
# PCTEST Engineering Laboratory, Inc.

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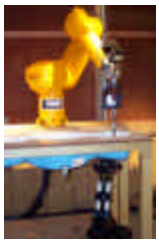

## CERTIFICATE OF COMPLIANCE
## FCC Part 24 & 22 Certification

**Matsushita Electric Industrial Co., Ltd.**
**1006 Oaza Kadoma, Kadoma**
**Osaka, 571 JAPAN**

**Dates of Tests: September 22, 2004**
**Test Report S/N: 22/24.240920543.ACJ**
**Test Site: PCTEST Lab, Columbia MD**
**Project No.: ITPD-04-F035A**

| | |
|---|---|
| **FCC ID** | **ACJ9TGCF-282** |
| **APPLICANT** | **Matsushita Electric Industrial Co., Ltd.** |

| | |
|---|---|
| **Classification:** | **PCS Licensed Transmitter (PCB)** |
| **FCC Rule Part(s):** | **§24(E), §22H; §2** |
| **EUT Type:** | **Panasonic Toughbook CF-28 w/ Sony Ericsson PCMCIA Card FCC ID: PY7FF031011** |
| **Model:** | ***CF-28*** |
| **Tx Frequency Range:** | **824.20 – 848.80MHz (GPRS) / 1851.20MHz – 1909.80MHz (PCS GPRS)** |
| **Rx Frequency Range:** | **869.20 – 893.80MHz (GPRS) / 1931.20MHz – 1989.80MHz (PCS GPRS)** |
| **Max. RF Output Power:** | **0.621 W ERP GPRS (27.920 dBm) / 0.813 W EIRP PCS GPRS (29.100 dBm)** |
| **Emission Designator(s):** | **300KGXW (GSM)** |
| **Test Device Serial No.** | **Identical Prototype [S/N: 1]** |

**This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947.**

**The Sony Ericsson PCMCIA Card is electrically identical to previously authorized FCC ID: PY7FF031011. RF conducted data is shown in that test report, included in this application.**

**I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.**

*PCTEST certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.*

Alfred Cirwithian
Vice President Engineering

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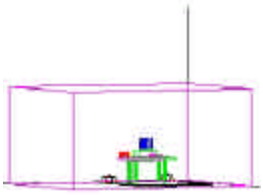
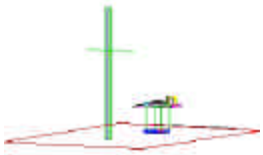
# MEASUREMENT REPORT



## 1.1 Scope

*Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.*



## §2.1033 General Information

| | |
|---|---|
| **Applicant Name:** | **Matsushita Electric Industrial Co., Ltd.** |
| **Address:** | **1006 Oaza Kadoma, Kadoma Oaza, 571 JAPAN** |

- FCC ID: **ACJ9TGCF-282**
- Quantity: Quantity production is planned
- Emission Designators: 300KGXW (GSM)
- Tx Freq. Range: 824.20 – 848.80 MHz (GPRS)
  1851.20 – 1909.80 MHz (PCS GPRS)
- Rx Freq. Range: 869.20 – 893.80 MHz (GPRS)
  1931.20 – 1989.80 MHz (PCS GPRS)
- Max. Power Rating: 0.621 W ERP GPRS (27.920 dBm)
  0.813 W EIRP PCS GPRS (29.100 dBm)
- FCC Classification(s): PCS Licensed Transmitter (PCB)
- Equipment (EUT) Type: Panasonic Toughbook CF-28 w/ Sony Ericsson PCMCIA Card
  FCC ID: PY7FF031011
- Modulation(s): GPRS
- Frequency Tolerance: ± 0.00025% (2.5 ppm)
- FCC Rule Part(s): § 24(E), §22H
- Dates of Tests: September 22, 2004
- Place of Tests: PCTEST Lab, Columbia, MD U.S.A.
- Test Report S/N: 22/24.240920543.ACJ
- Project No.: ITPD-04-F035A
- There is a provision for connection to an external antenna.
  The antenna will be professionally installed via a uniquely couple docking station.
- Deviation from measurement procedure.....NONE

## 2.1 INTRODUCTION

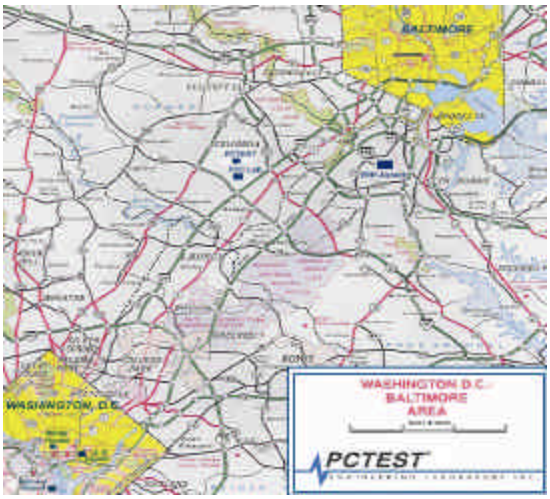



**Figure 1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area.**

These measurement tests were conducted at ***PCTEST Engineering Laboratory, Inc.*** facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on October 19, 1992.

