

# GBPPR 'Zine



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*"I understand... how the system works."*

--- Ending quote from Ron Paul in the uncensored version of his December 21, 2011 interview with CNN's Gloria Borger (Jew).

CNN edited this interview to make it appear as if Paul "stormed off." Note that Gloria Borger is married to Lance Morgan, who works for Powell Tate.

([www.youtube.com/watch?v=RLonnC\\_ZWQ](http://www.youtube.com/watch?v=RLonnC_ZWQ))

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**ELECTRONIC TANDEM SWITCHING  
SOFTWARE DESCRIPTION  
2-WIRE NO. 1/1A ELECTRONIC SWITCHING SYSTEM**

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**NOTICE**

Not for use or disclosure outside the  
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F.	ETS-RAO Routines . . . . .	20
<b>1. GENERAL</b>		
<b>INTRODUCTION</b>		
1.01	The Electronic Tandem Switching (ETS) feature software package consists of a group of programs which enable a No. 1/1A Electronic Switching System (ESS) to serve as a tandem office in a centrex network. It gives centrex customers additional flexibility by allowing them to control station features and routing of calls. It also provides information to the customer about the status of the network and of individual calls. These features enable customers to administer their network for maximum efficiency and economy.	
1.02	When this section is reissued, the reason for reissue will be given in this paragraph.	
1.03	Part 6 of this section provides a list of abbreviations and acronyms used in this section. Part 7 provides a list of references for further information.	
<b>PURPOSE OF THE ETS SOFTWARE</b>		
1.04	The ETS software provides stored program control of the routing of centrex calls. It also provides information and a degree of control to centrex customers to help them to administer their network.	
1.05	The ETS allows a customer to specify the routing of calls in order to obtain less expensive routing whenever possible. Additionally, all calls may be monitored for accounting purposes. In order to minimize costs and to allow efficient use of the network, the ETS feature provides the ability to deny calling features from some centrex lines entirely, or to deny the use of those features only at certain times. For centrex customers with several locations, the ETS feature provides a private network for efficient and economical communications between customer locations.	
<b>SCOPE OF SECTION</b>		
1.06	This section provides an introduction to the ETS software for a No. 1/1A ESS office. Fea-	

tures through the 1E7 (for No. 1 ESS) and 1AE7 (for No. 1A ESS) generics are covered.

**2. PROGRAM ORGANIZATION**

**2.01** The various ETS programs perform three main functions:

- Routing
- Handling customer control inputs
- Providing administrative information.

These functions are described in detail within this section.

**2.02** Within each of the three main functions listed above there are several subfeatures. The general relationship of the ETS features to the other call processing functions is shown in Fig. 1. Subfeature interfaces are shown in Fig. 2 and 3.

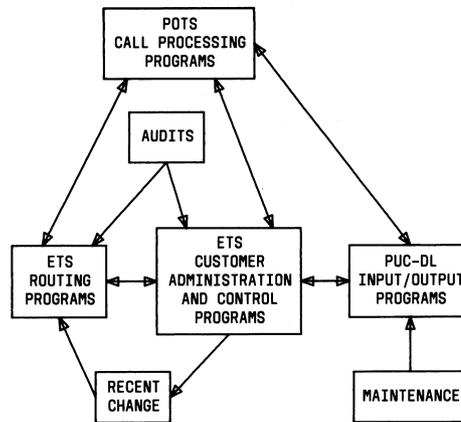


Fig. 1—ETS Feature Interfaces

**2.03** Most of the ETS features are implemented by inserting hooks and adding new subroutines to existing pidents. Some of the major types of pidents including ETS routines are:

- General call processing
- Centrex call processing
- Digit analysis
- Automatic message accounting
- Data link interface
- Recent change
- Queue handling
- Translations.

Table A lists the feature packages required for implementing ETS. Table B lists some of the major pidents containing ETS routines.

**3. GENERAL DESCRIPTION**

**ETS CONFIGURATIONS**

**3.01** The ETS is a software package that enables a No. 1/1A ESS office to serve as a tandem switch for centrex calls. It may be used in several different configurations. There may be only one ESS with one or more private branch exchanges (PBXs) or centrexes connected. See Fig. 4 for an example of this configuration. In that case, ETS serves primarily to enhance PBX or centrex features by providing improved administration, control, and data. The ETS may also be used as part of an Electronic Tandem Network (ETN) where several centrex systems are connected to different ESSs to form a private network over a wide geographic area. For example, a company with offices in several cities may use an ETN for a private communications network. Tandem switches in an ETN may include both ESSs with ETS and DIMENSION® PBXs with similar features. See Fig. 5 for an example of this configuration.

**UNIFORM NUMBERING PLAN**

**3.02** The ETS uses a uniform numbering (UN) plan. Under this plan, the customer dials an ETS access code (typically "8") plus 7 digits to reach

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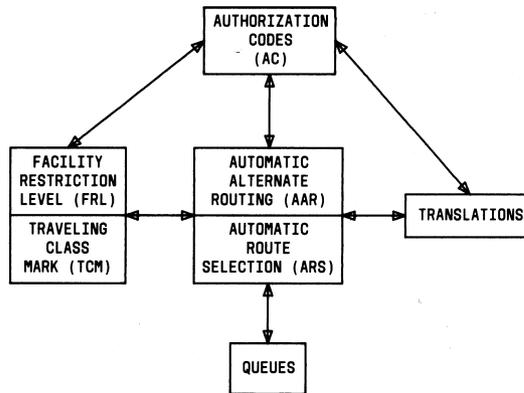


Fig. 2—Dependencies of ETS Routing Function

other stations in the private network, or 10 digits for calls to off-network stations. The 7-digit number is a private network number. The last 4 digits of the private number are always the same as the last 4 digits of the normal 10-digit public number.

**DIALING PLAN**

**3.03** The dialing plan for ETS customers is shown in Fig. 6. The first digit is an ETS access code. After getting dial tone from the ESS, the customer may optionally dial an account code. Then the desired number, 7 or 10 digits, is dialed. If an authorization code is required, recall dial tone (three short bursts of tone, then steady) is returned and the authorization code is collected. The account code and authorization code are discussed in more detail later.

**ETS HARDWARE**

**3.04** Administration and control information is passed between the ESS and the customer premises via a data link. The ESS interfaces to the data link via a peripheral unit controller (PUC) and a synchronous or asynchronous line interface unit (LIU). The equipment at the customer premises will vary depending on which features have been purchased. Equipment will typically include either a local customer administration terminal (LCAT) or customer administration and control system (CACS), and an attendant telephone set. Many customers will

have a 93A or a 94A customer premises system (CPS) tape drive.

**RECENT CHANGE**

**3.05** Recent change (RC) messages are available to build or change the translations data used by ETS. For information on these messages, see the Recent Change sections listed in Part 7, References.

**3.06** The control messages available to ETS customers also produce RC data. There is a limit on how much RC data the customer will be allowed to produce, to provide administration of RC resources. If the RC area is full or nearly full, a warning message is printed on the central office TTY.

**4. ROUTING FUNCTIONS**

**GENERAL**

**4.01** Any phone call can normally be sent over several different paths. For ETS calls, the route chosen is based on a route list. For any geographic area, there may be one or more possible routes given in the route list. When a customer accesses ETS and dials a number, the ETS software performs a digit translation to determine which route list is appropriate for the call. It then refers to the list for access to the first choice route. If the first choice route is available, it is seized and used to serve the call. If it is un-

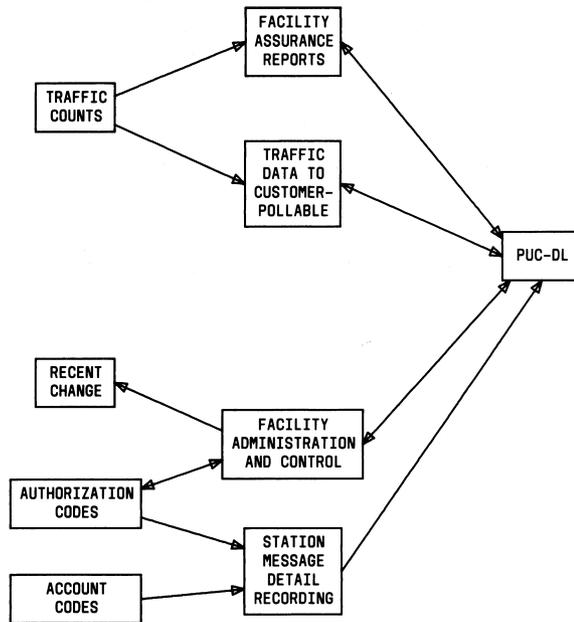


Fig. 3—Dependencies of ETS Administration and Control Functions

available, other choices may be available. Figure 7 provides a flowchart of routing functions. Details are given in the following paragraphs.

**4.02** Each ETS customer may purchase up to three route patterns for off-network calls. There is only one route pattern for on-network calls. Each route pattern consists of a group of route lists. There is a route list for each geographic area, giving possible routes to that area. Only one pattern is active at any given time. The active pattern is determined by time of day and day of week as preselected by the customer. The customer can also activate an alternate pattern with a command from a terminal at the customer's premises. In this way the customer can take advantage of varying rates and traffic levels.

**4.03** There are two similar features which provide for routing calls using route lists. Automatic route selection (ARS) handles off-network calls (di-

aled as 10 digits). Automatic alternate routing (AAR) handles on-network calls (dialed as 7 digits). The AAR can have up to four routes per route list. These routes would typically include facilities such as tie trunks, which would give the most direct and inexpensive route to the distant node in the ETN. The ARS may have up to ten possible routes per route list. These routes may include both real and simulated facilities.

**4.04** Translation routines are used to determine whether the call is on- or off-network and to select and index into the route list. The route list entry points to a first choice route. If that route is available, it is seized and used to serve the call. If it is unavailable, the programs will continue to search the list for an alternate route until one of the following occurs:

- (a) An idle facility is found.

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TABLE A  
ETS FEATURE PACKAGES

FEATURE GROUP	FEATURE PACKAGE
CFPF	CFPF
CFCO	CFCO
CFPN	CFPN
CTRF	CTRF OPSW
ETS	ACRB BQRS BTRK CCI DDDT DLUP ECAC EMDR ETS ETSQ PTRF QPRI RLST WOPI
IAC	ACS CLOG RCAD
PUC	DIAL PUC
PUCDL	PUCDL
SCOF	SCOF
TCM	TCM
LHTO	LHTO

(b) All routes in the list have been tried and found busy.

(c) Further searching is prohibited by the facility restriction level (FRL) or the inhibit alternate route hunt indicator.

4.05 With the 1E6/1AE6 generic, there is one 3-digit translator for each route pattern. There may be a maximum of three route patterns per customer. The current route pattern in effect is determined from the alternate route table and used to decide which of the three translators to use. The appropriate 3-digit translator is indexed by the first three digits dialed, either area code or office code. Each 3-digit translator entry points to either a route list or to a 6-digit foreign area translator (FAT) which then points to a route list. The route list contains information on the various possible routes to use for the call.

4.06 With the 1E7/1AE7 generic, there is only one 3-digit translator per customer. Each entry in the 3-digit translator points to the appropriate ARS or AAR route list. The route pattern currently in effect is then determined and used to index the route list to obtain the information on possible routes to use for the call.

4.07 Both the 1E6/1AE6 and 1E7/1AE7 translation methods yield identical results and can coexist in an office. However, the 1E7/1AE7 method provides more efficient use of memory. The 3- and 6-digit translators are done by routines TR3DAM and TR60PT respectively in pident TRBD.

ALTERNATE ROUTE TABLES

4.08 If the customer has purchased more than one route pattern, a program is entered every 15 minutes to determine which pattern should currently be active. It does this by consulting a table which lists which route pattern to use for each 15-minute period of each day of the week. It also checks to see if a customer override is currently in effect. This optional override allows the customer to specify a table other than the one which would be selected automatically. Whichever table is to be used is then activated.

FACILITY RESTRICTION LEVEL

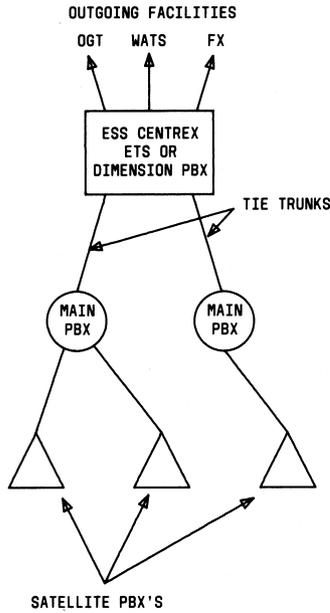
4.09 Each centrex station can be given a facility restriction level. This is a digit from 0 to 7 which is used to determine which routes in the route list may be used by the calling station. Each outgoing facility in a route list also has an FRL associated with it. An outgoing facility will only be eligible to serve a call if the FRL of the originating station is greater than or equal to the FRL of the outgoing facility. For example, a call with an FRL of 7 may be

TABLE B

PIDENTS CONTAINING ETS ROUTINES

PIDENT	DESCRIPTION
ADDX	Dialed additions for centrex
AMAC	AMA data accumulation
CFGR	Customer facility group register routines
CGTB	Carrier group alarm, trunk make busy
CHGD	Scanpoint change director
CTRF	Customer traffic data
CX1X	1XX tandem tie line
CXIC	Trunk digit analysis for centrex lines
CXOR	Originating digit analysis for centrex
DLUP	ETS dial up data link control
DPOP	Dial pulse outpulsing control
ECAC	Customer control and status
ICAL	Digit analysis for trunks
MDRO	Message detail record output
NMTG	Network management trunk group controls
ORDL	Originating digit analysis for lines
PTRF	ETS customer pollable traffic data
PUIO	PUC DL input/output
QAPR	Queue administration and processing
QCIA	Queue customer interface and audit
QEDA	Queue entry and destination assignment
QSIF	Queue state information features
QTRK	Terminate to trunk facilities
QWAT	Queuing for WATS
RCCX	Recent change: Centrex common block
RCEI	Recent change: EPSCS customer common block
RCFV	Recent change: Call forwarding
RCLI	Recent change: Line translations
RCRL	Recent change: Route list routing
RCSF	Recent change: Simulated facilities
RCTG	Recent change: Trunk group
RCTS	Recent change: Recent change tables
RCUP	Recent change: Recent change update
RCXD	Recent change: Centrex digit interpretation
SAQU	Variable length queue and timing list audit
SARG	Call register audit
TAND	Tandem connections program
TFCL	Traffic count collection
TFQR	Quarter-hour traffic data administration
TRBD	Basic digit analysis and conversion
TRBL	Basic line and directory number
TRBT	Basic trunk translations
TRCD	Centrex digit analysis
TRCT	Centrex trunk
TTxx	TTY output messages
TVBD	Verify basic digit analysis
TVBL	Verify basic line and directory number
TXFR	Temporary transfer
YAHA	Seize and release routines, L-, J-, and T-bit administration

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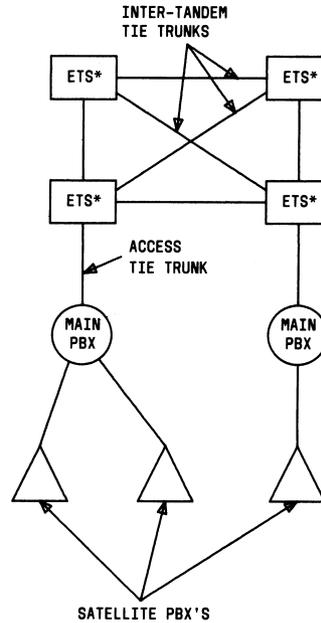


**Fig. 4—Typical ETS Configuration**

able to use any route on the list, while a call with an FRL of 2 will only be able to use outgoing facilities with an FRL of 0, 1, or 2.

**4.10** An FRL is assigned to each collocated station, incoming access trunk group, centrex tie trunk group, and intertandem trunk group. The FRL for a collocated station is stored in the private network option word (PNOW) in the auxiliary block for the LEN translator.

**4.11** In order to further restrict access to facilities at specific times, the customer may activate an alternate FRL table by typing a command from CACS or LCAT. When this alternate table is active, each FRL effectively has a new value. For example, all calls which have an FRL of 7 could be changed to receive treatment as if they had an FRL of 5. The alternate table is activated by routine ECCPAT. When a call is originated, routine ECAFRL, which is called by TRBD and CX1X, determines the proper FRL to use for the call. These routines are located in pident ECAC.



\* MAY BE EITHER A 1/1A ESS WITH ETS OR A DIMENSION PBX WITH ETS.

**Fig. 5—Typical ETS Tandem Network**

**TRAVELING CLASS MARK**

**4.12** If a call must go through more than one ETN office, an extra digit may be outpulsed after the called number. This extra digit, known as the traveling class mark (TCM) is used by the distant office for routing. It is sent using the same signaling method as is used to send the called number (dial pulse, multifrequency, or TOUCH-TONE® service signaling). The TCM normally has the same value as the FRL of the originating station, but may be derived from the authorization code, if one was dialed. If no TCM is sent, the call is processed at the distant end using the FRL of the incoming trunk.

**AUTHORIZATION CODES**

**4.13** Authorization codes (ACs) may be required to complete certain calls. The decision on

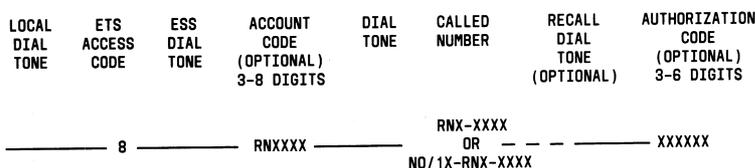


Fig. 6—ETS Dialing Plan Using Uniform Numbering

whether an AC is required is based on the first three digits dialed and the particular station originating the call. Typical restrictions are:

- No network calls allowed
- Selected network calls allowed
- All network calls allowed
- Some off-network calls allowed
- All calls allowed.

