```
      "The ratio of contended bid
acknowledgements sent from the central
       to all remotes over the number of
contended bid slots available,
       integrated over the previous
measurement period and expressed as
       a percentage.
       Valid only at the remote."
  ::= { rfCongestion 2 }

rfLocalBidUsage OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The ratio of contended bid
acknowledgements sent from the central
       to all but a particular remote over the
number of contended bid slots
       available,integrated over the previous
measurement period and
       expressed as a percentage.
       Valid only at the remote."
  ::= { rfCongestion 3 }

rfBidSuccessRate OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The ratio of contended bid
acknowledgements sent from the central
       to a particular remote over the number
of contended bid frames
       sent to the central from that remote,
integrated over the previous
       measurement period and expressed as a
percentage.
       Valid only at the remote."
  ::= { rfCongestion 4 }

rfTargetBidSuccessRate OBJECT TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The ideal contended bid success rate
for the current local
       usage, expressed as a percentage.
       Valid only at the remote."
  ::= { rfCongestion 5 }

rfDwellsPerBidPeriod OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The number of dwells constituting a
period during which a
       particular remote may transmit to the
central exactly one
       contended bid frame.
       Valid only at the remote."
  ::= { rfCongestion 6 }

rfCurrentBidDwell OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The current dwell number in the current
bid dwell period.
       Valid only at the remote."
  ::= { rfCongestion 7 }

rfBidSendDwell OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The dwell number in the current bid
dwell period during
       which the remote may transmit its
contended bid frame to the
       central.
       Valid only at the remote."
  ::= { rfCongestion 8 }


--Error log

elScrollControl  OBJECT-TYPE
  SYNTAX  INTEGER  {
           forward(1),
           backward(2),
           clearLog(3)
           }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "A variable used to control the
direction in which the error log
       is scrolled on repetitive reads, or to
clear the log of all
       entries."
  ::= { wn2458_ErrorLog 1 }

elLogEntryNumber   OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "The entry number of the trap at which
the next reading of the
       error log should commence."
  ::= { wn2458_ErrorLog 2 }

elLevelDisable  OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "The highest severity level of traps to
be ignored
       with respect to logging and trap
reporting."
  ::= { wn2458_ErrorLog 3 }


elTrapTable OBJECT-TYPE
  SYNTAX  SEQUENCE OF ElTrapEntry
  ACCESS  not-accessible
  STATUS  mandatory
  DESCRIPTION
      "The chronological list of error traps
that have occurred at
       this unit."
  ::= { wn2458_ErrorLog 4 }

elTrapEntry OBJECT-TYPE
```

```
  SYNTAX  ElTrapEntry
  ACCESS  not-accessible
  STATUS  mandatory
  DESCRIPTION
      "A single error log trap entry."
  INDEX   { elEntryNumber }
  ::= { elTrapTable 1 }

ElTrapEntry ::=
  SEQUENCE {
    elEntryNumber
      INTEGER,
    elSeverityLevel
      INTEGER,
    elMessage
      DisplayString,
    elParameter
      INTEGER,
    elTimeStamp
      DisplayString
  }

elEntryNumber   OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The entry number of the trap in the log
(0 is the oldest)."
  ::= { elTrapEntry 1 }

elSeverityLevel  OBJECT-TYPE
  SYNTAX  INTEGER  {
              empty(0),
              normal(1),
              warning(2),
              minor(3),
              major(4),
              critical(5)
              }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The severity level of the trap entry."
  ::= { elTrapEntry 2 }

elMessage OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..63))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The error message string of the trap
entry."
  ::= { elTrapEntry 3 }

elParameter OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "A context defined error parameter
value."
  ::= { elTrapEntry 4 }

elTimeStamp OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..23))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The time and date of the trap
occurrence."
  ::= { elTrapEntry 5 }

trapMessage OBJECT-TYPE
  SYNTAX  DisplayString (SIZE (0..63))
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The error message string of the most
recent trap."
  ::= { wn2458_ErrorLog 5 }

trapParameter OBJECT-TYPE
  SYNTAX  INTEGER
