MEASUREMENT TECHNIQUES

2.991 Measurements Required: Conducted Spurious and Harmonic Emissions at Antenna Terminals (Analog Mode)

Graph attached
EXHIBIT 9G

Definition - (as used herein) Spurious radiation are 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 - The magnitude of each spurious and harmonic emission that can be detected when the equipment is operated under the conditions specified in the alignment procedure, EXHIBIT 8B, shall be attenuated by 43 + 10 log P (mean output power). In the range of frequencies between 869.04MHz and 893.97MHz, no spur shall exceed -80dBm.

Method of Measurement - The transmitter was modulated with a 2500Hz tone at a level 16dB greater than that required to provide 50% modulation. 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 shall be measured by means of a calibrated receiving system. For the 869 to 894 MHz band, the measurements were made using a Rohde & Schwarz EMI Test Receiver with a 3 kHz bandwidth to verify that no emissions were present. Signals suspected of being generated by the EUT were independently investigated by adjusting bandwidths and/or disabling the transmitter to confirm whether actual emission signal or receiver sensitivity (MDS).

Measurements Required: Conducted Spurious and Harmonic Emissions at Antenna Terminals (Digital Mode)

Graph Attached
EXHIBIT 9G

Definition - (as used herein) Spurious radiation are 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 - The magnitude of each spurious and harmonic emission that can be detected when the equipment is operated under the conditions specified in the alignment procedure, EXHIBIT 8B, shall be attenuated by 43 + 10 log P (mean output power). In the range of frequencies between 869.04MHz and 893.97MHz, no spur shall exceed -80dBm.

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 shall be measured by means of a calibrated receiving system. For the 869 to 894 MHz band, the measurements were made using a Rohde & Schwarz EMI Test Receiver with a 3 kHz bandwidth to verify that no emissions were present. Signals suspected of being generated by the EUT were independently investigated by adjusting bandwidths and/or disabling the transmitter to confirm whether actual emission signal or receiver sensitivity (MDS).

2.993 Measurements Required: Radiated Spurious and Harmonic Radiation (Analog and Digital Modes)

Graph attached
EXHIBIT 9H

Definition - Radiated spurious and harmonic emissions are frequencies from the equipment when loaded into a non-radiating load on 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 the information being transmitted.

Minimum standard - Radiated spurious emissions shall be attenuated by 43 + 10 log P (mean output power).

Method of Measurement:

Test Site - All testing reported herein was performed at the Motorola SSTG open area test facility, located at 8201 E. McDowell Rd., Scottsdale, AZ. 85252. 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 November 2, 1995. 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, 1998..

Installation of Equipment:

The equipment under test is placed on the turntable, connected to a dummy RF load, and then placed 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 and can be horizontally and vertically polarized. A spectrum analyzer with pre-selector covering the necessary frequency range was used to detect and measure any radiation picked up by the antenna.

Measurement Procedure

The equipment is adjustable 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.

The testing procedure is repeated for both horizontal and vertical polarization of the receiving antenna. The actual radiated signal strength is calculated from the measured reading on the spectrum analyzer using the antenna factor, associated cable and attenuator losses, and pre-amp gain as applicable.

2.995 Measurements Required: Frequency Stability (Analog and Digital Modes)

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

Minimum standard - In the analog modes, the minimum frequency stability shall be ±0.000075% referenced to a received carrier frequency from a base station. This meets the requirement for operational accuracy of 0.00025% in wide mode and 0.00010% in narrow mode. In digital mode, the minimum frequency stability shall be ±300 Hz referenced to a received carrier frequency from a base station. This meets the requirement for operational accuracy of 0.00005% in digital mode.

Method of Measurement - Frequency measurements shall be made at the extremes of the temperature range -30° 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 extracting a sample of the carrier and measuring its center frequency by equipment having a degree of accuracy of at least 10 times that of the minimum to be measured.

The frequency stability of transmitting equipment shall be checked with variations in:

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

Graphs attached EXHIBITS 9J-1, 2 & 3.

(b) Primary Supply Voltage:

Vary the primary supply voltage over the specified battery voltage range.

Graphs attached EXHIBITS 9K-1, 2 & 3.

Timing Period and Procedure for Frequency Stability Measurements

1. The carrier frequency of the transmitter was measured at room temperature (usually between 25° 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, measurement of the carrier frequency of the transmitter was made within a three minute interval after applying power to the transmitter.

4. Frequency measurements were made at each 10°C interval (-30°, -20°, -10°, 0°, +10°, +20°, +30°, +40°, +50°, +60°). A period of at least one hour was provided to allow stabilization of the equipment at each temperature level.

5. In all measurements, at the various temperature intervals, the temperature was held to ±1°C from the temperature level.

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