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BIF003W/2-237533-83
24 May 1983

25X1

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Unit 10



LORRI II

LORRI II W BAND SRR

[redacted]

25X1

CLASSIFIED BY: BYE-1
DECLASSIFY ON: OADR

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**HANDLE VIA SYMBIAN
CONTROL SYSTEM ONLY**

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SRR AGENDA

18 MAY 1983

GENERAL SYSTEM REQUIREMENTS

- PERFORMANCE

DERIVED REQUIREMENTS

- SPACE SEGMENT
 - ANTENNA/PAYLOAD
 - ENGINEERING
 - POWER/SIGNAL DIST
 - MECHANICAL
 - SPACE SCIENCES
- GROUND SEGMENT
 - DATA HANDLING
 - TASKING
- COMMAND/CONTROL
- H.V. INTERFACE
- T.M. REQUIREMENTS

SUMMARY

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W-BAND SEARCH/INTERCEPT OBJECTIVES

- DEVELOP AN L-II COMPATIBLE ADD ON CAPABLE OF PROVIDING GENERAL AND DIRECTED SEARCH IN THE 92-96 GHz RF BAND FOR PULSED EMITTERS
- PROVIDE THE CAPABILITY TO DETECT AND MEASURE SIGNALS WITH THE EQUIVALENT POWER OF 1 kW INTO A 1 FT DISH
- GEOLOCATE DETECTED EMITTERS
- MEASURE FREQ, AMPLITUDE, PRI, PW, T.O.A. OF SINGLE PULSES
- USE AVAILABLE PAYLOAD DETECTION/PROCESSING/DATA STORAGE/TRANSMISSION
- SUPPORT A 1986 LAUNCH IF DIRECTED TO DO SO ON 3/1/84

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SPECIFIC COVERAGE

FREQUENCY RANGE	92-96 GHz
SIGNAL TYPES	PULSE - MAIN BEAM
PULSE WIDTHS	} SAME AS EHF SUBSYSTEM
TOA	
TIME OF MEASUREMENT	
PULSE AMPLITUDE	
FREQUENCY	±200 kHz

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PERFORMANCE SUMMARY

- **FREQUENCY COVERAGE** 92-96 GHz
- **PULSE DETECTION SENSITIVITY** { 120 W TRANSMITTER AND 1 FT ANTENNA @ 400 NM
1 KW TRANSMITTER AND 1 FT ANTENNA @ 150 TO
600 NM (5° TO 30° MAIN BEAM ELEVATION) }
- **TIME**
 - **ACCESSES** 1/DAY (ALL SITES)
 - **DWELL TIME** 6 MINUTES (AVERAGE) TRACK MODE
20 SECONDS (AVERAGE) SCAN MODE
- **SPATIAL**
 - **GEOGRAPHIC** 100 PERCENT (EUROPE AND ASIA) 7 TIMES/WEEK
 - **ANTENNA BEAMPRINT** 260 x 40 NM INSTANTANEOUS
(5° TO 15° EMITTER ELEVATION COVERAGE)
260 x 1200 NM RAPID SCAN COVERAGE
- **SIGNAL PARAMETER MEASUREMENTS** FREQUENCY, AMPLITUDE, PULSEWIDTH, TOA (PRF)
- **GEOLOCATION** BEAM SCAN CENTROIDING [REDACTED]

