Certification

TEST REPORT

Information on Sony UHF Synthesized Transmitter, model WRT-807A(64) for the application of Certification pursuant to sec. 2.1033 of FCC Rules and Regulations, Part 2.

(a) Name of applicant: Sony Corporation
7-35 Kitashinagawa 6-chome,
Shinagawa-ku, Tokyo, 141-0001 JAPAN
(Manufacturer of the subject model)

(b) Identification of equipment: SONY WRT-807A(64)
FCC ID: AK8WRT807A64

(c) Production quantity: 10000 units

(d) Technical description:

(1) Type of emission: 110KF3E

(2) Frequency range: 770.125MHz – 781.875MHz
(Refer to the attached Frequency range)

(3) Operating power: 10 mW

(4) Maximum power rating: 250 mW

(5) The DC voltage and DC current rating of the final radio frequency amplifying device:
Collector voltage: 3.0 V DC
Collector current: 14 mA DC

(6) Tune-up procedure at specific operating power levels:
Refer to the attached Tune-up procedure.

(7) A description of circuitry for determining and stabilizing frequency:
Refer to the attached description.

(8) A description of circuits for suppression of spurious radiation:
Refer to the attached description.

(e) The measurement data required by sec. 2.1046 through 2.1057
Refer to the attached report of measurement.

(d)-(2) Frequency range

TRANSMITTING CHANNEL AND FREQUENCY [WRT-807A(64)]

Channel	Frequency (MHz) TV-64 Band	Channel	Frequency (MHz) TV-65 Band
64-01	770.125	65-01	776.125
64-02	770.250	65-02	776.250
64-03	770.375	65-03	776.375
64-04	770.500	65-04	776.500
64-05	770.625	65-05	776.625
64-06	770.750	65-06	776.750
64-07	770.875	65-07	776.875
64-08	771.000	65-08	777.000
64-09	771.125	65-09	777.125
64-10	771.250	65-10	777.250
64-11	771.375	65-11	777.375
64-12	771.500	65-12	777.500
64-13	771.625	65-13	777.625
64-14	771.750	65-14	777.750
64-15	771.875	65-15	777.875
64-16	772.000	65-16	778.000
64-17	772.125	65-17	778.125
64-18	772.250	65-18	778.250
64-19	772.375	65-19	778.375
64-20	772.500	65-20	778.500
64-21	772.625	65-21	778.625
64-22	772.750	65-22	778.750
64-23	772.875	65-23	778.875
64-24	773.000	65-24	779.000
64-25	773.125	65-25	779.125
64-26	773.250	65-26	779.250
64-27	773.375	65-27	779.375
64-28	773.500	65-28	779.500
64-29	773.625	65-29	779.625
64-30	773.750	65-30	779.750
64-31	773.875	65-31	779.875
64-32	774.000	65-32	780.000
64-33	774.125	65-33	780.125
64-34	774.250	65-34	780.250
64-35	774.375	65-35	780.375
64-36	774.500	65-36	780.500
64-37	774.625	65-37	780.625
64-38	774.750	65-38	780.750
64-39	774.875	65-39	780.875
64-40	775.000	65-40	781.000
64-41	775.125	65-41	781.125
64-42	775.250	65-42	781.250
64-43	775.375	65-43	781.375
64-44	775.500	65-44	781.500
64-45	775.625	65-45	781.625
64-46	775.750	65-46	781.750
64-47	775.875	65-47	781.875

(d)-(6) Tune-up procedure at specific operating power levels:

(1) Vcc voltage of RF AMP block

DC-DC converter output is +3V constant. It supplies Vcc of the RF block and System Control block.

(2) Measurement of RF power output.

RF power output is measured at output terminal (CN305).

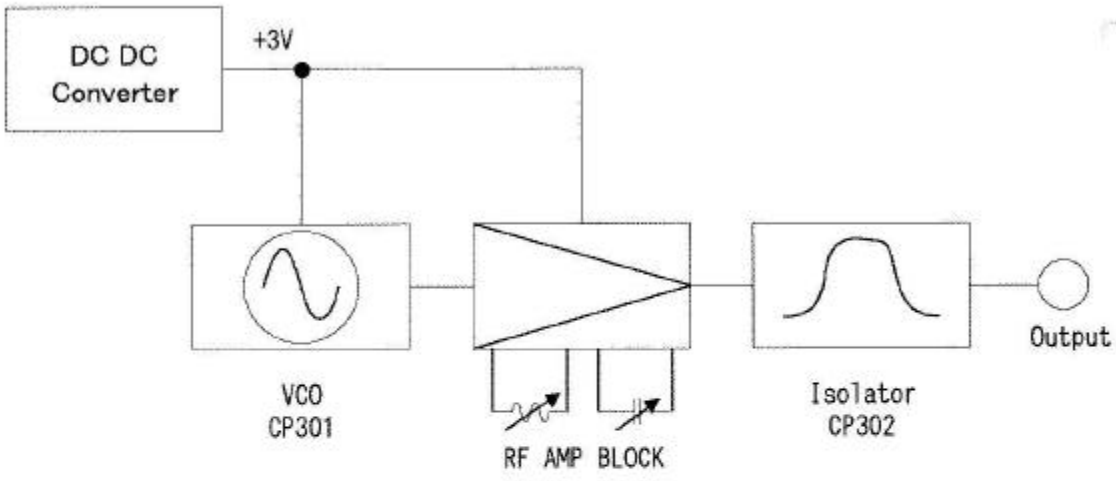
VCO(CP301) output is applied to RF AMP block and the output is applied to isolator.
So RF power output is decided by VCO and RF AMP block output power,
isolator insertion loss.

1) VCO RF output power is -1.5 ~ +2.0dBm(at 50Ω load) at 3V power supply voltage.

2) Adjust CT301 and RV305 so that RF AMP block output power is 10.5 ± 2.5dBm (at 50Ω load) when RF AMP block input power is -1.5 ~ +2.0dBm and 3V power supply voltage.

3) Isolator insertion loss is 0.5 ~ 0.9dB.

Therefore RF output power is 10mW(±2mW) by adjusting CT301 and RV305.



(d)-(7)A description of circuitry for determining and stabilizing frequency:

Determination and stability of frequency on PLL synthesizer

1. Divide the oscillation frequency[f] from the VCO(CP301) by a prescaler[1/M](IC304). A counter[1/A](IC304) and N counter[1/N](IC304) and apply it [fr'] to a phase detector.

$$fr' = \frac{1}{MN+A} f \quad \text{---- (1)}$$

2. The integrated output signal of the phase detector, which is taken by the phase difference from[fr'] to a reference oscillator[fr], and use the signal as the control voltage for the VCO.

