

(ITU- R)

:

:

11 가 . 2000

가 가

가

(S_q)

3 K .

가

1278 km/s

K
Kakioka

2000

SUMMARY

High density point-to-multipoint systems operate between terrestrial stations as fixed wireless systems for the delivery of voice, video, and data services. These applications typically provide a communications path for commercial and residential communications for the last few kilometres of a distribution network as an alternative to coax, fibre, or twisted pair solutions. High density fixed service(HDFS) describes a significant level of deployment of point-to-point and/or point-to-multipoint systems within a given area. In the bands above 30 GHz, propagation conditions, availability of small, light-weight components and a high degree of frequency reuse are key factors in permitting the deployment of a large population of fixed systems. At the central station, either a directional or an omnidirectional antenna may be used, depending on the characteristics of the system and the required service area. Normally, directional antennas are used at out-stations, while repeater stations use a mixture of directional and omnidirectional antennas, as required. To minimize interference, the central station may use directional antennas facing groups of out-stations. The beamwidth should, however, be sufficiently wide to cover the required service area.

1
2
2.1
2.2
3	(HDFS)
3.1	HDFS
3.2	30GHz HDFS
3.3	30GHz HDFS
3.4	30GHz HDFS
3.5
4	HDFS
4.1
4.2
4.3
5

2

2.1

가

FDMA

TDMA

가

TDMA

가

n

TDMA

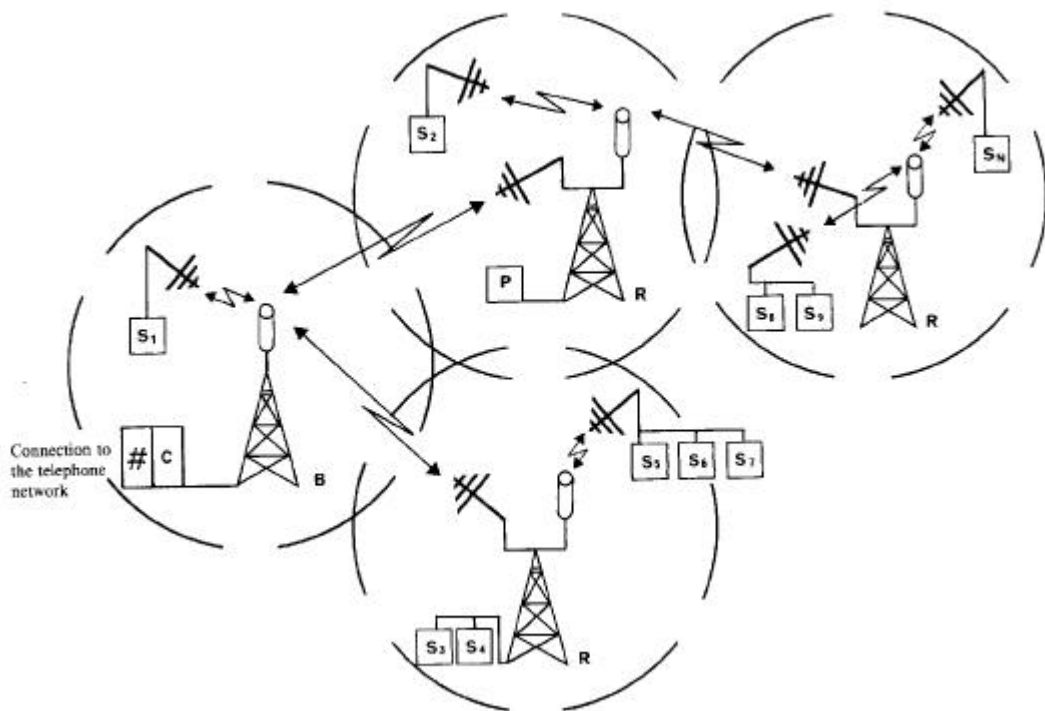
가

1

가

가

TDMA



< 1> 가 TDMA

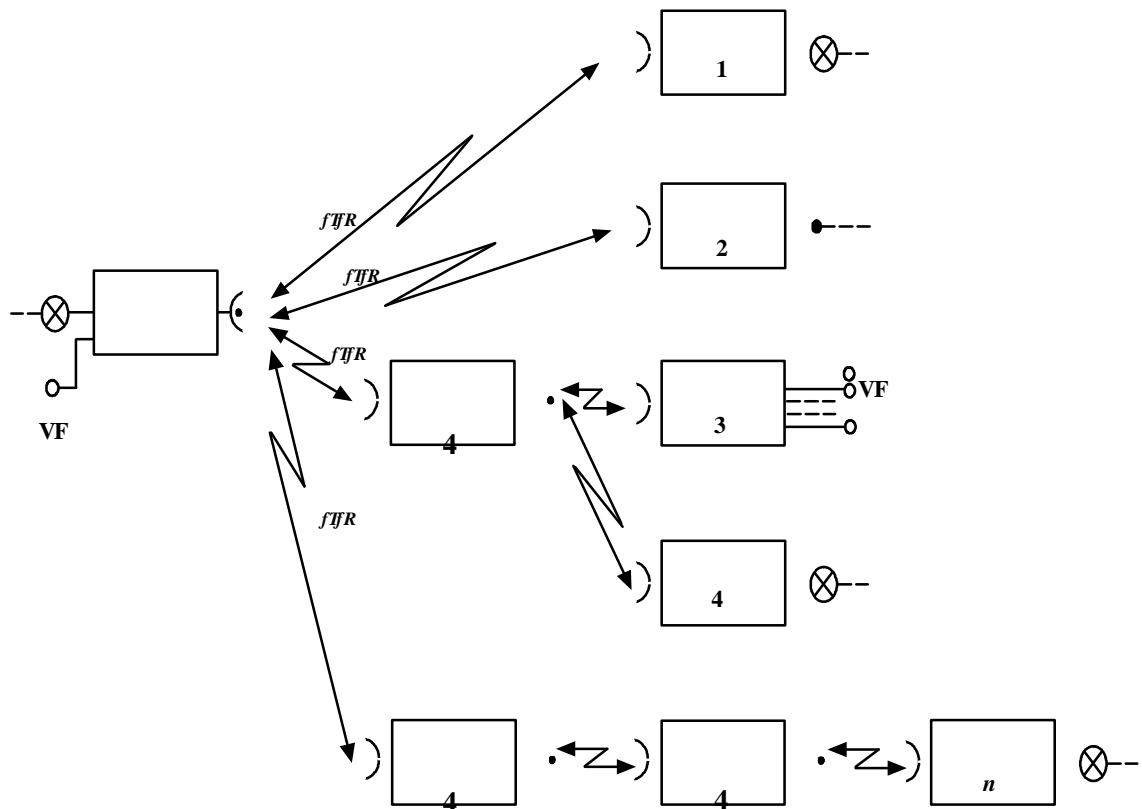
, Si 가 , R , B ,
P , C .

2.2

TDMA

TDM

2
TDMA



2. TDM

.

- . \otimes

- . \rightarrow ,

- . $($

- .

- . VF ()

- . $f_T f_R$.

.

.

.

.

.

,

가

.

가

.

3.1 HDFS

ITU-R 31.8 33.4GHz, 51.4 52.6GHz, 55.78 59GHz, 64 66GHz
HDFS , HDFS

. HDFS

. HDFS ,
66GHz , 66GHz

3.1.1 HDFS

37.5 40.5GHz HDFS HDFSS
20 44km,

3 15km .

. 30GHz HDFS

MMIC(Monolithic Microwave Integrated Circuits)

. 가
HDFS (FDD TDD) ,

3.1.2 HDFS

30GHz

. , 30GHz

가 . HDFS 310 Mbit/s

margin .

3.2.2.1 31.8 33.4GHz

31.8 33.4GHz
 , 30GHz
 .
 ,
 가 . 31.8 33.4GHz
 1,600MHz . 31.8
 33.4GHz HDFS
 ITU- R F.758- 1 . Rain outage event 31.8 33.4GHz
 . 99.99 99.999%
 .
 ITU- T ITU- R . ,
 14km,
 7km 가 .

3.2.2.2 37 40GHz

37 40GHz
 ,
 . 37 40GHz
 . 37 40GHz 가
 가
 . 38GHz
 , (256QAM) n ×
 155Mbit/s .

3.2.2.3 51.4 52.6GHz, 55.78 59GHz, 64 66GHz

51.4 52.6GHz, 55.78 59GHz, 64 66GHz HDFS
51.4 52.6GHz
HDFS
, 55.78 59GHz, 64 66GHz
ITU-R F.758-1 60GHz

51.4 52.6GHz
. Rain outage event
. 55.78 59GHz
O2 99.99 99.999%
1 7km 가 51.4
52.6GHz 1km 가
60GHz

3.2.3 38GHz EIRP

38GHz EIRP 가
, 3 3,794 EIRP
2E1, 4E1, 8E1
16E1 3.5, 7,
14, 28MHz가 1MHz EIRP
가 가
38GHz 2.6 km, rain zone E K
0.3m 0.6m 가
가 , EIRP C D

1km2 3km
80km2 5km 가 가
.

