

ANTENNAS FOR RADIO LINKS

Nhu BUI-HAI. Alcatel Thomson Faisceaux Hertzians
55 Rue Greffulhe . 92301 Levallois . France

1- INTRODUCTION

After the last war, the radio links are going up: the frequency bands move from - let say - 100 MHz before 1950 approximately up to now about 60 GHz. The antenna types are very numerous, varying from dipole antenna with a gain \approx 6 dB to Cassegrain antenna with a gain about 64 dB.

The purpose of this paper concerns the general investigation of the antennas used in radio links from about 40 years. Three kinds of Antennas for Radio links will be examined: line-of-sight, troposcatter and space.

2- LINE-OF-SIGHT ANTENNAS.

The antenna types used are quite different and function of frequency bands and antenna gain.

2.1. 1945-1955. Internationally and approximately, we can resume the antenna characteristics like following:

2.1.1. < 400 MHz. Dipole with reflector-Gain \approx 6 dB; Yagi antenna-Gain \approx 12 dB; Dihedral antenna-Gain \approx 9 dB; Log-periodic antenna-Gain 10 dB.

2.1.2. \approx 400-1000 MHz. Slot antenna-Gain \approx 10 dB; Helical antenna-Gain \approx 12 dB; Array of Helical antenna-Gain \approx 16 dB (Fig. 1 Four Helical antenna); Parabola antenna (generally with 1 polarization only, Fig. 2a) Gain for 4m in diameter, at 960 MHz \approx 27.5 dB

2.2. 1956-1970. The frequency bands move up to approximately 8 GHz. Some countries used Dielectric antenna, "Cigare" antenna, Lens antenna (Fig. 3). But the gain is only about 16 dB. The parabola antenna was more usual, its diameter arounds 4m and the polarization is dual (Fig. 2b). The off-set parabola antenna are also used (Fig. 1c). The efficiency was good: 0.65 instead of .50 - .55 for the parabola of revolution. The main antenna to mention for this time is the Horn-Reflector antenna (Fig. 4) which is multiband frequency : 4, 6 and 11 GHz .

2.3. 1971-1988. The parabola antennas are always used . The electrical performances are better : Efficiency is about .60 - .65, Pattern radiation level is lower : 65 to 75 dB down of the gain , and the VSWR < 1.06. A most part of parabola antennas is recovered by a radome in "hypalon neopren" which is fixed on the cylindrical equiped with absorber material (Fig. 1d). A Four Band Cassegrain Off-set antenna (Fig. 1e) : 4, 6.2, 6.7 and 11 GHz is actually the best for transmission capacity : 1800, 1800, 2700 and 1800 channels voices (\approx 36900 at all).

From some years now, the use of digital radio links incite an effort to obtain better cross-pol value .

3- TROPOSCATTER ANTENNA

The distance between two stations for troposcatter transmission is about 150 Km to 500 Km. Before 1950-1955, the frequency bands were approximately 150/450 MHz. The antenna diameter was about 10 m. Around 1960-70, the frequency bands were 760-960 MHz, 2 and 5 GHz. The antennas were for a great part, off-set type ("Bill-board" type) and the diameter was 18m , 27m and some , rarely , 40m (Fig. 4). Since communications by satellite, the troposcatter

transmission is now practically abandoned .

4- EARTH STATION ANTENNA

Three frequency bands are used : 4,6 and 11/14 GHz. The antenna is of three standards: A(\approx 32m in diameter),B(\approx 11m) and C(\approx 18m). The antenna type is Cassegrainian with conformal reflector feeded by a beam wave-guide . The antenna efficiency is about .75. The antenna temperature is about 40°K (Fig.5).

Now,the diameter of Standard A antenna is divided by two.

5- CONCLUSION

Actually and for analog radio links , it seems that for line - of - sight , the best antenna is the Four-band Cassegrain Off-set antenna covering simultaneously 4 , 6.2 , 6.7 and 11 GHz frequency bands.For digital radio links,-140 Mbit/s and 64 QAM for example-the cross-pol value should be better than 35 dB. For 40/60 GHz frequency bands,the antenna diameter beeing much smaller, some effort take a direction towards the plate array antenna particularly with a good efficiency and a very low VSWR.

. The Troposcatter radio links are now replaced by the Space transmission by satellite because mainly it is due to their low transmission capacity (\approx 120 channels voice) . The space transmission radio links stay open but the Standard A antenna diameter will be approximately the half only (\approx 16m).Probably,more Standard B antennas will be use for less channels voice capacity and nearer distance between stations.

