ENGINEERING STATEMENT

For Type Certification of

Ranger Communications (Shanghi) Inc.

Model No: VX-129CN

FCC ID: MEE-VX-129CN

I am an Electronics Engineer, a principal in the firm of Hyak Laboratories, Inc., Springfield, Virginia. My education and experience are a matter of record with the Federal Communications Commission.

Hyak Laboratories, Inc. has been authorized by Ranger Communications (Shanghi) Inc. to make type certification measurements on the VX-129CN transceiver. These tests were made by me or under my supervision in our Springfield laboratory.

Test data and documentation required by the FCC for type certification are included in this report. It is submitted that the above-mentioned transceiver meets all applicable FCC require-ments.

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Rowland S. Johnson

Dated: January 16, 2002

A. INTRODUCTION

The following data are submitted in connection with this request for type acceptance of the VX-129CN transceiver in accordance with Part 2, Subpart J of the FCC Rules.

The VX-129CN is a double sideband, amplitude modulated, transmitter/receiver combination intended for mobile operation in the citizens radio service. The transmitter has 40-channel capability in the 26.965 - 27.405 MHz band utilizing phase locked loop (PLL) technology.

B. GENERAL INFORMATION REQUIRED FOR TYPE ACCEPTANCE
(Paragraph 2.983 of the Rules)

1. Name of applicant: Ranger Communications (Shanghi) Inc.

2. Identification of equipment: FCC ID: MEE-VX-129CN

a. The equipment identification included as a separate exhibit.
b. Photographs of the equipment are included as a separate exhibit.

3. Quantity production is planned.

4. Technical description:

a. 6k00A3E emission
b. Frequency range: 26.965 - 27.406 MHz
c. Operating power of transmitter is fixed at the factory at less than 4 watts.
d. Maximum power rating under 95.635(c) of the Rules is 4 watts.
e. The dc voltage and dc currents at final amplifier:

Collector voltage: 13.7 V
Collector current: 620 mA @ 13.8 Vdc input.

f. Function of each active semiconductor device: See Appendix 1.
g. Complete circuit diagram is included as a separate exhibit
h. A draft instruction book is included as a separate exhibit.
i. The transmitter tune-up procedure is included as a separate exhibit.

B. GENERAL INFORMATION (Continued)

j. A description of circuits for stabilizing frequency is included in Appendix 2.

k. A description of circuits and devices employed for suppression of spurious radiation and for limiting modulation is included in Appendix 3.

l. Not applicable.

5. Data for 2.985 through 2.997 follow this section.

6. RF_Power_Output (Paragraph 2.985(a),(b)(1) of the Rules)

RF power output in the AM mode was measured with a Bird 4421 RF power meter and a Narda 765-20 50 ohm dummy load. (The transmitter was tuned by the factory.) Power was measured with a supply voltage of 13.8 volts, and indicated:

Channel	Power, watts
1	3.3
21	3.2
40	3.0

C. MODULATION CHARACTERISTICS

1. AF_Frequency_Response

A curve showing frequency response of the transmitter is shown in Figure 1. Reference level was taken as a 1 kHz tone with 50% modulation, as measured on a Data Tech 209 modulation meter, using a Audio Precision TRMS voltmeter and tracking generator.

2. Modulation_Limiting

Curves of AM modulation limiting for both positive and negative peaks are shown in Figures 2a and 2b, respectively. Characteristics at 300, 990, and 2500 Hz are shown using a Data Tech 209 modulation meter.

