JET PROPULSION LABORATORY

INTEROFFICE MEMORANDUM
ALB-78-133

November 22, 1978

TO: Distribution

FROM: A. L. Berman

SUBJECT: Reconstruction of Downlink Frequency from Open-Loop Data

REFERENCE: Berman, A. L.; "Radio Science Predictions," IOM ALB-78-26, February 16, 1978

There has been some confusion regarding the equations which reconstruct the downlink frequency (f) from the extracted open-loop frequency (f_{olr}). Based on the equations documented in the reference, the proper equations are as follows (with f_{po} = the commanded PO frequency at either 46 or 41 MHz):

Modified Block III Open Loop Receiver (DSS 14 & 43)

$$f_{po} \cong 46 \text{ MHz}$$

$$f_s = 48 \cdot f_{po} + 50 \times 10^6 - f_{olr}$$

$$f_x = \frac{11}{3} \left[48 \cdot f_{po} + 50 \times 10^6\right] - f_{olr}$$

Narrowband MMR (DSS 63)

$$f_{po} \cong 41 \text{ MHz}$$

$$f_s = 48 \cdot f_{po} + 300 \times 10^6 + f_{olr}$$

$$f_x = \frac{11}{3} \left[48 \cdot f_{po} + 300 \times 10^6\right] + f_{olr}$$

A. L. Berman

ALB:jv

Distribution:

J. W. Armstrong	K. R. Kimball	D. Sweetnam
H. Baugh	F. B. Leppla	R. Woo
B. Buckles	A. Liu	G. E. Wood
W. Hietzke	A. S. Patel	
A. J. Kliore	J. R. Smith	T. A. Croft, SRI

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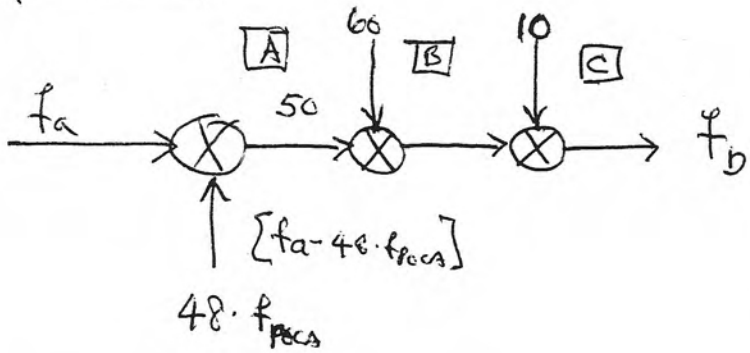
DSS43



$$\boxed{\frac{\partial f_b}{\partial f_{POCA}} = +48}$$

$$\boxed{\frac{\partial f_b}{\partial f_a} = -1}$$

A $\quad [f_a - 48\, f_{POCA}]$

B $\quad 60 - (f_a - 48 \cdot f_{POCA})$

C $\quad 60 - (f_a - 48 \cdot f_{POCA}) - 10 = f_b$

if $f_b = B/2 \qquad 50 + 48 \cdot f_{POCA} - f_a = B/2$

$$\boxed{f_{POCA} = \frac{f_a - 50 + B/2}{48}}$$

if $f_b = B/2 + \delta$

$$\boxed{f_{POCA} = \frac{f_a - 50 + B/2 + \delta}{48}}$$

Basic equation $\quad 50 + 48 \cdot f_{POCA} - f_a = f_b$

$$\boxed{50 + 48 \cdot f_{POCA} - (f_a + \delta) = f_b - \delta}$$

DSS 63

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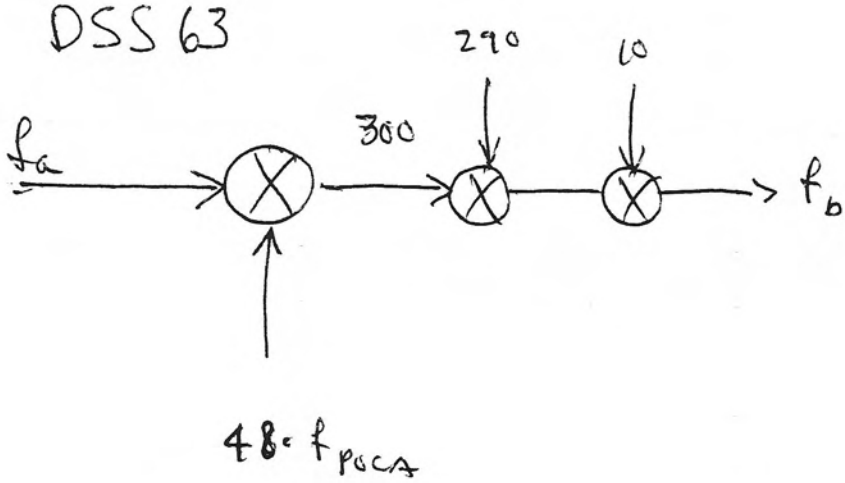

$$f_a - 48 \cdot f_{POCA} - 290 - 10 = f_b$$

$$f_a - 300 - 48 \cdot f_{POCA} = f_b$$

$$\boxed{f_{POCA} = \frac{f_a - B/2 - 300}{48}}$$

$$\boxed{f_a + \delta - 300 - 48 \cdot f_{POCA} = f_b + \delta}$$

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$$\frac{\partial f_b}{\partial f_{POCA}} = -48.$$

$$\frac{\partial f_b}{\partial f_a} = 1$$

10/22/80

Predict sets:

Δt = OCI entry for time offset

Δf = OCI entry for frequency offset

Time offsets:

$f(t)$ = predict set

$$f(t) \rightarrow f(t - \Delta t)$$

Positive Δt results in an earlier execution of the predict set.

Frequency offsets:

$$f_{POCA} \rightarrow [f_{POCA} + \Delta f/48]$$

DSS 43

$$f_b \rightarrow f_b + \Delta f$$

DSS 63

$$f_b \rightarrow f_b - \Delta f$$