



TEST REPORT

Test Report No. : UL-RPT-RP11458443JD01A

Manufacturer : Kenure Developments Ltd
Model No. : Smart Route ConfigTool
FCC ID : Q8Q-CFGTL
Technology : 920 MHz ISM Band Single Channel Low Power Transceiver
Test Standard(s) : FCC Parts 15.207, 15.209(a) & 15.249

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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 1.0.

Date of Issue: 18 November 2016

Checked by:

Ian Watch
Senior Engineer, Radio Laboratory

Company Signatory:

Sarah Williams
Senior Engineer, 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:	Kenure Developments Ltd
Address:	Springlakes Deadbrook Lane Aldershot Hampshire GU12 4UH United Kingdom

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.249
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.249
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Site Registration:	FCC: 209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	18 October 2016 to 15 November 2016

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	
Part 15.249(a)(e)	Transmitter Fundamental Field Strength	
Part 15.35(c)	Duty cycle	Note 1
Part 2.1049	Transmitter 20 dB Bandwidth	
Part 15.249(a)(d)(e)/ 15.209(a)	Transmitter Radiated Emissions	
Part 15.249(d)/ 15.209(a)	Transmitter Band Edge Radiated Emissions	
Key to Results  = Complied  = Did not comply		

Note(s):

1. The measurements were performed to assist in the calculation of radiated emissions to the average limit with duty cycle correction.

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:	Smart Route ConfigTool
Model Name or Number:	ConfigTool
Test Sample Serial Number:	4
Hardware Version:	0A
Software Version:	0.0.0.K
FCC ID:	Q8Q-CFGTL

3.2. Description of EUT

The Equipment Under Test was a USB configuration dongle for wireless water meters. It contains an integral chip antenna.

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:	920 MHz ISM Band Single Channel Low Power Transceiver	
Power Supply Requirement:	Nominal	5.0 VDC via USB
Type of Unit:	Transceiver	
Channel Spacing:	Single Channel	
Modulation:	2-FSK	
Transmit Frequency Range:	920 MHz	
Transmit Channel Tested:	Channel Frequency (MHz)	
	920	

3.5. Support Equipment

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

Description:	Laptop PC
Brand Name:	Dell Latitude
Model Name or Number:	E5410
Serial Number:	00732

Description:	AC adaptor for Laptop PC
Brand Name:	Dell
Model Name or Number:	PA-1650-05D2
Serial Number:	Not marked or stated

Description:	USB extension cable base. Length 1.5 metres
Brand Name:	D-Link
Model Name or Number:	USB-DLINK-EXTBSE
Serial Number:	Not marked or stated

Description:	USB extension cable. Length 2 metres
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 maximum power with a modulated carrier on a fixed frequency.
- Normal transmit mode (~2% duty cycle), at maximum power with a modulated carrier on a fixed frequency.

4.2. Configuration and Peripherals

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

- A laptop PC with an open source terminal application Tera Term V4.83 was used to place the EUT into test mode. Once in test mode, the EUT was configured following instructions provided by the customer contained within 'Set-up Instructions.doc' dated 13 October 2016. To enable control of the EUT, a USB cable was connected to the USB port of the EUT. The opposite end of the cable was connected to the USB port on a laptop PC. The cables remained in-situ for all testing.
- Radiated spurious emissions were performed with the EUT in 3 orientations to determine the worst case. There were no ports on the EUT to terminate.

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 AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Pauline Hooper	Test Date:	13 October 2016
Test Sample Serial Number:	4		

