



683-3, Yubang-Dong, Yongin-Si, Kyunggi-Do, Korea. 449-080

Tel: +82-31-321-2664 Fax: +82-31-321-1664

<http://www.digitalemcc.com>

## RF EXPOSURE EVALUTION

Dates of Reporting: November 27, 2007

Test Report S/N:DR50110711U

Test Site : DIGITAL EMC CO., LTD.

FCC ID.

**VP3GD30TF**

APPLICANT

**Questlabs Corp.**

<b>Classification</b>	<b>:</b>	<b>Licensed Non-Broadcast Station Transmitter(TNB)</b>
<b>FCC Rule Part(s)</b>	<b>:</b>	<b>Part 1(§1.1310), Part 2(§2.1091), Part 2(§2.1093)</b>
<b>Test Procedure</b>	<b>:</b>	<b>OET Bulletin 65</b>
<b>EUT Type</b>	<b>:</b>	<b>Quad Band GSM Fixed Wireless Terminal</b>
<b>Model name</b>	<b>:</b>	<b>GD850T</b>
<b>Brand name</b>	<b>:</b>	<b>Avvio</b>
<b>TX Frequency Range</b>	<b>:</b>	<b>824.2 ~ 848.8 MHz (GSM850) / 1850.2 ~ 1909.8 MHz (PCS1900)</b>
<b>RX Frequency Range</b>	<b>:</b>	<b>869.2 ~ 893.8 MHz (GSM850) / 1930.2 ~ 1989.8 MHz (PCS1900)</b>

The device bearing the FCC Identifier specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and has been tested in accordance with the measurement procedures specified in FCC OET Bulletin 65(See Test Report). These measurements were performed with no deviation from the standards.

NVLAP accreditation does not constitute any product endorsement by NVLAP or any agency of the United States Government. DigitalEMC 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.

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## 1. Scope

This report contains the result of tests performed by:

DIGITAL EMC CO., LTD.

Address : 683-3, Yubang-Dong, Yongin-Si, Kyunggi-Do, Korea. 449-080

<http://www.digitalemc.com> E-mail : demc@unitel.co.kr

Tel: +82-31-321-2664 Fax: +82-31-321-1664

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the "General requirements for the competents of calibration and testing laboratory".

This laboratory is accredited by NVLAP for NVLAP Lab. Code: 200559-0.

**Test operator: Engineer**

November 27, 2007

Won-Jung LEE

Data

Name

Signature

**Report Reviewed By: Director**

November 27, 2007

Harvey Sung

Data

Name

Signature

**Ordering party:**

Company name : Questlabs Corp.  
 Address : 6<sup>th</sup> Floor Uniquet Bldg., 271-2 Seohyeon-Dong  
 Zipcode : 463-824  
 City/town : Sungnam-Shi, Gyeonggi-Do  
 Country : KOREA  
 Date of order : October 24, 2007

## 2. RF EXPOSURE EVALUATION – Maximum Permissible Exposure(MPE)

### 2.1 Introduction

This document is prepared on behalf of **Questlabs Corp.** to show compliance with the RF Exposure requirements as required in §1.1310 of the FCC Rules and Regulations and RSS-102 of Industry Canada.

The limit for Maximum Permissible Exposure (MPE), specified in FCC §1.1310, is listed in Table 1-1.

According to FCC §1.1310 and RSS-102 the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency(RF) radiation as specified in §1.1307(b).

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (Minutes)
(A) Limits For Occupational / Control Exposure(f = frequency)				
30 ~ 300	61.4	0.163	1.0	6
300 ~ 1500	-	-	f / 300	6
1500 ~ 100,000	-	-	5.0	6
(B) Limits For General Population / Uncontrolled Exposure(f = frequency)				
30 ~ 300	-	-	0.2	30
300 ~ 1500	-	-	f / 1500	30
1500 ~ 100,000	-	-	1.0	30

Table 1-1. Limits for Maximum Permissible Exposure(MPE)

### 2.2 MPE Requirements

Three different categories of transmitters are defined by the FCC in OET Bulletin 65. These categories are fixed installation, mobile and portable and are defined as follows:

- **Fixed Installations:** fixed location means that the device, including its antenna, is physically secured at a permanent location and is not able to be easily moved to another location. Additionally, distance to humans from the antenna is maintained to at least 2 meters.
- **Mobile Devices:** a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to be generally used in such a way that a separation distance of at least 20Cm is normally maintained between the transmitter`s radiating structures and the body of the user or nearby persons. Transmitters designed to be used by consumers or workers that can be easily re-located, such as a wireless modem operating in a laptop computer, are considered mobile devices if they meet the 20Cm separation requirement. The FCC rules for evaluation mobile devices for RF compliance are found in 47 CFR §2.1091
- **Portable Devices:** a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20Cm of the body of the user. Portable device requirements are found in Section 2.1093 of the FCC`s Rules(47 CFR§2.1093).

