

234

INDIVIDUAL TECHNICAL ASSISTANCE REPORT

In Response to a Request for Technical Assistance

By the

Racine County, Wisconsin, Office of Emergency Government

September 19, 1973

NCJRS

NOV 20 1973

ACQUISITIONS

Prepared by:

Public Administration Service
1313 East 60th Street
Chicago, Illinois 60637

(Per Contract J-LEAA-015-72)

37846

I. PRELIMINARY INFORMATION

A. **Consultant Assigned:**

A. Robert Patzlaff
Communications Consultant

B. **Date Assignment Received:**

August 7, 1973

C. **Date of Contact with LEAA Regional Coordinator:**

August 7, 1973

D. **Dates of On-Site Consultation:**

August 13-14, 1973

E. **Individuals Contacted:**

Mr. Nicholas Braun, Director
Emergency Communications
Racine County

Mr. Thomas G. Rick
Investigator, County Welfare

Mr. Herb Goldschmidt, Captain
Burlington, Wisconsin, Police Department

Mr. Wayne Marque
Investigator, County Welfare

Mr. Frank G. Tomacek, Chief
Caledonia Township Police Department

Mr. Dick Prechter
Investigator, County Welfare

Mr. Carl Gahlman, Patrolman
Sturtevant, Wisconsin

Mr. Knud Hecthaven
Patrol Sergeant and Radio Dispatcher
Racine County

Mr. Robert Cole, Fire Chief
Mt. Pleasant Township

Mr. Nat Cacciotti
Records Department
Racine County

Chief Storbeck
Union Grove, Wisconsin

Mr. W. Allen Krenzke, Sergeant
Training Officer
City of Racine Police Department

Dorothy Gruenwald
Radio Supervisor
Waterford, Wisconsin

Mr. Al Hoffman, Sergeant
Planning Research
City of Racine Police Department

Mr. Dick Shulak
Chief Radio Technician
County and City of Racine

II. STATEMENT OF THE PROBLEM

A. **Problem as per Request for Technical Assistance:**

Technical assistance in performing a radio engineering study for a countywide police radio communications system that includes: (1) efficiency of alternative network designs; (2) equipment costs; and (3) the state-of-the-art of equipment development.

B. **Problem Actually Observed:**

As stated.

III. FACTS BEARING ON THE PROBLEM

See attached consultant's report.

IV. DISCUSSION OF POSSIBLE COURSES OF ACTION

See attached consultant's report.

V. RECOMMENDED COURSES OF ACTION

See attached consultant's report.

CONSULTANT'S REPORT

I. NATURE OF THE PROBLEM

Racine County in southeastern Wisconsin is essentially rectangular and measures 18 miles from the north-south direction and 24 miles in east-west direction. The County is divided up into nine townships. The townships are active in maintaining their own police and fire activities. Each township desires to operate independently but at the same time requires close cooperation with the Racine County Sheriff's Police, and the township and sheriff's departments work closely together. All of the townships operate their radio systems in the 45 MHz frequency band. However, the City of Racine, the county seat, has its Police Department operating on a radio frequency in the high band (150 MHz). The County has the following objectives in improving the effectiveness of its communication system:

1. Improved car-to-car communication range. The County would like for a car any place within the County to be able to speak to a car at any other location.
2. Elimination of the co-channel disruption of county transmissions by the Burlington City base station operating on the same channel.
3. A comprehensive communication plan which permits closer cooperation among adjacent police departments involved in coordinated activity and provides for orderly growth.
4. Expanded use of portable radio equipment and increased range from portable to base stations over that now being obtained.
5. Reduction in the co-channel interference being received from distant stations.

II. FACTS BEARING ON THE PROBLEM

Since each of the townships operates its own radio system, any modifications should be incorporated into the existing operations, which are working quite satisfactorily for the most part. Each township purchases its equipment independently and therefore any wholesale change-out of the entire network in order to accomplish closer communication on all new radio channels could be rather difficult to administer.

Many of these townships operate an extensive network of radio-controlled sirens and alert monitor receivers for calling volunteer personnel to duty. This operation is now satisfactory and should remain intact as much as possible. Not all of the townships are equipped for 24-hour dispatching and therefore the radio system must allow for these cars to switch to the county channel for dispatch service when the local station is not in operation. Also, new and growing communities in the County may require the services of the county radio dispatch facility. Table 1 gives a list of the radio frequencies used in the County at the present time and their assigned tone-coded squelch frequency.

Most of the units in the County operate in the carrier squelch mode so that they can receive the county transmission. Thus, while tone-coded squelch equipment is available on codes assigned, most of the townships are not enjoying the protection afforded by the tone-coded squelch under the present arrangement.

Table
**RADIO FREQUENCIES USED BY GOVERNMENTAL UNITS
 IN RACINE COUNTY, WISCONSIN**

<i>Town or Agency</i>	<i>Radio Frequency</i>	<i>Tone-Coded Squelch Frequency</i>	<i>Remarks</i>
Waterford	45.600 MHz	131.8 hz	Mobiles are three frequencies: 45.6, 46.08, and 45.98 MHz.
Union Grove	45.320 MHz	179.9 hz	Two frequency mobiles: 45.320 and 45.980 MHz. Chief dispatches cars when in office, using a remote control unit connected to bay station at Fire Department.
Kansasville	45.320 MHz	192.8 hz	
Raymond Center	45.480 MHz	(Not Available)	
Burlington	45.640 MHz	146.2 hz	Police dispatched on county frequency during day and on 45.640 MHz at night. The City controls 105 alert monitor receivers plus sirens.
Mount Pleasant	45.200 MHz	141.3 hz	Units are dispatched from Sturtevant.
Sturtevant	45.200 MHz	173.8 hz	
Caledonia	45.520 MHz	103.5 hz	Chief reports extremely poor portable range--three miles or less.
Norway Township	45.480 MHz	118.8 hz	
County Highway	45.720 MHz	Carrier	
County Sheriff	45.980 MHz	Carrier	
County Fire and Rescue	46.080 MHz	Carrier	Most county cars have this frequency and use it to call for ambulance units.
Racine City Police	155.550 MHz	Carrier	
Racine City Fire	154.370 MHz	Carrier	
Department of Public Works	155.760 MHz	Carrier	After 5:00 p.m. this frequency used for city intelligence units.
Civil Air Patrol	27.575 MHz	Carrier	Talks to civilian-owned mobile units for specific emergency situations.
Civilian Defense Alerting	155.040 MHz	Carrier	Used for activating alert monitor receivers in schools.
Civilian Defense Network	45.610 MHz	Carrier	

III. ANALYSIS OF PROBLEM AND POSSIBLE COURSES OF ACTION

The problem areas will be discussed in two parts:

1. Those dealing with the present radio mobile units.
2. A method for incorporating more effective portable radio coverage.

