ASCAS PART OR IDENTIFYING NUMBER	REVISIONS				
	LTR	DESCRIPTION	DATE	DR	CHECKED
698-50114-0001					

D 8/17/98 S. Bruga	C 8/17/98 W. Hunter
A 8-17-98 D. St Hilaire	A 8/17/98 W. Hunter

USED ON
RTA-83B

NEXT DRAWING
S.L. 697-50008

AlliedSignal Avionics, Inc. Commercial Avionics Systems
Fort Lauderdale, Florida

SPEC, FCC TYPE ACCEPTANCE REPORT TRANSMITTER SECTION OF ASCAS RTA-83B VHF DATA RADIO P/N 069-50002-0101

SIZE	CAGE CODE		DRAWING NUMBER
A	27914		698-50114
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ASCAS APPROVAL AND CERTIFICATION

This is to certify that based on the attached measurements, the receiver section of the AlliedSignal commercial Avionics Systems (ASCAS) type RTA-83B VHF Communication Transceiver complies with the requirements of the FCC Rules and Regulations, Part 87, under normal operation with the usual supervision, is hereby certified.

DATE: 8/17/98

J. Rivero
Product Line Manager
ASCAS, FT. Lauderdale, FL

CERTIFYING ENGINEER

I certify that the attached data was prepared by me and that to the best of my knowledge, the facts set forth were obtained using good engineering practice and are true and correct.

DATE: 8/17/98

D. J. Settlemire
Engineering Departments
ASCAS, Ft. Lauderdale, FL

STATEMENT OF QUALIFICATION

Mr. Settlemire was graduated from the Pennsylvania State University in 1960 with a Bachelor of Electrical Engineering degree. He was employed by The Bendix Corporation as a Design Engineer in military communications until 1964. From 1964 to 1968 he was employed by Westinghouse Air Brake Company as Design Engineer of railroad communications equipment. Since 1968, he has been employed by Bendix Avionics Division/AlliedSignal in the Design Engineering groups which deal with the design and development of communications and navigation equipment for commercial and general aviation aircraft. He is presently a Principal Engineer at ASCAS responsible for the design of communication and navigation equipment.

1. GENERAL INFORMATION

1.1 2.983(a) Applicant Name

AlliedSignal Commercial Avionics Systems (ASCAS)

2100 NW 62nd Street

Fort Lauderdale, FK 33309

1.2 2.983(b) Identification of Equipment

RTA-83B

1.3 2.983© Production Plans

Continuous, High Volume

2. TECHNICAL DESCRIPTION

2.1 2.983(d) (1) Types of Emission

7K00A9W

2.2 2.983(d) (2)Frequency Range

118.00 to 136.975 MHz, 760 channels, 25 Spacing

118.00 to 136.99 MHz, 2280 channels, 8.33 kHz Spacing

2.3 2.983(d) (3) Range of Operating Power

25 Watts (Nominal)

2.4 2.983(d) (4) Maximum Power Rating

Per FCC Rules and Regulations Part 87.63(a), the maximum output power required is that specified for satisfactory operation by the FAA per RTCA DO-186.

Maximum Output Power: DO-189 2.2.7.2 Note 2.

2.5 2.983(d) (5) TXDC Voltages and Currents

The following voltages and currents exist on the final RF amplifier of the RTA-83B Transceiver

APPLICABLE STAGE	SUPPLY VOLTAGE	SUPPLY CURRENT
Final Amp	28 VDC 5 Amps	(Typical)

2.6 2.983(d) (6) Function of Active Devices

The following transistors are used in the RTA-83B Transceiver:

U5007	Modulator
U5004	Buffer Amplifier
Q5004	Bias for Pre-Driver
Q5005	Pre-Driver
Q5004	Bias for Driver
Q5006	Driver
Q5002	Bias for Final Amplifier
Q5003	Final Amplifier

2.7 2.9839d) (9) Transmitter Alignment Procedure

RTA-83B TRANSMITTER
ALIGNMENT PROCEDURE

I. DC Alignment

1. Adjust R30, R92 and R14 Fully CCW.
2. Apply 15 Vdc and 5 Vdc Switched to Pin 1.
3. Adjust R30, R92, and R14 for –1 Vdc on the Pre-Driver, Driver and Final Gates
4. Remove the 5 Vdc and ensure the gates go to 0 Vdc (This checks the tx. switched circuitry)
5. With 5 Vdc = 0, apply 28 Vdc (I=0 Vdc amps)
6. Apply 5 Vdc and monitor the 28 volt current.
7. Adjust R30 CW until I = 300 ma.
8. Adjust R92 CW until I = 600 ma. total (additional 300 ma)
9. Adjust R14 CW until I = 825 ma total (additional 250 ma)

II. R.F. CW Alignment (15 Vdc, 5 Vdc and 28 Vdc)

1. Adjust R5 and R20 fully CCW
2. Adjust R66 fully CW
3. Apply RF drive @ - 15 dbm and slowly increase drive to obtain – 20 watts output
4. Check power flatness from 118 to 137 mHz (20 +/- - 4W)
5. Adjust trimmers C22,C39,C69,C26,C8 and C73 for balance of power at 118 and 137 mHz
6. Set frequency to –127 mHz and increase RF drive to –31W
7. Adjust R66 CCW for –27 watts
8. Increase RF drive to –1.5 dbm and ensure power leveling is holding pout constant (readjust R66 if necessary)

III. RF Modulation Alignment

1. Modulate the HP 8640 with 1 kHz @ 90%
2. Check the distortion across the 118 to 137 mHz range
3. Adjust R5 for minimum distortion

IV. RF Turn-On Alignment

1. Apply CW 127 mHz @ -1.5 dbm
2. Apply pulsed 5V (20 msec On, 20 msec OFF)
3. Check RF output on oscilloscope for smooth turn-on with no overshoot. Adjust R20 if required.

2.8 Synthesizer Theory of Operation

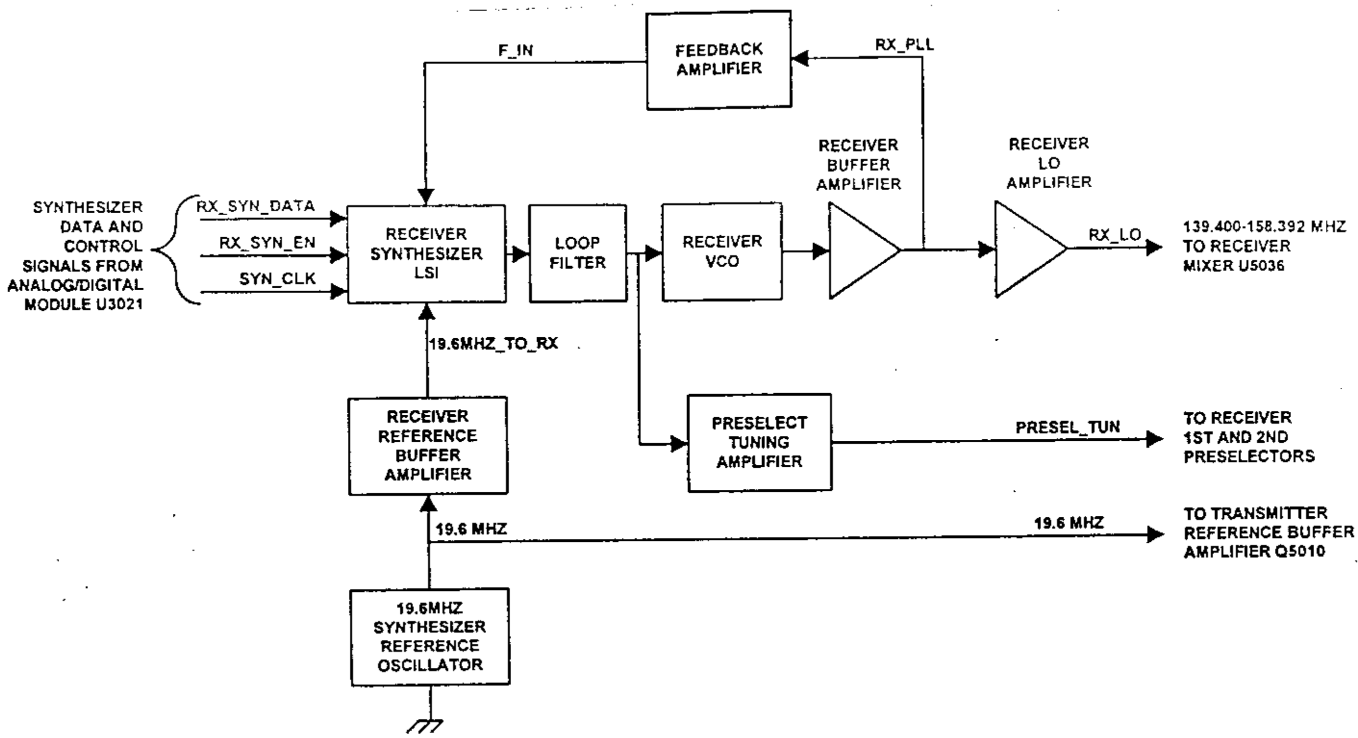
The RTA-83B synthesizer circuit consists of a receiver synthesizer and a transmitter synthesizer which are controlled by analog/digital module controller U3021. The RTA-83B receiver synthesizer provides and maintains a stable local oscillator signal for mixer U5036 of the receiver, and the transmitter synthesizer generates the proper operating frequencies for the RTA-83B transmitter section.