**4.14** When a call is dialed, routine TR3DAM or TR6OPT in TRBD checks to see if the AC bit is set in the supplementary call identification word (SCIW). If it is set, the originating station requires an AC for calls to the location indicated by the first three digits of the called number. Recall dial tone is returned and a digit receiver is attached to collect the 3- to 6-digit AC. When an AC is collected, its associated FRL is used for routing the call. If an alternate FRL table is active, the alternate FRL will be used. If the AC collected is invalid, the call is sent to reorder tone.

**4.15** The ACs used by ETS are stored in a table in ascending order as a list of ACs and corresponding FRLs. Both an AC and its FRL can be changed by the customer. However, due to the way the ACs are stored, an AC can only be changed to another number between the next smaller AC and the next larger AC. The range of possible values to which a particular AC can be changed is determined by routine TRDBND in TRBD. An AC is changed by routine TRCHAC, and an FRL is changed by TRCACF, both in TRBD. These routines will be called when a customer requests a change in authorization codes or facility restriction levels via CACS or LCAT.

**QUEUES**

**4.16** If no route is available, the call may be placed on a queue for the first route in the list, if the customer has purchased queuing. If queuing is not available, reorder is returned.

**4.17** Queues are available on a per route basis. Each queue may be divided into routine and priority sections. Routine queues may be either off-hook queues (OHQs) or ringback queues (RBQs), and serve only incoming calls to collocated stations. The priority section is always an OHQ and serves facilities as listed in Table C.

**4.18** Routine MISTRM in QAPR determines whether a call should be placed on an OHQ or an RBQ and determines if there is room on the queue. A queue register is then seized by routine YASZQR in YAHA. Routine queue registers are loaded by QALONQ in QAPR.

**4.19** Whenever a queued for facility becomes available, QAABQ1 in QAPR is called to remove the call register from the queue, and the call is completed over the idle facility. When there are routine calls on the queue, service protection timing is started by QATOSP in QAPR. If there is a priority call waiting when a facility becomes available, a check is made to see if service protection timing has expired. If it has not, a priority call is served. If it has expired, one more priority call is served, but the next idle facility will be given to a routine call. Service protection timing is then reset. This assures that routine calls receive periodic service even if the priority queue is never empty. The service protection timing is chosen to provide an acceptable grade of service to both priority and routine calls.

**4.20** The customer may specify a maximum amount of time a call may be on queue. This

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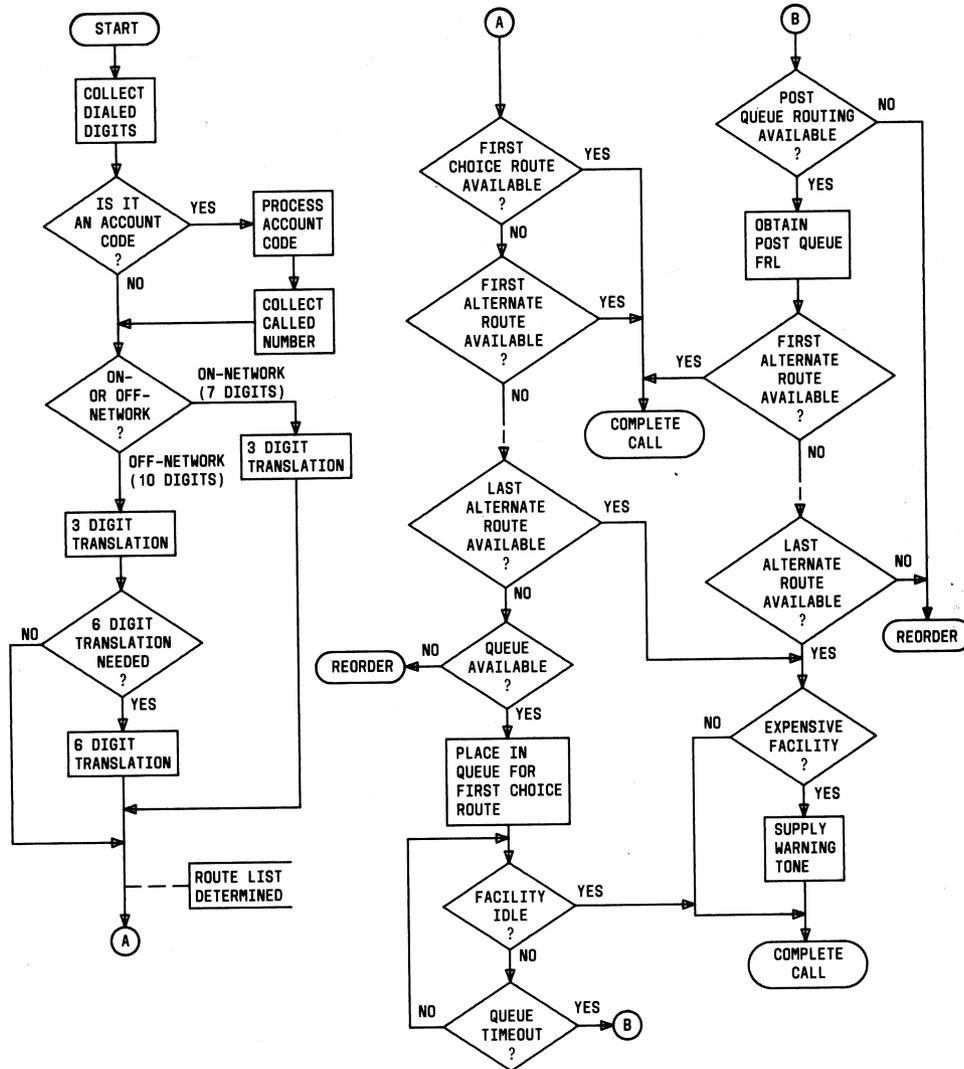


Fig. 7—ETS Routing and Queuing Using ARS/AAR — Flowchart

**TABLE C**  
**FACILITIES ASSOCIATED WITH ETS PRIORITY QUEUES**

INCOMING FACILITIES	OUTGOING FACILITIES
Collocated stations	Intertandem trunks
Attendant console	Off-network access trunks
Centrex tie trunks	Centrex tie trunks
Access trunk	Simulated OUTWATS
Intertandem trunks	Local off-network access lines (LONALS)

time-out period may be different for the priority and routine sections and may vary from 0 to 4094 seconds or be infinite (no time-out). Treatment of calls which time out on queue is discussed in following paragraphs.

**A. Off-hook Queue Operation**

**4.21** When all routes in a route list are busy, the call may be placed on an OHQ if all of the following conditions are met:

- The incoming facility does not have queuing inhibited.
- The first choice route has a queue associated with it.
- Queuing is allowed for all trunks involved.
- There is room on the queue.

If any of these conditions are not met, the customer is sent reorder.

**4.22** Customer-supplied music or announcement may be sent while a call is on queue. This music or announcement is established by QTMIL in QTAL for lines and by ADDAMI in ADDA for add-on calls. A call will remain on the queue until one of the following occurs:

- The queued-for facility is reported to be idle.
- The customer abandons.
- The queue entry times.

In the first case, the queue register is unloaded by routines in QTRK and the idle facility is seized and

used to serve the call. If the customer abandons, the queue register is removed from the queue by QABONQ in QAPR and the call is dropped. If the entry times out, a check is made to see if post-queue routing is allowed. If it is, the current FRL is compared to the post-queue FRL and the call hunts through the route list using whichever FRL is better. If an idle facility is found, it is used. If not, reorder is returned. Reorder is also returned if post-queue routing is not allowed. It is possible that the route chosen for post-queue routing will be marked "expensive." In this case, the expensive route warning tone (see further details below) is returned by QSIF.

**Major OHQ Pidents**

**4.23** The pidents containing routines that load calls onto an OHQ include CXOR, QAPR, ICAL, and QTAL. Calls are removed from the queue by routines in QTRK. Expensive route warning tone is supplied by routines in QSIF and ADPB.

**B. Ringback Queue Operation**

**4.24** When a customer requests to be put on an RBQ, the following conditions must be met:

- The desired facility is unavailable.
- Ringback queuing is offered for the desired facility.
- The originating party is permitted on an RBQ.
- There is room on the RBQ.
- The originating party does not have any other call on any RBQ.

If any of these conditions are not met, the call is sent reorder. If not, confirmation tone (three short bursts of tone) is returned, a queue register is seized and linked to the originating register, and timing is started by RBQQDIS. If the customer goes on-hook within 5 seconds, the originating register is released and the queue register is placed on the RBQ. If not, the registers are released and reorder is sent. The call remains on the queue until the facility becomes available or the queue entry times out. This time-out period may be different than that for the OHQ. If an RBQ entry times out, the call is dropped.

**4.25** Every 6 seconds, a D-level entry is made to QTETSD in QTRK, which attempts to serve

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the queue. If the facility becomes idle and the originating station is not busy, the originating station is sent a distinctive ring by ACRB in ACBC. If the line is busy, several more attempts, about 1 minute apart, are made before dropping the call. When a customer is rung back, they must go off-hook within three-to-four ringing cycles or the call is dropped. If the customer goes off-hook within the specified time, the call is completed over the facility that became idle.

**4.26** A customer may request information on the status of their RBQ call by dialing an access code. If this request is received, all the ringback queues in the office are searched. If the requesting station has a call on the queue, recall dial tone is returned; otherwise, reorder is returned.

**Major RBQ Pidents**

**4.27** The major pidents that contain RBQ routines include: CXOR, CXSF, ORDL, QEDA, QSIF, QTAL, QTRK, QWAT, YAHA, and YMGR.

**EXPENSIVE ROUTE WARNING TONE**

**4.28** The last route in a route list, if it is a simulated facility, may be marked "expensive." If this route is the only one available, a 1-second expensive route warning tone is sent to the calling station via the SD-1A218-01 tone circuit. The calling party then has the option of hanging up and trying later, in order to avoid the higher cost route. This mark is made on a per route list basis, so that a given route may be marked "expensive" on one list but not on another.

**SELECTIVE CUSTOMER CONTROL OF FACILITIES**

**4.29** The selective customer control of facilities (SCCOF) feature provides an ETS attendant with the capability to make an individual facility group unavailable to outgoing traffic. The attendant may deny access to a facility group by operating a locking key located at or near the attendant position. The feature is deactivated by releasing the key.

**4.30** There must be one key for each facility group to be controlled. Each key is associated with a master scanner scan point. The SCCOF scan points are monitored by supervisory scans. When a change in state is detected, the master scanner number is used by routine TRMSNA in CHGD to obtain information to determine what facility group is associated

with the particular SCCOF key that was operated and what data items to set or reset.

**4.31** When an SCCOF key is activated, an outgoing load control item in the corresponding trunk group head cell and a trunk group skip indicator in the trunk group annex are set. If the facility is a simulated facility, a simulated facility group skip item is set. When the SCCOF key is released, these items are reset. The bits are set and reset by routines SCOFON and SCOFOF respectively in pident CGTB.

**4.32** When an ETS customer originates an outgoing call, the trunk group or simulated facility group that is to be used to serve the call is checked by CHKSCOF or CHKSCOF1 in TRBT to determine if the group has the SCCOF feature. If not, call processing proceeds normally. If it does have the SCCOF feature, the outgoing load control indicator is checked. If it is not set, call processing will proceed normally. If it is set, the trunk group skip indicator (or simulated facility group skip indicator) must also be checked since the outgoing load control bit can also be set by network management. If the skip indicator is also set, the call will go over an alternate route or to overflow.

**4.33** If an SCCOF controlled trunk group has a trunk group busy lamp, it is necessary to light or extinguish the lamp when the SCCOF feature is activated or deactivated. Routine TRGNAA determines if there is a lamp present. If there is, routine TRENPS determines the centrex number which is used by CXTBON and CXTBOF in pident CXYKY to light or extinguish the appropriate lamp.

**4.34** The SCCOF feature takes precedence over ETS queuing when both are active on a facility group. When SCCOF is activated, calls will not queue and will not alternate route according to the post-queue route list. Queuing is turned off by CXSCOF in CXOR.

**CALL FORWARDING VARIABLE VIA PRIVATE FACILITIES**

**A. General**

**4.35** The call forwarding variable via private facilities (CFPF) feature is available in 1E7, 1AE7, and later generics. This feature allows all incoming calls to a given station to be forwarded or redirected to another station. The other station may be either on- or off-network.

**4.36** The CFPF feature is divided into two parts: calls forwarded from collocated stations and

calls forwarded from noncollocated stations. Collocated means that the tandem switch also serves as the business service switch for the ETS customer. If business service is provided by a separate switch, this is referred to as noncollocated. For the collocated switch, the information dialed by the customer is collected directly by the tandem switch. In the noncollocated case, the information must be collected by the business switch, then transmitted to the tandem switch. The CFPF feature does not apply to noncollocated satellite centrex customer stations.

**B. CFPF Activation**

**4.37** In order to activate CFPF, the customer must dial an activation code before dialing the ETS access code. The activation code is typically three digits long. The rest of the dialing follows the normal ETS dialing plan, with optional account code, the directory number of the station to be forwarded to, and the authorization code if required. If the calling station already has CFPF activated, reorder is returned. The tandem or business switch collects all digits dialed, providing dial tone when required. When all digits have been collected and found to be valid, confirmation tone (three short bursts of tone) is returned. If the customer remains off-hook, an activation call is placed to the station to which calls are to be forwarded. This allows the customer to notify the station of the forwarding and verify that they dialed the correct number. This call will be placed using AAR/ARS and, if necessary, may be placed on a queue. If the activation call cannot be placed for some reason, reorder tone is returned, or the call is given standard intercept treatment.

**4.38** When a customer requests CFPF activation, a 6-word customer originated recent change (CORC) block is seized. It is used to store the ETS access code, the directory number of the station to be forwarded to, and the account code and authorization code if dialed. A CORC02 message is printed on the customer originated recent change log (CLOG).

**4.39** For noncollocated customers, if the customer has the AC feature, an AC will be required for forwarding to an off-network station. At the customer's option, an AC may also be required for forwarding to some on-network stations.

**4.40** When a CFPF activation call is originated from an ETS station, routine GET\_TPT will seize, link, and initialize a call forwarding register.

The first 3 digits received are analyzed by TXOACK to determine if they represent an optional account code or the directory number of the station to which calls are to be forwarded. If the number of account code digits expected (NACDE) is greater than zero and the first digit is equal to the lead account code digit (LACD) and the second digit is not 0 or 1, the dialed number is assumed to be an account code. The account code is stored in the 6-word CORC block by TXOAEN. The COL7 collects a 7-digit directory number. If a 10-digit number is dialed, routine TXCC7 is invoked to collect the additional 3 digits. Authorization code indicators are checked to determine if an authorization code is required. If so, routine GETAC will apply recall dial tone and collect the first 3 digits. Since the authorization code may vary from 3 to 6 digits in length, 5-second timing is initiated by TXSTVT to wait for additional digits. Additional digits are collected by TXRTTX which also reinvoles the timing routine TXSTVT if less than 6 digits have been collected. If the 5-second timing expires, an end-of-dialing digit (#) is received, or 6 digits are received, TXOFTM is called to stop timing. Routine ETSPN builds the 6-word CORC block, returns confirmation tone, and places the activation call.

**C. CFPF Operation**

**4.41** When a call comes into a station having CFPF activated, routines in CXOR and TXFR are used to determine where the call is to be routed. The call is then routed to the distant station using AAR/ARS. If an AC was dialed at CFPF activation time, its FRL is used for routing all forwarded calls. An account code dialed at activation time will also be associated with all forwarded calls. A CFPF call will have a service feature code value of 2, which will be included in the expanded message detail recording records.

**D. CFPF Deactivation**

**4.42** The customer can deactivate CFPF by dialing an access code. When the ESS detects this code, confirmation tone is returned to the customer and the CORC block containing the information for forwarding is released.

**5. CUSTOMER ADMINISTRATION AND CONTROL FUNCTIONS**

**GENERAL**

**5.01** The ETS has provision for several optional features which give the customer considerable

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information about and control of the system. These include:

- Traffic Data to Customer—Pollable
- Facility Assurance Reports
- Station Message Detail Recording
- Facility Administration and Control.

These features are described in the following paragraphs.

**5.02** These features require that information be passed between the ESS and the customer's premises. This is done over a data link (DL). The DL interfaces with the ESS via a peripheral unit controller (PUC) and a line interface unit (LIU). The equipment at the customer's premises is typically a local customer administration terminal (LCAT) or a customer administration and control system (CACCS). The LCAT is simply a terminal, while the CACCS includes a DIMENSION (telecommunications switching apparatus) 400 processor and additional peripheral equipment. The CACCS and LCAT operate at 300 baud and are used to send or receive facility administration and control messages or to request traffic reports. Customers with Station Message De-

tail Recording or the Expanded Message Detail Recording feature must also have a 93 or 94A customer premises system (CPS) tape drive. The CPS operates at 2400 baud. Figure 8 shows DL facilities and interfaces.

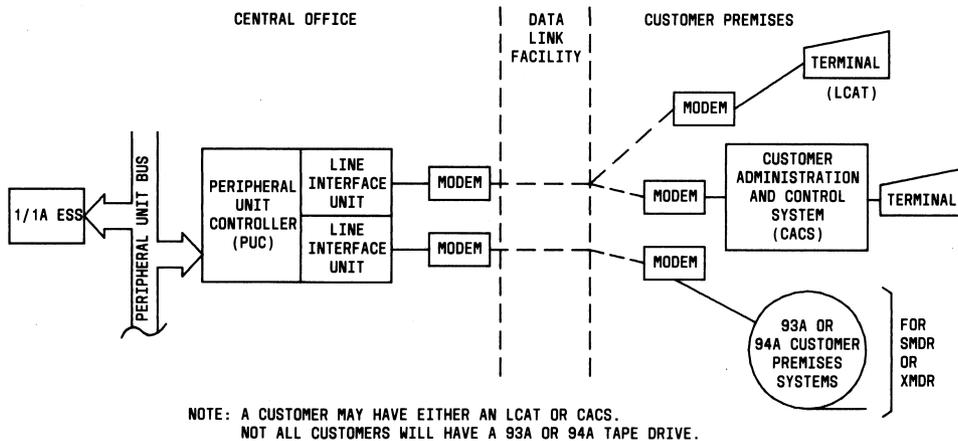
**PUC-DL MESSAGE RECEPTION**

**5.03** The PUC-DL can receive messages from the customer's CACS or LCAT. The PUC-DL message reception programs effectively have two parts: a log-on sequence, and message handling. The log-on sequence consists of the following:

- (1) Ringing detection
- (2) Carrier detection
- (3) Identification as CACS or LCAT
- (4) Security code reception and validity checking.