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
      "The parameter value of the most recent
trap."
  ::= { wn2458_ErrorLog 6 }

elTimeDate OBJECT-TYPE
  SYNTAX  SEQUENCE OF ElTimeEntry
  ACCESS  not-accessible
  STATUS  mandatory
  DESCRIPTION
      "The current time and date."
  ::= { wn2458_ErrorLog 7 }

elTimeEntry OBJECT-TYPE
  SYNTAX  ElTimeEntry
  ACCESS  not-accessible
  STATUS  mandatory
  DESCRIPTION
      "A single entry time and date table."
  ::= { elTimeDate 1 }

ElTimeEntry ::=
  SEQUENCE {
    elTimeHour
      INTEGER,
    elTimeMinute
      INTEGER,
    elTimeSecond
      INTEGER,
    elTimeMonth
      INTEGER,
    elTimeDay
      INTEGER,
    elTimeYear
      INTEGER
  }

elTimeHour  OBJECT-TYPE
  SYNTAX  INTEGER  (0..23)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "The current hour."
  ::= { elTimeEntry 1 }

elTimeMinute  OBJECT-TYPE
  SYNTAX  INTEGER  (0..59)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "The current minute."
  ::= { elTimeEntry 2 }
```

```
elTimeSecond  OBJECT-TYPE
  SYNTAX  INTEGER  (0..59)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "The current second."
  ::= { elTimeEntry 3 }

elTimeMonth  OBJECT-TYPE
  SYNTAX  INTEGER  (1..12)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "The current month."
  ::= { elTimeEntry 4 }

elTimeDay  OBJECT-TYPE
  SYNTAX  INTEGER  (1..31)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "The current day."
  ::= { elTimeEntry 5 }

elTimeYear  OBJECT-TYPE
  SYNTAX  INTEGER  (0..99)
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
      "The current year."
  ::= { elTimeEntry 6 }

criticalTrapCnt  TRAP-TYPE
  ENTERPRISE  wavenet_2458-central
  VARIABLES  { trapMessage, trapParameter }
  DESCRIPTION
    "A Multipoint trap that indicates a
failure of one or more of the
    unit's critical subassemblies resulting in
severe loss of functionality."
  ::= 1

majorTrapCnt  TRAP-TYPE
  ENTERPRISE  wavenet_2458-central
  VARIABLES  { trapMessage, trapParameter }
  DESCRIPTION
    "A Multipoint trap that indicates a
failure or impairment one of the
    unit's subassemblies resulting in major
loss of functionality."
  ::= 2

minorTrapCnt  TRAP-TYPE
  ENTERPRISE  wavenet_2458-central
  VARIABLES  { trapMessage, trapParameter }
  DESCRIPTION
    "A Multipoint trap that indicates a
failure or impairment of one of the
    unit's non critical subassemblies
resulting in some loss or impairment
    of functionality."
  ::= 3

warningTrapCnt  TRAP-TYPE
  ENTERPRISE  wavenet_2458-central
  VARIABLES  { trapMessage, trapParameter }
  DESCRIPTION
    "A Multipoint trap that indicates pending
or imminent failure or impairment
    of one of the unit's subassemblies which
may result in some loss
    or impairment of functionality in the near
future."
  ::= 4

normalTrapCnt  TRAP-TYPE
  ENTERPRISE  wavenet_2458-central
  VARIABLES  { trapMessage, trapParameter }
  DESCRIPTION
    "A Multipoint trap that indicates the
occurrence or completion
    of an event or process in the manner
expected."
  ::= 5

criticalTrapRmt  TRAP-TYPE
  ENTERPRISE  wavenet 2458-remote
  VARIABLES  { trapMessage, trapParameter }
  DESCRIPTION
    "A Multipoint trap that indicates a
failure of one or more of the
    unit's critical subassemblies resulting in
severe loss of functionality."
  ::= 1

majorTrapRmt  TRAP-TYPE
  ENTERPRISE  wavenet_2458-remote
  VARIABLES  { trapMessage, trapParameter }
  DESCRIPTION
    "A Multipoint trap that indicates a
failure or impairment one of the
    unit's subassemblies resulting in major
loss of functionality."
  ::= 2

minorTrapRmt  TRAP-TYPE
  ENTERPRISE  wavenet_2458-remote
  VARIABLES  { trapMessage, trapParameter }
  DESCRIPTION
    "A Multipoint trap that indicates a
failure or impairment of one of the
    unit's non-critical subassemblies
resulting in some loss or impairment
    of functionality."
  ::= 3

warningTrapRmt  TRAP-TYPE
  ENTERPRISE  wavenet_2458-remote
  VARIABLES  { trapMessage, trapParameter }
  DESCRIPTION
    "A Multipoint trap that indicates pending
or imminent failure or impairment
    of one of the unit's subassemblies which
may result in some loss
    or impairment of functionality in the near
future."
  ::= 4

normalTrapRmt  TRAP-TYPE
  ENTERPRISE  wavenet_2458-remote
  VARIABLES  { trapMessage, trapParameter }
  DESCRIPTION
    "A Multipoint trap that indicates the
occurrence or completion
    of an event or process in the manner
expected."
  ::= 5

linkupTrap  TRAP-TYPE
```

```
  ENTERPRISE  snmp
  DESCRIPTION
    "An SNMP trap that indicates that the RF
link has been
    established."
  ::= 3

linkdownTrap  TRAP-TYPE
  ENTERPRISE  snmp
  DESCRIPTION
    "An SNMP trap that indicates that the RF
link has been
    lost."
  ::= 2

END
```