Common to both the receiver and transmitter synthesizers is 19.6-MHz synthesizer reference oscillator Y5001. The 19.6-MHz reference frequency generated by Y5001 is used by the receiver synthesizer for comparison purposes to ensure the receiver synthesizer supplies the correct receiver local oscillator (LO) frequencies to mixer U5036. The 19.6-MHz reference frequency is also routed to the transmitter synthesizer for use as a reference signal for the transmitter frequencies generated by the transmitter synthesizer.

The transmitter synthesizer generates a lock-detect (TX SYN LOCK DET) signal in the form of a high level voltage with narrow low-going pulses when the transmitter synthesizer is phase locked. The high-level transmitter lock-detector (TX SYN LOCK DET) signal is routed to the analog/digital module controller U3021 to signify that the transmitter synthesizer is phase locked and the transmitter can then be enabled.

1. Receiver Synthesizer

   Receiver synthesizer (figure 1) programmed frequency-control device (MC145190) U5019 receives input signals RX_SYN DATA (data), RX_SYN EN (enable), and SYN *CLK* (clock) from analog/digital module controller U3021. The SYN CLK and RX SYN EN inputs clock-in the analog/digital module controller U3021 synthesizer data (RX SYN DATA) which controls the receiver synthesizer. The MC145190 device (U5019) is programmed through three registers (R, A, and C) which determine the count for the sampled VCO output frequency coming back from feedback amplifier U5026. Serial data (RX_SYN_DATA) is clocked into U5019 on the positive edge of the SYN_CLK clock pulses. The RX SYN DATA serial data represents a hexadecimal value that is stored in the MC145190 device R, A, and C registers when the active low RX_SYN_EN signal is removed (goes high). The programmed contents of the R, A, and C registers determine the desired dc voltage level necessary to tune the receiver (RX) VCO output frequency to produce the local oscillator frequency (RX_LO) for injection into receiver mixer U5036. The tuning voltage output from MC145190 device U5019 output is a dc voltage level with 8.33 kHz pulses riding on it.



RF Module Receiver Synthesizer Block Diagram
Figure 1

The tuning voltage signal is routed from the MC145190 device to the receiver (RX) VCO through active loop filters U5022A and U5022B which filters the 8.33 kHz pulses from the tuning voltage and prevents modulation of the RX VCO. The dc voltage level output of the loop filter tunes the RX VCO to generate a local oscillator frequency (RX LO) for injection into mixer U5036 through receiver buffer amplifier U5031 and receiver LO amplifier U5033. The RX VCO output frequency (139.400 to 158.392 MHz) is 21.4 MHz higher than the RTA-83B tune frequency (118.000 to 135.992 MHz).

Receiver buffer amplifier U5031 and receiver LO amplifier U5033 at the output of the RX VCO presents a constant load to the RX VCO and provides isolation from the succeeding stages.

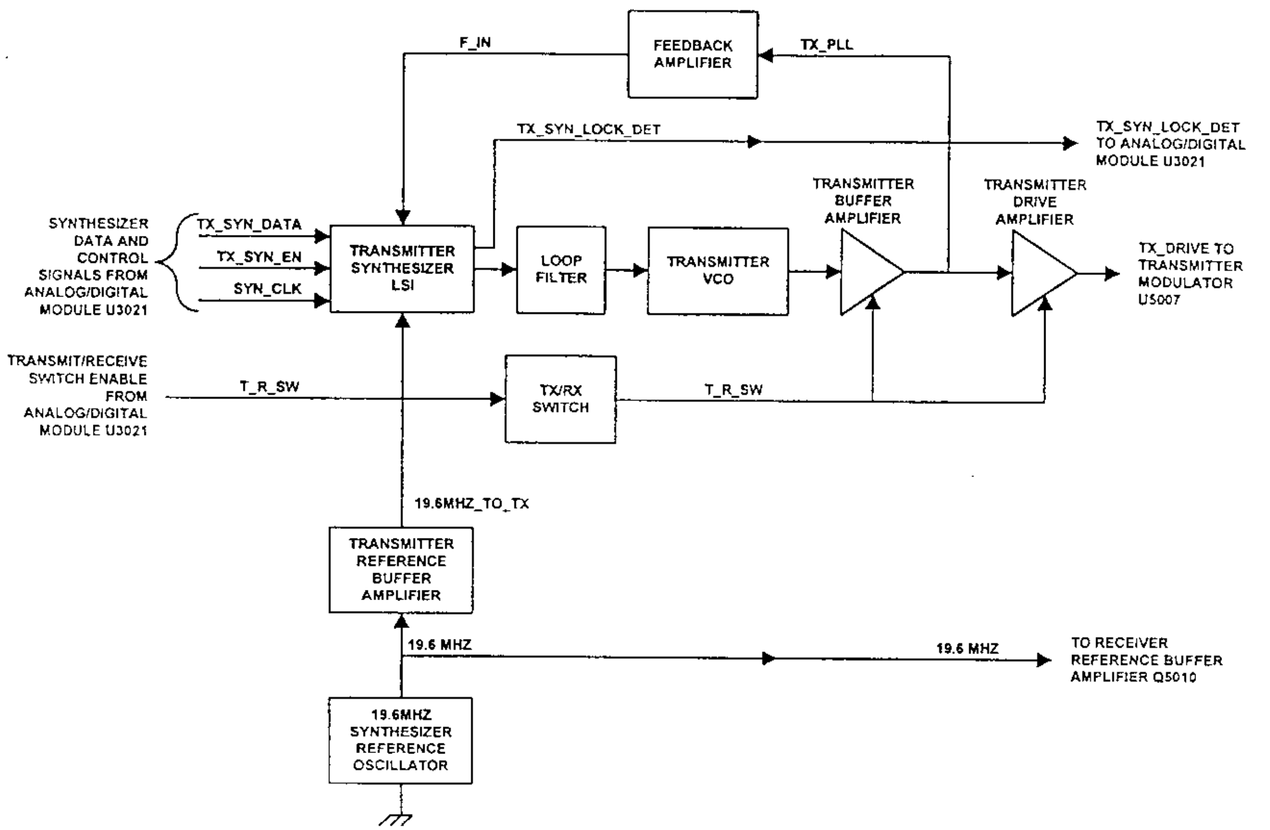
At the input of receiver LO amplifier U5033, a sample of the receiver VCO tuned frequency generated by the RX VCO is fed back to the phase detector of the MC145190 device U5019 via feedback amplifier U5026. Feedback amplifier U5026 is a MMIC (monolithic microwave integrated circuit) device to boost the sampled RX VCO feedback signal gain.

The sampled RX VCO feedback signal is fed back to U5019 for comparison to the 19.6-MHz synthesizer reference oscillator frequency. Both signals, the sampled RX VCO feedback signal and the 19.6-MHz synthesizer reference oscillator frequency, are divided down to 8.33 kHz and compared to the count stored in the MC145190 device registers. If a difference is detected, the dc output of the MC145190 is adjusted, and the cycle is repeated through the loop until the frequency count is correct.

The 19.6-Mhz synthesizer reference oscillator frequency is divided down to 8.33 kHz and is to be used as a reference point to which the MC145190 device can compare the feedback sampling of the VCO output frequency.

2. Transmitter Synthesizer

Transmitter synthesizer (figure 2) programmed frequency-control device (MC145190) U5018 receives input signals TX SYN DATA (data), TA SYN EN (enable), and SYN CLK (clock) from analog/digital module controller U3021. The SYN CLK and TX SYN EN inputs clock-in the analog digital module controller U3021 synthesizer data (TX SYN DATA) which controls the transmitter synthesizer. The MC145190 device (U5018) is programmed through three registers (R, A, and C) which determine the count for the sampled VCO frequency coming back from feedback amplifier U5014. Serial data (TX_DATA_IN) is clocked into &5018 on the positive edge of the SYN_CLK clock pulses. The TX SYN DATA serial data represents a nexadecimal value that is stored in the MC145190 device R, A, and C registers when the active low TX_SYN_EN signal is removed (goes high). The programmed contents of the R, A, and C registers determine the desired dc voltage level necessary to tune the transmitter (TX) VCO output frequency for injection into modulator U5007 of the transmitter. The tuning voltage output from the MC145190 device output is a dc voltage level with 8.33 kHz pulses riding on it.



RF Module Transmitter Synthesizer Block Diagram
Figure 2

The tuning voltage signal is routed from MC145190 device U5018 to the transmitter (TX) VCO through active loop filters U5023A and U5023B which filters the 8.33 kHz pulses from the tuning voltage and prevents modulation of the TX VCO. The dc voltage level output of the loop filter tunes the TX VCO to generate the transmitter output frequency of 118.000 to 135.992 MHz which is routed to the output amplifier.

Transmitter buffer amplifier U5011 and transmitter drive amplifier U5013 at the output of the TX VCO presents a constant load to the TX VCO and provides isolation from the succeeding stages.

At the input of transmitter drive amplifier U5013, a sample of the TX VCO tuned frequency generated by the TX VCO is fed back to phase detector of U5018 via feedback amplifier U5014. Feedback amplifier U5014 is a MMIC (monolithic microwave integrated circuit) device to boost the sampled TX VCO feedback signal gain.

