Serial No. GM28022x

TEST REPORT
FOR THE
TIDELAND SIGNAL CORPORATION
MODEL ATN01-311-03
AUTOMATIC IDENTIFICATION SYSTEM
AID TO NAVIGATION
PHYSICAL TESTS

Prepared for:

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

Submitted by:

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Revised: June 25, 2008

L3 Communications Aviation Recorders Corporation
CE Physical Testing
By
Green Mountain Electromagnetics, Inc.

Unit: Automatic Identification System Aid to Navigation (ATN01-311-03)
Tested: March 13 - 20, 2008
Revision: Section VIII - Additional Spurious Response and Blocking Data

I. Applicable Standards:

The unit described in this report was evaluated for compliance with paragraph 7, "AIS AtoN Station Tests" of IEC 62320-2, "Maritime Navigation and Radiocommunication Equipment and Systems – Automatic Identification System (AIS), Part 2: AIS AtoN Stations – Operational and Performance Requirements, Methods of Testing and Required Test Results (2007)." All procedures and equipment are in accordance with IEC 62320-2.

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.

II. Measurement Location:

This unit was tested at the manufacturer's laboratory. The L3 laboratory is located at 6000 Fruitville Road, Sarasota, FL.

III. Unit Tested:

The Tideland Signal Corporation, Automatic Identification System (AIS) Aid to Navigation (AtoN) Model ATN01-311-03 provides continuous remote signal and data transmission for ship identification. The ATN01-311-03 uses DC power, has a TDMA transmitter and two TDMA/GPS receivers. It consists of the multi-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
AIS AtoN ATN01-311-03	For Tideland Signal Corp. by L3 Communications Corp.	000531163

The following table describes the system physical and electrical properties:

Model	Volts/Amps/Hertz	H/W/D in cm
ATN01-311-03	12 VDC, 2.5 A	15/15/15

The table below describes the support equipment used during testing:

Product	Manufacturer	Model	Serial Number
PC	Antec	Custom by L3	L3ID 9835
Monitor	Dell	CN 0CC280	p/o L3ID 9835
Keyboard	Microsoft	Basic RT 9480	698200139238
Mouse	Logitech	MBT96A	HC6010201177
Antenna	Matsushita	GPS	n/a
Pattern/Modulation Generator (2)	Sine Qua Non	PMG-1	L3ID 5608/9
Power Supply (2)	HP	3634A	L3ID R10150/10321
Attenuator, 30 dB Fixed	Agilent	8489A	L3ID 5121
Combiner/Splitter	Mini-Circuits	ZSC-4-1	L3ID 5638
Band Reject Filter	n/a	n/a	n/a
Serial Hub	Quatech	n/a	L3ID 5636

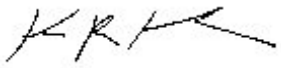
IV. Summary of Results:

The Tideland Signal Corporation, Model ATN01-311-03 complies with the requirements in IEC 62320-2, paragraph 7. Section VIII contains the results summarized in the table below. All results are for 25-kHz TDMA operation and both receivers.

	Test	Mode/Port	IEC 62320-2 Para.	Tolerance/Limit	Specified Value	Measured Value
1	Frequency Error	Transmit	**7.1.1.1**	±500 Hz ±500 Hz	156,025,000 Hz 162,025,000 Hz	156,025,194 Hz 162,025,192 Hz
2	Carrier Power	Transmit	**7.1.1.2**	±1.5 dB	40.97 dBm LF 40.97 dBm HF	40.95 dBm 41.03 dBm
3	Modulation Spectrum	Transmit	**7.1.1.3**	125-kHz lmt.	62320-2 Fig. 10	Within Mask
4	Test Sequence and Modulation Accuracy	Transmit	**7.1.1.4**	0 Start 24b 01 pattern b 0-1 < only b 2-3 ±20% b 4-31 ±10% b 32-199 ±10% b 32-199 ±10%	0 Start 24b 01 pattern 3400 Hz 2400 Hz 2400 Hz 1740 Hz TS1 2400 Hz TS2	0 Start 24b 01 pattern <3400 <±20% <±10% <±10% <±10%
5	Power vs. Time Function	Transmit	**7.1.1.5**	+1.5 dB/-3 dB +1.5 dB/-1 dB -50 dBPc off	62320-2 Fig. 12	Within Mask
6	Sensitivity	Receive	**7.1.2.1**	-107 dBm	≤20% PER	<5% PER
7	Error Behavior	Receive	**7.1.2.2**	-7/-77 dBm	≤10%/2% PER	<1% PER both
8	Co-channel Rejection	Receive	**7.1.2.3**	10 dB	≤20% PER	<10% PER
9	Adj-channel Selectivity	Receive	**7.1.2.4**	70 dB	≤20% PER	<10% PER
10	Spurious Rejection	Receive	**7.1.2.5**	70 dB	≤20% PER	<5% PER
11	Intermodulation Rejection	Receive	**7.1.2.6**	-101 dBm & -36 dBm	≤20% PER	<10% PER
12	Blocking/ Desensitization	Receive	**7.1.2.7**	-23 dBm & -15 dBm	≤20% PER	<5% PER
13	Conducted Spurious	Receive	**7.1.3.1**	9 kHz – 4 GHz	-57/-47 dBm	Within Limit
14	Conducted Spurious	Transmit	**7.1.3.2**	9 kHz – 4 GHz	-36/-30 dBm	Within Limit

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

L3 Communications Aviation Recorders Corp.
6000 Fruitville Road/(PO Box 3041 34230)
Sarasota, FL 34232
USA



Kyle R. Kowalczyk
4/07/08

VI. Measuring Equipment:

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

Unit	Manufacturer	Model	Serial #	Last Cal.	Next Cal.
Spectrum Analyzer	Rohde & Schwarz	ESU	L3ID5552	11/07/07	11/07/08
Spectrum Analyzer	Rohde & Schwarz	FSEB 20	L3ID R8004	12/13/07	12/13/08
Signal Generator	Hewlett-Packard	8644B	L3ID 5456	08/28/07	08/28/08
Signal Generator	Hewlett-Packard	E4432B	L3ID R40923	01/22/08	01/22/10
Signal Generator	Marconi	2041	L3ID 501892	06/18/07	06/18/08
Frequency Counter	Agilent	53181A	L3ID R02274	07/05/07	07/05/08
Power Meter	Agilent	E4418B	L3ID 5114	04/23/07	04/23/08
Power Sensor with 30 dB Attenuator	Agilent	E9301B	L3ID 5118	06/08/07	06/08/08