Mobile Radio Communications

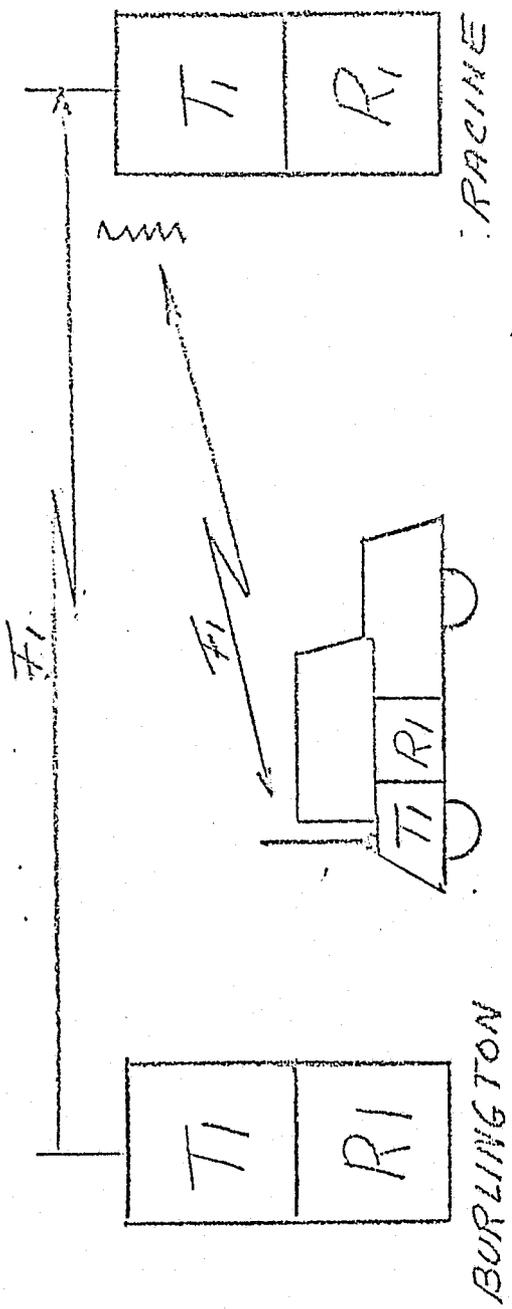
As mentioned earlier in this report, the problems experienced are those of interference to the Sheriff's base from Burlington skip interference and mobile-to-mobile range limited to about 8 or 10 miles. Exhibit 1 indicates the present proposed communications arrangements in relation to Burlington and Racine.

At the present time the Sheriff's Department operates on a Simplex frequency of 45.980 MHz and this is the reason for the co-channel interference during daylight hours when Burlington operates its mobile dispatch also on 45.980. Therefore it is recommended that the Sheriff's Department and Burlington obtain an additional 45 MHz frequency designated for mobile use only to be used as a mobile talk-back channel. One possible frequency for this application is 45.380 MHz. Making this change will provide for a mobile-to-base and a mobile-to-mobile channel in all cars. It must be recognized, however, that with this plan mobile units calling the station will not be heard by other mobile units in the area, and this fact should be recognized. However, mobile units may contact other mobile units directly by going to the mobile-to-mobile channel (45.380 MHz). There will be no need for cars to activate their tone-coded squelch switch since all units will be in the same code and operating in the same mode. All present and future township and Sheriff's cars should have a four-channel capability, the same squelch code, and for greater ease in training operators a uniform channel usage plan as illustrated in Exhibit 2.

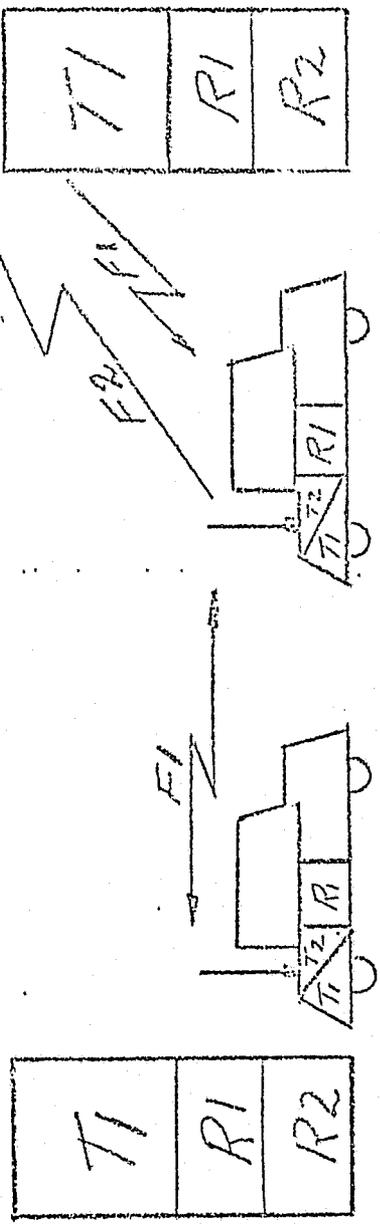
Skip Interference Protection

As pointed out previously, most township units are not using the tone-coded squelch so that they may receive transmissions from Sheriff's cars who operate as carrier squelch units. To make tone-coded squelch practical in the County, it is recommended that one tone code be used for all systems. In this way all township and sheriff units can receive the protection afforded by tone-coded squelch radio and still call units of other systems on another channel. With the county radio units now on carrier squelch and the townships on tone-coded squelch, the systems are not compatible unless an operator remembers to switch his squelch to the carrier mode or operate with carrier squelch when talking to a county car.

MOBILE SYSTEM MOD.



PRESENT SITUATION
RECOMMENDATION



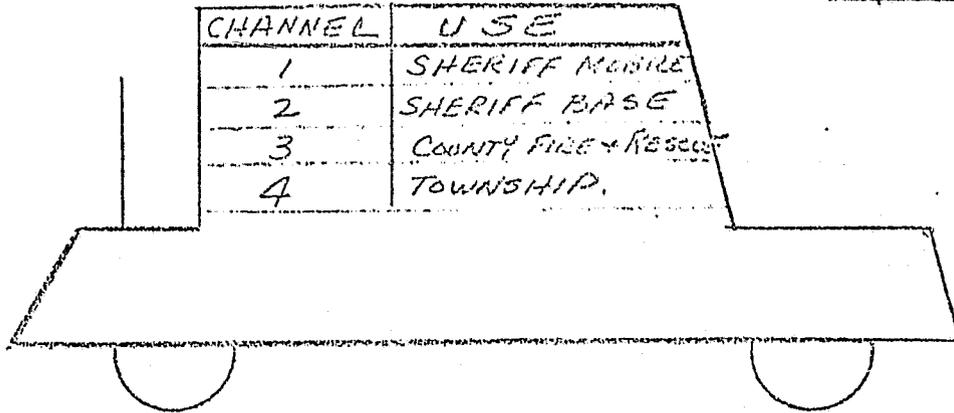
5
 USE NEW "MOBILE-ONLY" FREQUENCY FOR "MOBILE TALK BACK
 TO PREVENT BASE STATION BLOCKING" MOBILE MESSAGES
 F1 = 45.98MHZ F2 POSSIBILITIES: 45.38, 45.34, 45.30, 45.26
 RACINE COUNTY, WIS.
 EXHIBIT I BK: GAP 8/26/73

