



TEST REPORT

Test Report No. : UL-RPT-RP12700076-916A

Manufacturer : Ubisense
Model No. : UBIMOD31
FCC ID : SEAMOD31
Technology : IEEE 802.15.4f
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: 29 April 2019

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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:	Ubisense
Address:	St Andrew's House St Andrew's Road Chesterton, Cambridge CB4 1DL 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:	621311
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	25 February to 04 March 2018

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 2.1049	Transmitter 20 dB Bandwidth	
Parts 15.249(a)(d)(e)/ 15.209(a)	Transmitter Radiated Emissions	
Parts 15.249(d)/15.209(a)	Transmitter Band Edge Radiated Emissions	
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
Reference:	KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	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)

Brand Name:	UBISENSE
Model Name or Number:	UBIMOD31
Test Sample Serial Number:	0011CE0000000EDA (<i>Radiated sample</i>)
Hardware Version Number:	ModState1
Firmware Version Number:	Test Image
FCC ID:	SEAMOD31

3.2. Description of EUT

The Equipment Under Test was an UWB location-tracking tag containing an IEEE 802.15.4f transceiver operating in the 2.4 GHz ISM band. The unit has an integral antenna and is normally powered by host equipment from a nominal 5.0 VDC supply.

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:	IEEE 802.15.4f	
Power Supply Requirement:	Nominal	5.0 VDC via 120 VAC 60 Hz
Type of Unit:	Transceiver	
Modulation Type:	MSK	
Data Rate:	250 kbit/s	
Transmit Frequency Range:	2400 to 2483.5 MHz	
Transmit Channels Tested:	Channel ID	Channel Frequency (MHz)
	Bottom	2401.75
	Middle	2442.00
	Top	2481.75

3.5. Support Equipment

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

Description:	AC to DC Power supply
Brand Name:	XP Power
Model Name or Number:	VER05US050-JA
Serial Number:	Not marked or stated

Description:	Power Cable. Length 1.8 m.
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):

- Transmitting at maximum power, with and without a modulated signal on the bottom, middle and top channels as required.

4.2. Configuration and Peripherals

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

- The manufacturer pre-loaded test software/firmware prior to testing. This enabled the EUT to transmit with a 250 kbit/s modulated signal, or an unmodulated signal, on the bottom, middle or top channels as required. The customer supplied a document containing the setup instructions: 'Instruction for FCC_IC Test Units.pdf'.
- For testing purposes the EUT was powered by 5V via a 120VAC 60Hz XP power supply. The XP power supply was connected to the EUT via a multi-pin connector
- AC conducted emissions tests were performed with the XP power supply input connected to the 120VAC 60Hz single phase supply via a LISN. The XP power supply DC output was connected to the EUT via twin core cable and multi-pin connector.

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:	Andrew Edwards	Test Dates:	25 February 2019 & 04 March 2019
Test Sample Serial Number:	0011CE0000000EDA		

FCC Reference:	Part 15.207
Test Method Used:	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

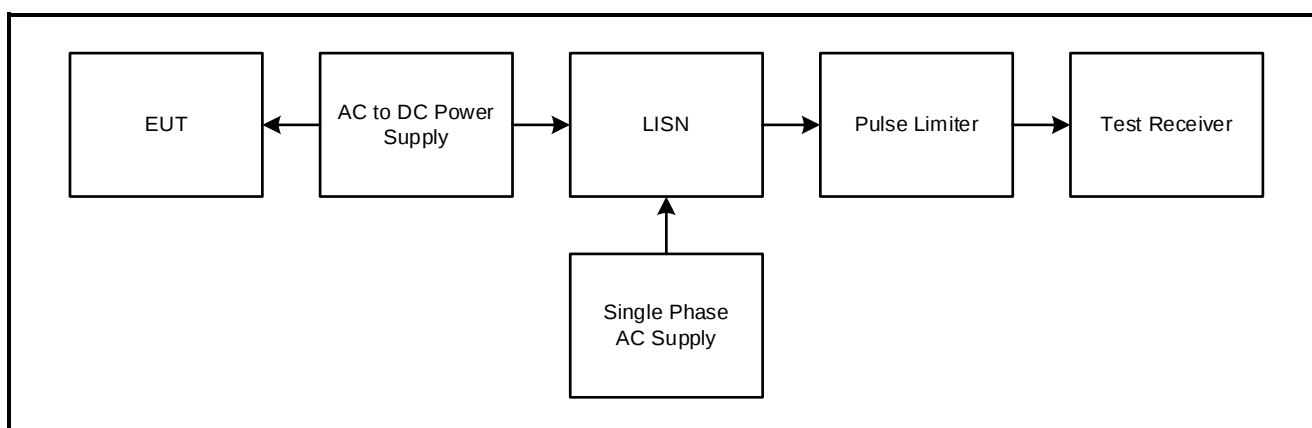
Environmental Conditions:

Temperature (°C):	20
Relative Humidity (%):	36 to 43

Note(s):

1. The EUT was connected to the AC to DC power supply which was connected to a 120 VAC 60 Hz single phase supply via a LISN.
2. In accordance with FCC KDB 174176 Q4, tests were performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the EUT power supply.
3. A pulse limiter was fitted between the LISN and the test receiver.
4. 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.

Test Setup Diagram for Transmitter AC Conducted Emissions



Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.344	Live	45.0	59.1	14.1	Complied
0.344	Live	45.1	59.1	14.0	Complied
0.609	Live	32.5	56.0	23.5	Complied
0.614	Live	32.8	56.0	23.2	Complied
0.947	Live	33.2	56.0	22.8	Complied
2.067	Live	32.2	56.0	23.8	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.344	Live	37.3	49.1	11.8	Complied
0.357	Live	37.4	48.8	11.4	Complied
0.600	Live	26.5	46.0	19.5	Complied
0.924	Live	26.5	46.0	19.5	Complied
1.545	Live	26.0	46.0	20.0	Complied
2.063	Live	25.6	46.0	20.4	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