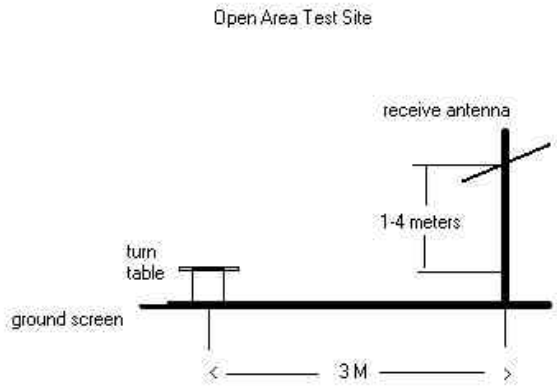



**Figure 2. Diagram of 3-meter outdoor test range**

### Measurement Procedure

The radiated and spurious measurements were made outdoors at a 3-meter test range (see Figure2). The equipment under test is placed on a wooden turntable 3-meters from the receive antenna. The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic antenna are taken into consideration.

## 3.1 INSERTS

### Function of Active Devices (Confidential)

The Function of active devices are shown in Attachment K.

### Block & Schematic Diagrams (Confidential)

The block diagrams are shown in Attachment I, and the schematic diagrams are shown in Attachment J.

### Operating Instructions

The instruction manual is shown in Attachment M.

### Parts List & Tune-Up Procedure (Confidential)

The parts list & tune-up procedure is shown in Attachment L.

### Description of Freq. Stabilization Circuit (Confidential)

The description of frequency stabilization circuit is shown in Attachment K.

### Description for Suppression of Spurious Radiation, for Limiting Modulation, and Harmonic Suppresion Circuits (Confidential)

The description of suppression stabilization circuits is shown in Attachment K.

# 4.1 DESCRIPTION OF TESTS (CONTINUED)

## 4.2 Occupied Bandwidth Emission Limits

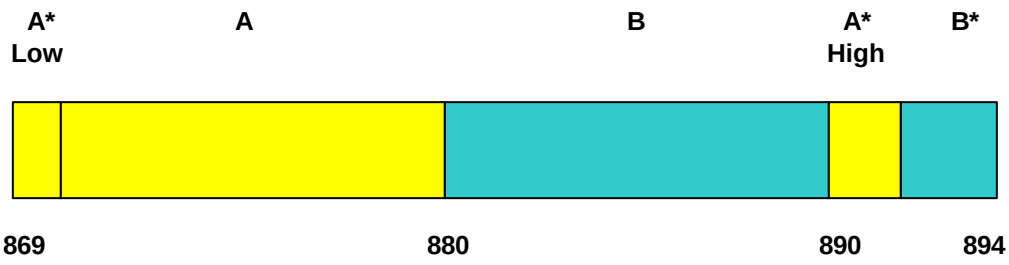
(a) On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log(P) dB.

(b) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

(c) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(d) The measurement of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

