GBPPR 'Zine

Issue #113 / The Monthly Journal of the American Hacker / September 2013

"I'm a bit confused. I grew up on the south side [Milwaukee, Wisconsin] in the 50's and 60's and our parents NEVER had to organize rallies and marches to voice their opposition to crime. Nobody locked their doors and we played outside on summer nights on the streets and even the alley ways in a safe and sound environment. Could someone please offer an explanation as to what happened to the south side of Milwaukee? NOTE – calling me a racist or telling me that 'these are different times' will not be considered acceptable."

––– User comment on the *Milwaukee Journal Sentinel* article entitled "South Side Milwaukee Neighborhood Rallies Against Violence."

In 1950, Milwaukee was 96.6% White and only 3.4% Black. By 2010, Milwaukee was a majority–Black city, with 40% of the population being Black and only 37% White.

(jsonline.com/news/milwaukee/south–side–milwaukee–neighborhood–rallies–against–violence–b9987054z1–221722561.html)

Table of Contents

(k) Item HSTC specifies the high signal strength for the cell site. When the power level that a cell site is transmitting at is higher than this value, the cell site will be attenuated. This field ranges from 0 (−30 dBm) to 127 (−130 dBm), evenly distributed throughout the numerical range.

(l) Item LSTC specifies the low level signal strength for the cell site. When the power level that a cell site is transmitting at is lower than this value, the cell site's power level will be boosted. This field has the same units as HSTM.

(m) Item NMAL specifies the maximum number of 4 dB steps that a mobile is allowed to attenuate below its normal value. This field is 4 bits long with a range from 0 to 15.

(n) Item NCAL specifies the maximum number of 4 dB steps that a cell site is allowed to attenuate below its normal value. This field is 4 bits long with a range from 0 to 15.

(o) Item HSTM specifies the high signal strength for the mobile. When the power level that a mobile is transmitting at is higher than this value, the mobile will be attenuated. This field ranges from 0 (−30 dBm) to 127 (−130 dBm) evenly distributed throughout the numerical range.

(p) Item LSTM specifies the low signal strength for the mobile. When the power level that is transmitting at is lower than this value, the mobile's power level will be boosted. This field has the same units as HSTM.

(q) Item MPDIF specifies a value in dB equal to the total gain ahead of a cell site voice radio receiver on the specific face minus the power that could be radiated on the specific cell site transmit antenna face if it were equipped with a programmable high power RF amplifier set for 0 dB attenuation plus the power that could be radiated by a class-I mobile with 0 dB (i.e., +36 dBm).

(r) Item CPCF specifies whether dynamic power control is turned off/on at the individual cell sites. Only the rightmost bit is used, the allowable value for the field is 0 or 1.

(s) Item MPCF specifies whether dynamic power control is turned off/on at the mobiles within the cell site. Only the rightmost bit is used, the allowable value for the field is 0 or 1.

(t) Item HIGH specifies the voice channel selection high threshold. This threshold is used during voice channel selection process. This threshold is set above the normal signal strength that would be allowed for a cell to hand off to, so if during the location process, a neighbor returns a signal strength of HIGH or above, the neighbor is not added to the candidate list. This field ranges from 0 to 127.

(u) Item NCS specifies the cell site number of the neighbor.

(v) Item NANT specifies a 4-bit field, indicating which of the antennas of the neighbor cell site are neighbor antennas. Bit 0 represents the neighbor omnidirectional antenna, with bits 1, 2, and 3 representing the neighbor directional antenna. Either the omni bit or one or more of the directional bits may be set. (If the neighbor is a dual cell, with one server group omnidirectional and the other directional, only one server group may be represented per neighbor entry. This means that a neighbor dual cell may be represented twice in this list, if both of the server groups are neighbors.)

(w) Item NSG specifies the neighbor server group (0 is primary, 1 is secondary).

(x) Item NSBGRP specifies the subgroup number for the neighbor cell. Each of the neighbor groups, as discussed in the GINGHBR field, may be further subdivided into three subgroups. The NSBGRP field is input as a decimal digit ranging from 0 through 2. The neighbors must be in numerical order according to subgroup number, ordered from group 1, subgroup 0 to group 2, subgroup 2.

B. Parameters/Call Store

4.54 A typical parameter word and duplicate call store layout is shown in Fig. 28. All of the duplicated call store memory defined by Fig. 28 must be contiguous in a single call store block. Parameter words and associated duplicate call store area are defined in paragraphs 4.56 through 4.87.

4.55 Parameter word QG2ASPMA contains the call store address of a 30-word scratch pad memory area. This block is built whenever set card 9F164 is activated and is used as a scratch area.

4.56 Parameter word QP2PMA contains the call store address of a 340-word paging message area. This block is built whenever set card 9Fl65 is activated and is used as a paging message storage area.

4.57 Parameter word QG2AIOUCAW contains the call store address of a 64-word area used for I/O unit controller activity words. This block is built whenever set card 9Fl64 is activated.

4.58 Parameter word QG2ADLQS contains the call store address of a 32-word area used for the data link queue status. This block is built whenever set card 9F164 is activated.

4.59 Parameter word QG2ADLS contains the call store address of the data link status table whose size is 16 × CELL + 1. Set card CELL is defined in Table C. This block is built when set card 9F164 is activated.

4.60 Parameter word QG2CDCT contains the call store address of a 64-word area used for the cell download control table. This block is built whenever set card 9F164 is activated.

4.61 Parameter word QG2AMSA contains the call store address of an 89-word area used for the temporary message storage area. This block is built whenever set card 9F164 is activated.

4.62 Parameter word QG2AIOMPW contains the call store address of an 8-word area used for the I/O microprocessor activity words. This block is built whenever set card 9F164 is activated.

4.63 Parameter word QG2CIT contains the call store address of the cell initialization table block whose size is (16 × CELL +1). Set card CELL is defined in Table C. This block is built whenever set card 9F164 is activated.

4.64 Parameter word QM2ACCT contains the call store address of the cell-to-channel, channel-to-cell table area whose size is 1 + CELL. Set card CELL is defined in Table C. This block is built whenever set card 9F163 is activated.

4.65 Parameter word QP2ARBT contains the call store address of the roamer busy table area whose size is 2 × NRMR. Set card NRMR defines the number of roamer mobile units allowed to access the system. The value of set card NRMR is submitted by the telephone company. If there is no value available, a value of 500 should be used. This block is built whenever set card 9F165 is activated.

4.66 Parameter word QG2AMMR contains the call store address of the mobile message register block whose size is MAX(9100,2 × [91 × CELL]). Set card CELL is defined in Table C. This block is built whenever set card 9F164 is activated.

4.67 Parameter word QM2ACTBRW contains the call store address of a 256-word area used for cell test bus resource words. This block is built whenever set card 9F163 is activated.

4.68 Parameter word QG2DLMB contains the call store address of the 200-word data link maintenance block. This block is built whenever set card 9F164 is activated.

4.69 Parameter word QG2ACTUDB contains the call store address of the 116-word cell translation update data block. This block is built whenever set card 9F164 is activated.

4.70 Parameter word QG2ACOS contains the call store address of the 64-word cell overload status table. This table is built whenever set card 9F164 is activated.

4.71 Parameter word QG2CELL contains the call store address of the call store area for set card CELL, whose size is equal to the value of set card CELL. This block is built whenever set card 9F164 is activated.

4.72 Parameter word XL2AIOUSLMP contains the call store address of the 16-word expanded IOP data block. This block is built when set card 9PAR04 is activated.

4.73 Parameter word QG2CSVPU contains the call store address of the 20-word cell site voice path usage table. This table is built whenever set card 9F164 is activated.

4.74 Parameter word QG2CSARRAY contains the call store address of the 85-word AMPS

equipped cell site table. This table is built whenever set card 9F164 is activated.

4.75 Parameter word QG2VCSA contains the call store address of the 50-word AMPS voice channel selection measurement table. This table is built whenever set card 9F164 is activated.

4.76 Parameter word QG2PLA contains the call store address of the 456-word AMPS active power level measurement table. This table is built whenever set card 9F164 is activated.

4.77 Parameter word QG2CSTABLE contains the call store address of the 256-word AMPS special studies traffic measurements call store table. This table is built whenever set card 9F164 is activated.

4.78 Parameter word QG2DLHOLD contains the call store address of the data link traffic measurement holding area for AMPS usage whose size is 8 × CELL. Set card CELL is defined in Table C. This block is built whenever set card 9F164 is activated.

4.79 Parameter word QG2DLCOL contains the call store address of the data link traffic measurement collection for AMPS usage whose size is 8 × CELL. Set card CELL is defined in Table C. This block is built whenever set card 9F164 is activated.

4.80 Parameter word OM2AMPSMTCE contains the call store address of the 12-word diagnostic scheduler maintenance block for AMPS usage. This block is built whenever set card 9F163 is activated.

4.81 Parameter word OG2CSCAN contains the call store address of the 128-word cell site voice path scan traffic measurement table. This table is built whenever set card 9F164 is activated.

4.82 Parameter word OG2VCSABUF contains the call store address of the 64-word traffic measurement output buffer table. This table is built whenever set card 9F164 is activated.

4.83 Parameter word OM2ACDUT contains the call store address of the 256-word AMPS cell dialup channel table. This table is built whenever set card 9F163 is activated.

4.84 Parameter word B6AMPS contains the call store address of a 50-word area used for comment traffic registers for AMPS. This block is built whenever set card 9F165 is activated.

4.85 Parameter word OP2MCGVT contains the call store address of the 64-word AMPS multicell generic version table. This table is built whenever set card 9F164 is activated.

4.86 Parameter word OP2MCGCT contains the call store address of the 32-word AMPS multicell generic control table. This table is built whenever set card 9F164 is activated.

4.87 Parameter word QM2ACSTSW (Fig. 29) contains the unduplicated call store address of the cell site trunk state word head table whose size is variable from one to the value of CELL. Set card CELL is defined in Table C. The size of the cell site trunk state words area, pointed to from the cell site trunk state word head table, is fixed at 96 words. These blocks are built whenever set card 9F163 is activated.

4.88 Call store pointer QG2AHHT points to a 12-word call store area containing the message hopper table entries which are built when set card 9F164 is activated. These entries are defined as follows:

(a) ***Page Response Hopper:*** The page response hopper block requires 96 words. Eight page response hoppers are required.

(b) ***Mobile Origination Hopper:*** This call store block is used to temporarily store mobile unit origination messages from the cell site. The size of the mobile origination hopper block is 475 words.

(c) ***General Call Processing Hoppers:*** The size of the general call processing hopper area is MAX(1200,8 × GCPH × 9F164). Set card GCPH specifies the number of call processing hoppers to be used for general use and is defined in Table C.

(d) ***Mobile Maintenance Hopper:*** This call store block is used to temporarily store maintenance messages from the cell site. The size of the mobile maintenance hopper block is MAX(1000,20 × CELL × 9F164). Set card CELL specifies the

number of mobile maintenance hopper entries and is defined in Table C.

(e) ***Administrative Hopper Area:*** The size of the administrative hopper area is MAX(1000,20 × CELL × 9F164). Set card CELL specifies the number of administrative hopper entries and is defined in Table C.

(f) ***Long Maintenance Message Hopper:*** The size of the long maintenance message hopper is MAX(890,89 × CELL/8 × 9F164). Set card LMMH specifies the number of long maintenance message hopper entries and is defined in Table C.

4.89 Three types of registers are associated with the MTSO feature and are defined below. The zeroing code for these registers is two. These registers are built whenever set card 9F165 is activated.

(a) ***Mobile Call Register:*** The mobile call register is a 32-word register which contains calling information for each mobile call. The number of mobile call registers is defined by set card NMCR.

(b) ***Mobile Originating Register:*** The mobile originating register is a 22-word register used to hold transient information during the origination phase of a mobile radio originated call. The number of mobile originating registers is defined by set card NMOR.

(c) ***Mobile Hand-off Register:*** The mobile hand-off register is a 12-word register used to hold information during the hand-off phase of a mobile call. The number of mobile hand-off registers is defined by set card NMHR.

FEATURE OPERATION

4.90 Feature operation for the MTSO feature includes the following network routing, basic call sequence, and call processing steps.

A. Network Routing

4.91 Mobile-originated calls into the land telephone network are outpulsed from the MTSO using MFS (multifrequency signaling). The MTSO selects and seizes the outgoing trunk to the zone office. The MTSO begins outpulsing the called digits after the zone office sends a start-pulse or wink signal. ⧫The wink is a battery reversal on the trunk.⧫ Answer and disconnect supervision signals are returned from the zone office to the MTSO, allowing charging records to be made.

