Welcome to the 19th Annual Central States VHF Society Conference. We hope you will enjoy the program of activities and your visit to Tulsa. It is a privilege and honor for me to serve as President of this prestigious group of amateurs. Last year the proceedings of the conference were published for the first time, and were very well received. We have decided to continue this tradition and publish the proceedings of the 1985 Conference. The proceedings will relieve the speakers from the burden of copying their material for handouts. It will also provide a means of distributing this material to all conference attendees as well as those unable to attend. Finally, it is hoped that the proceedings will become an established part of all future conferences to fully document and credit the work and accomplishments of the CSVHF Society.

This years conference is made possible through the dedicated efforts of the conference committee:

Connie Marshall, K5CM	Program Chairman
Pam Marshall, N5KW	Ladies Program
DeEdre Calhoun	Ladies Program
Sam Goldish, W5TVG	Registration
Al Ward, WB5LUA	Prizes/Wilson Award Chairman
Emily Ward	Ladies Prizes
John Fox, WØLER	Chambers Award Chairman
Tommy Henderson, WD5AGO	Conference Comm. Proceedings
Larry Papke, WB5MPU	Conference Comm. Registration
Marc Thorsen, WBØTEM	Antenna Measurements
Mike Watson, W5UC	Prizes

I would also like to recognize those listed on the program whose diligent work make up our technical program.

Your CSVHF Society officers and board of directors are:

Charlie Calhoun, WØRRY, Pres.
Connie Marshall, K5CM, V-Pres.
Ed Fitch, WØOHU, Secretary
Joe Muscanere, WA5HNK, Treas.
Ken Kucera, KAØY
Tony Bickel, K5PJR
Terry Van Benschoten, WØVB

Tom Clark, W3IWI
Russ Wicker, W4WD
Jim McKim, WØCY
Rod Blocksome, KØDAS
Marc Thorson, WBØTEM
Louis Anciuax, WB6NMT

73's Charlie, WØRRY

19th Annual CSVHF Conference Schedule, 1985

Thursday, July 25	
7:00 - 9:00PM	Registration - Outside Indian Nations Ballroom
9:00 -10:00PM	Board of Directors Meeting - Room 4201
Friday, July 26	
8:00AM	Registration - Outside Indian Nations Ballroom
8:30AM	Greetings and General Information
8:45AM	"VHF Beacons - A Major Resource for the VHF'er," Terry Van Benschoten, WØVB
9:45AM	Break
10:00AM	"Coaxial Cavity Amplifiers," Buzz Miklos, WA4GPM
11:00AM	"A look at 2300 MHZ EME," Paul Wilson, W4HHK
12:00PM	Lunch Break
1:00PM	"Sporadic E - Propagation," Jim Stewart, WA4MVI
2:00PM	"Automation and the VHF Hamshack," Russ Wicker, W4WD
3:00PM	"The Fall and Rise of a Five Meter Dish," Paul Shuch, N6TX
4:00PM	"Grid Expeditions Above 1 GHZ," Gerald Handley, WA5DBY
5:00PM	Supper Break
7:00 -12:00PM	Noise Figure Measurements & VHF/UHF Flea Market Indian Nations Ballroom
9:00PM	Board of Directors Meeting - Room 4201
Saturday, July 27	
8:30AM	Business Meeting
9:00AM	"ARRL Happenings," Bill Tynan, W3XO
9:30AM	"220 MHZ Activities," Ed Gran, WØSD
10:00AM	"EME Activities from KL7," Dr. Tom Clark
11:00AM	"1296 MHZ Transvertor Update," Al Ward, WB5LUA
12:00PM	Lunch Break
1:00PM	Antenna Gain Measurements - Marc Thorson, WBØTEM Parking Lot - West
6:30PM	Cash Bar - Indian Nations Ballroom and Lobby
7:00PM	Banquet - Banquet Speaker - Paul Shuch, N6TX
Sunday, July 28	
9:00AM	EME Forum
10:00Am	"AMSAT" Tom Clark, W3IWI

Family Program Schedule

Thursday, July 25	
7:00 -10:00PM	Get aquainted time - By the swimming pool
Friday, July 26	
7:30 - 8:30AM	Continental Breakfast - By the pool
9:00 - 1:00PM	Bus Tour - Oral Roberts University - Frankoma Pottery
1:00 - 3:00PM	Lunch Break
3:00 - 5:00PM	Handwriting Analysis - Kay Beverly (KC4EF) Certified Graphonalysist
8:00 -12:00PM	Chiefs Room - Women's Hospitality Room Available
Saturday, July 27	
8:00 - 9:00AM	Chiefs Room - Donuts and Coffee
9:00 -10:15AM	Chiefs Room - China Painting Demonstration Ara Mae Calhoun
10:15 -10:30AM	Break
10:30 -12:00AM	Chiefs Room - Color Analysis Susie Westerhouse Continued in Chiefs Room until 3:15PM as requested
12:30 - ?	Shopping Spree - Southroads Mall and Southland Shopping Center (Hotel Vans Avaliable)
3:30 - 4:30PM	Chiefs Room - Craft Quickies - For Children Pam Marshall (N5KW) Supplies Furnished
6:30 - 7:00PM	Kiddie Banquet - Chiefs Room - Hamburger, Fries, Drink Magic Show - Steve Lancaster Video Taped Movies
6:30 - 7:00PM	Social Half-Hour - Cash Bar Indian Nations Ballroom and lobby
7:00 -10:30PM	Banquet - Indian Nations Ballroom

NOTE: Ladies Hospitality Room - Chiefs Room
Babysitting - Creek Room
Please meet in the lobby fifteen (15) minutes prior to scheduled tour departure times.

TABLE OF CONTENTS

- VHF BEACONS -

A MAJOR RESOURCE FOR THE VHF'er

by Terry Van Benschoten, WØVB
Rochester, MN

Amateur Radio has the privilage of installing radio beacons on 10 meters and above. What follows is a discussion of the types of beacons allowed, how we can best use them, and where and what frequencies are being used today.

Included in this package are excerpts of the FCC rules governing the installation of beacons, highlights of beacon uses, and a work sheet for recording where the beacons are operating today.

It is very clear that beacons are a whole lot more than just "Propagation Monitors".

July/85 WØVB

Subpart C — Technical Standards

§ 97.61 Authorized frequencies and emissions.

(a) The following frequency bands and associated emissions are available to amateur radio stations for amateur radio operation, other than repeater operation, auxiliary operation and automatically-controlled beacon operation, subject to the limitations of §97.65 and paragraph (b) of this section:

Frequency band *(kHz)*	Emissions	Limitations (See paragraph[b])
1800-2000	A1,A3	
3500-4000	A1	
3500-3775	F1	
3775-4000	A3,A4,A5,F3,F4,F5	4
4383.8	A3A,A3J	13
7000-7300	A1	3,4
7000-7150	F1	3,4
7075-7100	A3,F3	11
7150-7300	A3,A4,A5,F3,F4,F5	3,4
14000-14350	A1	
14000-14150	F1	
14150-14350	A3,A4,A5,F3,F4,F5	
21000-21450	A1	
21000-21250	F1	
21250-21450	A3,A4,A5,F3,F4,F5	
28000-29700	A1	
28000-28500	F1	
28500-29700	A3,A4,A5,F3,F4,F5	

Frequency band	Emissions	Limitations (See paragraph[b])
(MHz)		
50.0-54.0	A1	
50.1-54.0	A2,A3,A4,A5,F1,F2,F3,F4,F5	
51.0-54.0	AØ,FØ	
144.0-148.0	A1	
144.1-148.0	AØ,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5	
220-225	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5	5
420-450	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5	5,7
1215-1300	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5	5
2300-2450	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5,P	5,8
(GHz)		
3.300-3.500	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5,P	5,12
5.650-5.925	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5,P	5,9
10.000-10.500	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5	5
24.000-24.250	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5,P	5,10
48.000-50.000	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5,P	
71.000-76.000	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5,P	
165.000-170.000	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5,P	
240.000-250.000	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5,P	
Above 300.000	AØ,A1,A2,A3,A4,A5,FØ,F1,F2,F3,F4,F5,P	

(b) Limitations:
(1) (Reserved)
(2) (Reserved)

97.61 (CONT)

(3) Where, in adjacent regions or subregions, a band of frequencies is allocated to different services of the same category, the basic principle is the equality of right to operate. Accordingly, the stations of each service in one region or subregion must operate so as not to cause harmful interference to services in the other regions or subregions (No. 117, the Radio Regulations, Geneva, 1959).

(4) 3900-4000 kHz and 7100-7300 kHz are not available in the following U.S. possessions: Baker, Canton, Enderbury, Guam, Howland, Jarvis, the Northern Mariana Islands, Palmyra, American Samoa, and Wake Islands.

(5) Amateur stations shall not cause interference to the Government radiolocation service.

(6) (Reserved)

(7) In the following areas the peak envelope power output of a transmitter used in the Amateur Radio Service shall not exceed 50 watts, except when authorized by the appropriate Commission Engineer-in-Charge and the appropriate Military Area Frequency Coordinator.

(i) Those portions of Texas and New Mexico bounded by latitude 33° 24′ N., 31° 53′., and longitude 105° 40′ W. and 106° 40′ W.

(ii) The State of Florida, including the Key West area and the areas enclosed within circles of 200-mile radius centered at 28° 21′ N., 80° 43′ W. and 30° 30′ N., 86° 30′ W.

(iii) The State of Arizona.

(iv) Those portions of California and Nevada south of latitude 37° 10′ N., and the area within a 200-mile radius of 34° 09′ N., 119° 11′ W.

(v) In the State of Massachusetts within a 160-kilometer (100 miles) radius of 41° 45′ N., 70° 32′ W.

(vi) In the State of California within a 240-kilometer (150 miles) radius of 39° 08′ N., 121° 26′ W.

(vii) In the State of Alaska within a 160-kilometer (100 miles) radius of 64° 17′ N., 149° 10′ W.

(viii) In the State of North Dakota within a 160-kilometer (100 miles) radius of 48° 43′ N., 97° 54′ W.

(8) No protection in the band 2400-2500 MHz is afforded from interference due to the operation of industrial, scientific, and medical devices on 2450 MHz.

(9) No protection in the band 5725-5875 MHz is afforded from interference due to the operation of industrial, scientific and medical devices on 5800 MHz.

(10) No protection in the band 24.00-24.25 GHz is afforded from interference due to the operation of industrial, scientific and medical devices on 24.125 GHz.

(11) The use of A3 and F3 in this band is limited to amateur radio stations located outside Region 2.

(12) Amateur stations shall not cause interference to the Fixed-Satellite Service operating in the band 3400-3500 MHz.

(13) The frequency 4383.8 kHz, maximum power 150 watts, may be used by any station authorized under this part to communicate with any other station authorized in the State of Alaska for emergency communications. No airborne operations will be permitted on this frequency. Additionally, all stations operating on this frequency must be located in or within 50 nautical miles of the State of Alaska.

(c) All amateur frequency bands above 29.5 MHz are available for repeater operation, except 50.0-52.0 MHz, 144.0-144.5 MHz, 145.5-146.0 MHz, 220.0-220.5 MHz, 431.0-433.0 MHz, and 435.0-438.0 MHz. Both the input (receiving) and output (transmitting) frequencies of a station in repeater operation shall be frequencies available for repeater operation.

(d) All amateur frequency bands above 220.5 MHz, except 431-433 MHz, and 435-438 MHz, are available for auxiliary operation.

(e) The following amateur frequency bands and emissions are available for automatically-controlled beacon operation: 28.20-28.30 MHz, 50.06-50.08 MHz, 144.05-144.06 MHz, 220.05-220.06 MHz, 222.05-222.06 MHz and 432.07-432.08 MHz using type AØ, A1, FØ, F1 or A2J emissions (when type F1 or A2J emissions are employed in these bands, the radio or audio frequency shift, as appropriate, shall not exceed 1000 Hz); all amateur frequency bands above 450 MHz using emission types authorized under paragraph (a) of this section. Limitations of paragraph (b) of this section apply. REF # 1

§ 97.63 Selection and use of frequencies.

(a) An amateur station may transmit on any frequency within any authorized amateur frequency band.

(b) Sideband frequencies resulting from keying or modulating a carrier wave shall be confined within the authorized amateur band.

(c) The frequencies available for use by a control operator of an amateur station are dependent on the operator license classification of the control operator and are listed in §97.7.

REF # 1 FREQ AVAILABLE, EMISSION TYPES, & FREQ SHIFT REQUIREMENTS

§ 97.65 Emission limitations.

(a) Type AØ emission, where not specifically designated in the bands listed in §97.61, may be used for short periods of time when required for authorized remote control purposes or for experimental purposes. However, these limitations do not apply where type AØ emission is specifically designated.

REF #2

(b) Whenever code practice, in accordance with §97.91(d), is conducted in bands authorized for A3 emission tone modulation of the radiotelephone transmitter may be utilized when interspersed with appropriate voice instructions.

(c) On frequencies below 29.0 MHz, the bandwidth of an F3 emission (frequency or phase modulation) shall not exceed that of an A3 emission having the same audio characteristics.

(d) On frequencies below 50 MHz, the bandwidth of A4, A5, F4 and F5 emissions shall not exceed that of an A3 single-sideband emission.

(e) On frequencies between 50 MHz and 225 MHz:

(1) The bandwidth of A4 and A5 singlesideband emissions shall not exceed the bandwidth of an A3 single-sideband emission.

(2) The bandwidth of A4 and A5 doublesideband emissions shall not exceed the bandwidth of an A3 double-sideband emissions.

(3) F4 and F5 emissions shall utilize a peak carrier deviation no greater than 5 kHz and a maximum modulating frequency no greater than 3 kHz or, alternatively, shall occupy a bandwidth no greater than 20 kHz. (For this purpose the bandwidth is defined as the width of the frequency band, outside of which the mean power of any emission is attenuated by at least 26 decibels below the mean power level of the total emission. A 3 kHz sampling bandwidth is used by the FCC in making this determination.)

(f) Below 225 MHz, an A3 emission may be used simultaneously with an A4 or A5 emission on the same carrier frequency, provided that the total bandwidth does not exceed that of an A3 double-sideband emission.

§ 97.67 Maximum authorized transmitting power.

(a) Notwithstanding other limitations of this section, amateur radio stations shall use the minimum transmitting power necessary to carry out the desired communications.

(b) Each amateur radio transmitter may be operated with a peak envelope power output (transmitter power) not exceeding 1500 watts, except as provided in paragraph (a) of this section. Other limitations of this section and §97.61 also apply.

(c) Within the limitations of paragraphs (a) and (b) of this section, the effective radiated power of an amateur radio station in repeater operation shall not exceed the power specified for the antenna height above average terrain [in the table above.]

(d) The peak envelope power output (transmitter power) of each amateur radio transmitter shall not exceed 200 watts when transmitting in any of the following frequency bands:

(1) 3700-3750 kHz;

(2) 7100-7150 kHz (7050-7075 kHz when the terrestrial location of the station is within Region 1 or 3);

(3) 21100-21200 kHz;

(4) 28100-28200 kHz.

(e) Within the limitations of paragraph (a) of this section, the peak envelope power output of an amateur radio station in beacon operation shall not exceed 100 watts.

REF #3

(f) An amateur radio station may transmit A3 emissions on or before June 1, 1990 with a transmitter power exceeding that authorized by paragraph (b) of this section, provided that the power input (both radio frequency and direct current) to the final amplifying stage supplying radio frequency power to the antenna feedline does not exceed 1000 watts, exclusive of power for heating the cathodes of vacuum tubes. Limitations of paragraphs (a), (c) and (d) of this section and limitations of §97.61 still apply.

REF #2 AØ EMISSION LIMITATIONS

REF #3 BEACON POWER LEVEL LIMITATIONS

97.84 Station Identification

(3) When identifying by radiotelephony, a station in beacon operation shall transmit the word "beacon" at the end of the station call sign. When identifying by radiotelegraphy, a station in beacon operation shall transmit the fraction bar $\overline{DN}$ followed by the letters "BCN" or "B" at the end of the station call sign. This station identification shall be made at intervals not to exceed one minute during any period of operation.

(e) A station in auxiliary operation may be identified by the call sign of its associated station.

(f) When operating under the temporary operating authority permitted by §1.925(e) with privileges which exceed the privileges of the licensee's permanent operator license, the station must be identified in the following manner

(1) On radiotelephony, by the transmission of the station call sign, followed by the word "temporary," followed by the identifier code(s) shown on the certificate(s) for successful completion of an amateur radio operator examination.

(2) On radiotelegraphy, by the transmission of the station call sign, followed by the fraction bar $\overline{DN}$, followed by the identifier code(s) shown on the cetificate(s) for successful completion of an amateur radio operator examination.

(g) The identification required by this section shall be given on each frequency being utilized for transmission and shall be made in one of the following manners:

(1) By telegraphy using the international Morse code (if this identification is made by an automatic device used only for identification, the code speed shall not exceed 20 words per minute);

REF #4
MAXIMUM CW SPEED FOR IDENTIFICATION

(2) By telephony using the English language (the Commission encourages the use of a nationally or internationally recognized standard phonetic alphabet as an aid for correct telephone identification);

(3) By telegraphy using any code authorized by §97.69(b), when the particular code is used for transmission of all or part of the communication or when the communication is transmitted in any digital code on frequencies above 50 MHz; or

(4) By video using readily legible characters when A5 emissions are used, the monochrome portions of which conform, at a minimum, to the monochrome transmission standards of §73.682(a)(6) through §73.682(a)(13), inclusive (with the exception of §73.682(a)(9)(iii) and §73.682(a)(9)(iv)).

(h) At the end of an exchange of third-party communications with a station located in a foreign country, each amateur radio station shall also give the call sign of the station with which third-party communications were exchanged.

§ 97.87 Beacon operation.

(a) A station in beacon operation shall not concurrently operate on more than one frequency in the same amateur frequency band, from the same location.

(b) A station in beacon operation, either locally controlled or remotely controlled, may also be operated by automatic control when devices have been installed and procedures have been implemented to ensure compliance with the rules when the duty control operator is not present at a control point of the station.

(c) Beacon operation shall cease upon notification by an Engineer-in-Charge of a Commission field facility that the station is operating improperly or causing undue interference to other operations. Beacon operation shall not resume without prior approval of the Engineer-in-Charge.

(d) The licensee of an amateur radio station, before modifying an existing station in automatically-controlled beacon operation in the National Radio Quiet Zone, or before placing his/her station in the National Radio Quiet Zone, shall give written notification thereof to the Director, National Radio Astronomy Observatory, P.O. Box 2, Green Bank, West Virginia 24944. Station modification is any change in frequency, power, antenna height or directivity, or the location of the station. In such cases, the rules of §97.85(f)(1), (2) and (3) shall apply.

REF #5

BEACON OPERATION

DEFINITION OF "BEACON"

Beacon Operation

A beacon station is simply a transmitter that alerts listeners to its presence. In the Radionavigation Service beacons are used to provide navigational guidance. In the Amateur Service, beacons are used primarily for the study of radio-wave propagation — to allow amateurs to tell when a band is open to different parts of the country or world.

The Rules define beacon operation as one-way communication conducted in order to facilitate measurement of radio equipment characteristics, adjustment of radio equipment, observation of propagation or transmission phenomena, or other related experimental activities. Automatically controlled beacon stations are limited to the following frequencies (in megahertz):

28.20-28.30	220.05-220.06	all amateur bands above 450 MHz
50.06-50.08	222.05-222.06	
144.05-144.06	432.07-432.08	

Emissions authorized for beacon operation are AØ, A1, FØ, F1 or A2J (when type F1 or A2J emissions are used below 450 MHz, the radio or audio-frequency shift, as appropriate, must be less than 1000 Hz. All amateur frequency bands above 450 MHz are available for beacon operation with the general emission limitations specified for each band. The minimum amount of power necessary to fulfill the function of the beacon must be used, provided peak envelope power output does not exceed 100 watts.

Beacons are identified with the letters BCN or B at the end of the call sign — K1CE/BCN, for example. On phone, the word "beacon" is added to the phone ID. Identification must be made at least *once* per minute.

A station in beacon operation must not operate concurrently on more than one frequency in the same frequency band from the same location.

A station in beacon operation may be controlled automatically (that is, no control operator is present) if devices and procedures are used to prevent Rules violations. Such devices and procedures include locked cabinets or doors, and limited disclosure of command codes.

BEACONS — AUTOMATIC CONTROL APPROVED

In Docket 81-823, the Commission amended its rules to authorize automatic control for Amateur Radio stations transmitting one-way "beacon transmissions to detect unusual propagation conditions and to check out and adjust radio equipment." Previously, beacon operations required manual control with the operator present at all times, though the Commission did routinely grant STAs to circumvent this requirement. That experience, in fact, helped convince the FCC that automatic control was adequate for complying with all the other rules.

Comments received on the proposal were generally supportive, though there was unanimous disagreement with the Commission's choice of frequencies to authorize beacon operation in the 10-meter band. The ARRL was concerned that provisions restricting *manually* controlled beacon operation to specific beacon subbands not be included because that would restrict experimentation.

The Commission cautioned that, while it was not placing frequency restrictions on manually controlled beacon operations, it "would not stand for illegally caused interference." Therefore, included in the rules is a provision for ordering the cessation of beacon operation when a station is operating improperly or causing undue interference.

Effective January 3, 1983, these new rules apply:

- *FCC-approved frequencies for automatically controlled beacon operation are*

28.20-28.30 MHz
50.06-50.08 MHz
144.05-144.06 MHz
220.05-220.06 MHz
222.05-222.06 MHz
432.07-432.08 MHz
All amateur bands above 450 MHz

REF #6

- *manually controlled beacon operations are not frequency restricted.* ← MANUALLY CONTROLLED (Attended)
- *AØ, A1, FØ, F1 or A2J emissions are authorized for beacon use.* When F1 or A2J are used, the radio or audio shift must be less than 900 Hz.
- *maximum power is 100-W input.* ← POWER LEVELS CHANGED TO OUTPUT JAN '84 per FCC
- *beacons must identify once each minute with the station call sign followed by the slant bar and the letters* BCN *or* B *(while using cw), or "beacon" (while using phone).* This station identification shall be made at intervals not to exceed one minute during any period of operation.
- *no beacon can operate on more than one frequency in the same band from the same location.*
- *automatic beacons operating in the National Radio Quiet Zone must follow special rules* (see June 1981 *QST*, page 54).
- *automatically controlled beacons must have devices installed and procedures implemented to ensure compliance with the rules when the duty control operator is not present at a control point of the station.*
- *beacon operation shall cease upon notification by any engineer-in-charge of a Commission field facility that the station is operating improperly or causing undue interference.* Beacon operation shall not resume without prior approval of the engineer-in-charge.

QST JAN 83

VHF BEACONS - A MAJOR RESOURCE FOR THE VHF'er

GENERAL DISCUSSION OF BEACONS

- Discuss what constitutes a Beacon
- Copy of FCC Rules regarding Beacons
- Attended vs UnAttended Beacons
- Frequencies and power levels available to each

AWARENESS FOR USERS AND OWNERS

- #1 Priority - 100% Availability!
- Constant ERP (power level)
- Constant Antenna Pattern
- Frequency Stability
- Beacon ID'er should Provide:
    - Grid Location
    - Call Letters
    - City and State
    - Effective Radiated Power
    - Antenna Polarization (Horiz, Vert, Omni, RH, LH)
    - Status (Experimental, Operational, Test)
    - Optional - Phone Number to call if no one else is on.
- Discuss costs incurred and value of reports returned

DX USES (Means you don't hear it most of the time)

- PROPAGATION! BAND OPENING!!!!!!!!!
- Provides first indication of an opening on a quiet band
- Help determine Type of DX Opening
- Check several beacons for extent of opening
- METEOR SHOWERS
    - Add stripchart recorder and determine peak of meteor shower also experiment with beam heading and elevation

VHF BEACONS - A MAJOR RESOURCE FOR THE VHF'er

LOCAL USES (Defined as hearing it the majority of the time)

- Use as a signal reference for station modifications
    - check coax
    - relays
    - preamps
    - feedlines
    - filters
    - etc
- Receiver system check
    - Complete system check of the receiving system
    - Comparison of different rigs/receivers
    - Frequency Checks
    - Check width of RIT
    - Drift-Frequency Stability
    - Squelch Check for sensitivity
    - Attenuator Checks
- Tower and Antenna
    - Calibrate Rotor - Azimuth
      did antenna or mast slip in rotor?
    - Plot Antenna Patterns
    - Verify antenna improvements
        - Replaced old yagi with new widgit
        - Went to multiple antennas - are they stacked correctly?
    - Check antenna lobes for moisture or iced up antennas
    - Verify antenna height in regards to tree foliage, etc
- Group Discussions
    - Frequency
    - Signal Strength
    - Relative "Quality" of the receiving stations
    - Update each other on Beacon changes

VHF BEACONS - A MAJOR RESOURCE FOR THE VHF'er

UNUSUAL USES

- Code Practice
- Debug computer hardware/software for code reception
- Check out equipment at hamfests (Buying and Selling)
- Demonstrating your station to visitors
- Depending on how LOCAL....
    - Can watch for local propagation enhancements
    - If real close, use it as signal source in an antenna range
- Bring along on DX'pedition to check out system
- Provides signals for those with SSB handhelds while Flying
- Uses for the Beacon Owner
    - Great for club discussions
    - How they replace repeater usage by serious VHFers

DISCUSS AND RECORD "Where's the Beacons?

DISCUSS BEACON PROPOSAL - The "L E D S" System

- de W0VB/B /EN34SB/400H/OMNI/STABLE
- format: / LOCATION / ERP+POLARIZATION / DIRECTIVITY / STATUS

CENTRAL STATES VHF SOCIETY
BEACON LIST
JUNE 1985

FREQ	CALL	GRID SQ	EIRP	LOCATION
50.005	VE8R			NW TERRITORY
50.005	W0HTH/KH6			HI
50.008	K0GUV			MN
50.040	WA6MHZ			SAN DIEGO, CA
~~50.040~~	~~KL7CDG~~			ALASKA
50.045	WB2MAI			NJ
50.048	WA6IJZ			CA
50.048	VE6ARC			ALBERTA
50.050	VE6NAB			?
50.050	VE8VHF			NW TERRITORY
50.050	WA1EXN			MAINE
~~50.050~~	~~K6FV~~			CA
50.055	WA9FEF			IL
50.056	N4NZ			
50.058	WA8IGY			FL
50.060	KH6EQI			HI
50.060	WA8ONQ		1	OH
50.062	W3VD	FM 19	0.1	LAUREL, MD
50.064	WB4IJY/4			FL
50.065	W0IJR		20	DENVER, CO
50.065	WB5ZRL		2	LA
.066	N6AMG			
50.070	KS2T			TOM'S RIVER, NJ
50.070	VP9WB			BERMUDA
50.070	K0HTF	EN 31 DX	2	DES MOINES, IA
50.071	W0BJ			NE
50.072	VE1CCP			PRINCE EDWARD IS
50.072	WA2YTM	FN 12 NH	15	ROCHESTER, NY
50.073	W7KMA			AZ
50.075	K5JM	EL 49	2	OK
50.077	N0LL	EM 09		N KANSAS
50.077	VE3DRL			TORONTO, ONT
50.080	W1AW			CT
50.085	WA6JRA			N CA
50.088	VE1ASJ			ST JOHN'S, NEW BRUNSWICK
50.088	VE1SIX			NEW BRUNSWICK
50.090	WA6JRA			CA
50.093	WA8FTA			MICHIGAN
50.095	K7IHZ			AZ
50.098	KG6JIH			GUAM
50.100	KH6EJQ			HI
50.103	N8AJD			OH
50.104	K4EJQ			TN
50.110	KG6DX			GUAM
~~50.110~~	~~AL7C~~			ALASKA
50.440	K1NFE	FN 31 MR	25	BURLINGTON, CT

FREQ	CALL	GRID	ERP	LOCATION
144.051	WB9VMY		2	OKLAHOMA CITY, OK
144.051	WB2IEY	FN 12 NH	3-15	ROCHESTER, NY
144.053	W0VB	EN 34	100	ROCHESTER, MN
144.054	WB2RJL	EL 98	10	ORLANDO, FL
144.055	WB0QIY			NB
144.055	K0PP/7		40	SW MONTANA
144.055	K0NG	EN 10	10	LINCOLN, NB
144.056	~~K5JL~~ KJ5Q			OKLAHOMA CITY, OK
144.056	W0PN	EN 36	100	DULUTH, MN
144.064	W5VAS		2	SE LA
.057	KH6HME			
220.052	KA0ADV/2	FN 12 NH	15	ROCHESTER, NY
220.055	WB4FQR	FM 18	13	WOODBRIDGE, VA
431.095	VE1SMU			NOVA SCOTIA
432.073	K0NG	EN 10		LINCOLN, NE
432.075	WA8ONQ			OH
432.075	WA4PGI			VA
432.077	N0UU	EM 19	7	ABILENE, KS
432.070	W4ODW		4	FL
.074	KH6HME			
1296.125	KF5N	EM 12	5	ARLINGTON, TX
1296.2[illegible]0	W4ODW		1.5	FL
1296.000	KH6HME			
2304.?	K3MTK		10	PROPOSED ?

