Attachment 2

ExhibitA-1_Vol_IofV_SystemDesign

E.F. JOHNSON COMPANY

Agreement for Services of Independent Contractor: System Equipment and Installation

Exhibit A: Scope of Services

Exhibit A-1: Revised Proposal Documents/Volume I of V

Volume I Components: System Design, System Drawings, Rack Drawings, RF Design, Radio Coverage Prediction Maps, Microwave Path Design

May 1, 2021

V 2.1

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JVCKENWOOD

This symbol indicates EFJohnson's response

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May 1, 2021

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A-1.1 System Design

E.F. Johnson Company's (JVCKENWOOD's) P25-compliant 19-site UHF P25 Phase II Trunked subsystem, 18-site VHF Conventional subsystem, and 7-Site 800 MHz P25 Phase II Trunked subsystem for Santa Barbara County, CA (the County) are based on a modern, Internet Protocol (IP)–based solution that utilizes our patented Latitude™ technology. Eighteen (18) of the nineteen (19) UHF trunked sites are co-located with the VHF Sites.

An overall view of JVCKENWOOD's ATLAS P25 System design, including the system architecture, components, and features, are provided in the following sections.

Site Name	Latitude	Longitude	VHF	UHF	800	Microwave Only
Admin	34.4251	-119.7035	☒	☒	☒	☐
Betteravia	34.9217	-120.4290	☐	☐	☐	☒
Comm Center	34.4444	-119.7771	☐	☐	☐	☒
Figueroa Mtn	34.7434	-119.9850	☒	☒	☐	☐
Fire Station 24	34.7452	-120.2798	☒	☒	☐	☐
Fire Station 41	34.9432	-119.6767	☒	☒	☐	☐
Gaviota	34.5137	-120.2312	☒	☒	☐	☐
Harris Grade	34.7386	-120.4458	☒	☒	☐	☐
Heritage Oil Platform	34.3517	-120.2678	☒	☒	☐	☐
La Cumbre Peak	34.5003	-119.7211	☒	☒	☒	☐
Lompoc Civic Center	34.6382	-120.4532	☒	☒	☐	☐
Mount Solomon	34.8348	-120.3832	☒	☒	☐	☐
Mount Abel	34.8291	-119.2039	☐	☐	☐	☒

Site Name	Latitude	Longitude	VHF	UHF	800	Microwave Only
Oak Mtn-GATR	34.5521	-120.5024	☒	☒	☐	☐
Plowshare	35.0501	-120.0410	☒	☒	☐	☐
Rincon	34.3728	-119.4210	☒	☒	☒	☐
San Antonio	34.8420	-120.4992	☒	☒	☒	☐
Santa Ynez	34.5266	-119.9785	☒	☒	☒	☐
Sudden	34.5663	-120.5001	☐	☒	☐	☐
Tepusquet	34.9151	-120.1827	☒	☒	☐	☐
Valley Peak	33.9989	-119.6836	☒	☒	☒	☐
Ventucopa	34.8126	-119.4545	☒	☒	☐	☐
EOC Fire Dispatch	34.4506	-119.7698	☐	☐	☒	☐
Sheriff Dispatch Center	34.4441	-119.7761	☐	☐	☐	☒
Santa Maria Backup Dispatch	34.9218	-120.4522	☐	☐	☐	☒

Figure 1.1-1. ATLAS Radio System Site List

The following sections include descriptions of the ATLAS radio site configurations.

A-1.1.1 VHF Simulcast System

The VHF system solution to be provided by JVCKENWOOD follows the County's currently existing frequency plan and is designed as a County wide analog simulcast system.

The analog VHF system solution consists of eighteen (18) radio sites, including a greenfield site in the Ventucopa area which is needed in order to meet the coverage requirement with consideration for body loss of a portable radio on the hip (belt clip). While the mounting heights for the VHF system radio antennas is below twenty (20) feet, the greenfield site requires a minimum tower height of 120 feet to make the microwave connection to Mount Abel.

The VHF simulcast sites are as follows:

- Admin Building
- La Cumbre Peak
- Valley Peak
- Santa Ynez Peak
- Figueroa Mountain
- Heritage Oil Platform
- Gaviota
- Oak Mtn-GATR
- Harris Grade
- Fire Station 24 (Greenfield)
- Lompoc Civic Center
- Mount Solomon
- Rincon
- San Antonio
- Tepusquet
- Plowshare
- Fire Station 41 (Greenfield)
- Ventucopa (Greenfield)

*The Rincon radio site has been added to the system design at the request of Santa Barbara County.

A-1.1.2 UHF Simulcast Zones

The UHF P25 Phase II ATLAS solution consists of six (6) simulcast zones using the same sites as the VHF solution, with the Sudden Peak radio site added to the Gaviota UHF Simulcast zone. Each of the UHF simulcast zones will contain five (5) P25 Phase II channels. Of these five channels, one (1) shall operate as the control channel with the remaining four channels operating as Phase II voice channels, providing a total of eight (8) Phase II talk paths per simulcast zone.

The UHF simulcast zone configurations are follows:

- Santa Barbara City Simulcast Zone
    - Admin Building
    - La Cumbre Peak
    - Valley Peak
    - Rincon
- Santa Ynez Simulcast Zone
    - Santa Ynez Peak
    - Figueroa Mountain
- Gaviota Simulcast Zone
    - Heritage Oil Platform
    - Gaviota
    - Oak Mtn-GATR
    - Sudden Peak
- Vandenburg Village Simulcast Zone
    - Harris Grade
    - Fire Station 24 (Greenfield)
    - Lompoc Civic Center
    - Mount Solomon
    - San Antonio
- Plowshare Simulcast Zone
    - Tepusquet
    - Plowshare
- Ventucopa Simulcast Zone
    - Fire Station 41 (Greenfield)
    - Ventucopa (Greenfield)

A-1.1.3 800 MHz Radio sites

The 800 MHz radio system solution utilizes sites that are included in the VHF/UHF design and consists of a multicast site and simulcast zone in the Santa Barbara City area, a multicast site to cover the Santa Maria area, and a multicast site to cover the Santa Ynez area.

The 800 MHz site configurations are as follows:

- Santa Barbara City 800 MHz Simulcast Zone
    - Admin Building
    - La Cumbre Peak
    - Valley Peak
    - EOC Fire Dispatch
- Santa Barbara City 800 MHz Multicast Site
    - Rincon
- Santa Maria 800 MHz Multicast Site
    - San Antonio
- Santa Ynez 800 MHz Multicast Site
    - Santa Ynez Peak

A-1.1.4 ATLAS P25 Distributed Technology

With Latitude technology, the County's KENWOOD ATLAS® P25 System will be deployed using modern distributed architecture, which eliminates the need for a central control point and associated equipment. Through ATLAS' resilient approach the network controller and management functionality are distributed among the subsystem controllers that are deployed throughout the system. This effectively turns each subsystem controller into a network controller, providing multiple levels of geographical redundancy. This distributed functionality makes the KENWOOD ATLAS P25 solution stand out among other vendors' P25 solutions and provides the most powerful, most reliable, and disaster resilient system available for public safety grade communications today.

What JVCKENWOOD's ATLAS P25 distributed technology means for the County:

- ***Every site has the capability to control a simulcast zone, eliminating a central point of failure***. In the event a site loses communications, the remaining sites will perform as normal. The individual site that lost communications can operate as a repeater site on its own until the heartbeat is detected again, and the system return to normal operation. If something goes wrong in Santa Maria, it shouldn't impact communications near Santa Barbara. With a true IP-based design, rerouting due to disruptions is automatic and instantaneous, significantly limiting any impact to the users on the network.
- ***There's no need for expensive centralized master and backup network controllers*** that other vendors' P25 systems employ. Eliminating the upfront cost of master network controllers gives the County the ability to grow the system on your own terms as needs and circumstances change.
- With no central server/controller, system management equipment, such as the ATLAS Network Management System (NMS) and interoperability gateways, ***can be connected anywhere on the network that supports sufficient bandwidth***.
- When the worst happens—whether it's a natural or man-made disaster—***ATLAS makes recovery simple for Santa Barbara County***. If a network connection fails and isolates a site or group of sites from the network, those sites continue to recognize public safety users and will route calls accordingly. When a network connection is reestablished after a failure, ***ATLAS heals itself without manual intervention***.
- System components are based on commercial off-the-shelf (COTS) hardware, ***significantly reducing system obsolescence, and extending the life of your critical investment***.
- ATLAS equipment has the ***smallest footprint in the industry***, which mitigates difficult configuration problems and makes it easy to co-locate new equipment with existing equipment, ***allowing for a quick, no-hassle deployment***.
- ATLAS provides the County an affordable path to grow the system over time. Additional unit IDs, affiliated users, talkgroups, and even dispatch positions can all be added to the ATLAS System ***without costly licensing fees***.
- Traditional simulcast management hardware like comparators and prime site controllers (which are used to find the best signal to be rebroadcast to the entire simulcast system) are consolidated into software, which is integrated into site controllers at each site, significantly increasing redundancy and

channel uptime in a simulcast system. ***This makes ATLAS the only technology in its class capable of full distribution.***

A-1.1.4.1 ATLAS P25 Subsystems

The P25 solution provides each individual subsystem an independent coverage footprint. The flexibility of the JVCKENWOOD ATLAS architecture, combined with a Network Management System (NMS) and ISSI gateway, allows for a single NMS to be used for all radio subsystems, while also providing the capability for each subsystem to operate autonomously without requiring additional equipment. Because the ATLAS System does not use a centralized system core, all subsystems have core functionality at each of their respective RF sites.

Since our ATLAS technology does not required a central controller, the modern ATLAS distributed system has no centralized single point of failure "prime site." Therefore, system management equipment and gateways can be connected anywhere on the network that support sufficient bandwidth. For the Santa Barbara County system, JVCKENWOOD is locating the Network Management equipment at the Sheriff Dispatch Center and Santa Maria Dispatch Centers.

Analog Gateways to connect to the County Interoperability equipment will be located at Sheriff Dispatch and Santa Maria Backup Dispatch Center equipment rooms. Equipment sufficient to connect to up 40 analog devices per dispatch center as required by the RFP have been included in the design. ISSI gateways have been located at the Sheriff Dispatch Center and Santa Maria Backup Dispatch Center to allow for connectivity to other P25 radio systems via the standard ISSI interface.

A-1.1.4.1.1 VHF Simulcast Analog Conventional Radio System

The ATLAS VHF conventional analog system consists of redundant ATLAS 8100 Conventional Network Interface (CSNI) controllers for each simulcast conventional channel combined with the ATLAS 4500 VHF simulcast repeaters at selected sites. The primary and secondary CSNIs for each simulcast channel can be located anywhere on the radio system network. Two sites within each simulcast zone have been selected as either a primary or secondary CSNI site.

A-1.1.4.1.2 UHF P25 Phase II Trunked Radio System

The ATLAS P25 UHF trunked system consists of Advanced ATLAS 8200 Trunking Site Network Interface (TSNI) controllers and ATLAS 4500 UHF simulcast repeaters at selected sites to provide the required coverage for the County. The ATLAS trunked system is based on industry-standard P25 operation and is dimensioned to provide Santa Barbara County with five channels per simulcast

zone. The five (5) repeater channels at each simulcast site are comprised of a P25 trunking control channel and four (4) voice channels operating in Phase II mode, providing a total of eight (8) P25 Phase II talkpaths within each UHF simulcast zone.

A-1.1.4.1.3 800 MHz P25 Phase II Trunked Radio System

The 800 MHz trunked system consists of Advanced ATLAS 8200 Trunking Site Network Interface (TSNI) controllers and ATLAS 4500 800 MHz simulcast/multicast repeaters at selected sites to provide the required coverage for Santa Barbara County. The five (5) repeater channels at each simulcast site and multicast sites are comprised of a control channel and four (4) voice channels operating in Phase II mode, providing the County with a total of eight (8) P25 Phase II talkpaths per 800 MHz area.

A-1.1.4.1.4 Network Management Systems

The system consists of the following Network Management Systems:

- ATLAS Radio Network Management System
- Aviat Provision Microwave Network Management System
- Castle Rock SNMP Alarm Network Management System

Each of the above network management systems are included with a redundant configuration with primary/backup servers residing at the Sheriff Dispatch Center and Santa Maria Backup Dispatch Center. In depth descriptions of these Network Management Systems can be found later in this document.

A-1.1.4.1.5 Analog Radio Gateways

The system includes analog radio gateways to support up to forty (40) connections to conventional radios at both the Sheriff Dispatch Center and Santa Maria Backup Dispatch.

A-1.1.4.1.6 Phase I FDMA and Phase II TDMA Dual Mode Functionality

The ATLAS P25 trunked system will be deployed as a fully functional and operational Phase II (TDMA) communication system, with the ability to also process calls in Phase I (FDMA) mode. This TDMA operation provides the County with channel efficiency by effectively doubling the working channel capacity as compared to a P25 Phase I system.

Additionally, the ATLAS P25 Phase II system supports Dynamic Dual Mode operations, which means the system is fully compatible with Phase I subscriber

radios without compromising Phase II functionality. If a talkgroup on the ATLAS system is comprised of only P25 Phase II users (identified through subscriber registration), the ATLAS system will process corresponding calls in Phase II mode. However, if at least one subscriber radio is operating in P25 Phase I mode, the corresponding talkgroup is marked as Phase I and all calls on this talkgroup will be set up as Phase I. Phase II users assigned to other talkgroups are completely unaffected.

A-1.1.4.2 High Level Equipment Summary

JVCKENWOOD is providing a full, turnkey solution including a P25 Phase II simulcast network, conventional analog system, all technical support, equipment, materials, and labor necessary to develop the radio sites into functional P25 radio facilities. All materials necessary to complete the successful implementation and operation of the system and its equipment groupings are included in this document and meet the minimum requirements specified in the RFP. The RF Subsystems have been designed to support complete and successful operation and meet the coverage needs for Santa Barbara County and the designated urban areas of Santa Barbara, Santa Ynez, and Santa Maria, CA.

Each radio site is configured for -48 VDC power systems and battery backup that supports up to 8-hours of continuous run time under a full load.

A-1.1.4.2.1 The City of Santa Barbara UHF and VHF Coverage Area

A-1.1.4.2.1 UHF Subsystem

JVCKENWOOD's UHF RF Subsystem design for the City of Santa Barbara coverage area is a four (4)-site simulcast zone comprised of the Admin Building, La Cumbre Peak, Valley Peak, and Rincon radio sites. The UHF simulcast zone includes five (5) UHF P25 Phase II trunked channels (eight talk paths).

All radio sites are equipped with a Trunked System Network Interface (TSNI), providing each site with the capability to operate as a simulcast cell controller for the UHF P25 Trunked Phase II Simulcast zone.

A-1.1.4.2.1 VHF Subsystem

The VHF subsystem design in the City of Santa Barbara coverage area consists of the Admin Building, La Cumbre Peak, Valley Peak, and Rincon radio sites. These radio sites are configured as part of the County wide simulcast system and contain six (6) analog simulcast channels.

The Admin Building and La Cumbre Peak radio sites are equipped with six (6) Conventional System Network Interfaces each, with a CSNI at one site operating as the controller for a simulcast conventional channel and the corresponding CSNI at the other site operating in the standby mode for the analog simulcast channel.

A list of all major components for the City of Santa Barbara UHF and VHF Subsystems is as follows:

Santa Barbara City UHF/VHF Coverage Area Equipment	Admin Building	La Cumbre	Valley Peak	Rincon
Advanced Trunking System Network Interface	1	1	1	1
SecureSync GPS Timing Reference and Ancillary Equipment for Microwave System	2	2	2	2
ATLAS 4500 UHF Phase II Simulcast Trunked Repeater	5	5	5	5
UHF Transmit Antenna	1	1	1	1
UHF Receive Antenna	1	1	1	1
UHF Transmit Power Monitor	1	1	1	1
UHF 5 Channel Combiner	1	1	1	1
UHF 8 Channel Receive Multicoupler	1	1	1	1
UHF Tower Top Amplifier	0	1	1	1
Conventional System Network Interface	6	6	0	0
ATLAS 4500 VHF Simulcast Conventional Analog Repeater	6	6	6	6
VHF Transmit Antenna	1	1	1	1
VHF Receive Antenna	1	1	1	1
VHF Transmit Power Monitor	1	1	1	1
VHF 6 Channel Combiner	1	1	1	1
VHF 8 Channel Receive Multicoupler	1	1	1	1
Asentria SiteBoss 530 Remote Site Manager alarm panel with temperature probe	1	1	1	1
DC Power Plant with 8 Hour Battery Backup	1	1	1	1
OmniStack Switch 6860	3	3	3	3
Nokia 7705 SAR-8 MPLS Router (Redundant)	1	1	1	1
Wireshark Network Analyzer	1	1	1	1

Figure 1.4-1. County of Santa Barbara RF Site Equipment List

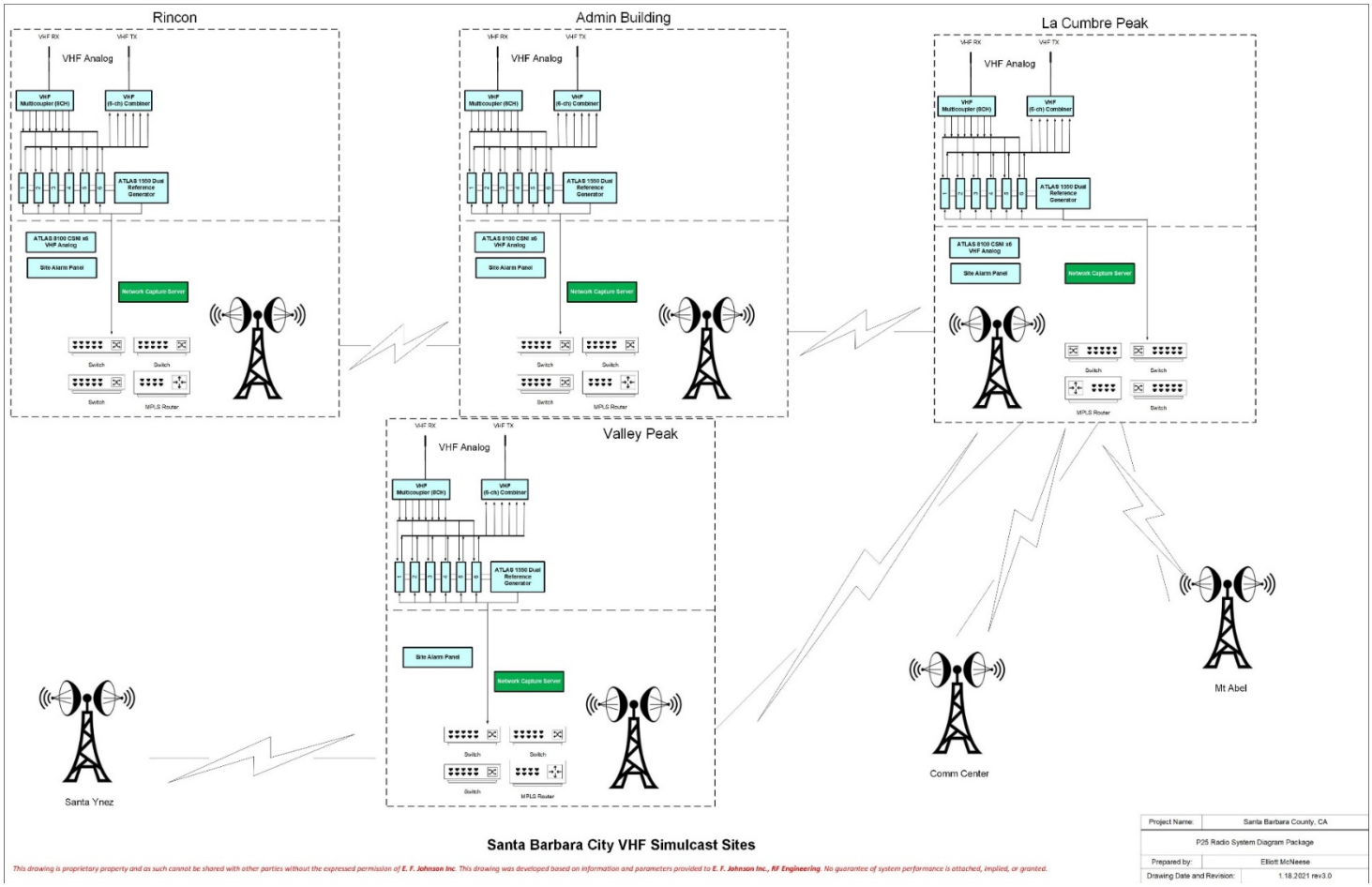


Figure 1.4-2. Santa Barbara City VHF Simulcast Sites

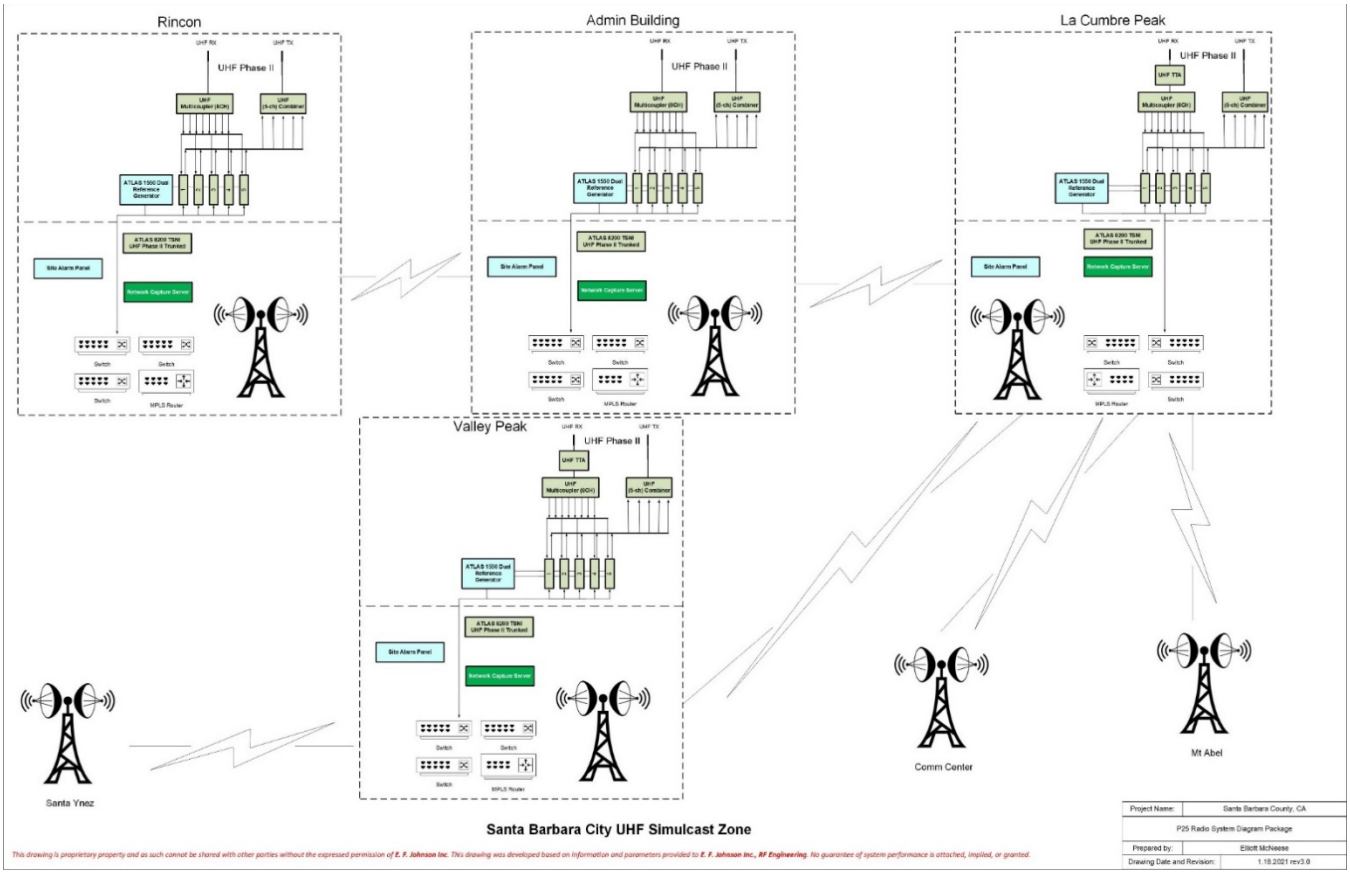


Figure 1.4-3. Santa Barbara City UHF Simulcast Zone

A-1.1.4.2.2 The City of Santa Barbara 800 MHz Coverage Area

JVCKENWOOD's 800 MHz RF subsystem design is comprised of the Admin Building, La Cumbre Peak, Valley Peak, and EOC Fire Dispatch radio sites configured together as a four (4)-site simulcast zone. The simulcast zone includes five (5) 800 MHz P25 Phase II Trunked channels. The Rincon site is configured as a multicast site with five (5) 800 MHz P25 Phase II Trunked Channels.

All sites are equipped with a Trunked System Network Interface, allowing any site in the simulcast cell to operate as a simulcast cell controller, or in regard to Rincon, a multicast site controller.

A summary of equipment by site is provided below:

Santa Barbara City 800 MHz Equipment	Admin Building	La Cumbre Peak	Valley Peak	EOC Fire Dispatch	Rincon
Advanced Trunking System Network Interface	1	1	1	1	2
ATLAS 4500 800 MHz Phase II Simulcast Trunked Repeater	5	5	5	5	-
ATLAS 4500 800 MHz Phase II Multicast Trunked Repeater	-	-	-	-	5
800 MHz Transmit Antenna	1	1	1	1	1
800 MHz Transmit Power Monitor	1	1	1	1	1
800 MHz 5 Channel Combiner	1	1	1	1	1
800 MHz Receive Antenna	1	1	1	1	1
800 MHz 8 Channel Receive Multicoupler with PDU	1	1	1	1	1
800 MHz Tower Top Amplifier	1	1	1	1	1
Asentria SiteBoss 530 Remote Site Manager alarm panel with temperature probe	1	1	1	1	1
DC Power Plant with 8 Hour Battery Backup	1	1	1	1	1
Omnistack Switch 6860	2	2	2	2	2
Nokia 7705 SAR-8 MPLS Router (Redundant)	1	1	1	1	1
Wireshark Network Analyzer	1	1	1	1	1
SecureSync GPS Timing Reference and Ancillary Equipment for Microwave System	2	2	2	2	2

Figure 1.4-4. City of Santa Barbara 800 MHz Equipment

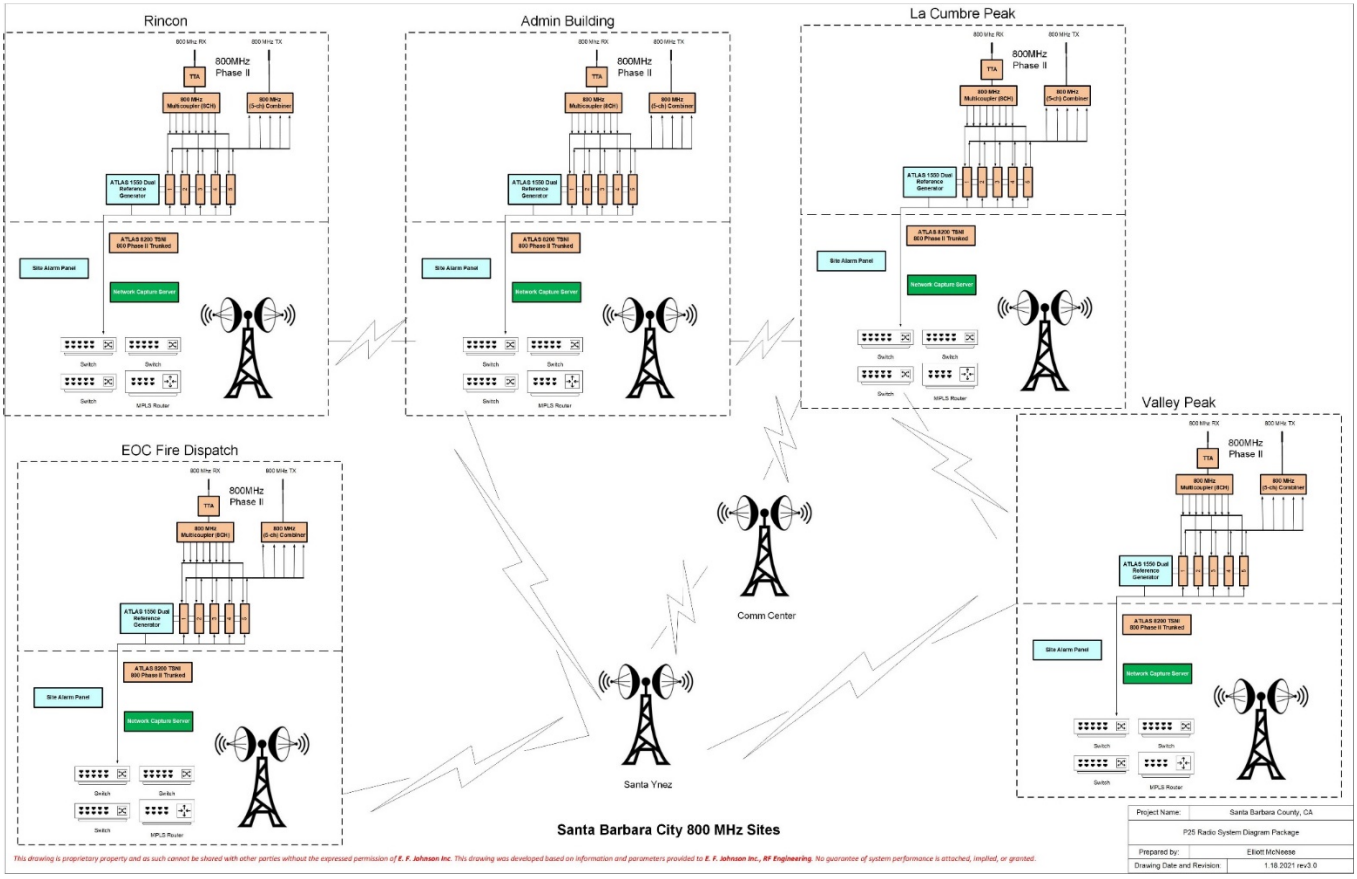


Figure 1.4-5. Santa Barbara City 800 MHz Sites

A-1.1.4.2.3 Gaviota Simulcast Zone Coverage Area

A-1.1.4.2.3 UHF Subsystem

JVCKENWOOD's UHF RF Subsystem design for the Gaviota coverage area is a four (4)-site simulcast zone comprised of the Gaviota, Heritage Oil Platform, Oak Mtn-GATR, and Sudden Peak radio sites. The simulcast zone includes five (5) UHF P25 Phase II trunked channels (eight talk paths).

All four radio sites are equipped with a Trunked System Network Interface (TSNI), providing each site with the capability to operate as a simulcast cell controller for the UHF P25 Trunked Phase II Simulcast zone.

A-1.1.4.2.3 VHF Subsystem

The VHF RF subsystem is comprised of the Gaviota, Oak Mtn-GATR, and Heritage Oil Platform radio sites. These radio sites are configured as part of the County wide simulcast system and contain six (6) analog simulcast channels.

The Gaviota and Oak Mtn-GATR radio sites are equipped with six (6) Conventional System Network Interfaces each, with a CSNI at one site operating as the controller for a simulcast conventional channel and the corresponding CSNI at the other site operating in the standby mode for the analog simulcast channel.

A list of all major components for the Santa Barbara County Southwest coverage area UHF and VHF sub systems is as follows:

Gaviota Coverage Area UHF/VHF Simulcast Equipment	Gaviota	Oak Mtn GATR	Heritage Oil Platform	Sudden Peak
Advanced Trunking System Network Interface	1	1	1	1
SecureSync GPS Timing Reference and Ancillary Equipment for Microwave System	2	2	2	2
ATLAS 4500 UHF Phase II Simulcast Trunked Repeater	5	5	5	5
UHF Transmit Antenna	1	1	1	1
UHF Receive Antenna	1	1	1	1
UHF Transmit Power Monitor	1	1	1	1

Gaviota Coverage Area UHF/VHF Simulcast Equipment	Gaviota	Oak Mtn GATR	Heritage Oil Platform	Sudden Peak
UHF 5 Channel Combiner	1	1	1	1
UHF 8 Channel Receive Multicoupler	1	1	1	1
UHF Tower Top Amplifier	0	0	1	1
Conventional System Network Interface	6	6	0	0
ATLAS 4500 VHF Simulcast Conventional Analog Repeater	6	6	6	0
VHF Transmit Antenna	1	1	1	0
VHF Receive Antenna	1	1	1	0
VHF Transmit Power Monitor	1	1	1	0
VHF 6 Channel Combiner	1	1	1	0
VHF 8 Channel Receive Multicoupler	1	1	1	0
Asentria SiteBoss 530 Remote Site Manager alarm panel with temperature probe	1	1	1	1
DC Power Plant with 8 Hour Battery Backup	1	1	1	1
Omnistack Switch 6860	3	3	3	2
Nokia 7705 SAR-8 MPLS Router (Redundant)	1	1	1	1
Wireshark Network Analyzer	1	1	1	1

Figure 1.4-6. Major components for the Southwest coverage area UHF and VHF sub systems

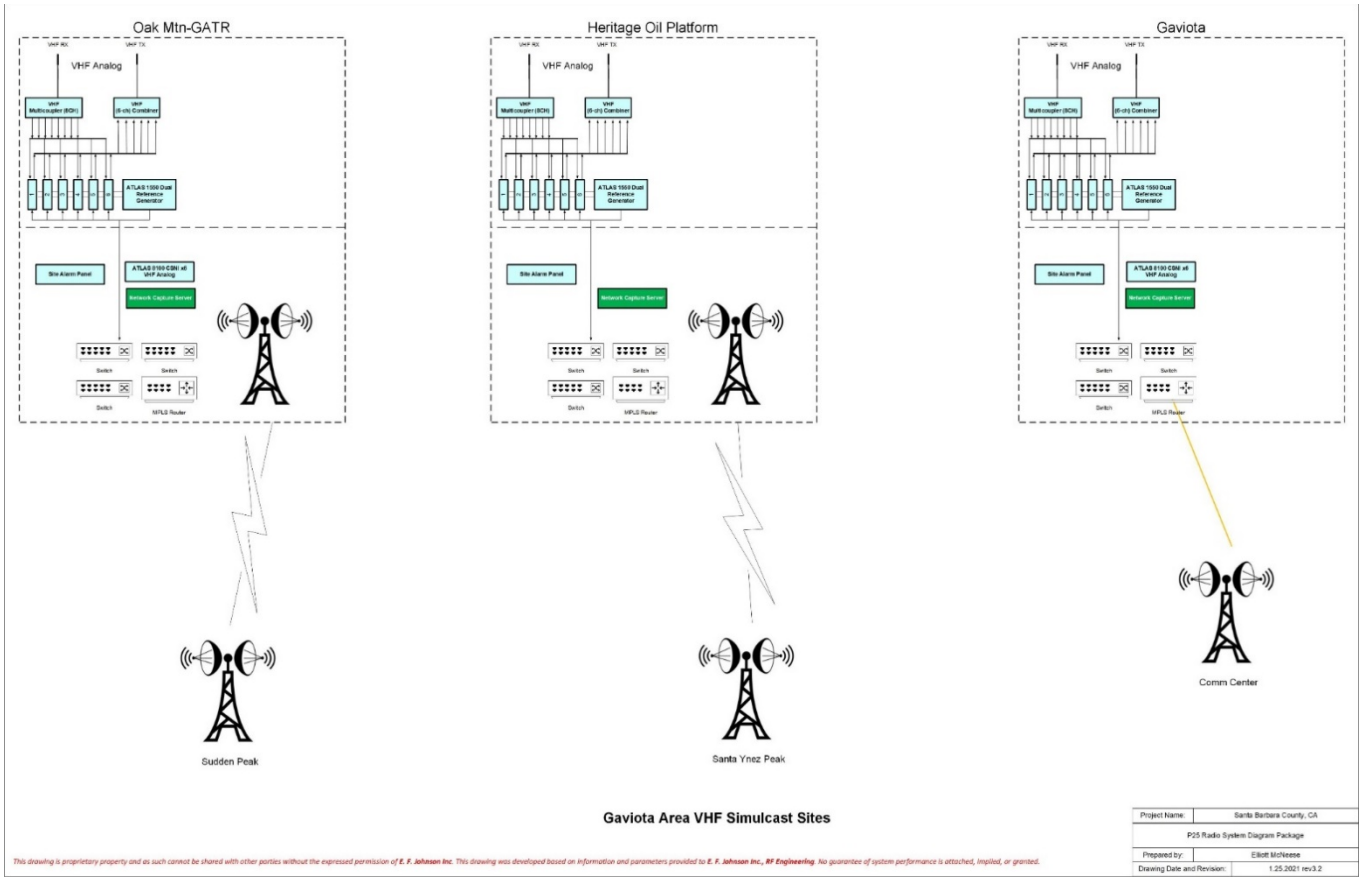


Figure 1.4-7. Gaviota Area VHF Simulcast Sites

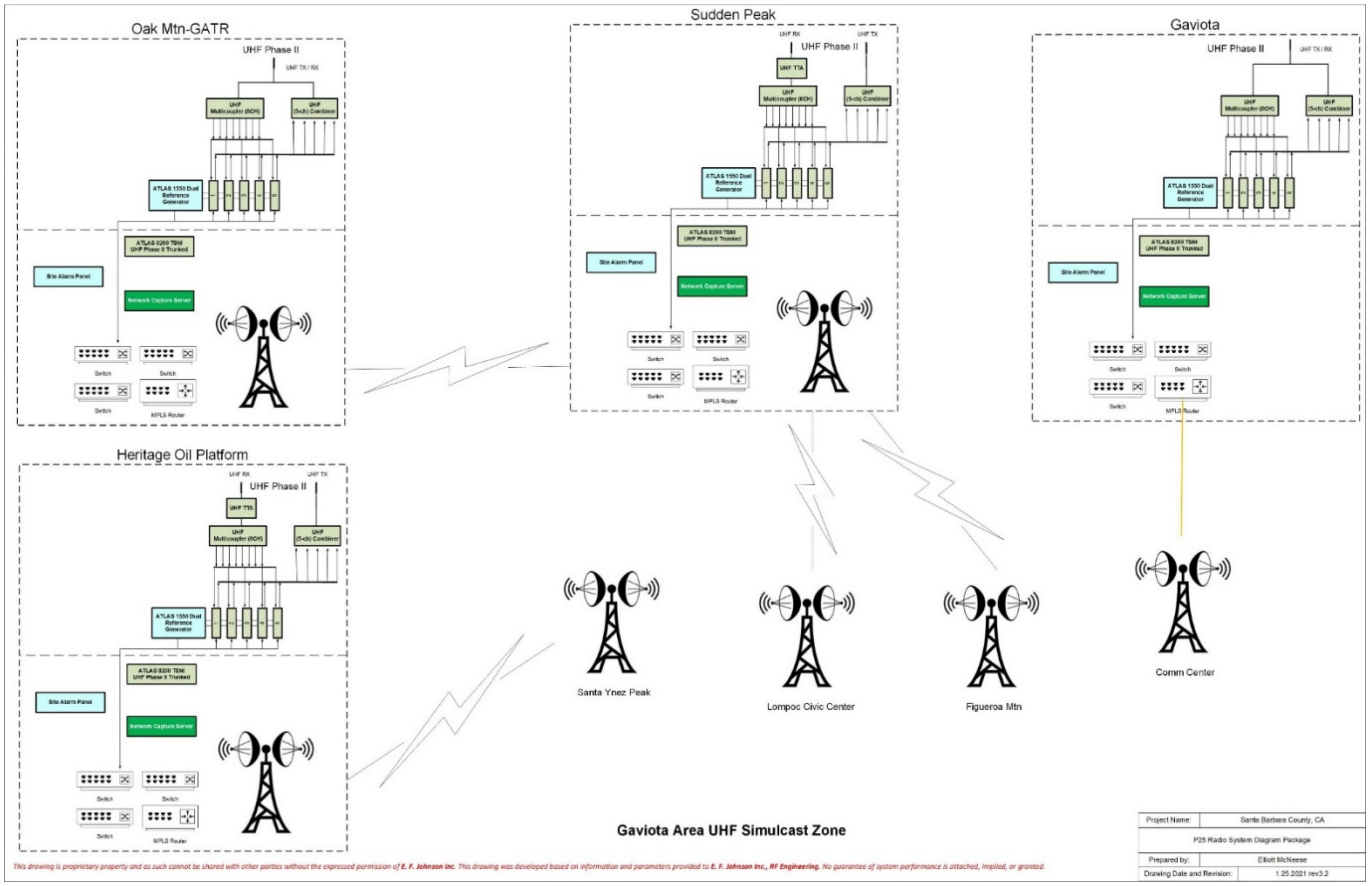


Figure 1.4-8. Gaviota Area UHF Simulcast Zone

A-1.1.4.2.4 The City of Santa Ynez, CA UHF and VHF Coverage Area

A-1.1.4.2.4 UHF Subsystem

JVCKENWOOD's design for the UHF RF Subsystem for the City of Santa Ynez is a two (2) site simulcast zone comprised of the Figueroa Mountain and Santa Ynez Peak radio sites. The simulcast zone includes six (6) VHF Analog simulcast channels and five (5) UHF P25 Phase II channels (eight talk paths).

Both radio sites in the simulcast cell are equipped with a Trunked System Network Interface, allowing either one to operate as a simulcast cell controller for the UHF Phase II Trunked simulcast cell.

A-1.1.4.2.4 VHF Subsystem

The VHF RF subsystem is comprised of the Figueroa Mountain and Santa Ynez Peak radio sites. These radio sites are configured as part of the County wide simulcast system and contain six (6) analog simulcast channels.

Both radio sites are equipped with six (6) Conventional System Network Interfaces each, with a CSNI at one site operating as the controller for a simulcast

conventional channel and the corresponding CSNI at the other site operating in the standby mode for the analog simulcast channel.

A summary of control and repeater equipment is provided below:

Santa Ynez UHF/VHF Simulcast Equipment	Figueroa Mtn	Santa Ynez
Advanced Trunking System Network Interface	1	1
SecureSync GPS Timing Reference and Ancillary Equipment for Microwave System	2	2
ATLAS 4500 UHF Phase II Simulcast Trunked Repeater	5	5
UHF Transmit Antenna	1	1
UHF Receive Antenna	1	1
UHF Transmit Power Monitor	1	1
UHF 5 Channel Combiner	1	1
UHF 8 Channel Receive Multicoupler with PDU	1	1
UHF Tower Top Amplifier	1	1
Conventional System Network Interface	6	6
ATLAS 4500 VHF Simulcast Conventional Analog Repeater	6	6
VHF Transmit Antenna	1	1
VHF Receive Antenna	1	1
VHF Transmit Power Monitor	1	1
VHF 6 Channel Combiner	1	1
VHF 8 Channel Receive Multicoupler	1	1
Asentria SiteBoss 530 Remote Site Manager alarm panel with temperature probe	1	1

Santa Ynez UHF/VHF Simulcast Equipment	Figueroa Mtn	Santa Ynez
DC Power Plant with 8 Hour Battery Backup	1	1
Omnistack Switch 6860	3	3
Nokia 7705 SAR-8 MPLS Router (Redundant)	1	1
Wireshark Network Analyzer	1	1

Figure 1.4-9. Santa Ynez RF Site Equipment

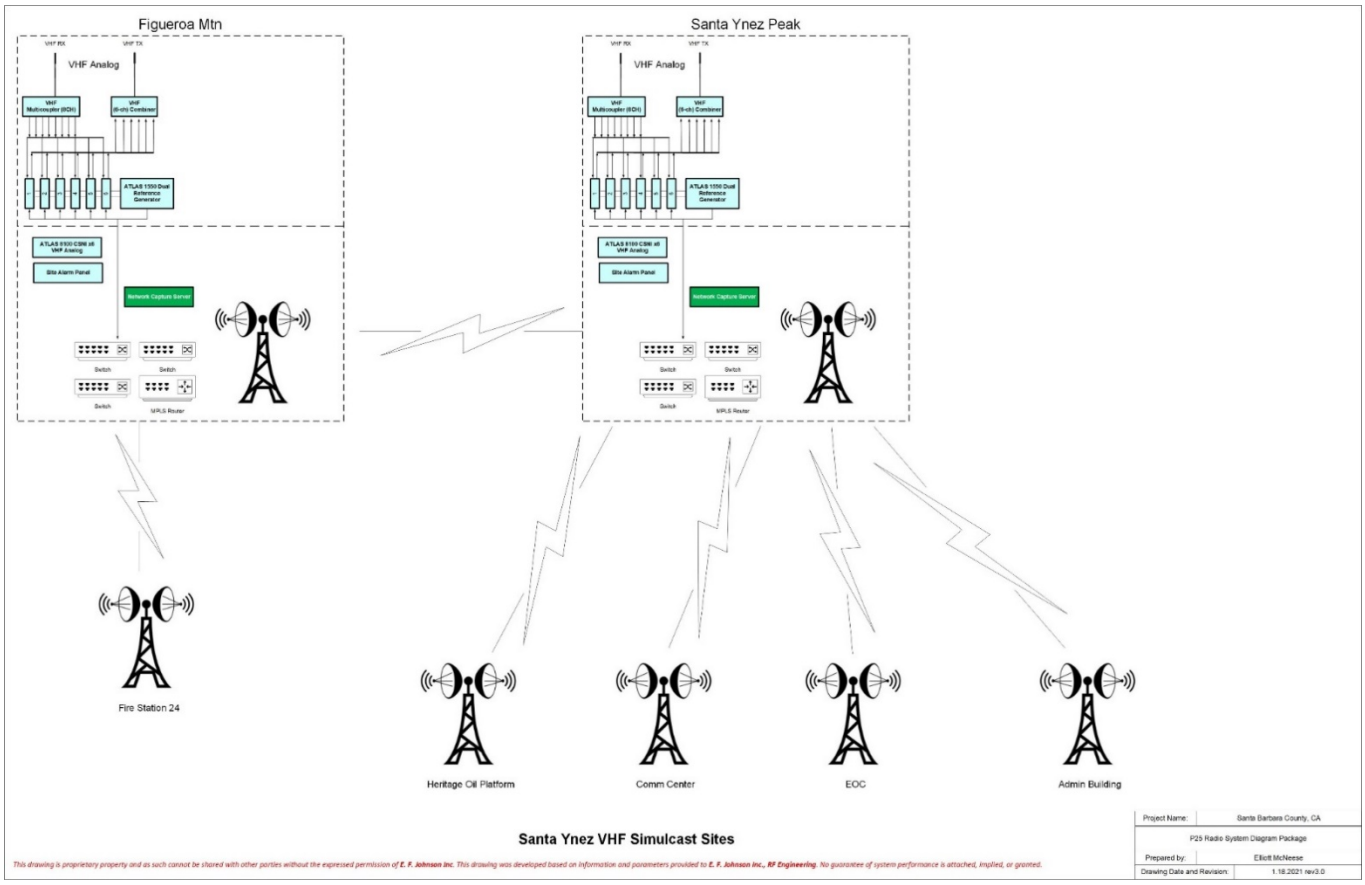


Figure 1.4-10. Santa Ynez City VHF Simulcast Sites

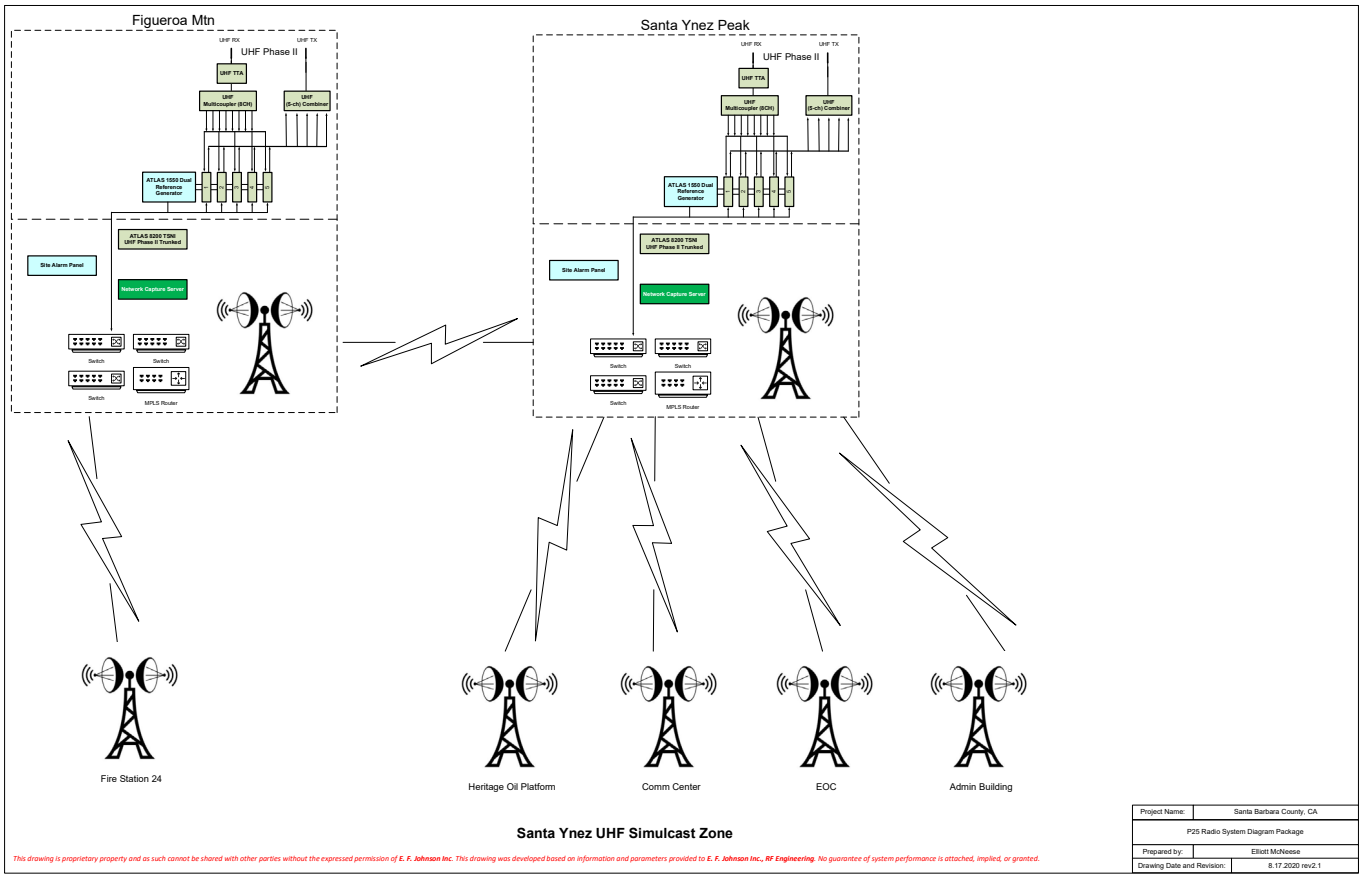


Figure 1.4-11 Santa Ynez UHF Simulcast Sites

A-1.1.4.2.5 City of Santa Ynez 800 MHz Coverage Area

The design for the 800 MHz RF Subsystem for the Santa Ynez coverage area is a single multicast site located at the Santa Ynez Peak radio site. The Santa Ynez radio site is configured with five (5) 800 MHz P25 Phase II Trunked channels with two (2) TSNI controllers.

A list of all major components for the Santa Ynez 800 MHz Multicast site are provided below.

Santa Ynez City 800 MHz Multicast Equipment	Santa Ynez
Advanced Trunking System Network Interface	2
ATLAS 4500 800 MHz Phase II Multicast Trunked Repeater	5
800 MHz Transmit Antenna	1
800 MHz Transmit Power Monitor	1
800 MHz 5 Channel Combiner	1

Santa Ynez City 800 MHz Multicast Equipment	Santa Ynez
800 MHz Receive Antenna	1
800 MHz 8 Channel Receive Multicoupler with PDU	1
800 MHz Tower Top Amplifier	1
Asentria SiteBoss 530 Remote Site Manager alarm panel with temperature probe	1
DC Power Plant with 8 Hour Battery Backup	1
Omnistack Switch 6860	2
Nokia 7705 SAR-8 MPLS Router (Redundant)	1
Wireshark Network Analyzer	1
SecureSync GPS Timing Reference and Ancillary Equipment for Microwave System	2

Figure 1.4-12. Santa Ynez 800 MHz RF Site Equipment Matrix

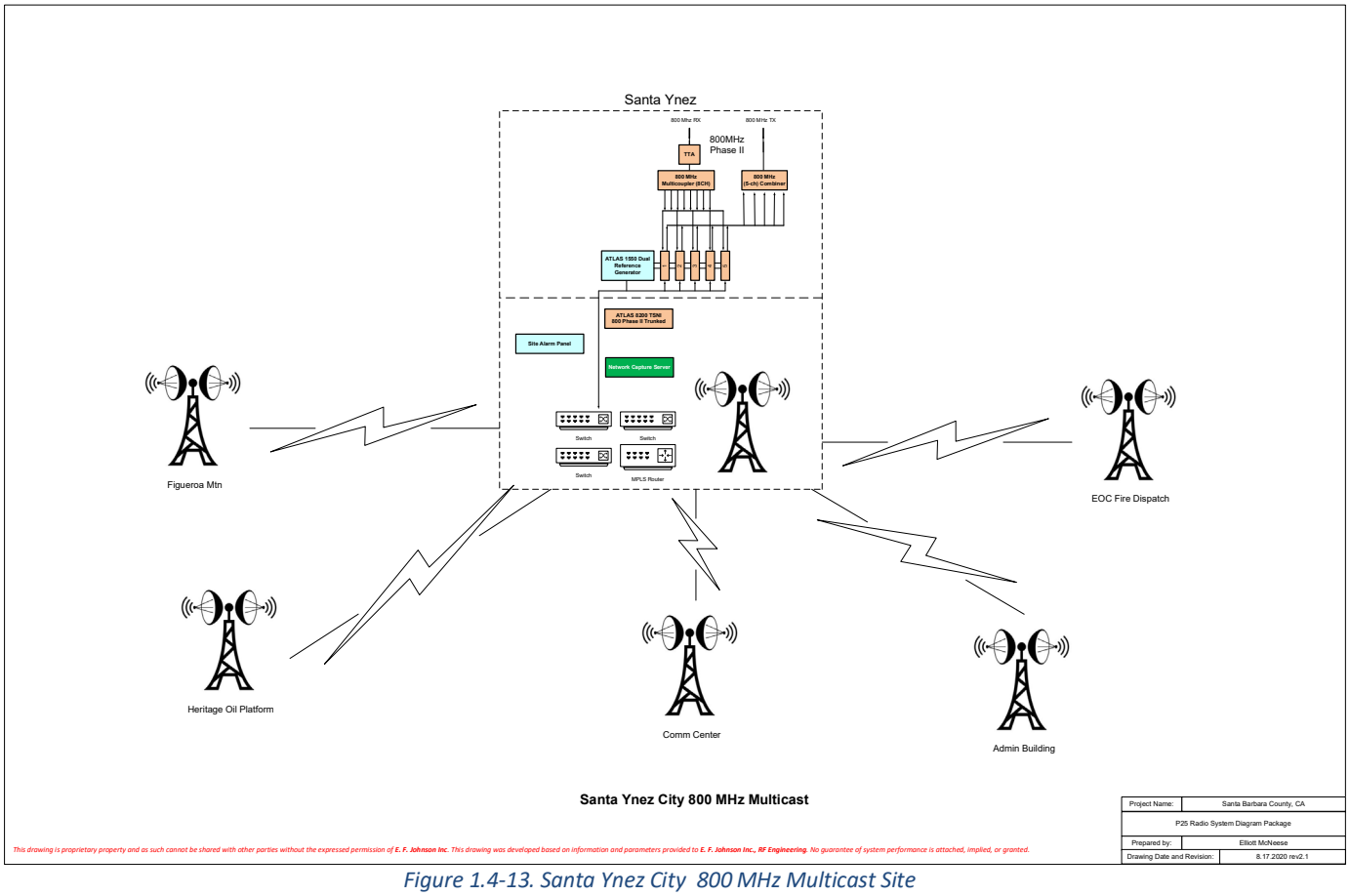


Figure 1.4-13. Santa Ynez City 800 MHz Multicast Site

A-1.1.4.2.6 Vandenburg Village and Air Force Base, CA UHF and VHF Coverage Area

A-1.1.4.2.6 UHF Subsystem

JVCKENWOOD's UHF RF Subsystem design for the Vandenburg Village and Air Force Base coverage area is a five (5) site simulcast zone comprised of the Harris Grade, Fire Station 24, San Antonio, Mount Solomon, and Lompoc Civic Center radio sites.

The simulcast zone includes five (5) UHF P25 Phase II channels (eight talk paths) at all sites. All radio sites in the simulcast cell are equipped with a Trunked System Network Interface, allowing any site to operate as a simulcast cell controller for the UHF Phase II Trunked simulcast cell.

A-1.1.4.2.6 VHF Subsystem

The VHF RF subsystem is comprised of the Harris Grade, Fire Station 24, San Antonio, Mount Solomon, and Lompoc Civic Center radio sites. These radio sites are configured as part of the County wide simulcast system and contain six (6) analog simulcast channels.

The Harris Grade and Mount Solomon radio sites are equipped with six (6) Conventional System Network Interfaces each, with a CSNI at one site operating as the controller for a simulcast conventional channel and the corresponding CSNI at the other site operating in the standby mode for the analog simulcast channel.