## 4.3 Cellular - Base Frequency Blocks



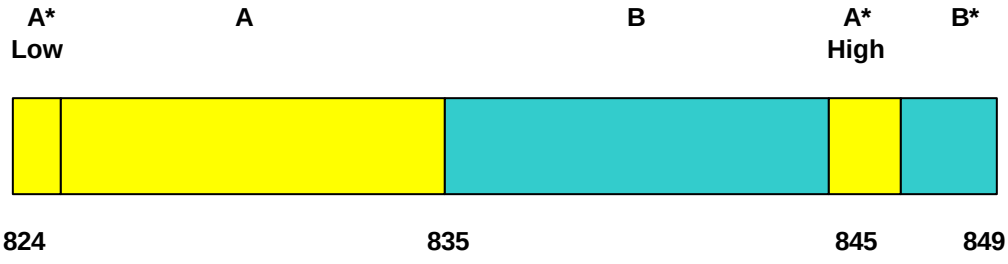

**BLOCK 1: 869 – 880 MHz (A* Low + A)**

**BLOCK 2: 880 – 890 MHz (B)**

**BLOCK 3: 890 – 891.5 MHz (A* High)**

**BLOCK 4: 891.5 – 894 MHz (B*)**

## 4.4 Cellular - Mobile Frequency Blocks




**BLOCK 1: 824 – 835 MHz (A* Low + A)**

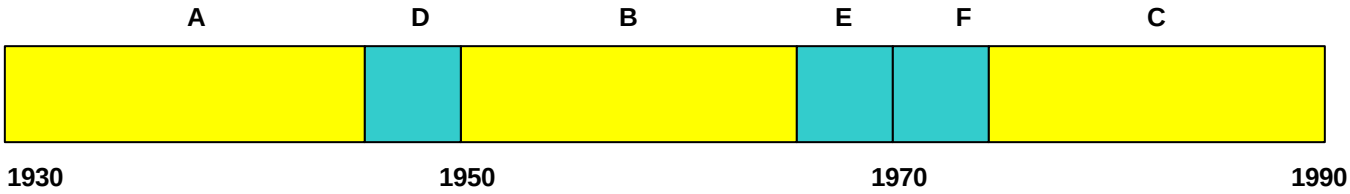
**BLOCK 2: 835 – 845 MHz (B)**

**BLOCK 3: 845 – 846.5 MHz (A* High)**

**BLOCK 4: 846.5 – 849 MHz (B*)**

## 4.1 DESCRIPTION OF TESTS (CONTINUED)

### 4.5 PCS - Base Frequency Blocks




**BLOCK 1: 1930 – 1945 MHz (A)**

**BLOCK 2: 1945 – 1950 MHz (D)**

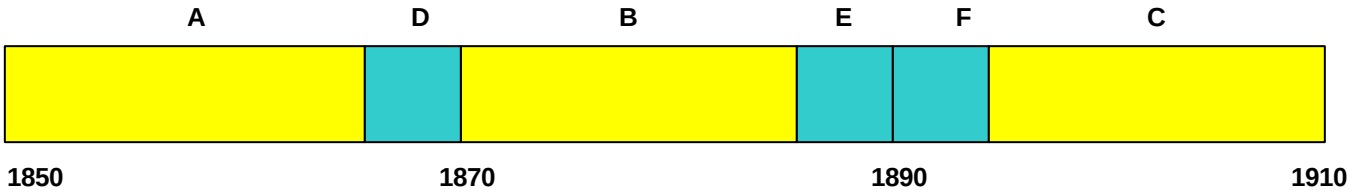
**BLOCK 3: 1950 – 1965 MHz (B)**

**BLOCK 4: 1965 – 1970 MHz (E)**

**BLOCK 5: 1970 – 1975 MHz (F)**

**BLOCK 6: 1975 – 1990 MHz (C)**

### 4.6 PCS - Mobile Frequency Blocks




**BLOCK 1: 1850 – 1865 MHz (A)**

**BLOCK 2: 1865 – 1870 MHz (D)**

**BLOCK 3: 1870 – 1885 MHz (B)**

**BLOCK 4: 1885 – 1890 MHz (E)**

**BLOCK 5: 1890 – 1895 MHz (F)**

**BLOCK 6: 1895 – 1910 MHz (C)**

## 4.7 Spurious and Harmonic Emissions at Antenna Terminal

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to 10 GHz. The transmitter is modulated with a 2500Hz tone at a level of 16dB greater than that required to provided 50% modulation.

At the input terminals of the spectrum analyzer, an isolator (RF circulator with on port terminated with 50 ohms) and an 870 MHz to 890 MHz bandpass filter is connected between the test transceiver (for conducted tests) or the receive antenna (for radiated tests) and the analyzer. The rejection of the bandpass filter to signals in the 825 – 845 MHz range is adequate to limit the transmit energy from the test transceiver which appears to a level which will allow the analyzer to measure signals less than –90dBm. Calibration of the test receiver is performed in the 870 – 890 MHz range to insure accuracy to allow variation in the bandpass filter insertion loss to be calibrated.

## 4.8 Frequencies

At the input terminals of the spectrum analyzer, an isolator (RF pad) and a high-pass filter are connected between the test transceiver (for conducted tests) or the receive antenna (for radiated tests) and the analyzer. The high-pass filter (signals below 1.6 GHz) is to limit the fundamental frequency from interfering with the measurement of low-level spurious and harmonic emissions and to ensure that the preamplifier is not saturated.

## 4.9 Radiation Spurious and Harmonic Emissions

Radiation and harmonic emissions are measured outdoors at our 3-meter test range. The equipment under test is placed on a wooden turntable 3-meters from the receive antenna. The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer reading. This level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

# 5.0 Frequency Stability/Temperature Variation.

The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +60°C using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

*Specification – The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025 (±2.5 ppm) of the center frequency*.

**Time Period and Procedure:**

1. The carrier frequency of the transmitter and the individual oscillators is measured at room temperature (22°C to 25°C to provide a reference).
2. The equipment is subjected to an overnight "soak" at -30°C without any power applied.
3. After the overnight "soak" at -30°C (usually 14-16 hours), the equipment is 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 is made within a three minute interval after applying power to the transmitter.
4. Frequency measurements are made at 10°C interval up to room temperature. At least a period of one and one half-hour is provided to allow stabilization of the equipment at each temperature level.
5. Again the transmitter carrier frequency and the individual oscillators is measured at room temperature to begin measurement of the upper temperature levels.
6. Frequency measurements are at 10 intervals starting at -30°C up to +50°C allowing at least two hours at each temperature for stabilization. In all measurements the frequency is measured within three minutes after re-applying power to the transmitter.
7. The artificial load is mounted external to the temperature chamber.

