TYPE OF EXHIBIT: Semiconductor Function List

FCC PART: 2.983 (d) (6)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

The following list specifies the Schematic Reference Designator, Ritron Part Number, Manufacturer, Manufacturer's Part Number, and Function of each semiconductor used in the RRX-452 Transmitter assembly.

Schematic Reference Designator	Ritron Part Number	Manufacturer	Manufacturer's Part Number	Function
CR203	48C1004E	MOTOROLA	MMBV-105G	TX Audio modulation varactor.
CR204	48C1004E	MOTOROLA	MMBV-105G	RF Synthesizer loop resonator.
CR205	04820119	MOTOROLA	1N5355A	+18 V Zener overvoltage shunt.
IC201	31010002	NATIONAL	78L05AC	+5 volt regulator.
IC202	31330001	FUJITSU	MB1504	UHF synthesizer.
IC204	03131015	MOTOROLA	MC78M08CT	+8 VDC requlator.
Q202	4801002A	MOTOROLA	MMBT-3906	VCO charge pump, + rail.
Q203	4801001Q	MOTOROLA	MMBT-5088	VCO charge pump, - rail.
Q204	4841006T	MOTOROLA	MMBFJ310T1	VCO UHF RF oscillator.
Q205	4821007Y	MOTOROLA	MMBR941LT1	RF oscillator 1st buffer/amp.
Q206	4821007Y	MOTOROLA	MMBR941LT1	RF oscillator 2nd buffer/amp.
Q207	04801030	MOTOROLA	MRF-555	RF Driver amp.
Q208	04800023	MOTOROLA	TIP-122	DC/RF Driver Power Control.
Q209	04801021	MOTOROLA	MRF-652	RF Power amp (output device).
Q210	4801001Q	MOTOROLA	MMBT-5088	TX ENABLE switched-DC driver.
Q211	48180001	SEIMENS	BCP-69	TX switched-DC pass element.
Q213	48220001	MOTOROLA	MRF-5812	TX RF pre-driver stage.
Y201*		TEW/SPECTRUM	TX1843M	Temp Comp Volt Cntl Xtal Osc.

* Y201 is a complete, vendor encased and characterized, TCVCXO. While this subassembly has semiconductors on its internal circuit board, this part is not built or repaired by RITRON, INC. Repair is specified as COMPLETE Y201 SUBASSEMBLY REPLACEMENT to ensure the manufacturers' guaranteed frequency tolerance of +/- 1.5 ppm over the -30* C to +50* C temperature specification is not compromised. Ritron periodically samples and tests these units to confirm the manufacturer's continuing compliance with this specification.

TYPE OF EXHIBIT: Semiconductor Function List

FCC PART: 2.983 (d) (6)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

The following list specifies the Schematic Reference Designator, Ritron Part Number, Manufacturer, Manufacturers Part Number, and Function of each semiconductor used in the RRX-452 Receiver assembly.

Schematic Reference Designator	Ritron Part Number	Manufacturer	Manufacturer's Part Number	Function
CR101	48A1005C	MOTOROLA	MMBD-7000	Temperature compensation, SQ.
CR102	48A1005C	MOTOROLA	MMBD-7000	Temperature compensation, SQ.
CR103	04820007	MOTOROLA	1N5232B	Receiver voltage regulation.
CR106	48C1004E	MOTOROLA	MMBV-105G	L.O. synthesizer varactor.
CR107	48C10051	MOTOROLA	MMBV-6091	Ref. Osc. varactor, temp comp.
CR108	48A1005B	MOTOROLA	MMBD-6100	Temp. comp., Reference Osc.
Or CR108	48A1005C	MOTOROLA	MMBD-7000	(selected alternate component)
CR109	48A1005C	MOTOROLA	MMBD-7000	Temp. comp., Reference Osc.
IC101	31030003	MOTOROLA	MC3371D	IF subsystem: LO, MIXER, DISC.
IC102	31010002	MOTOROLA	78L05AC	+5 volt regulator.
IC103	31330001	FUJITSU	MB1504	UHF L.O. synthesizer IC.
IC104	31010005	Texas Inst.	TLC272	Squelch voltage comparator.
Q101	4821007Y	MOTOROLA	MMBR941LT1	RF RX front end amplifier.
Q102	4841006T	MOTOROLA	MMBFJ310T1	Active 1st mixer, 21.4 MHz IF.
Q103	4821003E	MOTOROLA	MMBT-H10	1st IF (21.4 MHz) amplifier.
Q104	48010R02	MOTOROLA	MUN2211T1	Squelch line inverter/switch.
Q105	4801002A	MOTOROLA	MMBT-3906	VCO charge pump to +V rail.
Q106	4801001Q	MOTOROLA	MMBT-5088	VCO charge pump to GND rail.
Q107	4841006T	MOTOROLA	MMBFJ310T1	UHF RF Local Oscillator.
Q108	4821007Y	MOTOROLA	MMBR941LT1	L. O. 1st buffer/amplifier.
Q109	4821007Y	MOTOROLA	MMBR941LT1	L. O. 2nd buffer/amplifier.
Q110	4841006U	MOTOROLA	MMBFJ309L	Reference Oscillator.
Or Q110	4841006T	MOTOROLA	MMBFJ310T1	(selected alternate component)

TYPE OF EXHIBIT: Semiconductor Function List

FCC PART: 2.983 (d) (6)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

The following list specifies the Schematic Reference Designator, Ritron Part Number, Manufacturer, Manufacturers Part Number, and Function of each semiconductor used in the RRX-452 Control Board assembly.

Schematic Reference Designator	Ritron Part Number	Manufacturer	Manufacturer's Part Number	Function
CR401	48A1005C	MOTOROLA	MMBD7000	Diode switch, input isolation.
CR402	48A1005C	MOTOROLA	MMBD7000	Diode switch, input isolation.
CR403	48A1005C	MOTOROLA	MMBD7000	Diode switch, input isolation.
CR404	48A1005C	MOTOROLA	MMBD7000	Diode switch, input isolation.
CR405	48A1005C	MOTOROLA	MMBD7000	Temperature compensation.
CR407	48A1005C	MOTOROLA	MMBD7000	Diode switch, input isolation.
CR408	48A1005C	MOTOROLA	MMBD7000	External overvoltage shunt.
CR414	02450014	LUMEX	SSF-LXH100HGW	Bi-color LED, TX STATUS ind.
CR415	02450015	LITEON	LTL-533-11	GREEN LED, CARRIER DETECT ind.
CR416	48A1005B	MOTOROLA	MMBD6100	Diode switch, Squelch control.
CR501	02450013	LEDTECH	LT6411G-S2	RED LED, CNTRL BRD V+ ON ind.
IC401	31124066	MOTOROLA	MC14066	Quad analog logic switch.
IC402	31020324	NATIONAL	LMT324AD	Quad Op Amp.
IC403	31020001	NATIONAL	MF6CWM-50	6 pole Sw. Cap. Active Filter.
IC404	31020001	NATIONAL	MF6CWM-50	6 pole Sw. Cap. Active Filter.
IC405	31020001	NATIONAL	MF6CWM-50	6 pole Sw. Cap. Active Filter.
IC406	31010004	NATIONAL	LM386MX-1	Audio amplifier.
IC407	31010002	NATIONAL	78L05AC	+5 volt regulator to uP.
IC408	314A1001	MOTOROLA	MC68HC705C8FN	Microprocessor, programmed.
IC409	31210001	ATMEL	X24C01S	EEPROM.
IC410	31020324	NATIONAL	LMT324AD	Quad Op Amp.
IC501	31010009	MOTOROLA	78L08AC	+8 volt regulator.
Q401	48010R02	MOTOROLA	MUN2211T1	Subtone detect logic inverter.
Q402	4801002A	MOTOROLA	MMBT-3906	uP RESET pulse after PWR ON.
Q404	4801002A	MOTOROLA	MMBT-3906	PTT sense switch to bias Q405.
Q405	48010R02	MOTOROLA	MUN2211T1	PTT command logic switch.
Q408	4801002A	MOTOROLA	MMBT-3906	TX and RX NOR unLOCK DETECT.
Q410	48010R02	MOTOROLA	MUN2211T1	Subtone decode wave digitizer.
Q411	4801002V	MOTOROLA	MMBT-A64	Audiable (ID) tone oscillator.

TYPE OF EXHIBIT: Semiconductor Function List

FCC PART: 2.983 (d) (6)

MANUFACTURER: RITRON, INC.

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

The following list specifies the Schematic Reference Designator, Ritron Part Number, Manufacturer, Manufacturers Part Number, and Function of each semiconductor used in the RRX-452 Power Supply assembly.