The sampled TX VCO feedback signal is fed back to U5018 for comparison to the 19.6-MHz synthesizer reference oscillator frequency (TX_REF_OSC). Both signals, the sampled TX VCO feedback signal and the 19.6-MHz synthesizer reference oscillator frequency, are divided down to 8.33 kHz and compared to the count stored in the MC145190 device registers. If a difference is detected, the dc output of the Mc145190 is adjusted, and the cycle is repeated through the loop until the frequency count is correct.

The 19.6-MHz synthesizer reference oscillator frequency is divided down to 8.33 kHz and is to be used as a reference point to which the MC145190 device can compare the feedback sampling of the TX VCO output frequency.

The amplified TX VCO tuned frequency output of transmitter drive amplifier U5013 is routed to low-level diode modulator U5007 in the transmitter section where the transmit frequencies (TX DRIVE) are modulated with the MODULATION signal received from analog/digital module transmit voice compressor U3008B to produce the modulation envelope for the RF output signal.

The lock-detector (TX_SYN_LOCK_DET) signal from programmed-frequency-control device (MC145190) U5018 is in the form of a high-level voltage with narrow low-going pulses when the transmitter synthesizer is producing the desired transmitter frequency. The high-level transmitter lock-detector (TX_SYN_LOCK_DET) signal is routed through inverter Q3013 mounted on the analog/digital module to supply a low-level voltage signal (TX_SYN_LOCK_DET) to controller U3021 to signify that the transmitter synthesizer is phase locked. When the transmit frequency (TX_SYN DATA) selected by controller U3021 matches the frequency generated by the transmitter synthesizer and the transmitter synthesizer lock-detector (TX SYN LOCK DET) signal supplies a low-level signal (TX_SYN_LOCK_DET) to controller U3021, controller U3021 will then turn on the transmitter.

2.9 Transmitter Theory of Operation

The transmitter (refer to figure 3) operates as a linear, Class-AB amplifier and is controlled by the T_R_SW input signal from the analog/digital module controller U3021 to provide a nominal voice-mode power output of 25 watts.

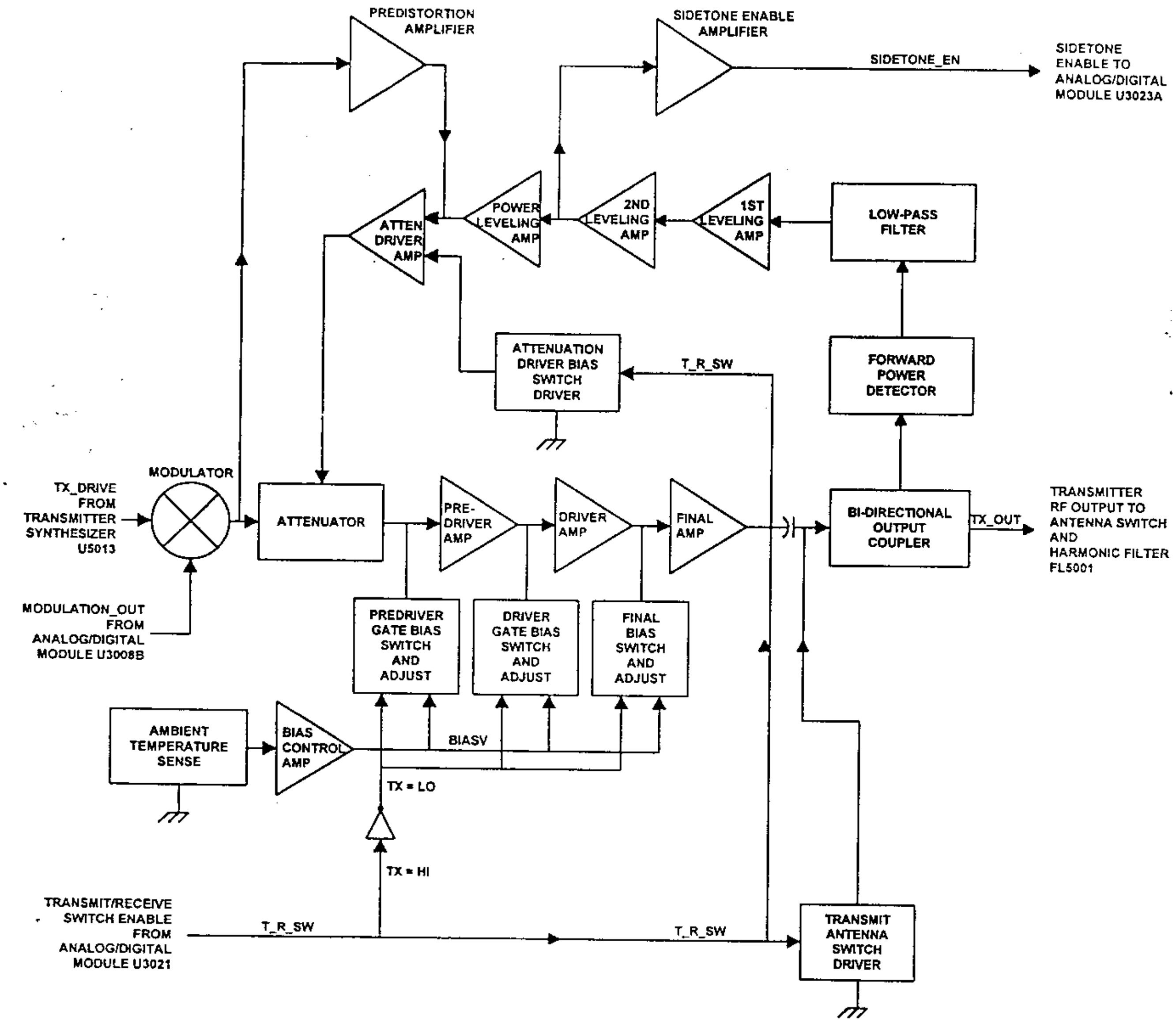
When the microphone push-to-talk (PTT) switch is keyed (pressed), the analog/digital module provides a transmit/receive switch enable (T_R_SW) signal through RF main module inverter U5006B to turn on gate bias switches Q5005, Q5009, Q5002 which in turn applies bias to predriver, driver, and final FET amplifiers Q5001, Q5006, and Q5003, respectively. The same T-R-SW signal routed through the transmit antenna switch driver circuit (U5006F, Q5007) where a positive voltage (1.7 volts dc) is supplied through the bi-directional output coupler (TX-OUT), to the antenna switch and harmonic filter section to switch the antenna switch circuit from its receive mode to its transmit mode. Zero volts dc from the transmit enable circuit sets the antenna switch to its receive mode. DC-blocking capacitor C5095 isolates the final amplifier output from the transmit enable dc switching voltage. In addition, the T_R_SW signal is routed through inverter U5006A to turn on gate bias switches Q5004 which in turn applies control voltage to attenuation driver amplifier U5002A.

Transmitter RF drive (TX_DRIVE) from transmitter synthesizer U5013 and MODULATION from analog/digital module U5008B are routed to low level modulator U5007 where the modulated RF voice/data output signal feeds into attenuator U5004.

Attenuator U5004 is part of a feedback loop which controls and maintains the output power level at a constant level of 25 watts.

Predistortion amplifier U5002B detects audio peaks on the modulator output RF signal in order to lower distortion in the signal. When audio peaks are detected, predistortion amplifier U5002B drives attenuation drive amplifier U5002A into less attentuation and drive predriver amplifier Q5001, driver amplifier Q5006, and final amplifier U5003 harder during those detected peaks.

The output of attenuator U5004 is fed to the next stage, a FET configured as a class AB predriver amplifier U5001. With 28 volts dc on the drain and a gate-to-source voltage of approximately three volts, the predriver amplifier stage provides 14 to 15 dB of gain for the incoming



RF Module Transmitter Block Diagram
Figure 3

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TX_DRIVE signal. The predriver amplifier stage is duplicated in the driver amplifier to provide an additional 14 to 15 dB of gain of the TX_DRIVE signal. At the output of the driver amplifier, the carrier-wave portion of the RF signal strength amounts to approximately one-watt and is routed to the input of final amplifier U5003.

The final amplifier is a power output FET which produces approximately 13 dB of gain with 28 volts dc on the drain and a gate-to-source voltage of approximately three volts. The output of the final amplifier is routed through dc-blocking capacitor C5095, through a bi-directional output coupler (TX_OUT), and to the antenna switch and harmonic filter section for transmission through the antenna.

The final amplifier output power is sampled by the forward power detector circuit and the reflected power detector. Forward power detector CR5007 is a Schottky diode (HP2800) that feeds back through operational amplifier stages to provide automatic gain control through the first leveling amplifier, operational amplifier U5001A, through the second leveling amplifier, operational amplifier U5010B, and through power leveling amplifier U5008A, also, an operational amplifier to the attenuation drive amplifier. This feedback adjusts attenuator U5004 to provide nearly constant transmitter power output throughout operating frequency band and for 27.5 VDC voltage variations.

Ambient temperature sensor U5009 and bias amplifier U5010A circuit controls the gate voltage (BIASV) to the three field-effect transistor (FET) power stages to keep the quiescent current of the FET's constant with respect to the RTA-83B ambient temperature. As temperature increases for a fixed voltage, the FET draws less current and as the temperature decreases for a fixed voltage, the FET draws more current. The ambient temperature sensor circuit senses this temperature fluctuation and regulates the FET gate voltage through bias control amplifier U5010A to lower the bias voltage to the FET power stages for increases of ambient temperature and raise the bias voltage to the FET power stages for decreases of ambient temperature.