The sending and receiving of messages is under the control of pidents DLUP and PUIO.

**5.04** After the log-on is complete, several things may occur which would cause the PUC to send a special control message to the ESS, eg, carrier lost or a request from the distant end to cancel the cur-



**Fig. 8—PUC-DL Facilities and Interfaces**

rent input line. If a complete message is received, it is checked for syntax errors. If there are none, the message is sent to the central control for further processing and execution. If errors are found, a syntax error message is sent to the customer.

**5.05** Once the ESS receives a message, programs further analyze the message to determine exactly what was requested. They take whatever action is required, such as to look up requested information. Any message which must be sent to the customer is formatted and passed to the PUC-DL input/output (I/O) routines in DLUP. These I/O routines send the message to the PUC. The PUC contains a microprocessor which converts the message to a form suitable for sending over the DL to the customer.

**5.06** During heavy DL usage, messages may be queued. If they cannot be sent within 10 to 20 seconds, the records are lost.

**MAINTENANCE AND ERROR HANDLING**

**5.07** There are a number of checks made to assure that data sent between the ESS and the customer premises are received without errors. There are also techniques used to try to correct errors when they do occur. These are discussed in the following paragraphs.

**A. Duplication**

**5.08** The PUC has fully duplicated controllers. If one fails, it will be taken out of service and its backup used instead. This is done automatically under software control.

**B. Parity**

**5.09** Each character of data sent includes a parity bit. If a parity error is detected, a message is sent back reporting the error so that the message can be sent again.

**C. Error Counts and Messages**

**5.10** If there are sending problems from the PUC, such as repeated parity error reports, an error count is incremented by the PUC. If this count exceeds a threshold, a message is printed on the TTY. If a problem occurs which is so severe that a message cannot be sent, an abort bit is set by the PUC to inform the central control. Before sending a message,

the central control checks this bit to see if the previous message was sent successfully. If it was not, message sending is halted until the problem can be cleared.

**D. Maintenance Messages**

**5.11** Maintenance messages are sent periodically to the 93A or 94A customer premises system. When the 93A or 94A receives a maintenance message (which is identified by a special maintenance header), it compares the received message with its permanent copy. If there is a mismatch, it requests that the message be sent again. After two or three failures, the trouble is reported on the central office TTY. Short maintenance messages are sent several times a day and a long message is sent once a day at a low traffic time (eg, midnight). These messages may also be requested by maintenance personnel when a problem is suspected.

**TRAFFIC DATA TO CUSTOMER—POLLABLE (PTRF)**

**5.12** The ESS maintains various counts which are available to the customer. These are obtained by dialing up the DL from the CACS or LCAT and entering a request. This is normally done on a daily or hourly basis. The schedule is established in the ESS translations per customer requirements. The schedule intervals may be changed by service order. The CACS can provide traffic data at designated intervals or the customer may manually poll for data. Measurements may be made in 15-minute increments and may be maintained on a total or peak basis at the customer's option. These counts are normally reset after they have been sent to the customer. The operating telephone company may also obtain the information by using the CTR message, but in that case the counts are not reset.

**5.13** Counts maintained by the ESS which are available to the customer include:

- (a) Trunk and simulated facility usage
  - Incoming peg count
  - Outgoing peg count
  - Total usage
  - Overflow to reorder/queue
  - Maintenance usage.

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- (b) Queues
- Peg count
  - Overflow
  - Abandons
  - Time outs.

Table D gives a summary of when the various counts are pegged.

**5.14** The CACS can receive additional information including:

- Number of collection periods passed since the last poll
- Indication of major or minor changes made since the last poll
- Customer id
- Traffic template which describes the format of traffic data sent.

This information is not available to an LCAT.

**5.15** If the counts are being updated when a request is received, a message is sent by SECT4 to inform the customer to try again later.

**5.16** The traffic data programs have three main functions:

- Pegging the counts
- Processing the data (totalizing, etc)
- Outputting data to the customer.

**5.17** The various counts are pegged by pident CTRF. Pident TFCL is entered every 100 seconds to totalize counts and pident TFQR is entered every 15 minutes to provide totals for quarter-hour summaries. Data is outputted to the customer by DLQST in pident DLUP which is called by pident PTRF.

**5.18** When SCCOF is active, no traffic counts for the facility group or queue associated with the facility group are pegged by calls attempting to ac-

cess that group. Calls in the talking state when control was activated will continue to peg usage counts until they are disconnected. Calls on queue when SCCOF is activated will continue to peg queue counts until they are abandoned or time-out.

**5.19** The customer has the ability to receive peak traffic data. The customer may identify one or more traffic counts as a "master" count. Each master count can have zero or more "slave" counts associated with it. At the end of each collection period, the value of each master count is compared with its previous peak value. If the current value exceeds its previous peak value, the current value replaces the previous peak value. The value of each associated slave count is also replaced by the value it has at the time its master count is found to have a new peak value. The only restriction is that a given count for a given facility may appear only once on the customer's traffic report. On the customer's output, counts are marked as master, slave, or hourly.

**5.20** Every 10 seconds, routine CTTBSY in CTRF is entered to scan each trunk to determine if it is idle, busy, maintenance busy, or on the high and wet list. Once a previously idle trunk is found busy, it is no longer scanned until the next collection period. Every two hours, beginning at 12:15 am, this information is used by CTNUTS to generate a list of trunks which were not used or were locked up on the high and wet list for the entire 2-hour period. This is the nonusage trunk scans/locked up trunk scans (NUTS/LUTS) list. If the customer requests this information, it is formatted and sent to the customer's terminal. The list includes the facility group number and member ID of each trunk on the list. The LUTS entries are marked with an asterisk.

**5.21** If a facility group is held unavailable during an entire 2-hour period by SCCOF, the trunks in the trunk group will appear on the NUTS report.

**STATION MESSAGE DETAIL RECORDING AND EXPANDED MESSAGE DETAIL RECORDING**

**A. General**

**5.22** The station message detail recording (SMDR) feature records considerable information about calls processed by ETS. This information can be used for accounting or cost control by the customer. The information is sent to the 93A or 94A customer premises system via data link and stored there

TABLE D  
ETS TRAFFIC COUNTS

	PRIMARY FACILITY PEG	PRIMARY FACILITY OVERFLOW	OVERFLOW TO REORDER/ QUEUE	ALTERNATE FACILITY PEG	ALTERNATE FACILITY OVERFLOW	QUEUE PEG	QUEUE OVERFLOW	QUEUE ABANDON	QUEUE TIME OUT	COMPLETED CALL
Primary Facility Idle	1									•
Primary Busy, Alternate Idle	1	1		1						•
Route List Busy—No Queue	1	1	1	1	1					
Route List Busy—Queue Available	1	1	1	1	1	1				
Route List Busy—Queue Full	1	1	1	1	1	1	1			
Abandon On Queue	1	1	1	1	1	1		1		
Service Queue	2	1	1	1	1	1				•
Timeout—No Post Queue Route List	1	1	1	1	1	1			1	
Timeout—Primary Idle	2	1	1	1	1	1			1	•
Timeout—Primary Busy Alternate Idle	2	2	1	2	1	1			1	•
Timeout—Route List Busy	2	2	2	2	2	1			1	
Ringback—Answer	2	1	1	1	1	1				•
Ringback—Busy	1	1	1	1	1	1				
Ringback—No Answer	1	1	1	1	1	1				

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on 9-track magnetic tape. The customer must have a Local Message Detail Recording System (LMDRS) or a Centralized Message Detail Recording System (CMDRS). The information is also used by the Bell System to assist in network design and maintenance.

**5.23** In 1E6/1AE6, SMDR provides records for originating calls, terminating ETS calls, and ineffective attempts. Calls to collocated stations where only the extension is dialed are not recorded. With 1E7/1AE7, additional information is available with the expanded message detail recording (XMDR) feature. "Dial 9," outgoing WATS, noncollocated common control switching arrangement (CCSA), foreign exchange (FX), and tie trunk calls with 'lxx' access codes may be included on XMDR records. The XMDR feature only includes originating calls and ineffective attempts. Table E lists the information available on SMDR and XMDR records, along with the number of digits in each record.

**5.24** When a call originates from or terminates to an ETS station, the MDRO or MDRI bits in the Centrex Common Block are checked to determine if a record is to be made. For XMDR, an XMDR indicator bit must also be set; and, for "dial 9" calls, the XMDR90 bit must be set. Various hooks are inserted into pidents CX1C, CXOR, ORDL, and ICAL to check the status of these bits.

**5.25** If it is determined that a record is to be made, a routine in pident AMAC is called to seize and initialize an appropriate automatic message accounting (AMA) register. Routine AMMD18 is used to seize and initialize an 18-word AMA register for SMDR originating calls. Routine AMMD13 is used to seize and initialize a 13-word AMA register for SMDR terminating calls. Routine AMXMNO is used to seize and initialize an 18-word AMA register for XMDR.

**5.26** Hooks are inserted into the main call processing programs to save information at appropriate

**TABLE E  
INFORMATION CONTAINED IN SMDR AND XMDR RECORDS**

ITEM	NUMBER OF BCD DIGITS IN SMDR RECORD (TYPE 01)	NUMBER OF BCD DIGITS IN XMDR RECORD (TYPE 05 OR 06)
Call event code	1	1
Service feature	1	1
End of dial time	7	N/A*
Time change	1	1
Answer time	7	7
ARS pattern	1	N/A*
Outgoing trunk ID	6	6
Called number	10	16
Facility restriction level	1	N/A*
Incoming trunk ID	6	6
Calling number	7	7
Authorization code	6	N/A*
Account code	8	8
End of outpulsing time	7	7
Midnights passed	1	1
Disconnect time	7	7
Access code	N/A*	5
Record type	2	2

\* Indicates that the item is not included in the specified record type.

ate times in the AMA register, for example, at the end of digit reception, or end of outpulsing.

**5.27** Records are formatted and sent to the customer by routines in pident MDRO. There are several different record types. All record types are outputted by routine MDOUTP. If a record cannot be sent to the PUC immediately, MDOUTP will place it on a queue. The queue will then be unloaded later by MDQSRV. Routine MDQSRV is run as an E-level job and will output a maximum of five message detail records per entry.

**5.28** Record type 01 contains SMDR information about an originating call. The information contained in this record type is as listed in Table E.

**5.29** Record type 02 contains SMDR information about a terminating call.

**5.30** Record type 03 is a time change record for both SMDR and XMDR. When the ESS clock is changed, the old and new clock states are sent to ETS customers by routine MDTCHG.

**5.31** Record type 04 is date information for both SMDR and XMDR. It is sent to the customer each midnight by routine MDDATE. This record includes an ESS identifier, the time, date, and a count of how many records have been lost either by the ESS or 93A CPS.

**5.32** Record type 05 contains XMDR information for noncollocated CCSA, WATS, tie trunk, or FX calls. Record type 06 contains XMDR information for "dial 9" calls. Both record types have the same format and contain information as listed in Table E.

**B. Account Codes**

**5.33** The customer may optionally have account codes. An account code is a number dialed before the called number. Optional account codes are recorded on SMDR records. Customer dialed account recording (CDAR) account codes may be included in XMDR records. The account code may be from 3 to 8 digits in length. The first digit of all account codes for a given customer is a unique Lead Account Code digit to indicate that an account code is being dialed. It must be chosen so as not to conflict with any on-network number (no on-network number can start with that digit). All account codes for any one customer must be of the same length. The second digit

of the account code must not be 0 or 1, so that it will not conflict with a numbering plan area (NPA) code. This enables the call processing routines to recognize the dialed number as an account code, collect the proper number of digits, and record it. The Lead Account Code digit is not recorded on SMDR.

**C. Call Event Codes**

**5.34** The call event code indicates how the call was disposed. The SMDR call event codes include:

- 0 – Completed directly
- 1 – Queued and completed
- 2 – Invalid NPA or NXX
- 3 – Invalid authorization code
- 4 – Insufficient FRL
- 5 – All facilities busy
- 6 – Abandoned on queue
- 7 – Timed out from queue
- 8 – Miscellaneous failure without queuing
- 9 – Miscellaneous failure after queuing.

Codes 0, 5, and 8 are also used for XMDR.

**D. Service Feature Codes**

**5.35** The service feature code indicates that there were feature interactions on the call which affect the contents of the record.

- (1) Station billing on attendant handled call applies.
- (2) The record applies to the base to remote portion of a forwarded call.
- (3) The call was routed to the attendant, due to the toll diversion feature (XMDR only).

**ETS COMPATIBILITY WITH SMDR VIA THE REVENUE ACCOUNTING OFFICE (RAO)**

**5.36** With 1E7/1AE7, AMA information is available via the Revenue Accounting Office (RAO). Information which is available includes:

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- (a) Individual station billing for calls routed over the DDD network or via WATS facilities
- (b) Nonbillable sample records for calls routed over FX trunks, centrex tie trunks, ETS access trunks, or ETS intertandem trunks
- (c) The CCSA sample records for calls routed over a CCSA access network trunk.

Most of the routines for ETS-RAO compatibility are located in pident AMAC. Table F provides a list of the functions of the major routines used to provide ETS-RAO records.

**5.37** When a route has been selected for a call, if the route list entry is marked for individual station billing, an AMA record will be made for RAO.

The information is saved in a 13-word AMA register. The AMA register is initialized by AMLSZS or AMTSZS. Routine AMLSZS interfaces with CXOR and AMTSZS interfaces with CXIC.

**5.38** If a call needs to be placed on a queue, some information needed for the RAO records would normally be lost. To retain this information, a holding AMA register is seized and initialized by routine ETHAMA. The holding AMA register contains the individual station billing number and a unique program tag.

**5.39** If an ETS customer has the customer dialed account recording (CDAR) feature, individual station billing must be applied to each route list entry for compatibility with RAO. If both a CDAR AMA register and a holding AMA register would be

**TABLE F  
ETS-RAO ROUTINES**

NAME	FUNCTION
<b>HOLDING AMA REGISTER PROCESSING</b>	
ETHAMA ETSQBL ETHCVB AMASM HAMQBN	Seize and initialize ETS holding AMA Post queue billable AMA actions Convert holding AMA to billable AMA Post queue sample AMA actions Holding AMA abandon from queue actions
<b>MDR-RAO/CCSA SAMPLE AMA PROCESSING</b>	
ETLSMPL ETTSMPL INIT/ICSLEN AMLSZS AMTSZS AMLCVS AMTCVS AMFDAM AMDUNC	Sample AMA actions for line Sample AMA actions for trunks Derive Individual Station Billing number for trunk originations Initialize 13-word AMA for lines and trunks (interfaces with CXOR) Initialize 13-word AMA for lines and trunks (interfaces with CXIC) Convert CDAR AMA into sample AMA for lines and trunks (inerfaces with CXOR) Convert CDAR AMA into sample AMA for lines and trunks (interfaces with CXIC) Search register link list for CDAR/MDR-RAO and holding AMA registers Set incomplete call attempt bit in MDR-RAO AMA

required for a call, the CDAR AMA register is converted into a holding AMA register, retaining the CDAR information.

**5.40** When a call is routed off-network to a PBX, it is possible that answer supervision will not be returned. In order that these calls will be recorded by RAO, a record is made of all uncompleted call attempts. These calls are marked by routine AMDUNC.

**5.41** At the conclusion of a call, the holding AMA register information is combined with other information to produce the RAO record by routine AMASM. Records are then output by INTPT in pident AMAC. The ETS-RAO records have a service feature code of 19.

**FACILITY ADMINISTRATION AND CONTROL**

**5.42** The ETS facility administration and control (ECAC) feature allows the customer to monitor the status of various items and change them as desired to quickly adjust to varying conditions. Items which can be requested for display include:

- Current route pattern in effect
- Queue status
- Alternate FRL status
- Authorization codes and associated FRLs
- Bounds for authorization codes
- ESS clock.

Messages can also be typed in to:

- Override the currently active route table either immediately or at some later time
- Activate/suspend queues
- Change ACs and FRLs
- Activate/suspend an alternate FRL table.

**5.43** There are a number of basic message types. When a message is received by DLUP and PUIO, the first keyword or mnemonic is analyzed by pident ECAC to determine the basic type. This type is used to index a table of pointers to routines which

either analyze the next word in the message or perform the requested action. Messages returned to the customer are formatted by routines in ECAC.

