

**TYPE ACCEPTANCE TEST REPORT**

FOR THE  
**UNILINK 601, 01066-00-000**  
**FCC PART 2 & 87**  
**COMPLIANCE**

**DATE OF ISSUE: JULY 1, 1998**

**PREPARED FOR:**

Universal Avionics  
11351 Willows Rd. N.E.  
Redmond, WA 98052-2552

P.O. No: 981620G  
W.O. No: 69,031

**Report No: FCTA98-003A**

**PREPARED BY:**

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Date of test: May 29 & 30, 1998

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ACA/NATA (Australia); SABS (South Africa); SWEDAC (Sweden); TUV Rheinland-Germany; TUV Rheinland-Korea; TUV Rheinland-Russia; Radio Communication Agency (RA); NEMKO (Norway).

## **ADMINISTRATIVE INFORMATION**

**DATE OF TEST:**

May 29 & 39, 1998

**PURPOSE OF TEST:**

To demonstrate the compliance of the  
Unilink 601, 01066-00-000, with the  
requirements for FCC Part 2 & 87 devices.

**MANUFACTURER:**

Universal Avionics  
11351 Willows Rd. N.E.  
Redmond, WA 98052-2552

**REPRESENTATIVE:**

Doug Hilderbrand

**TEST LOCATION:**

CKC Laboratories, Inc.  
22105 Wilson River Hwy  
Tillamook, OR 97141

**TEST PERSONNEL:**

Mike Wilkinson

**TEST METHOD:**

Part 2 & 87

**FREQUENCY RANGE TESTED:**

9 kHz - 2000 MHz

**EQUIPMENT UNDER TEST:**

**Flight Data Transceiver**

Manuf: Universal Avionics  
Model: UL 601  
Serial: NR-1  
FCC ID: Pending

## SUMMARY OF RESULTS

The Universal Avionics Unilink 601, 01066-00-000, was tested in accordance with FCC Part 2 & 87 for compliance with the requirements of the FCC Rules.

As received, the above equipment was found to be fully compliant with the FCC Part 2 & 87 limits of the FCC rules for all emission tests performed.

## EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Aircraft communications hub with embeded VHF transceiver.

## OPERATING FREQUENCY

The operating frequency of the unit is from 117.975 to 137.000 MHz.

## MEASUREMENT UNCERTAINTY

Associated with data in this report is a  $\pm 4$ dB measurement uncertainty.

## PERIPHERAL DEVICES

The EUT was tested with the following peripheral devices:

### NCU

Manuf: Universal Avionics  
Model: 1190-02-2111  
Serial: 999  
FCC ID:

### CDU

Manuf: Universal Avionics  
Model: 1018-1-110  
Serial: 912  
FCC ID:

### Test Mounting Fixture

Manuf: Universal Avionics  
Model: Sysyen Rack  
Serial: 1  
FCC ID:

### Power Supply

Manuf: Topward Elec.  
Model: TPS-2000  
Serial: 946269  
FCC ID:

### Function Generator

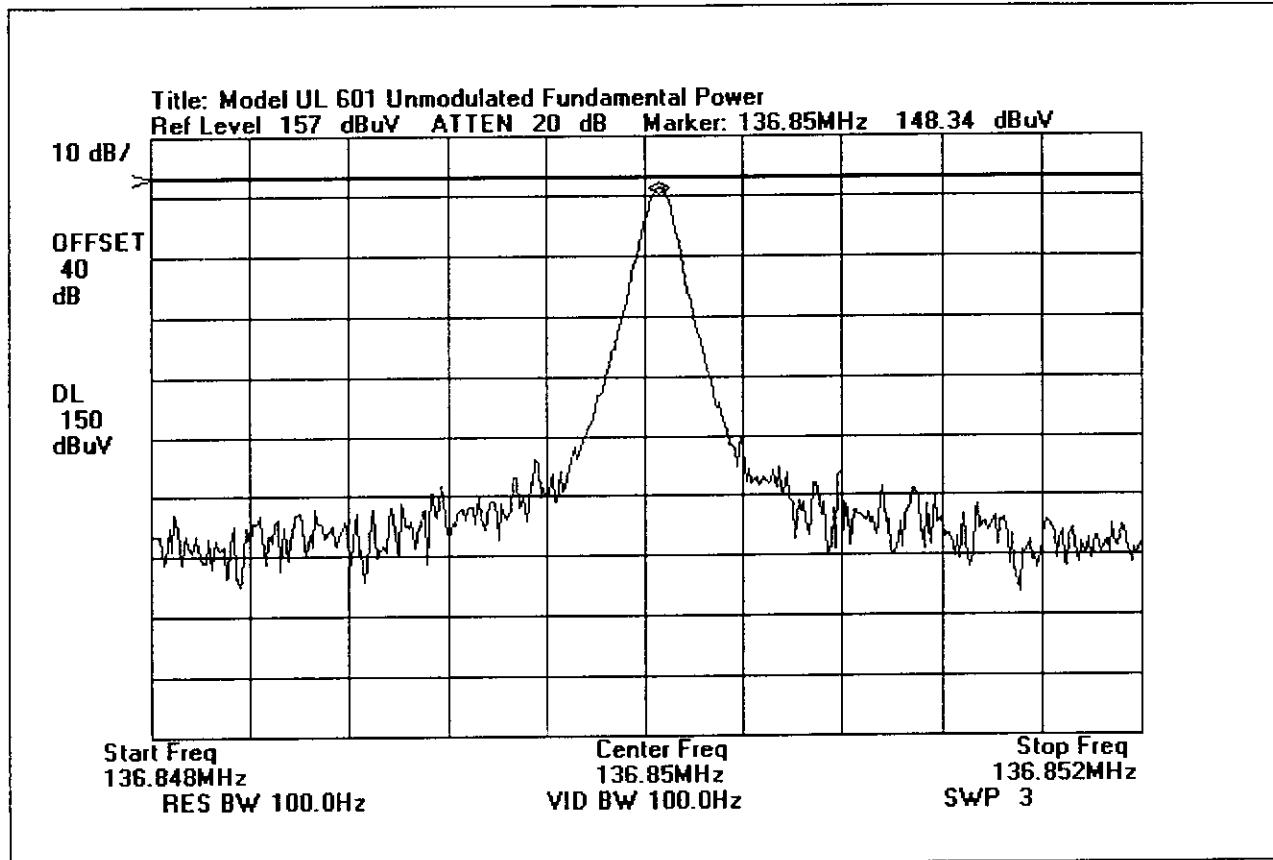
Manuf: BK  
Model: 4011  
Serial: 259-05324  
FCC ID:

## **SECTION A**

### **RF POWER OUTPUT**

**2.985**

**FCC Part 2.985/87.135**  
**RF Power Output**



## **SECTION B**

### **MODULATION CHARACTERISTICS**

**2.987**

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FCC 87.139 / FCC 2.987

Nominal Temperature and Voltage  
13: 11: 39 MAY 29, 1998

hp

REF 160.0 dB $\mu$ V AT 30 dB

147.43 dB $\mu$ V

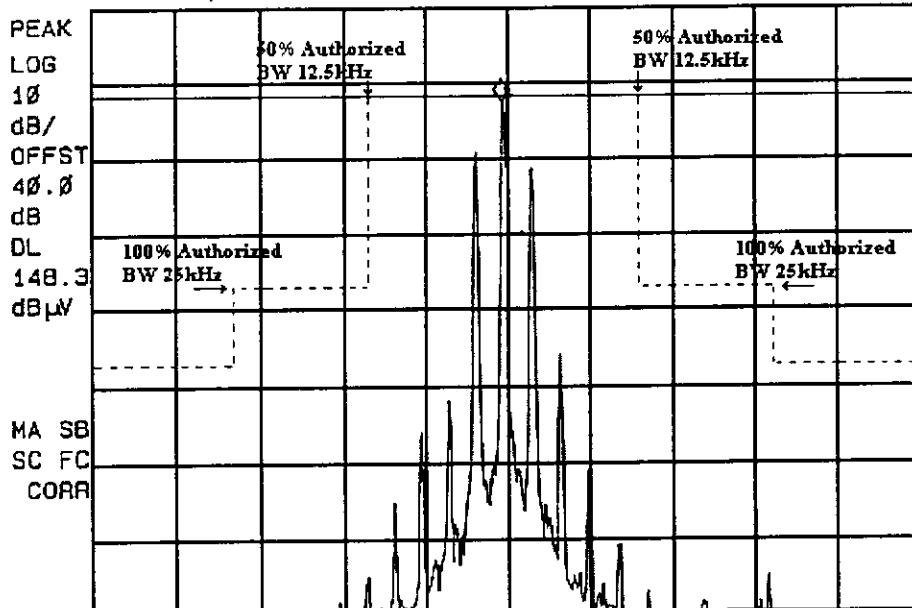
Modulation Characteristics

90% AM modulated  
with a 2.4kHz signal

MKA 136.84965 MHz

*mwh*

5-29-98



MARKER  
→ CF

MARKER  
Δ

NEXT  
PEAK

NEXT PK  
RIGHT

NEXT PK  
LEFT

More  
1 of 2



FCC 87.139 / FCC 2.987

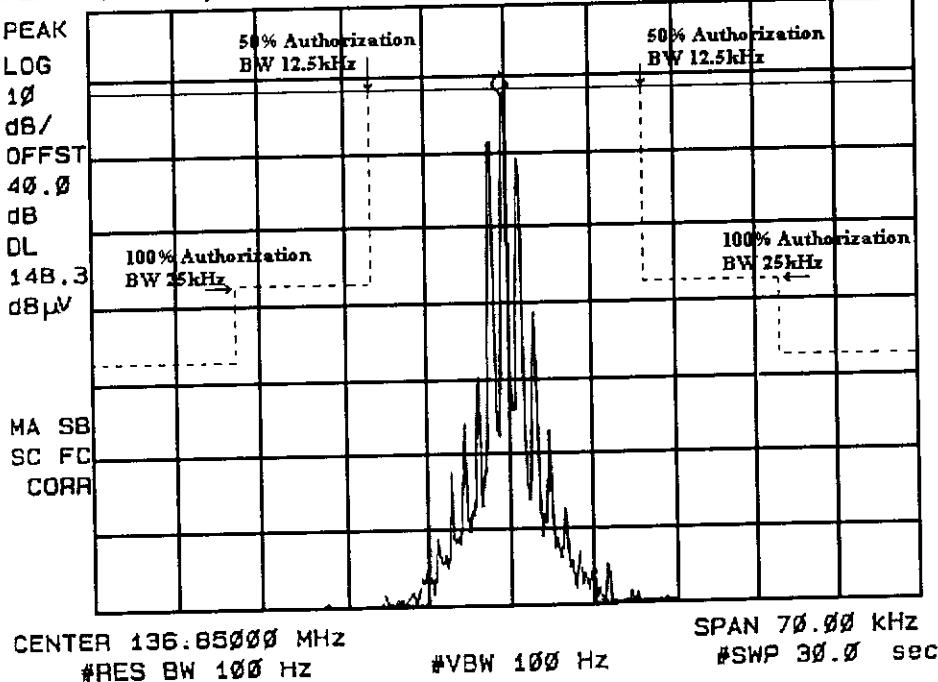
Nominal Temperature and Voltage  
13: 21: 08 MAY 29, 1998

1P

REF 160.0 dB $\mu$ V AT 30 dBModulation Characteristics90% AM modulated  
with a 1.2kHz signalMKR 136.84965 MHz  
147.43 dB $\mu$ Vu. Wilson  
5-24-98CLEAR  
WRITE AMAX  
HOLD A

VIEW A

BLANK A

Trace  
A B CMore  
1 of 3

FCC 87.139 / FCC 2.987

Nominal Temperature and Voltage  
10: 27: 56 MAY 29, 1998

REF 160.0 dB $\mu$ V AT 30 dB

Modulation Characteristics

90% AM modulated  
with a 2.4kHz signal *with* *sc-29-52*

MKA 136.85000 MHz

147.48 dB $\mu$ V

CENTER  
FREQ

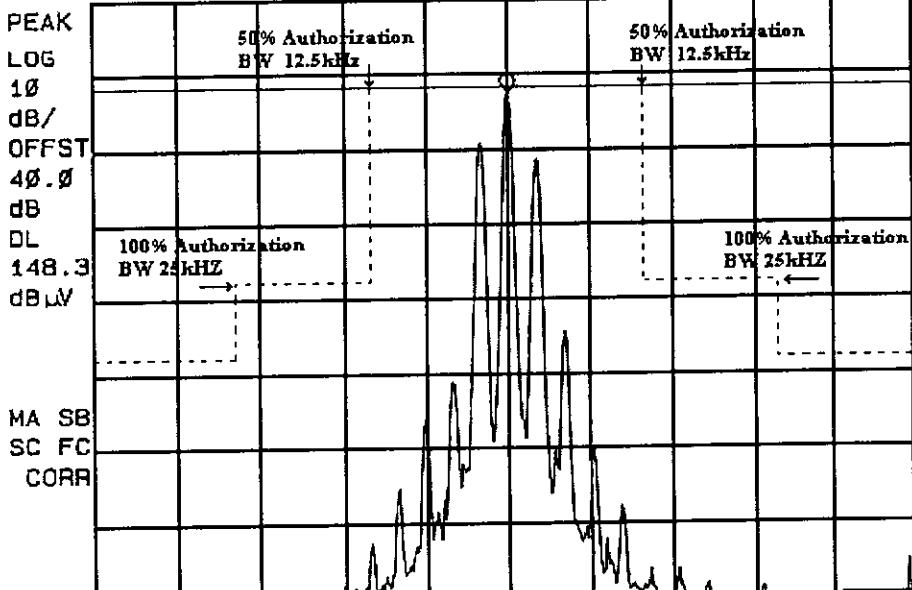
START  
FREQ

STOP  
FREQ

CF STEP  
AUTO MAN

FREQ  
OFFSET

Band  
Lock



CENTER 136.85000 MHz  
#RES BW 300 Hz

#VBW 300 Hz

SPAN 70.00 kHz  
#SWP 20.0 sec



FCC 87.139 / FCC 2.987  
Nominal Temperature and Voltage  
12: 46: 14 MAY 29, 1998

