

Meeting Date
12/1/15



AGENDA	
Section	Consent
Item No.	II.C.2

**AGENDA REPORT**  
**BREVARD COUNTY BOARD OF COUNTY COMMISSIONERS**

<b>SUBJECT:</b>	Permission to issue a Request for Proposal (RFP) and negotiate competitive agreements to select a qualified vendor to design and provision a backhaul connectivity solution to support the Brevard County 800 MHz Public Safety Radio System.
<b>DEPT/OFFICE:</b>	Central Services/Purchasing & Emergency Management

**Requested Action:**

It is requested that the Board of County Commissioners grant Purchasing and Emergency Management approval to perform the following actions:

1. Solicit competitive proposals to design and provision a backhaul connectivity solution to support the Brevard County 800 MHz Public Safety Radio System;
2. Establish a selection/negotiation committee approved by the County Manager or designee and award contract to the best-ranked proposer;
3. Utilize the \$12.50 surcharge fund, established in 1993 to provide funding for improvements for the Countywide Intergovernmental Radio System, for the backbone implementation.

It is also requested that the Board authorize the County Manager or designee to:

- a) Execute the contract, subject to approval by the County Attorney's Office & Risk Management.

**Summary Explanation & Background:**

**HISTORY & CURRENT SITUATION:** As part of the Public Safety 800 MHz Radio System, Emergency Management operates and maintains seven radio frequency (RF) sites and two radio network switches at different county-wide locations. All nine locations are currently linked through a backbone network, via 21 T-1 circuits over an AT&T SONET Ring and two County-owned microwave hops. Another two RF sites will be added in the near future to the radio network, increasing the number of locations to be connected from nine to eleven.

In determining the transition path from the current backhaul service (T-1 circuits) to a cost-effective solution capable of supporting the current analog radio system and the next generation of digital communication, Emergency Management was directed to test and validate with Bright House and AT&T the implementation of T-1 circuits emulation services over Ethernet (CESoE), see attached inter-office memo to County Manager. Both companies presented their proposal to Emergency Management tied to a 36 month contract with termination provisions. The County Attorney's Office has advised Emergency Management not to sign contracts for testing with either Bright House or AT&T, and instead issue a RFP with a proviso to include proof of successful testing for the vendor's solution.

**COST/BENEFIT ANALYSIS:** The existing cost of the Synchronous Optical Networking (SONET) services that support the Emergency Management 800 MHz T-1 circuits is \$26,074.50 per month, paid from General Fund and associated agencies of the Brevard County Board of County Commissioners. The migration of the 800 MHz radio system circuits to a standalone network solution will reduce the financial responsibilities from Brevard County agencies/departments to 21% of any recurring costs, expected to be less than current costs.

**FISCAL IMPACT:** Implementation costs will come from the \$12.50 Surcharge, limited by Section 316.655(6), Florida Statutes, to fund intergovernmental radio communication programs. Any recurring costs, which are expected to be reduced from current costs, will be shared between all the agencies/municipalities that use the countywide radio system; County departments represent 21% of the total system users.

Contact: Teresa Camarata, Central Services Director, 321-637-5492, [Teresa.camarata@brevardcounty.us](mailto:Teresa.camarata@brevardcounty.us)  
 Kimberly Prosser, Emergency Management Director, 321-637-6670, [Kimberly.prosser@brevardcounty.us](mailto:Kimberly.prosser@brevardcounty.us)

**Clerk to the Board Instructions:** Send Clerk Memorandum to Emergency Management along with one set of copies, please.

Exhibits Attached: Inter-Office Memo to County Manager dated April 14, 2015

<b>Contract /Agreement (If attached):</b>		<b>Reviewed by County Attorney</b>	Yes <input type="checkbox"/>	No <input type="checkbox"/>	PR <input type="checkbox"/>
County Manager	Assistant County Manager	Department Director / Extension Teresa Camarata, Central Serv. Director, ext. 55492 Kimberly Prosser Kimberly Prosser, Emergency Mgt. Director, ext. 56670			
Stockton Whitten	Frank Abbate				



Tammy Etheridge, Clerk to the Board, 400 South Street • P.O. Box 999, Titusville, Florida 32781-0999

Telephone: (321) 637-2001  
Fax: (321) 264-6972

December 2, 2015

MEMORANDUM

TO: Teresa Camarata, Central Services Director

RE: Item II.C.2., Permission to Issue a Request for Proposal (RFP) and Negotiate Competitive Agreements to Select a Qualified Vendor to Design and Provision a Backhaul Connectivity Solution to Support the Brevard County 800 MHz Public Safety Radio System

The Board of County Commissioners, in regular session on December 1, 2015, granted permission for Purchasing and Emergency Management to solicit competitive proposals to design and provision a backhaul connectivity solution to support the Brevard County 800 MHz Public Safety Radio System, and establish a negotiation committee approved by the County Manager or designee and award contract to the best-ranked proposer, and utilize the \$12.50 surcharge fund for the backbone implementation; and authorized the County Manager or designee to execute the contract, subject to approval by the County Attorney's Office and Risk Management.

Your continued cooperation is always appreciated.

Sincerely,

BOARD OF COUNTY COMMISSIONERS  
SCOTT ELLIS, CLERK

Tammy Etheridge, Deputy Clerk

/af

cc: Emergency Management  
County Manager  
Finance  
Budget



Emergency Management  
1746 Cedar Street  
Rockledge, Florida 32955

BOARD OF COUNTY COMMISSIONERS

## Inter-Office Memo

TO: Stockton Whitten, County Manager

FROM: Jon Sellers, Information Technology Director *JS*  
Kimberly Prosser, Emergency Management Director *Kimberly Prosser*

SUBJ: Migration from AT&T's SONET Ring

DATE: April 14, 2015

As previously discussed in person and via memo and project charter, the County's move from AT&T's SONET Ring to a BrightHouse Ethernet solution for network connectivity is, while cost-effective and robust for internet services, not currently viable for use by the 800 MHz public safety radio system.

Because the radio system is a circuit-switched system, not internet protocol, it needs serial connections over T1's or microwave/SONET DSO's for system functionality and reliability between all of the radio sites. According to Harris Corporation's radio system engineers, it will not function properly on an Ethernet-based system. However, AT&T and BrightHouse engineers believe that they can provide system functionality and reliability through their Ethernet-based systems.

Therefore, our recommendation is that the Emergency Management department work with AT&T and BrightHouse to test these connectivity solutions for the radio system, while the Information Technology department maintains the AT&T SONET Ring in its current form. The results of those tests will then determine the next steps.

*Stockton E. Whitten 4/14/15*  
Stockton Whitten, Brevard County Manager

RECEIVED  
APR 15 2015  
County Manager's Office

# COUNTY MANAGER

## CONTRACT INFORMATION FORM

### BREVARD COUNTY BOARD OF COUNTY COMMISSIONERS

CONTRACTOR	Communications International, Inc.	USER AGENCY	Emergency Management
ADDRESS	4450 Highway US 1	CONTACT NAME	EXT. # 5-6670
	Vero Beach, FL 32967	Kimberly Prosser, Director	
	Vendor ID #004110	# OF COPIES ATTACHED FOR SIGNATURE	2 copies
TELEPHONE NUMBER	772-569-5355		
FAX NUMBER	772-567-2292		

**Bid/Quote/Background Information- Summary.**

Brevard County's AT&T Synchronous Optical Networking (SONET) services that carry the T1 circuits used to supply connectivity to the Emergency Management Brevard County 800 MHz Public Safety Radio System are being replaced by a Spectrum Ethernet solution. While this solution may be sufficiently robust and feasible for a telephone network, it is not viable for stability or redundancy of the public safety radio system.

Therefore, a Request for Proposal was authorized by the Board of County Commissioners on December 1, 2015 and offered by Central Services in February 2016 to solicit competitive proposals to design and provision a backhaul connectivity solution to support the Brevard County 800 Mhz Public Safety Radio System. At the same meeting, the BOCC authorized the creation of a negotiation committee approved by the County Manager or his designee to determine the best ranked proposer and then to award the contract to vendor and to the utilization of the \$12.50 surcharge funds for the backbone implementation. It also authorized the County Manager or his designee to execute the contract, subject to approval by the County Attorney's Office and Risk Management. A copy of the BOCC Tammy Gram authorization dated December 2, 2015 is attached.

The negotiation committee selected the proposal offered by Communications International, Inc. as the most cost effective and efficient solution on September 7, 2016 and began negotiations with the vendor for a contract for implementation.

**COST/BENEFIT ANALYSIS:**

The existing cost of the Synchronous Optical Networking (SONET) services that support the Emergency Management 800 MHz T-1 circuits is estimated at \$26,074.50/month, to be paid by the 800 MHz User Fees. The microwave backhaul connectivity solution was budgeted at \$1.4 million; awarded as \$917,553.48, including implementation, and nine (9) years support and maintenance at less than \$25,000/year. The migration to a standalone network solution will reduce the financial responsibilities from Brevard County agencies/departments to 21% of any recurring cost (\$5,250/year).

**FISCAL IMPACT (TERM OF CONTRACT/AMOUNT OF CONTRACT):**

The funds for the implementation of the project have been designated by the Board of County Commissions to be from the \$12.50 Surcharge, limited by Section 316.655 (6) Florida Statutes, to fund intergovernmental radio communications programs. Any recurring costs, which are expected to be reduced from current costs, will be shared between all the agencies/municipalities that use the countywide radio system. The County departments represent 21% of the total system users. Refer to Attachment c - Payments in the contract.

**AGENCY APPROVAL**

User Agency	YES	<input checked="" type="checkbox"/>	NO	<input type="checkbox"/>	Date	3/6/17	Initials	kp
Contracts Admin.	YES	<input type="checkbox"/>	NO	<input type="checkbox"/>	Date		Initials	
Risk Mgmt.	YES	<input checked="" type="checkbox"/>	NO	<input type="checkbox"/>	Date	3-6-2017	Initials	ML
County Attorney	YES	<input checked="" type="checkbox"/>	NO	<input type="checkbox"/>	Date	3/9/17	Initials	JLH

AO 29: EXHIBIT V



BOARD OF COUNTY COMMISSIONERS

Emergency Management

1746 Cedar Street  
Rockledge, FL 32940

## Inter-Office Memo

Date: March 6, 2017

To: Stockton Whitten, County Manager

From: Kimberly Prosser, Emergency Management Director 

Re: Communications International – Microwave Agreement

Request that the County Manager sign the attached agreement for the installation and support of a backhaul microwave connectivity network for Emergency Management with Communications International, the selected vendor from an RFP offered by Central Services in 2016.

The purpose of this microwave network is to replace AT&T's T-1 lines currently supporting the 800 MHz Public Safety Radio Network. The T-1 lines were part of the original AT&T SONET Ring configuration for the county telephone system that is in the process of being replaced by Spectrum's (formerly Bright House) Ethernet solution. The Spectrum solution for the telephone network is not viable for the public safety radio network's stability and redundancy requirements.

Bright House (now Spectrum) and AT&T previously presented their own proposals to replace the T-1s tied to a 36-month contract with termination provisions. The County Attorney's Office recommended that rather than accept these contracts, an RFP be offered for the best and most cost-effective bidder to include a proviso to provide proof of successful testing for the winning vendor's solution. Per the Tammy Gram dated 12/2/15, the RFP was offered by Central Services on 2/11/16 and the contract was awarded on 9/7/16.

Therefore, it is requested that the County Manager, in keeping with the Board of County Commissioners direction, please sign the attached contract so that Emergency Management may proceed with the installation of this microwave backhaul replacement.

### Attachments:

Copy of BOCC Memorandum to County Manager dated 4/14/15

Copy of BOCC Agenda Report, Item II.C.2 – Permission for RFP by Central Services

Copy of BOCC Memorandum (Tammy Gram) 12/2/15 – Authorization for Central Services RFP

Two Originals of BOCC Agreement with Communications International for the Backhaul Network Installation & Maintenance

RECEIVED

MAR 14 2017

County Manager's  
Office



Purchasing Services  
 2725 Judge Fran Jamieson Way, Suite C303  
 Viera, FL 32940

Phone (321) 617-7390  
 Facsimile (321) 617-7391

**NOTICE OF AWARD**  
 September 7, 2016  
 RFP# P-4-16-11 / Public Safety Radio System Connectivity Network

Jon McLester, CPPO, CPPB

<u>VENDOR</u>	<u>MEETS MINIMUM REQUIREMENTS</u>	<u>ITEMS AWARDED</u>	<u>COST</u>
Communications International, Inc.	YES	ALL	First 3 year total - \$917,553.48 12 year total - \$1,116,396.99
Aviat	YES	NONE	First 3 year total - \$992,767.00 12 year total - \$1,614,030.00
AT&T	YES	NONE	First 3 year total - \$844,097.21 12 year total - \$2,711,978.25

BOARD AWARD--AGENDA ATTACHED

APPROVED AWARD (NON-BOARD AGENDA):  
 (Per Sections III.E. & III.I. & J., BCC-25, PROCUREMENT)

  
 Teresa Camarata, Central Services Director

- Award to best ranked proposer, minimum three bids received.
- Award to best ranked proposer, less than three responses received: (copy to Manager)

AWARDED BY A COMMITTEE CONSISTING OF: Jon McLester, Procurement Supervisor; Lizzet Ruiz, Emergency Management; Dennis Neterer, Deputy Fire Chief; Joseph Connors, Transit Services; Ron Spangler, Brevard County Sheriffs; and Ray Desmarais, Melbourne Police Department

FOR PURCHASING USE ONLY:

ONE TIME PURCHASE

ANNUAL BID:

EFFECTIVE DATE - Date of Contract Execution ENDING DATE Three (3) years from date of execution  
 RENEWAL OPTION  One year  Other Three (3) additional three (3) year periods

Prompt Payment Discount Offered  Yes \_\_\_\_\_ (Terms)  NO

**SPECIAL INSTRUCTIONS TO AWARDED VENDOR:**

Please provide certificate of insurance.

 LR



Tammy Etheridge, Clerk to the Board, 400 South Street • P.O. Box 999, Titusville, Florida 32781-0999

Telephone: (321) 637-2001  
Fax: (321) 264-6972

December 2, 2015

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TO: Teresa Camarata, Central Services Director

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BOARD OF COUNTY COMMISSIONERS  
SCOTT ELLIS, CLERK

*Tammy Etheridge*

Tammy Etheridge, Deputy Clerk

/af

cc:  Emergency Management  
County Manager  
Finance  
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Exhibits Attached: Inter-Office Memo to County Manager dated April 14, 2015

<b>Contract /Agreement (If attached):</b> Reviewed by County Attorney		Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	PR	<input type="checkbox"/>
County Manager		Assistant County Manager	Frank Abbate		Department Director Extension	Teresa Camarata, Central Serv. Director, ext. 55492	
Stockton Whitten		Frank Abbate			Kimberly Prosser	Kimberly Prosser, Emergency Mgt. Director, ext. 56670	



Emergency Management  
1746 Cedar Street  
Rockledge, Florida 32955

BOARD OF COUNTY COMMISSIONERS

## Inter-Office Memo

TO: Stockton Whitten, County Manager

FROM: Jon Sellers, Information Technology Director *JS*  
Kimberly Prosser, Emergency Management Director *Kimberly Prosser*

SUBJ: Migration from AT&T's SONET Ring

DATE: April 14, 2015

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*Stockton Whitten 4/14/15*  
Stockton Whitten, Brevard County Manager



## **AGREEMENT**

**THIS AGREEMENT** by and between the Board of County Commissioners of Brevard County, Florida, a political subdivision of the State of Florida (hereinafter the "County"), and **Communications International, Inc.**, a business having its primary business location at **4450 US HWY 1, Vero Beach, Florida 32967**, (hereinafter the "Contractor").

WITNESSETH:

**WHEREAS**, the County issued a Request for Proposal entitled " PUBLIC SAFETY RADIO SYSTEM CONNECTIVITY NETWORK REQUEST FOR PROPOSAL # P-4-16-11 " and originally dated February 11, 2016, as amended on February 26, 2016, March 4, 2016, March 15, 2016 and April 4, 2016 (collectively, the "RFP"), requesting proposals to provide County with a system and services as set forth in the RFP;

**WHEREAS**, Contractor delivered a proposal entitled "PUBLIC SAFETY RADIO SYSTEM CONNECTIVITY NETWORK REQUEST FOR PROPOSAL # P-4-16-11 " and originally dated April 8, 2016, (collectively, the "Contractor's Proposal") to provide the system and services requested by County in the RFP or the Contractor's Proposal;

**WHEREAS**, the County has selected Contractor's Proposal and now desires to enter into an agreement with Contractor to provide County with the system and services set forth in Contractor's Proposal; and

**WHEREAS**, the provision of such services shall mutually benefit the parties hereto and the residents of Brevard County, Florida.

**NOW THEREFORE**, in consideration of the covenants herein contained, it is mutually agreed between the parties as follows:

1. **ATTACHMENTS:** The attachments listed below are incorporated into and made part of this Contract.
  - ATTACHMENT A-1 – Scope of Services (9 pg)
  - ATTACHMENT A-2 – Contractor's Proposal (90 pg)
  - ATTACHMENT B – Software License Agreement (2 pg)
  - ATTACHMENT C – Payments (1 pg)
  - ATTACHMENT D – Sites And Bandwidth Requirements (2 pg)
  - ATTACHMENT E – Sample Acceptance Test Plan (27 pg)
  - ATTACHMENT F – Compliance Affidavit(s) (3 pg)
  - ATTACHMENT G – Insurance(s) (1 pg)
  
2. **SCOPE OF THE WORK:** The Contractor shall be prepared to furnish all labor, materials, equipment, machinery, tools, apparatus and transportation to perform all work or services specified in the Scope of Services, Attachment A-1 and the Contractor's Proposal, Attachment A-2, attached hereto and made a part hereof by this reference.

The Contractor has assigned an individual to oversee and be completely responsible for the Contractor's delivery of services under this Agreement. This individual shall manage and direct the required activities of the Contractor, shall coordinate all work between various parties involved and provide immediate liaison between the Contractor and the County.

3. **TERM:** The term of the Agreement shall begin November 1, 2016 (Effective Date) and continue through three (3) years. The County shall have the option to renew this agreement, by giving thirty (30) days prior written intention to contractor, for up to three (3) additional three (3) year

terms, upon the same terms and prices as set in the RFP. The term of the Software license is set forth in the Software License Agreement, Attachment B.

4. **PAYMENTS:** County shall pay the Contractor for (Work or Services) provided under this Agreement as provided in Attachment C to this agreement and made a part of this agreement by this reference. The County reserves the right to deduct from any contractor invoice an amount for defective or nonconforming work, or for work not provided but invoiced. The County shall remit payment in accordance with the Florida Prompt Payment Act, Florida Statute section 218.70, et seq.
5. **COUNTY'S OBLIGATIONS:** The County's obligations set forth in Contractor's Proposal and this Agreement shall be performed by County in a timely and proper fashion in accordance with the Installation Schedule, or as otherwise agreed upon by County and Contractor, to allow Contractor to timely perform its obligations under this Agreement.

In addition to the obligations specifically identified in Contractor's Proposal, County shall also have the following additional obligations;

- a. County shall designate a Project Manager to act as County's primary interface with the Contractor.
  - b. County shall provide ready access to all sites owned, leased or otherwise controlled by County.
  - c. All towers, shelters and associated equipment provided or mandated by County shall be satisfactory in all manners to accommodate the System proposed by the Contractor. Soil conditions at all sites provided by or mandated by County shall conform to normal soil standards in the area for the contemplated construction of new facilities.
6. **DELIVERY, TITLE AND RISK LOSS:** Contractor shall ship the Hardware to County at Contractor's expense on or before the dates set forth in the Installation Schedule, unless otherwise provided for in the Statement of Work. Partial deliveries shall be permitted. Upon delivery to the carrier, title to each portion of the Hardware and all risk of loss or damage shall pass to County; provided, however, that Contractor shall remain responsible until Acceptance of the System for loss or damage resulting from the willful misconduct or negligent acts or omissions of Contractor, its employees, agents, and subcontractors. County shall keep the Hardware fully insured for the total amount of all monies then due, or yet to become due, to Contractor with respect to this Agreement.
  7. **INDEMNIFICATION:** To the extent allowable by law, each Party (the "Indemnifying Party") shall indemnify and hold harmless the other Party from any and all liability, claims, damages, losses or expenses, including reasonable attorney's fees, arising out of or resulting from performance of this Agreement, where such claim, damage, loss, or expense is directly caused by the negligence or intentional wrongful act or omission of the Indemnifying Party, its agents, employees, or any of its subcontractors, in connection with or pursuant to this Agreement. This indemnification is subject to the provisions of Section 768.28, Florida Statutes, as it applies to Customer and as further limited by Section 2 hereof.
  8. **SOFTWARE LICENSE:** Subject to the terms and conditions of the Software License Agreement attached hereto as Attachment B, County is granted a license to use the Software only in conjunction with the System purchased under this Agreement. "Software" means the "Licensed Programs" as defined in the Software License Agreement.

9. **MODIFICATIONS TO CONTRACT:** This contract, together with any Attachments, Contractor's Proposal, task assignments and schedules constitute the entire contract between the County and the Contractor and supersedes all prior written or oral understandings. This contract and any Attachments, Contractor's Proposal, task assignments and schedules may only be amended, supplemented or canceled by a written instrument duly executed by the parties hereto.
10. **INSURANCE:** The Contractor, at its own expense, shall keep in force and at all times maintain during the term of this Agreement:
- a. **General Liability Insurance:** General Liability Insurance issued by responsible insurance companies and in a form acceptable to the County, with combined single limits of not less than One Million Dollars (\$1,000,000) for Bodily Injury and Property Damage per occurrence.
  - b. **Automobile Liability Insurance:** Automobile Liability coverage shall be in the minimum amount of One Million Dollars (\$1,000,000) combined single limits for Bodily Injury and Property Damage per accident.
  - c. **Workers' Compensation Coverage:** Full and complete Workers' Compensation Coverage, as required by State of Florida law, shall be provided.
  - d. **Insurance Certificates:** The Contractor shall provide the County with Certificate(s) of Insurance on all the policies of insurance and renewals thereof in a form(s) acceptable to the County. Said Liability Policies shall provide that the County be an additional insured. The County shall be notified in writing of any reduction, cancellation or substantial change of policy or policies at least thirty (30) days prior to the effective date of said action. All insurance policies shall be issued by responsible companies who are acceptable to the County and licensed and authorized under the laws of the State of Florida.
11. **ATTORNEY'S FEES:** In the event of any legal action to enforce the terms of this contract each party shall bear its own attorney's fees and costs.
12. **GOVERNING LAW:** This agreement shall be governed, interpreted and construed according to the laws of the State of Florida.
13. **COMPLIANCE WITH STATUTES:** It shall be the Contractor's responsibility to be aware of and comply with all federal, state and local laws, ordinances, codes, rules and regulations that may affect the work. The Contractor's ignorance of any law, rule, etc., will not relieve the Contractor from responsibility.
14. **VENUE:** Venue for any legal action by any party to this agreement to interpret, construe or enforce this Agreement shall be in a court of competent jurisdiction in and for Brevard County, Florida and any trial shall be non-jury.
15. **ASSIGNMENTS:** Contractor shall not assign any portion of this agreement without the written permission of the County.
16. **TERMINATION:** If either party fails or refuses to perform any of the provisions of this contract or otherwise fails to timely satisfy the contract provisions, either may notify the other party in writing of the nonperformance and terminate the contract or such part of the contract as to which there has been delay or a failure to properly perform. Such termination is effective upon the other party's receipt of the Notice of Termination. Any work completed or services provided prior to

the date of termination shall, at the option of the County, become the property of the County. The County is only responsible for payment for work completed prior to the effective date of termination.

17. **INDEPENDENT CONTRACTOR:** The contractor shall perform the services under this agreement as an independent contractor and nothing contained herein shall be construed to be inconsistent with this relationship or status. Nothing in this agreement shall be interpreted or construed to constitute the Contractor or any of its agents or employees to be the agent, employee or representative of the County.
18. **RIGHT TO AUDIT RECORDS:** The County and its auditors shall be entitled to audit the books and records of the Contractor to the extent that such books and records relate to the performance of this Agreement. Said records shall be made available, upon request, for audit purposes to Brevard County and its auditors. Such books and records shall be maintained by the Contractor for a period of three (3) years from the date of final payment under this Agreement unless a shorter period is otherwise authorized in writing.
19. **UNAUTHORIZED ALIEN WORKERS:** Brevard County will not intentionally award publicly-funded contracts to any contractor who knowingly employs unauthorized alien workers, constituting a violation of the employment provisions contained in 8 U.S.C. Section 1324a(e)(Section 274A(e) of the Immigration and Nationality Act "INA"). The County shall consider a contractor's intentional employment of unauthorized aliens as grounds for immediate termination of this Agreement.
20. **FEDERAL TAX ID NUMBER:** The Contractor shall provide to the County their Federal Tax ID Number or, if the Contractor is a sole proprietor, a Social Security Number.
21. **EMPLOYMENT:** The Contractor shall not engage the services of any person or persons now employed by the County, including any department, agency, board or commission thereof, to provide services relating to this contract without written consent from the County.
22. **PUBLIC ENTITY CRIMES:** A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to a public entity, may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids on leases of real property to a public entity, may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with a public entity, and may not transact business with any public entity in excess of the threshold amount provided in s. 287.017 for CATEGORY TWO for a period of thirty six (36) months from the date of being placed on the convicted vendor list.
23. **EXCUSABLE DELAYS:** In the event of any delay or failure excused by this Section, Contractor shall as soon as practical notify County and shall at the same time, or at the earliest practical date after such notice, specify the revised delivery and performance dates. In the event of such delay, the time of delivery or of performance shall be extended for a reasonable time period to compensate for the time lost by Contractor by reason of the delay. Contractor shall not be liable for delays in delivery or failure to perform due directly or indirectly to:
  - a) Causes beyond Contractor's reasonable control,
  - b) Acts of God, acts (including failure to act) of any governmental authority (de jure or de facto), wars (declared or undeclared), riots, revolutions, strikes or other labor disputes, fires, floods, sabotage, nuclear incidents, earthquakes, storms, epidemics,
  - c) Contractor's inability to timely obtain necessary materials, items, components or services from suppliers who are affected by the foregoing circumstances or

- d) The failure of the County to perform its obligations hereunder in a timely manner. The foregoing shall apply even though any of such causes exists at the time of signature of the Agreement by Contractor or occurs after delays in Contractor's performance of its obligations due to other reasons.

24. **TESTING AND ACCEPTANCE:** Contractor shall notify County that the System is ready for Acceptance Tests at least ten (10) days before commencement of the Acceptance Tests. County and Contractor shall jointly commence the Acceptance Tests on the date specified in Contractor's notice (or other mutually agreeable date) and a representative of Contractor and a representative of County shall sign off on the form provided as part of the test procedure whether each item of the test was passed or failed. If the System does not fulfill the requirements of the Acceptance Tests, Contractor shall correct the defects at no additional cost to County as soon as practicable. Upon correction of the defects the Acceptance Tests for the applicable part of the System shall be repeated in accordance with the procedures set forth in this Section. Successful completion of the Acceptance Test is the sole criterion for technical system acceptance and the initiation of the warranty period. Final system acceptance shall occur when the Hardware and Software for the System, Documentation Deliverables and Services have been furnished, delivered, installed and tested.

25. **WARRANTIES:** Hardware and installation Services furnished by Contractor under this Agreement are warranted by the Contractor to be free from defects in material and workmanship and shall conform to the Agreement specifications for a period equal to the longer of twelve (12) months or in the case of Hardware, the number of months under the warranty offered by the manufacturer of such equipment, from the Acceptance Date (the "Warranty Period"). Any and all claims for breach of this warranty are conclusively deemed waived unless made within the Warranty Period. The warranty period for additional Hardware purchased by County from Contractor after System Acceptance shall be for a period equal to the longer of twelve (12) months or the number of months under the warranty offered by the manufacturer of such equipment, from the date the equipment is delivered to County (the "Additional Warranty Period"). Any and all claims for breach of this warranty are conclusively deemed waived unless made within the Additional Warranty Period.

During the Warranty Period if any component of the Hardware or portion of the installation Services fails to meet the foregoing warranties, Contractor's sole obligation and County's exclusive remedy under this warranty shall be the correction by Contractor of the failure at Contractor's option (1) by repairing any defective component of the Hardware, or (2) by furnishing any necessary repaired or replacement parts, or (3) by the redoing of the faulty installation. Any such failure, or the repair or replacement of the defective component or the redoing of any installation, shall not extend the Warranty Period. Where such failure cannot be corrected by Contractor's reasonable efforts, the Parties will negotiate an equitable adjustment in price. Contractor will be responsible for all charges incurred in returning defective parts to Contractor's plant and shipping repaired or replacement parts to County. All warranty labor must be performed by an authorized service group approved by Contractor either at its place of business, for mobile or portable equipment, or at the County's location for fixed location equipment should Contractor determine that it is not feasible to return the fixed location equipment to Contractor's authorized service group.

26. **REMEDIES:** In the event of a material breach of this Agreement by Contractor which shall continue for one hundred twenty (120) or more days after written notice of such breach (including a reasonably detailed statement of the nature of such breach) shall have been given to Contractor by County, County shall be entitled to avail itself cumulatively of any and all

remedies available at law or in equity (provided such remedies are not otherwise limited under the terms of this Agreement) and either (1) suspend performance of its payment obligations under the Agreement for as long as the breach continues uncorrected or (2) terminate this Agreement by written notice to Contractor if the breach remains uncorrected.

In the event of (1) any failure by County to make any payment when due or (2) any other material breach of this Agreement by County which shall continue for one hundred twenty (120) or more days after written notice of such breach (including a reasonably detailed statement of the nature of such breach) shall have been given to County by Contractor, Contractor shall be entitled to avail itself cumulatively of any and all remedies available at law or in equity (provided such remedies are not otherwise limited under the terms of this Agreement) and either (1) suspend performance of its obligations under this Agreement for as long as the breach remains uncorrected or (2) terminate this Agreement by written notice to County if the breach remains uncorrected.

27. **CONSTRUCTION OF AGREEMENT:** The parties hereby acknowledge that they fully reviewed this agreement, its attachments and had the opportunity to consult with legal counsel of their choice, and that this agreement shall not be construed against any party as if they were the drafter of this Agreement.
28. **NOTICE:** Notice under this agreement shall be given by certified mail or hand delivery as follows:

To Brevard County:

Brevard County Emergency Management  
1746 Cedar Street  
Rockledge, Florida 32955  
ATTN to: Emergency Management Director

To the Contractor:

Communications International, Inc.  
4450 US HWY 1  
Vero Beach, Florida 32967  
ATTN: Barry Keim  
E-mail: bkeim@ask4ci.com

With copy to:

Communications International, Inc.  
4450 US HWY 1  
Vero Beach, Florida 32967  
ATTN: Agreement Administration  
E-mail: mswetz@ask4ci.com

IN WITNESS WHEREOF, the parties have hereunto set their hands and seals on the day and year first above written.

**THE COUNTY**

Brevard County Board of County Commissioners, A Political subdivision of the State of Florida

By:   
Stockton Whitten, County Manager

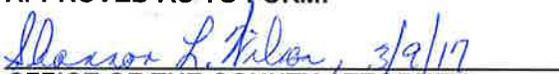
Date: 3/14/17

As approved by the Board on: 12/1/15

**ATTEST/AUTHENTICATED:**

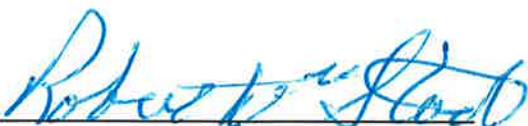
  
Scott Ellis, Clerk

**APPROVED AS TO FORM:**

 3/9/17  
**OFFICE OF THE COUNTY ATTORNEY:**

By: Shannon L. Wilson, Deputy  
County Attorney

**CONTRACTOR**

By:   
Signature

Date: 3/3/2017

Robert Wm Stork, CEP  
Name & Title, Typed or Printed

Communications International, Inc.  
Name of Company, Corp., etc.

4450 US HWY 1  
Mailing Address

Vero Beach, FL 32967  
City, State, Zip

772-569-5355  
Area Code/Telephone Number

**SEAL**

**ATTEST:**  
  
Signature

Susan Almeraz, Controller  
Name & Title, Typed or Printed

**ATTACHMENT A-1  
SCOPE OF SERVICE**

**Public Safety Radio System Connectivity Network**

1. **Introduction/Purpose**

The purpose of this Scope of Work is to set forth the requirements for the design, provision, and maintenance of a turnkey solution for a Digital Transmission Connectivity Network to support the Brevard County 800 MHz Public Safety Radio System, transitioning from the current T1 backhaul service to a cost-effective solution capable of supporting the current analog radio system and the next generation of digital communication. This Digital Transmission Connectivity Network must support Ethernet TCP/IP, DCP and TDM Synchronous T1 services. It is expected that this connectivity will provide the resilience and redundancy required for the Brevard County Public Safety Radio System for at least the next 12 years.

2. **Background**

Brevard County operates and maintains seven (7) radio frequency (RF) sites and two radio network switches (IMC) at different County-wide locations. All nine locations are currently linked through a backbone network, via twenty one (21) T1 circuits over an AT&T SONET Ring, two County-owned microwave hops, and a County-owned fiber link. Another two RF sites will be added in the near future to the radio network, increasing the number of sites to be connected. A total of eight (8) sites will require the new connectivity services, Attachment D, as the fiber and the two microwaves links will be retained as part of the network.

The new connectivity network shall support true TDM, for the current EDACS Simulcast System, and Ethernet connectivity to transport all traffic not associated with the simulcast voice and data transmissions. The vendor shall provide a private secure Ethernet transport service connected to the sites listed in Attachment D.

All costs associated with operation, outside plant, leases, preventative maintenance, software updates, hardware replacement, and equipment spares shall be shown on a year by year basis for the 12 year period after acceptance of the network. The price (see Attachment C) is all-inclusive of direct and indirect costs, including, but not limited to travel, overhead, fee or profit, clerical support, managerial (administrative) support, all documents, reports, forms, reproduction and any other costs. No additional fees or costs shall be paid by the County unless there is a change in the scope of work.

The Brevard County Public Safety Radio System shall remain fully functional during the installation of the network. Brevard County requires continuity of the existing quality of service (QoS) and system functionality required by the 800 MHz Public Safety Radio System by and throughout the installation and implementation of the new connectivity solution. All equipment provided must be able to be integrated to the current radio system and to be added to the Brevard County 800 MHz Maintenance Contract; otherwise maintenance services shall be included.

**SCOPE OF SERVICE**

1. **DEFINITIONS**

**Firm Fixed Price** – A price that is all-inclusive of direct cost and indirect costs, including, but not limited to travel, overhead, fee or profit, clerical support, managerial (administrative) support, all documents, reports, forms, reproduction and any other costs. No additional fees or costs shall be paid by the County unless there is a change in the scope of work.

**BER** - Bit Error Rate, the number of bit errors per unit time

**Connectivity** - the complete path between two terminals

**Microwave hop** – a microwave channel between two sites

**TDM** – Time Division Multiplexing

**2. SCOPE OF WORK**

The Contractor shall provide a turnkey solution and perform the necessary technical services to provide an operational and secure radio connectivity network, adhering to the best practices of cybersecurity.

All equipment provided must be able to be integrated to the current 800 MHz Radio System and to be added to the Brevard County 800 MHz Maintenance Contract. The cost of maintenance of equipment added under this Agreement is covered under the pricing as set forth in Attachment “C”. All permits, licenses and certifications must be obtained and completed by the Contractor.

**2.1.1 Instructions/service manuals**

Any manuals or technical references required to perform maintenance or repairs under this Agreement shall be provided by the Contractor at the sole expense of the Contractor.

**2.1.2 Materials and workmanship**

All replacement equipment and component parts furnished shall be new original equipment manufacturer's parts, or new after-market parts, which are interchangeable and comparable to new original equipment manufacturers parts, meet all requirements of this specification, the specifications of the manufacturer, and be in operable condition at time of delivery. Used or reconditioned parts may only be used on a case-by-case basis at the specific authorization of the County's Public Safety Radio System Manager.

**2.1.3 Inclusion of specification**

It is agreed that this specification document in its entirety is included in and made a part of this Agreement.

**2.2 SPECIAL CONDITIONS**

**2.2.1 Transition to digital technology**

The County and the Contractor will develop a transition plan to transition from T1 technology to digital technology during the first and second term (if renewed) of this Agreement.

**2.2.2 TDM T1 circuits supporting the EDACS Simulcast Radio System**

The Contractor has demonstrated implementation of TDM T1 circuits over the proposed network by presenting a compliance affidavit, Attachment F, from at least two public safety radio system managers within the State of Florida, operating an EDACS radio system with similar implemented solution/network. The objective of this affidavit is to guarantee that the proposed solution/network is capable of true TDM.

