000000000
Wanted uplink Access Scheme Type = FDMA/TDMA
Wanted uplink CDMA Spreading Factor = 0.0000000000000000
Wanted uplink CDMA Loading Factor = 0.0000000000000000
Wanted uplink FadeCountermeasures Off(1) or On(2) = 2
Wanted uplink Fade On Threshold = 1.0000000000000000
Wanted uplink Fade On Max Gain = 3.0000000000000000

Wanted downlink BER = 1.0000000000000000D-05
Wanted downlink Data Bit Rate = 2560.000000000000
Wanted downlink Error Correction gain = 5.5000000000000000
Wanted downlink Availability = 99.5000000000000000
Wanted downlink Centre Frequency = 19.7000000000000000
Wanted downlink Required Bandwidth = 3584.000000000000
Wanted downlink C/I Required = 18.2000000000000000
Wanted downlink Miscellaneous Losses = 2.0000000000000000
Wanted downlink Modulation - Coherent or Differential = Coherent
Wanted downlink Modulation Type = QPSK
Wanted downlink M or Eb/No if PSK or User Defined = 0.0000000000000000
Wanted downlink Access Scheme Type = FDMA/TDMA
Wanted downlink CDMA Spreading Factor = 0.0000000000000000
Wanted downlink CDMA Loading Factor = 0.0000000000000000
Wanted downlink FadeCountermeasures Off(1) or On(0) = 1
Wanted downlink Fade On Threshold = 0.0000000000000000
Wanted downlink Fade On Max Gain = 0.0000000000000000

Interfering Services Information

Number of interfering services for Wanted GS 1 = 1
Wanted service ident = 64 kbps TDMA/TDM
Interfering uplink BER = 1.0000000000000000D-05
Interfering uplink Data Bit Rate = 385.500000000000
Interfering uplink Error Correction gain = 5.5000000000000000
Interfering uplink Availability = 90.5000000000000000
Interfering uplink Centre Frequency = 29.7000000000000000
Interfering uplink Required Bandwidth = 540.000000000000
Interfering uplink C/I Required = 18.2000000000000000
Interfering uplink Miscellaneous Losses = 2.0000000000000000
Interfering uplink Modulation - Coherent or Differential = Coherent
Interfering uplink Modulation Type = QPSK
Interfering uplink M or Eb/No if PSK or User Defined = 0.0000000000000000
Interfering uplink Access Scheme Type = FDMA/TDMA
Interfering uplink CDMA Spreading Factor = 0.0000000000000000
Interfering uplink CDMA Loading Factor = 0.0000000000000000
Interfering uplink FadeCountermeasures Off(1) or On(2) = 2
Interfering uplink Fade On Threshold = 1.0000000000000000
Interfering uplink Fade On Max Gain = 3.0000000000000000

Interfering downlink BER = 1.0000000000000000D-05
Interfering downlink Data Bit Rate = 2560.000000000000
Interfering downlink Error Correction gain = 5.5000000000000000