REF 160.0 dB $\mu$ V AT 30 dB

Modulation Characteristics

90% AM modulated  
with a 2.4kHz signal

MKR 136.85000 MHz *4/29/98*  
147.30 dB $\mu$ V

CLEAR  
WRITE A

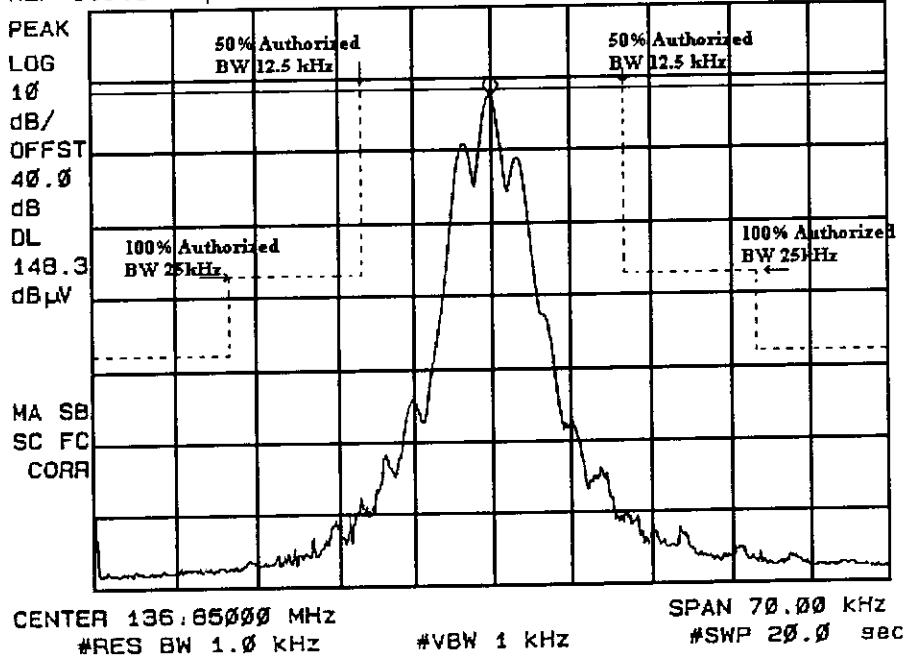
MAX  
HOLD A

VIEW A

BLANK A

Trace  
A B C

More  
1 of 3



## **SECTION C**

### **OCCUPIED BANDWIDTH**

**2.989**

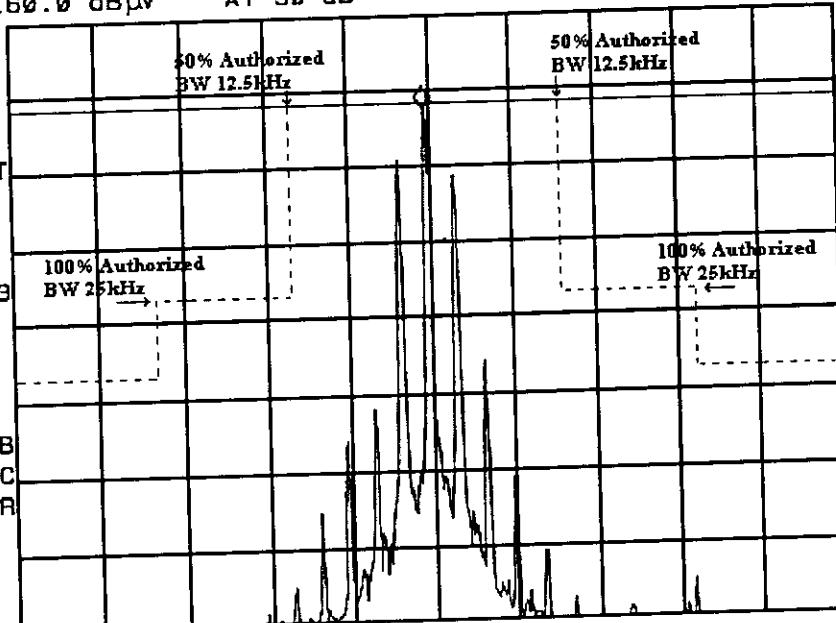
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FCC 87.135 / FCC 2.989  
Nominal Temperature and Voltage  
13: 11: 39 MAY 29, 1998

REF 160.0 dB $\mu$ V AT 30 dB

PEAK  
LOG  
10  
dB/  
OFFST  
40.0  
dB  
DL  
148.3  
dB $\mu$ V

MA SB  
SC FC  
CORR



CENTER 136.84965 MHz  
#RES BW 100 Hz

#VBW 100 Hz

SPAN 70.00 kHz  
#SWP 30.0 sec

Occupied Bandwidth

90% AM modulated  
with a 2.4kHz signal

MKA 136.84965 MHz *m. V. J. J. S.*  
5-29-98

147.43 dB $\mu$ V

MARKER  
→ CF

MARKER  
Δ

NEXT  
PEAK

NEXT PK  
RIGHT

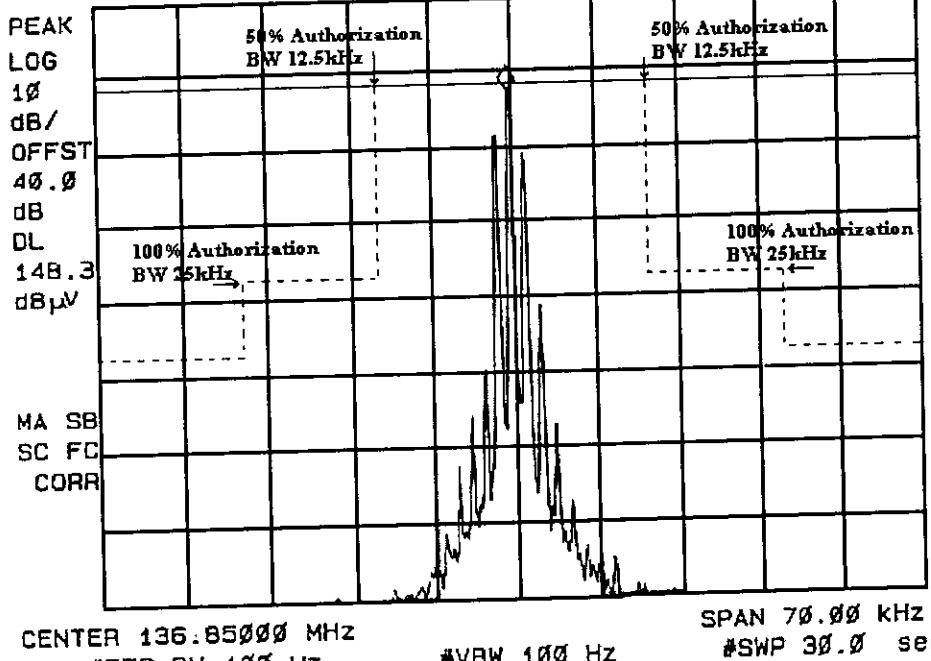
NEXT PK  
LEFT

More  
1 of 2

FCC 87.135 / FCC 2.989

Nominal Temperature and Voltage  
13: 21: 08 MAY 29, 1998

10

REF 160.0 dB $\mu$ V AT 30 dBOccupied Bandwidth90% AM modulated  
with a 1.2kHz signalMKR 136.84965 MHz  
147.43 dB $\mu$ V
*W. Wilson*  
 5-29-98  
 CLEAR  
 WRITE A


CENTER 136.85000 MHz

#RES BW 100 Hz

#VBW 100 Hz

SPAN 70.00 kHz

#SWP 30.0 sec



FCC 87.135 / FCC 2.989  
Nominal Temperature and Voltage  
12: 46: 14 MAY 29, 1998

REF 160.0 dB $\mu$ V AT 30 dB

Occupied Bandwidth

90% AM modulated  
with a 2.4kHz signal

MKA 136.85000 MHz *4621*  
147.30 dB $\mu$ V *5-29-98*

CLEAR

WRITE A

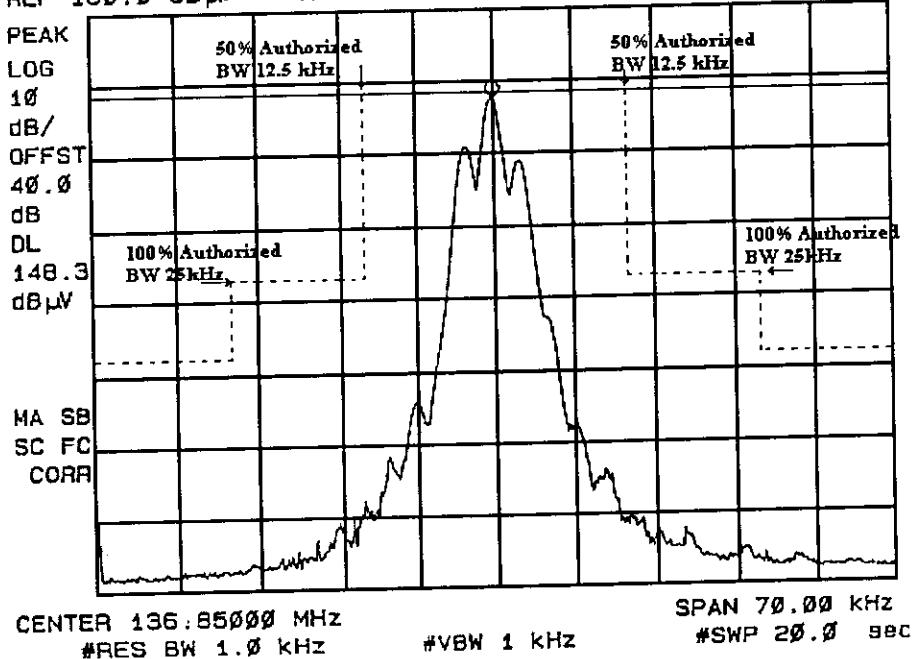
MAX  
HOLD A

VIEW A

BLANK A

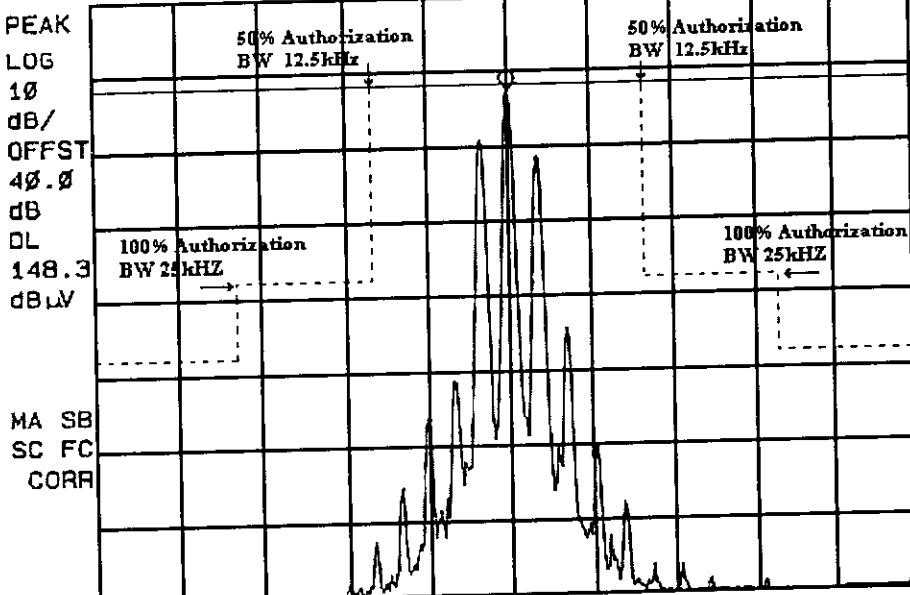
Trace  
A B C

More  
1 of 3





FCC 87.135 / FCC 2.989

Nominal Temperature and Voltage  
10: 27: 56 MAY 29, 1998REF 160.0 dB $\mu$ V AT 30 dBOccupied Bandwidth90% AM modulated  
with a 2.4kHz signal *width* ~~12.5kHz~~ ~~29.58~~  
MKA 136.85000 MHz147.48 dB $\mu$ VCENTER  
FREQSTART  
FREQSTOP  
FREQCF STEP  
AUTO MANFREQ  
OFFSETBand  
Lock

## **SECTION D**

### **SPURIOUS EMISSIONS AT ANTENNA TERMINAL**

**2.991**

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The following table reports the six highest levels recorded during the tests performed on the Unilink 601, 1066-00-000. The data sheets from which this table was compiled follow Table 1.

**Table 1: Six Highest Spurious Emissions at Antenna Terminal**

FREQUENCY MHz	METER READING dB $\mu$ V	CORRECTION FACTORS				CORRECTED READING dB $\mu$ V	SPEC LIMIT dB $\mu$ V	MARGIN dB	NOTES
		Lisn dB	dB	dB	DB				
86.090000	43.0	40.0				83.0	107.3	-24.3	N
136.851000	107.3	40.0				147.3	147.3	0.0	N
153.730000	45.6	40.0				85.6	107.3	-21.7	N
273.700000	48.0	40.0				88.0	107.3	-19.3	N
410.511000	43.7	40.0				83.7	107.3	-23.6	N
547.343000	42.7	40.0				82.7	107.3	-24.6	N

Test Method:  
Spec Limit:  
Test Distance:

Part 2.991  
Part 87.139  
No Distance

NOTES:  
Q = Quasi Peak Reading  
A = Average Reading  
B = Black Lead  
W = White Lead

**COMMENTS:** Test method was FCC part 2.991 & 87.139. Transmitting at 136.850 MHz with 2.4 kHz 90% AM modulation. Measurements are taken at the EUT antenna port. Input voltage is 27.5 VDC. The temperature was 65°F and the humidity was 55%. Frequency range tested was 9 kHz to 1.4 GHz.

Test Location: CKC LABORATORIES INC. • 22105 Wilson River Hwy, Site A • Tillamook, Oregon 97141  
 • (800) 500-4EMC

Customer: **Universal Avionics Systems** Date: May-29-98  
 Specification: **FCC 87.139 / 2.991** Time: 14:14  
 Test Type: **Antenna Cond. Emissions** Sequence#: 1  
 Equipment: **Flight Data Transceiver**  
 Manufacturer: Universal Avionics  
 Model: UL 601  
 S/N: NR-1  
 Tested By: Mike Wilkinson

***Equipment Under Test (\* = EUT):***

Function	Manufacturer	Model #	S/N
Flight Data Transceiver*	Universal Avionics	UL 601	NR-1

***Support Devices:***

Function	Manufacturer	Model #	S/N
NCU	Universal Avionics	1190-02-2111	999
CDU	Universal Avionics	1018-1-110	912
Test Mounting Fixture	Universal Avionics	Sysyen Rack	1
Power Supply	Topward Elec.	TPS-2000	946269
Function Generator	BK	4011	259-05324

***Test Conditions / Notes:***

Test method was FCC part 2.991 & 87.139. Transmitting at 136.850 MHz with 2.4 kHz 90% AM modulation. Measurements are taken at the EUT antenna port. Input voltage is 27.5 VDC. The temperature was 65°F and the humidity was 55%. Frequency range tested was 9 kHz to 1.4 GHz.