**3. GENERAL REQUIREMENTS**

- a) The Contractor shall use Brevard County existing sites/structure to the greatest extent possible.
- b) Brevard County does not provide storage space; all equipment shall be delivered and transported to the sites as needed.
- c) The Contractor must present a Customer Design Review (CDR) to Brevard County within 45 days of the Contract being fully executed by both parties. This CDR shall cover the finalized scope of work and all aspects of the project for review by the County before a notice to proceed will be issued.
- d) Installation of all electrical equipment and associated wiring shall comply with the latest edition of the National Electrical Code.
- e) The Contractor is responsible for procuring and installing all outside conduits including excavating, trenching and back filling. Brevard County must approve all pathways for conduit both inside and outside of the building prior to installation.
- f) Construction for incoming cables or fiber to the County buildings or shelters shall be installed within Vendor supplied conduit.
- g) Aerial entries to sites or buildings shall be avoided.

- h) Exterior wall penetrations must be waterproof and secure. Internal wall penetrations must meet all fire stopping and fire code requirements.
- i) All metallic cables entering buildings or shelters must have surge suppression and be grounded to the shelters common grounding system.
- j) All work shall be planned, coordinated and conducted with no unplanned disruption of service to the existing County radio system. The Contractor shall be responsible for the costs of any system recovery costs associated with an unplanned radio system outage.
- k) The Contractor must provide a technical support service that is available 24 hours per day, 7 days a week, and 365 days per year.
- l) The Contractor shall have a local service provider capable of responding on site to an emergency call for service within 1 hour. The Contractor shall maintain an answering service or other method of being able to receive calls for emergency services on a twenty-four hour basis acceptable to the County.
- m) Preventative Maintenance/Repair Work shall be normally scheduled during the hours of 8:00 AM to 5:00 PM Monday through Friday. However, the Contractor may elect to perform preventative maintenance at any other time whenever the equipment is available and at the concurrence of the County.
- n) The proposed network shall comply with the FCC standards outlined in "CFR-2012, Title 47, Volume 3, Part 64, Appendix A", which addresses Telecommunications Service Priority (TSP).
- o) The local service provider (as referred to in l. above) must be factory certified on the equipment and have a minimum of two years' experience maintaining similar systems of the same brand of equipment.
- p) The Contractor shall ensure that all personnel, who will be working at County's facilities, pass the Brevard County Sheriff's Office background check. All associated costs with the background checks shall be the responsibility of the Contractor.

### **3.1.1 Emergency services**

Repair of public safety communication systems shall be the Contractor's first priority in the event of a natural, human-caused, or technological disaster. Contractor shall have sufficient manpower and equipment to complete two separate assignments at once. During a hurricane, civil disturbance, or other County declared emergency, the Contractor will be required to begin response within thirty (30) minutes after notification and be on site no later than one(1) hour after notification unless due to circumstances beyond control of the Contractor (roadway damage, etc..).

### **3.1.2 Project Management**

Contractor shall provide a Project Management Plan (PMP) which includes a detailed Work Breakdown Structure (WBS), project scope, deliverables, and project schedules to completion, QA/QC processes, cutover plan and risk management plan.

The Contractor's Project Manager shall be PMP certified and have a minimum of 3 years' experience with similar projects.

The PMP shall describe how the Contractor intends to monitor and control the installation, deployment and cutover of the proposed system.

Project status meetings shall be established between the County team and the Contractors' PM on monthly basis.

The Contractor will develop and maintain a project schedule including tasks, milestones, start and end dates, task prerequisites, and task owners based on the approved WBS. The project schedule shall be updated with actual dates as tasks are completed.

The schedule shall address the following:

- Detailed design review.
- Equipment delivery.
- Site surveys.
- Final system design.
- System installation.
- System cutover.
- System documentation and delivery.
- System optimization.
- System acceptance testing.
- System training.

The Contractors' PM shall maintain a punch list in real time that is available to the County.

### **3.1.3 Project Engineer**

The Contractor's Project Engineer shall have the primary responsibility for managing the system design and ensuring that the system is installed in accordance with the approved system design.

The Project Engineer shall be responsible for the development and execution of the Acceptance Test Plan and guide the County through the processes necessary to prove the system performs as specified.

### **3.1.4 Documentation Requirements**

Contractor shall supply at acceptance a complete set of as built documents detailing the installed network and equipment to include:

- Training and operation manuals for all equipment provided.
- Block and level diagrams of the network.
- Cabling and termination demarcations.
- Plan and elevation drawings of all tower mounted equipment.
- Setup and alignment information.
- Successfully completed, signed and dated acceptance test plans.
- Hardware and software configuration settings.

### **3.1.5 Network Cutover Requirements**

The Contractor shall work together with the Brevard County's existing radio system maintenance provider to handle the migration of the radio circuits over to the new network to minimize radio traffic downtime. The Contractor's technicians shall work with the radio service technicians during the cutover and shall correct any issues that occur immediately as not to disrupt radio traffic. Cutovers should be coordinated during non-peak radio traffic hours to minimize downtime. The cost of network cutovers this shall be the responsibility of the Contractor.

### **3.1.6 Acceptance Testing Requirements**

The Contractor submitted a preliminary sample acceptance test plan for proposed network; Attachment E. Brevard County will work with the Contractor to develop a final Acceptance Test Plan (ATP) that is acceptable by both the Contractor and Brevard County.

The Contractor's Engineer will execute the ATP with Brevard County personnel in attendance. Any testing completed without a Brevard County Emergency Management representative present will not be accepted.

### **3.1.7 System Acceptance**

The County shall deem the system ready for final acceptance following successful completion and approval of the following:

- System installation completed.
- Final Inspection and punch list resolution.
- Network training completed.
- As Built documentation detailing the installed network, hardware and software configuration settings, and block and level diagrams of the network.
- Training and operation manuals for all equipment provided.
- Cabling and terminations demarcations and labeling designations.
- Plan and elevation drawings of any tower or shelter mounted equipment.
- Setup and alignment information.
- Successfully completed, signed and dated acceptance test plans; including acceptance affidavit (Attachment F) per each T1 circuit implemented.

### **3.1.8 Total Cost of Operation**

The Contract Price includes a the total cost to Brevard County for operation of the provided network for a life expectancy of no less than twelve years.

Any or all spares required to meet the specifications of this Scope of Work are the responsibility of the successful bidder for the 12 year period.

Brevard County is not responsible for any additional charges related to calls for services or outages during the 12 year operations period without the prior written authorization of Brevard County.

Brevard County is not responsible for any additional charges related to installation delays.

Brevard County is not responsible for any additional charges or change orders during the implementation and build out unless the Contractor can show compelling reasons why that the cost was omitted from the Agreement and why Brevard County should bear the cost of the omission.

Brevard County is not responsible for any additional charges unless a purchase order has been issued by the County.

## **4. TECHNICAL SPECIFICATIONS**

### **4.1.1 Network Design**

The network design should be considered a Point to Point to Point network incorporating either a ring based or redundant standby equipment topology. There must be no single point of failure within the IP network. Each site shall have redundant network interface equipment that supports either ring based or a spur based network. The network must reroute traffic in less than 50 milliseconds in the event of a path or device failure. The Contractor will guarantee that the provided network system will be compatible with the existing communications infrastructure. The Contractor will be responsible for providing the network service to a demarcation point within the County's radio tower shelters or buildings. The fixed network interface equipment provided will reside adjacent to the County's radio equipment in 19" equipment racks at each location. Any equipment provided must adhere to FCC Part 15 or Part 101 for microwave based proposals.

#### **4.1.2 Network Reliability**

The Network will be designed to operate at the public safety standard reliability level of 99.999% at the rated network bandwidth. The Contractor must provide documentation showing network reliability and QoS calculations between all network points. Digital terminal equipment proposed shall have a mean time between outages (MTBO) rate of at least 1 million hours or mean time between failures (MTBF) of 100,000 hours, based on upon failure data or Bellcore reliability calculations.

#### **4.1.3 Ethernet Bandwidth**

The full duplex bandwidth requirement for most of the network will be 155Mbps at most of the sites. At some locations the bandwidth requirement will be 45Mbps. Attachment D delineates the anticipated bandwidth and T1 partitions. Network bandwidth is to be shared between the Ethernet traffic and the TDM traffic. Any bandwidth not partitioned as TDM must automatically revert to Ethernet bandwidth.

For security reasons the supplied bandwidth must be dedicated to Brevard County only and not accessible from the internet. The Ethernet service shall be fully compliant with IEEE 802.3 Ethernet standards. The Ethernet service shall have the ability to aggregate traffic from multiple VLANs across a common interface within the network.

#### **4.1.4 Network Bandwidth Management**

The overall network shall have a common end to end software management and configuration tool capable of complete control of all network elements. The Contractor must supply a terminal or PC software application that allows Brevard County personnel the ability to repartition available bandwidth from Ethernet traffic to a T1 circuit and drop/insert that circuit between the desired points in the network or reverse this partition back to available Ethernet bandwidth without intervention from the Vendor. The tool shall support building an end to end path without requiring manual configuration of each intermediate device. The management tool shall support a hierarchical user authorization mechanism allowing assignment of various roles to users.

#### **4.1.5 Network Management System**

The Contractor must supply a network monitor PC that will show the overall health of the network. The Network Management System (NMS) must display equipment and traffic alarms for all locations in the provided network as well as bandwidth utilization. The NMS should also monitor and report packet loss, delay and jitter, reliability to 99.999% and BER. The NMS must show which equipment is active and which equipment is in standby mode. The NMS must have visual and an audio indication for all alarm events. Different visual and audio indicators are preferred for critical, major and minor alarm conditions. The NMS support Simple Network Management Protocol (SNMP) shall be configured so that alarms from other system equipment or devices can be monitored by the NMS. The NMS shall support email messages of alarms sent to a predetermined contact list.

#### **4.1.6 Network Specifications - Ethernet Specifications**

The Contactor's system shall meet the following performance specifications.

- IEEE 802.3
- Framing IPv4 and IPv6 IEEE802.3D
- Flow Control IEEE802.3x
- VLAN IEEE802.1Q
- Latency: less than 150 millisecond
- Jitter: less than 30 milliseconds
- Bit Error Rate: less than 10E-6

- Packet delivery rate: 99.9%
- Network availability: 99,999%
- Severely Errored Seconds shall be recorded and report.

#### 4.1.7 Network Specifications - TDM T1 Circuit Specifications

The Contractor's system shall meet the following performance specifications for T1 Circuits:

- Reliability and Availability Expectation: 99.999%.
- Bit Error Rate: 10E-6.
- Supports external clocking /timing source.
- Line Signal Levels:
  - TX: +/- 3volts nominal (mark) and 0 volts nominal (space).
  - RX: +/- 1 to 3 volts (mark) and 0 volts nominal (space).

##### Terminal T1 outputs:

Interface		DSX-1 interface per ANSI T1.403-1989
Rate		1.544 Mbps +/- 30ppm, using internal terminal timing
Pulse shape		Per ANSI T1.403-1989
Framing	**	(1) Extended Superframe (ESF) per AT&T 62411 (2) D4/Superframe (SF) per AT&T 43801 Specify (1) or (2) will be used by the terminals [Preferred & default is ESF].
Line Codes	**	(1) Bipolar with 8 zero substitution (B8ZS) (2) Alternate Mark Inversion (AMI) Specify (1) or (2) will be used by the terminals [Preferred & default is B8ZS].
Line equalization		Maximum of 655 feet from the DSX-1
Protection		Terminals are transformer - isolated. Output transformers do not have secondary center taps.
Terminal output Jitter		Less than 0.05 UI per AT&T 62411, using internal timing.

##### Terminal T1 inputs:

Rate		1.544 Mbps +/- 100ppm, when <i>not</i> loop or thru timed. 1.544 Mbps +/- 50ppm, when loop or thru timed.
Pulse shape		Per ANSI T1.403-1989
Input impedance		100 Ohms resistive (nominal).
Framing	**	(1) Extended Superframe (ESF) per AT&T 62411 (2) D4/Superframe (SF) per AT&T 43801 Specify (1) or (2) will be used by the terminals [preferred & default is ESF].
Line Codes	**	(1) Bipolar with 8 zero substitution (B8ZS) (2) Alternate Mark Inversion (AMI) Specify (1) or (2) will be used by the terminals [preferred & default is B8ZS].
Jitter		Circuit must meet AT&T 62411
Circuit BER		10-6 or better. 10-10 is preferred

**Reroute Limitations:**

Maximum circuit delay    Primary or any secondary path delay shall not exceed 29,995 microseconds.  
Rate of reroute            Once switched, circuit delay shall remain stable for greater than 10 minutes  
   before being rerouted again.

**T1 Clock:**

The T1 paths shall be capable of transporting the MUX clock from end to end of the link.

**4.1.8 Network Specifications-Proposer Fixed Network Interface Equipment (FNIE)**

The Contractor's FNIE shall meet the following specifications.

- Each of the Brevard RF sites has a 24VDC Power Plant. The Contractor shall maintain a minimum backup run time of 4 hours under full load.
- At the Sheriffs Operation Center no DC power is available; a power source with a minimum 4 hour backup run times should be supplied.

All equipment requires:

- Redundant power supplies and power feeds.
- All equipment shall be provided in new condition.
- 19" EIA rack mounted should be supplied if County's rack space in the shelters or buildings is not available.
- LED status indicators on the front panel.
- A minimum of two SFP Ethernet Electrical Interfaces at 1000BaseT for the County's equipment interface.
- A 4 port, 8 ports or 16 ports RJ-45 T1 interface based on Attachment D for TDM T1 circuit interfaces.
- The ability to bridge traffic TDM or Ethernet straight through without using a drop and insert interface.

**4.1.9 Microwave Only Specifications**

The Contractor's microwave solution must conform to the above specification as well as the following microwave only requirements.

- It shall be able to carry true TDM and Ethernet simultaneously, keeping each in its native format.
- Microwave equipment shall be all-indoor; split mount configurations are not acceptable.
- The Microwave design proposed shall be a Monitored Hot Standby (MHSB) or a Ring Protected Loop System. A Non Protected Design microwave design will not be considered.
- The microwave proposed shall be a two frequency, full duplex operation licensed under FCC Part 101 licensed bands. Unlicensed microwave links are not acceptable.
- Space Diversity shall be proposed if needed to meet reliability requirements.
- Microwave equipment will use the existing DC power plants at each site. At the Sheriffs Operation Center no DC power is available; a power source with a minimum 4 hour backup run times should be supplied.
- Shall provide preliminary microwave path data sheets for each link including:
  - Site Name and Geodetic NAD83 coordinates.
  - Ground elevation.
  - Antenna sizes.
  - Center line mounting height.
  - Transmission line type.
  - Transmission line lengths.
  - Fade margin calculations.

- Reliability predictions.
  - Path Fresnel zone clearance.
- Contractor's antennas must include radome.
- The microwave equipment must be able to reroute traffic in 50 milliseconds in the event of an equipment failure.
- Microwave solid dish antennas and radomes must be wind rated for a minimum of 120 mph. Each antenna shall be equipped with stiff arm to limit antenna vibration and flexing during high wind events.
- Microwave radios shall operate on an antenna system equal or exceeding a peak return loss of 20dB without degrading the specified performance of the system.
- Microwave equipment shall be provided with a CPR waveguide flange for connection of the external pressurized wave guide runs. Connections to the external wave guide may be flexible wave guide of 3 feet or less. The use of low loss coax will not be considered.
- The Contractor shall include an automatic dehydrator/pressurization system that maintains at least 5 PSIG positive pressure of conditioned air in the elliptical wave guide and antenna feed unit. Individual pressure gauges and valves on a distribution manifold shall be supplied for each line.
- The Contractor shall conduct physical path surveys to assure that all paths meet proper clearance criteria.
- The microwave equipment must be operationally compatible with all of the existing Brevard County radio equipment and must not emit any radio frequency interference (RFI) to any equipment located in the shelter or on the tower.
- Tower structure analysis and loading is the responsibility of the Contractor. Any structural improvement needed shall be identified in a technical report to the County; however, any structural improvements are not included in the Scope of Work under this Agreement.

#### **4.1.10 Grounding and Bonding Requirements**

As part of the work to be performed by the Contractor all equipment and all associated lines and hardware must be designed and installed in compliance with grounding and installation standards Motorola R-56 or latest revision, Harris 4618/1 R3A or latest version, or MIL 188-124B.

#### **4.1.11 System Training**

The Contractor shall provide onsite training for up to 10 network users on the Bandwidth Manager and the Network Monitor Systems.

#### **4.1.12 Spare Parts**

The Contractor shall provide an inventory of the stock of all the spare parts deemed necessary to restore any equipment failures. These spares are to be stored within and dedicated to Brevard County. The cost to maintain the spares on a rotational basis is included in the twelve year total cost – Attachment C.

New spare parts shall be available for a minimum of seven years from date of system acceptance. Repair and return services for board level spares or refurbished parts shall be available for the entire 12 year maintenance and operations period.

#### **4.1.13 Warranty and Maintenance Services**

Warranty period shall be a minimum of 2 years starting on the day of the system acceptance. Preventative maintenance, normal calls for service and emergency calls for service for a period of no less than twelve years shall be included as part of this proposal. This Contractor shall include all parts and labor costs associated for the twelve year period. The twelve years shall start on the day of system acceptance.

**ATTACHMENT A-2**  
**CONTRACTOR'S PROPOSAL**

*Public Safety Radio System Connectivity Network, Brevard County, FL*

*RFP P-4-16-11*

**COMPLIANCE SHEET**

The Vendor shall comply or take exception to all elements of the specifications. All exceptions to specifications must be addressed and clearly spelled out. Any applicable literature or information supporting the exception must be supplied. Please check appropriate box and indicate any exceptions.

RFP SECTION	DESCRIPTION	DEVIATIONS / NOTATIONS	COMPLIANCE	
			YES	NO
<b>2.2 SPECIAL CONDITIONS</b>				
2.2.1	TDM T1 circuits supporting the EDACS Simulcast Radio System		✓	
<b>3 GENERAL REQUIREMENTS</b>				
3	General requirements from (a) to (q)		✓	
3.1.1	Emergency Services		✓	
3.1.2	Project Management		✓	
3.1.3	Project Engineer		✓	
3.1.4	Documentation Requirements		✓	
3.1.5	Network Cutover Requirements		✓	
3.1.6	Acceptance Testing Requirements		✓	
3.1.7	System Acceptance		✓	
3.1.8	Total Cost of Operation		✓	
<b>4 TECHNICAL SPECIFICATIONS</b>				
4.1.1	Network Design		✓	
4.1.2	Network Reliability		✓	
4.1.3	Ethernet Bandwidth		✓	
4.1.4	Network Bandwidth Management		✓	
4.1.5	Network Management System		✓	
4.1.6	Network Specifications - Ethernet Specifications		✓	
4.1.7	Network Specifications – T1 Specifications		✓	

4.1.8	Network Specifications-Proposer Fixed Network Interface Equipment (FNIE)		✓	
4.1.9	Microwave Only Specifications		✓	
4.1.10	Grounding and Bonding Requirements		✓	
4.1.11	System Training		✓	
4.1.12	Spare Parts		✓	
4.1.13	Warranty and Maintenance Services		✓	

VENDOR NAME Communications International, Inc.

ADDRESS 4045 Pines Industrial Ave

AUTHORIZED SIGNATURE 

PRINTED SIGNATURE Robert W. M. to k DATE 3/9/16

TELEPHONE # 321-636-7720 FAX # 321-636-7720

EMAIL: mswetz@ask4ci.com

WEBSITE: ask4ci.com



## DIGITAL MICROWAVE NETWORK TECHNICAL DESCRIPTION (SECT. 4)

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Communications International, Inc. (Ci) offers this detailed system design and proposal as experienced systems integrators, having supplied engineering, equipment and implementation services on thousands of projects for over 40 years. The proposed system, in its entirety, is intended to meet the end-to-end requirements of the Brevard County system now and well into the future.

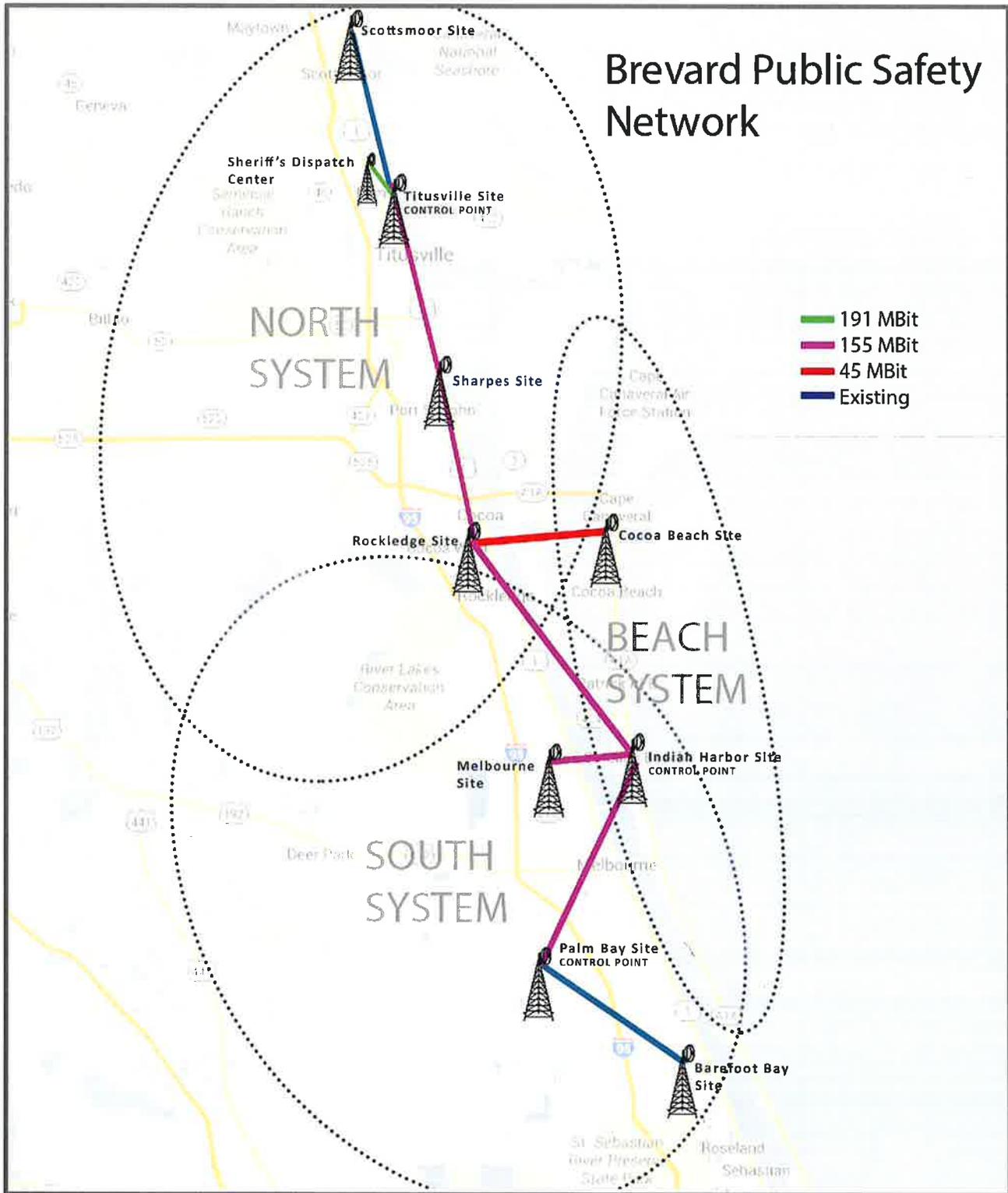
### **Ethernet Microwave Transport Network**

Public-safety networks face a variety of critical issues: inter-facility communications complexity, increased bandwidth requirements, ever increasing Ethernet requirements, convergence of departmental IT systems and the need to share data across jurisdictions. The proposed radio platform addresses all of these issues cost effectively, while providing the security and redundancy that public-safety networks require.

Ci is proposing a TCP/IP topology for the system backhaul network to provide site interconnectivity, audio routing, and interoperability with cooperating agencies. Network applications are converging to a data-centric environment and rely on Ethernet and IP functionality. Eliminating all of the existing TDM applications oftentimes impacts services and operations. The IP designed network proposed has the flexibility to provide a smooth migration from traditional TDM to IP at the pace acceptable to the user.

Ci has offered a networking solution that supplants the hop from Rockledge EOC - Melbourne and Melbourne - Palm Bay. The Melbourne site has repeatedly been difficult to successfully propose antenna additions without expensive engineering modifications to the tower. The offering by Ci suggests making Melbourne a spur from South Beach (maintaining a 155 Mbit path as required) while loading for the Network can utilize the South Beach as a hub (to/from Rockledge and Palm Bay) to complete the required north to south path. Please see the Network Capacity diagram in Figure 1 below for a visual of this modification we offer as a viable and robust solution to Brevard County. This resolution offers a single 4 foot dish be added to the Melbourne site thus saving engineering and financial considerations. Since all the equipment is the same this deviation may easily be reversed to build the normal pathing suggested by Brevard County's RFP. Either solution is fully compliant with the specifications and is offered with no cost increase or decrease within this proposal.

Figure 1: Brevard Public Safety Network





The digital microwave network for Brevard County is designed as a combined 1+1 Monitored Hot Standby configuration. All paths utilize radios with either 155 Mbps capacity or 50 Mbps depending on bandwidth requirements. Some paths will require space diversity to meet 99.999% path reliability.

The digital microwave network consists of Proteus MX-Series 6 GHz and 11 GHz radios. The Proteus MX-Series boasts virtually limitless interface options while providing the highest flexibility in the industry, allowing for easy expansion of the system in the future. The MX-Series is a medium to high capacity, Native TDM and IP Hybrid, point-to-point microwave radio. Capacity, channel bandwidth and modulation are all software defined in the MX-Series. Physical connections are available for DS1, DS3, OC3 and Gigabit (Electrical or Optical). Each radio terminal comes standard with integrated Gigabit Ethernet (2 switched ports) with VLAN and QoS, and with Rapid Ring Protection (RRP) for loop networks, as required.

### Reliability Comparison Chart

	Reliability Guarantee	Reference Seconds/year	Outage Seconds/Year	Outage Minutes/Year	Outage Hours/Year	Outage Hours/Month
Residential Grade	99%	31,536,000	315,360	5,256	88	7.30
<b>Commercial Grade</b>	<b>99.9%</b>	<b>31,536,000</b>	<b>31,536</b>	<b>525.6</b>	<b>8.8</b>	<b>0.73</b>
Industrial Grade	99.99%	31,536,000	3,154	52.6	0.9	0.07
<b>Public Safety Grade</b>	<b>99.999%</b>	<b>31,536,000</b>	<b>315</b>	<b>5.3</b>	<b>0.1</b>	<b>0.01</b>

### Proteus MX Radio

The Proteus MX-Series is one of the most technically advanced, cost effective, and flexible native TDM and native IP microwave solutions. Available in several different hardware and path protection configurations including non-protected (1+0 and 2+0), non-protected repeater, fully hot-standby protected (1+1), protected transmit with space diversity receivers and frequency diversity.

**Key features include:**

- Native Ethernet and Native TDM
- Combining IP and TDM networking, Proteus MX offers risk-free migration from DS1 to IP with the highest possible capacities at the lowest overall cost - addressing any deployment scenario.
- 6-350 Mbps per radio carrier (at 6 GHz & 11GHz)
- Capacities up to 2.5 Gbps
- 6-38 GHz licensed frequency
- 2.5-60 MHz channel bandwidth
- TDM: up to 32xDS1.
- Ethernet: 3x10/100/1000Base-T interfaces (FE/GbE), 1xGbE SFP 1000Base-X (Single Mode or Multi Mode), Auxiliary channels, support up to 10K byte Jumbo Frames.
- Integrated L2 Ethernet switch.
- Adaptive Coding & Modulation (ACM)
- Available Encryption: AES 128/256
- MicroBus – Repeater interconnect & traffic aggregation
- DACS – TDM Digital Cross Connection and Grooming
- Available SHARP - T1 Loop Protection
- Highest spectral efficiency
- Forward Error Correction for improved receiver threshold.
- A powerful Transversal Equalizer to provide high tolerance to dispersive fades, and in some configurations, transmit pre-distortion and Trellis Coding for higher overall system gain.
- Network Management: SNMP based element manager software for integration with NMS platforms, for comprehensive network management.
- Reliability: Use of proprietary digital processes, ensuring fiber like quality and tight data security and quality. Path recognition feature that enables only authorized system operation.
- Pay as You Grow- The Pay-as-you-grow model allows you to upgrade your capacity through a license key. There is no need to add new hardware. License keys can be purchased to enable increased capacity or additional features.

The radios will be mounted in 7'x19" racks equipped with a Trimm fuse/terminal block panel. The intra-rack DC power wiring will be connected to the Trimm fuse/terminal block panel and the DC circuit for all rack mounted equipment will be separately fused.

At sites with DS1 drops, our proposal also includes Telect DSX-1 cross-connect panels. The cross-connect panels provide monitor and circuit interrupting access points for the testing, monitoring, and patching of the DS1 circuits, and provide an RJ-45 interface for each DS1.

### Antenna System

Antennas quoted for all paths are RFS PAD Series standard antennas. PAD Series antennas are unshielded, parabolic antennas which meet FCC Part 101, Category A standards and provide rugged, high-quality performance at low initial costs when compared to using High Performance antennas. Radomes and additional antenna stiff-arms are also proposed for all antennas to reduce wind loading and enhance the survivability of the system.

Connection to the antennas is accomplished with Eupen elliptical waveguide. Eupen's pressurized, elliptical waveguide is the preferred choice for many microwave antenna feeder systems because it provides excellent electrical characteristics. The waveguide is precision-formed from high-conductivity copper with a corrugated wall for excellent crush strength. It is lightweight and has good flexibility for ease of handling. Andrew's recommended grounding system will be used on all waveguide runs. Flex waveguide transitions will be used to connect the waveguide to the radio terminal. This provides for ease of transition, improved aesthetics, and vibration and grounding isolation.

RFS APD-20 Series dehydrators were quoted at sites where required for antenna system pressurization. The APD-20 Series Automatic Pressurization Dehydrator is designed for reliable pressurization of elliptical waveguide. This compact, fully automatic membrane dehydrator is ideal for reliable pressurization of elliptical waveguide from 0.1 to 20 cu. ft. in volume. APD-20 Series dehydrators are fixed pressure units, factory set at 5 lb. /sq. in. Standard features include a built-in storage tank, low pressure alarm, pressure gauge, lighted On/Off switch and resettable circuit breaker.

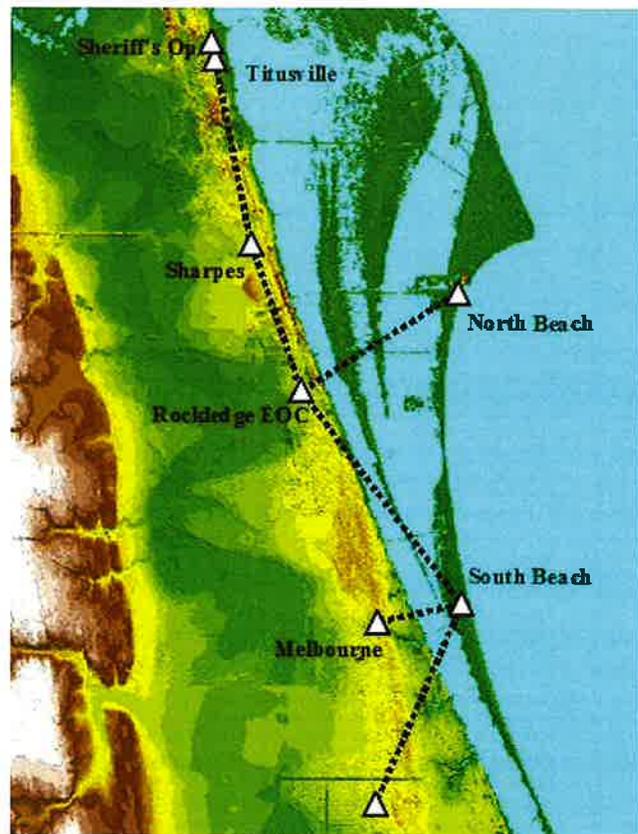


Figure 3: Microwave System Overview



## Network Management System (NMS)

Our Microwave Network Management System proposed has been quoted to monitor and control the proposed MNI digital microwave system. This system will also monitor the existing MNI microwave links at the Scottsmoor Fire Station, Titusville Tower, Barefoot Bay Tower and the Palm Bay Tower sites.

### MNI's NMS provides the following capabilities and features:

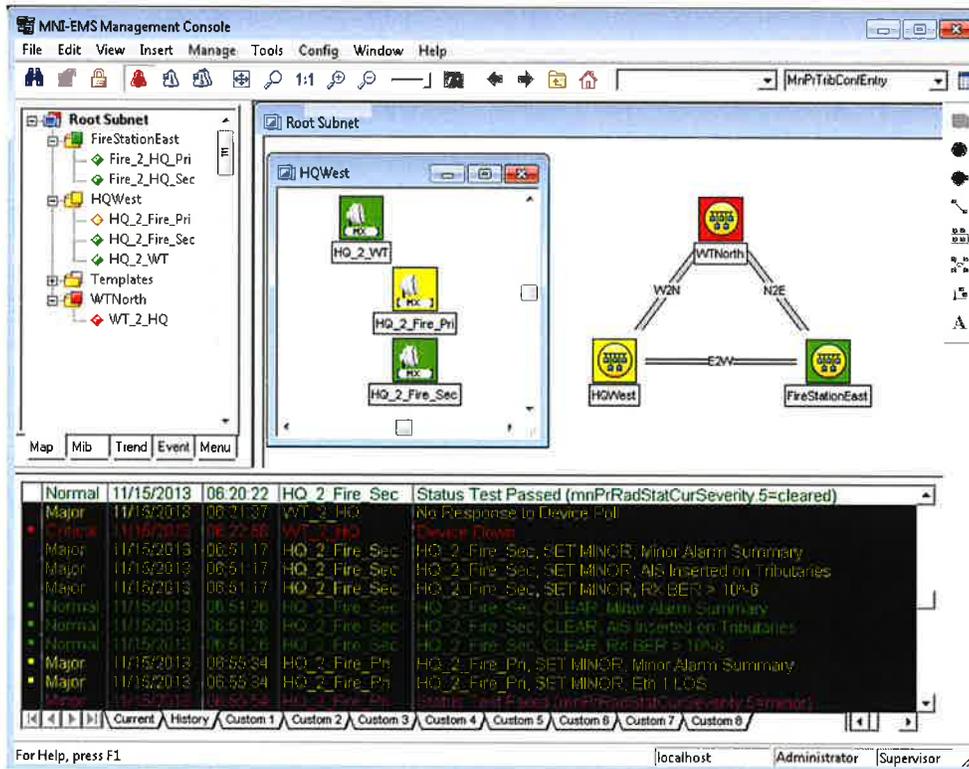
- Runs on Windows OS with modest hardware requirements. NMS is a completely open system allowing access to its data from external sources.
- NMS can be used to manage any SNMP enabled device.
- Supports a multi-level hierarchical map. Each hierarchy can represent cities, buildings, or sub-networks. Imported bitmaps of geographic maps or floor plans, along with manual or automatic network placement, lets you create a layout that closely matches the actual network.
- Automatically lay out each map network as a tree, ring, or bus topology. Each map object uses a device specific or user selected icon, and the object colour indicates the device status.
- The Map Navigation Tool Window displays the map as a tree for direct selection of objects. The Navigation tree also displays the current alarm status of each subnet to quickly locate failing devices.
- The map window Full Zoom feature automatically moves and zooms the view so that all devices are always visible in the window. The Pan/Zoom feature lets you select a region to zoom into from the complete set of devices in a view.
- Automatic network discovery agents find new nodes on the network and automatically place them on the root Map. Operators can then move the newly discovered node to any sub-map and configure how NMS will interact with the node.
- Uses distributed polling agent architecture to provide a high performance solution capable of monitoring networks from several hundred devices to tens of thousands. Remote software and Web based consoles provide network information to everyone who needs it.
- Provides remote access consoles through Java or Windows based client software. Each remote user is assigned a security level and unique view of the network based on their user login.
- Security and accountability through support for user audit trails. Any user access to the management platform or configuration changes are tracked and written to a log file. Alerts are automatically generated if an intrusion attempt is detected.
- Alarm events can be configured to automatically Email and or page appropriate service personnel.
- With the Trend Reporting capability, Polling Agents monitor all user-defined report variables for a learning period and calculate a baseline for typical patterns. Thereafter, the Polling Agents compare the actual polled data to the baseline and generate alarms when variables deviate excessively from the baseline. Polling Agents automatically



adjust baselines as traffic patterns change. You can also manually configure alarm thresholds for any polled variable.

