Agreement

between the telecommunications administrations of
Austria, the Czech Republic, Poland, the Slovak Republic and Germany

on the frequency coordination of systems using DCS 1800 standards

in the frequency bands 1710 - 1785 MHz and 1805 - 1880 MHz

Mainz, 1 October 1995

1. Introduction

The telecommunications administrations of Austria, the Czech Republic, Poland, the Slovak Republic and Germany concluded this agreement for the purpose of the frequency coordination of systems using the DCS 1800 standards.

2. Principles Background

The administrations mentioned above deemed it necessary to conclude an agreement on the division of preferential frequencies for DCS 1800 systems in conformity with the CEPT Recommendation T/R 22-07.

Such a division of preferential frequencies could form a common basis for complementary bilateral coordination agreements in which the compatibility with the fixed service should be taken into account.

When DCS 1800 systems are operated in neighbouring countries, the Vienna Agreement of 1993 shall be applied for the coordination procedure in the frequency bands 1710 - 1785 MHz and 1805 - 1880 MHz.

In order to enable each administration to decide on its own in which subbands DCS 1800 may be introduced and to decide on the number of operators the entire band was taken into account.

The entire band is divided into a number of subbands in which equal access to the spectrum is ensured for each administration. This enables each administration, if appropriate, to provide for equal coordination conditions for each DCS 1800 operator.

3. Coordination between DCS 1800 systems and technical provisions

3.1 The division into preferential frequencies can be found in Annex 1.

3.2 Preferential frequencies may produce a field strength not exceeding 25 dBµV/m at 3 m above ground at a distance of 15 km in the neighbouring country.

3.3 Non-preferential frequencies may produce a field strength not exceeding 25 dBµV/m at 3 m above ground at the border to the neighbouring country.

3.4 The coordination procedures laid down in the Vienna Agreement, 1993, shall be applied.

3.5 Propagation criteria for the calculation of the interfering field strength are described in Annex 2.

3.6 For adding multiple interferers, the simplified algorithm described in Annex 3 shall be applied.

3.7 The technical parameters described in Annex 4 shall be used.

4. Coordination between DCS 1800 systems and fixed services:

The coordination of frequencies between DCS 1800 systems and fixed services shall be based on complementary bilateral agreements covering the entire frequency bands 1710 - 1785 MHz and 1805 - 1880 MHz. These bilateral agreements should take into account the allotment of preferential frequencies laid down in this agreement as far as possible.

5. Date of entry into force

This agreement will enter into force on a bilateral or trilateral basis concerning those parts of the frequency bands 1710 - 1785 MHz and 1805 - 1880 MHz for which all the involved administrations have informed each other of their intention to put DCS 1800 systems into operation.

As an exception, if a coordination with the fixed services is required by at least one of the involved administrations, the date of entry into force of this agreement will be subject to signing the complementary agreement.

For the administration of Austria:

For the administration of the Czech Republic:

For the administration of Poland:

For the administration of the Slovak Republic:

For the administration of Germany: Thomas Hentmann

The original text of this agreement written in English language is retained by the German Administration.

Annex 1

Preferential division of the frequency band
1710 - 1785 / 1805 - 1880 MHz for DCS 1800

18_PRE25.DOC

01.10.95

frequency band	1725 (1820) - 1740 (1835) MHz											
channel number	587 - 593	594 - 599	600 - 605	606 - 611	612 - 618	619 - 624	625 - 630	631 - 636	637 - 643	644 - 649	650 - 655	656 - 661
no of channels	7	6	6	6	7	6	6	6	7	6	6	6
AUT/D/CZE	CZE	AUT	AUT	AUT 615	616 D		D	CZE	CZE	CZE	CZE	CZE
AUT/CZE	CZE	AUT	AUT	AUT	AUT	618 CZE	CZE	CZE	CZE	CZE	CZE	CZE
D/CZE	CZE	CZE	D	D	D	D	D	D	CZE	CZE	CZE	CZE
D/CZE/POL	POL	POL	POL	POL	D	D	D	D	CZE	CZE	CZE	CZE
CZE/POL	POL	POL	POL	POL	POL	POL	CZE	CZE	CZE	CZE	CZE	CZE
D/POL	POL	POL	POL	POL	D	D	D	D	D	D	POL	POL
AUT/CZE/SVK	CZE	AUT	AUT	AUT 615	616 SVK		SVK	CZE	CZE	CZE	CZE	CZE
AUT/SVK	AUT	AUT	AUT	AUT	SVK	SVK	SVK	SVK	SVK	SVK	SVK	SVK
AUT/SVK/HNG	HNG	AUT	AUT	AUT 615	616 SVK		SVK	HNG	HNG	HNG	HNG	HNG
CZE/POL/SVK	POL	POL	POL	POL	SVK	SVK	SVK	SVK	CZE	CZE	CZE	CZE
CZE/SVK	CZE	CZE	599 SVK	SVK	SVK	SVK	SVK	SVK	CZE	CZE	CZE	CZE
POL/SVK	POL	POL	POL	POL	SVK	SVK	SVK	SVK	SVK	SVK	649 POL	POL