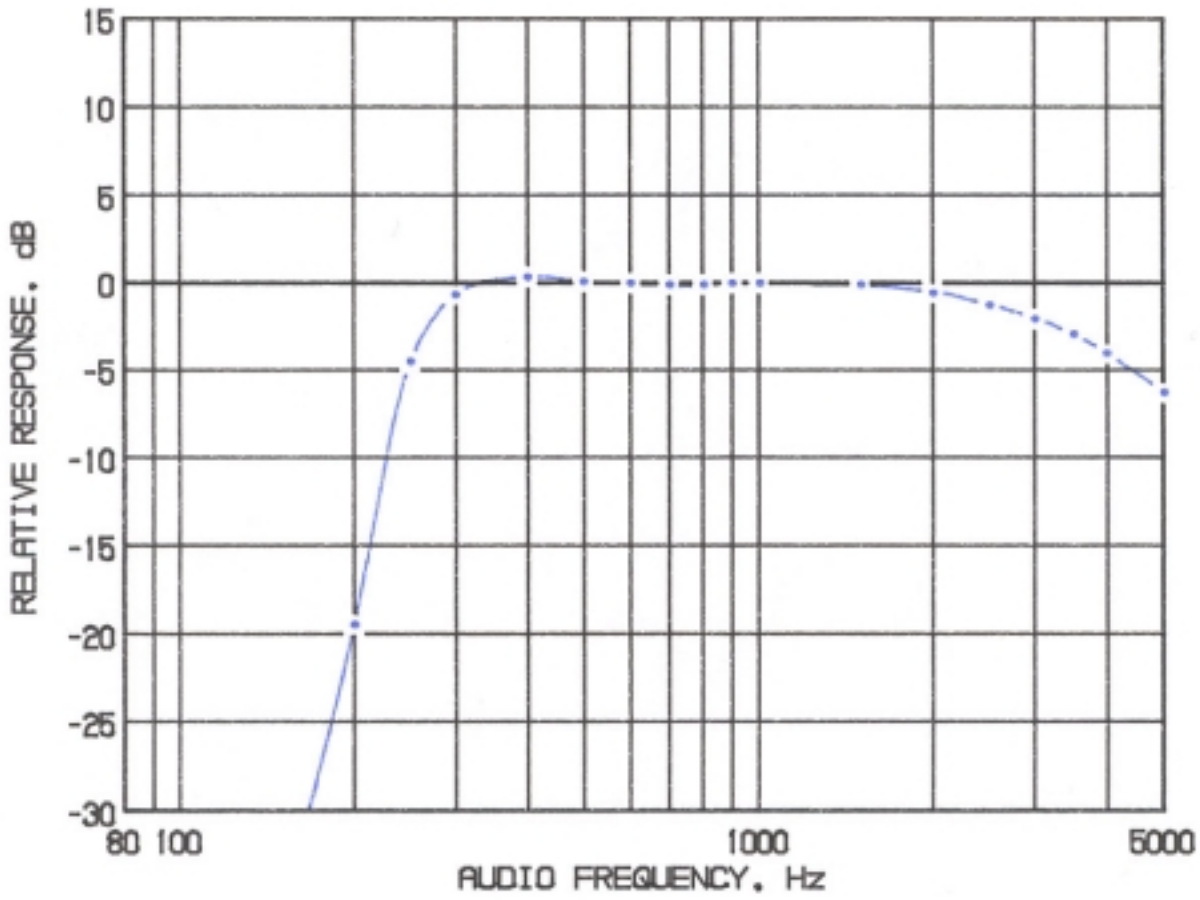
Signal level was established with a Audio Precision TRMS voltmeter and tracking generator. The curves show compliance with Paragraph 95.633(d) of the Rules.

3. Modulation_Limiter_Attack_Time

Modulation limiter attack time was measured by applying to the microphone input terminals a pulsed tone at 2500 Hz, 16 dB above the level required for 50% modulation at the frequency of maximum response, 990 Hz. The spectrum analyzer was tuned to upper and lower fourth-order sidebands in the time domain. Horizontal sweep of the analyzer was triggered in synchronism with the tone turn-on. Sweep speed was 100 milliseconds per division. Plots are included as Figures 3a and 3b. Any transients observed in excess of 33 dB attenuation as referenced to the carrier were less than 20 ms in duration.