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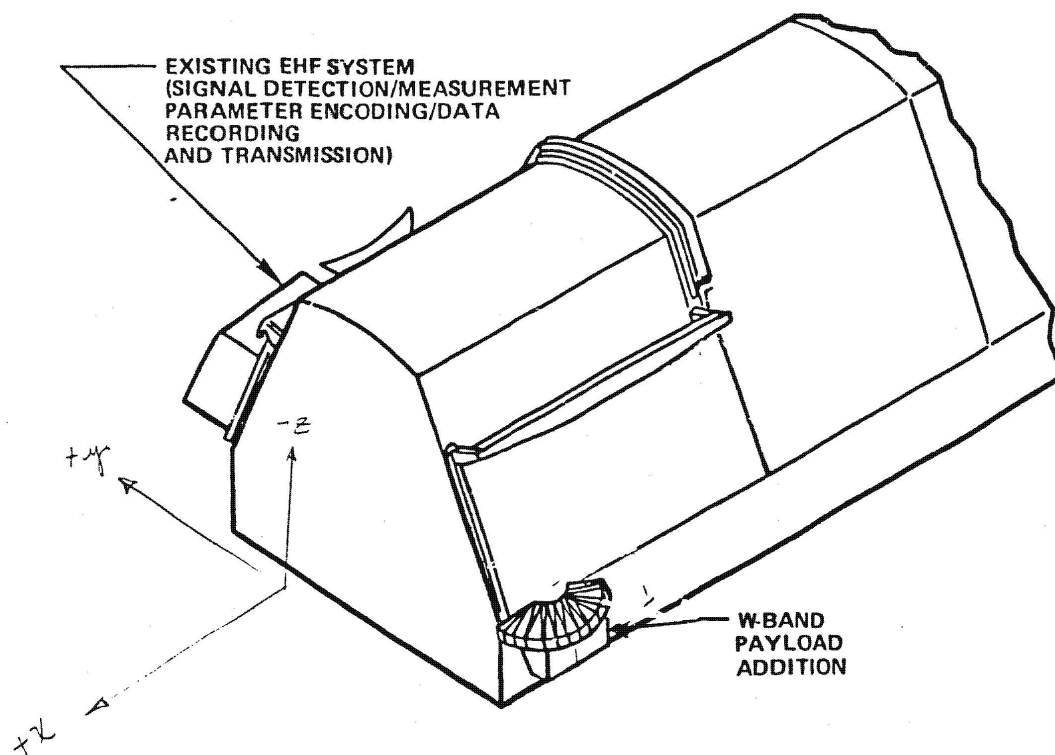
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W-BAND PALLET CONFIGURATION



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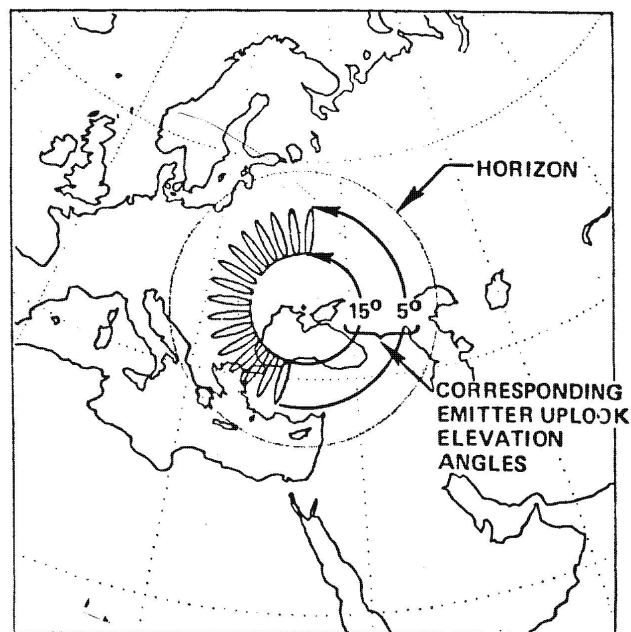
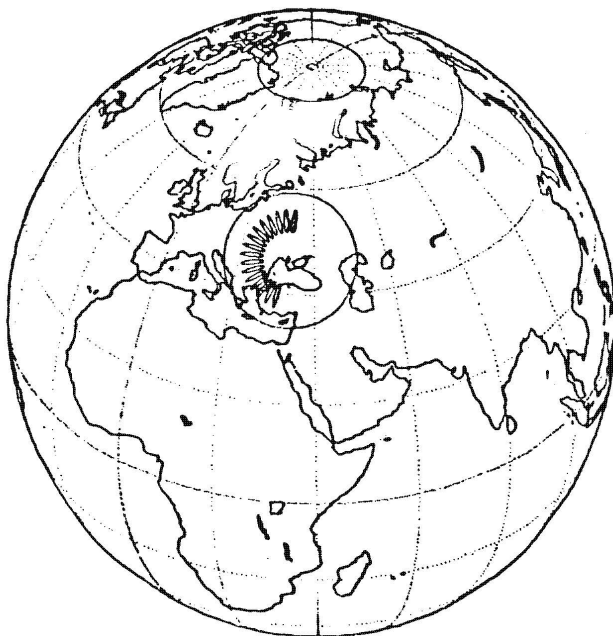
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(6 DEGREE, 30 dB GAIN, 3 dB BEAMWIDTH BEAM PRINTS)