3. With the above 1 and 2(loop 1 through 2), the circuit maintains its balance.

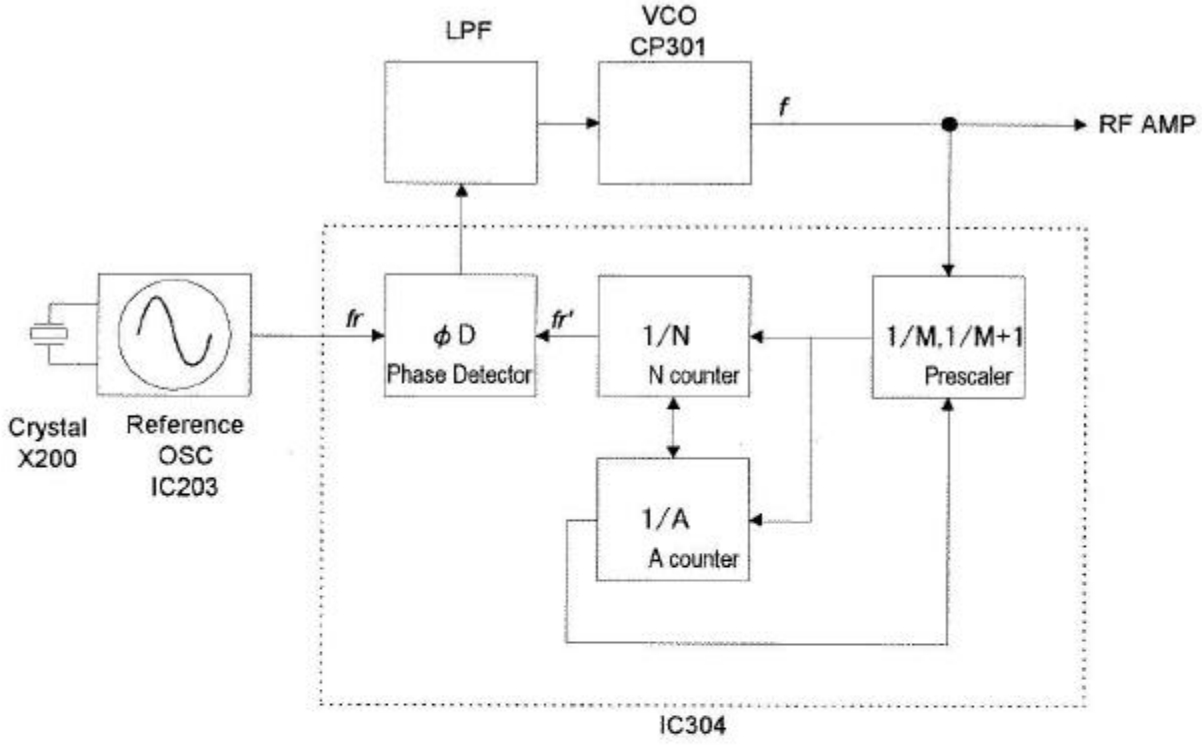
$$fr = fr' \quad \text{---- (2)}$$

by expression of (1), (2)

$$f = (MN+A)fr \quad \text{---- (3)}$$

4. Therefore transmitting frequency[f] is determined by [M], [N], [A], [fr] and stability is decided by stability of reference frequency[fr].

5. Stability of the reference frequency[fr] is ±35ppm(by stability of X'tal(X200) spec). So stability of transmitting frequency[f] is ±50ppm(0.005%).

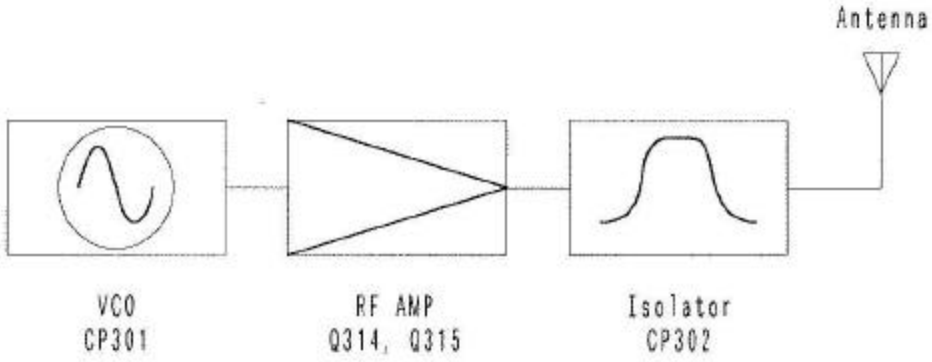


(d)-(8)A description of circuits for suppression of spurious radiation:

1. Radiation of higher harmonics are suppressed by installation of low pass filter and isolator in the next to a RF AMP.

2. By introducing direct oscillation system of transmitting frequency by the VCO, RF AMP are straightly amplified. So there is no spurious caused by frequency multiplier.

3. Shield of the VCO and the RF AMP block suppress spurious emission radiated from the transmitter chassis.



(c) Report of Measurement

-- Under FCC Rules and Regulations Parts 2 and 74 --

Report Date : March 11, 1999

Manufacturer:	Sony Corporation
Manufacturer's Address:	7-35 Kitashinagawa 6-chome Shinagawa-ku, Tokyo, 141-0001 JAPAN
Trade Name:	SONY
Model Number:	WRT-807A(64) (FCC ID: AK8WRT807A64)
Commodity:	UHF SYNTHESIZED TRANSMITTER
Test Method:	All Measurements were performed in accordance with the applicable sections in FCC Rules and Regulations Part 2 and 74.

I hereby state that the measurements shown in this report were made in accordance with the procedures indicated. I assume full responsibility for the accuracy of these measurements and vouch for the qualifications of all persons taking them.

Signed by:	Name (Print):	Title:
K. Nakayama	K. Nakayama	Manager, Product Safety Quality Assurance Department Broadcasting & Professional Systems Company
Company Name: Sony Corporation	Address: 7-35 Kitashinagawa 6-chome Shinagawa-ku, Tokyo, Japan	

2.1046 RF power output (The effective radiated power output)

Measurement procedure

1. The measurement shall be made on an open field test site which is free from reflecting objects that may affect the measurement results.

2. For radiated power output of the equipment, the measuring antenna was raised and lowered to obtain a maximum reading on the spectrum analyzer with the antenna vertically and horizontally polarized. The turntable was rotated a minimum of 360 degrees to further increase the reading on the spectrum analyzer. Then field strength was recorded in dBμV/m.

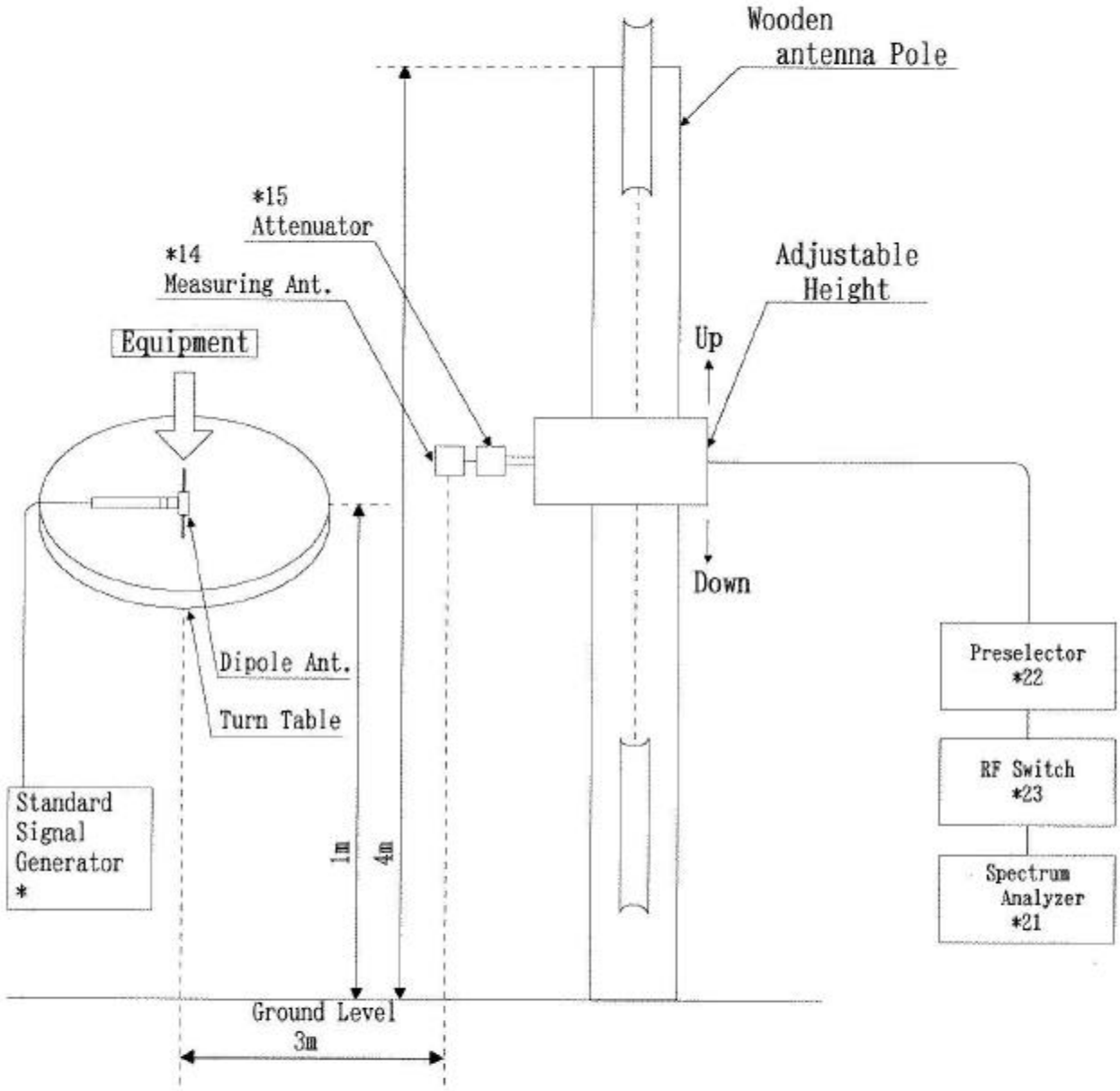
3. The unit was removed and replaced with a dipole antenna. (The antenna was adjusted to a half-wave of transmitting frequency.) The center of the dipole antenna was placed approximately at the same location as the center of the unit.

