RF Exposure Report

EUT Name: Form 12S REX Meter

EUT Model: ZC599A00000

FCC Title 47, Part 15.247(i), 1.1307(b), and 1.1310

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1.1 RF Exposure Measurement (Mobile Device) 15.247(i)

1.1.1 Test Methodology

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this product is measured in a Semi-Anechoic Chamber, and also the maximum total power input to the antenna is measured. Through the Friis transmission formula (see section 4.9.6) and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

1.1.2 RF Exposure Limit

According to FCC 1.1310 table 1: 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)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(A)Limits For Occupational / Control Exposures				
300-1500	…	…	F/300	6
1500-100,000	…	…	5	6
(B)Limits For General Population / Uncontrolled Exposure				
300-1500	…	…	F/1500	6
1500-100,000	…	…	1.0	30

F = Frequency in MHz

1.1.3 EUT Operating condition

The software provided by Manufacturer enabled the EUT to transmit data at lowest, middle and highest channel individually.

1.1.4 Classification

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in users manual. So, this device is classified as a **Mobile Device**.

1.1.5 Test Results

1.1.5.1 Antenna Gain

The maximum Gain measured in Semi-Anechoic Chamber is 5.87 dBi or 3.86 (numeric).

1.1.5.2 Output Power into Antenna & RF Exposure value at distance 20cm:

Calculations for this report are based on highest power measurement and the highest gain of the antenna. Limit for MPE (from FCC part 1.1310 table 1) is f(Mhz) / 1500 = 0.6 mW/cm^2

Highest Pout is 236mW, highest antenna gain (in linear scale) is 3.86, and R is 20cm.

Pd = (236*3.86) / (4* π* 400) = **0.1813 mW/cm^2**, which is 0.4186 mW/cm^2 below to the limit.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

1.1.6 Sample Calculation

The Friis transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$

Where;

Pd = power density in mW/cm^2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
$\pi \approx 3.1416$
R = distance between observation point and center of the radiator in cm

If we know the maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the MPE value at distance r.

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition, Page 640, Eq. (11-133).

1.1.7 Equivalent Models

Model Number (Elster Style Number)	Reason for Equivalence
ZCA1H000?00 ZCA19000?00 ZCA29000?00 ZCA39000?00 ZCC29000?00 ZCCWB000?00	The meter provided for testing is a Form 2S singlephase meter, style ZCC39000000. These meters are also singlephase meters. The H in the field 5 calls out the PCBA with the dual SAW filters 902-928 MHz in the receive path. Field 9 is a "?" because it can be different values based on a mechanical part used to block the optical port to prevent optical communications. Field 9 does not impact the radio or change the PCBA.
ZCCW9000?00 ZCC3B000?00 ZCC19000?00 ZCC39000?00 ZCC49000?00 ZCCY9000?00	The meter provided for testing is ZCC39000000, which is a Form 2S, 200A meter with voltage disconnect link. All of the equivalent styles are also Form 2S meters. "CW9" is the same except it does not have a voltage disconnect link. "C3B" is the same except it has an option board header populated on the main PCBA. "C49" is the same except it is rated for 320A operation.
ZCCT9A00?00 ZCC99A00?00 ZCA19A00?00 ZCC19A00?00 ZCA99A00?00 ZCA1HA00?00	All are singlephase meters with service disconnect styles. The style provided for testing is ZCC99A00000, which is a Form 2S 160A meter with voltage test link. The "CT" style does not have a voltage test link. The "A1" is a Form 1S meter rated for Class 100 operation. The "A9" style is a Form 1S meter rated for Class 160 operation. The H in the field 5 calls out the PCBA with the dual SAW filters 902-928 MHz in the receive path.
ZC5W9000?00 ZC519000?00 ZC539000?00 ZC549000?00	All are 12S styles. The meter provided for testing is ZC539000000. "5W9" is the same as "539" except "5W9" does not have a voltage test link. "519" is the same except the nameplate is marked for Class 100 operation instead of Class 200 operation. "549" is the same meter, except calibrated for Class 320A operation.
ZC519A00?00 ZC599A00?00	Both are 12S with service disconnect styles. The style provided for testing is ZC599A00000. The ZC519A00000 is the same meter, except the nameplate is marked as a Class 100 (max. current). Everything in the meter is otherwise the same.