AMPLITUDE SCINTILLATIONS IN A LOW ELEVATION DOWNLINK FROM SIRIO SATELLITE

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After an initial period over the Atlantic ocean in 1983 SIRIO satellite was displaced over the Indian ocean to perform telecommunication and propagation experiments with China.

Received frequency both in Rome and Beijing was 11.5 GHz.

Receiving systems were almost identical and used 3m antennas.The satellite is still operating in its last orbital position.

Using the station of ISPT in Rome some propagation experiments were performed by Fondazione U. Bordoni.

Scintillations measurements performed during this joint propagation experiment assumed a particular importance due to climatic conditions and latitudes of receiving sites and subsequent low elevation path angles.

Results presented here derive from the large amount of data recorded in Rome and allow for reliable conclusions both from physical and application point of view.

In this paper we will show examples of typical summer events as in presence of clouds.during summer noon and calm night hours.

Analysis of daily variations will also be performed It will be shown that scintillation intensity increases in accordance with the heating of the atmosphere due to solar radiation.On the other hand, during calm summer nights,amplitude scintillations generally falled down to a daily minimum.

The strongest events were recorded during diurnal hours.It will be shown that after careful analysis of metereological data particularly strong events might be highly related to the presence of clouds or unstable weather conditions.

Power spectra of amplitude scintillations obtained by direct FFT of recorded data will also be shown.

As an example for this summary in fig.1 strong amplitude scintillations time-behaviour in presence of clouds and unstable weather conditions is shown During this event the mean level of attenuation was the same as in clear air what makes sure that no rain was present along the path.

Fig.2 shows the spectral analysis performed by FFT on 4096 samples of log amplitude with sampling period of 0.2s.

In order to enhance the asymptotic behaviour of the spectra,"frequency smoothing" was performed over spectral lines.disregarding lines affected by various satellite artifacts.

The spectra obtained after this smoothing show very marked asymptotic behaviour particularly close to the theory for the horizontal low frequency asymptotes.

The high frequency asymptotes have various slopes.

A relationship will be also shown between the slopes and scintillation intensities Higher intensity events seem to be approximating the Kolmogorov theory.

Fig.3 shows the results of the frequency smoothing over the lines of power spectrum in Fig.2.

We note a marked horizontal asymptotic behaviour at low frequencies and a 3 decade/decade slope at the high frequency asymptote The asymptotes meet very steeply at the breakpoint frequency of 0.1Hz.

As for lower intensity events we will report how they occurred mainly during calm nigth hours.The high frequency asymptotes show lesser slopes then predictable by theory.

From described examples and from preliminary data analysis we will confirm that generally there is a relationship between scintillations intensity (e.g. expressed by its variance) and high frequency asymptote slope.

An approximate relationship between these quantities will be shown as derived from regression analysis of experimental points.