Annex 1

Preferential division of the frequency band
1710 - 1785 / 1805 - 1880 MHz for DCS 1800

18_PRE25.DOC

01.10.95

frequency band	1710 (1805) - 1725 (1820) MHz											
channel number	512 - 518	519 - 524	525 - 530	531 - 536	537 - 543	544 - 549	550 - 555	556 - 561	562 - 568	569 - 574	575 - 580	581 - 586
no of channels	7	6	6	6	7	6	6	6	7	6	6	6
AUT/D/CZE	AUT	AUT	AUT	D	D	D	D 556	CZE	CZE	CZE	CZE	CZE
AUT/CZE	AUT	AUT	AUT	AUT	AUT	AUT	CZE	CZE	CZE	CZE	CZE	CZE
D/CZE	CZE	CZE	D	D	D	D	D	D	CZE	CZE	CZE	CZE
D/CZE/POL	POL	POL	POL	POL	D	D	D	D	CZE	CZE	CZE	CZE
CZE/POL	POL	POL	POL	POL	POL	POL	CZE	CZE	CZE	CZE	CZE	CZE
D/POL	POL	POL	POL	POL	D	D	D	D	D	D	POL	POL
AUT/CZE/SVK	AUT	AUT	AUT	SVK	SVK	SVK	SVK 556	CZE	CZE	CZE	CZE	CZE
AUT/SVK	AUT	AUT	AUT	AUT	SVK	SVK	SVK	SVK	SVK	SVK	AUT	AUT
AUT/SVK/HNG	AUT	AUT	AUT	SVK	SVK	SVK	SVK 556	HNG	HNG	HNG	HNG	HNG
CZE/POL/SVK	POL	POL	POL	POL	SVK	SVK	SVK	SVK	CZE	CZE	CZE	CZE
CZE/SVK	CZE	CZE	SVK	SVK	SVK	SVK	SVK	SVK	CZE	CZE	CZE	CZE
POL/SVK	POL	POL	POL	POL	SVK	SVK	SVK	SVK	SVK	SVK	POL	POL

The numbering of the channels is defined in Recommendation GSM 05.05 (Version 4.5.0). Channel number n corresponds to a carrier frequency Fl(n) in the lower band and to a carrier frequency Fu(n) in the upper band, defined by the following equations (frequencies are in MHz):

$$Fl(n) = 1710{,}2 + 0{,}2 * (n-512)$$
$$Fu(n) = Fl(n) + 95$$

Annex 1

Preferential division of the frequency band
1710 - 1785 / 1805 - 1880 MHz for DCS 1800

18_PRE25.DOC

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frequency band	1740 (1835) - 1755 (1850) MHz											
channel number	662 - 668	669 - 674	675 - 680	681 - 686	687 - 693	694 - 699	700 - 705	706 - 711	712 - 718	719 - 724	725 - 730	731 - 736
no of channels	7	6	6	6	7	6	6	6	7	6	6	6
AUT/D/CZE	AUT	AUT	AUT	D	D	D	D	D	CZE	CZE 728		729 AUT
AUT/CZE	AUT	AUT	AUT	AUT	AUT	AUT	CZE	CZE	CZE	CZE	CZE	CZE
D/CZE	CZE	CZE	D	D	D	D	D	D	CZE	CZE	CZE	CZE
D/CZE/POL	POL	POL	POL	POL	D	D	D	D	CZE	CZE	CZE	CZE
CZE/POL	POL	POL	POL	POL	POL	POL	CZE	CZE	CZE	CZE	CZE	CZE
D/POL	POL	POL	POL	POL	D	D	D	D	D	D	POL	POL
AUT/CZE/SVK	AUT	AUT	AUT	SVK	SVK	SVK	SVK	SVK	CZE	CZE 728		729 AUT
AUT/SVK	AUT	AUT	AUT	AUT	SVK	SVK	SVK	SVK	SVK	SVK	AUT	AUT
AUT/SVK/HNG	AUT	AUT	AUT	SVK	SVK	SVK	SVK	SVK	HNG	HNG 728		729 AUT
CZE/POL/SVK	POL	POL	POL	POL	SVK	SVK	SVK	SVK	CZE	CZE	CZE	CZE
CZE/SVK	CZE	CZE	SVK	SVK	SVK	SVK	SVK	SVK	CZE	CZE	CZE	CZE
POL/SVK	POL	POL	POL	POL	SVK	SVK	SVK	SVK	SVK	SVK	POL	POL

