III. SYSTEM USED AT NORTHWEST CAPE, AUSTRALIA

In the Basic Principles section VLF aerials, matching and coupling networks, signalling methods and bandwidth widening techniques were discussed. For any particular VLF installation all of these areas will be important, but certain areas will vary among installations. In the writing of a computer program for VLF systems numerical values must be used, at least in the checkout phase of the program.

Rather extensive data on existing U. S. Navy VLF stations, as of 1963, has been compiled.[1] However, the installation at Northwest Cape, Australia was under actual construction during the time this thesis was being written, and could be expected to incorporate the latest techniques in the VLF art. Additionally, William E. Norris, Professor of Electrical Engineering, Naval Postgraduate School, was assigned to the installation and could provide up-to-date information. Field engineers were making minor corrections and numerous measurements daily, so a great quantity of detailed information was available. For these reasons, the Northwest Cape installation was chosen as the model for the computer program.

The transmitter-antenna system was designed to operate in the frequency range from 15.5 kHz to 30 kHz, with a radiated power of 1,000 KW. Major signalling is by 50 baud Teletype, using FSK with a shift of 25 Hz and a modulation index of one. CW operation would be available on an emergency basis. The assigned operating frequency is 15.5 kHz.

Table VI shows the major system parameters of the installation, and Figures 32 through 37 show the general schematics of the various units.

TABLE VI

DESIGN PARAMETERS FOR NORTHWEST CAPE, AUSTRALIA

General	Operating Frequency	15.5 kHz
	Radiated Power	1,000 KW
Aerial	Vertical monopole, with top-hat loading	
	Effective height	628 feet
	Required efficiency	50%
	Static Capacitance	0.164 μfd
	Downlead inductance	139.0 μh
	Radiation resistance	0.154 ohms
	Loss resistance	0.154 ohms
	Self-resonance frequency	33.3 kHz
	Aerial bandwidth	38.125 Hz
	Bandwidth (with loss)	76.250 Hz
	Antenna current (approx.)	2550 amps
Helix	Tuning Variometer	484 μh
	Coupling Variometer	20 μh
	Input impedance (at resonance)	12.5 ohms
Bandwidth Resistor	Resistor	33.25 ohms
	Maximum dissipation	500 KW
	Series Variometer tuning	200 - 800 μh

TABLE VI (continued)

Tee	Input impedance		20.0 ohms
	Output impedance		12.5 ohms
	Leg One	Inductor	25 - 275 μh
	Leg Two	Capacitor	.06 - .6 μfd
	Leg Three	Inductor	50 - 300 μh
Transformers	Output impedance		20 ohms
	Primary winding		430 μh
	Primary capacitor		0.25 μfd
	Secondary inductance and capacitor settings vary with number of units being used.		
	One unit	Inductance	71.5 μh
		Capacitance	1.475 μfd
		k	0.522
	Two units	Inductance	49.0 μh
		Capacitance	1.076 μfd
		k	0.474
	Three units	Inductance	35.3 μh
		Capacitance	0.996 μfd
		k	0.444
	Four units	Inductance	27.0 μh
		Capacitance	0.976 μfd
		k	0.508
Power Amplifiers	Four each AN/FRT-67 power amplifiers rated at (each)		500 KW
	Desired plate-to-plate load		420 ohms
Signalling	Teletype		50 baud
	FSK, modulation index		1.0
	Required minimum bandwidth		100 Hz
	CW for emergency use		

