CERTIFICATION TEST REPORT

FOR THE

MODE C AIRBORNE RADAR TRANSPONDER, SL70

FCC PART 87
COMPLIANCE

DATE OF ISSUE: AUGUST 19, 1999

PREPARED FOR:

UPS Aviation Technologies
2345 Turner Road SE
Salem, OR 97302

P.O. No: 555296
W.O. No: 72274

Report No: FC99-023

PREPARED BY:

Joyce Walker
CKC Laboratories, Inc.
5473A Clouds Rest
Mariposa, CA 95338

Date of test: August 5-7 & 9, 1999

DOCUMENTATION CONTROL:

Tracy Phillips
Documentation Control Supervisor
CKC Laboratories, Inc.

APPROVED BY:

Dennis Ward
Director of Laboratories
CKC Laboratories, Inc.

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ADMINISTRATIVE INFORMATION

DATE OF TEST:	August 5-7 & 9, 1999
PURPOSE OF TEST:	To demonstrate the compliance of the Mode C Airborne Radar Transponder, SL70, with the requirements for FCC Part 87 devices.
MANUFACTURER:	UPS Aviation Technologies 2345 Turner Road SE Salem, OR 97302
REPRESENTATIVE:	George Cooley
TEST LOCATION:	CKC Laboratories, Inc. 22105 Wilson River Hwy Tillamook, OR 97141
TEST PERSONNEL:	Mike Wilkinson & Kevin Daniel
TEST METHOD:	FCC Part 21.101, 21.105, 21.106 & 21.904/21.107
FREQUENCY RANGE TESTED:	20Hz – 11GHz

EQUIPMENT UNDER TEST:

Mode C Airborne Radar Transponder

Manuf:	UPS Aviation Technologies
Model:	SL70
Serial:	6018191
FCC ID:	EOJSL-70 (pending)

SL70 Install Kit

Manuf:	UPS Aviation Technologies
Model:	424-0306-00
Serial:	None
FCC ID:	N/A

SUMMARY OF RESULTS

The UPS Aviation Technologies Mode C Airborne Radar Transponder, SL70, was tested in accordance with FCC Part 87 for compliance with the transmitter characteristics requirements of the FCC Rules.

As received, the above equipment was found to be fully compliant with the limits of FCC Part 87.

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Airborne Radar Transponder, with mode C altitude encoding. Subject to FAA TSO-C74c for Airborne ATC Transponder Equipment.

MEASUREMENT UNCERTAINTY

Associated with data in this report is a ±4dB measurement uncertainty.

PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

DC Power Supply
Manuf: Astron
Model: RS-12M
Serial: 98110031
FCC ID: NA

Transponder I/O Test Interface
Manuf: II Morrow
Model: None
Serial: None
FCC ID: None

2.1033(c)(4) – Type(s) of Emissions

The emission designator is 14MO M1D.

2.1033(c)(5) – Frequency Range

Frequency Range tested from 1090 MHz +/-3 MHz per FAA TSO-C74c. Single channel.

2.1033(c)(6) –Range of Operating Power

No means are provided for varying the operating power levels.

2.1033(c)(7) – Maximum Power Rating

Maximum peak power for small (4) pulse group at 500 pulses per second:
370 Watts (312 mW average)
Maximum peak power for largest (15) pulse group at 1200 pulses per second:
344 Watts (2.6 Watts average)
Minimum operating power level is 200 W Peak.

Sample power calculation:

Average power = [peak power][duty factor]

Duty factor = [pulse rep rate][pulses/rep][pulse width]

Given: 344 Watts peak, 421 nS pulse width, 1200 reps/second, 15 pulses/rep

Average power = [344 Watts][1200 reps/sec][15 pulses/rep][421 nS/pulse] =
2.6 Watts

2.1033(c)(8) - DC Voltages

Transmitter High Voltage Supply

The +high volt supply is a high efficiency switching regulator operating at 300kHz. The +HV supply operates on the +8 volt supply and up-switches to approximately +45 volts DC. The +HV supply is used to supply the power for the transmitter.

The +HV supply supplies the power required for the transmitter by keeping the output capacitors, C198, C244, and C218 charged. The maximum peak transmitter power required from the +HV supply is approximately 800 watts. The maximum duty cycle is 0.97% for 15 pulse replies at 1200/second. Therefore, the average power required, at maximum duty cycle, is approximately 8 watts.

The +HV supply includes an adjustment, R268, to adjust the supply voltage for the transmitter.

45 Volt Regulator

The +45 volt linear regulator is intended to maintain transmitter supply voltage during pulse groups. The storage capacitors (C198 and C244) on the output of the +HV supply maintain supply voltage sufficiently through mode A and mode C reply pulse groups. Therefore, the +45 volt regulator is not used on the SL70. The 0 ohm R270 is installed on the board, and Q50 and related parts are left off.

2.1033(c)(9) – Tune-Up Procedure

There are no tune-up procedures required by the operator. The transmitter is tuned-up during the manufacturing process and requires no adjustments by the user.

2.1033(c)(10) – Frequency Stabilization, Modulation, & Spurious Radiation

(Schematics provided as separate data file uploads with FCC 731 electronic application.)

Frequency Stabilization

The 1090 MHz center frequency of the reply transmission is held to +/- 100 PPM over the operating temperature range. This is within +/- 3 MHz required by the FAA TSO C74c paragraph 2.10. Y2 supplies a 20 MHz reference signal to U25 of the transmitter synthesizer, where it is divided down to 50 kHz. A VCO consisting of U23, L17, C111, C110, C112, C113, C114, and D18 is sampled by U25 through buffer U24. U25 phase locks the 1090 MHz VCO signal to the 20 MHz reference signal. Y2 has temperature characteristics to maintain a stability of +/- 100 PPM.

Spurious Emissions Suppression

Spurious emissions are suppressed by controlling the rise-times and fall times of the pulse by a high level modulator. A low pass filter between the transmitter output and antenna port attenuates harmonics.

2.1033(c)(13) – Description of Modulation

Three circuits are used synergistically to modulate the pulse train: 1) the TX LO gate, 2) the High Level Modulator, and 3) the RF drive control. The first two circuits are located on the main board assembly, while the RF drive control is located on the transmitter board assembly.

The TX LO Gate is turned on during the entire reply pulse train. Individual pulses are gated on and off by the Hi Level modulator and RF Drive Control. The Hi level modulator is turned on first, then the RF drive control is turned up to form the leading edge of the pulse. The High Level Modulator then shuts the RF off and forms the falling edge of the pulse, after which the RF Drive Control is turned off and the sequence is repeated for the next pulse. When the entire pulse train is sent, the TX LO gate, High Level Modulator, and RF drive control is turned off.

SUMMARY OF TEST METHODS

1. EUT was measured for peak power using ATC-1400A.
2. Spectrum Analyzer bandwidth was opened up to 3MHz so that peak power observed was close to actual. A correction factor of about 2.1 dB was applied to the spectrum analyzer power reading and all of the spurious measurements above the fundamental.
3. A high pass filter was used to observe 2^{nd} harmonics and above.
4. Occupied bandwidth was measured using the spectrum analyzer's occupied bandwidth calculation function.
5. The harmonic limit based on 43 + 10 log pY was calculated. There was no discernable change in spurious levels if the unit transmitted a 1200 squawk code (4 pulses/rep) or a 7777 squawk code (14 pulses/rep). The peak power did decrease with 14 pulses from 370 watts to 344 watts. It was decided to use the 1200 squawk code to give the worst-case peak response. The average power differed from 300 mW to 1 watt affecting the spurious limit from 38 dB to 43.05 dB. The unit passed both limits.
6. Spurious limit applied to the conducted tests gave 162.7 dBuV (370 watts) – 38 dB = 124.7 dBuV.
7. The radiated limits where extrapolated for the 3 meter test. The difference was approximately 10 dB. This corresponded with the theoretical calculations. In theory 162.7 dBuV corresponded to 153.08 dBuV/m at 3 meters. So the theoretical limit was 115.08 dBuV/m for 4 pulses or 110.08 dBuV/m for the 14 pulse group.
8. All spurious passed both the 4 pulse and 14 pulse spurious limit calculations in the conducted as well as the radiated modes.

