



TOWNSEND WATER DEPARTMENT
540 Main Street West Townsend, Massachusetts 01474

Handwritten signatures and initials in blue ink.

Michael MacEachern, Chairman

Nathan Mattila, Vice-Chairman

Todd Melanson, Clerk

Paul Rafuse

(978) 597-2212

Water Superintendent

Email: water@townsend.ma.us

WATER COMMISSIONERS MEETING AGENDA

October 7, 2019 – 6:00 P.M.

Water Department 540 Main Street, Meeting Room

I. PRELIMINARIES:

- 1.1 NM called the meeting to order at 6:01 P.M., 540 Main Street.
- 1.2 Roll call showed Members Present: Nathan Mattila, (NM), Vice-Chair and Todd Melanson, (TM), Clerk. Michael MacEachern was absent. Guests Present: Rebecca McEnroe, Jennifer Pettit, and Joan Savoy.
- 1.3 NM announced that the meeting is being audio recorded.
- 1.4 Chairman's additions or deletions. Deleted 3.2 Bedford lock & key.
- 1.5 Approve meeting minutes of July 16, July 30, August 12, and August 19, 2019. TM moved to approve the meeting minutes of July 16, July 30, August 12, and August 19, 2019. NM seconded. Unanimous vote.
- 1.6 Review correspondence. None.

II. APPOINTMENTS:

- 2.1 6:30 P.M. Joan Savoy, 35 Adams Road RE: Discuss waterline to out building. The Board asked for her to contact a contractor and fill out a water application to be approved at the next BOWC meeting.

III. MEETING BUSINESS:

- 3.1 Discuss Winter Operations procedures, plowing and OT. Tabled.
- ~~3.2 Discuss/review estimate from Bedford lock & Key to replace all locks at pump stations and gates.~~
- 3.3 Discuss/Review recommendation to secure additional funding at fall town meeting. Rebecca responded that she just began to review the budgetary issues and should have a better handle on the situations by the next meeting.
- 3.4 Discuss/approve proposal from Tighe & Bond RE: 28 Adams Road Drainage Review. The Board suggested that we wait until spring to get the spring rain and snow melt. We would also like to work on getting access to the property.
- 3.5 Discuss/vote/refund \$161.74, 534 Main Street, Nancy Clough RE: Nancy submitted a bill for reimbursement from Lorden to clean/ repair furnace: suspected cause was from discolored water. The Board would like Ryan to get more information from Lorden before making a decision.
- 3.6 Commissioners' Department goals. NM would like to have the water department functioning at 100% in all aspects. TM suggested that we would need to re-visit water rates to provide the funding needed. TM believes that we would need to set the water rates in a tiered system. Commercial bulk rate would be possible for industry or commercial use.
- 3.7 FY21 Budget Planning. Rebecca plans on working with Brenda and Terry to define the budget discrepancies for this year and work with Ryan to discuss items needed for next year's budget such as Master Planning etc. Rebecca will have a better idea in the next couple of weeks.
- 3.8 Staff expenditures approval. Rebecca suggested that the staff would need to get approval for purchases over \$1,000.00 from Interim Superintendent and the BOWC approval greater than \$2,500.00.
- 3.9 Dump Truck re-purpose for the next Special Town Meeting. We need to get the service truck price down to \$50,000 then Rebecca will get in touch with Don Klein to begin the process of re-appropriation.
- 3.10 Interim Superintendent's RE: flexibility to extend past 10/2019. Currently Rebecca's contract will run out at the end of October. The Board recommends amending the contract until the end of the year.

IV. COMMISSIONERS UPDATES AND REPORT:

4.1 TM added 4.1.1. TM reported that Homeland Security contacted him and gave him two dates either November 6th or 7th, from 9:00AM to 2:00PM.

V. INTERIM SUPERINTENDENTS/FOREMANS UPDATES AND REPORTS:

5.1 Discuss Sanitary Survey. Rebecca reported that the Sanitary Survey was finished on September 30th and all went well.

5.2 Discuss Lead & Copper testing. All tests were completed and results found well below normal levels.

5.3 Inspection/Cleaning of the Highland Street and Fitchburg Road Tanks. Completed and will review the report when available.

5.4 Review/Discuss Water Line Inspection Form and procedure. The Board reviewed the form and would like the water departments logo added to the top of the form. The Board would also like a list of what you cannot use as map markers. Bushes, trees etc.

5.5 Report on stations/systems updates. Tabled

5.6 Review quote for SCADA radio repeater system. Tabled for a future meeting.

VI. OFFICE ADMINISTRATOR'S UPDATES AND REPORTS:

6.1 The Board scheduled the next BOWC meeting on October 21, 2019 at 6PM.

6.2 The Board reviewed and signed Bills Payable Warrants

6.3 The Board reviewed and signed Schedule of Bills Receivable report.

ADJOURNMENT:

TM motioned to review and sign reports and bill payable warrants out of session. NM seconded. Unanimous vote.

NM adjourned the BOWC at 7:30 PM.

Respectfully submitted,

Brenda Boudreau,

Office Administrator

Townsend Water Department.

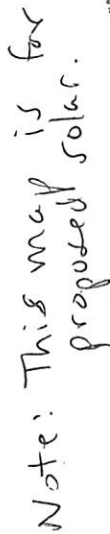
WATER DEPARTMENT MEETING

DATE October 7, 2019

NAME	ADDRESS	PH/EMAIL
Ryan Larrivee	5411 main st	Bog
Becky McEnre	406 Sugar Rd Bolton	Becky@mcenreconsulting.com
Jennifer Pettit	160 Highwood St.	jennpett1448@gmail.com
Jean Savoy	35 Adams Rd	Savoyjean@gmail.com

NAME: WILLIAM J CADOGAN STREET: 35 ADAMS ROAD		SERVICE INFO Main to Curb: Curb to Meter		REMARKS INSTALLED CONNECTOR TO HOUSE 10-24-88
TYPE METER: SEIUS US 58880003 REG # 37048433		ACCT. NUMBER 735		
TYPE CURB STOP:				
MAIN SIZE: 6" DEPTH: 5' 6"		TYPE: TRANSITE		

21



~~We're requesting
water be~~

brought in from road to art studio.