***Measurement Data:***

Sorted by Margin

Test Distance: None

40 dB							Dist	Corr	Spec	Margin	Polar
#	Freq	Rdng					dB	dB $\mu$ V/m	dB $\mu$ V/m	dB	
	MHz	dB $\mu$ V	dB	dB	dB	DB					
1	136.851	107.3	+40.0				+0.0	147.3	147.3	+0.0	None
2	273.700	48.0	+40.0				+0.0	88.0	107.3	-19.3	None
3	153.730	45.6	+40.0				+0.0	85.6	107.3	-21.7	None
4	410.511	43.7	+40.0				+0.0	83.7	107.3	-23.6	None
5	86.090	43.0	+40.0				+0.0	83.0	107.3	-24.3	None
6	547.343	42.7	+40.0				+0.0	82.7	107.3	-24.6	None
7	1368.503	41.2	+40.0				+0.0	81.2	107.3	-26.1	None

8	143.360	41.1	+40.0	+0.0	81.1	107.3	-26.2	None
9	1231.653	40.6	+40.0	+0.0	80.6	107.3	-26.7	None
10	2.688	21.0	+0.0	+0.0	21.0	107.3	-86.3	None

## **SECTION E**

### **FIELD STRENGTH OF SPURIOUS RADIATION**

**2.993**

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The following table reports the six highest levels recorded during the tests performed on the Unilink 601, 1066-00-000. The data sheets from which this table was compiled follow the Table 2.

Table 2: Six Highest Field Strength of Spurious Radiation									
FREQUENCY MHz	METER READING dB $\mu$ V	CORRECTION FACTORS				CORRECTED READING dB $\mu$ V/m	SPEC LIMIT dB $\mu$ V/m	MARGIN dB	NOTES
		Ant dB	Amp dB	Cable dB	Dist dB				
273.702	46.1	-5.4				40.7	107.3	-66.6	HQ
410.554	47.8	-6.3				41.5	107.3	-65.8	VQ
684.252	40.6	-1.6				39.0	107.3	-68.3	VQ
821.150	39.3	0.9				40.2	107.3	-67.1	H
1231.655	30.6	7.2				37.8	107.3	-69.5	H
1368.564	29.9	8.6				38.5	107.3	-68.8	V

Test Method: Part 2.993  
 Spec Limit: Part 87.139  
 Test Distance: 3 Meters

NOTES: H = Horizontal Polarization  
 V = Vertical Polarization  
 N = No Polarization  
 D = Dipole Reading  
 Q = Quasi Peak Reading  
 A = Average Reading

COMMENTS: EUT is transmitting into a load (40 dB attenuator) connected to the antenna port at 136.850 MHz with 2.4 kHz 90% modulation. This is a chassis radiation test. Input voltage is 27.5 VDC. The temperature was 65°F and the humidity was 55%. Frequency range tested was 9 kHz to 2 GHz.

Test Location: CKC LABORATORIES INC. • 22105 Wilson River Hwy, Site A • Tillamook, Oregon 97141  
 • (800) 500-4EMC

Customer: **Universal Avionics Systems** Date: May-30-98  
 Specification: **FCC 87.139 / 2.993** Time: 11:28  
 Test Type: **Maximized Emissions** Sequence#: 5  
 Equipment: **Flight Data Transceiver**  
 Manufacturer: Universal Avionics Tested By: Mike Wilkinson  
 Model: UL 601  
 S/N: NR-1

***Equipment Under Test (\* = EUT):***

Function	Manufacturer	Model #	S/N
Flight Data Transceiver*	Universal Avionics	UL 601	NR-1

***Support Devices:***

Function	Manufacturer	Model #	S/N
NCU	Universal Avionics	1190-02-2111	999
CDU	Universal Avionics	1018-1-110	912
Test Mounting Fixture	Universal Avionics	Sysyen Rack	1
Power Supply	Topward Elec.	TPS-2000	946269
Function Generator	BK	4011	259-05324

***Test Conditions / Notes:***

EUT is transmitting into a load (40 dB attenuator) connected to the antenna port at 136.850 MHz with 2.4 kHz 90% modulation. This is a chassis radiation test. Input voltage is 27.5 VDC. The temperature was 65°F and the humidity was 55%. Frequency range tested was 9 kHz to 2 GHz.

Measurement Data:		Sorted by Margin				Test Distance: 3 Meters					
#	Freq MHz	Rdng dB $\mu$ V	Amp-A	Bicon	Cable	Log A	Dist dB	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar
1	410.554	47.8	-27.2	+0.0	+4.7	+16.2	+0.0	41.5	107.3	-65.8	Vert
	Quasi Peak		+0.0								
2	410.552	47.1	-27.2	+0.0	+4.7	+16.2	+0.0	40.8	107.3	-66.5	Horiz
	Quasi Peak		+0.0								
3	273.702	46.0	-26.4	+17.4	+3.6	+0.0	+0.0	40.7	107.3	-66.7	Horiz
	Quasi Peak		+0.0								
4	821.150	39.3	-27.7	+0.0	+7.0	+21.6	+0.0	40.2	107.3	-67.1	Horiz
		+0.0									
5	684.252	40.6	-27.9	+0.0	+6.2	+20.1	+0.0	39.0	107.3	-68.3	Vert
	Quasi Peak		+0.0								
6	1368.496	29.9	-25.9	+0.0	+9.7	+0.0	+0.0	38.5	107.3	-68.8	Horiz
		+24.8									
7	1368.564	29.9	-25.9	+0.0	+9.7	+0.0	+0.0	38.5	107.3	-68.8	Vert
		+24.8									

8	273.742	43.4	-26.4 +0.0	+17.4	+3.6	+0.0	+0.0	38.0	107.3	-69.3	Vert
9	1231.655	30.6	-26.5 +24.8	+0.0	+8.9	+0.0	+0.0	37.8	107.3	-69.5	Horiz
10	126.045	50.8	-27.0 +0.0	+11.3	+2.3	+0.0	+0.0	37.4	107.3	-69.9	Horiz
11	160.006	48.9	-26.8 +0.0	+12.6	+2.6	+0.0	+0.0	37.3	107.3	-70.0	Horiz
12	1231.700	29.7	-26.5 +24.8	+0.0	+8.9	+0.0	+0.0	36.9	107.3	-70.4	Vert
13	1094.808	30.0	-27.0 +24.7	+0.0	+8.2	+0.0	+0.0	35.9	107.3	-71.4	Horiz
14	957.969	31.4	-27.4 +0.0	+0.0	+7.8	+23.7	+0.0	35.5	107.3	-71.8	Horiz
15	1094.809	29.5	-27.0 +24.7	+0.0	+8.2	+0.0	+0.0	35.4	107.3	-71.9	Vert
16	957.941	30.9	-27.4 +0.0	+0.0	+7.8	+23.7	+0.0	35.0	107.3	-72.3	Vert
17	140.006	46.9	-26.9 +0.0	+12.2	+2.4	+0.0	+0.0	34.6	107.3	-72.7	Horiz
18	821.004 Quasi Peak	32.4	-27.7 +0.0	+0.0	+7.0	+21.6	+0.0	33.3	107.3	-74.0	Vert
19	220.035	40.1	-26.5 +0.0	+15.3	+3.2	+0.0	+0.0	32.1	107.3	-75.2	Horiz
20	684.261	33.4	-27.9 +0.0	+0.0	+6.2	+20.1	+0.0	31.8	107.3	-75.5	Horiz
21	547.406	34.5	-27.9 +0.0	+0.0	+5.4	+18.1	+0.0	30.1	107.3	-77.2	Vert
22	547.385	33.2	-27.9 +0.0	+0.0	+5.4	+18.1	+0.0	28.8	107.3	-78.5	Horiz
23	136.850	74.7	-26.9 +0.0	+12.0	+2.3	+0.0	+0.0	62.1	147.3	-85.2	Vert

## **SECTION F**

### **FREQUENCY STABILITY**

**2.995**

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Table 3: Frequency Stability

Temp. °C	Voltage -15%	Nominal Voltage	Voltage +15%	Lower Limit (Hz)	Upper Limit (Hz)	Pass/Fail
-30	136,850,182	136,850,196	136,850,196	136,847,263	136,852,737	Pass
-20	136,850,151	136,850,159	136,850,148	136,847,263	136,852,737	Pass
-10	136,850,131	136,850,129	136,850,135	136,847,263	136,852,737	Pass
0	136,850,137	136,850,142	136,850,145	136,847,263	136,852,737	Pass
10	136,850,115	136,850,113	136,850,114	136,847,263	136,852,737	Pass
20	136,850,063	136,850,071	136,850,074	136,847,263	136,852,737	Pass
30	136,850,051	136,850,052	136,850,052	136,847,263	136,852,737	Pass
40	136,850,064	136,850,061	136,850,066	136,847,263	136,852,737	Pass
50	136,850,043	136,850,059	136,850,049	136,847,263	136,852,737	Pass

## Notes:

Test method: FCC Part 2 &amp; 87

Spec. Limit: FCC Part 87.133\2.995 ( 20 PPM)

Transmit Frequency = 136.850 MHz

Nominal Voltage = 27.5 VDC, -15% = 23.37 VDC, +15% = 31.62 VDC

## **SECTION G**

### **FREQUENCY SPECTRUM TO BE INVESTIGATED**

**2.997**

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**TABLE A**  
**LIST OF TEST EQUIPMENT**

1. Spectrum Analyzer, Hewlett Packard, Model No. 85680A S/N 2130A1602, (Display Unit ) 85662A, S/N 2112A02570.
2. Preamp, Hewlett Packard, Model No. 8447D, S/N 2727A05432.
3. Quasi-Peak Adapter, Hewlett Packard, Model No. 85650A, S/N 2043A00104.
4. Biconical Antenna, A. H. Systems, Model No. SAS200/540, S/N 273.
5. Horn Antenna, EMCO 3115, S/N 3413.
6. Magnetic Loop Antenna, Elec. Mech, S/N 6502.
7. Log Periodic Antenna, A. H. Systems, Model No. SAS200/510, S/N 55.
8. LISN, Solar Electronics, Model No. 50uH, S/N 373.
9. Test software, EMI Test 2.91.

## EUT SETUP

The equipment under test (EUT) and the peripherals listed were setup in a manner that represented their normal use, as shown in the setup photographs in Appendix A. Any special conditions required for the EUT to operate normally are identified in the comments that accompany Tables 1, 2, & 3.

During radiated emissions testing, the EUT was mounted on a nonconductive, rotating table approximately 80 cm above the conductive grid. The nonconductive table dimensions were 1 meter by 1.5 meters. This configuration is typical for radiated emissions testing of rack mounted devices.

I/O cables were connected to the EUT and peripherals in the manner required for normal operation of the system.

## TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed in Table A were used to collect both the radiated and conducted emissions data for the Unilink 601, 01066-00-000. For radiated measurements below 30MHz, the magnetic loop was used. For frequencies from 30 – 300 MHz the biconical antenna was used. For frequencies from 300 to 1000 MHz, the log periodic antenna was used. For frequencies above 1000 MHz the horn antenna was used. All antennas were located at a distance of 3 meters from the edge of the EUT. Conducted emissions tests required the use of the FCC type LISN's.

The HP spectrum analyzer was used for all measurements. Table B shows the analyzer bandwidth settings that were used in designated frequency bands. For conducted emissions, a reference level of 100 dB $\mu$ V and a vertical scale size of 10 dB per division were used. A 10 dB external attenuator was also used during conducted tests, with internal offset correction in the analyzer. During radiated testing, the measurements were made with 0 dB of attenuation, a reference level of 97 dB $\mu$ V, and a vertical scale of 10 dB per division.

TABLE B : ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE

TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	9 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	2000 MHz	1 MHz

## SPECTRUM ANALYZER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in Tables 1 & 2 indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "Peak" mode. Whenever a "Quasi-Peak" or "Average" reading is listed as one of the six highest readings, this is indicated as a "Q" or an "A" in Tables 1 & 2. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data for the Unilink 601, 01066-00-000.

### Peak

In this mode, the spectrum Analyzer or test engineer recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature of the analyzer called "peak hold," the analyzer had the ability to measure transients or low duty cycle transient emission peak levels. In this mode the analyzer made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

### Quasi-Peak

When the true peak values exceeded or were within 2 dB of the specification limit, quasi-peak measurements were taken using the HP 85650A Quasi-Peak Adapter for the HP 8568B spectrum Analyzer. The detailed procedure for making quasi peak measurements contained in the HP Quasi-Peak Adapter manual were followed.

### Average

When the frequencies exceed 1 GHz, average measurements may be made using the spectrum analyzer. To make these measurements, the test engineer reduces the video bandwidth on the analyzer until the modulation of the signal is filtered out. At this point the analyzer is set into the linear mode and the scan time is reduced.

## TEST METHODS

The emissions data of the Unilink 601, 01066-00-000, was taken with the HP spectrum Analyzer. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the "Sample Calculations". The corrected data was then compared to the applicable FCC 87 emissions limits to determine compliance.

Preliminary and final measurements were taken in order to better ensure that all emissions from the EUT were found and maximized.

### Radiated Emissions Testing

During the preliminary radiated scan, the EUT was powered up and operating in its defined FCC test mode with the I/O cables and line cords facing the antenna. For frequencies below 30 MHz the magnetic loop antenna was used. The frequency range of 30 MHz - 88 MHz was then scanned with the biconical antenna located about 1.5 meter above the ground plane in the vertical configuration. During this scan, the turntable was rotated and all peaks which were at or near the limit were recorded. The frequency range of 100 - 300 MHz was scanned in the same manner, using the biconical antenna, and the peaks recorded. Lastly, a scan of the FM band from 88 - 110 MHz was made, using a reduced resolution bandwidth and a reduced frequency span. The biconical antenna was changed to the horizontal polarity and the above steps were repeated. After changing to the log periodic antenna in the horizontal configuration, the frequency range of 300 - 1000 MHz was scanned. The log periodic antenna was changed to the vertical polarity and the frequency range of 300 - 1000 MHz was again scanned. The horn antenna was used to scan for frequencies above 1000 MHz. Care was taken to ensure that no frequencies were missed within the FM and TV bands. An analysis was performed to determine if the signals that were at or near the limit were caused by an ambient transmission. If unable to determine by analysis, the equipment was powered down to make the final determination if the EUT was the source of the emission.

