Serial No. GM26068x
Revised

# PHYSICAL TEST REPORT
# FOR THE
# L3 COMMUNICATIONS
# AVIATION RECORDERS CORPORATION
# AUTOMATIC IDENTIFICATION SYSTEM (AISA1)
# PERFORMANCE TESTS

**Prepared for:**

L3 Communications Aviation Recorders Corp.
6000 Fruitville Road
Sarasota, FL 34232
USA

**Submitted by:**

Green Mountain Electromagnetics, Inc.

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**219 Blake Roy Road • Middlebury, Vermont 05753**


Revised: February 27, 2007

# L3 Communications Aviation Recorders Corporation
# Physical Tests
# At
# Green Mountain Electromagnetics, Inc.
# Middlebury, Vermont

**Unit: Automatic Identification System (AISA1)**
**Evaluated: October 23 - 27, 2006**

## I. Applicable Standards:

The unit described in this report was evaluated for compliance with paragraph 15, "Physical Tests" of IEC 61993-2, "Maritime Navigation and Radiocommunication Equipment and Systems – Automatic Identification Systems (AIS), Part 2: Class A Shipborne Equipment of the Universal AIS – Operational and Performance Requirements, Methods of Test and Required Test Results (December 2001)."

The unit described in this report was also measured for compliance with paragraph 7.2, "Power Supply - Excessive Conditions" and paragraph 11.1, "Acoustic Noise and Signals" of European Standard IEC 60945, "Maritime Navigation and Radiocommunication Equipment and Systems – General Requirements – Methods of Testing and Required Test Results (August 2002)." All procedures and equipment are in accordance with IEC 61993 and IEC 60945.

## II. Laboratory Description:

The GME laboratory and Open Area Test Site (OATS) are located at 219 Blake Roy Road, Middlebury, VT. GME is internationally accredited by the American Association for Laboratory Accreditation (A2LA) and meets the quality requirements in ISO/IEC 17025 (2005), "General Requirements for the Competence of Testing and Calibration Laboratories." For scope of accreditation, contact GME.

## III. Unit Tested:

The L3 Communications Aviation Recorders Corporation, Automatic Identification System provides continuous signal and data transmission for ship identification. The AISA1 uses DC power, has TDMA/DSC transmitters and TDMA/GPS/DSC receivers. It consists of the two-piece metal enclosure with connector hardware, the transmit/receive circuits, the microprocessor/data-storage electronics, and the antenna interface. The table below describes the unit tested to determine compliance with the standards:

| Model/P/N | Manufacturer | Serial Number |
|---|---|---|
| AISA1-000-10 | L3 Communications Corp. | 000383088 |

The following table describes the system physical and electrical properties:

| Model | Volts/Amps/Hertz | H/W/D in cm |
|---|---|---|
| AISA1-000-10 | 12 - 24 VDC, 5 A | 8/16/19 |

The table below describes the support equipment used:

| Product | Manufacturer | Model | Serial Number |
|---|---|---|---|
| AISA1 | L3 | AISA1-000-90 | 000374785 |
| Power Supply | MFJ | MFJ-4035MV | L31D 5144 |
| Power Supply | Tenma | 72-7695 | 0003094 |
| PC | Antec | Custom by L3 | L3ID 9851 |
| Attenuator, Fixed | Bird | 25-A-MFN-30 | 0323 |
| Attenuator, Variable | Agilent | 8496A | MY42140708 |
| Attenuator, Variable | Agilent | 8494A | MY42140564 |
| Monitor | Princeton | EO700 | KNAA4621773 |
| Mouse | Microsoft | Intellimouse | 3882A611 |
| Keyboard | Microsoft | KWD 203 | 9910249571 |
| Antennas (2) | L3 | GPS | n/a |

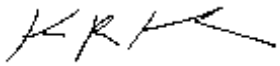
## IV. Summary of Results:

The L3 Communications Aviation Recorders Corporation AISA1 complies with the requirements in IEC 61993-2, paragraph 15 and EN 60945, paragraphs 7.2 and 11.1. Section VIII contains the results summarized in the table below.

| | Test | Mode/Port | IEC 61993-2 Para. | Tolerance/Limit | Specified Value | Measured Value |
|---|---|---|---|---|---|---|
| **1** | Frequency Error | TDMA Transmit | **15.1.1** | ±500 Hz<br>±500 Hz<br>±500 Hz<br>±500 Hz | 156,025,000 Hz<br>157,412,500 Hz<br>160,637,500 Hz<br>162,025,000 Hz | 156,025,167 Hz<br>157,412,661 Hz<br>160,637,658 Hz<br>162,025,157 Hz |
| **2** | Carrier Power | TDMA Transmit | **15.1.2** | ±1.5 dB | 40.96 dBm<br>33.01 dBm | 40.25 dBm<br>34.02 dBm |
| **3** | Modulation Spectrum | TDMA Transmit | **15.1.3**<br>**15.1.4** | 25 kHz lmt.<br>12.5 kHz lt. | 61993-2 Fig. 4<br>61993-2 Fig. 5 | Within Limit<br>Within Limit |
| **4** | Attack and Release Times | TDMA Transmit | **15.1.5**<br>**15.1.6** | +1.5 dB<br>-50 dBPc | <1 ms<br><1 ms | <1 ms<br><1 ms |
| **5** | Sensitivity and Error at High Input | TDMA Receive | **15.3.1**<br>**15.3.2**<br>**15.3.3** | 20% PER<br>20% PER<br>1% PER | -107 dBm<br>-98 dBm<br>-7 dBm | -107 dBm<br>-98 dBm<br>-7 dBm |
| **6** | Co-channel Rejection | TDMA Receive | **15.3.4**<br>**15.3.5** | 20% PER<br>20% PER | -10 to 0 dB<br>-18 to 0 dB | -10 dB<br>-18 dB |
| **7** | Adjacent Channel Selectivity | TDMA Receive | **15.3.6**<br>**15.3.7** | 20% PER<br>20% PER | ≥70 dB<br>≥50 dB | 70 dB<br>50 dB |
| **8** | Spurious Rejection | TDMA Receive | **15.3.8** | 20% PER | ≥70 dB | 70 dB |
| **9** | Inter-modulation Rejection | TDMA Receive | **15.3.9** | 20% PER | A = -101 dBm<br>B/C= -27 dBm<br>D = -15 dBm | A = -101 dBm<br>B/C= -27 dBm<br>D = -15 dBm |
| **10** | Power Supply Extreme Voltage | Transceive | **60945 par. 7** | Reverse Polarity<br>Voltage Variation | Safe<br>10.8-31.2 VDC | Compliant<br>9.2-37.1 VDC |
| **11** | Acoustic | Transceive | **60945 par. 11.1** | Operating | ≤60 dBA | <60 dBA |

Testing was performed by Kyle R. Kowalczyk, president, Green Mountain Electromagnetics and requested by:

L3 Communications Aviation Recorders Corp.
6000 Fruitville Road
Sarasota, FL 34232
USA



Kyle R. Kowalczyk
11/6/06

**V. Measuring Equipment:**

The table below describes the instrumentation used by Green Mountain Electromagnetics to perform this testing:

| Unit | Manufacturer | Model | Serial/ID # | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E4404B | MY45104836 | 4/4/06 | 4/4/07 |
| Signal Generator | Hewlett-Packard | E4421B | US38220195 | 10/31/05 | 11/31/06 |
| Frequency Counter | Agilent | 53181A | MY40003289 | 4/26/06 | 4/27/07 |
| Power Meter | Agilent | E4418B | GB42421582 | 4/26/05 | 4/27/07 |
| Volt-Ohm-Amp, Meter | BK Precision | Test Bench Model 390 | 25205312 | 6/06/06 | 6/06/07 |
| Signal Generator | Hewlett-Packard | 8657B | 3538U07387 | 4/4/06 | 4/4/07 |
| Oscilloscope | Tektronix | TDS684C | B020630 | 4/4/06 | 4/4/07 |
| Radio Test Set | Marconi | 2955/2957 | 132113/131958 | 4/4/06 | 4/4/07 |
| Sound Meter | Extech | 407703A | 9144841 | 5/30/03 | 5/30/07 |
| Splitter/Combiner | Mini-Circuits | ZSC-4-1 | n/a | n/a | n/a |
| Plotter | Hewlett-Packard | 7475A | 2517A05281 | n/a | n/a |

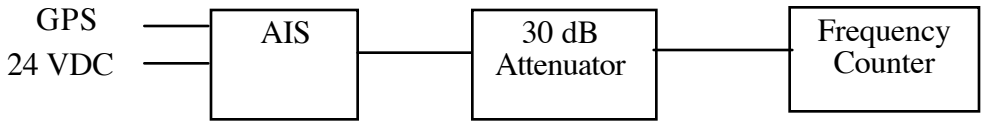
## VI. Measurement Procedures for AISA1 Physical Tests:

### 1. Frequency Error.

TDMA Frequencies: 156.025, 157.4125, 160.6375, 162.025 MHz

Specification: ±0.5 kHz Normal Operation

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AIS to 24-VDC power and GPS antenna; attach 30-dB attenuator to VHF port.
b. Verify frequency counter and AIS operation.
   i. Frequency counter is connected to 30-dB attenuator.
   ii. AIS channels are selected from front panel.
   iii. Frequency counter requires warm-up period.
c. Verify AIS frequency with non-contact probe and spectrum analyzer.
d. Operate EUT at first selected channel with no modulation.
e. Record frequency displayed on counter.
   i. Repeat for each TDMA channel – settings are 1060, 1228, 2260 & 2088.




Block Diagram of Frequency Test

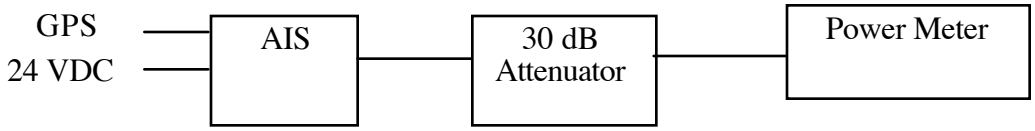
## VI. Measurement Procedures for AISA1 Physical Tests Cont'd:

**2. Carrier Power.**

High Specification: 40.96 ± 1.5 dBm (12.5W +5.1W/-3.1W) Normal Operation

Low Specification: 33.01 ± 1.5 dBm (2W +.8W/-.6W) Normal Operation

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AIS to 24-VDC power and GPS antenna; attach 30-dB attenuator to VHF port.
b. Verify power meter and AIS operation.
   i. Power meter is connected to 30-dB attenuator.
   ii. AIS channels are selected from front panel.
   iii. Power meter requires warm-up period, calibration and zeroing.
c. Verify AIS frequency with spectrum analyzer.
d. Operate EUT at high power unmodulated.
e. Record level displayed on meter.
f. Repeat for low power.




Block Diagram of Carrier Power Test

## VI. Measurement Procedures for AISA1 Physical Tests Cont'd:

### 3. Modulation Spectrum.

25kHz Envelope: 0dB ±10kHz, decrease -25dBc to -70dBc from ±10kHz to ±25kHz

12.5kHz Envelope: 0dB ±2.5kHz, decrease 0dBc to -60dBc from ±2.5kHz to ±12.5kHz

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AIS to 24-VDC power and GPS antenna; attach 30-dB attenuator to VHF port.

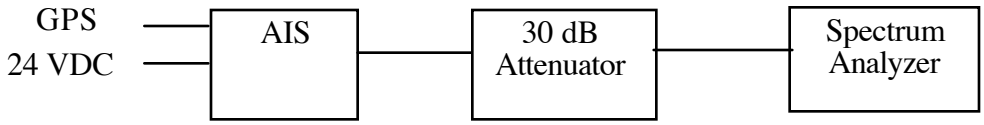
b. Verify analyzer and AIS operation.
   i. Spectrum analyzer is connected to 30-dB attenuator.
   ii. AIS test signals 2 & 3 per 61993-2, para. 10.4 are selected from front panel.
   iii. Spectrum analyzer requires warm-up period.

c. Verify AIS test signal on spectrum analyzer.

d. Operate EUT at first selected test signal with standard modulation.

e. Record frequency spectrum displayed on analyzer.

f. Repeat for each TDMA test signal.




Block Diagram of Modulation Spectrum Test

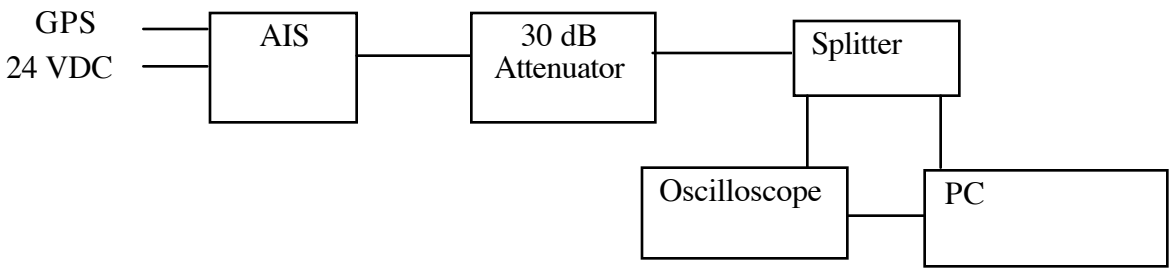
## VI. Measurement Procedures for AISA1 Physical Tests Cont'd:

### 4. Attack/Release Time.

Attack Specification: 1.5 dB at 1 ms

Release Specification: 50 dB below power at 1 ms

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AIS to 24-VDC power and GPS antenna; attach 30-dB attenuator to VHF port.
b. Verify Oscilloscope and AIS operation.
   i. Power splitter input is connected to 30-dB attenuator.
   ii. PC uses other splitter output.
c. Verify system sensitivity is 30-dB down and trigger on leading edge.
d. Operate EUT.
e. Record rise time (attack) transient displayed on oscilloscope.
f. Repeat for falling edge (release time).




Block Diagram of Transmitter Attack/Release Time Test

## VI. Measurement Procedures for AISA1 Physical Tests Cont'd:

**5. Sensitivity including Error at High Input.**

25 kHz Specification: -107 dBm @ 20% PER Normal, -7dBm @ 1% PER High Input

12.5 kHz Specification: -98 dBm @ 20% PER Normal Operation

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AIS to 24-VDC power and GPS antenna.

b. Verify PC and AIS operation.
   i. PC provides input to AIS.
   ii. Signal generator set to provide -107 dBm at EUT (25 kHz) through combiner.
   iii. Spectrum analyzer verifies correct signal level.

c. Operate with standard modulation at 156.025 MHz.

d. Operate AIS EUT with standard modulation at 156.025 MHz.

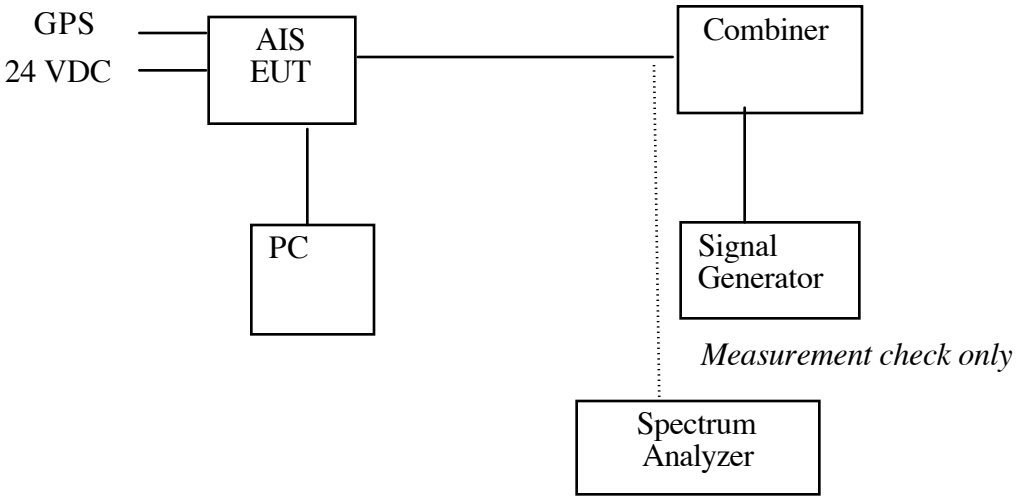
e. Run sensitivity software program on PC.
   i. Software determines TDMA packet error rate.

f. Repeat step e. for 162.025 MHz.

g. Set signal generator to provide -98 dBm (12.5 kHz).

h. Repeat step e. for 157.4125 MHz and 160.6375 MHz.

i. Repeat step e. to provide -77 dBm and -7 dBm.
   i. Use 30-dB power attenuator for error at high input.




