GENERAL INFORMATION REQUIRED FOR TYPE ACCEPTANCE

The following information and data listed below is an addendum to the original submittal dated 8/31/98, FCC ID: N29RF100, Form 731 conformation # EA91595. This information is provided per the request of Correspondence # 3848.

2.983 (a,b,c) Emkay Innovative Products, Inc. will manufacture the RF100 in quantity for use under FCC RULES PART 90.265(b), Wireless Microphones.

2.983 (d) TECHNICAL DESCRIPTION

(1) Type of Emission: 46K0F3E

Bn = 2M + 2DK
M = 8000
D = 15kHz (Peak Deviation)
K = 1

Bn = 16k + 2(15k)(1) = 46k

ALLOWED AUTHORIZED BANDWIDTH = 54kHz.
90.265(b)(1).

(2) Frequency Range: The eight operating frequencies as specified in Part 90.265 (b) beginning with 169.445MHz and ending with 171.905MHz.

(3) Power Range and Controls: Unit has no controls.

(4) Maximum Output Power Rating: 30μWatts into a 50 ohm resistive load.

(5) DC Voltages and Current into Final Amplifier:

Final Amplifier Characteristics:

Power Supply:	2.15 Volts regulated from 2.5 V Battery.
Vce:	1.75 Volts
Ice:	3.2mA

2.983(d) TECHNICAL DESCRIPTION (CONT.)

(6) Function of Each Semiconductor Device:

U1	Microphone Amp / ALC Amp	NE578D
Y1	Fundamental Mode Crystal	
CR1	Diode Reference	MA4CP101A

(6) Function of Each Semiconductor Device (Cont.):

CR2	Modulation Diode	MA45438
Q1	Oscillator Transistor	MMBR931
Q2	Output Amplifier Transistor	AT30533
U4	Voltage Regulator	LP2951CM
U2	Part of the Magnetic Receiver	
U3	Part of the Magnetic Receiver	

(7) Complete Circuit Diagram: The schematic diagram is included as Exhibit A. The block diagram was included in the original submittal.

Note: Component value changes are as follows: R3 to 6.8k, R24 to 110k, R11 to 15k and C12 to 2.2nF.

(8) The INSTRUCTION MANUAL was included in the original submittal.

(9) The TUNE-UP PROCEDURE is included as Exhibit B.

(10) Description of all circuitry and devices provided for determining and stabilizing frequency. The transmitter frequency is controlled by a crystal. The crystal specification is included as Exhibit C. The crystal can be trimmed by adjusting C49.

(11) Description of any circuits or devices employed for suppression of spurious radiation, for limiting modulation, and for limiting power.

The circuitry is described in the Theory of Operation and was included in the original submittal.

Suppression of Spurious Radiation:
The circuitry between the collector of Q1 and the base of Q2 and the circuitry between the collector of Q2 and the Antenna are coupled resonator filters centered at the

transmitter frequency and suppress all out of band harmonics.

Limiting Modulation:
The transmitter audio processing is contained in U1 and the external circuitry connected to U1. This IC is configured as an ALC circuit providing microphone gain and compression beyond a certain drive level.

Limiting Power:
There is no circuitry specifically included to limit power. Output power is limited by the collector current in Q2.

(12) Digital Modulation: The unit does not employ digital modulation.

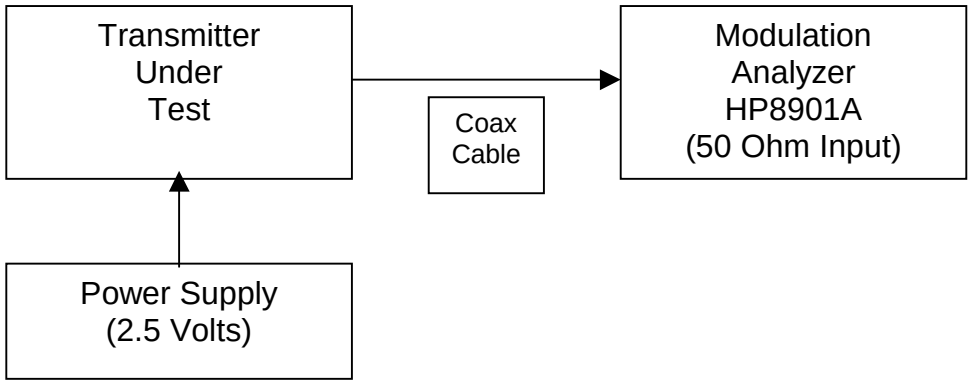
2.983 (e) The data required by 2.985 through 2.997 is submitted below.

2.985 (a) RF Power Output.

