Electromagnetic Compatibility Test Report

Prepared in accordance with

FCC Part 15C, RSS-210 Issue 8 and ANSI C63.10

On

Active RFID Tag

P400

OMNI-ID
1200 Ridgeway Avenue
Rochester, NY 14615

Prepared by:

TUV Rheinland of North America, Inc.

MANUFACTURERS STATEMENT

Omni-ID®
Identify with innovation

Manufacturer's statement - attestation

The manufacturer; Omni-ID, as the responsible party for the equipment tested, hereby affirms:

a) That he has reviewed and concurs that the test shown in this report are reflective of the operational characteristics of the device for which certification is sought;

b) That the device in this test report will be representative of production units;

c) That all changes (in hardware and software/firmware) to the subject device will be reviewed.

d) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving (certifying) the subject equipment.

Ed Nabrotzky Printed name of official	 Signature of official
1200 Ridgeway Ave **Suite 106** **Rochester, NY 14615** Address	16 MAY 2013 Date
(585) 697-9913 Telephone number	ed.nabrotzky@omni-id.com Email address of official

Client:	OMNI-ID 1200 Ridgeway Avenue Rochester, NY 14615	Contact: Tel: Fax: e-mail	Len Desmond 585-713-1021 len.desmond@omni-id.com
Identification:	Active RFID Tag	***Serial No.:***	0D25 0103 1000 1610
Test item:	Model P400	***Date Test Completed:***	8/30/2014
Testing location:	TUV Rheinland of North America 336 Initiative Drive Rochester, NY 14624-6217 U.S.A.	Tel: (585) 426-5555 Fax: 585-568-8338	
Test specification:	Emissions: FCC Part 15.231 Radiated Emissions Std FCC Part 15.209 and RSS - 210 Issue 8, FCC Part 15.231(b) and RSS - 210 Issue 8, FCC Part 15.231(c) and RSS - 210 Issue 8		
Test Result:	**The above product was found to be Compliant to the above test standard(s)**		

tested by: Randall Masline	***reviewed by:*** Cecil Gittens
11 August 2014 — Randall E Masline	11 August 2014 — Cecil Gittens
Date ***Name*** ***Signature***	***Date*** ***Name*** ***Signature***
Other Aspects:	**None**

Abbreviations: OK, Pass, Compliant, Complies = passed
Fail, Not Compliant, Does Not Comply = failed
N/A = not applicable

FC	ilac-MRA A2LA ACCREDITED	**Industry Canada**	**VCCI**	**BSMI**
US5253	**Testing Cert.# 3331.04**	**3466C-1**	**A-0037**	**SL2-IN-E-050R**

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1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Part 15C, RSS-210 Issue 8 and ANSI C63.10 based on the results of testing performed on 8/30/2014 on the Active RFID Tag, Model Number. P400, manufactured by OMNI-ID. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the performance of the EUT (Equipment Under Test) in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 *Summary of Test Results*

Applicant	OMNI-ID 1200 Ridgeway Avenue Rochester, NY 14615	**Tel**	585-713-1021	**Contact**	Len Desmond
		Fax		**e-mail**	len.desmond@omni-id.com

Description	Active RFID Tag	**Model Number**	P400
Serial Number	0D25 0103 1000 1610	**Test Voltage/Freq.**	3.0 VDC Battery
Test Date Completed:	8/30/2014	**Test Engineer**	Randall Masline

Standards	Description	Severity Level or Limit	Measured	Test Result
FCC Part 15 subpart C Standard	Radio Frequency Devices - Subpart C: Intentional Radiators	See called out parts below	See Below	Complies
RSS-210 Issue 8 Standard	Licence-exempt Radio Apparatus (All Fequency Bands): Category 1 Equipment	See called out parts below	See Below	Complies
FCC Part 15.231	Periodic operation in the band 260 Mhz to 470 Mhz	See Basic Standards Below	See Below	**Complies**
FCC Part 15.209 and RSS - 210 Issue 8	Radiated Emissions	Class B, 30 - 1000 MHz Spurious up to 2500 Mhz	Limit	**Complies**
FCC Part 15.231(a)	Deactivation of Transmitter	5 Seconds, 433 MHz	Within 5 seconds	**NA**
FCC Part 15.231(b) and RSS - 210 Issue 8	Field Strength of Fundamental and Spurious Emissions	15.231(b) Table Limit is 80.8 dBuV at 433 MHz without Duty Cycle Correction Factor 120.8 dBuV with Duty Cycle Correction Factor	63.34 dBuV Field Strength of Fundamental	**Complies**
FCC Part 15.231(c) and RSS - 210 Issue 8	Bandwidth	Part 15.231(c) 1082.5 kHz RSS – 210 99% BW	496.9 kHz 424.8 kHz	**Complies**

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at, 336 Initiative Drive, Rochester, NY 14624-6217 is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90575). The laboratory scope of accreditation includes: Title 47 CFR Part 15, and 18. The accreditation is updated every 3 years.

2.1.2 A2LA

This is a program which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Standard 17025:2005 (Lab code: 134287). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 VCCI

VCCI Accredited test lab. Registration numbers A-0037, R-3673, C-4113, C-4114, C-4115, T-1158, T-1159 G429.

2.1.4 Industry Canada

(Registration No.: 3466C-1) The OATS has been accepted by Industry Canada to perform testing to 3 and to 10m, based on the test procedures described in ANSI C63.4-2009.