Fig.1 HELICAL ANTENNA

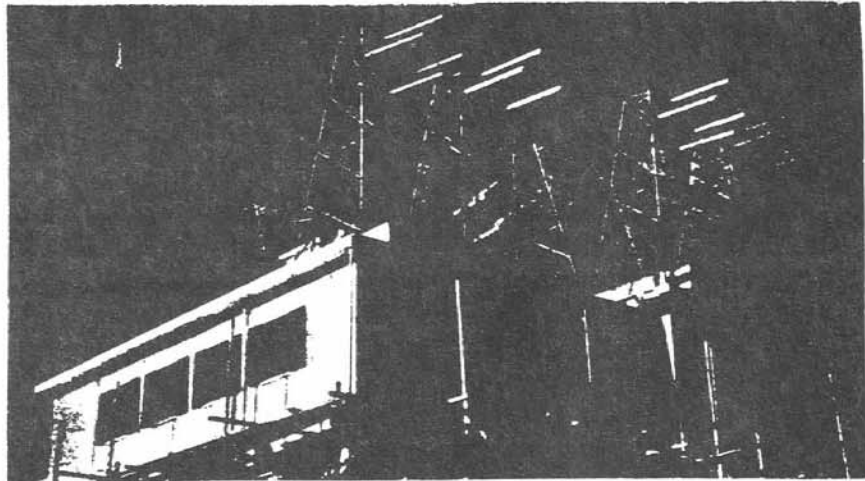
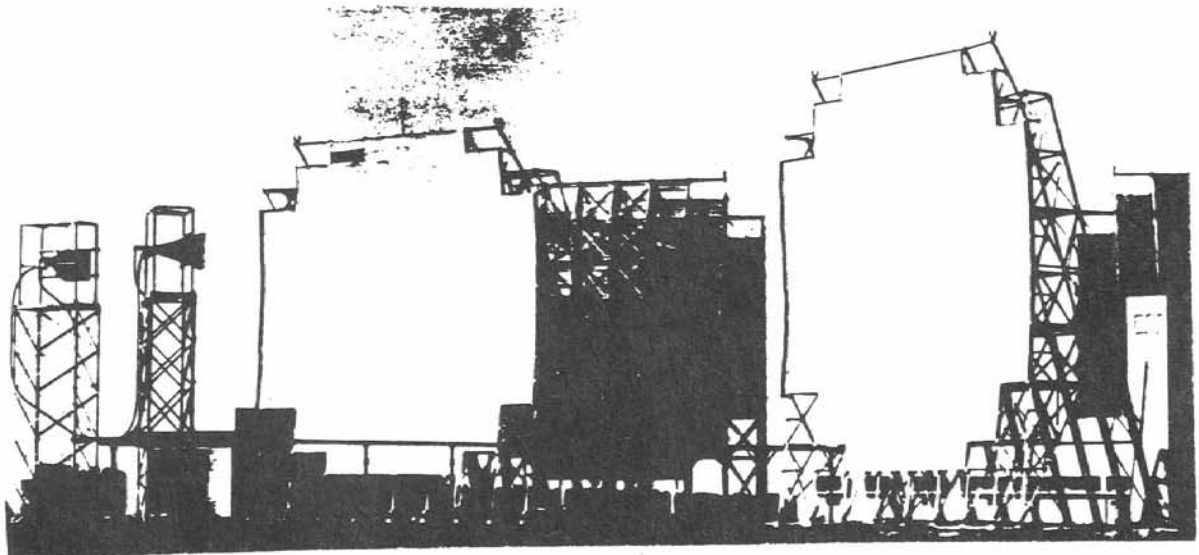


Fig.2 TROPOSCATTER ANTENNA (BILL-BBOARD ANTENNAS)



