



Motorola Solutions, Inc.

**PUBLIC SAFETY SIGNAL IN-
BUILDING PROPOSAL TO THE CITY
OF COCONUT CREEK, FLORIDA**

For

Coconut Creek High School

1400 NW 44th Ave

Coconut Creek, FL 33066



**Submitted by MOTOROLA SOLUTIONS
INC.**

April 28, 2015

**UPDATED JUNE 7, 2016 PER NEW
BROWARD COUNTY BUILDING
CODE, SECTION 118**

UPDATED JANUARY 12, 2017



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Company Profile

Motorola Solutions, Inc. (Motorola) has partnered with a nationwide leader for in-building signal enhancement systems; Mann Wireless, Ltd. (Mann). The partnership between Motorola and Mann ensures our customers the specialized expertise available in the in-building signal enhancement field along with the unwavering commitment by Motorola our customers have come to expect.

Mann was co-founded in 1998 by Andrea Mann, PhD., and Ernest Mann. Ernest received his bachelor's degree in electrical engineering in 1982 from the University of Buffalo and started his career with TX/RX Systems. He has held high-level positions with the Raytheon Company and Central Maine Power Company and has over 30 years of diverse wireless engineering experience. The corporate office is located in New York with satellite offices in Florida and Tennessee.

Mann provides world class in-building signal enhancement system design, installation, and integration services. To date, Mann personnel have been involved in the enhancement of over 400 million square feet of floor space and miles of underground tunnels. Mann has expertise in the application of all major manufacturers bi-directional repeater amplifier (BDA) and fiber optic based products. The company has successfully completed coverage enhancement projects in the following facility types: electric power generation, including nuclear, fossil, steam and hydro, Veterans Administration, private health care, residential high rises, warehouse, distribution, academic, automotive manufacturing, shopping mall, government and sports arenas. The Mann staff has experience with all major commercial cellular carriers, private land mobile radio and public safety systems ranging in operation from 100 MHz to 2.4 GHz. Additional engineering services are also available, such as interference resolution, intermodulation studies, propagation modeling and analysis.

Mann is ISO 9001 compliant, customer oriented, and prides itself in installations that are neat and as invisible to the eye as possible. They also have a substantial health and safety program with an excellent track record.

Mann has a skilled work force of approximately 40 personnel with a blend of engineers, project managers and technicians. In addition to its field crew, Mann has a broad range of fiber optic and RF test equipment to support its field operations activities. For design support and performance modeling Mann has the full complement of iBwave modules as well as drive test and walk-test software platforms to both baseline (pre-install) and verify signal metrics after the system has been completed. The company is known throughout the industry for its professionalism, competence and integrity. With extensive experience and



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a friendly, knowledgeable staff, Mann works with its clients to create technically proficient, cost-effective solutions.

Site Overview

Coconut Creek High School is a facility located in Coconut Creek, Florida, which includes grades 9 thru 12. The school is a part of the Broward County School District and opened in 1970. The building construction is solid and block concrete. There is an older, legacy in-building amplification system installed in the main building. The newer building with the auditorium and gym doesn't have a signal enhancement system. The primary problem areas, from a public safety signal standpoint, are the boys' and girls' locker rooms among other areas as documented below. This proposal is revision 1 to the original. The change covers making the whole school NFPA 72 in accordance to and Broward County Building Code, Section 118. Bullet points below call out the additions to the system. It is understood that NFPA 72 2010 and BCBC Section 118 that is being enforced as of April 15th is being used as a guide. Additional requirement that the Authority Having Jurisdiction require but are not called out in these two documents are not quoted. Additional funds may be needed if other requirements present themselves

- 12 hours of UPS power will be added at the headend in NEMA enclosure.
- The system will be tied into the fire alarm panel.
- PE stamped drawings will be submitted.
- Propagation modeling will be submitted.
- Mann Wireless will be responsible for permitting if required.
- 700 MHz amp will be added at this time.
- An additional 700 MHz donor antenna will be added.
- Annual testing will be quoted for duration of 3 years.
- A service and maintenance agreement will be established for duration of 3 years.