For the final radiated scan, the equipment was again positioned with its I/O and power cables facing the antenna. A thorough scan of all frequencies was manually made using a small frequency span, rotating the turntable as needed. Comparison with the previously recorded measurements was then made.

Using the peak readings from both scans as a guide, the test engineer then maximized the readings with respect to the table rotation, antenna height and configuration of the peripherals and cables. Maximizing of the cables was achieved by monitoring the spectrum analyzer on a closed circuit television monitor while the EUT cables were being moved and rearranged on the EUT table for maximum emissions. Photographs showing the final worst case configuration of the EUT are contained in Appendix A.

### **RF Power Output 2.985**

The Unilink 601, 01066-00-000, was tested in accordance to FCC Part 2 & 87 and is compliant with the requirements for FCC Part 2.985 & 87.135. The data obtained for this test is contained in Section A.

### **Modulation Characteristics 2.987**

The Unilink 601, 01066-00-000, was tested in accordance to FCC Part 2 & 87 and is compliant with the requirements for FCC Part 2.987 & 87.139. The data obtained for this test is contained in Section B.

### **Occupied Bandwidth 2.989**

The Unilink 601, 01066-00-000, was tested in accordance FCC Part 2 & 87 and is compliant with the requirements for FCC Part 2.989 & 87.135. The data obtained for this test is contained in Section C.

### **Spurious Emissions at Antenna Terminal 2.991**

The Unilink 601, 01066-00-000, was tested in accordance to FCC Part 2 & 87 and is compliant with the requirements for FCC Part 2.991 & 87.139. All data sheets and a six highest readings summary table are contained in Section D.

### **Field Strength of Spurious Radiation 2.993**

The Unilink 601, 01066-00-000, was tested in accordance to FCC Part 2 & 87 and is compliant with the requirements for FCC Part 2.993 & 87.139. All data sheets and a six highest readings summary table are contained in Section E.

### **Frequency Stability 2.995**

The Unilink 601, 01066-00-000, was tested in accordance to FCC Part 2 & 87 and is compliant with the requirements for FCC Part 2.995 & 87.133. The data obtained for this test is contained in Section F.

## SAMPLE CALCULATIONS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in Section E. For radiated emissions in dB $\mu$ V/m, the spectrum analyzer reading in dB $\mu$ V was corrected by using the following formula:

Meter reading (dB $\mu$ V)  
 + Antenna Factor (dB)  
 + Cable Loss (dB)  
 - Distance Correction (dB)  
 - Pre-amplifier Gain (dB)  
 = Corrected Reading(dB $\mu$ V/m)

This reading was then compared to the applicable specification limit to determine compliance. For conducted emissions, no correction factors were needed when 50  $\mu$ H LISN's were used.

#	Freq MHz	Rdng dB $\mu$ V	Amp A	Bicon	LOG A	Horn	Cable	Dist	Corr dBm	40 dB	Spec	Margin	Polar
---	-------------	--------------------	----------	-------	-------	------	-------	------	-------------	----------	------	--------	-------

# means reading number

**Freq MHz** is the frequency in MHz of the obtained reading.

**Rdng dB $\mu$ V** is the reading obtained on the spectrum analyzer in dB $\mu$ V.

**Amp A** is short for the preamplifier factor or gain in dB.

**Horn** is the Horn Antenna factor in dB.

**Bicon** is the Biconical antenna factor in dB.

**LOG A** is the Log Periodic Antenna factor in dB.

**Cable** are the cable loss factor in dB of the coaxial cable at the 10 meter stub-up position on the OATS.

**Dist** is the distance factor (in dB). It is used when testing at a different test distance than the one stated in the spec.

**Corr dBm** is the Corrected reading which is now in dBm (field strength).

**Spec** is the Specification limit (dB) stated in the agency's regulations.

**Margin** is the closeness to the specified limit in dB; + is over and - is under the limit.

**Polar** is the Polarity of the antenna with respect to earth.

**40 dB** is the 40 dB attenuator factor.

**APPENDIX A**  
**INFORMATION ABOUT THE EQUIPMENT UNDER TEST**

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**INFORMATION ABOUT THE EQUIPMENT UNDER TEST**

Test Software/Firmware: SCN 11.1 AND 4/23  
 LCD was displaying: Unilink frequency page  
 Power Supply Manufacturer: Universal Avionics  
 Power Supply Part Number: 01066080  
 AC Line Filter Manufacturer: N/A  
 AC Line Filter Part Number: N/A

Line voltage used during testing: 27.5 VDC

I/O PORTS	
Type	#
RS232/422	8
ARINC 429 TX	3
ARINC 429 RX	8

CRYSTAL OSCILLATORS	
Type	Freq In MHz
Xt	20
Xt	11.9808
Xt	14.74
Xt	10.7

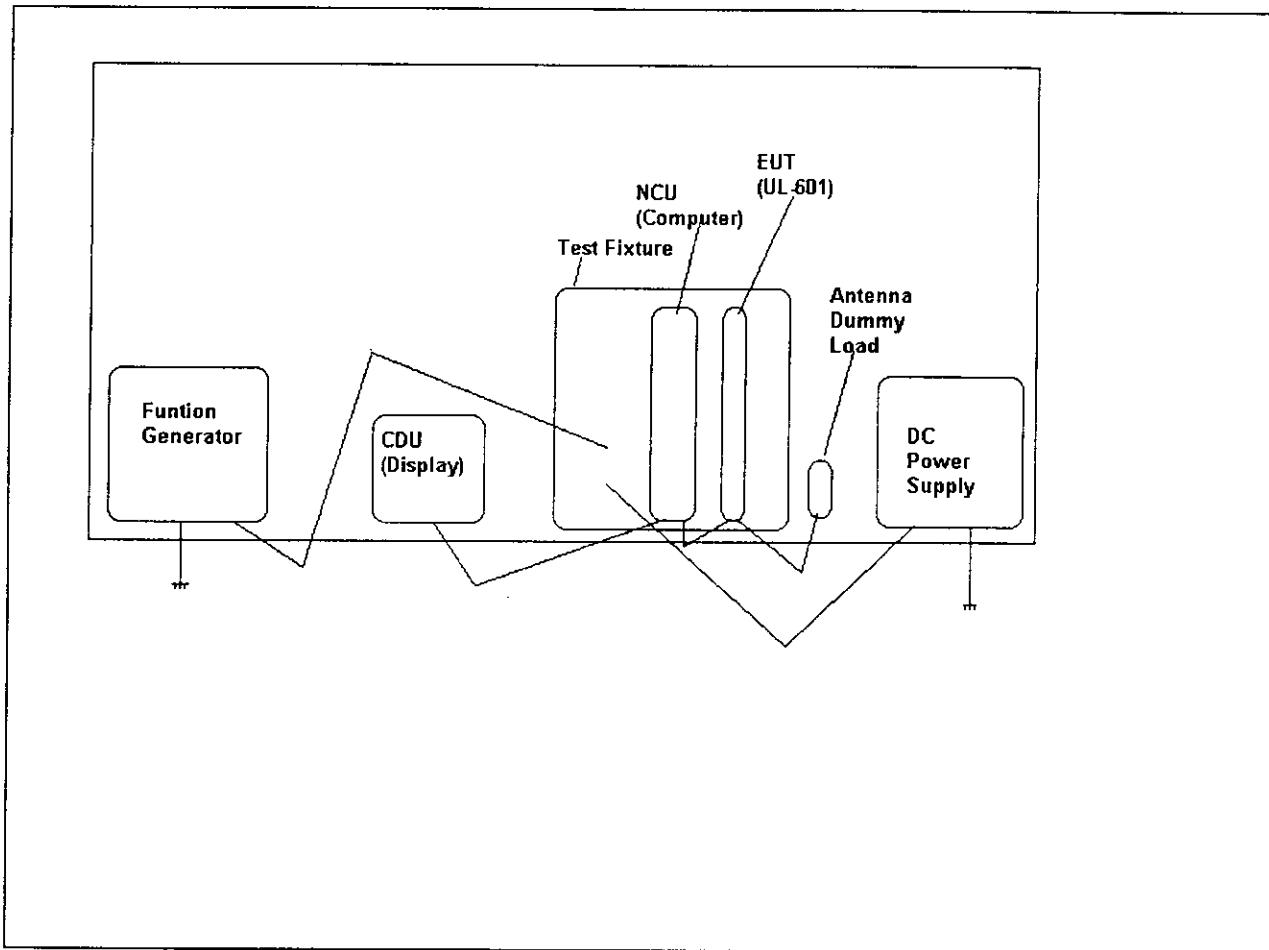
**PRINTED CIRCUIT BOARDS**

Function	Model & Rev	Clocks, MHz	Layers	Location
01065086	UL 600	20, 11.9808	6	Rear slot
01065850	Modem	14.74	4	On UL 600
01066300	Transceiver	10.7	6	Fwd slot
01066310	Amplifier	N/A	4	On Transceiver
01066320	Digital board	7.37, 4.00	4	On Transceiver
01066080	SM Power supply	100 kHz	4	Chassis cavity

### CABLE INFORMATION

Cable #: System rack	Cable(s) of this type:
Cable Type: Construction: Point to point Connected To End (1): Connector At End (1): Shield Grounded At (1): Part Number:	Shield Type: Length In Meters: Connected To End (2): Connector At End (2): Shield Grounded At (2): Number of Conductors:
Notes: A rack in which all components are plugged into.	

### EQUIPMENT CONFIGURATION BLOCK DIAGRAM





*EXHIBIT D*

CKC TEST REPORT



VERIFICATION TEST REPORT

FOR THE

UNILINK 601, 01066-00-000

FCC PART 2 & 87

COMPLIANCE

DATE OF ISSUE: JULY 1, 1998

PREPARED FOR:

Universal Avionics  
11351 Willows Rd. N.E.  
Redmond, WA 98052-2552

P.O. No: 981620G  
W.O. No: 69,031

Report No: FCTA98-003

PREPARED BY:

Monika Lopez  
CKC Laboratories, Inc.  
5473A Clouds Rest  
Mariposa, CA 95338

Date of test: May 29 & 30, 1998

DOCUMENTATION CONTROL:

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CKC Laboratories, Inc.

APPROVED BY:

Dennis Ward  
Dennis Ward  
Director of Laboratories  
CKC Laboratories, Inc.

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**CKC Laboratories, Inc. has Certificates of Accreditation from the following agencies:**  
DATech (Germany); A2LA (USA); FCC (USA); VCCI (Japan); BCIQ (Taiwan); HOKLAS (Hong Kong).  
**CKC Laboratories, Inc. has Letters of Acceptance through an MRA for the following agencies:**  
ACA/NATA (Australia); SABS (South Africa); SWEDAC (Sweden); TUV Rheinland-Germany; TUV Rheinland-Korea; TUV Rheinland-Russia; Radio Communication Agency (RA); NEMKO (Norway).

## ADMINISTRATIVE INFORMATION

**DATE OF TEST:** May 29 & 30, 1998

**PURPOSE OF TEST:** To demonstrate the compliance of the Unilink 601, 01066-00-000, with the requirements for FCC Part 2 & 87 devices.

**MANUFACTURER:** Universal Avionics  
11351 Willows Rd. N.E.  
Redmond, WA 98052-2552

**REPRESENTATIVE:** Doug Hilderbrand

**TEST LOCATION:** CKC Laboratories, Inc.  
22105 Wilson River Hwy  
Tillamook, OR 97141

**TEST PERSONNEL:** Mike Wilkinson

**TEST METHOD:** Part 2 & 87

**FREQUENCY RANGE TESTED:** 9 kHz - 2000 MHz

**EQUIPMENT UNDER TEST:**

<b>Flight Data Transceiver</b>	
Manuf:	Universal Avionics
Model:	UL 601
Serial:	NR-1
FCC ID:	Pending

## SUMMARY OF RESULTS

The Universal Avionics Unilink 601, 01066-00-000, was tested in accordance with FCC Part 2 & 87 for compliance with the requirements of the FCC Rules.

As received, the above equipment was found to be fully compliant with the FCC Part 2 & 87 limits of the FCC rules for all emission tests performed.

## EQUIPMENT UNDER TEST (EUT) DESCRIPTION

Aircraft communications hub with embeded VHF transceiver.

## MEASUREMENT UNCERTAINTY

Associated with data in this report is a  $\pm 4$ dB measurement uncertainty.

## PERIPHERAL DEVICES

The EUT was tested with the following peripheral devices:

### NCU

Manuf: Universal Avionics  
Model: 1190-02-2111  
Serial: 999  
FCC ID:

### CDU

Manuf: Universal Avionics  
Model: 1018-1-110  
Serial: 912  
FCC ID:

### Test Mounting Fixture

Manuf: Universal Avionics  
Model: Sysyen Rack  
Serial: 1  
FCC ID:

### Power Supply

Manuf: Topward Elec.  
Model: TPS-2000  
Serial: 946269  
FCC ID:

### Function Generator

Manuf: BK  
Model: 4011  
Serial: 259-05324  
FCC ID:

## REPORT OF MEASUREMENTS

The following tables report the levels recorded during the tests performed on the Unilink 601, 01066-00-000. The data sheets from which these tables were compiled are contained in Appendix B.

**Table 1: Six Highest Radiated Emission Levels 9 kHz - 2 GHz**

FREQUENCY MHz	METER READING dB $\mu$ V	CORRECTION FACTORS				CORRECTED READING dB $\mu$ V/m	SPEC LIMIT dB $\mu$ V/m	MARGIN dB	NOTES
		Ant dB	Amp dB	Cable dB	Dist dB				
126.045	50.8	11.3	-27.0	2.3		37.4	43.5	-6.1	H
160.006	48.9	12.6	-26.8	2.6		37.3	43.5	-6.2	H
273.702	46.1	17.4	-26.4	3.6		40.7	46.0	-5.3	HQ
410.554	47.8	16.2	-27.2	4.7		41.5	46.0	-4.5	VQ
684.252	40.6	20.1	-27.9	6.2		39.0	46.0	-7.0	VQ
821.150	39.3	21.6	-27.7	7.0		40.2	46.0	-5.8	H

Test Method:

Part 2 & 87

NOTES:

H = Horizontal Polarization

Spec Limit :

FCC Part 2.993\87.139(a)\15.209

V = Vertical Polarization

Test Distance:

3 Meters

N = No Polarization

D = Dipole Reading

Q = Quasi Peak Reading

A = Average Reading

**COMMENTS:** EUT is transmitting into a load (40 dB attenuator) connected to the antenna port at 136.850 MHz with 2.4 kHz 90% modulation. Input voltage is 27.5 VDC. The temperature was 65 Degrees Fahrenheit and the humidity was 55%. Frequency range tested was 9 kHz to 2 GHz.

