Public Safety Communications Proposal

Christopher M. Leusner
Chief of Police

March 24, 2015

Introduction

Introduction

Mayor and Committee:

In this packet you find information related to our communication system and the steps that have been taken in years past to address our communication problems. In Section#1 you will get an overview the communication system that was designed by a communication consultant, VCOMM and built by a radio contractor, Tektron. In Section#2 you will find the reports from the Radio Task Force that I ordered in 2010 and the Capital Improvements recommended and purchased as a result. In the third tab, you will find information about New Jersey Statewide P25 Communications Network. Also, in Section#3 you will find letters from 5 Sergeants, 4 Senior Communications Operators, and the PBA on their experience testing New Jersey's Statewide P25 Communications Network. In Section#4 you will find my recommendation to Township Committee on how to move forward with solving our communication problems.

Section#1

Section#1: Original System

In this section you will see a letter from 2002 where Captain Evangelista at the time was identifying tower site locations in the planning and research phase of designing a new communication system with our consultant, VCOMM. This planning process was over two years and ended in the end of 2004 when we went live with the new communication system. I have attached the Project Breakdown from the radio contractor, Tektron that was provided to the Township in August of 2003. The cost of the project was approximately $539,869.00. This cost DOES NOT include the fees paid to VCOMM for the design of the system and the cost of monitoring the construction and problem shooting activities that lasted up until December of 2009. I can't be sure of the exact total cost of the communication system in 2004, but I believe it was around $1,300,000.

I also included a letter that I wrote as Sergeant in 2005 outlining a number of issues we were experiencing with the new radio system. Unfortunately, the issues never were fixed. I know there was a lot of effort on behalf of Chief Evangelista working with VCOMM and Tektron to get the issues addressed, but the bottom line is the radio system never performed as promised. At the end of 2009, one of my first recommendations as Chief was to terminate our arrangement with VCOMM and Tektron.

MIDDLE TOWNSHIP POLICE DEPARTMENT

31 Mechanic Street, Cape May Court House, N.J. 08210
609-465-8700 Fax: 609-465-6748

To: Twp. Administrator James Alexis
From: Capt. Joseph M. Evangelista
Date: Sept. 12, 2002
Re: Antenna Locations / Ownership

1. Green Creek Fire Dept. Location

Ownership: Nextel Communications
3329 Street Road
Bensalem, Pa.

Tower Height: 150 feet

Tower Location: North 39*02.813'
West 074*54.218'

2. Tomlin Property, State Highway 47, Goshen

Ownership: Sprint Spectrum
1 International Blvd.
Mahwah, N.J. 07495

Tower Height: 143 feet

Tower Location: North 39*08.882'
West 074*51.448

3. CR657 / Goshen Swainton Rd Location

Ownershilp: Equity Communications
One Liberty Square
Boston, MA. 02109

Tower Height: 292 feet

Tower Location: North 39*07.684'
West 074*49.508'

TekTron

New Technologies in Critical Communications

August 13, 2003

Chief Evangelista
Middle Township Police Department
31 Mechanic Street
Cape May Court House, N.J. 08210

Dear Chief,

I have been requested by Dominic Vallecco of V-Comm Engineering to forward the attached finalized proposal to you for your review. This document includes all of the information discussed during our last meeting and does reflect all of the changes and design criteria as agreed to.

I trust that this will meet your needs and look forward to a long and mutually conducive relationship between TekTron Corporation and Middle Twp.

If you have any questions or require further information, please contact me at any time.

Sincerely,

James Foley
TekTron Corporation

Corporate Headquarters: 6845 Westfield Avenue • Pennsauken, NJ 08110-1527 • 856.665.4400 or 800.245.2289 • Fax 856.665.5303
13 Kennedy Boulevard • East Brunswick, NJ 08816-1250 • 732.937.9376 or 888.283.5876 • Fax: 732.937.9338
www.tektroncorp.com

Project Breakdown (Middle Twp)

Purchase Order #	Description	Make P.O. Out To		Amount	State Contract #
#1	Radio Infrastructure	M/A Com in care of TekTron	$	217,904.33	A53753
#2	Mobile Radios	M/A Com in care of TekTron	$	113,685.00	A53753
#3	Portable Radios	M/A Com in care of TekTron	$	92,528.00	A53753
#4	Dispatch Center	***TEKTRON CORP***	$	115,752.52	***A53752***
		Project Total---------->	$	539,869.85	

Middle Township Police and Fire Dept Infrastructure Proposal
13, August 2003

Item	Part Number	Description	EC	Unit List	P->S %	Unit Sale	Quantity	Ext Sale
10	MM100SX	Manual,Instl,Mastr III ADC Conv	V	60	0	60	1	60
20	MM210SX	Manual,Maint,Conv,ADC Mastr III,VHF	V	60	0	60	1	60
30	SXHMCX	STATION,CONV MASTR III,150.8-174MHZ,110W	C	5916	20	4732.8	1	4732.8
40	SXSF1W	FEATURE,VOTING TONE(1950HZ)	N	50	20	40	1	40
50	SXCA1S	CABINET,37 IN	N	570	20	456	1	456
60	SXMN7F	KIT,MOUNTING HDWR,37 IN CABINET	N	39	20	31.2	1	31.2
70	SXPS5G	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
80	SXMN9L	Kit,Mounting Bracket,TX PA,37/45 IN Cab	N	25	20	20	1	20
90	SXSU3A	KIT,ANTENNA SWITCH	N	400	20	320	1	320
100	SXVG3F	KIT,GETC,AEGIS/VOICE GUARD,E/E REM/RPT	N	5365	20	4292	1	4292
110	SXMC3B	MICROPHONE,MOBILE(SERVICE)	N	65	20	52	1	52
120	MM001SR	MANUAL,INSTL,MASTR III AUX RECEIVER	V	30	0	30	1	30
130	MM002SR	MANUAL,MAINT,MASTR III AUX RECEIVER,VHF	V	60	0	60	1	60
140	SRDNCX	SYSTEM EQUIPMENT,MASTR III AUX RX,CONV	C	435	20	348	1	348
150	SRCA1S	CABINET,37 IN	N	570	20	456	1	456
160	SRMN7X	KIT,MOUNTING HARDWARE,37 IN CABINET	N	39	20	31.2	1	31.2
170	SRPS1N	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
180	SRHN01	RECEIVER,MASTR III AUX RX,150.8-174MHZ	C	2025	20	1620	1	1620
190	SRSF1W	FEATURE,VOTING TONE,1950HZ	N	50	20	40	1	40
200	SRCF3U	KIT,CABLE,37/69 IN CAB,SHELF #1	N	100	20	80	1	80
210	SRVG3J	SHELF,DIGITAL,AEGIS/VOICE GUARD	N	2295	20	1836	1	1836
220	SRRB1N	SHELF,AUX RX	N	750	20	600	1	600
230	SRMN5Z	PANEL,BLANK	N	30	20	24	1	24
240	MM001SR	MANUAL,INSTL,MASTR III AUX RECEIVER	V	30	0	30	1	30
250	MM002SR	MANUAL,MAINT,MASTR III AUX RECEIVER,VHF	V	60	0	60	1	60
260	SRDNCX	SYSTEM EQUIPMENT,MASTR III AUX RX,CONV	C	435	20	348	1	348
270	SRCA1S	CABINET,37 IN	N	570	20	456	1	456
280	SRMN7X	KIT,MOUNTING HARDWARE,37 IN CABINET	N	39	20	31.2	1	31.2
290	SRPS1N	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
300	SRHN01	RECEIVER,MASTR III AUX RX,150.8-174MHZ	C	2025	20	1620	1	1620
310	SRSF1W	FEATURE,VOTING TONE,1950HZ	N	50	20	40	1	40
320	SRCF3U	KIT,CABLE,37/69 IN CAB,SHELF #1	N	100	20	80	1	80
330	SRVG3J	SHELF,DIGITAL,AEGIS/VOICE GUARD	N	2295	20	1836	1	1836

340	SRRB1N	SHELF,AUX RX	N	750	20	600	1	600
350	SRMN5Z	PANEL,BLANK	N	30	20	24	1	24
360	MM001SR	MANUAL,INSTL,MASTR III AUX RECEIVER	V	30	0	30	1	30
370	MM002SR	MANUAL,MAINT,MASTR III AUX RECEIVER,VHF	V	60	0	60	1	60
380	SRDNCX	SYSTEM EQUIPMENT,MASTR III AUX RX,CONV	C	435	20	348	1	348
390	SRCA1S	CABINET,37 IN	N	570	20	456	1	456
400	SRMN7X	KIT,MOUNTING HARDWARE,37 IN CABINET	N	39	20	31.2	1	31.2
410	SRPS1N	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
420	SRHN01	RECEIVER,MASTR III AUX RX,150.8-174MHZ	C	2025	20	1620	1	1620
430	SRSF1W	FEATURE,VOTING TONE,1950HZ	N	50	20	40	1	40
440	SRCF3U	KIT,CABLE,37/69 IN CAB,SHELF #1	N	100	20	80	1	80
450	SRVG3J	SHELF,DIGITAL,AEGIS/VOICE GUARD	N	2295	20	1836	1	1836
460	SRRB1N	SHELF,AUX RX	N	750	20	600	1	600
470	SRMN5Z	PANEL,BLANK	N	30	20	24	1	24
480	MM100SX	Manual,Instl,Mastr III ADC Conv	V	60	0	60	1	60
490	MM210SX	Manual,Maint,Conv,ADC Mastr III,VHF	V	60	0	60	1	60
500	SXHMCX	STATION,CONV MASTR III,150.8-174MHZ,110W	C	5916	20	4732.8	1	4732.8
510	SXSF1W	FEATURE,VOTING TONE(1950HZ)	N	50	20	40	1	40
520	SXCA1D	CABINET,69 IN	N	1350	20	1080	1	1080
530	SXMN3Y	KIT,MOUNTING HDWR,69/83/86 CAB/RACK	N	25	20	20	1	20
540	SXMN9C	COVER,SCREEN,T/R SHELF	N	15	20	12	1	12
550	SXPS5G	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
560	SXFN1A	FAN,120VAC	N	450	20	360	1	360
570	SXCN1Z	OUTLET STRIP,120VAC	N	65	20	52	1	52
580	SXMN9M	Kit,Mt Bracket,TX PA,69/83/86 IN Cab/Rck	N	25	20	20	1	20
590	SXSU3A	KIT,ANTENNA SWITCH	N	400	20	320	1	320
600	SXHMCX	STATION,CONV MASTR III,150.8-174MHZ,110W	C	5916	20	4732.8	1	4732.8
610	SXSF1W	FEATURE,VOTING TONE(1950HZ)	N	50	20	40	1	40
620	SXAP3K	INSTRUCTION,MASTR III MULTI-CABINET/RACK	N	0.03	20	0.02	1	0.02
630	SXMN3Y	KIT,MOUNTING HDWR,69/83/86 CAB/RACK	N	25	20	20	1	20
640	SXMN9C	COVER,SCREEN,T/R SHELF	N	15	20	12	1	12
650	SXPS5G	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
660	SXMN9M	Kit,Mt Bracket,TX PA,69/83/86 IN Cab/Rck	N	25	20	20	1	20
670	SXSU3A	KIT,ANTENNA SWITCH	N	400	20	320	1	320
680	SXHMCX	STATION,CONV MASTR III,150.8-174MHZ,110W	C	5916	20	4732.8	1	4732.8
690	SXSF1W	FEATURE,VOTING TONE(1950HZ)	N	50	20	40	1	40
700	SXAP3K	INSTRUCTION,MASTR III MULTI-CABINET/RACK	N	0.03	20	0.02	1	0.02

710	SXMN3Y	KIT,MOUNTING HDWR,69/83/86 CAB/RACK	N	25	20	20	1	20
720	SXMN9C	COVER,SCREEN,T/R SHELF	N	15	20	12	1	12
730	SXPS5G	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
740	SXMN9M	Kit,Mt Bracket,TX PA,69/83/86 IN Cab/Rck	N	25	20	20	1	20
750	SXSU3A	KIT,ANTENNA SWITCH	N	400	20	320	1	320
760	SXHMCX	STATION,CONV MASTR III,150.8-174MHZ,110W	C	5916	20	4732.8	1	4732.8
770	SXSF1W	FEATURE,VOTING TONE(1950HZ)	N	50	20	40	1	40
780	SXCA1D	CABINET,69 IN	N	1350	20	1080	1	1080
790	SXMN3Y	KIT,MOUNTING HDWR,69/83/86 CAB/RACK	N	25	20	20	1	20
800	SXMN9C	COVER,SCREEN,T/R SHELF	N	15	20	12	1	12
810	SXPS5G	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
820	SXFN1A	FAN,120VAC	N	450	20	360	1	360
830	SXCN1Z	OUTLET STRIP,120VAC	N	65	20	52	1	52
840	SXMN9M	Kit,Mt Bracket,TX PA,69/83/86 IN Cab/Rck	N	25	20	20	1	20
850	SXSU3A	KIT,ANTENNA SWITCH	N	400	20	320	1	320
860	SXHMCX	STATION,CONV MASTR III,150.8-174MHZ,110W	C	5916	20	4732.8	1	4732.8
870	SXSF3J	FEATURE,4 WIRE AUDIO	N	50	20	40	1	40
880	SXAP3K	INSTRUCTION,MASTR III MULTI-CABINET/RACK	N	0.03	20	0.02	1	0.02
890	SXMN3Y	KIT,MOUNTING HDWR,69/83/86 CAB/RACK	N	25	20	20	1	20
900	SXMN9C	COVER,SCREEN,T/R SHELF	N	15	20	12	1	12
910	SXPS5G	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
920	SXMN9M	Kit,Mt Bracket,TX PA,69/83/86 IN Cab/Rck	N	25	20	20	1	20
930	SXSU3A	KIT,ANTENNA SWITCH	N	400	20	320	1	320
940	SXHMCX	STATION,CONV MASTR III,150.8-174MHZ,110W	C	5916	20	4732.8	1	4732.8
950	SXSF3J	FEATURE,4 WIRE AUDIO	N	50	20	40	1	40
960	SXAP3K	INSTRUCTION,MASTR III MULTI-CABINET/RACK	N	0.03	20	0.02	1	0.02
970	SXMN3Y	KIT,MOUNTING HDWR,69/83/86 CAB/RACK	N	25	20	20	1	20
980	SXMN9C	COVER,SCREEN,T/R SHELF	N	15	20	12	1	12
990	SXPS5G	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
1000	SXMN9M	Kit,Mt Bracket,TX PA,69/83/86 IN Cab/Rck	N	25	20	20	1	20
1010	SXSU3A	KIT,ANTENNA SWITCH	N	400	20	320	1	320
1020	SXHMCX	STATION,CONV MASTR III,150.8-174MHZ,110W	C	5916	20	4732.8	1	4732.8
1030	SXSF1W	FEATURE,VOTING TONE(1950HZ)	N	50	20	40	1	40
1040	SXCA1D	CABINET,69 IN	N	1350	20	1080	1	1080
1050	SXMN3Y	KIT,MOUNTING HDWR,69/83/86 CAB/RACK	N	25	20	20	1	20
1060	SXMN9C	COVER,SCREEN,T/R SHELF	N	15	20	12	1	12
1070	SXPS5G	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580

1080	SXFN1A	FAN,120VAC	N	450	20	360	1	360
1090	SXCN1Z	OUTLET STRIP,120VAC	N	65	20	52	1	52
1100	SXMN9M	Kit,Mt Bracket,TX PA,69/83/86 IN Cab/Rck	N	25	20	20	1	20
1110	SXSU3A	KIT,ANTENNA SWITCH	N	400	20	320	1	320
1120	SXHMCX	STATION,CONV MASTR III,150.8-174MHZ,110W	C	5916	20	4732.8	1	4732.8
1130	SXSF1W	FEATURE,VOTING TONE(1950HZ)	N	50	20	40	1	40
1140	SXAP3K	INSTRUCTION,MASTR III MULTI-CABINET/RACK	N	0.03	20	0.02	1	0.02
1150	SXMN3Y	KIT,MOUNTING HDWR,69/83/86 CAB/RACK	N	25	20	20	1	20
1160	SXMN9C	COVER,SCREEN,T/R SHELF	N	15	20	12	1	12
1170	SXPS5G	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
1180	SXMN9M	Kit,Mt Bracket,TX PA,69/83/86 IN Cab/Rck	N	25	20	20	1	20
1190	SXSU3A	KIT,ANTENNA SWITCH	N	400	20	320	1	320
1200	MM100SX	Manual,Instl,Mastr III ADC Conv	V	60	0	60	1	60
1210	MM210SX	Manual,Maint,Conv,ADC Mastr III,VHF	V	60	0	60	1	60
1220	SXHMCX	STATION,CONV MASTR III,150.8-174MHZ,110W	C	5916	20	4732.8	1	4732.8
1230	SXSF3H	PROGRAMMING,TONE REMOTE/REPEAT	N	0.01	20	0.01	1	0.01
1240	SXSF1W	FEATURE,VOTING TONE(1950HZ)	N	50	20	40	1	40
1250	SXCA1S	CABINET,37 IN	N	570	20	456	1	456
1260	SXMN7F	KIT,MOUNTING HDWR,37 IN CABINET	N	39	20	31.2	1	31.2
1270	SXPS5G	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
1280	SXMN9L	Kit,Mounting Bracket,TX PA,37/45 IN Cab	N	25	20	20	1	20
1290	SXDE5B	KIT,TX DATA	N	495	20	396	1	396
1300	SXDU1J	DUPLEXER,150-162,2-12MHZ MAX SEPARATION	N	1795	20	1436	1	1436
1310	SXMC3B	MICROPHONE,MOBILE(SERVICE)	N	65	20	52	1	52
1320	MM001SR	MANUAL,INSTL,MASTR III AUX RECEIVER	V	30	0	30	1	30
1330	MM002SR	MANUAL,MAINT,MASTR III AUX RECEIVER,VHF	V	60	0	60	1	60
1340	SRDNCX	SYSTEM EQUIPMENT,MASTR III AUX RX,CONV	C	435	20	348	1	348
1350	SRCA1S	CABINET,37 IN	N	570	20	456	1	456
1360	SRMN7X	KIT,MOUNTING HARDWARE,37 IN CABINET	N	39	20	31.2	1	31.2
1370	SRPS1N	POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
1380	SRHN01	RECEIVER,MASTR III AUX RX,150.8-174MHZ	C	2025	20	1620	1	1620
1390	SRSF1W	FEATURE,VOTING TONE,1950HZ	N	50	20	40	1	40
1400	SRCF3U	KIT,CABLE,37/69 IN CAB,SHELF #1	N	100	20	80	1	80
1410	SRRB1N	SHELF,AUX RX	N	750	20	600	1	600
1420	SRMN5Z	PANEL,BLANK	N	30	20	24	1	24
1430	MM001SR	MANUAL,INSTL,MASTR III AUX RECEIVER	V	30	0	30	1	30
1440	MM002SR	MANUAL,MAINT,MASTR III AUX RECEIVER,VHF	V	60	0	60	1	60

1450	SRDNCX		SYSTEM EQUIPMENT,MASTR III AUX RX,CONV	C	435	20	348	1	348
1460	SRCA1S		CABINET,37 IN	N	570	20	456	1	456
1470	SRMN7X		KIT,MOUNTING HARDWARE,37 IN CABINET	N	39	20	31.2	1	31.2
1480	SRPS1N		POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
1490	SRHN01		RECEIVER,MASTR III AUX RX,150.8-174MHZ	C	2025	20	1620	1	1620
1500	SRSF1W		FEATURE,VOTING TONE,1950HZ	N	50	20	40	1	40
1510	SRCF3U		KIT,CABLE,37/69 IN CAB,SHELF #1	N	100	20	80	1	80
1520	SRRB1N		SHELF,AUX RX	N	750	20	600	1	600
1530	SRMN5Z		PANEL,BLANK	N	30	20	24	1	24
1540	MM001SR		MANUAL,INSTL,MASTR III AUX RECEIVER	V	30	0	30	1	30
1550	MM002SR		MANUAL,MAINT,MASTR III AUX RECEIVER,VHF	V	60	0	60	1	60
1560	SRDNCX		SYSTEM EQUIPMENT,MASTR III AUX RX,CONV	C	435	20	348	1	348
1570	SRCA1S		CABINET,37 IN	N	570	20	456	1	456
1580	SRMN7X		KIT,MOUNTING HARDWARE,37 IN CABINET	N	39	20	31.2	1	31.2
1590	SRPS1N		POWER SUPPLY,120VAC,60HZ,12VDC,33A	N	725	20	580	1	580
1600	SRHN01		RECEIVER,MASTR III AUX RX,150.8-174MHZ	C	2025	20	1620	1	1620
1610	SRSF1W		FEATURE,VOTING TONE,1950HZ	N	50	20	40	1	40
1620	SRCF3U		KIT,CABLE,37/69 IN CAB,SHELF #1	N	100	20	80	1	80
1630	SRRB1N		SHELF,AUX RX	N	750	20	600	1	600
1640	SRMN5Z		PANEL,BLANK	N	30	20	24	1	24
1650	VVDC		VOTER,CONV DIGITAL,4 RX SHELVES	C	25700	20	20560	1	20560
1660	VJCJPSX		Voter,Conventional Analog	C	0.01	20	0.01	1	0.01
1670	VJCA3A		Cabinet,37 Inch	N	417	20	333.6	1	333.6
1680	VJCN5Y		Outlet Strip,120VAC	N	50	20	40	1	40
1690	VJVT3G		System,Analog Voter,1 Ch,4 Sites	N	9832	20	7865.6	1	7865.6
1700	VJLB1S		Manual,Install/Oper,Analog Voter,JPS	N	75	20	60	1	60
1710	VJCJPSX		Voter,Conventional Analog	C	0.01	20	0.01	1	0.01
1720	VJCA3A		Cabinet,37 Inch	N	417	20	333.6	1	333.6
1730	VJCN5Y		Outlet Strip,120VAC	N	50	20	40	1	40
1740	VJVT3G		System,Analog Voter,1 Ch,4 Sites	N	9832	20	7865.6	1	7865.6
1750	VJLB1S		Manual,Install/Oper,Analog Voter,JPS	N	75	20	60	1	60
1760	D2HMCX		MOBILE,CONV ORION,150-174MHZ,50W	C	1020	20	816	2	1632
1770	D2CP5R		CONTROL UNIT,SCAN,REMOTE MOUNT	N	450	20	360	2	720
1780	D2MC7T		Microphone,Standard	N	75	20	60	2	120
1790	D2ZN1H		KIT,ACC,RMT W/EXTD OPTN CBL,50W TX & BLW	N	295	20	236	2	472
1800	D2VA		DIGITAL VOICE,AEGIS UNENCRYPTED	N	650	20	520	2	1040
1810		7603	ANTENNA,150-160MHZ,OMNI,9DB,DB228-A	V	1575	5	1496.25	11	16458.75

1820	AWLDF5-50A		CABLE,COAX,7/8 IN,50 OHM,PE FOAM	V	6.18	5	5.87	900	5283
1830	AWL5NF		CONNECTOR,N FEMALE,FOR LDF5-50A	V	77	5	73.15	14	1024.1
1840		7736	CABLE,6FT,NM/NM,1/2H,F4-NMNM-6/FSJ4-50B	V	117	5	111.15	14	1556.1
1850		7239	FILTER,LIGHTNING,125-1000,IS-B50LN-C2-MA	V	95	5	90.25	9	812.25
1860	INSTALL		SERVICE,INSTALLATION	BC	36000	20	28800	1	28800
1870	INSTALL		SERVICE,INSTALLATION	BC	30000	33.3333	20000	1	20000
1880	AWLDF4-50A		CABLE,COAX,1/2 IN,50 OHM,PE FOAM	V	2.55	5	2.42	1600	3872
1890	AWL4NF		CONNECTOR,N FEMALE,FOR LDF4-50A	V	32	5	30.4	20	608
1900		7239	FILTER,LIGHTNING,125-1000,IS-B50LN-C2-MA	V	95	5	90.25	8	722

Total Infrastructure Price----------> $ 217,904.33

EDACS Radio Quotation

TekTron

Middle Twp Police
Mobile Radio Proposal
13, August 2003

Item	Qty	Part Number	Description	Unit	Extended
1	33	7100M	Digital Mobile Radio w/ Digital Voice, Remote Mount Antenna and Installation	$ 3,445.00	$ 113,685.00

M/A Com Inc, In Care of
TekTron Corporation
6845 Westfield Avenue
Pennsauken, N.J. 08110
State Contract A53753

TekTron

Middle Twp Police
Portable Radio Proposal
13, August 2003

Item	Qty	Part Number	Description	Unit	Extended
1	52	HT7150SH1	7100P Digital Portable	$ 1,240.00	$ 64,480.00
	52	HTCV	Feature Set Conventional	$ 1.00	$ 52.00
	52	HTVA	Aegis Digital Voice	$ 200.00	$ 10,400.00
	52	HTPA9P	Battery (NIMH)	$ 104.00	$ 5,408.00
	52	HTCH9E	Charger	$ 92.00	$ 4,784.00
	52	HTNC1C	Antenna	$ 16.00	$ 832.00
	52	HTAE7A	Speaker Microphone	$ 104.00	$ 5,408.00
	52	HTHC7P	Metal Belt Clip	$ 12.00	$ 624.00
	3	HTMR	Immersion option	$ 180.00	$ 540.00
			Total---------->		$ 92,528.00

M/A Com Inc, In Care of
TekTron Corporation
6845 Westfield Avenue
Pennsauken, N.J. 08110
State Contract A53753

TekTron

Middle Twp Police
Dispatch Console 3 Position
13, August 2003

Item	Qty	Part Number	Description	Unit	Extended	Comm Code
1	3	TK1671	Windows NT Operators Position	$ 13,200.00	$ 39,600.00	837-48-047338
	3	TK1326	Custom Console Monitor	$ 1,870.00	$ 5,610.00	837-48-047338
	3	TKEPP	Paging option	$ 475.20	$ 1,425.60	837-48-047338
	3	TK1560	Microphone	$ 176.00	$ 528.00	837-48-047338
	3	TK8461	Head set interface module	$ 413.60	$ 1,240.80	837-48-047338
	6	TK0213	Foot switch	$ 88.00	$ 528.00	837-48-047338
	1	TK1254	Common Control Equipment	$ 3,519.12	$ 3,519.12	837-48-047338
	5	TK0920	Universal Control Card	$ 2,195.60	$ 10,978.00	837-48-047338
	2	TK0978	Orion Interface Card	$ 2,455.20	$ 4,910.40	837-48-047338
	2	TK0979	Orion Interface Module	$ 528.00	$ 1,056.00	837-48-047338
	3	TK0706	Console Interface Card	$ 2,195.00	$ 6,585.00	837-48-047338
	1	TK0705	Patch Card	$ 1,579.60	$ 1,579.60	837-48-047338
	1	TK1314	10 Patch option	$ 88.00	$ 88.00	837-48-047338
	10	TK1115	25 Pair Cable	$ 44.00	$ 440.00	837-48-047338
	10	TK0462	Connectorized Punchdown Block	$ 44.00	$ 440.00	837-48-047338
	8	TK0200	Protected Punchdown Block	$ 528.00	$ 4,224.00	837-48-047338
	2		Misc Rack Mount Hardware	$ 1,500.00	$ 3,000.00	Open Market
	1		Installation and Project Engineering	$ 6,000.00	$ 6,000.00	837-48-047338
	6	TKEE902	Equipment Enclosure (medium)	$ 3,000.00	$ 18,000.00	837-48-047338
	3	TKEE901	Equipment Enclosure (Small)	$ 2,000.00	$ 6,000.00	837-48-047338
	2	TKEE950	Hardware Kit			
			Console---------->		$ 115,752.52	

TekTron Corporation
6845 Westfield Avenue
Pennsauken, N.J. 08110
Attention; James Foley
State Contract A53752

JAMES E. MCGREEVEY
Governor

State of New Jersey

DEPARTMENT OF THE TREASURY
DIVISION OF PURCHASE AND PROPERTY
P. O. BOX 230
TRENTON, NEW JERSEY 08625-0230
(609) 984-9703

JOHN E. MCCORMAC CPA
State Treasurer

July 25, 2003

Ms. Barbara Waxman
TekTron Corporation
6845 Westfield Avenue
Pennsauken, NJ 08110

Ref: Radio Communication Equipment & Accessories
Contract A53752

Dear Ms. Waxman:

I am writing in response to your letter dated June 16, 2003 regarding the addition of equipment to your product line under the subject contract. Please be advised that the State hereby accepts and approves your request to add these products to the above referenced contract.