VI. Measurement Procedures for ATN01-311-03 Physical Tests:

1. Frequency Error.

Frequencies: 156.025, 162.025 MHz

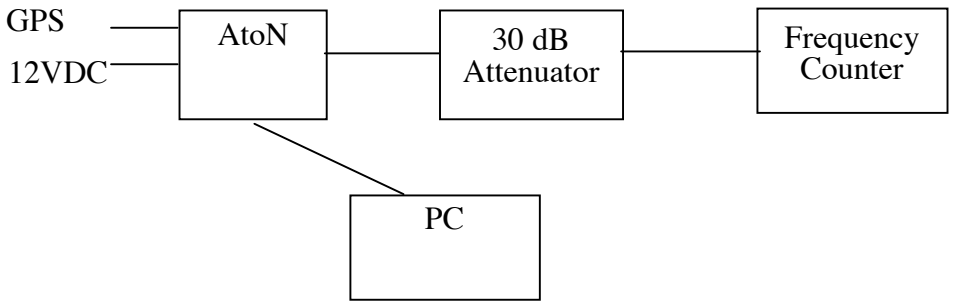
Specification: ±0.5 kHz Normal Operation

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AtoN to 12-VDC power, PC, and GPS antenna; attach 30-dB attenuator to VHF port.

b. Verify frequency counter and AtoN operation.
   i. Frequency counter is connected to 30-dB attenuator.
   ii. AtoN channels are selected from PC.
   iii. Frequency counter requires warm-up period.

c. Operate EUT at low channel with no modulation.

d. Record frequency displayed on counter.
   i. Repeat for high channel – settings are 1060 & 2088.



Block Diagram of Frequency Test

VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

2. Carrier Power.

Specification: 40.97 ±1.5 dBm (12.5W) Normal Operation

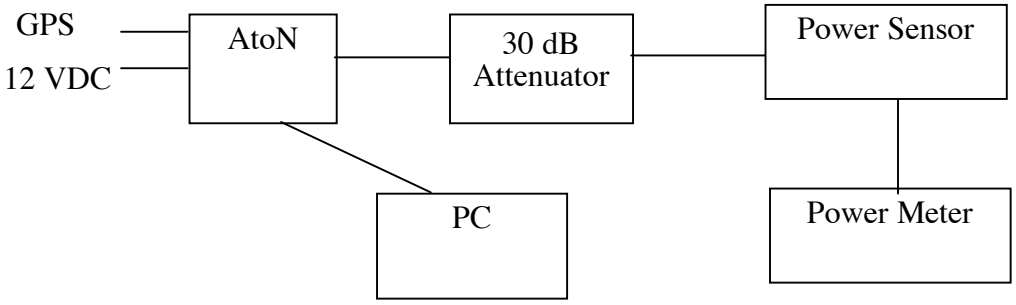
a. Set up EUT and test instrumentation in laboratory.
   i. Connect AtoN to 12-VDC power, PC, and GPS antenna; attach power-sensor specific 30-dB attenuator to VHF port. Connect power meter to sensor.

b. Verify power meter and AtoN operation.
   i. Power sensor is connected to companion 30-dB attenuator.
   ii. AtoN channels are selected from PC. Use 162.025 MHz channel.
   iii. Power meter requires warm-up period, calibration and zeroing.

c. Operate EUT at high power unmodulated.

d. Record level displayed on meter.

e. Repeat for 156.025 MHz channel.



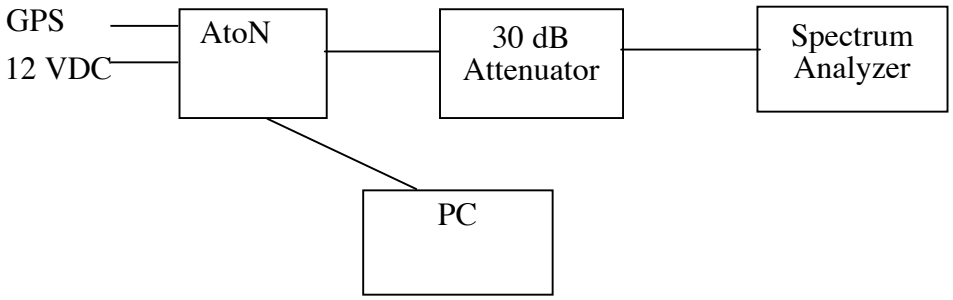
Block Diagram of Carrier Power Test

VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

3. Modulation Spectrum Slotted Transmission.

125-kHz Envelope: 0 dBc ±10 kHz,
Decrease -25 dBc to -60 dBc (or -30 dBm) from ±10 kHz to ±25 kHz,
-60 dBc (or -30 dBm) from ±25 kHz to ±62.5 kHz

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AtoN to 12-VDC power, PC, and GPS antenna; attach 30-dB attenuator to VHF port.
b. Verify analyzer and AtoN operation. Set for channel 1060 (156.025 MHz).
   i. Spectrum analyzer is connected to 30-dB attenuator.
   ii. AtoN test signal 3 per 62320-2, para. 6.2.4.3 is selected from PC.
   iii. Spectrum analyzer requires warm-up period. Use 1-kHz RBW and 3-kHz VBW.
c. Verify AtoN test signal on spectrum analyzer.
d. Operate EUT at selected test signal with standard modulation.
e. Record peak frequency spectrum displayed on analyzer. Figure 10 is limit.
f. Repeat for channel 2088 (162.025 MHz).