Please note any errors or additions. I am trying to keep this as up to date as possible. I have not heard from all these stations so if you know one of these operators please have him confirm his beacon data. I have a blank data sheet I will send to anyone interested.

Report changes to:

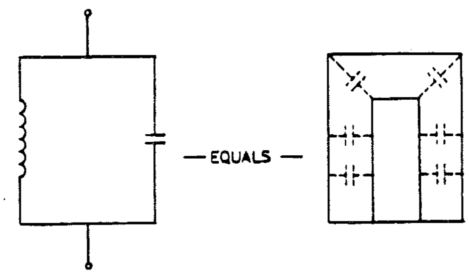
Barry Buelow WA0RJT
4110 Emerson Ave. N.E.
Cedar Rapids, IA 52402
319-393-2969 Central Time (8-10PM) Central Time

COAXIAL CAVITY AMPLIFIERS

Buzz Miklos WA4GPM
R&D Engineer
EIMAC Div. of Varian
1678 Pioneer Road
Salt Lake City, UT 84102

I. COAXIAL CAVITY THEORY FUNDAMENTALS

The coaxial cavity resonator is nothing more than an extension of the LC tuned circuit used on the lower frequencies. The inductor or coil becomes the walls of the cavity and the capacitor becomes the distributed capacitance along the coaxial lines.



LUMPED OR DISTRIBUTED
ELEMENT EQUIVALENCE

For the low frequency circuit, the condition of resonance is met when the capacitive reactance equals the inductive reactance or

$$\frac{1}{j\omega C} = j\omega L$$

For the coaxial circuit the same conditions must hold true. Since the values of inductance and capacitance are distributed along the line it is a little more difficult to mathematically describe resonance. A good approximation, however, which will lead to the length of the coaxial line is a relationship based on the input inpedence of the line.

$$Z_{in} = jZ_o \tan \theta$$

If we try to match the line to the foreshortening capacitance C_o, we will have

$$\frac{1}{j\omega C_o} = jZ_o \tan \theta$$

where C_o is the forehortening capacitance at the top of the line, jZo is the characteristic impedance of the line and θ is the electrical length of the line in degrees. To use the above formula, it may help to review that the characteristic impedance of the line is given by

$$Z_o = 138 \log \frac{D_1}{D_2}$$

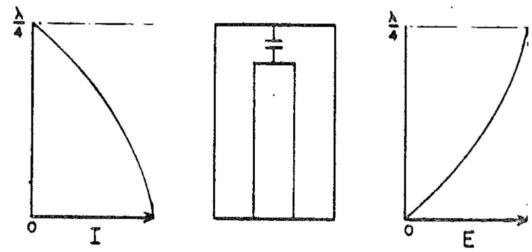
and the wavelength is defined by:

$$\frac{3 \times 10^8 \text{ meters/sec}}{F_{MHZ}} \quad \text{or} \quad \frac{11808}{F_{MHZ}} = \lambda \text{ inches}$$

II. COAXIAL LINE CHARACTERISTICS

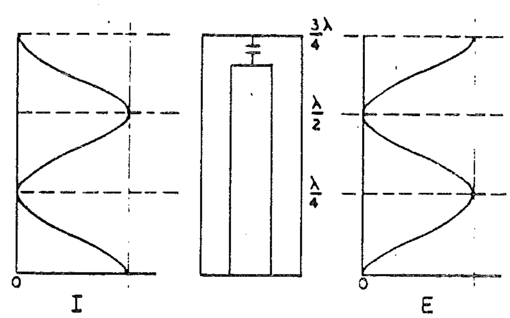
A. Voltage-current Distribution

For a quarter-wave line the voltage and current distributions are shown below.



VOLTAGE & CURRENT DISTRIBUTION ALONG $\frac{\lambda}{4}$ LINE

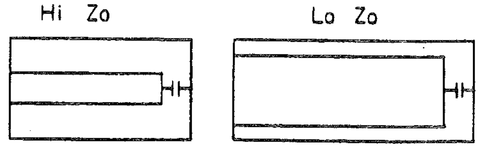
For longer lines the voltage and current distribution will repeat every half wavelength. Note the distribution for the 3/4 wave line shown below.



CURRENT & VOLTAGE DISTRIBUTION ALONG $\frac{3\lambda}{4}$ LINE

B. Length of Line vs. Characteristic Impedance

The physical length of coaxial lines is dependent mainly on frequency but also on the characteristic impedanceof the line. A line with a high Zo will be shorter than a similar line resonant for the same frequency, but with a lower Zo.



BOTH LINES RESONANT AT SAME FREQUENCY

C. Bandwidth

The quarter-wave coaxial resonator can be characterized as having the least losses and the highest gain bandwidth in amplifier operation. Longer lines such as 3/4 and 5/4 wave lines are characterized by greater losses and decreased bandwidth. This is partially explained by the fact that these longer lines have increased stored energy associated with them and have a higher loaded Q. If possible, designing for a high characteristic impedance (50 to 90 ohms) with 1/4 wave resonance will result in a more efficient circuit than one with a longer length line.

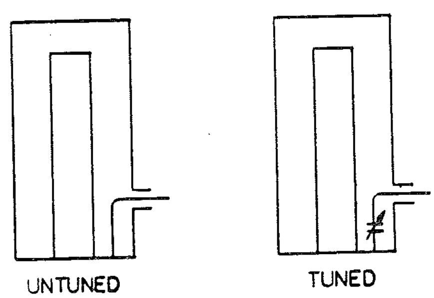
III. COUPLING

Coupling energy into and out of a coaxial resonator is accomplished with any one of several coupling methods. The most popular are the capacitive probe and the inductive loop.

A. Loop Coupling

Inductive or loop coupling couples the R.F. energy via the magnetic field and will be at a maximum when the loop is placed at the point of maximum current along the line. Such a loop will also act as an impedance transformer and perform a matching function between the coaxial line and the load.

The simplest form of inductive coupling is an untuned loop. This form is usually fixed in size and position so that the degree of coupling is also fixed.

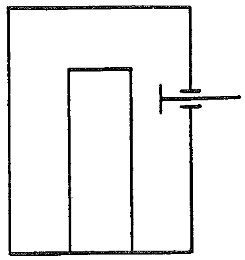


INDUCTIVE OR LOOP COUPLING

By adding a capacitor in series with the loop, the reactance of the loop can be tuned out and the circuit is able to cope with high standing wave ratios on the outgoing transmission line. The degree of coupling, however, is still fixed unless some means are provided to vary the position of the loop.

B. Capacitive Probe.

Capacitive coupling couples energy from the high-voltage point of the coaxial line. The coupling is varied by moving the probe nearer to, or farther from the center conductor of the coaxial line.

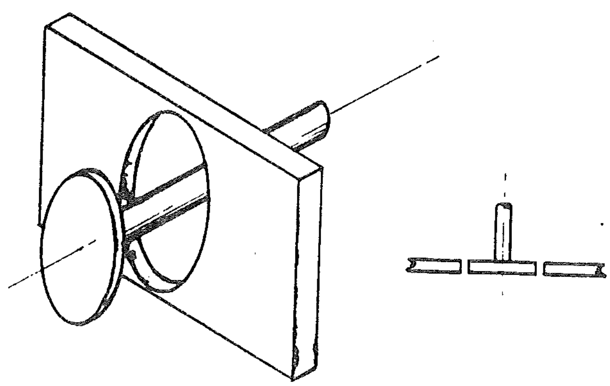


CAPACITIVE PROBE COUPLING

The capacitive probe also affords an impedance match between the high impedance of the line and the low impedance of the output line. The value of the capacitance is usually quite low, in the order of a few picofarads.

C. Combined probe and loop.

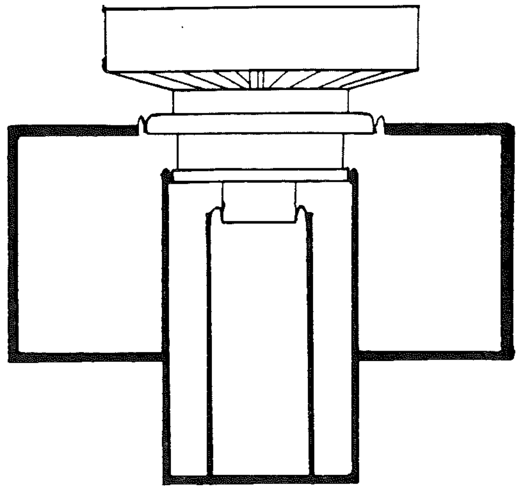
In some cases where a coaxial line is made to tune over a very wide frequency range the coupling must also be made to move in order to be efficient. If this is impractical, it might be easier to combine capacitive and loop coupling and thereby simplify the mechanical design. Shown below is an example of probe-loop coupling.



When the probe is close to the fixed arm, the coupling is similar to loop coupling with a variable amount of capacitance depending upon the proximity of the probe to the fixed arm. As the probe is moved further away from the fixed arm, the coupling tends to be more capacitive. This type of coupling is found on many types of military surplus cavities and is shown here for the purpose of understanding what might be found in some of these circuits.

IV. DESIGN EXAMPLE - Y-846 TO OPERATE AT 1296 MHZ

We desire to operate the tube using a coaxial resonator on input and output and be of such design that the tube can be easily replaced and tuned. This suggests a cavity following the outline shown below.



1. Determine wavelength for 1296 MHZ

$$\frac{11808}{1296} = 9.1111 \text{ inches}$$

2. Determine the characteristic impedance of line. (This is a practial consideration based on what sizes of tubing are available and the size of the contact surfaces of the tube.

   For our case, let the I.D. of the anode be 3.75 inches and the O.D. of the grid line be 2.00. Therefore,

$$Z_o = 138 \log (3.75/2.00) = 34.94\Omega$$

3. Next, calculate the capacitive reactance of the anode. From the data sheet C_o for the Y-846 is 8pf. Therefore,

$$X_c = \frac{1}{j\omega C_o}$$

$$= \frac{1}{2 * \pi * 1.296 \times 10^9 \times 8 \times 10^{-12}}$$

$$= 15.35\Omega$$

4. Now use the general formula for coaxial lines where

$$jXc = jZ_o \tan \theta$$

$$\theta = \tan^{-1} \cdot \left(\frac{15.35}{34.94}\right)$$

$$\theta = 23.71^o$$

the line length in degrees must now be converted to inches by simply using the relationship

$$\frac{\theta \cdot \lambda}{360} = \text{inches}$$

$$\frac{23.71 * 9.1111}{360} = .6001 \text{ inches}$$

5. Since .6001 inches would be an impractical length for a plate line--we will add a half wavelength and use a 3/4 wave line.

$$.6001 + (9.1111/2) = 5.156 \text{ inches}$$

6. Input Line: Follow the same procedure for the grid/cathode line using the appropriate value for C_{in} and a practical Zo.

I.D. of Grid Line 1.75

O.D. of Cathode 1.125

C_{gk} = 18pf

Calculate Z0 = 138 Log (1.75/1.125) = 26.48Ω

Calculate Xc = $\frac{1}{j\omega C_{gk}}$ = 6.82Ω

Calculate length of 1/4 wave line in electrical degrees

$$\theta = \tan^{-1} \cdot \left(\frac{6.82}{26.48}\right)$$

Calculate line length in inches.

$$\frac{14.443 * 9.1111}{360} = .3655 \text{ inches}$$

Since 1/4 wave line is too short to be practical, make it a 5/4 wave line. Length is then

$$.3655 + 9.111 \quad = \quad 9.4766 \text{ in.}$$

7. Output tuning and coupling.

Since the cavity is designed to operate over a narrow frequency range, a single capacitive element will be added to the anode line rather than changing the length of the line with a plunger. Not more than 1 to 1.5 pf will be required and this can be easily done with a 3/4" disc soldered to the end of a 3/8 X 24 screw in the anode line side wall. It must be placed at a voltage maximum which would be 1/4 wave above the bottom end of the anode line. Therefore, the tuning cap should be

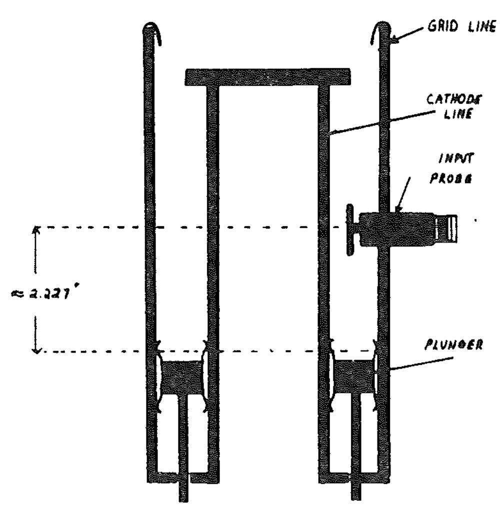
$$9.1111/4 = 2.27 \text{ inches above the bottom}$$

of the anode.

Likewise the output probe is placed 1/4 wave above the cold end of the cavity and a 3/4" disc will provide the required capacitance. An outline drawing for an output probe is included in the appendix.

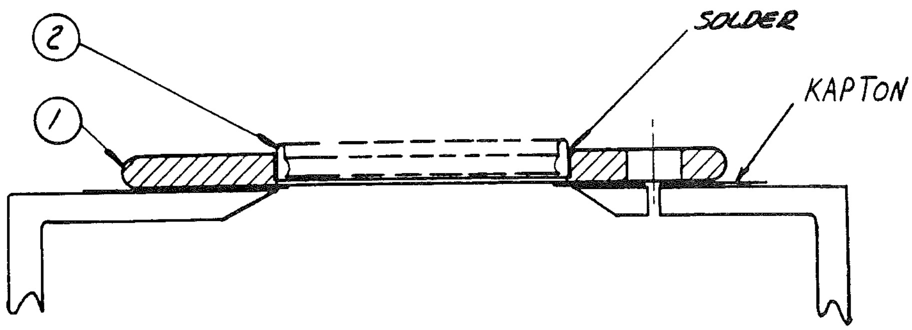
8. Input tuning and coupling.

To accomplish a good input VSWR a plunger is chosen to tune the grid/cathode line and a capacitive probe is used to match the input to the line. The placement of the input probe has to be estimated to some extent since the final position of the plunger is variable. However, it still must be placed 1/4 wave above the plunger position and for this cavity 2.227 inches above the predicted position of the plunger.

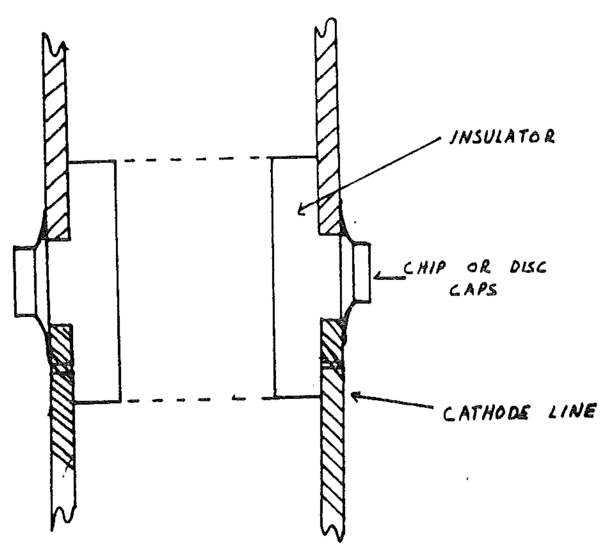


9. Bypassing and Voltage Feed.

The plate bypass is a simple capacitor made with KAPTON. This material has excellent high voltage hold off, does not cold flow like teflon and has a dielectric constent of about 3.6. An example design is shown below using 5 mil KAPTON which will hold off over 10KV and provide 200pf of capacitance.

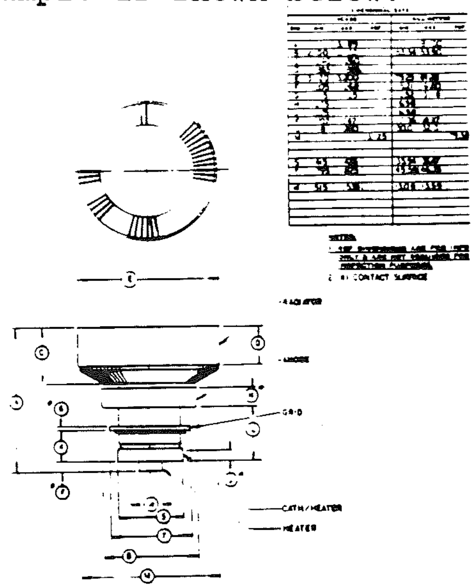


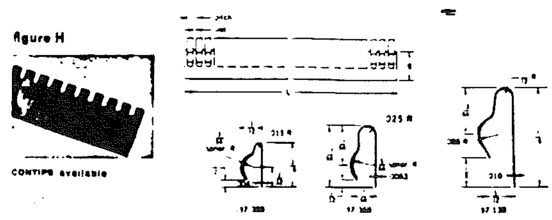
The cathode needs to be insulated above ground for bias purposes and this can be accomplished by splitting the line with an insulator near the tube and bridging the dis-continuity with capacitors. Four to eight chip capacitors or ceramic disc caps of about 100 pf each will be sufficient for this part of the circuit. Since the split occurs at a voltage minium on the line no choke is needed when bringing the bias and filament line into the cathode.



10. Finger stock and contact surfaces.

Finger stock provides a flexible, low inductance contact to the tube as well as allowing for easy tube installation and removal . When designing collets for finger stock use the dimensions supplied by the manufacturer of the fingers and the outline drawing of the tube to determine the proper dimensions. Providing .015" to .025" interference per side between tube surface and finger will result in a snug fit. A design example is shown below.





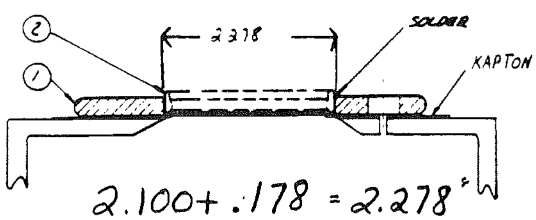
1. ANODE FLANGE DIM B
   2.100 — 2.122

2. FINGER STOCK 97-360
   DEPTH 7/64 = .109

3. ALLOW .020" INTERFERENCE PER SIDE OR .040".

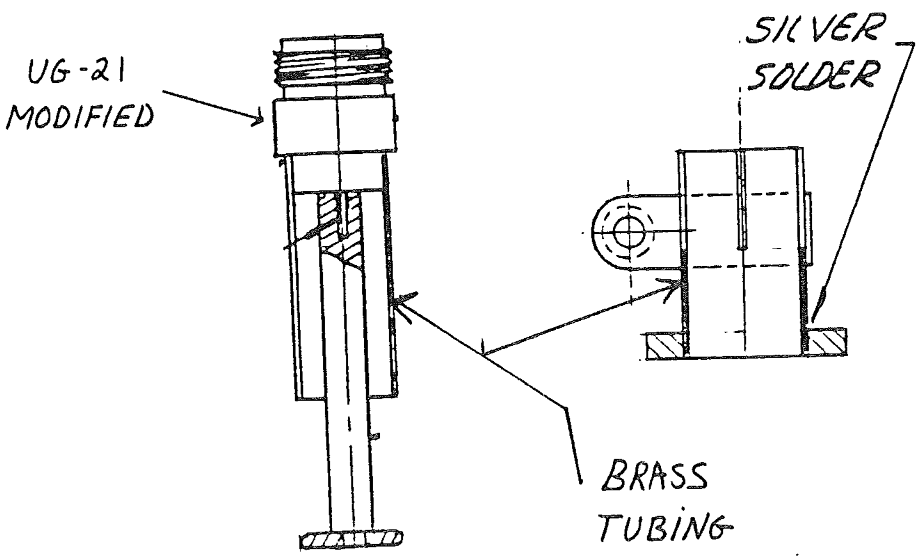
4. SUBTRACT .040 FROM THE TOTAL FINGER STOCK DEPTH FOR THE DIAMETER
   .218 - .040 = .178"

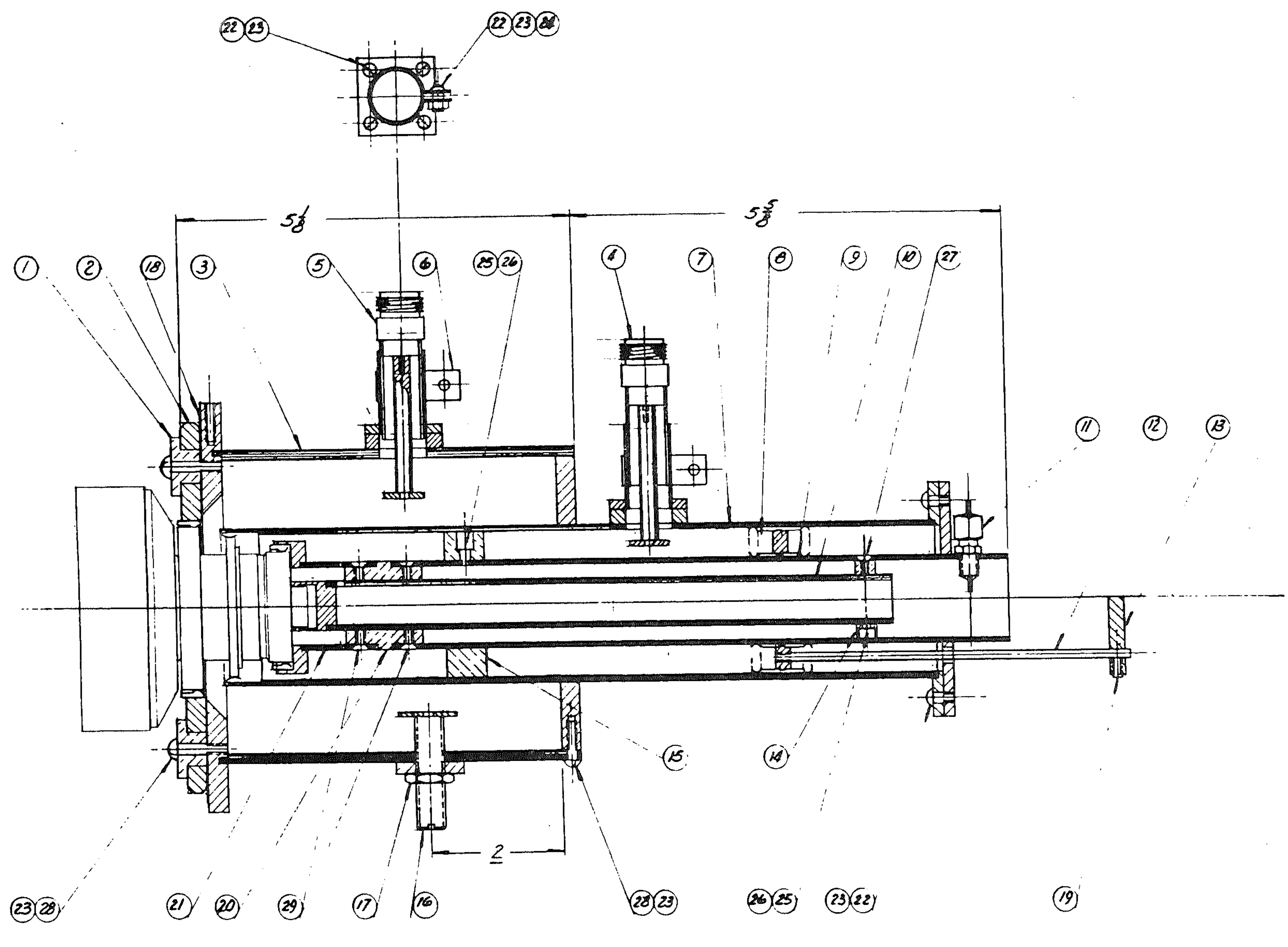
5. TO OBTAIN THE WIDTH OF THE COLLET. ADD .178 TO THE SMALLEST DIA FOR THE ANODE FLANGE.



During assembly of finger stock and collets try to avoid the use of a torch--over heating the fingers will remove the temper and they will no longer be springy. Use a hot plate to heat the work and if possible, make an aluminum plug to hold the fingers while soldering them in place.

INPUT / OUTPUT PROBE





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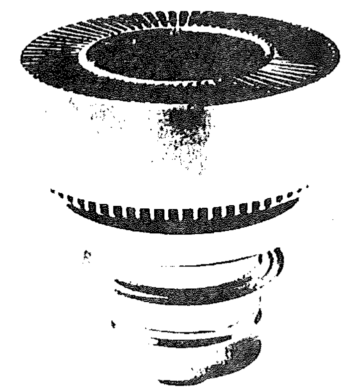
TECHNICAL DATA

PLANAR TRIODE

The Y846 is a planar triode of ceramic/metal construction and rugged design to be used especially in highly linear amplifier operations up to 1.5 GHz.

The Y846 may be used as an amplifier or an oscillator in the CW as well as the grid or plate-pulsed mode. In TV translator service, transmitting video and aural signals simultaneously in the same channel, the intermodulation distortion level is better than -52 dB.



GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential

Heater: Voltage	5.7 ± 0.15V
Current, at 5.7V	3.3A
Transconductance (average):	
Ib = 350 mA	120 mmhos
Amplification Factor (average):	160
Direct Interelectrode Capacitance (grounded cathode)[2]	
Cin	18.0pF
Cout	0.07pF
Cgp	7.3pF
Frequency of Maximum Rating:	1.5 GHz

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. Varian EIMAC should be consulted before using this information for final equipment design.

2. Capacitance values are for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid-cathode capacitance will increase from the cold value by approximately 2pF due to thermal expansion of the cathode.

4695 4/84 2500

Printed in U.S.A.

Varian EIMAC/1678 South Pioneer Road / Salt Lake City / Utah 84104 / 972-5000

MECHANICAL

Maximum Overall Dimensions:	
Length	3.188 in; 81.0 mm
Diameter	3.180 in; 80.8 mm
Net Weight	35.3 oz; 1000 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250° C
Cooling	forced air

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.
Heater: Current at 5.7 volts	3.0	3.5 amps
Cathode Warmup Time	120	— sec.
Interelectode Capacitance* (grounded cathode connection)		
Cin	16.0	20.5 pF
Cout	—	0.07 pF
Cgp	7.0	7.9 pF

* Capacitance values are for a cold tube as measured in a special shielded fixture.

AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	3000 VOLTS
PEAK PULSE PLATE VOLTAGE	3500 VOLTS
DC GRID VOLTAGE	-150 VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE	
Grid negative to cathode	300 VOLTS
Grid positive to cathode	30 VOLTS
DC PLATE CURRENT	0.6 AMPERES
DC GRID CURRENT	0.05 AMPERES
AVERAGE PLATE DISSIPATION	
Forced Air Cooling	1500 WATTS
GRID DISSIPATION (Average)	1.5 WATTS

TYPICAL OPERATION

Class A linear amplifier in TV translator service, aural and video signals simultaneously.