**6. ABBREVIATIONS AND ACRONYMS**

**6.01** The following abbreviations and acronyms are used throughout this section.

AAR	Automatic Alternate Routing
AC	Authorization Code
AMA	Automatic Message Accounting
ARS	Automatic Route Selection
CACS	Customer Administration and Control System
CCSA	Common Control Switching Arrangement
CDAR	Customer Dialed Account Recording
CFPF	Call Forwarding Variable Via Private Facilities
CIW	Call Identification Word
CLOG	Customer Originated Recent Change LOG
CMDRS	Centralized Message Detail Recording System
CORC	Customer Originated Recent Change
CPS	Customer Premises System
DL	Data Link
ECAC	ETS Facility Administration and Control
ESS	Electronic Switching System
ETN	Electronic Tandem Network
ETS	Electronic Tandem Switching
FAT	Foreign Area Translator

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FRL	Facility Restriction Level	TCM	Traveling Class Mark
FX	Foreign Exchange	WATS	Wide Area Telecommunications Service
LACD	Lead Account Code Digit	XMDR	Expanded Message Detail Recording
LCAT	Local Customer Administration Terminal		
LEN	Line Equipment Number		
LIU	Line Interface Unit		
LMDRS	Local Message Detail Recording System		
LUTS	Locked-up Trunk Scans		
NACDE	Number of Account Code Digits Expected		
NPA	Numbering Plan Area		
NUTS	Nonusage Trunk Scans		
OHQ	Off-Hook Queue		
PBX	Private Branch Exchange		
PNOW	Private Network Option Word		
PTRF	Traffic data to customer – Pollable		
PUC	Peripheral Unit Controller		
RAO	Revenue Accounting Office		
RBQ	Ringback Queue		
RC	Recent Change		
SCCOF	Selective Customer Control of Facilities		
SCIW	Supplementary Call Identification Word		
SFG	Simulated Facilities Group		
SMDR	Station Message Detail Recording		
TAMA	Tie line Automatic Message Accounting		

**7. REFERENCES**

**7.01** For further information consult the following:

- (a) Pidents including ETS programs—See Table A for feature packages involved. See Table B for pidents.
- (b) Section 231-045-105—Call Processing—POTS
- (c) Section 231-045-106—Call Processing—Centrex
- (d) Section 231-048-304—Rate and Route Translation Recent Change Formats for NOCNOG, DNHT, NOGRAC, RATPAT, DIGTRN, CCOL, RI, CHRGX, DITABS, TNDM, IDDD, TDXD, and RLST
- (e) Section 231-048-307—Traffic Measurement Recent Change Formats for DIGTRN, TRFSLB, TRFLCU, TRFHC, TNCTX, CTRF, and NUTS
- (f) Section 231-048-308—RC Formats for AC, ACTABL, CUSTCB, DALNK, DAMBI, DAMSK, DATER, ESCO, ESN, SAC, TCM, and TNESN
- (g) Section 231-048-309—Centrex-CO/ESSX-1 Recent Change Formats for CTXCB, CTXDI, CTXEXR, CXDICH, DITABS, DLG, FLXDG, FLXRD, and FLXRS
- (h) Section 231-048-312—LINE RC Formats for LINE, TWOPTY, MPTY, SCLIST, MLHG, ACT, CFV, VSS, and SIMFAC
- (i) Section 231-048-348—Recent Change Implementation Procedures for Electronic Tandem Switching
- (j) Section 231-090-074—Call Forwarding Variable Feature
- (k) Section 231-090-135—User Dialed Authorization Codes (EPSCS and ETS)

## GBPPR Non-Linear Junction Detector – Part 2

### Overview

The second part of the GBPPR Non-Linear Junction Detector project will be constructing the first local oscillator/mixer and the transmitter circuits. While these would have been difficult circuits to construct just a few years ago, the availability of pre-built synthesizer modules significantly increases the ease of construction. A Mini-Circuits DSN-2300A-1119 1690 to 2310 MHz frequency synthesizer will be used for the first local oscillator and a Z-Communications PSN0930A 900 to 960 MHz frequency synthesizer will be used for the transmitter's main oscillator.

Those synthesizers are programmed using the standard three-wire serial interface (Data, Clock, Load Enable). The DSN-2300A-1119 is based around the Analog Devices ADF4106 PLL, while the PSN0930A is based around the National LMX2316 PLL. Both of those PLL chips are programmed in a quite similar fashion (by loading an initialization/function register, a "R" divider register, and a "N" divider register), but the specific bit values will be different. The Z-Comm PSN0930A is designed for 100 kHz tuning steps and the Mini-Circuits DSN-2300A-1119 is designed for 250 kHz. Those are both fixed step values and you'll need to take this into account when programming the synthesizer's final frequency.

The PLLs will be programmed using a BASIC Stamp 2 controller. I'm still working on the actual "software" of the NLJD, but some example code will be given for those wishing to experiment.

The first local oscillator will switch between 2240 and 2270 MHz to receive the 2nd or 3rd harmonic. This signal will directly feed the LO port on a Mini-Circuits SRA-3500 mixer. The 436 MHz IF output from the SRA-3500 mixer will be amplified around 18 dB by a WJ Communications/TriQuint AH31 high-dynamic range IF amplifier and bandpass filtered by a Toko 492S-1055A filter.

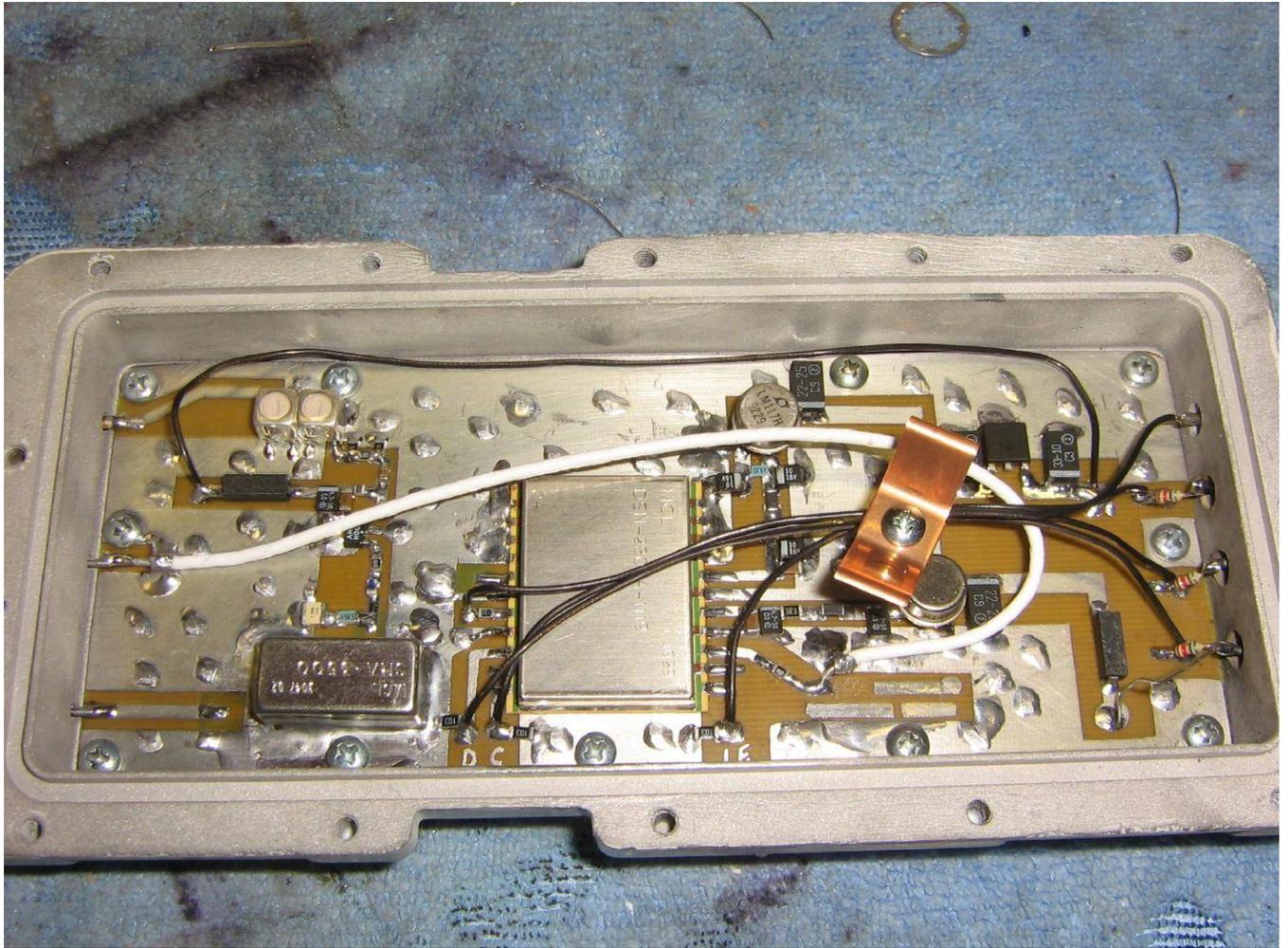
The two hopping local oscillator signals will generate a 436 MHz IF output with a RF input frequency of either 1804 MHz, the second harmonic of the 902 MHz illumination carrier (2240 – 1804 MHz) or 2706 MHz, the third harmonic of the 902 MHz illumination carrier (2706 – 2270 MHz).

Both of the frequency synthesizers will be sharing the same 10 MHz TCXO time base. One quirk with the Mini-Circuits DSN-2300A-1119 is its requirement for a reference signal with a "slew rate > 50 V/μS" when operating below 20 MHz. That's just a fancy way of saying the reference signal *may* need to be a square wave. Everything did appear to test fine with the stock 1 volt peak-to-peak output signal from the EG&G TCXO circuit described earlier.

There were two problems encountered during the construction and testing of the first local oscillator & mixer and transmitter circuits. First, the SRA-3500 I used showed significantly higher conversion loss than it should. The SRA-3500 was salvaged from some other radio gear, so it may have been damaged to begin with. The first mixer's performance is *critical* in this application and it should have low conversion loss and high isolation on all ports. High conversion loss essentially makes the receiver "deaf" from the get-go.

The second problem was I blew up the Pacific Monolithics PM2111 RF power amplifier while testing the circuit! It does work fine, as long as you follow the PM2111's datasheet closely. I was running the PM2111 from a separate power supply without any current limiting or voltage spike protection and must of just caught it at the wrong moment. The PM2111 "popped" when I flipped on the power and was destroyed. Oh well...

## Pictures & Construction Notes



Overview of the first local oscillator and mixer.

What would have been a complicated circuit is now simplified by using a pre-built Mini-Circuits DSN-2300A-1119 synthesizer module.

The Mini-Circuits DSN-2300A-1119 does require a clean source of +5 VDC and +12.5 VDC. These are provided by the LM140 and LM117 voltage regulators on the right side.

The Mini-Circuits SRA-3500 mixer is on the lower-left with the WJ/TriQuint AH31 IF amplifier and Toko bandpass filter just above it.



Alternate view.

The 78M05 voltage regulator (lower-left) is only for the WJ/TriQuint AH31 IF amplifier. The AH31 has a fairly high current draw (150 mA) and the series ferrite bead and inductor should be chosen after taking this into account.

The **Data**, **Clock**, **Load Enable**, and **Lock Detect** signals are routed via the 1,000 pF feed-through capacitors on the left. Four holes were drilled and tapped (#12-32) for the feed-through capacitors.

The Mini-Circuits DSN-2300A-1119 requires "3 volt" level logic signals, so simple resistor voltage dividers are used to convert the 5 volt output logic signals from the BASIC Stamp down to 3 volts.



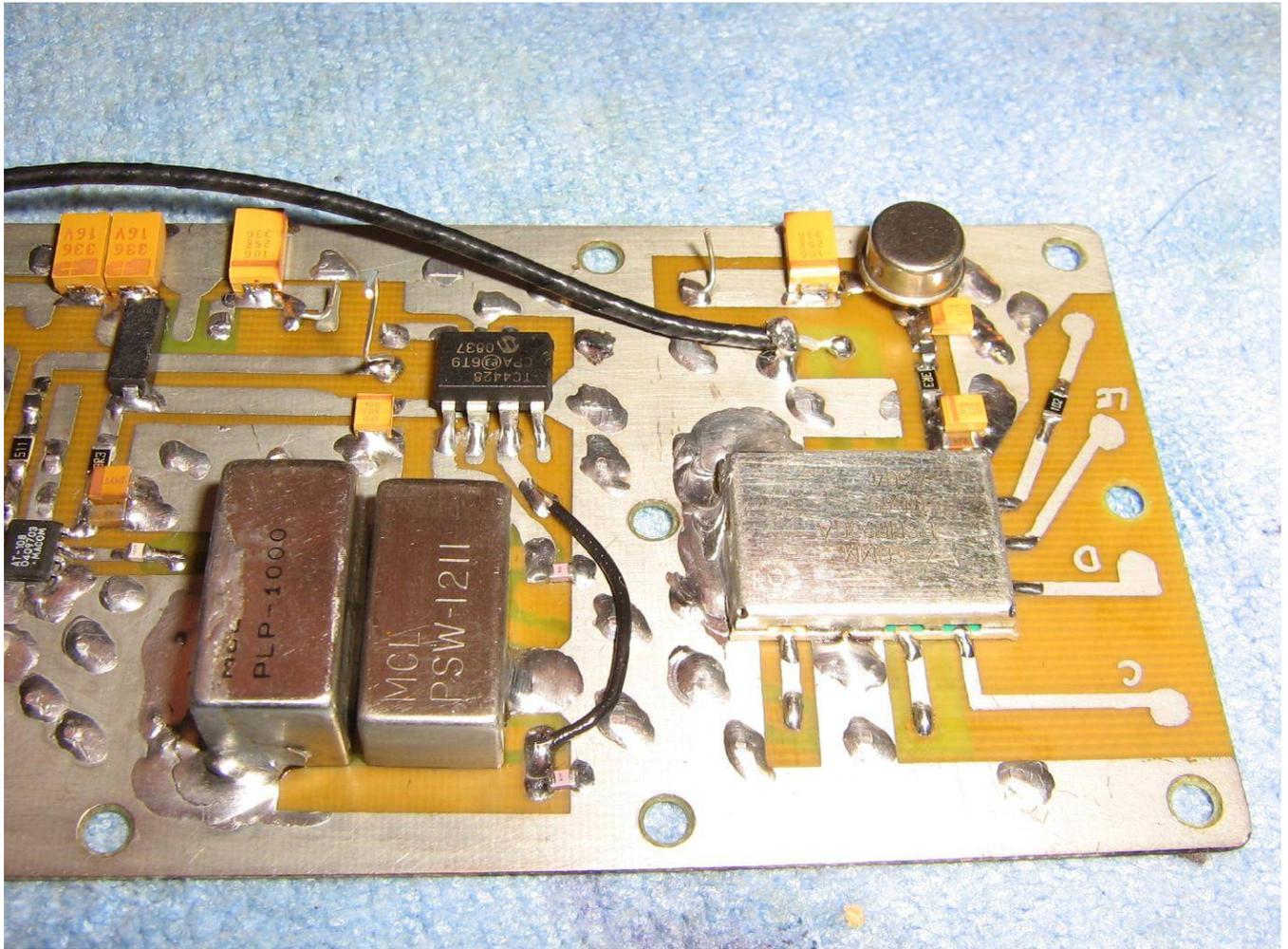
Overview of the Mini-Circuits SRA-3500 mixer and WJ/TriQuint AH31 IF amplifier section.

A simple one-pole diplexer centered at 436 MHz is on the IF output of the mixer.

The WJ/TriQuint AH31 operates at around 150 mA and has its own voltage regulator. A 3 dB attenuator is on the output of the AH31 to help the IF amplifier and mixer to "see" 50 ohms. Final gain from the IF amplifier circuit was around 14 dB.

The Toko 492S-1055A filter (type 5CHW pinout) was purchased from Digi-Key (Part No. TK5442CT-ND), but it doesn't appear to be available anymore. Any similar bandpass filter (430-450 MHz range) should work. Since the 436 MHz IF frequency we are using is in the middle of the 70 cm amateur radio band, you may be able to salvage similar filters from older radio gear.

The N connector on the upper-right is the RF input to the mixer. The middle F connector is the 10 MHz reference input for the Mini-Circuits DSN-2300A-1119. The TNC connector on the lower-right is the 436 MHz IF output.



Overview of the transmitter circuit.

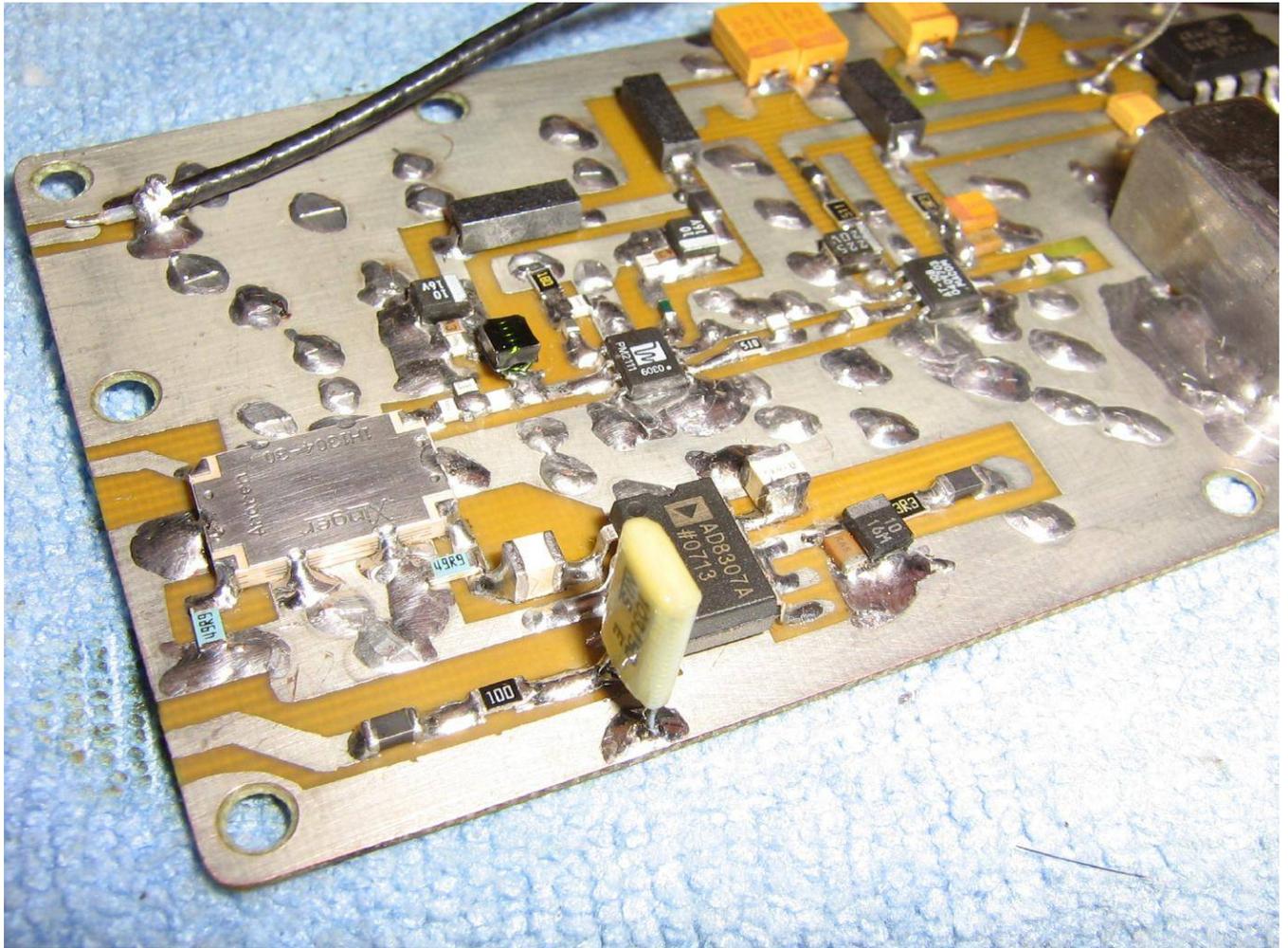
The Z-Communications PSN0930A frequency synthesizer module is on the right and is powered from its own LM140 voltage regulator. The 10 MHz reference signal is coming in via the coaxial cable along the top.

