COMMUNICATION SITE

MANAGEMENT PLANS

HUALAPAI PEAK

HAYDEN PEAK

POTATO PATCH

ADDENDUM

ATTACHMENT 2

EXHIBITS G - Q

Exhibit G

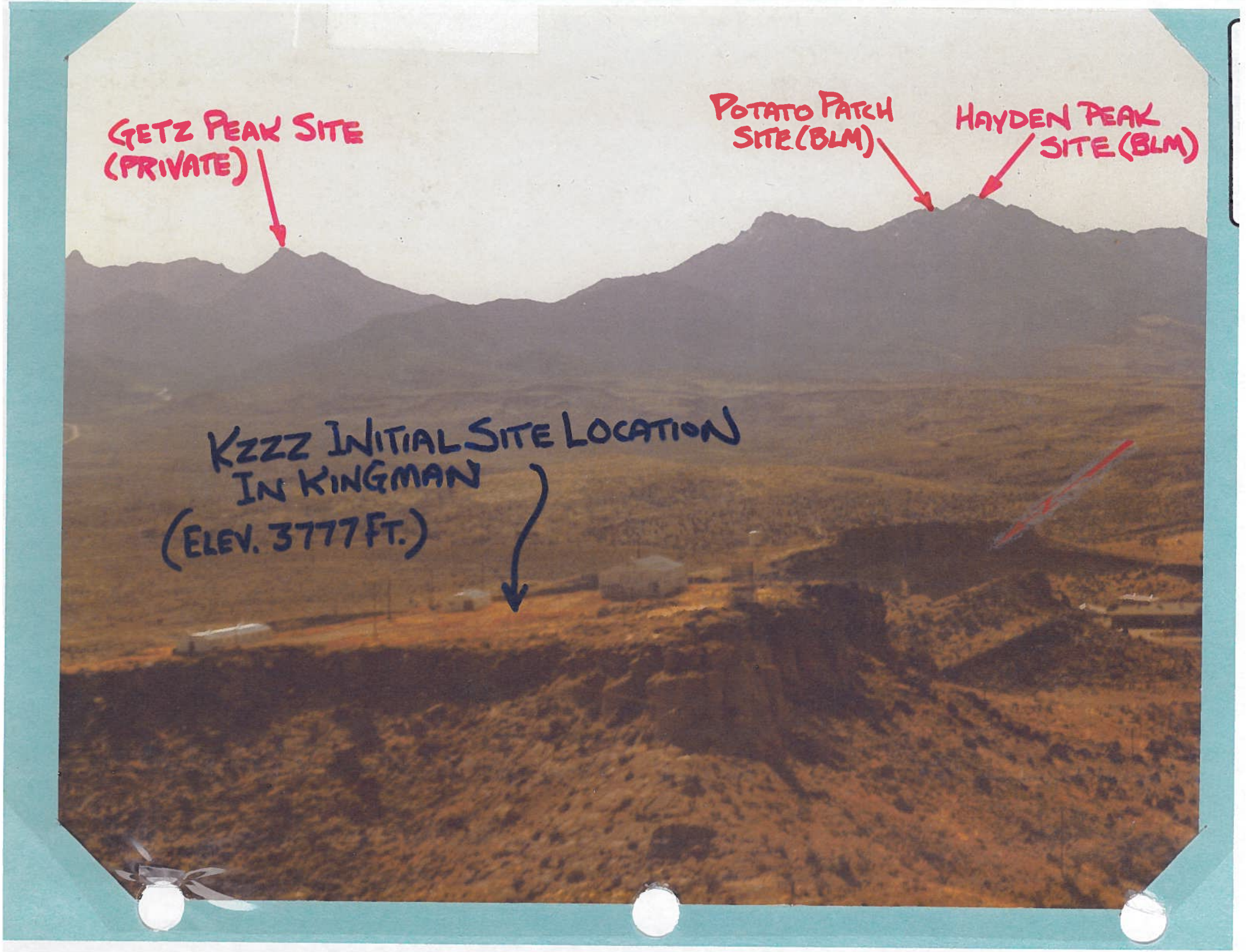

GETZ PEAK SITE
(PRIVATE)
POTATO PATCH
SITE (BLM)
HAYDEN PEAK
SITE (BLM)
KZZZ INITIAL SITE LOCATION
IN KINGMAN
(ELEV. 3777 FT.)

Exhibit H

December 18, 1984

Lannis J. Simpson
3801 Bern
Flagstaff, AZ 86001

Mike Thompson
Bureau of Land Management
Kingman Resource Area
2475 Beverly Avenue
Kingman, AZ 86401

Dear Mr. Thompson:

Enclosed please find recommendation report and exhibits E-1 through E-9 for consideration in your new usage plan for Hualapai Mountain.

Please advise if you need further information.

Very truly yours,

Lannis J. Simpson

LJS:gb

Enclosures

Exhibit H

RECOMMENDATION REPORT

HUALAPAI MOUNTAIN ELECTRONIC SITE

USAGE PLAN

By

LANNIS J. SIMPSON

For

BUREAU OF LAND MANAGEMENT

KINGMAN RESOURCE AREA

KINGMAN, ARIZONA 86401

DECEMBER, 1984

RECOMMENDATION REPORT

HUALAPAI MOUNTAIN ELECTRONIC SITE

PROPOSED TO BUREAU OF LAND MANAGEMENT

The purpose of this report is to present recommendations for consideration to the Bureau of Land Management, Kingman Resource Area, for protection of present communication users located at Hualapai Mountain electronic sites. Recommendations will be presented in four alternative forms for consideration and implementation into a proposed usage plan. Each alternative will have the expressed purpose of protection of present users of Hualapai Mountain. This protection is from harmful Radio Frequency Interference (RFI), protection from reduction of communication coverage, and protection from an increase in electromagnetic fields above present level due to continuous High-Power transmissions. This type of protection will prevent the future loss of capital investments by present users of the mountain electronic sites. These alternatives are only expressed as possible guidelines to Bureau of Land Management (BLM). The orderly growth of interference-free electronic sites depends on alternatives as stated in this report.

PROBLEM

The problem is a loss of effective communication coverage by present users if incompatible electronic sites are allowed to be

established by BLM on Hualapai Mountain. These incompatible users would increase RFI and electromagnetic field levels by continuous transmissions. This type of incompatibility may have possible effects on life, property and vital services to community such as police protection and control. The secondary problem is RFI protection from the present site users and their future growth. The problem will be in the form of increased frequency usage and its being available for intermodulation plus associated transmitter noise.

ALTERNATIVE ONE

The simple solution for BLM and its new USAGE PLAN is maintaining a status quo of present users. The operation and maintenance practices of user would go unchecked. Site maintenance would not remove rusty wire, nails or tin cans. Broken antennas would remain on site along with used tubes and excess wiring which remains unterminated. The building ground system would remain questionable as to proper grounding. Towers and butane tanks would also remain in their present condition, with grounding system condition unknown. The prevention of RFI would also remain at its present level. The present users are not required to install isolators or cavities to prevent RFI. There are no restraints on maximum power transmitted except the limitations of transmitter. Tower maintenance is also enforced so possibility of loose and rusted tower guying exists. Tower choice is also decided by user; guyed or the self-supporting style.

There are many advantages to this type of site usage. The present radio coverage is not reduced by cavities and filters. The capital investment of these devices is not incurred. The enforcement cost and time required to check on site usage is the biggest advantage of this alternative. There are not any rules or regulations to enforce.

The disadvantages are the eventual loss of effective coverage, increase RFI, and finally the entire loss of investment by the user.

The recommendation is to use this alternative as an example of present problems, if any, and provide means in usage plan to correct them if they do exist. Other mountain sites followed this alternative and now are in the process of solving interference problems.

ALTERNATIVE TWO

This alternative forms guidelines for present users and helps to prevent future problems. Site maintenance guidelines are the most important because it is the most often neglected by the site user. The cleaning up of all debris, and especially rusty metal such as nails, is most important. This will remove stray RFI sources. User should perform ground measurement tests on all site structures made of metal. The detection of any problem should be resolved by standard engineering practices. The site ground should be connected to commercial service ground throughout communication sites. User should attempt to remove any source of possible RFI.

This would include chain link fencing, rusted towers, guys and guy anchorings. A limitation on above ground wiring within boundary of sites should also be established. The use of unshielded wire should also be eliminated in communication usage.

Guidelines for reduction of equipment produced RFI should be established. The use of isolators, see Exhibit E-1, would be installed on all transmitters. This will be for protection of other site users. A cavity must be installed after isolator to prevent unwanted frequency transmissions caused by isolator. The reduction of output power to meet needed coverage should also be enforced.

The advantage of alternative two is a reduction of RFI and an establishment of a known reference point of minimal interference. This point will be established for future reference to determine the amount of RFI a user is causing. Another advantage is a protection of present radio coverage area. This is achieved by elimination of RFI sources which might cause future problems. These advantages will protect present investments of the user.

There are several disadvantages to alternative two. BLM will have to construct an agreement for site usage and provide enforcement on a yearly inspection basis. There will be capital investment required by present users in the form of isolators, cavities, self-supporting towers, if user has rusted guy tower, and state-of-the-art equipment for transmitters and receivers that can not be adjusted for elimination of RFI. The last disadvantage is the time required to implement alternative, time required to

solve any existing problems, and the time required to install required isolators after ordering them. The establishment of ground-noise-levels will require time also. This will be done after all users have cleared all RFI sources.

Recommend the incorporation of alternative two in the new site plan for Hualapai as a minimum standard to ensure a positive step towards maximum effectiveness of resources.

ALTERNATIVE THREE

This alternative forms guidelines for present users and future users as well. The implementation of alternative two or similar plan must be accomplished before additional site permits are issued. The establishment of ground-floor readings and reduction of any existing RFI must also be accomplished before any permit is issued. The new site permittee must prove valid reason for site and is required to be compatible with existing users. The compatibility requirement is the permittee's burden-of-proof. The permit will not be issued if any probability of RFI exists. BLM will then issue notice informing each user that a temporary permit is being issued and will allow thirty days for objection period. A temporary permit will be issued at the end of this period for duration of three months which will allow time to resolve any RFI problems. BLM will require all installations to be the state-of-the-art equipment on all new permit sites. The use of isolators and cavities would also be required. A self-supporting tower will be used to eliminate possible RFI from guy

wires. It will be new user responsibility to purchase any equipment necessary to eliminate induced RFI in existing equipment before permanent permit is issued. It would be the responsibility of current users to cooperate with new user to eliminate induced RFI.

