



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES PERDUE
GOVERNOR

EUGENE A. CONTI, JR.
SECRETARY

November 1, 2011

Addendum No. 1

RE: Contract ID C202576

WBS # 45241.3.1

F. A. # STP-0314(5)

Onslow County (U-5168)

Computerized Signal System in Jacksonville

November 15, 2011 Letting

To Whom It May Concern:

Reference is made to the plans furnished to you on this project.

The following revisions have been made to the plans:

Sheet No. 1B has been revised. Please void Sheet No. 1B in your plans and staple the revised Sheet No. 1B thereto.

Sheet Nos. 2D and 2E have been deleted. Please void Sheet Nos. 2D and 2E in your plans.

Sheet Nos. 3A thru 3E, "Summary of Work by Cable Routing" have been revised. Please void Sheet Nos. 3A thru 3E in your plans and staple the revised Sheet Nos. 3A thru 3E thereto.

Sheet No. 3L, "Summary of Work by CCTV", has been revised. Please void Sheet No. 3L in your plans and staple the revised Sheet No. 3L thereto.

Sheet Nos. 68, 78, 103, 110, 183 thru 185, 187 and 188 have been revised. Please void Sheet Nos. 68, 78, 103, 110, 183 thru 185, 187 and 188 and staple the revised sheets thereto.

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
CONTRACT STANDARDS AND DEVELOPMENT UNIT
1591 MAIL SERVICE CENTER
RALEIGH NC 27699-1591

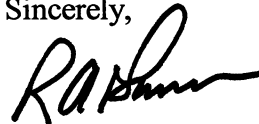
TELEPHONE: 919-707-6900
FAX: 919-250-4119
WEBSITE: WWW.NCDOT.ORG

LOCATION:
CENTURY CENTER COMPLEX
ENTRANCE B-2
1020 BIRCH RIDGE DRIVE
RALEIGH NC 27610

The following revision has been made to the Proposal:

Page Nos. 177 thru 189 has been revised to change Chapter 28 from "Spread Spectrum Wireless Ethernet Radio" to "Wireless Broadband Ethernet Radio System". Please void Page Nos. 177 thru 189 in your proposal and staple the revised Page Nos. 177 thru 189 thereto.

Sincerely,



R. A. Garris, PE
Contract Officer

RAG/jag
Attachment

cc: Mr. Jon Nance, PE
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Mr. H. A. Pope, PE
Ms. D. M. Barbour, PE
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Mr. R.E. Davenport, PE
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Ms. Lori Strickland

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28. WIRELESS BROADBAND ETHERNET RADIO SYSTEM**28.1. DESCRIPTION**

Furnish and install a wireless broadband Ethernet radio system with all necessary hardware in accordance with the plans and specifications to provide a video and data link between a CCTV camera and a fiber access point. Provide a radio system with a bi-directional communications channel between two "line-of-sight" antennas using license free technology operating in the 2.4 / 5.8 GHz frequency band.

Furnish material and workmanship conforming to the National Electrical Code (NEC), the National Electrical Safety Code (NEC), Underwriter's Laboratories (UL) or a third-party listing agency accredited by the North Carolina Department of Insurance, and all local safety codes in effect on the date of advertisement. Comply with all regulations and codes imposed by the owner of affected utility poles.

28.2. MATERIALS**A. General**

Furnish a point to point & point to multi-point wireless broadband Ethernet data radio system. 5.8 GHz is to be used for broadband connectivity applications with an inbuilt 2.4 GHz for 802.11 WiFi connection. The system may consist of connectorized radios and/or radios with integrated panel antennas.

Furnish a dual 2.4 & 5.8 GHz wireless broadband system with the following minimum general operating characteristics:

Frequency	5.2 GHz UNII & 5.8 GHz ISM Dynamic Frequency Selection (DFS) and 2.4 - 2.4835 GHz ISM Dynamic Frequency Selection (DFS)
Wireless Technology	E-OFDM and DSSS
Operating Mode	Point-to-point, point to multipoint
Range	>20 Miles (LOS)
Bandwidth	Up to 54 Mbps

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Compliance	SWRI tested, FCC & Industry Canada, RSS-210 approved.
Weatherproof Outdoor Unit	IP67 rated with either a connectorized unit (2 n-male ports) or with integrated 23 dB panel antenna & one 2.4 GHz n-male antenna port

