Project	**IEEE 802.16 Broadband Wireless Access Working Group**
Title	**Adjacent Frequency Block TDD/FDD Coexistence Scenarios for BWA**
Date Submitted	**1999-01-17**
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Re:	This document is a formal submission of the presentation made to the 802.16.2 Coexistence Task Group at Meeting #5; held Jan. 10-14, 2000 in Richardson Texas. This document is in response to the Call For Contributions on Interference Scenarios dated Dec. 17, 1999
Abstract	Same area-adjacent frequency block system coordination will be a requirement for coexistence of BWA systems. Adjacent carrier interference mitigation may require frequency guard bands, polarization discrimination and substitution of sector frequency assignments. This report examines one example of the coordination issues that need to be considered. A TDD system is selected as the interference source and an FDD system is specified to be the victim. Interference simulation estimates indicate that the reserve carrier assignments that can be made available with some TDD frequency re-use plans are very effective as a coexistence resolution technique.
Purpose	This document is submitted for both information and discussion purposes. It identifies interference scenarios that can be included within the coexistence practice document.
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Release	The contributor acknowledges and accepts that this contribution may be made public by 802.16.
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ADJACENT FREQUENCY BLOCK TDD/FDD COEXISTENCE FOR BWA

ASSUMPTIONS

- **2 BWA OPERATORS IN THE SAME AREA**
- **ADJACENT FREQUENCY BLOCK OPERATION**
- **1 CXR. GUARD BAND B BETWEEN OPERATORS**
- **OPERATOR 1:**

  TDD @ 30 DEGREE SECTORS
  N=9 FREQUENCY RE-USE
  6 PAIRED CARRIERS

- **OPERATOR 2:**

  FDD @ 90 DEGREE SECTORS
  ARBITRARY RE-USE PLAN
  ARBITRARY # OF CARRIERS

TDD FREQUENCY RE-USE

- **6 PAIRED CARRIERS**
- **2 POLARIZATIONS H/V**
- **24 FREQ/POL ASSIGNMENTS**
- **FREQUENCY REPEAT @ 180 DEGREES**
- **6 SECTOR ASSIGNMENTS PER CELL**
- **4 DISTINCT CELL TYPES (CT)**
- **3 CELL TYPES REQUIRED FOR AN N=9 CLUSTER**
- **6 RESERVE FREQ/POL ASSIGNMENTS**

INTERFERENCE SCENARIO

- **WORST CASE HUB TO HUB**
- **DYNAMIC ASYMMETRIC TDD OPERATION**
- **FDD VICTIM**
- **MINIMUM SEPARATION OF CXRS F and a (2B)**
- **ARBITRARY RELATIVE HUB LOCATIONS**
- **ASSUME CT 2 LOCATED IN SECTOR Ha**
- **SUBSTITUTE HF WITH RESERVE FREQ HQ**