All other terms and conditions of your original award remain the same. Retain this letter to serve as your authorization to offer these products to the Using Agencies.

Very truly yours,

Toni Lello

Toni Lello
Purchase Bureau

C: Dave Blackwell

TekTron

New Technologies in Critical Communications

June 16, 2003

Ms. Antoinette Lello
State of New Jersey
Bureau of Purchasing
33 West State Street, 9th Floor
Trenton, NJ 08625-0230

Dear Ms. Lello:

TekTron Corporation is pleased to offer the following products for addition to our New Jersey State Contract #A53752. These items are available at the same discount of 12% off list price. Please see the attached list of items and commodity codes.

Commodity Code	Part Number	Description	List price
837-48-047338	TKEE901	19" Rack Mount Equipment Enclosure Small	$ 2,000.00
837-48-047338	TKEE902	19" Rack Mount Equipment Enclosure Med.	$ 3,000.00
837-48-047338	TKEE903	19" Rack Mount Equipment Enclosure Lrg.	$ 3,950.00
837-48-047338	TKEE950	Hardware Kit for Equipment Enclosure	$ 500.00
837-48-047388	TKEE990	Power Supply/Filter Kit for TekTron Console	$ 2,654.00
837-48-047329	720JUNO	Speaker Mic for TekTron Portable (Immersible)	$ 157.00
837-48-047329	720Sword	Speaker Microphone for TekTron Portable	$ 125.00
837-48-047329	720RPTR	Vehicular Repeater for TekTron Mobile	$ 1,800.00
837-48-047329	7201677	Notch Filter for Vehicular Repeater	$ 190.00
837-48-047329	7201678	Preselector for Vehicular Repeater	$ 360.00
837-48-047329	720D2	Wire Harness for Vehicular Repeater	$ 120.00

If you have any questions, please do not hesitate to call me. We appreciate your prompt attention to this matter.

Very truly yours,

Scott M. Batt
Director of Sales & Marketing
TekTron Corporation

Corporate Headquarters: 6845 Westfield Avenue • Pennsauken, NJ 08110-1527 • 856.665.4400 or 800.245.2289 • Fax 856.665.5303
13 Kennedy Boulevard • East Brunswick, NJ 08816-1250 • 732.937.9376 or 888.283.5876 • Fax: 732.937.9338
Service Warehouse: Marmora, NJ 609.390.3338
www.tektroncorp.com

STATE OF NEW JERSEY

BUREAU OF PURCHASE
33 WEST STATE ST 8TH FL TRENTON, NJ 08625-0230

TERM CONTRACT

RADIO COMMUNICATION EQUIPMENT
AND ACCESSORIES

NUMBER	: A53752
DATE	: 12/30/02
BUYER	: ANTOINETTE LELLO
PHONE	: (609) 984-9703
EFFECTIVE DATE	: 01/01/03
EXPIRATION DATE	: 12/31/03
T-NUMBER	: T0109
CONTRACTOR	: TEKTRON CORPORATION

TEKTRON CORPORATION
6845 WESTFIELD AVENUE
PENNSAUKEN NJ 08110

VENDOR NO.	: 222010883
VENDOR PHONE	: (609)665-4400
FEIN/SSN	: 222010883
REQ AGENCY	: 822050 BUREAU OF PURCHASE
AGENCY REQ NO.	:
PURCH REQ NO.	: 1020922
FISCAL YEAR	: 03
COMMODITY CODE	: 83748
SOLICITATION #:	32903
BID OPEN DATE	: 07/25/02

TERM CONTRACT FROM: 01/01/03 TO: 12/31/03 ESTIMATED AMOUNT: $ 75,000.00

1. ORDERING PERIOD: CONTRACT BEGINNING ORDERING PERIOD IS:01/01/03
   CONTRACT ENDING ORDERING PERIOD DATE IS:12/31/03
2. F.O.B. POINT: DESTINATION
3. DELIVERY: DELIVERY WILL BE MADE WITHIN090 DAYS ARO UNLESS SPECIFIED DIFFERENTLY ON EACH LINE OR UNLESS AN ALTERNATE DELIVERY SCHEDULE IS INDICATED. AN ALTERNATE DELIVERY SCHEDULE IS ENCLOSED HEREIN:NO
4. CASH DISCOUNT TERMS: CASH DISCOUNT TERMS ARE00.00% DAYS.
5. PERFORMANCE BOND: PERFORMANCE BOND REQUIRED:NO ; DATE REQUIRED00/00/00
   AMOUNT $0 ; PERCENT OF CONTRACT 0.00%
   RETAINAGE: RETAINAGE PERCENT IS 0.00%
7. COOPERATIVE PROC: THIS CONTRACT IS AVAILABLE FOR POLITICAL SUBDIVISION USE UNDER THE COOPERATIVE PROCUREMENT PROGRAMYES
8. BID REFERENCE NO: YOUR BID REFERENCE NUMBER IS:
9. AWARDED LINES: YOU WERE AWARDED 26 LINES FROM THE SOLICITATION NUMBER32903 . THESE LINES ARE INCLUDED AS A PART OF THIS CONTRACT.

ALL TERMS AND CONDITIONS AS A PART OF SOLICITATION NUMBER32903 INCLUDING ANY ADDENDA THERETO AND ALSO INCLUDING THE BIDDER'S PROPOSAL AS ACCEPTED BY THE STATE ARE INCLUDED HEREIN BY REFERENCE AND MADE PART HEREOF EXCEPT AS SPECIFIED HEREIN

THIS IS NOTICE OF ACCEPTANCE BY THE DIRECTOR OF THE DIVISION OF PURCHASE AND PROPERTY ACTING FOR AND ON BEHALF OF THE STATE OF NEW JERSEY, OF THE OFFER REFERENCED ABOVE BY YOUR FIRM WHOSE NAME AND ADDRESS APPEAR ABOVE.

BUYER _____ DATE _____

Antoinette Lello 1/6/03
FOR DIRECTOR DATE
DIVISION OF PURCHASE AND PROPERTY

USING AGENCIES CANNOT PROCESS INVOICES FOR PAYMENT OF DELIVERED GOODS AND/OR SERVICES UNTIL THE PROPERLY EXECUTED BOND HAS BEEN RECEIVED AND ACCEPTED BY THE PURCHASE BUREAU.

VENDOR COPY

PRICE SHEET	TERM CONTRACT	
BUREAU OF PURCHASE PURCHASE BUREAU STATE OF NEW JERSEY WEST STATE ST 8TH FL BOX 230 TRENTON NJ 08625-0230	NUMBER : A53752 T-NUMBER : T0109 CONTRACTOR: TEKTRON CORPORATION	PAGE 2

LINE NO.	COMMODITY/SERVICE DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE OR PERCENT DISCOUNTS	EXTENDED AMT IF APPLICABLE
	UNLESS SPECIFIED OTHERWISE BELOW: SHIP TO: R1 STATE-WIDE ONLY				
00001	COMMODITY CODE: 837-48-033745 RADIO EQUIPMENT - ANALOG, TRUNKED BRAND: E. F. JOHNSON P/L - 10/01	1	EACH	12.00%	
00008	COMMODITY CODE: 837-48-033746 RADIO EQUIPMENT - ANALOG, NON-TRUNKED BRAND: E. F. JOHNSON P/L - 10/01	1	EACH	12.00%	
00070	COMMODITY CODE: 837-48-036207 LABOR RATE AT CONTRACTOR'S SHOP STRAIGHT TIME, MONDAY THRU FRIDAY 8:00 A.M. TO 5:00 P.M.	1	HOUR	$ 95.00	
00071	COMMODITY CODE: 837-48-036208 LABOR RATE AT CONTRACTOR'S SHOP OVERTIME, MONDAY THRU SATURDAY 5:01 P.M. TO 7:49 A.M.	1	HOUR	$ 142.50	
00072	COMMODITY CODE: 837-48-036209 LABOR AT CONTRACTOR'S SHOP SUNDAY AND HOLIDAYS	1	HOUR	$ 190.00	
00073	COMMODITY CODE: 837-48-036212 LABOR RATE AT USING AGENCY'S FACILITY STRAIGHT TIME, MONDAY THRU FRIDAY 8:00 A.M. TO 5:00 P.M.	1	HOUR	$ 125.00	
00074	COMMODITY CODE: 837-48-036213 LABOR RATE AT USING AGENCY'S FACILITY OVERTIME, MONDAY THRU SATURDAY 5:01 P.M. TO 7:49 A.M.	1	HOUR	$ 172.50	
00075	COMMODITY CODE: 837-48-036214 LABOR RATE AT USING AGENCY'S FACILITY SUNDAY AND HOLIDAYS	1	HOUR	$ 220.00	
00076	COMMODITY CODE: 837-48-035456 SCHEDULE A MOBILE INSTALLATIONS TO BE PERFORMED IN CONTRACTOR'S SHOP PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00077	COMMODITY CODE: 837-48-035457 SCHEDULE B MOBILE INSTALLATIONS TO BE PERFORMED IN USING AGENCY FACILITY - FIELD RATE PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00078	COMMODITY CODE: 837-48-035458 SCHEDULE C MOBILE REMOVALS TO BE PERFORMED AT THE CONTRACTOR'S SHOP PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00079	COMMODITY CODE: 837-48-035459 SCHEDULE D MOBILE REMOVALS TO BE PERFORMED AT THE USING AGENCY FACILITY - FIELD RATE	1	HOUR	NET	

PRICE SHEET	TERM CONTRACT	
BUREAU OF PURCHASE PURCHASE BUREAU STATE OF NEW JERSEY WEST STATE ST 8TH FL BOX 230 TRENTON NJ 08625-0230	NUMBER : A53752 T-NUMBER : T0109 CONTRACTOR: TEKTRON CORPORATION	PAGE 3

LINE NO.	COMMODITY/SERVICE DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE OR PERCENT DISCOUNTS	EXTENDED AMT IF APPLICABLE
	PRICES AS LISTED IN BID PROPOSAL				
00080	COMMODITY CODE: 837-48-035460 SCHEDULE E MOBILE REMOVALS AND RE-INSTALLS TO BE PERFORMED AT THE SAME TIME AT THE CONTRACTOR'S SHOP PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00081	COMMODITY CODE: 837-48-035461 SCHEDULE F MOBILE REMOVALS AND RE-INSTALLS TO BE PERFORMED AT THE SAME TIME AT THE USING AGENCY FACILITY - FIELD RATE PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00082	COMMODITY CODE: 837-48-035462 SCHEDULE G BASE STATION INSTALLATION PRICE SCHEDULE PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00083	COMMODITY CODE: 837-48-035454 SCHEDULE H MAINTENANCE TO RADIO COMMUNICATION EQUIPMENT ALL INCLUSIVE ANNUAL MAINTENANCE (EXHIBIT A) PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00084	COMMODITY CODE: 837-48-035455 SCHEDULE I MAINTENANCE TO RADIO COMMUNICATION EQUIPMENT TIME & MATERIAL HOURLY RATE (EXHIBIT B) PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00085	COMMODITY CODE: 837-48-045507 SCHEDULE J PROJECT ENGINEERING/MANAGEMENT, SITE MANAGEMENT PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00086	COMMODITY CODE: 837-48-045508 SCHEDULE K TRAINING COSTS PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00087	COMMODITY CODE: 837-48-038496 SCHEDULE L PROGRAMMING COSTS RADIO EQUIPMENT PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00088	COMMODITY CODE: 837-48-038498 SCHEDULE M MANUALS RADIO COMMUNICATION PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00089	COMMODITY CODE: 837-48-038497 SCHEDULE N EXTENDED WARRANTY RADIO COMMUNICATION PRICES AS LISTED IN BID PROPOSAL	1	HOUR	NET	
00090	COMMODITY CODE: 837-48-047076 SCHEDULE O SYSTEM DESIGN PRICES AS LISTED IN BID PROPOSAL.	1	HOUR	NET	
00095	COMMODITY CODE: 837-48-047329	1	EACH	NET	

PRICE SHEET	TERM CONTRACT	
BUREAU OF PURCHASE PURCHASE BUREAU STATE OF NEW JERSEY WEST STATE ST 8TH FL BOX 230 TRENTON NJ 08625-0230	NUMBER : A53752 T-NUMBER : T0109 CONTRACTOR: TEKTRON CORPORATION	PAGE 4

LINE NO.	COMMODITY/SERVICE DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE OR PERCENT DISCOUNTS	EXTENDED AMT IF APPLICABLE
	RADIO EQUIPMENT - ANALOG, TRUNKED BRAND: TEKTRON BRAND: 12 P/L - 7/02				
00100	COMMODITY CODE: 837-48-047336 RADIO EQUIPMENT - DIGITAL, TRUNKED BRAND: DX RADIO BRAND: 12 P/L - 7/02	1	EACH	NET	
00103	COMMODITY CODE: 837-48-047338 RADIO - BASE STATION CONTROL EQUIPMENT BRAND: TEKTRON BRAND: 12 P/L - 7/02	1	EACH	NET	

TekTron

New Technologies in Critical Communications

March 21, 2002

Ms. Antoinette Lello
Purchase Bureau
State of New Jersey
33 West State Street
PO Box 230
Trenton NJ 08625

Re: Request for Proposal No. 02-X-32903
Radio Communication Equipment and Accessories

Dear Ms. Lello:

In accordance with Section 5.11 of the above referenced bid specifications, TekTron Corporation, an authorized dealer for M/A-Com Wireless Systems, Inc., will accept all terms, conditions and pricing as submitted by M/A-Com in response to the above referenced bid request.

Very truly yours,

Scott M. Batt
Director of Sales
TekTron Corporation

SMB/dfp

Corporate Headquarters: 6845 Westfield Avenue • Pennsauken, NJ 08110-1527 • 856.665.4400 or 800.245.2289 • Fax 856.665.5303
13 Kennedy Boulevard • East Brunswick, NJ 08816-1250 • 732.937.9376 or 888.283.5876 • Fax: 732.937.9338
Service Warehouse: Marmora, NJ 609.390.3338
www.tektroncorp.com

STATE OF NEW JERSEY

BUREAU OF PURCHASE
33 WEST STATE ST 8TH FL TRENTON, NJ 08625-0230

TERM CONTRACT

RADIO COMMUNICATION EQUIPMENT
AND ACCESSORIES

NUMBER	:	A53753
DATE	:	12/30/02
BUYER	:	ANTOINETTE LELLO
PHONE	:	(609) 984-9703
EFFECTIVE DATE	:	01/01/03
EXPIRATION DATE	:	12/31/03
T-NUMBER	:	T0109
CONTRACTOR	:	M A COM PRIVATE RADIO SYSTEMS

M A COM PRIVATE RADIO SYSTEMS
INC
SUITE R 4
1930 EAST ROUTE 70
CHERRY HILL NJ 08003

VENDOR NO.	:	251849837
VENDOR PHONE	:	(856)751-4145
FEIN/SSN	:	251849837
REQ AGENCY	:	822050 BUREAU OF PURCHASE
AGENCY REQ NO.	:	
PURCH REQ NO.	:	1020922
FISCAL YEAR	:	03
COMMODITY CODE	:	83748
SOLICITATION #:		32903
BID OPEN DATE	:	07/25/02

TERM CONTRACT FROM: 01/01/03 TO: 12/31/03 ESTIMATED AMOUNT: $ 100,000.00

1. ORDERING PERIOD: CONTRACT BEGINNING ORDERING PERIOD IS:01/01/03
   CONTRACT ENDING ORDERING PERIOD DATE IS:12/31/03
2. F.O.B. POINT: DESTINATION
3. DELIVERY: DELIVERY WILL BE MADE WITHIN030 DAYS ARO UNLESS SPECIFIED DIFFERENTLY ON EACH LINE OR UNLESS AN ALTERNATE DELIVERY SCHEDULE IS INDICATED. AN ALTERNATE DELIVERY SCHEDULE IS ENCLOSED HEREIN:NO
4. CASH DISCOUNT TERMS: CASH DISCOUNT TERMS ARE00.00% DAYS.
5. PERFORMANCE BOND: PERFORMANCE BOND REQUIRED:NO ; DATE REQUIRED00/00/00
   AMOUNT $0 ; PERCENT OF CONTRACT 0.00%
6. RETAINAGE: RETAINAGE PERCENT IS 0.00%
7. COOPERATIVE PROC: THIS CONTRACT IS AVAILABLE FOR POLITICAL SUBDIVISION USE UNDER THE COOPERATIVE PROCUREMENT PROGRAMYES
8. BID REFERENCE NO: YOUR BID REFERENCE NUMBER IS:MBP#22047
9. AWARDED LINES: YOU WERE AWARDED 32 LINES FROM THE SOLICITATION NUMBER32903 . THESE LINES ARE INCLUDED AS A PART OF THIS CONTRACT.

ALL TERMS AND CONDITIONS AS A PART OF SOLICITATION NUMBER32903 INCLUDING ANY ADDENDA THERETO AND ALSO INCLUDING THE BIDDER'S PROPOSAL AS ACCEPTED BY THE STATE ARE INCLUDED HEREIN BY REFERENCE AND MADE PART HEREOF EXCEPT AS SPECIFIED HEREIN

THIS IS NOTICE OF ACCEPTANCE BY THE DIRECTOR OF THE DIVISION OF PURCHASE AND PROPERTY ACTING FOR AND ON BEHALF OF THE STATE OF NEW JERSEY, OF THE OFFER REFERENCED ABOVE BY YOUR FIRM WHOSE NAME AND ADDRESS APPEAR ABOVE.

BUYER _____ DATE _____

Antoinette Lello 1/6/03
FOR DIRECTOR DATE
DIVISION OF PURCHASE AND PROPERTY

USING AGENCIES CANNOT PROCESS INVOICES FOR PAYMENT OF DELIVERED GOODS AND/OR SERVICES UNTIL THE PROPERLY EXECUTED BOND HAS BEEN RECEIVED AND ACCEPTED BY THE PURCHASE BUREAU.

VENDOR COPY

PRICE SHEET	TERM CONTRACT	
BUREAU OF PURCHASE PURCHASE BUREAU STATE OF NEW JERSEY 33 WEST STATE ST 8TH FL PO BOX 230 TRENTON NJ 08625-0230	NUMBER : A53753 T-NUMBER : T0109 CONTRACTOR: M A COM PRIVATE RADIO SYSTEMS	PAGE 2

LINE NO.	COMMODITY/SERVICE DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE OR PERCENT DISCOUNTS	EXTENDED AMT IF APPLICABLE
	UNLESS SPECIFIED OTHERWISE BELOW: SHIP TO: R1 STATE-WIDE ONLY				
00002	COMMODITY CODE: 837-48-033734 RADIO EQUIPMENT - ANALOG, TRUNKED BRAND: M/A COM WIRELESS P/L - 5/02	1	EACH	20.00%	
00010	COMMODITY CODE: 837-48-033747 RADIO EQUIPMENT - ANALOG, NON-TRUNKED BRAND: M/A COM WIRELESS P/L - 5/02	1	EACH	20.00%	
00015	COMMODITY CODE: 837-48-033768 RADIO EQUIPMENT - DIGITAL, TRUNKED BRAND: M/A COM WIRELESS P/L - 5/02	1	EACH	15.00%	
00017	COMMODITY CODE: 837-48-033765 RADIO EQUIPMENT - DIGITAL, NON-TRUNKED BRAND: AMP P/L - 5/02	1	EACH	17.00%	
00018	COMMODITY CODE: 837-48-033788 RADIO EQUIPMENT - DIGITAL, NON-TRUNKED BRAND: M/A COM WIRELESS P/L - 5/02	1	EACH	20.00%	
00023	COMMODITY CODE: 837-48-033815 RADIO - BASE STATION CONTROL EQUIPMENT BRAND: M/A COM WIRELESS P/L - 5/02	1	EACH	20.00%	
00049	COMMODITY CODE: 837-48-045410 SPARE PARTS BRAND: M/A COM WIRELESS P/L - 5/02	1	EACH	20.00%	
00067	COMMODITY CODE: 837-48-045488 RADIO EQUIPMENT - FIRE PAGING BRAND: M/A COM WIRELESS P/L - 5/02	1	EACH	5.00%	
00070	COMMODITY CODE: 837-48-036207 LABOR RATE AT CONTRACTOR'S SHOP STRAIGHT TIME, MONDAY THRU FRIDAY 8:00 A.M. TO 5:00 P.M.	1	HOUR	$ 95.00	
00071	COMMODITY CODE: 837-48-036208 LABOR RATE AT CONTRACTOR'S SHOP OVERTIME, MONDAY THRU SATURDAY 5:01 P.M. TO 7:49 A.M.	1	HOUR	$ 142.50	
00072	COMMODITY CODE: 837-48-036209 LABOR AT CONTRACTOR'S SHOP SUNDAY AND HOLIDAYS	1	HOUR	$ 190.00	
00073	COMMODITY CODE: 837-48-036212	1	HOUR	$ 95.00	

PRICE SHEET	TERM CONTRACT	
BUREAU OF PURCHASE PURCHASE BUREAU STATE OF NEW JERSEY 33 WEST STATE ST 8TH FL PO BOX 230 TRENTON NJ 08625-0230	NUMBER : A53753 T-NUMBER : T0109 CONTRACTOR: M A COM PRIVATE RADIO SYSTEMS	PAGE 3

LINE NO.	COMMODITY/SERVICE DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE OR PERCENT DISCOUNTS	EXTENDED AMT IF APPLICABLE
	LABOR RATE AT USING AGENCY'S FACILITY STRAIGHT TIME, MONDAY THRU FRIDAY 8:00 A.M. TO 5:00 P.M.				
00074	COMMODITY CODE: 837-48-036213 LABOR RATE AT USING AGENCY'S FACILITY OVERTIME, MONDAY THRU SATURDAY 5:01 P.M. TO 7:49 A.M.	1	HOUR	$ 142.50	
00075	COMMODITY CODE: 837-48-036214 LABOR RATE AT USING AGENCY'S FACILITY SUNDAY AND HOLIDAYS	1	HOUR	$ 190.00	
00076	COMMODITY CODE: 837-48-035456 SCHEDULE A MOBILE INSTALLATIONS TO BE PERFORMED IN CONTRACTOR'S SHOP PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00077	COMMODITY CODE: 837-48-035457 SCHEDULE B MOBILE INSTALLATIONS TO BE PERFORMED IN USING AGENCY FACILITY - FIELD RATE PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00078	COMMODITY CODE: 837-48-035458 SCHEDULE C MOBILE REMOVALS TO BE PERFORMED AT THE CONTRACTOR'S SHOP PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00079	COMMODITY CODE: 837-48-035459 SCHEDULE D MOBILE REMOVALS TO BE PERFORMED AT THE USING AGENCY FACILITY - FIELD RATE PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00080	COMMODITY CODE: 837-48-035460 SCHEDULE E MOBILE REMOVALS AND RE-INSTALLS TO BE PERFORMED AT THE SAME TIME AT THE CONTRACTOR'S SHOP PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00081	COMMODITY CODE: 837-48-035461 SCHEDULE F MOBILE REMOVALS AND RE-INSTALLS TO BE PERFORMED AT THE SAME TIME AT THE USING AGENCY FACILITY - FIELD RATE PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00082	COMMODITY CODE: 837-48-035462 SCHEDULE G BASE STATION INSTALLATION PRICE SCHEDULE PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00083	COMMODITY CODE: 837-48-035454 SCHEDULE H MAINTENANCE TO RADIO COMMUNICATION EQUIPMENT ALL INCLUSIVE ANNUAL MAINTENANCE (EXHIBIT A) PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00084	COMMODITY CODE: 837-48-035455 SCHEDULE I MAINTENANCE TO RADIO COMMUNICATION EQUIPMENT TIME & MATERIAL HOURLY RATE	1	HOUR	NET	

PRICE SHEET

TERM CONTRACT

BUREAU OF PURCHASE
PURCHASE BUREAU
STATE OF NEW JERSEY
33 WEST STATE ST 8TH FL
PO BOX 230
TRENTON NJ 08625-0230

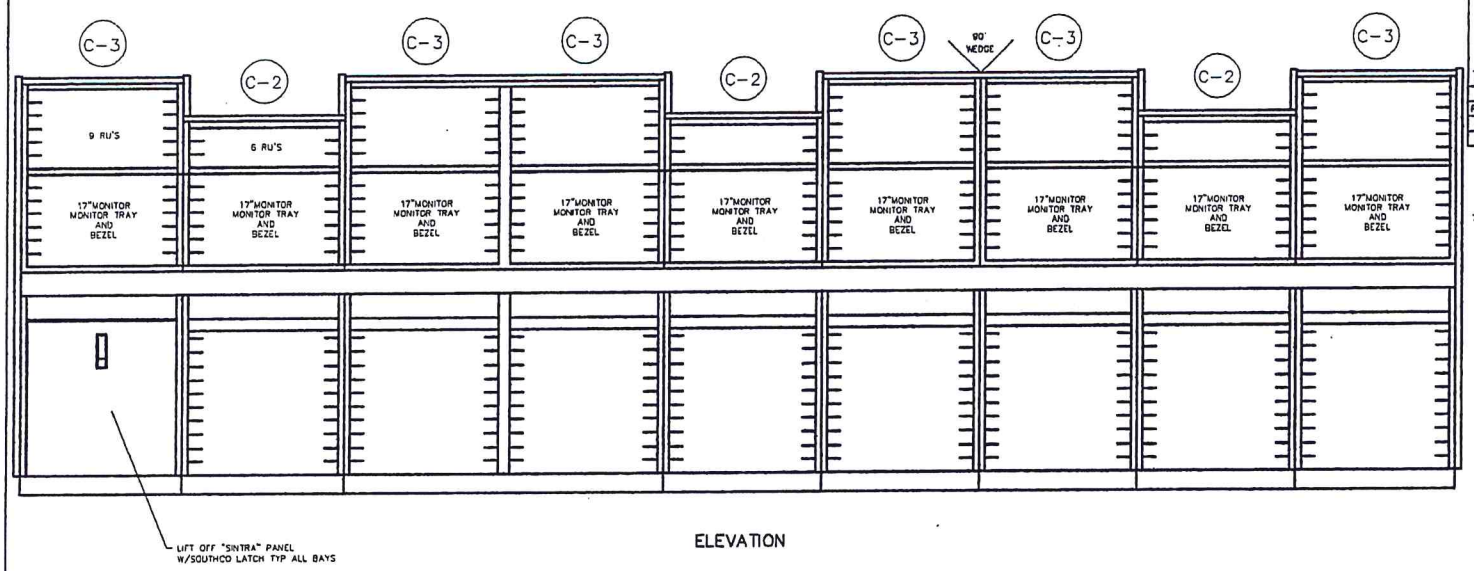
NUMBER : A53753
T-NUMBER : T0109

CONTRACTOR: M A COM PRIVATE RADIO SYSTEMS

LINE NO.	COMMODITY/SERVICE DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE OR PERCENT DISCOUNTS	EXTENDED AMT IF APPLICABLE
	(EXHIBIT B) PRICES A LISTED IN THE BID PROPOSAL				
00085	COMMODITY CODE: 837-48-045507 SCHEDULE J PROJECT ENGINEERING/MANAGEMENT, SITE MANAGEMENT PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00086	COMMODITY CODE: 837-48-045508 SCHEDULE K TRAINING COSTS PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00087	COMMODITY CODE: 837-48-038496 SCHEDULE L PROGRAMMING COSTS RADIO EQUIPMENT PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00088	COMMODITY CODE: 837-48-038498 SCHEDULE M MANUALS RADIO COMMUNICATION PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00089	COMMODITY CODE: 837-48-038497 SCHEDULE N EXTENDED WARRANTY RADIO COMMUNICATION PRICES A LISTED IN THE BID PROPOSAL	1	HOUR	NET	
00090	COMMODITY CODE: 837-48-047076 SCHEDULE O SYSTEM DESIGN PRICES AS LISTED IN THE BID PROPOSAL.	1	EACH	NET	
00110	COMMODITY CODE: 837-48-047345 ANTENNAS - MOBILE, PORTABLE,BASE STATION BRAND: MA/COM P/L - 5/02	1	EACH	20.00%	
00111	COMMODITY CODE: 837-48-047345 ANTENNAS - MOBILE, PORTABLE,BASE STATION BRAND: MA/COM P/L - 5/02	1	EACH	5.00%	
00113	COMMODITY CODE: 837-48-047347 CONSOLES BRAND: M/A COM P/L - 5/02	1	EACH	20.00%	