The bias adjust controls (R5030 and R5092) for the predriver and driver amplifiers are set for a drain-to-source current of 350 milliamperes with no RF signal. When the RF drive is added to the input of the modulator stage and the final amplifier is providing full power out, the total current output is between 4 and 5 amperes

Impedance matching of 50 ohms between the stages is accomplished through the use of microstrip impedance-matching sections (printed-circuit coils, inductors, and capacitors) on the PC board.

2.9.1 Spurious Emissions Control Circuits

The transmitter output is filtered by a fixed tuned five pole low pass elliptic filter located on the transceiver assembly. The RF output is then fed through the antenna switch to a second fixed tuned five pole low pass elliptic filter located on the rear interconnect board. The cutoff frequencies of the filters is approximately 170 MHz. The function of the filters is to ensure transmitter harmonic energy does not exceed regulatory or system requirements.

2.10 2.983(d) (12) Modulation Theory of Operation

The RTA-83B VHF Transceiver employs an analog modulator technique for both voice and data mode.

2.10.1 Modulator Theory of Operation

The microphone voice input is amplifier, low pass filtered, compressed and fed to the modulator through the voice/data switch. The analog data information is amplifier and filtered, then fed to the voice/data switch for application to the modulator. The modulator is an RF mixer, with transmit RF energy fed to the input port and modulation applied to the local oscillator port. The result is an RF modulated signal at the output port.

2.11 2.983 (f) Identification Plate (Dwg # 057-50021-0009)

2.12 2.983 (g) LRU Photographs (Reference Attachment 2)

3. TEST PROCEDURES AND DATA

3.1 2.985 (a) RF Power Output

Test Equipment Used:

The RF load used was a Model 612 (Termaline) RF wattmeter manufactured by the Bird Electronics Corporatio, Cleveland, OH.

The calibration of this wattmeter is periodically checked by the Measurements and Standards Department of ASCAS. This type of RF wattmeter is an accurate 51.5 ohm load with a crystal diode rectifier and a meter calibrated to read directly in watts.

Test Procedure:

Voltage was adjusted to provide 27.5 VDC at the input of the unit at 118.00 MHz. Power was determined by direct measurements into a Bird Termaline Wattmeter. The RF power output was measured with a short length of RG-58/U cable between the transmitter and wattmeter.

Test Data:

Frequency (MHZ)	Power (Watts)
118.00	26
120.00	26.5
124.00	26.5
127.00	26
130.00	25
134.00	25
136.975	25

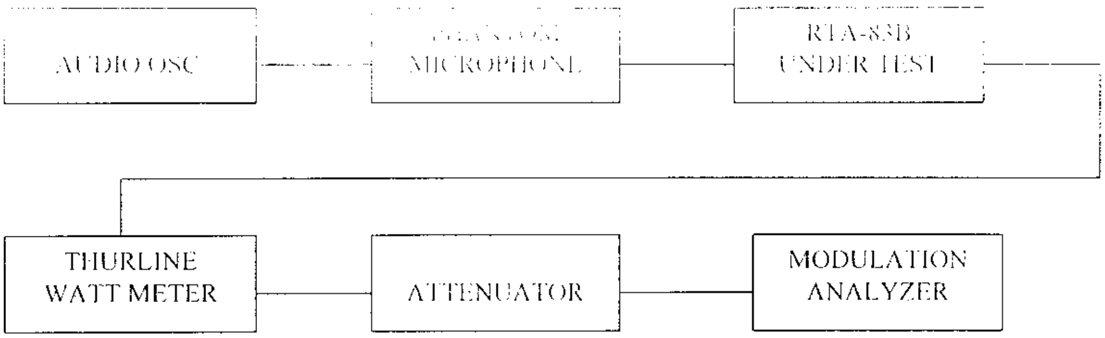
3.2 2.987(d) Modulation Characteristics

The curve of the audio modulating circuit frequency response is shown for the range of 100 to 5000 Hz on page 22. The curve showing percent modulation versus audio input voltage is shown on page 23.

Test Equipment Used:

Type	Model No.	Serial No.
Audio Oscillator	Hewlett Packard 8093B	140-4-5636
Modulation Analyzer	Hewlett Packard 8091B	140-4-6820
Wattmeter	Bird 43	7820
Oscilloscope	Tektronix	B317482
Phantom Microphone	ASCAS Fabricated	---
Power Attenuator	Pasternack PE7026-30	---

Figure 6 shows the test set-up used. A constant voltage was applied to the RTA-83B modulator input and the frequency of the applied voltage was varied between 100 and 5000 Hz. The transmitter percent modulation was checked at the various frequencies. The frequency was then set to 1 kHz and the input voltage was varied to check modulation limiting.



AM Modulation Characteristics Test Set-Up
Figure 6

Test Data:

Modulation Response vs Modulating Frequency

Audio Frequency (Hz)	**Demodulated Response (dB)**
100	-11.8
200	-4.9
300	-3.6
500	-1.6
800	-0.35
1000	0 – REF
1500	0.1
2000	0
2500	-.5
3000	-30
5000	-35
2700	-14.7
2600	-3.1

% Modulation vs Audio Input Voltage

Input Voltage (RMS Volts)	Modulation (%)
.02	18
.06	82
.15	91
.25	91
.40	91
.60	91
.80	91.2
1.0	91.5
2.0	92
3.0	92.3
4.0	92.5

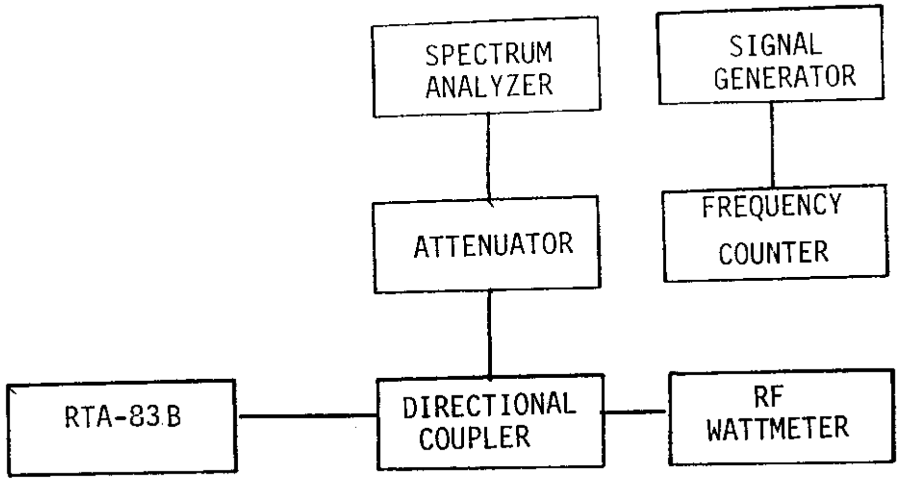
3.3 2.984 (I) Occupied Bandwidth

The equipment was set up as shown in Figure 4. Photographs of the spectrum were obtained with the transmitter unmodulated and then modulated at 2.5 kHz (16 dB greater than that required for 50% modulation) with the analyzer frequency span at 10 kHz/div and 10 kHz/div.

Test Equipment Used:

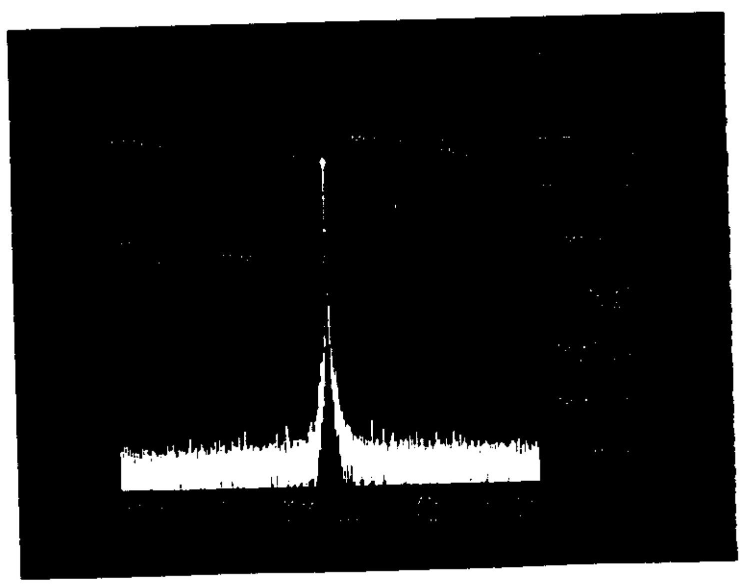
Type	Model No.	Serial No.
Spectrum Analyzer	Hewlett Packard 8568A	140-3-4490
Attenuator		
Signal Generator	Marconi 2030	140-4-6876
RF Wattmeter	Bird 612	3940
Directional Coupler	NARDA 3020	317

Test Set-Up:

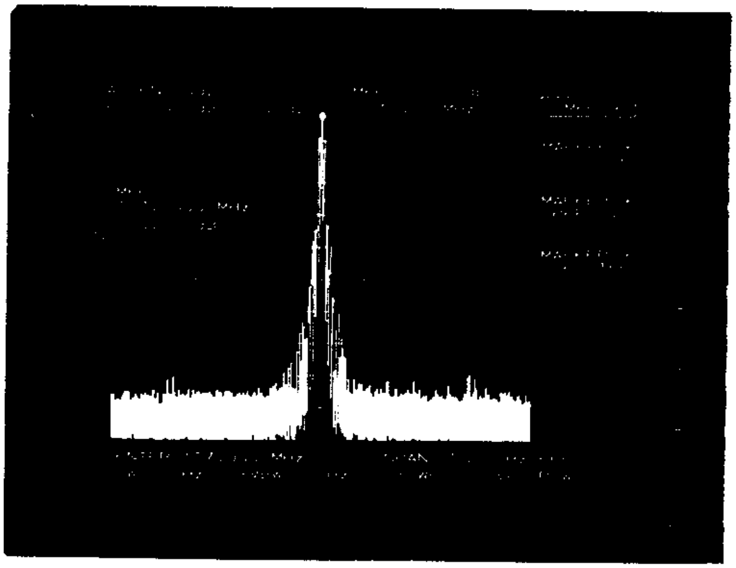


Test Data:

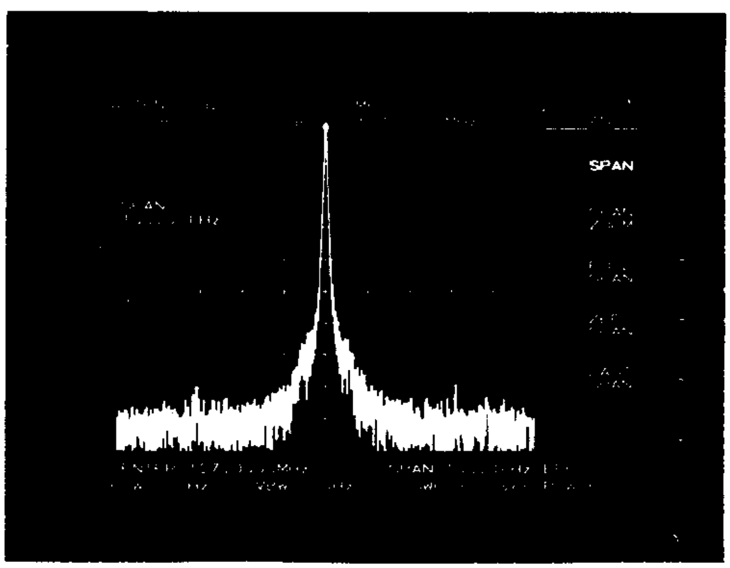
Photograph #1 – RTA-83B Unmodulated Spectrum



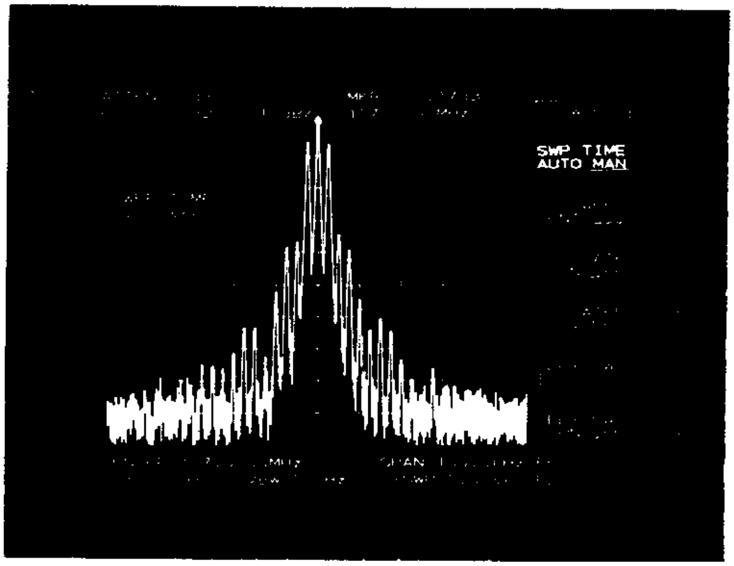
Photograph #2 RTA-83B Modulated With 2.5 kHz at Input Level 16 dB Above That Producing 50% Modulation



Photograph #3 - RTA-83B Unmodulated Spectrum



Photograph #4 RTA-83B Modulated at 2.5 kHz 16 dB Input Above 50% Modulation



3.4 2.991 Spurious Emissions at Antenna Terminal

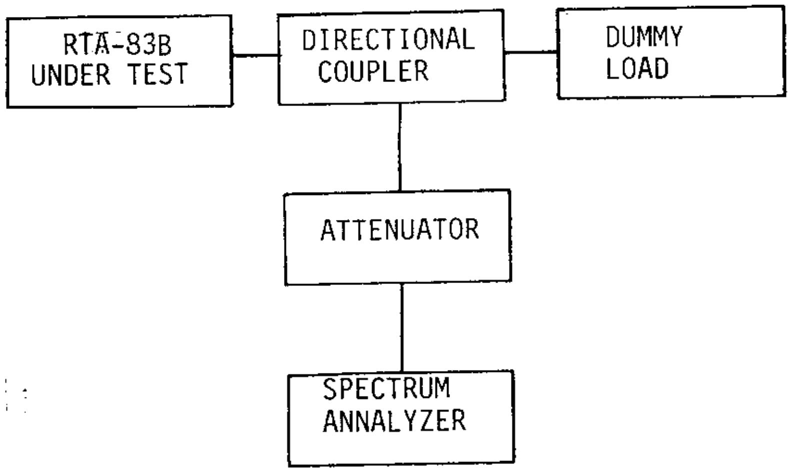
Test Equipment Used:

Type	Model No.	Serial No.
Attenuator	Weinschel 114-33	5666
RF Wattmeter	Bird 612	3940
Spectrum Analyzer	HP8568A	140-3-4489
Directional Coupler	NARDA 3020	317

Test Procedure:

The antenna conducted spurious emissions test set-up is shown in Figure 5. The transceiver was modulated with a 2500 Hz signal 16 dB greater than that required to produce 50% modulation. With the transceiver keyed, the frequency range starting at 1 MHz was scanned through 1.5K MHz. All detected signals and their power levels were noted and recorded.

Using the above procedure, the only detected signal that was greater than 69 dB below 1 watt was the second harmonic of 118.00 MHz. Because of this the second harmonic at several other frequencies was tested.



Test Set-Up for Antenna Conducted Spurious Emissions

Figure 5

Test Data:

Channel Frequency – 118.000 MHz

Spurious Frequency (MHz)	Spurious Level (dBw)	**Remarks**
236	-104 dBw	2nd Harmonic
354	-103.5	3rd Harmonic
472	>-120	4th Harmonic
590	>-120	5th Harmonic
708	>-120	6th Harmonic
826	>-120	7th Harmonic
944	>-120	8th Harmonic
1062	>-120	9th Harmonic
1280	>-120	10th Harmonic

Channel Frequency = 127.000 MHz

Spurious Frequency (MHz)	Spurious Level (dBw)	Remarks
254	-104 dBw	2nd Harmonic
381	-103	3rd Harmonic
508	>-120	4th Harmonic
635	>-120	5th Harmonic
762	>-120	6th Harmonic
889	>-120	7th Harmonic
1016	>-120	8th Harmonic
1143	>-120	9th Harmonic
1270	>-120	10th Harmonic

Channel Frequency = 136.75 MHz

Spurious Frequency (MHz)	Spurious Level (dBw)	Remarks
239.050	-97 dBw	2nd Harmonic
410.925	-88 dBw	3rd Harmonic
547.900	-120 dBw	4th Harmonic
684.975	-120 dBw	5th Harmonic
821.850	-120 dBw	6th Harmonic
958.925	-120 dBw	7th Harmonic
1095.80	-120 dBw	8th Harmonic
1232.775	-120 dBw	9h Harmonic
1369.750	-120 dBw	10th Harmonic

Remarks:

All detected signals were within FCC limits: (43 plus 10 log) (mean output power in watts) = 43 + 10 log 25 = -57 dBw.