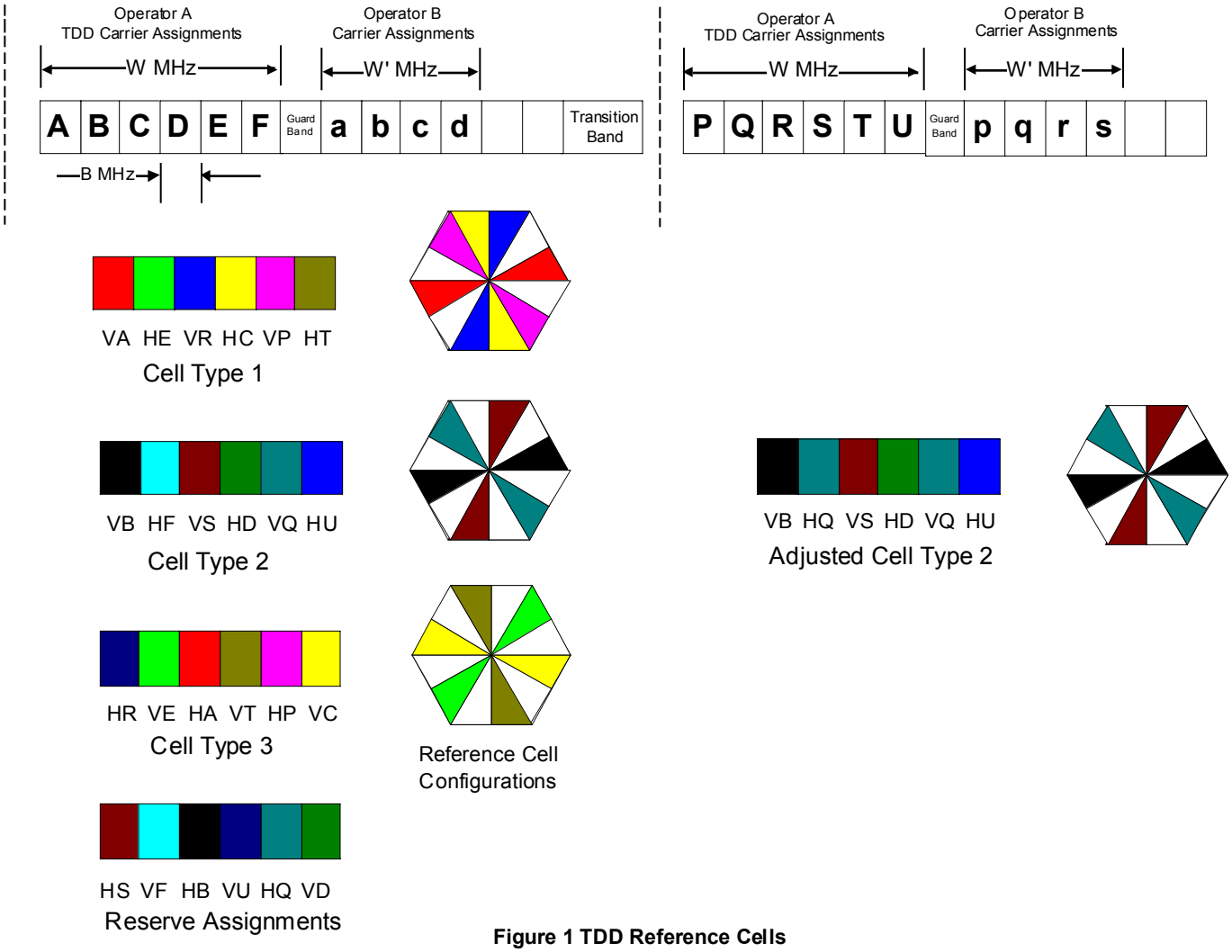

Figure 1 TDD Reference Cells

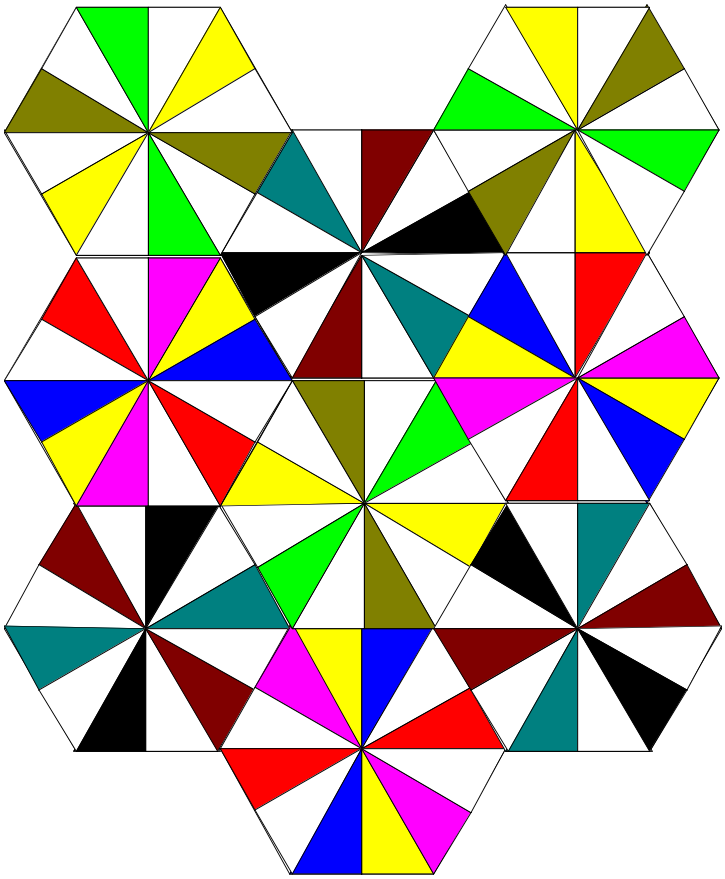

Figure 2 Adjusted TDD Cell Cluster for N=9

INTERFERENCE COMPUTATION

- **LOCATE TDD INTERFERENCE CELL IN Ha SECTOR**

- **POSITION AT SEPARATION DISTANCE S**
- **ASSUME RANDOM SECTOR ALIGNMENT**
- **SEQUENTIALLY ROTATE TDD CELL IN 1 DEGREE STEPS**
- **COMPUTE INTERFERENCE FROM EACH SECTOR INTO Ha BASED ON:**