Survey Results

An extensive site walk survey of the entire facility was performed on March 31, 2015. The objective of the survey was to obtain the necessary information to complete an in-building system design and develop solution options and quotations. The results of the survey indicated nonexistent to marginal coverage in the boys' and girls' locker rooms. The main building passed the initial testing but it was learned that the Elisra in-building system was installed in the early 2000s. This unit has an 18 MHz pass band and has not been re-banded to the new public safety spectrum therefore it is out of compliance for the FCC-Sprint Rebanding Initiative from several years ago. The legacy unit currently amplifies the public safety spectrum, however if and when Sprint utilizes spectrum in the upper part of the band, it will negatively impact the system in a significant way. It is recommended that this unit be upgraded to a Motorola approved channelized in-building



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repeater system. A channelized system can be easily upgraded to pass the Broward County impending deployment of the digital P25 and 700 MHz signals. The specific in scope areas are the boys' and girls' locker rooms, but it recommended that the main building's system be upgraded as well.

An Anritsu S412E spectrum analyzer was used for the baseline testing. This proposal includes new requirements by NFPA 72 2010 version chapter 24.5.2 and the new Broward County Building Code section 118 requirements. The primary power must be on dedicated circuits. All AC power requirements will be provided by others. Annual testing has been added in the quote for duration of 3 years. A service and maintenance agreement has been added for duration of 3 years. Specifics of the S&M agreement will be submitted in a separate document. A report will be provided with the results of the test when the system is deemed on air. The system will be monitored by others via the fire alarm panel. If required, additional funds will be needed.

Conditions of Proposal

- The system will require 700 and 800 MHz Public Safety signal enhancement.
- An Andrew Node A repeater will provide the channel resources for the DAS.
- The repeater will be wall mounted.
- 12 hours of UPS backup power will be provided at the headend in a NEMA enclosure.
- The donor antennas will be mounted on the existing tower on the roof. Per Broward County an additional 700 MHz donor antenna will be added to account for 700 sites not co-located with 800 sites. A penetration exists and will be utilized.
- Installation hours will be Monday – Friday from 9AM to 5 PM.
- 110 VAC power will be provided by the City of Coconut Creek, Florida at the headend. Power is available.
- Costs to cover permit fees and a PE stamp for the prints has been included.
- Cat5 will be run to the fire alarm panel in room 101 which will provide alarms from the signal booster via dry contact closures. The alarm panel will be monitored by others.
- The Public Safety donor site must have a 20 dB quieting (SINAD) receiver sensitivity of -105 dBm (or better) and does not experience interfering levels that produce greater than 5 dB of desensitization from their published sensitivity specification.
- Mann Wireless guarantees the installation portion of the project scope to be completed in no more than 2 weeks, barring any delays outside of Mann Wireless' control.



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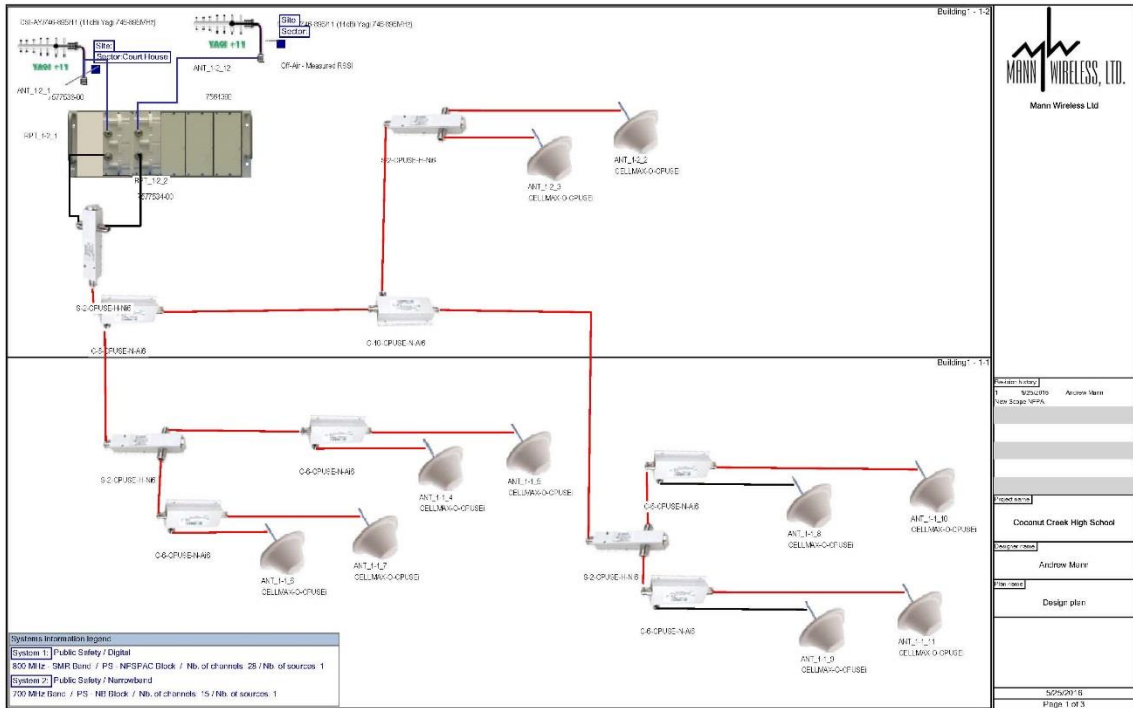
- Any delays, additional on-site work days or additional site visits caused by Mann Wireless will be at the sole expense of Mann Wireless. Any delays that require additional on-site work or site visits in excess of the above specified allocation may require a change order to the City of Coconut Creek, Florida.
- On-site work will be completed during normal business hours (Monday thru Friday, 8 am to 6 pm local time) and on consecutive business days.
- Unimpeded access to all areas of facility (including rooftop), as required, to perform work will be provided. It is understood that all Motorola and Mann employees will have passed clearances for the "Jessica Lunsford Act".
- No union labor or prevailing wages required. Mann Wireless can use its own employees to perform all work.
- A dedicated circuit with back-up power is required. The dedicated circuit and power will be provided by the City of Coconut Creek, Florida at its own costs prior to the installation date. Power circuits and receptacles will be properly sized to meet the DAS (and headend) equipment specifications.
- No special installation requirements (conduit, stealthing, etc.) required inside of the building. Conduit will be installed from the old building to the new building.
- New wall penetrations will be sleeved and fire caulked by Mann Wireless.
- Proper grounding practices will be implemented by Mann Wireless.
- Target signal levels will be -95 dBm or better for all areas.