B. Radio

Furnish a radio with the following minimum general operating characteristics:

Multiple Frequency Bands	5.2 GHz UNII 5.8 GHz ISM Non-overlapping Channels: 40 x 5 MHz 20 x 10 MHz, 10 x 20 MHz, 5 x 40 MHz 2.4 GHz ISM Non-overlapping Channels: 16 x 5 MHz 8 x 10 MHz, 4 x 20 MHz, 2 x 40 MHz
Radio Type	E-Orthogonal Frequency Division Multiplexing (E-OFDM)
Standards Compliance	802.3, 802.11i, 802.11a hardware with proprietary bridging extensions
Radio Output Power	Max radio output power 26dB
Data Rate	Up to 54 Mbps
Receiver Sensitivity (dBm)	-70 to -93
Modulation	64QAM, 16QAM, QPSK, BPSK
Wireless Operating Modes	Point to Multipoint, Backhaul (point to point), Repeater, and Hotspot
Remote Power System	Power-over-Ethernet remote power to IP67 rated outdoor unit. Input: 100-240 AC, 50-60 Hz, Output: 18V, .4A. c/w inline surge suppressor
Security	AES-256/WEP 152-bit data encryption options, VPN support for Ethernet tagged frames (802.1q, 802.1p)
Firmware Upgrades	Web Based downloadable – configurable over the air
Antenna Alignment	Built-in Spectrum Analyzer, Real-time RSSI (Signal Strength) monitor; link optimization and throughput maximization utility

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Indoor LED Status Indicator	Indoor remote power indicator
Real-Time Link Monitoring	Secure Management Interface- Real-time signal strength, authentication data, system uptime, data rate, and channel selection

Furnish a radio with the following minimum general mechanical and environmental characteristics:

Radio Dimensions	12" x 12" x 0.6" (Integrated Antenna) or 0.8" x 0.7" x 0.2" (Connectorized)
POE Dimensions	3" x 2" x 1.5"
Radio Operating Temperature	-22°F to 140°F. Outdoor units are weather protected (IP67)
Radio Operating Humidity	Max. 95% non-condensing
Outdoor Antenna	-50°F to +140°F
Wind Survivability	125 Mph

Furnish a radio with the following minimum certifications:

EMC	FCC Part 15, Industry Canada RSS-210, Mexico, ETSI
Safety	UL-Canada, USA, CE
Radio	FCC 15.407 (UNII, ISM), Industry Canada RSS-210, ETSI (w/TPC & DFS), MII SRRC, TXDOT and SWRI Tested.

C. 2.4/5.8 GHz Wireless Ethernet Repeater Standalone Radio System

C.1. General

Furnish an operational 2.4/5.8 GHz wireless broadband Ethernet repeater radio system installed in a NEMA Type 3R enclosure for pole mounting. As a minimum, ensure the repeater radio meets the specifications provided above.

C.2. Cabinet

Furnish the cabinet shell constructed from unpainted, natural aluminum. Ensure that all non-

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aluminum hardware on the cabinet is stainless steel or an approved non-corrosive alternate. Ensure that each exterior cabinet plane surface is constructed of a single sheet of aluminum and is seamless. Provide continuous welds made from the inside wherever possible. On the exterior, provide joints that are smooth and flush. Ensure that no screws, bolts, or rivets protrude to the outside of the cabinet shell.

Ensure that all components are arranged for easy access during servicing.

Provide sufficient size so the installed equipment will not occupy more than 60 percent of the total cabinet volume.

Provide a handle and three point latching mechanism designed to be disassembled using hand tools. Provide a shaft connecting the latching plate to the door handle by passing through the door within a bushing, bearing, or equivalent device. Provide a latching plate at least 1/8 inch thick and that mates securely with the lock bolt. Provide a lock bolt with a flat end (no bevel) and that has at least 1/4 inch of length in contact with the latching plate.

Ensure that the handle and lock are positioned so that the lock does not lie in the path of the rotating handle as the door is unlatched and that the handle points down in the latched position.

Provide a main door opening that encompasses the full frontal area of the cabinet shell. Ensure that the cabinet shell is sturdy and does not exhibit noticeable flexing, bending or distortion under normal conditions, except that a minor amount of flexing is permitted in the main door when the cabinet is open. In such case, the flexing must not result in permanent deformation of the door.

A police panel door is not required for this cabinet.