  -LOS DISTANCE S
  -ANGULAR ANTENNA DISCRIMINATION
  -XPD
  -ADJACENT CARRIER EMISSION LEVELS
  -VICTIM INBOUND POWER CONTROL PC
  -MAXIMUM VICTIM LINK DISTANCE R

- **COMPUTE C/I FOR EACH ROTATION**
- **SORT AND COMPUTE GOS**

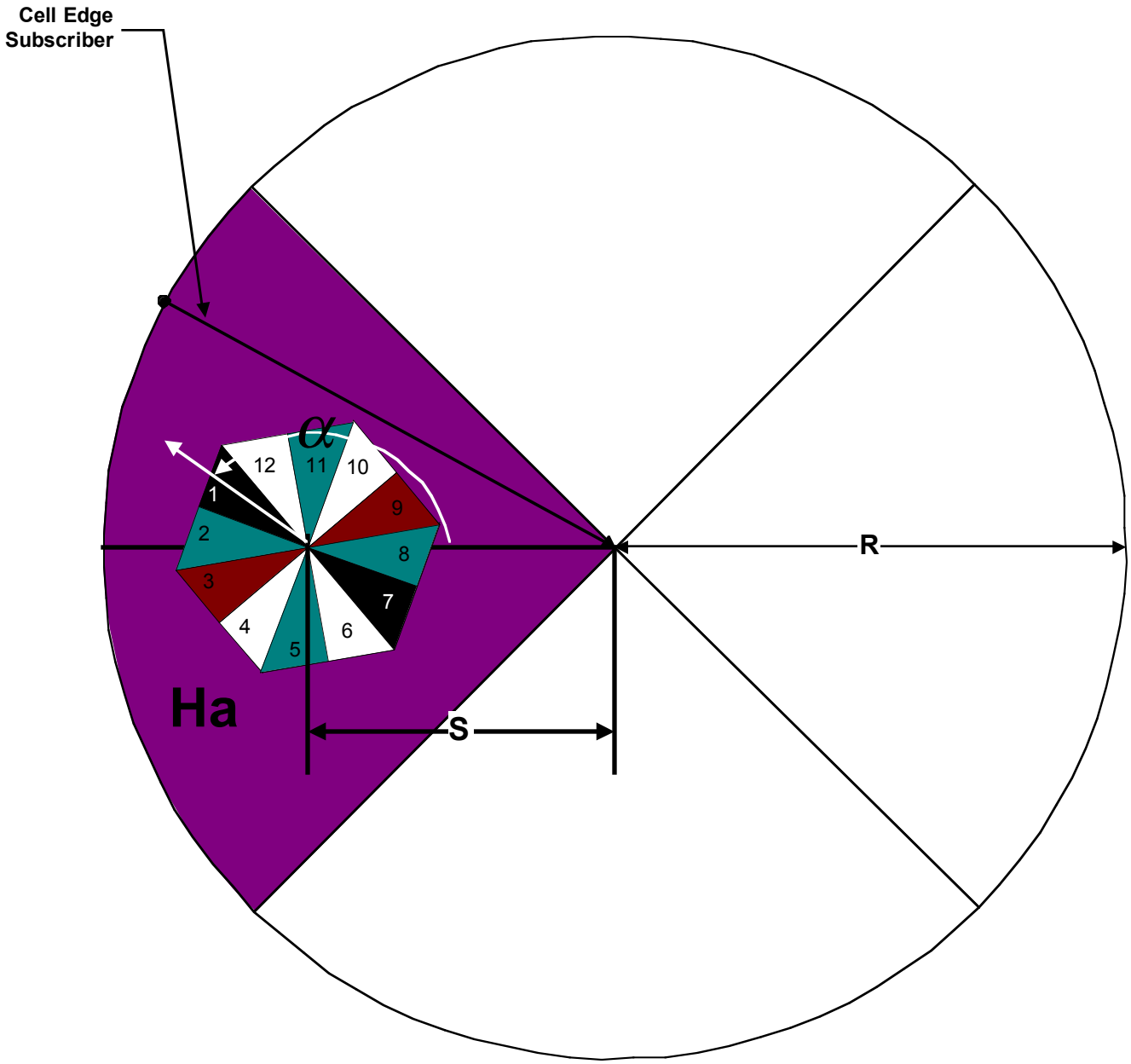

Figure 3 Interference Configuration for Clear Sky

COMPUTATION PARAMETERS

FREQUENCY: 26 GHz

CELL RADIUS R: 3km

TDD/FDD TX POWER: SAME

TDD HUB ANT. GAIN: +20 dBi

