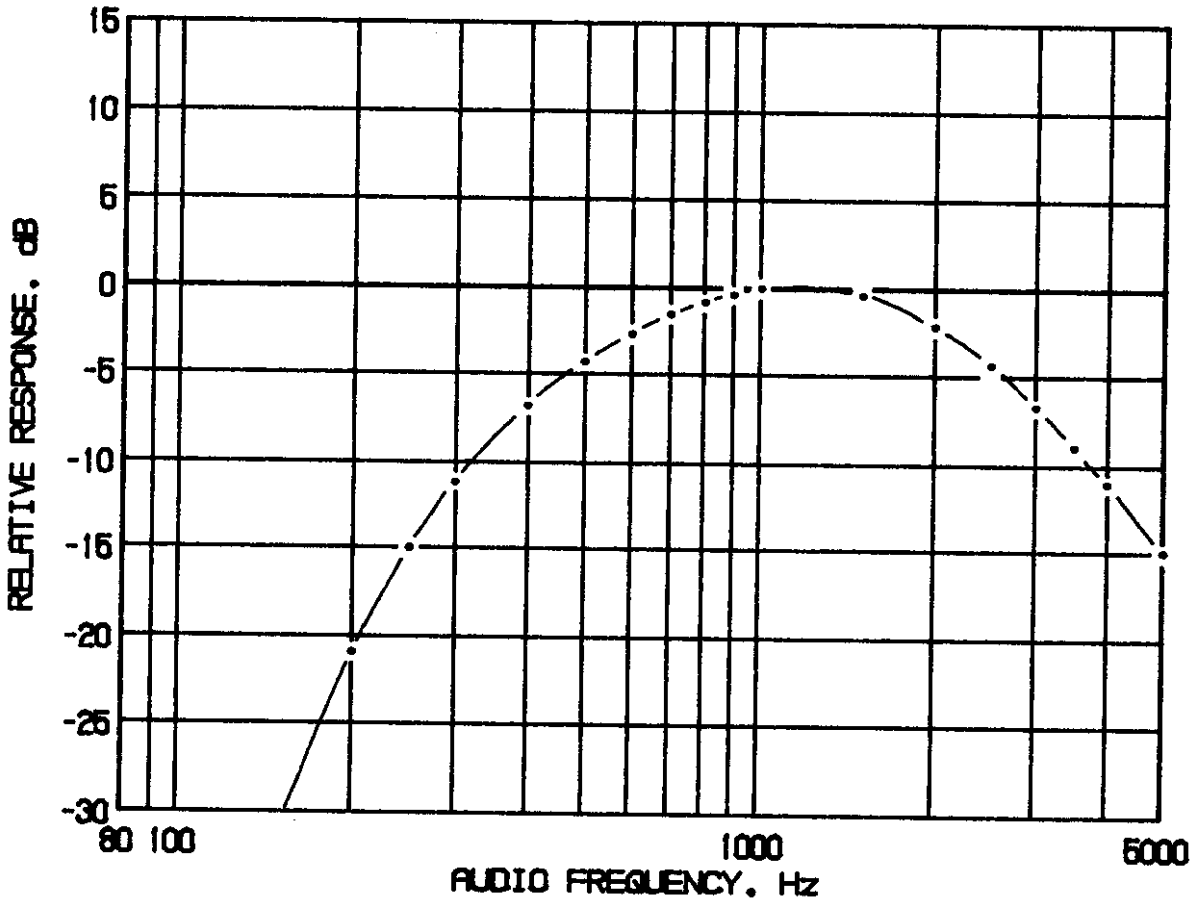
APPENDIX 3

FUNCTION OF DEVICES

Reference	Type	Function
Q13	2SA1980M(Y)	Automatic Modulation Control (AMC)
Q14	2SC5343M(Y)	AMC Attenuator
Q22	2SC5343M(Y)	VCO Amp.
Q23	2SC5343M(Y)	Buffer
Q24	2SC2314E	Doubler
Q25	KTC2078	Pre-Driver
Q26	2SC2314E	Driver
Q27	KTC2078	Final RF Amplifier
IC1	LC72322	CPU/PLL
IC2	4558	Mike Amp/Limiter
IC3	TDA2003V	Modulator