- Allows for changing the color of map objects and performs other actions based on received events. Event Action Filters select the action to take when an event occurs.
- Automatically export Map Topology, trend statistics and event log entries to industry standard databases for further processing. Use familiar tools such as Microsoft Access to generate customized trend reports.
- Automatically generates scheduled daily, weekly, and monthly statistical reports. Report formats include graph, bar chart, distribution, and summary. They can be exported to a variety of destinations, including printers, files, or a WEB server.
- User defined custom menus directly perform commands without having to select MIB objects. Custom menus can display a MIB table; edit, graph or chart any set of MIB variables; set an SNMP MIB variable; or run an application program.

MNI's NMS provides the most immediate real-time health indication of the network by the color of the icons representing the sub-networks, sites and individual radios in the network map: each icon's color represents the severity of the most serious problem that the NMS knows of in the radio or radios that that icon represents. The NMS determines the severity level of the radio by polling the radio's MonitorPrRadStatCurSeverity object, and also by tracking the setting and clearing SNMP traps that the radio can be configured to send to one or more NMS consoles.





MNI's NMS uses received traps and polling to maintain logs of Active (current) and historical Events (alarms) for the entire network and for each network element.

The Proteus MX radio's MIB contains dozens of status variables, and these can be viewed directly using NMS, or in a more formatted fashion using the Element Manager. In addition, any status variable can be polled by the NMS or NMS script, and the NMS can trigger a notification event if the monitored variable exceeds specified thresholds.



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

	Tville	Brev SO
Rain region	Melbourne, Florida	

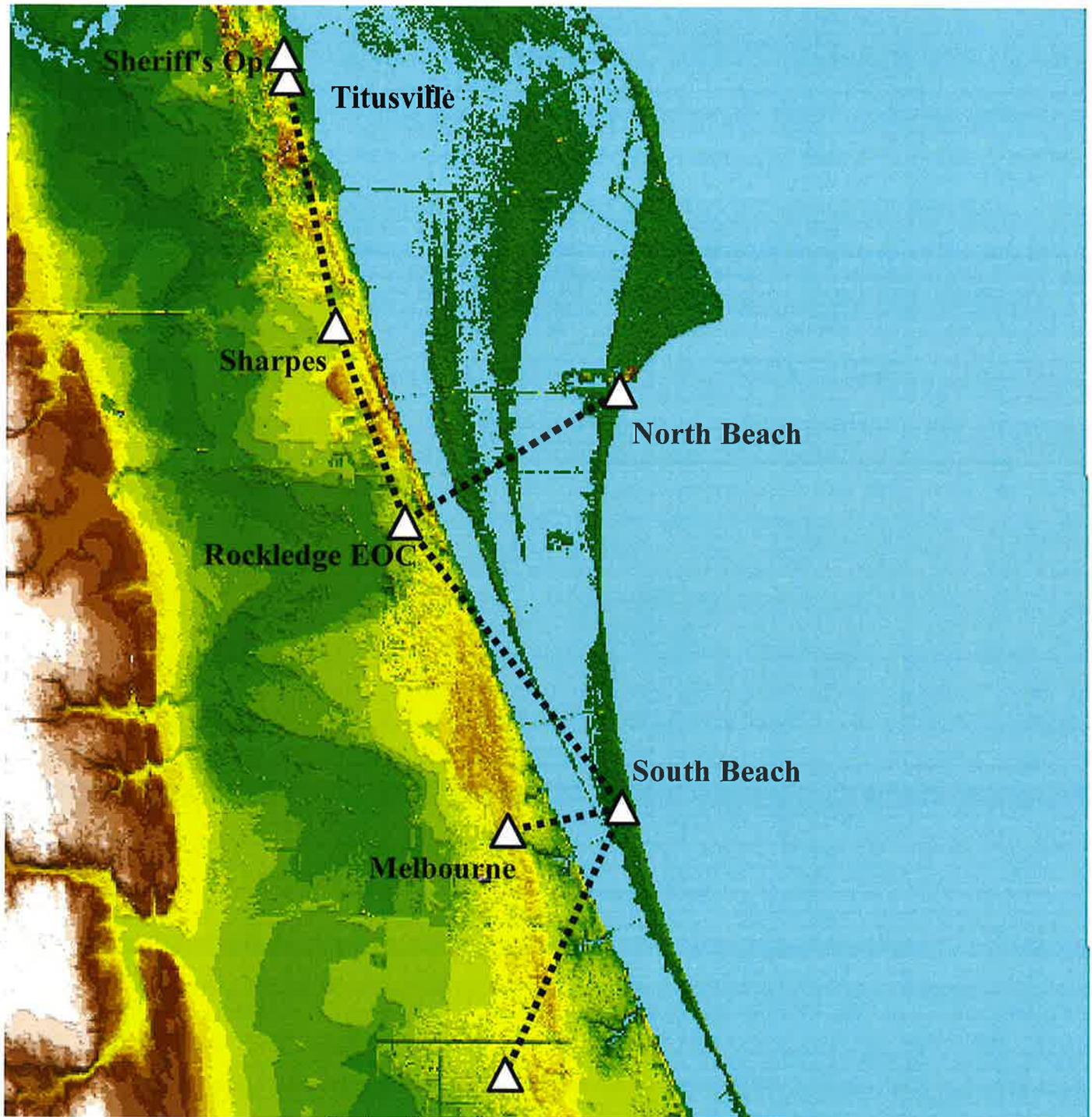
	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
256 QAM 191 Mbps	23.00	23.00	-64.50	-64.50	47.86	49.50	-46.75	-46.75	17.75	17.75	17.75	17.75
256 QAM 180 Mbps	23.00	23.00	-67.50	-67.50	47.86	49.50	-46.75	-46.75	20.75	20.75	20.75	20.75
128 QAM 166 Mbps	24.00	24.00	-69.00	-69.00	48.86	50.50	-45.75	-45.75	23.25	23.25	23.25	23.25
128 QAM 155 Mbps	24.00	24.00	-70.50	-70.50	48.86	50.50	-45.75	-45.75	24.75	24.75	24.75	24.75
64 QAM 134 Mbps	25.00	25.00	-73.00	-73.00	49.86	51.50	-44.75	-44.75	28.25	28.25	28.25	28.25
32 QAM 105 Mbps	26.00	26.00	-76.00	-76.00	50.86	52.50	-43.75	-43.75	32.25	32.25	32.25	32.25
16 QAM 90 Mbps	27.00	27.00	-78.50	-78.50	51.86	53.50	-42.75	-42.75	35.75	35.75	35.75	35.75
16 QAM 76 Mbps	27.00	27.00	-80.00	-80.00	51.86	53.50	-42.75	-42.75	37.25	37.25	37.25	37.25
8 QAM 64 Mbps	28.00	28.00	-80.50	-80.50	52.86	54.50	-41.75	-41.75	38.75	38.75	38.75	38.75
QPSK 38 Mbps	28.00	28.00	-87.00	-87.00	52.86	54.50	-41.75	-41.75	45.25	45.25	45.25	45.25

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
256 QAM 191 Mbps	99.9991	99.9991	99.9996	99.9996	99.9999	99.9999	99.9992	99.9992
256 QAM 180 Mbps	99.9994	99.9994	99.9998	99.9998	99.9999	99.9999	99.9996	0.0004
128 QAM 166 Mbps	99.9997	99.9997	99.9999	99.9999	99.9999	99.9999	99.9998	0.0002
128 QAM 155 Mbps	99.9998	99.9998	99.9999	99.9999	99.9999	99.9999	99.9998	0.0001
64 QAM 134 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0001
32 QAM 105 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
16 QAM 90 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
16 QAM 76 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
8 QAM 64 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
QPSK 38 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000

Multipath fading method - Vigants - Barnett

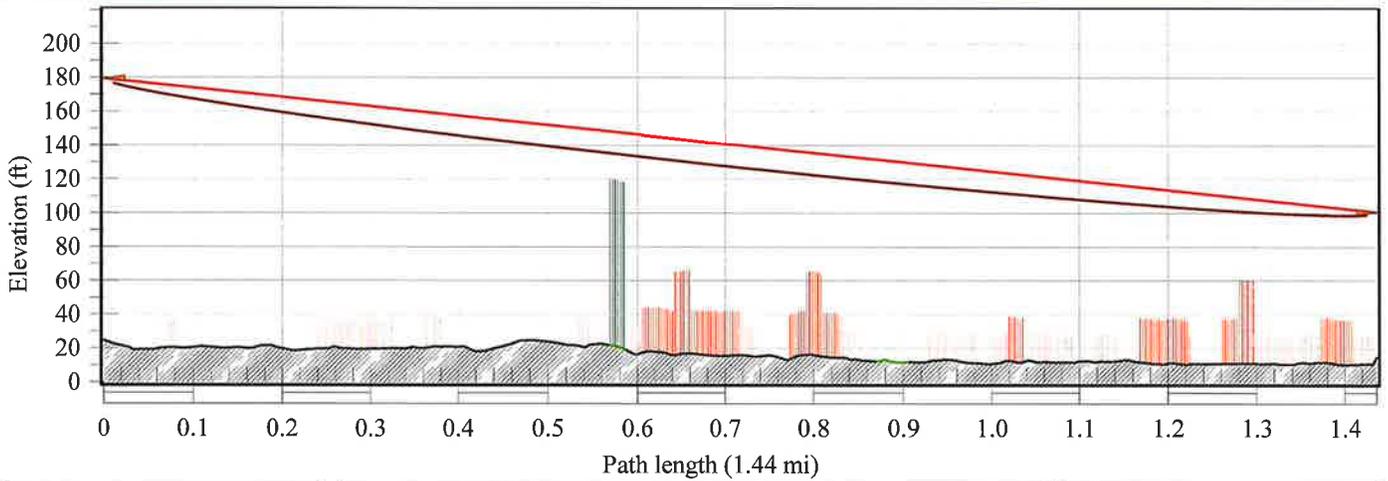
Rain fading method - Crane

## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)





## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)



Titusville	
Latitude	28 35 36.00 N
Longitude	080 49 00.00 W
Azimuth	351.87°
Elevation	25 ft ASL
Antenna CL	155.0 ft AGL

Frequency (MHz) = 11000.0
Main 1 K = 1.330 %F1 = 100.00

Sheriff's Op	
Latitude	28 36 27.53 N
Longitude	080 49 08.34 W
Azimuth	171.87°
Elevation	15 ft ASL
Antenna CL	85.9 ft AGL



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

Transmission details (tville-brev so.pl5)

	Titusville	Sheriff's Op
Latitude	28 35 36.00 N	28 36 27.53 N
Longitude	080 49 00.00 W	080 49 08.34 W
True azimuth (°)	351.87	171.87
Elevation (ft)	24.55	14.81
Tower height (ft)	379.90	90.00
Tower type	guyed	guyed
Antenna model	PA2-103A (TR)	PA2-103A (TR)
Antenna file name	pa2-103a	pa2-103a
Antenna gain (dBi)	33.50	33.50
Radome loss (dB)	2.00	2.00
Antenna height (ft)	155.00	85.92
TX line model	EWP90	EWP90
TX line unit loss (dB/100 ft)	2.73	2.73
TX line length (ft)	170.00	110.00
TX line loss (dB)	4.64	3.00
Connector loss (dB)	1.00	1.00
Miscellaneous loss (dB)	1.00	1.00
RX hybrid loss (dB)	0.50	0.50
Frequency (MHz)	11000.00	
Polarization	Vertical	
Path length (mi)	1.44	



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

	Titusville	Sheriff's Op
Free space loss (dB)	120.58	
Atmospheric absorption loss (dB)	0.04	
Net path loss (dB)	69.75	69.75
Configuration	Hot-Standby	Hot-Standby
Radio model	MX/I/11G/30M/SP	MX/I/11G/30M/SP
Radio file name	mxi11-30-sp	mxi11-30-sp
Emission designator	30M0D7W	30M0D7W
Climatic factor	2.50	
Terrain roughness (ft)	20.00	
C factor	8.23	
Average annual temperature (°F)	71.52	
Fade occurrence factor (Po)	6.710E-004	
Polarization	Vertical	
Rain region	Melbourne, Florida	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
256 QAM 191 Mbps	23.00	23.00	-64.50	-64.50	47.86	49.50	-46.75	-46.75	17.75	17.75	17.75	17.75
256 QAM 180 Mbps	23.00	23.00	-67.50	-67.50	47.86	49.50	-46.75	-46.75	20.75	20.75	20.75	20.75
128 QAM 166 Mbps	24.00	24.00	-69.00	-69.00	48.86	50.50	-45.75	-45.75	23.25	23.25	23.25	23.25
128 QAM 155 Mbps	24.00	24.00	-70.50	-70.50	48.86	50.50	-45.75	-45.75	24.75	24.75	24.75	24.75
64 QAM 134 Mbps	25.00	25.00	-73.00	-73.00	49.86	51.50	-44.75	-44.75	28.25	28.25	28.25	28.25
32 QAM 105 Mbps	26.00	26.00	-76.00	-76.00	50.86	52.50	-43.75	-43.75	32.25	32.25	32.25	32.25
16 QAM 90 Mbps	27.00	27.00	-78.50	-78.50	51.86	53.50	-42.75	-42.75	35.75	35.75	35.75	35.75



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
16 QAM 76 Mbps	27.00	27.00	-80.00	-80.00	51.86	53.50	-42.75	-42.75	37.25	37.25	37.25	37.25
8 QAM 64 Mbps	28.00	28.00	-80.50	-80.50	52.86	54.50	-41.75	-41.75	38.75	38.75	38.75	38.75
QPSK 38 Mbps	28.00	28.00	-87.00	-87.00	52.86	54.50	-41.75	-41.75	45.25	45.25	45.25	45.25

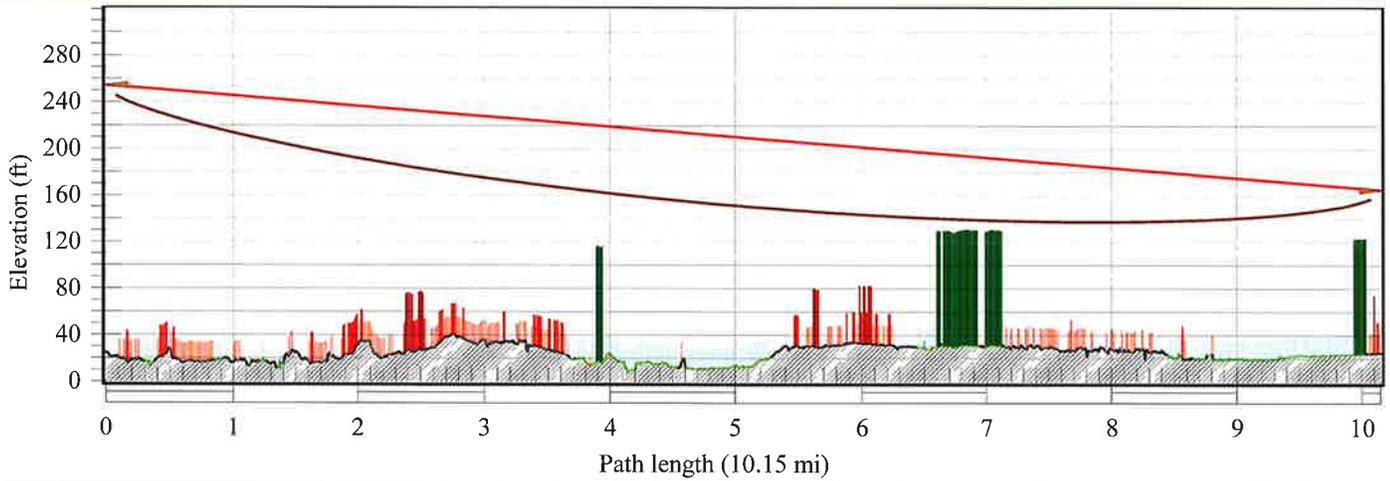
	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
256 QAM 191 Mbps	99.9990	99.9990	99.9996	99.9996	99.9999	99.9999	99.9992	99.9992
256 QAM 180 Mbps	99.9994	99.9994	99.9998	99.9998	99.9999	99.9999	99.9996	0.0004
128 QAM 166 Mbps	99.9997	99.9997	99.9999	99.9999	99.9999	99.9999	99.9998	0.0002
128 QAM 155 Mbps	99.9998	99.9998	99.9999	99.9999	99.9999	99.9999	99.9998	0.0001
64 QAM 134 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0001
32 QAM 105 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
16 QAM 90 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
16 QAM 76 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
8 QAM 64 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
QPSK 38 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



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)



Titusville	
Latitude	28 35 36.00 N
Longitude	080 49 00.00 W
Azimuth	168.84°
Elevation	25 ft ASL
Antenna CL	230.0 ft AGL

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

Sharpes	
Latitude	28 26 43.00 N
Longitude	080 47 01.00 W
Azimuth	348.85°
Elevation	25 ft ASL
Antenna CL	140.0 ft AGL



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

Transmission details (tville-sharpes.pl5)

	Titusville	Sharpes
Latitude	28 35 36.00 N	28 26 43.00 N
Longitude	080 49 00.00 W	080 47 01.00 W
True azimuth (°)	168.84	348.85
Elevation (ft)	24.55	24.93
Tower height (ft)	379.90	140.00
Tower type	guyed	self supporting
Antenna model	PAD6-59W (TR)	PAD6-59W (TR)
Antenna file name	pad6-w59	pad6-w59
Antenna gain (dBi)	39.10	39.10
Antenna height (ft)	230.00	140.00
TX line model	EW63	EW63
TX line unit loss (dB/100 ft)	1.44	1.44
TX line length (ft)	240.00	165.00
TX line loss (dB)	3.45	2.37
RX hybrid loss (dB)	0.50	0.50
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	10.15	
Free space loss (dB)	132.54	
Atmospheric absorption loss (dB)	0.14	
Net path loss (dB)	60.80	60.80



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

	Titusville	Sharpes
Configuration	Hot-Standby	Hot-Standby
Radio model	MX/I/6G/30M/HP	MX/I/6G/30M/HP
Radio file name	mxi6-30-hp	mxi6-30-hp
Emission designator	30M0D7W	30M0D7W
Climatic factor	2.50	
Terrain roughness (ft)	20.00	
C factor	8.23	
Average annual temperature (°F)	71.55	
Fade occurrence factor (Po)	1.328E-001	
Polarization	Vertical	
Rain region	Melbourne, Florida	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
128 QAM 155 Mbps	32.00	32.00	-71.00	-71.00	67.65	68.73	-28.80	-28.80	42.20	42.20	42.20	42.20
64 QAM 134 Mbps	32.00	32.00	-73.50	-73.50	67.65	68.73	-28.80	-28.80	44.70	44.70	44.70	44.70
32 QAM 105 Mbps	33.00	33.00	-76.50	-76.50	68.65	69.73	-27.80	-27.80	48.70	48.70	48.70	48.70
16 QAM 90 Mbps	33.00	33.00	-79.00	-79.00	68.65	69.73	-27.80	-27.80	51.20	51.20	51.20	51.20
16 QAM 76 Mbps	33.00	33.00	-80.50	-80.50	68.65	69.73	-27.80	-27.80	52.70	52.70	52.70	52.70
8 QAM 64 Mbps	34.00	34.00	-81.00	-81.00	69.65	70.73	-26.80	-26.80	54.20	54.20	54.20	54.20
QPSK 38 Mbps	34.00	34.00	-87.50	-87.50	69.65	70.73	-26.80	-26.80	60.70	60.70	60.70	60.70



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

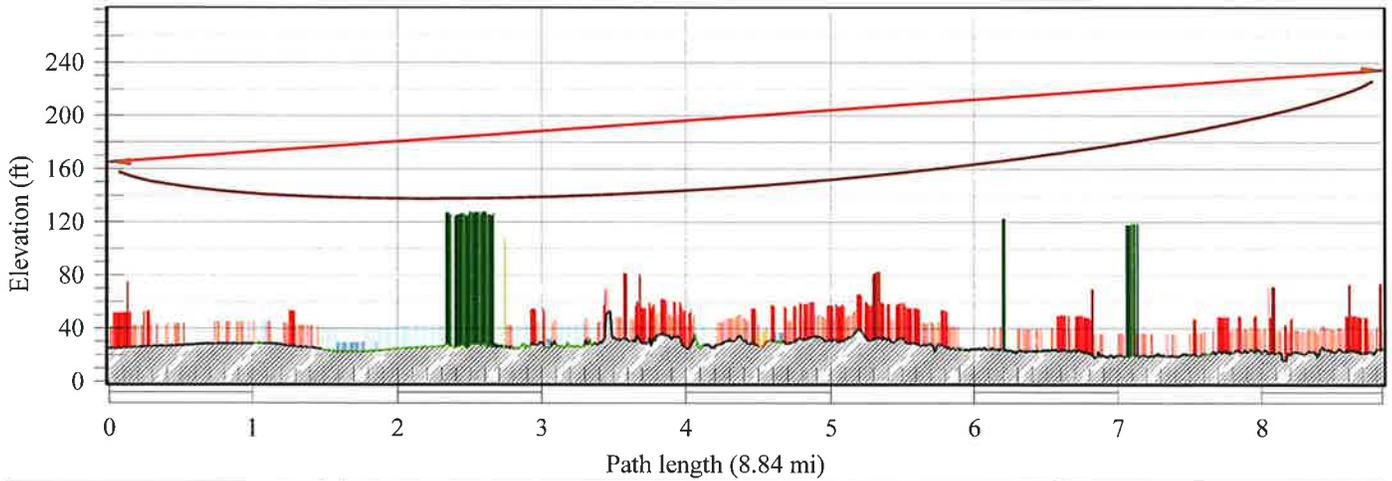
	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
128 QAM 155 Mbps	99.9990	99.9990	99.9992	99.9992	99.9999	99.9999	99.9991	99.9991
64 QAM 134 Mbps	99.9992	99.9992	99.9997	99.9997	99.9999	99.9999	99.9994	0.0010
32 QAM 105 Mbps	99.9997	99.9997	99.9999	99.9999	99.9999	99.9999	99.9998	0.0003
16 QAM 90 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0001
16 QAM 76 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
8 QAM 64 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
QPSK 38 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



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)



Sharpes	
Latitude	28 26 43.00 N
Longitude	080 47 01.00 W
Azimuth	160.78°
Elevation	25 ft ASL
Antenna CL	140.0 ft AGL

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

Rockledge EOC	
Latitude	28 19 39.00 N
Longitude	080 44 14.00 W
Azimuth	340.81°
Elevation	25 ft ASL
Antenna CL	210.0 ft AGL



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

Transmission details (sharpes-rockldg.pl5)

	Sharpes	Rockledge EOC
Latitude	28 26 43.00 N	28 19 39.00 N
Longitude	080 47 01.00 W	080 44 14.00 W
True azimuth (°)	160.78	340.81
Elevation (ft)	24.93	24.68
Tower height (ft)	140.00	387.10
Tower type	self supporting	guyed
Antenna model	PAD6-59 (TR)	PAD6-59 (TR)
Antenna file name	pad6-59	pad6-59
Antenna gain (dBi)	38.70	38.70
Radome loss (dB)	0.50	0.50
Antenna height (ft)	140.00	210.00
TX line model	EW63	EW63
TX line unit loss (dB/100 ft)	1.44	1.44
TX line length (ft)	165.00	196.00
TX line loss (dB)	2.37	2.82
RX hybrid loss (dB)	0.50	0.50
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	8.84	
Free space loss (dB)	131.34	
Atmospheric absorption loss (dB)	0.12	



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

	Sharpes	Rockledge EOC
Net path loss (dB)	60.75	60.75
Configuration	Hot-Standby	Hot-Standby
Radio model	MX/I/6G/30M/HP	MX/I/6G/30M/HP
Radio file name	mxi6-30-hp	mxi6-30-hp
Emission designator	30M0D7W	30M0D7W
Climatic factor	2.50	
Terrain roughness (ft)	20.00	
C factor	8.23	
Average annual temperature (°F)	71.64	
Fade occurrence factor (Po)	8.765E-002	
Polarization	Vertical	
Rain region	Melbourne, Florida	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
128 QAM 155 Mbps	32.00	32.00	-71.00	-71.00	67.83	67.38	-28.75	-28.75	42.25	42.25	42.25	42.25
64 QAM 134 Mbps	32.00	32.00	-73.50	-73.50	67.83	67.38	-28.75	-28.75	44.75	44.75	44.75	44.75
32 QAM 105 Mbps	33.00	33.00	-76.50	-76.50	68.83	68.38	-27.75	-27.75	48.75	48.75	48.75	48.75
16 QAM 90 Mbps	33.00	33.00	-79.00	-79.00	68.83	68.38	-27.75	-27.75	51.25	51.25	51.25	51.25
16 QAM 76 Mbps	33.00	33.00	-80.50	-80.50	68.83	68.38	-27.75	-27.75	52.75	52.75	52.75	52.75
8 QAM 64 Mbps	34.00	34.00	-81.00	-81.00	69.83	69.38	-26.75	-26.75	54.25	54.25	54.25	54.25
QPSK 38 Mbps	34.00	34.00	-87.50	-87.50	69.83	69.38	-26.75	-26.75	60.75	60.75	60.75	60.75



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

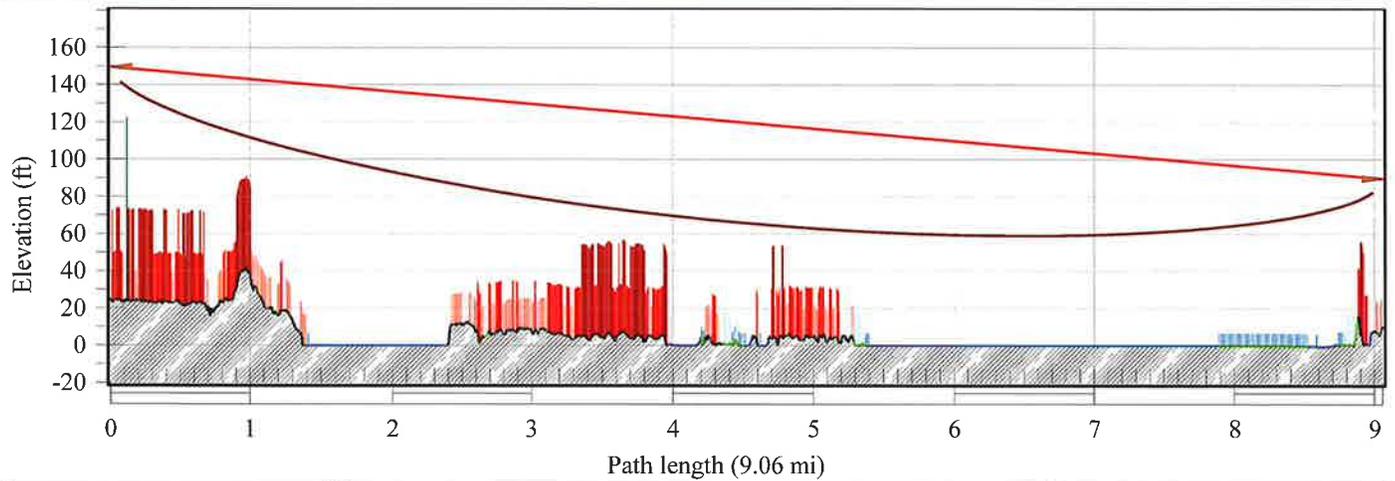
	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
128 QAM 155 Mbps	99.9990	99.9990	99.9995	99.9995	99.9999	99.9999	99.9991	99.9991
64 QAM 134 Mbps	99.9995	99.9995	99.9998	99.9998	99.9999	99.9999	99.9996	0.0006
32 QAM 105 Mbps	99.9998	99.9998	99.9999	99.9999	99.9999	99.9999	99.9999	0.0002
16 QAM 90 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0001
16 QAM 76 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
8 QAM 64 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
QPSK 38 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



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)



Rockledge EOC	
Latitude	28 19 39.00 N
Longitude	080 44 14.00 W
Azimuth	57.96°
Elevation	25 ft ASL
Antenna CL	125.0 ft AGL

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

North Beach	
Latitude	28 24 23.68 N
Longitude	080 35 39.00 W
Azimuth	238.03°
Elevation	10 ft ASL
Antenna CL	80.0 ft AGL



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

Transmission details (rockldg-cape c.pl5)

	Rockledge EOC	North Beach
Latitude	28 19 39.00 N	28 24 23.68 N
Longitude	080 44 14.00 W	080 35 39.00 W
True azimuth (°)	57.96	238.03
Elevation (ft)	24.68	9.86
Tower height (ft)	387.10	249.90
Tower type	guyed	self supporting
Antenna model	PAD6-59 (TR)	PAD6-59 (TR)
Antenna file name	pad6-59	pad6-59
Antenna gain (dBi)	38.70	38.70
Radome loss (dB)	0.50	0.50
Antenna height (ft)	125.00	80.00
TX line model	EW63	EW63
TX line unit loss (dB/100 ft)	1.44	1.44
TX line length (ft)	155.00	155.00
TX line loss (dB)	2.23	2.23
Connector loss (dB)	0.50	0.50
Miscellaneous loss (dB)	0.50	0.50
RX hybrid loss (dB)	0.50	0.50
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	9.06	



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

	Rockledge EOC	North Beach
Free space loss (dB)	131.56	
Atmospheric absorption loss (dB)	0.13	
Net path loss (dB)	62.24	62.24
Configuration	Hot-Standby	Hot-Standby
Radio model	MX/I/6G/10M/SP	MX/I/6G/10M/SP
Radio file name	mxi6-10-sp	mxi6-10-sp
Emission designator	10M0D7W	10M0D7W
Climatic factor	2.50	
Terrain roughness (ft)	20.00	
C factor	8.23	
Average annual temperature (°F)	71.78	
Fade occurrence factor (Po)	9.448E-002	
Polarization	Vertical	
Rain region	Melbourne, Florida	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
64 QAM 45 Mbps	28.00	28.00	-77.50	-77.50	62.97	62.97	-34.24	-34.24	43.26	43.26	43.26	43.26
32 QAM 35 Mbps	29.00	29.00	-81.00	-81.00	63.97	63.97	-33.24	-33.24	47.76	47.76	47.76	47.76
16 QAM 25 Mbps	30.00	30.00	-85.50	-85.50	64.97	64.97	-32.24	-32.24	53.26	53.26	53.26	53.26
8 QAM 19.1 Mbps	31.00	31.00	-87.00	-87.00	65.97	65.97	-31.24	-31.24	55.76	55.76	55.76	55.76
QPSK 12.7 Mbps	31.00	31.00	-92.50	-92.50	65.97	65.97	-31.24	-31.24	61.26	61.26	61.26	61.26



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

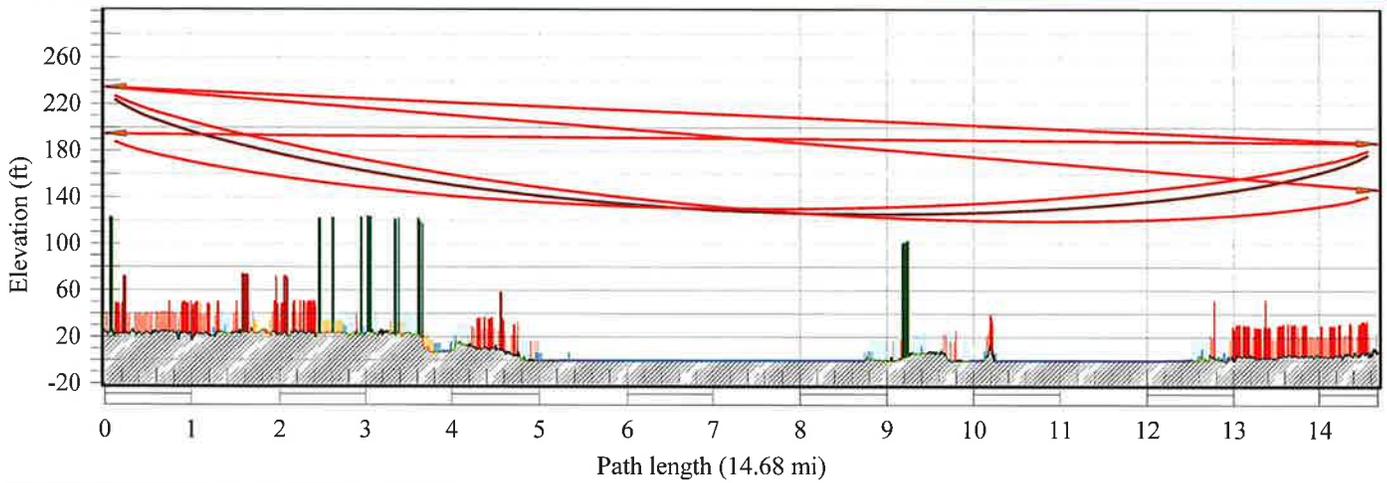
	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
64 QAM 45 Mbps	99.9995	99.9995	99.9998	99.9998	99.9999	99.9999	99.9996	99.9996
32 QAM 35 Mbps	99.9998	99.9998	99.9999	99.9999	99.9999	99.9999	99.9999	0.0002
16 QAM 25 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0001
8 QAM 19.1 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
QPSK 12.7 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



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)



Rockledge EOC	
Latitude	28 19 39.00 N
Longitude	080 44 14.00 W
Azimuth	143.06°
Elevation	25 ft ASL
Antenna CL	210.0, 170.0 ft AGL

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

South Beach	
Latitude	28 09 24.30 N
Longitude	080 35 32.70 W
Azimuth	323.13°
Elevation	7 ft ASL
Antenna CL	180.0, 140.0 ft AGL



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

Transmission details (rockldg-ihb.pl5)

	Rockledge EOC	South Beach
Latitude	28 19 39.00 N	28 09 24.30 N
Longitude	080 44 14.00 W	080 35 32.70 W
True azimuth (°)	143.06	323.13
Elevation (ft)	24.68	7.16
Tower height (ft)	387.10	249.90
Tower type	guyed	self supporting
Antenna model	PAD6-59 (TR)	PAD6-59 (TR)
Antenna file name	pad6-59	pad6-59
Antenna gain (dBi)	38.70	38.70
Radome loss (dB)	0.50	0.50
Antenna height (ft)	210.00	180.00
TX line model	EW63	EW63
TX line unit loss (dB/100 ft)	1.44	1.44
TX line length (ft)	210.00	210.00
TX line loss (dB)	3.02	3.02
Connector loss (dB)	0.50	0.50
Miscellaneous loss (dB)	0.50	0.50
RX hybrid loss (dB)	0.50	0.50
Antenna model	SP4-59A(P) (DR)	SP4-59A(P) (DR)
Antenna file name	sp4-59a	sp4-59a
Antenna gain (dBi)	35.30	35.30



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

	Rockledge EOC	South Beach
Radome loss (dB)	1.00	1.00
Antenna height (ft)	170.00	140.00
TX line model	EW63	EW63
TX line unit loss (dB/100 ft)	1.44	1.44
TX line length (ft)	170.00	170.00
TX line loss (dB)	2.44	2.44
Connector loss (dB)	0.50	0.50
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	14.68	
Free space loss (dB)	135.75	
Atmospheric absorption loss (dB)	0.20	
Main net path loss (dB)	68.09	68.09
Diversity net path loss (dB)	70.41	70.41
Configuration	Hot-Standby	Hot-Standby
Radio model	MX/I/6G/30M/SP	MX/I/6G/30M/SP
Radio file name	mxi6-30-sp	mxi6-30-sp
Emission designator	30M0D7W	30M0D7W
Climatic factor	2.50	
Terrain roughness (ft)	20.00	
C factor	8.23	
Average annual temperature (°F)	71.84	
Fade occurrence factor (Po)	4.015E-001	



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

	Rockledge EOC	South Beach
SD improvement factor	200.00	200.00
Polarization	Vertical	
Rain region	Melbourne, Florida	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
128 QAM 155 Mbps	29.00	29.00	-71.00	-71.00	63.18	63.18	-39.09	-39.09	31.91	31.91	31.91	31.91
64 QAM 134 Mbps	29.00	29.00	-73.50	-73.50	63.18	63.18	-39.09	-39.09	34.41	34.41	34.41	34.41
32 QAM 105 Mbps	30.00	30.00	-76.50	-76.50	64.18	64.18	-38.09	-38.09	38.41	38.41	38.41	38.41
16 QAM 90 Mbps	30.00	30.00	-79.00	-79.00	64.18	64.18	-38.09	-38.09	40.91	40.91	40.91	40.91
16 QAM 76 Mbps	30.00	30.00	-80.50	-80.50	64.18	64.18	-38.09	-38.09	42.41	42.41	42.41	42.41
8 QAM 64 Mbps	31.00	31.00	-81.00	-81.00	65.18	65.18	-37.09	-37.09	43.91	43.91	43.91	43.91
QPSK 38 Mbps	31.00	31.00	-87.50	-87.50	65.18	65.18	-37.09	-37.09	50.41	50.41	50.41	50.41