4. The dipole antenna at the unit end was connected to a signal generator with a coaxial cable. With the antennas at both ends vertically and horizontally polarized and signal generator tuned to the transmitting frequency, the level of the signal generator output was adjusted to the previously recorded maximum reading for this set of conditions was obtained.

5. The input power into the dipole antenna was calculated from the coaxial cable loss and the signal generator output voltage obtained in these readings.

For the measured data, refer to Page 17.

For the setup, refer to the diagram below.



Measuring site

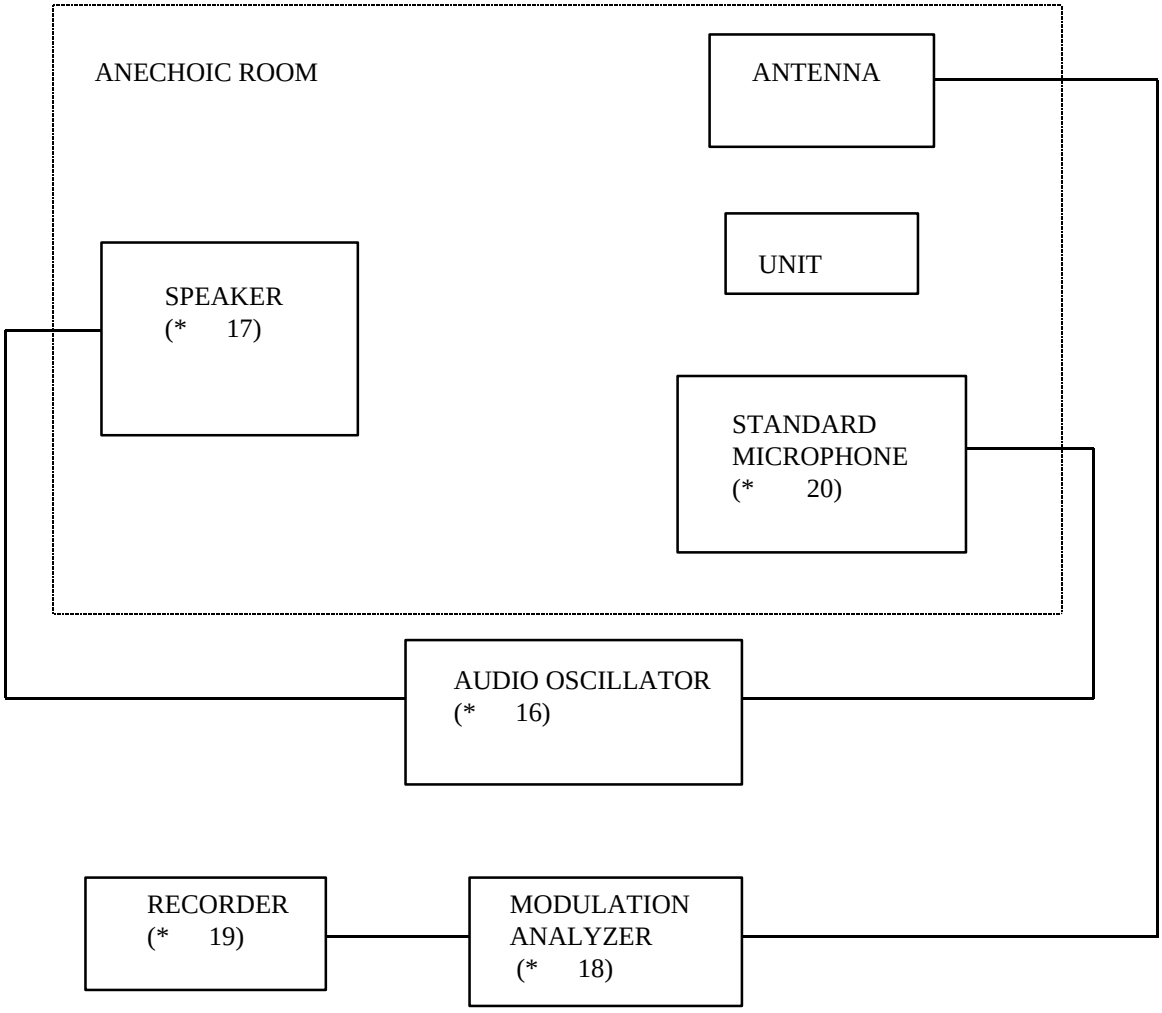
Distance between Antenna ---- 3 meters

Location ---- Atsugi Technology Center, Kanagawa, Japan

2.1047 Modulation characteristics

A. Measurement procedure (Acoustical Frequency Response)

The test sound signal was applied to the unit in the anechoic chamber.
The sound pressure level was made 94 dB constant.
A Modulation analyzer was connected to the antenna and the level recorder.
The test sound signal frequency was swept 50 Hz to 15 kHz and output of the modulation analyzer was recorded.
For the test set-up, refer to the diagram below.



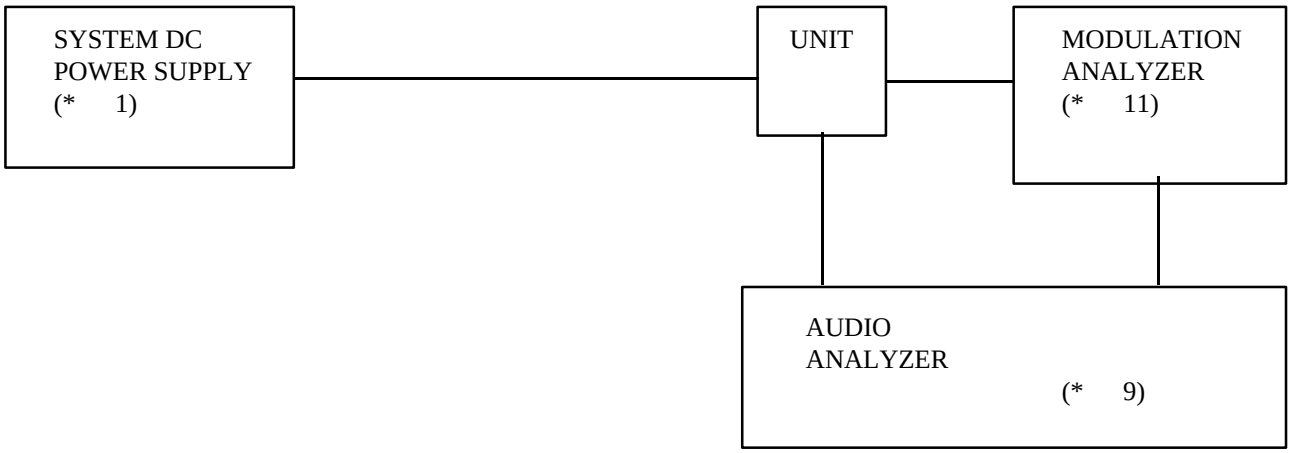
For the measured data, refer to Page 18 – 20.

