Troubleshooting Your ALERT2 Transmitter

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What we will be covering:

- Basic ALERT2 Transmitter Architecture.
- ALERT2 Troubleshooting Equipment.
- ALERT2 Troubleshooting Strategies.
- ALERT2 Transmitter Complications and Solutions.
Part 1: Basic ALERT2 Transmitter Architecture.

A Brief Overview of ALERT2 Transmitter Physical Layout and Operation.
ALERT2 Transmitter Physical Layout:
Time Division Multiple Access:

FRAME LENGTH

EACH TRANSMITTER IS ASSIGNED A TIME SLOT INSIDE THE FRAME
Assign each ALERT2 Transmitter a specific time to transmit to avoid data collisions.

All transmitters using the same frequency must share the same clock time.

GPS gives us access to atomic clock accuracy at a fraction of the cost.

Requires a TDMA Plan.
- Plan of when each ALERT2 Transmitter starts transmitting, and for how long.
- You **MUST** maintain an **ACCURATE and UPDATED** record of your TDMA plan.
TDMA Vocabulary:

FRAME LENGTH

OFFSET

SLOT LENGTH
ALERT2 Transmitter Operation Information:

- **MANT Parameters:**
  - **Hop Limit**
    - How many times the ALERT2 Data from the transmitter is repeated.
    - *Transmitter Hop Limit should equal the number of repeaters in the path.*
  - **Add Path Service: Enabled/Disabled**
    - Enabled adds the ALERT2 Repeater(s) ID(s) to the ALERT2 Data Packet.
Add Path Service Example:

- Tells us which Repeaters are repeating our ALERT2 Transmitter data packets.
ALERT2 Transmitter Finished Sensor Data:

- ALERT2 Transmitters transmit Finished Data to the Base Station.
- ALERT transmits Raw Data Values. (e.g. Wind Speed = 402)
- ALERT2 transmits Finished Data Values. (e.g. Wind Speed = 6 mph)
- Rain Tips can be sent as Tips or as Finished Data.
ALERT2 Transmitted Report Types:

**TBR – Tipping Bucket Report:**
- Several Rain Tips transmitted in one packet.
- ALERT2 Tips will be sent as **GSR** for Timed Reports.
- ALERT2 Tips will be sent as **TBR** for Rain Gauge Tip Events.

**GSR – General Sensor Report:**
- Sensor ID Range: 0-254.
- Decimal precision set by transmitter.
- Can be used if your base station/data collection software cannot decode an MSR report.
ALERT2 Transmitted Report Types:

MSR – Multi-Sensor Report:
- Compressed report containing sensor readings.
- Only supports IDs 1-8.
- Wind Speed resolution of 1 mph.
- Battery Resolution of 0.1V.

MMR – Metric Multi-Sensor Report:
- Metric version of MSR.
ALERT2 Transmitter Radio Settings:

- Air Link Parameters:
  - Section of Programmable Radio Parameters.
  - Normal Modulation.
  - Inverted Modulation.
  - Selection depends on your Transmit Radio.
ALERT2 Transmitter Architecture:

- SENSOR
- SENSOR
- SENSOR
- GPS
- ALERT2 ENCODER
- TX RADIO
- LTX
- POWER SUPPLY (BATTERY/SOLAR/AC)
- GPS ANTENNA
- RADIO ANTENNA

Diagram showing the flow of data and components in the ALERT2 Transmitter Architecture.
Because guessing isn’t a good troubleshooting practice...
ALERT2 Troubleshooting Equipment:

- Fully Charged Laptop with All Necessary Communication Cables.
  - USB to Serial Converter/Communication Cables
  - Terminal Emulation Software or User Interface

- Digital Multi-Meter. (Voltage and Current Measurement)

- DC Ammeter. (Measure Current Draw W/O Special Cables)

- Watt Meter with appropriate Dummy Load. (Radio TX Power and Reflected Power)
**ALERT2 Troubleshooting Equipment:**

- ALERT2 Field Decoder.
  - Receives, decodes, and displays ALERT2 Data Packets.
  - Scanners are not very effective for ALERT2 signals.