3.3.2 HDFS

HDFS IS 847- 1

tool .

(1) .

$$P_r (p) = P_t + G_t + G_r - L_b (p) \quad (1)$$

,
Pr{p} : p%

Gt :

Gr :

Lb(p) : 가

HDFS 가 ,
가 .
(1)
(2) .

$$P_r (p) = \{ P_t + G_t + 10 \text{ Log } (n) \} + G_r - L_b (p) \quad (2)$$

, “n” HDFS
, { P_t + G_t + 10 Log (n) }

EIRP . HDFS 46
dBi 0.8 ° .
가 46 dBi 0.8 ° (2)

가 . 22.6 dBi
 . , 22.6 dBi (2) G_t
 (2) (3) .

$$P_r(p) = \{ -3 + 22.6 + 10 \log(1500) \} + G_r - L_b(p)$$

$$= 51.4 + G_r - L_b(p) \quad (3)$$

51.4 dB $\{ -3 + 46 + 10 \log(7) \}$ HDFS
 (boresite) EIRP 46 dBW 가 . (2) (3) 4.5 가
 HDFS P_t G_t 가
 HDFS “n” 7 . 18 가
 (2) “n” 28 가 .
 $\{ P_t + G_t + 10 \log(n) \}$ 3 5 가
 57.4 dB . 가
 1 km² 3 , 80 km²
 가 .

$10 \log(n)$
 24 dB가 . 4 EIRP
 , 24 dB
 . HDFS
 . 32GHz EIRP
 $\{ P_t + G_t + 10 \log(n) \}$ 57.4 $P_r(p)$ $L_b(p)$
 , 18 가 HDFS
 (3) (4) .

$$10 \log(k) + 10 \log(T_R) + 10 \log(B_R) + P_R - F_B$$

$$= 57.4 + G_r - \{ 150.1 + \log_{10}(p) + 5 * p^{0.5} + (0.223 + 0.16 p^{0.1}) * d \} \quad (4)$$

,
 G_r :

k : , $10 \text{ Log } (k) - 228.6 \text{ dB}$
 T_R :
 B_R :
 p : %
 P_R : dB I/N
 F_B : , 0 1 dB,
 B_T 가 B_R - $10 \text{ Log } (B_T / B_R)$,
“ n ” .
 d :

32 GHz 5
S5.550 .

< 5> 32 GHz

Boresite (dBi)	78 dBi
Boresite	5 °
(dBi)	14.5 dBi
	60. K
	15. K
가	99.999 %
	2 MHz

5 , .
 G_r : 14.5 dBi, 5 ° { 32 - 25 Log () }

p : 0.001, , 가 가 99.999 %
 T_R : 60. K 17.8 dB (. K)
 B_R : 2 MHz 63 dB (sec-1)
 P_R : - 6.0 dB, 15. K

가 7 4 FSK, 16, 32, 128 QAM 3.5, 7, 14, 28, 56MHz

3.4.2 ITU-R F.758

HDFS 3 31.8 33.4GHz(726), 37 40GHz(133), 51.4 52.6GHz(726) , HDFS TDMA FDMA , CDMA , 28MHz Sector Dish V/H HDFS 55.78 57GHz, 57 59GHz 64 66GHz

