



TEST REPORT

Test Report No. : UL-RPT-RP11012145JD05A V2.0

Manufacturer : SureFlap Ltd
Model No. : HRP
FCC ID : XO9-HR000N
Test Standard(s) : FCC Parts 15.209 & 15.215 (c)

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
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: 25 October 2016

Checked by:

Ian Watch
Senior Engineer, Radio Laboratory

Company Signatory:

Steven White
Service Lead, Radio Laboratory
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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1. Customer Information

Company Name:	SureFlap Ltd
Address:	7 The Irwin Centre Dry Drayton Cambridge CB23 8AR United Kingdom

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.209 and 47CFR15.215
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Sections 15.209 & 15.215
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	04 December 2015 to 18 December 2015

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.209	Transmitter Radiated Emissions	
Part 15.209	Transmitter Radiated Emissions (Fundamental)	
Part 15.215(c)	Transmitter 20 dB Bandwidth	
Key to Results  = Complied  = Did not comply		

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

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)

Brand Name:	SureSense Microchip Reader
Model Name or Number:	HRP
Test Sample Serial Number:	15
Hardware Version:	04
Software Version:	54
FCC ID:	XO9-HR000N

3.2. Description of EUT

The equipment under test was a *Bluetooth*-enabled handheld microchip temperature reader, which incorporated an RFID module operating at 134.45 kHz and *Bluetooth* Low Energy.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Tested Technology:	RFID	
Power Supply Requirement:	Nominal	3.2 VDC
Type of Unit:	Transceiver	
Modulation:	AM	
Transmit Frequency:	134.45 kHz	

3.5. Support Equipment

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

Description:	USB Hub
Brand Name:	BELKIN
Model Name or Number:	F5U404
Serial Number:	Not marked or stated

Description:	Micro USB Cable
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

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.

4.2. Configuration and Peripherals

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

- For transmitter test: The EUT was enabled by pressing the on button and a picture of a dog's head appeared on the EUT's LCD display. The EUT transmitted continuously with a modulated signal.
- The EUT was powered by 2 AA alkaline batteries. New batteries were fitted before testing commenced and were monitored throughout testing with a calibrated multimeter.
- A USB Hub was used to terminate all possible ports.

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 Uncertainty 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 Radiated Spurious Emissions

Test Summary:

Test Engineer:	Andrew Edwards	Test Dates:	04 December 2015 & 05 December 2015
Test Sample Serial Number:	15		

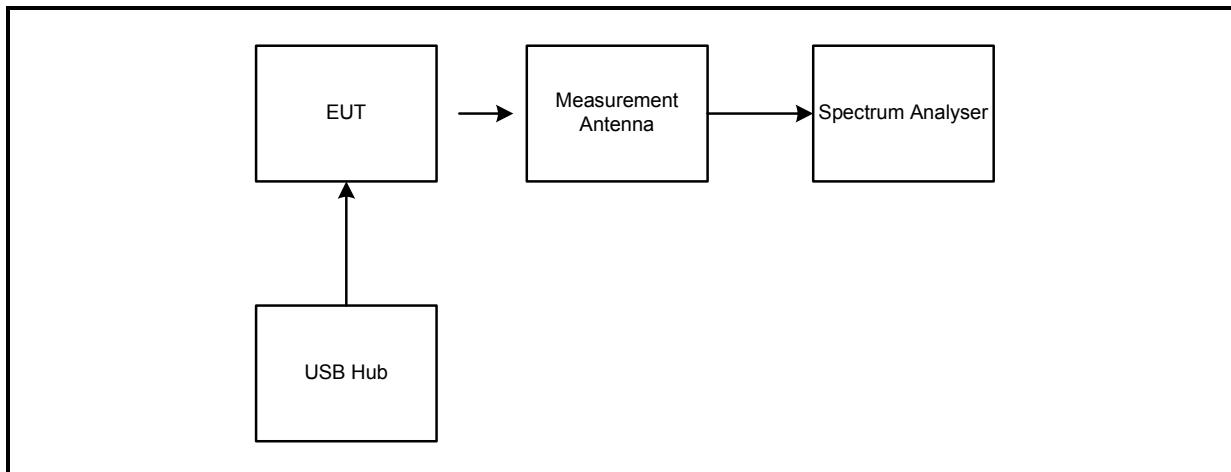
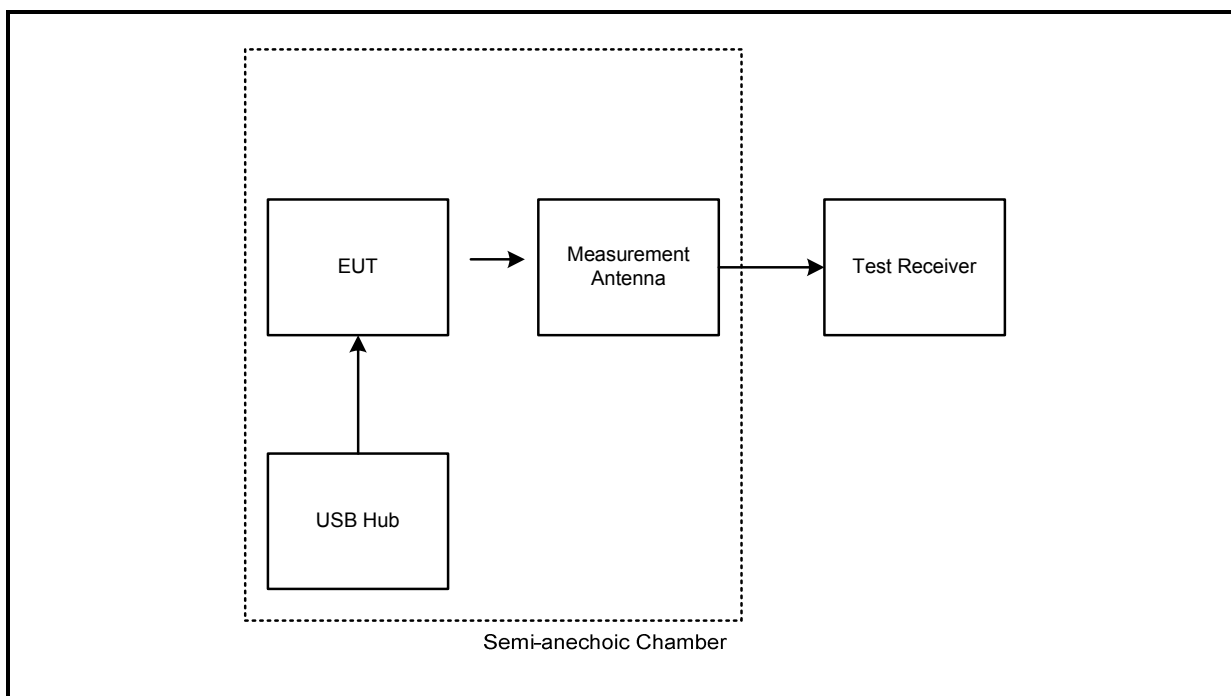
FCC Reference:	Part 15.209
Test Method Used:	ANSI C63.10 Sections 6.3, 6.4 and 6.5
Frequency Range:	9 kHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	39 to 41