Block Diagram of Modulation Spectrum Test

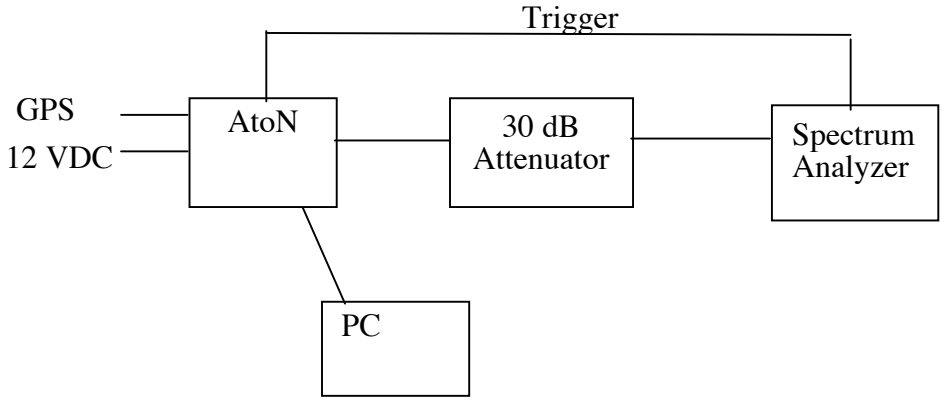
VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

4. Test Sequence and Modulation Accuracy.

Test Signal 1 Specification: 24 bit 01 pattern, Start with 0 bit
Bits 0-1 deviation <3400 Hz
Bits 2-3 deviation 1920 Hz to 2880 Hz
Bits 4-31 deviation 2160 Hz to 2640 Hz
Bits 32-199 deviation 1565 Hz to 1915 Hz

Test Signal 2 Specification: 24 bit 01 pattern, Start with 0 bit
Bits 0-1 deviation <3400 Hz
Bits 2-3 deviation 1920 Hz to 2880 Hz
Bits 4-199 deviation 2160 Hz to 2640 Hz

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AtoN to 12-VDC power, PC, and GPS antenna; attach 30-dB attenuator to VHF port. Use configuration A from figure 11. Trigger is direct into analyzer.
b. Verify analyzer and AtoN operation. Set for 162.025 MHz.
   i. Spectrum analyzer is connected to 30-dB attenuator.
   ii. AtoN test signals 1 & 2 per 62320-2, para. 6.2.4.1/2 are selected from PC.
   iii. Spectrum analyzer requires warm-up period.
c. Operate EUT at first test signal with standard modulation.
d. Record deviation displayed on analyzer. Use vector mode, and analog demodulation.
e. Repeat for second test signal.
f. Repeat for 156.025 MHz.



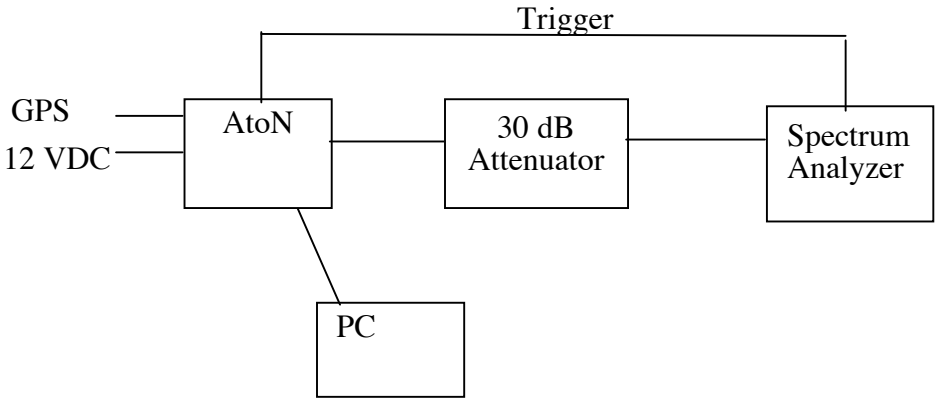
Block Diagram of Transmitter Accuracy Test

VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

5. Transmitter Output Power vs. Time Function.

Start Specification: <-50 dBc at 0 μs
Delay Specification: >-50 dBc at <624 μs
Attack Specification 1: +1.5/-3 dB at 624 μs
Attack Specification 2: +1.5/-1 dB at 832.4 μs
Release Specification 1: +1.5/-1 dB at 24.024 ms
Release Specification 2: <-50 dBc at 26.146 ms
Duration Specification: Between 25.522 ms and 26.146 ms

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AtoN to 12-VDC power, PC, and GPS antenna; attach 30-dB attenuator to VHF port. Trigger is direct into analyzer.
b. Verify analyzer and AtoN operation. Set for channel 1060 (156.025 MHz).
   i. Spectrum analyzer is connected to 30-dB attenuator.
   ii. AtoN test signal 1 per 62320-2, para. 6.2.4.1 is selected from PC.
   iii. Spectrum analyzer requires warm-up period. Use 1-MHz RBW and 1-MHz VBW.
c. Operate EUT at first selected test signal with standard modulation.
d. Record deviation displayed on analyzer. Use zero span.
e. Repeat for 162.025 MHz. Mask is from figure 12.



Block Diagram of Transmitter Time Function Test

VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

6. Sensitivity.

Specification: -107 dBm @ ≤20% PER Normal

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AtoN to 12-VDC power, PC, and GPS antenna; for overload protection, attach 30-dB attenuator to VHF port.

b. Verify PC and AtoN operation.
   i. PC provides input to AtoN.
   ii. Use modulation generator to provide test signal 4 per 62320-2, para. 6.2.4.4 and 200 packets.
   iii. Signal generator set to provide -107 dBm at EUT (account for attenuator).

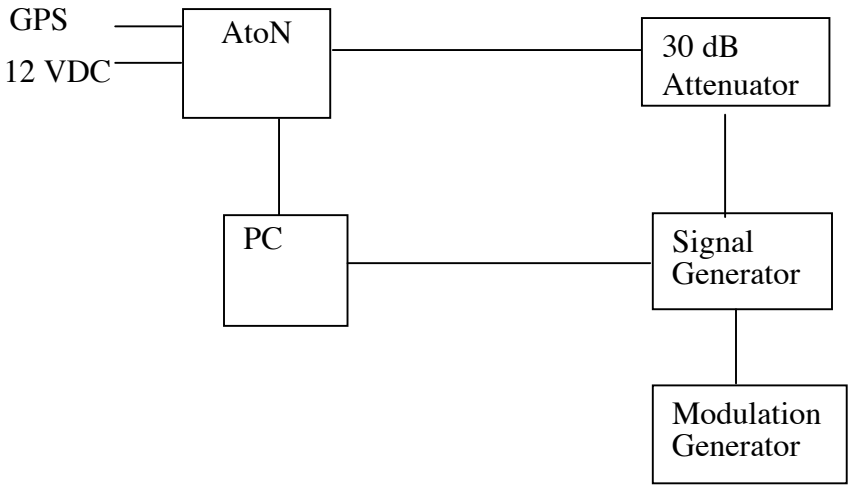
c. Operate with standard modulation at 156.025 MHz.

