



UL LLC  
333 Pfingsten Rd.  
Northbrook, IL 60062

[www.ul.com/emc](http://www.ul.com/emc)  
(847) 272-8800

Order Number:	10343507A
Date:	August 14, 2014
Model:	IWL252
FCC ID	XKB-IWLTBB
IC	2586D-IWLTBB

# Electromagnetic Compatibility Test Report

For

**Ingenico**

**Copyright © 2012 UL LLC**

UL LLC authorizes the above-named company to reproduce this Report provided it is reproduced in its entirety.

Order Number: 10343507A  
Model Number: IWL252  
Client Name: Ingenico

FCC ID: XKB-IWLTBB  
IC: 2586D-IWLTBB

Page 2 of 40

## Test Report Details

Tests Performed By: **UL LLC**  
**333 Pfingsten Rd.**  
**Northbrook, IL 60062**

Tests Performed For: **Ingenico SA**  
**9, Avenue de la gare**  
**Rovaltain TGV**  
**26958 Valence Cedex 9 - France**

Applicant Contact: **Nicolas Jacquemont**  
Phone: **33 (0)1 58 01 80 00**  
E-mail: [nicolas.jacquemont@ingenico.com](mailto:nicolas.jacquemont@ingenico.com)

Test Report Date: **August 14, 2014**

Product Type: **Transmitter**

Product standards **FCC Part 15, RSS-210, RSS-GEN**

Model Number: **IWL252**  
FCC ID **XKB-IWLTBB**  
ID **2586D-IWLTBB**

Sample Serial Number: **N/A**

EUT Category: **RFID**

Testing Start Date: **June 1, 2014**

Date Testing Complete: **August 14, 2014**

**Overall Results: Compliant**

UL LLC reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL LLC shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL LLC issued reports. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

This report may contain test results that are not covered by the NVLAP or A2LA accreditation. The scope of accreditation is limited to the specific tests that are listed on the NVLAP and/or A2LA websites referenced at the end of this report.

## Report Directory

1.0	GENERAL - Product Description .....	4
1.1	Equipment Description .....	4
1.2	Equipment Marking Plate .....	4
1.3	Device Configuration During Test .....	5
1.3.1	Equipment Used During Test: .....	5
1.3.2	Input/Output Ports: .....	5
1.3.3	EUT Internal Operating Frequencies: .....	6
1.3.4	Power Interface: .....	6
1.4	Block Diagram: .....	7
1.5	EUT Configurations .....	8
1.6	EUT Operation Modes .....	8
1.7	Rational for EUT Configuration .....	8
2.0	Summary .....	9
2.1	Deviations from standard test methods .....	9
2.2	Device Modifications Necessary for Compliance .....	9
2.3	Reference Standards .....	9
2.4	Results Summary .....	10
3.0	Calibration of Equipment Used for Measurement .....	11
4.0	EMISSIONS TEST RESULTS .....	11
4.1	Test Conditions and Results – MAINS TERMINAL – CONDUCTED EMISSIONS .....	12
4.2	Test Conditions and Results – Frequency Stability .....	19
4.3	Test Conditions and Results – Occupied Bandwidth .....	21
4.4	Test Conditions and Results – RADIATED EMISSIONS .....	24
Appendix A	.....	33
	Accreditations and Authorizations .....	33
Appendix B	Test Setup .....	35

Report Revision History

Revision Date	Description	Revised By	Revision Reviewed By
None			

1.0 GENERAL - Product Description

1.1 Equipment Description

Equipment Under Test (EUT) is a Terminal. It is both battery powered and AC via AC/DC external power supply connected to charging base. It contains a RFID operating at 13.56MHz. EUT also contains a Bluetooth which is investigated under report 10343507B.

1.2 Equipment Marking Plate



### 1.3 Device Configuration During Test

#### 1.3.1 Equipment Used During Test:

Use	Product Type	Manufacturer	Model	Comments
EUT	Terminal	Ingenico	IWL252	None
EUT	Base	Ingenico	IWL200	None
EUT	Power Supply	Ingenico	192011331	None
EUT	Battery	Intenico	L01J44006	None

Note: **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, or **SIM** - Simulator (Not Subjected to Test)

#### 1.3.2 Input/Output Ports:

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	None
1	Mains	AC	Y	N	None
2	USB	IO	Y	Y	None
3	Ethernet	TP	Y	N	None
4	Phone	TP	Y	N	None

Note:

AC = AC Power Port      DC = DC Power Port      N/E = Non-Electrical  
 I/O = Signal Input or Output Port (Not Involved in Process Control)  
 TP = Telecommunication Ports

**1.3.3 EUT Internal Operating Frequencies:**

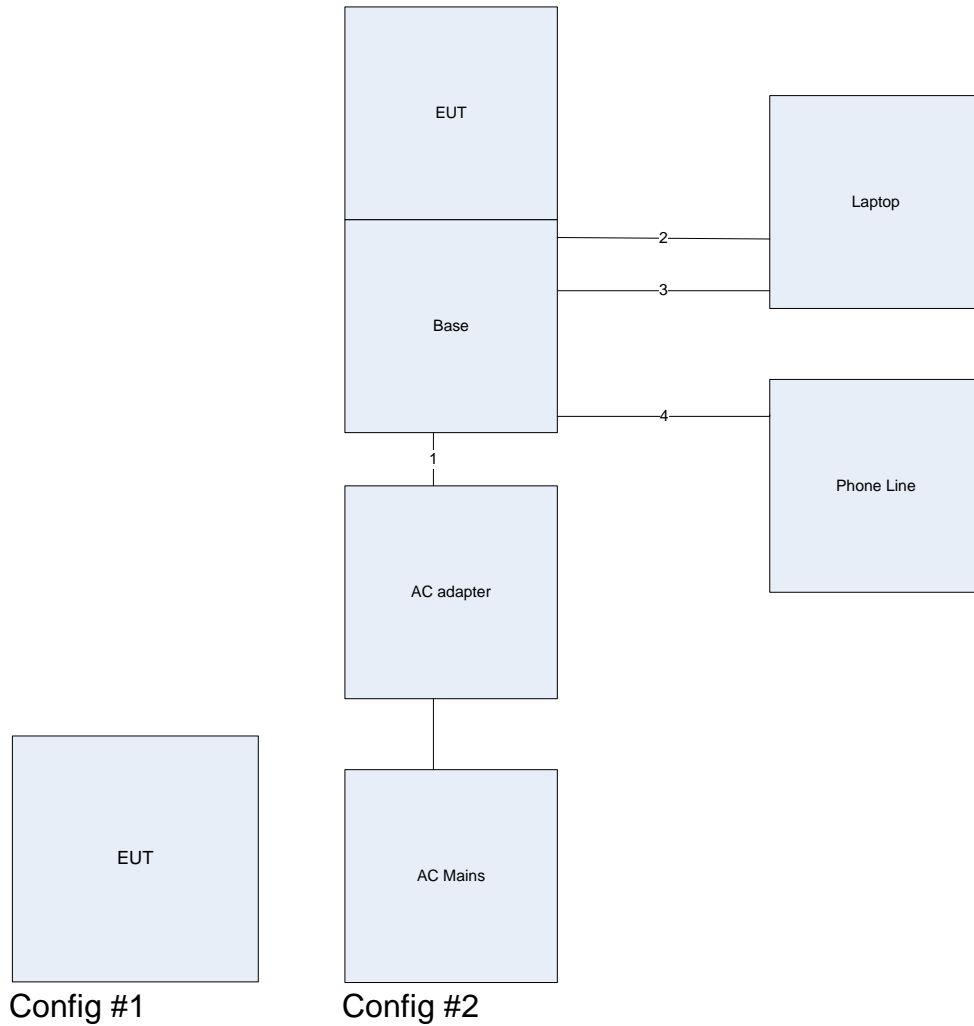
Frequency (MHz)	Description
13.56	RFID
2400	BT
<108	EUT digital circuitry

**1.3.4 Power Interface:**

Mode # /Rated	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
1	3.6VDC	-	-	DC	1	Battery
2	120VAC	-	-	AC-60Hz	1	Via Charging Base

**1.4 Block Diagram:**

The diagram below illustrates the configuration of the equipment above.



### 1.5 EUT Configurations

Mode #	Description
1	EUT Configured in battery mode
2	EUT configured on base with IO connections, Phone input connected active phone line, USB and Ethernet active connection to Laptop.