- If tied into house
- If from Adams Road



32

Bedford Lock & Key, LLC

44A North Road
 Bedford, MA 01730
 PH: 781-275-1597
 FX: 781-275-1511

Estimate

Date	Estimate #
9/6/2019	090619

Name / Address
Town of Townsend - Water Department 540 Main Street West Townsend, MA 01469

			Project
Description	Qty	Rate	Total
The Master Lock No. 6621 ProSeries® Weather Tough® Covered Laminated Padlock features a 2-1/8in (54mm) heavy steel body to withstand physical attack	33	38.90	1,283.70
Single Cylinder Deadbolt, Grade 2, Adjustable 2-3/8" or 2-3/4" Backset, Satin Chrome	1	85.00	85.00
Original Keys. master key, and service key.	2	7.50	15.00
Duplicate Keys	8	5.00	40.00
key locks to new key system	38	20.50	779.00
rekey all lock's in shop and on location at pump stations		385.00	385.00
		Subtotal	\$2,587.70
		Sales Tax (6.25%)	\$0.00
		Total	\$2,587.70

T-0354
September 17, 2019

Board of Water Commissioners
Townsend Water Department
540 Main Street
West Townsend, MA 01474

Re: **28 Adams Road Drainage Review Proposal**

Dear Board of Commissioners:

Tighe & Bond is pleased to provide the Townsend Water Department with the following proposal for a review of the changes associated with stormwater drainage at the property located at 28 Adams Road as it relates to its diversion of stormwater toward the Water Department's property off Cross Street.

Scope of Services

Site Visit

Tighe & Bond will conduct a site visit to 28 Adams Road to review the changes to the stormwater drainage, which has been reported to have caused a diversion of stormwater runoff from that property to the Water Department's property off Cross Street. The Water Department's property located off Cross Street is the location of their Cross Street groundwater well, which is registered as a public water supply. There is concern that a diversion of stormwater from the 28 Adams Road property may negatively impact the water quality at the Cross Street groundwater well or increase the risk of contamination.

During the site visit Tighe & Bond will:

- Review the changes associated with the drainage of stormwater at 28 Adams Road (to the extent that access is provided)
- Observe the flow path of water from 28 Adams Road toward the Cross Street well site (to the extent that access is provided)
- Collect water quality data associated with the Cross Street Well before and after the changes to stormwater drainage

Memorandum of Findings

Tighe & Bond will provide a memorandum that summarizes the information we collect during our site visit and our evaluation of the water quality data from the Cross Street Well. We will provide our opinion of the risk associated with the current stormwater drainage route as it relates to the water quality of the Cross Street Well. In addition, we will provide our opinion on whether this type of diversion of stormwater violates aquifer protection laws or is inconsistent with wellhead and aquifer protection policies.

Fee

Tighe & Bond will perform the site visit and provide a memorandum of our findings for a lump sum fee of **\$5,500**, invoiced monthly based on percentage complete. In the event that the

scope of work is increased for any reason, the lump sum fee to complete the work shall be mutually revised by written amendment. Our attached Terms and Conditions is part of this letter agreement.

We look forward to assisting the Townsend Water Department in this matter. If you have any questions regarding this proposal, please feel free to contact Lou Soracco at (508) 304-6358, or Tom Mahanna at (508) 471-9607.

Very truly yours,

TIGHE & BOND, INC.



Thomas Mahanna, PE
Vice President



Louis Soracco, PE
Senior Project Manager

Enclosures: Terms & Conditions

Acceptance

On behalf of the Townsend Water Department, the scope, fee, and terms of this proposal are hereby accepted.

Authorized Representative

Date

Enclosure: Terms & Conditions

Board of Selectmen:

Sue Lisio, Chairman

Date

Wayne Miller, Vice Chairman

Date

Don Klein, Clerk

Date





Theresa Walsh <terry.e.walsh@gmail.com>

Fwd: Townsend 28 Adams Road Request for Additional Information

1 message

Jennifer Pettit <jennpettit1448@gmail.com>
To: Theresa Walsh <terry.e.walsh@gmail.com>

Mon, Oct 7, 2019 at 9:47 AM

Hi Terry,

This is what Denise Child's viewed on the site walk with the Conservation Commission. The residents who filed the appeal were not allowed on the property. There is also a video that was shown before the walk that shocked me at the amount of water clearly seen rushing through these trenches back towards Zone 1 of the Cross St. well. This is part of the public record that the agent, David Henkels has. I believe that Ms Child had a discussion with the homeowner and the Commission about what might be done to better serve conservation interests, I assume better check dams to catch sedimentation, etc. but I was not allowed to be present.

At the very least, I would hope that the Water Dept. might meet with the Conservation Commission about how to protect our well fields.

Thanks for your consideration of this matter, Jennifer

----- Forwarded message -----

From: **Child, Denise (DEP)** <denise.child@state.ma.us>

Date: Thu, Aug 1, 2019 at 1:57 PM

Subject: Townsend 28 Adams Road Request for Additional Information

To: Rhonda Gallant <gallantr@aol.com>

Cc: jennpettit1448@gmail.com <jennpettit1448@gmail.com>, neegagner@gmail.com <neegagner@gmail.com>, Bill Cadogan <bill.cadogan@gmail.com>, Joan Savoy <savoyjoan@gmail.com>, David Henkels (dhenkels@townsend.ma.us) <dhenkels@townsend.ma.us>, conservation@townsend.ma.us <conservation@townsend.ma.us>, Lyndsy Butler <lbutler@townsend.ma.us>, djhussey@comcast.net <djhussey@comcast.net>, stuffycoyote@msn.com <stuffycoyote@msn.com>, khill9@verizon.net <khill9@verizon.net>, Veronica Kell <vakdlc@gmail.com>

Dear Mr. and Ms. Gallant,

It was nice to meet you Tuesday. As promised I've attached the sign in sheet with everyone's contact information.

