



# TEST REPORT

**Test Report No. : UL-RPT-RP10875975JD02A V2.0**

**Manufacturer** : Ingenico

**Model No.** : IMP550-11T3104A

**FCC ID** : XKB-IMP550BTCL

**Test Standard(s)** : FCC Parts 2.1049, 15.207, 15.209(a) & 15.225

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2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

**Date of Issue:** 15 October 2015

**Checked by:**

Ian Watch  
Senior Engineer, Radio Laboratory

**Issued by :**

pp

John Newell  
Quality Manager,  
UL VS LTD



This laboratory is accredited by UKAS. The tests reported herein have been performed in accordance with its terms of accreditation.

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## UL VS LTD

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**Table of Contents**

<b>1. Customer Information.....</b>	<b>4</b>
<b>2. Summary of Testing.....</b>	<b>5</b>
2.1. General Information	5
2.2. Summary of Test Results	5
2.3. Methods and Procedures	6
2.4. Deviations from the Test Specification	6
<b>3. Equipment Under Test (EUT) .....</b>	<b>7</b>
3.1. Identification of Equipment Under Test (EUT)	7
3.2. Description of EUT	7
3.3. Modifications Incorporated in the EUT	7
3.4. Additional Information Related to Testing	7
3.5. Support Equipment	8
<b>4. Operation and Monitoring of the EUT during Testing .....</b>	<b>9</b>
4.1. Operating Modes	9
4.2. Configuration and Peripherals	9
<b>5. Measurements, Examinations and Derived Results.....</b>	<b>10</b>
5.1. General Comments	10
5.2. Test Results	11
5.2.1. Transmitter AC Conducted Spurious Emissions	11
5.2.2. Transmitter Fundamental Field Strength	17
5.2.3. Transmitter Radiated Spurious Emissions	20
5.2.4. Transmitter Band Edge Radiated Emissions	28
5.2.5. Transmitter 20 dB Bandwidth	30
5.2.6. Transmitter Frequency Stability (Temperature & Voltage Variation)	32
<b>6. Measurement Uncertainty .....</b>	<b>35</b>
<b>7. Report Revision History .....</b>	<b>36</b>
<b>8. Appendix 1 .....</b>	<b>37</b>

### **1. Customer Information**









<b>Company Name:</b>	Ingenico
<b>Address:</b>	9 avenue de la Gare Rovaltain TGV BP25126 Valence 26958 France

## **2. Summary of Testing**

### **2.1. General Information**

<b>Specification Reference:</b>	47CFR15.225
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Radio Frequency Devices) - Section 15.225
<b>Specification Reference:</b>	47CFR15.207 and 47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
<b>Site Registration:</b>	FCC: 209735
<b>Location of Testing:</b>	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
<b>Test Dates:</b>	29 July 2015 to 05 August 2015

### **2.2. Summary of Test Results**

<b>FCC Reference (47CFR)</b>	<b>Measurement</b>	<b>Result</b>
Part 15.207	Transmitter AC Conducted Emissions	
Part 15.225(a)(b)(c)(d)	Transmitter Fundamental Field Strength	
Part 15.209(a)/ 15.225(d)	Transmitter Radiated Emissions	
Part 15.209(a)/ 15.225(c)(d)	Transmitter Band Edge Radiated Emissions	
Part 2.1049	Transmitter 20 dB Bandwidth	
Part 15.225(e)	Transmitter Frequency Stability (Temperature & Voltage Variation)	
<b>Key to Results</b>		
 = Complied  = Did not comply		

### **2.3. Methods and Procedures**

<b>Reference:</b>	ANSI C63.4-2014
<b>Title:</b>	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
<b>Reference:</b>	ANSI C63.10-2013
<b>Title:</b>	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
<b>Reference:</b>	FCC KDB Publication Number 937606 Date: 10/10/2014
<b>Title:</b>	Test Site Requirements for Part 15 and 18 Devices Operating Below 30 MHz
<b>Reference:</b>	FCC KDB Publication Number 174176 Date: June 3, 2015
<b>Title:</b>	AC Power-Line Conducted Emissions Frequently Asked Questions.

### **2.4. Deviations from the Test Specification**

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

### **3. Equipment Under Test (EUT)**

#### **3.1. Identification of Equipment Under Test (EUT)**

<b>Brand Name:</b>	INGENICO – ISMP3
<b>Model Name or Number:</b>	IMP550-11T3104A
<b>Test Sample Serial Number:</b>	15198PP00008479 ( <i>Radiated sample</i> )
<b>Hardware Version:</b>	296185183AB
<b>Software Version:</b>	TM_8451 / TS_4352
<b>FCC ID:</b>	XKB-IMP550BTCL

<b>Brand Name:</b>	INGENICO – ISMP3
<b>Model Name or Number:</b>	IMP550-11T3104A
<b>Test Sample Serial Number:</b>	15202PP00008582 ( <i>AC conducted emissions sample – Modified antenna</i> )
<b>Hardware Version:</b>	296185183AB
<b>Software Version:</b>	TM_8451 / TS_4352
<b>FCC ID:</b>	XKB-IMP550BTCL

#### **3.2. Description of EUT**

The Equipment Under Test was a mobile payment terminal device which is used in conjunction with an Apple iPhone 6 cellular handset. It contains an RFID transceiver and is powered by a 3.7 Volt battery.

#### **3.3. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

#### **3.4. Additional Information Related to Testing**

<b>Tested Technology:</b>	RFID	
<b>Category of Equipment:</b>	Transceiver	
<b>Channel Spacing:</b>	Single channel device	
<b>Modulation:</b>	ASK	
<b>Transmit Frequency Range:</b>	13.56 MHz	
<b>Power Supply Requirement:</b>	Nominal	3.7 VDC
	Minimum	3.3 VDC
	Maximum	4.2 VDC
<b>Tested Temperature Range:</b>	Minimum	-10°C
	Maximum	45°C

### **3.5. Support Equipment**

The following support equipment was used to exercise the EUT during testing:

<b>Description:</b>	AC to DC switching power supply
<b>Brand Name:</b>	Phihong
<b>Model Name or Number:</b>	PSAI05R-050Q
<b>Serial Number:</b>	D142700135A1

<b>Description:</b>	Micro USB Cable
<b>Brand Name:</b>	Not marked or stated
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Battery
<b>Brand Name:</b>	Ingenico
<b>Model Name or Number:</b>	296118442
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Dummy battery
<b>Brand Name:</b>	Ingenico
<b>Model Name or Number:</b>	296118442
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Cellular handset
<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	iPhone 6
<b>Serial Number:</b>	C5FPGCQW5MN
<b>IMEI:</b>	359260067813458



## **4. Operation and Monitoring of the EUT during Testing**

### **4.1. Operating Modes**

The EUT was tested in the following operating mode(s):

- Constantly transmitting at full power with a modulated carrier in RFID test mode for all measurements. The EUT was transmitting in test mode with a 100% duty cycle.

### **4.2. Configuration and Peripherals**

The EUT was tested in the following configuration(s):

- RFID test mode was enabled by following instructions in the customer's document ISMP3\_Instructions\_for\_RFID.pdf.
- The EUT supported three different data rates. Fundamental field strength measurements were performed on all data rates to determine the worst case mode for all testing. As the fundamental field strength was same across all modes, the mode that produced the worst case modulation around the carrier was used for all transmitter tests, this was 100% ASK.
- For AC conducted emissions, fundamental field strength, radiated spurious emissions and band edge radiated emissions tests, the USB cable was connected to an AC to DC switching power supply. An iPhone 6 was connected to the EUT and it was placed in airplane mode.
- Testing at voltage extremes was performed with the EUT powered by an external DC power supply. The customer supplied a dummy battery to perform this test.
- Refer to Appendix 1 of this test report for details of radiated tests on an open field test site.