There are three advantages to alternative three. The original user will have all RFI problems eliminated and, if new users are required to maintain same standards, it will be easy to maintain effective site usage. Alternative allows for progressive growth without possible depredation to every communication system on Hualapai Mountain. The plan will be easy to enforce with signed usage agreements and annual site inspections.

The disadvantages are enforcement and capital investment by the new users. The enforcement will be difficult unless usage agreement is void of any legal or technical mistakes. The cost of installation will have added burden of compatible proof and RFI prevention.

Recommend that alternative three be considered as the prime alternative in forming the new site usage plan because it has the necessary features. It protects the present users, allows for controlled growth, provides means for compatible uses of electronic sites, and provides means to solve present problems plus prevention of possible future problems.

ALTERNATIVE FOUR

This alternative forms guidelines by using alternative three recommendations, but establishes means for electronic systems that

are not compatible with present users. This is accomplished by the establishment of a two site system. The High-Power usage will be located at the highest possible elevation while the Low-Power is located at the lower levels of the mountain. This site plan causes vertical separation of incompatible users and will help to reduce desensitization of lower site receivers. Horizontal separation is not as effective as vertical. The next step is to establish agreement for users removal when receiver desensitization can not be resolved.

Alternative four has several advantages. BLM will have the ability to approve any applicant on a temporary basis. BLM also will have the ability to remove any applicant that induces RFI. The applicant will have designated site usage compatibility.

The disadvantages are cost and loss of protection for original user group. First applicant that is not compatible will be required to relocate original users to compatible site. This would be costly to applicant. The original user may lose system coverage that was experienced at the higher elevation.

Recommend Bureau of Land Management check with other government agencies on their decisions on incompatible electronic users. Please see Exhibits E-2, E-3.

DATA

Each mountain electronic site has its own unique characteristics. This problem makes RFI problems difficult to define prior to new transmitter installation. Once the applicant

is in place and RFI problems occur, it is hard to remove when large capital investment is involved. The data from RFI problems on other mountain sites can aid in the prevention of the same mistakes being repeated on Hualapai Mountain. Exhibits E-1 through E-8 present data on how different agencies resolved RFI problems. These data sources range from a technician, engineers of opposite views, RFI equipment manufacturers, site management, to judicatory views. The problem of RFI still exists as it does on Hualapai and its future. These potential RFI problems exist at all electronic sites, present and future. They remain silent until excited by a strong electromagnetic field such as the ones created by continous High-Power transmitters. This is the reason to require site maintenance by present users before new users create additional problems. The removal of site debris, building maintenance and equipment maintenance will help to eliminate these future problems.

SUMMARY AND CONCLUSION

User compatibility is a major problem when continuous High-Power and Low-Power occupy the same site. The High-Power station is in the business of sending out signals in a one-way format. The two-way business has to send, but it also has to receive in order to have effective communications. The site plan for Hualapai that includes two sites which have incompatible usages may work, but it does not protect present users and its two-way systems. The theory is good and may work, but only the

actual installation will prove either side of the question. At this point, the protection of original mountain site users may be forfeited which will necessitate their relocation to inferior mountain communication site.

The Bureau of Land Management, Kingman Resource Area, has the legal precedence to prevent reduction of present radio coverage caused by RFI and excessive electromagnetic levels by denying any applicant that can not prove compatibility with existing users. The applicant also has to present a justified reason to occupy Hualapai Mountain electronic site. BLM has an obligation to utilize electronic site resources in such a way that the mass majority is served while at the same time providing protection of investments for current users.

Exhibit I

Mike T,

ARIZONA DEPARTMENT OF PUBLIC SAFETY

NORTH 20th AVENUE P. O. BOX 6638 PHOENIX, ARIZONA 85005 (602) 262-8011

BRUCE BABBITT
GOVERNOR

RALPH T. MILSTEAD
DIRECTOR

January 28, 1985

Roger G. Taylor, Area Manager
Bureau of Land Management
Kingman Resource Area
2475 Beverly Avenue
Kingman, AZ 86401

Dear Mr. Taylor:

The State of Arizona, Department of Public Safety, operates a radio communications facility at the 10 Acre Potato Patch Site in the Hualapai Mountains.

The state agencies within this facility that we maintain communications systems for are as follows:

Arizona Highway Patrol
Arizona Emergency Medical Services
Arizona Department of Transportation
Arizona Game & Fish
Motor Vehicle Division
Criminal Investigations Bureau
Interagency communications with the State of Nevada

All of the above agencies are charged with protecting the public's safety and well-being within the State of Arizona, and the Hualapai Mountain site is the primary radio communications facility in Mohave County for these agencies.

In considering the application of KZZZ Radio for a high power (38 KW ERP) continuous duty station adjacent to our site, (approximately 200 feet) with a transmitting antenna at the same vertical elevation, we have determined there will be harmful degradation of our public safety 2-way radio systems.

Using the technical information from the KZZZ Engineering Exhibit, the Engineering Services Section of the Technical Communications Division completed an engineering study on the impact of a High Power FM Transmitter on our Hualapai Mountain facility. (See Exhibit #1.)

With the information from our engineering analysis and the actual received signal levels taken during tests in January 1985 (See Exhibit #2), it becomes apparent that the wideband transmitter noise will severely degrade our Public Safety 2-way communications systems.

Two-way radio coverage from the DPS Hualapai Mountain site (Potato Patch) is currently useable in approximately 98% of the design service area (Exhibit 3). Operation of the proposed KZZZ transmitter, meeting FCC standards for wideband noise emission, will reduce the effective radio service area to approximately

Exhibit 1

40% of design (Exhibit 4). Loss of this area is not acceptable. Alternative solutions to retain service area include:

1. Relocate DPS site in Hualapai Range, possibly to Hayden Peak, with transmitter filtering to exceed FCC minimum standards.
   Estimated move cost: $190,000 - $250,000.

2. Construct two new sites to compliment Hualapai site.
   Estimated cost: $200,000 - $350,000.

3. Broadcast station applicant demonstrate that wide-band emission in 4-50 MHz, 150-160 MHz, and 450-470 MHz bands, will be no greater than -120 dBm as received in DPS antenna systems.

We understand BLM's requirement to provide for the maximum utilization of the communications site by the greatest number of users with a minimum degree of conflict. The extent or severity of the interference in actual practice is unknown at this time but past experience shows that a serious potential exists for disruptive interference to us and other users of the site. We would like to recommend that the BLM maintain this communications site for low power 2-way and M/W systems and that the BLM provide for or assist with the location of high power FM and TV transmitters to a site for their specific use at a location further isolated from sensitive 2-way receiving equipment.