A summary of the control and repeater equipment is provided below:

Vandenburg UHF/VHF Simulcast Equipment	Harris Grade	Fire Station 24	San Antonio	Mount Solomon	Lompoc Civic Center
Advanced Trunking System Network Interface	1	1	1	1	1
SecureSync GPS Timing Reference and Ancillary Equipment for Microwave System	2	2	2	2	2
ATLAS 4500 UHF Phase II Simulcast Trunked Repeater	5	5	5	5	5
UHF Transmit Antenna	1	1	1	1	1
UHF Receive Antenna	1	1	1	1	1
UHF Transmit Power Monitor	1	1	1	1	1
UHF 5 Channel Combiner	1	1	1	1	1
UHF 8 Channel Receive Multicoupler with PDU	1	1	1	1	1
UHF Tower Top Amplifier	1	1	1	1	1
Conventional System Network Interface	6	0	0	6	0
ATLAS 4500 VHF Simulcast Conventional Analog Repeater	6	6	6	6	6
VHF Transmit Antenna	1	1	1	1	1
VHF Receive Antenna	1	1	1	1	1
VHF Transmit Power Monitor	1	1	1	1	1
VHF 6 Channel Combiner	1	1	1	1	1
VHF 8 Channel Receive Multicoupler	1	1	1	1	1
Asentria SiteBoss 530 Remote Site Manager alarm panel with temperature probe	1	1	1	1	1
DC Power Plant with 8 Hour Battery Backup	1	1	1	1	1
Omnistack Switch 6860	3	3	3	3	3
Nokia 7705 SAR-8 MPLS Router (Redundant)	1	1	1	1	1
Network Analyzer	1	1	1	1	1

Figure 1.4-14. Vandenburg RF Site Equipment Matrix

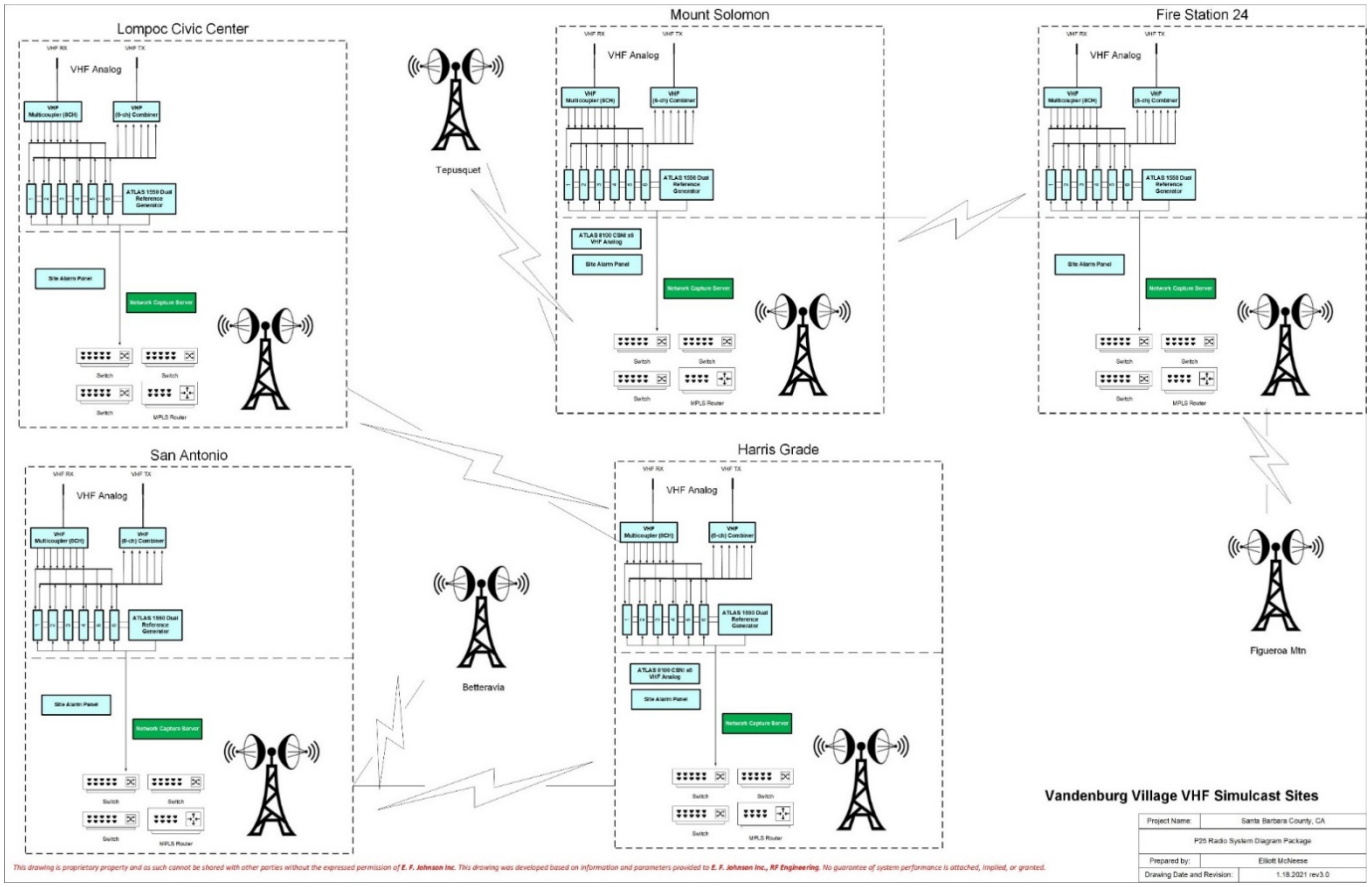


Figure 1.4-15. Vandenburg VHF Simulcast Sites

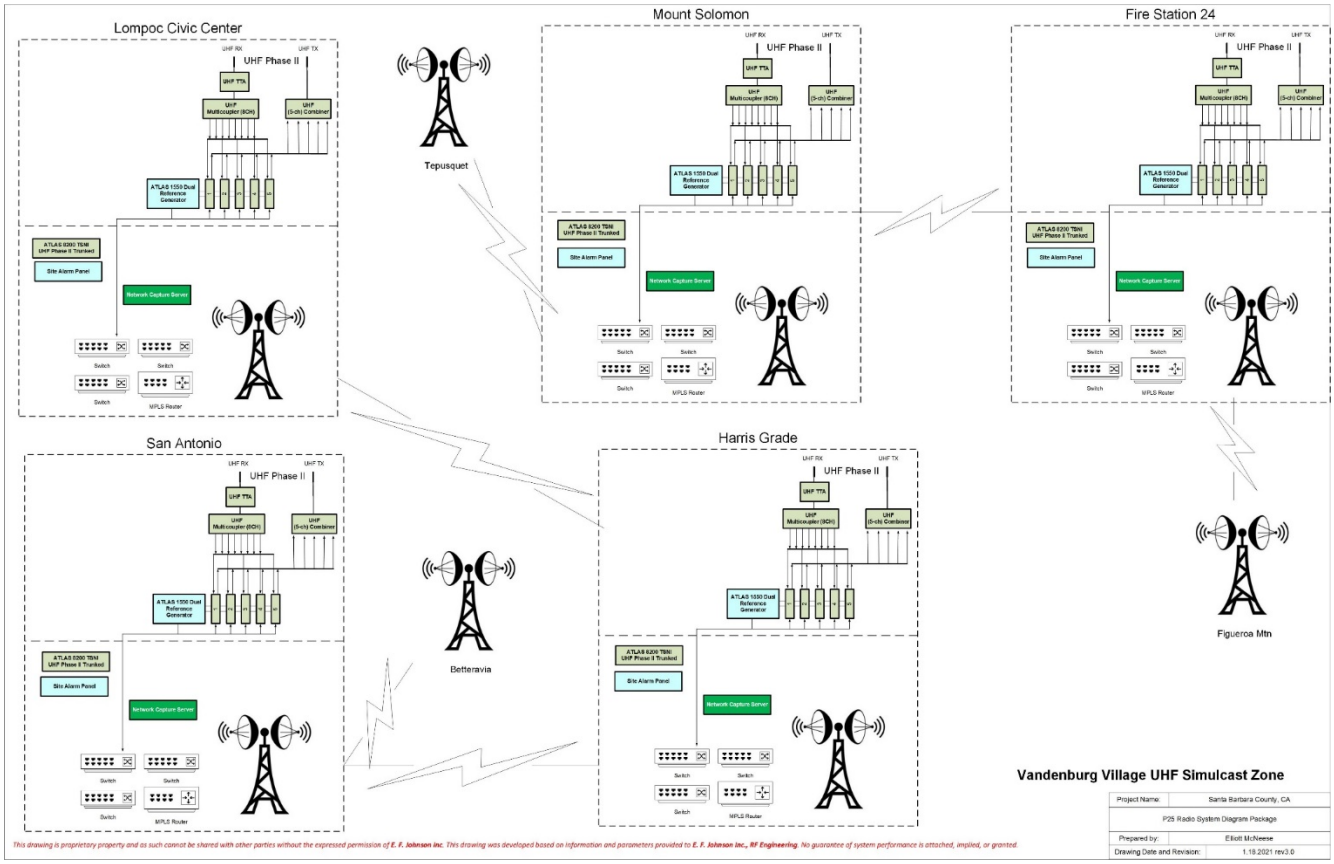


Figure 1.4-16 Vandenburg UHF Simulcast Sites

A-1.1.4.2.7 Plowshare UHF and VHF Coverage Area

A-1.1.4.2.7 UHF Subsystem

JVCKENWOOD's design for the UHF/VHF RF subsystem for the Plowshare coverage area is a two (2) site simulcast zone comprised of the Tepusquet and Plowshare radio sites. The simulcast zone includes five (5) UHF P25 Phase II channels (eight talk paths).

Both radio sites in the simulcast cell are equipped with a Trunked System Network Interface, allowing either one to operate as a simulcast cell controller for the UHF Phase II Trunked simulcast cell.

A-1.1.4.2.7 VHF Subsystem

The VHF RF subsystem is comprised of the Tepusquet and Plowshare radio sites. These radio sites are configured as part of the County wide simulcast system and contain six (6) analog simulcast channels.

Both radio sites are equipped with six (6) Conventional System Network Interfaces, with a CSNI at one site operating as the controller for a simulcast

conventional channel and the corresponding CSNI at the other site operating in the standby mode for the analog simulcast channel.

A summary of the control and repeater equipment is provided below:

Plowshare Coverage Area UHF/VHF Simulcast Equipment	Tepusquet	Plowshare
Advanced Trunking System Network Interface	1	1
SecureSync GPS Timing Reference and Ancillary Equipment for Microwave System	2	2
ATLAS 4500 UHF Phase II Simulcast Trunked Repeater	5	5
UHF Transmit Antenna	1	1
UHF Receive Antenna	1	1
UHF Transmit Power Monitor	1	1
UHF 5 Channel Combiner	1	1
UHF 8 Channel Receive Multicoupler with PDU	1	1
UHF Tower Top Amplifier	1	1
Conventional System Network Interface	6	6
ATLAS 4500 VHF Simulcast Conventional Analog Repeater	6	6
VHF Transmit Antenna	1	1
VHF Receive Antenna	1	1
VHF Transmit Power Monitor	1	1
VHF 6 Channel Combiner	1	1
VHF 8 Channel Receive Multicoupler	1	1
Asentria SiteBoss 530 Remote Site Manager alarm panel with temperature probe	1	1
DC Power Plant with 8 Hour Battery Backup	1	1
Omnistack Switch 6860	3	3
Nokia 7705 SAR-8 MPLS Router (Redundant)	1	1
Network Analyzer	1	1

Figure 1.4-17. Santa Maria City RF Site Equipment Matrix

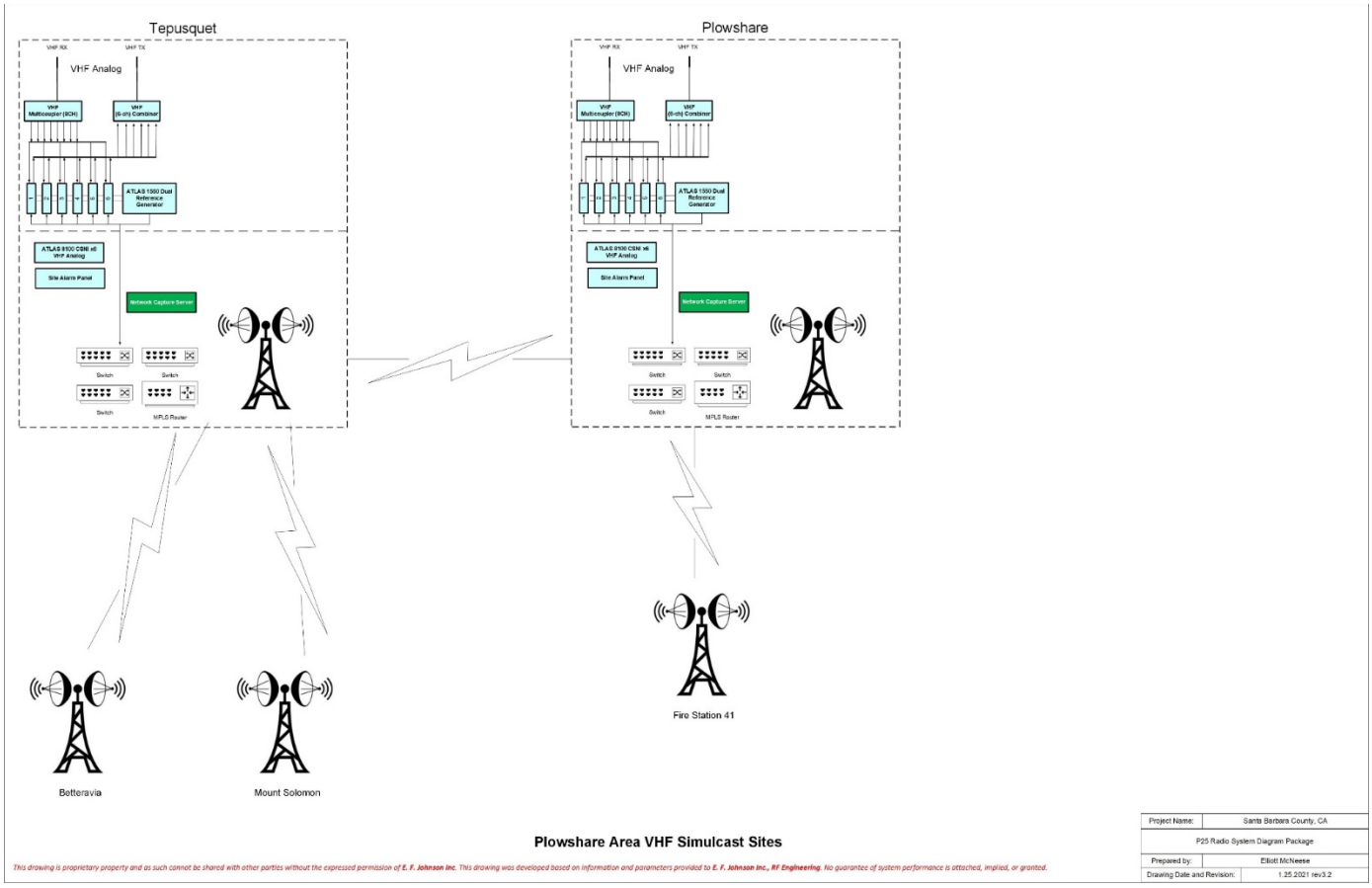


Figure 1.4-18. Plowshare Coverage Area VHF Simulcast Sites

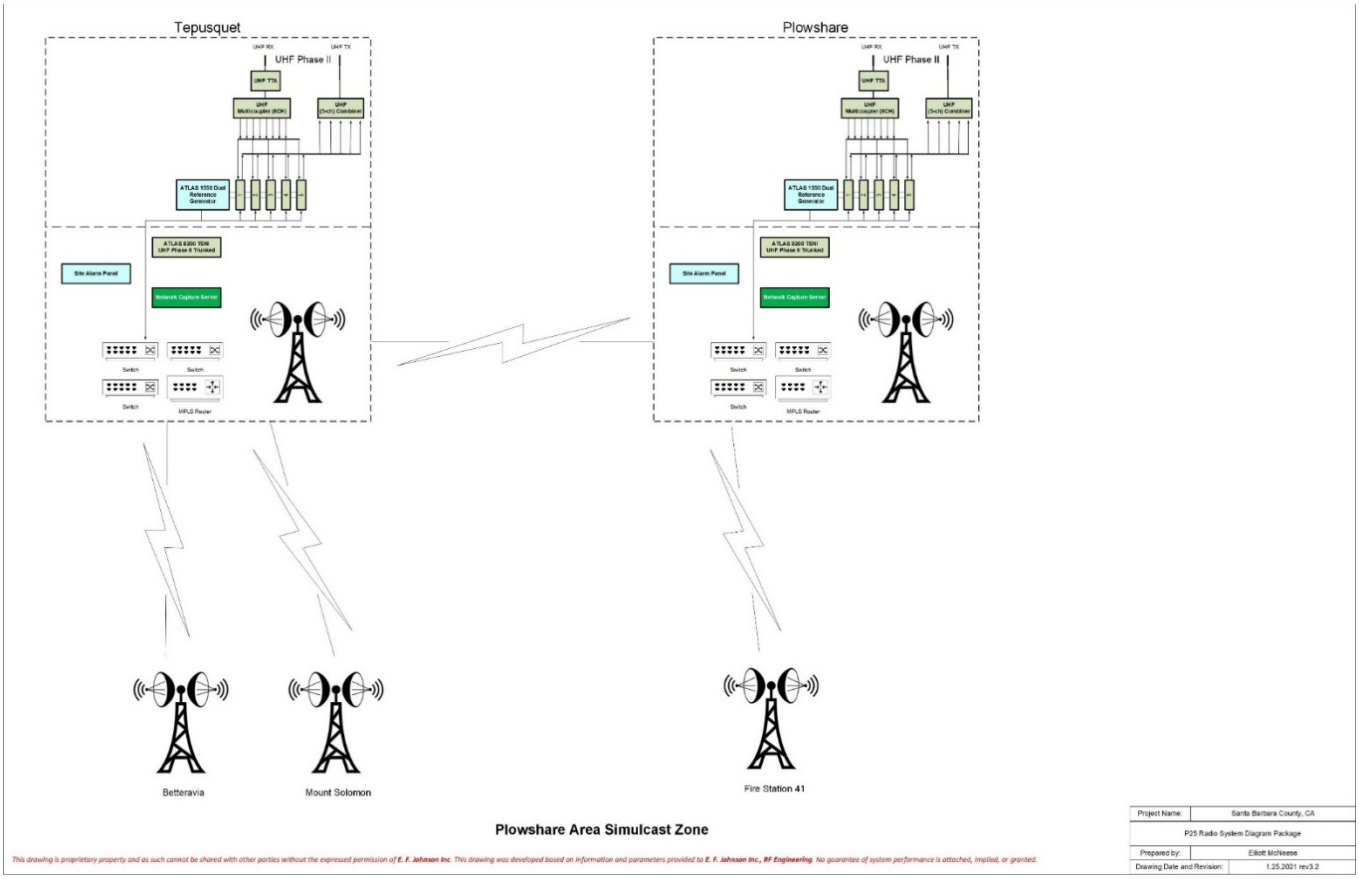


Figure 1.4-19 Plowshare Coverage Area UHF Simulcast Sites

A-1.1.4.2.8 City of Santa Maria 800 MHz Coverage Area

JVCKENWOOD's design for the 800 MHz RF subsystem is a single multicast site collocated with the VHF and UHF systems at the San Antonio radio site.

Two Trunked System Network interfaces are included at the multicast site to act as the primary/standby simulcast site controllers.

A list of all major components for the City of Santa Maria 800 MHz site is provided below.

Santa Maria City 800 MHz Equipment	San Antonio
Advanced Trunking System Network Interface	2
ATLAS 4500 800 MHz Phase II Multicast Trunked Repeater	5
800 MHz Transmit Antenna	1
800 MHz Transmit Power Monitor	1
800 MHz 5 Channel Combiner	1
800 MHz Receive Antenna	1
800 MHz 8 Channel Receive Multicoupler with PDU	1
800 MHz Tower Top Amplifier	1
Asentria SiteBoss 530 Remote Site Manager alarm panel with temperature probe	1
DC Power Plant with 8 Hour Battery Backup	1
Omnistack Switch 6860	2
Nokia 7705 SAR-8 MPLS Router (Redundant)	1
Wireshark Network Analyzer	1
SecureSync GPS Timing Reference and Ancillary Equipment for Microwave System	2

Figure 1.4-20. Sana Maria City 800 MHz Site Equipment List

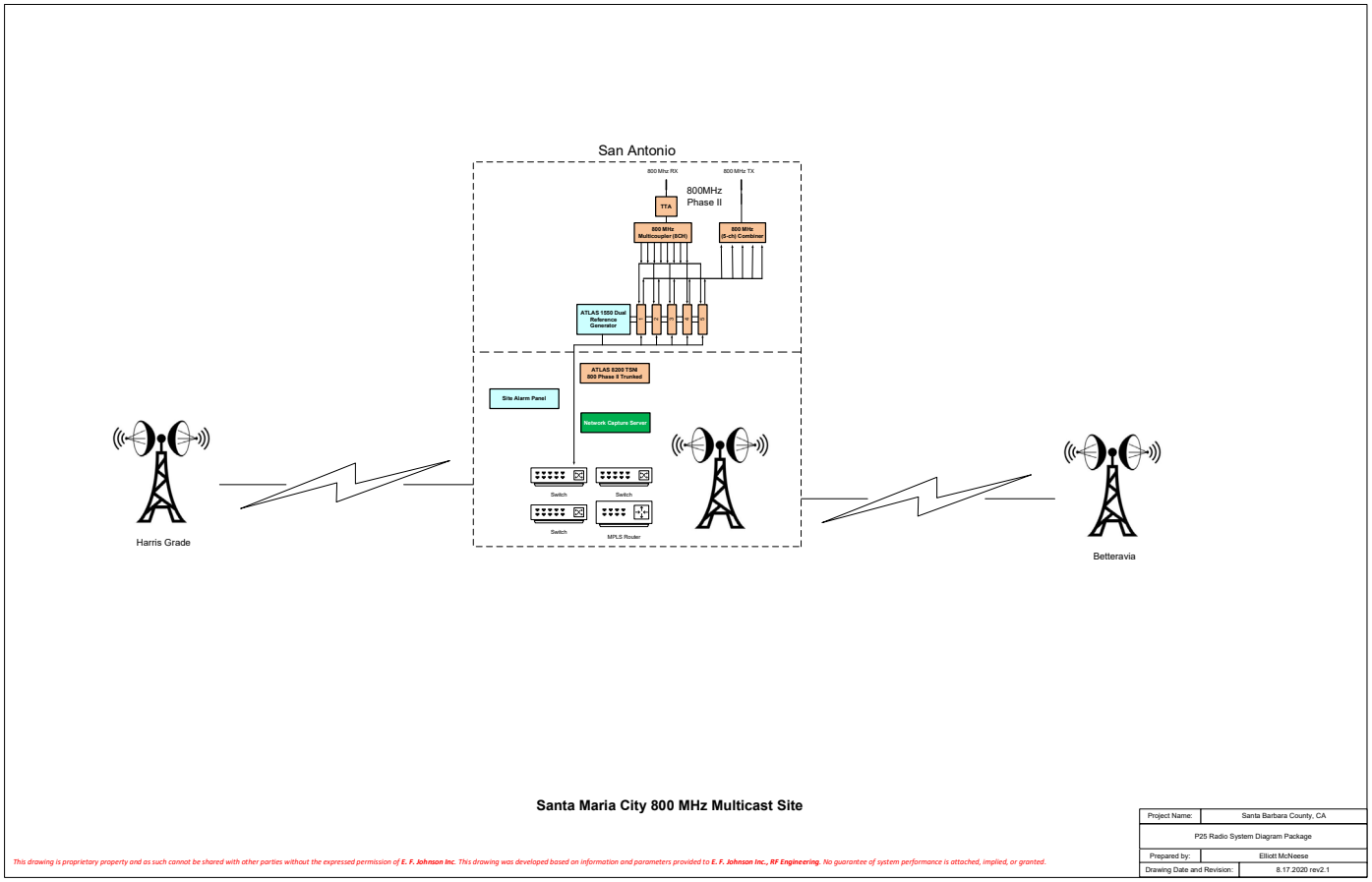


Figure 1.4-21. Santa Maria City 800 MHz Simulcast Sites

A-1.1.4.2.9 Ventucopa Coverage Area UHF and VHF Coverage Area

A-1.1.4.2.9 UHF Subsystem

JVCKENWOOD's design for the UHF RF subsystem for the Ventucopa Coverage area is a two (2) site simulcast zone comprised of the Fire Station 41 and Ventucopa radio sites. The simulcast zone includes five (5) UHF P25 Phase II channels (eight talk paths).

Both radio sites in the simulcast cell are equipped with a Trunked System Network Interface, allowing either one to operate as a simulcast cell controller for the UHF Phase II Trunked simulcast cell.

A-1.1.4.2.9 VHF Subsystem

The VHF RF subsystem is comprised of the Fire Station 41 and Ventucopa radio sites. These radio sites are configured as part of the County wide simulcast system and contain six (6) analog simulcast channels.

Both radio sites are equipped with six (6) Conventional System Network Interfaces each, with a CSNI at one site operating as the controller for a simulcast conventional channel and the corresponding CSNI at the other site operating in the standby mode for the analog simulcast channel.

A list of all major components for the Northeast Santa Barbara County sites is provided below.

Ventucopa Coverage Area UHF/VHF Simulcast Equipment	Fire Station 41	Ventucopa
Advanced Trunking System Network Interface	1	1
SecureSync GPS Timing Reference and Ancillary Equipment for Microwave System	2	2
ATLAS 4500 UHF Phase II Simulcast Trunked Repeater	5	5
UHF Transmit Antenna	1	1
UHF Receive Antenna	1	1
UHF Transmit Power Monitor	1	1
UHF 5 Channel Combiner	1	1
UHF 8 Channel Receive Multicoupler with PDU	1	1
UHF Tower Top Amplifier	1	1
Conventional System Network Interface	6	6
ATLAS 4500 VHF Simulcast Conventional Analog Repeater	6	6
VHF Transmit Antenna	1	1
VHF Receive Antenna	1	1
VHF Transmit Power Monitor	1	1
VHF 6 Channel Combiner	1	1
VHF 8 Channel Receive Multicoupler	1	1
Asentria SiteBoss 530 Remote Site Manager alarm panel with temperature probe	1	1
DC Power Plant with 8 Hour Battery Backup	1	1
Omnistack Switch 6860	3	3
Nokia 7705 SAR-8 MPLS Router (Redundant)	1	1
Network Analyzer	1	1

Figure 1.4-22. Northeast Santa Barbara County RF Equipment Site Matrix

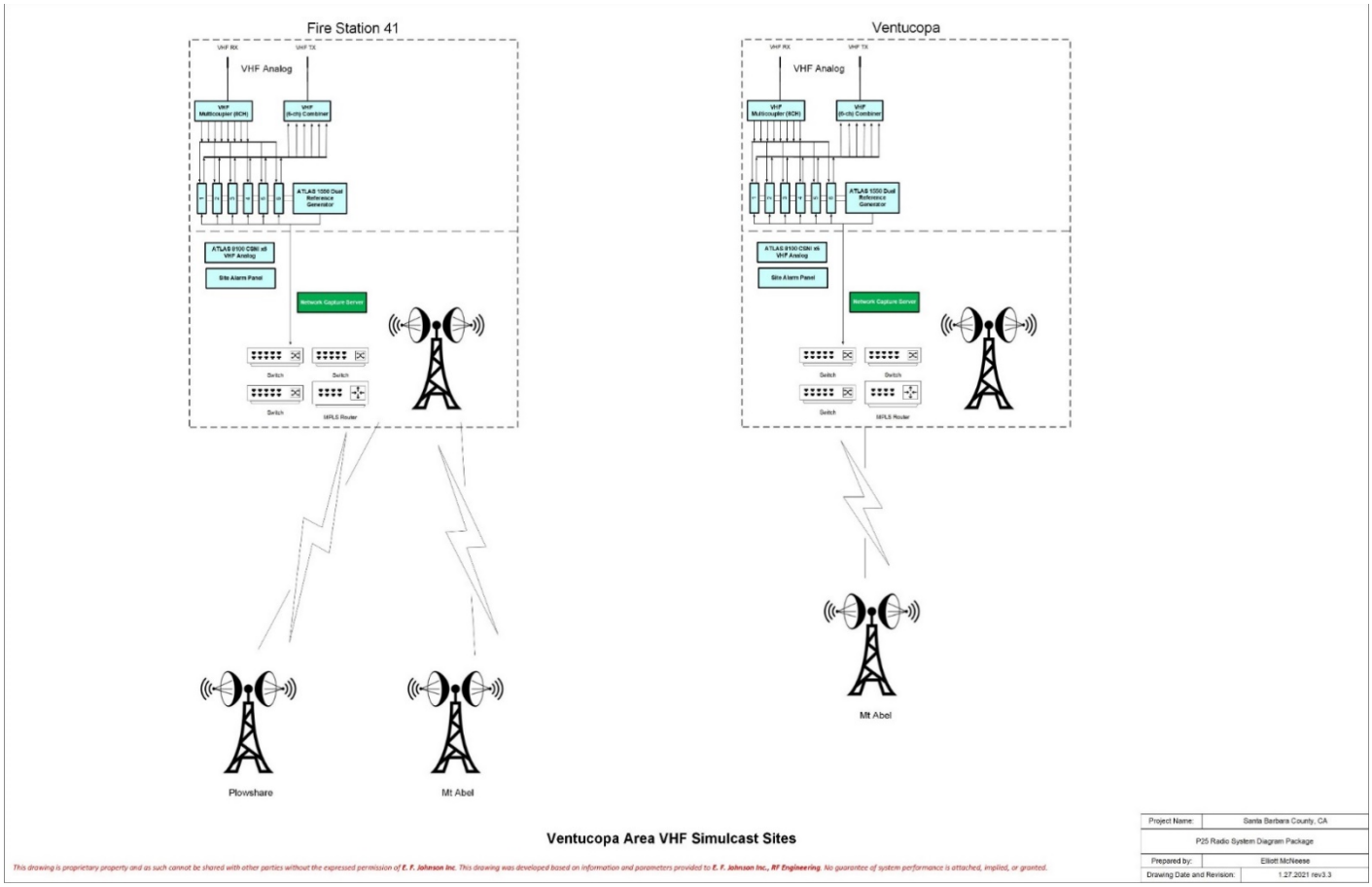


Figure 1.4-23. Ventucopa Area VHF Simulcast Sites

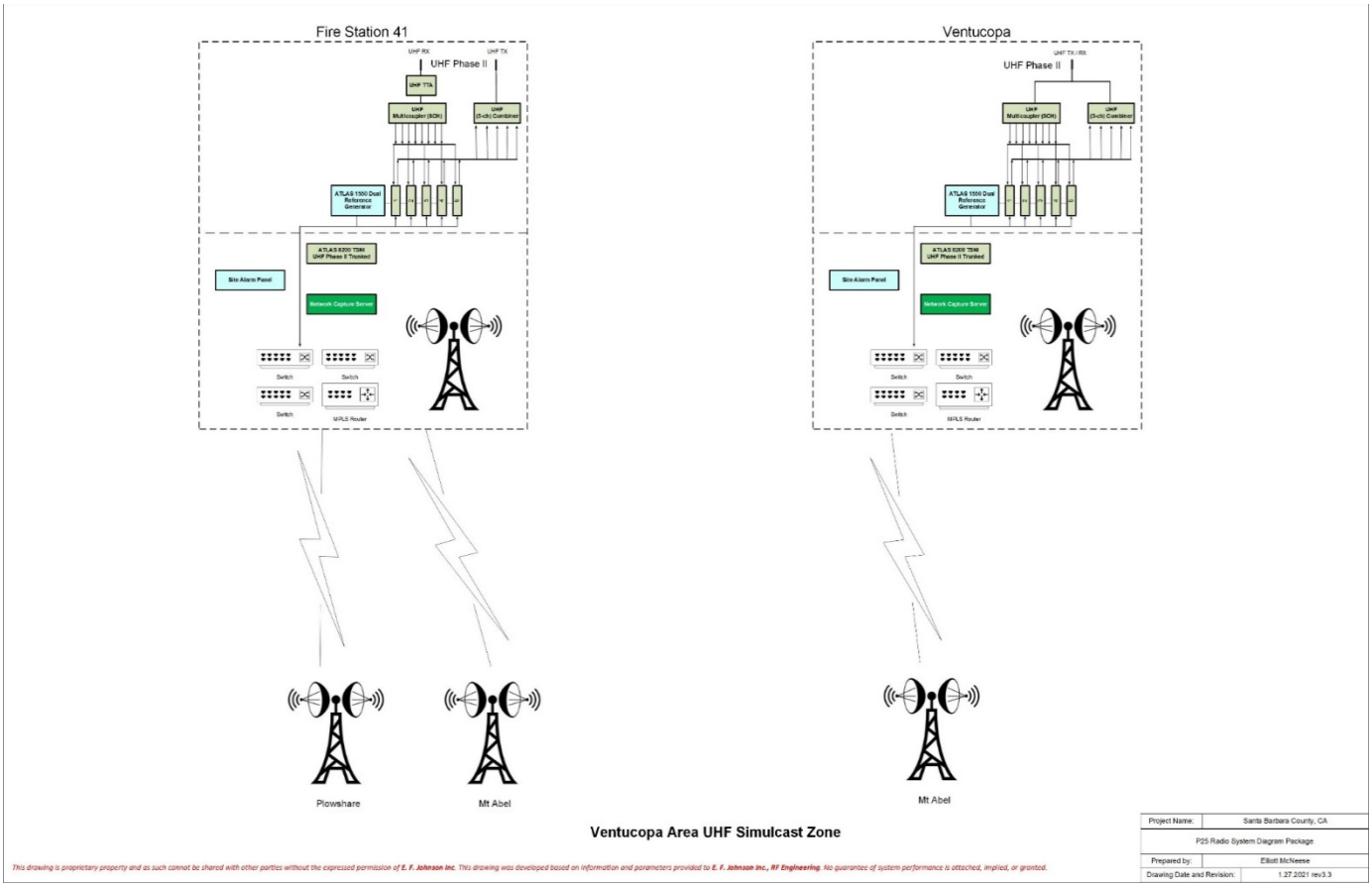


Figure 1.4-24 Ventucopa Area UHF Simulcast Sites

A-1.1.4.2.10 Conventional Analog Stand-alone Sites

Per the RFP, JVCKENWOOD has included ATLAS 4500 repeaters to replace the existing conventional analog repeaters at the following stand-alone RF sites:

Site Name	Frequency Band
Santa Barbara (SB) Courts	UHF
SB Jail	800 MHz
Sheriff 3	UHF
Sheriff 4	UHF
Sheriff 8	UHF

Site Name	Frequency Band
Santa Maria (SM) Courts	UHF
SM Jail	800 MHz
SM Juvenile Hall	UHF
Tajiguas	UHF

A-1.1.4.3 Network Management System and Dispatch Centers

JVCKENWOOD is providing redundant ATLAS and Microwave management equipment for the County's system. The management equipment will be installed in the equipment room of the following locations:

Sheriff Dispatch

- One (1) ATLAS 6200 Advanced NMS server to provide centralized network management functionality for all ATLAS infrastructure products, including operator access and management
- One (1) Alarm Management System (AMS) server, with Castle Rock's SNMPc Enterprise Alarm Management System software: monitors system equipment and site environment alarm sensors
- One (1) Microwave Backhaul NMS (Aviat Provision)
- One (1) ATLAS 6500 Key Management Facility (KMF), including Data Gateway functionality
- One (1) ATLAS 6300 Network Management Terminal (NMT): COTS PC-based terminal device with keyboard, display, and mouse, which allows a user to access a system server such as the ATLAS NMS and ATLAS KMF. The workstation can be placed at any location with system network connectivity.
- One (1) ATLAS 6600 ISSI Gateway with optional redundancy, which supports up to 24 foreign ISSI connections, 96 configured talkgroups, and 24 simultaneous active calls with no additional license fees.

- One (1) ESChat PTToC Solution with optional redundancy and failover capability to provide reliable and encrypted PTT communication between the County's ATLAS P25 network and cellular networks.
- Redundant configured Nokia 7705 MPLS router
- Redundant Nokia OmniStack Switches (6860) with SFB Fiber Interface Module to provide connectivity into the existing network.

Santa Maria Backup Dispatch Center

- One (1) Back-up ATLAS 6200 Advanced NMS server to provide centralized network management functionality for all ATLAS infrastructure products, including operator access and management
- One (1) ATLAS 6300 NMT to access the ATLAS 6200 NMS server and the AMS server
- One (1) Back-up Alarm Management System (AMS) server, with Castle Rock's SNMPc Enterprise Alarm Management System software: monitors system equipment and site environment alarm sensors
- One (1) Back-up Microwave Backhaul NMS (Aviat Provision)

Dispatch Centers

Sheriffs Dispatch Center

JVCKENWOOD is providing the following dispatch equipment, to be located at the Sheriff Dispatch Center:

- Eight (8) Dispatch Consoles
- Eight (8) KENWOOD Viking® VM5000 UHF backup console control stations with 12-channel control station combiner, antennas, and feedline. Control station radios to be racked and housed in equipment room and interfaced to eight (8) ATLAS Mobile Radio Gateways (MRGWs).
- Eight (8) KENWOOD Viking® VM5000 VHF backup consoles control stations with 12-channel control station combiner, antennas, and feedline. Control station radios to be racked and housed in equipment room and interfaced to eight (8) ATLAS Mobile Radio Gateways (MRGWs).
- Eight (8) KENWOOD Viking® VM5000 800 MHz backup consoles control stations with 12-channel control station combiner, antennas, and feedline.

Control station radios to be racked and housed in equipment room and interfaced to eight (8) ATLAS Mobile Radio Gateways (MRGWs).

- One (1) Dispatch Console for training
- One (1) Dispatch Console for maintenance
- Four Alcatel Lucent OmniStack Switches (6860), one set with SFB Fiber Interface Modules to provide connectivity to EOC Fire Dispatch
- One (1) Nokia SAR-8 MPLS Router (redundant chassis configuration)
- One (1) P25 Eventide NexLog Communications 740 Logging Recorder
- One (1) Cisco ASA 5508 internet firewall
- One (1) rack of Microwave equipment
- One (1) rack of DC Power plant as battery backup for the Microwave equipment

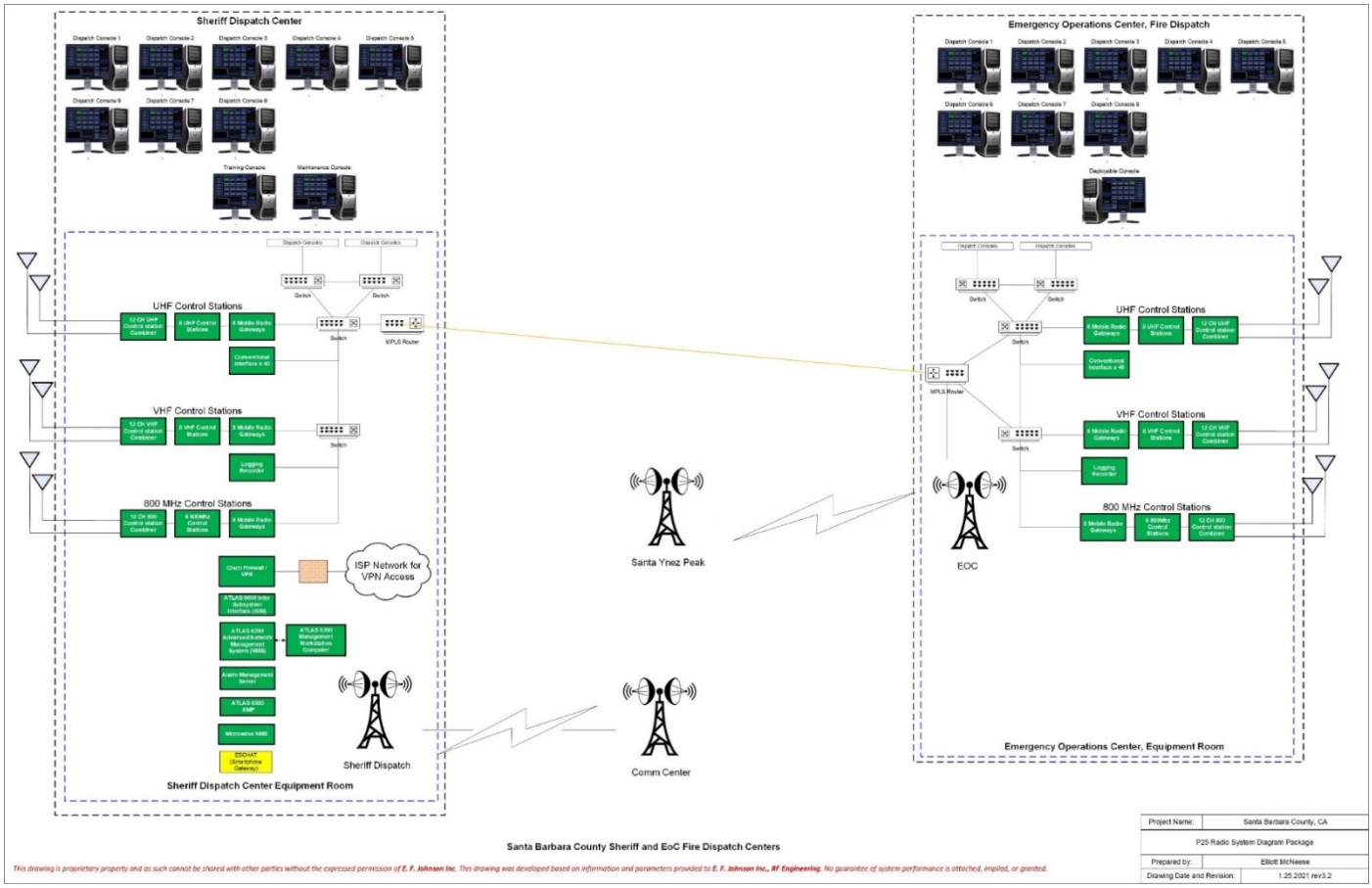


Figure 1.4-25. Sheriff Dispatch and EOC Fire Dispatch

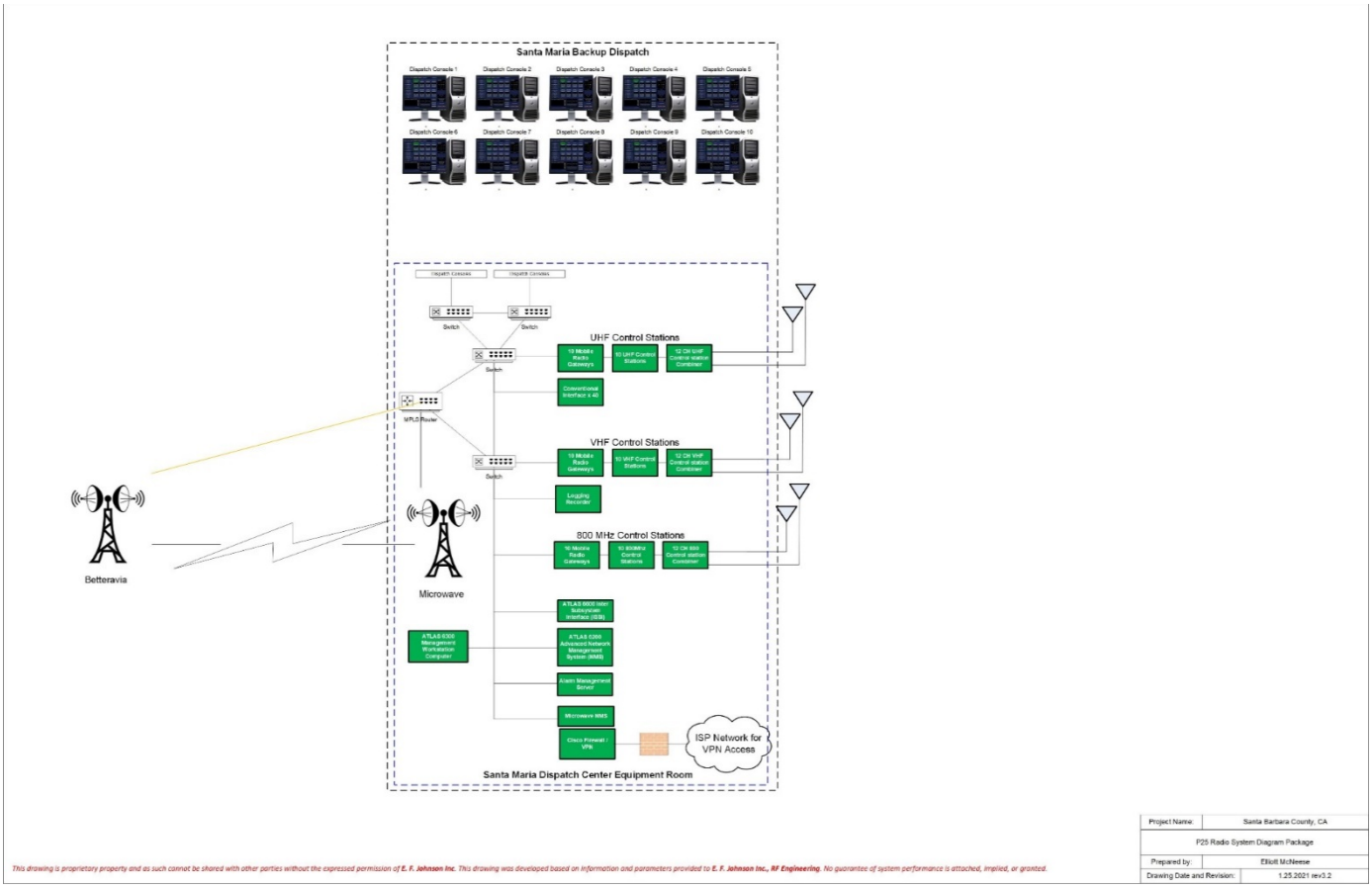


Figure 1.4-26. Santa Maria Backup Dispatch Center

EOC Fire Dispatch Center

- Eight (8) Dispatch Consoles
- Eight (8) KENWOOD Viking® VM5000 UHF backup consoles control stations with 12-channel control station combiner, antennas, and feedline. Control station radios to be racked and housed in equipment room and interfaced to eight (8) ATLAS Mobile Radio Gateways (MRGWs).
- Eight (8) KENWOOD Viking® VM5000 VHF backup consoles control stations with 12-channel control station combiner, antennas, and feedline. Control station radios to be racked and housed in equipment room and interfaced to eight (8) ATLAS Mobile Radio Gateways (MRGWs).
- Eight (8) KENWOOD Viking® VM5000 800 MHz backup consoles control stations with 12-channel control station combiner, antennas, and feedline. Control station radios to be racked and housed in equipment room and interfaced to eight (8) ATLAS Mobile Radio Gateways (MRGWs).
- One (1) Deployable Console

- One (1) P25 Eventide NexLog Communications 740 Logging Recorder
- Four Alcatel Lucent OmniStack Switches (6860), one set with SFB Fiber Interface Modules to provide connectivity to the Sheriff Dispatch Center.
- One (1) Nokia SAR-8 MPLS Router (redundant chassis configuration)
- One (1) rack of Microwave equipment
- One (1) rack of DC Power plant as battery backup for the Microwave Equipment

Santa Maria Backup Dispatch Center

- Ten (10) Dispatch Consoles
- Ten (10) KENWOOD Viking® VM5000 UHF backup consoles control stations with 12-channel control station combiner, antennas, and feedline. Control station radios to be racked and housed in equipment room and interfaced to ten (10) ATLAS Mobile Radio Gateways (MRGWs).
- Ten (10) KENWOOD Viking® VM5000 VHF backup consoles control stations with 12-channel control station combiner, antennas, and feedline. Control station radios to be racked and housed in equipment room and interfaced to ten (10) ATLAS Mobile Radio Gateways (MRGWs).
- Ten (10) KENWOOD Viking® VM5000 800 MHz backup consoles control stations with 12-channel control station combiner, antennas, and feedline. Control station radios to be racked and housed in equipment room and interfaced to ten (10) ATLAS Mobile Radio Gateways (MRGWs).
- One (1) P25 Eventide NexLog Communications 740 Logging Recorder
- Four Alcatel Lucent OmniStack Switches (6860), one set with SFB Fiber Interface Modules to provide connectivity to the County provided Fiber.
- One (1) Nokia SAR-8 MPLS Router (redundant chassis configuration)
- One (1) rack of Microwave equipment
- One (1) rack of DC Power plant as battery backup for the Microwave Equipment

Dispatch Center Equipment	Sheriff Dispatch	EOC Fire Dispatch	Santa Maria Dispatch
ATLAS Network Management System	1	0	1
ATLAS ISSI Gateway	1	0	1
Alarm Management Server	1	0	1
Microwave Network Management System	1	0	1
SecureSync GPS timing and ancillary equipment	2	2	0
Network Management Workstation	1	1	0
ATLAS Key Management Facility	1	0	0
OmniStack Switch 6860	4	4	4
Nokia 7705 SAR-8 MPLS Router (Redundant)	1	1	1
SFB Fiber Interface Module	2	2	1
Wireshark Network Analyzer	1	1	1
Asentria SiteBoss 530 Remote Site Manager alarm panel with temperature probe	1	1	1
DC Power Plant with 8 Hour Battery Backup for Microwave Equipment	1	1	1
Maintenance Dispatch Console	1	0	0
Dispatch Console	8	8	10
Dispatch Console (Training)	1	0	
Dispatch Console (Deployable)	0	1	
UHF Control Station Radios	8	8	10
UHF Control Station Combiner	1	1	1
UHF Control Station Combiner Antennas	2	2	2
VHF Control Station Radios	8	8	10
VHF Control Station Combiner	1	1	1
VHF Control Station Combiner Antennas	2	2	2
ATLAS 8300 Mobile Radio Gateway	20	20	20
Cisco ASA Firewall/VPN Appliance	1	0	1
ATLAS 8410 Analog Gateway, Supports 4 Analog Connections per unit	10	0	10
Eventide Logging Recorder	1	1	1

Dispatch Center Equipment	Sheriff Dispatch	EOC Fire Dispatch	Santa Maria Dispatch
SecureSync GPS Timing Reference and Ancillary Equipment for Microwave System	2	2	0

Figure 1.4-27. Dispatch and NMS Site Equipment Matrix

A-1.1.4.4 Microwave Backhaul Topology

JVCKENWOOD has partnered with Aviat Networks to provide a world class microwave backhaul network to the County.

A-1.1.4.4.1 Microwave Backhaul for ATLAS Radio System

The new microwave backhaul system will upgrade the existing TDM based microwave backhaul network to provide a highspeed hybrid microwave backhaul that will support the requirements for the County's upgrade of their Public Safety Wireless Communications Systems to the IP based ATLAS P25 Land Mobile Radio system. The microwave backhaul system consists of the Eclipse Packet Node (INUe) paired with the all-indoor IRU600 RF unit. With the IRU600 EHP radios having a system gain of more than 8 dB higher than the competitor allows the use of smaller antennas while meeting the reliability objective and capacity requirement. This feature will result to a potential savings on tower lease, tower modification and tower replacement.

The new microwave backhaul network is designed to provide a minimum aggregate air-link capacity of 300Mbps on the core backhaul four-ring network. With ACM enabled, each link in the core backhaul will be able to provide maximum airlink capacity up to 400Mbps during normal/non-faded path conditions.

The microwave network capacity has been sized to ensure that in any event of path failure(s) within the network, each hop/path will have sufficient bandwidth to serve as an alternate path with available bandwidth to support the total aggregate Ethernet link bandwidth requirement between each RF site and the Dispatch Centers.

The preliminary microwave backhaul network system layout consists of five (5) interconnected rings with Five (5) spurs (Figure 2). There are total 27 microwave hops interconnecting the radio system sites, including the Primary Core site (Comm Center), Backup Core/ Fire Dispatch site (EOC) and Santa Maria Backup Dispatch Center.

As shown in the System Layout, four radio sites (Heritage Oil Platform, Oak Mtn-GATR, Ventucopa) are on spurs as required. The Santa Maria Backup Dispatch Center site is also included as a spur, with County fiber providing an alternate path. All other radio sites and Dispatch sites are on ring(s). The County fiber between the existing Sheriff

Dispatch and EOC Fire Dispatch is used to establish ring connectivity with microwave links to maximize the number of LMR sites on the ring.

The new microwave backhaul network topology design has been developed with five (5) interconnected rings wherein each ring has two connection points to adjacent rings, to provide redundant routes for inter-ring traffic as required by the RFP. Aviat Networks' design engineering team will work closely with JVCKENWOOD and the County to further develop and optimize the microwave backhaul network layout during the DDR.

All paths in the core backhaul network have been designed with CCDP/XPIC enabled as required by the RFP, each using two (2) 30MHz channels, one on Vertical-polarization and the other on Horizontal-polarization, assuming same frequency pair, and using Layer 1 Link Aggregation (L1LA), to provide the minimum 310Mbps air-link capacity per path. Network provides a summary of the Eclipse IRU600v4 radios configurations and air-link capacities for the twenty-seven (27) paths.

Site Name 1	Site Name 2	Configuration with CCDP
Betteravia	Tepusquet	2*(1+0)
Comm Center	Sheriff Dispatch	2*(1+0)
Comm Center	Santa Ynez	2*(1+0)
Fire Station 24	Figueroa Mtn	2*(1+0)
Fire Station 41	Mt Abel	2+2 MHSB/SD
Harris Grade	Lompoc Civic Center	2*(1+0)
Heritage Oil Platform	Santa Ynez	2+2 MHSB/SD
La Cumbre Peak	Comm Center	2*(1+0)
La Cumbre Peak	Valley Peak	2+2 MHSB/SD
La Cumbre Peak	Admin	2*(1+0)
Mount Solomon	Fire Station 24	2*(1+0)
Mount Solomon	Tepusquet	2*(1+0)
Mt Abel	La Cumbre Peak	2+2 MHSB/SD
Plowshare	Fire Station 41	2+2 MHSB/SD
San Antonio	Betteravia	2*(1+0)
San Antonio	Harris Grade	2*(1+0)
Santa Ynez	Valley Peak	2+2 MHSB/SD

Site Name 1	Site Name 2	Configuration with CCDP
Santa Ynez	Figueroa Mtn	2*(1+0)
Santa Ynez	EOC (Fire Dispatch)	2*(1+0)
Santa Ynez	Admin	2*(1+0)
Sudden	Figueroa Mtn	2+2 MHSB/SD
Sudden	Oak Mtn - GATR	2+2 MHSB equal
Sudden	Lompoc Civic Center	2*(1+0)
Tepusquet	Plowshare	2*(1+0)
Ventucopa	Mt Abel	2+2 MHSB equal
Admin Building	Rincon	2+2 MHSB / SD
Betteravia	Santa Maria Dispatch	2+2 MHSB Equal

Figure 1.4-28. Microwave Links, UHF/VHF/800 System

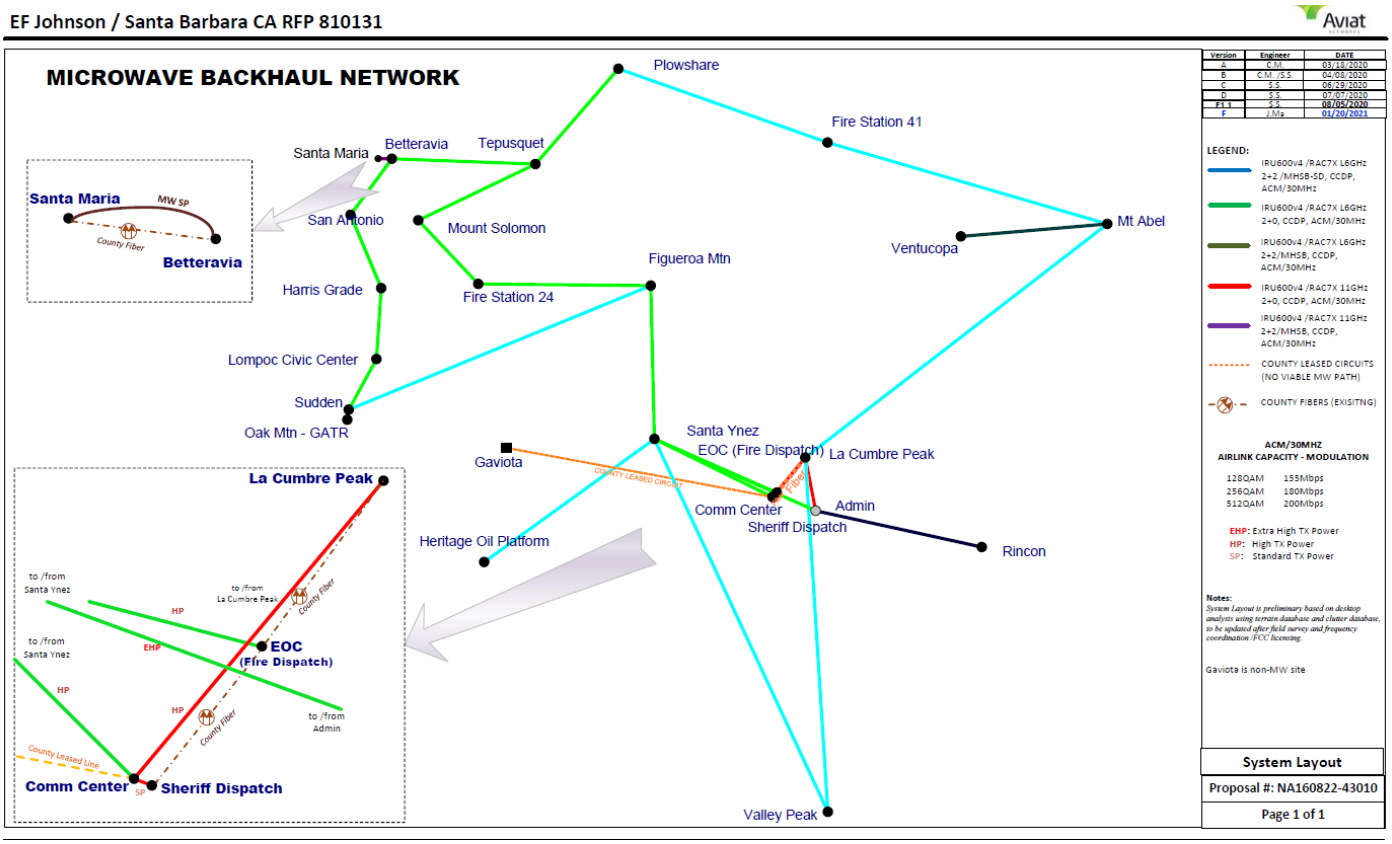


Figure 1.4-29. Microwave Backhaul Topology for the Primary UHF/VHF/800 Radio System

A-1.1.4.4.2 Path Loss and Fade Margin Calculations

Preliminary Path Loss and Fade Margin Calculations have been performed using the industry recognized Pathloss 5.1 transmission design software tool. Our preliminary path calculation reports and path profiles are submitted as part of the System Design document for reference. The Vigants 1975 reliability models are used for Multipath fading calculations, and Crane Rain Region in California are used for rain fading calculation in 11GHz.