M/A-COM AUTHORIZED DEALERS/DISTRIBUTORS

Tektron
6845 Westfield Avenue
Pennsauken, NJ 08110
Telephone: 609-665-4400
Fax: 609-665-5303



ELEVATION

CLIENT APPROVAL

☐ APPROVED – MANUFACTURING MAY PROCEED

☐ APPROVED AS CORRECTED – MANUFACTURING MAY PROCEED

SIGNATURE _____ DATE _____

REVISIONS

REV	DESCRIPTION	DATE
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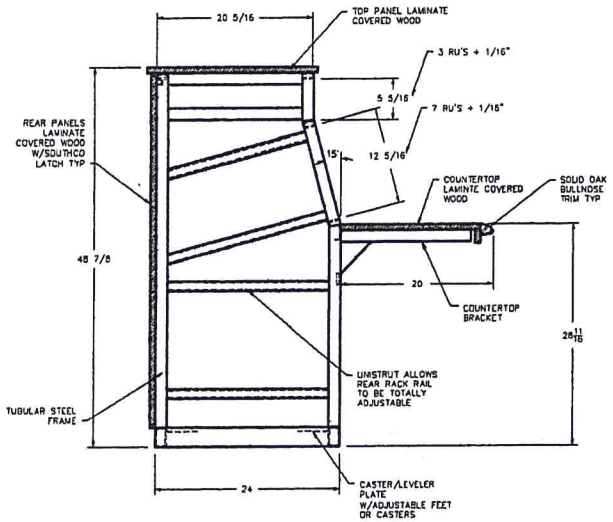
B	REVISED CONSOLE #1 C-2 & C-3	08-12-03



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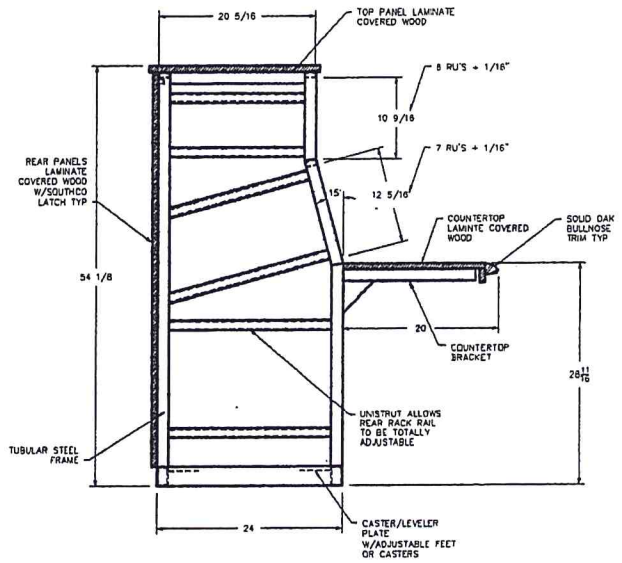


C-3 CONSOLE SECTION – TYP

WRITTEN DIMENSIONS ON THIS DRAWING SHALL HAVE PRECEDENCE OVER ANY SCALED DIMENSION.

AFTER AFFIXING HIS SIGNATURE ON THE APPROVAL BLOCK, THE APPROPRIATE DESIGNEE ACKNOWLEDGES THAT HE HAS STUDIED THE DRAWING AND THE SPECIFICATIONS AND GIVES HIS APPROVAL THEREOF.

DRAWN BY: DENNIS OTTESON

DESIGN CHECK BY:

WOOD SHOP CHECK BY:

METAL SHOP CHECK BY:

TRUCK SHOP CHECK BY:

PROJECT: CONSOLE OPTION #1

CLIENT: TEKTRON FOR MIDDLE TOWNSHIP P.O. NJ

DRAWING TITLE: ELEVATION, AND SECTIONS

SCALE: 1/16"=1" | SHEET: 2 OF 2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES

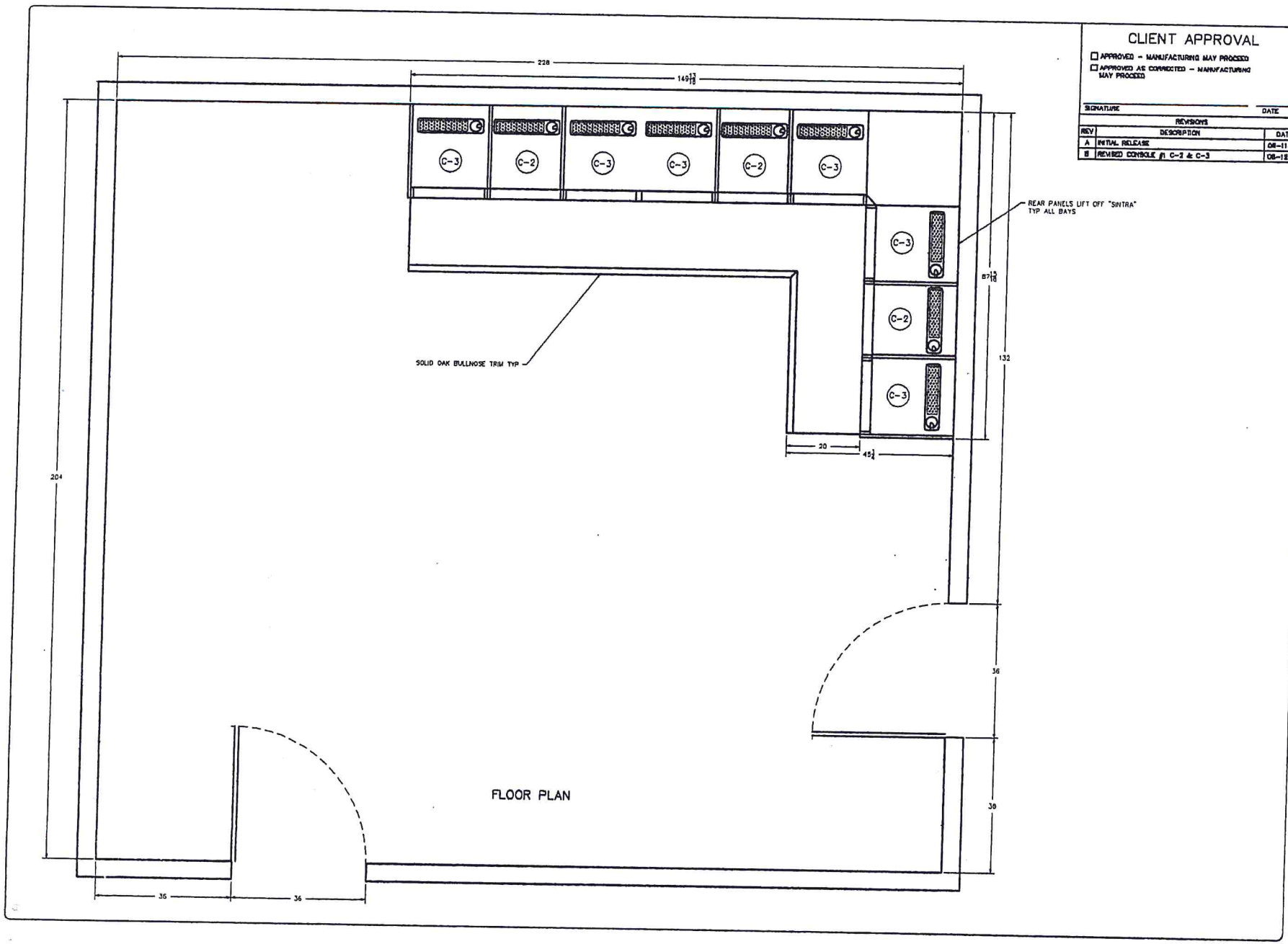
DECIMALS: .XX ±.02, .XXX ±.005

ANGLES: ±1°

DRAWING NUMBER: 203104 | REV: B

CHARGE LABOR TO THE NUMBER BELOW: 3-620-420-

EME
EMERGENCY MANAGEMENT EQUIPMENT
2664 ALEXANDER STREET
SALT LAKE CITY, UTAH
84119
(800) 484-1345
(801) 972-0901
FAX (801) 972-0787



CLIENT APPROVAL

☐ APPROVED – MANUFACTURING MAY PROCEED

☐ APPROVED AS CORRECTED – MANUFACTURING MAY PROCEED

SIGNATURE _____ DATE _____

REVISIONS		
REV	DESCRIPTION	DATE
A	INITIAL RELEASE	08-11-03
B	REVISED CONSOLE #1 C-2 & C-3	08-13-03

DRAWN BY: DENNIS OTTESON

DESIGN CHECK BY:

WOOD SHOP CHECK BY:

METAL SHOP CHECK BY:

TRUCK SHOP CHECK BY:

PROJECT: CONSOLE OPTION #1

CLIENT: TEKTRON FOR MIDDLE TOWNSHIP P.O. NJ

DRAWING TITLE: FLOOR PLAN

SCALE: 1/2"=1'-0" | SHEET: 1 OF 2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES:
DECIMALS: .xx ±.03, .xxx ±.005
ANGLES: ±1°

DRAWING NUMBER 203140 | REV B

CHARGE LABOR TO THE NUMBER BELOW: 3-620-420-

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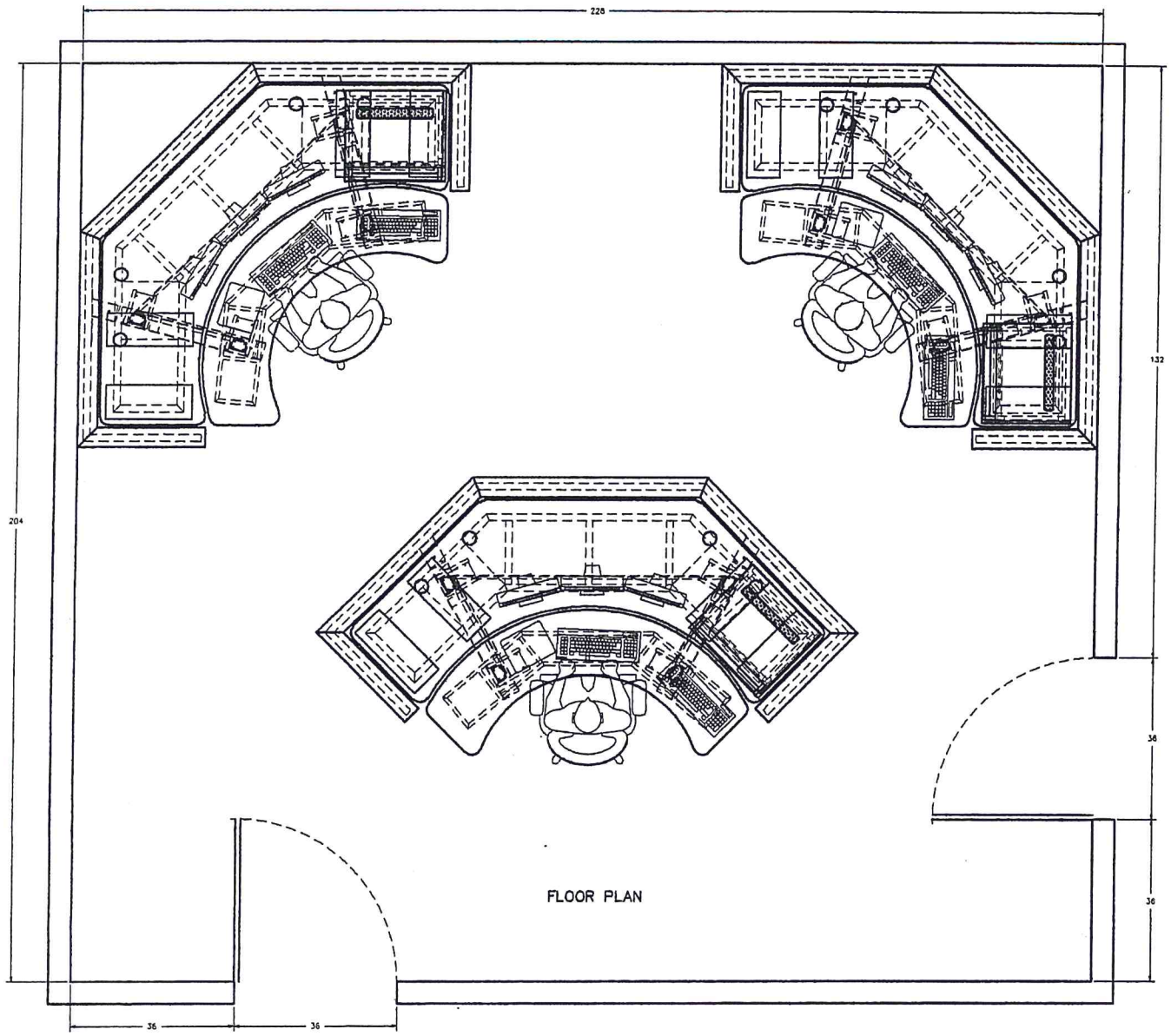
EMERGENCY MANAGEMENT EQUIPMENT
2084 ALEXANDER STREET
SALT LAKE CITY, UTAH
84119
(800) 495-1345
(801) 973-0801
FAX (801) 973-0797



CLIENT APPROVAL

- ☐ APPROVED – MANUFACTURING MAY PROCEED
- ☐ APPROVED AS CORRECTED – MANUFACTURING MAY PROCEED

SIGNATURE _____ DATE _____

REVISIONS

REV	DESCRIPTION	DATE
A	INITIAL RELEASE	08-11-03

DRAWN BY: DENNIS OTTESON

DESIGN CHECK BY:

WOOD SHOP CHECK BY:

METAL SHOP CHECK BY:

TRUCK SHOP CHECK BY:

PROJECT: CONSOLE OPTION #2

CLIENT: TEKTRON FOR MIDDLE TOWNSHIP P.D. NJ

DRAWING TITLE: FLOOR PLAN

SCALE: 1/2"=1'-0"

SHEET: 3 OF 4

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES:

DECIMALS: .xx ± .02, .xxx ± .005

ANGLES: ±1°

DRAWING NUMBER: 203140

REV: A

CHARGE LABOR TO THE NUMBER BELOW: 3-620-420-

ENE
EMERGENCY MANAGEMENT EQUIPMENT
2064 ALEXANDER STREET
SALT LAKE CITY, UTAH
84119
(800) 486-1348
(801) 973-0801
FAX (801) 973-0707

CHAPTER 6

Aegis and Encryption

Aegis

Aegis (e'jis): The name Aegis comes from Greek mythology. Aegis was the shield of the gods. It symbolizes protection and security.

Aegis digital voice technology from Ericsson GE represents the first step toward the digital radio future. Aegis is available now. It offers outstanding audio clarity and improved fringe area performance.

Aegis technology represents Ericsson GE's continuing commitment to protect our customer's investment. This commitment has two parts: first, state of the art digital technology available today. And second, there is a migration plan to integrate this technology into existing systems for full backward compatibility now and in the future.

Aegis Is:

- Digital technology
- Available on EDACS
- Available today

Available on Enhanced Digital Access Communication System (EDACS), Aegis advances this proven technology by providing an ALL DIGITAL system. Beyond digital access, Aegis now provides digital voice.

Communication systems are designed to increase productivity and provide security. Aegis technology is a shield which adds a powerful reinforcement of security to an existing system.

Aegis is a high speed digital communications technology. The analog voice input is digitized using a sophisticated digital speech coding technology, or vocoder. Added to the vocoded message are features such as channel signalling which synchronize the signal at the receiving end, as well as error detection and correction.

And best of all, Aegis digital technology is available TODAY, with affordable upgrade options for most communication applications.

What is Aegis?

Aegis is a high speed, 9600 bits per second, digital communication technology. It depends on sophisticated digital speech coding, or vocoding, called Adaptive Multiband Encoding (AME). AME transforms the analog voice input to a digital signal. Added to vocoded message are channel signalling features to synchronize the signal at the receiving end as well as error detection and correction.

The advantage to the user is that Aegis delivers high quality audio with improved weak signal performance. The user receives the same voice recognition capability experienced with analog voice. In fact, in fringe radio coverage areas, the digital audio received is much clearer because noise is "discarded" rather than being passed through the receiver.

Aegis technology is an integral part of Ericsson GE's Enhanced Digital Communications System (EDACS). Both use the same 9600 baud rate. EDACS is the first ALL DIGITAL radio system available.

Aegis encryption is also available to provide an extra measure of security for those who require it. There are two encryption algorithms available with Aegis:

- The Data Encryption Standard (DES) algorithm approved for "sensitive but unclassified" United States Government communications. There are 7.2×10^{16} possible keys. Use is generally only permitted in the United States and Canada.
- The Voice Guard Encryption (VGE) algorithm is Ericsson GE's proprietary algorithm. It has a total of 1.8×10^{19} possible code combinations. An additional layer of security is provided by the Customer Unique Encryption (CUE), a customer-defined code. Export from the United States requires a State Department license.

Aegis Modes:

- Digital - high quality
- Encryption - very high security
- Analog - backward compatibility

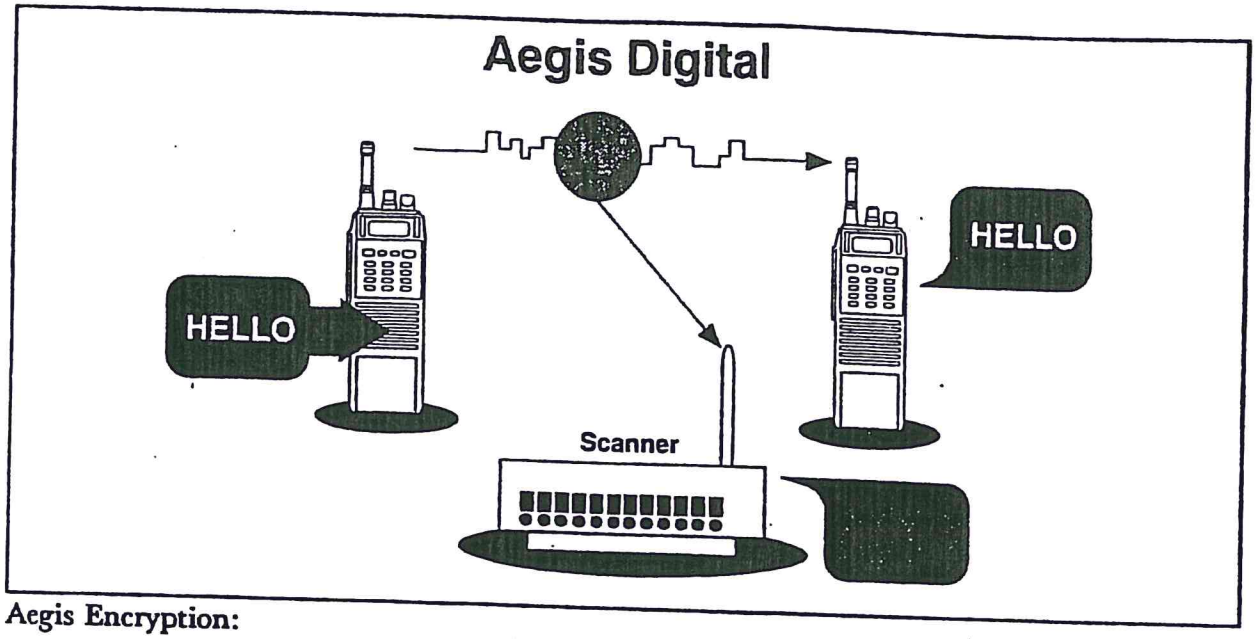
Aegis Modes

Digital:

Digitized voice with digital signaling for talk group selection and other functions.

Advantage:

High quality digital audio. Improved weak signal performance and intrinsic security from eavesdroppers.

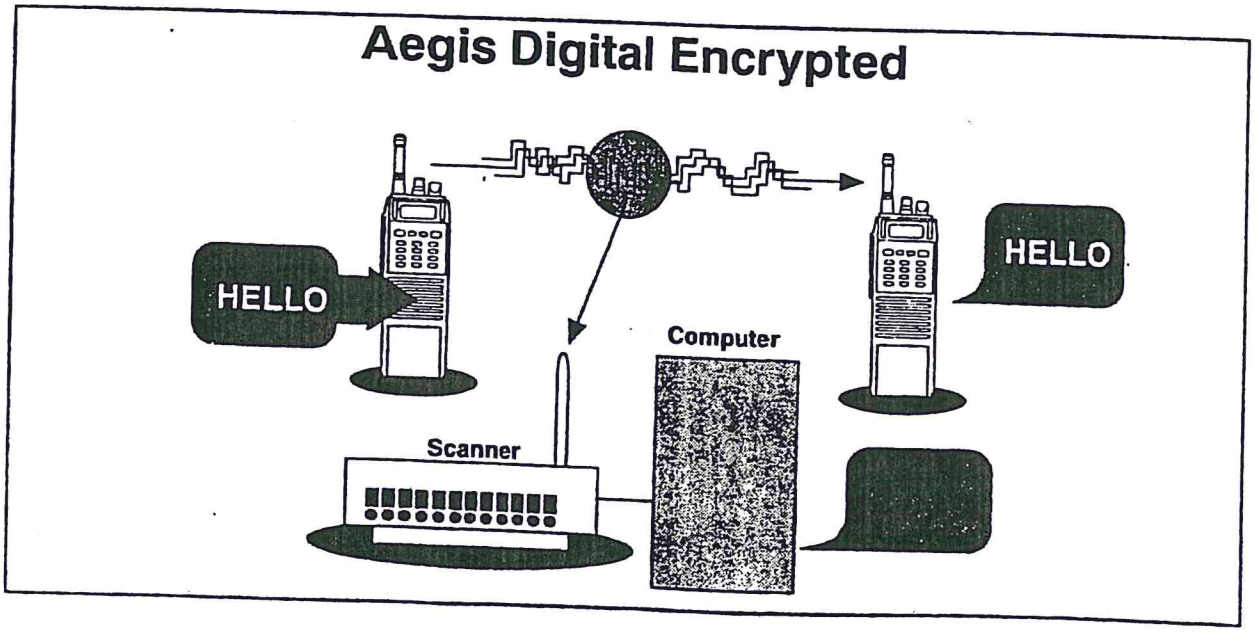


Aegis Encryption:

Encrypting the already digitized voice provides very secure communications even against sophisticated eavesdroppers. So secure, in fact, that it would require several years with a super computer to test all the possible combinations of encryption key codes to determine which one had been used.

Advantage:

Aegis encryption provides very high security with no loss of audio quality. Both DES and VGE algorithms are available.



Analog:

Aegis radios operate in an analog mode using Channel Guard or Digital Channel Guard.

Advantage:

Aegis subscriber radios are backward compatible with existing fleets of trunked or conventional analog radios.

Voice Guard:

Aegis radios may also be programmed to operate in Voice Guard mode (if Aegis radio is equipped with optional encryption).

Advantage:

This provides backward compatibility with existing Voice Guard Radios.

Aegis Advantages:

- Security - shields communications
- Range - improved performance
- Backward compatibility - communicates with Aegis radios, analog radios and Voice Guard Radios

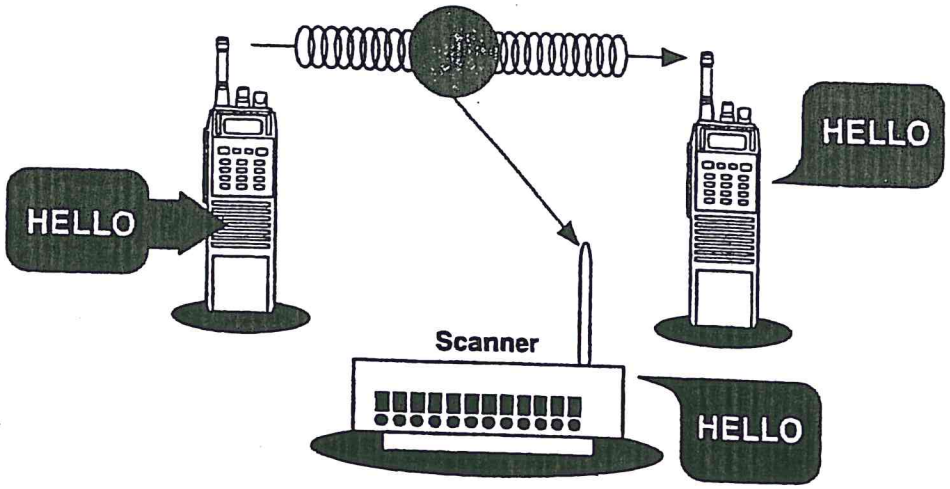
What Are Aegis Advantages?

Security

Security is the first and most important Aegis advantage. Because of the digital voice capability, even without encryption, Aegis transmissions cannot be overheard on standard radio scanners which rely on analog technology. Scanners can still receive the Aegis transmission signal, but the digital nature of the signalling shields you from unauthorized listeners.

Add Aegis encryption and the transmission becomes secure, providing protection against even the most sophisticated eavesdroppers.