2.1033(c)(14)/2.1046 - RF Power Output

Test Conditions:

EUT is connected to the spectrum analyzer through 40 dB of attenuators and 3 meters of RG 400 cable for Fundamental signal at 1089.8 MHz and 40 dB of attenuators, 3 meter of RG 400 cable. EUT is placed in the Install Kit that is connected by the cable harness (Red Label s/n A) to the I/O test interface. The test interface's only function in the test setup is to control transmitter on/off function. The EUT has been modified to allow the test interface to switch the transmitter on or off. The EUT is in the transmit mode: 500 repetitions per second, 4 pulses per repetition and 421 nano second pulse width. The EUT controls are set as follows: Squawk code is 1200. The rest of the displays are lighted bars. The readings in this data sheet have been adjusted to reflect the levels measured using the IFR test set to determine the peak power of the fundamental transmitted signal. The measurement was made as follows: The EUT was connected directly to the IFR ATC-1400A test set with the IFR controls set to: XPDR Code, Mode A and 500 reps per sec. This produces the same conditions as the "self transmit mode" necessary to observe the signal on the spectrum analyzer. These conditions are 500 reps per second and 4 pulses per rep. Knowing the pulse width, average power can be calculated from the peak power reading on the IFR test set in the following manner: Given: Squawk Code = 1200, Pulse Width = 421nS, Rep Rate = 500 Reps per Sec. & 4 pulses/rep. IFR ATC-1400A reading = 370 Watts peak = 55.69 dBm = 162.69 dBuV Average power = (Peak Power) (Duty Factor) Duty Factor = (Rep Rate) (Pulses/Rep) (Pulse Width) Duty Factor = (500 Reps/Sec) (4 Pulses/Rep) (421 nS) Duty Factor = (842 X 10E-6) Average Power = (370 Watts Peak) (842 X 10E-6) = 311.54 mW. Part 87.139(d) Spurious Emissions = 43 + 10 log pY (pY =average power) = 43 + 10 log (311.54 X 10E-3 Watts) = 38 dBc 370 W peak = 162.69 dBuV - 38 dBc = 124.7 dBuV

Diagram Of Test Setup Used for Peak Power Measurement:

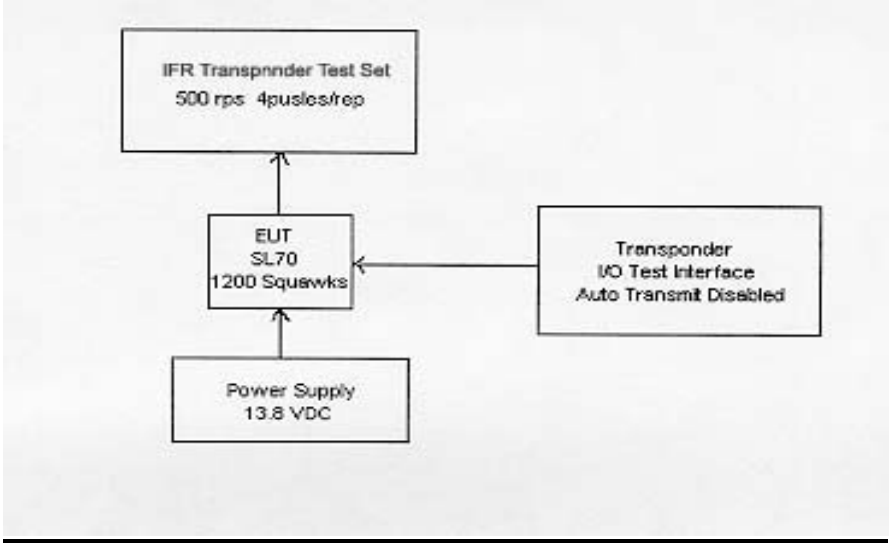
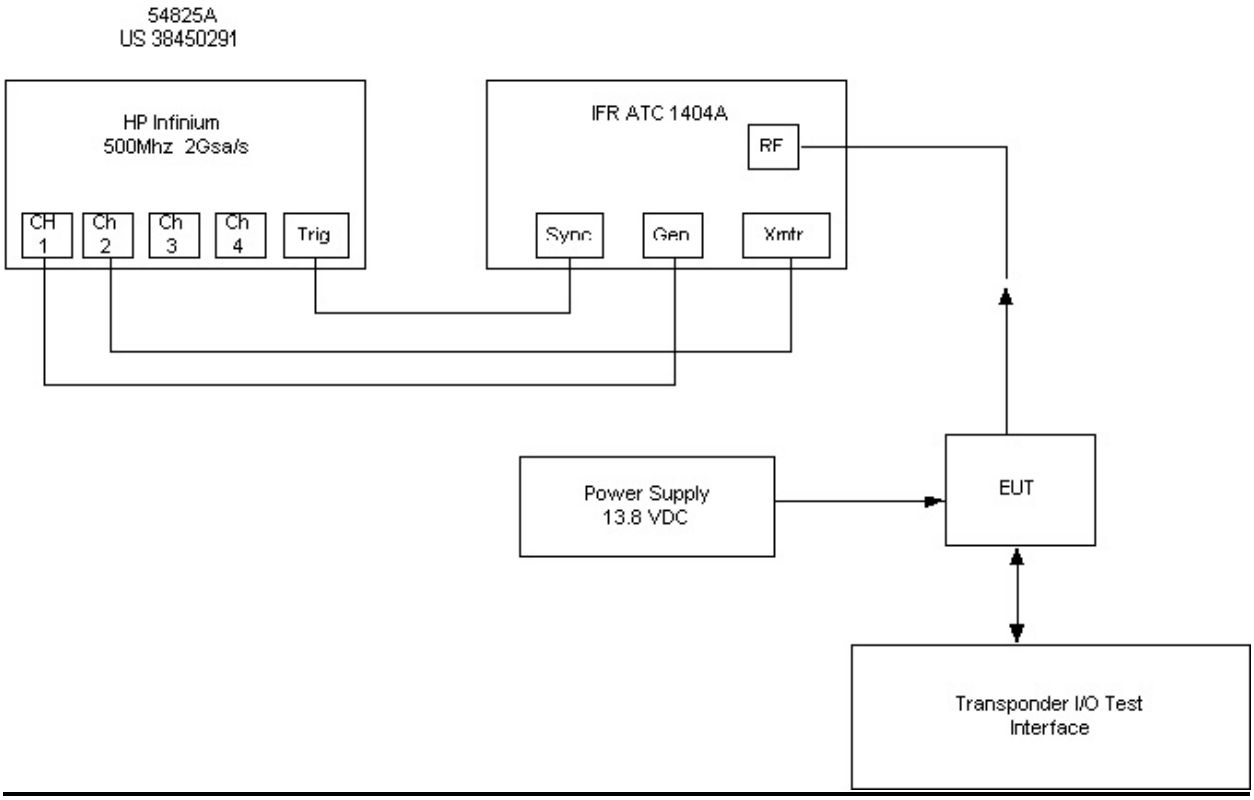


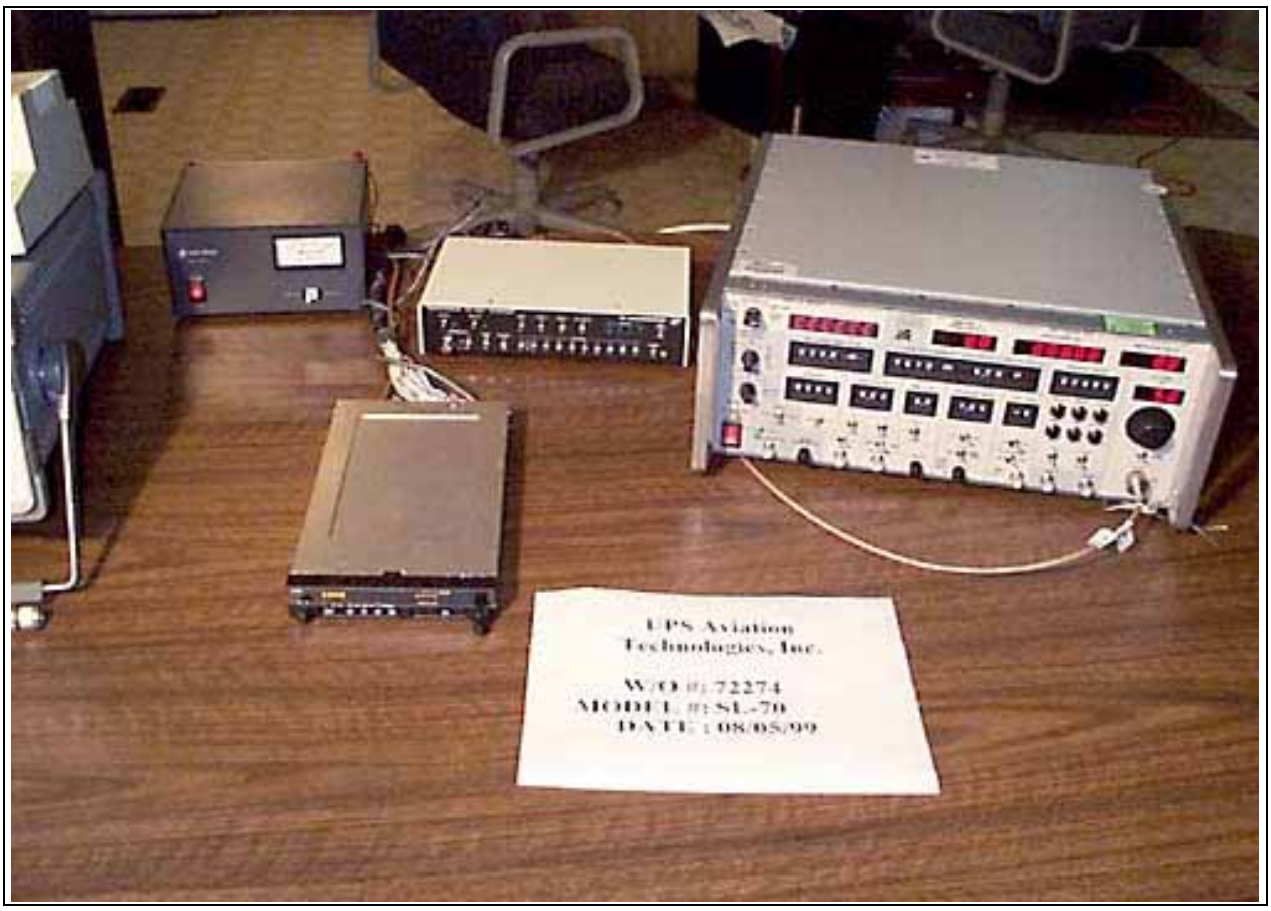
Diagram Of Test Setup Used for Pulse Width Measurement:



Notes: Pulse shape observed on the oscilloscope was derived from a crystal detector inside the ATC 1400A. The signal comes out on the transmitter port and was piped into CH2 of oscilloscope.