FIGURE 1

TRANSMITTER FREQUENCY RESPONSE

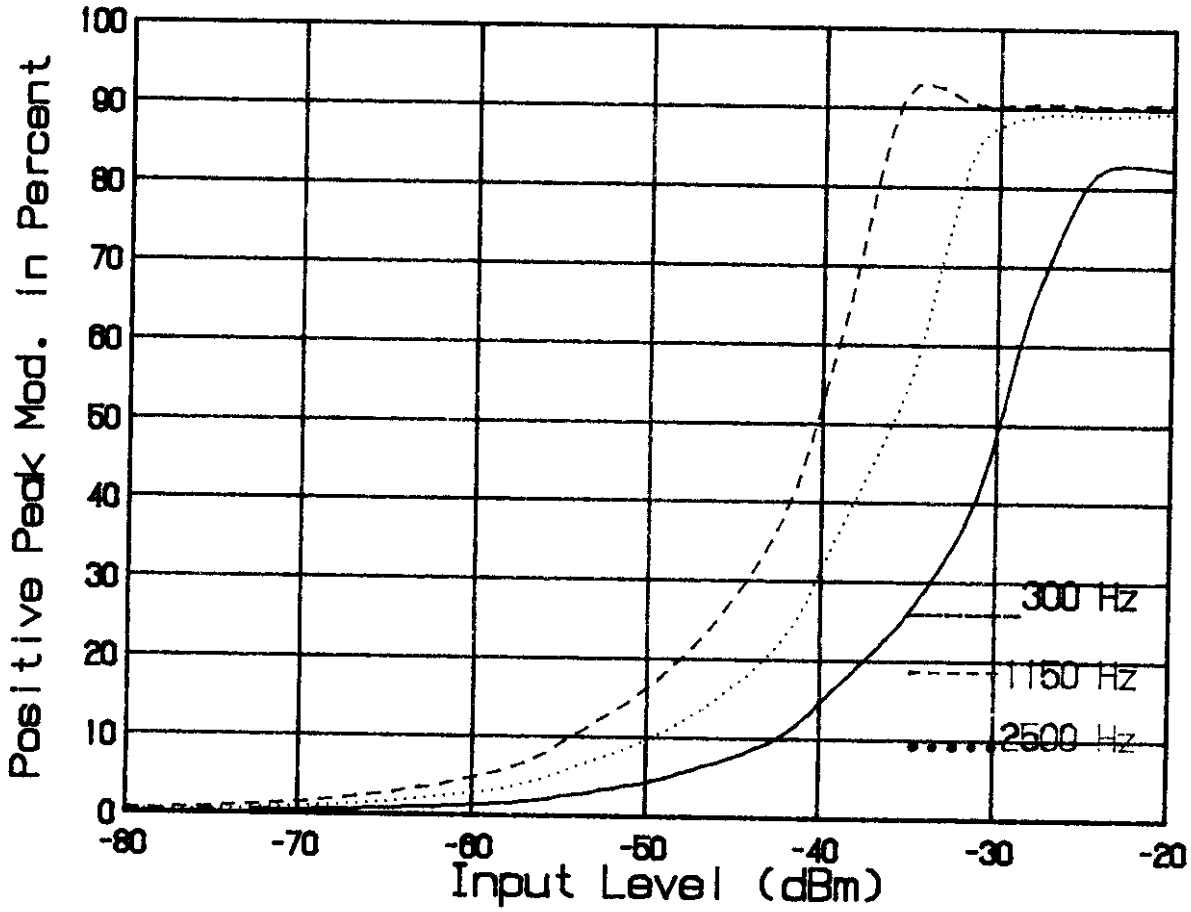


TRANSMITTER FREQUENCY RESPONSE
FCC ID: MMA77255ESP

FIGURE 1

FIGURE 2a

AM MODULATION LIMITING - POSITIVE PEAKS