FIGURE 1

TRANSMITTER FREQUENCY RESPONSE



TRANSMITTER FREQUENCY RESPONSE
FCC ID: MEE-VX-129CN

FIGURE 1

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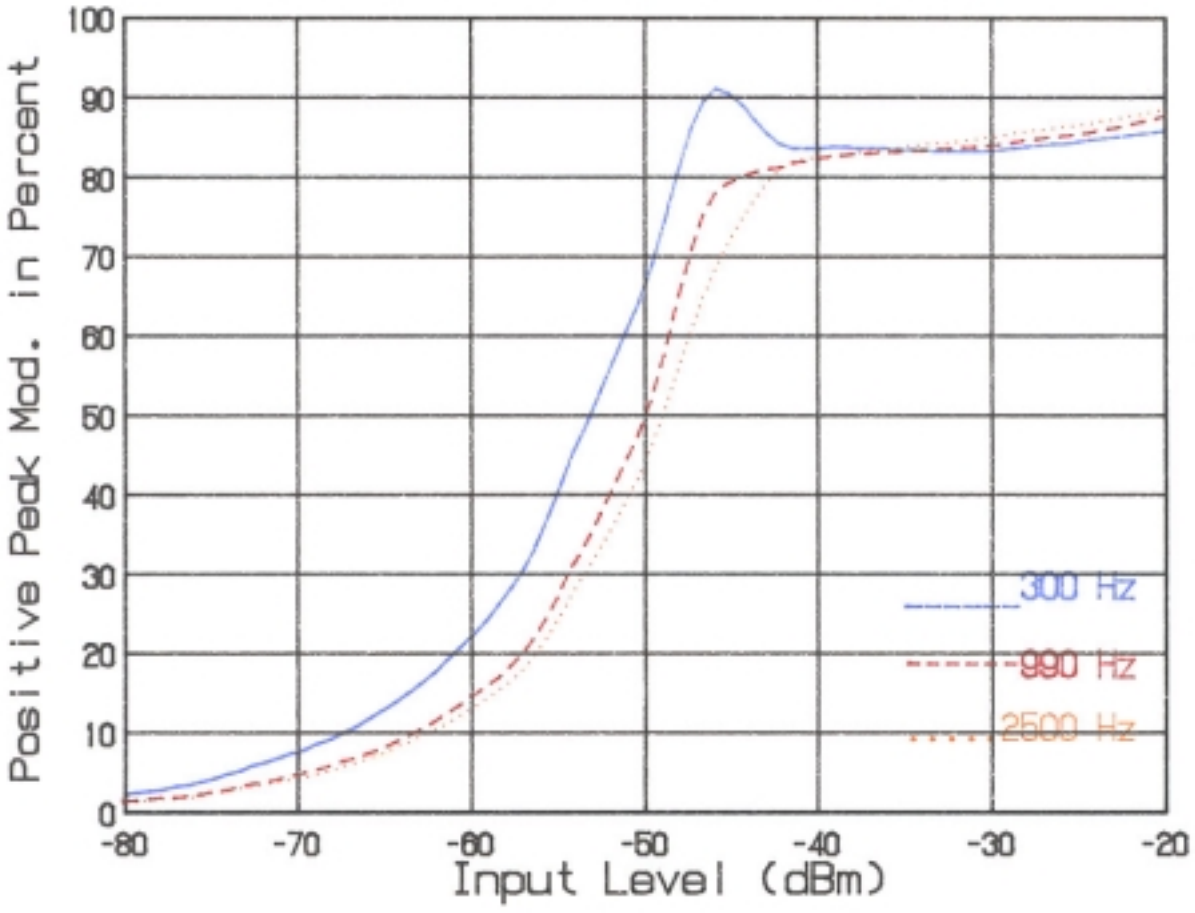
FIGURE 2a

AM MODULATION LIMITING - POSITIVE PEAKS



MODULATION LIMITING CHARACTERISTICS

Percent modulation as a function of input level at microphone jack in dBm for 300 Hz, 990 Hz, and 2500 Hz tones.