2.1047 Modulation characteristics

B. Measurement procedure

The test signal was applied to the audio input terminal of the transmitter.
A modulation analyzer was connected to the output terminals of the transmitter.
The test signal frequency was switched over 100Hz, 2.5kHz and 15kHz.

For the test set-up, refer to the diagram below.



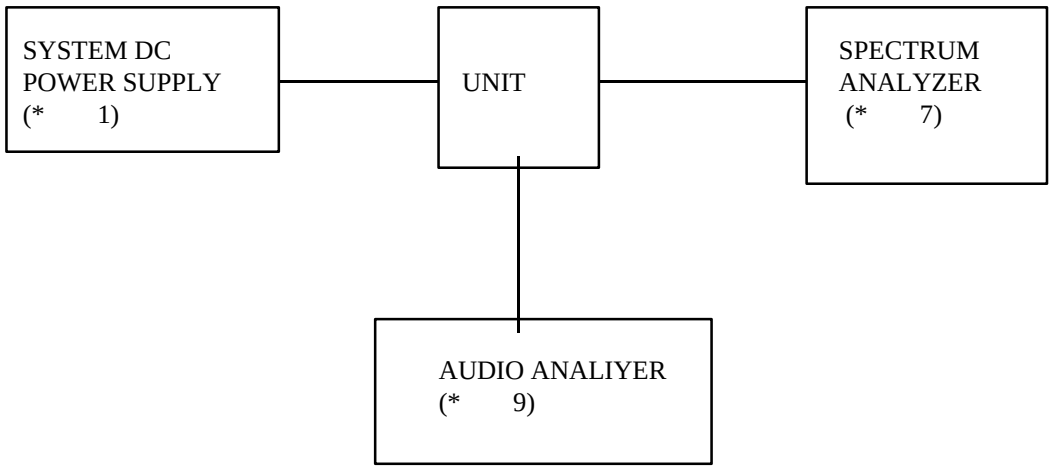
For the measured data, refer to Page 21 – 23.

2.1049 Occupied bandwidth

Measurement procedure

Manufacturer's necessary bandwidth is 110KHz.
A spectrum analyzer was connected to the output terminals.
The unit was modulated by a 15kHz tone of sufficient level to produce at least 85 percent modulation.
The occupied bandwidth was measured with the spectrum analyzer set at 50KHz/div. scan and 10dB/div.

For the test set-up, refer to the diagram below.



For the measured data, refer to Page 24 – 25.

2.1051 Spurious emissions at antenna terminals

Measurement procedure

The conducted spurious test is not applicable because this device has a fixed antenna (not removable).

2.1053 Field strength of spurious radiation

A. Measurement procedure (from lowest frequency to 1000MHz)

1. The measurement shall be made on an open field test site which is free from reflecting objects that may affect the measurement results.

2. This procedure was intended to determine the level of spurious emission radiated from the antenna and the unit chassis. The radio frequency spectrum was scanned from lowest frequency generated in the equipment to 1000MHz.

3. For each spurious or harmonic measurement, the measuring antenna was adjusted to the correct length for the frequency involved. This length was made from the lowest frequency generated in the equipment to 1000MHz.

4. For each frequency generated in the equipment, the measuring antenna was raised and lowered to obtain a maximum reading on the spectrum analyzer with the antenna vertically polarized. The turntable was rotated a minimum of 360 degrees to further increase the reading on the spectrum analyzer. Then field strength was recorded in dBμV/m.

5. The unit was removed and replaced with a dipole antenna. (The antenna was adjusted to a half-wave of transmitting frequency.) The center of the dipole antenna was placed approximately at the same location as the center of the unit.

6. The dipole antenna at the unit end was fed with a signal generator. With the antennas at both ends vertically polarized and signal generator tuned to the transmitting frequency, the level of the signal generator output was adjusted to the previously recorded maximum reading for this set of conditions was obtained.

7. The entire procedure for each spurious and harmonics frequency with the FSM antenna horizontally polarized was repeated.

8. The input power into the dipole antenna was calculated from the impedance and the signal generator voltage obtained in these readings.

For the measured data, refer to the page 26.

2.1053 Field strength of spurious radiation

B. Measurement procedure (from 1GHz to 10 GHz)

1. The measurement shall be made on an open field which is free from reflecting objects that may affect the measurement results.

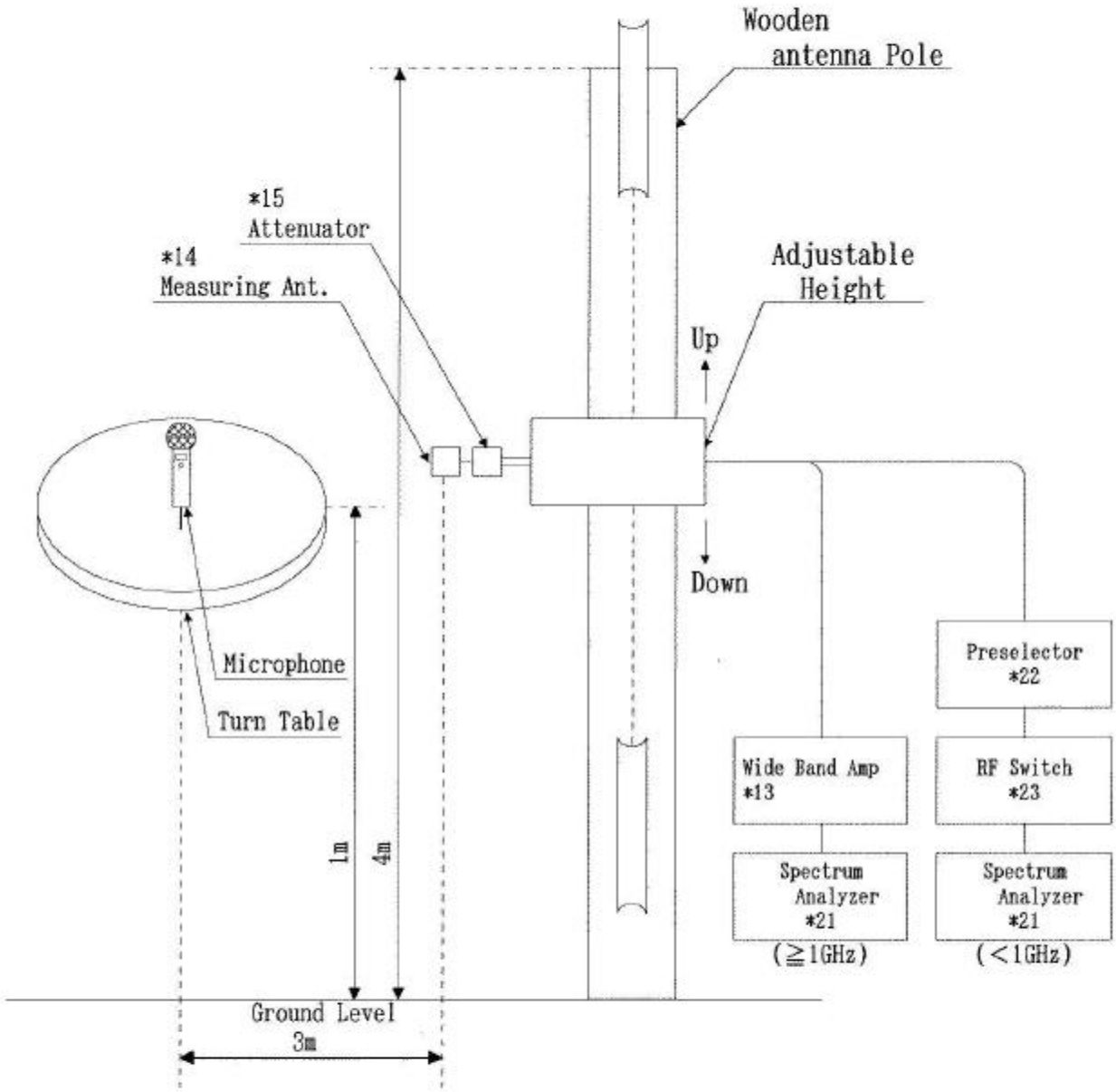
2. This procedure was intended to determine the level of spurious emission radiated from the antenna and the unit chassis. The radio frequency spectrum was scanned from 1GHz frequency generated in the equipment to 10GHz.