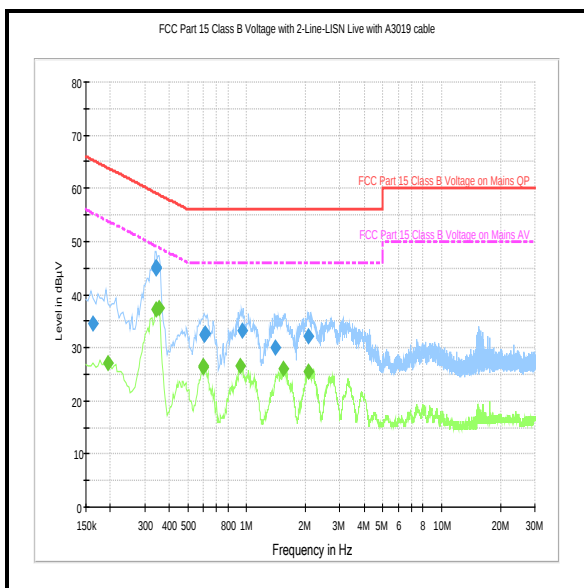
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.339	Neutral	41.4	59.2	17.8	Complied
0.488	Neutral	26.2	56.2	30.0	Complied
0.596	Neutral	26.1	56.0	29.9	Complied
0.942	Neutral	29.3	56.0	26.7	Complied
1.554	Neutral	27.4	56.0	28.6	Complied
2.090	Neutral	26.6	56.0	29.4	Complied

Results: Neutral / Average / 120 VAC 60 Hz

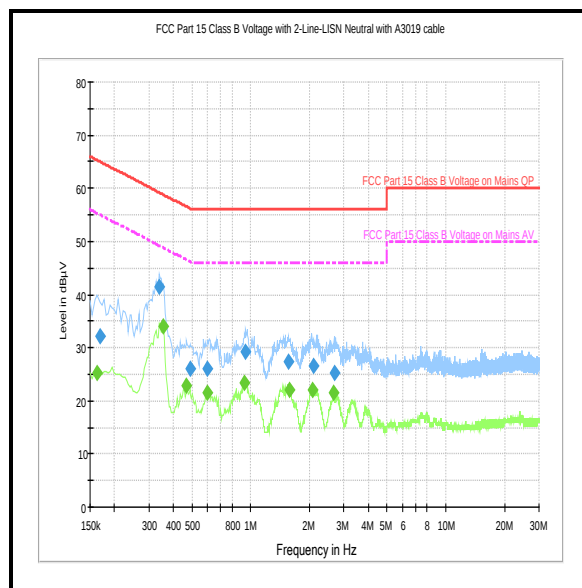
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.357	Neutral	34.1	48.8	14.7	Complied
0.470	Neutral	23.0	46.5	23.5	Complied
0.600	Neutral	21.6	46.0	24.4	Complied
0.924	Neutral	23.5	46.0	22.5	Complied
1.577	Neutral	22.1	46.0	23.9	Complied
2.063	Neutral	22.2	46.0	23.8	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: 120 VAC 60 Hz



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)**Results: Live / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.339	Live	46.9	59.2	12.3	Complied
0.357	Live	49.1	58.8	9.7	Complied
0.555	Live	36.4	56.0	19.6	Complied
0.690	Live	36.0	56.0	20.0	Complied
1.230	Live	35.6	56.0	20.4	Complied
1.334	Live	36.9	56.0	19.1	Complied

Results: Live / Average / 240 VAC 60 Hz

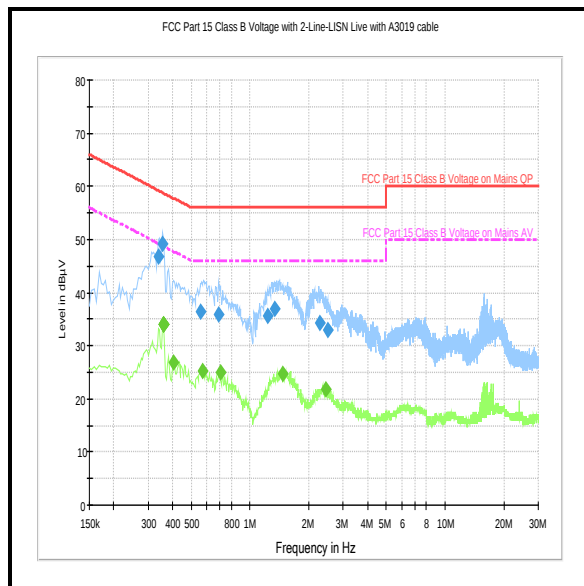
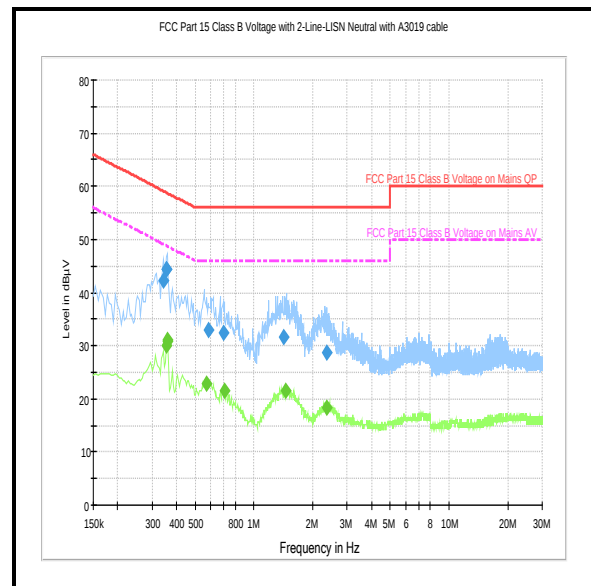
Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.362	Live	34.1	48.7	14.6	Complied
0.407	Live	26.9	47.7	20.8	Complied
0.569	Live	25.3	46.0	20.7	Complied
0.704	Live	25.0	46.0	21.0	Complied
1.473	Live	24.8	46.0	21.2	Complied
2.454	Live	21.8	46.0	24.2	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.344	Neutral	42.2	59.1	16.9	Complied
0.357	Neutral	44.4	58.8	14.4	Complied
0.587	Neutral	33.0	56.0	23.0	Complied
0.699	Neutral	32.5	56.0	23.5	Complied
1.426	Neutral	31.7	56.0	24.3	Complied
2.351	Neutral	28.7	56.0	27.4	Complied

Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.357	Neutral	30.2	48.8	18.6	Complied
0.362	Neutral	31.0	48.7	17.7	Complied
0.569	Neutral	23.0	46.0	23.0	Complied
0.704	Neutral	21.5	46.0	24.5	Complied
1.451	Neutral	21.4	46.0	24.6	Complied
2.360	Neutral	18.3	46.0	27.7	Complied

Transmitter AC Conducted Spurious Emissions (continued)**Results: 240 VAC 60 Hz****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)
M2037	Thermohygrometer	Testo	608-H1	45124925	06 Jan 2020	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	18 Dec 2019	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	23 Aug 2019	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	06 Apr 2019	12

Test Measurement Software/Firmware Used

Name	Version	Release Date
Rohde & Schwarz EMC32	6.30.0	2018

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

Test Engineer:	Andrew Edwards	Test Date:	27 February 2019
Test Sample Serial Number:	0011CE0000000EDA		

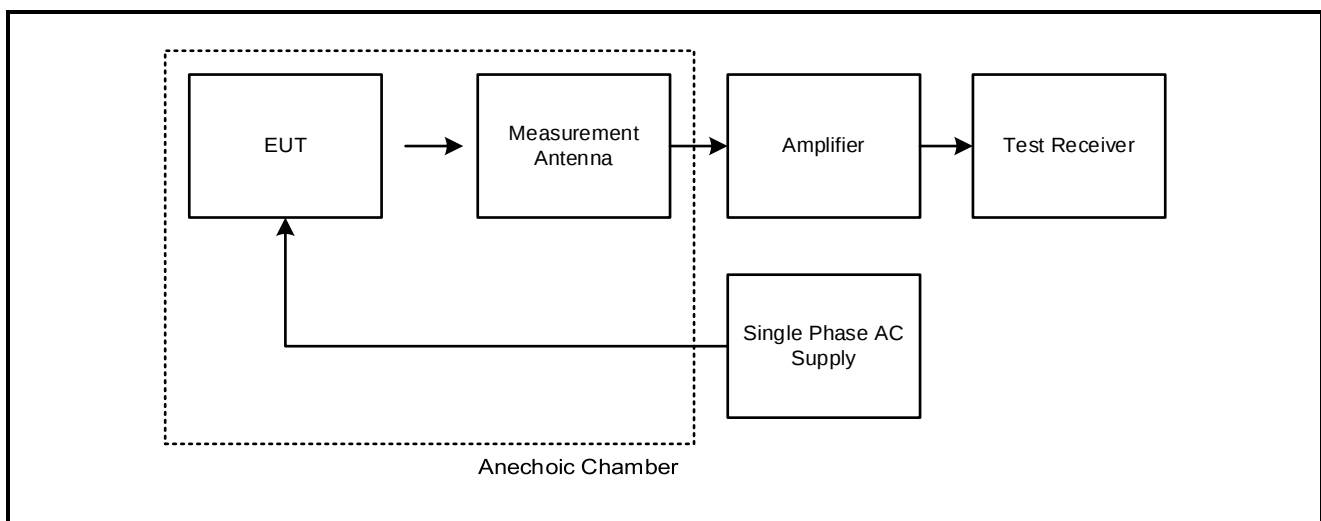
FCC Reference:	Part 15.249(a) & (e)
Test Method Used:	ANSI C63.10 Section 6.6

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	35

Note(s):

1. The final measured value in the tables below incorporates the calibrated antenna factor and cable loss.
2. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.

Test Setup Diagram for Transmitter Fundamental Field Strength:

Transmitter Fundamental Field Strength (continued)**Results: Bottom Channel / Peak**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2401.718	Vertical	92.8	114.0	21.2	Complied

Results: Bottom Channel / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2401.750	Vertical	92.7	94.0	1.3	Complied

Results: Middle Channel / Peak

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2441.760	Vertical	92.6	114.0	21.4	Complied

Results: Middle Channel / Average

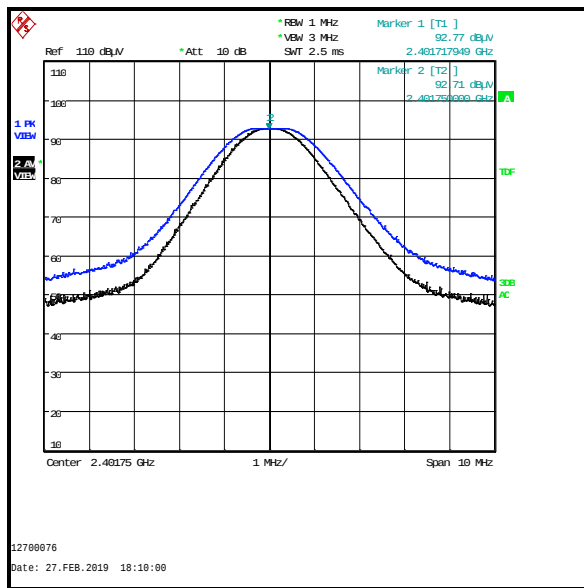
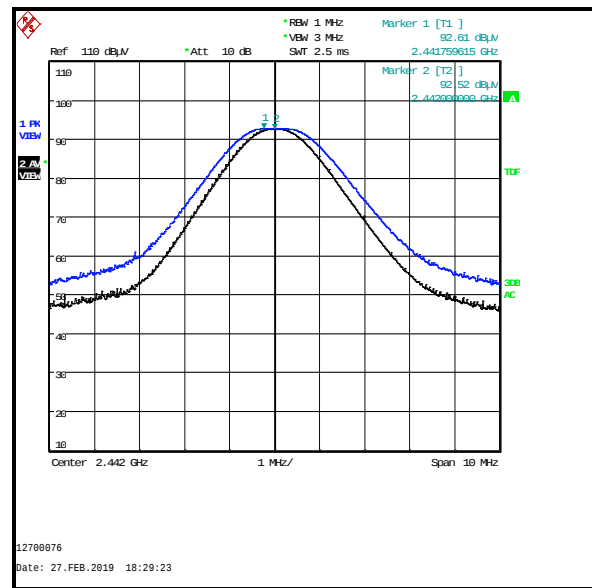
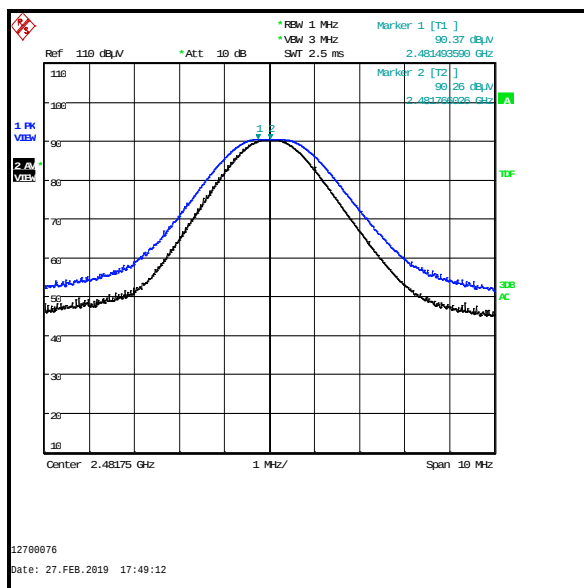
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2442.000	Vertical	92.5	94.0	1.5	Complied

