



TEST REPORT

Test Report No. : UL-RPT-RP12149979-1116A V2.0

Manufacturer : Miura Systems
Model No. : M010
FCC ID : 2AO4FM010-1
Technology : *Bluetooth* – Basic Rate & EDR
Test Standard(s) : FCC Parts 15.207, 15.209(a) & 15.247

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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 June 2018

Checked by:

Ian Watch
Senior Engineer, Radio Laboratory

Company Signatory:

Sarah Williams
Senior Engineer, Radio Laboratory
UL VS LTD



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1. Customer Information










Company Name:	Miura Systems
Address:	40 Oxford Road Stokenchurch High Wycombe Buckinghamshire HP14 3SX United Kingdom

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
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:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	06 February 2018 to 14 February 2018

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	
Part 15.247(a)(1)	Transmitter 20 dB Bandwidth	
Part 15.247(a)(1)	Transmitter Carrier Frequency Separation	
Part 15.247(a)(1)(iii)	Transmitter Number of Hopping Frequencies and Average Time of Occupancy	
Part 15.247(b)(1)	Transmitter Maximum Peak Output Power	
Part 15.247(d) & 15.209(a)	Transmitter Radiated Emissions	
Part 15.247(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:	Miura Systems
Model Name or Number:	M010
Test Sample Serial Number:	010-926332 (<i>Conducted RF sample</i>)
Hardware Version:	M010 PCB01 V1.11
Software Version:	Test MPI V1.46 (EMC), Testexercise01 V0.7
FCC ID:	2AO4FM010-1

Brand Name:	Miura Systems
Model Name or Number:	M010
Test Sample Serial Number:	010-926337 (<i>Radiated RF sample</i>)
Hardware Version:	M010 PCB01 V1.11
Software Version:	Test MPI V1.46 (EMC), Testexercise01 V0.7
FCC ID:	2AO4FM010-1

3.2. Description of EUT

The Equipment Under Test was a Hand held payment terminal with *Bluetooth* and RFID. It contains an internal chip antenna and is powered from an internal rechargeable battery.

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:	Bluetooth		
Power Supply Requirement:	Nominal	3.8 VDC via 120 VAC 60 Hz	
Type of Unit:	Transceiver		
Channel Spacing:	1 MHz		
Mode:	Basic Rate	Enhanced Data Rate	
Modulation:	GFSK	π/4-DQPSK	8DPSK
Packet Type: (Maximum Payload)	DH5	2DH5	3DH5
Data Rate (Mbps):	1	2	3
Antenna Gain:	3.5 dBi		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	0	2402
	Middle	39	2441
	Top	78	2480

3.5. Support Equipment

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

Description:	USB Switch mode power supply
Brand Name:	HN Electronics
Model Name or Number:	HNP06UK-USB
Serial Number:	Not marked or stated

Description:	USB cable. Length 1 metre
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	USB extension cable. Length 3 metres
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Electronic Debit Card
Brand Name:	CornerCard
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	<i>Bluetooth</i> tester
Brand Name:	Tescom
Model Name or Number:	TC-3000A
UL VS LTD Asset Number:	M1632

Description:	<i>Bluetooth</i> tester
Brand Name:	Rohde & Schwarz
Model Name or Number:	CBT
UL VS LTD Asset Number:	M2023

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- Continuously transmitting at maximum power on bottom, middle and top channels in Basic Rate (DH5 packets) or EDR (2DH5 or 3DH5 packets) as required.
- Continuously transmitting at maximum power in hopping mode on all channels in Basic Rate (DH5 packets) or EDR (2DH5 or 3DH5 packets) as required.