Ken Nelson, Supervisor
Communications Systems
Northern Area

KN:JB

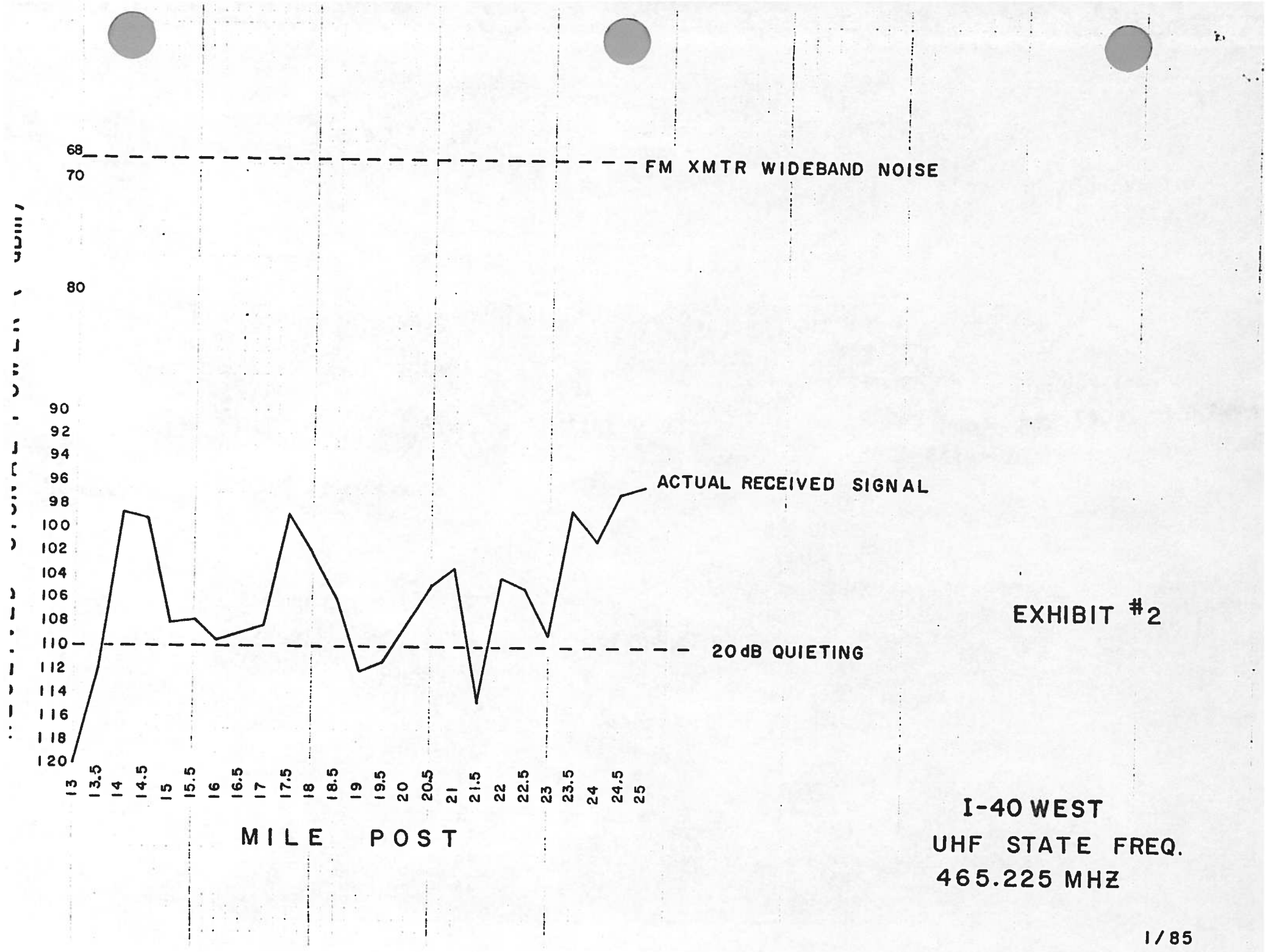
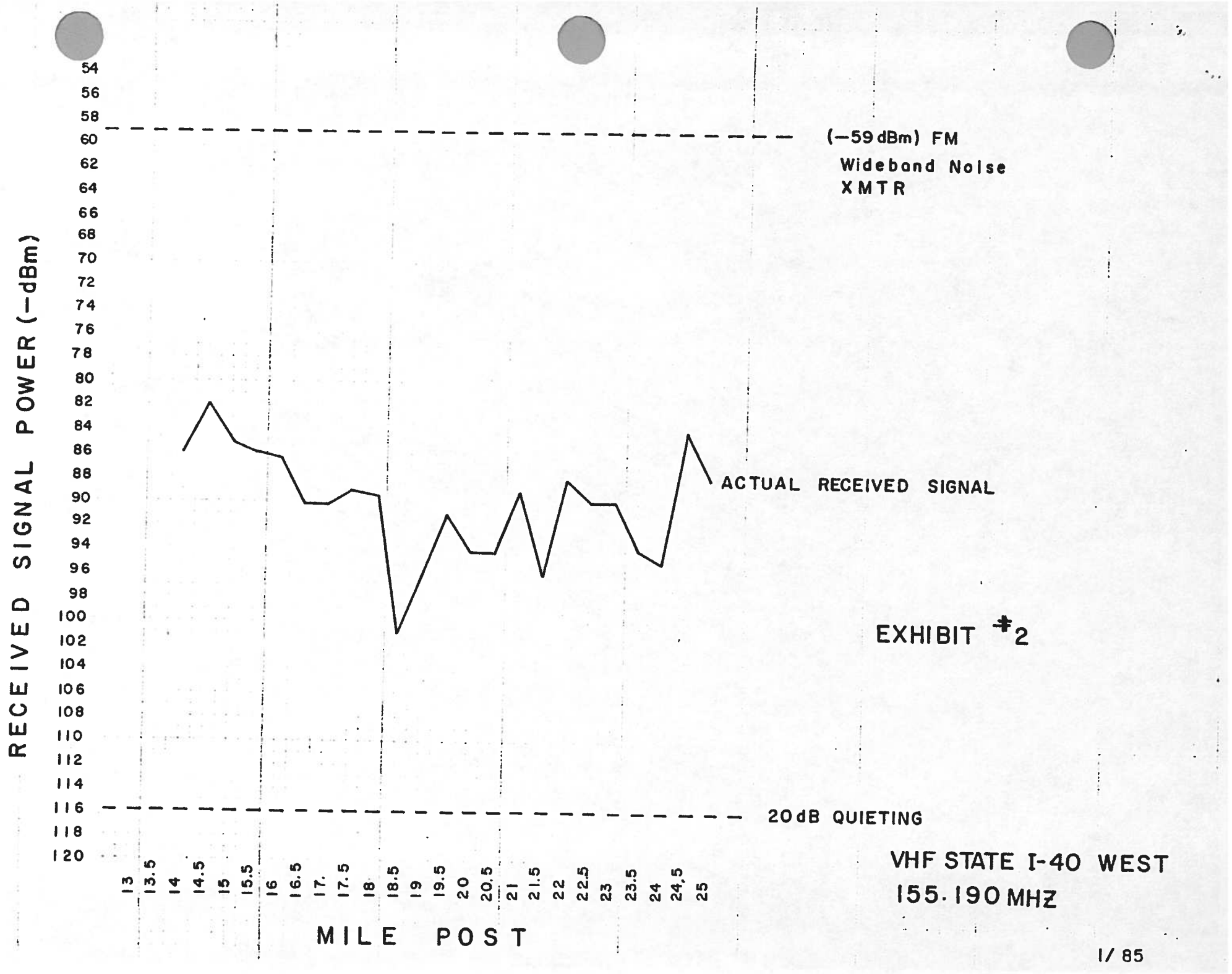


EXHIBIT #2

I-40 WEST
UHF STATE FREQ.
465.225 MHZ

1/85


RECEIVED SIGNAL POWER (-dBm)
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62
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86
88
90
92
94
96
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116
118
120
(-59dBm) FM
Wideband Noise
XMTR
ACTUAL RECEIVED SIGNAL
20dB QUIETING
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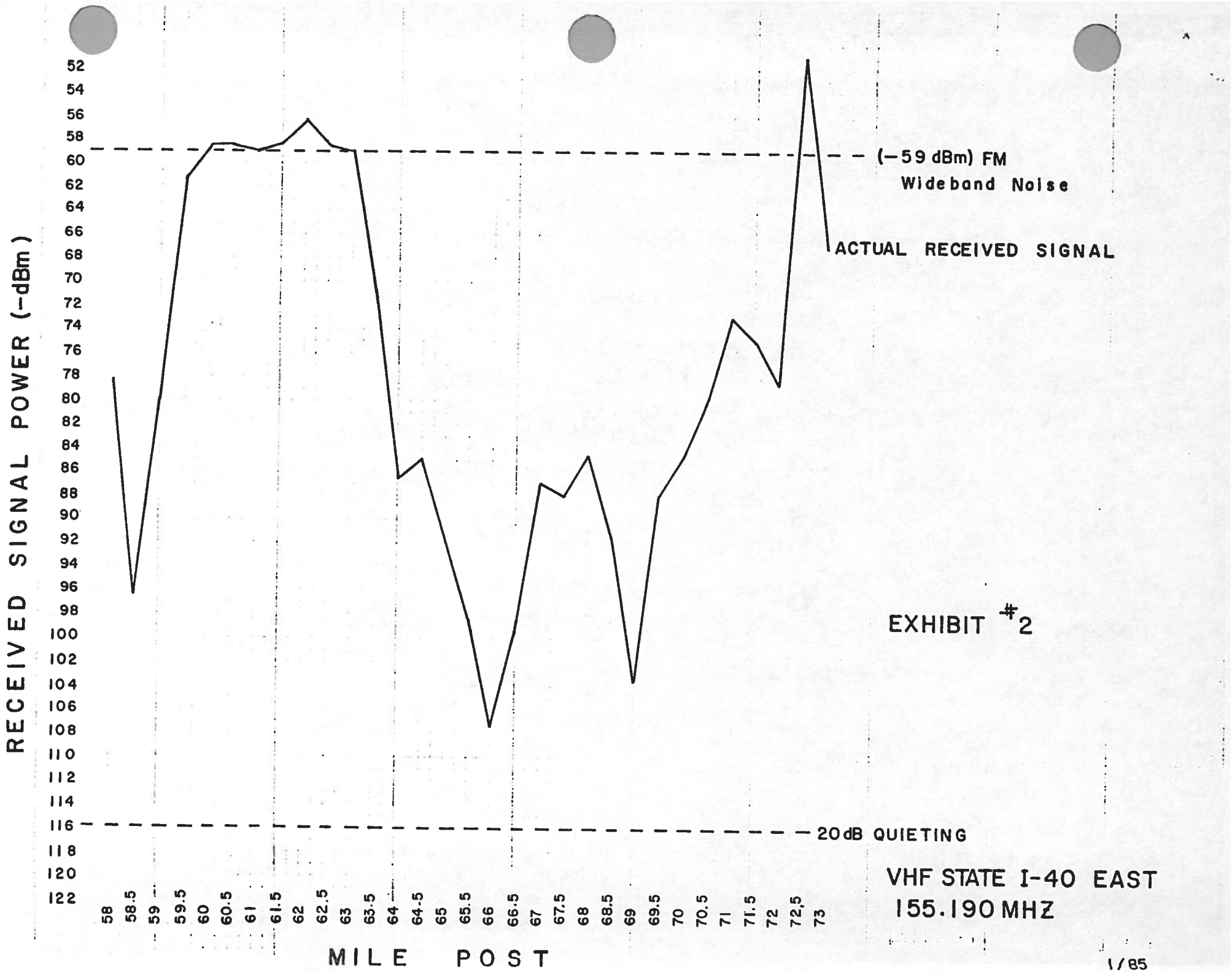
MILE POST
EXHIBIT #2
VHF STATE I-40 WEST
155.190 MHZ
1/85