For those who were not able to enter the property, I can relay that my observations were consistent with the description provided in the file and by the applicant in the roadside meeting with the following exceptions:

1. I did see an area of sedimentation in the pond at the end of the trench where it empties into the "fire pond." The area was about 10X10 feet and at least a few inches in thickness. Some of it appeared to be deposited recently (over this year's growth of vegetation) but it is not possible to be sure how old it all is.
2. The trenches were excavated deeper than was described, I'd say between 2 and 3 feet deep. The material excavated from the trenches was piled immediately next to the trench and spread out either by rake or by the excavator over the apparent BVW for an area about five feet back from the edge of the trench, in varying thickness. Most of the larger stones in the excavated material had been picked out and returned to the excavation either in piles as "check dams" or simply lining the trench floor. Much of area where the excavated material was spread beside the trenches has begun to revegetate and was relatively stable.

After reviewing the file and the after-the-fact project in the field, I've determined that additional information is necessary for me to determine if the project required the filing of a Notice of Intent. I'm requesting that you submit a plan which shows the property boundaries, the wetland resource area boundaries (I understand that these were delineated in 1990 and could be outdated, but please provide the best information you have), the boundaries of the area of the property which is and was "land in agricultural use" at the time of the work, the location of the trenches/swale where the work was conducted, and the area where excavated material was placed and remains at the property. The plan does not necessarily need to be surveyed or stamped by an engineer but it should be at least approximately to scale with relevant distances taped off and indicated on the plan.

You can submit the additional information in hard copy or as an email attachment but either way please copy all the parties.

Thank you,

Denise Child, Wetlands Section Chief

MassDEP CERO Bureau of Water Resources

8 New Bond Street, Worcester, MA 01606

508-767-2846



Townsend-28 Adams Rd-SV Attendance sheet-20190730.pdf

69K



Lorden

The Home Climate Company

Please call (800) 828-3395 with any questions.

www.lorden.com

Nancy Clough
534 Main St.
West Townsend, MA 01474

INVOICE

3.5

Customer #:	103564
Invoice #:	2186653
Invoice Date	09/09/2019
Total Due Upon Receipt	\$161.74

Make Check Payable to: Lorden

Amount Enclosed: \$ _____

Remit To:
Lorden
PO Box 669
Ayer, MA 01432

Customer Name	Delivery/Service Address	Cust #	Invoice #	Inv Date
Nancy Clough	534 Main St. - West Townsend, MA 01474	103564	2186653	09/09/2019
Quantity	Description	Unit Price	TOTAL	
3.00	3/4 inch Copper Fitting	\$2.7500	\$8.25	
2.00	3/4 inch Copper per Foot	\$3.7500	\$7.50	
1.00	Service Labor - Overtime Rate	\$145.0000	\$145.00	
	A - MA Sales Tax:	\$0.99		

For Fuel or Service At:

534 Main St. - West Townsend, MA 01474

Sub Total	\$160.75
Charges	\$0.00
Tax Total	\$0.99
TOTAL DUE	\$161.74

Account Balance including this invoice:	\$161.74	TOTAL DUE	\$161.74
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09/09/2019 - Technician: Patrick Carvalho - Work Performed: Oil Water Leak - Added diverter pipe to backflow checked over system all check

Lorden
PO Box 669
Ayer, MA 01432

Please call (800) 828-3395 with any questions.

www.lorden.com

Water line inspection Form

If service is over 475 feet then require a meter pit.	
Water line must be 5 or more feet in depth with a minimum of 12 inches of sand in a continuous sleeve with fernco couplings on either side	
All connections must be compression	
All new water service installations must be inspected by The Townsend Water Department (Trenches shall not be filled in until inspection has been completed)	
Curb stop in good condition and at acceptable grade level	
Shutoff, meter and check valve installed inside by Townsend Water Department	
All Services Must have Tracer Wire , Waterline Caution Tape	
A Plan Is to be made of Service and Curb stop	
Water line tested by water Department	
In Case of an emergency if Water Department can't be on site for inspection, Contractor can Provide pictures of entire view of line on property, But Must provide measurements of beginning, middle and End of Water line, Must be Time Stamped and must provide clean fill/Sand (To Be Approved by Water department only)	

Approved by _____

Date and Time _____

Add TWD
Log -

5.7



PO Box 5192, 85 Lafayette Road
Salisbury, MA 01952
Phone (978) 465-7932 Fax (978) 462-8980 www.tcscommunications.com

QUOTE

DATE: July 29, 2019
QUOTE # Townsend Water / Repeater Station

Bill To: Townsend Water Department
540 Main Street
Townsend MA 01476

Ship To: Same
Attn: Kevin Keefe
walerlech@townsend.ma.us
978-877-3174

Comments or Special Instructions: SCADA RADIO REPEATER SYSTEM BUDGETARY PRICING

SALESPERSON	SITE NAME	P.O. NUMBER	SHIP DATE	SHIP VIA	F.O.B. POINT	TERMS
Dean Marengi						NET 30

QTY	PART NUMBER	DESCRIPTION	UNIT PRICE	AMOUNT
		Repeater Radio for SCADA, Bayberry Hill Tower		
1	140-5028-504	CalAmp Viper SC+200 IP router, 215-240 MHz	\$1,615.00	\$1,615.00
1	Z3441	PC TEL 5db gain fiberglass omnidirectional antenna, 215-225 MHz	\$935.00	\$935.00
1	VHF50HN	Polyphaser surge arrestor	\$105.00	\$105.00
150	LMR-600	Times Microwave 1/2" low loss coaxial cable (length estimated)	\$3.05	\$457.50
2	EZ-600-NMH-X	Type N male connectors for LMR-600 cable	\$28.00	\$56.00
2	GK-S600TT	Grounding kits for LMR-600 cable	\$35.00	\$70.00
1	LMR-400 jumper	Jumper cable from Polyphaser to Viper radio	\$100.00	\$100.00
1	Tower bracket	Mounting bracket to attach antenna to existing tower	\$400.00	\$400.00
1	Rack mount panel	19" rack mount panel for mounting Viper radio and power supply	\$100.00	\$100.00
1	DR-4524	Moxa power supply, 110VAC to 24VDC	\$145.00	\$145.00
1	Installation	Projected installation cost: Install radio, antenna, cable, etc.	\$4,500.00	\$4,500.00
1	FCC license mod	Modify FCC license to include Bayberry Hill repeater site	\$600.00	\$600.00
1	Programming	Modify existing radio network to add Bayberry Hill repeater site	\$1,200.00	\$1,200.00
* ALL PRICING PROVIDED IS FOR BUDGETARY PURPOSES AND IS SUBJECT TO CONFIRMATION BASED ON SITE INSPECTION.				

