

INSTRUCTION MANUAL

Preliminary Manual Attached

Complete Manual Attached

MEASUREMENT PROCEDURE AND TEST EQUIPMENT USED

Except where otherwise stated, all measurements are made following the Electronic Industries Association (EIA) Minimum Standard for Portable/Personal Land Mobile Communications FM or PM Equipment 25-1000 MHz-(EIA/TIA-603).

This exhibit presents a brief summary of how the measurements were made, the required limits, and the test equipment used.

The following procedures are presented with this application.

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|----|------------------------------|---------------|
| 1. | RF Power Output | <u> </u> X |
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TEST EQUIPMENT LIST

Pursuant To FCC Rules 2.999

1. HP8566B Spectrum Analyzer
2. HP 8657B RF Signal Generator
3. R+S Temperature Chamber
4. HP8901B Modulation Analyzer
5. HP 436A RF Power Meters
6. HP8903B Audio Analyzer
7. Rohde & Schwarz SMFP II
8. Wandel & Goltermann PCM4
9. HP 6033A Power Supply
10. Electronic Camera Minolta RD-175
11. Log. Periodic Antennas Rohde & Schwarz HUF2Z, HUF3Z

RF POWER OUTPUT

Pursuant to FCC Rules 2.985 (a)

Method of Measurement

The RF power output is measured with the transmitter adjusted in accordance with the tune-up procedure to give the value of voltage and current specified in the tune-up procedure to give the value of voltage and current specified in Exhibit 3 as required by 2.983(d) (5). A 50 ohm RF attenuator of proper power rating was used as a load for making these measurements. For Transmitter having an output impedance other than 50 ohm, a suitable matching network is placed between the transmitter and the load.

The power measurements are made using a Hewlett Packard series HP XXX power meter and 30 dB attenuator or a HP XXX power meter.

AUDIO FREQUENCY RESPONSE

Pursuant FCC Rules 2.987 (a)

Method of Measurement

Operate the transmitter under standard test conditions and monitor the output with a frequency deviation meter or calibrated test receiver. With 1000 Hz sine wave audio input applied through a dummy microphone circuit, adjust the audio input to give 30% of full rated system deviation. Maintaining constant deviation, vary the input frequency from 100 to 5000 Hz, and observe the level necessary to maintain a constant 30% modulation.

Minimum Standard

The audio frequency response shall not vary more than +1 or -3 dB from 300 to 3000 Hz as referenced to 1000 Hz level (with the exception of a permissible 6 dB/octave roll off from 2500 to 3000 Hz)

POST LIMITER FILTER FREQUENCY RESPONSE

Pursuant FCC Rules 2.987 (a)

Method of Measurement

Operate the transmitter under standard test conditions and monitor the output of the post limiter low-pass filter with an audio spectrum analyzer or AC voltmeter. Adjust the audio input frequency to 1000 Hz and the input level to 20 dB greater than that required to produce standard test modulation. Note the output level on the audio spectrum analyzer

or AC voltmeter. Use this output dB level as reference (LEV_{REF}), vary the modulating frequency from 3000 Hz to the upper low pass filter limit and record the dB level on the audio spectrum analyzer or AC voltmeter as LEV_{FREQ} while maintaining a constant input level. The audio frequency response of the low-pass filter in accordance with the following formula:

$$\text{Low-Pass Filter Response} = LEV_{FREQ} - LEV_{REF}$$

FCC Limits -- Per applicable rule parts.

A. 25 to 450 MHz.

Frequencies between 3 kHz and 15 kHz shall be attenuated greater than the attenuation at 1 kHz by $40 \log_{10}(f/3)$ dB.

Frequencies above 15 kHz shall be attenuated 28 dB.

B. 450 to 869 MHz & VHF Marine.

Frequencies between 3 kHz and 20 kHz shall be attenuated greater than the attenuation at 1 kHz by $60 \log_{10}(f/3)$ dB.

Frequencies above 20 kHz shall be attenuated at least 50 dB.

C. 896-901 MHz or 935-940 MHz

Frequencies between 3 kHz and 20 kHz shall be attenuated greater than the attenuation at 1 kHz by $100 \log_{10}(f/3)$ dB.

MODULATION LIMITING

Pursuant FCC Rules 2.987 (a)

Method of Measurement

The transmitter shall be adjusted for full rated system deviation. Adjust the audio input for 60% of rated system deviation at 1000 Hz. Using this level as a reference (0 dB) vary the audio input level from the reference to a level 20 dB above it for modulation frequencies of 300, 1000 and 3000 Hz. Record the system deviation obtained as a function of the input level.