With CCDP /XPIC enabled as required by RFP, each microwave path in the core backhaul network have been designed to meet the per-hop microwave path availability objective target of 99.999% annual two-way at BER10-6 RX threshold, and target >30dB Effective Fade Margin, with the minimum air-link capacity at 155Mbps/128QAM per 30MHz channel (~310Mbps Aggregate link capacity) in 6GHz and 11GHz FCC licensed bands.

The design includes the use of the IRU600v4 Extra High-Power (EHP) RFU in long/difficult paths. The IRU600v4 EHP RFU has the highest transmit output power for a microwave radio available in the market. EHP provides better overall path system gain and performance with the smallest possible antennas, reducing Santa Barbara County's costs and risks associate with tower loading.

Adaptive Modulation (ACM) license is equipped on all microwave radio links in the core ring as required by the RFP. Eclipse radio 30MHz ACM modem profiles are used in the preliminary path calculations. Three ACM steps are provided for each core network path. The corresponding per-channel radio air-link capacities are listed in the following table.

Modulation Steps	Air-Link Capacity 30 MHz Channel
128QAM*	155 Mbps
256QAM	180Mbps
512QAM	200Mbps

Figure 1.4-30. Modulation Steps and Air-link Capacities

ACM maximizes the use of available bandwidth through automatic adjustment of modulation so that the most data efficient (highest possible) modulation with high air-link capacity is used over the prevailing path conditions. When used in conjunction with traffic prioritization (QoS), it can be configured to ensure all high priority traffic continues to get through when path conditions deteriorate causing the radio to switch from high modulation with high air-link capacity to low but more robust modulation with less air-link capacity, and only low priority "best effort" data is discarded. It is understood /assumed that the radio air-link capacity when operating at the lowest ACM modulation step (i.e., 128QAM in this case) is enough to support the bandwidth requirements for the critical traffic.

For optimum RSL balance on V-pol and H-pol links, and hence optimum CCDP/XPIC effectiveness, ATPC should be OFF on both RAC co-channel links. ATPC should not be used on CCDP/XPIC links where the V+H dual-polarized antenna cross polarization discrimination (XPD) level during normal operation is less than 25dB or the link /path is long/difficult. Similarly, ACM which by default uses ATPC, should not be used on such CCDP/XPIC links. In this case, two different/parallel frequency channel pairs (ACAP or ACCP) are recommended, subject to frequency coordination/FCC licensing results.

CCDP/XPIC is not commonly used in 6GHz bands in the United States since most, if not all regions are heavily encumbered with single-channel paths and it is very difficult to coordinate a frequency pair utilizing both polarizations (CCDP) on the same link/path. This can even be more complicated at junction sites like Santa Ynez, Tepusquet, and La Cumbre Peak where cross polarization would usually be required for co-channel, and often times adjacent-channel use on different paths. The established 6 GHz base has extensively used cross-polarization between co-channel and adjacent channel systems to facilitate frequency re-use in congested areas. Attempting to place a new CCDP/XPIC system in these areas does not facilitate efficient spectrum utilization, rather it retards it in most instances as new paths in the area will not be able to gain the cross-polarized improvement for either the co-channel or both adjacent channels. In many countries that allocate by frequency blocks, most common in ETSI regions, CCDP/XPIC is required before another frequency can be assigned. Under an assignment system that allows all users access to the entire band, using CCDP/XPIC actually makes it harder to add new paths in areas with CCDP/XPIC facilities.

CCDP/XPIC incurs system gain penalty and should be used only if required as a result of frequency coordination. It is not recommended, particularly with ACM, in problematic propagation areas or paths. There are several ways to achieve the minimum 300 Mbps air-link capacity requirements using two 30MHz channels. CCDP is one of the approaches. Other possible alternatives are: ACAP (Adjacent Channel Alternate Polarization) which is the primary method utilized on the installed base - particularly in

the 6GHz bands; or ACCP (Adjacent Channel Co-Polarization) using two different frequency channels co-polarized, meeting radio minimum T-T/R-R, and Inter-RFU T-R spacing and inter-mod requirements; or by using a single 60MHz channel (L6GHz) or 80MHz channel (11GHz) if available. The specific approaches can be reviewed and discussed with the County during the project engineering phase.

The preliminary Path Profiles used in the design were generated using USGS National Elevation Dataset (NED) with 1/3 Arc Second resolution (approx. 10m) Terrain Data in Grid Float format and National Land Cover Database (NLCD) clutter data.

Considering that the County of Santa Barbara, CA is in a "Poor" microwave propagation region, the Clearance Criteria used to estimate the antenna centerlines for each path in our preliminary path designs are as listed below:

Climate Areas	Fresnel	K Factor
	Main Dish	
Poor	100% of F1	K = 1.33
	Grazing	K = 0.5
	Diversity Dish	
All Areas	60% of F1	K = 1.33

Figure 1.4-31. Clearance Criteria

Based on local experience, Space Diversity is added on paths along the coast area although the preliminary path calculation meets the per-hop objective with non-diversity radios. A detailed design review and collaboration with the County will be essential for the optimization of the microwave path designs during project engineering phase.

It must be noted however that the NLCD clutter database are not very accurate. Tree and Structure clutter heights shown on the preliminary path profiles are estimates only based on Google earth images. Given the limited tower heights at some sites, the field path survey will verify the actual tree and/or structure clutter heights which is when antenna centerlines will be optimized for clear Line-of-Sight for each path.

A-1.1.4.4.3 Microwave Radio Equipment

The all-indoor RFU being provided is the IRU600v4 which is optimized for 1+1 protection with options to be configured as 1+0 non-protected with a single RFU XCVR module, and 1+0 repeater or 2+0 with two RFU XCVR modules. The IRU600v4 is available in FCC licensed frequency bands 6, 7, 10, and 11 GHz. The IRU600v4 RFU is software configurable to support 3.75 to 80 MHz channel BW sizes in modulations from QPSK to 4096QAM.

The IRU600v4 is available with three TX power output levels; Standard Power (SP), High Power (HP) and Extra High Power (EHP). All three levels are used in the Santa Barbara County design where applicable to meet the required per-path RF availability objective. The IRU600v4 SP/HP RFU hardware is designed with a Flexible Power Mode (FPM) feature wherein the RFU is available with Standard Tx output power be default, and the High Tx output power is enabled via an optional feature software license, adding 2 to 3 dBm output across all modulation. This allows Aviat customers to save cost by minimizing RFU hardware sparing requirements.

The IRU 600v4 EHP RFU is a different hardware. The IRU600v4 EHP has the highest system gain across all QAM modulation schemes, as measured at the RFU interface. This is about 3-6 dB more output power than that of high-power radios. With the highest transmitter output power of any microwave radio on the market, network designers can have the peace of mind to be able to design microwave links with smaller antennas, longer paths, and higher capacity.

Radio configurations used to support the backhaul design are 2+0 CCDP or 2+2 MHSB/SD CCDP for paths on the ring, and 2+2 MHSB CCDP or 2+2 MHSB/SD CCDP for paths on spur.

IRU600v4 ACU has Expansion ports that can be connected to the existing radio temporarily for them to operate in parallel sharing the same antenna & waveguide system on the path if needed, minimize the traffic down time, if the new and existing radios are in same polarization and frequency band and meet the radio minimum T/T, T/R spacing and inter-mod requirements.

The height of IRU600v4 is 2RU. Multiple IRU600 radios can be mounted in same one rack. IRU600 intra-rack waveguide Extension Kits are provided to extend radios antenna ports to the Top-of-Rack (ToR), types and quantities are estimated for now. It is assumed that each path can be frequency coordinated with two 30MHz channels, one on V-pol and another on H-pol for now, to be confirmed.

The Eclipse RAC7X plug in module is a XPIC capable modem card used with the IRU600v4 and ODU600v2 RFU platforms. The RAC7X modem card is software

configurable to support 3.75 to 80MHz channel BW sizes in modulations from QPSK to 4096QAM providing air-link capacities up to 716 Mbps per channel. The RAC7X modem cards can be configured to operate for non-protected or protected /diversity operation. It can also be configured for non-XPIC operation. Adaptive Modulation is an optional feature providing hitless modulation switching which can be enabled via a software feature license which we have included in our System Design document. FIPS 197 certified Payload Encryption is also an optional feature which can be enabled via an optional software feature license.

The Packet Node indoor nodal unit (INUe) are equipped with the Eclipse DAC GE3 GigE switch module/s. Each DAC GE3 has five (5) Gigabit Ethernet interfaces (3x10/100/1000Base-T + 2x multi-purpose GigE SFP). The Eclipse DAC GE3 proprietary Layer 1 Link Aggregation (L1LA) is a licensed feature and equipped for this new project where applicable. DAC GE3 also supports Layer 2 Link Aggregation (Static LAG or LACP) as a standard feature.

The DAC GE3 switch module (layer-2) supports port prioritization and tag prioritization for QoS congestion management. Port prioritization simply gives the data coming in one port preference over the data coming in on another using eight levels of priority. Tag prioritization gives preference to data traffic on a frame-by-frame basis using Class of Service (CoS/802.1p) bits in the VLAN field of the Ethernet header, the DSCP bits in the IP header (DiffServ), or prioritization based on MPLS experimental (Exp) bits.

Either can be used to prioritize traffic through the radio link. Traffic policing using TrTCM (Two-rate, Three Color Metering) is also a standard feature and can be enabled where required.

One DAC GE3 card is equipped per end of a microwave path on ring, and two protected DAC GE3 cards via stacking are equipped per end of a microwave path on spur, interfacing with external IP/MPLS routers provided by JVCKENWOOD. The demarcation point for Ethernet traffic is at the GigE ports on DACGE3. Our System Design document assumes that the Ethernet interface to the external MPLS routers are via Electrical RJ45 GigE interfaces. Optical SFP modules are provided at EOC and Sheriff Dispatch. It is assumed that the interconnection between DACGE3 and external IP/MPLS router will be single-feed for ring and dual-feed for spur, details to be confirmed with JVCKENWOOD later. The QoS Plan and VLAN Plan (if required) will also be discussed with JVCKENWOOD and provided later during project engineering phase.

- For ring networks where DS1 loop protection is required, Eclipse Network Convergence Module (NCM) is equipped to provide the internal loop

protection switching for DS1 circuits. Each INUe in a ring node equipped with the NCM requires the Loop Switch feature software license. The Eclipse internal loop switch feature reduces cost to our customers and helps save valuable rack space that would be occupied by external 3rd party loop switches and therefore eliminating the need for the extra DSX panels.

The NCM provides DS1 loop protection switching for individual tributaries. Each NCM module can support loop switching of up to 63xDS1. The module is equipped with 8xDS1 front panel ports and 55xDS1 backplane ports. All NCM loop switch modules for this project will be supplied and configured with 1+1 protection. For the new system, at sites where the required local DS1 drops will be more than 8xDS1 circuits, the NCM and additional DAC 16x cards will be used together. Where necessary, the mapping of loop protected DS1 circuits between INUe shelves can be supported by interconnecting the INUe shelves using Eclipse DAC3xDS3M M13 mux modules.

- The Eclipse Packet Node INUe will be equipped with the Eclipse DAC 16x module where required. Each DAC 16x module supports 16xDS1 tributary ports. The DAC 16x cards are configured with 1+1 protection.

Based on RFP Appendix-O and Addendum No.8 Attachment-20, the preliminary number of TDM T1s Add/Drop estimation at the existing sites that are included in new microwave backhaul network are listed at the following , to be confirmed.

Site Name	T1s Add/Drop	Site Name	T1s Add/Drop
SUDDEN	1	ADMIN	15
SANTA YNEZ	15	LA CUMBRE PEAK	2
BETTERAVIA	25	COMM CENTER	54
TEPUSQUET	26	PLOWSHARE	1
LOMPOC	10	SAN ANTONIO	1
HARRIS GRADE	5	VALLEY PEAK	1
RINCON	1	SANTA MARIA	0

For some existing sites (e.g., Foster, Cook, Solvang, Rincon, etc.) that are not included in the new microwave backhaul network but have existing TDM T1 add/drop, it is understood that the existing microwave radios /paths (e.g., Harris Grade/Foster/Tepusquet, Cook/Tepusquet, Solvang/Santa Ynez, Rincon/Admin, etc.) that connect them to the sites in new microwave backhaul network will remain as needed until the legacy TDM T1 circuits are migrated to new Ethernet, to be discussed and confirmed with JVCKENWOOD/the County. The detail equipment configurations for TDM traffic will be updated later once the TDM T1

Plan for new network will be clarified and confirmed with JVCKENWOOD/the County.

The Eclipse Packet Node Indoor Nodal Unit (INUe) is a 2RU chassis which can support a total of 6 radios (RACs), depending on the number of interface cards (DACs) required. Each INUe configuration for all sites are equipped with a Node Protection card (NPC) to provide BUS controller redundancy and DC power redundancy.

The Eclipse INUe is equipped with two separate traffic control planes. The data packet plane (DPP) is used for passing Ethernet/IP traffic, and the High-Speed Backplane BUS can be used to transport TDM traffic and/or Ethernet traffic as well.

The following optional Strong Security feature can be enabled with the available optional feature software licenses:

- RADIUS Client
- Secure Management with SNMPv3
- Payload Encryption
- FIPS 140-2 Strong Security

The RADIUS Client feature license enables each INUe to support user authentication and authorization from a centralized RADIUS/AAA server, rather than in each individual INUe in the network. The Eclipse RADIUS Client implementation is based on RFC-2865. This feature however provides the option to use both local user account management and RADIUS management to have a backup in any event that the RADIUS/AAA server communication fails. The RADIUS/AAA server is not included and is assumed to be provided by the County.

The Secure Management feature license enables support for SNMPv3 and advanced user account management and security features. Secure Management is a subset of Aviat Networks Eclipse Strong Security product suite. Secure management applies to Eclipse NMS access over the network, and to local access via the Portal craft tool. Full security with encryption will only apply if SNMPv3 is enabled.

- Within Eclipse secure access is achieved on the NMS port by securing all protocols that use the port.
- It secures access and control of the radio so no one can tamper with it locally or remotely.

- RADIUS client capability; user accounts can only be managed locally. A RADIUS client license must be purchased in order to perform remote user account authentication and management.
- When secure management is implemented, only secure versions of the protocols are allowed to access the NMS port; TLS on portal connections, HTTPS for software downloads.
- Mechanized attack prevention monitors number of failed log-in attempts over a user-configurable attack window.
- Four available user account permission levels (access rights)
- Each Eclipse INUe enforces password complexity policing.
- Access Control List for user access limitation
- Locks out users if the number of failed logins exceeds a configurable threshold.
- Locks out locked-out users for a configurable blocking period.
- Session timeout mechanism
- Syslog forwarding
- All unused physical NMS ports can be disabled.
- User selectable encryption cipher suites apply to the Portal connection. Selection is enabled only at the Crypto user level.

The Eclipse Payload Encryption Operation is FIPS-197 validated and can be enabled/disabled independently for each wireless link from an INUe using the RAC 70/7X modem card. Operation is applicable on most modulation profiles (fixed or adaptive) and on selected CCDP/XPIC options. Traffic can include Ethernet, DS1/E1, DS3, OC3/STM1, or any mix up to the max capacity allowed by the capacity license.

Under payload encryption the integrity of each data frame sent over the link is checked to ensure received data has been sent by the intended transmitter. Received data is replaced with AIS if it detects it has been modified (man-in-the-middle attack). It provides the same level of security as Wi-Fi and WiMAX.

Encryption selection and cipher key management features include:

- AES-CCM cipher suite with AES counter mode data encryption and CBC-MAC data integrity validation.
- The encryption scheme is selectable from AES 128 CCM, AES 192 CCM, AES 256CCM.

- Each link has a randomly generated encryption key.
  - With Basic or Strong security Diffie-Hellman is used for key agreement between each side of the link.
  - With FIPS, keys are exchanged through a DTLS tunnel (Datagram Transport layer Security).
- A user configurable key change option specifies the maximum time a particular key can be used. Key change is errorless.
- A user-configurable Group ID for key generation ensures that only radios that belong to the group can negotiate an encryption key.
- The Eclipse FIPS 140-2 Strong Security operation complements the Secure Management license and Payload

Encryption license and adds the following FIPS 140-2 validated security processes to each INUe:

- FIPS 140-2 validated/certified operation.
- Provision of only FIPS approved cryptographic algorithms for secure management interfaces and SNMPv3.
- Tamper-evidence protection and opacity.
- Power-up self-test sequences including software integrity, known answer tests, etc.
- Key zeroization capability, both manually and automated.
- Integrity checking of new software upgrades using FIPS validated algorithms.
- Prevention of accidental deactivation of FIPS mode.

A-1.1.4.4.4 Microwave Network Management System

Aviat Networks' ProVision EMS will be used for fault management and monitoring of the new microwave backhaul network. ProVision is a comprehensive Element Management solution for events, faults, performance, configuration, and inventory management. It is based on SNMP (Simple Network Management Protocol), the widely accepted standard for performing network management functions.

The ProVision EMS Northbound Interface (NBI) will interface with JVCKENWOOD's Network Management System (NMS). The ProVision NBI provides easy to implement data integration interfaces, supporting network data in a range of formats, such as ACSII, CSV, SNMP, and XML. The ProVision EMS Redundant Server solution provides uninterrupted business-critical supervision of Aviat Networks equipment. Using two

ProVision EMS servers means users will not lose the ability to manage the network even if one server fails.

There are two types of Redundant Server configuration options supported by the ProVision EMS:

- The Redundancy Controller provides automatic server failover (Hot Standby) with near real-time data synchronization; only the primary server is fully active and communicating with the network at a given time; the primary and standby servers can be installed remotely from each other to provide maximum geographical redundancy and security.
- The Standby Server supports manual server failover (Cold Standby) with automated data synchronization performed on a daily basis; both servers are active and communicating with the network at a given time (although there are restrictions imposed on the standby server such as performance data collection, and NBI notifications are disabled); enabling the standby server to be used to support an increased number of simultaneous user logins; the primary and standby servers can be installed remotely from each other to provide maximum geographical redundancy and security.

The server redundancy configuration for the County of Santa Barbara uses the Redundancy Controller feature providing automatic failover protection in an event of a failure of the primary ProVision EMS server.

ProVision EMS Deployment is Server/Client based. The server can support multiple user accounts. While the number of simultaneous client sessions is limited by/ dependent on the server hardware /software configurations and Server Loading Value (SLV). For large networks, usually the Client software is installed in separate/different hardware. Note that with Redundant Controller configuration, only one server is active, and the clients can only login to the active server.

The ProVision EMS clients can be operated on a local client machine (LAN client) or a remote client machine via WAN (WAN client). The WAN connections typically exhibit higher latency and lower bandwidth when compared with LAN connections. On most cases, a WAN client solution needs to be deployed that will require a WAN Client Server using Windows Terminal Services (or equivalent). ProVision EMS client machines and WAN client solution is not included. Such requirements can be discussed in further details with JVCKENWOOD/the County during the detailed design review.

The server hardware are rack mounted servers and will be supplied with Windows Server OS and with the ProVision EMS pre-installed and pre-configured. The servers have been sized to have sufficient capacity to manage the new microwave backhaul

network. As an alternative, each Eclipse Packet Node (INUe) can also support forwarding of SNMP traps directly to JVCKENWOOD's NMS if preferred.

A-1.1.4.4.5 Provision EMS Features

ProVision EMS provides a rich set of network/service assurance and provisioning features spanning both current and legacy Aviat platforms. Many partner products and third-party platforms are also supported by the core subset of network assurance features.

Below are some of the highlights of ProVision EMS:

Network Assurance Features

- Highly scalable tree, map, and tabular views of network resources
- Automatic discovery of devices, configurations, RF links
- Event collection with browsers, notifications (email, SMS, etc.) and graphical scoreboards views
- Device and RF (G.826, RX/TX, etc.) performance collection with history and trend views, and alarm thresholding
- Ethernet interface performance collection with history and trend views, and alarm thresholding
- Ethernet link bandwidth utilization network analysis
- Carrier Ethernet network analysis
- Automatic backup of device configurations with ability to restore
- RF, Ethernet and Clock sync network health analysis and reporting

Service Assurance Features

- Ethernet Services
- VLAN, Ethernet OAM, and ERPS automated discovery and visualization
- Automated end-to-end continuity testing
- Loopback and Link-Trace diagnostic testing

Provisioning Features

- Provisioning of settings for multiple devices in bulk through predefined Configuration Profiles
- Software loading of devices in bulk with scheduled activation
- License loading of devices in bulk

- TDM end-to-end circuit provisioning through graphical user interface
- Ethernet OAM/ERPS provisioning
- Device integration

A-1.1.4.4.6 Provision EMS Security

ProVision supports user log-in security utilizing six security profiles and works in parallel with the Eclipse Packet Node security settings for basic or strong security (if Secure Management feature is enabled). The list below details the access rights for each level with the Secure Management features added shown in parenthesis:

- ***Administration*** – Perform administrative tasks on user accounts and database administration as well as view ProVision data.
- ***Configuration*** – Change managed devices and ProVision configurations as well as view ProVision data.
- ***Maintenance*** – Set maintenance controls on devices and view ProVision data.
- ***Upgrade*** – Perform software upgrades on the network and view ProVision data.
- ***View*** – View ProVision data only.

(***Security***) – (Configure and enable user authentication and view security logs.)

A-1.1.4.5 System Reliability

ATLAS P25 is different from anything else on the market today thanks to our modern IP-based Latitude technology. ***ATLAS P25 distributed technology utilizes virtual control points, hosted on COTS hardware, located throughout the geography of the system.*** Additionally, the ATLAS P25 system for the County has been designed with reliability and redundancy as a principal consideration.

JVCKENWOOD's approach to system reliability and availability consists of the following:

- ***Distributed Call and Simulcast Control***—By taking the LMR model and putting it into an IT context, JVCKENWOOD's patented Latitude technology distributes the call control functionality to every site, which means the ATLAS System architecture does not require a dedicated centralized core.
- ***Reliable and Redundant Design Philosophy***—The ATLAS P25 System uses highly reliable equipment and redundant controllers. The system for the County of Santa Barbara incorporates multiple simulcast zones and multicast sites. Each radio site within the simulcast zones has been designed with an

ATLAS 8200 TSNI , providing the County with a Public Safety Radio System that is designed from the ground up with multiple levels of fallback and unmatched resiliency and reliability.

A-1.1.4.5.1 Controller Redundancy

Built-in system reliability: *Controllers are redundant between sites to maintain communication even during catastrophic situations.*

On an ATLAS system, the Advanced ATLAS 8200 TSNI controllers serve as the P25 Trunking call routing controller for the entire simulcast cell. Since the ATLAS P25 System is built on distributed control components, the trunked simulcast system for the County will have multiple ATLAS 8200 TSNIs in each simulcast zone.

Each simulcast zone contains a TSNI controller per radio site for call routing. This means that in a simulcast zone like ***Santa Barbara City,*** there is one (1) active TSNI and 2 standby TSNIs***, providing unmatched redundancy. By deploying TSNI components across radio sites within the simulcast zones, the ATLAS P25 simulcast sub systems can withstand multiple network failures and continue operating without going into site trunking.***

All TSNIs listen for a "heartbeat" multiple times a minute, and if the active TSNI fails, the standby TSNI immediately reacts and takes over call routing and control with an interruption of less than 15 seconds. The County can also optimize the redundant failback scenarios by pre-programming primary and backup controllers. ***Additionally, if a network connection fails and isolates a site, or group of sites, from the active TSNI, one of the TSNIs in the newly isolated system recognizes the lost heartbeat and comes online. This TSNI recognizes the assets available in that new smaller system, and routes calls accordingly. When the network is reconnected, the TSNI relinquishes control to the original primary controller.***

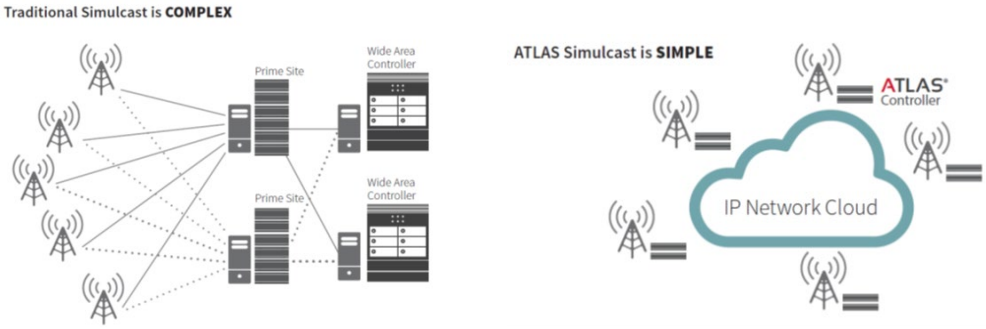
The County's VHF conventional systems utilize an ATLAS 8100 CSNI to process calls from each of the simulcast conventional channels, with a second CSNI for redundancy.

A-1.1.4.5.2 Simulcast Control Point Redundancy

True Distributed Architecture: *While Simulcast depends on a shared voting and comparator function in the network, ATLAS votes per channel. There is one ATLAS 4500 base station designated as the master channel for each frequency, with each master channel distributed to different sites. Thus, if any one site is taken offline, only the channel with the master at that site is lost.*

Typical simulcast systems have a single active "prime" site and multiple remote sites. The prime site synchronizes the system timing so that calls are transmitted simultaneously at all sites for a given repeater channel, which reduces the quantity of frequencies needed for the system and simplifies frequency coordination. It also manages the voting process for each channel, which compares the signal strength of each received signal and selects the best one.

Our Latitude technology allows JVCKENWOOD to implement simulcast communications differently. In an ATLAS P25 System, the ATLAS TSNI and CSNI controllers installed at each site manage the voting, compare process, and assign launch times for the sites, mitigating the need to have this functionality processed at a single physical location. Subsequently, the "master channel" for each simulcast channel can be assigned to repeaters at different locations. Therefore, the functionality that other systems handle through a single "prime" site can be distributed to different sites on an ATLAS system for each simulcast channel.



Traditional Legacy Network Architecture with Expensive Core Network

Modern ATLAS P25 Distributed Architecture

Figure 1.4-32. Traditional Architecture vs. ATLAS Distributed Architecture

RF Repeaters

In a trunked system, trunking operation relies on one of the repeaters to be the control channel. This control channel assigns an available voice channel repeater to serve as the channel for a given call. ***In an ATLAS P25 trunking system, any repeater at a site can be the control channel.*** If the primary control channel fails, the system will automatically designate an alternate control channel and system operation will continue.

Conventional systems have dedicated repeater channels for specific talkgroups or system users and are typically deployed in regions covering large geographic areas and comprising of a moderate number of users. System users will manually select a channel and, therefore, no control channels are required. Often, system user

groups are organized based on responsibility, such as: Fire, Police, EMS, Public Works, or Mutual Aid. In most cases, each of these groups has a corresponding dedicated repeater channel or channels. Users are free to use the channels available to them if no one else is using the channel. In the situation where a conventional channel is unavailable, users will be alerted, but they will have to manually switch to a different channel to continue system communications.

A-1.1.4.5.3 Failure Modes

The following is a list of failure mitigation methods for various ATLAS System component failures.

System Component Failure	Failure Mitigation Method	Result of Failure	Classification	Restore By	Restoration Time
Loss of transmitter operation	Inherent redundancy of simulcast systems; trunked system controller (TSNI) would detect the failure and remove the channel associated with the failed component from system service	Reduced trunked system capacity; failed channels are marked for low priority or taken out of service	Minor reduction in system capacity	Maintenance Technician to replace component equipment	6-hour system restoration guarantee
Loss of receiver operation	Inherent redundancy of simulcast systems; trunked system controller (TSNI) would detect the failure and remove the channel associated with the failed component from system service	Reduced trunked system capacity; failed channels are marked for low priority or taken out of service	Minor reduction in system capacity	Maintenance Technician to replace component equipment	6-hour system restoration guarantee
Failure of dispatch console terminal	StarGate Dispatch consoles provide independent operations and are individually connected to network, with user profiles accessible by the NMS. This allows any user to sign into any of the available physical StarGate dispatch console positions. Thus, the dispatch center does not need any standby console positions programmed to mirror an active position configuration.	Dispatch will lose dispatching capability from the failed console position	Minor interruption	Dispatcher moves to spare or unused dispatch console position and signs in	~2 min to move positions and sign in
Failure of console/audio interface	The StarGate console subsystem is fully distributed and are individually connected to network via direct IP connection. Thus, there are no interfaces or central equipment required for the StarGate to operate on the ATLAS System.				

System Component Failure	Failure Mitigation Method	Result of Failure	Classification	Restore By	Restoration Time
Failure of trunked system controller (TSNI)	Automatic rollover to redundant TSNI at each site	Possible drop of call in progress at the local site	Minor interruption	Transfer to backup unit; Maintenance Technician to replace component equipment	Interruption <15 seconds during transfer to backup unit
Failure of conventional system controller (CSNI)	Automatic rollover to redundant CSNI at site	Possible dropped call in progress at the local site	Minor interruption	Transfer to backup unit; Maintenance Technician to replace component equipment	Interruption <15 seconds during transfer to backup unit
Commercial Power Failure	When commercial power fails the automatic transfer switch activates the Generator. The Generator Provides power to the site until commercial power is restored	Site is operational via Generator Power; time is based on amount of fuel the generator can hold		Commercial Utility owns restoration	Dependent on Commercial Utility Company
Site Generator Failure	If commercial power is down and the site generator fails to start, the UPS with Battery backup provides <X> number of hours of site operation	Site Operational for <X> number of hours based on battery capacity and site loading		Restore Commercial Power, Fix Generator	Dependent on specifics of generator failure
Failure of entire tower site	Inherent overlapping coverage and site transmissions of simulcast systems	Reduced coverage footprint previously provided of loss repeater site	Major degradation (due to catastrophic event)		Repair/rebuild site as needed
Loss of control channel	Alternate channel will be automatically designated by the TSNI, and system operation will continue; any repeater at a site can be the control channel, and the system has call routing control redundancy at every site	Possible drop of call in progress at the local site; Channel is placed out of service system-wide until repairs are made	Minor degradation in capacity	Maintenance Technician to replace component equipment	Interruption <15 seconds during transfer to alternate control channel; 6-hour system restoration guarantee
Microwave Link Failure, Site on Ring	All traffic on the affected network will be automatically rerouted over the alternate microwave link at the site	Minimal impact, possible dropped audio during call		Maintenance technician to diagnose and replace failed equipment	Dependent on failure. System will operate normally while the system is being restored

System Component Failure	Failure Mitigation Method	Result of Failure	Classification	Restore By	Restoration Time
Microwave Link Failure, Site on Spur	In the event of a radio failure at a site on the spur, the secondary radio configured as Monitored Hot Standby will become active	Minimal impact, possible dropped audio during call		Maintenance technician to diagnose and replace failed equipment	Dependent on failure. System will operate normally while the system is being restored
Loss of prime site/control point	Not Applicable—The ATLAS P25 system architecture does not require a single prime site or control point. Instead, the prime site/control point functionality is software-based and distributed among the redundant subsystem controllers at each site, providing multiple levels of geographical redundancy.				
Loss of Primary/Redundant network controller	Not Applicable—The ATLAS P25 system architecture does not require a dedicated system core. Instead, the system controller functionality is distributed among the redundant subsystem controllers at each site, providing multiple levels of geographical redundancy.				
Loss of ISSI, Base Station or Broadband Gateway Devices	While the session is properly reporting, the Active ISSI Gateway will stay Active and processing the services it delivers. Should a loss of connection be seen by the Standby ISSI Gateway, it is ready to become the Active Gateway and take over	When a Failover occurs, all Group Calls in progress managed on the Active Gateway will be lost. The foreign systems and consoles will need to re-establish the services (e.g. Registrations of Talkgroups) before they can resume any calls which will look like new calls to the newly Active ISSI Gateway.	Minor interruption	Transfer to backup unit; Maintenance Technician to replace component equipment	The amount of time required to re-register talkgroups of interest.
Failure of GPS Time Reference	The ATLAS system uses two Orolia (formerly Spectracom) GPS Time References at each site connected into an Orolia SAS17E GPS Amplifier / Switch Unit. When 2 external clocks are connected, the SAS-E offers a powerful redundant function by selecting, automatically, the better source.	The SAS17E GPS Switch automatically switches to the secondary time source. The repeaters reboot in order to synchronize their internal clocks with the new GPS source. The reboot process takes less than 20 seconds.	Minor Interruption	Diagnose and replace failed GPS Time Reference	Radio site is functional using secondary time source. Repair / Replace the failed GPS Time Reference per the Service Level Agreement

System Component Failure	Failure Mitigation Method	Result of Failure	Classification	Restore By	Restoration Time
Failure of a component of the MPLS Router	The Nokia 7705 SAR-8 is configured with redundant components, including dual power feeds, in a single 2RU chassis.	Interface failure on the SAR-8: the local switch reroutes traffic to the secondary interface on the SAR-8 Power Failure on one side of the SAR-8: the local switch reroutes traffic to the functioning SAR-8 interface	Minor Interruption	Replace Failed module	System operation is restored almost immediately. Replace the failed SAR-8 module per the Service Level Agreement
Failure of an Alcatel-Lucent Network Switch	The switches used in the design are the Alcatel-Lucent 6860 switches configured in a stacked solution with redundant power supplies.	Failure of a switchport: the TSNI, CSNI, and ATLAS 4500 repeaters have redundant network interface cards and will use the secondary NIC if a port to the switch fails. Noncritical equipment will be offline until the switch is replaced Failure of an entire switch: the TSNI, CSNI, and ATLAS 4500 repeaters have redundant network interface cards and will use the secondary NIC. Noncritical components connected to the switch will be offline until the switch is replaced. Failure of a switch power supply: network switch continues normal operation. SNMP trap is sent to the	Minor Interruption	TNSI, CSNI, and ATLAS 4500 equipment automatically switches to secondary network interface and resumes normal operation.	System resumes normal operation almost immediately. Replace the failed Alcatel-Lucent 6860 switch per the Service Level Agreement

System Component Failure	Failure Mitigation Method	Result of Failure	Classification	Restore By	Restoration Time
		alarm management system regarding the power supply failure.			

Figure 1.4-33. Possible Failure Scenarios and Impact of Each

A-1.1.4.6 System Expansion

The ATLAS P25 System supports 16,000 configured talkgroups and 48,000 configured subscribers without any additional license fees or replacement of site controllers and NMS-related equipment. With the ***ATLAS P25 system, Santa Barbara County has the ability to add users, channels, and sites without system disruption and with no additional license fees.*** The ATLAS P25 System can support the following without the replacement of any site controllers or network management-related equipment:

Specification	ATLAS 6200 Advanced NMS
Maximum Number of Configured Subscribers	48,000
Maximum Number of Configured Talkgroups	16,000
Subscriber ID Range	1–16,777,215
Talkgroup ID Range	1–65,535
Number of Configurable Trunking Sites	125
Number of Configurable Conventional Sites	125
Number of Configurable StarGate Consoles	100

Figure 1.4-34. ATLAS 6200 Advanced NMS Specifications

JVCKENWOOD has completed a traffic capacity analysis to determine the optimal amount of talkpaths to maintain the urban areas of County's existing operations with a net 2% yearly growth potential over 10 years, assuming 1500 subscribers in year 1.

The Grade of Service analysis is based on the Erlang C formula and assumes 300 active users in each trunked simulcast cell during the busy hour. Based on the preliminary analysis, a 5-channel P25 Phase II Trunked system (1 control channel and 8 talkpaths) is required to provide the County with a system that meets a Grade of Service of less than 1%.

JVCKENWOOD's traffic analysis was performed with the following assumptions based on a typical public safety profile:

- 1% GoS
- 300 users at busy hour in each simulcast cell with 2 second allowable delay
- Total fleet -> 1793 users at year 10 (includes portables and mobiles)

Assumed User Traffic profile:

- User call Rate per hour – 5
- Average PTT – 6 seconds

A-1.1.4.7 Interoperability Solution

JVCKENWOOD understands Santa Barbara County's need to interoperate with neighboring agencies and systems. The system for the County provides multiple levels of interoperability, which are outlined below in Figure 1.4-35.

JVCKENWOOD Offering	Interoperability Benefits to Santa Barbara County
ATLAS P25 ISSI Gateway	The ISSI solution provides interoperability capability between the ATLAS P25 System and neighboring P25 systems
ATLAS Analog Radio Gateway	The ATLAS 8410 Analog Radio Gateway provides up to 4 interfaces to analog equipment per ATLAS 8410. The system has been designed with ten (10) 8410 Analog Radio Gateway units (40 total interfaces) at the Sheriff Dispatch Center and ten (10) 8410 Analog Radio Gateway units (40 total interfaces) at the EOC Fire Dispatch Center.
Optional ESChat Broadband Gateway	The ESChat Push-to-Talk Over Cellular (PTToC) solution creates a bridge between cellular networks, including FirstNet, and the ATLAS P25 network and maps between the cellular talkgroup and P25 talkgroup.
P25 Phase I and Phase II Dynamic Dual Mode Operations	The ATLAS system leverages a common hardware platform for Phase I and Phase II operations. The Viking subscriber radios are fully P25 Phase I and Phase II compliant. ATLAS allows both P25 Phase I and Phase II subscribers to operate in the same talkgroup, with the system processing the call as Phase I if at least one of the subscribers is operating in Phase I mode.

Figure 1.4-35. Multiple Layers of Interoperability for Santa Barbara County System

A-1.1.4.7.1 ATLAS 6600 ISSI Gateway

The ATLAS ISSI Gateway supports up to 96 simultaneous talkpaths. Full ISSI capability is available to the County for no additional license fees.

The ATLAS 6600 ISSI/CSSI Gateway facilitates intersystem communication, roaming, and dispatch console interoperability. The ATLAS ISSI Gateway is a software application that resides on standard off-the-shelf hardware and can be configured through the ATLAS 6200 NMS. The ISSI Gateway facilitates intersystem communication, roaming, and dispatch console interoperability and ***supports up to 24 foreign ISSI connections, 96 configured talkgroups, and 24 simultaneous active calls with no additional license fees.***

The ATLAS ISSI Gateway supports network-level interoperability for selected services and functions between ATLAS P25 Systems and other manufacturers' ISSI-compatible Radio Frequency Subsystems (RFSS) to create an extended service coverage area. The ATLAS ISSI provides a means to track and locate desired subscriber units belonging to a given LMR system and route service support to these subscribers. Simultaneous communications can occur in both systems without users physically being in range of the disparate system.

The ATLAS ISSI Gateway supports the following P25 Trunking Voice Features:

- Broadcast Call
- Announcement Group Call
- Confirmed Group Voice Service (Call)
- Busy queueing with callback
- Unconfirmed Group Voice Service (Call)
- Transport of PTT-ID
- Emergency Group Call
- Encrypted Group Call
- Voice AES Encryption
- Voice DES Encryption

- Full-rate vocoder (FDMA)
- Half-rate vocoder (TDMA)
- Message Trunking
- Transmission Trunking

The ATLAS ISSI Gateway supports the following P25 Trunking Mobility and Registration Services Over ISSI:

- Unit Registration; Inter System SUs
- Unit Registration; Inter WACN SUs
- Secure Unit Registration (Radio Authentication), Inter System SUs
- Secure Unit Registration (Radio Authentication), Inter WACN SUs
- Transport of Authentication Credential
- Deregistration Subscriber
- Deregistration Talkgroup (De-affiliation)
- Affiliation; Inter System TGs
- Affiliation; Inter WACN TGs
- RFSS Polling Request (without Capabilities)
- RFSS Polling Response (without Capabilities)
- RFSS Polling Request (with Capabilities)
- RFSS Polling Response (with Capabilities)

A-1.1.4.7.2 ATLAS 8410 Analog Gateway

The ATLAS Analog Gateway is a full featured, highly flexible four-port Radio-Over-IP (ROIP) Gateway, designed to provide voice-over-IP extensions for analog radio equipment and to facilitate interoperability between a diverse assortment of radio systems. The ATLAS 8410 provides interoperability between trunked and conventional P25 systems and legacy analog devices, 2-wire and 4-wire tone and E&M controlled equipment, and analog logging recorders.

An Analog Gateway consists of two 1U rack mount devices—An ATLAS 8000 Series Controller and an ATLAS 8400 Analog Interface. Combined, the two devices mount in a 19" rack and occupy 2U of vertical space (3.5"/89 mm). The equipment is class B compliant to Part 15 of the FCC Rules.

A-1.1.4.7.3 ESChat Broadband Gateway (Option not Exercised)

JVCKENWOOD has included an option to purchase SLA Corporation's ESChat PTToC Solution with the ATLAS system to provide reliable and encrypted PTT communication between the County's ATLAS P25 network and cellular networks. Since the modern ATLAS P25 system has no central controller, system management equipment and ISSI/Broadband gateways can be connected anywhere on the network that supports sufficient bandwidth. For the Santa Barbara County system, the ESChat solution will be installed on a COTS server located with the rest of the system management equipment at the Comm Center. The PTT cellular application can be purchased in a bundle of 25 ESChat Customer Hosted licenses, four (4) such ESChat license bundles are included with the proposed solution.

JVCKENWOOD has included the option for a secondary ESChat gateway server to be located at the Backup 911 Dispatch Center. If the primary ESChat Gateway should fail, the redundant Gateway device will automatically take over. The ESChat PTT cellular application supports Android and iOS Mobile devices, and Windows PC devices. The application can be purchased in bundles of 25 ESChat Customer Hosted licenses. JVCKENWOOD has priced 100 user.

Integrated Contact List | *Integrated Group List* | *Integrated GPS Display* | *iPad with Integrated LTE/LMR Contacts & GPS Location Display*

The ESChat Gateway provides a bridge between the cellular network and the P25 network, and maps between the cellular talkgroup and P25 talkgroup. A PTT-originated call from a cellular user is received by the ESChat Gateway, which converts the cellular call to a P25 call and sends it to the ATLAS ISSI Gateway. The ATLAS ISSI Gateway then transfers the call to the P25 network. In this configuration, a public IP is used for Internet devices to connect to the gateway, while a private IP is used for connection with the LMR network.

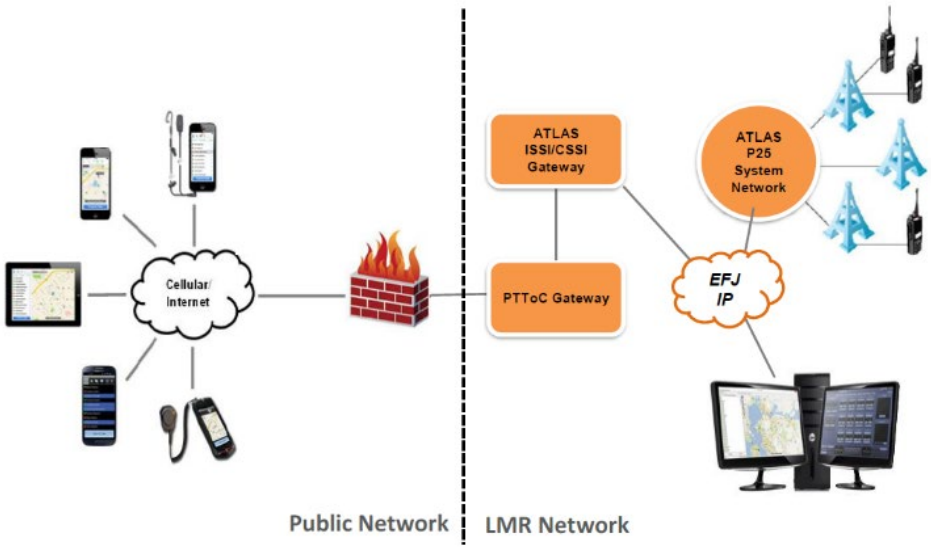


Figure 1.4-36. ATLAS Broadband Integration Architecture

The ESChat solution can interface with 3G/4G LTE wireless networks, including FirstNet. It supports normal P25 voice radio user functionality, including AES 256-bit encryption.

A-1.1.4.8 Call Privacy and Encryption

On an ATLAS P25 system, unidentified radios can be prohibited from registering on the system altogether, which offers a first line of defense in preventing unauthorized listeners from monitoring network calls. Moreover, any unauthorized radios can be remotely disabled by the system.

The ATLAS P25 system supports the ability to configure talkgroup profiles on the NMS, which can be used to segregate conversations within the network. Registered users can be excluded from participation in certain calls by barring them access to particular talkgroups. Furthermore, unauthorized users can be prevented from being able to monitor conversations by configuring a talkgroup to use encryption. Encryption keys can be regularly rotated, and the use of hardware system keys can prevent the programming of a new unauthorized radio onto the system or the cloning of existing authorized radios.

Security:
ATLAS offers pure end-to-end P25-compliant encryption throughout the network.

The ATLAS P25 system offers P25-compliant encryption capability to the County users, supporting both DES and AES Algorithms per the standards defined in Federal Information Processing Standards (FIPS) Publication 140-2. When operating in encrypted mode, the system will provide the same coverage, voice clarity, and intelligibility as the clear mode of operation.

The built-in local encryption module on ATLAS StarGate Dispatch Consoles and ATLAS 8000 controllers/gateways provides truly end-to-end encryption, ensuring voice never travels over the network unencrypted. Encrypted packets are only decrypted in the network when there is an interoperability call between a P25 Phase I call and P25 Phase II call.

A-1.1.4.9 ATLAS 6500 Key Management Facility including Data Gateway functionality

JVCKENWOOD has included the ATLAS 6500 Key Management Facility (KMF) data server, to be located at the Sheriff Dispatch Center equipment room to enable over the air rekeying (OTAR) to P25 subscribers. The KMF includes an ATLAS Data Gateway which can be used for over-the-air programming (OTAP) and GPS support.

A-1.1.4.9.1 ATLAS KMF

The management of encryption keys is critical in maintaining secure radio systems and communications. JVCKENWOOD's ATLAS 6500 KMF is a secure, fast, P25-compliant solution that simplifies secure key management and distribution. The KMF Server stores the encryption keys for the subscribers and is responsible for updating the keys as needed. The KMF Client software provides an intuitive user interface for creating and managing encryption keys as well as facilitating OTAR. If a radio is lost or falls into the wrong hands, all encryption keys residing on the radio can be erased (zeroized) directly from the KMF. The KMF controls the encryption keys for every P25 radio on a radio system network.

Key Benefits and Features of the ATLAS KMF include:

- **Open Architecture**—Manage encryption keys for any P25 Over-the-Air-Rekeying (OTAR) compliant mobile and portable radio.
- **OTAR**—Send encryption keys and KMMs over-the-air to specific subscriber radios and consoles quickly and securely, updating keys remotely without the need to bring radios to a maintenance facility.

- **Over-the-Network Rekeying (OTNR)**—Send encryption keys and KMMs over-the-air to specific fixed system components and consoles quickly and securely.
- **Flexibility**—Send new keys to all radios in your system or set up secure groups to provide encryption to the personnel responding to a specific incident or emergency.
- **Organization**—Manage all secure radio communications among talkgroups and enable operators to visually track members and encryption keys assigned to each group.
- **Convenience**—Manage key encryption using the Subscriber Manager Assistant (SMA) key-loader.

A-1.1.4.9.2 ATLAS OTAP Solution

JVCKENWOOD's OTAP is an over-the-air programming feature for subscriber parameter files designed to make radio software programming simple by reducing the burden of updating a fleet of radios. Using the OTAP feature, parameter files can be updated and changed in the field, eliminating the need to take the radio out of service to perform updates. All that is required for a JVCKENWOOD OTAP implementation is a Data Gateway, a Viking radio optioned and configured for OTAP, and our Armada Fleet Management Software running on COTS hardware.

JVCKENWOOD's OTAP implementation is made up of three components: Armada Fleet Management Software, the OTAP Server, and the Data Registration Server. All three components are software applications included in the Armada Fleet Management distribution and run on off-the-shelf computers running Microsoft® Windows 7,8, and 10. All three applications can be installed on either the same machine or separate machines connected to the network.

The following are advantages of JVCKENWOOD's OTAP for Santa Barbara County radio users and fleet managers:

JVCKENWOOD's OTAP solution is the only one to feature "Smart Update"—Our template-based programming allows only the changes made to be transferred over the air, not the entire codeplug

- **Automatic or user-selected codeplug update**—An OTAP-enabled Viking radio can be programmed automatically with a scheduled write update or manually written to by the programmer. The Update Confirmation option in the radio configuration settings determines when a codeplug update is applied to the radio; either the radio can restart and apply the new configuration as soon as it has been received, or the update can be applied the next time the radio is turned off and back on.
- **Smart Update**—When a write operation is performed on an OTAP-connected radio after a programmer has made changes to the radio template, a compressed file will be transferred to the radio containing only the changes made rather than the entire codeplug. If the configuration includes voice announcements, which consume a disproportionate amount of configuration space, only the voice files that are needed will be transferred.
- **Priority settings for voice and data**—The radio configuration parameters have an Rx Voice Interrupts Data setting to ensure that a voice call can interrupt a data transmission. When this setting is enabled, if a voice call is received during OTAP programming, the programming session is immediately suspended to allow the user to take the call. Once the call is completed, programming is automatically restarted.
- **No user interface changes**—The software interface for programming radios is the same whether the radio is being programmed via USB cable or using OTAP.

A-1.1.4.10 Cyber Security

A-1.1.4.10.1 Network Firewall

A Cisco ASA 5508 firewall appliance with FirePOWER® protection is included, to be installed at the Main Dispatch Center location to provide security for IP traffic moving in and out of the network should the County wish to connect to an external network and/or the Internet. The firewall appliance supports more than 4,000 application-layer and risk-based controls that can launch tailored intrusion prevention system (IPS) threat detection policies to optimize security.

The Cisco ASA appliance will be configured within an individual zone where each type of external connectivity will terminate. In addition, it will be configured with the default outside and inside zones. JVCKENWOOD will configure these zones so

that ISSI connections to external networks will terminate in a separate firewall zone from where the ATLAS radio network is connected.

A-1.1.4.10.2 Cyber Security Measures

JVCKENWOOD is capable of providing multiple levels of increasing network security depending on the needs of the customer and the capabilities of the network support staff after the system has been installed as security and convenience are always a direct trade-off. In all network installations, JVCKENWOOD practices defense in depth and applies security configuration guidelines based on National Security Agency (NSA) best practices as described in NSA publications I33-011R-2006 and C4-040R-02.

At a minimum the following practices are always followed:

- All unused services (software that can be accessed from other servers) are turned off so that nothing can use those services to gain access or disrupt the network.
- Passwords for user accounts on all devices are stored as encrypted.
- Locally originated traffic uses a special type of interface (called a loopback adapter) to guard against remote traffic spoofing.
- Encrypted connections (using SSH) are used for remote access
- MD5 authentication is used in OSPF peering (a routing protocol) to guarantee that no unauthorized machine can change, influence, or access routing tables.
- Command logging is enabled on all network devices and logs are buffered and sent to a remote server (via a tool called syslog). This prevents someone from being able to hide their activities on a network device.

Recognizing that adding layers of security adds layers of management responsibility, JVCKENWOOD is capable of and ready to implement the following additional security practices at the customer's request. Implementing these practices requires a thorough review of pre-existing network architecture.

- **802.1x**—This is an Institute of Electrical and Electronics Engineers (IEEE) standard for port-based network access control, which offers a standardized method for guarantee that no one replaces existing equipment or add additional unauthorized equipment on the network.
- **Authentication, Authorization, and Accounting (AAA)**—AAA provides a way to guarantee that users on the system have access to only the resources they have intentionally been granted access to. This ensures these users can

only use those resources at pre-defined levels and that the use of those resources is identified and traceable to a particular user. In this context, Authentication means being sure a user is who they say they are, Authorization means knowing exactly what that user is allowed to do, and Accounting refers to tracking and reporting on what a user actually does.

- **Public-key Infrastructure (PKI)**—In simple terms, PKI applies encryption (using registered certificates) to reliably verify the identities of the participating machines in any given network conversation.
- **Firewalls**—Used appropriately, firewalls analyze the traffic passing into or out of a network and apply a set of rules to determine if the traffic should be allowed to enter or leave. Firewalls are typically used between a trusted network (one you own) and an untrusted network (the internet or another group's radio network). There are a large variety of different firewall types and capabilities, and recommendations about how and where to deploy firewalls can be made after thorough review of pre-existing network architecture.
- **Intrusion Detection and Intrusion Prevention Systems (IDS and IPS)**—Sometimes these systems are deployed separately, but in a modern network they are usually deployed together. An Intrusion Detection System identifies attempts to compromise the security of a machine or network, while an Intrusion Prevention System takes automatic action to stop the potential compromise when it is detected.
- **IPSec Virtual Private Networks (VPNs)**—The Internet Protocol Security (IPsec) suite provides a means to implement encrypted network links in such a way that all of the traffic passing over those links is encrypted without the applications generating the traffic needing to be aware that encryption is being used. This is useful to guarantee that all of the network traffic is encrypted, even if third party tools or software is used that were not built with security in mind. Unfortunately, this encryption adds processing and bandwidth overhead and rules out certain network configurations. Recommendations about how and where to deploy IPsec VPNs can be made after thorough review of pre-existing network architecture and the applications to run on top of the network.

A-1.1.4.11 P25 Compliance Assessment Program

JVCKENWOOD maintains one of only eight U.S. Department of Homeland Security-approved CAP P25 subscriber interoperability certification laboratories in the United States. We have tested products from every P25 radio vendor in the market and is a Project 25 CAP manufacturer. Because the ATLAS System is fully P25 compliant, other manufacturers' P25-compliant radios can be used on the network, including:

- Motorola Solutions
- Harris Corporation
- Relm Wireless Corporation
- Tait Communications
- JVCKENWOOD (JVCKENWOOD USA Corporation)

A-1.1.4.12 Infrastructure Equipment Overview

The ATLAS site equipment for the County is built from four basic system components. These high-performing COTS computing platforms are IP–based and managed remotely, which allows JVCKENWOOD to focus on a unique, software-driven solution, resulting in low operational and implementation risk.

ATLAS equipment's minimal space requirements, with the smallest footprint in the industry, mitigate difficult configuration problems and make it easy to co-locate new equipment with existing equipment.

ATLAS® 4000 Series Repeaters/Multimode Base Stations	
 3.5" tall—2U of vertical rack space	The ATLAS 4000 series of repeaters/multimode base stations provide over-the-air communications for simulcast and non-simulcast systems.
ATLAS® 6000 Series NMS, Optional Gateways, and Key Management Facility (KMF)	
 1.75" tall—1U of vertical rack space	This COTS rack-mount server is used to host the ATLAS 6200 NMS, ATLAS 6400 Data Gateway, ATLAS 6500 Key Management Facility, and ATLAS 6600 ISSI Gateway.

ATLAS® 8000 Series Controllers	
 1.75" tall—1U of vertical rack space	The ATLAS 8000 controller is an industrial-grade, rack-mount device that acts as a configurable controller, capable of driving a number of other devices, including the 8200 Trunked Site Network Interface (TSNI) and 8100 Conventional Site Network Interface (CSNI).

Figure 1.4-37. The ATLAS System's Basic Components

A-1.1.4.12.1 RF Site Equipment

A-1.1.4.12.1 Base Station Equipment

The ATLAS 4500 Multimode Station, the model for the County's system, is the latest model in our base station/repeater series. The ATLAS 4500 Multimode Station offers market-leading P25 trunked, P25 conventional, analog, and mixed-mode capabilities in a robust, reliable, and compact form factor.

In the Santa Barbara County system, the repeater model is the same for both the P25 trunked and conventional radio systems.

The ATLAS 4500 supports APCO P25 Phase I and Phase II modulation formats, including Linear Simulcast Modulation (LSM), and functions in either trunked or conventional mode, determined by the site controller.

