RF Exposure Evaluation Report

FOR:

Company: Coulomb Technologies
Model Name: CT2000/CT2021/CT2025
FCC ID: W38-CT21002000-01
IC ID: 8854A-21002000

References:

1. FCC OET Bulletin 65 Supplement C
2. FCC CFR Part 2
3. RSS-102- Radio Frequency Exposure Compliance of Radiocommunication Apparatus Issue 4 March 2010

1 Administrative Data

1.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Test Lab Director:	Heiko Strehlow
Responsible Project Leader:	Rami Saman

1.2 Identification of the Client

Applicant's Name:	Coulomb Technologies
Street Address:	1692 Dell Ave
City/Zip Code	Campbell, CA 95008
Country	USA
Contact Person:	Thanh Pham/Gary Eldridge
Phone No.	408-841-4542
e-mail:	thanh@coulombtech.com

1.3 Identification of the Manufacturer

Same as above client.

2 Equipment under Test (EUT)

2.1 Specification of the Equipment under Test

Marketing Name:	Coulomb Technologies
Model No:	CT2000/CT2021/CT2025
HW Revision:	Coulomb R. A; Gobi3000 rev: P4
SW Revision:	Coulomb Rev:1; Gobi3000 rev: 1575
FCC-ID:	W38-CT21002000-01
IC-ID:	8854A-21002000
Product Description:	Electric Vehicle Charging Station
GPRS Multislot Class:	10
Frequency Range:	GSM 850: 824.2-848.8MHz PCS 1900: 1850.2-1909.8MHz FDD V: 826.4-846.6MHz FDD II: 1852.4-1907.6MHz FDD IV: 1711.25-1753.75MHz Zigbee: 2400 – 2483.5 MHz RFID: 13.56 MHz
Number of Channels:	GSM850: 125 PCS 1900: 300 FDD II: 278 FDD V: 103 FDD IV: 203 Zigbee: 16 RFID: 1
Type(s) of Modulation:	GSM 850/PCS 1900: GMSK, 8-PSK FDD V/II/IV: QPSK; 16QAM Zigbee: OQPSK RFID: FSK
Antenna Type and Gain:	GSM/WCDMA: Internal Stubby Antenna, Max Gain: 850 band: 1 dBi 1700 band: 2 dBi 1900 band: 2.5 dBi Zigbee: Internal 0 dBi
Co-located Transmitters/ Antennas?	Cellular/RFID/Zigbee Cellular/RFID Cellular/Zigbee RFID/Zigbee

Power supply:	208 VAC
Operating temperature range:	-30°C to 50°C
Prototype / Production unit:	Pre-Production
Device Category:	■ Fixed Installation ☐ Mobile ☐ Portable
Exposure Category:	☐ Occupational/ Controlled ■ General Population/ Uncontrolled

3 Assessment

This report serves as the Technical Information regarding RF Exposure evaluation against the requirements in 47 CFR 2.1091and as the RF Exposure Technical Brief according to RSS-102 Ch. 2.2.

The following device has been evaluated and meets/is exempt from the RF Exposure Limits defined in 47 CFR 1.310 and RSS-102 Issue 4 Ch. 4.

Company	Description	Model #
Coulomb Technologies	Electric Vehicle Charging Station	CT2000/CT2021/CT2025

Date	Section	Name	Signature
2012-04-25	Compliance	Josie Sabado (Project Engineer)	

4 RF Exposure Evaluation Requirements

4.1 FCC:

Calculations can be made to predict RF field strength and power density levels around typical RF sources using the general equations (3) and (4) on page 19 of the following FCC document:
"OET Bulletin 65, Edition 97-01 - Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields".