In accordance with FCC Part 15.209, 9kHz-1.4GHz. Alternately, if  $-(43+10\log E)$  is a lesser attenuation (where E is the average field strength measured at the center frequency with the transmitter operating into a dummy load), this attenuation may be used. In Band emissions are excluded from the spurious emissions requirement but meet 2.989.

**Table 2: Six Highest Radiated Emission Levels 30 MHz - 2 GHz**

FREQUENCY MHz	METER READING dB $\mu$ V	CORRECTION FACTORS				CORRECTED READING dB $\mu$ V/m	SPEC LIMIT dB $\mu$ V/m	MARGIN dB	NOTES
		Ant dB	Amp dB	Cable dB	Dist dB				
122.015	49.6	11.1	-27.0	2.2		35.9	43.5	-7.6	H
126.015	50.7	11.3	-27.0	2.3		37.3	43.5	-6.2	H
128.043	49.7	11.4	-27.0	2.3		36.4	43.5	-7.1	H
140.000	49.9	12.2	-26.9	2.4		37.6	43.5	-5.9	HQ
160.005	54.0	12.6	-26.8	2.6		42.4	43.5	-1.1	HQ
219.997	46.3	15.3	-26.5	3.2		38.3	46.0	-7.7	H

Test Method: ANSI C63.4 1992  
 Spec Limit : FCC Part 15.209  
 Test Distance: 3 Meters

NOTES: H = Horizontal Polarization  
 V = Vertical Polarization  
 N = No Polarization  
 D = Dipole Reading  
 Q = Quasi Peak Reading  
 A = Average Reading

**COMMENTS:** The table above was compiled from a combination of the following test conditions:

- EUT is in the receive only mode and is tuned to 118.000 MHz. Input voltage is 27.5 VDC. The temperature was 65 Degrees Fahrenheit and the humidity was 55%. Frequency range tested was 30 MHz to 2 GHz.
- EUT is in the receive only mode and is tuned to 126.500 MHz. Input voltage is 27.5 VDC. The temperature was 65 Degrees Fahrenheit and the humidity was 55%. Frequency range tested was 30 MHz to 2 GHz.
- EUT is in the receive only mode and is tuned to 136.850 MHz. Input voltage is 27.5 VDC. The temperature was 65 Degrees Fahrenheit and the humidity was 55%. Frequency range tested was 30 MHz to 2 GHz.

**Table 3: Six Highest Antenna Port Conducted Emission Levels 9kHz - 1.4 GHz**

FREQUENCY MHz	METER READING dB $\mu$ V	CORRECTION FACTORS				CORRECTED READING dB $\mu$ V	SPEC LIMIT dB $\mu$ V	MARGIN dB	NOTES
		40 dB	40 dB	40 dB	40 dB				
86.090000	43.0	40.0				83.0	108.4	-25.4	N
136.850600	107.3	40.0				147.3	148.4	-1.1	N
153.730000	45.6	40.0				85.6	108.4	-22.8	N
273.700000	48.0	40.0				88.0	108.4	-20.4	N
410.511200	43.7	40.0				83.7	108.4	-24.7	N
547.343000	42.7	40.0				82.7	108.4	-25.7	N

Test Method:

Part 2 &amp; 87

NOTES: Q = Quasi Peak Reading

Spec Limit :

FCC Part 2.991\87.139 (a)

A = Average Reading

Test Distance:

No Distance

B = Black Lead

W = White Lead

N = No Polarity

**COMMENTS:** Test method was FCC part 2 & 87. Transmitting at 136.850 MHz with 2.4 kHz 90% AM modulation. Measurements are taken at the EUT antenna port. Input voltage is 27.5 VDC. The temperature was 65 Degrees Fahrenheit and the humidity was 55%. Frequency range tested was 9 kHz to 1.4 GHz.

$$\begin{aligned}
 \text{Measured Power Output in mW} &= 148.4 \text{dBuV} - 107 \text{ dB} \\
 &= (41.4/10) \text{Inv log} \\
 &= 4.14 \text{ Inv log} \\
 &= 13804 \text{ mW}
 \end{aligned}$$

**Measured Power Output = 13.804 Watts**

**Table 4: Frequency Stability**

Temp. °C	Voltage -15%	Nominal Voltage	Voltage +15%	Lower Limit (Hz)	Upper Limit (Hz)	Pass/Fail
-30	136,850,182	136,850,196	136,850,196	136,847,263	136,852,737	Pass
-20	136,850,151	136,850,159	136,850,148	136,847,263	136,852,737	Pass
-10	136,850,131	136,850,129	136,850,135	136,847,263	136,852,737	Pass
0	136,850,137	136,850,142	136,850,145	136,847,263	136,852,737	Pass
10	136,850,115	136,850,113	136,850,114	136,847,263	136,852,737	Pass
20	136,850,063	136,850,071	136,850,074	136,847,263	136,852,737	Pass
30	136,850,051	136,850,052	136,850,052	136,847,263	136,852,737	Pass
40	136,850,064	136,850,061	136,850,066	136,847,263	136,852,737	Pass
50	136,850,043	136,850,059	136,850,049	136,847,263	136,852,737	Pass

**Notes:**

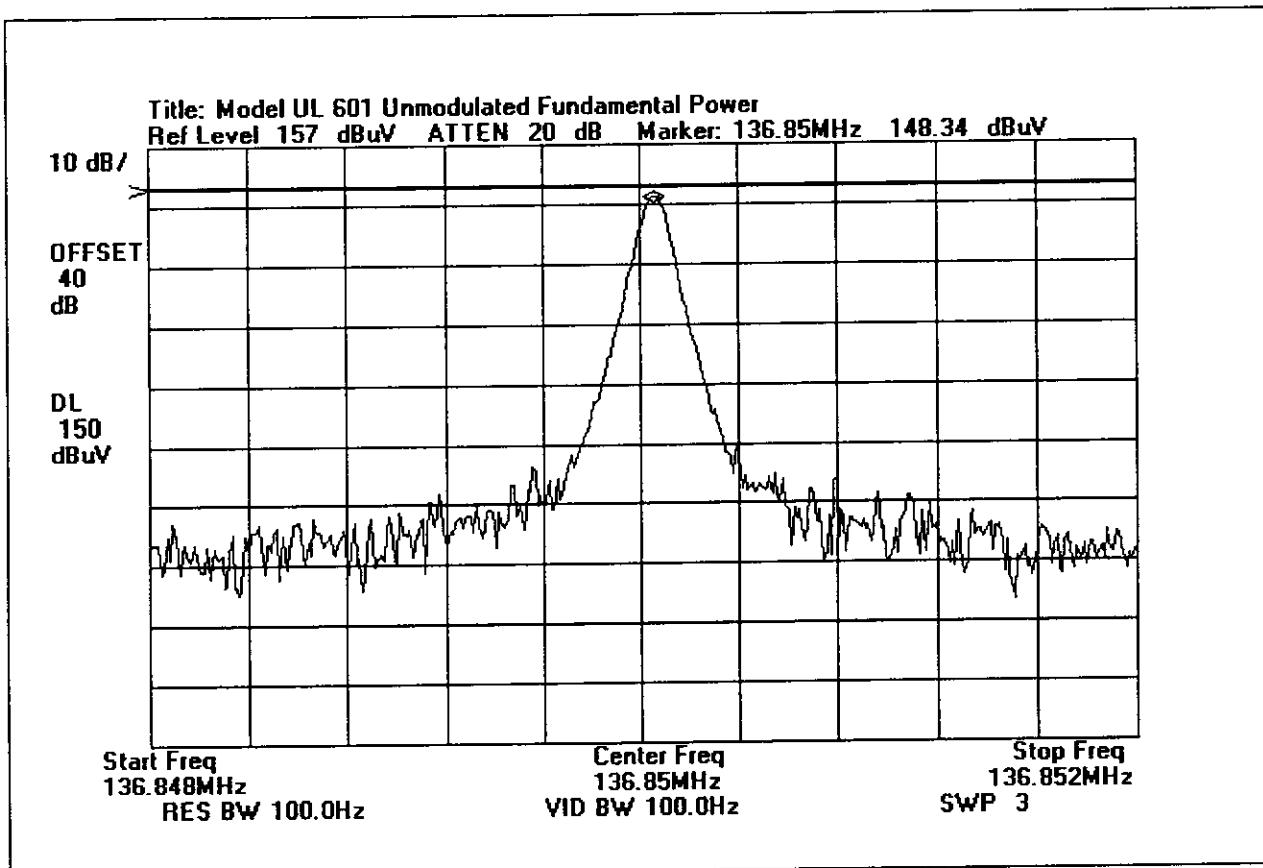
Test method: FCC Part 2 &amp; 87

Spec. Limit: FCC Part 87.133\2.995 ( 20 PPM)