RF Power is measured by connecting a 50 ohm cable to the output terminals of the transmitter and then connecting the other end of the cable to a Modulation Analyzer and selecting the RF Level Measurement. With an input voltage of 2.5 volts (battery voltage) and the transmitter frequency properly adjusted, the RF output measures:

INPUT POWER: (1.75V)(0.0032A) = 5.6mWatts

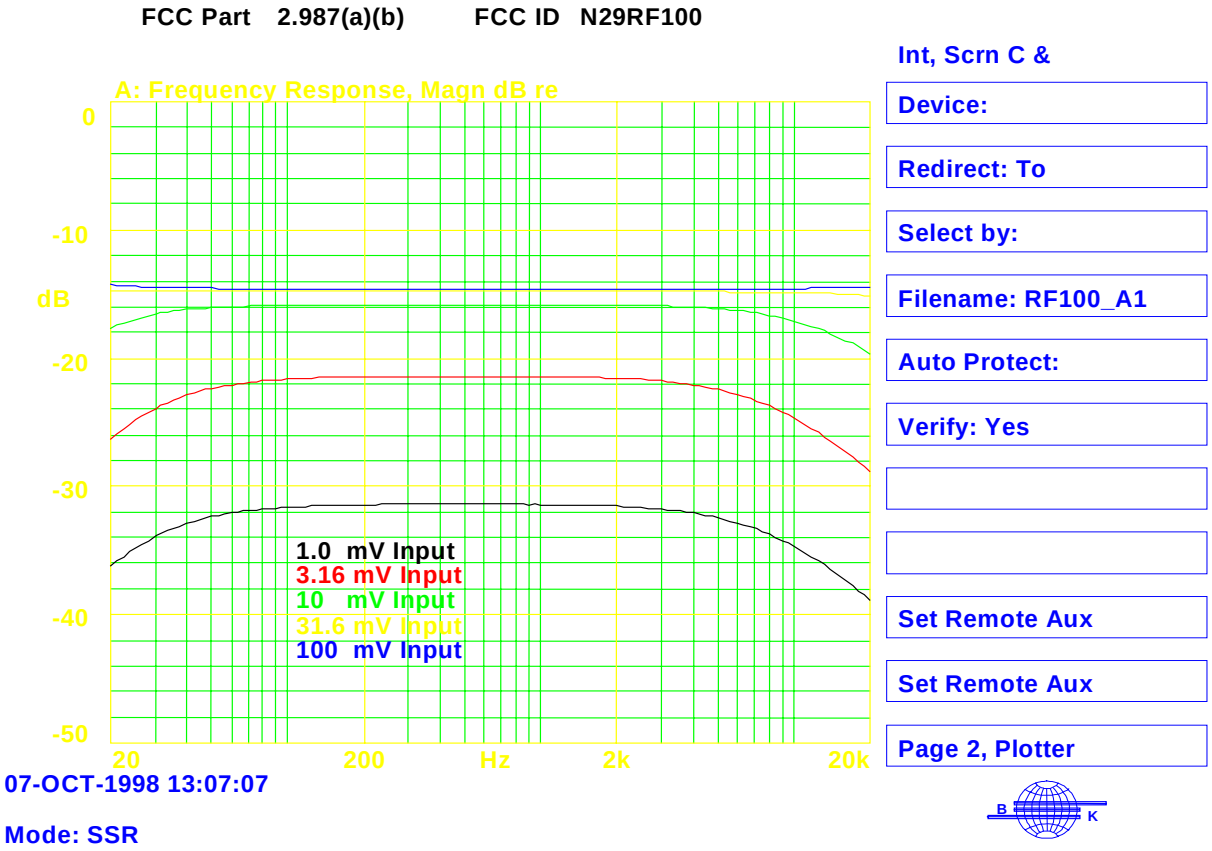
OUTPUT POWER: 15μWatts.



2.987 (a)(b) Modulation Characteristics

Audio Frequency Response / Modulation Limiting
The audio frequency response was measured by injecting a swept audio into the microphone input terminals and measuring the output level at the modulation input to the RF Oscillator. An audio analyzer was used as the audio stimulus and measuring receiver.

Audio Low Pass Filter
The audio low pass filter is not required in this unit.