Appendix B: Messages, and Traps

This is an abbreviated listing of the common messages/traps that may be generated by the routers. There are other errors that can be emitted by the routers, but they will typically occur in conjunction with the ones listed below, or else indicate internal problems with the router. Recurring critical or major severity errors should be reported to your primary support organization.

Critical Severity Messages

Radio init has failed.

The attempt to initialize the radio has failed. The radio interface code will make three attempts to do so before being unable to continue. . Indicates that the unit is unable to function over the RF link. There are severe problems with the radio or its support files, depending on the previous error messages containing supplemental information.

The radio selftest has failed.

The radio responded to a selftest request with a failure indication, or did not respond at all. The radio interface code will make three attempts to reinitialize before being unable to continue.

Major Severity Messages

Note that the radio will attempt to self-heal if there is a transient loss of radio connectivity. This should not be considered a serious condition as long the frequency of such occurrences is low.

The radio link is up.

A remote has associated with its central, or a central has associated with at least one remote (displays only once at the central on first association).

Packet dropped, excessive rexmits.

A packet was discarded due to an excessive number of failed attempts to transmit it over the radio interface.

Packet dropped, excessive rercvs.

A packet was discarded due to an excessive number of failed attempts to receive it over the radio interface.

TxAllowed timeout, link down.

The radio is reporting a lack of synchronization and proper association with a distant unit. The link is down. Indicates that the far end station is down, or that the local station cannot maintain a viable RF link. Automatic reboot of the radio is imminent

TxReady timeout, link down.

The radio is reporting that its buffers are full for an excessive period of time. The link is down. Automatic reboot of the radio is imminent.

Remote station not responding.
A link that was up has been lost.

Remote station has been restored.
A link that was lost has been restored.

Minor Severity Messages

Rcvd invalid authorization addr.
An attempt was made to associate by a remote station not on the authorization list.

Warnings

Radio config file has been lost.
The radio configuration file was not found. A default version has been created. Most probably the file was never installed. This is a normal event for new units.

Authorization file has been lost.
The authorization file was not found. A default version has been created. Most probably the file was never installed. This is a normal event for new units.

Packet dropped, buffers exhausted.
A packet was discarded due to high traffic levels and a lack of available buffers.

Normal (Informational) Messages

The radio has been initialized.
The radio sub-assembly has initialized correctly and indicated a successful selftest.

Appendix C: Maximum FCC Tx Power Settings

The following tables show the maximum transmit power allowed within the FCC 4-watt EIRP limits when using the antennas that are currently offered by Wireless, Inc..

Central Units

This table applies to central site units that transmit to more than one remote unit in a point-to-multipoint configuration (the typical case). Transmit power setting in table assumes zero dB cable loss between transmit port and the antenna.