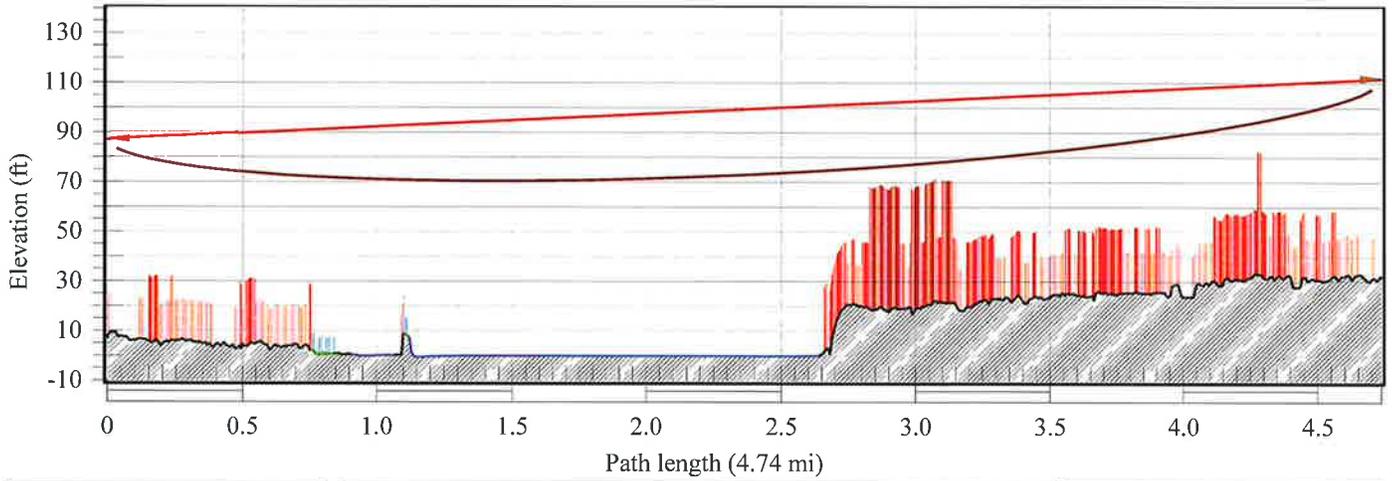
	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
128 QAM 155 Mbps	99.9994	99.9994	99.9998	99.9998	99.9999	99.9999	99.9996	99.9996
64 QAM 134 Mbps	99.9998	99.9998	99.9999	99.9999	99.9999	99.9999	99.9999	0.0003
32 QAM 105 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0001
16 QAM 90 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
16 QAM 76 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
8 QAM 64 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
QPSK 38 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



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)



South Beach	
Latitude	28 09 24.30 N
Longitude	080 35 32.70 W
Azimuth	258.08°
Elevation	7 ft ASL
Antenna CL	80.0 ft AGL

Frequency (MHz) = 11000.0
Main 1 K = 1.330 %F1 = 100.00

Melbourne	
Latitude	28 08 33.20 N
Longitude	080 40 05.40 W
Azimuth	78.05°
Elevation	32 ft ASL
Antenna CL	80.0 ft AGL



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

Transmission details (ihb-lansing.pl5)

	South Beach	Melbourne
Latitude	28 09 24.30 N	28 08 33.20 N
Longitude	080 35 32.70 W	080 40 05.40 W
True azimuth (°)	258.08	78.05
Elevation (ft)	7.16	31.87
Tower height (ft)	249.90	259.80
Tower type	self supporting	self supporting
Antenna model	PA4-103A (TR)	PA4-103A (TR)
Antenna file name	pa4-103a	pa2-103a
Antenna gain (dBi)	39.80	39.80
Radome loss (dB)	1.00	1.00
Antenna height (ft)	80.00	80.00
TX line model	EWP90	EWP90
TX line unit loss (dB/100 ft)	2.86	2.86
TX line length (ft)	100.00	100.00
TX line loss (dB)	2.86	2.86
RX hybrid loss (dB)	0.50	0.50
Frequency (MHz)	11000.00	
Polarization	Vertical	
Path length (mi)	4.74	
Free space loss (dB)	130.94	
Atmospheric absorption loss (dB)	0.12	



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

	South Beach	Melbourne
Net path loss (dB)	59.67	59.67
Configuration	Hot-Standby	Hot-Standby
Radio model	MX/I/11G/30M/HP	MX/I/11G/30M/HP
Radio file name	mxi11-30-hp	mxi11-30-hp
Emission designator	30M0D7W	30M0D7W
Climatic factor	2.50	
Terrain roughness (ft)	20.00	
C factor	8.23	
Average annual temperature (°F)	71.92	
Fade occurrence factor (Po)	2.404E-002	
Polarization	Vertical	
Rain region	Melbourne, Florida	

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
128 QAM 155 Mbps	27.00	27.00	-70.50	-70.50	62.94	62.94	-32.67	-32.67	37.83	37.83	37.83	37.83
64 QAM 134 Mbps	28.00	28.00	-73.00	-73.00	63.94	63.94	-31.67	-31.67	41.33	41.33	41.33	41.33
32 QAM 105 Mbps	29.00	29.00	-76.00	-76.00	64.94	64.94	-30.67	-30.67	45.33	45.33	45.33	45.33
16 QAM 90 Mbps	30.00	30.00	-78.50	-78.50	65.94	65.94	-29.67	-29.67	48.83	48.83	48.83	48.83
16 QAM 76 Mbps	30.00	30.00	-80.00	-80.00	65.94	65.94	-29.67	-29.67	50.33	50.33	50.33	50.33
8 QAM 64 Mbps	31.00	31.00	-80.50	-80.50	66.94	66.94	-28.67	-28.67	51.83	51.83	51.83	51.83
QPSK 38 Mbps	31.00	31.00	-87.00	-87.00	66.94	66.94	-28.67	-28.67	58.33	58.33	58.33	58.33



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

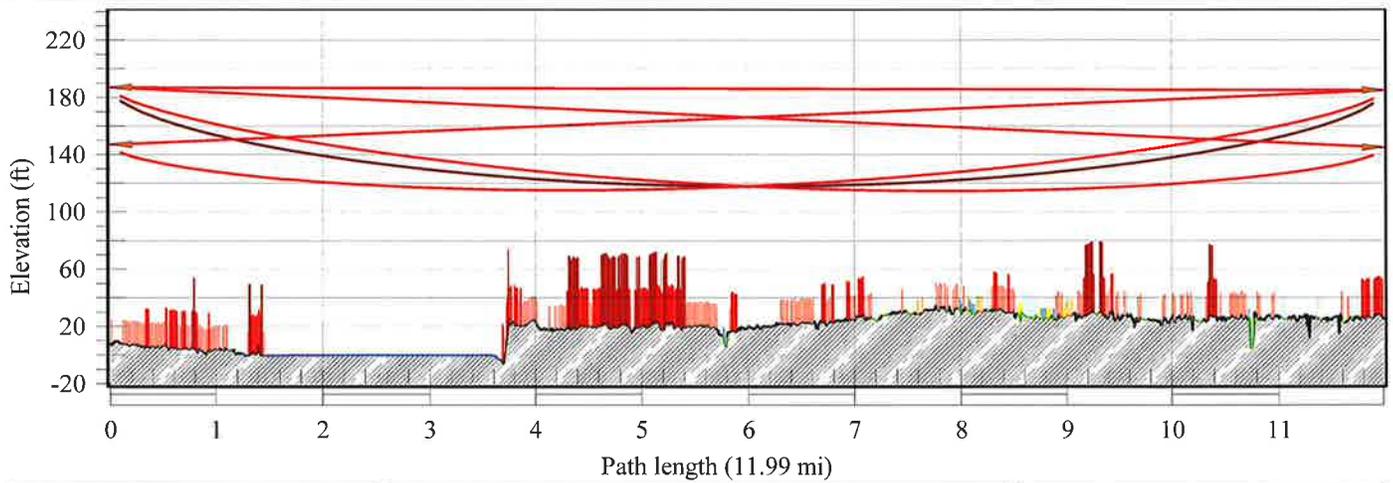
	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
128 QAM 155 Mbps	99.9994	99.9994	99.9998	99.9998	99.9999	99.9999	99.9995	99.9995
64 QAM 134 Mbps	99.9998	99.9998	99.9999	99.9999	99.9999	99.9999	99.9998	0.0003
32 QAM 105 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0001
16 QAM 90 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
16 QAM 76 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
8 QAM 64 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
QPSK 38 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



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)



South Beach	
Latitude	28 09 24.30 N
Longitude	080 35 32.70 W
Azimuth	203.17°
Elevation	7 ft ASL
Antenna CL	180.0, 140.0 ft AGL

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

Palm Bay	
Latitude	27 59 47.00 N
Longitude	080 40 11.00 W
Azimuth	23.13°
Elevation	25 ft ASL
Antenna CL	160.0, 120.0 ft AGL



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

Transmission details (ihb-palm bay.pl5)

	South Beach	Palm Bay
Latitude	28 09 24.30 N	27 59 47.00 N
Longitude	080 35 32.70 W	080 40 11.00 W
True azimuth (°)	203.17	23.13
Elevation (ft)	7.16	25.06
Tower height (ft)	249.90	391.00
Tower type	self supporting	guyed
Antenna model	PAD6-59 (TR)	PAD6-59 (TR)
Antenna file name	pad6-59	pad6-59
Antenna gain (dBi)	38.70	38.70
Antenna height (ft)	180.00	160.00
TX line model	EW63	EW63
TX line unit loss (dB/100 ft)	1.44	1.44
TX line length (ft)	210.00	180.00
TX line loss (dB)	3.02	2.59
RX hybrid loss (dB)	0.50	0.50
Antenna model	SP4-59A(P) (DR)	SP4-59A(P) (DR)
Antenna file name	sp4-59a	sp4-59a
Antenna gain (dBi)	35.30	35.30
Radome loss (dB)	1.00	1.00
Antenna height (ft)	140.00	120.00
TX line model	EW63	EW63



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

	South Beach	Palm Bay
TX line unit loss (dB/100 ft)	1.44	1.44
TX line length (ft)	170.00	150.00
TX line loss (dB)	2.44	2.16
Other diversity RX loss (dB)	0.50	0.50
Frequency (MHz)	6175.00	
Polarization	Vertical	
Path length (mi)	11.99	
Free space loss (dB)	133.99	
Atmospheric absorption loss (dB)	0.17	
Main net path loss (dB)	62.86	62.86
Diversity net path loss (dB)	66.68	66.83
Configuration	Hot-Standby	Hot-Standby
Radio model	MX/I/6G/30M/SP	MX/I/6G/30M/SP
Radio file name	mxi6-30-sp	mxi6-30-sp
Emission designator	30M0D7W	30M0D7W
Climatic factor	2.50	
Terrain roughness (ft)	20.00	
C factor	8.23	
Average annual temperature (°F)	71.94	
Fade occurrence factor (Po)	2.188E-001	
SD improvement factor	200.00	200.00
Polarization	Vertical	
Rain region	Melbourne, Florida	



## BREVARD COUNTY MICROWAVE CONNECTIVITY SOLUTION (SECT. 4.19)

	TX power (dBm)		RX threshold level (dBm)		EIRP (dBm)		Receive signal (dBm)		Thermal fade margin (dB)		Flat fade margin - multipath (dB)	
128 QAM 155 Mbps	29.00	29.00	-71.00	-71.00	64.68	65.11	-33.86	-33.86	37.14	37.14	37.14	37.14
64 QAM 134 Mbps	29.00	29.00	-73.50	-73.50	64.68	65.11	-33.86	-33.86	39.64	39.64	39.64	39.64
32 QAM 105 Mbps	30.00	30.00	-76.50	-76.50	65.68	66.11	-32.86	-32.86	43.64	43.64	43.64	43.64
16 QAM 90 Mbps	30.00	30.00	-79.00	-79.00	65.68	66.11	-32.86	-32.86	46.14	46.14	46.14	46.14
16 QAM 76 Mbps	30.00	30.00	-80.50	-80.50	65.68	66.11	-32.86	-32.86	47.64	47.64	47.64	47.64
8 QAM 64 Mbps	31.00	31.00	-81.00	-81.00	66.68	67.11	-31.86	-31.86	49.14	49.14	49.14	49.14
QPSK 38 Mbps	31.00	31.00	-87.50	-87.50	66.68	67.11	-31.86	-31.86	55.64	55.64	55.64	55.64

	Worst month multipath		Annual multipath		Annual rain		Total annual (2 way)	Time in mode (2 way)
128 QAM 155 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999
64 QAM 134 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
32 QAM 105 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
16 QAM 90 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
16 QAM 76 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
8 QAM 64 Mbps	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	99.9999	0.0000
QPSK 38 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

# EQUIPMENT LIST

## MICROWAVE NETWORK

Units	Description	Coordinates with
<b>PALM BAY SITE</b>		
1	Proteus MX 6GHz Gigabit Ethernet Radio, Hot Standby Protected, Standard Power, Space Diversity, All Indoor, w Microbus, DACC,32 TDM Traffic Line Interface card, 155Mbps Throughput , Automatic Code Modulation	Indian Harbour Beach
1	Wave Guide Extension Kit 6GHz Space Diversity	
2	Champ DSX Interface Cable	
2	Telect 8 Port DSX 1 RJ 45 w 19" Shelf 1RU	
1	7'X19" EIA Rack Assembly	
1	Fuse Panel +/- 48 / 24 VDC 19" 1 RU	
1	Microwave Antenna 6Ft RFS PAD 6GHz Series with Radome	
1	Microwave Antenna 4Ft RFS PAD 6GHz Series Diversity Receive with Radome	
2	Microwave Antenna Pipe Mount Kit	
310	Eupen EU-63 6GHz Waveguide and Connector Kits	
4	RFS Wave Guide Flex 6GHz WR-137 Flange	
1	RFS APD-20 Automatic Wave Guide Dehydrator w Shelf and Pressure Manifold	
1 LOT	Wave Guide Hanger, Hoisting Grips, Grounding Kits and Hardware	
	<i>Note: Integrate Microbus connection to existing MNI Microwave radio for Alarms and DACC</i>	



Units	Description	Coordinates with
<b>INDIAN HARBOUR BEACH SITE</b>		
1	Proteus MX 6GHz Gigabit Ethernet Radio, Hot Standby Protected, High Power, Space Diversity, All Indoor, w Microbus, DACC,32 TDM Traffic Line Interface card, 155Mbps Throughput , Automatic Code Modulation	Palm Bay
1	Proteus MX 6GHz Gigabit Ethernet Radio, Hot Standby Protected, Standard Power, Space Diversity, All Indoor, w Microbus, DACC,32 TDM Traffic Line Interface card, 155Mbps Throughput , Automatic Code Modulation	Rockledge
1	Proteus MX 11GHz Gigabit Ethernet Radio, Hot Standby Protected, Standard Power, All Indoor, w Microbus, DACC, 32 TDM Traffic Line Interface card, 155Mbps Throughput , Automatic Code Modulation	Melbourne
1	Wave Guide Extension Kit 6GHz Space Diversity	
1	Wave Guide Extension Kit 6GHz	
1	Wave Guide Extension Kit 11GHz	
2	Telect 8 Port DSX 1 RJ 45 w 19" Shelf 1RU	
6	Champ DSX Interface Cable	
1	7'X19" EIA Rack Assembly	
1	Fuse Panel +/- 48 / 24 VDC 19" 1 RU	
2	Microwave Antenna 6Ft RFS PAD 6GHz Series with Radome	
2	Microwave Antenna 4Ft RFS PAD 6GHz Series Diversity Receive with Radome	
1	Microwave Antenna 4Ft RFS PA 4 11GHz Series with Radome	
5	Microwave Antenna Pipe Mount Kit	
4	Monopole Mounting Rings	
800	Eupen EU-63 6GHz Waveguide and Connector Kits	
150	Eupen EU-105 11GHz Waveguide and Connector Kits	
8	RFS Wave Guide Flex 6GHz WR-137 Flange	



Units	Description	Coordinates with
2	RFS Wave Guide Flex 11GHz WR-90 Flange	
1	RFS APD-20 Automatic Wave Guide Dehydrator w Shelf and Pressure Manifold	
1 LOT	Wave Guide Hanger, Hoisting Grips, Grounding Kits and Hardware	
<b>ROCKLEDGE SITE</b>		
1	Proteus MX 6GHz Gigabit Ethernet Radio, Hot Standby Protected, Standard Power, Space Diversity, All Indoor, w Microbus, DACC, 32 TDM Traffic Line Interface card, 155Mbps Throughput , Automatic Code Modulation	Indian Harbour Beach
1	Proteus MX 6GHz Gigabit Ethernet Radio, Hot Standby Protected, High Power, All Indoor, w Microbus, DACC, 32 TDM Traffic Line Interface card, 155Mbps Throughput , Automatic Code Modulation	Sharpes
1	Proteus MX 6GHz Gigabit Ethernet Radio, Hot Standby Protected, STD Power, All Indoor, w Microbus, DACC, 32 TDM Traffic Line Interface card, 50 Mbps Throughput , Automatic Code Modulation	Cocoa Beach
1	Wave Guide Extension Kit 6GHz Space Diversity	
2	Wave Guide Extension Kit 6GHz	
2	Telect 8 Port DSX 1 RJ 45 w 19" Shelf 1RU	
6	Champ DSX Interface Cable	
1	7'X19" EIA Rack Assembly	
1	Fuse Panel +/- 48 / 24 VDC 19" 1 RU	
3	Microwave Antenna 6Ft RFS PAD 6GHz Series with Radome	
1	Microwave Antenna 4Ft RFS PAD 6GHz Series Diversity Receive with Radome	
4	Microwave Antenna Pipe Mount Kit	
835	Eupen EU-63 6GHz Waveguide and Connector Kits	
8	RFS Wave Guide Flex 6GHz WR-137 Flange	
1	RFS APD-20 Automatic Wave Guide Dehydrator w Shelf and Pressure Manifold	
1 LOT	Wave Guide Hanger, Hoisting Grips, Grounding Kits and Hardware	



Units	Description	Coordinates with
<b>SHARPES SITE</b>		
1	Proteus MX 6GHz Gigabit Ethernet Radio, Hot Standby Protected, High Power, All Indoor, w Microbus, DACC, 32 TDM Traffic Line Interface card, 155Mbps Throughput , Automatic Code Modulation	Rockledge
1	Proteus MX 6GHz Gigabit Ethernet Radio, Hot Standby Protected, High Power, All Indoor, w Microbus, DACC, 32 TDM Traffic Line Interface card, 155Mbps Throughput , Automatic Code Modulation	Titusville
2	Wave Guide Extension Kit 6GHz	
2	Telect 8 Port DSX 1 RJ 45 w 19" Shelf 1RU	
4	Champ DSX Interface Cable	
1	7'X19" EIA Rack Assembly	
1	Fuse Panel +/- 48 / 24 VDC 19" 1 RU	
2	Microwave Antenna 6Ft RFS PAD 6GHz Series with Radome	
2	Microwave Antenna Pipe Mount Kit	
360	Eupen EU-63 6GHz Waveguide and Connector Kits	
4	RFS Wave Guide Flex 6GHz WR-137 Flange	
1	RFS APD-20 Automatic Wave Guide Dehydrator w Shelf and Pressure Manifold	
1 LOT	Wave Guide Hanger, Hoisting Grips, Grounding Kits and Hardware	
<b>TITUSVILLE SITE</b>		
1	Proteus MX 11GHz Gigabit Ethernet Radio, Hot Standby Protected, Standard Power, All Indoor, w Microbus, DACC, 32 TDM Traffic Line Interface card, 155Mbps Throughput , Automatic Code Modulation	Sharpes
1	Proteus MX 11GHz Gigabit Ethernet Radio, Hot Standby Protected, Standard Power, All Indoor, w Microbus, DACC, 32 TDM Traffic Line Interface card, 155Mbps Throughput , Automatic Code Modulation	BCSO Dispatch
1	Wave Guide Extension Kit 6GHz	
1	Wave Guide Extension Kit 11GHz	



Units	Description	Coordinates with
4	Champ DSX Interface Cable	
2	Telect 8 Port DSX 1 RJ 45 w 19" Shelf 1RU	
1	7'X19" EIA Rack Assembly	
1	Fuse Panel +/- 48 / 24 VDC 19" 1 RU	
1	Microwave Antenna 6Ft RFS PAD 6GHz Series with Radome	
1	Microwave Antenna 4Ft RFS PA 4 11GHz Series with Radome	
2	Microwave Antenna Pipe Mount Kit	
150	Eupen EU-63 6GHz Waveguide and Connector Kits	
180	Eupen EU-105 11GHz Waveguide and Connector Kits	
2	RFS Wave Guide Flex 6GHz WR-137 Flange	
2	RFS Wave Guide Flex 11GHz WR-90 Flange	
1	RFS APD-20 Automatic Wave Guide Dehydrator w Shelf and Pressure Manifold	
1 LOT	Wave Guide Hanger, Hoisting Grips, Grounding Kits and Hardware	
<b>BCSO DISPATCH SITE</b>		
1	Proteus MX 11GHz Gigabit Ethernet Radio, Hot Standby Protected, Standard Power, All Indoor, w Microbus, DACC, 32 TDM Traffic Line Interface card, 155Mbps Throughput , Automatic Code Modulation	Titusville
1	Wave Guide Extension Kit 11GHz	
2	Champ DSX Interface Cable	
2	Telect 8 Port DSX 1 RJ 45 w 19" Shelf 1RU	
1	7'X19" EIA Rack Assembly	
1	Fuse Panel +/- 48 / 24 VDC 19" 1 RU	
1	Microwave Antenna 4Ft RFS PA 4 11GHz Series with Radome	



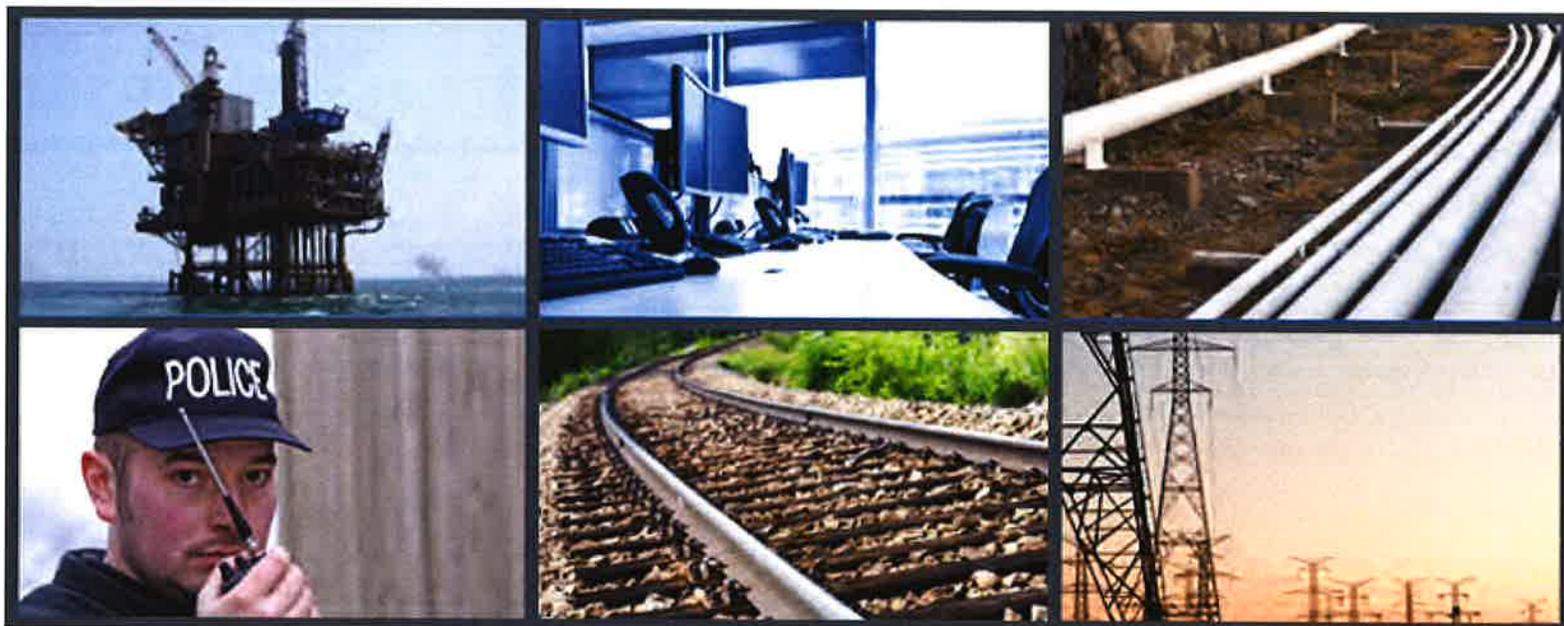
Units	Description	Coordinates with
1	Microwave Antenna Pipe Mount Kit	
150	Eupen EU-105 11GHz Waveguide and Connector Kits	
2	RFS Wave Guide Flex 11GHz WR-90 Flange	
1	RFS APD-20 Automatic Wave Guide Dehydrator w Shelf and Pressure Manifold	
1	Eletek DC Power Battery Plant 4 Hour Run Time	
1	Wave Guide Hanger, Hoisting Grips, Grounding Kits and Hardware	
<b>COCOA BEACH SITE</b>		
1	Proteus MX 6GHz Gigabit Ethernet Radio, Hot Standby Protected, STD Power, All Indoor, w Microbus, DACC, 32 TDM Traffic Line Interface card, 50 Mbps Throughput , Automatic Code Modulation	Rockledge
1	Wave Guide Extension Kit 6GHz	
2	Champ DSX Interface Cable	
1	Telect 8 Port DSX 1 RJ 45 w 19" Shelf 1RU	
1	7'X19" EIA Rack Assembly	
1	Fuse Panel +/- 48 / 24 VDC 19" 1 RU	
1	Microwave Antenna 6Ft RFS PAD 6GHz Series with Radome	
1	Microwave Antenna Pipe Mount Kit	
175	Eupen EU-63 6GHz Waveguide and Connector Kits	
2	RFS Wave Guide Flex 6GHz WR-137 Flange	
1	RFS APD-20 Automatic Wave Guide Dehydrator w Shelf and Pressure Manifold	
1	Wave Guide Hanger, Hoisting Grips, Grounding Kits and Hardware	



Units	Description	Coordinates with
<b>MELBOURNE SITE</b>		
1	Proteus MX 11GHz Gigabit Ethernet Radio, Hot Standby Protected, Standard Power, All Indoor, w Microbus, DACC, 32 TDM Traffic Line Interface card, 155Mbps Throughput , Automatic Code Modulation	
1	Wave Guide Extension Kit 11GHz	
2	Champ DSX Interface Cable	
1	Telect 8 Port DSX 1 RJ 45 w 19" Shelf 1RU	
1	7'X19" EIA Rack Assembly	
1	Fuse Panel +/- 48 / 24 VDC 19" 1 RU	
130	Microwave Antenna 4Ft RFS PA 4 11GHz Series with Radome	
1	Microwave Antenna Pipe Mount Kit	
1	Eupen EU-105 11GHz Waveguide and Connector Kits	
1	RFS APD-20 Automatic Wave Guide Dehydrator w Shelf and Pressure Manifold	
1 LOT	Wave Guide Hanger, Hoisting Grips, Grounding Kits and Hardware	

# Proteus MX

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## Native DS1 and IP Hybrid Transport Radio

6 to 38 GHz

6 to 350 Mbps



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## Intelligent Bandwidth for Evolving Networks

The convergence of voice, data, and video networks is quickly changing the wireless telecommunications landscape. Network operators must protect existing infrastructure investments while quickly moving to provide more capacity and new IP based services. The need to deliver substantial cost savings and scalable architecture has never been greater. Microwave Networks is ready to extend your core infrastructure investments, reduce costs, and simplify operations with our unique point-to-point microwave radio products.

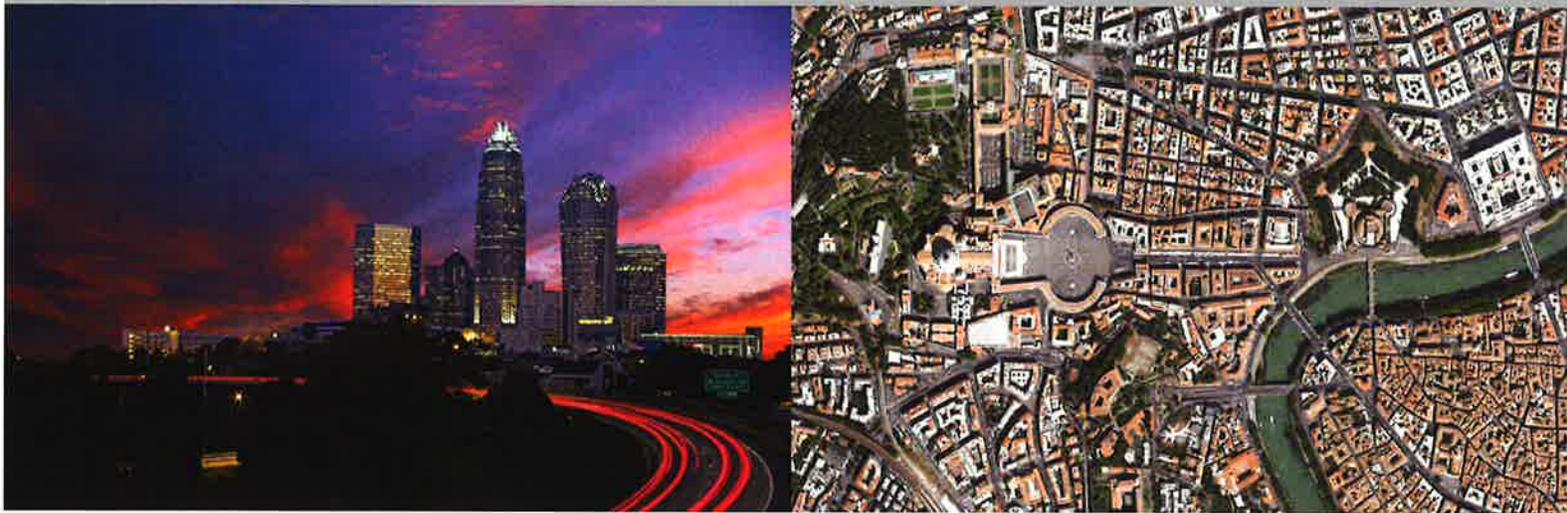
The Proteus MX is MNI's next generation Ethernet/TDM Hybrid backhaul radio. Designed for capacities up to 350 Mbps, it offers carrier-class Ethernet and TDM in a single, feature rich and extremely flexible platform allowing easy and cost effective migration from legacy networks to Gigabit Ethernet.

The unique combination of integrated add/drop mux, DS1 loop protection, and comprehensive data grooming along with the use of Adaptive Code Modulation (ACM) to increase throughput while protecting critical traffic sets Proteus MX apart from other radios. Whether you're keeping pace with growing traffic demands or regularly reconfiguring radio-link payload for new services, the Proteus MX is specifically designed to adapt to your needs at the lowest cost of ownership.

The Proteus MX is designed for applications requiring extreme reliability and features 100% redundancy of all traffic and overhead channels with automatic switchover. This makes it the perfect choice for Public Safety and Utility networks where critical traffic must be maintained, as well as for Mobile Carriers, Wireless Broadband, Railroad, and Enterprise LANs and WANs.

# Proteus MX

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## LTE Migration

With Proteus MX, migrating from existing TDM to new IP-based networks and services including 4G/LTE is simple, convenient, and economical. The unique combinations of native TDM and native IP configurations are the most comprehensive in the industry on a single radio platform. Proteus MX's unmatched traffic management features combined with software-based configuration and upgrades gives network providers the needed control over how and when to make the transition and maximize the return on their investment.

### TDM and IP Convergence

- Native Gigabit Ethernet is combined with native TDM (DS1, DS3, OC-3) on the same hardware platform.
- Software-selected bandwidth, modulation, capacity, channel frequency, and output power. Increase capacity through software license upgrade w/o hardware changes.
- Reallocate payload among interface types as needed to accommodate changing traffic patterns.
- Adaptive Code Modulation (ACM) can be configured to maintain critical traffic during adverse path conditions while operating at a significantly higher throughput under normal conditions.
- VLAN using IEEE 802.1p & 802.1Q for Traffic Class priorities (QoS), port-based and tag-based VLAN.
- MPLS and LTE compatible.

### Reliability and Management

- Errorless diversity switching protection options including.
- Complete hot-standby protection; 100% redundancy of *all* active components.
- Removable license card retains terminal configuration during changeovers.
- Secure Network Management with SNMPv3.
- Built-in chart recorder for real-time diagnostics and link performance monitoring.

### Integrated Traffic Management

- Dynamic Payload Mapping™ suite of features:
  - Integrated add/drop mux from DS3.
  - Self-healing DS1-level loop protection and Rapid Ethernet Ring Protection for ring network topologies.
  - Detailed traffic routing and cross-connect across the hop and between co-located terminals at a node. Reallocate payload among interface types as needed.
- Microbus™ interface simplifies connections and reduces expense at repeater and nodal sites.
  - Only dropped tributaries need to be terminated.
  - The remaining payload is passed between terminals using the Microbus™ high-speed serial interface and a standard Cat-5 cable.

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## System Specifications

Operating Frequencies	T/R Spacing (MHz)
5.925 - 7.125 GHz	All FCC, ETSI, and ITU spacings
7.125 - 7.900 GHz	154, 160, 161, 196
7.900 - 8.500 GHz	119, 126, 208, 266, 311.32
10.70 - 11.70 GHz	490, 530
12.75 - 13.25 GHz	266
14.40 - 15.35 GHz	315, 420, 475, 490, 640, 644, 728
17.70 - 19.70 GHz	1008, 1010, 1560
21.20 - 23.60 GHz	1008, 1200, 1232
24.20 - 26.50 GHz	800, 1008
37.00 - 40.00 GHz	700, 1260
Frequency Stability	+/- 10 ppm (.001 %)
RX overload	-20 dBm for <math>10^{-6}</math> BER
Residual BER	Better than $10^{-12}$
Output Power Control	Manual or Automatic, -4 dBm to Max.
Power Consumption (max.)	Split-mount: 80 W non-protect, 166 W protected All-indoor: 180 W non-protect, 360 W protected

## RF Unit and Antenna

	Split-mount RF	All-indoor RF
Frequencies	6, 7, 8, 11, 13, 15, 18, 23, 26 and 38 GHz	6, 7, 8, and 11 GHz
Configuration	Split-mount; SPU inside / ODU outside	All indoor rack mounted
Dimensions	10.2 in. diameter; 5.9 in. deep	7.0 in. x 19 in. x 11.5 in. (4RU)
Weight	10.8 lbs.	47 lbs.
Temperature		
Full Performance	-27°F to 131°F (-33° C to +55° C)	+23° F to +122° F (-5° C to +50° C)
Operational	-67°F to 131°F (-55° C to +55° C)	
Humidity	Up to 100%	95% (no condensation)
Altitude	15,000 ft.	15,000 ft.
SPU to ODU Interface	TNC female (SPU); N-type female (ODU)	
Recommended Cable	Times LMR-400 or RG-8A/U equivalent; 50 Ohms	
Max. SPU to ODU distance	850 feet using LMR-400	
Intermediate Frequencies	IDU to ODU - 350 MHz; ODU to IDU - 140 MHz	
Antenna Diameters (ft.)	1, 1.5, 2, 3, 4, 6	
Antenna Connection Options	Integrated push-fit or remote mounting	Remote mount with elliptical waveguide; CMR-137F (6G); UG-51/U (7/8G); UG-39/U (11G)

## Signal Processing Unit (SPU)

Data Line Interface	32xDS1 (64-pin Telco) ; 4xDS3 (75-ohm BNC) ; 155 Mbps (optical LC; SM or MM)
Gigabit Ethernet	2 x 10/100/1000 BaseT Gigabit Ethernet ports
FEC & Coding	Reed Solomon FEC; Low Density Parity Check (LDPC) coding
Auxiliary Interfaces	
Digital Engineering Orderwire	Integrated Digital or External RS-422 Digital O/W; 2 x RJ-45 jacks for daisy chain/external connection
Auxiliary Data Channels	2 x RS-232 up to 19.2 kbps async; 1 x RS-422 at 64 kbps async (not available if EOW configured)
Relay Alarm Outputs	4 x Form-C relays, NO & NC contacts, (software mapped)
External Inputs	6 x TTL floating inputs
Configuration Memory	Removable SD FLASH memory card (store link/terminal data)
Dimensions (h x w x d)	3.5 in. x 19 in. x 11.2 in. (2RU)
Weight	9.7 lbs.
Temperature	+23° F to +122° F (-5° C to +50° C)
Humidity	Up to 95% non-condensing
Input Power	+/- 19 to +/- 60 volts DC

\* All specifications are subject to change without notice

# Proteus MX

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## Management

Protocol	SNMPv3 (supports SNMP v1 and v2)
Element Manager (EM)	Java based management software from MNI; access radio through any local/remote management
NMS Interface	2 x RJ-45; 10/100 BaseT; for access and bridging
Command Line Interface	RS-232 serial DB-9; for local VT-100 type interface or TELNET access
Modem (PPP)	RS-232 serial DB9; for dial-up access
Management IP Routing	RIP2 and OSPF dynamic routing or static route maps
NMS Compatibility	OpenView™, NetView™, SNMPc™, or other SNMP-based NMS; Motorola MOSCAD

## Standards Compliance

Safety	EN 60950
EMI/EMC	EN 301 489; EN 300 385
RF	EN 302 217-2
Power Supply	EN 300 132-2
Storage	ETS 300 019-1-1 (Class 1.1E)
Transport	ETS 300 019-1-2 (Class 2.1E)
Environmental - SPU	ETS 300 019-1-3 (Class 3.1E)

## Additional Branching Loss

	Split Mount		All-Indoor	
	Primary	Standby	Primary	Standby
<b>Hot-Standby</b>				
Transmitter	1.9 dB	6.5 dB	0.0 dB	1.0 dB
Receiver	1.9 dB	6.5 dB	0.5 dB	10.5 dB
<b>Space Diversity</b>				
Transmitter	0.0 dB	0.0 dB	0.0 dB	1.0 dB
Receiver	0.0 dB	0.0 dB	0.0 dB	0.0 dB



Hot-Standby Protected SPU (2RU)

\* All specifications are subject to change without notice

# Proteus MX

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## System Specifications

The table below indicates Transmitter and Receiver specifications grouped by channel bandwidth and capacity. For each configuration the radio can operate in different combinations of DS1, DS3, OC-3, and Ethernet up to the maximum data throughput indicated. The maximum equivalent for each interface type and combination is shown as a reference.