LINE - OF - SIGHT ANTENNAS
FIG.2

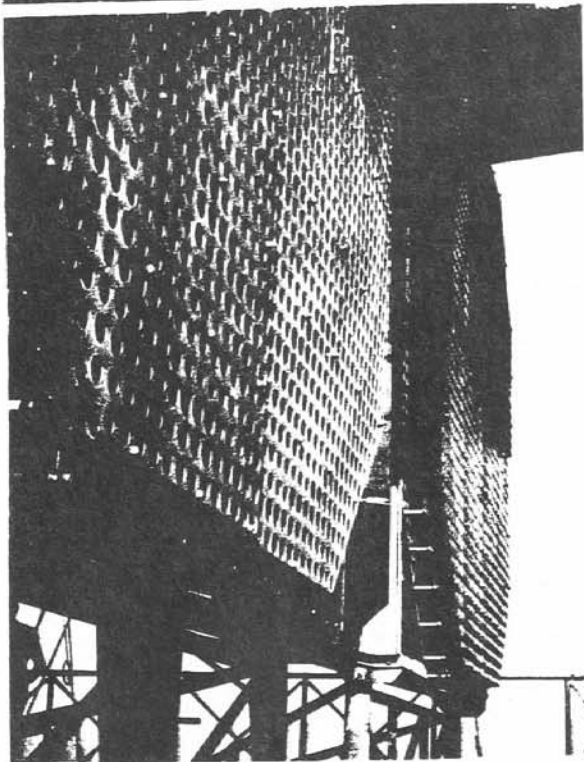
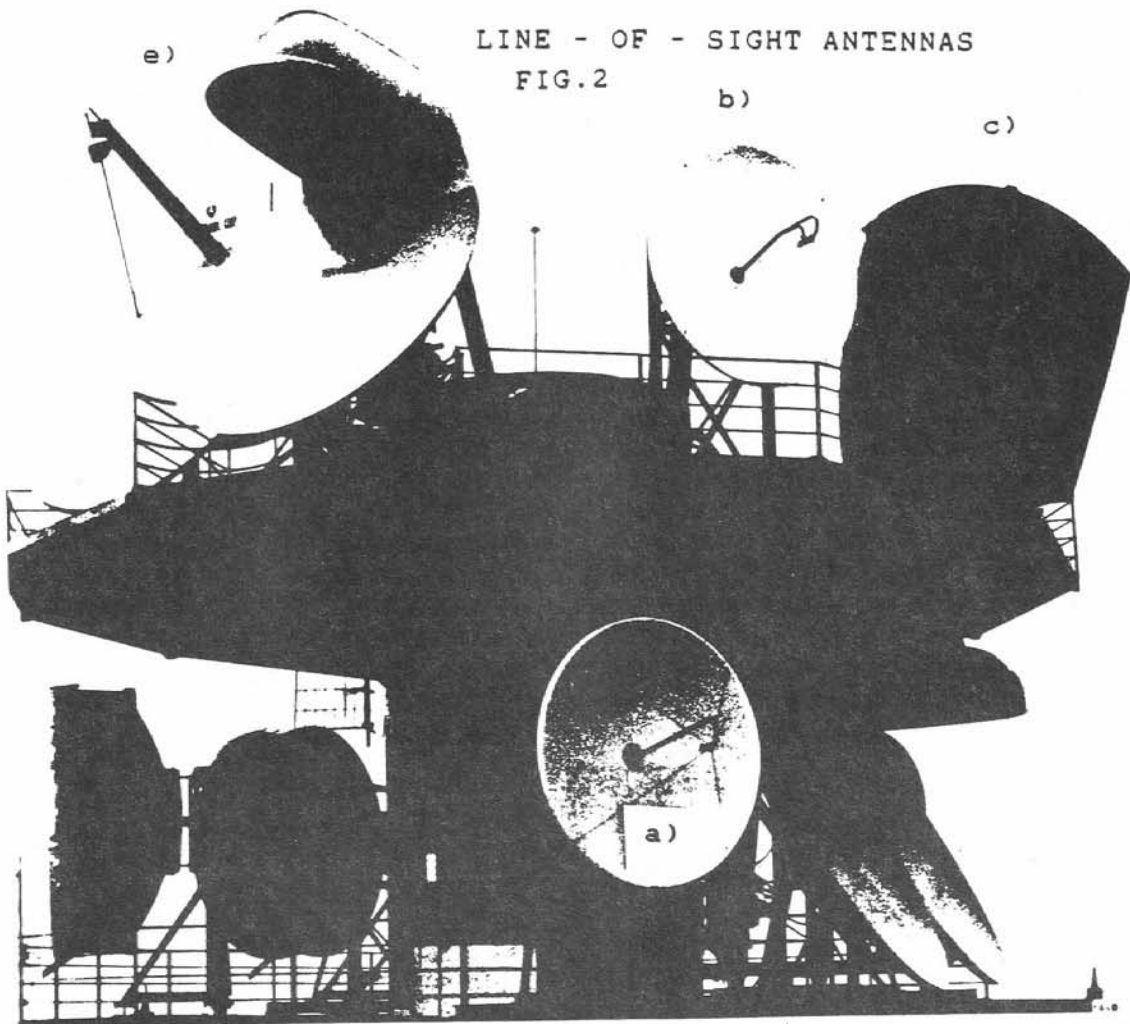
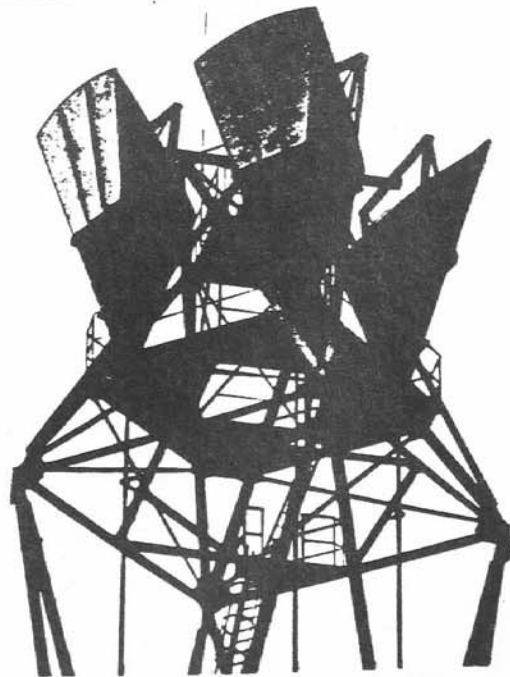


FIG.3 LENS ANTENNA



HORN - REFLECTOR ANTENNA

FIG.4

Fig.6a STANDARS B ANTENNA



Fig.6b STANDARD A ANTENNA