A-1.1.4.12.1 Site Control Equipment

The ATLAS 8000 provides a common platform and common support services for running a variety of applications, including the ATLAS 8200 Trunked System Network Interface (TSNI) and the ATLAS 8100 Conventional Site Network Interface (CSNI), which are both included in the system. The ATLAS 8000 controller is an industrial-grade, rack-mount device that serves a key role in ***distributing the intelligence of the JVCKENWOOD ATLAS solution throughout the County radio network. Every site in the Santa Barbara County simulcast system includes redundant TSNI controllers.***

The ATLAS 8000 is built using components specifically selected for long life—rugged duty, low power usage, and flexible deployment. It is packaged in a space-saving 1 RU chassis and provides a network-centric design (including four Ethernet ports) and a large variety of peripheral connections.

The ATLAS 8000 series equipment has core-level integration with the ATLAS 6200 Advanced Network Management System (NMS), allowing the NMS to remotely configure the device, install and update software, and manage fault reporting for the controller, regardless of the application currently deployed on the controller.

A-1.1.4.13 Network and Alarm Management Equipment

The ATLAS 6200 Advanced Network Management System is a state-of-the-art, Web-based NMS that provides centralized network management functionality for all JVCKENWOOD infrastructure products. ***With Web-based client access, the ATLAS NMS offers unified management, configuration, and monitoring to all infrastructure solutions, including conventional systems, trunked systems, consoles, and gateways.***

A key design focus of JVCKENWOOD equipment is ensuring that it can be managed from any workstation on the County network, or remotely through a VPN. Once connected to the network, accessing the ATLAS NMS interface is as simple as opening a Web browser, entering the ATLAS NMS IP address or hostname in the browser address field, and logging in with your credentials.

Figure 1.4-38. ATLAS 6200 Advanced Network Management System

The NMS client is browser-based and can be run on any standard PC, eliminating the need for a dedicated client machine

A-1.1.4.13.1 ATLAS NMS Application Suite

The primary applications in the ATLAS NMS suite are illustrated below in Figure 4.5.2.1-1 and are briefly described in the paragraphs that follow.

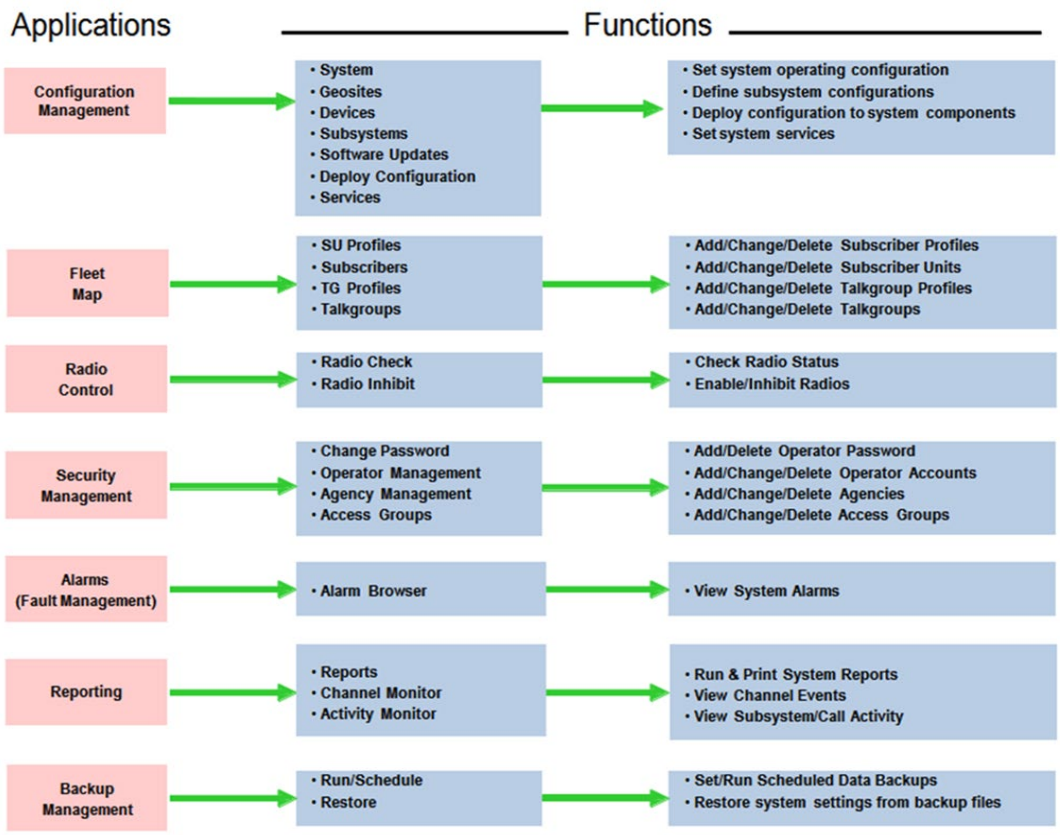


Figure 1.4-39. ATLAS NMS Applications Functional Overview

Configuration Management

The Configuration Management application defines the parameters and settings necessary to configure the system and system components. These settings determine the operating characteristics of the system, system identification information, and component configuration. The application provides the tools to set system site addresses and identify and configure all radio repeaters, dispatch consoles, and other system-configurable components.

Fleet Map

The Fleet Map application defines all subscribers and talkgroups on the system. Each radio subscriber must be defined and registered on the system to provide communications security (system authorization) and to allow routing of radio calls between subscribers.

Radio Control

The Radio Control application provides administrative control of all system radios and provides both check and inhibit functionality. The radio check functionality allows individual subscriber radios to be checked in conventional systems to verify operation and the range access to the system. With the radio inhibit functionality, radios can be disabled when lost, stolen, or otherwise compromised, and can be re-enabled once found or restored.

Security Management

The Security Management application defines who can access the ATLAS NMS. Authorized personnel define who can log on to the system, what components they can access, and what functions they can perform on the system.

Alarms (Fault Management)

The Fault Management application enables collecting, prioritizing, and viewing of all system and many component alarms. The ATLAS NMS collects alarms and logs events from all critical system components. A system administrator or authorized operator monitors the browser to see any system problems so they may take the appropriate action(s) to resolve any problems before there is a significant impact on system communication.

Reporting

The Reporting application enables the NMS administrator to generate various system reports and view various activity monitors. The application can generate reports on system configuration, fleet map configuration, alarms, and collected metrics from system traffic, to help verify if the system is operating at its optimum capacity and performance. The monitors show live traffic data as it is received by the NMS.

Maintenance and Backup Management

The Maintenance menu contains links to Services, Backups, and Database Reports. The ATLAS NMS has a number of background processes (Services) that are responsible for much of the core functionality of the NMS. The Services application enables operators to view and perform various actions on the services.

Proper management for any data system requires that the system data be protected if a soft or hard failure occurs. The backup application provides the tools to back up all system configuration, operating settings, and event data when an ATLAS NMS failure occurs. It also allows an operator to perform unscheduled backups and restore previously backed up databases. Employing a backup strategy can ensure minimum system downtime in the event of data loss or corruption.

The reports provide information that cannot be found elsewhere—specifically, daily, and weekly reports with statistical information and charts that can be used to monitor the functionality of the database.

A-1.1.4.13.2 Alias Database Management

Subscriber Management configures the subscriber and talkgroup databases, specifying valid subscribers, talkgroups, and their privileges. Depending on the security privileges, the operator may view, add, modify, and remove subscribers, subscriber profiles, and talkgroups.

The following can be configured through subscriber management:

- Talkgroup definitions
- Subscriber profiles
- Enabling/disabling subscriber units
- Import/export fleet map data

The system maintains two databases: a master database on the Network Management System (NMS) server for configuration and reporting, and a smaller operational database shared by individual sites for radio access control and site-specific configuration persistence. The master database informs individual sites of operator-defined settings and the individual site databases provide redundancy, scalability, and speed of access during system operation. This ensures that access to the master database is not a requirement for call activity on the system and the NMS is not a critical point of failure.

A-1.1.4.13.3 Operator Access and Management

The ATLAS NMS allows authenticated system administrators to add sites, configure talkgroups and channels, and set up subscriber access to the system. The functions of programming Viking subscribers and encryption keys are performed by the Armada® subscriber management software.

All subscriber access of the system is logged in the system and can be viewed using the NMS reporting functions. ***The NMS has password protection as well as role definitions to control what a logged-in operator is allowed to do in the NMS***. The ATLAS 6200 will support up to 12 simultaneous users and unlimited sessions.

Security Logging

The ATLAS NMS keeps track of all log-in attempts (both successful and unsuccessful). Information tracked in the ATLAS NMS database for a successful log-in includes username, IP address, log-in time, log-out time, duration, and whether or not the log out was due to a session timeout. This information can be viewed via the ATLAS NMS Access and Activity Log report.

Access Overview

Operator access to system features and functions is controlled first by a secure login, and then by various features that provide rights and multi-level access control.

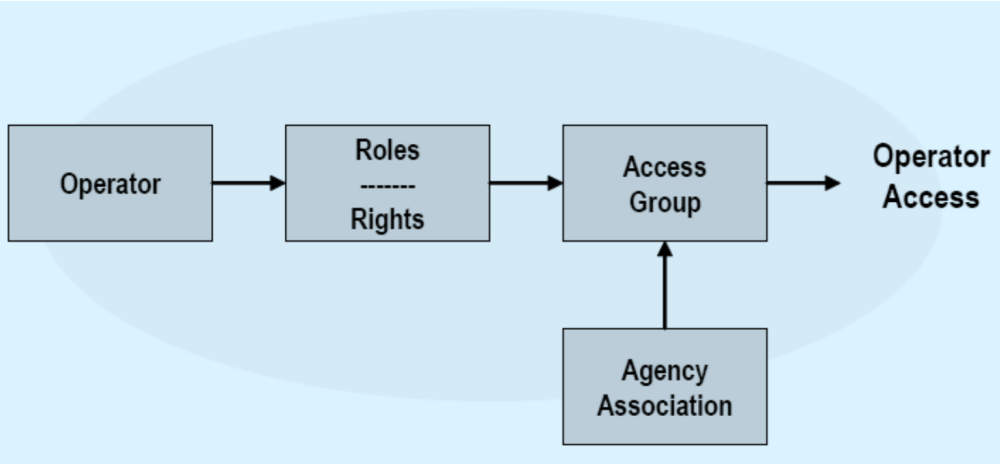


Figure 1.4-40. ATLAS NMS Operator Roles, Rights, and Access

The access features combine to provide a variety of user configurations that determine each user's level of access and abilities. Agencies are assigned to an access group, and then an access group is assigned to an operator account. Operators have access to the data associated with all of the agencies in the access group according to the rights afforded by their role.

A-1.1.4.13.4 ATLAS 6300 Network Management Terminal

The ATLAS 6300 is a COTS PC-based terminal device with keyboard, display, and mouse, ***which can be placed at any location with system network connectivity***. Remote access to any server is security protected and allows a user to access, view, and change management equipment settings and database entries.

A-1.1.4.13.5 Alarm Management System

Robust failure monitoring and notification is provided for the Santa Barbara County system over the IP network using the Simple Network Management Protocol (SNMP) and centrally located Alarm Management (AMS) and Network Management (NMS) Systems.

For remote monitoring and notification, no additional software or equipment is required beyond the NMS and AMS components for Santa Barbara County's ATLAS P25 System, as well as County-provided access through a Virtual Private Network (VPN). As noted above, once connected to the network, users can access the ATLAS NMS interface by opening a Web browser, entering the ATLAS NMS IP address or hostname in the browser address field, and logging in with their credentials. System alarm notification messages can be sent out via email, page, or SMS.

A-1.1.4.13.5 System Monitoring and Report Generation

The ATLAS NMS monitors all JVCKENWOOD equipment using a heartbeat mechanism. Every device (repeater, TSNI, Gateway, etc.) periodically sends a status message to the NMS, which tracks the heartbeats and marks those that are missed. If the threshold of missed heartbeats is exceeded, an alarm is thrown for that device. Both the interval of sending/expecting heartbeats and the threshold for the number of missed heartbeats are programmable within the NMS.

The NMS forwards "traps" for all device alarms to the SNMP server, Castle Rock. Non-JVCKENWOOD network equipment reports its status directly to the SNMP server for the system.

The monitors show live traffic data as it is received by the NMS, while the reporting application enables the NMS administrator to generate key system reports and view various activity monitors. Five categories of reports are available:

Alarms

Personnel trying to identify or resolve issues need access to alarm data that may no longer be displayed in the ATLAS NMS alarm browser. Access to this data is provided by a number of predefined reports. Data reported includes both alarms currently displayed in the ATLAS NMS Alarm Browser and alarms that have been previously cleared.

Configuration

Configuration reports list the various system configurations and parameter settings. These reports can be used to document system, subscriber, and talkgroup configurations.

Metrics

Metrics reports list various call and talkgroup statistics. Metrics can be used to analyze call traffic on the system, along with talkgroup usage and busy hour statistics. This data is useful to determine how the system is being utilized and if it is performing to meet the traffic load.

Security

Security reports list all operator access and activity on ATLAS NMS.

Fleet Map

The Fleet Map Reports function creates reports showing various subscriber unit, subscriber profile, and talkgroup settings data.

A-1.1.4.13.5 Site Environmental Monitoring

1.4.13.5..1. Asentria SiteBoss 530 Remote Terminal Unit

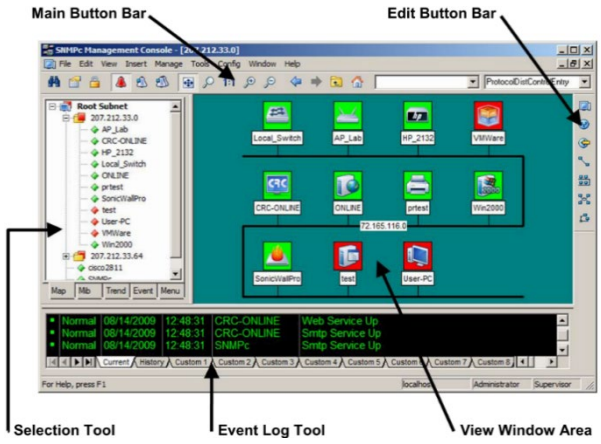
Santa Barbara County's system includes Asentria SiteBoss 530 Remote Terminal Unit monitoring panels at each of the 19 RF sites. The Asentria SiteBoss 530 Remote Site Manager/Controller captures environmental alarm points within the radio communication site shelters, such as door open (if SNMP trap is provided), HVAC monitoring, microwave system alarms, temperature, humidity, etc. Site environmental information is routed via the P25 network back to the alarm server using Castle Rock's SNMPc Enterprise software.

1.4.13.5..2. Castle Rock SNMPc Enterprise Software

Site environmental information is routed via the P25 network back to the alarm server using Castle Rock's SNMPc Enterprise software, which also provides flexible presentation options for trend analysis, including Microsoft Visio Graphics, pre-canned reports, high-level summaries, and custom dashboards.

The following reports are available:

- Router Dashboard
- Server Dashboard
- Availability Report—Shows response time and percent uptime for regular SNMPc polling (ICMP or SNMP) and configured TCP poll services
- Interface Reports—Show Percent Utilization and Bandwidth Usage (BPS)
- Server CPU Report—Shows the CPU usage for each processor on the system
- Server Disk Report—Shows information about mounted drives on Microsoft servers including the name, type, size, and amount of free space



A-1.1.4.13.5 System Alarms

ATLAS P25 System alarms are categorized by the following severity levels:

- WARNING—Used to alert general event information to the network operator that is not service-affecting.
- MINOR—For conditions that are not necessarily service-affecting but denote a problem. Problems in establishing necessary handshaking between software components that quickly get resolved fall into this category.
- MAJOR—Used to notify the network operator about service-affecting conditions that can make the system operate in a degraded capacity. A repeater Channel Controller not communicating with the Site Controller is an example condition that would create this level of alarm.
- CRITICAL—The highest in severity, this alarm level indicates conditions that are service-affecting and could also prevent the system from fulfilling its intended function, especially if the system cannot recover without operator intervention. Included are failures that could result in physical damage to system components or to operations personnel.

A-1.1.4.14 Optional Asset Management (Commshop)

The County has the option to purchase MCMtech's Commshop Solution, a robust, feature-rich software solution designed to manage a complex radio systems and repair shop environment. The Commshop Asset module contains all records of the County's serialized equipment and lists of all assets in the database, providing users the ability to edit the order of the list and export the list to Excel or CSV formats. Assets can also be linked to a site record to allow users to easily search and find which assets are assigned at each site.

The system allows for custom queries to be built to allow the data to be filtered down to a specific set of data. A global search feature allows users to enter or scan any value and have it search the entire asset database for matches. Users all have the ability to edit asset records from the list view or toggle to the Detail view to make changes to records.

Commshop also includes dashboard features, providing high level graphical output of the data in the system related to your assets, work orders and inventory. The system also includes an integrated alerting tool to have notifications sent out in the system and via email when certain changes take place or when a time is coming due. Alerts are configured for each implementation to specifically accommodate and enhance the customer's workflow processes.


Asset
Swap Asset
Bulk Asset
Transfer Asset
List
Details
portable radio
1 of 15
Default
15
Asset Number
Serial Number
Agency
Class
Category
System 1 Radio ID
System 1 Alias
Vehicle #
000001838
CN78DRR38N
Radio
Portable Radio
3013040
1313720672 1313720672 102 Radio Portable Radio 3031037 FALCON 1
205CDQ0202 205CDQ0202 399 Radio Portable Radio 3047538
205CDQ0203 205CDQ0203 399 Radio Portable Radio 3047537
205CDQ0205 205CDQ0205 399 Radio Portable Radio 3013041 Murray1
205CGK1437 205CGK1437 AC Sheriff Radio Portable Radio 3069453 ACSO SRJ001
205CGM0742 205CGM0742 AC Sheriff Radio Portable Radio
205CGM0744 205CGM0744 AC Sheriff Radio Portable Radio 3067685 ACSO SRJ038
205CGM0745 205CGM0745 AC Sheriff Radio Portable Radio 3067686 ACSO SRJ039
205CGM0749 205CGM0749 AC Sheriff Radio Portable Radio 3067690 ACSO SRJ043
205CGM0759 205CGM0759 AC Sheriff Radio Portable Radio 3067700 ACSO SRJ053
205CGM0761 205CGM0761 AC Sheriff Radio Portable Radio 3013035 ACSO SRJ055
205CGM0771 205CGM0771 AC Sheriff Radio Portable Radio 3067712 ACSO SRJ065
205CGM0781 205CGM0781 AC Sheriff Radio Portable Radio 3067719 ACSO SRJ072
205CGM0787 205CGM0787 AC Sheriff Radio Portable Radio 3067725 ACSO SRJ078
1 of 61
Total Records: 915
Asset
Swap Asset
Bulk Asset
Transfer Asset
List
Details
portable radio
1 of 15
Asset Number
000001838
Serial Number
CN78DRR38N
Model
242517F874G86
Model Desc
5100ES
Class
Radio
Category
Portable Radio
Asset Desc
HP
Parent Asset
Status
Active
Agency
182
City of Harris Fire Dept.
Sub Agency
182
City of Harris Fire Dept.
Site
15
Big Cabin
Employee
Assigned To
Jonny Campbell
Building/Room/Floor
2
Vehicle # / Asset #
Year / Make / Marked
License Tag / VIN
1 of 61
ID Management
Configuration Details
Work Orders
Child Asset
Purchasing Info
Maintenance
Notes
History
System Name
StateNET
Range Name
Master Range
Radio ID
3013040
HEX
2DF9B0
Alias

A-1.1.4.15 Vehicular Repeaters Overview

If this option is exercised by the County, JVCKENWOOD will provide SVR-P252 full duplex repeaters by Pyramid Communications to support P25 Phase II UHF Trunked operations in Santa Barbara County. The SVR-P252 is the next generation analog vehicular repeater from Pyramid Communications. Available in VHF, UHF, 700, 800, and 900 MHz, these repeaters are PC programmable for up to 20 channels, with wideband/narrowband, CTCSS/DCS, emergency or dual tone on a per channel basis.

The SVR-252 can interface to analog or P25 digital mobile radios, providing flexible interoperability between systems that wouldn't normally be able to communicate with analog portable radios on a scene. The SVR-P252 can also interface to conventional or trunking mobiles and is capable of operating with SkyTerra (formally MSV) mobile satellite phones.

In trunking mode, the SVR-252 ensures proper acquisition of the trunking channel and uses the Smart Trunking Access™ mechanism of alerting the portable users of trunking status information.

A-1.1.4.16 Optional Computer Aided Dispatch (CAD) Interface

The JVCKENWOOD engineering team will work with the County's CAD vendor to define and implement a CAD interface. The interface will require a discussion of the features/functionality CAD will be able to provide through the dispatch consoles, as well as a project plan for implementation and integration. Post contract, the County shall provide JVCKENWOOD with the contact of their CAD vendor to start this discussion and JVCKENWOOD will work with the CAD vendor to ensure all interface requirements are met.

A-1.1.4.17 Optional Unit Location (GPS) Interface

JVCKENWOOD's ATLAS Solution allows connection to a GPS location solution via our ATLAS 6400 DATA Gateway or Location Gateway. The location gateway is a P25 Standards-Based Tier 2 Location Services application running inside the Data server. This Location Gateway is intended to interface P25 radios with third-party GPS applications that do not directly support P25 Tier 2 location services themselves. It allows GPS application vendors to avoid implementing complex Tier 2 location services and instead adopt a simpler protocol. When a location gateway is installed, the radio sends the GPS location as tier 2 data packet to the location gateway. Location data sources other than P25 subscribers supporting tier 2 location services may be added as desired in the future.

The Location Gateway supports communicating with third party location systems using one or more WebSockets hosted by the location gateway. The Location Gateway listens for JSON formatted data to control when location data is sent from subscribers. All location data received from subscribers is broadcasted across all connected WebSockets using JSON messages. Because the P25 Tier 2 location information is translated to and from JSON, the specific P25 messages do not need to be known by the third-party system. The Location Gateway does not store any location data and as such it is up to the third-party system to store data if data permanence is desired.

A-1.1.4.18 Summary

JVCKENWOOD is grateful for the opportunity to partner with Santa Barbara County to install a turnkey P25 solution that satisfies your mission-critical needs. Our P25-compliant, standards-based public safety solution, featuring JVCKENWOOD's patented Latitude technology, stands out as the only truly distributed solution, providing flexible network capability, multi-level and inherent redundancy, and unprecedented reliability across your entire system's lifetime.

As discussed in this section, the designed distributed architecture ATLAS P25 communication system addresses all the County's requirements with the most modern system architecture on the market today:

- **Manageable Total Cost of Ownership that is flexible and predictable**—ATLAS System components are based on COTS hardware, significantly reducing system obsolescence, and extending the life of your critical investment. Additionally, JVCKENWOOD's flat pricing model for the ATLAS System means there are no additional fees for operating licenses.
- **Reliable Redundancy to Protect First Responders and Citizens**—with self-healing and network rerouting capabilities.
- **Interoperability with surrounding counties**—including compatibility with all P25 vendor networks
- **Clear Communication**—with KENWOOD Viking subscriber radios TrueVoice™ software-based noise cancellation.

A-1.1.5 System Drawings

System Drawings can be found on the following pages.

Sheriff Dispatch Center

Dispatch Console 1
Dispatch Console 2
Dispatch Console 3
Dispatch Console 4
Dispatch Console 5
Dispatch Console 6
Dispatch Console 7
Dispatch Console 8
Training Console
Maintenance Console

Dispatch Consoles
Dispatch Consoles
Switch
Switch
Switch
MPLS Router

UHF Control Stations
12 CH UHF Control station Combiner
8 UHF Control Stations
8 Mobile Radio Gateways
Conventional Interface x 40

VHF Control Stations
12 CH VHF Control station Combiner
8 VHF Control Stations
8 Mobile Radio Gateways
Switch
Logging Recorder

800 MHz Control Stations
12 CH 800 Control station Combiner
8 800Mhz Control Stations
8 Mobile Radio Gateways

Cisco Firewall / VPN
ISP Network for VPN Access
ATLAS 6600 Inter Subsystem Interface (ISSI)
ATLAS 6200 Advanced Network Management System (NMS)
ATLAS 6300 Management Workstation Computer
Alarm Management Server
ATLAS 6500 KMF
Microwave NMS
ESCHAT (Smartphone Gateway)

Sheriff Dispatch

Sheriff Dispatch Center Equipment Room

Santa Ynez Peak

Comm Center

Emergency Operations Center, Fire Dispatch

Dispatch Console 1
Dispatch Console 2
Dispatch Console 3
Dispatch Console 4
Dispatch Console 5
Dispatch Console 6
Dispatch Console 7
Dispatch Console 8
Deployable Console

Dispatch Consoles
Dispatch Consoles
Switch
Switch
Switch
MPLS Router

UHF Control Stations
8 Mobile Radio Gateways
8 UHF Control Stations
12 CH UHF Control station Combiner
Conventional Interface x 40

VHF Control Stations
8 Mobile Radio Gateways
8 VHF Control Stations
12 CH VHF Control station Combiner
Switch
Logging Recorder

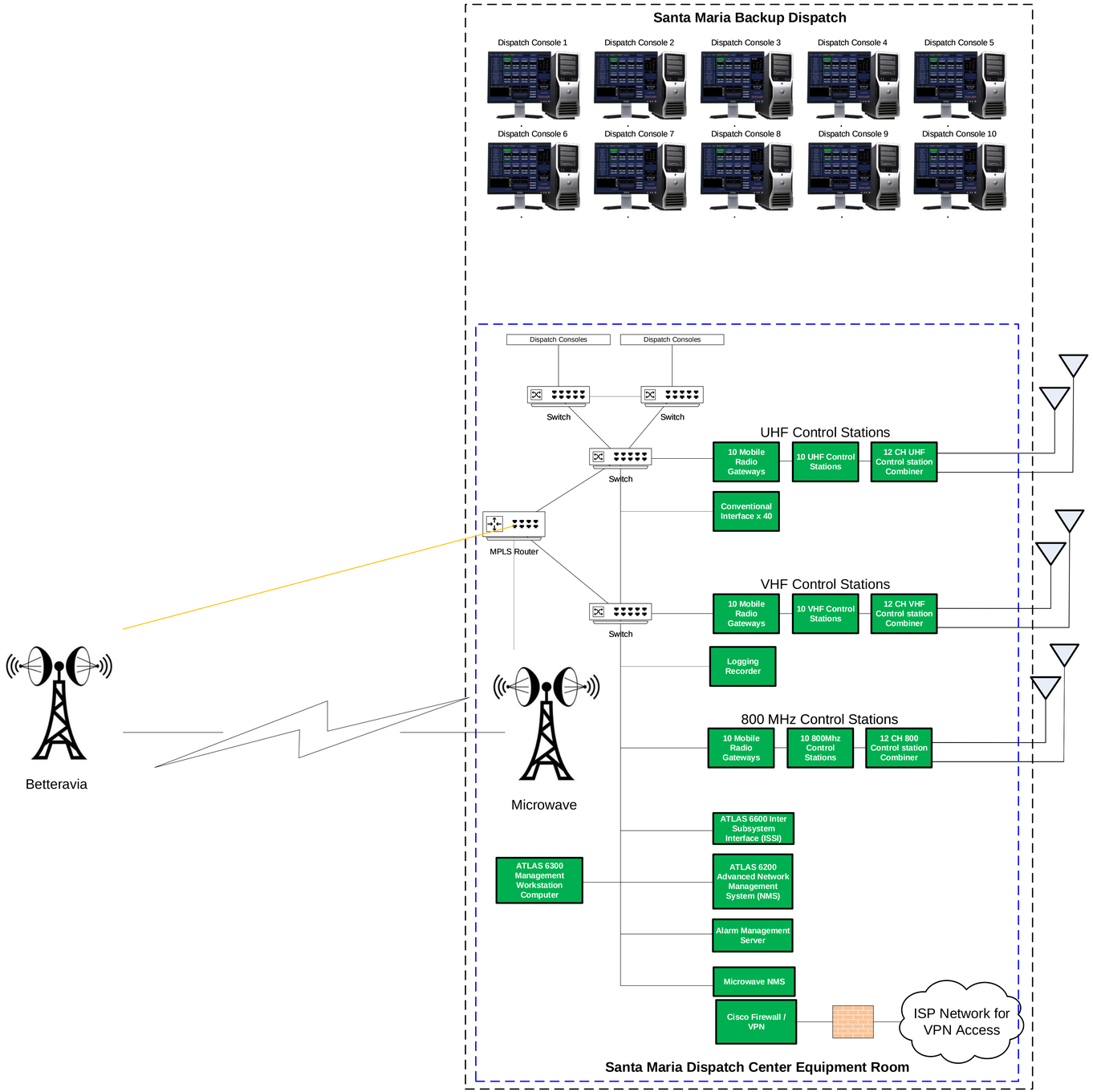
800 MHz Control Stations
8 Mobile Radio Gateways
8 800Mhz Control Stations
12 CH 800 Control station Combiner

EOC

Emergency Operations Center, Equipment Room

Santa Barbara County Sheriff and EoC Fire Dispatch Centers

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4



Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

Rincon

VHF RX
VHF TX
VHF Analog
VHF Multicoupler (8CH)
VHF (6-ch) Combiner
1
2
3
4
5
6
ATLAS 1550 Dual Reference Generator
ATLAS 8100 CSNI x6 VHF Analog
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
MPLS Router

Admin Building

VHF RX
VHF TX
VHF Analog
VHF Multicoupler (8CH)
VHF (6-ch) Combiner
1
2
3
4
5
6
ATLAS 1550 Dual Reference Generator
ATLAS 8100 CSNI x6 VHF Analog
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
MPLS Router

La Cumbre Peak

VHF RX
VHF TX
VHF Analog
VHF Multicoupler (8CH)
VHF (6-ch) Combiner
1
2
3
4
5
6
ATLAS 1550 Dual Reference Generator
ATLAS 8100 CSNI x6 VHF Analog
Site Alarm Panel
Network Capture Server
Switch
Switch
MPLS Router
Switch

Valley Peak

VHF RX
VHF TX
VHF Analog
VHF Multicoupler (8CH)
VHF (6-ch) Combiner
1
2
3
4
5
6
ATLAS 1550 Dual Reference Generator
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
MPLS Router

Santa Ynez

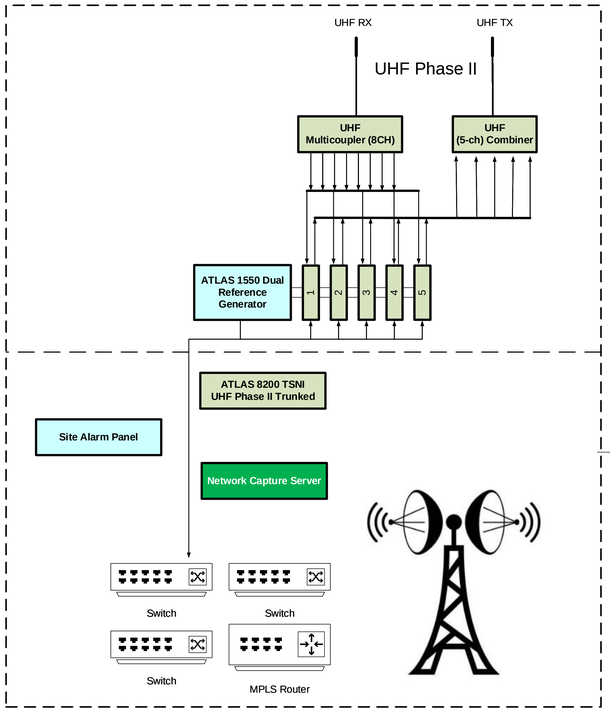
Comm Center

Mt Abel

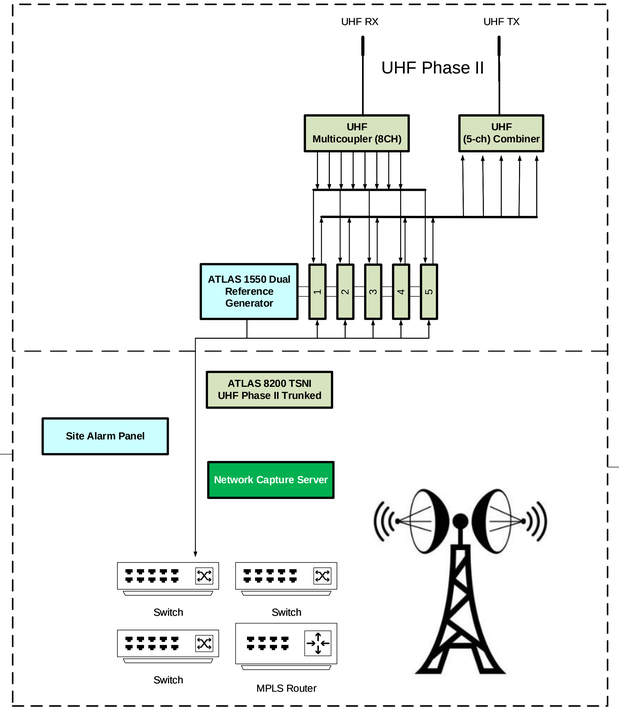
Santa Barbara City VHF Simulcast Sites

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

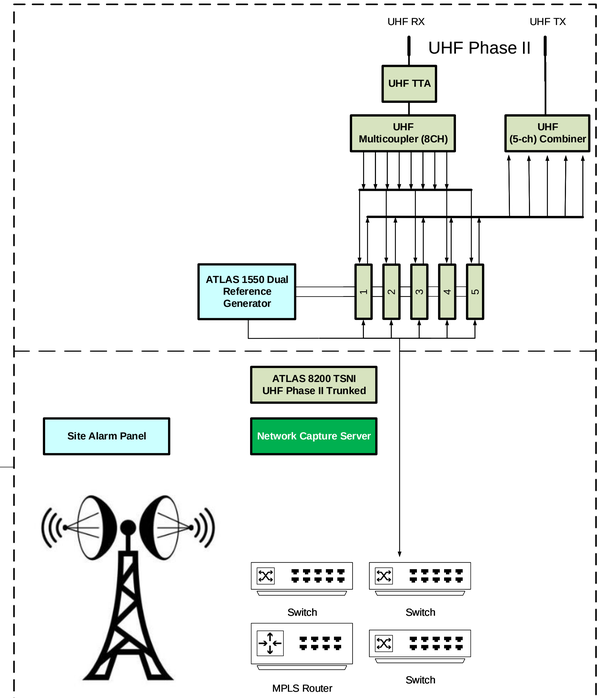
Rincon



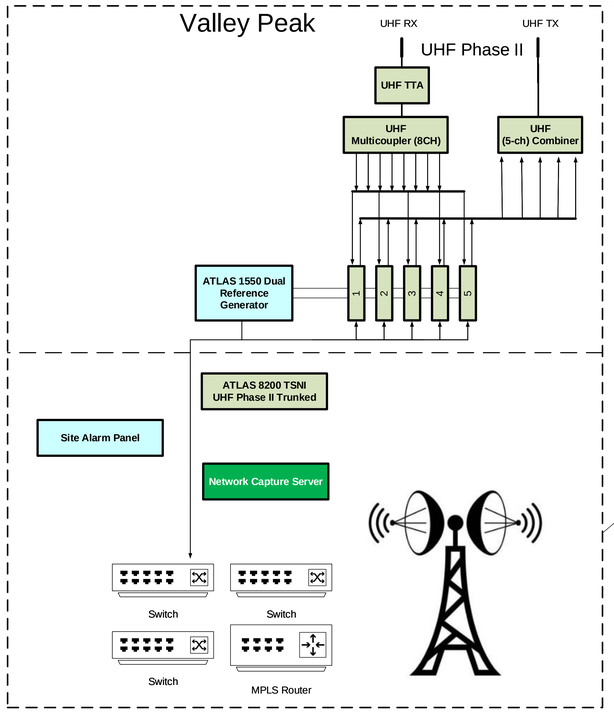
Admin Building



La Cumbre Peak



Valley Peak



Santa Ynez

Comm Center

Mt Abel

Santa Barbara City UHF Simulcast Zone

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

Oak Mtn-GATR

VHF RX

VHF TX

VHF Analog

VHF Multicoupler (8CH)

VHF (6-ch) Combiner

1 2 3 4 5 6

ATLAS 1550 Dual Reference Generator

Site Alarm Panel

ATLAS 8100 CSNI x6 VHF Analog

Network Capture Server

Switch

Switch

Switch

MPLS Router

Sudden Peak

Heritage Oil Platform

VHF RX

VHF TX

VHF Analog

VHF Multicoupler (8CH)

VHF (6-ch) Combiner

1 2 3 4 5 6

ATLAS 1550 Dual Reference Generator

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Santa Ynez Peak

Gaviota

VHF RX

VHF TX

VHF Analog

VHF Multicoupler (8CH)

VHF (6-ch) Combiner

1 2 3 4 5 6

ATLAS 1550 Dual Reference Generator

Site Alarm Panel

ATLAS 8100 CSNI x6 VHF Analog

Network Capture Server

Switch

Switch

Switch

MPLS Router

Comm Center

Gaviota Area VHF Simulcast Sites

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

Oak Mtn-GATR

UHF Phase II

UHF TX / RX

UHF Multicoupler (8CH)

UHF (5-ch) Combiner

ATLAS 1550 Dual Reference Generator

1 2 3 4 5

ATLAS 8200 TSNI UHF Phase II Trunked

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Sudden Peak

UHF RX

UHF TX

UHF Phase II

UHF TTA

UHF Multicoupler (8CH)

UHF (5-ch) Combiner

ATLAS 1550 Dual Reference Generator

1 2 3 4 5

ATLAS 8200 TSNI UHF Phase II Trunked

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Gaviota

UHF Phase II

UHF TX / RX

UHF Multicoupler (8CH)

UHF (5-ch) Combiner

ATLAS 1550 Dual Reference Generator

1 2 3 4 5

ATLAS 8200 TSNI UHF Phase II Trunked

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Heritage Oil Platform

UHF RX

UHF TX

UHF Phase II

UHF TTA

UHF Multicoupler (8CH)

UHF (5-ch) Combiner

ATLAS 1550 Dual Reference Generator

1 2 3 4 5

ATLAS 8200 TSNI UHF Phase II Trunked

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Santa Ynez Peak

Lompoc Civic Center

Figueroa Mtn

Comm Center

Gaviota Area UHF Simulcast Zone

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

Figueroa Mtn

VHF RX

VHF TX

VHF Analog

VHF Multicoupler (8CH)

VHF (6-ch) Combiner

1 2 3 4 5 6

ATLAS 1550 Dual Reference Generator

ATLAS 8100 CSNI x6 VHF Analog

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Fire Station 24

Santa Ynez Peak

VHF RX

VHF TX

VHF Analog

VHF Multicoupler (8CH)

VHF (6-ch) Combiner

1 2 3 4 5 6

ATLAS 1550 Dual Reference Generator

ATLAS 8100 CSNI x6 VHF Analog

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Heritage Oil Platform

Comm Center

EOC

Admin Building

Santa Ynez VHF Simulcast Sites

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

Figueroa Mtn

UHF RX

UHF TX

UHF Phase II

UHF TTA

UHF Multicoupler (8CH)

UHF (5-ch) Combiner

ATLAS 1550 Dual Reference Generator

1 2 3 4 5

ATLAS 8200 TSNI UHF Phase II Trunked

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Fire Station 24

Santa Ynez Peak

UHF RX

UHF TX

UHF Phase II

UHF TTA

UHF Multicoupler (8CH)

UHF (5-ch) Combiner

ATLAS 1550 Dual Reference Generator

1 2 3 4 5

ATLAS 8200 TSNI UHF Phase II Trunked

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Heritage Oil Platform

Comm Center

EOC

Admin Building

Santa Ynez UHF Simulcast Zone

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

Tepusquet

VHF RX

VHF TX

VHF Analog

VHF Multicoupler (8CH)

VHF (6-ch) Combiner

1 2 3 4 5 6

ATLAS 1550 Dual Reference Generator

ATLAS 8100 CSNI x6 VHF Analog

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Plowshare

VHF RX

VHF TX

VHF Analog

VHF Multicoupler (8CH)

VHF (6-ch) Combiner

1 2 3 4 5 6

ATLAS 1550 Dual Reference Generator

ATLAS 8100 CSNI x6 VHF Analog

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Betteravia

Mount Solomon

Fire Station 41

Plowshare Area VHF Simulcast Sites

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

Tepusquet

UHF RX

UHF TX

UHF Phase II

UHF TTA

UHF Multicoupler (8CH)

UHF (5-ch) Combiner

ATLAS 1550 Dual Reference Generator

1 2 3 4 5

ATLAS 8200 TSNI UHF Phase II Trunked

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Plowshare

UHF RX

UHF TX

UHF Phase II

UHF TTA

UHF Multicoupler (8CH)

UHF (5-ch) Combiner

ATLAS 1550 Dual Reference Generator

1 2 3 4 5

ATLAS 8200 TSNI UHF Phase II Trunked

Site Alarm Panel

Network Capture Server

Switch

Switch

Switch

MPLS Router

Betteravia

Mount Solomon

Fire Station 41

Plowshare Area Simulcast Zone

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

Lompoc Civic Center

VHF RX
VHF TX
VHF Analog
VHF Multicoupler (8CH)
VHF (6-ch) Combiner
1
2
3
4
5
6
ATLAS 1550 Dual Reference Generator
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
MPLS Router

Tepusquet

Mount Solomon

VHF RX
VHF TX
VHF Analog
VHF Multicoupler (8CH)
VHF (6-ch) Combiner
1
2
3
4
5
6
ATLAS 1550 Dual Reference Generator
ATLAS 8100 CSNI x6 VHF Analog
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
MPLS Router

Fire Station 24

VHF RX
VHF TX
VHF Analog
VHF Multicoupler (8CH)
VHF (6-ch) Combiner
1
2
3
4
5
6
ATLAS 1550 Dual Reference Generator
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
MPLS Router

Figueroa Mtn

San Antonio

VHF RX
VHF TX
VHF Analog
VHF Multicoupler (8CH)
VHF (6-ch) Combiner
1
2
3
4
5
6
ATLAS 1550 Dual Reference Generator
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
MPLS Router

Betteravia

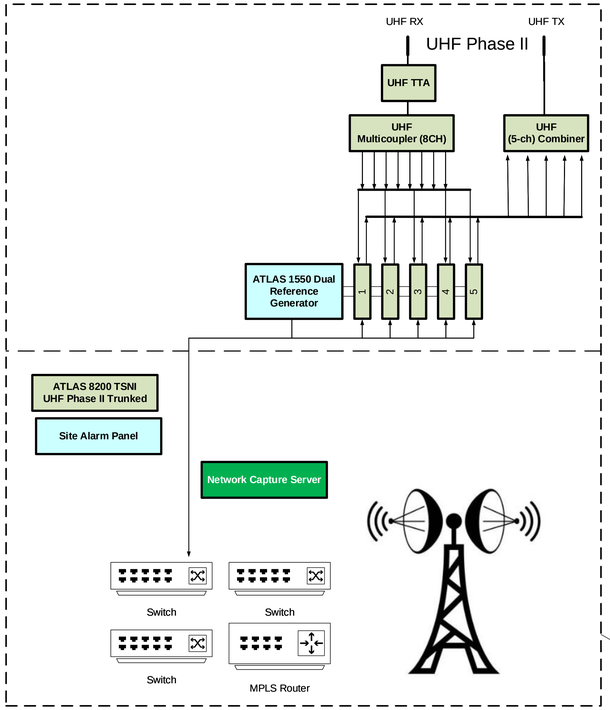
Harris Grade

VHF RX
VHF TX
VHF Analog
VHF Multicoupler (8CH)
VHF (6-ch) Combiner
1
2
3
4
5
6
ATLAS 1550 Dual Reference Generator
ATLAS 8100 CSNI x6 VHF Analog
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
MPLS Router

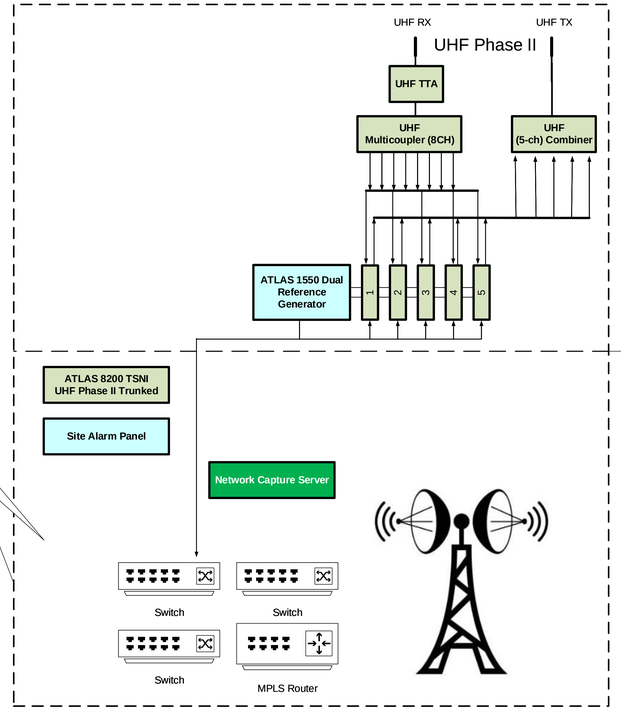
Vandenburg Village VHF Simulcast Sites

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

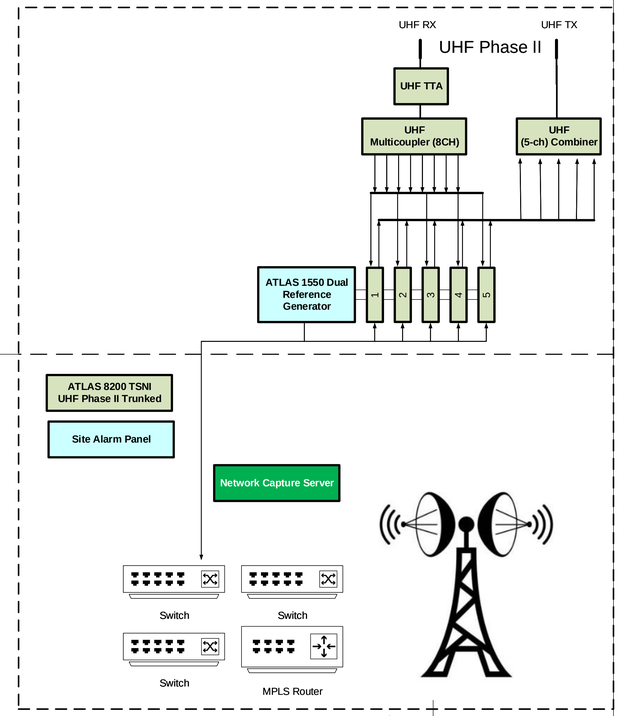
Lompoc Civic Center



Mount Solomon

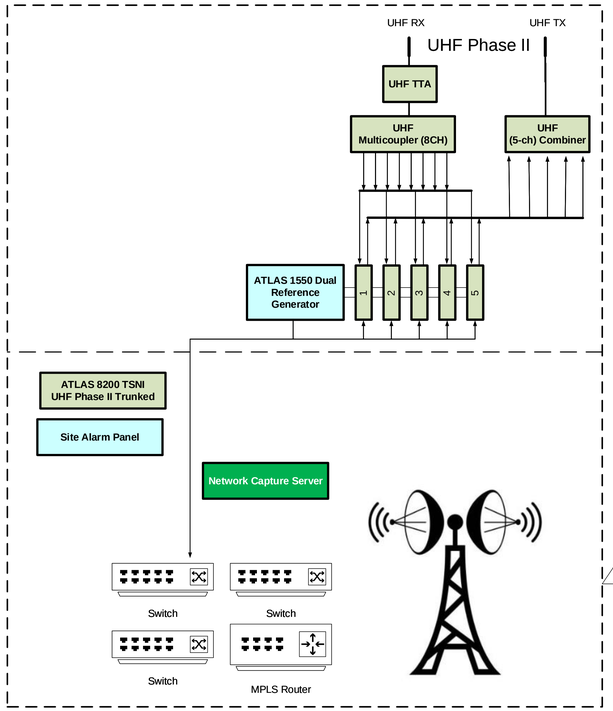


Fire Station 24



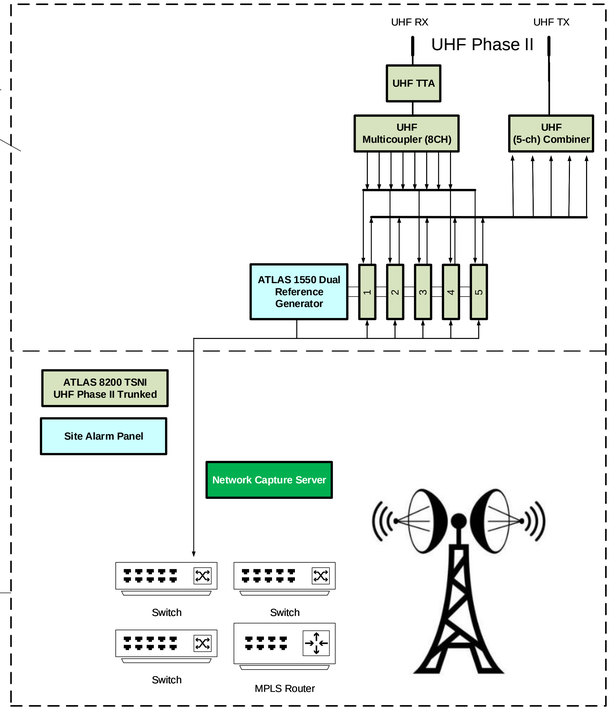
Tepusquet

San Antonio



Betteravia

Harris Grade

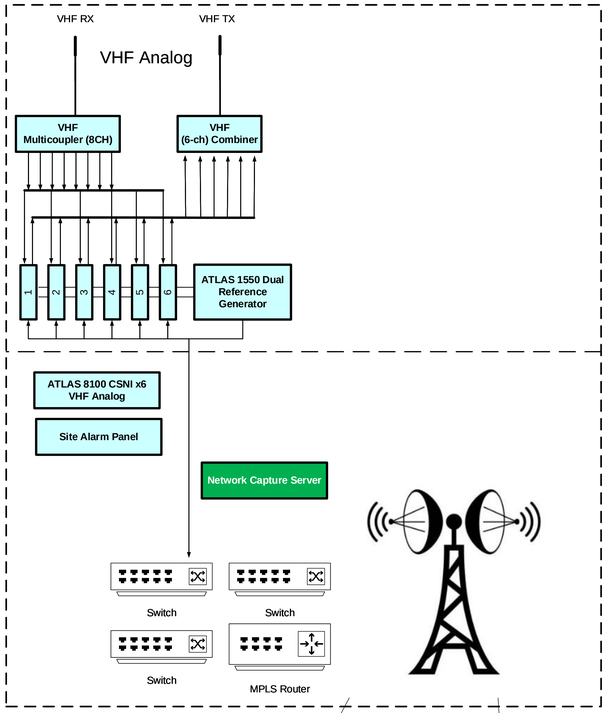


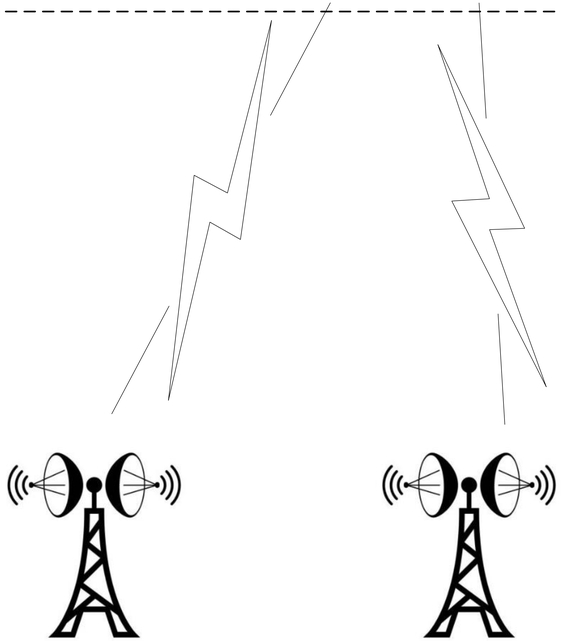
Figueroa Mtn

Vandenburg Village UHF Simulcast Zone

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

Fire Station 41

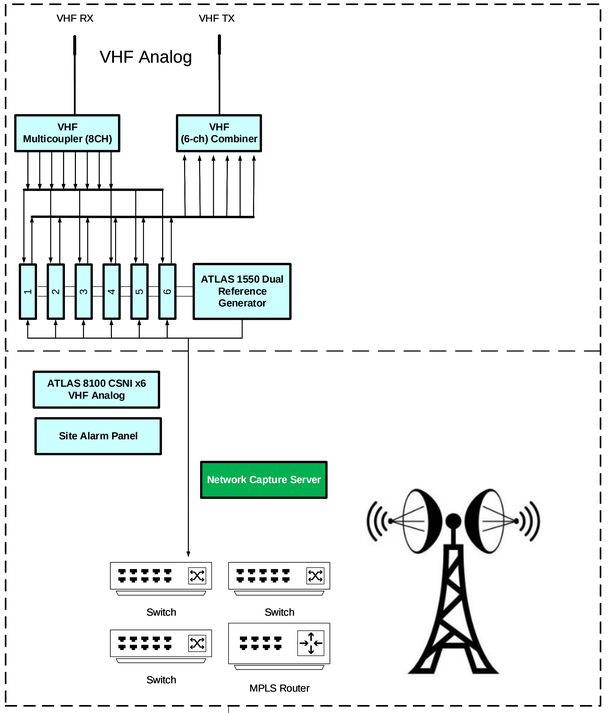


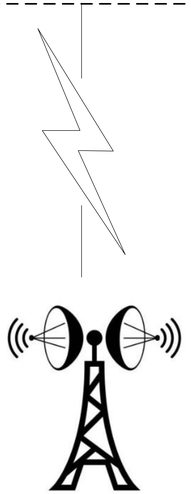


Plowshare

Mt Abel

Ventucopa



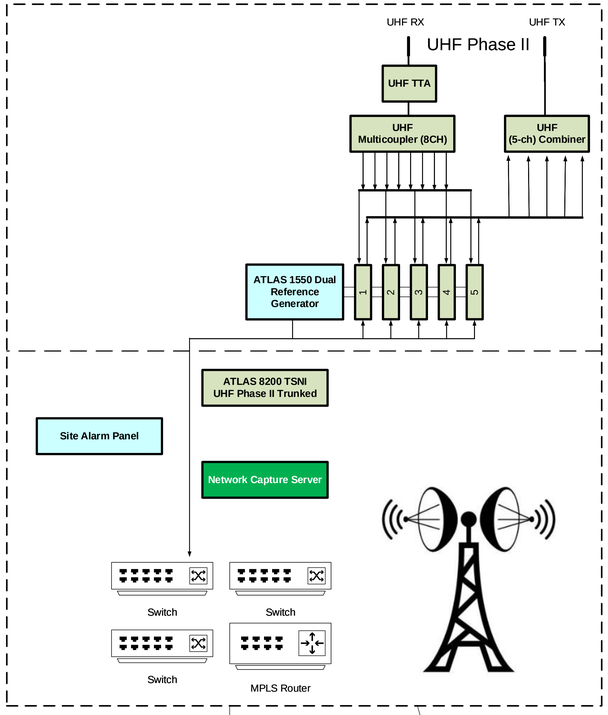


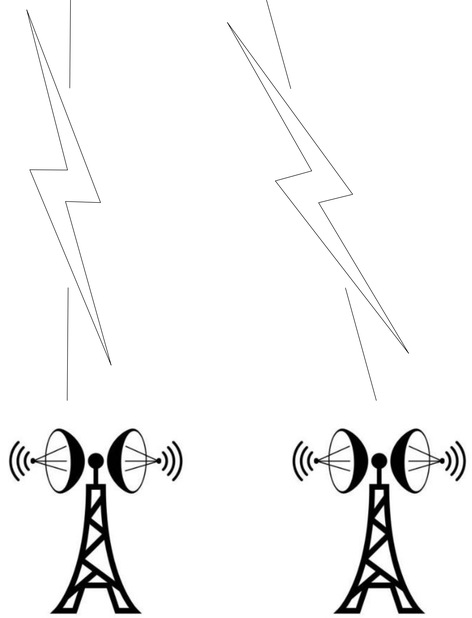
Mt Abel

Ventucopa Area VHF Simulcast Sites

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

Fire Station 41

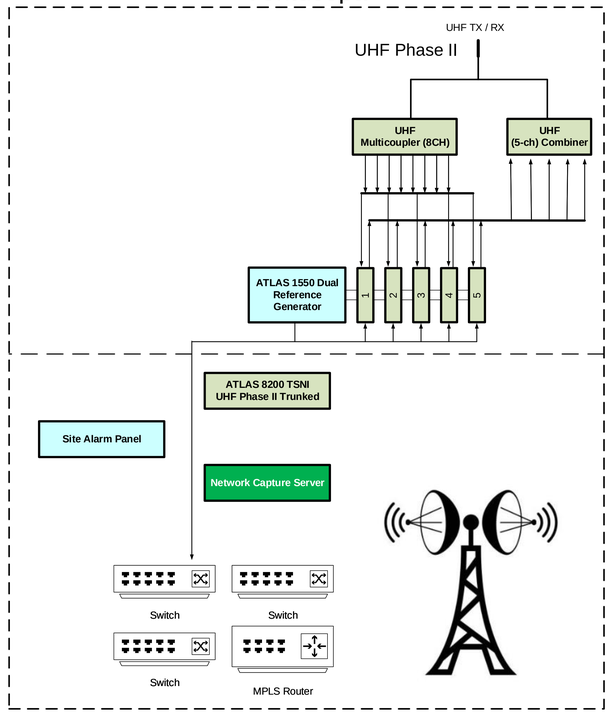


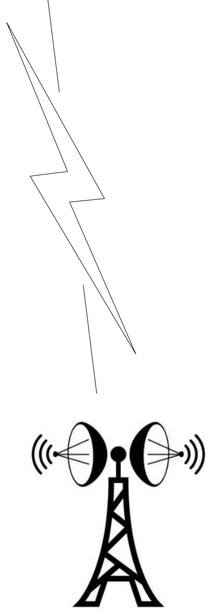


Plowshare

Mt Abel

Ventucopa





Mt Abel

Ventucopa Area UHF Simulcast Zone

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

Rincon

800 Mhz RX
800 MHz TX
800MHz Phase II
TTA
800 MHz Multicoupler (8CH)
800 MHz (5-ch) Combiner
ATLAS 1550 Dual Reference Generator
1
2
3
4
5
ATLAS 8200 TSNI 800 Phase II Trunked
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
Switch
MPLS Router

