

RADIO FREQUENCY EXPOSURE REPORT

REVISED TEST REPORT TO 103300-11

Device: 3.5GHz Base Station
Model: QUANTUM 6636

Report No.: 103300-11A

Date of issue: September 16, 2020

PREPARED FOR:
Mercury Wireless
1111 Main St.
Kansas City, MO 64105

PREPARED BY:
Benny Lovan
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Revision History

Original: Testing of the Testing of the 3.5GHz Base Station Model: QUANTUM 6636.

Revision A: Updated list of declared antennas. Updated maximum EIRP and Spectral Density with revised maximum antenna gain. Added clarification to manufacturer's specifications.

Purpose:

To demonstrate compliance with United States RF Exposure requirements for Fixed/Mobile equipment (devices used >20cm from the body) where Maximum Permissible Exposure (MPE) Calculations apply.

Device and Antenna Operating Configuration:

Device operating at maximum output power with continuous transmission of modulated data. The present report is assessing compliance for the band of 3550 – 3700MHz.

There are multiple antennas that may be used; the gain of the most frequently used antenna is 15dBi. Depending on which antenna is used, the power will be adjusted accordingly as noted in the referenced test report.

Test Procedure:

This equipment is evaluated in accordance with the guidelines set forth in KDB 447498 & ANSI C95.1 for the US, Health Canada Safety Code 6 & RSS 102 for Canada, ARPANSA RPS3 for AU and EN 62479 or EN 62311 for EU.

Other Considerations:

Report considers stand-alone configurations only. RF Exposure limits are calculated at the mid-point of the operating band. The EUT does not support simultaneous transmission and therefore the RF Exposure Power Density Assessment for Multi Transmitter, Simultaneous Transmission is not applicable. Results below assume non-overlapping antenna pattern; collocation / power aggregation is not assessed. This report includes both general population exposure conditions for bystander configuration and occupational exposure conditions for professional installer configuration.

Referenced Test Reports:

The following test report was referenced in conjunction with this assessment:
103300-10 FCC Part 96E, 3550 - 3700MHz

RF Exposure Power Density Assessment (Single Transmitter, Stand Alone)

MPE Calculation:

$$\text{Power Density } (S) = \frac{\text{EIRP}}{4\pi d^2} \quad \text{Given: EIRP in mW or W and d in cm or m}$$

US MPE Assessment

Power Reported is:		<input type="checkbox"/> Peak <input checked="" type="checkbox"/> Average					
Limit Used is:		<input checked="" type="checkbox"/> General Population <input type="checkbox"/> Occupational Exposure					
Operating Band MHz	Power dBm	Ant Type/Gain dBi	EIRP dBm	Distance cm	MPE mW/cm ²	Limit mW/cm ²	Comments
3550 – 3700 MHz	27.36	Dual Polarized Panel / 17dBi	44.4	46.6	1	1	Pass*

US MPE Assessment

Power Reported is:		<input type="checkbox"/> Peak <input checked="" type="checkbox"/> Average					
Limit Used is:		<input type="checkbox"/> General Population <input checked="" type="checkbox"/> Occupational Exposure					
Operating Band MHz	Power dBm	Ant Type/Gain dBi	EIRP dBm	Distance cm	MPE mW/cm ²	Limit mW/cm ²	Comments
3550 – 3700 MHz	27.36	Dual Polarized Panel / 17dBi	43.787	20.8	5	5	Pass

Note: Worst case average power output is assumed without consideration of source-based time averaging. The Power in dBm is the raw data measured from the analyzer with a duty cycle of 72%. EIRP is calculated by Measured RF Output Power + Gain (dBi) + Duty Cycle Correction Factor (1.427) in accordance with ANSI C63.26. The MPE value reported is the worst case across all channel bandwidths and modulation types evaluated in referenced test report.

*Assumes fixed-mounted antenna installation at height or separation meeting required distance.

Summary:*MPE Calculation Results:*

Equipment demonstrating compliance with MPE calculations have been evaluated, without further testing, for use under mobile RF exposure configurations as identified herein. Additional configurations including collocation or simultaneous transmission with other transmitters (including necessary separation distances) are subject to further assessment. It is assumed that the manufacturer shall design the equipment such that the minimum separation distance of 20cm (or greater, as listed above) is met or that the manufacturer provides a protection guide (e.g. installation instructions) to the end user such that the antenna(s) may be installed in accordance with the manufacturer's instructions in such a manner to maintain the minimum separation distance.