Schematic Reference Designator	Ritron Part Number	Manufacturer	Manufacturer's Part Number	Function
CR301	04820119	MOTOROLA	1N5355A	Overvoltage protection, 18 V.
CR302	04810003	MOTOROLA	1N4001	Battery Charge isolation.
CR303	04810009	MOTOROLA	MR 751	AC power rectifier.
CR304	04810009	MOTOROLA	MR 751	AC power rectifier.
CR305	04810003	MOTOROLA	1N4001	Loss of AC Mains detection.
CR306	04810003	MOTOROLA	1N4001	Relay de-energize shunt.
CR307	04820028	MOTOROLA	1N6282	Surge supressor.
CR308	04820038	MOTOROLA	1N5925B	Zener reference.
CR309	04810001	MOTOROLA	1N4148	Voltage regulator switch.
IC301	03131027	MOTOROLA	LM317T	Charge voltage regulator.
IC302	03131053	MOTOROLA	MC1723	Adjustable voltage regulator.
Q 301	04800006	MOTOROLA	2N4124	Battery charge switch.
Q 302	04800006	MOTOROLA	2N4124	Battery charge switch.
Q 303	04800011	MOTOROLA	2N4126	Charge limiter.
Q 304	04800006	MOTOROLA	2N4124	AC Mains sense switch.
Q 305	04800048	MOTOROLA	MPSW01A	Relay cutuut if AC Mains lost.
Q 306	04800019	MOTOROLA	TIP42	Regulated DC Pass element.
Or Q 306	04800027	MOTOROLA	TIP36	High power DC Pass element, pr.
Q 308	04800027	MOTOROLA	TIP36	High power DC Pass element, pr.
Q 307	04800012	MOTOROLA	2N6724	Fan switch.

TYPE OF EXHIBIT:	Statement of Certifying Engineer
FCC PART:	2.947
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 28, 1998

I, Arnal Cook, possess a current FCC GENERAL RADIO TELEPHONE License issued January 2, 1985, PG-18-13343, (converted by the FCC from a FCC 1ST CLASS RADIOTELEPHONE License, P1-18-45406, issued April 25, 1978).

I have been the Repeater Project Engineer for 3 years at RITRON, INC.

I hereby certify that all the measurements and data herein were taken by me, or under my direct supervision and that they were obtained using sound and accepted engineering principles, and that they accurately reflect the performance and characteristics of the unit tested.

Signed: Arnal P Cook

Arnal Cook - Project Engineer

Date: May 2, 1998

TYPE OF EXHIBIT: Test Equipment Used

FCC PART: 2.947 (d)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

The measured data in this report was obtained using one or more of the following pieces of equipment. The particular equipment used in any one test is detailed in the procedure for that test.

ITEM	MANUFACTURER	MODEL NO.	SERIAL NO.	
Regulated DC Power Supply	Astron	VS-20M	9406023	ACC
Multimeter	Beckman Industrial	4410	50710069	ACC
Multimeter	BK Precision	2704A	234-008455	
Wattmeter Calibrator*	Hewlett Packard	435B	2441A10170	BAM
RF Power Sensor *	Hewlett Packard	8482B	2349A01936	BAM
RF Load, Calibrated*	Hewlett Packard	8482B	2349A01936	BAM
* Traceable Calibrated Source of matching serial numbers.				
Wattmeter	Telewave	44	8172	ACC
RF Test Set	IFR	FM/AM 1500	R# 01027	ACC
includes RF Power meter, Audio Tone Generator, Frequency Counter				
Spectrum Analyzer	Hewlett Packard	8559A	2010A 06979	ACC
Communications Test Set	Hewlett Packard	8920A	R# 01498	SPH
Digital Storage Scope	Fluke/Phillips	PM3335	DM630034	SPH
Plotter	Hewlett Packard	7585B	2503A05509	
Temperature Chamber	Delta Design	3900 CL	0-52-R	ACC
Pyrometer	Omega	7035-J-225	7504	ACC

TYPE OF EXHIBIT:	Description of Measurement Facility
FCC PART:	2.948
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 28, 1998

The Field Strength measurements filed with this application were made on a site certified by RITRON, INC. Data pertaining to this site is on file with the FCC and is current.

This site is used exclusively by RITRON, INC. and is utilized only for RF Field Strength Measurements of equipment designed and Manufactured by RITRON, INC.. It is NOT used for measurements by or for any other party on a contract basis or otherwise.

TYPE OF TEST:	Radio Frequency Power Output
FCC PART:	2.985
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 28, 1998

PROCEDURE:

The RRX-452 was aligned for transmitter operation on 464.600 MHz. (Fo) per the tune-up procedure outlined in the preliminary manual.

110 VAC power was supplied to the RRX-452. The RRX-452 was connected at the antenna port terminal to the input of an IFR model 1500 Communications Service Monitor, within 1 year of calibration, and recently checked for RF power accuracy. This device provides a single 50 ohm resistively loaded input port for measurements for all measurements.

The collector supply line to Q209, the final RF amplifier transistor, was broken at Z205 and a Beckman Industrial, 4.5 digit, model 4410 DMM was connected in series to measure the collector current during transmit. Supply voltage was measured, also at Z205, using the same DMM, during transmit.

TYPE OF TEST: Radio Frequency Power Output

FCC PART: 2.985

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

TEST FREQUENCY: 464.600 MHz.

RF Output was loaded and measured by the 50 ohm resistive port of the IFR 1500 Communications Service Monitor, or a Telewave 'thru line' RF wattmeter connected to a 50 ohm resistive load.

Input Power (Z205) (VDC)	Input Current (Z205) (Amps)	Input Power (Watts)	*Output Power (Watts)
12.68 (TX)	1.14 (TX)	14.46	4.45

* On Serial Number 22345 submitted for Type Acceptance, RF Output Power was measured at the EXTERNAL antenna port, i.e. AFTER the internal duplexer, allowing for thermal stabilization. Without the internal duplexer, 6.6 Watts was measured at the internal transmitter 50 ohm output terminal, i.e. BEFORE the internal duplexer. This is a typical 1.7 dB on-frequency thru-loss of the internal duplexer.

This product is available to the End User in LESS-DUPLEXER (optional) custom configurations of the basic RRX-452 model to allow the End User to connect to external duplexers of larger size, separate TX and RX antennas, after-market RF combiners, amplifiers, etc. Maximum RF output (i.e. less duplexer) in ANY configuration is eight watts typical maximum, and will always be less than ten watts, at the external antenna port of the RRX-452.

****

Certifying Engineer: Arnal Cook
Date: April 21,1998

TYPE OF TEST: Modulator Limiter Response

FCC PART: 2.987 (a), (b)

MANUFACTURER: RITRON, INC.

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

PROCEDURE: The RRX-452 was aligned for transmitter operation on 464.6 MHz. (Fo) per the tune-up procedure outlined in the preliminary manual. The modulation Limiter was set for a hard limit at 2.5 KHz deviation.

110 VAC power was supplied to the RRX-452. The output of the IFR 1500 Service Monitor/Tone Generator was applied to the External TX Modulation input on the Control Board (J411, pin 4) via the rear panel DB-25 Accessory connector, pin 3. The tone generator has a sine wave output. The amplitude was set to 0.1900 VACrms to produce +/- 1.25 KHz (50%) of deviation, at 1000 Hz audio, to ensure the modulator was not in Limiting.

The modulated RF output was connected to the "TRANS" 50 ohm resistive RF input of the same IFR 1500 Service Monitor. The IFR 1500 receiver bandwidth was set to FM1.

(a) The audio range was manually swept from 100 Hz to 5000 Hz in 100 Hz steps while the RRX-452 was keyed for transmit, watching the Deviation readout on the IFR 1500 Service Monitor. In the range of peak Deviation for constant input amplitude, the frequency steps were reduced to 10 Hz steps and manually swept (by auto-sequential digital steps) again over the narrow range of peak response. During this phase of tests, the digital readout (numerical values on video display) of Deviation on the IFR 1500 was used to read to a resolution of 0.01 KHz of Deviation. Single Hz steps produced no variation in Deviation output.

The peak audio response was determined to be 2950 Hz.

(b) To show the Limiter keeps the radio within bandwidth specifications, the audio modulation input was increased by a factor of x100 (+20 dB). The modulation input voltage was raised to1.900 VACrms (4.52 VACp-p) and the test rerun. The second column shows that at all audio frequencies at this excessive input level, all Deviations were Limited to less than 2.50 KHz.

The peak audio response in this "abusive" condition was at 1150 Hz and was limited to 2.42 KHz Deviation.

TYPE OF TEST: Modulator Limiter Response

FCC PART: 2.987 (a), (b)

MANUFACTURER: RITRON, INC.

MODEL: RRX-452

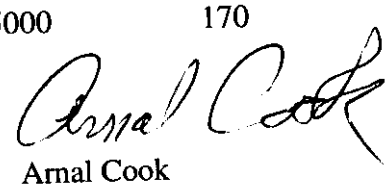
TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

TEST FREQUENCY: 464.600 MHz.