The FCC also categorizes the use of the device as based upon the user's awareness and ability to exercise control over his or her exposure. The two categories defined are Occupational / Controlled Exposure and General Population / Uncontrolled Exposure. These two categories are defined as follow:

- **Occupational / Controlled Exposure:** In general, occupational / Controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population / uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on methods to minimize such exposure risks.
- **General Population / Uncontrolled Exposure:** The general population / uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or can not exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related (for example, in the case of a wireless transmitter that exposes persons in its vicinity). Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational / controlled category, and the general population / uncontrolled exposure limits apply to these devices.

The **Quad Band GSM Fixed Wireless Terminal** of **Questlabs Corp.(FCCID: VP3GD30TF)** is evaluated to the **Mobile Device requirement** and is considered a device to be used by the **General Population / Uncontrolled Exposure**

## 2.3 Procedure

The procedure used to determine the RF power density was based upon a calculation for determining compliance with the MPE requirement.

The power generated by this product is measured with a radiated methodology to determine the ERP/EIRP. Through use of the Friis transmission formula and knowledge of the maximum ERP/EIRP in each band, the power density level is calculated at a distance of 20Cm.

### - Friis Transmission Formula

$$S = \frac{EIRP}{4\pi R^2}$$

$S$  = Power Density(mW/Cm<sup>2</sup>)

$EIRP$  = Maximum Equivalent Isotropic Radiated Power(mW)

$\pi$  = 3.141593

$R$  = distance between observation point and center of the radiator(Cm)

### - Calculated MPE

The power density limit for General Population / Uncontrolled Exposure at each frequency is determined based on the information in Table 1-1. The EUT has maximum transmit duty cycle in GPRS Class 10 2-Tx mode of **24%** in the GSM850 band and **24%** in the GSM1900 band. Plots of the worst case timing and pulse widths are shown in Plot1 and Plot 2.

The maximum power can be therefore be reduced by the duty cycle correction factors.

$$EIRP_{adj} = EIRP_{max}[dBm] + 10 \times \text{Log}(\text{Duty Cycle})[dB]$$

Given the EIRP, the following power densities are calculated by frequency at 20Cm spacing.

## 2.4 GSM850 Band Calculation

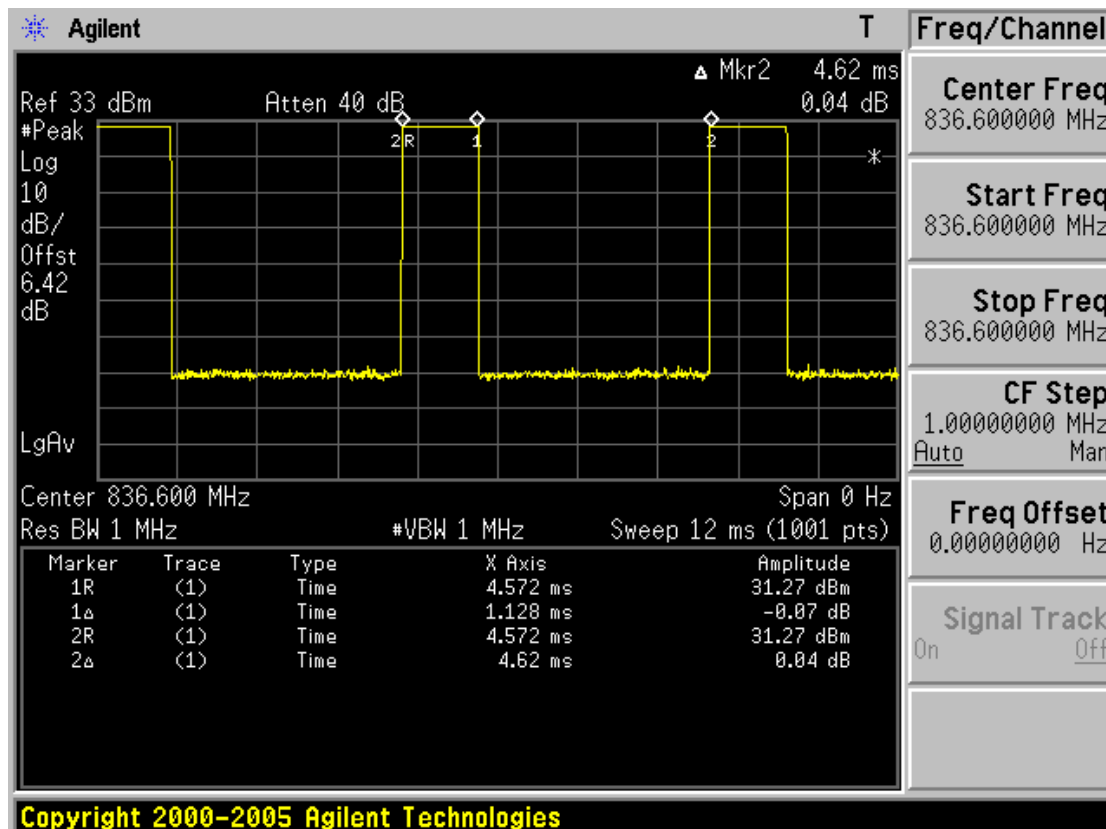
### -GPRS Class 10 2 TX Mode for Worst case MPE