- System Documentation (e.g. Manuals, TDMA Plan).

- Necessary hand tools.

- Fully charged cell phone.
Fused Test Cable:
In-Line Measurement Test Cable:
Bad Radio? Current Limiting Power Supply:
Current Limiting Power Supply: Good Radio
Current Limiting Power Supply: Shorted Radio
Optional Field Equipment/Spare Parts:

- Tested GPS Antenna with Tested Cable.
- Tested/Programmed Transmit Radio.
- Spare Cables.
- Fuses.
Part 3: ALERT2 Troubleshooting Strategies
Troubleshooting Process:

- Inspection.
- Evaluation.
- Create a Detailed Description of the Problem.
- Identify the Cause(s) of the Problem.
- Take Corrective Action.
Inspect the Transmitter:

- Visually inspect the transmitter for loose connections, broken wires, environmental damage, and safety issues.

- Inspect any Indicator LEDs you have available.

- Does it smell of burnt electronics?

- Is the transmitter making weird noises?

Disclaimer: HydroLynx does not recommend using your sense of taste to inspect your ALERT2 Transmitter.
Purpose of the Evaluation:

- **Verify** what **IS** working.

- **Verify** what **ISN’T** working.
Cables and Connectors.
- Verify all required cables present.
- Verify all connectors are properly installed and seated.

Power.
- Verify Unit Power.
- Verify Back-Up Battery Power.
- Verify battery charge circuit is functional.

Communication.
- Verify communication is functional between parts, and as a whole.
- Verify Start-Up Procedures.
- Verify Baud Rates.

Software Settings and Programmable Parameters.
- Verify programmed parameters are entered correctly.
Evaluation Depth Depends on the Inspection:

INSPECTION

- NO
  - PERFORM PROGRESSIVE POWER UP EVALUATION.
- YES
  - EVALUATE THE TRANSMITTER AS A COMPLETE UNIT.

DOES THE INSPECTION LOOK NORMAL?
Complete Unit Evaluation: 4 Checks

Evaluate the Transmitter as a “Whole Unit.”

- Cables and Connectors
- Power
- Communication
- Software Settings and Programmable Parameters
Evaluation Depth Depends on the Inspection:

INSPECTION

- NO: PERFORM PROGRESSIVE POWER UP EVALUATION.
- YES: DOES THE INSPECTION LOOK NORMAL?
  - NO: PERFORM PROGRESSIVE POWER UP EVALUATION.
  - YES: EVALUATE THE TRANSMITTER AS A COMPLETE UNIT.
Progressive Power Up Evaluation:

- Isolate and Evaluate Individual Components.
Progressive Power Up Evaluation: 4 Checks

Isolate Individual Components or System, then Evaluate.

- Cables and Connectors
- Communication
- Power
- Software Settings and Programmable Parameters
Progressive Power Up Evaluation: 4 Checks

- Add a Single Component and Evaluate again.

- **Cables and Connectors**
- **Power.**
- **Switched Power.**
- **Transmit Power.**
- **Communication**
- **Software Settings and Programmable Parameters**
Progressive Power Up Evaluation: 4 Checks

- Keep Adding in Components Until Failures are Identified

- Cables and Connectors
- Power
- Communication
- Software Settings and Programmable Parameters
Pro Tip: Radio Power/Reflected Power Testing

TX RADIO → WATT METER → LTX → RADIO ANTENNA

TX RADIO → LTX → WATT METER → RADIO ANTENNA
The Goal of Your Evaluation:

Gather data so you can describe the problem, to yourself, in as much detail as possible.
We want to get from a vague description...