## **5. Measurements, Examinations and Derived Results**

### **5.1. General Comments**

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6: Measurement Uncertainties* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

## **5.2. Test Results**

### **5.2.1. Transmitter AC Conducted Spurious Emissions**

#### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Dates:</b>	03 August 2015 & 05 August 2015
<b>Test Sample Serial Numbers:</b>	15198PP00008479 & 15202PP00008582		

<b>FCC Reference:</b>	Part 15.207
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4. FCC KDB 174176 and Notes below

#### **Environmental Conditions:**

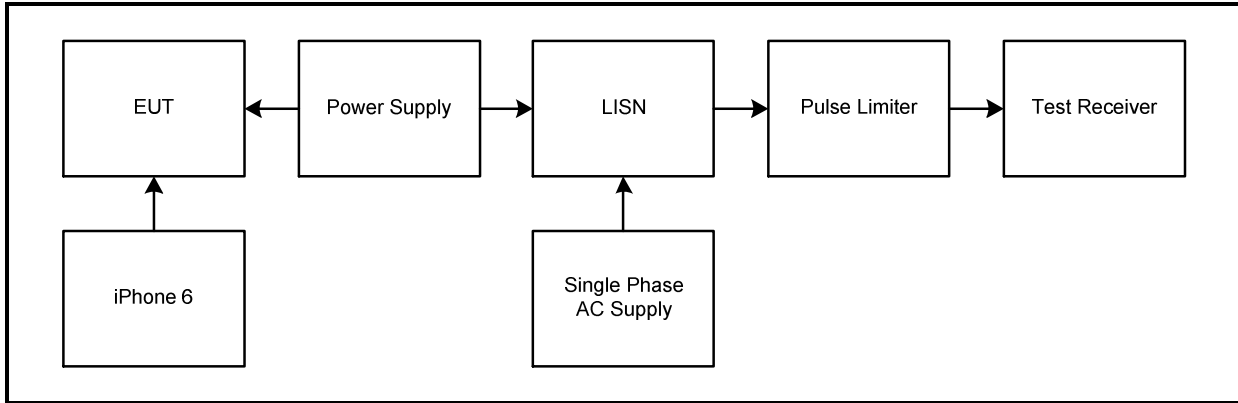
<b>Temperature (°C):</b>	21 to 24
<b>Relative Humidity (%):</b>	38 to 50

#### **Note(s):**

1. An AC to DC switching power supply output was connected to the EUT via a USB cable. The AC to DC switching power supply input was connected to a 120 VAC 60 Hz single phase supply via a LISN.
2. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
3. A pulse limiter was fitted between the LISN and the test receiver.
4. The EUT was initially tested with the standard antenna connected (Test sample Serial No. 15198PP00008479). An emission at the carrier frequency of 13.56 MHz was found to be non-compliant as it exceeded the test limit. The customer supplied a second, modified sample (Test sample Serial No. 15202PP00008582). The standard antenna was disconnected and a dummy load fitted in accordance with FCC KDB 174176. The test was repeated and the EUT was found to be compliant.
5. \* Test results prior to modification of the EUT (standard antenna/Test sample Serial No. 15198PP00008479)
6. \*\*Test results with modified sample (transmitter terminated into a dummy load/Test sample Serial No. 15202PP00008582).

**Transmitter AC Conducted Spurious Emissions (continued)**

**Test setup for AC conducted spurious emissions measurements:**



**Transmitter AC Conducted Spurious Emissions (continued)****Results: Live / Quasi Peak**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.150	Live	44.4*	66.0	21.6	Complied
0.240	Live	38.9*	62.1	23.2	Complied
0.402	Live	37.4*	57.8	20.4	Complied
0.560	Live	33.8*	56.0	22.2	Complied
13.560	Live	26.4**	60.0	33.6	Complied
27.119	Live	33.4*	60.0	26.6	Complied

**Results: Live / Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.159	Live	35.7*	55.5	19.8	Complied
0.281	Live	32.7*	50.8	18.1	Complied
0.402	Live	33.0*	47.8	14.8	Complied
0.560	Live	32.5*	46.0	13.5	Complied
13.560	Live	18.7**	50.0	31.3	Complied
27.119	Live	26.9*	50.0	23.1	Complied

**Transmitter AC Conducted Spurious Emissions (continued)****Results: Neutral / Quasi Peak**

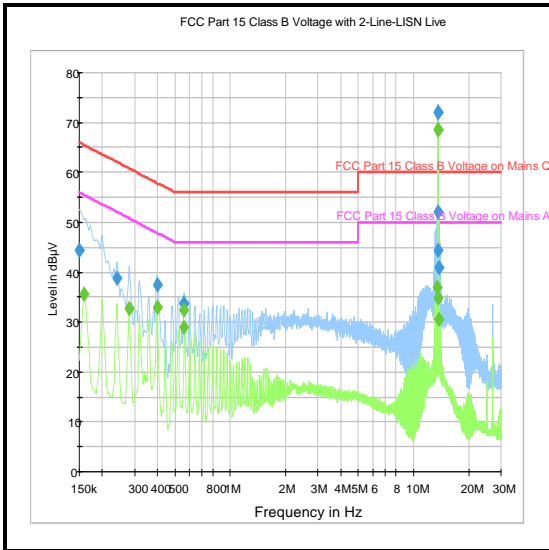
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.159	Neutral	46.2*	65.5	19.3	Complied
0.200	Neutral	43.1*	63.6	20.5	Complied
0.357	Neutral	38.4*	58.8	20.4	Complied
0.362	Neutral	40.6*	58.7	18.1	Complied
13.560	Neutral	28.5**	60.0	31.5	Complied
27.119	Neutral	38.1*	60.0	21.9	Complied

**Results: Neutral / Average**

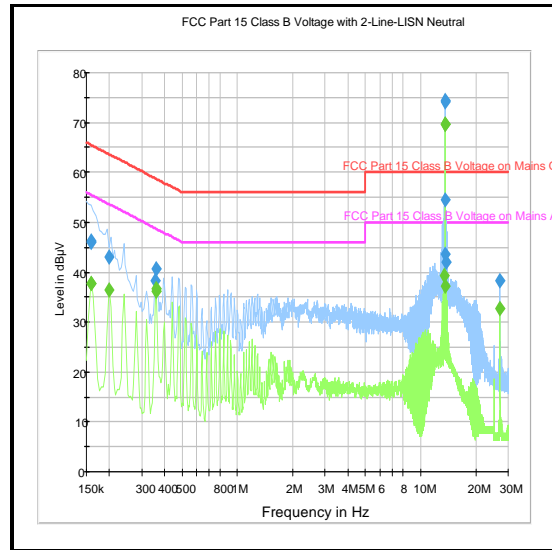
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.159	Neutral	37.7*	55.5	17.8	Complied
0.200	Neutral	36.5*	53.6	17.1	Complied
0.321	Neutral	30.5*	49.7	19.2	Complied
0.362	Neutral	36.6*	48.7	12.1	Complied
13.560	Neutral	22.8**	50.0	27.2	Complied
27.119	Neutral	32.7*	50.0	17.3	Complied