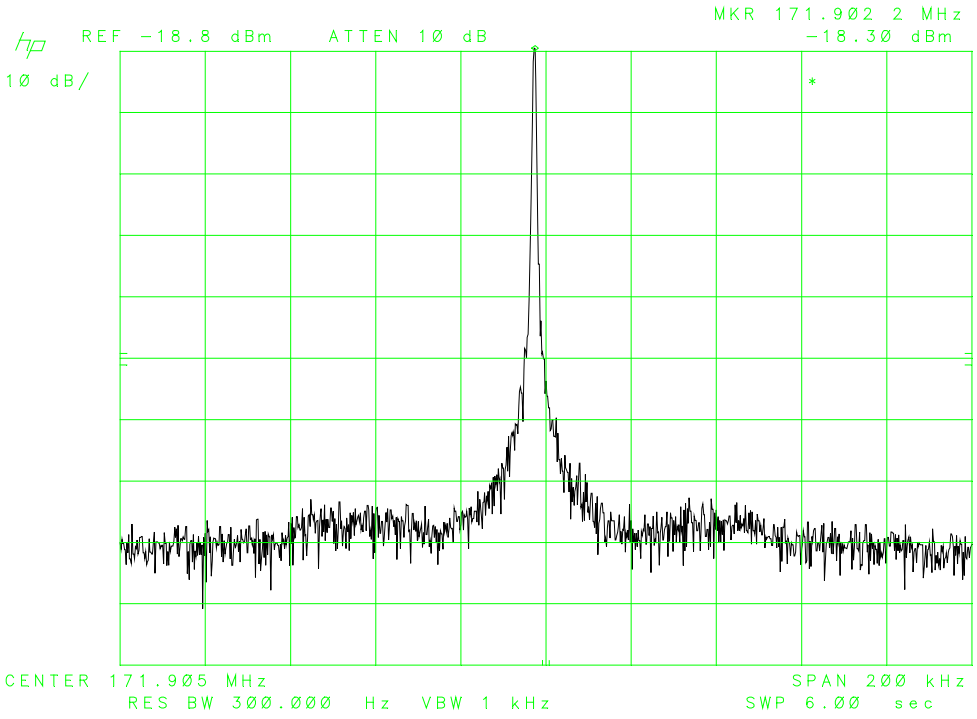


Audio Bandwidth and Modulation Limiting Plot

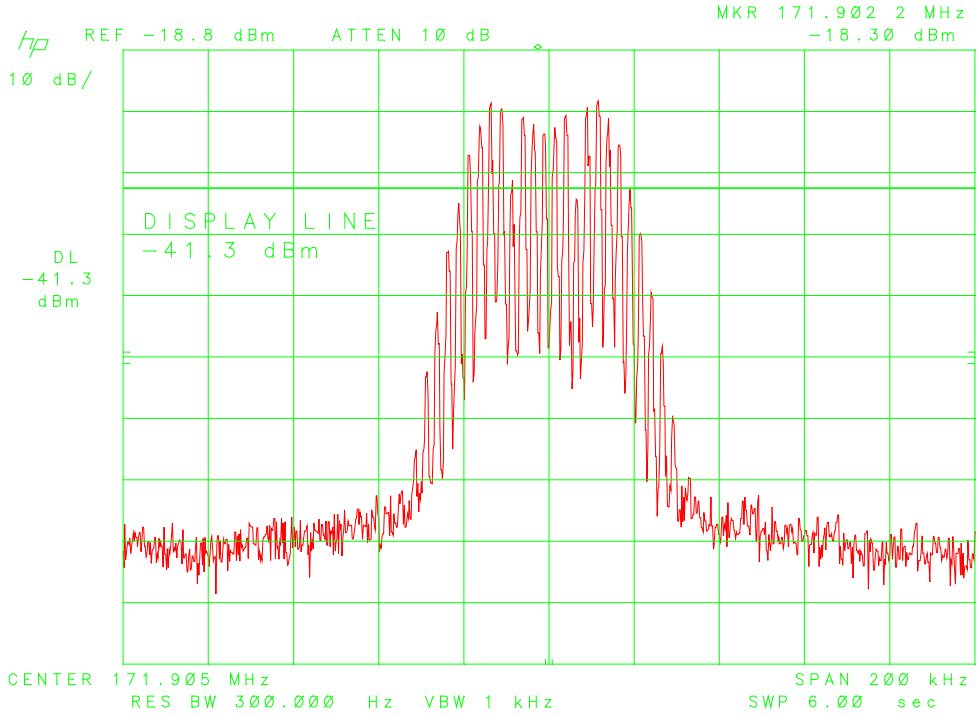
2.989 (c)

Occupied Bandwidth

Data in the figures below show that all sidebands beyond the authorized bandwidth are less than 0.5% of the unmodulated carrier. The transmitter was modulated with a 2500Hz tone and was adjusted for 50% modulation plus 16dB.