RACINE COUNTY, WIS.
 EXHIBIT 2
 45 MHz FREQ. PLAN

TOWNSHIP CARS

6
FREQ. MHz

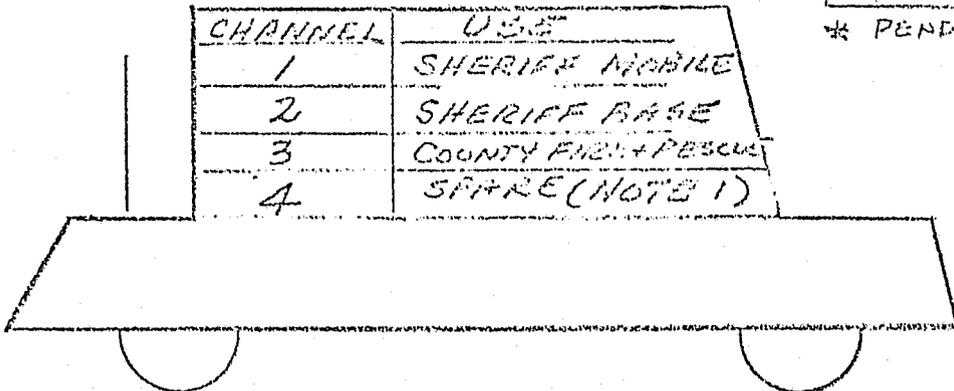
CH	XMIT	REC.
1	45.96	45.96
2	45.38	45.72
3	45.03	45.03
4	SEE FREQ. LIST IN REPORT	



SHERIFF CARS

FREQ. MHz

CH	XMIT	REC.
1	45.96	45.96
2	45.38	45.96
3	45.03	45.03
4	45.72	45.72



* PENDING APPROVAL

NOTE 1: THIS POSITION COULD BE FOR CIVILIAN DEFENSE USE ON HIGHWAY FREQ. LISTED

- A. TO MINIMIZE CONFUSION, SET UP RADIO CHANNEL CONVENTIONAL PLAN
- B. ALL NEW UNITS TO BE A FREQ.
- C. ALL UNITS USE SAME TONE SQUELCH CODE
- D. SCAN ALL REC. FREQ. IN UNITS - PRIORITY ON SHERIFF BASE FREQ.

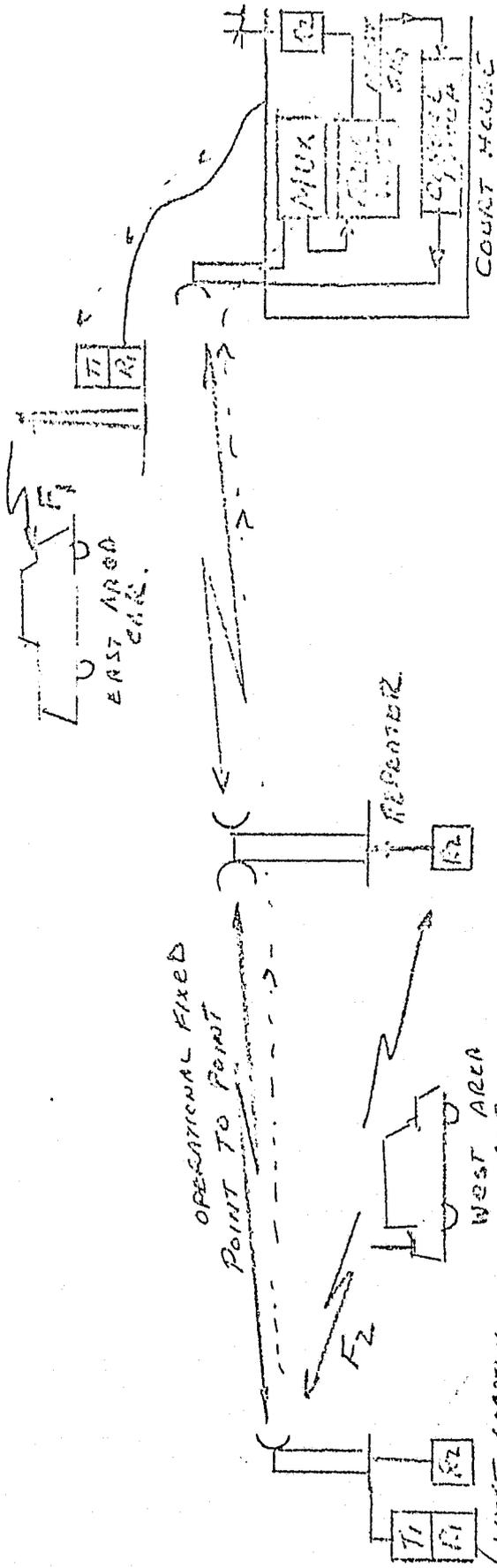
APP 8/20/13

This need for activating two switches leads to the possibility of operator error resulting in his not being in the proper mode for receiving his transmissions. The townships are already receiving interference protection from one another by virtue of the different frequencies used in each township; they do not each need a unique tone-squelch code. Only in Sturtevant and Mount Pleasant is a frequency shared between two townships. However, since these towns share a common mobile dispatcher, it is quite probable that neither one of them is using its tone-coded squelch since the base station could not be transmitting on both codes. In these small towns, of course, the dispatching is often done from a mobile unit by the Chief and then the squelch code would afford isolation to mobiles of the adjacent town. In a case of this nature, where these towns are closely related, it would seem they could share a common frequency and tone and hear each other's transmissions. It is recognized that a common squelch code may subject some of the townships to some skip interference, but the overall advantage to the county system far outweighs this occasional interference. The County should solicit the help of equipment vendors in finding the best "common" code for the frequencies involved, since they have the best history of user assignments.

Improved Car-To-Car Communication Range

Exhibit 3 gives a plan for improving the car-to-car range as well as the mobile talk-back range from the western portion of the County. The plan suggests the installation of a point-to-point (possibly 960 MHz) operational fixed controlled radio link from Racine to the western portion of the County. This microwave radio link would control a second county base station, possibly at Burlington. If there is other county property in this area used for a garage or some other purpose, it could perhaps serve as the base station site, and Burlington could wire-line control this station and discontinue use of the one located on its premises, if another location is better for the County. The dispatcher at Racine would have the ability to select either the Racine or the western base station over the 960 MHz control link. Incoming signals from the receiver in the western portion and a repeater point at the county highway office building on Route 20 would all be received at Racine where a voting circuitry would determine the best signal. The dispatcher would always hear a good quality signal. For a mobile in the eastern part of the County needing direct communication, but beyond the range of the one in the western portion, the dispatcher should be equipped with patch circuitry to take the received signal from the mobile talk-back frequency and send it out over the control channel to the base station in the vicinity of the other mobile unit to be contacted. The transmission between the cars would be via the microwave link. This points up another advantage of the separate talk-back channel. The dispatcher can hear mobiles calling in while the dispatcher is transmitting.

The transmitter being activated will mute the receiver within in its own cabinetry. It is not necessary to have a midway transmitting station on the county frequency since talk-out coverage is already adequate from the existing station in Racine. However, with the east, midway, and west, receiver coverage should be excellent over the County. The maximum distance a mobile unit would need to talk to a receiving antenna would be approximately eight miles. This assumes the midway repeater in the point-to-point circuitry. A 960 MHz circuit could probably be operated without the County Highway Office midway



RACINE COUNTY

EXHIBIT B

PLAN FOR EXTENDED CAR TO CAR
 ADDRESS CONFR.