**Transmitter AC Conducted Spurious Emissions (continued)**

**Test results with unmodified sample**

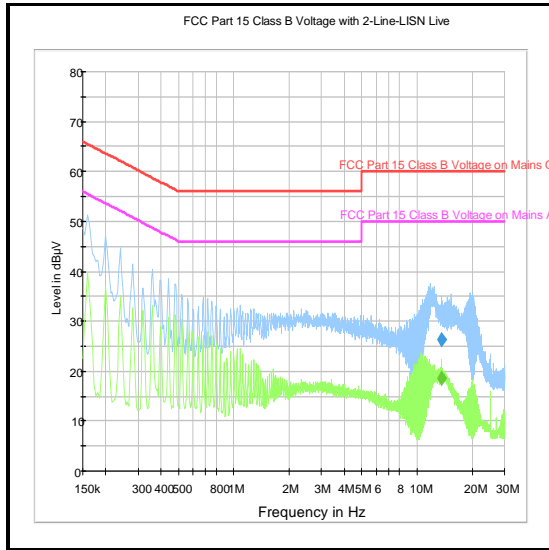


**Live**

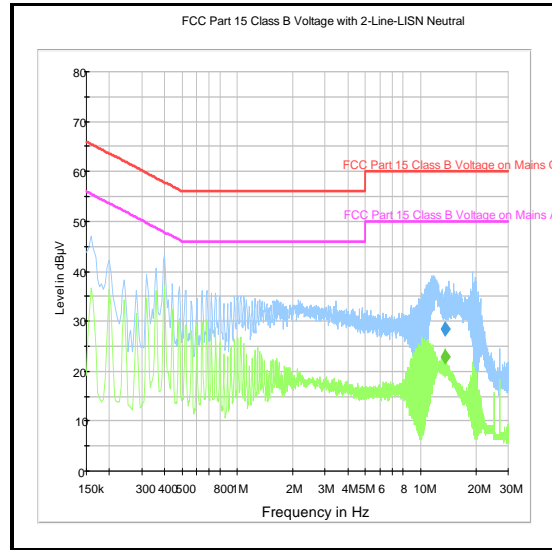


**Neutral**

**Test results with modified sample (transmitter terminated into a dummy load)**



**Live**



**Neutral**

*Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.*

**Transmitter AC Conducted Spurious Emissions (continued)****Test Equipment Used:**

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
M1625	Thermohygrometer	JM Handelspunkt	30.5015.06	None stated	07 Jan 2016	12
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002	14 Aug 2015	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	02 Mar 2016	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	14 Oct 2015	12



**5.2.2. Transmitter Fundamental Field Strength****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Dates:</b>	31 July 2015 & 02 August 2015
<b>Test Sample Serial Number:</b>	15198PP00008479		

<b>FCC Reference:</b>	Part 15.225(a)(b)(c)(d)
<b>Test Method Used:</b>	FCC KDB 937606 referencing ANSI C63.10 Section 6.4

**Environmental Conditions:**

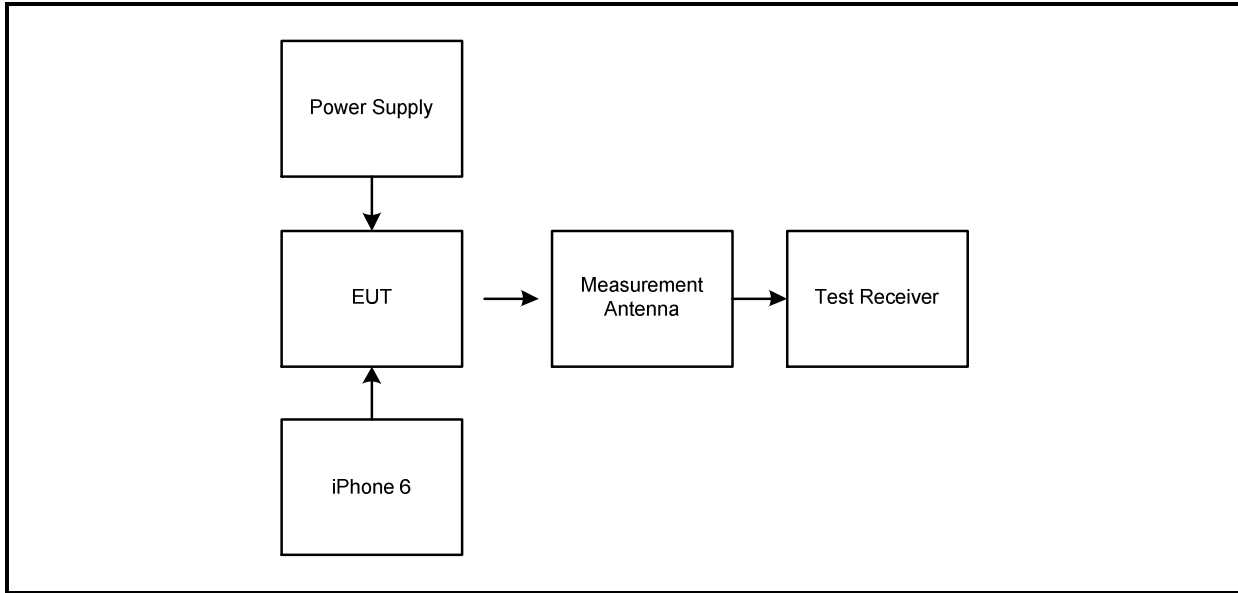
<b>Temperature (°C):</b>	24 to 25
<b>Relative Humidity (%):</b>	32 to 38

**Note(s):**

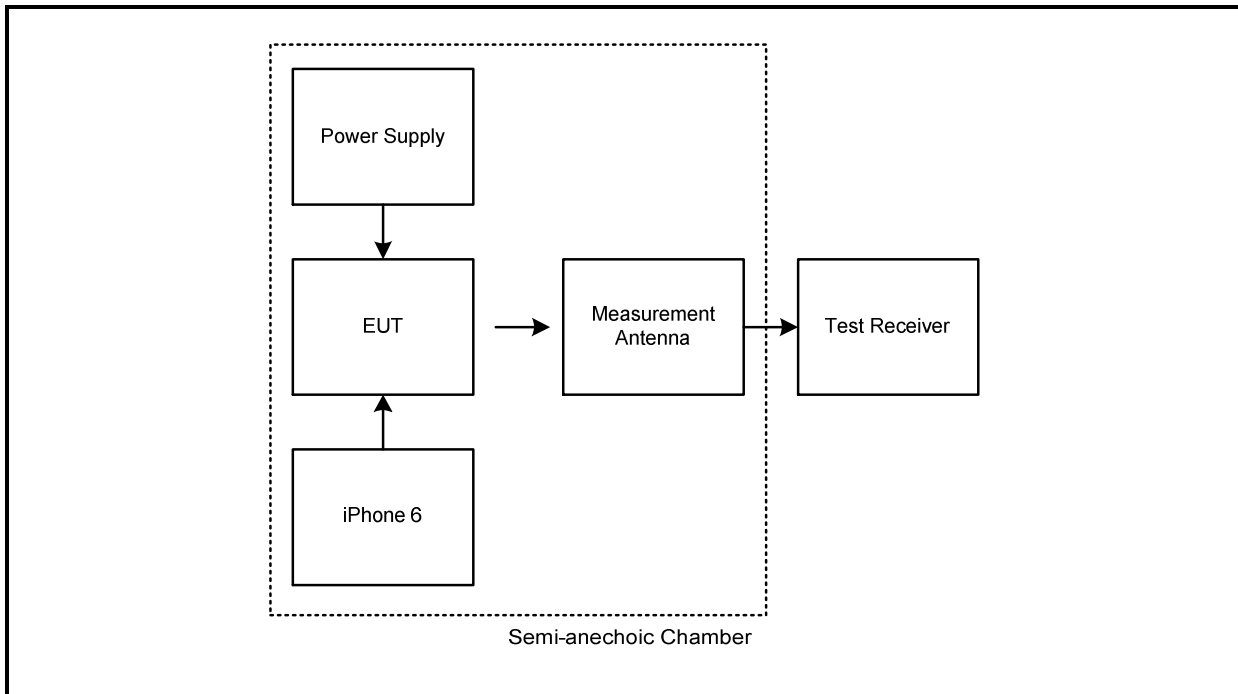
1. In accordance with FCC KDB 937606, measurements of the transmitter fundamental field strength at 30 metres on an open field test site are used to show compliance to the limit.
2. Due to the ambient emissions present on the open field test site, compliance with the spectrum mask is shown by measurements performed in a semi-anechoic chamber. For the field strength measurements in a semi-anechoic chamber, a reference level offset on the test receiver was used to replicate the measurement at 30 metres on the open field test site. Background scans of the open field test site and further information are shown in Appendix 1 of this test report.
3. Pre-scan measurements were performed using a peak detector and measurement bandwidth of 10 kHz. The fundamental field strength was maximized by rotating the measurement antenna and EUT. A peak level of 51.0 dB $\mu$ V/m at a measurement distance of 30 metres was recorded and shown on the pre-scan plot below. The spectrum analyser was then switched to test receiver mode and the final measurement on the maximized level was performed. In accordance with and CISPR 16-1-1 as stated in ANSI C63.10 Clause 4.2.3.2.1, a quasi-peak detector was used in conjunction with a measurement bandwidth of 9 kHz and 0.2 second sweep time. A quasi-peak level of 51.7 dB $\mu$ V/m was recorded.
4. A transducer factor was used on the spectrum analyser during open field tests. This factor includes correction between the fixed gain of the magnetic loop antenna and the calibration values. It also includes the value of the RF cable used to connect the antenna to the spectrum analyser which was incorporated into the annual calibration of the magnetic loop antenna.