On the lower-left, is a Mini-Circuits PSW-1211 PIN diode RF switch and a Mini-Circuits PLP-1000 low-pass filter.

The Mini-Circuits PSW-1211 can be used to "modulate" the main illumination carrier by pulsing it on and off. This is optional, but having an audio tone on the received signal is helpful for detection using only your ears. It's also possible to use the timing of the pulses to locate the *distance* to the surveillance device your trying to find, but that'll be for another day.

The Mini-Circuits PLP-1000 low-pass filter provides the first round of low-pass filtering to remove any harmonics of the main illumination carrier RF signal.

A Microchip TC4428 dual high-speed power MOSFET driver is used to control the Mini-Circuits PSW-1211 PIN diode RF switch. A panel-mounted SPDT (center-off) switch will select between a CW or 1,000 Hz modulated RF carrier. The center-off position will disable the RF output.



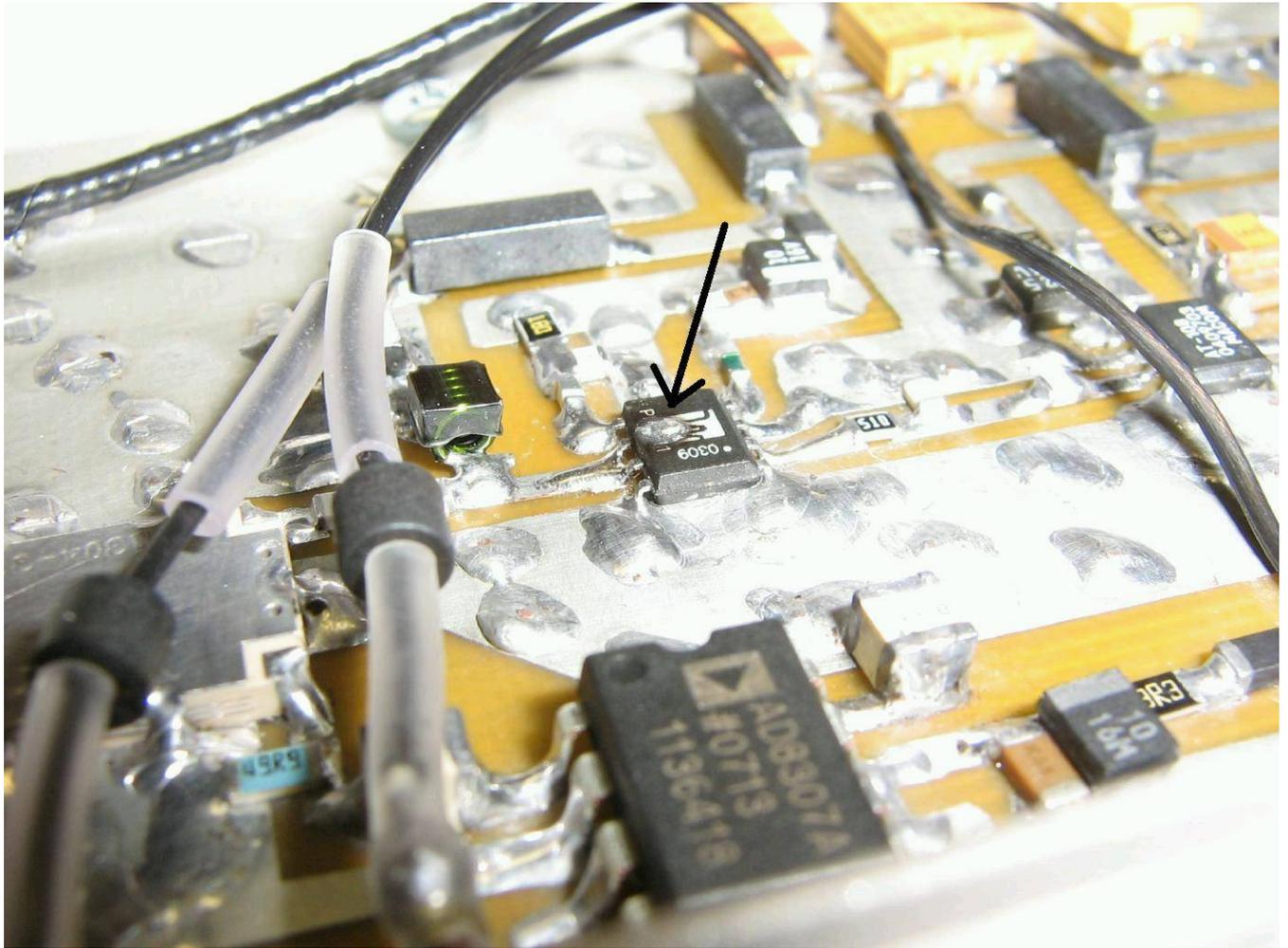
Output of the transmitter circuit.

A M/A-Com AT-108 voltage-variable attenuator is the 8-pin SMT IC on the middle-right. This provides an approximate 0 to 40 dB attenuation range of the transmit RF carrier. This control is done via a panel-mounted potentiometer.

The center 8-pin SMT IC is a Pacific Monolithics PM2111 800–1700 MHz RF power amplifier – before I blew it up. The PM2111 amplifies the 900 MHz RF carrier around 30 dB for a maximum final RF output power of around 1 watt (+30 dBm). The Pacific Monolithics PM2111 is linear biased, which is required to reduce the creation of harmonics and to allow low-power signals to drive the PM2111.

Combined with the M/A-Com AT-108, the final RF output power is variable from around –10 to +30 dBm (0.1 mW to 1W).

The RF output from the Pacific Monolithics PM2111 is taken through an Anaren 1H1304-30 800–1000 MHz 30 dB directional coupler. The output from the directional coupler is sent to an Analog Devices AD8307 logarithmic RF detector for a TX power LED display.



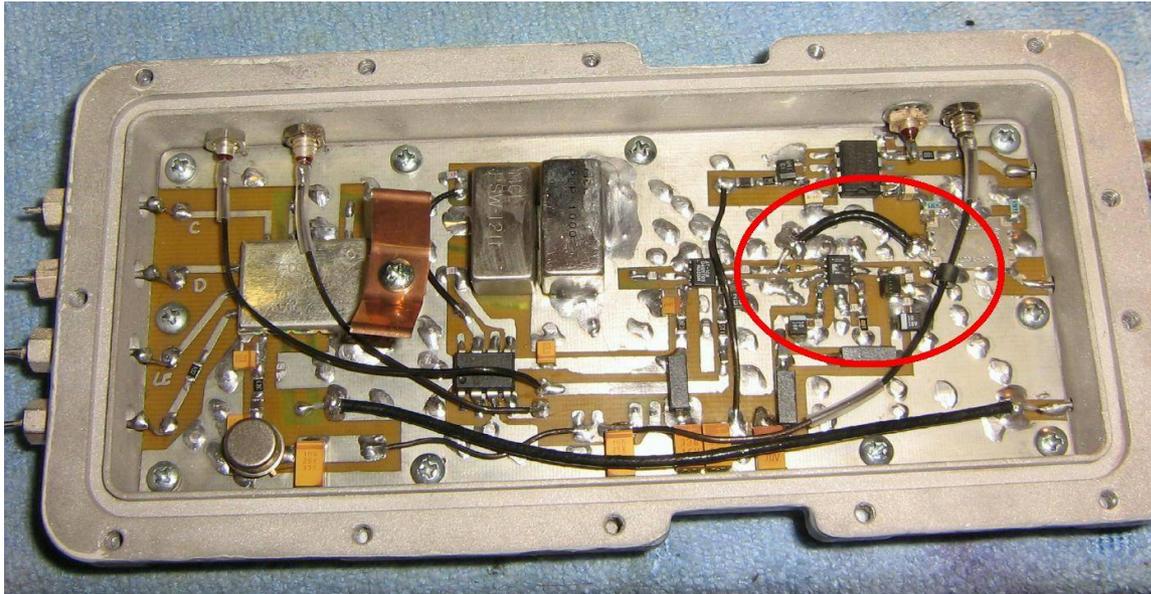
And then it died... Everything *did* work before this, though.

Study the datasheet for the Pacific Monolithics PM2111 very carefully. Be sure the SMT inductors you use have a self-resonant frequency above 900 MHz, and also make sure the 18 nH inductor can handle the high current (620 mA) the PM2111 requires. The capacitors for the PM2111's RF input/output matching section should also be of high-quality.

The PM2111 has a solder tab on the bottom of its IC package. "Pool" a little puddle of solder under the PM2111 using a heat gun, then quickly "drop" the PM2111 into position.

Proper microwave construction techniques must be followed when constructing the transmitter circuit to prevent the PM2111 from oscillating.

There were some small reference spurs  $\pm 100$  kHz of the main RF carrier, but these are at an acceptable level.



Overview of the modified transmitter circuit.

PM2111 with a coax jumper from the output of the AT-108 to the input of the directional coupler.

Below is a chart of the actual RF output power (as low as I could measure) of this circuit with the bypassed PM2111. The PM2111 would have added another 30 dB or so to the final RF output power.

<u>AT-108 Control Voltage</u>	<u>RF Output Power</u>
5.0	-1.2 dBm
4.0	-2.5 dBm
3.0	-12.2 dBm
2.5	-15.8 dBm
2.0	-20.0 dBm

The AD8307 provides a 0.5 – 1.6 VDC output indicating the final RF output power. The AD8307 isn't really designed to work at 900 MHz, but it does work. Refer to *Figure 45* in the AD8307's datasheet for a graph of output voltage vs. input RF power at 900 MHz. My "blown up" amplifier only reached a peak output voltage of around 0.8 VDC. Remember to make into account the 30 dB loss from the directional coupler.

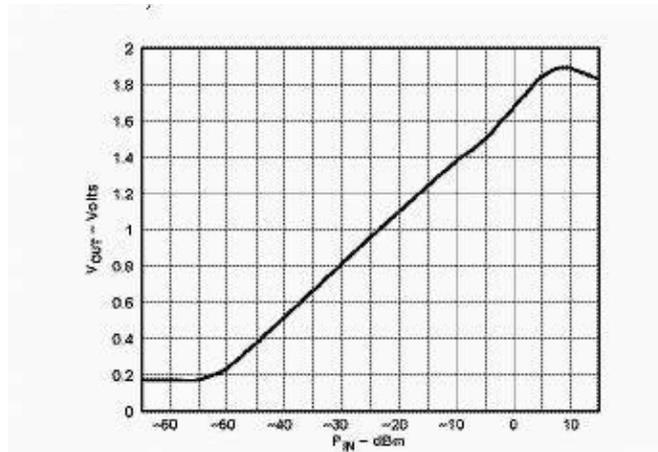


Figure 45: Output vs. Input Level for a 900 MHz Input Signal



Experimental diplexer and low-noise receive amplifier circuit.

The key to a decent working non-linear junction detector is *isolation* of the transmitter and receiver. The receiver shouldn't hear the transmitter. Period.

This, of course, turns out to be a big problem in the real-world. There are commercial diplexers ("cans") available which are tuned to allow the transmitter and receiver to share a single antenna, but tend to be expensive, difficult to locate, and even more difficult to homebrew.

Thankfully, the frequency range(s) of this non-linear junction detector fall within the frequency range(s) used by most cellular phones. M/A-Com makes the DP52-0002 diplexer, which is a 8-pin SMT dual-band diplexer that provides a low-pass/high-pass function for 900/1800 MHz cellular phones. This little chip allows a single antenna to operate at two frequency bands. The isolation between all the diplexer's ports isn't great – only around 20 to 30 dB – but it will be a good start and there are a few tricks we can use to further increase the isolation.

M/A-Com also makes the FL05-0002, which is a high-pass filter with a 3 dB corner at 1.7 GHz and 20+ dB attenuation at 900 MHz. Adding a few of these after the RX port on the DP52-0002 diplexer will greatly improve the isolation.

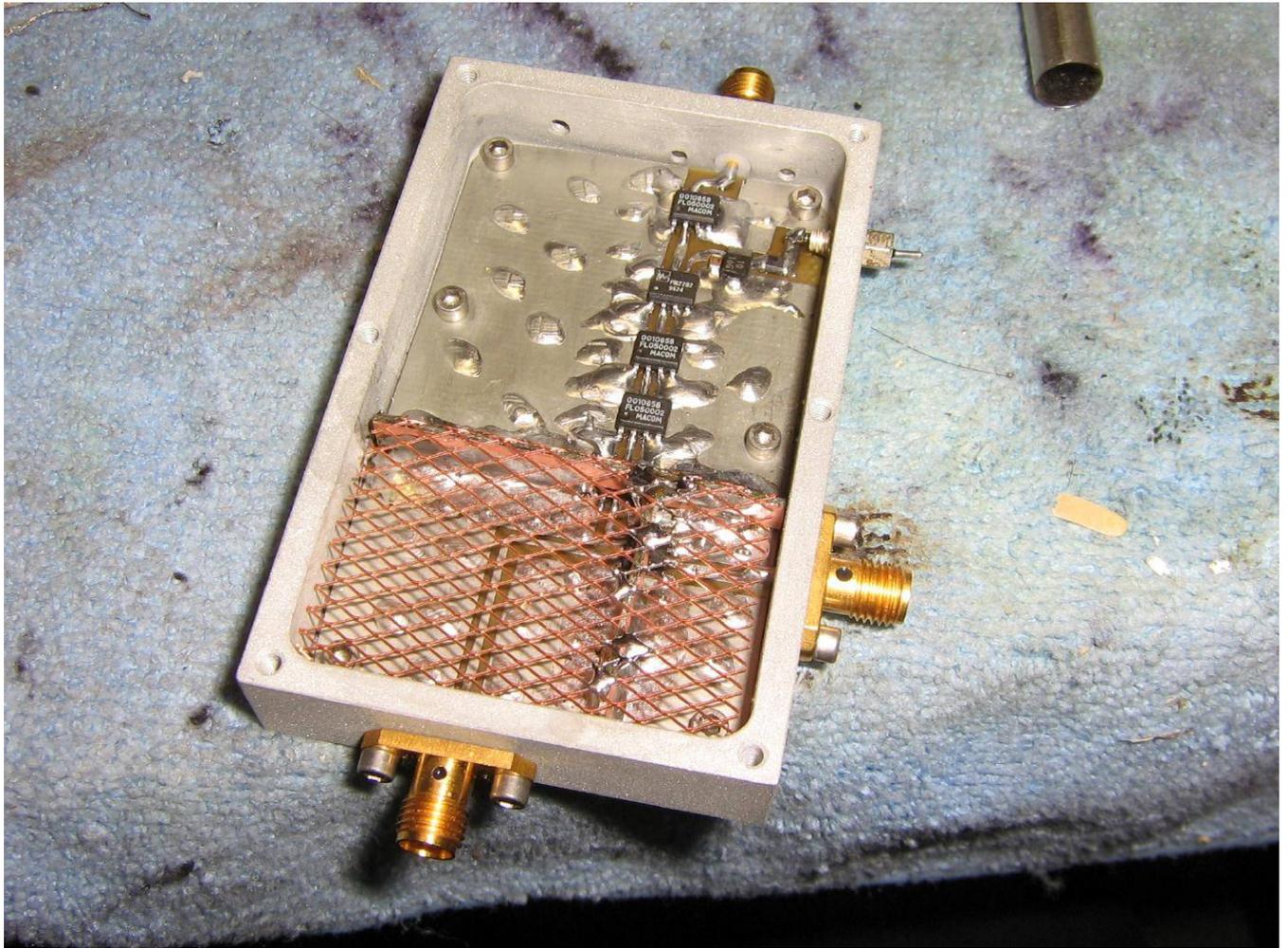
In the photo above, the M/A-Com DP52-0002 is on the middle-right (horizontal position). Three M/A-Com FL05-0002s follow on the RX port of the DP52-0002. A Pacific Monolithics PM2202 low-noise amplifier then follow those. A single FL05-0002 high-pass filter is on the output of the PM2202.



Alternate view.