### 1.6 EUT Operation Modes

Mode #	Description
1	EUT programed for RFID TX continuously transmitting.

### 1.7 Rational for EUT Configuration

Mode #	Description
1	The selected EUT configuration was chosen to maximize emissions. X-axis was determined worst case and in battery mode.



## 2.0 Summary

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL LLC in accordance with the procedures stated in each test requirement and specification. The applicant determined the list of tests performed were applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

### 2.1 Deviations from standard test methods

None
------

### 2.2 Device Modifications Necessary for Compliance

None
------

### 2.3 Reference Standards

Standard Number	Standard Name	Standard Date
47 CFR Part 15	Radio Frequency Devices	2013
RSS-210	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment	2010
RSS-Gen	General Requirements and Information for the Certification of Radio Apparatus	2010

## 2.4 Results Summary

This product is considered Class A

Requirement – Test	Result (Compliant / Non-Compliant)*
Conducted Emissions - Mains	<b>Compliant</b>
Frequency Stability	<b>Compliant</b>
20dB BW	<b>Compliant</b>
Radiated Emissions	<b>Compliant</b>

Test Engineer:



Michael Ferrer (Ext.41312)  
WiSE Program Manager  
Consumer Technology Division  
Verification Services

Reviewer:



Bartlomiej Mucha(Ext.41216)  
WiSE Staff Engineer  
Consumer Technology Division  
Verification Services

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

### 3.0 Calibration of Equipment Used for Measurement

All test equipment and test accessories are calibrated on a regular basis. The maximum time between calibrations is one year or the manufacturers' recommendation, whichever is less.

All test equipment calibrations are traceable to the National Institute of Standards and Technology (NIST); therefore, all test data recorded in this report is traceable to NIST.

### 4.0 EMISSIONS TEST RESULTS

The emissions tests were performed according to following regulations:

----- North America -----

47 CFR Part 15	Radio Frequency Devices
RSS-210	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS-Gen	General Requirements and Information for the Certification of Radio Apparatus

Unless specified otherwise in the individual Methods, the tests shall be conducted under the following ambient conditions. Confirmation of these conditions shall be verified at the time the test is conducted.

Ambient Temperature, °C	22.5 ± 2.5	Relative Humidity, %	45 ± 15	Barometric Pressure, mBar	950 ± 150
-------------------------	------------	----------------------	---------	---------------------------	-----------

#### Measurement Uncertainty

Test	Range	Equipment	Uncertainty k=2
Conducted Emissions	150k-30MHz	LISN	2.29dB
Conducted Emissions	150k-30MHz	AAN ISN	2.73dB
Radiated Emissions	9k-30MHz	E-Field Rod	2.88dB
Radiated Emissions	30-200MHz	Bicon 10m Horz	4.27dB
Radiated Emissions	30-200MHz	Bicon 10m Vert	4.28dB
Radiated Emissions	200-1000MHz	LogP 10m Horz	3.33dB
Radiated Emissions	200-1000MHz	LogP 10m Vert	3.39dB

#### Sample Calculations

Radiated Field Strength and Conducted Emissions data contained within this report is calculated on the following basis:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Meter Reading (dBuV)} + \text{AF (dB/m)} - \text{Gain (dB)} + \text{Cable Loss (dB)} \\ \text{Conducted Voltage (dBuV)} &= \text{Meter Reading (dBuV)} + \text{Cable Loss (dB)} + \text{LISN IL (dB)} \\ \text{Conducted Current (dBuA)} &= \text{Meter Reading (dBuV)} + \text{Cable Loss (dB)} - \text{Transducer Factor (dBohms)} \end{aligned}$$

**4.1 Test Conditions and Results – MAINS TERMINAL – CONDUCTED EMISSIONS**

Test Description	Measurements were made on a ground plane. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.	
Basic Standard	FCC Part 15	
UL LPG	80-EM-S0026	
	Frequency range on each side of line	Measurement Point
Fully configured sample scanned over the following frequency range	150kHz to 30MHz	Mains
<b>Limits - Class B</b>		
Frequency (MHz)	Limit (dBµV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50
Supplementary information:		

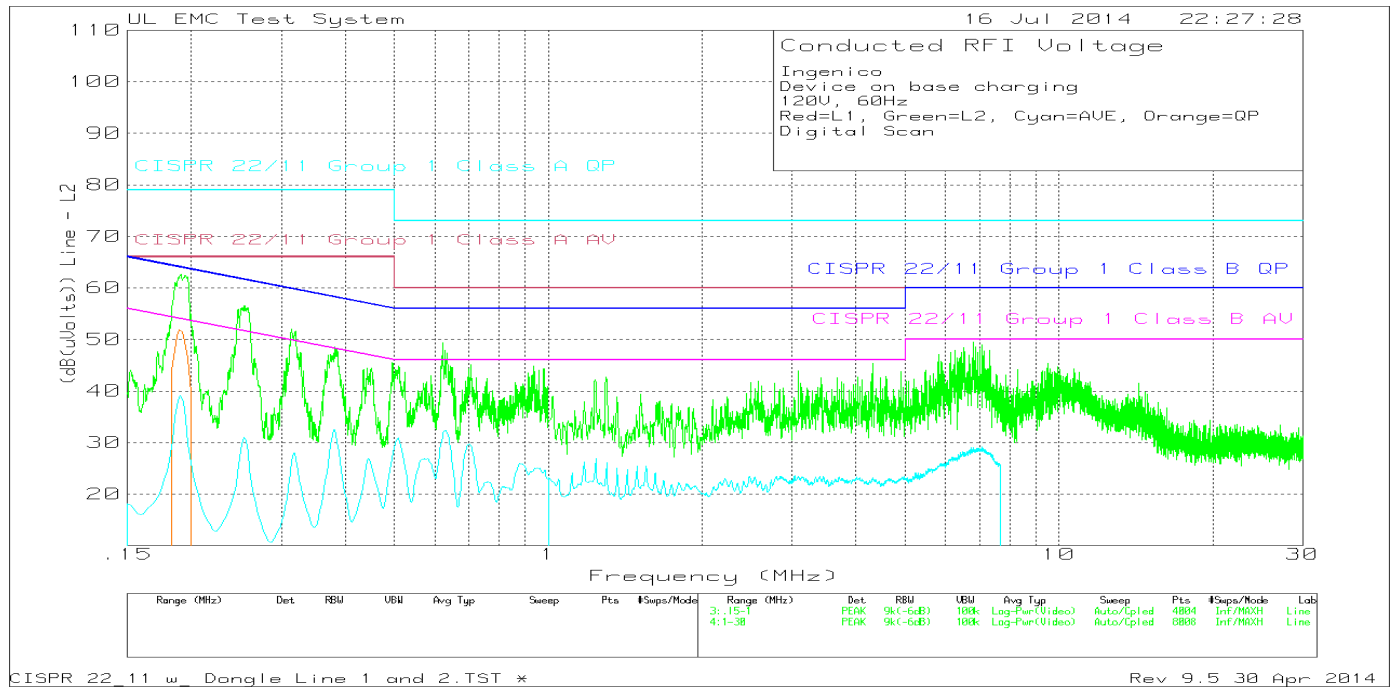
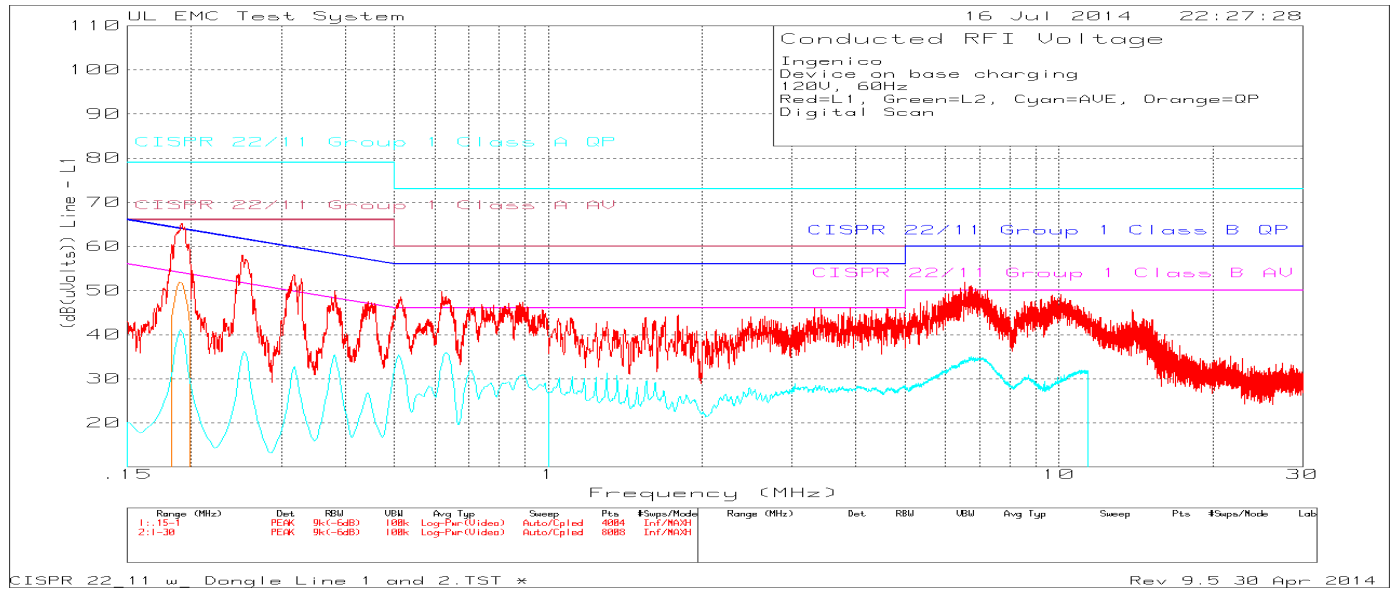
**Table 1 Conducted Emissions EUT Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
2	2	1
Supplementary information: Antenna was terminated		