## All-Indoor Configurations

Modulation	2.5 MHz			3.75 MHz			5 MHz			10 MHz						
	16 QAM	128 QAM		8 QAM*	32 QAM	128 QAM	16 QAM*	32 QAM	128 QAM	4 QAM*	8 QAM*	16 QAM*	32 QAM*	64 QAM	128 QAM	256 QAM
<b>Maximum Data Configurations<sup>1</sup></b>																
DS1 only <sup>2</sup>	4xDS1	8xDS1		4xDS1	8xDS1	12xDS1	8xDS1	12xDS1	16xDS1	8xDS1	12xDS1	16xDS1	22xDS1	28xDS1	32xDS1	38xDS1
DS3 + DS1														1xDS3	1xDS3+4xDS1	1xDS3+10xDS1
Ethernet Only (Mbps) <sup>3</sup>	6.45	12.72		6.49	12.72	19.00	12.74	19.00	25.27	12.73	18.99	25.37	34.86	45.00	52.87	60.71
<b>RX Threshold (10<sup>-6</sup> BER) (dBm)</b>																
6 GHz	-89.0	-78.0		-89.5	-83.5	-78.0	-87.5	-82.5	-79.5	-90.0	-86.0	-85.0	-81.0	-78.0	-75.5	-71.5
7, 8 GHz	-89.0	-78.0		-89.5	-83.5	-78.0	-87.5	-82.5	-79.5	-90.0	-86.0	-85.0	-81.0	-78.0	-75.5	-71.5
11 GHz	-88.0	-77.0		-88.5	-82.5	-77.0	-86.5	-81.5	-78.5	-89.0	-85.0	-84.0	-80.0	-77.0	-74.5	-70.5
<b>TX Power (dBm)</b>																
6 GHz	30.0	28.0		30.0	30.0	29.0	31.0	31.0	30.0	32.0	32.0	32.0	32.0	32.0	31.0	29.0
7, 8 GHz	29.0	27.0		29.0	29.0	28.0	30.0	30.0	29.0	31.0	31.0	31.0	31.0	31.0	30.0	28.0
11 GHz	27.0	25.0		27.0	27.0	26.0	28.0	28.0	27.0	29.0	29.0	29.0	29.0	29.0	28.0	26.0
<b>System Gain (10<sup>-6</sup> BER) (dB)</b>																
6 GHz	119.0	106.0		119.5	113.5	107.0	118.5	113.5	109.5	122.0	118.0	117.0	113.0	110.0	106.5	100.5
7, 8 GHz	118.0	105.0		118.5	112.5	106.0	117.5	112.5	108.5	121.0	117.0	116.0	112.0	109.0	105.5	99.5
11 GHz	115.0	102.0		115.5	109.5	103.0	114.5	109.5	105.5	118.0	114.0	113.0	109.0	106.0	102.5	96.5
<b>Dispersive Fade Margin (10<sup>-6</sup> BER) (dB)</b>																
	72.5	61.0		71.0	65.5	59.0	69.0	64.5	57.5	72.0	69.0	66.0	61.5	56.5	54.5	47.5
<b>Emission Designator</b>	2M50D7W			3M75D7W			5M00D7W			10M0D7W						

Modulation	30 MHz											40 MHz				
	4 QAM*	4 QAM*	8 QAM*	16 QAM*	16 QAM**	32 QAM**	64 QAM	128 QAM	128 QAM	256 QAM	256 QAM	8 QAM*	32 QAM**	64 QAM**	128 QAM**	256 QAM**
<b>Maximum Data Configurations<sup>1</sup></b>																
DS1 only <sup>2</sup>	23xDS1	28xDS1	40xDS1	48xDS1	56xDS1	65xDS1	84xDS1	92xDS1	104xDS1	112xDS1	116xDS1	56xDS1	84xDS1	112xDS1	116xDS1	116xDS1
DS3 + DS1		1xDS3	1DS3+12DS1	1DS3+20DS1	2xDS3	2DS3+9DS1	3xDS3	3DS3+12DS1	3DS3+20DS1	4xDS3	4DS3+8DS1	2xDS3	3xDS3	4xDS3	5xDS3	5DS3+18DS1
OC-3								1xOC3	1OC3+8DS1	1OC3+18DS1	1OC3+22DS1			1OC3+18DS1	1OC3+46DS1	1OC3+64DS1
Ethernet Only (Mbps) <sup>3</sup>	37.08	44.99	63.76	76.31	89.90	104.62	134.47	156.09	165.80	179.21	191.76	89.94	136.61	179.57	223.95	252.73
<b>RX Threshold (10<sup>-6</sup> BER) (dBm)</b>																
6 GHz	-87.5	-86.0	-81.5	-81.5	-80.0	-77.5	-74.5	-71.5	-69.5	-68.0	-65.5	-80.0	-76.5	-73.5	-68.0	-65.0
7, 8 GHz	-87.5	-86.0	-81.5	-81.5	-80.0	-77.5	-74.5	-71.5	-69.5	-68.0	-65.5	-80.0	-76.5	-73.5	-68.0	-65.0
11 GHz	-86.5	-85.0	-80.5	-80.5	-79.0	-76.5	-73.5	-70.5	-68.5	-67.0	-64.5	-79.0	-75.5	-72.5	-67.0	-64.0
<b>TX Power (dBm)</b>																
6 GHz	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	30.0	30.0	32.0	32.0	32.0	32.0	30.0
7, 8 GHz	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0	29.0	29.0	31.0	31.0	31.0	31.0	29.0
11 GHz	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	27.0	27.0	29.0	29.0	29.0	29.0	27.0
<b>System Gain (10<sup>-6</sup> BER) (dB)</b>																
6 GHz	119.5	118.0	113.5	113.5	112.0	109.5	106.5	103.5	101.5	98.0	95.5	112.0	108.5	105.5	100.0	95.0
7, 8 GHz	118.5	117.0	112.5	112.5	111.0	108.5	105.5	102.5	100.5	97.0	94.5	111.0	107.5	104.5	99.0	94.0
11 GHz	115.5	114.0	109.5	109.5	108.0	105.5	102.5	99.5	97.5	94.0	91.5	108.0	104.5	101.5	96.0	91.0
<b>Dispersive Fade Margin (10<sup>-6</sup> BER) (dB)</b>																
	67.0	67.0	64.0	62.0	61.0	56.5	52.0	49.5	49.5	43.0	43.0	63.0	55.5	51.0	48.5	42.0
<b>Emission Designator</b>	30M0D7W											40M0D7W				

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# Proteus MX

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## System Specifications

The table below indicates Transmitter and Receiver specifications grouped by channel bandwidth and capacity. For each configuration the radio can operate in different combinations of DS1, DS3, OC-3, and Ethernet up to the maximum data throughput indicated. The maximum equivalent for each interface type and combination is shown as a reference.

## Split-Mount Configurations

	2.5 MHz		3.75 MHz		5 MHz		10 MHz			
<b>Modulation</b>	16 QAM	8 QAM*	32 QAM	16 QAM*	32 QAM	4 QAM*	8 QAM*	16 QAM*	32 QAM*	64 QAM
<b>Maximum Data Configurations<sup>1</sup></b>										
DS1 only <sup>2</sup>	4xDS1	4xDS1	8xDS1	8xDS1	12xDS1	8xDS1	12xDS1	16xDS1	22xDS1	28xDS1
DS3 + DS1										1xDS3
OC-3										
Ethernet Only (Mbps) <sup>3</sup>	6.45	6.49	12.72	12.74	19.00	12.73	18.99	25.37	34.86	45.00
<b>RX Threshold (10<sup>-5</sup> BER) (dBm)</b>										
6 GHz	-88.0	-88.5	-82.5	-86.5	-81.5	-89.0	-85.0	-84.0	-80.0	-77.0
7, 8 GHz	-88.0	-88.5	-82.5	-86.5	-81.5	-89.0	-85.0	-84.0	-80.0	-77.0
11 GHz	-88.5	-89.0	-83.0	-87.0	-82.0	-89.5	-85.5	-84.5	-80.5	-77.5
13,15 GHz	-88.5	-89.0	-83.0	-87.0	-82.0	-89.5	-85.5	-84.5	-80.5	-77.5
18 GHz	--	--	--	--	--	-89.5	-85.5	-84.5	-80.5	-77.5
23, 26 GHz	--	--	--	--	--	-89.0	-85.0	-84.0	-80.0	--
32 GHz	--	--	--	--	--	-88.0	-84.0	-83.0	-79.0	--
38 GHz	--	--	--	--	--	-87.0	-83.0	-82.0	-78.0	--
<b>TX Power (dBm) - Std. / High Power</b>										
6 GHz	13.0 / 22.0	17.0 / 27.0	17.0 / 27.0	23.0 / 28.0	23.0 / 28.0	25.0 / 30.0	24.0 / 29.0	23.0 / 28.0	22.0 / 28.0	21.0 / 25.0
7, 8 GHz	15.0 / 22.0	17.0 / 27.0	17.0 / 27.0	21.0 / 28.0	21.0 / 28.0	26.0 / 30.0	23.0 / 29.0	22.0 / 28.0	21.0 / 28.0	19.0 / 25.0
11 GHz	14.0 / 20.0	16.0 / 25.0	16.0 / 25.0	20.0 / 26.0	20.0 / 26.0	25.0 / 28.0	22.0 / 27.0	21.0 / 26.0	20.0 / 26.0	18.0 / 22.0
13,15 GHz	14.0 / 17.0	16.0 / 22.0	16.0 / 22.0	20.0 / 23.0	20.0 / 23.0	25.0 / 26.0	22.0 / 24.0	21.0 / 23.0	20.0 / 23.0	18.0 / 19.0
18 GHz	--	--	--	--	--	24.0 / 25.0	21.0 / 23.0	20.0 / 22.0	20.0 / 22.0	17.0 / 18.0
23, 26 GHz	--	--	--	--	--	23.0 / 25.0	20.0 / 23.0	19.0 / 22.0	19.0 / 22.0	--
32 GHz	--	--	--	--	--	21.0 / 23.0	18.0 / 22.0	17.0 / 21.0	17.0 / 21.0	--
38 GHz	--	--	--	--	--	20.0 / 23.0	17.0 / 21.0	16.0 / 20.0	16.0 / 20.0	--
<b>System Gain (10<sup>-6</sup> BER) (dB) - Std. / High Power</b>										
6 GHz	101.0 / 110.0	105.5 / 115.5	99.5 / 109.5	109.5 / 114.5	104.5 / 109.5	114.0 / 119.0	109.0 / 114.0	107.0 / 112.0	102.0 / 108.0	98.0 / 102.0
7, 8 GHz	103.0 / 110.0	105.5 / 115.5	99.5 / 109.5	107.5 / 114.5	102.5 / 109.5	115.0 / 119.0	108.0 / 114.0	106.0 / 112.0	101.0 / 108.0	96.0 / 102.0
11 GHz	102.5 / 108.5	105.0 / 114.0	99.0 / 108.0	107.0 / 113.0	102.0 / 108.0	114.5 / 117.5	107.5 / 112.5	105.5 / 110.5	100.5 / 106.5	95.5 / 99.5
13,15 GHz	102.5 / 105.5	105.0 / 111.0	99.0 / 105.0	107.0 / 110.0	102.0 / 105.0	114.5 / 115.5	107.5 / 109.5	105.5 / 107.5	100.5 / 103.5	95.5 / 96.5
18 GHz	--	--	--	--	--	113.5 / 114.5	106.5 / 108.5	104.5 / 106.5	100.5 / 102.5	94.5 / 95.5
23, 26 GHz	--	--	--	--	--	112.0 / 114.0	105.0 / 108.0	103.0 / 106.0	99.0 / 102.0	--
32 GHz	--	--	--	--	--	109.0 / 111.0	102.0 / 106.0	100.0 / 104.0	96.0 / 100.0	--
38 GHz	--	--	--	--	--	107.0 / 110.0	100.0 / 104.0	98.0 / 102.0	94.0 / 98.0	--
<b>Dispersive Fade Margin (10<sup>-6</sup> BER) (dB)</b>										
	72.5	71.0	65.5	69.0	64.5	72.0	69.0	66.0	61.5	56.5
<b>Emission Designator</b>										
	2M50D7W		3M75D7W		5M00D7W		10MOD7W			

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## System Specifications

The table below indicates Transmitter and Receiver specifications grouped by channel bandwidth and capacity. For each configuration the radio can operate in different combinations of DS1, DS3, OC-3, and Ethernet up to the maximum data throughput indicated. The maximum equivalent for each interface type and combination is shown as a reference.

## Split-Mount Configurations

20 MHz

Modulation	4 QAM	8 QAM	8 QAM	16 QAM	16 QAM	32 QAM	64 QAM	128 QAM
<b>Maximum Data Configurations<sup>1</sup></b>								
DS1 only <sup>2</sup>	16xDS1	23xDS1	28xDS1	31xDS1	38DS1	47xDS1	56xDS1	67xDS1
DS3 + DS1			1xDS3	1DS3+3DS1	1DS3+10DS1	1DS3+19DS1	2xDS3	2DS3+11DS1
OC-3								
Ethernet Only (Mbps) <sup>3</sup>	25.29	36.92	45.04	49.70	60.67	74.71	89.89	107.19
<b>RX Threshold (10<sup>-6</sup> BER) (dBm)</b>								
6 GHz	-87.0	-82.5	-81.0	-81.5	-79.5	-76.5	-75.0	-72.0
7, 8 GHz	-87.0	-82.5	-81.0	-81.5	-79.5	-76.5	-75.0	-72.0
11 GHz	-87.5	-83.0	-81.5	-82.0	-80.0	-77.0	-75.5	-72.5
13,15 GHz	-87.5	-83.0	-81.5	-82.0	-80.0	-77.0	-75.5	-72.5
18 GHz	-87.5	-83.0	-81.5	-82.0	-80.0	-77.0	-75.5	-72.5
23, 26 GHz	-87.0	-82.5	-81.0	-81.5	-79.5	-76.5	-75.0	--
32 GHz	-86.0	-81.5	-80.0	-80.5	-78.5	-75.5	-74.0	--
38 GHz	-85.0	-80.5	-79.0	-79.5	-77.5	-74.5	-73.0	--
<b>TX Power (dBm) - Std. / High Power</b>								
6 GHz	25.0 / 30.0	24.0 / 29.0	24.0 / 29.0	23.0 / 28.0	23.0 / 28.0	22.0 / 28.0	21.0 / 25.0	20.0 / 24.0
7, 8 GHz	26.0 / 30.0	23.0 / 29.0	23.0 / 29.0	22.0 / 28.0	22.0 / 28.0	21.0 / 28.0	19.0 / 25.0	17.0 / 24.0
11 GHz	25.0 / 28.0	22.0 / 27.0	22.0 / 27.0	21.0 / 26.0	21.0 / 26.0	20.0 / 26.0	18.0 / 22.0	16.0 / 21.0
13,15 GHz	25.0 / 26.0	22.0 / 24.0	22.0 / 24.0	21.0 / 23.0	21.0 / 23.0	20.0 / 23.0	18.0 / 19.0	16.0 / 18.0
18 GHz	24.0 / 25.0	21.0 / 23.0	21.0 / 23.0	20.0 / 22.0	20.0 / 22.0	20.0 / 22.0	17.0 / 18.0	16.0 / 17.0
23, 26 GHz	23.0 / 25.0	20.0 / 23.0	20.0 / 23.0	19.0 / 22.0	19.0 / 22.0	19.0 / 22.0	16.0 / 18.0	--
32 GHz	21.0 / 23.0	18.0 / 22.0	18.0 / 22.0	17.0 / 21.0	17.0 / 21.0	17.0 / 21.0	14.0 / 17.0	--
38 GHz	20.0 / 23.0	17.0 / 21.0	17.0 / 21.0	16.0 / 20.0	16.0 / 20.0	16.0 / 20.0	13.0 / 17.0	--
<b>System Gain (10<sup>-6</sup> BER) (dB) - Std. / High Power</b>								
6 GHz	112.0 / 117.0	106.5 / 111.5	105.0 / 110.0	104.5 / 109.5	102.5 / 107.5	98.5 / 104.5	96.0 / 100.0	92.0 / 96.0
7, 8 GHz	113.0 / 117.0	105.5 / 111.5	104.0 / 110.0	103.5 / 109.5	101.5 / 107.5	97.5 / 104.5	94.0 / 100.0	89.0 / 96.0
11 GHz	112.5 / 115.5	105.0 / 110.0	103.5 / 108.5	103.0 / 108.0	101.0 / 106.0	97.0 / 103.0	93.5 / 97.5	88.5 / 93.5
13,15 GHz	112.5 / 113.5	105.0 / 107.0	103.5 / 105.5	103.0 / 105.0	101.0 / 103.0	97.0 / 100.0	93.5 / 94.5	88.5 / 90.5
18 GHz	111.5 / 112.5	104.0 / 106.0	102.5 / 104.5	102.0 / 104.0	100.0 / 102.0	97.0 / 99.0	92.5 / 93.5	88.5 / 89.5
23, 26 GHz	110.0 / 112.0	102.5 / 105.5	101.0 / 104.0	100.5 / 103.5	98.5 / 101.5	95.5 / 98.5	91.0 / 93.0	--
32 GHz	107.0 / 109.0	99.5 / 103.5	98.0 / 102.0	97.5 / 101.5	95.5 / 99.5	92.5 / 96.5	88.0 / 91.0	--
38 GHz	105.0 / 108.0	97.5 / 101.5	96.0 / 100.0	95.5 / 99.5	93.5 / 97.5	90.5 / 94.5	86.0 / 90.0	--
<b>Dispersive Fade Margin (10<sup>-6</sup> BER) (dB)</b>								
	69.0	67.5	67.5	64.0	64.0	59.0	54.0	51.5
<b>Emission Designator</b>								
	20M0D7W							

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## System Specifications

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## Split-Mount Configurations

30 MHz

Modulation	4 QAM*	4 QAM*	8 QAM*	16 QAM*	16 QAM**	32 QAM**	64 QAM	128 QAM	128 QAM	256 QAM	256 QAM
<b>Maximum Data Configurations<sup>1</sup></b>											
DS1 only <sup>2</sup>	23xDS1	28xDS1	40xDS1	48xDS1	56xDS1	65xDS1	84xDS1	92xDS1	104xDS1	112xDS1	116xDS1
DS3 + DS1		1xDS3	1xDS3+12DS1	1xDS3+20xDS1	2xDS3	2xDS3+9xDS1	3xDS3	3xDS3+12xDS1	3xDS3+20xDS1	4xDS3	4xDS3+8xDS1
OC-3								1xOC3	1xOC3+8xDS1	1xOC3+18xDS1	1xOC3+22xDS1
Ethernet Only (Mbps) <sup>3</sup>	37.08	44.99	63.76	76.31	89.90	104.62	134.47	156.09	165.80	179.21	191.76
<b>RX Threshold (10<sup>-6</sup> BER) (dBm)</b>											
6 GHz	-86.5	-85.0	-80.5	-80.5	-79.0	-76.5	-73.5	-70.5	-68.5	-67.0	-64.5
7, 8 GHz	-86.5	-85.0	-80.5	-80.5	-79.0	-76.5	-73.5	-70.5	-68.5	-67.0	-64.5
11 GHz	-87.0	-85.5	-81.0	-81.0	-79.5	-77.0	-74.0	-71.0	-69.0	-67.5	-65.0
13,15 GHz	-87.0	-85.5	-81.0	-81.0	-79.5	-77.0	-74.0	-71.0	-69.0	-67.5	-65.0
18 GHz	-87.0	-85.5	-81.0	-81.0	-79.5	-77.0	-74.0	-70.5	-68.5	-67.0	-65.0
23, 26 GHz	-86.5	-85.0	-80.5	-80.5	-79.0	-76.5	-73.5	-70.5	-68.5	--	--
32 GHz	-85.5	-84.0	-79.5	-79.5	-78.0	-75.5	-72.5	-69.5	--	--	--
38 GHz	-84.5	-83.0	-78.5	-78.5	-77.0	-74.5	-71.5	-68.5	--	--	--
<b>TX Power (dBm) - Std. / High Power</b>											
6 GHz	25.0 / 30.0	25.0 / 30.0	24.0 / 29.0	23.0 / 28.0	23.0 / 28.0	22.0 / 28.0	21.0 / 25.0	20.0 / 24.0	20.0 / 24.0	18.0 / 21.0	18.0 / 21.0
7, 8 GHz	26.0 / 30.0	26.0 / 30.0	23.0 / 29.0	22.0 / 28.0	22.0 / 28.0	21.0 / 28.0	19.0 / 25.0	17.0 / 24.0	17.0 / 24.0	15.0 / 21.0	-- / 21.0
11 GHz	25.0 / 28.0	25.0 / 28.0	22.0 / 27.0	21.0 / 26.0	21.0 / 26.0	20.0 / 26.0	18.0 / 22.0	16.0 / 21.0	16.0 / 21.0	14.0 / 18.0	-- / 18.0
13,15 GHz	25.0 / 26.0	25.0 / 26.0	22.0 / 24.0	21.0 / 23.0	21.0 / 23.0	20.0 / 23.0	18.0 / 19.0	16.0 / 18.0	16.0 / 18.0	14.0 / 15.0	-- / 15.0
18 GHz	24.0 / 25.0	24.0 / 25.0	21.0 / 23.0	20.0 / 22.0	20.0 / 22.0	20.0 / 22.0	17.0 / 18.0	16.0 / 17.0	16.0 / 17.0	13.0 / 14.0	-- / 14.0
23, 26 GHz	23.0 / 25.0	23.0 / 25.0	20.0 / 23.0	19.0 / 22.0	19.0 / 22.0	19.0 / 22.0	16.0 / 18.0	14.0 / 17.0	14.0 / 17.0	--	--
32 GHz	21.0 / 23.0	21.0 / 23.0	18.0 / 22.0	17.0 / 21.0	17.0 / 21.0	17.0 / 21.0	14.0 / 17.0	12.0 / 16.0	--	--	--
38 GHz	20.0 / 23.0	20.0 / 23.0	17.0 / 21.0	16.0 / 20.0	16.0 / 20.0	16.0 / 20.0	13.0 / 17.0	11.0 / 16.0	--	--	--
<b>System Gain (10<sup>-6</sup> BER) (dB) - Std. / High Power</b>											
6 GHz	111.5 / 116.5	110.0 / 115.0	104.5 / 109.5	103.5 / 108.5	102.0 / 107.0	98.5 / 104.5	94.5 / 98.5	90.5 / 94.5	88.5 / 92.5	85.0 / 88.0	82.5 / 85.5
7, 8 GHz	112.5 / 116.5	111.0 / 115.0	103.5 / 109.5	102.5 / 108.5	101.0 / 107.0	97.5 / 104.5	92.5 / 98.5	87.5 / 94.5	85.5 / 92.5	82.0 / 88.0	-- / 85.5
11 GHz	112.0 / 115.0	110.5 / 113.5	103.0 / 108.0	102.0 / 107.0	100.5 / 105.5	97.0 / 103.0	92.0 / 96.0	87.0 / 92.0	85.0 / 90.0	81.5 / 85.5	-- / 83.0
13,15 GHz	112.0 / 113.0	110.5 / 111.5	103.0 / 105.0	102.0 / 104.0	100.5 / 102.5	97.0 / 100.0	92.0 / 93.0	87.0 / 89.0	85.0 / 87.0	81.5 / 82.5	-- / 80.0
18 GHz	111.0 / 112.0	109.5 / 110.5	102.0 / 104.0	101.0 / 103.0	99.5 / 101.5	97.0 / 99.0	91.0 / 92.0	86.5 / 87.5	84.5 / 85.5	80.0 / 81.0	-- / 79.0
23, 26 GHz	109.5 / 111.5	108.0 / 110.0	100.5 / 103.5	99.5 / 102.5	98.0 / 101.0	95.5 / 98.5	89.5 / 91.5	84.5 / 87.5	82.5 / 85.5	--	--
32 GHz	106.5 / 108.5	105.0 / 107.0	97.5 / 101.5	96.5 / 100.5	95.0 / 99.0	92.5 / 96.5	86.5 / 89.5	81.5 / 85.5	--	--	--
38 GHz	104.5 / 107.5	103.0 / 106.0	95.5 / 99.5	94.5 / 98.5	93.0 / 97.0	90.5 / 94.5	84.5 / 88.5	79.5 / 84.5	--	--	--
<b>Dispersive Fade Margin (10<sup>-6</sup> BER) (dB)</b>											
	67.0	67.0	64.0	62.0	61.0	56.5	52.0	49.5	49.5	43.0	43.0
<b>Emission Designator</b>	30MOD7W										

Rev. 11/10

Note: Specifications represent non-protected configurations intended for preliminary network planning and may change without notice. Improvements may be attained depending on actual project requirements.

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- 1. Not all variations of quantity and type of data are shown. Any combination is allowed as long as total capacity does not exceed the maximum data throughput. Contact MNI for more information.
- 2. The total number of DS1s that can be transported across the link is shown. However, the actual number of DS1s that can be dropped at a site is limited to the physical interfaces available at the SPU.
- 3. Empty bytes between packets and within the IP header are removed to achieve a type of compression. The values shown indicate the minimum Ethernet throughput that can be achieved when all packet sizes = 1518 bytes. Maximum throughput occurs with 64 byte packets and is 18% greater than shown.

# Proteus MX

ANSI



## System Specifications

The table below indicates Transmitter and Receiver specifications grouped by channel bandwidth and capacity. For each configuration the radio can operate in different combinations of DS1, DS3, OC-3, and Ethernet up to the maximum data throughput indicated. The maximum equivalent for each interface type and combination is shown as a reference.

## Split-Mount Configurations

40 MHz

Modulation	8 QAM*	32 QAM**	64 QAM**	128 QAM**	256 QAM**
<b>Maximum Data Configurations<sup>1</sup></b>					
DS1 only <sup>2</sup>	56xDS1	84xDS1	112xDS1	116xDS1	116xDS1
DS3 + DS1	2xDS3	3xDS3	4xDS3	5xDS3	5DS3+18DS1
OC-3			10C3+18xDS1	10C+46DS1	10C3+64DS1
Ethernet Only (Mbps) <sup>3</sup>	89.94	136.61	179.57	223.95	252.73
<b>RX Threshold (10<sup>-6</sup> BER) (dBm)</b>					
6 GHz	-79.0	-75.5	-72.5	-67.0	-64.0
7, 8 GHz	-79.0	-75.5	-72.5	-67.0	-64.0
11 GHz	-79.5	-76.0	-73.0	-67.5	-64.5
13,15 GHz	-79.5	-76.0	-73.0	-67.5	-64.5
18 GHz	-79.5	-76.0	-73.0	-67.5	-64.5
23, 26 GHz	-79.0	-75.5	-72.5	-67.0	--
32 GHz	-78.0	-74.5	-71.5	-66.0	--
38 GHz	-77.0	-73.5	-70.5	-65.0	--
<b>TX Power (dBm) - Std. / High Power</b>					
6 GHz	-- / 29.0	-- / 28.0	-- / 25.0	-- / 24.0	-- / 21.0
7, 8 GHz	-- / 29.0	-- / 28.0	-- / 25.0	-- / 24.0	-- / 21.0
11 GHz	-- / 27.0	-- / 26.0	-- / 22.0	-- / 21.0	-- / 18.0
13,15 GHz	-- / 24.0	-- / 23.0	-- / 19.0	-- / 18.0	-- / 15.0
18 GHz	-- / 23.0	-- / 22.0	-- / 18.0	-- / 17.0	-- / 14.0
23, 26 GHz	-- / 23.0	-- / 22.0	-- / 18.0	-- / 17.0	--
32 GHz	-- / 22.0	-- / 21.0	-- / 17.0	-- / 16.0	--
38 GHz	-- / 21.0	-- / 20.0	-- / 17.0	-- / 16.0	--
<b>System Gain (10<sup>-6</sup> BER) (dB) - Std. / High Power</b>					
6 GHz	-- / 108.00	-- / 103.50	-- / 97.50	-- / 91.00	-- / 85.00
7, 8 GHz	-- / 108.00	-- / 103.50	-- / 97.50	-- / 91.00	-- / 85.00
11 GHz	-- / 106.50	-- / 102.00	-- / 95.00	-- / 88.50	-- / 82.50
13,15 GHz	-- / 103.50	-- / 99.00	-- / 92.00	-- / 85.50	-- / 79.50
18 GHz	-- / 102.50	-- / 98.00	-- / 91.00	-- / 84.50	-- / 78.50
23, 26 GHz	-- / 102.00	-- / 97.50	-- / 90.50	-- / 84.00	--
32 GHz	-- / 100.00	-- / 95.50	-- / 88.50	-- / 82.00	--
38 GHz	-- / 98.00	-- / 93.50	-- / 87.50	-- / 81.00	--
<b>Dispersive Fade Margin (10<sup>-6</sup> BER) (dB)</b>					
	63	55.5	51	48.5	42
<b>Emission Designator</b>					
	40MOD7W				

Rev. 11/10

Note: Specifications represent non-protected configurations intended for preliminary network planning and may change without notice. Improvements may be attained depending on actual project requirements.

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- 1. Not all variations of quantity and type of data are shown. Any combination is allowed as long as total capacity does not exceed the maximum data throughput. Contact MNI for more information.
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- 3. Empty bytes between packets and within the IP header are removed to achieve a type of compression. The values shown indicate the minimum Ethernet throughput that can be achieved when all packet sizes = 1518 bytes. Maximum throughput occurs with 64 byte packets and is 18% greater than shown.

# REFERENCES

**REFERENCE FORM**  
**Public Safety Radio System Connectivity Network, Brevard County, FL**  
**RFP # P-4-16-11**

**REFERENCES – PROJECTS**

List customers for the services specified in the solicitation in the spaces provided below giving the company name, contact person, address, telephone number, and date services were performed, as described.

Note: A contact person shall be someone who has personal knowledge of the bidder's performance for the specific requirement listed. Contact person must have been informed that they are being used as a reference and that the County may be calling them. DO NOT list persons who will be unable to answer specific questions regarding the requirements.

1. Customer/Client Hillsborough County Sheriff  
Date of Services: 2008-present  
Description of Services: see attached Detailed References document  
Contact Person: Steven Mitchell  
Address \_\_\_\_\_  
\_\_\_\_\_  
Telephone Number: 813-247-0715  
Fax \_\_\_\_\_ Email smitchel@hcsotampa.fl.us  
Project Size: \$15M
  
2. Customer/Client Aventura, Florida  
Date of Services: 2000-present  
Description of Services: see attached Detailed Reference document  
Contact Person: Tom Labombarda  
Address \_\_\_\_\_  
\_\_\_\_\_  
Telephone Number: 305-466-1336  
Fax \_\_\_\_\_ Email labombardat@aventurapolice.com  
Project Size: \$5M
  
3. Customer/Client City of Clearwater, FL  
Date of Services: 2014-present  
Description of Services: Radio System Upgrade including a MNI monitored hot standby 11 GHz microwave system  
Contact Person: Scot MacDonald  
Address \_\_\_\_\_  
\_\_\_\_\_  
Telephone Number: 727-562-4890 ext 2890  
Fax \_\_\_\_\_ Email Scot.MacDonald@myclearwater.com  
Project Size: \$5M
  
4. Customer/Client Collier County, FL  
Date of Services: 2008- present  
Description of Services: see attached Detailed References document  
Contact Person: John Daly  
Address \_\_\_\_\_  
\_\_\_\_\_  
Telephone Number: 239-732-2531  
Fax \_\_\_\_\_ Email johndaly@colliergov.net  
Project Size: \$10M

-----  
VENDOR NAME Communications International, Inc.  
ADDRESS 4450 US Hwy 1, Vero Beach, FL 32967  
PRINTED SIGNATURE Robert Wm. Stork  
AUTHORIZED SIGNATURE \_\_\_\_\_  
PHONE # 772-569-5355 FAX# 772-567-2292 DATE 4/8/16

# PRICING STRUCTURE

*Public Safety Radio System Connectivity Network, Brevard County, FL*

**RFP # P-4-16-11**

**PRICE SHEET**

Bid price to provide all labor, materials, equipment, transportation and other facilities as necessary and/or required to execute all of the work described by the bidding documents for the lump sum price of:

**Lump Sum Pricing – Initial Term (3 Years):**

\$ 917,553.48

**Lump Sum Pricing of recurring cost (if any) – First Additional 3 Year Term:**

\$ 61,436.22

**Lump Sum Pricing of recurring cost (if any) – Second Additional 3 Year Term:**

\$ 66,160.10

**Lump Sum Pricing of recurring cost (if any) – Third Additional 3 Year Term:**

\$ 71,247.19

**Line Item Pricing:**

Item Description	Quantity	Unit Price	Extended Price
<b>Year 1 - TOTAL</b>		\$	<b>\$ 898,065.47</b>
System Build Out/Construction Costs	Included	\$	\$
Equipment Costs	1	\$ 563,820.74	\$ 563,820.74
Spare Parts	1	\$ 39,194.13	\$ 39,194.13
Implementation Services/Installation	1	\$ 237,972.60	\$ 237,972.60
PM & Engineering Services	1	\$ 144,314.00	\$ 144,314.00
Cutover Costs	Included	\$	\$
Lease Operation	NA	\$	\$
Maintenance & 24X7 Service response	Included	\$	\$
Miscellaneous (please itemize)	Preferred Discount	\$ (160,000.00)	\$ (160,000.00)
Tower Structure Analysis Services	1	\$ 36,000.00	\$ 36,000.00
FCC Licensing , Path Study Services & Training	1	\$ 36,764.00	\$ 36,764.00
<b>Year 2 - TOTAL</b>		\$	<b>\$ 0.01</b>
Lease Operation	NA	\$	\$
Maintenance & 24X7 Service response	Included	\$	\$
Required hardware or software updates	NA	\$	\$
Miscellaneous (please itemize)	NA	\$	\$
<b>Year 3 - TOTAL</b>		\$	<b>\$ 19,488.00</b>
Lease Operation	NA	\$	\$
Maintenance & 24X7 Service response	1	\$ 19,488.00	\$ 19,488.00
Required hardware or software updates	NA	\$	\$
Miscellaneous (please itemize)	NA	\$	\$
<b>TOTAL PRICE – 3 Year Period</b>			<b>\$ 917,553.48</b>
<b>Year 4 - TOTAL</b>		\$	<b>\$ 19,975.20</b>
Lease Operation	NA	\$	\$
Maintenance & 24X7 Service response	1	\$ 19,975.20	\$ 19,975.20
Required hardware or software updates	NA	\$	\$
Miscellaneous (please itemize)	NA	\$	\$
<b>Year 5 - TOTAL</b>		\$	<b>\$ 20,474.58</b>
Lease Operation	NA	\$	\$
Maintenance & 24X7 Service response	1	\$ 20,474.58	\$ 20,474.58
Required hardware or software updates	NA	\$	\$
Miscellaneous (please itemize)	NA	\$	\$

<b>Year 6 - TOTAL</b>			\$	\$	<b>20,986.44</b>
Lease Operation	NA		\$		
Maintenance & 24X7 Service response	1		\$	<b>20,986.44</b>	<b>20,986.44</b>
Required hardware or software updates	NA		\$		
Miscellaneous (please itemize)	NA		\$		
<b>TOTAL PRICE – 1st Additional 3 Year Period</b>				\$	<b>61,436.22</b>
<b>Year 7 - TOTAL</b>			\$	\$	<b>21,511.11</b>
Lease Operation	NA		\$		
Maintenance & 24X7 Service response	1		\$	<b>21,511.11</b>	<b>21,511.11</b>
Required hardware or software updates	NA		\$		
Miscellaneous (please itemize)	NA		\$		
<b>Year 8 - TOTAL</b>			\$	\$	<b>22,048.88</b>
Lease Operation	NA		\$		
Maintenance & 24X7 Service response	1		\$	<b>22,048.88</b>	<b>22,048.88</b>
Required hardware or software updates	NA		\$		
Miscellaneous (please itemize)	NA		\$		
<b>Year 9 - TOTAL</b>			\$	\$	<b>22,600.11</b>
Lease Operation	NA		\$		
Maintenance & 24X7 Service response	1		\$	<b>22,600.11</b>	<b>22,600.11</b>
Required hardware or software updates	NA		\$		
Miscellaneous (please itemize)	NA		\$		
<b>TOTAL PRICE – 2nd Additional 3 Year Period</b>				\$	<b>66,160.10</b>
<b>Year 10 - TOTAL</b>			\$	\$	<b>23,165.11</b>
Lease Operation	NA		\$		
Maintenance & 24X7 Service response	1		\$	<b>23,165.11</b>	<b>23,165.11</b>
Required hardware or software updates	NA		\$		
Miscellaneous (please itemize)	NA		\$		
<b>Year 11 - TOTAL</b>			\$	\$	<b>23,744.24</b>
Lease Operation	NA		\$		
Maintenance & 24X7 Service response	1		\$	<b>23,744.24</b>	<b>23,744.24</b>
Required hardware or software updates	NA		\$		
Miscellaneous (please itemize)	NA		\$		
<b>Year 12 - TOTAL</b>			\$	\$	<b>24,337.84</b>
Lease Operation	NA		\$		
Maintenance & 24X7 Service response	1		\$	<b>24,337.84</b>	<b>24,337.84</b>
Required hardware or software updates	NA		\$		
Miscellaneous (please itemize)	NA		\$		
<b>TOTAL PRICE – 3rd Additional 3 Year Period</b>				\$	<b>71,247.19</b>
<b>TOTAL PRICE – 12 Year Period</b>			\$	\$	<b>1,116,396.99</b>

**PROMPT PAYMENT DISCOUNT**

Brevard County shall remit payment in accordance with the Florida Prompt Payment Act, Florida Statutes section 218.70. Bidders may offer cash discounts for prompt payment but they will not be considered in determination of award. If a bidder offers a discount, it is understood that the discount time will be from the date of satisfactory delivery, at the place of acceptance, and receipt of correct invoice, at the office specified, whichever occurs last.