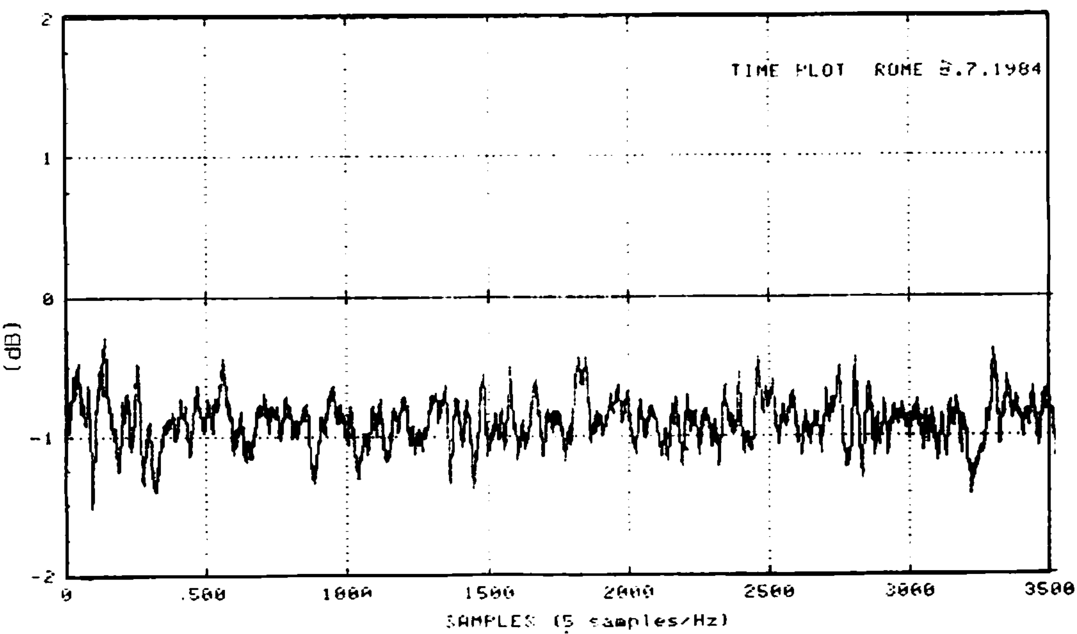

Fig.1

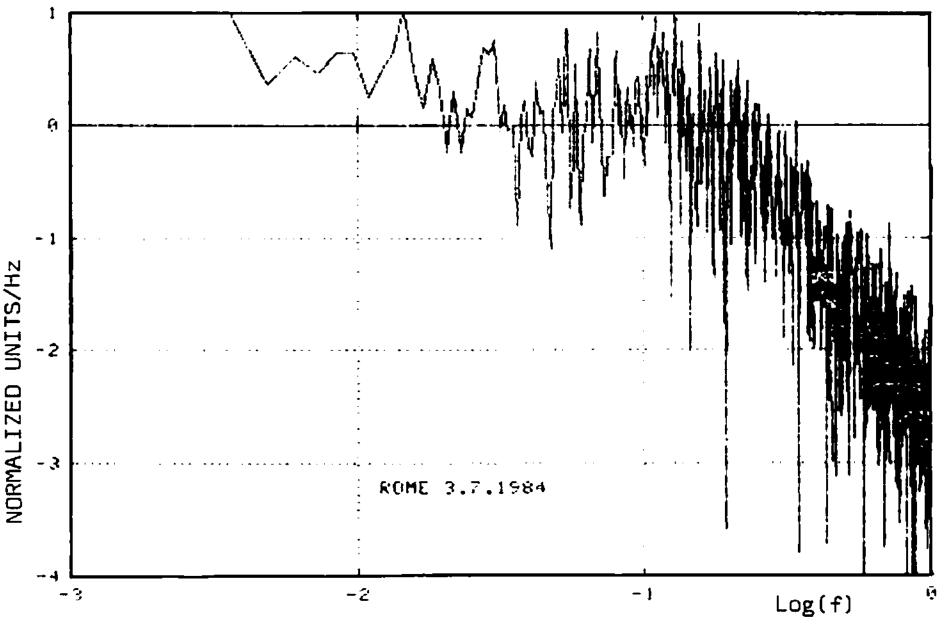
1
0
-1
-2
-3
-4
NORMALIZED UNITS/Hz
ROME 3.7.1984
-3
-2
-1
Log(f)
0

Fig.2

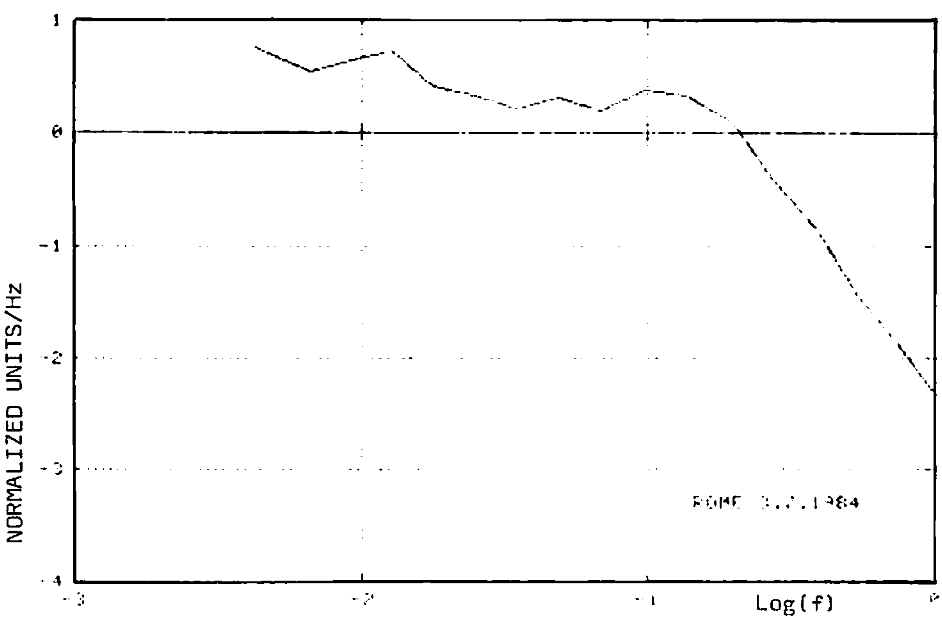
1
0
-1
-2
-3
-4
NORMALIZED UNITS/Hz
Log(f)

Fig.3