4.2. Configuration and Peripherals

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

- The customer supplied instructions (M10 Software Instructions v2.pdf Date: 23 January 2018) to configure the EUT into test mode. Once in *Bluetooth* test mode, a link was established with a *Bluetooth* tester which was then used to control the EUT.
- Both EDR/Basic rate modes were compared and tests were performed with the mode that presented the worst-case result. For output power, bandwidth, band edge and channel separation, all modes were tested.
- AC conducted emissions and radiated spurious emissions were tested with the EUT transmitting on the middle channel using DH5 packet type, as this mode was found to transmit the highest power.
- Radiated spurious emission measurements were performed with the EUT connected to a USB power supply and a debit card placed in the EUT. The USB charger was placed outside the test chamber. Prescans were performed with the EUT oriented in the X, Y & Z planes. Y orientation was found to be the worst-case orientation with respect to emission levels and final measurements were performed with the EUT in this position.
- The conducted RF sample was used for Transmitter 20 dB Bandwidth, Transmitter Carrier Frequency Separation, Transmitter Number of Hopping Frequencies and Average Time of Occupancy and Transmitter Maximum Peak Output Power tests.
- The radiated RF sample was used for AC conducted emissions and radiated spurious emissions tests.

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:	Doug Freegard	Test Date:	14 February 2018
Test Sample Serial Number:	010-926337		

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

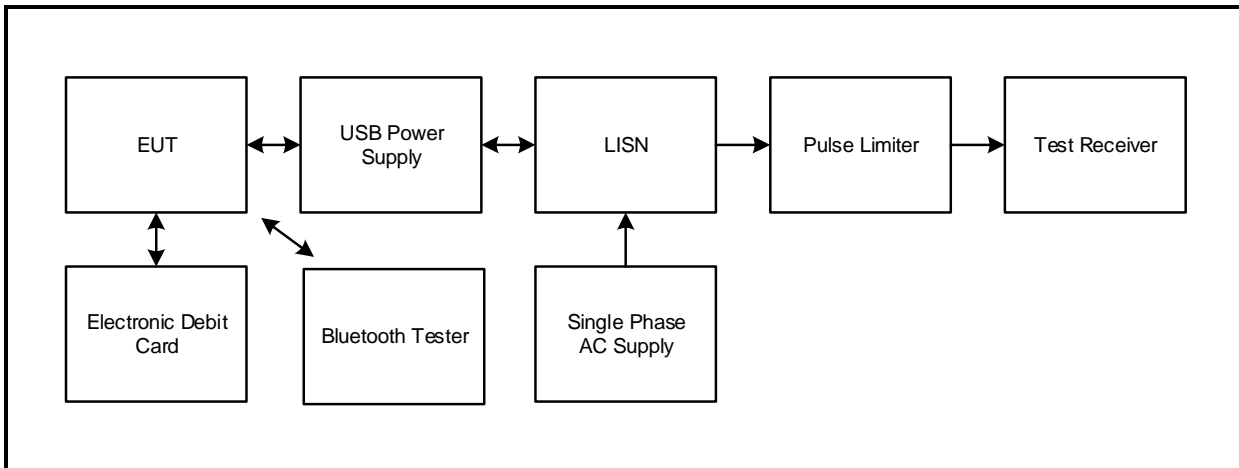
Environmental Conditions:

Temperature (°C):	20
Relative Humidity (%):	31

Note(s):

1. The EUT was connected to the power supply input 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 power supply.
3. A pulse limiter was fitted between the LISN and 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:



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

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.150	Live	30.5	66.0	35.5	Complied
0.474	Live	34.7	56.4	21.7	Complied
0.825	Live	26.4	56.0	29.6	Complied
10.455	Live	19.1	60.0	40.9	Complied
12.003	Live	13.1	60.0	46.9	Complied
25.058	Live	27.5	60.0	32.5	Complied

