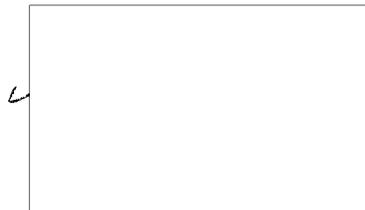~~TOP SECRET~~

BIF003W/B 239915-85

6 sheets, Unit #27,
COPY #2

DATE: 4 March 1985

TO:

FROM:

APR   9 1987

SUBJ: Limited Recovery of FARRAH I Pulse Omni
          ERP Capability

          There is a potential means to recover some limited
FARRAH I ERP/omni capability based on the use of the single
omni PFM carried on FARRAH I. The omni PFM can serve as a
means of deriving which antenna channel received the
intercepted signal.

          Currently the omni PFM is tasked to allow the PFM
great flexibility in switching between omni antennas.
However, it is possible to limit the ability of the PFM to
switch between omni antennas by tasking the PFM in a
different manner which would tend to keep the PFM on the
same antenna for longer periods of time. This can be done
by tasking the PFM to continue the antenna assignment as
long as pulses are received on that channel during the
previous 32 msec assignment period.

          While tasked in this mode, the vast majority of
pulses received would tend to be from the omni channel that

WARNING - THIS DOCUMENT SHALL NOT BE USED
AS A SOURCE FOR DERIVATIVE CLASSIFICATION

-1-

~~TOP SECRET~~

HANDLE VIA BYEMAN
CONTROL SYSTEM ONLY

TOP SECRET   BIF-771-562/85

the PFM is assigned. However, some higher amplitude pulses
from the channel which the PFM is not assigned to may still
receive a NB-TOA. Also, from the region near the spacecraft
waist-line other not so high amplitude pulse from the
channel not assigned may also receive a NB-TOA.

        Although some pulses from the not assigned channel
may be assigned a NB-TOA, those pulses in the higher gain
region away from the crossover will mostly be from the
channel to which the PFM is assigned. Therefore, for pulse
signals from known locations, it may be possible to
reconstruct the ERP on the high gain parts of the omni
antennas by properly tasking the PFM. The concept is an
expansion of an idea originally mentioned by