Antenna	Max. Tx Power Setting
Decibel DB906S, 8dBi Omni	+24 dBm
Decibel DB977H90, 16dBi Panel	+20 dBm
RadioWaves SP1-2/5, 14 dBi/23 dBi Dual Band 1' Parabolic	+24 dBm*
RadioWaves SP2-2/5, 21 dBi/28 dBi Dual Band 2' Parabolic	+24 dBm*

* (If used point-to-point)

Remote Units

This table applies to remote sites. Transmit power setting in table assumes zero dB cable loss between transmit port and the antenna.

Antenna	Max. Tx Power Setting
RadioWaves SP1-2/5, 14 dBi/23 dBi Dual Band 1' Parabolic	+24 dBm
RadioWaves SP2-2/5, 21 dBi/28 dBi Dual Band 2' Parabolic	+24 dBm

Meeting any regulatory transmitter output power and/or EIRP requirements is the installer's responsibility. The formula for EIRP is given below:

$$EIRP_{dBm} = \text{Tx Power}_{dBm} + \text{Tx Antenna Gain}_{dBi} - \text{Tx Antenna Cable Loss}_{dB}$$

For example, to meet the FCC EIRP limit of +36 dBm (4W) using a 16 dBi sector antenna with a 1 dB loss antenna cable, the transmit power must be set to +21 dBm or lower.

Appendix D: List of antennas for FCC Type Certification

List of antennas to be certified for used with the *WaveNet IP 2458* system on Central radios (transmitting at 2.4 GHz and receiving at 5.8 GHz):

Model	Gain	
Decibel DB906S *RadioWaves OMN-H-5-8*	2.4 GHz, 8 dBi Omni *5.8 GHz, 8 dBi Omni*	*(tested as a pair)*
Decibel DB977H90 RadioWaves SEC-H-5-16-90	2.4 GHz, 16 dBi 90° Panel 5.8 GHz, 16 dBi 90° Sector	(tested as a pair)

RadioWaves SP1-2/5 14 dBi @ 2.4 GHz / 23 dBi @ 5.8 GHz Dual Band 1' Parabolic Antenna

RadioWaves SP2-2/5 21 dBi @ 2.4 GHz / 28 dBi @ 5.8 GHz Dual Band 2' Parabolic Antenna

List of antennas to be certified for used with the *WaveNet IP 2458* system on Remote radios (transmitting at 5.8 GHz and receiving at 2.4 GHz):

Model	Gain	
RadioWaves SP1-2/5	14 dBi / 23 dBi	Dual Band 1' Parabolic Antenna
RadioWaves SP2-2/5	21 dBi / 28 dBi	Dual Band 2' Parabolic Antenna

Additional antennas may be added in the future, any additional antennas will be tested prior to adding them to the list.

Appendix E: Grounding Practices and Lightning Protection Information

General

Good grounding ("earthing") practices, when used in telecommunications, have some direct benefits which can help you maximize the up time of your system as well as ensure the safety of those people working on the system. Among these benefits are:

1. Protection of personnel from electric shock and fire hazards.
2. Reduction of radiated and conducted electromagnetic susceptibility.
3. Improved system tolerance to discharge of electrostatic energy and lightning interference.
4. Minimized service interruptions and service damage.

There is no practice or formula which can completely eliminate the above risks, but we at Wireless, Inc. believe that good grounding and bonding practices can significantly reduce the risk of many of these hazards. We have included a bibliography at the end of this appendix which contains several publications that are readily available and contain detailed information on many aspects of grounding systems and their design, implementation, measurement, and maintenance.

Please note that every telecommunication site is unique, and must be evaluated accordingly. The following information is provided for generic reference and educational purposes only. The grounding plans and practices for a given site should only be established and accomplished by trained professionals, working in accordance with local practices and regulations.

Ground Connections

There should be a grounding plan designed at the outset of site design in order to provide the best grounding procedures and to minimize ground loop currents. This should be achieved by connecting the outer conductors of the cables through a large section copper strap to a central grounding point and the size of the conductor should be increased as each branch path is added. The final conductor should be connected directly to the grounding system. For a radio site a single copper grounding rod is insufficient because its impedance is likely to be too high.