Photo Showing Test Setup of Pulse Width Measurement

Photograph Showing Conducted Peak Power



Front View

Photograph Showing Conducted Peak Power

Back View

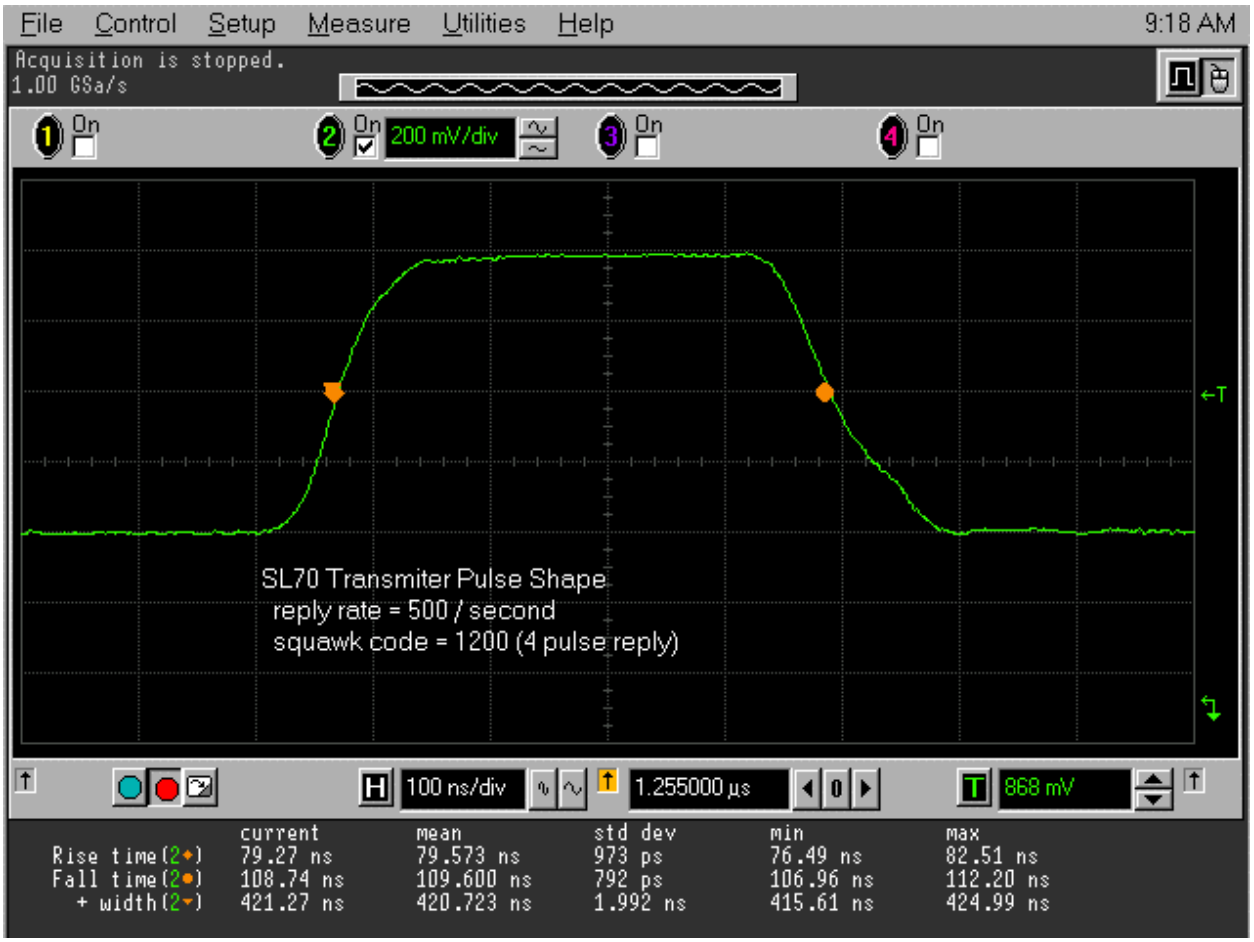
Test Equipment Used:

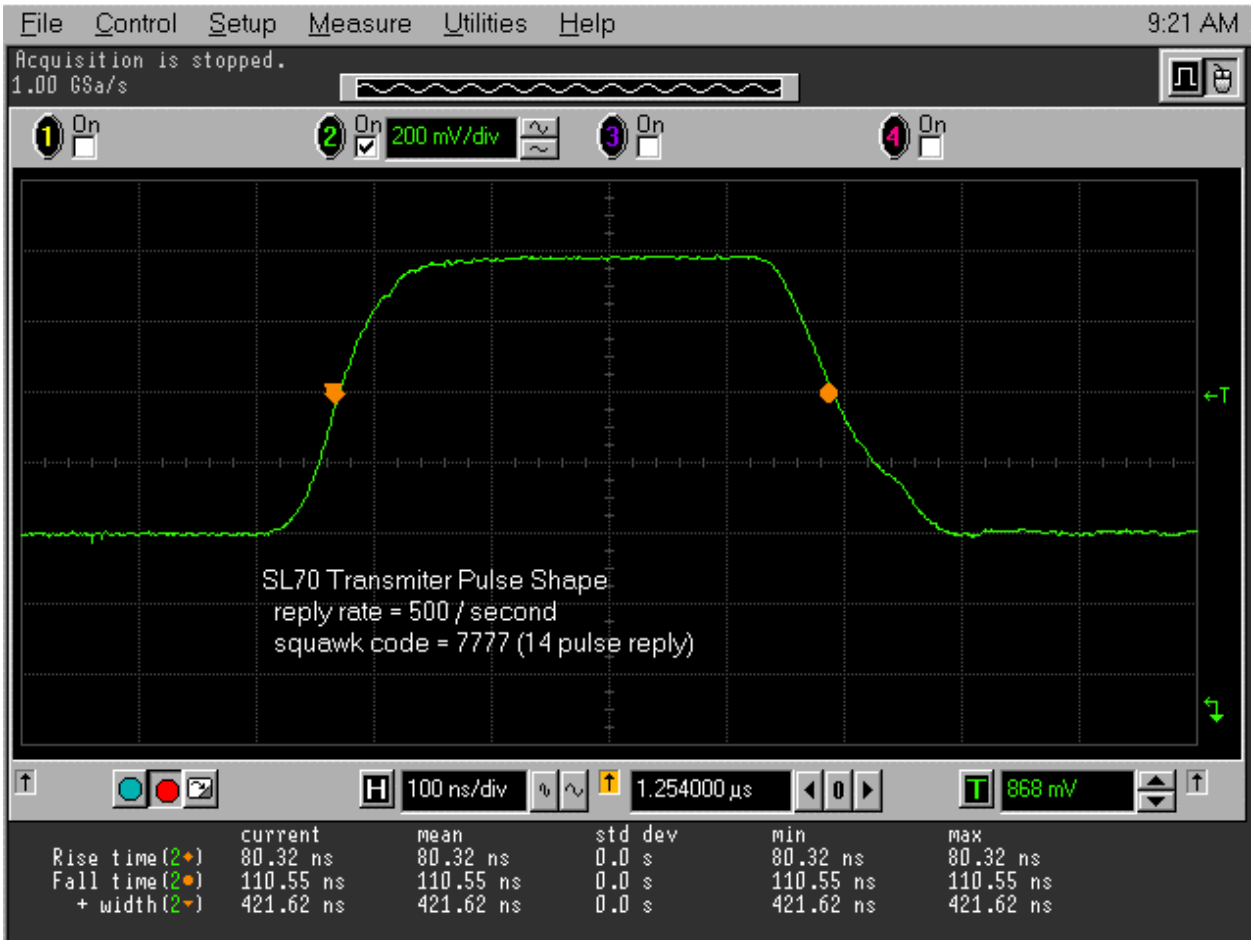
1. ATC, IFR Americas, Model 1400A-2, S/N 6648. Calibration date: March 25, 1999. Calibration due date: March 25, 2000.
2. Infinium Oscilloscope, HP, Model 54825A. Calibration date: January 1, 1999. Calibration due date: January 1, 2000.