Analog

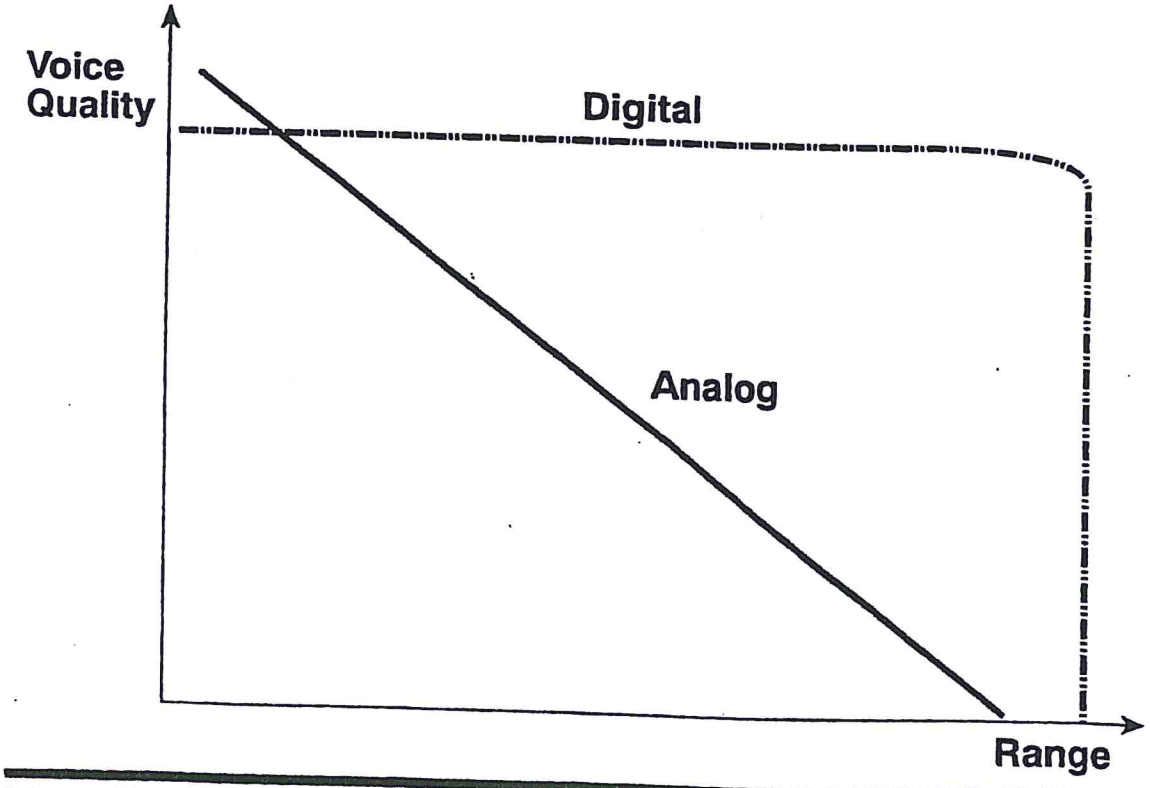


Range

Because Aegis is all digital, the radios no longer rely on signal strength alone to deliver the message. Sophisticated error detection and correction processing operates in every Aegis radio to reconstruct corrupted parts of a weak signal. Aegis technology also incorporates a unique audio regeneration technique to fill in missing parts of audio signals which are too weak to correct.

The result is improved performance in weak signal areas. Where an analog radio is putting out static, Aegis radios continue to perform. In fact, Aegis radios produce audio which is as clear near the fringe as it is close to the tower. Aegis delivers.

Range of Performance



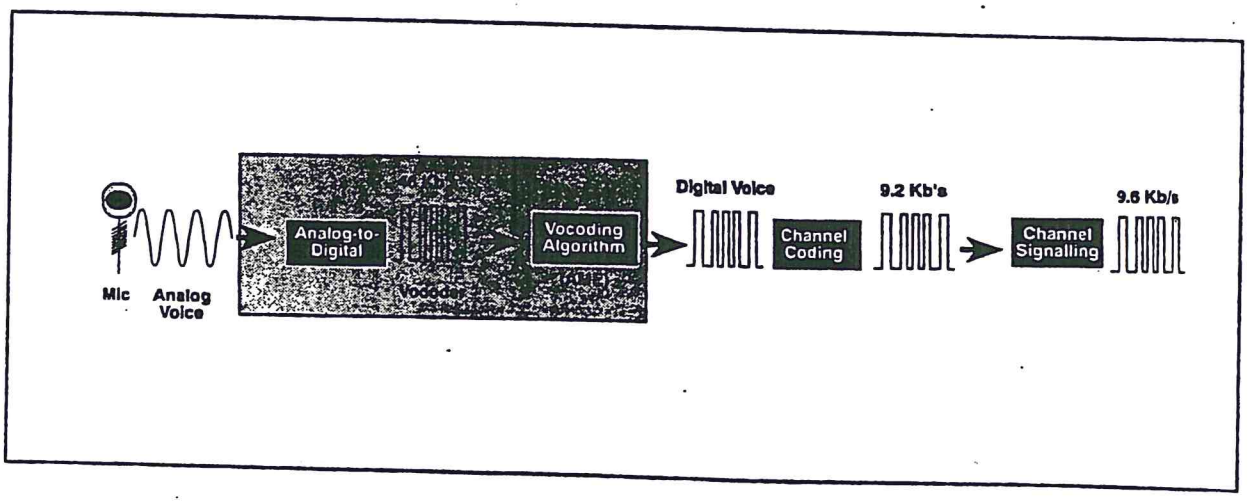
Full Backward Compatibility

Every Aegis radio is backward compatible with all existing EDACS radios and with any EDACS system infrastructure. This means that an Aegis digital user can communicate through an EDACS system with others who have either similar Aegis radios, existing analog radios, or existing Voice Guard radios.

How is Aegis Implemented?

Aegis is an ALL DIGITAL technology. This means that all transmissions on an Aegis radio channel are digitized. Every piece of information, speech, synchronization and embedded signalling is transmitted digitally on the radio channel.

The technique for converting analog speech signals to a digital data stream is called vocoding. The figure below depicts the vocoding process. The process consists of first converting to digital or sampling the input speech signal at some standard rate. The sampling rate used is 5800 samples per second. Each sample is assigned a "code" of 8 bits, producing a data stream of 46.4 Kilobits per second. The heart of the vocoding process now consists of "compressing" this high data rate to a lower, more manageable data rate in order to fit into a radio channel. This compression is accomplished by an advanced Digital Signal Processor (DSP).



The "compression" algorithm is key to producing high quality audio information at a data rate that will fit within a land mobile channel. Ericsson GE's Aegis technology has at its heart a proprietary, state-of-the-art digital signal processing technique called Adaptive Multiband Encoding (AME). AME dynamically adapts to the individual nature of each speaker to produce an "optimally" encoded digital audio stream.

After the vocoding process, error protection codes are added to the digitized audio stream. These sophisticated codes help correct data errors and protect the data stream in weak signal areas. This error correction performance is augmented in Aegis technology by a unique process called "Synthetic Audio Regeneration" (SAR) which actually replaces portions of the voice signal corrupted by noise with usable segments of speech.

Weak Signal performance is particularly important in the radio environment where fading and noise are commonplace. The result is that Aegis provides enhanced weak signal performance. In fact, Ericsson GE's Aegis technology operates with channel bit error rates (BERs) as high as 10%. This translates to signal conditions causing 1 in 10 bits to be in error. Such BERs are typical of signal conditions between 10 and 13 dB SINAD. Analog communication would be possible, but the noise makes it quite unpleasant and may interfere with understanding. This is the primary reason for the enhanced weak signal performance of Aegis.

The digitized audio stream along with its channel coding is split into data frames before transmission. Each of these frames are "encapsulated" with synchronization and embedded signalling information to form the 9600 bits per second data stream that is transmitted on the channel. This is the same 9.6 Kilobit data rate used everywhere on the EDACS system.

The signalling information in the Aegis data stream is used for a number of purposes on EDACS. These include:

- Unit Identification (or Push-to-talk identifications - ID's);
- Cryptographic synchronization when using Aegis Encryption;
- System update;
- Priority Scan information, and
- Talkgroup segmentation.

What Are The Components of Aegis?

The basic components of an EDACS system are as follows:

- The MASTR II, MASTR IIe or MASTR III EDACS Base Station
- Aegis M-PA portables

For Aegis encrypted applications, add the following:

- Aegis M-PA encryption option, either VGE or DES
- Cryptographic Keyloader - DES or VGE

For dispatch console applications, add the following:

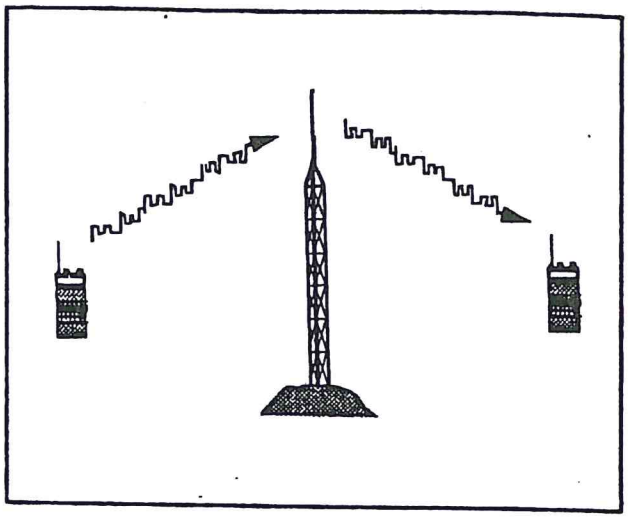
- Aegis Digital Voice Interface Unit (DVIU)

For EDACS, the upgrade to Aegis is as simple as purchasing Aegis Portable or Mobile units and programming them for operation on the trunked system. Every EDACS base station is inherently Aegis Capable.

The M-PA Aegis portable is identical in size and form factor to a standard EDACS or Conventional M-PA.

For Aegis encryption applications, the DES or VGE Cryptographic Keyloader must be used to lead crypto keys into the radio for secure operation.

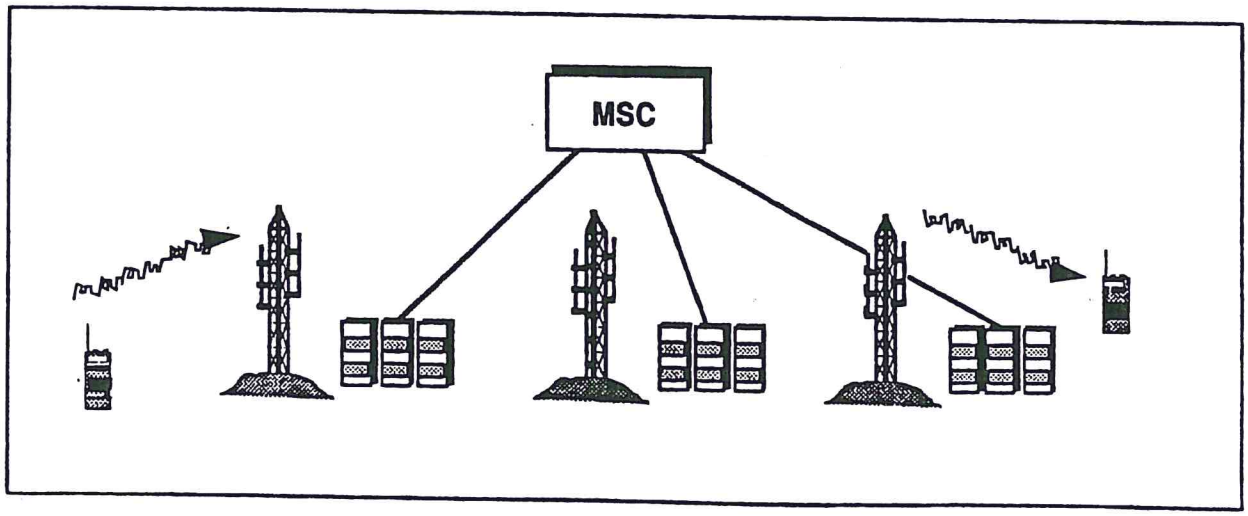
The Aegis DVIU is used to provide Aegis Digital voice capability at a Dispatch console.



Configurations: Simple System

Aegis is available in a Basic EDACS on a simple repeat basis. Here digitized signals are transmitted over the R.F. channel from the initiating radio to other radios in its talkgroup or to another individual radio in the case of an EDACS Individual Call.

The Simple Repeat configuration is the lowest cost option available for adding Aegis to an existing EDACS.



Configurations: More Complex Systems

More complex configurations on EDACS or conventional systems are possible to meet the requirements of virtually any communication need. Aegis EDACS configurations will include receiver voting, simulcast and multisite networks.

Summary

Aegis Technology is an ALL DIGITAL extension of EDACS. It provides outstanding audio performance while continuing the modular, building block approach of all Ericsson GE systems. Aegis is fully backward compatible with existing EDACS. This approach provides the best options for state-of-the-art, affordable digital performance. And, Aegis can be implemented today.

SECTION 9

9.1 OVERVIEW

Aegis provides fully digitized, high quality voice communication as an option on an EDACS or conventional system. The Aegis digitized voice transmission operates with the same 9.6 Kilobits/second data rate used by EDACS. On an EDACS system, digitized voice along with mobile terminal data are transported through the system at the standard rate of 9.6 Kilobits/second. All digital communications at a single, high data rate simplifies the system implementation and increases reliability. Aegis combines state-of-the-art digital communication with a variety of channel signalling features

An Aegis radio is capable of three voice modes, analog, digital and optional DES or VGE digital encrypted. An Aegis radio may operate in any of the three voice modes through either an EDACS station WITHOUT MODIFICATION or a conventional Mastr II/III station equipped with either a Voice Guard shelf or a digital shelf.

Aegis uses a vocoding method called Adaptive Multiband Encoding (AME). This unique vocoding method is responsible for the high quality digital voice exhibited by Aegis.

All the capability of Aegis is provided in a digital radio that is no bigger than the current M-PA analog radio.

Aegis, from Greek mythology, meant shield of the gods. Today, Aegis protects your communications and your investment in your communication system.

9.2 AEGIS BENEFITS

Aegis offers numerous benefits to a communications system operator. The primary benefits are described below.

ENHANCED RANGE PERFORMANCE

Aegis enhances the usable range of the radio. Digitizing audio permits the use of error correction bits to protect speech information such that the effects of a weak radio signal are minimized. Because weak signals are particularly evident at a greater distance from a radio tower, digital audio yields better audio quality than analog audio with increasing distance from the radio tower. Thus the usable range of an Aegis radio is enhanced.

Aegis' sophisticated bit error detection and correction method is the reason for the very good weak signal

performance. As the received signal weakens, bit errors are corrected and there is little change in the listener's audio signal. At even weaker signals, a process called synthetic regeneration is used to replace portions of the voice corrupted by noise and to provide usable communication. Aegis provides usable audio under weak signal conditions where as much as 10 percent of the digital data is in error.

The Diagnostic Rhyme Test (DRT), a measure of voice intelligibility, has shown that at weak signal levels, Aegis has better intelligibility than analog. For example, at 12 dB SINAD, the normal limit for analog communication, Aegis has a DRT score 25% better than analog.

Aegis also interleaves the voice and synchronization data providing late entry capability without voice interruption as well as scan operation in both digital and digital encrypted mode.

Inherent Security

Aegis is an inherently secure system, it is scanner-proof. Aegis digitized audio cannot be decoded by scanners which respond only to analog signals. Therefore, scanners cannot listen in on sensitive communications which is especially important during emergency situations. The Aegis signal, when decoded on a scanner, has no voice- like sounds providing even further security.

Enhanced Security

In addition to scanner-proof security, Aegis offers optional enhanced security. For extremely sensitive operations the digitized audio data stream may be encrypted with either the DES or VGE encryption algorithms. This provides communications security that is virtually breakproof.

Digital Performance With No Increase in Portable Radio Size

The AEGIS system provides analog voice, digital voice, and digital voice encryption all in the same size MPA portable radio package as the current analog radio. There is no size penalty for the added digital or digital encrypted performance. It's not worth getting digital performance if you have to sacrifice increased size in the portable radio.

High Quality Digital Voice

High quality digital voice is provided by the AME vocoding. AME was developed at the GE Research and Development Laboratory in Schenectady NY and patents have been applied for this unique process. One of the main features of AME is that it is computationally efficient which allows implementation in a Digital Signal Processor (DSP) chip that

is both size and current efficient. AME samples and allocates voice data bits 48 times per second to provide the high quality voice for all types of speakers and background sounds.

Full Backward Compatibility

Not only is the Aegis radio backward compatible with the system infrastructure in the analog mode but it is also backward compatible in the digital mode (and digital encrypted mode). No other digital radio provides this capability. Aegis provides FULLY FUNCTIONAL backward compatibility to protect your investment in your infrastructure and provide communications capability with other EDACS systems.

Aegis radios may also "down shift" to operate in Voice Guard mode if equipped with encryption. This allows interoperability with existing Voice Guard radios.

System Applicability

AEGIS is applicable to both conventional radios and trunking (EDACS) systems. In addition, the EDACS trunking system is AEGIS ready since the same 9.6 kilobit data rate is used for both signalling and AEGIS digital voice. Encryption using either the DES or proprietary VGE algorithm is available, providing much improved encrypted voice quality over previous digital encryption systems.

LEDR™ Subrate Series

LEDR 400S 330-512 MHz
LEDR 900S 800-960 MHz
LEDR 1400S 1350-1535 MHz
LEDR Protected
LEDR Fractional T1/E1 Interface

wireless

Features

- Frequency Range: 330 MHz to 512 MHz, 800 MHz to 960 MHz, or 1350 MHz to 1535 MHz
- Data Rates: Scalable from 64 kbps to 768 kbps
- Spectrally Efficient: Selectable 32 QAM, 16 QAM or QPSK
- Excellent Sensitivity: Better than −101 dBm @ 10^{-6} BER at 64 kbps
- Advanced Modem Features: FEC, Interleaver and Adaptive Equalizer
- Front Panel Displays for Easy Maintenance and Link Monitoring
- Built-in NMS Element Manager
- SNMP Network Management for Fault, Configuration, Performance and Security Management
- Integrated HTML web server allows networkwide management via the Internet
- Built in 9600 bps Data Service Channel
- Local Loopback and Remote Loopback
- 8 Relay Alarm Contacts per Radio
- DTMF Compatible Orderwire
- Optional interfaces for direct connection to Fractional T1/E1 circuits
- Optional 1+1 hot standby protected configuration
- Optional space diversity configuration

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For over 15 years, Microwave Data Systems (MDS) has been providing wireless networking solutions with applications in SCADA, telemetry, telecommunications, and online transaction markets. MDS provides licensed and unlicensed solutions, with more than 500,000 radios installed in over 110 countries.

Applications

- Point-to-point transmission applications
- Cost effective thin route applications
- Long haul telecommunication links
- Cellular backhaul
- Last mile links
- Trunked radio
- SCADA

Product Overview

The new subrate LEDR microwave radio family provides full duplex, scalable bandwidth and capacity from 64 kbps to 768 kbps in a 200 kHz channel. These radios are designed to operate in a point to point environment with a wide range of applications. They are especially effective for telecommunications access and transport links, wireless backbones for SCADA systems, and for use as backhauls to extend existing telecommunication channels. The subrate LEDR microwave radio is designed to connect to any industry standard EIA-530, V.35, fractional T1 or E1 source.

Maximum Data Throughput

Channel Size	Data Rate
25 kHz	64 kbps
50 kHz	128 kbps
100 kHz	256 kbps
200 kHz	768 kbps

industrial/wireless/performance

MDS

LEDR™ Subrate Series Specifications

General Specifications

Frequency Ranges:	
LEDR 400S	330-512 MHz
LEDR 900S	800-960 MHz
LEDR 1400S	1350-1535 MHz
RF Occupied Bandwidth:	25, 50, 100 and 200 kHz
User Data Rates:	64 kbps, 128 kbps, 256 kbps, 384 kbps, 512 kbps, 768 kbps

Permitted Data Throughput:

Channel Size	Data Rate
25 kHz	64 kbps
50 kHz	64 kbps to 128 kbps
100 kHz	64 kbps to 256 kbps
200 kHz	64 kbps to 768 kbps

Modulation Type:	32 QAM, 16 QAM, QPSK
FEC:	Reed Solomon
Temperature Range:	–5° to 50° C
Humidity:	<90% non-condensing
Voltage Range:	24 Vdc, or 48 Vdc (±20%)
Power Consumption:	<60 W
Size:	4.5cm (1U) x 48cm x 30cm 1.75in x 19in x 12in

Transmitter

Power Output:	+30 dBm (1W) at antenna port
Output Control Range:	0 dB to -10 dB
Frequency Stability:	1.5 ppm
Spurious Outputs:	< –60 dBc

Receiver

Sensitivity:

Bandwidth	Data Rate	BER @ 10^{-6}
25 kHz	64 kbps	–101 dBm
50 kHz	128 kbps	–98 dBm
100 kHz	256 kbps	–95 dBm
200 kHz	768 kbps	–92 dBm

Residual BER:	<1 x 10^{-10}
Dynamic Range:	>65 dB

Interfaces

Data:	EIA-530
Orderwire:	DTMF capable
Data Service Channel:	RS-232, 9600 bps
Ethernet NMS:	10 Base-T
Console Port:	RS-232, 9600 bps to 115.2 kbps
Alarms:	4 programmable outputs, 4 programmable inputs
Antenna:	50 Ohms Impedance

Options

- Space Diversity
- Hot-standby Protected
- Bandwidth Upgrade Kits (consult factory for details)

Accessories

- 110/240 VAC , 50/60 Hz Power Supply
- Orderwire Handset
- G.703 120 Ohms to 75 Ohms balun

Network Management

Local LED Indicators:	Front Panel LED status indicate: Power, Active, General Alarm, Rx Alarm, Tx Alarm, I/O Alarm.
Front Panel LCD:	Display & keypad for management of local & remote radio.
Element Management:	Full management of LEDR network via command line interface.
SNMP Management:	Full IP-based management of LEDR network and SNMP-enabled peripherals via custom enterprise MIB
HTML Webserver:	Full IP-based management of LEDR network and web-enabled peripherals via any web browser (eg Netscape™ or Internet Explorer™)

Protected

Configuration:	2 x LEDR radios, connected via protected switch box
Total Size:	2 x 1 RU high + 1 x 2 RU high
Transmit Switching:	Hitless, <100ms
Transmit Branching Loss:	2 dB
Receive Branching Loss:	5 dB

Agency Approvals

LEDR 400S:	Transmission: FCC Part 90, IC RSS-119 EMC: ETS 300 385, FCC Part 15
LEDR 900S:	Transmission: FCC Part 101, IC RSS-119 EMC: FCC Part 15
LEDR 1400S:	Transmission: ETS 300 630, MPT 1717 Environmental: ETS 300 019, Class 3.2 EMC: ETS 300 385 Safety: CE Mark

LEDR Fractional T1/E1 Interface Card

General Specifications

Line rate:	T1 (1.544 Mbps); E1 (2.048 Mbps)
Channel Size:	200 kHz,
Data Rate:	768 kbps (12 x 64 kbps)
Framing:	SF, ESF (T1); FAS, CAS, CRC (E1)
Signalling:	RBS (T1); Time Slot 16 CAS (E1)
Line Codes:	AMI, B8ZS, B7ZS (T1); AMI, HDB3 (E1)
Interface:	RJ48C Balanced Interface 100 Ohms (T1), 120 Ohms (E1)

General

Size:	15.24 cm x 12.7 cm (6 in x 5 in)
Configuration:	Option card, fitted internal to LEDR chassis
Availability:	Fractional T1: LEDR 900S Fractional E1: LEDR 400S, LEDR 900S, LEDR 1400S

industrial/wireless/performance

MDS

Microwave Data Systems Inc.
175 Science Parkway
Rochester, New York 14620, USA
Phone (585) 242-9600
Fax (585) 242-9620
www.microwavedata.com

MIDDLE TOWNSHIP POLICE DEPARTMENT

31 Mechanic Street, Cape May Court House, N.J. 08210
609-465-8700 Fax: 609-465-6748

To: Captain Webster

From: Sgt. C. Leusner

Re: Radio Problems- 01-15-2005

Date: January 15, 2005

Captain,
I received complaints from dispatchers and officers about radio problems during the shift. Officers were inside houses on Bayview Ave. and School Lane and dispatch was unable to get through to them. Ptl. Loftus was on a property check at Village Shops, found a unlocked door and was unable to communicate it to dispatch. He walked back to his car to transmit for back-up and a emergency contact. I had problems communicating on my portable in the station to officers in vehicles and on portable. Dispatch copied me loud and clear and then relayed my message successfully for me. During the shift I conduct a radio test from different locations.

Economy Motel- Portable loud and clear to dispatch.

Rio Grande Wawa-Portable loud and clear to dispatch, but unable to communicate with Ptl. Harron who was on portable at the Green Creek Sub-station. Ptl. Harron was able to communicate with dispatch but not me on portable.

Green Greek Sub-station-loud and clear to dispatch, but unable to communicate with Ptl. Loftus who was on portable in Mayville. Ptl. Loftus was able to communicate with dispatch but not me.

Sunray Beach Road and the Bay-first transmission was loud and clear to dispatch. The following transmissions when I was trying to reach other units in the vehicles and on portable were not copied by dispatch. I do not know why they copied the initial transmission but not any that followed.

State Highway 47 and CR 657- Unable to reach dispatch or any other unit.

Note: I waited for the beep before every transmission and kept my mouth at the proper distance from the microphone.

I just wanted to let you know so hopefully we can get these kinks worked out.

Respectfully Submitted,
Sgt. Chris Leusner

Section#2

Section#2: 2010 Radio Task Force

In this section you will find a Memorandum dated January 28, 2010 to Township Committee requesting $205,186 in Capital to upgrade our Communication System. You will also find the reports from the Radio Task Force that prompted the above requests. In the Spring of 2010, Township Committee authorized the Capital funds and purchased 50 new portables, 3 radio links, and equipment for the links. These upgrades did make an improvement but the system still did not perform to an acceptable level. We were still experiencing dead spots in the south end of the Township, some in the very northern end and in building coverage was spotty at best.

Memorandum

To: Township Committee

CC: Chief P. Hand, Chief R. Sweeten, Chief D. Zeiss, Chief B. Myers, PBA Local#59

From: Chief Christopher M. Leusner

Date: January 28, 2010

Re: Radio System Proposal

Dear Committee,

In October of 2009 three officers were assigned to a Radio Task Force, Captain Paul Fritsch, Patrol Sgt. P. Conte and PBA Local#59 representative Det. C. Stocker. The Task Force mission was to identify a company to solve our radio issues. WPCS, Inc., formerly Quality Communications was recommended by the Task Force to conduct a review of our radio system. They found many of our portables and mobile radios were programmed with different firmware, not the latest version from Mia-Com. They also attempted to get error reports from Verizon on the T-1 lines that run from our repeater sites to headquarters. Verizon did not get back to WPCS, but acknowledged that there were periodic problems with the T-1 lines. This has been confirmed by Chief B. Myers from the Goshen Fire Company, who recently retired from Verizon. We are proposing the following steps to fix our radio system.

1. Reprogram all mobile and portable radios to the latest firmware. (Covered under new maintenance agreement with WPCS)
2. Install Wireless Links on all three Repeaters Sites. This will eliminate the need for the T-1 lines.
3. Purchase new portable radios.