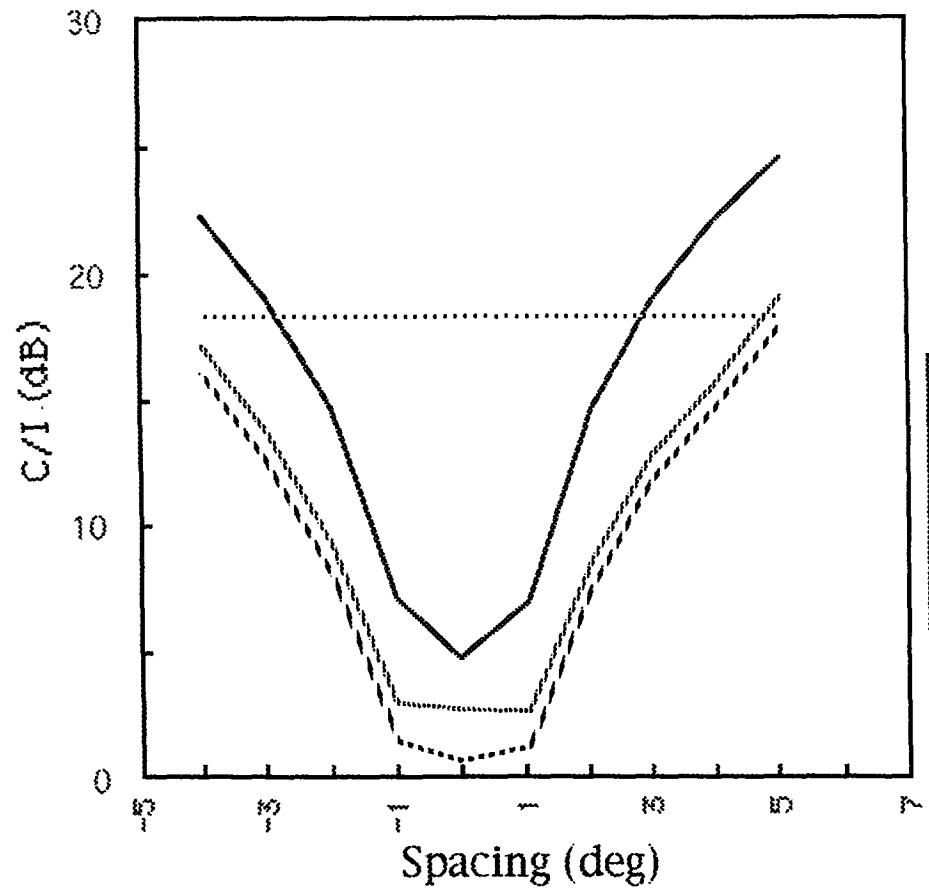
Interfering downlink Availability = 99.50000000000000
 Interfering downlink Centre Frequency = 19.70000000000000
 Interfering downlink Required Bandwidth = 3584.000000000000
 Interfering downlink C/I Required = 18.20000000000000
 Interfering downlink Miscellaneous Losses = 2.00000000000000
 Interfering downlink Modulation - Coherent or Differential = Coherent
 Interfering downlink Modulation Type = QPSK
 Interfering downlink M or Eb/No if PSK or User Defined = 0.00000000000000
 Interfering downlink Access Scheme Type = FDMA/TDMA
 Interfering downlink CDMA Spreading Factor = 0.00000000000000
 Interfering downlink CDMA Loading Factor = 0.00000000000000
 Interfering downlink FadeCountermeasures Off(1) or On(2) = 1
 Interfering downlink Fade On Threshold = 0.00000000000000
 Interfering downlink Fade On Max Gain = 0.00000000000000

Number of interfering services for Wanted GS 2 = 1
 Wanted service ident = 64 kbps TDMA/TDM
 Interfering uplink BER = 1.00000000000000D-05
 Interfering uplink Data Bit Rate = 385.500000000000
 Interfering uplink Error Correction gain = 5.50000000000000
 Interfering uplink Availability = 90.50000000000000
 Interfering uplink Centre Frequency = 29.70000000000000
 Interfering uplink Required Bandwidth = 540.000000000000
 Interfering uplink C/I Required = 18.20000000000000
 Interfering uplink Miscellaneous Losses = 2.00000000000000
 Interfering uplink Modulation - Coherent or Differential = Coherent
 Interfering uplink Modulation Type = QPSK
 Interfering uplink M or Eb/No if PSK or User Defined = 0.00000000000000
 Interfering uplink Access Scheme Type = FDMA/TDMA
 Interfering uplink CDMA Spreading Factor = 0.00000000000000
 Interfering uplink CDMA Loading Factor = 0.00000000000000
 Interfering uplink FadeCountermeasures Off(1) or On(2) = 2
 Interfering uplink Fade On Threshold = 1.00000000000000
 Interfering uplink Fade On Max Gain = 3.00000000000000