MODULATION LIMITING POSITIVE PEAKS
FCC ID: MEE-VX-129CN

FIGURE 2a
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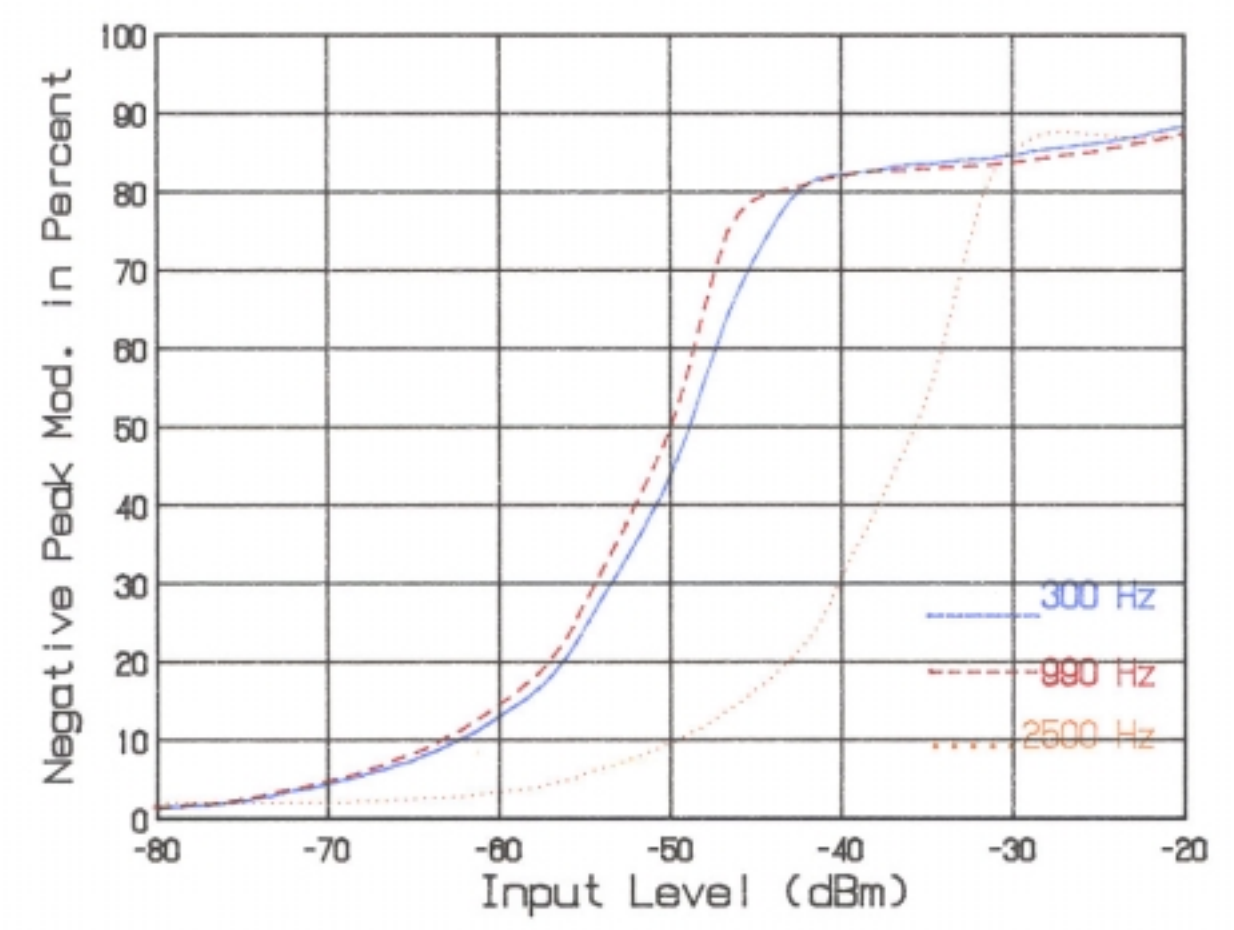
FIGURE 2b

AM MODULATION LIMITING - NEGATIVE PEAKS



MODULATION LIMITING CHARACTERISTICS

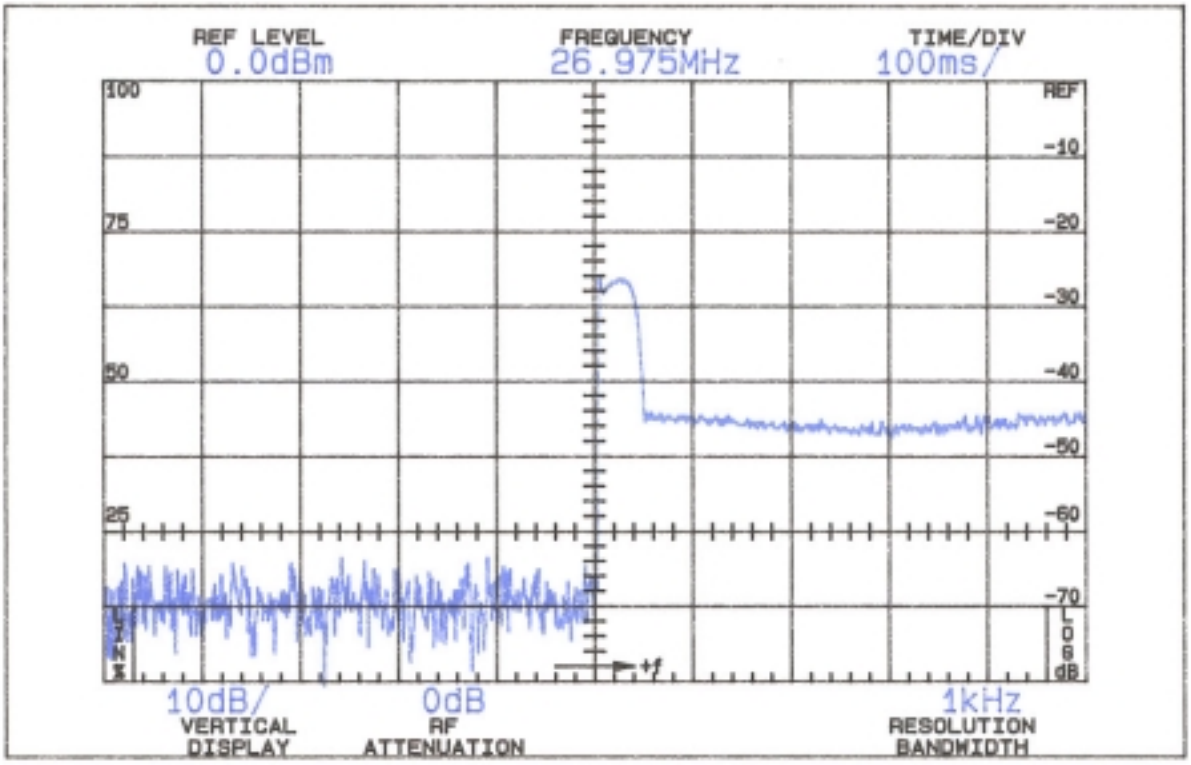
Percent modulation as a function of input level at microphone jack in dBm for 300 Hz, 990 Hz, and 2500 Hz tones.