Results: Top Channel / Peak

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2481.494	Vertical	90.4	114.0	23.6	Complied

Results: Top Channel / Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2481.766	Vertical	90.3	94.0	3.7	Complied

Transmitter Fundamental Field Strength (continued)**Bottom Channel****Middle Channel****Top Channel****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2040	Thermohygrometer	Testo	608-H1	45124934	06 Jan 2020	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Oct 2019	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	17 Apr 2019	12
A3155	Pre Amplifier	Com-Power	PAM-118A	18040037	14 Sep 2019	12
A3138	Antenna	Schwarzbeck	BBHA 9120 B	00702	03 Oct 2019	12

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

Test Engineer:	Andrew Edwards	Test Date:	27 February 2019
Test Sample Serial Number:	0011CE0000000EDA		

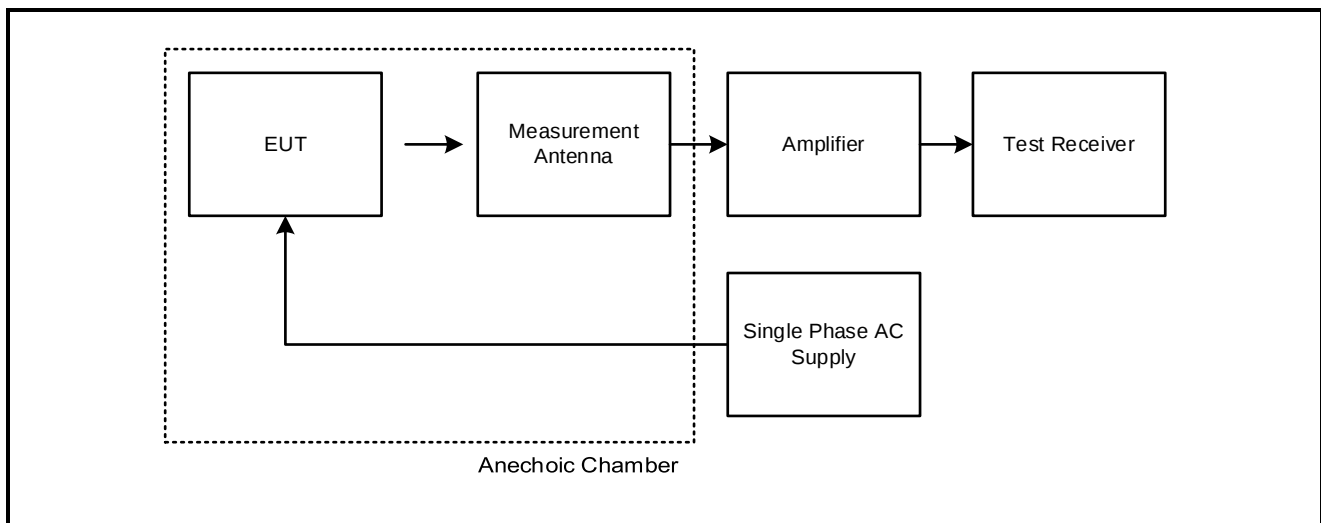
FCC Reference:	Part 2.1049
Test Method Used:	ANSI C63.10 Section 6.9.2

Environmental Conditions:

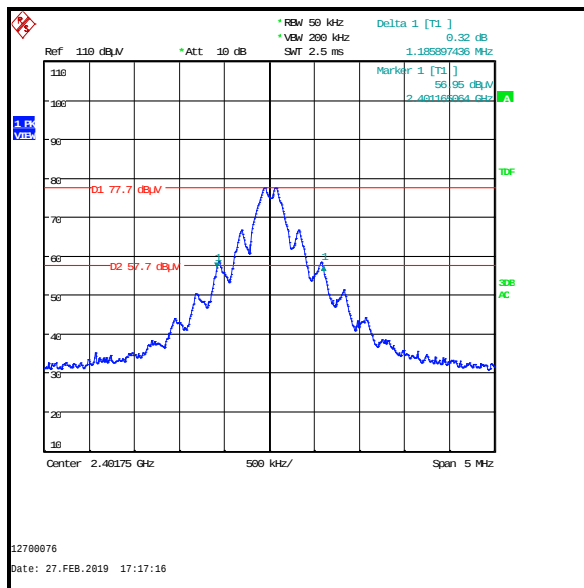
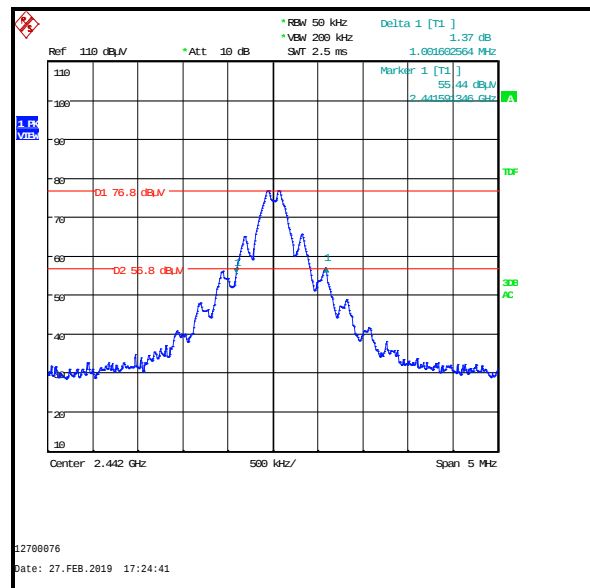
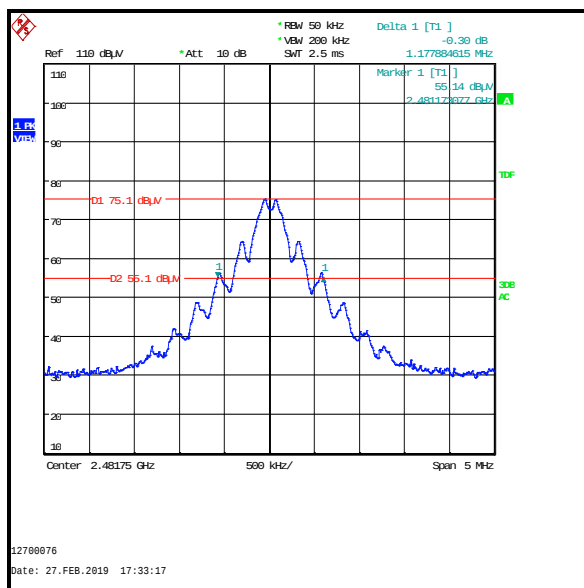
Temperature (°C):	23
Relative Humidity (%):	35