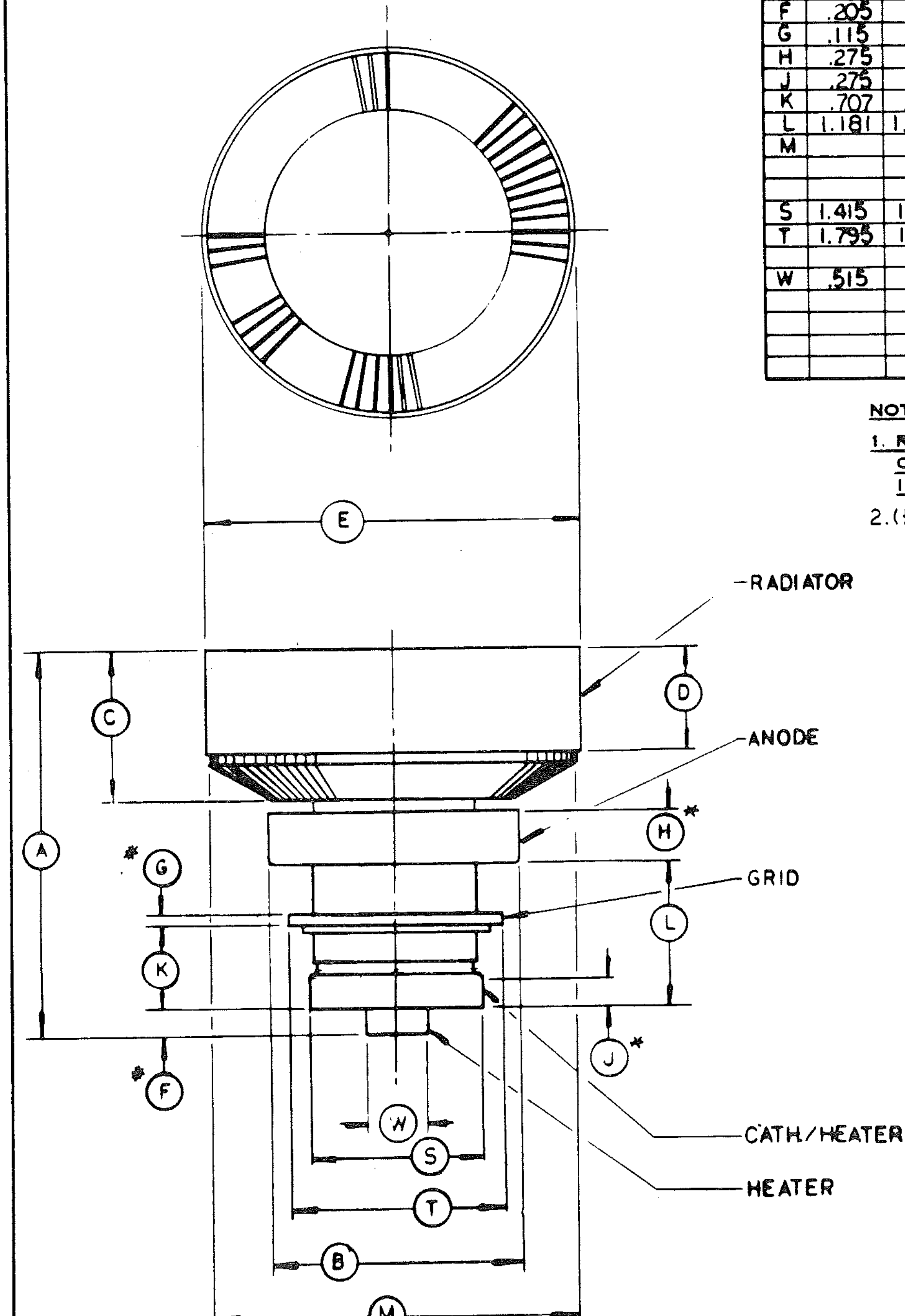
Frequency	760 MHz
Heater Voltage	5.7 VOLTS
DC Plate Voltage	2400 VOLTS
DC Grid Voltage (Approximate)	8 VOLTS
DC Plate Current	340
Gain	19 dB
Power Output (Peak Sync)	200 WATTS
IMD (3 Tone Test)	> -52 dB*

*Typically, the IMD 3-tone test data observed are -55 to -57dB depending on the cavity/circuit used and the adjustments made.

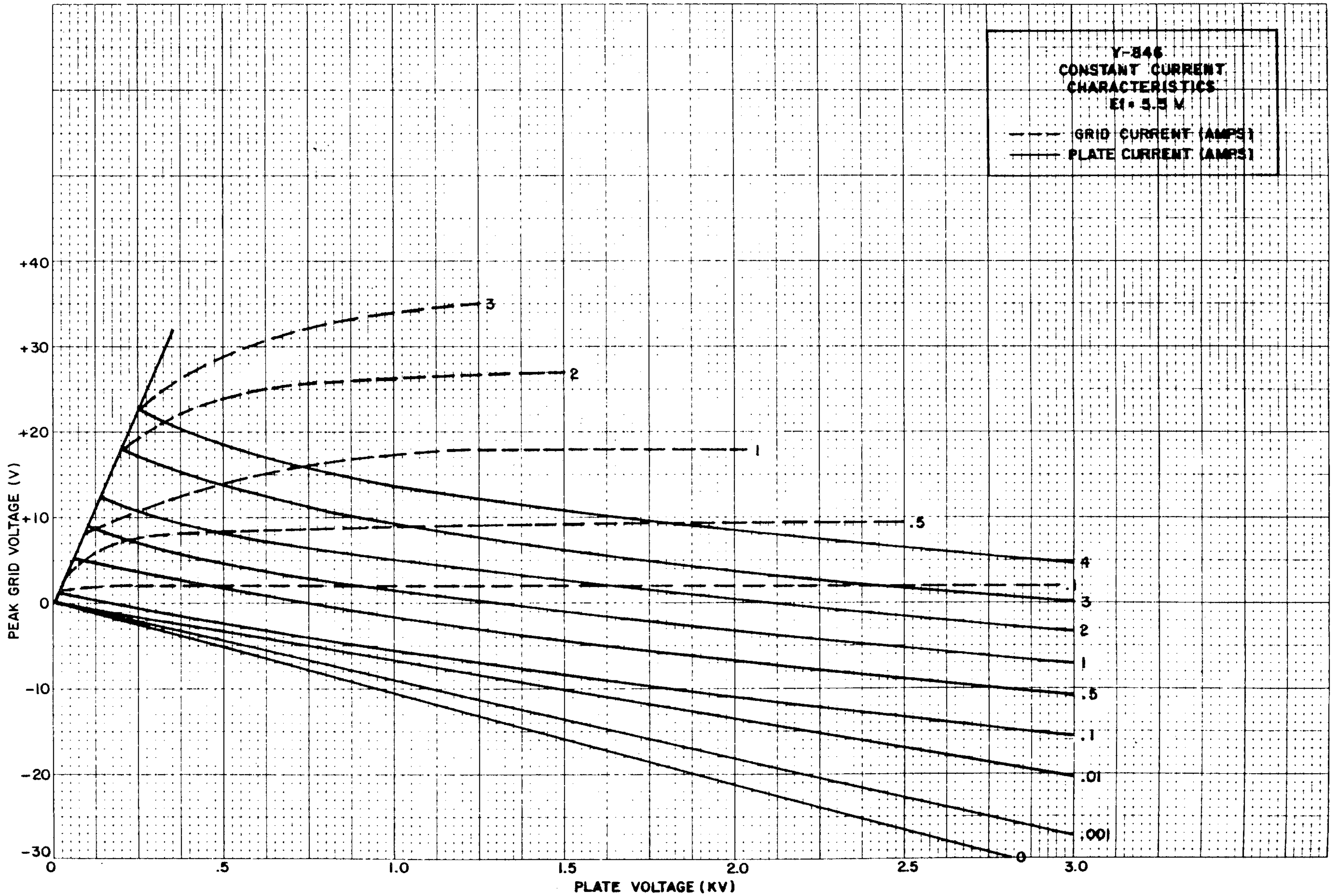
DIMENSIONAL DATA						
	INCHES			MILLIMETERS		
DIM.	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A		3.189			81.00	
B	2.100	2.122		53.34	53.90	
C	1.240	1.260				
D	.865	.885				
E	3.120	3.200		79.25	81.28	
F	.205	.268		5.21	6.80	
G	.115	.125		2.92	3.18	
H	.275			6.98		
J	.275			6.98		
K	.707	.747		17.96	18.97	
L	1.181	1.260		30.0	32.0	
M			3.125			79.38
S	1.415	1.436		35.94	36.47	
T	1.795	1.825		45.59	46.35	
W	.515	.535		13.08	13.59	

NOTES:

1. REF DIMENSIONS ARE FOR INFO ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.
2. (*) CONTACT SURFACE



MB-4002



Y-846
CONSTANT CURRENT
CHARACTERISTICS
Ef = 5.5 V
GRID CURRENT (AMPS)
PLATE CURRENT (AMPS)
PEAK GRID VOLTAGE (V)
+40
+30
+20
+10
0
-10
-20
-30
PLATE VOLTAGE (KV)
0
.5
1.0
1.5
2.0
2.5
3.0
3
2
1
.5
4
3
2
1
.5
.1
.01
.001
0

finger contact strips

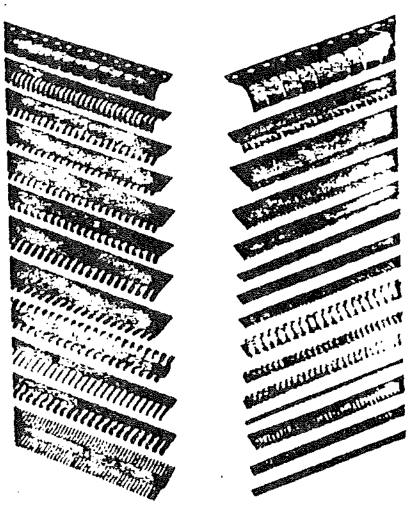
of beryllium copper, alloy 25

for grounding and shielding in high-frequency equipment . . . for forming large-diameter contact rings

A wide variety of beryllium copper finger contact strips provides engineers and designers with flexibility in the solution of grounding and shielding problems. Various lengths, widths, thicknesses, contours and hole locations are possible for many of the standard catalog items shown here.

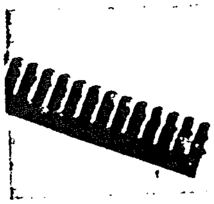
Engineering Design Kit Available

An Engineering Design Kit is available to permit the engineer the utmost latitude in his search for the exact strip configuration to effectively meet his needs. Each assortment contains short lengths of at least 34 items listed on Pages 6 through 11. Includes data sheet on elastic performance of finger strips.



Order assortment by Number 97-272.

figure A



CONTIPS available

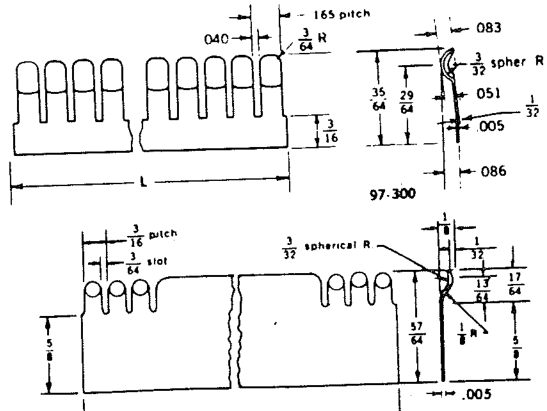
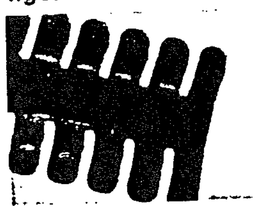


figure B



CONTIPS available

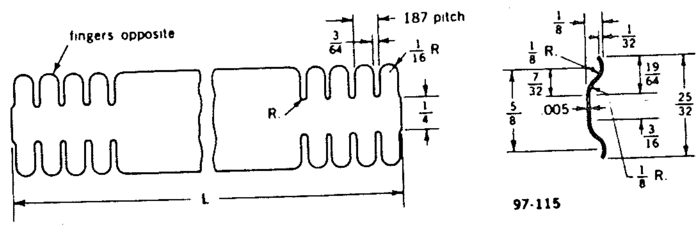
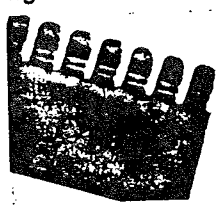


figure C



CONTIPS available on 97-111, 97-112, 97-114 and 97-116 only

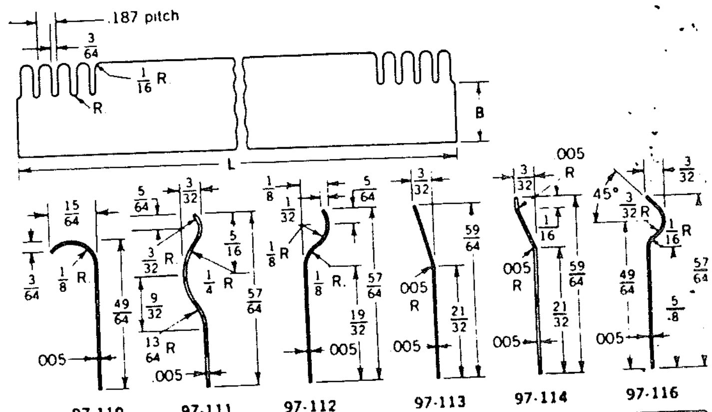
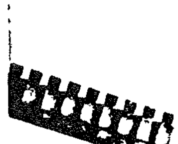


figure D



not available with CONTIPS

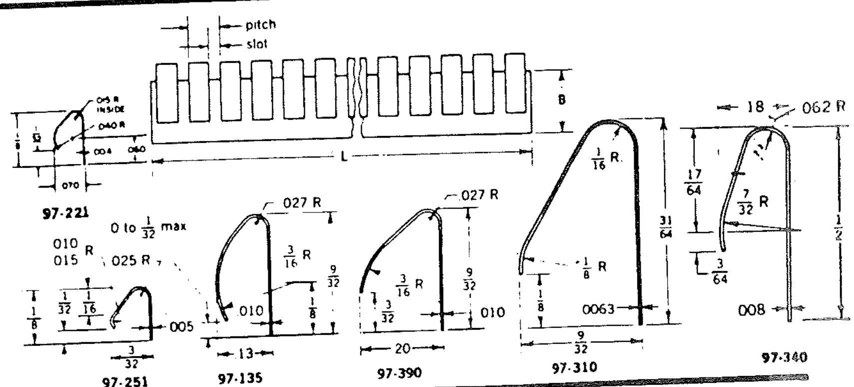
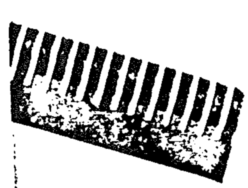
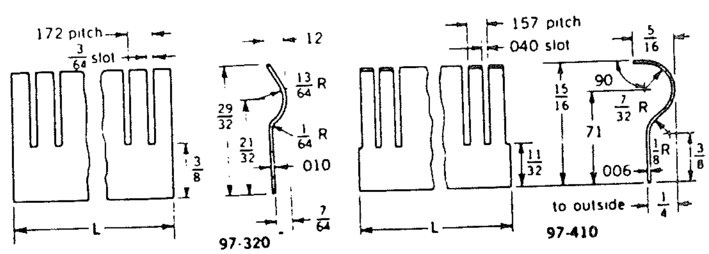


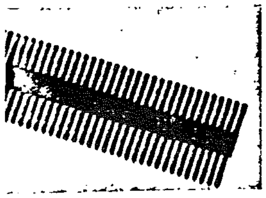
figure E

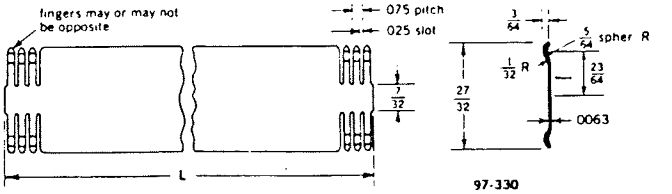


CONTIPS available



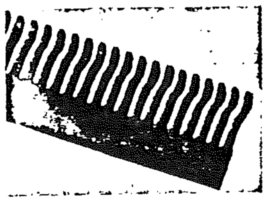
of beryllium copper

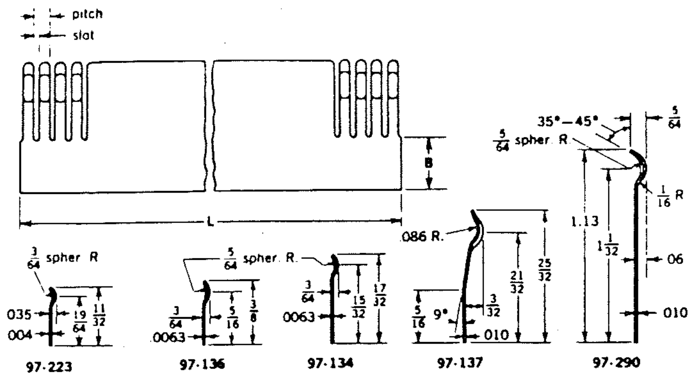




CONTIPS available

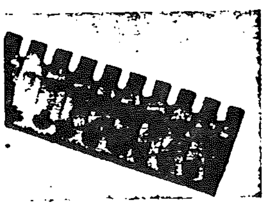
figure G

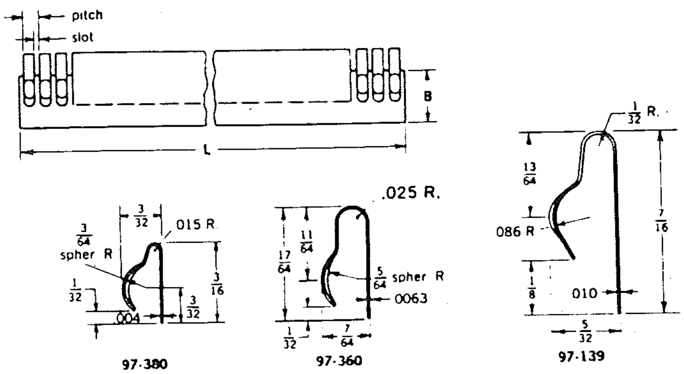




CONTIPS available

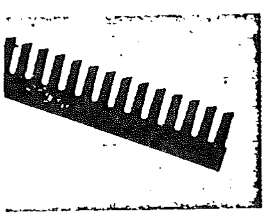
figure H

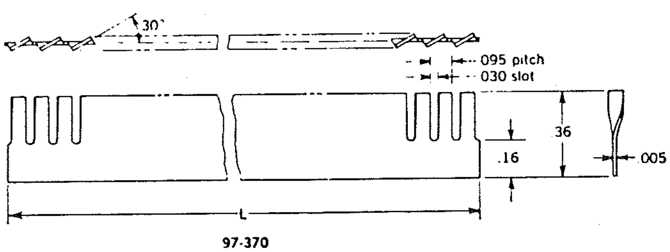




CONTIPS available

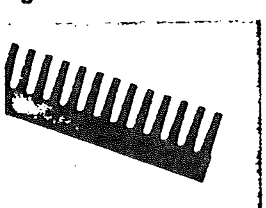
figure I

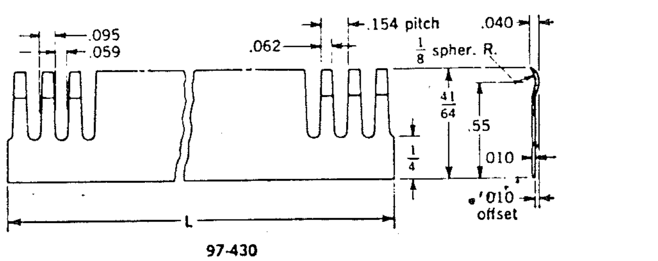




not available with CONTIPS

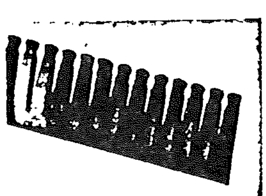
figure J

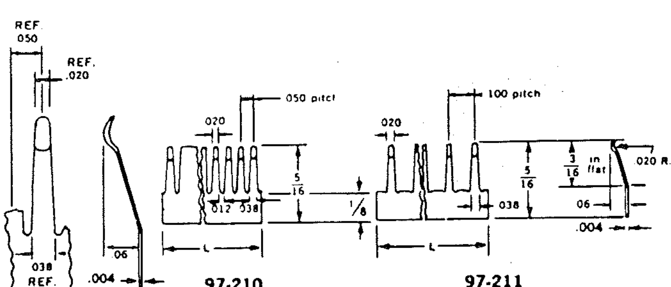




CONTIPS available

figure JJ





CONTIPS available

dimensions in inches

catalog number	figure	pitch	slot	B	stock length L■	wt. per 1000 in., lb
97-110	C	.187	.047	5/8	16	1.3
97-111	C	.187	.047	5/8	16	1.3
97-112	C	.187	.047	5/8	16	1.3
97-113	C	.187	.047	5/8	16	1.3
97-114	C	.187	.047	5/8	16	1.3
97-115	B	.187	.047		16	1.1
97-116	C	.187	.047	41/64	16	1.3
97-117	A	.187	.047	5/8	16	1.3
97-134	G	.075	.025	7/32	16	.9
97-135	D	.134	.040	15/64	16	1.4
97-136	G	.075	.025	1/16	16	.6
97-137	G	.094	.031	5/16	16	2.0
97-139	H	.094	.031	5/16	16	2.0
97-210	JJ	.050	.012	1/8	12	.5
97-211	JJ	.100	.062	1/8	12	.5
97-221	D	.060	.020	3/32	12	.3
97-223	G	.060	.020	1/8	16	.35
97-251	D	.127	.050	3/32	12	.3
97-290	G	.075	.025	11/16	16	3.0
97-300	A	.165	.040	3/16	16	.8
97-310	D	.187	.062	3/8	16	1.4
97-320	E	.172	.047	3/8	16	2.4
97-330	F	.075	.025		16	1.3
97-340	D	.163	.015	1/4	16	1.6
97-360	H	.075	.025	7/32	16	.9
97-370	I	.095	.030	.16	16	.43
97-380	H	.060	.020	1/8	16	.35
97-390	D	.134	.040	15/64	16	1.4
97-410	E	.157	.040	11/32	16-	1.8
97-430	J	.154	.059	1/4	16	1.4

■ **lengths:** Stock lengths supplied unless shorter lengths are specified . . . cut to nearest slot. Specified lengths may have partial fingers removed.

widths: Other widths and special contours available to order.

standard finishes

	add suffix to catalog number
as heat-treated user to apply finish	—H
bright finish for welding, soldering	—A
silver plated .0002 (±.0001) inch thick	—S
gold plated .000050 in. min.	—G

other finishes to specification

CONTIPS

localized deposits of silver or gold

	add suffix to catalog number
SILVER CONTIPS only	—K
SILVER CONTIPS plus silver plating	—KS
GOLD CONTIPS only	—GK
GOLD CONTIPS plus gold plating	—GKG

A P P E N D I X

KAPTON: Advance Electric Labs
Belmont, CA - 1-415-592-4550

TEFLON: Commercial Plastics
AIN Plastics
Local Dealers

FINGER STOCK: Instrument Specialties
P.O. Box A
Delaware Water Gap, PA 18327 - 1-717-424-8510

BRASS TUBING

Copper & Brass Sales
1295 67th St.
Emeryville, CA 94623

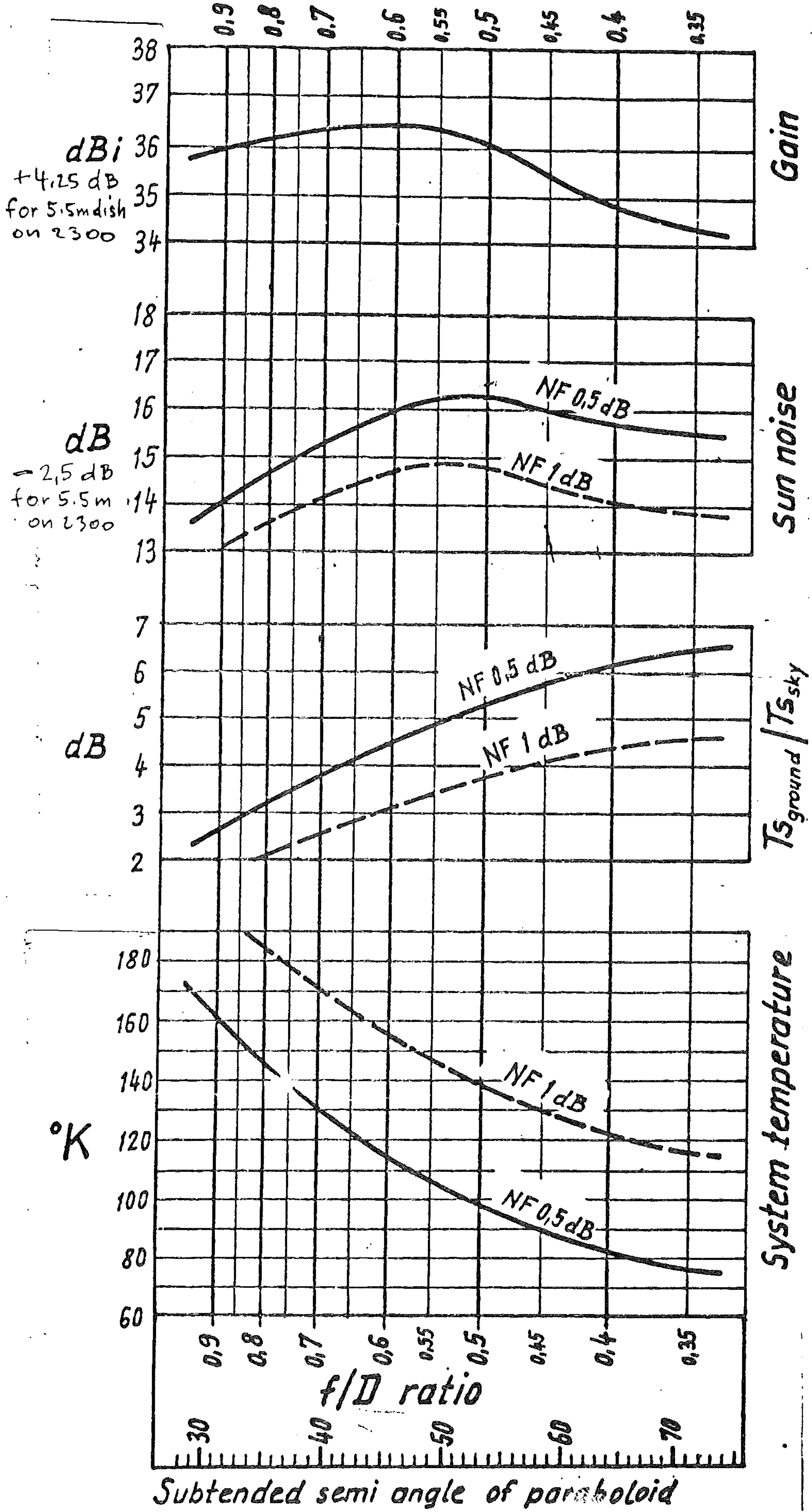
1-415-658-7212

RCVD 10/31/84

2300 MC EME STN's

Callsign	dish ant	polar.	sunnoise	power	preamp - NF	achievement
DFØEME	30 ft	lin./circ.	16-18 dB	900	MGF 1412	wkd 9XX1, 1KIR, 3WDG, 4HGN, ...
DJ8QL	22 ft	circular		900	MGF 1412	hrd
G3LTF	20 ft					hrd DFØEME
G3WDG	13 ft	circular	9,5 dB	100	MGF 1403, 0,5 dB	wkd DFØEME, OE9XX1; hrd 4HGN, 4HHK
LX1DB	30 ft	circular	≈ 16 dB	120		wkd 9XX1, ... hrd all others QRV
OE9FKI	13 ft	circular		150	MGF 1412 0,6 dB	next time QRV
OE9XX1	25 ft	circ./lin.	16 dB	130	MGF 1412, 0,6 dB	wkd ØEME, 1DB, 1KIR, 3WDG, 4HGN
OK1KIR	18 ft	circ./lin.	10,5 dB	60	MGF 1412	wkd ØEME, 9XX1, ... hrd all others Q[illegible]
PAØSSB	20 ft			200		not QRV at present; wkd W6YFK
VE4MA	9 ft				MGF 1402	hrd
W4HHK	18 ft	linear		400		wkd WA4HGN, W3GKP(†)
WA4HGN	28 ft	lin. rotat.		400		wkd W4HHK, DFØEME, OE9XX1
W6YFK	20 ft					not QRV at precent, wkd PAØSSB
YU1AW	(40) 20 ft	circular	9 dB	50	NF 1,2 dB	hrd ØEME, 9XX1, 4HGN, 4HHK
YU2RGC	16 ft			100		next time QRV

Performance of a dish antenna in relation to f/D ratio, illuminated by a dual mode horn (W2 IMU design) on 1296 Mc



TRANSMISSION PERFORMANCE

•Gain of 2oft dish dia

On o,59 f/D maximum apertur efficiency $\eta^f = 0{,}645$, where spill-over $\eta^s = 0{,}831$ and illumination $\eta^i = 0{,}776$

RECEPTION PERFORMANCE

maximum at o,52 (o,54) f/D ratio

Calculated sun noise (Flux 65) for a 2oft dish and o.5(1.o)dB noise figure preamp.

