The Integrity Checks of KIWI-OSD and IOTA-VTI

by Dave of Kuriwa Observatory (E28), Australia

Introduction

On the Yahoo IOTAoccultations forum, (see message 53755) KIWI Geoff (a.k.a Geoff Hitchcox, Christchurch New Zealand) claimed that;

Quote

…that the KIWI has more integrity checks than the IOTA-VTI, so if you put a KIWI and IOTA-VTI system in series, the KIWI will give you X's on the screen well before the IOTA-VTI detects a problem.

EndQuote

He goes on to rave about "balanced" and "unbalanced" circuitry.

Well, I'm not an electrical, electronics, or software engineer, so I can't comment on the degree or otherwise of the state of balance of circuits, but rather I'm an experienced behind the telescope and in front of the VTI sort of guy, so I decided to do what I do best and setup as Geoff suggested and observe what happens.

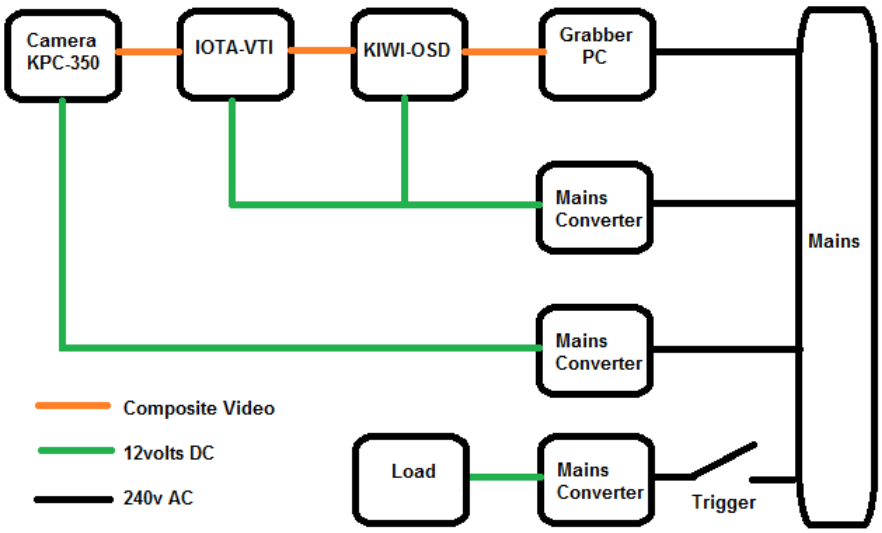
The contenders

In the Blue corner is a production model IOTA-VTI (S/No #275) that is fitted with an external GPS.

In the Red corner is a prototype model KIWI-OSD (S/No #0001) that has a Deluo GPS and is the only KIWI-OSD available to me at the time of this test. I understand that this is not a representative sample of the vast majority of KIWI-OSDs, however the smarts of the device is in the code resident on the PIC chip and this device does indeed have the same code of all other devices, namely V3.

The setup

As suggested by Geoff, I put the two Video Time Inserter (VTI) systems in series and both behind a KPC-350 video camera then the video was grabbed straight to my observatory PC. Both VTIs were supplied 12vDC from the same 240vAC converter. The camera had its own supply from the mains. Finally there was a load that I could turn on and off to induce (hopefully) a electromagnetic spike fault that would be detected by the VTIs as general interference.



For clarity, here is a diagram of the arrangement of equipment.

How are Integrity Errors reported?

KIWI-OSD

Two methods are used to alert the observer of a fault event. *(No doubt these descriptions do not meet Geoff's exacting standards, so I'm happy to stand corrected, and will insert Geoff's exact wording if he supplies text.)*

1) When the Reset Button on the KIWI-OSD device is pressed, the software makes a calculation of the current time based on the time at the end of the Startup Sequence and the number of 1pps (1 pulse per second) pulses it received since the end of the Startup sequence, then it reads the NMEA sentence from the GPS and compares the two. If the two time values don't tally then the device displays "ERROR: USE FIELD COUNT".
   a. This method requires operator input for the integrity process to start, therefore it is possible for the system to suffer an integrity error and for the operator to be unaware of it – until the reset button is pressed.
2) At any time the display will insert "XXXXXXXX" in place of "hh:mm:ss" and these displays will swap at alternate seconds.