Audio Freq. (Hz.)	FM Deviation (+/- Hz.) (a)	Limiter Deviation (b)
100	50	680
150	100	1280
200	170	1830
300	270	2080
500	490	2170
750	760	2350
1000	1000	2380
1150	-	2410
1500	1410	2320
1950	1690	2250
2450	1790	2180
2950	1730	2020
3100	1670	1940
3500	1400	1600
4000	830	940
4500	390	460
5000	170	190



Certifying Engineer: Arnal Cook

Date: April 28, 1998

TYPE OF TEST: Modulator Frequency Response

FCC PART: 2.987 (a), (b)

MANUFACTURER: RITRON, INC.

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: May 2, 1998

PROCEDURE: The RRX-452 was aligned for transmitter operation on 464.6 MHz. (Fo) per the tune-up procedure outlined in the preliminary manual.

The modulation input to the transmitter was isolated by breaking the input line from the RRX-452 Control board J406 pin 3 to the transmitter J202 pin 3. Only C202, a DC blocking 1 ufd tantalum capacitor, remained before the input to the modulator stage. An audio generator (HP RF Test Set) injected a fixed amplitude signal into this transmitter modulator input point. The input was set to 1 KHz audio at 390 mVACrms to generate 1.5 KHz Deviation.

The frequency response of the modulator was determined to be essentially flate (within 1 dB) from 40 Hz to 27,000 Hz. Any variation between 10 Hz to 40Hz was limited to +/- 1.5 dB.

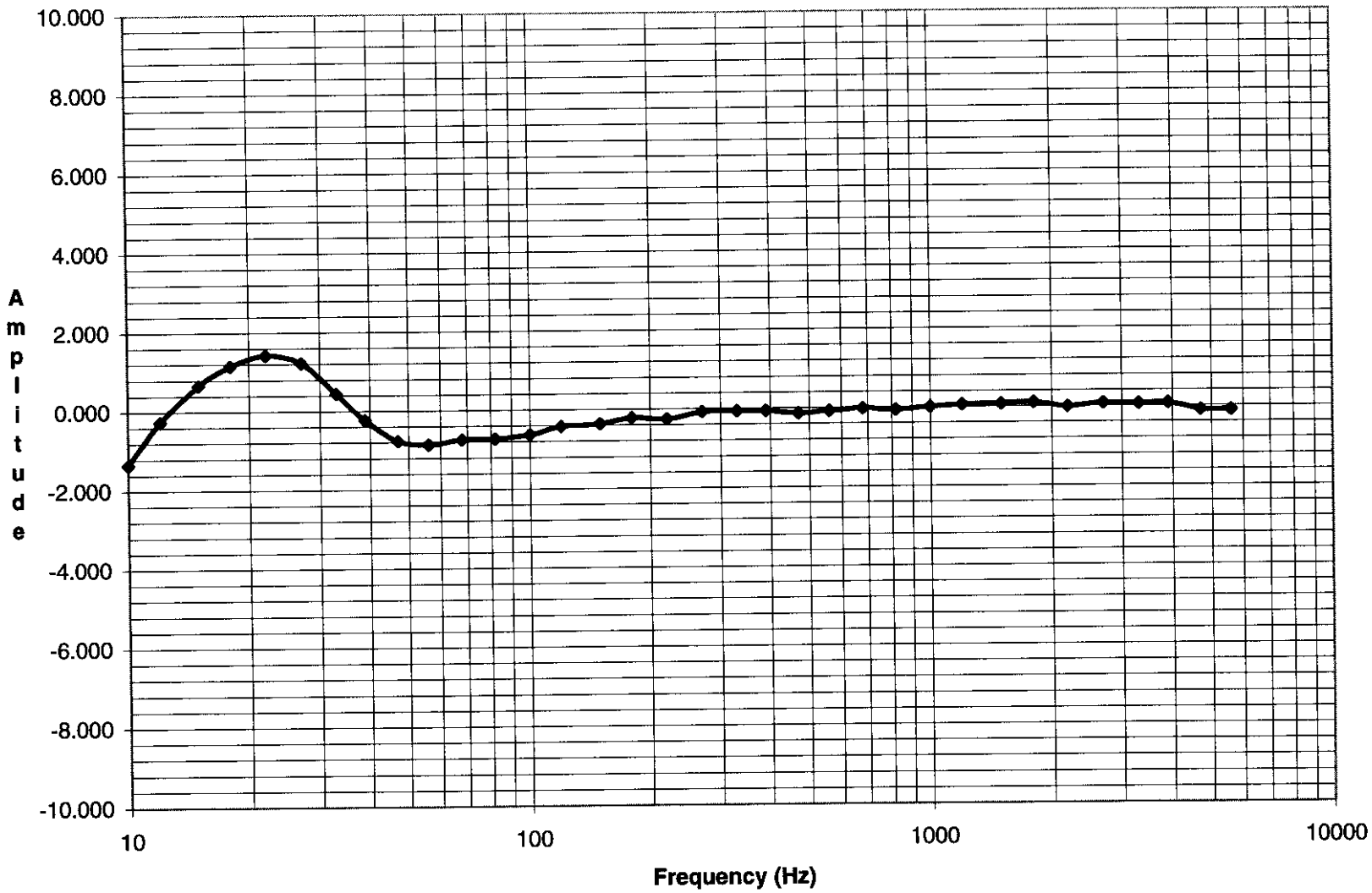
The following pages show the results in tabular and graphical form.

Certifying Engineer: Arnal Cook
Date: May 2, 1998

MODULATOR FREQUENCY RESPONSE

Modulation Frequency (Hz)	Deviation Amplitude (+/-kHz)	Relative Amplitude (dB)
10	1308	-1.345
12	1482	-0.260
15	1646	0.652
18	1743	1.149
22	1798	1.419
27	1756	1.214
33	1605	0.433
39	1487	-0.231
47	1397	-0.773
56	1382	-0.867
68	1403	-0.736
82	1405	-0.723
100	1421	-0.625
120	1453	-0.431
150	1463	-0.372
180	1489	-0.219
220	1481	-0.266
270	1512	-0.086
330	1514	-0.074
390	1516	-0.063
470	1504	-0.132
560	1512	-0.086
680	1521	-0.034
820	1514	-0.074
1000	1527	0.000
1200	1536	0.051
1500	1538	0.062
1800	1545	0.102
2200	1525	-0.011
2700	1539	0.068
3300	1536	0.051
3900	1539	0.068
4700	1509	-0.103
5600	1509	-0.103
6800	1515	-0.069
8200	1507	-0.115
10000	1515	-0.069
12000	1513	-0.080
15000	1491	-0.207
18000	1490	-0.213
22000	1483	-0.254
27000	1449	-0.455

Modulator Frequency Response



TYPE OF TEST:	Modulator Low Pass Response
FCC PART:	2.987 (a), (b)
MANUFACTURER:	RITRON, INC.
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 28, 1998

PROCEDURE: The RRX-452 was aligned for transmitter operation on 464.6 MHz. (Fo) per the tune-up procedure outlined in the preliminary manual.