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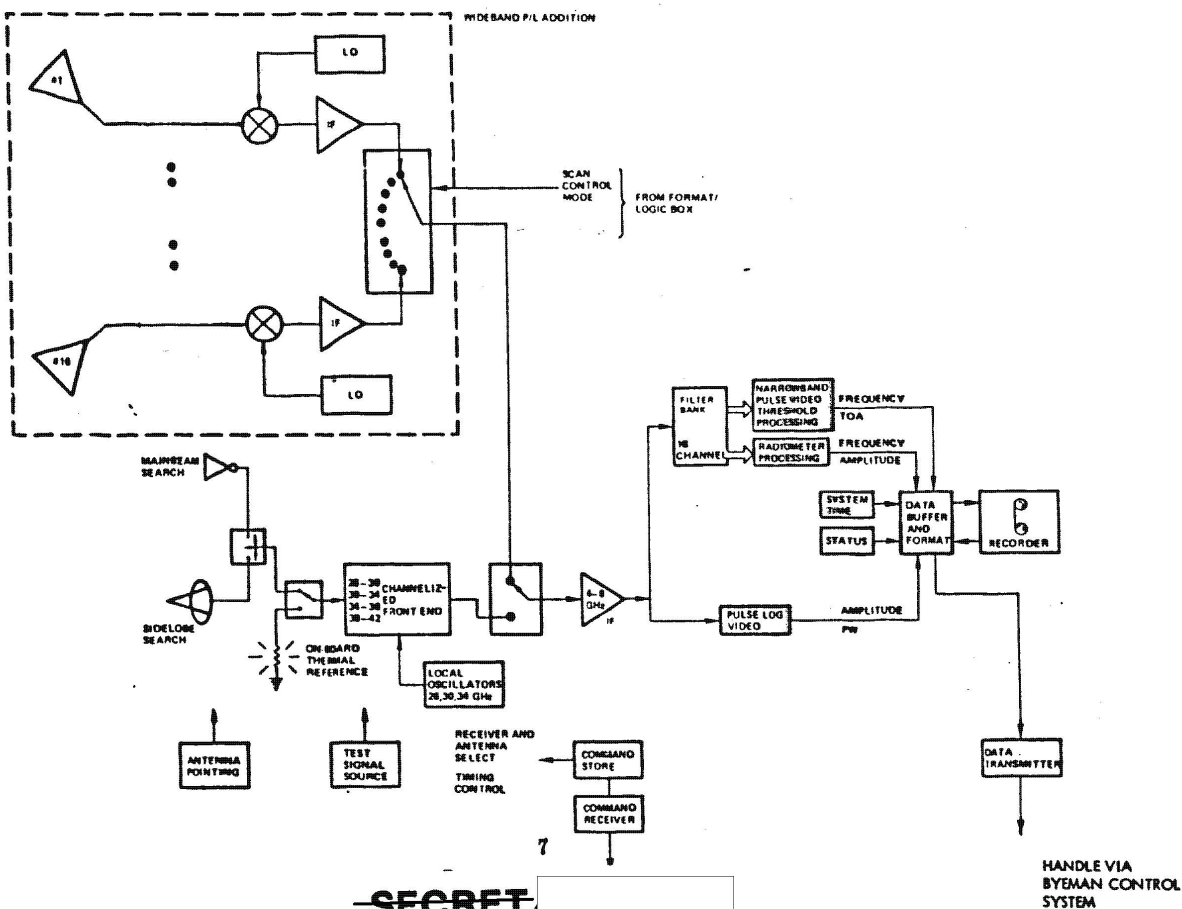
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COLLECTION SYSTEM BLOCK DIAGRAM