Admin Building

800 Mhz RX
800 MHz TX
800MHz Phase II
TTA
800 MHz Multicoupler (8CH)
800 MHz (5-ch) Combiner
ATLAS 1550 Dual Reference Generator
1
2
3
4
5
ATLAS 8200 TSNI 800 Phase II Trunked
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
MPLS Router

La Cumbre Peak

800 Mhz RX
800 MHz TX
800MHz Phase II
TTA
800 MHz Multicoupler (8CH)
800 MHz (5-ch) Combiner
ATLAS 1550 Dual Reference Generator
1
2
3
4
5
ATLAS 8200 TSNI 800 Phase II Trunked
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
MPLS Router

Valley Peak

800 Mhz RX
800 MHz TX
800MHz Phase II
TTA
800 MHz Multicoupler (8CH)
800 MHz (5-ch) Combiner
ATLAS 1550 Dual Reference Generator
1
2
3
4
5
ATLAS 8200 TSNI 800 Phase II Trunked
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
MPLS Router

EOC Fire Dispatch

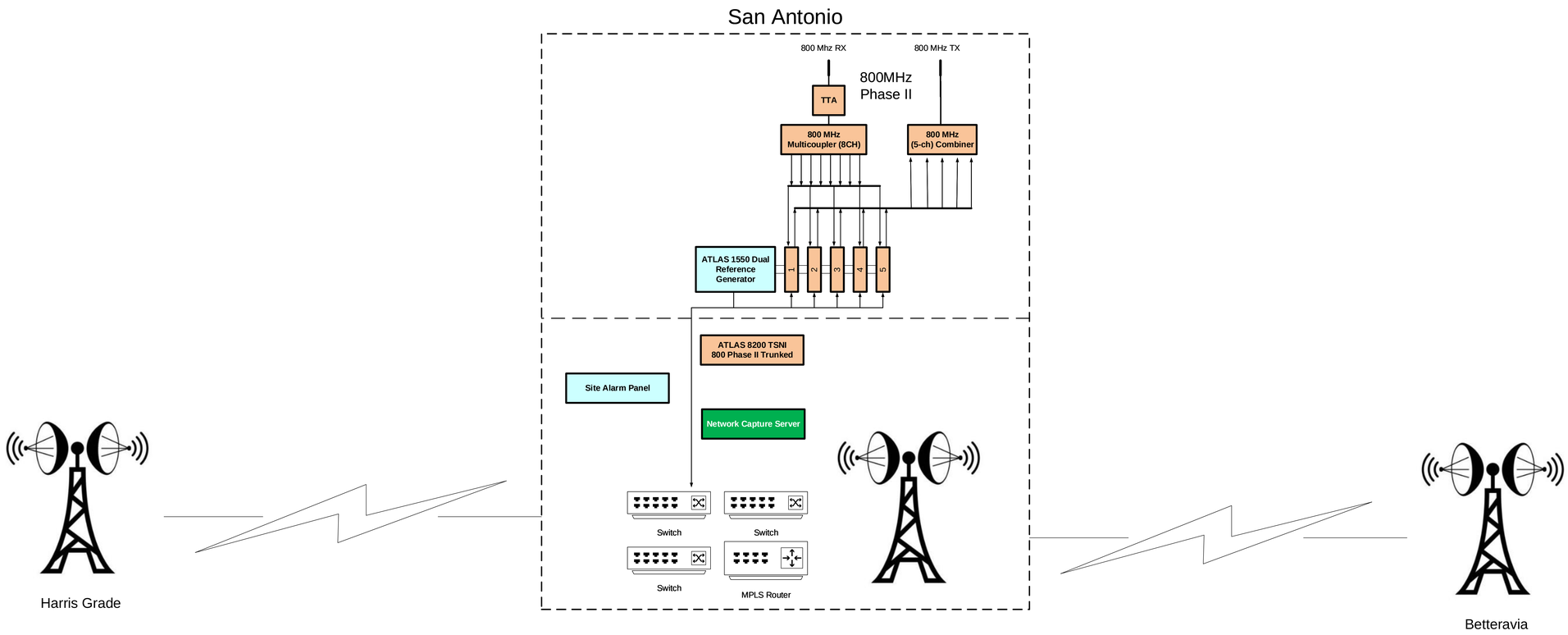
800 Mhz RX
800 MHz TX
800MHz Phase II
TTA
800 MHz Multicoupler (8CH)
800 MHz (5-ch) Combiner
ATLAS 1550 Dual Reference Generator
1
2
3
4
5
ATLAS 8200 TSNI 800 Phase II Trunked
Site Alarm Panel
Network Capture Server
Switch
Switch
Switch
MPLS Router

Comm Center

Santa Ynez

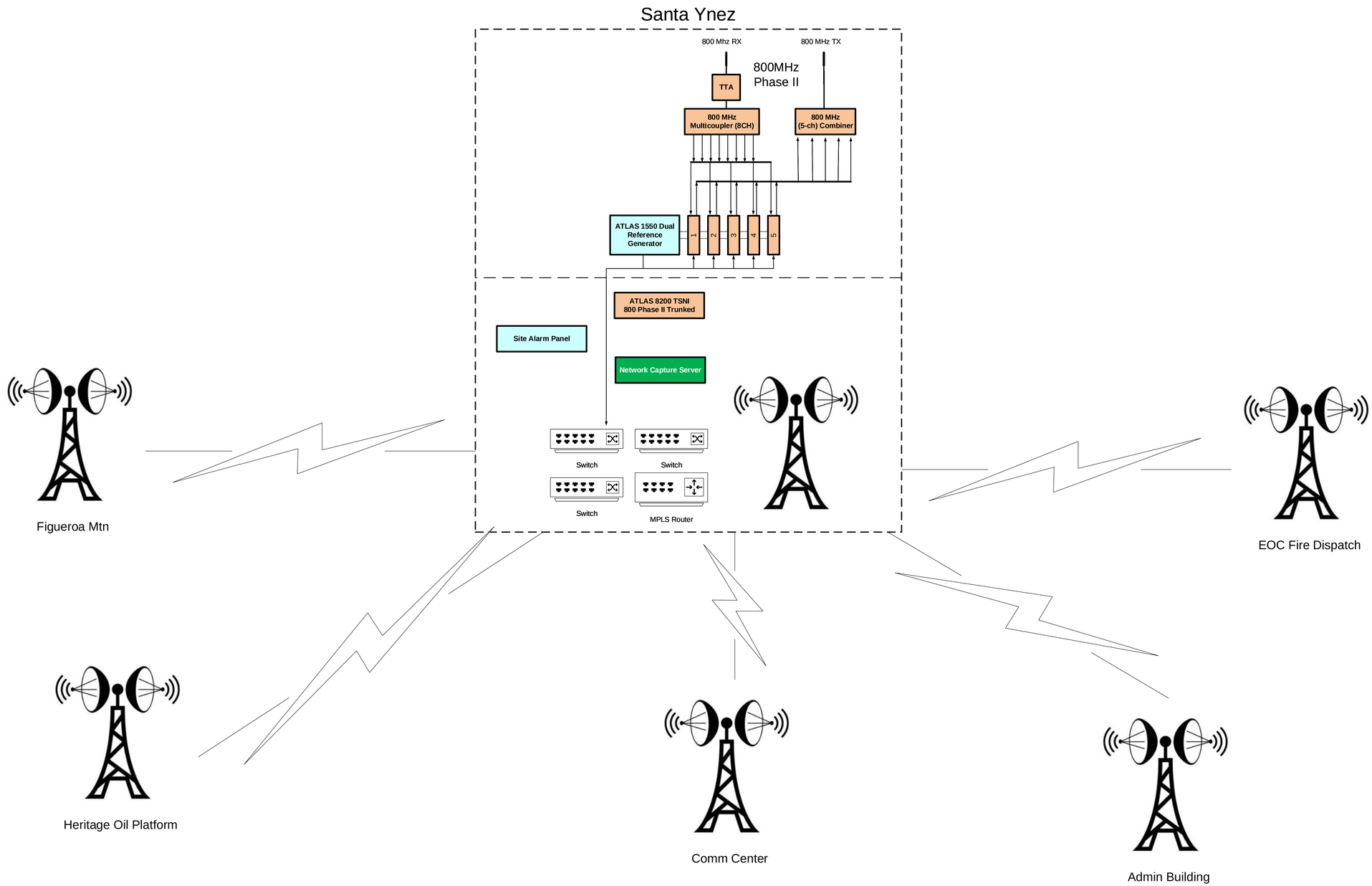
Santa Barbara City 800 MHz Sites

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4



Santa Maria City 800 MHz Multicast Site

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

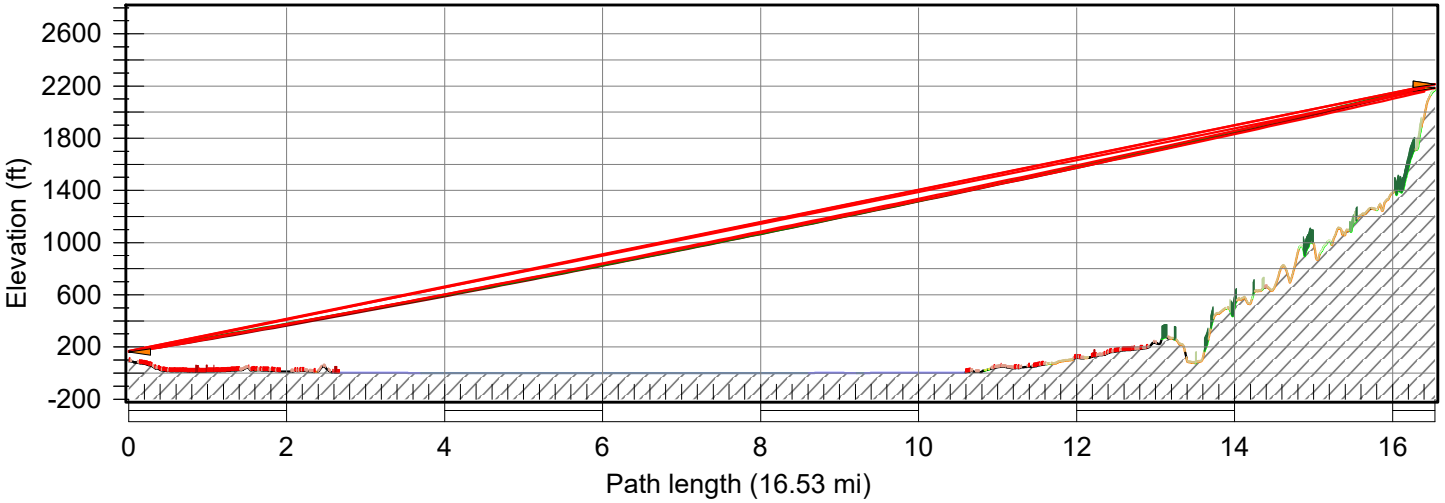


Santa Ynez City 800 MHz Multicast

Project Name:	Santa Barbara County, CA
P25 Radio System Diagram Package	
Prepared by:	Elliott McNeese
Drawing Date and Revision:	1.27.2021 rev3.4

A-1.1.7 Microwave Path Design

Microwave path design documents can be found on the following pages.



Admin	
Latitude	34 25 30.20 N
Longitude	119 42 12.60 W
Azimuth	102.49°
Elevation	90 ft ASL
Antenna CL	79.0, 71.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500
Divr 1 K = 1.330 %F1 = 60.00

Rincon	
Latitude	34 22 22.30 N
Longitude	119 25 15.82 W
Azimuth	282.65°
Elevation	2169 ft ASL
Antenna CL	45.0, 15.0 ft AGL

Transmission details (Admin-Rincon_SD opt.pl5)

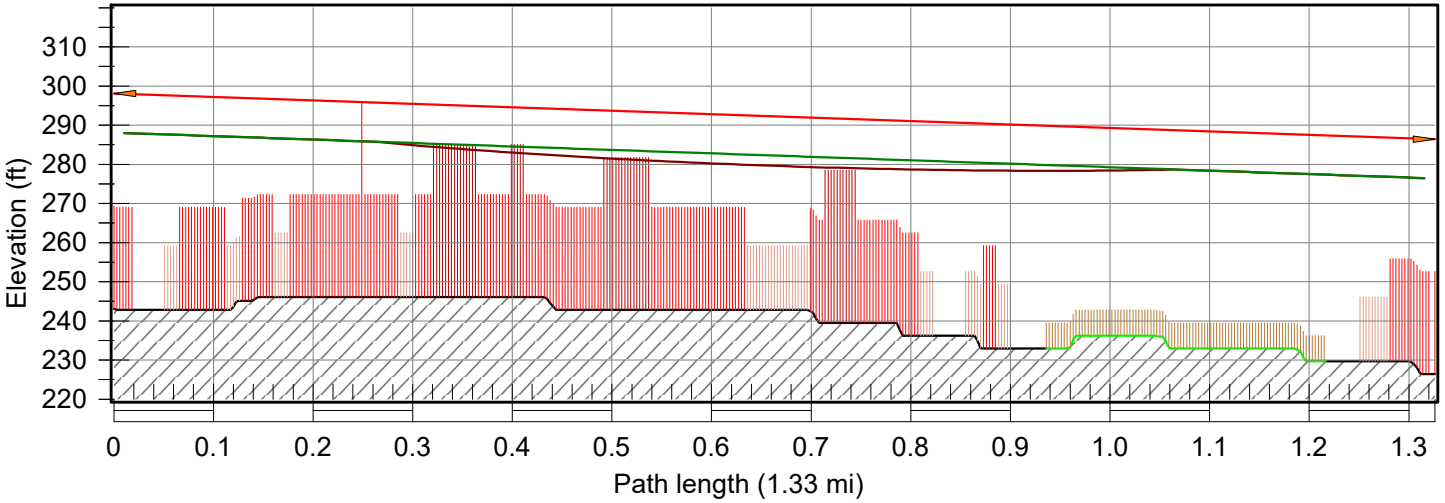
	Admin	Rincon
Latitude	34 25 30.20 N	34 22 22.30 N
Longitude	119 42 12.60 W	119 25 15.82 W
True azimuth (°)	102.49	282.65
Vertical angle (°)	1.25	-1.43
Elevation (ft)	90.11	2168.57
Tower height (ft)	91.00	100.00
Tower type	roof mount	
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	79.00	45.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	125.00	75.00
TX line loss (dB)	1.79	1.08
Connector loss (dB)	0.30	0.30
TX switch loss (dB)	0.40	0.40
Antenna model	HX6-6W (DR)	HX6-6W (DR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	71.00	15.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	117.00	45.00
TX line loss (dB)	1.68	0.65
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	

	Admin	Rincon
Configuration	2+2 MHSB/SD	2+2 MHSB/SD
Radio model	I6V4HL6_30M_ACM_R70	I6V4HL6_30M_ACM_R70
Radio file name	i4hl630macm_r70	i4hl630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	38.04	38.04
Climatic factor	2.00	
Terrain roughness (ft)	122.37	
C factor	0.62	
Average annual temperature (°F)	58.58	
Fade occurrence factor (Po)	4.364E-002	
SD improvement factor	7.44	98.75

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	30.50	30.50	-65.00	-65.00	66.71	67.42	-32.98	-32.98	32.13	32.45	30.05	30.24
256QAM 180 Mbps	31.00	31.00	-67.50	-67.50	67.21	67.92	-32.48	-32.48	35.13	35.45	31.94	32.09
128QAM 155 Mbps	**31.50**	**31.50**	**-73.75**	**-73.75**	**67.71**	**68.42**	**-31.98**	**-31.98**	**41.88**	**42.20**	**36.54**	**36.63**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9974	99.9998	99.9992	99.9999			99.9992	99.9992
256QAM 180 Mbps	99.9989	99.9999	99.9997	99.9999			99.9997	0.0005
128QAM 155 Mbps	**99.9999**	**99.9999**	**99.9999**	**99.9999**			**99.9999**	**0.0003**

Multipath fading method - Vigants - Barnett



Betteravia	
Latitude	34 55 18.23 N
Longitude	120 25 44.00 W
Azimuth	270.32°
Elevation	243 ft ASL
Antenna CL	55.0 ft AGL

Frequency (MHz) = 11200.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.670 %F1 = 30.00

Santa Maria	
Latitude	34 55 18.60 N
Longitude	120 27 08.07 W
Azimuth	90.30°
Elevation	226 ft ASL
Antenna CL	60.0 ft AGL

Transmission details (Betteravia-Santa Maria.pl5)

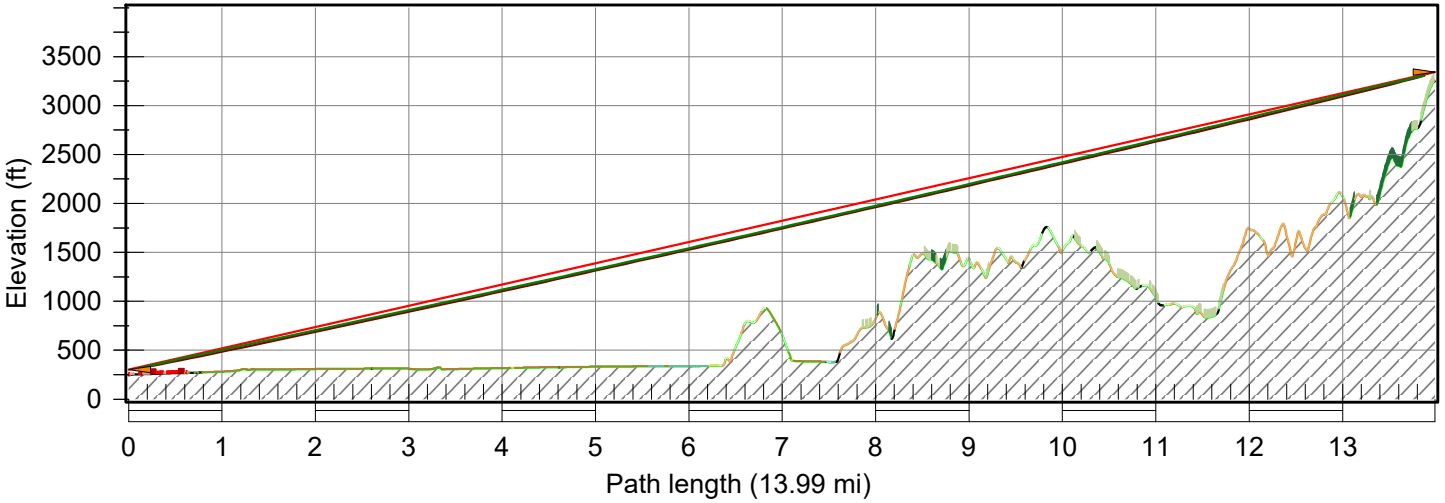
	Betteravia	Santa Maria
Latitude	34 55 18.23 N	34 55 18.60 N
Longitude	120 25 44.00 W	120 27 08.07 W
True azimuth (°)	270.32	90.30
Vertical angle (°)	-0.10	0.09
Elevation (ft)	243.08	226.38
Tower height (ft)	58.00	100.00
Antenna model	UXA4-107 (TR)	UXA4-107 (TR)
Antenna file name	uxa4-107a	uxa4-107a
Antenna gain (dBi)	40.40	40.40
Antenna height (ft)	55.00	60.00
Orientation loss (dB)	0.00	0.00
TX line model	E105	E105
TX line unit loss (dB/100 ft)	2.75	2.75
TX line length (ft)	85.00	90.00
TX line loss (dB)	2.34	2.47
Connector loss (dB)	0.50	0.50
TX switch loss (dB)	0.70	0.70
Other TX loss (dB)	6.50	6.50
RX filter loss (dB)	3.20	3.20
Frequency (MHz)	11200.00	
Polarization	Vertical	
Path length (mi)	1.33	
Free space loss (dB)	120.04	
Atmospheric absorption loss (dB)	0.03	
Net path loss (dB)	55.48	55.48
Configuration	2+2 MHSB equal	2+2 MHSB equal
Radio model	I6V4S11_30M_ACM_R70	I6V4S11_30M_ACM_R70
Radio file name	i4s1130macm_r70	i4s1130macm_r70
Emission designator	30M0D7W	30M0D7W

	Betteravia	Santa Maria
Rain region	San Luis Obispo, California	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	25.00	25.00	-64.00	-64.00	55.36	55.23	-30.48	-30.48	33.52	33.52	33.52	33.52
256QAM 180 Mbps	25.50	25.50	-66.50	-66.50	55.86	55.73	-29.98	-29.98	36.52	36.52	36.52	36.52
128QAM 155 Mbps	**26.00**	**26.00**	**-73.00**	**-73.00**	**56.36**	**56.23**	**-29.48**	**-29.48**	**43.52**	**43.52**	**43.52**	**43.52**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999
256QAM 180 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
128QAM 155 Mbps	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**0.0000**

Multipath fading method - Vigants - Barnett
Rain fading method - Crane



Betteravia	
Latitude	34 55 18.23 N
Longitude	120 25 44.00 W
Azimuth	91.81°
Elevation	244 ft ASL
Antenna CL	58.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Tepusquet	
Latitude	34 54 54.25 N
Longitude	120 10 57.68 W
Azimuth	271.95°
Elevation	3246 ft ASL
Antenna CL	95.0 ft AGL

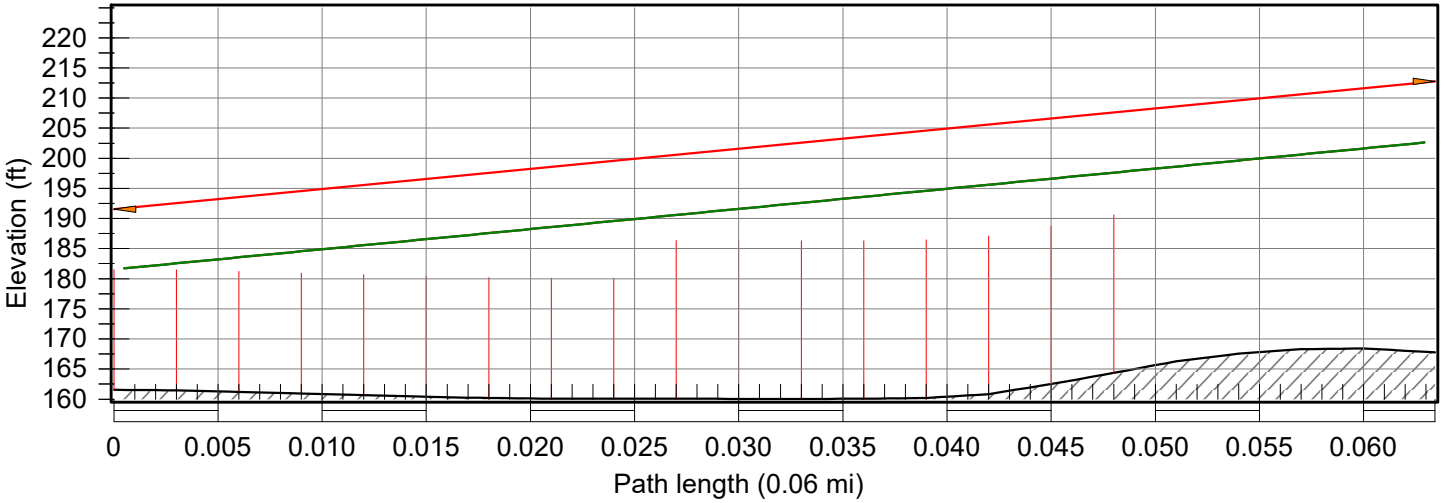
Transmission details (Betteravia-Tepusquet.pl5)

	Betteravia	Tepusquet
Latitude	34 55 18.23 N	34 54 54.25 N
Longitude	120 25 44.00 W	120 10 57.68 W
True azimuth (°)	91.81	271.95
Vertical angle (°)	2.28	-2.43
Elevation (ft)	243.95	3245.95
Tower height (ft)	58.00	125.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	58.00	95.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	90.00	125.00
TX line loss (dB)	1.29	1.79
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	14.00	
Free space loss (dB)	135.34	
Atmospheric absorption loss (dB)	0.19	
Net path loss (dB)	61.80	61.80
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4HL6_30M_ACM_R70	I6V4HL6_30M_ACM_R70
Radio file name	i4hl630macm_r70	i4hl630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	37.30	37.30
Climatic factor	2.00	
Terrain roughness (ft)	140.00	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	30.50	30.50	-65.00	-65.00	67.61	67.11	-31.30	-31.30	33.70	33.70	30.59	30.59
256QAM 180 Mbps	31.00	31.00	-67.50	-67.50	68.11	67.61	-30.80	-30.80	36.70	36.70	32.15	32.15
128QAM 155 Mbps	**31.50**	**31.50**	**-73.75**	**-73.75**	**68.61**	**68.11**	**-30.30**	**-30.30**	**43.45**	**43.45**	**36.35**	**36.35**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9980	99.9980	99.9994	99.9994			99.9988	99.9988
256QAM 180 Mbps	99.9986	99.9986	99.9996	99.9996			99.9992	0.0004
128QAM 155 Mbps	**99.9995**	**99.9995**	**99.9998**	**99.9998**			**99.9997**	**0.0005**

Multipath fading method - Vigants - Barnett



Comm Center	
Latitude	34 26 39.90 N
Longitude	119 46 37.60 W
Azimuth	110.69°
Elevation	162 ft ASL
Antenna CL	30.0 ft AGL

Frequency (MHz) = 11200.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Sheriff Dispatch	
Latitude	34 26 38.73 N
Longitude	119 46 33.86 W
Azimuth	290.69°
Elevation	168 ft ASL
Antenna CL	45.0 ft AGL

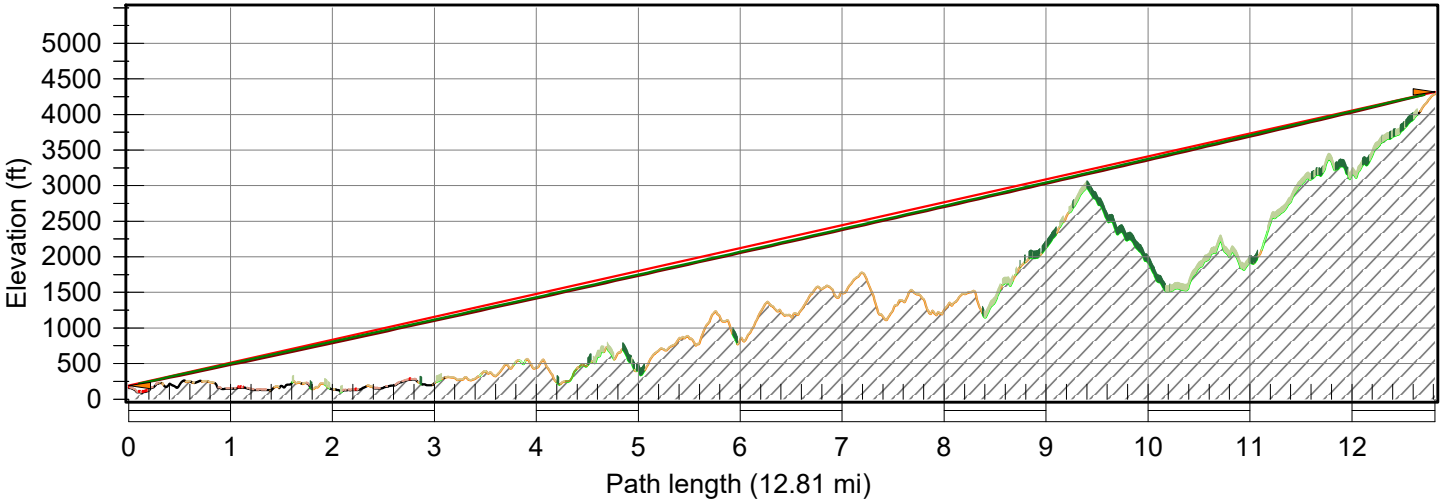
Transmission details (Comm Center-Sheriff Dispatch_IRU 11G 30MHz CCDP.pl5)

	Comm Center	Sheriff Dispatch
Latitude	34 26 39.90 N	34 26 38.73 N
Longitude	119 46 37.60 W	119 46 33.86 W
True azimuth (°)	110.69	290.69
Vertical angle (°)	3.63	-3.63
Elevation (ft)	161.54	167.78
Tower height (ft)	30.00	50.00
Antenna model	UXA4-107 (TR)	UXA4-107 (TR)
Antenna file name	uxa4-107a	uxa4-107a
Antenna gain (dBi)	40.40	40.40
Antenna height (ft)	30.00	45.00
Orientation loss (dB)	0.00	0.00
TX line model	E105J	E105J
TX line unit loss (dB/100 ft)	2.75	2.75
TX line length (ft)	70.00	85.00
TX line loss (dB)	1.93	2.34
Connector loss (dB)	0.40	0.40
Other TX loss (dB)	47.00	47.00
Frequency (MHz)	11200.00	
Polarization	Vertical	
Path length (mi)	0.06	
Free space loss (dB)	93.65	
Atmospheric absorption loss (dB)	0.00	
Net path loss (dB)	64.91	64.91
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4S11_30M_ACM_R70	I6V4S11_30M_ACM_R70
Radio file name	i4s1130macm_r70	i4s1130macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	34.86	34.86
Climatic factor	2.00	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	25.00	25.00	-64.00	-64.00	16.08	15.66	-39.91	-39.91	24.09	24.09	23.26	23.26
256QAM 180 Mbps	25.50	25.50	-66.50	-66.50	16.58	16.16	-39.41	-39.41	27.09	27.09	25.71	25.71
128QAM 155 Mbps	**26.00**	**26.00**	**-73.00**	**-73.00**	**17.08**	**16.66**	**-38.91**	**-38.91**	**34.09**	**34.09**	**31.45**	**31.45**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999
256QAM 180 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
128QAM 155 Mbps	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**0.0000**

Multipath fading method - Vigants - Barnett
Rain fading method - Crane



Comm Center	
Latitude	34 26 39.90 N
Longitude	119 46 37.60 W
Azimuth	296.31°
Elevation	158 ft ASL
Antenna CL	34.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Santa Ynez	
Latitude	34 31 35.87 N
Longitude	119 58 42.42 W
Azimuth	116.19°
Elevation	4284 ft ASL
Antenna CL	35.0 ft AGL

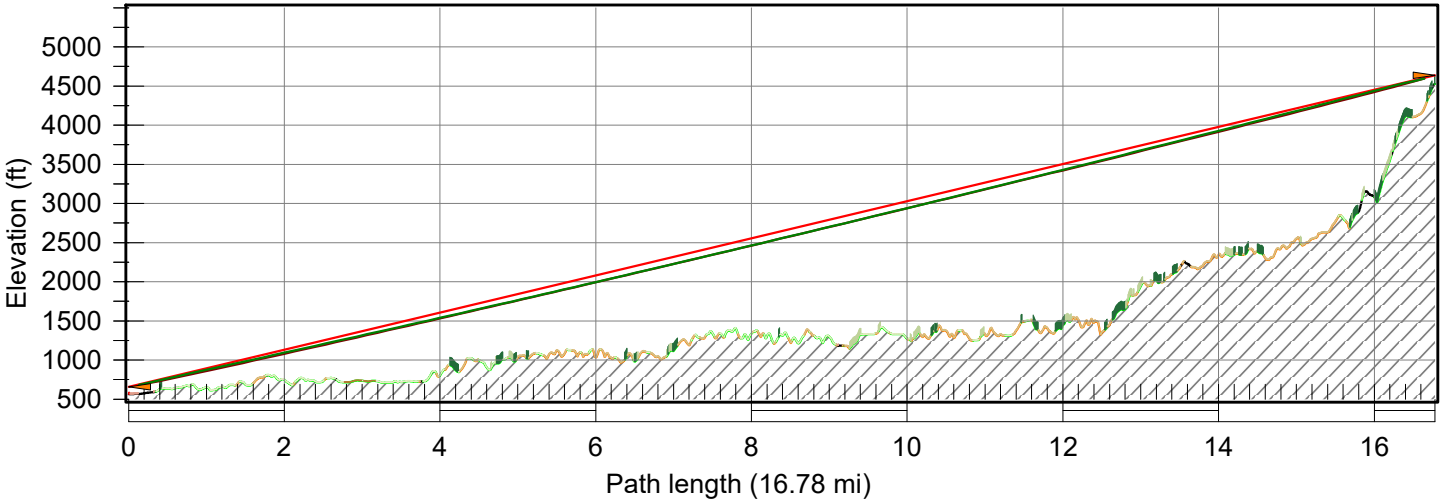
Transmission details (Comm Center (SB Jail)-Santa Ynez.pl5)

	Comm Center	Santa Ynez
Latitude	34 26 39.90 N	34 31 35.87 N
Longitude	119 46 37.60 W	119 58 42.42 W
True azimuth (°)	296.31	116.19
Vertical angle (°)	3.42	-3.56
Elevation (ft)	157.81	4284.09
Tower height (ft)	30.00	60.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	34.00	35.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	65.00	65.00
TX line loss (dB)	0.93	0.93
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	12.84	
Free space loss (dB)	134.58	
Atmospheric absorption loss (dB)	0.19	
Net path loss (dB)	59.84	59.84
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4HL6_30M_ACM_R70	I6V4HL6_30M_ACM_R70
Radio file name	i4hl630macm_r70	i4hl630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	37.01	37.01
Climatic factor	2.00	
Terrain roughness (ft)	140.00	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	30.50	30.50	-65.00	-65.00	67.97	67.97	-29.34	-29.34	35.66	35.66	31.28	31.28
256QAM 180 Mbps	31.00	31.00	-67.50	-67.50	68.47	68.47	-28.84	-28.84	38.66	38.66	32.54	32.54
128QAM 155 Mbps	**31.50**	**31.50**	**-73.75**	**-73.75**	**68.97**	**68.97**	**-28.34**	**-28.34**	**45.41**	**45.41**	**36.42**	**36.42**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9987	99.9987	99.9996	99.9996			99.9992	99.9992
256QAM 180 Mbps	99.9990	99.9990	99.9997	99.9997			99.9994	0.0002
128QAM 155 Mbps	**99.9996**	**99.9996**	**99.9999**	**99.9999**			**99.9998**	**0.0003**

Multipath fading method - Vigants - Barnett



Fire Station 24	
Latitude	34 44 42.83 N
Longitude	120 16 47.28 W
Azimuth	90.35°
Elevation	563 ft ASL
Antenna CL	95.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Figueroa Mtn	
Latitude	34 44 36.24 N
Longitude	119 59 05.86 W
Azimuth	270.51°
Elevation	4528 ft ASL
Antenna CL	110.0 ft AGL

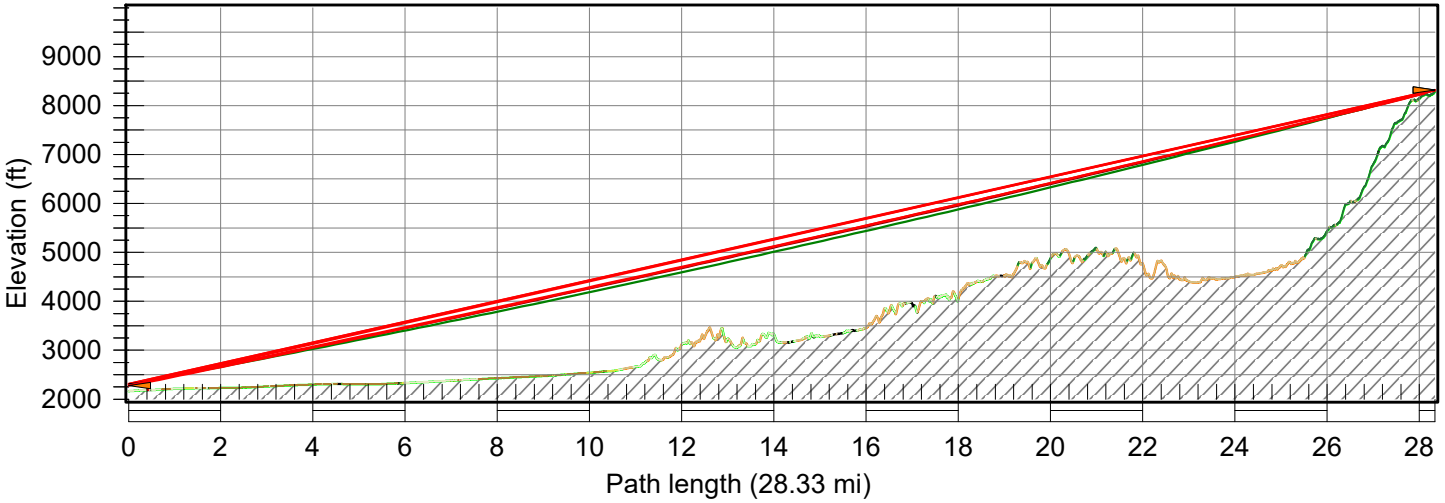
Transmission details (Fire Station 24-Figueroa Mtn.pl5)

	Fire Station 24	Figueroa Mtn
Latitude	34 44 42.83 N	34 44 36.24 N
Longitude	120 16 47.28 W	119 59 05.86 W
True azimuth (°)	90.35	270.51
Vertical angle (°)	2.48	-2.66
Elevation (ft)	563.18	4527.88
Tower height (ft)	330.00	125.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	95.00	110.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	125.00	140.00
TX line loss (dB)	1.79	2.00
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	16.80	
Free space loss (dB)	136.92	
Atmospheric absorption loss (dB)	0.23	
Net path loss (dB)	64.14	64.14
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4EHL6_30M_ACM_R70	I6V4EHL6_30M_ACM_R70
Radio file name	i4el630macm_r70	i4el630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	37.90	37.90
Climatic factor	2.00	
Terrain roughness (ft)	140.00	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	36.00	36.00	-65.00	-65.00	72.61	72.40	-28.14	-28.14	36.86	36.86	32.28	32.28
256QAM 180 Mbps	37.00	37.00	-67.50	-67.50	73.61	73.40	-27.14	-27.14	40.36	40.36	33.61	33.61
128QAM 155 Mbps	**37.00**	**37.00**	**-73.75**	**-73.75**	**73.61**	**73.40**	**-27.14**	**-27.14**	**46.61**	**46.61**	**37.35**	**37.35**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9977	99.9977	99.9993	99.9993			99.9986	99.9986
256QAM 180 Mbps	99.9983	99.9983	99.9995	99.9995			99.9990	0.0004
128QAM 155 Mbps	**99.9993**	**99.9993**	**99.9998**	**99.9998**			**99.9996**	**0.0006**

Multipath fading method - Vigants - Barnett



Fire Station 41	
Latitude	34 56 44.91 N
Longitude	119 40 55.64 W
Azimuth	106.36°
Elevation	2162 ft ASL
Antenna CL	145.0, 115.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500
Divr 1 K = 1.330 %F1 = 60.00

Mt Abel	
Latitude	34 49 44.65 N
Longitude	119 12 13.86 W
Azimuth	286.64°
Elevation	8270 ft ASL
Antenna CL	50.0, 35.0 ft AGL

Transmission details (Fire Station 41-Mt Abel.pl5)

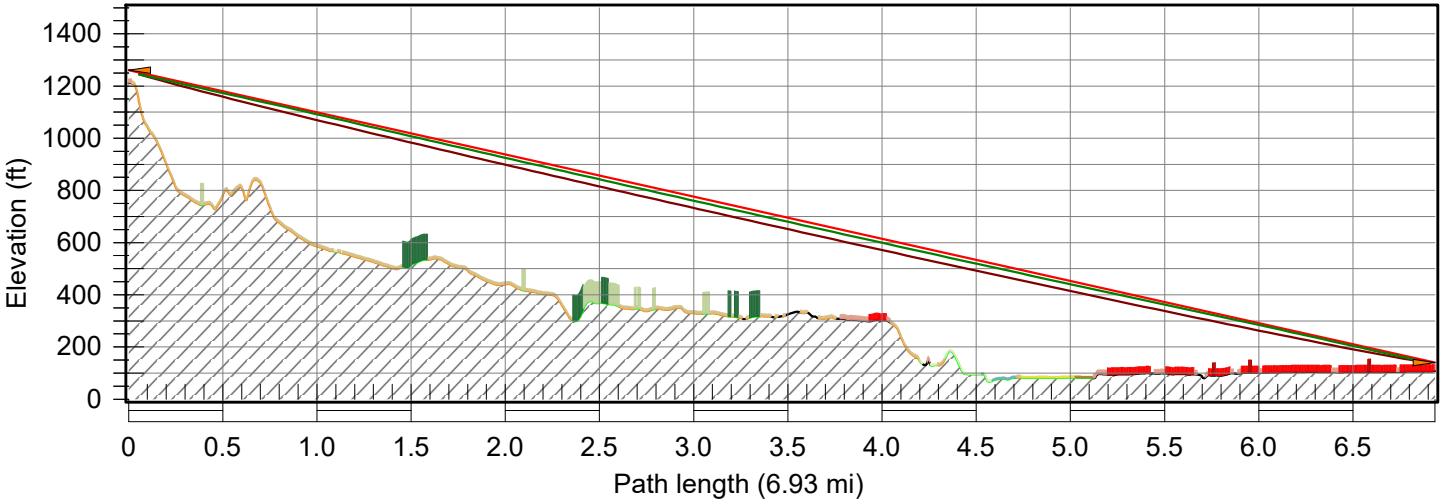
	Fire Station 41	Mt Abel
Latitude	34 56 44.91 N	34 49 44.65 N
Longitude	119 40 55.64 W	119 12 13.86 W
True azimuth (°)	106.36	286.64
Vertical angle (°)	2.15	-2.46
Elevation (ft)	2162.41	8269.51
Tower height (ft)	150.00	50.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	145.00	50.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	175.00	80.00
TX line loss (dB)	2.51	1.15
Connector loss (dB)	0.30	0.30
TX switch loss (dB)	0.40	0.40
Antenna model	HX6-6W (DR)	HX6-6W (DR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	115.00	35.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	145.00	65.00
TX line loss (dB)	2.08	0.93
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	28.36	
Free space loss (dB)	141.47	

	Fire Station 41	Mt Abel
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	39.69	39.69
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	59.02	
Fade occurrence factor (Po)	1.847E-001	
SD improvement factor	73.96	19.14

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	36.00	36.00	-65.00	-65.00	71.49	72.85	-33.14	-33.14	32.29	32.07	30.71	30.56
256QAM 180 Mbps	37.00	37.00	-67.50	-67.50	72.49	73.85	-32.14	-32.14	35.79	35.57	33.08	32.96
128QAM 155 Mbps	**37.00**	**37.00**	**-73.75**	**-73.75**	**72.49**	**73.85**	**-32.14**	**-32.14**	**42.04**	**41.82**	**37.70**	**37.61**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9989	99.9956	99.9997	99.9987			99.9984	99.9984
256QAM 180 Mbps	99.9996	99.9986	99.9999	99.9996			99.9995	0.0011
128QAM 155 Mbps	**99.9999**	**99.9998**	**99.9999**	**99.9999**			**99.9999**	**0.0005**

Multipath fading method - Vigants - Barnett



Harris Grade	
Latitude	34 44 18.82 N
Longitude	120 26 44.81 W
Azimuth	183.49°
Elevation	1211 ft ASL
Antenna CL	50.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Lompoc Civic Center	
Latitude	34 38 17.34 N
Longitude	120 27 11.48 W
Azimuth	3.49°
Elevation	107 ft ASL
Antenna CL	34.0 ft AGL

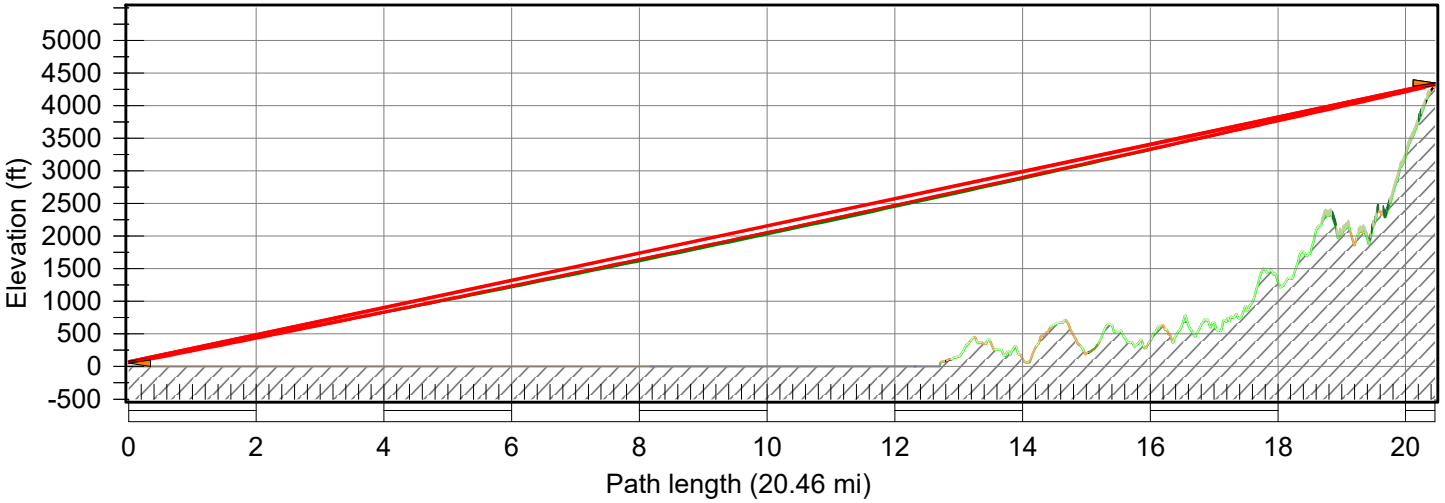
Transmission details (Harris Grade-Lompoc Civic Center.pl5)

	Harris Grade	Lompoc Civic Center
Latitude	34 44 18.82 N	34 38 17.34 N
Longitude	120 26 44.81 W	120 27 11.48 W
True azimuth (°)	183.49	3.49
Vertical angle (°)	-1.79	1.71
Elevation (ft)	1210.95	106.79
Tower height (ft)	100.00	30.00
Tower type		roof mount
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	50.00	34.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	80.00	75.00
TX line loss (dB)	1.15	1.08
Connector loss (dB)	0.30	0.30
TX filter loss (dB)	2.30	2.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	6.94	
Free space loss (dB)	129.24	
Atmospheric absorption loss (dB)	0.10	
Net path loss (dB)	57.06	57.06
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4SL6_30M_ACM_R70	I6V4SL6_30M_ACM_R70
Radio file name	i4sl630macm_r70	i4sl630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	36.16	36.16

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	28.00	28.00	-65.00	-65.00	62.95	63.02	-29.06	-29.06	35.94	35.94	30.81	30.81
256QAM 180 Mbps	28.50	28.50	-67.50	-67.50	63.45	63.52	-28.56	-28.56	38.94	38.94	31.94	31.94
128QAM 155 Mbps	**29.00**	**29.00**	**-73.75**	**-73.75**	**63.95**	**64.02**	**-28.06**	**-28.06**	**45.69**	**45.69**	**35.70**	**35.70**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9993	99.9993	99.9998	99.9998			99.9996	99.9996
256QAM 180 Mbps	99.9995	99.9995	99.9998	99.9998			99.9997	0.0001
128QAM 155 Mbps	**99.9998**	**99.9998**	**99.9999**	**99.9999**			**99.9999**	**0.0002**

Multipath fading method - Vigants - Barnett



Heritage Oil Platform	
Latitude	34 21 06.01 N
Longitude	120 16 04.01 W
Azimuth	53.79°
Elevation	0 ft ASL
Antenna CL	80.0, 50.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500
Divr 1 K = 1.330 %F1 = 60.00

Santa Ynez	
Latitude	34 31 35.87 N
Longitude	119 58 42.42 W
Azimuth	233.96°
Elevation	4284 ft ASL
Antenna CL	60.0, 30.0 ft AGL

Transmission details (Heritage Oil Platform-Santa Ynez.pl5)

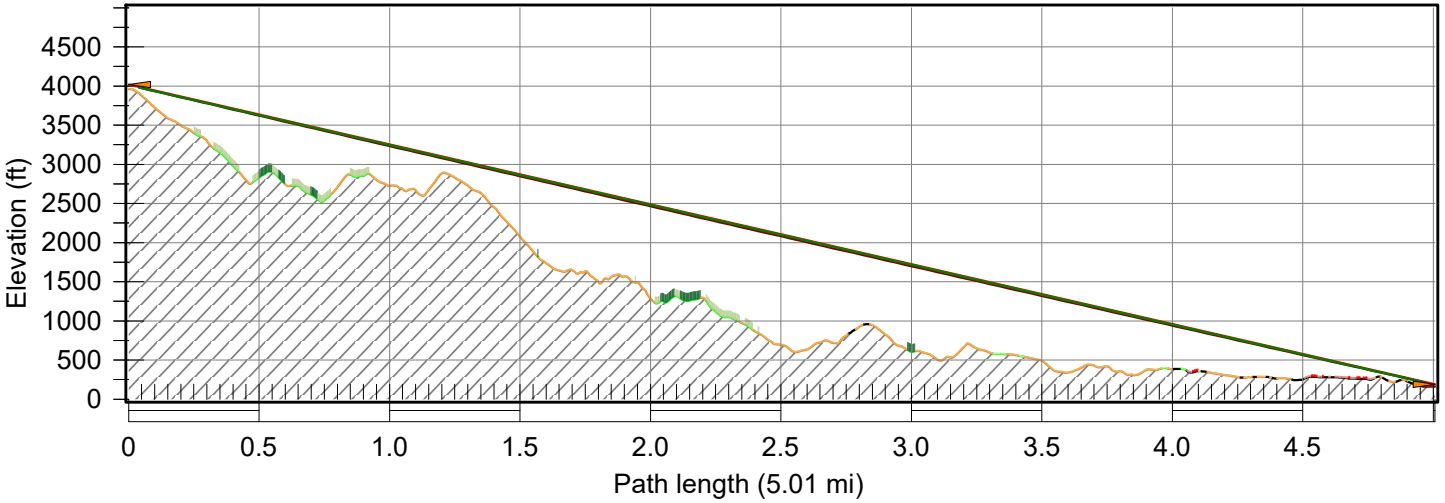
	Heritage Oil Platform	Santa Ynez
Latitude	34 21 06.01 N	34 31 35.87 N
Longitude	120 16 04.01 W	119 58 42.42 W
True azimuth (°)	53.79	233.96
Vertical angle (°)	2.15	-2.37
Elevation (ft)	0.00	4284.09
Tower height (ft)	120.00	60.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	80.00	60.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	110.00	90.00
TX line loss (dB)	1.57	1.29
Connector loss (dB)	0.30	0.30
TX switch loss (dB)	0.40	0.40
Antenna model	HX6-6W (DR)	HX6-6W (DR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	50.00	30.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	80.00	60.00
TX line loss (dB)	1.14	0.86
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	20.47	
Free space loss (dB)	138.64	

	Heritage Oil Platform	Santa Ynez
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	38.56	38.56
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	58.93	
Fade occurrence factor (Po)	6.949E-002	
SD improvement factor	74.54	74.54

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	30.50	30.50	-65.00	-65.00	66.93	67.21	-34.90	-34.90	30.53	30.53	29.13	29.13
256QAM 180 Mbps	31.00	31.00	-67.50	-67.50	67.43	67.71	-34.40	-34.40	33.53	33.53	31.31	31.31
128QAM 155 Mbps	**31.50**	**31.50**	**-73.75**	**-73.75**	**67.93**	**68.21**	**-33.90**	**-33.90**	**40.28**	**40.28**	**36.33**	**36.33**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9994	99.9994	99.9998	99.9998			99.9996	99.9996
256QAM 180 Mbps	99.9998	99.9998	99.9999	99.9999			99.9999	0.0002
128QAM 155 Mbps	**99.9999**	**99.9999**	**99.9999**	**99.9999**			**99.9999**	**0.0001**

Multipath fading method - Vigants - Barnett



La Cumbre Peak	
Latitude	34 30 01.08 N
Longitude	119 43 16.03 W
Azimuth	219.70°
Elevation	3959 ft ASL
Antenna CL	60.0 ft AGL

Frequency (MHz) = 11200.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Comm Center	
Latitude	34 26 39.90 N
Longitude	119 46 37.60 W
Azimuth	39.67°
Elevation	162 ft ASL
Antenna CL	30.0 ft AGL

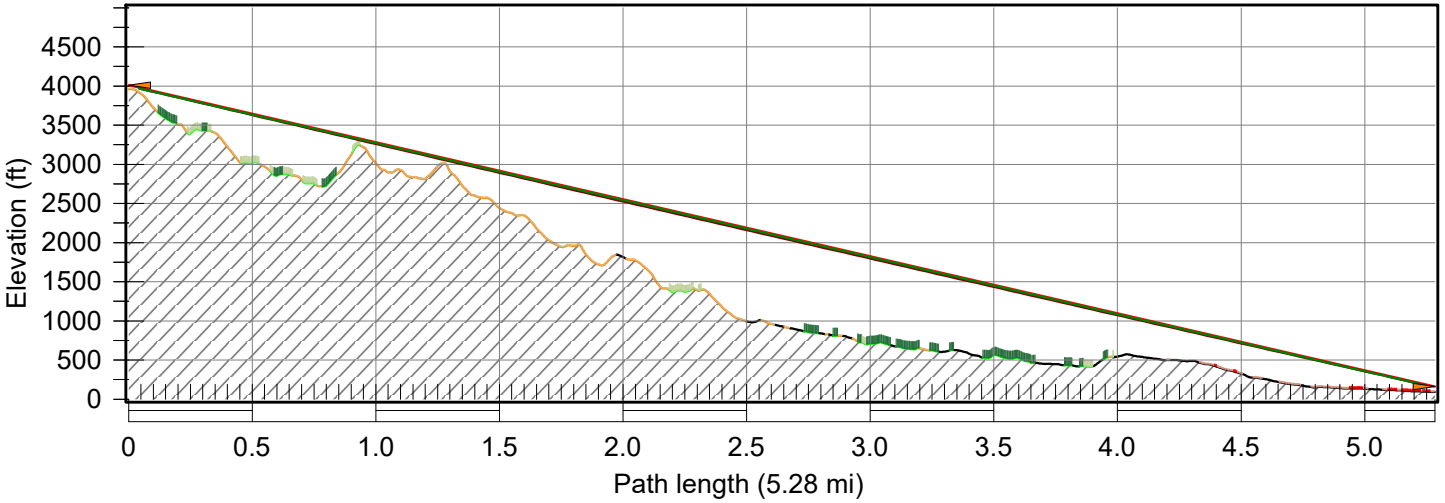
Transmission details (La Cumbre Peak-Comm Center (SB Jail).pl5)

	La Cumbre Peak	Comm Center
Latitude	34 30 01.08 N	34 26 39.90 N
Longitude	119 43 16.03 W	119 46 37.60 W
True azimuth (°)	219.70	39.67
Vertical angle (°)	-8.27	8.21
Elevation (ft)	3958.88	161.54
Tower height (ft)	70.00	30.00
Antenna model	UXA4-107 (TR)	UXA4-107 (TR)
Antenna file name	uxa4-107a	uxa4-107a
Antenna gain (dBi)	40.40	40.40
Antenna height (ft)	60.00	30.00
TX line model	E105	E105
TX line unit loss (dB/100 ft)	2.75	2.75
TX line length (ft)	90.00	65.00
TX line loss (dB)	2.47	1.79
Connector loss (dB)	0.40	0.40
Frequency (MHz)	11200.00	
Polarization	Vertical	
Path length (mi)	5.06	
Free space loss (dB)	131.66	
Atmospheric absorption loss (dB)	0.14	
Net path loss (dB)	56.07	56.07
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4H11_30M_ACM_R70	I6V4H11_30M_ACM_R70
Radio file name	i4h1130macm_r70	i4h1130macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	36.61	36.61
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	27.50	27.50	-64.00	-64.00	65.03	65.71	-28.57	-28.57	35.43	35.43	30.78	30.78
256QAM 180 Mbps	28.00	28.00	-66.50	-66.50	65.53	66.21	-28.07	-28.07	38.43	38.43	31.99	31.99
128QAM 155 Mbps	**28.50**	**28.50**	**-73.00**	**-73.00**	**66.03**	**66.71**	**-27.57**	**-27.57**	**45.43**	**45.43**	**36.07**	**36.07**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9998	99.9998	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999
256QAM 180 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
128QAM 155 Mbps	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**0.0001**

Multipath fading method - Vigants - Barnett
Rain fading method - Crane



La Cumbre Peak	
Latitude	34 30 01.08 N
Longitude	119 43 16.03 W
Azimuth	169.02°
Elevation	3959 ft ASL
Antenna CL	50.0 ft AGL