Note(s):

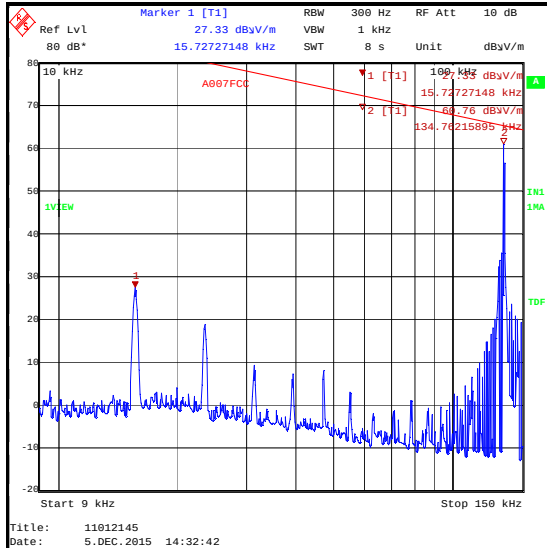
1. In accordance with FCC KDB 937606, a *bona fide* attempt was made to perform measurements at the distances specified in Part 15.209(a) on an open field test site. It was not possible to determine the spurious emission values at the test distances specified below 30 MHz on an open field test site, 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 04 December 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 05 December 2015 are shown in this section. 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. All emissions were greater than 20 dB below the applicable limit, below the noise floor of the measurement system or ambient. Therefore the highest measurement noise floor has been recorded.
3. Measurements on 05 December 2015 were performed in a semi-anechoic chamber (UL VS LTD Asset Number K0001) at a distance of 3 metres. The EUT loop 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.
4. 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.
5. 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 Radiated Spurious Emissions (continued)**Test setup for radiated measurements: Open Field Test Site****Test setup for radiated measurements: Semi-Anechoic Chamber**

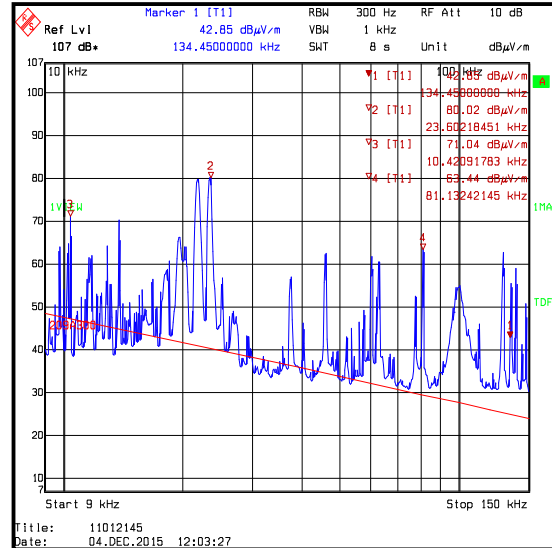
Transmitter Radiated Spurious Emissions (continued)

Results:

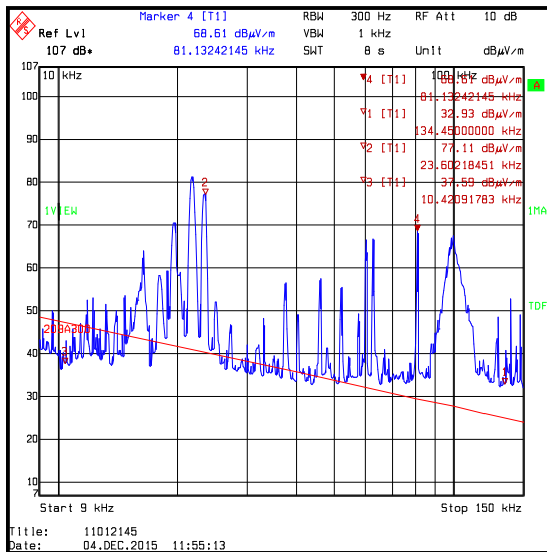
Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
990.741	Vertical	33.0	54.0	21.0	Complied



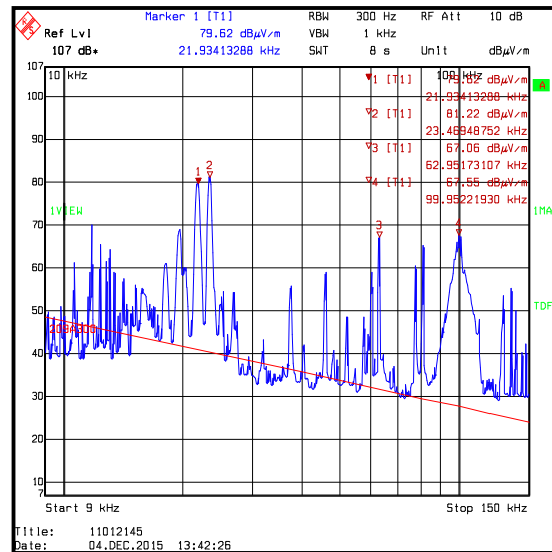
**9 kHz to 150 kHz / peak detector (worst case) /
measured at 3 metres extrapolated to 30 metres /
measured in a semi-anechoic chamber**



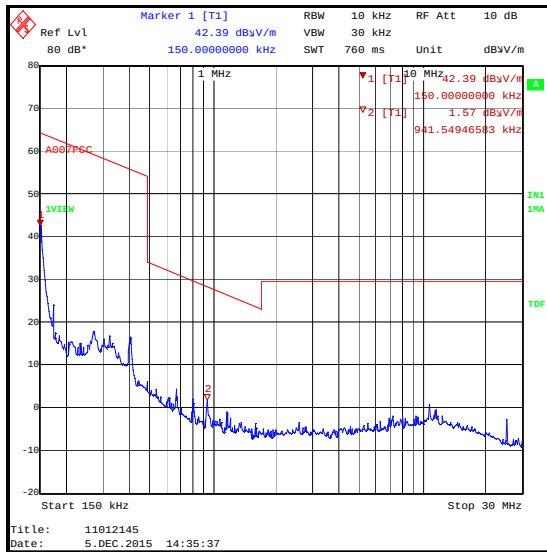
**9 kHz to 150 kHz / peak detector (worst case) / EUT
operating / measured at 3 metres on an open field test
site**