Authorized Signature:	Dean A. Marengi Vice President
Date:	July 29, 2019

SUBTOTAL	\$10,283.50
TAX RATE	0.00%
SALES TAX	-
SHIPPING & HANDLING	300.00
TOTAL	\$ 10,583.50

Make all checks payable to TCS Communications Corp.

If you have any questions concerning this invoice, contact Dean Marengi, (978) 465-7932, dean.marengi@tcscommunications.com

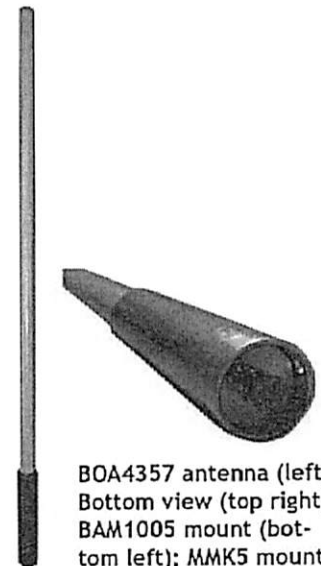
THANK YOU FOR YOUR BUSINESS!

PCTEL Carrier Grade VHF/UHF Omnidirectional Base Station Antennas

The BOA VHF/UHF omnidirectional base station antenna series consist of a linear array, encapsulated in a heavy duty fiberglass radome with a thick walled 6061-T6 aluminum mounting base for reliable long term use. The rugged design allows the BOA series to withstand harsh environments and is ideal for Industrial Wireless applications. The series is DC grounded and is UPS shippable.

Features

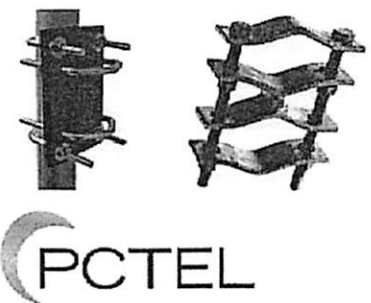
- UV Stable Light Gray Fiberglass Radome
- Hard-Coat Anodized Mounting Base
- Galvanized Mounting Hardware
- Removable Drain Plug for Upright or Inverted Mounting



BOA4357 antenna (left);
Bottom view (top right);
BAM1005 mount (bottom left);
MMK5 mount (bottom right)

RF/Electrical Specifications

Model	Frequency Range	Nominal Gain	Return Loss	SWR	E-Plane Beamwidth
BOA2175	215-225 MHz	5 dBi/3 dBd	>10 dB	<2.0	18°
BOA2177	217-222 MHz	7.1 dBi/5 dBd	>10 dB	<2.0	18°
BOA4409	440-460 MHz	9.1 dBi/7 dBd	>12 dB	<1.7	11°
BOA4357	430-470MHz	7.1 dBi/5 dBd	>12 dB	<1.7	18°



PCTEL

Mechanical Specifications

Model	Weight (Mass)	Height	Bending Moment at Rated Wind	Lateral Thrust at Rated Wind	Equivalent Flat Plate Area
BOA2175	10 lbs	122"	685 ft-lbs	74 lbs	1.7 ft²
BOA2177	12 lbs	151"	965 ft-lbs	88 lbs	2.10 ft²
BOA4409	12 lbs	151"	965 ft-lbs	88 lbs	2.10 ft²
BOA4357	7.0 lbs	83"	250 ft-lbs	45 lbs	1.125 ft²

Technical Data

Maximum Power: 250 watts
Nominal Impedance: 50 ohms
Radome Material: Pultruded Fiberglass (2" Outside Diameter)
ESD Protection: DC grounded
Rated Wind: 125 mph
Termination: N female bulkhead
Mounting Hardware: BAM1005 or MMK5 (Included)



Viper SC+™

Intelligent IP Router for Licensed Spectrum



EXPERIENCE THE ADVANTAGE

- Up to 4X the speed of devices in its class
- Optimum control for managing data flow
- Get the most out of your RF channel
- User selected channel size: 6.25, 12.5, 25, 50 and 100 KHz
- 4kbps to 256 kbps speeds based on application requirements; Configurable to adapt to your applications
- QoS for simultaneous use of multiple applications and data transfer prioritization
- Easily deployed and managed via web browser

MORE SPEED. MORE INTELLIGENCE.

Designed for the energy and utility segment as well as the water or wastewater industries, the CalAmp Viper SC+ is an intelligent, point-to-multipoint bridge or router for licensed narrowband spectrum holders. The ruggedized Viper SC+ reliably delivers faster data speeds to support telemetry and SCADA applications in bandwidths ranging from 6.25 kHz to 100 kHz. Flexible for long-distance applications, this software-programmable router is fast, secure and intelligent.

FAST & RELIABLE

Four times as fast as devices in its category, the Viper SC+ offers 256 kbps in 100 kHz channels, providing increased throughput for reliable, remote business-critical communications. The Viper SC+ boasts multispeed operation, which allows each Viper SC+ to communicate to a Viper SC+ Base Station at the fastest speed supported by a given signal strength. The result is a network where each RF link is optimized for performance and reliability.

INTELLIGENT & SECURE

Featuring advanced QoS, the Viper SC+ allocates guaranteed RF bandwidth to critical, high-priority user-defined applications. Able to support multiple applications simultaneously, the Viper SC+ also boasts data prioritization for the ultimate in router intelligence. The Virtual Local Area Network (VLAN) routing capability of the Viper SC+ improves scalability, security and traffic-flow management of the data transmitted and permits a greater number of remote device connections. Versatile and scalable for the future, the Viper SC+ can be used as an IP router, terminal server, Ethernet bridge, access point or remote site.

CENTRALIZED MANAGEMENT

Viper SC+ can be managed via an intuitive webpage, SNMP, or telnet enabling remote management for every application. Viper's device management capabilities allow administrators to set-up and view device information, configure network parameters and deploy unit upgrades from any location. These remote management tools reduce the time and cost of maintaining network infrastructure while improving workforce efficiency for managing and monitoring industrial equipment in the field.