Provide a roof with a slope from front to back at a minimum ratio of 1 inch drop per 2 feet. Ensure the cabinet is vented at the top and in the door. Supply a cabinet door assembly with a louvered air vent and standard-sized fiberglass air filter.

Provide one equipment shelf in the cabinet that extends the practical width of the cabinet. Ensure that the shelf can be moved up and down within the cabinet. Do not locate permanently mounted equipment in such a way that will restrict access to terminals.

C.3. Cabinet Electrical

Furnish a cabinet with two 15 Amp, single pole circuit breakers for power distribution. Ensure one 15 Amp auxiliary breaker provides the electrical circuit to accommodate a thermostatically controlled cabinet exhaust fan, door activated fluorescent light, and one GFCI convenience receptacle.

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Ensure the second 15 Amp equipment breaker provides the electrical circuit to accommodate the electrical equipment installed in the cabinet with a minimum of two duplex receptacles.

Provide a two-stage power line surge protector between the electrical equipment receptacles and the 15 Amp equipment breaker. Ensure a maximum continuous current of at least 10A at 120V. Ensure that the device can withstand a minimum of 20 peak surge current occurrences at 20,000A for an 8x20 microsecond waveform. Provide a maximum clamp voltage of 280V at 20,000A with a nominal series inductance of 200 μ h. Ensure that the voltage does not exceed 280V. Provide devices that comply with the following:

Frequency (Hz)	Minimum Insertion Loss (dB)
60	0
10,000	30
50,000	55
100,000	50
500,000	50
2,000,000	60
5,000,000	40
10,000,000	20
20,000,000	25

Ensure the two-stage power line surge protector will allow connection of a radio frequency interference filter between the two stages of the device. Ensure the radio frequency interference filter minimizes interference generated in the cabinet in both the broadcast and aircraft frequencies. Ensure the filter(s) provide attenuation of at least 50 decibels over a frequency range of 200 kilohertz to 75 megahertz. Furnish a filter that is hermetically sealed in an insulated metal case. Ensure the filter is rated at least at the rated current of the main circuit breaker, 125-volts, 60Hz.

Furnish a fluorescent fixture with lamps mounted above the shelf to light the equipment area.

Fasten all wiring and harness supports to the cabinet with screws or other removable mechanical means. Do not use adhesives.

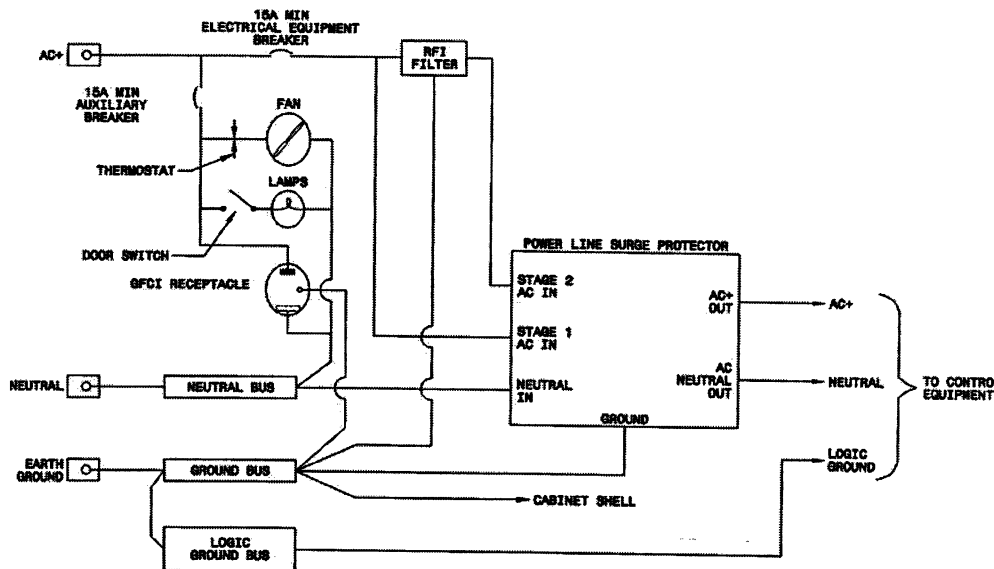
Do not locate terminals on the underside of the shelf or at other places where they are not readily

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visible and accessible, or where they may be a hazard to personnel. Provide a clear plastic guard for exposed 120-volt AC terminals on the power panel.