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

e. Repeat step d. for 156.025 MHz ± 500 Hz.

f. Repeat step d. for 162.025 MHz.

g. Repeat step d. for 162.025 MHz ± 500 Hz.



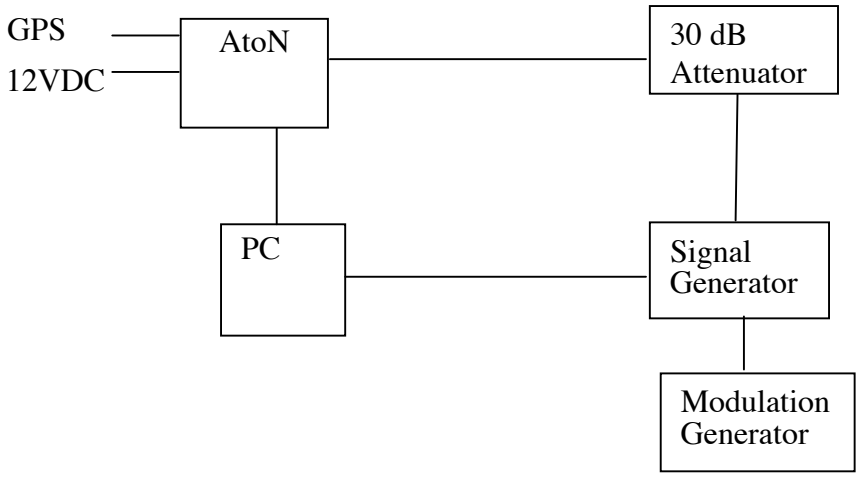
Block Diagram of Receiver Sensitivity Test

VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

7. Error Behavior at High Input Levels.

Specification: -7 dBm @ ≤10% PER, and -77 dBm @ ≤2% PER

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AtoN to 12-VDC power, PC, and GPS antenna; for overload protection, attach 30-dB attenuator to VHF port.
b. Verify PC and AtoN operation.
   i. PC provides input to AtoN.
   ii. Use modulation generator to provide test signal 4 and 200 packets.
   iii. Operate with modulation at 156.025 MHz
c. Signal generator set to provide -77 dBm at EUT (account for attenuator).
d. Run sensitivity software program on PC.
   i. Software determines packet error rate.
e. Signal generator set to provide -7 dBm.
f. Run sensitivity software program on PC.
g. Repeat steps c. to f. at 162.025 MHz.



Block Diagram of Receiver Error Behavior Test

VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

8. Co-Channel Rejection.

Specification: PER ≤20%

a. Set up EUT and test instrumentation in laboratory.
   i. Connect ATON to 12-VDC power, PC, and GPS antenna; for overload protection, attach 30-dB attenuator to VHF port.

b. Verify PC and AtoN operation.
   i. PC provides input to AtoN. Connect combiner output to attenuator input.
   ii. Use modulation generator 1 to provide test signal 4 and 200 packets to SG A.
   iii. Use modulation generator 2 to provide test signal 3 and 200 packets to SG B.

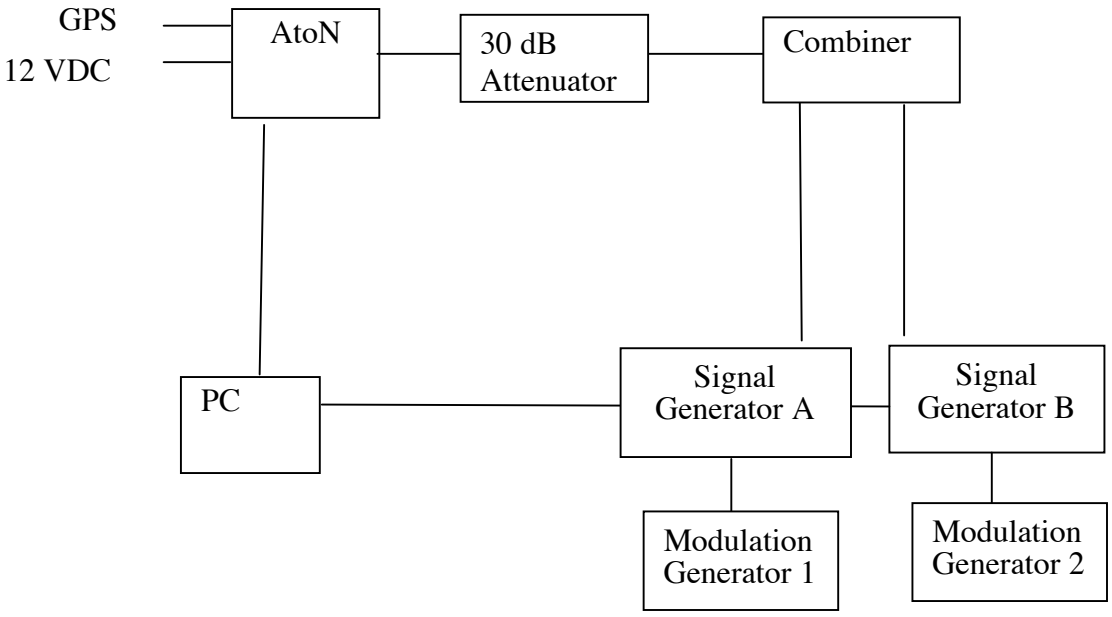
c. PC is connected to signal generators A & B, then A & B are connected to combiner.
   i. Signal generator A is set to provide -101 dBm at 156.025 MHz.
   ii. Signal generator B is set to provide -111 dBm to EUT at same channel as A.

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

e. Repeat step d. for 156.025 MHz ± 1000 Hz.

f. Repeat step d. for 162.025 MHz.

g. Repeat step d. for 162.025 MHz ± 1000 Hz.



Block Diagram of Receiver Co-Channel Test

VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

9. Adjacent Channel Selectivity.

Specification: PER ≤20%

a. Set up EUT and test instrumentation in laboratory.
   i. Connect ATON to 12-VDC power, PC, and GPS antenna; for overload protection, attach 30-dB attenuator to VHF port.