3. For each spurious or harmonic measurement, the measuring antenna was changed according to frequency range.

4. For each frequency generated in the equipment, the measuring antenna was raised and lowered to obtain a maximum reading on the spectrum analyzer with the antenna vertically polarized. The turntable was rotated a minimum of 360 degrees to further increase the reading on the spectrum analyzer. Then field strength was recorded in dBμV/m.

For the measured data, refer to the page 26.

For the setup, refer to the diagram below.



Measuring site

Distance between Antenna ---- 3 meters

Location ---- Atsugi Technology Center, Kanagawa, Japan

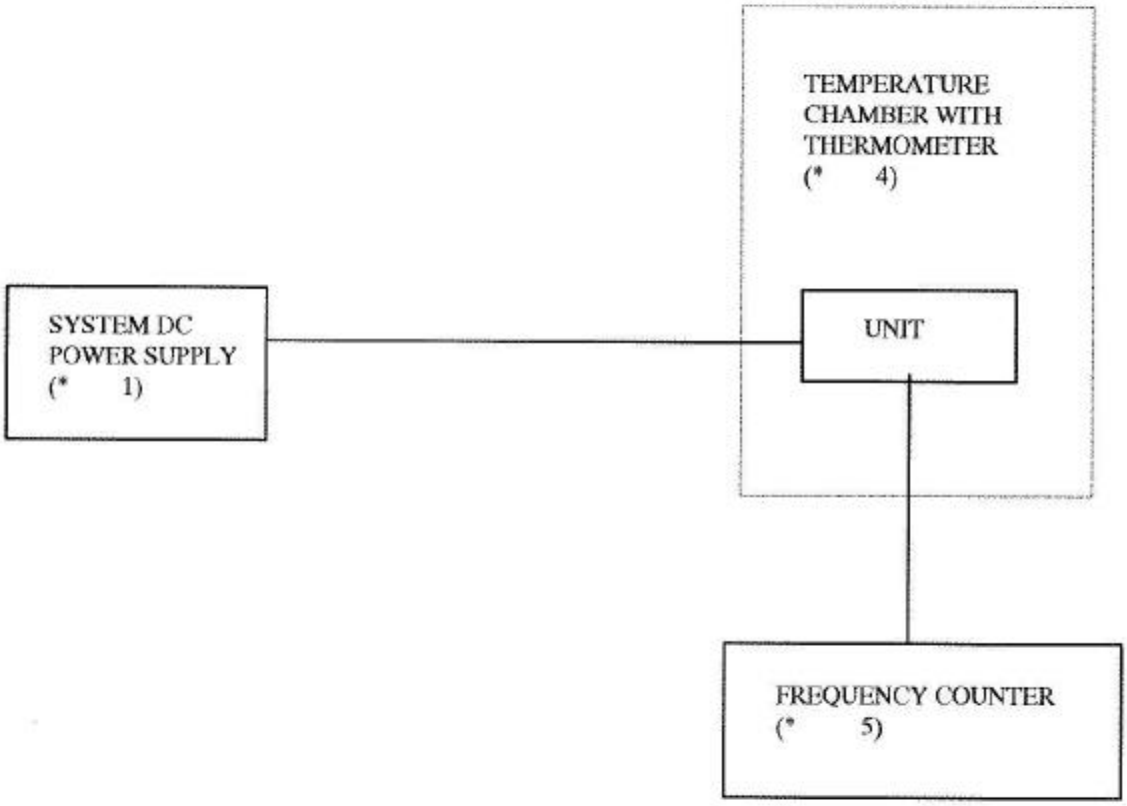
2.1055 Frequency stability

(1) Frequency vs. Ambient temperature

Measurement procedure

The unit was placed in the temperature cycle chamber and was kept at a temperature of -30° ±1° for 1 hour. The rated test voltage was applied for two minutes. The transmitting frequency was measured during this period and recorded. A similar measurement was performed with the temperatures changed 10℃ each time up to maximum of 50℃.

For the test setup, refer to the diagram below.



For the measured data, refer to Page 28 – 29.

2.1055 Frequency stability

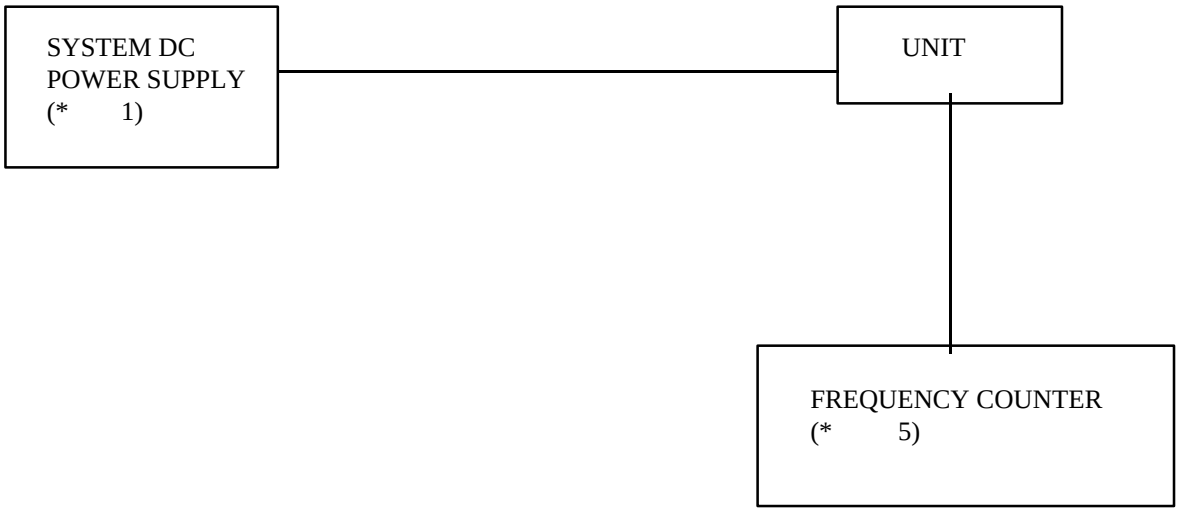
(2) Frequency vs. Supply voltage

Measurement procedure

The power supply voltage to the unit under test is varied from 1.0 V to 1.725 V.

Nominal Value	1.50 V
85% of the nominal value	1.275 V
115% of the nominal value	1.725 V
Battery operating end point which shall be specified by the manufacturer	1.00 V

For the test setup, refer to the diagram below.



For the measured data, refer to Page 28 – 29.