Provide a neutral that is not connected to the earth ground or the logic ground anywhere within the cabinet. Ensure that the earth ground bus and the neutral ground bus each have ten compression type terminals each of which can accommodate wires ranging from number 14 through number 4.

Furnish a cabinet wiring schematic to be placed in the cabinet. Reference the cabinet wiring schematic below for additional details:



D. Software

Furnish units with a software program that uses a GUI (Graphical User Interface) to provide “remote programming, radio configuration, remote maintenance, diagnostics and spectrum analyzer” features. Provide software that is designed to function with the approved wireless radio. Provide configuration software that can be upgraded in the future at no additional charge.

Ensure the radio modem is configurable from a single location (i.e. master radio location) via supplied software (no extra cost). Furnish software supplied with drivers to allow easy set-up with all industry standard CCTV cameras.

E. Panel Antenna

For 2.4 / 5.8 GHz radio systems, furnish a 23 dBd Gain panel antenna that will allow the system to function as designed.

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All antennas furnished shall meet the following minimum specifications:

Frequency Range	5.2 GHz UNII 5.85 GHz ISM
Gain	23 dBi
3 dB Beam width	10.5deg/ 50deg
Polarization	Single linear, vertical
Dimensions	305mm x 305mm x 15mm (diamond shape)
VSWR	<1.9:1
Front to Back Ratio	>35dB
Cross Polarization	>24 dB
Power rating	10 Watts
Impedance	50 Ohms
Lightning Protection	DC ground
Weight	1.7lb
Radome	UV stabilized plastic
Wind Survivability	125 Mph (201 kph)
Wind Load	1.23 ft ²
Operating Temp.	-45C to +75C
Weatherproof	IP67 Rating

F. Antenna Mounting Hardware Kit

Furnish an antenna mounting kit to support the antenna when attached to a metal pole, mast arm, or wood pole as recommended by the manufacturer of the antenna and as approved by the Engineer.

G. Lightning Arrestor:

Furnish a lightning arrestor installed in line between each antenna and its designated radio modem inside the equipment cabinet. Furnish a lightning arrestor that meets the following minimum specifications:

- Filter Type – DC Block (None gas tube design)

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- Surge: 20kA, 800MHz to 2.0GHz < 1.1 : 1 VSWR
18kA, 800MHz to 2.3GHz < 1.1 : 1 VSWR
700MHz to 2.7GHz < 1.2 : 1 VSWR
- Insertion Loss: ≤ 0.1 dB over frequency range
- Max Power: 500 w @ 920MHz (750 W @ at 122° F)
- RF Power: 300 Watts
- Let Through Voltage: ≤ +/- 3 Volts for 3kA @ 8/20 μs Waveform
- Throughput energy: ≤ 0.5 μJ for 3kA @ 8/20 μs Waveform
- Temperature: -40 to 185° F Storage/Operating 122° F
- Vibration: 1G at 5 Hz up to 100Hz
- Unit Impedance: 50Ω
- VSWR: 1.1:1
- Frequency Range: 800 MHz to 2200 MHz
- Multistrike capability
- Low strike throughput energy
- Flange mount and bulkhead mount options
- Standard N-Type Female Connector on both the surge side and protected side connectors

H. Disconnect Switch

Furnish a double pole, single throw snap switch in a weatherproof outlet box with cover, suitable for use in wet locations. Ensure outlet box and cover supports a lockout tag device. Ensure outlet box includes one ½-inch hole in back of box. Furnish mounting hardware, sealing gaskets and lockout tag. (NOTE: On NCDOT owned poles the “Disconnect Switch” can be omitted.)

I. Warning Signs(s) and Decal(s)

Furnish Warning Sign and Decal at locations called for in the plans. Furnish mounting hardware to secure the Sign to either metal or wood poles. Secure the sign to the pole using ‘Band-It’ brackets or a method approved by the engineer. (NOTE: On NCDOT owned poles the “Warning Sign” is required, however, the “Decal” may be omitted.)