NOTE: A STATEMENT OF NEED WOULD BE FILED
 WITH FILE

BURLINGTON

repeater, but it can serve additional purposes in the portable and overall county communication program to be discussed in later paragraphs. This improved receiver capability in the County will permit lower power mobile units to be purchased at additional savings to the County and townships as they will not be wholly dependent on mobile-to-mobile communication. The mobile-to-mobile channel can be used for mobiles in relatively close proximity to each other.

Scanning Equipment

It is recommended that all township and sheriff mobile units be equipped with scanning equipment that will continuously scan the local government, sheriff and county fire frequencies in the case of township cars, and the county sheriff and fire frequencies in the case of Sheriff's control cars. It is also recommended that priority be established on the Sheriff's frequency because the Sheriff has the overall county police responsibility, and bulletins of a countywide nature will then always be cleared in the township cars. A further refinement and option which is recommended for each of the township and Sheriff's cars is the use of a digital signal that will provide automatic identification of the car initiating a transmission. The Sheriff's dispatcher is an extremely busy position and it is easy for him to fail to identify the car calling while he is attending to other duties. Therefore, automatic transmission of car identification and the indication of this at the dispatch location would greatly facilitate the operation of the system. This digital coding scheme would also have other applications in the portable system to be described later. The identification facet of it, however, could be used regardless of how the portable system is incorporated into the overall plan, and additional digital codes could be used to initiate a quick call for assistance or other predetermined messages which might have application in the County, such as a request for an ambulance. The appearance of these messages on the status board provides positive identification of the unit calling and of the service requested and serves as an electronic memory for a busy dispatcher.

Portable Radio Communications

There are several approaches which could be taken to improve portable radio communications. However, certain factors were considered in the overall evaluation, for example, the desire to have positive communication between the Racine City Police, which operates on high band, and the Sheriff's units. Other considerations in the portable plan were that many of the investigative units complain about the large size of present low band portable radio units and desire to have smaller-sized equipment which are currently only available in VHF (150 MHz band). Another factor influencing portable usage is that the Wisconsin Police Emergency Radio Network, a network which is used for cooperation among departments in a major operation, operates on the high band region. Balanced against all of these reasons for high band equipment is the fact that the Sheriff and townships operate on low band channels, and this system could not be readily abandoned in favor of a complete high band communications network for the entire County and townships. The installation of a complete high band communication network is further hampered by the fact that there is a shortage of high band base station frequencies in the State. Racine, in the

southern portion of Wisconsin, must compete with the usage of these frequencies by highly urbanized areas in Northern Illinois. A further reason that a complete switch-over to high band radio communications in the County is not practical is that it would require change-out of the hundreds of alert monitor receivers and sirens now being operated unless these continue to operate on low band. One of the options considered for incorporating portables into the system was to change the entire system to high band frequencies, but this was rejected for the reasons stated in the preceding sentences.

High band, hand-held portables do offer the advantage of greater range because of higher powers and more efficient antennas. They also are available in smaller sizes.

Receivers for Talk-Back

Exhibit 4 shows portable receiver locations. A network of high band, talk-back receivers could be tied into the microwave system by wire lines. However, without a new high band "base" frequency other methods for base to portable transmission have to be explored.

Mobile Repeater Stations

A solution for this requirement is the use of a mobile repeater station in each of the cars. A mobile "talk-out" repeater station would permit portable radios to operate on a high band frequency. The plan would be that the portable radios would talk into a network of high band receivers to be added at existing equipment sites; portables would receive transmissions from a low power, high band transmitter actuated by the 45 MHz basic mobile unit.

Portable System Description

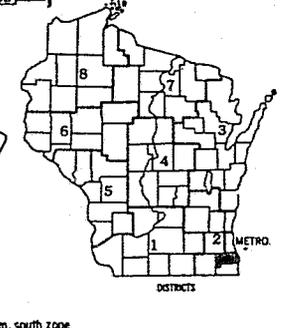
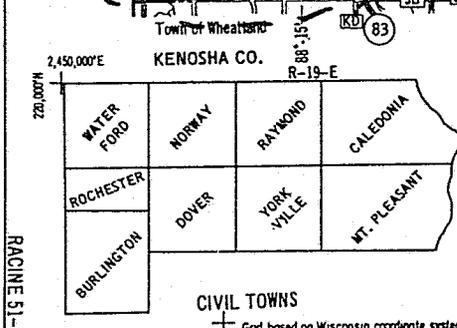
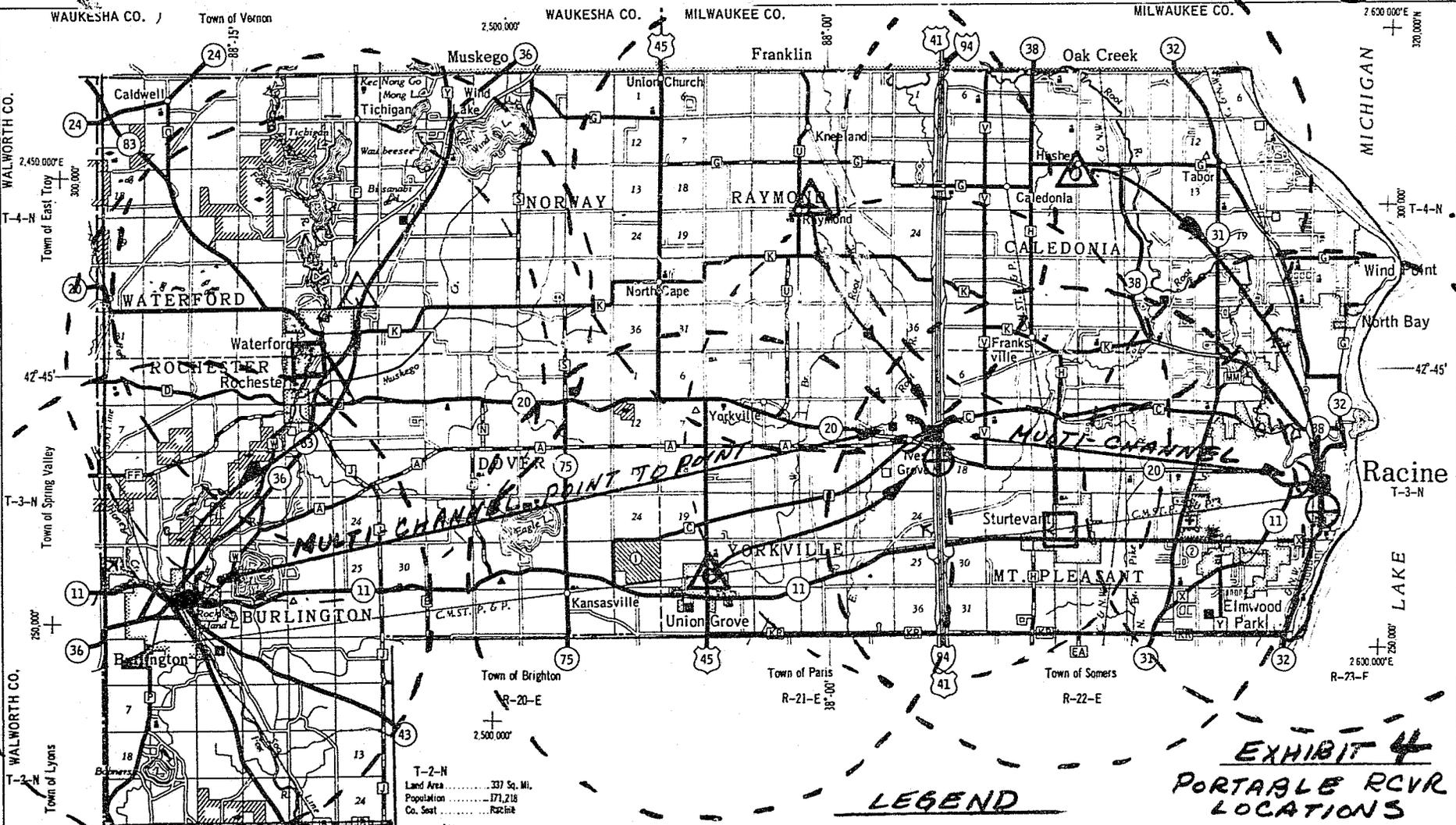
The recommended portable system would operate in the high band. It would require two or three mobile-only frequencies and would not require a new base-mobile frequency which may be difficult to obtain. The three frequencies which would be used for these purposes are:

Frequency A: Portable to Call Sheriff (new)

Frequency B: Portable to Call Any Township (new)

Frequency C: Relay Frequency From Mobile to Portable (This could be new or could be the Racine City frequency.)

Portables would talk directly to a township base or the Sheriff's Department dispatcher. Receivers would be located at existing equipment facilities. At some township locations a receiver on the Sheriff's frequency will be located and the signal brought into a channel of the microwave system over a wireline. Receiver voting equipment will select the best signal for reception by the dispatcher. All portable units will transmit on the common tone-coded squelch code used throughout the County. A special mobile housing for the portable would be specified to include digital coding and decoding equipment, battery charger, antenna transfer, audio amplifier, and microphone.



- LEGEND**
- MICROWAVE TERMINAL
 - MICROWAVE REPEATER
 - RCVR-SHERIFF & TOWN
 - RCVR-TOWN ONLY
 - RCVR-SHERIFF ONLY

EXHIBIT 4
PORTABLE RCVR LOCATIONS

RACINE CO.
 DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS
 STATE OFFICE BUILDING
 Madison, Wisconsin

SCALE 0 1 2 MILES
 Corrected for
 JAN. 1972

Compiled from U.S.G.S. Quadrangles
 Based on Aerial Photographs

Portable Operation

When a patrolman removes the portable from holder, a digital signal would be sent to dispatcher, indicating "man - leaving - car." The signal would be repeated until automatically verified. The signal will be sent on the Sheriff's "base-receive" or "township" frequency, depending on who is dispatching the car at that time. The position of the mobile frequency switch will determine which frequency. A countywide car numbering plan must be agreed upon so each car has a different number, and a distinct digital identification code will be assigned each car in the County. When a dispatch point equipped with the digital circuitry receives the code indicating an officer has removed his portable and is out of his car, a lamp will light indicating that fact to the dispatcher. When out of the car, the portable can talk directly to a local dispatcher or to the Sheriff through the "pick-up" receiver network. For talk-out to a portable, the dispatcher must depress the button for the car through which he wants to repeat; this is the only way the repeat function will be activated. This gives the dispatcher control over which car repeats so that in a situation involving several cars only one at the scene will repeat. The repeat select key, when depressed, will cause the car repeater unit to remain in the repeat mode until disabled by the Sheriff's Department dispatcher or the unit is returned to the holder. An officer returning to his vehicle and replacing the portable back in the holder will cause his I.D. and an "in vehicle" code to be sent until acknowledged. When acknowledged, the repeat function will be deactivated for that unit, and the "repeater-actuated" lamp at the dispatcher console will be turned off.

Additional Digital Codes

Since the portable applique unit will contain basic digital circuitry, an additional "send help" code, which can be activated by a foot switch or a pushbutton, should be specified. This should add very little cost to the basic unit. The digital code equipment will provide the routine identification of any car transmitting on the 45 MHz frequency. For optimal operation, digital equipment should be at each township and the Sheriff's dispatch office. However, for economy, it could initially be used only at the Sheriff's dispatch point. When in the car, the microphone on the portable applique unit will permit transmission on the high band frequency selected, thus allowing the unit to double as a low-power mobile on high band. This will permit Sheriff's vehicles to communicate directly to Racine City Police. It will also provide a back-up, talk-in frequency on the portable channel for communication with the dispatcher. A coordinated portable radio channel frequency plan should be followed throughout the County. Note that all portable radios are of standard design. However, the supplier of the portable must provide the repeater/charger/digital/applique unit to match his portable. A print-out of all digital codes sent and received with time information is an accessory item recommended at the Sheriff's dispatch facility, which would be valuable for recorded verification.

Portable System Frequencies

To conserve the number of frequencies in use, it is possible for the relay transmitting unit in the patrol cars to transmit on the same frequency as the Racine City Police. By using the Racine City frequency for repeat from the vehicle to portable, a man out of his car in Racine would switch off his portable unit squelch code to hear both Racine City and Sheriff's Department dispatchers. Racine City would be heard directly and Sheriff's calls would be heard through the mobile talk-out repeater. Eventually Racine City should use tone-coded squelch to prevent nuisance interference from outside stations. Here, again, the Racine City should use the common code agreed on for use throughout the County. Portable channels are depicted in Exhibit 5.

Two possibilities for mobile only channels to be used by the portables are 155.520 and 154.710 MHz. These should be submitted to the state frequency coordinator for approval as a portable only radio frequency. While three frequencies (mobile only) may be needed, it should be pointed out that they will serve at least 11 police agencies in the County.