MODULATION LIMITING NEGATIVE PEAKS
FCC ID: MEE-VX-129CN

FIGURE 2b

FIGURE 3a

MODULATION LIMITER ATTACK TIME



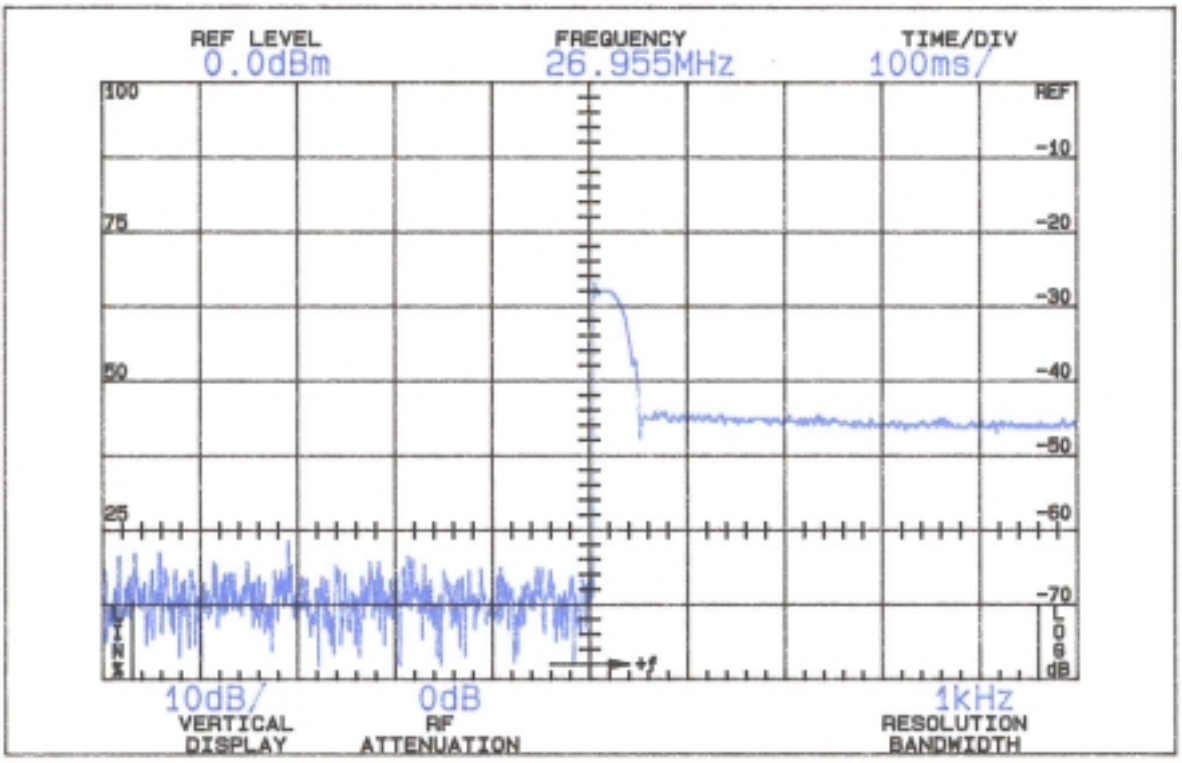
Measurement_Conditions: 16 dB over 50% modulation level at 990 Hz with 2500 Hz tone, upper fourth order sideband; horizontal scale 100 ms/div.

UPPER FOURTH-ORDER SIDEBAND
LIMITER ATTACK TIME
FCC ID: MEE-VX-129CN

FIGURE 3a

FIGURE 3b

MODULATION LIMITER ATTACK TIME



Measurement_Conditions: 16 dB over 50% modulation level at 990 Hz with 2500 Hz tone, lower fourth order sideband; horizontal scale 100 ms/div.

