TABLE OF CONTENTS LIST

APPLICANT: YAESU MUSEN CO., LTD.
FCC ID: K66VX-210U

TEST REPORT:

EXHIBITS CONTAINING:

DATE: AUGUST 24, 1999
REPORT #: F:\CUS\Y\YAE\YAE347A9\YAE347A9.RPT
PAGE: TABLE OF CONTENTS

GENERAL INFORMATION REQUIRED
FOR TYPE ACCEPTANCE

2.983 (a,b,c) YAESU MUSEN CO., LTD. will sell the FCCID: K66VX-210U UHF transciever in quantity, for use under FCC RULES PART 22, 74, 90, 95, & 90.210.

2.983 (d) TECHNICAL_DESCRIPTION

(1) ALLOWED AUTHORIZED BANDWIDTH = 11.25KHz.
90.209(b)(5)

Bn = 2M + 2DK
M = 3000
D = 2.5KHz (Peak Deviation)
K = 1
Bn = 2(3.0K) + 2(2.5K)(1) = 6.0K + 5.0K = 11.0K

Type of Emission: 11K0F3E

(2) ALLOWED AUTHORIZED BANDWIDTH = 20.0KHz.
90.209(b)(5)

Bn = 2M + 2DK
M = 3000
D = 5.0KHz (Peak Deviation)
K = 1
Bn = 2(3.0K) + 2(5.0K)(1) = 6.0K + 10.0K = 16.0K

Type of Emission: 16K0F3E

(2) Frequency Range: 421-512 MHz

(3) Power Range and Controls:This UUT has two(2) power ranges, 1.0Watt & 5.0Watt.

(4) Maximum Output Power Rating: 5.0Watts into a 50 ohm resistive load.

(5) DC Voltages and Current into Final Amplifier:

POWER INPUT	FINAL AMPLIFIER ONLY
POWER OUT	5.4
Vce Volts	7.2
Ice Amps	1.5
Pin Watts	10.2

(6) Function of each electron tube or semiconductor device or other active circuit device: See attached list in Exhibit 9

2.983 (d)(6)

2.983(d) (7) Complete Circuit Diagrams: The circuit diagram is included as PAGES 7-8. The block diagram is included as PAGE 6.

(8) Instruction book. The instruction manual is in cluded as 10A-10B.

(9) Tune-up procedure. The tune-up procedure is given in the user's manual.

(10) Description of all circuitry and devices provided for determining and stabilizing frequency is included in the circuit description in 11A-11C.

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

In addition to the interstage filtering the multi-section low pass filter is described in paragraph 6.3.5 of the instruction manuel.

Limiting Modulaton:
The transmitter audio limiting circuitry is contained in the loop filter U501, U502, & U503.

Limiting Power: The power is preset at the factory for either high or low. There is no provision for limiting power.

(12) Digital modulation. This unit does NOT use digital modulation.

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

2.985(a) RF_power_output. The test procedure used was TIA/EIA-603 S2.2.1. RF power is measured by connecting a 50 ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage of 7.2V, and the transmitter properly adjusted the RF output measures:

INPUT POWER: (7.2V)(1.5A) = 10.80Watts
OUTPUT POWER: 5.4 Watts Efficiency: 47%

INPUT POWER(LO): (7.2V)(0.9) = 6.48 Watts
OUTPUT POWER(LO): 1.3 Watts Effeciency: 20%

2.985(a) RF power output. The test procedure used was TIA/EIA-603 S2.2.1.

```
   /---------------\
   |  Dummy        |
 /-|  Microphone   |
 | |               |
 | \---------------/
 |
 | /------------\          /------------\   /---------\
 | |            |          |  STANDARD  |   | RF      |
 | | Transmitter|----------| TRANSMITTER|---| POWER   |
 \-| under test |          |  LOAD      |   | METER   |
   \------------/          \------------/   \---------/
```

2.987(a) Modulation_characteristics:

AUDIO_FREQUENCY_RESPONSE The audio frequency response was measured in accordance with TIA/EIA Specification TIA/EIA-603 S2.2.6.2.1. The audio frequency response curve is shown in Exhibits 13A-13B.

2.987(b) AUDIO_LOW_PASS_FILTER Transmitters utilizing analog emissions that are equipped with an audio low-pass filter must meet the requirements in S90.210. See Exhibit 15.