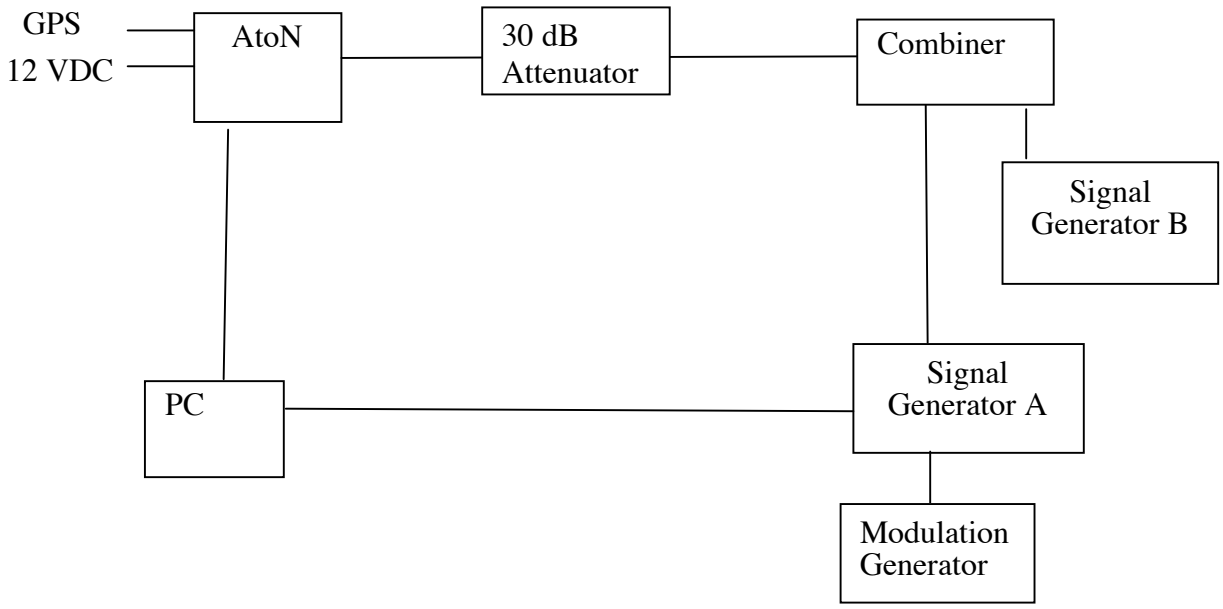
b. Verify PC and AtoN operation.
   i. PC provides input to AtoN. Connect combiner output to attenuator input.
   ii. Use modulation generator to provide test signal 4 and 200 packets to SG A.
   iii. Use settings on SG B for 400-Hz modulation with 3-kHz deviation.

c. PC is connected to signal generators A & B, then A & B are connected to combiner.
   i. Signal generator A is set to provide -101 dBm at 156.025 MHz.
   ii. Signal generator B is set to provide -31 dBm to EUT at channel 25 kHz above A.

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

e. Repeat step d. at channel 25 kHz below A.

f. Repeat step c. to e. for 162.025 MHz.



Block Diagram of Receiver Adj-Channel Test

VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

10. Spurious Response Rejection.

Specification: PER ≤20%.

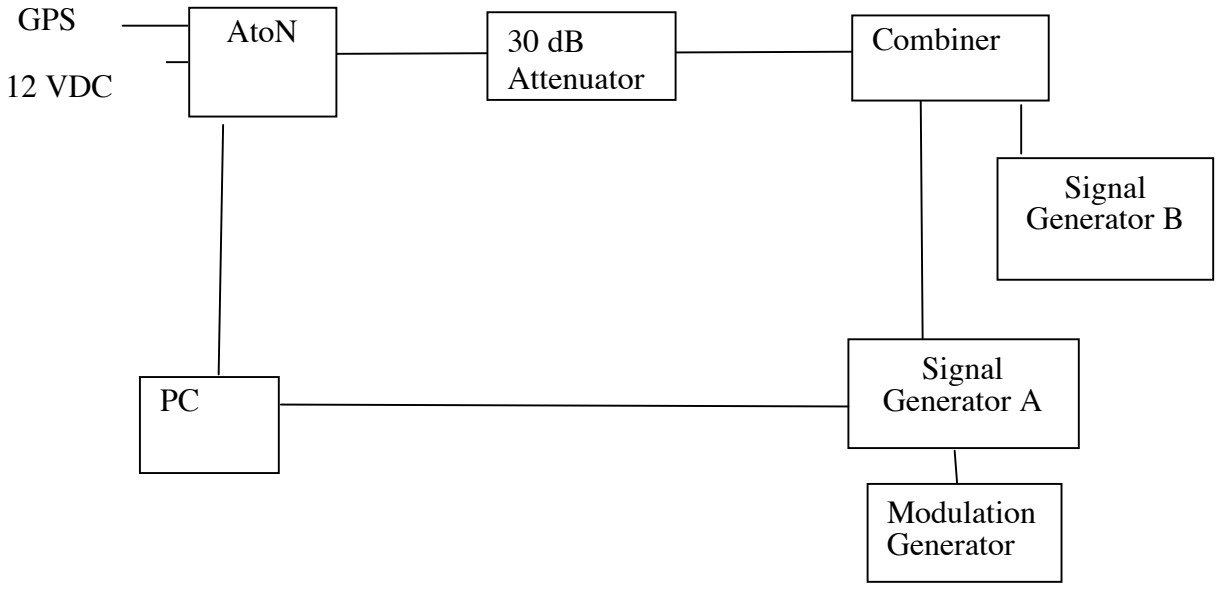
a. Set up EUT and test instrumentation in laboratory.
   i. Connect AtoN to 12-VDC power, PC, and GPS antenna; for overload protection, attach 30-dB attenuator to VHF port. Use PER method for sweeps and at specified frequencies. SFI calculations are in results.

b. Verify PC and AtoN operation.
   i. PC provides input to AtoN. Connect combiner output to attenuator input.
   ii. Use modulation generator to provide test signal 4 and 200 packets to SG A.

c. PC is connected to signal generators A & B, then A & B are connected to combiner.
   i. Signal generator A is set to provide EUT with -101 dBm at 162.025 MHz
   ii. Signal generator B set to provide -31 dBm EUT, FM modulated 400 Hz/3 kHz.
   iii. Signal generator B set to provide sweeps to EUT per calculations in results (VIII-10).

d. Run sensitivity software program on PC. Sweep over limited frequency range.
   i. Software determines packet error rate.
   ii. Record frequencies that create PER ≥2%.

e. Run PER for frequencies identified during sweeps and all calculated SFI's.