**NOTE: The EUT is tested down to the battery endpoint.**

# 5.1 Test Data

## 5.2 Effective Radiated Power Output

A. POWER: **High (GSM 850 Mode)**

| Freq. Tuned (MHz) | REF. LEVEL (dBm) | POL (H/V) | ERP (W) | ERP (dBm) | BATTERY |
|---|---|---|---|---|---|
| 824.20 | -10.450 | H | 0.611 | 27.860 | Standard |
| 836.60 | -11.000 | H | 0.621 | 27.920 | Standard |
| 848.80 | -10.900 | H | 0.607 | 27.830 | Standard |

Note: Standard batteries are the only options for this phone

**NOTES:**

Effective Radiated Power Output Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3 MHz. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW = 1 MHz. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminals of the dipole is measured. The ERP is recorded.

# 6.1 Test Data

## 6.2 Equivalent Isotropic Radiated Power (E.I.R.P.)

**Radiated measurements at 3 meters**

**Supply Voltage: 3.7 VDC**

**Modulation: GSM PCS**

| FREQ. (MHz) | REF. LEVEL (dBm) | POL (H/V) | Azimuth (o angle) | EIRP (dBm) | EIRP (W) | Battery |
|---|---|---|---|---|---|---|
| 1850.80 | -10.250 | H | 60 | 29.020 | 0.798 | Standard |
| 1880.00 | -10.800 | H | 60 | 29.100 | 0.813 | Standard |
| 1909.80 | -11.000 | H | 60 | 29.000 | 0.794 | Standard |

Note: Standard and extended batteries are options for this phone

**NOTES:**

Equivalent Isotropic Radiated Power Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3 MHz. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW = 1 MHz. A Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminals of the Horn antenna is measured. The difference between the gain of the horn and an isotropic antenna is taken into consideration and the EIRP is recorded.

# 7.1 Test Data (Continued)

## 7.2 GSM 800 Mhz. Radiated Measurements

Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 824.20 MHz
CHANNEL: 128 (Low)
MEASURED OUTPUT POWER: 27.920 dBm = 0.621 W
MODULATION SIGNAL: GSM (Internal)
DISTANCE: 3 meters
LIMIT: 43 + 10 $\log_{10}$ (W) = 40.93 dBc

| FREQ. (MHz) | LEVEL @ ANTENNA TERMINALS (dBm) | SUBSTITUTE ANTENNA GAIN (dBd) | CORRECT GENERATOR LEVEL (dBm) | POL (H/V) | (dBc) |
|---|---|---|---|---|---|
| 1648.40 | -21.30 | 6.10 | -15.20 | H | 43.1 |
| 2472.60 | -24.81 | 6.70 | -18.11 | H | 46.0 |
| 3296.80 | -29.39 | 6.80 | -22.59 | H | 50.5 |
| 4121.00 | -33.59 | 6.50 | -27.09 | H | 55.0 |
| 4945.20 | -34.68 | 7.00 | -27.68 | H | 55.6 |

**NOTES:**

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3 MHz. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW = 1 MHz. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This spurious level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

# 7.1 Test Data (Continued)

## 7.3 GSM 800 Mhz. Radiated Measurements

Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 836.60 MHz
CHANNEL: 190 (Mid)
MEASURED OUTPUT POWER: 27.920 dBm = 0.621 W
MODULATION SIGNAL: GSM (Internal)
DISTANCE: 3 meters
LIMIT: 43 + 10 $\log_{10}$ (W) = 40.93 dBc

| FREQ. (MHz) | LEVEL @ ANTENNA TERMINALS (dBm) | SUBSTITUTE ANTENNA GAIN (dBd) | CORRECT GENERATOR LEVEL (dBm) | POL (H/V) | (dBc) |
|---|---|---|---|---|---|
| 1673.20 | -21.78 | 6.10 | -15.68 | H | 43.6 |
| 2509.80 | -25.28 | 6.70 | -18.58 | H | 46.5 |
| 3346.40 | -30.58 | 6.80 | -23.78 | H | 51.7 |
| 4183.00 | -31.70 | 6.50 | -25.20 | H | 53.1 |
| 5019.60 | -36.08 | 7.00 | -29.08 | H | 57.0 |

**NOTES:**

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3 MHz. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW = 1 MHz. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This spurious level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

# 7.1 Test Data (Continued)

## 7.4 GSM 800 Mhz. Radiated Measurements

Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 848.80 MHz
CHANNEL: 251 (High)
MEASURED OUTPUT POWER: 27.920 dBm = 0.621 W
MODULATION SIGNAL: GSM (Internal)
DISTANCE: 3 meters
LIMIT: $43 + 10 \log_{10} (W)$ = 40.93 dBc

| FREQ. (MHz) | LEVEL @ ANTENNA TERMINALS (dBm) | SUBSTITUTE ANTENNA GAIN (dBd) | CORRECT GENERATOR LEVEL (dBm) | POL (H/V) | (dBc) |
|---|---|---|---|---|---|
| 1697.60 | -22.68 | 6.10 | -16.58 | H | 44.5 |
| 2546.40 | -26.18 | 6.70 | -19.48 | H | 47.4 |
| 3395.20 | -29.38 | 6.80 | -22.58 | H | 50.5 |
| 4244.00 | -32.48 | 6.50 | -25.98 | H | 53.9 |
| 5092.80 | -36.38 | 7.00 | -29.38 | H | 57.3 |