Passive DAS System Description

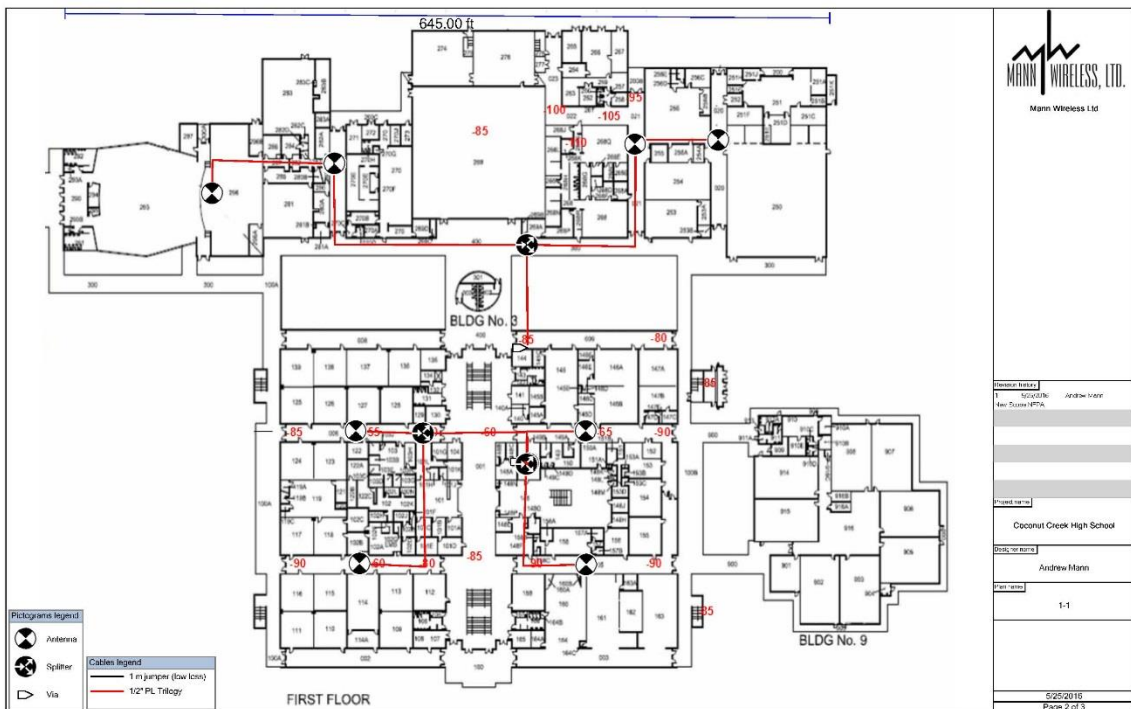
Two major sections describe the in-building system: headend RF equipment and signal distribution. The headend equipment consists of an external directional antenna and a repeater. The RF signal distribution system consists of: coaxial cable, low profile antennas and power dividers. The external antenna assists in establishing the air interface communications link to the local tower. A yagi type directional antenna is proposed. It will be mounted on the roof. Bi-directional amplification to support two-way transmissions of the Public Safety signals is accomplished with an Andrew Node A repeater. Figure 1 shows the logical and design for the upgrade and full build.