Annex 1

Preferential division of the frequency band
1710 - 1785 / 1805 - 1880 MHz for DCS 1800

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frequency band	1755 (1850) - 1770 (1865) MHz											
channel number	737 - 743	744 - 749	750 - 755	756 - 761	762 - 768	769 - 774	775 - 780	781 - 786	787 - 793	794 - 799	800 - 805	806 - 811
no of channels	7	6	6	6	7	6	6	6	7	6	6	6
AUT/D/CZE	AUT	AUT	750 D	D	D	D	D	D	CZE	CZE	CZE	805 AUT
AUT/CZE	AUT	AUT	AUT	AUT	AUT	AUT	AUT	CZE	CZE	CZE	CZE	CZE
D/CZE	CZE	CZE	D	D	D	D	D	D	CZE	CZE	CZE	CZE
D/CZE/POL	POL	POL	POL	POL	D	D	D	D	CZE	CZE	CZE	CZE
CZE/POL	POL	POL	POL	POL	POL	POL	CZE	CZE	CZE	CZE	CZE	CZE
D/POL	POL	POL	POL	POL	D	D	D	D	D	D	POL	POL
AUT/CZE/SVK	AUT	AUT	750 SVK	SVK	SVK	SVK	SVK	SVK	CZE	CZE	CZE	805 AUT
AUT/SVK	AUT	AUT	AUT	AUT	SVK	SVK	SVK	SVK	SVK	SVK	AUT	AUT
AUT/SVK/HNG	AUT	AUT	750 SVK	SVK	SVK	SVK	SVK	SVK	HNG	HNG	HNG	805 AUT
CZE/POL/SVK	POL	POL	POL	POL	SVK	SVK	SVK	SVK	CZE	CZE	CZE	CZE
CZE/SVK	CZE	CZE	749 SVK	SVK	SVK	SVK	SVK	SVK	CZE	CZE	CZE	CZE
POL/SVK	POL	POL	POL	POL	SVK	SVK	SVK	SVK	SVK	SVK	799 POL	POL

Annex 1

Preferential division of the frequency band
1710 - 1785 / 1805 - 1880 MHz for DCS 1800

18_PRE25.DOC

01.10.95

frequency band	1770 (1865) - 1785 (1880) MHz											
channel number	812 - 818	819 - 824	825 - 830	831 - 836	837 - 843	844 - 849	850 - 855	856 - 861	862 - 867	868 - 873	874 - 879	880 - 885
no of channels	7	6	6	6	7	6	6	6	6	6	6	6
AUT/D/CZE	AUT	AUT	AUT	AUT	AUT 845	D	D	D	CZE	CZE	CZE	CZE
AUT/CZE I CZE	813 AUT	AUT	AUT	AUT	AUT	AUT	AUT	CZE	CZE	CZE	CZE	CZE
D/CZE	CZE	CZE	D	D	D	D	D	D	CZE	CZE	CZE	CZE
D/CZE/POL	POL	POL	POL	POL	D	D	D	D	CZE	CZE	CZE	CZE
CZE/POL	POL	POL	POL	POL	POL	POL	CZE	CZE	CZE	CZE	CZE	CZE
D/POL	POL	POL	POL	POL	D	D	D	D	D	D	POL	POL
AUT/CZE/SVK	AUT	AUT	AUT	AUT	AUT 845	SVK	SVK	SVK	CZE	CZE	CZE	CZE
AUT/SVK	AUT	AUT	AUT	AUT	SVK	SVK	SVK	SVK	AUT	AUT	AUT	AUT
AUT/SVK/HNG	AUT	AUT	AUT	AUT	AUT 845	SVK	SVK	SVK	HNG	HNG	HNG	HNG
CZE/POL/SVK	POL	POL	POL	POL	SVK	SVK	SVK	SVK	CZE	CZE	CZE	CZE
CZE/SVK	CZE	CZE	SVK	SVK	SVK	SVK	SVK	SVK	CZE	CZE	CZE	CZE
POL/SVK	POL	POL	POL	POL	SVK	SVK	SVK	SVK	SVK	SVK	POL	POL

Propagation criteria

The curves attached to this Annex should be used to determine the interfering field strength. Administrations may agree on other curves, e.g. the latest version of CCIR Report 567.