Results: Live / Average / 120 VAC 60 Hz

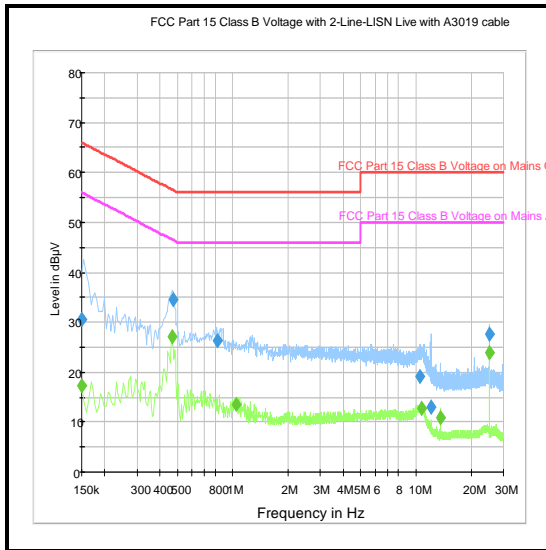
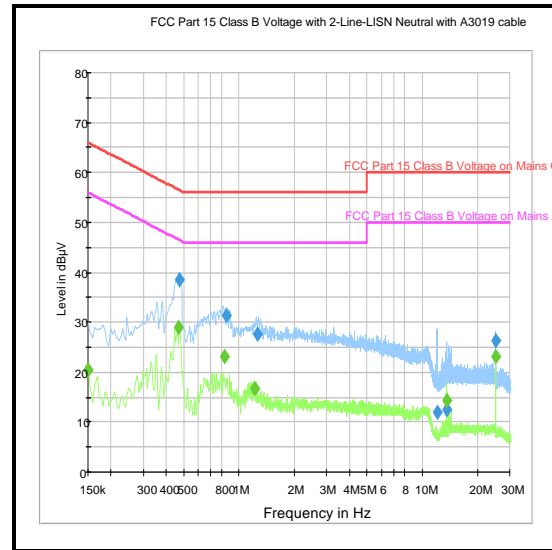
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.150	Live	17.2	56.0	38.8	Complied
0.470	Live	27.0	46.5	19.5	Complied
1.046	Live	13.6	46.0	32.4	Complied
10.703	Live	12.7	50.0	37.3	Complied
13.560	Live	11.0	50.0	39.0	Complied
25.058	Live	23.9	50.0	26.1	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.474	Neutral	38.5	56.4	17.9	Complied
0.857	Neutral	31.2	56.0	24.8	Complied
1.266	Neutral	27.7	56.0	28.3	Complied
11.999	Neutral	11.9	60.0	48.1	Complied
13.574	Neutral	12.5	60.0	47.5	Complied
25.058	Neutral	26.4	60.0	33.6	Complied

Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.150	Neutral	20.5	56.0	35.5	Complied
0.470	Neutral	29.1	46.5	17.4	Complied
0.830	Neutral	23.0	46.0	23.0	Complied
1.212	Neutral	16.8	46.0	29.2	Complied
13.560	Neutral	14.5	50.0	35.5	Complied
25.058	Neutral	23.2	50.0	26.8	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 (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.434	Live	30.7	57.2	26.5	Complied
1.221	Live	25.3	56.0	30.7	Complied
2.027	Live	27.7	56.0	28.3	Complied
2.945	Live	23.9	56.0	32.1	Complied
12.017	Live	21.2	60.0	38.8	Complied
25.058	Live	27.2	60.0	32.8	Complied