Frequency (MHz) = 11200.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Admin	
Latitude	34 25 30.20 N
Longitude	119 42 12.60 W
Azimuth	349.03°
Elevation	90 ft ASL
Antenna CL	71.0 ft AGL

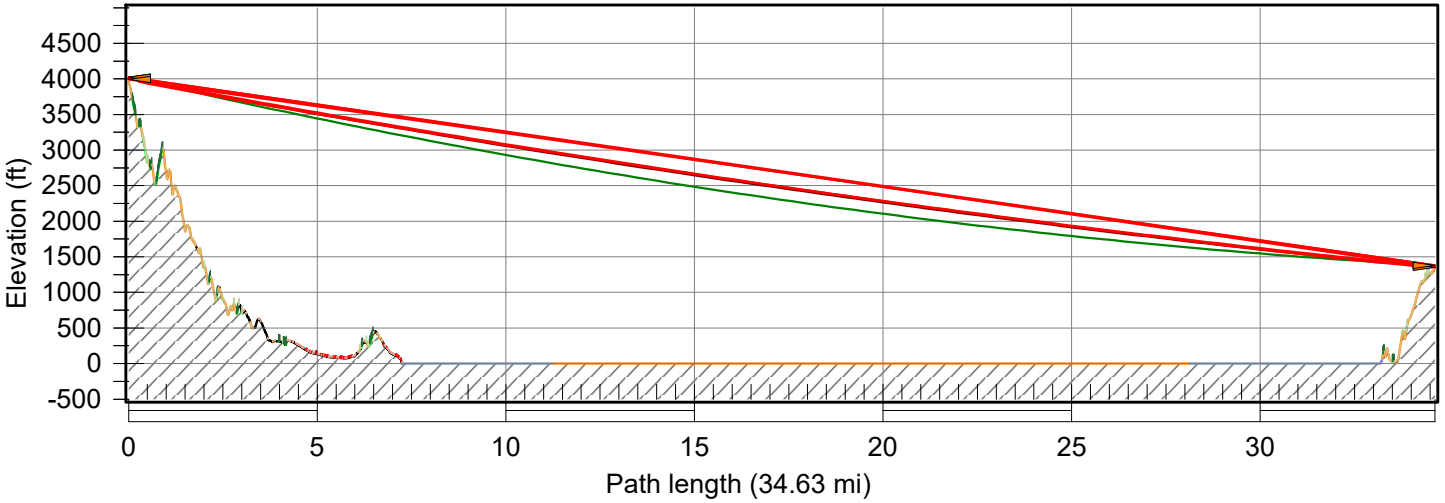
Transmission details (La Cumbre Peak-Admin.pl5)

	La Cumbre Peak	Admin
Latitude	34 30 01.08 N	34 25 30.20 N
Longitude	119 43 16.03 W	119 42 12.60 W
True azimuth (°)	169.02	349.03
Vertical angle (°)	-7.88	7.83
Elevation (ft)	3958.88	90.11
Tower height (ft)	70.00	91.00
Tower type		roof mount
Antenna model	UXA4-107 (TR)	UXA4-107 (TR)
Antenna file name	uxa4-107a	uxa4-107a
Antenna gain (dBi)	40.40	40.40
Antenna height (ft)	50.00	71.00
Orientation loss (dB)	0.00	0.00
TX line model	E105J	E105J
TX line unit loss (dB/100 ft)	2.75	2.75
TX line length (ft)	80.00	120.00
TX line loss (dB)	2.20	3.30
Connector loss (dB)	0.40	0.40
Frequency (MHz)	11200.00	
Polarization	Vertical	
Path length (mi)	5.33	
Free space loss (dB)	132.13	
Atmospheric absorption loss (dB)	0.14	
Net path loss (dB)	57.77	57.77
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4H11_30M_ACM_R70	I6V4H11_30M_ACM_R70
Radio file name	i4h1130macm_r70	i4h1130macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	36.78	36.78
Climatic factor	2.00	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	27.50	27.50	-64.00	-64.00	65.30	64.20	-30.27	-30.27	33.73	33.73	30.22	30.22
256QAM 180 Mbps	28.00	28.00	-66.50	-66.50	65.80	64.70	-29.77	-29.77	36.73	36.73	31.66	31.66
128QAM 155 Mbps	**28.50**	**28.50**	**-73.00**	**-73.00**	**66.30**	**65.20**	**-29.27**	**-29.27**	**43.73**	**43.73**	**35.98**	**35.98**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9998	99.9998	99.9999	99.9999	99.9999	99.9999	99.9998	99.9998
256QAM 180 Mbps	99.9998	99.9998	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
128QAM 155 Mbps	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**0.0001**

Multipath fading method - Vigants - Barnett
Rain fading method - Crane



La Cumbre Peak	
Latitude	34 30 01.08 N
Longitude	119 43 16.03 W
Azimuth	176.43°
Elevation	3959 ft ASL
Antenna CL	65.0, 35.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500
Divr 1 K = 1.330 %F1 = 60.00

Valley Peak	
Latitude	33 59 56.15 N
Longitude	119 41 01.00 W
Azimuth	356.46°
Elevation	1332 ft ASL
Antenna CL	45.0, 20.0 ft AGL

Transmission details (La Cumbre Peak-Valley Peak.pl5)

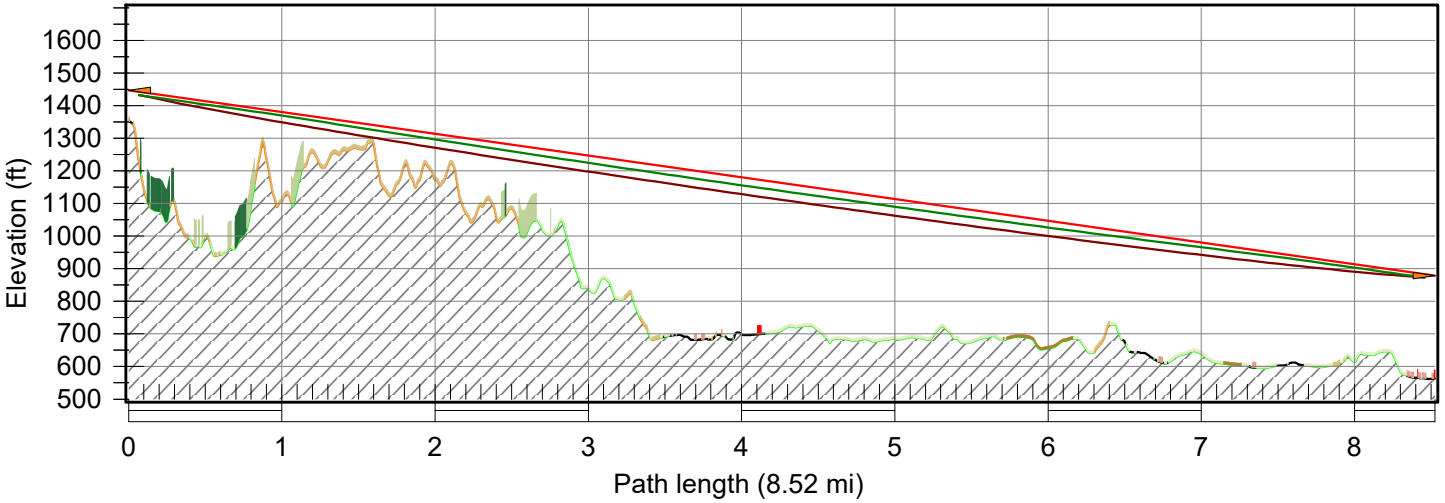
	La Cumbre Peak	Valley Peak
Latitude	34 30 01.08 N	33 59 56.15 N
Longitude	119 43 16.03 W	119 41 01.00 W
True azimuth (°)	176.43	356.46
Vertical angle (°)	-1.02	0.64
Elevation (ft)	3958.88	1331.84
Tower height (ft)	70.00	45.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	65.00	45.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	95.00	75.00
TX line loss (dB)	1.36	1.08
Connector loss (dB)	0.30	0.30
TX switch loss (dB)	0.40	0.40
Antenna model	HX6-6W (DR)	HX6-6W (DR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	35.00	20.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	65.00	50.00
TX line loss (dB)	0.93	0.72
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	

	La Cumbre Peak	Valley Peak
Radio model	I6V4EHL6_30M_ACM_R70	I6V4EHL6_30M_ACM_R70
Radio file name	i4el630macm_r70	i4el630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	41.69	41.69
Climatic factor	2.00	
Terrain roughness (ft)	64.97	
C factor	1.42	
Average annual temperature (°F)	59.01	
Fade occurrence factor (Po)	9.124E-001	
SD improvement factor	74.05	51.95

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	36.00	36.00	-65.00	-65.00	72.64	72.92	-33.72	-33.72	31.71	31.64	30.76	30.70
256QAM 180 Mbps	37.00	37.00	-67.50	-67.50	73.64	73.92	-32.72	-32.72	35.21	35.14	33.50	33.46
128QAM 155 Mbps	**37.00**	**37.00**	**-73.75**	**-73.75**	**73.64**	**73.92**	**-32.72**	**-32.72**	**41.46**	**41.39**	**38.56**	**38.53**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9937	99.9908	99.9981	99.9973			99.9954	99.9954
256QAM 180 Mbps	99.9982	99.9974	99.9995	99.9992			99.9987	0.0033
128QAM 155 Mbps	**99.9998**	**99.9997**	**99.9999**	**99.9999**			**99.9999**	**0.0012**

Multipath fading method - Vigants - Barnett



Mount Solomon	
Latitude	34 50 05.10 N
Longitude	120 22 59.48 W
Azimuth	136.36°
Elevation	1352 ft ASL
Antenna CL	95.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Fire Station 24	
Latitude	34 44 42.83 N
Longitude	120 16 47.28 W
Azimuth	316.41°
Elevation	563 ft ASL
Antenna CL	315.0 ft AGL

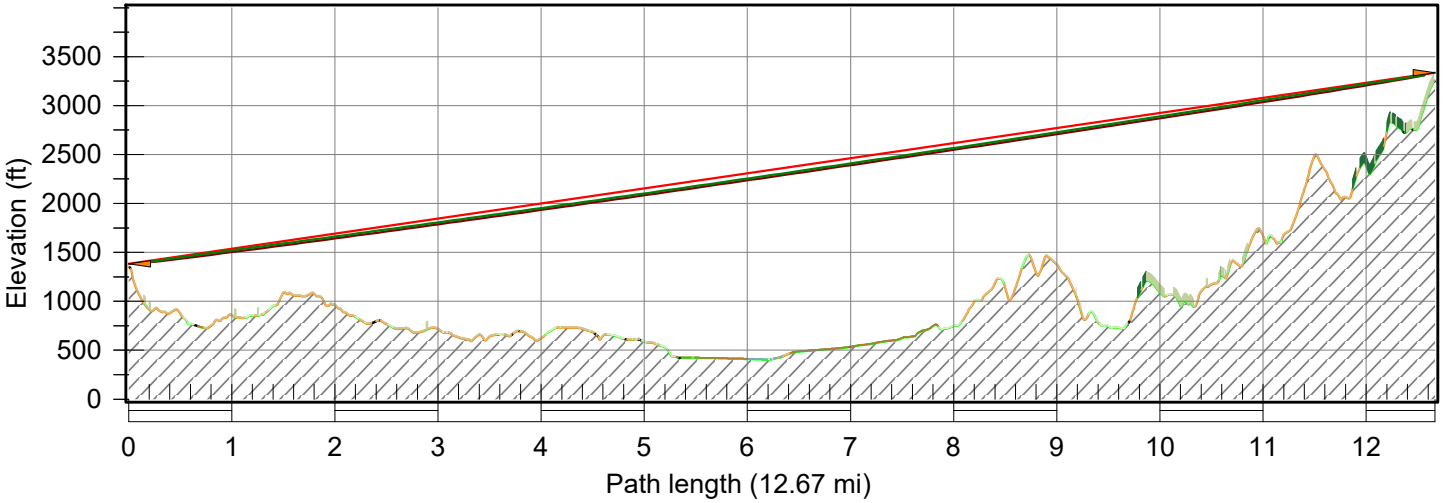
Transmission details (Mount Solomon-Fire Station 24.pl5)

	Mount Solomon	Fire Station 24
Latitude	34 50 05.10 N	34 44 42.83 N
Longitude	120 22 59.48 W	120 16 47.28 W
True azimuth (°)	136.36	316.41
Vertical angle (°)	-0.77	0.68
Elevation (ft)	1351.55	563.18
Tower height (ft)	100.00	330.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	95.00	315.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	125.00	345.00
TX line loss (dB)	1.79	4.93
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	8.52	
Free space loss (dB)	131.03	
Atmospheric absorption loss (dB)	0.12	
Net path loss (dB)	61.07	61.07
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4HL6_30M_ACM_R70	I6V4HL6_30M_ACM_R70
Radio file name	i4hl630macm_r70	i4hl630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	36.03	36.03
Climatic factor	2.00	
Terrain roughness (ft)	107.83	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	30.50	30.50	-65.00	-65.00	67.11	63.97	-30.57	-30.57	34.43	34.43	30.21	30.21
256QAM 180 Mbps	31.00	31.00	-67.50	-67.50	67.61	64.47	-30.07	-30.07	37.43	37.43	31.50	31.50
128QAM 155 Mbps	**31.50**	**31.50**	**-73.75**	**-73.75**	**68.11**	**64.97**	**-29.57**	**-29.57**	**44.18**	**44.18**	**35.42**	**35.42**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9993	99.9993	99.9998	99.9998			99.9996	99.9996
256QAM 180 Mbps	99.9995	99.9995	99.9998	99.9998			99.9997	0.0001
128QAM 155 Mbps	**99.9998**	**99.9998**	**99.9999**	**99.9999**			**99.9999**	**0.0002**

Multipath fading method - Vigants - Barnett



Mount Solomon	
Latitude	34 50 05.10 N
Longitude	120 22 59.48 W
Azimuth	64.02°
Elevation	1352 ft ASL
Antenna CL	30.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Tepusquet	
Latitude	34 54 54.25 N
Longitude	120 10 57.68 W
Azimuth	244.13°
Elevation	3246 ft ASL
Antenna CL	90.0 ft AGL

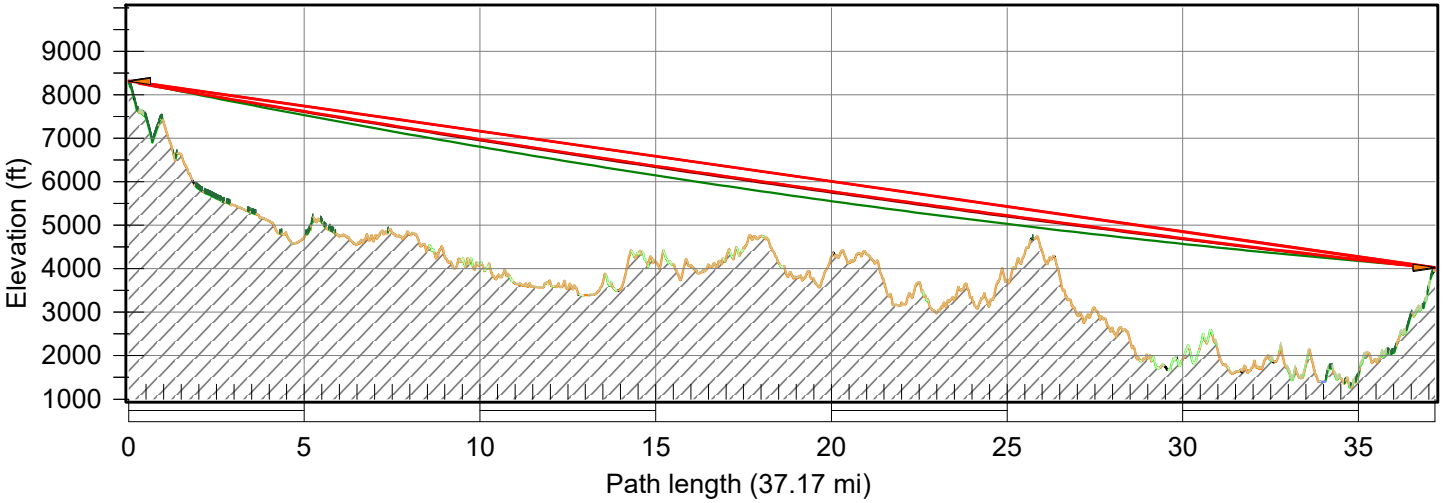
Transmission details (Mount Solomon-Tepusquet.pl5)

	Mount Solomon	Tepusquet
Latitude	34 50 05.10 N	34 54 54.25 N
Longitude	120 22 59.48 W	120 10 57.68 W
True azimuth (°)	64.02	244.13
Vertical angle (°)	1.61	-1.74
Elevation (ft)	1351.55	3245.95
Tower height (ft)	100.00	125.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	30.00	90.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	60.00	120.00
TX line loss (dB)	0.86	1.72
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	12.67	
Free space loss (dB)	134.47	
Atmospheric absorption loss (dB)	0.19	
Net path loss (dB)	60.44	60.44
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4HL6_30M_ACM_R70	I6V4HL6_30M_ACM_R70
Radio file name	i4hl630macm_r70	i4hl630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	36.97	36.97
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
256QAM 180 Mbps	31.00	31.00	-67.50	-67.50	68.54	67.68	-29.44	-29.44	38.06	38.06	32.35	32.35
128QAM 155 Mbps	**31.50**	**31.50**	**-73.75**	**-73.75**	**69.04**	**68.18**	**-28.94**	**-28.94**	**44.81**	**44.81**	**36.31**	**36.31**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9987	99.9987	99.9996	99.9996			99.9992	99.9992
256QAM 180 Mbps	99.9990	99.9990	99.9997	99.9997			99.9994	0.0002
128QAM 155 Mbps	**99.9996**	**99.9996**	**99.9999**	**99.9999**			**99.9998**	**0.0004**

Multipath fading method - Vigants - Barnett



Mt Abel	
Latitude	34 49 44.65 N
Longitude	119 12 13.86 W
Azimuth	232.58°
Elevation	8270 ft ASL
Antenna CL	50.0, 35.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500
Divr 1 K = 1.330 %F1 = 60.00

La Cumbre Peak	
Latitude	34 30 01.08 N
Longitude	119 43 16.03 W
Azimuth	52.28°
Elevation	3959 ft ASL
Antenna CL	70.0, 50.0 ft AGL

Transmission details (Mt Abel-La Cumbre Peak.pl5)

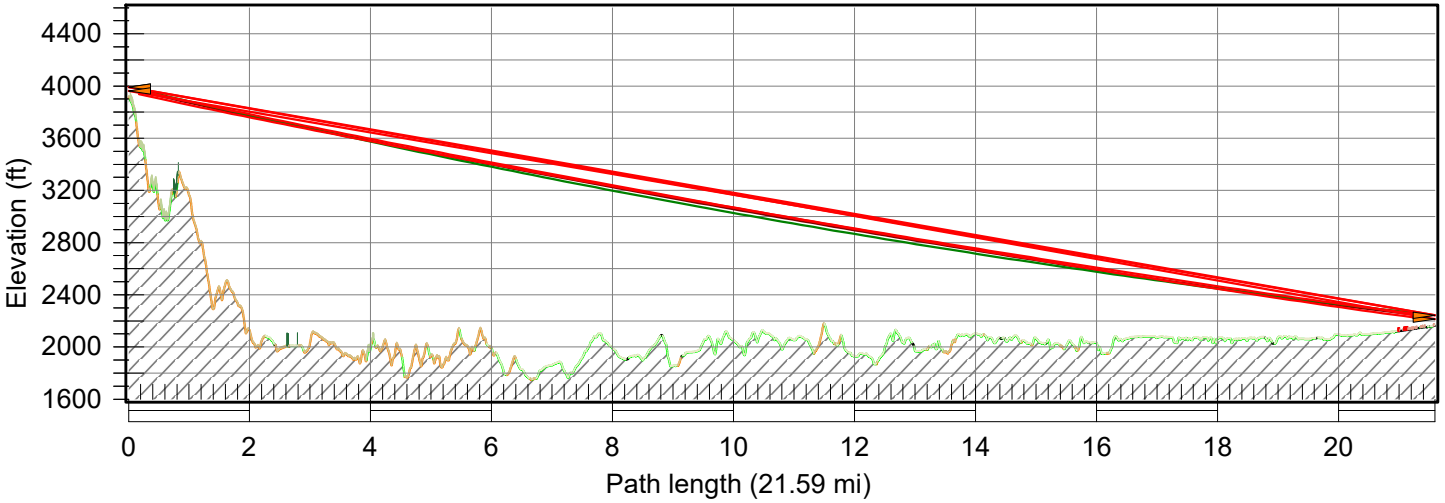
	Mt Abel	La Cumbre Peak
Latitude	34 49 44.65 N	34 30 01.08 N
Longitude	119 12 13.86 W	119 43 16.03 W
True azimuth (°)	232.58	52.28
Vertical angle (°)	-1.45	1.05
Elevation (ft)	8269.51	3958.88
Tower height (ft)	50.00	70.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	50.00	70.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	80.00	100.00
TX line loss (dB)	1.14	1.43
Connector loss (dB)	0.30	0.30
TX switch loss (dB)	0.40	0.40
Antenna model	HX6-6W (DR)	HX6-6W (DR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	35.00	50.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	70.00	80.00
TX line loss (dB)	1.00	1.14
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	37.19	
Free space loss (dB)	143.82	

	Mt Abel	La Cumbre Peak
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	40.66	40.66
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	58.62	
Fade occurrence factor (Po)	4.164E-001	
SD improvement factor	14.44	25.26

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	36.00	36.00	-65.00	-65.00	72.86	72.57	-34.54	-34.54	30.60	30.75	29.67	29.78
256QAM 180 Mbps	37.00	37.00	-67.50	-67.50	73.86	73.57	-33.54	-33.54	34.10	34.25	32.43	32.52
128QAM 155 Mbps	**37.00**	**37.00**	**-73.75**	**-73.75**	**73.86**	**73.57**	**-33.54**	**-33.54**	**40.35**	**40.50**	**37.50**	**37.57**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9808	99.9894	99.9944	99.9969			99.9913	99.9913
256QAM 180 Mbps	99.9946	99.9970	99.9984	99.9991			99.9975	0.0063
128QAM 155 Mbps	**99.9995**	**99.9997**	**99.9998**	**99.9999**			**99.9998**	**0.0022**

Multipath fading method - Vigants - Barnett



Plowshare	
Latitude	35 03 00.22 N
Longitude	120 02 27.67 W
Azimuth	109.34°
Elevation	3913 ft ASL
Antenna CL	78.0, 49.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500
Divr 1 K = 1.330 %F1 = 60.00

Fire Station 41	
Latitude	34 56 44.91 N
Longitude	119 40 55.64 W
Azimuth	289.55°
Elevation	2162 ft ASL
Antenna CL	80.0, 50.0 ft AGL

Transmission details (Plowshare-Fire Station 41.pl5)

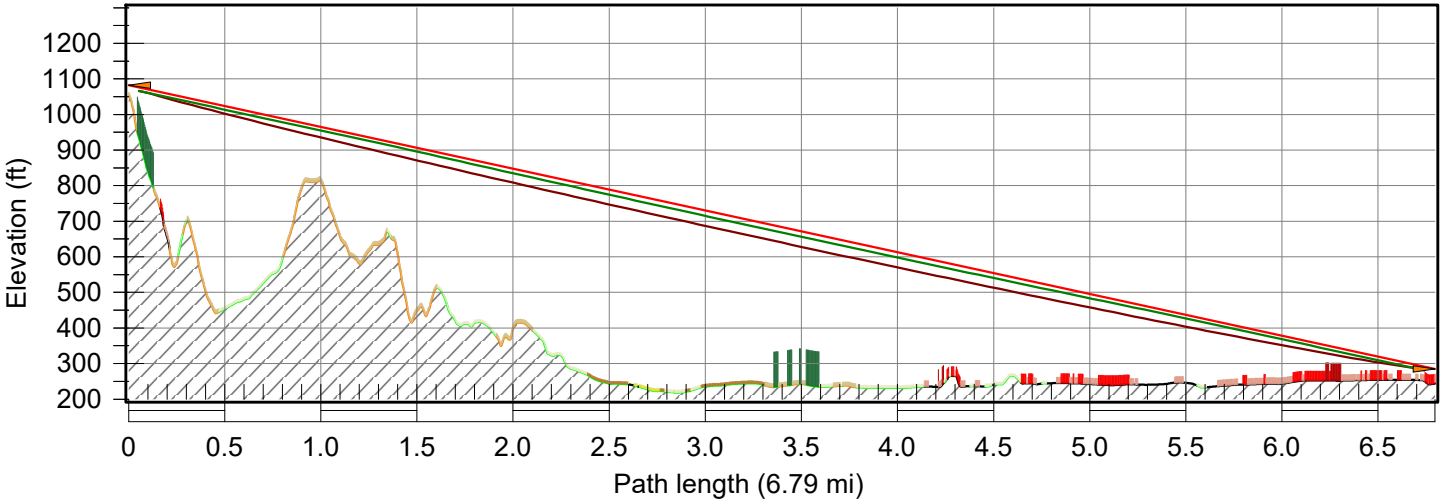
	Plowshare	Fire Station 41
Latitude	35 03 00.22 N	34 56 44.91 N
Longitude	120 02 27.67 W	119 40 55.64 W
True azimuth (°)	109.34	289.55
Vertical angle (°)	-1.00	0.76
Elevation (ft)	3913.16	2162.41
Tower height (ft)	80.00	150.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	78.00	80.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	110.00	110.00
TX line loss (dB)	1.57	1.57
Connector loss (dB)	0.30	0.30
TX switch loss (dB)	0.40	0.40
Antenna model	HX6-6W (DR)	HX6-6W (DR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	49.00	50.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	80.00	80.00
TX line loss (dB)	1.15	1.15
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	21.60	
Free space loss (dB)	139.10	

	Plowshare	Fire Station 41
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	38.74	38.74
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	61.53	
Fade occurrence factor (Po)	8.154E-002	
SD improvement factor	62.73	67.11

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	30.50	30.50	-65.00	-65.00	66.93	66.93	-35.66	-35.66	29.76	29.76	28.60	28.60
256QAM 180 Mbps	31.00	31.00	-67.50	-67.50	67.43	67.43	-35.16	-35.16	32.76	32.76	30.89	30.89
128QAM 155 Mbps	**31.50**	**31.50**	**-73.75**	**-73.75**	**67.93**	**67.93**	**-34.66**	**-34.66**	**39.51**	**39.51**	**36.10**	**36.10**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9990	99.9990	99.9997	99.9997			99.9994	99.9994
256QAM 180 Mbps	99.9996	99.9997	99.9999	99.9999			99.9998	0.0004
128QAM 155 Mbps	**99.9999**	**99.9999**	**99.9999**	**99.9999**			**99.9999**	**0.0002**

Multipath fading method - Vigants - Barnett



San Antonio	
Latitude	34 50 31.09 N
Longitude	120 29 57.01 W
Azimuth	35.96°
Elevation	1052 ft ASL
Antenna CL	30.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Betteravia	
Latitude	34 55 18.23 N
Longitude	120 25 44.00 W
Azimuth	216.00°
Elevation	244 ft ASL
Antenna CL	41.0 ft AGL

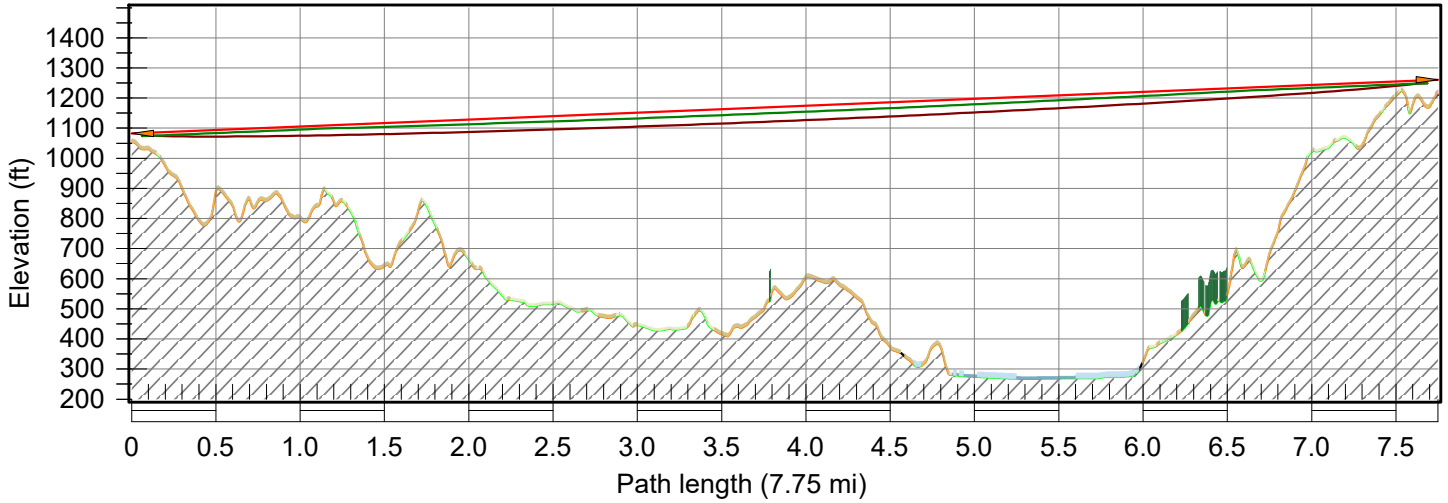
Transmission details (San Antonio-Betteravia.pl5)

	San Antonio	Betteravia
Latitude	34 50 31.09 N	34 55 18.23 N
Longitude	120 29 57.01 W	120 25 44.00 W
True azimuth (°)	35.96	216.00
Vertical angle (°)	-1.31	1.24
Elevation (ft)	1052.28	243.95
Tower height (ft)	52.00	58.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	30.00	41.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	60.00	90.00
TX line loss (dB)	0.86	1.29
Connector loss (dB)	0.30	0.30
Other TX loss (dB)	2.20	2.20
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	6.80	
Free space loss (dB)	129.06	
Atmospheric absorption loss (dB)	0.09	
Net path loss (dB)	56.71	56.71
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4SL6_30M_ACM_R70	I6V4SL6_30M_ACM_R70
Radio file name	i4sl630macm_r70	i4sl630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	35.33	35.33
Climatic factor	2.00	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	28.00	28.00	-65.00	-65.00	63.34	62.91	-28.71	-28.71	36.29	36.29	30.31	30.31
256QAM 180 Mbps	28.50	28.50	-67.50	-67.50	63.84	63.41	-28.21	-28.21	39.29	39.29	31.33	31.33
128QAM 155 Mbps	**29.00**	**29.00**	**-73.75**	**-73.75**	**64.34**	**63.91**	**-27.71**	**-27.71**	**46.04**	**46.04**	**34.98**	**34.98**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9997	99.9997	99.9999	99.9999			99.9998	99.9998
256QAM 180 Mbps	99.9997	99.9997	99.9999	99.9999			99.9998	0.0000
128QAM 155 Mbps	**99.9999**	**99.9999**	**99.9999**	**99.9999**			**99.9999**	**0.0001**

Multipath fading method - Vigants - Barnett



San Antonio	
Latitude	34 50 31.09 N
Longitude	120 29 57.01 W
Azimuth	156.91°
Elevation	1052 ft ASL
Antenna CL	30.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Harris Grade	
Latitude	34 44 18.82 N
Longitude	120 26 44.81 W
Azimuth	336.95°
Elevation	1211 ft ASL
Antenna CL	50.0 ft AGL

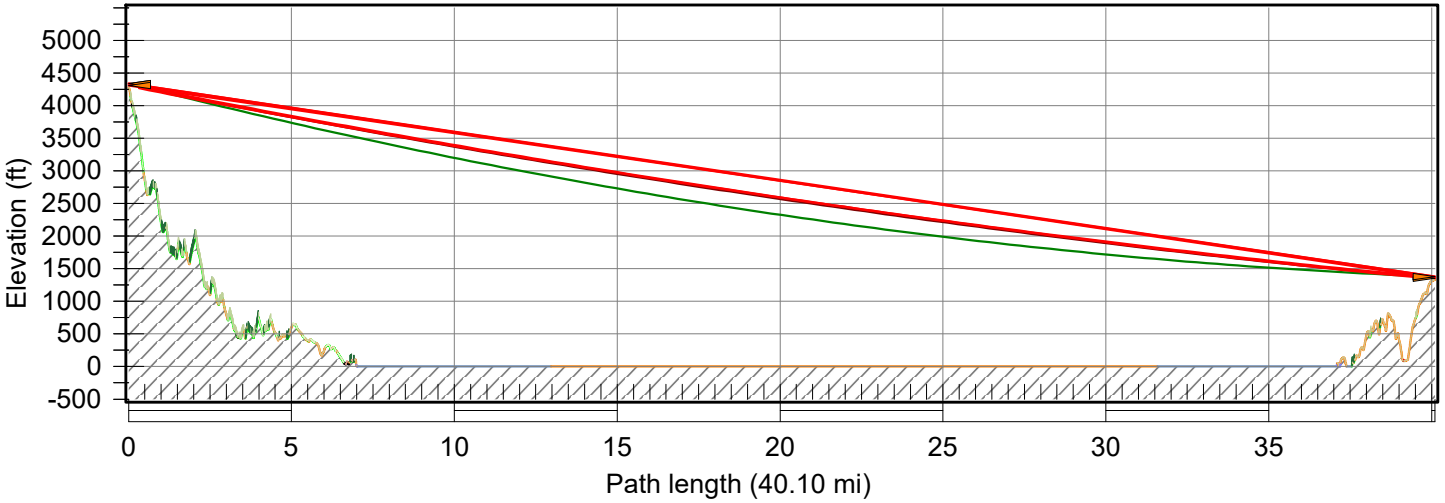
Transmission details (San Antonio-Harris Grade.pl5)

	San Antonio	Harris Grade
Latitude	34 50 31.09 N	34 44 18.82 N
Longitude	120 29 57.01 W	120 26 44.81 W
True azimuth (°)	156.91	336.95
Vertical angle (°)	0.21	-0.29
Elevation (ft)	1052.28	1210.95
Tower height (ft)	52.00	100.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	30.00	50.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	60.00	80.00
TX line loss (dB)	0.86	1.15
Connector loss (dB)	0.30	0.30
Other TX loss (dB)	1.50	1.50
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	7.75	
Free space loss (dB)	130.20	
Atmospheric absorption loss (dB)	0.11	
Net path loss (dB)	57.02	57.02
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4SL6_30M_ACM_R70	I6V4SL6_30M_ACM_R70
Radio file name	i4sl630macm_r70	i4sl630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	35.35	35.35
Climatic factor	2.00	
Terrain roughness (ft)	140.00	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	28.00	28.00	-65.00	-65.00	64.04	63.75	-29.02	-29.02	35.98	35.98	30.24	30.24
256QAM 180 Mbps	28.50	28.50	-67.50	-67.50	64.54	64.25	-28.52	-28.52	38.98	38.98	31.29	31.29
128QAM 155 Mbps	**29.00**	**29.00**	**-73.75**	**-73.75**	**65.04**	**64.75**	**-28.02**	**-28.02**	**45.73**	**45.73**	**34.97**	**34.97**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9996	99.9996	99.9999	99.9999			99.9998	99.9998
256QAM 180 Mbps	99.9997	99.9997	99.9999	99.9999			99.9998	0.0000
128QAM 155 Mbps	**99.9999**	**99.9999**	**99.9999**	**99.9999**			**99.9999**	**0.0001**

Multipath fading method - Vigants - Barnett



Santa Ynez	
Latitude	34 31 35.87 N
Longitude	119 58 42.42 W
Azimuth	155.03°
Elevation	4284 ft ASL
Antenna CL	55.0, 25.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500
Divr 1 K = 1.330 %F1 = 60.00

Valley Peak	
Latitude	33 59 56.15 N
Longitude	119 41 01.00 W
Azimuth	335.20°
Elevation	1332 ft ASL
Antenna CL	45.0, 20.0 ft AGL

Transmission details (Santa Ynez-Valley Peak.pl5)

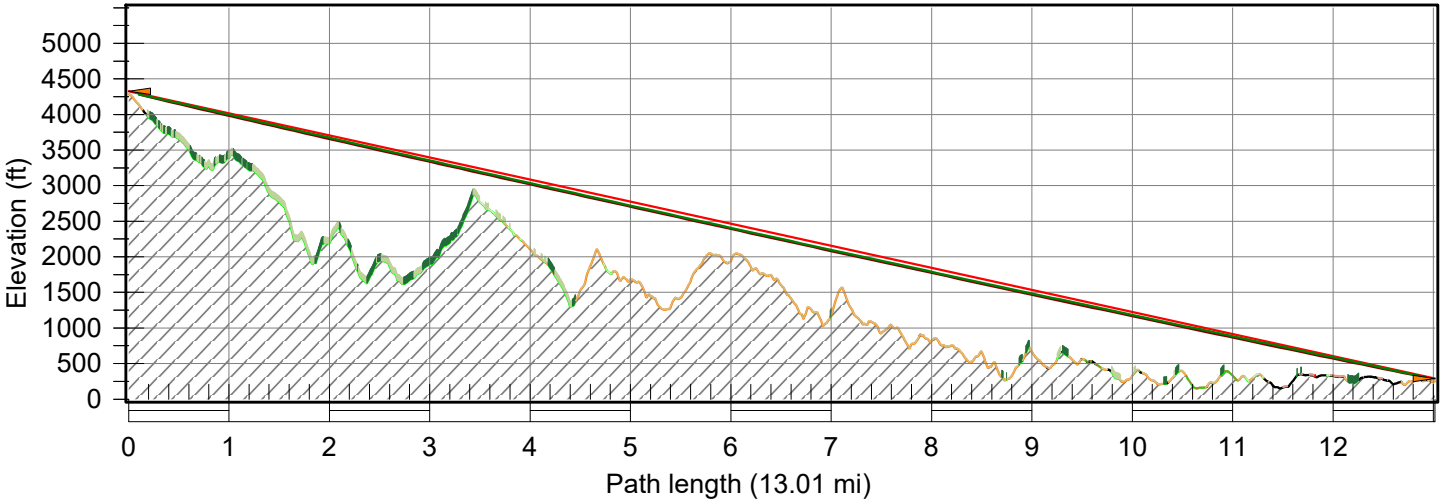
	Santa Ynez	Valley Peak
Latitude	34 31 35.87 N	33 59 56.15 N
Longitude	119 58 42.42 W	119 41 01.00 W
True azimuth (°)	155.03	335.20
Vertical angle (°)	-1.02	0.58
Elevation (ft)	4284.09	1331.84
Tower height (ft)	60.00	45.00
Antenna model	USX6-6W (TR)	USX6-6W (TR)
Antenna file name	usx6-6w	usx6-6w
Antenna gain (dBi)	38.55	38.55
Antenna height (ft)	55.00	45.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	85.00	75.00
TX line loss (dB)	1.22	1.08
Connector loss (dB)	0.30	0.30
TX switch loss (dB)	0.40	0.40
Antenna model	USX6-6W (DR)	USX6-6W (DR)
Antenna file name	usx6-6w	usx6-6w
Antenna gain (dBi)	38.55	38.55
Antenna height (ft)	25.00	20.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	55.00	50.00
TX line loss (dB)	0.79	0.72
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	

	Santa Ynez	Valley Peak
Radio model	I6V4EHL6_30M_ACM_R70	I6V4EHL6_30M_ACM_R70
Radio file name	i4el630macm_r70	i4el630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	43.77	43.77
Climatic factor	2.00	
Terrain roughness (ft)	87.55	
C factor	0.97	
Average annual temperature (°F)	59.02	
Fade occurrence factor (Po)	9.614E-001	
SD improvement factor	62.27	43.53

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	36.00	36.00	-65.00	-65.00	72.63	72.77	-35.23	-35.23	30.20	30.13	29.76	29.70
256QAM 180 Mbps	37.00	37.00	-67.50	-67.50	73.63	73.77	-34.23	-34.23	33.70	33.63	32.88	32.82
128QAM 155 Mbps	**37.00**	**37.00**	**-73.75**	**-73.75**	**73.63**	**73.77**	**-34.23**	**-34.23**	**39.95**	**39.88**	**38.44**	**38.39**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9878	99.9822	99.9964	99.9947			99.9911	99.9911
256QAM 180 Mbps	99.9971	99.9958	99.9991	99.9987			99.9979	0.0067
128QAM 155 Mbps	**99.9998**	**99.9997**	**99.9999**	**99.9999**			**99.9998**	**0.0019**

Multipath fading method - Vigants - Barnett



Santa Ynez	
Latitude	34 31 35.87 N
Longitude	119 58 42.42 W
Azimuth	113.70°
Elevation	4284 ft ASL
Antenna CL	40.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

EOC (Fire Dispatch)	
Latitude	34 27 02.02 N
Longitude	119 46 11.17 W
Azimuth	293.82°
Elevation	250 ft ASL
Antenna CL	40.0 ft AGL

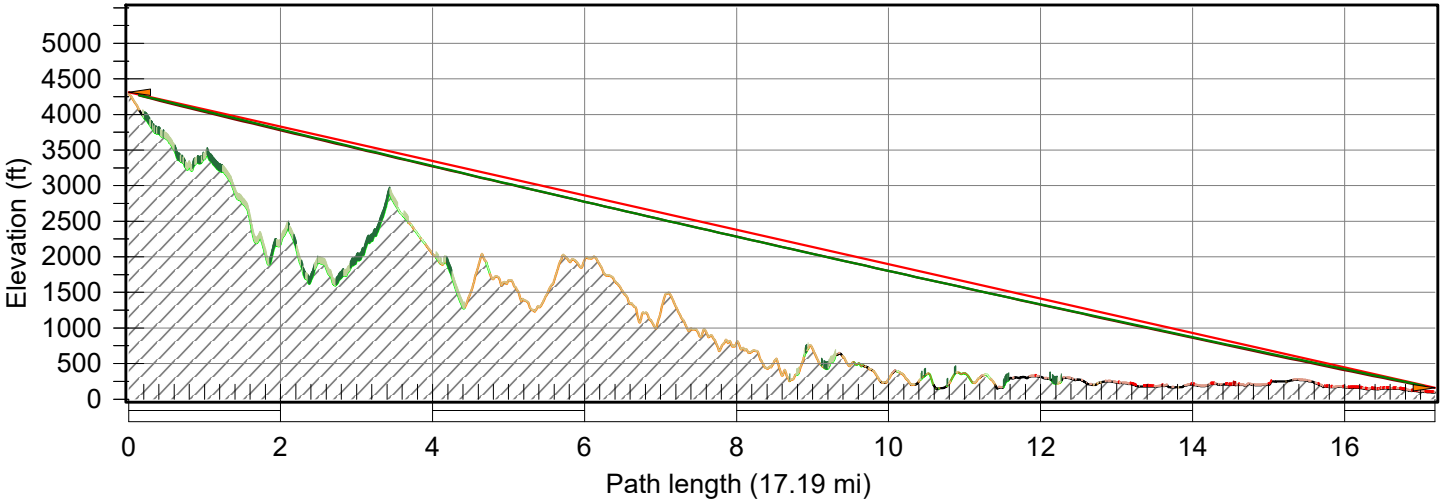
Transmission details (Santa Ynez-EOC.pl5)

	Santa Ynez	EOC (Fire Dispatch)
Latitude	34 31 35.87 N	34 27 02.02 N
Longitude	119 58 42.42 W	119 46 11.17 W
True azimuth (°)	113.70	293.82
Vertical angle (°)	-3.43	3.29
Elevation (ft)	4284.09	249.78
Tower height (ft)	60.00	70.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	40.00	40.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	70.00	70.00
TX line loss (dB)	1.00	1.00
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	13.04	
Free space loss (dB)	134.72	
Atmospheric absorption loss (dB)	0.19	
Net path loss (dB)	60.12	60.12
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4HL6_30M_ACM_R70	I6V4HL6_30M_ACM_R70
Radio file name	i4hl630macm_r70	i4hl630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	37.06	37.06
Climatic factor	2.00	
Terrain roughness (ft)	140.00	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	30.50	30.50	-65.00	-65.00	67.90	67.90	-29.62	-29.62	35.38	35.38	31.20	31.20
256QAM 180 Mbps	31.00	31.00	-67.50	-67.50	68.40	68.40	-29.12	-29.12	38.38	38.38	32.50	32.50
128QAM 155 Mbps	**31.50**	**31.50**	**-73.75**	**-73.75**	**68.90**	**68.90**	**-28.62**	**-28.62**	**45.13**	**45.13**	**36.43**	**36.43**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9986	99.9986	99.9996	99.9996			99.9992	99.9992
256QAM 180 Mbps	99.9990	99.9990	99.9997	99.9997			99.9994	0.0002
128QAM 155 Mbps	**99.9996**	**99.9996**	**99.9999**	**99.9999**			**99.9998**	**0.0004**

Multipath fading method - Vigants - Barnett



Santa Ynez	
Latitude	34 31 35.87 N
Longitude	119 58 42.42 W
Azimuth	113.96°
Elevation	4284 ft ASL
Antenna CL	30.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Admin	
Latitude	34 25 30.20 N
Longitude	119 42 12.60 W
Azimuth	294.12°
Elevation	90 ft ASL
Antenna CL	71.0 ft AGL

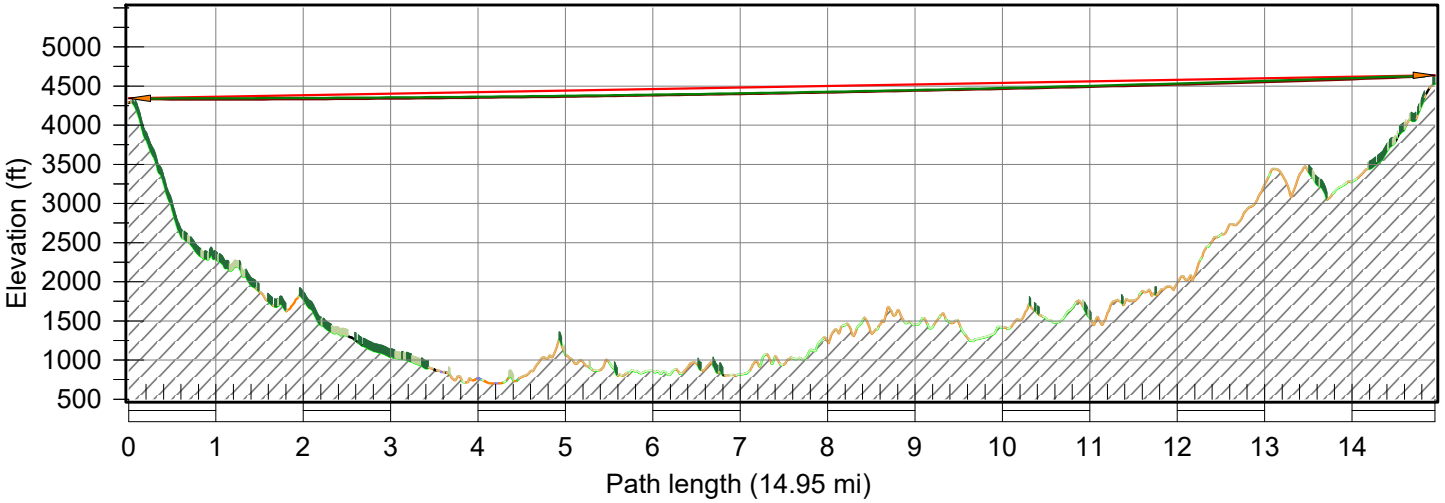
Transmission details (Santa Ynez-Admin.pl5)

	Santa Ynez	Admin
Latitude	34 31 35.87 N	34 25 30.20 N
Longitude	119 58 42.42 W	119 42 12.60 W
True azimuth (°)	113.96	294.12
Vertical angle (°)	-2.71	2.53
Elevation (ft)	4284.09	90.11
Tower height (ft)	60.00	91.00
Tower type		roof mount
Antenna model	USX6-6W (TR)	USX6-6W (TR)
Antenna file name	usx6-6w	usx6-6w
Antenna gain (dBi)	38.55	38.55
Antenna height (ft)	30.00	71.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	60.00	105.00
TX line loss (dB)	0.86	1.51
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	17.21	
Free space loss (dB)	137.13	
Atmospheric absorption loss (dB)	0.24	
Net path loss (dB)	63.23	63.23
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4EHL6_30M_ACM_R70	I6V4EHL6_30M_ACM_R70
Radio file name	i4el630macm_r70	i4el630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	39.98	39.98
Climatic factor	2.00	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	36.00	36.00	-65.00	-65.00	73.39	72.74	-27.23	-27.23	37.77	37.77	33.92	33.92
256QAM 180 Mbps	37.00	37.00	-67.50	-67.50	74.39	73.74	-26.23	-26.23	41.27	41.27	35.42	35.42
128QAM 155 Mbps	**37.00**	**37.00**	**-73.75**	**-73.75**	**74.39**	**73.74**	**-26.23**	**-26.23**	**47.52**	**47.52**	**39.28**	**39.28**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9983	99.9983	99.9995	99.9995			99.9990	99.9990
256QAM 180 Mbps	99.9988	99.9988	99.9996	99.9996			99.9993	0.0003
128QAM 155 Mbps	**99.9995**	**99.9995**	**99.9999**	**99.9999**			**99.9997**	**0.0004**

Multipath fading method - Vigants - Barnett



Santa Ynez	
Latitude	34 31 35.87 N
Longitude	119 58 42.42 W
Azimuth	358.58°
Elevation	4284 ft ASL
Antenna CL	58.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Figueroa Mtn	
Latitude	34 44 36.24 N
Longitude	119 59 05.86 W
Azimuth	178.58°
Elevation	4528 ft ASL
Antenna CL	110.0 ft AGL

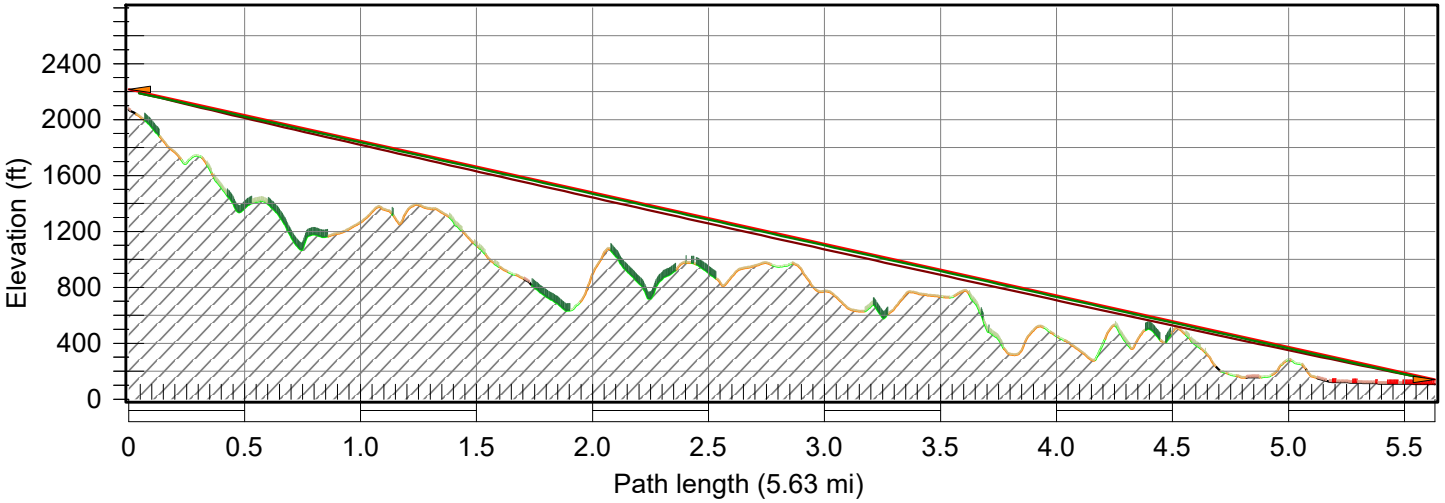
Transmission details (Santa Ynez-Figueroa Mtn.pl5)

	Santa Ynez	Figueroa Mtn
Latitude	34 31 35.87 N	34 44 36.24 N
Longitude	119 58 42.42 W	119 59 05.86 W
True azimuth (°)	358.58	178.58
Vertical angle (°)	0.13	-0.30
Elevation (ft)	4284.09	4527.88
Tower height (ft)	60.00	125.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	58.00	110.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	90.00	140.00
TX line loss (dB)	1.29	2.00
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	14.95	
Free space loss (dB)	135.91	
Atmospheric absorption loss (dB)	0.22	
Net path loss (dB)	62.61	62.61
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4HL6_30M_ACM_R70	I6V4HL6_30M_ACM_R70
Radio file name	i4hl630macm_r70	i4hl630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	37.51	37.51
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
256QAM 180 Mbps	31.00	31.00	-67.50	-67.50	68.11	67.40	-31.61	-31.61	35.89	35.89	31.98	31.98
128QAM 155 Mbps	**31.50**	**31.50**	**-73.75**	**-73.75**	**68.61**	**67.90**	**-31.11**	**-31.11**	**42.64**	**42.64**	**36.35**	**36.35**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9974	99.9974	99.9992	99.9992			99.9985	99.9985
256QAM 180 Mbps	99.9983	99.9983	99.9995	99.9995			99.9990	0.0005
128QAM 155 Mbps	**99.9994**	**99.9994**	**99.9998**	**99.9998**			**99.9996**	**0.0007**

Multipath fading method - Vigants - Barnett



Sudden	
Latitude	34 33 58.50 N
Longitude	120 30 00.22 W
Azimuth	28.31°
Elevation	2071 ft ASL
Antenna CL	145.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Lompoc Civic Center	
Latitude	34 38 17.34 N
Longitude	120 27 11.48 W
Azimuth	208.34°
Elevation	107 ft ASL
Antenna CL	34.0 ft AGL

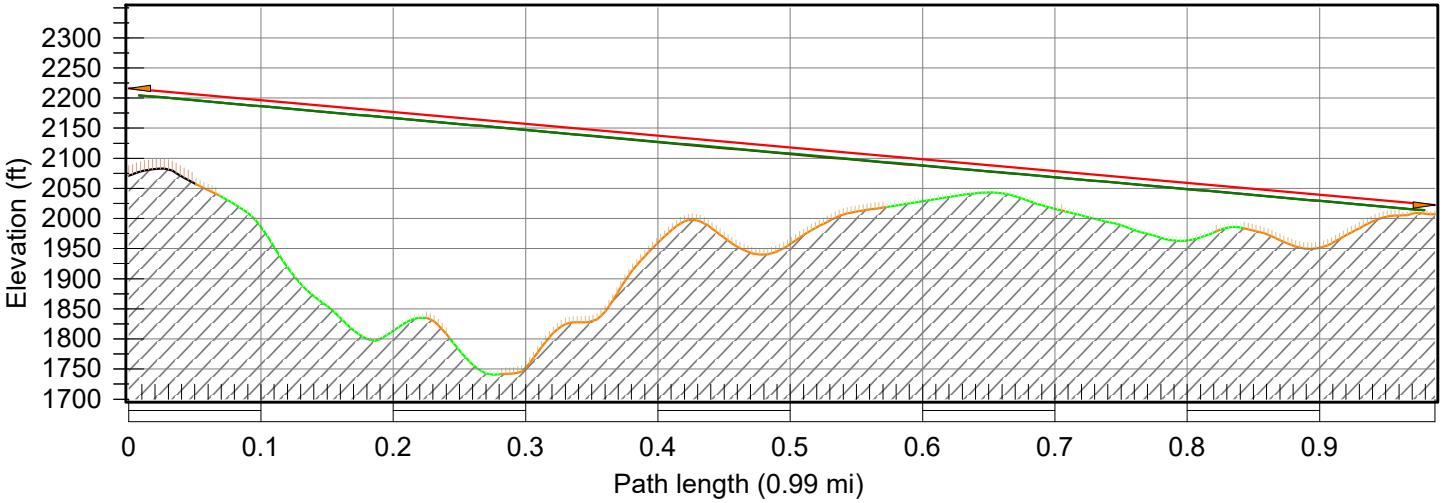
Transmission details (Sudden-Lompoc Civic Center.pl5)

	Sudden	Lompoc Civic Center
Latitude	34 33 58.50 N	34 38 17.34 N
Longitude	120 30 00.22 W	120 27 11.48 W
True azimuth (°)	28.31	208.34
Vertical angle (°)	-4.02	3.96
Elevation (ft)	2071.06	106.79
Tower height (ft)	150.00	30.00
Tower type		roof mount
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	145.00	34.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	175.00	75.00
TX line loss (dB)	2.51	1.08
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	5.64	
Free space loss (dB)	127.45	
Atmospheric absorption loss (dB)	0.08	
Net path loss (dB)	54.31	54.31
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4SL6_30M_ACM_R70	I6V4SL6_30M_ACM_R70
Radio file name	i4sl630macm_r70	i4sl630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	34.43	34.43
Climatic factor	2.00	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	28.00	28.00	-65.00	-65.00	63.89	65.32	-26.31	-26.31	38.69	38.69	30.04	30.04
256QAM 180 Mbps	28.50	28.50	-67.50	-67.50	64.39	65.82	-25.81	-25.81	41.69	41.69	30.81	30.81
128QAM 155 Mbps	**29.00**	**29.00**	**-73.75**	**-73.75**	**64.89**	**66.32**	**-25.31**	**-25.31**	**48.44**	**48.44**	**34.26**	**34.26**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9998	99.9998	99.9999	99.9999			99.9999	99.9999
256QAM 180 Mbps	99.9999	99.9999	99.9999	99.9999			99.9999	0.0000
128QAM 155 Mbps	**99.9999**	**99.9999**	**99.9999**	**99.9999**			**99.9999**	**0.0000**