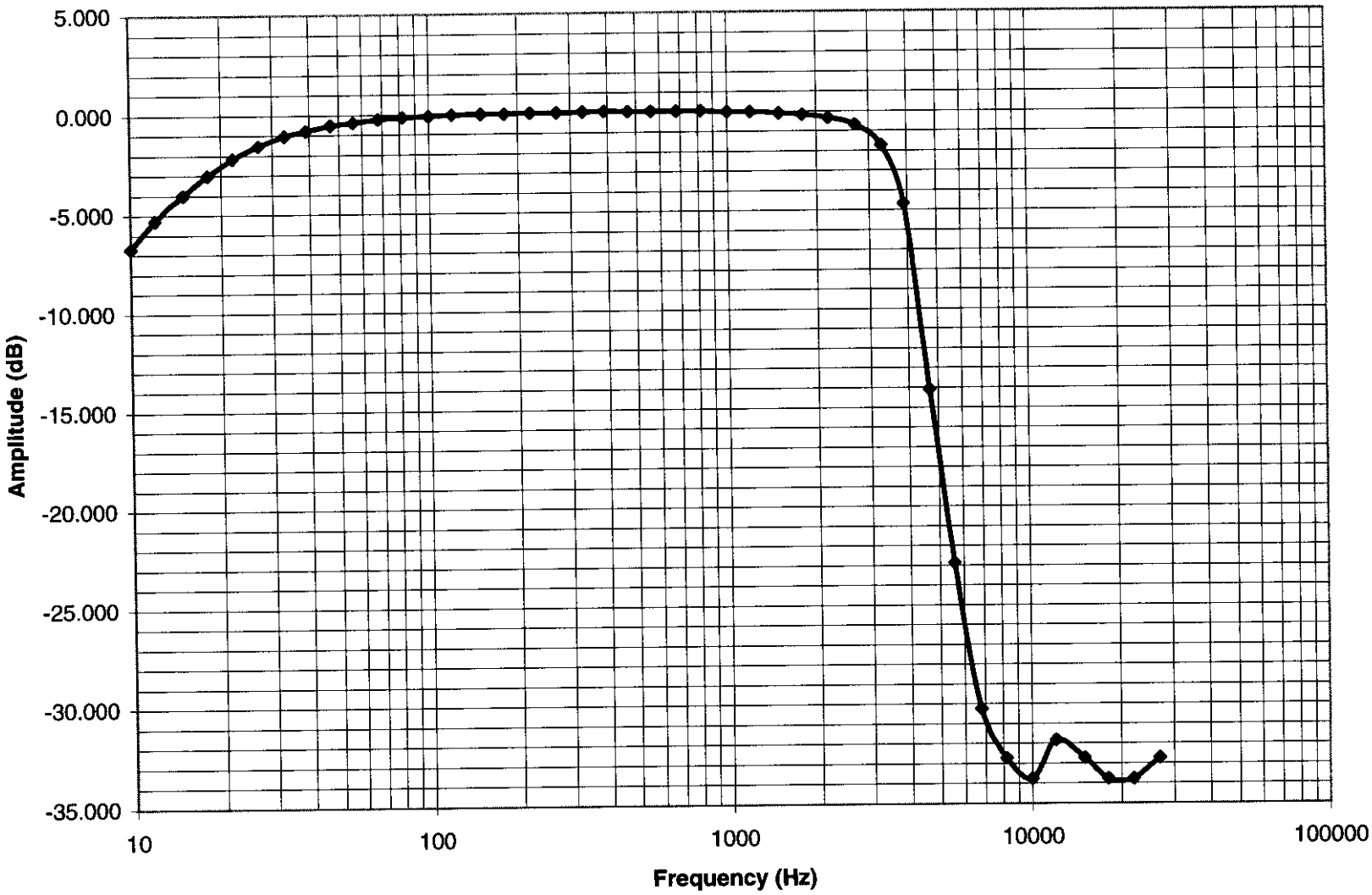
The input side of the low-pass filter was isolated from the rest of the circuitry by lifting the input side of control potentiometer R426. An audio generator (HP RF Test set) was then connected to the input of R426 (Voice Deviation control) and set to produce an output frequency of 1000 Hz.

The ouput level of the HP audio generator was adjusted for 1400 mVACrms. The output of the Low Pass filter to the transmitter, isolated in the previous test at Control board J406 pin 3, was the point where the filter response was measured.

The frequency of the HP audio generator was varied between 10 Hz and 27,000 Hz. The filter's output is shown in tabulated and graphical forms on the following pages.

Certifying Engineer: Arnal Cook
Date: April 28, 1998

Modulation Low Pass Filter Response



Audio Low Pass Filter Response

Applied Frequency (Hz)	Measured Amplitude (mV)	Relative Amplitude (dB)
10	180	-6.716
12	212	-5.295
15	246	-4.003
18	275	-3.035
22	304	-2.164
27	327	-1.530
33	346	-1.040
39	356	-0.792
47	367	-0.528
56	373	-0.387
68	380	-0.226
82	383	-0.157
100	386	-0.090
120	388	-0.045
150	390	0.000
180	390	0.000
220	391	0.022
270	391	0.022
330	392	0.044
390	393	0.067
470	392	0.044
560	392	0.044
680	392	0.044
820	392	0.044
1000	390	0.000
1200	389	-0.022
1500	386	-0.090
1800	382	-0.180
2200	375	-0.341
2700	360	-0.695
3300	319	-1.745
3900	228	-4.663
4700	77	-14.091
5600	28	-22.878
6800	12	-30.238
8200	9	-32.736
10000	8	-33.759
12000	10	-31.821
15000	9	-32.736
18000	8	-33.759
22000	8	-33.759
27000	9	-32.736

TYPE OF TEST: Percent Modulation vs. Modulation Input Voltage

FCC PART: 2.987 (a), (b)

MANUFACTURER: RITRON, INC.

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

PROCEDURE: The RRX-452 was aligned for transmitter operation on 464.6 MHz. (Fo) per the tune-up procedure outlined in the preliminary manual.

An audio generator (HP RF Test set) was connected to the Accessory TX Audio input port (DB-25 connector pin 3) to drive the modulation amplifier. The output of the generator was set at a level high enough to ensure that the audio madulation limiter was in full Limiting. The output of the modulation amplifier, including the audio low-pass filter, was monitored while the frequency of the audio generator was adjusted to find the frequency of maximum response.

The Voice Deviation control (R426) was then set to give an output deviation of +/- 2.5 KHz at the frequency of maximum response.

The frequency of the audio generator was set to 300 Hz and the output level adjusted t\from 0 to at least 16 dB over that required to produce 50% modulation at 300 Hz. The deviation of the carrier was measured over this range.

This procedure was repeated for the frequencies of 330 Hz, 500 Hz, 1000 Hz, 2000 Hz, and 3300 Hz. The data for each frequency is tabulated and plotted in a family of curves on the following pages.

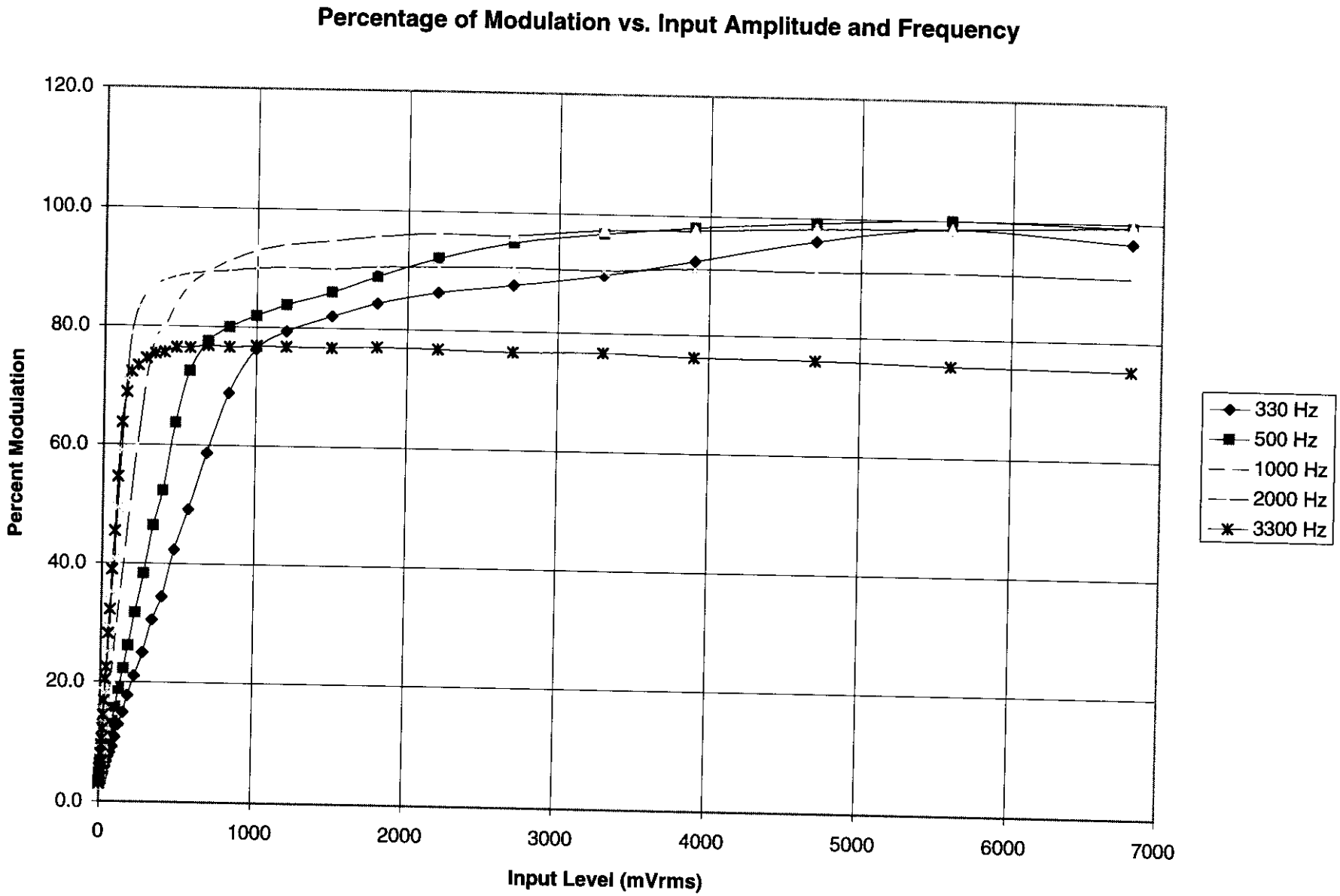
Certifying Engineer: Arnal Cook
Date: April 28, 1998