LOWER FOURTH-ORDER SIDEBAND
LIMITER ATTACK TIME
FCC ID: MEE-VX-129CN

FIGURE 3b

C. MODULATION CHARACTERISTICS (Continued)

4. Occupied Bandwidth-AM
(Para.2.989(c) of the Rules)

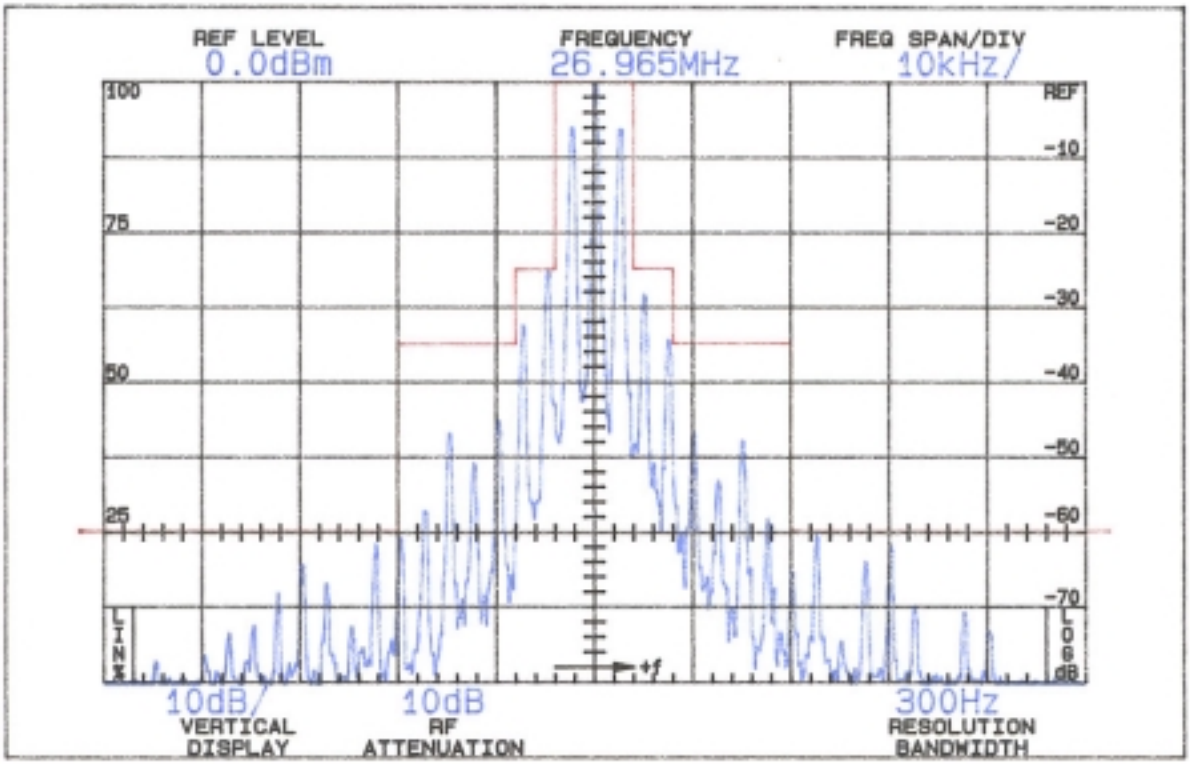
Figure 4 is a plot of the sideband envelope of the transmitter taken from a Tektronix 494P spectrum analyzer. Modulation corresponded to conditions of 2.989(a) and consisted of 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50% modulation at 990 Hz, the frequency of maximum response. Measured modulation under these conditions was 89% pos., 87% neg.

The plots are within the limits imposed by Paragraph 95.631(b)(1,3) for double sideband AM modulation. The horizontal scale, frequency, is 10 kHz per division and the vertical scale, amplitude, is a logarithmic presentation equal to 10 dB per division.

NOTE: Reference of 0 dBc is unmodulated transmitter power.

FIGURE 4

OCCUPIED BANDWIDTH



	ATTENUATION IN dB BELOW MEAN OUTPUT POWER Required
On any frequency more than 50% up to and including 100% of the authorized bandwidth, 8kHz (4-8kHz)	25
On any frequency more than 100%, up to and including 250% of the authorized bandwidth (8-20kHz)	35
On any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth	60

OCCUPIED BANDWIDTH
FCC ID: MEE-VX-129CN

FIGURE 4

D. SPURIOUS EMISSIONS AT THE ANTENNA TERMINALS
(Paragraph 2.991 of the Rules)

The VX-129CN transmitter was tested in the AM mode for spurious emissions at the antenna terminals while the equipment was modulated with a 2500 Hz signal, 16 dB above minimum input signal for 50% modulation at 990 Hz, the frequency of highest sensitivity.