Interfering downlink BER = 1.00000000000000D-05
 Interfering downlink Data Bit Rate = 2560.000000000000
 Interfering downlink Error Correction gain = 5.50000000000000
 Interfering downlink Availability = 99.50000000000000
 Interfering downlink Centre Frequency = 19.70000000000000
 Interfering downlink Required Bandwidth = 3584.000000000000
 Interfering downlink C/I Required = 18.20000000000000
 Interfering downlink Miscellaneous Losses = 2.00000000000000
 Interfering downlink Modulation - Coherent or Differential = Coherent
 Interfering downlink Modulation Type = QPSK
 Interfering downlink M or Eb/No if PSK or User Defined = 0.00000000000000
 Interfering downlink Access Scheme Type = FDMA/TDMA
 Interfering downlink CDMA Spreading Factor = 0.00000000000000
 Interfering downlink CDMA Loading Factor = 0.00000000000000
 Interfering downlink FadeCountermeasures Off(1) or On(2) = 1
 Interfering downlink Fade On Threshold = 0.00000000000000
 Interfering downlink Fade On Max Gain = 0.00000000000000

Appendix B
Conventional Repeater

C/I vs Spacing



- 64 kbps TDMA/TDM Up Link A
- 64 kbps TDMA/TDM Down Link A
- 64 kbps TDMA/TDM Total A
- 64 kbps TDMA/TDM C/I Req Up
- 64 kbps TDMA/TDM C/I Req Down

KAMPSS Satellite Network Information

Network name = Network May 1/94 Regenerative

Wanted satellite information

Wanted Sat ident = Wanted Satcomx2
 Wanted Sat Loc Latitude = 0.0000000000000000
 Wanted Sat Loc Longitude = 245.00000000000000
 Wanted Sat Height = 35786.020000000000
 Wanted Sat Repeater Type = Regenerative

Wanted Sat Tx Loc Azimuth = 147.90300000000000
 Wanted Sat Tx Loc Elevation = 82.15510000000000
 Wanted Sat Tx Loc Latitude = 45.35000000000000
 Wanted Sat Tx Loc Longitude = 284.10000000000000
 Wanted Sat Tx Max O/P Power = 50.00000000000000
 Wanted Sat Tx Pattern Type = Modified CCIR
 Wanted Sat Tx Pattern Gain = 45.00000000000000
 Wanted Sat Tx FieldX1 = 0.0000000000000000
 Wanted Sat Tx FieldX2 = 0.3000000000000000
 Wanted Sat Tx FieldA1 = 45.00000000000000
 Wanted Sat Tx FieldB1 = 0.0000000000000000
 Wanted Sat Tx FieldA2 = 32.00000000000000
 Wanted Sat Tx FieldB2 = 25.00000000000000
 Wanted Sat Tx File name user for defined pattern = untitled file name

Wanted Sat Rx Loc Azimuth = 147.90300000000000
 Wanted Sat Rx Loc Elevation = 82.15510000000000
 Wanted Sat Rx Loc Latitude = 45.35000000000000
 Wanted Sat Rx Loc Longitude = 284.10000000000000
 Wanted Sat Rx G/Ts = 18.30000000000000

Wanted Sat Rx Pattern Type = Modified CCIR
 Wanted Sat Rx Pattern Gain = 45.00000000000000
 Wanted Sat Rx X1or3dBdW = 0.0000000000000000
 Wanted Sat Rx FieldX2 = 0.3000000000000000
 Wanted Sat Rx FieldA1 = 45.00000000000000
 Wanted Sat Rx FieldB1 = 0.0000000000000000
 Wanted Sat Rx FieldA2 = 32.00000000000000
 Wanted Sat Rx FieldB2 = 25.00000000000000
 Wanted Sat Rx File name user for defined pattern = untitled file name

Interfering Satellite Information

Interfering Sat Ident = Interf Satellite2
 Interfering Sat Loc Latitude = 0.0000000000000000
 Interfering Sat Loc Longitude = 240.00000000000000
 Interfering Sat Height = 35786.020000000000
 Interfering Sat Repeater Type = Regenerative
 Interfering Sat Number of GSt/TxRxA = 1