4.92 On land-to-mobile calls, the zone office outpulses the called mobile's telephone number to the MTSO using MFS. The MTSO returns answer and disconnect supervision signals back to the zone office.

4.93 The MTSO routes calls within the primary system into the wire-line network. The simplest call routing is the mobile-to-mobile call in the same MSA. The MTSO receives the dialed digits from the calling mobile, determines that the called number is another mobile, and completes the connection to that called mobile (Fig. 30). None of the zone offices are involved.

4.94 On direct-dialed, mobile-to-land calls, the MTSO routes the call into the land telephone network through one of the zone offices. Routing tables stored in the MTSO provide the association between the called number and the proper zone office to be used. ⧫For standard calls, the DN of the calling mobile does not influence the routing. Exceptions to this would be operator assistance, emergency service, and repair service.⧫

4.95 Land subscribers can directly dial calls to mobiles. Since mobile DNs are assigned from those available in local exchanges, there is a correspondence between each mobile and a particular zone office. The land telephone network directs calls to the zone office serving the exchange of the called number without knowing the call is to a mobile. Upon receiving such a call, the zone office connects that call to a direct trunk to the MTSO which, in turn, completes the connection to the mobile. ⧫The network routing for a land-to-mobile call is similar to the mobile-to-land call (Fig. 30).⧫

4.96 Operator-assisted and service calls (e.g., repair service) can also be dialed from a mobile. The MTSO does not have direct trunks to operator or service bureau positions. Instead, it makes use of those services already available in the zone offices. ⧫On mobile-to-land/mobile-operator-assisted calls, the MTSO routes the call to a zone office which connects the call to operator and service position trunks [Fig. 30(c)].⧫

B. Call Sequence

4.97 Call sequence within the System 100 primary system is determined by which one of the following call configurations is initiated:

- Mobile-completed calls
- Mobile-originated calls
- Handoff
- Disconnect.

4.98 Mobile-completed call sequence and each associated channel path configuration includes six major steps.

(a) ***Paging:*** From the calling party's zone office, the call is routed by standard wire-line network routing procedures to the home MTSO of the mobile unit. ◗The MTSO collects the digits, converts them to the mobile's identification number, performs standard checks on the DN, and checks busy/idle status of the mobile unit. The MTSO then sends audible ringing to the calling party and instructs the cell sites to page the mobile over the forward setup channels (sometimes called paging channels). There is a sufficient number of paging cell sites to ensure that the paging message is broadcast over the entire MSA [Fig. 31(a)].◖

(b) ***Cell Site Selection:*** The mobile unit, after recognizing its page and using parameters derived from the overhead word message, scans the setup channels used for access in the MSA and selects the strongest one. The selected channel will probably be associated with a nearby cell site (usually the nearest cell site) [Fig. 31(b)].

(c) ***Page Response:*** The mobile replies to the cell site it selected over the reverse setup channel (sometimes called access channel). The selected cell site then reports the page reply to the MTSO over its dedicated cell site data link [Fig. 31(c)]. ◗If the cell site is equipped with directional antenna, then the cell site will perform a directional locate and send information regarding which antenna face the call is to be serviced on along with page response to the MTSO.◖

(d) ***Channel Designation:*** The MTSO selects an idle voice channel (and associated cell site trunk) to the cell site that handled the page response and informs the cell site of its choice over the appropriate data link. The serving cell site, in turn, informs the mobile of its channel designation over the forward setup channel. ◗The mobile tunes to the channel designation and detects the SAT (supervisory audio tone) that is continuously transmitted from the cell site. The mobile unit, acting as a transponder, then transmits the same SAT over the designated voice channel to the cell site. The cell site interprets the returned SAT as successful voice channel communication [Fig. 31(d)].

(e) ***Alerting:*** On recognizing the returned SAT, the serving cell site transmits an alert order data message over the voice channel to the mobile unit which, in turn, signals the customer that they have an incoming call. When the mobile unit receives the alert order, it transmits ST (signaling tone) to the serving cell site. The cell site interprets the ST as successful alerting [Fig. 31(e)].

(f) ***Talking:*** When the customer answers, the cell site recognizes removal of signaling tone by the mobile unit and sends an answer message to the MTSO over the cell site data link. The MTSO removes the audible ringing circuit and establishes the talking connection so that conversation can begin [Fig. 31(f)].◖

4.99 Mobile-originated call sequence and each channel path configuration includes six major steps.

(a) ◗***Preorigination:*** Using preorigination dialing procedures, the customer enters the dialed digits into the mobile units memory and depresses SEND key to initiate the call [Fig. 32(a)].◖

(b) ***Cell Site Selection:*** The mobile unit seizes a reverse setup channel, usually from the nearest cell site. This is a process similar to that described previously for the mobile-completed call [Fig. 32(b)].

(c) ◗***Origination:*** The stored digits, along with the MIN and service number (if requested) are transmitted over the reverse setup channel selected by the mobile.◖ The selected cell site associated with this setup channel receives this information and relays it to the MTSO over its cell

site data link. ◗If the cell site is equipped with directional antenna, the cell site action is similar to that described previously for page response during the mobile-completed call [Fig. 32(c)].

(d) ***Channel Designations:*** The MTSO determines routing and charging information at this time by analyzing the dialed digits. If the MIN, serial number, or dialed digits are invalid, the call is terminated by the MTSO. As with the mobile-completed call, the MTSO now designates a voice channel and establishes voice communication with the mobile through the cell site [Fig. 32(d)].

(e) ***Digit Outpulsing:*** When the cell site detects the returned SAT, it transmits a voice channel confirmation message to the MTSO.◖ The MTSO then completes the call through the wire-line network using standard digit outpulsing techniques [Fig. 32(e)].

(f) ***Talking:*** When outpulsing is completed, the MTSO establishes a talking connection. Communication between customers takes place when the called party answers [Fig. 32(f)].

4.100 Hand-off call sequence and each channel path configuration includes three major steps.

(a) ◗***New Channel Preparation:*** The serving cell site, working with its group 1 and group 2 neighbor lists, combines locating information from surrounding cell sites with its own and assembles a handoff list of cell site/antenna faces on which to service the call. The handoff list is then transmitted to the MTSO by the serving cell site. The MTSO analyzes the data and decides that a handoff to a new voice channel is to be attempted. The MTSO then selects an idle voice channel (and an associated cell site trunk) based on the priority in the handoff list. It then sends a message to the cell site associated with the new voice channel. That cell site (for an intercell or intracell handoff) turns on the selected voice channel and transmits SAT [Fig. 33(a)].

(b) ***Mobile Handoff Command:*** The MTSO sends a message to the serving cell site containing the new voice channel identity. The serving cell site, in turn, transmits this information to the mobile unit over the forward voice channel by a blank-and-burst data message [Fig. 33(b)].

(c) ***Channel/Path Reconfiguration:*** The mobile unit transmits a brief burst of ST, turns off its transmitter, tunes to the new voice channel, and transmits the received SAT. The original serving cell site, on recognizing the ST burst, sends a handoff confirmation message to the MTSO. The MTSO reconfigures its switching network, connecting the other party with the appropriate cell site trunk to the new voice channel. The cell site with the new channel (even for an intracell handoff), upon recognizing the returned SAT over the new channel, sends a voice channel confirmation message to the MTSO. The MTSO interprets this message as a successful handoff [Fig. 33(c)].◖

4.101 The call sequence and each channel path configuration for mobile-initiated and system-initiated disconnect includes three major steps each.

(a) The mobile-initiated disconnect actions occurring when the mobile party goes on-hook are:

(1) ***Release:*** The mobile unit transmits ST and turns off its transmitter. The ST is received by the cell site, which times the ST and determines that a release has occurred [Fig. 34(a)].

(2) ◗***Cell Site Transmitter Shutdown:*** In response to the release message, the cell site will shut down its own transmitter associated with the call. It then sends a release message to the MTSO over the cell site data link [Fig. 34(b)].

(3) ***Idle:*** As the final action in the call, the MTSO idles all switching office resources associated with the call and sends any necessary disconnect signals through the wire-line network. All equipment used on this call may now be used on subsequent calls [Fig. 34(c)].◖

(b) The system-initiated disconnect actions occurring when the land party goes on-hook are:

(1) ◗***Release:*** The MTSO receives a disconnect message from the wire-line network. The MSTO sends a release order message to the serving cell site. The cell site transmits this

order to the mobile unit over the voice channel. The mobile confirms receipt of the message by invoking the same release sequence as with a mobile-initiated disconnect [Fig. 35(a)].

(2) ***Cell Site Transmitter Shutdown:*** The cell site response to the mobile units ST is the same as the mobile-initiated disconnect [Fig. 35(b)].

(3) ***Idle:*** In response to the release message from the cell site, the MTSO idles all switching office resources associated with the call [Fig. 35(c)].

C. Call Processing Steps

4.102 The call processing sequence performed by the system elements are for land- or mobile-originated calls. The sequence of these calls is given in Fig. 36 and 37, respectively.

CHARACTERISTICS

5. FEATURE ASSIGNMENT

5.01 Not applicable.

6. LIMITATIONS

6.01 Frequency assignments for a Mobile Phone System in a given area are grouped into two channel groups, A and B, each containing 333 channel pairs (transmit and receive). A minimum of 21 channel pairs in each group is used for system access and control, which leaves a maximum of 312 channel pairs for voice radio assignment. Channel group A consists of frequencies in the 870- through 880-MHz band for cell site transmission (with a corresponding cell site receiving frequency from 825- through 835-MHz band). Group B consists of frequencies in the 880- through 890-MHz band for cell site transmission (cell site receiving frequency from 835- through 845-MHz band). Each channel pair is spaced 30 kHz apart, with channel pair number 1 designated as the frequency pair 870.030 MHz and 825.030 MHz for cell site transmit and receive, respectively. Therefore, channel numbers would range from 1 to 312 if the system is operating in group A and 355 to 666 if in group B (channels 313 through 333 in group A and channels 334 through 354 in group B are used for access and control frequencies).

6.02 Unique office codes must exist within the mobile service area.

7. INTERACTIONS

7.01 Not applicable.

8. RESTRICTION CAPABILITY

8.01 Not applicable.

INCORPORATION INTO SYSTEM

9. INSTALLATION/ADDITION/DELETION

9.01 Figure 38 illustrates the procedure for adding the MTSO feature. Refer to Part 13 for testing information.

9.02 Table C contains a summation of the set cards required by the MTSO feature. Both the maximum range and the typical values for a MTSO office are given where available. Feature group and feature package set cards are shown in Table D.

10. HARDWARE REQUIREMENTS

A. Input/Output (I/O) Processor Frame

10.01 A MTSO may be equipped with a maximum of 32 I/O processor frames. Each I/O processor frame contains two selectors. Each of the I/O selectors (0 through 63) can be equipped with up to 16 data links (8 for data links and 8 for TTY links). The two data links provided for a given cell site are required to be on different I/O processor frames for reliability. The number of I/O processor frames required is determined by the number of cell sites equipped. A maximum of 255 cell sites may be equipped with two data links each. The I/O processor frames are connected to the 1A processor by duplicated PUB (peripheral unit bus) interfaces.

10.02 Eight supervisory master scanner points are required for each I/O processor frame. The first two scan points are the scan points for the peripheral bus 0, the next two scan points are for bus 1, the next two scan points are for IOUS 0 on the frame, and the last two scan points are for IOUS 1. The scan points are assigned in groups of eight consecutive points, starting on an even boundary, representing the four I/O processor frames of an I/O group.

10.03 Eight central pulse distributor points are required for each I/O processor frame. The eight central pulse distributor points represent the I/O processor frame as detailed in paragraph 10.02.

10.04 Each I/O processor frame requires a pair of GCP (generated control pulse) points, starting with IOUS 0 having the even numbered pulse point and IOUS 1 having the odd-numbered pulse point. These pulse points must be assigned in the pulse source range PPU030 to pulse source PPU093. Pulse points PPU030 and PPU031 are the first pulse point pair in this range.

B. Cell Site MTSO Data Links

10.05 Two cell site MTSO data links are required for each cell site equipped. The number of cell sites equipped can be estimated from the maximum number of users and the average number of users per cell site. The average number of users per cell site depends on the spectrum available. The data required to determine the number of cell sites is presented in Table E.

C. Trunk Circuit SD-1A236-05

10.06 Voice grade trunks that are connected between the MTSO and cell sites utilize SD-1A236-05 trunk circuits. Since one of these trunk circuits is required per voice trunk, the number of these trunk circuits required may be determined from Table F. A maximum of 96 trunk circuits may be assigned to a trunk group. Each antenna face can have one trunk group.