Block Diagram of Receiver Sensitivity Test

## VI. Measurement Procedures for AISA1 Physical Tests Cont'd:

### 6. Co-Channel Rejection.

25 kHz Specification: -10 dB to 0 dB

12.5 kHz Specification: -18 dB to 0 dB

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AIS to PC, 24-VDC power, GPS antenna.

b. Verify PC and AIS operation.
   i. PC is connected to signal generator A, then sig. gen. A & B are connected to combiner.
   ii. PC is set to provide -104 dBm at EUT (25 kHz).
   iii. Signal generator B set to provide -104 to EUT (0-dBm result) at same channel as AIS.
   iv. Spectrum analyzer verifies correct signal level.

c. Operate PC with standard modulation at default channel and test signal 2.

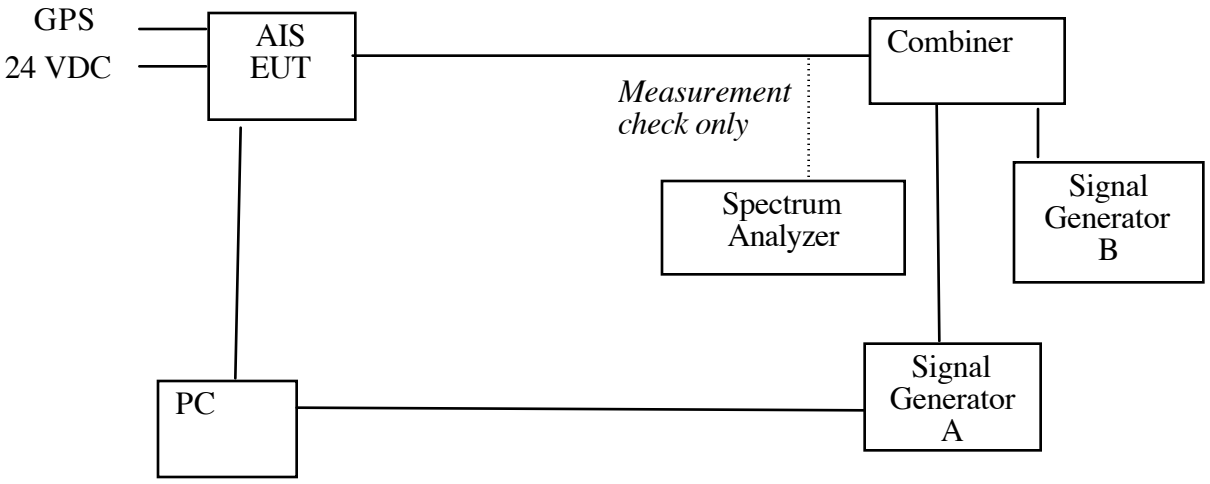
d. Operate EUT with standard modulation at default channel and test signal 2.

e. Run co-channel software program on PC.
   i. Software determines packet error rate from messages.
   ii. Proceed as in IEC 61993 para. 15.3.4 steps a. – i. if PER >20%.

f. Repeat step e. for test signal 3.

g. Repeat step a. – f. with signal generator B set to frequencies of ±12% of channel separation.

h. Set signal generator to provide -95 dBm (12.5 kHz) and repeat steps b. – g.




Block Diagram of Receiver Co-Channel Test

## VI. Measurement Procedures for AISA1 Physical Tests Cont'd:

### 7. Adjacent Channel Selectivity.

25 kHz Specification: 70 dB Normal Operation

12.5 kHz Specification: 50 dB Normal Operation

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AIS to PC, 24-VDC power, GPS antenna.

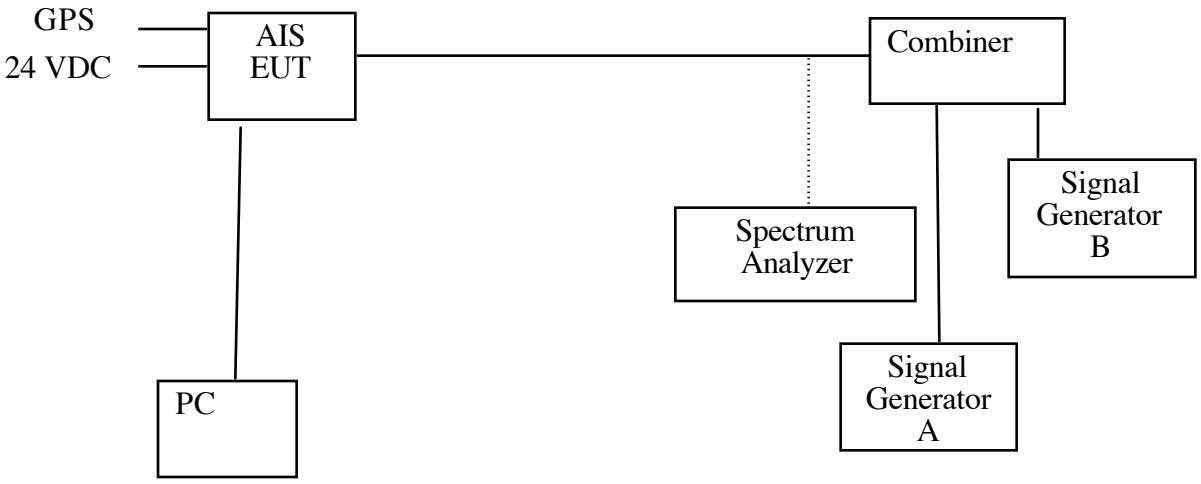
b. Verify PC and AIS operation.
   i. PC monitors AIS, then sig. gen. A & B are connected to combiner.
   ii. Signal generator is set to provide -104 dBm at EUT (25 kHz).
   iii. Signal generator B set to provide -34 to EUT (70-dB result) at channel immediately above the AIS channel.
   iv. Spectrum analyzer verifies correct signal level.

c. Operate PC and AIS EUT with standard modulation at default channel.

d. Run adjacent-channel software program on PC.
   i. Software determines packet error rate from messages.
   ii. Proceed as in IEC 61993 para. 15.3.6 steps a. – k. if PER >20%.

e. Repeat step d. for channel immediately below AIS channel.

f. Repeat steps d. and e. for 12.5-kHz AIS channel.
   i. Set signal generator to provide -95 dBm/-50 dBm.




Block Diagram of Receiver Adjacent-Channel Test

## VI. Measurement Procedures for AISA1 Physical Tests Cont'd:

**8. Spurious Rejection.**

Specification: 70 dB Normal Operation

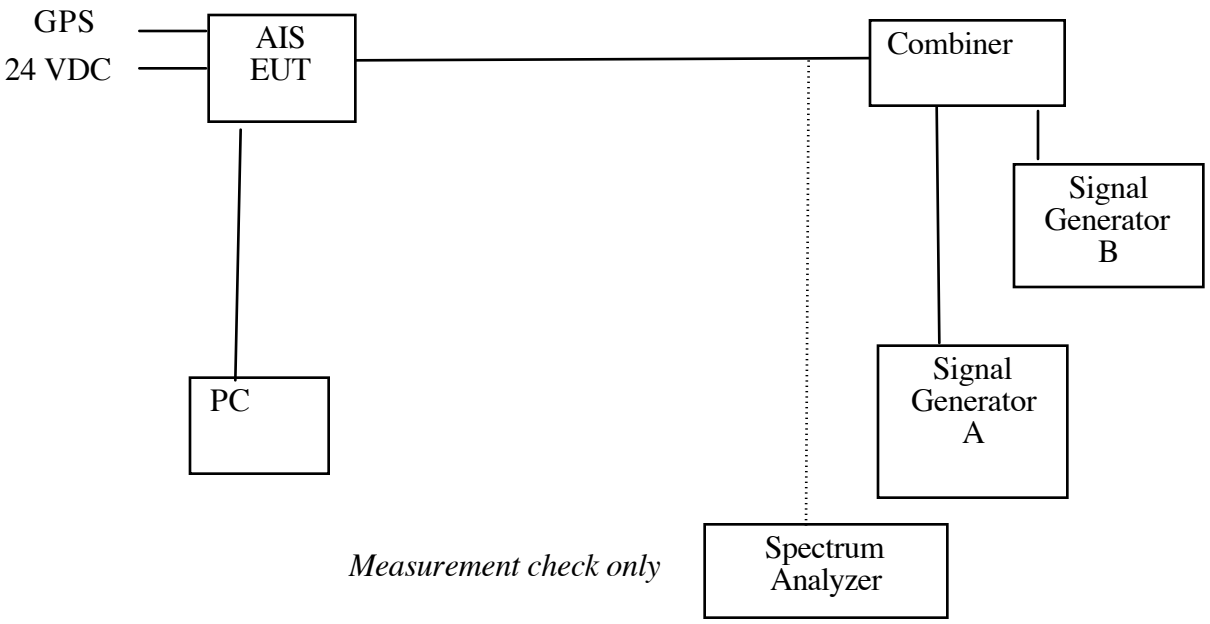
a. Set up EUT and test instrumentation in laboratory.
   i. Connect AIS to PC, 24-VDC power, GPS antenna.

b. Verify PC and AIS operation.
   i. PC is connected to AIS, then sig. gen. A & B are connected to combiner.
   ii. Signal generator is set to provide -104 dBm at EUT (25 kHz).
   iii. Signal generator B set to provide -27 dBm EUT, FM modulated 400 Hz/3kHz.
   iv. Signal generator B set to provide sweeps to EUT per calculations in results (VIII-8).
   v. Spectrum analyzer verifies correct signal levels.

c. Operate PC with standard modulation at default channel.

d. Operate EUT with standard modulation at default channel.

e. Run spurious-rejection software program on PC.
   i. Software determines packet error rate from messages.
   ii. Proceed as in IEC 61993 para. 15.3.8 steps a. – h. if PER >20%.




Block Diagram of Receiver Spurious Rejection Test

## VI. Measurement Procedures for AISA1 Physical Tests Cont'd:

### 9. Intermodulation Rejection.

Specification: PER ≤20% Normal Operation

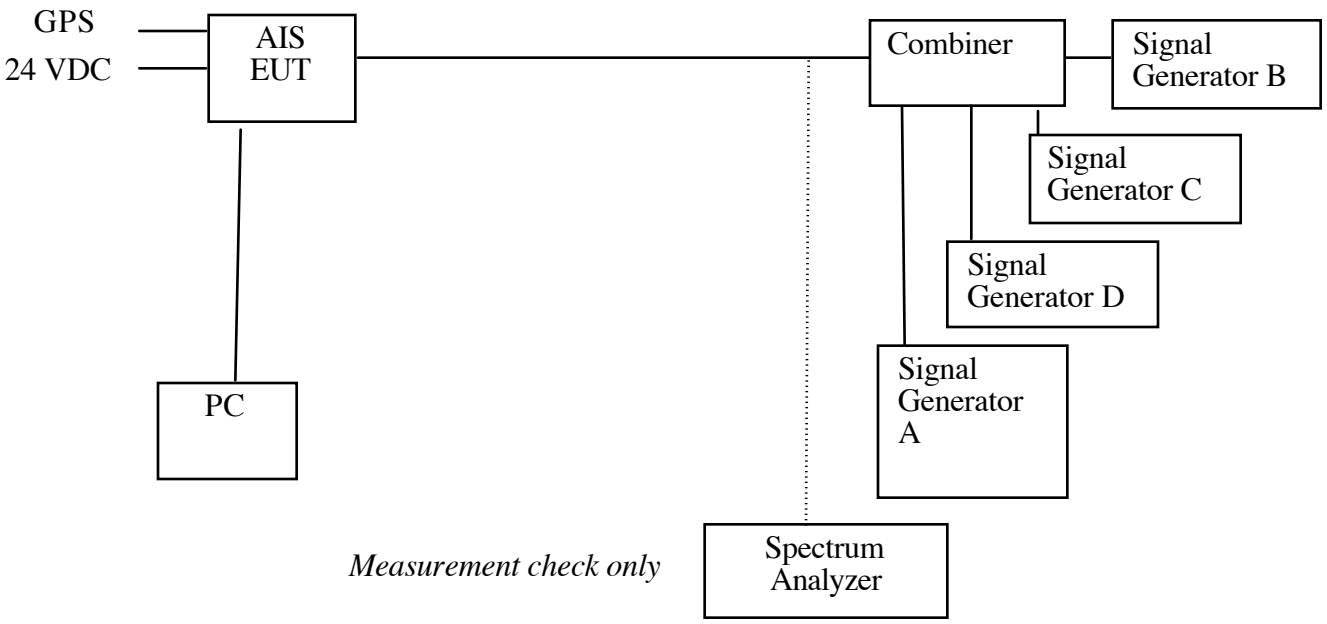
a. Set up EUT and test instrumentation in laboratory.
   i. Connect AIS to PC, 24-VDC power, GPS antenna.

b. Verify PC and AIS operation.
   i. PC monitors AIS (A); sig. gen. A – D are connected to combiner.
   ii. Signal generator is set to provide -101 dBm at 162.025 MHz.
   iii. Signal generator B provides -27 dBm at 162.525 MHz, FM modulated at 400 Hz/3kHz.
   iv. Signal generator C provides -27 dBm at 161.025, unmodulated.
   v. Signal Generator D set to -15 dBm at 167.750 unmodulated.
   vi. Spectrum analyzer verifies correct signal levels.

c. Record generator levels necessary for correct signal at EUT.

d. Operate EUT with standard modulation at selected (A) channel.

e. Run intermodulation software program on PC.
   i. Software determines packet error rate from messages.




Block Diagram of Receiver Intermodulation Test

## VI. Measurement Procedures for AISA1 Physical Tests Cont'd:

### 10. Power Supply.

Overvoltage Specification: 40 V Extreme Operation

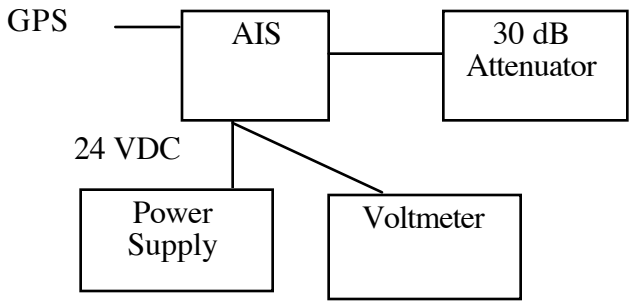
Reverse Polarity: No Damage, Extreme Operation

Voltage Variation: 10.8 to 31.2 VDC, Extreme Operation

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AIS to 24-VDC power, GPS antenna, and 30-dB attenuator.

b. Verify AIS operation.
   i. Power supply is increased to max and effects noted.
   ii. Polarity is reversed and effects noted.
   iii. Power supply is varied and effects noted.

c. Voltage is verified with voltmeter.




Block Diagram of Power Supply Test

## VI. Measurement Procedures for AISA1 Physical Tests Cont'd:

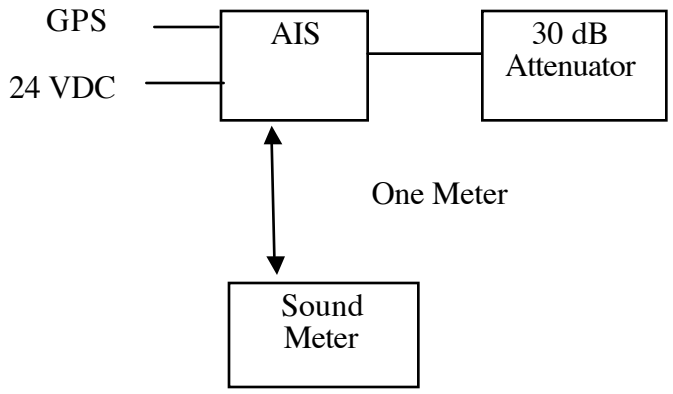
### 11. Acoustic.

Specification: ≤60 dBA Normal Operation, No Alarms

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AIS to 24-VDC power, GPS antenna, and 30-dB attenuator.