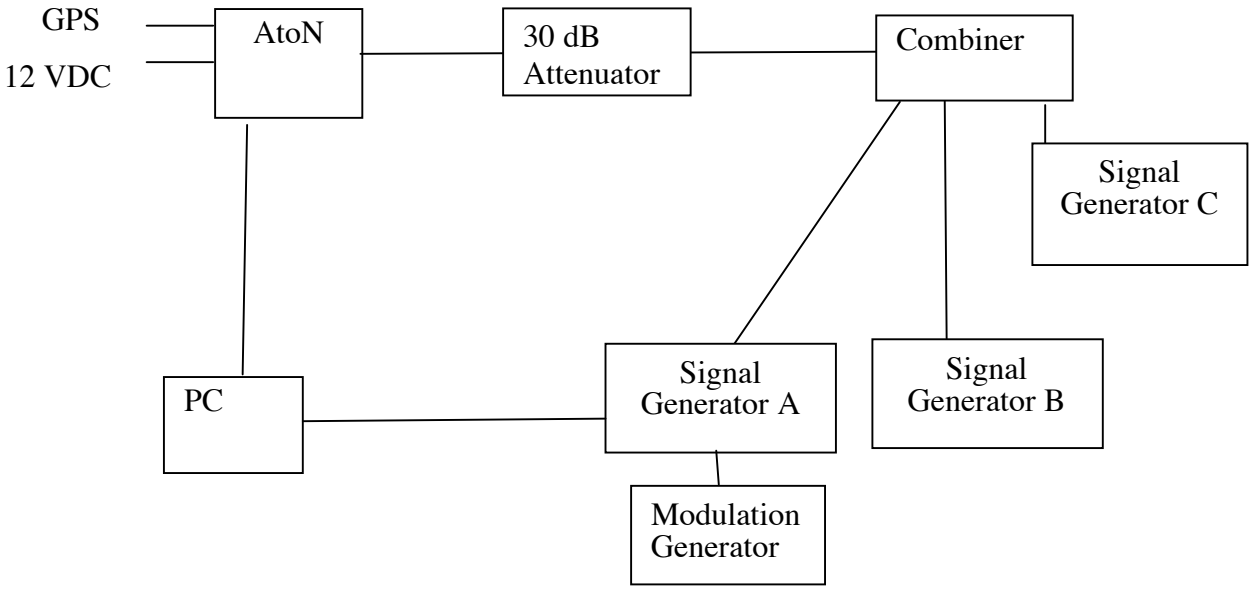
Block Diagram of Receiver Spurious Rejection Test

VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

11. Intermodulation Rejection.

Specification: PER ≤20%

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AtoN to 12-VDC power, PC, and GPS antenna; for overload protection, attach 30-dB attenuator to VHF port.
b. Verify PC and AtoN operation.
   i. PC provides input to AtoN. Connect combiner output to attenuator input.
   ii. Use modulation generator to provide test signal 4 and 200 packets to SG A.
c. PC controls signal generator A, and SG A – C are connected to combiner.
   i. Signal generator A is set to provide -101 dBm at 162.025 MHz.
   ii. Signal generator B provides -36 dBm at 161.525 MHz, unmodulated.
   iii. Signal generator C provides -36 dBm at 161.025, FM modulated at 400 Hz/3 kHz.
d. Record generator levels necessary for correct signal at EUT.
e. Operate EUT with standard modulation at selected (A) channel.
f. Run sensitivity software program on PC.
   i. Software determines packet error rate.
g. Repeat step e. with A at 156.025 MHz, B at 156.525 MHz, and C at 157.025 MHz.



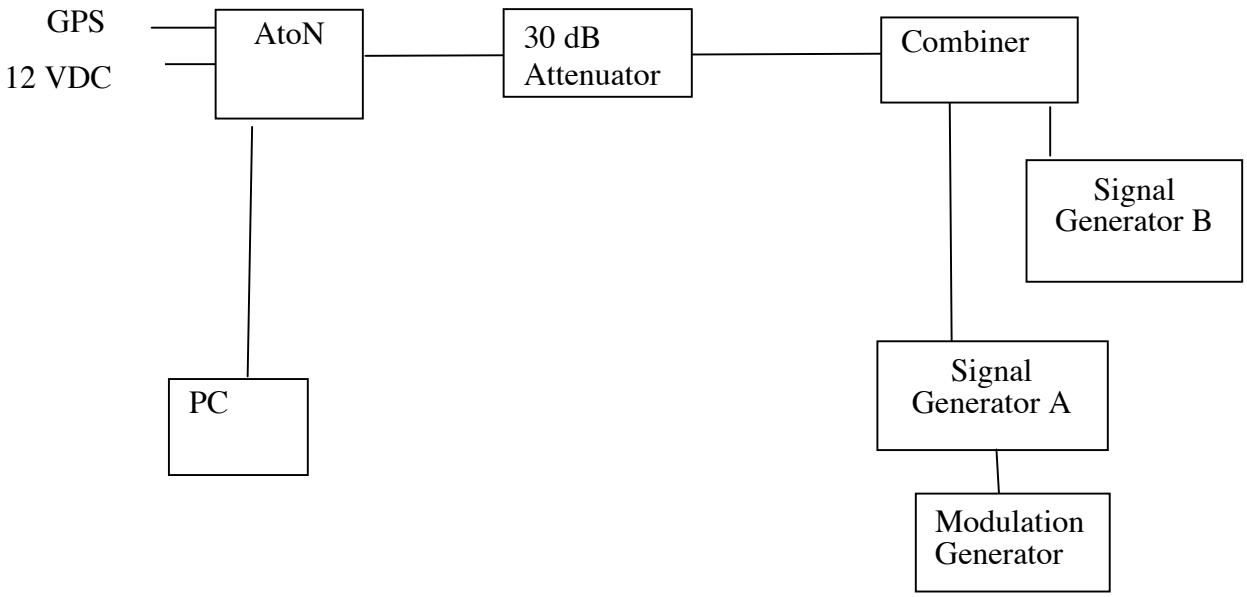
Block Diagram of Receiver Intermodulation Rejection Test

VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

12. Blocking or Desensitization.

Specification: PER ≤20%

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AtoN to 12-VDC power, PC, and GPS antenna; for overload protection, attach 30-dB attenuator to VHF port.
b. Verify PC and AtoN operation.
   i. PC provides input to AtoN. Connect combiner output to attenuator input.
   ii. Use modulation generator to provide test signal 4 and 200 packets to SG A.
c. PC monitors signal generator A and SG A – B are connected to combiner.
   i. Signal generator A is set to provide -101 dBm at 156.025 MHz.
   ii. Signal generator B set to provide -23 dBm at 156.525 MHz, unmodulated.
d. Run spurious-rejection software program on PC.
   i. Software determines packet error rate.
e. Repeat step d. with B at 155.525, 157.025, 155.025, 158.025, 154.025 all MHz.
f. Set B to -15 dBm, keep A at 156.025 MHz.
g. Repeat step d. with B at 161.025, 151.025, 166.025, 146.025 all MHz.
h. Repeat step d. with B set to -23 dB at 162.525 MHz, and A at 162.025 MHz.
i. Repeat step d. with B at 161.525, 163.025, 161.025, 164.025, 160.025 all MHz.
j. Set B to -15 dBm, keep A at 162.025 MHz.
k. Repeat step d. with B at 167.025, 157.025, 172.025, 152.025 all MHz.



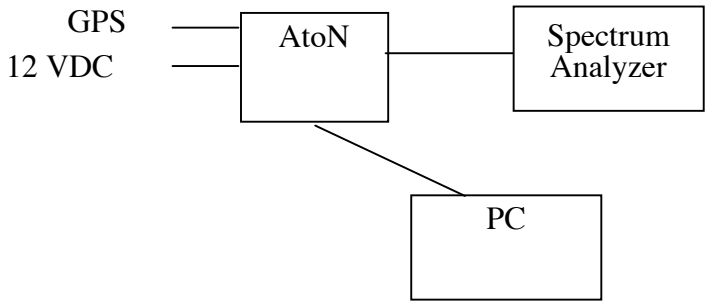
Block Diagram of Receiver Blocking Test

VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

13. Conducted Spurious - Receive.

Specification: 9 kHz to 1 GHz: -57 dBm
1 GHz to 4 GHz: -47 dBm

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AtoN to 12-VDC power and GPS antenna.
b. Verify analyzer and AtoN operation.
   i. Spectrum analyzer is connected to VHF port.
   ii. Spectrum analyzer requires warm-up period.
c. Verify AtoN test signal on spectrum analyzer.
d. Put AtoN in receive only mode.
e. Record frequency spectrum displayed on analyzer.



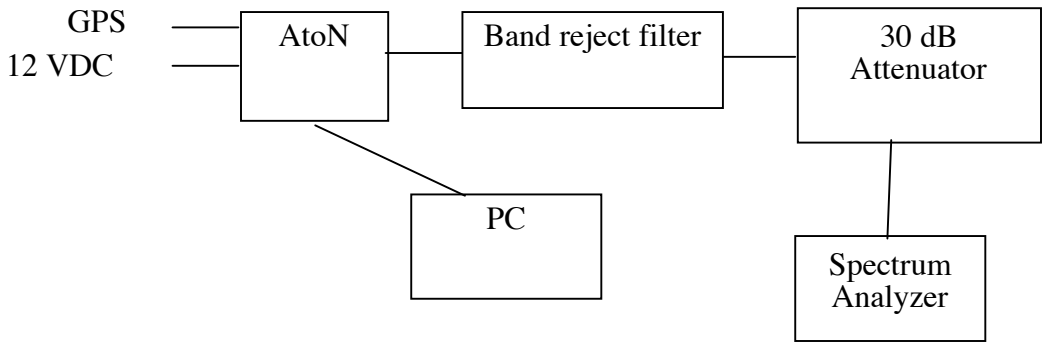
Block Diagram of Conducted Spurious Test