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ANTENNA SPECIFICATIONS

NUMBER	16 IDENTICAL UNITS
GAIN	26 dB (TO MATCHED POLARIZATION) 23 dB (OPTIONAL)
POLARIZATION	
BEAMWIDTH	6° (3 dB POINTS)
ELEV ANGLE	6° - 10° (TBD)
AZIMUTH ORIENTATION	16 ANTENNAS IN 169° SECTOR (BS OF NO. 1 & NO. 16 5.6 FROM HV X AXIS)
LOCATION	-Y SIDE OF HOST

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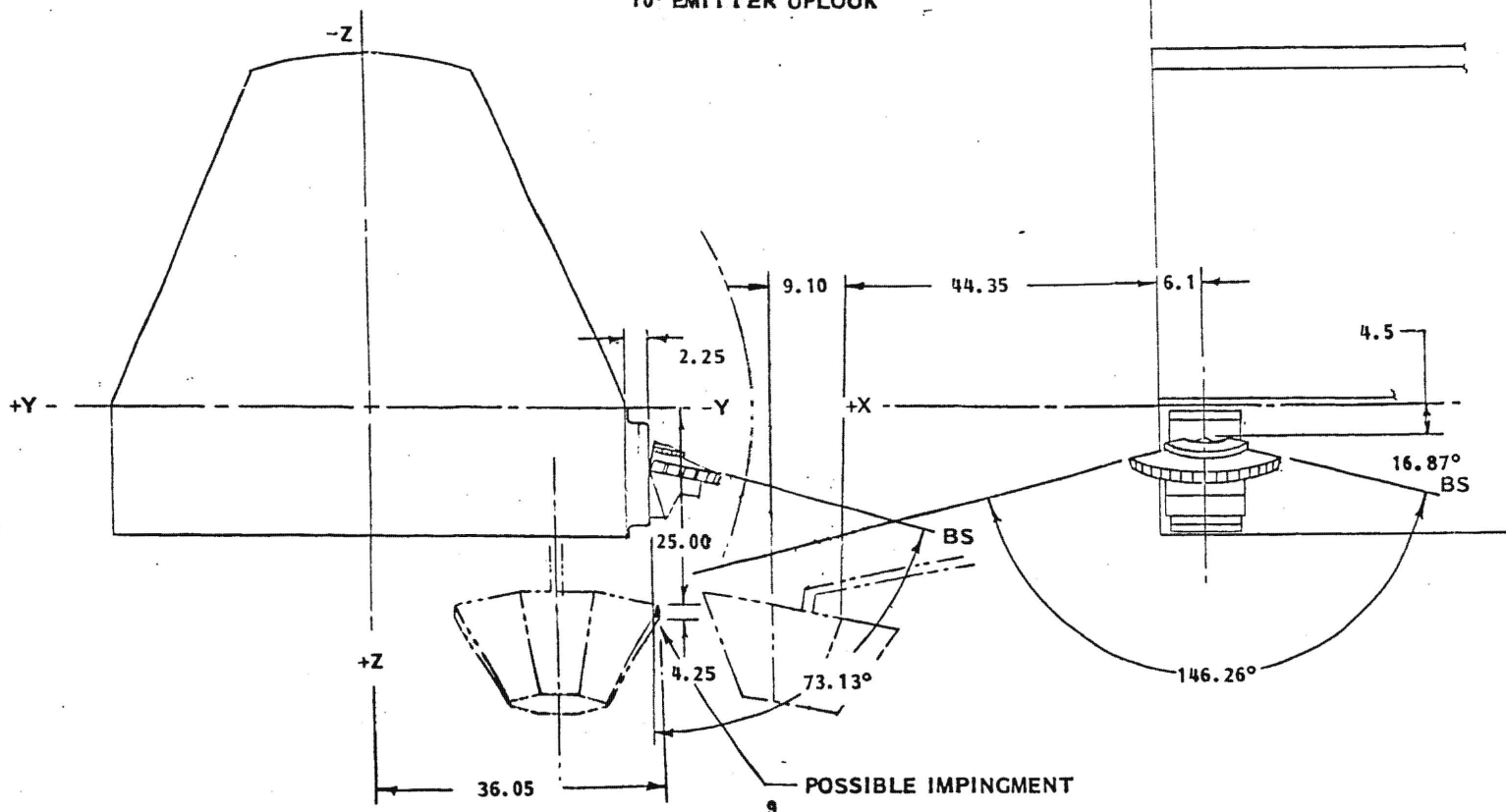
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VIEW ANGLE ENVELOPE