The Radio Task Force has recommended the purchase of new portable radios. The upgrade to the latest firmware will be an improvement, but we still have issues with the actual hardware. The Mia-Com portable radios are poor quality and have been repaired constantly since we received them in 2003. We have gone through hundreds of knobs, the antennas have been replaced numerous times, the battery lives of the portables are poor and many have gone back for problems with the push to talk button.

In 2007, we started to purchase Motorola digital portables and have not had any hardware issues and they appear to perform better. We currently have six Motorola digital portables in the field. The price of a Motorola digital portable is: $1875.00. This is significantly higher than a Motorola analog portable radio. If the digital frequency works properly, it should provide transmissions that have greater clarity and better coverage.

The digital frequency does isolate us from other Law Enforcement agencies and the public. This creates interoperability problems with other Law Enforcement agencies. Middle Township's size and central location in the County for government and business districts presents many incidents that require coordination with these agencies. Part of the argument for digital in 2003 was the privacy and security of transmitting information that was not heard by the general public on their scanners. We now have mobile data terminals in each patrol car and these allow for silent dispatch and secure transmissions if necessary. The public has assisted us in a number of situations over the years from hearing different calls dispatched to our officers.

We recommend the installation of Wireless links as soon as possible. After the installation, we would then review the performance of our Motorola and Mia-Com digital portables in the field. If we see a significant difference in the performance of the radios from digital to analog, then we would ask the Township to purchase new Motorola digital portable radios. If we do not see a significant difference in the performance of the digital radios, than we would ask the Township to purchase new Motorola analog radios at a cost of approximately $500.00.

I am somewhat suspicious of the performance of digital in the 150 frequency range. We currently operate in the 150 frequency range. The digital frequencies in this area are in the 400 to 800 frequency range. I had spoken with the consultant, Dominic Villecco, from VCOMM and he states digital systems in the 150 range are a success in the Mid-West. I would be more confident, if a municipality in similar characteristics to Middle Township had a successful digital system in the 150 range.

We are asking the Township to allocate Capital funds to cover the installation of the Wireless Links and new Motorola Portable Radios. Although, it is unknown if we would purchase the

more expensive digital portables, we would like to have the funds available if it appears the digital is a better option.

Cost:

Wireless Links and Installation:	$111,391.00
50-Motorola Digital Portable Radios:	$93,795.00
Total Cost:	**$205,186**

Note: WPCS, Inc. states that it will take 90 to 120 days to install the Wireless Links depending on how fast they get FCC approval. The Wireless Links are under State Contract. I would ask the Township to research the feasibility of starting the process of ordering these links as soon as possible.

Finally, there will be a savings in the elimination of the monthly cost of maintaining the Verizon T-1 lines.

Respectfully Submitted,

Chief Christopher M. Leusner

COPY

Radio Task Force

November 4, 2009

Det. Clint Stocker and I, Capt. Paul Fritsch went to the North Brunswick Police Department, 710 Hermann Road, North Brunswick, Middlesex County, New Jersey. We were escorted for our radio review by Lt. Ken Pado and administrative clerk Jim Curry, who is a retired police officer. We were shown the radio room, dispatch center, and took a ride in a police vehicle to check their radio system. The following facts are noted:

- The North Brunswick police department has 80 members, and covers approximately 12 square miles.

- Approximately 3 years ago, they received a new radio system installed by the Motorola Company "Quality Communications" which is now "WPCS". They went with Quality Communications because they wanted Motorola equipment. Officers said that Motorola equipment worked better than other equipment they had in their previous radio system. They also researched the "Zetron" dispatch boards and wanted them, which Quality also installs.

- Quality installed a Mixed Mode (digital and analog) radio system in the 400 to 512 MHz range. Their output power is 100 watts. (See attached 5 pages of radio system description) Middle Township's area is larger than North Brunswick's, but the radio systems are similar. Middle Township has a main site and three receive sites. North Brunswick has a main site and two receive sites. They do not use microwaves from the receive sites, but do use phone lines. It should be noted that all phone lines were installed new from their two receive sites to the main site when their radio system was done. It should also be noted that before Quality did their system, they had 6 receive sites, and now with the two they have, the system works better.

- The portables they use are the Motorola XTS2500. The mobiles are the XTL2500, except for their command vehicles which have the XTL5000. This allows the command vehicles to have a separate radio head in the rear in case the vehicle is used as a command post.

- Their entire system cost approximately 1.1 million dollars. (This included 100 portable radios.)

- It is reported that in the three years using their portable radios, they have not had to buy any batteries for the portables. Lt. Pado showed us his portable, and the battery was 4 years old and still worked like new.

- During inspection of the radio room, the installation work done by Quality Communications was noted to be very neat and professionally installed.

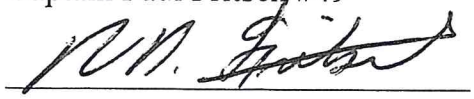
- In the dispatch center, the radio transmissions in the digital mode were very clear. At no time was there any mis-understanding of what was being said.

- During our ride in the police vehicle, Lt. Pado made many radio checks. He drove approximately 7 miles from the station. He spoke on his portable and vehicle radio to other portable and mobile radios, as well as the dispatch center in digital mode. He also spoke to the Public Works department in the analog mode. All communication was excellent, being clear and understandable. It should be noted that the digital does have a little different sound to it. This is what we have been told by Tectron with Middle Township's digital system. North Brunswick's different sound cannot be compared to Middle Township's different sound. North Brunswick's was a little different, but completely understandable. It was "night and day" better that Middle Township's digital sound.

- Lt. Pado stated that some surrounding police departments use Quality Communications for their radio work. He has not heard of any problems with any of the systems. One of the neighboring departments actually went with Quality Communications because of how good North Brunswick's system was.

I would highly recommend that the Middle Township Police Department contract with "WPCS" to inspect Middle Township's radio system, to find out what is wrong. Once this is done, I would hope that WPCS would be contracted to fix our system. (See Det. Stockers report also)

Captain Paul Fritsch #49



SYSTEM DESCRIPTION

Motorola is proposing a one channel Mixed-Mode radio system, to provide enhanced voice communications for North Brunswick, NJ.

The proposed system will have the following topology:

- Adams Lane (Main Site)
  - Three (3) Quantar Repeaters operating in both Analog and ASTRO digital.
- Renaissance Water Tank
  - Three (3) Quantar Receivers operating in both Analog and ASTRO digital.
- North Brunswick PD (Back-Up Station)
  - Three (3) Quantar Repeaters / Receivers operating in both Analog and ASTRO digital

All remote radio sites will connect via customer provided radio tie line circuits to an ASTRO-TAC 3000 Voting Comparator (ATAC). A DIU 3000 (Digital Interface Unit) will interface the voting comparator to the Console system. ~~Note: a Motorola console system will need to be purchased in order to work with the DIU as an Analog/Digital mixed mode~~ system.

Each receive only site will be equipped with a 60" indoor cabinet. Due to environmental conditions at some of these sites, Motorola highly recommends HVAC cabinets to maintain the equipments operational specification. These cabinets are not part of this quote, but they can be quote as requested.

Mixed Mode Operation

Analog and ASTRO 15 digital operation on the channel is transparent, in that it is automatically selected by the input of the subscriber radio in either mode. Like a radio user, the console operator (when included) can select to transmit in either mode. Digital operation does not provide the CTCSS PL tone and will not normally be heard by analog units until they monitor the channel prior to transmission. Analog transmissions will automatically be heard by digital capable radios by coding the channel personality for digital channel access selection using the mixed mode receive option. Digital operation can also be established radio to radio in a talk around mode if that operation is required.

Adams Lane (Main Site)

Motorola will install ~~One~~ three (3) 100-Watt Quantar repeaters in the radio room at Adams Lane. The station will transmit at 502.3875, 506.600, 471.100 MHz. The repeaters will be equipped with ASTRO modems to interface to the ASTRO-TAC 3000 comparators. The ASTRO-TAC 3000 comparators will interface the DIU 3000 which will convert the digital signal into analog or the analog signal into digital. The signal will then pass over to the console. The repeaters, comparators, and DIUs will be installed in a 60" Indoor cabinet.
A combiner, multicoupler and UPS will also be mounted in the cabinet.
Motorola will provide and install ~~one~~ two new antenna and transmission line. The antenna will be mounted at 150 foot level using 7/8" LDF line.

Renaissance Water Tank (Receive Only Site)

The Renaissance Water Tank receiver site will be equipped with a ~~One~~ three (3) Astro-Tac receivers mounted in a 60" indoor cabinet. The receivers will be equipped with an ASTRO modems that will be tied back to the comparator at Police Headquarters via customer provided radio tie lines.
Motorola will provide and install two new antennas and transmission lines. The antennas will be mounted at 150 foot level using 7/8" LDF line.

North Brunswick Police Department (Back-Up Station)

Motorola will install ~~One~~ three (3) 100-Watt Quantar repeaters mounted in a 60" indoor cabinet at the radio shelter of the North Brunswick Police Department. The stations will operate as a receivers only until such time as the back-up station repeaters are required. The Quantars when activated will assume the repeater operation. Activation will be tied to the console. Motorola will provide and install two new antennas and transmission lines. The antennas will be mounted at 130 foot level using 7/8" LDF line. Note: North Brunswick Police Department site will serve as a back-up to the Adams Lane site if it goes off the air.

Astro-Tac 3000 Comparator

The Astro-Tac Comparator is a band independent device that acts as a system-wide signal collector, voter, and distributor. It extracts the best possible signals from multiple signal sources and delivers it to single or multiple destination(s). In order to do that, the comparator communicates with the surrounding ASTRO infrastructure elements such as base stations/repeaters, satellite receivers and dispatch consoles via a Digital Interface Unit (DIU). The method of signal selection is based upon a combination of specific voting parameters such as BER (bit error rate) and ECC (error correction coding).

The Astro-Tac Comparator features a state-of-the-art digital voting methodology: Frame Diversity Reception. The Astro-Tac™ Comparator votes on 30 msec segments of each signal based upon certain digital signal parameters. As the comparator receives the various signals, it looks at each of the 30 msec data frames and compares the BER and ECC. The comparator then selects the data frame or signal with the lowest BER and ECC and re-sends it. By utilizing the best pieces (data frames) of each input signal, the result is often a better output signal than any one signal being received at the comparator.

Digital Interface Unit (DIU)

Current analog system tone remote console products can be interfaced to an ASTRO radio infrastructure by way of a Digital Interface Unit (DIU). The DIU is a stand-alone device connected between a control console (with one or more operators) and the Astro-Tac™ 3000. The DIU performs three key functions for the console operator(s):

- It contains the IMBE circuitry used to perform the analog-to-digital (A/D) signal conversion of outbound voice messages and the digital-to-analog (D/A) signal conversion of inbound voice messages.
- It generates ASTRO station keying command sequences. Any tone remote control sequences sent by the console are converted to digital commands and then inserted in the ASTRO signal's embedded signaling.
- It routes ASTRO embedded signaling information to a separate port, so the appropriate console hardware or external device can access it for decoding.

Coverage Expected Performance

As part of this proposal, Motorola has included a coverage test to prove that the predicted coverage maps are accurate.

Motorola will guarantee a Delivered Audio Quality of 3.0 with 97% area reliability using a Portable in-street, only in the color shaded areas within the Town of North Brunswick borders as shown in the coverage prediction survey. A Delivered Audio Quality of 3.0 represents a received signal where speech is understandable with slight effort. Occasional repetition may be required due to noise and/or distortion. In-building coverage **is not** guaranteed under this proposal. Coverage maps shown in this proposal were based on the FCC License Call Sign WQBC455 provided by North Brunswick, using an Effective Radiated Power (ERP) of 100 watts and 502.3875 MHz transmit frequency. Any changes to

this license ERP, coordinates, frequencies, sites locations or antenna heights will result in a change of coverage and new maps will have to be generated, Motorola can generate new maps for North Brunswick via a change order to the original contract where the Township will be responsible for the extra charges that will occur. Furthermore, if for some reason North Brunswick cannot use the proposed sites as part of the conventional system, the Coverage Acceptance Test Plan CATP and coverage guarantee included with this proposal will be void.

Phone Line Requirements

The following table defines the parameters required as part of the Type 5 specifications.

Tone Remote Phone Line Requirement	Type 5 Specifications	3001 Specifications
Insertion Loss @ 1 KHz	0 to 16 dB (Depends on NeOnerk Interface)	16 dB
Loss Variation @ 1 KHz • Long-Term • Short-Term	± 4 dB	± 4 dB ± 3 dB
Modem Tolerance • Bandwidth	1700 KHz (300-3000 Hz)	1700 KHz (300-3000 Hz)
Frequency Response (Ref 1000 Hz) • 400 - 1800 Hz • 500 - 1500 Hz • 300 - 3000 Hz	 Loss, -1 to +10 dB Loss, -1 to + 8 dB Loss, -1 to +11 dB	 Loss, -1 to + 8 dB Loss, -1 to +11 dB
Delay Distortion 800 - 1600 Hz	1750 µsec	1750 µsec
Maximum Average Input Signal Level	-5 dBm at NeOnerk Interface	-5 dBm at NeOnerk Interface
Maximum Test Tone Level	0 dBm at NeOnerk Interface	0 dBm at NeOnerk Interface
Signal to C-Message Noise Level	>14 dB	>14 dB

Frequency Shift	±3 Hz	±5 Hz
Phase Jitter	<10 Degrees (10-300 Hz)	<10 Degrees
Local Channel Termination (at NeOnerk Interface) • Full Duplex DVM • Simplex TX or RX DVM	Specify 4-wire, FD Specify 1 wire, FD	Specify 4-wire, FD Specify 1 wire, FD

Phone line circuits for satellite receiver only sites

- Three (3) 4-Wire Type 5 circuit with D conditioning from Renaissance Water Tank to a punch block inside of the radio room at Police Headquarters.
- Three (3) 4-Wire Type 5 circuit with D conditioning from North Brunswick PD (Back-Up Station) to a punch block inside of the radio room at Adams Lane.

Motorola will review all circuit requirements as part of the development of the cutover plan. The development of the cutover plan must take place prior to installation of equipment.

"Radio Task Force"

November 4, 2009

Captain Fritsch and I went to North Brunswick Police Department, 710 Hermann Road, North Brunswick, Middlesex County, New Jersey. We were escorted for our radio review by Lt. Ken Pado and administrative clerk, Jim Curry, who is a retired police office. We were shown the radio room, dispatch center, and took a ride in a police vehicle to hear communications on their radio system.

We were escorted into the radio room. I observed the installation of the radio system to be very neat and orderly. I photographed the radio system and the photographs were burned onto the attached CD-R. Lt. Pado stated they installed the radio system three years ago and stated that "Quality Communications" which is now "WPCS" installed the system and they have had no problems what so ever with their radio system.

We were then taken into the dispatch center where I tape recorded communications between the dispatch center and patrol officers on their daily routine calls on their digital radio channel. Both transmissions from dispatch to the patrol officers and from the patrol officers to dispatch were crystal clear. I could hear every word with no problem. The digital transmissions were slightly different in sound then the analog system. There was no comparison between their digital system and ours. Their digital communications were clear and understandable where our digital system sounds like your talking in a tin can and parts of the transmissions are dropped. I couldn't believe they were on a digital system after being told by Tektron that our system is the best it was going to be for a digital system.

After our time in the dispatch center we were taken for a ride around North Brunswick in a police vehicle. Several radio checks were performed by Lt. Pado. The digital transmissions were crystal clear. At one point he shut off his car radio and turned on his portable. A radio check from dispatch to the portable radio operating inside Lt. Pado's car was crystal clear. Lt. Pado switched his car radio to the analog side and conducted a radio check. The analog system was clear but their digital system sounds better. These radio transmissions were also recorded and are on the attached mini cassette tape.

Members of the North Brunswick Police Department report having no problems or complaints with their radio system. They indicate that their portable battery life is outstanding and go for a week at times before having to charge their batteries. Their portable radios have had the same batteries in them for the past three years.

I would recommend that the Middle Township Police Department contract with "WPCS" to inspect our radio system to find out what is wrong. Once their inspection is complete, I would hope they would be contracted to fix our radio system.

Refer to "Task Force Report" submitted by Captain Paul Fritsch for details on the radio system North Brunswick Police Department has in place.

Detective Clint Stocker #070
Middle Township Police Department

COPY

Radio Task Force

January 27, 2010
Update and action plan on Middle Township Police Department's radio system.

The following State contract quotes were received from WPCS.
01-04-2010 $93795.00 fifty (50), Motorola XTS2500 digital portable radios.
01-05-2010 $67444.95 equipment for three(3) integrated radio links (microwaves).
01-18-2010 $43946.50 Installation of the (3) integrated radio links (microwaves).
(Attached are copies of all 3 quotes)

On 02-01-2010, a WPCS tech will be here to upgrade the 2 mobile and 6 portable Motorola radios that we have. Soon there after, they will upgrade the rest of the Macom mobile and portable radios that we have. (This has to be done as WPCS discovered that our Macom radios had a variety of different software upgrades installed dating back to 2006, although they were supposed to have been upgraded by Tectron in 2009.) This should improve the radio system as a whole. The only question then would be the intermittent problems of our radio system. (We are not on the digital side of the TAC 1 now due to intermittent problems.) Most persons questioned believe this intermittent problem to be attributed to the T-1 phone lines that connect the three remote receive sites, and transfer the signal back to the station. (This even was the opinion of a retired Verizon employee.) The task force believes that even after the upgrades of all of the departments mobile and portable radios, the township should plan now, and be ready to proceed with the following two main items:

1/ The quality of the Macom portable radios has been questioned since we received them 5 years ago. There has been numerous problems and repairs required on them. Even if they are upgraded, if they "fall apart" we will still need to replace them with new Motorola portable radios.
2/ The intermittent radio problems in general seem to always get directed back to the "T-1" Verizon lines. We must also plan to replace this part of the system with microwave links.

There is an alternative which would save some money. The Motorola digital portables have a price of almost $1900.00 per radio. You can get a Motorola analog radio that would be about 75% less. Back when we first went digital, one of the benefits was to be more secretive with our communications. With the inception of MDT's in the cars, I don't know how imperative it is to have digital radio's. There is an argument that a digital signal is better than analog. But if we install the microwaves and the analog signal is just as good, I would suggest saving money and purchase analog radios, and keep the digital channel for a back up, utilizing what digital radios we have.

Capt. Paul Fritsch #49

Det. Clint Stocker #70

Customer Name:	**Middle Township PD**	Creation Date:	1/4/10		
Customer Address:	31 Mechanic St. Cape May Courthouse, NJ	Revised On:			
Equipment Description:	Portable Radios	Print Date:	1/4/10		
Motorola Sales Person:	Ken Lamastra	Valid Until:	6/30/10		
Motorola Engineer:		State Contract#	53804		

MOTOROLA
C/O
WPCS International Inc.
1985 Swarthmore Ave.
Lakewood, NJ.08701

Commodity Code	Line No	MODEL #	DESCRIPTION	List	discount	List price	QTY	Extended
837-48-033794	00019	H46SDC9PW5AN	XTS2500 Astro Digital Portable, Model 1.5, UHF	$950.00	25%	$712.50	50	$35,625.00
837-48-033794	00019	Q811	P25 Conventional Software	$1,060.00	25%	$795.00	50	$39,750.00
837-48-033794	00019	H885	Extended Warranty	$41.00	0%	$41.00	50	$2,050.00
725-78-038496	00087	PRGRM	Portable Programming	$41.30	0%	$41.30	50	$2,065.00
837-48-033794	00019	WPLN4111AR	Single Unit Impres Charger	$165.00	20%	$132.00	50	$6,600.00
837-48-033794	00019	NNTN4116	Leather Case w/ High Activity Swivel 2.5" Loop	$60.00	20%	$48.00	50	$2,400.00
837-48-033794	00019	NTN9858AR	NiMH Battery, 7.5 V, 1525 mAh	$121.00	70%	$36.30	50	$1,815.00
837-48-033794	00019	NMN6193	Remote Speaker Mic	$87.25	20%	$69.80	50	$3,490.00

New Jersey State Contract **Total** **$93,795.00**

NJ STATE CONTRACT PURCHASES - SALES TERMS AND CONDITIONS:

1) Payment Terms: Payment is due within 30 days after the equipment is shipped from our factories. Individual items are billed as they are shipped.

2) Price & Terms Validity: All prices, terms, & conditions in this quotation are based on Motorola's New Jersey state contract # 53804. Our state contract is valid until June 30, 2010 and all prices were discounted in accordance with our state contract.

3) Warranty Period: Motorola's standard warranty is one year on parts and labor, from the date of shipment of the equipment.

4) Shipping: Shipping is done via UPS, truck freight, or electronics delivery van. Delivery is FOB destination and ground shipping charges are are paid by Motorola under the terms of our state contract. Ground shipping time normally takes approximately 7-10 days.

5) Delivery Schedule: All delivery times are from the date the FACTORY receives the order. Order processing time may add up to an additional week to the factory delivery times quoted below. Delivery: 2 to 3 weeks.

Parts & Accessory items (if in stock) 1-2 weeks

Customer Name: **Middle Township Police Department**
Customer Address:

Equipment Description: PTP Links
Motorola Sales Person: Ken Lamastra
Motorola Engineer:

Creation Date: 1/5/10
Revised On:
Print Date: 1/5/10

Valid Until: 6/31/2010
State Contract# **53804**

MOTOROLA
C/O
WPCS International Incorporated
1985 Swarthmore Ave.
Lakewood, NJ. 08701

Commodity Code	Line No	MODEL #	DESCRIPTION	List	discount	List price	QTY	Extended
837-48-033738	00004	WB3225AA	**PTP 49600 INTEGRATED LINK- COMPLETE**	$13,995.00	15%	$11,895.75	3	$35,687.25
837-48-033738	00004	WB3229AA	PTP49600 INTEGRATED END-SPARE	$7,695.00	15%	$6,540.75	1	$6,540.75
837-48-033738	00004	WB3001	MEMORY LINK SYNCRONIZATION UNIT	$495.00	15%	$420.75	3	$1,262.25
837-48-033738	00004	WB2978AA	LIGHTNING PROTECTION UNIT	$150.00	15%	$127.50	6	$765.00
837-48-033738	00004	WB2533A	2 YEAR WARRANTY AND ADVANCE REPLACE	$3,047.00	15%	$2,589.95	6	$15,539.70
837-48-033738	00004	WB3108A	SW SUPPORT	$1,500.00	15%	$1,275.00	6	$7,650.00

New Jersey State Contract **Total** **$67,444.95**

NJ STATE CONTRACT PURCHASES - SALES TERMS AND CONDITIONS:

1) Payment Terms: Payment is due within 30 days after the equipment is shipped from our factories. Individual items are billed as they are shipped.

2) Price & Terms Validity: All prices, terms, & conditions in this quotation are based on Motorola's New Jersey state contract # 53804. Our state contract is valid until June 31, 2010 and all prices were discounted in accordance with our state contract.

3) Warranty Period: Motorola's standard warranty is one year on parts and labor, from the date of shipment of the equipment.

4) Shipping: Shipping is done via UPS, truck freight, or electronics delivery van. Delivery is FOB destination and ground shipping charges are are paid by Motorola under the terms of our state contract. Ground shipping time normally takes approximately 7-10 days.

5) Delivery Schedule: All delivery times are from the date the FACTORY receives the order. Order processing time may add up to an additional week to the factory delivery times quoted below. Delivery: 2 to 3 weeks.

Parts & Accessory items (if in stock) 1-2 weeks

WPCS International Inc

Lakewood Operations
1985 Swarthmore Ave
Suite 4
Lakewood, NJ 08701
Phone: 732-730-9000
Fax: 732-730-9005

Engineering for the Future

Quote No: Q14016

Prepared for: Capt. Paul Fritsch

Date: 1/18/2010

Customer Address: **AcctNo:** 26201

MIDDLE TOWNSHIP POLICE
31 MECHANIC STREET
CAPE MAY COURT HOUSE, NJ 08210

Terms: Net 30 Days

The following proposal represents the equipment and labor required to link the Police and Fire radio channels from the Remote Receiver Sites back to Headquarters. The links are wireless, eliminating the cost and need of the current T-1 leased lines.
The Reciever Sites included are Goshen Tower, Rio Grand Comcast Tower and Green Creek Fire Tower.

WPCS State Contract A53766

Description	Qty	Price	Extended
FCC LICENSING APPLICATION	1.00	1,500.00	1,500.00
Orthogon Surge Supressor	6.00	225.00	1,350.00
Outdoor rated Cat 6 cable- 500'	3.00	370.50	1,111.50
INSTALLATION OF EQUIPMENT: Includes Antenna Installation at PD Headquarters, Goshen Tower, Green Creek Fire Tower and Rio Grande Comcast Tower, Cable Runs, Equipment mounting, Optimization and 1 year warranty.	1.00	39,985.00	39,985.00

Thank you for the opportunity to provide this quotation.

Sub Total: 43,946.50
Sales Tax: 0.00

Sales Rep: KENNETH J LAMASTRA **Ext.** 106
ken.lamastra@wpcs.com

Total Quoted Amount: 43,946.50

Section#3

Section#3: NJ Statewide P25 Network

In this section you will see an article from New Jersey Law magazine that talks about Public Safety Telecommunications Post 9/11 and New Jersey's Statewide P25 Network. New Jersey's Statewide P25 Network is a 700MHz digital trunked radio communication network and it provides coverage in 95% of the state. Included is a print screen shot from the website http://www.nj.gov/911/p25/index.shtml that is dedicated to explaining this network.

In Cape May County the state has three tower sites:

1. **Cape May County Library**
2. **Woodbine**
3. **Cape May County Airport**

We tested this system for over a month earlier this year and I asked the Sergeants, the Senior Dispatchers and the PBA to provide me a letter on their experience with the system and whether or not I should recommend it's purchase to Township Committee. You will find a copy of each letter in this section.

Telecommunication and Public Safety Post 9/11

by Paul P. Josephson

Ever-evolving communications technologies present every person and organization with a bewildering array of choices among technologies, devices, providers, operating systems, features, speed, and cost structures. As soon as we think we have figured out the most effective and efficient technologies for our needs, another technological breakthrough reshapes the entire field. If not square one, we have to go back and figure out whether we need that new technology and how to pay for it.

These changes in modes, methods and the commercial terms of communications dominate the business news. They are reshaping industry after industry.

Leveraging these new communications technologies is perhaps nowhere more critical than for public safety and first responders—police, fire, EMS and others with mission-critical communications needs. First responders need fully interoperable communications systems that allow them to speak with each other in times of crisis, when the cell phone network is down or overloaded by civilian traffic. They need to be able to plug-and-play new technologies into those systems with minimal upgrade costs. They need to take advantage of new technologies as quickly as possible.

Today, the average citizen can shoot and post to the Internet video of a tornado or civil disturbance while it is in progress. It can be viewed worldwide, while it is happening, and can go viral within hours via Twitter, Facebook, and other social media platforms. But can police or fire units from different towns speak directly with each other when responding to that same incident? Can they send their own video back to a central command center for superiors to make critical decisions about how best to defuse that disturbance? Can a helicopter surveilling a disaster scene from above send video of the scene to responders on the ground to enhance their search and rescue efforts?

Just as the average consumer wants the newest smartphone with the latest features the public safety community wants and needs access to the latest communications technologies.