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure:

Frequency Range (MHz)	Power density (mW/cm^2)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100.000	1.0	30

Using the equation from page 19 of OET Bulletin 65, Edition 97-01:

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

where: S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW)
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Note:
1. This device is to be used only for fixed and mobile applications.
2. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Additionally, according to § 2.1091:
The limit for <1.5 GHz mobile operations where no routine evaluation is required is: 1.5W ERP
The limit for >1.5 GHz mobile operations where no routine evaluation is required is: 3W ERP

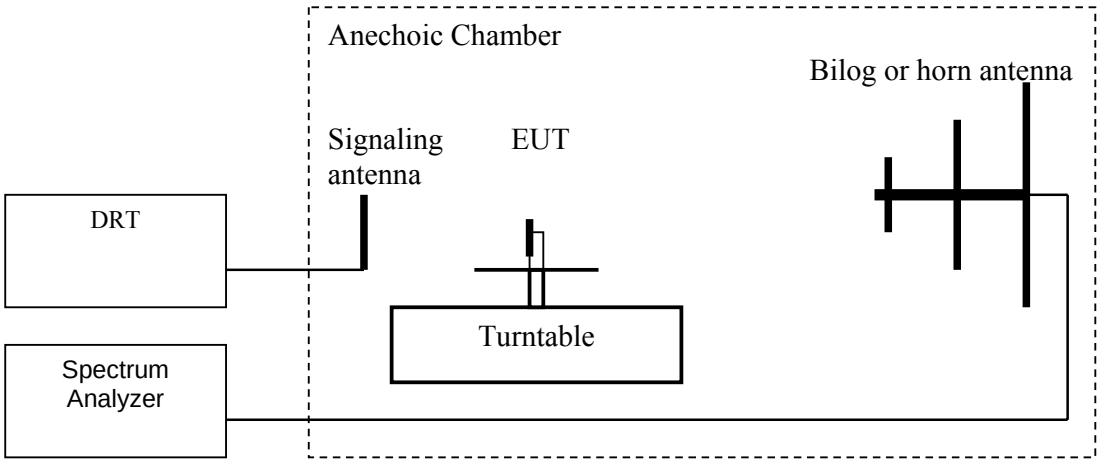
4.2 IC:

RSS-102 Section 2.5.2
RF exposure evaluation is required if the separation distance between the user and the device's radiating element is greater than 20 cm, except when the device operates as follows:
- below 1.5 GHz and the maximum EIRP of the device is equal to or less than 2.5 W;
- at or above 1.5 GHz and the maximum EIRP of the device is equal to or less than 5 W.

RSS-102 4.2: RF Field strength limits for devices used by the General Public (Uncontrolled Environment):
Power density
300MHz- 1500 MHz= f/150 W/m^2
1500 MHz- 1500000 MHz= 10 W/m^2