\* If Prompt Payment Discount is offered please state discount and terms:

Maintenance & 24X7 Service response	Included	\$	\$
Required hardware or software updates	Included	\$	\$
Miscellaneous (please itemize)	Included	\$	\$
<b>TOTAL PRICE – 1st additional 3 Year Period</b>			<b>\$ 430,000.00</b>
<b>Year 7 - TOTAL</b>		\$	<b>\$ 100,000.00</b>
Lease Operation	1	\$ 100,000.00	\$ 100,000.00
Maintenance & 24X7 Service response	Included	\$	\$
Required hardware or software updates	Included	\$	\$
Miscellaneous (please itemize)	Included	\$	\$
<b>Year 8 - TOTAL</b>		\$	<b>\$ 80,000.00</b>
Lease Operation	1	\$ 80,000.00	\$ 80,000.00
Maintenance & 24X7 Service response	Included	\$	\$
Required hardware or software updates	Included	\$	\$
Miscellaneous (please itemize)	Included	\$	\$
<b>Year 9 - TOTAL</b>		\$	<b>\$ 50,000.00</b>
Lease Operation	1	\$ 50,000.00	\$ 50,000.00
Maintenance & 24X7 Service response	Included	\$	\$
Required hardware or software updates	Included	\$	\$
Miscellaneous (please itemize)	Included	\$	\$
<b>TOTAL PRICE – 2nd Additional 3 Year Period</b>			<b>\$ 230,000.00</b>
<b>Year 10 - TOTAL</b>		\$	<b>\$ 40,000.00</b>
Lease Operation	1	\$ 40,000.00	\$ 40,000.00
Maintenance & 24X7 Service response	Included	\$	\$
Required hardware or software updates	Included	\$	\$
Miscellaneous (please itemize)	Included	\$	\$
<b>Year 11 - TOTAL</b>		\$	<b>\$ 25,000.00</b>
Lease Operation	1	\$ 25,000.00	\$ 25,000.00
Maintenance & 24X7 Service response	Included	\$	\$
Required hardware or software updates	Included	\$	\$
Miscellaneous (please itemize)	Included	\$	\$
<b>Year 12 - TOTAL</b>		\$	<b>\$ 25,000.00</b>
Lease Operation	1	\$ 25,000.00	\$ 25,000.00
Maintenance & 24X7 Service response	Included	\$	\$
Required hardware or software updates	Included	\$	\$
Miscellaneous (please itemize)	Included	\$	\$
<b>TOTAL PRICE – 3rd Additional 3 Year Period</b>			<b>\$ 90,000.00</b>
<b>TOTAL PRICE – 12 Year Period</b>		<b>\$</b>	<b>\$ 1,290,000.00</b>

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\* If Prompt Payment Discount is offered please state discount and terms:

# IMPLEMENTATION PLAN SCHEDULE

ID	Task Name	Task Mode	Duration	Start	Finish	Predecessor/Resource Names	April	May	June	July	August	September	October	November	December
1	Brevard Microwave Connectivity Network		147 days	Mon 5/2/16	Tue 11/22/16										
2	Contract Signed (NTP)		1 day	Mon 5/2/16	Mon 5/2/16	Brevard									
3	Kick-off Meeting On Site		1 day	Tue 5/3/16	Tue 5/3/16	Ci, Brevard									
4	Customer Design Review (CDR)		23 days	Mon 5/2/16	Wed 6/1/16										
5	Requirement Review/Gathering Meetings		1 day	Wed 5/4/16	Wed 5/4/16	Ci									
6	Site Surveys		15 days	Thu 5/5/16	Wed 5/25/16	Ci									
7	Prepare Frequency Planning and Microwave Path Studies		20 days	Thu 5/5/16	Wed 6/1/16	Ci									
8	Prepare site drawings, floor plan & Rack drawings		5 days	Mon 5/2/16	Fri 5/6/16	Ci									
9	CDR (Customer Design Review) / Project Plan		5 days	Mon 5/9/16	Fri 5/13/16	Ci, Brevard									
10	Customer approval of Customer Design Review		1 day	Mon 5/16/16	Mon 5/16/16	Brevard									
11															
12	Equipment Procurement and Staging		41 days	Tue 5/17/16	Tue 7/12/16										
13	Equipment Procurement		40 days	Tue 5/17/16	Mon 7/11/16										
14	Order MINI Microwave Equipment		10 days	Tue 5/17/16	Mon 5/30/16	Ci									
15	Order RFS Dish Antennas		40 days	Tue 5/17/16	Mon 7/11/16	Ci									
16	Order Support Equipment such as Waveguide, Hangers, etc.		40 days	Tue 5/17/16	Mon 7/11/16	Ci									
17															
18	Microwave System Staging		31 days	Tue 5/31/16	Tue 7/12/16										
19	Rack and Cable Site Equipment		10 days	Tue 5/31/16	Mon 6/13/16	Ci									
20	MINI Program Radios and Routers and Set Factory Levels		10 days	Tue 6/14/16	Mon 6/27/16	Ci									
21	Run Factory Acceptance Test Plan (FATP) at Microwave Facility		5 days	Tue 6/28/16	Mon 7/4/16	Ci									
22	Deliver equipment to the Ci Service Center		5 days	Tue 7/5/16	Mon 7/11/16	Ci									
23	Customer Asset Tag Equipment		1 day	Tue 7/12/16	Tue 7/12/16	Brevard									
24															
25	Hop/Link Site Equipment Installation		43 days	Wed 7/13/16	Fri 9/9/16										
26	Site 1 - Palm Bay		11 days	Wed 7/13/16	Wed 7/27/16										
27	Perform Electrical Rectifier Connections		5 days	Wed 7/13/16	Tue 7/19/16	Ci									
28	Install Hop/Link Site Equipment		5 days	Wed 7/13/16	Tue 7/19/16	Ci									
29	Install Antenna and Waveguide		2 days	Wed 7/20/16	Thu 7/21/16	Ci									
30	Ground all Equipment		2 days	Fri 7/22/16	Mon 7/25/16	Ci									
31	Connect All alarms Points to MNI Alarm System		1 day	Tue 7/26/16	Tue 7/26/16	Ci									
32	Site Civils and Clean Up		1 day	Wed 7/27/16	Wed 7/27/16	Ci									
33															
34	Site 2 - Indian Harbour Beach		11 days	Wed 7/13/16	Wed 7/27/16										
35	Perform Electrical Rectifier Connections		5 days	Wed 7/13/16	Tue 7/19/16	Ci									
36	Install Hop/Link Site Equipment		5 days	Wed 7/13/16	Tue 7/19/16	Ci									
37	Install Antenna and Waveguide		2 days	Wed 7/20/16	Thu 7/21/16	Ci									

**Project:** Brevard County Microw  
**Date:** Fri 4/8/16

Task: █ Project Summary █ Manual Task

Split: █ Inactive Task █ Duration-only

Milestone: ◆ Inactive Milestone █ Manual Summary Rollup

Summary: █ Inactive Summary █ Manual Summary

Start-only: █ Start-only

Finish-only: █ Finish-only

External Tasks: █ External Tasks

External Milestone: █ External Milestone

Deadline: █ Deadline

Progress: █ Progress

Manual Progress: █ Manual Progress

# IMPLEMENTATION PLAN SCHEDULE (CON'T)

ID	Task Name	Task Mode	Duration	Start	Finish	Predecessor Names	Resource Names	April	May	June	July	August	September	October	November	December
38	Ground all Equipment		2 days	Fri 7/22/16	Mon 7/25/16	37	CI									
39	Connect All alarms Points to MNI Alarm System		1 day	Tue 7/26/16	Tue 7/26/16	38	CI									
40	Site Civils and Clean Up		1 day	Wed 7/27/16	Wed 7/27/16	39	CI									
41	Site 3 - Rockledge		11 days	Wed 7/13/16	Wed 7/27/16		CI									
49	Site 4 - Sharpes		11 days	Thu 7/28/16	Thu 8/11/16		CI									
56	Site 5 - Titusville		11 days	Thu 7/28/16	Thu 8/11/16		CI									
63	Site 6 - BCSO Dispatch		11 days	Thu 7/28/16	Thu 8/11/16		CI									
70	Site 7 - Cocoa Beach		11 days	Fri 8/12/16	Fri 8/26/16		CI									
77	Site 8 - Lansing ST		11 days	Fri 8/12/16	Fri 8/26/16		CI									
84	Site 9 - Keystone		11 days	Fri 8/12/16	Fri 8/26/16		CI									
91																
92	<b>Equipment Optimization and Leveling</b>		10 days	Mon 8/29/16	Fri 9/9/16											
93	Measure and record TX/RX local oscillator frequency		3 days	Mon 8/29/16	Wed 8/31/16	84	CI									
94	Measure and record power and fade margin		2 days	Thu 9/1/16	Fri 9/2/16	93	CI									
95	Perform (12) twelve hour Bit-Error-Rate Test (BERT)		3 days	Mon 9/5/16	Wed 9/7/16	94	CI									
96	Test equipment alarms and fail over		2 days	Thu 9/8/16	Fri 9/9/16	95	CI									
97																
98	<b>Acceptance Testing</b>		13 days	Mon 9/12/16	Wed 9/28/16											
99	Customer Approve Final Site Inspections		5 days	Mon 9/12/16	Fri 9/16/16	96	Brevard									
100	Run MNI Microwave Acceptance Test Procedures		1 day	Mon 9/19/16	Mon 9/19/16	99	CI, Brevard									
101	Customer Approve Acceptance Test Procedures		1 day	Tue 9/20/16	Tue 9/20/16	100	Brevard									
102	Submit Test Documentation and Site Measurements		1 day	Wed 9/21/16	Wed 9/21/16	101	CI									
103	Submit System documentation and final as-built drawings.		5 days	Thu 9/22/16	Wed 9/28/16	102	CI									
104																
105	<b>MNI Training</b>		5 days	Thu 9/29/16	Wed 10/5/16											
106	MNI Provided System Admin Training		5 days	Thu 9/29/16	Wed 10/5/16	98	CI, Brevard									
107	<b>Cutover</b>		33 days	Thu 10/6/16	Mon 11/21/16	105										
108	Notify departments of Cutover time		5 days	Thu 10/6/16	Wed 10/12/16	105	CI, Brevard									
109	Cutover from T1 circuits to Microwave Connectivity Network		2 days	Thu 10/13/16	Fri 10/14/16	108	CI, Brevard									
110	Conduct 30-work day operational trial period		20 days	Mon 10/17/16	Fri 11/11/16	109	CI, Brevard									
111	Final System Acceptance		1 day	Mon 11/14/16	Mon 11/14/16	110	CI, Brevard									
112	Customer signoff on the Radio System and close the project		5 days	Tue 11/15/16	Mon 11/21/16	111	CI, Brevard									
113	<b>Warranty Begins</b>		1 day	Tue 11/22/16	Tue 11/22/16	112	CI									

**Project:** Brevard County Microw  
**Date:** Fri 4/8/16

Task Summary: Manual Task, Duration-only, Manual Summary, Rollup, Manual Summary

Task: Manual Task, Duration-only, Manual Summary, Rollup, Manual Summary

Split: Manual Task, Duration-only, Manual Summary, Rollup, Manual Summary

Milestone: Manual Task, Duration-only, Manual Summary, Rollup, Manual Summary

Summary: Manual Task, Duration-only, Manual Summary, Rollup, Manual Summary

Start-only: Manual Task, Duration-only, Manual Summary, Rollup, Manual Summary

Finish-only: Manual Task, Duration-only, Manual Summary, Rollup, Manual Summary

External Tasks: Manual Task, Duration-only, Manual Summary, Rollup, Manual Summary

External Milestone: Manual Task, Duration-only, Manual Summary, Rollup, Manual Summary

Deadline: Manual Task, Duration-only, Manual Summary, Rollup, Manual Summary

Progress: Manual Task, Duration-only, Manual Summary, Rollup, Manual Summary

Manual Progress: Manual Task, Duration-only, Manual Summary, Rollup, Manual Summary

END OF AVAILABILITY MATRIX, IF APPLICABLE,  
MAINTENANCE SERVICE, IF APPLICABLE

## End of Availability

Proposer should specify if they have an anticipated end of availability for each of the proposed services.

Service Type	No Planned EOA	End of Availability
		Year
n/a		

**\*\*Communications International does not anticipate any end of availability at this time for any of the proposed services in this RFP.**

# IMPLEMENTATION PLAN INCLUDING PROJECT MANAGEMENT AND SUPPORT

## IMPLEMENTATION PLAN (SECT. 3.1.2)

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### Scope

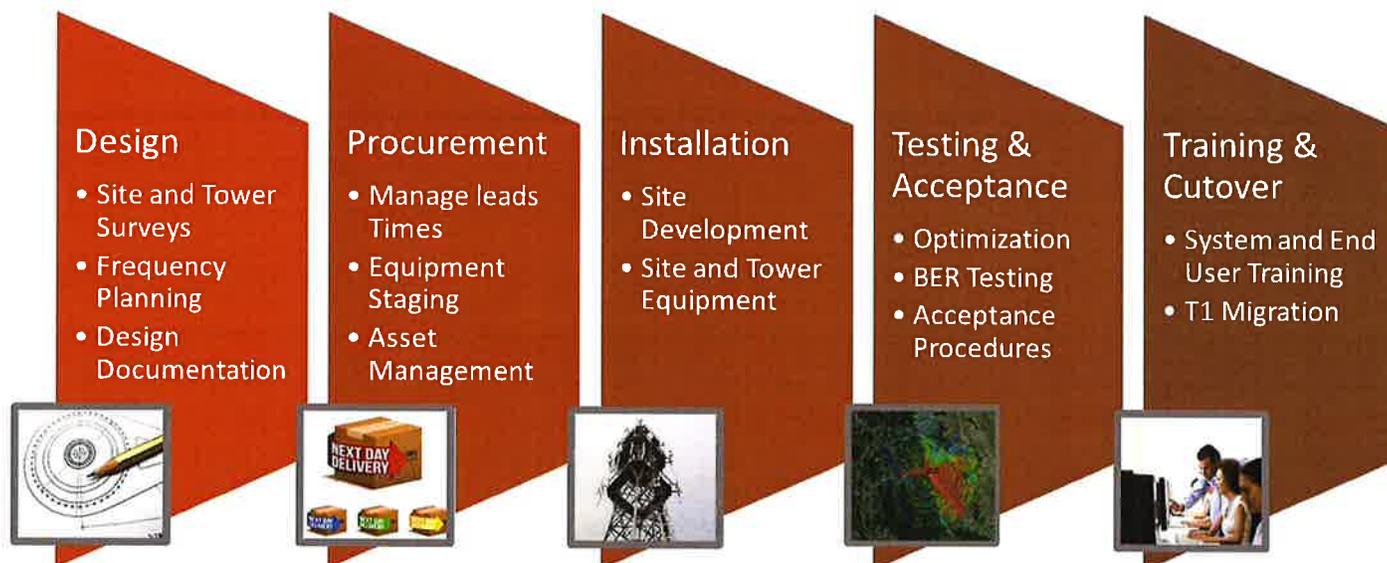
This document describes how Ci will manage the system implementation and training for Brevard County's Microwave Connectivity Network project in support of the Public Safety 800MHZ Radio System.

### Project Management Plan

Upon contract award, Ci's formal project management organization will supervise the project-level administrative overview and corresponding activities necessary for a successful project implementation. The PMP certified Project Manager will develop and implement a plan to efficiently and effectively execute the deliverables of the contract and to assure customer satisfaction. The following sections will help provide an overview of the major components of the Project Management Plan.

## Schedule

Ci will conduct regular project schedule reviews with Brevard County to report on progress, identify issues, and make scope modifications as warranted. The project will follow the phases in the graphic below. Each project phase will have its unique set of challenges and risks, but with proper scheduling the related impacts are planned and expected. Modifications to the project schedule will be approved and accepted by the County and Ci to ensure ownership and clarity throughout the project.



## Reporting

Brevard County representatives and the Ci Project Manager will jointly schedule and attend regular project review meetings. These meeting will include:

- Review project status
- Review project schedule
- Review open and closed action item(s) and project risk register
- Review written correspondence exchanged since the last meeting
- Obtain clarifications of issue(s) or documentation
- Capture requests for new information
- Discuss next steps and actionable items



The Ci Project Manager will prepare the meeting agenda, record the meeting minutes and forward them to Brevard County for review and approval. Ci will also conduct project presentations and briefings with Brevard County stakeholders as required. Ci will participate in other County requested meetings, as-needed.

Ci will prepare and submit monthly project progress/status reports to the County that include updates to the following items:

- Project Schedule
- Open action items and issues log
- Status of open change requests and change orders
- Current and anticipated project problem areas or risks

### Quality Control/Quality Assurance

Ci will develop and maintain total project quality by executing the Brevard County Microwave Connectivity Network project with a high level of Process/Quality Control (QC), coupled with strong Quality Assurance (QA) rooted in best practices of successful system implementation projects. Cost control is a direct result and benefit of Ci's QA and QC activities. Experience demonstrates that maintaining total project quality is the most direct way of developing and maintaining cost controls and, with this combined benefit, Brevard County will be very pleased with the results.

#### Successful Planning = Successful Projects

- ✓ Ci designed, planned and installed the largest 700/800 MHz trunked Radio system with Microwave Network Connectivity in all of Florida
- ✓ There is a reason Harris trusts Ci to be their largest Integrator in North America – Planning for On-Schedule and On-Budget projects



## Risks and Mitigation

Ci will provide a rigorous risk management plan to anticipate, identify, evaluate, mitigate and retire project risks that can adversely affect the project team’s ability to meet its schedule, cost, and technical requirements through each phase of the project. Ci uses a project risk register to organize and evaluate the impact of upcoming project phase risk. The risk register is comprised of the following sections:

- Risk Category (i.e. Labor, Material, Technology, etc.)
- Risk Detail (explain the risk and possible impact to the project)
- Date added to the risk registry
- Probability (How likely the risk will happen, above 80% should be planned event)
- Mitigation Status (Open or Closed Risk)
- Migration Strategy or the Trigger Release Event
- Mitigation Owner (Ci personnel or Customer team member)
- Mitigation Date

Below is an example of a standard project Risk Register:

Category	Detail	Date Added	Prob	Mitigation Status	Mitigation Strategy / Trigger Release Event	Mitigation Owner	Mitigation Date
Labor	No site details provided w/ handoff, possible unidentified installation obstacles	Dec-15	50%	Closed	Assign additional labor / Installation productivity falls 3 days behind project schedule	PM	Mar-15
Materials	Sales omitted commodities from cost estimate	Jan-16	20%	Open	Release reserve to purchase needed commodities / Need for such commodities is positively identified and quantified	PM	Apr-16

## SCOPE OF WORK (SECT. 3.1.3-3.1.7)

---

### Purpose

Ci 's proposal provides Brevard County with an extremely reliable and robust MNI Microwave Connectivity Network allowing them to move away from the current leased T1 circuits. The Microwave Connectivity Network will provide a true public safety grade end-to-end IP network. Each path boasts a **minimum** of **99.999%** reliability and give Brevard County ownership and management of their site connectivity network.

### Scope

Ci will perform the tasks required to engineer, install, and integrate the Microwave Connectivity Network to Brevard County's 800MHZ Radio System. In addition, Ci will designate a Ci Project Manager (PM) that has the overall responsibility for providing the deliverables required for the implementation of the Microwave Connectivity Network and management of the project deliverables and schedule. From past experience, Ci recommends the County provide a dedicated Project Manager to act as the single point of contact for all administrative, technical, and scheduling tasks. The following sections outlines specific phases of work with a brief description of the anticipated effort; summary of actions to be performed and timeframes to complete the phase. The Ci proposed MNI Microwave Connectivity Network solution includes the following:

- An Integrated TCP/IP –TDM communications network
- Network Monitor and Alarm System with paging and email alerts
- Network Bandwidth Management Software Tools
- DC Power Plant at BCSO Dispatch
- Public Safety Grade Antenna Systems
- Automated Wave Guide Pressurization Equipment

### Project Kick off

When the County issues a Notice-To-Proceed (NTP) for the project, the Ci Project Manager will schedule the Project Kick Off Meeting with Brevard County at a mutually agreed upon time and location. The Ci PM will introduce all the project participants and discuss the proposed work plan and project schedule to include:

- Roles of the project participants
- Overall project scope and objectives
- Resource and scheduling requirements
- Current site status
- Proposed frequency plan and coordination



We have found the strategy of setting clear expectations of the roles and ownership of the project tasks leads to a more engaged project team. The strategy streamlines resolutions to project issues and questions that often slow down a project. As part the strategy the following is a Responsibility Matrix of the overall project task and owner of the task. The matrix below is part of setting an expectation and hopefully driving issues to the early phase of the project

Description	Ci	Brevard County
Create Project Schedule	X	
Provide detailed design and engineering of proposed system	X	
Conduct final design review	X	Participate
Conduct local frequency licensing and coordination	X	
Provide all required equipment per the final design	X	
Receive, document, and inventory all shipped equipment, retain shipping documents	X	
Assist Brevard County with their inventory and affix asset tags, if required	X	X
Stage, program, and configure equipment, and conduct pre-ship conformance test	X	Participate
Provide access, adequate equipment space, adequate primary and backup electrical power, adequate HVAC and other support equipment necessary for proper installation (existing sites)		X
Install Ci provided equipment in accordance with the final design requirements	X	
Provide access to a public/static IP address allowing access into the network for diagnostics/maintenance		X
Configure, test, and validate the installed product/system	X	Participate
Perform existing county tower structural analysis and loading inspections (if required)	X	-
Provide towers suitable in available space and strength to accommodate the installation of Ci-proposed antennas and lines (existing sites)		X
Provide suitable shelter floor space that will accommodate the size and weight requirements of the new equipment racks (existing locations)		X
Conduct formal Acceptance Test	X	Participate
Brevard County Acceptance – sign off		X
Provide and conduct system training as specified and per the agreed-upon schedule	X	Participate
Develop cutover plan and perform system cutover, provide all materials and personnel required	X	Participate
At existing sites, provide adequate shelter and tower grounding system to accommodate new system equipment		X
At all sites, provide basic ground system conductivity inspections and reporting	X	

## Frequency Planning

Ci will provide initial system design work which will include professional services to develop a frequency plan for the Brevard County Microwave Connectivity Network within this contract. Upon completion of the initial assignment of frequency pairings by channel and by tower site, each microwave frequency pair will be licensed in Brevard County's name.

## Microwave Path Studies and Surveys

Ci will conduct site and path surveys to verify the performance capability of each recommended microwave path as required. The results of these path surveys will be reviewed by Ci to determine if the proposed paths will meet the specification requirements and if any alternative path solutions are required. The results will then be provided to the County for review.

## Site Surveys

Immediately following the Project Kick off Meeting, the Ci PM and County representative will arrange site surveys to collect further data about each individual site to help prepare for implementation. Ci will conduct the detailed electrical, grounding, and tower surveys as well as determine whether sufficient space in the shelter and on the tower exists to support the proposed design at each the sites.

The site survey results will be used to prepare the documents for each site detailing the floor plans, rack space, and tower requirements. Ci will conduct an internal review of all the survey analyses, the resultant drawings and Acceptance Test Plans (ATP) as applicable.

## Customer Design Review

After the site surveys, Ci will incorporate the information into a Customer Design Review (CDR) and begin preparing the final design documents. All sites locations, frequencies coordination and path surveys will be finalized prior the CDR meeting. This is necessary to properly prepare for the CDR and microwave procurement process. Brevard County and Ci may mutually agree to conduct a preliminary design reviewing in order to make risk-based decisions necessary for the overall benefit of the project and finalize the CDR.

At the CDR, Ci will present in detail the design and how the Microwave Connectivity Network will be implemented and integrated. The engineers will present their design decisions used to support the microwave design, and the Project Manager will present their site development plans, as required, for each site. The following are standard agenda topics during the CDR of a Microwave Connectivity Network:

### Technical

- Technical Description of System Configuration
- Backhaul Infrastructure Descriptions
- Alarm Plan Description
- Equipment Configurations

- Network Manager Description
- Interfaces
  - Interface between the new microwave network system and existing transport systems
  - Interface between new microwave network and legacy radio systems
  - Interface between new equipment and Power and DC Plants
- Testing/Acceptance Overview
- Schedule Review
- Floor Plans, Electrical Layout

### Training, Cutover, and Migration

- System migration and implementation at existing facilities
- A preliminary cutover plan will be provided to Brevard County prior to the Final Design Review
- Microwave installation at new tower sites
- The training plan will be reviewed and finalized

At the end of the CDR, Brevard County will review the material, and within 30 days, provide written approval to Ci to proceed. For the purpose of maintaining the schedule, open issues will be captured and transferred to the Action Item log where Brevard County and Ci can mutually agree to proceed with the Microwave Connectivity Network implementation.

## **System Staging**

After a mutually agreed upon CDR, Ci will start the procurement phase. As part of the MNI procurement, Ci will factory stage Brevard County's new MNI Microwave Connectivity Network prior to delivery to the field. Staging of the microwave radio equipment allows for verification of connectivity, performance capabilities, and to identify and eliminate equipment and system defects prior to shipment of the Microwave Connectivity Network to the field.

MNI will set up the system hardware and load all equipment software at the staging facility. Physical set up and location of hardware will comply with the network equipment layout plans. All cables will be labeled with to/from information to clarify interconnection for field installation. The staging technicians will power up, load software, set levels, and optimize the microwave equipment. The "system" levels will be recorded and documented to provide baseline information to the field integration team; all levels will be checked and reset, where applicable, prior to final optimization in the field. Staging of the MNI radio system connectivity network will be at the MNI Staging Facility in Stafford, TX. The County will be provided with all data from the factory acceptance testing.

## **Site Equipment Installation**

As described in the system description, the Ci designed MNI Microwave Connectivity Network for Brevard County is a seven (7) hop/link, fully redundant hot stand by microwave system. The Ci Project Manager will work with Brevard County to provide site access to our field service installation team after the equipment has been delivered from MNI. Adhering to the equipment installation standards and proven experience, our engineering and installation team focus on the following areas:

### Grounding Connections

Ci will ground all equipment it installs with an equipment grounding conductor that bonds all components to a single point ground bus located near the equipment installation. The installation of the hop/link equipment will be connected by the designated size and type of grounding conductors. This connection will be to a single point ground window located near the equipment installation and connected to a suitable ground connection.

For all grounding standards, Ci follows guidelines that have been prepared to improve personal safety and prevent equipment damage. In particular, the Harris guidelines – “Site Grounding and Lightning Protection” AE/LZT 123 4618/1 – which has been refined over several decades of Land Mobile Radio system implementations, supports the single point ground systems approach and exceeds both NEC and local building codes.

### Rack Placement and Mounting

Ci will install the Microwave Connectivity Network one rack per site at the agreed-upon floor plans that were developed during the design reviews. Thirty-six (36) inch clearances will be provided in the front or side aisles (as applicable) to satisfy all safety codes. Equipment will be installed such that no equipment will be required to be moved for maintenance after installation.

### Antenna Systems

Ci will follow the manufacturer’s specifications, guidelines, and/or structural engineer’s recommendations in the assembly and installation of all antenna systems. Ci will utilize appropriate cable manufacturer’s connectors, and assemble the cables per the manufacturer’s specifications and guidelines. Transmission lines will be properly secured/fastened to the cable tray or ladder and attached to the tower using the manufacturer’s recommended devices while following the manufacturer’s recommendations. After installation of transmission lines, Ci technicians will sweep and pressure test the transmission lines. The sweeps will be archived and submitted to the County as part of the documentation package. Finally a pressure test will ensure transmission line connections and joints were properly installed to prevent moisture damage.

### Alarm monitoring system

The MNI microwave radios are equipped with a network alarm monitoring system that constantly monitors the microwave equipment and automatically notifies the Network System Manager of local equipment failures. Using the developed microwave alarm plan, Ci will install the site alarms at each of the site’s alarming point and ensure operation by viewing the alarms in the Network System Manager. The microwave alarms and performance of the Network System Manager will be tested during the Acceptance Testing phase. Ci System Engineers will provide as-built drawing packages of the equipment racks with cabling and alarm information.

## Equipment Optimization and Leveling

Once the Microwave Connectivity Network racks and antenna system installations are complete, the Ci System Engineer will work with the on-site technicians to optimize the microwave network. As part of the optimization and dry run of the ATP for the microwave network, Ci will:

- Perform antenna and path alignments at affected tower sites per design
- Measure and record TX/RX local oscillator frequency
- Measure and record transmitter power at the monitor port
- Measure and record fade margin
- Perform (12) twelve hour Bit-Error-Rate Test (BERT) at DS1 level on the primary equipment and record results
- Perform (4) four hour BERT at DS1 level on standby equipment and record the results
- Simulate a failure of the primary equipment and verify switching to standby equipment
- Verify the operation of all local alarm using the network monitoring system
- Verify alarm system database is functional
- Record test data for inclusion in the "as built" documentation

## Integration and Acceptance Testing

Once the system installation and optimization process is complete, Ci will start the integration and formal testing portion of the project. This will start with system and site optimization and integration and end with Acceptance Test Procedure (ATP) provided by MNI and included in the proposal. This robust testing strategy ensures the system will be able to handle the County's operational requirements.

The ATP is intended to confirm the operation and performance of each link in the system. The test procedure start testing the basic functions of the link such as reviewing RF power and Frequency settings. It then builds on these lower level tests by testing and documenting higher level functions such as BERT and Failover test. Upon completion of the ATP, Brevard County will have observed each of the requirements of the RFP being demonstrated and documented.

## Punch List

All identified project related deficiencies during the execution of the ATP will be documented on a punch list form. The recording of these punch list items on a documented form will allow the Ci Project Manager and the County Project Manager to track any project related deficiencies and expedite satisfactory resolutions. The purpose of the project punch list is to document system deficiencies and agree on the severity and timeline for resolution.

## Migration Management and Cutover

After a successful ATP with the Brevard County representatives, Ci will be responsible for implementing a detailed migration plan for existing land mobile radio T1 circuits, leased lines, and the counties existing MNI microwave radio circuits. This plan will ensure a smooth transfer of communications from existing networks onto the Microwave Connectivity Network and the continued usability of legacy systems as agreed during migration planning sessions. As the

existing maintenance provider for Brevard County's 800MHz Public Safety Radio System Ci is extremely well versed on the intricacies involved with this transition.

The final cutover plan will provide detailed list of the cutover activities. This plan will be created to include the specifics of Brevard County's design and implementation as presented at the Final Design Review. This process will yield a well-thought out, final Cutover Plan that is custom-tailored to Brevard County's needs.

## Project Documentation

Part of a successful system cutover is providing the proper documentation to Brevard County. As part of the closing efforts, Ci will provide system manuals, which will include the as-built documents for the system. These system manuals will include the following information:

- Training and operation manuals for all equipment provided.
- Block and level diagrams of the network.
- Cabling and termination demarcations.
- Plan and elevation drawings of all tower mounted equipment.
- Setup and alignment information.
- Successfully completed, signed and dated acceptance test plans.
- Hardware and software configuration settings.

## Implementation Summary

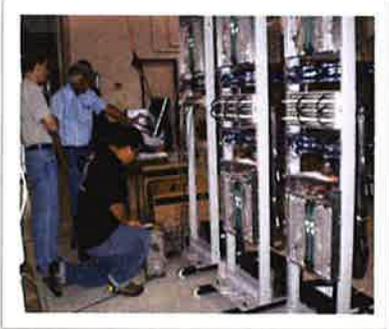
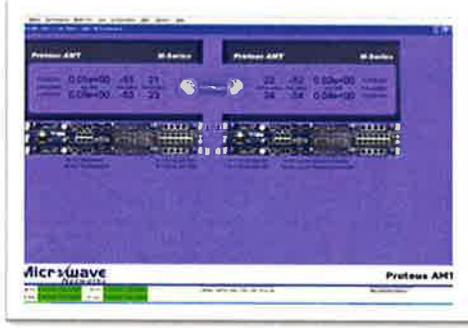
Ci has offered a custom networking solution that supplants the hop from Rockledge EOC - Melbourne and Melbourne - Palm Bay to be implemented in Brevard County. The Melbourne site has repeatedly been difficult to successfully propose antenna additions without expensive engineering modifications to the tower. The offering by Ci suggests making Melbourne a spur from South Beach (maintaining a 155 Mbit path as required) while loading for the Network can utilize the South Beach as a hub (to/from Rockledge and Palm Bay) to complete the required north to south path. Please see the Network Capacity diagram on page 37 for a visual of this modification we offer as a viable and robust solution to Brevard County. This resolution offers a single 4 foot dish be added to the Melbourne site thus saving engineering and financial considerations. Since all the equipment is the same this deviation may easily be reversed to build the normal pathing suggested by Brevard County's RFP. Either solution is fully compliant with the specifications and is offered with no cost increase or decrease within this proposal.

## TRAINING (SECT. 4.1.11)

If Brevard County personnel so desire Ci can provide high quality, performance based training that will build and enhance personnel competence. In addition, training will enable the County to optimally use the features and capabilities of our solution to meet and exceed communication requirements.

Following completion of such training, Brevard County may perpetually utilize the knowledge and experience acquired and copies of documentation and materials provided by Ci in conjunction with such training to provide subsequent internal training of the County's personnel.

Training will be provided at a time and to be determined location within the County, for the Proteus MX Series Microwave Radios. Training will be performed for up to 10 network users. At least a three week notice is required to schedule the training. The training syllabus is as follows.

Proteus Microwave Radio Course Syllabus	
<b>Objective:</b> Provide the customer microwave network support personnel with the necessary knowledge and skills required to install, maintain, troubleshoot, repair and align the Proteus Series Microwave Radios.	
 <b>Troubleshooting Techniques</b>	 <b>Network Management System</b>
 <b>Radio Configuration Tools</b>	 <b>Radio Status and Alarm Monitoring</b>
<b>Prerequisites:</b>	A working knowledge of Electronics, FM Theory, and Basic Logic Circuits. Knowledge of digital electronics would be helpful, but an introduction to Microwave Radios is included at the beginning of the course.
<b>Products</b>	Proteus Family of Radios: M, MX, MX-T, MXE, LX, MX-D, OIP, UMX, E-Band and S3
<b>Course Location</b>	Courses Available onsite or at the Microwave Networks Corporate office located: 4000 Greenbriar Stafford, Texas 77477
<b>Course Duration:</b>	3 days, 9:00A.M. To 4:00 P.M.