2.987(b) AUDIO_INPUT_VERSUS_MODULATION The audio frequency input versus deviation was measured in accordance with TIA/EIA Specification 603 S2.2.6.2.1. with the following exceptions; starting with 1000Hz the input was increased well beyond the deviation changing. This measurement was repeated for the band limits and any frequency deemed appropriate. See Exhibit 14A-14F.

```
   /---------------\  /----------\    /----------\
   |  Dummy        |  | Audio    |    | RMS      |
 /-|  Microphone   |--| Generator|  /-| VOLTMETER|
 | |               |  \----------/  | \----------/
 | \---------------/                |
 |---------------------------------/
 | /------------\          /------------\   /---------\
 | |            |          |  STANDARD  |   | Test    |
 | | Transmitter|----------| TRANSMITTER|---| Receiver|
 \-| under test |          |  PROBE     |   |         |
   \------------/          \------------/   \---------/
```

1.The test receiver audio bandwidth was <50Hz to >20,000Hz.

2.989(c) Occupied bandwidth:

90.210 (b)

(1) On any frequency removed from the assigned frequency by more than 50% of the authorized bandwidth: At least 25 dB.
(2) On any frequency removed from the assigned frequency by more than 100%, but not more than 250% of the authorized bandwidth: At least 35dB.
(3) On any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth: At least 43 + 10 log(P) dB.

90.210 (d) 2

Requirement For 12.5KHz channel bandwidth equipment, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows;
(1) On any frequency from the center of the authorized bandwidth f0: Zero dB.
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fdd kHz) of more than 5.625kHz but no more than 12.5kHz: At least 7.27(fd-2.88kHz)dB
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fdd kHz) of more than 12.5kHz: At least 50 + 10 log(P) dB or 70dB, whichever is the lesser attenuation.

See Exhibit 16.

2.989(c) Occupied bandwidth: Using TIA/EIA 2.2.11 sideband Spectrum TIA/EIA-603 S2.2.11 was used to measure the occupied bandwidth. Plots were made of the highest frequency and at 2500Hz. Data in the plots show that all sidebands beyond the authorized bandwidth are less than 0.5% of the unmodulated carrier. The plots show the transmitter modulation with;

For 12.5KHz spacing no modulation, 2500Hz, 3000Hz Tones
For 25.0KHz Channel spacing no modulation, 2500Hz, 3000Hz

At each of the tone input was adjusted for 50% modulation plus 16 dB. The spectrum analyzer was set with the unmodulated carrier at the top of the screen. The test procedure diagram and occupied bandwidth plots follow.

Test procedure diagram

OCCUPIED BANDWIDTH MEASUREMENT

```
   /---------------\  /----------\    /----------\
   |  Dummy        |  | Audio    |    | RMS      |
 /-|  Microphone   |--| Generator|  /-| VOLTMETER|
 | |               |  \----------/  | \----------/
 | \---------------/                |
 |----------------------------------/
 | /------------\        /------------\   /---------\
 | |            |        |  STANDARD  |   | TEST    |
 | | Transmitter|--------| TRANSMITTER|---| RECEIVER|
 \-| under test |        |  LOAD      |   |         |
   \------------/        \------------/   \---------/
```

2.991 Spurious emissions at antenna terminals(conducted):

The following data shows the level of conducted spurious responses at the antenna terminal. The test procedure used was TIA/EIA 603 S2.2.13 with the exception that the emissions were recorded in dBc. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental.

```
   /---------------\  /----------\    /----------\
   |  Dummy        |  | Audio    |    | RMS      |
 /-|  Microphone   |--| Generator|  /-| VOLTMETER|
 | |               |  \----------/  | \----------/
 | \---------------/                |
 |----------------------------------/
 |
 | /------------\         /------------\       /---------\
 | |            |         |  STANDARD  |       | SPECTRUM|
 | | Transmitter|---------| TRANSMITTER|-------| ANALYZER|
 \-| under test |     |   |  LOAD      |       |         |
   \------------/     |   \------------/       \---------/
                      |
                      |  /--------\   /-----------\ |
                      |  |  NOTCH |   | STANDARD  | |
                      \--| FILTER |---|TRANSMITTER|-/
                         |        |   | LOAD      |
                         \--------/   \-----------/
```

Method of Measuring Conducted Spurious Emissions

NAME OF TEST: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

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

HIGH POWER 43 + 10log(5.4) = 50.3dB
LOW POWER At least 70dBc

EMISSION FREQUENCY MHz	dB BELOW CARRIER	
450.025	00.0	0.0
900.05	-76.1	-78.2
1350.08	-74.5	-88.4
1800.12	-90.3	-84.0
2250.14	-80.1	-90.3
2700.10	-78.6	-78.7
3150.14	-81.2	-94.5
3600.14	-100.2	-93.0
4050.10	-99.5	-101.3
4500.25	-97.9	-105.2

2.993(a)(b) Field strength of spurious emissions:

The tabulated Data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 to 4.7 GHz. This test was conducted per ANSI C63.4-1992 with the exception of briefly connecting the transmitter to a half wave dipole for the purpose of establishing a reference.

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

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

50 + 10log(5.4) = 57.30 dB or
70dBc, whichever is the lessor.
NOTE: FOR THE MARGIN CALCULATION BELOW 70dB WAS USED.