MODULATION LIMITING CHARACTERISTICS

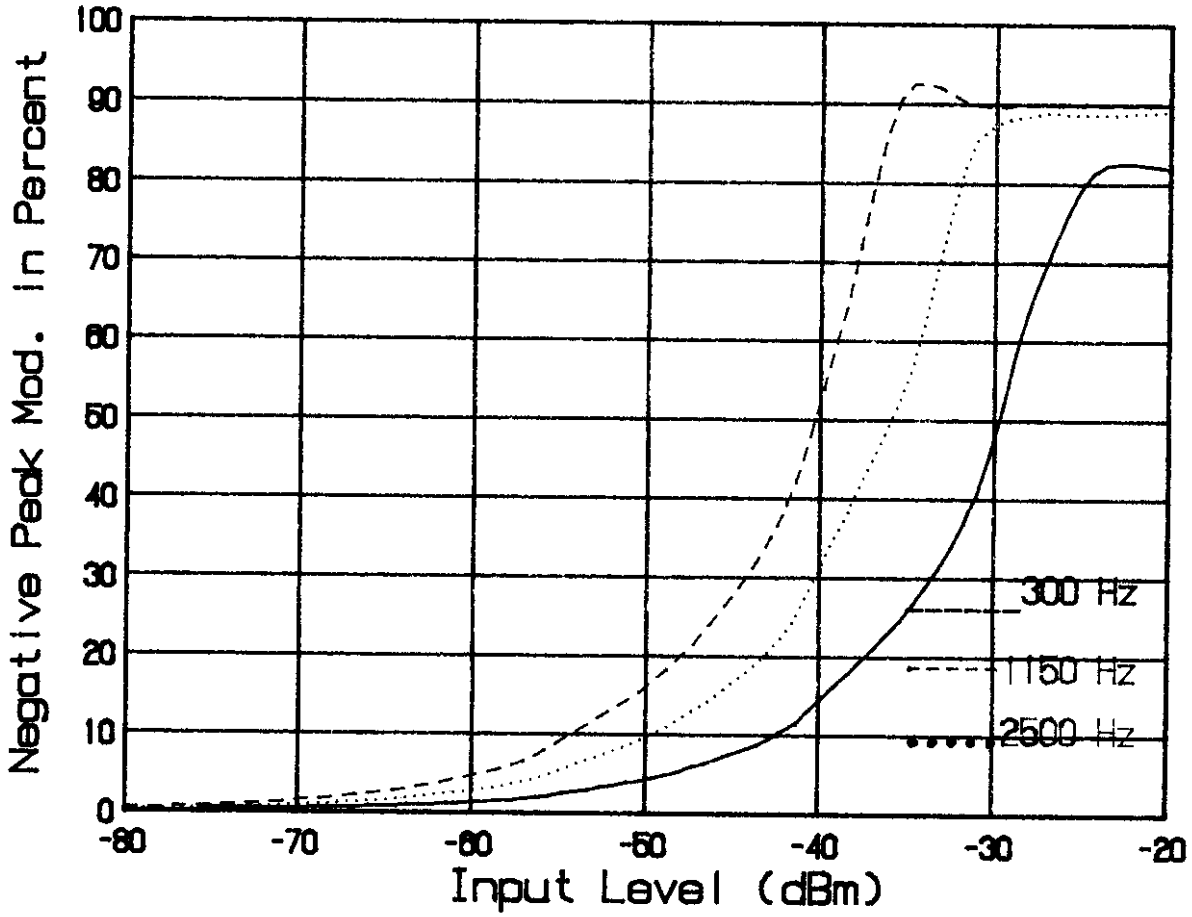
Percent modulation as a function of input level at microphone jack in dBm for 300 Hz, 1150 Hz, and 2500 Hz tones.