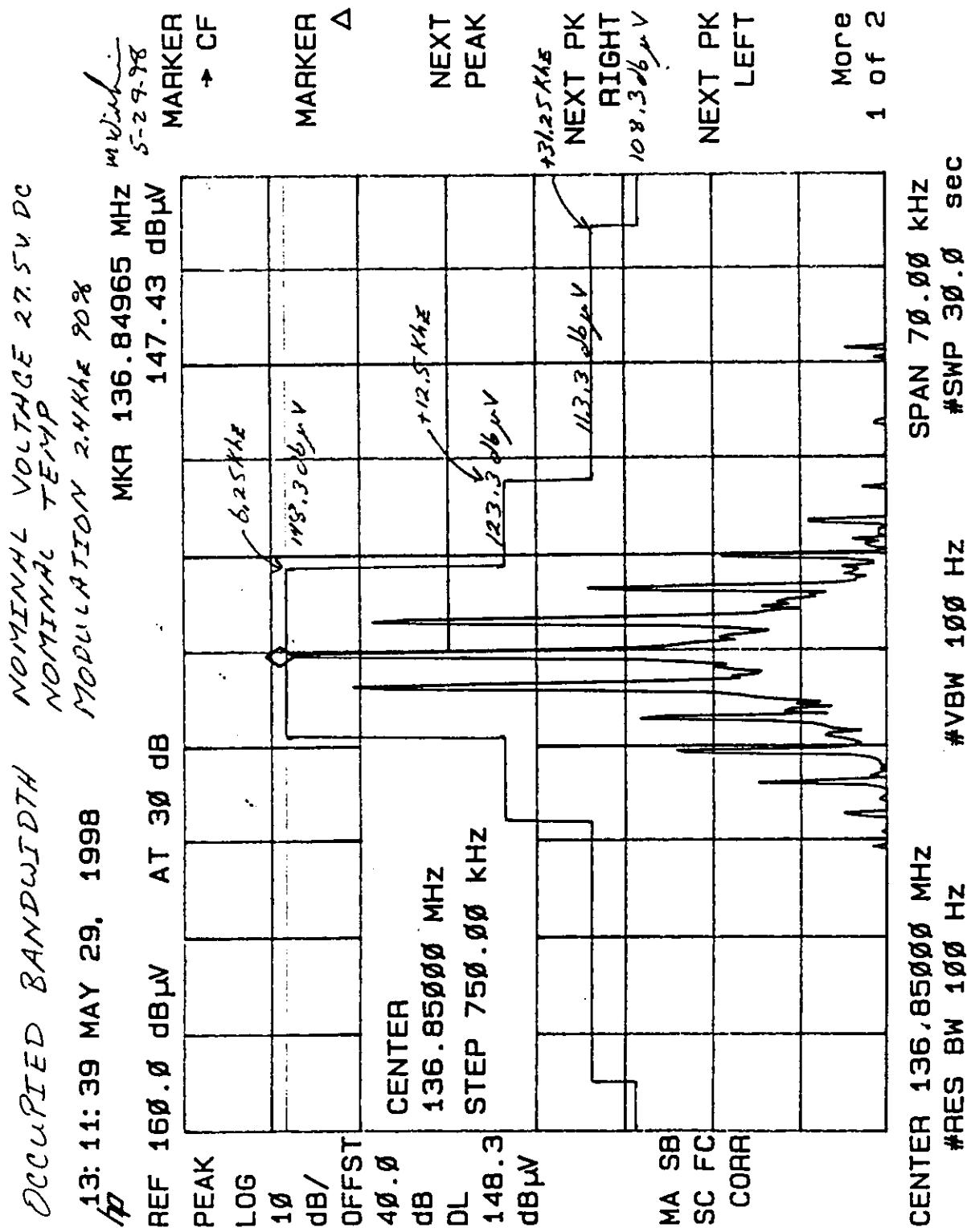
Transmit Frequency = 136.850 MHz

Nominal Voltage = 27.5 VDC, -15% = 23.37 VDC, +15% = 31.62 VDC

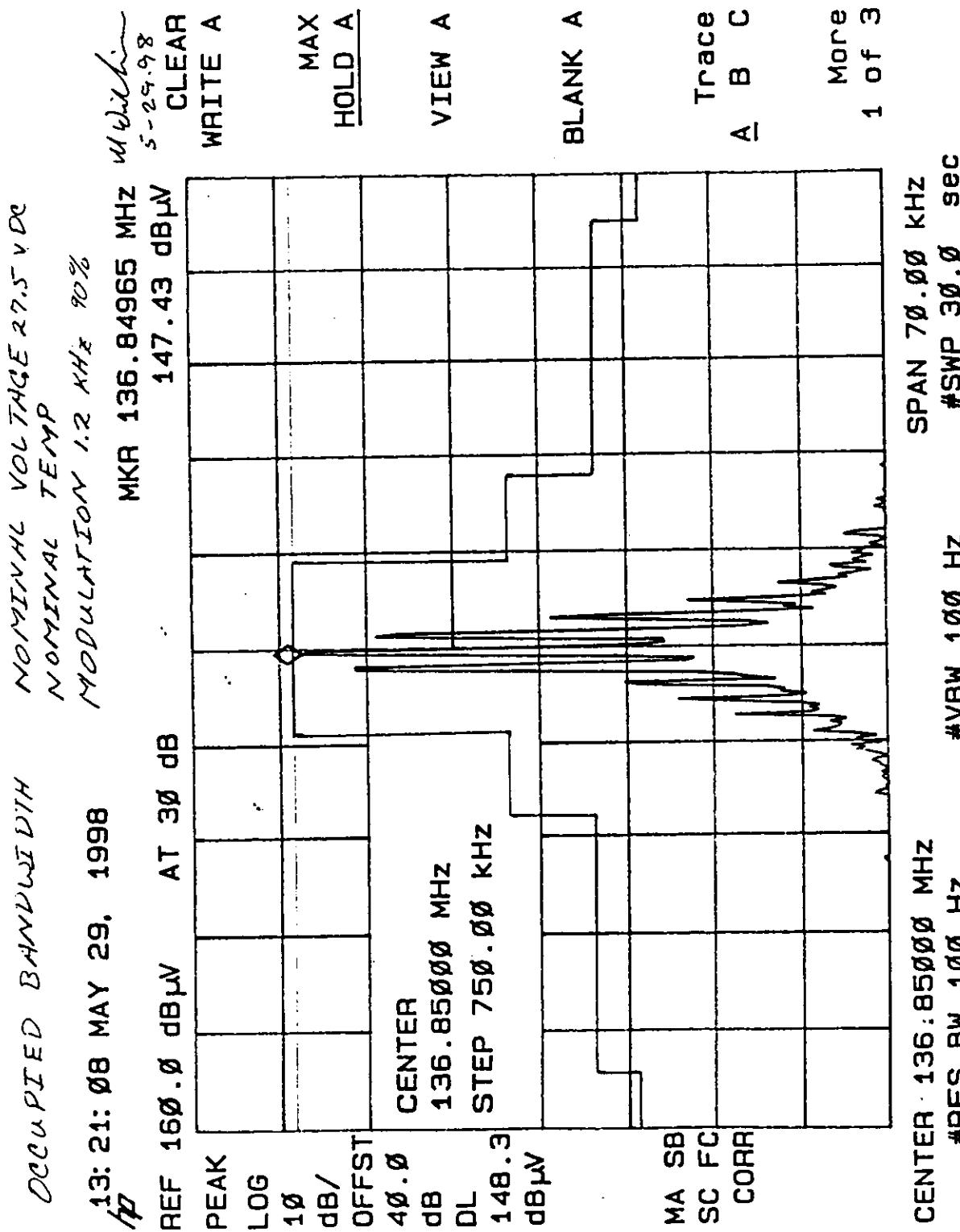
FCC Part 87.135\87.139 Occupied Bandwidth Plot 1



## FCC Part 87.135/87.139 Occupied Bandwidth Plot 2



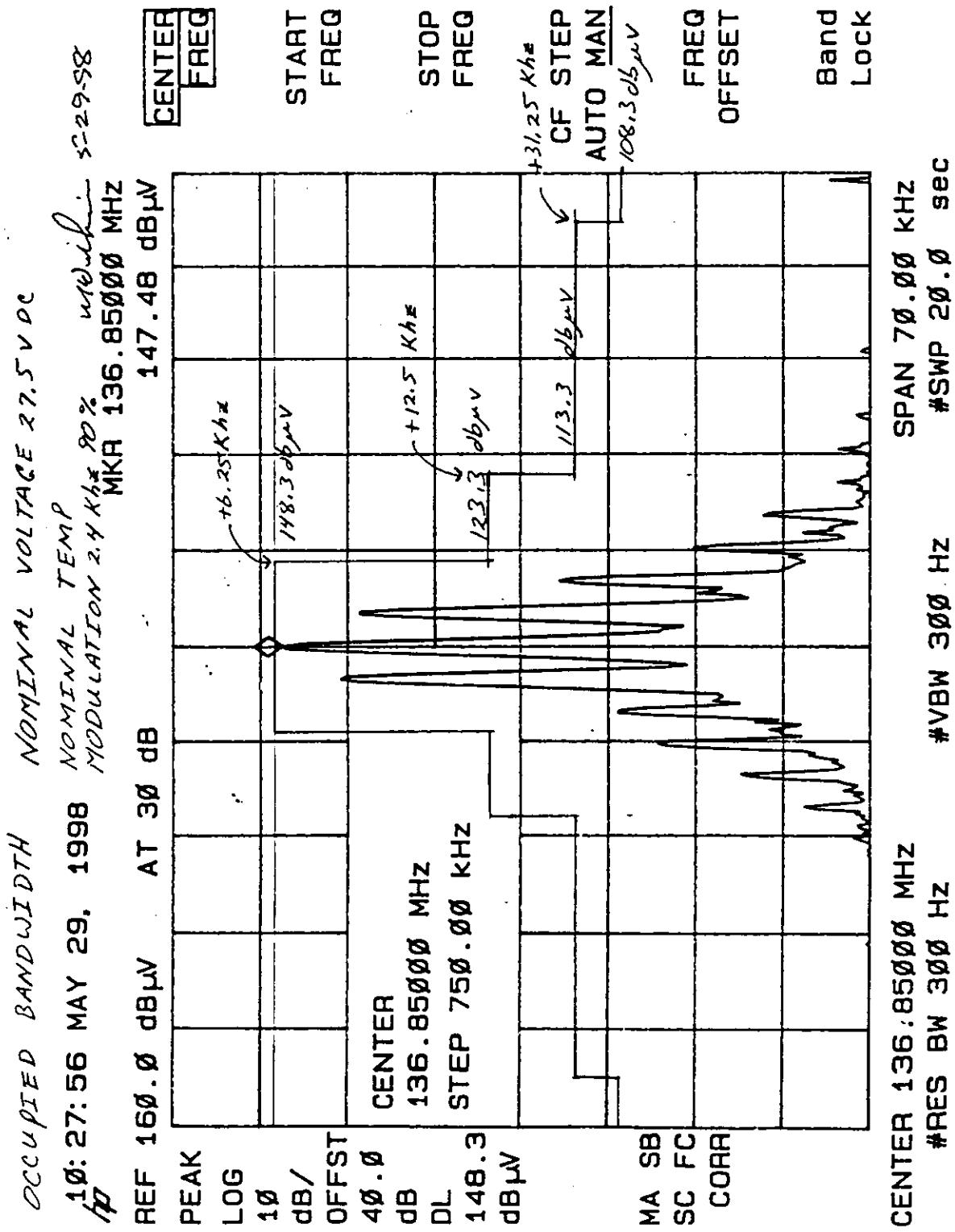
FCC Part 87.135\87.139 Occupied Bandwidth Plot 3



CENTER: 136.85000 MHz  
#RES BW 100 Hz

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Report No: FCTA98-003

FCC Part 87.135\87.139 Occupied Bandwidth Plot 4



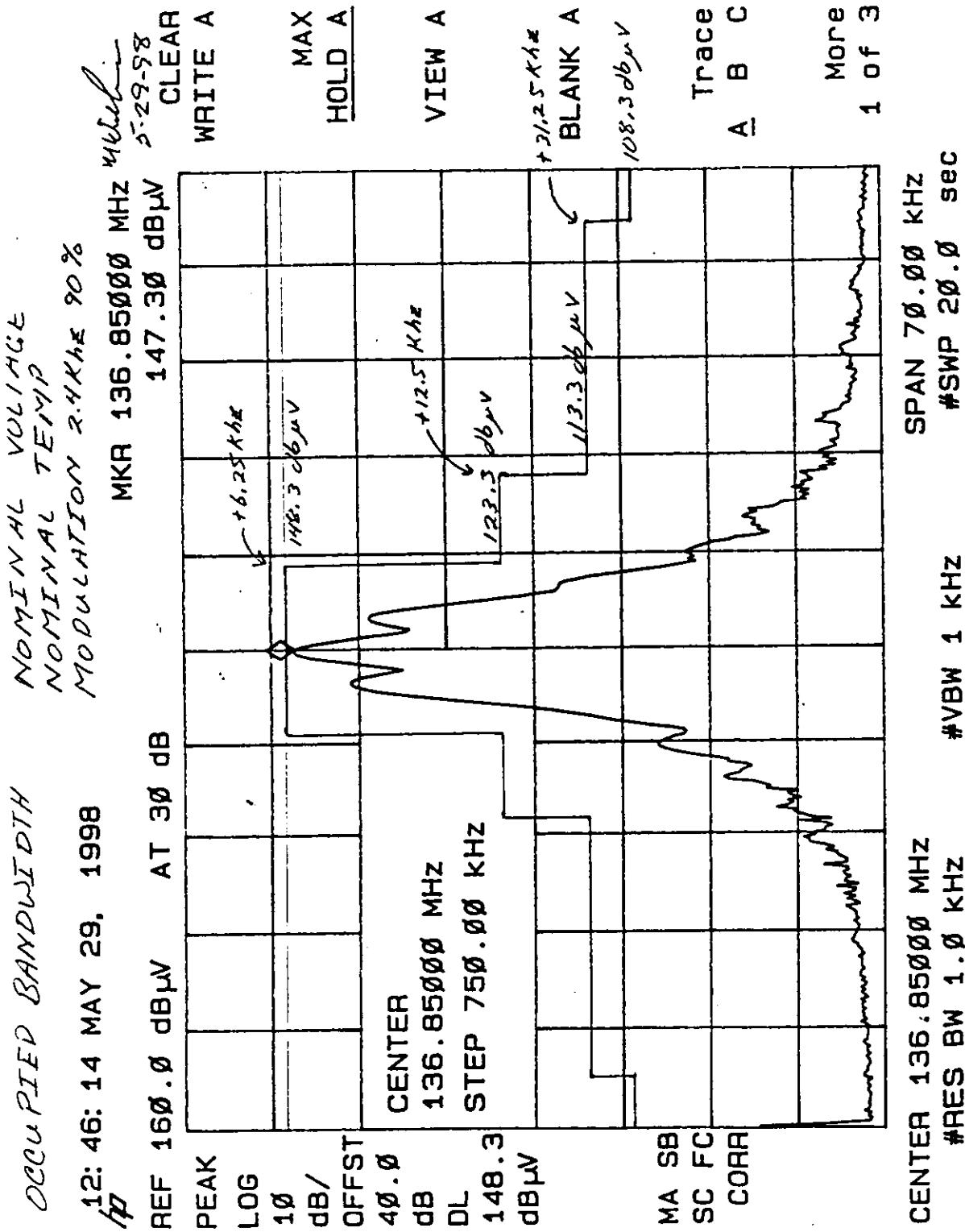
**FCC Part 87.135\87.139 Occupied Bandwidth Plot 5**


TABLE A  
LIST OF TEST EQUIPMENT  
**VCCI Acceptance No. R-591 & C-606**

1. Spectrum Analyzer, Hewlett Packard, Model No. 85680A S/N 2130A1602, (Display Unit ) 85662A, S/N 2112A02570.
2. Preamp, Hewlett Packard, Model No. 8447D, S/N 2727A05432.
3. Quasi-Peak Adapter, Hewlett Packard, Model No. 85650A, S/N 2043A00104.
4. Biconical Antenna, A. H. Systems, Model No. SAS200/540, S/N 273.
5. Horn Antenna, EMCO 3115, S/N 3413.
6. Magnetic Loop Antenna, Elec. Mech, S/N 6502.
7. Log Periodic Antenna, A. H. Systems, Model No. SAS200/510, S/N 55.
8. LISN, Solar Electronics, Model No. 50uH, S/N 373.
9. Test software, EMI Test 2.91.

## EUT SETUP

The equipment under test (EUT) and the peripherals listed were setup in a manner that represented their normal use, as shown in the setup photographs in Appendix A. Any special conditions required for the EUT to operate normally are identified in the comments that accompany Table 1 & 2 for radiated emissions, Table 3 for antenna port conducted and Table 4 for frequency stability.

During radiated emissions testing, the EUT was mounted on a nonconductive, rotating table approximately 80 cm above the conductive grid. The nonconductive table dimensions were 1 meter by 1.5 meters. This configuration is typical for radiated emissions testing of rack mounted devices.

I/O cables were connected to the EUT and peripherals in the manner required for normal operation of the system.

## TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed in Table A were used to collect both the radiated and conducted emissions data for the Unilink 601, 01066-00-000. For radiated measurements below 30MHz, the magnetic loop was used. For frequencies from 30 – 300 MHz the biconical antenna was used. For frequencies from 300 to 1000 MHz, the log periodic antenna was used. For frequencies above 1000 MHz the horn antenna was used. All antennas were located at a distance of 3 meters from the edge of the EUT. Conducted emissions tests required the use of the FCC type LISN's.

The HP spectrum analyzer was used for all measurements. Table B shows the analyzer bandwidth settings that were used in designated frequency bands. For conducted emissions, a reference level of 100 dB $\mu$ V and a vertical scale size of 10 dB per division were used. A 10 dB external attenuator was also used during conducted tests, with internal offset correction in the analyzer. During radiated testing, the measurements were made with 0 dB of attenuation, a reference level of 97 dB $\mu$ V, and a vertical scale of 10 dB per division.

TABLE B : ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE

TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	9 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	2000 MHz	1 MHz

## SPECTRUM ANALYZER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in Tables 1 through 3 indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "Peak" mode. Whenever a "Quasi-Peak" or "Average" reading is listed as one of the six highest readings, this is indicated as a "Q" or an "A" in Tables 1 through 3. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data for the Unilink 601, 01066-00-000.

### Peak

In this mode, the spectrum Analyzer or test engineer recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature of the analyzer called "peak hold," the analyzer had the ability to measure transients or low duty cycle transient emission peak levels. In this mode the analyzer made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

### Quasi-Peak

When the true peak values exceeded or were within 2 dB of the specification limit, quasi-peak measurements were taken using the HP 85650A Quasi-Peak Adapter for the HP 8568B spectrum Analyzer. The detailed procedure for making quasi peak measurements contained in the HP Quasi-Peak Adapter manual were followed.

### Average

When the frequencies exceed 1 GHz, average measurements may be made using the spectrum analyzer. To make these measurements, the test engineer reduces the video bandwidth on the analyzer until the modulation of the signal is filtered out. At this point the analyzer is set into the linear mode and the scan time is reduced.