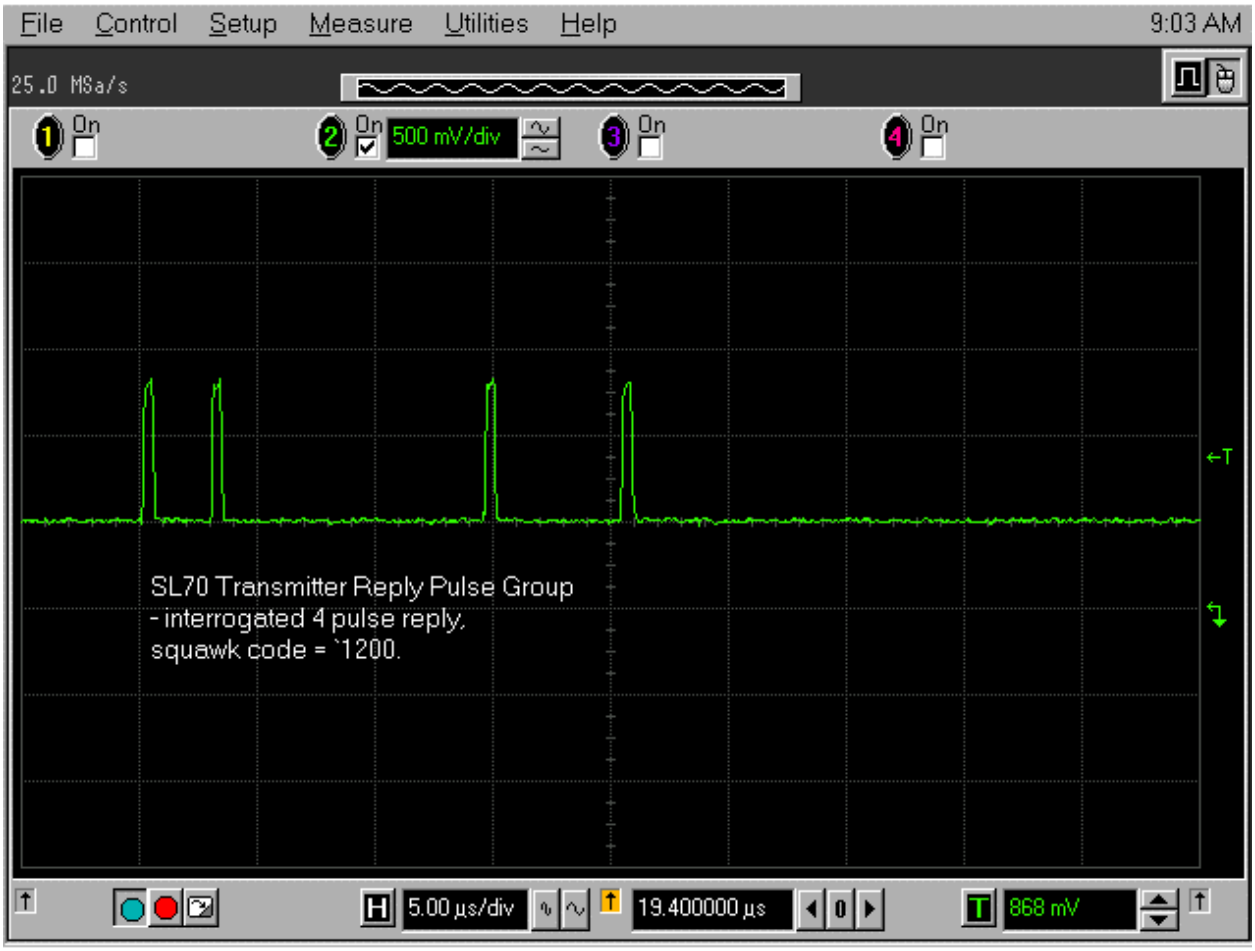
Test Data:

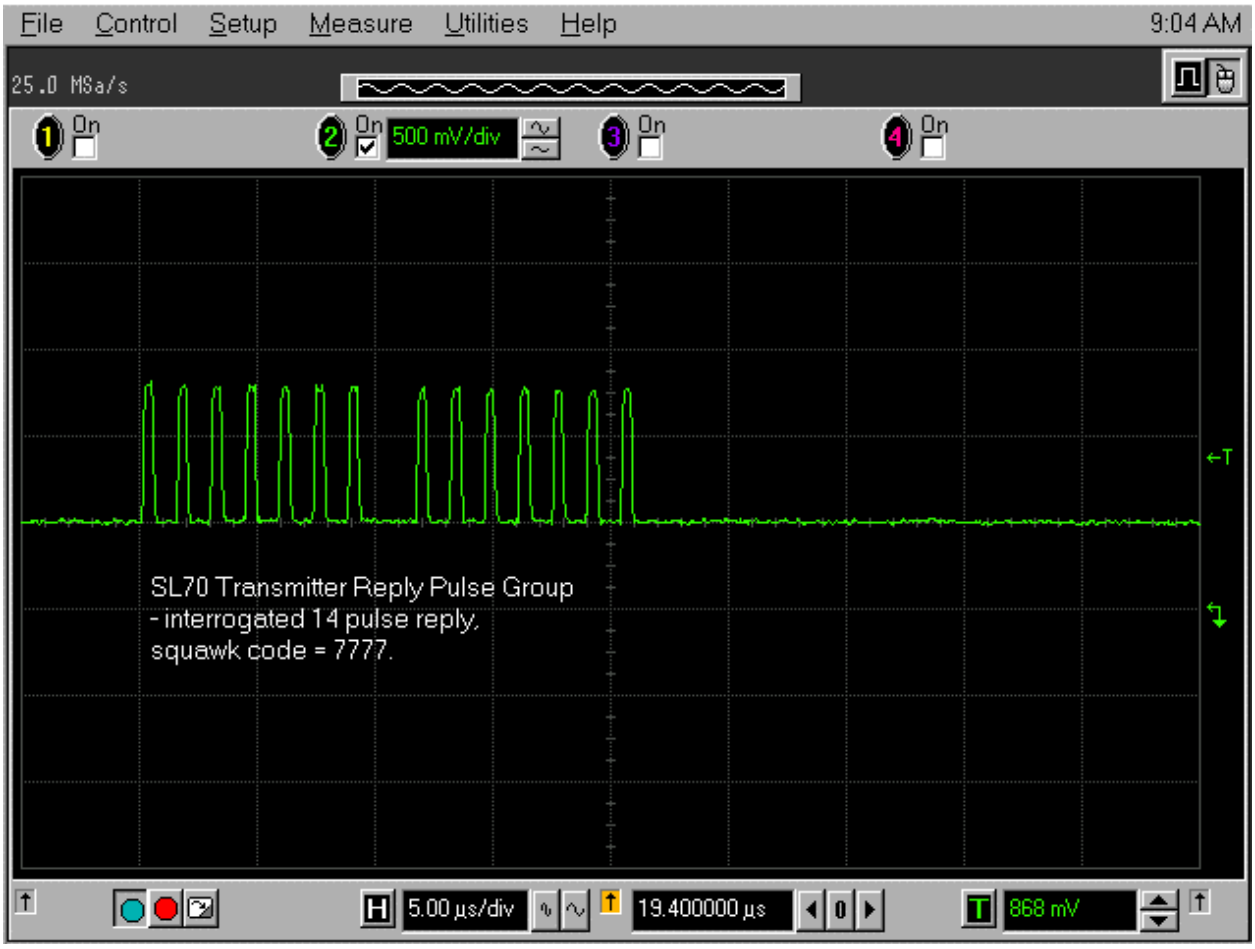
Measurement Data: Sorted by Margin Test Distance: None