Correction factors

A general correction factor of -9 dB is used in the 1800 MHz band

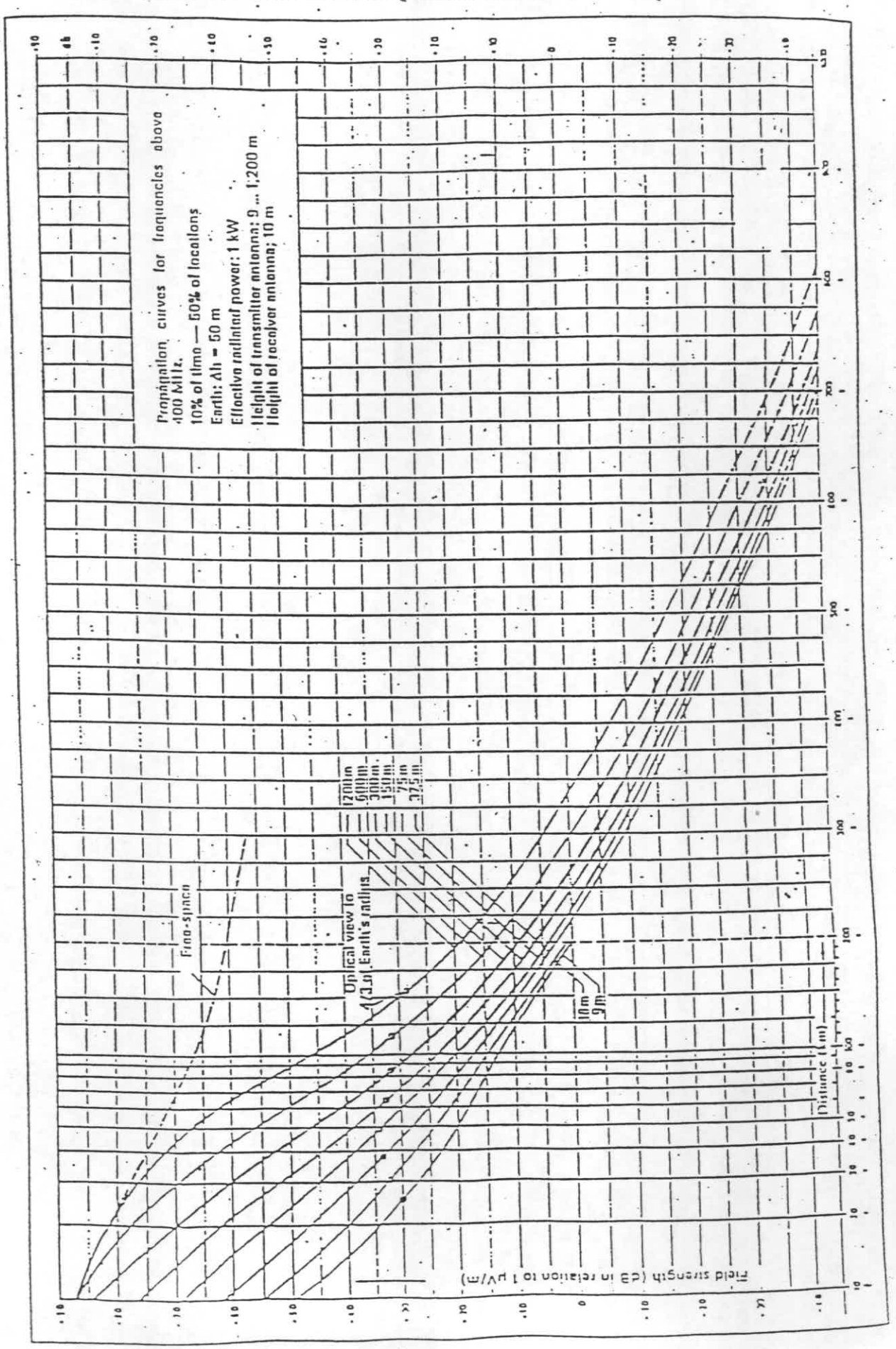
Correction factor for receiving antenna from 10 m to 3 m:
Distance < 50 km: -10 dB
Distance > 100 km: -3 dB