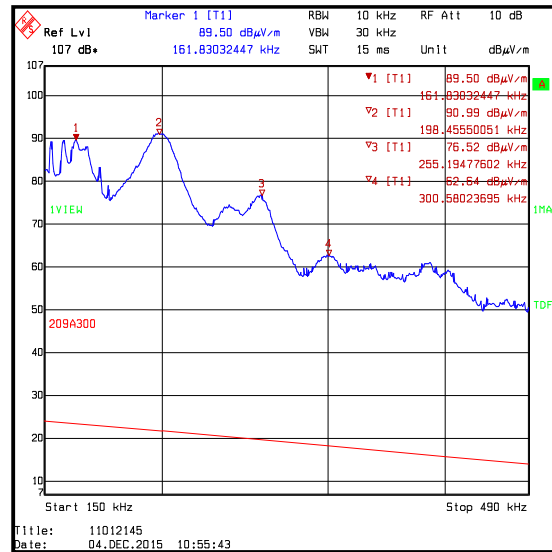
9 kHz to 150 kHz / peak detector (worst case) / EUT
operating / measured at 30 metres on an open field
test site



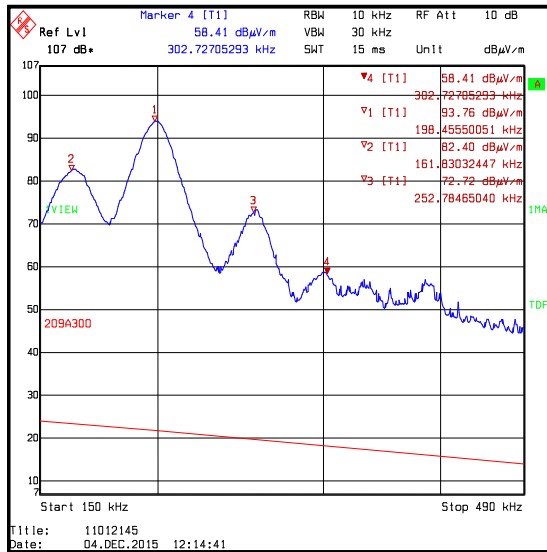
9 kHz to 150 kHz / peak detector (worst case) / EUT
operating / measured at 300 metres on an open field
test site

Transmitter Radiated Spurious Emissions (continued)

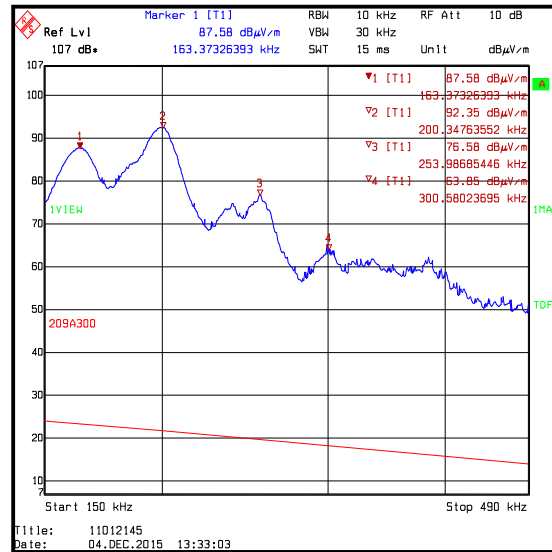
150 kHz to 30 MHz / peak detector (worst case) / EUT operating / measured at 3 metres extrapolated to 30 metres / measured in a semi-anechoic chamber



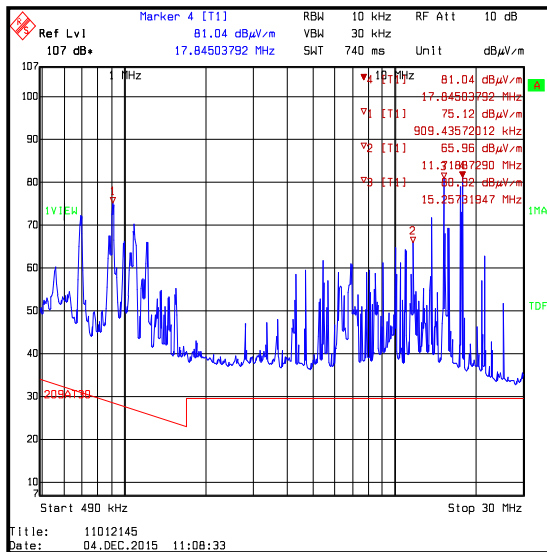
150 kHz to 490 kHz / peak detector (worst case) / EUT operating / measured at 3 metres on an open field test site



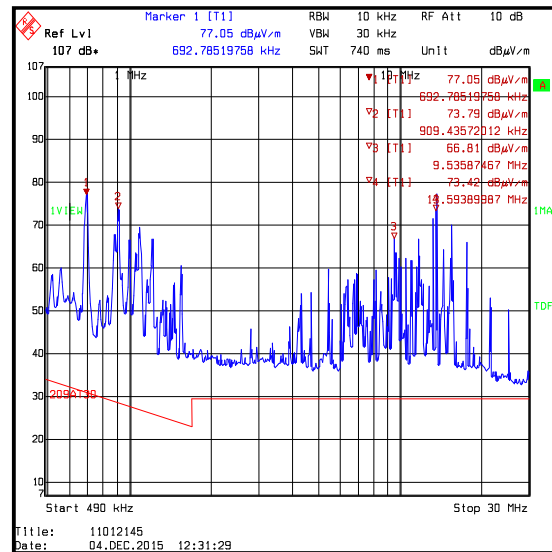
150 kHz to 490 kHz / peak detector (worst case) / EUT operating / measured at 30 metres on an open field test site



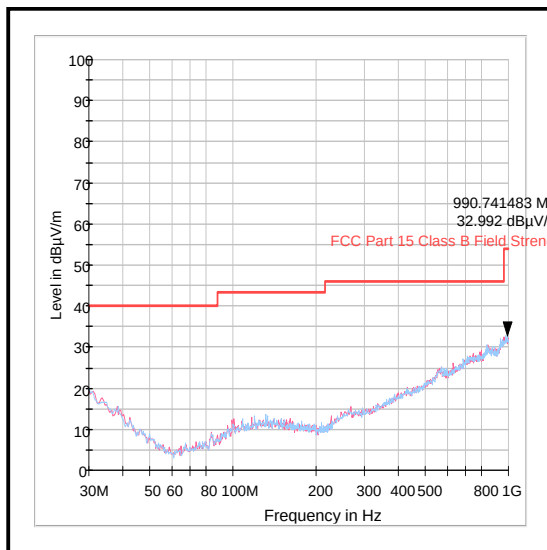
150 kHz to 490 kHz / peak detector (worst case) / EUT operating / measured at 300 metres on an open field test site