Results: Live / Average / 240 VAC 60 Hz

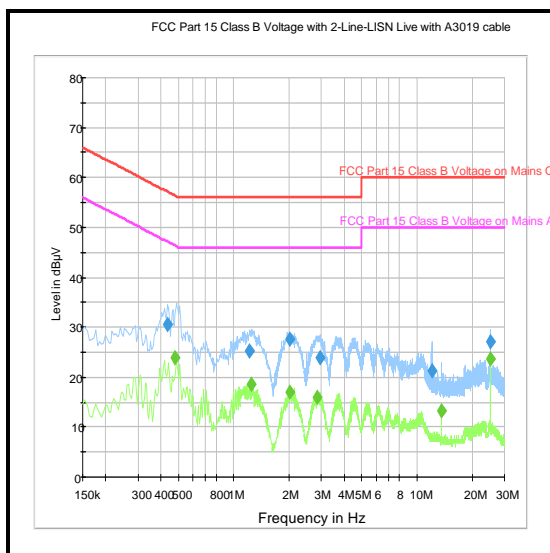
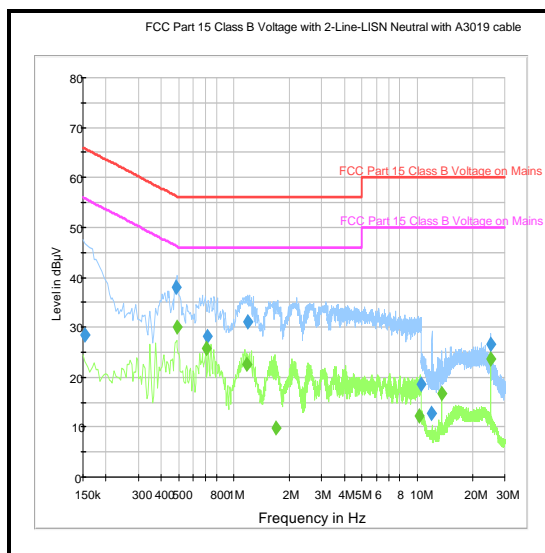
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.479	Live	23.8	46.4	22.6	Complied
1.239	Live	18.7	46.0	27.3	Complied
2.031	Live	17.1	46.0	28.9	Complied
2.841	Live	15.9	46.0	30.1	Complied
13.560	Live	13.2	50.0	36.8	Complied
25.058	Live	23.8	50.0	26.2	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.483	Neutral	37.9	56.3	18.4	Complied
0.713	Neutral	28.1	56.0	27.9	Complied
1.194	Neutral	31.2	56.0	24.8	Complied
10.478	Neutral	18.7	60.0	41.3	Complied
11.994	Neutral	12.6	60.0	47.4	Complied
25.058	Neutral	26.6	60.0	33.4	Complied

Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.708	Neutral	25.8	46.0	20.2	Complied
1.172	Neutral	22.5	46.0	23.5	Complied
1.694	Neutral	9.9	46.0	36.1	Complied
10.271	Neutral	12.3	50.0	37.7	Complied
13.560	Neutral	16.7	50.0	33.3	Complied
25.058	Neutral	23.8	50.0	26.2	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)
M2013	Thermohygrometer	Testo	608-H1	45046424	20 Jun 2018	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	09 Aug 2018	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	09 May 2018	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	13 Nov 2018	12

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

Test Engineer:	Stefan Ho	Test Date:	06 February 2018
Test Sample Serial Number:	010-926332		

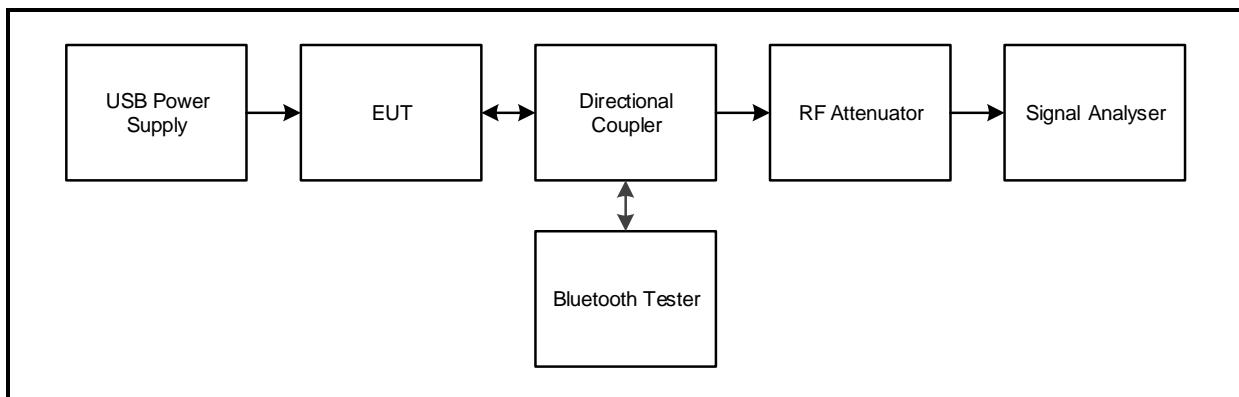
FCC Reference:	Part 15.247(a)(1)
Test Method Used:	ANSI C63.10 Section 6.9.2