Ratio of thermal earth noise (antenna aimed at ground, -2o° elevation) to cold sky reception.

It is a measure of receiver system temperature independent of antenna gain.

Noise temperature of receiving system with o.5(1.o)dB NF front end, antenna aimed at zenith.

All values are calculated based on a measured beam pattern diagram of the feed horn.
Reflector-, phase- and polarization efficiencies are η = 1..

June 1984, OE 9 PMJ

CHECKLIST FOR PARABOLIC ANTENNA DESIGN

by H. Paul Shuch, N6TX

STEP:	PROCEDURE:	EXAMPLE:
1.	Specify operating frequency and wavelength. Remember that $\lambda = 30/f$ where f is in GHz, and λ is in cm.	f = 1296 MHz $\lambda = 30/1.3$ $= 23$ cm
2.	Determine antenna diameter from required gain. $A_p = \frac{\eta \pi^2 D^2}{\lambda^2}$ where D and λ are in the same units (i.e. cm), η represents efficiency (typically .55), and A_p is a power ratio (not dB).	for 30 dB of gain, $A_p = 1000$ thus D = 312 cm
3.	Select desired focal length to diameter ratio: $F/D \leq .3$ for lowest side lobes $F/D \geq .5$ for narrowest main lobe	as a compromise, let F/D = .4
4.	Calculate focal length by multiplying F/D ratio (step 3) by diameter (step 2).	F = 125 cm
5.	Compute 3-dB beamwidth, in degrees: Φ (Radians) $\approx \lambda / D$; Degrees = (Radians x 180) / π	$\Phi \approx .074$ Rad $\approx 4.2°$
6.	For each point on the surface of the dish, calculate distance from center (y) and depth from the back (x) from the equation: $Y^2 = 4 F X$	at the rim, y = D/2 = 156 cm; $x = y^2 / 4F$ = 49 cm
7.	Determine required dimensional precision from: $\Delta \approx 0.1 \lambda$	$\Delta \approx 2.3$ cm
8.	INSTANT DISH	

1296 Mhz. TRANSVERTER NOTES

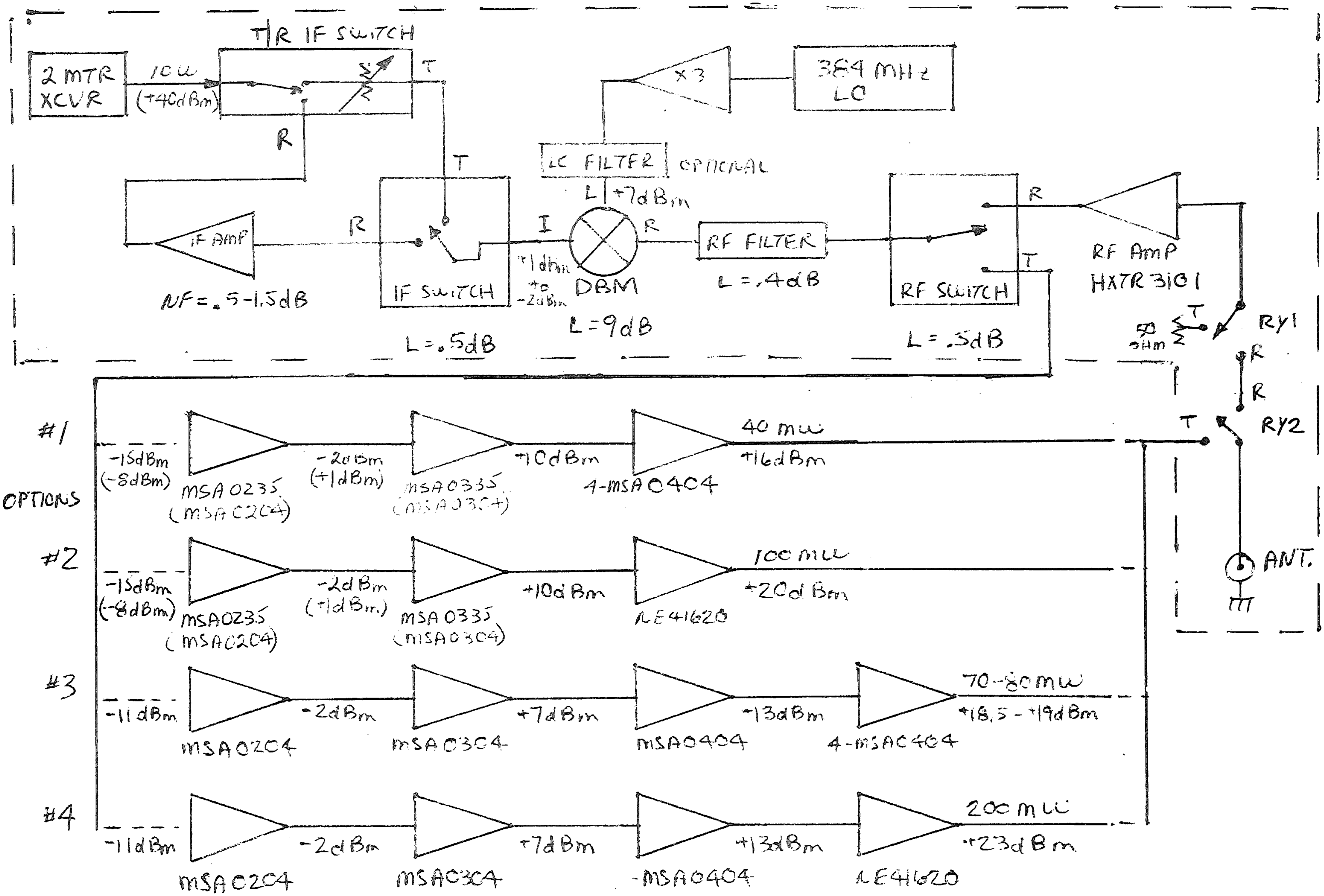
UPDATE

BY

AL WARD

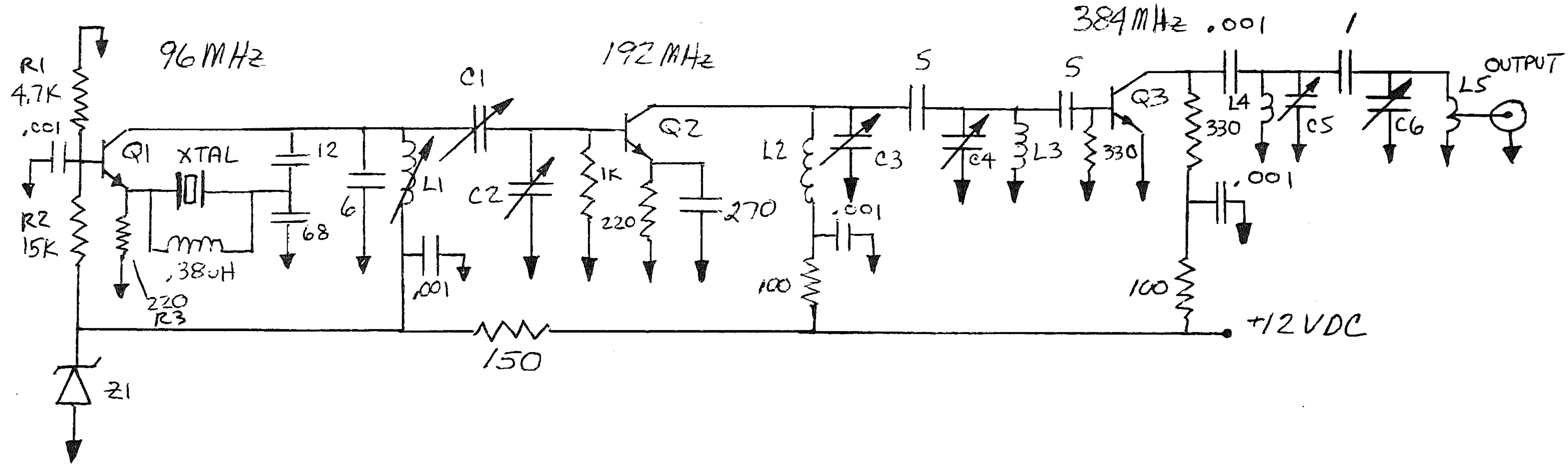
WB5LUA

JUNE 28,1985



1296 MHz TRANSVERTER
BLOCK DIAGRAM
FIGURE 1

A.J. WARD
WB5LUA
5-2?-85



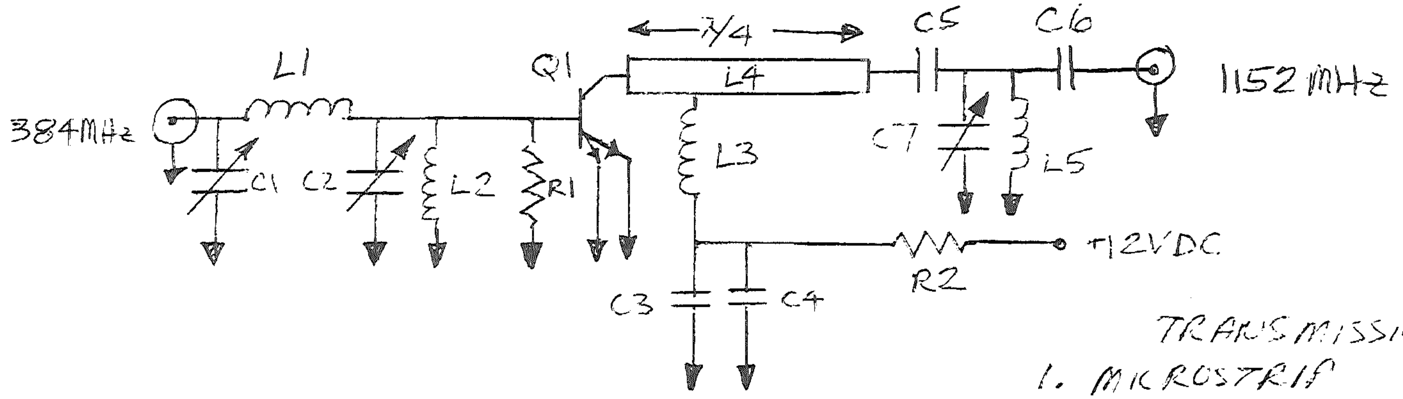
PERFORMANCE

1. 384 MHz OUTPUT AT +7dBm
2. ALL UNDESIRED HARMONICS ARE -40dBC.

Q1, Q2	2N918, 2N3570, MPS 3563, etc.
Q3	MRF901
Z1	1N757 9V ZENER DIODE
C1–C6	.8-10pf PISTON TRIMMER
L1	4 TURNS #24 ENAMEL WHITE CORE CLOSE SPACED
L2, L3	3 TURNS #14 .25" I.D. SPACED WIRE DIAMETER
L4	1 TURN #14 .25" I.D.
L5	1 TURN #14 .25" I.D. TAPPED 1/2 TURN
XTAL	96.000 MHz OVERTONE CRYSTAL

384 MHz. LO

WB5LUA
A.J. WARD
4-18-84



TRANSMISSION LINE SUGGESTIONS

1. MICROSTRIP
   Er = 2.2
   LINE WIDTH = .050"
   Ground Plane ht = .062"
   LINE LENGTH ≈ 1.9"

2. REMOVE CENTER CONDUCTOR FROM .141" SEMI RIGID CABLE AND REPLACE WITH .010" DIA WIRE.
   CABLE LENGTH = 1.7"

C1, C2, C7	.8-10 pf PISTON TRIMMER
C3	.1 ufd DISC CAP
C4, C5	30 pf UNELCO CAP.
C6	2 pf CAP
R1	820 Ω 1/8 WATT
R2	100 Ω 1/4 WATT
L1	5 TURNS #24 GUAGE .2" DIAMETER, .36" LONG
L2	7 TURNS #24 GUAGE .2" DIAMETER, .36" LONG
L3	3 TURNS #24 GUAGE .2" DIAMETER .6" LONG TAPPED .3" FROM Q1
L4	λ/4 100 Ω MICROSTRIP OR 100 Ω COAXIAL TRANSMISSION LINE
L5	.3" LENGTH OF #24 GUAGE WIRE FROM TOP OF C7 TO GROUND.
Q1	MRF901

P_{IN} = +4 dBm

P_{OUT} = +6 to +8 dBm

I_c = 24 mA

HARMONIC REJECTION

384 MHz	-16 dBc
768 MHz	-30 dBc
1536 MHz	-23 dBc

ORIGINAL DESIGN BY JOHN STANKUS KN5N

384 TO 1152 MHz MULTIPLIER

WB5LUA
A.J. WARD
4-18-84

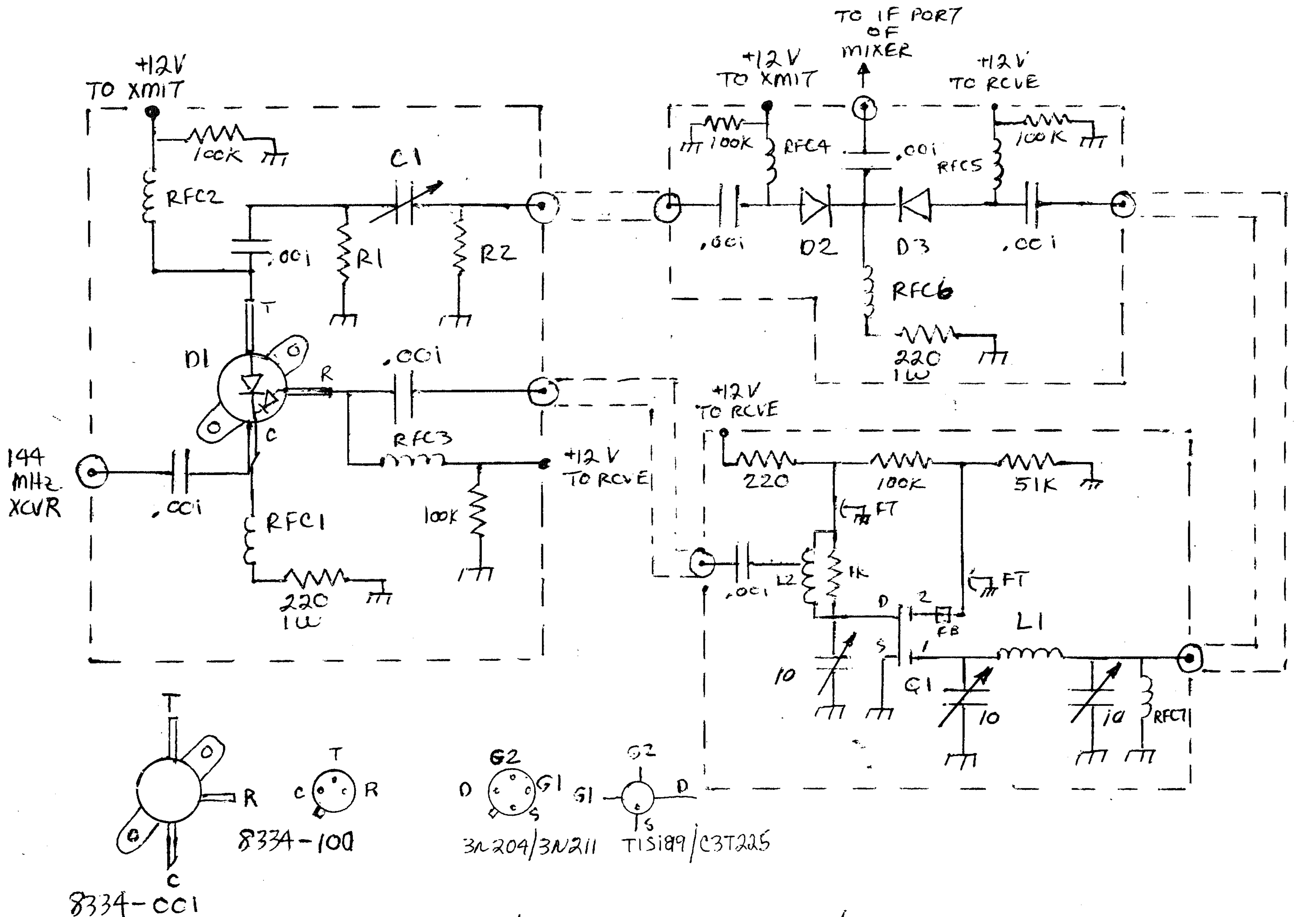
DOUBLE BALANCE MIXERS

MANUFACTURER	MODEL	ADVERTISED LO/RF FREQ. (MHz)	IF FREQ. (MHz)	TYPICAL CONV. LOSS @ 1300 MHz	COST
MINI-CIRCUITS P.O. BOX 166 BROOKLYN, N.Y. 11235 (718) 934-4500	SRA-4	5-1250	5-500	9 dB	1-4 $26.95 5-24 $16.95
	SRA-5	5-1500	10-600	8.5 dB	1-4 $31.95 5-24 $21.95
	SBL-1X	10-1000	5-500	9 dB	1-9 $11.95 10-49 $5.95
	TFM-2	1-1000	DC-1000	8 dB	1-49 $11.95
SYNERGY 483 Mc LEAN BLVD + 18th Ave. PATTERSON, N.J. 07504 (201) 881-8800	S-4	10-1000	5-1000	10 dB	1-9 $10.95 10-49 $5.35
	CLP-211	50-1500	DC-1000	7 dB	1-9 $23.00
TELE-TECH CORP. 2050 FAIRWAY DR. BOX 1827 BOZEMAN, MT. 59715 (406) 586-0291	** MT55L	1-1500	DC-1000	9 dB	1-24 $26.00
	MT55	1-1500	DC-1000	9 dB	1-24 $21.00
	MT85	5-1500	DC-1000	9 dB	1-24 $21.00
	MT57	10-2000	DC-1000	9 dB	1-24 $8.00

TABLE I

A.J. WARD
WB5LUA
5-28-85

** +3dBm LO POWER



TRANSMIT/RECEIVE IF SWITCH/IF AMPLIFIER
FIGURE 4

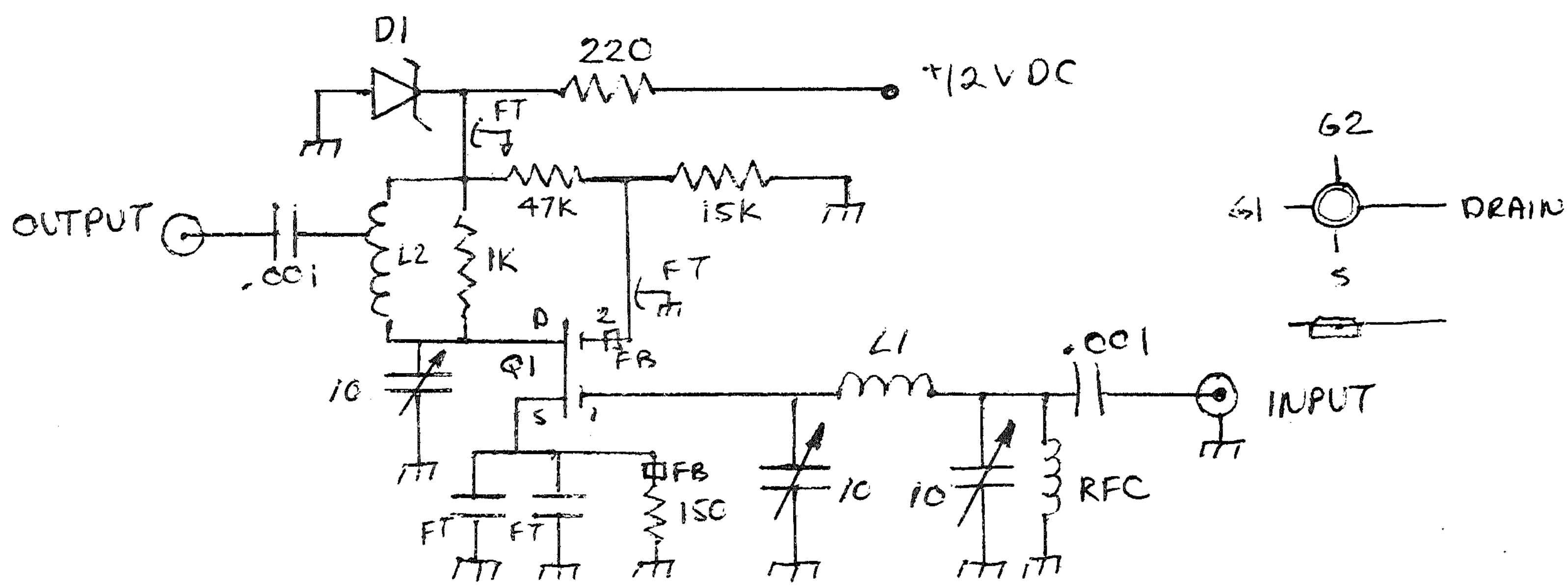
AJWARD
WB5LUA
5-28-85

Q1	TIS189, 3N204, 3N211 DUAL GATE FET
D1	MA8334 T/R SWITCH SERIES (-100 is 10W version and -001 is 100W)
D2, D3	MA 47047, 47110, 47123 PIN SWITCHING DIODE or HP 5082-3379
RFC1-RFC7	1 uH MINIATURE RF CHOKE
R1	50Ω 10W NONINDUCTIVE RESISTOR
R2	51Ω 1/2W CARBON RESISTOR
C1	1-2 pf ADJUST FOR DESIRED DRIVE LEVEL AT DBM
FB	FERRITE BEAD
L1	6 TURNS #18 GUAGE .25" I.D. SPACED WIRE DIAMETER
L2	5 TURNS #18 GUAGE .25" I.D. S.W.D., TAP 1 TURN FROM COLD END
FT	470-1000 pf FEEDTHROUGH CAPACITOR

- UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/4 WATT CARBON
- UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE DIPPED SILVER MICA

T/R IF SWITCH/IF AMPLIFIER

AJWARD
WB5LUA
5-28-85



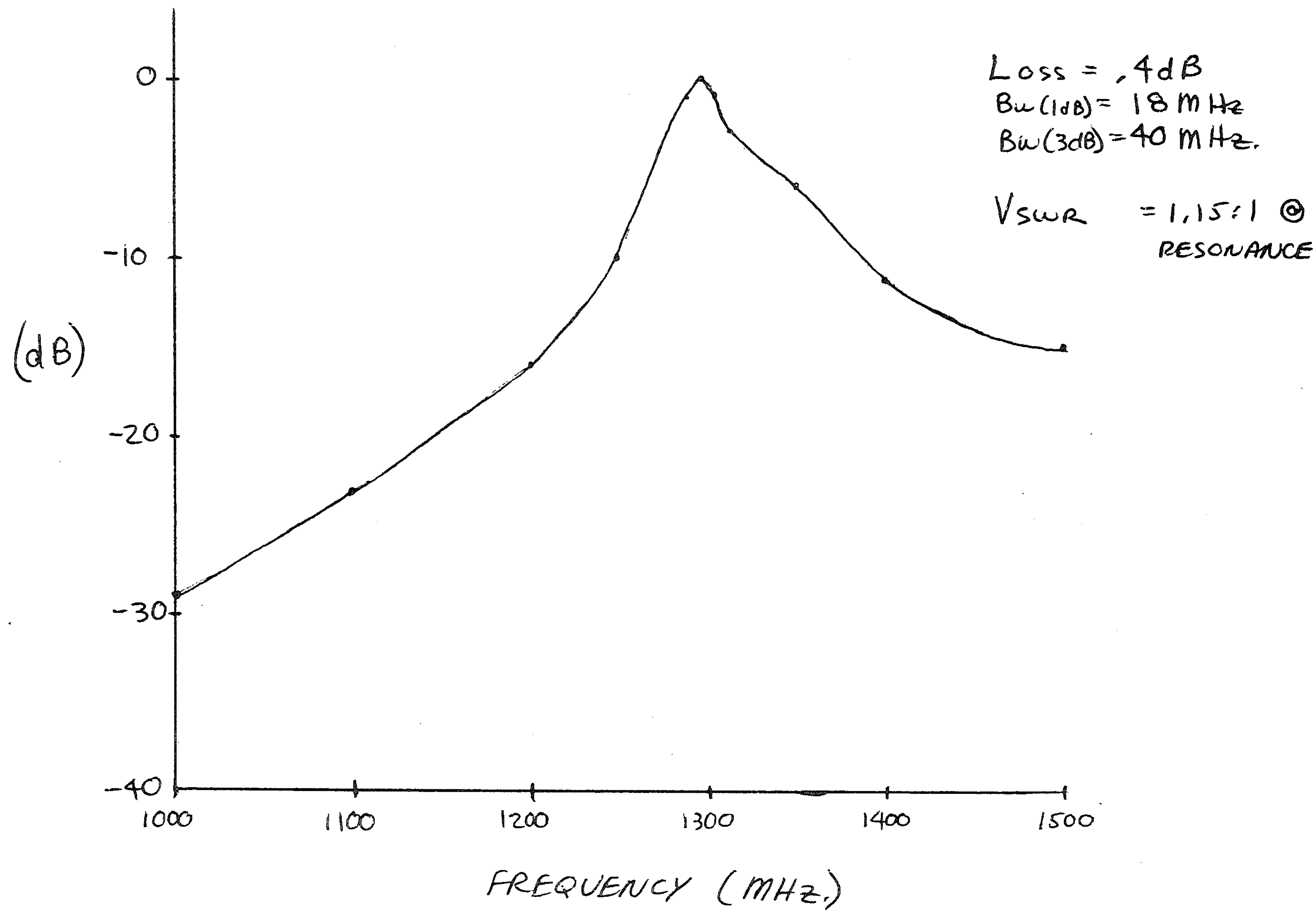
Q1	NE41137 GaAs DUAL GATE MESFET (CALIFORNIA EASTERN LABORATORIES)
L1	6 TURNS #24 GUAGE WIRE .25" I.D. S.W.D
L2	5 TURNS #24 GUAGE WIRE .25" I.D. SWD TAPPED 1 TURN FROM COLD END.
D1	1N752 ZENER DIODE (5.6 VOLT)
FT	470-1000 pf FEED THROUGH / BYPASS CAPACITOR
FB	FERRITE BEAD
RFC	1uH MINIATURE RF CHOKE