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

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1945	Thermohygrometer	JM Handelspunkt	30.5015.01	Not stated	23 Apr 2016	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	19 Mar 2016	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	19 Mar 2016	12
A490	Antenna	Chase	CBL6111A	1590	30 Apr 2016	12
G0543	Amplifier	Sonoma	310N	230801	10 Feb 2016	3
A1834	Attenuator	Hewlett Packard	8491B	10444	05 Mar 2016	12
M1783	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB30	842659/016	11 Aug 2016	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	06 May 2016	12

5.2.2. Transmitter Radiated Emissions (Fundamental)**Test Summary:**

Test Engineer:	Andrew Edwards	Test Dates:	04 December 2015 & 05 December 2015
Test Sample Serial Number:	15		

FCC Reference:	Part 15.209
Test Method Used:	ANSI C63.10 Section 6.4

Environmental Conditions:

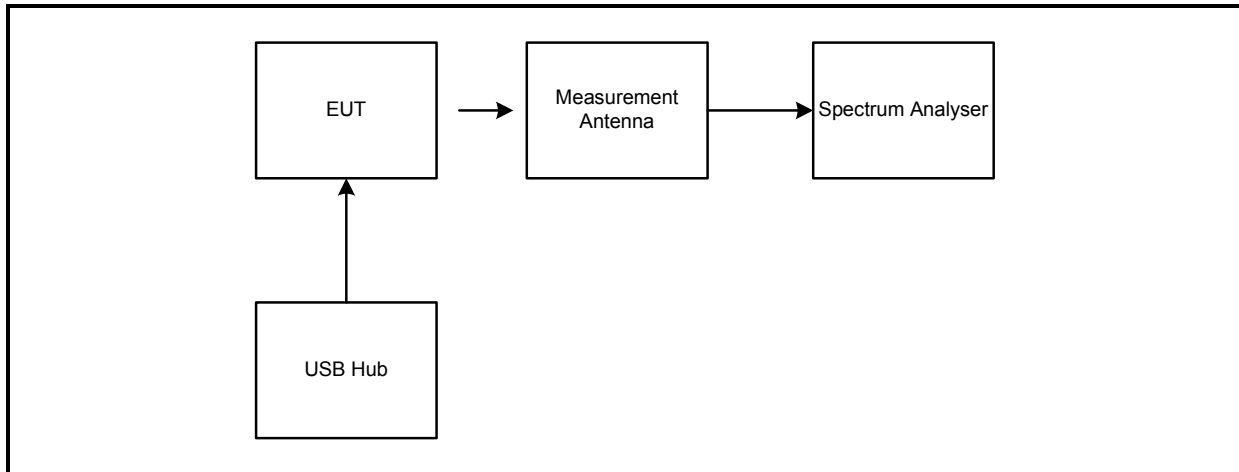
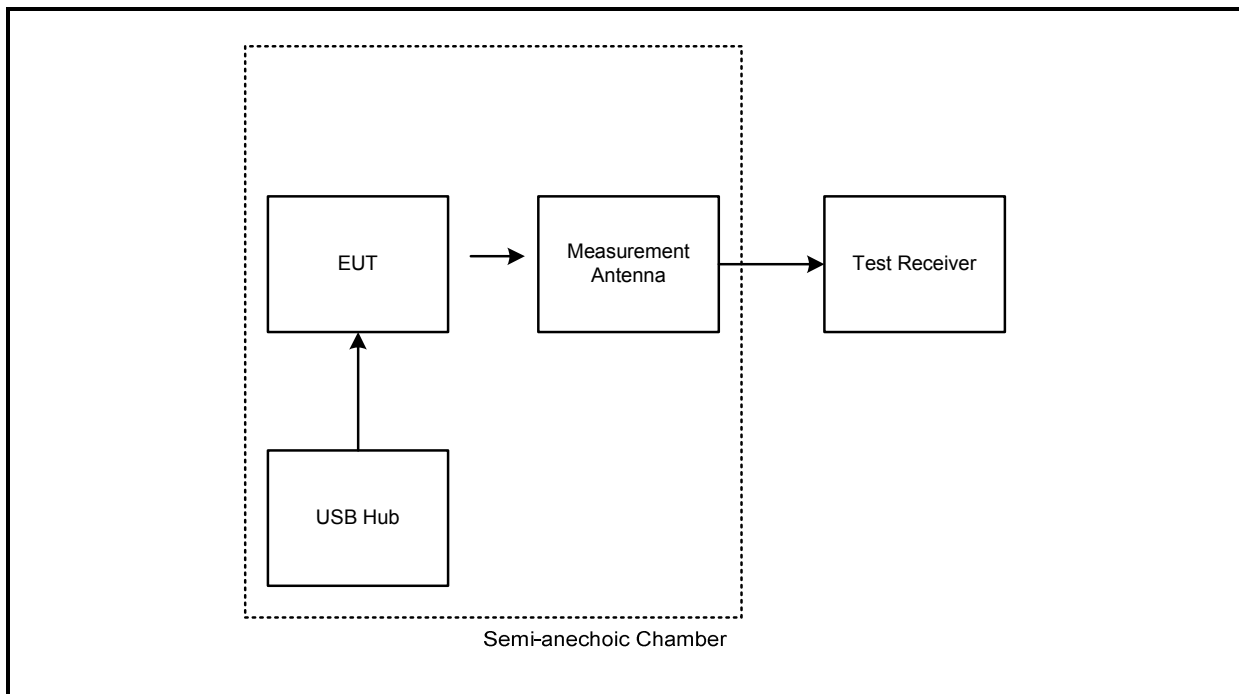
Temperature (°C):	22 to 23
Relative Humidity (%):	39 to 41

Note(s):

1. The EUT was constantly transmitting in test mode at maximum power with a modulated carrier. The measurements were performed using a magnetic loop antenna connected to a spectrum analyser.
2. The limit is specified at a test distance of 300 metres. However, as specified by FCC Section 15.31 (f)(2), measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor (40dB/decade).
3. 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 emission value at the test distances specified below 300 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 the fundamental at 3 metres on an open field test site on 04 December 2015. Unfortunately the emission could not be seen above the ambient emissions or the noise floor of the measurement system at a distance of 300 metres. Background scans of the open field test site and further information are shown in Appendix 1 of this test report.
4. Pre-scan measurements were performed at the open field test site and in the semi-anechoic chamber using a spectrum analyser with a peak detector and measurement bandwidth of 300 Hz. The fundamental field strength was maximized by rotating the measurement antenna and EUT. A peak level of 98.0 dBµV/m at a measurement distance of 3 metres was recorded and shown on the pre-scan plots below.
5. Final measurements were performed in the semi-anechoic chamber using an average detector as stated in FCC Part 15.209(d). A level of 97.4 dBµV/m at a measurement distance of 3 metres was recorded. A further 80 dB was subtracted to extrapolate the level measured at 3 metres to the required distance of 300 metres:

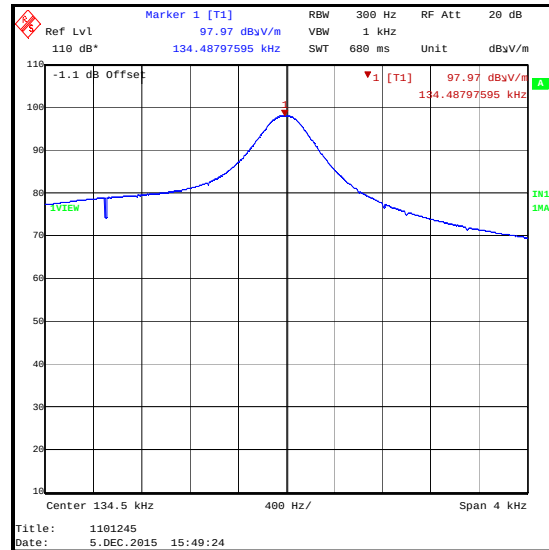
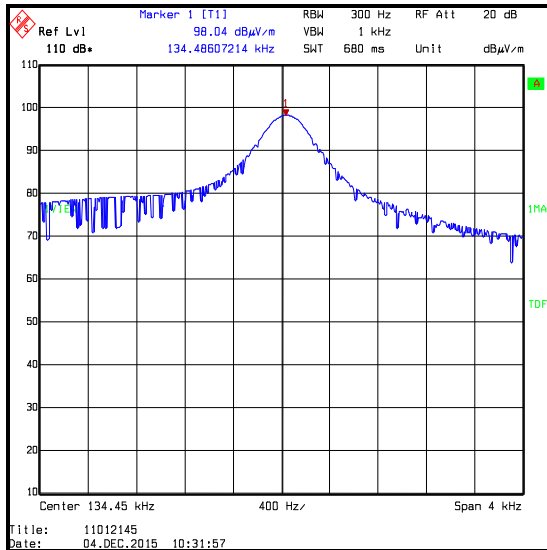
$$\text{Corrected level } 97.4 - 80 = 17.4 \text{ dB}\mu\text{V/m at 300 metres}$$

6. A transducer factor was used on the spectrum analyser during open field tests. This factor included correction between the fixed gain of the magnetic loop antenna and the calibration values. It also included 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 Radiated Emissions (Fundamental) (continued)**Test setup: Open Field Test Site****Test setup for radiated measurements: Semi-Anechoic Chamber**

Transmitter Radiated Emissions (Fundamental) (continued)**Results: Average**

Frequency (kHz)	Antenna Polarity	Level at 300 m (dB μ V/m)	Limit at 300 m (dB μ V/m)	Margin (dB)	Result
134.45	Tip of antenna 90° to EUT	17.4	25.0	7.6	Complied

Results:

Fundamental field strength / EUT operating / measured at 3 metres / measured on an open field test site

Fundamental field strength / EUT operating / measured at 3 metres / measured in a semi-anechoic chamber

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

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1945	Thermohygrometer	JM Handelspunkt	30.5015.01	Not stated	23 Apr 2016	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	19 Mar 2016	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	19 Mar 2016	12
M1783	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB30	842659/016	11 Aug 2016	12
M1568	Magnetic Loop Antenna	Rohde & Schwarz	HFH2-Z2	879284/2	06 May 2016	12

5.2.3. Transmitter 20 dB Bandwidth**Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	18 December 2015
Test Sample Serial Number:	15		

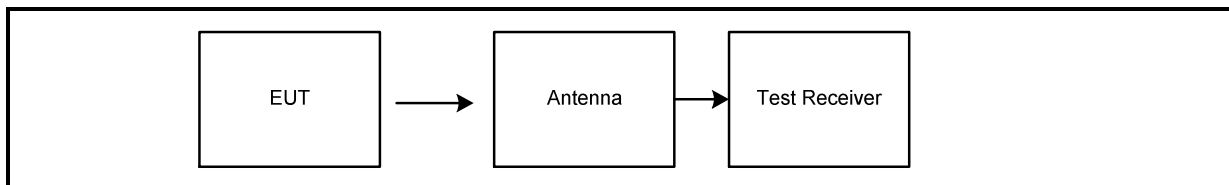
FCC Reference:	Part 15.215(c)
Test Method Used:	ANSI C63.10 Section 6.9.2

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	42

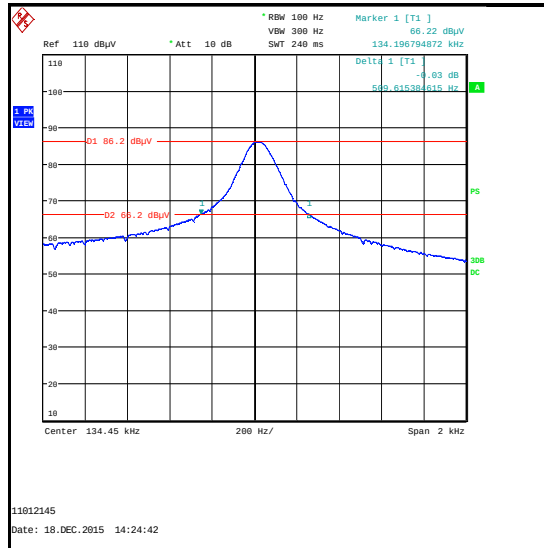
Note(s):

1. As can be seen from the plot below, the 20 dB bandwidth of the emission remains within the non-restricted band of operation between 0.110 MHz and 0.495 MHz.

Test setup:

Transmitter 20 dB Bandwidth (continued)**Results:**

20 dB Bandwidth (kHz)
0.510

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	12 Jun 2016	12

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".