2.1046 RF power output (The effective radiated power output)

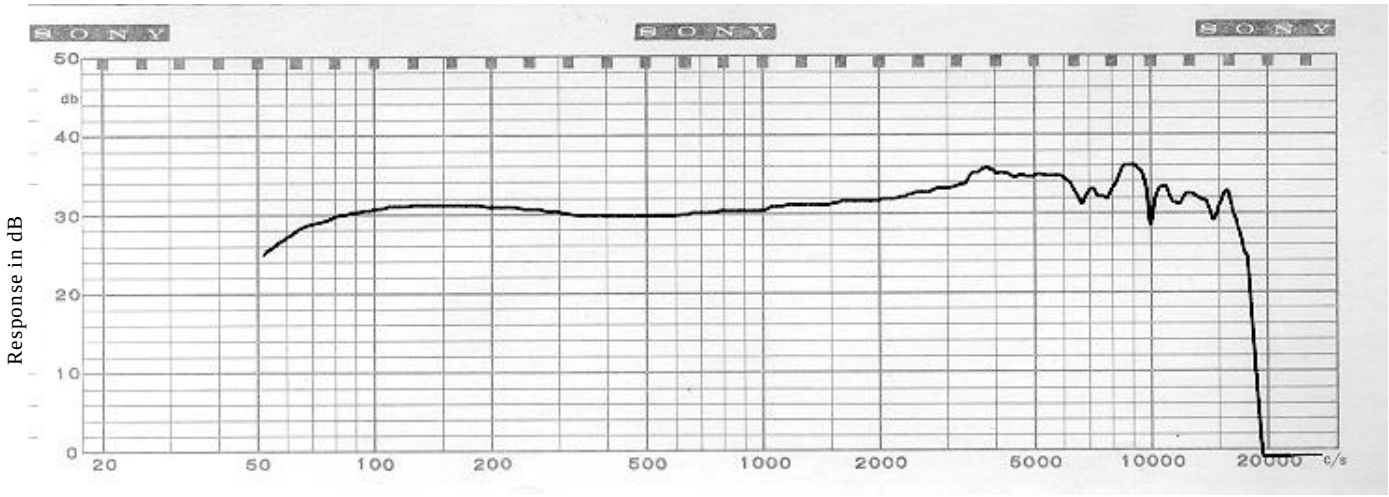
Model: WRT-807A(64)
FCC ID: AK8WRT807A64
POWER SUPPLY: 1.5V DC

Frequency (MHz)	CH No.	ERP (mW)
770.125	64-01	9.863
776.125	65-01	10.3
781.875	65-47	11.53

2.1047 Modulation characteristics

A. Modulation Frequency Response (Acoustical Frequency Response)

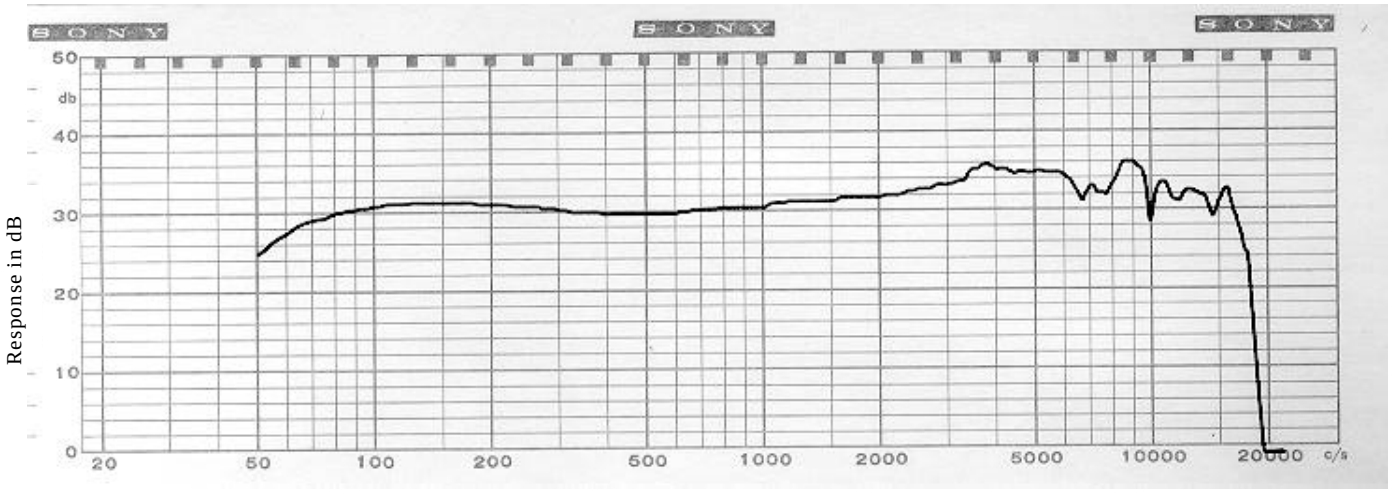
Model:	WRT-807A(64)
FCC ID:	AK8WRT807A64
Transmitting Freq.:	770.125MHz (CH No. 64-01)



2.1047 Modulation characteristics

A. Modulation Frequency Response (Acoustical Frequency Response)

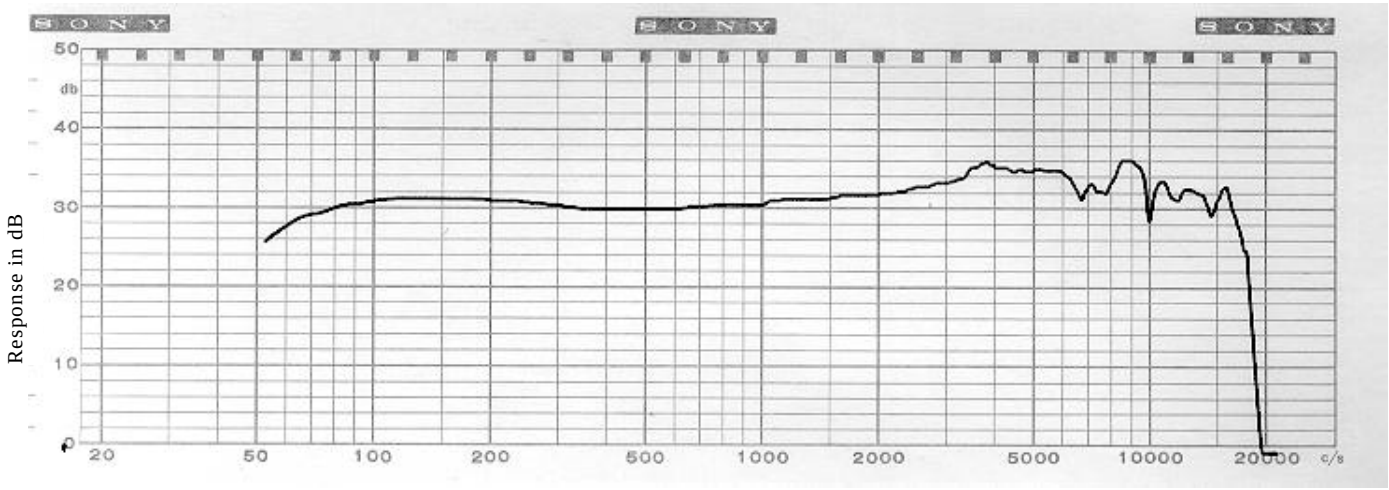
Model:	WRT-807A(64)
FCC ID:	AK8WRT807A64
Transmitting Freq.:	776.125MHz (CH No. 65-01)