        The attached charts provide a hypothetical
example. The first chart illustrates two signals - one
which would favor a plus antenna (marked +) and the second
(marked -) (in red) which would favor the minus antenna.
The solid line above the series of incoming pulses of
varying amplitudes represents the required amplitude for a
pulse to be received on the unfavorable antenna. This value
would vary with theta and phi around the antenna. The
actual value would be further distorted by the axial
ratio/polarization performance of the omni antennas.
However, it is not necessary to determine this value. The
key is that the technique can only be used away from the
crossover region where the required amplitude to receive a
NB-TOA is sufficient to remove many of the lower amplitude
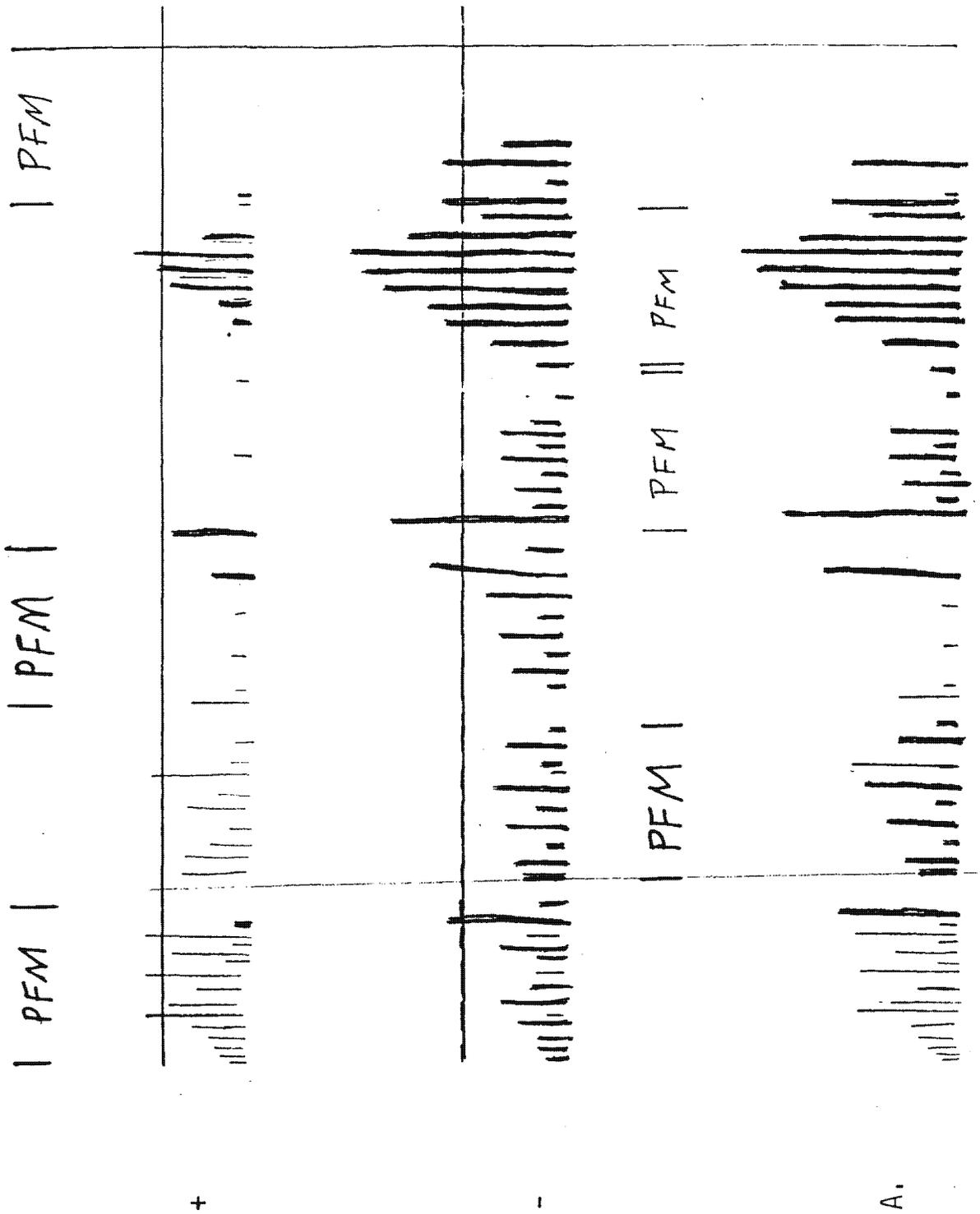pulses intercepted on the channel to which the PFM is not
assigned.

TOP SECRET   HANDLE VIA BYEMAN
                              CONTROL SYSTEM ONLY

BIF-771-562/85

EXAMPLE CURRENT PFM TASKING

| PFM | PFM | PFM | PFM | PFM | PFM || PFM | PFM | PFM

+

A.

HANDLE VIA BYEMAN
CONTROL SYSTEM ONLY

The line marked A illustrates what would be received from the two channels with the WB-TOA inhibit was invoked. It represents a hodge podge of data that is unuseable due to the data handler latchup. This is the way the PFM is currently tasked.

On the second page is a case B where the PFM is tasked to remain on the antenna assigned if data continues to be intercepted on that channel during a 32 msec assignment period. Note that the vast majority of the plus channel pulses have been removed, which allow a term analyst the opportunity to use frequency and other information to isolate the signal of interest.

There is still the risk of the P/L initially choosing a PFM assignment which would be unfavorable to the emitter of interest location. On line C is a hypothetical example illustrating what can happen when the unfavorable case occurs.