This race to embrace new technology has been especially important since the events of Sept. 11, 2001, when we discovered the need to improve voice and data communications among public safety agencies and their first responders, to allow public safety agencies to communicate with each other despite differing technology choices, and to be sure critical data in the government's possession can be accessed by public safety in real time.

These technologies are changing how police and other public safety officers work. Not so long ago, a typical police cruiser contained little more than a radio communications unit in the way of technology. An officer responding to a crime or pulling over a vehicle typically had to radio license plate information to a dispatcher to obtain information in the course of a traffic stop, and then either fill out a report in longhand with carbon copies or travel to the station to type a written report. Today, the typical police cruiser is packed with technology—license plate readers that can scan every plate around the cruiser as it rolls and alert the officer to vehicles that have been reported stolen or with outstanding violations, video recorders, wireless streaming of that video, GPS to track the cruiser or suspects, and laptop computers to document and generate reports on the scene. Each device can dramatically improve efficiency and accountability.

A 2011 survey by the Police Executive Research Forum[1] highlighted the number of national police agencies using the following technologies:[2]

- In-car video recording: 71 percent in some vehicles, 25 percent in all
- Wireless video streaming: 46 percent
- License plate readers: 71 percent
- GPS to track police vehicles: 69 percent

Likewise, firefighters now have access to technology that can give field commanders access to building plans and inspection reports that can prove invaluable to directing first responders in an emergency. In fact, the precise location of

individual firefighters within a burning building can be monitored on scene by commanders.

Each of these new public safety technologies is highly dependent on communications infrastructure to work effectively. No longer does public safety simply require a voice connection by radio; now officials need data connections with tremendous bandwith to make effective use of these technologies. They need secure systems that will function as well in times of crisis as they do in ordinary day-to-day situations.

Society's burgeoning data demands have led to a scramble for spectrum to accommodate all of these technologies, in both the civil and public safety arenas. This scramble for communications spectrum is of vital importance to the public safety community, and also to the public entities that must make significant financial investments in the technology, hardware, and infrastructure that makes it all work.

Thus, attorneys representing public entities, as well as those representing technology vendors selling to the public sector, face a new set of challenges that law school did not prepare them for—what technologies to acquire, what communications platforms to select, and how to contract to obtain the hardware, software and communications infrastructure in a cost-effective manner.

Unfortunately, New Jersey's public procurement methods, like those in many states, especially at the local and county levels, do not provide the flexibility needed to quickly acquire these technologies, or to change course if technologies change while procurement is pending.

This article highlights key recent developments practitioners need to be aware of to help public safety clients respond to and manage rapid changes in the area of public safety communication technology.

Interoperability

Interoperable emergency communication is integral to initial response, public health, safety of communities, national security and economic stability. Of all the problems experienced during disasters, one of the most serious concerns is the lack of appropriate and efficient means to collect, process and transmit important and timely information. In some cases, legacy radio communication systems are incompatible and inoperable, not only within a jurisdiction but within departments or agencies of the same community. Non-interoperability can result from outdated equipment, limited availability of radio frequencies, isolated or independent planning, lack of coordination and cooperation between agencies, community priorities competing for resources, funding, ownership and control of communications systems.

Recognizing and understanding this need, Project 25 (P25) was initiated in 1989 by public safety agencies and manufacturers of digital radio communication.[3] P25 is a collaborative project to ensure that two-way radios are interoperable. The goal of P25 is to enable public safety responders to communicate with each other and, thus, achieve enhanced coordination, timely response, and efficient and effective use of communications equipment.

P25 is an open-source standard that allows different radio communications systems across North America to speak with each other, adopted through the joint efforts of the Association of Public Safety Communications Officials International (APCO), the National Association of State Telecommunications Directors (NASTD), selected federal agencies including the National Telecommunications and Information Administration (NTIA), the National Communications System (NCS), the National Security Agency (NSA) and the Department of Defense (DoD). It was standardized under the Telecommunications Industry Association (TIA).

The P25 suite of standards involves digital land mobile radio (LMR) services for local, state and federal public safety organizations and agencies. P25 is applicable to LMR equipment authorized or licensed in the U.S. under NTIA and Federal Communications Commission (FCC) rules and regulations. (Europe has established an equivalent common standard, the European terrestrial trunked radio (TETRA) protocol, although TETRA equipment is not interoperable with P25 equipment.)

Although developed primarily for North American public safety services, P25 technology and products are not limited to public safety alone, and have been selected and deployed in other public services, as well as private system applications. Transportation and public works departments, public and private utilities, and transportation networks such as rail facilities are prime candidates.

Since Sept. 11, the federal government has made substantial funding available to the states through numerous grant programs to enhance the interoperability of public safety radio communications systems. The Public Safety Interoperable Communications (PSIC) Grant Program[4] led to the award of $968,385,000 to fund interoperable communications projects in the 56 states and territories. This represents the largest single infusion of federal funding ever provided for state, territory, and local agencies to implement communications solutions. In most cases, public entities relying on federal grants (or state grants funded by the federal government) today must procure P25-compliant technology and equipment.

New Jersey's P25 Network

Since the events of Sept. 11, New Jersey has been at the technical forefront of shifting to an interoperable, digital future. State agencies including the Office of Information Technology (OIT),

the State Police, the Office of Homeland Security and the Department of Transportation have, over the past decade, invested tens of millions of dollars in various federal grant funds the state received into a statewide radio communications network known as the P25 Network.

In 2012, OIT began deploying the P25 Network, a 700 MHz digital trunked radio communications network that provides 95 percent coverage statewide. One side of the network is designed to accommodate state agencies, while the other side can accommodate county and municipal users. The state has launched a website dedicated to the P25 Network.[5]

Together, the network represents perhaps the ultimate shared service arrangement undertaken by the state to date. In the past, counties and individual municipalities typically built and designed their own freestanding communications systems that might—or might not—be interoperable with neighboring entities. These systems, consisting of antenna sites, control centers, dispatch centers and associated equipment, typically cost tens of millions of dollars to properly design, build, operate, maintain and upgrade to the latest technology.

Now, counties and municipalities can avoid many of those infrastructure costs by participating in the statewide P25 Network. Significant cost savings can be expected from participating in the statewide network. Because it will be subscription-based, there will be far lower infrastructure costs to network participants. Municipalities will benefit from the economy of scale that can be leveraged with a single infrastructure, as well as ongoing technology enhancements and upgrades that will be procured by the state for the system. Participating municipalities and counties can add existing or new facilities to the statewide network to enhance coverage rates for their specific needs.

The P25 Network represents perhaps the lowest-cost option for towns to become interoperable and to take advantages of the technology investments the state makes for the benefit of State Police, DOT and other first responders. While procurement methodologies are still being worked out, it is anticipated towns will be able to procure their equipment and installation services off current and pending state radio communications contracts, without the need to conduct their own procurements.[6]

In keeping with New Jersey's policies, home rule options remain, however. Counties or municipalities that have their own radio network can still maintain it while linking to the P25 Network to achieve statewide interoperability. Presently, local officials have been provided guidance by the state that such systems generally must be procured through the traditional low-bid methodology. The low-bid methodology is ideally suited for purchasing essentially identical commodity goods (paper, milk, etc.) and construction services. But when applied to procure complex technical systems, it can force a public agency to buy the cheapest system offered rather than the one that offers the best value and best suits the agency's specific needs. Of course, lowest cost does not necessarily mean best value when it comes to technology. Low bidding also prohibits cost and technical negotiations that can help refine bidders' proposals to best suit the agency's needs.

From a policy perspective, serious questions can be raised regarding whether low bidding should be required in these cases, given the advanced technical and professional skills associated with designing and installing these systems. Certainly the state does not use low-bid methodology for procuring its complex technology systems, as a consequence of state law that allows for vendors to be selected based on the best value to the state, price and other factors.[7]

State law presently permits towns and counties, upon resolution, to use the 'competitive contracting' process, which permits award to the bidder who best satisfies evaluation criteria rather than merely the lowest price, in certain cases.[8] These cases include professional services, 'special equipment for confidential investigation,' 'extraordinary unspecifiable services,' and 'operation, management or administration of data processing services,' and upon approval of the director of Local Government Services, other services.

Depending on the scope of engineering design services included in a contract for a radio communications system, as well as whether the operation of the communications system is to be outsourced as part of the contract, the agreement might be eligible for competitive contracting.

One solution is legislative amendments authorizing competitive contracting and negotiations for public entity communications technologies that provide local public agencies flexibility to seek competition among vendors and select the best technology, provider and terms for their specific needs.

Second, communities should consider retaining highly qualified communications consultants to guide them through the maze of technology options and to assist in developing procurement documents. Communities should also contact OIT and thoroughly investigate the significant advantages of joining the state's P25 Network before making any new communications investments.

FCC Spectrum Issues and FirstNet Authorization

The establishment of a national communication network for first responders is one of the final outstanding recommendation of the 9/11 Commission, which was led by two eminent New Jer-

seyans, former Governor Thomas Kean and former Attorney General John Farmer.

If the three most important factors in real estate are location, location, and location, the most important factors in radio and data communications are spectrum, spectrum and spectrum. Wireless carriers, broadcast radio and television operators, and public safety, public service and business users all compete for the same finite radio spectrum to provide for the nation's exploding digital data needs.

The FCC serves as the nation's communications traffic controller, assigning appropriate uses for various bands within the spectrum, and licensing individual agencies to use specific frequencies within those bands for their needs.

As noted above, public safety users have many new data-intensive technologies available to them. Obtaining the needed bandwith to carry that data is critical to the success of the technology. Consider a football game at the Meadowlands where many fans are trying to send video of a play to their friends via smartphone; too many users competing for the same cell site will overwhelm the site, and users either cannot access the cell network or experience extremely sluggish response times.

While a delay in sending the latest Eli Manning triumph to friends can be tolerated, public safety cannot tolerate delays during emergencies.

For this reason, when the FCC moved over the air television broadcasting to digital, the commission dedicated portions of the 700 MHz radio band to public safety users, and allocated a total of 12 MHz for narrowband, P25 voice use.

With respect to public safety data needs, New Jersey was at the forefront of the broadband communications revolution. The state was one of a handful of jurisdictions nationally to secure a special Broadband Technology Opportunities Program grant (BTOP) to establish a new broadband network for public safety data use on the 700 MHz band in Northern New Jersey, for 30,000 public safety users. Other BTOP recipients included Los Angeles; San Francisco; Charlotte, N.C.; Mississippi; and New Mexico. The state was awarded $43 million for its broadband network efforts, and in 2011 received proposals for a new broadband system. But shifting federal policy has halted the state's procurement.

As a result of legislation enacted in Feb. 2012, Congress established the First Responder Network Authority (FRNA, or FirstNet) as an independent authority within NTIA to establish a nationwide, interoperable public safety broadband network.[9] The legislation provides $7 billion in funding for this network out of anticipated spectrum auctions in the future. As part of this law, each governor has the option to decide whether to opt in to the FirstNet system, or to develop and deploy its own broadband radio access network.

As part of this legislation, Congress reallocated the 10 MHz so-called 'D Block' to public safety data uses, to provide a total of 32 MHz of spectrum for public safety use. 20 MHz is reserved for broadband (data) use; the other 12 MHz is reserved for narrowband (voice) use.

The authorization of FirstNet, critical to advancing interoperability nationwide, has unfortunately had the negative impact of halting New Jersey's cutting-edge efforts to launch its regional broadband data network. The FCC has frozen the use of BTOP grant monies by jurisdictions like New Jersey until it decides how best to use those funds in light of the new FirstNet authority.[10] FirstNet will take several years to launch; in the meanwhile communications leaders like New Jersey are pushing aggressively for federal guidance to allow them to use those monies to advance their public safety broadband efforts now.

The so-called D Block Spectrum Act and FirstNet network have no impact on most existing public safety radio systems nationally, except that the act requires public safety users on the UHF T-Band between 470-512MHz (where digital television signals are now broadcast) to vacate that spectrum within approximately nine to 11 years.

This impact does affect New Jersey public safety users, many of whom are currently licensed and equipped to run their systems in the UHF T-Band. When digital television was mandated by the FCC, many public safety users in New Jersey who had been licensed to use the UHF band began to experience significant interference from digital television signals.

In seeking to acquire the newest interoperable technologies, communities licensed to use UHF spectrum between 470 and 512 MHz rather than the 700 MHz band must make a choice: whether it is better to invest in technology optimized for their current licensed UHF spectrum but likely to become obsolete within a decade, or move now to the 700 MHz band as part of upgrading their systems. Many of these users are choosing to move to the 700 MHz band.

By moving to the state's P25 Network, which also operates in the 700 MHz band, public agencies may be able to achieve considerable savings when upgrading their technology, and avoid obsolescence issues inherent in staying on the UHF T-Band.

Conclusion

The only constant in the field of communications technology is change. Public safety agencies and governing bodies need to plan for change just as they plan for emergencies, taking the time to understand the changing field to make the wisest communications investments. Qualified communications consultants can help them understand the best options for their current and anticipated voice and data needs.

As a place where so many historic communications breakthroughs were made, it should come as no surprise that New Jersey has been at the forefront of efforts to establish a framework for public safety communications in the digital world. The state's public safety and technology leadership recognize the need to be proactive but smart in the investments they make, evidenced by New Jersey's shared service P25 Network for voice communications.

Given the high costs of going it alone, any town or county trying to plan for the future should keep a close eye on the state's initiatives in the coming months, and give serious consideration to joining the state's communication systems as the cheapest and best way to access the latest technical advances for both voice and data needs.

Endnotes

1. Founded in 1976 as a nonprofit organization, the Police Executive Research Forum is a police research organization and a provider of management services, technical assistance, and executive-level education to support law enforcement agencies.
2. Police Executive Research Forum, "Use of Technology in Policing: The Chief's Perspective," April 4, 2011. Over 70 police agencies with an average population of 531,011 responded to this survey. *See* www.policeforum.org/library/critical-issues-in-policing-series/perfpresentation.pdf.
3. *See* www.project25.org.
4. Created by the Deficit Reduction Act of 2005 (Public Law 109-171), as amended by the Implementing Recommendations of the 9/11 Commission Act of 2007 (Public Law 110-53) and by Public Law 111-96.
5. *See* www.nj.gov/911/p25.
6. *See* www.nj.gov/911/p25/index. shtml.
7. *See* N.J.S.A. 52:34-12; N.J.A.C. 17:12-2.7.
8. N.J.S.A. 40A:11-4.1, *et seq.*
9. *See* Middle Class Tax Relief and Job Creation Act of 2012, Public Law 112-96, Feb. 22, 2012. www.nita.doc.gov/category/public.saftey.
10. Police Networks Hit U.S. Roadblock, *Wall St. J.*, at A4 (July 30, 2012).

Paul P. Josephson *is partner-in-charge of the regulatory and government practice group at Hill Wallack LLP in Princeton.*

STATE OF NEW JERSEY
PROJECT 25 (P-25)

Next Step for Interoperabiltiy

First responders widely recognize two-way radio communications as a valuable and indispensible tool needed to perform duties in the interest of maintaining or restoring public safety on behalf of our citizens.

P(())25
Land Mobile Radio System

"The FCC Narrowbanding mandate requires all public safety entities using land mobile radio systems ..."

"There is a significant cost savings to participating in the statewide network."

"P-25 is the most current public safety communications standard available today . . ."

MIDDLE TOWNSHIP POLICE DEPARTMENT

31 Mechanic Street, Cape May Court House, New Jersey 08210

Christopher Leusner
Chief of Police

John Edwards
Captain
Executive Officer

William Adams
Lieutenant
Operations/Patrol

Donald Nelson
Lieutenant
Administration

Doug Osmundsen
Detective Sergeant
Major Crimes Unit

James Loftus
Sergeant
Special Services Unit

Patrol Division
Squad C Sergeant
Francis Fiore

Communications:
609 465-8700
Fax: 465-6748

Records:
609-465-8712
Fax: 465-4121

Major Crimes Unit:
609-465-8704
Fax: 465-9407

Administration
609-465-6645
Fax: 465-9407

To: Chief C. Leusner
Fr: Sgt. F. Fiore
Re: Radio System
Date: 3/11/2015

Chief,

As requested, please accept this letter as my recommendation for us to move forward with the Statewide Radio System. As you are aware from the Sgt. Meeting, I have concerns as to the clarity of the system at times. However, I believe at this point, it is the best option to date. I feel confident that should the need arise for emergency communications between Officer's and dispatch, the ability of transmissions being successful with this system will be achieved. Currently and routinely as you know, that is not always possible.

I have utilized and tested the new radios on patrol and am confident in their performance. I have also researched the system as well as other systems currently on the market. By far this seems to be superior. Additionally, utilizing the new microphones we have obtained recently has made a difference. There is more clarity in Officer's voices in my opinion.

The safety of our Officer's is paramount and I feel that without this acquisition, it is more of a question of when than if we could face a problematic situation with the current system as it stands.

Respectfully submitted,

Sgt. Francis Fiore #73

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To: Chief Christopher Leusner
From: Sergeant Mark Higginbottom
Date: March 15, 2015

Re: Statewide Radio Testing and Recommendation

Sir,

As requested, I am writing this letter to give you my feedback, findings during the radio test period, and to offer my recommendation on how we should proceed.

While testing the statewide radios, I noticed a few minor issues that I feel are all correctable and mainly operator error. One of the only issues I noticed was that the statewide radios had a very distinct and at times distorted sound. At first it was very difficult to understand what was being transmitted and at times difficult in determining what officers were transmitting. This is something that over the short period of time we tested the radios I learned to get used to, and I feel it would be an issue that all officers would get used to.

Second, I noticed if officers spoke too fast, or didn't speak directly into the microphone, or spoke too softly that their transmission would be distorted. I feel with proper training and as officers get more familiar with the new equipment this issue would correct itself.

Lastly, I noticed that officers who did not pause that one or two seconds before they began speaking would cut the first part of their transmission off at times. Again, I feel this was more operator error and would correct itself as time went on.

My opinion and recommendation for proceeding is as follows. I feel the statewide radio system was tested and it works. The coverage is something this township hasn't had for as long as I have been employed with the township and prior. I feel staying with our current system would be a mistake and a waste of money. The minor errors we experienced while testing the statewide radio system seemed to be more operator error or officers just getting familiar with the new system.

In closing, my recommendation is we should switch to the statewide radio system. I feel the minor issues we had would correct themselves when the system was fully installed and dispatch was fully operational.

Respectfully Submitted,

Sergeant Mark Higginbottom #1489

MIDDLE TOWNSHIP POLICE DEPARTMENT

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Administration
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Fax: 465-9407

March 13, 2015

To: Chief Christopher Leusner

From: Robert J. Eagan
Senior Dispatcher, Alpha Squad

Chief:

For the brief time that we the Motorola radios (state-wide radio system) was, to say the least, a remarkable experience. For the fourteen years I've been "behind the mike" it was amazing to discover that, every place the officers went in the Township, I could hear them (over their radios) and they could hear me! This includes previously "dead zones" inside buildings such as the Rio Sub Station, and the Loss Prevention offices of Shop Rite, K-Mart and Wal-Mart. In addition, the vocal quality (of the transmissions) is much better than anything our Department has ever had in the past.

I would recommend that our Department do whatever is necessary to acquire this radio system.

Robert J. Eagan
Senior Operator
Alpha Squad

MIDDLE TOWNSHIP POLICE DEPARTMENT

31 Mechanic Street, Cape May Court House, New Jersey 08210

To: Chief Christopher Leusner
Fr: Sgt. Clint Stocker
Ref: Radio System

March 12, 2015

Chief,

At this time, please accept this letter recommending us to move forward in purchasing the new Statewide Radio System. I initially had concerns with the systems clarity and felt at times it was hard to understand what the officers were saying and who the officer was that was transmitting, but the radios did seem to work no matter where the officer was located unlike the current radios.

On March 11, 2015, when I came to work, I found that four of the portables had a new mic system on them. I immediately took one and tried the new mic system on March 11, 2015 and March 12, 2015. I feel the new mic system made a big difference in the clarity of the officer's transmissions which changed my mind about the Statewide Radio System. I was initially not sold on the new system and thought if I owned a business and had to purchase the new radio system myself, if I actually would.

At this time, I feel that I would purchase the Statewide Radio System and once the system is installed it will cure the radio and officer safety issues we have had for years.

Respectfully submitted,

Sgt. Clint Stocker

MIDDLE TOWNSHIP POLICE DEPARTMENT

31 Mechanic Street, Cape May Court House, New Jersey 08210

March 8, 2015

Chief Leusner,

I am submitting this letter to you in reference to the pilot program we did with the portables. We were able to use the portables through many different scenarios and many different weather conditions in several different locations throughout the township and I have to say that for as many years that I have been here I had actually felt confident my message to the patrols would go through and their message to dispatch would be received.

Over the years we had several different areas throughout the township that were what we would call "dead spots", which meant that we could not receive or transmit in these areas leaving us with no communication with the units. During the pilot program we were able to both receive and transmit with a good clear transmission even in the "dead spots". A few areas that are a concern throughout the township are, inside the hospital, supermarkets or any large structure. With the pilot portables transmissions came across clear and readable. On days of heavy rain or poor weather conditions transmissions with the pilot portables were pretty clear where the portables we have now are horrible in those conditions and we as dispatchers have to depend more on each other and trying to understand what was and who was transmitting.

The pilot portables will definitely take a little getting used to as far as sounding different than the ones we have now but we all seemed to have been getting used to them and getting a custom on how to work them correctly. There are always issues with change in the beginning.

After asking the opinion of my partner Operator Loefflad, he also felt the there was nothing negative about the pilot portables. We both felt much better about being in contact with the units with the pilot portable then we do with the current portables. My may concern as a communications operator is the patrol units and their safety. I feel that the safety of the officers is a priority and the portables we have now puts them at risk of us not hearing their transmission or even a click if they try to call us. These portable would definetly be a asset to the department just for that reason alone!!!!!

Respectfully Submitted,

S. Graham

Senior Communications Operator Graham

P.O. Box 650
704 New Jersey Avenue
Wildwood, NJ 08260

Phone: 609-522-5408
Email: pba59@verizon.net
Web: www.pba59.com

PBA LOCAL #59

To: Chief Christopher Leusner, M.T.P.D.

From: Ptl. David Hagan, M.T.P.D. P.B.A. Representative

Ptl. Leonard Larkin, M.T.P.D. P.B.A. Representative

Date: March 07, 2015

Re: 700 MHz State Radio System

Sir,

On behalf of members of the Middle Township Police Department and P.B.A. Local 59 I am writing this letter in regards to the recent trial period of the 700 MHz State Radio System utilized by officers of this agency. After speaking with the majority of officers of this agency about the performance of the 700 MHz State Radio System we have come to the conclusion that this system out performs the current radio system. There are still some concerns about the 700 MHz system, but these concerns are minimal compared to our current radio system. Officers feel they were finally able to transmit in all areas in the Township which they are unable to do with our current radio system.

There are many safety concerns for our officers and the public such as dropped transmissions, inability to make or receive transmissions in certain businesses and residences, as well as the constant radio failure with the current radio system. Although these problems are not new, they continue to hinder the safety of officers and the community that they serve. During our recent trial period with the 700 MHz State Radio System, although brief, the previous mentioned concerns were not a reoccurring issue.

While we are no experts in the radio communication field we feel the performance to the 700 MHz State Radio System would be beneficial to the officers and community of Middle Township.

Respectfully Submitted,

Ptl. David W Hagan #92

Ptl. Leonard P Larkin #102

MIDDLE TOWNSHIP POLICE DEPARTMENT

31 Mechanic Street, Cape May Court House, New Jersey 08210

Christopher Leusner
Chief of Police

John Edwards
Captain
Executive Officer

William Adams
Lieutenant
Operations/Patrol

Donald Nelson
Lieutenant
Administration

Doug Osmundsen
Detective Sergeant
Major Crimes Unit

James Loftus
Sergeant
Special Services Unit

Communications:
609 465-8700
Fax: 465-6748

Records:
609-465-8712
Fax: 465-4121

Major Crimes Unit:
609-465-8704
Fax: 465-9407

Administration
609-465-6645
Fax: 465-9407

Chief Leusner:

In review of the trial period of the 700 Mhz State Radio System, I would like to briefly express both my concerns and commendations for a switch to the 700 Mhz State Radio System. Although there were flaws with the 700 Mhz State Radio System, these flaws were minor compared to what is experienced with the radio system the department currently utilizes. Through the use of the 700 Mhz State Radio System via portable radio, I was able to routinely both receive and transmit radio communication with officers. Specifically, there was a noted improvement while officers were in the Del Haven and Rio Grande sections of Middle Township, both areas which have routinely been problematic when using the current radio system. Despite this benefit, I routinely experienced a voice echoing when transmitting on the 700 MHz State Radio System via portable radio from dispatch. Whereby leaving to question if the echoing issue would be existent with the use of 700 Mhz State Radio System via a base station.

Although the new radio system would come at an expense to the Township, effective communication is an invaluable asset to public safety and is necessary to ensure the safety of both the officers of this agency and the residents of Middle Township.

Respectively submitted,

Dispatcher Madonna Sill #143

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3/8/2015

Chief Leusner

The statewide radio system we tested had a number of problems. The audio was garbled with a underwater sound to it and the volume was inconsistent. Some of the problems I think were because we had to use portables in dispatch. Without going to a department that utilizes this system and sitting in the dispatch center it is hard to know how well it would work as a complete radio system.

The recommendation as of now without using a complete radio system would have to be No I would not recommend the system.

Keith Woodrow
Sr. Communications Operator
Bravo Squad

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TO: Chief Christopher Leusner
FROM: Sergeant Robert Shepherd
DATE: 05 – March – 2015
RE: Radio Testing and Recommendation

Dear Sir,

As requested, I am writing this letter to give my findings during the radio testing period and make recommendation on how I think we should proceed.

While testing the radios, I noticed some issues. First, the digital radio has a very distinctive and different sound. In the beginning, this made understanding and differentiating between officers a bit difficult, but I soon became used to the different sound and this was not as much of an issue anymore. I feel that this is something that I would continue to get used to the longer the radios were in service.

Second, the radio itself seemed to not be as user friendly as our current radio and allowed for more operator error. If an officer spoke too fast, or didn't speak directly into the microphone, or had their mouth too far or too close, it distorted the transmission. Again, this problem corrected itself as officers learned the best way to use the radio. I believe this problem would continue to get better as officers trained themselves on better habits.

Next, I noticed that when receiving transmissions, I would have to direct or position the microphone/speaker toward me. This seemed to help with understanding communications. This issue, I believe, would be fixed with having actual radios and speakers in the car and not relying solely on portable radios.

Lastly, there is an issue with the time before you could speak when actually pushing the push to talk button. The officers would have a problem with talking too soon, and cutting off the beginning of a transmission. Also, if you released the button and tried to immediately push it again, to add additional transmission, the radio would not let you speak. It would make an error tone, and you would have to release the button and attempt your transmission again. Sometimes, this became an officer vs. radio battle until the officer stopped, waited a few seconds for the radio to clear itself, and then started from the beginning waiting for the tone allowing you to talk.

As for the testing period, and noting issues, I believe most problems to be operator error and seem to be correctable with use and experience. Officers will learn how to position the mics, speak more clearly and slowly, and the received communications will become more understandable with time and practicing good radio use habits. I feel the testing phase went well and most of the officer feedback I received was feedback stating the above issues.