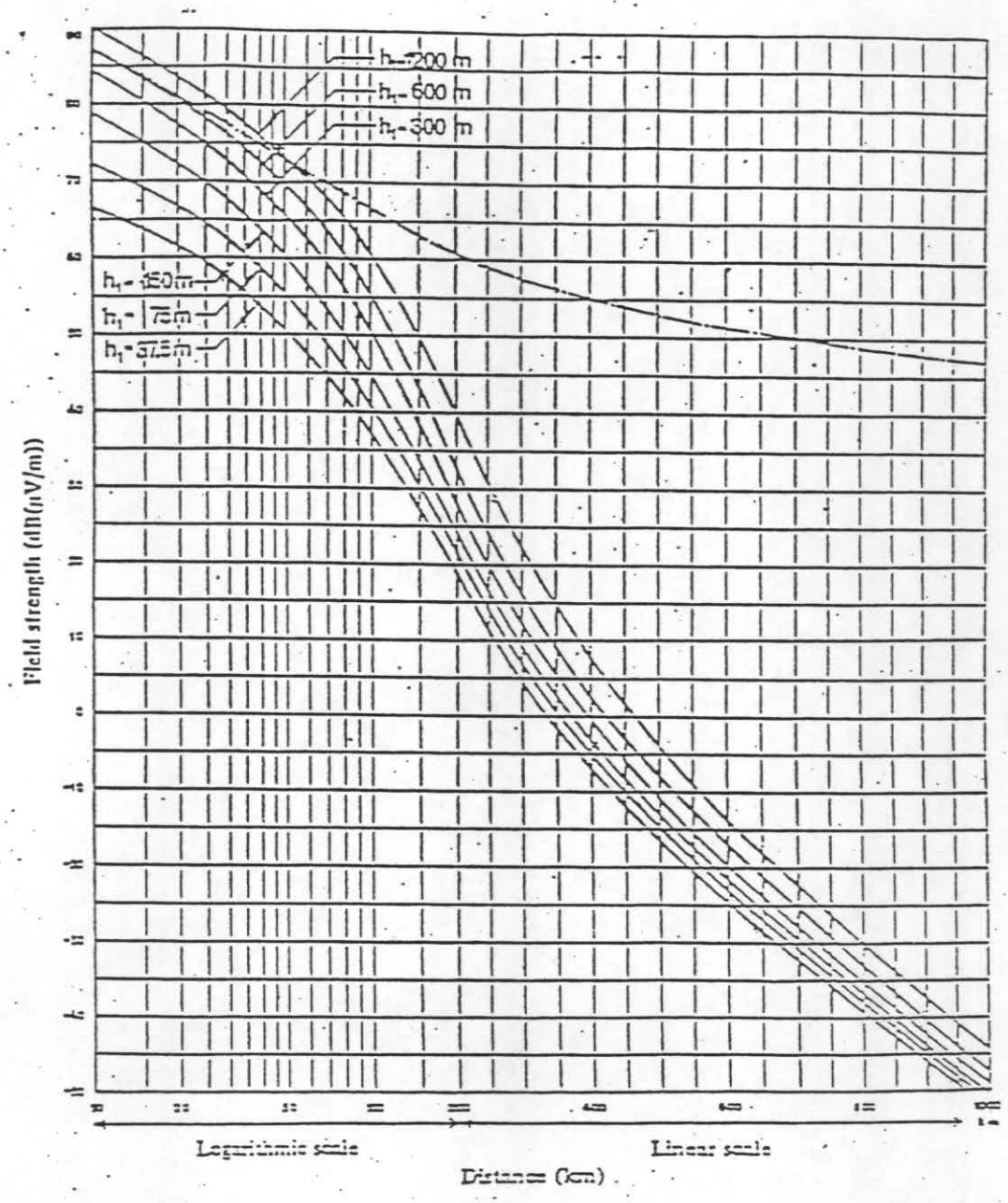
Linear interpolation is used for intermediate distances.
For sea path propagation the correction factor for receiving antenna from 10 m to 3 m is -10 dB.