Note(s):

- The test receiver resolution bandwidth was set 50 kHz and video bandwidth 200 kHz. A peak detector was used, sweep time was set to auto and the trace mode was max hold. The span was set to 5 MHz. Normal and delta markers were placed 20 dB down from the peak of the carrier.

Test Setup Diagram for Transmitter 20 dB Bandwidth:**Results:**

Channel	20 dB Bandwidth (kHz)
Bottom	1185.897
Middle	1001.603
Top	1177.885

Transmitter 20 dB Bandwidth (continued)**Bottom Channel****Middle Channel****Top Channel****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2040	Thermohygrometer	Testo	608-H1	45124934	06 Jan 2020	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Oct 2019	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	17 Apr 2019	12
A3155	Pre Amplifier	Com-Power	PAM-118A	18040037	14 Sep 2019	12
A3138	Antenna	Schwarzbeck	BBHA 9120 B	00702	03 Oct 2019	12

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

Test Engineer:	Andrew Edwards	Test Date:	28 February 2019
Test Sample Serial Number:	0011CE0000000EDA		

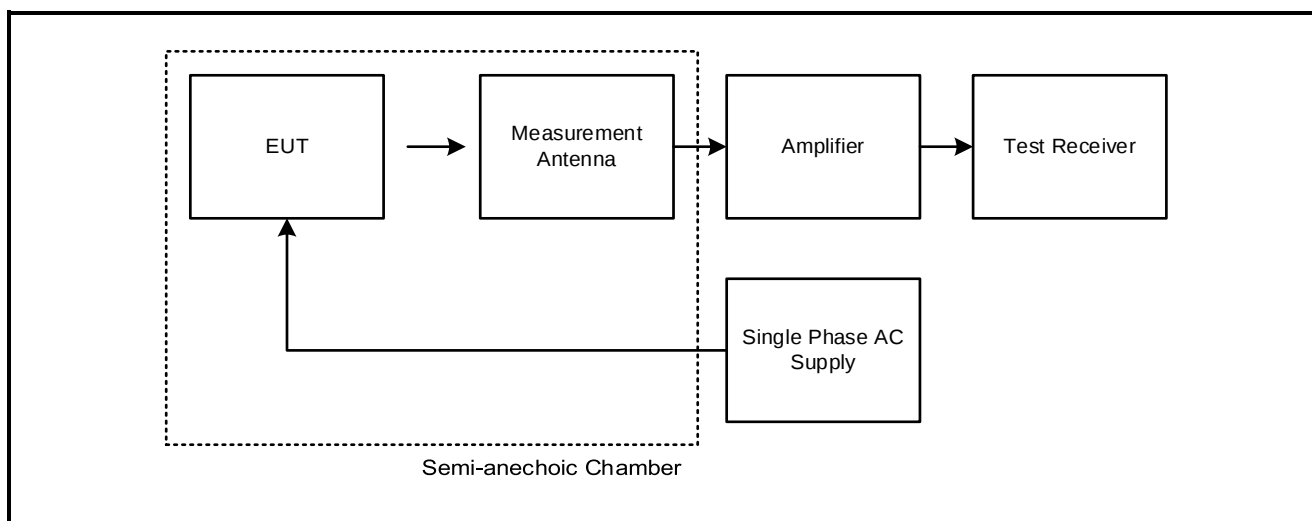
FCC Reference:	Parts 15.249(a)(d)(e) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

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

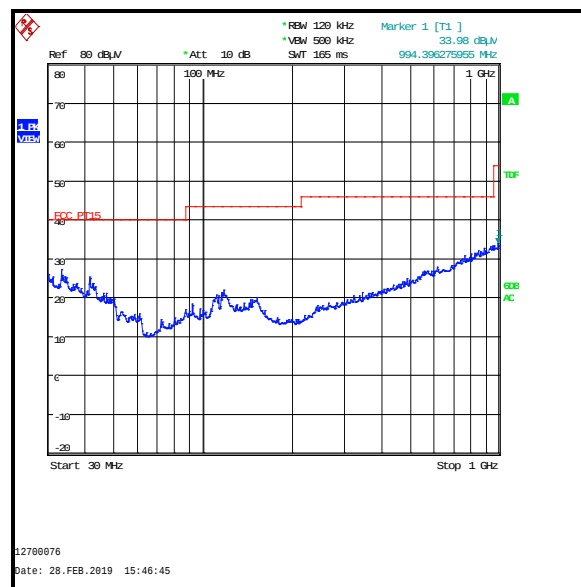
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All 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.
3. Measurements below 1 GHz were performed in a semi-anechoic chamber (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. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
4. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 120 kHz and video bandwidth 500 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.