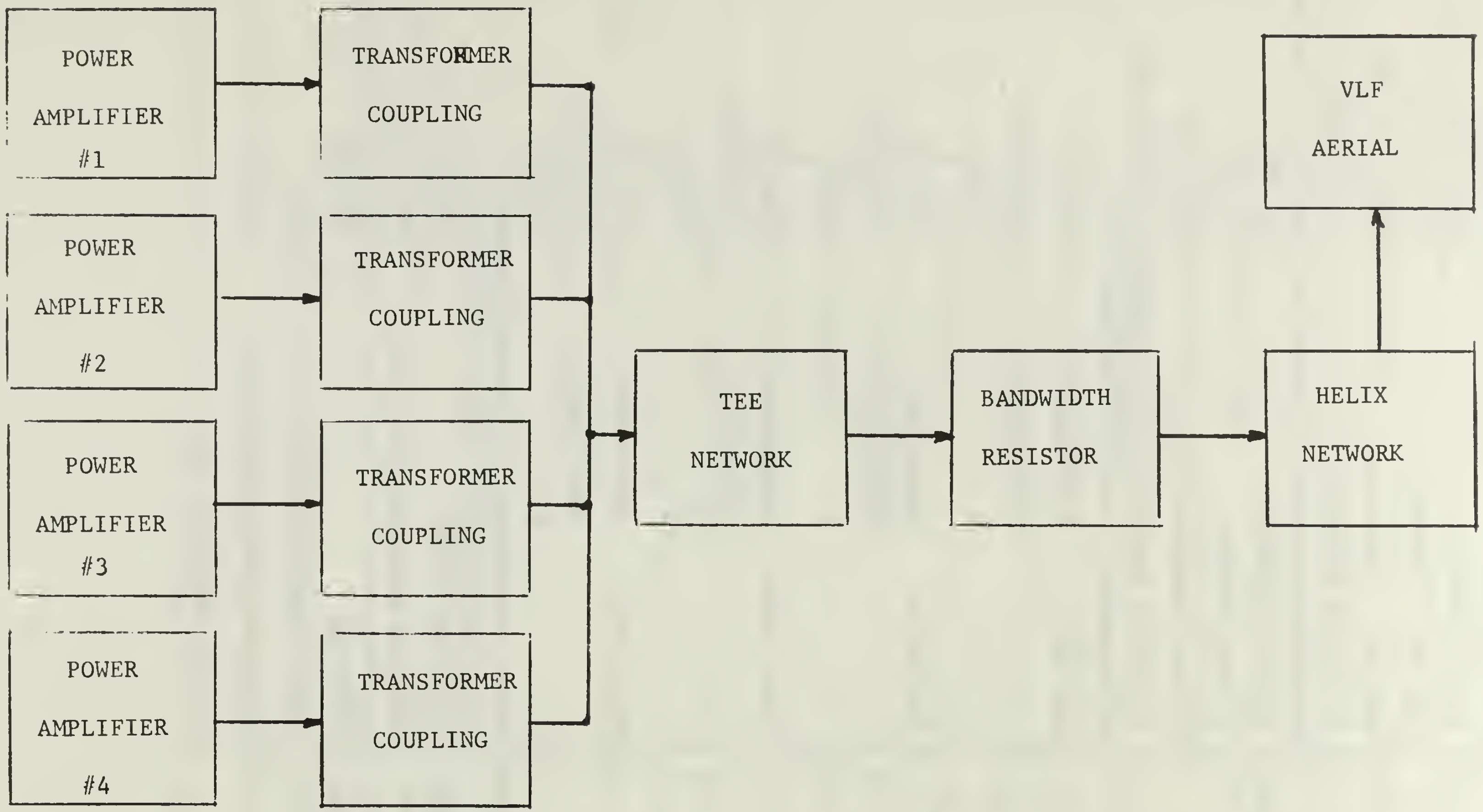


Figure 31. Block Diagram of Northwest Cape Installation

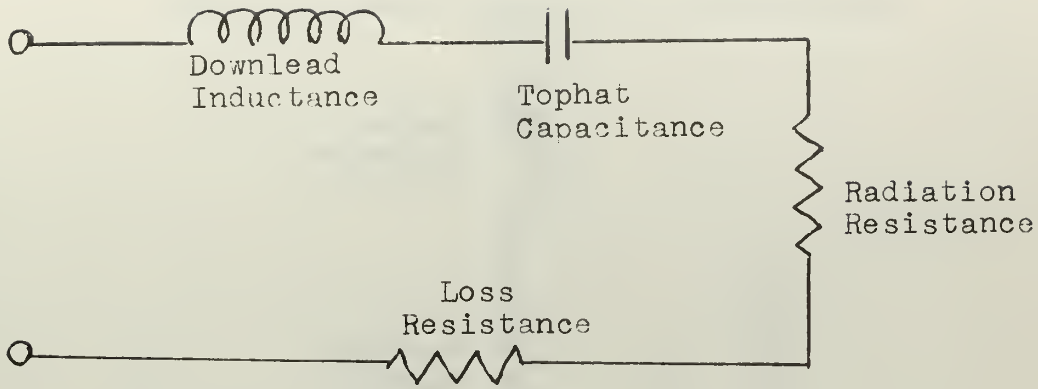


Figure 32. Aerial System