Frequency	=	836.6 MHz
Power	=	31.69 dBm
Ant Gain	=	3.5 dBi
EIRP	=	35.19 dBm = 3304 mW
Duty On Time	=	1.128 ms
Duty On+OFF Time	=	4.62 ms
Duty Cycle	=	24 %
Corrected EIRP	=	29.07 dBm = 807 mW
Limit(at 20Cm)	=	0.5494667 mW/Cm <sup>2</sup> (at 824.2MHz for worst case limit)
Power Density(S)	=	0.1604713 mW/Cm <sup>2</sup>
Minimum Distance	=	10.808314 Cm

- Result: **Comply**

### - Timing Plot

The following plot shows the transmitter set to operate at maximum power with maximum amount of “on” time and one full period. This plot provides a mean by which to calculate a duty cycle which can be used adjust the power used in the calculation of power density.



Plot 1. Transmitter Maximum Duty Cycle Operation in GSM850 Band(GPRS Class 10)

## 2.4 GSM190 Band Calculation

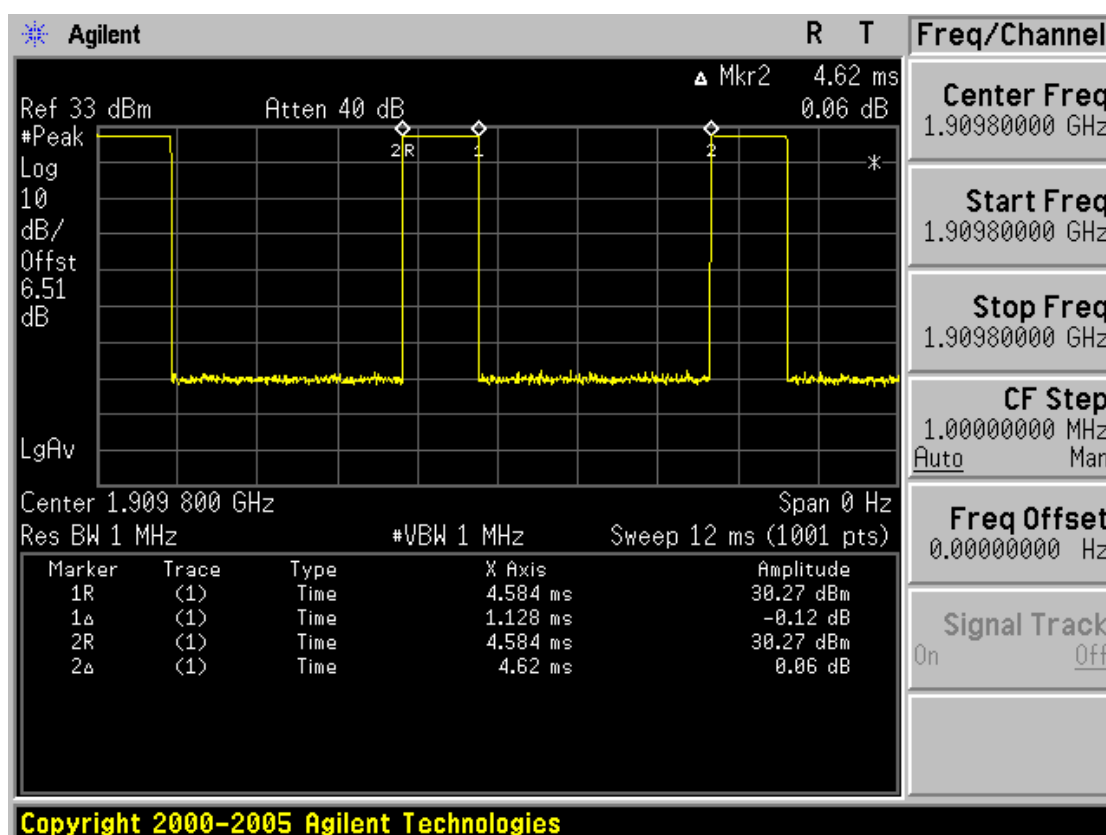
### -GPRS Class 10 2 TX Mode for Worst case MPE

Frequency	=	1909.8 MHz
Power	=	30.28 dBm
Ant Gain	=	0.5 dBi
EIRP	=	30.78 dBm = 1197 mW
Duty On Time	=	1.128 ms
Duty On+OFF Time	=	4.62 ms
Duty Cycle	=	24 %
Corrected EIRP	=	24.66 dBm = 292 mW
Limit(at 20Cm)	=	1 mW/Cm <sup>2</sup>
Power Density(S)	=	0.0581296 mW/Cm <sup>2</sup>
Minimum Distance	=	4.8220158 Cm

- Result: **Comply**

### - Timing Plot

The following plot shows the transmitter set to operate at maximum power with maximum amount of “on” time and one full period. This plot provides a mean by which to calculate a duty cycle which can be used adjust the power used in the calculation of power density.



Plot 1. Transmitter Maximum Duty Cycle Operation in GSM1900 Band(GPRS Class 10)