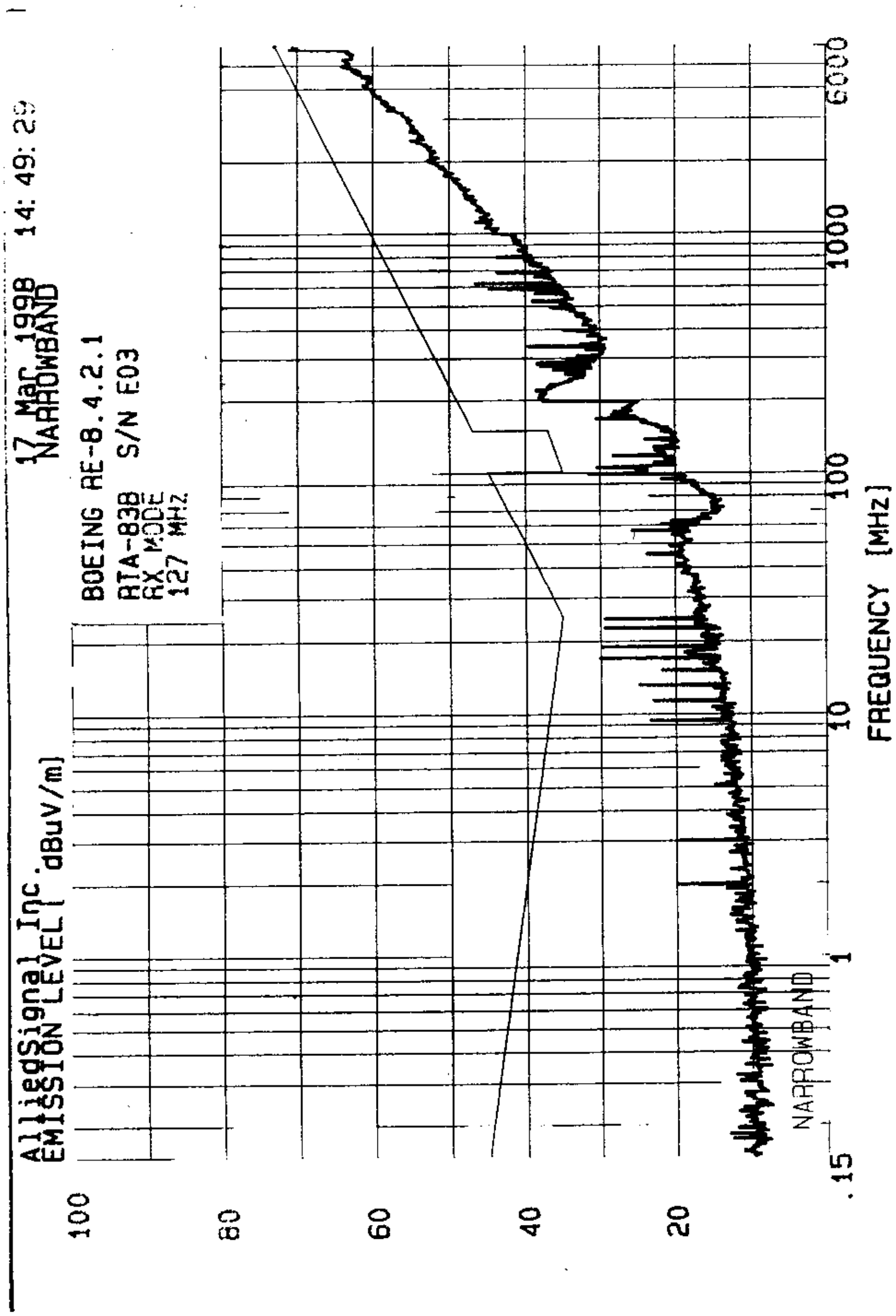
All other detected signals not recorded were greater than 20 dB below the permissible value.

3.5 2.993 Field Strength of Spurious Radiation

In accordance with FCC Part 2.993 , this submission is offered in lieu of far-field measurements. The emission measurements are representative of a typical airframe installation for which this equipment is intended.

The radiated spurious emissions are measure in accordance with AlliedSignal documents 004-50252 RTA-83B Test Plan) and 004-50253 (RTA-83B EMC Test Report). The test methodology and results are in accordance with RTCA Document DO-160C and Boeing Requirements Document D6-16050-4. The emissions limits are compatible with the airframe isolation characteristics to ensure interference free operation between both aircraft-instlled and external-to-aircraft equipments and antennas.

The Following plots compliance with RTCA DO-160C Section 21,"Emission of Radio Frequency Energy".



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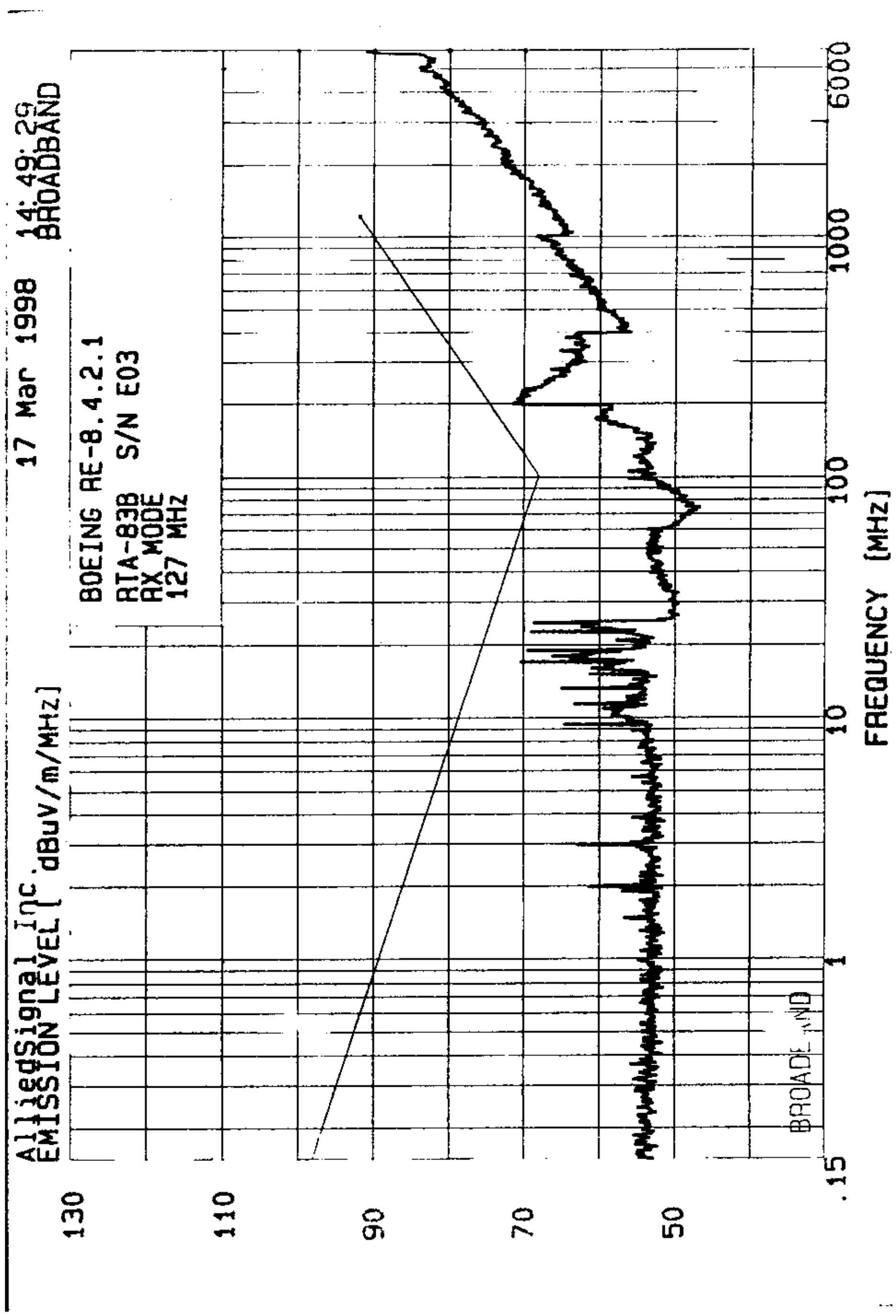
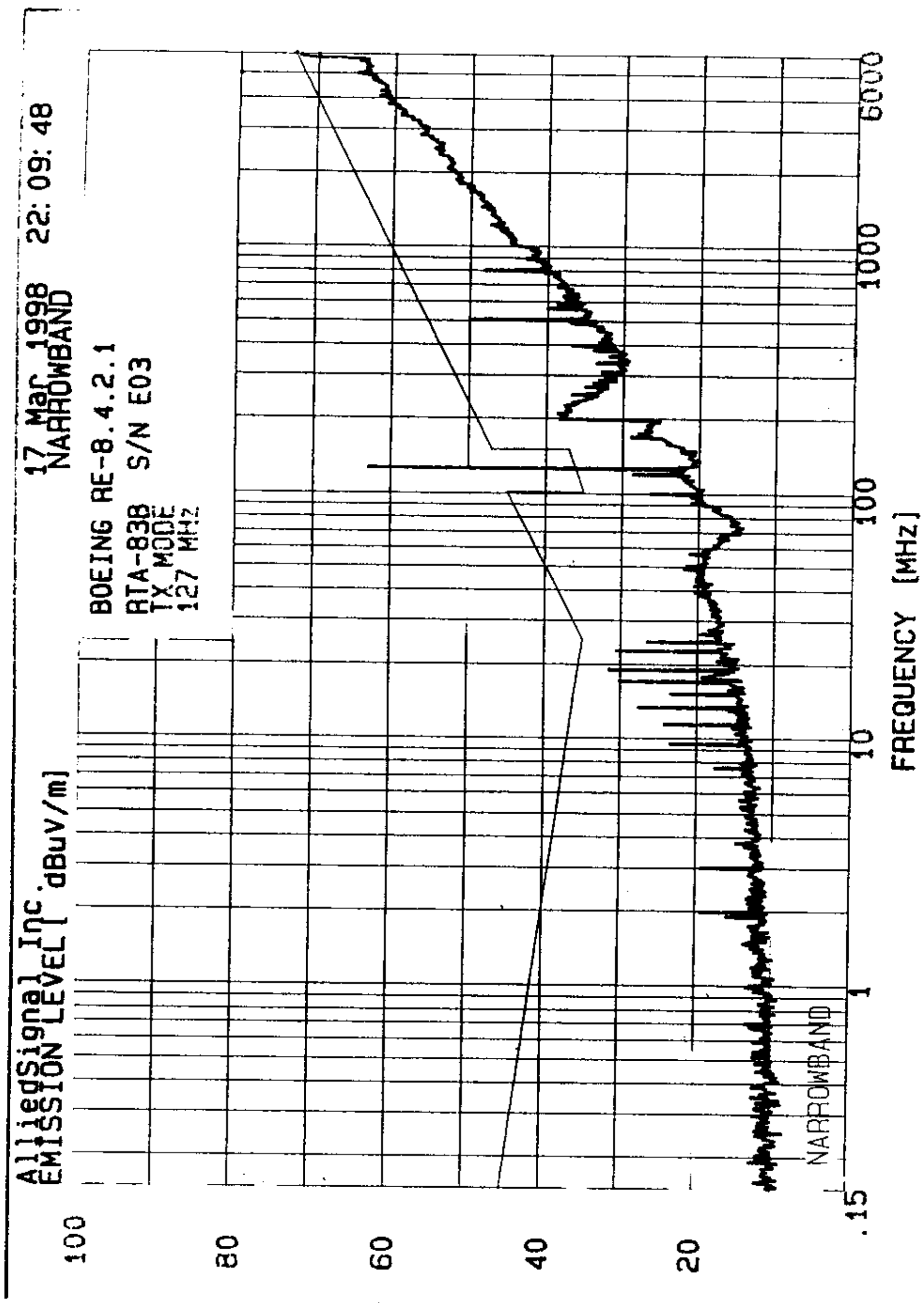
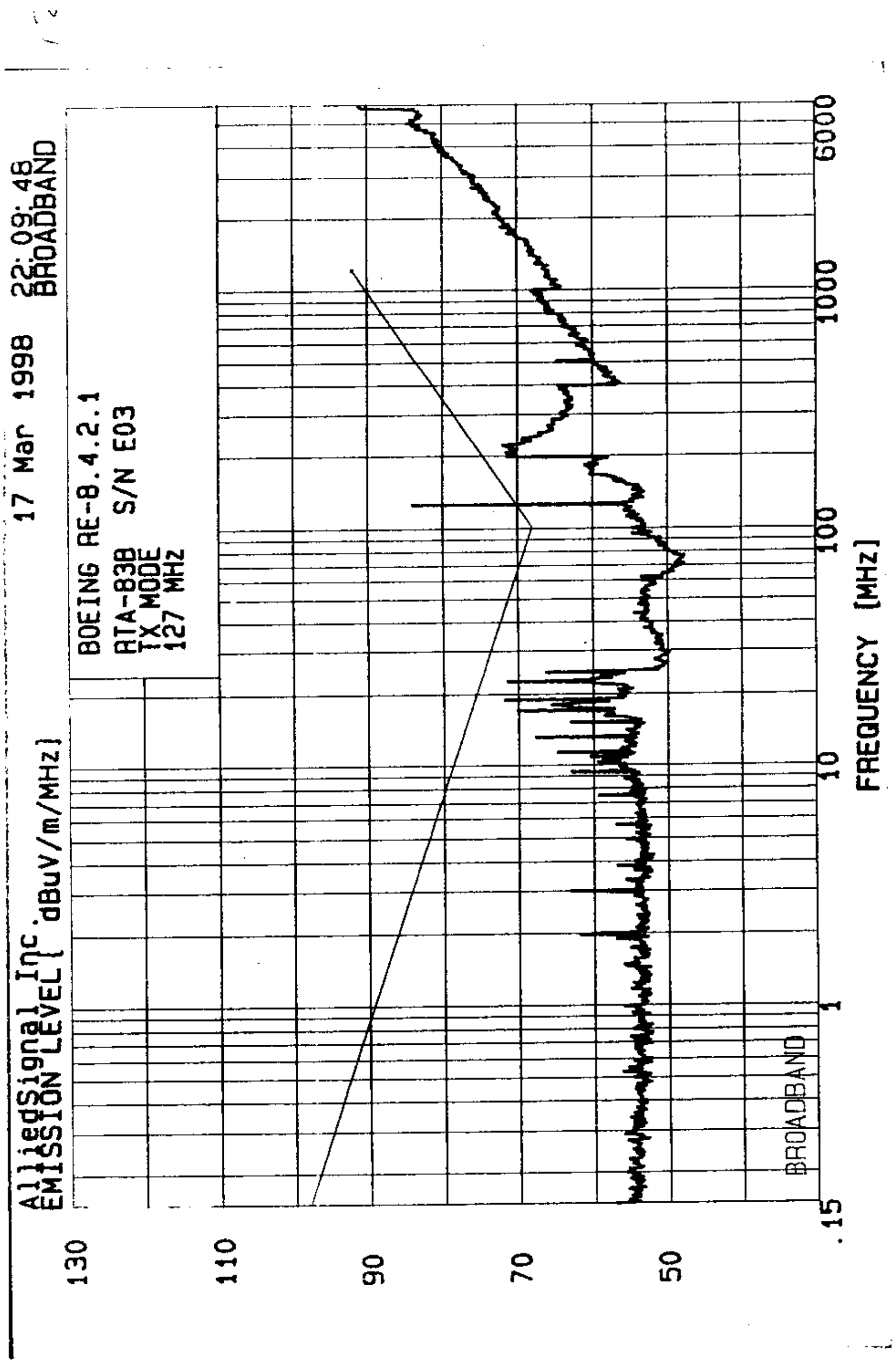
A	27914		698-50116
SCALE		SHEET 22 OF 29	