VIPER SC+ TECHNICAL SPECIFICATIONS

PRODUCT HIGHLIGHTS

- Highly secure, intelligent and versatile narrowband spectrum router
- Up to 256 kbps speeds for reliable delivery of business critical data*
- Highly secure VLAN, designed to meet FIPS 140-2

CONNECTORS/INTERFACE

Ethernet	VHF/UHF: 10 Base-T Auto-MDIX RJ-45 200/900: 10/100 Base-T Auto-MDIX RJ45*
Serial COM 1, COM 2	RS-232 DB-9
Antenna	TNC Female (Tx/Rx) SMA Female (Rx) - Dual port models only

MECHANICAL

Dimensions	5.50 W x 2.125 H x 4.25" D. (13.97 x 5.40 x 10.8 cm)
Weight	2.4 lbs, 1.1 kg

ENVIRONMENTAL

Operating Temperature	-40° to +70° C
Specified Temperature	-30° to +60° C
Operating Humidity	5% to 95% Non-condensing

LED

Power, Status, Ethernet Activity, Ethernet Link, Receive/Transmit

POWER

Tx Current	1W: 1.6A@10V; 0.8A@20V; 0.6A@30V 8/10W: 4.3A@10V; 2.1A@20V; 1.4A@30V
Rx Current	600mA@10V; 300mA@20V; 225mA@30V
Primary Power	10-30 VDC

STANDARDS & CERTIFICATIONS

- FCC
- IC
- UL (Pending)
- ROHS2 Compliant

TRANSMITTER

Frequency Stability	1.0 ppm
Carrier Output Power	1 -10 Watts (VHF, 200, UHF), 1-8 Watts (900)
Duty Cycle	100% (Power Foldback for High Temps)
Output Impedance	50Ω

*Viper SC+ 200, 900 with 100 kHz channel capability

FREQUENCY BANDS

	Frequency	Channel Bandwidth
VHF:	136-174 MHz	6.25/12.5/25/50kHz
200:	215-240 MHz	6.25/12.5/25/50/100kHz
UHF:	406.1-512 MHz	6.25/12.5/25/50kHz
900 (NPCS):	880-902 MHz	12.5/25/50/100kHz
900 (NPCS, MAS):	928-960 MHz	12.5/25/50/100kHz

Modes of Operation	Simplex, Half-Duplex
Modulation	2FSK, 4FSK, 8FSK, 16FSK

RECEIVER

VHF, 200, UHF, BER @ 1 x 10⁻⁶

6.25 kHz	-115dBm@4kbps; -106dBm@8kbps; -100dBm@12kbps
12.5 kHz	-116dBm@8kbps; -109dBm@16kbps; -102dBm@24kbps; -95dBm@32kbps
25 kHz	-114dBm@16kbps; -106dBm@32kbps; -100dBm@48kbps; -92dBm@64 kbps
50 kHz	-111dBm@32kbps; -104dBm@64 kbps; -97dBm@96kbps; -88dBm@128kbps
100 kHz(200 only)	-103dBm@64kbps; -96dBm@128 kbps; -89dBm@192kbps; -80dBm@256kbps

900 BER @ 1 x 10⁻⁶

12.5 kHz	-112dBm@8kbps; -106dBm@16kbps; -99dBm@24kbps; -90dBm@32kbps
25 kHz	-111dBm@16kbps; -104dBm@32kbps; -97dBm@48kbps; -89dBm@64 kbps
50 kHz	-108dBm@32kbps; -101dBm@64 kbps; -94dBm@96kbps; -85dBm@128kbps
100kHz	-100dBm@64kbps; -93dBm@128kbps; -86dBm@192kbps; -77dBm@256kbps

Adjacent Channel

VHF, 200, UHF	60dB@12.5 kHz; 70 dB@25 kHz; 75 dB@50 kHz; 75dB@100kHz
900	55 dB@12.5 kHz; 65 dB@25 kHz; 70 dB@50kHz; 70dB@100kHz

SECURITY

VLAN, AES-128, VPN with AES-128/192/256, RADIUS, Designed to meet FIPS 140-2

APPLICATIONS

- Telemetry
- SCADA
- Real-time communications

TCS Communications Corp

85 Lafayette Road PO Box 5192
Salisbury, MA 01952
T: 978.466.7932 F: 978.462.8980

www.tcscommunications.com



© 2013 CalAmp. All specifications are typical and subject to change without notice.

CalAmp Corp.

1401 N. Rice Avenue
Oxnard, CA 93030
T: 805.987.9000 F: 805.987.8359

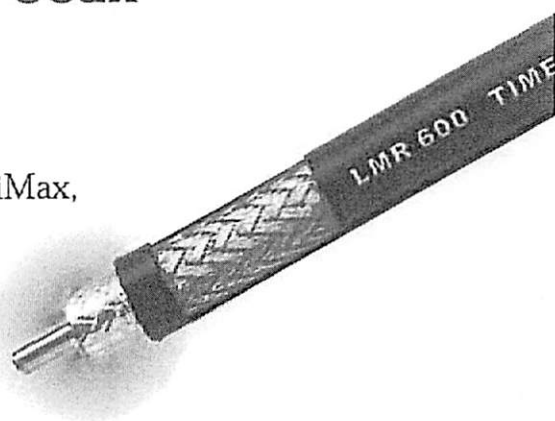
www.calamp.com

LMR®-600

Flexible Low Loss Communications Coax

Ideal for...

- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR, WLAN, WISP, WiMax, SCADA, Mobile Antennas) requiring an easily routed, low loss RF cable



• **LMR®** standard is a UV Resistant Polyethylene jacketed cable designed for 20-year service outdoor use. The bending and handling characteristics are significantly better than air-dielectric and corrugated hard-line cables.

• **LMR®-DB** is identical to standard LMR plus has the advantage of being watertight. The addition of waterproofing compound in and around the foil/braid insures continuous reliable service should the jacket be inadvertently damaged during installation or in the future.

• **LMR®-FR** is a non-halogen (non-toxic), low smoke, fire retardant cable designed for in-building runs that can be routed anywhere except air handling plenums. LMR-FR is UL/NEC & CSA rated 'CMR' and 'FT4' respectively, meets FAA FAR25 requirements and is MSHA-P for mining applications.