FCC Reference:	Part 15.207(a)
Test Method Used:	ANSI C63.10 Section 6.2

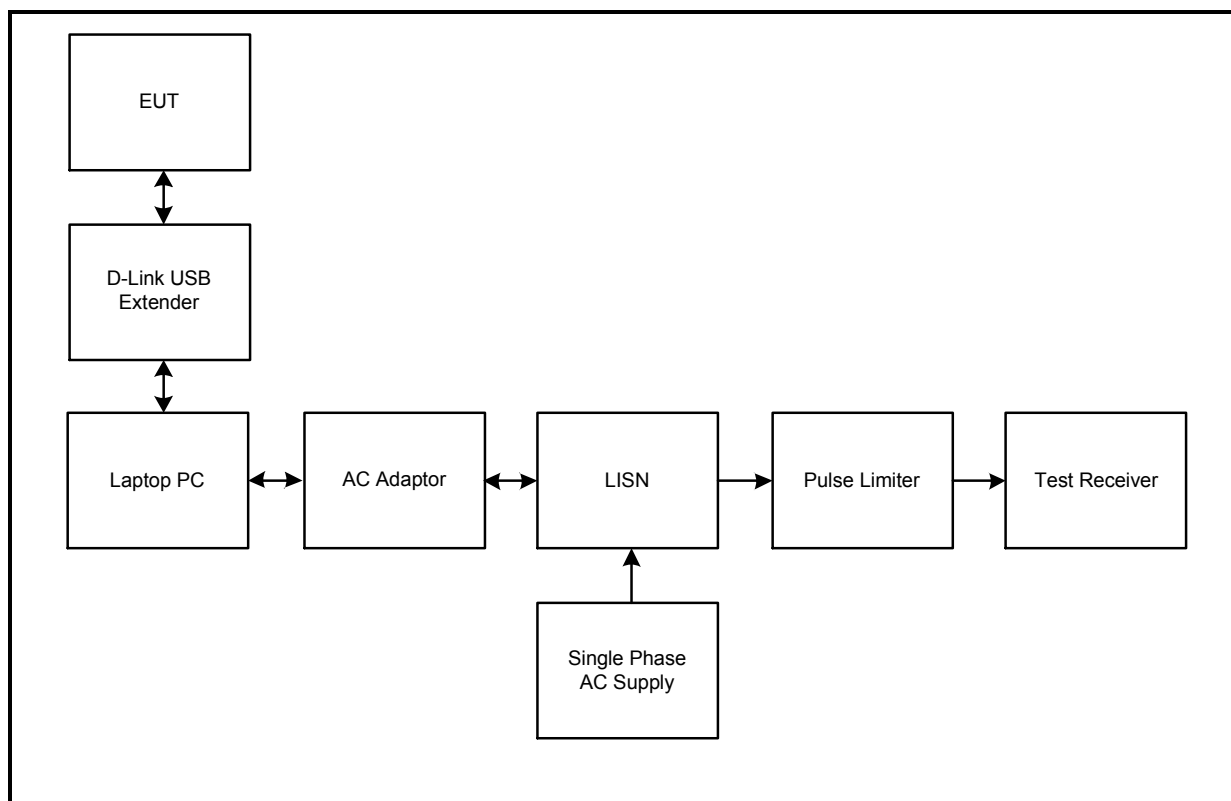
Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	40

Note(s):

1. The EUT was connected to a USB cable extender. The cable extender was connected to a USB port on the laptop PC. The output of the laptop PC power supply was connected to the laptop PC and the input 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.

Test setup:



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

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.271500	Live	48.8	61.1	12.3	Complied
0.541500	Live	43.9	56.0	12.1	Complied
0.712500	Live	41.5	56.0	14.5	Complied
1.099500	Live	36.4	56.0	19.6	Complied
5.433000	Live	30.3	60.0	29.7	Complied
6.886500	Live	27.2	60.0	32.8	Complied

Results: Live / Average

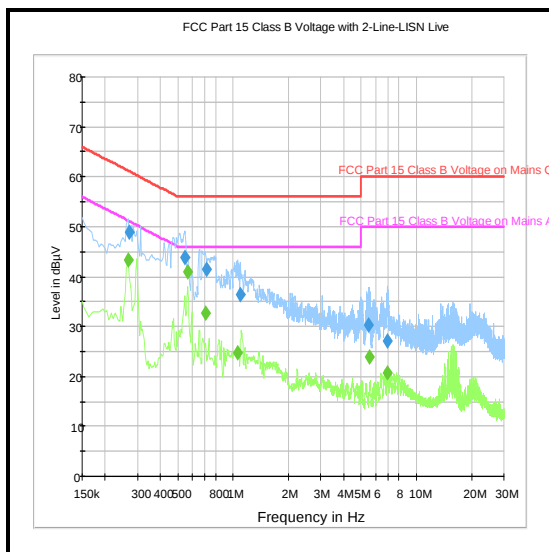
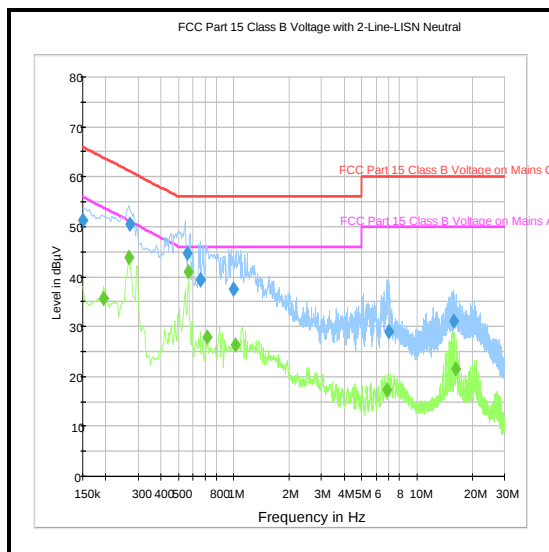
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.267000	Live	43.4	51.2	7.8	Complied
0.564000	Live	41.0	46.0	5.0	Complied
0.708000	Live	32.7	46.0	13.3	Complied
1.050000	Live	24.8	46.0	21.2	Complied
5.541000	Live	23.8	50.0	26.2	Complied
6.958500	Live	20.7	50.0	29.3	Complied

Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.150000	Neutral	51.3	66.0	14.7	Complied
0.271500	Neutral	50.5	61.1	10.6	Complied
0.555000	Neutral	44.6	56.0	11.4	Complied
0.654000	Neutral	39.5	56.0	16.5	Complied
0.996000	Neutral	37.3	56.0	18.7	Complied
15.850500	Neutral	31.1	60.0	28.9	Complied

Results: Neutral / Average

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.195000	Neutral	35.6	53.8	18.2	Complied
0.267000	Neutral	43.9	51.2	7.3	Complied
0.564000	Neutral	40.9	46.0	5.1	Complied
0.712500	Neutral	27.9	46.0	18.1	Complied
1.023000	Neutral	26.4	46.0	19.6	Complied
16.215000	Neutral	21.5	50.0	28.5	Complied

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

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

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2015	Thermohygrometer	Testo	608-H1	45046424	10 Jun 2017	12
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	15 Dec 2107	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	08 Mar 2017	12
A004	Single Phase LISN	Rohde & Schwarz	ESH3-Z5	890604/027	08 Feb 2017	12

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

Test Engineer:	John Ferdinand	Test Date:	14 November 2016
Test Sample Serial Number:	4		

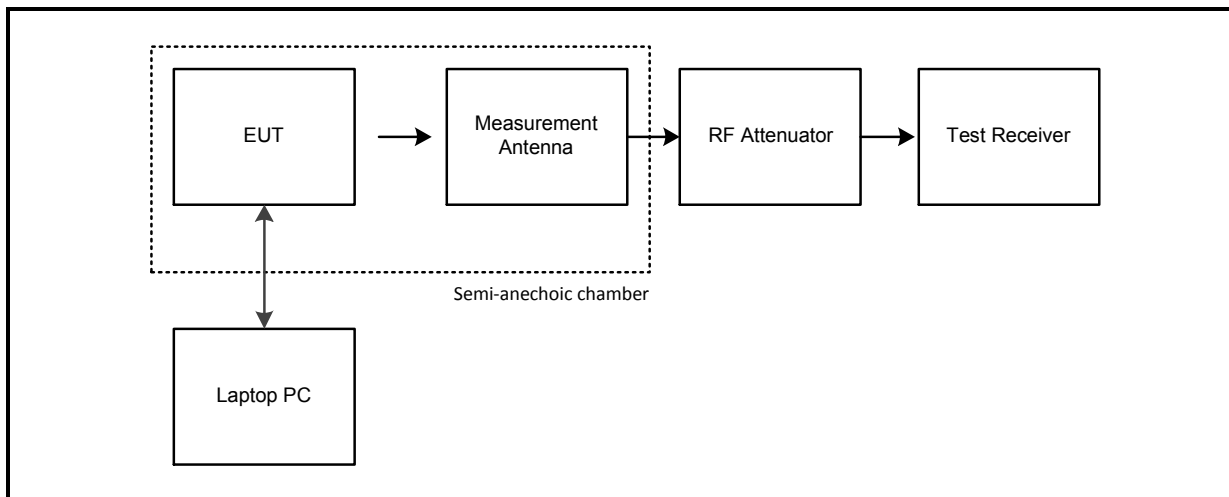
FCC Reference:	Part 15.249(a)
Test Method Used:	ANSI C63.10 Section 6.5

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	39

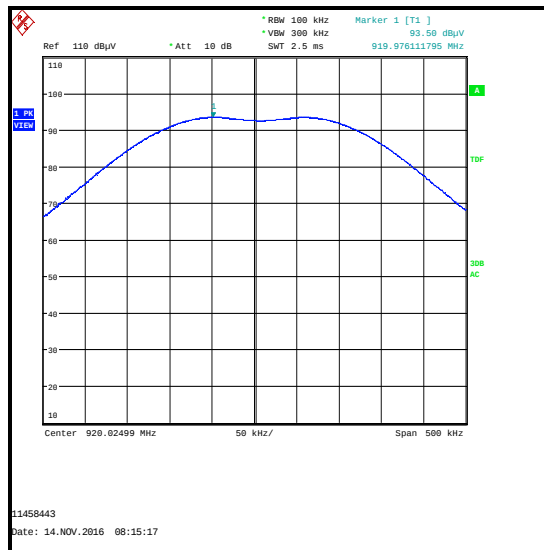
Note(s):

1. The final measured value in the table below incorporates the calibrated antenna factor and cable loss.
2. The measurement of the fundamental shown on the following page was performed using a peak detector.