**Table 2 Conducted Emissions Test Equipment**

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC4328	12/15/13	12/31/14
Transient Limiter	Electro-Metrics	EM7600-2	EMC4224	N/A	N/A
HighPass Filter	Solar Electronics	2803-150	885551	N/A	N/A
Attenuator	HP	8494B	2831A00838	N/A	N/A
LISN - L1	Solar	8602-50-TS-50-N	EMC4052	01/16/14	01/16/15
LISN - L2	Solar	8602-50-TS-50-N	EMC4064	01/16/14	01/16/15

Figure 1 Conducted Emissions Graph Ant terminated



**Table 3 Conducted Emissions Data Points Ant terminated**

Ingenico  
 Device on base charging  
 120V, 60Hz  
 Red=L1, Green=L2, Cyan=AVE, Orange=QP  
 Digital Scan

Line - L1 .15 - 1MHz

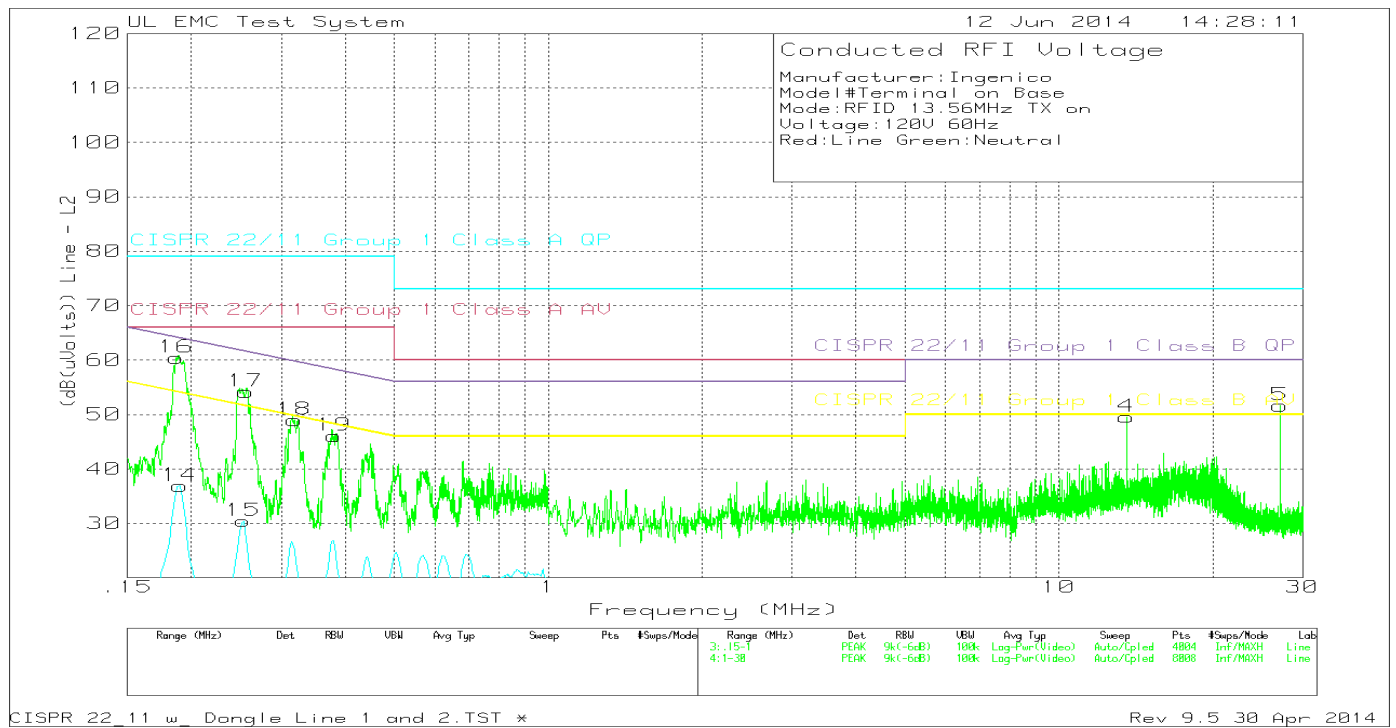
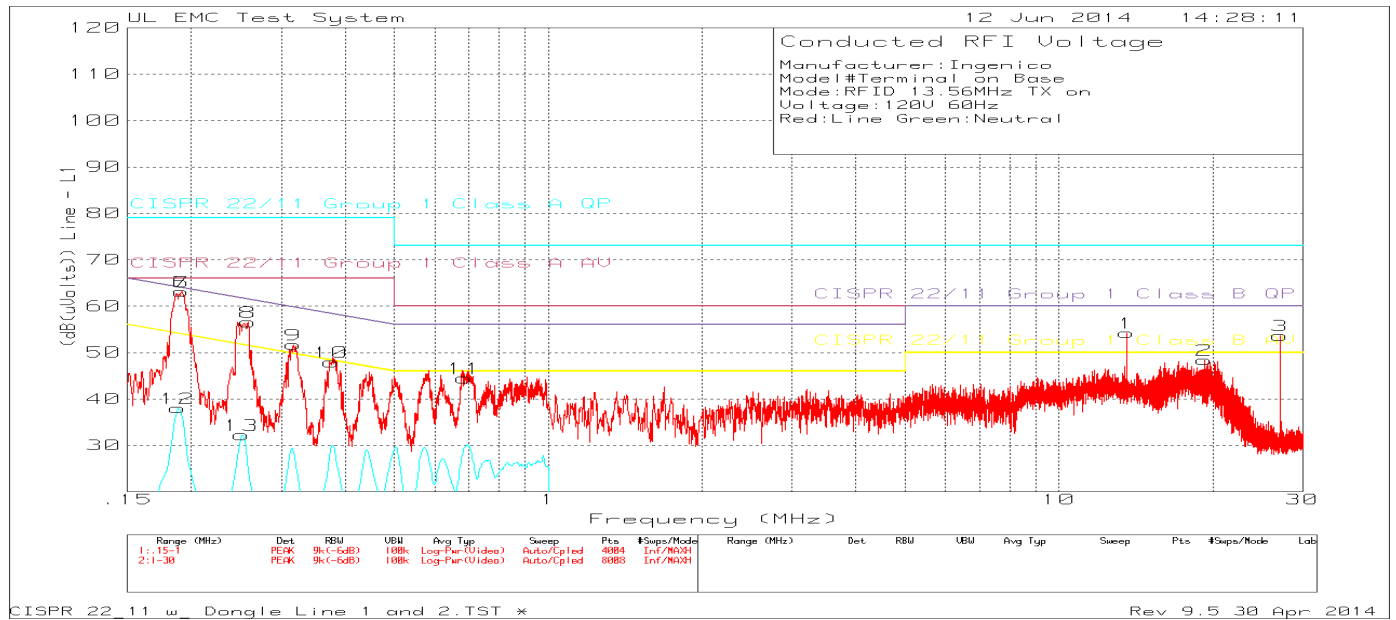
Test Frequency (MHz)	Meter Reading (dBuV)	Detector	LISN Factor (dB)	Cable Factor (dB)	Corrected Reading (dB(uVolts))	CISPR 22/11 Group 1 Class B QP (dB)	Margin (dB)	CISPR 22/11 Group 1 Class B AV (dB)	Margin (dB)
0.1905	29.45	Av	0.1	11.6	41.15	64.01	-22.86	54.01	-12.86
0.2535	24.89	Av	0.1	11.2	36.19	61.64	-25.45	51.64	-15.45
0.31875	21.82	Av	0.1	10.8	32.72	59.74	-27.02	49.74	-17.02
0.38175	24.52	Av	0.1	10.8	35.42	58.24	-22.82	48.24	-12.82
0.44475	16.03	Av	0.1	10.7	26.83	56.97	-30.14	46.97	-20.14
0.51	24.84	Av	0	10.6	35.44	56	-20.56	46	-10.56
0.6315	25.17	Av	0.1	10.6	35.87	56	-20.13	46	-10.13
0.89025	20.17	Av	0.1	10.6	30.87	56	-25.13	46	-15.13
0.18971	40.18	QP	0.1	11.6	51.88	64.05	-12.17	54.05	-2.17
3.394	17.75	Av	0.1	10.6	28.45	56	-27.55	46	-17.55
4.627	17.18	Av	0.1	10.7	27.98	56	-28.02	46	-18.02
6.7285	24.06	Av	0.1	10.8	34.96	60	-25.04	50	-15.04
10.873	20.47	Av	0.2	11	31.67	60	-28.33	50	-18.33
13.91605	34.33	PK	0.2	11.1	45.63	60	-14.37	50	-4.37