Cont…

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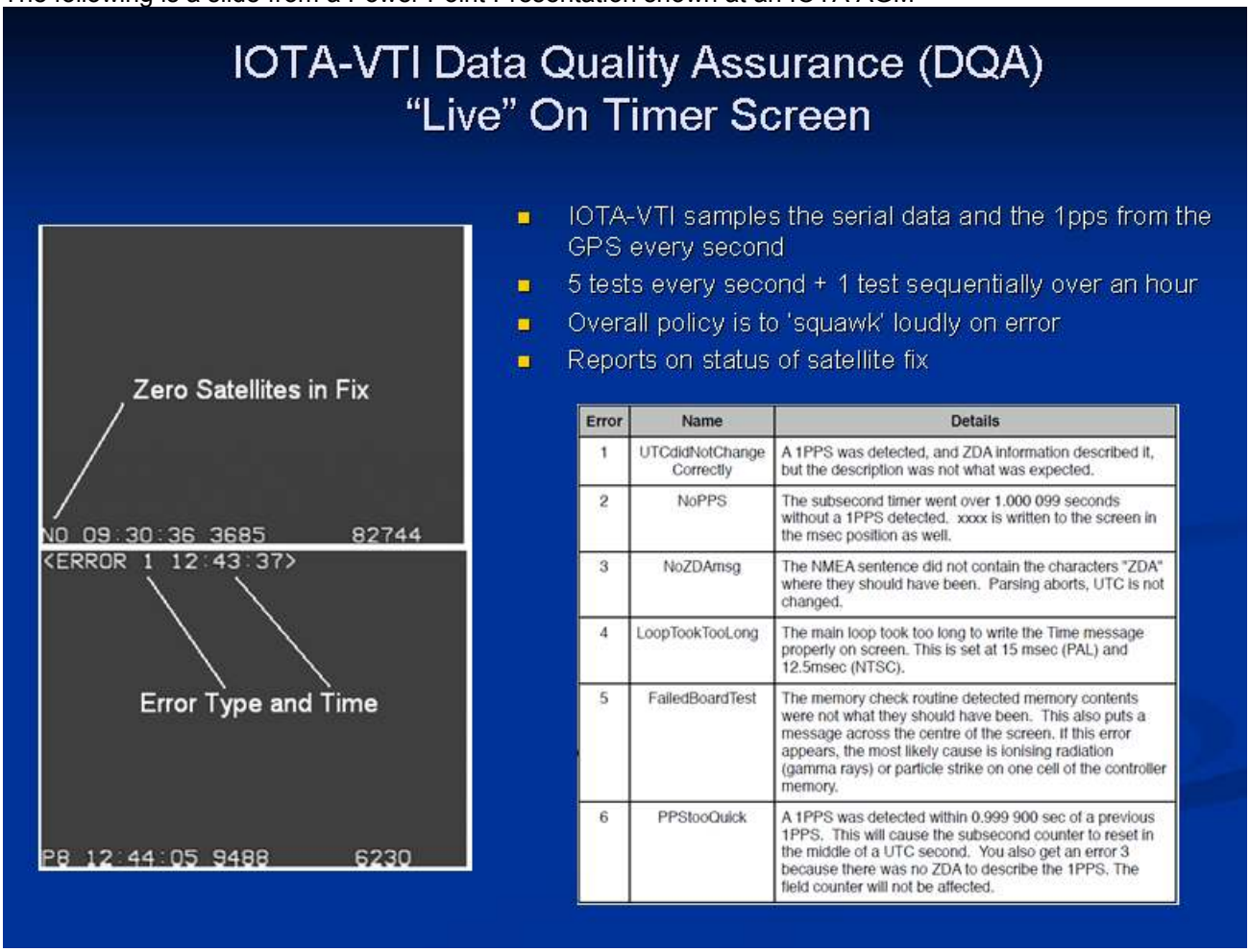
IOTA-VTI

The following is a slide from a Power Point Presentation shown at an IOTA AGM



Usually IOTA-VTI will detect multiple integrity errors and all will be time stamped (within 1 second of the fault occurring) and will fill the screen top to bottom to overflow if need be and will remain on screen until cleared. The observer is left in no doubt that something serious just happened.