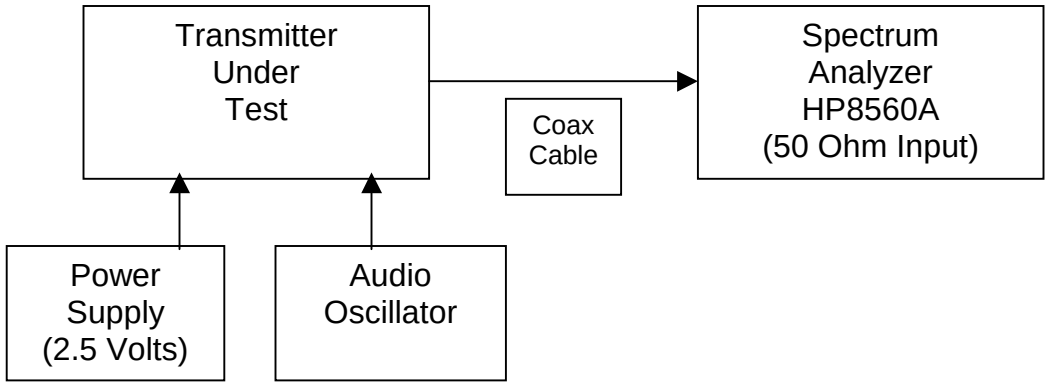
Un-modulated Carrier



2500 Hz, 50% +16dB

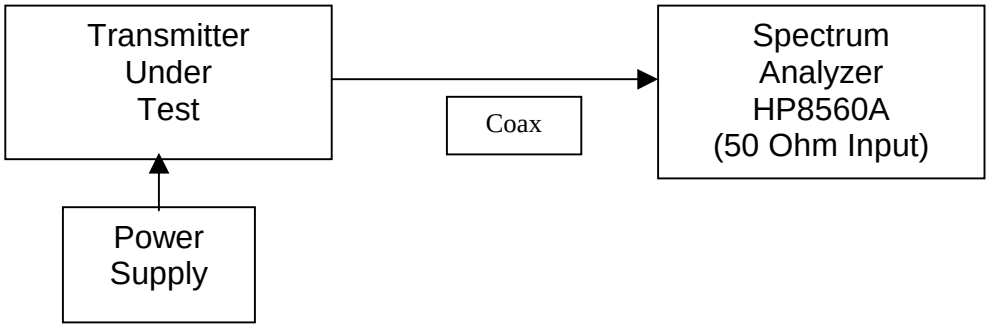
Measurement Results: The figure above indicates that the unit meets the FCC requirement. The Emission bandwidth is approximately 40 kHz.

Requirement: Part 90.265 (b)(1) Emission bandwidth of 54kHz or less.



2.991 Spurious Emissions at the Antenna Terminals (Conducted)

The following data shows the level of conducted spurious responses. The carrier was modulated in accordance with 2.989. The spectrum was scanned from 9 kHz to 2000 MHz.



Requirement:
Emissions must be 43 +10log(Po) dB below the mean power output of the transmitter.

43 + 10log(0.0003) = 8 dB

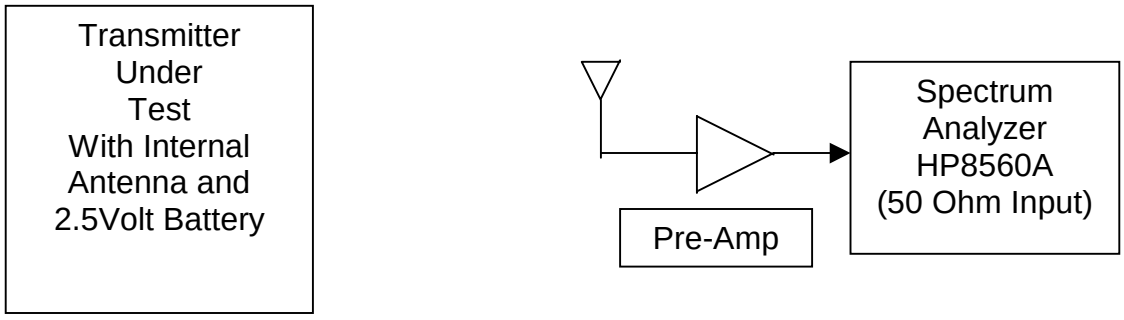
conducted spurious emissions tests, Part 2.991

Frequency MHz	Measured Amplitude dBuV	Cable Loss dB	Amplifier Gain dB	Signal Level dBuV	dB down from fundamental
171.909	88.2	0.3	0.0	88.5	0.0
34.381	17.3	0.1	0.0	17.4	71.2
68.764	28.4	0.1	0.0	28.5	60.0
103.203	35.2	0.2	0.0	35.4	53.1
137.505	58.0	0.3	0.0	58.3	30.3
206.273	55.9	0.4	0.0	56.3	32.2
240.687	42.8	0.5	0.0	43.3	45.3
275.007	36.0	0.6	0.0	36.6	52.0
343.790	53.1	0.7	0.0	53.8	34.8
378.191	23.8	0.8	0.0	24.6	64.0
412.572	22.2	0.8	0.0	23.0	65.5
446.953	19.2	0.9	0.0	20.1	68.4
481.334	21.2	1.0	0.0	22.2	66.4

No emissions were present from 500 MHz to 2000 MHz.