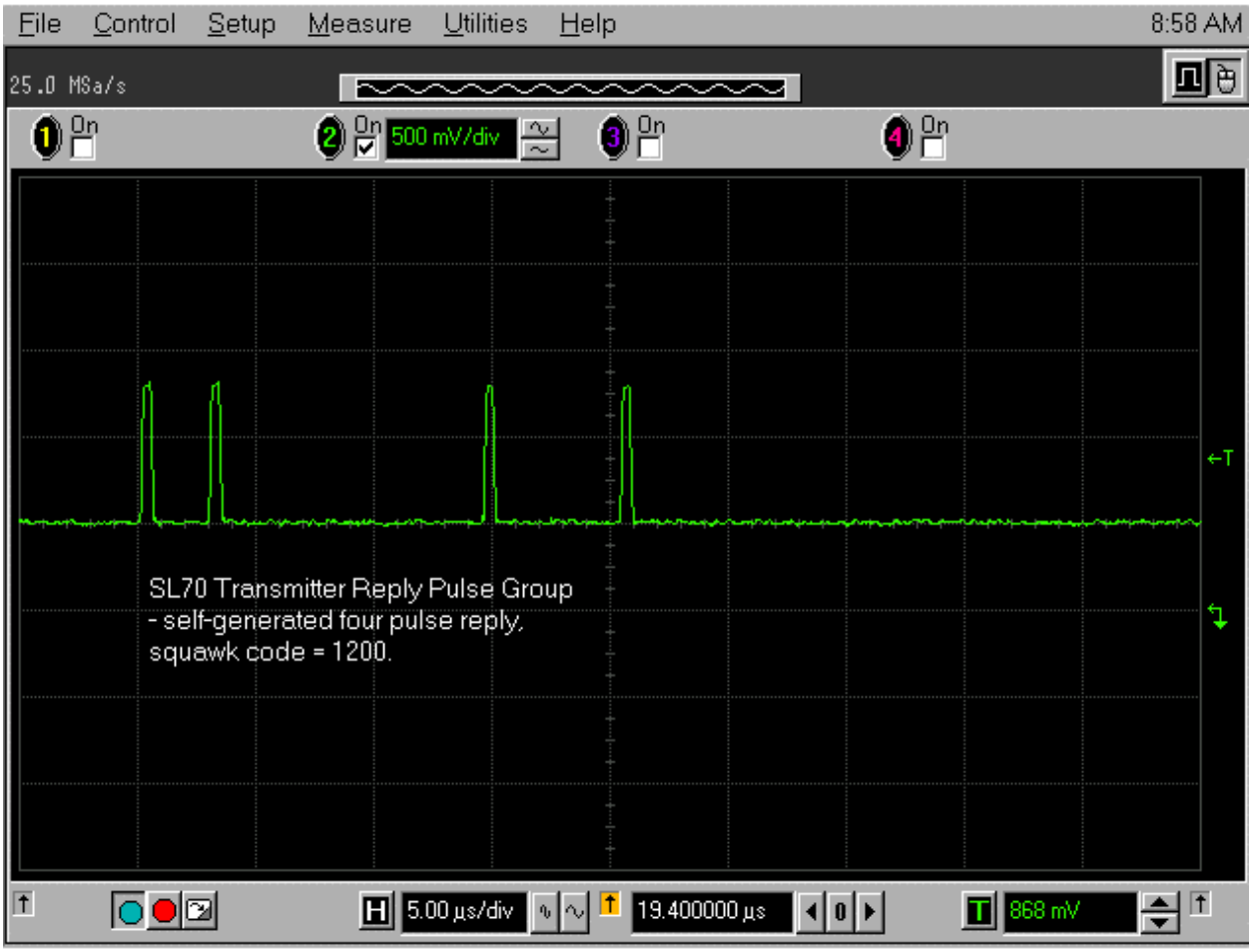
#	Freq MHz	Rdng dBµV	Attenuator Cable Factor dB	dB	dB	dB	Dist dB	Corr dBµV	Spec dBµV	Margin dB	Polar
1	1089.830	121.0	+41.7				+0.0	162.7	162.7	+0.0	None

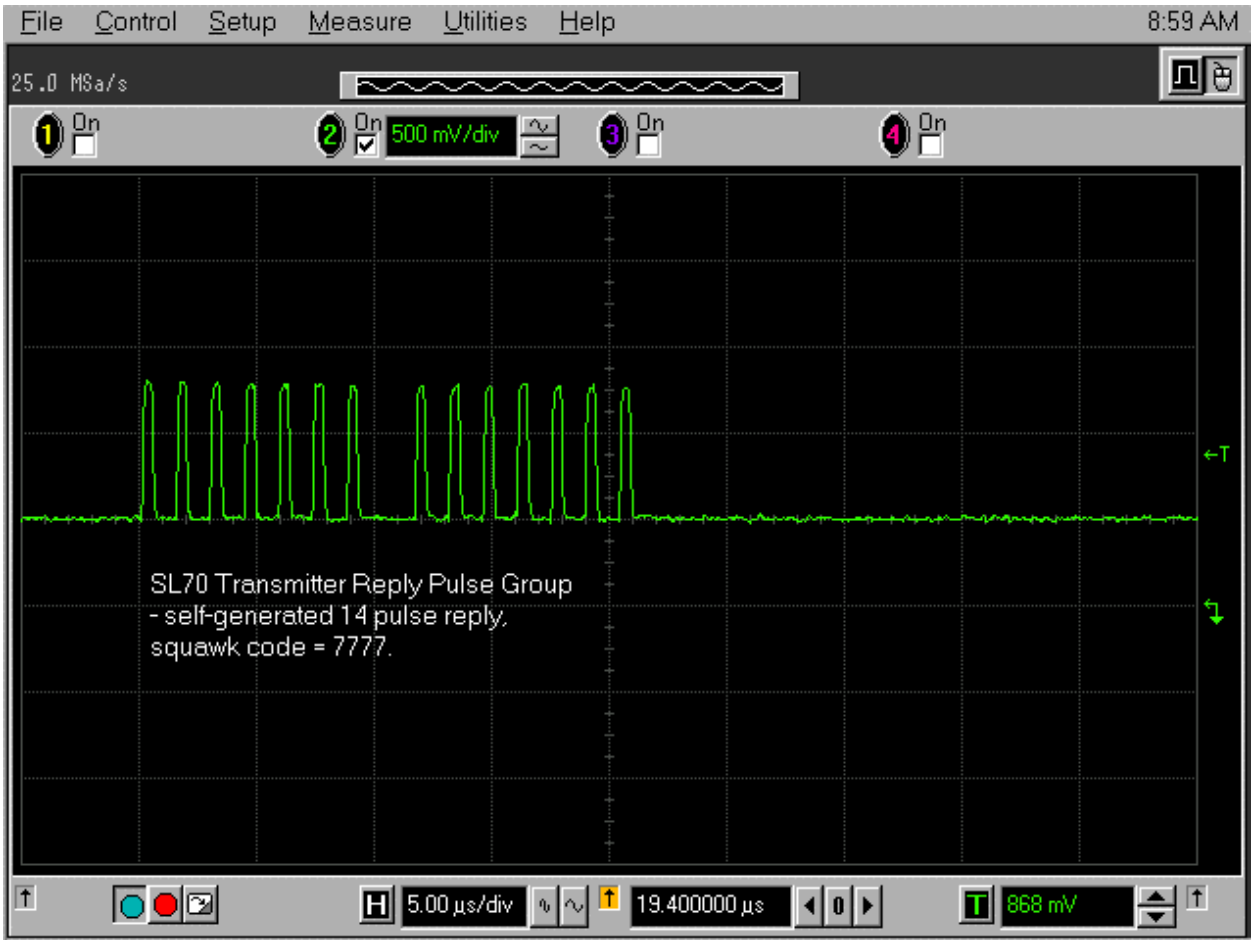

File Control Setup Measure Utilities Help 9:18 AM
Acquisition is stopped.
1.00 GSa/s
On
On
200 mV/div
On
On
SL70 Transmiter Pulse Shape
reply rate = 500 / second
squawk code = 1200 (4 pulse reply)
100 ns/div
1.255000 µs
868 mV
current mean std dev min max
Rise time(2) 79.27 ns 79.573 ns 973 ps 76.49 ns 82.51 ns
Fall time(2) 108.74 ns 109.600 ns 792 ps 106.96 ns 112.20 ns
+ width(2) 421.27 ns 420.723 ns 1.992 ns 415.61 ns 424.99 ns


File Control Setup Measure Utilities Help
9:21 AM
Acquisition is stopped.
1.00 GSa/s
On
On
200 mV/div
On
On
SL70 Transmiter Pulse Shape
reply rate = 500 / second
squawk code = 7777 (14 pulse reply)
100 ns/div
1.254000 µs
868 mV
current mean std dev min max
Rise time(2) 80.32 ns 80.32 ns 0.0 s 80.32 ns 80.32 ns
Fall time(2) 110.55 ns 110.55 ns 0.0 s 110.55 ns 110.55 ns
+ width(2) 421.62 ns 421.62 ns 0.0 s 421.62 ns 421.62 ns


File Control Setup Measure Utilities Help
9:03 AM
25.0 MSa/s
On
On
500 mV/div
On
On
SL70 Transmitter Reply Pulse Group
- interrogated 4 pulse reply,
squawk code = `1200.
5.00 µs/div
19.400000 µs
868 mV


File Control Setup Measure Utilities Help
9:04 AM
25.0 MSa/s
On
On
500 mV/div
On
On
SL70 Transmitter Reply Pulse Group
- interrogated 14 pulse reply,
squawk code = 7777.
5.00 µs/div
19.400000 µs
868 mV


File Control Setup Measure Utilities Help
8:58 AM
25.0 MSa/s
On
On
500 mV/div
On
On
SL70 Transmitter Reply Pulse Group
- self-generated four pulse reply,
squawk code = 1200.
5.00 µs/div
19.400000 µs
868 mV


File Control Setup Measure Utilities Help
8:59 AM
25.0 MSa/s
On
On
500 mV/div
On
On
SL70 Transmitter Reply Pulse Group
- self-generated 14 pulse reply,
squawk code = 7777.
5.00 µs/div
19.400000 µs
868 mV

2.1033(c)(14)/2.1047(a) - MODULATION CHARACTERISTICS – Audio Frequency Response

Not applicable to this unit.