<u>Testing Method</u>

1) Setup and start the equipment as described, above.
2) Give sufficient time for the GPSs to have done housekeeping tasks. i.e. download fresh almanacs.
3) Start a recording and operate the trigger three times.
    a. If an integrity error is detected by one or the other device, then stop the recording.
    b. If an integrity error is not detected after three operations of the trigger, press the reset button on KIWI-OSD to see if "ERROR: USE FIELD COUNT" is displayed.
4) Repeat this process until sufficient data is collected.
5) Analyse and report.

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Analysis

1) 16 recordings were made.
2) Approximately 30 operations of the trigger were made.
3) 1 recording had no detections of the operations of the trigger.
4) KIWI-OSD detected 13 integrity faults
5) IOTA-VTI detected 11 integrity faults
6) There were four instances where KIWI-OSD detected an integrity fault and IOTA-VTI did not.
7) There were two instances where IOTA-VTI detected an integrity fault and KIWI-OSD did not.
8) If both systems detected an integrity fault, then both systems mostly first reported the fault in the same video field.
   a. However there was one instance where KIWI-OSD reported XXXXXXXX 8 frames after IOTA-VTI first detected the fault.
9) A video of one of the recordings can be seen here: http://youtu.be/KGDlFyyTkd0
10) Here is one of the frames of that recording.
    a. At the bottom of the frame is the timing display region of the next video frame.
    b. This is simply to demonstrate the alternating 'Xs" and hh:mm:ss of KIWI-OSD.

11) Stepping through the videos frame-by-frame around the time of the integrity fault revealed no corruption of the sequence of 10th millisecond displays of IOTA-VTI and the millisecond displays of KIWI-OSD.
12) The field counters of both VTIs remained consistent for all videos.
13) Note: the hh:mm:ss display of KIWI-OSD, when not alternating with XXXXXXXX displays a time that is 27 seconds ahead of Universal Time.
    a. All videos that display XXXXXXXX show a time that is many seconds ahead of Universal Time, to a greater or lesser degree as the sample shown above.
14)

Cont…

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Conclusions

1) Both VTI devices detected integrity faults due to induced electro magnetic interferences.
2) KIWI-OSD was more susceptible to disturbance than IOTA-VTI.
3) Geoff's assertion that *"KIWI has more integrity checks than the IOTA-VTI"* can not be verified, as there is no publicly available information on the nature of KIWI-OSD integrity test regime.
   a. The nature of the IOTA-VTI integrity test regime is available in the device Manual and is reproduced above.
4) Geoff's assertion that "*KIWI will give you X's on the screen well before the IOTA-VTI detects a problem"* the emphasis on "well before" is **untrue**.
5) IOTA-VTI displayed correct Universal Time at all times.
6) The integrity fault detection philosophy of IOTA-VTI is strong, and is;
   a. to squawk loudly (and immediately) on error detection
   b. to give every means to the observer to enable identification of the fault
   c. to enable salvage of any observation that incurs an integrity fault event.
7) Post fault, the alternating hh:mm:ss - XXXXXXXX display of KIWI-OSD was shown to leap ahead of true Universal Time, (see example above) by 27 seconds. This is a serious problem.
   a. It would be much better if the display was a continuous XXXXXXXX, as the hasty observer may take the alternating hh:mm:ss display as true time.
   b. The reason for the advance of the hh:mm:ss display is probably the detection of false 1pps signals.
   c. Since a product recall is not feasible for a discontinued product, it would be appropriate to publicize this situation in all IOTA journals, thereby minimizing the chance of reporting erroneous timings.
8) The integrity fault detection philosophy of KIWI-OSD is weak, because there is a possibility for a integrity fault to have occurred, and the fault may well remain unreported until the observer presses the reset button. If the observer forgets to press the reset button, before switching the device off, then the integrity fault advice is lost and bad timings will result.

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