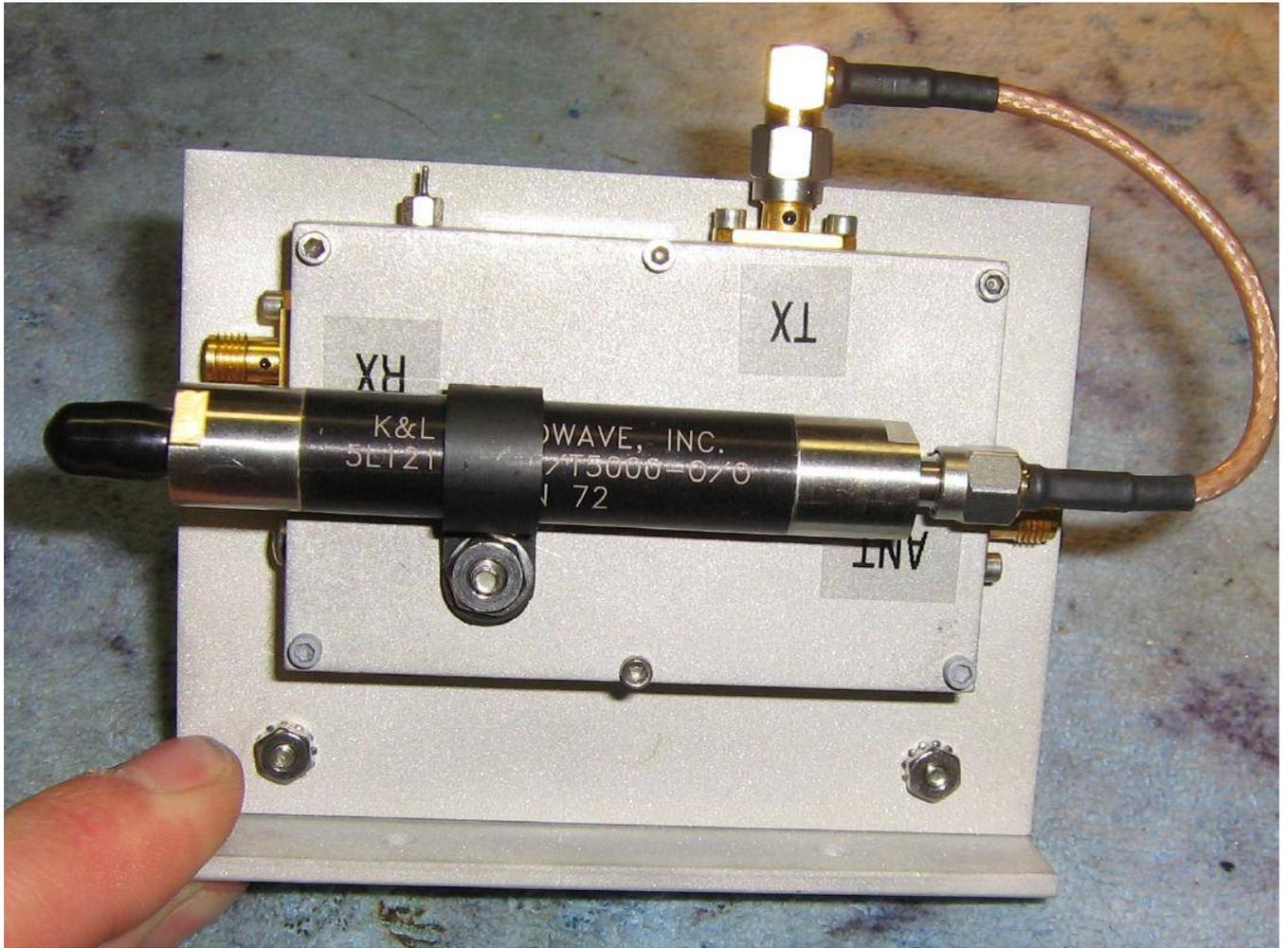
The Pacific Monolithics PM2202 low-noise amplifier has around 13 dB of gain between 1.8–2.5 GHz and doesn't require any fancy impedance matching on its RF input/output.

The bottom SMA connector is the common antenna port, the SMA connector on the right is for the transmitter (902 MHz) input, and the top SMA connector goes to the main receive port (1804/2706 MHz) on the first local oscillator / mixer circuit.



To further help increase the isolation between the ports I added little copper shields using scraps of PC board material and some copper screen material available at most hobby stores.

Proper microwave construction techniques must be followed to reduce RF signal losses in the diplexer circuit and to maintain high isolation.

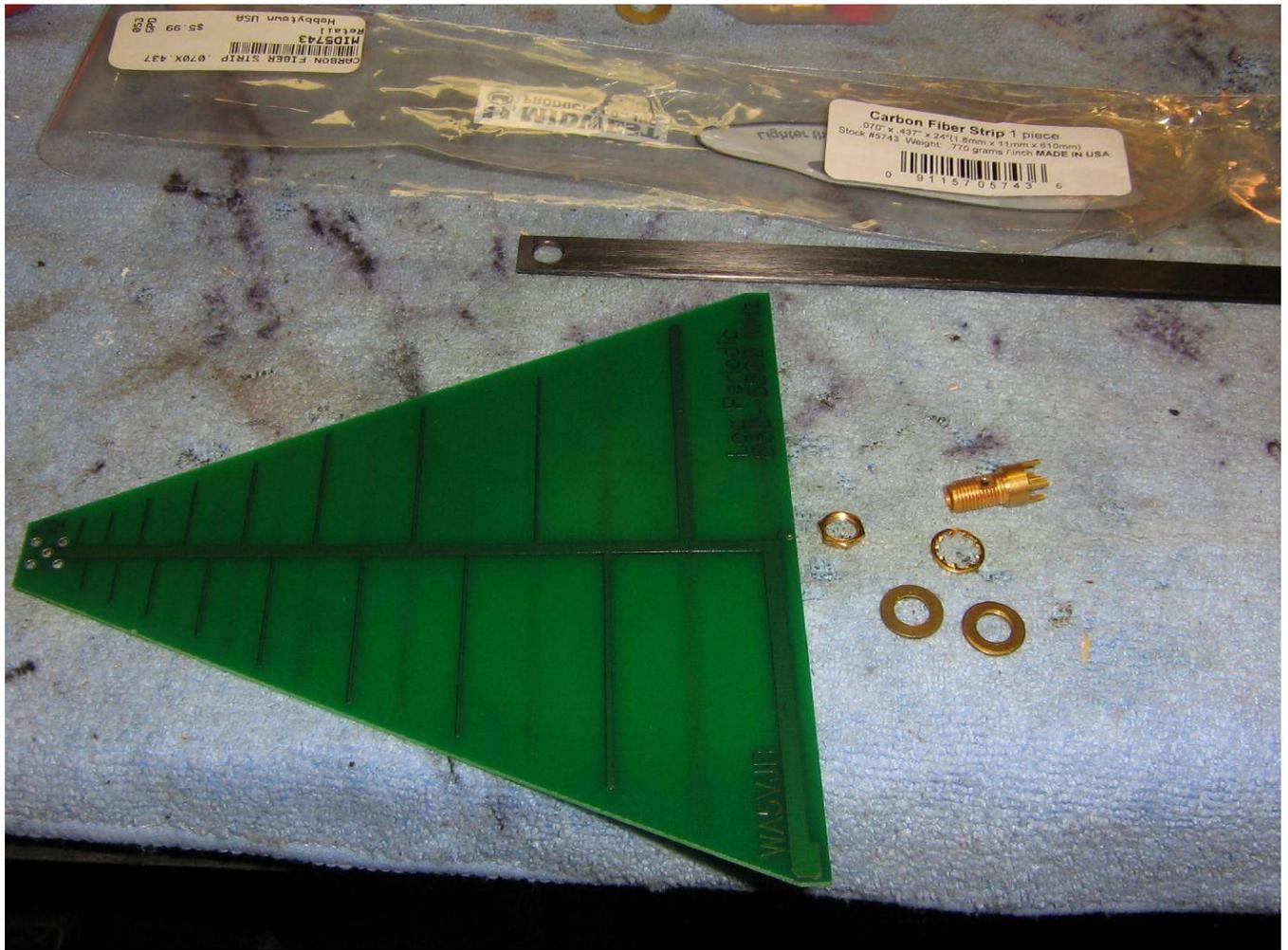


Finished diplexer circuit.

It's mounted in an old cellular pre-amplifier case and is attached to its own little aluminum bracket.

A high-quality external low-pass filter (or two) is *required* on the transmit port.

A K&L Microwave 5L121-1000/T5000-0/0 is shown above. The Mini-Circuits SLP-1000 is an equivalent.



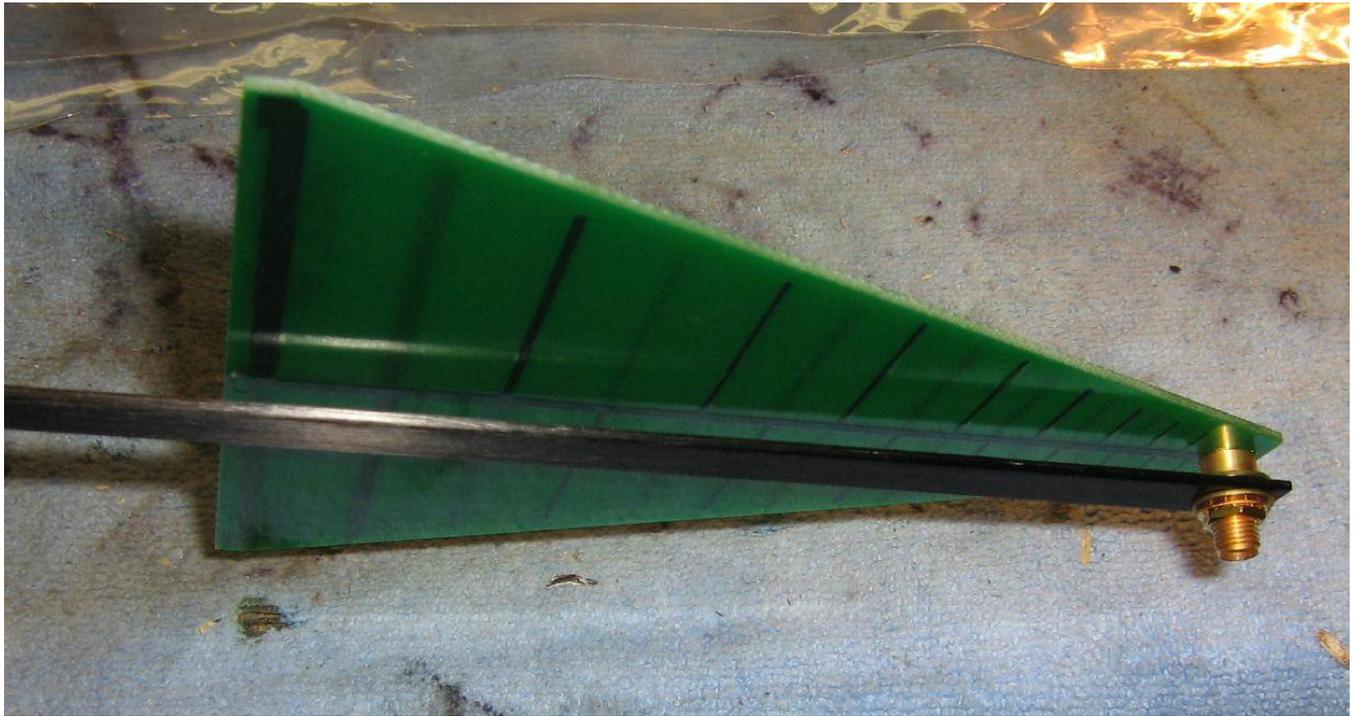
WA5VJB 850–6500 MHz log periodic antenna.

The diplexer allows the use of a single antenna for both transmitting and receiving. Since this will be a fairly wide frequency range, we'll need to a log periodic antenna.

Circular polarized antennas are recommended for non-linear junction detectors as the re-radiated signal from a proper non-linear junction will have the same polarity as the transmitted signal, while reflections from nearby objects will have the polarity "reversed." That provides an additional 20 dB isolation between the target and false signals. Unfortunately, homebrewing circulator polarized antennas for these frequencies can be quite difficult.

The WA5VJB 850–6500 MHz log periodic antenna has solder pads for installing a SMA connector and it is recommended you do this. A vertical panel-mount SMA connector is used here.

The log periodic antenna was then mounted to a short carbon fiber boom.



Overview of the semi-finished log periodic antenna.

Still trying to develop some type of additional mounting system. Real non-linear junction detectors have their antennas mounted on booms in order to scan hard-to-reach areas.

It should also be possible to easily change the non-linear junction detector's antenna polarization. After scanning an area with a vertical polarized antenna, switch to horizontal polarization and re-scan just be sure you didn't miss anything.

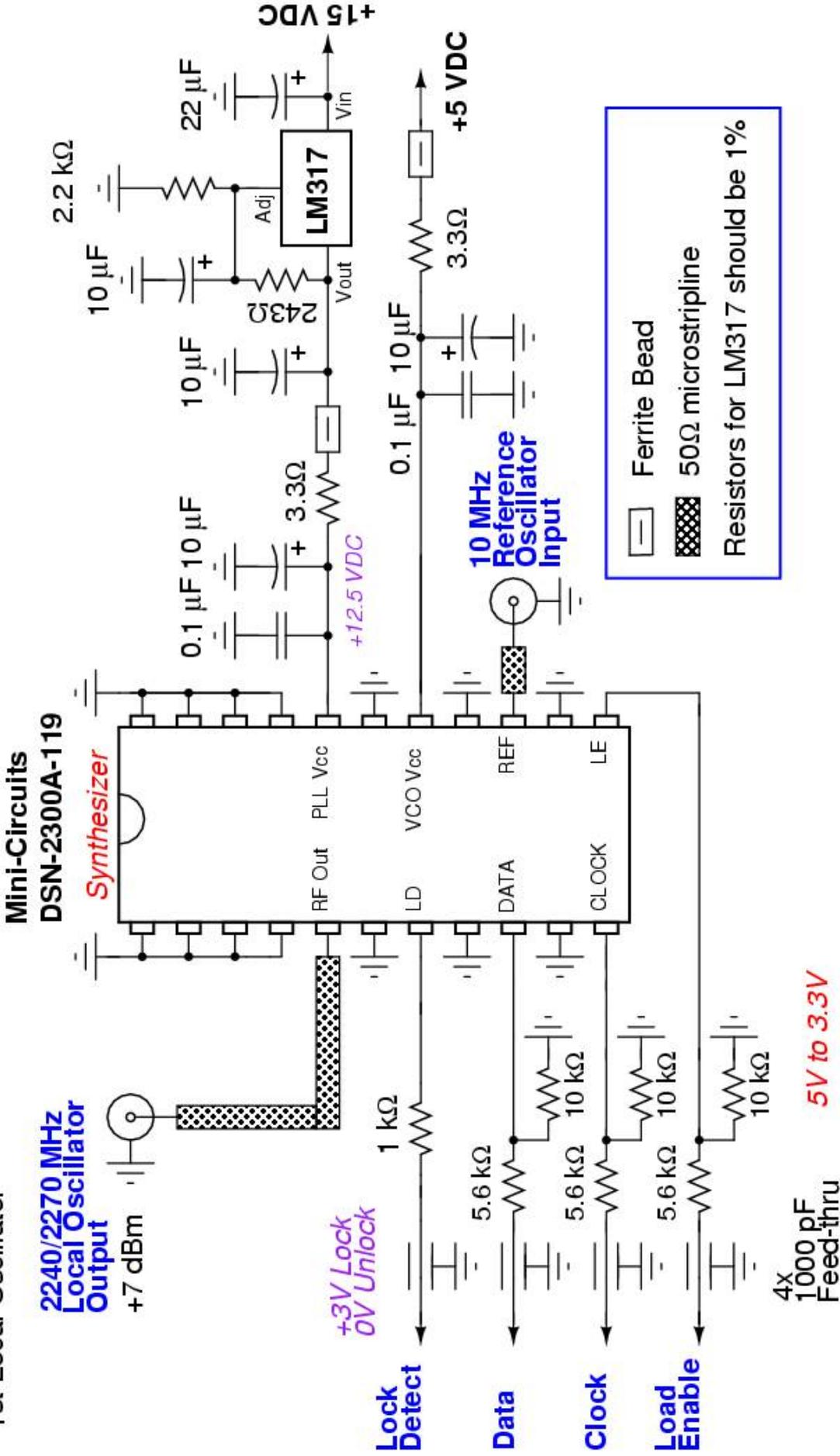
It's also possible to use two separate antennas for transmitting and receiving. This tends to provide the highest isolation and is the easiest setup when using higher RF illumination power.

These antennas are also very handy for other SIGINT applications so you may want to keep them portable.