Percent Modulation vs. Modulation Input Voltage and Frequency

Input Voltage (mVrms)	@330 Hz Deviation (Hz)	@500 Hz Deviation (Hz)	@1000 Hz Deviation (Hz)	@2000 Hz Deviation (Hz)	@3300 Hz Deviation (Hz)
1	74	75	76	76	85
1.2	75	77	72	81	75
1.5	79	77	71	91	86
1.8	83	80	75	81	94
2.2	76	82	76	95	102
2.7	69	88	90	94	101
3.3	78	81	97	113	118
3.9	77	82	93	104	114
4.7	80	91	103	121	137
5.6	82	86	107	137	140
6.8	91	89	113	147	156
8.2	74	91	124	156	171
10	84	101	132	177	199
12	101	98	149	214	235
15	98	117	173	243	262
18	107	121	191	277	304
22	113	144	217	328	360
27	124	158	241	379	421
33	142	168	284	454	510
39	147	196	318	517	561
47	168	207	370	626	703
56	191	256	438	732	805
68	204	295	507	877	973
82	229	335	605	1017	1135
100	269	395	727	1233	1364
120	323	469	867	1473	1593
150	372	557	1043	1776	1721
180	445	653	1238	1971	1808
220	528	793	1486	2079	1833
270	624	956	1763	2143	1865
330	761	1159	1947	2178	1886
390	859	1307	1999	2195	1892
470	1057	1594	2101	2212	1911
560	1229	1812	2179	2224	1911
680	1468	1939	2236	2232	1923
820	1722	2000	2281	2237	1916
1000	1907	2050	2323	2247	1922
1200	1985	2097	2350	2254	1920
1500	2051	2153	2368	2250	1918
1800	2108	2222	2389	2262	1924
2200	2158	2303	2407	2266	1919
2700	2196	2374	2405	2271	1914
3300	2244	2418	2431	2265	1917
3900	2311	2451	2439	2279	1906
4700	2403	2479	2454	2274	1902
5600	2462	2500	2464	2278	1888
6800	2415	2484	2483	2269	1880

Percent Modulation vs. Modulation Input Voltage and Frequency

	@330 Hz	@500 Hz	@1000 Hz	@2000 Hz	@3300 Hz
Input Voltage (mVrms)	Deviation (%)	Deviation (%)	Deviation (%)	Deviation (%)	Deviation (%)
1	3.0	3.0	3.0	3.0	3.4
1.2	3.0	3.1	2.9	3.2	3.0
1.5	3.2	3.1	2.9	3.6	3.4
1.8	3.3	3.2	3.0	3.2	3.8
2.2	3.0	3.3	3.0	3.8	4.1
2.7	2.8	3.5	3.6	3.8	4.0
3.3	3.1	3.2	3.9	4.5	4.7
3.9	3.1	3.3	3.7	4.2	4.6
4.7	3.2	3.6	4.1	4.8	5.5
5.6	3.3	3.4	4.3	5.5	5.6
6.8	3.6	3.6	4.5	5.9	6.3
8.2	3.0	3.6	5.0	6.3	6.9
10	3.4	4.0	5.3	7.1	8.0
12	4.0	3.9	6.0	8.6	9.4
15	3.9	4.7	6.9	9.7	10.5
18	4.3	4.8	7.6	11.1	12.2
22	4.5	5.7	8.7	13.1	14.4
27	5.0	6.3	9.6	15.2	16.8
33	5.7	6.7	11.4	18.2	20.4
39	5.9	7.8	12.7	20.7	22.5
47	6.7	8.3	14.8	25.0	28.1
56	7.6	10.3	17.5	29.3	32.2
68	8.2	11.8	20.3	35.1	38.9
82	9.1	13.4	24.2	40.7	45.4
100	10.8	15.8	29.1	49.3	54.6
120	12.9	18.8	34.7	58.9	63.7
150	14.9	22.3	41.7	71.0	68.8
180	17.8	26.1	49.5	78.8	72.3
220	21.1	31.7	59.4	83.2	73.3
270	24.9	38.3	70.5	85.7	74.6
330	30.5	46.4	77.9	87.1	75.4
390	34.4	52.3	80.0	87.8	75.7
470	42.3	63.8	84.0	88.5	76.4
560	49.1	72.5	87.2	88.9	76.4
680	58.7	77.6	89.5	89.3	76.9
820	68.9	80.0	91.2	89.5	76.6
1000	76.3	82.0	92.9	89.9	76.9
1200	79.4	83.9	94.0	90.2	76.8
1500	82.1	86.1	94.7	90.0	76.7
1800	84.3	88.9	95.6	90.5	76.9
2200	86.3	92.1	96.3	90.6	76.7
2700	87.8	95.0	96.2	90.8	76.5
3300	89.8	96.7	97.3	90.6	76.7
3900	92.4	98.0	97.6	91.2	76.2
4700	96.1	99.2	98.2	91.0	76.1
5600	98.5	100.0	98.6	91.1	75.5
6800	96.6	99.4	99.3	90.8	75.2


Percentage of Modulation vs. Input Amplitude and Frequency
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Percent Modulation
0
1000
2000
3000
4000
5000
6000
7000
Input Level (mVrms)
330 Hz
500 Hz
1000 Hz
2000 Hz
3300 Hz

TYPE OF TEST:	Occupied Bandwidth
FCC PART:	2.989 (c) (1), and 90.210 (d) et al
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 28, 1998

PROCEDURE:

The RRX-452 was aligned for transmitter operation on 464.6 MHz. (Fo) per the tune-up procedure outlined in the preliminary manual.

110 VAC was applied to the RRX-452. The RRX-452 was connected at the antenna terminal by a 2' long piece of 50 ohm coaxial cable to a 50 ohm RF Load with a -30 dB sampling port, then to the ANT input of an IFR 1500, with 40 dB ATTENUATOR selected, to the Spectrum Analyzer for detailed readings on the 1 KHz ANALY DISPR.

This test set up was duplicated to the HP 8559A Spectrum Analyzer to confirm there were no spurs beyond the first +/- 20 KHz of channel width. This allowed a full scale setting on the SA display by means of variable attenuation on the input, which was not available on the IFR. This feature allowed the full 80 dB of dynamic range for readings.

To obtain a reference power level, the sub-audible tone generator was logically secured and no other modulation source was connected. This allows the RRX-452 to output a non-modulated "CARRIER FREQUENCY". The result of this measurement was then recorded as 0 dBc.

To obtain a modulated spectrum plot, the IFR's Tone Generator was set to 2500 Hz and level controlled as specified in 2.989 (c) (1) to "16 dB greater than that necessary to produce 50 percent (1.25 KHz) modulation .... at the frequency of maximum response of the audio modulating circuit." Thus, this test was conducted at 566.0 mVACrms input to the TX Audio input port of the RRX-452, J411 pin 4 via connection to rear panel DB-25 pin 3.

TYPE OF TEST:	Occupied Bandwidth
FCC PART:	2.989 (c) (1), 90.210 (d) et al
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 30, 1998

GRAPHS:

The following plots represent the occupied bandwidth of the RRX-452 while modulated as specified in 2.989 (c) (1) for the 11.25 KHz Emission Mask specified in 90.210 (d) et al .

Certifying Engineer:	Arnal Cook
Date:	April 30, 1998

TYPE OF TEST: Occupied Bandwidth

FCC PART: 2.989 (c) and 90.210 (d) et al

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

GRAPHS:

The attached graph shows the modulated spectrum of the transmitter. This graph also indicates the FCC limits referenced to the unmodulated carrier power for compliance with Emission Mask D for 12.5 KHz Channel Spacing per 90.210 (d) et al. The computed Occupied Bandwidth is 10 kHz.

Modulation Input: 2500 Hz @ +16 dB over that required to produce 50% modulation (1.25 KHz Deviation) at the most sensitive audio frequency.

