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Cell Bounce
MPE REPORT

SCOPE OF WORK
MPE CALCULATION
ON THE CB34U

REPORT NUMBER
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MPE TEST REPORT

Report Number:	**104295343LEX-004**
Project Number:	**G104295343**
Report Issue Date:	**4/27/2020**
Product Name:	**CB34U**
Standards:	**FCC Part 1.1310 Limits for Maximum Permissible Exposure (MPE)** **RSS-102 Issue 5 RF Field Strength Limits for Devices Used by the General Public**

Tested by:
Intertek Testing Services NA, Inc.
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Lexington, KY 40510
USA

Client:
Cell Bounce
2055 Corte Del Nogal
Carlsbad, CA 92011
USA

Report prepared by

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Report reviewed by

Bryan Taylor,
Team Leader

Table of Contents

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
10	FCC Part 1.1310 Limits for Maximum Permissible Exposure (MPE) (Limits for General Population / Uncontrolled Exposure)	Pass
	RSS-102 Issue 5 RF Field Strength Limits (For Devices Used by the General Public)	Pass

3 Client Information

This product was tested at the request of the following:

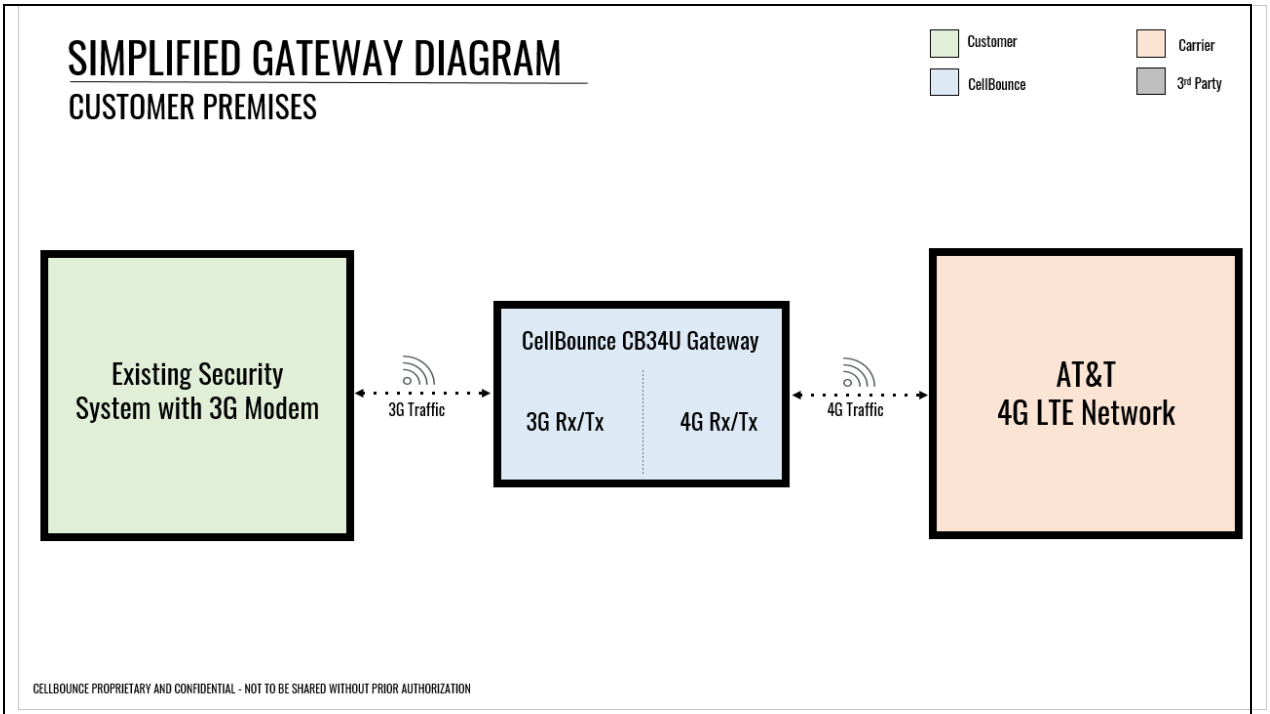
Client Information	
Client Name:	Cell Bounce
Address:	2055 Corte Del Nogal Carlsbad, CA 92011 USA
Contact:	Gary Hu
Telephone:	+1 469 939 7899
Email:	Gary@cellbounce.com
Manufacturer Information	
Manufacturer Name:	Cell Bounce
Manufacturer Address:	2055 Corte Del Nogal Carlsbad, CA 92011 USA