10.07 The SD-1A236-05 (J1A088CB-1, trunk circuit, trunk order code 02107) has one network appearance and is mounted on the miscellaneous trunk frame. The trunk circuit is equipped with two scan points and five signal distributor points. Scan point 0 is assigned TPI 0 and scan point 1 is assigned TPI 57. The trunk circuit is assigned a CPI of 21 and uses multifrequency pulsing and E&M supervision.

10.08 Loop-around trunk circuits are used in the MTSO to connect two cell site trunks together for mobile-to-mobile calls within the same MTSO. The SD-1A236-05 trunk circuit is used in this application. The number of trunk circuits required may be determined from Table F.

D. Program Store

10.09 Nine 256K program store modules (J5A010A-1) are required for System 100 release 2. This is an increase of one module over the eight modules required for release 1.

E. APS Generic

10.10 The loading of the AP2 generic (release 2) will cause deactivation of the third APS disk drive (cold spare) which is no longer required. This drive can therefore be removed or utilized as one of the two additional drives required to support the multicell generic capability.

F. Hardware Changes (Release 2)

10.11 Hardware changes are required to the MTSO to provide maintenance capabilities for System 100. Two lamp/keys are added on the master control center control and display frame. One lamp/key is located on the overload subgroup of the traffic panel. The second lamp/key is located on the equipment status panel. When the MTSO interfaces with the ACC (AMPS control center), the lamp/key located on the equipment status panel is remoted via the RAI (remote access interface) circuit and E2A telemetry to the ACC. The following CRIs (circuit revision instructions) provide detailed instructions to modify the existing equipment in the MTSO.

- CRI 5A014-01-25 PPI Circuit
- CRI 5A029-01-10 C and D Circuit
- CRI 5A030-01-9 SSL Circuit
- CRI 5A050-01-11 RAI Circuit.

11. SOFTWARE REQUIREMENTS

MEMORY

A. Fixed

11.01 Sixty-six parameter words are required in the ***Base Generic Program (Program Store and Attached Processor System)*** for the MTSO feature.

B. Conditional

11.02 The following conditional memory is required for the MTSO feature.

(a) ***Optionally Loaded Feature Groups (Program Store and Attached Processor System):*** Feature groups that must be loaded to provide the MTSO feature are summarized in Table D.

(b) ***Unduplicated Call Store and Attached Processor System:*** The unduplicated call store and Attached Processor System requirements are as follows:

(1) The size of the cell site trunk state word head table is defined by set card CELL.

(2) Set card CELL is defined in Table C.

(c) ***Duplicated Call Store:*** The duplicated call store requirements are as follows:

(1) ***Scratch Pad Memory Area (ASPMA):*** Thirty words are required.

(2) ***Paging Message Area (PMA):*** This area requires 340 words.

(3) ***Input/Output Unit Controller Activity Words (AIOPAW):*** Sixty-four words are required.

(4) ***Data Link Queue Status (ADLQS):*** Thirty-two words are required.

(5) ***Data Link Status Table (ADLS):*** The size of this table is equal to 16 × CELL + 1.

(6) ***Cell Download Control Table (CDCT):*** Sixty-four words are required.

(7) ***Temporary Message Storage Area:*** Eighty-nine words are required.

(8) ***Input/Output Microprocessor Activity Words:*** Eight words are required.

(9) ***Cell Initialization Table Block (CIT):*** The size of this block is equal to [16 × (CELL + 1)]. Set card CELL is defined in Table C.

(10) ***Cell-to-Channel/Channel-to-Cell Table (ACCT):*** The size of this block is equal to 1 + CELL.

(11) ***Roamer Busy Table (ARBT):*** The size of this table is equal to 2 × NRMR. The value of set card NRMR is submitted by the telephone company. If there is no value available, a value of 500 should be used.

(12) ***Mobile Message Register Block (AMMR):*** The size of this block is equal to (9100,2 × [91 × CELL]). There is a minimum of 100 mobile message registers. Each register requires 91 words.

(13) ***Cell Test Bus Resource Words (ACTBRW):*** This area requires 256 words.

(14) ***Data Link Maintenance Block (DLMB):*** This block requires 200 words.

(15) ***Cell Translation Update Data Block (ACTUDB):*** This block requires 116 words.

(16) ***Cell Overload Status Table (ACOS):*** This table requires 64 words.

(17) ***Set Card CELL:*** The number of words required for this area is equal to the value of set card CELL.

(18) ***Expanded IOP Data Block (AIOUSLMP):*** Sixteen words are required.

(19) ***Cell Site Voice Path Usage Table (CSUPU):*** Twenty words are required for the cell site voice path usage table.

(20) ***AMPS Equipped Cell Site Table (CSARRAY):*** Eighty-five words are required for the AMPS equipped cell site table.

(21) ***AMPS Voice Channel Selection Measurement Table (VCSA):*** Fifty words are required for the AMPS voice channel selection measurement table.

(22) ***AMPS Active Power Level Measurement Table (PLA):*** This table requires 456 words.

(23) ***AMPS Special Studies Traffic Measurements Call Store Table (CSTABLE):*** This table requires 256 words.

(24) ***Data Link Traffic Measurement Holding Area for AMPS Usage (DLHOLD):*** The size of this holding area is 8 × CELL. Set card CELL is defined in Table C.

(25) ***Data Link Traffic Measurement Collection for AMPS Usage (DLCOL):*** The size of this area is 8 × CELL. Set card cell is defined in Table C.

(26) ***Diagnostic Scheduler Maintenance Block for AMPS Usage (AMPSMTCE):*** Twelve words are required for the diagnostic scheduler maintenance block for AMPS usage.

(27) ***Cell Site Voice Path Scan Traffic Measurement Table (CSCAN):*** This table requires 128 words.

(28) ***Traffic Measurement Output Buffer Table (VCSABUF):*** Sixty-four words are required for the traffic measurement output buffer table.

(29) ***AMPS Cell Dialup Channel Table (ACDUT):*** This table requires 256 words.

(30) ***Comment Traffic Registers for AMPS:*** Fifty words are required for the comment traffic registers for AMPS area.

(31) ***Cell Site Trunk State Words (ACTSTW):*** Ninety-six words are required. The number of blocks required is equal to the value of set card CELL. Set card CELL is defined in Table C.

(32) Sixty-four words are required for the AMPS multicell generic version table.

(33) Thirty-two words are required for the AMPS multicell generic control table.

(34) ***Message Hopper Table:*** Twelve words are required.

(35) ***Page Response Hopper (HPGR):*** Ninety-six words are required for the page response hopper. Eight page response hoppers are required.

(36) ***Mobile Origination Hopper (HMOR):*** The mobile origination hopper requires 400 words.

(37) ***General Call Processing Hoppers (MCPG):*** The size of this hopper is equal to MAX(1200,8 × GCPH × 9F164). Set card GCPH is defined in Table C.

(38) ***Mobile Maintenance Hopper (HMM):*** The size of this hopper is equal to MAX(1000,20 × CELL × 9F164). Set card CELL is defined in Table C.

(39) ***Administrative Hopper Area (HADM):*** The size of this hopper area is equal to MAX(1000,20 × CELL × 9F164). Set card CELL is defined in Table C.

(40) ***Long Maintenance Message Hopper (MMHL):*** The size of this hopper is equal to MAX(890,89 × CELL/8 × 9F164). Set card CELL is defined in Table C.

(41) ***Mobile Call Register (MCR):*** Twenty-eight words are required for the mobile call register. Set card NMCR specifies the number of mobile call registers required and is defined in Table C.

(42) ***Mobile Originating Register (MOR):*** Twenty words are required for the mobile originating register. Set card NMOR specifies the number of mobile originating registers required and is defined in Table C.

(43) ***Mobile Hand-Off Register (MHR):*** The mobile hand-off register requires ten words. Set card NMHR specifies the number of mobile hand-off registers required and is defined in Table C.

(44) ***Set Card CELL:*** This specifies the highest member number of the cell sites in

the mobile service area. The calculation for set card CELL is as follows:

Quantity—Number of cells in the mobile service area = N where N = highest cell site member number + projected cell site growth. Cell site growth may be accomplished by either assigning vacant cell site member numbers less than the highest assigned cell site member number, or adding cell site member numbers higher than the highest assigned cell site member number. In either case, the total number of cell sites must stay within the limits of 1 through 255.

(45) ***Set Card NMHR:*** This specifies the number of mobile hand-off registers to be used by the MTSO feature. The calculation for set card NMHR is as follows:

NMHR = P001

(46) ***Set Card GCPH:*** This specifies the number of call processing hoppers to be used for general use. The calculation for set card GCPH is as follows:

GCPH = Max 150

(47) ***Set Card NMCR:*** This set card specifies the number of mobile call registers. The calculation for set card MNCR is as follows:

NMCR = P001

(48) ***Set Card NMOR:*** This set card specifies the number of mobile originating registers. The calculation for set card NMOR is as follows:

NMOR = (NMCR × .1)///1

(49) ***Set Card NRMR:*** This set card specifies the number of roamer units allowed to access the system. The calculation for set card NRMR is as follows:

NRMR = MAX(50, 0.1 × number of BH calls).

C. Variable

11.03 The following ***translations (unduplicated call store and Attached Processor System)*** memory is required for the MTSO feature.

(a) ***Directory Number Subtranslator:*** One word is required for each PLEN.

(b) ***Directory Number Abbreviated Code Expansion Table:*** Four words are required for each PLEN.

(c) ***Line Equipment Number Subtranslator:*** One word is required for each LEN.

(d) ***Line Equipment Number Abbreviated Code Expansion Table:*** Four words are required for each DN.

(e) ***Trunk Group Number Head Table:*** One word is required for each trunk group.

(f) ***Trunk Group Number Auxiliary Block:*** Three words are required per trunk group. A maximum of six trunk groups (one per logical antenna face server group) per cell site may be equipped.

(g) ***Trunk Network Number to Trunk Group Number Auxiliary Block for Loop Around Trunks:*** Three words are required for each TNN (trunk network number). One trunk group with a maximum of 40 loop-around trunk circuits may be equipped.

(h) ***Trunk Network Number to Trunk Group Number Auxiliary Block for Cell Site Trunks:*** Three words are required for each TNN. Additional words are required if carrier group alarm or trunk make busy keys exist. A maximum of six trunk groups per cell may be equipped. Each trunk group may be equipped with a maximum of 96 trunk circuits.

(i) ***Directory Number to Serial Number Head Table:*** This head table requires 128 words.

(j) ***Directory Number to Serial Number Subtranslator:*** This subtranslator requires 2000 words.

(k) ***Cell Site Head Table:*** Five words are required.

(l) ***Cell Site Trunking Translator Head Table:*** This head table requires 256 words. One head table is required per cell site.

(m) ***Cell Site Trunking Translator Auxiliary Block:*** Ten fixed words are required. One additional word is required for each radio equipped at the cell site.

(n) ***Cell Master Status Translator Head Table:*** This head table requires 256 words. One word is required per cell site.

(o) ***Cell Master Status Translator Auxiliary Block:*** Three words are required. One auxiliary block is required per cell site.

(p) ***Cell Master Equipage Translator Head Table:*** This head table requires 256 words. One word is required per cell site.

(q) ***Cell Master Equipage Translator Auxiliary Block:*** Twelve fixed words are required. Additional words are required as follows:

(1) One word is required per functional group to supply the address of the voice radio functional group auxiliary block. The maximum number of words required for this purpose is 12.

(2) Four words are required per physical antenna face (0 through 3). The maximum number of words required for this purpose is 16.

(r) ***Voice Radio Functional Group Auxiliary Block:*** One fixed word is required. One additional word is required for each radio equipped up to a total of eight radios. One auxiliary block is required per functional group.

(s) ***Cell Master Location Translator Head Table:*** This head table requires 256 words. One word is required per cell site.

(t) ***Cell Master Location Translator Auxiliary Block:*** Four fixed words are required. One additional word is required per antenna server group to supply the address of the cell site neighbor auxiliary block. The maximum number of words required for this purpose is eight.

(u) ***Cell Site Neighbor Auxiliary Block:*** Ten fixed words are required. One additional word is required for each cell site neighbor. The maximum number of words used for this purpose is 12.

(v) ***AMPS Miscellaneous Information Head Table:*** Five words are required.

(w) ***AMPS Miscellaneous Auxiliary Block:*** Eight words are required.

(x) ***Paging Cell Sites Auxiliary Block:*** Two fixed words are required. Additional words are required to store the paging cell numbers (three paging cell numbers per word). The maximum number of words used for this purpose is 85.

(y) ***Roamer Service List Auxiliary Block:*** Two fixed words are required plus one word for each roamer. The maximum number of roamers is 300.