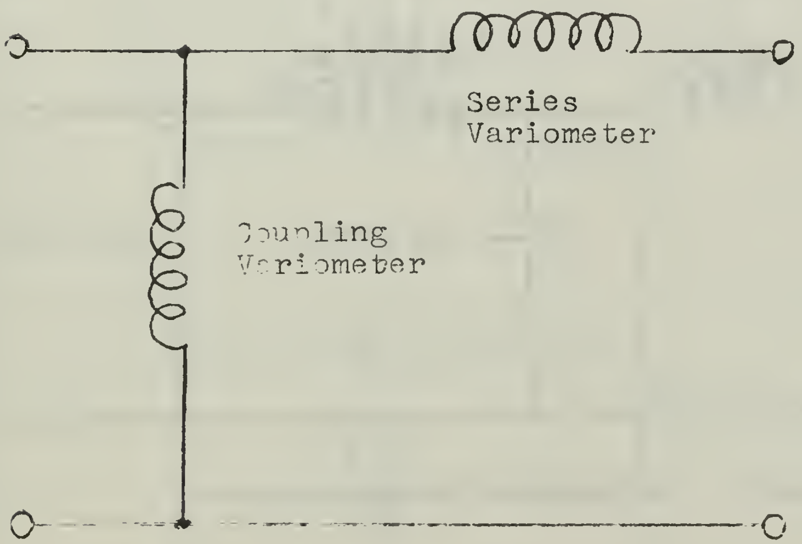


Figure 33. Helix Coupling Network

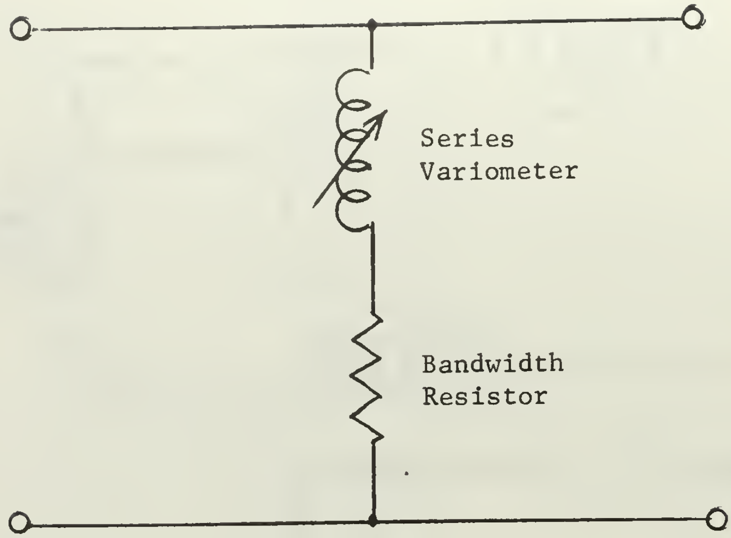


Figure 34. Bandwidth Resistor Network

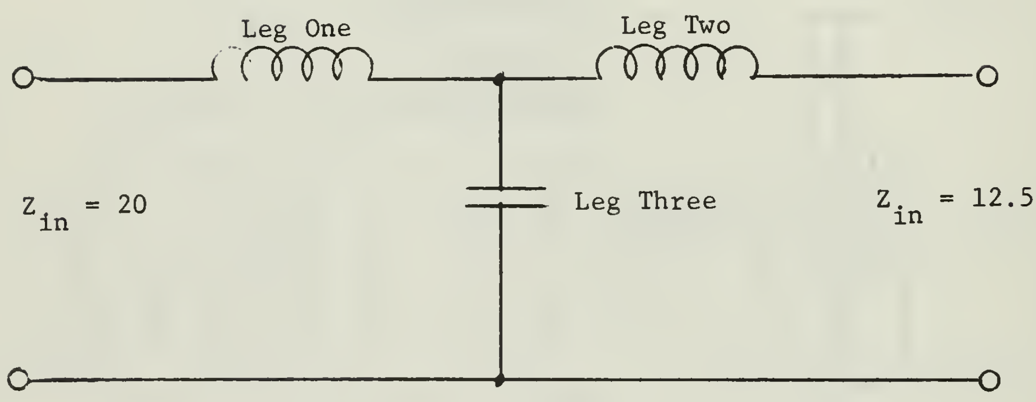