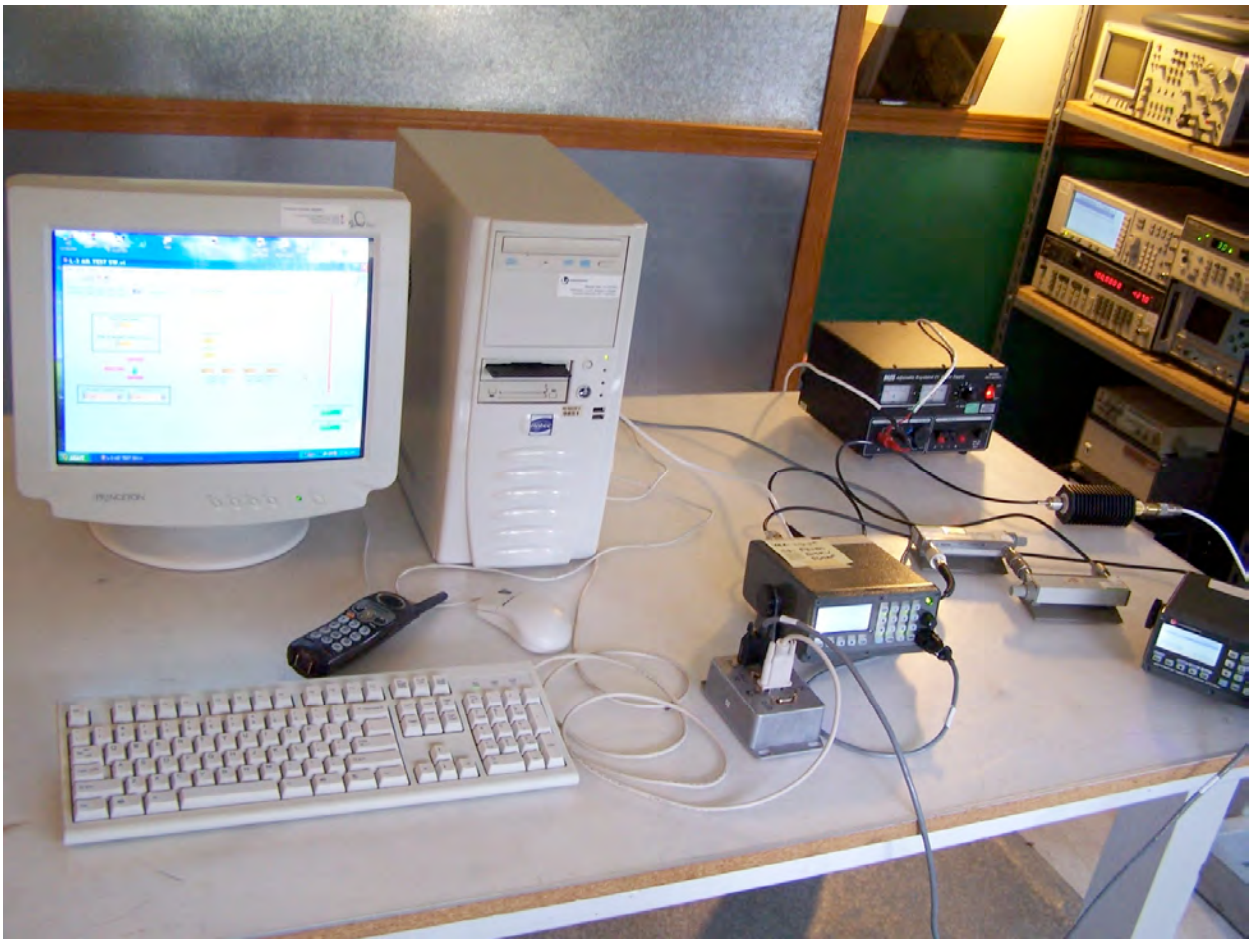
b. Verify AIS and sound meter operation.
   i. Sound meter is 1 meter away from each face.
   ii. AIS operated normally.

c. Values on sound meter are recorded.



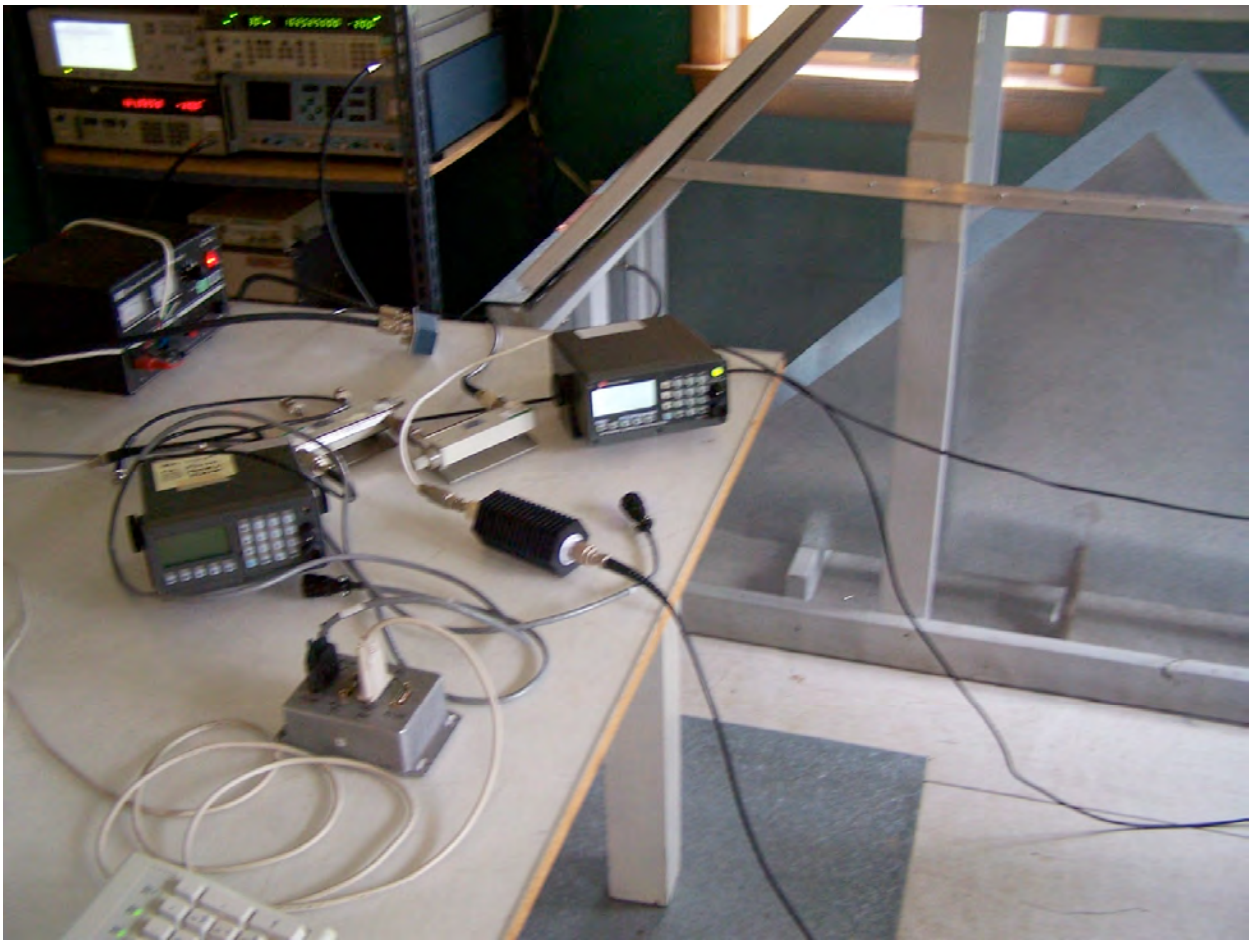

Block Diagram of Acoustic Test

## VII. Test Setup Photographs for AISA1 Physical Tests:



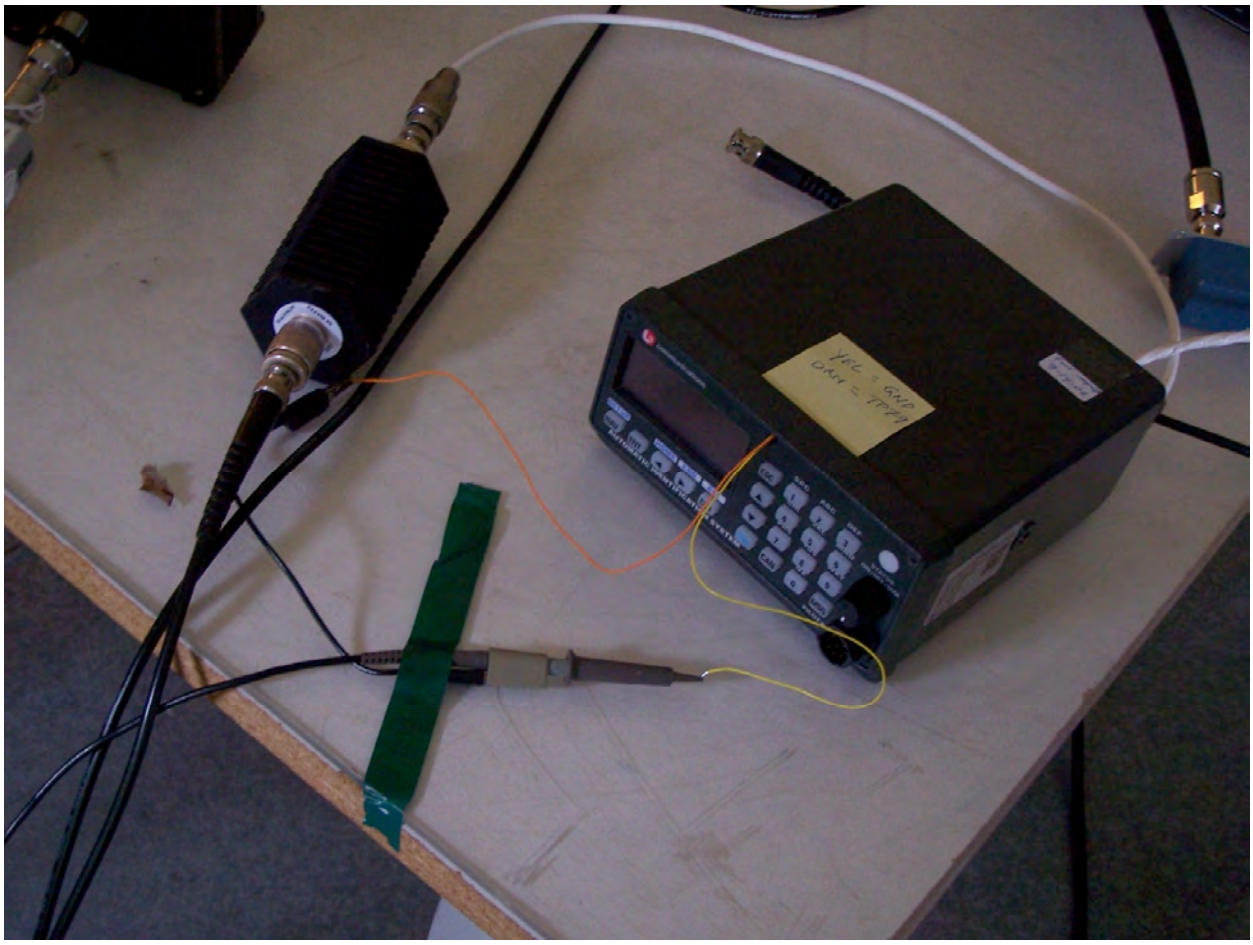
Equipment Under Test - Receiver Tests

## VII. Test Setup Photographs for AISA1 Physical Tests Cont'd:



EUT - Transmitter Tests

## VII. Test Setup Photographs for AISA1 Physical Tests Cont'd:



EUT - Attack/Release Time

## VIII. Measurement Results for AISA1 Physical Tests:

### 1. Frequency Error.

Frequencies: 156.025, 157.4125 MHz

Specification: ±0.5 kHz Normal Operation


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 1. Frequency Error Cont'd.

Frequencies: 160.6375, 162.025 MHz

Specification: ±0.5 kHz Normal Operation


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

**2. Carrier Power.**

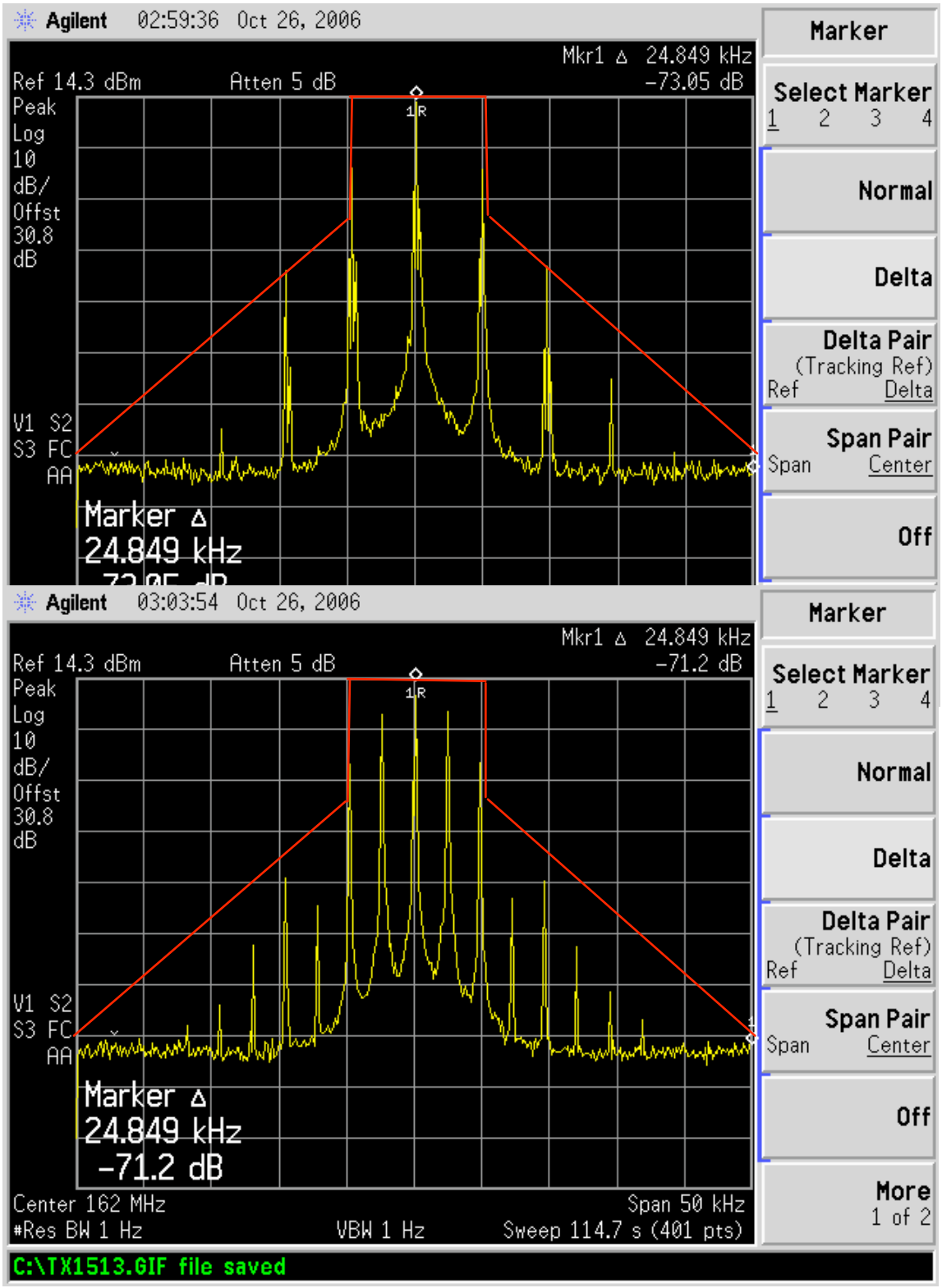
High Specification: 40.96 ±1.5 dBm (12.5W +5.1W/-3.1W)

Low Specification: 33.01 ±1.5 dBm (2W +.8W/-.6W)

## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 3. Modulation Spectrum 25 kHz Channel TDMA Signals 2 & 3.