5 Measurement procedure:

5.1 Radiated power measurement- ERP/EIRP-

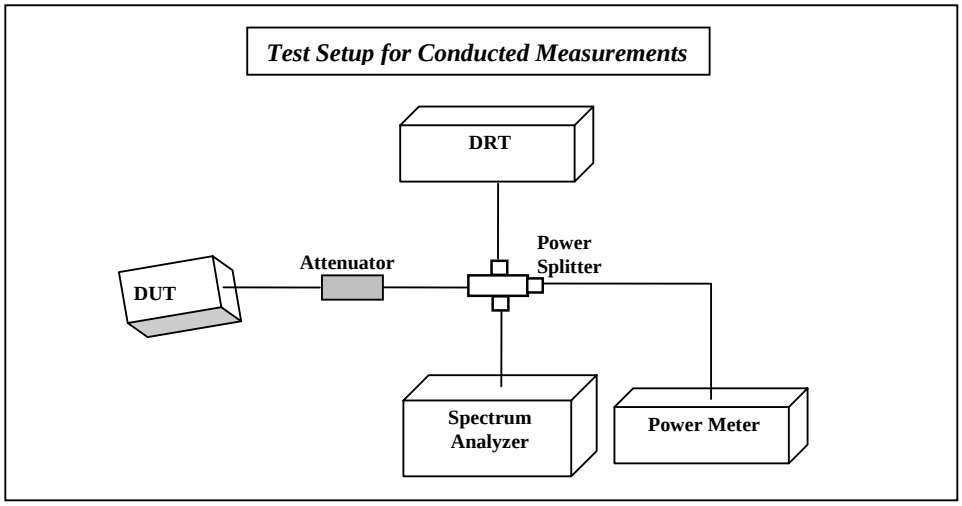


1. Connect the equipment as shown in the above diagram with the EUT's antenna in center of the turn table.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to the channel frequency. Set the analyzer to measure peak hold with the required settings.
4. Rotate the EUT 360°. Record the peak level in dBm (**LVL**).
5. Replace the EUT with a vertically polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS)**. **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the ERP using the following equation:
   ERP (dBm) = **LVL** (dBm) + **LOSS** (dB)
8. Determine the EIRP using the following equation:
   EIRP (dBm) = **ERP** (dBm) + 2.14 (dB)
9. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

Measurement uncertainty: +/-3.0 dB

(**Note:** Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4, 7 and 8 above are performed with test software.)

5.2 Radiated power Calculation- ERP/EIRP-



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to connect the EUT at the required channel (OR) alternatively use the EUT to set to transmit at a specific mode.
3. Measure conducted power using the power meter or the Spectrum Analyzer.
4. ERP/EIRP is calculated by adding the antenna gain to the measured conducted power.
   EIRP= Measured conducted power+ Antenna Gain (dBi)
   (Antenna gain based on measurement or data from the antenna manufacturer.)
   ERP= EIRP- 2.14

5.3 Measurement Equipment information:

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
Radio Communication Tester	CMU 200	Rohde & Schwarz	101821	May 2011	2 Years
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2011	2 Years
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	May 2011	2 Years
Loop Antenna	6512	EMCO	00049838	Aug 2011	3 years
Biconilog Antenna	3141	EMCO	0005-1186	June 2009	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035114	Mar 2012	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035111	April 2012	3 years
Horn Antenna (18-40GHz)	3116	ETS	00070497	Aug 2011	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
Power Smart Sensor	R&S	NRP-Z81	100161	May 2011	2 Years

5.4 Measurement Summary:

Band of operation	Peak Radiated Power- EIRP		Peak Radiated Power ERP	
	dBm	mW	dBm	mW
GSM 850	33.346	2160.728	31.206	1320.079
PCS 1900	31.88	1541.7	29.74	941.8896
WCDMA FDD V	25.538	357.9316	23.398	218.6754
WCDMA FDD II	29.530	897.4288	27.39	548.277
WCDMA FDD IV	29.570	905.7326	27.43	553.3501
Zigbee	0.90	1.23	-1.24	0.75

Power Density:

Band of operation	Peak Radiated Power- EIRP		Duty Cycle	Distance (R)	Power Density $(EIRP*DutyCycle)/(4\pi R^2)$	Limit	Verdict
	dBm	mW		cm	mW/cm^2	mW/cm^2	
GSM 850[1]	33.346	2160.728	25%	20	0.10752	0.55	Pass
PCS 1900[1]	31.88	1541.7	25%	20	0.076717	1.0	Pass
WCDMA FDD V	25.538	357.9316	100%	20	0.071244	0.55	Pass
WCDMA FDD II	29.530	897.4288	100%	20	0.178628	1.0	Pass
WCDMA FDD IV	29.570	905.7326	100%	20	0.180281	1.0	Pass
Zigbee	0.90	1.23	100%	20	0.000245	1.0	Pass