MODULATION LIMITING POSITIVE PEAKS
FCC ID: MMA77255ESP

FIGURE 2a

FIGURE 2b

AM MODULATION LIMITING - NEGATIVE PEAKS



MODULATION LIMITING CHARACTERISTICS

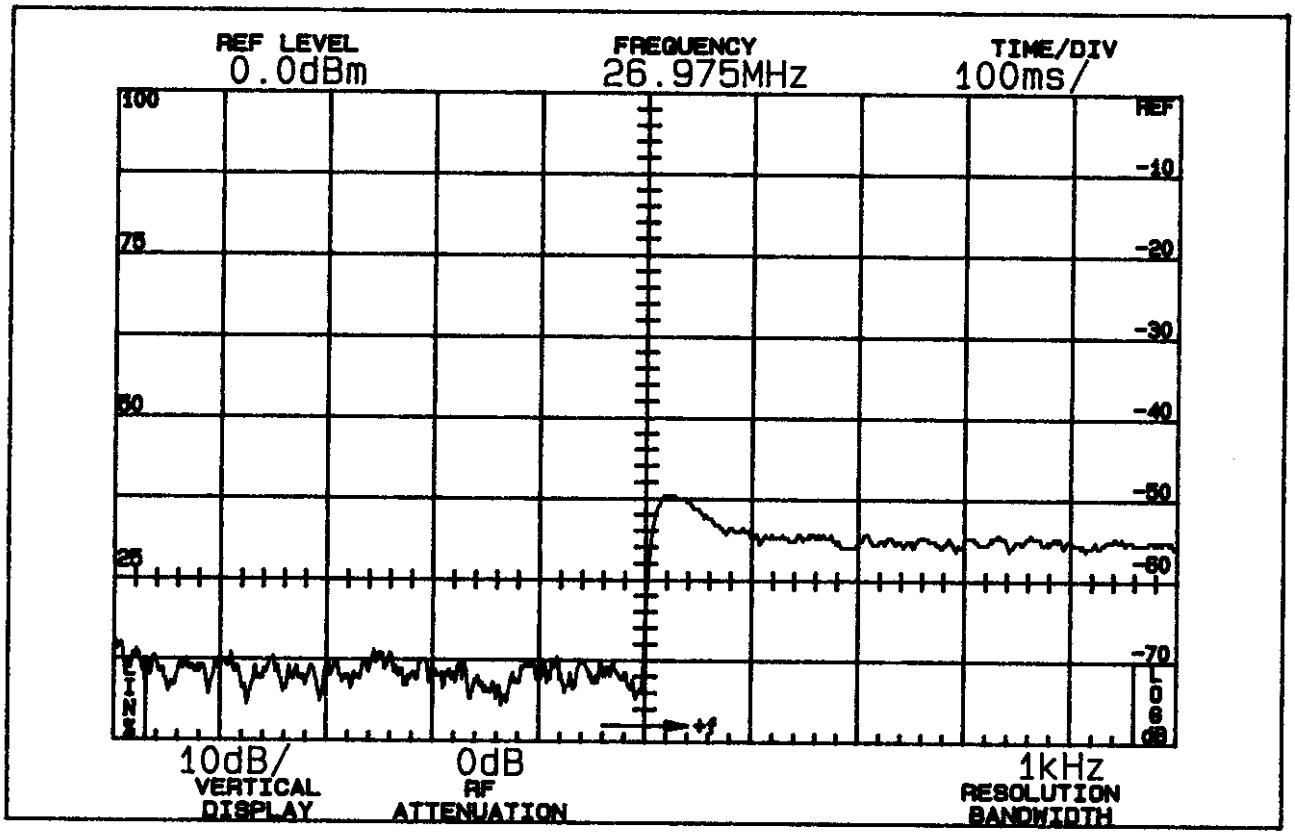
Percent modulation as a function of input level at microphone jack in dBm for 300 Hz, 1150 Hz, and 2500 Hz tones.