2.1033(c)(14)/2.1047(b) - MODULATION CHARACTERISTICS – Modulation Limiting Response

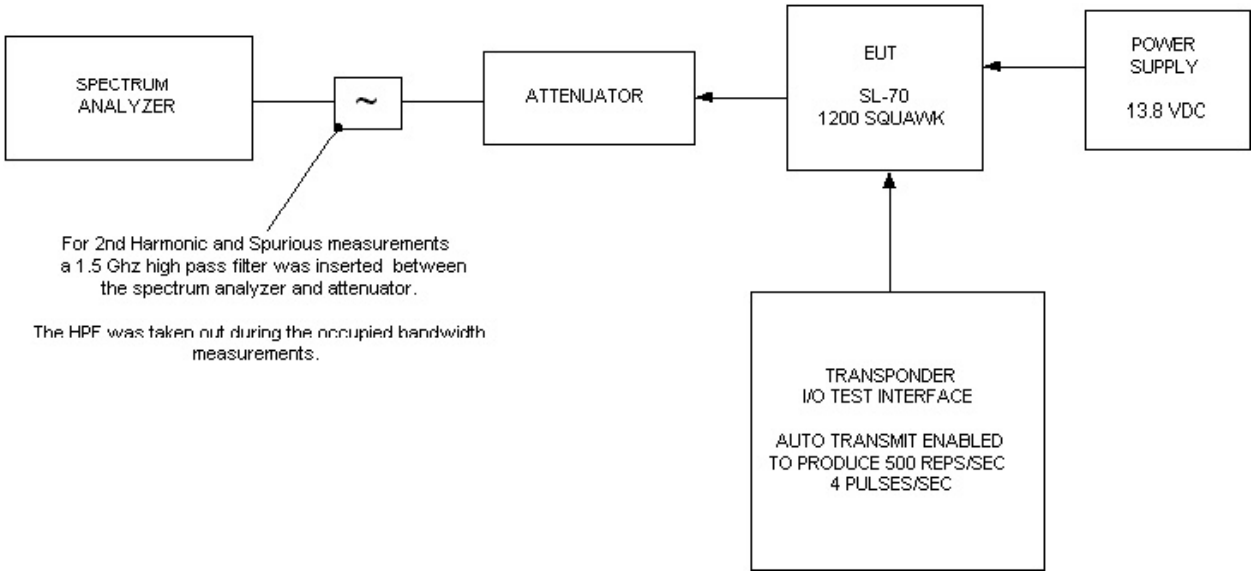
Not applicable to this unit.

2.1033(c)(14)/2.1049(i) - OCCUPIED BANDWIDTH

Test Conditions:

Measurements were made with the EUT connected directly to the SA with the SA bandwidths set to 100 kHz, span = 50 MHz and swp = 1 sec. The SA 99% power bandwidth was used. The results were printed out on a printer.

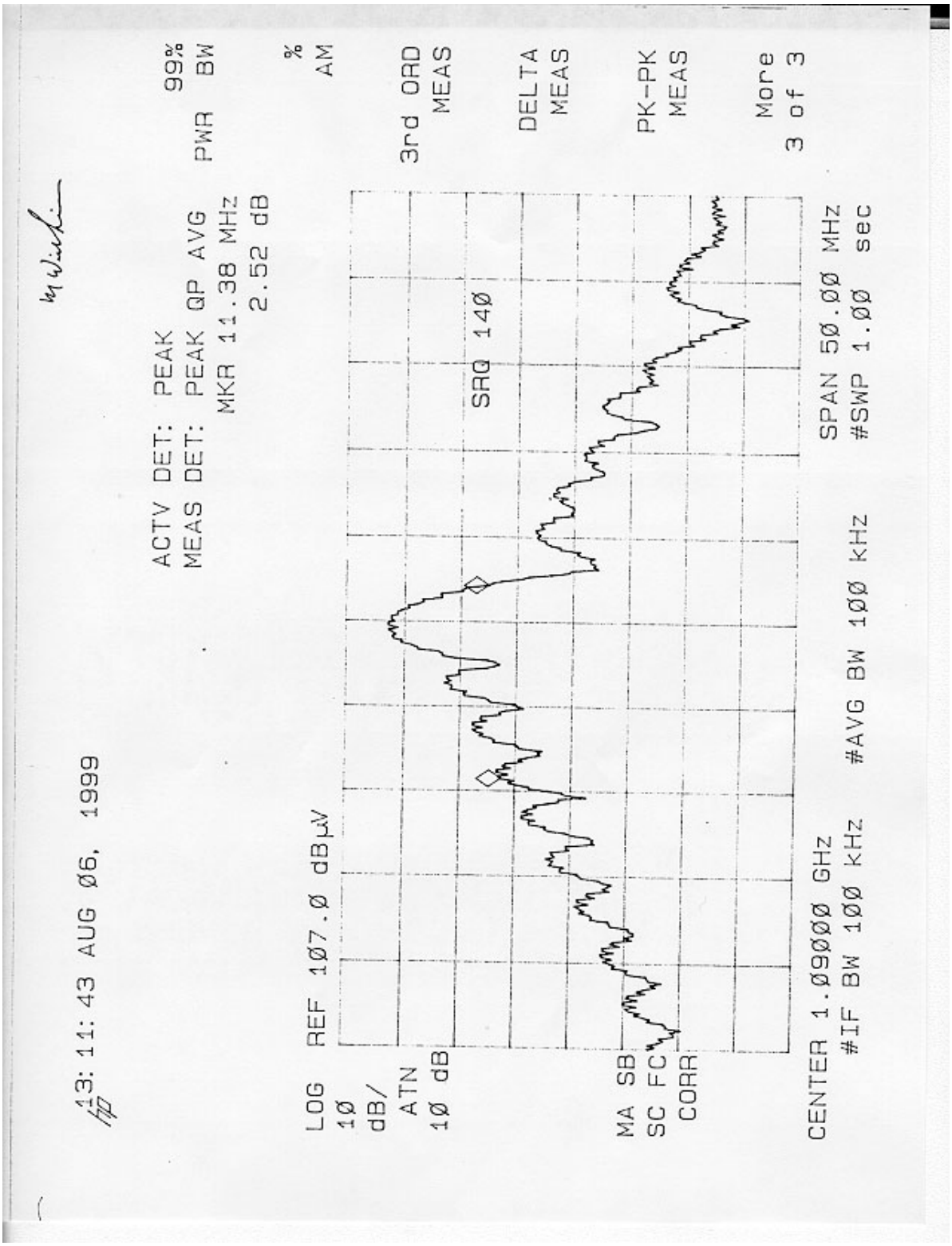
Diagram Of Test Setup Used for Test:



Test Equipment Used:

1. Spectrum Analyzer, HP, Model 8568B, S/N 2207A01865. Calibration date: January 11, 1999. Calibration due date: January 11, 2000.

Occupied Bandwidth Plot



2.1033(c)(14)/2.1051 - SPURIOUS EMISSIONS AT ANTENNA TERMINAL

Test Conditions:

EUT is connected to the spectrum analyzer through 40 dB of attenuators and 3 meters of RG 400 cable for Fundamental signal at 1089.8 MHz and 40 dB of attenuators, 3 meter of RG 400 cable & a low pass filter was used for signals above 1090 MHz. EUT is placed in the Install Kit that is connected by the cable harness (Red Label s/n A) to the I/O test interface. The test interface's only function in the test setup is to control transmitter on/off function. The EUT has been modified to allow the test interface to switch the transmitter on or off. The EUT is in the transmit mode: 500 repetitions per second, 4 pulses per repetition and 421 nano second pulse width. The EUT controls are set as follows: Squawk code is 1200. The rest of the displays are lighted bars. The readings in this data sheet have been adjusted to reflect the levels measured using the IFR test set to determine the peak power of the fundamental transmitted signal. The measurement was made as follows:

The EUT was connected directly to the IFR ATC-1400A test set with the IFR controls set to: XPDR Code, Mode A and 500 reps per sec. This produces the same conditions as the "self transmit mode" necessary to observe the signal on the spectrum analyzer. These conditions are 500 reps per second and 4 pulses per rep. Knowing the pulse width, average power can be calculated from the peak power reading on the IFR test set in the following manner:

Given; Squawk Code = 1200, Pulse Width = 421nS, Rep Rate = 500 Reps per Sec. & 4 pulses/rep.
IFR ATC-1400A reading = 370 Watts peak = 55.69 dBm = 162.69 dBuV
Average power = (Peak Power) (Duty Factor)
Duty Factor = (Rep Rate) (Pulses/Rep) (Pulse Width)
Duty Factor = (500 Reps/Sec) (4 Pulses/Rep) (421 nS)
Duty Factor = (842 X 10E-6)
Average Power = (370 Watts Peak) (842 X 10E-6) = 311.54 mW

Part 87.139d Spurious Emissions = 43 + 10 log pY (pY = average power output of transmitter)
Spurious Emissions = 43 + 10 log (311.54 X 10E-3 Watts)
Spurious Emissions = 43 - 5 dB = 38 dBc
370 Watts peak = 162.69 dBuV
Spurious Emission Limit = 162.69 dBuV - 38 dBc = 124.69 dBuV

NOTE: For the above data sheet the Spectrum Analyzer IF & Ave Bandwidths were set to: 3 MHz 1090 MHz and above, below 1090 MHz 1 MHz was used.