VI. Measurement Procedures for ATN01-311-03 Physical Tests Cont'd:

14. Conducted Spurious - Transmit.

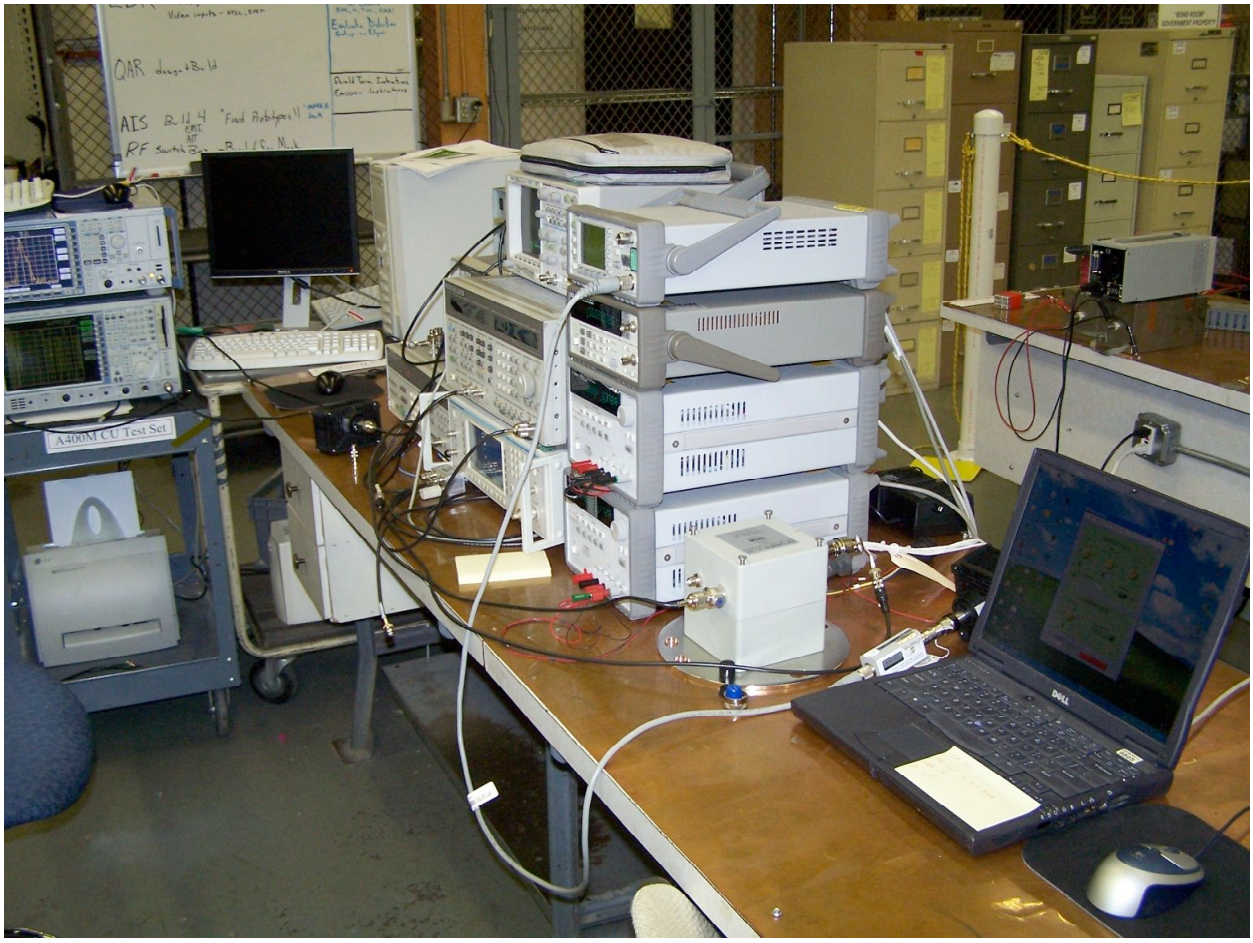
Specification: 9 kHz to 1 GHz: -36 dBm
1 GHz to 4 GHz: -30 dBm

a. Set up EUT and test instrumentation in laboratory.
   i. Connect AtoN to 12-VDC power and GPS antenna.
b. Verify analyzer and AtoN operation.
   i. Spectrum analyzer is connected to attenuator and filter VHF port.
   ii. Spectrum analyzer requires warm-up period.
   iii. Connect filter to VHF port.
c. Operate AtoN transmitter unmodulated.
d. Tune band reject filter to fundamental frequency of transmitter: Exclude frequencies ±62.5 kHz from fundamental.
e. Record required frequency spectrum displayed on analyzer.



Block Diagram of Conducted Spurious Test

VII. Test Setup Photographs for ATN01-311-03 Physical Tests:



VIII. Measurement Results for ATN01-311-03 Physical Tests:

1. Frequency Error - Low.

Frequencies: 156.025 MHz

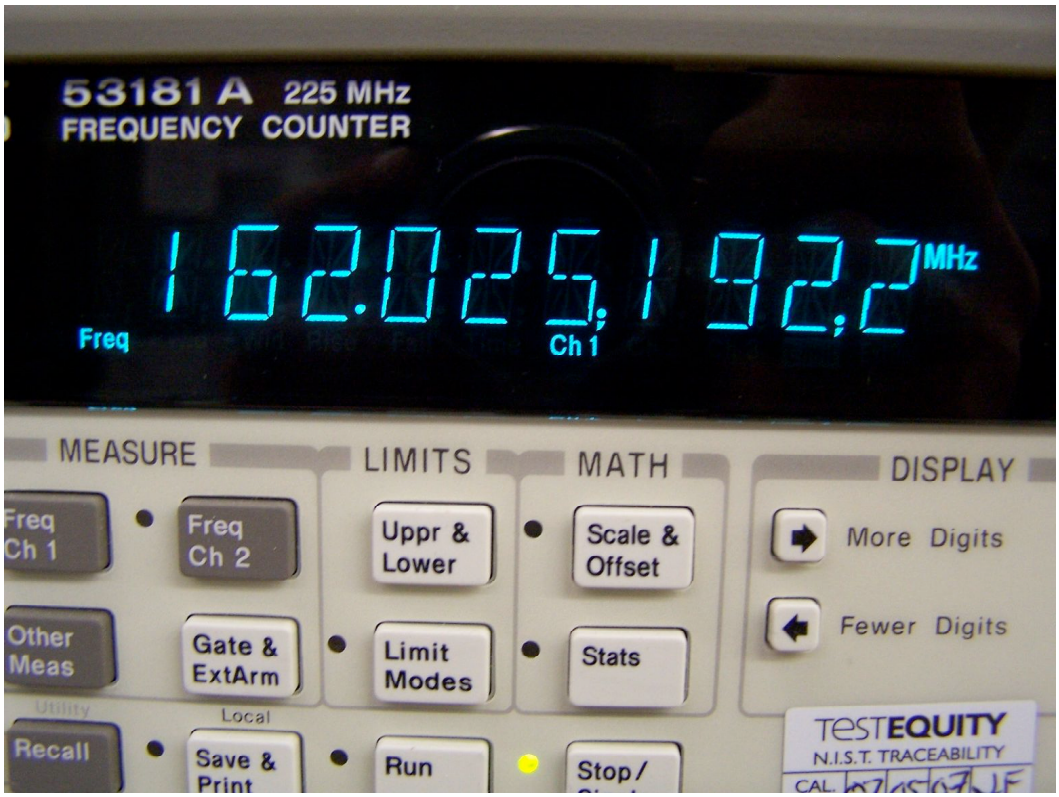
Specification: ±0.5 kHz Normal Operation

VIII. Measurement Results for ATN01-311-03 Physical Tests:

1. Frequency Error High.

Frequencies: 162.025 MHz

Specification: ±0.5 kHz Normal Operation



VIII. Measurement Results for ATN01-311-03 Physical Tests Cont'd:

2. Carrier Power at 156.025 MHz.

Specification: 40.97 ±1.5 dBm (39.47 dBm to 42.47 dBm)

VIII. Measurement Results for ATN01-311-03 Physical Tests Cont'd:

2. Carrier Power at 162.025 MHz.

Specification: 40.97 ±1.5 dBm (39.47 dBm to 42.47 dBm)