

TABLE OF CONTENTS LIST

APPLICANT: WOOJIN E & T, LTD.

FCC ID: M23FRS-460

TEST REPORT:

PAGE	1.....	COVER SHEET - GENERAL INFORMATION & TECHNICAL DESCR.
PAGE	2.....	TECHNICAL DESCRIPTION CONTD. & RF POWER OUTPUT
PAGE	3.....	RF POWER OUTPUT CONTD. & MODULATION CHARACTERISTICS
PAGE	4.....	OCCUPIED BANDWIDTH
PAGE	5.....	SPURIOUS EMISSIONS AT ANTENNA TERMINALS AND FIELD STRENGTH OF SPURIOUS EMISSIONS
PAGE	6.....	METHOD OF MEASURING RADIATED SPURIOUS EMISSIONS
PAGE	7.....	FREQUENCY STABILITY
PAGE	8.....	CERTIFICATION OF TECHNICAL DATA AND LIST OF TEST EQUIPMENT

EXHIBITS CONTAINING:

EXHIBIT	1.....	POWER OF ATTORNEY LETTER
EXHIBIT	2.....	FCC ID LABEL SAMPLE
EXHIBIT	3.....	SKETCH OF FCC ID LABEL LOCATION
EXHIBIT	4A.....	EXTERNAL REAR VIEW PHOTOGRAPH
EXHIBIT	4B.....	EXTERNAL FRONT VIEW PHOTOGRAPH
EXHIBIT	4C-4D.....	INTERNAL COMPONENT SIDE PHOTOGRAPH
EXHIBIT	4E-4F.....	INTERNAL SOLDER SIDE PHOTOGRAPH
EXHIBIT	5.....	BLOCK DIAGRAM
EXHIBIT	6A-6E.....	PARTS LIST
EXHIBIT	7.....	SCHEMATIC
EXHIBIT	8A-8U.....	USER'S MANUAL
EXHIBIT	9.....	AUDIO FREQUENCY RESPONSE GRAPHS
EXHIBIT	10A-10C...	AUDIO INPUT VS DEVIATION GRAPH
EXHIBIT	11.....	AUDIO LOW PASS FILTER GRAPH
EXHIBIT	12.....	OCCUPIED BANDWIDTH CW PLOT
EXHIBIT	13.....	OCCUPIED BANDWIDTH With DEVIATION PLOT

APPLICANT: WOOJIN E & T, LTD.

FCC ID: M23FRS-460

REPORT #: F:\CUS\W\WOOJIN\WET224A9.RPT

PAGE: TABLE OF CONTENTS

GENERAL\_INFORMATION\_REQUIRED  
FOR\_TYPE\_ACCEPTANCE

2.983 (a,b,c) WOOJIN E & T, LTD. will manufacture the  
FCCID: M23FRS-460 FAMILY RADIO SERVICES 14 CHANNEL  
TRANSCIVER in quantity, for use under FCC RULES  
PART 95.

2.983 (d) TECHNICAL\_DESCRIPTION

2.983 (d) (1) Type of Emission: 10K2F3E  
95.629

Bn = 2M + 2DK

M = 3000

D = 2.1K

Bn = 2(3.0)+2(2.1) = 10.20K

Authorized Bandwidth 12.5KHz

2.983 (d) (2) Frequency Range: 1. 462.5625 8. 467.5625  
95.627 2. 462.5875 9. 467.5875  
3. 462.6125 10. 467.6125  
4. 462.6375 11. 467.6375  
5. 462.6625 12. 467.6625  
6. 462.6875 13. 467.6875  
7. 462.7125 14. 467.7125 MHz

2.983 (d) (3) Power Output shall not exceed 0.500Watts effective  
95.637 radiated power. There can be no provisions for  
95.647 increasing the power.

2.983 (d) (4) Maximum Output Power Rating: 500 milliWatts  
95.637 effective radiated power.