RECEIVED SIGNAL POWER (-dBm)
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84
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(-59 dBm) FM
Wideband Noise
ACTUAL RECEIVED SIGNAL
EXHIBIT #2
20dB QUIETING
VHF STATE I-40 EAST
155.190 MHZ
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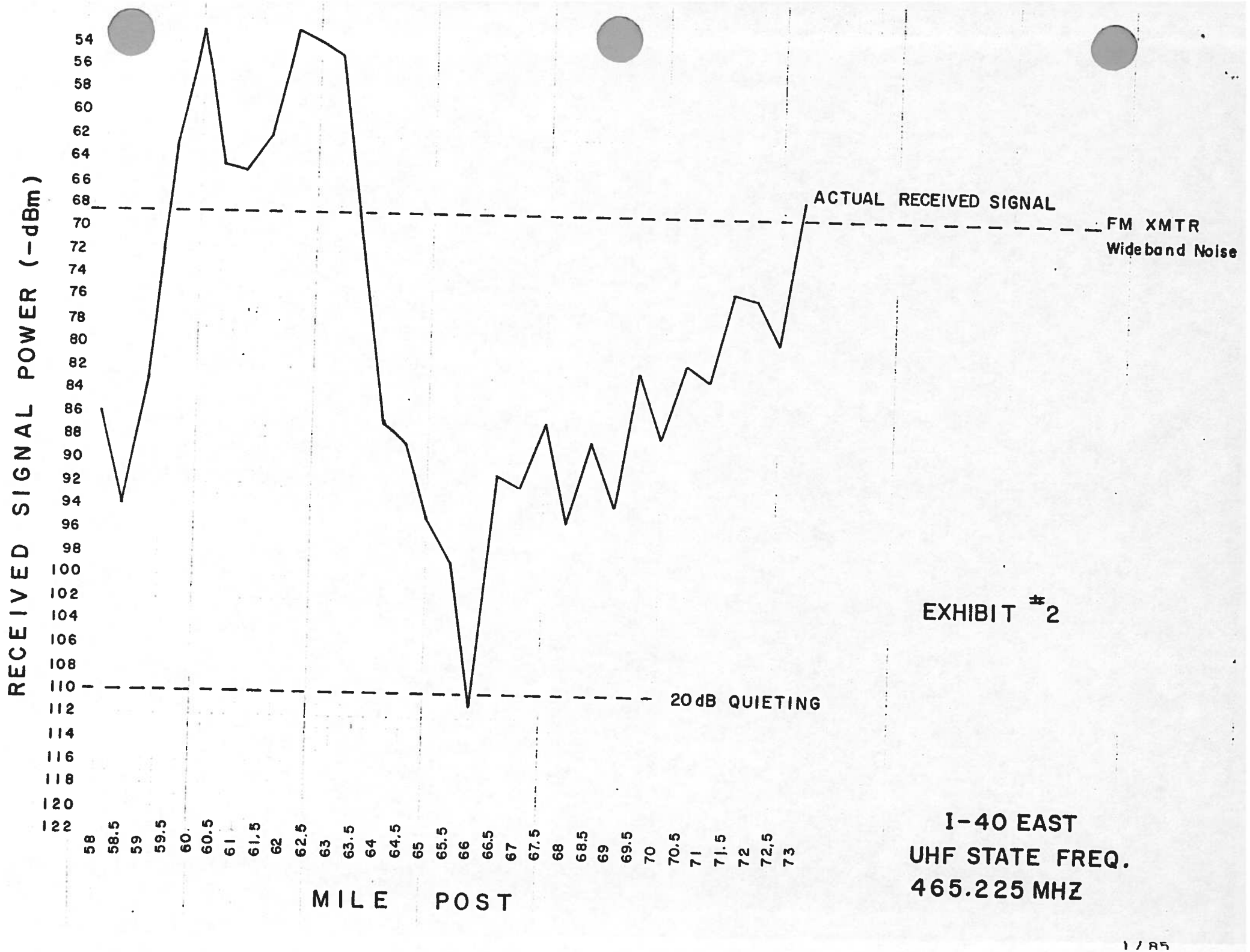
MILE POST
1/85


RECEIVED SIGNAL POWER (-dBm)
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ACTUAL RECEIVED SIGNAL
FM XMTR
Wideband Noise
20dB QUIETING
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MILE POST
EXHIBIT #2
I-40 EAST
UHF STATE FREQ.
465.225 MHZ

1/85

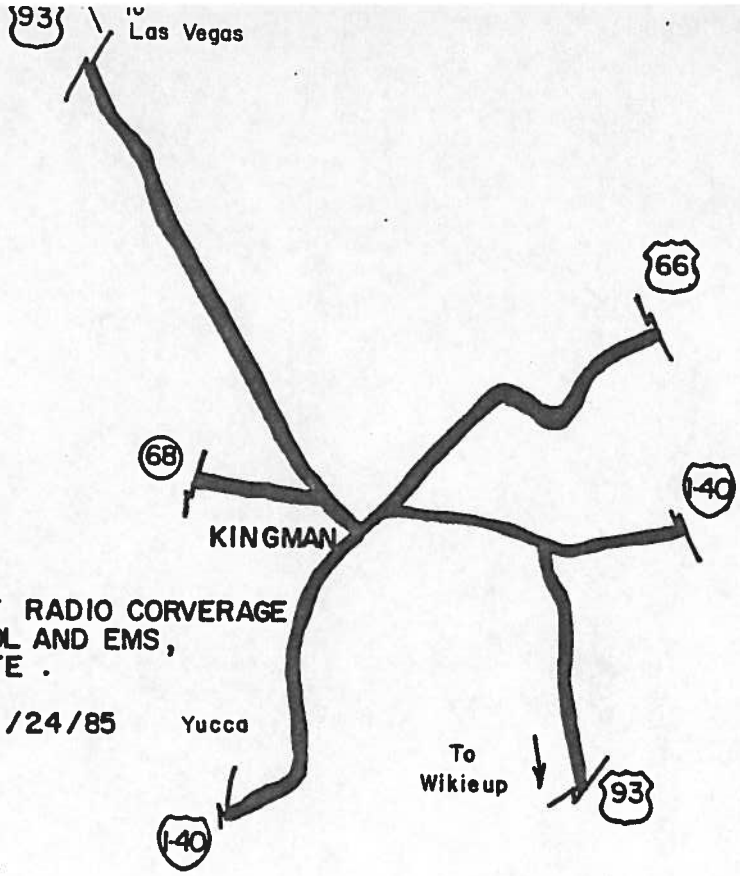


EXHIBIT 3

EXISTING TWO-WAY RADIO CORVERAGE FOR HIGHWAY PATROL AND EMS, HUALAPAI MTN. SITE .

1/24/85

N

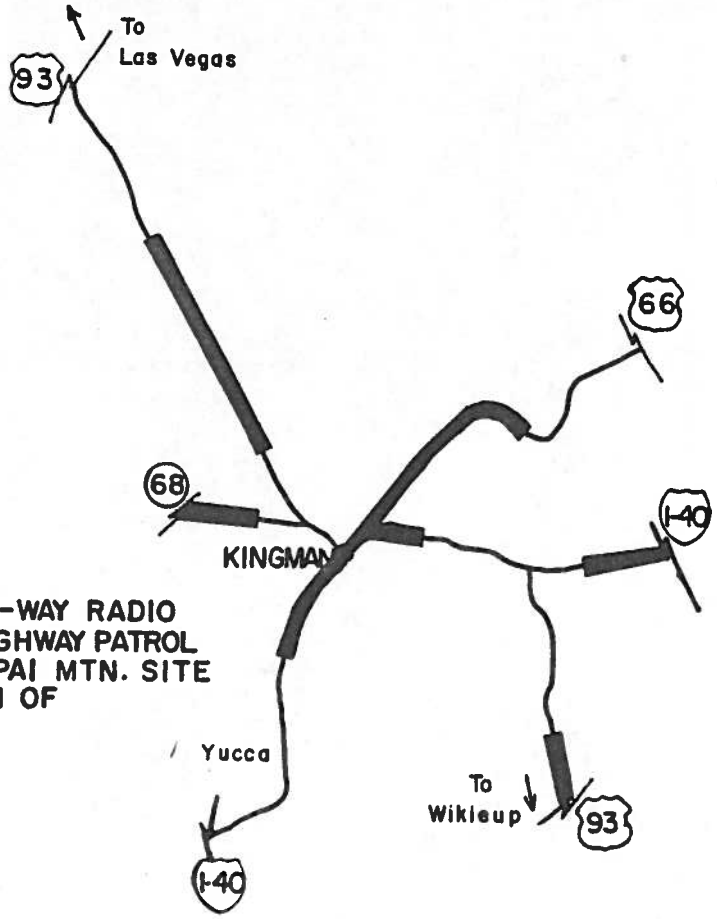


EXHIBIT 4

CALCULATED TWO-WAY RADIO COVERAGE FOR HIGHWAY PATROL AND EMS , HUALAPAI MTN. SITE AFTER OPERATION OF FM BROADCAST.

ARIZONA DEPARTMENT OF PUBLIC SAFETY

INTEROFFICE MEMORANDUM

RALPH T. MILSTEAD
DIRECTOR

DATE: January 28, 1985

TO: Ken Nelson, Communications Systems Supervisor

FROM: Bob Reynolds, Manager, Engineering Services Section

SUBJECT: IMPACT OF FM TRANSMITTER KZZZ ON HUALAPAI MOUNTAIN FACILITY

The Engineering Services Section has analyzed the impact of the installation of proposed FM station KZZZ adjacent to the existing two-way DPS facility on Hualapai Mountain. The high field intensities associated with KZZZ can cause significant interference problems when located near a two-way communications facility. These interference problems arise from the FM transmitter wideband noise and intermodulation products resulting from the FM transmissions mixing with transmissions from existing two-way stations. Receiver desensitization problems occur when the high power FM station overloads the receivers on the site. Test equipment is also adversely affected by the high field intensities, thereby making simple equipment measurements difficult. The purpose of this memo is to analyze the magnitude of these problems for existing DPS stations on the site.

Transmitter Wideband Noise

Transmitter wideband noise is a characteristic of all transmitters. Wideband noise may be defined as the ambient noise level generated by the transmitter outside of its normal bandwidth. The magnitude of the wideband noise in a well-designed transmitter is generally quite low compared to the carrier power level. This relationship holds true for broadcast transmitters as well. However, since the broadcast transmitter carrier power is generally quite high, the wideband noise level will represent a significant source of RF energy. This energy can fall directly on a receive frequency thereby interfering with normal traffic on that channel.

In their proposal, KZZZ states that they will comply with all FCC technical requirements when installing their 20 KW transmitter. One such requirement which specifically addresses wideband noise appears in FCC rules and Regulations Part 73.317(a)(14) (see attached). This particular rule requires that all emissions appearing more than 600 kHz from the carrier shall be attenuated at least $43 + 10 \log_{10}$ (power, in watts)dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation. Since KZZZ gave no indication in their proposals as to the noise levels from their transmitter, it must be assumed, as a worst case, that they will merely satisfy the FCC's requirements. Power levels reaching the various on-site receivers may then be calculated as follows (disregarding antenna gains):

Low Band VHF

Station affected: MVD at 44.66 MHz

Broadcast Station = 94.7 MHz
MVD = 44.66 MHz

Frequency Separation = 50.04 MHz

Broadcast Tx Power = 20 KW = 73 dBm

43 +10 log (20,000) = 86.0 dB

Therefore the FCC attenuation requirement is 80 dB.