(z) ***Fraudulent Serial Number Auxiliary Block:*** This auxiliary block requires 2002 words.

(aa) ***Cell Dialup Channel Translator Head Table:*** This head table requires a maximum of 257 words. One word is required per cell site.

(bb) ***Cell Dialup Channel Translator Auxiliary Block:*** Four words are required. One auxiliary block is required per cell site.

(cc) ***IOP K-Code to Cell Site Channel Number Translator:*** Two fixed words are required. Additional words required are as follows:

(1) ***IOP K-Code to Cell Site Channel Number Table:*** This table requires 1024 words.

(2) ***Cell Site Channel Number to IOP K-Code Table:*** A maximum of 512 words is required. The number of words required is determined by the number of channels assigned. One word is required per channel.

(dd) ***I/O Processor Member Number Subtranslator:*** Sixty-five words are required.

(ee) ***I/O Processor Member Number Auxiliary Block:*** Forty-five words are required. One auxiliary block is required per I/O frame.

(ff) ***Normalized Office Code to Number Group Number Translator:*** This translator requires 321 words.

REAL TIME IMPACT

11.04 Not applicable.

12. DATA ASSIGNMENTS AND RECORDS

TRANSLATION FORMS

12.01 The following ESS translation forms, detailed in reference (13) in Part 18, are applicable to the MTSO feature:

- ESS 1101—Directory Number Record
- ESS 1102—Line Equipment Record
- ESS 1107—Supplementary Information Record/Centrex Group Supplementary Information Record
- ESS 1202—Trunk Group Record
- ESS 1204—Trunk Class Code Record
- ESS 1216—Trunk Group Supplementary Record
- ESS 1219—Combined Miscellaneous Trunk Frame Record
- ESS 1222—TNN and TGN Miscellaneous Information Record
- ESS 1303—Trunk and Service Circuit Route Index Record
- ESS 1400—Traffic Register Assignment Record
- ESS 1500A—Head Table Capacity Record
- ESS 1501—Office Code Record
- ESS 1502—Abbreviated Class Code Record
- ESS 15051/2—Automatic Trunk Testing Table Record
- ESS 1900—Cell Site Trunking Record
- ESS 1902—Cell Site Location and Status Record
- ESS 1903A/B—Cell Site Equipage Record and Cell Site Voice Radio Functional Group Record
- ESS 1905—Roamer Service Record
- ESS 1906—AMPS Miscellaneous and Fraudulent Serial Number Record.

RECENT CHANGES

12.02 The following RC (recent change) messages are affected by the MTSO feature. See references (1), (2), (3), and (10) in Part 18 for details.

MESSAGE	FUNCTION
RC:MOBL	This message is required to modify DN and LEN translations and to build data in the DN/SN translator. Abbreviated codes are used for LEN translations without speed calling, and also for DN translations if call forwarding is not used for the given DN.
RC:TG	Trunk groups with trunks between the MTSO and the cell site are to have trunk group type (keyword TYP) equal to 13 for 1-way trunks or equal to 6 for 2-way trunks. Trunk usage, a field of the TCC (trunk class code), must always be 0 or 1-way trunks or 2 for 2-way trunks, indicating 2-way outgoing trunks. The following keywords are added to the RC:TG message for cell site trunk groups. Keyword SGANT a specifies the server group or set of radios (in an antenna) on which the mobile is to be served (0 = primary, 1 = secondary). Keyword SGANT b specifies the antenna number (0 through 3). Antenna 0 represents an omnidirectional antenna. Antennas 1 through 3 represent

MESSAGE	FUNCTION
	directional antennas. Keyword CSN specifies the cell site number. Trunk groups, consisting of MTSO loop-around trunks, are required to have trunk group type (keyword TYP) equal to 2. Trunk usage is equal to 2, indicating 2-way trunks. Keyword LATG specifies the loop-around trunk group.
RC:TGMEM	The TNN-TGN auxiliary block requires two added fields for the MTSO feature. The radio at the cell site transmits over a specific channel. To set up and control the voice path, the radio number and channel number are required. Keyword CHN specifies the channel number (1 through 312 for group A or 355 through 666 for group B) the radio is using to transmit and receive on. Keyword RADN specifies the radio number.
RC:AMI	This message builds the AMPS miscellaneous auxiliary block. The auxiliary block contains miscellaneous functional capabilities and MSA wide data for AMPS software. The auxiliary block is pointed to by the AMPS miscellaneous information head table.
RC:PCS	This message builds the paging cell sites auxiliary block. The auxiliary block contains the list of paging cell sites for this MSA. The auxiliary block is pointed to by the AMPS miscellaneous information head table.
RC:RSL	This message builds the roamer service list auxiliary block. The auxiliary block contains the encoded NPAs or encoded NPA-NXXs of roamers who are allowed access to the system. The auxiliary block is pointed to by the AMPS miscellaneous information head table.
RC:FSN	This message builds the fraudulent serial number auxiliary block. The auxiliary block contains the serial numbers of roamers who are denied access to the system. The auxiliary block is pointed to by the AMPS miscellaneous information head table.
RC:CST	This message builds the cell site trunking translator. This translator is required to assign a route index to an antenna face and server group. The route index provides the necessary trunking information for the call.
RC:IOP	This message builds the K-code number to cell channel number translation information. The function of this translator is to translate the antenna face and server group to a specific data link hardware location, needed by the data link software in order to send messages.
RC:MSTAT	This message builds the cell master status translation information. This information describes the interface between the cell and the mobile. A master copy of this data is kept at the MTSO and is sent to the cell when the cell is in a phase and/or MTSO request (RC). This is to ensure that the cell has up-to-date information.
RC:CELEQ	The master equipage translator provides the cell with initialization information for peripheral equipment and maintenance power and frequency thresholds. Two RC messages are necessary to build and insert data

MESSAGE	FUNCTION
	in this translator. The RC:CELEQ message builds information relating to each cell site in the auxiliary block. The RC:VRAD message builds information relating to the voice radio functional groups at the cell site in the voice radio functional group auxiliary block.
RC:MLOC	This message builds the cell master location translator. This translator is used to identify neighbors of a cell. Information needed for cell handoff is contained in this translator.
RC:CDU	This message builds the cell dialup translations. The cell dialup translator is used to obtain the DN of the dedicated maintenance TTY channel to a cell site so that cell maintenance can be done remotely from the MTSO.

13. TESTING

13.01 The TTY input and output messages given in references (14), (18), and (20) in Part 18 can be used to verify translation data for the MTSO feature. The messages are:

(a) The existing VF:TNNSVY input message is changed for System 100 to allow a search for loop-around trunks. System response is a TR14 output message which includes the System 100 optional words information.

(b) The VFY:TKGN input message requests the system to verify one trunk group number or all trunk group number translations. System response is a TR10 message which includes the following System 100 TGN data:

- AMPS server group
- Antenna number
- Cell site number.

(c) The VFY-TNN message requests the system to verify a TNN translation of all TNNs on a trunk switch frame. System response is a TR14 message containing the TNN data.

(d) The VF:AMPS input message initiates a search of the System 100 translators for specified data and, if that data is located which satisfies the input parameters, that data is output. System response is one or more of the following messages:

(1) A TR122 message printing the SN and DN for the MTSO feature when keywords DN or SN are input

(2) A TR123 message printing the system-wide parameters, which are broadcast from the cell to the mobile for the System 100 feature when keyword MISC is input

(3) A TR124 message printing a single (or list) of paging cell(s), or roamers which are allowed access to the system when keywords PAGE or NPA/NXX are input

(4) A TR125 message printing a list of fraudulent SNs when keyword FSN is input

(5) A TR126 message printing a specific data link hardware location from the logical cell site number and vice-versa when keywords IOPKC or CSN/PRI are input

(6) A TR127 message printing information for the cell site to broadcast to the mobile when keywords CSN/MSTAT are input

(7) A TR128 message printing the cell site trunking information when keywords CSN/RADN are input

(8) A TR129 message printing the DN (including 1 + dialing indication) of the dedicated maintenance TTY channel to a cell site and the CI 10xxx field, when keywords CSN/CDU are input

(9) A TR130 message printing all cell site numbers having the EMIN and/or WFOM bits set when keywords CSN, EMIN/WFOM and, optionally, LIST are input.

(10) A TR131 message printing the results of a search of the voice radio functional group auxiliary block of the cell master equipage auxiliary block of the input CSN for the voice radio number that:

- Has a particular status (STAT) and/or;
- Is associated with a particular SG and antenna face (SGANT) and/or;
- Transmits and receives on a certain frequency channel (VRCH) at a cell.

(11) A TR132 message printing one of the following in response to keywords CSN, ANT, and, optionally, LIST:

- A count and list of the (assigned) antenna face(s) followed by the four auxiliary words associated with the antenna face(s).
- A count of assigned antenna faces found.

(12) A TR133 message printing data about neighbors of a cell in response to keywords CSN, SGANT, and GRP. The TR133 message is printed only if the DPCI (dynamic power control indicator) is not set. If DPCI is set, a TR133A message is printed. The TR133 message gives a list of the data found in the first two words of the cell site neighbor auxiliary block plus one of the following:

- If CSN, SGANT, and GRP (without data) are input, all the neighbors (group 1 and group 2) of the cell site, SG, and antenna face.
- If CSN, SGANT and GRP = 1 are input, all group 1 neighbors of the cell site, SG, and antenna face.
- If CSN, SGANT and GRP = 2 are input, all group 2 neighbors of the cell site, SG, and antenna face.

(13) A TR133A message printing the same output as the TR133 message if the DPCI bit is set. In addition to the TR133 output, the following fields are printed:

- Cell Site Power Control Flag (CPCF)
- Mobile Power Control Flag (MPCF)
- High Signal Strength for the Mobile (HSTM)
- High Signal Strength for the Cell Site (HSTC)
- Low Signal Strength for the Mobile (LSTM)
- Low Signal Strength for the Cell Site (LSTC)
- Voice Channel Selection High Threshold (HIGH)
- Maximum Power Differential (MPDIF)
- Number of Mobile Attenuaton Levels (NMAL)
- Number of Cell Site Attenuation Levels (NCAL)
- Server Group Power Amplifier Identifier (SGPAID)
- Speed Trending Flag (STF).

(14) A TR134 message printing the CSN when keywords CSN and RETRY are entered. The CSN is followed by the data from the first word of the cell master location translator plus the directed retry list. The six DRL fields which contain the CSNs that the mobile is redirected to is retrieved from the cell master location translator of the input CSN, or range of CSNs.

(15) A TR135 message printing a list of words 1 through 11 of the IOMTRANS auxiliary block for that IOUS if keyword IOUS only is input. If keywords IOUS and CHAN are both input, in addition to the above data output, the TR135 output message prints out the two data words associated with each requested channel (CHAN).

(16) A TR139 message printing the cell equipage translator contents when keywords CSN and EQUIP are input.

14. OTHER PLANNING TOPICS

14.01 Not applicable.

ADMINISTRATION

15. MEASUREMENTS

15.01 For detailed information concerning traffic measurements unique to the MTSO feature, see reference (6) in Part 18.

16. CHARGING

AUTOMATIC MESSAGE ACCOUNTING

16.01 For detailed information as to how and when charging applies, see reference (5) in Part 18.

SUPPLEMENTARY INFORMATION

17. GLOSSARY

17.01 The following terms are defined as they apply to this feature.

Access Channel—A setup channel used by a mobile unit to access a system to obtain service.

Cell—A geographical region within which calls are expected to be served by a particular cell site.

Cell Site—An installation containing the radio and control equipment necessary to complete the talking path to the mobile unit.

Cell Site Face—A distinct sector covered by an antenna pattern at a cell site.

Cell Site Trunk—Provides a voice communication path from MTSO to cell site. Each trunk is physically connected from the MTSO switching network to a voice radio at a cell site (also called voice trunks).

Channel—Refers to a pair of frequencies used for mobile communication. One is used for cell-site-to-mobile transmission while the other is used for mobile-to-cell-site transmission.

Channel Assignment—(1) The process of specifying which voice channels are to be used at each cell site face in a MSA (mobile service area), (2) a channel(s) so assigned.

Channel Designation—The process of instructing a mobile unit to tune to a selected channel.

Channel Set—A group of channels which will generally be assigned collectively to a cell site.

Data Link—A voice frequency signaling path for transmitting data messages between a switch unit and control unit. For System 100, the components of a data link include the IOP (input/output processor) hardware at the MTSO, the DLI (data link interface) and CSC (cell site controller) hardware at the cell site, and the transmission facilities connecting both ends.

Data Link Interface—An interface, at a cell site, between the transmission facilities and the CSC.