2.1.5 BSMI

Registration No.: SL2-IN-E-050R. The BSMI accreditation was obtained by NIST MRA with the BSMI.

2.1.6 Korea

Recognized by Radio Research Agency as an accredited Conformity Assessment Body (CAB) under the terms of Phase I of the APEC TEL.

2.1.7 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.2 Measurement Uncertainty Emissions

	U_{lab}	U_{cispr}
Radiated Disturbance @ 10m		
30 MHz – 1,000 MHz	4.57 dB	5.2 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	2.62 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	3.88 dB	4.5 dB

2.3 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

2.4 Measurement Equipment Used

Equipment	Manufacturer	Model #	Ref.	Serial #	Last Cal dd/mm/yy	Next Cal dd/mm/yy	Test
Radiated Emissions							
Horn	EMCO	3115	C031	9812-5635	23-Mar 12	23-Mar 14	RE
BiLog	Chase	CBL6111	C041	1170	12-Sept-12	12-Sept-14	RE
Analyzer w RF Filter Section 85460A	HP	8546A		3325A00134	11-Sept-12	27-Aug-14	RE
Receiver (20Hz-40GHz)	Rohde & Schwarz	ESI(B) 40	C320	839283/005	13-Sept-12	28-Aug-14	RE
Multimeter	Fluke	83	C437	48162892	13-Sept-12	27-Aug-14	RE
Amplifier (1-26.5 GHz.)	Agilent	8449B	C438	3008A01842	7-Nov-11	5-Jul-15	RE
BiLog	Chase	CBL6111B	C448	2081	22-Feb-12	22-Feb-14	RE
Pressure/Temperature/RH	Extech	SD700	C482	Q668892	3-Oct-12	3-Oct-13	RE
General Laboratory Equipment							
Multimeter	Fluke	87	C445	59890224	13-Sept-12	27-Aug-14	
Multimeter	Fluke	8062A	C452	4715199	13-Sept-12	27-Aug-14	
Pressure/Temperature/RH	Extech	SD700	C481	Q668884	3-Oct-12	3-Oct-13	

3 Product Information

3.1 Equipment Modifications

No modifications were needed to bring product into compliance.

3.2 Test Plan

The EUT product information, test configuration, mode of operation, test types, test procedures, test levels, pass/failure criteria, in this report were carried out per the product test plan located in appendix A of this report.

The Active tag operates with an internal 3.0 DC Battery at 433.272 MHz and transmits 0nce every 3 seconds for duration of 1.2ms.

Figure 1 – External Photo of EUT - Active Tag

4 Emissions

4.1 Radiated Emissions

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT and may affect the performance of other nearby electronic equipment.

4.1.1 Over View of Test

Results	**Complies** (as tested per this report)					**Date**	8/29/2013
Standard	FCC Part 15.209 and RSS - 210 Issue 8						
Product Model	P400			**Serial#**	0D25 0103 1000 1610		
Configuration	See test plan for details						
Test Set-up	Tested at 10m O.A.T.S. placed on turn-table at 3 meters, see test plans for details						
EUT Powered By	3.0 VDC Battery	**Temp**	24ºC	**Humidity**	52%	**Pressure**	1013mbar
Frequency Range	30 - 1000 MHz @ 3m Spurious emissions to 2500 Mhz						
Perf. Criteria	Class B. (Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Randall Masline		

4.1.2 Test Procedure

Radiated FCC emissions tests were performed using the procedures of ANSI C63.4 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration. Further radiated emission tests were performed per the procedures stated in the other emissions standards listed in this report.

The frequency range from 30 - 1000 MHz was investigated for radiated emissions.

Radiated emission testing was first performed at a distance of 3 meters in the semi-anechoic chamber in order to identify the specific frequencies for which these measurements will be made on the 10 m OATS, at a distance of 3 meters.

4.1.3 Deviations

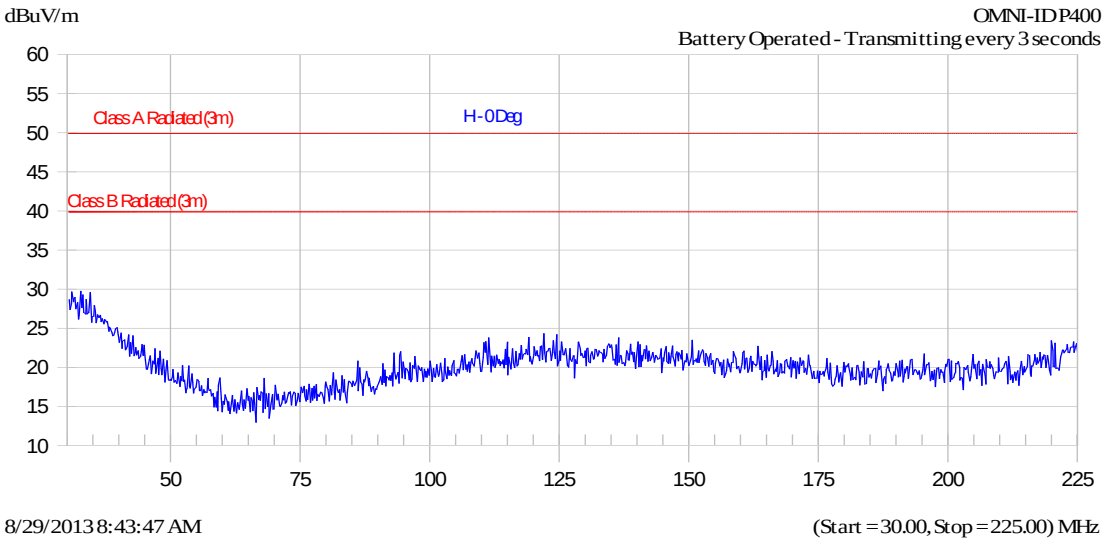
There were no deviations from the test methodology listed in the test plan for the radiated emission test.