The space attenuation for 200' separation at 44.66 MHz will be:

$36.6 + 20 \log F_{MHz} + 20 \log d_{mi}$

$= 36.6 + 20 \log (44.66) + 20 \log (200) \left(\frac{1}{5280}\right)$

$= 36.6 + 33 - 28.4 =$ 41.2 dB

Broadcast Tx = 73.0 dBm

Free space loss = -41.2 dB

FCC attenuation = - 80 dB

Received signal power = -48.2 dBm = 15.1 nW

Into a 50 Ω load $\left(P = \frac{V^2}{R}\right)$

$V = \sqrt{PR} = \sqrt{(15.1 \times 10^{-9})(50)} =$ 868.9 μV

High Band VHF

Station affected: VHF state at 155.190 MHz

VHF State Station = 155.19 MHz

Broadcast Station = 94.70 MHz

Frequency Separation = 60.49 MHz

Free space attentuation for 200' separation at 155.190 MHz will be:

$$36.6 + 20 \log (155.190) + 20 \log (200) \left(\frac{1}{5280}\right)$$

$$= 36.6 + 43.8 - 28.4$$

$$= 52 \text{ dB}$$

Broadcast Tx =	73.0	dBm
Free space loss =	-52	dB
FCC attenuation =	-80	dB
Received signal power =	-59	dBm = 1.26 nW

Into 50 Ω load:

$$V = \sqrt{(1.26 \times 10^{-9})(50)} = 251 \ \mu V$$

UHF

Station affected: D1 at	465.225 MHz
UHF D1 =	465.225 MHz
Broadcast Station =	94.700 MHz
Frequency Separation =	370.525 MHz

Free space attenuation for 200' separation at 465.225 MHz will be:

$$36.6 + 20 \log (465.225) + 20 \log (200) \left(\frac{1}{5280}\right)$$

$$= 36.6 + 53.4 - 28.4 = 61.6 \text{ dB}$$

Broadcast Tx =	73.0	dBm
Free Space Loss =	-61.6	dB
FCC attenuation =	-80	dB
Received signal power =	-68.6	dBm = 0.138 nW

Into 50 Ω load:

$$V = \sqrt{(.138 \times 10^{-9})(50)} = 83\ \mu V$$

The three receivers above are not the only ones which would be affected by the potentially high, although legal, spurious/noise levels emanating from the KZZZ transmitter. All other receivers would see similar levels.

Normal quieting on a receiver occurs with .5 microvolts of received signal. As can be seen from the calculations, on-channel emmisions are of sufficient magnitude to disrupt normal mobile to base communications.

One possible solution to wideband noise problems is to physically separate the offending transmitter from the vulnerable receivers. An example may be evaluated for moving DPS to Hayden Peak and allowing KZZZ to install their station at the Potato Patch Communications site:

Hayden Peak latitude	=	35° 04' 52"
Hayden Peak longitude	=	113° 54' 14"
Hayden Peak elevation	=	8,390'
Potato Patch latitude	=	35° 05' 39"
Potato Patch longitude	=	113° 54' 17"
Potato Patch elevation	=	7,680'
Horizontal separation	=	4,758 ft.
Elevation change	=	710 ft.
Elevation angle	=	8.5°

The contribution from the vertical separation in this case will be negligible. Free space attenuation for 4,758 ft. horizontal separation at 465.225 MHz will be:

$$36.6 + 20 \log (465.225) + 20 \log (4758) \frac{(1)}{5280}$$

$$= 36.6 + 53.4 - .9 = 89.1\ dB$$

Broadcast Tx	=	73.0 dBm
Free Space Loss	=	- 89.1 dB
FCC Attenuation	=	- 80 dB
Received signal power	=	- 96.1 dBm = 2.45×10^{-4} nW

Into a 50 Ω load:

$$v = \sqrt{(2.45 \times 10^{-13})(50)} = 3.5\ \mu V$$

Again, it should be noted that normal receiver quieting occurs with .5 microvolts of received signal. The signal received from the geographically separated KZZZ without additional filtering still exceeds this level.

Receiver Desensitization

Emissions not falling on the receive frequency may also degrade receiver performance. The high signal level associated with the main FM broadcast frequency may desensitize the two-way receiver so that it can not respond to normal traffic. Effective power levels hitting the receiver are given below. All three frequency bands (LB, VHF, α UHF) are affected the same. The actual amount of receiver desensitization is dependent on the internal design of a given receiver. Field tests are necessary to determine the extent of the receiver desensitization problem.

Receiver De-sense

Low Band VHF

Station affected: MVD at 44.66 MHz

Broadcast Tx power = 20 KW = 73 dBm

Free space attenuation for 200' separation at 94.7 MHz will be:

$36.6 + 20 \log F_{MHz} + 20 \log d_{mi}$

$= 36.6 + 20 \log (94.7) + 20 \log (200) \left(\frac{1}{5280}\right)$

$= 36.6 + 39.53 - 28.43 =$ 47.7 dBm

Broadcast power reaching the receiver front-end circuits:

Broadcast Tx =	73.0	dBm
Free space loss =	-47.7	dB
RF power level hitting the receiver =	25.3	dBm = .34 W

High Band VHF

Station affected: VHF state at 155.190 MHz

Same as above

UHF

Station affected: D1 at 465.225 MHz

Same as above

Intermodulation Products

Intermodulation products are a major concern at two-way communication facilities. With several transmitters occupying the same site, there is a possibility of two or more tranmitter frequencies mixing together to produce additional frequencies. These new frequencies, or intermodulation products, may fall in or near a receiver's passband causing harmful interference. The continuous duty, high power transmissions from the commercial broadcast station only enhance the generation of intermodulation products. With the high broadcast power levels the generation of intermodulation products can occcur not only in the receiver front-ends and transmitter output stages, but also in any metal to metal connection associated with the radio towers, fences, metal buildings, etc. No intermodulation products affecting DPS receivers were found to result from the KZZZ Station mixing with the transmitters listed in the Ellis α Associates Report. This list did not represent all users on the site. Intermodulation products to the 7th order were analyzed.

Equipment Maintenance

Equipment maintenance becomes difficult when there are large field intensities in the area. This situation presently exists at Phoenix South Mountain where most types of test equipment will not give valid readings. In this instance, maintenance must be performed using only basic test instruments such as an analog VOM. This severely limits the technician in performing his maintenance duties.

Summary

In summary, it can be shown that severe RF interference problems occur from the KZZZ station located adjacent to the DPS facility. The worst situation is with transmitter wideband noise. Severely degraded receiver performance can be expected. RF interference problems are often resolved for two-way equipment using cavities in the transmitter or receiver lines. Transmitter wideband noise may be resolved by using a cavity in the offending tranmitter's RF line. Similar equipment may be available for high power broadcast stations. KZZZ should demonstrate, theoretically, their ability to resolve these problems using commercially available equipment.

Another possible solution to reduce the wideband noise problem, is to physically locate KZZZ at a site away from the DPS facility. As illustrated above, placing DPS at Hayden Peak and KZZZ at Potato Patch does not totally solve the defined wideband noise problem. A combination of geographical site location plus the use of transmitter filters may be necessary.

Bob Reynolds

Bob Reynolds, P.E.
Manager, Engineering Services Section

Concurrence:

L. L. Hallman

L. L. Hallman, Manager
Technical Communications Division

RR:JB

cc: Mr. J. Toye

Exhibit J

Arizona Public Service Company
P.O. BOX 21666 • PHOENIX, ARIZONA 85036

February 22, 1985

Mr. Roger G. Taylor, Area Manager
Bureau of Land Management
Kingman Resource Area
2475 Beverly Ave.
Kingman, AZ 86401

Dear Mr. Taylor:

The purpose of this letter is to explain the Arizona Public Service Company's (APS) position on the operation of a high powered FM broadcast transmitter near our communications facilities on Hualapai Mountain.

Historically, similar type operations, such as Sandia Crest near Albuquerque, Lookout Mountain near Denver, Mount Sutro near San Francisco, Shasta Bally near Redmond, California and many others have encountered severe interference problems. Unfortunately, the interference is usually the result of high powered broadcast transmitters interfering with low powered land mobile and microwave facilities rather than the other way around. High powered FM and TV broadcast transmitters are likely sources of high ambient noise levels and intermodulation product (IM) interference. The noise will tend to desensitize nearby receivers thereby reducing the ability of distant transmitters to provide enough signal for reliable communications.

The IM type interference is usually the type that comes and goes depending on which combination of transmitters are transmitting at a given time. This type of interference is the result of the combining of two or more transmitter frequencies which generate a new frequency that can totally block a communications system. The probability of this type of interference occurring increases when one or more of the interfering transmitters transmits continuously, as is the case of an FM broadcast transmitter. Also, the probability of this type of interference occurring increases when one or more of the interfering transmitters operates at a high power, as is the case of an FM broadcast transmitter. Additionally, the probability of this type of interference occurring increases when one or more of the interfering transmitters operates on a wide channel width, as is the case of an FM broadcast transmitter.

Exhibit J

Generally, only 3rd order and 5th order IM type interference are of any consequence. Higher order IM products are possible, but rarely occur.

APS has performed an IM product study which includes only those interference cases that would affect APS communications on Hualapai Mountain. Interference that might occur to other users on Hualapai Mountain were not included in the study. Also, the study results were restricted so that only the new interference cases resulting from the proposed high powered broadcast transmitter be printed. The printout predicted that over 2500 potential IM interference cases were possible. Realistically, only a small percentage of these cases will likely result in interference serious enough to disrupt APS' communications, however, the potential for interference is high.

Usually, most interference cases are eventually resolved, or at least reduced in severity, but only after much expenditure of time and effort. Initially, the broadcast station operators are usually willing to cooperate to the extent of compensating the existing users for the time and materials necessary to resolve any interference cases. Unfortunately, this cooperativeness is short-lived once the initial interference cases have been resolved. Any low powered user adding to or modifying his facilities at a later time will likely find that any corrective action necessary to resolve broadcast-caused interference will no longer be paid for by the broadcast station.

Also, the probability exists that even though all of the initially detected interference cases have been resolved, additional undetected cases will show up at a later date. Frequently these interference cases occur intermittently and are difficult to find. They may continue for many years without ever being resolved. They tend to reduce the overall reliability of the affected communications system and sometimes occur at very inopportune times.

Reliability of APS' communications system is of the utmost importance. Our company operates and maintains a 500kV power transmission line supplying power to the Southern California Edison Company (SCE). The line originates from APS' Four Corners Power Plant in New Mexico and terminates at SCE's El Dorado Switching Station in California. A portion of this line is routed through Central Mohave County approximately 35 miles north of Kingman, Arizona.