95.645 The antenna is an intergral part to the unit, it cannot  
be removed without rendering the unit inoperative. In  
order to remove the antenna the case must unscrewed,  
then the PCB assemblies must be removed then the  
antenna can be removed.

2.983 (d) (5) DC Voltages and Current into Final Amplifier:

FINAL AMPLIFIER ONLY

Vce = 4.5 Volts DC Ice = 0.33A.

Pin = 1.51 Watts

APPLICANT: WOOJIN E & T, LTD.

FCC ID: M23FRS-460

REPORT #: F:\CUS\W\WOOJIN\WET224A9.RPT

PAGE #: 1

2.983 (d) (6) Function of each electron tube or semiconductor device or other active circuit device:

SEE EXHIBIT #:

2.983(d) (7) Complete Circuit Diagrams: The circuit diagram is included as EXHIBIT of this report. The block diagrams are included as EXHIBIT 5 of this report.

2.983(d) (8) Instruction book. A draft copy of the instruction manual is included as EXHIBIT 8.

2.983 (d) (9) Tune-up procedure. The tune-up procedure is included INCLUDED IN USER'S MANUAL.

(10) Description of all circuitry and devices provided for determining and stabilizing frequency is given in EXHIBIT 8. The crystal specifications are included as PAGES NA.

2.983 (d)(11) Description of any circuits or devices employed for suppression of spurious radiation, for limiting modulation, and for limiting power will be INCLUDED IN USER'S MANUAL.

(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.

95.637 RF power is measured by measuring the radiated power at 3 meters and then replacing the transmitter with a signal generator to determine the effective radiated power. The ERP shall not exceed 0.500 Watts.

MEASURED POWER OUTPUT = 500 milliWatts ERP

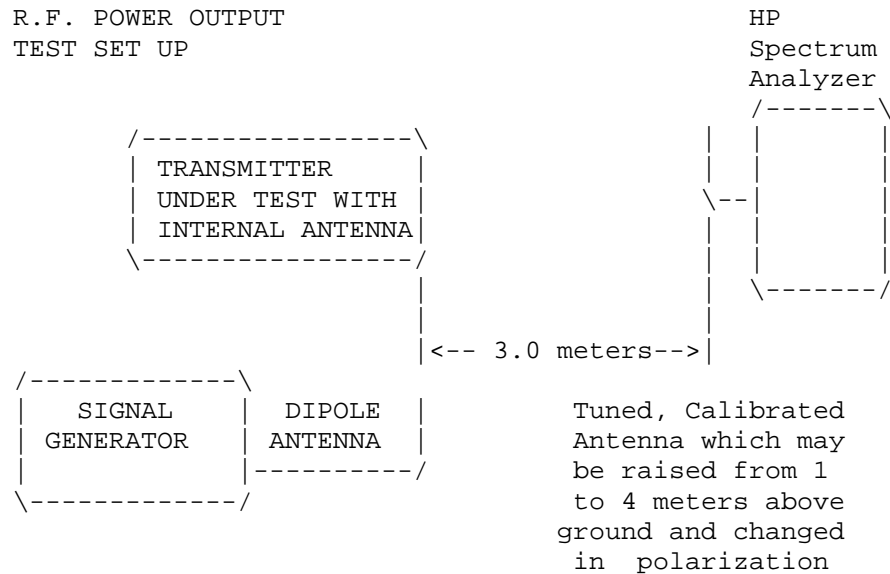
APPLICANT: WOOJIN E & T, LTD.

FCC ID: M23FRS-460

REPORT #: F:\CUS\W\WOOJIN\WET224A9.RPT

PAGE #: 2

R.F. POWER OUTPUT  
TEST SET UP



Equipment placed 1 meter above ground on a rotatable platform.

2.987(a)(b) Modulation\_characteristics:

AUDIO\_FREQUENCY\_RESPONSE

The audio frequency response was measured in accordance with TIA/EIA Specification 603. The audio frequency response curve is shown on the next page. The audio signal was fed into a dummy microphone circuit and into the microphone connector. The input required to produce 30 percent modulation level was measured.