2.993 (a)(b) Field Strength of Spurious Emissions

The tabulated data below shows the results of the radiated field strength emissions test. The spectrum was scanned from 25 MHz to 2000 MHz.



Note: See test set up Photos in original submittal.

Requirements:
Emissions must be 43 +10log(Po) dB below the mean power output of the transmitter.

43 + 10log(0.0003) = 8 dB

Radiated Measurements:

171.905 transmit frequency

Frequency MHz	Measured Amplitude dBuV	Antenna Factor dB/m	Cable Loss dB	Amplifier Gain DB	Field Strength dBuV/m	dB down from fundamental
Vertical Polarization						
34.351	25.1	16.3	1.5	38.5	4.4	67.8
68.732	37.9	6.9	2.1	38.5	8.4	63.8
103.113	49.1	10.6	2.5	38.5	23.9	48.3
137.494	30.9	14.1	2.8	38.5	9.3	62.9
171.905	91.9	15.7	3.1	38.5	72.2	0.0
206.286	55.7	17.2	3.4	38.4	37.8	34.4
240.667	29.7	17.0	3.6	38.5	12.0	60.2
275.048	28.7	18.3	3.9	38.5	12.5	59.7
309.428	32.7	14.8	4.2	38.4	13.3	58.9
859.524	35.2	23.3	7.2	38.5	27.2	45.0
Horizontal Polarization						
34.380	30.0	16.3	1.5	38.5	9.3	56.1
68.761	42.7	6.9	2.1	38.5	13.2	52.2

103.142	43.6	10.6	2.5	38.5	18.3	47.1
137.523	32.1	14.1	2.8	38.5	10.5	54.9
171.904	85.1	15.7	3.1	38.5	65.4	0.0
206.285	53.0	17.2	3.4	38.4	35.1	30.3
240.666	27.5	17.0	3.6	38.5	9.7	55.7
275.047	23.5	18.3	3.9	38.5	7.3	58.1
309.429	28.0	14.8	4.2	38.4	8.5	56.9
343.810	48.0	15.9	4.5	38.4	29.9	35.5
859.525	37.0	23.3	7.2	38.5	29.0	36.4

Note: No other measurable signals to 1.72 GHz.

169.451 transmit frequency

Frequency MHz	Measured Amplitude dBuV	Antenna Factor dB/m	Cable Loss dB	Amplifier Gain DB	Field Strength dBuV/m	dB down from fundamental
Vertical Polarization						
33.911	35.0	16.6	1.4	38.5	14.6	67.5
67.796	41.0	7.1	2.1	38.5	11.7	70.4
135.566	42.1	13.9	2.8	38.5	20.3	61.7
169.451	101.8	15.6	3.1	38.5	82.1	0.0
203.336	54.1	17.2	3.4	38.4	36.2	45.8
203.343	57.2	17.2	3.4	38.4	39.4	42.7
237.221	38.0	16.9	3.6	38.5	20.1	62.0
271.106	33.2	17.9	3.9	38.5	16.5	65.6
Horizontal Polarization						
33.911	34.3	16.6	1.4	38.5	13.9	49.2
67.796	45.4	7.1	2.1	38.5	16.1	47.0
135.566	32.7	13.9	2.8	38.5	10.9	52.1
135.566	35.4	13.9	2.8	38.5	13.6	49.5
169.451	82.8	15.6	3.1	38.5	63.1	0.0
203.336	41.0	17.2	3.4	38.4	23.2	39.9
237.221	33.5	16.9	3.6	38.5	15.5	47.5
271.106	31.8	17.9	3.9	38.5	15.1	47.9
305.013	34.7	14.7	4.2	38.4	15.2	47.9
338.900	57.1	15.8	4.4	38.4	38.9	24.2

Note: No other measurable signals to 1.69 GHz.

Note: The above radiated emissions data is a reconfiguration of the original data submitted on 8/31/98 to conform to the reporting requirements of 2.993.

2.995 (a)(b)(d) <u>Frequency Stability</u>

Temperature and voltage tests were performed to verify that the frequency remains within the requirements of Part 90.265 (b)(3).