Line - L2 .15 - 1MHz

Test Frequency (MHz)	Meter Reading (dBuV)	Detector	LISN Factor (dB)	Cable Factor (dB)	Corrected Reading (dB(uVolts))	CISPR 22/11 Group 1 Class B QP (dB)	Margin (dB)	CISPR 22/11 Group 1 Class B AV (dB)	Margin (dB)
0.1905	27.47	Av	0.1	11.6	39.17	64.01	-24.84	54.01	-14.84
0.2535	19.7	Av	0.1	11.2	31	61.64	-30.64	51.64	-20.64
0.31875	17.12	Av	0.1	10.8	28.02	59.74	-31.72	49.74	-21.72
0.38175	21.66	Av	0.1	10.8	32.56	58.24	-25.68	48.24	-15.68
0.44925	15.4	Av	0.1	10.7	26.2	56.89	-30.69	46.89	-20.69
0.51	19.87	Av	0.1	10.7	30.67	56	-25.33	46	-15.33
0.63375	21.17	Av	0.1	10.6	31.87	56	-24.13	46	-14.13
0.7035	18.94	Av	0.1	10.6	29.64	56	-26.36	46	-16.36
0.879	15.23	Av	0.1	10.6	25.93	56	-30.07	46	-20.07
0.18971	40.16	QP	0.1	11.6	51.86	64.05	-12.19	54.05	-2.19
4.3165	12.37	Av	0.1	10.7	23.17	56	-32.83	46	-22.83
7.0615	18.18	Av	0.1	10.9	29.18	60	-30.82	50	-20.82

PK - Peak detector  
 QP - Quasi-Peak detector  
 Av - CISPR average detection

Figure 2 Conducted Emissions Graph Ant not terminated



Order Number: 10343507A  
 Model Number: IWL252  
 Client Name: Ingenico

FCC ID: XKB-IWLTBB  
 IC: 2586D-IWLTBB

**Table 4 Conducted Emissions Data Points Ant not terminated**

Manufacturer:Ingenico  
 Model#Terminal on Base  
 Mode:RFID 13.56MHz TX on  
 Voltage:120V 60Hz  
 Red:Line Green:Neutral

Trace Markers											
No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB (uVolts))	Limit:1	2	3	4	5	6
===== ===											
Line - L1 .15 - 1MHz -----											
6	.19134	51.46dBuV PK	.1	11.6	63.16	79	66	63.98	53.98	-	-
					Margin (dB)	-15.84	-2.84	-.82	9.18	-	-
7	.19134	51.46dBuV PK	.1	11.6	63.16	79	66	63.98	53.98	-	-
					Margin (dB)	-15.84	-2.84	-.82	9.18	-	-
8	.25812	45.33dBuV PK	.1	11.1	56.53	79	66	61.49	51.49	-	-
					Margin (dB)	-22.47	-9.47	-4.96	5.04	-	-
9	.31727	40.81dBuV PK	.1	10.8	51.71	79	66	59.78	49.78	-	-
					Margin (dB)	-27.29	-14.29	-8.07	1.93	-	-
10	.3762	37.06dBuV PK	.1	10.8	47.96	79	66	58.36	48.36	-	-
					Margin (dB)	-31.04	-18.04	-10.4	-.4	-	-
11	.68551	33.76dBuV PK	.1	10.6	44.46	73	60	56	46	-	-
					Margin (dB)	-28.54	-15.54	-11.54	-1.54	-	-
12	.18807	26.32dBuV Av	.1	11.6	38.02	79	66	64.12	54.12	-	-
					Margin (dB)	-40.98	-27.98	-26.1	-16.1	-	-
13	.25107	20.92dBuV Av	.1	11.2	32.22	79	66	61.72	51.72	-	-
					Margin (dB)	-46.78	-33.78	-29.5	-19.5	-	-
Line - L1 1 - 30MHz -----											
1	13.5611	42.93dBuV PK	.2	11.1	54.23	73	60	60	50	-	-
					Margin (dB)	-18.77	-5.77	-5.77	4.23	-	-
2	19.25126	36.81dBuV PK	.2	11.4	48.41	73	60	60	50	-	-
					Margin (dB)	-24.59	-11.59	-11.59	-1.59	-	-
3	27.12186	41.47dBuV PK	.4	11.8	53.67	73	60	60	50	-	-
					Margin (dB)	-19.33	-6.33	-6.33	3.67	-	-
Line - L2 .15 - 1MHz -----											
14	.19001	25.17dBuV Av	.1	11.6	36.87	79	66	64.04	54.04	-	-
					Margin (dB)	-42.13	-29.13	-27.17	-17.17	-	-
15	.25301	19.15dBuV Av	.1	11.2	30.45	79	66	61.66	51.66	-	-
					Margin (dB)	-48.55	-35.55	-31.21	-21.21	-	-
16	.18689	48.75dBuV PK	.1	11.6	60.45	79	66	64.17	54.17	-	-
					Margin (dB)	-18.55	-5.55	-3.72	6.28	-	-
17	.25579	42.87dBuV PK	.1	11.2	54.17	79	66	61.57	51.57	-	-
					Margin (dB)	-24.83	-11.83	-7.4	2.6	-	-
18	.31833	38.1dBuV PK	.1	10.8	49	79	66	59.75	49.75	-	-
					Margin (dB)	-30	-17	-10.75	-.75	-	-
19	.38108	35.21dBuV PK	.1	10.8	46.11	79	66	58.26	48.26	-	-
					Margin (dB)	-32.89	-19.89	-12.15	-2.15	-	-
Line - L2 1 - 30MHz -----											
4	13.5611	38.17dBuV PK	.3	11.1	49.57	73	60	60	50	-	-
					Margin (dB)	-23.43	-10.43	-10.43	-.43	-	-
5	27.12549	39.57dBuV PK	.3	11.8	51.67	73	60	60	50	-	-
					Margin (dB)	-21.33	-8.33	-8.33	1.67	-	-

LIMIT 1: CISPR 22/11 Group 1 Class A QP  
 LIMIT 2: CISPR 22/11 Group 1 Class A AV  
 LIMIT 3: CISPR 22/11 Group 1 Class B QP  
 LIMIT 4: CISPR 22/11 Group 1 Class B AV  
 PK - Peak detector  
 Av - CISPR average detection



Order Number: 10343507A  
 Model Number: IWL252  
 Client Name: Ingenico

FCC ID: XKB-IWLTBB  
 IC: 2586D-IWLTBB

Manufacturer: Ingenico  
 Model# Terminal on Base  
 Mode: RFID 13.56MHz TX on  
 Voltage: 120V 60Hz  
 Red: Line Green: Neutral

