MEANS FOR DETERMINING AND STABILIZING FREQUENCY, SUPPRESSION OF SPURIOUS RADIATION, LIMITING MODULATION, AND LIMITING POWER

As required by § 2.1033(c)(10), this exhibit details the methods employed to determine and stabilize frequency, suppress spurious radiation and to limit both modulation and power

Means for Determining and Stabilizing Frequency

No absolute frequency stability requirements are levied against broadband PCS equipment operating under the authority of Part 24, Subpart J. However, per § 24.235, the frequency stability of the equipment shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. Specifically, this is accomplished as follows:

The transmit RF carrier of the Core Engine is generated by a voltage controlled oscillator (VCO) which is phase locked to a 13 MHz master reference source. This 13 MHz source is synchronized to the GSM network and, within the Core Engine, is controlled by an 11 bit DAC to keep the carrier to within ±0.1 ppm of the network reference.

Measurements of the stability of the fundamental emission of the Core Engine over variations in temperature and input voltage are presented in the test report. As a GSM-compliant terminal, the stability of the Core Engine carrier is to be within ±0.1 ppm (±200 Hz in 2000 MHz) of the nominal value, in accordance with GSM performance requirements (see J-STD-007, Personal Communications Services, Air Interface Specification; Volume 1, Radio Path Physical Layer, Section 7.4.1).

Means for Suppression of Spurious Radiation

Suppression of spurious and harmonic radiation in the Core Engine is ensured through good engineering practices and proper transmitter design, lay-out, and construction.

1. Transmitter Architecture and Design

Frequency plan of the transmitter– local oscillator frequencies were selected to minimize spurious products.

Use of an upconversion loop architecture to minimize spurious and noise power level in the PCS1900 receive band (1930-1990 MHz).

Lowpass filtering within and prior to the T/R switch to further reduce harmonics.

2. Physical Realization of the Core Engine

Fully shielded GSM radio module construction with filtering on all signal (data, control, clock) and power supply leads.

Localized shielding over the GSM radio and digital/baseband sections.

Careful component placement and layout, multi-layer circuit board construction,
microstrip signal routing, and construction techniques to eliminate cavity moding
and resonances.

Means for Limiting Modulation

Per GSM specifications, the modulation scheme implemented by the Core Engine is Gaussian MSK (GMSK), with a bandwidth-time product of BT = 0.3. Modulation rate is 1625/6 kbps, or approximately 280.83 kbps. To minimize spreading of the spectrum, GSM standards require that the RF output spectrum meet the mask shown in Figure E6.1. In the Core Engine, modulation accuracy is maintained through the use of direct digital synthesis techniques.

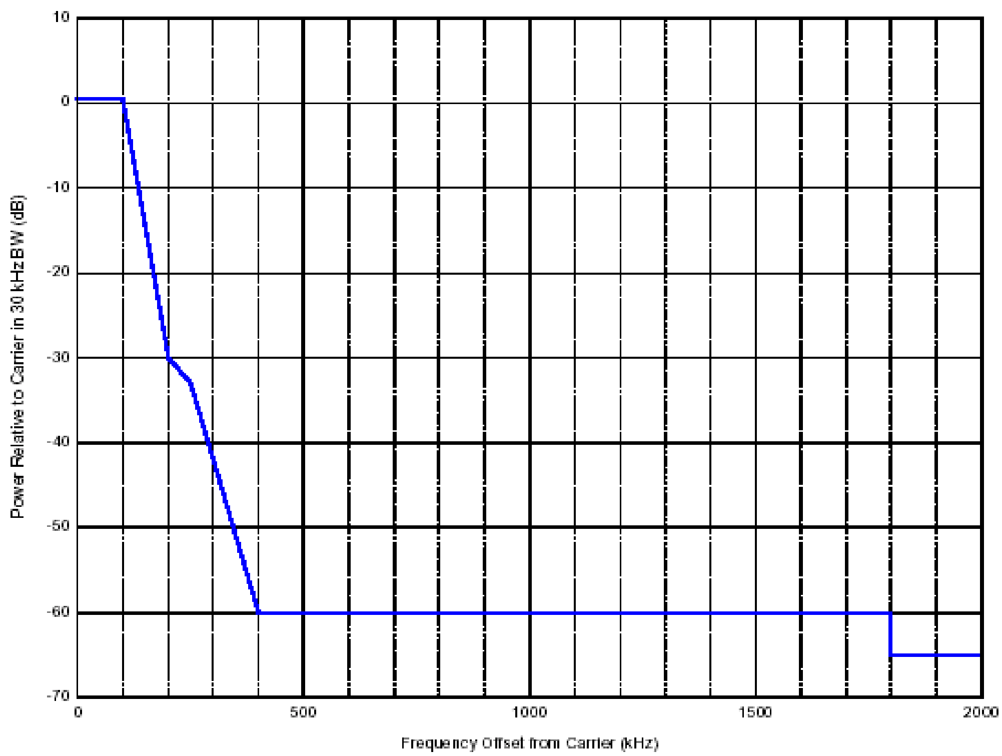

Figure E6.1. GSM terminal modulation mask.

Figure E6.1. GSM terminal modulation mask.

Means for Limiting Power

As a GSM-compliant terminal, the Core Engine is capable of transmitting at any of the 16
defined nominal RF output power levels, ranging from 30.0 dBm to 0.0 dBm, during its assignedTDMA frame. Core Engine transmitter operation (output power level) is controlled by

the GSM network, and specifically by the base station to which the Core Engine is attached. Maximum RF output power of the Core Engine is set at the factory and cannot be altered or increased. Furthermore, the temporal variation in power level within each transmission (i.e., transmission burst time mask) is in accordance with GSM requirements. This is accomplished by adjusting transmitter gain through a discrete time power control loop and ramping the transmitter on and off at the beginning and ending of each burst. The power control loop is implemented using an open loop technique proven to have little effect on output power versus temperature. Maximum RF power is adjusted to within the specified tolerance during each burst, at the output power level specified by the base station.