TEST DATA: HIGH POWER

EMISSION FREQUENCY MHz	METER READING @ 3m dBuV	COAX LOSS dB	ACF dB	FIELD STRENGTH dBuV/m	ATT. LEVEL dB	MARGIN dB	ANT.
450.00	115.20	1.60	18.15	134.95	0.00	0.00	H
900.00	17.20	2.90	24.20	44.30	85.45	15.45	H
1350.10	13.20	1.00	25.40	39.60	90.15	20.15	V
1800.10	14.10	1.00	27.20	42.30	87.45	17.45	V
2250.10	12.60	1.07	28.63	42.29	87.46	17.46	H
2700.10	11.90	1.14	29.75	42.79	86.96	16.96	H
3150.10	6.40	1.20	30.88	38.48	91.27	21.27	H
3600.10	6.50	1.27	32.00	39.77	89.98	19.98	H
4050.10	2.20	1.34	33.06	36.59	93.16	23.16	H
4500.30	1.50	1.41	33.56	36.47	93.28	23.28	H

TEST DATA: LOW POWER

EMISSION FREQUENCY MHz	METER READING @ 3m dBuV	COAX LOSS dB	ACF dB	FIELD STRENGTH dBuV/m	ATT. LEVEL dB	MARGIN dB	ANT.
450.10	108.20	1.60	18.15	127.95	0.00	0.00	H
900.00	17.30	2.90	24.20	44.40	87.45	17.45	V
1350.00	15.30	1.00	25.40	41.70	90.15	20.15	V
1800.10	14.20	1.00	27.20	42.40	89.45	19.45	H
2250.10	14.50	1.07	28.63	44.19	87.66	17.66	H
2700.10	0.00	1.14	29.75	30.89	100.97	30.97	H
2700.10	14.20	1.14	29.75	45.09	86.77	16.77	H
3150.10	12.70	1.20	30.88	44.78	87.07	17.07	H
3600.10	12.80	1.27	32.00	46.07	85.78	15.78	H
4050.10	12.10	1.34	33.06	46.49	85.36	15.36	H
4500.30	8.60	1.41	33.56	43.57	88.28	18.28	H

2.993(a)(b) CONTINUED: Field strength of spurious emissions:

METHOD OF MEASUREMENT: The procedure used was ANSI STANDARD C63.4-1992 with the following exception: the unit was operated into a dipole antenna with the antenna at a height of 1.5 meters in order to establish a reference, then connected to a dummy load. The spectrum was scanned from 30MHz to at least the tenth harmonic of the fundamental using a HP model 8566B spectrum analyzer, an Eaton model 94455-1 Biconical Antenna, a ElectroMetrics antennas models TDA, TDS-25-1, TDS-25-2, RGA-180. Measurements were made at the open field test site of TIMCO ENGINEERING INC. located at 6051 N.W. 19th LANE, GAINESVILLE, FL 32605.

Method of Measuring Radiated Spurious Emissions

```
                                                        Hewlett Packard
                                                            Spectrum
                                                            Analyzer
                                                            HP8566A

/-----------\       /----------------\                         /----\
|           |       |                |                |     |    |
|TRANSMITTER|-------|50 OHM RESISTIVE|                \-----|    |
| UNDER TEST|       | LOAD           |                      |    |
\-----------/       \----------------/                      \----/
     |                               |                |
     |                               |                |
     |                               |? 3.0 meters--?|
     |
     |                                 Tuned, Calibrated
     |                                   Antenna which may
/--------------\                          be raised from 4
|              |                          to 20' above ground
|POWER SUPPLY  |                          and changed
|              |                          in  polarization
\--------------/
```

Equipment placed 4' above ground
on a rotatable platform.

2.995(a)(b)(d) Frequency stability:
90.213

Temperature and voltage tests were performed to verify that the frequency remains within the .00025%, 2.5 ppm specification limit. The test was conducted as follows: The transmitter was placed in the temperature chamber at 25 degrees C and allowed to stabilize for one hour. The transmitter was keyed ON for one minute during which four frequency readings were recorded at 15 second intervals. The worse case number was taken for temperature plotting. The assigned channel frequency was considered to be the reference frequency. The temperature was then reduced to -30 degrees C after which the transmitter was again allowed to stabilize for one hour. The transmitter was keyed ON for one minute, and again frequency readings were noted at 15 second intervals. The worst case number was recorded for temperature plotting. This procedure was repeated in 10 degree increments up to + 50 degrees C.

Readings were also taken at plus & minus 15% of the supply voltage of 13.6VDC.

MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency): 450.025 000MHz

TEMPERATURE_C	FREQUENCY_MHz	PPM
REFERENCE	450.025 000	00.0
-30	450.024 720	-0.62
-20	450.024 900	-0.22
-10	450.025 530	+1.18
0	450.025 780	+1.73
+10	450.025 730	+1.62
+20	450.025 490	1.09
+30	450.025 060	0.13
+40	450.024 840	-0.35
+50	450.024 970	-0.07

-15% Supply Voltage 11.56VDC	450.025 150	0.33
+15% Supply Voltage 15.64VDC	450.025 050	0.11
+Battery End-point 6.0VDC	450.025 310	0.68

RESULTS OF MEASUREMENTS: The maximum frequency variation over the temperature range was +1.73 to -0.62ppm. The maximum frequency variation over the voltage range was +0.68 ppm.

2.995(a)(b)(d) Frequency stability:

90.214 Transient Frequency Behavior

REQUIREMENTS:In the 450-500MHz frequency band, transient frequencies must be within the maximum frequency difference limits during the time interval indicated below for 25kHz Channels:

Time Interval	Maximum Frequency	Portable Radios 450-500Mhz
t1	+25kHz	10.0ms
t2	+12.5kHz	25.0ms
t3	+25.0kHz	10.0ms

TEST PROCEEDURE: TIA/EIA TS603 PARA 2.2.19, the levels were set as follows;

1. Using the varible attenuator the transmitter level was set to 40dB below the test recievers maximum input level, then the transmitter was turned off.
2. With the Transmitter off the signal generator was set 20dB below the level of the transmitter in the above step, this level will be maintained with the signal generator through-out the test.
3. Reduce the attenuation between the transmitter and the RF detector by 30dB.
4. With the levels set as above the transient frequency behavior was observed & recorded.

2.995(a)(b)(d) <u>Frequency stability:</u>

90.214   Transient Frequency Behavior
(Continued)

```
  /------------\                     /------------\
  |  DUMMY     |                     | RF SIGNAL  |    /---------\
  | MICROPHONE |                     | GENERATOR  |----|COMBINING|
  \------------/                     \------------/    |NETWORK  |-\
       |                                             /--|         | |
  /-------------\  /-------------\   /------------\ |  \---------/ |
  | TRANSMITTER |  |  STANDARD   |   | DIRECTIONAL| |              |
  | UNDER TEST  |--| TRANSMITTER |---| COUPLER    |-/              |
  \-------------/  | & VARIABLE  |   |            |                |
                   | ATTENUATOR  |   \------------/                |
                   \-------------/     |       |                   |
                                       | /-----/                   |
                    /------------------/ |                         |
              /----------\      /----------\  /----------\         |
              | RF       |      |  5O OHM  |  | RF POWER |         |
              | DETECTOR |      |  LOAD    |  |  METER   |----\    |
              \----------/      \----------/  \----------/    ?    |
                    |                                         -----/
                    \---------\                               ?
                              |                /---------\    |
        /------------\      /--------------\   | TEST    |----/
        |            |      | Trig    Vert |---| RECEIVER|
        |  PLOTTER   |------|              |   |         |
        |            |      |  STORAGE     |   \---------/
        \------------/      | OSCILLASCOPE |
                            \--------------/
```

2.983(f) Photo or Drawing of Label:
See Exhibit 2.

2.983(g) Photos of Equipment:
See Exhibits 5A-5G.

2.999 Measurement Procedures for Type Acceptance:

Measurement techniques have been in accordance with TIA/EIA specifications and the FCC requirements.

2.909 Certification of Technical Data by Engineers

We, the undersigned, certify that the enclosed measurements and enclosed data are true and correct.

S.S. Sanders
Engineer

TEST EQUIPMENT LIST

1. Spectrum Analyzer: Hewlett Packard 8566B - Opt 462, w/ preselector 85685A, & Quasi-Peak Adapter HP 8565OA, & HP 8449B - OPT H02 Cal. 7/6/99
2. Signal Generator, Hewlett Packard 8640B, cal. 10/1/98
3. Signal Generator, HP 8614A Serial No.2015A07428 cal. 5/27/99
3. Eaton Biconnical Antenna Model 94455-1
   20-200 MHz Serial No. 0997 Cal. 10/30/98
4. Electro-Metric Dipole Kit, 20-1000 MHz, Model TDA-30 10/31/98
5. Electro-Metric Horn 1-18 GHz, Model RGA-180, Cal. 10/30/98
6. Electro-Metric Antennas Model TDA-30/1-4,Cal. 10/15/98
7. Electro-Metric Line Impedance Stabilization Network Model No. EM-7821, Serial No. 101; 100KHz-30MHz 50uH. Cal.11/19/98
8. Electro-Metric Line Impedance Stabilization Network Model No. EM-7820, Serial No. 2682; 10KHz-30MHz 50uH. Cal. 11/19/98
9. Special low loss cable was used above 1 GHz
10. Tenney Temperature Chamber