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	32

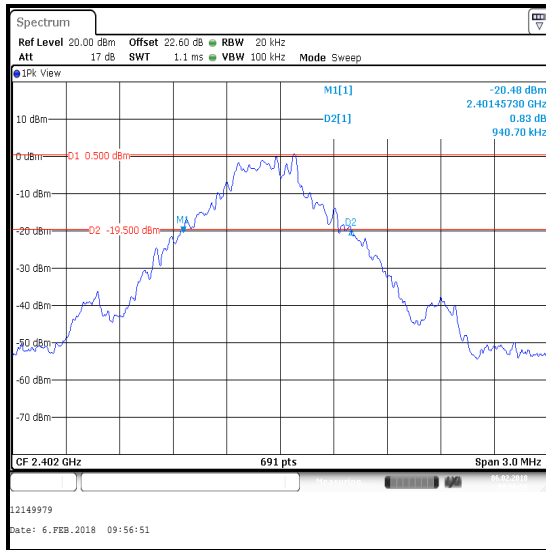
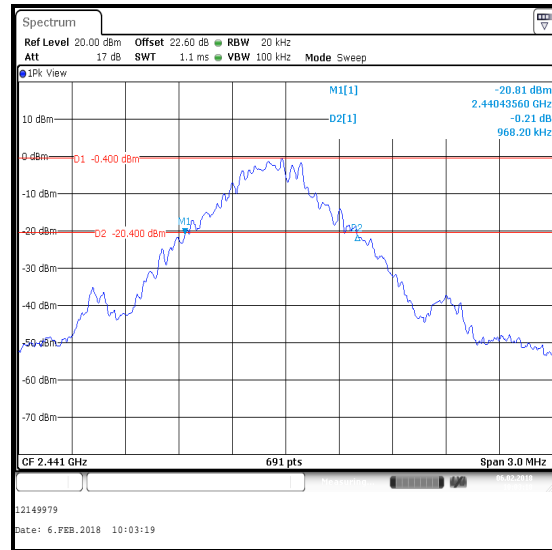
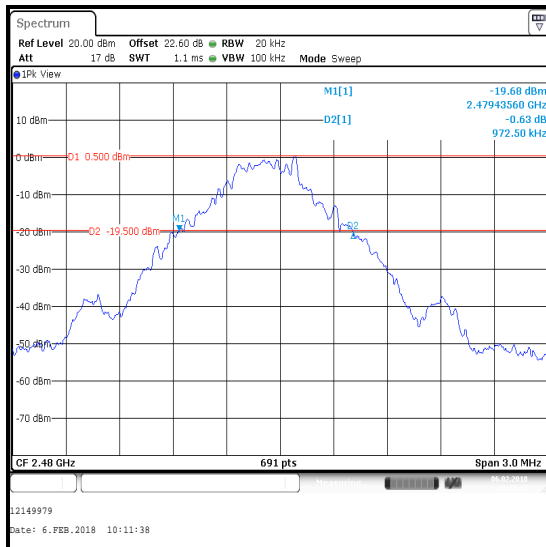
Note(s):

1. The signal analyser resolution bandwidth was set to 20 kHz and video bandwidth 100 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 3.0 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. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

Test setup:

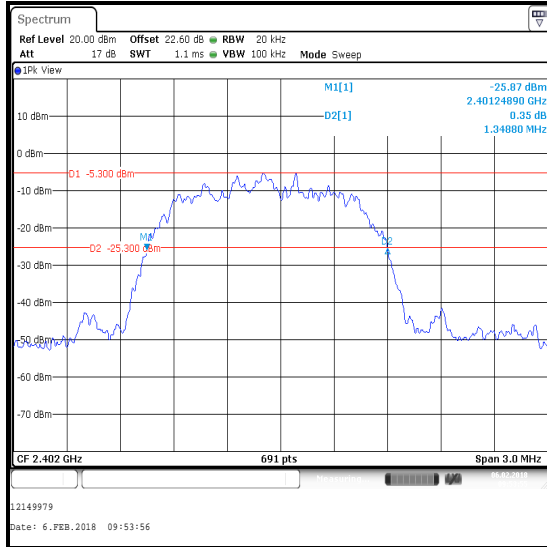
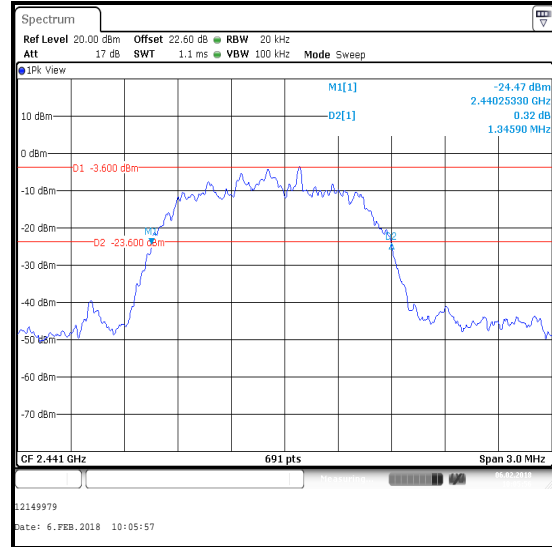
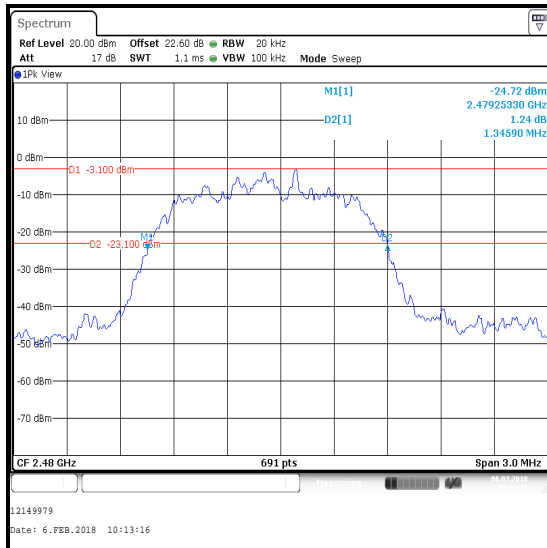
Transmitter 20 dB Bandwidth (continued)**Results DH5:**