The following measurements were recorded:

FM Sideband:	Measured:	"dB down":	FCC requirement "dB down":
Carrier only	+36.5 dBm	Reference	0
Carrier w/ mod	+34.5 dBm	2 dB	0
+/- 2.5 KHz	+26.5 dBm	10 dB	0
+/- 5.0 KHz	+12.5 dBm	14 dB	0
+/- 7.5 KHz	- 5.5 dBm	42 dB	33.6 dB
+/- 10.0 KHz	- 23.5 dBm	60 dB	51.8 dB
+/- 12.5 KHz	-33.5 dBm	70 dB	69.9 dB

Certifying Engineer: Arnal Cook
Date: April 28, 1998

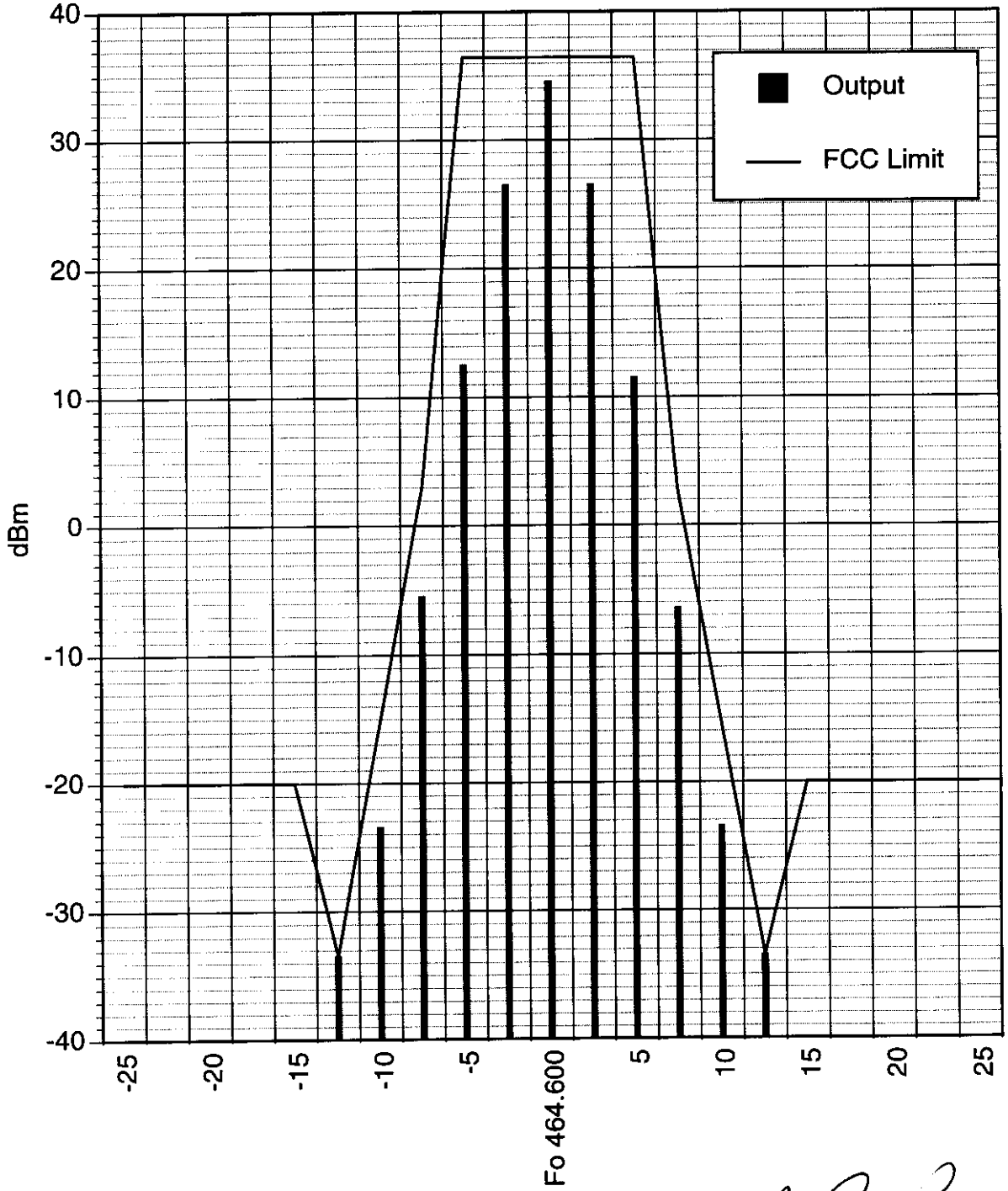
TYPE OF TEST: OCCUPIED BANDWIDTH
FCC PART: 2.989 (c) (1), 90.210 (d) et al
MODELS: RRX-452
FCC ID: AIERIT05-452

Carrier Frequency:	464.6	**MHz**
Power Output:	4.45	**Watts**
Power Output:	36.48	**dBm**
Frequency of Maximum Audio Response:	2950	**Hz**
Input Level to Produce 50% Modulation:	89.7	**mVRMS**
Input Level at 2500 Hz (+16 dB):	566.0	**mVRMS**
Mean Reference Power (MRP):	35.33	**dBm**
Occupied Bandwidth:	10.0	**KHz**

Emission Frequency (fo +/-)	Lower Sidebands (dBm)	% MRP	Sum of % MRP	FCC Limit (dBm)	Upper Sidebands (dBm)	% MRP	Sum of % MRP	FCC Limit (dBm)
Carrier	34.5	82.65%						
2.5 KHz	26.5	13.10%	13.63%	36.48	26.5	11.90%	12.29%	36.48
5 KHz	12.5	0.52%	0.53%	36.48	11.5	0.38%	0.38%	36.48
7.5 KHz	-5.5	0.01%	0.01%	2.90	-6.5	0.01%	0.01%	2.90
10 KHz	-23.5	0.00%	0.00%	-15.28	-23.5	0.00%	0.00%	-15.28
12.5 KHz	-33.5	0.00%	0.00%	-33.45	-33.5	0.00%	0.00%	-33.45
15 KHz				-20.00				-20.00
17.5 KHz				-20.00				-20.00
20 KHz				-20.00				-20.00
22.5 KHz				-20.00				-20.00
25 KHz				-20.00				-20.00

CERTIFYING ENGINEER: Arnal C. Cook
DATE: April 28, 1998

TYPE OF TEST: OCCUPIED BANDWIDTH
FCC PART: 2.989 (c) (1), 90.210(d)et al
MODELS: RRX-452
FCC ID: AIERIT05-452



CERTIFYING ENGINEER: Arnal Cook
DATE: April 28, 1998

TYPE OF TEST: Spurious Emissions at Antenna Terminals

FCC PART: 2.991

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

PROCEDURE:

The RRX-452 was aligned for transmitter operation on 464.600 MHz. (Fo) per the tune-up procedure outlined in the preliminary manual.

These tests were conducted as specified in 2.991 "under the conditions specified in 2.989 as appropriate", i.e. "when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation" "... at the frequency of maximum response of the audio modulating circuit."

110 VAC power was applied to the RRX-452 by a the supplied AC line cord. The RRX-452 was connected at the external antenna terminal to a 100 Watt, 50 Ohm resistive load with 30 dB pad. The HP was set to read the top REF line as +10 dBm. The HP variable attenuator was adjusted (for -1.4 dB off of the input attenuation) to set 0 dBc on the top REF line for -dBc measurements. REF therefore = +37 dBm.

A notch filter tuned was tuned for 464.6 MHz with a Sweep Generator (-42 dB). The output of the notch filter was then connected to a Hewlett Packard Model 8559A Spectrum Analyzer to verify -42 dB at the fundamental frequency. Its response was characterized through 1000 MHz, showing -3.3 dB through loss at the second harmonic of 929.2 MHz. This is reflected in the Correction charts. While this filter had significant impact on obtaining valid readings on 929.2 MHz (by eliminating harmonics generated in the HP, evidenced by >3 dB difference in readings), it had only a 1 dB (through loss) impact at higher frequencies. Readings are shown for measurements WITHOUT the fundamental notch filter in line above the second harmonic.

The spectrum was searched from 4 MHz. to the 10th harmonic of the operating frequency. All unreported emissions were more than 20 dB below the FCC limit of 50 + 10 log P, or

-50 dBW = -20 dBm, per 90.210 (d) (3).

The measured insertion loss of the pad, cables, and notch filter are listed as "Corrected Factor (dB)" on the data sheet. A 3 dB increase (from +27 to +30 dB) in the CORRECTION FACTOR reflects the measured insertion loss of the fundamental frequency notch filter at the frequency under test. As measurements differed little on the higher harmonics, the filter was removed to simplify the test set up and reduce errors or unknowns.

The same tests were run a second time WITHOUT the internal duplexer. The RF output of the transmitter module was connected directly to the RF Load with integral -30 dB sampling port. Again, the HP Spectrum Analyzer was adjusted for 0 dBc on the top, "full scale", REF line. This test emulates models sold without the internal RITRON duplexer to allow the connection of external duplexers, combiners, and/or separate antennas. Such models have a back panel with two separate (one for TX, one for RX) antenna ports. The lack of the internal duplexer had little effect on the harmonic or spurious output. No effect exceeded any FCC emission limitations of -50 dBW = -20 dBm. This is reported in the sixth column as dBm.

TYPE OF TEST: Spurious Emissions at Antenna Terminals

FCC PART: 2.991

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

TEST FREQUENCY: 464.600 MHz.
POWER OUTPUT: 4.45 Watts (temperature stable)

Emission Frequency (MHz.)	Measured Amplitude (dBc)	(dBm)	Correction Factor (dB)	Resultant Amplitude (dBm)	Amplitude less Duplexer (dBm)
464.6	0	+10	+27	+37	+38
929.2	- 70	- 60	+30	- 30	- 23
1393.8	>-80	-	+30	-	- 31
1858.4	- 67	-57	+27	-30	- 38
2323.0	- 62	-52	+27	-25	- 26
2787.6	- 68	-58	+27	-31	- 40
3716.8	- 64	-54	+27	- 27	- 33

Certifying Engineer: Arnal Cook
Date: April 15, 1998

TYPE OF TEST:	Field Strength of Spurious Radiation
FCC PART:	2.993 (b)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 28, 1998

PROCEDURE:

The following measurements were taken at the RITRON, INC. 3 meter test site. Measurements were made in accordance with FCC Rules and Regulations Part 2.947, using the procedures of IEC Publication 106.