Test setup:

Transmitter Fundamental Field Strength (continued)**Results:**

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
919.999	Vertical	93.5	94.0	0.5	Complied

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	07 Apr 2017	12

5.2.3. Transmitter Duty Cycle**Test Summary:**

Test Engineer:	John Ferdinand	Test Date:	15 November 2016
Test Sample Serial Number:	4		

FCC Reference:	Part 15.35(c)
Test Method Used:	ANSI C63.10 Section 7.5

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	44

Note(s):

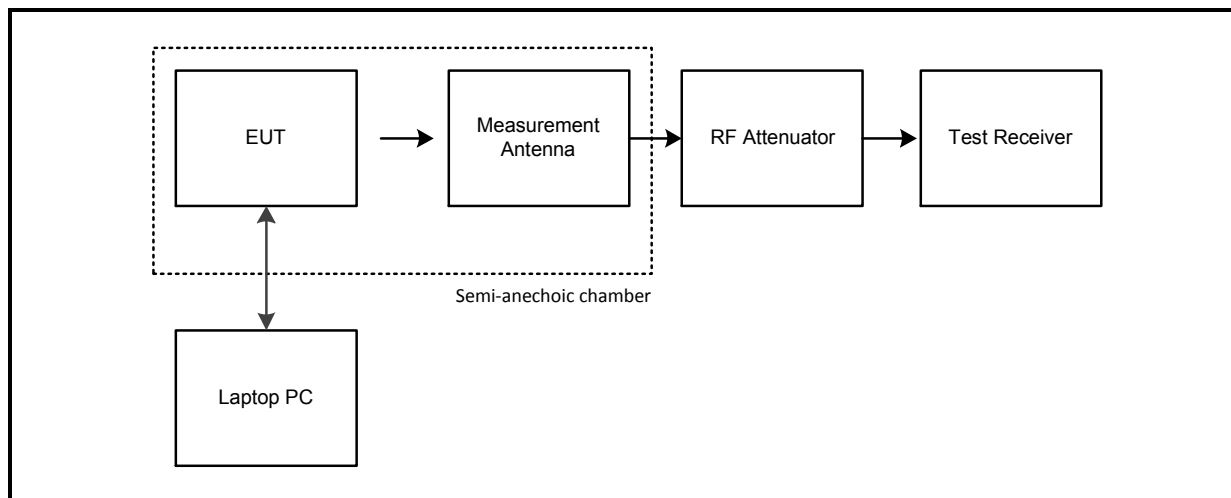
1. In order to assist with the determination of the average level of fundamental and spurious emissions field strength, measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by $20 \log(\text{On Time} / \text{Period or } 100 \text{ ms whichever is the lesser})$

$$\text{Duty cycle} = 20 \log ((3.138 \text{ ms}) / (100 \text{ ms}))$$

$$\text{Duty cycle} = 20 \log (0.0314)$$

$$\text{Duty cycle} = 30.07 \text{ dB}$$

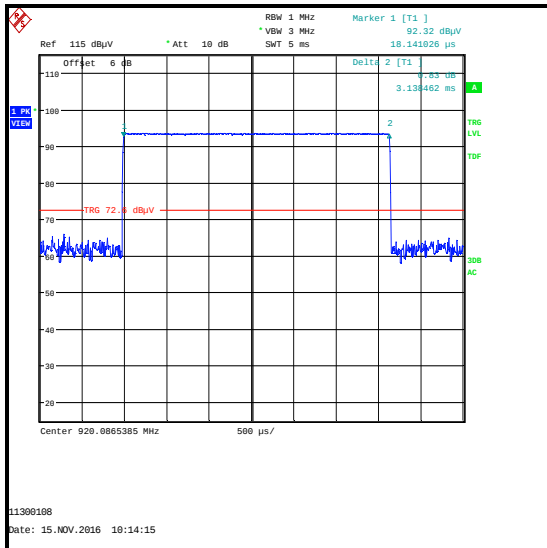
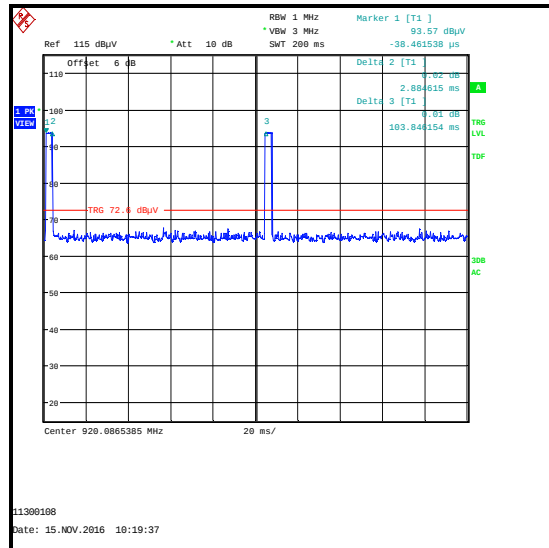
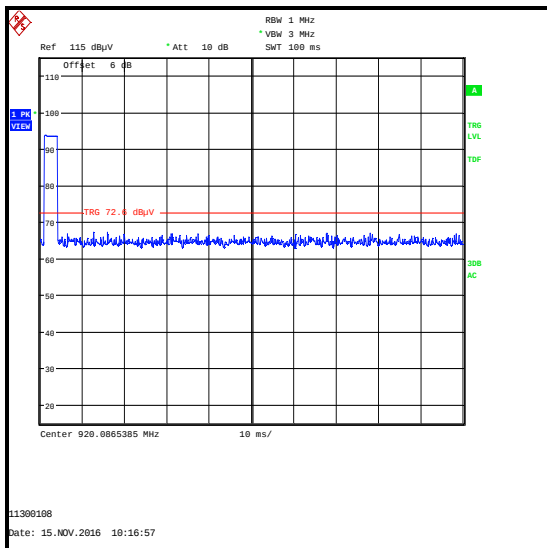
2. The measurement was performed using a radiated sample in a fully anechoic chamber (Asset Number K0017) at a distance of 3 metres.