The operation and maintenance of this portion of the line is controlled through Microwave, UHF, and VHF radio facilities located on Hualapai Mountain. Also, UHF and VHF communications facilities located in the Detrital and Kohinoor Springs areas are used by maintenance crews working in the remote areas where the transmission line is routed. These sites are operated through operational fixed UHF radio links controlled by the microwave backbone system passing through the Hualapai Mountain site.

The maintenance crew's only means of communications is through the communications facilities described herein. The type of work involved can be hazardous. Anyone injured in this remote area can be assisted by medically trained helicopter crews in less than 90 minutes, providing reliable communications are available. The only other means of reaching medically trained personnel would be to transfer injured workers with line maintenance vehicles. The trip could require up to four hours of travel time - much of which would be over rough terrain.

Another important factor to consider is the reliability of operation of the transmission line. Even a moment's interruption of the communications system could be disastrous as far as transmission line operation is concerned. The communications facilities on Hualapai Mountain are almost exclusively used in conjunction with power line operation. Types of communications used include protective relaying, telemetering, fault locating, supervisory control, telephone, and land mobile radio circuits. In fact, over 24 separate circuits are routed through the Hualapai Mountain communications facilities, all of which are either directly or indirectly used to maintain a reliable and efficient flow of electrical energy.

It is estimated that in the event of failure of the transmission line, the lost revenue to the utility companies using the transmission line would be approximately $30,000.00 for each hour the line is out of service. This does not include the loss of productivity of industrial and commercial customers or the inconvenience to everyone in the event a power outage occurs.

In summary, it is the opinion of the Arizona Public Service Company that the interference produced by the proposed FM broadcast station would likely compromise our communications system reliability. The consequences of this could endanger the lives of our workers and increase the chances of disruption of electrical service.

We request that the application submitted by KZZZ Radio for the operation of a high powered FM broadcast station near our communications facilities on Hualapai Mountain be rejected.

Sincerely,

Don Tellis

Don Tellis, Manager
Telecommunications and
Electronic Engineering

DT/NB:mc

Arizona Public Service Company
P.O. BOX 21666 • PHOENIX, ARIZONA 85036

April 23, 1985

Federal Communications Commission
Broadcast Bureau
1919 M Street
Washington, DC 20054

Subject: Opposition to Pending Construction Permit BPH830907AF
for Modification to Station KZZZ

Gentlemen:

The subject application, submitted to you by Mohave Sun Broadcasting, requests the relocation of their Station KZZZ to Hayden Peak, 11 miles southeast of Kingman, Arizona. The station is to operate in the FM broadcast band on 94.7 MHz with an effective radiated power of 25,000 Watts. The specific location of the station is to be within an area presently occupied by low-powered land mobile and microwave facilities.

It is the concern of Arizona Public Service Company (APS) and other users in the area that severe degradation in the performance of the existing communications facilities would result should the subject application be granted. High-powered FM and TV broadcast transmitters are likely sources of noise and intermodulation product type interference.

APS performed an Intermodulation Product (IM) Study which restricted only those products resulting from the addition of the FM broadcast station to the existing electromagnetic environment. Also, only 3rd and 5th order "hits" on APS' receive frequencies were considered. The results of the study predicted the possibility of over 2500 interference cases.

Realistically, only a small percentage of these cases will likely result in interference levels serious enough to disrupt communications, however, the potential for IM Product interference is still high. Also, broadcast stations, unlike land mobile communications stations, operate at a 100% duty cycle at high power levels and wide bandwidths which will increase the probability of interference.

The Hayden Peak, Potato Patch and other nearby communications sites serve not only the Kingman, Arizona area, but also serve thousands of square miles in the remote areas of Mohave County. The Arizona Public Service Company, for example, has land mobile and operational fixed microwave facilities at one of the nearby sites. These facilities provide the communications required by maintenance crews working on power transmission lines in northern Mohave County.

Because of the rough terrain and long propagation distances, the mobile radios used by these crews provide only marginal signal strengths at APS' communications site. The addition of the new FM broadcast station will not only generate IM Product interference, but will also increase the ambient noise level and desensitize receivers. The already weak signal levels will likely be obliterated. Important and even vital communications would go unheard. Such lost communications could disrupt electrical service or even endanger the lives of the transmission line crews.

It can be argued that receiver desensitization, intermodulation product generation, spurious emissions, etc., can all be corrected through the judicious use of filters, isolators, etc. Unfortunately, the use of such devices has several technical drawbacks, the worst of which is the insertion loss they introduce. Typically, insertion losses of 6 dB or more are not uncommon and result in greatly reduced receiver sensitivity and/or transmitter power. Again, already weak signals will be further attenuated through the use of these devices resulting in lost communications.

In summary, it is the opinion of the Arizona Public Service Company that the interference produced by the proposed FM broadcast station would likely compromise the reliability of the existing communications system in the Hayden Peak area. We, therefore, request that the subject application be denied.

Sincerely,

Don O. Tellis, Manager
Telecommunications and
Electronic Engineering

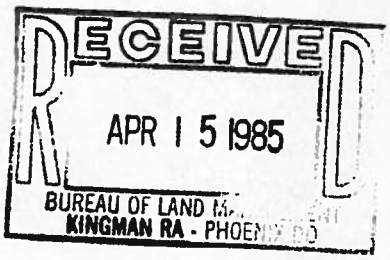
DT/NB:mc

Exhibit K

El Paso
Natural Gas Company

P. O. BOX 1492
EL PASO, TEXAS 79978

PHONE: 915-541-2600



April 11, 1985

United States Department of the Interior
Bureau of Land Management, Kingman Resource Area
2475 Beverly Avenue
Kingman, Arizona 86401

Gentlemen:

This is to protest the proposed construction of the transmission facilities for Mojave Broadcasting Company's FM Station KZZZ on a site on Hayden Peak near Kingman, Arizona. The engineering report submitted by Mojave Sun Broadcasting for construction and station licensing refers repeatedly to interference and intermodulation products which are the very problems which El Paso envisions.

As you are probably aware, El Paso Natural Gas Company for more than 50 years has operated an interstate natural gas pipeline system including three large-diameter pipelines and related facilities in the Kingman area. El Paso's pipeline system serves five western states including all of California. It is imperative that El Paso maintain consistent and clear communications with its personnel who are responsible for the system operation. It was our desire to improve our communications capability which led to the construction of our microwave and VHF base station on Hayden Peak in the early 1950's. The threat of possible disruption of our service through a communications mishap is of grave concern. Particularly during the winter months a disruption of service could cause serious hardships to schools, hospitals anad private homes.

Mojave Sun Broadcasting has attempted to justify their application for locating an FM broadcast transmitter at Hayden Peak, AZ by claiming that high power (broadcast) and low power (two-way/microwave) installations routinely coexist at a common electronic site, with nonexistent or readily correctable detriment to the low power users. Experience, however, does not support such a statement. Though high and low power users are frequently forced to share a strategic location as a result of economics, geography, or other situations, it is always with the compromise of performance on the part of the low power two-way user. That many two-way users are forced to live with degraded performance in a situation they cannot control does not mean that the degradation does not exist.

Exhibit K

Regardless of how "clean" a transmitter (and its associated installation) are made, the increase in RF radiation density it contributes serves to raise the "noise floor" at the site, and hence reduce the effective sensitivity of all receivers, along with the effective range and coverage of their associated communications systems. In analogy, there is no problem seeing across a room occupied by several smokers; setting the trash can afire is another matter indeed. Similarly, any potential seat of intermodulation (non-linear junction) is more likely to generate undesirable mixing when imbedded in a high density RF field such as produced by a high power broadcast transmitter. Mojave Sun Broadcasting's claim that their proposed antenna system will not cause high field intensities in the space occupied by the other Hayden Peak installations is based on theoretical calculations that do not take into account the existence of other "real world" objects in the area that will tend to reflect signals and otherwise alter the idealized situation.

Mojave Sun Broadcasting's intermodulation study (which already points up a dismaying number of potential intermodulation products) fails to take into account the wide bandwidth of the broadcast transmitter. Not only does the broadcast transmitter sweep 75 KHz either side of its base frequency (the intermodulation study as presented only treats products within 50 KHz of narrowband systems) but when harmonics are involved, this 75 KHz is further multiplied (the second harmonic sweeps +150 KHz, etc.) expanding the list of potential harmful mixes virtually beyond tabulation.

The BLM has suggested the possibility of moving the existing Hayden Peak antennas to Mojave Sun's tower. This situation is unacceptable to us. Any advantage gained by locating directly in the shadow of the FM broadcast antenna would be offset by increases in interference due to the extreme proximity of antennas and transmission lines, and/or degradation resulting from disadvantaged antenna location. The tower under consideration is too small to offer optimum antenna location to all, especially considering the directional requirements of microwave systems. Additionally, the structure has presumably been engineered to accomodate the FM broadcast antenna. The addition of a large number of additional antennas, including large microwave dishes, will greatly increase the wind and ice loading, thus reducing the safety and reliability factors for the entire tower. Provided that all existing antennas could in fact be crowded onto the single structure in a manner acceptable to all (which seems unlikely,) there would be little if any room for future expansion, ultimately necessitating additional towers, which defeats the intent and purpose of such a consideration.

Mojave Sun Broadcasting has referenced "well established" "thoroughly proven" techniques for interference resolution. Unfortunately, the actual implementation of such techniques is considerably less effective than they would lead us to believe. Offending sources of interference, be they frequencies or nonlinear junctions (including but not limited to transmitters whose frequencies are or are not involved, cable connectors, tower bolts, door hinges, and debris) can be frustratingly elusive and undetectable by spectrum analyzer or other conventional equipment. The identification of interference sources is rarely swift, positive, or easy, and their elimination is never necessarily permanent because the idealized conditions prevalent in theory can be neither achieved or even maintained in reliable approximation in the hostile environment of a mountaintop.

"Equipment susceptibility" is a very relative measure. Though all Hayden Peak Association members have committed to reasonable protection of their equipment from stray interference, Mojave Sun Broadcasting seems to suggest that existing users might be forced to carry the burden of upgrading equipment in order to cope with the elevation in "noise floor" caused by the FM transmitter, even though the equipment is more than adequate to operate in the present "low power" environment.