Temperature test was conducted as follows: The transmitter was placed in the temperature chamber at 22 degrees C and allowed to stabilize for ½ hour. Power was applied to the unit and after 1 minute the transmitter frequency was measured at approximately 15 second intervals. A total of four readings were taken. The temperature was then reduced to –30 degrees C and allowed to stabilize for ½ hour. Power was then applied to the unit and the measurement procedure was repeated. Data was then taken at every 10 degree C intervals up to 50 degrees C. The data is tabulated in the table below:

The battery tests were conducted between 85% and 115% of the nominal voltage of 2.5 volts. The battery pack is 2 rechargeable Ni-MH Cells in series. The nominal voltage at the 50 % discharge point is 1.25 volts. The discharge rate of the batteries is less than 0.1C. The 100% discharge rate of the cell occurs at approximately 1.1 volts or greater. The battery data sheet is given in Exhibit E.

Note: The temperature chamber uses liquid nitrogen as a coolant and extreme cold temperatures can be reached in 5 minutes or less.

Measurement Data

Assigned Frequency (Reference Frequency): 171.905 MHz.

Temperature (C)	Frequency (MHz)	Offset from Reference (kHz)
-30	171.894580	-10.420
-20	171.897975	-7.025
-10	171.900272	-4.728
0	171.901845	-3.155
10	171.902995	-2.005
20	171.903950	-1.050
30	171.905583	0.583
40	171.906249	1.249
50	171.906870	1.870
Battery Voltage		

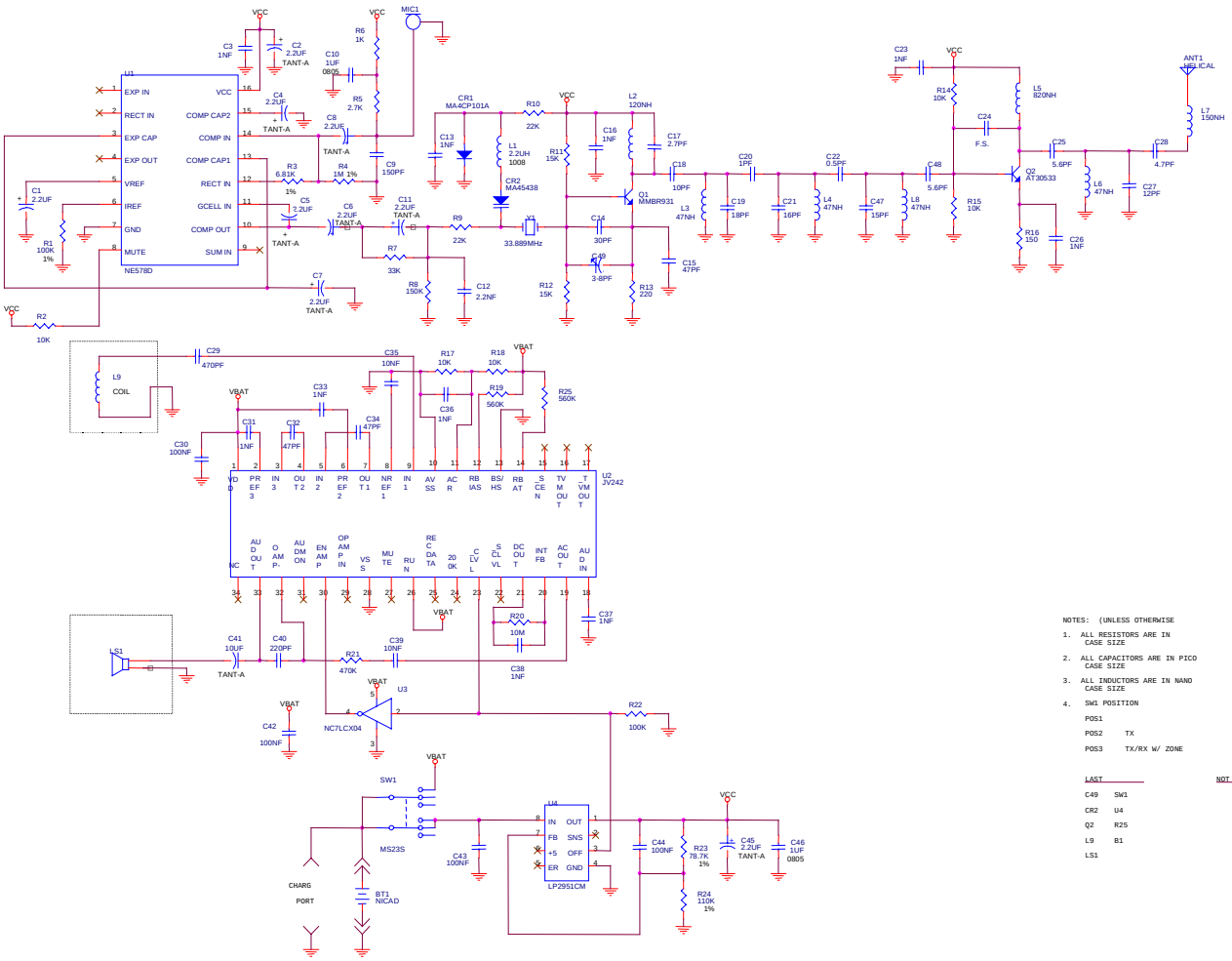
.85(2.5v)	171.898355	-6.645
1.15(2.5v)	171.904925	-0.075

Requirement:

Part 90.265 (b)(3) requires the frequency stability of the total emission to be +/- 32.5 kHz of the assigned frequency.