Test setup:

Transmitter Duty Cycle (continued)**Results:**

Pulse Duration (μ s)	Duty Cycle (dB)
3138.462	30.1

Period (ms)
103.846

**Tx on****Tx on+off****Tx on time within 100 ms period**

Transmitter Duty Cycle (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	07 Apr 2017	12
A2937	Attenuator	AtlanTecRF	AN18W5-06	208147#1	23 May 2017	12

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

Test Engineer:	John Ferdinand	Test Date:	27 October 2016
Test Sample Serial Number:	4		

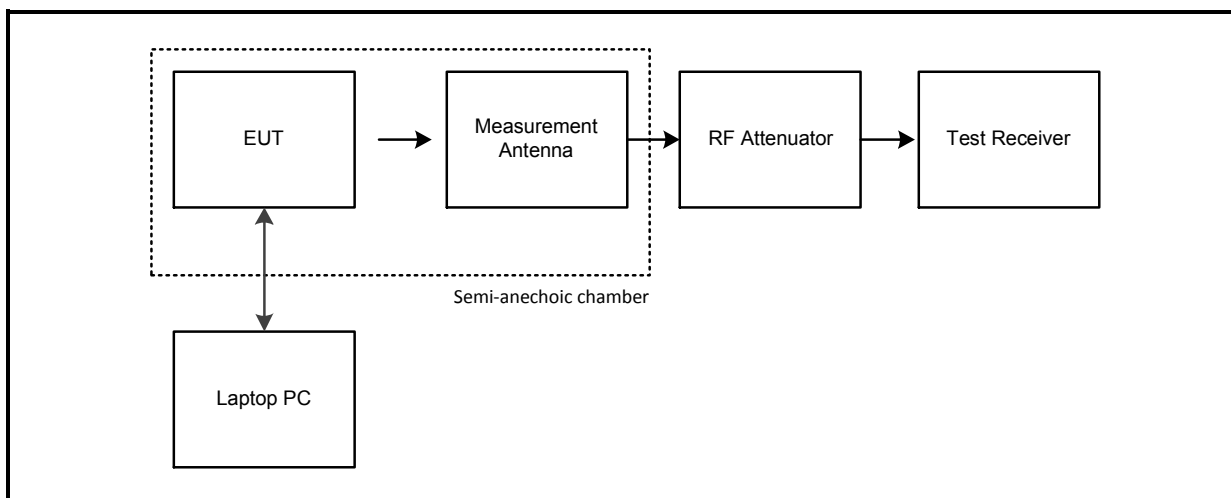
FCC Reference:	Part 2.1049
Test Method Used:	ANSI C63.10 Section 6.9.2

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	39

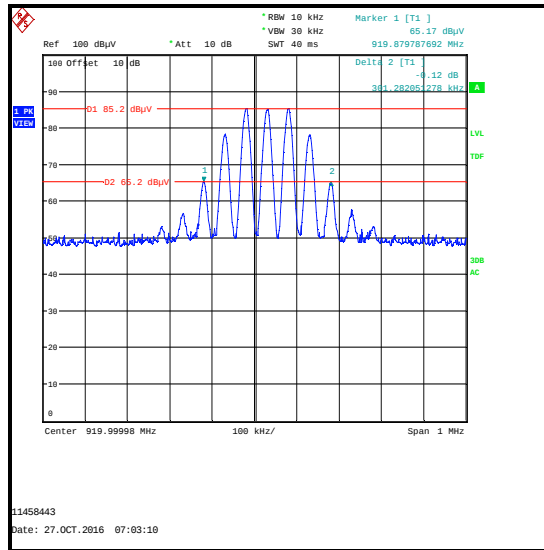
Note(s):

1. The test receiver resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 1.0 MHz. Normal and delta markers were placed 20 dB down from the peak of the carrier. These results are documented in the table below.
2. These tests were performed radiated. The reason for this being that the EUT has an integral antenna and does not have an external antenna port to allow for a conducted measurement.