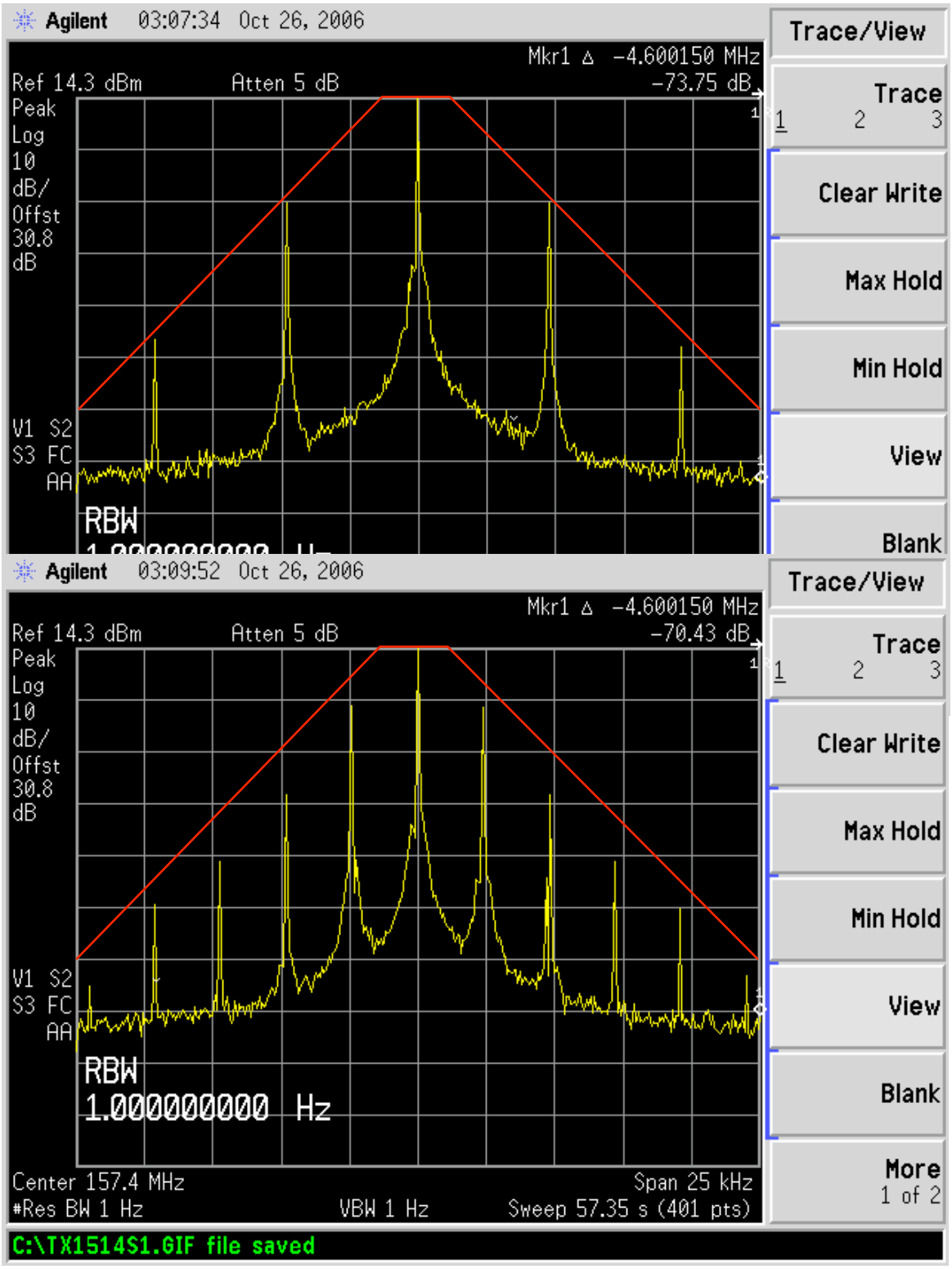
25kHz Envelope: 0dB ±10kHz, decrease -25dBc to -70dBc from ±10kHz to ±25kHz



## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 3. Modulation Spectrum 12.5 kHz TDMA Signals 2 & 3.

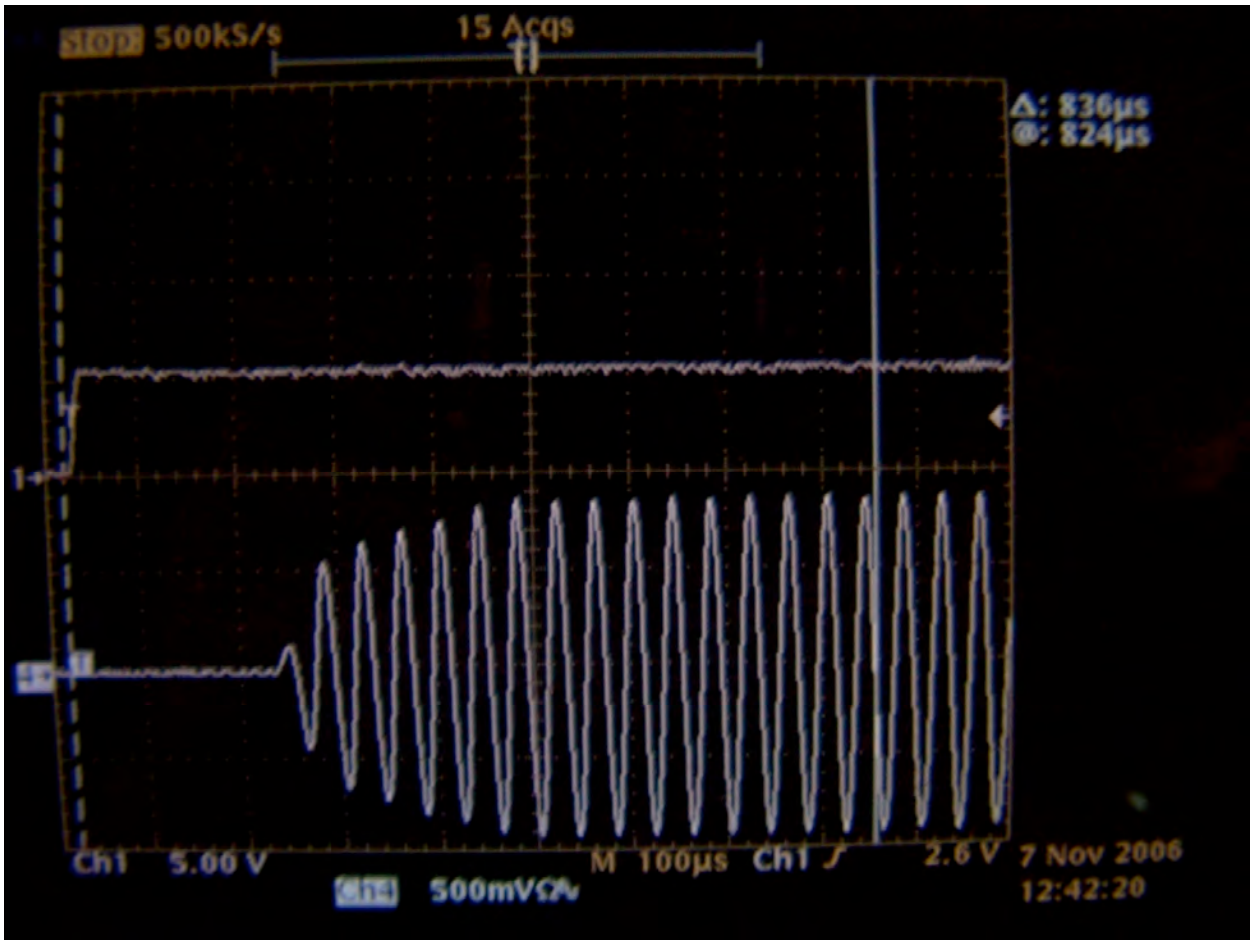
12.5kHz Envelope: 0dB ±2.5kHz, decrease 0dBc to -60dBc from ±2.5kHz to ±12.5kHz



## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 4. Attack/Release Time.

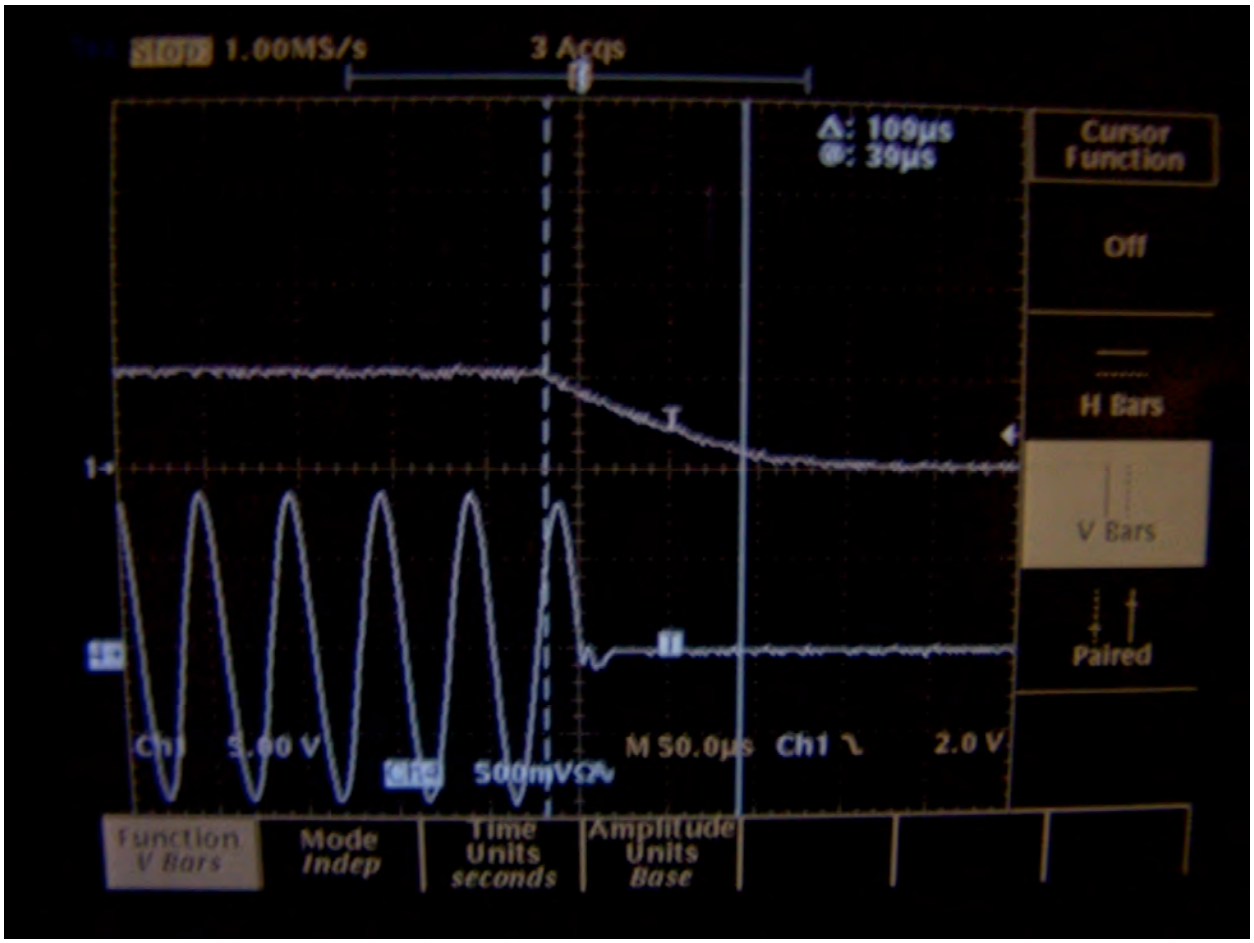
Attack Specification: 1.5 dB at 1 ms



## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 4. Attack/Release Time Cont'd.

Release Specification: -50% dBPc at 1 ms



## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

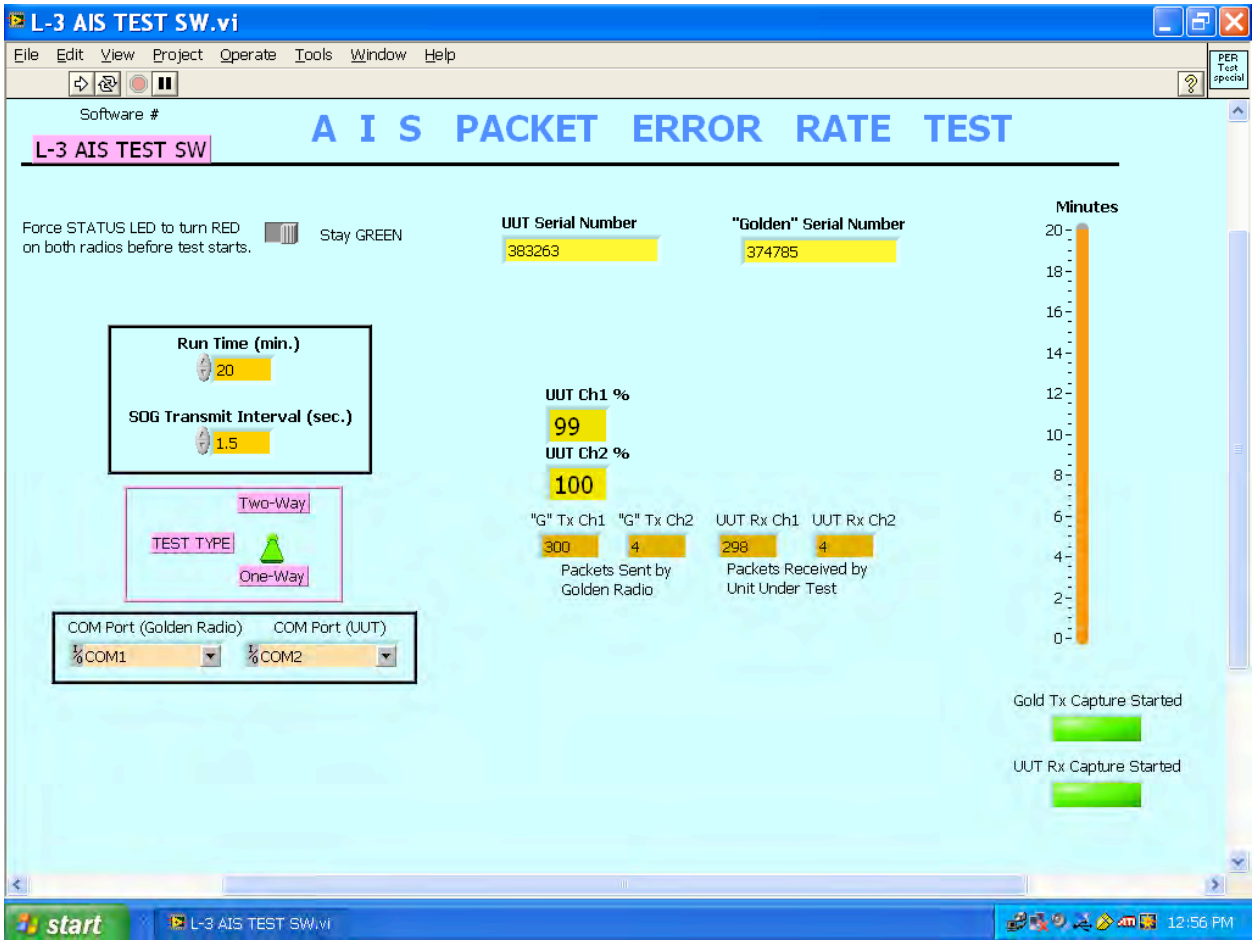
### 5. Sensitivity.

25 kHz Specification: -107 dBm @ 20% PER Normal Operation

Settings: -100 dBm out -7 dB combiner = -107 dBm at EUT

Measured: -107 dBm @ <20% PER

One anomaly occurred during sensitivity testing @ 25 kHz (Section 15.3.1). There were only 4 transmissions on channel 2 compared to 300 on channel 1. This was a test equipment failure that we had failed to observe during this particular test. The Labview based test software had a known bug in it that it got into a mode where the Channel 2 port transmitted less packets than Channel 1. The remedy for this problem is to refresh the Windows based Labview program. The less number of packets reported on Channel 2 is not a reflection on the performance of the product as can be seen in all the other tests.



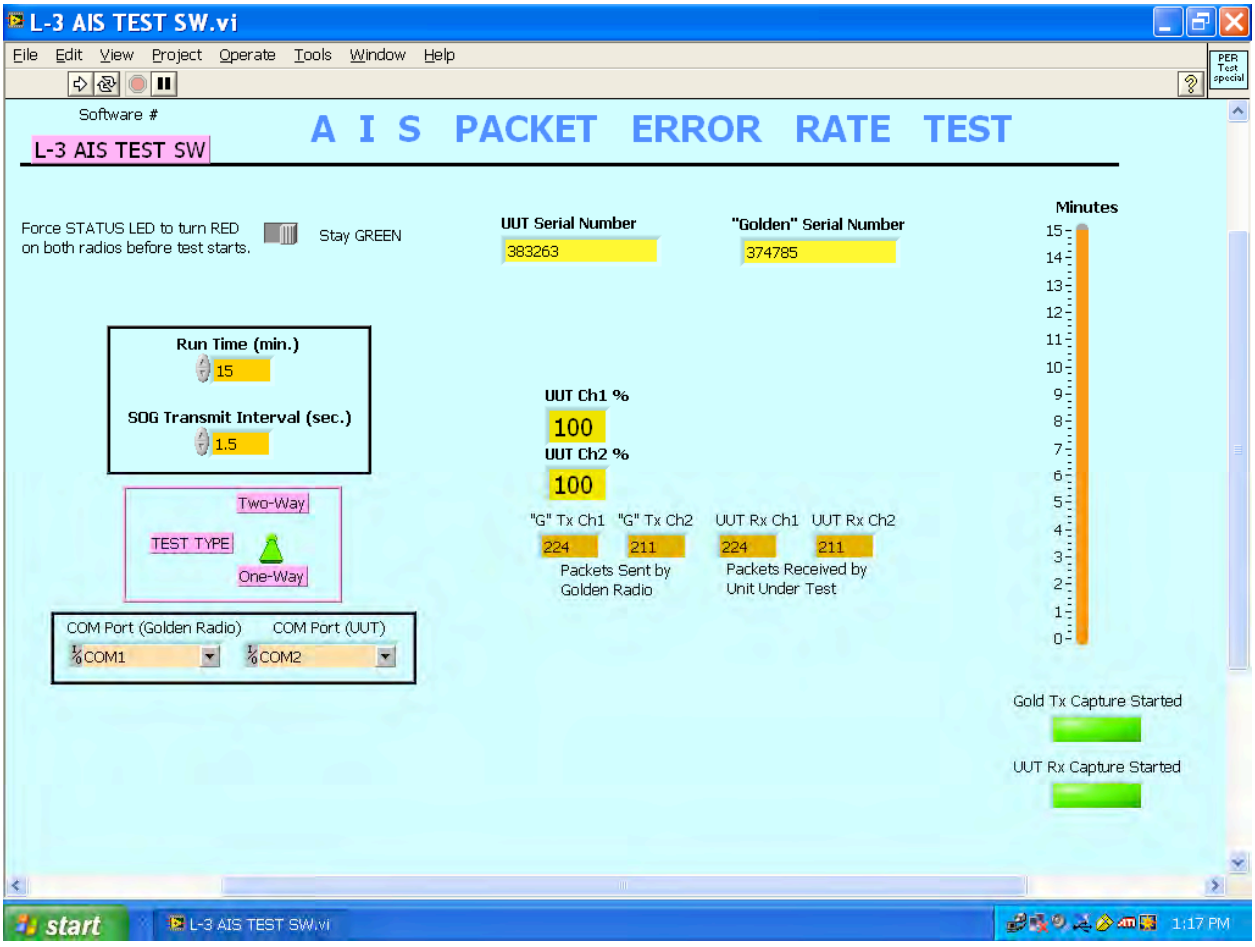
## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 5. Sensitivity Cont'd.