Multipath fading method - Vigants - Barnett



Sudden	
Latitude	34 33 58.50 N
Longitude	120 30 00.22 W
Azimuth	187.70°
Elevation	2071 ft ASL
Antenna CL	145.0 ft AGL

Frequency (MHz) = 11200.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Oak Mtn - GATR	
Latitude	34 33 07.42 N
Longitude	120 30 08.57 W
Azimuth	7.70°
Elevation	2007 ft ASL
Antenna CL	15.0 ft AGL

Transmission details (Sudden-Oak Mtn - GATR.pl5)

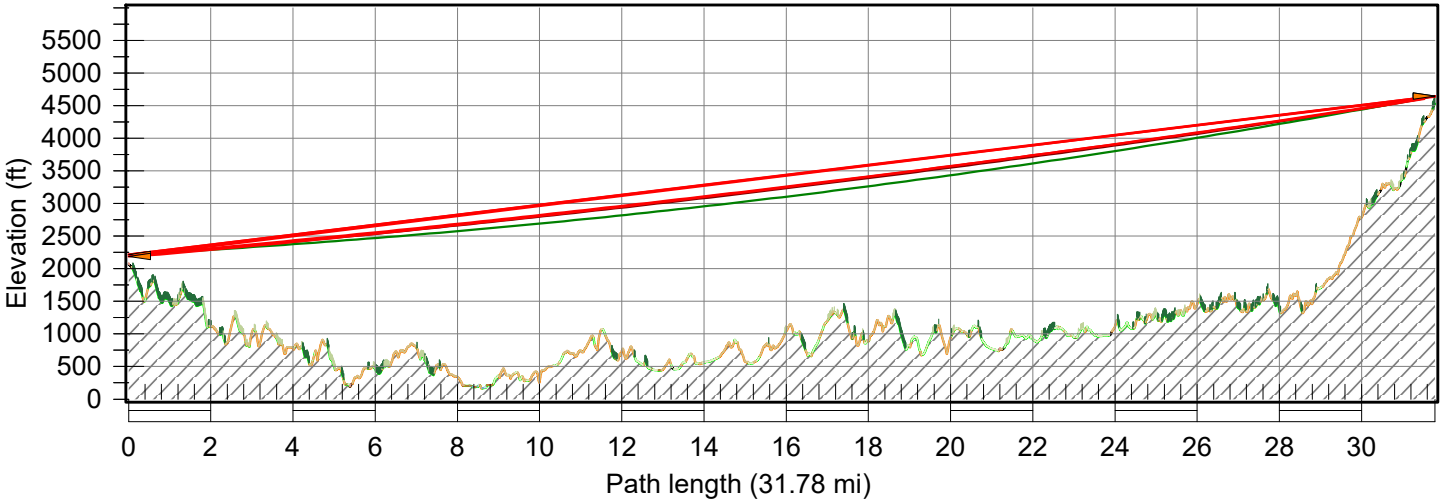
	Sudden	Oak Mtn - GATR
Latitude	34 33 58.50 N	34 33 07.42 N
Longitude	120 30 00.22 W	120 30 08.57 W
True azimuth (°)	187.70	7.70
Vertical angle (°)	-2.14	2.13
Elevation (ft)	2071.06	2007.10
Tower height (ft)	150.00	25.00
Antenna model	UXA4-107 (TR)	UXA4-107 (TR)
Antenna file name	uxa4-107a	uxa4-107a
Antenna gain (dBi)	40.40	40.40
Antenna height (ft)	145.00	15.00
Orientation loss (dB)	0.00	0.00
TX line model	E105	E105
TX line unit loss (dB/100 ft)	2.75	2.75
TX line length (ft)	175.00	45.00
TX line loss (dB)	4.81	1.24
Connector loss (dB)	0.40	0.40
TX switch loss (dB)	0.70	0.70
Other TX loss (dB)	6.50	6.50
RX filter loss (dB)	3.20	3.20
Frequency (MHz)	11200.00	
Polarization	Vertical	
Path length (mi)	0.99	
Free space loss (dB)	117.48	
Atmospheric absorption loss (dB)	0.03	
Net path loss (dB)	53.95	53.95
Configuration	2+2 MHSB equal	2+2 MHSB equal
Radio model	I6V4S11_30M_ACM_R70	I6V4S11_30M_ACM_R70
Radio file name	i4s1130macm_r70	i4s1130macm_r70
Emission designator	30M0D7W	30M0D7W

	Sudden	Oak Mtn - GATR
Polarization	Vertical	
Rain region	San Luis Obispo, California	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	25.00	25.00	-64.00	-64.00	52.99	56.56	-28.95	-28.95	35.05	35.05	29.46	29.46
256QAM 180 Mbps	25.50	25.50	-66.50	-66.50	53.49	57.06	-28.45	-28.45	38.05	38.05	30.52	30.52
128QAM 155 Mbps	**26.00**	**26.00**	**-73.00**	**-73.00**	**53.99**	**57.56**	**-27.95**	**-27.95**	**45.05**	**45.05**	**34.47**	**34.47**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999
256QAM 180 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
128QAM 155 Mbps	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**99.9999**	**0.0000**

Multipath fading method - Vigants - Barnett
Rain fading method - Crane



Sudden	
Latitude	34 33 58.50 N
Longitude	120 30 00.22 W
Azimuth	67.26°
Elevation	2071 ft ASL
Antenna CL	145.0, 115.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500
Divr 1 K = 1.330 %F1 = 60.00

Figueroa Mtn	
Latitude	34 44 36.24 N
Longitude	119 59 05.86 W
Azimuth	247.55°
Elevation	4528 ft ASL
Antenna CL	120.0, 107.0 ft AGL

Transmission details (Sudden-Figueroa Mtn.pl5)

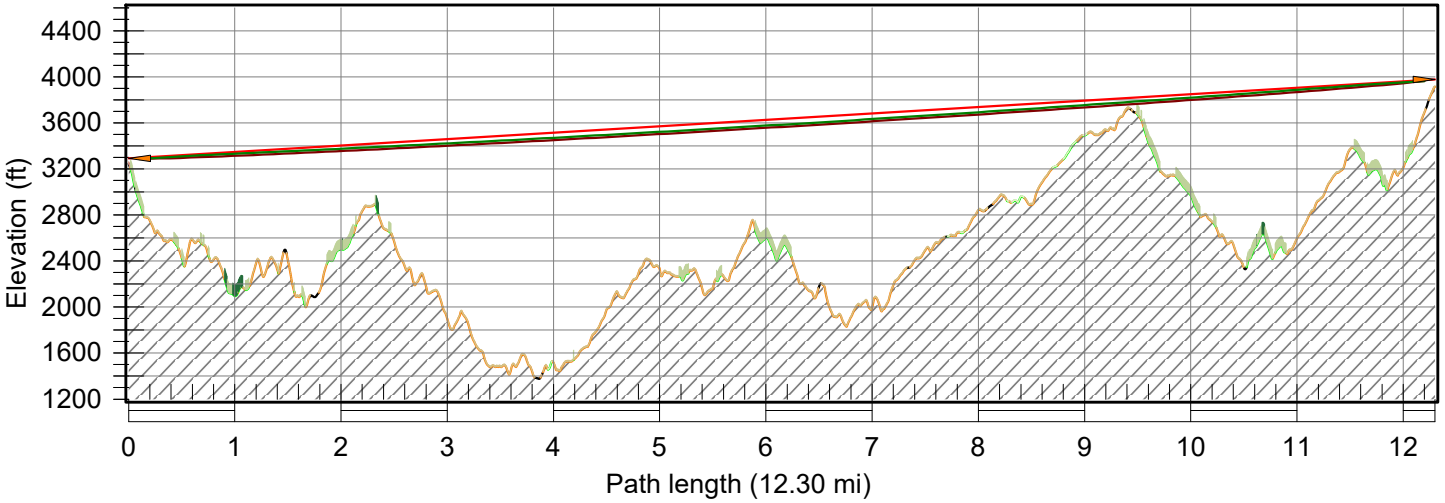
	Sudden	Figueroa Mtn
Latitude	34 33 58.50 N	34 44 36.24 N
Longitude	120 30 00.22 W	119 59 05.86 W
True azimuth (°)	67.26	247.55
Vertical angle (°)	0.66	-1.00
Elevation (ft)	2071.06	4527.88
Tower height (ft)	150.00	125.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	145.00	120.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	175.00	150.00
TX line loss (dB)	2.51	2.15
Connector loss (dB)	0.30	0.30
TX switch loss (dB)	0.40	0.40
Antenna model	HX6-6W (DR)	HX6-6W (DR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	115.00	107.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	145.00	140.00
TX line loss (dB)	2.08	2.01
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	

	Sudden	Figueroa Mtn
Radio model	I6V4EHL6_30M_ACM_R70	I6V4EHL6_30M_ACM_R70
Radio file name	i4el630macm_r70	i4el630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	40.09	40.09
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	
Average annual temperature (°F)	59.88	
Fade occurrence factor (Po)	2.601E-001	
SD improvement factor	56.69	11.03

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	36.00	36.00	-65.00	-65.00	71.49	71.85	-35.16	-35.16	30.27	29.98	29.28	29.05
256QAM 180 Mbps	37.00	37.00	-67.50	-67.50	72.49	72.85	-34.16	-34.16	33.77	33.48	32.01	31.82
128QAM 155 Mbps	**37.00**	**37.00**	**-73.75**	**-73.75**	**72.49**	**72.85**	**-34.16**	**-34.16**	**40.02**	**39.73**	**37.04**	**36.89**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9967	99.9819	99.9990	99.9946			99.9936	99.9936
256QAM 180 Mbps	99.9991	99.9949	99.9997	99.9985			99.9982	0.0046
128QAM 155 Mbps	**99.9999**	**99.9995**	**99.9999**	**99.9999**			**99.9998**	**0.0016**

Multipath fading method - Vigants - Barnett



Tepusquet	
Latitude	34 54 54.25 N
Longitude	120 10 57.68 W
Azimuth	40.78°
Elevation	3246 ft ASL
Antenna CL	45.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Plowshare	
Latitude	35 03 00.22 N
Longitude	120 02 27.67 W
Azimuth	220.86°
Elevation	3913 ft ASL
Antenna CL	65.0 ft AGL

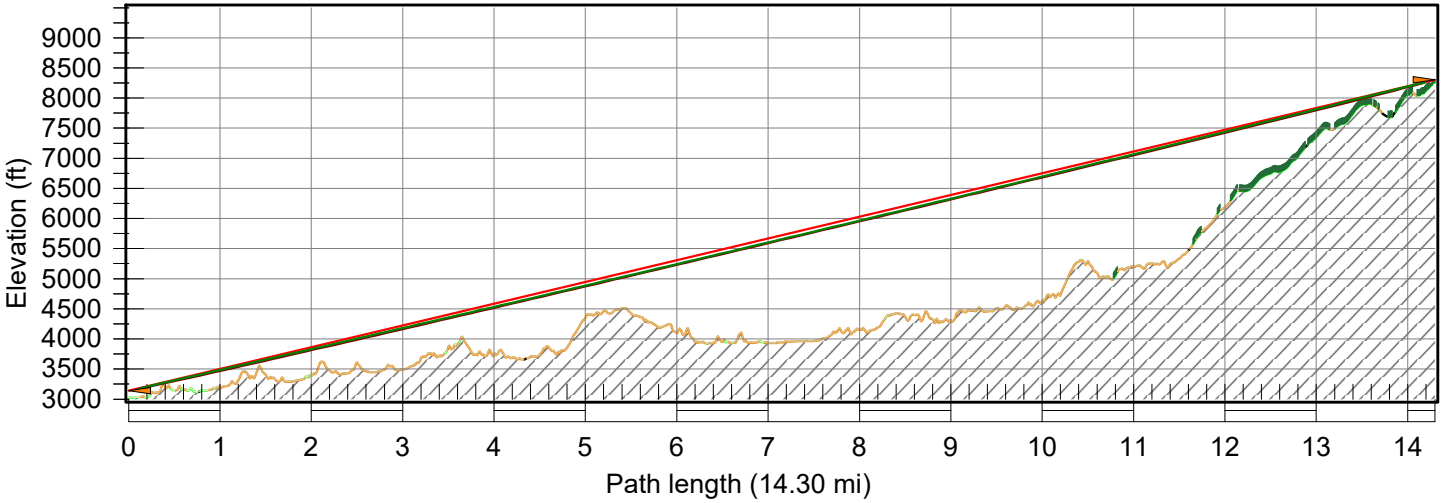
Transmission details (Tepusquet-Plowshare.pl5)

	Tepusquet	Plowshare
Latitude	34 54 54.25 N	35 03 00.22 N
Longitude	120 10 57.68 W	120 02 27.67 W
True azimuth (°)	40.78	220.86
Vertical angle (°)	0.54	-0.67
Elevation (ft)	3245.95	3913.16
Tower height (ft)	125.00	80.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	45.00	65.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	75.00	95.00
TX line loss (dB)	1.07	1.36
Connector loss (dB)	0.30	0.30
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	12.30	
Free space loss (dB)	134.21	
Atmospheric absorption loss (dB)	0.18	
Net path loss (dB)	60.02	60.02
Configuration	2*(1+0)	2*(1+0)
Radio model	I6V4HL6_30M_ACM_R70	I6V4HL6_30M_ACM_R70
Radio file name	i4hl630macm_r70	i4hl630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	36.87	36.87
Climatic factor	2.00	
Terrain roughness (ft)	140.00	
C factor	0.52	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
256QAM 180 Mbps	31.00	31.00	-67.50	-67.50	68.33	68.04	-29.02	-29.02	38.48	38.48	32.39	32.39
128QAM 155 Mbps	**31.50**	**31.50**	**-73.75**	**-73.75**	**68.83**	**68.54**	**-28.52**	**-28.52**	**45.23**	**45.23**	**36.28**	**36.28**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9988	99.9988	99.9996	99.9996			99.9993	99.9993
256QAM 180 Mbps	99.9991	99.9991	99.9997	99.9997			99.9995	0.0002
128QAM 155 Mbps	**99.9996**	**99.9996**	**99.9999**	**99.9999**			**99.9998**	**0.0003**

Multipath fading method - Vigants - Barnett



Ventucopa	
Latitude	34 48 45.51 N
Longitude	119 27 16.37 W
Azimuth	85.39°
Elevation	3021 ft ASL
Antenna CL	120.0 ft AGL

Frequency (MHz) = 6175.0
Main 1 K = 1.330 %F1 = 100.00
Main 2 K = 0.500

Mt Abel	
Latitude	34 49 44.65 N
Longitude	119 12 13.86 W
Azimuth	265.53°
Elevation	8256 ft ASL
Antenna CL	50.0 ft AGL

Transmission details (Ventucopa-Mt Abel.pl5)

	Ventucopa	Mt Abel
Latitude	34 48 45.51 N	34 49 44.65 N
Longitude	119 27 16.37 W	119 12 13.86 W
True azimuth (°)	85.39	265.53
Vertical angle (°)	3.84	-3.99
Elevation (ft)	3021.04	8256.07
Tower height (ft)	130.00	50.00
Antenna model	HX6-6W (TR)	HX6-6W (TR)
Antenna file name	hx6-6w	hx6-6w
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	120.00	50.00
Orientation loss (dB)	0.00	0.00
TX line model	E65J	E65J
TX line unit loss (dB/100 ft)	1.43	1.43
TX line length (ft)	150.00	80.00
TX line loss (dB)	2.15	1.15
Connector loss (dB)	0.30	0.30
TX switch loss (dB)	0.40	0.40
RX filter loss (dB)	3.00	3.00
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	14.33	
Free space loss (dB)	135.54	
Atmospheric absorption loss (dB)	0.20	
Net path loss (dB)	65.64	65.64
Configuration	2+2 MHSB equal	2+2 MHSB equal
Radio model	I6V4EHL6_30M_ACM_R70	I6V4EHL6_30M_ACM_R70
Radio file name	i4el630macm_r70	i4el630macm_r70
Emission designator	30M0D7W	30M0D7W
XPD fade margin - multipath (dB)	37.37	37.37

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
512QAM 200 Mbps	36.00	36.00	-65.00	-65.00	71.85	72.85	-29.64	-29.64	35.36	35.36	31.38	31.38
256QAM 180 Mbps	37.00	37.00	-67.50	-67.50	72.85	73.85	-28.64	-28.64	38.86	38.86	32.86	32.86
128QAM 155 Mbps	**37.00**	**37.00**	**-73.75**	**-73.75**	**72.85**	**73.85**	**-28.64**	**-28.64**	**45.11**	**45.11**	**36.70**	**36.70**

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
512QAM 200 Mbps	99.9982	99.9982	99.9995	99.9995			99.9990	99.9990
256QAM 180 Mbps	99.9988	99.9988	99.9996	99.9996			99.9993	0.0003
128QAM 155 Mbps	**99.9995**	**99.9995**	**99.9998**	**99.9998**			**99.9997**	**0.0004**

Multipath fading method - Vigants - Barnett

E.F. JOHNSON COMPANY

Agreement for Services of Independent Contractor: System Equipment and Installation

Exhibit A-1.2 RF Design Narrative

May 1, 2021

EFJohnson | **a JVCKENWOOD Company**
1440 Corporate Drive, Irving, TX 75038
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JVCKENWOOD

A-1.2 RF Design Narrative

JVCKENWOOD has performed a radio network design for Santa Barbara County, California based on the requirements in RFP #810131 ATTACHMENT B – FUNCTIONAL SPECIFICATIONS. This section is specific to the RF component of the Santa Barbara County system solution.

JVCKENWOOD has developed a RF simulcast solution for each of the Santa Barbara areas of concern also providing service in the more remote areas for the UFH P25 Phase II UHF Trunked and the VHF Conventional Sub-Systems. JVCKENWOOD is additionally providing a design for an optional P25 700/800 MHz LMR system solution to provide improved in-building coverage within the areas of interest described in the RFP. These designs are based on requirements specific to Santa Barbara County, utilizes candidate sites identified by the county and are bound by the specifications of the RFP and the design presented.

JVCKENWOOD, RF Engineering has determined the solutions, constructed in accordance with the design parameter within this document, will satisfy the system coverage requirements, detailed below, for both the UHF and VHF subsystems to be provided. In addition, JVCKENWOOD has determined that the 700/800 sub-system to be provided will satisfy the County's requirement to improve in-building coverage.

VHF Sub-System Requirements

- 85% Service Area Coverage for VHF Portable On-Street operation focusing on the defined service areas:
  - Santa Barbara
  - Santa Ynez
  - Santa Maria
  - Vandenberg Air Force Base
- 60% Service Area Coverage for VHF Portable On-Street operation within the County of Santa Barbara service area
- Delivered Audio Quality of 3.4

UHF Sub-System Requirements

- 95% Service Area Coverage for UHF Portable On-Street operation within the defined service areas of:
  - Santa Barbara
  - Santa Ynez
  - Santa Maria
  - Vandenberg Air Force Base

- 65% Service Area Coverage for UHF Portable On-Street operation within the County of Santa Barbara service area
- Delivered Audio Quality of 3.4

700/800 MHz Sub-System Requirements

- 95% Service Area Coverage for 700/800 MHz Portable operation within the defined service areas of:
  - Santa Barbara, In 12 dB buildings
  - Santa Maria, In 12 dB buildings
  - Santa Ynez, In 12 dB buildings
- Delivered Audio Quality of 3.4

A-1.2.1 System Solution

JVCKENWOOD has developed a VHF, UHF RF system solutions for the County of Santa Barbara with a primary focus on performance on population centers, major thoroughfares within the county, and other areas of concern as defined by Santa Barbara County, see Figure 2.1-1. Primary Focus Areas for Radio Coverage.

Population Centers	*Highways*	*Other*
Santa Barbara Area (i.e. Santa Barbara, Goleta, Montecito, Carpinteria and Summerland)	Highway 101 through the County	Cachuma Lake County Park
Santa Maria Area (i.e. Santa Maria, Guadalupe, Orcutt and Sisquoc)	Highway 1 through the County	Jalama Beach
Santa Ynez Valley (i.e. Santa Ynez, Los Olivos, Buellton and Solvang)	Highway 166 from Santa Maria to Cuyama	Ocean Park (Northwest of Lompoc)
Los Alamos	Hwy 154 from Los Olivos to Santa Barbara	Dunes West of Guadalupe
Lompoc	Hwy 246 from Buellton to Lompoc	South County Coastline
Vandenberg Air Force Base and Village	Roads through the hills north of Santa Barbara and Montecito	Dunes West of Guadalupe
Cuyama Valley, including Ventucopa	Highway 33 south from Cuyama	
Casmalia	Highway 1 and San Antonio Road (NE of Vandenberg AFB and SE of Casmalia)	

Figure 2.1-1. Primary Focus Areas for Radio Coverage

In response to the County of Santa Barbara RFP # 810131 JVCKENWOOD offers the following VHF, UHF, and 700/800 system solutions. In addition, a description for the "stand-alone" components has been included in this section also.

A-1.2.1.1 VHF Conventional Solution

JVCKENWOOD developed a VHF Conventional simulcast solution following the philosophy dictated in RFP #810131, focusing on the population centers of Santa Barbara, Santa Maria, Santa Ynez, and Vandenburg Village. Rural coverage is derived from focusing on coverage for the Highways and the other areas. Sites were selected from the site candidate list provided in the RFP and prioritized following the guidelines found in RFP #810131, ATTACHMENT B – FUNCTIONAL SPECIFICATIONS, SECTION 1.5.B. Refer to Figure 2.1-2 below.

Site Name	Site Lat	Site Long	Frequency Band
Gaviota	34.513680	-120.231160	VHF
Heritage Oil Platform	34.351670	-120.267780	VHF
Oak Mtn-GATR	34.552060	-120.502380	VHF
Plowshare	35.050060	-120.041020	VHF
Tepusquet	34.915070	-120.182690	VHF
Admin	34.425056	-119.703500	VHF
La Cumbre Peak	34.500300	-119.721120	VHF
Valley Peak	33.998930	-119.683610	VHF
Figueroa Mtn	34.743400	-119.984960	VHF
Santa Ynez	34.526630	-119.978450	VHF
Fire Station 24	34.745230	-120.279800	VHF
Harris Grade	34.738560	-120.445780	VHF
Lompoc Civic Center	34.638150	-120.453190	VHF
Mount Solomon	34.834750	-120.383190	VHF
San Antonio	34.841970	-120.499170	VHF
Fire Station 41	34.943150	-119.676690	VHF
Ventucopa	34.812642	-119.454548	VHF
Rincon Add-On	34.372860	-119.421060	VHF

Figure 2.1-2. VHF Site List

A-1.2.1.1.1 Santa Barbara County VHF Conventional Solution

The VHF Conventional system is an 18-site solution intended to provide RF coverage to the focal areas designated by Santa Barbara County. The 18-site solution comprises a single simulcast cell. Each site is populated with six (6) ATLAS 4500 repeaters in combination with an antenna system designed specifically and optimized to the candidate site. JVCKENWOOD assumes the frequencies currently licensed by Santa Barbara County will be reused for the JVCKENWOOD solution.

A-1.2.1.1.2 Santa Barbara Area

The Santa Barbara Area is defined as the combined service areas of Santa Barbara, Goleta, Montecito, Carpinteria and Summerland. The operational goal is to provide ≥ 85% service area coverage with a DAQ of 3.4.

The VHF Conventional Simulcast solution, bound by the parameters found in Figure 2.2-7, for Santa Barbara County provides greater than the required service level of 85% for the Cities of Santa Barbara, Goleta, Montecito, Carpinteria and Summerland. The primary service for the Santa Barbara area is provided by four (4) sites, see Figure 2.1-3, each site populated with six (6) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

Site Name	Site Lat	Site Long	Frequency Band
Admin	34.425056	-119.703500	VHF
La Cumbre Peak	34.500300	-119.721120	VHF
Valley Peak	33.998930	-119.683610	VHF
Rincon Add-On	34.372860	-119.421060	VHF

Figure 2.1-3. Santa Barbara Area of Interest Service Provider

A-1.2.1.1.3 Santa Maria Area

The Santa Maria Area is defined as the combined service areas of Santa Maria, Guadalupe, Orcutt, and Sisquoc. The operational goal is to provide ≥ 85% service area coverage with a DAQ of 3.4.

The VHF Conventional Simulcast solution, bound by the for Santa Barbara County provides greater than the required service level of 85% for the Cities of Santa Maria, Orcutt, Guadalupe, and Sisquoc. The primary service for the Santa Maria area is provided by seven (7) sites, see Figure 2.1-4, each site is populated with six

(6) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

Site Name	Site Lat	Site Long	Frequency Band	Simulcast Cell
Plowshare	35.050060	-120.041020	VHF	Plowshare
Tepusquet	34.915070	-120.182690	VHF	Plowshare
Fire Station 24	34.745230	-120.279800	VHF	VAFB
Harris Grade	34.738560	-120.445780	VHF	VAFB
Lompoc Civic Center	34.638150	-120.453190	VHF	VAFB
Mount Solomon	34.834750	-120.383190	VHF	VAFB
San Antonio	34.841970	-120.499170	VHF	VAFB

Figure 2.1-4. Santa Maria VHF Simulcast Cell

A-1.2.1.1.4 Santa Ynez Area

The Santa Ynez Area is defined as the combined service areas of Santa Ynez, Los Olivos, Buellton, and Solvang. The operational goal is to provide ≥ 85% service area coverage with a DAQ of 3.4.

The VHF Conventional Simulcast solution, bound by the parameters found in Figure 2.2-7 for Santa Barbara County provides greater than the required service level of 85% for the Cities of Santa Ynez, Los Olivos, Buellton, and Solvang. The primary service for the Santa Ynez area is provided by two (2) sites, see Figure 2.1-5 each populated with six (6) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

Site Name	Site Lat	Site Long	Frequency Band	Simulcast Cell
Figueroa Mtn	34.743400	-119.984960	VHF	Santa Ynez
Santa Ynez	34.526630	-119.978450	VHF	Santa Ynez

Figure 2.1-5. Santa Ynez VHF Simulcast Site List

A-1.2.1.1.5 Vandenberg Air Force Base Area

The Vandenberg Air Force Base Area is defined as the combined service areas of Vandenberg Air Force Base, Vandenberg Village, Lompoc, Los Alamos and Casmalia. The operational goal is to provide ≥ 85% service area coverage with a DAQ of 3.4.

The VHF Conventional Simulcast solution, bound by the parameters found in Figure 2.2-7 for Santa Barbara County provides greater than the required service

level of 85% for the areas of Vandenberg Air Force Base and Vandenberg Village, in addition to the cities of Lompoc, Los Alamos and Casmalia. The primary service for the Vandenberg Air Force Base Area is provided by five (5) sites, see Figure 2.1-6 each populated with six (6) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

Site Name	Site Lat	Site Long	Frequency Band	Simulcast Cell
Fire Station 24	34.745230	-120.279800	VHF	VAFB
Harris Grade	34.738560	-120.445780	VHF	VAFB
Lompoc Civic Center	34.638150	-120.453190	VHF	VAFB
Mount Solomon	34.834750	-120.383190	VHF	VAFB
San Antonio	34.841970	-120.499170	VHF	VAFB

Figure 2.1-6. Vandenberg VHF Simulcast Site List

A-1.2.1.1.6 Plowshare Area

The Plowshare area is the area inclusive of the highway from Santa Maria to Cuyama Valley. The operational goal is to provide ≥ 85% service area coverage within urban areas such as Santa Maria and ≥ 60% coverage on Highway 166 with a DAQ of 3.4.

The VHF Conventional Simulcast solution, bound by the parameters found in Figure 2.2-7, for Santa Barbara County provides the required service level for the Plowshare area and Santa Maria. The primary service is provided by two (2) sites, see Figure 2.1-7, each populated with six (6) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

Site Name	Site Lat	Site Long	Frequency Band	Simulcast Cell
Plowshare	35.050060	-120.041020	VHF	Plowshare
Tepusquet	34.915070	-120.182690	VHF	Plowshare

Figure 2.1-7. Plowshare VHF Simulcast Site List

A-1.2.1.1.7 Ventucopa Area

The Ventucopa Area consists of the Cuyama Valley, Cuyama, New Cuyama, and Ventucopa urban areas as well as highway coverage in Cuyama Valley. The operational goal is to provide ≥85% service area coverage within the urban areas and ≥ 60% coverage on highways with a DAQ of 3.4.

The VHF Conventional Simulcast solution, bound by the parameters found in Figure 2.2-7, for Santa Barbara County provide greater than the required service level for the Cuyama Valley area including highway coverage in the Cuyama Valley, and the cities of Cuyama, New Cuyama, and Ventucopa. The primary service is provided by two (2) sites, see Figure 2.1-8, each populated with six (6) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

Site Name	Site Lat	Site Long	Frequency Band	Simulcast Cell
Fire Station 41	34.943150	-119.676690	VHF	Ventucopa
Ventucopa	34.812642	-119.454548	VHF	Ventucopa

Figure 2.1-8. Ventucopa VHF Simulcast Site List

A-1.2.1.1.8 Gaviota VHF Cell Solution

The Gaviota Cell provides coverage to the South County coastline and Jalama Beach areas as well as highway coverage along the southern coast. The operational goal is to provide ≥ 85% service area coverage within the urban areas and ≥ 60% coverage on highways and rural areas with a DAQ of 3.4.

The VHF Conventional Simulcast solution, bound by the parameters found in Figure 2.2-7, for Santa Barbara County provides the required coverage for these areas. The primary service is provided by three (3) sites, see Figure 2.1-9, each populated with six (6) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

Site Name	Site Lat	Site Long	Frequency Band	Simulcast Cell
Gaviota	34.513680	-120.231160	VHF	Gaviota
Heritage Oil Platform	34.351670	-120.267780	VHF	Gaviota
Oak Mtn-GATR	34.552060	-120.502380	VHF	Gaviota

Figure 2.1-9. Gaviota VHF Simulcast Site List

A-1.2.1.1.9 VHF Link Budget

JVCKENWOOD developed a link budget for the VHF Conventional solution to be provided to Santa Barbara County in consideration of the assumptions listed in Section A-1.2.1.1.9. The link budget was prepared in accordance with the calculations and methodologies provided in TSB-88.1-D and standard engineering practices.

A-1.2.1.1.9 VHF Link Budget Assumptions

- System Technology:
  - Analog Conventional
  - Hybrid Configuration (Simulcast and Multicast)
- Frequency Band
  - VHF
- Delivered Audio Quality
  - ≥ DAQ 3.4 (20 dB SINAD) for Talk-Out and Talk-In/Talk-Back Mobile operations
  - ≥ DAQ 3.4 (20 dB SINAD) for Talk-Out Portable On-Hip, On-Street operations
  - ≥ DAQ 3.4 (20 dB SINAD) for Talk-In/Talk-Back Portable @ Head, On-Street operations
  - ≥ DAQ 3.4 (20 dB SINAD) for Talk-Out and Talk-In/Talk-Back Portable SMA, On-Street operations
- Mobile Radio
  - VHF ERP-20 Watts
  - Unity Gain Antenna center of roof
- VHF Portable Radio
  - ERP – 5 Watts (fixed)
  - On-Hip operations; Belt clip, Unity Gain Antenna, at a height of 3 ft. AGL
- Body Loss
  - On-Hip = 22.8 dB Loss (Body Loss + Antenna Correction Factor)
- Repeater: ATLAS 4500
  - Receive Specifications:
    - Analog – Reference Sensitivity (12 dB SINAD) =-123.0 dBm
  - Transmitter Specifications:
    - Output Power Max = 100 W (50 dBm)
  - Transmitter power balanced at combiner output respective to portable radio operations
- Antenna System
  - Combiner Loss (DB4348-Series)
    - 6 channel VHF Combiner Loss – 3.6 dB
  - Receive Multicoupler
    - Effective Receive Multicoupler Gain (EMG) – 1.13 dB
  - Transmit Antenna
    - Based on a balanced path with respect to portable on-street operations
  - Receive Antenna
    - Based on a balanced path with respect to portable on-street operations
  - Feedline
    - Transmit feedline
      - Feedline Lengths < 125 feet – ½ inch coaxial cable
      - Feedline Lengths > 125 feet and < 250feet – ⅞ inch coaxial cable

- Feedline Lengths > 250 feet and < 350 feet – 1 ¼ inch coaxial cable
  - Exception for the two (2) sites recommended by the site survey team

▪ Receive feedline -

- Feedline Lengths < 125 feet – ½ inch coaxial cable
- Feedline Lengths > 125 feet and < 250feet – ⅞ inch coaxial cable
- Feedline Lengths > 250 feet and < 350 feet – 1 ¼ inch coaxial cable
  - Exception for the two (2) sites recommended by the site survey team

A-1.2.1.2 UHF P25 Solution

JVCKENWOOD developed a UHF P25 Phase II hybrid solution following the philosophy dictated in RFP #810131, focusing on the population centers of Santa Barbara, Santa Marie, Santa Ynez, and Los Alamos. Rural coverage is derived from focusing on coverage for the Highways and the other areas identified in Table 2 of the RFP. Sites were selected from the site candidate provided in the RFP and prioritized following the guidelines found in RFP #810131, ATTACHMENT B – FUNCTIONAL SPECIFICATIONS, SECTION 1.5.B. Refer to Figure 2.1-10.

Site Name	Site Lat	Site Long	Frequency	Simulcast Cell
Gaviota	34.513680	-120.231160	UHF	Gaviota
Heritage Oil Platform	34.351670	-120.267780	UHF	Gaviota
Oak Mtn-GATR	34.552060	-120.502380	UHF	Gaviota
Sudden	34.566250	-120.500060	UHF	Gaviota
Plowshare	35.050060	-120.041020	UHF	Plowshare
Tepusquet	34.915070	-120.182690	UHF	Plowshare
Admin	34.425056	-119.703500	UHF	Santa Barbara
La Cumbre Peak	34.500300	-119.721120	UHF	Santa Barbara
Valley Peak	33.998930	-119.683610	UHF	Santa Barbara
Figueroa Mtn	34.743400	-119.984960	UHF	Santa Ynez
Santa Ynez	34.526630	-119.978450	UHF	Santa Ynez
Fire Station 24	34.745230	-120.279800	UHF	VAFB
Harris Grade	34.738560	-120.445780	UHF	VAFB
Lompoc Civic Center	34.638150	-120.453190	UHF	VAFB
Mount Solomon	34.834750	-120.383190	UHF	VAFB
San Antonio	34.841970	-120.499170	UHF	VAFB
Fire Station 41	34.943150	-119.676690	UHF	Ventucopa
Ventucopa	34.822066	-119.465913	UHF	Ventucopa
Rincon	34.372860	-119.421060	UHF	Santa Barbara/Multicast

Figure 2.1-10. UHF Site List

A-1.2.1.2.1 Santa Barbara County UHF P25 Solution

The UHF P25 system is a 19-site solution, Rincon, intended to provide RF coverage to the focal areas designated by Santa Barbara County. The 19-site base solution is comprised of six (6) simulcast cells. Each site is populated with five (5) ATLAS 4500 repeaters in combination with an antenna system designed specifically and optimized to the candidate site. JVCKENWOOD assumes the frequencies currently licensed by Santa Barbara County will be reused for the JVCKENWOOD solution.

A-1.2.1.2.2 Santa Barbara Area UHF Simulcast Cell Solution

The Santa Barbara Area is defined as the combined service areas of Santa Barbara, Goleta, Montecito, Carpinteria and Summerland. The operational goal is to provide ≥ 95% service area coverage with a DAQ of 3.4.

JVCKENWOOD has developed a UHF P25 Simulcast solution, bound by the parameters found in Figure 2.2-8 and Figure 2.2-9. The primary solution consists of three (3) sites, see Figure 2.1-11, each site populated with five (5) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

The Santa Barbara Cell provides the required service to the Santa Barbara Area as well as some other areas as defined in ATTACHMENT B, TABLE 2.

Site Name	Site Lat	Site Long	Frequency	Simulcast Cell
Admin	34.425056	-119.703500	UHF	Santa Barbara
La Cumbre Peak	34.500300	-119.721120	UHF	Santa Barbara
Valley Peak	33.998930	-119.683610	UHF	Santa Barbara

Figure 2.1-11. City of Santa Barbara UHF Simulcast Cell Site List

A-1.2.1.2.3 Rincon Add-On

In compliance with Santa Barbara County's request to include the Rincon site the City of Santa Barbara UHF Simulcast Cell has been expanded to include Rincon. The site has the versatility of being configured as either a simulcast component site or as a multicast site. In the multicast configuration the Rincon site will provide additional channel resources for the support of operations in the Carpinteria area of interest extending into the Summerland area of interest as well. As a simulcast component site, Rincon will provide overlapping overage to the Carpinteria area of interest as well as the Summerland area of interest.

Site Name	Site Lat	Site Long	Frequency	Simulcast Cell
Rincon	34.372860	-119.421060	UHF	Santa Barbara/Multicast

Figure 2.1-12. City of Santa Barbara Rincon Site Add-on

A-1.2.1.2.4 Santa Maria Area Solution

The Santa Maria Area is defined as the combined service areas of Santa Maria, Guadalupe, Orcutt, and Sisquoc. The operational goal is to provide ≥ 95% service area coverage with a DAQ of 3.4. Coverage is provided by two (2) cells, Vandenburg and Plowshare, both providing the required coverage independently.

JVCKENWOOD has developed a UHF P25 Simulcast solution, bound by the parameters found in Figure 2.2-9 and Figure 2.2-10 for Santa Barbara County. The solution consists of two (2) cells, seven (7) sites, see Figure 2.1-13, each site populated with five (5) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

These cells provide the required service to the Santa Maria Area as well as some other areas as defined in **ATTACHMENT B, TABLE 2**.

Site Name	Site Lat	Site Long	Frequency	Simulcast Cell
Plowshare	35.050060	-120.041020	UHF	Plowshare
Tepusquet	34.915070	-120.182690	UHF	Plowshare
Fire Station 24	34.745230	-120.279800	UHF	VAFB
Harris Grade	34.738560	-120.445780	UHF	VAFB
Lompoc Civic Center	34.638150	-120.453190	UHF	VAFB
Mount Solomon	34.834750	-120.383190	UHF	VAFB
San Antonio	34.841970	-120.499170	UHF	VAFB

Figure 2.1-13. City of Santa Maria UHF Simulcast Cell Site List

A-1.2.1.2.5 Santa Ynez Valley UHF Cell Solution

The Santa Ynez Area is defined as the combined service areas of Santa Ynez, Los Olivos, Buellton, and Solvang. The operational goal is to provide ≥ 95% service area coverage with a DAQ of 3.4.

JVCKENWOOD has developed a UHF P25 Simulcast solution, bound by the parameters found in Figure 2.2-9 and Figure 2.2-10 for Santa Barbara County. The solution consists of two (2) sites, see **Error! Reference source not found.** each populated with five (5) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

The Santa Ynez Cell provides the required service to the Santa Ynez Area as well as some other areas as defined in **ATTACHMENT B, TABLE 2**.

Site Name	Site Lat	Site Long	Frequency	Simulcast Cell
Figueroa Mtn	34.743400	-119.984960	UHF	Santa Ynez
Santa Ynez	34.526630	-119.978450	UHF	Santa Ynez

Figure 2.1-14. City of Santa Ynez UHF Simulcast Site List

A-1.2.1.2.6 Vandenberg Air Force Base Area UHF Cell Solution

The Vandenberg Air Force Base Area is defined as the combined service areas of Vandenberg Air Force Base, Vandenberg Village, Lompoc, Los Alamos and Casmalia. The operational goal is to provide ≥ 95% service area coverage with a DAQ of 3.4.

JVCKENWOOD has developed a UHF P25 Simulcast solution, bound by the parameters found in Figure 2.2-8 and Figure 2.2-9 for Santa Barbara County. The solution consists of five (5) sites, see Figure 2.1-15 each populated with five (5) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

The Vandenberg Cell provides the required service to the Santa Ynez Area as well as some other areas as defined in **ATTACHMENT B, TABLE 2**. Please refer to Section A-1.2.1.2.11 for a description of the coverage provided by Focus Area.

Site Name	Site Lat	Site Long	Frequency	Simulcast Cell
Fire Station 24	34.745230	-120.279800	UHF	VAFB
Harris Grade	34.738560	-120.445780	UHF	VAFB
Lompoc Civic Center	34.638150	-120.453190	UHF	VAFB
Mount Solomon	34.834750	-120.383190	UHF	VAFB
San Antonio	34.841970	-120.499170	UHF	VAFB

Figure 2.1-15. Vandenberg Air Force Base UHF Simulcast Site List

A-1.2.1.2.7 Plowshare UHF Simulcast Cell Solution

The Plowshare Cell provides coverage to the Santa Maria Area as well as highway coverage from Santa Maria to Cuyama Valley. The operational goal is to provide ≥ 95% service area coverage within Santa Maria and ≥ 65% coverage on Highway 166 with a DAQ of 3.4.

JVCKENWOOD has developed a UHF P25 Simulcast solution, bound by the parameters found in Figure 2.2-8 and Figure 2.2-9 for Santa Barbara County. The

solution consists of two (2) sites, see Figure 2.1-16, each populated with five (5) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

The Plowshare Cell provides the required service to the Santa Maria, Highway 166 as described as well as some other areas as defined in **ATTACHMENT B, TABLE 2**. Please refer to Section A-1.2.1.2.11 for a description of the coverage provided by Focus Area.

Site Name	Site Lat	Site Long	Frequency Band	Simulcast Cell
Plowshare	35.050060	-120.041020	UHF	Plowshare
Tepusquet	34.915070	-120.182690	UHF	Plowshare

Figure 2.1-16. Plowshare UHF Simulcast Site List

A-1.2.1.2.8 Ventucopa UHF Cell Solution

The Ventucopa Cell provides coverage to the Cuyama Valley, Cuyama, New Cuyama, and Ventucopa urban areas as well as highway coverage in Cuyama Valley. The operational goal is to provide ≥ 95% service area coverage within the urban areas and ≥ 65% coverage on highways with a DAQ of 3.4.

JVCKENWOOD has developed a UHF P25 Simulcast solution, bound by the parameters found in Figure 2.2-8 and Figure 2.2-9, for Santa Barbara County. The solution consists of two (2) sites, see Figure 2.1-17, each populated with five (5) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

The Ventucopa Cell provides the required service to Cuyama Valley, the urban areas within as well as the identified Highways 133 and 166 as defined in **ATTACHMENT B, TABLE 2**. Please refer to Section A-1.2.1.2.11 for a description of the coverage provided by Focus Area.

Site Name	Site Lat	Site Long	Frequency	Simulcast Cell
Fire Station 41	34.943150	-119.676690	UHF	Ventucopa
Ventucopa	34.822066	-119.465913	UHF	Ventucopa

Figure 2.1-17. Ventucopa VHF Simulcast Site List

A-1.2.1.2.9 Gaviota UHF Cell Solution

The Gaviota Cell provides coverage to the South County coastline and Jalama Beach areas as well as highway coverage along the southern coast. The operational

goal is to provide ≥ 95% service area coverage within the urban areas and ≥ 65% coverage on highways with a DAQ of 3.4.

JVCKENWOOD has developed a UHF P25 Simulcast solution, bound by the parameters found in Figure 2.2-8 and Figure 2.2-9, for Santa Barbara County. The solution consists of two four (4) sites, see Figure 2.1-18, each populated with five (5) channels, in accordance with RFP #810131, and utilizes antenna systems which were designed to optimize the site performance.

The Gaviota Cell provides the required service to South County Coastline, Jalama Beach, as well as the identified Highways along the southern coast as defined in **ATTACHMENT B, TABLE 2**.

Site Name	Site Lat	Site Long	Frequency	Simulcast Cell
Gaviota	34.513680	-120.231160	UHF	Gaviota
Heritage Oil Platform	34.351670	-120.267780	UHF	Gaviota
Oak Mtn-GATR	34.552060	-120.502380	UHF	Gaviota
Sudden	34.566250	-120.500060	UHF	Gaviota

Figure 2.1-18. Gaviota VHF Simulcast Site List

A-1.2.1.2.10 UHF Link Budget

JVCKENWOOD developed a link budget for the UHF P25 solution to be provided to Santa Barbara County in consideration of the assumptions listed in Section A-1.2.1.2.10. The link budget was prepared in accordance with the calculations and methodologies provided in TSB-88.1-D and standard engineering practices.

A-1.2.1.2.10 UHF Link Budget Assumptions

- System Technology:
  - P25 Phase II
  - Hybrid Configuration (Simulcast and Multicast)
- Frequency Band
  - UHF
- Delivered Audio Quality
  - ≥ DAQ 3.4 (5% BER) for Talk-Out and Talk-In/Talk-Back Mobile operations
  - ≥ DAQ 3.4 (5% BER) for Talk-Out/Talk-In Portable On-Hip, On-Street operations
- Mobile Radio
  - UHF ERP-20 Watts
  - Unity Gain Antenna center of roof
- UHF Portable Radio

- ERP – 5 Watts as requested by Santa Barbara County
- On-Hip operations; Belt Clip, Unity Gain Antenna at a height of 3 ft. AGL

- Body Loss
  - On-Hip = 13.2 dB Loss (Body Loss + Antenna Correction Factor)
- Repeater: ATLAS 4500
  - Receive Specifications:
    - Digital – Reference Sensitivity (5% BER) =-123.0 dBm
  - Transmitter Specifications:
    - Output Power Max = 100 W (50 dBm)
    - Transmitter power balanced at combiner output respective to portable radio balanced link budget
  - Balance is respective to portable radio balanced link budget
- Antenna System
  - Combiner Loss (DB4368 Series)
    - 5 channel UHF Combiner Loss – 3.5 dB
  - Effective Receive Multicoupler Gain (EMG)
    - Receive Multicoupler Gain (EMG) – 1.77 dB
    - Receive Multicoupler/ Tower Top Amplifier Gain (EMG) – 0.00 dB
  - Transmit Antenna selection
    - Based on a balanced path with respect to portable on-street operations
  - Receive Antenna selection
    - Based on a balanced path with respect to portable on-street operations
  - Feedline
    - Transmit feedline
      - Lengths < 90 feet – ½ inch coaxial cable
      - Lengths > 90 feet & < 175 feet - ⅞ inch coaxial cable
      - Lengths > 175 feet & < 235 feet – 1 ¼ inch coaxial cable
      - Lengths > 235 feet – 1 ⅝ inch coaxial cable
    - Receive feedline -
      - Lengths < 90 feet – ½ inch coaxial cable
      - Lengths > 90 feet & < 175 feet - ⅞ inch coaxial cable
      - Lengths > 175 feet & < 235 feet – 1 ¼ inch coaxial cable
      - Lengths > 235 feet – 1 ⅝ inch coaxial cable

A-1.2.1.1.2.10 UHF Link Budget Calculations

Link budget is considered as limited by thermal noise, unless otherwise stated: noise, interferences or intermodulation situations are handled as an on-field risk

and will be treated on a case-by-case basis during site deployment. The results of the Link Budget calculations are reflected in Figure 2.1-19.

All link budget calculations are performed in accordance with TSB-88 recommendations

Terminal Unit, Down-Link, Outdoors (Talk-Out)

A typical UHF terminal unit has a RX Static Sensitivity @ 5%BER equal to -119.0 dBm.

For P25 TDMA, TSB-88.1-D, Annex A, Table A 1- Projected VCPC Parameters for Different DAQs, provide a Static Carrier to Noise Ratio @ 5%BER (CS/N) value of 7.3 dB and a Rayleigh faded Carrier to interferer and Noise ratio for a 2.4%BER or DAQ 3.4 (Cf/(ΣI +ΣN)) of 16.4 dB.

Downlink RX Faded Performance Threshold (FPT)

Downlink FPT = RX Static Sensitivity – CS/N + Cf/(ΣI +ΣN)

For P25 TDMA Downlink RFS = -119.0 dBm – 7.3 dB + 16.4 dB = –109.9 dBm

P25 TDMA Downlink Faded Performance Threshold is – 109.9 dBm

While the Downlink RX Faded Sensitivity is appropriate for determining Mobile Talk-Out performance, to evaluate Portable performance it is necessary to include Body Loss (per TSB-88) and Building Penetration Loss with the design threshold value:

Portable Talk-Out Design Threshold

= Downlink Faded Performance Threshold + Body Loss + Building Penetration Loss

Portable on Hip Design Threshold = -109.9 dBm + 13.2 dB + 0 dB = **-96.7 dBm**

Terminal Unit, Up-Link, Outdoors (Talk-In/Talk-Back)

The JVCKENWOOD ATLAS 4500 Static Sensitivity is -123.0 dBm at 5%BER, with a CS/N of 9.0 dB and a Cf/(ΣI +ΣN) of 18.7 dB

The Effective Receiver Multicoupler/TTA Gain (EMG) is factored at 0.0 dB

The Adjusted RX Static Sensitivity of the receiver is calculated:

- Adjusted RX Reference Sensitivity
- = Reference Sensitivity – EMG
- = -123.0 dBm – 0.0 dB = -123.0 dBm

- From the Adjusted RX Reference Sensitivity, the Uplink Faded Performance Threshold (FPT) can be calculated
- Uplink Faded Performance Threshold
- = Adjusted RX Reference Sensitivity – CS/N + Cf/(ΣI +ΣN)

Uplink Faded Performance Threshold = -123.0 dBm – 9.0 dB + 18.7 dB = -113.3 dBm

P25 TDMA Uplink Faded Performance Threshold is -113.3 dBm

While the Uplink, Faded Performance Threshold is appropriate for determining Mobile Talk-In/Talk-Back performance, to evaluate Portable performance it is necessary to include Body Loss (per TSB-88) and Building Penetration Loss with the design threshold value:

- Portable Talk-In/Talk-Back Design Threshold
- = Faded Performance Threshold + Body Loss (per TSB-88) + Building Penetration Loss
- Portable @ Hip Belt-Clip Design Threshold = -113.3 dBm + 13.2 dB + 0 dB = -100.1 dBm

System Design Target Values

The results of the link budget can be found in Figure 2.1-19.

Terminal Unit Operation	Talk-Out	Talk-In/Talk-Back
Mobile	-109.9 dBm	-114.5 dBm
Portable 5W @ Hip, Belt Clip, On-Street	-96.7 dBm	-100.1

Figure 2.1-19. UHF Design Target Values

A-1.2.1.2.10 Link Budget Balance

JVCKENWOOD utilizes link budget balancing to ensure both the Talk-Out and Talk-In/Talk-Back link provide the similar performance. Link balancing is typically performed in consideration of both the mobile and portable on-street links. Unless otherwise requested by the customer the balancing goal is to achieve < 3.0 dB imbalance for mobile and portable on-street operations (up-link to down-link).

A-1.2.1.2.11 UHF Most Likely Server for Focus Areas

A most likely server study was performed to identify which cell or multicast site was predicted to provide service to the area identified in **RFP #810131, Attachment B – Functional Specifications, Table 2 – Primary Areas for Radio Coverage** and shown in Figure 2.1-20.

Population Centers	
Santa Barbara Area	Santa Barbara Cell, Santa Ynez Cell
Santa Maria Area	Vandenberg Cell, Plowshare Cell
Santa Ynez Valley	Santa Ynez Cell
Los Alamos	Vandenberg Cell
Lompoc	Vandenberg Cell
Vandenberg Air Force Base and Village	Vandenberg Cell
Cuyama Valley, including Ventucopa	Ventucopa Cell
Casmalia	Vandenberg Cell

Figure 2.1-20. UHF Most Likely Server by Population Centers Focus Area

Highways	
Highway 101 through the County	Santa Barbara Cell, Santa Ynez Cell, Vandenberg Cell, Plowshare Cell, Gaviota Cell
Highway 1 through the County	Vandenberg Cell, Santa Ynez Cell, Santa Barbara Cell, Plowshare Cell, Gaviota Cell
Highway 166 from Santa Maria to Cuyama	Plowshare Cell, Ventucopa Cell
Hwy 154 from Los Olivos to Santa Barbara	Santa Barbara Cell, Santa Ynez Cell
Hwy 246 from Buellton to Lompoc	Santa Ynez Cell, Vandenberg Cell
Roads through the hills north of Santa Barbara and Montecito	Santa Barbara Cell, Santa Ynez Cell
Highway 33 south from Cuyama	Ventucopa Cell
Highway 1 and San Antonio Road (NE of Vandenberg AFB and SE of Casmalia)	Vandenberg Cell

Figure 2.1-21. UHF Most Likely Server by Highways Focus Area

Other	
Cachuma Lake County Park	Santa Ynez Cell
Jalama Beach	Gaviota Cell
Ocean Park (northwest of Lompoc)	Vandenberg Cell
Dunes west of Guadalupe	Plowshare Cell, Vandenburg Cell
South County coastline	Gaviota Cell

Figure 2.1-22. UHF Most Likely Server by Other Focus Area

A-1.2.1.3 Santa Barbara County Stand-Alone Equipment

JVCKENWOOD has included a replacement of the repeaters for the Stand-Alone sites identified in the RFP utilizing the frequencies currently deployed at the locations listed in Figure 2.1-23.

Site Name	*Latitude*	*Longitude*	*TX Mount*	*RX Mount*	*Frequency (UHF/800)*
Comm Ctr. /SB Jail	34.444	-119.777	25	25	800-Stand-Alone-Analog
SM Jail *DAS*	34.917	-120.492	15	15	800-Stand-Alone-Analog
SB Court	34.423	-119.700	20	20	UHF-Stand-Alone-Analog
Sheriff-3	34.411	-119.854	20	20	UHF-Stand-Alone-Analog
Sheriff-4	34.738	-120.446	100	100	UHF-Stand-Alone-Analog
Sheriff-8	34.526	-119.978	60	60	UHF-Stand-Alone-Analog
SM-Court	34.948	-120.432	40	40	UHF-Stand-Alone-Analog
SM-Juvenile-Hall	34.880	-120.446	20	20	UHF-Stand-Alone-Analog
Tajiguas	34.479	-120.132	20	20	UHF-Stand-Alone-Analog

Figure 2.1-23. Stand-Alone Site List

A-1.2.1.4 700/800 MHz P25 Solution

JVCKENWOOD developed an 700/800 MHz P25 Phase II simulcast solution following the philosophy dictated in **RFP #810131**, focusing on the in-building (12dB building loss factor) portable coverage for the urban areas of Santa Barbara, Santa Maria, and Santa Ynez identified in **RFP #810131, ATTACHMENT B – FUNCTIONAL SPECIFICATIONS, SECTION 1.6.1.I**. Sites were selected from the site candidate provided in the RFP and prioritized following the guidelines found in **RFP #810131, ATTACHMENT B – FUNCTIONAL SPECIFICATIONS, SECTION 1.5.B**. Refer to Figure 2.1-24.

Site Name	Site Lat	Site Long	Frequency Band	Configuration
Admin	34.425056	-119.703500	800 MHz	Simulcast (Santa Barbara Cell)
EOC	34.450560	-119.769770	800 MHz	Simulcast (Santa Barbara Cell)
La Cumbre Peak	34.500300	-119.721120	800 MHz	Simulcast (Santa Barbara Cell)
Valley Peak	33.998930	-119.683610	800 MHz	Simulcast (Santa Barbara Cell)
San Antonio	34.841970	-120.499170	800 MHz	Multicast (Santa Maria Cell)
Santa Ynez	34.526630	-119.978450	800 MHz	Multicast (Santa Ynez Cell)
Rincon	34.372860	-119.421060	800 MHz	Santa Barbara/Multicast Cell

Figure 2.1-24. 700/800 MHz Site List

A-1.2.1.4.1 Santa Barbara County 700/800 MHz P25 Solution

The 700/800 MHz P25 system is a 7-site solution intended to provide RF in-building portable coverage to the urban areas of Santa Barbara, Santa Maria, and Santa Ynez a designated by Santa Barbara County. The 7-site solution is comprised of one (1) simulcast cell and three (3) multicast sites. Each site is populated with five (5) ATLAS 4500 repeaters in combination with an antenna system designed specifically and optimized to the candidate site. JVCKENWOOD assumes the frequencies currently licensed by Santa Barbara County will be reused for the JVCKENWOOD solution.

A-1.2.1.4.2 Santa Barbara Area 700/800 MHz Cell Solution

The Santa Barbara Area is defined as the urban service area of Santa Barbara. The operational goal is to provide ≥95% In-12dB-Building service area coverage with a DAQ of 3.4.

JVCKENWOOD has developed an 700/800 MHz P25 Simulcast solution, bound by the parameters found in Section 3.4, for Santa Barbara County. The simulcast solution consists of five (5) sites, see Figure 2.1-25, each site populated with five (5) channels, in accordance with **RFP #810131**, and utilizes antenna systems which were designed to optimize the site performance.

The Santa Barbara Cell provides the required in-building service to the urban area of Santa Barbara.

Site Name	Site Lat	Site Long	Frequency Band	Cell
Admin	34.425056	-119.703500	800 MHz	Santa Barbara Cell
EOC	34.450560	-119.769770	800 MHz	Santa Barbara Cell

Site Name	Site Lat	Site Long	Frequency Band	Cell
La Cumbre Peak	34.500300	-119.721120	800 MHz	Santa Barbara Cell
Valley Peak	33.998930	-119.683610	800 MHz	Santa Barbara Cell
Rincon	34.372860	-119.421060	800 MHz	Santa Barbara Multicast Site

Figure 2.1-25. City of Santa Barbara 700/800 MHz Simulcast Cell Site List

A-1.2.1.4.3 Santa Maria Area 700/800 MHz Multicast Site Solution

The Santa Maria Area is defined as the urban service area of Santa Maria. The operational goal is to provide ≥ 95% service area coverage with a DAQ of 3.4. JVCKENWOOD has developed an 700/800 MHz P25 multicast solution, bound by the parameters found in Section A-1.2.2.4, for Santa Barbara County. The solution consists of one (1) site, see Figure 2.1-26 populated with five (5) channels, in accordance with **RFP #810131**, and utilizes antenna systems which were designed to optimize the site performance.