2.987(b) 1 Audio\_input\_versus\_modulation

The audio input level needed for a particular percentage of modulation was measured in accordance with TIA/EIA Specification 603. The audio input curves versus modulation are on the following pages. Curves are provided for audio input frequencies of 300, 1000, and 3000 Hz.

95.635(b) Post Limiter Filter

The filter must be between the modulation limiter and the modulated stage. At any frequency between 3 & 20KHz the filter must have an attenuation of  $60 \log (f/3)$  greater than the attenuation at 1KHz. see the proceeding page.

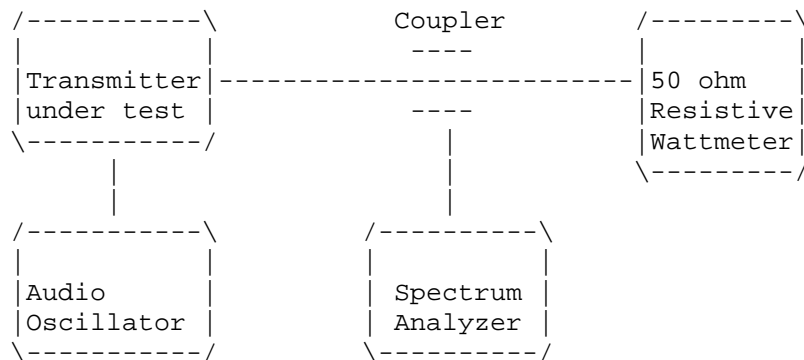
2.989(c) EMISSION BANDWIDTH:  
95.633(b)(1)(3)(7)

Data in the plots shows that the sidebands from greater than 50% to 100% of the authorized bandwidth must be attenuated by at least 25dB and from 100 to 250% the sidebands must be attenuated by at least 35dB. Beyond 250% the sidebands must be attenuated by at least  $43 + \log_{10}(TP)$ . The transmitter was modulated with 2500 Hz, 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.

Radiotelephone transmitter with modulation limiter.

Test procedure diagram

OCCUPIED BANDWIDTH MEASUREMENT



APPLICANT: WOOJIN E & T, LTD.  
FCC ID: M23FRS-460  
REPORT #: F:\CUS\W\WOOJIN\WET224A9.RPT  
PAGE #: 4

2.991 Not Applicable, no antenna terminal allowed.

2.993(a)(b) UNWANTED\_RADIATION:  
95.635(b)(7)

REQUIREMENTS: Emissions must be attenuated by at least the following below the output of the transmitter.

$$43 + 10\log(TP) = 43 + 10\log(0.5) = 40.00\text{dB}$$

TEST DATA:

EMISSION FREQ. MHz	METER READING @ 3m dBuV	COAX LOSS dB	ACF dB	FIELD STRNGTH dBuV/m	ATT. dBuV/m	MARGIN dB	ANT.
462.62	104.10	1.60	18.44	124.14	0.0	0.0	V
925.20	31.90	2.90	24.10	58.90	65.24	25.24	V
1388.00	26.30	1.00	25.55	52.85	71.29	31.29	V
1850.00	29.00	1.01	27.40	57.41	66.73	26.73	V
2313.00	33.00	1.08	28.78	62.86	61.28	21.28	V
2775.00	29.10	1.15	29.94	60.18	63.96	23.96	V
3228.00	15.00	1.21	31.07	47.28	76.86	36.86	V
3701.00	24.00	1.29	32.25	57.54	66.60	26.60	V
4163.00	6.30	1.35	33.18	40.84	83.30	43.30	V
4626.20	10.70	1.42	33.70	45.83	78.31	38.31	H