12.5 kHz Specification: -98 dBm @ 20% PER Normal Operation

Settings: -91dBm out -7dB combiner = -98 dBm at EUT

Measured: -98 dBm @ <20% PER



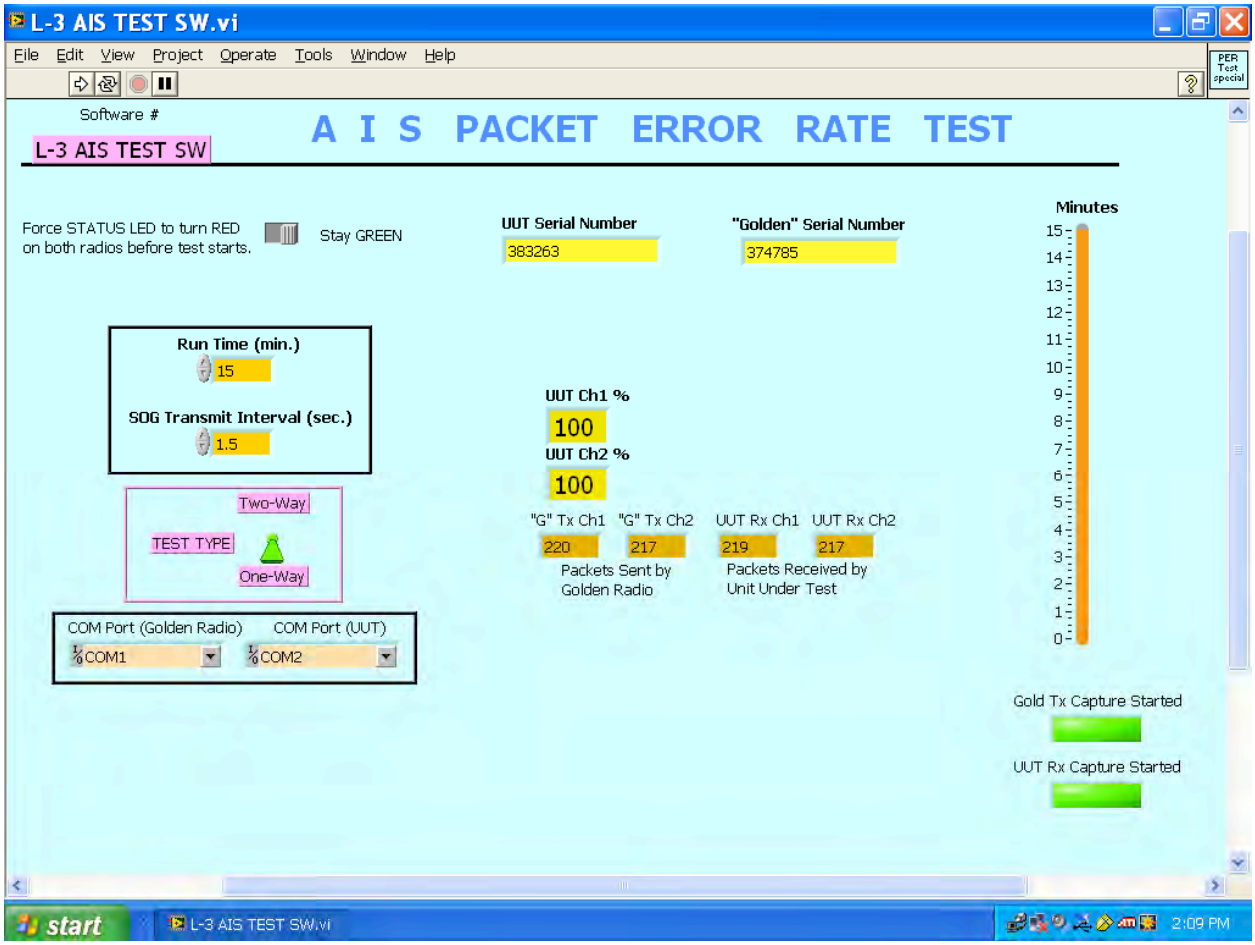
## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 5. Sensitivity (Error at High Input).

Specification: -7 dBm @ 1% PER Normal

Settings: 0 dBm out -7 dB combiner = -7 dBm at EUT

Measured: -7 dBm @ 0% PER

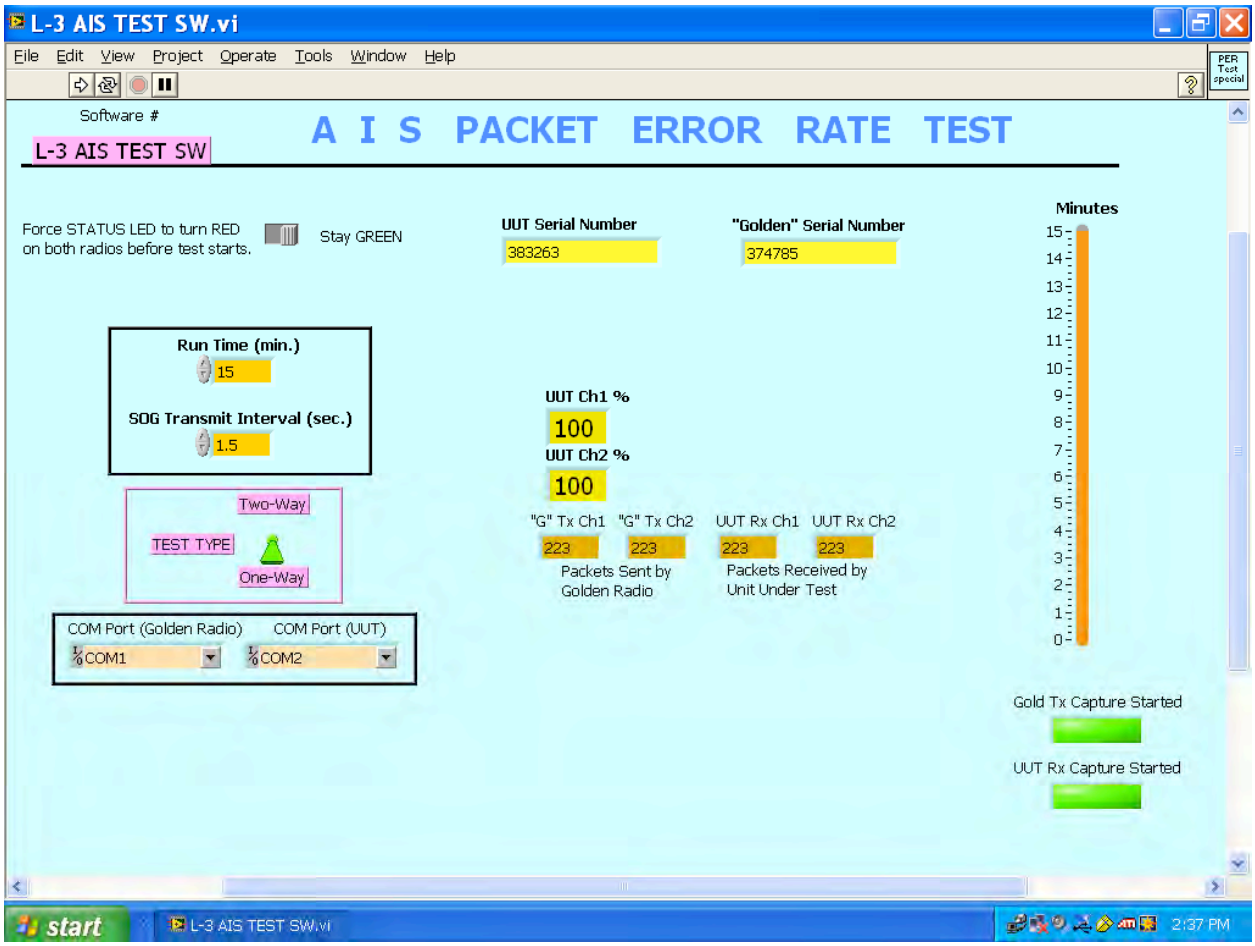


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 6. Co-Channel Rejection.

25 kHz Specification: -10 dB to 0 dB @ Nominal

Measured: -10 dB @ <20% PER

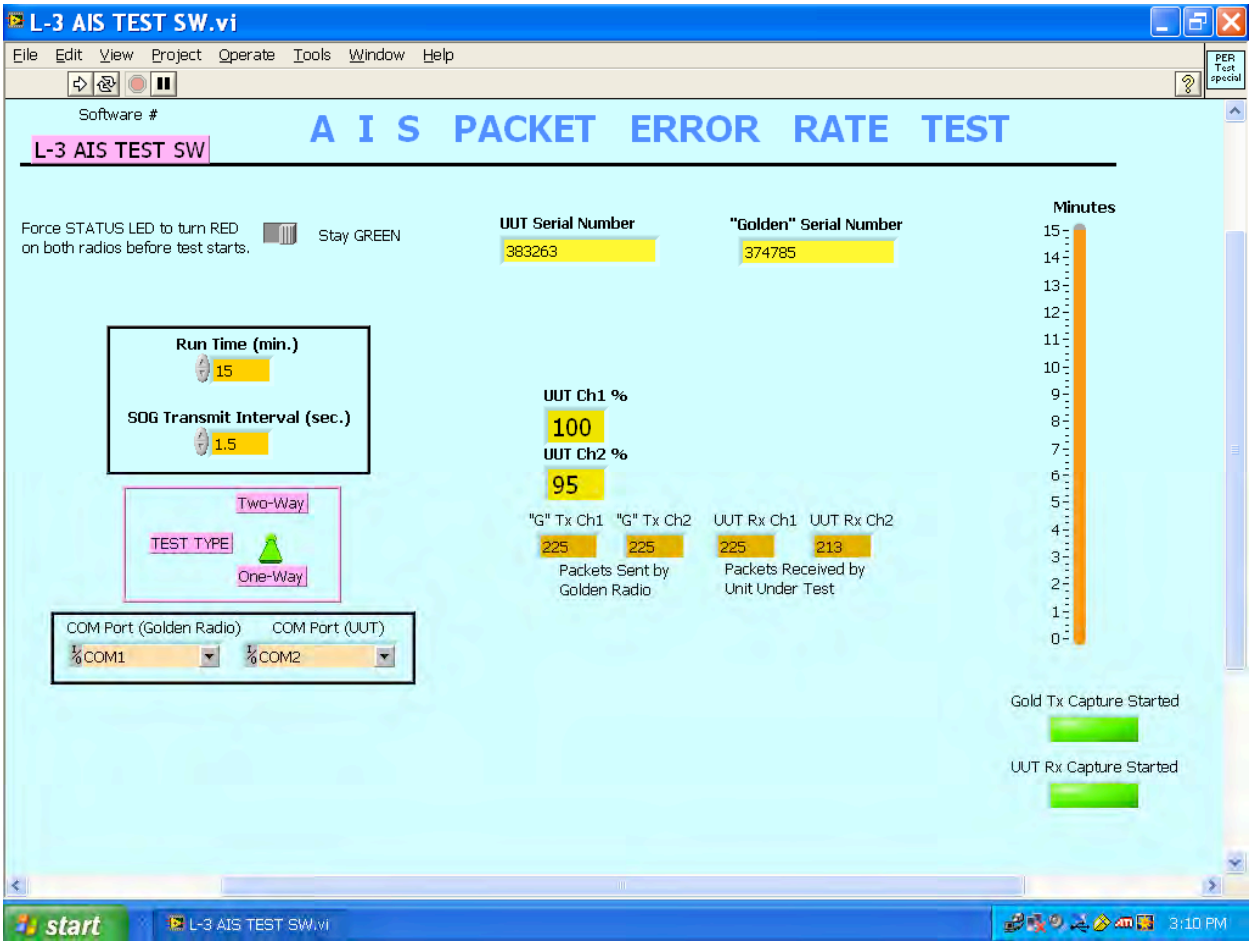


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 6. Co-Channel Rejection.

25 kHz Specification: -10 dB to 0 dB @ -3kHz

Measured: -10 dB @ <20% PER

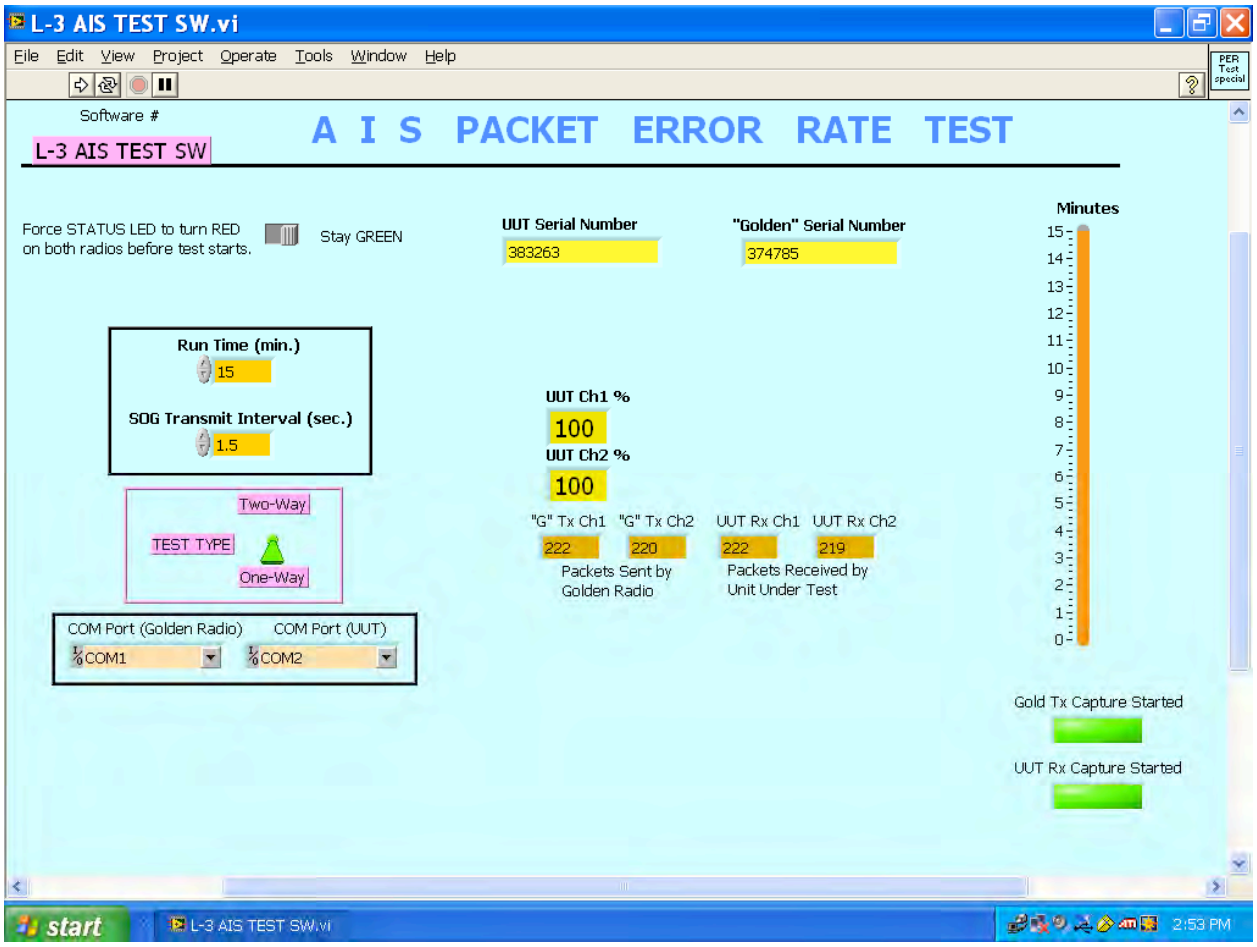


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 6. Co-Channel Rejection Cont'd.