Data Link Pair—Two dedicated transmission paths, 0 or 1, connecting data sets between a MTSO and a cell site.

Data Set—Equipment for performing the conversion of signals between data processors or terminals (usually digital) into signals suitable for transmission over data link pairs and for control of the connection.

Forward Setup Channel—A setup channel used from a cell site to a mobile unit.

Forward Voice Channel—A voice channel used from a cell site to a mobile unit.

Home Mobile Unit—A mobile unit which operates in the MSA from which service is subscribed.

Home Mobile Service Area—The MSA from which the mobile unit subscribes service.

Mobile-Originated Call—A call originating from a mobile unit.

Mobile-Terminated Call—A call completed to a mobile unit (also referred to as land-originated call).

Mobile Service Area—A basic coverage region in which System 100 is made available.

Omnidirectional Antenna—A radio antenna that transmits and receives energy equally well in all azimuthal directions.

Paging—The process in which the MTSO, via cell sites, sends a data stream over paging channels

throughout a mobile service area informing mobile units when they are receiving calls from the network.

Paging Channel—A forward setup channel which is used to page mobile units and send orders.

Reorder Tone—A low tone interrupted at 120 ipm which indicates that the local switching paths to the called office, or equipment serving the called customer, are busy or that no toll circuit is available. This signal may also indicate a condition such as a timed-out sender or unassigned code dialed.

Reverse Control Channel—The control channel used from a mobile unit to a cell site.

Reverse Setup Channel—The setup channel used from a mobile unit to a cell site.

Reverse Voice Channel—The voice channel used from a mobile unit to a cell site.

Roamer—A mobile unit which operates in a mobile service area other than the one from which service is subscribed.

Signaling Tone—A 10-kHz tone transmitted by a mobile unit on a voice channel to: (1) confirm orders, (2) signal flash requests, and (3) signal release requests.

Voice Channel—A radio frequency channel on which a voice conversation occurs and on which brief digital messages may be sent from a cell site to a mobile unit or from a mobile unit to a cell site.

Voice Channel Selection—The process by which one of the channels assigned to a cell site face is chosen for a particular call.

Zone Office—A class 5 telephone switching office which provides System 100 access to the public switched telephone network.

18. REFERENCES

18.01 The following documentation contains information related to or affected by the MTSO feature.

(1) 231-090-120—Carrier Interconnect—Feature Document

(2) 231-090-219—Remote Office Test Line and Processor Controlled Interrogator—Feature Document (Issue 4 or later)

(3) 231-200-005—Mobile Telephone Switching Office, Cell Site, and Mobile Unit—Description—AUTOPLEX System 100

(4) 231-218-301—Recent Change Formats and Implementation—Description and Procedures—AUTOPLEX System 100

(5) 231-290-604—Traffic Measurements—Feature Document—AUTOPLEX System 100

(6) 231-290-606—Speed Calling—Feature Document—AUTOPLEX System 100

(7) 231-290-607—Immediate Call Forwarding—Feature Document—AUTOPLEX System 100

(8) 231-290-608—Conditional Call Forwarding—Feature Document—AUTOPLEX System 100

(9) 231-290-609—Three-Way Calling—Feature Document—AUTOPLEX System 100

(10) 231-290-610—Call Waiting—Feature Document—AUTOPLEX System 100

(11) 231-290-611—Priority Calling—Feature Document—AUTOPLEX System 100

(12) 231-290-615—Roamer I—Feature Document—AUTOPLEX System 100

(13) 231-290-616—Roamer II—Feature Document—AUTOPLEX System 100

(14) 231-290-620—Automatic Message Accounting—Feature Document—AUTOPLEX System 100

(15) 231-290-621—Data Privacy—Feature Document—AUTOPLEX System 100

(16) 231-290-622—Message Desk Service—Feature Document—AUTOPLEX System 100

(17) 401-200-100—Cell Site Description—AUTOPLEX System 100.

(18) Input Message Manual IM-6A001

(19) Output Message Manual OM-6A001

(20) Translation Guide TG-1A

(21) Office Parameter Specification PA-6A001

(22) Parameter Guide PG-1A

(23) Translation Output Configuration PA-6A002.

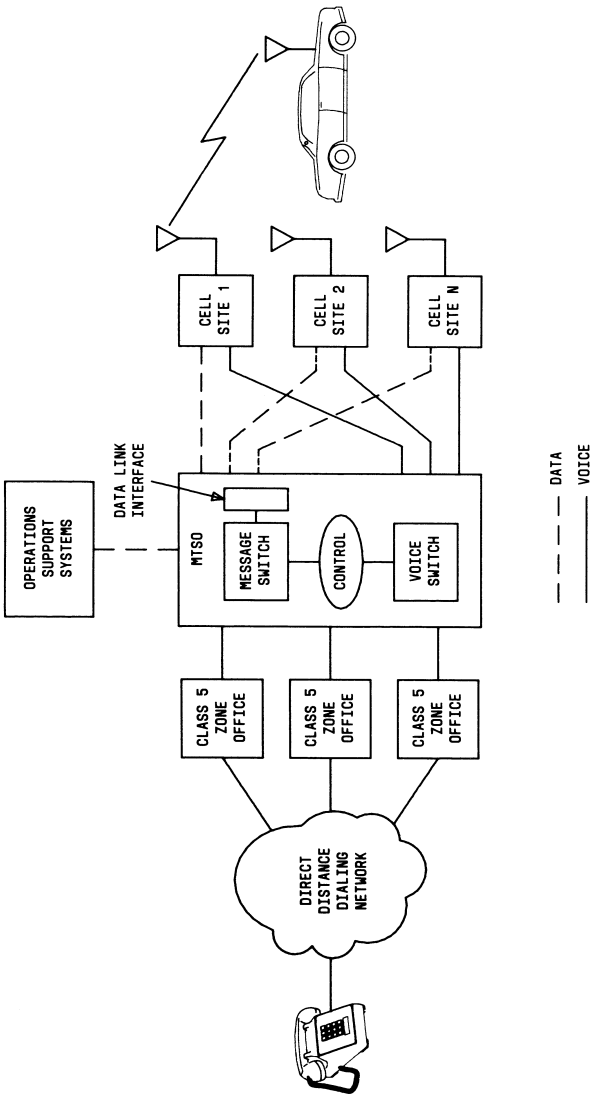


Fig. 1—AUTOPLEX System 100 Hierarchy

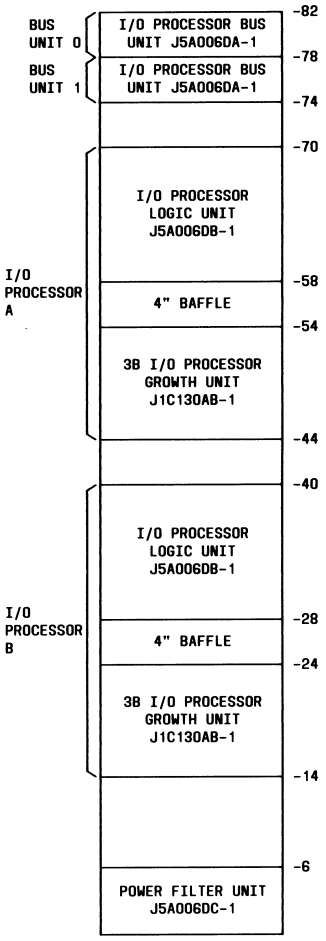


Fig. 2—I/O Processor Frame J5A006D-1 (Equipped With 3B I/O Growth)—Front View

AT&T 231-290-600

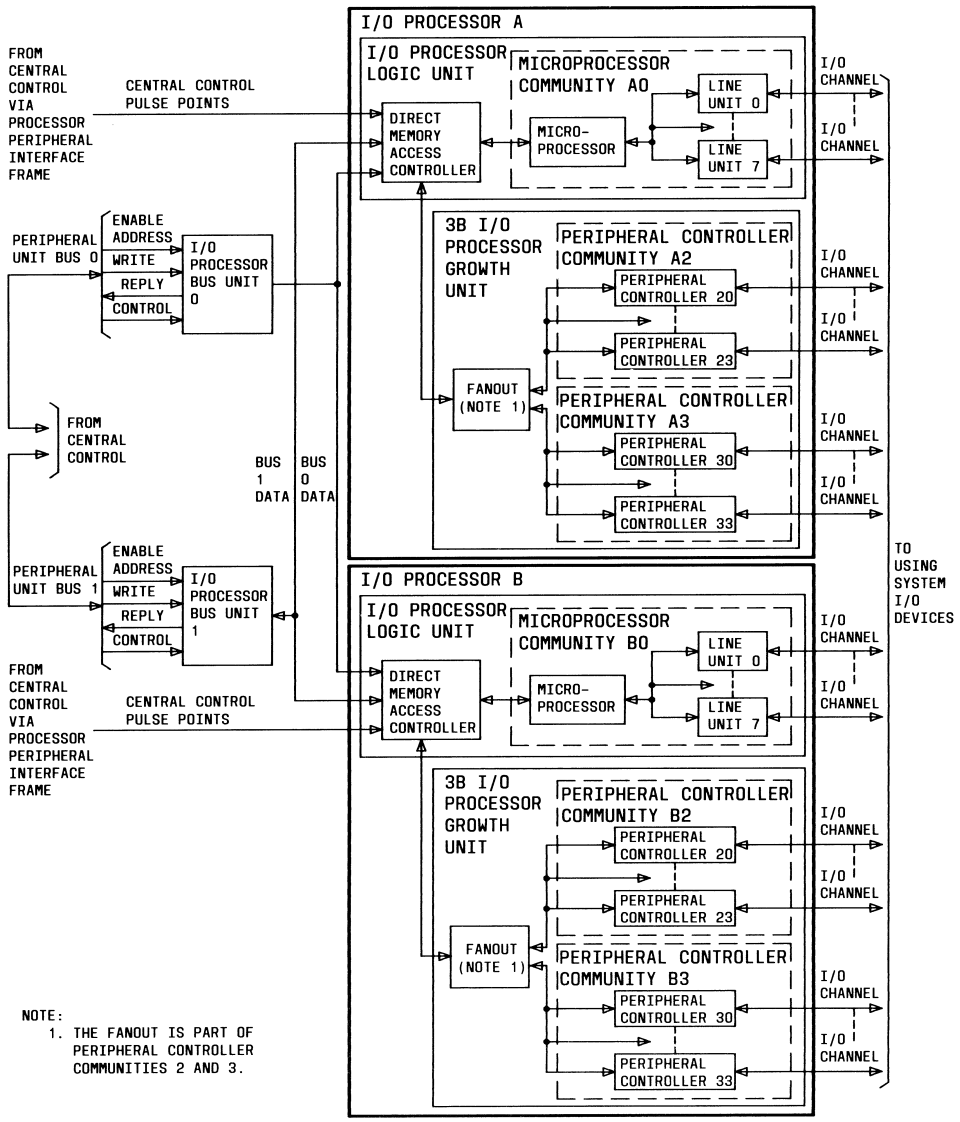


Fig. 3—I/O Processor Frame (Equipped With 3B Processor Growth Units)—Block Diagram

Page 44

Scotty's Spectrum Analyzer – Logarithmic Detector

Overview

This is my version of the logarithmic detector for Scotty Sprowls' Modularized Spectrum Analyzer (MSA) project. The original logarithmic detector design is SLIM–LD–8306.

The only major change was adding a Mini–Circuits ADC–20–4 20 dB directional coupler to tap the incoming (filtered) 10.7 MHz IF signal. This signal will be routed to a panel–mounted RF connector on the spectrum analyzer's case for further processing. Using a 10.7 MHz FM/AM/video/etc. demodulator will allow the spectrum analyzer to be turned into a high–performance communications receiver.

The Analog Devices AD8306 High–Precision Limiting–Logarithmic Amplifier (Digi–Key Part: AD8306ARZ–ND) used in this module has two functions. Its main purpose is as a RF detector to convert the incoming RF signal (at 10.7 MHz) to an equivalent DC voltage representation of the power level (also called the Received Signal Strength Indicator – RSSI), and it can also act as a high–gain, RF–limited amplifier for use with the optional Vector Network Analyzer (VNA).

The RSSI dynamic range is approximately –90 dBm to +10 dBm, with a corresponding DC output voltage of +0.4 volts to +2.4 volts on the module's **MAGVOLTS** output.

The logarithmic detector module has an input impedance of 50 ohms and an operating bandwidth of approximately 3 MHz to 120 MHz. The RF bandwidth of the module is mainly determined by the pass bandwidth of the input Mini–Circuits T16–1 (50 to 800 ohm) impedance matching transformer, which is 120 MHz maximum in this case. The AD8306 itself has a much wider operating bandwidth, to well over 400 MHz.