Figure 1 – Logical next page

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MANN WIRELESS, LTD. Mann Wireless Ltd	
Project Name	Andrew Mann
Project No.	5252016
View Scale	View Scale: N/A
Project Location	Coconut Creek High School
Design Name	Andrew Mann
Drawn Name	
Design Date	
Sheet No.	525-2016 Page 2 of 3



MANN WIRELESS, LTD. Mann Wireless Ltd	
Project Name	Andrew Mann
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Design Date	
Sheet No.	1-1
Sheet Title	
Sheet Date	
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The reliability of the system will be demonstrated by transmission testing between a mobile operator walking the facility with a portable radio (test unit) and a fixed operator. The fixed operator will be stationed in an area that has reliable communications back to the radio transmission site. This is important because a poor transmission must be solely the result of the mobile test unit. The detail of the test plan procedure can be found below in the section titled "Acceptance Test Plan."

Link Budget Calculations for Design

Antennas Report						
Project name: Coconut Creek High School		Design company: Mann Wireless Ltd				
Project creation date: 5/25/2016		Designer: Andrew Mann				
Antenna ERP report						
Antenna ID	System ID	Antenna gain (dBd)	Total loss/gain (dB)	Power / channel	Antenna ERP (dBm) Composite power	RSCP/RSRP
ANT_1-1_4	System 1	-0.65	37.84	-1.81	12.66	-
ANT_1-1_5	System 1	-0.65	39.87	0.22	14.69	-
ANT_1-1_6	System 1	-0.65	39.83	0.18	14.65	-
ANT_1-1_7	System 1	-0.65	42.92	3.27	17.74	-
ANT_1-1_8	System 1	-0.65	36.63	-3.02	11.45	-
ANT_1-1_9	System 1	-0.65	35.50	-4.15	10.32	-
ANT_1-1_10	System 1	-0.65	39.52	-0.13	14.34	-
ANT_1-1_11	System 1	-0.65	37.21	-2.44	12.03	-
ANT_1-2_2	System 1	-0.65	38.85	-0.80	13.67	-
ANT_1-2_3	System 1	-0.65	36.51	-3.14	11.33	-
Antenna ERP Statistics (Power / Channel)						
System ID	Average (dBm)	Std. dev. (dB)	Minimum (dBm) Antenna ID	ERP	Maximum (dBm) Antenna ID	ERP
System 1	-1.18	2.18	ANT_1-1_9	-4.15	ANT_1-1_7	3.27
System legend						
System 1 / Public Safety / Digital / 800 MHz - SMR Band / PS - NPSPAC Block / Nb. of channels: 28 / Nb. of sources: 1 / Sector ID:Co						



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Timeline of Project

ARO (6 weeks prior start date)	Monday
Order System Electronics	Planned
Initiate Permit Process	Planned

Two Weeks Prior to Install Start	Monday
Receive & Test Repeater	Planned
Order Infrastructure	Planned
Confirm Permit Approval	Planned

Install Week 1	Day 1 (Monday)	Day 2 (Tuesday)	Day 3 (Wednesday)	Day 4 (Thursday)	Day 5 (Friday)
Preconstruction Walk / Meet	Planned				
Stage Equipment	Planned				
Donor Antenna & Donor Cable Install		Planned			
Antenna/Mast/Cable Grounding (external)		Planned			
Mount Node A (BDA)		Planned			
Bus Bar/BDA/Cable Grounding (internal)		Planned			
Conduit Installation to New building			Planned		
Cable Installation and Termination				Planned	
Cable Installation and Termination					Planned

Install Week 2	Day 1 (Monday)	Day 2 (Tuesday)	Day 3 (Wednesday)	Day 4 (Thursday)	Day 5 (Friday)
Cable Installation and Termination	Planned				
Integrate Donor Signals to BDA		Planned			
Test & Commission Donor & Distribution System		Planned			
Preliminary System Performance Testing			Planned		
Modify/Expand Distribution System (if applicable)			Planned		



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Perform System Acceptance Testing				Planned	
Obtain Client/Motorola Sign Off on Installation				Planned	

Acceptance Test Plan

The process to ensure reliable system performance is presented in this section. The service area will be partitioned via a grid pattern that will establish a route where a series of tests will be performed to evaluate system performance. The grid configuration will be near uniformly distributed throughout the area being tested. The optimal grid configuration for the building will be an approximate dimension of 20' square. This will ensure that entire area is encompassed by the test plan.