25 kHz Specification: -10 dB to 0 dB @ +3 kHz

Measured: -10 dB @ <20% PER

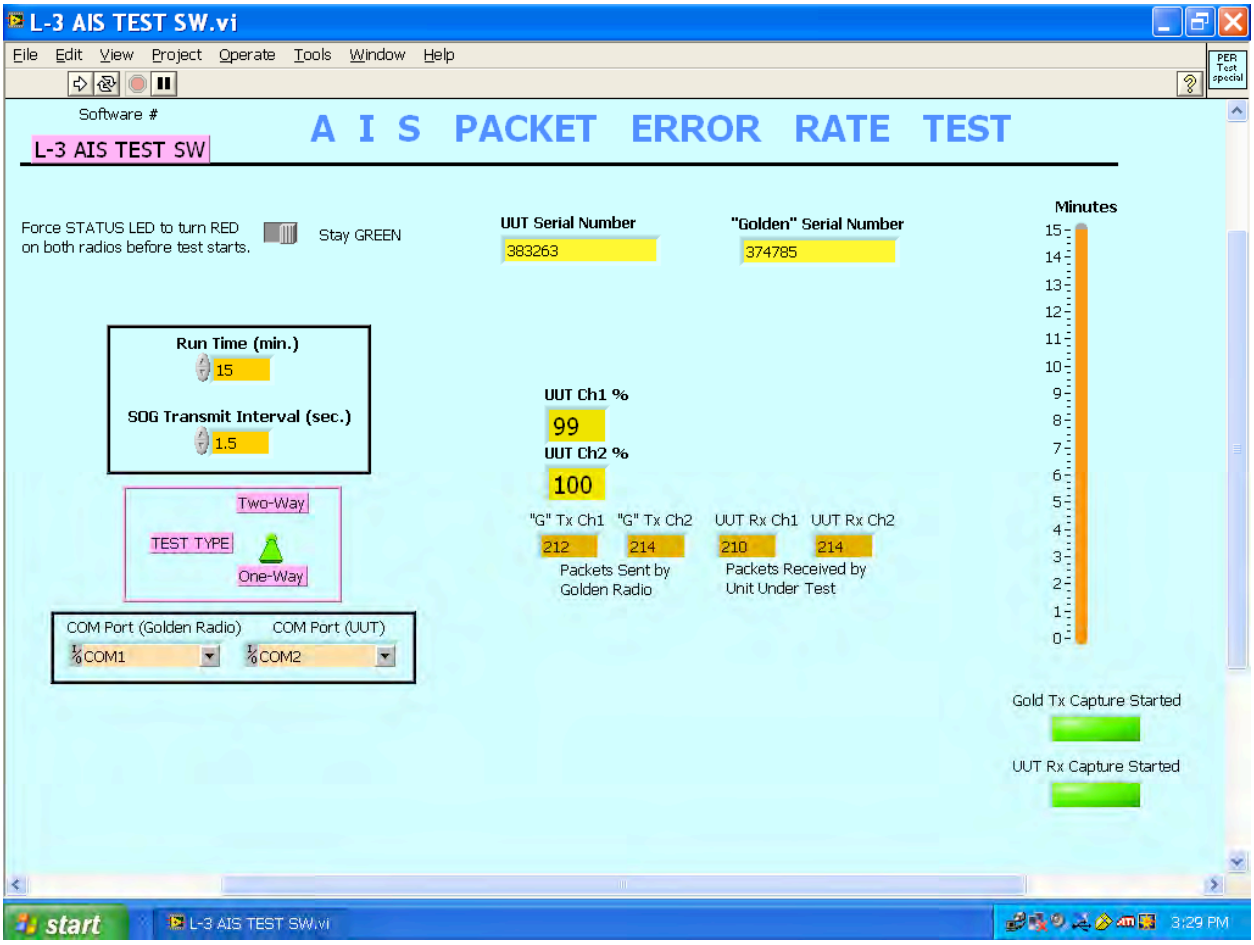


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 6. Co-Channel Rejection Cont'd.

12.5 kHz Specification: -18 dB to 0 dB @ nominal

Measured: -18 dB @ <20% PER

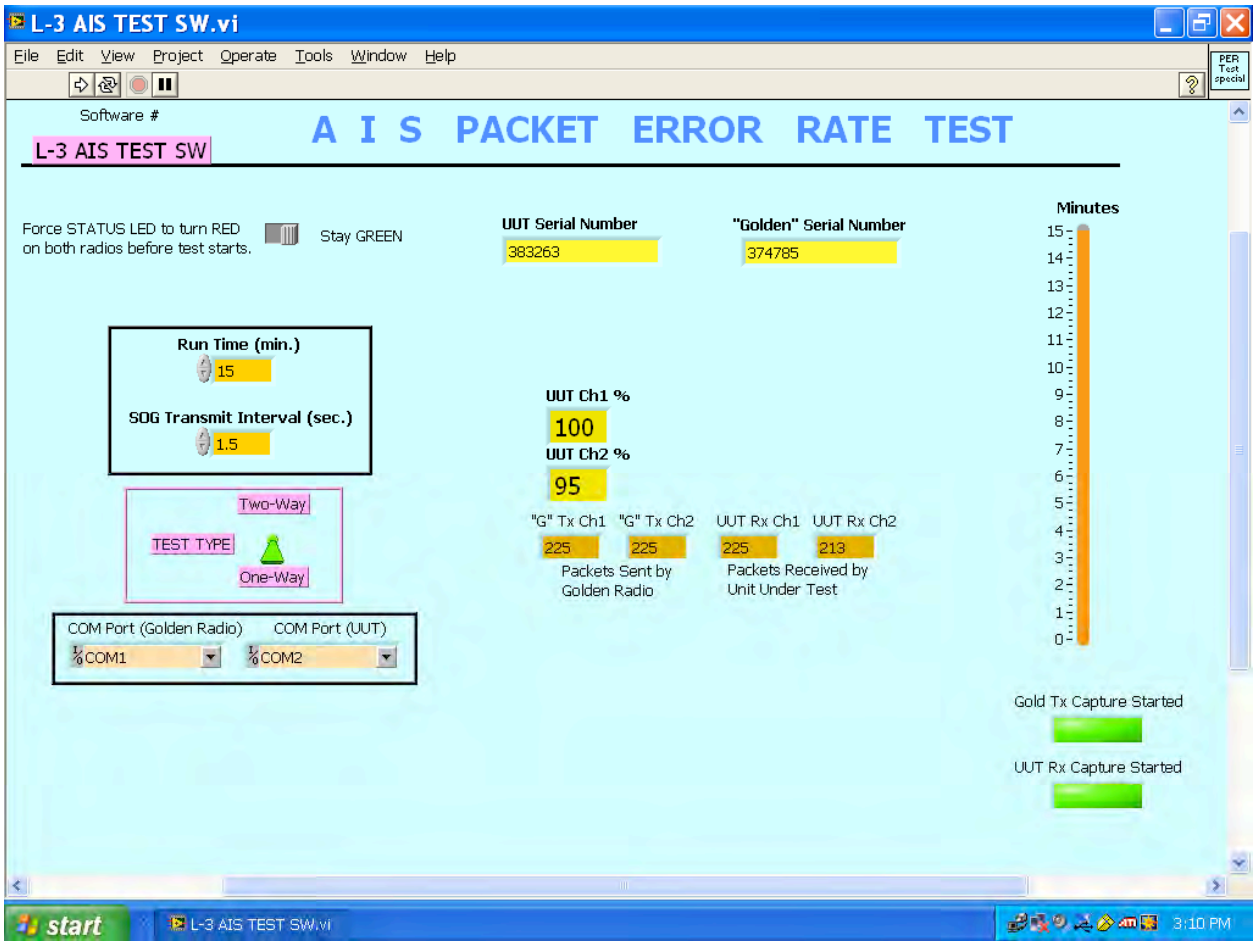


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 6. Co-Channel Rejection Cont'd.

12.5 kHz Specification: -18 dB to 0 dB @ -1.5 kHz

Measured: -18 dB @ <20% PER

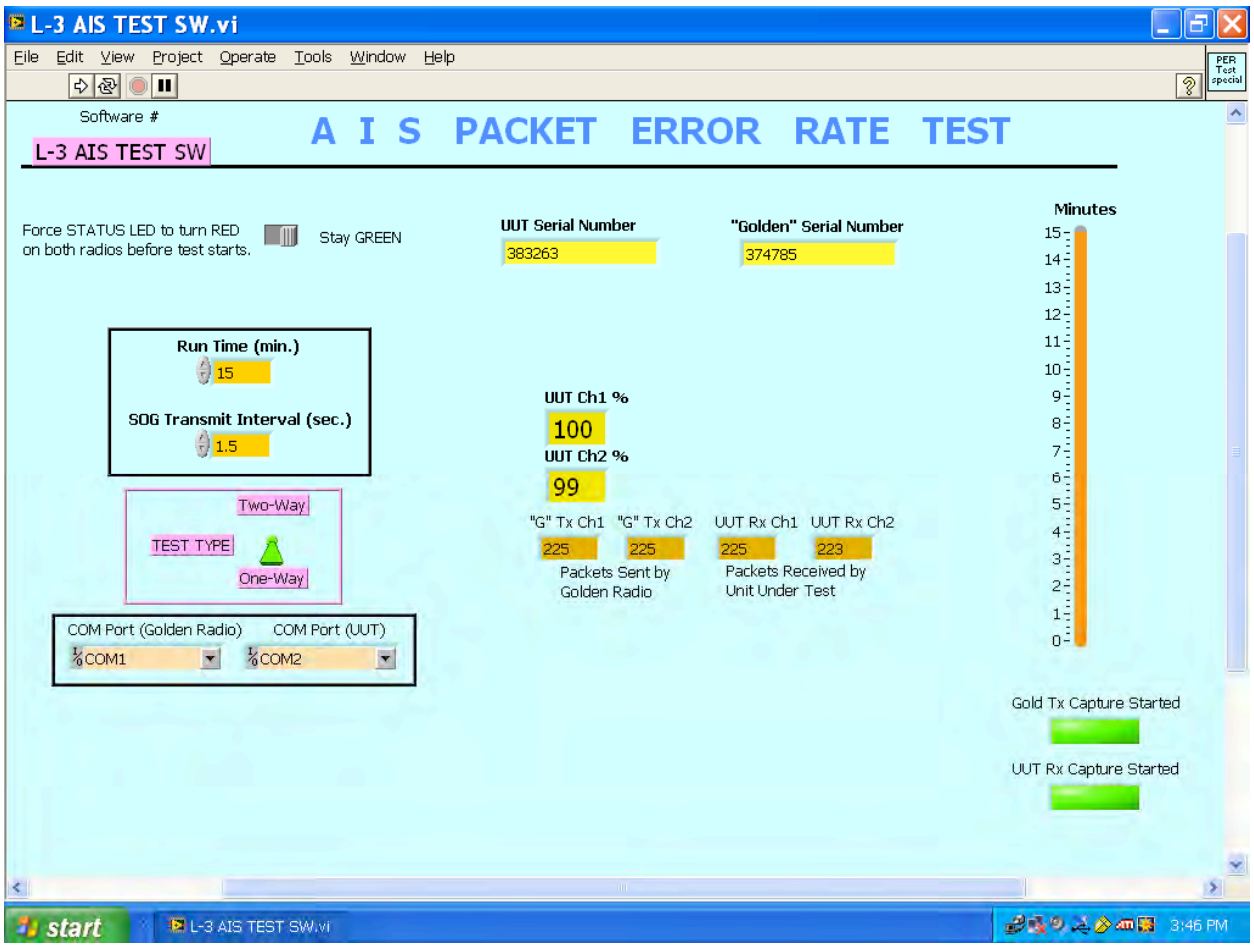


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 6. Co-Channel Rejection Cont'd.

12.5 kHz Specification: -18 dB to 0 dB @ + 1.5Khz

Measured: -18 dB @ <20% PER

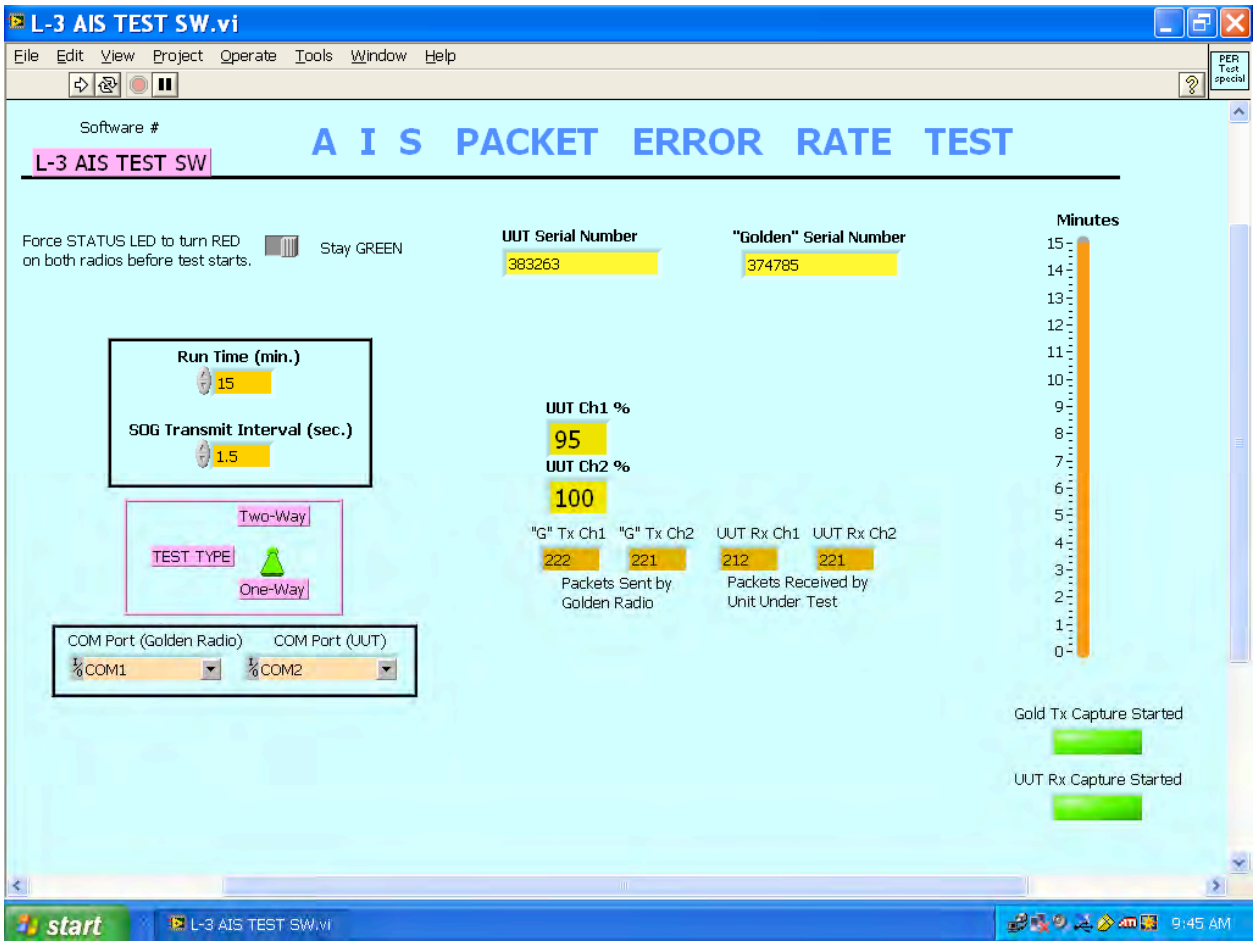


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 7. Adjacent Channel Selectivity.