Interfering Sat Tx Loc Azimuth = 149.99600000000000
 Interfering Sat Tx Loc Elevation = 82.32740000000000
 Interfering Sat Tx Loc Longitude = 45.00000000000000
 Interfering Sat Tx Loc Latitude = 275.00000000000000
 Interfering Sat Tx MaxO/P Power = 50.00000000000000
 Interfering Sat Tx Pattern Type = Modified CCIR
 Interfering Sat Tx Pattern Gain = 45.00000000000000
 Interfering Sat Tx Pattern FieldX1 = 0.0000000000000000
 Interfering Sat Tx Pattern FieldX2 = 0.3000000000000000
 Interfering Sat Tx Pattern FieldA1 = 45.00000000000000
 Interfering Sat Tx Pattern FieldB1 = 0.0000000000000000
 Interfering Sat Tx Pattern FieldA2 = 32.00000000000000
 Interfering Sat Tx Pattern FieldB2 = 25.00000000000000
 Interfering Sat Tx File name user for defined pattern = untitled file name

Interfering Sat Rx Loc Azimuth = 149.99600000000000
 Interfering Sat Rx Loc Elevation = 82.32740000000000
 Interfering Sat Rx Loc Longitude = 45.00000000000000
 Interfering Sat Rx Loc Latitude = 275.00000000000000
 Interfering Sat Rx G/Ts = 18.30000000000000
 Interfering Sat Rx Pattern Type = Modified CCIR
 Interfering Sat Rx Pattern Gain = 45.00000000000000
 Interfering Sat Rx Pattern FieldX1 = 0.0000000000000000
 Interfering Sat Rx Pattern FieldX2 = 0.3000000000000000
 Interfering Sat Rx Pattern FieldA1 = 45.00000000000000
 Interfering Sat Rx Pattern FieldB1 = 0.0000000000000000
 Interfering Sat Rx Pattern FieldA2 = 32.00000000000000
 Interfering Sat Rx Pattern FieldB2 = 25.00000000000000
 Interfering Sat Rx File name user for defined pattern = untitled file name

Wanted Ground Station Information

Number of wanted Ground Stations = 1
 Wanted Ground Station Ident = Wanted GS1-2
 Wanted Ground Station Loc Type = 1

Wanted Ground Station Loc Azimuth = 147.903000000000
 Wanted Ground Station Loc Elevation = 82.155100000000
 Wanted Ground Station Loc Latitude = 45.350000000000
 Wanted Ground Station Loc Longitude = 284.100000000000
 Wanted Ground Station Height(m) = 126000.00000000

Wanted Grnd Stion Tx Loc Azimuth = 228.827402357817
 Wanted Grnd Stion Tx Loc Elevation = 25.0386176432811
 Wanted Grnd Stion Tx Loc Az Pointing error = 0.000000000000
 Wanted Grnd Stion Tx Loc El Pointing error = 0.000000000000
 Wanted Grnd Stion Tx Max O/P Power = 5.000000000000
 Wanted Grnd Stion Tx Pattern Type = Modified CCIR
 Wanted Grnd Stion Tx Pattern Gain = 37.300000000000
 Wanted Grnd Stion Tx Pattern FieldX1 = 0.000000000000
 Wanted Grnd Stion Tx Pattern FieldX2 = 0.950000000000
 Wanted Grnd Stion Tx Pattern FieldA1 = 37.300000000000
 Wanted Grnd Stion Tx Pattern FieldB1 = 0.000000000000
 Wanted Grnd Stion Tx Pattern FieldA2 = 34.000000000000
 Wanted Grnd Stion Tx Pattern FieldB2 = 25.000000000000
 Wanted Grnd Stion Tx File name user for defined pattern = untitled file name