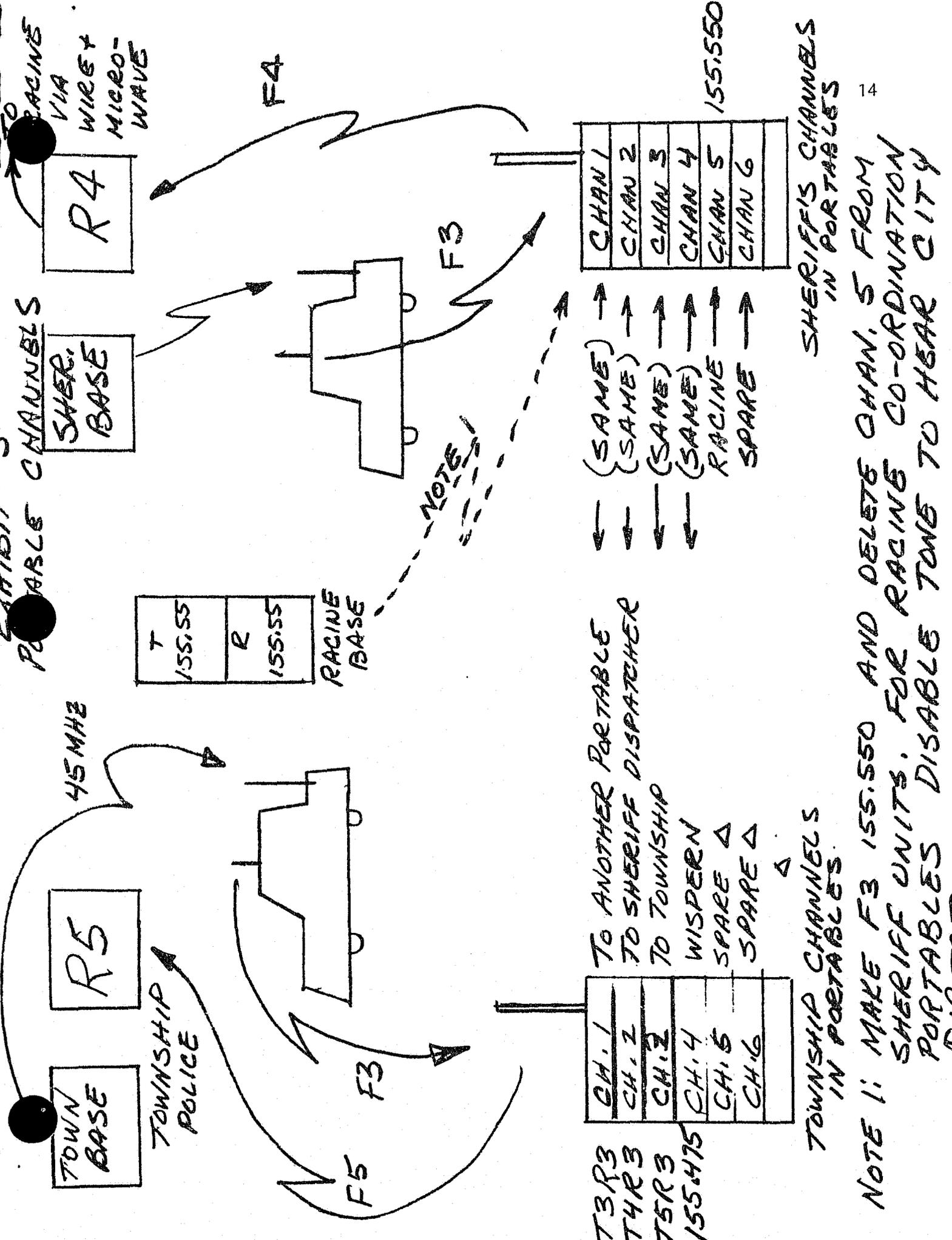
Applique Unit

Exhibit 6 is a drawing of an applique unit which should be submitted for pricing by the various equipment manufacturers. This unit would contain a receptacle for the portable radio. When the portable radio is installed in this receptacle, the unit would automatically connect to a high band vehicle antenna, an audio amplifier and speaker, and portable battery charger equipment. These functions are already standard with most manufacturers where used with portable radio equipment. In addition to these functions, however, when the portable radio was removed from the vehicle, it would cause a switch to activate circuitry which would do several things: (1) it would transfer the antenna previously connected to the portable transmitter to the relay transmitter in the car used for transmission to and from the portable unit; (2) it would immediately send out a signal on a mobile radio transmit frequency and identify that the unit has been removed from the car and identify which car has now gone to portable operation. This indication would be received as a signal at the dispatch point and be converted to a visual indication on a mobile status panel so that the dispatcher immediately knows when a man leaves his vehicle. The digital circuitry will also incorporate digital decoding equipment to enable the dispatcher to activate or disable the repeat function in any mobile unit.

The applique unit recommended would contain a receiver and microphone which would permit a second officer in the car to talk to the field officer when the portable is removed from the car. Thus, two men working together in a single car could communicate. FCC requirements limit the power output of the transmitting unit used for relaying messages from a car to a portable unit to a level of 2½ watts.

The conception of this applique unit would essentially be a rectangular housing with self-contained speaker to amplify the audio output when the portable is installed. It would contain a pushbutton for quick transmission of "help requested" signals over the existing mobile radio unit. It would have a lamp to indicate a call received from headquarters when the operator may have missed it or been out of the vehicle without his

EXHIBIT 5
PORTABLE CHANNELS



T	155.55
R	155.55

RACINE BASE

T3R3	CH. 1	TO ANOTHER PORTABLE
T4R3	CH. 2	TO SHERIFF DISPATCHER
T5R3	CH. 2	TO TOWNSHIP
155.475	CH. 4	WISPERN
	CH. 5	SPARE Δ
	CH. 6	SPARE Δ

TOWNSHIP CHANNELS
IN PORTABLES

(SAME)	CHAN 1
(SAME)	CHAN 2
(SAME)	CHAN 3
(SAME)	CHAN 4
RACINE	CHAN 5
SPARE	CHAN 6

155.550

SHERIFF'S CHANNELS
IN PORTABLES

NOTE 1: MAKE F3 155.550 AND DELETE CHAN. 5 FROM SHERIFF UNITS. FOR RACINE CO-ORDINATION PORTABLES DISABLE TONE TO HEAR CITY DIRECT.

portable radio. Other functions that the County feels necessary could also be handled using additional digital codes. However, by keeping the codes to a minimum the equipment would be simplified and not too difficult to build. This equipment should be specified to connect to the existing mobile unit through a cable adaptor which should be provided by the equipment supplier. Note that by using the Racine City police frequency as the transmit frequency in the mobile relay unit that portable units operating in this area will hear their transmission directly from Racine City and from the Sheriff's dispatcher without changing channel.