The main drawback of the concept is that it won't work in the crossover region near theta equals 90 degrees. However, with the current antenna performance the system is at best marginal in this region anyway.

The PFM had been tasked in this recommended mode during the initial on-orbit period of FARRAH I but was changed to the current mode to provide greater flexibility in servicing both Omni channels. Tasking the PFM in the suggested mode would not be wise if the latchup problem went
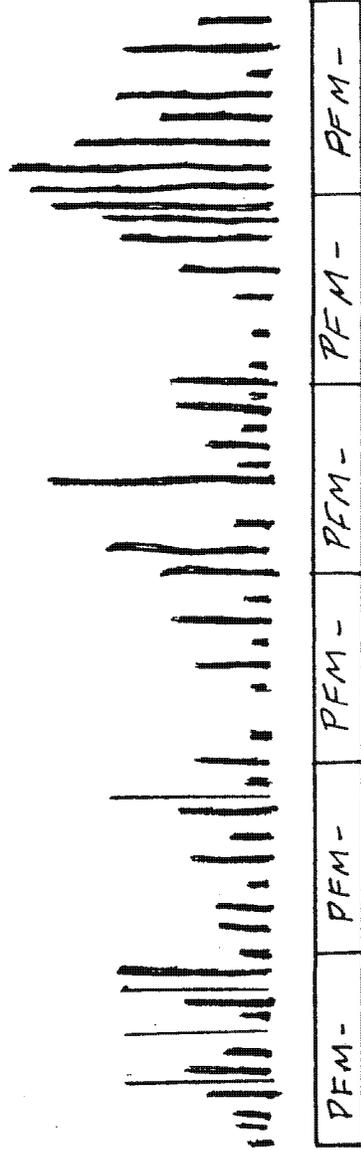
-4-

TOP SECRET BIF-771-562/85

EXAMPLE OF POSSIBLE PFM TASKING

B.

PFM- | PFM- | PFM- | PFM- | PFM- | PFM- | PFM-

C.

PFM+ | PFM+ | PFM+ | PFM+ | PFM+ | PFM+ | PFM+
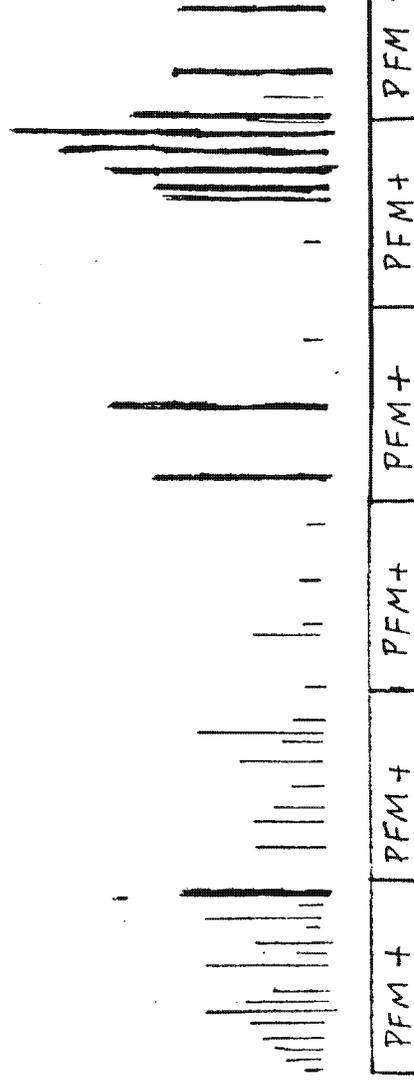
TOP SECRET

HANDLE VIA BYEMAN
CONTROL SYSTEM ONLY

TOP SECRET   BIF-771-562/85

away but it is a means to provide a limited ERP capability
on the premise that a quarter of a loaf is better than none.

        If you are interested in this concept, we would be
happy to discuss it with you at your convenience.

TOP SECRET   HANDLE VIA BYEMAN
                                   CONTROL SYSTEM ONLY