4.1.4 Radiated Emission Graphs

NOTES:

Radiated Emissions
Vertical / Horizontal

H - 0 Deg

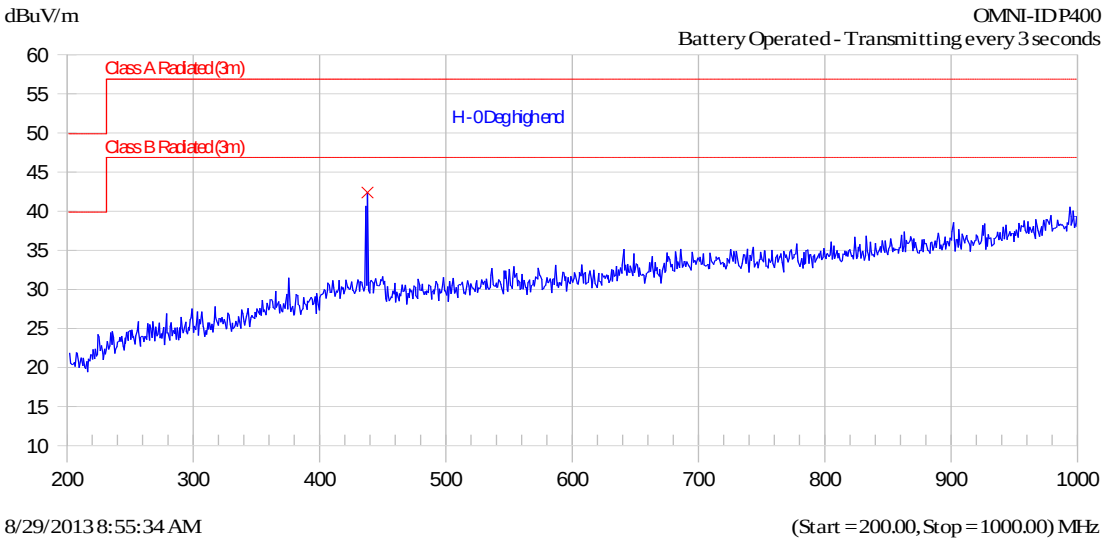


Frequency	Peak	QP	Class B-QP	Class A-QP	Trace Name
MHz	dBuV/m	dBuV/m	dB	dB	

NOTES:

Radiated Emissions
Vertical / Horizontal

H - 0 Deg high end

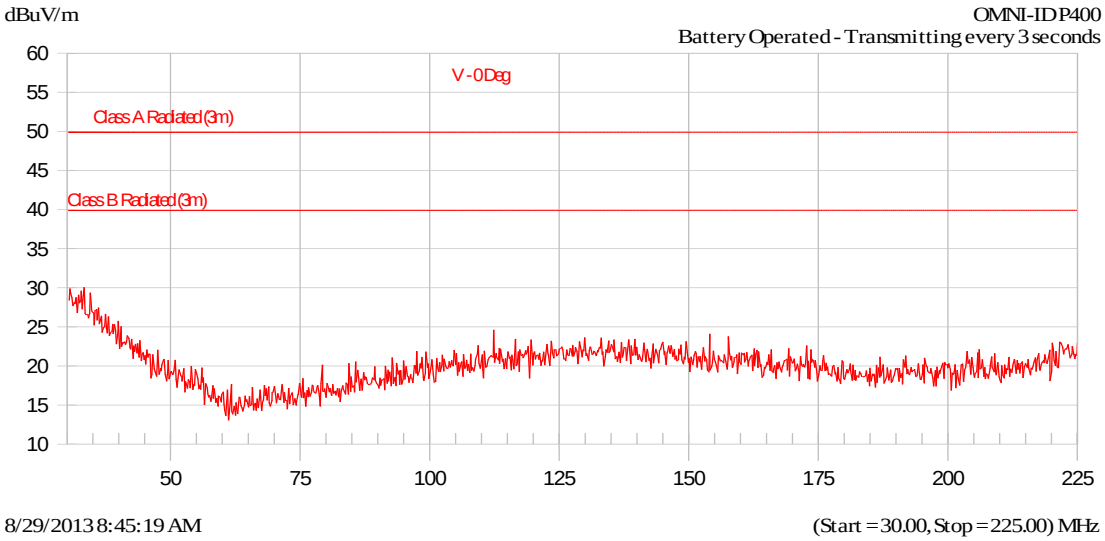


Frequency	Peak	QP	Class B-QP	Class A-QP	Trace Name
MHz	dBuV/m	dBuV/m	dB	dB	
436.516	42.5				H - 0 Deg high end Fundamental Carrier Frequency

NOTES:

Radiated Emissions
Vertical / Horizontal

V - 0 Deg

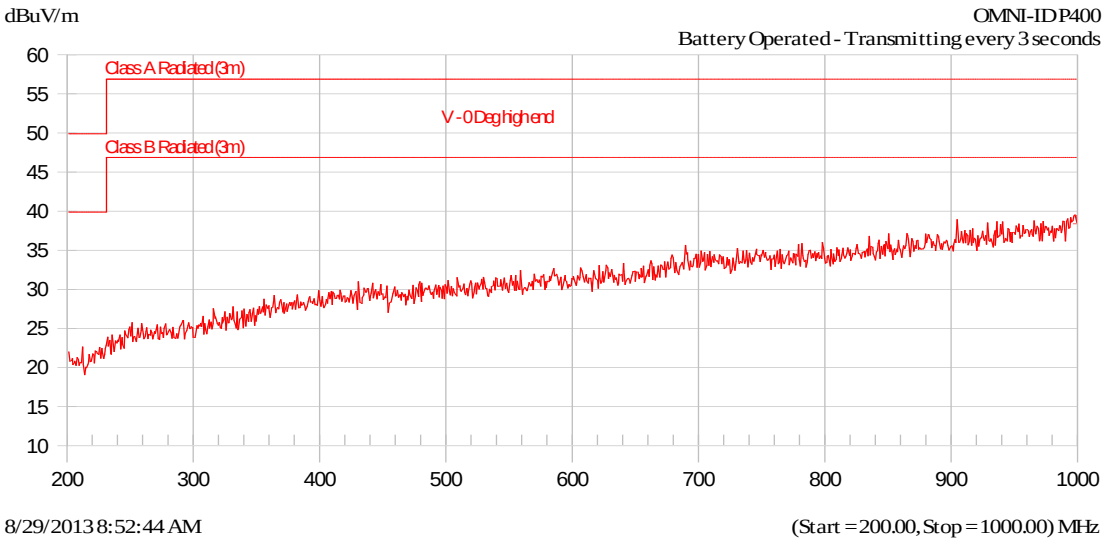


Frequency	Peak	QP	Class B-QP	Class A-QP	Trace Name
MHz	dBuV/m	dBuV/m	dB	dB	

NOTES:

Radiated Emissions
Vertical / Horizontal

V - 0 Deg high end



Frequency	Peak	QP	Class B-QP	Class A-QP	Trace Name
MHz	dBuV/m	dBuV/m	dB	dB	

4.2 Deactivation of Transmitter

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

4.2.1 Over View of Test

Results	**NA** (as tested per this report)					**Date**	
Standard	FCC Part 15.231(a)						
Product Model	P400			**Serial#**	0D25 0103 1000 1610		
Configuration	See test plan for details						
Test Set-up	Tested in anechoic chamber EUT placed on table see test plans for details						
EUT Powered By	3.0 VDC Battery	**Temp**	º C	**Humidity**	%	**Pressure**	mbar
Frequency Range	433 MHz						
Perf. Criteria	5 Seconds (Below Limit)	**Perf. Verification**					
Mod. to EUT	None	**Test Performed By**	Randall Masline				

4.2.2 Test Procedure

Testing was not performed. The EUT does not employ a manual switch – in normal operation of the device the active tag transmits once every 6 hours for a duration of 1.7ms for each transmission.

4.2.3 Deviations

There were no deviations from the test methodology listed in the test plan for the conducted emission test.

4.2.4 Final Test

All final measurements were below (in compliance) the limits.

Testing was not performed. The EUT does not employ a manual switch – in normal operation of the device the active tag transmits once every 6 hours for a duration of 1.3ms for each transmission.

4.3 Fundamental Field Strength and Harmonic Emissions

This test evaluates the field strength of the fundamental and field strength of the spurious emissions.

4.3.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	8/29/2013
Standard	FCC Part 15.231(b) and RSS - 210 Issue 8						
Product Model	P400			**Serial#**	0D25 0103 1000 1610		
Configuration	See test plan for details						
Test Set-up	Tested in anechoic chamber EUT placed on table See test plan for details						
EUT Powered By	3.0 VDC Battery	**Temp**	21º C	**Humidity**	48%	**Pressure**	1021mbar
Perf. Criteria	15.231(b) Table (Below Limit)		**Perf. Verification**		Readings under Limit		
Mod to EUT	None		**Test Performed By**		Randall Masline		

4.3.2 Test Procedure

The EUT was placed on a table 3 meters from the antenna and all 3 orthogonal positions were investigated for highest field strength and highest spurious emissions. The fundamental frequency of the EUT is 433 MHz, therefore in addition to the requirements of 15.205 the EUT was tested to meet the following requirements in 15.231(b). The highest emissions were taken with the EUT on its side with the barcode facing the antenna,

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	\1\ 1,250 to 3,750	\1\ 125 to 375
174-260	3,750	375
260-470	\1\ 3,750 to 12,500.	\1\ 375 to 1,250
Above 470	12,500	1,250

4.3.3 Deviations

There were no deviations from the test methodology listed in the test plan for the harmonic current emissions test.

4.3.4 Final Test

All final measurements were below (in compliance) the limits.

