

TABLE OF CONTENTS LIST

APPLICANT: KACE ELECTRONICS (ASIA) INC.

FCC ID: MUDFR-130

TEST REPORT:

PAGE 1.....COVER SHEET - GENERAL INFORMATION & TECHNICAL DESCRIPTIVE
PAGE 2.....TECHNICAL DESCRIPTION CONTINUED
PAGE 3.....RF POWER OUTPUT
PAGE 4.....MODULATION CHARACTERISTICS
PAGE 5.....OCCUPIED BANDWIDTH
PAGE 6.....UNWANTED RADIATION
PAGE 7.....METHOD OF MEASURING RADIATED SPURIOUS EMISSIONS
PAGE 8.....FREQUENCY STABILITY
PAGE 9.....CERTIFICATION OF TECHNICAL DATA
PAGE 10.....LIST OF TEST EQUIPMENT

EXHIBITS:

EXHIBIT 1.....POWER OF ATTORNEY LETTER
EXHIBIT 2A-2B.....LIST OF ACTIVE DEVICES
EXHIBIT 3.....FCC ID LABEL SAMPLE AND SKETCH OF LOCATION
EXHIBIT 4.....BLOCK DIAGRAM
EXHIBIT 5.....SCHEMATIC
EXHIBIT 6A-6D.....THEORY OF OPERATION
EXHIBIT 7A-7B.....TUNING PROCEDURE
EXHIBIT 8.....AUDIO FREQUENCY RESPONSE GRAPH
EXHIBIT 9.....AUDIO INPUT VS DEVIATION GRAPH
EXHIBIT 10.....AUDIO LOW PASS FILTER GRAPH
EXHIBIT 11.....OCCUPIED BANDWIDTH PLOT - CW
EXHIBIT 12.....OCCUPIED BANDWIDTH PLOT - 3KHZ TONE
EXHIBIT 13.....EXTERNAL PHOTO - FRONT VIEW
EXHIBIT 14.....EXTERNAL PHOTO - REAR VIEW
EXHIBIT 15.....INTERNAL PHOTO - COMPONENT SIDE
EXHIBIT 16.....INTERNAL PHOTO - COPPER SIDE
EXHIBIT 17A-17E.....USERS MANUAL

APPLICANT: KACE ELECTRONICS (ASIA) INC.

FCC ID: MUDFR-130

REPORT #: F:\CUS\K\KACE\KEA174A8.RPT

PAGE: TABLE OF CONTENTS

GENERAL INFORMATION REQUIRED
FOR TYPE ACCEPTANCE

2.983 (a,b,c) KACE ELECTRONICS (ASIA) INC. will manufacture the FCCID: MUDFR-130 FAMILY RADIO SERVICES SINGLE CHANNEL TRANSCEIVER in quantity, for use under FCC RULES PART 95.

2.983 (d) TECHNICAL DESCRIPTION

2.983 (d) (1) Type of Emission: 8K0F3E
95.629

$$\begin{aligned} B_n &= 2M + 2DK \\ M &= 3000 \\ D &= 1.5K \\ B_n &= 2(3.0) + 2(1.5) = 8.0K \end{aligned}$$

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: 250 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 = 0.16A.
Pin = 0.72 Watts

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

APPLICANT: KACE ELECTRONICS (ASIA) INC.
FCC ID: MUDFR-130
REPORT #: F:\CUS\K\KACE\KEA174A8.RPT
PAGE #: 1

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

SEE EXHIBITS 2A-2B

2.983(d) (7) Complete Circuit Diagrams: The circuit diagram is included as EXHIBIT 5 of this report. The block diagrams are included as EXHIBIT 4 of this report.

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

2.983 (d) (9) Tune-up procedure. The tune-up procedure is included as EXHIBIT 7A-7B.

(10) Description of all circuitry and devices provided for determining and stabilizing frequency is given in EXHIBIT 17. The crystal specifications 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 EXHIBIT 17.

(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.

APPLICANT: KACE ELECTRONICS (ASIA) INC.