**Transmitter Fundamental Field Strength (continued)**

**Test setup for fundamental field strength radiated measurements on an open field test site:**



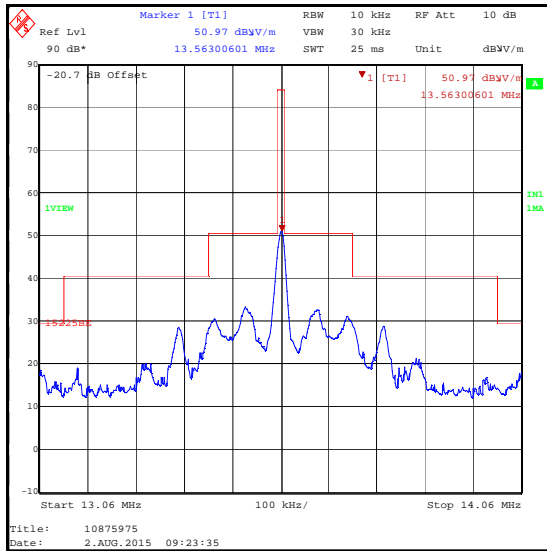
**Test setup for fundamental field strength radiated measurements in a Semi-Anechoic Chamber:**



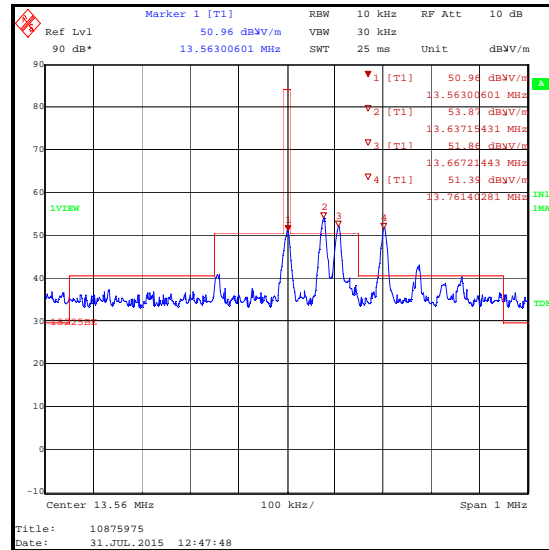
**Transmitter Fundamental Field Strength (continued)**

**Results: Quasi Peak**

Frequency (MHz)	Measurement Antenna Position	Level (dBµV/m)	Limit at 30 m (dBµV/m)	Margin (dB)	Result
13.56	Tip towards EUT	51.7	84.0	32.3	Complied



**Fundamental field strength and spectrum mask / measured at 3 metres / measured in a semi-anechoic chamber**



**Fundamental field strength / EUT operating / measured at 30 metres / measured on an open field test site**

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1945	Thermohygrometer	JM Handelspunkt	30.5015.01	0112	23 Apr 2016	12
M1659	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
K0001	5 m RSE Chamber	Rainford EMC	N/A	N/A	19 Mar 2016	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	19 Mar 2016	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	06 May 2016	12

**5.2.3. Transmitter Radiated Spurious Emissions****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Dates:</b>	29 July 2015, 31 July 2015 & 02 August 2015
<b>Test Sample Serial Number:</b>	15198PP00008479		

<b>FCC Reference:</b>	Parts 15.225(d) & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Sections 6.3, 6.4, 6.5 and FCC KDB 937606 referencing ANSI C63.4
<b>Frequency Range:</b>	9 kHz to 1000 MHz

**Environmental Conditions:**

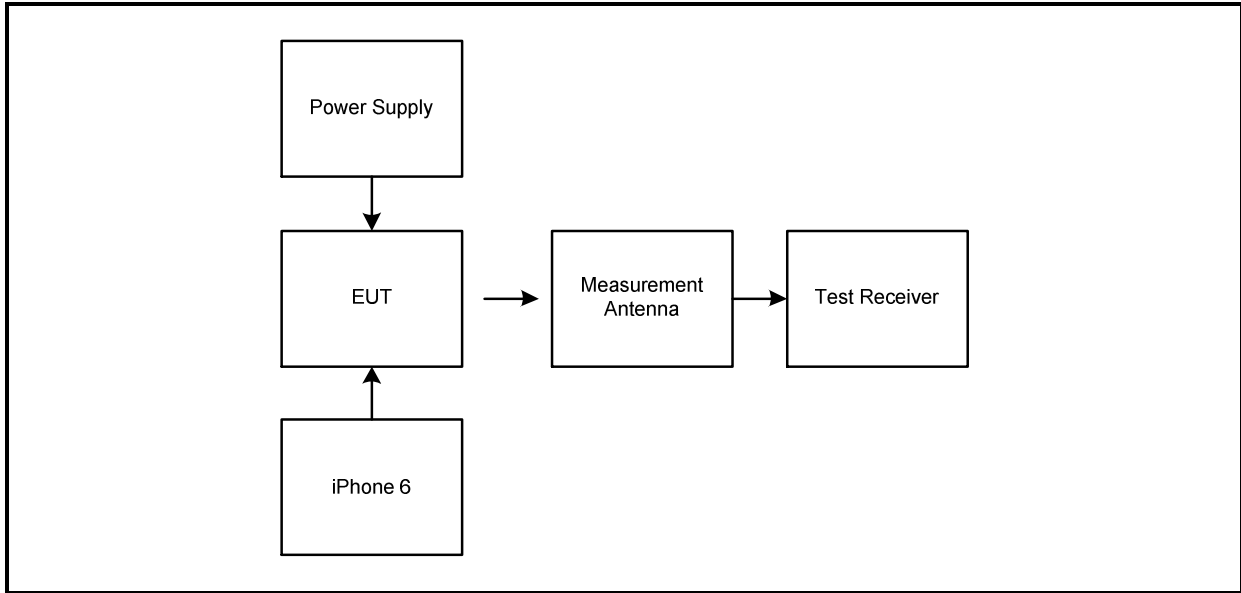
<b>Temperature (°C):</b>	23 to 25
<b>Relative Humidity (%):</b>	32 to 38