Test Setup Diagram for Transmitter Radiated Emissions:

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

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
994.396	Vertical	34.0	54.0	20.0	Complied

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2040	Thermohygrometer	Testo	608-H1	45124934	06 Jan 2020	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Oct 2019	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	17 Apr 2019	12
A3154	Pre-Amplifier	Com-Power	PAM-103	18020012	14 Sep 2020	12
A553	Antenna	Chase	CBL6111A	1593	08 Oct 2019	12
A3112	Attenuator	AtlanTecRF	AN18-06	219706#2	08 Oct 2019	12

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

Test Engineer:	Andrew Edwards	Test Dates:	27 February 2019 & 01 March 2019
Test Sample Serial Number:	0011CE0000000EDA		

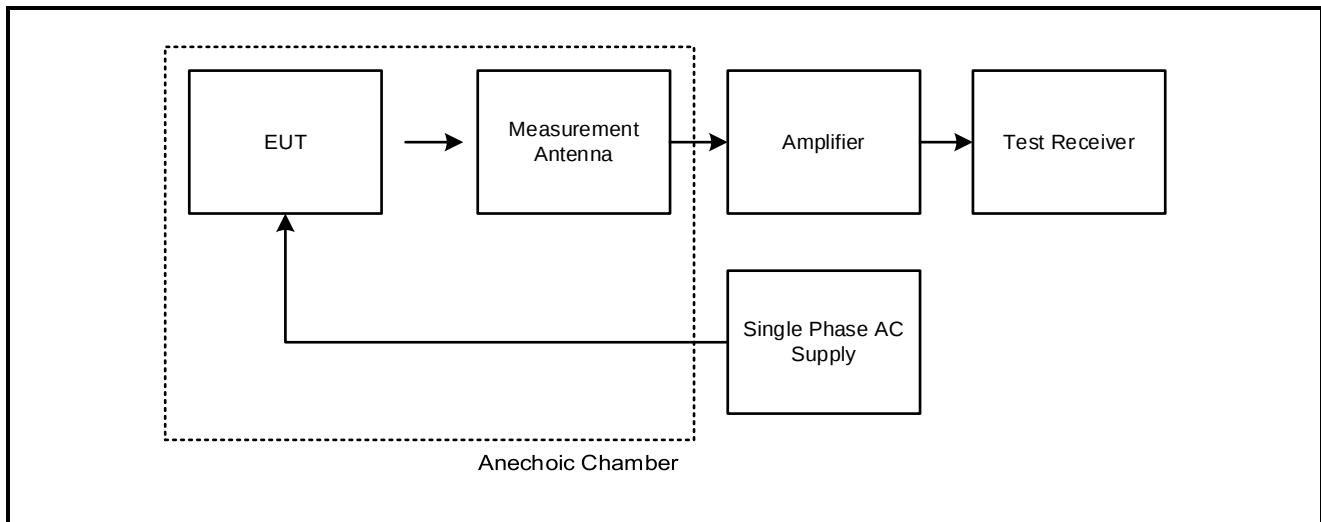
FCC Reference:	Parts 15.249(a)(d)(e) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.6
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	22 to 28
Relative Humidity (%):	35 to 38

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 emission shown on the 1 GHz to 3 GHz plot is the EUT fundamental at 2442 MHz.
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. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0001) 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. Final measurements above 1 GHz were performed in a fully anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 m 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 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.
6. All final measurement > 1 GHz were tested in accordance with ANSI C63.10 Section 6.6.4.3, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.

Transmitter Radiated Emissions (continued)**Test Setup Diagram for Transmitter Radiated Emissions:****Results: Bottom Channel**

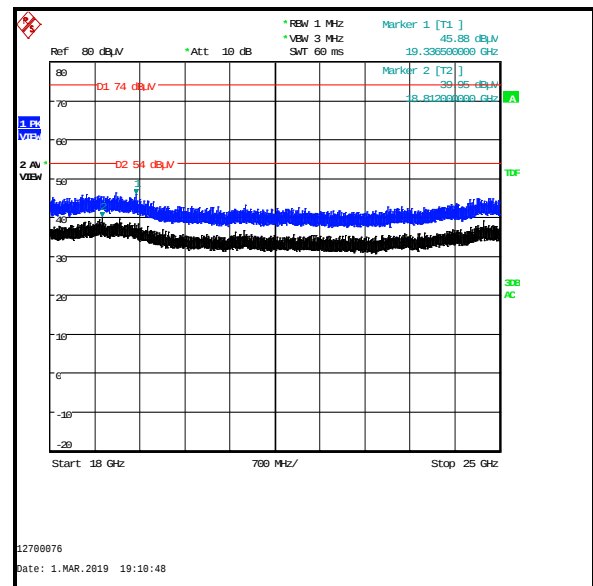
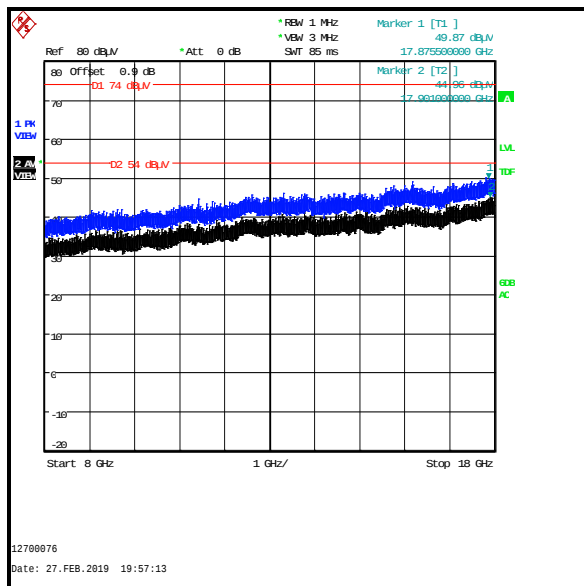
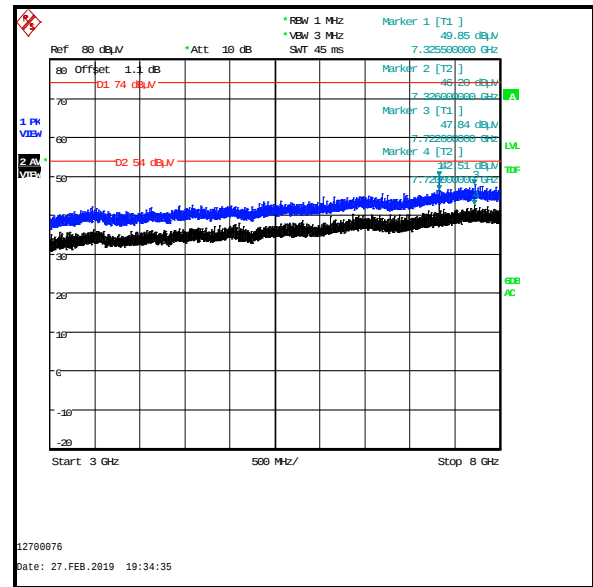
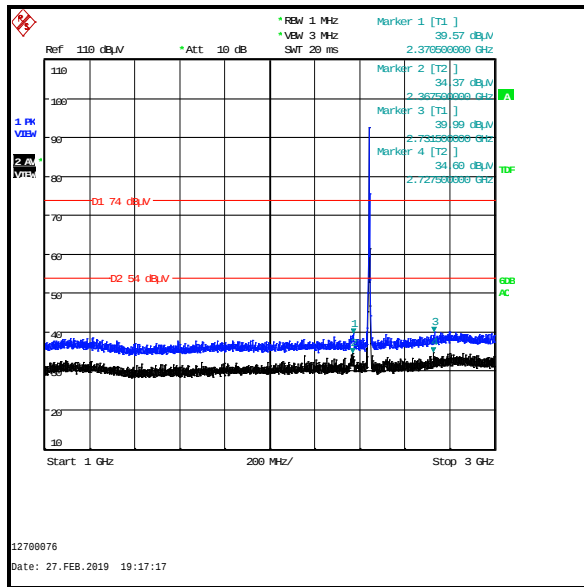
Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
2323.590	Vertical	40.6	54.0	13.4	Complied
7205.442	Horizontal	52.5	54.0	1.5	Complied