General Comments:

The absorption and distribution of Electromagnetic energy in the body is a very complex phenomena that depends on the mass, shape and physiological condition of the body; the orientation of the body with respect to the fields; and, the electrical properties of the body and the environment. Variables that may play a substantial role in possible biological effects are those that characterize the environment (including but not limited to: ambient temperature, air velocity, relative humidity and body insulation); and those that characterize the individual (including but not limited to: age, gender, activity level and existing debilitation or disease). Because innumerable factors may interact to determine specific biological effects of exposure to electromagnetic fields, any protection guide should consider both intended and unintended operational environments and provide guidance for installation and use of the product such that proper separation distances can be maintained. (ANSI C95.1)

APPENDIX A - RF Exposure Limits

United States Compliance Requirements (1.1310):

RF Exposure Evaluation Limits Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842 / f _{MHz}	4.89 / f _{MHz}	*(900 / f _{MHz} ²)	6
30-300	61.4	0.163	1	6
300-1500	---	---	f _{MHz} / 300	6
1500-100,000	---	---	5.0	6

RF Exposure Evaluation Limits General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824 / f _{MHz}	2.19 / f _{MHz}	*(180 / f _{MHz} ²)	30
30-300	27.5	0.073	0.2	30
300-1500	---	---	f _{MHz} / 1500	30
1500-100,000	---	---	1.0	30

* Plane wave equivalent power density

Limit is calculated based on the mid-band frequency used in the operating frequency range.

Exemption Limits for Stand-Alone SAR Evaluation:

In accordance with KDB 447498 D01

Max Output Power at Exemption Limit (mW)		
Frequency (MHz)	$d \leq 50\text{mm}$	$50\text{mm} < d \leq 20\text{cm}$
<100	$\frac{1}{2} \cdot \left(\frac{R \cdot 50}{\sqrt{0.1}} \right) \cdot \left(1 + \text{LOG} \left(\frac{100}{f_{\text{MHz}}} \right) \right)$	$\left(\frac{R \cdot 50}{\sqrt{0.1}} + (d - 50) \frac{100}{150} \right) \cdot \left(1 + \text{LOG} \left(\frac{100}{f_{\text{MHz}}} \right) \right)$
100-1500	$\left(\frac{R \cdot d}{\sqrt{f_{\text{GHz}}}} \right)$	$\left(\frac{R \cdot 50}{\sqrt{f_{\text{GHz}}}} + (d - 50) \frac{f_{\text{MHz}}}{150} \right)$
1500-6000		$\left(\frac{R \cdot 50}{\sqrt{f_{\text{GHz}}}} + (d - 50) \cdot 10 \right)$

R is the allowed ratio: 3 for 1-g SAR and 7.5 for 10-g extremity SAR.

d is distance in mm, rounded to the nearest mm.

Appendix B - References

1. ACMA Radiocommunications (Electromagnetic Radio – Human Exposure) Standard, 2014.
2. AS/NZS 2772.2, Radiofrequency fields – Principles and method of measurement and computation – 3 kHz to 300 GHz, 2011.
3. Australian Radiation Protection and Nuclear Safety Agency, ARPANSA RPS 3, Maximum Exposure Levels to Radiofrequency Fields 3 kHz to 300 GHz, 2016.
4. New Zealand Standard, NZS 2772.1, Radiofrequency Fields Part 1: Maximum Exposure Levels 3 kHz to 300 GHz, 2009.
5. Federal Communications Commission Knowledge Database (KDB) Publication 447498, “What are the RF exposure requirements and procedures for mobile and portable devices?” As in effect on the issue date of this report.
6. Title 47 Code of Federal Regulations, Part 1.1310, “Radiofrequency radiation exposure limits.” As in effect on the issue date of this report.
7. Title 47 Code of Federal Regulations, Part 2.1091, “Radiofrequency radiation exposure evaluation: mobile devices.” As in effect on the issue date of this report.
8. ANSI C95.1 (2005) IEEE Standard for Safety Level with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 GHz, 2005.
9. Health Canada Safety Code 6 Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz, 2015.
10. Industry Canada GL-01 Guidelines for the Measurement of Radio Frequency Fields at Frequencies From 3 kHz to 300 GHz, Issue 3, March 2015.
11. Industry Canada RSS-102 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 5, March 2015.
12. EC Council Recommendation 1999/519/EC “On the limitation of exposure of the general public to electromagnetic fields (0Hz to 300GHz),” (1999).
13. European Committee for Electrotechnical Standardization. European Normative, EN 62311 Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz to 300 GHz), 2008.
14. European Committee for Electrotechnical Standardization. European Normative, EN 62479 Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz), 2010.
15. International Commission on Non-Ionizing Radiation Protection. Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz). Health Physics 74 (4): 494-522; 1998.
16. International Commission on Non-Ionizing Radiation Protection Statement on the "Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz). Health Physics 97(3):257-259, 2009.