## TEST METHODS

The emissions data of the Unilink 601, 01066-00-000, was taken with the HP spectrum Analyzer. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the "Sample Calculations". The corrected data was then compared to the applicable FCC Part 2 & 87 emissions limits to determine compliance.

Preliminary and final measurements were taken in order to better ensure that all emissions from the EUT were found and maximized.

### Radiated Emissions Testing

During the preliminary radiated scan, the EUT was powered up and operating in its defined FCC test mode with the I/O cables and line cords facing the antenna. For frequencies below 30 MHz the magnetic loop antenna was used. The frequency range of 30 MHz - 88 MHz was then scanned with the biconical antenna located about 1.5 meter above the ground plane in the vertical configuration. During this scan, the turntable was rotated and all peaks which were at or near the limit were recorded. The frequency range of 100 - 300 MHz was scanned in the same manner, using the biconical antenna, and the peaks recorded. Lastly, a scan of the FM band from 88 - 110 MHz was made, using a reduced resolution bandwidth and a reduced frequency span. The biconical antenna was changed to the horizontal polarity and the above steps were repeated. After changing to the log periodic antenna in the horizontal configuration, the frequency range of 300 - 1000 MHz was scanned. The log periodic antenna was changed to the vertical polarity and the frequency range of 300 - 1000 MHz was again scanned. The horn antenna was used to scan for frequencies above 1000 MHz. Care was taken to ensure that no frequencies were missed within the FM and TV bands. An analysis was performed to determine if the signals that were at or near the limit were caused by an ambient transmission. If unable to determine by analysis, the equipment was powered down to make the final determination if the EUT was the source of the emission.

For the final radiated scan, the equipment was again positioned with its I/O and power cables facing the antenna. A thorough scan of all frequencies was manually made using a small frequency span, rotating the turntable as needed. Comparison with the previously recorded measurements was then made.

Using the peak readings from both scans as a guide, the test engineer then maximized the readings with respect to the table rotation, antenna height and configuration of the peripherals and cables. Maximizing of the cables was achieved by monitoring the spectrum analyzer on a closed circuit television monitor while the EUT cables were being moved and rearranged on the EUT table for maximum emissions. Photographs showing the final worst case configuration of the EUT are contained in Appendix A.

### **Antenna Conducted Emissions Testing**

The Unilink 601, 01066-00-000, was tested in accordance to FCC Part 2 & 87 and is compliant with the requirements for FCC Part 2.991 & 87.139. The data obtained for this test is contained in Appendix B and the six highest readings are contained in Table 3.

### **Occupied Bandwidth**

The Unilink 601, 01066-00-000, was tested in accordance FCC Part 2 & 87 and is compliant with the requirements for FCC Part 2.989 & 87.135/87.139. The data obtained for this test is contained in the occupied bandwidth plots 1-5.

### **Power Output**

The Unilink 601, 01066-00-000, was tested in accordance to FCC Part 2 & 87 and is compliant with the requirements for FCC Part 2.985 & 87.139. The data obtained for this test is contained in Appendix B and the six highest readings are contained in Table 3.

### **Frequency Stability**

The Unilink 601, 01066-00-000, was tested in accordance to FCC Part 2 & 87 and is compliant with the requirements for FCC Part 2.995 & 87.133. The data obtained for this test is contained in Appendix B and the six highest readings are contained in Table 5.

### **Modulation Characteristics**

The Unilink 601, 01066-00-000, was tested in accordance to FCC Part 2 & 87 and is compliant with the requirements for FCC Part 2.995 & 87.133. The data obtained for this test is contained in Appendix B and the six highest readings are contained in Table 5.

## SAMPLE CALCULATIONS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in Tables 1-5. For radiated emissions in dB $\mu$ V/m, the spectrum analyzer reading in dB $\mu$ V was corrected by using the following formula:

Meter reading (dB $\mu$ V)  
 + Antenna Factor (dB)  
 + Cable Loss (dB)  
 - Distance Correction (dB)  
 - Pre-amplifier Gain (dB)  
 = Corrected Reading(dB $\mu$ V/m)

This reading was then compared to the applicable specification limit to determine compliance. For conducted emissions, no correction factors were needed when 50  $\mu$ H LISN's were used.

#	Freq MHz	Rdng dB $\mu$ V	Amp A	Bicon	LOG A	Horn	Cable	Dist	Corr dBm	40 dB	Spec	Margin	Polar
---	-------------	--------------------	----------	-------	-------	------	-------	------	-------------	----------	------	--------	-------

# means reading number

**Freq MHz** is the frequency in MHz of the obtained reading.

**Rdng dB $\mu$ V** is the reading obtained on the spectrum analyzer in dB $\mu$ V.

**Amp A** is short for the preamplifier factor or gain in dB.

**Horn** is the Horn Antenna factor in dB.

**Bicon** is the Biconical antenna factor in dB.

**LOG A** is the Log Periodic Antenna factor in dB.

**Cable** are the cable loss factor in dB of the coaxial cable at the 10 meter stub-up position on the OATS.

**Dist** is the distance factor (in dB). It is used when testing at a different test distance than the one stated in the spec.

**Corr dBm** is the Corrected reading which is now in dBm (field strength).

**Spec** is the Specification limit (dB) stated in the agency's regulations.

**Margin** is the closeness to the specified limit in dB; + is over and - is under the limit.

**Polar** is the Polarity of the antenna with respect to earth.

**40 dB** is the 40 dB attenuator factor.

**APPENDIX A**

**INFORMATION ABOUT THE EQUIPMENT UNDER TEST**

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**INFORMATION ABOUT THE EQUIPMENT UNDER TEST**

Test Software/Firmware: SCN 11.1 AND 4/23

LCD was displaying: Unilink frequency page

Power Supply Manufacturer: Universal Avionics

Power Supply Part Number: 01066080

AC Line Filter Manufacturer: N/A

AC Line Filter Part Number: N/A

Line voltage used during testing: 27.5 VDC

I/O PORTS	
Type	#
RS232/422	8
ARINC 429 TX	3
ARINC 429 RX	8

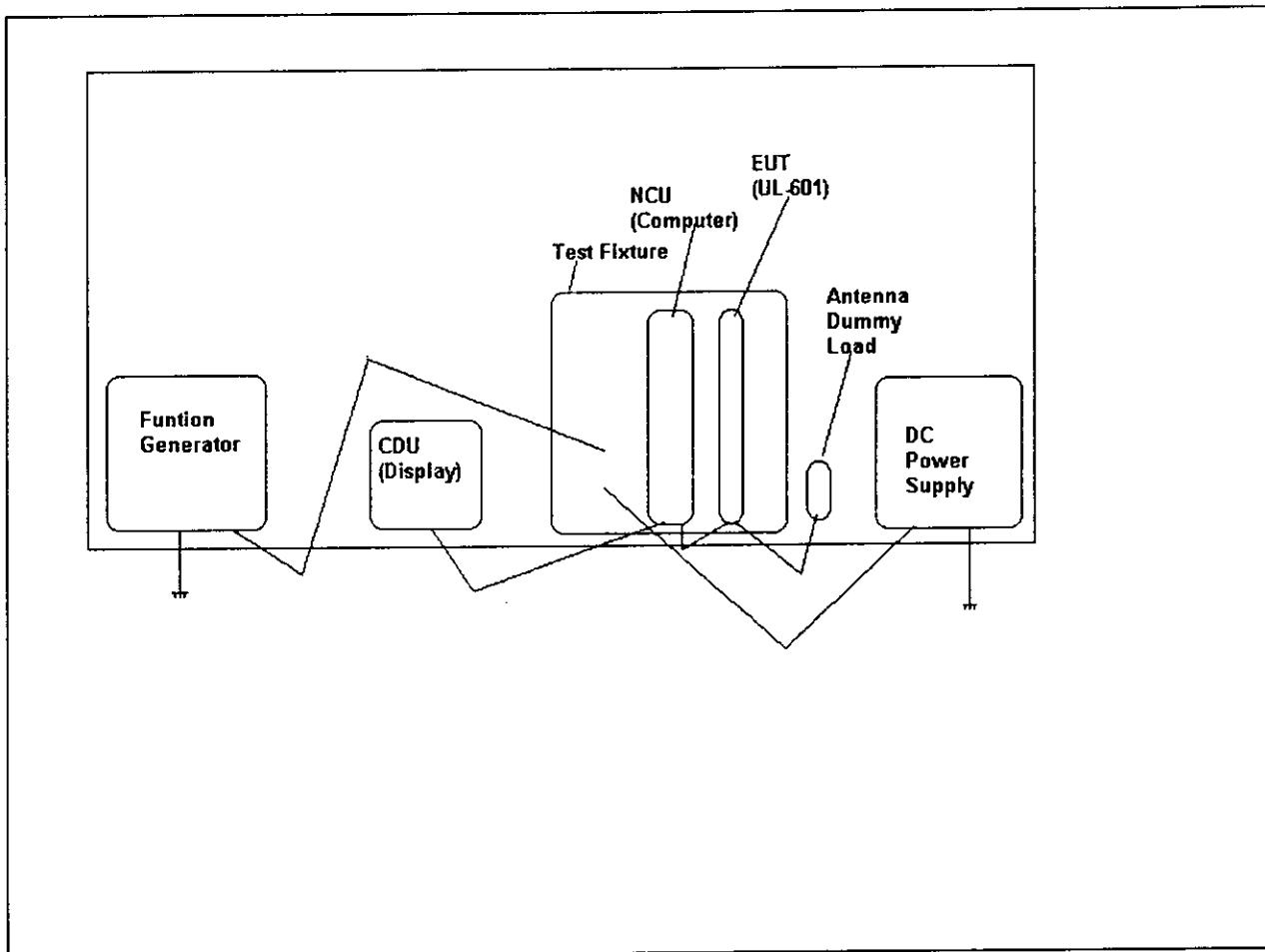
CRYSTAL OSCILLATORS	
Type	Freq In MHz
Xt	20
Xt	11.9808
Xt	14.74
Xt	10.7

**PRINTED CIRCUIT BOARDS**

Function	Model & Rev	Clocks, MHz	Layers	Location
01065086	UL 600	20, 11.9808	6	Rear slot
01065850	Modem	14.74	4	On UL 600
01066300	Transceiver	10.7	6	Fwd slot
01066310	Amplifier	N/A	4	On Transceiver
01066320	Digital board	7.37, 4.00	4	On Transceiver
01066080	SM Power supply	100 kHz	4	Chassis cavity

**CABLE INFORMATION**

Cable #:	System rack	Cable(s) of this type:
Cable Type:		Shield Type:
Construction:	Point to point	Length In Meters:
Connected To End (1):		Connected To End (2):
Connector At End (1):		Connector At End (2):
Shield Grounded At (1):		Shield Grounded At (2):
Part Number:		Number of Conductors:
Notes: A rack in which all components are plugged into.		

**EQUIPMENT CONFIGURATION BLOCK DIAGRAM**

**APPENDIX B**  
**MEASUREMENT DATA SHEETS**

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Report No: FCTA98-003

Test Location: CKC LABORATORIES INC. • 22105 Wilson River Hwy, Site A • Tillamook, Oregon 97141  
 • (800) 500-4EMC

Customer: Universal Avionics Systems Date: May-30-98  
 Specification: FCC15.209 Time: 11:28  
 Test Type: Maximized Emissions Sequence#: 5  
 Equipment: Flight Data Transceiver  
 Manufacturer: Universal Avionics Tested By: Mike Wilkinson  
 Model: UL 601  
 S/N: NR-1

***Equipment Under Test (\* = EUT):***

Function	Manufacturer	Model #	S/N
Flight Data Transceiver*	Universal Avionics	UL 601	NR-1

***Support Devices:***

Function	Manufacturer	Model #	S/N
NCU	Universal Avionics	1190-02-2111	999
CDU	Universal Avionics	1018-1-110	912
Test Mounting Fixture	Universal Avionics	Sysyen Rack	1
Power Supply	Topward Elec.	TPS-2000	946269
Funtion Generator	BK	4011	259-05324

***Test Conditions / Notes:***

EUT is transmitting into a load (40 dB attenuator) connected to the antenna port at 136.850 MHz with 2.4 kHz 90% modulation. Input voltage is 27.5 VDC. The temperature was 65 Degrees Fahrenheit and the humidity was 55%. Frequency range tested was 9 kHz to 2 GHz.

***Measurement Data:***

Sorted by Margin

Test Distance: 3 Meters

#	Freq MHz	Rdng dB $\mu$ V	Amp-A	Bicon	Cable	Log A	Dist dB	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar
1	410.554	47.8	-27.2 +0.0	+0.0	+4.7	+16.2	+0.0	41.5	46.0	-4.5	Vert
	Quasi Peak										
2	410.552	47.1	-27.2 +0.0	+0.0	+4.7	+16.2	+0.0	40.8	46.0	-5.2	Horiz
	Quasi Peak										
3	273.702	46.0	-26.4 +0.0	+17.4	+3.6	+0.0	+0.0	40.6	46.0	-5.4	Horiz
	Quasi Peak										
4	821.150	39.3	-27.7 +0.0	+0.0	+7.0	+21.6	+0.0	40.2	46.0	-5.8	Horiz
5	126.045	50.8	-27.0 +0.0	+11.3	+2.3	+0.0	+0.0	37.4	43.5	-6.1	Horiz
6	160.006	48.9	-26.8 +0.0	+12.6	+2.6	+0.0	+0.0	37.3	43.5	-6.2	Horiz
7	684.252	40.6	-27.9 +0.0	+0.0	+6.2	+20.1	+0.0	39.0	46.0	-7.0	Vert
	Quasi Peak										
8	273.742	43.4	-26.4 +0.0	+17.4	+3.6	+0.0	+0.0	38.0	46.0	-8.0	Vert