"X" PAYLOAD
10° EMITTER UPLOOKSTA
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RF SUBSYSTEM

- EACH ANTENNA HAS ITS OWN MIXER, L.O AND IF AMPS
- SWITCHING BETWEEN CHANNELS WILL BE DONE AT IF (REDUNDANT SWITCH PROVIDED)
- IF 4 - 8 GHz
- OUTPUT WILL BE SWITCHED INTO THE 38 - 42 GHz IF
- NO IMAGE REJECTION FILTERS ARE REQUIRED
- CABLE LENGTH FROM W-BAND SUBSYSTEM TO MWFE IS 15' (5 & 8 MAX LOSS)

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SENSITIVITY REQUIREMENTS

	$B_R = 250 \text{ MHz}$	$B_R = 4 \text{ GHz}$
RECEIVER (50% POD (FAR $\leq 1/\text{sec}$))	-71 dBm	-66 dBm
ANTENNA GAIN (MATCHED POLARIZATION)	26 dB	
VSWR LOSS (MAX)	1 dB	
SYSTEM SENSITIVITY (MATCHED POLARIZATION)	-96 dBm	-91 dBm

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MAINBEAM DETECTION LINK CALCULATION (94 GHz)

	$B_R = 2.50 \text{ MHz}$		$B_R = 4 \text{ GHz}$	
SYSTEM SENSITIVITY (50% POD, FAR $\leq 1/\text{sec}$) (MATCHED POLARIZATION)	-96 dBm		-91 dBm	
FREE SPACE LOSS	10° UL 190.0 dB	6° UL 192 dB	10° UL 190.0 dB	6° UL 192.0 dB
ATMOSPHERIC LOSS (CLEAR DAY)	3.8 dB	6.9 dB	3.8 dB	6.9 dB
MAINBEAM ERP DETECTION SENSITIVITY	97.8 dBm	102.9 dBm	102.8 dBm	107.9 dBm
EMITTER ANTENNA GAIN (1 FT DISH)	47.0 dB	47.0 dB	47.0 dB	47.0 dB
EMITTER TRANSMITTER	50.8 dBm (120 WATTS)	55.9 dBm (389 WATTS)	55.8 dBm (380 WATTS)	60.9 dBm (1230 WATTS)

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UPLOOK ANGLES VS ELEVATION (DEGS FROM NADIR @ 100 nm)