25 kHz Specification: ≥70 dB Normal @ upper channel

Measured: 70 dB @ <20% PER

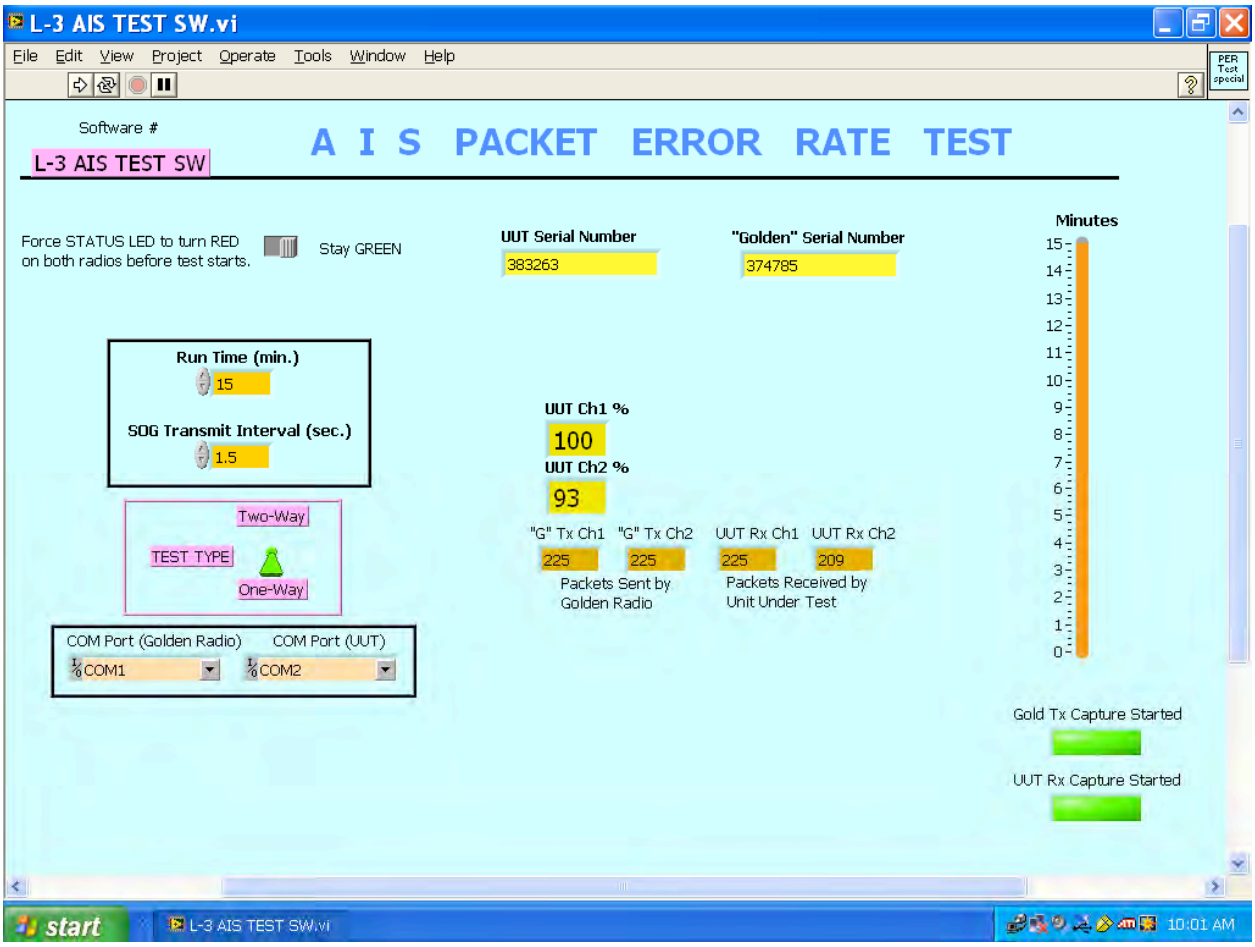


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 7. Adjacent Channel Selectivity Cont'd.

25 kHz Specification: ≥70 dB Normal @ lower channel

Measured: 70 dB @ <20% PER

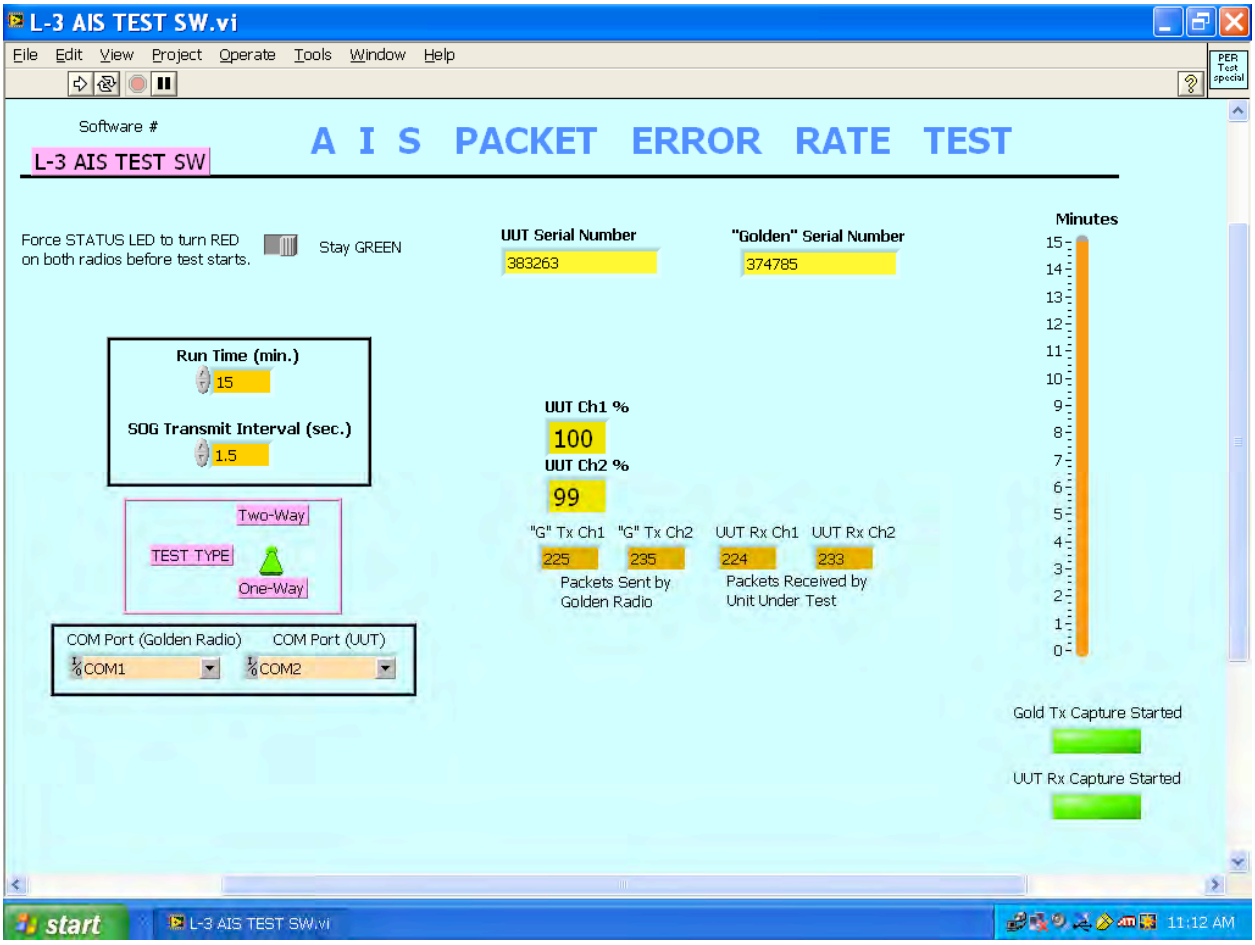


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 7. Adjacent Channel Selectivity Cont'd.

12.5 kHz Specification: ≥50 dB Normal at upper channel

Measured: 50 dB @ <20% PER

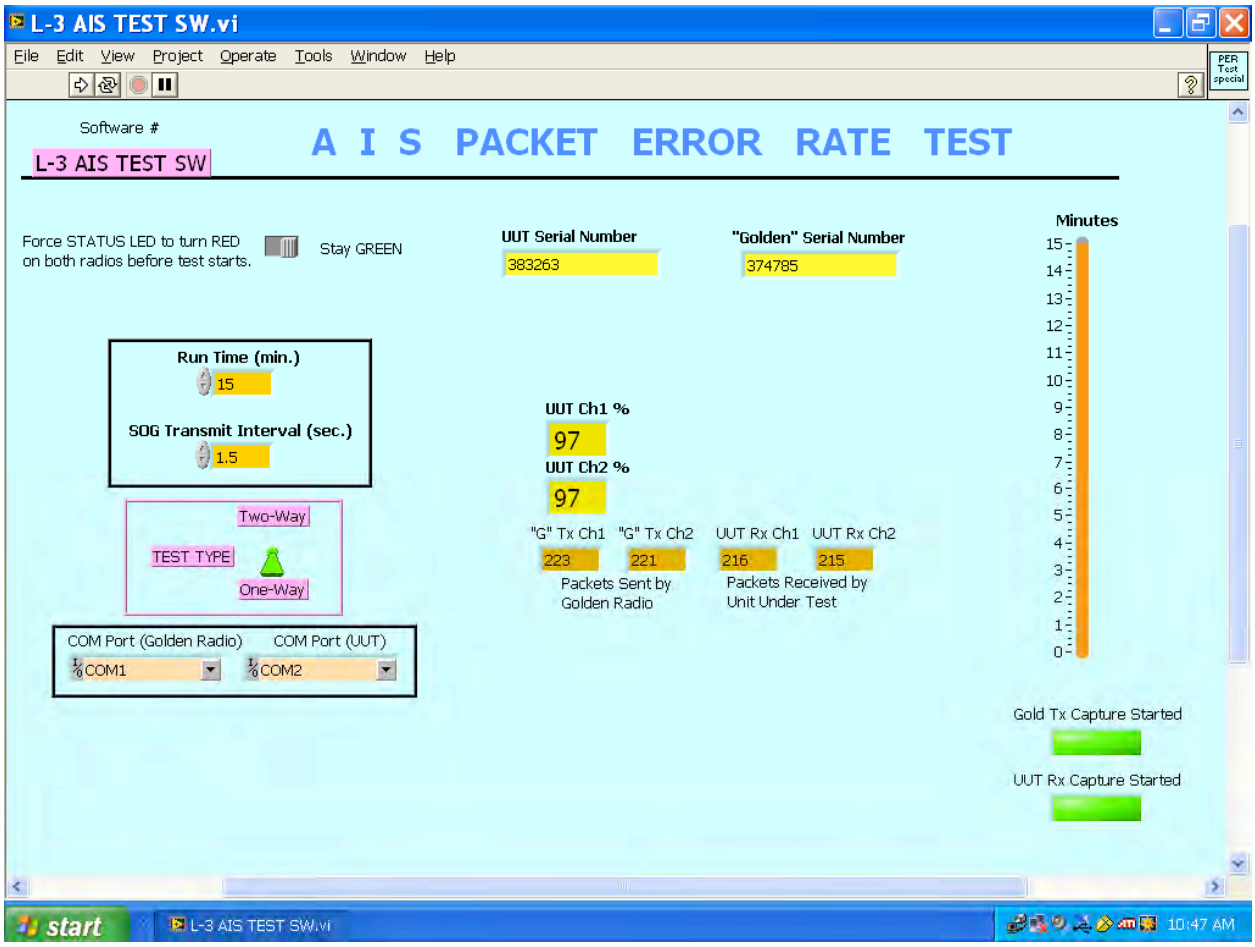


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 7. Adjacent Channel Selectivity Cont'd.

12.5 kHz Specification: ≥50 dB Normal @ lower channel

Measured: 50 dB @ <20% PER



## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 8. Spurious Rejection.

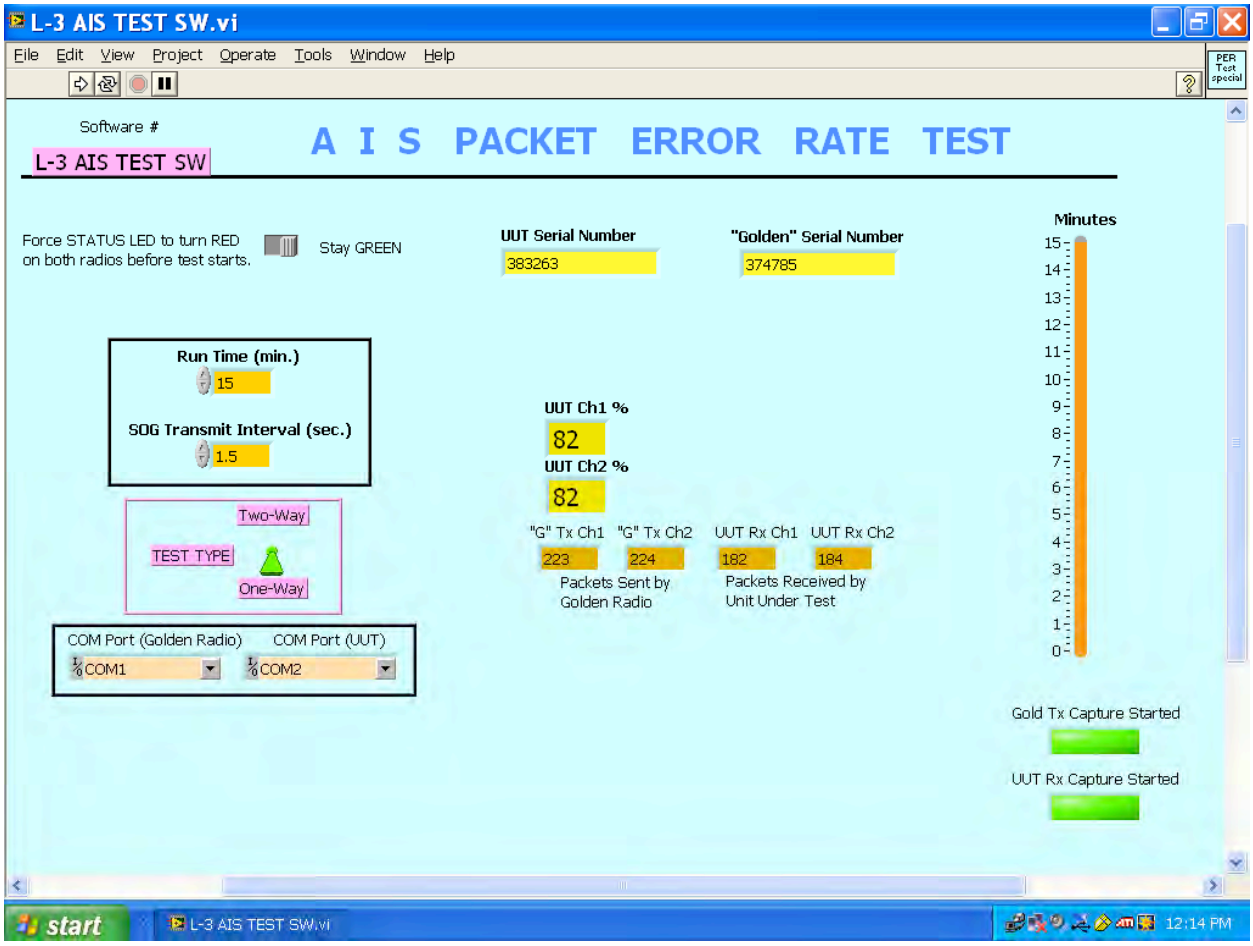
Specification: ≥70 dB

Measured: 70 dB @ <20% PER

Calculations for limited frequency band of interest "F1 to F2":

F1 = $f_{lo}$-($f_{i1}$+$f_{I2}$)-sr/2, F2 = $f_{lo}$+($f_{i1}$+$f_{i2}$)+sr/2, sr = 7 MHz (163 MHz – 156 MHz)

| Channel | $f_{lo}$ MHz | $f_{I1}$ MHz | $f_{I2}$ MHz | F1 | F2 |
|---|---|---|---|---|---|
| AIS1 Rx1 | 166.725 | 10.7 | 0.455 | 152.07 | 181.38 |



## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 8. Spurious Rejection Cont'd.