Though many interference problems can be reduced through the addition of pass cavities or notch filters, it should be noted that performance is degraded by the introduction of such devices because their inherent insertion loss characteristics decrease overall receiver sensitivity, proportionally to the amount of filtering provided. Though theory can suggest what filtering might be required, the effectiveness of such devices in actual practice can only be determined after the equipment has been purchased and installed. It should be noted that cavities and filters applicable to our low band communications repeater are approximately eleven feet long, and cost typically $600 to $1500.

Since interference involving "third party" equipment that results when formerly dormant noise sources are awakened by the increased radiation density produced by the broadcast transmitter would probably not be considered a "direct result" of the broadcast transmitter, we anticipate expensive, time costly problems for which we have no practical recourse. Over and above this, there may be no guarantee of recourse, should unacceptable interference conditions arise which Mojave Sun Broadcasting cannot or will not correct. It should further be noted that the isolation and/or identification of interference problems is frequently time consuming, and delivery times for the filtering equipment necessary to alleviate a problem can also be very long. Once the broadcast transmitter is on the air and operating, there is no practical mechanism for removing it. Traditionally, while

difficulties are being researched, isolated, and corrected (if even possible) the low power offended user suffers that loss of communications while the broadcaster suffers not at all, and has no incentive to expedite correction.

Mojave Sun Broadcasting has indeed offered their assistance in remedying interference problems; unfortunately, however, broadcast engineers typically have limited experience with or understanding of the problems characteristic of low power two-way systems. Broadcast equipment is concerned principally with the transmission of RF power, the only necessary receiver being the studio-transmitter link (typically microwave). In order to maintain broadcast quality information, the studio-transmitter link must produce a high signal level at the mountaintop receiver. In contrast, the low power user must deal with extremely low signal levels, especially at a remote site such as Hayden Peak, which must accomodate large geographical distances and receive signals from comparably low powered units in the field. Such systems routinely process signals of a few tenths of a microvolt, levels with which a broadcast engineer rarely deals.

Because of the vast differences in their modes of operation, and because it is almost always the low power user who suffers the interference, a basic inherent incompatibility will always exist between high power broadcast and low power two-way users. If the BLM establishes Hayden Peak as a high power electronic site by permitting KZZZ FM to locate there, then additional broadcast interests cannot be excluded in the future. Nor can the BLM guarantee the agency's future policies regarding problem resolution. With each introduction of high power, all potential problems treated herein (as well as in Mojave Sun Broadcasting's proposal) will be exponentially compounded. Interference which would (in the case of a single high power transmitter) be simply time costly and expensive to isolate and correct can quickly become impossible, as is all too often the case at various existing congested mixed sites.

The rapid population expansion in this area of the country (evidenced by the application for a commercial broadcast station to serve it) can only lead to an increased demand for two-way communications, data transmission, microwave, mobile telephone, and broadcast installations as well to meet the growing communications needs of the population base. Hayden Peak is a very small site, with little option for expansion, requiring in all probability major improvements in both access road and electric power line in order to accomodate any significant escalation in usage. If the surrounding population base continues to increase at its present rate, an alternative site (to Hayden Peak) will ultimately become necessary, probably in the very near future. If a second site, a road, and a power line are ultimately going to be required anyway, we strongly recommend

that the new site be established now, and opened exclusively to broadcast usage. Such foresighted and judicious planning on the part of the BLM would circumvent the inevitable conflicts arising from high power/low power incompatibility, both now and in the future, and would provide for the optimized and most cost-effective operation for both low and high power interests, and in so doing would best serve the public need as well.

El Paso Natural Gas Company believes that in view of the needs of FM-KZZZ and possible problems which could be caused by the station, that a new site be found that would accommodate KZZZ's requirements while preserving the integrity of the Hayden Peak facilities. It is safe to assume that interference problems that could be caused by commercial broadcasts could have a serious and possibly service threatening effect upon El Paso's interstate pipeline transmission system.

Donald N. Bigbie
Vice President, Southern Division

Exhibit L

DEPARTMENT OF ENERGY
Western Area Power Administration
Phoenix District Office
P.O. Box 6457
Phoenix, Arizona 85005

MAY 16 1985

IN REPLY
REFER TO: H8000 (Ashton)

MEMORANDUM FOR ASSISTANT ADMINISTRATOR FOR POWER MANAGEMENT AND
OPERATIONS AND MAINTENANCE, GOLDEN, CO
ATTN: A6220 (HANSON)

SUBJECT: PROPOSED RELOCATION OF A CLASS A FM TRANSMITTER TO HUALAPAI MOUNTAIN

Mohave Sun Broadcasting has applied to the Federal Communications Commission (FCC) and to the Bureau of Land Management (BLM) to move their KZZZ FM broadcast transmitter location to Hayden Peak, our Hualapai Mountain radio repeater site. A mountaintop users' group has been formed for that site and for Potato Patch, the other site in the Hualapai Mountain vicinity. The Hualapai Mountain Users' Group Technical Committee has responded to the BLM about the expected impact to the site if KZZZ were to locate there. The impact on Western, though, needs to be brought to the FCC's attention directly.

The proposed FM broadcast installation would have significant adverse impact on Western's Power System Communications as well as the Bureau of Reclamation's Colorado River Control System. The extraband spurious and harmonic emissions would overwhelm our radio receivers' front ends, the tower location would preclude parking at our site, and at least one intermodulation product, which would result from the addition of their transmit frequency at the site, will interfere directly with our Power System Radio frequency.

All of the existing transmitters on Hualapai are low-power two-way or TV translation equipment. Even so, there are already some intermodulation products which occasionally cause some users problems. With the addition of a 25.226kW (ERP) continuous-duty FM transmitter, the noise power density would be significantly increased, and the frequency and severity of intermodulation-related problems would increase for all users. Specifically, at Western's tower, KZZZ's extraband spurious emissions in the range of our Power System radio could reach our antenna at up to -43.1dBm, or 1.57 millivolts. In contrast, a typical mobile's signal is received at -100dBm, or 2.24 microvolts. Our squelch threshold for optimum performance is -115dBm, or 0.5 microvolts. Therefore, if KZZZ's transmitter had any spurious outputs near our receive frequency, our desired signals would obviously not be received. The receiver would break squelch due to high noise levels, and if it were adjusted not to squelch, the noise would still override the signal.

Exhibit L

The consulting agency which conducted KZZZ's compatibility study had not visited the site when they called Western to correct the frequencies in their study. Instead, they used a rough sketch as their plat of the tower site. The sketch they used was made by BLM for them to give them an idea of what the site was like. It was neither to scale nor complete. One of the details not evident on the sketch, which a site visit would have revealed, is that the proposed tower location is the only spot on the mountain where a vehicle can be safely parked. It is also directly in the middle of the access road. Clearly, it is not in anyone's best interest, including employees of KZZZ, to have no level place to park one's vehicle, considering the snow and ice conditions which occur on Hualapai.

As the tower location shows insufficient study of the physical compatibility aspects of KZZZ's proposal, so the intermodulation studies show insufficient consideration of the impact of the intermodulation products which will result from the addition of their transmit frequency at the site. The bandwidths considered were chosen for their economy of computer time, rather than for accuracy of results, as the engineering firm themselves explain in their Exhibit 280, pg 3, para 2. KZZZ's bandwidth in their first harmonic must be 150kHz, 75kHz on either side of their center frequency. Only 50kHz total was used for calculation of intermodulation products. Also, their program does not flag products which are close enough to interfere, only those "hits" exactly coinciding with an existing frequency. These program shortfalls were not compensated for by a thorough review of the output data. Even where many direct hits were found, the potential impact of those hits was not fully and carefully considered. For example, in Exhibit 290, pp 14 & 15, their "summary of possible interference", only direct hits on TV stations are listed. Not listed as possible interference are all the frequencies which will impact existing two-way receivers (e.g., 6*KZZZ - TX007 = RX058 + 25kHz, or 5*KZZZ - 2*TX014 = RX006 - 10kHz).

Of particular concern to Western is the fact that our Power System VHF transmit frequency and the Bureau of Reclamation's River Control System VHF receive frequency were omitted altogether from the calculations, and our receive UHF frequency was entered as 414.825 instead of 414.325, so the true impact to Western cannot be represented accurately by KZZZ's study. Even with these oversights, there are several intermodulation products which fall within range of our receivers and would probably require sensitivity degradation and the addition of filtering, thus reducing our geographical coverage.

Three intermodulation products must be noted because they are within our receiver passband and cannot be filtered out or blocked. 169.125=A+B-2C (where A is KZZZ's frequency and B and C are frequencies of two existing transmitters), 169.080=2B+C-A, and 169.105=C-(A+B) all involve combinations of fundamental and second harmonic frequencies, so the level of these products is significant, and all are too close to our center frequency to avoid. None of these products were cited by Wiebe & Ellis, KZZZ's consulting firm, as a problem or even a potential difficulty. Any one of these third-order combinations will disable our communications whenever it occurs.

This matter needs to be brought to the FCC's attention so that KZZZ's application to change their construction permit will not be approved. If their application is approved, KZZZ will hold that the FCC has certified their compatibility and that their right-of-way should automatically be approved. Under sufficient legal and public pressure, BLM may decide to ignore the obvious technical consequences detailed herein, and approve KZZZ's right-of-way application. The FCC is in a better position than BLM to understand the effects on our system that KZZZ's proposal would have, so FCC officials need to be made aware of the pertinent characteristics of this site. Also, the potential loss of life, electrical service, and damage to equipment should be explained to the appropriate persons at the FCC. When the communications lifeline to our crew personnel working under hot line orders and clearances has potential for being broken, we are seriously concerned.