FCC ID: MUDFR-130

REPORT #: F:\CUS\K\KACE\KEA174A8.RPT

PAGE #: 2

2.985(a)

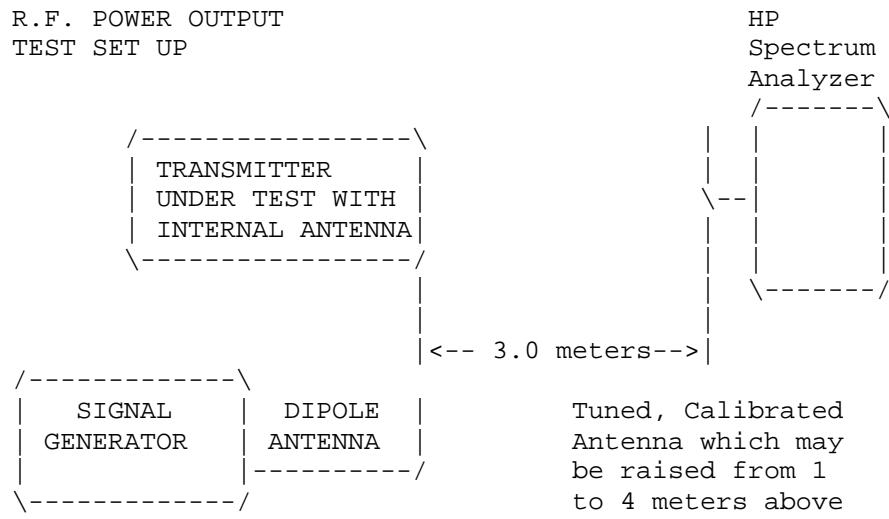
RF power output.

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 = 250 milliWatts ERP

R.F. POWER OUTPUT
TEST SET UP



Tuned, Calibrated
Antenna which may
be raised from 1
to 4 meters above
ground and changed
in polarization

Equipment placed 1 meter above ground
on a rotatable platform.

APPLICANT: KACE ELECTRONICS (ASIA) INC.

FCC ID: MUDFR-130

REPORT #: F:\CUS\K\KACE\KEA174A8.RPT

PAGE #: 3

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. See exhibit 8.

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. See exhibit 9.

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 exhibit 10.

APPLICANT: KACE ELECTRONICS (ASIA) INC.

FCC ID: MUDFR-130

REPORT #: F:\CUS\K\KACE\KEA174A8.RPT

PAGE #: 4

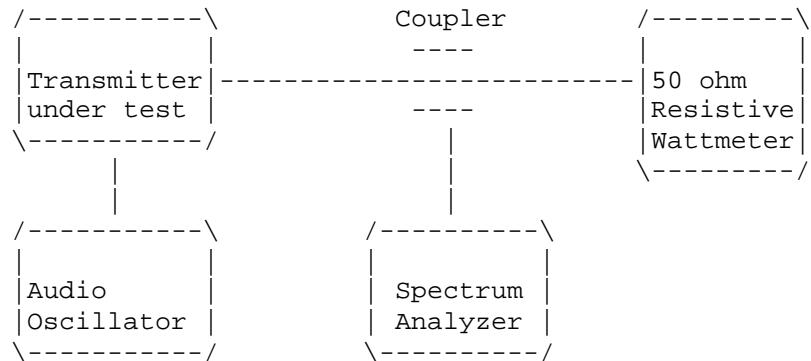
2.989(c) EMISSION BANDWIDTH:
95.633(b)(1)(3)(7)

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 follows. The occupied bandwidth plots are exhibits 12 and 13.

Radiotelephone transmitter with modulation limiter.

Test procedure diagram

OCCUPIED BANDWIDTH MEASUREMENT



APPLICANT: KACE ELECTRONICS (ASIA) INC.
FCC ID: MUDFR-130
REPORT #: F:\CUS\K\KACE\KEA174A8.RPT

2.991

Not Applicable, no antenna terminal allowed.

2.993(a)(b)
95.635(b)(7)UNWANTED RADIATION:

REQUIREMENTS:

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

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

EMISSION FREQUENCY MHz	METER READING @3m	COAX LOSS dB	A.C.F. dB	AVERAGE			
				FIELD STRENGTH dBuV/m@3m	ATT.	MARGIN	
						dB	ANT.
462.62	101.40	1.60	18.44	121.44	0.00	0.00	V
925.24	50.70	2.90	24.10	77.70	43.74	3.74	V
1387.86	43.50	1.00	25.55	70.05	51.39	11.39	H
1850.48	47.80	1.01	27.40	76.21	45.23	5.23	H
2313.10	44.90	1.08	28.78	74.76	46.68	6.68	H
2775.72	41.60	1.15	29.94	72.69	48.75	8.75	H
3238.34	41.60	1.22	31.10	73.91	47.53	7.53	H
3700.96	37.90	1.29	32.25	71.44	50.00	10.00	H
4163.58	29.60	1.35	33.18	64.14	57.30	17.30	H
4626.20	20.00	1.42	33.70	55.13	66.31	26.31	V