Measurements were made with Tektronix 494P spectrum analyzer coupled to the transmitter output terminal through Narda 765-20 50 ohm power attenuator.

In order to improve measurement system dynamic range, a series trap tuned to the carrier frequency was used on the Narda attenuator output. The trap, which had negligible shunt attenuation at the second harmonic and high frequencies, provided 26 dB attenuation of the fundamental. The trap was not used during close-in (within 10 MHz of the carrier) spurious measurements.

During the tests, the transmitter was terminated in the Narda 765-20 dummy load. Power was monitored on a Bird 43 Thru-Line wattmeter; dc supply was 13.8 volts throughout the tests.

Spurious emission was measured on Channels 1, 21, and 40 throughout the RF spectrum from 4.5 to 300 MHz. Any emissions that were between the 60 dB attenuation required and the 100 dB

noise floor of the spectrum analyzer were recorded. Data are shown in Table 1.

E. MEASUREMENTS OF SPURIOUS RADIATION
(Paragraph 2.993(a)(b,2) of the Rules)

Measurements of radiated spurious emissions from the VX-129CN transmitter were made by substitution/comparison with a Tektronix 494P spectrum analyzer and dummy load located in an open field 3 meters from the test antenna. Output power was 3.9 watts. The supply voltage was 13.8 volts. The transmitter and test antennae were arranged according to OCE 42 to maximize pickup. Measurements were made with and without accessory cable. Both vertical and horizontal test antenna polarization were employed.

Measurements were made from 4.5 MHz to 10 times the maximum operating frequency of 26.965 or 269.650 MHz

TABLE 1

TRANSMITTER CONDUCTED SPURIOUS

Channel	Spurious Frequency MHz	dB Below Unmod Carrier Ref.
1	53.930	81
1	80.895	70
1	107.860	84
1	134.825	77
1	161.790	84
1	188.755	97
1	215.720	91
1	242.685	90
1	269.650	74
21	54.430	76
21	81.645	76
21	108.860	86
21	136.075	78
21	163.290	84
21	190.505	94
21	217.720	91

21	244.935	89
21	272.150	72
40	54.810	75
40	82.215	82
40	109.620	87
40	137.025	79
40	164.430	87
40	191.835	96
40	219.240	92
40	246.645	89
40	274.050	71
	Required:	60

All other spurious were more than 20 dB below required 60 dB suppression. Carrier was attenuated with a notch filter.

E. MEASUREMENTS OF SPURIOUS RADIATION (continued)

TABLE 2

TRANSMITTER CABINET RADIATED SPURIOUS

Channel 1, 26.965 MHz; 3.3 watts, 13.8 Vdc

Frequency, MHz	dB Below Carrier Reference

All emissions were <80 dB below reference carrier.

Required: 60

F. FREQUENCY STABILITY
(Paragraph 2.995(a)(1) of the Rules)

Measurement of frequency stability versus temperature was made at temperatures from -30°C to +50°C in 10° increments. At each temperature, the unit was exposed to the test chamber ambient a minimum of 60 minutes after indicated chamber temperature ambient had stabilized to within ± 2° of the desired test temperature. Following a 30 minute soak at each temperature, the unit was turned on, keyed and frequency measured within 2 minutes. Test temperature was sequenced in the order shown in Table 3, starting with -30°C.

A Thermotron S1.2 temperature chamber was used. The transmitter output stage was terminated in a dummy load. Primary supply was 13.8 volts. Frequency was measured with a HP 5385A digital frequency counter connected to the transmitter through a power attenuator. Measurements were made on Channel 9, 27.065 MHz. No transient keying effects were observed.

G. FREQUENCY STABILITY (Continued)

TABLE 3

Temperature	Output Frequency, MHz
-29.8	27.065097
-19.7	27.065161
-10.4	27.065181
0.0	27.065174
10.3	27.065132
20.1	27.065081
30.2	27.064995
40.3	27.064944
50.5	27.064913
Maximum frequency error:	27.065181
	27.065000
	+ .000181 MHz

FCC Rule 95.625(b) specifies .005% or a maximum of ± .001353 MHz.

G. FREQUENCY STABILITY AS A FUNCTION OF SUPPLY VOLTAGE
(Paragraph 2.995(d)(2) of the Rules)

Oscillator frequency as a function of power supply voltage was measured with a HP 5385A digital frequency counter as supply voltage provided by an HP 6264B variable dc power supply was varied ± 15% from the nominal 13.8 volt rating. A Keithley 197 digital voltmeter was used to measure supply voltage at transmitter primary input terminals. Measurements were made at 20°C ambient.