Channel	20 dB Bandwidth (kHz)
Bottom	940.700
Middle	968.200
Top	972.500

**Bottom Channel****Middle Channel****Top Channel**

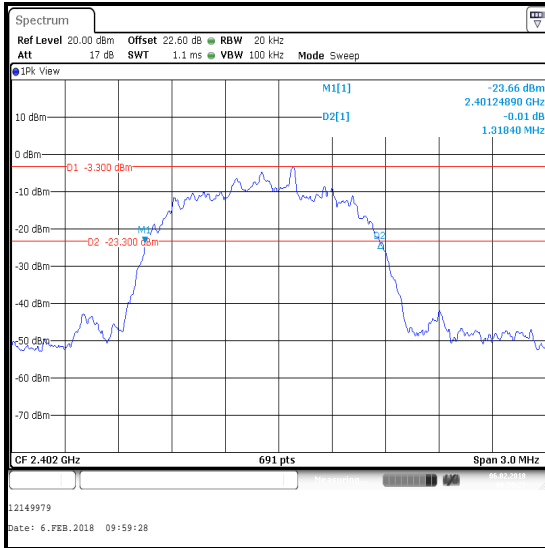
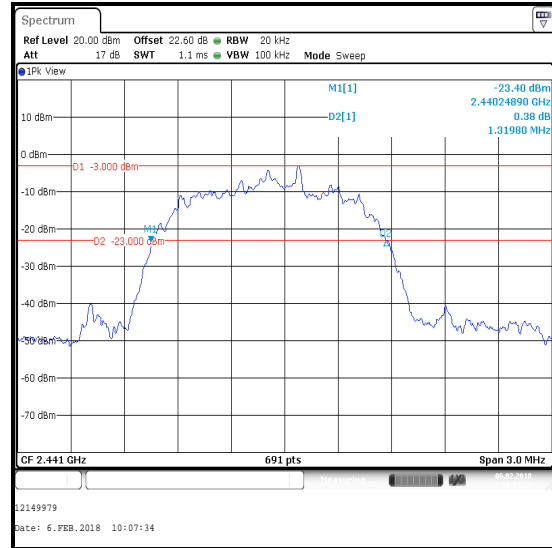
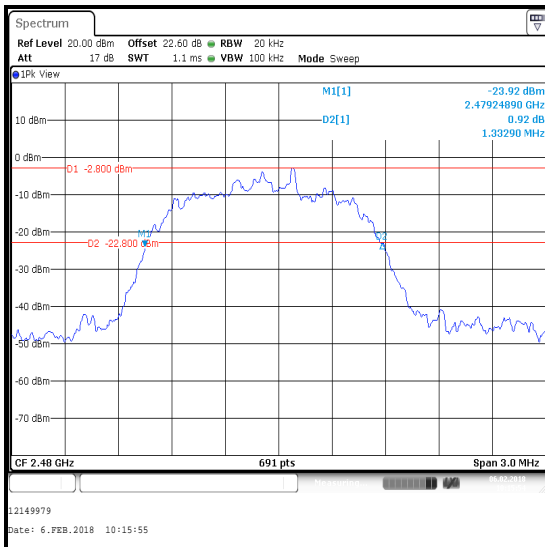
Transmitter 20 dB Bandwidth (continued)**Results 2DH5:**

Channel	20 dB Bandwidth (kHz)
Bottom	1348.800
Middle	1345.900
Top	1345.900

**Bottom Channel****Middle Channel****Top Channel**

Transmitter 20 dB Bandwidth (continued)**Results 3DH5:**

Channel	20 dB Bandwidth (kHz)
Bottom	1318.400
Middle	1319.800
Top	1332.900

**Bottom Channel****Middle Channel****Top Channel**

Transmitter 20 dB Bandwidth (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2005	Thermohygrometer	Testo	608-H1	45046700	22 Feb 2018	12
M1996	Signal Analyser	Rohde & Schwarz	FSV13	100975	27 Nov 2018	12
M1804	Signal Generator	Rohde & Schwarz	SMP22	100026	28 Feb 2019	24
A2505	Directional Coupler	AtlanTecRF	CDC-003060-20	1101230	Calibrated before use	-
A2924	Attenuator	AtlanTecRF	AN18W5-20	832828#7	Calibrated before use	-

5.2.3. Transmitter Carrier Frequency Separation**Test Summary:**

Test Engineer:	Stefan Ho	Test Date:	06 February 2018
Test Sample Serial Number:	010-926332		

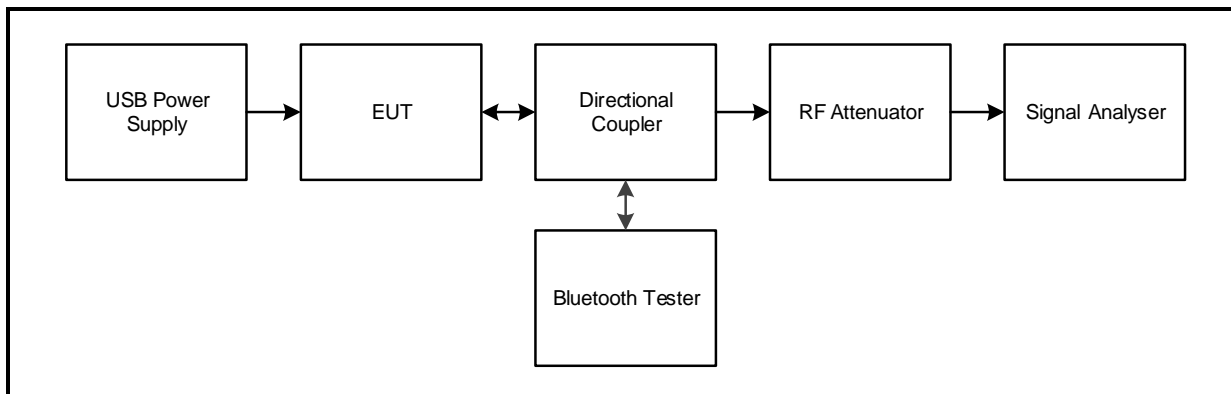
FCC Reference:	Part 15.247(a)(1)
Test Method Used:	ANSI C63.10 Section 7.8.2