**NOTES:**

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3 MHz. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW = 1 MHz. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This spurious level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

# 7.1 Test Data (Continued)

## 7.5 GSM PCS Radiated Measurements

Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 1850.20 MHz
CHANNEL: 512 (Low)
MEASURED OUTPUT POWER: 29.100 dBm = 0.813 W
MODULATION SIGNAL: GSM (Internal)
DISTANCE: 3 meters
LIMIT: $43 + 10 \log_{10} (W)$ = 42.10 dBc

| FREQ. (MHz) | LEVEL @ ANTENNA TERMINALS (dBm) | SUBSTITUTE ANTENNA GAIN (dBi) | CORRECT GENERATOR LEVEL (dBm) | POL (H/V) | (dBc) |
|---|---|---|---|---|---|
| 3700.40 | -25.36 | 8.70 | -16.66 | H | 45.8 |
| 5550.60 | -26.85 | 9.70 | -17.15 | H | 46.2 |
| 7400.80 | -31.96 | 9.90 | -22.06 | H | 51.2 |
| 9251.00 | -35.63 | 11.40 | -24.23 | H | 53.3 |
| 11101.20 | -40.07 | 12.10 | -27.97 | H | 57.1 |

**NOTES:**

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3 MHz. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW = 1 MHz. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This spurious level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

# 7.1 Test Data (Continued)

## 7.6 GSM PCS Radiated Measurements

Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 1880.00 MHz
CHANNEL: 661 (Mid)
MEASURED OUTPUT POWER: 29.100 dBm = 0.813 W
MODULATION SIGNAL: GSM (Internal)
DISTANCE: 3 meters
LIMIT: $43 + 10 \log_{10} (W)$ = 42.10 dBc

| FREQ. (MHz) | LEVEL @ ANTENNA TERMINALS (dBm) | SUBSTITUTE ANTENNA GAIN (dBi) | CORRECT GENERATOR LEVEL (dBm) | POL (H/V) | (dBc) |
|---|---|---|---|---|---|
| 3760.00 | -26.23 | 8.70 | -17.53 | H | 46.6 |
| 5640.00 | -26.37 | 9.70 | -16.67 | H | 45.8 |
| 7520.00 | -28.45 | 9.90 | -18.55 | H | 47.6 |
| 9400.00 | -32.54 | 11.40 | -21.14 | H | 50.2 |
| 11280.00 | -38.23 | 12.10 | -26.13 | H | 55.2 |

**NOTES:**

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3 MHz. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW = 1 MHz. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This spurious level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

# 7.1 Test Data (Continued)

## 7.7 GSM PCS Radiated Measurements

Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 1909.80 MHz
CHANNEL: 810 (High)
MEASURED OUTPUT POWER: 29.100 dBm = 0.813 W
MODULATION SIGNAL: GSM (Internal)
DISTANCE: 3 meters
LIMIT: 43 + 10 $\log_{10}$ (W) = 42.10 dBc

| FREQ. (MHz) | LEVEL @ ANTENNA TERMINALS (dBm) | SUBSTITUTE ANTENNA GAIN (dBi) | CORRECT GENERATOR LEVEL (dBm) | POL (H/V) | (dBc) |
|---|---|---|---|---|---|
| 3819.60 | -25.17 | 8.70 | -16.47 | H | 45.6 |
| 5729.40 | -27.13 | 9.70 | -17.43 | H | 46.5 |
| 7639.20 | -29.25 | 9.90 | -19.35 | H | 48.4 |
| 9549.00 | -38.14 | 11.40 | -26.74 | H | 55.8 |
| 11458.80 | -44.33 | 12.10 | -32.23 | H | 61.3 |

**NOTES:**

Radiated Spurious Emission Measurements by Substitution Method according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. For CDMA signals, a peak detector is used, with RBW = VBW = 3 MHz. For AMPS, GSM, and NADC TDMA signals, a peak detector is used, with RBW = VBW = 1 MHz. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This spurious level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

