MEASUREMENT TECHNIQUES

2.1051 Measurements Required: Conducted Spurious and Harmonic Emissions at Antenna Terminals

Graph Attached
EXHIBIT NO. 9C

Definition - (as used herein) Spurious radiation is the radio frequency voltages or power generated within the equipment and appearing at the equipment's output terminals when properly loaded with its characteristic non-radiating artificial load.

Minimum Standard - Conducted spurious and harmonic emissions shall be attenuated 43 dB + 10Log10(the mean power output). In the range of frequencies between 1930 MHz and 1990 MHz, no spur shall exceed -81 dBm.

Method of Measurement - The transmitter was modulated with OQPSK modulation using pseudo random data. The spectrum was scanned from the lowest frequency generated in the equipment to the tenth harmonic of the carrier. The level of the carrier and the various conducted spurious and harmonic frequencies were measured by means of a calibrated receiving system.

The measurement of the allocation band edges were performed according to EXHIBIT 13 using 1% of the carrier necessary bandwidth and Brickwall filter techniques.

2.1053 Measurement Required: Radiated Spurious and Harmonic Emissions

Graph Attached
EXHIBIT NO. 9D

Definition - Radiated spurious and harmonic emissions from the equipment at a frequency or frequencies which are outside an occupied band sufficient to insure transmission of information of required quality for the class of communications desired. The reduction in the level of these spurious emissions will not effect the quality of information being transmitted.

Minimum Standard - Radiated spurious and harmonic emissions shall be attenuated 43 dB + 10Log10(the mean power output).

Method of Measurement:

Test Site - All testing reported herein was performed at the Motorola SSG open area test facility, located at 8201 E. McDowell Rd., Scottsdale, AZ. 85252. The OATS is located on the roof of the building and is built in accordance with ANSI C63.7. The facility has been found to be in compliance with the requirements of Section 2.948 of the FCC rules, per FCC letter 31040/SIT dated October 6, 1998. The facility has also been issued a Certificate of Accreditation through the National Voluntary Laboratory Accreditation Program (NVLAP) by NIST. This is under NVLAP Code: 100405-0 and is effective through September 30, 1999.

Installation of Equipment

The equipment under test is placed on the turntable in normal operation using the intended power source. A receiving antenna located 3 meters from the turntable picks up any signal radiated from the transmitter and its operating accessories. The antenna is adjustable in height from 1 to 4 meters and can be horizontally and vertically polarized. A HP 8566B spectrum analyzer system is used to scan the applicable frequency range to detect and measure any radiation picked up by the antenna. Preliminary radiated emission scans are conducted in a semi-anechoic enclosure in order to isolate emissions in an ambient free environment.

Measurement Procedure

The procedures of ANSI 63.4 are followed for radiated emission measurements. The equipment under test is adjusted to obtain peak readings of received signals wherever they occur in the spectrum by:

1. Rotating the transmitter under test.

2. Adjusting the antenna height and polarization.

The testing procedure is repeated for both horizontal and vertical polarization of the receiving antenna. The radiated signal strength is derived from the received power levels and measured antenna factors. Also included in the field strength derivation are the cable losses and any other corrections for external attenuation and/or pre-amplification. The final measurement field strengths are recorded on the attached graphs.

2.995 Measurement Required: Frequency Stability

Definition - The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

Minimum Standard - The minimum frequency stability shall be +/-150Hz at any time during closed loop operation.

Method of Measurement - Frequency measurements shall be made at the extremes of the temperature range -30°C to +60°C and at intervals of not more than 10° C throughout the range. A period of time sufficient to stabilize all of the components in the equipment shall be allowed prior to each frequency measurement. The frequency of the transmitter shall be measured by supplying a received signal to the transceiver and the transmitter carrier frequency offset shall be measured with respect to the received signal frequency. The frequency stability of transmitting equipment shall be checked with variations in:

(a) Temperature:
Vary the ambient temperature from -30°C to +60°C.

Graph Attached : EXHIBIT NO. 9E

(b) Primary Supply Voltage:
Vary the primary supply voltage from 2.9V to 5.4 V at the input to the power cable supplied or at the power supply terminals if cables are not normally supplied.

Graph Attached : EXHIBIT NO. 9F

TIMING PERIOD AND PROCEDURE

1. The carrier frequency of the transmitter and the individual oscillators were measured at room temperature (usually between 25°C and 27°C) to provide a reference.

2. The equipment was then subjected to an overnight "soak" at -30° C without any power applied.

3. After an overnight "soak" at -30°C (usually 14 to 16 hours) the equipment was turned on in a "standby" condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter and the individual oscillators was made within a three minute interval after applying power to the transmitter.

4. Frequency measurements were made at each 10°C interval up to room temperature (-30°C, -20°C, -10°C, 0°C, +10°C, +20°C). At least a period of one and one half hours was provided to allow stabilization of the equipment at each temperature level.

5. Again the transmitter carrier frequency and the individual oscillators were measured at room temperature to begin measurement of the upper temperature extreme.

6. Frequency measurements were made at 10°C intervals starting at +30°C and ending at +60°C allowing at least two hours at each temperature for stabilization. In all measurements the frequency was measured within three minutes after applying power to the transmitter.

7. In all measurements, at the various temperature intervals, the temperature was held to +1° C from the temperature level and the equipment turned on for one minute standby condition before applying transmitter power.

8.The artificial load was mounted external to the temperature chamber.