BS	UPL00K ANGLE BW (3 dB)	ELEVATION FROM NADIR (DEG)	FREE SPACE LOSS (dB)	ATMOSPHERIC LOSS (dB)	TOTAL PATH LOSS (dB)
6°	4.0 - 13.5°	75.1	192.1	6.9	199.0
10°	6.5 - 15.0°	73.1	189.0	3.8	193.7 $\Delta = 5.3$

HORIZON IS 76.3° FROM NADIR

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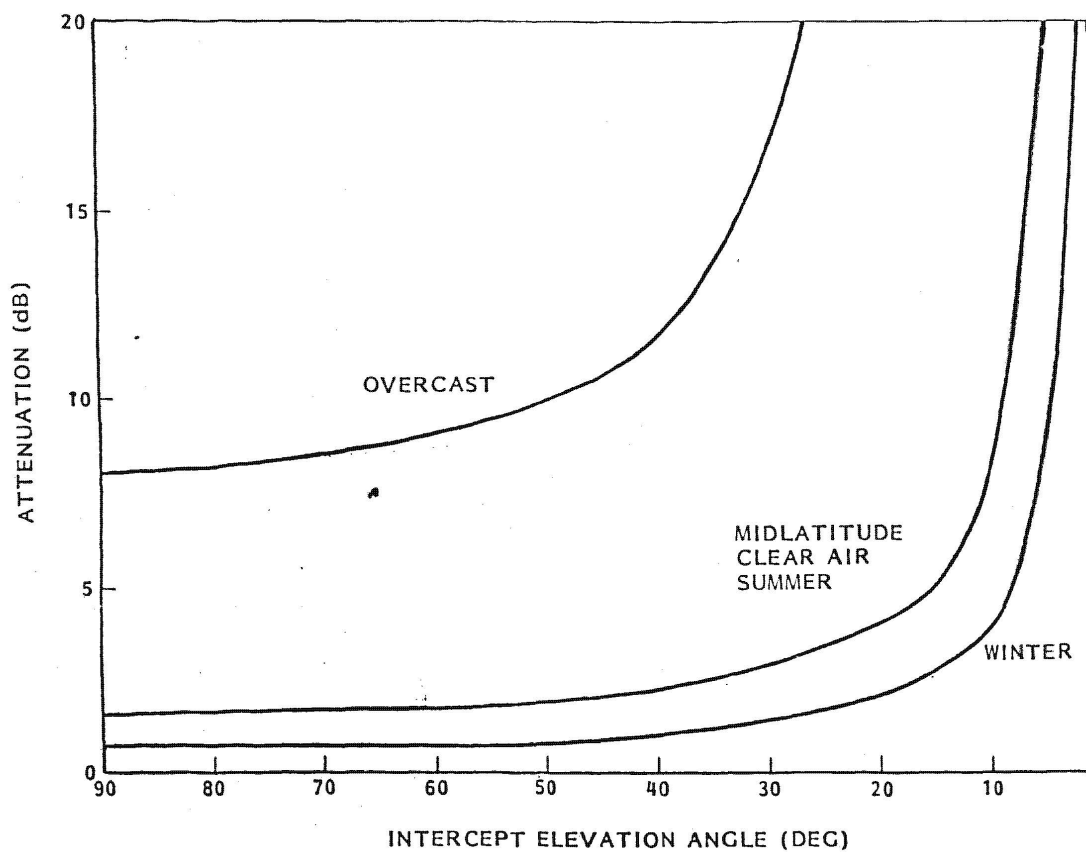
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95 GHZ ATMOSPHERIC ATTENUATION



INTERCEPT ELEVATION ANGLE (DEG)

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PARAMETER MEASUREMENTS

		<u>RANGE</u>	<u>RESOLUTION</u>	<u>ACCURACY</u>
PULSE SIGNALS	*FREQUENCY	92 - 96 GHz	250 MHz	±200 MHz
	AMPLITUDE	25 dB	1 dB	±5 dB
	PULSEWIDTH	21.4 - 386 ns 0.36 - 9.63 μs	21.4 ns 0.214 μs	±41.8 ns ±0.1 μs ±10%
	TOA	Signal Duration	1 μs	±1 μs PLUS ±1 μs/SEC
	TIME OF MEASUREMENT	HV Time	200 ms	±25 ms