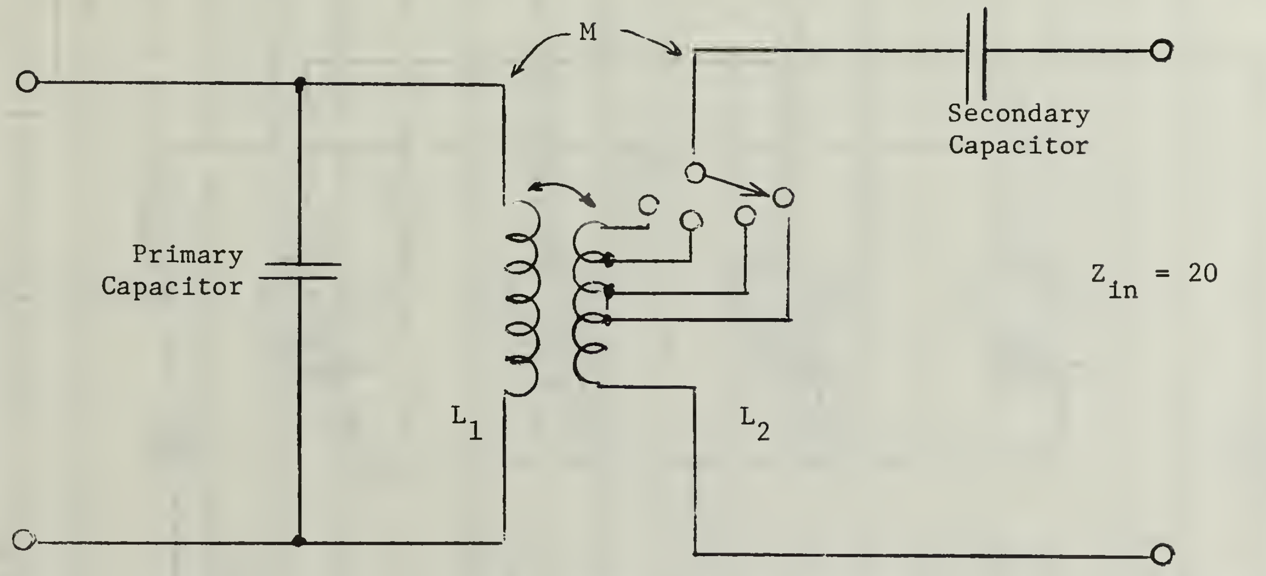


Figure 35. Tee Impedance Matching Network



Note: Transformer secondary varies with number of power amplifiers on the line.