MARGIN = (Field strength of Fund - 40dB) - FS OF EMISSION

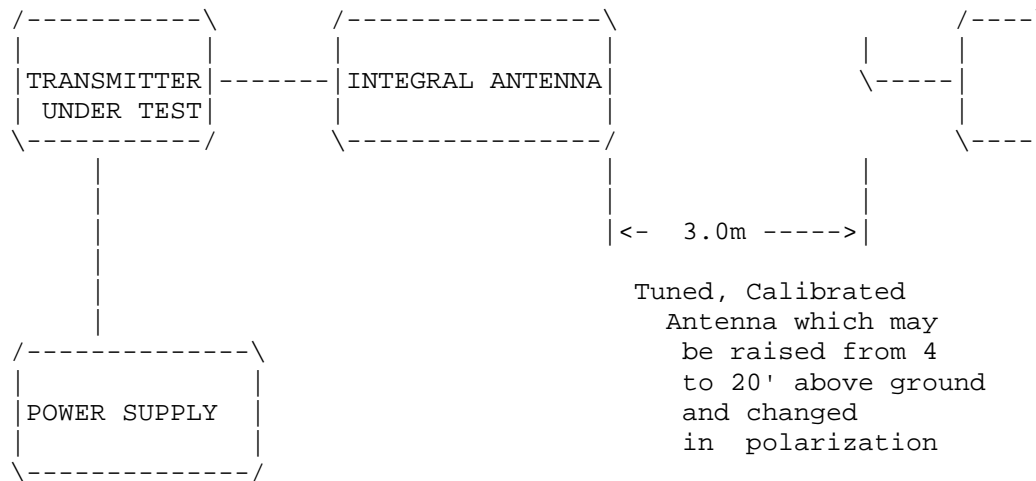
METHOD OF MEASUREMENT: The procedure used was C63.4-1992 for intentional radiators. The spectrum was scanned from 30 to at least the tenth harmonic of the fundamental using a HP model 8566B spectrum analyzer, an Eaton model 94455-1 Biconical Antenna, ElectroMetrics antennas models TDA, TDS-25-1, TDS-25-2 and 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.

APPLICANT: WOOJIN E & T, LTD.  
FCC ID: M23FRS-460  
REPORT #: F:\CUS\W\WOOJIN\WET224A9.RPT  
PAGE #: 5

2.993(a)(b) UNWANTED\_RADIATION:  
95.631(b)(8)(9)

# Method of Measuring Radiated Spurious Emissions

Hewlett Packard  
Spectrum  
Analyzer  
HP8566B



Equipment placed 4' above ground  
on a rotatable platform.

2.995(a)(b)(d) Frequency\_stability:

Temperature and voltage tests were performed to verify that the frequency remains within the 0.00025%, 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 and minus 15% of the battery voltage of 4.5 VDC.

MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency): 462.562 500

TEMPERATURE_C	FREQUENCY_MHz	PPM
REFERENCE_____	462.562 500	00.00
-20_____	462.561 500	-2.16
-10_____	462.561 990	-1.10
0_____	462.562 030	+1.01
+10_____	462.563 260	+1.64
+20_____	462.563 280	+1.69
+30_____	462.563 060	+1.21
+40_____	462.562 660	+0.35
+50_____	462.562 600	+0.22

20c BATT. End-Point 4.5V/dc 462.562 720 +0.47

RESULTS OF MEASUREMENTS: The maximum frequency variation over the temperature range was -2.16 to -1.69 ppm. The maximum frequency variation with voltage was +0.47ppm.

APPLICANT: WOOJIN E & T, LTD.  
FCC ID: M23FRS-460  
REPORT #: F:\CUS\W\WOOJIN\WET224A9.RPT  
PAGE #: 7



- 2.983(f) Photo\_or\_Drawing\_of\_Label:  
See EXHIBIT 3.
- 2.983(g) Photos\_of\_Equipment:  
See EXHIBIT 4.
- 2.999 Measurement\_Procedures\_for\_Type\_Acceptance:  
  
Measurement techniques have been in accordance with 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 85650A, & HP 8449B - OPT H02 Cal. 6/26/98
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

APPLICANT: WOOJIN E & T, LTD.  
FCC ID: M23FRS-460  
REPORT #: F:\CUS\W\WOOJIN\WET224A9.RPT  
PAGE #: 8