• **LMR®-FR-PVC** is a general-purpose indoor cable and has a UL/NEC & CSA rating of 'CMR' and 'FT4' respectively. It is less expensive than LMR-FR, however it emits toxic fumes (HCL) and greater smoke density when burned.

• **LMR®-PVC** is designed for low loss general-purpose applications and is somewhat more flexible than the standard polyethylene jacketed LMR.

• **LMR®-PVC-W** is a white-jacketed version of LMR-PVC for marine and other applications where color compatibility is desired.

• **Flexibility** and bendability are hallmarks of the LMR-600 cable design. The flexible outer conductor enables the tightest bend radius available for any cable of similar size and performance.

• **Low Loss** is another hallmark feature of LMR-600.

Size for size LMR has the lowest loss of any flexible cable and comparable loss to semirigid hard-line cables.

• **RF Shielding** is 50 dB greater than typical single shielded coax (40 dB). The multi-ply bonded foil outer conductor is rated conservatively at > 90 dB (i.e. > 180 dB between two adjacent cables).

• **Weatherability:** LMR-600 cables designed for outdoor exposure incorporate the best materials for UV resistance and have life expectancy in excess of 20 years.

• **Connectors:** A wide variety of connectors are available for LMR-600 cable, including all common interface types, reverse polarity, and a choice of solder or non-solder center pins. Most LMR connectors employ crimp outer attachment using standard hex crimp sizes.

• **Cable Assemblies:** All LMR-600 cable types are available as pre-terminated cable assemblies. Refer to the section on FlexTech for further details.

Part Description				Stock
Part Number	Application	Jacket Color	Code	
LMR-600	Outdoor	PE	Black	54003
LMR-600-DB	Outdoor/Watertight	PE	Black	54093
LMR-600-FR	Indoor/Outdoor Riser CMR	FRPE	Black	54032
LMR-600-FR-PVC	Indoor/Outdoor Riser CMR	FRPVC	Black	54074
LMR-600-PVC	General Purpose	PVC	Black	54219
LMR-600-PVC-W	General Purpose	PVC	White	54206

Construction Specifications			
Description	Material	In.	(mm)
Inner Conductor	Solid BCCAI	0.176	(4.47)
Dielectric	Foam PE	0.455	(11.56)
Outer Conductor	Aluminum Tape	0.461	(11.71)
Overall Braid	Tinned Copper	0.490	(12.45)
Jacket	(see table above)	0.590	(14.99)

Mechanical Specifications

Performance Property	Units	US	(metric)
Bend Radius: installation	in. (mm)	1.50	(38.1)
Bend Radius: repeated	in. (mm)	6.0	(152.4)
Bending Moment	ft-lb (N-m)	2.75	(3.73)
Weight	lb/ft (kg/m)	0.131	(0.20)
Tensile Strength	lb (kg)	350	(158.9)
Flat Plate Crush	lb/in. (kg/mm)	60	(1.07)

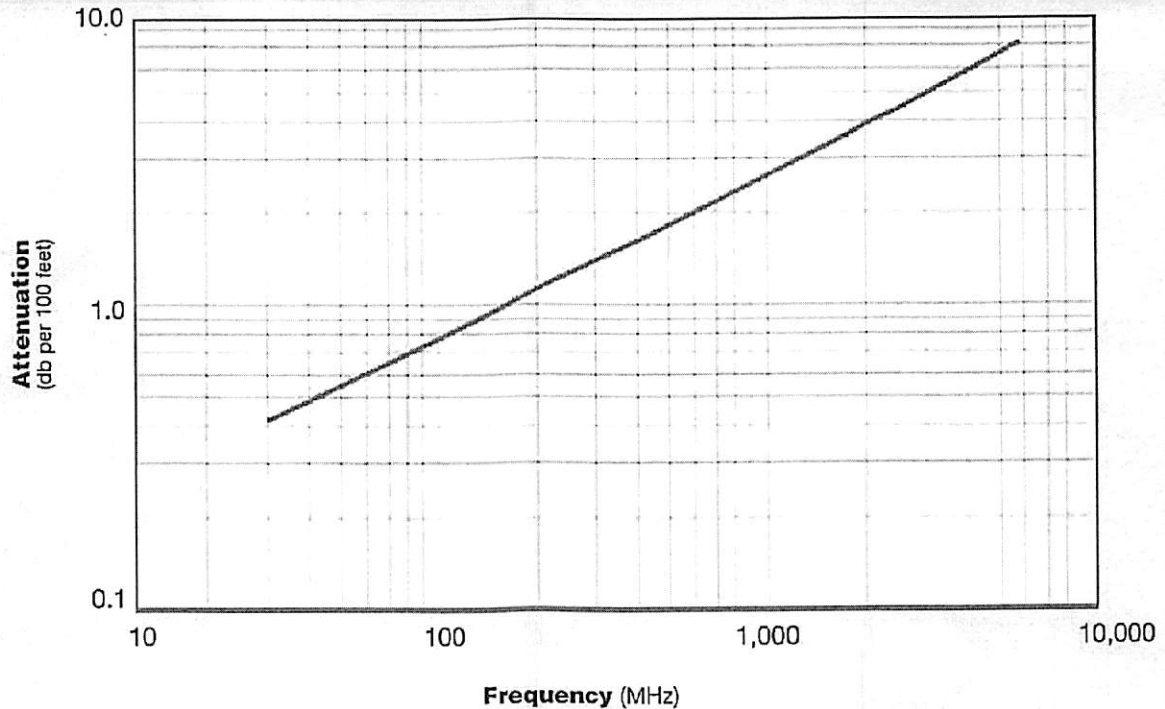
Environmental Specifications

Performance Property	°F	°C
Installation Temperature Range	-40/+185	-40/+85
Storage Temperature Range	-94/+185	-70/+85
Operating Temperature Range	-40/+185	-40/+85