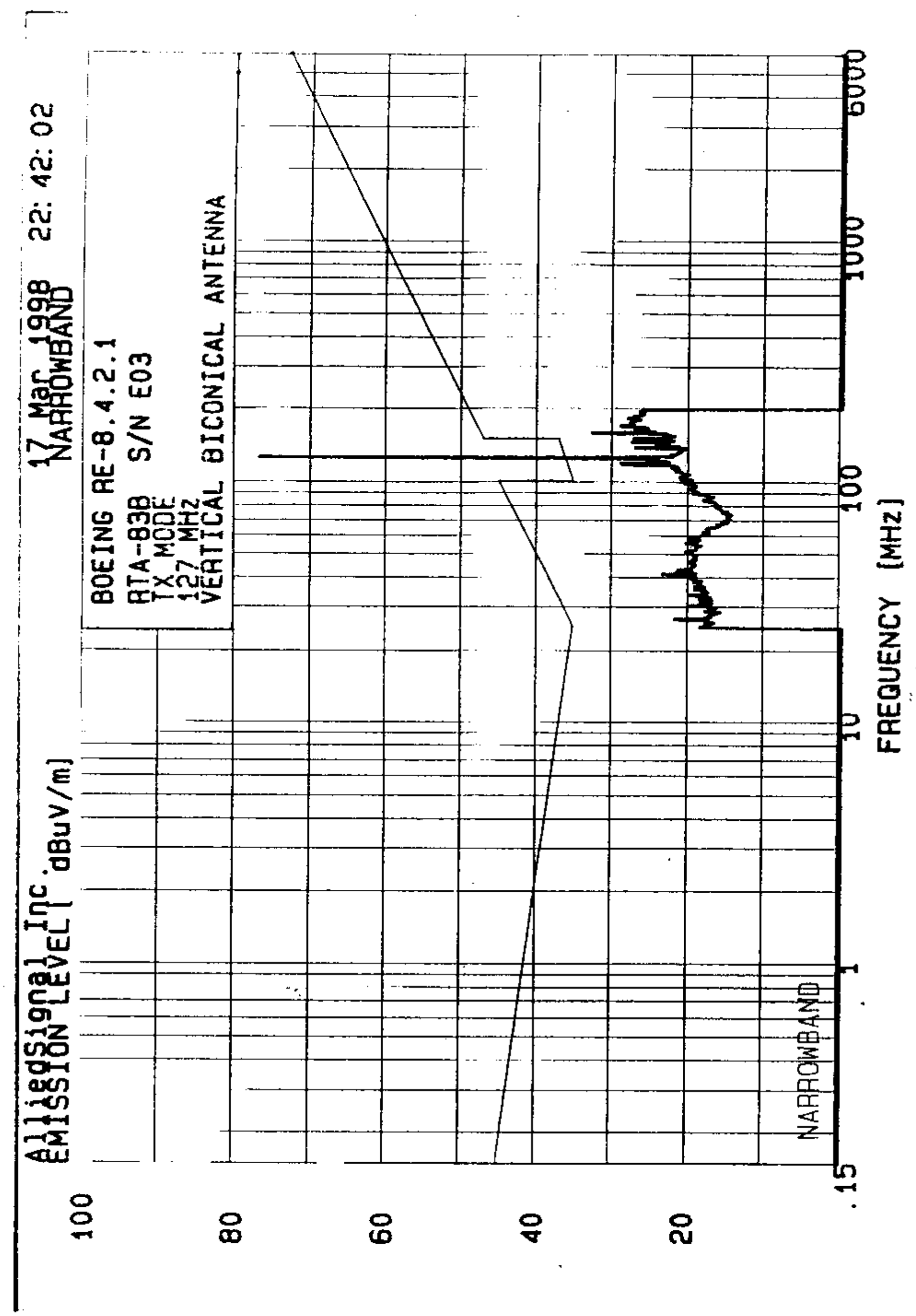
SIZE	CAGE CODE		DRAWING NUMBER
A	27914		698-50116
SCALE			SHEET 23 OF 29