The emission per 2.989 (c) is less than +/- 20 kHz. The worst case frequency drift allowed is 12.5 kHz. All measurements are with-in this requirement.

Exhibit A: Circuit Diagram.



Phonic Ear Inc.		
3880 Cypress Dr. Petaluma, CA 94954		
Title: KNOWLES TMX TRANSMITTER		
Size: C	Document Number: ENG-890-970207-201	Rev: B
Date: Friday, October 09, 1998	Sheet 1 of 1	

FILE NAME:

Exhibit B: Tune Up Procedure

WIRELESS HEADSET

RF TRANSMITTER BOARD LEVEL

MANUAL TEST PROCEDURE

1.0 SCOPE

The purpose of this test procedure is to align and verify the minimum performance requirements for the Wireless Headset RF Transmitter Assembly.

2.0 TEST EQUIPMENT

The recommended test equipment is listed in the table below. Equivalent test equipment may be substituted.

Model Number	Description	Manufacturer
HP8920A	RF Communications Test Set	Hewlett-Packard
P6201	FET Probe	Tektronix
1101A	FET Probe Power Supply	Tektronix
E3620A	DC Power Supply	Hewlett-Packard
	BNC Cables	Any
	UUT Test Interface Assembly	Knowles
	100MHz Oscilloscope	Any
	DMM	Any

3.0 TEST SET UP

The UUT build level should be a completed PCB Assembly with the TVM die attached and sealed. The speaker, antenna, and the magnetic pickup coil should not be installed. The test set up is shown in Figure 1.

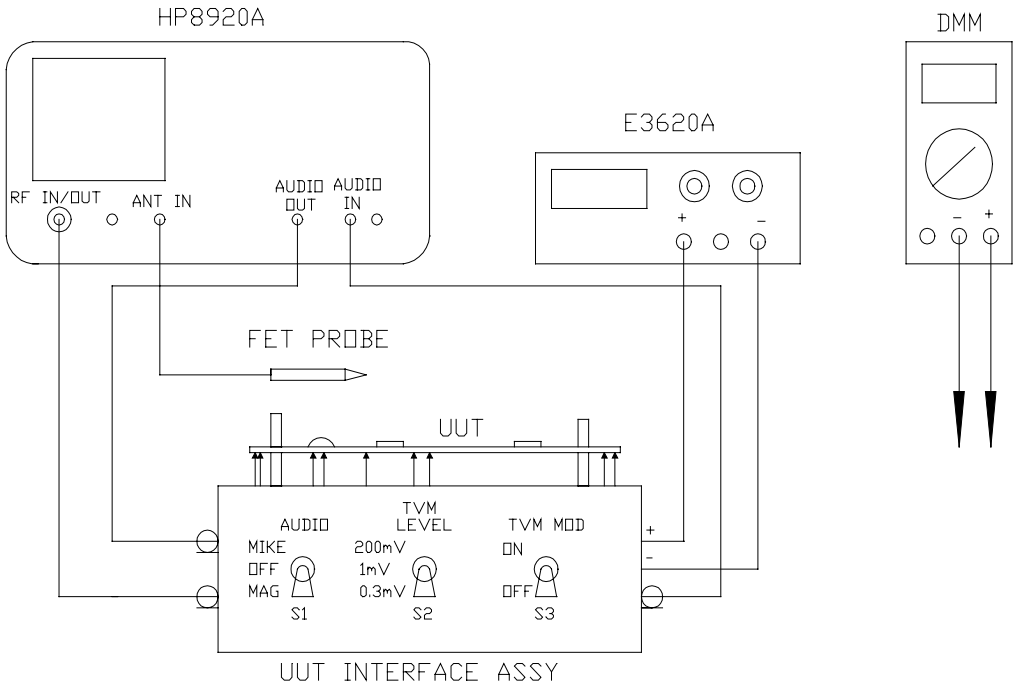


FIGURE 1

TEST SET UP

4.0 TEST EQUIPMENT CONFIGURATION

A.) HP8920A

1. Turn HP8920A on and press “Preset.”
2. Press “TX” under Screen Control.
3. Set “Tune Mode” to Manual.
4. Set “Tune Frequency” to 169.445 MHz.
5. Set “TX Power” units to dBm.
6. Set “IF Filter” to 230 kHz.
7. Set “De-Emphasis” to Off.
8. Change “AF Freq” on display to “Distn.”
9. Program “AFGen 1 Lvl” to 10mV RMS.
10. Save instrument state in appropriate register.