<b>Proteus Microwave Radio Course Syllabus</b>	
<b>Course Content:</b>	<b>Digital Microwave System Overview</b>
	<ul style="list-style-type: none"> <li>• Radio Basics</li> <li>• Propagation</li> <li>• Frequency Planning</li> <li>• Link Engineering</li> <li>• Antennas</li> <li>• Technical Parameters</li> <li>• System Engineering</li> <li>• Digital Microwave Systems</li> <li>• Performance</li> <li>• Protection and Diversity</li> <li>• Modulation</li> </ul>
	<b>Proteus Series Microwave Radio</b>
	<u>Signal Processing Unit</u>
	<ul style="list-style-type: none"> <li>• Chassis</li> <li>• SPU Circuit Boards</li> <li>• SPU Front Panel</li> <li>• Power Supply Module</li> <li>• Line Interface</li> </ul>
	<u>RF</u>
	<ul style="list-style-type: none"> <li>• Indoor RF Unit (RFU)</li> <li>• Outdoor Unit (ODU)</li> <li>• Antennas</li> <li>• Connectors</li> </ul>
	<u>Interconnect Cables</u>
	<ul style="list-style-type: none"> <li>• IDU to ODU/RFU</li> <li>• SPU Cables</li> </ul>
	<u>Simplified Radio Block Diagrams</u>
<ul style="list-style-type: none"> <li>• Basic Diagram</li> <li>• Line Interface</li> <li>• Signal Multiplexing</li> <li>• Service Channels</li> <li>• Management Channels</li> </ul>	
<u>Operation</u>	
<u>Modulation and Coding</u>	
<ul style="list-style-type: none"> <li>• QPSK</li> <li>• QAM</li> </ul>	
<u>IF Conversion and Multiplexing</u>	
<u>RF Conversion</u>	
<u>AES Encryption</u>	
<u>VLAN</u>	



<b>Proteus Microwave Radio Course Syllabus</b>		
	<b><u>Protection Switching</u></b>	<u>Hot-Standby (Protected) Configuration</u> <ul style="list-style-type: none"> <li>Reverse Channel Switching</li> <li>Space Diversity Switching</li> </ul>
		<u>Ring Protection</u> <ul style="list-style-type: none"> <li>Ethernet Rapid Ring Protection</li> <li>DS1 SHARP (Self-Healing Alternate Route Protection)</li> </ul>
	<b><u>Guaranteed Specifications</u></b>	<u>Specification Sheets</u>
		<u>Reliability</u> <ul style="list-style-type: none"> <li>Switchover: Transmit and Receive</li> <li>Automatic Power Control (APC)</li> <li>Adaptive Code Modulation (ACM)</li> <li>Forward Error Correction (FEC)</li> </ul>
		<u>Flexibility</u> <ul style="list-style-type: none"> <li>Change of Protection</li> <li>Change of Frequency</li> <li>Upgrade of Capacity</li> </ul>
	<b><u>Installation</u></b>	<u>Cautions</u> <ul style="list-style-type: none"> <li>Location</li> <li>Environment</li> <li>Grounding</li> </ul>
		<u>Hands-on</u> <ul style="list-style-type: none"> <li>Assembling and installing the Cable (SPU to ODU)</li> <li>Mounting the SPU                             <ul style="list-style-type: none"> <li>Connecting Power</li> <li>Connecting Tributaries</li> <li>Connecting Network Management</li> <li>Connecting Auxiliary Interfaces</li> </ul> </li> <li>Installing the ODU                             <ul style="list-style-type: none"> <li>Mounting Assembly</li> <li>Antenna</li> <li>Outdoor Unit</li> <li>Coaxial Cable or Elliptical Waveguide</li> </ul> </li> </ul>
	<b><u>Radio Management</u></b>	<u>Interfaces</u> <ul style="list-style-type: none"> <li>RS232- serial connection</li> <li>NMS-RJ-45 Ethernet Interface</li> </ul>
		<u>SNMP</u> <ul style="list-style-type: none"> <li>SNMP Management Application</li> <li>Management Information Base (MIB)</li> </ul>
		<u>IP Addressing</u> <ul style="list-style-type: none"> <li>Basics on Binary</li> <li>IP Structure</li> <li>Subnetting</li> </ul>
		<u>Element Manager</u>



Proteus Microwave Radio Course Syllabus		
		<ul style="list-style-type: none"> <li>• Element Manager Graphics</li> <li>• Key Features</li> <li>• System Requirements</li> <li>• Basic Operation                             <ul style="list-style-type: none"> <li>○ Polling</li> <li>○ Alarms</li> <li>○ Element Manager Menus</li> </ul> </li> </ul>
		<u>Craft Terminal Command Line Interface (CTI)</u> <ul style="list-style-type: none"> <li>• <u>Character Based</u></li> <li>• <u>Menus</u></li> </ul>
	<u>Commissioning</u>	<u>Powering</u>
		<u>ODU Alignment</u>
	<u>Configuring</u> <ul style="list-style-type: none"> <li>• ODU                             <ul style="list-style-type: none"> <li>○ Setting TX and RX Frequency</li> <li>○ Setting TX Power Output</li> </ul> </li> <li>• SPU                             <ul style="list-style-type: none"> <li>○ Setting Capacity</li> <li>○ Setting Tributaries</li> </ul> </li> </ul>	
	<u>Verifying Operation</u>	
<u>Maintenance</u>	<u>SPU Components</u> <ul style="list-style-type: none"> <li>• Replacing Cards</li> <li>• Replacing Power Supply Board and Fuse</li> <li>• Upgrading Radio Payload Configuration and Capacity</li> </ul>	
	<u>Outdoor Unit</u>	
	<u>PMIs</u> <ul style="list-style-type: none"> <li>• Monthly</li> <li>• Semi-Annual</li> <li>• Annual</li> </ul>	
		<u>Troubleshooting</u>
<u>Summary</u>		

## WARRANTY AND MAINTENANCE (SECTION 4.1.13)

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### MAINTENANCE SERVICES DESCRIPTION

As Brevard County has experienced, Ci has a Service Assurance Program designed to meet the support service needs of its customers. The Service Assurance Program allows customers to implement a support service plan that meets their unique requirements. It is ideally suited to meet the requirements of Brevard County during the pre-acceptance, warranty and post-warranty periods. Our team offers a full range of services from basic “break – fix” to full network and system remedial and preventive maintenance, to network / system operation and administrative / management services.

#### Microwave System Warranty

During the two (2) year warranty period, Ci and its partner suppliers will meet or exceed the service levels requested by Brevard County.

#### Equipment Warranty

For Brevard County, MNI will provide a two (2) year warranty on the microwave equipment. The warranty will start upon System Acceptance of the microwave by Brevard County and will continue as appropriate. During the warranty period Ci will provide labor, parts, shipping and transportation normally required and/or consumed in maintaining the system in order to meet original factory specifications.

#### Enhanced Warranty Service

Ci will also provide enhanced warranty service in addition to traditional remedial, “break/fix” warranties. This consists of an annual preventive maintenance service during the warranty period to assure the system is performing in accordance with factory specification as demonstrated and documented during the final system acceptance test.

#### Post Warranty Service

Ci has also provide post warranty service cost in this proposal for the entire 12 year period requested. This includes 24/7/365 calls for services as well as annual preventive maintenance service during the 12 year maintenance period to assure the system is performing in accordance with factory specification as demonstrated and documented during the final system acceptance test



## SPARES

Ci will provide spare parts stored in our Brevard County location as required in the RFP.

## SUPPORT AND REPAIR POLICIES

### Technical Support

In addition to the Ci on-site support service team, Brevard County will have access to Ci's Technical Assistance Center (TAC). Ci will provide Brevard County a toll-free number to call for all service requests and to report system and user equipment problems. The calls will be logged and tracked through completion of the service request and /or resolution of the reported problem. This number will be available 24x7x365.

Ci's TAC is staffed with experienced engineers and senior technicians that will provide phone support to Brevard County. TAC is available during normal business hours for routine requests and 24x7x365 for emergency support. TAC has the capability to conduct enhanced remote diagnostics and troubleshooting. If granted by Brevard County, dial-up access to the Brevard County's microwave system will enable TAC personnel to begin remedial action as soon as the service request is received, logged in and assigned to a TAC engineer or senior service technician. If the problem is one that can be resolved on-line, this capability greatly reduces restoration times.

### Service Escalation Process

We are confident Brevard County will be completely satisfied with the day-to-day operation of the microwave system. However, should Brevard County experience an issue and report a system or equipment problem to the Ci toll free number or TAC; it will trigger the clock for response service time requirements. Each fault will be assigned a case number and have an automatic, time-driven escalation to management. In addition, monthly repair activity reports detailing all activities performed on the system will be provided to Brevard County.

# REQUIRED PROPOSAL FORMS

**SUBMIT PROPOSALS TO:**  
**PURCHASING SERVICES**  
**2725 JUDGE FRAN JAMIESON WAY,**  
**BLDG. C, 3<sup>rd</sup> FLOOR, SUITE C-303**  
**VIERA, FL. 32940**



**PROPOSAL INVITATION**  
**Proposal Acknowledgment**

**PROCUREMENT ANALYST: PHONE (321) 617-7390**  
**Jonathan McLester, CPPO, CPPB**

**AN EQUAL OPPORTUNITY EMPLOYER,**  
**FLORIDA TAX EXEMPT #85-8012621749C-1**  
**FEDERAL TAX EXEMPT #59-6000523**

**PROPOSAL SPECS. MAY BE PICKED UP AT:**  
 Purchasing Services, 2725 Judge Fran Jamieson Way, Bldg. C, Suite 303, Viera, FL. 32940

**MAILING DATE:**  
 February 11, 2016

**PROPOSAL TITLE:** *Public Safety Radio System Connectivity Network, Brevard County*

**PROPOSAL NUMBER**  
 P-4-16-11

**PROPOSAL OPENING DATE & TIME**  
 March 10, 2016 at 2:00 p.m.

**PRE PROPOSAL DATE, TIME AND LOCATION:**  Mandatory  Non-Mandatory  
**A pre-proposal meeting will be held on February 29, 2016 at 9:00 a.m. located at the Emergency Operation Center, 1746 Cedar Street, Rockledge, FL 32955**

**PROPOSALS RECEIVED AFTER ABOVE DATE AND TIME WILL NOT BE ACCEPTED**

**PROPOSER NAME/ADDRESS**  
 Communications International, Inc.  
 4045 Pines Industrial Ave.  
 Rockledge, FL 32955  
**TELEPHONE NUMBER/TOLL FREE NUMBER:**  
 321-636-9885 or 888-275-4244

**VENDOR MUST COMPLETE THIS AREA AND RETURN FORM. NOTARIZED. FORM IS REQUIRED.**  
 If returning as a "no" state reason:  
 FEDERAL EMPLOYER IDENTIFICATION NUMBER OR S.S NUMBER 59-1885709

I certify that this Proposal is made without prior understanding, agreement, or connections with any corporation, firm or person submitting a Proposal for the same materials, supplies or equipment, and is in all respects fair and without collusion or fraud. I agree to all conditions of this Proposal and certify that I am authorized to sign this Proposal for the Proposer. In submitting a Proposal to the County of Brevard the Proposer offers and agrees that if the Proposal is accepted, the Proposer will convey, sell, assign or transfer to the County of Brevard all rights, title, and interest in and to all causes of action it may now or hereafter acquire under the Anti-trust laws of the United States and the State of Florida for price fixing relating to the particular commodities or services purchased or acquired by the County of Brevard. At the County's discretion, such assignment shall be made and become effective at the time the County tenders final payment to the Proposer.

**X** *Robert Wm. Stork*  
 AUTHORIZED SIGNATURE (MANUAL)  
 Robert Wm. Stork  
 TYPED NAME  
 CEO 4/8/16  
 TITLE DATE

**THIS FORM MUST BE NOTARIZED BELOW**

Sworn to and subscribed to me this 8 day of April, 2016.  
 Personally known:   
 Or produced identification:  Type of ID: \_\_\_\_\_  
 Notary Signature *Melinda Swetz* Florida  
 State



My commission expires: 10/9/17  
 (AFFIX SEAL or STAMP)

**BOND DATA**

**VENDOR MUST PROVIDE:** **AMOUNT:**  
 Yes  No  PROPOSAL BOND \_\_\_\_\_  
 Yes  No  PERFORMANCE BOND \_\_\_\_\_  
 Yes  No  LABOR, MATERIAL, PERFORMANCE BOND \_\_\_\_\_

In cases where the amount of a surety bond exceeds \$500,000, the surety company must have an A. M. Best's rating as specified in this document and depending on the amount of the bond, shall have a minimum A. M. Best's financial size category ranking as follows:

BOND AMOUNT UP TO	FINANCIAL CLASS	BOND AMOUNT UP TO	FINANCIAL CLASS
\$ 1,000,000	V	\$ 25,000,000	IX
\$ 2,500,000	VI	\$ 50,000,000	X
\$ 5,000,000	VII	\$ 75,000,000	XI
\$ 10,000,000	VIII	\$ 100,000,000	XII

Bonds must be issued by Bonding Company who complies with the requirements of Florida Statutes Section 287.0935

**THE COUNTY OF BREVARD RESERVES THE RIGHT TO REJECT ANY OR ALL PROPOSALS, TO WAIVE INFORMALITIES, AND TO ACCEPT ALL OR ANY PART OF ANY PROPOSAL AS MAY BE DEEMED TO BE IN THE BEST INTEREST OF THE COUNTY UNLESS OTHERWISE NOTED, PAYMENT OF GOODS OR SERVICES PROVIDED AS A RESULT OF THIS SOLICITATION WILL BE MADE PER FLORIDA STATUTE. ALL FIRST TIME VENDORS MUST SUBMIT A W-9 FORM.**

ADDENDUM ACKNOWLEDGMENT:

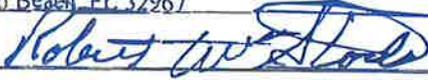
Add. No. 1 Dated 2/26/16 / Add. No. 3 Dated 3/15/16

Add. No. 2 Dated 3/4/16 / Add. No. 4 Dated 4/4/16

I hereby acknowledge that I have read, understand, and agree to all terms, conditions, insurance, scope of work, specifications and pricing for Proposal # P-4-16-11.

VENDOR NAME Communications International, Inc.

ADDRESS 4450 US HWY 1, Vero Beach, FL 32967

AUTHORIZED SIGNATURE 

PRINTED SIGNATURE Robert Wm. Stork DATE 4/8/16

TELEPHONE # 772-569-5355 FAX # 772-567-2292

EMAIL: mswetz@ask4ci.com



**LOCAL VENDOR AFFIDAVIT OF ELIGIBILITY – SECTION VIII**

**THIS FORM MUST BE SIGNED AND SWORN TO IN THE PRESENCE OF A NOTARY PUBLIC OR OTHER OFFICIAL AUTHORIZED TO ADMINISTER OATHS.**

1. This sworn statement is submitted to

BREVARD COUNTY BOARD OF COUNTY COMMISSIONERS  
Purchasing Services Office

by Robert Wm. Stork, CEO  
[print individual's name and title]

for Communications International, Inc.  
[print name of Company/Individual submitting sworn statement]

whose business address is 4450 US HWY 1, Vero Beach, FL 32967

(if applicable) its Federal Employer Identification Number (FEIN) is 59-1885709

(If the entity has no FEIN, include the Social Security Number of the individual signing this sworn statement) : \_\_\_\_\_

2. BID/RFP # and TITLE: P-4-16-11 - Public Safety Radio System Connectivity Network, Brevard County

3. LOCAL PREFERENCE ELIGIBILITY

***DO NOT check multiple categories; bidders shall select the applicable category for their company.***

A. "Category 1" – Vendor has maintained a **permanent place of business located in Brevard County for a minimum of one (1) year immediately preceding the advertisement of the bid or request for proposals.**

YES

B. "Category 2" – Vendor has established and maintains a permanent place of business located in the State of Florida.

YES

**It is understood that the submission of a Local Vendor Affidavit of Eligibility to Brevard County Purchasing Services with the bid/proposal is for the Brevard County Board of County Commissioners only, and the Affidavit is valid only for the bid/RFP specified. Local Preference shall not apply to bid/proposal that exceeds the Project Budget or proposed values exceed \$1,000,000. The bidder/Proposer assumes sole responsibility for the correctness of the Local Vendor Affidavit of Eligibility submitted. The business category claimed by the bidder/Proposer will be the only preference applied and shall not be changed or altered after bid/proposal opening. A bidder's/Proposer's claim of an error in the completing of the Local Vendor Affidavit of Eligibility form shall not be grounds for submitting a formal protest. The bidder/Proposer also understands that failure to maintain the requirements of the vendor category stated on the Local Vendor Affidavit of Eligibility through completion of the awarded bid or contract may be grounds for immediate termination and may be used for consideration in future awards.**

**I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR THE PUBLIC ENTITY IDENTIFIED IN PARAGRAPH 1 (ONE) ABOVE IS FOR THAT PUBLIC**

ENTITY ONLY AND, THAT THIS FORM IS VALID ONLY FOR THE BID/RFP SPECIFIED. I ALSO UNDERSTAND THAT FAILURE TO MAINTAIN THE REQUIREMENTS OF THE CATEGORY INDICATED THROUGH COMPLETION OF THE AWARDED BID OR CONTRACT MAY BE GROUNDS FOR IMMEDIATE TERMINATION AND MAY BE USED FOR CONSIDERATION FOR FUTURE AWARDS.

Robert Wm. Stork  
[Signature]

4/8/16  
[Date]

STATE OF FLORIDA

COUNTY OF Florida

PERSONALLY APPEARED BEFORE ME, the undersigned authority Robert Wm. Stork  
[Name of Individual Signing]  
who, after first being sworn by me, affixed his signature in the space provided above on this

8 day of April, 2016.

Melinda Swetz  
NOTARY PUBLIC

My commission expires: 10/9/17

(Affix Seal)



# ATTACHMENT B

BREVARD COUNTY  
PUBLIC SAFETY RADIO SYSTEM CONNECTIVITY NETWORK  
REQUEST FOR PROPOSAL # P-4-16-11



## MNI SOFTWARE LICENSE AGREEMENT

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### Software License

#### END-USER LICENSE AGREEMENT

#### IMPORTANT – READ CAREFULLY:

This End-User License Agreement (EULA) is a legal agreement between you (either individual or entity, the "BUYER"), and Microwave Networks Incorporated (MNI). Installation of this software on a computer constitutes acceptance of this agreement.

The terms of license contained herein apply to all quotations made and purchase orders entered into by MNI for the software named above. Some of the terms set out here may differ from those in BUYER'S purchase order. Acceptance of purchase orders is expressly conditional on BUYER'S assent to the terms set out here in lieu of those in BUYER'S purchase order. MNI's failure to object to provisions contained in any communication from BUYER shall not be deemed a waiver of any provisions of this license. The terms of this license shall be applicable whether or not it is attached to or enclosed with the software.

Please read this entire agreement before installing the software.

#### SOFTWARE PRODUCT LICENSE

##### 1. GRANT OF LICENSE

MNI grants the BUYER the non-exclusive right to use one copy of the software identified in the title above (the "SOFTWARE") on a single computer. BUYER may transfer the SOFTWARE to another single computer PROVIDED BUYER does so no more often than once every thirty (30) days and no copies of the SOFTWARE licensed herein are retained for use on any other computer. The right to use this software is not transferable. For purposes of this section, "use" means loading the software into RAM, as well as installation on a hard disk or other storage device. Installation on a network server or use over a local area network is not permitted under the terms of this license.

##### 2. COPYRIGHT

This SOFTWARE is owned by MNI and it is protected by United States copyright laws and international treaty provisions. Therefore, the BUYER must treat the software like any other copyrighted material (e.g., a book or musical recording) except that BUYER may make one copy of the software solely for backup or archival purposes. BUYER may not copy the written materials that accompany the SOFTWARE without written permission from MNI.

#### Limited Warranty.

MNI warrants that (a) the SOFTWARE PRODUCT will perform substantially in accordance with the accompanying written materials for a period of ninety (90) days from the date of receipt, and (b) any Support Services provided by MNI shall be substantially as described in applicable written materials provided to you by MNI. MNI support engineers will make commercially reasonable efforts to solve any problem. To the extent allowed by applicable law, implied warranties on the SOFTWARE PRODUCT, if any, are limited to ninety (90) days.



RELY ON Ci. WE'RE RIGHT THERE WITH YOU.



Customer Remedies.

MNI's and its suppliers' entire liability and your exclusive remedy shall be, at MNI's option, either (a) return of the price paid, if any, or (b) repair or replacement of the SOFTWARE PRODUCT that does not meet MNI's Limited Warranty and that is returned to MNI with a copy of your receipt. This Limited Warranty is void if failure of the SOFTWARE PRODUCT has resulted from accident, abuse, or misapplication. Any replacement SOFTWARE PRODUCT will be warranted for the remainder of the original warranty period or thirty (30) days, whichever is longer. Outside the United States, neither these remedies nor any product support services offered by MNI are available without proof of purchase.

No Other Warranties.

To The Maximum Extent Permitted By Applicable Law, MNI And Its Suppliers Disclaim All Other Warranties And Conditions, Either Express Or Implied, Including, But Not Limited To, Implied Warranties Or Conditions Of Merchantability, Fitness For A Particular Purpose, Title And Non-Infringement, With Regard To The Software Product, And The Provision Of Or Failure To Provide Support Services. This Limited Warranty Gives You Specific Legal Rights. You May Have Others, Which Vary From State/Jurisdiction To State/Jurisdiction.

Limitation Of Liability.

To The Maximum Extent Permitted By Applicable Law, In No Event Shall MNI Or Its Suppliers Be Liable For Any Special, Incidental, Indirect, Or Consequential Damages Whatsoever (Including, Without Limitation, Damages For Loss Of Business Profits, Business Interruption, Loss Of Business Information, Or Any Other Pecuniary Loss) Arising Out Of The Use Of Or Inability To Use The Software Product Or The Failure To Provide Support Services, Even If MNI Has Been Advised Of The Possibility Of Such Damages. In Any Case, MNI's Entire Liability Under Any Provision Of This EULA Shall Be Limited To The Greater Of The Amount Actually Paid By You For The Software Product Or U.S.\$5.00; Provided, However, If You Have Entered Into A Support Services Agreement With MNI, MNI's Entire Liability Regarding Support Services Shall Be Governed By The Terms Of That Agreement.

**ATTACHMENT C  
PAYMENTS**

**A.1. Initial Three (3) Years Period: Infrastructure Hardware, Implementation and Maintenance Services for a total of \$917,553.48.**

1. Twenty percent (20%) (\$183,510.69) of the initial three (3) years Price shall be due at the time of the signing of the Agreement by the County and Contractor.
2. Ten percent (10%) (\$91,755.36) of the initial three (3) years Price shall be due at the time of the first System design review meeting or within sixty (60) days of the Effective Date of this Agreement if no System design review meeting is scheduled, whichever occurs earlier.
3. Twenty percent (20%) (\$183,510.69) of the initial three (3) years Price shall be due at the time of Hardware factory staging as described in the Project Schedule.
4. Twenty-five percent (20%) (\$183,510.69) of the initial three (3) years Price shall be due upon Hardware shipment as described in the Project Schedule.
5. Twenty percent (20%) (\$183,510.69) of the initial three (3) years Price for Services shall be divided equally into 7 installments to match the number of microwave links provide by the system. Each installment will be due upon the successful completion of an individual links BER test, as described in the CDR.
6. Ten percent (10%) (\$91,755.36) of the initial three (3) years Price plus any remaining Agreement Value for all Hardware, Software and Services shall be due upon final Acceptance of the System.

**A.2. 1<sup>st</sup> Additional 3 Year Period: Maintenance Services and 24X7 Service Response**

Starting on Effective Day, just after the third initial three (3) years, Services shall be paid by the County to Contractor as follow:

1. On November 7, 2019 Price to be paid by County to Contractor is \$19,975.20
2. On November 7, 2020 Price to be paid by County to Contractor is \$20,474.58
3. On November 7, 2021 Price to be paid by County to Contractor is \$20,986.44

**A.3. 2<sup>nd</sup> Additional 3 Year Period: Maintenance Services and 24X7 Service Response**

Starting on Effective Day, just after the first additional three (3) years period, Services shall be paid by the County to Contractor as follow:

1. On November 7, 2022 Price to be paid by County to Contractor is \$21,511.11
2. On November 7, 2023 Price to be paid by County to Contractor is \$22,048.88
3. On November 7, 2024 Price to be paid by County to Contractor is \$22,600.11

**A.4. 3<sup>rd</sup> Additional 3 Year Period: Maintenance Services and 24X7 Service Response**

Starting on Effective Day, just after the second additional three (3) years period, Services shall be paid by the County to Contractor as follow:

1. On November 7, 2025 Price to be paid by County to Contractor is \$23,165.11
2. On November 7, 2026 Price to be paid by County to Contractor is \$23,744.24
3. On November 7, 2027 Price to be paid by County to Contractor is \$24,337.84

**ATTACHMENT D  
SITES AND BANDWIDTH REQUIREMENTS**

Site Name & Location 1	Site Name & Location 2	Total Bandwidth Required	T1 Circuits
Titusville RF 1141 Day Street Titusville - FL 32780 Lat. 28-35'36.000" N Long 80-49'00.000' W	Sheriffs Operation Center 700 Park Ave. Titusville - FL 32780 Lat. 28-36'-27.530" N Long 80-49'08.335" W	155 Mbps	3
Titusville RF 1141 Day Street Titusville - FL 32780 Lat. 28-35'36.000" N Long 80-49'00.000' W	Sharpes RF Brevard County Jail 866 Camp Rd, Cocoa - FL 32927 Lat. 28-26'-43.000" N Long 80-47'-01.000" W	45 Mbps	2
Titusville RF 1141 Day Street Titusville - FL 32780 Lat. 28-35'36.000" N Long 80-49'00.000' W	Rockledge EOC 1746 Cedar St Rockledge - FL Lat. 28-19'-39.000" N Long 80-44'-14.000" W	155 Mbps	1
Rockledge EOC 1746 Cedar St Rockledge - FL 32955 Lat. 28-19'-39.000" N Long 80-44'-14.000" W	Sharpes RF Brevard County Jail 866 Camp Rd, Cocoa - FL 32927 Lat. 28-26'-43.000" N Long 80-47'-01.000" W	45 Mbps	0
Rockledge EOC 1746 Cedar St Rockledge - FL 32955 Lat. 28-19'-39.000" N Long 80-44'-14.000" W	Sheriffs Operation Center 700 Park Ave. Titusville - FL 32780 Lat. 28-36'-27.530" N Long 80-49'08.335" W	155 Mbps	4
Rockledge EOC 1746 Cedar St Rockledge - FL 32955 Lat. 28-19'-39.000" N Long 80-44'-14.000" W	North Beach RF Site <i>Site to be determined</i> Lat. TBD Long TBD	45 Mbps	2
Rockledge EOC	Palm Bay RF Site RF	155 Mbps	6

1746 Cedar St  
Rockledge - FL 32955  
Lat. 28-19'-39.000" N  
Long 80-44'-14.000" W

140 Malabar Rd. SE  
Palm Bay - FL 32907  
Lat. 27-59'-47.000" N  
Long 80-40'-11.000 W

Melbourne RF Site  
2140 Lansing Street  
Melbourne - FL 32935  
Lat. 28-08'-33.000" N  
Long 80-40'-06.000" W

South Beach RF Site  
55 N. Osceola Dr.  
Indian Harbor Beach - FL 32937  
Lat. 28-09'-24.300" N  
Long 80-35'-32.700" W

45 Mbps 2

Melbourne RF Site  
2140 Lansing Street  
Melbourne - FL 32935  
Lat. 28-08'-33.000" N  
Long 80-40'-06.000" W

Palm Bay RF Site RF  
140 Malabar Rd. SE  
Palm Bay - FL 32907  
Lat. 27-59'-47.000" N  
Long 80-40'-11.000 W

45 Mbps 2

Palm Bay RF Site RF  
140 Malabar Rd. SE  
Palm Bay - FL 32907  
Lat. 27-59'-47.000" N  
Long 80-40'-11.000 W

Sheriffs Operation Center  
700 Park Ave.  
Titusville - FL 32780  
Lat. 28-36'-27.530" N  
Long 80-49'08.335" W

155 Mbps 2

**ATTACHMENT E**  
**SAMPLE ACCEPTANCE TEST PLAN**

ATTACHMENT E - SAMPLE ACCEPTANCE TEST PLAN



*“Your Satisfaction Is Our Goal”*

**Brevard County**

Acceptance Test Plan

Date:

### Field Acceptance Plan

Configuration Verification / Functional Tests		PASS/ ACCEPT	FAIL/ REJECT
I	System Configuration		
II	Cable & Equipment Labeling		
III	Equipment Inventory		
IV	Antenna System Configuration		
V	Microwave Terminal Configuration (SP & RF)		
1.1	Field Path Loss		
1.2	TX: RF Power Test		
1.3	TX: RF Frequency Test		
1.4	TX: RF Fade Test		
1.5	TX: ATPC Test		
2	RX: RSL / AGC Test		
3.1	Proteus MX Switching Test - Automatic		
3.2	Proteus MX Switching Test - Manual		
3.3	Proteus MX Switching Test - Power Interruption		
4.1	DS1 Traffic Routing Test – T1 Routing		
5.1	Microwave Terminal Alarms Test – Minor, Major, Normal		
6	Network Loop 24 Hour BER Test (Loop 1,2,3)		
7	Ethernet Test		
8	Network Management System (NMS) Test		

Exceptions/Comments:

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Customer Representative – \_\_\_\_\_

\_\_\_\_\_ Date

Communications International Representative – \_\_\_\_\_

\_\_\_\_\_ Date

## **I. System Configuration**

---

### **A. Description**

The system is physically staged for the Field Acceptance Test (FAT) as it will be installed in the Brevard County, FL system.

All the equipment is powered using the DC power system supporting our Systems Integration test area.

Note: All DS1s are configured for B8ZS.

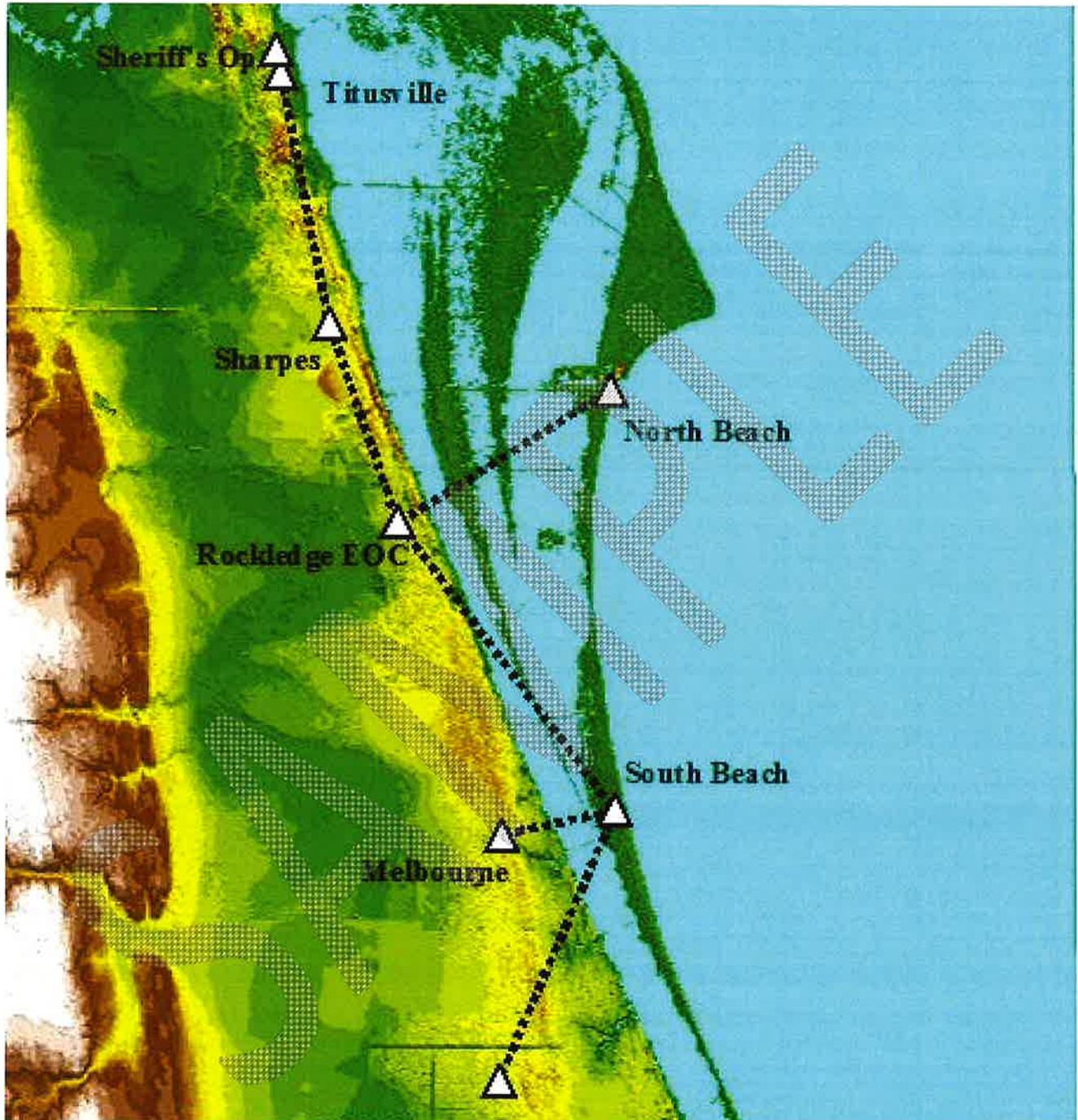
Note: All terminals are connected to antenna system. Receive Signal Levels (RSL) will be between -30/-50dBm.

### **B. Instructions**

Verify each site is physically present and interconnected per the System Map

### **C. Result**

The system configuration is consistent with the System Map. Each site is accounted for and is connected to its coordinating sites.



## II. Cable & Equipment Labeling

---

### A. Description

Demonstrate all wiring in the system is clearly labeled and dressed into the equipment racks. Each cable is labeled at both ends with the cable function, destination and rack profile identifier. All wiring is documented on the Wiring List (WL).

Note: Specific customer labeling requirements are required at least 30 days prior the scheduled FAT.

### B. Instructions

On a sample basis verify wiring and labeling is consistent with system documentation (Wiring List and Block & Level Drawing).

### C. Result

Audited cables are routed per the Wiring List and labeled at both ends with the cable function, destination and rack profile identifier.

## III. Equipment Inventory

---

### A. Description

Demonstrate all equipment ordered through Microwave Networks Incorporated is present.

This step is accomplished by comparing the equipment list with the actual equipment on-site.

### B. Instructions

Verify each line item on the Equipment List is present.

### C. Result

All equipment specified on the Equipment List (EL) is accounted for. For the FAT this excludes all "drop ship" equipment.

#### **IV. Antenna System Configuration**

---

##### **A. Description**

Each antenna will be verified for antenna type, azimuth, polarization, centerline, waveguide length, and waveguide type following antenna alignment.

This information will be documented on the Terminal Acceptance form in Section 1.

##### **B. Instructions**

Record the antenna type, azimuth, polarization, actual centerline, actual waveguide length and waveguide type used in Section 1 of the Terminal Acceptance form.

Compare the recorded data with the FCC Supplemental Showing for the hop being installed.

Take Digital photographs of the antenna installation showing antenna mount, polarization, side struts, and waveguide routing / grounding.

##### **C. Result**

Antenna type, azimuth, polarization, centerline, waveguide length, and waveguide type match what is stated on the FCC Supplemental Showing.

Note: Measured Antenna Centerline must be +/- 3 feet of Centerline specified on Supplemental Showing.

## **V. Microwave Terminal Configuration (SP & RF)**

---

### **A. Description**

Demonstrate each terminal's SP and RF Part #, Serial #, Software Version and TLI type match what is recorded on the System Test data sheet.

### **B. Instructions**

1. Record the Proteus MX SP part number and serial number shown on the sticker located on the SP Shelf in Section 2 of the Terminal Acceptance form.
2. Record the Proteus MX RF part number and serial number shown on the sticker located on the RF Shelf in Section 2 of the Terminal Acceptance form.
3. Record the TLI type shown on the front of each TLI (the silk screen type printed on the lower right corner) in Section 2 of the Terminal Acceptance data form.
4. Record the Software version for the SP and RF in Section 2 of the Terminal Acceptance form.
  - a. "Log-In" to the respective terminal using the following procedure:
    - i. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled "COMPUTER"
    - ii. Open the EM2 software and on the initial log-in screen select "Serial" from the pull down and choose the appropriate "COM PORT" that the PC is using.
    - iii. Enter the username: "Admin" (note this cannot be changed) enter the password. The default password is "password" which can be changed). Once the correct "Admin" and "User Password" is entered you will be "logged on" and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.
  - b. Go to "Terminal Info" in the menu and select "Inventory ..." this will bring up a screen that includes the software versions.
  - c. Go to "View Full table (System Test data sheet)/Save Info" button at the bottom of this window and it will bring up a detailed inventory of the terminal with all of its active parts. Save the information on this screen to a "text" file and print.