2.1047 Modulation characteristics

A. Modulation Frequency Response (Acoustical Frequency Response)

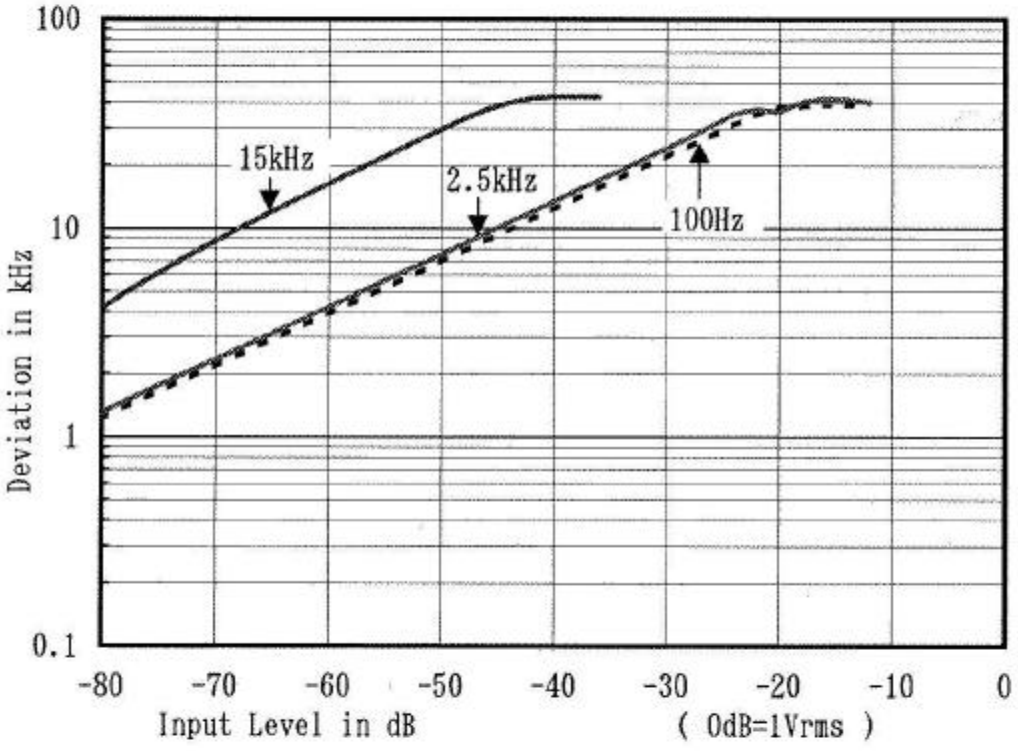
Model:	WRT-807A(64)
FCC ID:	AK8WRT807A64
Transmitting Freq.:	781.875MHz (CH No. 65-47)



2.1047 Modulation characteristics

B. Deviation VS. Input Level

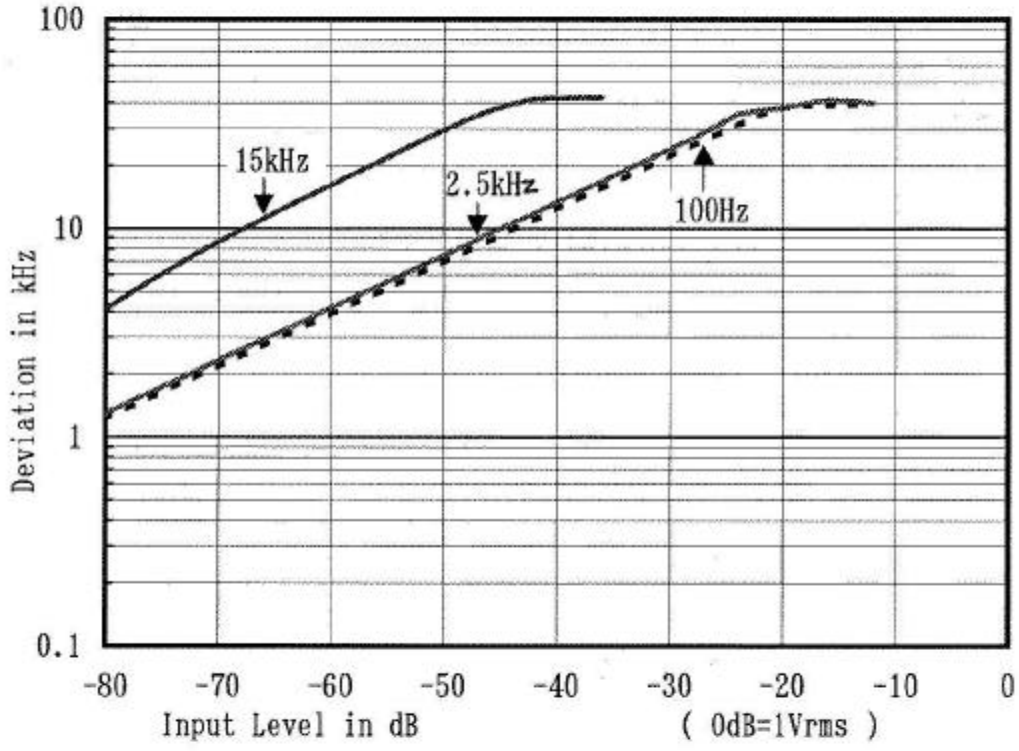
Model: WRT-807A(64)
FCC ID: AK8WRT807A64
Transmitting Freq.: 770.125MHz (CH 64-01)



2.1047 Modulation characteristics

B. Deviation VS. Input Level

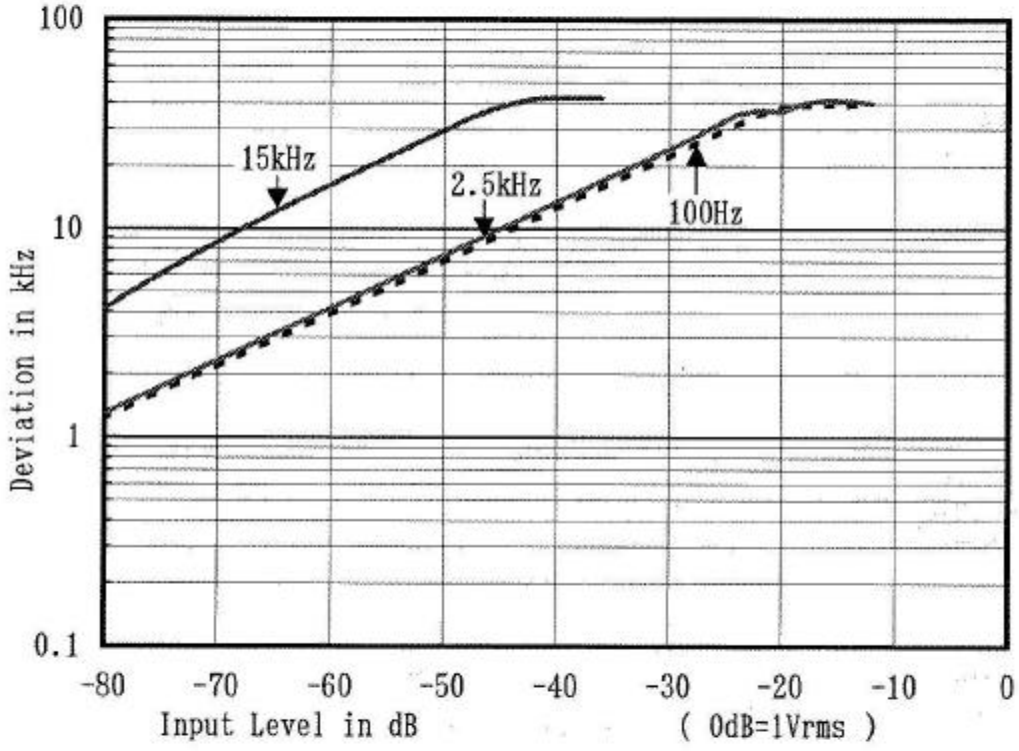
Model: WRT-807A(64)
FCC ID: AK8WRT807A64
Transmitting Freq.: 776.125MHz (CH 65-01)



2.1047 Modulation characteristics

B. Deviation VS. Input Level

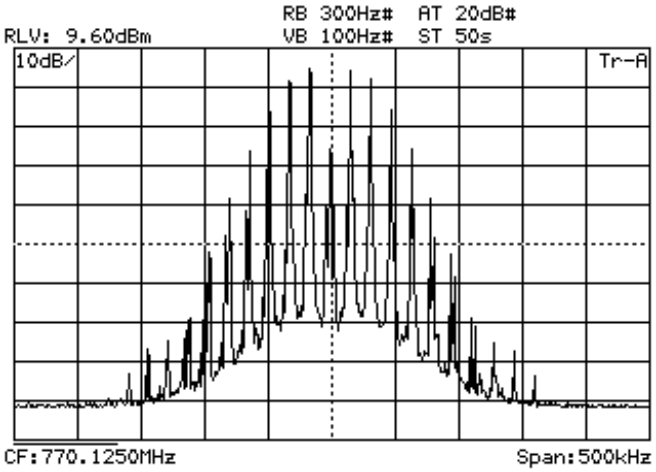
Model: WRT-807A(64)
FCC ID: AK8WRT807A64
Transmitting Freq.: 781.875MHz (CH 65-47)