Using a wideband transformer instead of a narrowband matching network allows the logarithmic detector module to be used as a "drop–in" replacement module if you wish to use an alternate final IF frequency or design.

The input Mini–Circuits transformer can be replaced with a similar 1–to–16 ratio impedance matching transformer, such as the Coilcraft WBC16–1TLB, which is available as a free sample. It could also be omitted entirely and replaced with a proper inductor/capacitor impedance matching network, but this is only suitable for narrow frequency bandwidth applications. Refer to the AD8306's datasheet for the proper component values to use and their configuration.

The AD8306's limited IF output is biased by the 390 ohm resistor for a minimal (1 mA) output. This will help prevent excessive feedback within the module which could induce self–oscillation and create spurious images. The AD8306's limited IF output is a 50 mV peak–to–peak square wave equivalent of the incoming IF signal The AD8306's limiter input dynamic range is from approximately –77 dBm to +10 dBm. This output can drive a high–impedance or 50 ohm load.

The input impedance for the logarithmic detector module is designed for 50 ohms, while the input impedance to the Analog Devices AD8306 is around 1000 ohms. This is why the Mini–Circuits T16–1 transformer is included on the input. A parallel 3.9 kohm resistor was added to match the approximate 1000 ohm input impedance of the AD8306 to the 800 ohm output impedance of the Mini–Circuits T16–1 transformer for maximum power transfer.

The Mini−Circuits T16−1 is a 1:4 turns ratio transformer, which means the *voltage* transformation ratio from the primary to secondary is 1−to−4 (1 volt to 4 volts, for example). The *impedance* transformation ratio is equal to the number of turns squared, or 1−to−16 (50 ohms to 800 ohms, for example). The *power* transformation should be 1−to−1, but there is some slight loss within the Mini−Circuits T16−1.

Since the AD8306 has a high input impedance (1000 ohms), Analog Devices uses voltage measurements (dBV) in their datasheet and not power (dBm) measurements. I am using power measurements (dBm) in the previous paragraphs, because I am specifying the inputs and outputs of the module itself, not the actual AD8306. Once we move from the T16−1 transformer's primary to the secondary, we are no longer in a 50 ohm system. It is also more accurate to use voltage measurements at this point.

As a reference point, let us assume the input voltage to the module (primary of transformer) is 1 volt (RMS). This is 0 dBV. The output of the transformer (1:4) is 4 volts (RMS). This is +12.04 dBV. The transformer *looks* like it has a gain of 12.04 dB. For voltage only, this is true. But for total power, there is no gain.

Analog Devices specifies the dynamic range of the AD8306 to be from −91 dBV to +9 dBV. Since this is the secondary of the transformer, the dynamic range on the primary side is −103 dBV to −3 dBV. This equates to a 50 ohm power input of −90 dBm to +10 dBm.

The limiter amplifier of the AD8306 begins limiting at approximately −78 dBV and remains stable up to +9 dBV. This equates to an input voltage on the primary side of the transformer of −90 dBV to −3 dBV. As a 50 ohm input power to the module, this is −77 dBm to +10 dBm.

If the limiter output of this module is never going to be used, it is advisable to omit the 51 ohm pull−up resistors on pin 12 & 13, and the 390 ohm current setting resistor on pin 9. This will lower overall power consumption and eliminate any possibility of limiter feedback oscillations.

It should be noted that this module is *extremely* sensitive to outside noise influence and temperature. It is important that this module be totally shielded without any of its connections exposed to the outside, and it should be mounted in the coolest spot possible.

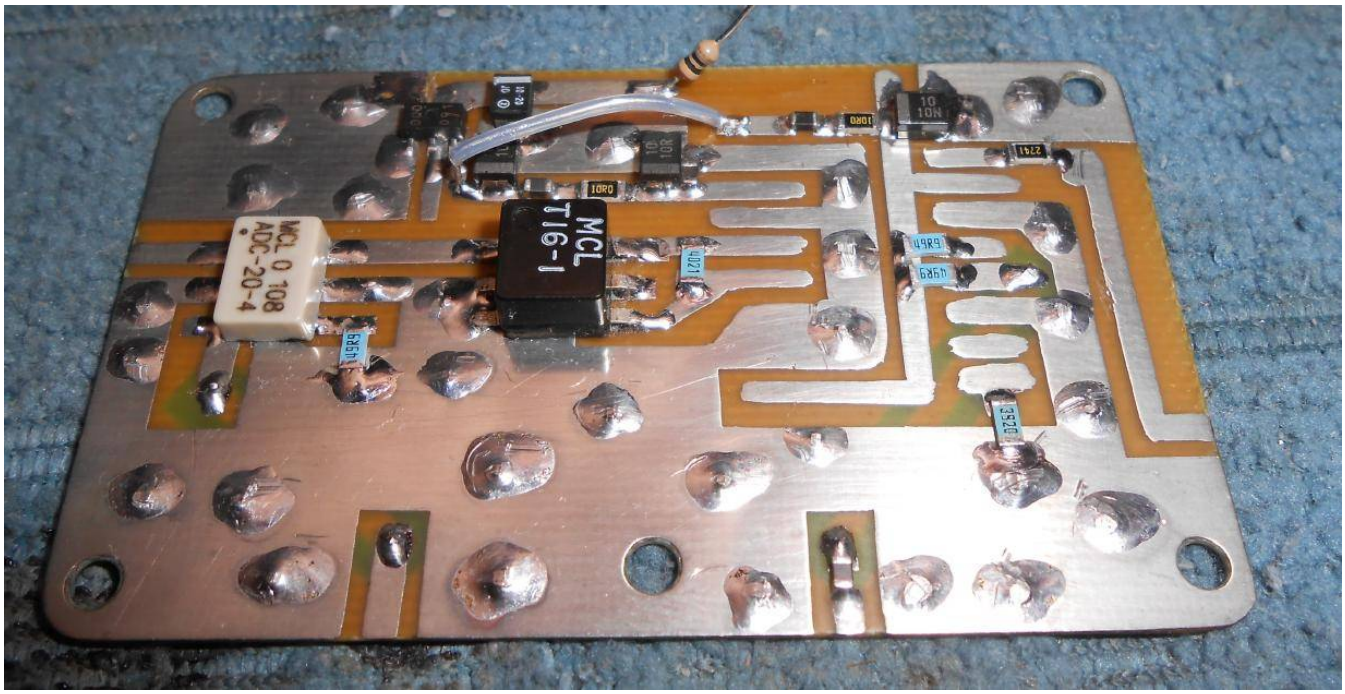
Below is the AD8306 logarithmic detector module's RF input power (10.7 MHz) to DC voltage (**MAGVOLTS**) mapping. With an open on the IF input, the output was 0.457 volts and with a 50 ohm load the output was 0.372 volts. That will be the baseline for minimum signal detection which is around −100 dBm. The logarithmic output voltage slope is 20 mV/dB.

RF Input (dBm)	MAGVOLTS Output (Volts)
−100.0	0.374
−90.0	0.397
−80.0	0.524
−70.0	0.722
−60.0	0.924
−50.0	1.126
−40.0	1.331
−30.0	1.534
−20.0	1.737
−10.0	1.947
0.0	2.155
+10.0	2.367

That mapping is for the logarithmic detector module *only.* The finished spectrum analyzer will require a proper calibration which will result in slightly different output voltages because of the losses in the mixers/filters and gain from the 10.7 MHz IF amplifier.

The logarithmic detector module must be preceded by a narrowband resolution filter stage to limit the input noise and to help further increase the maximum signal detection sensitivity.

Pictures & Construction Notes



Overview of the logarithmic detector circuit board before the installation of the AD8306.

The Analog Devices AD8306 will be mounted on an optional 16−pin SOP−to−DIP carrier board for easier soldering.

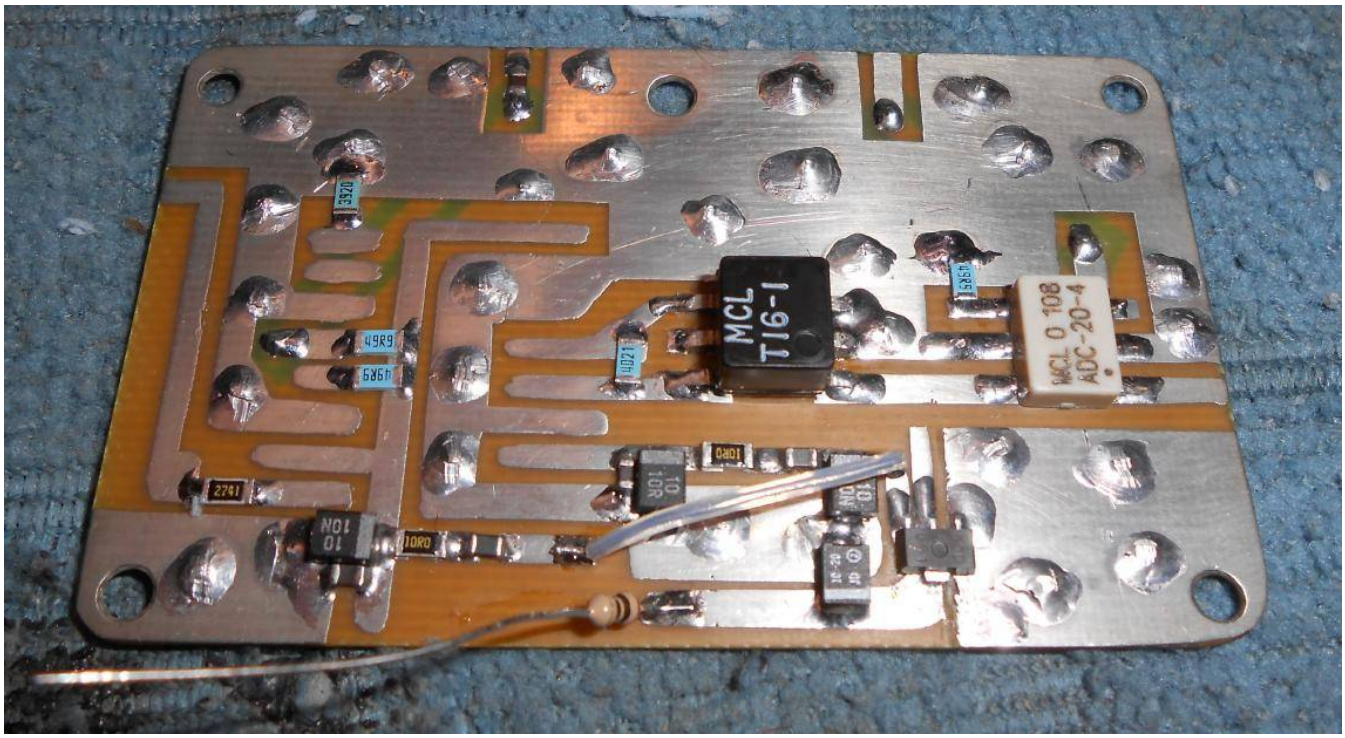
The 10.7 MHz IF input from the resolution filter is on the left side.

The white box device is the Mini−Circuits ADC−20−4 directional coupler providing the −20 dB tap.

The black box device is the Mini−Circuits T16−1 impedance matching (50−to−800 ohm) transformer.

Note that the index mark on the Mini−Circuits T16−1 is pin 6!

The +5 VDC power supply for the logarithmic detector circuit should be from a very stable and fairly low−noise regulator, like a Sieko S−81250SG, but a regular 78L05 will do.