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
20 dB Bandwidth	125 kHz	95%	±3.92 %
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	±3.73 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	±5.65 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 & 6	-	Changed model name from 'HRPB1N' to 'HRP'

8. Appendix 1

Test setup/arrangement of EUT during open field tests on 04 December 2014



GPS coordinates

Mag loop location (upper marker on photo)

N51° 08.971' W001° 26.293'

Decimal: 51.149517, -1.438217

30 metre test point (middle marker on photo)

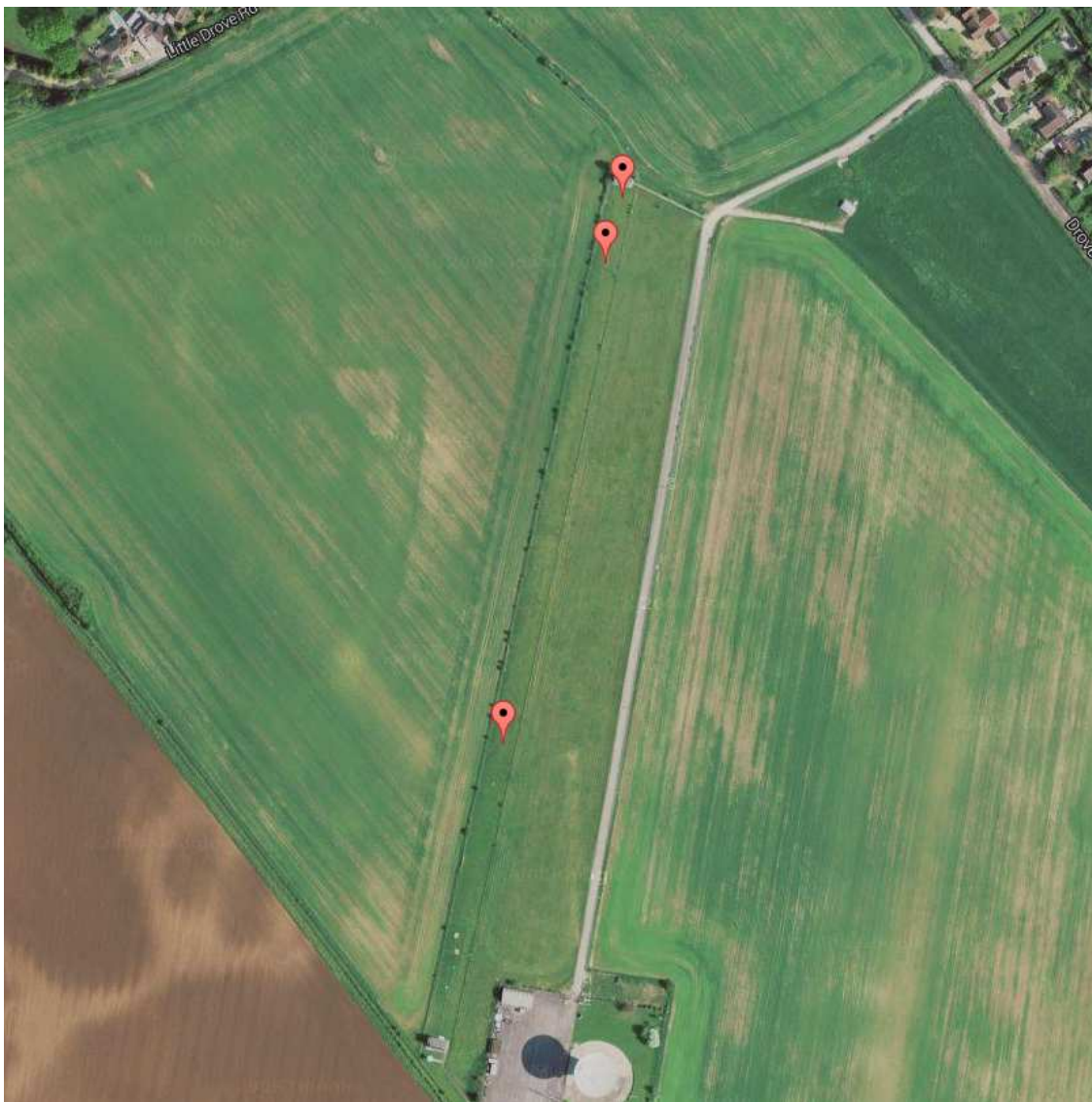
N51° 08.951' W001° 26.302'

Decimal: 51.149183, -1.438367

300 metre test point (lower marker on photo)

N51° 08.803' W001° 26.352'

Decimal: 51.146717, -1.439200



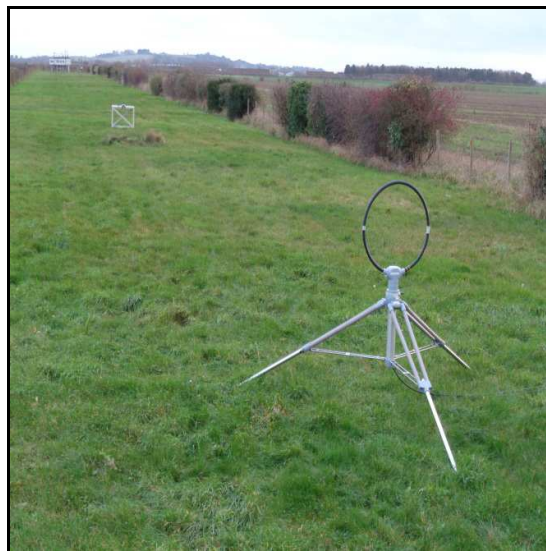
Details of 3 metre and 30 metre open field test site used on 04 December 2015

Temperature: 23°C Relative Humidity: 39%

Ground conditions: Wet



Set up for 3 metre measurements



Set up for 30 metre measurements

Measurements at 3 and 30 metres

The test site was free from underground metal objects.

The EUT was powered at its nominal voltage from its internal battery. The USB cable was connected to the USB hub to terminate all ports.

The EUT was placed on a plastic table at a height of 0.8 metres above ground level. All associated cables and support equipment were arranged according to ANSI C63.4-2013 Section 6.3.

The spectrum analyser used for measurements was located in a cabin >10 metres from the magnetic loop antenna. Power to the test equipment was from a single phase supply.

The test distance was from the centre of the mag loop antenna to the closest periphery of the EUT. This distance was maintained as the EUT was rotated.

The EUT was rotated through 360 degrees in 60 degree steps at both measurement distances. The mag loop antenna was rotated through 90 degrees in 30 degree steps at every position the EUT was moved to.

Details of 300 metre open field test site used on 04 December 2015

Temperature: 23°C Relative Humidity: 39%

Ground conditions: Wet



Set up for 300 metre measurements



Set up for 300 metre measurements

Measurements at 300 metres

The test site was free from underground metal objects.

The EUT was powered at its nominal voltage from its internal battery. The USB cable was connected to the USB hub to terminate all ports.

The EUT was placed on a plastic table at a height of 0.8 metres above ground level. All associated cables and support equipment were arranged according to ANSI C63.10-2013 Section 6.3.

The spectrum analyser used for measurements was located in a cabin >10 metres from the magnetic loop antenna. Power to the test equipment was from a single phase supply.

The test distance was from the centre of the mag loop antenna to the closest periphery of the EUT. This distance was maintained as the EUT was rotated.