ALL RESISTORS ARE 1/4 WATT CARBON
ALL CAPACITORS ARE DISC OR S.M. UNLESS OTHER WISE SPECIFIED

NF = .5-1.0 dB $V_{DS} \approx 4V$ $V_{G2S} \approx .5V$
G = 24 dB TYP $I_D \approx 6\text{-}10mA$

NE411 I.F. AMPLIFIER
FIGURE 5

WB5LUA
H J KIRL
5-28-85 6



1296 MHz CAVITY FILTER RESPONSE
FIGURE 6

A.J. WARD
WB5LUA
5-28-85

CAPACITIVE COUPLED BPF

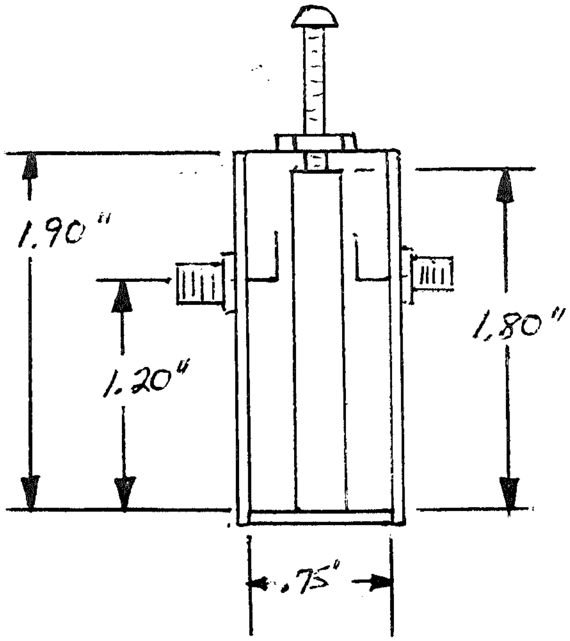
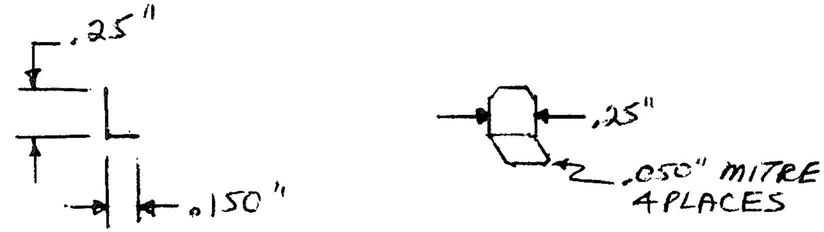
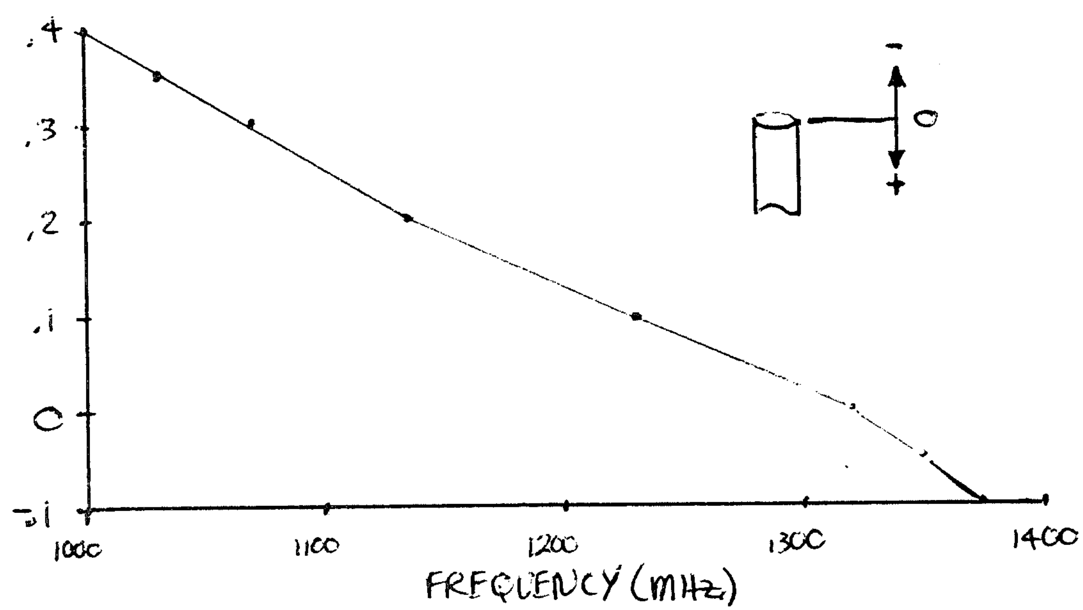


FIGURE 7





RESONANT FREQUENCY VERSUS SCREW PENETRATION
FIGURE 8

A.J. WARD
WB5LUA
5-28-85

INDUCTIVE COUPLED BPF

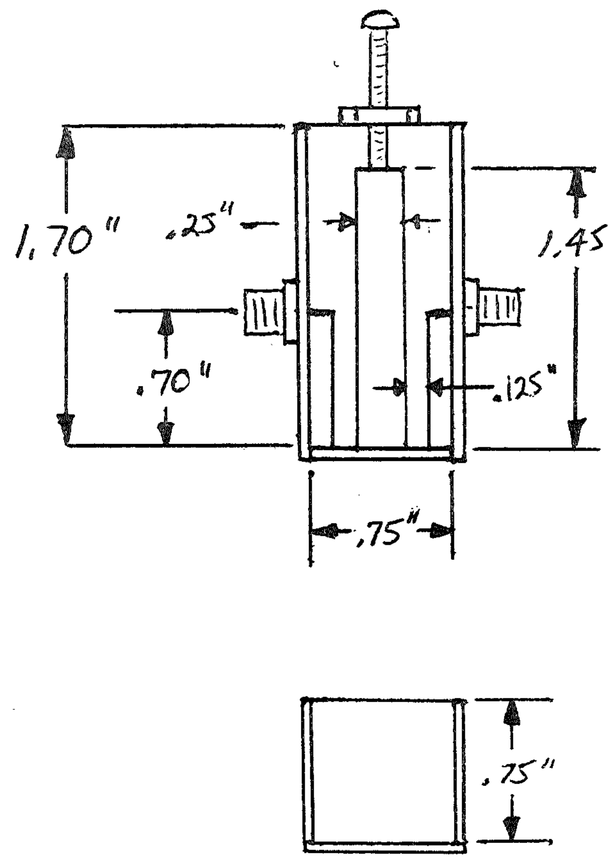


FIGURE 9

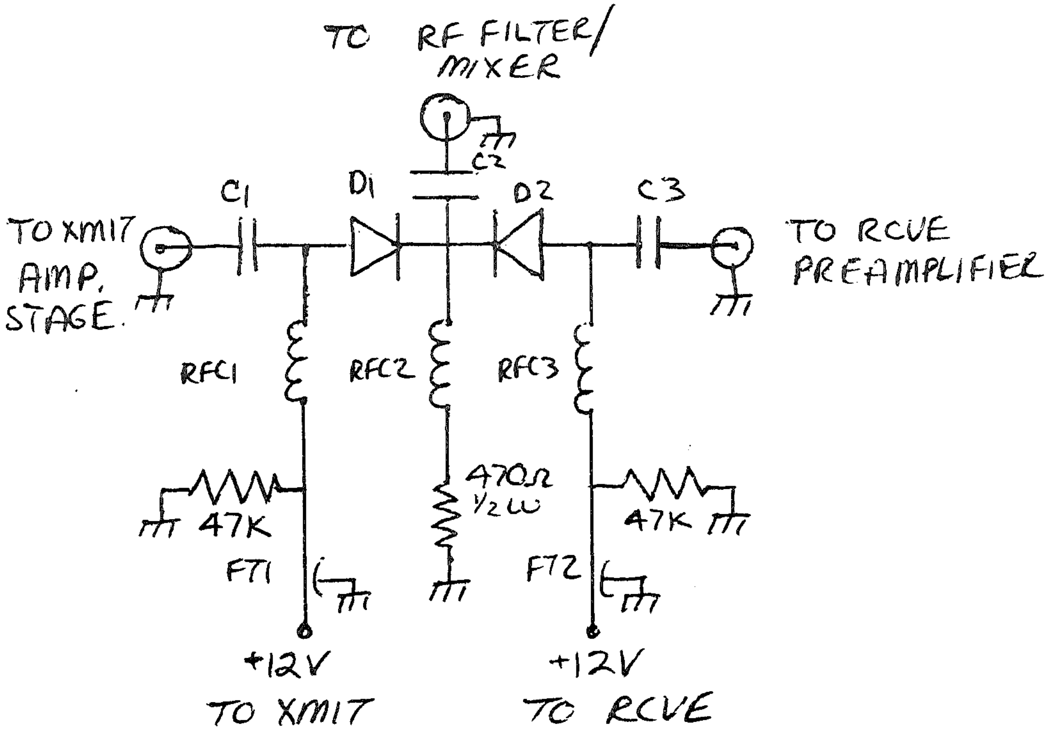
LOSS = 0.5dB
BW(1dB) = 30MHz
BW(3dB) = 56 MHz

VSWR = 1.17:1 @ RESONANCE

FREQ.	ATTN
1008 MHz	-18dB
1240 MHz	-7.5dB
1270 MHz	-3.0dB
1480 MHz	-20dB

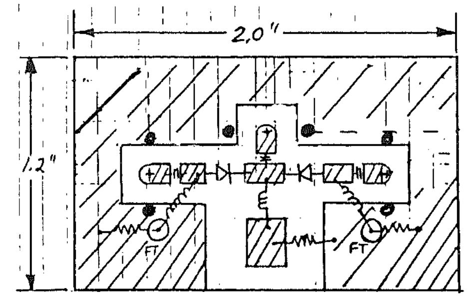
NOTES: 1. RESONANCE AT 1296MHz REQUIRES 6-32 TUNING SCREW TO PENETRATE .28" INTO THE RESONATOR.
2. COUPLING ELEMENTS MADE FROM #20 GA. WIRE

AJWARD
WB5LUA
5-28-85



C1, C2, C3	100pf CHIP CAPACITOR
D1, D2	PIN DIODE HP 5082-3379
FT1, FT2	100-470pf FEEDTHROUGH CAPACITOR
RFC1, RFC2, RFC3	6 TURNS #24 GUAGE ENAMEL WIRE .125" I.D. CLOSE WOUND

RF SWITCH DIAGRAM
FIGURE 10

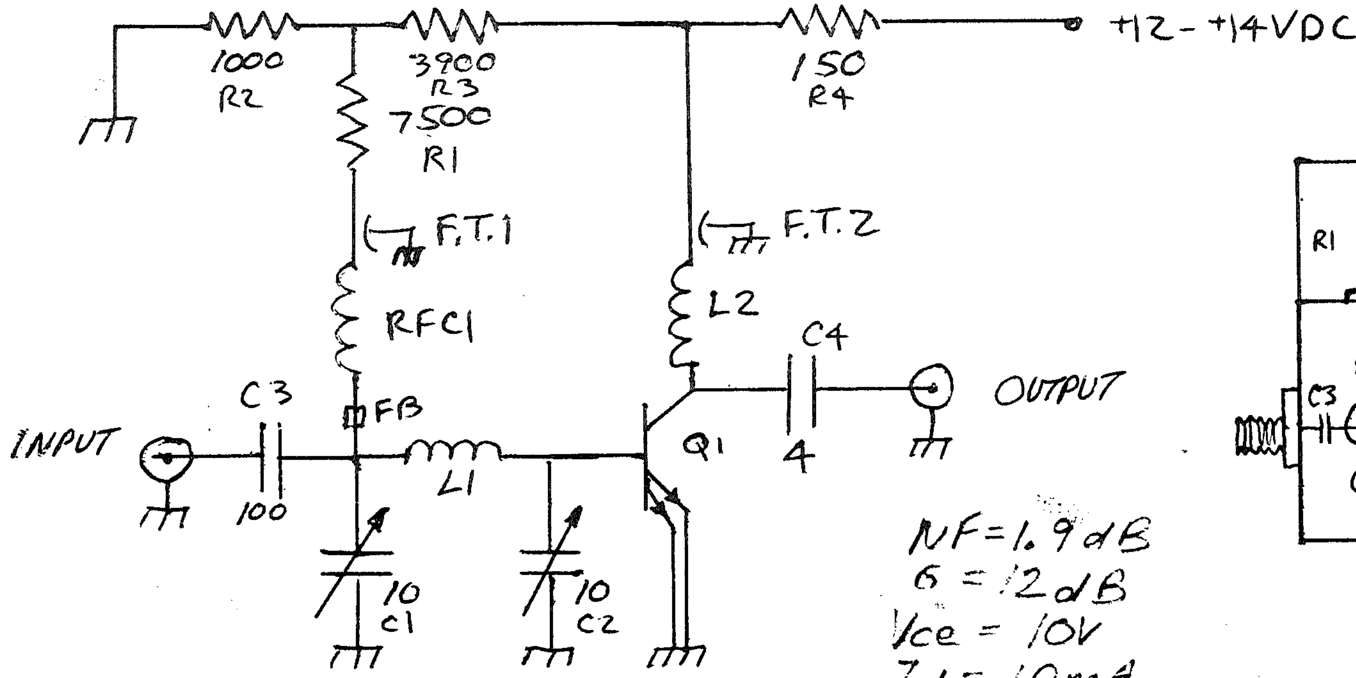


NOTES: SLASHED AREA IS COPPER
• 50OHM LINEWIDTHS ARE .100"

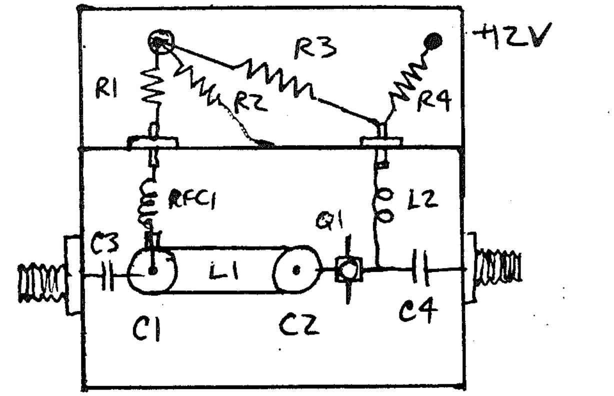
RF SWITCH LAYOUT
FIGURE 11

LOSS = 0.5dB
ISOLATION = 21dB

AJ WARD
WB5LUA
5-28-85



NF = 1.9 dB
G = 12 dB
Vce = 10V
Id = 10mA



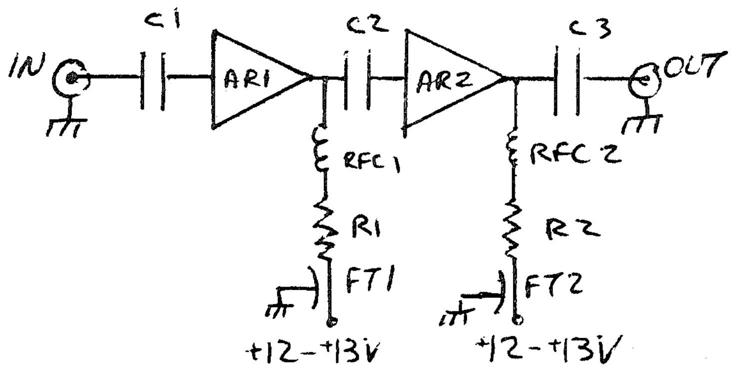
LAYOUT

Q1	HXTR 3101 BIPOLAR TRANSISTOR (HEWLETT PACKARD) ($4.00 each)	
L1	.25" WIDE MICROSTRIPLINE (SEE TEXT)	
L2	2 TURNS #24 GUAGE WIRE, .125" I.D. S.W.D.	
RFC1	6 TURNS #24 GUAGE WIRE, .125" I.D. CLOSE SPACED	
FT1, FT2	470-1000 pf FEEDTHROUGH/BYPASS CAPACITOR	
FB	FERRITE BEAD	

UNLESS OTHERWISE SPECIFIED ALL FIXED CAPACITORS ARE SILVER MICA.
UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE .25 WATT

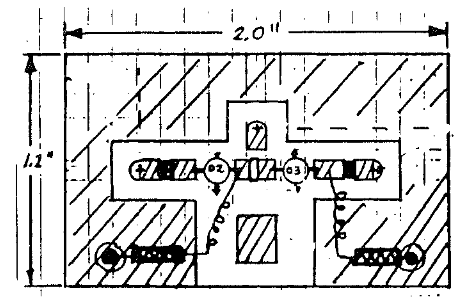
HXTR 3101 1296MHz PREAMPLIFIER
FIGURE 12

A.J. WARD
WB5LUA
5-28-85 11



C1-C3 100 pf CHIP CAPACITOR
RFC1-2 6 TURNS #24 GA. ENAMEL WIRE
1/8" I.D. CLOSE WOUND
R1, R2 USE RESISTOR VALUES IN
TABLE III FOR INITIAL SETUP
FT1, FT2 100-470 pf FEEDTHROUGH CAPACITOR
AR1, AR2 SEE TEXT

SCHEMATIC DIAGRAM



NOTES: • SLASHED AREA IS COPPER
• 50 OHM LINE WIDTHS ARE .100"

COMPONENT LAYOUT

LOW POWER RF AMPLIFIER

FIGURE 13

A.J. WARD
WB5LUA
5-28-85

MMIC PERFORMANCE AT 1300 MHz.

DEVICE	I_c (mA)	BIAS RESISTOR OHMS FOR V_{cc}=13V	DISSIPATION WATTS	P_{OUT} @1dB C.P. (dBm)	Gain @ LOW LEVEL (dB)	COST (SINGLE QTY'S)
MSA 0104	30	267	.24	+1	13	$2.75
MSA 0135-21	30	267	.24	+1	16	$9.15
MSA 0204	30	267	.24	+5	9	$2.90
MSA 0235-21	50	160	.40	+10	13	$9.15
MSA 0304	40	200	.32	+10	9	$3.00
MSA 0335-21	50	160	.40	+12	12	$9.15
MSA 0404	50	150	.38	+13	7	$3.25
MSA 0435	60	125	.45	+13	8	$9.40
MSA 0420	90	72	.59	+15	8	$33.50

TABLE III

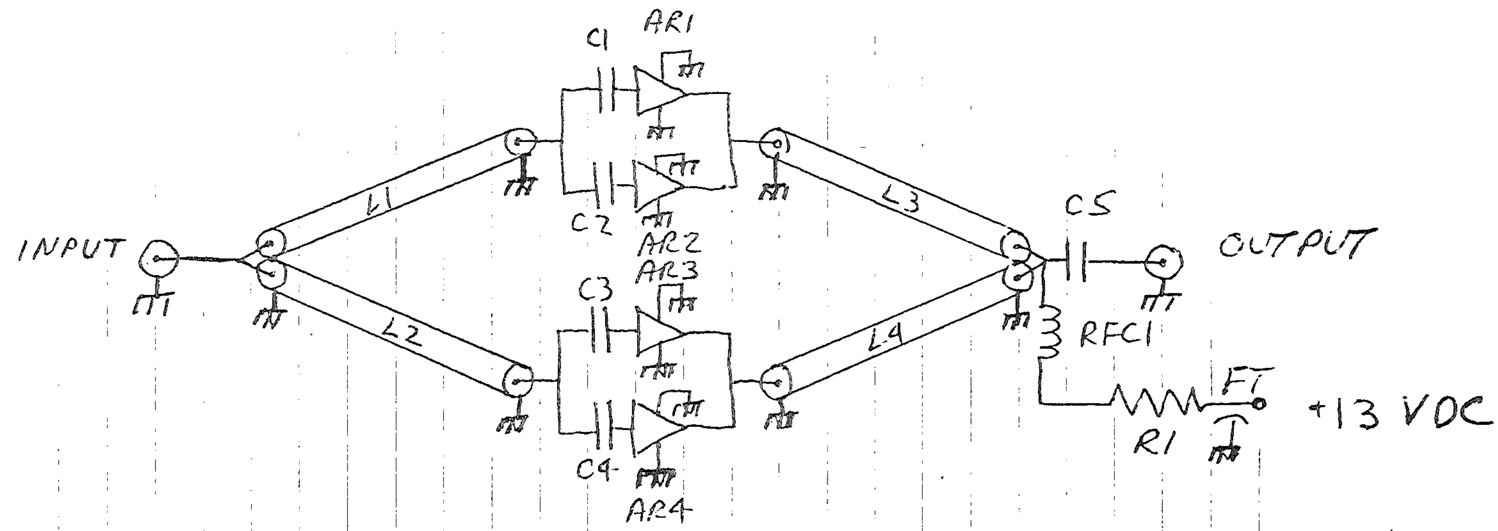
A.J. WARD
WB5LUA
5-28-85

	LINEUP MSA-____	P_{OUT} @ 1dB C.P. (dBm)	Gain @ Low level (dB)	P_{IN} @ 1dB C.P. (dBm)
1.	0235 → 0335	+12	25	-13
2.	0204 → 0304	+10	20	-10
3.	0304 → 0404	+13	16	-3
4.	0204 → 0304 → 0404	+13	25	-12

CASCADED MMIC PERFORMANCE

TABLE IV

A.J.WARD
WB5LUA
5-28-85

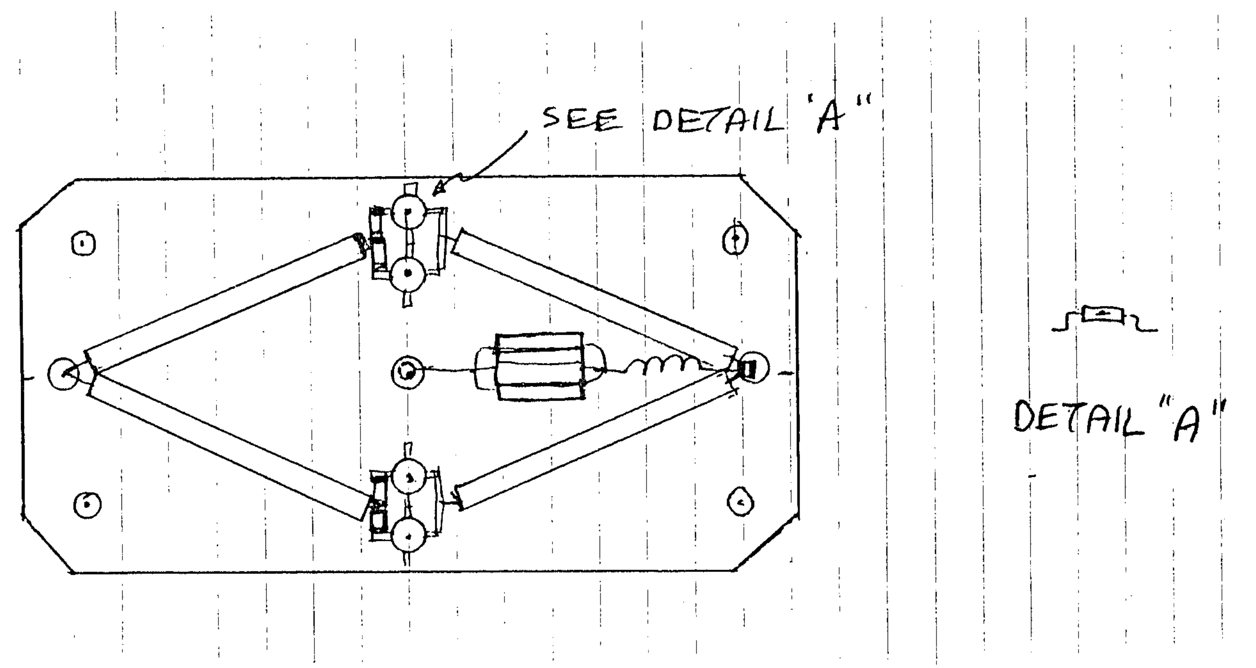


AR1-AR4	MSA-0404 AVANTEK MMIC
C1-C5	100-820pf BLOCKING CAPACITOR - VALUE NOT CRITICAL
L1-L4	QUARTER WAVE (3/4) 50OHM SEMI-RIGID CABLE 1.6" LONG SHIELD TO SHIELD
RFC1	6 TURNS #24GAUGE WIRE, .125" I.D. S.W.D.
R1	40 OHMS AT 2WATTS - MODIFY AS NECESSARY TO LIMIT CURRENT TO 200mA MAX.
FT	470-1000 pf FEEDTHROUGH CAPACITOR