Results: Middle Channel

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
2357.874	Vertical	42.6	54.0	11.4	Complied
2511.785	Vertical	40.8	54.0	13.2	Complied
7326.016	Horizontal	52.4	54.0	1.6	Complied

Results: Top Channel

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
7445.216	Horizontal	51.2	54.0	2.8	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)
M2040	Thermohygrometer	Testo	608-H1	45124934	06 Jan 2020	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Oct 2019	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	17 Apr 2019	12
A3155	Pre Amplifier	Com-Power	PAM-118A	18040037	14 Sep 2019	12
A3141	Pre Amplifier	Schwarzbeck	BBV 9718 B	00021	21 Nov 2019	12
A2896	Pre Amplifier	Schwarzbeck	BBV 9721	9721 - 023	08 Feb 2020	12
A3138	Antenna	Schwarzbeck	BBHA 9120 B	00702	03 Oct 2019	12
A3139	Antenna	Schwarzbeck	HWRD750	00027	04 Oct 2019	12
A2895	Antenna	Schwarzbeck	BBHA 9170	9170-728	08 Feb 2020	12
A3093	High Pass Filter	AtlanTecRF	AFH-03000	18051800077	29 Jun 2019	12
A3095	High Pass Filter	AtlanTecRF	AFH-07000	18051600012	29 Jun 2019	12

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

Test Engineer:	Andrew Edwards	Test Date:	27 February 2019
Test Sample Serial Number:	0011CE0000000EDA		

FCC Reference:	Parts 15.249(d) & 15.209
Test Method Used:	ANSI C63.10 Section 6.10.4, 6.10.5 & 6.10.6

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	35

Note(s):

- The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
- The lower band edge falls in a non-restricted band, therefore 15.249(d) limits have been applied. 15.249(d) states all emissions radiating outside of 2400-2483.5 MHz shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in 15.209, whichever is the lesser attenuation.
- * The lower and upper band edge average measurement were performed using ANSI C63.10 Section 6.10.6 marker-delta method. An in-band field strength measurement was initially performed. A second measurement was performed using a reduced RBW of 100 kHz which is 1% of the 10 MHz span. The amplitude delta between the peak of the fundamental emission and the emission level at each band edge was noted. The delta was subtracted from the initial in-band field strength level to obtain the band edge levels. Result plots can be found at the end of this section.

Initial fundamental peak emission level using a RBW/VBW of 1 MHz / 3 MHz

Lower Band Edge = 92.3 dB μ V/m

Upper Band Edge = 90.4 dB μ V/m

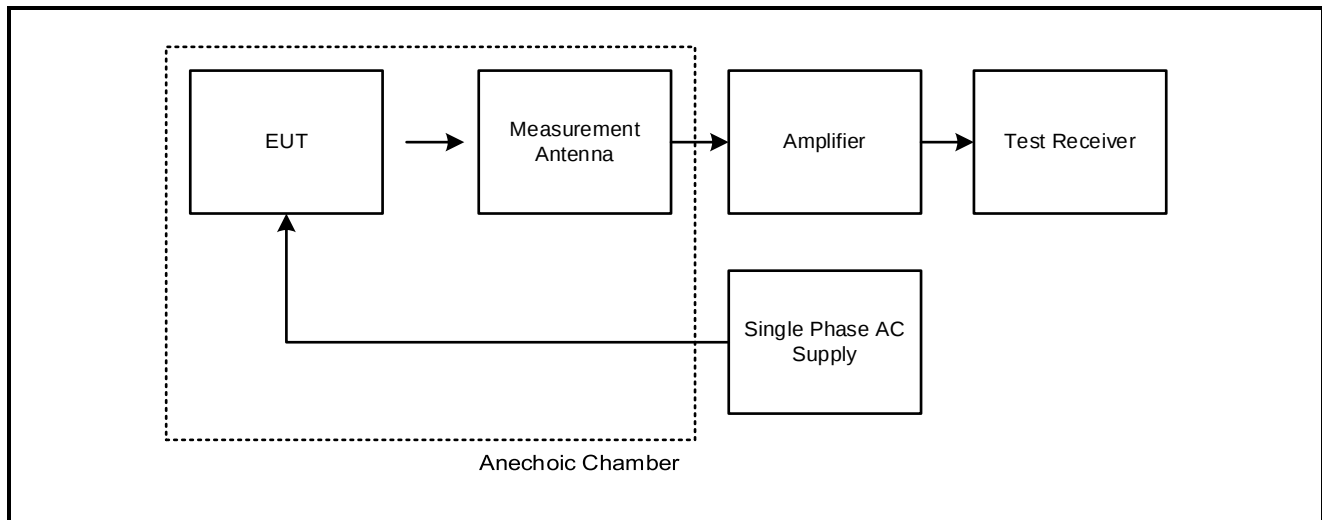
Delta between fundamental and band edge using RBW/VBW of 100 kHz / 300 kHz