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

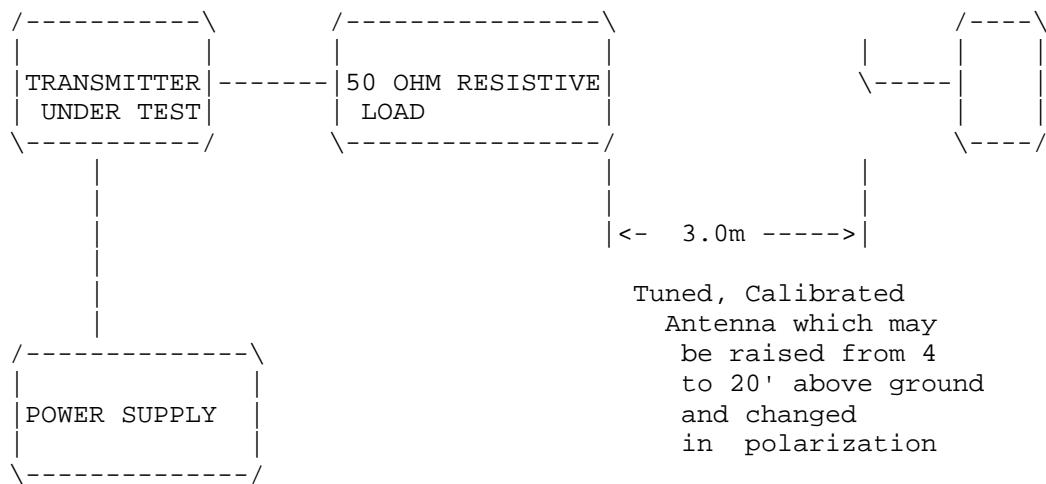
METHOD OF MEASUREMENT: The procedure used was C63.4-1992 for intentional radiators. The spectrum was scanned from 30 to at least the tenth harmonic of the fundamental using a HP model 8566B spectrum analyzer, an Eaton model 94455-1 Biconical Antenna, ElectroMetrics antennas models TDA, TDS-25-1, TDS-25-2 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: KACE ELECTRONICS (ASIA) INC.
 FCC ID: MUDFR-130
 REPORT #: F:\CUS\K\KACE\KEA174A8.RPT
 PAGE #: 6

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.

APPLICANT: KACE ELECTRONICS (ASIA) INC.
FCC ID: MUDFR-130
REPORT #: F:\CUS\K\KACE\KEA174A8.RPT
PAGE #: 7

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_____	462.561 570	-2.01
-10_____	462.562 890	+0.84
0_____	462.563 310	+1.75
+10_____	462.563 120	+1.34
+20_____	462.562 610	+0.24
+30_____	462.561 740	-1.64
+40_____	462.561 590	-1.96
+50_____	462.562 020	-1.04
20c BATT. End-Point 4.5V/dc	462.562 550	+0.10

RESULTS OF MEASUREMENTS: The maximum frequency variation over the temperature range was 2.01 to -1.96 ppm. The maximum frequency variation with voltage was +0.1ppm.

APPLICANT: KACE ELECTRONICS (ASIA) INC.

FCC ID: MUDFR-130

REPORT #: F:\CUS\K\KACE\KEA174A8.RPT

PAGE #: 8

2.983(f) Photo or Drawing of Label:
See Exhibit 3.

2.983(g) Photos of Equipment:
See Exhibits 13-16.

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
S.S. Sanders
Engineer

APPLICANT: KACE ELECTRONICS (ASIA) INC.
FCC ID: MUDFR-130
REPORT #: F:\CUS\K\KACE\KEA174A8.RPT
PAGE #: 9

LIST OF TEST EQUIPMENT

1. Frequency Counter - Hewlett Packard Model 5383A
S/N 2338A06071
2. SPECTRUM ANALYZER - HP Model 8566B
3. RF PRE-SELECTOR - HP Model 85685A
4. QUASI-PEAK ADAPTER - HP 85650A
5. RF Power Meter - Bird Model 43 Serial 81398
6. RF Attenuators - Narda MOD 766-20
7. Audio Oscillator - Hewlett Packard Model 201C
Serial 351-06107
8. Modulation meter - IFR MODEL AM/FM 500A.
9. Voltmeter - Hewlett Packard Model 427A
Serial Number 731-0751
10. HP Distortion Analyzer Model No. 334A
Serial Number 822-01817
11. Tenney Temperature Chamber
11. Eaton Biconical antenna Model 94455-1 antenna kit 20-200 MHz
12. Electro-Metric Dipole Kit 20-1000MHz, Model TDA 25
13. Electro-Metrics RGA-180 antenna kit 1- 18 GHz
14. HP broadband preamplifier model 8447D, serial no.
1644A00978, 30 - 1000 MHz.

APPLICANT: KACE ELECTRONICS (ASIA) INC.
FCC ID: MUDFR-130
REPORT #: F:\CUS\K\KACE\KEA174A8.RPT
PAGE #: 10