3.5

HDFS , HDFS 가 3 FSS . HDFS intraservice interservice ,

가

10-6 BER 3dB . 50GHz

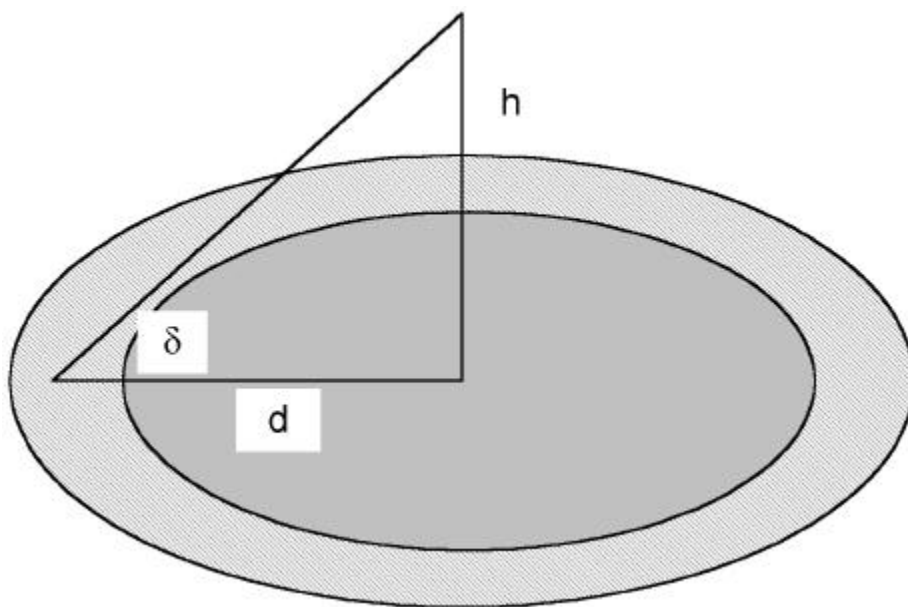
rain outage events . 가

99.97% 99.999%

. 가 가가

1km 가 . 50GHz

.



< 5> 가

d_0 km 가 . 가
 가 . ,
 가 h(km) , 가
 d(km) . 가
 1 2 5

. 5 (7) 가 .

$$P (\quad _1 \quad _2) \quad d_1^2 - \quad d_2^2 \quad (7)$$

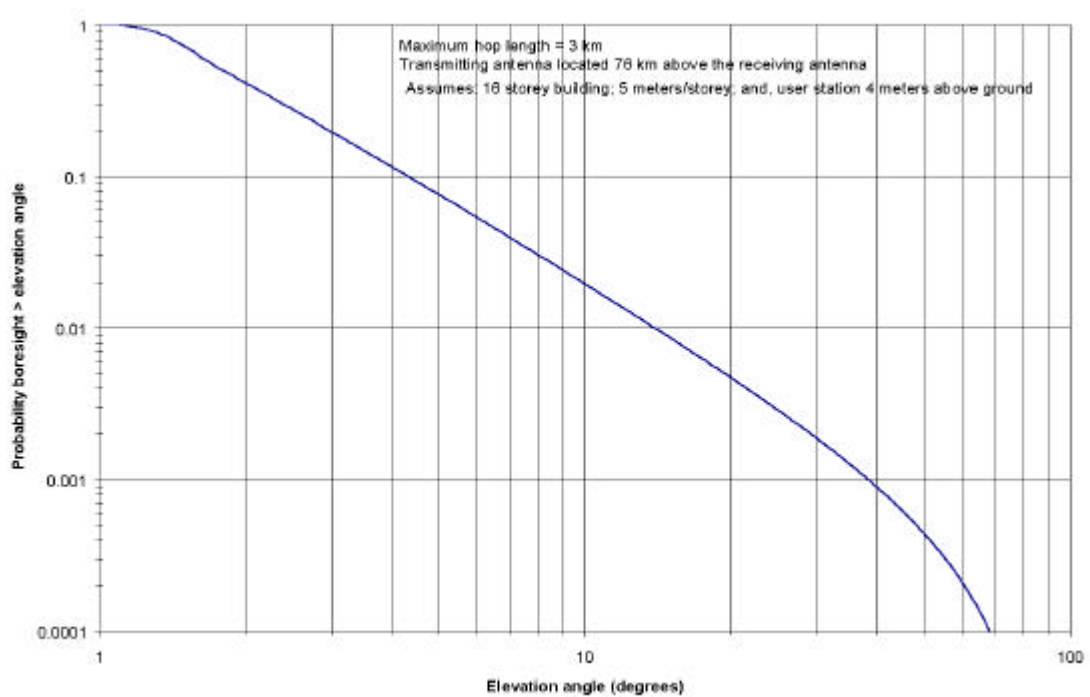
$$, \quad d_i = \frac{h}{\tan \quad _i} , \quad i = 0 , 1 , 2 \quad (8)$$

(7) (9)