Test setup:

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

20 dB Bandwidth (kHz)
301.282

**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	02 Apr 2017	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 Mar 2017	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	30 Apr 2017	12
A2903	Antenna	Schwarzbeck	VULB 9163	N/A	22 Aug 2017	12

5.2.5. Transmitter Radiated Emissions**Test Summary:**

Test Engineer:	John Ferdinand	Test Date:	28 October 2016
Test Sample Serial Number:	4		

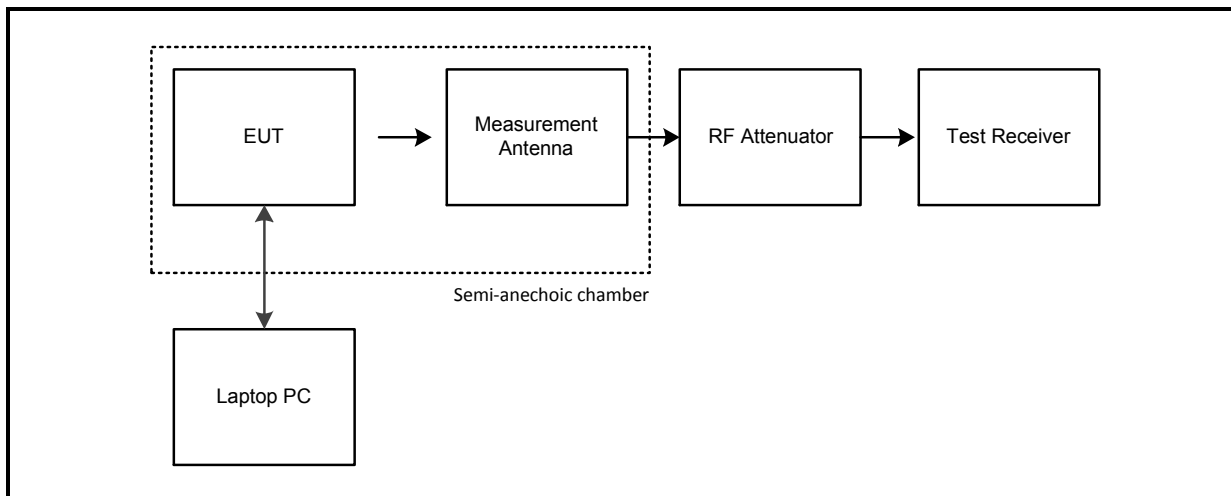
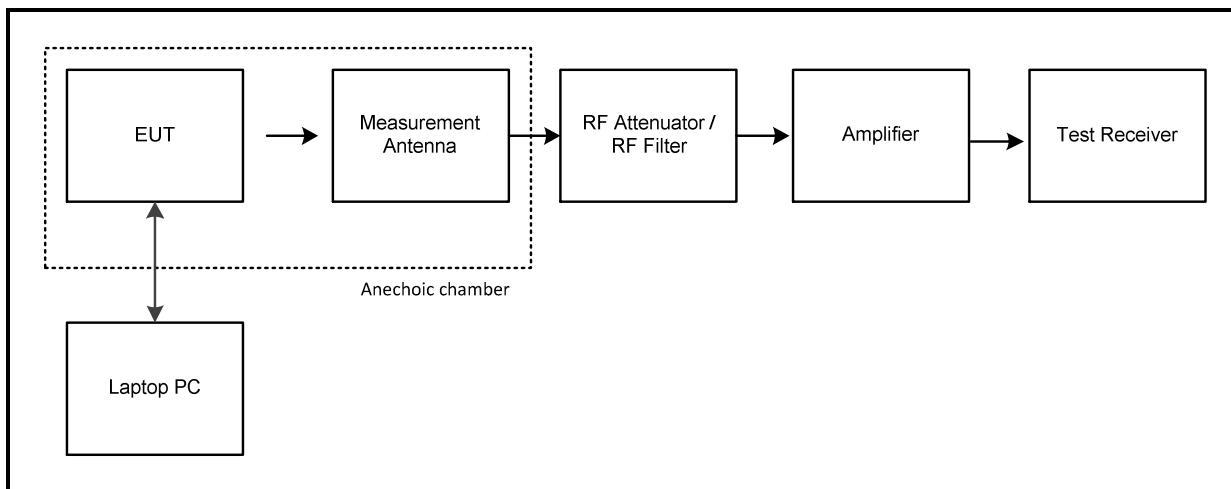
FCC Reference:	Parts 15.249(a) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	39