MODULATION LIMITING NEGATIVE PEAKS
FCC ID: MMA77255ESP

FIGURE 2b

FIGURE 3a

MODULATION LIMITER ATTACK TIME



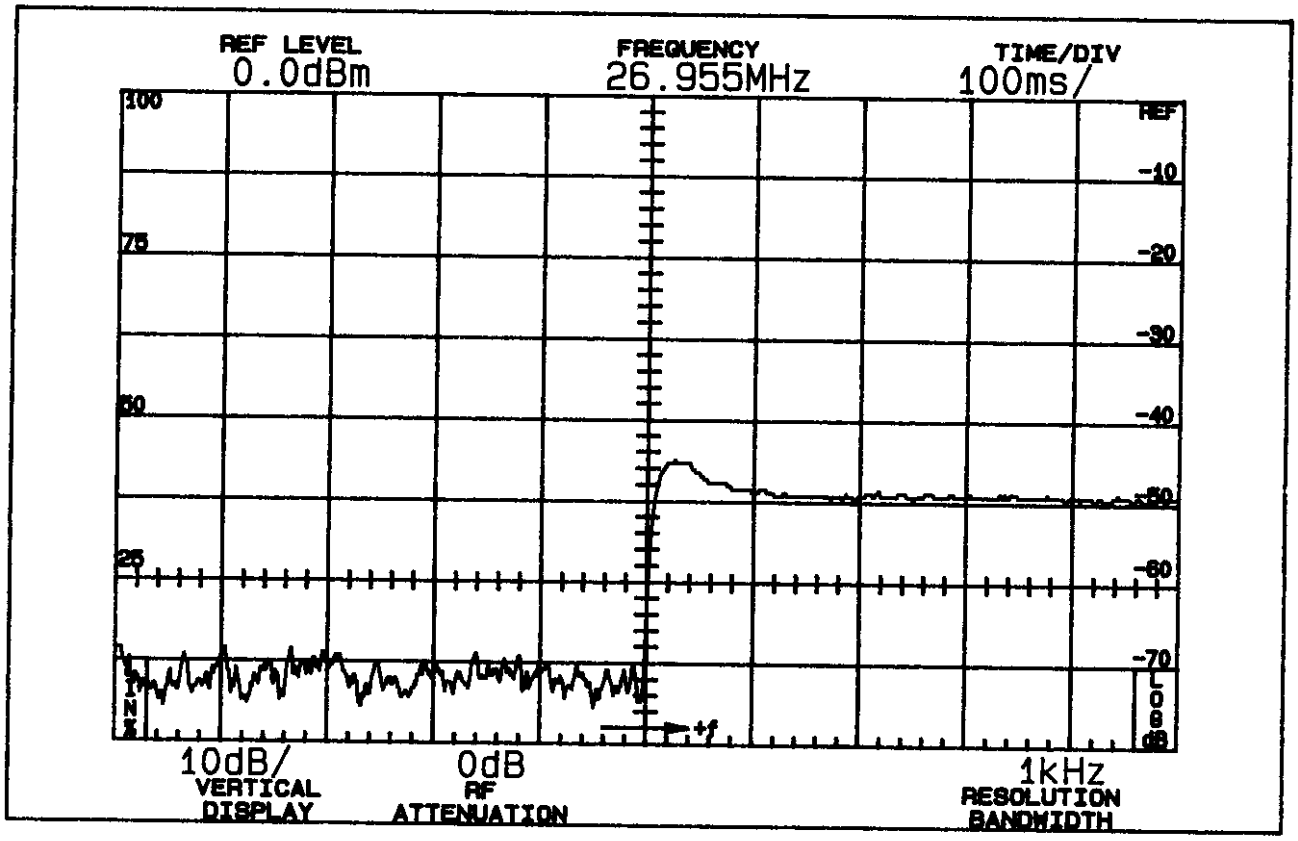
Measurement Conditions: 16 dB over 50% modulation level at 1150 Hz with 2500 Hz tone, upper fourth order sideband; horizontal scale 100 ms/div.

UPPER FOURTH-ORDER SIDEBAND
LIMITER ATTACK TIME
FCC ID: MMA77255ESP

FIGURE 3a

FIGURE 3b

MODULATION LIMITER ATTACK TIME



Measurement Conditions: 16 dB over 50% modulation level at 1150 Hz with 2500 Hz tone, lower fourth order sideband; horizontal scale 100 ms/div.

LOWER FOURTH-ORDER SIDEBAND
LIMITER ATTACK TIME
FCC ID: MMA77255ESP

FIGURE 3b

C. MODULATION CHARACTERISTICS (Continued)

4. Occupied Bandwidth - AM
(Paragraph 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 1150 Hz, the frequency of maximum response. Measured modulation at 1150 Hz was 89% positive, 88% negative.