Effective antenna height

The effective antenna height is the difference between the physical height of the antenna and the average height of the terrain. The average height of the terrain is the arithmetic mean of the terrain heights as measured at intervals of 1, 2, 3 ..., 14, 15 km in the direction being considered. If, beyond the 15 km limit, there are mountains which constitute major topographical obstacles, a distance of more than 15 km may be taken into account.

PROPAGATION CURVES FOR FREQUENCIES ABOVE 400 MHz





Field strength (dB (μV/m)) for 1 kW e.r.p.

Frequency: 450 to 1000 MHz (Bands IV and V) – Cold sea – 10% of the time – 50% of the locations – h_2 = 10 m

— · — Free space

Annex 3

1. Simplified algorithm for frequency co-ordination

1.1 Notation

P = e.i.r.p of wanted transmitter in direction of receiver (dBm)
L = Isotropic path loss from wanted transmitter to receiver (dB)
P_i = e.i.r.p of interfering transmitter i in direction of receiver (dBm)
L_i = Isotropic path loss from interfering transmitter i to receiver (dB)
α = Receiver antenna gain towards wanted transmitter (dBi)
α_i = Receiver antenna gain towards interfering transmitter i (dBi)
β_i = Gain due to receiver filter selectivity on interference from transmitter i (dB)
γ = Estimated shadowing margin to be allowed on C/I value (dB)
C = Total wanted carrier power at receiver input (dBm)
I_i = Effective interfering power due to transmitter i at receiver input (allowing for the effect of receiver filtering) (dBm)
I = Total effective interfering power at receiver input (allowing for shadowing margin) (dBm)
λ = C/I threshold value

1.2. Base-mobile Path Algorithm

(a) For each cell in question, take one or more "worst case" mobile station MS locations. These are locations at which the C/I is known, or believed to be, lowest.

(b) Calculate the wanted carrier power at the receiver input:
$C = P - L + \alpha$

(c) Calculate the effective interfering power due to each potentially interfering transmitter (whether co-channel or adjacent channel) at the receiver input (allowing for the effect of receiver filtering):
$I_i = P_i - L_i + \alpha_i + \beta_i$

(d) Sum the interfering powers at the receiver and allow for the shadowing margin:
$I = 10 \log_{10} \Sigma 10^{(I_i/10)} + \gamma$

(e) Check the effective C/I ratio (C-I) against the threshold value λ.

1.3. Mobile-base Path Algorithm

(a) Take each cell that has a potentially interfering mobile station (MS). If N is the number of carrier frequencies allocated to that cell that can cause potential interference to the base station (BS), assume there are N MS's, one radiating each carrier, in that cell.

A proportion of the total number of MS's so identified (e.g. 20%) should be assumed to be at the worst case locations of their cells and the rest at the mid-point of their cells.

Alternatively a "Monte Carlo" simulation can be undertaken in which a number of "snapshots" of the interference scenario are taken. In each snapshot, the interfering MS's are placed at random locations (uniformly distributed) within their cells. To find for example the 90% C/I value, 100 snapshots could be taken, and the C/I which is exceeded by 90 of the snapshots used.

(b) Perform steps (b) to (e) of the base-mobile path algorithm.

1.4. Notes on Calculation of Parameters

(a) P, P_i - These should be supplied by the public land mobile network (PLMN) operators. For DCS-1800 transmitters, each P, P_i, is the power in the active part of the time slot.

(b) L, L_i - These can either be calculated using appropriate terrain modelling, or some simplified power distance law, e.g. $d^{-3.3}$.

(c) α, α_i - These should be supplied by the PLMN operators.

(d) β_i - These can be read off Figure A3-1

(e) If shadowing effects have been allowed for in the calculation of L and L_i, γ can be set to 0. Otherwise a value of 7 dB could be used (this assumes the wanted and unwanted signals each have a 5 dB shadowing margin (log-normal distribution) and the composite shadowing margin is 1,41 x 5 dB, i.e. 7 dB).

(f) λ can be taken as follows:

DCS receiver: = 9 dB

Note: The calculation must take into account all interfering transmitters from the wanted PLMN as well those from the neighbouring PLMN's.