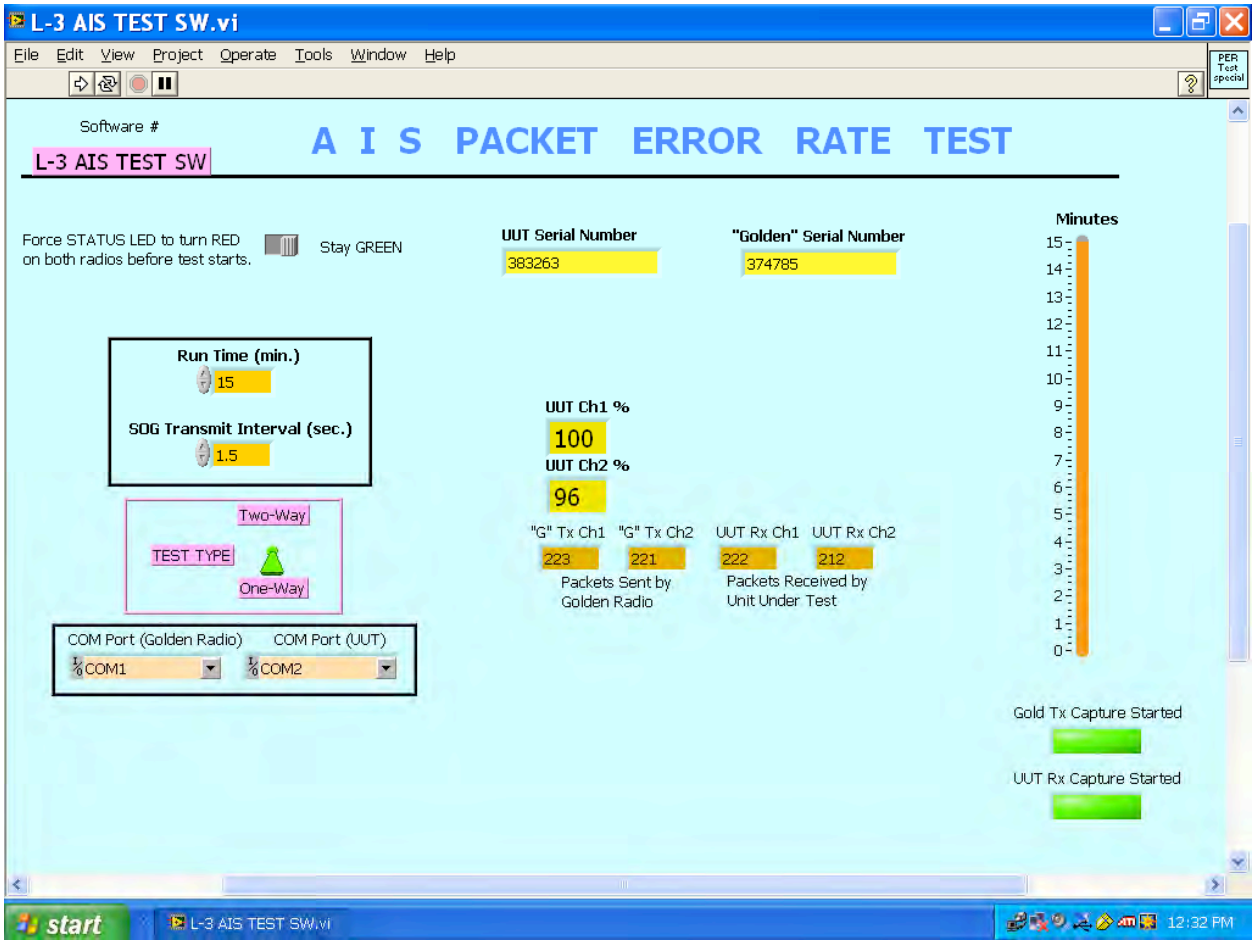
Specification: ≥70 dB

Measured: 70 dB @ <20% PER

Calculations for limited frequency band of interest "F1 to F2":

F1 = $f_{lo}$-($f_{i1}$+$f_{I2}$)-sr/2, F2 = $f_{lo}$+($f_{i1}$+$f_{i2}$)+sr/2, sr = 7 MHz (163 MHz – 156 MHz)

| Channel | $f_{lo}$ MHz | $f_{I1}$ MHz | $f_{I2}$ MHz | F1 | F2 |
|---|---|---|---|---|---|
| AIS1 Rx2 | 183.425 | 21.4 | 0.455 | 158.07 | 208.78 |



## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 8. Spurious Rejection Cont'd.

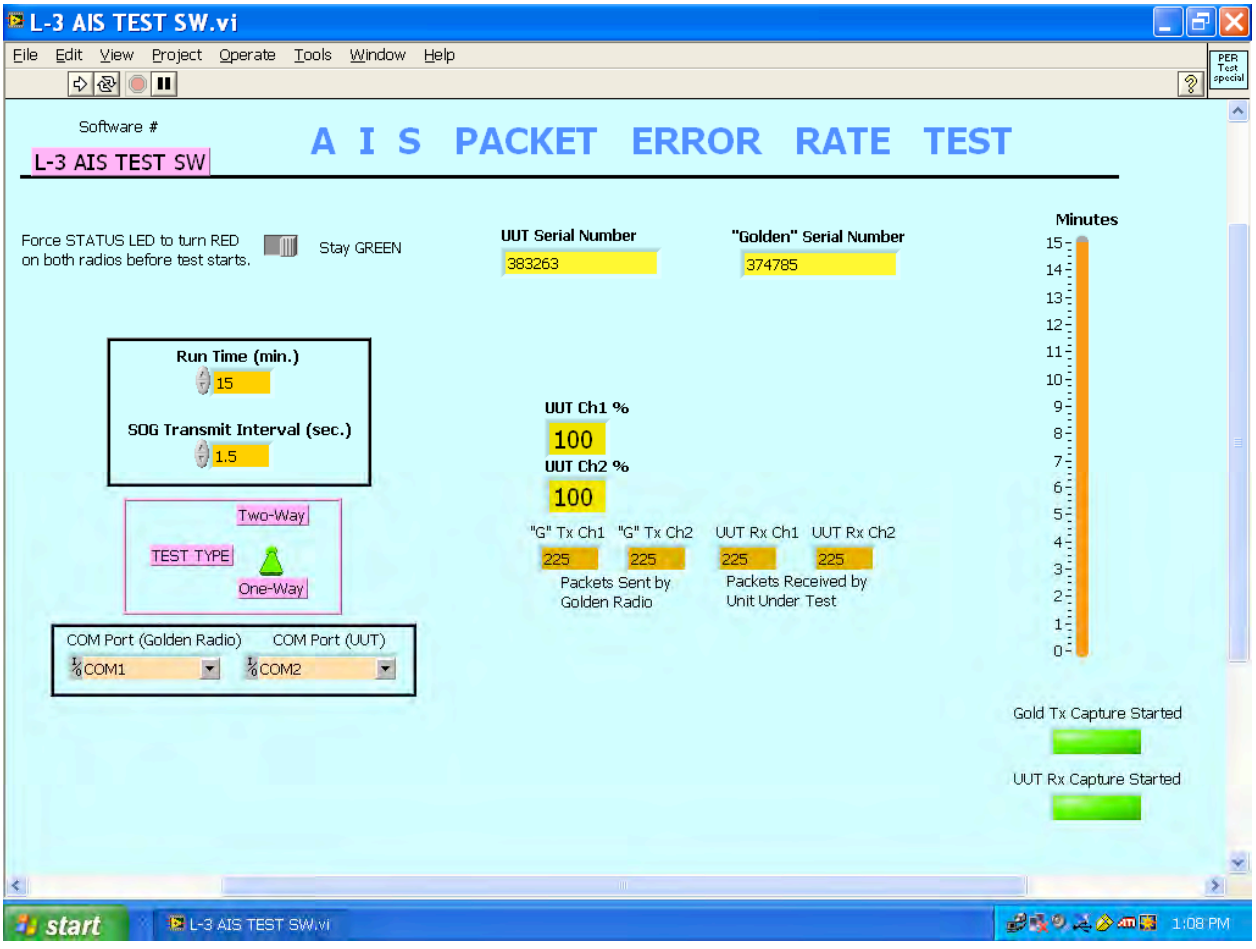
Specification: ≥70 dB

Measured: 70 dB @ <20% PER

Calculations for spurious responses outside the limited frequency band of interest "FS1 and FS2":

$FS1 = nf_{lo}-f_i$, $FS2 = nf_{lo}+f_i$, n= 2

| Channel | $f_{lo}$ MHz | $f_{I1}$ MHz | $f_{I2}$ MHz | FS1 | FS2 |
|---|---|---|---|---|---|
| AIS1 Rx1 | 166.725 | 10.7 | 0.455 | 322.75 | 344.5 |



## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

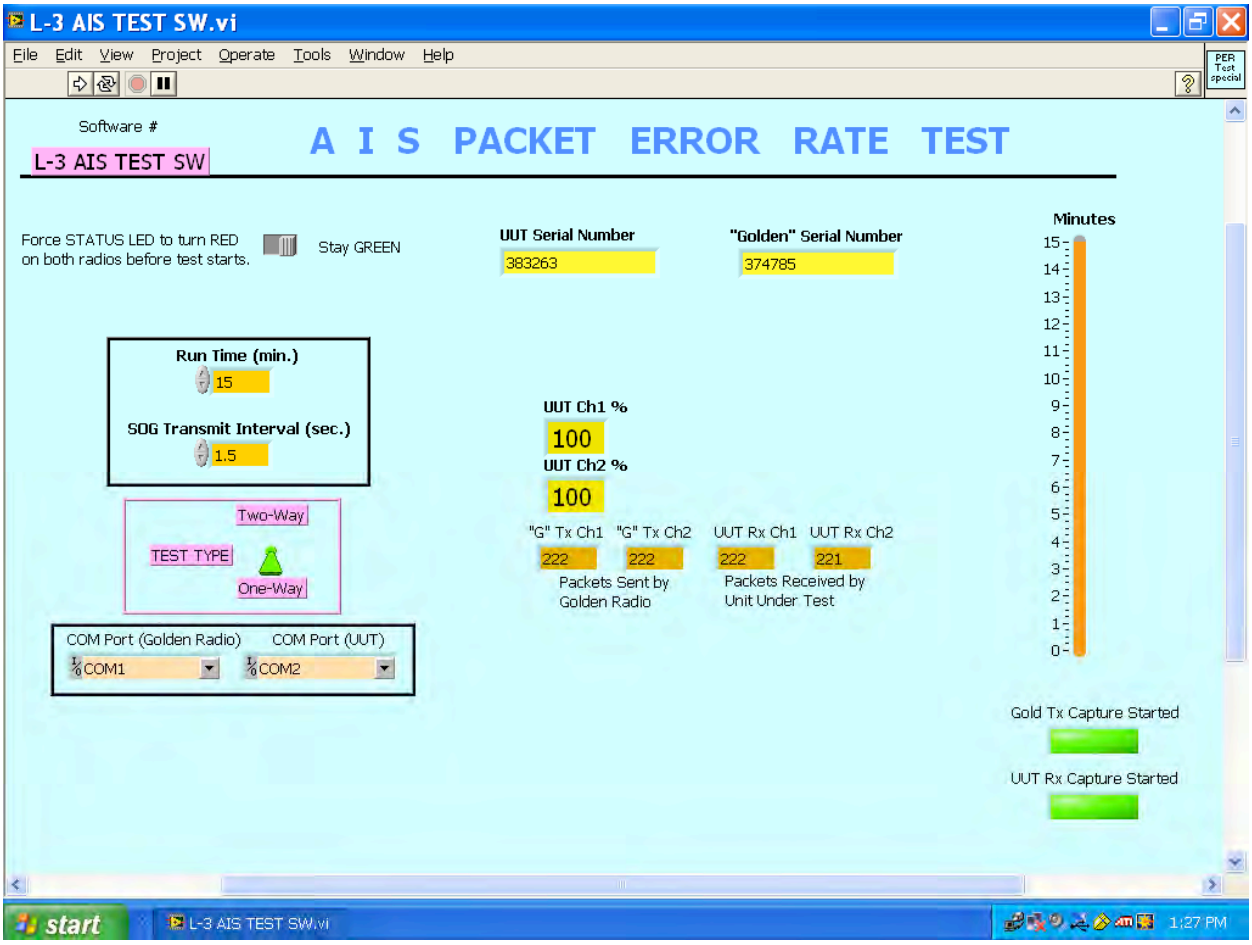
### 8. Spurious Rejection Cont'd.

Specification: ≥70 dB

Measured: 70 dB @ <20% PER

Calculations for spurious responses outside the limited frequency band of interest "FS1 and FS2":
$FS1 = nf_{lo}-f_i$, $FS2 = nf_{lo}+f_i$, n= 2

| Channel | $f_{lo}$ MHz | $f_{I1}$ MHz | $f_{I2}$ MHz | FS1 | FS2 |
|---|---|---|---|---|---|
| AIS1 Rx2 | 183.425 | 21.4 | 0.455 | 345.45 | 388.25 |

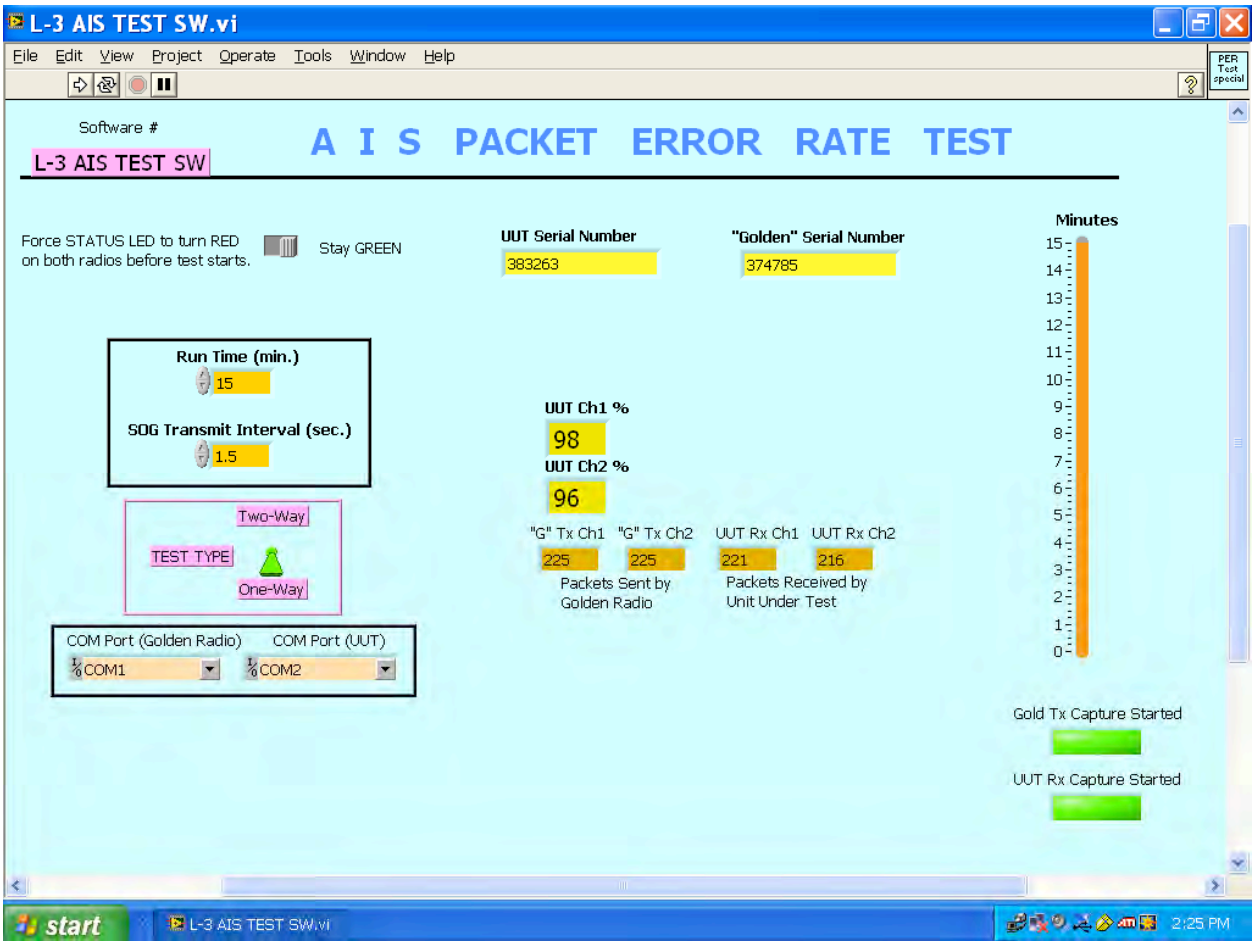


## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 9. Intermodulation Rejection.

Specification: PER ≤20%, Measured: PER <20%

| Signal Generator | A | B | C | D |
|---|---|---|---|---|
| Frequency1 MHz | 162.025 | 162.525 | 161.025 | 167.750 |
| Value at EUT | -101 | -27 | -27 | -15 |



## VIII. Measurement Results for AISA1 Physical Tests Cont'd:

### 10. Power Supply.

Overvoltage Specification: 40 VDC Extreme Operation

Reverse Polarity: No Damage, Extreme Operation

Voltage Variation: 10.8 VDC to 31.2, Extreme Operation

| Mode | Specified Value | Measured Value | Observed Effect |
|---|---|---|---|
| Overvoltage | 40 VDC | 40 VDC | Unit Shuts Down |
| Reverse Polarity | -24 VDC | -24 VDC | No Effect |
| Voltage Variation | 10.8 VDC to 31.2 VDC | 9.2 VDC to 37.1 VDC | Unit Operates Normally |

### 11. Acoustic.

Specification: ≤60 dBA @ 1 Meter

| AIS Face | Specification dBA | Measured dBA |
|---|---|---|
| Front | 60 | 48 |
| Top | 60 | 48 |
| Bottom | 60 | 49 |
| Right Side | 60 | 48 |
| Left Side | 60 | 50 |
| Rear | 60 | 47 |