*SAME AS EHF PLUS 88 GHz LOCAL OSCILLATOR ERRORS

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SEARCH AND TRACK

MODES

NUMBER OF COMMANDS AVAILABLE 16

- SEARCH MODE
 - 4 SCAN RATES
 - 4 SECTOR SCAN SELECTIONS
- TRACK MODE
 - 8 TRACK MODE ANTENNA SEQUENCING SELECTIONS
 - 16 OPTIONAL

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GROUND SEGMENT

MISSION PLANNING SUBSYSTEM - GENERAL SEARCH BASELINE

- 16-ANTENNA SCAN; SINGLE SCAN RATE
- TARGET AREAS DEFINED BY LAT-LONG RECTANGLES
- ACQUIRE TARGET AT CENTER ANTENNA FOOTPRINT INTERSECT (NORMAL TO TRACK)
- ADD TO EHF/VHF TARGET ACQUISITION
- ADD TO EHF/VHF AUTOMATIC TARGET SELECTION

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FLIGHT DATA PROCESSING SUBSYSTEM

- SELECT W-BAND DATA,PULSE ONLY
&
- DETERMINE ANTENNA NUMBER
(INFO REQUIRED: DEFINITION OF SCAN START
VS TOA)
- ASSUME COMMON ANTENNA GAIN VALUE AND RF
CALIBRATION
- COMPUTE PULSE LAT-LONG, RF, PA, PW, TOA, Δ TOA
- OUTPUT PULSE FILE AND LISTING TO ANALYST

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MISSION ANALYSIS AND CALIBRATION

MISSION ANALYSIS SUBSYSTEM

SELECT W-BAND PULSE DATA
FORM SIGNALS FROM PULSE DATA
PLOT SIGNALS ON DATA GRAPHICS / VERSATEK
STORE / RETRIEVE SIGNAL HISTORY DATA

ON-ORBIT CALIBRATION - ARV SUPPORT

1 kW TRANSMITTER, ANTENNA, HARDWARE
SINGLE RF; CONSTANT PW AND PRI EACH
INTERCEPT; FLY-THROUGH INTERCEPT,
NOT TRACKING

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HV INTERFACE

LOCATION	-Y (NEAR HV STA 1642)
MAXIMUM WEIGHT	30 LB + CABLES AND ATTACHMENT TO HV
POWER REQUIREMENTS	30 WATTS
PHYSICAL SIZE LIMITS	SEE ENVELOPE DRAWING
ATTACHMENT FITTINGS	USE EXISTING HOLES