Wanted Grnd Stion Rx Loc Azimuth = 228.827402357817
 Wanted Grnd Stion Rx Loc Elevation = 25.0386176432811
 Wanted Grnd Stion Rx Az Pointing error = 0.000000000000
 Wanted Grnd Stion Rx El Pointing error = 0.000000000000
 Wanted Grnd Stion Rx G/Ts = 13.000000000000
 Wanted Grnd Stion Rx Pattern Type = Modified CCIR
 Wanted Grnd Stion Rx Pattern Gain = 33.700000000000
 Wanted Grnd Stion Rx Pattern FieldX1 = 0.000000000000
 Wanted Grnd Stion Rx Pattern FieldX2 = 1.780000000000
 Wanted Grnd Stion Rx Pattern FieldA1 = 33.700000000000
 Wanted Grnd Stion Rx Pattern FieldB1 = 0.000000000000
 Wanted Grnd Stion Rx Pattern FieldA2 = 36.000000000000
 Wanted Grnd Stion Rx Pattern FieldB2 = 25.000000000000
 Wanted Grnd Stion Rx File name user for defined pattern = untitled file name

Interfering Ground Station Information

Number of interfering ground stations = 1
 Interfering ground station ident = Interf GS2-2
 Interfering ground station Loc Type = 1
 Interfering ground station Loc Azimuth = 149.996000000000
 Interfering ground station Loc Elevation = 82.327400000000
 Interfering ground station Loc Latitude = 45.000000000000
 Interfering ground station Loc Longitude = 275.000000000000
 Interfering ground station Loc Height(m) = 126000.00000000
 Interfering Grnd Stion Tx Loc Azimuth = 224.744209195366
 Interfering Grnd Stion Tx Loc Elevation = 27.5587802689950
 Interfering Grnd Stion Tx Loc Az Pointing error = 0.000000000000
 Interfering Grnd Stion Tx Loc El Pointing error = 0.000000000000
 Interfering Grnd Stion TxMax O/P Power = 5.000000000000
 Interfering Grnd Stion Tx Pattern Type = Modified CCIR
 Interfering Grnd Stion Tx Pattern Gain = 37.300000000000
 Interfering Grnd Stion Tx Pattern X1or3dBw = 0.000000000000
 Interfering Grnd Stion Tx Pattern FieldX2 = 0.950000000000
 Interfering Grnd Stion Tx Pattern FieldA1 = 37.300000000000
 Interfering Grnd Stion Tx Pattern FieldB1 = 0.000000000000
 Interfering Grnd Stion Tx Pattern FieldA2 = 36.000000000000
 Interfering Grnd Stion Tx Pattern FieldB2 = 25.000000000000
 Interfering Grnd Stion Tx File name user for defined pattern = untitled file name

Interfering Grnd Stion Rx Loc Azimuth = 224.744209195366
 Interfering Grnd Stion Rx Loc Elevation = 27.5587802689950
 Interfering Grnd Stion Rx Loc Az Pointing error = 0.000000000000
 Interfering Grnd Stion Rx Loc El Pointing error = 0.000000000000
 Interfering Grnd Stion RX G/Ts = 13.000000000000
 Interfering Grnd Stion Rx Pattern Type = FCC/CCIR
 Interfering Grnd Stion Rx Pattern Gain = 37.000000000000
 Interfering Grnd Stion Rx Pattern FieldX1 = 0.500000000000
 Interfering Grnd Stion Rx Pattern FieldX2 = 0.000000000000
 Interfering Grnd Stion Rx Pattern FieldA1 = 32.000000000000
 Interfering Grnd Stion Rx Pattern FieldB1 = 25.000000000000
 Interfering Grnd Stion Rx Pattern FieldA2 = 0.000000000000
 Interfering Grnd Stion Rx Pattern FieldB2 = 0.000000000000
 Interfering Grnd Stion Rx File name user for defined pattern = untitled file name

Wanted Services Information

Number of wanted services for Wanted GS 1 = 1
 Wanted service ident = 64 kbps TDMA/TDM
 Wanted uplink BER = 1.000000000000D-05
 Wanted uplink Data Bit Rate = 385.500000000000
 Wanted uplink Error Correction gain = 5.500000000000