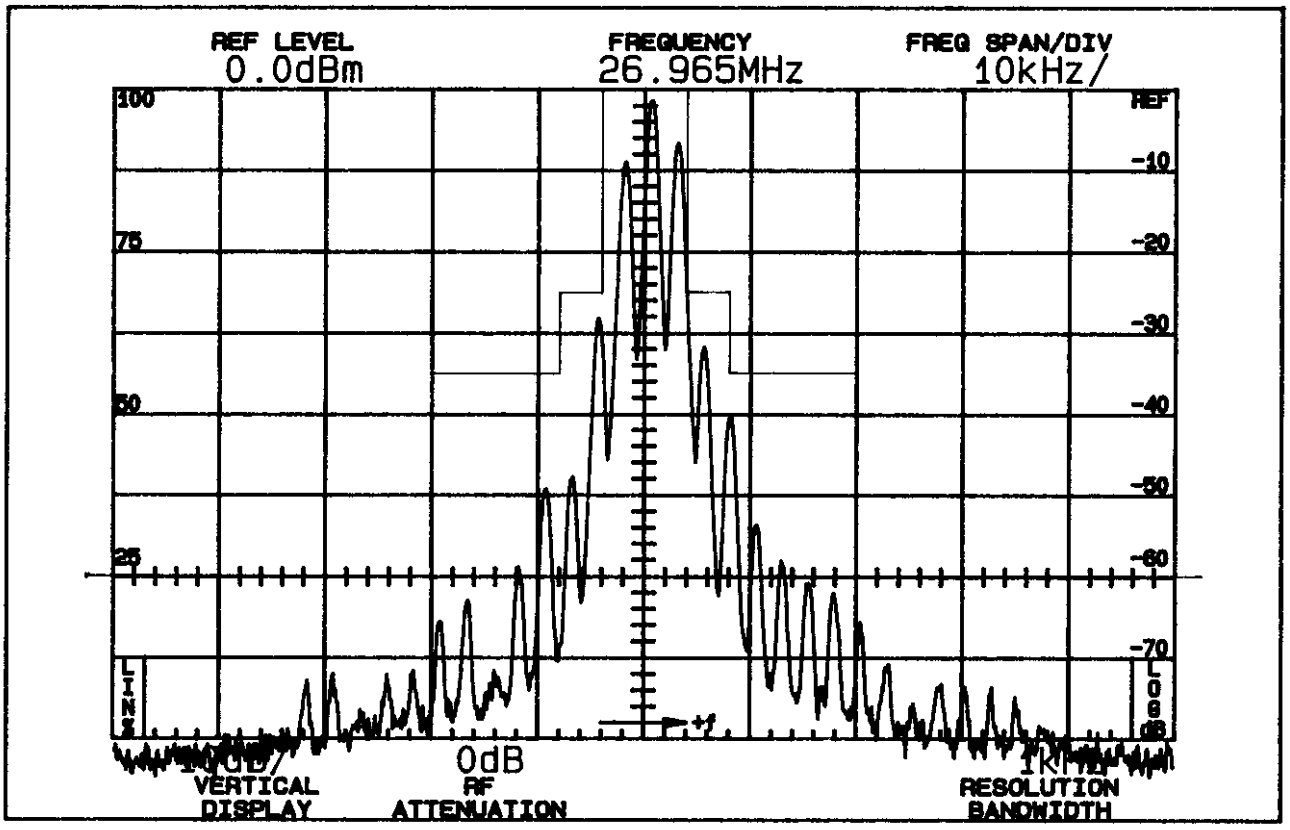
The plot is within the limits imposed by Paragraph 95.631(b)(1,3) for double sideband AM modulation. The horizontal scale, frequency, is 10 kHz per division and the vertical scale, amplitude, is a logarithmic presentation equal to 10 dB per division.

Reference carrier was set to 0 dB.

Mic gain set full cw.

FIGURE 4

OCCUPIED BANDWIDTH - AM



	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 - AM
FCC ID: MMA77255ESP

FIGURE 4

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

The 77-255ESP transmitter was tested 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 1150 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 attenuation.

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; supply was 13.8 Vdc throughout the tests.

Spurious emission was measured on Channels 1, 21, and 40 throughout the RF spectrum from 10 to 300 MHz. Any emissions that were between the 60 dB attenuation required and the noise floor of the spectrum analyzer were recorded. Data are shown in Table 1.

TABLE 1

TRANSMITTER CONDUCTED SPURIOUS

Channel	Spurious Frequency MHz	dB Below Unmod Carrier Ref.
1	53.930	77
1	80.895	82
1	107.860	90
1	134.825	99
1	161.790	80
1	188.755	96
1	215.720	102
1	242.685	95
1	269.650	95
21	54.430	76
21	81.645	81
21	108.860	89
21	136.075	101
21	163.290	81
21	190.505	96
21	217.720	103
21	244.935	98
21	272.150	96
40	54.810	77
40	82.215	81
40	109.620	90
40	137.025	101
40	164.430	82
40	191.835	97
40	219.240	102
40	246.645	98
40	274.405	98
	Required:	60

All other spurious were over 20 dB below required 60 dB suppression.