TDD HUB ANT. PATTERN: ETSI EN 301 215-2

TDD EMISSIONS MASK: FIGURE 4

FDD HUB ANT. GAIN: +19 dBi

FDD REMOTE ANT. GAIN: +34 dBi

FDD REMOTE PC: <=15 dB

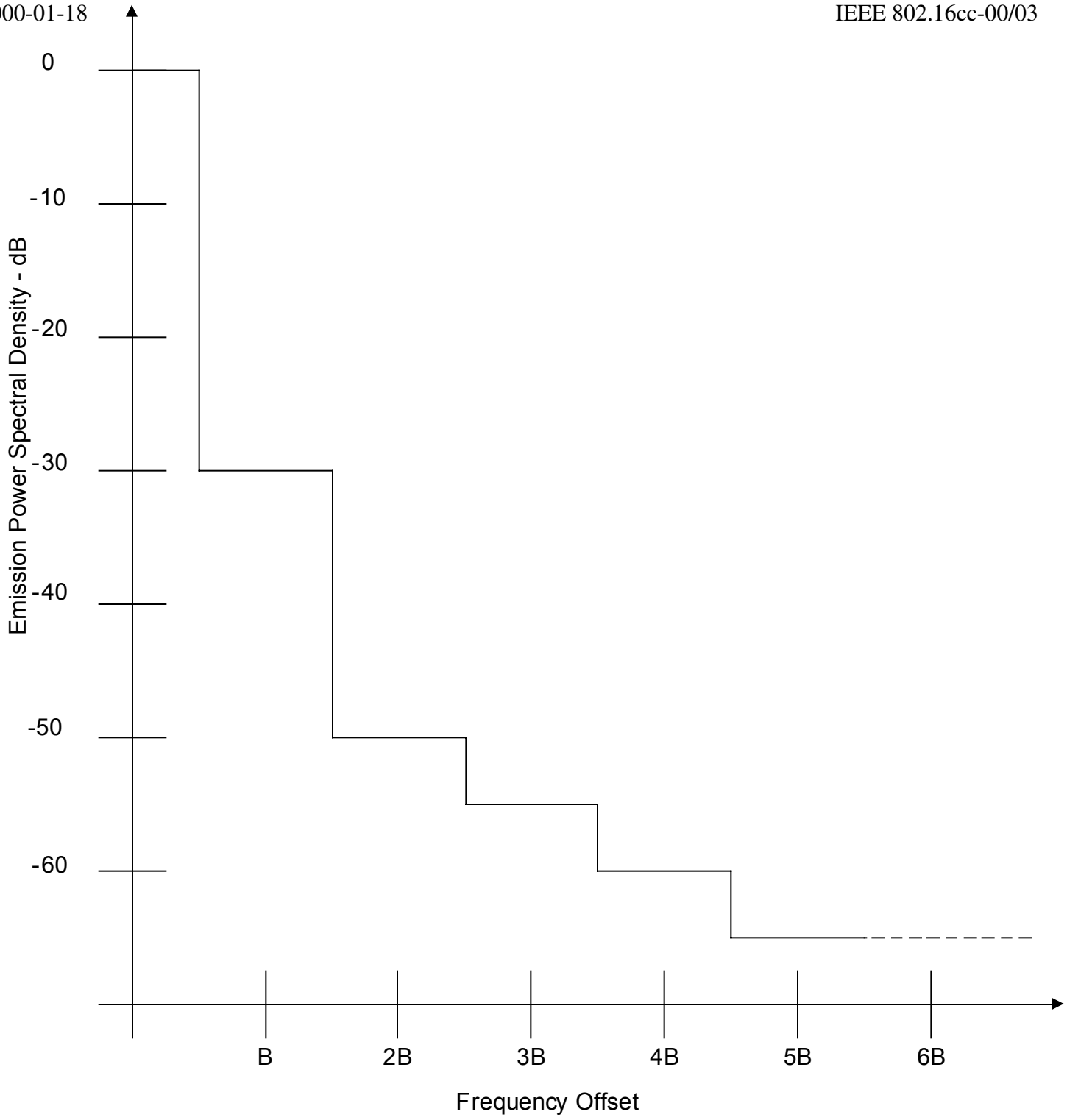

Figure 4 TDD Emission Power Spectral Density vs Frequency Offset

COMPUTATION RESULTS

- **C/I >23 dB @ S = 50 m**
- **C/I> 29 dB @ S=100 m**
- **C/I> 35 dB @ S= 200 m**
- **C/I IMPROVES LINEARLY WITH PC REDUCTION**