**Transmitter Radiated Spurious Emissions (continued)****Note(s):**

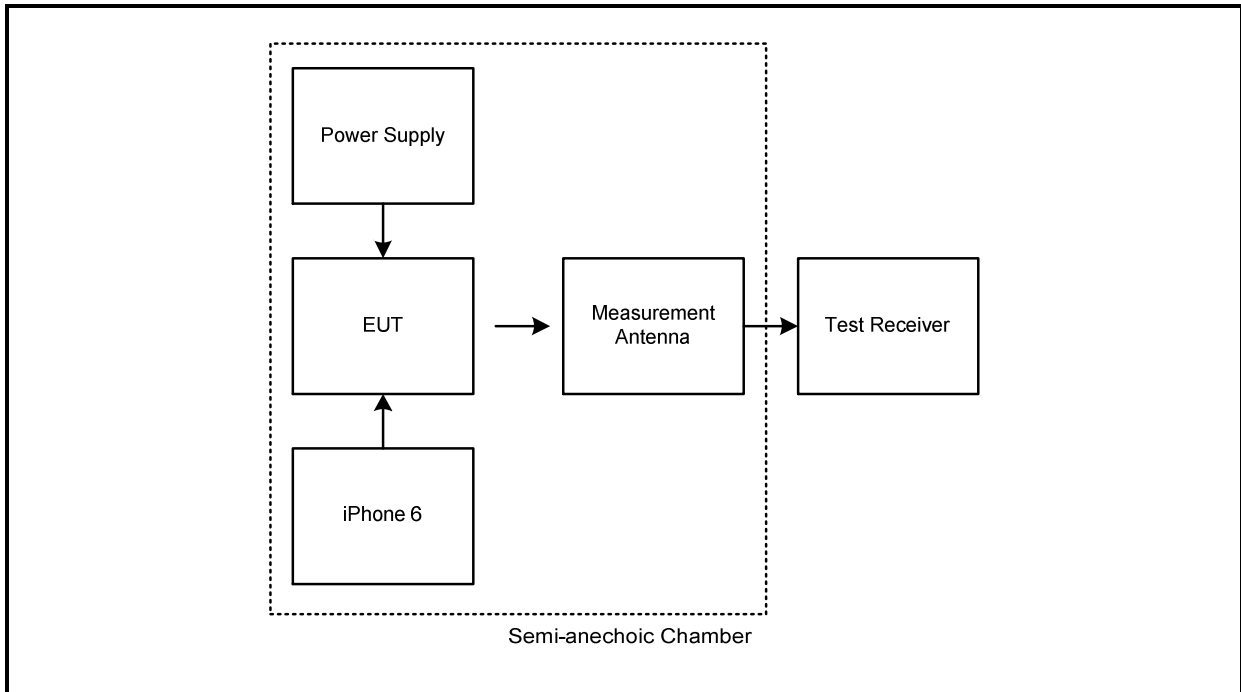
1. In accordance with FCC KDB 937606, a *bona fide* attempt was made to perform measurements at the distances specified in Part 15.209(a) on an open field test site. It was not possible to determine the spurious emission values at the test distances specified below 30 MHz on an open field test site, therefore in accordance with 47 CFR 15.31(f), measurements were made at closer distances. Attempts were made to measure spurious emissions at 3, 30 and 300 metres on an open field test site on 31 July 2015. Unfortunately, spurious emissions from the EUT could not be seen above the ambient emissions present at the open field test site or the noise floor of the measurement system. Final measurement results from the semi-anechoic chamber tests on 02 August 2015 are shown in this section are referenced to the fundamental field strength level record on the open field at 30 metres. In addition, the open field test result plots for measurements between 9 kHz and 30 MHz are also shown. These measurement plots are identical to background scan plots of the open field test site. Background scans of the open field test site and further information are shown in Appendix 1 of this test report.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss. Only spurious emissions in the range 30 MHz to 1 GHz were recorded. Markers were placed on the peaks of the pre-scan plot and final measurements were performed using a quasi peak detector.
3. All other emissions were greater than 20 dB below the applicable limit, below the noise floor of the measurement system or ambient.
4. Measurements on 02 August 2015 were performed in a semi-anechoic chamber (UL VS LTD Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Between 30 MHz and 1 GHz, maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
5. Measurement plots in this section for tests between 9 kHz and 30 MHz on an open field test site have markers placed on the highest level ambient emissions. This is for information only.
6. The EUT carrier at 13.56 MHz is shown on some prescan plots.
7. Limit lines shown on open field test site plots from 9 kHz to 490 kHz have been extrapolated using a factor of 40 dB/decade to a test distance of 30 metres and are for indication only.
8. A transducer factor was used on the spectrum analyser during open field tests. This factor includes correction between the fixed gain of the magnetic loop antenna and the calibration values. It also includes the value of the RF cable used to connect the antenna to the spectrum analyser which was incorporated into the annual calibration of the magnetic loop antenna.
9. A reference level of 90 dB $\mu$ V/m has been used on the 9 kHz to 150 kHz pre-scan plot when measured at 300 metres on the open field test site. This reference level is different to similar pre-scan plots in this section of the test report. The 9 kHz to 150 kHz pre-scan plot at 300 metres is correct, the reference level used has no effect on the measurement result. Only ambient emissions were observed.

**Transmitter Radiated Spurious Emissions (continued)**

**Test setup for radiated spurious emissions measurements on an open field test site:**



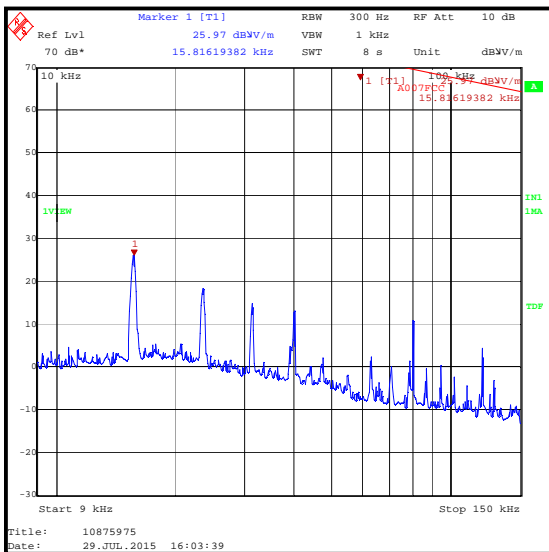
**Test setup for radiated spurious emissions measurements in a Semi-Anechoic Chamber:**



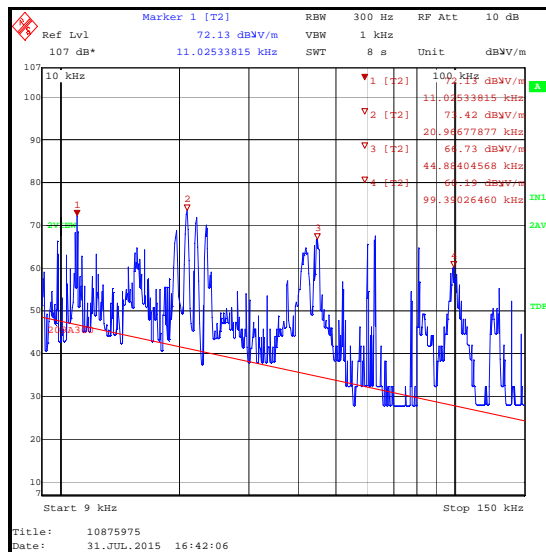
**Transmitter Radiated Spurious Emissions (continued)****Results: Quasi Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
40.663	Vertical	36.4	40.0	3.6	Complied
72.920	Vertical	25.9	40.0	14.1	Complied
142.311	Vertical	32.3	43.5	11.2	Complied
290.256	Horizontal	28.4	46.0	17.6	Complied
677.282	Horizontal	27.1	46.0	18.9	Complied
870.795	Horizontal	26.5	46.0	19.5	Complied