4.3.5 Final Data

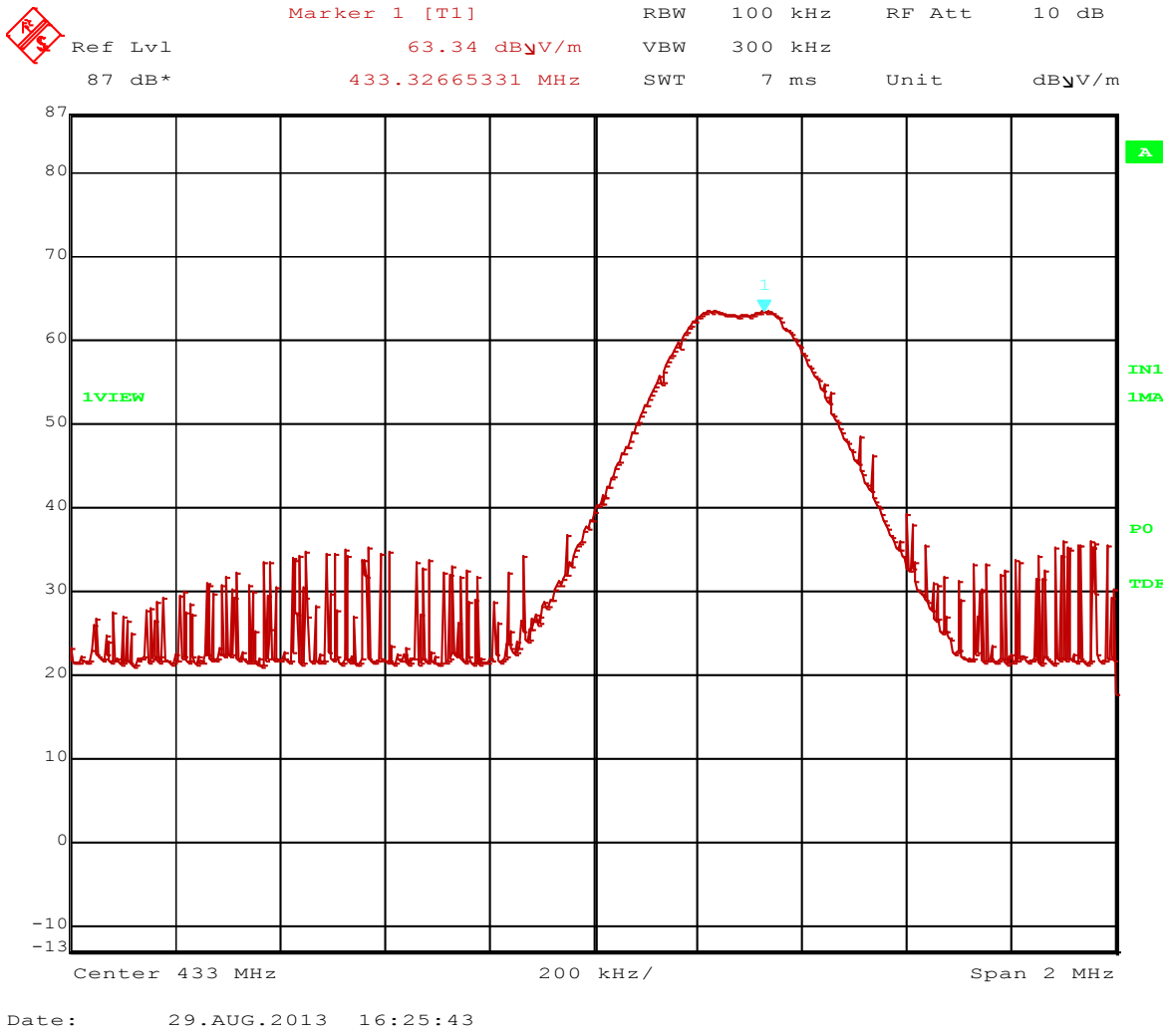


Figure 2 – Peak Field Strength is 63.34 dBuV at 3 meters, limit is 80.8 dBuV at 433 MHz

The Duty Cycle is 1.2% therefore the duty cycle correction factor is as follows

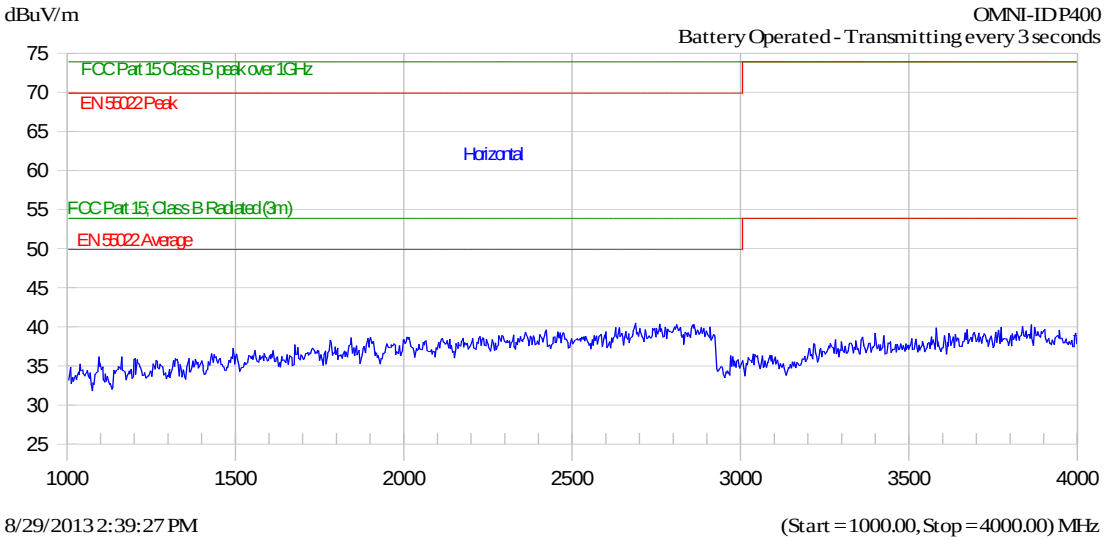
20 log(1.2) = 15.6 dB

Increasing the Peak limit from 80.8 dBuV to = 96.4 dBuV

NOTES:

Radiated Emissions
Vertical / Horizontal

Horizontal



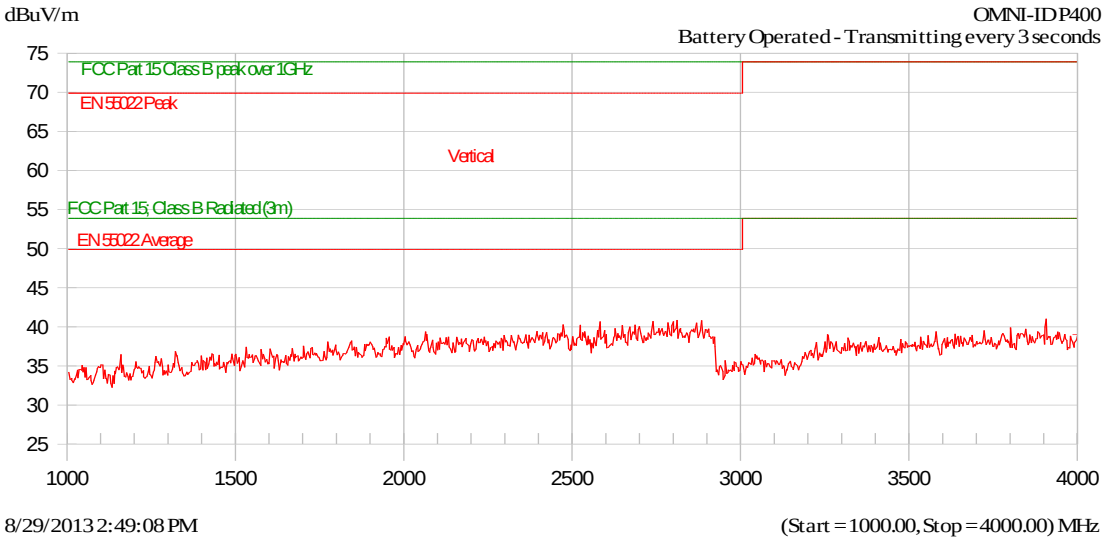
Frequency	Peak	Avg	EN 55022 Avg-Limit	FCC Avg-Limit	Trace Name
MHz	dBuV/m	dBuV/m	dB	dB	

Figure 3 – Spurious Emissions (Horizontal) 1 to 4 GHz

NOTES:

Radiated Emissions
Vertical / Horizontal

Vertical



Frequency	Peak	Avg	EN 55022 Avg-Limit	FCC Avg-Limit	Trace Name
MHz	dBuV/m	dBuV/m	dB	dB	

Figure 4 – Spurious Emissions (Vertical) 1 to 4 GHz

4.4 Bandwidth

This test measures the Bandwidth of the fundamental emission.

4.4.1 Test Over View

Results	**Complies** (as tested per this report)				**Date**	8/29/2013	
Standard	FCC Part 15.231(c) and RSS - 210 Issue 8						
Product Model	P400		**Serial#**	0D25 0103 1000 1610			
Configuration	See test plan for details						
Test Set-up	Tested in an anechoic chamber EUT placed on table See test plan for details						
EUT Powered By	3.0 VDC Battery	**Temp**	21º C	**Humidity**	48%	**Pressure**	1021mbar
Perf. Criteria	Part 15.231(c) (Below Limit)		**Perf. Verification**	Readings under Limit			
Mod to EUT	None		**Test Performed By**	Randall Masline			

4.4.2 Test Procedure

Bandwidth measurements were made according to FCC part 15.31 and FCC part 15.231(c). For Industry Canada the bandwidth measurements were made in accordance with RSS – 210 Issue 8

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points
20 dB down from the modulated carrier.

The Fundamental Frequency is 433 MHz therefore 0.25% of 433 MHz is 1082.5 khz

4.4.3 Deviations

There were no deviations from the test methodology.

4.4.4 Final Test

All final measurements were within (in compliance) the limits.