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

Field intensity measurements of radiated spurious emissions from the 77-255ESP transmitter were made with a Tektronix 494P spectrum analyzer and dummy load located in an open field 3 meters from the test antenna. Output power was 4.0 watts. The supply voltage was 13.8 Vdc. The transmitter and test antennae were arranged according to OCE 42 to maximize pickup. The unit has no accessory jacks. Both vertical and horizontal test antenna polarization were employed.

Measurements were made from 10 MHz to 10 times the maximum operating frequency of 26.965 or 270 MHz.

Reference level for the spurious radiations was taken as an ideal dipole excited by 4.0 watts, the output power of the transmitter according to the following relationship:*

$$E = \frac{(49.2 \times P_t)^{1/2}}{R}$$

where E = electric-field intensity in volts/meter

P_t = transmitter power in watts

R = distance in meters

for this case $E = \frac{(49.2 \times 4.0)^{1/2}}{3} = 4.7$ V/m

Since the spectrum analyzer is calibrated in decibels above one milliwatt (dBm):

4.7 volts/meter = 4.7×10^6 uV/m

dBu/m = 20 $\text{Log}_{10}(4.7 \times 10^6)$

= 133 dBu/m

Since 1 uV/m = -107 dBm, the reference becomes

133 - 107 = 26 dBm

Representing a conversion for convenience, from dBu to dBm. The measurement system was capable of detecting signals 100 dB or more below the carrier reference level. Data, including antenna factor and line loss corrections, are shown in Table 2.

*Reference Data for Radio Engineers, International Telephone and Telegraph Corporation, Sixth Edition.

F. FIELD STRENGTH MEASUREMENTS (Continued)

TABLE 2

TRANSMITTER CABINET RADIATED SPURIOUS
Channel 1, 26.965 MHz; 4.0 watts; 13.8 Vdc

	dB Below Carrier Reference			
	With Accessories		Without Accessories	
Frequency, MHz	Vertical	Horizontal	Vertical	Horizontal
53.930	74	77	95	100
80.895	62	69	81	88
107.860	73	82	97	95
134.825	77	85	96	86
161.790	98	90	100	90
188.755	92	103	105	100
215.720	87	84	97	98
242.685	91	88	95	89
269.650	90	87	94	83
FCC Limit:	60	60	60	60

Unlisted spurious were more than 80 below carrier reference from 10 to 270 MHz.

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 Vdc. 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. Data are shown in Table 3.

G. FREQUENCY STABILITY (Continued)

TABLE 3

Temperature	Output Frequency, MHz
-28.3	27.064179
-19.7	27.064398
- 9.9	27.064627
0.3	27.064805
10.6	27.064937
20.3	27.065059
29.8	27.065168
39.7	27.065288
50.1	27.065454
Maximum frequency error:	27.065000
	27.064179
	- .000821 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 Heath SP-5220 variable ac power supply was varied from ±15% above the nominal 13.8 Vdc. A Keithley 177 digital voltmeter was used to measure supply voltage at transmitter primary input terminals. Measurements were made at 20°C ambient. (See Table 4).

TABLE 4

Supply Voltage	Output Frequency, MHz
15.87	27.065052
15.18	27.065054
14.49	27.065056
13.80	27.065059
13.11	27.065062
12.42	27.065063
11.73	27.065064
Maximum frequency error:	27.065064
	27.065000
	+ .000064 MHz

FCC Rule 95.625(b) specifies .005% or a maximum of ± .0001353 MHz. No effects on frequency related to keying the unit were observed.

H. ADDITIONAL REQUIREMENTS FOR TYPE ACCEPTANCE
(Paragraph 95.669 of the Rules)

The 77-235ESP meets the applicable provision of 95.669(a).

External controls are limited to the following per 95.669(a):

1. Primary power connection
2. Microphone jack
3. RF output power connection
4. External speaker jack
5. On-off switch (combined with receiver volume control)
6. Not applicable, AM only
7. Not applicable
8. Transmitting frequency selector
9. Transmit-receive switch
10. Meter for monitoring transmitter performance
11. Meter/pilot lamp for RF output indication

Other front panel controls and functions follow on pages 17 and 18, and are representative of functions approved on other submissions.

The serial number of each unit will be implemented in accordance with 95.971.

A copy of Part 95, 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 95.673.