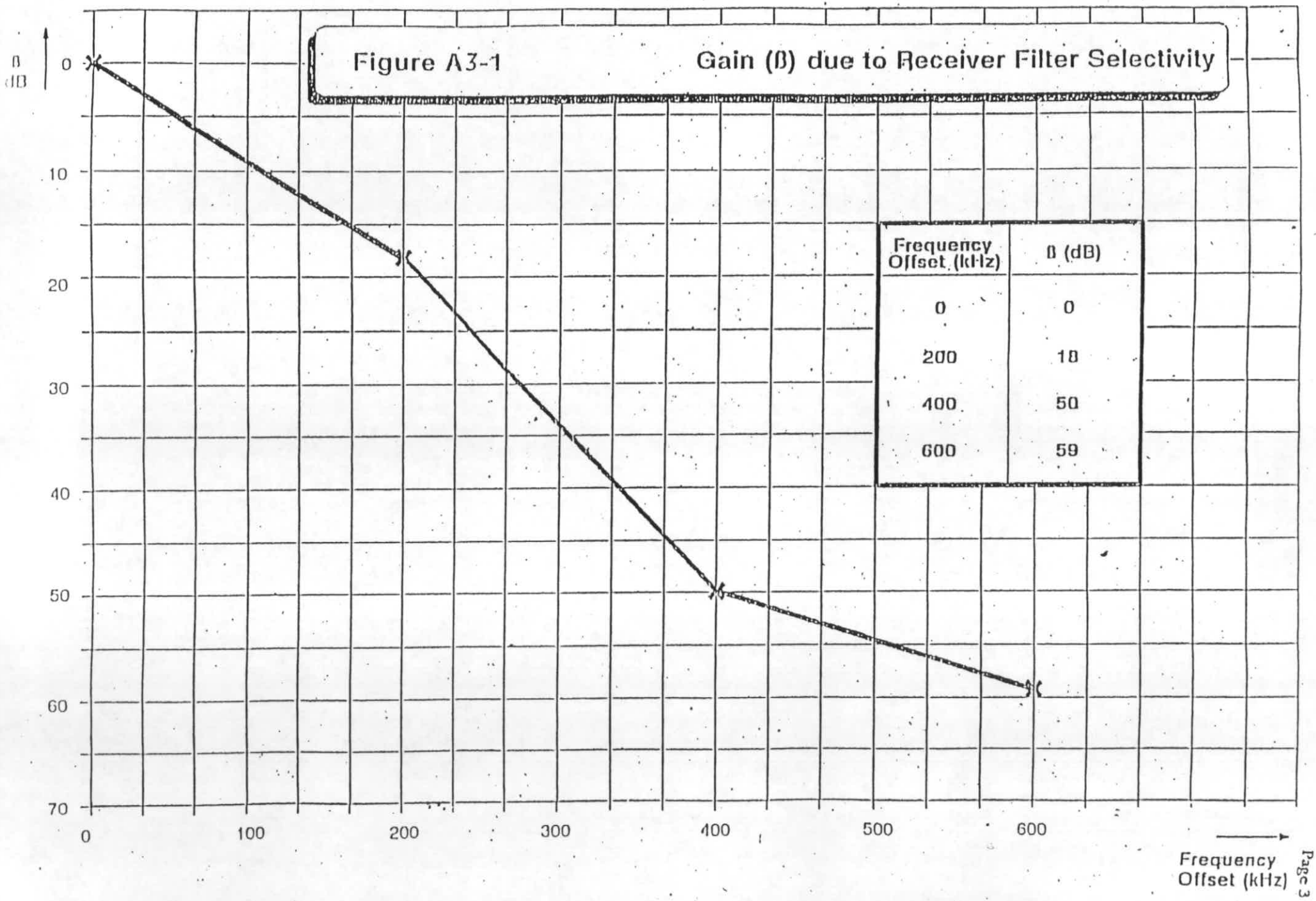


Figure A3-1
Gain (ß) due to Receiver Filter Selectivity
ß (dB)
0
10
20
30
40
50
60
70
0
100
200
300
400
500
600
Frequency Offset (kHz)
Frequency Offset (kHz)
ß (dB)
0
0
200
18
400
50
600
59

ANNEX

Annex 4

Technical parameters of the DCS-1800 system

C/I ratios

The C/I ratio is the ratio between signal power to interfering signal power at the receiver input during the active part of the DCS-1800 timeslot including multiple interferers.

The following C/I ratios apply:

Wanted	Interferer	Co-channel	200 kHz	400 kHz	600 kHz
DCS-1800 (1)	DCS-1800	9 dB	- 9 dB	- 41 dB	- 49 dB

A curve indicating C/I values for intermediate values of frequency offset are attached to this Annex. (Figure A4-1)

Notes:

Minimum field strength to be protected (E_{min}):

(50% of location - 50% of time).