# GBPPR Non-Linear Junction Detector

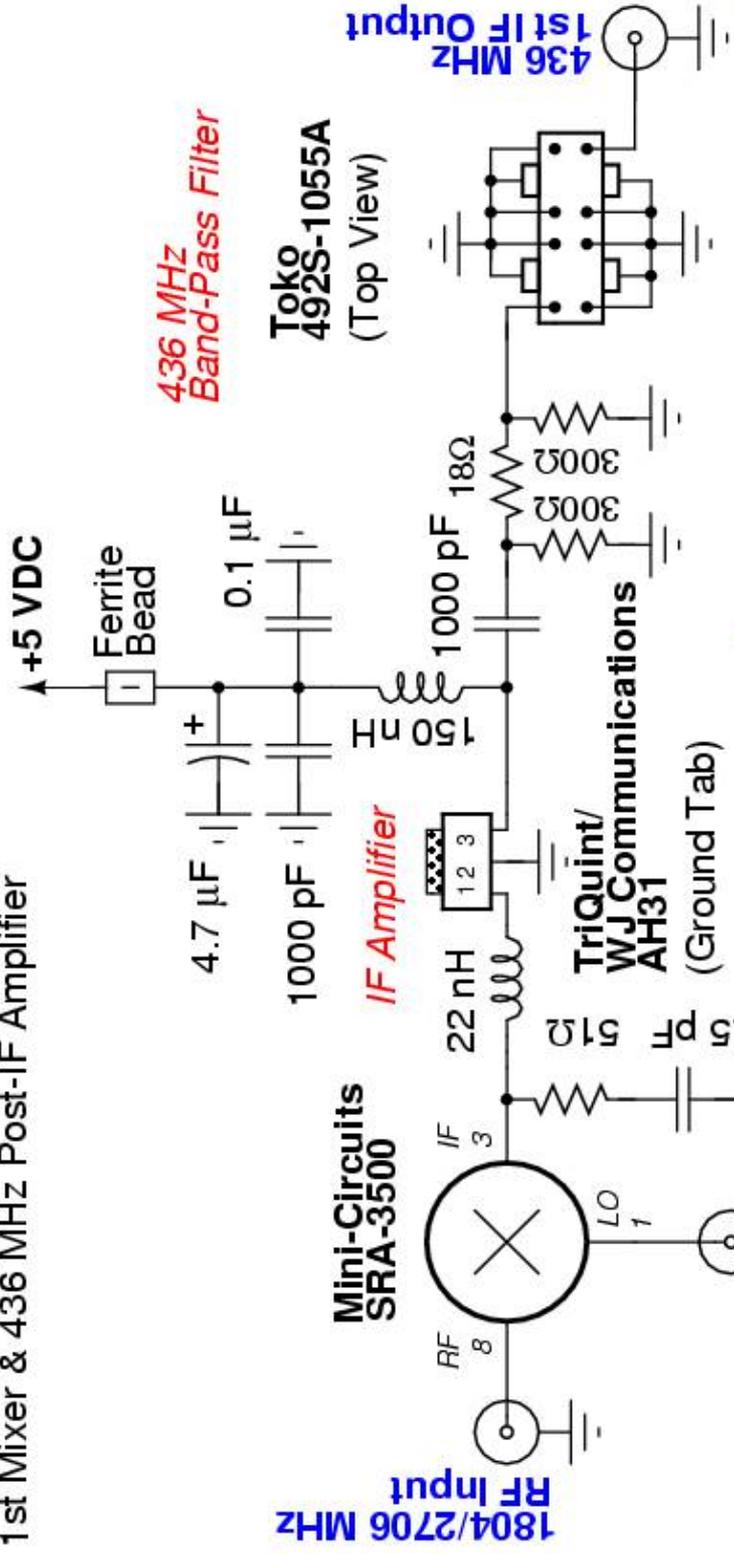
1st Local Oscillator

2240/2270 MHz  
Local Oscillator  
Output  
+7 dBm



# GBPPR Non-Linear Junction Detector

1st Mixer & 436 MHz Post-IF Amplifier



Filter is Digi-Key TKS5442CT-ND  
 Current draw of AH31 is fairly high, approx. 150 mA. Be sure inductor can handle the current.

2240/2270 MHz  
 Local Oscillator Input  
 +7 dBm

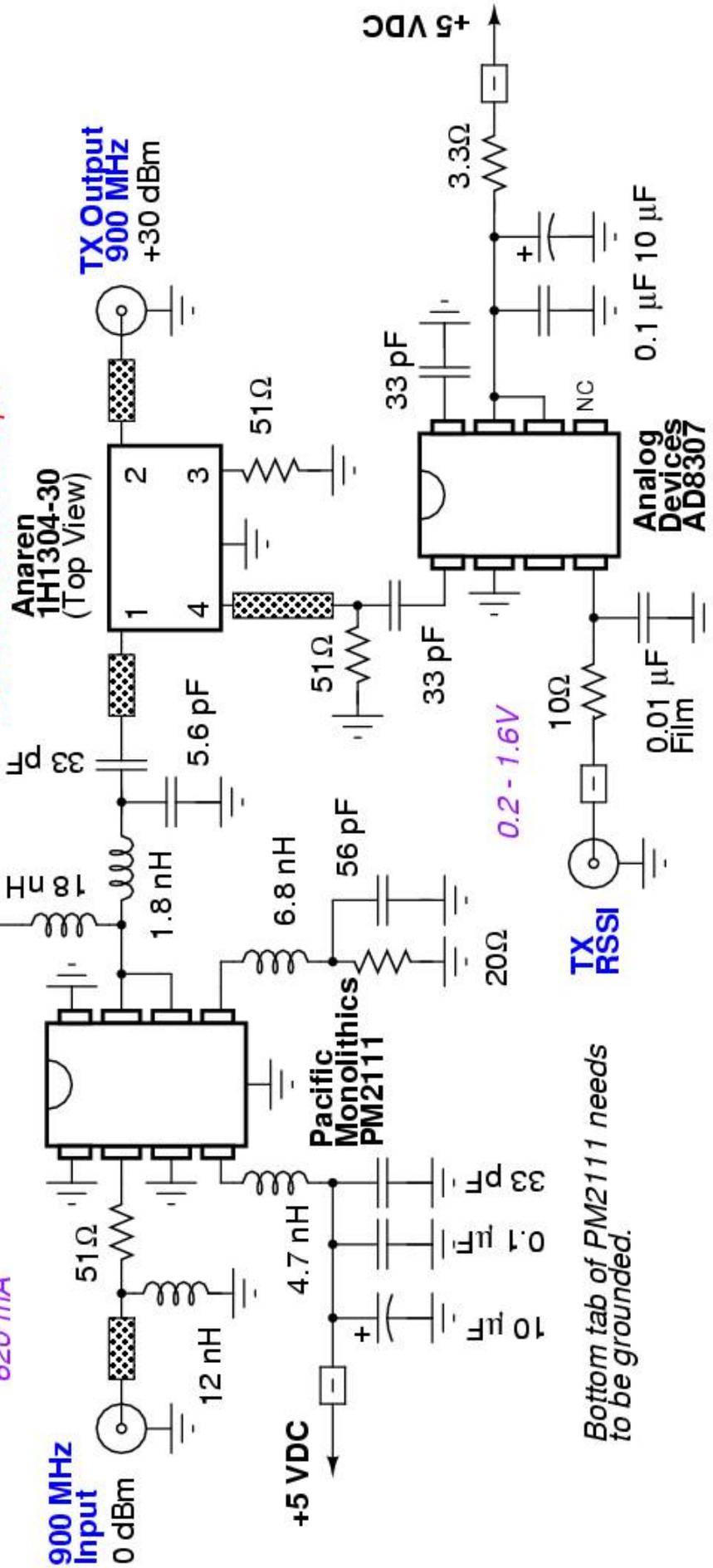


# GBPPR Non-Linear Junction Detector

Transmitter - Section 2

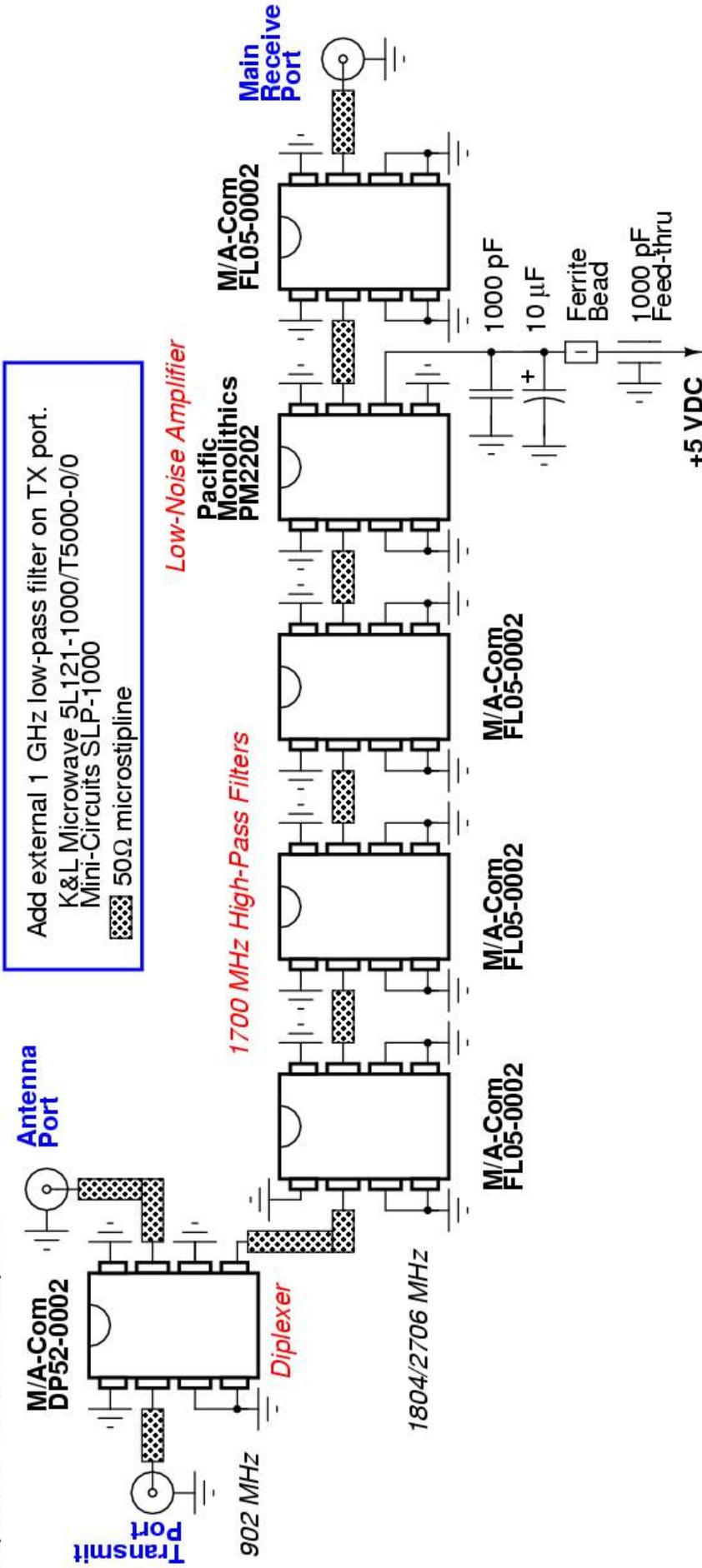
50Ω microstripline  
 Ferrite Bead  
 18 nH should be air core to handle the high current.

30 dB Directional Coupler



# GBPPR Non-Linear Junction Detector

Diplexer / Low-Noise Amplifier



## Z-Comm PSN0930A Programming Notes

Refer to the National LMX2316 datasheet for a more detailed explanation of the latches.

The Z-Comm PSN0930A is designed to be run in normal mode only. The FastLock options are not usable.

The latches should be loaded in this order: Initialization Latch, Function Latch, R Counter, and N Counter.

The "Initialization Latch" really isn't required, but it's listed in the datasheet so load it anyway.

All the latches are programmed as a 21-bit shift register with the Most Significant Bit (MSB) first and on the rising edge of the clock signal. Place the required value ("1" or "0") on the PSN0930A's **Data** line then bring the **Clock** line high then back low. Load the final 21-bit value into the PLL's latch by bringing the **Load Enable** line high then low. All this can be accomplished by using the `SHIFTOUT` command on the BASIC Stamp.

### Function and Initialization Latches

MSB																			LSB	
F19	F18	F17	F16	F15	F14	F13	F12	F11	F10	F9	F8	F7	F6	F5	F4	F3	F2	F1	C2	C1
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0

- **C1, C2: Control Bits** Should be "1 1" for Initialization Latch initialization.
- **C1, C2: Control Bits** Should be "0 1" for Function Latch initialization.
- **F1: Counter Reset** Should be "0" for normal operation.
- **F2, F18: Power Down** Should be "0" for normal operation.
- **F3-F5: Lock Detect Modes** Should be "1 0 0" for digital lock detect.
- **F6: Phase Detector Polarity** Should be "1" for Z-Comm synthesizers.
- **F7: Charge Pump Tri-State** Should be "0" for normal operation.
- **F8-F17: Fast Lock & Test Modes** All these bits should be set to "0" for normal operation.
- **F19: Test Mode** Should be "0" for normal operation.

### R Counter

Since the Z-Comm PSN0930A will be using a 10 MHz reference frequency and the step size needs to be 100 kHz, the "R Counter" will be 100.

This means the "64," "32," and "4" bit divider ratios should be set to "1".

MSB																			LSB	
R19	R18	R17	R16	R15	R14	R13	R12	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	C2	C1
0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0
					8	4	2	1	5	2	1	6	3	1	8	4	2	1		
					1	0	0	0	1	5	2	4	2	6						
					9	9	4	2	2	6	8									
					2	6	8	4												

- **C1, C2: Control Bits** Should be "0 0" for R Counter initialization.
- **R1-R14: Divide Ratio** This counter must be between 3 & 16,383.
- **R15-R18: Test Mode** Should be "0" for normal operation.
- **R19: Lock Detect Precision** Number of cycles to use for PLL lock detect.

## N Counter

This is the main divider ratio and swallow bit counter for the PLL. Since the transmit frequency will be 902.0 MHz, the "N Counter" will need to be 9020 (902 MHz divided by the 100 kHz step size). The LMX2316 PLL has an internal dual-modulus "divide-by-32" prescaler its RF input, so the "N Counter" is actually divided into a separate "B Counter" and "A Counter." The "B counter" will be 281 (integer of 9020 divided by 32) and the "A counter" will be 28. This is the swallow counter value required to get  $281 * 32$  (8992) to equal 9020.

$$\begin{aligned} N &= (32 * B) + A \\ B &= \text{div}(N / 32) \\ A &= N - (B * 32) \end{aligned}$$

Where  $\text{div}(x)$  is defined as the integer portion and 32 is the prescaler value.

An example "N" value for the transmitter at 902.0 MHz:  $9020 = (32 * 281) + 28$

The "B Counter" will be 281. This means the "256," "16," "8," and "1" bit divider ratios should be set to "1".

The "A Counter" will be 28. This means the "16," "8," and "4" bit divider ratios should be set to "1".

MSB																			LSB	
N19	N18	N17	N16	N15	N14	N13	N12	N11	N10	N9	N8	N7	N6	N5	N4	N3	N2	N1	C2	C1
1	0	0	0	0	1	0	0	0	1	1	0	0	1	1	1	1	0	0	0	1
	4	2	1	5	2	1	6	3	1	8	4	2	1	1	8	4	2	1		
	0	0	0	1	5	2	4	2	6					6						
	9	4	2	2	6	8														
	6	8	4																	
<-----B Counter----->													<-A Counter->							

- **C1, C2: Control Bits** Should be "1 0" for N Counter initialization.
- **N1-N5: A Counter** This counter must be between 0 & 31.
- **N6-N18: B Counter** This counter must be between 3 & 8,191.
- **N19: GO Bit** Charge pump output current (1 mA). Should be "1" for Z-Comm synthesizers.

The BASIC Stamp `SHIFTOUT` command will be used to program the Z-Comm PSN0930A. Refer to the *BASIC Stamp Syntax and Reference Manual* for all the nitty-gritty details you'll need for the `SHIFTOUT` command.

```
SHIFTOUT, DataPin, ClockPin, Mode, [OutputData\Bits]
```

Where `DataPin` is the BASIC Stamp pin connected to the Z-Comm PSN0930A **Data** line and `ClockPin` is connected to the Z-Comm PSN0930A **Clock** line.

The `Mode` will be Most Significant Bit (MSB) first, which is common in these applications. This should be set to "1".

The `[OutputData\Bits]` is the complicated part, as the `SHIFTOUT` command only works 16 bits at a time and the LMX2316 in the Z-Comm PSN0930A requires a 21-bit latch.

We can overcome this by loading the data in two separate `SHIFTOUT` calls. One to load the first 16 bits then another to load only the last 5 bits. The **Load Enable** line can be controlled using the normal `HIGH` and `LOW` BASIC Stamp commands.

## Mini-Circuits DSN-2300A-1119 Programming Notes

Refer to the Analog Devices ADF4106 datasheet for a more detailed explanation of the latches.

This device is quite similar to programming the PSN0930A except that the shift registers are 24 bits long and some bit values are a little different.

The latches should be loaded in this order: Initialization Latch, Function Latch, R Counter, and N Counter.

### Function and Initialization Latches

MSB																							LSB	
F22	F21	F20	F19	F18	F17	F16	F15	F14	F13	F12	F11	F10	F9	F8	F7	F6	F5	F4	F3	F2	F1	C2	C1	
1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	

- **C1, C2: Control Bits** Should be "1 1" for Initialization Latch initialization.
- **C1, C2: Control Bits** Should be "0 1" for Function Latch initialization.
- **F1: Counter Reset** Should be "0" for normal operation.
- **F2, F20: Power Down** Should be "0" for normal operation.
- **F3-F5: Lock Detect Modes** Should be "1 0 0" for digital lock detect.
- **F6: Phase Detector Polarity** Should be "0" for Mini-Circuits synthesizers.
- **F7: Charge Pump Tri-State** Should be "0" for normal operation.
- **F8, F9: FastLock** Should be "0 0" for normal operation.
- **F10-F13: Timer Counter** Should be "0 0 0 0" for normal operation.
- **F14-F19: Charge Pump Current Setting** Should be "1 1 1 1 1" for Mini-Circuits synthesizers.
- **F21-F22: Prescaler** Should be "0 1" for divide-by-32.

### R Counter

Since the Mini-Circuits DSN-2300A-1119 will be using a 10 MHz reference frequency and the step size needs to 250 kHz, the "R Counter" will be 40.

This means the "32" and "8" bit divider ratios should be set to "1".