Trace Markers											
No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	5	6
=====											
Line - L1 1 - 30MHz -----											
1	13.5611	42.93dBuV PK	.2	11.1	54.23	73	60	60	50	-	-
					Margin (dB)	-18.77	-5.77	-5.77	4.23	-	-
2	19.25126	36.81dBuV PK	.2	11.4	48.41	73	60	60	50	-	-
					Margin (dB)	-24.59	-11.59	-11.59	-1.59	-	-
3	27.12186	41.47dBuV PK	.4	11.8	53.67	73	60	60	50	-	-
					Margin (dB)	-19.33	-6.33	-6.33	3.67	-	-
Line - L2 1 - 30MHz -----											
4	13.5611	38.17dBuV PK	.3	11.1	49.57	73	60	60	50	-	-
					Margin (dB)	-23.43	-10.43	-10.43	-4.43	-	-
5	27.12549	39.57dBuV PK	.3	11.8	51.67	73	60	60	50	-	-
					Margin (dB)	-21.33	-8.33	-8.33	1.67	-	-

LIMIT 1: CISPR 22/11 Group 1 Class A QP  
 LIMIT 2: CISPR 22/11 Group 1 Class A AV  
 LIMIT 3: CISPR 22/11 Group 1 Class B QP  
 LIMIT 4: CISPR 22/11 Group 1 Class B AV

PK - Peak detector

Quasi-peak Data											
No.	Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	5	6
=====											
Line - L1 1 - 30MHz -----											
	13.55973	40.52dBuV QP	.2	11.1	51.82	73	60	60	50	-	-
					Margin (dB):	-21.18	-8.18	-8.18	1.82	-	-
	19.2496	27.53dBuV QP	.2	11.4	39.13	73	60	60	50	-	-
					Margin (dB):	-33.87	-20.87	-20.87	-10.87	-	-
	27.1187	40.8dBuV QP	.4	11.8	53	73	60	60	50	-	-
					Margin (dB):	-20	-7	-7	3	-	-
Line - L2 1 - 30MHz -----											
	13.55918	34.31dBuV QP	.3	11.1	45.71	73	60	60	50	-	-
					Margin (dB):	-27.29	-14.29	-14.29	-4.29	-	-
	27.11918	36.58dBuV QP	.3	11.8	48.68	73	60	60	50	-	-
					Margin (dB):	-24.32	-11.32	-11.32	-1.32	-	-

LIMIT 1: CISPR 22/11 Group 1 Class A QP  
 LIMIT 2: CISPR 22/11 Group 1 Class A AV  
 LIMIT 3: CISPR 22/11 Group 1 Class B QP  
 LIMIT 4: CISPR 22/11 Group 1 Class B AV

NOTE: "+" - Indicates an emission level in excess of the applicable limit(s).

QP - Quasi-Peak detector

Order Number: 10343507A  
 Model Number: IWL252  
 Client Name: Ingenico

FCC ID: XKB-IWLTBB  
 IC: 2586D-IWLTBB

Average Data

Test Frequency (MHz)	Meter Reading	Transducer Factor (dB)	Gain/Loss Factor (dB)	Corrected Reading (dB(uVolts))	Limit:1	2	3	4	5	6
=====										
=										
Line - L1 1 - 30MHz										
13.55973	34.61dBuV Av	.2	11.1	45.91	73	60	60	50	-	-
				Margin (dB):	-27.09	-14.09	-14.09	-4.09	-	-
19.2496	14.12dBuV Av	.2	11.4	25.72	73	60	60	50	-	-
				Margin (dB):	-47.28	-34.28	-34.28	-24.28	-	-
27.1187	37.89dBuV Av	.4	11.8	50.09	73	60	60	50	-	-
				Margin (dB):	-22.91	-9.91	-9.91	.09	-	-
Line - L2 1 - 30MHz										
13.55918	30.44dBuV Av	.3	11.1	41.84	73	60	60	50	-	-
				Margin (dB):	-31.16	-18.16	-18.16	-8.16	-	-
27.11918	35.03dBuV Av	.3	11.8	47.13	73	60	60	50	-	-
				Margin (dB):	-25.87	-12.87	-12.87	-2.87	-	-

LIMIT 1: CISPR 22/11 Group 1 Class A QP  
 LIMIT 2: CISPR 22/11 Group 1 Class A AV  
 LIMIT 3: CISPR 22/11 Group 1 Class B QP  
 LIMIT 4: CISPR 22/11 Group 1 Class B AV

NOTE: "+" - Indicates an emission level in excess of the applicable limit(s).

Av - CISPR average detection

**4.2 Test Conditions and Results – Frequency Stability**

Test Description	<p>For Temperature Frequency Stability, measurements were made with the product placed in an environmental chamber and the temperature varied from –30C to +50C at the normal supply voltage. The frequency drift of the fundamental frequency was measured with a spectrum analyzer.</p> <p>For Power Supply Frequency Stability, measurements were made in a laboratory environment and the supply voltage varied from 85% to 115%. The ambient temperature was 20C.</p>	
Basic Standard	15.225(e)	
<b>Frequency Stability Limits</b>		
+/- 0.01% of the Operating Frequency (13.56MHz)		

**Table 5 Frequency Stability Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

**Table 6 Frequency Stability Test Equipment**

<b>Test Equipment Used</b>					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due
Thermal Chamber	Thermotron	SM-32-7800	EMC4232	04/21/14	04/21/15
Frequency Counter	HP	5386A	EMC4087	12/19/13	12/31/14
Antenna	EMCO	7405-902	-	N/A	N/A

**Table 7 Frequency Stability Data – Frequency vs. Temperature**

Time (min)	Frequency (MHz)	Temperature (°C)	Voltage	Within 0.01% (range below)
0	13.5513	20	100%	NA
2	13.5520	20	100%	Yes
5	13.5512	20	100%	Yes
10	13.5518	20	100%	Yes
0	13.5513	20	92%	Yes
2	13.5512	20	92%	Yes
5	13.5520	20	92%	Yes
10	13.5518	20	92%	Yes
0	13.5515	20	115%	Yes
2	13.5518	20	115%	Yes
5	13.5512	20	115%	Yes
10	13.5513	20	115%	Yes
0	13.5521	-20	100%	Yes
2	13.5525	-20	100%	Yes
5	13.5516	-20	100%	Yes
10	13.5523	-20	100%	Yes
0	13.5507	50	100%	Yes
2	13.5519	50	100%	Yes
5	13.5518	50	100%	Yes
10	13.5503	50	100%	Yes

13.5513 MHz  
 Range = 13.54994487 – 13.55265513

**4.3 Test Conditions and Results – Occupied Bandwidth**

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.	
Basic Standard	15.215(c)	
<b>Occupied Bandwidth Limits</b>		
Reporting purposes		

**Table 8 20dB Bandwidth Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

**Table 9 20dB Bandwidth Spectrum Analyzer Settings**

Resolution Bandwidth (MHz)	Occupied Bandwidth Requirements	
	dBc	%
1% of the Span	-20	99
Supplementary information: None		

**Table 10 20dB Bandwidth Test Equipment**

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due
Spectrum Analyzer	Agilent	N903A	EMC4360	12/21/13	12/21/14
Antenna	EMCO	7405-902	-	N/A	N/A