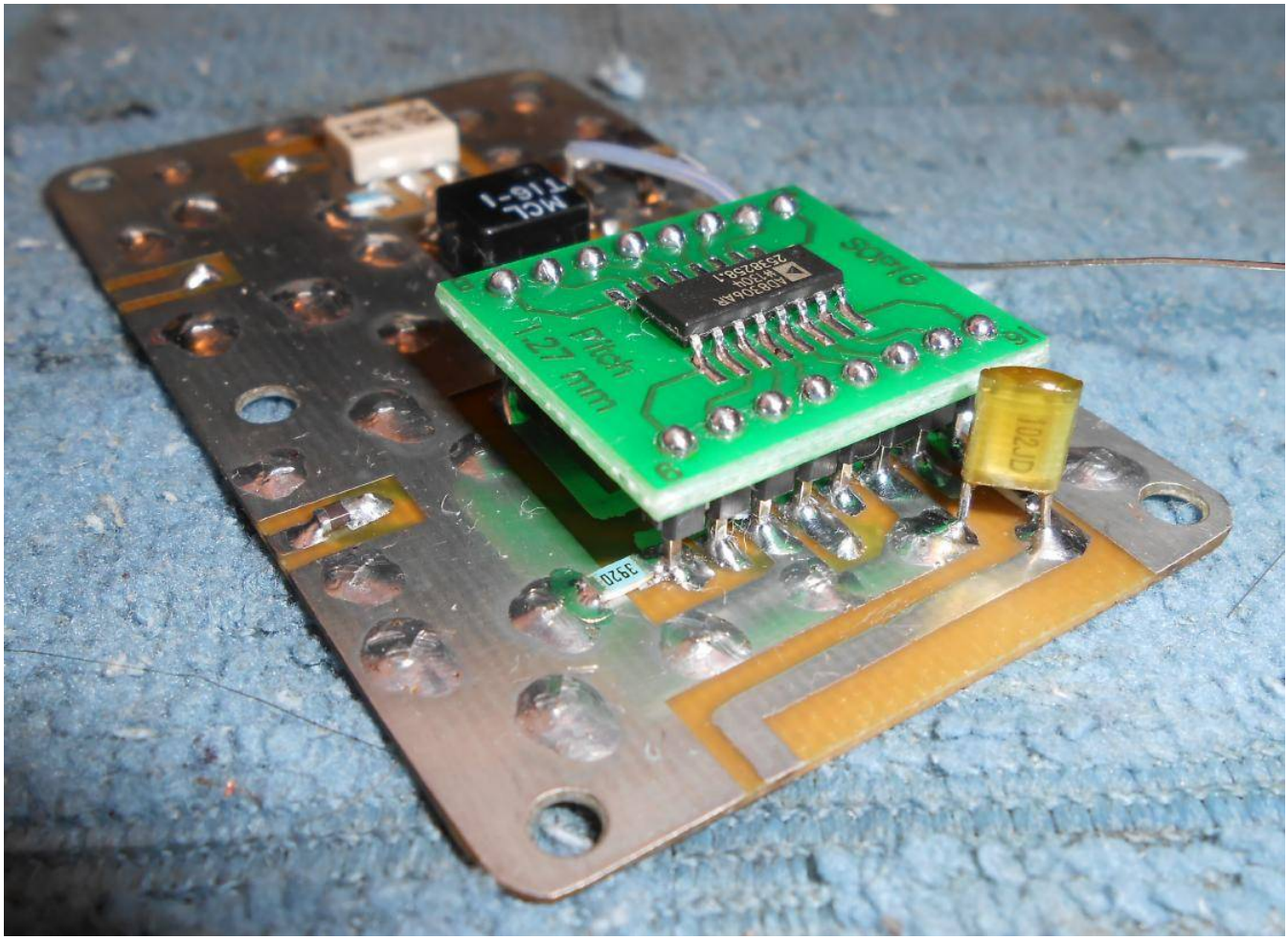


Alternate view.

The SOT−89 device is a Sieko S−81250SG precision 5 volt regulator.

Overview of the bottom of the printed circuit board.

These are the traces for the limited IF output and the directional coupler output which are connected back to the case's SMA connectors.



Installing the Analog Devices AD8306 with the SOP−to−DIP carrier board.

Technically, this device should be surface−mounted without the carrier board, but at 10.7 MHz we can get away with a little bit of extra inductance.

Note the 1000 pF low−leakage polystyrene filter capacitor on the **MAGVOLTS** output. This video filter capacitor should be of high quality and non−microphonic.

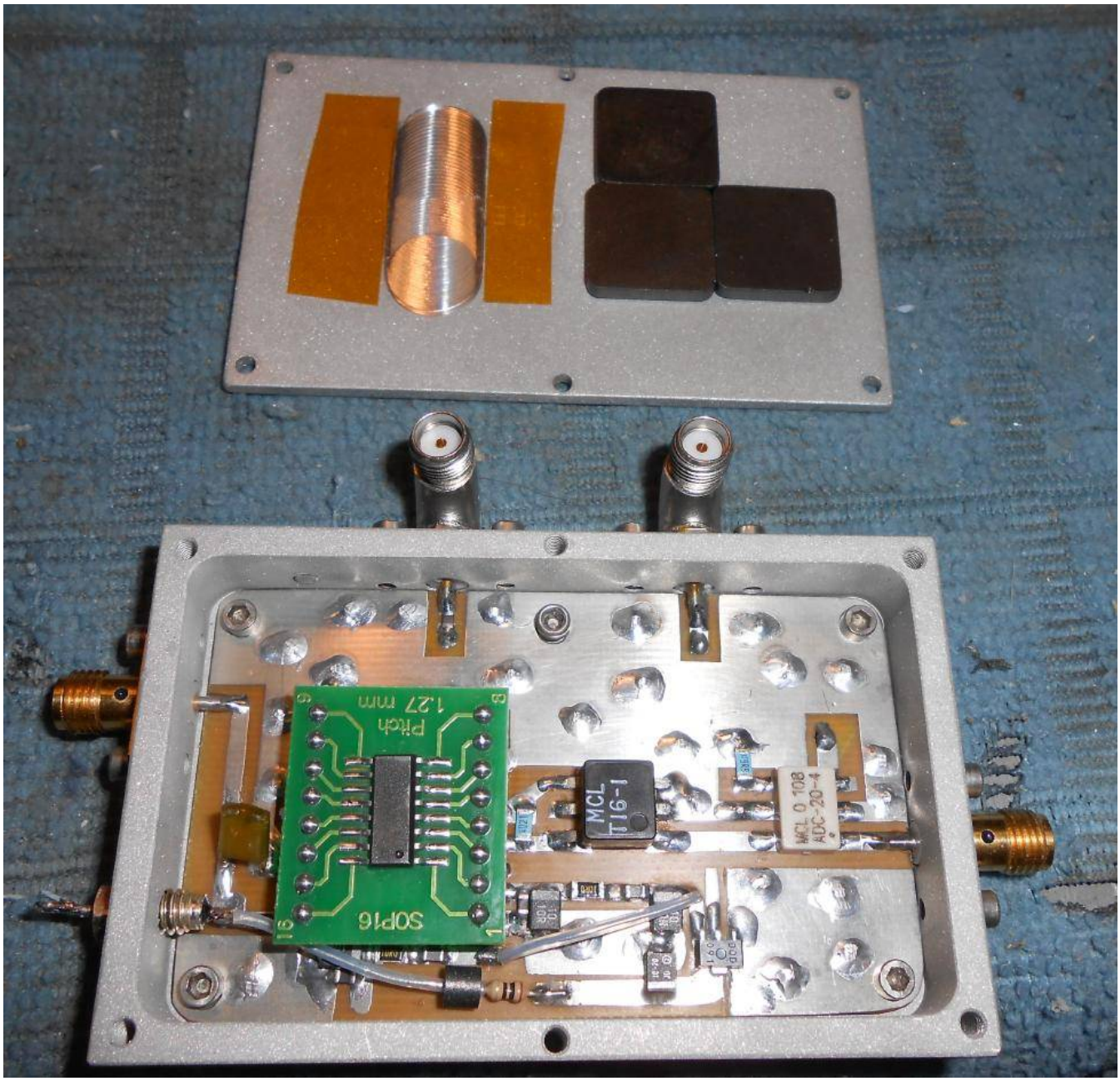
Completed overview of the logarithmic detector.

It's mounted inside an old 800 MHz cellular phone receive pre−amplifier case.

Four SMA jacks are used for the **10.7 MHz IF Input** (bottom), **−20 dB IF Tap** (right−side, bottom), **Limited IF Output** (right−side, top) and the **MAGVOLTS** (top) output.

Alternate view.

A 1000 pF feed–through capacitor is used for the +12 VDC power input.



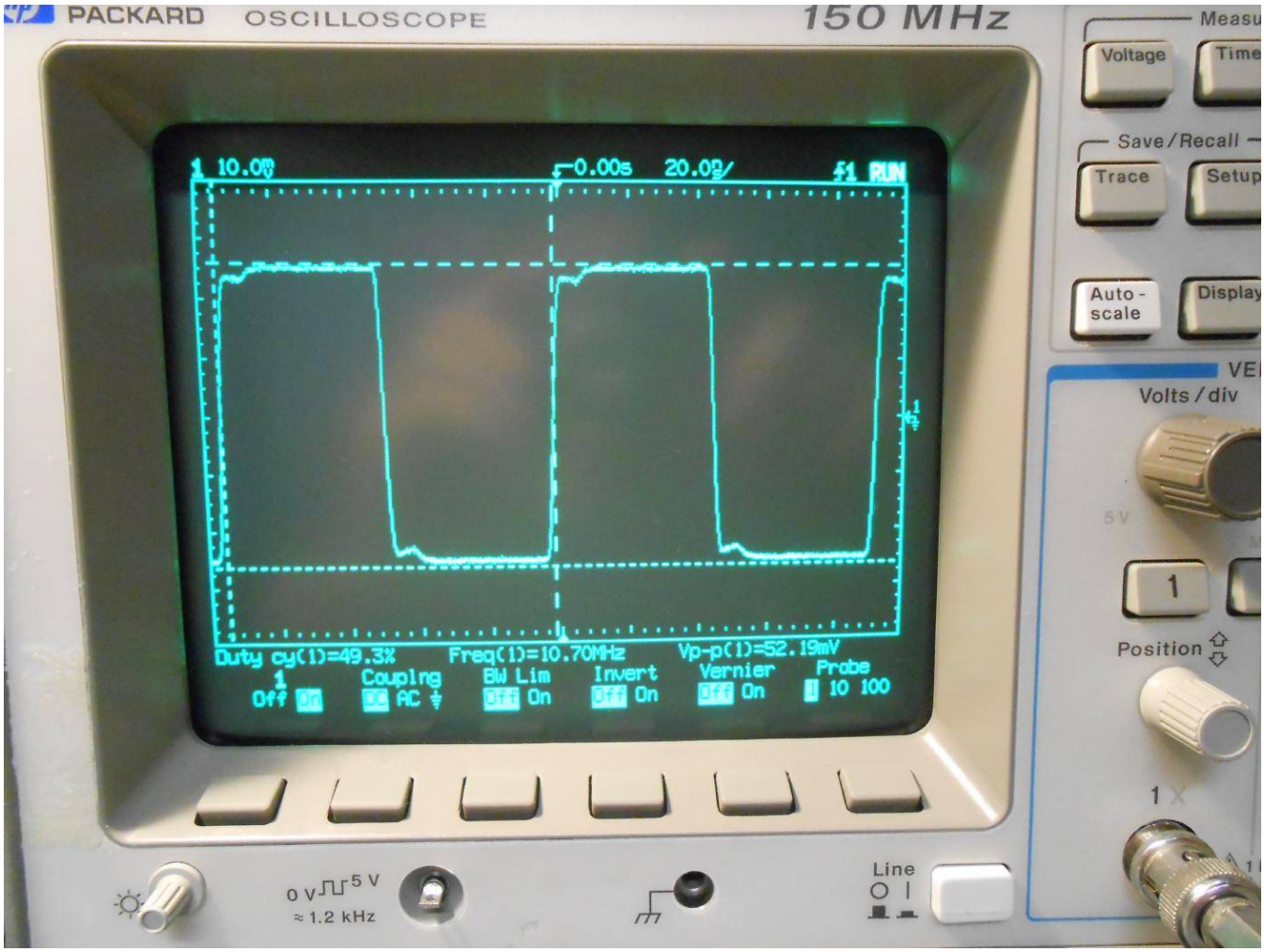
The AD8306 mounted on the SOP−to−DIP carrier board was just a little too high to fit inside the case, so I had to mill out a little bit of the top cover plate so it would sit flat.

The lid of the case has a few stick−on ferrite EMI absorption plates (Digi−Key Part: 240−2264−ND). These are optional, but the idea is to help reduce any radiated interference from the limited IF output from creating spurious images on the spectrum analyzer display.

Finished case overview.

I had to add right−angle SMA jacks as the rack−mount case I'll be mounting these modules in is just a little too small.

The **MAGVOLTS** output of this module will then be connected to the 16−bit Analog−to−Digital Converter stage before being processed by the computer.



Oscilloscope view of the limited IF output signal.