Electrical Specifications

Performance Property	Units	US	(metric)
Velocity of Propagation	%	87	
Dielectric Constant	NA	1.32	
Time Delay	nS/ft (nS/m)	1.17	(3.83)
Impedance	ohms	50	
Capacitance	pF/ft (pF/m)	23.4	(76.6)
Inductance	uH/ft (uH/m)	0.058	(0.19)
Shielding Effectiveness	dB	>90	
DC Resistance			
Inner Conductor	ohms/1000ft (/km)	0.53	(1.7)
Outer Conductor	ohms/1000ft (/km)	1.2	(3.9)
Voltage Withstand	Volts DC	4000	
Jacket Spark	Volts RMS	8000	
Peak Power	kW	40	

Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.4	0.5	1.0	1.2	1.7	2.5	3.3	3.7	3.9	4.4	7.3
Attenuation dB/100 m	1.4	1.8	3.2	3.9	5.6	8.2	10.9	12.1	12.8	14.5	23.8
Avg. Power kW	5.51	4.24	2.41	1.97	1.35	0.93	0.70	0.63	0.59	0.52	0.32

Calculate Attenuation =

$(0.075550) \cdot \sqrt{\text{FMHz}} + (0.000260) \cdot \text{FMHz}$ (interactive calculator available at http://www.timesmicrowave.com/cable_calculators)

Attenuation:

VSWR=1.0; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

LMR®-600 Flexible Low Loss Communications Coax



Connectors

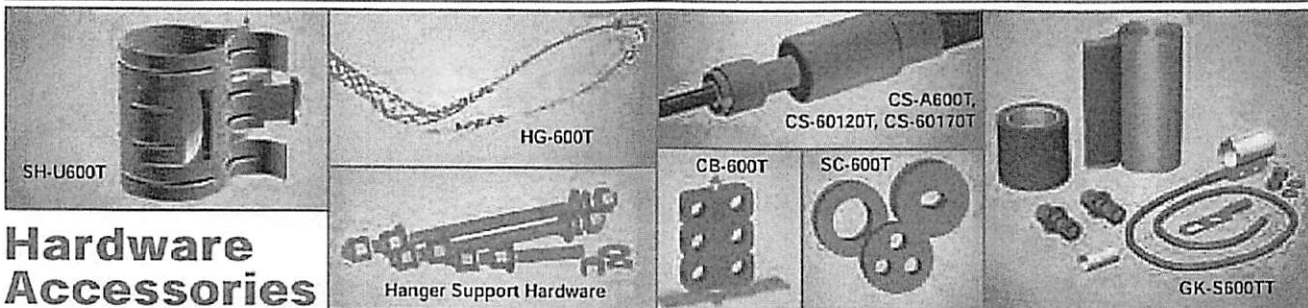
Interface	Description	Part Number	Stock Code	VSWR**	Coupling Freq. (GHz)	Inner Contact	Outer Contact	Finish*	Length in (mm)	Width in (mm)	Weight lb (g)
1. 7/8 EIA	Flange	EZ-600-78EIA	3190-1373	<1.25:1	(2.5)	NA	Spring Finger	Clamp	S/S	2.3 (58)	2.60 (66.0) 0.873 (396.0)
2. 7-16 DIN Female	Straight Jack	TC-600-716FC	3190-375	<1.25:1	(2.5)	NA	Solder	Clamp	S/S	1.1 (28)	1.00 (25.4) 0.249 (112.9)
3. 7-16 DIN	Straight Plug	EZ-600-716M-X	3190-2643	<1.30:1	(6)	Hex	Spring Finger	Crimp	A/S	1.6 (42)	1.38 (35.0) 0.209 (94.80)
4. 7-16 DIN	Straight Plug	TC-600-716M-X	3190-2642	<1.30:1	(6)	Hex	Solder	Crimp	A/S	1.6 (40)	1.38 (35.0) 0.191 (86.6)
5. 7-16 DIN	Straight Plug	TC-600-716MC	3190-502	<1.25:1	(2.5)	Hex	Solder	Clamp	S/S	2.0 (51)	1.30 (33.0) 0.347 (157.4)
6. 7/16 Male	Right Angle	EZ-600-716M-RA-X	3190-2546	<1.35:1	(6)	Hex	Spring Finger	Crimp	A/G	1.6 (40)	1.38 (35.0) 0.462 (210.0)
7. 7-16 DIN	Right Angle	TC-600-716M-RA-D	3190-2599	<1.35:1	(6)	Hex	Solder	Crimp	A/S	1.7 (44)	2.00 (50.9) 0.362 (164.2)
8. 7-16 DIN	Straight Jack	EZ-600-716F	3190-2447	<1.25:1	(6)	Hex	Spring Finger	Crimp	A/G	1.8 (45)	1.32 (33.6) 0.158 (71.7)
9. HN Male	Straight Plug	TC-600-HNMC	3190-1429	<1.25:1	(6)	Knurl	Solder	Clamp	S/G	2.3 (59.2)	0.88 (22.4) 0.25 (113)
10. LC Male	Straight Plug	TC-600-LCM	3190-1406	<1.25:1	(6)	Hex	Solder	Clamp	N/S	3.1 (78.0)	1.62 (41.1) 1.20 (544)
11. N Female	Straight Jack	TC-600-NF-X	3190-2816	<1.30:1	(6)	NA	Solder	Crimp	A/G	1.7 (43)	0.69 (17.6) 0.076 (34.6)
12. N Female	Straight Jack	EZ-600-NF-X	3190-2817	<1.30:1	(6)	NA	Spring Finger	Crimp	A/G	1.7 (43)	0.69 (17.6) 0.090 (40.6)
13. N Female	Bulkhead Jack	EZ-600-NF-BH	3190-616	<1.25:1	(2.5)	NA	Spring Finger	Crimp	S/G	2.4 (61)	0.88 (22.4) 0.195 (88.5)
14. N Female	Bulkhead Jack	TC-600-NF-BH	3190-589	<1.25:1	(2.5)	NA	Solder	Crimp	S/G	2.4 (61)	0.88 (22.4) 0.195 (88.5)
15. N Female	Bulkhead Jack	TC-600-NFC-BH	3190-466	<1.25:1	(2.5)	NA	Solder	Clamp	S/G	2.2 (56)	0.94 (23.9) 0.214 (97.1)
16. N Male	Straight Plug	EZ-600-NMK	3190-669	<1.25:1	(2.5)	Knurl	Spring Finger	Crimp	S/G	2.1 (53)	0.92 (23.4) 0.164 (74.4)
17. N Male	Straight Plug	EZ-600-NMC-2-D	3190-2641	<1.25:1	(6)	Hex/Knurl	Spring Finger	Clamp	A/G	2.1 (53)	0.92 (23.4) 0.202 (91.6)
18. N Male	Straight Plug	TC-600-NMC	3190-357	<1.25:1	(2.5)	Hex	Solder	Clamp	S/G	2.1 (53)	0.92 (23.4) 0.208 (93.4)
19. N Male	Straight Plug	EZ-600-NMH-X	3190-2627	<1.25:1	(8)	Hex/Knurl	Spring Finger	Crimp	A/G	2.1 (53)	0.92 (23.4) 0.164 (74.4)
20. N Male	Straight Plug	TC-600-NMH-X	3190-2628	<1.25:1	(8)	Hex/Knurl	Spring Finger	Crimp	A/G	2.1 (53)	0.92 (23.4) 0.166 (75.3)
21. N Male	Right Angle	EZ-600-NMH-RA-X	3190-2639	<1.35:1	(6)	Hex	Spring Finger	Crimp	A/G	2.0 (50)	1.42 (36.0) 0.224 (101.7)
22. N Male	Right Angle	TC-600-NMH-RA-D	3190-2427	<1.35:1	(6)	Hex	Solder	Crimp	A/G	1.8 (46.5)	1.62 (41.2) 0.185 (84.3)
23. N Male	Straight Plug	TC-600-NMH-75-50	3190-1610	<1.35:1	(6)	Hex	Solder	Crimp	N/G	2.1 (52.8)	0.91 (23.1) 0.130 (59.0)
24. QDS Male	Straight Plug	TC-600-QDSM	3190-825	<1.25:1	(6)	Knurl	Solder	Clamp	A/G	2.2 (55.6)	1.00 (25.4) 0.25 (113)
25. TNC Male	Straight Plug	TC-600-TM-X	3190-2530	<1.25:1	(6)	Hex/Knurl	Solder	Crimp	A/G	2.3 (57.6)	0.75 (19.0) 0.100 (45.6)
26. TNC Male	Straight Plug	EZ-600-TM-X	3190-2531	<1.25:1	(6)	Hex/Knurl	Spring Finger	Crimp	A/G	2.3 (57.6)	0.75 (19.0) 0.100 (45.6)
27. TNC Male	Reverse Polarity	EZ-600-TM-RP	3190-796	<1.25:1	(2.5)	Knurl	Spring Finger	Crimp	A/G	2.2 (56)	0.87 (22.0) 0.112 (50.8)
28. TNC Male	Reverse Polarity	TC-600-TM-RP	3190-1064	<1.25:1	(6)	Knurl	Solder	Crimp	N/G	2.1 (53.3)	0.68 (17.3) 0.112 (50.8)
29. TNC Male	Right Angle	TC-600-TM-RA-D	3190-2707	<1.35:1	(6)	Hex/Knurl	Solder	Crimp	A/G	1.6 (41)	1.75 (44.5) 0.164 (74.3)
30. TNC Female	Reverse Polarity	EZ-600-TF-RP	3190-797	<1.25:1	(2.5)	NA	Spring Finger	Crimp	A/G	2.3 (58)	0.87 (22.0) 0.100 (45.4)
31. TNC	Reverse Polarity	TC-600-TF-RP	3190-1065	<1.35:1	(6)	Knurl	Solder	Crimp	N/G	2.2 (55.8)	0.68 (17.3) 0.100 (45.4)
32. UHF Male	Straight Plug	EZ-600-UM	3190-615	<1.25:1	(2.5)	Knurl	Spring Finger	Crimp	S/G	1.7 (43)	0.88 (22.4) 0.164 (74.4)
33. UHF Male	Straight Plug	TC-600-UMC	3190-213	<1.25:1	(2.5)	Knurl	Solder	Clamp	S/G	1.7 (43)	0.88 (22.4) 0.198 (89.8)