Figure 3 20dB Bandwidth Graph

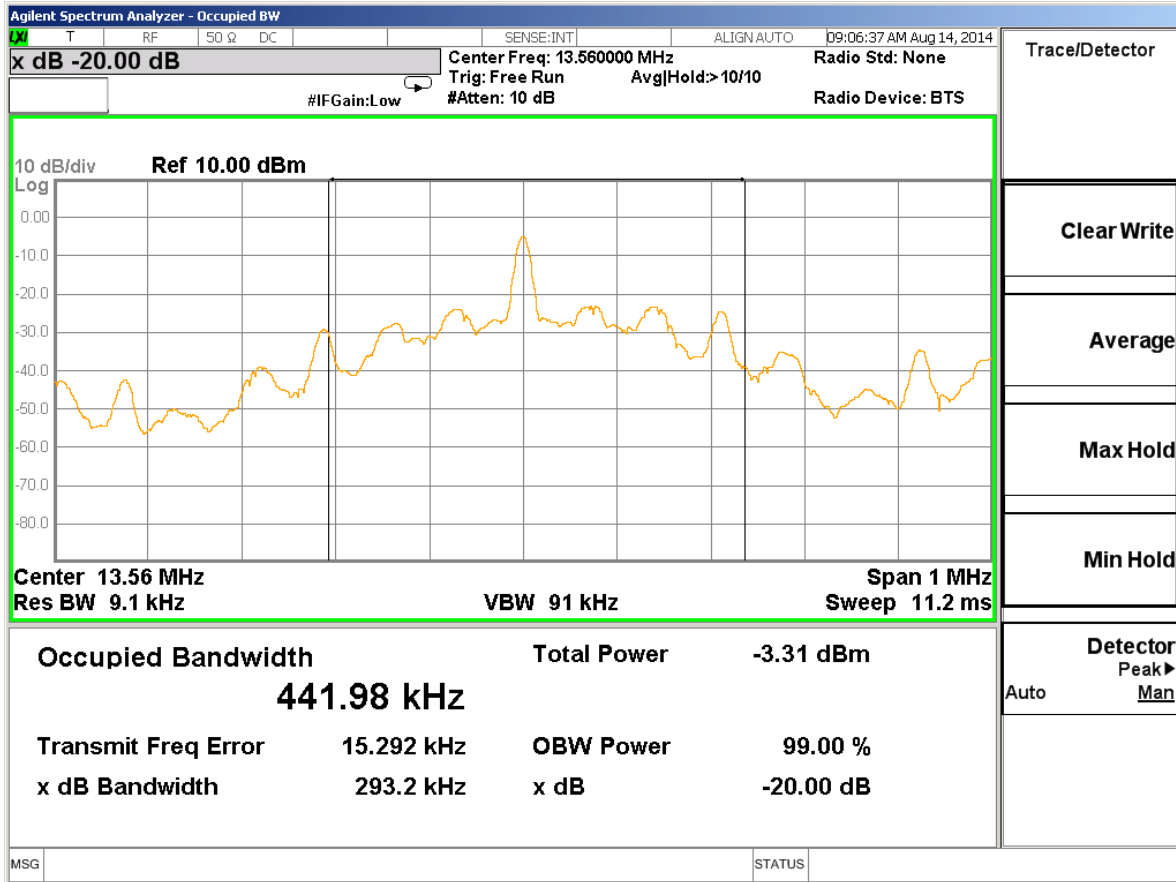
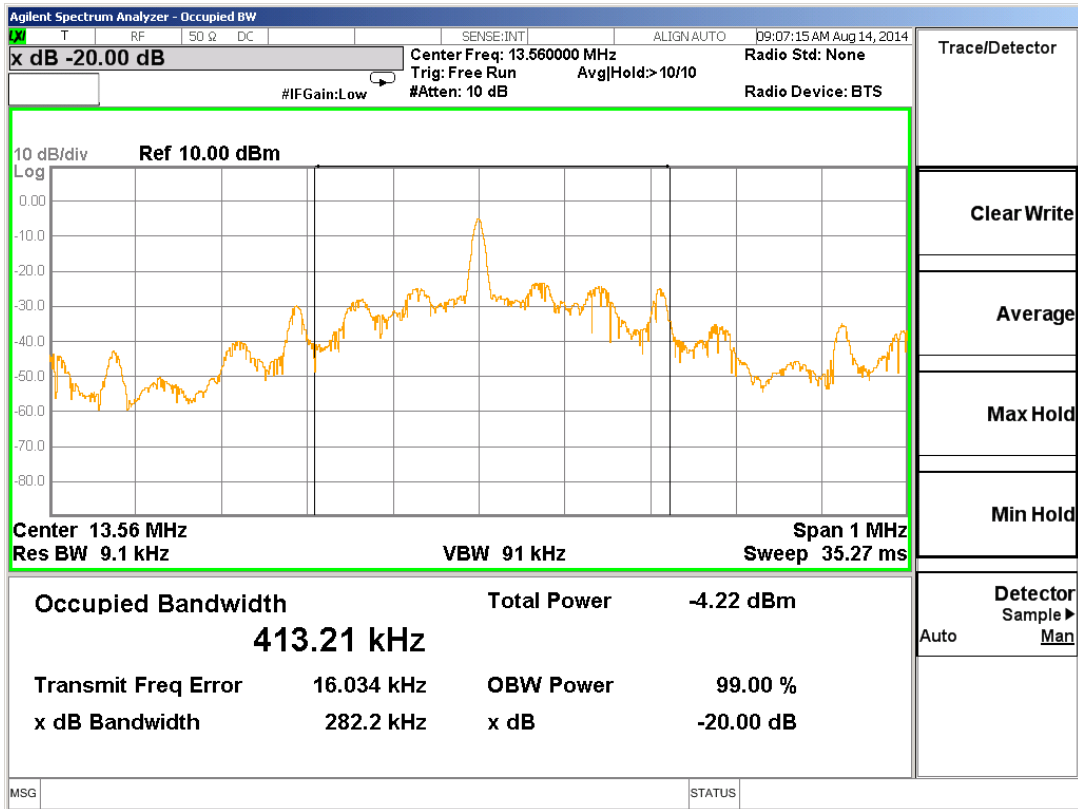


Figure 4 99% Bandwidth Graph



**4.4 Test Conditions and Results – RADIATED EMISSIONS**

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 and 10-meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height to 1m for below 30MHz and from 1 to 4-meters for above 30MHz. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.	
Basic Standard	FCC Part 15.225	
UL LPG	80-EM-S0029	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	9kHz – 30MHz	(3 meter measurement distance)
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	(10 meter measurement distance)
<b>Limits</b>		
Frequency (MHz)	Limit (dBµV/m)	
	General Emissions	
0.009 – 0.490	128.5 – 93.8	
0.490 – 1.705	73.8 – 63	
1.705 – 30	69.5	
30 – 88	29.6	
88 – 216	33.1	
216-960	35.6	
960-1000	43.53	
	Fundamental	
13.553 – 13.567	124	
13.110 – 13.410	80.506	
13.710 – 14.010	80.506	
13.410 – 13.553	90.47	
13.567 – 13.710	90.47	
Supplementary information: Use Avg. detector for frequencies 9-90kHz, 110-490kHz, all others use Quasi-peak detector		



**Table 11 Radiated Emissions EUT Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

**Table 12 Radiated Emissions Test Equipment**

Description	Manufacturer	Model	Identifier	Cal Date	Cal Due
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	12/20/14	12/31/14
Bicon Antenna	Chase	VBA6106A	EMC4078	04/01/14	04/01/15
Log-P Antenna	Chase	UPA6109	EMC4258	12/11/13	12/31/14
Loop Antenna	EMCO	6502/1	EMC4026	03/18/14	03/18/15