Lightning Protection

Radio sites can be particularly prone to lightning strikes by virtue of their normally exposed locations and the presence of relatively tall antenna support structures.

It is not possible to provide and guarantee complete protection from the effects of lightning; however, they can be significantly reduced by careful attention to grounding, protection devices, and the layout of the site itself.

Reference should also be made to various publications, some of which are listed in the Bibliography. Where any site owner or user is in doubt about the protection requirements for any particular location, the appropriate authority should be consulted.

Protection Arrangements

The purpose of any protection arrangement should be to provide a suitable path to ground for the lightning current, to ensure adequate bonding between structures and all metalwork on the site and the common grounding system in order to reduce the side flashing, and to attempt to prevent the entry of flashes or surges into the building.

The resistance to ground should be kept to a minimum and a value of less than 10-ohms is recommended. The most important feature is that the system should ideally be at equal potential across the entire site.

Certain authorities and service providers have their own particular practices which have to be followed where applicable.

Arrangements will vary considerably from very simple sites to complicated sites with multiple buildings, antenna support structures and associated equipment, and may involve integration with existing systems. Such systems may require upgrading.

Lightning conductors

Down conductors, bonding interconnections, ground rings and radial tapes should be of uninsulated 000 AWG copper cable or solid copper tape with a minimum cross section of 25 x 3 mm with all connections protected by non reactive paste.

Protected test points should be included if appropriate, and sacrificial ground lugs should be clearly marked and easily accessible for periodic inspection.

Grounding of antenna support structures

A structure will generally act as its own lightning conductor and therefore will not require an additional conductor from the top to the base. A lightning rod may be required to extend the zone of protection to protect equipment mounted on the top of the structure. The lightning rod should extend 2.5-meters above the highest equipment.

Ground mounted support structures should be connected at their base to a ground ring via sacrificial ground lugs. Towers should have a connection from each leg.

A ground ring should consist of copper cable or solid copper tape with ground rods equally spaced at 2-meter intervals around the base of the structure as close to it as possible, buried approximately 0.6-meters deep where soil conditions allow. An alternative method using radials rather than rings is detailed in "The 'Grounds' for Lightning and EMP Protection", second edition, published by PolyPhaser Corporation.

The ground ring should be connected to the main building ground by the most direct route, buried as appropriate.

Roof mounted structures should be connected to the main building ground by the most direct route using sacrificial lugs and copper cable or tape as appropriate. Tower guy wires should be directly bonded at their lowest point to a suitable ground electrode or connected to the site ground by the most direct route.

Grounding of feeders

All antenna feeders should be bonded to the tower at the upper and lower ends and grounded at the point of entry into the building. Weatherproof grounding kits are available from antenna manufacturers.

> Note: Many of the cables used by Wireless, Inc. have braided rather than solid outer conductors; this type of grounding is not appropriate. In these cases we recommend the use of Wireless, Inc. approved lightning arrestors. For information on lightning arrestors, please contact Wireless, Inc.'s Customer Service department.

Grounding of buildings

A ground ring ideally should surround the building and be connected to individual grounds associated with feeder entry, antenna support structure, building lightning conductor, equipment room, main AC supply and other facilities. Each connection should be made by the most direct route in order to minimize interaction between the different grounding functions.

The ground ring should consist of copper cable or tape with electrodes 2- meters or greater in length, buried to a depth of 0.6-meters and at a distance from the building not to exceed 1-meter.

Buildings may require lightning rods where they are not within the zone of another protected structure.

BIBLIOGRAPHY

ITU - T K.40	Protection against LEMP in telecommunications centres
ITU - T K.27	Bonding configurations and earthing inside a telecommunication building
ITU - T K.35	Bonding configurations and earthing at remote electronic sites

ITU - T K.39 Risk assessment of damages to telecommunications sites due to lightning discharges

ITU - T Lightning Handbook The protection of telecommunication lines and equipment against lightning discharges

IEEE Emerald Book - Powering and Grounding

The "Grounds" for Lightning and EMP Protection, second edition
Published by PolyPhaser Corporation