# 8.1 Test Data

## 8.2 FREQUENCY STABILITY (GPRS)

OPERATING FREQUENCY: 836,600,008 Hz

CHANNEL: 190

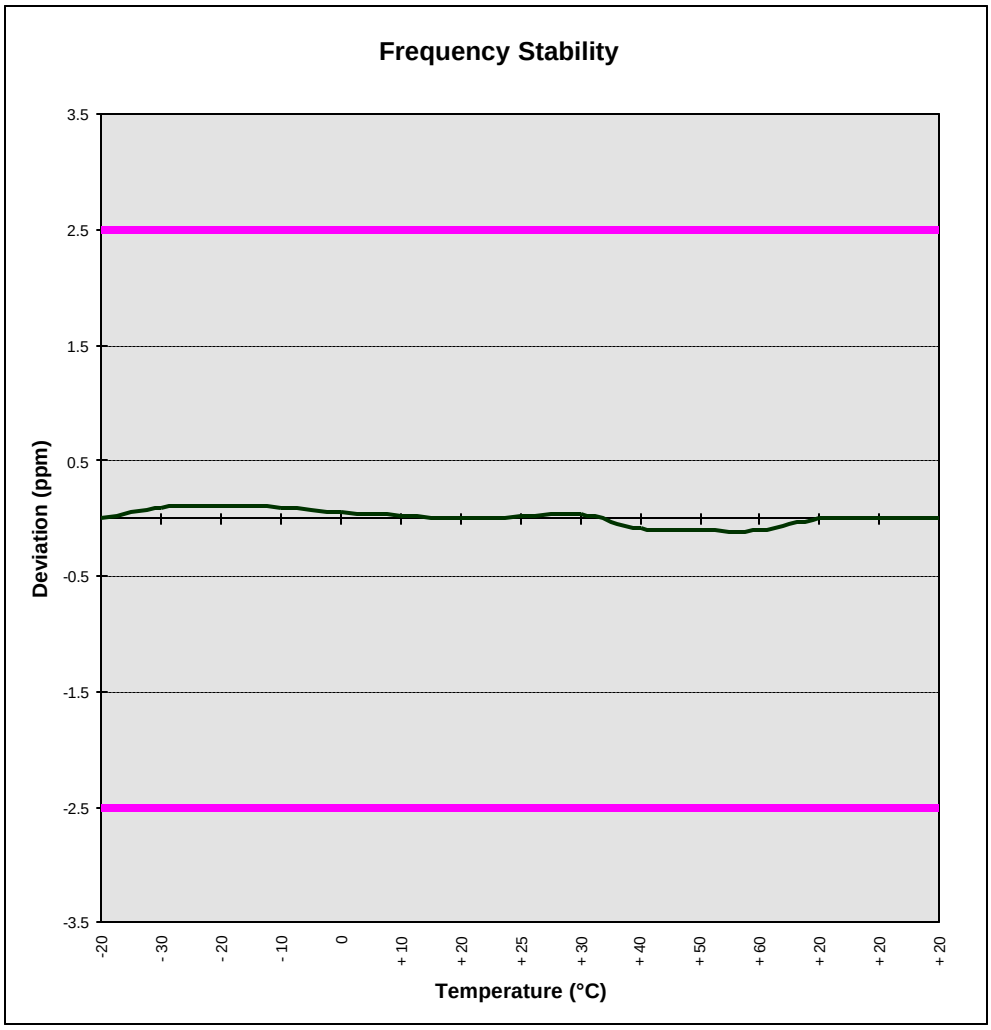
REFERENCE VOLTAGE: 3.7 VDC

DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

| VOLTAGE (%) | POWER (VDC) | TEMP (ºC) | FREQ. (Hz) | Deviation (%) |
|---|---|---|---|---|
| 100 % | 3.70 | + 20 (Ref) | 836,600,008 | 0.000000 |
| 100 % | | - 30 | 836,599,924 | 0.000010 |
| 100 % | | - 20 | 836,599,916 | 0.000011 |
| 100 % | | - 10 | 836,599,924 | 0.000010 |
| 100 % | | 0 | 836,599,966 | 0.000005 |
| 100 % | | + 10 | 836,599,983 | 0.000003 |
| 100 % | | + 20 | 836,600,008 | 0.000000 |
| 100 % | | + 25 | 836,599,991 | 0.000002 |
| 100 % | | + 30 | 836,599,975 | 0.000004 |
| 100 % | | + 40 | 836,600,083 | -0.000009 |
| 100 % | | + 50 | 836,600,092 | -0.000010 |
| 100 % | | + 60 | 836,600,092 | -0.000010 |
| 85 % | 3.17 | + 20 | 836,600,008 | 0.000000 |
| 115 % | 4.26 | + 20 | 836,600,008 | 0.000000 |
| BATT. ENDPOINT | 2.95 | + 20 | 836,600,008 | 0.000000 |