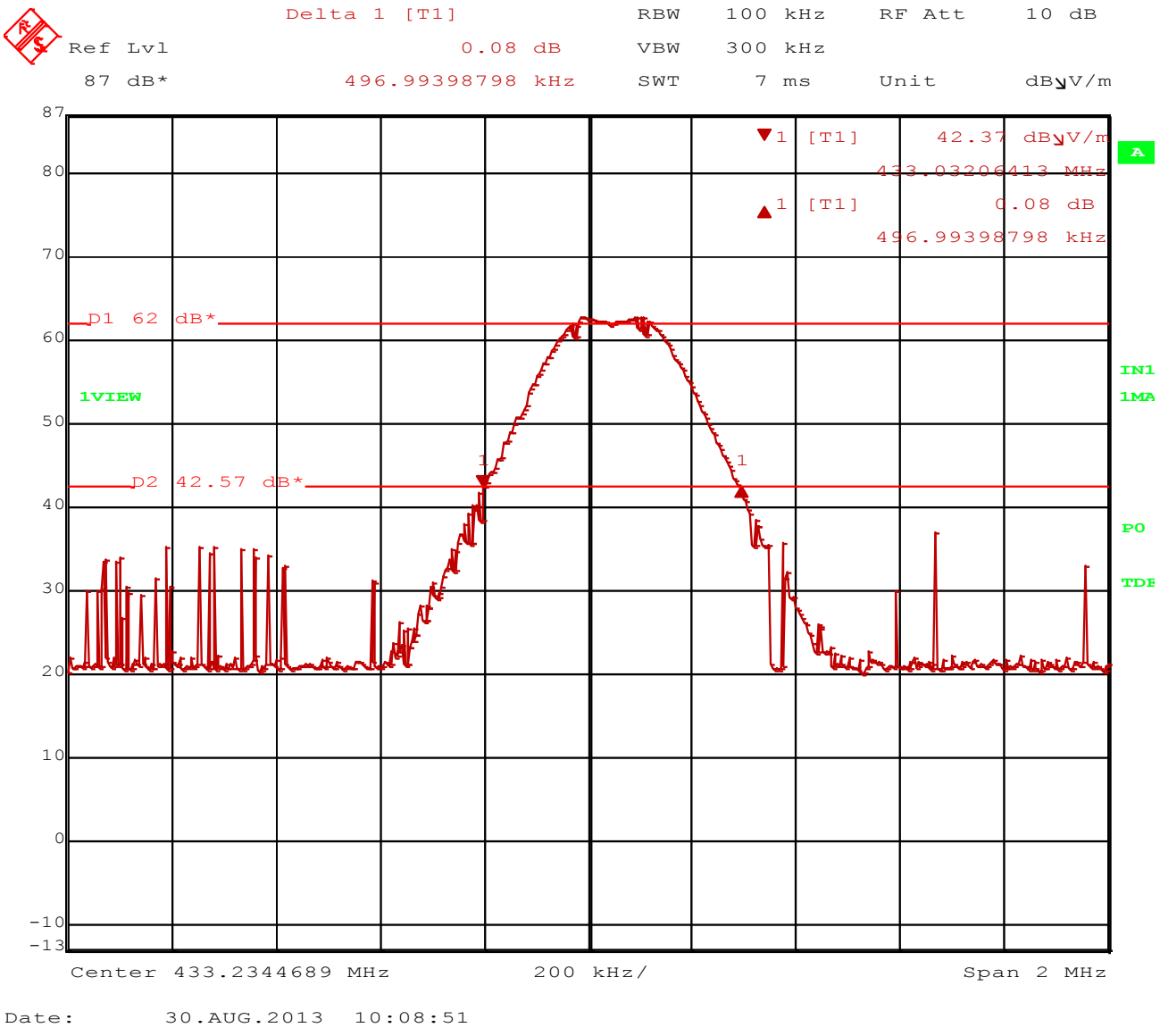


Figure 5 – 20 dB Bandwidth is 496.9 kHz

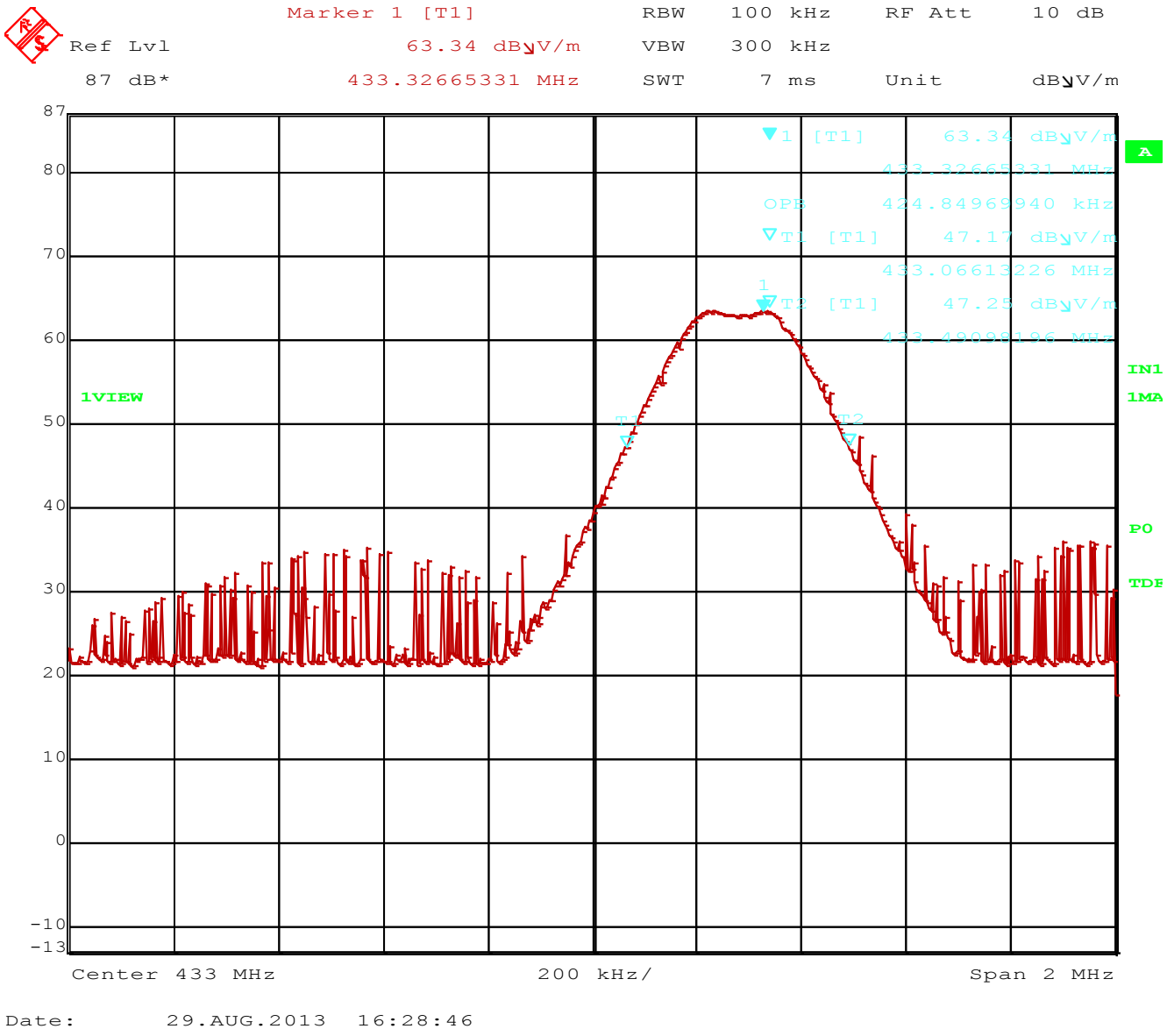


Figure 6 – 99% BW is 424.8 kHz

4.5 RF Exposure Measurement (Mobile Device) (i)

4.5.1 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.

4.5.2 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)

TABLE 1—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

F = Frequency in MHz

4.5.3 EUT Operating condition

The software provided by Manufacturer enabled the EUT to transmit data at highest channel.

4.5.4 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. Therefore, this device is classified as a **Mobile Device**.

4.5.5 Test Results

4.5.5.1 Antenna Gain

The maximum Gain measured in Semi-Anechoic Chamber is 0 dBi or 1 (numeric).

4.5.5.2 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 = 0.288 mW/cm^2

Highest Pout is 0.04uW, highest antenna gain (in linear scale) is 1, and R is 20cm.

Pd = $(0.04*1) / (4*\pi*20^2)$ = 0.00079 **mW/cm^2**, which is 0.0280 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).

4.5.6 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

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

Appendix A

5 Test Plan

This test report is intended to follow this test plan outlined here in unless other wise stated in this here report. The following test plan will give details on product information, standards to be used, test set ups and refer to TUV test procedures. The test procedures will give the steps to be taken when performing the stated test. The product information below came via client, product manual, product itself and or the internet.

5.1 General Information

Client	OMNI-ID
Address 1	1200 Ridgeway Avenue
Address 2	Rochester, NY 14615
Contact Person	Len Desmond
Telephone	585-713-1021