The Santa Maria site provides the required in-building service to the urban area of Santa Maria.

Site Name	Site Lat	Site Long	Frequency Band	Configuration
San Antonio	34.841970	-120.499170	800 MHz	Multicast Site (Santa Maria)

Figure 2.1-26. City of Santa Maria 700/800 MHz Simulcast Cell Site List

A-1.2.1.4.4 Santa Ynez Valley Area 700/800 MHz Multicast Site Solution

The Santa Ynez Area is defined as the urban service area of Santa Ynez. The operational goal is to provide ≥ 95% service area coverage with a DAQ of 3.4.

JVCKENWOOD has developed an 700/800 MHz P25 multicast solution. The solution consists of one (1) site, see Figure 2.1-27 populated with five (5) channels, in accordance with **RFP #810131**, and utilizes antenna systems which were designed to optimize the site performance.The Santa Ynez Cell provides the required in-building service to the urban area of Santa Ynez Area.

Site Name	Site Lat	Site Long	Frequency Band	Configuration
Santa Ynez	34.526630	-119.978450	800 MHz	Multicast Site (Santa Ynez)

Figure 2.1-27. City of Santa Ynez 700/800 MHz Simulcast Cell Site List

A-1.2.1.4.5 700/800 MHz Link Budget

JVCKENWOOD developed a link budget for the 700/800 MHz P25 solution to be provided to Santa Barbara County in consideration of the assumptions listed in Section A-1.2.1.4.5. The link budget was prepared in accordance with the calculations and methodologies provided in TSB-88.1-D and standard engineering practices.

A-1.2.1.4.5 700/800 MHz Link Budget Assumptions

- System Technology
  - P25 Phase II
  - Hybrid Configuration (Simulcast and Multicast)
- Frequency Band
  - 700/800 MHz
- Delivered Audio Quality
  - ≥ DAQ 3.4 (5% BER) for Talk-Out Portable On-Hip, On-Street operations
  - ≥ DAQ 3.4 (5% BER) for Talk-In/Talk-Back Portable @ Head, On-Street operations
  - ≥ DAQ 3.4 (5% BER) for Talk-Out and Talk-In/Talk-Back Portable SMA, On-Street operations
- UHF Portable Radio
  - ERP – 3 Watts (fixed)
  - On-Hip operations; Unity Gain Antenna at a height of 3 ft. AGL
    - Belt clip
  - At-Head operations; Unity Gain Antenna at a height of 6ft AGL
  - On-Shoulder operations; Unity Gain Antenna at a height of 5ft AGL
    - Shoulder Mounted Antenna (SMA)
- Body Loss
  - On-Hip = 10.8 dB Loss (Body Loss + Antenna Correction Factor)
- In-Building Loss
  - In-Building Loss = 12dB Loss
- Repeater: ATLAS 4500
  - Receive Specifications:
    - Digital – Reference Sensitivity (5% BER) = -123.0 dBm
  - Transmitter Specifications
- Output Power Max = 100 W (50 dBm)
  - Transmitter power balanced at combiner output respective to portable radio balanced link budget
  - Balance is respective to portable radio balanced link budget

- Antenna System
  - Combiner Loss (DSCC Series)
    - 5-channel Combiner Loss = 3.5 dB
  - Receive Multicoupler
    - Effective Receive Multicoupler Gain (EMG) = 2.29 dB
  - Transmit Antenna
    - Based on a balanced path with respect to portable on-street operations
  - Receive Antenna
    - Based on a balanced path with respect to portable on-street operations
  - Feedline
    - Transmit feedline
      - ⅞ inch coaxial cable – All sites mounting less than 100 feet
    - Receive feedline -
      - ⅞ inch coaxial cable – All sites mounting less than 100 feet

A-1.2.1.4.5 700/800 MHz Link Budget Calculations

Link budget is considered as limited by thermal noise, unless otherwise stated: noise, interferences or intermodulation situations are handled as an on-field risk and will be treated on a case-by-case basis during site deployment. The results of the Link Budget calculations are reflected in Figure 2.1-28.

All link budget calculations are performed in accordance with TSB-88 recommendations

Terminal Unit, Down-Link, Outdoors (Talk-Out)

A typical 700/800 MHz terminal unit has a RX Static Sensitivity @ 5%BER equal to -119.0 dBm.

For P25 TDMA, TSB-88.1-D, Annex A, Table A 1- Projected VCPC Parameters for Different DAQs, provide a Static Carrier to Noise Ratio @ 5%BER (CS/N) value of 7.3 dB and a Rayleigh faded Carrier to interferer and Noise ratio for a 2.4%BER or DAQ 3.4 (Cf/(ΣI +ΣN)) of 16.4 dB.

Downlink RX Faded Performance Threshold (FPT)

For P25 TDMA Downlink FPT = RX Static Sensitivity – CS/N + Cf/(ΣI +ΣN)

= -119.0 dBm – 7.3 dB + 16.4 dB = –109.9 dBm

P25 TDMA Downlink Faded Performance Threshold is –109.9 dBm

While the Downlink RX Faded Sensitivity is appropriate for determining Mobile Talk-Out performance, to evaluate Portable performance it is necessary to include Body Loss (per TSB-88) and Building Penetration Loss with the design threshold value:

Portable Talk-Out Design Threshold

= Downlink Faded Performance Threshold + Body Loss + Building Penetration Loss

Portable on Hip Design Threshold = -109.9 dBm + 10.3 dB + 12.0 dB = -86.2 dBm

Terminal Unit, Up-Link, Outdoors (Talk-In/Talk-Back)

The JVCKENWOOD ATLAS 4500 Static Sensitivity is -123.0 dBm at 5% BER, with a CS/N of 9.0 dB and a Cf/(ΣI +ΣN) of 18.7 dB

The Effective Receiver Multicoupler/TTA Gain (EMG) is factored at 2.29 dB

The Adjusted RX Static Sensitivity of the receiver is calculated:

Adjusted RX Reference Sensitivity

= Reference Sensitivity – EMG

= -123.0 dBm – 2.29 dB = -125.3 dBm

From the Adjusted RX Reference Sensitivity, the Uplink Faded Performance Threshold can be calculated

Uplink Faded Performance Threshold

= Adjusted RX Reference Sensitivity – CS/N + Cf/(ΣI +ΣN)

= -124.2 dBm – 9.0 dB + 18.7 dB = -115.6 dBm

P25 TDMA Uplink Faded Performance Threshold is -115.6 dBm

While the Uplink Faded Performance, Threshold is appropriate for determining Mobile Talk-In/Talk-Back performance, to evaluate Portable performance it is necessary to include Body Loss (per TSB-88) and Building Penetration Loss with the design threshold value:

Portable Talk-In/Talk-Back Design Threshold

= Faded Performance Threshold + Body Loss (per TSB-88) + Building Penetration Loss

Portable on Hip Design Threshold = -115.6 dBm + 10.3 dB + 12.0 dB = -93.3 dBm

System Design Target Values

The results of the link budget can be found in Figure 2.1-28.

Terminal Unit Operation	Talk-Out	Talk-In/Talk-Back
Portable 3W @ hip In-12dB-Building, Belt Clip	-87.6 dBm	-93.3 dBm

Figure 2.1-28. 700/800 MHz Design Target Values

A-1.2.1.4.5 Link Budget Balance

JVCKENWOOD utilizes link budget balancing to ensure both the Talk-Out and Talk-In/Talk-Back link provide the similar performance. Link balancing is typically performed in consideration of both the mobile and portable on-street links. Unless otherwise requested by the customer the balancing goal is to achieve < 3.0 dB imbalance for mobile and portable on-street operations (up-link to down-link).

A-1.2.1.5 Frequency Plan

JVCKENWOOD intends to use, to the fullest extent possible, the frequencies currently licensed by Santa Barbara County for the UHF, VHF and 700/800 system solutions. JVCKENWOOD will conduct frequency coordination and licensing tasks, in accordance with FCC regulations, TSB-88 recommendations, and standard engineering practices for Santa Barbara County.

A-1.2.2 RF Coverage

JVCKENWOOD has based the RF coverage predictions and antenna system design on TSB-88 recommendations and the requirements of Santa Barbara County. JVCKENWOOD created composite coverage projections for Santa Barbara County, California.

A-1.2.2.1 Coverage Requirements

The projected goals coverage for Santa Barbara County:

- VHF Conventional Mobile and Portable On-Street
  - ≥ 85% Talk-Out Service Area coverage with a DAQ of ≥ 3.4 within Urban Zones
  - ≥ 85% Talk-In/Talk-Back Service Area coverage with a DAQ of ≥ 3.4 within Urban Zones
  - ≥ 60% Talk-Out Service Area coverage with a DAQ of ≥ 3.4 within Rural Zones
  - ≥ 60% Talk-In/Talk-Back Service Area coverage with a DAQ of ≥ 3.4 within Rural Zones
- P25 Phase II UHF Mobile and Portable On-Street
  - ≥ 95% Talk-Out Service Area coverage with a DAQ of ≥ 3.4 within Urban Zones
  - ≥ 95% Talk-In/Talk-Back Service Area coverage with a DAQ of ≥ 3.4 within Urban Zones

- ➢ ≥ 65% Talk-Out Service Area coverage with a DAQ of ≥ 3.4 within Rural Zones
- ➢ ≥ 65% Talk-In/Talk-Back Service Area coverage with a DAQ of ≥ 3.4 within Rural Zones

- o P25 Phase II 700/800 MHz Mobile and Portable On-Street
  - ➢ ≥ 95% Talk-Out Service Area coverage with a DAQ of ≥ 3.4 within Urban Zones
  - ➢ ≥ 95% Talk-In/Talk-Back Service Area coverage with a DAQ of ≥ 3.4 within Urban Zones

A-1.2.2.2 Predicted Coverage Analysis Results

JVCKENWOOD has prepared an analysis of the predicted RF coverage calculated utilizing EDX SignalPro V9.1. The following results are representative of the actual coverage expected and are based on the design parameters contained within this document.

VHF Analysis Results Santa Barbara County, CA					
Mobile	Talk Out	Talk In	Portable On-Street, Belt-Clip Operation	Talk Out	Talk In
Countywide	≥ 60%	≥ 60%	Countywide	≥ 60%	≥ 60%
Portable On Hip Santa Barbara Area	Talk Out	Talk In	Portable On Hip VAFB Area	Talk Out	Talk In
Santa Barbara	≥ 85%	≥ 85%	Vandenberg Air Force Base	≥ 85%	≥ 85%
Goleta	≥ 85%	≥ 85%	Vandenberg Village	≥ 85%	≥ 85%
Montecito	≥ 85%	≥ 85%	Los Alamos	≥ 85%	≥ 85%
Carpinteria	≥ 85%	≥ 85%	Lompoc	≥ 85%	≥ 85%
Summerland	≥ 85%	≥ 85%	Casmalia	≥ 85%	≥ 85%
Isla Vista	≥ 85%	≥ 85%	Portable On Hip Cuyama Valley	Talk Out	Talk In
Portable On Hip Santa Maria Cell	Talk Out	Talk In	Cuyama	≥ 85%	≥ 85%
Santa Maria	≥ 85%	≥ 85%	Cuyama Valley	≥ 85%	≥ 85%
Guadalupe	≥ 85%	≥ 85%	New Cuyama	≥ 85%	≥ 85%
Orcutt	≥ 85%	≥ 85%	Ventucopa	≥ 85%	≥ 85%
Sisquo	≥ 85%	≥ 85%	Portable On Hip in Other Areas	Talk Out	Talk In
Portable On Hip Santa Ynez Valley	Talk Out	Talk In	Cachuma Lake County Park	≥ 85%	≥ 85%
Santa Ynez	≥ 85%	≥ 85%	Jalama Beach	≥ 85%	≥ 85%
Los Olivos	≥ 85%	≥ 85%	Ocean Park (northwest of Lompoc)	≥ 85%	≥ 85%
Buellton	≥ 85%	≥ 85%	Dunes west of Guadalupe	≥ 85%	≥ 85%
Solvang	≥ 85%	≥ 85%	South County coastline	≥ 85%	≥ 85%
Portable On Hip on Highways Identified	Talk Out	Talk In	Portable On Hip on Highways Identified	Talk Out	Talk In
Highway 101 through the County	≥ 60%	≥ 60%	Hwy 246 from Buellton to Lompoc	≥ 60%	≥ 60%
Highway 1 through the County	≥ 60%	≥ 60%	Roads through the hills north of Santa Barbara and Montecito	≥ 60%	≥ 60%
Highway 166 from Santa Maria to Cuyama	≥ 60%	≥ 60%	Highway 33 south from Cuyama	≥ 60%	≥ 60%
Hwy 154 from Los Olivos to Santa Barbara	≥ 60%	≥ 60%	Highway 1 and San Antonio Road (NE of Vandenberg AFB and SE of Casmalia)	≥ 60%	≥ 60%

Figure 2.2-1. Santa Barbara County – VHF-Conventional Coverage Analysis Results

UHF Analysis Results Santa Barbara County, CA					
Mobile	**Talk Out**	**Talk In**	**Portable On-Street, Belt-Clip Operation**	**Talk Out**	**Talk In**
Countywide	≥ 65%	≥ 65%	Countywide	≥ 65%	≥ 65%
Portable On Hip Santa Barbara Area	**Talk Out**	**Talk In**	**Portable On Hip VAFB Area**	**Talk Out**	**Talk In**
Santa Barbara	≥ 95%	≥ 95%	Vandenberg Air Force Base	≥ 95%	≥ 95%
Goleta	≥ 95%	≥ 95%	Vandenberg Village	≥ 95%	≥ 95%
Montecito	≥ 95%	≥ 95%	Los Alamos	≥ 95%	≥ 95%
Carpinteria	≥ 95%	≥ 95%	Lompoc	≥ 95%	≥ 95%
Summerland	≥ 95%	≥ 95%	Casmalia	≥ 95%	≥ 95%
Isla Vista	≥ 95%	≥ 95%	**Portable On Hip Cuyama Valley**	**Talk Out**	**Talk In**
Portable On Hip Santa Maria Cell	**Talk Out**	**Talk In**	Cuyama	≥ 95%	≥ 95%
Santa Maria	≥ 95%	≥ 95%	Cuyama Valley	≥ 95%	≥ 95%
Guadalupe	≥ 95%	≥ 95%	New Cuyama	≥ 95%	≥ 95%
Orcutt	≥ 95%	≥ 95%	Ventucopa	≥ 95%	≥ 95%
Sisquo	≥ 95%	≥ 95%	**Portable On Hip in Other Areas**	**Talk Out**	**Talk In**
Portable On Hip Santa Ynez Valley	**Talk Out**	**Talk In**	Cachuma Lake County Park	≥ 95%	≥ 95%
Santa Ynez	≥ 95%	≥ 95%	Jalama Beach	≥ 95%	≥ 95%
Los Olivos	≥ 95%	≥ 95%	Ocean Park (northwest of Lompoc)	≥ 95%	≥ 95%
Buellton	≥ 95%	≥ 95%	Dunes west of Guadalupe	≥ 95%	≥ 95%
Solvang	≥ 95%	≥ 95%	South County coastline	≥ 95%	≥ 95%
Portable On Hip on Highways Identified	**Talk Out**	**Talk In**	**Portable On Hip on Highways Identified**	**Talk Out**	**Talk In**
Highway 101 through the County	≥ 65%	≥ 65%	Hwy 246 from Buellton to Lompoc	≥ 65%	≥ 65%
Highway 1 through the County	≥ 65%	≥ 65%	Roads through the hills north of Santa Barbara and Montecito	≥ 65%	≥ 65%
Highway 166 from Santa Maria to Cuyama	≥ 65%	≥ 65%	Highway 33 south from Cuyama	≥ 65%	≥ 65%
Hwy 154 from Los Olivos to Santa Barbara	≥ 65%	≥ 65%	Highway 1 and San Antonio Road (NE of Vandenberg AFB and SE of Casmalia)	≥ 65%	≥ 65%

Figure 2.2-2. Santa Barbara County – UHF-P25-Phase II Coverage Analysis Results

800 Study Results Santa Barbara		
Portable In 12 dB Building @ Hip Belt Clip	TO	TI
Santa Barbara	≥ 95%	≥ 95%
Santa Maria	≥ 95%	≥ 95%
Santa Ynez	≥ 95%	≥ 95%

Figure 2.2-3. Santa Barbara County –800MHz-P25-Phase II Coverage Analysis Results

A-1.2.2.3 Propagation Study Area

JVCKENWOOD has provided computer generated radio coverage predictions for Santa Barbara County, California solution with the site locations, coverage boundary, and major thoroughfares clearly identified.

Figure 2.2-4. VHF Conventional Study Areas

Figure 2.2-5. UHF P25 Phase II Study Areas

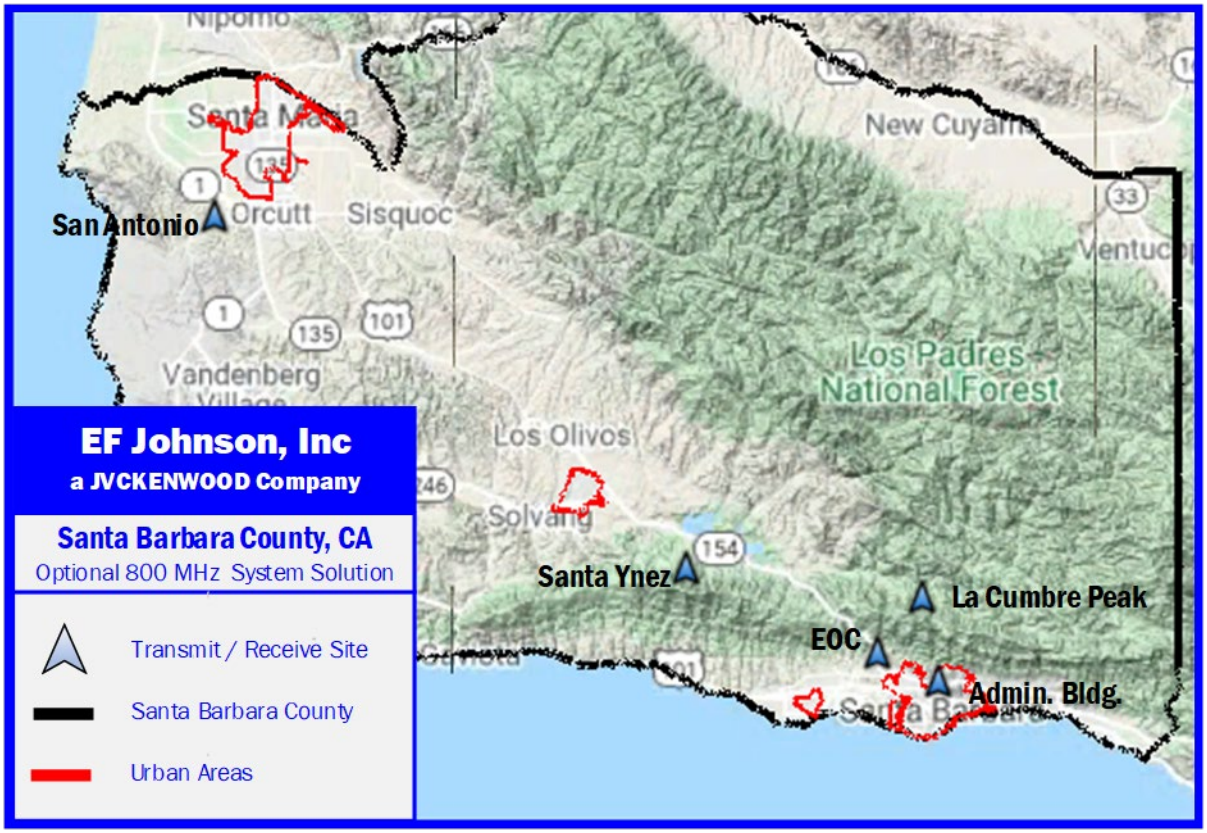


Figure 2.2-6. 700/800 MHz Study Areas

A-1.2.2.4 Coverage Design Parameters

The coverage predictions generated by JVCKENWOOD are bound to the RF design parameters shown in Figure 2.2-7 through Figure 2.2-11. Any changes to these parameters can affect system coverage performance of the system.

Transmit Antenna System																				
Site Name	Site Lat	Site Long	Frequency Band	TX Antenna	Horizonal Beamwidth	Qty	TX Mount	TX Rad Cntr	HTT	Gain (dBd)	Azmuth	Mech. Tilt	Elec. Tilt	PA Out / Channel	C/(I+N) (for 20dBS)	TX Feedline	Feedline Loss	Misc. Losses	Combiner Loss	ERP	Tx-Rx Imbalance	Delay Offset
Admin	34.425056	-119.703500	VHF	DS1F03P36U-D	360°	1	93.4'	99.7'	106.0'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	LDF4-50B	1.02 dB	0.70 dB	4.60 dB	46.26 dBm	0.01 dB	125 µS
Figueroa Mtn	34.743400	-119.984960	VHF	DS1F03P36U-D	360°	1	115.4'	121.7'	128.0'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	AVA5-50	1.02 dB	0.70 dB	4.60 dB	46.26 dBm	0.01 dB	2 µS
Fire Station 24	34.745230	-120.279800	VHF	DS1F03P36U-D	360°	1	210.4'	216.7'	223.0'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	AVA5-50	1.02 dB	0.70 dB	4.60 dB	46.26 dBm	0.01 dB	0 µS
Fire Station 41	34.943150	-119.676690	VHF	DS1F03P36U-D	360°	1	142.4'	148.7'	155.0'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	AVA5-50	1.50 dB	0.70 dB	4.60 dB	45.78 dBm	0.01 dB	0 µS
Gaviota	34.513680	-120.231160	VHF	DS1F03P36U-D	360°	1	32.4'	38.7'	45.0'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	LDF4-50B	1.50 dB	0.70 dB	4.60 dB	45.78 dBm	0.01 dB	0 µS
Harris Grade	34.738560	-120.445780	VHF	DS1F03P36U-D	360°	1	92.4'	98.7'	105.0'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	LDF4-50B	1.02 dB	0.70 dB	4.60 dB	46.26 dBm	0.01 dB	0 µS
Heritage Oil Platform	34.351670	-120.267780	VHF	SV227-SF2SNM	120°	1	117.0'	120.0'	123.0'	7.0 dB	0°	0°	0°	50.00 dBm	26.0 dB	AVA5-50	1.02 dB	0.70 dB	4.60 dB	50.68 dBm	0.07 dB	40 µS
La Cumbre Peak	34.500300	-119.721120	VHF	DS1F03P36U-D	360°	1	60.4'	66.7'	73.0'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	LDF4-50B	1.02 dB	0.70 dB	4.60 dB	46.26 dBm	0.01 dB	125 µS
Lompoc Civic Center	34.638150	-120.453190	VHF	DS1F03P36U-D	360°	1	38.7'	45.0'	51.3'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	LDF4-50B	1.02 dB	0.70 dB	4.60 dB	46.26 dBm	0.01 dB	0 µS
Mount Solomon	34.834750	-120.383190	VHF	DS1F03P36U-D	360°	1	92.4'	98.7'	105.0'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	LDF4-50B	1.02 dB	0.70 dB	4.60 dB	46.26 dBm	0.01 dB	0 µS
Oak Mtn-GATR	34.552060	-120.502380	VHF	DS1F03P36U-D	360°	1	22.0'	25.0'	28.0'	2.9 dB	0°	0°	0°	46.90 dBm	26.0 dB	LDF4-50B	0.30 dB	0.50 dB	4.60 dB	44.40 dBm	0.01 dB	0 µS
Plowshare	35.050060	-120.041020	VHF	DS1F03P36U-D	360°	1	70.4'	76.7'	83.0'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	LDF4-50B	1.00 dB	0.70 dB	4.60 dB	46.28 dBm	0.01 dB	0 µS
San Antonio	34.841970	-120.499170	VHF	DS1F03P36U-D	360°	1	42.4'	48.7'	55.0'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	LDF4-50B	1.02 dB	0.70 dB	4.60 dB	46.26 dBm	0.01 dB	0 µS
Santa Ynez	34.526630	-119.978450	VHF	DS1F03P36U-D	360°	1	45.7'	48.7'	51.7'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	LDF4-50B	1.02 dB	0.70 dB	4.60 dB	46.26 dBm	0.01 dB	5 µS
Tepusquet	34.915070	-120.182690	VHF	DS1F03P36U-D	360°	1	115.4'	121.7'	128.0'	2.9 dB	0°	0°	0°	49.68 dBm	26.0 dB	AVA5-50	1.00 dB	0.70 dB	4.60 dB	46.28 dBm	0.01 dB	0 µS
Valley Peak	33.998930	-119.683610	VHF	SV227-SF2SNM	120°	1	30.4'	36.7'	43.0'	7.0 dB	0°	0°	0°	50.00 dBm	26.0 dB	LDF4-50B	1.00 dB	0.70 dB	4.60 dB	50.70 dBm	0.07 dB	0 µS
Ventucopa	34.812642	-119.454548	VHF	DS1F03P36U-D	360°	1	18.7'	25.0'	31.3'	0.0 dB	0°	0°	0°	46.90 dBm	26.0 dB	LDF4-50B	0.30 dB	0.50 dB	4.60 dB	41.50 dBm	0.00 dB	10 µS
Rincon Add-On	34.372860	-119.421060	VHF	DS1F00F36U-D	360°	1	72.0'	76.1'	80.2'	0.0 dB	0°	0°	0°	47.00 dBm	26.0 dB	LDF4-50B	1.02 dB	0.70 dB	4.60 dB	40.58 dBm	0.01 dB	140 µS

Receive Antenna System																				
Site Name	Site Lat	Site Long	Frequency Band	RX Antenna	Horizonal Beamwidth	Qty	RX Mount	RX Rad Cntr	HTT	Gain	Azmuth	Mech. Tilt	Elec. Tilt	RXMC Model	Receive System Gain	Static Sensitivity	Receive Filter	Filter Loss	RX Feedline	Feedline Loss	C/(I+N) (for 20 dBS)	Misc. Losses
Admin	34.425056	-119.703500	VHF	DS1F06P36U-D	360°	1	93.4'	99.7'	106.0'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	1.02 dB	26.0 dB	0.20 dB
Figueroa Mtn	34.743400	-119.984960	VHF	DS1F06P36U-D	360°	1	107.0'	117.5'	128.0'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	AVA5-50	1.02 dB	26.0 dB	0.50 dB
Fire Station 24	34.745230	-120.279800	VHF	DS1F06P36U-D	360°	1	212.5'	212.5'	212.5'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	AVA5-50	1.02 dB	26.0 dB	0.20 dB
Fire Station 41	34.943150	-119.676690	VHF	DS1F06P36U-D	360°	1	139.0'	145.3'	151.6'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	AVA5-50	1.50 dB	26.0 dB	0.20 dB
Gaviota	34.513680	-120.231160	VHF	DS1F03P36U-D	360°	1	32.4'	34.5'	45.0'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	1.50 dB	26.0 dB	0.20 dB
Harris Grade	34.738560	-120.445780	VHF	DS1F06P36U-D	360°	1	84.0'	94.5'	105.0'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	1.02 dB	26.0 dB	0.20 dB
Heritage Oil Platform	34.351670	-120.267780	VHF	SV228-SF2SNM	90°	1	117.0'	120.0'	123.0'	10.0 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	AVA5-50	1.02 dB	26.0 dB	0.20 dB
La Cumbre Peak	34.500300	-119.721120	VHF	DS1F06P36U-D	360°	1	50.5'	61.0'	71.5'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	1.02 dB	26.0 dB	0.20 dB
Lompoc Civic Center	34.638150	-120.453190	VHF	DS1F06P36U-D	360°	1	38.5'	49.0'	59.5'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	1.02 dB	26.0 dB	0.20 dB
Mount Solomon	34.834750	-120.383190	VHF	DS1F06P36U-D	360°	1	84.0'	94.5'	105.0'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	1.02 dB	26.0 dB	0.20 dB
Oak Mtn-GATR	34.552060	-120.502380	VHF	DS1F03P36U-D	360°	1	39.5'	42.5'	45.5'	2.9 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	0.30 dB	26.0 dB	0.20 dB
Plowshare	35.050060	-120.041020	VHF	DS1F06P36U-D	360°	1	14.5'	25.0'	35.5'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	1.00 dB	26.0 dB	0.20 dB
San Antonio	34.841970	-120.499170	VHF	DS1F06P36U-D	360°	1	62.0'	72.5'	83.0'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	1.02 dB	26.0 dB	0.20 dB
Santa Ynez	34.526630	-119.978450	VHF	SV228-SF2SNM	360°	1	69.0'	72.0'	75.0'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	1.02 dB	26.0 dB	0.20 dB
Tepusquet	34.915070	-120.182690	VHF	DS1F06P36U-D	360°	1	34.0'	44.5'	55.0'	5.5 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	AVA5-50	1.00 dB	26.0 dB	0.20 dB
Valley Peak	33.998930	-119.683610	VHF	DS1F06P36U-D	90°	1	19.0'	29.5'	40.0'	10.0 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	1.00 dB	26.0 dB	0.20 dB
Ventucopa	34.812642	-119.454548	VHF	DS1F06P36U-D	360°	1	134.0'	144.5'	155.0'	0.0 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	0.30 dB	26.0 dB	0.20 dB
Rincon Add-On	34.372860	-119.421060	VHF	DS1F03F36U-D	360°	1	72.0'	78.3'	84.6'	3.0 dB	0°	0°	0°	DSRMC06	1.18 dB	-124.18 dBm	MWF1BU-N	2.50 dB	LDF4-50B	1.02 dB	26.0 dB	0.40 dB

Figure 2.2-7. Santa Barbara County VHF P25 Antenna System Parameters

Transmit Antenna System																				
Site Name	Site Lat	Site Long	Frequency	TX Antenna	Horizonal Beamwidth	Qty	TX Mount	TX Rad Cntr	HTT	Gain (dBd)	Azmth (deg)	Mech. Tilt	Elec. Tilt	PA Out / Channel	C/(I+N) (DAQ3.4.H-DQPSK)	TX Feedline	Feedline Loss	Misc. Losses	Combiner Loss	ERP	Tx-Rx Imbalance	Delay Offset
Admin	34.425056	-119.703500	UHF	DS4F06P36U-D	360°	1	97.9'	104.0'	110.2'	6.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	7/8" Foam	1.30 dB	0.75 dB	3.50 dB	50.45 dBm	0.20 dB	135 µS
Figueroa Mtn	34.743400	-119.984960	UHF	DS4F06P36U-D	360°	1	118.9'	125.0'	131.2'	6.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	7/8" Foam	1.07 dB	0.75 dB	3.50 dB	50.68 dBm	0.20 dB	35 µS
Fire Station 24	34.745230	-120.279800	UHF	DS4F08P36U-D	360°	1	199.3'	209.0'	218.8'	8.0 dB	0°	0°	0°	48.86 dBm	16.4 dB	1-1/4" Foam	1.26 dB	0.75 dB	3.50 dB	51.35 dBm	0.00 dB	30 µS
Fire Station 41	34.943150	-119.676690	UHF	DS4F06P36U-D	360°	1	148.9'	155.0'	161.2'	6.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	1-1/4" Foam	1.30 dB	0.75 dB	3.50 dB	50.45 dBm	0.20 dB	10 µS
Gaviota	34.513680	-120.231160	UHF	DS4F06P36D6D	360°	1 Upper	43.9'	50.0'	56.2'	6.0 dB	0°	0°	0°	48.06 dBm	16.4 dB	1/2" Foam	1.30 dB	0.75 dB	3.50 dB	48.51 dBm	0.02 dB	60 µS
Harris Grade	34.738560	-120.445780	UHF	DS4F08P36U-D	360°	1	90.3'	100.0'	109.8'	8.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	7/8" Foam	1.30 dB	0.75 dB	3.50 dB	52.45 dBm	0.20 dB	0 µS
Heritage Oil Platform	34.351670	-120.267780	UHF	SV227-SF2SNM	120°	1	95.0'	97.0'	99.0'	9.5 dB	0°	0°	0°	48.06 dBm	16.4 dB	7/8" Foam	1.30 dB	0.75 dB	3.50 dB	52.01 dBm	0.02 dB	0 µS
La Cumbre Peak	34.500300	-119.721120	UHF	DS4F08P36U-D	360°	1	69.3'	79.0'	88.8'	8.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	7/8" foam	1.70 dB	0.75 dB	3.50 dB	52.05 dBm	0.20 dB	145 µS
Lompoc Civic Center	34.638150	-120.453190	UHF	DS4F08P36U-D	360°	1	32.3'	42.0'	51.8'	8.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	1/2" Foam	1.30 dB	0.75 dB	3.50 dB	52.45 dBm	0.20 dB	15 µS
Mount Solomon	34.834750	-120.383190	UHF	DS4F06P36U-D	360°	1	98.9'	105.0'	111.2'	6.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	7/8" Foam	1.30 dB	0.75 dB	3.50 dB	50.45 dBm	0.20 dB	0 µS
Oak Mtn-GATR	34.552060	-120.502380	UHF	DS4F03P36D6D	360°	1 Upper	15.3'	25.0'	34.7'	3.0 dB	0°	0°	0°	45.68 dBm	16.4 dB	1/2" Foam	0.80 dB	0.75 dB	3.50 dB	43.63 dBm	0.00 dB	15 µS
Plowshare	35.050060	-120.041020	UHF	DS4F08P36U-D	360°	1	75.3'	85.0'	94.8'	8.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	1-1/4" foam	1.30 dB	0.75 dB	3.50 dB	52.45 dBm	0.20 dB	0 µS
San Antonio	34.841970	-120.499170	UHF	DS4F08P36U-D	360°	1	47.3'	57.0'	66.8'	8.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	1/2" Foam	1.30 dB	0.75 dB	3.50 dB	52.45 dBm	0.20 dB	0 µS
Santa Ynez	34.526630	-119.978450	UHF	DS4F06P36U-D	360°	1	28.9'	35.0'	41.2'	6.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	1/2" Foam	1.30 dB	0.75 dB	3.50 dB	50.45 dBm	0.20 dB	25 µS
Sudden	34.566250	-120.500060	UHF	DS4F08P36U-D	360°	1	140.3'	150.0'	159.8'	8.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	1-1/4" foam	1.60 dB	0.75 dB	3.50 dB	52.15 dBm	0.20 dB	15 µS
Tepusquet	34.915070	-120.182690	UHF	DS4F06P36U-D	360°	1	113.9'	120.0'	126.2'	6.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	1-1/4" foam	1.42 dB	0.75 dB	3.50 dB	50.33 dBm	0.20 dB	20 µS
Valley Peak	33.998930	-119.683610	UHF	DS4E06P18U-N	180°	1	52.8'	56.0'	59.2'	6.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	1/2" Foam	1.39 dB	0.65 dB	3.50 dB	50.46 dBm	0.20 dB	0 µS
Ventucopa	34.822066	-119.465913	UHF	DS4C00CS36DN	360°	1 Upper	22.0'	25.0'	28.3'	0.0 dB	0°	0°	0°	50.00 dBm	16.4 dB	1/2" Foam	1.20 dB	0.90 dB	3.50 dB	44.40 dBm	0.20 dB	27 µS
Rincon Add-On	34.372860	-119.421060	UHF	DS4C00F36U-D	360°	1	90.0'	91.4'	92.8'	0.0 dB	0°	0°	0°	47.00 dBm	16.4 dB	7/8" Foam	1.30 dB	0.75 dB	3.50 dB	41.45 dBm	0.20 dB	110 µS

Figure 2.2-8. Santa Barbara County UHF P25 Phase II Transmit Antenna System Parameters

Receive Antenna System																				
Site Name	Site Lat	Site Long	Frequency	RX Antenna	Horizonal Beamwidth	Qty	RX Mount	RX Rad Cntr	HTT	Gain	Azmth	Mech. Tilt	Elec. Tilt	TTA	PDU	EMTG (Effective System Gain)	Static Sensitivity	RX Feedline	Feedline Loss	C/(I+N) (DAQ3.4.H-CPM)	Misc. Losses
Admin	34.425056	-119.703500	UHF	DS4F08P36U-D	360°	1	94.3'	104.0'	113.8'	10.0 dB	0°	0°	0°	None	DSRMC06	1.76 dB	-124.76 dBm	7/8" Foam	1.30 dB	18.7 dB	0.60 dB
Figueroa Mtn	34.743400	-119.984960	UHF	DS4F08P36U-D	360°	1	108.5'	118.3'	128.0'	8.0 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-121.92 dBm	7/8" Foam	1.07 dB	18.7 dB	0.20 dB
Fire Station 24	34.745230	-120.279800	UHF	DS4C10F36U-D	360°	1	197.0'	209.0'	221.0'	8.0 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-121.92 dBm	1-1/4" Foam	1.26 dB	18.7 dB	0.20 dB
Fire Station 41	34.943150	-119.676690	UHF	DS4F08P36U-D	360°	1	135.5'	145.3'	155.0'	8.0 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-121.92 dBm	1-1/4" Foam	1.30 dB	18.7 dB	0.20 dB
Gaviota	34.513680	-120.231160	UHF	DS4F06P36D6D	360°	1 Lower	43.9'	38.9'	56.2'	6.0 dB	0°	0°	0°	None	DSRMC06	1.76 dB	-124.76 dBm	1/2" Foam	1.30 dB	18.7 dB	0.60 dB
Harris Grade	34.738560	-120.445780	UHF	DS4C10F36U-D	360°	1	81.0'	93.0'	105.0'	10.0 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-121.92 dBm	7/8" Foam	1.30 dB	18.7 dB	0.20 dB
Heritage Oil Platform	34.351670	-120.267780	UHF	SV228-SF2SNM	90°	1	117.0'	120.0'	123.0'	9.5 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-121.92 dBm	7/8" Foam	1.30 dB	18.7 dB	0.20 dB
La Cumbre Peak	34.500300	-119.721120	UHF	DS4C10F36U-D	360°	1	49.0'	61.0'	73.0'	10.0 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-121.92 dBm	7/8" foam	1.70 dB	18.7 dB	0.20 dB
Lompoc Civic Center	34.638150	-120.453190	UHF	DS4C10F36U-D	360°	1	30.0'	42.0'	52.0'	10.0 dB	0°	0°	0°	None	DSRMC06	1.76 dB	-124.76 dBm	1/2" Foam	1.30 dB	18.7 dB	0.60 dB
Mount Solomon	34.834750	-120.383190	UHF	DS4F08P36U-D	360°	1	85.5'	95.3'	105.0'	8.0 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-121.92 dBm	7/8" Foam	1.30 dB	18.7 dB	0.20 dB
Oak Mtn-GATR	34.552060	-120.502380	UHF	DS4F03P36D6D	360°	1 Lower	75.3'	25.0'	94.8'	3.0 dB	0°	0°	0°	None	DSRMC06	1.76 dB	-124.76 dBm	1/2" Foam	0.80 dB	18.7 dB	0.60 dB
Plowshare	35.050060	-120.041020	UHF	DS4C10F36U-D	360°	1	59.0'	71.0'	83.0'	10.0 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-125.25 dBm	1-1/4" foam	1.30 dB	18.7 dB	0.20 dB
San Antonio	34.841970	-120.499170	UHF	DS4C10F36U-D	360°	1	31.0'	43.0'	55.0'	10.0 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-125.25 dBm	1/2" Foam	1.30 dB	18.7 dB	0.20 dB
Santa Ynez	34.526630	-119.978450	UHF	DS4F08P36U-D	360°	1	25.3'	35.0'	35.0'	8.0 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-125.25 dBm	1/2" Foam	1.30 dB	18.7 dB	0.20 dB
Sudden	34.566250	-120.500060	UHF	DS4C10F36U-D	360°	1	131.0'	143.0'	155.0'	8.0 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-125.25 dBm	1-1/4" Foam	1.60 dB	18.7 dB	0.20 dB
Tepusquet	34.915070	-120.182690	UHF	DS4F08P36U-D	360°	1	110.3'	120.0'	129.8'	8.0 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-125.25 dBm	1-1/4" Foam	1.42 dB	18.7 dB	0.20 dB
Valley Peak	33.998930	-119.683610	UHF	DS4E10P12U-D	120°	1	50.0'	53.0'	56.0'	9.2 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-125.25 dBm	1/2" Foam	1.39 dB	18.7 dB	0.20 dB
Ventucopa	34.822066	-119.465913	UHF	DS4C00CS36DN	360°	1 Lower	22.0'	25.0'	28.0'	0.0 dB	0°	0°	0°	None	DSRMC06	1.76 dB	-124.76 dBm	1/2" Foam	1.20 dB	18.7 dB	0.60 dB
Rincon Add-On	34.372860	-119.421060	UHF	DS4C03F36U-N	360°	1	95.0'	99.0'	103.0'	3.0 dB	0°	0°	0°	ATS4TMA	DBSMCP	-1.08 dB	-125.25 dB	7/8" Foam	1.30 dB	18.7 dB	0.20 dB

Figure 2.2-9. Santa Barbara County UHF P25 Phase II Receive Antenna System Parameters

Transmit Antenna System																					
Site Name	Site Lat	Site Long	Frequency Band	TX Antenna	Horizonal Beamwidth	Qty	TX Mount	TX Rad Cntr	HTT	Gain (dBd)	Azmuth	Mech. Tilt	Elec. Tilt	PA Out / Channel	Cf/(I+N) (DAQ3.4,H-DQPSK)	TX Feedline	Feedline Loss	Misc. Losses	Combiner	Combiner Loss	ERP	Tx-Rx Imbalance	Delay Offset
Admin	34.425056	-119.703500	700/800 MHz	DS8A12F36U-D	360°	1	64.0'	75.0'	86.0'	12.0 dBd	0°	0°	0°	50.00 dBm	16.4 dB	7/8" Foam	1.37 dB	0.90 dB	DSCC Series	3.50 dB	56.23 dBm	0.20 dB	135 µS
EOC	34.450560	-119.769770	700/800 MHz	DS7A12P90U-D	90°	1	39.0'	42.0'	45.0'	12.0 dBd	90°	0°	0°	50.00 dBm	16.4 dB	7/8" Foam	1.37 dB	0.90 dB	DSCC Series	3.50 dB	56.23 dBm	0.20 dB	140 µS
La Cumbre Peak	34.500300	-119.721120	700/800 MHz	DS7A12P90U-D	90°	1	63.7'	66.7'	69.7'	12.0 dBd	162°	0°	0°	50.00 dBm	16.4 dB	7/8" Foam	1.37 dB	0.90 dB	DSCC Series	3.50 dB	56.23 dBm	0.00 dB	145 µS
San Antonio	34.841970	-120.499170	700/800 MHz	DS8A06F36U-D	360°	1	44.7'	48.7'	52.7'	6.0 dBd	0°	0°	0°	50.00 dBm	16.4 dB	7/8" Foam	1.37 dB	0.90 dB	DSCC Series	3.50 dB	50.23 dBm	0.20 dB	0 µS
Santa Ynez	34.526630	-119.978450	700/800 MHz	DS8A06F36U-D	360°	1	44.7'	48.7'	52.7'	6.0 dBd	0°	0°	0°	50.00 dBm	16.4 dB	7/8" Foam	1.37 dB	0.90 dB	DSCC Series	3.50 dB	50.23 dBm	0.02 dB	5 µS
Valley Peak	33.998930	-119.683610	700/800 MHz	DS7A12P90U-D	90°	1	33.7'	36.7'	39.7'	12.0 dBd	0°	0°	0°	46.13 dBm	16.4 dB	7/8" Foam	1.37 dB	0.90 dB	DSCC Series	3.50 dB	52.36 dBm	0.20 dB	0 µS
Rincon	34.372860	-119.421060	700/800 MHz	DS7A12P90U-D	90°	1	72.0'	74.5'	77.0'	12.0 dBd	288°	0°	0°	46.90 dBm	16.4 dB	7/8" Foam	1.37 dB	0.90 dB	DSCC Series	3.50 dB	53.13 dBm	0.00 dB	N/A

Figure 2.2-10. Santa Barbara County 700/800MHz P25 Phase II Transmit Antenna Parameters

Receive Antenna System																				
Site Name	Site Lat	Site Long	Frequency Band	RX Antenna	Horizonal Beamwidth	Qty	RX Mount	RX Rad Cntr	HTT	Gain	Azmuth	Mech. Tilt	Elec. Tilt	TTA	PDU	EMTG (Effective System Gain)	Static Sensitivity	RX Feedline	Feedline Loss	C/(I+N) (DAQ3.4 H-CPM)	Misc. Losses
Admin	34.425056	-119.703500	700/800 MHz	DS8A12F36U-D	360°	1	64.0'	75.0'	86.0'	12.0 dB	0°	0°	0°	DS7TMA17C	DSX7PDU	2.31 dB	-125.31 dBm	7/8" Foam	1.37 dB	18.7 dB	0.10 dB
EOC	34.450560	-119.769770	700/800 MHz	DS7A12P90U-D	90°	1	39.0'	42.0'	45.0'	12.0 dB	90°	0°	0°	DS7TMA17C	DSX7PDU	2.31 dB	-125.31 dBm	7/8" Foam	1.37 dB	18.7 dB	0.10 dB
La Cumbre Peak	34.500300	-119.721120	700/800 MHz	DS7A12P90U-D	90°	1	58.0'	61.0'	64.0'	12.0 dB	162°	0°	0°	DS7TMA17C	DSX7PDU	2.31 dB	-125.31 dBm	7/8" Foam	1.37 dB	18.7 dB	0.10 dB
San Antonio	34.841970	-120.499170	700/800 MHz	DS7C10F36U-D	360°	1	37.5'	44.5'	52.0'	10.0 dB	0°	0°	0°	DS7TMA17C	DSX7PDU	2.31 dB	-125.31 dBm	7/8" Foam	1.37 dB	18.7 dB	0.10 dB
Santa Ynez	34.526630	-119.978450	700/800 MHz	DS7C10F36U-D	360°	1	37.5'	44.5'	52.0'	10.0 dB	0°	0°	0°	DS7TMA17C	DSX7PDU	2.31 dB	-125.31 dBm	7/8" Foam	1.37 dB	18.7 dB	0.10 dB
Valley Peak	33.998930	-119.683610	700/800 MHz	DS7A12P90U-D	90°	1	29.5'	32.5'	35.5'	12.0 dB	0°	0°	0°	DS7TMA17C	DSX7PDU	2.31 dB	-125.31 dBm	7/8" Foam	1.37 dB	18.7 dB	0.10 dB
Rincon	34.372860	-119.421060	700/800 MHz	DS7A12P90U-D	90°	1	72.0'	74.5'	77.0'	12.0 dB	288°	0°	0°	DS7TMA17C	DSX7PDU	2.31 dB	-125.31 dBm	7/8" Foam	1.37 dB	18.7 dB	0.10 dB

Figure 2.2-11. Santa Barbara County 700/800MHz P25 Phase II Receive Antenna Parameters

A-1.2.2.5 Model Parameters

JVCKENWOOD, RF Engineering employed EDX SignalPro V9.1.4.24445 to calculate the predicted RF coverage for Santa Barbara County, California hybrid solution utilizing the Anderson 2D propagation model. Anderson 2D is a deterministic study model considered to be an industry standard and recommended by the Telecommunications Industry Association (TIA). Refer to Figure 2.2-12 for the modeling parameters used during the coverage analysis.

Modeling Parameters		
Propagation Study Tool	EDX SignalPro 9.1.4.24445	
Propagation Model	Anderson 2D	
Diffraction Mode	Epstein - Peterson	
Simulcast Capture Ratio	12.0 dB	
Max Simulcast Delay Spread, LSM	65 µS	
Terrain	EGS Technologies, 1 Arc-sec Terrain: CONUS	Published June 5, 2015
Land Use	EGS Technologies, 1 Arc-sec Clutter: Eastern CONUS	Published June 5, 2015

Figure 2.2-12. Santa Barbara County Coverage Model Parameters

A-1.2.2.6 Land Use Definition

JVCKENWOOD utilized land use and clutter absorption data for the Santa Barbara County, California coverage studies. Refer to Table Figure 2.2-13 and Figure 2.2-14.

EDX Land Use Attribute Definition					
#	Clutter Type (Defined)	Height (ft.)	Traffic	Faded Std. Dev.	Multipath
1	'Open Water'	0	0	5.6	1
2	'Perennial Ice/Snow'	0	0	5.6	1
3	'Developed Open Space'	9.8	0	5.6	1
4	'Developed Low Intensity'	16.4	0	5.6	2
5	'Developed Medium Intensity'	26.2	0	5.6	2
6	'Developed High Intensity'	39.4	0	5.6	3
7	'Bare Rock/Sand/Clay'	0	0	5.6	1
8	'Deciduous Forest'	49.2	0	5.6	1
9	'Evergreen Forest'	49.2	0	5.6	1
10	'Mixed Forest'	49.2	0	5.6	1
11	'Dwarf Scrub'	0.7	0	5.6	1
12	'Shrub/Scrub'	16.4	0	5.6	1
13	'Grassland/Herbaceous'	0	0	5.6	1
14	'Sedge/Herbaceous'	0	0	5.6	1
15	'Lichens'	0	0	5.6	1
16	'Moss'	0	0	5.6	1
17	'Pasture/Hay'	1.6	0	5.6	1
18	'Cultivated Crops'	3.3	0	5.6	1
19	'Woody Wetlands'	16.4	0	5.6	1
20	'Emergent Herbaceous Wetlands'	6.6	0	5.6	1

Figure 2.2-13. Land Use Definitions

Clutter Absorption Loss (dB) for Frequency (MHz)								
Clutter Type	40	150	220	450	850	2400	5000	10000
1	1	3	3	3	5	8	12	15
2	1	3	3	3	5	8	12	15
3	1	3	3	3	5	8	12	15
4	3	14	15	16	20	23	25	25
5	4	15	16	17	21	24	26	26
6	4	16	17	18	22	25	27	27
7	1	3	3	3	5	8	12	15
8	3	8	9	12	25	25	25	25
9	3	8	9	12	25	25	25	25
10	3	8	9	12	25	25	25	25
11	1	3	3	3	5	8	12	15
12	1	3	3	3	5	8	12	15
13	1	3	3	3	5	8	12	15
14	1	3	3	3	5	8	12	15
15	1	3	3	3	5	8	12	15
16	1	3	3	3	5	8	12	15
17	2	3	3	4	18	20	20	20
18	2	3	3	4	18	20	20	20
19	3	8	9	12	25	25	25	25
20	1	3	3	3	3	5	10	12

Figure 2.2-14. Clutter Absorption Loss by Frequency

A-1.2.2.7 Coverage Confidence Estimation

EDX SignalPro uses three elements as a measure of RF Coverage Confidence, defined below. These elements are area, location, and time.

- Area Calculations: TSB-88 demonstrates this element as either Area Covered or Geographic Area Percentage Covered (GAPC). JVCKENWOOD design and this report use the Geographic Area Covered method. This method utilizes the accumulation of 30 meters bins (within the defined polygon) that meet or exceed the link budget design values per bin and any related time and location confidence values as described below to determine the predicted coverage percentage
- Percentage of Time, based on the amount of signal fades, over time, in any given location based on the velocity (stopped, slow, and fast) of the terminal unit. TSB-88 refers to this element as Digital Audio Quality or DAQ. A DAQ of 3.4 (or equivalent measurement of a Bit Error Rate of 2.4%) yields a 16.4 dB design fade margin for the Talk-Out talk path and 18.7 dB design fade margin for the Talk-In/Talk-Back talk path.

- Percentage of Location, characterized with 50% location viability, this Percentage of Location value translates to a 10-dB margin thus ensuring a 30-m^2 bin reliability of ≥ 95% assuming an 8 dB or better model standard deviation. To achieve a 97% bin reliability TSB-88 recommends an additional 1.88 dB deviant added to the standard deviation.

JVCKENWOOD has applied a 5.3-dB design margin to the EDX SignalPro Anderson 2D study parameters to accommodate a reliability of ≥ 95%.

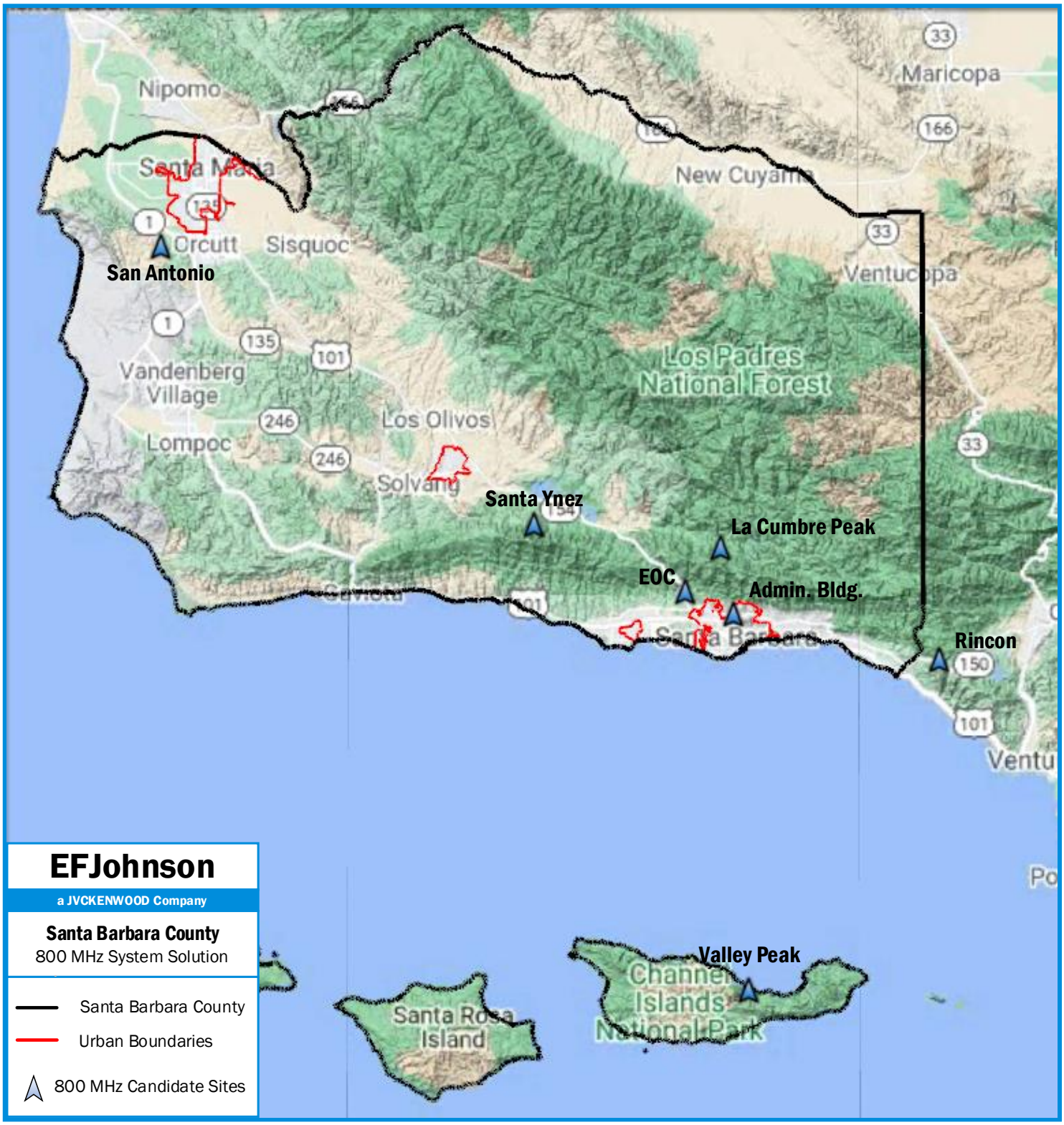
A-1.2.2.8 Simulcast Time Delay Interference

In a simulcast system there is a potential for self-interference referred to as Time Delay Interference (TDI) or as Inter-Symbol Interference (ISI). TDI is mitigated adjustment of offset delays, antenna pattern tilting, sectorization of the transmit antenna, and radiated power adjustments. During the design phase of the Santa Barbara solution, JVCKENWOOD performed adjustments to the antenna system to mitigate TDI. While these adjustments typically produce the desired results prior to system testing, an Optimization Phase is included in the event fine-tuning of the system performance is required.

The Simulcast offset delay values assigned to each site are located in Figure 2.2-7 for the VHF Conventional solution, Figure 2.2-7 for the UHF P25 Phase II solution, and Figure 2.2-10 and Figure 2.2-11 for the 700/800 MHz solution.

A-1.2.2.9 Consolidated Coverage Maps

The coverage maps showing the composite coverage for the VHF Conventional, UHF P25 Phase II, and 700/800 MHz system solutions are attached to this RF Design Narrative. These maps represent the normal operating mode of the system and represent the expected day-to-day performance of the system. JVCKENWOODS's RF Engineering utilized the EDX SignalPro prediction tool to design the RF coverage.


Nipomo
Santa Maria
Orcutt
Sisquoc
San Antonio
Vandenberg Village
Lompoc
Los Olivos
Solvang
Santa Ynez
New Cuyama
Maricopa
Ventucopa
Los Padres National Forest
La Cumbre Peak
EOC
Admin. Bldg.
Santa Barbara
Rincon
Ventu
Valley Peak
Channel Islands National Park
Santa Rosa Island
EFJohnson
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Santa Barbara County
800 MHz System Solution
Santa Barbara County
Urban Boundaries
800 MHz Candidate Sites