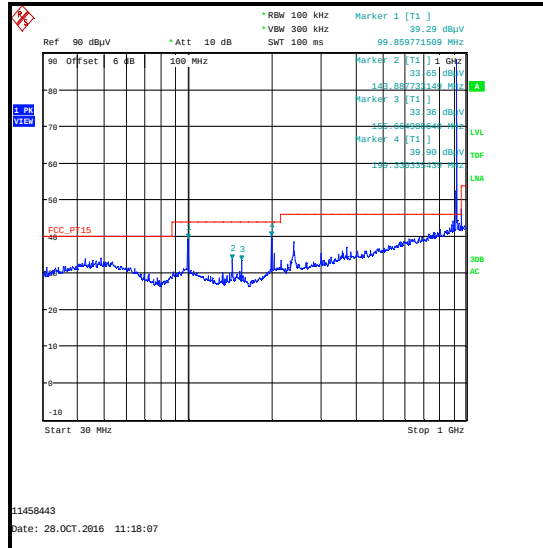
Note(s):

1. The emission at approximately 920 MHz shown on the 30 MHz to 1 GHz plot is the EUT fundamental.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
4. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) 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. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
5. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. The sweep time was set to auto. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.

Transmitter Radiated Emissions (continued)**Test setup for radiated measurements:****Semi-anechoic chamber****Anechoic chamber**

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

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
960.128	Vertical	40.2	54.0	13.8	Complied



Note: This plot is a pre-scan 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)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	07 Apr 2017	12
A2937	Attenuator	AtlanTecRF	AN18W5-06	208147#1	23 May 2017	12

Transmitter Radiated Emissions (continued)**Test Summary:**

Test Engineer:	John Ferdinand	Test Dates:	26 October 2016 to 01 November 2016
Test Sample Serial Number:	4		

FCC Reference:	Parts 15.249(a)(d)(e) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3, 6.6 & 7.5
Frequency Range	1 GHz to 9.3 GHz

Environmental Conditions:

Temperature (°C):	22 to 24
Relative Humidity (%):	39 to 43

Note(s):

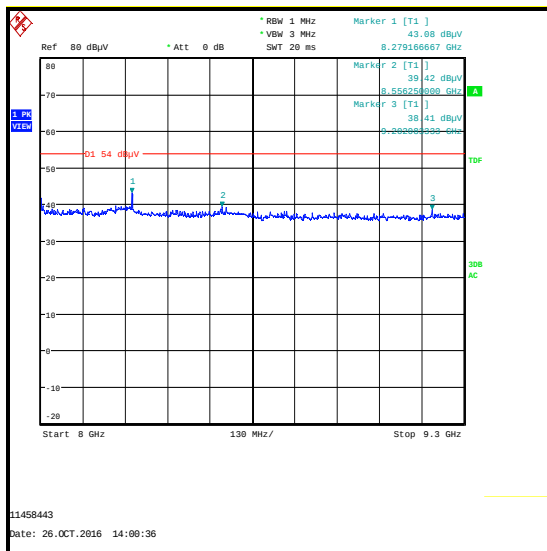
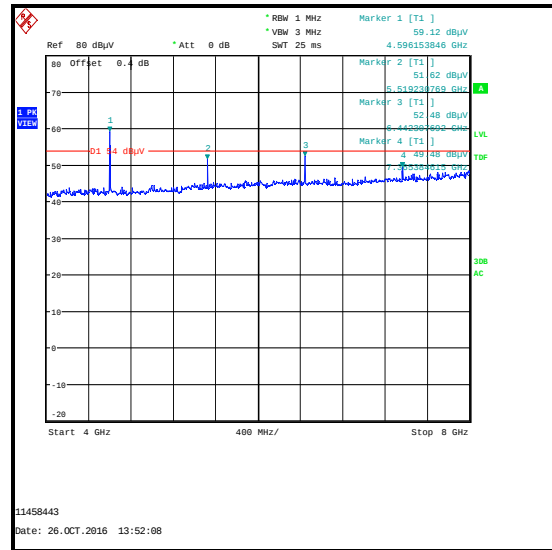
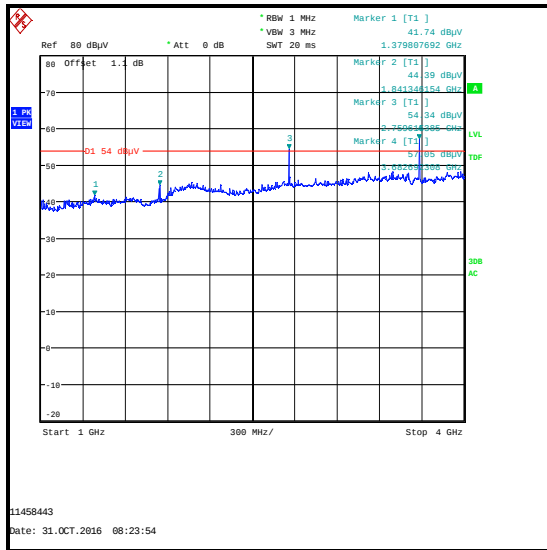
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. Measurements above 1 GHz were performed in a fully anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
3. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto. Peak and average measurements were performed with appropriate detectors during the pre-scan measurements.
4. Average levels of pulsed emissions within the restricted bands were obtained using the test method and procedure stated in ANSI C63.10 Section 7.5. A duty cycle correction factor of -20 dB (maximum permitted) was used. All other average measurements were >30 dB below the applicable limit.