“This thing isn’t working…”
...to a Very Detailed Problem Description:

- My TX battery is a 13.25VDC, and all PCB power is good.
- System communication is functional.
- The transmitter has GPS Lock.
- The radio is transmitting with an output of 5.1W, measured at the antenna.
- I am receiving decodable, ALERT2 test transmissions, on both my ALERT2 Field decoder, and at the base station.

**But I am NOT receiving my timed hourly reports at the base station.**
Part 4: ALERT2 Troubleshooting Complications and Solutions

Pro Tips and Common Issues Encountered When Upgrading/Installing ALERT2 Transmitters.
**ALERT2 Test Transmission Types**

Two different types of test transmissions:

1.) 5 Second ALERT2 Test Transmission. (Power Testing.)

2.) Test Transmission that sends an ALERT2 Data Transmission using the Programmed TDMA Parameters.
   - 2 Min Frame Length = Waiting 2 Min for Test Transmission.

I recommend setting the station TDMA Parameters right away.
Testing then Programming can introduce errors.
Radio Modulation:

- Radio Modulation can be set to Normal or Inverted.
  - The proper setting depends on the radio.
  - If you are unsure, try both and see what works.

Symptom:

- Setting up the ALERT2 Transmitter and execute a test transmission.
- Radio Power Out measures 5W.
- Reflected Power is almost 0W.
- No ALERT2 Transmission received at the Base Station or on an ALERT2 Field Decoder.
If upgrading ALERT to ALERT2, keep in mind that the ALERT2 radio signal is very complex and your old radio may not work.

- ALERT signal has an audible signal that you can hear with a scanner.

- Using a scanner the ALERT2 radio signal sounds like breaking squelch.

- ALERT2 Field Decoder is the best option for verifying a good packet.

- I have encountered old radios that can TX ALERT, but not ALERT2 radio signals effectively.
TDMA Problems:

- Two Transmitters Sharing the same TDMA Parameters:
  - If two transmitters share the same TDMA settings, we intentionally cause a data collision during the timed reports.
  - **Test transmissions** may arrive at base station/field decoder because only the transmitter you are testing is transmitting at that time.
  - If you are missing two stations, this is something to look into.
TDMA Problems:

TDMA Frame Length is shorter than the Offset:

Our TDMA Plan States:
- Frame Length: 60000
- Offset: 48000
- Slot Length: 500

We Enter (by mistake):
- Frame Length: 6000
- Offset: 48000
- Slot Length: 500
TDMA Problems:

- 6 Second Frame Length.
ALERT2 Transmitter Hop Limit should be the same as the number of repeaters the signal must travel through.

Verify your pass/block lists when installing the repeaters.
Symptoms:

- Get several transmissions reporting the GPS status as “Not Locked.”
- Missing Timed Transmissions.
- Transmitting in “Drift Mode.”
- GPS Lock Indicator LED’s indicate the unit is not “Locked.”
  - Best practice is to communicate with the ALERT2 Transmitter and check the status.
GPS Indicator LEDs:
(Example ALERT2 Encoder Board. Your equipment may vary)

<table>
<thead>
<tr>
<th>Label</th>
<th>Name</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D2</td>
<td>SERIAL 1</td>
<td>Red</td>
<td>Data in transmit buffer</td>
</tr>
<tr>
<td>D5</td>
<td>SERIAL 0</td>
<td>Green</td>
<td>Data in transmit buffer</td>
</tr>
<tr>
<td>D3</td>
<td>GPS ON</td>
<td>Red</td>
<td>GPS power on</td>
</tr>
<tr>
<td>D6</td>
<td>GPS LK</td>
<td>Green</td>
<td>GPS time synced</td>
</tr>
<tr>
<td>D4</td>
<td>RADIO TX</td>
<td>Red</td>
<td>Radio transmit on</td>
</tr>
<tr>
<td>D7</td>
<td>RADIO ON</td>
<td>Green</td>
<td>Radio power on</td>
</tr>
</tbody>
</table>
No GPS Lock?