9	140.006	46.9	-26.9 +0.0	+12.2	+2.4	+0.0	+0.0	34.6	43.5	-8.9	Horiz
10	957.969	31.4	-27.4 +0.0	+0.0	+7.8	+23.7	+0.0	35.5	46.0	-10.5	Horiz
11	957.941	30.9	-27.4 +0.0	+0.0	+7.8	+23.7	+0.0	35.0	46.0	-11.0	Vert
12	821.004	32.4	-27.7 +0.0	+0.0	+7.0	+21.6	+0.0	33.3	46.0	-12.7	Vert
	Quasi Peak										
13	220.035	40.1	-26.5 +0.0	+15.3	+3.2	+0.0	+0.0	32.1	46.0	-13.9	Horiz
14	684.261	33.4	-27.9 +0.0	+0.0	+6.2	+20.1	+0.0	31.8	46.0	-14.2	Horiz
15	1368.496	29.9	-25.9 +24.8	+0.0	+9.7	+0.0	+0.0	38.5	54.0	-15.5	Horiz
16	1368.564	29.9	-25.9 +24.8	+0.0	+9.7	+0.0	+0.0	38.5	54.0	-15.5	Vert
17	547.406	34.5	-27.9 +0.0	+0.0	+5.4	+18.1	+0.0	30.1	46.0	-15.9	Vert
18	1231.655	30.6	-26.5 +24.8	+0.0	+8.9	+0.0	+0.0	37.8	54.0	-16.2	Horiz
19	1231.700	29.7	-26.5 +24.8	+0.0	+8.9	+0.0	+0.0	36.9	54.0	-17.1	Vert
20	547.385	33.2	-27.9 +0.0	+0.0	+5.4	+18.1	+0.0	28.8	46.0	-17.2	Horiz
21	1094.808	30.0	-27.0 +24.7	+0.0	+8.2	+0.0	+0.0	35.9	54.0	-18.1	Horiz
22	1094.809	29.5	-27.0 +24.7	+0.0	+8.2	+0.0	+0.0	35.4	54.0	-18.6	Vert
23	136.850	74.7	-26.9 +0.0	+12.0	+2.3	+0.0	+0.0	62.1	150.0	-87.9	Vert

Test Location: CKC LABORATORIES INC. • 22105 Wilson River Hwy, Site A • Tillamook, Oregon 97141  
 • (800) 500-4EMC

Customer: **Universal Avionics Systems** Date: May-30-98  
 Specification: **FCC B RADIATED** Time: 09:19  
 Test Type: **Maximized Emissions** Sequence#: 4  
 Equipment: **Flight Data Transceiver**  
 Manufacturer: Universal Avionics  
 Model: UL 601  
 S/N: NR-1  
 Tested By: Mike Wilkinson

**Equipment Under Test (\* = EUT):**

Function	Manufacturer	Model #	S/N
Flight Data Transceiver*	Universal Avionics	UL 601	NR-1

**Support Devices:**

Function	Manufacturer	Model #	S/N
NCU	Universal Avionics	1190-02-2111	999
CDU	Universal Avionics	1018-1-110	912
Test Mounting Fixture	Universal Avionics	Sysyen Rack	1
Power Supply	Topward Elec.	TPS-2000	946269
Funtion Generator	BK	4011	259-05324

**Test Conditions / Notes:**

EUT is in the receive only mode and is tuned to 118.000 MHz. Input voltage is 27.5 VDC. The temperature was 65 Degrees Fahrenheit and the humidity was 55%. Frequency range tested was 30 MHz to 2 GHz.

**Measurement Data:**

#	Freq MHz	Rdng dB $\mu$ V	Sorted by Margin			Test Distance: 3 Meters				
			Amp-A	Bicon	Cable	Dist dB	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar
1	160.005	54.0	-26.8	+12.6	+2.6	+0.0	42.4	43.5	-1.1	Horiz
	Quasi Peak									
2	140.041	49.2	-26.9	+12.2	+2.4	+0.0	36.9	43.5	-6.6	Horiz
3	219.997	46.3	-26.5	+15.3	+3.2	+0.0	38.3	46.0	-7.7	Horiz
4	122.043	48.4	-27.0	+11.1	+2.2	+0.0	34.7	43.5	-8.8	Horiz
5	125.972	47.1	-27.0	+11.3	+2.3	+0.0	33.7	43.5	-9.8	Horiz
6	159.997	44.9	-26.8	+12.6	+2.6	+0.0	33.3	43.5	-10.2	Vert
7	131.988	45.4	-26.9	+11.7	+2.3	+0.0	32.5	43.5	-11.0	Horiz
8	166.001	43.3	-26.8	+12.8	+2.7	+0.0	32.0	43.5	-11.5	Horiz

9	128.014	42.5	-27.0	+11.4	+2.3	+0.0	29.2	43.5	-14.3	Vert
10	69.996	39.3	-27.1	+9.2	+1.6	+0.0	23.0	40.0	-17.0	Horiz

Test Location: CKC LABORATORIES INC. • 22105 Wilson River Hwy, Site A • Tillamook, Oregon 97141  
 • (800) 500-4EMC

Customer: **Universal Avionics Systems** Date: May-30-98  
 Specification: **FCC B RADIATED** Time: 08:44  
 Test Type: **Maximized Emissions** Sequence#: 3  
 Equipment: **Flight Data Transceiver**  
 Manufacturer: Universal Avionics  
 Model: UL 601  
 S/N: NR-1  
 Tested By: Mike Wilkinson

***Equipment Under Test (\* = EUT):***

Function	Manufacturer	Model #	S/N
Flight Data Transceiver*	Universal Avionics	UL 601	NR-1

***Support Devices:***

Function	Manufacturer	Model #	S/N
NCU	Universal Avionics	1190-02-2111	999
CDU	Universal Avionics	1018-1-110	912
Test Mounting Fixture	Universal Avionics	Sysyen Rack	1
Power Supply	Topward Elec.	TPS-2000	946269
Function Generator	BK	4011	259-05324

***Test Conditions / Notes:***

EUT is in the receive only mode and is tuned to 126.500 MHz. Input voltage is 27.5 VDC. The temperature was 65 Degrees Fahrenheit and the humidity was 55%. Frequency range tested was 30 MHz to 2 GHz.

***Measurement Data:***

Sorted by Margin

Test Distance: 3 Meters

#	Freq MHz	Rdng dB $\mu$ V	Amp-A	Bicon	Cable	Dist dB	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar
1	160.009	53.8	-26.8	+12.6	+2.6	+0.0	42.2	43.5	-1.3	Horiz
	Quasi Peak									
2	140.003	49.3	-26.9	+12.2	+2.4	+0.0	37.0	43.5	-6.5	Horiz
	Quasi Peak									
3	128.043	49.7	-27.0	+11.4	+2.3	+0.0	36.4	43.5	-7.1	Horiz
4	220.016	45.4	-26.5	+15.3	+3.2	+0.0	37.4	46.0	-8.6	Horiz
5	126.025	46.9	-27.0	+11.3	+2.3	+0.0	33.5	43.5	-10.0	Horiz
	Quasi Peak									
6	229.993	43.5	-26.5	+15.6	+3.3	+0.0	35.9	46.0	-10.1	Horiz
7	128.043	46.0	-27.0	+11.4	+2.3	+0.0	32.7	43.5	-10.8	Vert
8	122.024	45.8	-27.0	+11.1	+2.2	+0.0	32.1	43.5	-11.4	Horiz
	Quasi Peak									

9	70.014	35.9	-27.1	+9.2	+1.6	+0.0	19.6	40.0	-20.4	Vert
10	174.523	32.6	-26.8	+13.2	+2.8	+0.0	21.8	43.5	-21.7	Vert

Test Location: CKC LABORATORIES INC. • 22105 Wilson River Hwy, Site A • Tillamook, Oregon 97141  
 • (800) 500-4EMC

Customer: **Universal Avionics Systems** Date: **May-29-98**  
 Specification: **FCC B RADIATED** Time: **18:04**  
 Test Type: **Radiated Scan** Sequence#: **2**  
 Equipment: **Flight Data Transceiver**  
 Manufacturer: **Universal Avionics** Tested By: **Mike Wilkinson**  
 Model: **UL 601**  
 S/N: **NR-1**

***Equipment Under Test (\* = EUT):***

Function	Manufacturer	Model #	S/N
Flight Data Transceiver*	Universal Avionics	UL 601	NR-1

***Support Devices:***

Function	Manufacturer	Model #	S/N
NCU	Universal Avionics	1190-02-2111	999
CDU	Universal Avionics	1018-1-110	912
Test Mounting Fixture	Universal Avionics	Sysyen Rack	1
Power Supply	Topward Elec.	TPS-2000	946269
Funtion Generator	BK	4011	259-05324

***Test Conditions / Notes:***

EUT is in the receive only mode and is tuned to 136.850 MHz. Input voltage is 27.5 VDC. The temperature was 65 Degrees Fahrenheit and the humidity was 55%. Frequency range tested was 30 MHz to 2 GHz.

***Measurement Data:***

Sorted by Margin

Test Distance: 3 Meters

#	Freq MHz	Rdng dB $\mu$ V	Amp-A dB	Bicon dB	Cable dB	Log A dB	Dist dB	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar
1	160.002	53.9	-26.8	+12.6	+2.6	+0.0	+0.0	42.3	43.5	-1.2	Horiz
	Quasi Peak										
2	140.000	49.9	-26.9	+12.2	+2.4	+0.0	+0.0	37.6	43.5	-5.9	Horiz
	Quasi Peak										
^	139.996	51.8	-26.9	+12.2	+2.4	+0.0	+0.0	39.5	43.5	-4.0	Horiz
4	126.015	50.7	-27.0	+11.3	+2.3	+0.0	+0.0	37.3	43.5	-6.2	Horiz
5	122.015	49.6	-27.0	+11.1	+2.2	+0.0	+0.0	35.9	43.5	-7.6	Horiz
6	160.057	45.3	-26.8	+12.6	+2.6	+0.0	+0.0	33.7	43.5	-9.8	Vert
7	220.036	43.9	-26.5	+15.3	+3.2	+0.0	+0.0	35.9	46.0	-10.1	Horiz
8	131.889	46.3	-26.9	+11.7	+2.3	+0.0	+0.0	33.4	43.5	-10.1	Horiz
9	230.052	43.2	-26.5	+15.6	+3.3	+0.0	+0.0	35.6	46.0	-10.4	Horiz



10	200.017	41.7	-26.6	+14.7	+3.1	+0.0	+0.0	32.9	43.5	-10.6	Horiz
11	128.004	46.2	-27.0	+11.4	+2.3	+0.0	+0.0	32.9	43.5	-10.6	Vert
12	324.052	37.2	-26.6	+0.0	+3.8	+20.8	+0.0	35.2	46.0	-10.8	Horiz
13	124.043 Quasi Peak	46.1	-27.0	+11.2	+2.3	+0.0	+0.0	32.6	43.5	-10.9	Horiz
14	118.049	45.9	-27.0	+11.0	+2.1	+0.0	+0.0	32.0	43.5	-11.5	Horiz
15	114.011	45.9	-27.0	+10.8	+2.1	+0.0	+0.0	31.8	43.5	-11.7	Horiz
16	240.010	40.7	-26.4	+15.8	+3.3	+0.0	+0.0	33.4	46.0	-12.6	Vert
17	181.851	40.7	-26.7	+13.4	+2.8	+0.0	+0.0	30.2	43.5	-13.3	Horiz
18	340.010	35.4	-26.6	+0.0	+4.1	+19.7	+0.0	32.6	46.0	-13.4	Horiz
19	110.033	44.6	-27.1	+10.5	+2.0	+0.0	+0.0	30.0	43.5	-13.5	Horiz
20	91.878	45.7	-27.1	+9.4	+1.8	+0.0	+0.0	29.8	43.5	-13.7	Horiz
21	149.234	40.0	-26.8	+12.4	+2.5	+0.0	+0.0	28.1	43.5	-15.4	Vert
22	32.147	36.1	-27.2	+14.4	+0.9	+0.0	+0.0	24.2	40.0	-15.8	Vert
23	360.010	32.8	-26.8	+0.0	+4.2	+18.4	+0.0	28.6	46.0	-17.4	Horiz
24	178.006	36.1	-26.8	+13.3	+2.8	+0.0	+0.0	25.4	43.5	-18.1	Horiz
25	570.048	31.4	-27.9	+0.0	+5.6	+18.4	+0.0	27.5	46.0	-18.5	Vert
26	185.759	34.7	-26.7	+13.7	+2.9	+0.0	+0.0	24.6	43.5	-18.9	Vert
27	70.017	35.6	-27.1	+9.2	+1.6	+0.0	+0.0	19.3	40.0	-20.7	Vert

Test Location: CKC LABORATORIES INC. • 22105 Wilson River Hwy, Site A • Tillamook, Oregon 97141  
 • (800) 500-4EMC

Customer: **Universal Avionics Systems** Date: **May-29-98**  
 Specification: **FCC 87.139** Time: **14:14**  
 Test Type: **Antenna Cond. Emissions** Sequence#: **1**  
 Equipment: **Flight Data Transceiver**  
 Manufacturer: **Universal Avionics** Tested By: **Mike Wilkinson**  
 Model: **UL 601**  
 S/N: **NR-1**

***Equipment Under Test (\* = EUT):***

Function	Manufacturer	Model #	S/N
Flight Data Transceiver*	Universal Avionics	UL 601	NR-1

***Support Devices:***

Function	Manufacturer	Model #	S/N
NCU	Universal Avionics	1190-02-2111	999
CDU	Universal Avionics	1018-1-110	912
Test Mounting Fixture	Universal Avionics	Sysyen Rack	1
Power Supply	Topward Elec.	TPS-2000	946269
Funtion Generator	BK	4011	259-05324

***Test Conditions / Notes:***

Test method was FCC part 2 & 87. Transmitting at 136.850 MHz with 2.4 kHz 90% AM modulation. Measurements are taken at the EUT antenna port. Input voltage is 27.5 VDC. The temperature was 65 Degrees Fahrenheit and the humidity was 55%. Frequency range tested was 9 kHz to 1.4 GHz.

***Measurement Data:***

Sorted by Margin

Test Distance: None

#	Freq MHz	Rdng dB $\mu$ V	40 dB				Dist dB	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar
			dB	dB	dB	dB					
1	136.851	107.3	+40.0				+0.0	147.3	148.4	-1.1	None
2	273.700	48.0	+40.0				+0.0	88.0	108.4	-20.4	None
3	153.730	45.6	+40.0				+0.0	85.6	108.4	-22.8	None
4	410.511	43.7	+40.0				+0.0	83.7	108.4	-24.7	None
5	86.090	43.0	+40.0				+0.0	83.0	108.4	-25.4	None
6	547.343	42.7	+40.0				+0.0	82.7	108.4	-25.7	None
7	1368.503	41.2	+40.0				+0.0	81.2	108.4	-27.2	None
8	143.360	41.1	+40.0				+0.0	81.1	108.4	-27.3	None

9	1231.653	40.6	+40.0	+0.0	80.6	108.4	-27.8	None
10	2.688	21.0	+0.0	+0.0	21.0	108.4	-87.4	None