My opinion for proceeding is this. I feel we have three choices. One, we can stay with a broken, patched together system, which has been a problem just about every day. Two, we can seek a company to build a system from the ground up, hoping that this new system turns out better than what we have. Or three, we can go with the statewide system which was tested. I believe staying with our current system is the worst choice. We know the system is no good and I think we all can agree something needs to be done to correct this. Going with the unknown has not worked for us in the past, and may lead us down the same path we are currently on. The statewide system seems to me to be the obvious choice. The system seemed to have good coverage, and only some minor issues which may be linked to operator error or the officers not being used to the new system.

In closing, my recommendation is we switch to the statewide radio system. I believe that once the system is fully installed and operational we will see most of the issues corrected by officer's experience. I also, think that once the communications center is converted and car radios are installed, the system will sound much better and the department as a whole will begin to get used to the system over time.

Respectfully Submitted,

Sgt #79

Sergeant Robert Shepherd #1479

MIDDLE TOWNSHIP POLICE DEPARTMENT

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To: Chief Leusner

From: Sgt. Loftus

Date: 03/04/2015

Re: Statewide Radio System

Chief,

I was only able to use the Statewide Radio on a few occasions due to limited availability of the demo radios. The radio transmissions were clear and I did not experience any problems. Ptl. Dalonzo was also able to use the radio on several occasions and he too found that the transmissions were clear. The only negative experience he encountered was when the radio did not receive transmissions while he was in Fletchers Corner, which is an all steel framed building. Based on my experience and Ptl. Dalonzo's experience with the radios, I believe the radios would be a much needed improvement over our current system. I, therefore, recommend that the Department make a request to Township Committee for the purchase of the Statewide Radio system equipment.

Sgt. James Loftus

Section#4

Section#4 Recommendations

I have been very frustrated over the problems with our communication system for many years. As an officer on the street I was frustrated on a daily basis and only grew more frustrated as I moved through the ranks when proposed solutions did not work as promised. I made solving our communications problems my number one priority as Chief in 2009. The Radio Task Force seemed to me to be a common sense approach to solving our problem. We identified a company with a proven record of success in the area of Public Safety Communications and brought them in to solve our problems. Unfortunately, it did not work.

I am not an expert in Public Safety Communications but I tried to educate myself as much as possible and apply common sense in trying to solve this problem. I learned about the New Jersey Statewide P25 Network two years ago. I had a number of meetings with the Director of the program, Craig Reiner and we tested a couple of radios. However, with the expense of the upgrade and the limited testing we did, I was reluctant to recommend this purchase because of the history of not be able to solve this problem.

In the meantime we continued to monitor technology and research other options such as the Non P25 Complaint DMR System. I have attached a Proposal for this system to this section as Appendix A. The cost of this option would be approximately $150,000. The risk with this option is we will be doing what we have done in the past, purchasing or upgrading our system and not knowing for sure it will work until it has already been funded and built. The other issue is it is not the recommended P25 standard for Public Safety and does not fit in with the long term options if County Dispatch develops in the future.

In January of this year, I decided to ask the State if we could borrow enough radios to run our patrol shifts. This would allow us to evaluate this option in the field. The results were positive as you can see from letters contained in this packet. We experienced some minor issues that seem to be related to a learning curve of operating a different piece of equipment and other issues related to only using portables in our testing phase. In the full upgrade we would be using a base station in Dispatch and Mobile Radios in our Patrol Cars which should significantly improve the minor issues discussed earlier. While the testing phase was only a month, I feel the indications are we can move forward with a high degree of certainty this system will meet Middle Township's Public Safety Communication needs.

The cost to move to the MTPD to the NJ Statewide P25 Network would be:

MTPD: $375,000.

If you wanted to add Middle Township Rescue there would be an additional cost of:

Rescue: $86,000 (18 portable radios)

I would also recommend that we consider purchasing 8 additional portable radios. We met with the Fire Chiefs on March 16th and there was discussion on how important it was for Senior Fire Officials to monitor the Police channel. Some of the Fire Chiefs would have a difficult time obtaining funding this time of the year and perhaps next year. Chief Zeiss from Green Creek believes there is a grant opportunity specific to Volunteer Fire Companies.

We could utilize these additional 8 portables and loan them to the Fire Company until they can purchase their own portables. We would also have these radios available in the future if an officer has a radio that needs to be repaired or to issue a radio to some of the Township Officials during Emergency Management Incidents, like we did during Hurricane Irene and Sandy. The cost of the additional portables would be:

8 Additional Portables: $38,000

Total Cost: $499,000. See attached Proposal under Appendix B

There would also be a yearly subscription fee to the State of New Jersey to utilize the system. If we were to utilize the system to dispatch Police, Fire and Rescue, we would need two sets of talk groups at $4500.00 each, a total of $9000.00 a year. However, this would relieve of us of significant costs related to maintaining our existing system. The subscription fee could be reallocated within the Police Department Budget and not increase of our operating expenses. There would also be an additional benefit of not having to plan for capital purchases in the future to repair or upgrade our existing system. We would need to maintain our tower and infrastructure at headquarters, but not the other 3 receive sites. The tower and infrastructure at headquarters would still be needed because we cannot send out tones for Fire and Rescue on the state system.

Finally, the County of Cape May has purchased these radios for the Cape May County Prosecutors Office and Sheriff's Department. The Board of Chosen of Freeholders has contracted with VCOMM to acquire frequencies in the 700MHz range for those agencies but also additional space in case Central Dispatch materializes in the future.

Appendix A

Non P25 Complaint DMR Proposal

Digital Radio Proposal
By Tekk Comm Communications

2015

Present Day Safety & Maintenance Issues

- Age of handheld, mobile equipment and infrastructure
- Availability of radios for all mission critical operations
- System and multiple site failures (continuously going offline)
- Poor portable reception and transmission in buildings
- Existing radios can be scanned by media outlets and anyone else with a scanner or phone app. Such as the criminal elements.
- Lack of Maintenance and upgrade plan's through the years has hurt our ability to keep up with equipment deterioration
- FCC Narrowband Compliance & digital conversion
  - Static…Static… and More Static…
  - Too many areas with poor to almost no communications
  - Technical modifications have been made but still fall short
  - They made TV go digital…they will eventually make radio!!

Present Day Facilities Inspection

- A walk through of all sites and locations was conducted and deficiencies were noted in December 2015.

- 4 Locations inspected: Middle Twp Police Administration Building (monopole tower)
  Goshen Facility and tower (Guyed tower approx. 200 ft.)
  Green Creek Facility and tower (monopole tower)
  Rio Grande Facility and tower (self standing tower)

- It was noted at the conclusion of the site inspections that the Goshen tower site would be optimum due to the height of the structure.

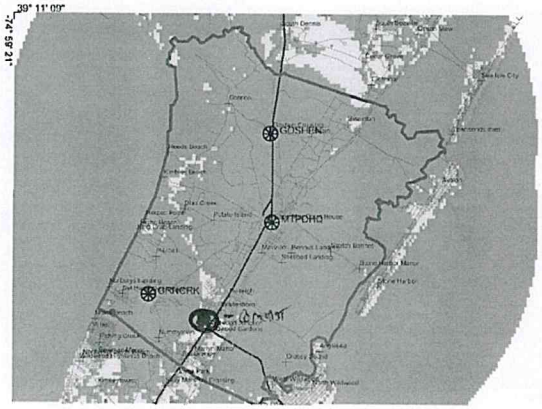
- It was noted that the Green Creek tower should be eliminated if a new system would be purchased due to the small height of the structure. It would eliminate additional cost of equipment.

Current Topographical Maps

RAPTR Version 17.0 XP b29
Monday, December 12, 2011 18:15:01
Project: Middle Twp NJ
MBP: 090711
Figure:
Design: Bounded Area
Service: Portable, Talkback, Indoors, No SMA, NB Analog Conventional
Engineer: GWRR
Map type - 1:168,453
Note: Map depicts coverage across the defined service area. Statistical variability does not allow for guarantee of coverage in specific locations, but does represent graphically area % coverage.

< -117.0dBm < -109.0dBm <0 dBm

Scale - miles
0 4



Tower site locations noted above

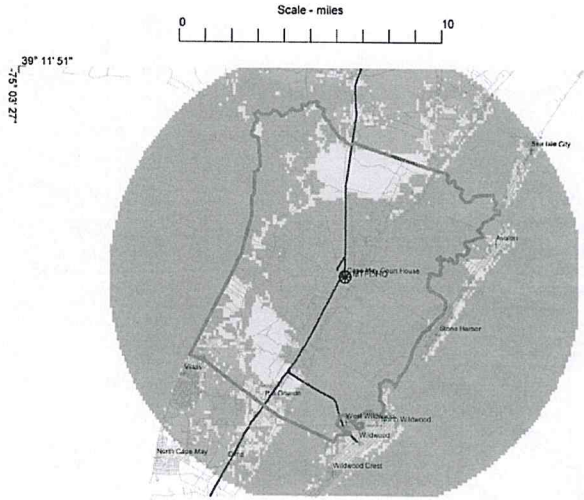
Yellow indicates weak while
Red indicates no coverage

RAPTR Version 17.0 XP b29
Tuesday, September 20, 2011 11:15:28
Project: Middle Twp NJ
MBP: 090711
Figure:
Design: Bounded Area
Service: Portable, Talkout, Indoors, No SMA, NB Analog Conventional
Engineer: GWRR
Map type - 1:201,420
Note: Map depicts coverage across the defined service area. Statistical variability does not allow for guarantee of coverage in specific locations, but does represent graphically area % coverage.

< -117.0dBm < -109.0dBm <0 dBm

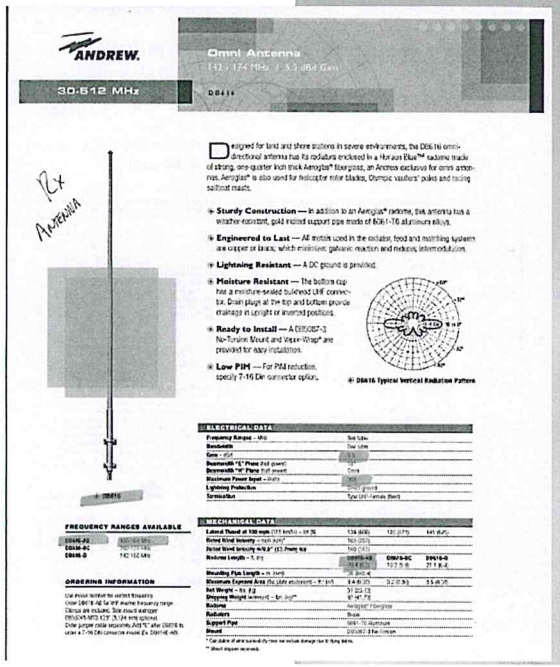
POWER TRANSMIT OUT

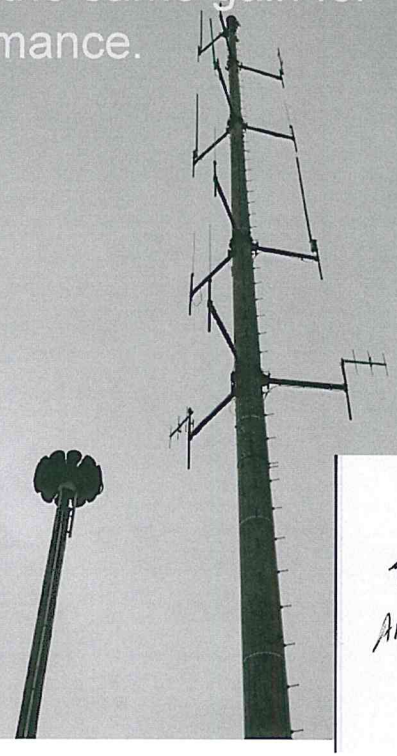
Scale - miles
0 10

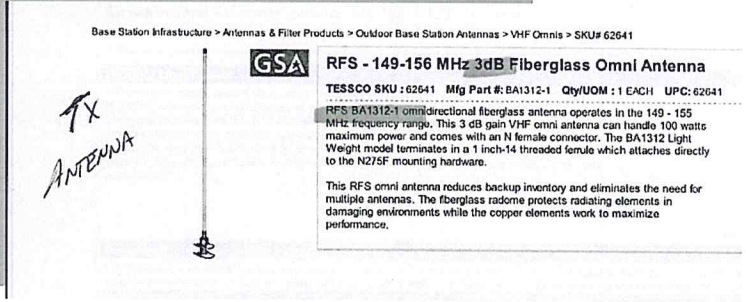


System Deficiencies

Mixed matched antenna's, fault's are different dbi gain of antenna's. They should all be of the same gain for optimum performance.

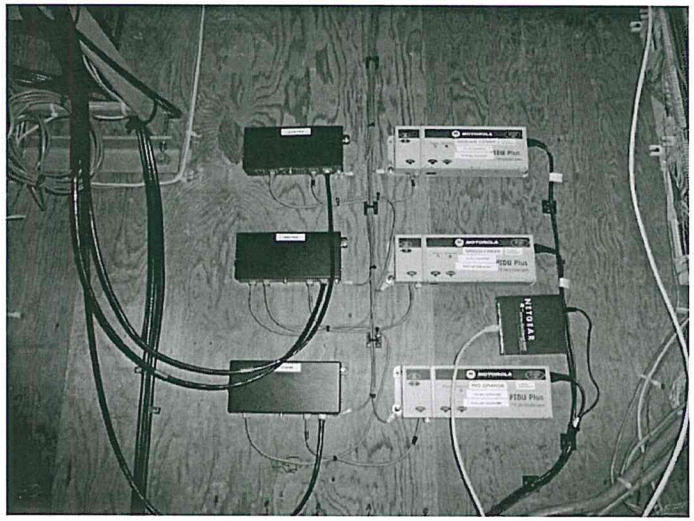




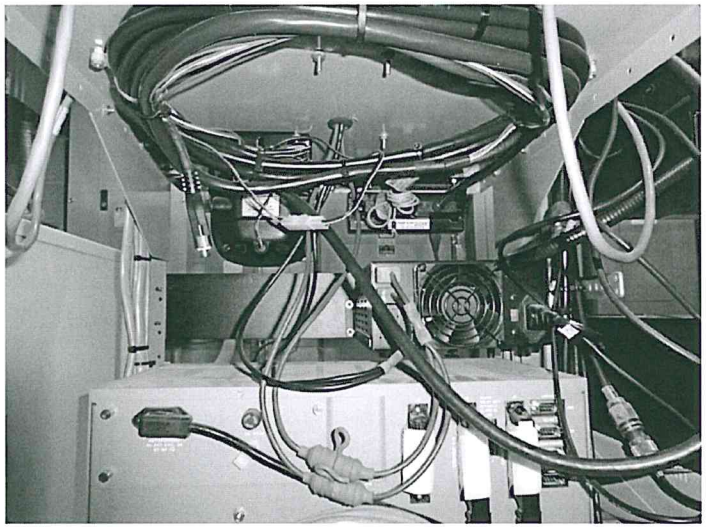


System Deficiencies

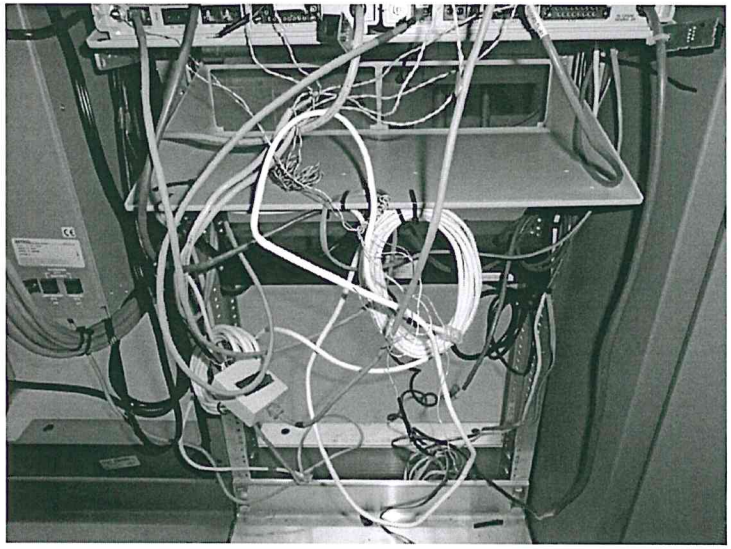
Out dated and unsupported equipment as shown above and below



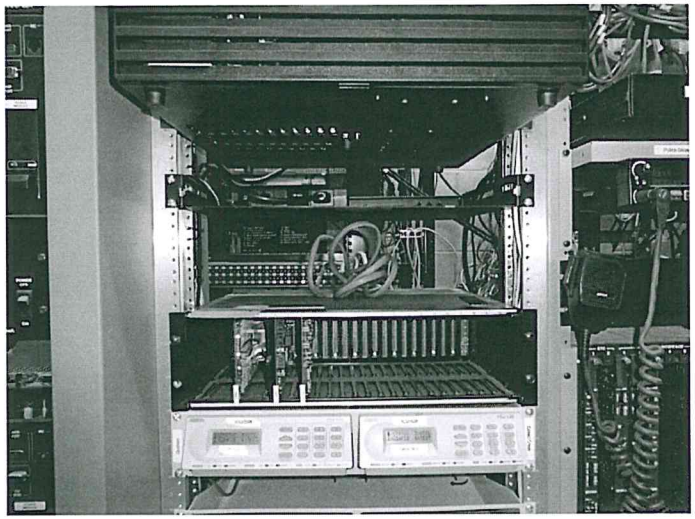
System Deficiencies



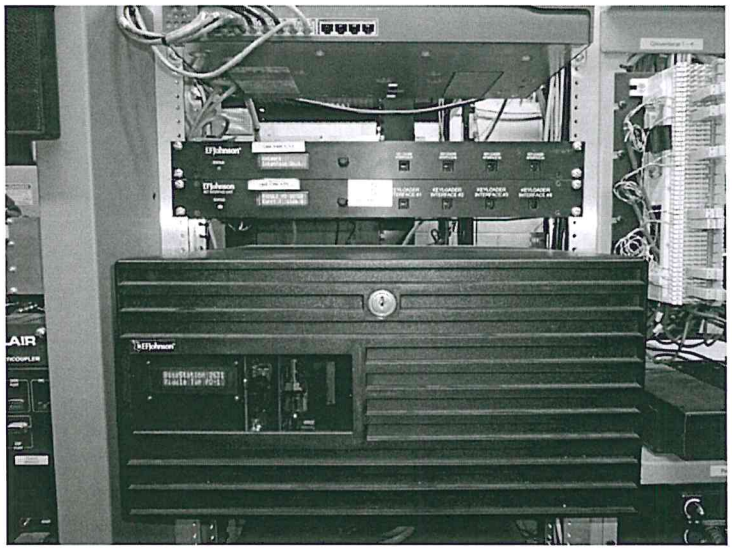
Improper Cable or wrong type
For the application



System Deficiencies

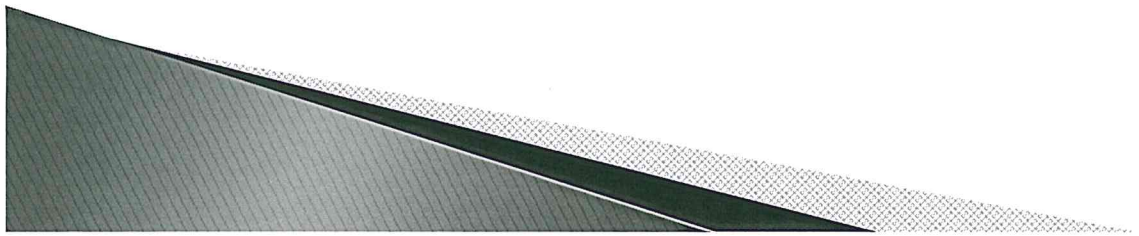


Unsupported Equipment, Cannot get parts



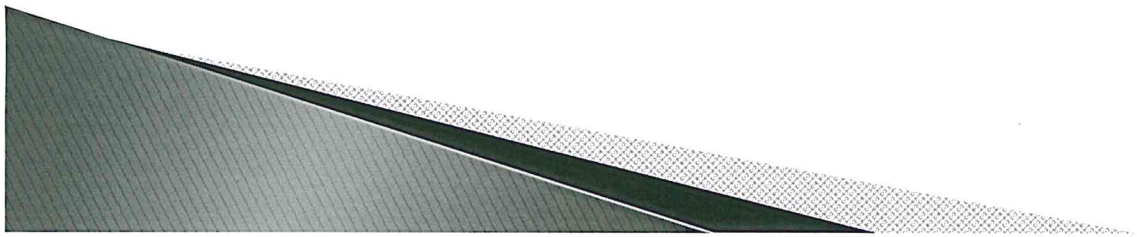
System Deficiencies

- Many minor issues which create major system performance issues
- With unmatched tower sites, system will never operate as a balanced system
- Poor rf filtering was noted at all site locations
- Excessive antenna's on towers which causes receive system failures due to loss as well as transmission bleed over into other channels.
- Poor rf connectors which create loss in both receive and transmit
- Tower and site structures are unequal in height. no way to balance the system for optimum performance. One site may be doing all the work while the others are under performing.
- All antenna's should be of the same gain. With mixed matched antenna's, it will create a poor receive and transmit environment. Most antenna's are only rated for a 10 year life span. Cannot determine the current age of antenna's currently being used.



Why DMR over P25

- Proponents of Project 25 (P25) cite interoperability as a primary advantage of the protocol. However, consider a very common scenario — a particular community uses UHF P25, while the neighbor on one side uses VHF P25 and the neighbor on the other side uses 800 MHz P25. How does using the same digital protocol help any of these communities? It doesn't — it only helps the vendor they purchased the system from.



Why DMR over P25

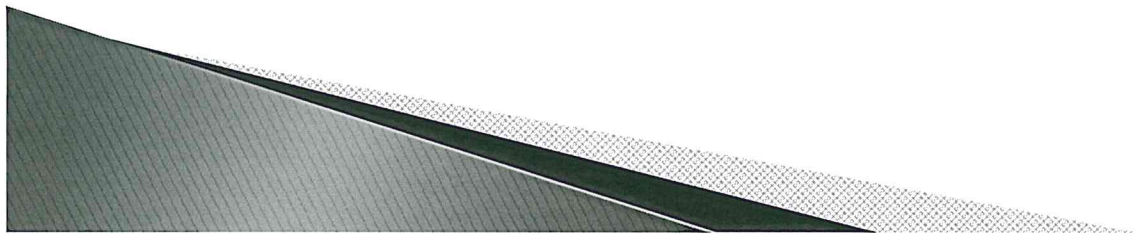
- When it comes to interoperability, analog remains the industry standard. Digital Mobile Radio (DMR) is an advanced and open standard that retains analog functionality for interoperability while offering many advantages over P25.

Why DMR over P25

- DMR offers two-slot TDMA technology, simulcast and cross-band communications at low cost, as well as high-level encryption from at least one vendor at no additional charge. P25 offers two slots per channel with Phase 2, but with a tight budget, this is an expensive proposition. Why wait for two-slot capabilities when increasing capacity requirements demand it now, and DMR is significantly more cost effective?

Why DMR over P25

- For example, take a congested area where a fire department uses one channel for paging and dispatch. If we installed two-slot DMR, the fire department doubles its capacity and retains analog paging. This new channel can be used to patch cross-band to any other band or protocol for interoperability, using IP gateways, audio bridges, back-to-back radios or dispatch consoles.



Why DMR over P25

- The DMR protocol allows for GPS, man-down, ambient listening, text messaging and Tier 3 trunking with or without simulcast. DMR IP67-rated radios with five-year warranties can be purchased for less than $650.

Why DMR over P25

- Several vendors are concentrating on production of sub-$1,000 P25/DMR dual-protocol radios. This is great news for public safety — whichever technology you choose, the future promises increasing digital interoperability. The only question is how much money do you want to spend getting there?

Why DMR over P25

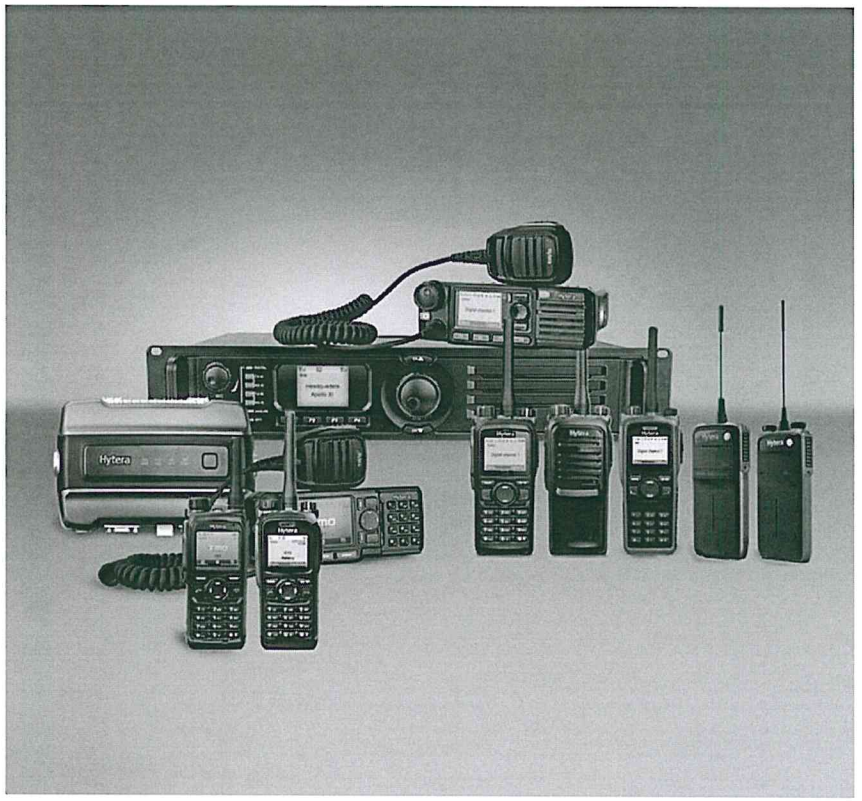
- If I had the choice and bandwidth, TETRA is the best protocol for public safety, having four slots per channel and robust data; unfortunately, narrow banding put a stop to that, with some exceptions

Why DMR over P25

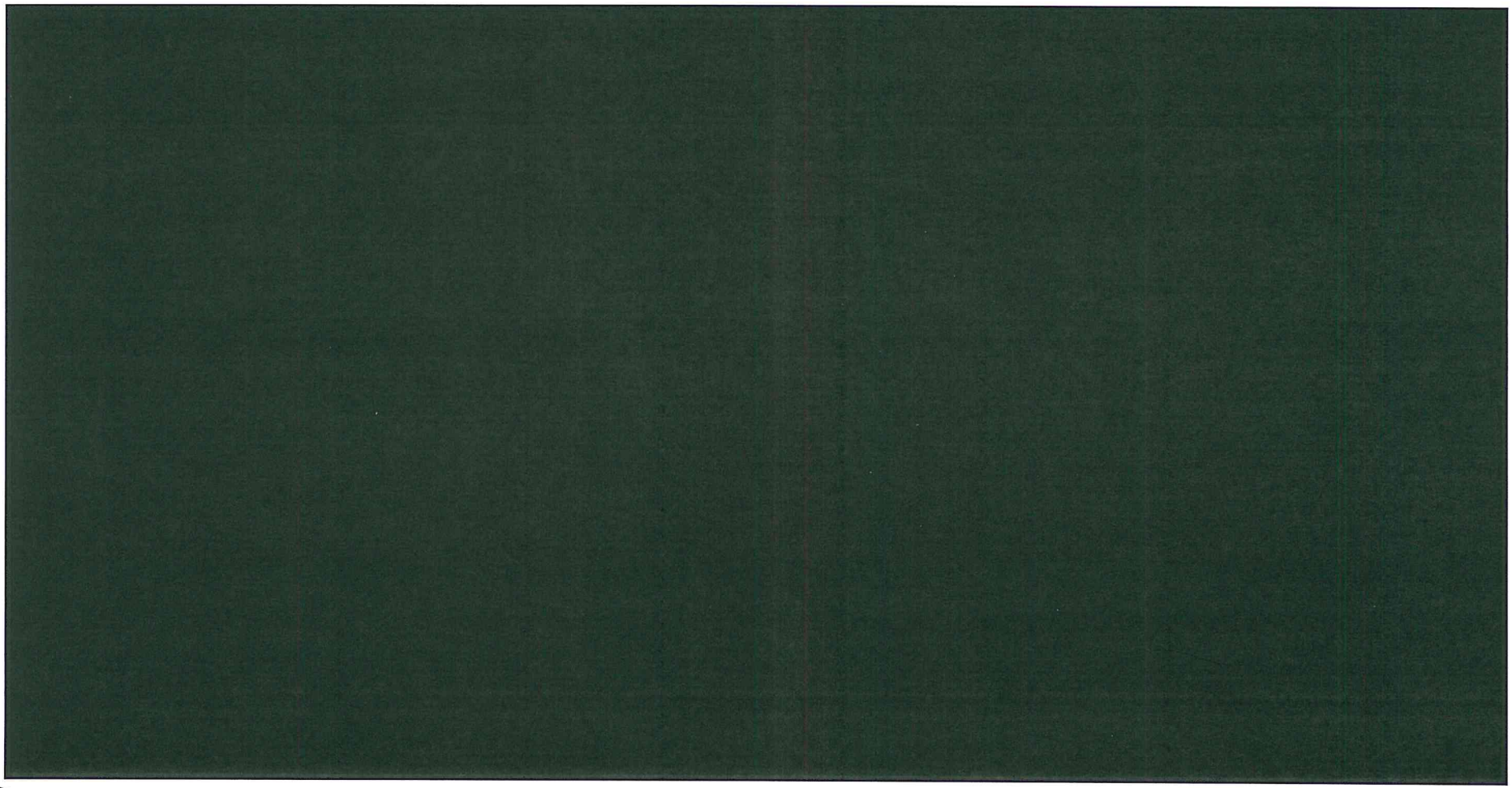
- Any way you slice it, software-defined radio (SDR) is the way to go. May the best, lowest cost and most efficient protocol win. Open standard DMR is a European Telecommunications Standards Institute (ETSI) standard on Tiers 1, 2 and 3 and provides the best choice for competition and price.