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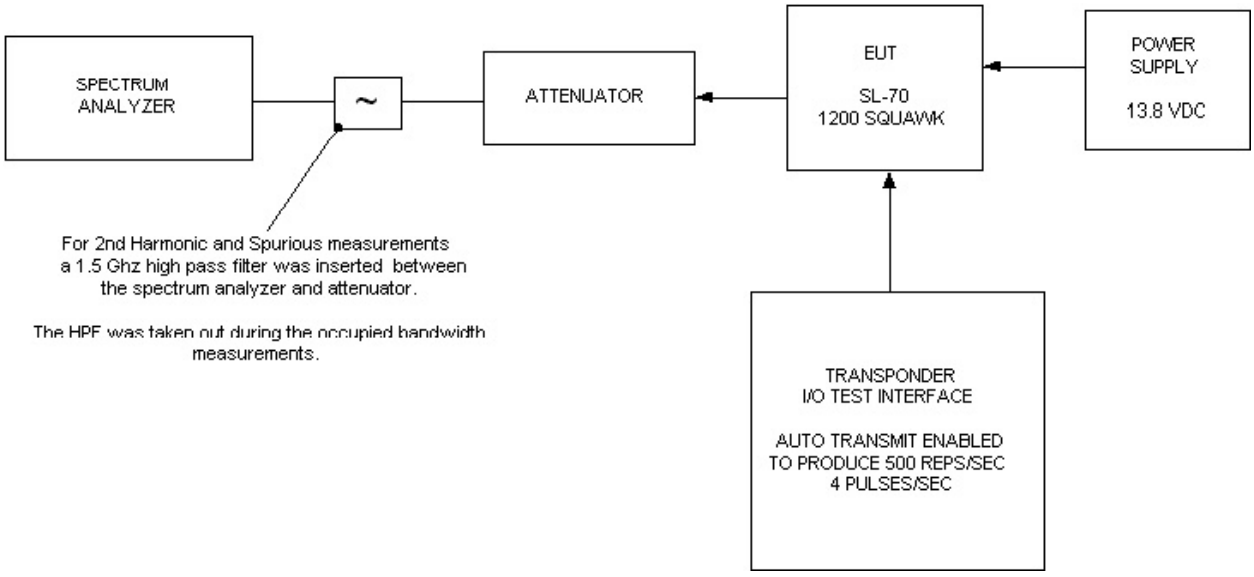
Video Bandwidth and Resolution Bandwidth Settings:

Frequency Range	Signal Analyzer VBW & RBW Setting
150kHz - 30MHz	100kHz
30MHz – 1MHz	1MHz
1GHz – 11GHz	1MHz

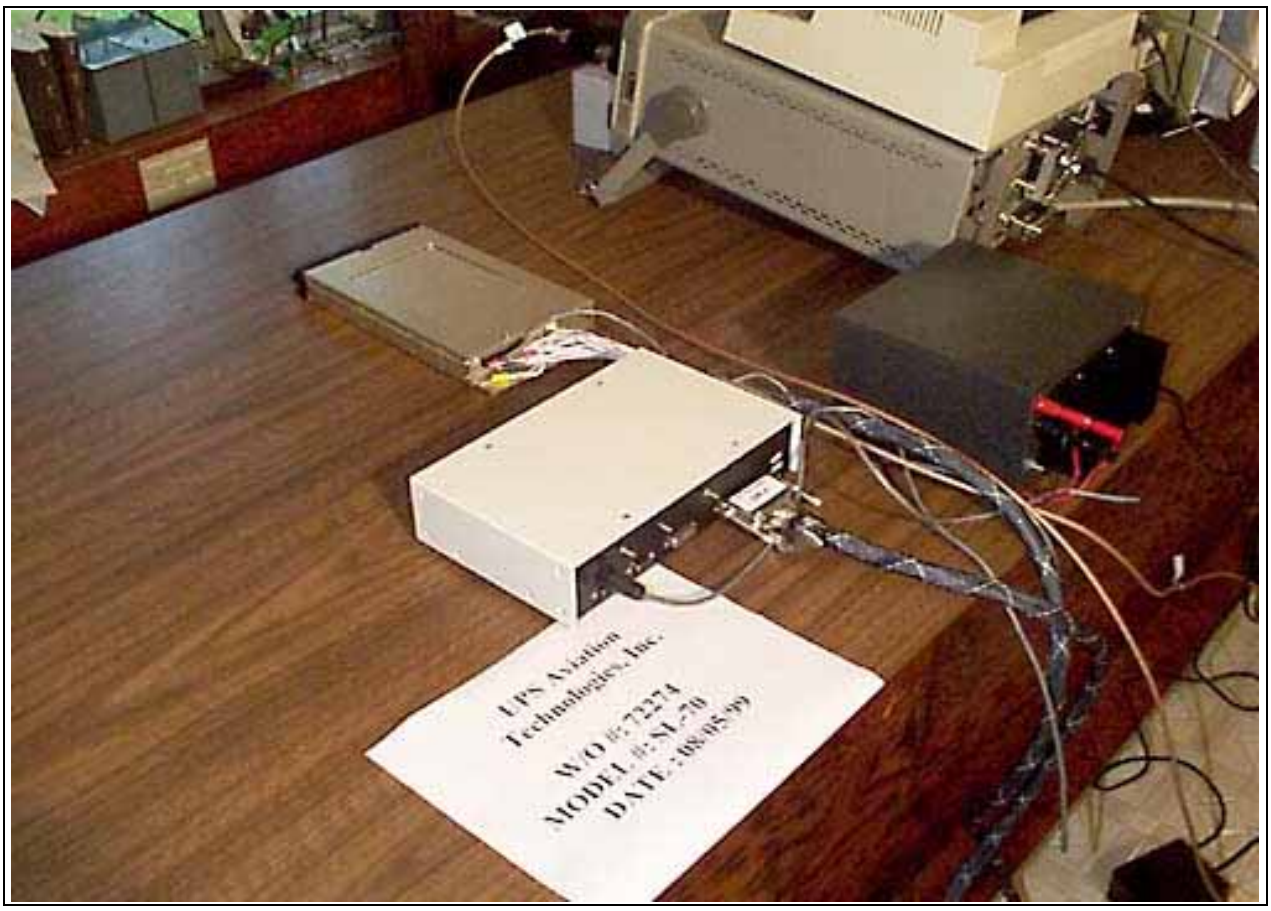
Diagram Of Test Setup Used for Test:



Photograph Showing Conducted Spurious – Bandwidth

Front View

Photograph Showing Conducted Spurious – Bandwidth



Back View

Test Equipment Used:

1. Spectrum Analyzer, HP, Model 8568B, S/N 2207A01865. Calibration date: January 11, 1999. Calibration due date: January 11, 2000.

2. Preamp, HP, Model 8447D, S/N 2944A08286. Calibration date: March 22, 1999. Calibration due date: March 22, 2000.

3. Preamp, Hewlett Packard, Model No. 83017A, S/N 3123A00321. Calibration date: October 26, 1998. Calibration due date: October 26, 1999.

Test Data:

Test Location:	CKC Laboratories, Inc. • 22105 Wilson River Hwy • Tillamook, OR 97141 • 800 500-4EMC		
Customer:	UPS Aviation Technologies, Inc	Date:	Aug-06-99
Specification:	87.139D	Time:	16:10
Test Type:	Maximized Emissions	Sequence#:	1
Equipment:	Mode C Airborne Radar Transponder		
Manufacturer:	UPS Aviation Technologies	Tested By:	Mike Wilkinson
Model:	SL70		
S/N:	6018191		

Measurement Data: Sorted by Margin Test Distance: None

#	Freq MHz	Rdng dBµV	Antenuator Cable Factor dB	dB	dB	dB	Dist dB	Corr dBµV	Spec dBµV	Margin dB	Polar
1	1089.830	121.0	+41.7				+0.0	162.7	162.7	+0.0	None
2	2179.730	61.0	+42.3				+0.0	103.3	124.7	-21.4	None
3	3269.280	43.6	+42.3				+0.0	85.9	124.7	-38.8	None
4	4359.180	36.8	+42.3				+0.0	79.1	124.7	-45.6	None

2.1033(c)(14)/2.1053 - FIELD STRENGTH OF SPURIOUS RADIATION

Test Conditions:

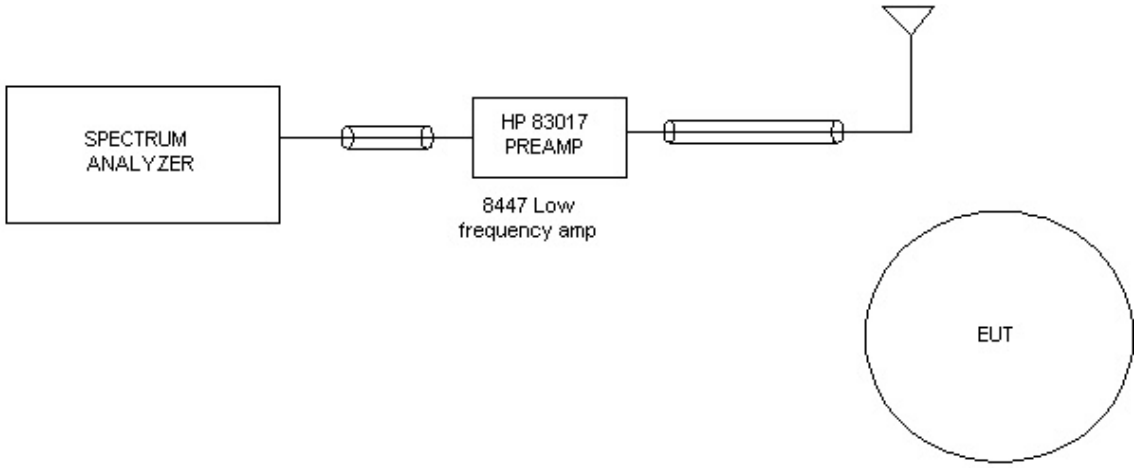
EUT is placed on the OATS and in the Install Kit that is connected by the cable harness (Red Label S/N A) to the I/O test interface. EUT power is 12 VDC from the support power supply. The test interface's only function in the test setup is to control transmitter on/off function. The EUT has been modified to allow the test interface to switch the transmitter on or off. The EUT is in the transmit mode: 500 repetitions per second, 4 pulses per repetition and 421 nano second pulse width. The EUT controls are set as follows: Squawk code is 1200. The rest of the displays are lighted bars. The frequency range investigated was 20 MHz to 11.0 GHz. The temperature was 70°F and the humidity was 50 %.