### **C. Result**

1. Recorded data: SP and RF Part #, Serial #, Software Version and TLI type matches that recorded on the System Test Data Sheet.

## 1.1 Field Path Loss (TX Flange to RX Flange Loss)

---

### A. Description

To establish a reference “Field Path Loss” which is equal to the “Far End” TX Reference Power Out minus the “Near End” Receive signal Level (RSL)

### B. Instructions

1. Note: Perform this in conjunction with 1.2 TX: RF Power Test so that Power Meter is only connected once.
2. Log on to the Terminal under test if you have not already logged on.
  - a. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled “COMPUTER”
  - b. Open the EM2 software and on the initial log-in screen select “Serial” from the pull down and choose the appropriate “COM PORT” that the PC is using.
  - c. Enter the username: “Admin” (note this cannot be changed) enter the password. The default password is “password” which can be changed). Once the correct “Admin” and “User Password” is entered you will be “logged on” and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.
3. If the Terminal under test is a Hot-Standby or Space-Diversity terminal, position the “On Line” switch on the front of the Switching Shelf to “Primary” on both the Near End and Far End terminals.
4. Adjust the ‘Far End’ ATPC MAX TX PWR out to achieve a “Near End” AGC voltage equal to a recorded point In the AGC Voltage - RSL table in the Systems Test Data Sheet. Record both the RSL from the AGC curve (measured) and the Indicated RSL in Section 10 of the Terminal Acceptance form.
5. If the Terminal under test is a Hot-Standby or Space-Diversity terminal, position the “On Line” switch on the front of the Switching Shelf to “Secondary” on both the Near End and Far End terminals and repeat Step 4.
6. In the EM2 software go to the “Test” and “RFU Mute” selection and MUTE all the RF portions of the terminal (Factory location only). Set the time to be “0” so it does not UN-Mute.

**Warning – In the field DO NOT Mute the Far End terminal without setting a time out. You will lose communication to that terminal which can only be un-muted by logging on locally.**

7. Remove the mating flange to the RF unit under test and connect an RF transition. Connect the Power Meter to the transition.

**Warning: Do not to exceed the power rating of the Power Sensor. Use a “high power” sensor capable of + 33 DBm or use a calibrated attenuator.**

8. If the Terminal under test is a Hot-Standby or Space-Diversity terminal, position the “On Line” switch on the front of the Switching Shelf to “Primary” on both the Near End and Far End terminals.

## 1.1 Field Path Loss (TX Flange to RX Flange Loss) - (Continued)

---

9. In the EM2 software, go back to the "Test" and "RFU Mute" screen and set the transmitter connected to the power meter to "On Line". Measure the power and record in Section 13 of the Terminal Acceptance form. Also record the indicated TX PWR OUT.
10. If the Terminal under test is a Hot-Standby or Space-Diversity terminal, position the "On Line" switch on the front of the Switching Shelf to "Secondary" on both the Near End and Far End terminals.
11. Repeat Step 9.
12. In the EM2 software go to the "Test" and "RFU Mute" selection and MUTE all the RF portions of the terminal (Factory location only). Set the time to be "0" so it does not UN-Mute.  
**Warning – In the field DO NOT Mute the Far End terminal without setting a time out. You will lose communication to that terminal which can only be un-muted by logging on locally.**
13. Re-Set for the Primary and Secondary ATPC MAX TX PWR Outs to the specified FCC MAX Power level.
14. Re-connect Flange disconnected in Step 7 unless you will perform Step 1.2 next.

### C. Result

1. Calculate the Field Path Loss TX PWR (dBm) minus RSL (dBm) and enter into Section 13 Terminal Acceptance form for both the "measured" values and the "indicated" values.

## 1.2 TX: RF Power Test

---

### C. Description

Measurement of TX RF Power

Note: For an MX terminal the power output is software configurable not hardware set. There is no “fine tune” adjustment. You set the desired output power using the EM2 software. The Terminal output power is set per the PCN requirements.

### D. Instructions

1. Log on to the Terminal under test if you have not already logged on.
  - a. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled “COMPUTER”
  - b. Open the EM2 software and on the initial log-in screen select “Serial” from the pull down and choose the appropriate “COM PORT” that the PC is using.
  - c. Enter the username: “Admin” (note this cannot be changed) enter the password. The default password is “password” which can be changed). Once the correct “Admin” and “User Password” is entered you will be “logged on” and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.

2. If the Terminal under test is a Hot-Standby or Space-Diversity terminal, position the “On Line” switch on the front of the Switching Shelf to “Primary” on both the Near End and Far End terminals.

3. In the EM2 software go to the “Test” and “RFU Mute” selection and MUTE all the RF portions of the terminal (Factory location only). Set the time to be “0” so it does not UN-Mute.

**Warning – In the field DO NOT Mute the Far End terminal unless you set a time out. You will lose communication to that terminal which can only be un-muted by logging on locally.**

4. Remove the mating flange to the RF unit under test and connect an RF transition. Connect the Power Meter to the transition.

**Warning: Do not to exceed the power rating of the Power Sensor. Use a “high power” sensor capable of + 33 DBm or use a calibrated attenuator.**

5. In the EM2 software, go back to the “Test” and “RFU Mute” screen and set the transmitter connected to the power meter to “On Line”. Measure the power and record in Section 3 of the Terminal Acceptance form.
6. Mute the transmitter for the Secondary terminal if applicable and repeat steps 2 – 5. Repeat steps 2 – 6 on the Far End terminal.
7. Re-connect flange disconnected in step 4.
8. Un-Mute all RF units.
9. Ensure that the “On Line” switch is set to “Auto” on the Switching Shelf for protected terminals.

### E. Result

1. Indicated Power (EM2 Screen) =’s measured power +/- 1 dB.

### 1.3 TX: RF Frequency Test

---

#### A. Description

Measurement of TX frequency

#### B. Instructions

1. Exit out of the EM2 software if logged on and log on to terminal using HyperTerminal.
  - a. Open the HyperTerminal program and set the following parameters:
    - i. Data Bits: 8
    - ii. Parity: None
    - iii. Stop Bits: 1
    - iv. No Flow Control
    - v. Baud Rate: 9600
  - b. Connect the computer to the terminal using the "COMPUTER" port on the front panel.
2. If the Terminal under test is a Hot-Standby or Space-Diversity terminal, position the "On Line" switch on the front of the Switching Shelf to "Primary" on both the Near End and Far End terminals.

**CAUTION: The Power Output Level at the "On Line" Monitor Port is +5 dBm. If this value is greater than the maximum RF level allowed by the Frequency Counter, use a +20dB 2W Attenuator to attenuate the signal so no damage occurs.**

3. Connect a Frequency Counter to the "TX Monitor" port of the terminal under test and follow the steps below to configure the terminal to measure the transmitter frequency:
  - a. In the Command Line Interface (CLI) go to menu item 3 "Test"
  - b. Under the test menu select menu item 6 "Modem RF Test"
  - c. Under Modem RF Test, select option 1 (toggle): Continuous Wave (CW) Test.  
Note: CW mode removes the modulation from the carrier to allow accurate frequency measurement.
  - d. Measure the frequency of the terminal and record it under Section 3 of the Terminal Acceptance sheet.
  - e. Under Modem RF Test, select option 1 (Toggle): "On Line" to return the terminal back to normal operation.
4. Switch to the Secondary terminal if applicable and repeat step 3.
5. Repeat steps 1 – 4 for the Far End terminal
6. Ensure that all of the terminals are returned to "Normal" operation and the Frequency Counter is disconnected.

#### C. Result

Measured frequency is  $\pm 10$  ppm of the indicated frequency on the Supplemental Showing.

## 1.4 TX: RF Fade Test

---

### D. Description

Measure Receive Signal Level for threshold of  $10E-6$  by fading the TX RF.

A variable attenuator is inserted between the Terminal RF Out and the Transmission Line in order to simulate a fade, i.e. reducing the Receive Signal Level (RSL) at the coordinating receiver.

Note: Due to the sophisticated Forward Error Correction Algorithm, there is a very minimal difference between RSL's for  $10E-6$  and  $10E-3$ . There is no specification for  $10E-3$ .

### E. Instructions

1. Log on to the Terminal under test if you have not already logged on.
  - a. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled "COMPUTER"
  - b. Open the EM2 software and on the initial log-in screen select "Serial" from the pull down and choose the appropriate "COM PORT" that the PC is using.
  - c. Enter the username: "Admin" (note this cannot be changed) enter the password. The default password is "password" which can be changed). Once the correct "Admin" and "User Password" is entered you will be "logged on" and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.
2. Connect a DS1 test set to the Near End and Far End terminals and ensure it is running error free before starting the test.
3. In the EM2 software go to the "Test" and "RFU Mute" selection and MUTE all the RF portions of the terminal. Set the time to be "0" so it does not UN-Mute.

**Warning – In the field DO NOT Mute the Far End terminal unless you set a time out. You will lose communication to that terminal which can only be un-muted by logging on locally.**
4. Disconnect the RF connection at the waveguide flange of the terminal and insert a variable attenuator in line with the coordinating terminal.
5. Set the variable attenuator to "0dB" and connect a Power Meter to the "output" of the RF cable that connects to the Receiver under test.
6. In the EM2 software Go back to the "Test" then "RFU Mute" screen and set the terminal to "On Line".
7. In the EM2 software Go back to "Configuration" then "RFU" and click on "ATPC Enable" (toggle). "ATPC Off" will be displayed.
8. Connect a Digital Voltmeter to the AGC port on the coordinating receiver

**1.4 TX: RF Fade Test (Continued)**

- For the Test determine the “Fixed” Losses. Measure the TX PWR OUT at the flange and note. Measure the Power at the end of the cable which includes the fixed attenuators, splitter for space diversity plus the Variable Attenuator set to 0 dB. Fixed loss = TX PWR out – PWR Out at the end of the cable. Required for step 15.

Example:

TX PWR OUT (Measured)	+29 dBm
Variable Attenuator (Set)	0 dB
PWR at End of cable(Measured)	-36 dBm
Fixed Losses	65 dB

- For the Field Test Measure and record the power to establish a reference RSL with “0dB” attenuation for the variable attenuator. Required for step 16.
- In the EM2 software go to the “Test” and “RFU Mute” selection and MUTE all the RF portions of the terminal. Set the time to be “0” so it does not UN-Mute.

**Warning – In the field DO NOT Mute the Far End terminal unless you set a time out. You will lose communication to that terminal which can only be un-muted by logging on locally.**

- Re-connect the cable from transmitting terminal to the receiver under test.
- In the EM2 software Go back to the “Test” then “RFU Mute” screen and set the terminal to “On Line”.
- Fade the TX by adjusting the variable attenuator (adding attenuation). Add attenuation in 5 dB increments to an RSL of -65 dBm, then continue to slowly increase attenuation until the coordinating receiver has a BER of 10E-6. Note: This is a continuously variable attenuator, not a step attenuator.
- For the Factory Test Determine the RSL which is equal to the TX PWR OUT plus the Fixed Losses (determined in step 9) + Variable Loss (Variable Attenuator for BER of 10E-6).

Example

TX PWR OUT (Measured)	+29 dBm
FIXED Losses (Determined in step 9)	-65 dBm
Variable Attenuator (Attenuation for BER 10E-6)	-34 dBm
Threshold	-70 dBm

**1.4 TX: RF Fade Test (Continued)**

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16. For the Field Test, Compare the attenuator reading and AGC voltage at each 5 dB step to the AGC table recorded on the System Form. Record the AGC voltage for a BER of 10E-6 on the Terminal Acceptance form and determine the RSL from the AGC table on the System Test Data sheet and record in Section 4 of the Terminal Acceptance form.(Field Test only)
17. In the EM2 software goes to "Configuration" then "RFU" and click on "ATPC Enable" (toggle). "ATPC On" will be displayed.
18. Leave the attenuator in the path. It is required for following ATPC test.

**F. Result**

1. Measured AGC voltage is +/- .05 of voltage indicated on AGC table (System Test data sheet)
2. RSL at 10E-6 is less than -69.0 dBm
3. Indicated RSL (EM2 Screen) +/- 2 dB of actual.

## 1.5 TX: ATPC Test

---

### A. Description

Verification of ATPC (Automatic TX Power Control)

### B. Instructions

1. Confirm you are still logged on the hop you are testing.
2. Go to the EM2 Screen "Terminal Info" with "Link View" checked. This will provide a pictorial representation of the MX terminal.
3. If the Terminal under test is a Hot-Standby or Space-Diversity terminal then switch the "On Line" switch on the front of the Switching Shelf to "Primary" on both the Near End and Far End terminals.
4. Set the "path" attenuator to 0 dB.
5. Note the Power Out
6. Note the RSL (coordinating receiver) = the ATPC set point
7. Record the RSL Set Point in Section 3 of the Terminal Acceptance data sheet
8. Slowly increase the attenuation while monitoring the power level and the RSL.
9. Slowly reduce the attenuation to 0 dB.
10. Repeat steps 3-9 for Secondary transmitter if present.
11. Mute the RF, remove the attenuator and restore the connection
12. Un-Mute the RF and set the "On Line" switch to auto.
13. Confirm Terminal is in "normal" operation.

### C. Result

1. As attenuation is increased the power will increase and the RSL will remain constant.
2. When the TX is at maximum allowed power the terminal will display a minor alarm.
3. As the attenuation is reduced the power will decrease, the minor alarm is extinguished.
4. Power Output is equal to that observed in Step 5 above

## 2. **RX: RSL / AGC Test**

---

### A. **Description**

Verify RSL-AGC Table (System Test data sheet) correlation

Verify Field RSL equals expected RSL

### B. **Instructions**

1. Log on to the Terminal under test if you have not already logged on.
  - a. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled "COMPUTER"
  - b. Open the EM2 software and on the initial log-in screen select "Serial" from the pull down and choose the appropriate "COM PORT" that the PC is using.
  - c. Enter the username: "Admin" (note this cannot be changed) enter the password. The default password is "password" which can be changed). Once the correct "Admin" and "User Password" is entered you will be "logged on" and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.
2. If the Terminal under test is a Hot-Standby or Space-Diversity terminal then position the "On Line" switch located on the front of the Switching Shelf to "Primary" on both the Near End and Far End terminals.
3. From the Supplemental Showing find the Calculated RSL reading and record it in the appropriate box of Section 4 of the Terminal Acceptance sheet.
4. Record the RF unit's RX frequency in the appropriate location of Section 4 of the Terminal Acceptance sheet. The frequency can be found on the RF unit's label.
5. Using a Digital Volt Meter measure the AGC voltage for RF unit under test (AGC test point is on front of RF unit). Record the AGC voltage in the appropriate box in Section 4 of the Terminal Acceptance test form.
6. Repeat steps 2 – 5 for the Secondary terminal if it is a protected terminal and then repeat steps 1 – 6 on the Far End terminal.
7. Ensure that all of the terminals are returned to Normal operation and the "On Line" switch located on the Switching Shelf is set back to "AUTO".

### C. **Result**

1. Factory Measurement - the Indicated RSL on the EM2 screen =s the actual RSL +/- 2dB.
2. Factory Measurement – the Indicated RSL on the EM2 screen =s the interpolated RSL from the AGC table (System Test data sheet) +/- 2 dB
3. Field Measurement – the interpolated RSL from the AGC table (System Test data sheet) =s the expected RSL from the Supplemental Showing +/- 2 dB
4. Field Measurement – the indicated RSL on the EM2 screen =s the interpolated RSL from the AGC table (System Test data sheet).

### 3.1 Proteus MX Switching Test - Automatic

---

#### A. Description

Demonstrate a forced switch occurs when an “on-line” Section of the terminal fails resulting in a successful switch to the redundant device.

Note: This test only applies to Monitored Hot and Space Diversity configured terminals.

#### B. Instructions

1. Connect a DS1 level test set to the Near End and Far End terminals and ensure it is running error free before starting the test.
2. Verify the connection by injecting an error to each test set.
3. Position the “On Line” switch located on the Switching Shelf to “Primary” on both the Near End and Far End terminals. Once both terminals are locked on the Primary Terminal, position the “On Line” Switch back in the “Auto” position. This is to insure traffic is on the Primary terminal.
4. Simulate a failure by Unscrewing and removing the TLI module from the Primary terminal.
5. Once the DS1 test set has cleared, allow it to run for 10-15 seconds to verify error free operations.
6. Re-install the TLI module into the Primary terminal.
7. Once all alarms have cleared from the terminal, unscrew and remove the TLI Module from the Secondary terminal and the terminal will switch the necessary hardware to re-route the traffic.
8. Once the DS1 test set has cleared, allow it to run for 10-15 seconds to verify error free operations.
9. Repeat steps 4 – 8 on the Far End terminal.

#### C. Result

1. Data carried by the Primary terminal switches to the Secondary terminal upon removal of the TLI from the Primary terminal;
2. Data carried by the Secondary terminal switches back to the Primary terminal after the Primary terminal TLI is replaced and the TLI in the secondary terminal is removed.

#### **\*NOTE\***

A successful switch is defined as, a switch which reverts data to the redundant component and resumes traffic error free. Typically, switching will not cause a resynchronization of termination equipment, this however, cannot be guaranteed.

### 3.2 Proteus MX Switching Test - Manual

---

#### A. Description

Demonstrate a forced switch occurs when the on-line terminal is instructed to switch (via the EM2 software), resulting in a successful switch to the redundant device.

Note: This test only applies to Monitored Hot and Space Diversity configured terminals.

#### B. Instructions

1. Connect a DS1 level test set to the Near End and Far End terminals and ensure it is running error free before starting the test.
2. Verify the connection by injecting an error to each test set.
3. Position the "On Line" switch located on the Switching Shelf to "Primary Terminal" on both the Near End and Far End terminals. Once both terminals are locked on the Primary Terminal, position the "On Line" switch back into the "Auto" position. This is to insure traffic is on the Primary terminal.
4. Log on to the Terminal under test if you have not already logged on.
  - a. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled "COMPUTER"
  - b. Open the EM2 software and on the initial log-in screen select "Serial" from the pull down and choose the appropriate "COM PORT" that the PC is using.
  - c. Enter the username: "Admin" (note this cannot be changed) enter the password. The default password is "password" which can be changed). Once the correct "Admin" and "User Password" is entered you will be "logged on" and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.
5. Go to the "TEST" menu and choose "TEST PROTECTION STATUS/SWITCHING"
  - a. This screen allows you to call for Online Requests (OLR). At this point the Primary terminal on both sides of the hop should show "IS" and the secondary should show "OOS".
  - b. On the Near End Secondary and Far End Secondary terminals click on the "OLR OFF" button and it will change to "OLR ON" and the color Section will begin to flash indicating a pending change.
  - c. Once all 8 locations are set to "OLR ON" and flashing select "APPLY" and the terminal will start the switching process.
  - d. The LED on the front of the terminal will begin to flash indicating a manual condition is set in the terminal.
  - e. While this is set to "OLR ON" the terminal WILL NOT switch back to the Primary terminal until it is taken out of the "OLR ON" condition.
  - f. Go back and click on all 8 of the buttons to change them to "OLR OFF" and then click "APPLY".
  - g. The terminal will stay on the secondary terminal but will now go back to a normal operating state and now the "IS" will be on the Secondary terminals and the "OOS" will be on the Primary terminals.

### 3.2 Proteus MX Switching Test – Manual (Continued)

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6. Repeat steps 3-5 for the Secondary terminal.

#### C. Result

1. Data carried by the Primary terminal switches to the Secondary terminal following the Manual Switch command “Apply” in step 5c.
2. Data carried by the Secondary terminal does not switch back to the Primary terminal following the Manual Switch command “Apply” in step 5f.

Note: A RXU/DEMODO switch will result in a hitless switch (no errors). A TXU/MOD switch will result in a momentary error burst.

SAMPLE

### 3.3 Proteus MX Switching Test - Power Interruption

---

#### A. Description

Demonstrate the redundancy of the power supplies provided with the MX platform.

Note: This test only applies to Monitored Hot and Space Diversity configured terminals.

#### B. Instructions

1. Connect a DS1 level test set to the Near End and Far End terminals and ensure it is running error free before starting the test.
2. Verify the connection by injecting an error to each test set.
3. Position the "On Line" switch located on the Switching Shelf to "Primary Terminal" on both the Near End and Far End terminals. Once both terminals are locked on the Primary Terminal, position the "On Line" switch back in the "Auto" position. This is to insure traffic is on the Primary terminal.
4. Disconnect the power to the Primary terminal to simulate power interruption.
5. The data will be switched to the Secondary terminal and the DS1 test set will clear.
6. Allow the terminal to run on the Secondary for 10-15 seconds to show error free operations and then replace the power to the primary.
7. Once the alarms have cleared on the Primary terminal, disconnect the power to the Secondary terminal. Traffic will switch back to the Primary terminal and resume error free operations.
8. Re-connect Power to the Secondary terminal and verify all alarms have cleared.
9. Repeat steps 3-8 on the Far End terminal.

#### C. Result

1. Data carried by the Primary terminal switches to the Secondary terminal following the removal of power from the Primary terminal.
2. Data carried by the Secondary terminal switches back to the Primary terminal following the restoration of Power to the Primary terminal and subsequent removal of power from the Secondary terminal.

## 4.1 DS1 Traffic Routing Test –T1 Routing

---

### A. Description

Demonstrate all DS1 circuits in the network are wired and routed in accordance with the Brevard County System Channel Plan.

Each circuit is routed from its point of origin to its point of destination. The demarcation point at each site provides entry and exit access. The demarcation point is the RJ48 DSX panel(s) at each site.

### B. Instructions

1. Start with the first DS1 on the Channel Plan.
  - a. Identify from the Channel Plan each DS1's point of origin and point of destination.
  - b. Identify the DSX port the DS1 is connected to at each site.
2. Connect a DS1 test set to the local (point of origin) RJ48 Port and connect a DS1 test set to the Far End (point of destination) RJ48 Port for the DS1 being tested.
3. At the SHARP MUX at the point of origin pull the connection going East to ensure the DS1s are all routing correctly through the system in the "West" direction
4. Demonstrate connectivity by injecting an error on the near end terminal's test set and ensure the Far End site sees the error. Then have the Far End site send an error and ensure it shows up on the near end site.
5. Allow each DS1 to run for 10-15 seconds error free.
6. Re-insert the East connection and wait for the alarms to clear.
7. Pull the connection going "West". This will insure the DS1's are routed correctly through the system in the "East" direction
8. Demonstrate connectivity by injecting an error on the near end terminal's test set and ensure the Far End site sees the error. Then have the Far End site send an error and ensure it shows up on the near end site.
9. Allow each DS1 to run for 10-15 seconds error free.
10. Re-insert the "West" connection and wait for the alarms to clear.
11. Repeat steps 2 – 10 for each DS1 on the channel plan.

### C. Result

1. Connectivity of each DS1 (both "East" and "West" directions) is verified by one DS1 test set communicating with the other over the DS1 being tested and running error free for 10-15 seconds.
2. All DS1's within the network are properly routed and fully functional.

## 5.1 Microwave Terminal Alarms Test – Minor, Major, Normal

---

### A. Description

Demonstrate that both the EM2 software and the external LED's display Minor and Major alarms

### B. Instructions

Begin by ensuring that no alarms exist on the terminal to be tested. If any alarms are present troubleshoot those alarms and then continue with the test.

1. Log on to the Terminal under test if you have not already logged on.
  - a. Connect a PC with the EM2 software installed via the serial connector on the front of the terminal labeled "COMPUTER"
  - b. Open the EM2 software and on the initial log-in screen select "Serial" from the pull down and choose the appropriate "COM PORT" that the PC is using.
  - c. Enter the username: "Admin" (note this cannot be changed) enter the password. The default password is "password" which can be changed). Once the correct "Admin" and "User Password" is entered you will be "logged on" and the displayed terminal icons will go from gray to blue to indicate communication with the terminal under test.
2. Go to the "Status" and then "Link Alarms" screen. This will show the presence of alarms for all terminals on the hop being tested.
3. On protected terminals pull the NMS interconnect cable and a MINOR alarm LED will show. With Non-protected terminals a MINOR alarm can be caused by pulling an equipped DS1 connection from the TLI card.
4. Return the cables to the normal operating position and all alarms should clear except the Severity Section of the Link Alarm screen. It holds the color of the highest alarm until reset. Also the "Latched" alarms will show on the main screen as a blue indicator until latched alarms are reset.
5. Once all the alarms have cleared click on the "RESET" button to get back to a green indicator.
6. Now a Major alarm is to be tested by pulling the TLI card from the chassis and monitor both the external LED and the internal Link Alarm screen.
7. Return the TLI to the normal operating position and watch to ensure that all alarms clear.
8. Reset the Latched alarms once all alarms are clear.
9. Repeat steps 2-8 for the Far End terminal.

## 5.1 Microwave Terminal Alarms Test – Minor, Major, Normal (Continued)

---

### C. Result

1. When a minor alarm is caused it is visible on the "Link" screen and the "Minor" alarm LED illuminates.
2. When a major alarm is caused it is visible on the "Link" screen and the "Major" alarm LED illuminates.
3. Latched alarms remain until manually reset.
4. "Latched Alarm" reset clears latched alarms.

Note: All alarm indications come on as explained and clear up after everything is replaced and normal operations are resumed. Latched alarms have to be manually reset as they are an indication feature on this system.

## 6. Network Loop 24 Hour BER Test

---

### A. Description

Demonstrate that the loop's operates error free for 12 hours in the "clockwise" direction for twelve (12) hours and then the "counter-clockwise" direction for twelve (12) hours.

### B. Instructions

1. Select a DS1 that goes around the loop from PSB to OSW\_LJN within the loop.
2. Connect a DS1 test set at PSB and OSW\_LJN and verify continuity.
3. Configure the SHARP to transport traffic in the "clockwise" direction" by using the manual-forced switching capability under the SPU SHARP TLI menu.
4. Verify the DS1 test set is "Green" and commence the BER test.
5. Record BER Result after the 12 hour test.
6. Re-configure the SHARP to transport traffic in the "counter-clockwise direction" by using the manual-forced switching capability under the SPU SHARP TLI menu.
7. Verify the DS1 test set is "Green" and commence the BER test.
8. Record BER Result after the 12 hour test.
9. Record BER Result after the 12 hour test.
10. Normalize all the connections.

### C. Result

Each 12 hour BER test is error free.

## 7. Ethernet Test

---

### A. Description

Demonstrates Ethernet connectivity around the system.

Note:

All the Ethernet ports of the radio will be bridged; the interconnection can be verified along any of the network radio terminals.

### B. Instructions

1. Connect an Ethernet test set into the hub at PSB.
2. Verify connectivity to all sites

### C. Result

The Ethernet connectivity is verified for all sites.

SAMPLE

## 8. Network Management System (NMS) Test

---

### A. Description

Demonstrate the functionality of the Network Management System (NMS) with regard to the microwave terminal.

### B. Instructions

1. Open the NMS software and view the main site map.
2. Double click on a network element icon on the right hand side of the screen which will open the site and show the terminal icons.
3. Double click on a selected terminal icon which will launch the EM2 software so that individual terminal manipulation can be done.
4. Exit the EM2 software and browse the NMS sites and select another terminal and log in by double clicking on the icon.
5. Alarm reporting
  - a. While viewing the Icon and alarm log location of the NMS remove a cable or TLI from a terminal and observe the "alarm" screen for the reported alarm, icon changes color.
  - b. Re-install the removed cable or TLI and view the "alarm" screen to see that the alarm clears and the icon returns to a green color.
  - c. Note: the "Current" logs are shown on the main screen of the NMS.
  - d. Note: Alarms are also recorded in History, open the "History" tab to view
  - e. Clear all alarms
  - f. Once all alarms are clear the "Current" alarms should be clear also and normal operations can resume.

### C. Result

1. NMS displays icons for each site in the network
2. Each site can be accessed by double clicking the site icon.
3. The NMS accesses the EM2 software; thus, allowing the user to perform the required function that can be done via the EM2 software.
4. The "Active" alarm screen displays the correct alarm at the correct site only when present.
5. The "History" alarm screen will display all alarms that have occurred until reset.

**ATTACHMENT F  
COMPLIANCE AFFIDAVIT(S)**

## T1 Circuit Preliminary Test - Scope of Work

### Goal

To test T1 circuits' functionality and reliability over the proposed network conforming to the specifications under Section 4.1.7.

### Test Scope

- Commission a T1 connectivity between 1141 Day Street, Titusville-32780 (Control Point for the North Simulcast System) and 1746 Cedar Street, Rockledge-32955 (Rockledge Tower).
- Run loopback test on the commissioned T1 for two weeks, collecting all the necessary information to verify circuit specifications. The T1 must achieve a minimum of 99.999 % error free performance. Results should be verified by the County.
- Connect the Rockledge Tower to the Control Point via the commissioned T1 and run a signal delay test for a period of 48 hours. Each T1 should have no more than 10,000  $\mu$ sec of propagation delay. Results should be verified by the County.
- The County will run a full simulcast system test for two weeks.
- Final evaluation report from the Proposer to the County including acceptance affidavit signed by the County.

### Timeline

Milestone Description	Start	Finish
T1 Circuits over Metro-E Test	MM/DD/YY	MM/DD/YY
<b>Proposer:</b> Installation at 1141 Day Street, Titusville-32780 (Control Point for the North Simulcast System)	MM/DD/YY	MM/DD/YY
<b>Proposer:</b> Implementation of a point-to-point T1 between 1141 Day Street, Titusville-32780 (Control Point for the North Simulcast System) and 1746 Cedar Street, Rockledge-32955 (Rockledge Tower)	MM/DD/YY	MM/DD/YY
<b>Proposer:</b> Loopback test on the commissioned T1	MM/DD/YY	MM/DD/YY
<b>Proposer:</b> Signal delay test	MM/DD/YY	MM/DD/YY
<b>County:</b> Full simulcast system test over the commissioned T1	MM/DD/YY	MM/DD/YY
Evaluation report from Proposer and conclusion of the test	MM/DD/YY	MM/DD/YY

**\*\*Communications International understands the above requirement and will comply.**

## T1 Circuit Acceptance Affidavit

This document is intended to confirm T1 circuit compliance over the proposed/implemented network by Communications International  
Vendor's name

**Location #1:**

Address: Day Street, Titusville, FL

**Location #2:**

Address: BCFR Fire Station, Scottsmoor

**Terminal T1 outputs**

Comply

Interface		DSX-1 interface per ANSI T1.403-1989
Rate		1.544 Mbps +/- 30ppm, using internal terminal timing
Pulse shape		Per ANSI T1.403-1989
Framing	**	(1) Extended Superframe (ESF) per AT&T 62411 (2) D4/Superframe (SF) per AT&T 43801 Specify (1) or (2) will be used by the terminals [Preferred & default is ESF].
Line Codes	**	(1) Bipolar with 8 zero substitution (B8ZS) (2) Alternate Mark Inversion (AMI) Specify (1) or (2) will be used by the terminals [Preferred & default is B8ZS].
Line equalization		Maximum of 655 feet from the DSX-1
Protection		Terminals are transformer - isolated. Output transformers do not have secondary center taps.
Terminal output Jitter		Less than 0.05 UI per AT&T 62411, using internal timing.

**Terminal T1 inputs**

Comply

Rate		1.544 Mbps +/- 100ppm, when <i>not</i> loop or thru timed. 1.544 Mbps +/- 50ppm, when loop or thru timed.
Pulse shape		Per ANSI T1.403-1989
Input impedance		100 Ohms resistive (nominal).
Framing	**	(1) Extended Superframe (ESF) per AT&T 62411 (2) D4/Superframe (SF) per AT&T 43801 Specify (1) or (2) will be used by the terminals [preferred & default is ESF].
Line Codes	**	(1) Bipolar with 8 zero substitution (B8ZS) (2) Alternate Mark Inversion (AMI) Specify (1) or (2) will be used by the terminals [preferred & default is B8ZS].
Jitter		Circuit must meet AT&T 62411
Circuit BER		10-6 or better. 10-10 is preferred

**Reroute Limitations**

Comply

Maximum circuit delay Primary or any secondary path delay shall not exceed 29,995 microseconds.

Rate of reroute Once switched, circuit delay shall remain stable for greater than 10 minutes before being rerouted again.

**T1 Clock**

Comply

The T1 paths shall be capable of transporting the MUX clock from end to end of the link.

**Public Safety Agency/County:** Hillsborough County Sheriff's Office

**Type of Radio System:** EDACS Simulcast and P25 Simulcast

**Number of T1 circuits implemented:** 2.5

**Contact Information Name/Title:** Steve Fisher, Chief Engineer

SIGNATURE:  

DATE: 4/8/16

TELEPHONE #: 772-978-4105

EMAIL: sfisher@ask4ci.com

**ATTACHMENT G  
INSURANCE**





# CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)  
3/2/2017

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

**IMPORTANT:** If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

<b>PRODUCER</b> Commercial Lines - (813) 639-3000 Wells Fargo Insurance Services USA, Inc. 2502 N. Rocky Point Drive, Suite 400 Tampa, FL 33607		<b>CONTACT NAME:</b> Cindy Staley <b>PHONE (A/C, No, Ext):</b> (800) 282 3343 <b>FAX (A/C, No):</b> (877) 302 4034 <b>E-MAIL ADDRESS:</b> Cindy.Staley@wellsfargo.com															
<b>INSURED</b> Communications International, Inc. 4450 US Highway 1 Vero Beach, FL 32967		<table border="1"> <thead> <tr> <th>INSURER(S) AFFORDING COVERAGE</th> <th>NAIC #</th> </tr> </thead> <tbody> <tr> <td>INSURER A : Old Republic Insurance Company</td> <td>24147</td> </tr> <tr> <td>INSURER B : XL Specialty Insurance Company</td> <td>37885</td> </tr> <tr> <td>INSURER C : Old Republic General Insurance Corporation</td> <td>24139</td> </tr> <tr> <td>INSURER D :</td> <td></td> </tr> <tr> <td>INSURER E :</td> <td></td> </tr> <tr> <td>INSURER F :</td> <td></td> </tr> </tbody> </table>		INSURER(S) AFFORDING COVERAGE	NAIC #	INSURER A : Old Republic Insurance Company	24147	INSURER B : XL Specialty Insurance Company	37885	INSURER C : Old Republic General Insurance Corporation	24139	INSURER D :		INSURER E :		INSURER F :	
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**COVERAGES**      **CERTIFICATE NUMBER:** 11526981      **REVISION NUMBER:** See below

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	<input checked="" type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS-MADE <input checked="" type="checkbox"/> OCCUR  GEN'L AGGREGATE LIMIT APPLIES PER: <input type="checkbox"/> POLICY <input checked="" type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC OTHER:			MWZY309696	03/01/2017	03/01/2018	EACH OCCURRENCE	\$ 1,000,000
							DAMAGE TO RENTED PREMISES (Ea occurrence)	\$ 500,000
							MED EXP (Any one person)	\$ 10,000
							PERSONAL & ADV INJURY	\$ 1,000,000
							GENERAL AGGREGATE	\$ 2,000,000
							PRODUCTS - COMP/OP AGG	\$ 2,000,000
								\$
A	<input checked="" type="checkbox"/> AUTOMOBILE LIABILITY <input checked="" type="checkbox"/> ANY AUTO <input type="checkbox"/> OWNED AUTOS ONLY <input type="checkbox"/> SCHEDULED AUTOS <input type="checkbox"/> HIRED AUTOS ONLY <input type="checkbox"/> NON-OWNED AUTOS ONLY			MWTB309697	03/01/2017	03/01/2018	COMBINED SINGLE LIMIT (Ea accident)	\$ 1,000,000
							BODILY INJURY (Per person)	\$
							BODILY INJURY (Per accident)	\$
							PROPERTY DAMAGE (Per accident)	\$
								\$
B	<input checked="" type="checkbox"/> UMBRELLA LIAB <input checked="" type="checkbox"/> OCCUR <input type="checkbox"/> EXCESS LIAB <input type="checkbox"/> CLAIMS-MADE DED    RETENTION \$			US00069118L116A	03/01/17	03/01/2018	EACH OCCURRENCE	\$ 1,000,000
							AGGREGATE	\$ 1,000,000
								\$
A	<input checked="" type="checkbox"/> WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below			MWC30969500	03/01/17	03/01/2018	<input checked="" type="checkbox"/> PER STATUTE <input type="checkbox"/> OTHER E.L. EACH ACCIDENT	\$ 1,000,000
							E.L. DISEASE - EA EMPLOYEE	\$ 1,000,000
							E.L. DISEASE - POLICY LIMIT	\$ 1,000,000
C	Garagekeepers			MWZY306664	03/01/2017	03/01/2018	\$400,000	

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)  
Proof of Coverage

<b>CERTIFICATE HOLDER</b> Brevard County Office of Emergency Management Attn: Kimberly Prosser 1746 Cedar Street Rockledge, FL 32955	<b>CANCELLATION</b> SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.
	AUTHORIZED REPRESENTATIVE 

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