NOTE: It is noted that systems that do not perform well in the uplink (reverse) direction when downlink levels are stronger than -90 dBm are likely being subjected to excessive noise or a level of co-channel interference (see pre-performance testing below).

The grid tests that will be performed consist of the measurement of the downlink received signal strength (RSSI). If this test provides a "pass" then an audio fidelity test will be performed based on the subjective delivered audio quality (DAQ) metric. In general, a downlink signal strength measurement of -95 dBm will be adequate to support reliable two-way communications. If the RSSI meets the pass criteria an audio test will be performed to characterize channel signal fidelity. The standard DAQ 3.4 metric will be used to qualify audio fidelity.

Test Methodology

There are a series of three tests that Mann recommends prior to the testing of the in-building enhancement system. These tests would ensure the donor transmission site is performing properly. The initial test would quantify the effective sensitivity of the site receivers. The second would ensure that the uplink noise is not desensitizing the site receivers, while the third test would validate the in-building performance metrics can be met in a known area of good coverage. These three tests will be achieved by 1) injecting a standard 20 dB quieting signal, to un-squelch the receiver, and monitor the receiver audio while the receivers are subjected to the external RF environment and system transmit signals, 2) monitor site noise and receiver 20 dB quieting performance with the repeater on and off, and 3) perform similar testing as that planned inside the facility at a known location of good system performance. Once the donor site tests described



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above have been successfully completed, the planned in-building tests can commence. The test methodology will be as follows:

- Two working radios with fully charged batteries.
- Two groups of personnel are requisitioned to support the testing.
- Each group establishes communications (with each other) while outside the facility and ensures that the portable radios are working properly.
- One group will remain outside the facility to ensure a reliable transmission path is available to the radio transmission site while the second group enters the building to commence system testing.
- The internal portable operator will follow the test grid route as referenced above.
- In each test grid, measure RSSI and document same. If the RSSI is stronger than -95 dBm then a DAQ test should be performed.
- Perform DAQ testing audio quality in each direction and if transmission quality meets or exceeds DAQ 3.4 criteria, the grid receives a pass (if not, then a fail).
- Tabulate the % of grids that pass and if pass grids equal or exceed 95% then the facility will receive conditional acceptance.
- If the % of passing grids is below 95%, Mann Wireless will commence activities to immediately resolve the areas that received a fail status.
- Re-testing of the complete system will be done following resolution of any failed sections of the test grid.

The RSSI measurements will be performed by a Motorola approved device. Mann will use an Anritsu LMR Master S412E with appropriate options to measure required signal metrics.

Inspection of Records by The School Board of Broward County, Florida

Motorola shall establish and maintain books, records and documents (including electronic storage media) related to the removal of the existing Bi-Directional Amplifier (BDA), the installation of the new BDA, and the maintenance of the new BDA, if applicable, at Coconut Creek High School. All of the Motorola's Records, regardless of the form in which they are kept, shall be open to inspection and subject to audit, inspection, examination, evaluation and/or reproduction, during normal working hours, by The School Board of Broward County's (SBBC) agent or its authorized representative. Motorola's Records subject to examination shall include, without limitation, any and all records and documents. For the purpose of such audits, inspections, examinations, evaluations and/or reproductions, SBBC's agent or authorized representative shall have access to the Motorola's Records from the effective date of the Agreement between SBBC and the City of Coconut Creek regarding the BDA (Agreement), for the duration of the term of the Agreement, and until the later of five (5) years after the termination of the Agreement. SBBC's agent or its authorized representative shall provide the Motorola reasonable advance notice (not to exceed two (2) weeks) of any intended audit, inspection, examination, evaluation and or reproduction. SBBC's agent or its authorized representative shall have access to the Motorola's facilities and to any and all records related to the Agreement, and shall be provided adequate and



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appropriate work space in order to exercise the rights permitted under this section. Motorola shall comply and cooperate immediately with any inspections, reviews, investigations, or audits deemed necessary by the Florida Office of the Inspector General or by any other state or federal officials.

Pricing to be found on Motorola Quotation on the next page