Proposed Digital Infrastructure and Radio's

- Hytera is a competitive solution over Motorola, Icom and other manufactures.
- Digital handhelds and mobiles are tested to meet military specs.
- These radios are rated to be submersible up to about 4' of H2O
- Hytera products comply with the DMR standard.
- Digital Communications are Secure
- and has a built in option for encryption.
- 5 Year Warranty on Hytera handhelds and 3 years on repeaters. No other manufacture in the industry offers this warranty.
- No Cost for maintenance plan (5 years subscriber, 3 years infrastructure.



DMR (Digital Mobile Radio)



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- Hospitality
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- The list is endless !!!!

RD-982S Repeater

- RD-982S Repeater
- TDMA = 2 slots (1 repeater is equivalent to having 2)
- Available in VHF or UHF
- 50 watt continuous duty or optional external amplifier up to 100 watt.
- IP ready, Ethernet port built in
- Only DMR repeater in its class to offer multi-site simulcast, multi site trunking or single site trunking.
- Duplexer or combiner (option)
- 19 inch rack mount
- 3 year warranty.

MD-782 Mobile

- MD-782 Mobile Radio
- 50 watt
- Available in VHF or UHF
- 1024 channel capacity
- 64 Zones
- Digital or analog modes all in one.
- Color display
- Available in dash or remote mount.
- Supports, DMR tier 1, 2 or 3.
- Built in encryption
- Single or multi site trunking.
- Emergency man down
- 5 year warranty.

MD-652 Mobile

- MD-652 Mobile Radio
- 25 watt
- Available in UHF or VHF
- 1024 channel capacity
- 64 Zones
- Fully controlled by microphone
- Digital or Analog operation
- Color Display non alpha numeric
- Supports DMR tier 1, 2 and 3
- Voice announcement
- Built in encryption
- Single or multi site trunking
- Emergency man down
- 5 year warranty

PD-782 Portable

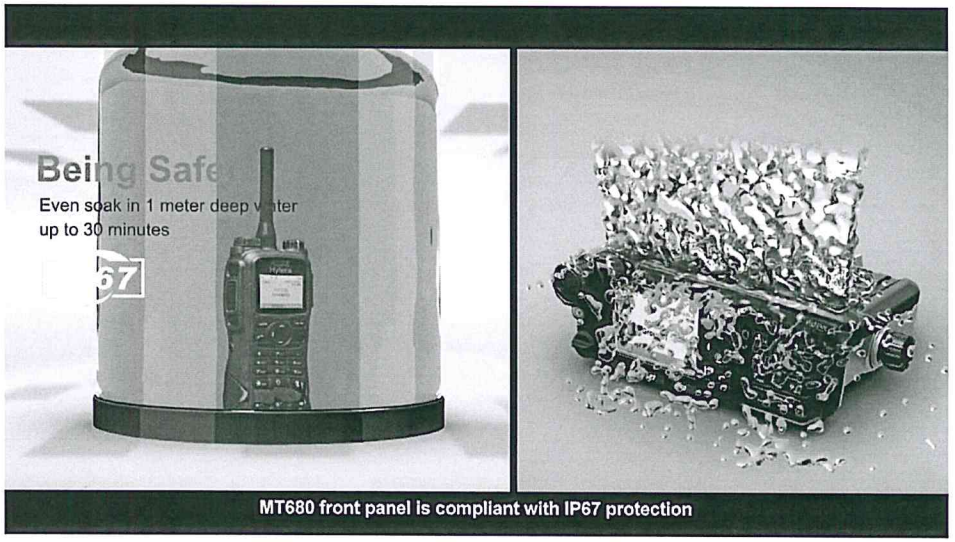
- PD-782 Portable
- 4 watt UHF or 5 watt VHF
- 1024 channel capacity (Display only)
- 64 Zones
- IP 67 Submersible up to 4 feet of H2O
- Color display
- Blue tooth option available
- User friendly operation
- DMR tier 1, 2 or 3 compatible
- Single or multi site trunking
- Emergency man down
- Available with out keypad (PD752)
- 5 year warranty

PD-662 Portable

- PD-6 Series Portables
- 4 watt UHF, 5 watt VHF
- 1024 channel capacity (Display only)
- 64 Zones
- IP 67 submersible up to 4 feet of H2O
- Blue tooth (optional)
- Limited or full key pad
- Color display
- User friendly operation
- DMR tier 1,2 and 3
- Single or multi site trunking
- Digital Emergency
- 5 year warranty

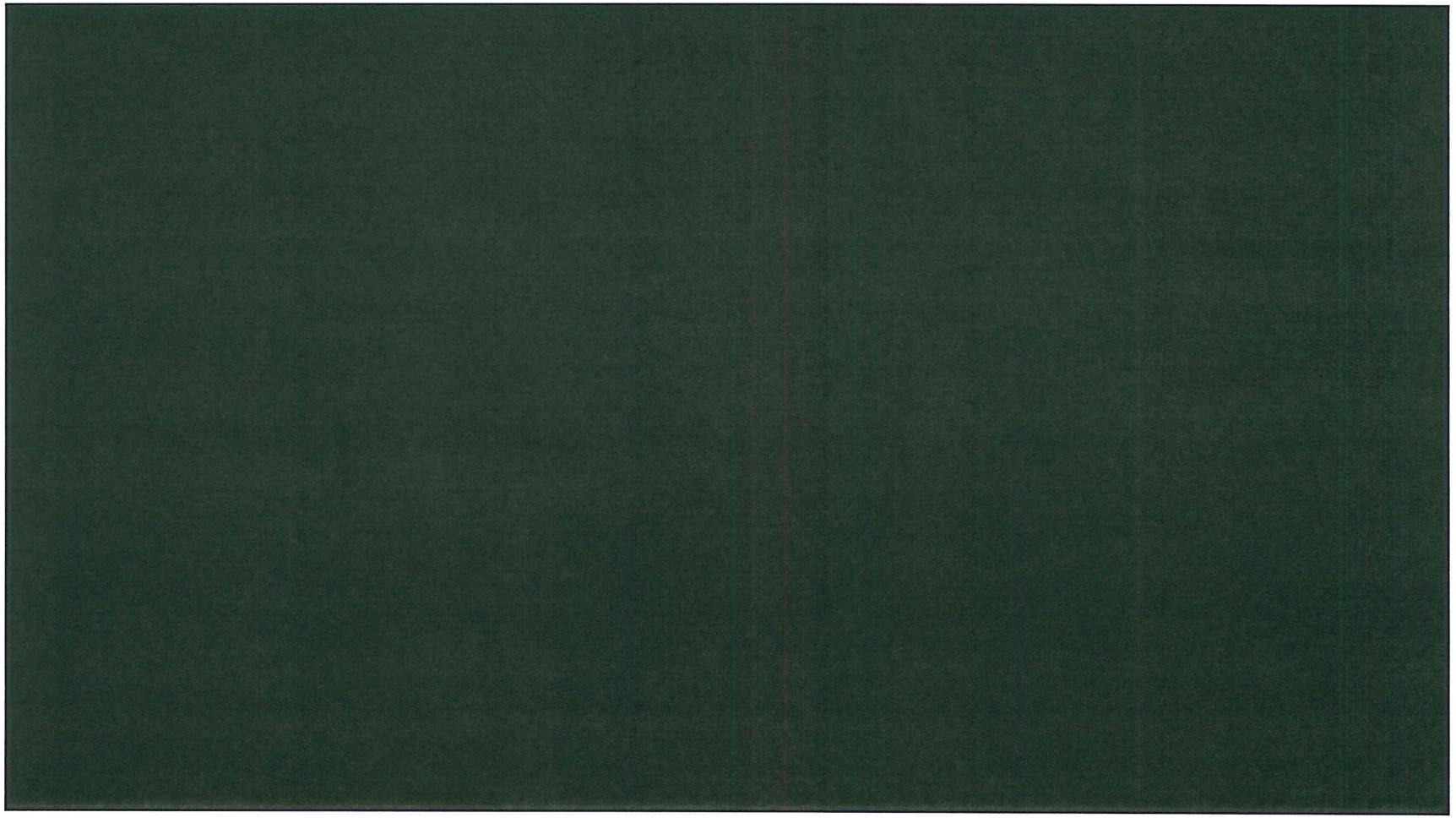
Tested to the Extreme !!!

All products are tested under severe conditions
To serve you flawlessly under mission critical operations when your life depends on it.



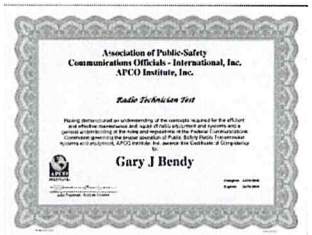
MT680 front panel is compliant with IP67 protection

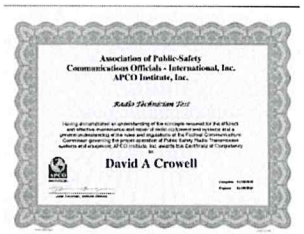
Testing and Certification

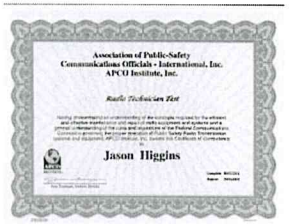


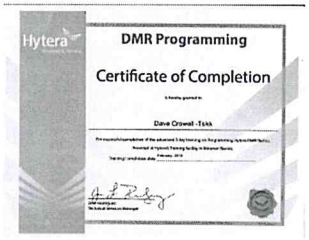
Our Certified Personnel

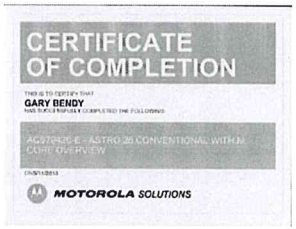
- Your equipment is in Apco certified technicians hands. Every tech must be certified. This is our current standard.
- Our technicians must complete recertification's every 6 month's with every brand of radio's that we sell or service.
- We are in the top of our class for overall customer service.
- Every vehicle in our fleet is fully equipped with the required service equipment.











Details and Timing A

- We propose the Hytera PD-6 series portables for PD
- We propose the Hytera PD-7 series portables for FD and E.M.S. departments.
- We propose the Hytera MD782 mobile for All Department's along with the MD652 for Detective vehicles. (stealth)
- Tekk Comm is prepared to install a beta test repeater along with duplexer at the Goshen tower site. We feel due to the height of the structure and corresponding mapping data that this would be a sufficient site to do so and perform system coverage. (Tekk Comm would absorb cost except cable and antenna)

Details and Timing B

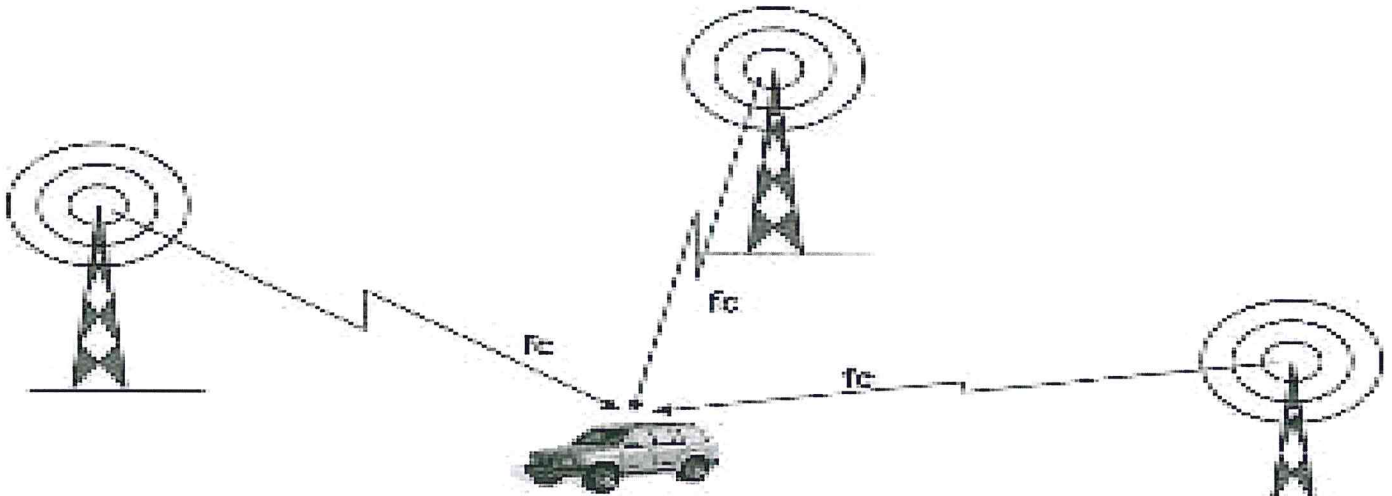
- Due to the age of the antenna and cable at the Goshen tower facility, we recommend that the Twp. absorb the cost to have it replaced. We recommend 7/8 inch hard line and a high gain antenna. Tekk Comm can provide cost for each of the above.
- The beta test system could be deployed in as little as 4 to 6 weeks. Some FCC licensing may have to be changed to accommodate a transmitter for this location.
- We recommend that if the beta test system is installed, full portable testing will be conducted excluding mobiles.

Details and Timing C

- Tekk Comm would supply 6 portable units for testing purposes with speaker mics. Customer selects which model portable they want to use.
- All testing should be done with the portable worn on the hip.
- The proposed system is not proprietary and complies with the DMR open standard.
- Any FCC or associated licensing fee's are to be absorbed by the Twp. Tekk Comm will however assist you in getting the required paperwork and assist with the filing.

Details and Proposed Future System

- Hytera DMR, Multi site simulcast system. (982S)
- Total of sites TBD after testing.
- All sites receive and transmit simultaneously.
- Subscriber units need not to change channels.



Summary

- All of this is a significant safety issue we have to address
- It's not a cheap problem and it could become much more expensive if not addressed
- There are payment options we can pursue if the Capital Budget has too many other priorities. (lease to own option)
- Too many benefits like a 5 year warranty, a maintenance plan, Open standard protocol, secure radio traffic, more capacity and equipment for all mission critical agencies, Police, Fire, EMS and Emergency Management.

Summary

- Subscriber units (portables) could be deployed first until all mobile radio's would be installed. Approximate time for installation would be 2 weeks. This would include all departments.
- At NO time would any emergency communication be interrupted for any agency.
- Interoperability *can be* accomplished with surrounding agencies utilizing a back to back system.

Summary

- Infrastructure upgrades:
- Updated antennas (high gain)
- Updated transmission line (tx / rx)
- Updated combining equipment
- Updated preselector equipment
- Updated grounding of equipment
- Remote system diagonistics (no on-site resetting, can be performed from any remote PC)
- Less annual expense due to less towers

Payment Options

- **Lease to Own**
- (Marlin Leasing, 3rd Party)

- Problems Solved Immediately
- Includes repeater modifications, subscriber units including accessories and maintenance.
- 1st and Last Month Payment up front to start
- $1 per radio to own at the end of term
- 5 Year Warranty
- Maintenance performed by Tekk Comm

- 2015 Capital Budget ?

- Problems solved immediately
- Includes infrastructure modifications, repeater's, portable and mobile delivery and installation, remote base into existing consoles.
- 5 Year Warranty
- Maintenance performed by Tekk Comm

Payment Options

- Estimated cost per discipline
- Tower (per site): $25,000.00
- Mobiles per unit: $640.00
- Portables per unit: $525.00
- Speaker mics not included in above pricing
- Savings (discount for subscriber units):
- 1-9 units standard price
- 10-30 units 4%
- 31-60 units 8%
- 61and up 12%

Questions

Thank you for allowing Tekk Comm communications to make this presentation.

Tekk Comm Communications
2205 Delsea Drive
Franklinville, NJ 08322
856-694-6580
www.tekkcomm.com

Appendix B

New Jersey P25 Communication Proposal

NEW JERSEY STATE CONTRACT 83909

Customer Name: MIDDLE TWP
Customer Address: 31 Mechanic St
CMCH, NJ 08210
Chief Chris Leusner
Equipment Description: APX7000 PORTABLES
Motorola Sales Person: JOHN HURON
Phone: 609-569-1271
Fax: 609-569-9147
Email: jhuron@wirelessce.com

Creation Date: 2/2/15
Revised On:
Print Date:
Valid Until: 4/1/18
State Contract# 83909

MOTOROLA
C/O WIRELESS C&E
153 COOPER
WEST BERLIN, NJ 08091

Commodity Code	Line No.	Model #	Description	List Price	Discount	Your Price	Quantity	Extended
726-88-085633	00002	H97TGD9PW1	APX7000	$2,632.00	25%	$1,974.00	81	$159,894.00
726-88-085633	00002	H207	DELETE STD BATTERY	($47.00)	25%	-$35.25	81	-$2,855.25
726-88-085633	00002	QA00569	7/800 MHZ PRI BAND	$0.00	0%	$0.00	81	$0.00
726-88-085633	00002	QA00574	VHF SECONDARY BAND	$0.00	0%	$0.00	81	$0.00
726-88-085633	00002	QA00579	ENABLE DUAL BAND	$1,000.00	25%	$750.00	81	$60,750.00
726-88-085633	00002	Q806	ASTRO DIG CAI OPERATION	$515.00	25%	$386.25	81	$31,286.25
726-88-085633	00002	H38	SMARTZONE OPERATION	$1,500.00	25%	$1,125.00	81	$91,125.00
726-88-085633	00002	Q361	9600 BAUD TRUNKING	$300.00	25%	$225.00	81	$18,225.00
726-88-085633	00002	QA00580	TDMA OPERATION	$450.00	25%	$337.50	81	$27,337.50
726-88-085633	00002	QA01648	ADVANCE SYS KEY HARDWARE KEY	$5.00	25%	$3.75	81	$303.75
726-90-085643	00013	PMNN4403	2050 MAH IP57 BATTERY	$127.00	40%	$76.20	81	$6,172.20
726-90-085643	00013	WPLN7080	IMPRES SINGLE UNIT CHARGER	$125.00	20%	$100.00	81	$8,100.00
726-90-085643	00013	PMMN4024	REMOTE SPK MIC IP57 3.5MM JACH	$78.00	20%	$62.40	45	$2,808.00
726-90-085643	00013	NNTN7624	IMPRES VEH CHARGER	$390.00	20%	$312.00	10	$3,120.00
726-90-085643	00013	NNTN7073	IMPRES MUC W/DISPLAY	$1,350.00	20%	$1,080.00	3	$3,240.00
961-53-085650	00032	SCHEDULE B	VOL DISCOUNT	($500.00)	0%	-$500.00	55	-$27,500.00
920-37-085644	00002	SCHEDULE B	INSTALLATION	$254.00	0%	$254.00	10	$2,544.00
								$384,550.45
								TOTAL

909 PURCHASE ORDER GUIDELINES ***

1) MAKE PURCHASE ORDER TO "MOTOROLA SOLUTIONS C/O WIRELESS C&E"
2) MOTOROLA WILL NOT ACCEPT PURCHASE *REQUISITIONS*. ONLY PURCHASE *ORDERS* ARE ACCEPTED.
3) INCLUDE STATE CONTRACT NUMBER "83909" ON PURCHASE ORDER
4) PURCHASE ORDER MUST CONTAIN A CUSTOMER SIGNATURE (TREASURER, OFFICIAL, ETC.)
5) "SHIP TO" ADDRESS MUST BE CLEARLY LABELED WITH THE WORDS "SHIP TO"
6) "BILL TO" ADDRESS MUST BE CLEARLY LABELED WITH THE WORDS "BILL TO"
7) FAX/EMAIL PURCHASE ORDER TO JOHN HURON AT 609-569-9147 JHURON@WIRELESSCE.COM BEFORE MAILING IT
8) MAIL PURCHASE ORDER TO:

MOTOROLA SOLUTIONS C/O WIRELESS C&E
153 COOPER RD
ATTN:JOHN HURON
WEST BERLIN , NJ 08091

NEW JERSEY STATE CONTRACT 83909

Customer Name: **MIDDLE TWP**
31 Mechanic St
Customer Address: **CMCH, NJ 08210**
Chief Chris Ieusner
Equipment Description: APX7500/MCD5000
Motorola Sales Person: JOHN HURON
Phone: 609-569-1271
Fax: 609-569-9147
Email: jhuron@wirelessce.com

Creation Date: 2/1/15
Revised On:
Print Date:
Valid Until: 4/1/18
State Contract# 83909

MOTOROLA
C/O WIRELESS C&E
153 COOPER
WEST BERLIN, NJ 08091

Commodity Code	Line No.	Model #	Description	List Price	Discount	Your Price	Quantity	Extended
726-88-085633	00003	L30URS9PW1	APX7500 SINGLE BAND 7/800	$3,980.00	25%	$2,985.00	4	$11,940.00
726-88-085633	00003	GA00244	PRIMARY 7/800 BAND	$0.00	0%	$0.00	4	$0.00
726-88-085633	00003	G806	ENH: ASTRO DIGITAL CAI OPER APX	$515.00	25%	$386.25	4	$1,545.00
726-88-085633	00003	G50	SMARTNET OPERATION APX	$1,200.00	25%	$900.00	4	$3,600.00
726-88-085633	00003	QA01648	ADD:ADVANCE SYSTEM HARDWARE KEY	$5.00	25%	$3.75	4	$15.00
726-88-085633	00003	G361	P25 TRUNKING SOFTWARE	$300.00	25%	$225.00	4	$900.00
726-88-085633	00003	GA00580	TDMA OPERATION	$400.00	25%	$300.00	4	$1,200.00
726-88-085633	00003	L999	FULL FP W/05 KEYPAD/CLOCK/VU	$789.00	25%	$591.75	4	$2,367.00
726-88-085633	00003	G90	NO MIC NEEDED	$0.00	0%	$0.00	4	$0.00
726-88-085633	00003	CA01598	AC LINE CORD	$0.00	0%	$0.00	4	$0.00
961-53-085650	00032		VOL DISCOUNT	($500.00)	0%	-$500.00	4	-$2,000.00
915-70-085645	00026	SCHEDULE B	INSTALLATION	$11,038.47	0%	########	1	$11,038.47
								$30,605.47
								TOTAL

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153 COOPER RD
ATTN:JOHN HURON
WEST BERLIN , NJ 08091

NEW JERSEY STATE CONTRACT 83909

Customer Name: **MIDDLE TWP**
31 Mechanic St
Customer Address: **CMCH, Nj 08210**
Chief Chris Leusner
Equipment Description: APX4500 MOBILE
Motorola Sales Person: JOHN HURON
Phone: 609-569-1271
Fax: 609-569-9147
Email: jhuron@wirelessce.com

Creation Date: 2/2/15
Revised On:
Print Date:
Valid Until: 4/1/18
State Contract# 83909

MOTOROLA
C/O WIRELESS C&E
153 COOPER
WEST BERLIN, NJ 08091

Commodity Code	Line No.	Model #	Description	List Price	Discount	Your Price	Quantity	Extended
726-88-085633	00003	M22URS9PW1	APX4500	$1,099.00	25%	$824.25	24	$19,782.00
726-88-085633	00003	QA02756	9600 BAUD TRUNKING	$1,570.00	25%	$1,177.50	24	$28,260.00
726-88-085633	00003	Q811	P25 CONV SOSTWARE	$650.00	25%	$487.50	24	$11,700.00
726-88-085633	00003	QA01648	ADVANCE SYS KEY HARDWARE	$5.00	25%	$3.75	24	$90.00
726-88-085633	00003	GA00580	TDMA OPERATION	$450.00	25%	$318.75	24	$7,650.00
726-88-085633	00003	GA00804	APX 02 CONTROL HEAD	$492.00	25%	$369.00	24	$8,856.00
726-88-085633	00003	G444	APX CONTROL HEAD SOFTWARE	$0.00	0%	$0.00	24	$0.00
726-88-085633	00003	G66	DASH MOUNT	$125.00	25%	$93.75	24	$2,250.00
726-88-085633	00003	G335	1/4 WAVE ANTENNA	$14.00	25%	$10.50	24	$252.00
726-88-085633	00003	W22	PALM MIC	$72.00	25%	$54.00	24	$1,296.00
726-88-085633	00003	G831	15W REMOTE SPK	$60.00	25%	$45.00	24	$1,080.00
961-53-085650	00032		VOL DISCOUNT	($300.00)	0%	-$300.00	24	-$7,200.00
920-37-085644	00025	SCHEDULE B	INSTALLATION	$319.60	0%	$319.60	24	$7,670.40
								$81,686.40
								TOTAL

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