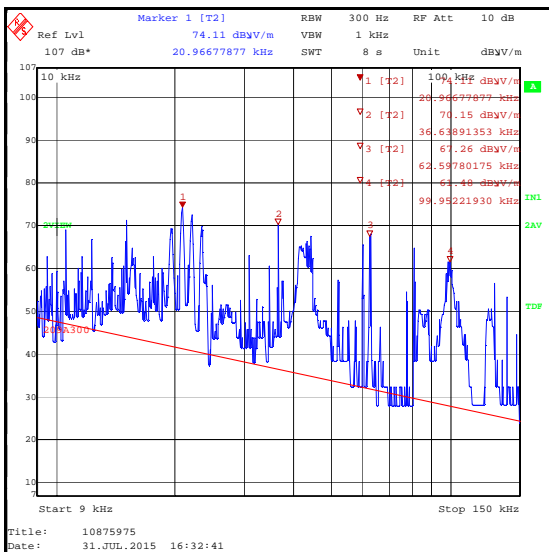
**Transmitter Radiated Spurious Emissions (continued)**



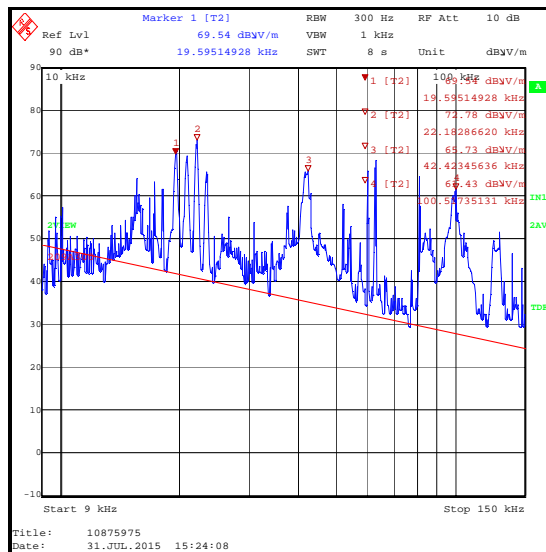
**9 kHz to 150 kHz / peak detector / measured at 3 metres / measured in a semi-anechoic chamber**



**9 kHz to 150 kHz / average detector / EUT operating / measured at 3 metres on an open field test site**



**9 kHz to 150 kHz / average detector / EUT operating / measured at 30 metres on an open field test site**

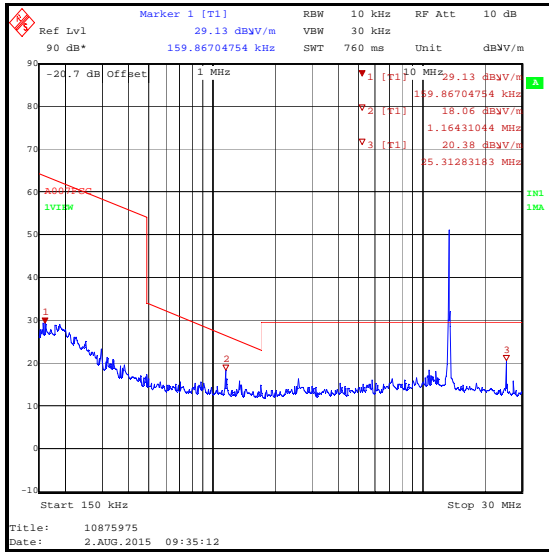


**9 kHz to 150 kHz / average detector / EUT operating / measured at 300 metres on an open field test site**

*Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.*



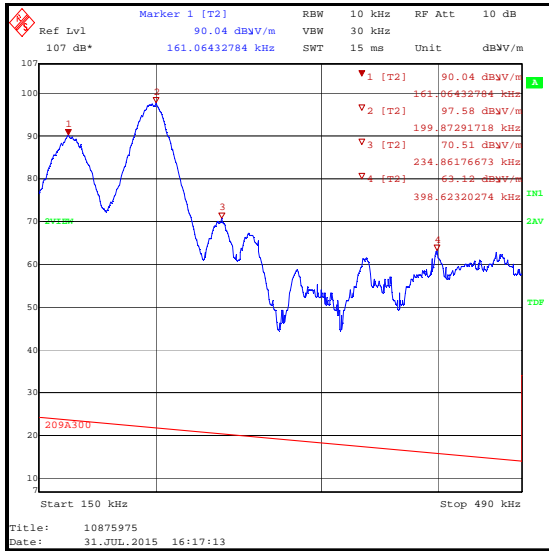
**Transmitter Radiated Spurious Emissions (continued)**



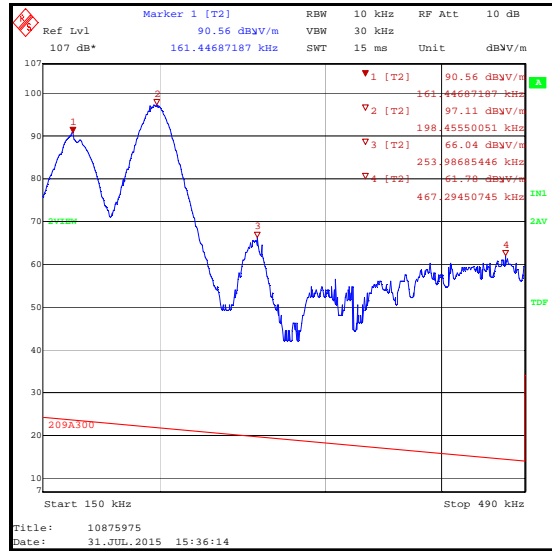
**150 kHz to 30 MHz / peak detector (worst case) / EUT operating / measured in a semi-anechoic chamber**



**150 kHz to 490 kHz / average detector / EUT operating / measured at 3 metres on an open field test site**



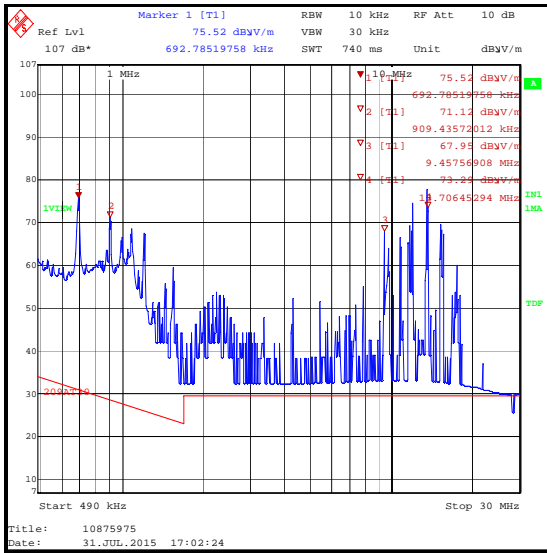
**150 kHz to 490 kHz / average detector / EUT operating / measured at 30 metres on an open field test site**



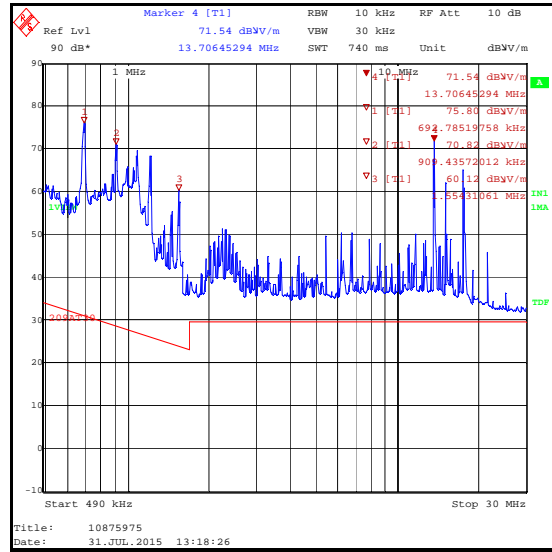
**150 kHz to 490 kHz / average detector / EUT operating / measured at 300 metres on an open field test site**

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.