Finish metals: N=Nickel, S=Silver, G=Gold, SS=Stainless Steel, A=Alloy **VSWR spec based on 3 foot cable with a connector pair *Available in bulk pack



Install Tools

Type	Part Number	Stock Code	Description
Crimp Tool	HX-4	3190-200	Crimp Handle
Crimp Dies	Y1720	3190-203	.610" Hex Dies
Crimp Rings	CR-600	3190-831	Crimp Rings for TC/EZ-600 connectors (pkg of 10)
Strip Tool	CST-600	3192-052	Combination prep tool for LMR-600 crimp and clamp style connectors
Replacement Blades	RB-456	3190-421	Replacement Blades for Strip Tools
Deburr Tool	DBT-U	3192-001	Removes center conductor rough edges
Midspan Strip Tool	GST-600A	3190-1051	For ground strap attachment
Wrench	WR-600	3190-1435	15/16" Box Wrench (2 required for EZ-600-NMC-2)
Cutting Tool	CCT-01	3190-1544	Cable end flush cut tool
Replacement Blade	RB-01	3190-1609	Replacement blade for cutting tool
Replacement Blade Kit	RB-CST	3192-086	Replacement blade kit for all CST strip tools
Tool Kit	TK-600EZ	3190-1602	Tool kit for LMR crimp/clamp connectors (includes CCT-01, CST-600, HX-4, Y1720, Tool Pouch)



Hardware Accessories

Type	Part Number	Stock Code	Description
Ground Kit	GK-S600TT	GK-S600TT	Standard Grounding Kit (each)
Hoisting Grip	HG-600T	HG-600T	Split/Laced Type (each)
Cold Shrink	CS-A600T	CS-A600T	Cable to Antenna Junction (each)
Cold Shrink	CS-60120T	CS-60120T	LMR-600 to -1200 Junction (each)
Cold Shrink	CS-60170T	CS-60170T	LMR-600 to -1700 Junction (each)
Hanger Blocks	CB-600T	CB-600T	Dual Cable Support Block (kit of 10)
Standard Entry			
Port Cushion	SC-600T-3	SC-600T-3	Three cables (each)
Snap-In Hangers	SH-U600T	SH-U600T	Snap-In Hangers (Kit of 10)
Hanger Block Supporting Hardware			Complete Range of Supporting Hardware & Adapters Available