**Table 13 Radiated Emissions Data Points**

Fundamental Measurements

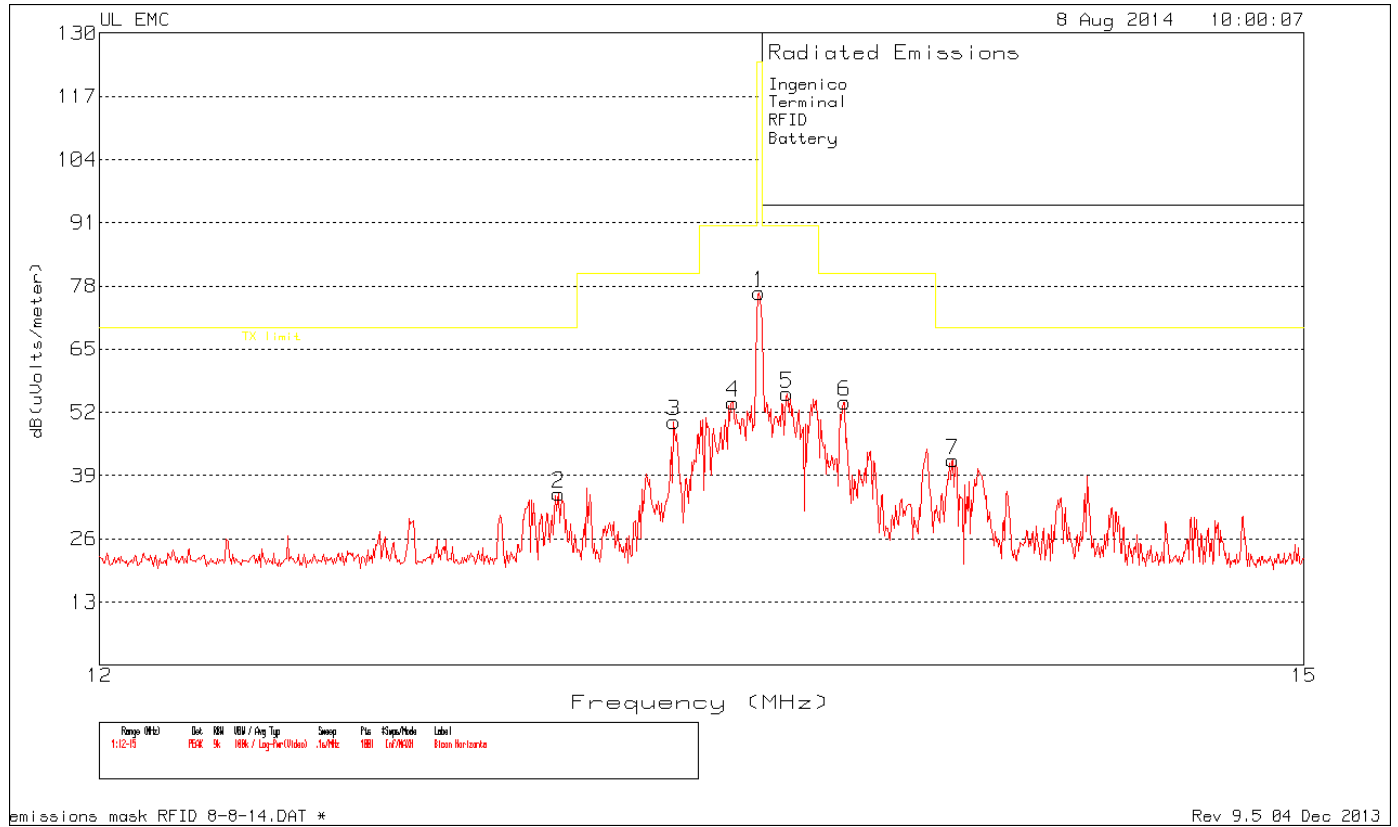
Test Frequency (MHz)	Meter Reading (dBuV)		Antenna Factor (dB/m)		Cable Factor (dB)	Corrected Reading (dB(uVolts/ meter))	FCC Part 15 3M	Margin (dB)	Azimuth [Degs]	Notes
	Reading	Detector	Factor	dB/m						
13.559548	58.32	QP	11.2	-1.5	-1.5	68.02	124	-55.98	187	1
13.559516	64	QP	11.2	-1.5	-1.5	73.7	124	-50.3	268	2
13.559516	63.62	QP	11.2	-1.5	-1.5	73.32	124	-50.68	266	3

Notes:

- 1 - x-axis flat, ant loop upright
- 2 - Y-axis side, ant loop upright
- 3 - Z-axis Upright, ant loop upright

QP - Quasi-Peak detector

Figure 5 Radiated Emissions Graph

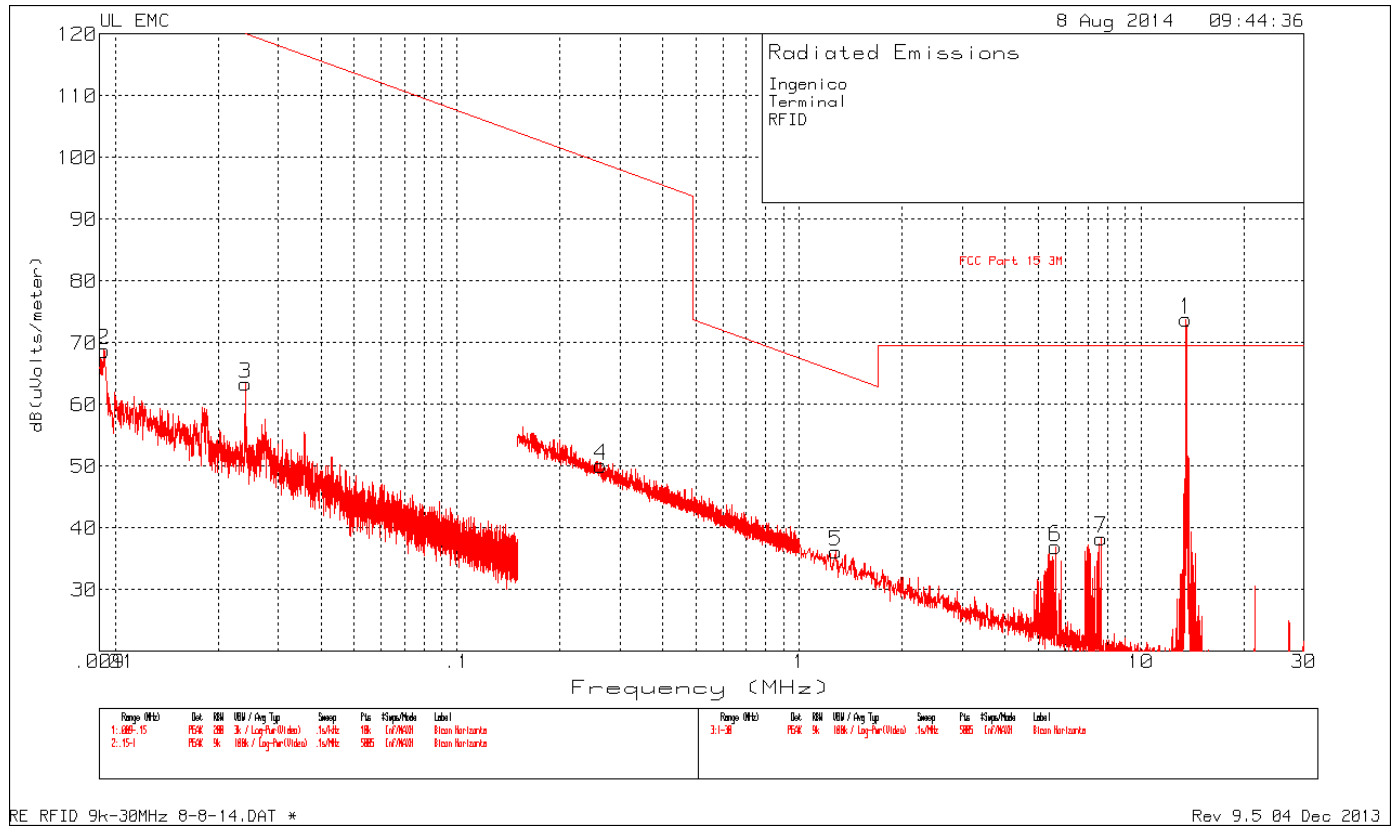


**Table 14 Radiated Emissions Data Points**

Marker No.	Test Frequency (MHz)	Meter Reading( dBuV) Detector	Antenna Factor dB/m	Cable Factor dB	Corrected Reading dB(uVolts/ meter)	TX limit	Margin (dB)	Azimuth [Degs]
1	13.56	63.98 PK	11.2	1.5	76.68	124	-47.32	0-360
2	13.065	22.78 PK	11.2	1.3	35.28	69.5	-34.22	0-360
3	13.347	37.54 PK	11.2	1.4	50.14	80.5	-30.36	0-360
4	13.494	41.34 PK	11.2	1.5	54.04	90.5	-36.46	0-360
5	13.629	43.17 PK	11.2	1.5	55.87	90.5	-34.63	0-360
6	13.776	41.66 PK	11.1	1.4	54.16	80.5	-26.34	0-360
7	14.055	29.58 PK	11.1	1.5	42.18	69.5	-27.32	0-360