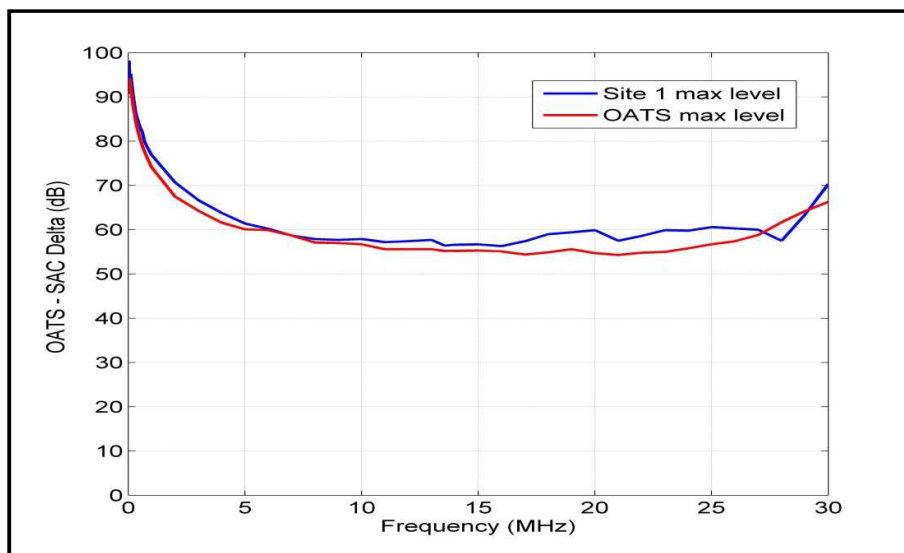
The EUT was rotated through 360 degrees in 60 degree steps. The mag loop antenna was rotated through 90 degrees in 30 degree steps at every position the EUT was moved to.

Comparison of open field test site with semi-anechoic chamber measurements at 3 metres

Radiated measurements were performed on an open field test site (referred to here as 'OATS') and within a 3 metre semi-anechoic chamber (referred to as 'Site 1').

For the signal source, a modified loop antenna was connected to a signal generator at the transmit side. A standard active magnetic loop antenna was connected to a spectrum analyser at the receive side. The signal generator was set to its maximum supported output power and the signal was transmitted to the spectrum analyser via the two antennas and associated RF cables.

A sweep in small frequency increments was performed from 9 kHz to 30 MHz. The sweep was repeatedly performed with both antennas rotated about the axis in various orientations. Received levels for all orientations were recorded and the maximum levels for the open field test site and the semi-anechoic chamber are shown on the graph below. Full data for both tests are archived on the UL VS LTD IT server and available for inspection on request.



The conclusion was that the open field test site compares well with the semi-anechoic chamber at a measurement distance of 3 metres. If anything, the semi-anechoic chamber results are generally slightly higher. This means that if the measurement passes in the semi-anechoic chamber, it will pass with a higher margin on an open field test site.

The magnetic loop antenna used to perform these measurements is the same antenna or same type of antenna used during measurements contained in this test report.

Verification of open field test site and semi-anechoic chamber measurements at 3 metres prior to performing measurements

Two reference units are used for verification of the measurement system before testing commences. Both reference units are door entry systems modified by the manufacturer for test purposes only.

One reference unit transmits a continuous, modulated signal at a fixed frequency of 125 kHz when a 12 Volt battery is connected. The output power is fixed and known to be stable.

The second transmits a continuous, modulated signal at a fixed frequency of 13.56 MHz when a 12 Volt battery is connected. The output power is fixed and known to be stable.

Both frequencies are commonly used RFID frequencies.

A UL VS LTD internal verification document explains the procedure in detail. A brief description is given below.

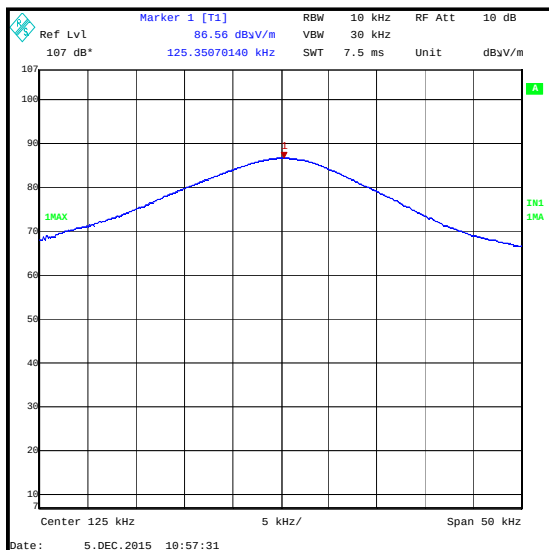
The centre of the magnetic loop antenna is placed exactly 3 metres from the reference unit. The reference unit is placed on a plastic table at a height of 0.8 metres above floor level and the centre of the mag loop antenna is 1 metre above the floor level. The mag loop antenna and reference unit are oriented in certain positions to ensure repeatability.

Each reference unit is connected to a 12 Volt battery and once transmitting, the maximum raw received level at each of the two frequencies is read on the spectrum analyser by using the marker peak function. The measured level has to be within certain levels as specified in the UL VS LTD internal test procedure. The plot of the verification measurement is archived on the UL VS LTD IT server. The peak level of each reference unit is recorded on a spreadsheet which is also archived on the UL VS LTD IT server.

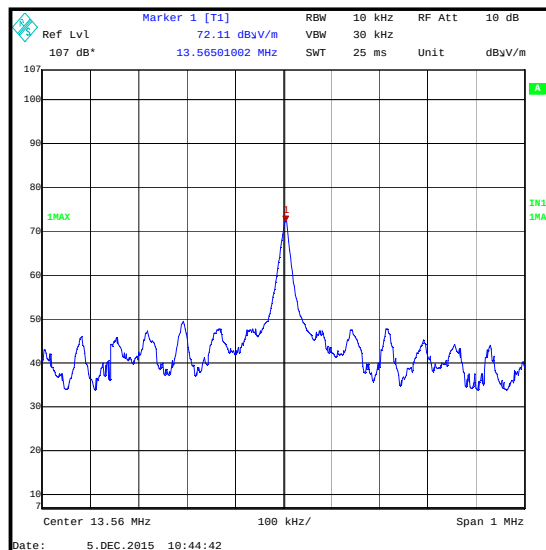
The internal verification procedure and verification plots are available for inspection on request.

Radiated measurements below 30 MHz were performed in a semi-anechoic chamber at a distance of 3 metres.