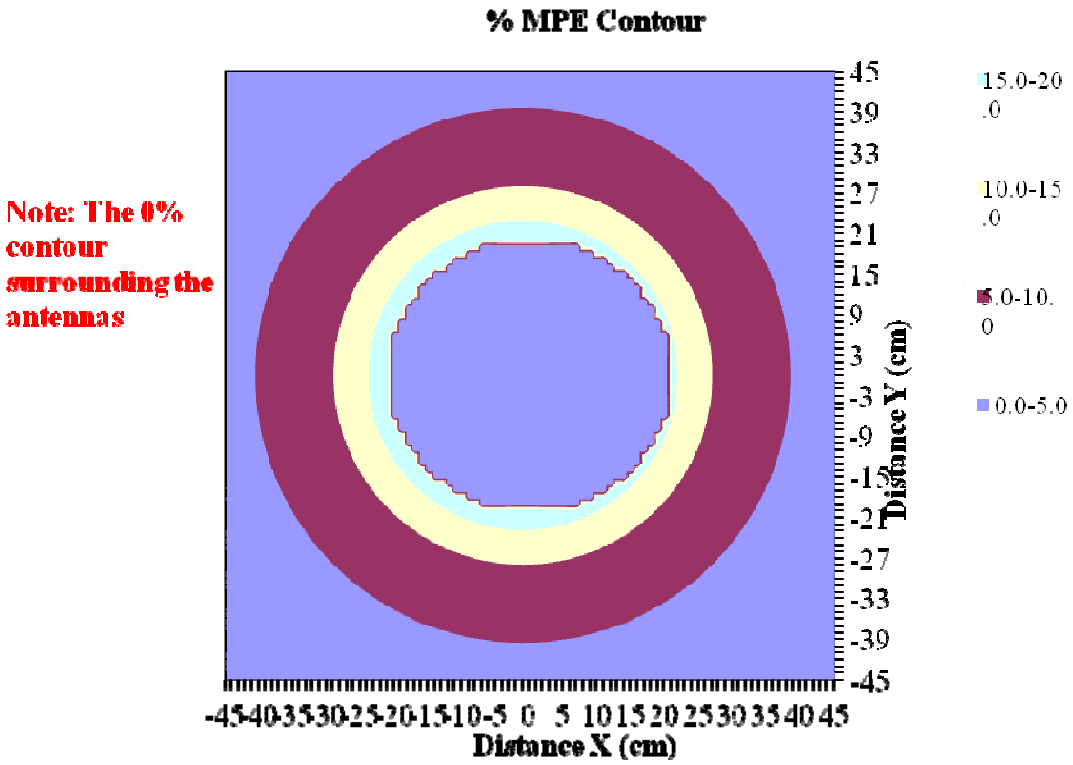
Notes:

1. GPRS Multislot Class 10 maximum duty cycle is 25%.

Prediction for Simultaneous Transmission

The MPE limit was made using a separation distance of 1 cm to represent the worse case.
Output power listed below is for 25% duty cycle in GPRS mode.

Antenna No.		Total	1	2
Tx Status			On	On
Frequency	MHz		824.4	2450
MPE Limit	mW/cm^2		0.55	1.00
Max % MPE	%	52.9	19.5	0.0
Power	(W)	1.545	0.540	0.001
Antenna Gain	dBi		0.00	0.00
EIRP	(W)	1.55	0.540	0.001
X	(cm)		-1.0	1.0
Y	(cm)		0.0	0.0
Sector			FALSE	FALSE
Arc			FALSE	FALSE
$\square_1$	degs	input	-120	-120
$\square_2$			60	60
$\square_1$		actual	-120	-120
$\square_2$			60	60



Antenna No.		Total	1	2
Tx Status			On	On
Frequency	MHz		1850.2	2450
MPE Limit	mW/cm^2		1.00	1.00
Max % MPE	%	11.7	7.7	0.0
Power	(W)	0.590	0.385	0.001
Antenna Gain	dBi		0.00	0.00
EIRP	(W)	0.59	0.385	0.001
X	(cm)		-1.0	1.0
Y	(cm)		0.0	0.0
Sector			FALSE	FALSE
Arc			FALSE	FALSE
$\square_1$	degs	input	-120	-120
$\square_2$			60	60
$\square_1$		actual	-120	-120
$\square_2$			60	60

Note: The 0% contour surrounding the antennas