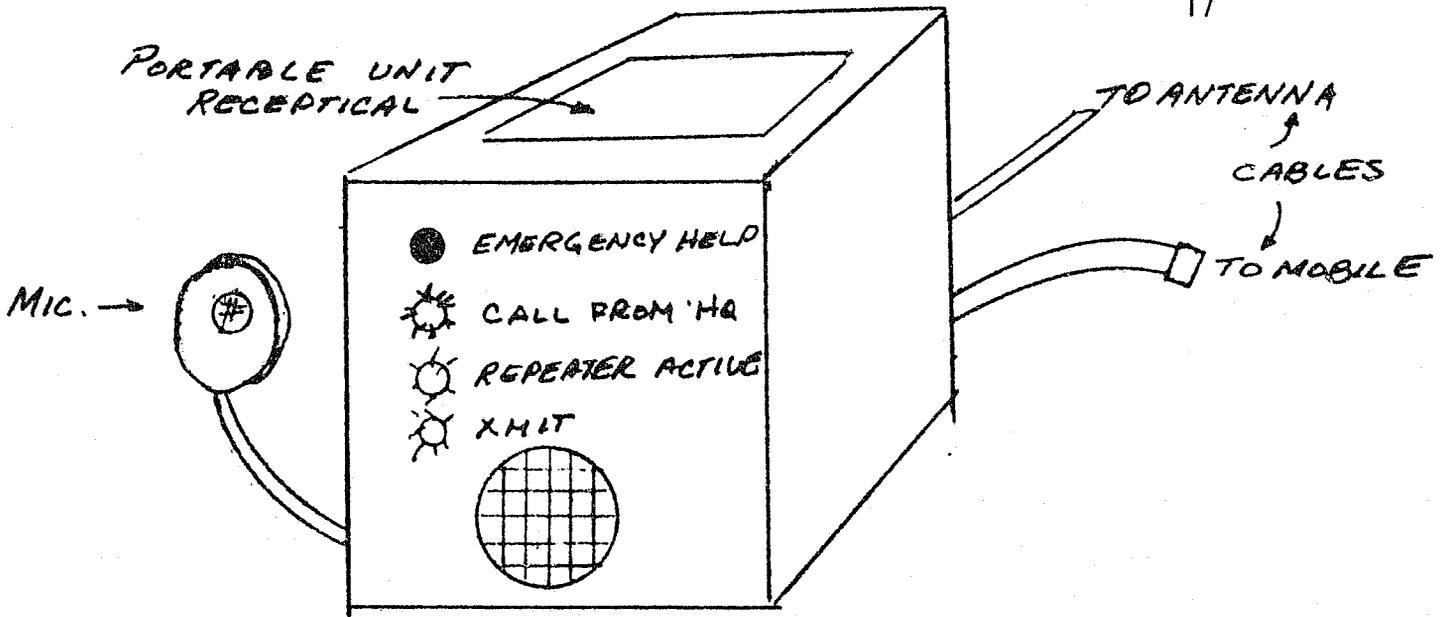
The exact unit suitable for the county operation is not standard with any manufacturer but due to the large number of radio units in the County, it is felt that equipment manufacturers could be attracted to bid on such a device. It is desirable that the unit provided be capable of addition to existing mobile units so that the County would not have to apply for all new mobile radio units at the present time but could add this interphase unit into their existing mobile units and replace mobile units as time progresses. Exhibit 7 gives a conceptual view of the applique unit.

Interim Operation for Township Cars

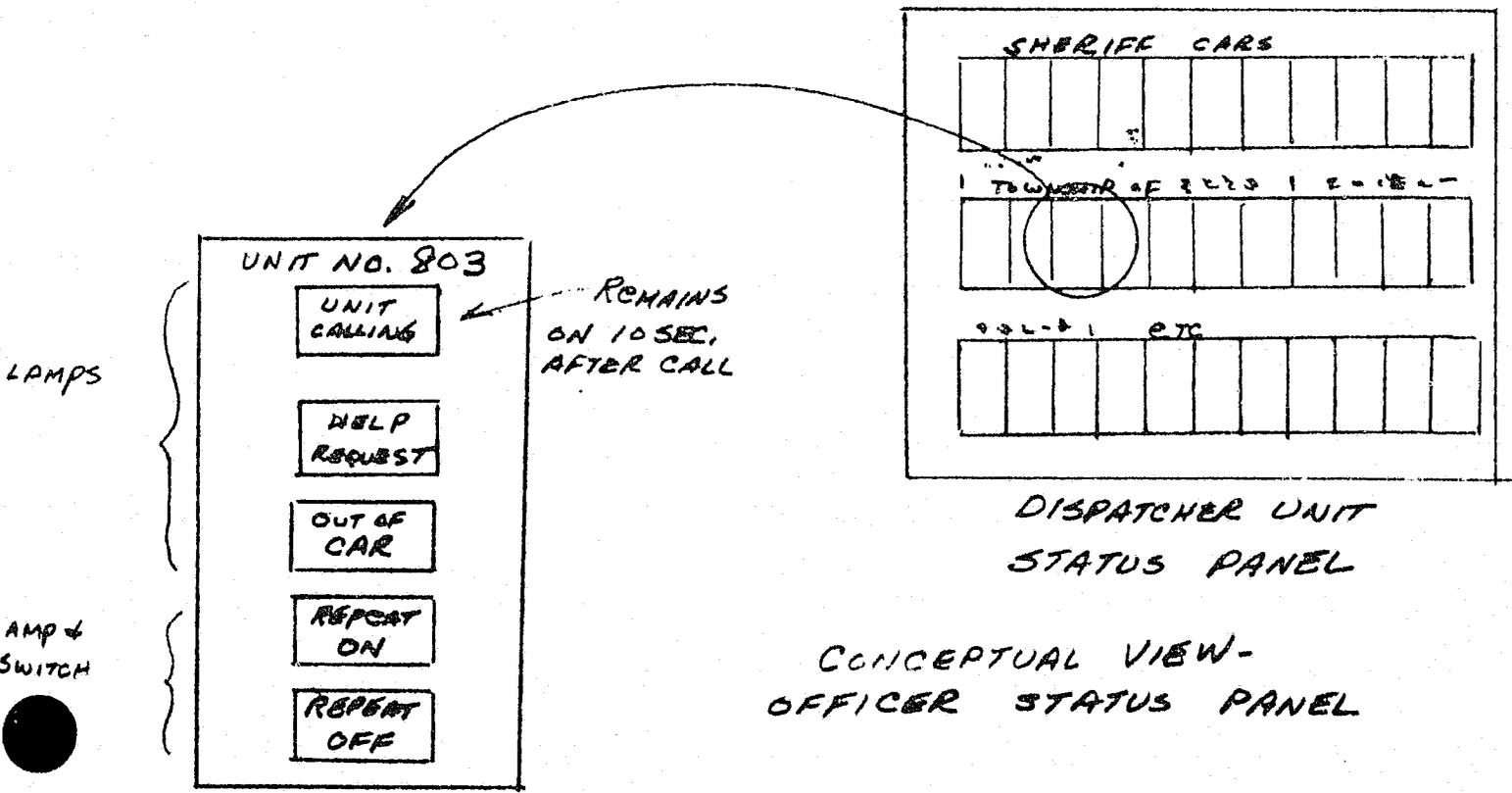
As an interim measure, township cars could use a high band portable to a receiver in their township dispatch location; and when out of the vehicle and nearby, they could hear the dispatcher over their P.A. Unit Speaker and talk back on the portable. They would talk directly between portables on high band. This mode of operation could be used prior to installing the repeater applique unit. Exhibit 8 depicts this alternative.

Dispatcher Control Facility Modification

At the present time the County Sheriff's dispatcher who is the key coordinator for all county activities operates in extremely cramped quarters which are not providing conditions needed for effective radio dispatching. The teletype machine is removed only about four feet from the operating position, and this generates considerable noise into transmissions made to mobile units when the teletype is in operation. When more than one person is in the room, there is virtually little room for operation, and the confusion and noise also hamper dispatch and generate noise over the radio system. It is recommended that a new dispatch location be investigated, possibly in the area now being used by the shift commanders in the Sheriff's Department. A move to that area would be far more secure than the present area bordering the outside alley way which provides outsiders a view of the operating position and makes it vulnerable to attack from the outside. Some consideration may be given to locating the county radio dispatcher in the City Building or the county highway office building. If the highway building facilities can be used, extra channels on microwave back to the Courthouse could provide the necessary dispatch requirements from the records department, detective department, welfare department, and other departments needing direct communication from their respective departments to a mobile radio unit and telephone connections between these facilities. The console will have to be revised to accommodate the digital equipment and status board. It would be recommended that a status board containing a position for each mobile unit in the County be set up which would