TABLE 4

Supply_Voltage	Output_Frequency,_MHz
15.87	27.065081
15.19	27.065081
14.49	27.065081
13.80	27.065081
13.11	27.065080
12.42	27.065079
11.73	27.065004
Maximum frequency error:	27.065081
	27.065000
	+ .000081 MHz

FCC Rule 95.625(b) specifies .005% or a maximum of ± .001353 MHz. No effects on frequency related to keying the unit were observed.

H. ADDITIONAL REQUIREMENTS FOR TYPE ACCEPTANCE
(Paragraph 95.665 of the Rules)

The VX-129CN meets the applicable provision of 95.665(a).

External controls are limited to the following per 95.665(a):

1. Primary power connection
2. Microphone
3. RF output power connection
4. N/A
5. On-off switch (combined with receiver volume control)
6. Not applicable, AM only
7. Not applicable, AM only
8. Transmitting frequency selector
9. Transmit-receive switch
10. See #1

11. Not applicable

The serial number of each unit will be implemented in accordance with 95.667.

A copy of Part 5, Subpart D, of the FCC rules for the Citizens Band Radio Service, current at the time of packing of the transmitter, must be furnished with each CB transmitter marketed per 95.669.

I. PLL RESTRICTIONS
(Per Public Notice of April 27, 1978)

FUNCTION OF DEVICES
MODEL VX-129CN

Reference	Type	Function
TR1	2SC1675L	Noise Blanker
TR2	2SC1675L	Noise Blanker
TR3	2SC945P	Noise Blanker
TR4	2SA733P	Noise Blanker
TR5	2SC945P	Noise Blanker
TR6	2SC1675L	AM 2 nd IF
TR7	2SC1675L	AM 2 nd IF
TR8	2SC1675L	AM 2 nd IF
TR9	2SC945P	Squelch Control
TR10	2SC945P	Squelch Control
TR11	2SC945P	RF Gain Control
TR12	2SC1674L	RF Amplifier
TR13	2SK192ABL	First Mixer
TR14	2SK192AGR	Second Mixer
TR15	2SC945P	Squelch Control
TR16	2SC2078	TX Power
TR17	2SC2314	Driver
TR18	2SC1906	Driver
TR19	2SC945P	MIC Amplifier
TR20	2SA733P	AF AGC
TR21	2SC945P	SWR Sense
TR22	2SA733P	SWR Led Driver
TR23	2SC1675L	IN Loop Mixer
TR24	2SA733P	TX/RX SW
TR25	2SD880-Y	Regulator
TR26	2SC1675L	Buffer
TR27	2SC1675L	Loop Oscillator
TR28	2SC2314	Led Control
TR29	DTC114Y	Power SW
IC1	TA7222AP	AF Power Amplifier
IC2	MB8719	PLL
IC3	UHIC07A	VCO
IC4	TA7310P	TX Mixer

FUNCTION OF DEVICES
FCC ID: MEE-VX-129CN

APPENDIX 1
APPENDIX 2

CIRCUITS AND DEVICES TO STABILIZE FREQUENCY

All 40 channels of transmitting, and receiving, frequencies are provided by PLL (Phase Locked Loop)(IC 2, MB8719) circuitry.

The purpose of the PLL is to provide a multiple number of frequencies from a VCO (Voltage Controlled Oscillator) with quartz crystal accuracy and stability locked to crystal oscillator reference frequency.

The reference crystal oscillator frequency is 10.240 MHz.

CIRCUITS AND DEVICES TO
STABILIZE FREQUENCY
FCC ID: MEE-VX-129CN

APPENDIX 2

APPENDIX 3

1. Circuits_For_Suppression_Of_Spurious_Radiation

The tuning circuit between frequency synthesizer and final amp and “PI” network L11, L12, L13, L14, C56, C57, C58, C59 in the output circuit serve to suppress spurious radiation. This network serves to impedance match final rf amplifier to the antenna and to reduce spurious content to acceptable levels in the frequency synthesizer.

2. Circuits_For_Limiting_Modulation

A very effective ALC (Automatic Level Control) circuit is used to limit audio gain so as not to over modulate beyond 90%. The dynamic range of the AKC circuit for this purpose is over 50 dB.

The output audio level is sensed and applied to IC1 mike amp/limiter to provide mike gain inversely proportional to rf output.

To eliminate modulation percentage variation due to power supply voltage change a supply voltage sensor circuit is incorporated into the ALC system.

DEVICES AND CIRCUITS TO SUPPRESS SPURIOUS RADIATION AND LIMIT MODULATION

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APPENDIX 3