PK - Peak detector

Figure 6 Radiated Emissions Graph

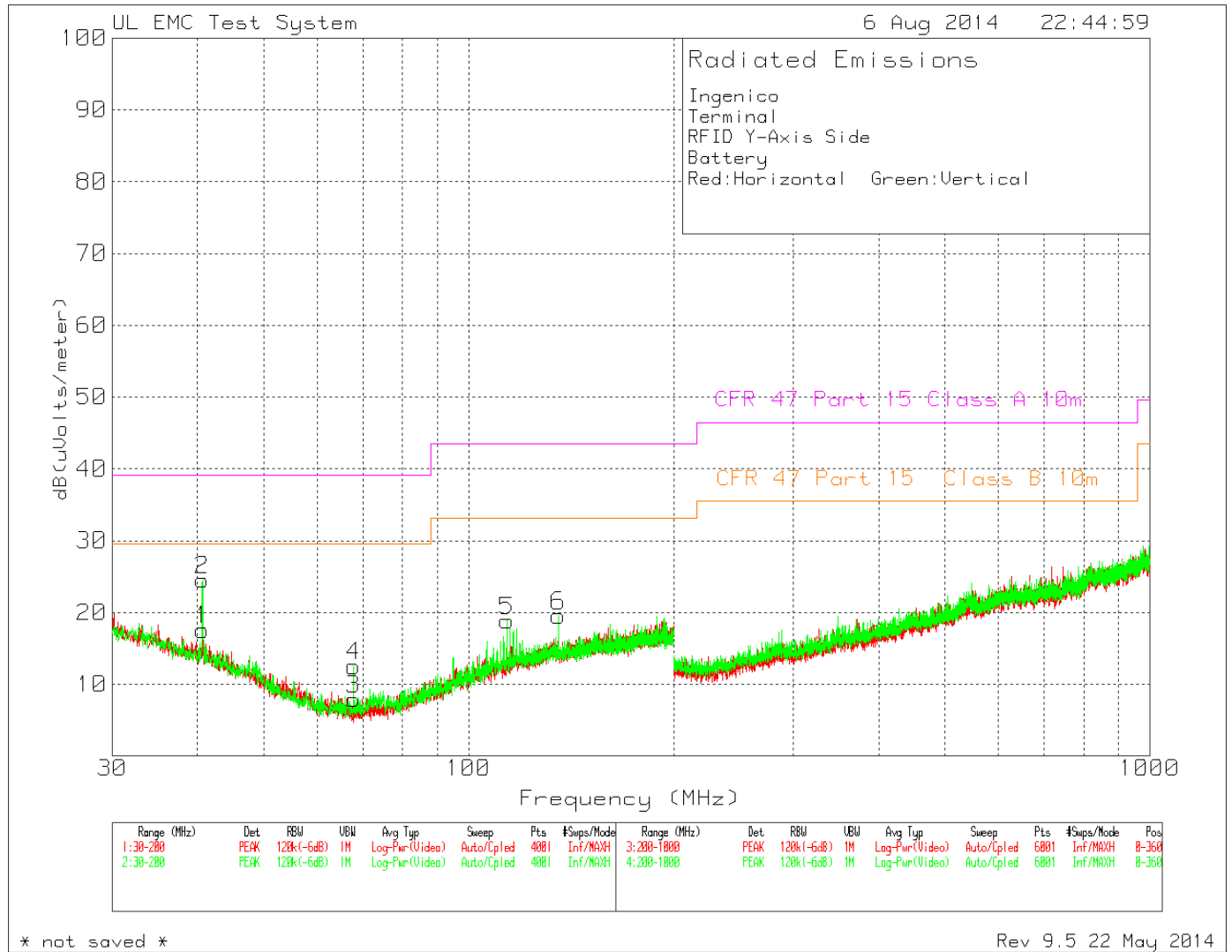


**Table 15 Radiated Emissions Data Points**

Marker No.	Test Frequency (MHz)	Meter Reading		Antenna		Corrected Reading dB(uVolts/ meter)	FCC Part 15 3M	Margin (dB)	Azimuth [Degs]
		Reading( dBuV)	Detector	Factor dB/m	Cable Factor dB				
2	0.009254	46.77	PK	22.1	-0.1	68.77	128.26	-59.49	0-360
3	0.023989	47.08	PK	16.4	-0.1	63.38	119.99	-56.61	0-360
4	0.26313	38.9	PK	11.9	-0.7	50.1	99.2	-49.1	0-360
1	13.55777	64.08	PK	11.2	-1.5	73.78	124	-50.22	0-360
5	1.27818	25.36	PK	12.5	-1.7	36.16	65.47	-29.31	0-360
6	5.6305	26.57	PK	11.9	-1.5	36.97	69.54	-32.57	0-360
7	7.63569	28.4	PK	11.5	-1.6	38.3	69.54	-31.24	0-360

PK - Peak detector

Figure 7 Radiated Emissions Graph



**Table 16 Radiated Emissions Data Points**

Ingenico  
 Terminal  
 RFID Y-Axis Side  
 Battery  
 Red:Horizontal Green:Vertical

Marker No.	Test Frequency (MHz)	Meter Reading (dBuV)	Antenna Factor (dB/m)	Cable factor (dB)	Corrected Reading		Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
					dB(uVolts/meter)	CFR 47 Part 15 10m				
1	40.6675	33.9 PK	13.8	-30.1	17.6	29.55	-11.95	0-360	250	H
3	67.825	31.84 PK	6.1	-30	7.94	29.55	-21.61	0-360	250	H
2	40.6675	40.85 PK	13.8	-30.1	24.55	29.55	-5	0-360	99	V
4	67.825	36.45 PK	6.1	-30	12.55	29.55	-17	0-360	249	V
5	113.81	36.05 PK	12.6	-29.8	18.85	33.07	-14.22	0-360	99	V
6	135.6125	34.93 PK	14.3	-29.7	19.53	33.07	-13.54	0-360	99	V

PK - Peak detector

Test Frequency (MHz)	Meter Reading (dBuV)	Antenna Factor (dB/m)	Cable factor (dB)	Corrected Reading		Margin (dB)	Azimuth [Degs]	Height [cm]	Polarity
				dB(uVolts/meter)	CFR 47 Part 15 10m				
40.677903	39.97 QP	13.8	-30.1	23.67	29.55	-5.88	187	100	V

QP - Quasi-Peak detector



## Appendix A

### Accreditations and Authorizations



NVLAP Lab code: 100414-0

NVLAP: The National Institute of Standards and Technology (NIST) administers the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP is comprised of laboratory accreditation programs (LAPs) which are established on the basis of requests and demonstrated need. Each LAP includes specific calibration and/or test standards and related methods and protocols assembled to satisfy the unique needs for accreditation in a field of testing or calibration. NVLAP accredits public and private laboratories based on evaluation of their technical qualifications and competence to carry out specific calibrations or tests. Accreditation criteria are established in accordance with the U.S. Code of Federal Regulations (CFR, Title 15, Part 285), NVLAP Procedures and General Requirements, and encompass the requirements of ISO/IEC 17025. For a full scope listing see <http://ts.nist.gov/standards/scopes/1004140.htm>



FCC: Details of the measurement facilities used for these tests have been filed with the Federal Communications Commission's Laboratory in Columbia, Maryland (Ref. No. 91044).



Industry Canada Industrie Canada

Industry of Canada: Accredited by Industry Canada for performance of radiated measurements. Our test site complies with RSP 100, Issue 7, Section 3.3. File #: IC 2180A



VCCI: Accepted as an Associate Member to the VCCI. The measurement facilities detailed in this test report have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. Registration Nos.: A0140.



ICASA: ICASA (Independent Communications Authority of South Africa) has appointed UL as a Designated Test Laboratory to test Telecommunications equipment for type approval in compliance with CISPR 22 to assist in fulfilling its mandate under section 54(1) of the Telecommunications Act, 1996 (Act 103 of 1996).



NIST/CAB: Validated by the European Commission as a U.S. Conformity Assessment Body (CAB) of the U.S.-EU Mutual Recognition Agreement (MRA) for the Electromagnetic Compatibility - Council Directive 2004/108/EC, Annex III (2-3). Also validated for the Telecommunication Equipment-Council Directive 99/5/EC, Annex III and IV, Identification Number: 0983.

NIST/CAB: Provisioned to act as a U.S. Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the Asia Pacific Economic Cooperation (APEC) MRA between the American Institute in Taiwan (AIT) and the United States. Our laboratory is considered qualified to test equipment subject to the applicable EMC regulations of the Chinese Taipei Bureau of Standards, Metrology and Inspection (BSMI) which require testing to CNS 13438 (CISPR 22).

NIST/CAB: Recognized by the Infocomm Development Authority of Singapore (IDA) under the Asia Pacific Economic Cooperation Mutual Recognition Agreement (APEC MRA). Our laboratory is provisionally designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the APEC MRA. Our scope of designation includes IDA TS EMC (CISPR 22), IEC 61000-4-2, -4-3, -4-4, -4-5, and -4-6