4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	CB34U
Model Number	CellBounce Gateway/CB34U
Hardware Version	CB34UHW01
Software Version	CB34UR01S
Supported Transmit Bands	LTE Bands: 2, 4, 12 (uplink) 3G (UMTS) Bands: 2, 5 (downlink)
Embedded Module	SARA-R410M
Module HW Version	306A06
Module SW Version	L0.0.00.00.06.10
FCCID	XPY2AGQN4NNN
Receive Date	4/08/2020
Test Start Date	4/13/2020
Test End Date	4/22/2020
Device Received Condition	Good
Test Sample Type	Production
Rated Voltage	120Vac 60Hz (12VDC Nominal)

Description of Equipment Under Test (provided by client)

The Alarm Panel industry is facing a major challenge: As carriers retire their 3G networks the numerous existing 3G Alarm Panels will no longer be able to connect to a carrier network. CellBounce's cellular experts and engineers have developed patent-pending technology specifically designed to keep 3G Alarm Panels connected through future network changes, with no technician required.
The CB34U Gateway is a complete RF-to-bits-to-RF gateway, providing a seamless 3G UMTS to 4G LTE connection between an existing 3G Alarm Panel and the carrier's 4G network. The Gateway is simple to activate and can be installed in minutes by the homeowner. The Gateway's simple installation eliminates the need for the Alarm Monitoring company to upgrade or modify the Alarm Panel, or even visit the residence.
The CB34U Gateway establishes a private network between itself and the 3G Alarm Panel—all carrier core network functions are emulated within the CB34U Gateway. Authentication of the 3G Panel is via a dedicated APN to a 3G Authentication Gateway hosted by AT&T.



How It Works:
The CB34U Gateway employs an embedded 3G femto base station which connects to a customer's existing 3G Alarm Panel modem. The femto base station attaches only to the Alarm Panel's programmed whitelist IMEI. The 3G RF power link is significantly reduced as to not interfere with new services on B2 & B5 LTE bands. The femto base station supports TR-069 for remote management allowing auto-configuration and monitoring after deployment.
The 4G LTE modem provides connectivity to the 3G femto base station and embedded controller. The 3G femto base station is always on, listening for an attach request from the Alarm Panel. Upon request, the 3G Alarm Panel is attached, authenticated and allowed to connect to the 4G network. Bi-directional data traffic is transferred between the Alarm Panel and monitoring location; no encryption is performed. Voice traffic is established as a Voice over LTE (VoLTE) service.
Installation requires the customer to place the CB34U Gateway within 50 feet of their Alarm Panel. The customer plugs the gateway power adapter into a common household outlet, per UL standards. The gateway then automatically begins the boot up sequence. Several minutes are required for the 4G modem to register on a carrier network, followed by the Alarm panel registering with the 3G femto base station.
The CB34U Gateway's LED indicators for power, 3G connectivity, and 4G connectivity are established.

4.1 Variant Models:
There were no variant models covered by this evaluation.

5 Antenna Gains:

The Antenna used was manufactured by 2J antennas (part number 2JE18). This antenna is used for both the UMTS radio and LTE radio that is incorporated into the EUT. The gain specifications for this antenna are shown below:

Parameters	CELLULAR / LTE Antenna		
Standards	2G,3G and 4G		
Band (MHz)	700/850/900	1700/1800/1900/2100	2600
Frequency (MHz)	698-960	1710-2170	2500-2700
Return Loss (dB)	~-6.6	~-15.5	~-12.6
VSWR	~2.8:1	~1.5:1	~1.7:1
Efficiency (%)	~54.8	~67.5	~70.1
Peak Gain (dBi)	~1.2	~4.1	~4.2
Average Gain (dB)	~-2.6	~-1.7	~-1.5
Impendance (Ohm)	50		
Polarisation	Linear		
Radiation Pattern	Omni-Directional		
Max. Input Power (W)	25		

Antenna Measurement Conditions:

Mounted on ground plane of 120 x 40.4 mm

Measured in Certified CTIA 3D Anechoic Chamber

6 Output Power:

The maximum output power used for the MPE calculations (23dBm) for the LTE module was taken from the module specification sheet and is shown below:

Item	SARA-R404M	SARA-R410M
Protocol stack	3GPP Release 13	3GPP Release 13
RAT	LTE Cat M1 Half-Duplex	LTE Cat M1 Half-Duplex LTE Cat NB1 Half-Duplex [2, 4, 5, 7]
LTE FDD bands	Band 13 (750 MHz)	Band 1 (2100 MHz) [2, 5] Band 2 (1900 MHz) [7] Band 3 (1800 MHz) [2, 5] Band 4 (1700 MHz) [7] Band 5 (850 MHz) Band 8 (900 MHz) [2, 5] Band 12 (700 MHz) [7] Band 13 (750 MHz) [2, 7] Band 18 (850 MHz) [2, 4, 5, 7] Band 19 (850 MHz) [2, 4, 5] Band 20 (800 MHz) [2, 5, 7] Band 25 (1900 MHz) [2, 3, 4, 5, 6, 7] Band 26 (850 MHz) [2, 4, 5] Band 28 (700 MHz) [2, 5, 7]
2G bands		
Power class	LTE Cat M1: Class 3 (23 dBm)	LTE Cat M1 / NB1 [9]: Class 3 (23 dBm)

The CB34U incorporates SARA-R410M.