David O. Onstad
District Manager

Attachment

cc: G2400 (Ross) w/cy atch

Bureau of Land Management
Mike Thompson
Realty Specialist
2745 Beverly Ave
Kingman, AZ 86401

Exhibit M

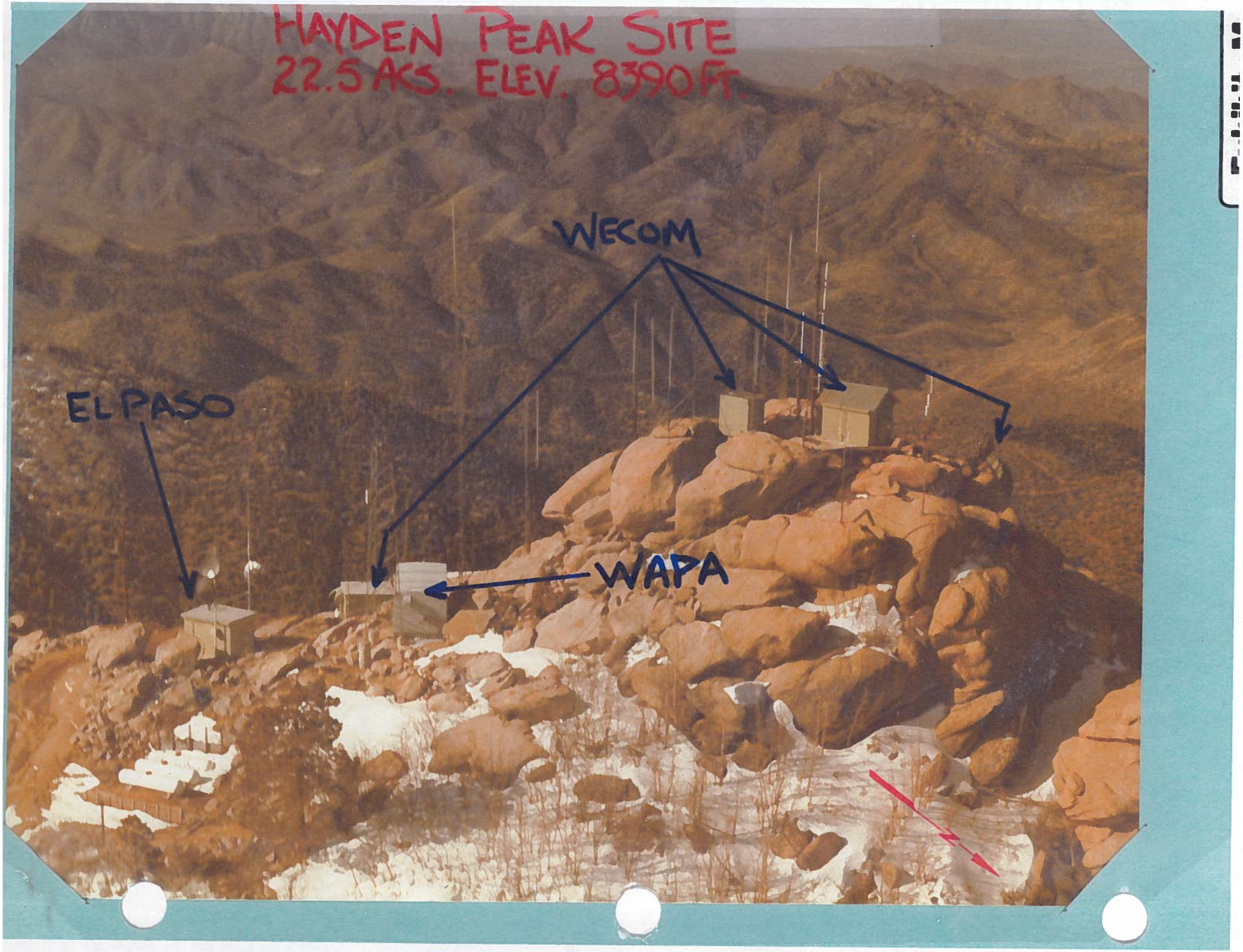

HAYDEN PEAK SITE
22.5 AKS. ELEV. 8390 FT.
WECOM
EL PASO
WAPA

Exhibit N

HAYDEN PEAK SITE

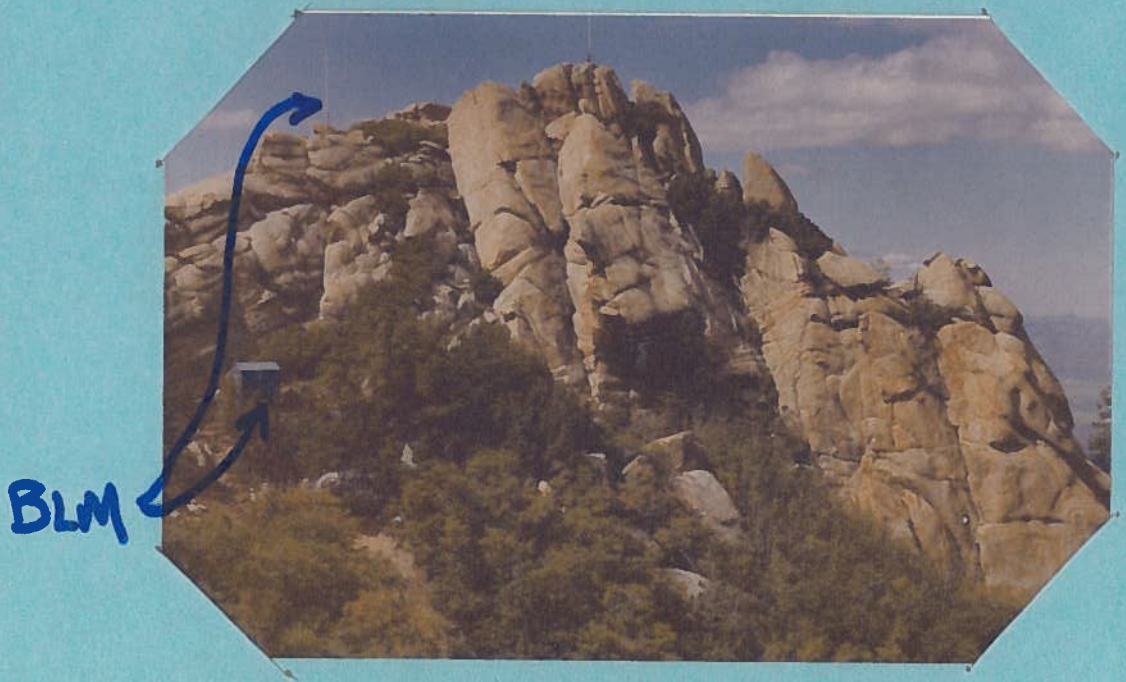


Exhibit N

Exhibit O

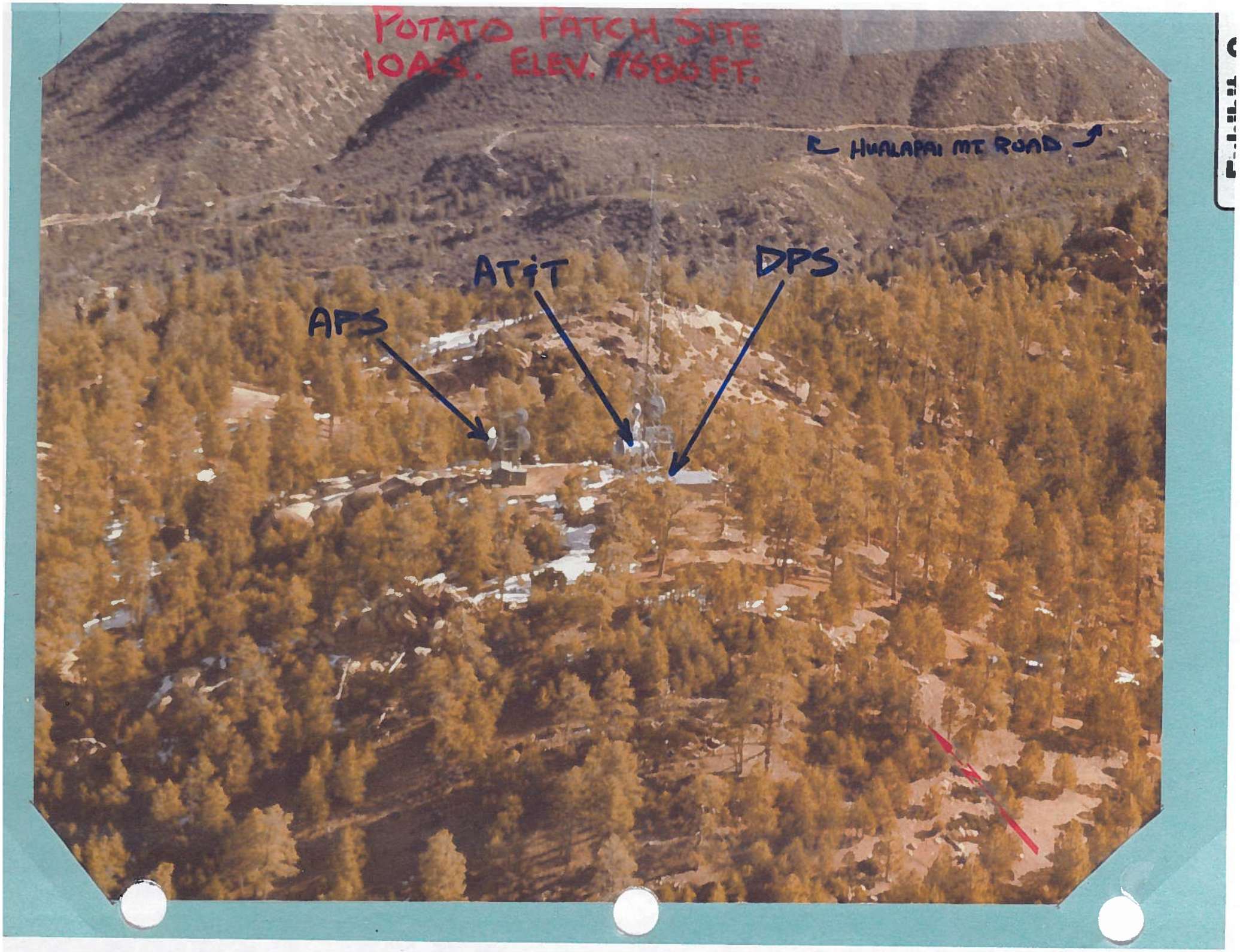

POTATO PATCH SITE
10 ACS. ELEV. 7680 FT.
HUALAPAI MT ROAD
APS
AT&T
DPS

Exhibit P

Exhibit P

Exhibit Q

Exhibit C