Note: The spurious/harmonic limit was calculated. No discernable change was observed in signal levels if the EUT transmitted a 1200 squawk code (4pulses/rep) or a 7777 squawk code (14 pulses/rep). The peak power did decrease with 14 pulses from 370 watts to 344 watts. The 1200 squawk code was used to give the worst case peak response. The average power differed from 0.3 watt to 1.0 watt (4 pulses to 14 pulses) affecting the spurious limit from 38 dBc to 43 dBc. The EUT passed both limits conducted and radiated.

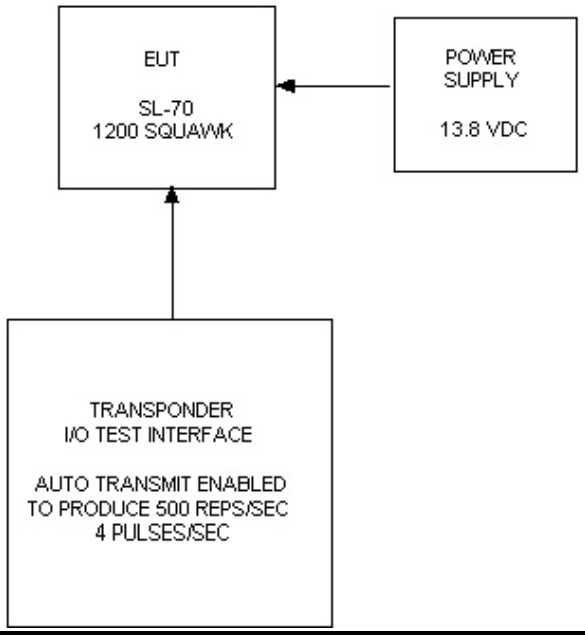
Video Bandwidth and Resolution Bandwidth Settings:

Frequency Range	Signal Analyzer VBW & RBW Setting
150kHz - 30MHz	100kHz
30MHz – 1MHz	1MHz
1GHz – 11GHz	1MHz

Diagram Of Test Setup Used for Test:



EUT:



Photograph Showing Radiated Emissions

Front View

Photograph Showing Radiated Emissions

Back View

FCC Part 87.139(d)

FCC Part 2.1053 Measurements required: Field strength of spurious radiation

Operating Channel - **1089.9MHz**

Polarity	Freq (MHz)	Reading in dBuV/m	PreAmp Factor	Cable Factor	Horn/ biconilog Antenna	High Pass Filter	Corrected E (dBuV/M)	V/M	ERP (Watts)	Spec Limit Watts	Pass or Fail
Vertical	2179.73	78.90	-36.00	7.4	27.6	0.4	78.30	0.008222426	0.000012367	0.057000000	Pass
Horizontal	2179.70	73.80	-36.00	7.4	27.6	0.4	73.20	0.004570882	0.000003822	0.057000000	Pass
Vertical	6540.15	54.70	-32.90	14.5	34.1	0.6	71.00	0.003548134	0.000002303	0.057000000	Pass
Vertical	4359.90	61.20	-33.00	9.6	32.2	0.5	70.50	0.003349654	0.000002052	0.057000000	Pass
Vertical	7630.80	52.90	-34.20	15.2	35.5	0.1	69.50	0.002985383	0.000001630	0.057000000	Pass
Horizontal	4359.80	60.10	-33.00	9.6	32.2	0.5	69.40	0.002951209	0.000001593	0.057000000	Pass
Horizontal	3270.10	60.60	-34.50	9.9	31.3	0.5	67.80	0.002454709	0.000001102	0.057000000	Pass
Horizontal	6540.15	51.00	-32.90	14.5	34.1	0.6	67.30	0.002317395	0.000000982	0.057000000	Pass
Vertical	3269.55	57.60	-34.50	9.9	31.3	0.5	64.80	0.001737801	0.000000552	0.057000000	Pass
Vertical	5449.80	50.00	-33.00	12.3	34.3	1.0	64.60	0.001698244	0.000000528	0.057000000	Pass
Horizontal	5449.80	49.40	-33.00	12.3	34.3	1.0	64.00	0.001584893	0.000000459	0.057000000	Pass
Vertical	959.85	45.50	-27.50	4.8	23.7	0.0	46.50	0.000211349	0.000000008	0.057000000	Pass

Notes: Frequency range investigated was from 20MHz to 11GHz. All spurious and harmonic emissions were investigated. All emissions detected that were less than 20dB below the permissible value were reported. Rated Power output of transmitter at **1089.9MHz = 370 Watts**

CALCULATIONS

Note: The data taken is relative to the radiated power of each spurious emission with reference to the rated power output of the transmitter.

10 log (370W/1mW) = 55.6dBm

55.6dBm - 38dBc =17.6

Inv Log (17.6 dBm/10) = 57.54mW

Spec Limit = 0.057 Watts

ERP Calculations

ERP = $(Ed)^2/30(G)$

E = V/m

d= distance

G = Gain of Antenna (numerical gain of half wave dipole antenna 1.64) per Part 2.1053(a)

Conversion of dBuV/m to V/m

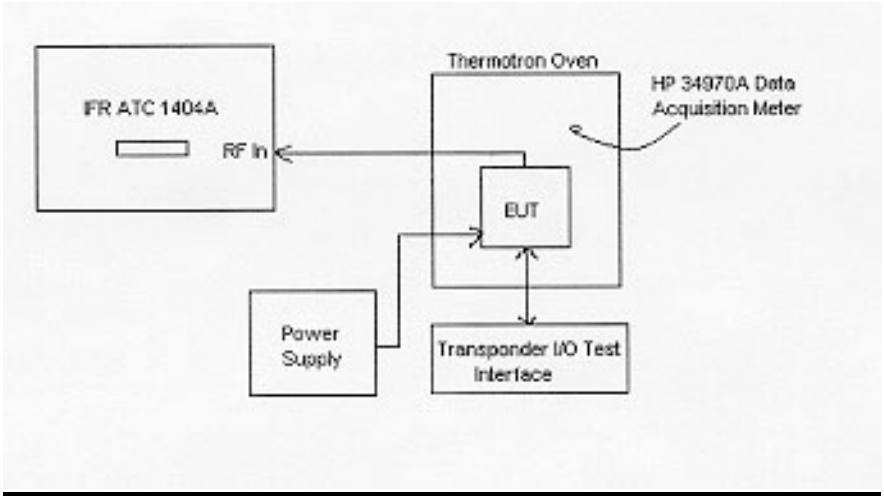
[invlog(Reading in dBuV/m/20)]*.000001 = V/m

2.1033(c)(14)/2.1055/21.101 - FREQUENCY STABILITY

Test Conditions:

The temperature range is from -20°C to 50°C taken in 10° steps. The EUT is setup in the 1200 group mode and is being interrogated by the ATC 1404A during the test. Voltage was at 13.6 nominal, varying 11.6 to 15.6 volts. Transponder was set at 1200 squawk code, integrated by ATC 1400A and 500 reps/sec (and 4 pulses/rep @ 1200).

Diagram of Test Setup Used for Test:



Test Equipment Used:

1. ATC, IFR Americas, Model 1400A-2, S/N 6648. Calibration date: March 25, 1999.
2. Data Acquisition Meter, HP, Model 34970A, S/N US37003067. Calibration date: January 25, 1999. Calibration due date: January 25, 2000.

Test Data:

Temperature(°C)	Frequency(MHz) Vnominal 13.6VDC	Frequency(MHz) Vminimum 11.6VDC	Frequency(MHz) Vmaximum 15.6VDC
Ambient (21.5°C)	1089.87	1089.88	1089.88
-20°C	1089.85	1089.85	1089.85
-10°C	1089.85	1089.86	1089.86
0°C	1089.87	1089.86	1089.86
10°C	1089.86	1089.86	1089.86
20°C	1089.86	1089.86	1089.86
30°C	1089.85	1089.85	1089.85
40°C	1089.86	1089.86	1089.85
50°C	1089.86	1089.86	1089.86