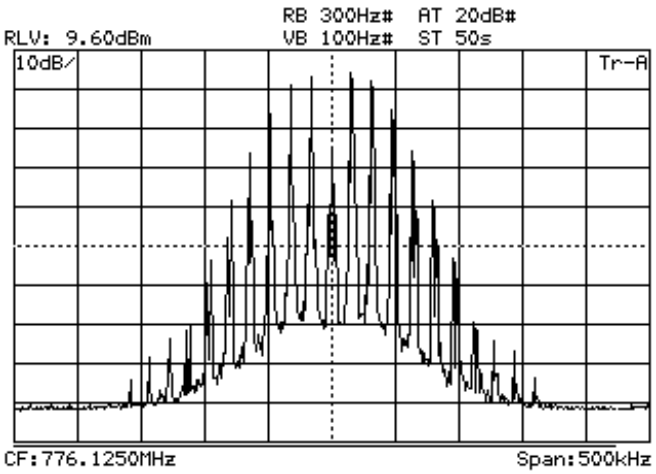
2.1049 Occupied bandwidth

Model: WRT-807A(64)
FCC ID: AK8WRT807A64

Modulating frequency: 15kHz
Input Level: -48.5dB(0dB=1Vrms)
Center Frequency
770.125 MHz (CH No. 64-01)



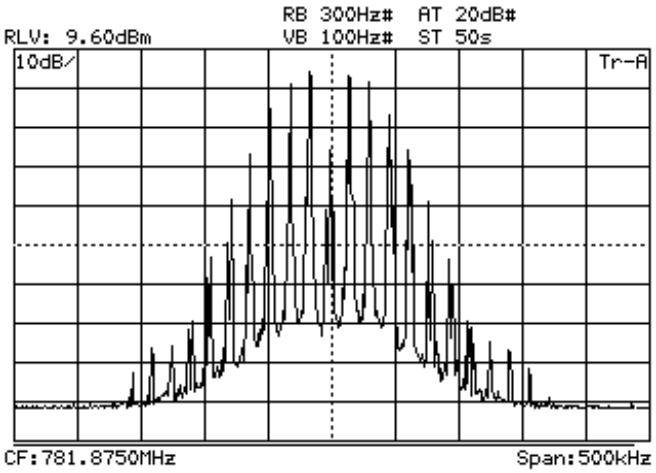
Center Frequency
776.125MHz (CH No. 65-01)



2.1049 Occupied bandwidth

Model: WRT-807A(64)
FCC ID: AK8WRT807A64

Center Frequency
781.875MHz (CH No. 65-47)



2.1053 Field strength of spurious radiation

Model: WRT-807A(64)
FCC ID: AK8WRT807A64

Frequency: 770.125MHz (CH No. 64-01)
Power supply: AA size battery x 1 1.5V

Frequency (MHz)	Field strength (dBμV/m)
** 770.125	109.40 (*0.0)

Frequency: 776.125MHz (CH No. 65-01)
Power supply: AA size battery x 1 1.5V

Frequency (MHz)	Field strength (dBμV/m)
** 776.125	109.60 (*0.0)

Frequency: 781.875MHz (CH No. 65-47)
Power supply: AA size battery x 1 1.5V

Frequency (MHz)	Field strength (dBμV/m)
** 793.125	110.00 (*0.0)

Note: * In parenthesis figure shows spurious and harmonic emission level.
Unit: dB (0dB = carrier level)
** Carrier frequency

Method of Calculating Field Strength

1. “Substitution Method” is employed in case that reading of spectrum analyzer is extremely higher than the noise level.

   Field Strength [dBμV/m] = S.S.G. Output Level [dBμV/m] (at 50Ω)
   + Balun Loss of Reception Antenna [dB]
   + Antenna Factor [dB]

2. Following calculation is employed in case that S.S.G. is not employed.

   Field Strength [dBμV/m] = Meter Reading [dBμV]
   + Antenna Factor (including Balun Loss) [dB]
   + Cable Loss + 20log(3m/10m) [dB]

2.1055 Frequency stability

Nominal frequency : 770.125MHz (CH No. 64-01)

Power supply	Frequency stability (%)			
Ambient temperature(degrees centigrade)	1.0V DC	1.275 V DC	1.5V DC	1.725V DC
-30	0.000032	0.000032	0.000032	0.000032
-20	0.000391	0.000391	0.000391	0.000391
-10	0.000421	0.000421	0.000421	0.000421
0	0.000459	0.000459	0.000459	0.000459
10	0.000342	0.000342	0.000343	0.000342
20	0.000162	0.000161	0.000162	0.000162
30	0.000076	0.000076	0.000076	0.000076
40	0.000294	0.000294	0.000294	0.000294
50	0.000396	0.000396	0.000396	0.000396

Nominal frequency : 776.125MHz (CH No. 65-01)

Power supply	Frequency stability (%)			
Ambient temperature(degrees centigrade)	1.0V DC	1.275 V DC	1.5V DC	1.725V DC
-30	0.000032	0.000032	0.000032	0.000032
-20	0.000186	0.000186	0.000186	0.000186
-10	0.000323	0.000323	0.000323	0.000323
0	0.000464	0.000464	0.000464	0.000464
10	0.000354	0.000354	0.000354	0.000354
20	0.000176	0.000177	0.000177	0.000176
30	0.000074	0.000073	0.000074	0.000074
40	0.000291	0.000291	0.000291	0.000291
50	0.000406	0.000406	0.000406	0.000406

2.1055 Frequency stability

Nominal frequency : 781.875MHz (CH No. 65-47)

Power supply	Frequency stability (%)			
Ambient temperature(degrees centigrade)	1.0V DC	1.275 V DC	1.5V DC	1.725V DC
-30	0.000079	0.000079	0.000079	0.000079
-20	0.000377	0.000377	0.000377	0.000378
-10	0.000379	0.000379	0.000379	0.000379
0	0.000453	0.000453	0.000453	0.000453
10	0.000330	0.000330	0.000331	0.000330
20	0.000159	0.000159	0.000159	0.000159
30	0.000077	0.000076	0.000077	0.000077
40	0.000290	0.000290	0.000290	0.000290
50	0.000394	0.000394	0.000394	0.000394

List of Test Equipment

Equipment	Manufacturer	Type	Serial No.
*1 System DC Power supply	Hewlett Packard	6632A	3002A-04211
*4 Temperature Chamber	Tabai	PL-1	2223871
*5 Frequency Counter	Anritsu	MF76A	MT59216
*6 Power Meter Power Sensor	Giga-tronics Giga-tronics	8541B 80421A	1830890 1829984
*7 Spectrum Analyzer	Anritsu	MS2663B	MT06468
*9 Audio Analyzer	Audio Precision	System One	Sys1-30309
*11 Modulation Analyzer	Anritsu	MS616B	M94665
*12 Spectrum Analyzer	ADVANTEST	R3265	15060251
*13 Wide Band Amplifier	Anritsu	A4H1002S	-
*14 Horn Antenna Log-Periodic Antenna	SCHWARZBECK SCHWARZBECK	BBHA 9120-B UHALP9107	102/93 -
*15 3dB Attenuator	Hewlett Packard	8491B	2708A
*16 Audio Oscillator	Bruel & Kjaer	2010	1037139
*17 Speaker	Coral	BEATA8	
*18 Modulation Analyzer	Anritsu	MS61B	M17096
*19 Recorder	Bruel & Kjaer	2307A	1146446
*20 Microphone Cartridge Preamplifier	Bruel & Kjaer	4133 2619	810279 593729
*21 Spectrum Analyzer	ADVANTEST	TR4172	60690030
*22 Preselector	ADVANTEST	TR14307	68360004
*23 RF Switch	ADVANTEST	TR14308	8604004
*24 Standard Signal Generator	Anritsu	MG645B1	M54866