GAIN = 5.5 to 6.0dB
P_{OUT} (1dB) = +19dBm
P_{OUT} (SAT) ≥ +20dBm

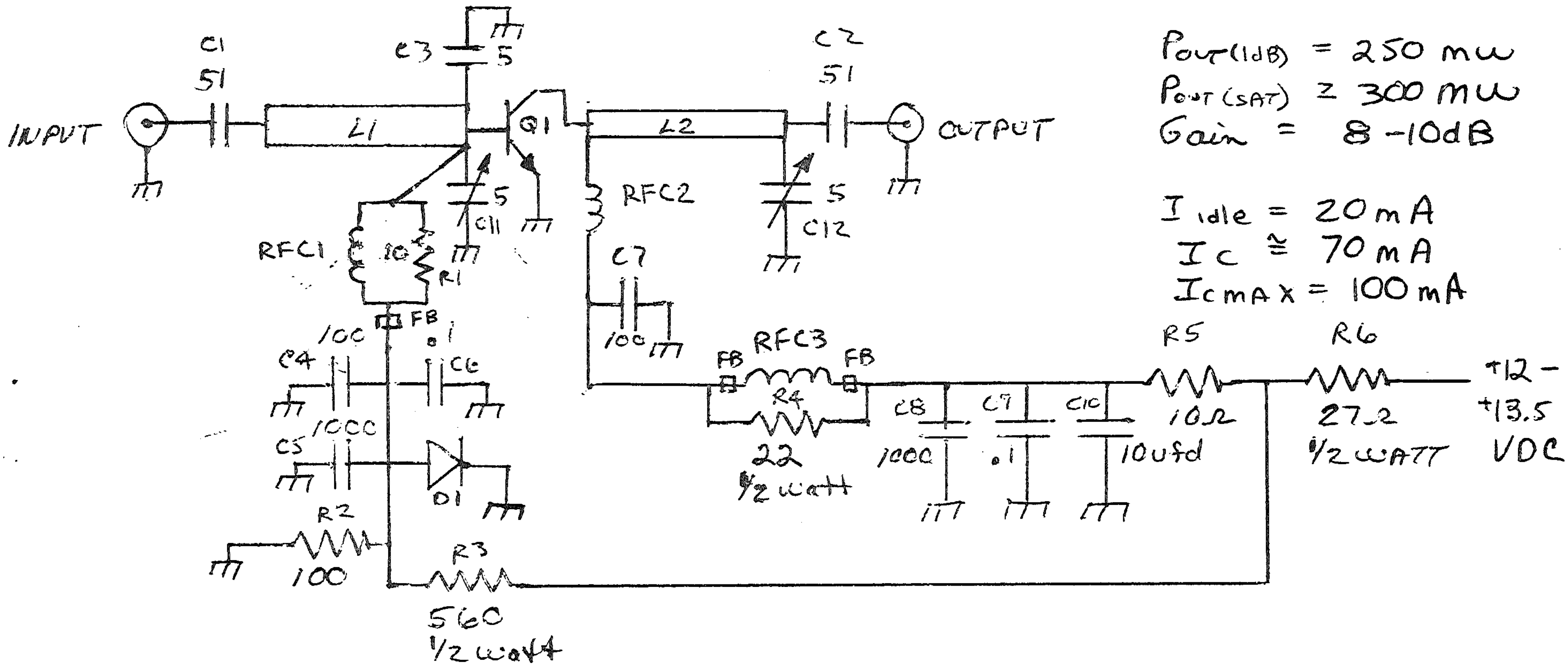
EC MLU AMPLIFIER
1296 MHz
FIGURE 14

AJWARD
WB5LUA
5-28-85



80 MW AMPLIFIER
COMPONENT LAYOUT
FIGURE 15

AJWARD
WB5LUA
5-28-85



NE41620 1296 MHz AMPLIFIER

FIGURE 16

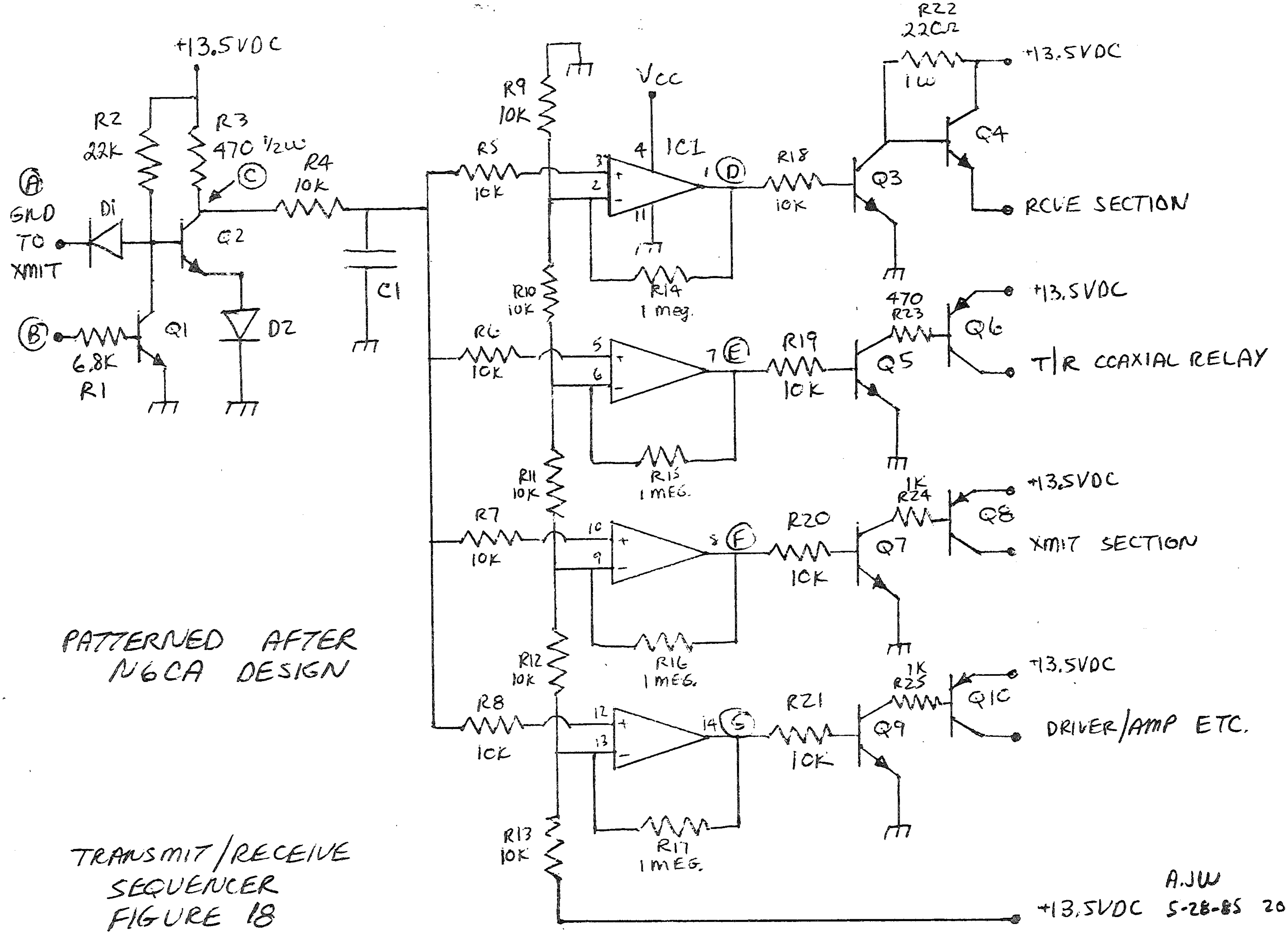
A.J. WARD
WB5LUA
5-28-85

Q1	NE41620 POWER TRANSISTOR (C.E.L.)
D1	1N4001 OR 1N914
RFC1	4 TURNS .125" I.D. #24 GUAGE ENAMEL WIRE, .375" LONG
RFC2	3 TURNS .125" I.D. #24 GUAGE ENAMEL WIRE, .25" LONG
RFC3	1 uH RF CHOKE, 18 TURNS #24 GUAGE ENAMEL WIRE CLOSE SPACED WOUND ON AMIDON T50-10 TOROID
C1, C2	51 pf CHIP CAPACITOR
C3	5 pf CHIP CAPACITOR
C4, C7	100 pf CHIP CAPACITOR
C5, C8	1000 pf CHIP CAPACITOR
C6, C9	.1 ufd DISC CAPACITOR
C10	10 ufd ELECTROLYTIC CAPACITOR
C11, C12	5 pf VARIABLE CAPACITOR
FB	FERRITE BEAD
L1	27 Ω MICROSTRIPLINE - QUARTER WAVE LONG
L2	51 Ω MICROSTRIP LINE - QUARTER WAVE LONG

• UNLESS OTHERWISE SPECIFIED ALL RESISTORS ARE 1/4 WATT CARBON

A.J WARD
WB5LUA
5-28-85

FIGURE 16



PATTERNED AFTER N6CA DESIGN

TRANSMIT/RECEIVE SEQUENCER
FIGURE 18

20

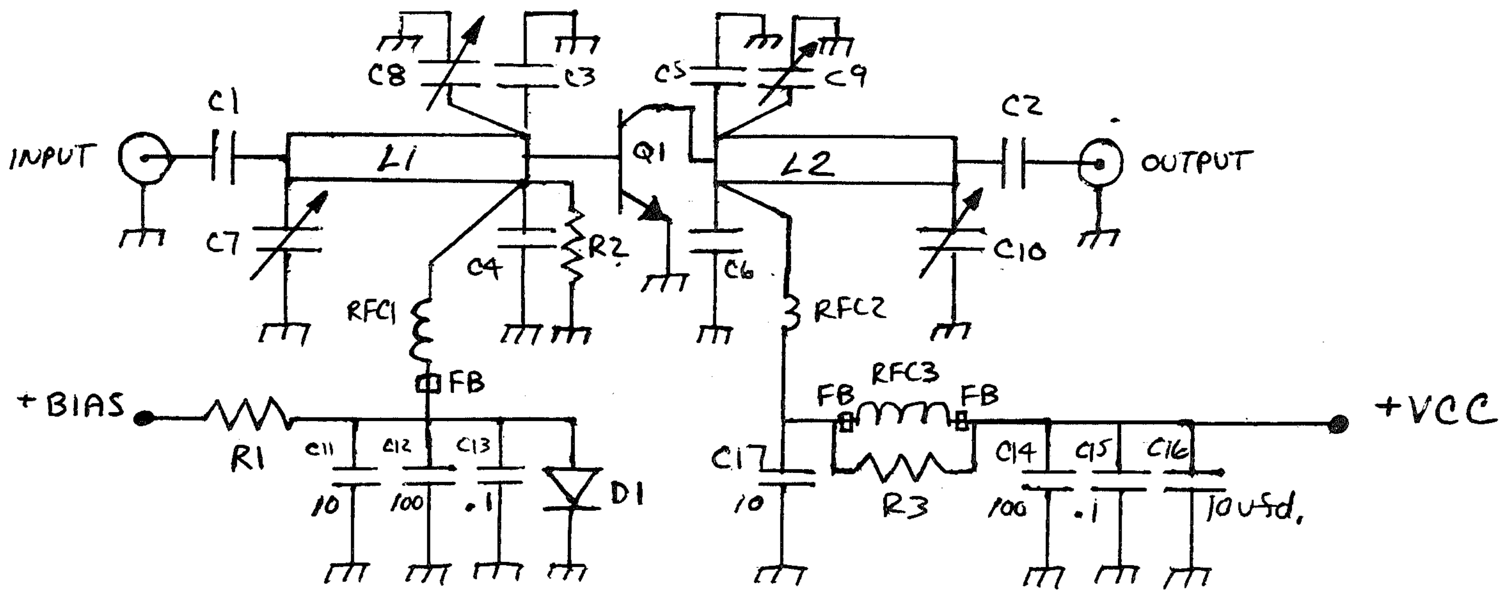
Q1, Q2, Q3, Q4, Q5, Q7, Q9	2N2222 (RS 276-2009)
Q6	2N2907 (RS276-2023)
Q8, Q10	TIP32 (RS276-2027)
C1	20ufd TYPICAL - SEE TEXT
D1 D2	1N914 SWITCHING DIODE
IC1	LM324 QUAD OP-AMP (RS276-1711)

ALL RESISTORS ARE 1/4 WATT CARBON UNLESS OTHERWISE SPECIFIED

T/R SEQUENCER
FIGURE 18

A.J. WARD
WB5LUA
5-28-85

NEL1300 SERIES 1296MHz AMPLIFIERS



Device	NEL130681-12	NEL132081-12
Pout (1dBC.P.)	7 watts	18 watts
Gain (1dBC.P.)	6 dB typ.	5 dB typ.
Collector EFF.	40-50%	40-50%
Idling Current	50mA	150mA
Ic @ 1dBC.P.	1.1 Amps	3.0 Amps
Vcc	13.5V	13.5V
Power Input	14.9 watts	40.5 watts

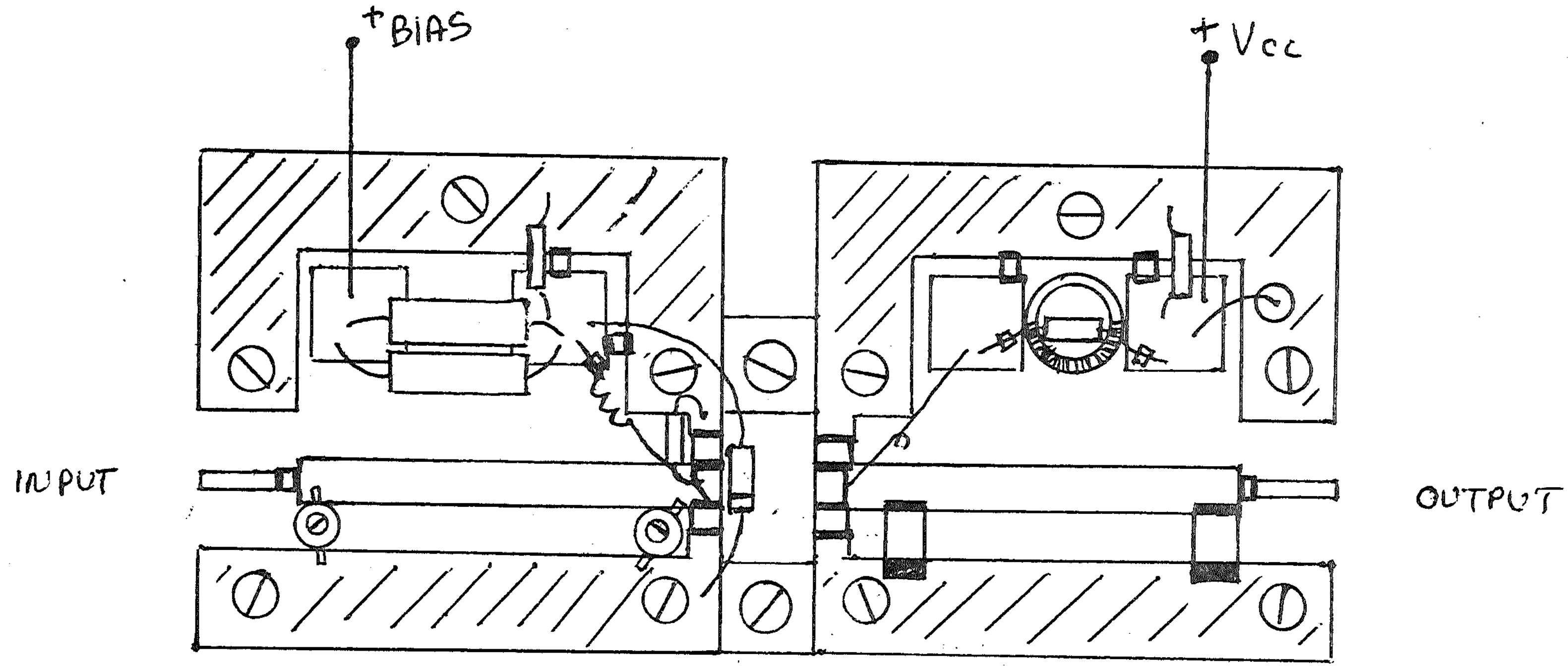
TABLE 1

A.J.WARD
WB5LUA
5-28-85

Q1	NEL130681-12/NEL132081-12 POWER TRANSISTOR (C.E.L.)
D1	1N4007
RFC1	3 TURNS #24 GUAGE WIRE, .125" DIA S.W.D.
RFC2	TURNS #24 GUAGE WIRE, .125" DIA S.W.D.
RFC3	1 uH RF CHOKE, 18 TURNS #24 GUAGE ENAMEL WIRE CLOSE SPACED WOUND ON T50-10 TOROID
C1, C2, C11, C17	10 pf CHIP CAPACITOR
C3, C4, C5, C6	3.6 - 5.0 pf CHIP CAPACITOR
C7, C8	1.8 to 6.0 pf MINIATURE VARIABLE CAPACITOR (MOUSER ELECT. P.N. 24AA070)
C9, C10	.8 - 10 pf PISTON TRIMMER FOR NEL1320 (JOHANSON 5221 or 8053) SAME AS C7, C8 FOR NEL1306 (SEE TEXT)
C12, C14	100 pf CHIP CAPACITOR
C13, C15	.1 ufd DISC CAPACITOR
C16	10 ufd ELECTROLYTIC CAPACITOR
FB	FERRITE BEAD
L1, L2	30 OHM MICROSTRIPLINE - QUARTER WAVE LONG
R1	82-100 OHM ATLEAST 2 WATT - VARY RESISTOR VALUE FOR SPECIFIED IDLING CURRENT
R2	10 OHM 1/4 WATT CARBON RESISTOR
R3	15 OHM 1 WATT CARBON RESISTOR

FIGURE 1

A.J. WARD
WB5LUA
5-28-85



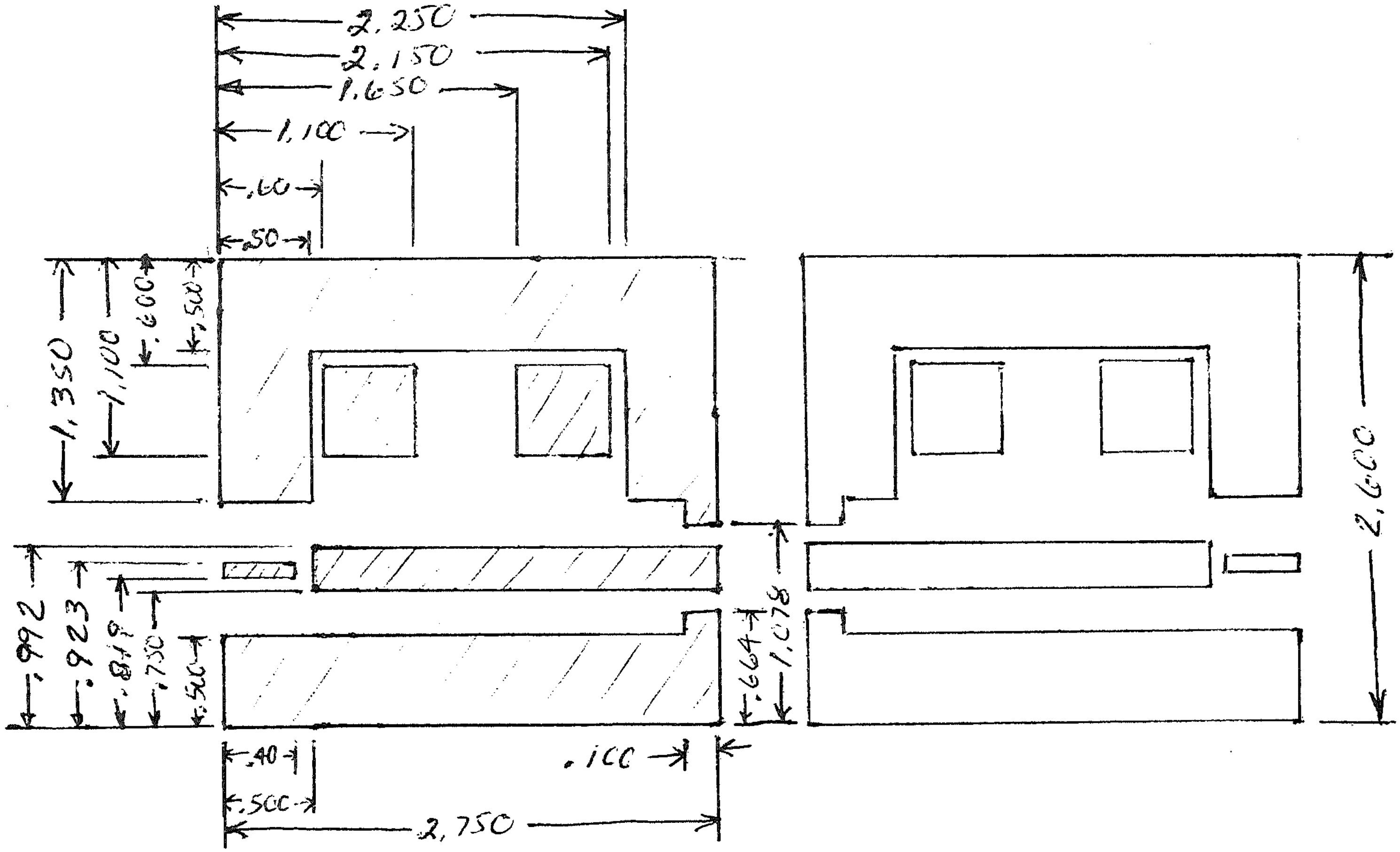
NEL1320 LAYOUT

2X SIZE

FIGURE 4

NOTE: NEL1306 LAYOUT UTILIZES SAME SHUNT VARIABLE CAPACITOR ON OUTPUT CIRCUIT AS ON INPUT CIRCUIT

A.J. WARD
WB5LUA
5-28-85



NOTES: 1. DIMENSIONS ARE 2X
2. DIMENSIONS ARE IN INCHES
3. RIGHT SIDE IS MIRROR IMAGE OF LEFT SIDE.
4. SLASHED AREA IS COPPER

NEL 1300
1296 mHz
POWER AMPLIFIER
ϵ_r = 5.0
H = .031"
A.J. WARD
JAN 3, 1984

PO Box 73
Edgewood, NM 87015
July 1, 1985

Charlie Calhoun, W0RRY,
President, CSVHF Society.
13914 N. 90 E. Ave.
Collinsville, Okla. 74021

Dear Charlie:

In response to your request for computer program listings of interest to Society members, I enclose two listings of programs which I have written especially for CSVHF moon-bouncers.

The programs were written primarily for speed of execution, while keeping them simple without the frills that make some of the programs overly tedious to enter.

The first program is one that I use with my Polar-mounted dish, and will compute Greenwich Hour Angle , Declination, and Right Ascension.

The other program is for use by those with an antenna aimed by using Azimuth - Elevation readouts.

Both programs are 'selfcontained' and need no input other than the date desired for the run, and the 'window' in GHA or the minimum elevation at which to begin the computations, whichever is appropriate.

For efficient operation line 70 should be modified to show the user's callsign, the interval between calculations (I), the proper year, and the Latitude and Longitude of the user in radians. (The Radian entries are obtained by multiplying the user's Latitude & Longitude in decimal degrees by the figure shown in line 60).

You may distribute copies of these at the Conference, or include them in the Proceedings, whichever you consider appropriate. If for whatever reason you do not wish to use them, please return them to me by mail or at the Conference with no distribution.

For those desiring a more comprehensive but still speedy program, I would refer them to the one published in the July, 1984 issue of CQ Magazine. It calculates Azimuth, Elevation, GHA, Declination, and Right Ascension. For anyone having problems with any of these programs, I will help them as best I can . An SASE would be appreciated.

-73-

Fred

Fred Fish , W 5 F F

```
10 '*****************************************************
20 '**  'FF' MOONLOCATOR PROGRAM GIVES GHA & DECLINATION   **
30 '*****************************************************
40 '
50 'PGM WRITTEN IN BASIC FOR A TRS-80 MODEL III.  -  by  W5FF
60 'MODIFY LINE 70 FOR UR QTH-DEGREES x .01745329 FOR LAT & LO.
70 CL$="W5FF" : LAT=.6105744 : LO=1.854417 : I=10 :Y=1985
80 PI=3.1415925 : TUPI=6.283185 : DEG=57.29578 : RAD=.01745329
90 DEF FNA(X)=(X-INT(X))*TUPI
100 INPUT"INPUT START GHA OF UR WINDOW IN DEGREES";Z1:Z1=Z1*RAD
110 INPUT"INPUT END OF UR WINDOW IN GHA (DEGREES)";Z2:Z2=Z2*RAD
120 INPUT "INPUT MONTH AND DAY DESIRED";M,D:IF M >= 3 THEN 150
130 J=365*(Y-1853)+D+30*(M+9)+INT((M+10)/2)+INT((Y-1853)/4)
140 GOTO 170
150 IF M=9 OR M=11 THEN C=1  ELSE C=0
160 J=365*(Y-1852)+D+30*(M-3)+INT((M-2)/2)+INT((Y-1852)/4)+C-1
170 T1=J-17472.5 : UTC=0
180 CLS:PRINT" UTC";TAB(15)"GHA";TAB(30)"DEC";TAB(46)"RA":PRINT
190 MR=(UTC-INT(UTC/100)*100)+INT(UTC/100)*60-1440
200 IF MR <= 0 THEN 210 ELSE UTC=2400
210 T2=(UTC-INT(UTC/100)*100)/1440+INT(UTC/100)/24:T=T1+T2
220 K1=FNA(.751213+.036601102*T):K2=FNA(.822513+.0362916457*T)
230 K3=FNA(.995766+.00273777852*T):K4=FNA(.974271+.0338631922*T)
240 K5=FNA(.0312525+.0367481957*T)
250 L1=K1+RAD*(.658*SIN(2*K4)+6.289*SIN(K2))
260 L1=L1+RAD*(-1.274*SIN(K2-2*K4)-.186*SIN(K3))
270 L1=L1+RAD*(.214*SIN(2*K2)-.114*SIN(2*K5))
280 L1=L1+RAD*(-.059*SIN(2*K2-2*K4)-.057*SIN(K2+K3-2*K4))
290 K6=K5+RAD*(.6593*SIN(2*K4)+6.2303*SIN(K2)-1.272*SIN(K2-2*K4))
300 L2=RAD*(5.144*SIN(K6)-.146*SIN(K5-2*K4))
310 D1=COS(L2)*SIN(L1)*.397821+SIN(L2)*.917463
320 D1=ATN(D1/(SQR(1-D1*D1)))
330 A1=(COS(L2)*SIN(L1)*.917463-SIN(L2)*.397821)/COS(D1)
340 A2=COS(L2)*COS(L1)/COS(D1)
350 IF A2 > 0 AND A1 >= 0 THEN R1=ATN(A1/A2):GOTO 370
360 IF A2<0 THEN R1=ATN(A1/A2)+PI ELSE R1=ATN(A1/A2)+TUPI
370 LST=.065709822*T1
380 LST=T2*24*1.002738+6.646055+(LST-INT(LST/24)*24)
390 LST=(LST-INT(LST/24)*24):GHA=(LST/24)*TUPI-R1
400 IF GHA<0 THEN GHA=GHA+TUPI ELSEIF GHA>TUPI THEN GHA=GHA-TUPI
410 IF GHA > Z1 AND GHA < Z2 GOTO 480
420 IF GHA <= Z1 THEN  440
430 PRINT:B1=INT(237*(TUPI-GHA+Z1)/60)*100:UTC=UTC+B1:GOTO 450
440 UTC=UTC+I+237*(Z1-GHA)
450 UTC=INT(UTC/10)*10:IF UTC > 2400 THEN 100
460 Z=(UTC-INT(UTC/100)*100)-60:IF Z<0 THEN 190
470 UTC=INT(UTC/100)*100+100+Z:GOTO 190
480 A$="###.#":PRINT UTC;TAB(13)USING A$;GHA*DEG;
490 PRINTTAB(28)USING A$;D1*DEG;:PRINTTAB(44)USING A$;R1*DEG/15
500 UTC=UTC+I:IF UTC > 2400 THEN 100
510 Z=(UTC-INT(UTC/100)*100)-60:IF Z<0 THEN 190
520 UTC=INT(UTC/100)*100+100+Z:GOTO 190
```

```
10 '************************************************************
20 '**   'FF' MOONLOCATOR PROGRAM GIVES AZIMUTH-ELEVATION    **
30 '************************************************************
40 '
50 'PGM WRITTEN IN BASIC FOR A TRS-80 MODEL III.  -  by  W5FF
60 'MODIFY LINE 70 FOR UR QTH-DEGREES x .01745329 FOR LAT & LO.
70 CL$ = "W5FF" : LAT=.6105744 : LO=1.854417 : I = 10 : Y=1985
80 PI=3.1415925 : TUPI=6.283185 : DEG=57.29578 : RAD=.01745329
90 DEF FNA(X)=(X-INT(X))*TUPI
100 INPUT"MINIMUM ELEVATION FOR PRINTOUT";ME : ME = ME*RAD
110 INPUT"INPUT MONTH & DAY DESIRED";M,D : IF M >= 3 THEN 140
120 J = 365*(Y-1853)+D+30*(M+9)+INT((M+10)/2)+INT((Y-1853)/4)
130 GOTO 160
140 IF M = 9 OR M = 11 THEN C = 1 ELSE C = 0
150 J=365*(Y-1852)+D+30*(M-3)+INT((M-2)/2)+INT((Y-1852)/4)+C-1
160 T1=J-17472.5 : UTC=0
170 PRINT"MOON DATA FOR ";CL$;" ON ";M;"/";D;"/";Y:PRINT
180 PRINT " UTC";TAB(12)"AZIM";TAB(23)"ELEV":B$="----"
190 PRINT B$;TAB(12)B$;TAB(23)B$
200 MR=((UTC-INT(UTC/100)*100)+INT(UTC/100)*60)-1440
210 IF MR <= 0 THEN 220 ELSEIF MR-I >=0 THEN 100 ELSE UTC=2400
220 T2=(UTC-INT(UTC/100)*100)/1440+INT(UTC/100)/24:T=T1+T2
230 K1=FNA(.751213+.036601102*T):K2=FNA(.822513+.0362916457*T)
240 K3=FNA(.995766+.00273777852*T):K4=FNA(.974271+.0338631922*T)
250 K5=FNA(.0312525+.0367481957*T)
260 L1=K1+RAD*(.658*SIN(2*K4)+6.289*SIN(K2))
270 L1=L1+RAD*(-1.274*SIN(K2-2*K4)-.186*SIN(K3))
280 L1=L1+RAD*(.214*SIN(2*K2)-.114*SIN(2*K5))
290 L1=L1+RAD*(-.059*SIN(2*K2-2*K4)-.057*SIN(K2+K3-2*K4))
300 K6=K5+RAD*(.6593*SIN(2*K4)+6.2303*SIN(K2)-1.272*SIN(K2-2*K4))
310 L2=RAD*(5.144*SIN(K6)-.146*SIN(K5-2*K4))
320 D1=COS(L2)*SIN(L1)*.397821+SIN(L2)*.917463
330 D1=ATN(D1/(SQR(1-D1*D1)))
340 A1=(COS(L2)*SIN(L1)*.917463-SIN(L2)*.397821)/COS(D1)
350 A2=COS(L2)*COS(L1)/COS(D1):GOSUB 540
360 LST=.065709822*T1
370 LST=T2*24*1.002738+6.646055+(LST-INT(LST/24)*24)
380 LST=(LST-INT(LST/24)*24):GHA=(LST/24)*TUPI-FT
390 IF GHA<0 THEN GHA=GHA+TUPI ELSEIF GHA>TUPI THEN GHA=GHA-TUPI
400 H=LO-GHA
410 E1=COS(LAT)*COS(H)*COS(D1)+SIN(D1)*SIN(LAT):E2=SQR(1-(E1*E1))
420 EL=ATN((E1/E2)-(1/(61.33*E2))):F=ATN(E1/E2)
430 IF EL<ME THEN ADD=60*(((ME-EL)*DEG)/(14.5*COS(LAT)))ELSE 460
440 UTC=INT(UTC/100)*60+UTC-(INT(UTC/100)*100)+ADD
450 UTC=(INT(UTC/60)*100)+UTC-(INT(UTC/60)*60):GOTO 510
460 A1=SIN(LAT)*SIN(D1)+COS(LAT)*COS(D1)*COS(H)
470 A1=SIN(H)*COS(D1)/SQR(1-A1*A1)
480 A2=SIN(D1)/(COS(LAT)*COS(F))-(TAN(LAT)*TAN(F)):GOSUB 540
490 A$="###.#":PRINT USING"**##";UTC;:PRINTTAB(11)USING A$;FT*DEG;
500 PRINTTAB(22)USING A$;EL*DEG
510 UTC=INT((UTC*10)/100)*10:UTC=UTC+I:IF UTC > 2400 THEN 100
520 Z=(UTC-INT(UTC/100)*100)-60:IF Z < 0 THEN 200
530 UTC=INT(UTC/100)*100+100+Z:GOTO 200
540 IF A2 > 0 AND A1 >= 0 THEN FT=ATN(A1/A2):GOTO 570
550 IF A2 < 0 THEN FT=ATN(A1/A2)+PI:GOTO 570
560 FT=ATN(A1/A2)+TUPI
570 RETURN
```

plate line will allow compensation for small variances in plate output capacitance of different tubes. Several different tube types have been used sucessfully- 7289, 2C39A+B, 3CX100A5. Tubes with larger output capacitance such as a Y667 or 7211 will not work. Neither will tubes designed for pulse service(high anode voltage) with the longer ceramic between grid and plate. It may also be possible to use this amplifier as an active tripler by injecting 432mhz into the cathode though power output will be substantially lower. A low impedance bias supply is a requirement due to the grid current drawn. If one is not provided, the grid current will create a more negative voltage on the grid limiting the power out. Penlight batteries work well as does a zener. R1 in the filament circuit is needed to reduce filament voltage so excessive cathode heating does not occur.