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

The 77-235ESP meets the following conditions specified:

1. All frequency-determining elements, including crystals, PLL integrated circuits and channel selector switches are permanently wired and soldered in place.

2. The PLL integrated circuit division ratio selection is BCD coded. All the 40 channels are mask programmed into the CPU and can not be changed.

3. Channel selection is controlled by the masked program of the CPU and has only 40 positions for use in the US.

4. All the undedicated leads in the CPU and PLL integrated circuits are disabled and not serviceable by the user.

5. A copy of the PLL data sheet is shown in Appendix 9.

J. FINAL AMPLIFIER DATA

1. A copy of the final RF amplifier data sheet is included in Appendix 10.

FRONT PANEL CONTROL DESCRIPTIONS

FRONT PANEL CONTROLS

1. **ROTARY CHANNEL SELECTOR:** This easy to operate control allows changing of weather or CB channel, either up or down. This control will not operate when the channel "LOCK" function has been activated.

2. **MICROPHONE CONNECTOR:** Plug in the supplied microphone to this connector. The collar ring has a screw on locking ring. Push the ring onto the units collar and screw on until it is tight.

3. **ON/OFF VOLUME:** In the off position your transceiver's power is off. Turn this control clockwise to switch on the unit and adjust the volume.

4. **SQUELCH CONTROL:** Adjust this control until background noise just disappears. If the control is adjusted too far clockwise it may cause muting of weaker signals.

5. **RF GAIN CONTROL:** This control adjusts the receiver sensitivity. Adjust the control for best reception of distant or local stations. Begin with control fully clockwise. To reduce reception of unwanted distant stations, turn control counter-clockwise until only desired stations are heard.

6. **MIC GAIN CONTROL:** Rotating this control fully clockwise will result in the greatest microphone output. /rotating the control counter-clockwise reduces the microphone output, improving the sound in high noise environments. This control can also be used to control optional power microphone output.

7. **CHANNEL DISPLAY:** LCD (liquid crystal display) read-out of selected CB or weather channel.

8,11,13. **M1, M2, M3 INDICATOR:** These LCD boxes are illuminated when a memory button has been used to select the CB channel.

9. **TX INDICATOR:** LCD indicator for showing the unit is transmitting.

10. **SCAN INDICATOR:** This indicates channel scanning is operating.

12. **WX INDICATOR:** When this indicator is illuminated it indicates your unit is in the weather receive mode. Weather channels are displayed.

14. **S/RF DISPLAY:** LCD read-out of received signal strength and relative transmitter power output.

FRONT PANEL CONTROL DESCRIPTIONS (CONT.)

15. **CB/WX:** This button causes your unit to change modes between NOAA weather bureau receiver and CB operation.

16. **M1, M2, M3 BUTTONS: These buttons select CB channels previously set by the operator for quick recall. To store channels** to memory:
   a. Select the desired channel using the rotary channel selector knob.
   b. Press and hold the memory button to be set for two seconds. Two beeps will sound when the channel is memorized.
   c. To recall a channel for use, press the desired memory button. The memorized channel will be selected and displayed.

17. **SCAN BUTTON:** This button when pressed and when the squelch is closed causes the channels to be scanned until a signal opens the squelch. Pressing the button again cancels scanning.

18. **TALK BACK SWITCH: This switch allows the user to hear the transmitted audio as it is transmitted when it is set to "ON". This provides the operator with a means to monitor the effects of microphone gain adjustment and the sound of special audio effects units.**

19. **ESP SWITCH:** Pressing this button controls the ESP2™ audio system. Channel noises are reduced and voices enhanced when ESP2™ is active.

20. **BRIGHT/DIM SWITCH:** Pressing this button causes the backlighting of the display to switch between dimmed and full brightness.

BACK PANEL

ANTENNA CONNECTOR: Connect a standard 50-ohm CB antenna to this connector.

S-METER JACK: A DC voltmeter may be connected to this jack for precision monitoring of received signal strength.

EXT SPEAKER JACK: When a speaker is connected to this jack the internal speaker is by-passed. All received signals will be heard through the external speaker when it is connected. The speaker connected to the "EXT" jack should be rated at 8 ohms and 5 watts or more.

APPENDIX 1

EQUIPMENT IDENTIFICATION LABEL

Sketch of equipment identification label follows this sheet.