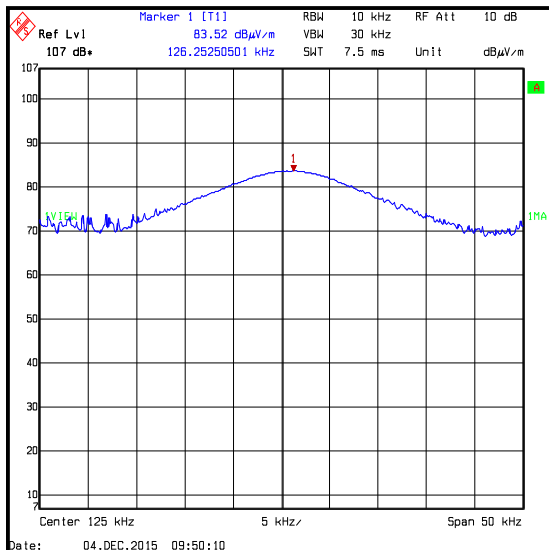
Verification plots of the two reference units at a measurement distance of 3 metres are shown on the following page. Plots were taken on an open field test site (04 December 2015) and in a semi-anechoic chamber (05 December 2015).



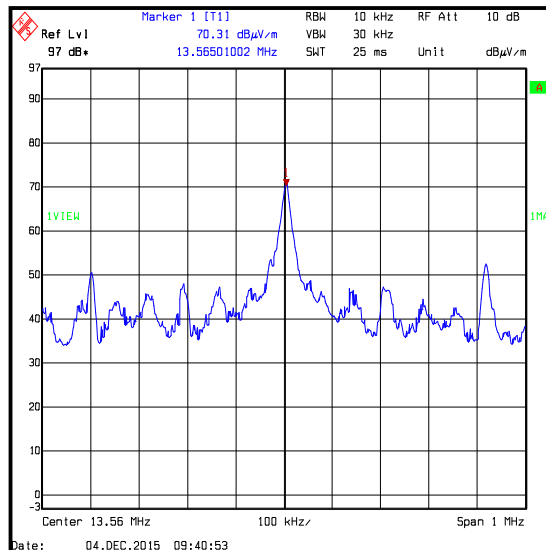
125 kHz reference unit signal at 3 metres in a semi-anechoic chamber on 05 December 2015



13.56 MHz reference unit signal at 3 metres in a semi-anechoic chamber on 05 December 2015



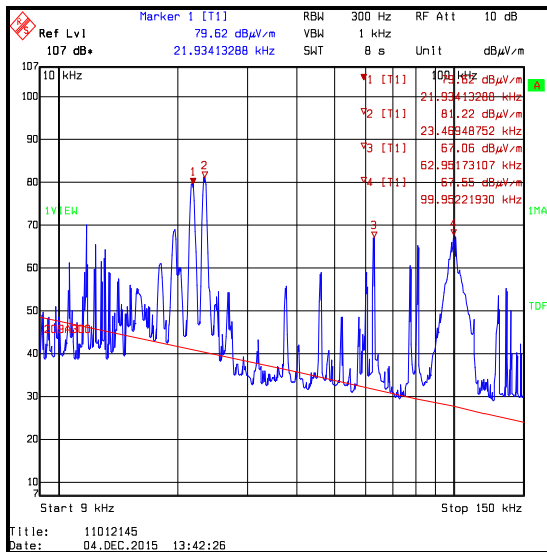
125 kHz reference unit signal at 3 metres on an open field test site on 04 December 2015



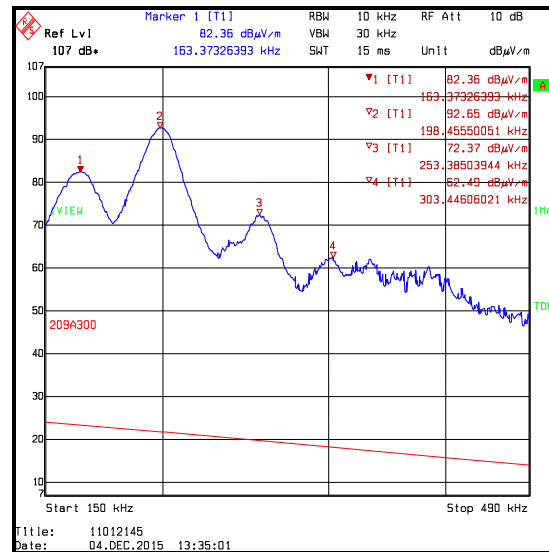
13.56 MHz reference unit signal at 3 metres on an open field test site on 04 December 2015

Note(s):

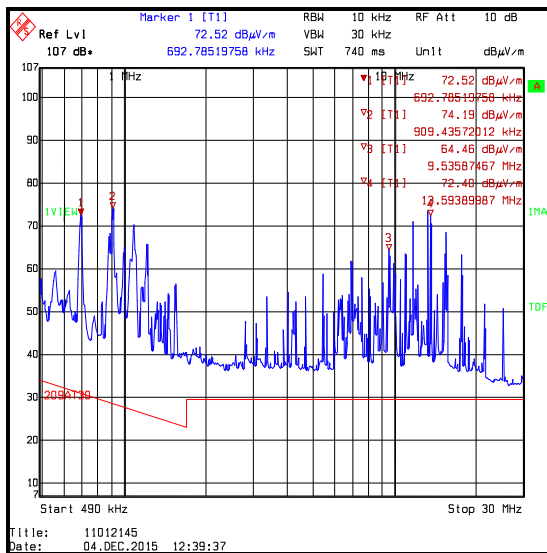
1. The above plots show comparable measurements of reference units on an open field test site and in a semi-anechoic chamber at spot frequencies.

Background scans of the open field test site

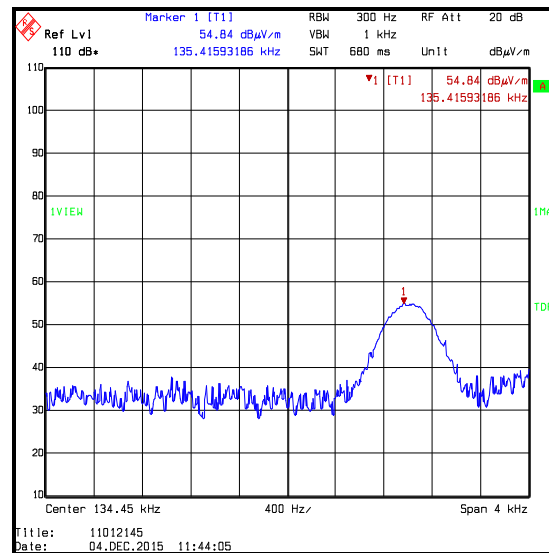
**Frequency range: 9 kHz to 150 kHz
Peak detector / background scan**



**Frequency range: 150 kHz to 490 kHz
Peak detector / background scan**



**Frequency range: 490 kHz to 30 MHz
Peak detector / background scan**



**Frequency: 134.45 kHz with a span of 4 kHz /
background scan of the open field test site**

Note(s):

1. The above plots are background scans of the open field test site. The EUT and generator (when used) were turned off when the background scans were performed.

--- END OF REPORT ---