Things to check:

- GPS Antenna Cable and Lightning Protection:
  - Continuity and Isolation of Signal and Shield.
  - GPS is a Powered Antenna (3.3VDC).
  - Use a “Known Good” Antenna and Cable to compare performance.

- Verify Communication between ALERT2 Encoder and DCP:
  - Observe handshake process during start-up or program ALERT2 parameters.
  - No Communication = Bad Cable/Baud Rate Issue/Power Problem
  - Time Sync Sample Interval
DCP to GPS/ALERT2 Encoder Communication:
DCP to GPS ALERT2 Encoder Communication:

Observe Start-Up Handshaking or Program ALERT2 Parameters:

- Wakeup ALERT2 encoder
- ALERT2\r\n\r
Timeout
- Wakeup ALERT2 encoder
- ALERT2\r\n\r
Set Station ID
- ALERT2\r
- Set AirLink parameters
- ALERT2\r\n\r
Set MANT parameters
- ALERT2\r\n\r
Set TDMA parameters
- ALERT2!@\r\n\r
Save configuration
- ALERT2\r
\r
Read GPS Time
GPS Time Sampling: Quartz vs. GPS

(Pictures for example purposes. Your equipment may vary.)

- Check your Sample Intervals.
- The GPS time should be sampled often.
- The ALERT2 Encoder and your main board need to talk often to keep the clocks ticking at same time.
- If the Sample Interval is too long, the main board time will drift around and TDMA windows may be missed.

```
> set-gps
GPS 1 ID : 10
Report Type : GSR
Transmit Interval : 3600 sec(s)
Sample Interval : 300 sec(s)
Change to Txmit : 1
Txmit Threshold : 0
Multiplier : 1
Divisor : 1
Base Value : 0
Display Digits : 0
>-
```
Pro Tip: Start With Your Radio

- Transmit radios are usually the largest current draw on an ALERT2 Transmitter:
  - Use a current limiting power supply when possible, a fused cable when not possible.
    - This can save you from destroying other equipment.

- Can’t communicate with your transmitter?
  - A radio that is shorted/bad can pull down the voltage on the rest of the ALERT2 Transmitter.
Pro Tip: Reset Count

Logging Excessive Resets:

- Reset when Analog Power is switched on?
  - May indicate a shorted sensor.

- Reset on Transmit.
  - May indicate a shorted radio.
  - May only be shorted when transmitting.

- Power problem.
Isolate/Evaluate Whole Sections to identify cause of resets

- Isolate Sensors and Radio
- Switch on Analog Power and observe
- Isolate Radio
- Test Transmit and observe.

Excessive Reset Count:

- Isolate Sensors and Radio
- Switch on Analog Power and observe
- Isolate Radio
- Test Transmit and observe.
Parallel Replacement Technique:

Using Tested or “Known Good” parts from a working transmitter to Diagnose a non-functional transmitter.

Replace only one component at a time.

Caution: A loose connection can often be fixed when swapping parts. Ensure all connectors are properly seated and cables are not visibly damaged when using this technique.
Pro Tip: Use your Log Files

If you are missing transmissions at your Base Station:

- Use the ALERT2 Transmitter Log Files to help diagnose a problem.

- If the ALERT2 Transmitter logged a transmission that the Base Station did not receive, check:
  - Radio and Radio Signal Path for loose or intermittent connections.
  - Radio Power and current consumption.
  - GPS Time Sync Sample Interval.
  - Check your Reset Count.
Pro Tip: Document Everything

Before and after any repair, connect to the ALERT2 Transmitter, and document any Site Programming or Site Configuration Information.

- Have a record of “This is how I found it,” and “This is how I left it.”
- Take screenshots or copy the settings into Notepad.
- Allows you to share your settings with your Technical Support.

- After a successful repair document the problem and solution.
If you need assistance with troubleshooting your equipment, use your vendor as a resource.

If you are happy, we are happy!

The more communication we have between the users and the manufacturers, the better the equipment will get.
Questions?