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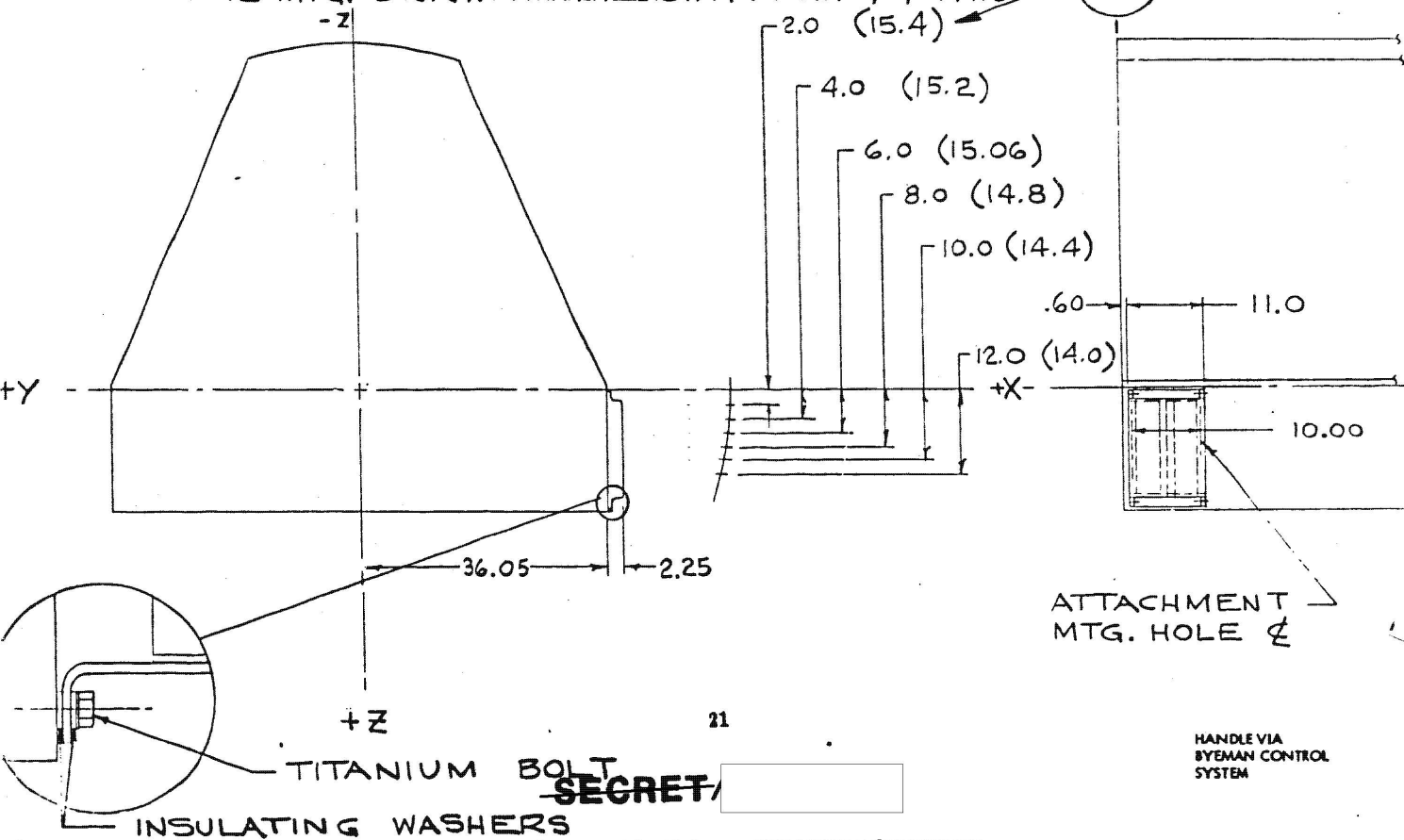
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"W" BAND ENVELOPE

DIMENSIONS IN PARENTHESIS INDICATE
MAX. LIMIT UNDER MAGIC CIRCLE FROM
THE MTG. BRKT. AT THE DIM. FROM Y-Y AXIS



ATTACHMENT
MTG. HOLE $\varnothing$

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SPACE SCIENCES

THERMAL CONTROL

- THERMALLY ISOLATED WITH NONMETALLIC WASHERS
- PROTECTION FROM FREE MOLECULAR FLOW (TBD)

VIBRATION/ACOUSTIC

TBD

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CABLING INTERFACE

IF CABLING

- 15 FT COAX TO MWFE
- MAX LOSS 5.0 dB

COMMAND CONTROL

- ROUTED TO FORMAL BOX

STATUS/TM

- ROUTED TO FORMAT BOX

POWER

- SUPPLIED FROM VHF ELECTRONICS BOX

ALL CONNECTORS ARE TO BE LOCATED ON +X OR -Z ENDS OF W-BAND PACKAGE.

CABLE SIZES, NUMBERS AND CONNECTORS (TBD)

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