Modifications

1. Remove cover and tube
2. Remove 4 screws holding plate bypass(mica) and plate line.
3. Remove output link and brown access tube through plate line.
4. Unsolder plate bypass plate from plate line and save the plate as it forms part of the plate bypass.
5. Remove lower half of plate line by drilling out rivets.
6. Reassemble pieces of plate bypass in the original position.
7. Cut plate line carefully to 2-3/8" length on the faint scribe line 2" from the bypass end.
8. Round off edges of plate tuning vane to provide clearance to plate line. This is necessary to prevent the vane from shorting out the B+. Turn vane 360 degrees and check before applying voltage. Plate tuning vane will vary about 45 degrees between 1269 and 1296 mhz. At 1269 it should be parallel to sides of cage.

Units with round tuning caps over the tube anode work equally well.

1269 - 1296 Mhz Amplifier - KØKE

RF power generation at 23cm is not a difficult task. A Motorola T-44(450mhz) final amplifier cage can be converted to operate quite efficiently and cover the full frequency range from Mode L satellite band to weak signal frequencies at 23cm. This amplifier should find use as a box to raise low power transverters etc. to reasonable and useful power levels or as a driver for larger amplifiers. Stage gains of 8 - 10 db are possible depending on anode voltage and drive levels. Two units may be cascaded to approach 80 - 100 watts from the 2 watt level. If this is done, the first driver should be run at a lower anode voltage. These units are readily available at surplus events and are also available from WA5VJB. The design is readily repeatable and requires NO machine work. The plate circuit is high Q and will also serve to clean up the output of "dirty" drivers. Heat drift is minimal if the plate circuit is adjusted correctly. Cooling air can be a small squirrel cage or a muffin fan blowing air through the cage. Nominal results acheived are as follows: (Bird 43 - 50J slug)

Drive	Plate Voltage	Output Power
2w	650v	18w
5w	650v	32w
9w	650v	55w
5w	1200v	55w
9w	1200v	90w

The original cathode line works in the 3/4 wavelength mode. Both input and output are link coupled. The plate line evolved from an amplifier published in the RSGB VHF manual. Output link coupling is adjusted by twisting the plate line at an angle to vary the distance to the output link. The Q of the plate circuit will require very small incremental adjustments to the link coupling distance to achieve the stated efficiencies and nominal outputs. The sliding adjustment bar on the tube end of the

The input tuning can be adjusted to near resonance prior to applying voltage. Simply apply drive and tune for best VSWR with tube in socket. This will vary slightly with drive levels and loading as the cathode impedance does vary slightly at different output powers. Likewise, a rough approximation for the plate circuit can be determined by injecting low drive into the output link and tuning the plate circuit, loading and coupling for best VSWR.

The original driver stage is not useable as it was a tripler from 150mhz and does not have the cathode line in place. The plate circuits are identical and can serve as spare parts or a second try.

Power supplies for older tube transceivers are excellent for powering these amplifiers. The lower voltage tap originally used for screen and lower level tubes (350v) will work nicely to get you from 2w to around 10w to drive a second amp to higher powers.

RF leakage is virtually undetectable even at the high powers. However, maintain all seals as these power levels can be dangerous. Edges can act as slot radiators.

The utter simplicity of this amplifier will hopefully stimulate greater activity at these frequencies.

Keith R. Ericson

KØKE - Eric

5195 E. Missouri

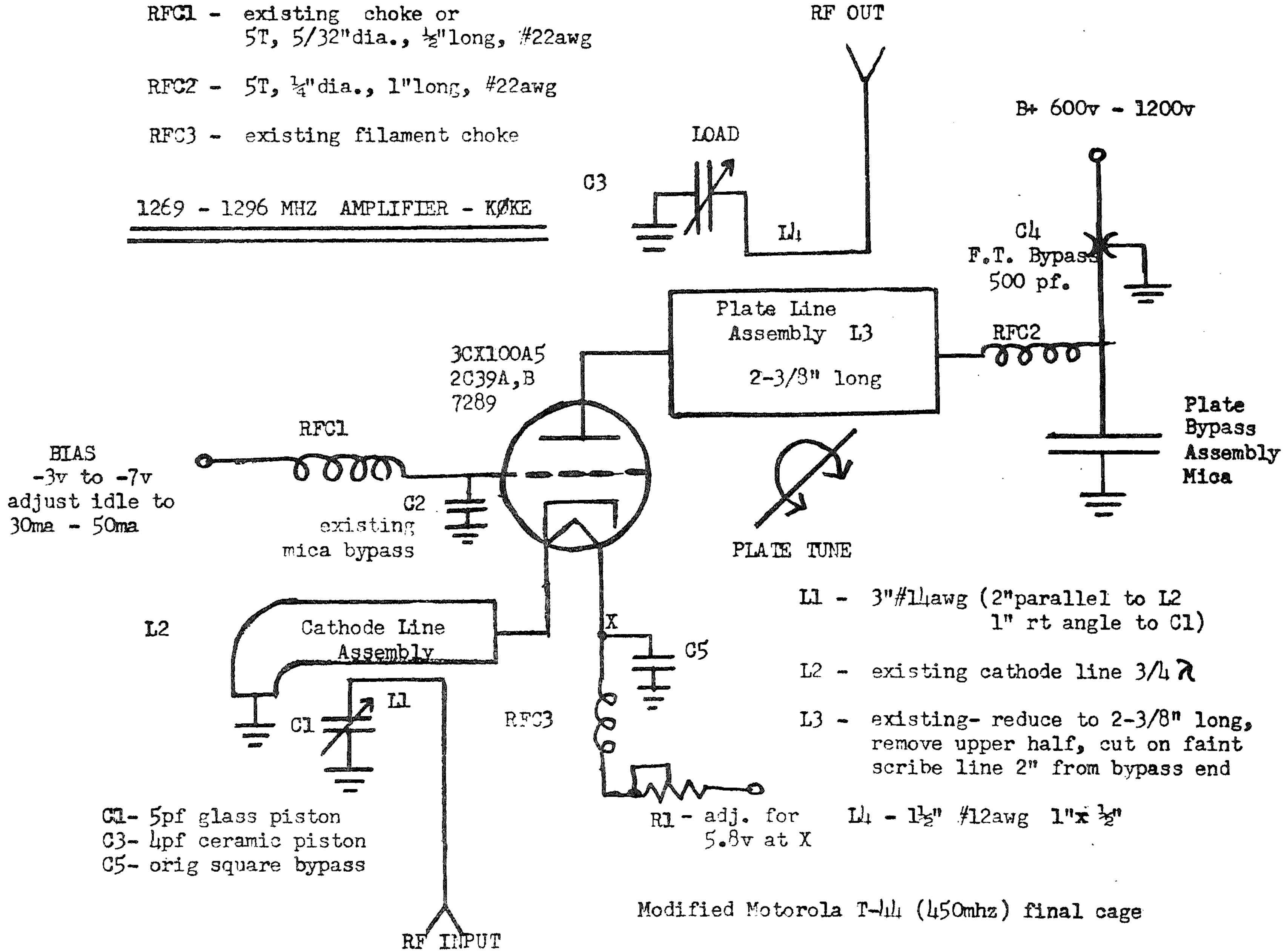
Denver, Colorado 80222

RFC1 - existing choke or
5T, 5/32"dia., ½"long, #22awg

RFC2 - 5T, ¼"dia., 1"long, #22awg

RFC3 - existing filament choke

1269 - 1296 MHZ AMPLIFIER - KØKE



L1 - 3"#14awg (2"parallel to L2
1" rt angle to C1)

L2 - existing cathode line 3/4 λ

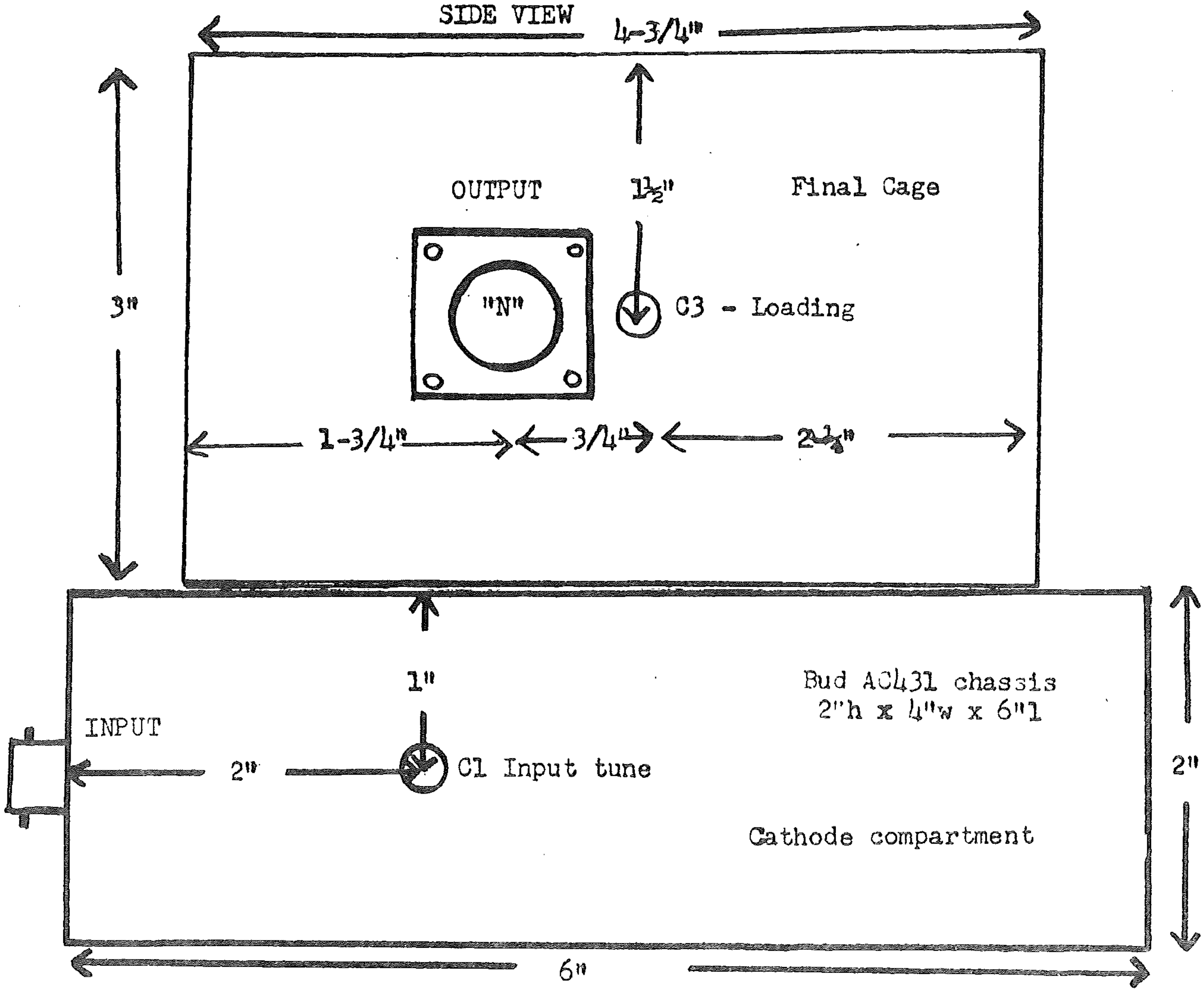
L3 - existing- reduce to 2-3/8" long, remove upper half, cut on faint scribe line 2" from bypass end

L4 - 1½" #12awg 1"x ½"

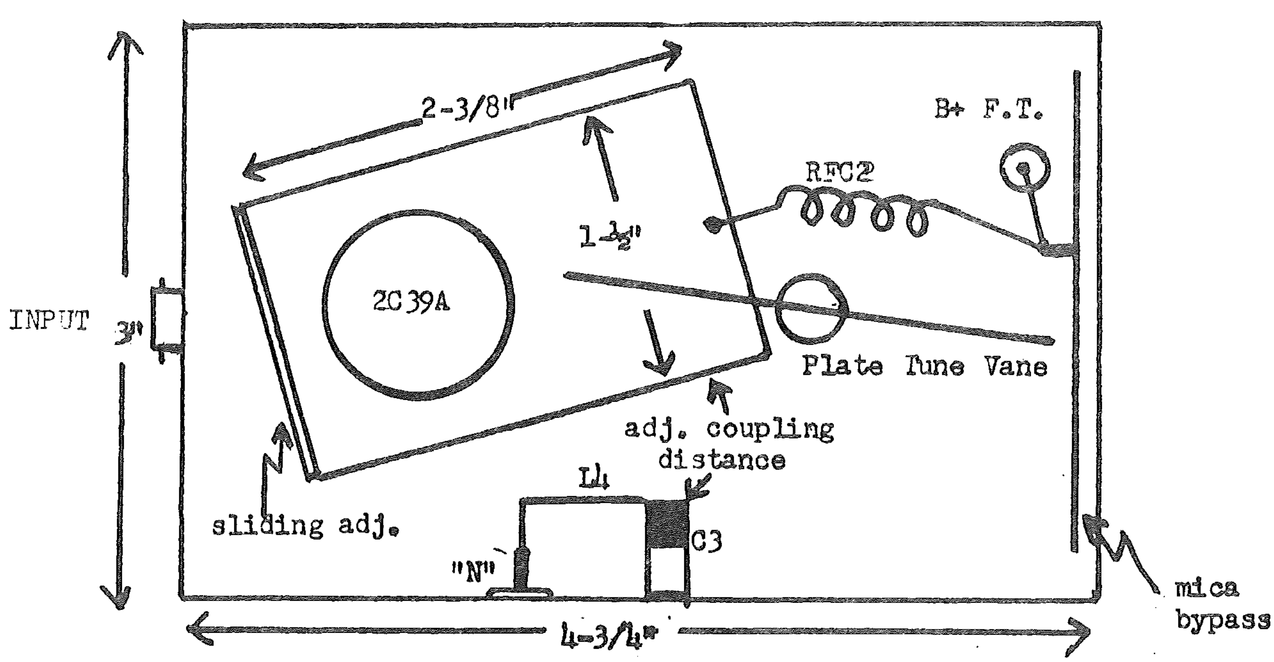
C1- 5pf glass piston
C3- 4pf ceramic piston
C5- orig square bypass

Modified Motorola T-44 (450mhz) final cage

SIDE VIEW



TOP VIEW



THE FOLLOWING TEXT "HOW WE PUT THE G-LINE TO WORK" BY WARREN WELDON W5DFU WAS PUBLISHED IN THE PROCEEDINGS OF THE 1984 CENTRAL STATES VHF CONFERENCE BUT CONTAINED A NUMBER OF DIMENSIONAL AND TYPOGRAPHICAL ERRORS. A CORRECTED COPY IS BEING PRINTED IN THIS YEAR'S PROCEEDINGS TO ASSIST THOSE THAT MIGHT WISH TO TRY THIS INEXPENSIVE AND EFFICIENT MICROWAVE FEEDLINE METHOD.

HOW WE PUT THE G-LINE TO WORK

BY

WARREN WELDON W5DFU

The Surface Wave Transmission Line, or more popularly known as G-Line, was developed around 1950 by Dr. George Goubou of the Signal Corps. Two significant articles covered the amateur applications of this unique antenna feedline system in past years. The first being an article titled "The G-Line" by Major Walter White, Jr., K2CHF appeared in the April 1953 issue of CQ magazine. The second titled "Putting the G-Line to Work" by George A. Hatherall K6LK appeared in The June 1974 issue of QST.

The system consists of a coaxial feed to a launcher, an unshielded single wire transmission line and a collector which feeds again into a coaxial line. The mechanical and electrical design of the launcher and collector are identical. If you are interested in a very detailed description of the theory, design and application of this system, I urge you to read the two excellent articles noted above.

The participants in the story that follow are Merlin Berrie W5HTZ of Wewoka, OK and Warren Weldon W5DFU of Tulsa, OK. Both have spent most of their ham careers in the pursuit of the higher frequencies and are avid home brewers of equipment to achieve better ham communications at those frequencies.

Merlin and I have been communicating with each other and experimenting with such equipment for 36 years and have had a nightly schedule for the past 8 years. The G-line has always interested us and when we got serious about the 1296 Mhz band 3 years ago, we decided the G-line was a good choice since much of the early experimental work by others had been done on that band.

G - Line   Warren Weldon W5DFU and Merlin Berrie W5HTZ

In the winter of 1981 the search for a good light weight, highly conductive amd easily solderable material for use in constructing the launcher and collector cones led us to the use of double sided 0.007 inch thick PC material. We were able to obtain this material in 3 ft x 4 ft sheets.

Each sheet provided sufficient material to fabricate 2 cones which are 21 inchs long and 13 inchs in diameter at the open end. Merlin laid out a posterboard template for the cones using a string compass. Allowance was made for a 0.750 inch overlap when the cone was rolled. After cutting, the PC material was rolled and clamped between two pieces of wood. The inside and outside of the cone were then soldered. The copper cladding on this thickness material is very thin and care must be exercised during the soldering to not over heat the copper and delaminate it from the fiberglass.

Merlin then soldered a rolled copper tube 0.375 inch ID x 3 inchs long into the apex of each cone so the tube extends slightly into the cone. A set screw was provided near the outer end of the tube to clamp another copper tube placed inside the first tube but over the shield braid of the coax feed cable. These telescoping tubes were used to match the cone to the coax feed cable.

I used a different method to clamp the cone to the coax feed cable tube. A 0.5 inch copper pipe coupling, 1.0 inch long, is slotted for one half its length, the resulting tabs are bent out to match the cone angle at the apex. Into the other end of the tube I soldered the male threaded end of a brass 0.375 inch tube to 0.375 inch pipe male connector compression tube fitting. I then soldered the flared tabs of the copper coupling to the apex of the cone. The compression tube fitting provides a mechanically and electrically secure method to clamp the cone apex to the coax feed cable tube. It also permits easy adjustment for matching the cone to the coax feed during tune-up.

During the period of construction, Merlin exchanged correspondence with George Hatherall K6LK (author of the QST article). George provided many helpful suggestions including this improved method of cone to coax matching.

A short length (8 ft) of Belden #8214 coax for the feedline at each cone is prepared in the following manner. The outer vinyl jacket is removed for 5 feet at one end to form a G-Line pigtail. Push the copper braid backslightly and cut off 1 inch of the foam insulation and center conductor.

Prepare a 5 inch long piece of 0.375 inch copper tubing by slightly flaring one end with a tubing flaring tool. On the coax, pull the braid forward over the end of the insulation so as to compress the braid into a smaller diamter bundle. Carefully feed the braid into the flared end of the copper tube keeping the braid over the foam tightly compressed. The flare on the tube should act as a funnel to aid in this operation. When the free braid emerges from the other end of the tube, clamp this braid in a bench vise to enable you to keep the braid tight. Continue to slide the tube over the braided shield until the flared end seats against the vinyl jacket. Cut off the braid 0.050 inchs beyond the unflared end of the tube and slide the remaining braid off the foam. Carefully solder the 0.050 inchs of braid to the end of the tube. Using a file, dress the solder to the same OD as the tube.

Take a 1.0 inch long piece of 0.187 inch brass or copper rod and using a #33 drill (0.113 inch), bore a hole the entire length of the rod. Being careful not to nick the center conductor, strip 0.5 inchs of foam from the pigtail and tin with solder. Tin the hole in the rod. With heat applied to the rod, press it over the center conductor. The remaining 0.5 inch hole will be used to attach the actual G-Line conductor.

Thread the pigtail into the outer end of the clamping hardware you soldered to the apex of the cone. The pigtail should telescope into the cone apex support and about 32 inchs of the pigtail should now protrude from the open (13 inch diameter) end of the cone. The purpose of the pigtail is to collimate the RF to make it travel along the line and not radiate since there is no braided shield to contain it. K6LK determined the 4.5 foot length at each end is optimum.

I suggest you use a thin polyethylene dish (I use flower pot dishes) over the open end of the cone with the pigtail passing through a small hole in the center. The lower cone should be sealed with RTV. This will keep out the rain and nesting birds.

George and other early experimenters showed that the efficiency of the G-Line was highly dependant on the choice of the wire and its insulation material and thickness. During the winter of 1981-82 Merlin spent many weeks trying differenet types of wire on his test rig strung between two trees in his yard. For the majority of his tests he used a MicroWave Modules MMT 144/1296 transverter as the RF generator. The following are the results of the wire tests:

	Wire/Insulation Type	Loss
1.	No. 14 solid / 0.062 inchs polyethelyne	1.8 db/80 ft
2.	No. 12 solid / enamel	2.7 db/80 ft
3.	No. 12 solid / thermoplastic (house wire)	2.7 db/80 ft
4.	7/22 stranded mild steel / plastic(cloths line)	5.8 db/80 ft
5.	No. 20 stranded / plastic (hookup wire)	4.5 db/80 ft
6.	No. 8 stranded / 0.025 inch teflon	1.3 db/100 ft
7.	No. 14 Stranded / 0.015 inch teflon	1.2 db/100 ft
8.	No. 14 stranded / 0.015 inch teflon	2.8 db/200 ft
9.	Cones nose to nose (pigtails only)	0.4 db

G - Line Warren Weldon W5DFU and Merlin Berrie W5HTZ

In our systems we used the No. 14 stranded with 0.015 inchs of Teflon insulation. When both the launcher and collector cones have been prepared as described above, solder each end of your G-Line wire into the connector rods on the cone pigtails. Apply over this splice a thin layer of teflon tape, the same tape plumbers use, and spray with a clear plastic to keep it in place.

Install an N connector on each coax feed cable for connection to the equipment. Right here is an important point to remember anytime you are installing an N connector on Belden 8214. The center of the 8214 is 0.110 inchs in diameter and the inside diameter of the solder cup on the N connector is 0.090 inchs. In order to not create an impedance bump (which will "eat your lunch" at 1296 MHz), do NOT cut off strands to make the center fit the solder cup. Instead tin all strands together and with a small file dress all strnds to form a short tapered section and then dress the OD of the remainder to fit into the solder cup. Sometime make up a test section of cable using both methods and compare the results at 1296 MHz using a sensitive SWR-power meter. It will make a believer out of you!

A wedge type cable clamp sold to support powerline service drops we found at Pay n Pak that fits snugly over the coax back of the cones makes an excellent means of anchoring each end of the assembly.

String up the line assembly where ever it is fairly taut, in the clear along its entire length and affords access to both cones. Apply RF power through an SWR reading power meter to one end of the coax and connect a power reading dummy load or power meter and antenna to the other end. Tune the system by moving the cones back and forth on th coax feed lines in small increments by means of the telescoping copper tubes until the lowest SWR reading at the input end and the highest power reading on load end is acheived. When optimum tuning is acheived, tighten the tube locking method used and coat the hardware junctions with RTV to weatherproof them. On my system the tuning tubes project into the apex of the cones about 2 inchs.

The follwoing are some notes on the performance of the G-Line:

1. Provides lower loss for equal length compared to 0.75 inch helical coax cable at a considerable cost and weight savings.
2. Very durable. Merlin's and mine have been in serivce for 2 years with winds up to 80 mph with no electrical or mechanical problems.
3. Ideal for use with telescoping and fold-over towers (which I use) where use of a stiff helical cable would present major problems.
4. Loss factor remains equally low at 2304 Mhz.
5. Best suited to straight-run feedline applications as losses rise sharply if bends are attempted.
6. The length of the coax at each end of the system should be kept very short as losses rise rapidly in this cable.
7. The area immediately surrounding (roughly 6.5 inch radius) of the G-Line and the pigtails must be kept clear of all objects.
8. Performance remains good when operated under rain and snow conditions.

 Warren Weldon W5DFU and Merlin Berrie W5HTZ

Merlin is using a 7 ft dish and I am using a single 45 element loop yagi. For several months we maintained nightly communications over the 80 mile path between our locations with each of us using only 1 watt output of our Microwave Modules transverters. Merlin's best DX is W5LDV in Houston at 365 miles and mine is W9ZIH at Hickory Hills, IL at 600 miles. We are satisfied G-Line users and would like to see other ham microwave operators take advantage of this dandy feedline method.

We wish to express our gratitude to George Hatherell, K6LK for his inspirational QST article that sparked our enthusiasm to try the G-Line and for his most helpful support and suggestions during our experimentation to build a couple of highly successful working systems.

ALUMINIUM NUMBERS

Common Alloy Numbers:	2024	Good Formability, High strength.
	5052	Excellent Surface finish, Excellent Corrorosion Resistance, but normally not heat treatable for high strength.
	6061	Good Machinability, Good Weldability, but can be brittle at the higher tempers.
	7075	Good Formability, High strength.
Common Tempers:	T0	Special soft condition (CAUTION !!)
	T3	Hard
	T6	Very Hard, possably brittle.
	TXXX	Three digit Tempers are usually specalized high strength heat treatments, similar to T6.