MSB																							LSB	
R22	R21	R20	R19	R18	R17	R16	R15	R14	R13	R12	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	C2	C1	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	
								8	4	2	1	5	2	1	6	3	1	8	4	2	1			
								1	0	0	0	1	5	2	4	2	6							
								9	9	4	2	2	6	8										
								2	6	8	4													

- **C1, C2: Control Bits** Should be "0 0" for R Counter initialization.
- **R1-R14: Divide Ratio** This counter must be between 3 & 16,383.
- **R15, R16: Anti-Backlash** Should be "0 0" for normal operation.
- **R17, R18: Test Mode** Should be "0 0" for normal operation.
- **R19: Lock Detect Precision** Number of cycles to use for PLL lock detect.
- **R20-R22: Not Used** Should be "0 0 0" for normal operation.

## N Counter

This is the main divider ratio and swallow bit counter for the PLL. Since the local oscillator frequency will be 2240 and 2270 MHz, the "N Counter" will need to switch between 8960 (2240 MHz divided by the 250 kHz step size) and 9080. The ADF4106 will be programmed to use a dual-modulus "divide-by-32" prescaler on its RF input.

The "B counter" for generating 2240 MHz will be 280 (integer of 8960 divided by 32) and the "A counter" will be 0. The "B counter" for generating 2270 MHz will be 283 (integer of 9080 divided by 32) and the "A counter" will be 24.

You can change the N counter "on the fly" after the other latches are all programmed.

$$N = (32 * B) + A$$

$$B = \text{div}(N / 32)$$

$$A = N - (B * 32)$$

Where  $\text{div}(x)$  is defined as the integer portion and 32 is the prescaler value.

An example "N" value for the oscillator at 2240 MHz:  $8960 = (32 * 280) + 0$

An example "N" value for the oscillator at 2270 MHz:  $9080 = (32 * 283) + 24$

For 2240 MHz, the "B Counter" will be 280. This means the "256," "16," and "8" bit divider ratios should be set to "1". The "A Counter" will be 0. This means all the bit divider ratios should be set to "0".

For 2270 MHz, the "B Counter" will be 283. This means the "256," "16," "8," "2," and "1" bit divider ratios should be set to "1". The "A Counter" will be 24. This means the "16," and "8" bit divider ratios should be set to "1".

MSB																				For 2240 MHz																						LSB	
N22	N21	N20	N19	N18	N17	N16	N15	N14	N13	N12	N11	N10	N9	N8	N7	N6	N5	N4	N3	N2	N1	C2	C1																				
0	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1																				
			4	2	1	5	2	1	6	3	1	8	4	2	1	3	1	8	4	2	1																						
			0	0	0	1	5	2	4	2	6					2	6																										
			9	4	2	2	6	8																																			
			6	8	4																																						
												<-----B Counter----->										<--A Counter-->																					

- **C1, C2: Control Bits** Should be "1 0" for N Counter initialization.
- **N1-N6: A Counter** This counter must be between 0 & 63.
- **N7-N19: B Counter** This counter must be between 3 & 8,191.
- **N20: Charge Pump Gain** Should be "1" for Mini-Circuits synthesizers.
- **N21-N22: Not Used** Should be "0 0" for normal operation.

## Z-Comm PSN0930A Example BASIC Stamp Code

```
' {$STAMP BS2}
' {$PBASIC 2.5}
'
' Z-Comm PSN0930A PLL Frequency Synthesizer Loader Code
' GBPPR Non-Linear Junction Detector / BASIC Stamp 2
'
' !!!!! EXAMPLE CODE ONLY !!!!!
'
' Z-Comm PSN0930A Pin      BASIC Stamp Pin
' -----
' DATA (5)                P1
' CLK (4)                  P0
' LE (6)                   P2
'
' 10 MHz reference frequency / 100 kHz step size
' 902 MHz TX frequency
'

IVAL1  VAR    Word
IVAL2  VAR    Byte

FVAL1  VAR    Word
FVAL2  VAR    Byte

RVAL1  VAR    Word
RVAL2  VAR    Byte

NVAL1  VAR    Word
NVAL2  VAR    Byte

' Settings
IVAL1 = $0004
IVAL2 = $13

FVAL1 = $0004
FVAL2 = $12

RVAL1 = $000C      ' R = 100
RVAL2 = $10

NVAL1 = $8467     ' N = 9020 / B = 281 A = 28
NVAL2 = $11

LOW 0
LOW 1
LOW 2

' Load Initialization
SHIFTOUT 1,0,1,[IVAL1\16]
SHIFTOUT 1,0,1,[IVAL2\5]
HIGH 2          ' Bring LE high, then low
LOW 2
PAUSE 5

' Load Function
SHIFTOUT 1,0,1,[FVAL1\16]
SHIFTOUT 1,0,1,[FVAL2\5]
HIGH 2          ' Bring LE high, then low
LOW 2
PAUSE 5
```

```
' Load /R
SHIFTOUT 1,0,1,[RVAL1\16]
SHIFTOUT 1,0,1,[RVAL2\5]
HIGH 2           ' Bring LE high, then low
LOW 2
PAUSE 5

'Load /N
SHIFTOUT 1,0,1,[NVAL1\16]
SHIFTOUT 1,0,1,[NVAL2\5]
HIGH 2           ' Bring LE high, then low
LOW 2

END
```

## Mini-Circuits DSN-2300A-1119 Example BASIC Stamp Code

```
' {$STAMP BS2}
' {$PBASIC 2.5}
'
' Mini-Circuits DSN-2300A-1119 PLL Frequency Synthesizer Loader Code
' GBPPR Non-Linear Junction Detector / BASIC Stamp 2
'
' !!!!! EXAMPLE CODE ONLY !!!!!
'
' DSN-2300A-1119 Pin      BASIC Stamp Pin
' -----
' DATA (9)              P0
' CLK (11)               P1
' LE (12)                P2
'
' 10 MHz reference frequency / 250 kHz step size
' 2240 MHz LO frequency
'
' {$STAMP BS2}
' {$PBASIC 2.5}

IVAL1 VAR Word
IVAL2 VAR Byte

FVAL1 VAR Word
FVAL2 VAR Byte

RVAL1 VAR Word
RVAL2 VAR Byte

NVAL1 VAR Word
NVAL2 VAR Byte

IVAL1 = $9F80
IVAL2 = $13

FVAL1 = $9F80 ' Prescaler = /32
FVAL2 = $12

RVAL1 = $1000 ' R = 40
RVAL2 = $A0

NVAL1 = $2118 ' N = 8906 / B = 280 A = 0
NVAL2 = $01

LOW 0
LOW 1
LOW 2

' Load Initial
SHIFTOUT 0,1,1,[IVAL1\16]
SHIFTOUT 0,1,1,[IVAL2]
PULSOOUT 2, 1 ' Bring LE high, then low
PAUSE 5

' Load Function
SHIFTOUT 0,1,1,[FVAL1\16]
SHIFTOUT 0,1,1,[FVAL2]
PULSOOUT 2, 1 ' Bring LE high, then low
PAUSE 5
```

```
' Load /R
SHIFTOUT 0,1,1,[RVAL1\16]
SHIFTOUT 0,1,1,[RVAL2]
PULSOUT 2, 1          ' Bring LE high, then low
PAUSE 5
```

```
' Load /N
SHIFTOUT 0,1,1,[NVAL1\16]
SHIFTOUT 0,1,1,[NVAL2]
PULSOUT 2, 1          ' Bring LE high, then low
```

```
END
```

# Bonus

## Newsletter

Mrs. Mauthe's Class

December 19 - 22, 2011

### Theme of the Week

Our theme this week is Celebrations Around the World. We will be doing lots of fun activities including:

#### Art

Finish up Christmas Gifts  
Kwanzaa Flag  
Star of David

#### Stories

A Great Miracle Happened There  
Celebrating Kwanzaa  
Chanukah Fun  
What is Hanukkah

#### Songs

Lighting All the Candles  
Kwanzaa's Here  
Spin the Dreidel  
Hanukkah, Hanukkah

#### Religion

Lesson 12 - I Can Pray

\*\* Just a reminder that Thursday, December 22nd will be our Christmas Party. We will be decorating Christmas cookies and listening to fun Christmas music. Please have your child dress in red and green or some kind of fun Christmas attire ☺ If you volunteered to help on Thursday, please be here by 10:30 and plan to stay until 11:30 at the latest. Thanks!

### Letter of the Week

Our letter of the week is Mm. We will also incorporate Mm into our learning this week with:

- \* Picking out all of the M's in our names
- \* Practice drawing M's on our friends' backs
- \* Incorporating M into our learning centers
- \* Tracing M's and starting to practice writing M's.

### Star of the Week

This week our Star of the Week is Connor

### Specials

Tuesday - Art Assistance  
(9:20 - 9:40)

Wednesday - Music  
(1:45 - 2:15)

Thursday - Christmas Party  
(10:30 - 11:30)

Friday - No School  
Merry Christmas!!!



## What the FUCK!?!?

Cultural Marxist propaganda is now entering private schools!

Kwanzaa is just some nigger bullshit invented in the 1960s.

Hanukkah is a celebration of the Jewish attack on Gentile culture 165 years *before* the birth of Christ.

Well, at least they still call it "Christmas."

## *End of Issue #93*



**Any Questions?**

### **Editorial and Rants**



Say hello to ObamaLand!

## **Former State Senator Says "Goodbye, Illinois"**

December 22, 2011 – From: [godfatherpolitics.com](http://godfatherpolitics.com)

Former State Senator and Republican Cook County Board President candidate Roger Keats and his wife Tina left Illinois to live in Texas. They bid farewell to their Illinois friends in a *Wilmette Beacon* article, and with this letter, saying they're "voting with their feet and their wallets."

GOOD BYE AND GOOD LUCK

As we leave Illinois for good, I wanted to say goodbye to my friends and wish all of you well. I am a lifelong son of the heartland and proud of it. After 60 years, I leave Illinois with a heavy heart. BUT enough is enough! The leaders of Illinois refuse to see we can't continue going in the direction we are and expect people who have options to stay here. I remember when Illinois had 25 congressmen. In 2012 we will have 18, compared to the rest of the country, we have lost 1/4th of our population. Don't blame the weather, because I love 4 seasons.

Illinois just sold still more bonds and our credit rating is so bad we pay higher interest rates than junk bonds! Junk bonds!

Illinois is ranked:

- **50th for fiscal policy.**
- **47th in job creation.**
- **1st in unfunded pension liabilities.**
- **2nd largest budget deficit.**
- **1st in failing schools.**
- **1st in bonded indebtedness.**
- **Highest sales tax in the nation.**
- **Most judges indicted (Operations Greylord and Gambat).**
- **5 of our last 9 elected governors have been indicted. That is more than the other 49 states added together!**

Then add 32 Chicago Aldermen and (according to the *Chicago Tribune*) over 1000 state and municipal employees indicted. The corruption tax is a real cost of doing business. We are the butt of jokes for stand up comics.

We live in the most corrupt big city, in the most corrupt big county in the most corrupt state in America. I am sick and tired of subsidizing crooks. A day rarely passes without an article about the corruption and incompetence. Chicago even got caught rigging the tests to hire police and fire!

Our Crook County CORPORATE property tax system is intentionally corrupt. The Democrat State Chairman who is also the Speaker of the Illinois House (Spkr. Mike Madigan) and the most senior alderman in Chicago each make well over a million dollars a year putting the fix in for their clients' tax assessments.

We are moving to Texas where there is no income tax, while Illinois' just went up 67%. Texas sales tax is 1/2 of ours, which is the highest in the nation. Southern states are supportive of job producers, tax payers and folks who offer opportunities to their residents. Illinois shakes them down for every penny that can be extorted from them.

In the Hill Country of Texas (near Austin and San Antonio ) we bought a gracious home on almost 2 acres with a swimming pool. It is new, will cost us around 40% of what our home in Wilmette just sold for and the property taxes are 1/3rd of what they are here. Cook County's property tax system is a disaster: Wilmette homes near ours sell for 50% more and their property taxes are 1/2 of ours. Our assessed home value was 50% higher than the sales price. The system is unfair and incompetent.

Our home value is down 40%, our property taxes are up 20% and our local schools have still another referendum on the ballot to increase taxes over 20% in one year.

I could go on, but enough is enough. I feel as if we are standing on the deck of the Titanic and I can see the icebergs right in front of us. I will miss our friends a great deal. I have called Illinois home for essentially my entire life. But it is time to go where there is honest, competent and cost effective government. We have chosen to vote with our feet and our wallets. My best to all of you and good luck!





*Stop and think about what this vile anti-White kike is really saying... She's finally admitting Whites and non-Whites can't live together – which any sane person already knew was true. Also note how she views Democrats as objects or groups, not as individuals capable of making their own decisions. See the Jew...*

## **DNC Chairwoman Wasserman Schultz: "Natural Home" for Minorities is Democratic Party**

January 13, 2012 – From: [realclearpolitics.com](http://realclearpolitics.com)

DNC Chairwoman Rep. Debbie Wasserman Schultz (FL) appeared on the season premiere of HBO's "Real Time" with host Bill Maher this Friday. In the Overtime portion of the show, which is broadcasted and available only on the internet, Wasserman Schultz got into race politics, claiming the Democratic Party is the "natural home" for minorities.

Wasserman Schultz says minorities feel "comfortable" because the Democratic Party stands up for "the issues that matter to those communities and Republicans shun them." Transcript below.

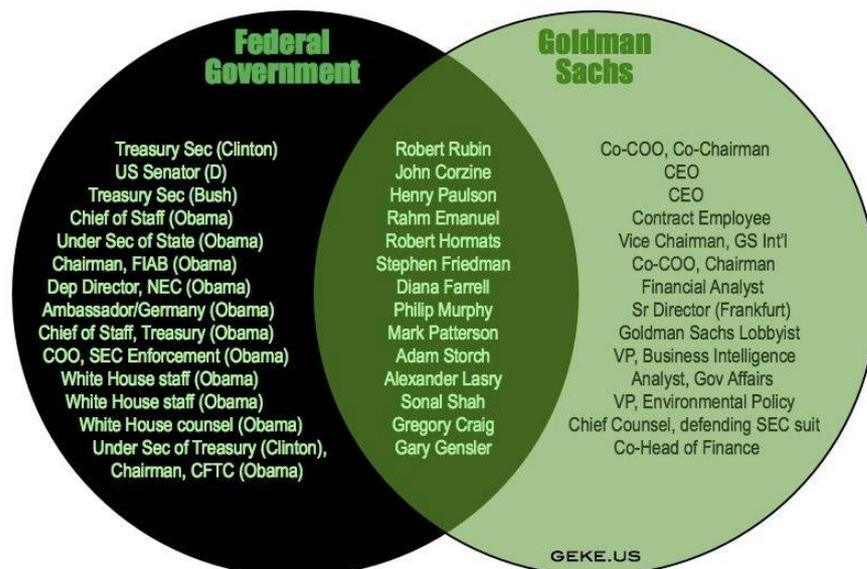
Debbie Wasserman Schultz, DNC Chairwoman: "Just look at the chamber at the State of the Union. Look at the side of the chamber that the Democrats sit on and the side of the chamber that Republicans sit on. And you can notice a dramatic difference in who chooses to affiliate as Democrats and who chooses to affiliate as Republicans. The diversity in the Democratic Party is remarkable. We truly are the big tent party."

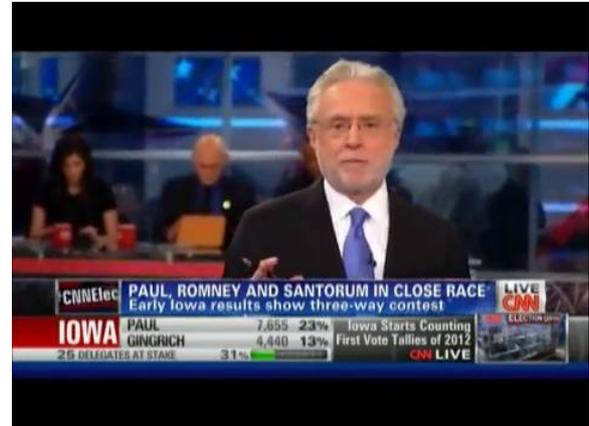
"There is a reason that the Democratic Party is far more diverse than the Republican Party, because the natural home, politically on major issues to Hispanics, to women, to Jews, to Asian-Americans, the diverse spectrum -- to African Americans."

"The entire spectrum of diversity is comfortable in the Democratic Party because we stand up for the issues that matter to those communities and Republicans shun them."

---

Now, isn't it funny how Obongo talks about "diversity," then he stacks his cabinet (and the other federal positions) with Jews from Goldman Sachs? And don't forget Goldman Sachs' Elena Kagan (Jew) on the Supreme Court!





See the Jew...

([www.youtube.com/watch?v=5Lx1UtRfc8o](http://www.youtube.com/watch?v=5Lx1UtRfc8o))  
 ([www.youtube.com/watch?v=3TSxm2V8aVQ](http://www.youtube.com/watch?v=3TSxm2V8aVQ))

After the January 3, 2012 Iowa Caucus, CNN's Dana Bash (Schwarz [Jew]) held an interview with U.S. Army Corporal Jesse Thorsen at the Ron Paul headquarters. After a short discussion on how Thorsen believes it's time to end all the wars for Israel, he mentioned Israel was capable of defending itself from Iran. The video signal was then suddenly "lost." *Yeah, right...*

Some low-I.Q. "skeptics" claim this was just satellite interference, but it wasn't. Satellite interference tends to rise and fall as the interference passes through the satellite dish's beamwidth.

The "interference" shown on the Col. Jesse Thorsen video clearly shows a loss of the vertical synchronization signal (the rolling effect). This indicates the video signal was still analog (from the camera) when the loss of video took place. Someone pulled a plug, literally.

It should also be noted that CNN's Dana Bash is married to CNN's John King and she has made numerous anti-Ron Paul comments on air.

And guess who was conveniently back at the CNN Election Center handling this mess? None other than Wolf Blitzer (Jew)! You know, the former American Israel Public Affairs Committee (AIPAC) lobbyist and textbook definition of an "Israeli-firster."

***"Pay no attention to that man behind the curtain!"***

**Hope! Change! War! LOL!**