FCC Limits

Minimum Standard - The transmitter modulation must not exceed rated system deviation at any audio frequency input or reasonable change in input level.

OCCUPIED BANDWIDTH

Pursuant to FCC Rules 2.989

Method of Measurement

Data on occupied bandwidth is presented in the form of a spectrum analyzer photograph which illustrates the transmitter sidebands. A photograph is taken of the unmodulated carrier, for reference, to which is superimposed the sideband display generated by modulating the carrier with a 2500 Hz tone at a level 16 dB greater than that required to produce 50 percent modulation. If tone or digital coded squelch is indicated, photographs using both the 2500 Hz tone and the indicated squelch signal are used to modulate the transmitter. During these measurements, the instantaneous Deviation Control is set for a maximum of +5 kHz.

EXHIBIT 12

FCC Limits - Per Applicable Rule Parts.

Measured Data: At least +25 dB down on any frequency removed from the assigned frequency by more than 50 % and up to and including 100% of the authorized bandwidth. At least +35 dB down on any frequency removed from the assigned frequency by more than 100% up to and including 250% of the authorized bandwidth; at least 43 plus $10 \log_{10}$ (mean output power in watts) decibels or 80 decibels, whichever is the lesser attenuation.

RADIATED SPURIOUS EMISSIONS

Pursuant to FCC Rules 2.993

Test Site:

The site, located at Taunusstein, Germany in a region which is reasonably free from RF interference and has been not approved yet by the Commission for Spurious Measurements.

The equipment is placed on the turntable, connected to a dummy RF load and then placed in normal operation using the intended power source. A broadband receiving antenna located 100 ft. from the transmitter picks up any signal radiated from the transmitter and its operation accessories. The antenna is adjustable in height and can be horizontally and vertically polarized a spectrum analyzer covering the necessary frequency range is used to detect and measure any radiation picked up by the antenna.

Method of Measurement:

The equipment is adjusted to obtain peak reading of received signals wherever they occur in the spectrum by:

1. Rotating the transmitter under test.
2. Adjusting the antenna height.

The testing procedure is repeated for both horizontal and vertical polarization of the receiving antenna. Relative signal strength is indicated on the spectrum analyzer connected to this antenna. To obtain actual radiated signal strength for each spurious and harmonic frequency observed, a standard signal generator with calibrated output is connected to a dipole antenna adjusted to that particular frequency. This dipole antenna is substituted for the transmitter under test. The signal generator is adjusted in output level until a reading identical to that obtained with the actual transmitter is observed on the spectrum analyzer. Signal strength is then read directly from the generator. Actual measurements are recorded on the attached graphs.

FCC Limits -- Per Applicable Rule Parts.

Radiated spurious emissions shall be attenuated below the maximum level of emission of the carrier frequency in accordance with the following formula:

Spurious attenuation in dB = $43 + 10 \log_{10}$ (Power output in watts)

CONDUCTED SPURIOUS EMISSIONS

Pursuant to FCC Rule 2.991

Method of Measurement:

The transmitter is terminated into a 50 ohm load and interfaced with a spectrum analyzer which allows the spurious emission level relative to the carrier level to be measured directly. Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that required to produce 50% of rated system deviation at 1000 Hz. Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier or as high as the state of the art permits except for that region close to the carrier equal to $\pm 250\%$ of the authorized bandwidth.

FCC Limits - Per Applicable Rule Parts.

Conducted spurious emissions shall be attenuated below the maximum level of emission of the carrier frequency in accordance with the following formula:

Spurious attenuation in dB = $43 + 10 \log_{10}$ (Power output in watts)

FREQUENCY STABILITY

Pursuant to FCC Rule 2.995

Method of Measurement:

- A. Temperature (Non-heated type crystals oscillators):
Frequency measurements are made at the extremes of the temperature range -30 to +60 degrees centigrade and at intervals of not more than 10 degrees centigrade through out the range. Sufficient time is allowed prior to each measurement for the circuit components to stabilize.
- B. Power Supply Voltage:
The primary voltage was varied from 85% to 115% of the normal supply voltage. Voltage is measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

FCC Limits -- Per 2.995 (1) & (2) and Applicable Rule Parts

Temperature - Frequency Stability of $\pm 0.00025\%$ from -30 to +60 degrees centigrade (-20 to + 50 degrees centigrade Maritime Rule Part 80).

Power Supply Voltage - Frequency Stability of ± 0.00025 % from 75% to 125% of nominal voltage. (See CFR Rule Part 90.213)

*Per Applicable Rule Parts

EXHIBIT 12