Transmitter Radiated Emissions (continued)**Results: Peak Level**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2760.209	Vertical	54.5	74.0	19.5	Complied
3680.129	Vertical	59.1	74.0	14.9	Complied
4600.160	Vertical	60.2	74.0	13.8	Complied
5519.840	Vertical	50.9	74.0	23.1	Complied
6440.705	Vertical	54.3	74.0	19.7	Complied
7360.128	Vertical	50.8	74.0	23.2	Complied

Results: Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2760.209	Vertical	24.4	54.0	29.6	Complied
3680.129	Vertical	29.0	54.0	25.0	Complied
4600.160	Vertical	30.1	54.0	23.9	Complied

Transmitter Radiated Emissions (continued)

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

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	07 Apr 2017	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	07 Apr 2017	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	06 May 2017	12
A2863	Pre-Amplifier	Agilent	8449B	3008A02100	07 Jan 2017	12
A2891	Pre-Amplifier	Schwarzbeck	BBV 9718	9718-306	07 Apr 2017	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	19 May 2017	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	01 Jun 2017	12
A2908	High Pass Filter	Wainwright Instruments	WHJE5-920	3	23 May 2017	12
A2937	Attenuator	AtlanTecRF	AN18W5-06	208147#1	23 May 2017	12

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

Test Engineer:	John Ferdinand	Test Date:	15 November 2016
Test Sample Serial Number:	4		

FCC Reference:	Parts 15.249(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10.4 & 6.10.5

Environmental Conditions:

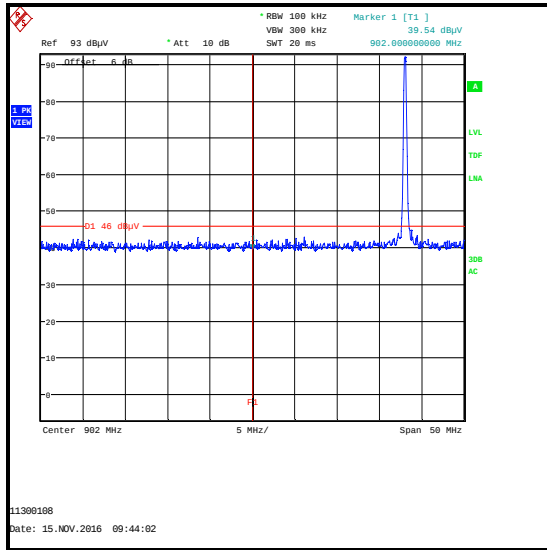
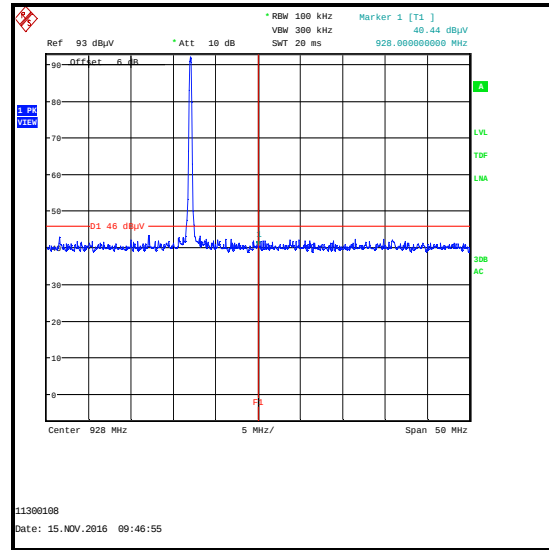
Temperature (°C):	23
Relative Humidity (%):	44

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The plots shown on the following page were performed using a peak detector with final measurements being made with a quasi-peak detector

Results: Quasi-Peak

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
902	Vertical	32.2	46.0	13.8	Complied
928	Vertical	34.4	46.0	11.6	Complied

Transmitter Band Edge Radiated Emissions (continued)**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	07 Apr 2017	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	19 May 2017	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
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB
Radiated Maximum Peak Output Power	902 MHz to 928 MHz	95%	±2.94 dB
Duty Cycle	902 MHz to 928 MHz	95%	±1.14 %
20 dB Bandwidth	902 MHz to 928 MHz	95%	±4.59 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 9.3 GHz	95%	±2.94 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

--- END OF REPORT ---