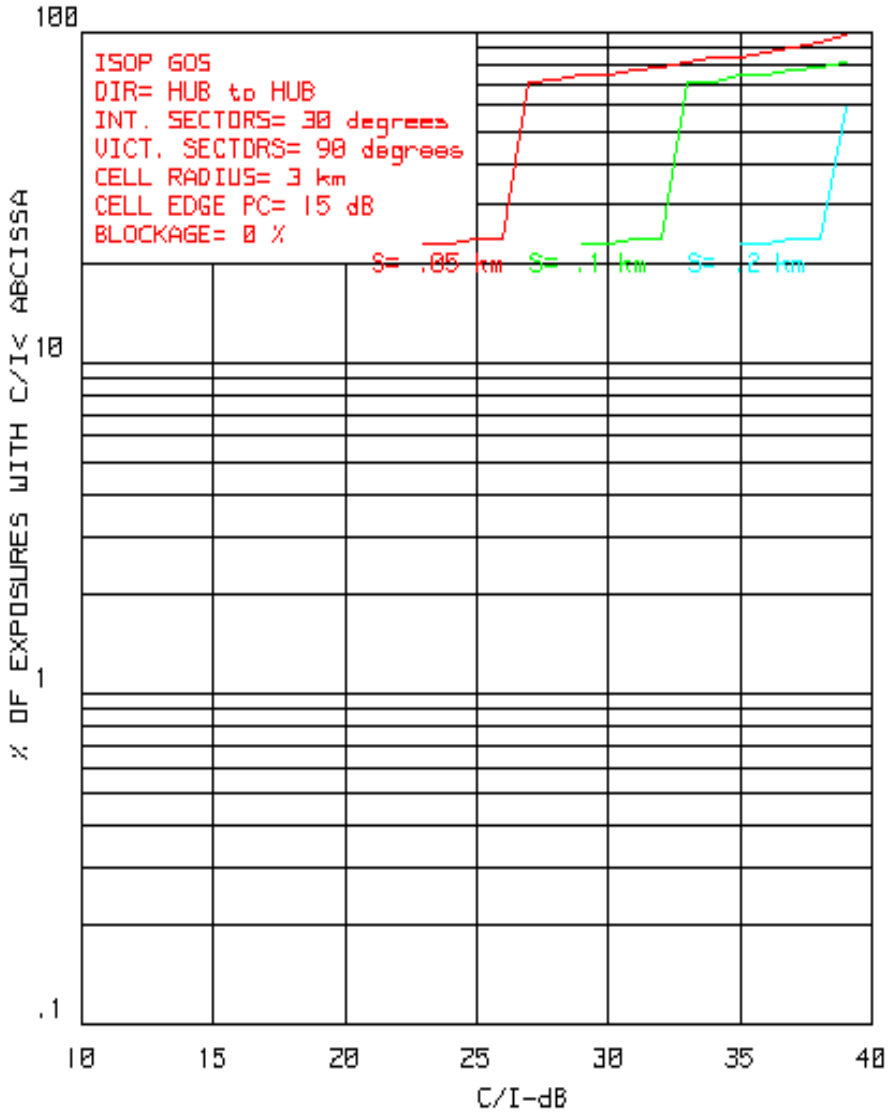

Figure 5 Interference Hub to Hub GOS vs Hub Separation Distance for PC = 15 dB

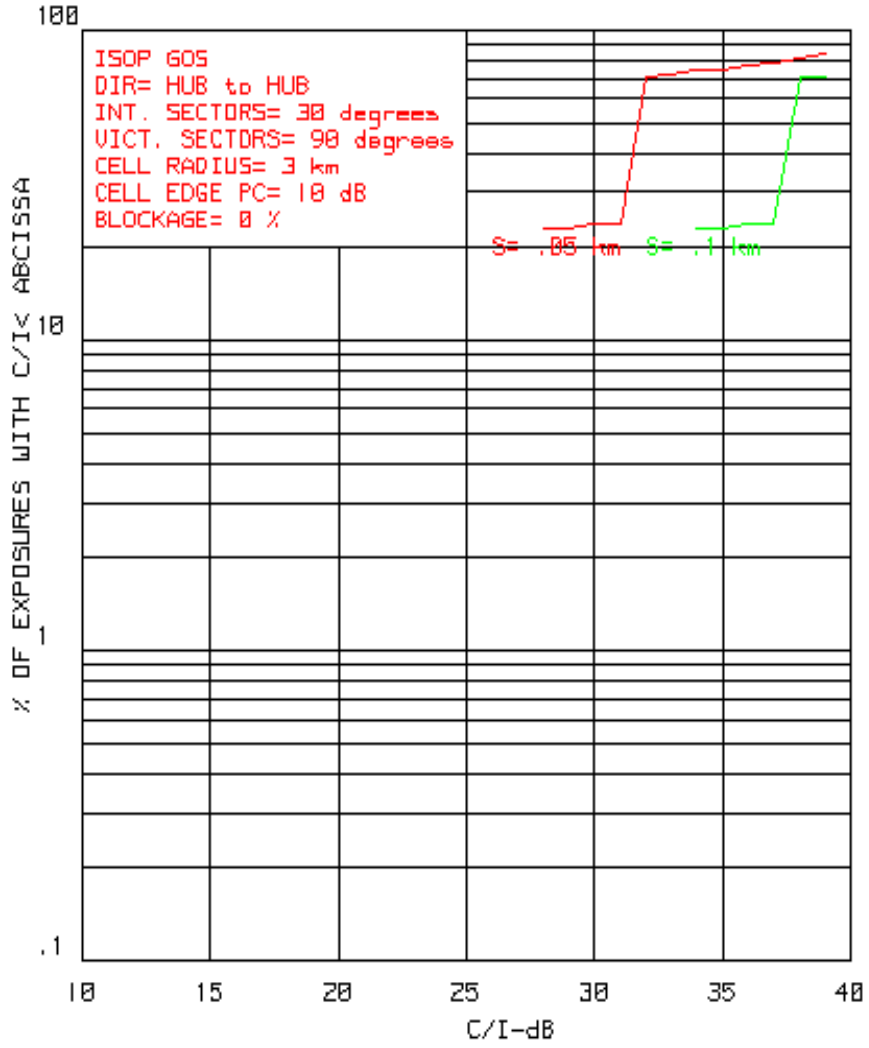

Figure 6 Interference Hub to Hub GOS vs Hub Separation Distance for PC = 10 dB

OTHER INTERFERENCE CONSIDERATIONS

HUB TO HUB

CASE DESCRIBED IS MOST LIKELY DUE THE SECTOR WIDTHS OF 2 HUB ANTENNAS.
VICTIM LINK CAN OPERATE AT REDUCED PC TO IMPROVE C/I.

REMOTE TO HUB

LESS LIKELY AS IT REQUIRES A BORESIGHT ALIGNMENT OF THE REMOTE 4 DEGREE ANT.
LINK GAIN IS BALANCED IF BOTH OPERATORS EMPLOY INBOUND PC.

HUB TO REMOTE

LESS LIKELY AS IT REQUIRES A BORESIGHT ALIGNMENT OF THE REMOTE 4 DEGREE ANT.
LINK GAIN IS BALANCED.

REMOTE TO REMOTE

VERY UNLIKELY AS IT REQUIRES A BORESIGHT ALIGNMENT OF BOTH REMOTE 4 DEGREE ANT.
LINK GAIN IS BALANCED IF THE INTERFERENCE REMOTE EMPLOYS PC.

SUMMARY

- **TDD CAN DEVELOP FLEXIBLE RE-USE PLANS AS EVERY PAIRED CARRIER FREQUENCY CAN BE EMPLOYED**
- **A TDD N=9 FREQUENCY RE-USE PLAN PLAN PROVIDES RESERVE CARRIER ASSIGNMENTS**
- **RESERVE CARRIERS CAN BE EFFECTIVELY EMPLOYED TO MINIMIZE INTERFERENCE EXPOSURE**
- **COMPUTATIONAL ANALYSIS FOR WORST CASE HUB TO HUB DEMONSTRATES CONTROLLED LEVELS OF INTERFERENCE**