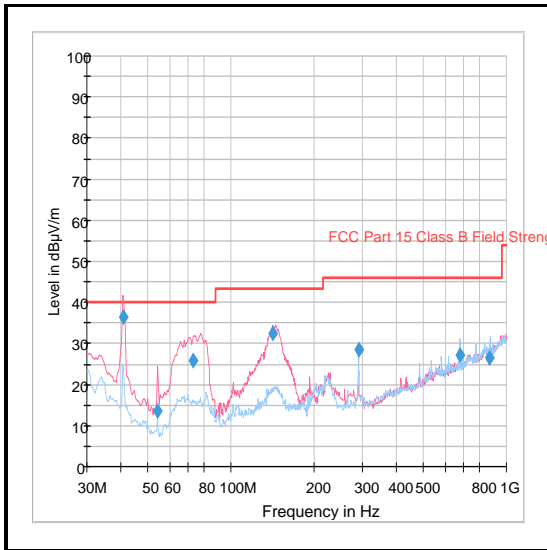
**Transmitter Radiated Spurious Emissions (continued)**



490 kHz to 30 MHz / peak detector / EUT operating / measured at 3 metres on an open field test site



490 kHz to 30 MHz / peak detector / EUT operating / measured at 30 metres on an open field test site



30 MHz to 1 GHz / peak detector (worst case) / measured at 3 metres in a semi-anechoic chamber

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying table.

**Transmitter Radiated Spurious Emissions (continued)****Test Equipment Used:**

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
M1945	Thermohygrometer	JM Handelpunkt	30.5015.01	0112	23 Apr 2016	12
M1659	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	23 Apr 2016	12
K0001	5 m RSE Chamber	Rainford EMC	N/A	N/A	19 Mar 2016	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	19 Mar 2016	12
M1124	Test Receiver	Rohde & Schwarz	ESIB26	100046	06 Oct 2015	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	06 May 2016	12
A259	Antenna	Chase	CBL6111	1513	09 Apr 2016	12
G0543	Amplifier	Sonoma	310N	230801	05 Aug 2015	3
A1834	Attenuator	Hewlett Packard	8491B	10444	05 Mar 2016	12

**5.2.4. Transmitter Band Edge Radiated Emissions****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	02 August 2015
<b>Test Sample Serial Number:</b>	15198PP00008479		

<b>FCC Reference:</b>	Parts 15.225(c)(d) & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.4

**Environmental Conditions:**

<b>Temperature (°C):</b>	25
<b>Relative Humidity (%):</b>	38

**Note(s):**

1. In accordance with FCC KDB 937606, a *bona fide* attempt was made to perform measurements at the distances specified in Part 15.209(a). It was not possible to determine the band edge emission values at the test distances specified below 30 MHz on an open field test site due to the presence of ambient emissions, therefore in accordance with 47 CFR 15.31(f), measurements were made at closer distances. Attempts were made to measure the fundamental and band edges at 3 metres on an open field test site on 31 July 2015. Unfortunately the emission could not be seen above the ambient emissions or the noise floor of the measurement system. Therefore the results from the semi-anechoic chamber tests on 2 August 2015 are shown in this section of the test report. Background scans of the open field test site are shown in Appendix 1 of this test report.
2. Field strength measurements in a semi-anechoic chamber had an RF level offset applied to replicate the fundamental field strength level measured on the open field test site at 30 metres.
3. Final measurements at the band edge frequencies were performed using a peak detector as it is worst case.

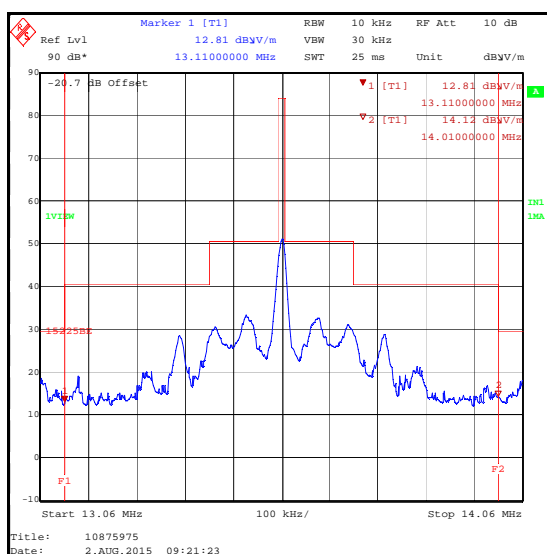
**Transmitter Band Edge Radiated Emissions (continued)**

**Results: Peak / Lower Band Edge**

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
13.11	12.8	29.5	16.7	Complied

**Results: Peak / Upper Band Edge**

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
14.01	14.1	29.5	15.4	Complied



**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1945	Thermohygrometer	JM Handelspunkt	30.5015.01	0112	23 Apr 2016	12
M1659	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
K0001	5 m RSE Chamber	Rainford EMC	N/A	N/A	19 Mar 2016	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	19 Mar 2016	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	06 May 2016	12

**5.2.5. Transmitter 20 dB Bandwidth**

**Test Summary:**

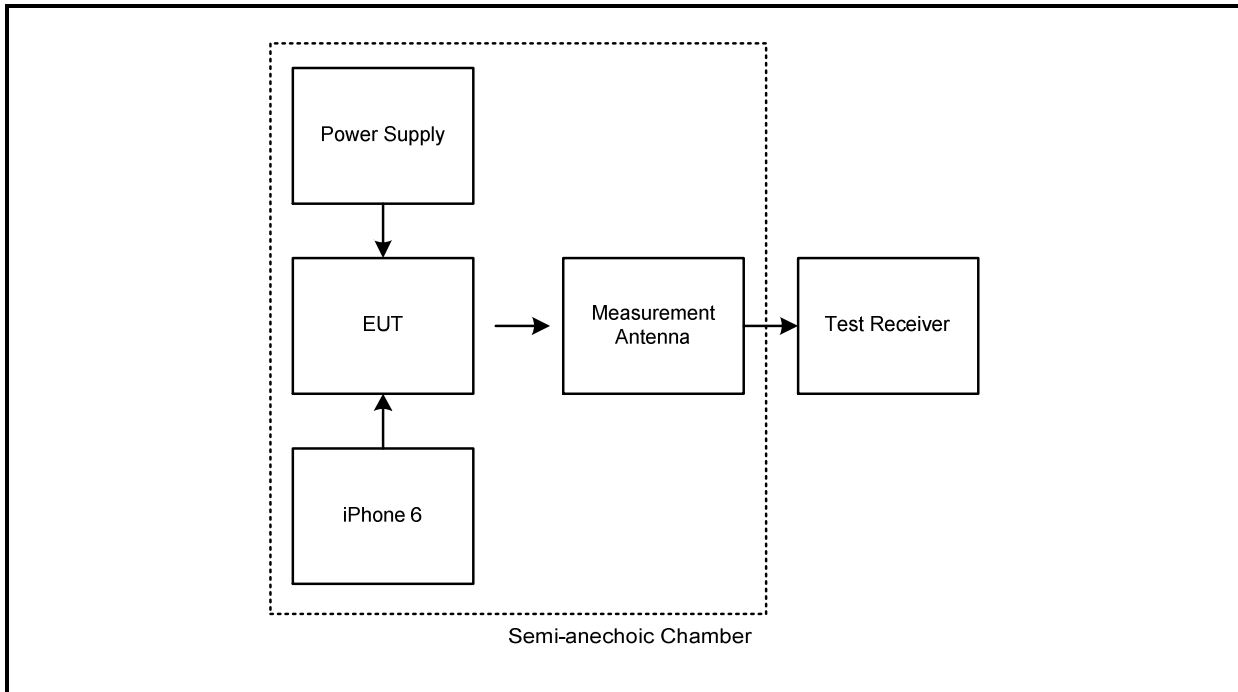
<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	29 July 2015
<b>Test Sample Serial Number:</b>	15198PP00008479		