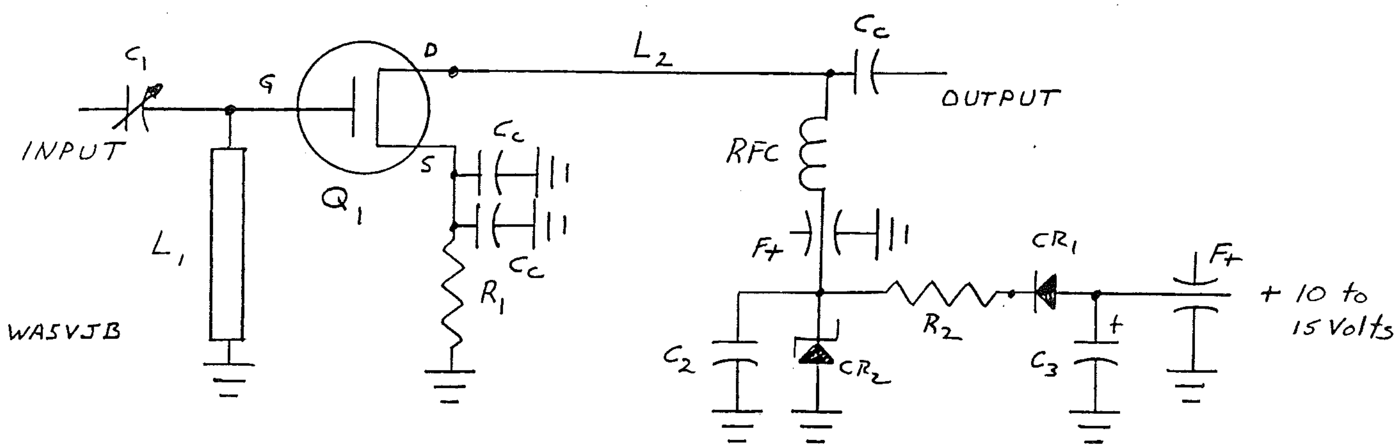
General Uses:

2024-T3, 7075-T3
Chassis boxes, Antennas; anything you plan to bend or will flex alot.

6061-T6
Mounting plates, Welded assemblies, or Machined parts.

Kent Britain WA5VJB

1296 MHz GaAs FET Pre-Amp



C_1 .5 to 3pf Variable Capicator
Johannson 5806 or Giga-trim Series
Voltronics EQ or M Series
Erie MVM-003 Series
Johnson Teflon Trimmer

C_2 .01 to .1 MFd Ceramic Capacitor

C_3 1 to 20 MFD Electrolitic Capacitor at 25Volts

C_c Chip Cap 200 to 1000 pf.

R_1 100Ω 1/4 or 1/8 watt Metal film or carbon

R_2 200Ω 1 or 2 watt

CR_1 1N914 - 1N4148 etc.

CR_2 3.9 V 1watt Zener

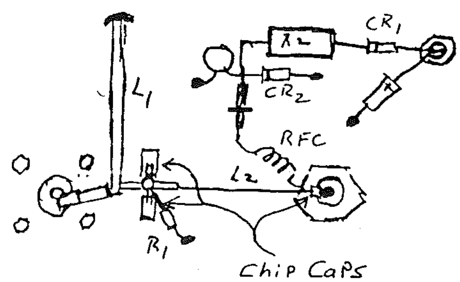
F+ Feed thru Capacitor 500 to 1000 pf.

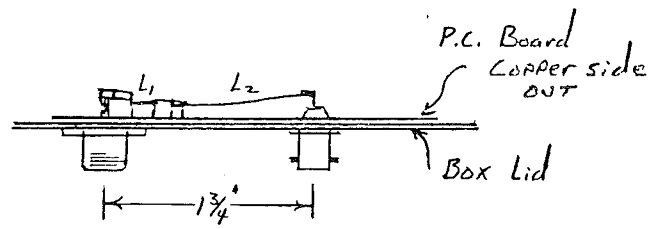
L_1 1½" long 1/8" wide 1/8" high .020 or .032 sheet Brass

L_2 3/4" long #24 Copper wire

Box: Bud CU-124
Hammon 1590B or similar

RFC 6 turns 1/8" dia. close spaced #24 copper wire





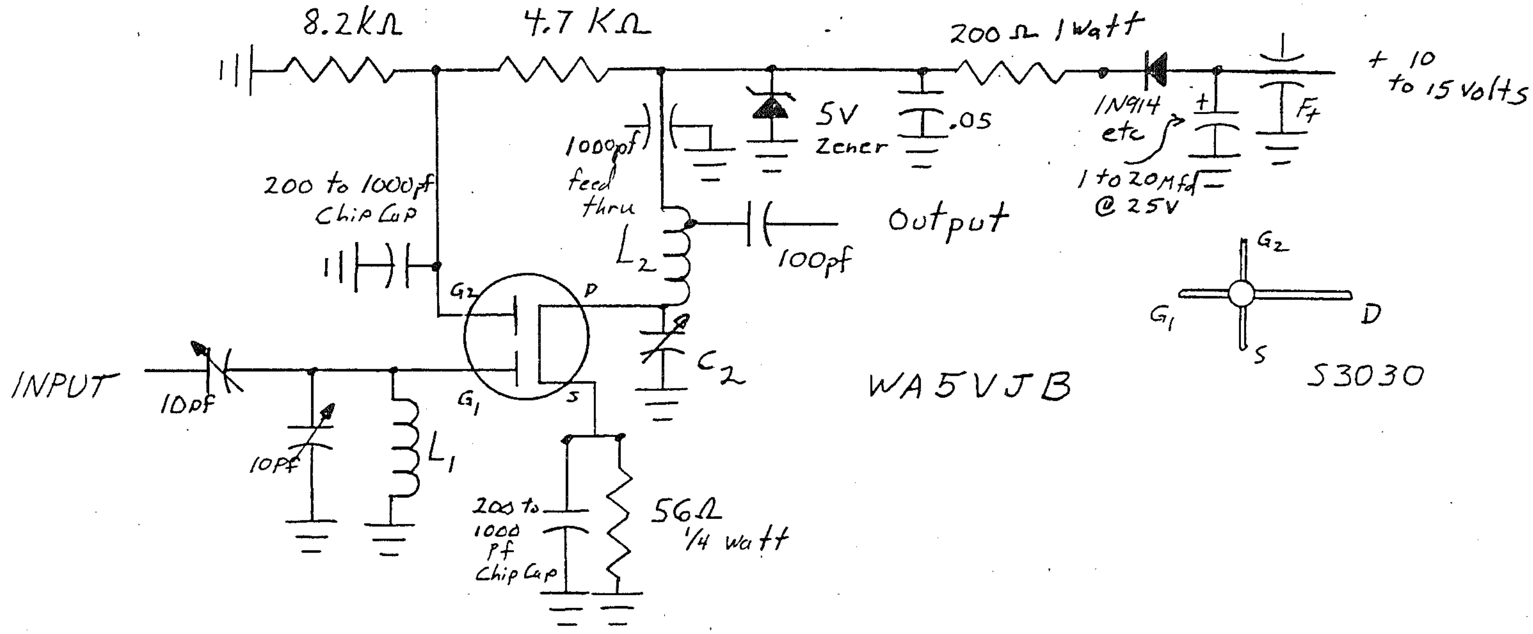
Notes:

It is very important that C_1 is capable of tuning to ½ pf or less. Normal Matching is between ½ + 1 pf and the common Johanson trimmers will often not tune low enough.

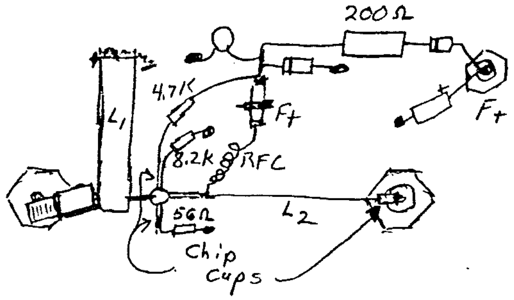
Because L_1 is so close to ground, you have to mount most bypass capicators at an angle.

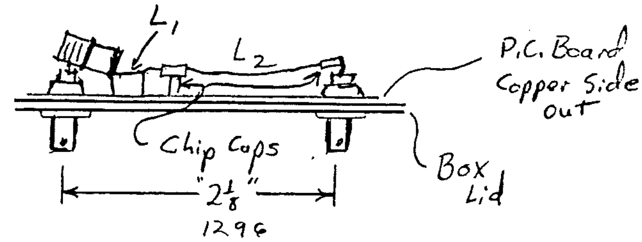
This pre-amp has been built using Dexcel, NEC, and MGF devices. For those with the equipment and inclination to squeeze out the last 1/10 db from your favorite GaAs Fet, L_1 can be constructed a bit long and a brass foil sliding short used to find the optimum point. L_2 can be changed by substituting finer wire for more inductance or strips of brass

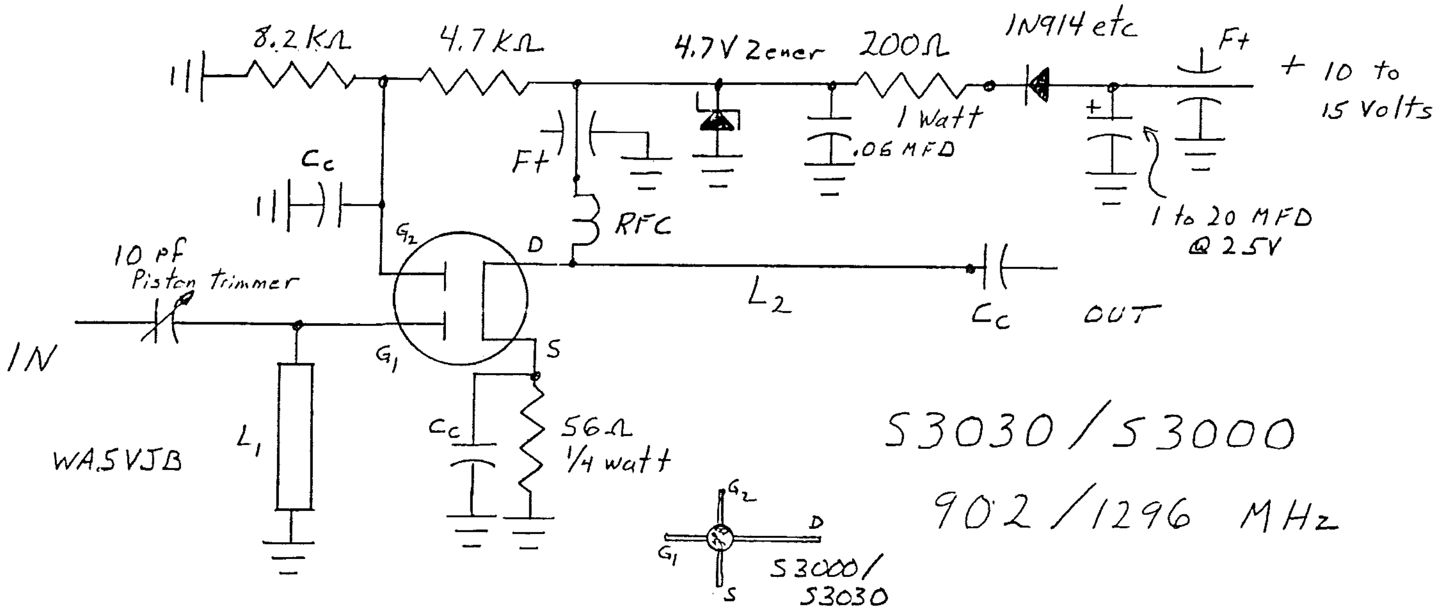
S3030 T.I. GaAs Fet



	L1		C2	L2		
144 MHz	8 turns	3/16" dia	20pf	7 turns	tap. at	2 turns
220 MHz	5 turns	"	10pf	5 turns	"	1½ turns
432 MHz	2½ turns	"	10pf	2 turns	"	1 turn



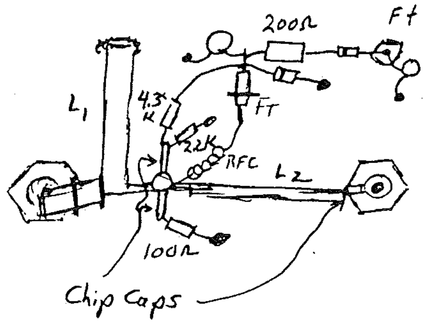


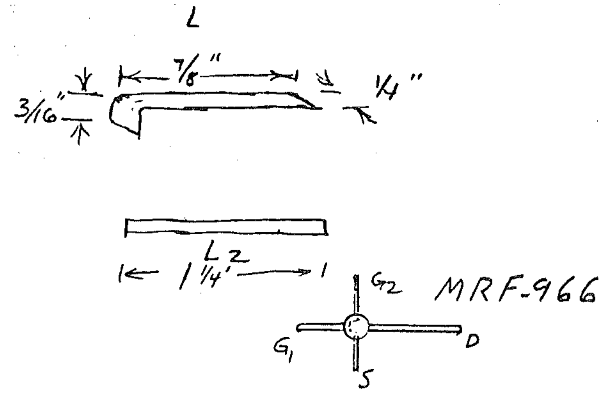


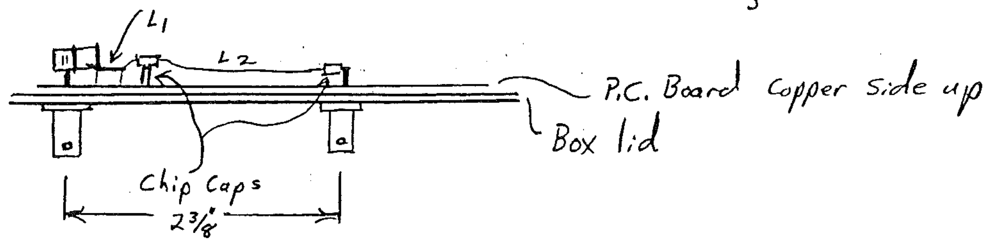
	902 MHz	1296 MHz
L_1	1/4" wide, 1 5/8" long 3/16" high brass Strip	1/4" wide, 1" long 3/16" high brass Strip.
L_2	1 1/2" long #24 copper Wire	1 1/8" long #24 copper wire
RFC	8 turns close spaced #24 copper wire	6 turns close spaced #24 Copper Wire

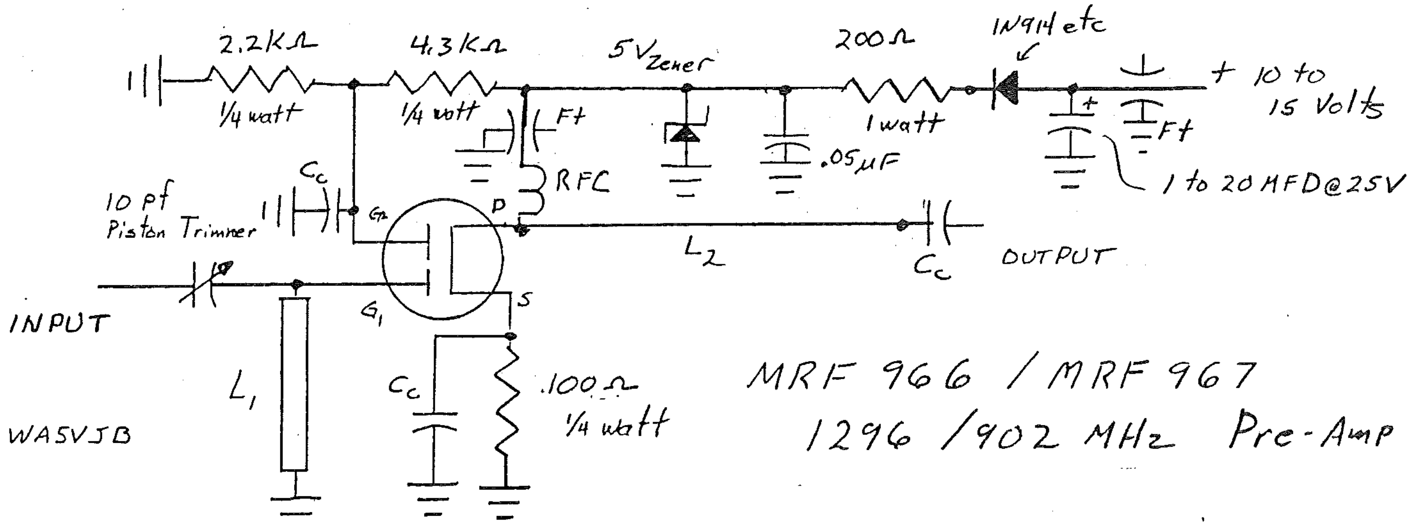
C_c Chip Cap 200 to 1000 pf.

F_t Feed thru capicator 500 - 1000pf.









WA5VJB

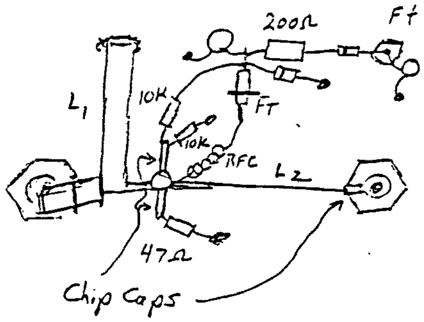
MRF 966 / MRF 967
1296 / 902 MHz Pre-Amp

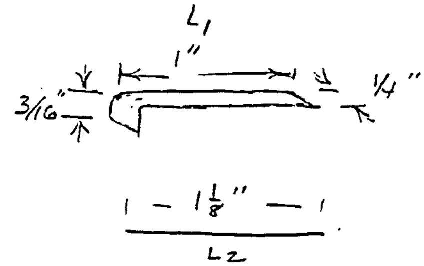
	902 MHz	1296 MHz
L_1	1/4" wide Brass 1½" long 3/16" high	1/4" Wide Brass 7/8" long 3/16" high
L_2	#24 Copper Wire 1¼" long	1/8" Wide Brass 1¼" long 1/4" high

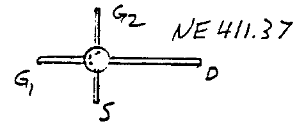
RFC 6 turns 22-24 Gauge copper wire, close spacing

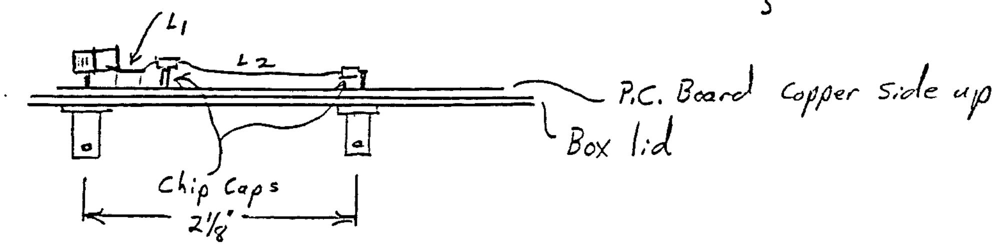
C_c Chip Caps 200 - 1000 pf

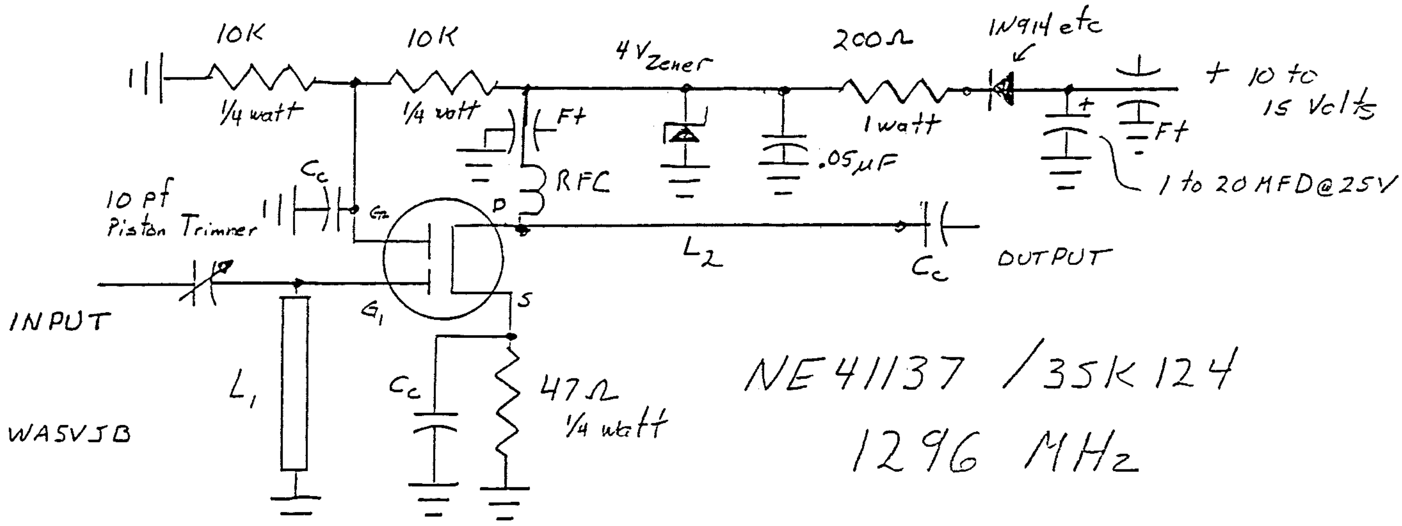
F_t Feed thru cap. 200 - 1000 pf











L1 1/4" wide strip brass
1" long - 3/16" high

L2 Solid Copper wire 22 to 24 Gauge
1 1/8" from body of GaAs Fet to chip Cap.

RFC 6 turns 22-24 Gauge copper wire, close spacing

Cc Chip Caps 200-1000 pf

Ft Feed thru cap. 200-1000 pf

HISTORY OF THE CENTRAL STATES VHF SOCIETY

CONTINUED

In 1984, the Eighteenth Conference was hosted by Rod Blocksome, KODAS, in Cedar Rapids, Iowa. An outstanding program of technical speakers highlighted the weekend. Antenna gain and noise figure measurements produced a lot of interest. The John Chambers Award was presented to Ron Dunbar, WOPN. The Mel Wilson Award went to Ray Nichols, W5HFV, a charter member of the CSVHF Society and Society Historian. A donation of $400 was made to AMSAT. Al and Emily Ward out did themselves in putting together the prizes for the banquet.

ANTENNA GAIN MEASUREMENTS - 1984
Cedar Rapids, Iowa

144 MHz

WØSD	18 ele Yagi H.B. 28 ft. boom	13.9 dBd
KCØP	3.2 19 ele Cushcraft	13.2 dBd
WA9HCZ	6 ele Yagi	12.3 dBd
KCØP	8 ele Quadyagi	11.8 dBd
WBØTEM	8 ele Yagi REFERENCE	9.9 dBd
K9FYV	5 ele H.B. Yagi	9.7 dBd
N9BD	stacked mobile	5.4 dBd
KD6R	Egg beater	4.4 dBd
WA9HCZ	3 ele Wheel	4.3 dBd

220 MHz

KCØW	17 ele Cushcraft Boomer	13.7 dBd
WBØTEM	13 ele homebrew	13.6 dBd
KB9NM	28 foot Quagi	13.4 dBd
KCØP	8 ele Quagi	11.7 dBd

432 MHz

WBØTEM	31 ele H.B. Yagi, 24 ft boom	17.65dBd
KØGJX	Cushcraft 24 ele	16.3 dBd
WBØZKG	24 ele 18 ft. Boom H.B	15.9 dBd
WBØTEM	19 ele RIW H.B	15.2 dBd
WBØQCD	88 ele J-Beam	14.6 dBd
WBØDGF	15 ele NBS HB	13.9 dBd
KFØM	11 ele Quagi H.B	13.7 dBd
WBØQCD	48 ele J-Beam	12.1 dBd
WBØDGF	4.2 NBS HB Yagi	10.9 dBd
WØUC	5.2 NBS	10.8 dBd
WBØHXY	11 ele Quagi	10.2 dBd
WA5DBY	4 foot HB dish	9.9 dBd
KØCQ	EIA Standard stacked dipoles	9.8 dBd
WBØHXY	8 ele Quagi H.B	9.4 dBd
K5IS	15 ele Quagi H.B	9.2 dBd
WØWL	NBS Yagi 9 foot boom	7.5 dBd
WBØQCD	6 ele KLM commercial	7.3 dBd
KA7APJ	5 ele Commercial Yagi, portable	6.8 dBd

1296 MHz

WB5DBY/K5ASZ	4 foot HB dish	22.3 dBi
K9UIF	45 element Loop, K9KFR	20.0 dBi
KØKE	57 ele 16 foot Yagi	18.7 dBi
WDØBWQ	25 ele Loop Yagi	18.4 dBi
KCØW	23 ele F9FT	18.3 dBi
KØKE	23 ele F9FT	18.2 dBi
W4ODW	Metal Boom Quagi	17.4 dBi

1296 MHz (continued)

KØKE	Modified 30 element F9FT 8 ft..............	16.8 dBi
KF4JU	16 ele Soild Reflector Yagi.................	16.6 dBi
W4ODW	19 ele Screen Reflector Yagi................	16.4 dBi
WA5VJB	Coffee Can with V-beam......................	13.2 dBi
KA7APJ	Collinear...................................	13.1 dBi
WA5VJB	Coffee Can..................................	11.6 dBi
K5IS	14 ele Quagi................................	10.1 dBi
WBØTEM	11 ele Yagi REFERENCE.......................	14.6 dBi

2304 MHz

W4ODW	29-inch Dish, 1lb. coffee can feed.........	23.5 dBi
W4ODW	29-inch Dish, dipole splasher feed.........	23.2 dBi
WA5DBY/K5ASZ	4-ft Dish, 1lb coffee can feed........	22.0 dBi
WA5DBY/K5ASZ	4-ft Dish, 2lb coffee can feed........	22.0 dBi
WA5VJB	60 element Loop Yagi.......................	20.8 dBi
WA5VJB	40 element Loop Yagi.......................	19.8 dBi
WA5VJB	20 element Loop Yagi.......................	17.8 dBi
W9ZIH	Standard Gain Horn.........................	13.4 dBi
K5PJR	Standard Gain Horn.........................	13.2 dBi
WA5VJB	3 lb. coffee can...........................	10.0 dBi
WB5LUA	1-10 GHz Log Periodic antenna..............	7.6 dBi
WA5DBY/K5ASZ	2 - 1lb. coffee can...................	5.3 dBi
KA7APJ	3456 MHz corner reflector..................	5.1 dBi
WA5DBY/K5ASZ	1 - 1lb coffee can....................	4.6 dBi
WB5LUA	1lb standard gain coffee can,REFERENCE.....	9.0 dBi

NOISE FIGURE MEASUREMENTS - 1984
Only top 4 of each band listed

2304 MHz		N.F.	Gain
VE4MA	MGF1402, OE9XXI................	0.90 dB	13.08 dB
WA6MGZ	MGF1402........................	0.94	28.78
VE4MA	MGF1402........................	0.97	12.77
W9ZIH	WE 103B........................	0.97	11.54

1296 MHz			
WB8BKC	MGF1402 ala Krause.............	0.55 dB	15.92 dB
WBØTEM	MGF1402........................	0.59	17.57
VE3CRU	MGF1402 ala W6PO...............	0.60	15.74
K2YXO	MGF1402........................	0.65	17.34

432 MHz			
WDØEKP	MGF1200........................	0.39 dB	17.55 dB
WA6YBT	MGF1402........................	0.40	20.07
WBØTEM	MGF1402........................	0.46	18.41
NØIS	MGF1402........................	0.49	19.43

NOISE FIGURE MEASUREMENTS (continued)

902 MHz			
VE4MA	MGF1402 ala W6PO.................	0.72 dB	14.58 dB
K2YXO	MGF1402.........................	0.98	17.22
WA5VJB	NE64535.........................	1.10	20.77
****Following used for machine confidence only****			
WB6NMT	DXL D432 (first preamp of evening)	0.79	14.67
WB6NMT	DXL D432 (last preamp of evening)	0.78	14.65
220 MHz			
WB6NMT	D432 (NO ENTRY)..................	0.34	22.41
N7NW	MGF1202.........................	0.40	20.45
N6AMG	MGF1202.........................	0.42	19.77
KØLQZ	MGF1200.........................	0.43	22.15
144 MHz			
K7KOT	MGF1202.........................	0.25	26.32
WØRRY	DXL2501.........................	0.32	25.73
K9LQZ	MGF1200.........................	0.32	20.06
N7NW	MGF1202.........................	0.33	21.96
N7NW	MGF1202.........................	0.34	22.81
WA5VJB	DXL2503.........................	0.39	21.62