# 8.1 Test Data (Continued)

## 8.3 FREQUENCY STABILITY (GPRS)



# 8.1 Test Data (Continued)

## 8.4 FREQUENCY STABILITY (PCS GPRS)

OPERATING FREQUENCY: 1,880,000,011 Hz

CHANNEL: 661

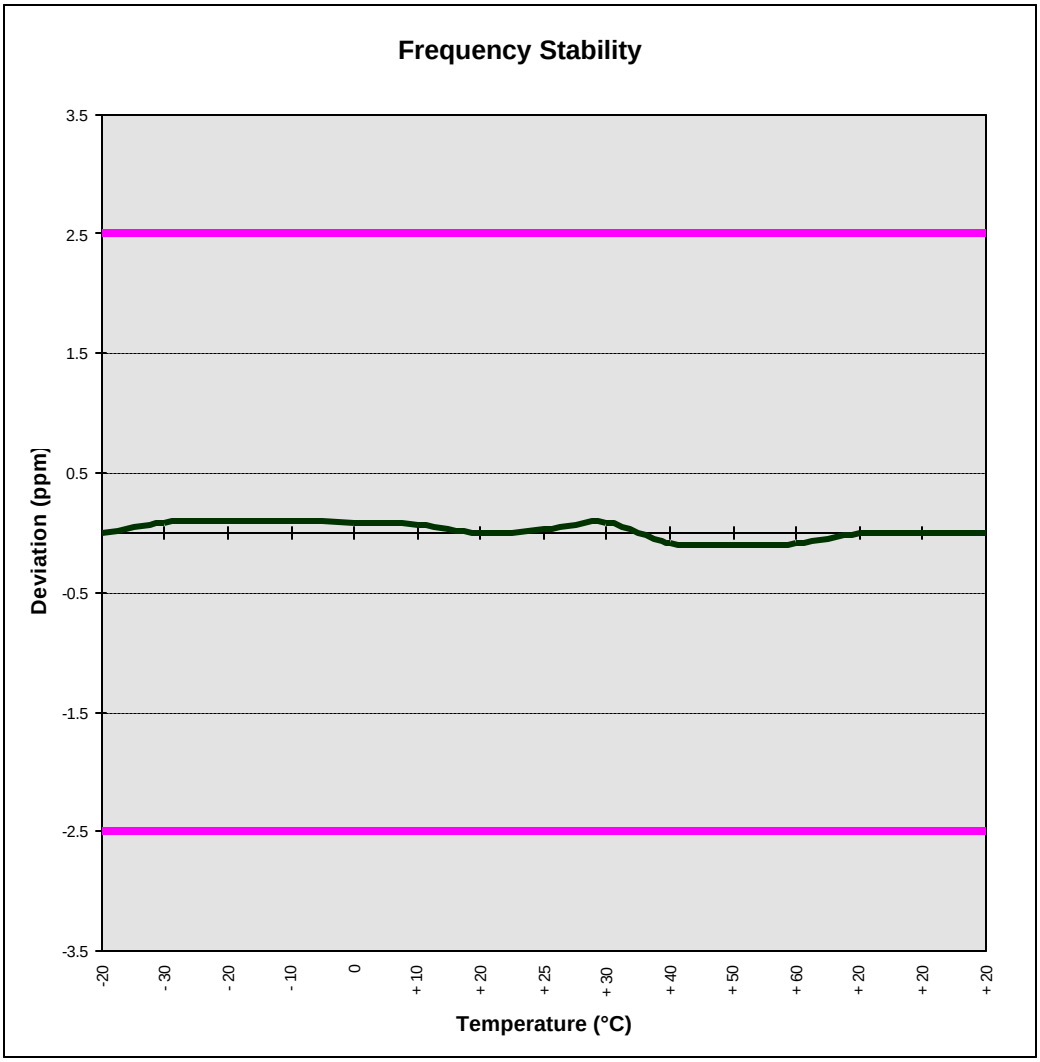
REFERENCE VOLTAGE: 3.7 VAC

DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

| VOLTAGE (%) | POWER (VDC) | TEMP (ºC) | FREQ. (Hz) | Deviation (%) |
|---|---|---|---|---|
| 100 % | 3.70 | + 20 (Ref) | 1,880,000,011 | 0.000000 |
| 100 % | | - 30 | 1,879,999,842 | 0.000009 |
| 100 % | | - 20 | 1,879,999,823 | 0.000010 |
| 100 % | | - 10 | 1,879,999,823 | 0.000010 |
| 100 % | | 0 | 1,879,999,842 | 0.000009 |
| 100 % | | + 10 | 1,879,999,879 | 0.000007 |
| 100 % | | + 20 | 1,880,000,011 | 0.000000 |
| 100 % | | + 25 | 1,879,999,955 | 0.000003 |
| 100 % | | + 30 | 1,879,999,842 | 0.000009 |
| 100 % | | + 40 | 1,880,000,180 | -0.000009 |
| 100 % | | + 50 | 1,880,000,199 | -0.000010 |
| 100 % | | + 60 | 1,880,000,180 | -0.000009 |
| 85 % | 3.17 | + 20 | 1,880,000,011 | 0.000000 |
| 115 % | 4.26 | + 20 | 1,880,000,011 | 0.000000 |
| BATT. ENDPOINT | 2.95 | + 20 | 1,880,000,011 | 0.000000 |