DCS-1800 MS 42 dBµV/m (1)

DCS-1800 BS 38 dBµV/m (1)

(1) Values from GSM recommendation 05-05 (Version 4.3.0)

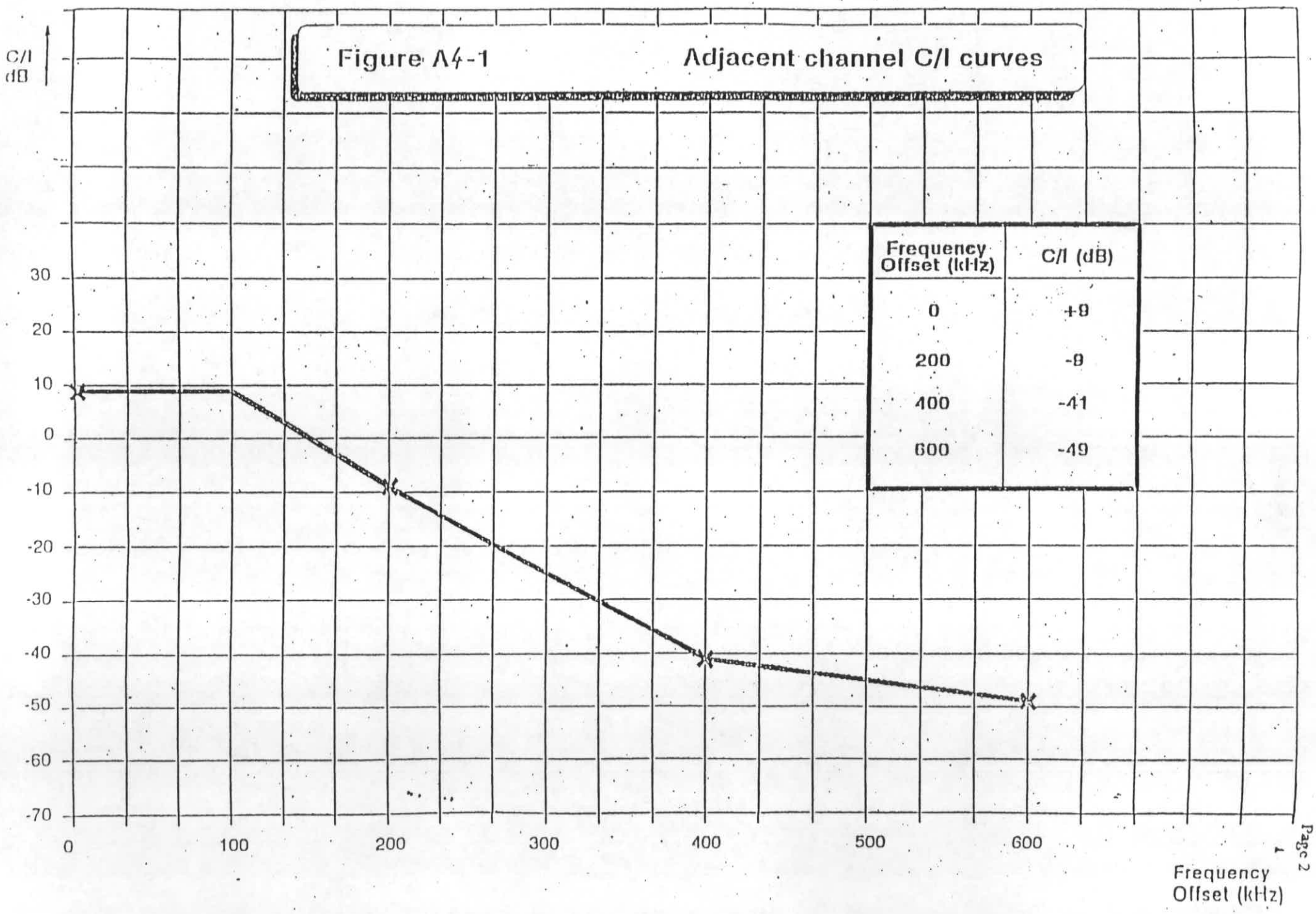


Figure A4-1 Adjacent channel C/I curves
C/I dB
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
0
100
200
300
400
500
600
Frequency Offset (kHz)
Frequency Offset (kHz) | C/I (dB)
0 | +9
200 | -9
400 | -41
600 | -49

ANNEX