Figure 36. Transformer Coupling

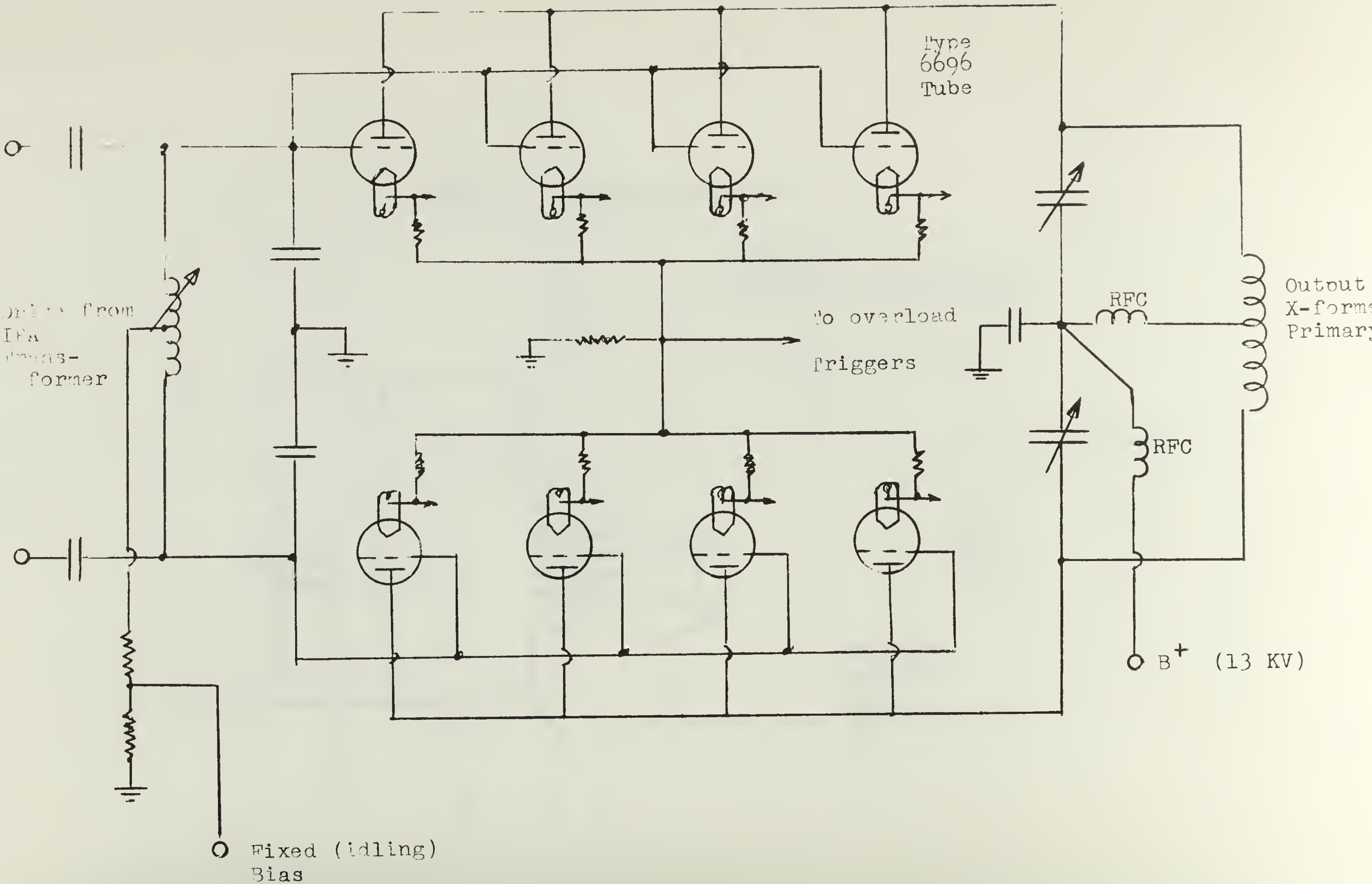


Figure 37. AN/FRT-67 Power Amplifiers