Fax	
e-mail	len.desmond@omni-id.com

5.2 Model(s) Name

P400

5.3 Type of Product

Active RFID Tag

5.4 Equipment Under Test (EUT) Description

The OMNIP400 RFID tag is powered by a 3V Lithium ion primary battery and is designed to tag materials and equipment in the industrial, oil & gas and manufacturing industries. The usage environments are industrial factories, warehouses and commercial locations. The transmitter will communicate with a gateway device to exchange presence and location information between the tag and the back end process control system

5.5 Modifications

No modifications were necessary to meet the requirements.

5.6 Product Environment

☒	**Residential**	☐	**Hospital**
☒	**Light Industrial**	☐	**Small Clinic**
☐	**Industrial**	☐	**Doctor's office**
☐	**Other**		

*Check all that apply

5.7 Countries

☒	**USA**
☒	**Canada**

*Check all that apply

5.8 Applicable Documents

Standards	Description
FCC Part 15.231	Periodic operation in the band 260 Mhz to 470 Mhz
FCC Part 15.209 and RSS - 210 Issue 8	Radiated Emissions
FCC Part 15.231(a)	Deactivation of Transmitter
FCC Part 15.231(b) and RSS - 210 Issue 8	Field Strength of Fundamental and Sourious Emissions
FCC Part 15.231(c) and RSS - 210 Issue 8	Bandwidth

5.9 General Product Information

Size	**H**	3cm	**W**	3.5cm	**L**	12cm	
Weight	<1kg		**Fork-Lift Needed**		No		
Notes							

5.10 EUT Electrical Powered Information

5.10.1 Electrical Power Type

☐	**AC**	☐	**DC**	☒	**Batteries**	☐	**Host -**

5.10.2 Electrical Power Information

Name	**Type**	**Voltage**		**Frequency**	**Current**	**Notes**
		min	**max**			
Battery	DC	1.2	3.5	DC		
Notes						

5.11 EUT Modes of Operation

Continuously transmitter at fundamental frequency, for testing purposes only. Normal mode is to transmit every 3 seconds for 1.2ms.