Wanted uplink Availability = 90.50000000000000
 Wanted uplink Centre Frequency = 29.70000000000000
 Wanted uplink Required Bandwidth = 540.00000000000000
 Wanted uplink C/I Required = 18.20000000000000
 Wanted uplink Miscellaneous Losses = 2.00000000000000
 Wanted uplink Modulation - Coherent or Differential = Coherent
 Wanted uplink Modulation Type = QPSK
 Wanted uplink M or Eb/No if PSK or User Defined = 0.00000000000000
 Wanted uplink Access Scheme Type = FDMA/TDMA
 Wanted uplink CDMA Spreading Factor = 0.00000000000000
 Wanted uplink CDMA Loading Factor = 0.00000000000000
 Wanted uplink FadeCountermeasures Off(1) or On(2) = 2
 Wanted uplink Fade On Threshold = 1.00000000000000
 Wanted uplink Fade On Max Gain = 3.00000000000000

Wanted downlink BER = 1.00000000000000D-05
 Wanted downlink Data Bit Rate = 2560.000000000000
 Wanted downlink Error Correction gain = 5.50000000000000
 Wanted downlink Availability = 99.50000000000000
 Wanted downlink Centre Frequency = 19.70000000000000
 Wanted downlink Required Bandwidth = 3584.000000000000
 Wanted downlink C/I Required = 18.20000000000000
 Wanted downlink Miscellaneous Losses = 2.00000000000000
 Wanted downlink Modulation - Coherent or Differential = Coherent
 Wanted downlink Modulation Type = QPSK
 Wanted downlink M or Eb/No if PSK or User Defined = 0.00000000000000
 Wanted downlink Access Scheme Type = FDMA/TDMA
 Wanted downlink CDMA Spreading Factor = 0.00000000000000
 Wanted downlink CDMA Loading Factor = 0.00000000000000
 Wanted downlink FadeCountermeasures Off(1) or On(0) = 1
 Wanted downlink Fade On Threshold = 0.00000000000000
 Wanted downlink Fade On Max Gain = 0.00000000000000

Interfering Services Information

Number of interfering services for Wanted GS 1 = 1
 Wanted service ident = 64 kbps TDMA/TDM
 Interfering uplink BER = 1.00000000000000D-05
 Interfering uplink Data Bit Rate = 385.500000000000
 Interfering uplink Error Correction gain = 5.50000000000000
 Interfering uplink Availability = 90.50000000000000
 Interfering uplink Centre Frequency = 29.70000000000000
 Interfering uplink Required Bandwidth = 540.00000000000000
 Interfering uplink C/I Required = 18.20000000000000
 Interfering uplink Miscellaneous Losses = 2.00000000000000
 Interfering uplink Modulation - Coherent or Differential = Coherent
 Interfering uplink Modulation Type = QPSK
 Interfering uplink M or Eb/No if PSK or User Defined = 0.00000000000000
 Interfering uplink Access Scheme Type = FDMA/TDMA
 Interfering uplink CDMA Spreading Factor = 0.00000000000000
 Interfering uplink CDMA Loading Factor = 0.00000000000000
 Interfering uplink FadeCountermeasures Off(1) or On(2) = 2
 Interfering uplink Fade On Threshold = 1.00000000000000
 Interfering uplink Fade On Max Gain = 3.00000000000000

Interfering downlink BER = 1.00000000000000D-05
 Interfering downlink Data Bit Rate = 2560.000000000000
 Interfering downlink Error Correction gain = 5.50000000000000
 Interfering downlink Availability = 99.50000000000000
 Interfering downlink Centre Frequency = 19.70000000000000
 Interfering downlink Required Bandwidth = 3584.000000000000
 Interfering downlink C/I Required = 18.20000000000000
 Interfering downlink Miscellaneous Losses = 2.00000000000000
 Interfering downlink Modulation - Coherent or Differential = Coherent
 Interfering downlink Modulation Type = QPSK
 Interfering downlink M or Eb/No if PSK or User Defined = 0.00000000000000
 Interfering downlink Access Scheme Type = FDMA/TDMA
 Interfering downlink CDMA Spreading Factor = 0.00000000000000
 Interfering downlink CDMA Loading Factor = 0.00000000000000
 Interfering downlink FadeCountermeasures Off(1) or On(2) = 1
 Interfering downlink Fade On Threshold = 0.00000000000000
 Interfering downlink Fade On Max Gain = 0.00000000000000

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