# 8.1 Test Data (Continued)

## 8.5 FREQUENCY STABILITY (PCS GPRS)



## 9.1 PLOT(S) OF EMISSIONS

**(SEE ATTACHMENT D)**

## 10.1 TEST EQUIPMENT

| Type | Model | Cal. Due Date | S/N |
|---|---|---|---|
| Microwave Spectrum Analyzer | 8566B (100Hz-22GHz) HP | 08/15/05 | 3638A08713 |
| Microwave Spectrum Analyzer | HP 8566B (100Hz-22GHz) | 04/17/05 | 2542A11898 |
| Spectrum Analyzer/Tracking Gen. | HP 8591A (100Hz-1.8GHz) | 08/10/05 | 3144A02458 |
| Signal Generator* | HP 8640B (500Hz-1GHz) | 06/03/05 | 2232A19558 |
| Signal Generator* | HP 8640B (500Hz-1GHz) | 06/03/05 | 1851A09816 |
| Signal Generator* | Rohde & Schwarz (0.1-1000MHz) | 09/11/05 | 894215/012 |
| Ailtech/Eaton Receiver | NM 37/57A-SL (30-1000MHz) | 04/12/05 | 0792-032 |
| Ailtech/Eaton Receiver | NM 37/57A (30-1000MHz) | 03/11/05 | 0805-03334 |
| Ailtech/Eaton Receiver | NM 17/27A (0.1-32MHz) | 09/17/05 | 0608-03241 |
| Quasi-Peak Adapter | HP 85650A | 08/15/05 | 2043A00301 |
| Ailtech/Eaton Adapter | CCA-7 CISPR/ANSI QP Adapter | 03/11/05 | 0194-04082 |
| Gigatronics Universal Power Meter | 8657A | | 1835256 |
| Gigatronics Power Sensor | 80701A (0.05-18GHz) | | 1833460 |
| Signal Generator | HP 8648D (9kHz-4GHz) | | 3613A00315 |
| Amplifier Research | 5S1G4 (5W, 800MHz-4.2GHz) | | 22322 |
| Network Analyzer | HP 8753E (30kHz-3GHz) | | JP38020182 |
| Audio Analyzer | HP 8903B | | 3011A09025 |
| Modulation Analyzer | HP 8901A | | 2432A03467 |
| Power Meter | HP 437B | | 3125U24437 |
| Power Sensor | HP 8482H (30µW-3W) | | 2237A02084 |
| Harmonic/Flicker | Test System HP 6841A (IEC 555-2/3) | | 3531A00115 |
| Broadband Amplifier (2) | HP 8447D | | 1145A00470, 1937A03348 |
| Broadband Amplifier | HP 8447F | | 2443A03784 |
| Horn Antenna | EMCO Model 3115 (1-18GHz) | | 9704-5182 |
| Horn Antenna | EMCO Model 3115 (1-18GHz) | | 9205-3874 |
| Horn Antenna | EMCO Model 3116 (18-40GHz) | | 9203-2178 |
| Biconical Antenna (4) | Eaton 94455/Eaton 94455-1/Singer 94455-1/Compliance Design | | 1295, 1332, 0355 |
| Log-Spiral Antenna (3) | Ailtech/Eaton 93490-1 | | 0608, 1103, 1104 |
| Roberts Dipoles | Compliance Design (1 set) | | |
| Ailtech Dipoles | DM-105A (1 set) | | 33448-111 |
| EMCO LISN (6) | 3816/2 | | 1079 |
| Microwave Preamplifier 40dB | Gain HP 83017A (0.5-26.5GHz) | | 3123A00181 |
| Microwave Cables | MicroCoax (1.0-26.5GHz) | | |
| Ailtech/Eaton Receiver | NM37/57A-SL | | 0792-03271 |
| Spectrum Analyzer | HP 8594A | | 3051A00187 |
| Spectrum Analyzer (2) | HP 8591A | | 3034A01395, 3108A02053 |
| Microwave Survey Meter | Holaday Model 1501 (2.450GHz) | | 80931 |
| Digital Thermometer | Extech Instruments 421305 | | 426966 |
| Attenuator | HP 8495A (0-70dB) DC-4GHz | | |
| Bi-Directional Coax Coupler | Narda 3020A (50-1000MHz) | | |
| Shielded Screen Room | RF Lindgren Model 26-2/2-0 | | 6710 (PCT270) |
| Shielded Semi-Anechoic Chamber | Ray Proof Model S81 | | R2437 (PCT278) |
| Enviromental Chamber | Associated Systems Model 1025 (Temperature/Humidity) | | PCT285 |

* Calibration traceable to the National Institute of Standards and Technology (NIST).

# 11.1 SAMPLE CALCULATIONS

## A. Emission Designator

**Emission Designator = 1M25F9W**

CDMA BW = 1.25 MHz
F = Frequency Modulation
9 = Composite Digital Info
W = Combination (Audio/Data)
(Measured at the 99.75% power bandwidth)

## B. Spurious Radiated Emission - PCS Band

**Example: Channel 25 PCS Mode 2nd Harmonic (3702.50 MHz)**

The receive analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the receive analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 3702.50 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80) = 50.3 dBc

## 12.1 CONCLUSION

The data collected shows that the **Panasonic Toughbook w/ SONY Ericsson PCMCIA Card FCC ID: ACJ9TGCF-282** complies with all the requirements of Parts 2, 22, and 24 of the FCC rules.