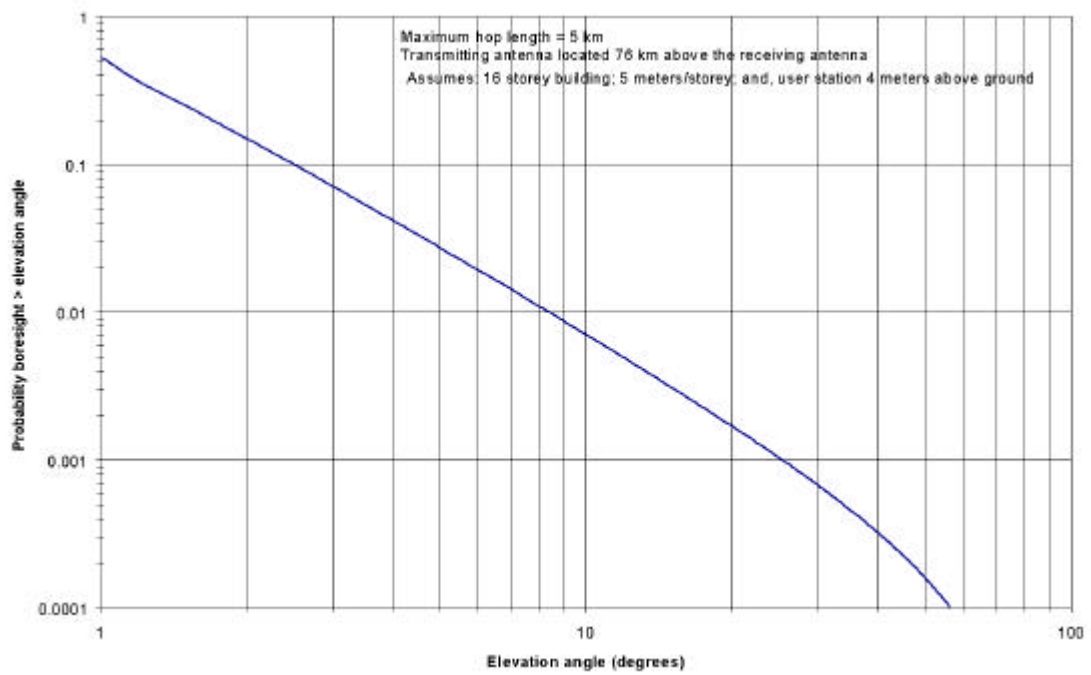
가 .

$$P(d_1 < d_2) = \frac{d_1^2 - d_2^2}{d_0^2} \quad (9)$$

, $d_0 =$ (3 5 km), (9)
 3 5 km 가
 . 6
 7 . 6 가 76m
 3km 가
 . 7 6
 5km . 3km
 6 , 가
 1% 14 ° . 5km
 7 , 가
 1% 8 ° .
 가 , low elevation angles will
 predominate.



< 6> 3 km



< 7> 5 km

4.2

37 40GHz

가

, fade margin

.

가

가

hops

가

fade margin

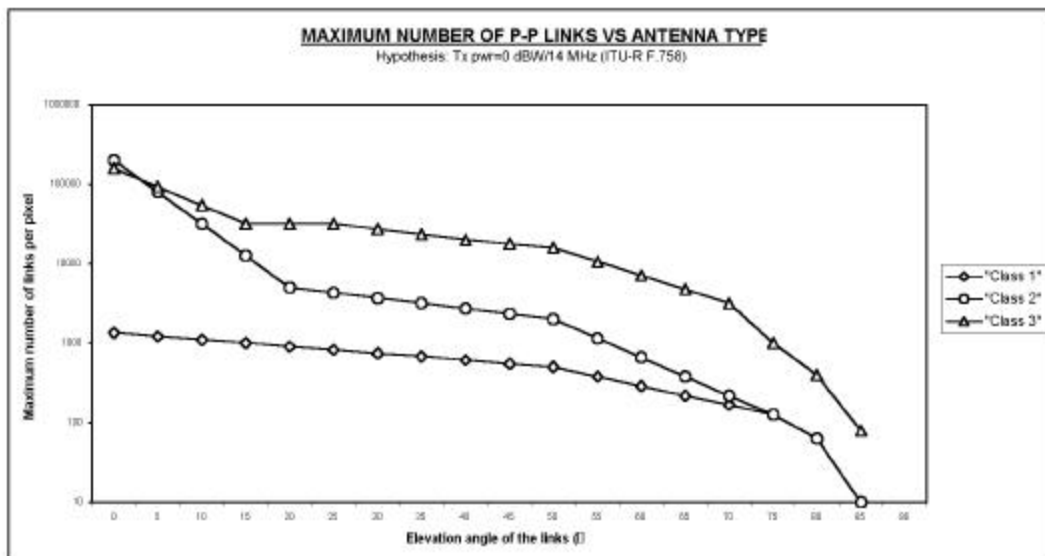
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EIRP

가

.

net effect fade margin



< 16> Zenith , 56.36 56.96GHz slot
(《High》 power- density case)

가

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ITU-R

가

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