The RRX-452 was aligned for transmitter operation on 464.6 MHz. (Fo) per the tune-up procedure outlined in the preliminary manual. This unit was then terminated at the antenna port with a non-radiating 50 ohm terminating load.

All field strength measurements were made with the Hewlett Packard Model 8559A Spectrum Analyzer and the appropriate antenna for the frequency being measured. The antennas used were:

Electro-Metrics BDA-25 Dipole Antenna at 0 to 200 MHz.
Electro-Metrics LPA-25 Log Periodic Antenna at 200 to 1000 MHz.
Polarad CA-B Microwave Test Antenna at 1000 to 10,000 MHz.

For each emission, the height and polarization of the field strength measuring antenna and the orientation of the RRX-452 were varied to provide maximum field strength. The spectrum was searched from 4 MHz. to the 10th harmonic of the transmit frequency. All unreported emissions were more than 20 dB below FCC limits.

TYPE OF TEST: Field Strength of Spurious Radiation

FCC PART: 2.993 (b)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

EQUATIONS:

Analyzer readings in dBm and the calibrated antenna factor were converted to field strength as follows:

$$P_{3m} = R + 107 + K$$
$$E_{3m} = Log^{-1} (P_{3m} / 20)$$

P_{3m} = Power output at 3 meters in dBm.
R = Reading direct from spectrum analyzer in dBm.
K = Antenna factor in dB at 3 meters.
E_{3m} = Field strength at 3 meters in μV/m.

The reference level for a half wave dipole was computed as follows:

$$E_{ref} = 1000000 * \sqrt{} (49.2 * P) / D$$

P = Transmitter power in Watts.
D = Distance (3) in meters.

The amount, in dB, that the measured field strength is below the reference field strength was computed as follows:

$$E = 20 \text{ Log } (E_{3m} / E_{ref})$$

E = The amount below reference level in dB.
E_{3m} = Field strength at 3 meters in μV/m.
E_{ref} = Reference field strength at 3 meters in μV/m.

TYPE OF TEST: Field Strength of Spurious Radiation

FCC PART: 2.993 (b)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 28, 1998

CARRIER FREQUENCY: 464.6 MHz.
POWER OUTPUT: 4.45 Watts
DIPOLE REFERENCE LEVEL: 4, 932,207 µV/m

Emission Frequency MHz.	Multiple of Carrier	Antenna	Analyzer Reading dBm	Antenna Factor dB	Field Strength µV/m	Below Reference dB	dB Below FCC Limits
464.6	Fund	Log Periodic	-74	21.6	536	-79.3	-22.79
929.2	2 nd	Log Periodic	-64	28.5	3737	-62.4	-5.93
1393.8	3 rd	Microwave	-66	28.9	3124	-64.0	-7.48
1858.4	4 th	Microwave	-69	30.9	2783	-65.0	-8.49

Certifying Engineer: Arnal Cook
Date: April 15, 1998

TYPE OF TEST: Frequency Stability vs. Temperature

FCC PART: 2.995 (a)

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

FCC ID: AIERIT05-452

DATE: April 15, 1998

PROCEDURE:

The transmitter portion of an RRX-452, with Reference Oscillator, Voltage Controlled Oscillator, and RF amplifiers thorough the Final output device and filters, was tested in operation on 463.5 MHz. (Fo) per the Tune-Up procedure outlined in the preliminary manual on page 27. This RRX-452 Transmitter was then placed into a Delta Design Model 3900 Temperature Chamber. An OMEGA thermocouple was attached directly to the Reference Oscillator module for temperature readout.

12 VDC was applied to the RRX-452 Control board and the Transmitter. The Transmitter was connected by coaxial cable to an external 50 Ohm RF dummy load. The IFR 1500 had 1 hour of warm-up time and was frequency checked against WWV (to better than 0.1 PPM). A coupling loop was loosely placed in the vicinity of the VCO for "no load" pickup and routed out of the test chamber via coax to the IFR 1500 frequency meter. The transmitter was given enough time to temperature stabilize at each tested increment. TX was initiated and measurements on the radiated (loaded) TX frequency was made and recorded.

This data was then tabulated on the following page with the error in PPM listed. All readings are within FCC limits of +/- 1.5 PPM of the carrier frequency.

TYPE OF TEST: Frequency Stability vs. Temperature

FCC PART: 2.995 (a)

MANUFACTURER: RITRON, INC.

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

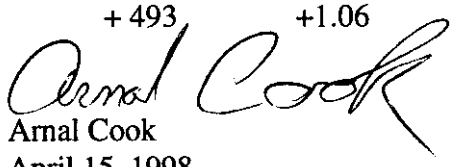
FCC ID: AIERIT05-452

DATE: April 28, 1998

TEST FREQUENCY: 463.500 MHz.

NOMINAL TEMPERATURE: 26°C

Temperature (°C)	Error Freq. (Hz.)	Error (ppm)
- 35	- 136	- 0.29
- 30	+250	+0.54
- 25	+395	+0.85
- 20	+460	+1.00
- 15	+450	+0.97
- 10	+440	+0.95
- 5	+425	+0.92
0	+390	+0.84
+ 5	+317	+0.68
+10	+265	+0.57
+15	+100	+0.22
+20	- 20	- 0.04
+25	+305	- 0.42
+30	- 300	- 0.65
+35	- 372	- 0.80
+40	- 317	- 0.68
+45	- 155	- 0.33
+50	+ 83	+0.18
+55	+ 493	+1.06



Certifying Engineer: Arnal Cook
Date: April 15, 1998

TYPE OF TEST:	Frequency Stability vs. Input Voltage
FCC PART:	2.995 (d)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 28, 1998

PROCEDURE:

The RRX-452 was aligned for transmitter operation on 464.6 MHz. (Fo) per the tune-up procedure outlined in the preliminary manual.

117 VAC line voltage was applied to a Variac, then to the RRX-452. The RRX-452 was connected at the antenna terminal to a 100 Watt, 50 Ohm RF Dummy Load with integral - 30 dB sampling pad, then to an IFR 1500 with frequency counter and error meter.

The primary AC supply voltage of the RRX-452 was monitored and adjusted, using a Beckman Industrial 4.5 digit DMM. The primary voltage was adjusted from less than 85% to over 115% of the nominal supply voltage of 115.0 VAC. Frequency drift measurements were taken, using the frequency error meter and counter.

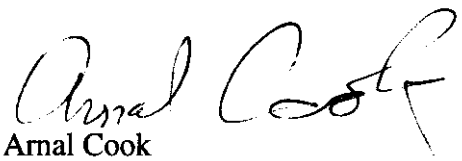
The AC power cord was disconnected for the DC voltage variation tests. The DC supply was an Astron model VS-20M, a 20 amp, adjustable supply. The DC voltage was monitored by a Beckman Industries 4.5 digit DMM at the radio DC input. The supply was varied above and below the nominal 12.6 VDC input from 10.0 to 15.0 volts, exceeding the required +/- 15% variation. The TX frequency was monitored in the same way as above.

TYPE OF TEST:	Frequency Stability vs. Input Voltage
FCC PART:	2.995 (d)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 28, 1998

TEST RESULTS:

At 5 volt intervals over the voltage range of 95.0 VAC up to 135.0 VAC, the maximum frequency difference from nominal values was +9 to -12 Hz. This was mostly due to radiated heat from the RF devices during the test, as the beginning and ending nominal values changed by -8 Hz, typical during the first minutes of transmissions.

For DC, an Astron variable power supply was used as an external DC supply to the entire radio. While its ouput voltage was varied over the range of 10.0 to 15.0 volts, the TX frequency variation was less than +/- 5 Hz on the short time interval, and +/- 20 Hz on the long time interval. This larger variation was due solely to the operating efficiency of the DC cooling fan and its changes in air pulling power with changes in the DC supply voltage.



Certifying Engineer: Arnal Cook
Date: April 28, 1998

TYPE OF TEST:	Statement of Spectrum Efficiency
FCC PART:	90.203 (j) (3)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 30, 1998

CERTIFICATION:

As a 12.5 KHz channel spacing radio, the RRX-452 is capable of transmitting and recieving 9600 bits per second of data.

Therefore this unit meets the requirement of 4800 bits per second of data per 6.25 KHz of channel band width.