B.) E3620A DC Power Supply

1. Set the voltage to 2.5V.
2. Set the current limit to 50mA (if available on the supply).

C.) Oscilloscope and DMM.

1. No set up required.

D.) UUT INTERFACE ASSEMBLY

1. Connect the UUT Interface Assembly as shown in Figure 1.
2. Set S1, Audio, to the MIKE position.
3. Set S3, TVM MOD, to the OFF position.

5.0 POWER UP TEST

1. Place the UUT onto the Interface Assembly.
2. Turn on the DC Power Supply.
3. Set the switch on the UUT to the middle position (TX only).
4. Verify the current is between 4mA and 6mA.
5. Measure the voltage on TP12 with the DMM and verify the output is 2.15V, +/- 0.1V.

5.1 TRANSMITTER TESTS

1. Observe the “TX Freq Error” on the HP8920A display and adjust C49 until the error is 0 Hz, +/- 2 kHz.

2. Observe the “TX Power” on the display and verify the level is greater than -15dBm.
3. Observe the “FM Deviation” on the display and verify the deviation is 15kHz peak.
4. Observe the “Distn” on the display and verify the distortion is less than 2.2%.
5. Increase the “AFGen 1 Lvl” to 100mV and verify the “FM Deviation” is less than 15 kHz and the “Distn” is less than 2.5%.
6. Set “AFGen 1 Lvl” to 0mV.
7. Go to “SPEC ANL” Display and program the “Center Freq” to 169.445 MHz, “Ref Level” to -10 dBm, and the “Span” to 300 MHz.

Verify the 2 adjacent spurs are at least -20 dBc from the main carrier and the remaining spurs are at least -30 dBc.

Exhibit C: Typical Crystal Specification

Crystal Specification

Operating Frequency:	34.381000 MHz, +/- 50 ppm
Operating Mode:	Fundamental
Resonance Type:	Series
Package Style:	UM-1 or Equivalent
Motional Capacitance:	
Pulling Frequency:	+/- 4 kHz
Temperature Coefficient:	+/- 20 ppm, 0 - 50 °C
ESR:	< 30 Ohms
Drive Level:	500 micro watts, nominal
Spurious Attenuation:	> 4 dB
Static Capacitance, Co:	5pF Max

Exhibit D: Addendum to List of Test Equipment.

(Items 1 through 7 are listed in the original submittal)

8. Hewlett Packard 8901A Modulation Analyzer, cal due 3-04-99

9. Hewlett Packard 53131A Frequency Counter, cal due 10/04/99

10. Bruel & Kjaer Model 2012 Audio Analyzer, cal due 4/16/99\

11. Hewlett Packard E3620A Power Supply, cal due 3/15/99

12. Tenney TH Jr. Environmental Chamber, cal due 3/26/99

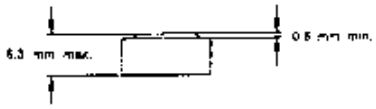
Exhibit E: Battery Specification

GP. SYLVA • CHARGE GP70BVH

Data Sheet for GP70BVH

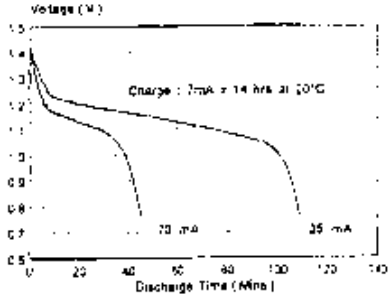
Specifications :

Type	: Rechargeable Nickel Metal Hydride Button Cell
Model	: GP70BVH
Nominal Dimension For Bare Cell	: Φ = 15.4 mm max. H = 6.3 mm max.
Applications	: Recommended discharge current 0.7 to 70 mA
Nominal Voltage	: 1.2 V
Nominal Capacity	: 70 mAh when discharge at 14 mA to 1.0 V at 20°C
Charging Condition	: 7 mA for 14 hrs at 20°C
Service Life	: 500 - 1000 Cycles
Continuous Overcharge	: 7 mA maximum permissible current. No conspicuous deformation and/or leakage
Weight	: 3.7 g
Internal Resistance	: Under 1300 mΩ upon fully charged
Max Charging Voltage	: 1.5 V at 7 mA charging
Temperature Range	: Charging : 0°C to 35°C Discharging : 0°C to 45°C Storage : -20°C to 35°C



Characteristics :

Discharge (At High Rate)



Discharge (At Low Rate)