The device also includes a 3G transmitter on the device with a maximum output power of -4.5 dBm (including tolerance) according to the client.

7 FCC Limits

§ 1.1310: The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Part 1.1310 Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

8 RSS-102 Issue 5 Exposure Limits:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142\ f^{0.3417}$	$0.008335\ f^{0.3417}$	$0.02619\ f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158\ f^{0.5}$	$4.21 \times 10^{-4}\ f^{0.5}$	$6.67 \times 10^{-5}\ f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
* Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

9 Test Procedure

An MPE evaluation for was performed in order to show that the device was compliant with the general population exposure limits from FCC §2.1091 and RSS-102 Issue 5. The maximum power density was calculated for each transmitter band at a separation distance of 20cm using the maximum declared output power including tune up tolerance.

For each transmitter the maximum RF exposure at a 20 cm distance using the formula:

$$ConductedPower_{mW} = 10^{ConductedPower(dBm)/10}$$

$$PowerDensity = \frac{ConductedPower_{mW} \times Ant.Gain}{4\pi \times (20_{cm})^2}$$

For transmitters that could operate simultaneously, the MPE to limit ratio for each was calculated and then summed. If the sum of the MPE to limit ratios was less than 1, that specific combination of transmitters was deemed to comply.

10 Results:

The calculated maximum power density at 20cm distance was equal to or less than the required limits for general population exposure for FCC Part 1.1310, and RSS-102 Issue 5

FCC MPE Data

Duty Cycle	100 (%)							
Separation Dist.	20 (cm)							
Operating Mode	Frequecy (MHz)	Declared Max Cond. Power (Inc. Tolerance) (dBm)	Duty Cycle Adjusted Cond. Output Power (dBm)	Antenna Gain (dB)	MPE Value (mW/cm^2)	MPE Limit (mW/cm^2)	Margin to Limit (mW/cm^2)	MPE / Limit Ratio (for Co-Location)
UMTS Band 2	1932	-4.5	-4.5	4.1	0.0002	1.00	0.9998	0.0002
UMTS Band 5	871	-4.5	-4.5	1.2	0.0001	0.58	0.5806	0.0002
LTE Band 2	1850	23	23	4.1	0.1020	1.00	0.8980	0.1020
LTE Band 4	1710	23	23	1.2	0.0523	1.00	0.9477	0.0523
LTE Band 12	699	23	23	1.2	0.0523	0.47	0.4137	0.1123

The worst case simultaneous transmission scenario is UMTS Band 2, and LTE Band 12 transmitting simultaneously. The co-location calculation is as follows:

0.0002 + 0.1123 = 0.1125 < 1

Since the combined MPE/limit value is less than 1, the device is deemed to comply with simultaneous transmission requirements.

RSS-102 Issue 5 MPE Data

Duty Cycle	100 (%)							
Separation Dist.	20 (cm)							
Operating Mode	Frequecy (MHz)	Declared Max Cond. Power (Inc. Tolerance) (dBm)	Duty Cycle Adjusted Cond. Output Power (dBm)	Antenna Gain (dBi)	MPE Value (W/m^2)	MPE Limit (W/m^2)	Margin to Limit (W/m^2)	MPE / Limit Ratio (for Co-Location)
UMTS Band 2	1932	-4.5	-4.5	4.1	0.0018	4.61	4.6092	0.000393
UMTS Band 5	871	-4.5	-4.5	1.2	0.0009	2.68	2.6742	0.000348
LTE Band 2	1850	23	23	4.1	1.0203	4.48	3.4560	0.227934
LTE Band 4	1710	23	23	1.2	0.5233	4.24	3.7187	0.123357
LTE Band 12	699	23	23	1.2	0.5233	2.30	1.7784	0.227342

The worst case simultaneous transmission scenario is UMTS Band 2, and LTE Band 12 transmitting simultaneously. The co-location calculation is as follows:

0.000393 + 0.227342 = 0.227735 < 1

Since the combined MPE/limit value is less than 1, the device is deemed to comply with simultaneous transmission requirements.

11 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	4/27/2020	104295343LEX-004	BN	BCT	Original Issue