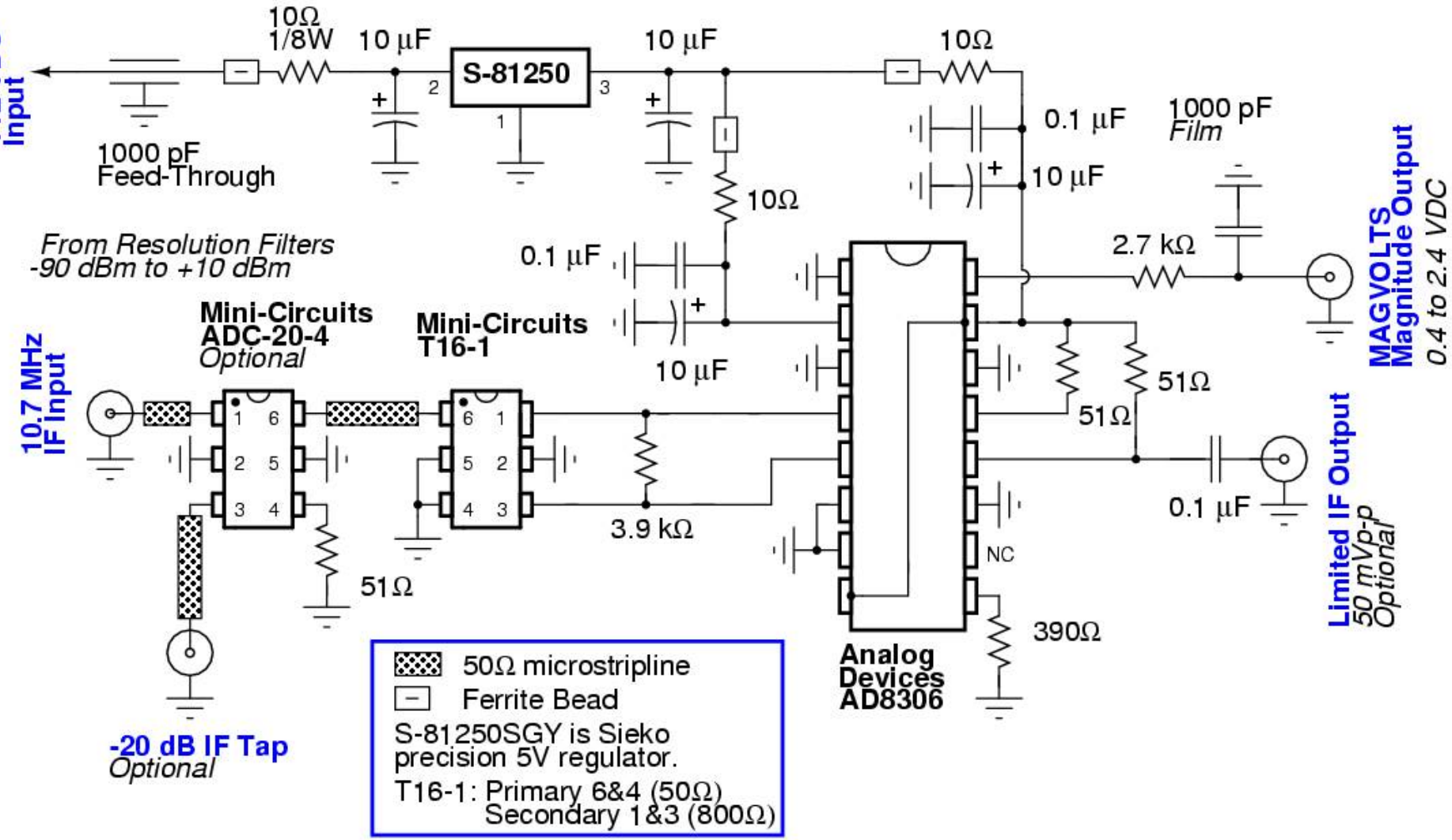
The limiting action kicks in at around a –77 dBm IF input and remains constant up to +10 dBm.

The output signal is a square wave representation of the input IF signal at around 50 millivolts peak–to–peak.

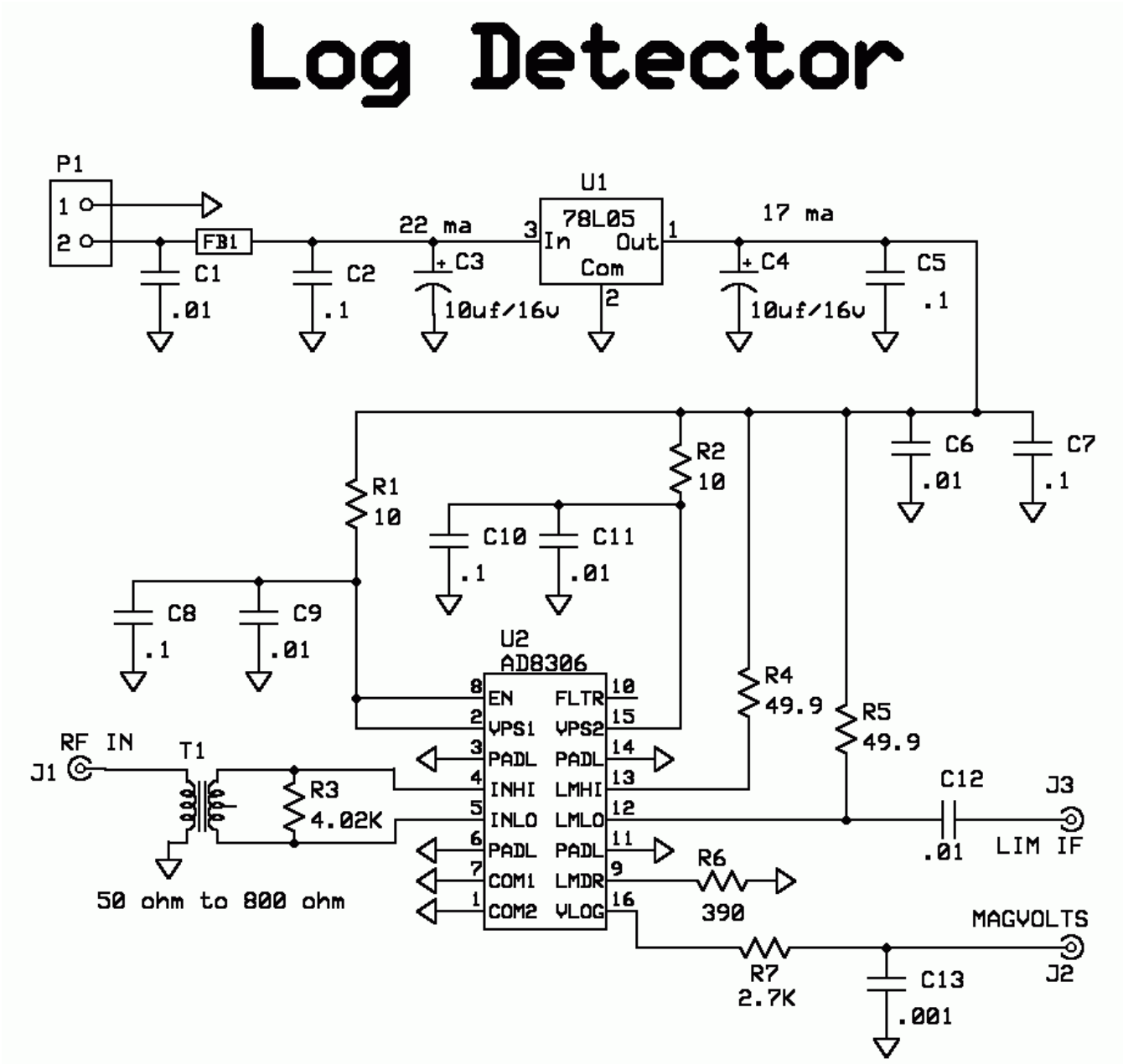
The limited IF output signal should be very well shielded to prevent feedback oscillation or spurious images from being created.

Scotty's Spectrum Analyzer

Logarithmic Detector
MSA Equiv. SLIM-LD-8306

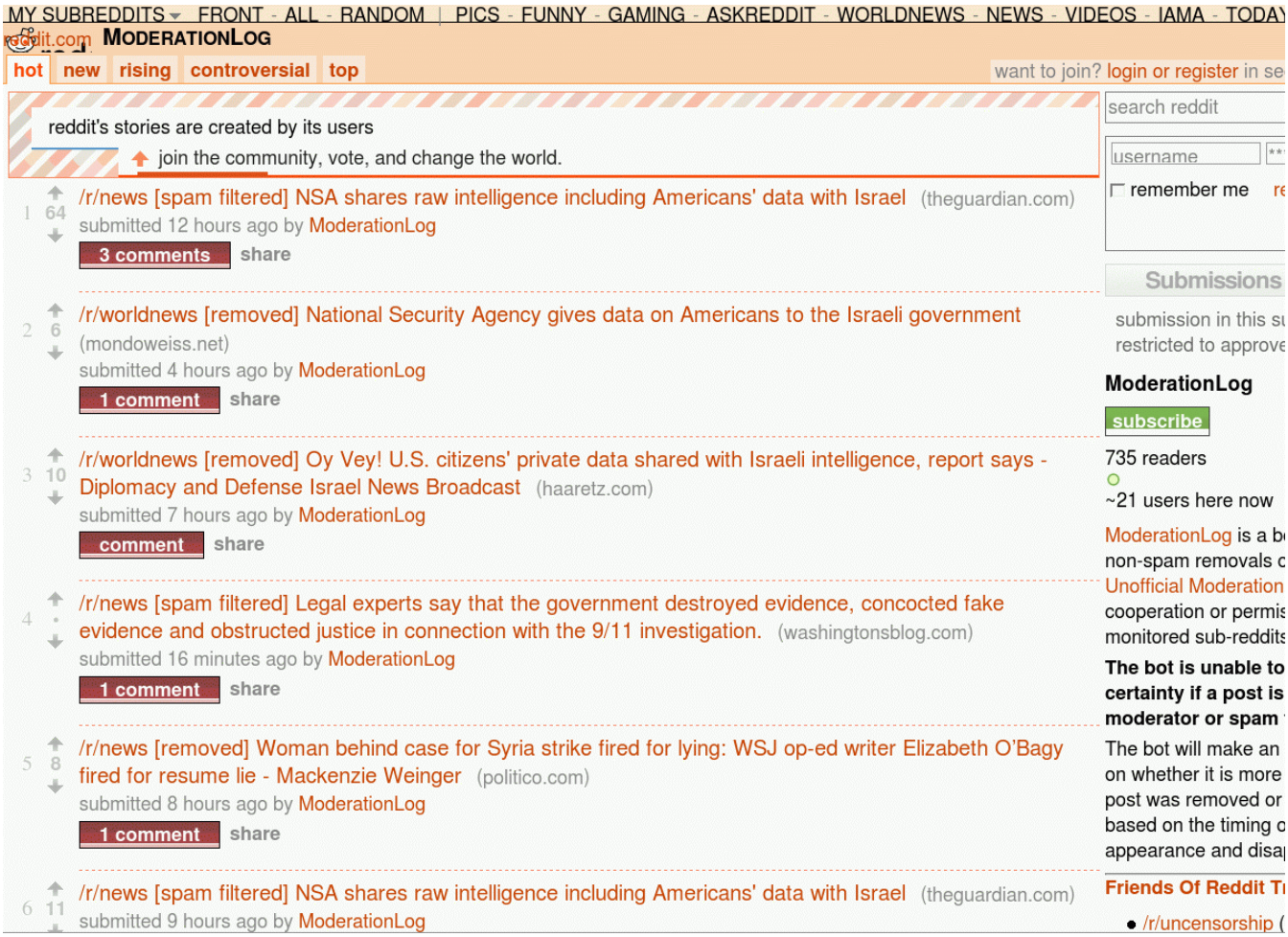


Original SLIM–LD–8306 Schematic



Document:	SKSLIM-LD-8306	Rev 0
For	Logrithmic Detector	7/01/2007
Part No.	SLIM-LD-8306	Schematic
Parts List	PLSLIM-LD-8306	
Scotty Sprowls		Pg. 1 of 1

Bonus



What censorship?

After *The Guardian* broke the news that the NSA sends raw intercepted intelligence data – including the private information of Americans – to Israel for them to sift through, Jew–run websites like Reddit did everthing possible to keep a lid on the story and censored anyone posting links or info about it.

(theguardian.com/world/2013/sep/11/nsa–americans–personal–data–israel–documents)

Change!

End of Issue #113

Any Questions?

Editorial and Rants

Because when you think of Australia, you think of this...

Not this.

Muslim extremist group given a permit by the Obama regime to hold a rally in Washington D.C. on September 11, 2013.

Counter–Muslim extremist group ***NOT*** given a permit by the Obama regime to hold a rally in Washington D.C. on September 11, 2013.

But they showed up anyway!

BRAVO FOXTROT

It's not hollywood Kuz those guys think I'm god and give me lots of money hmmm?...

It's not video games either, kuz those are pretty bad ass... wouldnt want to violate anybodys constitutional rights.. hmmm, Probibly get money from them too.

I'll take the guns away from the republicans! Fucken hate thoes guys...