<b>FCC Reference:</b>	Part 2.1049
<b>Test Method Used:</b>	ANSI C63.10 Section 6.9.2

**Environmental Conditions:**

<b>Temperature (°C):</b>	25
<b>Relative Humidity (%):</b>	38

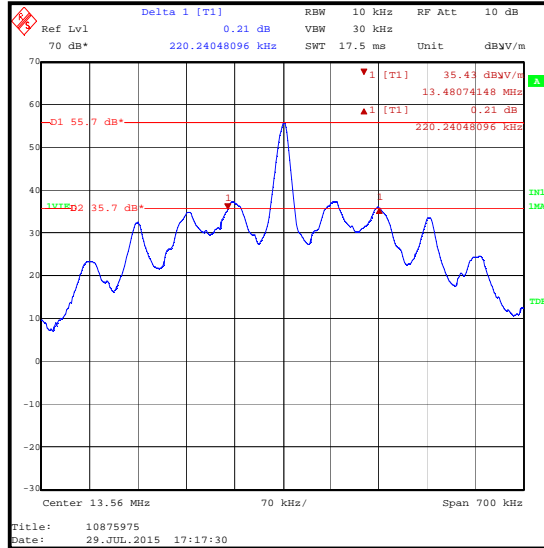
**Test setup for 20 dB bandwidth radiated measurements in a Semi-Anechoic Chamber**



**Transmitter 20 dB Bandwidth (continued)**

**Results:**

<b>20 dB Bandwidth (kHz)</b>
220.240



**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1945	Thermohygrometer	JM Handelspunkt	30.5015.01	0112	23 Apr 2016	12
K0001	5 m RSE Chamber	Rainford EMC	N/A	N/A	19 Mar 2016	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	19 Mar 2016	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	06 May 2016	12

**5.2.6. Transmitter Frequency Stability (Temperature & Voltage Variation)****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	05 August 2015
<b>Test Sample Serial Number:</b>	15198PP00008479		

<b>FCC Reference:</b>	Part 15.225(e)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.8.1 and 6.8.2

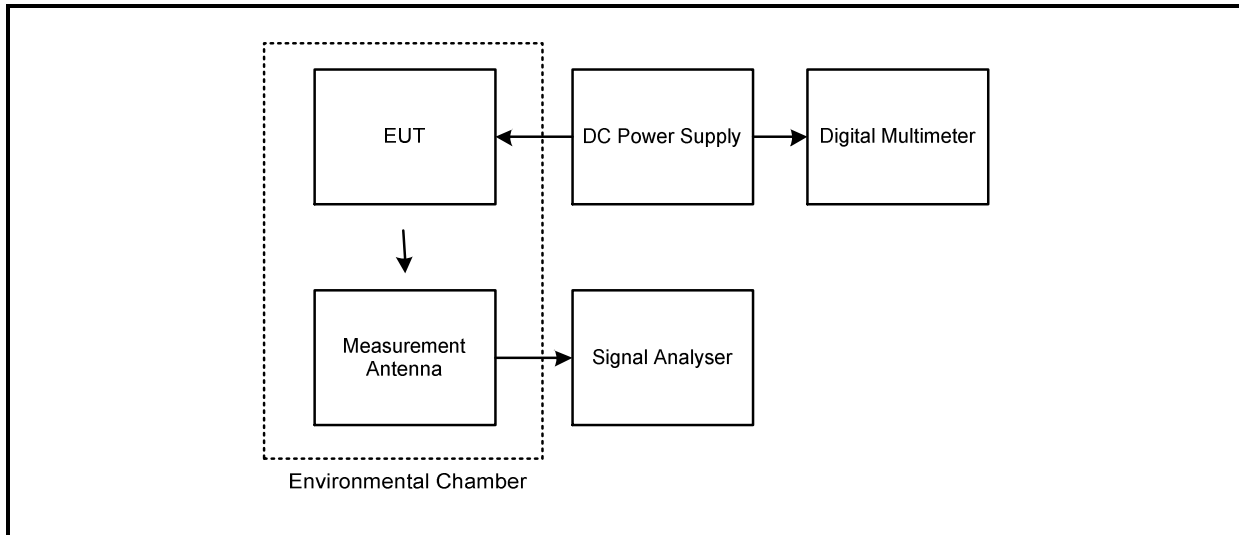
**Environmental Conditions:**

<b>Ambient Temperature (°C):</b>	26
<b>Ambient Relative Humidity (%):</b>	35

**Note(s):**

1. Testing at voltage extremes was performed with the EUT powered by an external DC power supply. The customer supplied a dummy battery for test purposes. This allowed an external power supply to be connected to the EUT.
2. It was not possible to perform the frequency stability measurements with an unmodulated carrier, therefore testing was performed with a modulated carrier. The measurement was performed using the signal analyser marker count function. The marker counter function was set to 1 Hz before any measurements were performed.
3. The manufacturer declared that the EUT would not operate at the required temperatures of -20°C and 50°C, therefore the EUT has been tested with a minimum temperature of -10°C and a maximum temperature of 45°C.
4. The manufacturer declared that the EUT minimum and maximum primary supply voltages are 3.3 and 4.2.
5. Frequency error was measured using a calibrated Rohde & Schwarz signal analyser.
6. Temperature was monitored throughout the test with a calibrated digital thermometer.
7. Voltage was monitored throughout the test with a calibrated digital voltmeter.



**Transmitter Frequency Stability (Temperature & Voltage Variation) (continued)****Test setup for frequency stability measurements:****Results: Maximum frequency error of the EUT with variations in ambient temperature**

Temperature (°C)	Time after Start-up			
	0 minutes	2 minutes	5 minutes	10 minutes
-10	13.559469 MHz	13.559473 MHz	13.559475 MHz	13.559475 MHz
20	13.559439 MHz	13.559429 MHz	13.559425 MHz	13.559420 MHz
45	13.559356 MHz	13.559351 MHz	13.559347 MHz	13.559345 MHz

Frequency with Worst Case Deviation (MHz)	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Margin (%)	Result
13.559345	655	0.00483	0.01	0.00517	Complied

**Results: Maximum frequency error of the EUT with variations in nominal operating voltage at an ambient temperature of 20°C**

Supply Voltage (V)	Nominal Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (%)	Limit (%)	Margin (%)	Result
3.3	13.56	13.559418	582	0.00429	0.01	0.00571	Complied
3.7	13.56	13.559420	580	0.00428	0.01	0.00572	Complied
4.2	13.56	13.559417	583	0.00430	0.01	0.00570	Complied

**Transmitter Frequency Stability (Temperature & Voltage Variation) (continued)****Test Equipment Used:**

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
M1659	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	23 Apr 2016	12
M1883	Signal Analyser	Rohde & Schwarz	FSV30	103084	23 Jul 2016	12
M1249	Thermometer	Fluke	52II	88800049	27 May 2016	12
M1229	Multimeter	Fluke	179	87640015	23 Apr 2016	12
S0558	DC Power Supply	TTI	EL303R	395825	Calibrated before use	-
E0513	Environmental Chamber	TAS	LT600 Series 3	23900506	Calibrated before use	-

## **6. Measurement Uncertainty**

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB
20 dB Bandwidth	13 MHz to 14 MHz	95%	±3.92 %
Frequency Stability	13 MHz to 14 MHz	95%	±0.92 ppm
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	±3.73 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	±5.65 dB
Transmitter Fundamental Field Strength	13 MHz to 14 MHz	95%	±3.73 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

## **7. Report Revision History**

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version
2.0	1 & 4	-	Changed Ingenico France to Ingenico. Changed address.