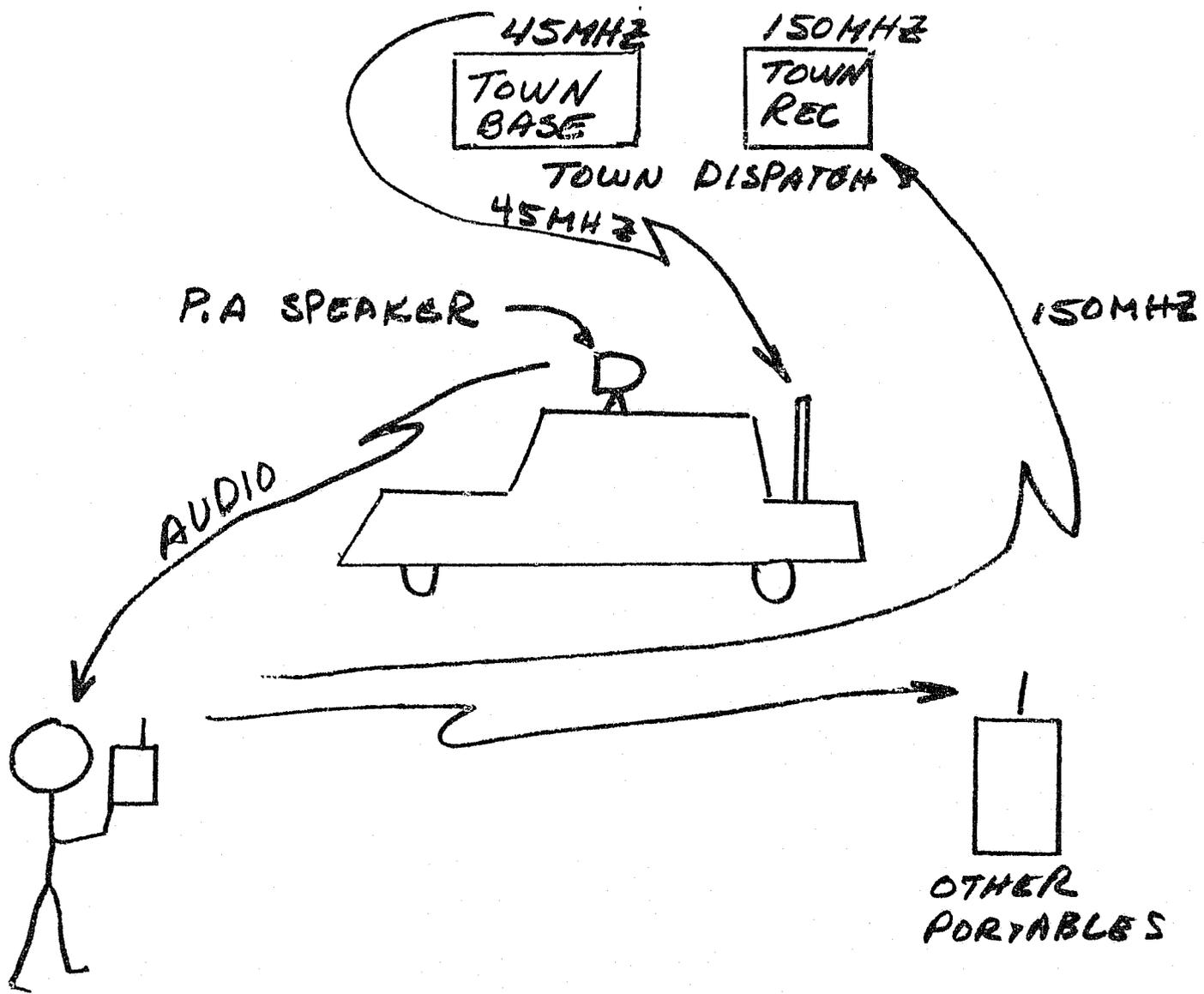
CONCEPTUAL VIEW
APPLIQUE UNIT FOR VEHICLE



CONCEPTUAL VIEW -
OFFICER STATUS PANEL

UNIT ESCUTCHEON

Exhibit 8
INTERIM OPERATION



provide indications of a call received from the unit and when the unit is out of the car. Thus, any township or Sheriff's mobile unit in the entire County could depend on the County Sheriff's dispatcher knowing his exact status at any time, day or night, when operating on the county frequency. Since it was recommended that units be equipped with scanning equipments, the Sheriff's dispatcher would be able to leave any message in any car over the Sheriff's channel since this channel would have priority in all of the cars, and there would be no chance that a mobile unit would listen to the wrong channel.

Capabilities at the dispatch location that would need to be added are as follows:

1. The ability to select the Racine or Burlington area transmitter.
2. The ability to know which receiver is receiving the strongest signal from a mobile or portable unit.
3. The ability to mute any receiver which becomes inoperative or generates noise in the system.
4. The ability to patch the mobile or portable talk-back channels to the transmitter either at Racine or in the Burlington area for extended mobile-to-mobile capability.

It is recommended that the County remove the teletype from the dispatcher room. Teletype and telephone answering duties could be performed by a desk clerk outside the service dispatch area. A remote control unit could enable the desk clerk to supply directly to vehicles any information received on license checks and the like. Also, a dispatch point in the records could permit direct response for the information from the records area. With teletype and telephone answering duties removed from dispatch routine, the operator can concentrate more on basic duties of mobile coordination and assistance. Data from calls received would be submitted in written form to the radio room by the telephone clerk.

Alternate Considerations

It was recognized that mobile repeat installation could be accomplished without the use of the digital circuitry used to control the repeat function at the mobile units. A system could be arranged so that the mobile unit operator would activate a manual switch when leaving his car to place his repeater in operation. The danger of this operation is that if several cars arrive at a scene and they all operate in the repeat mode, the officers would receive garbled transmissions and the repeat capability would thus become ineffective. Proper system discipline would, however, require that the first car on the scene activate his repeater, but there is always a chance for a slip-up in this operation. Another scheme would be to equip only the commander's car with the repeat capability so that whenever a commander arrives on the scene he would place his car in the repeat mode. This, however, does not provide the protection needed by an individual officer when he leaves his vehicle and has the advantage of portable radio communications. With the plan presented, the portables become useful both to the township and the Sheriff, since a township officer can

leave his car with his transmitter set on the township channel and receive messages from the township. For extended portable-to-portable communication, the dispatcher can patch the portable receive channel to the base talk-out channel and thus portable-to-portable communication over many miles could be made, the route being from a portable to base to the second car out to portables in the vicinity of the second car. Lock-up is prevented by virtue of the fact that separate transmit and receive frequencies are used.

IV. CONCLUSION

It is felt that the plan presented allows the County to continue operating under its present plan and to add portable equipment to the system with a minimum of disruption. The advantage of all portables being the same permits units to cover the entire County and to communicate with one another or with units from out of the County operating on the WISPERN frequency. Sheriff's units which must operate with the Racine City Police Department can call police cars directly without waiting for a dispatcher to make a patch circuit. This greatly assists coordination of city and county units. When the portable unit is installed in the vehicle and a Sheriff's car is operating in the vicinity of the Racine City, the portable unit would serve as a mobile unit on the city frequency and all city calls would be heard. Diagrams attached indicate the various possibilities of communication in the system.

END

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