Lower Band Edge = 44.6 dB μ V/m

Upper Band Edge = 46.7 dB μ V/m

Lower Band Edge Average level = 92.3 – 44.6 = 47.7 dB μ V/m

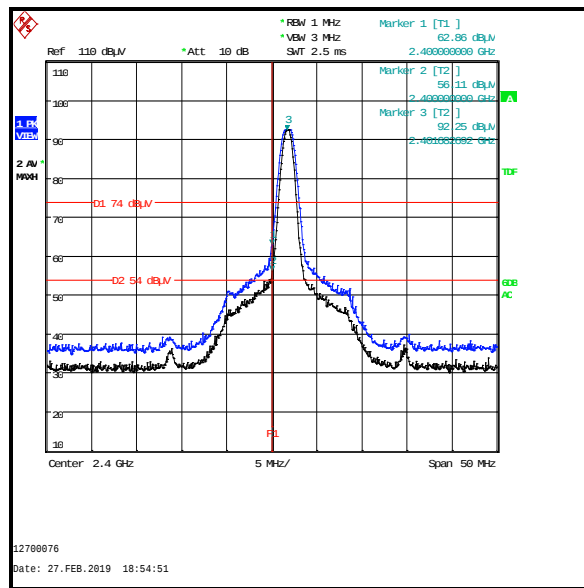
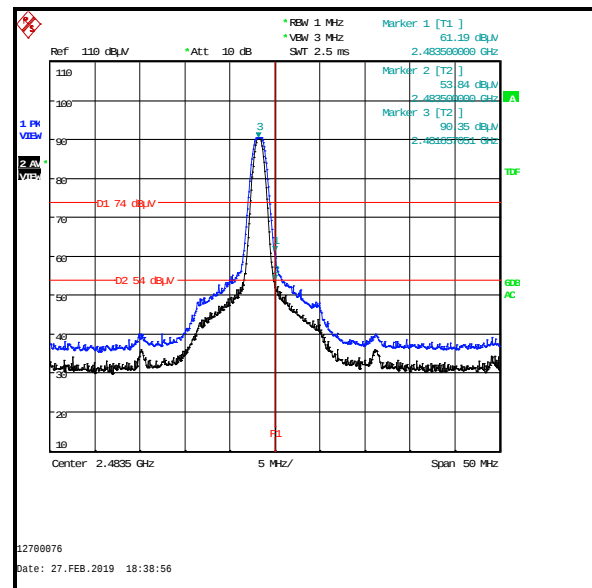
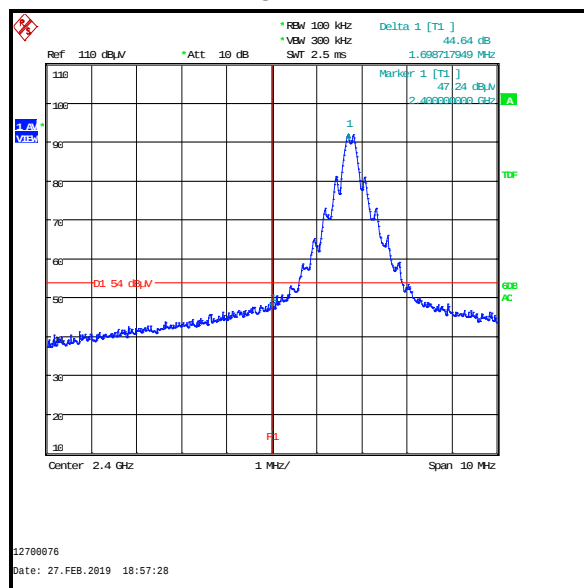
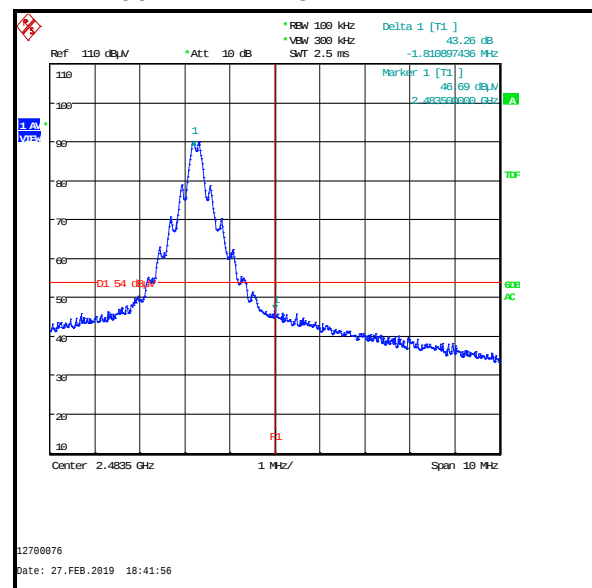
Upper Band Edge Average level = 90.4 – 46.7 = 43.7 dB μ V/m

Transmitter Band Edge Radiated Emissions (continued)**Test Setup Diagram for Transmitter Band Edge Radiated Emissions:****Results: Peak**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400	Vertical	62.9	74.0	11.1	Complied
2483.5	Vertical	61.2	74.0	12.8	Complied

Results: Average

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400	Vertical	47.7*	54.0	6.3	Complied
2483.5	Vertical	43.7*	54.0	10.3	Complied

Transmitter Band Edge Radiated Emissions (continued)**Lower Band Edge Peak Measurement****Upper Band Edge Measurement****Lower Band Edge Average Measurement – Marked Delta method****Upper Band Edge Average Measurement – Marked Delta method****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2040	Thermohygrometer	Testo	608-H1	45124934	06 Jan 2020	12
K0001	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Oct 2019	12
M2044	Test Receiver	Rohde & Schwarz	ESU26	100122	17 Apr 2019	12
A3155	Pre Amplifier	Com-Power	PAM-118A	18040037	14 Sep 2019	12
A3138	Antenna	Schwarzbeck	BBHA 9120 B	00702	03 Oct 2019	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%	±2.40 dB
Fundamental Field Strength	2.4 GHz to 2.4835 GHz	95%	±2.94 dB
20 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±4.59 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±4.65 dB
Radiated Spurious Emissions	1 GHz to 25 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 ---