Certifying Engineer: Arnal Cook
Date: April 30, 1998

TYPE OF TEST: Transient Frequency Behavior

FCC PART: 90.214

MANUFACTURER: RITRON, INC.
505 West Carmel Drive
Carmel, IN 46032

MODEL: RRX-452

TYPE OF UNIT: UHF-FM Voice and Data Full Duplex Repeater

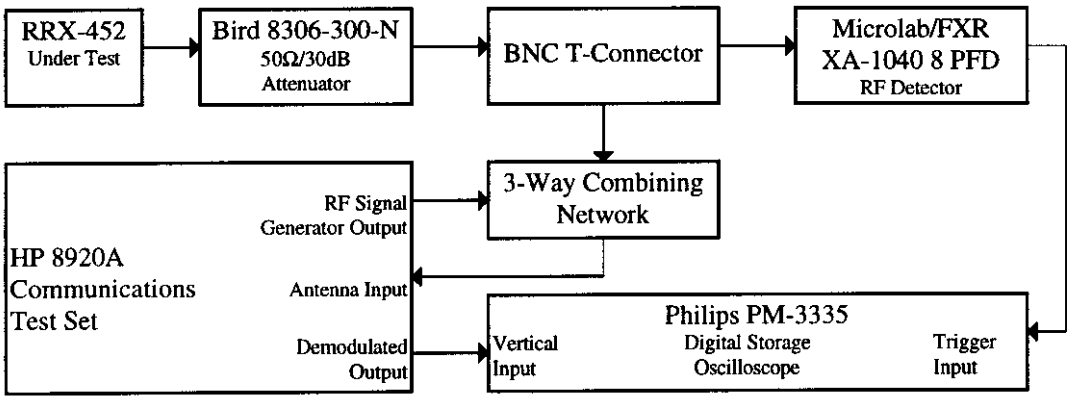
FCC ID: AIERIT05-452

DATE: April 30, 1998

PROCEDURE:

The RRX-452 was aligned for transmitter operation on 464.6 MHz (Fo) per the tune-up procedure outlined in the preliminary manual. The following tests were conducted per EIA-603 Part 2.2.19 as follows:

1. The Test equipment was connected per the following diagram:



2. The Hewlett Packard 8920A receiver was set to measure FM deviation with the audio bandwidth set at ≤20 Hz to 15 KHz and the RF frequency set to 464.6 MHz.

3. The RRX-452 transmitter under test was turned on and the Hewlett Packard 8920A Spectrum Analyzer was used to measure the RF power level through the test network.

4. The RRX-452 transmitter was turned off.

TYPE OF TEST: Transient Frequency Behavior (cont.)

5. The Hewlett Packard 8920A RF Signal Generator was set to 464.6 MHz at a RF level 50 dB below that measured in step 3, modulated with a 1 KHz tone at ±25 KHz deviation.

6. The Philips PM-3335 digital oscilloscope horizontal sweep rate was set to 10 mS per division. The vertical amplitude control was adjusted to display the 1000 Hz demodulated audio from the signal generator at ±4 divisions, vertically centered on the screen.

7. The Philips PM-335 digital oscilloscope was set to trigger at 1 division from the left side of the display when the RF detector senses RF power from the RRX-452 transmitter.

8. The RRX-452 transmitter was turned on and the resulting waveform on the oscilloscope display was stored and plotted. The FCC limits per Part 90.214 were added to the plot in the same manner illustrated in EIA-603 Part 3.2.19.2. The resulting plot is labeled "switch on condition" and shows compliance with FCC Part 90.214.

9. The Philips PM-335 digital oscilloscope was set to trigger at 1 division from the right side of the display when the RF detector senses loss of RF power from the RRX-452 transmitter.

10. The RRX-452 transmitter was turned off and the resulting waveform on the oscilloscope display was stored and plotted. The FCC limits per Part 90.214 were added to the plot in the same manner illustrated in EIA-603 Part 3.2.19.2. The resulting plot is labeled "switch off condition" and shows compliance with FCC Part 90.214.

Certifying Engineer: Arnal Cook
Date: April 30, 1998

TYPE OF TEST: Transient Frequency Behavior (cont.)

Figure 1. 10ms/div Horizontal, 6.25kHz/div Vertical

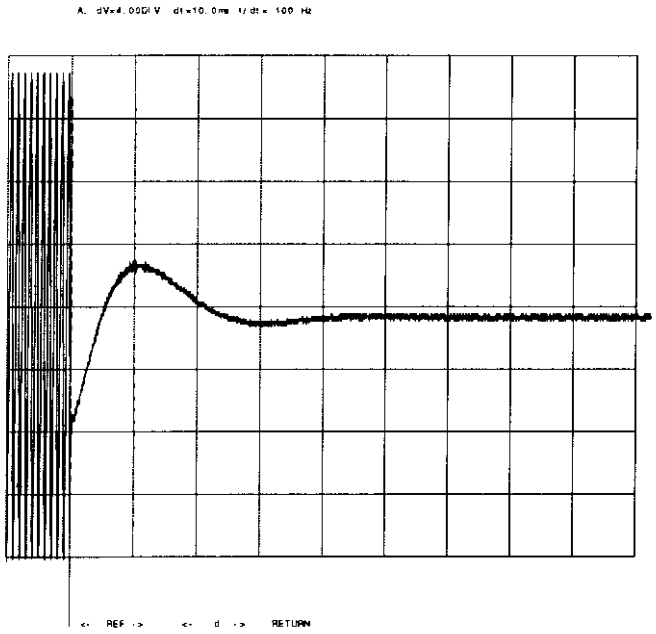
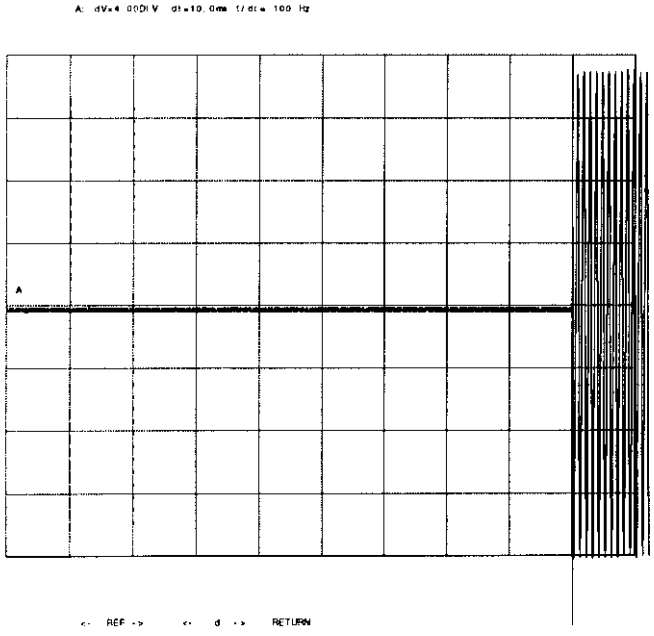


Figure 2. 10ms/div Horizontal, 6.25kHz/div Vertical



TYPE OF EXHIBIT:	FCC Data Label
FCC PART:	2.983 (f)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 28, 1998

The drawing on the following page specifies the FCC label for the RITRON Model RRX-452. The FCC label is placed on the rear panel of the RRX-452, on the left side as viewed from the rear. The enclosed photograph indicates the position of the label on the case. Each label contains the Model Number, FCC ID, and serial number.

Drawing number 142000 shows the label (actual Size) and describes the font, size, and location of the text on the label. A sample label has been applied to the enclosed sheet. A picture of the FCC ID label, attached to the RRX-452, is included in the photographs.

Serialization will begin with serial number 22345.

Certifying Engineer: Arnal Cook
Date: April 28, 1998

TYPE OF EXHIBIT:	FCC DATA LABEL PLACEMENT
FCC PART:	90.203 (j) (3)
MANUFACTURER:	RITRON, INC. 505 West Carmel Drive Carmel, IN 46032
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 30, 1998

EXHIBIT:

The following page shows a portion of the blueprint of the rear panel of the AIERIT 05-452 with FCC ID Label in the designated spot for placement on the left side of the rear panel.

TYPE OF EXHIBIT:	Photographs and Drawings
FCC PART:	2.983 (f) (g)
MANUFACTURER:	RITRON, INC.
MODEL:	RRX-452
TYPE OF UNIT:	UHF-FM Voice and Data Full Duplex Repeater
FCC ID:	AIERIT05-452
DATE:	April 28, 1998

The (Preliminary) Maintenance/Repair/Operating Manual of the RITRON Model RRX-452 UHF-FM Voice and Data Full Duplex Repeater contains sufficiently detailed diagrams of the following:

1. Internal construction to define component placement and chassis assembly (page 72).
2. Printed circuit board layout (pages 41 - 70).
3. External connections (pages 72 and 73).

The Maintenance Manual does not show the FCC ID Label placement. Included on the preceding pages are copies of RITRON blueprints for the FCC ID Label itself, including an actual sample label placed over the "actual size" block to show the type of material and durability.

The second page shows the relevant portion of the mechanical blueprints used for manufacturing instruction for the FCC ID Label's placement on the rear panel.

1. FCC ID Label specification, with actual sample label afixed.
2. Location of FCC ID label.

Certifying Engineer: Arnal Cook
Date: April 28, 1998