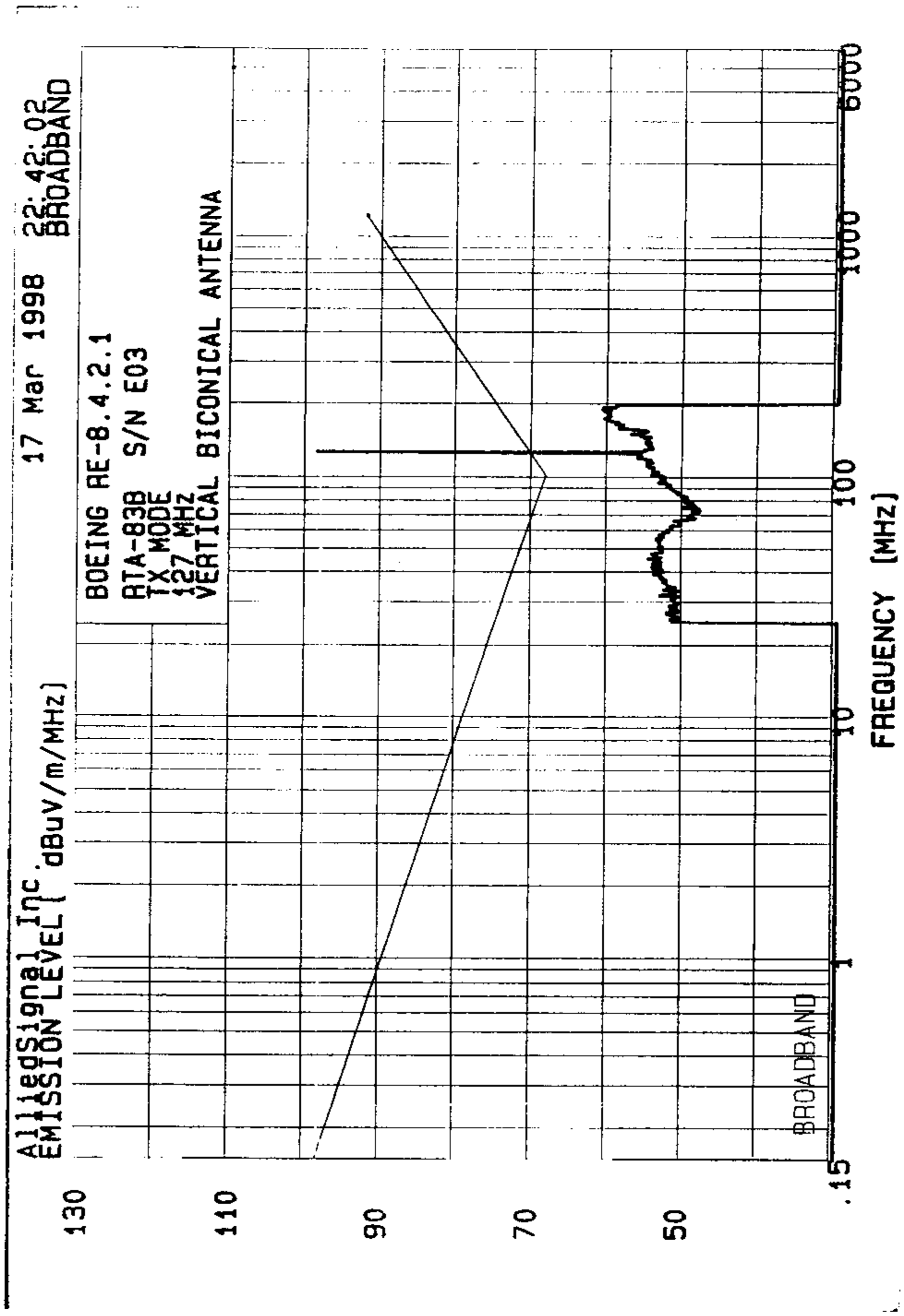
SIZE	CAGE CODE		DRAWING NUMBER
A	27914		698-50116
SCALE			SHEET 24 OF 29



SIZE A	CAGE CODE 27914		DRAWING NUMBER 698-50116
SCALE		SHEET 25 OF 29	



SIZE	CAGE CODE		DRAWING NUMBER
A	27914		698-50116
SCALE		SHEET 26 OF 29	



SIZE	CAGE CODE		DRAWING NUMBER
A	27914		698-50116
SCALE			SHEET 27 OF 29

3.6 2.995 Frequency Stability

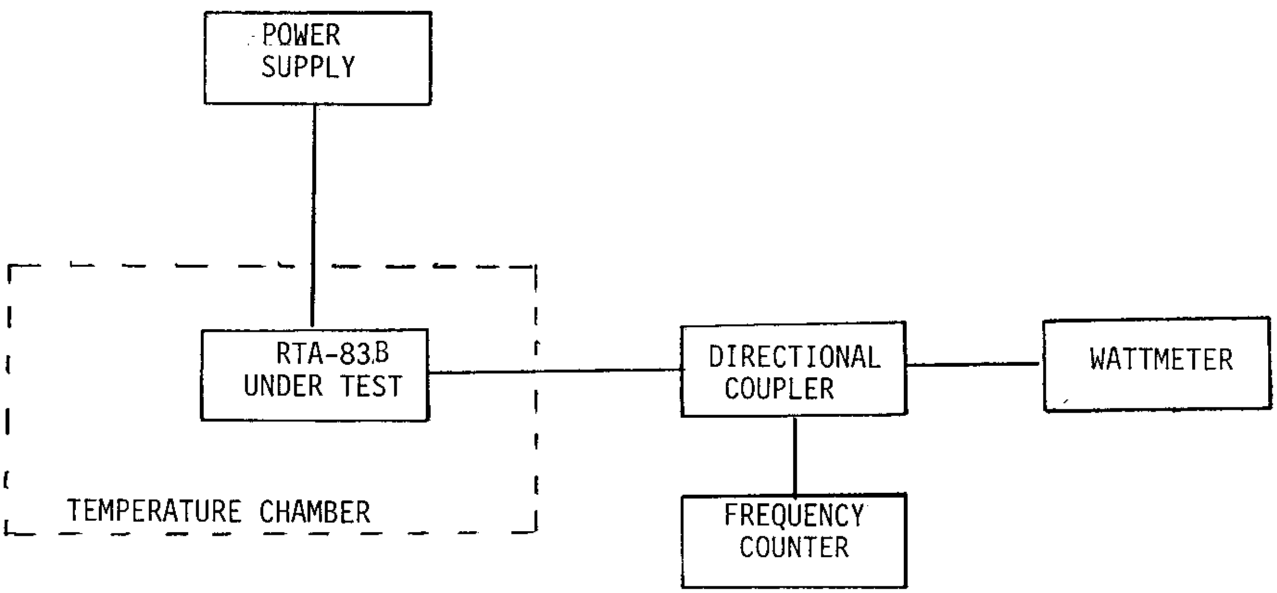
Test Equipment Used:

Type	Model	Serial No.
DC Power Supply	HP6268B	140-3-3380
Frequency Counter	HP5382A	F800184
RF Wattmeter	Bird 612	3940
Bi-Directional Coupler	NARDA 3020	317
Temperature Chamber	Thermotron S-4	25-1280-11

Test Procedure:

The transceiver was placed into a controller temperature chamber and stabilized at several different temperatures between -65°C and +65°C. The test set-up is shown in Figure 10. The transmitter operating frequency was measured at several frequencies at each of the temperatures the transceiver was stabilized.

The transceiver was checked for frequency shift due to power supply variations. The test set-up in Figure 6 was used, except that the temperature chamber was not used. Transmitter output frequency was checked at several channel frequencies when the Dc input voltage to the transceiver was set to three different voltage levels. These levels are 22.5 VDC (85% of nominal), 27.5 VDC (100% of nominal), and 31.6 VDC (115% of nominal).



Frequency Stability Test Set-Up
Figure 6

Test Data:

Carrier Frequency Stability Temperature Variation Test

Temp (°)	Frequency Change From channel Freq (Hz)	Frequency Change from 25°C Reading (%)
25	127.5000500 (0 Ref)	0%
35	-100	.0000787
45	-100	-.0000787
55	-200	-.000157
65	-200	-.000157
15	0	0
5	0	0
-5	0	0
-15	0	0
-25	0	0
-35	0	0
-45	0	0
-55	0	0

V_{IN} = 27.5 VDC Channel Frequency = 127.000 MHz

Carrier Frequency Stability Voltage Variation Test Temperature = 25°C

Selected Freq (MHz)	22.5 VDC (85%) Freq (MHz)	22.5 VDC (100%) Freq (MHz)	31.6 VDC (115%) Freq (MHz)	F Max (Hz)	F Max (%)
118.000000	117.999980	117.999890	117.999990	20	.0000167
119.100000	119.099980	119.099890	1119.100000	20	.0000169
120.200000	120.199980	120.199920	120.200010	80	.000066
121.300000	121.299980	121.299930	121.300010	70	.000057
122.400000	122.399980	122.399960	122.400010	40	.0000326
123.500000	123.499980	123.499960	123.500010	40	.0000323
124.600000	125.599980	124.599960	124.600010	40	.0000321
125.700000	125.699990	125.699960	125.700020	40	.0000318
126.800000	126.799990	126.799960	126.800010	40`	.0000315
127.900000	127.899990	127.899960	127.900020	40	.0000312
130.250000	130.024990	130.024960	130.025020	40	.0000304
131.050000	131.049990	131.049960	131.050020	40	.0000304
132.075000	132.074990	132.074960	132.075020	40	.0000302
133.000000	132.999990	132.999960	133.000020	40	.0000300
134.000000	133.999990	133.999960	134.000020	40	.0000298
135.000000	134.999990	134.999960	135.000020	40	.0000296
136.000000	135.999990	135.999960	136.000020	40	.0000294
136.975000	136.974990	136.074960	136.075030	40	.0000292