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28.3. CONSTRUCTION METHODS**A. General**

Perform a radio path Site Survey test before installing any equipment. Ensure the test evaluates the Signal Strength (dBm), Fade Margin (dB), Signal-to-Noise Ratio, Data Integrity (poll test), and a complete frequency spectrum scan. Ensure the radio path site survey test is performed using the supplied brand of radio equipment to be deployed. During the initial radio path signal strength test it may be determined that a repeater station may be necessary to complete the intended link. Provide the test results to the Engineer for review and approval. Submit copies of the test results and colored copies of the frequency spectrum scan along with an electronic copy of this information. The Engineer will approve final locations of antennas and any necessary repeater stations. Install a coaxial cable – power divider, antenna splitter cable and additional antenna at locations where it is determined that a dual antenna configuration is necessary to accommodate communications in multiple directions.

Install the antenna in such a manner that avoids conflicts with other utilities (separation distances in accordance with the guidelines of the NESC) and as specified in the antenna manufacturer's recommendations. Secure the antenna mounting hardware to the pole. On wood pole installations, bond the antenna mounting hardware to the pole ground using # 6 AWG bare copper wire using split bolt or compression type fitting.

Connect the lightning arrestor to the coaxial cable in the equipment cabinet. Properly ground and secure the arrestor in the cabinet. Permanently label all cables entering the cabinet. Ensure the power supply for the radio system is NOT connected to the GFCI receptacle circuit located in the cabinet. Place a copy of all manufacturer equipment specifications and instruction and maintenance manuals in the equipment cabinet.

At certain locations it may be necessary to integrate the radio system with a fiber optic system. Follow the details shown in the fiber optic splice plans.

B. Repeater Cabinets

Do not obstruct the sight distance of vehicles when locating and installing cabinets.

Install the pole-mounted cabinet approximately five feet from the ground line to the top of the cabinet. Secure the cabinet to the pole using 'Band-It' brackets or a method approved by the Engineer. Leave the RS-232 data interface cable in the cabinet.

C. Disconnect Switch

At all locations, where the antenna is mounted on a joint use pole, install a double pole, snap

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switch to remove power from the spread spectrum wireless radio system. Do not mount weatherproof box on the field equipment cabinet door. Drill a hole in the side of the field equipment cabinet. Mount the outlet box over the hole using a ½-inch chase nipple and bushings. Ensure sealing gaskets are in place and no water can enter the cabinet. Securely mount the weatherproof outlet box with additional mounting screws. Bond the outlet box to the equipment ground bus. See plans for approximate mounting height. Run the power supply cord of the spread spectrum radio unit into the outlet box and connect to switch. Securely attach power supply cord to equipment rack. Install disconnect switch with lockout tag cover.

Do not install power supply for the radio in a GFCI protected outlet.

D. Warning Sign(s) and Decal(s)

At all locations, where the antenna is mounted on a joint use pole, secure a Warning Sign to pole. Mount Warning Sign(s) at locations called for on the plans. Ensure there are no conflicts between the warning sign and surrounding utilities. Mount Warning Sign to be easily viewed. Do not mount Warning Sign under pole grounds or conduit.

Clean and remove any dirt or oil on traffic cabinet before placing Decal. Place decal adjacent to the disconnect switch located on the outside of traffic cabinet. If the antenna is mounted on an NCDOT owned pole the Decal and Switch may be omitted.

28.4. WARRANTY

Provide a minimum two-year warranty with each radio and antenna assembly to ensure the products are free of manufacturing defects in material and workmanship. The warranty commences on the date the radio system is accepted by the Engineer.

28.5. MEASUREMENT AND PAYMENT

Actual number of *2.4/5.8 GHz wireless ethernet radio systems* furnished, installed and accepted.

This item includes the appropriate sized antenna(s), radio, power supplies, disconnect/snap switch, signs, decals, data interface cable/serial cable, lightning arrestor, labeling and any integration between the wireless radio system and a fiber optic network if necessary, installation materials and configuration software necessary to complete this work, including the radio path Site Survey test and warranties, will be incidental.

Actual number of *2.4/5.8 GHz wireless Ethernet repeater standalone radio systems* furnished, installed and accepted.

This item includes the appropriate sized NEMA 3R cabinet, antenna(s), radio, power supplies,

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disconnect/snap switch, signs, decals, data interface cable/serial cable, lightning arrestor, labeling and any integration, installation materials and configuration software necessary to complete this work, including the radio path Site Survey test and warranties, will be incidental.

Payment will be made under:

- 2.4/5.8 GHz Wireless Ethernet Radio SystemEach
- 2.4/5.8 GHz Wireless Ethernet Repeater Standalone Radio SystemEach

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