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	34

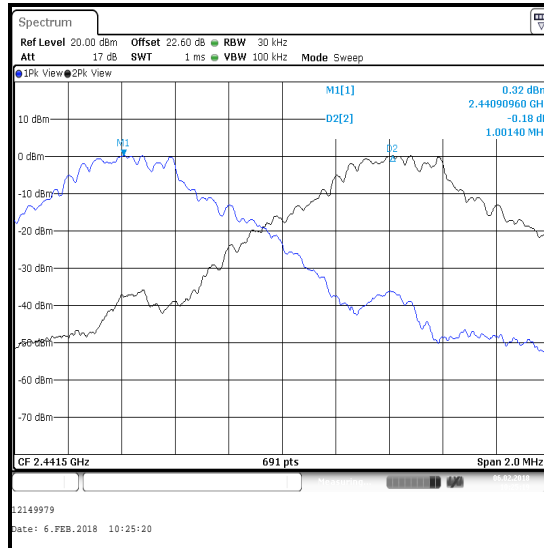
Note(s):

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.

Test setup:

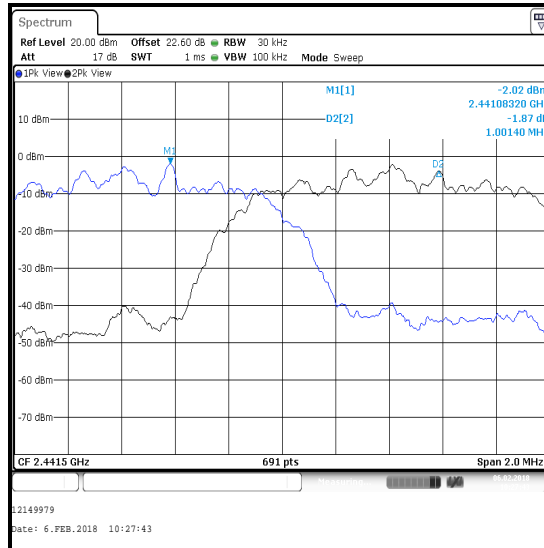
Transmitter Carrier Frequency Separation (continued)**Results: DH5**

Carrier Frequency Separation (kHz)	Limit ($2/3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1001.400	645.467	355.933	Complied



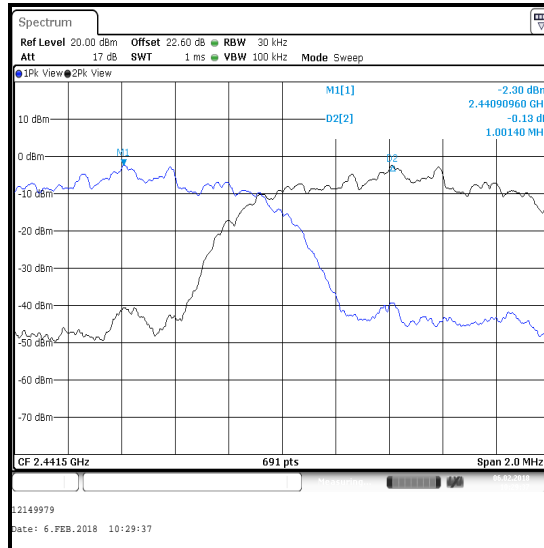
Transmitter Carrier Frequency Separation (continued)**Results: 2DH5**

Carrier Frequency Separation (kHz)	Limit ($2/3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1001.400	897.267	104.133	Complied



Transmitter Carrier Frequency Separation (continued)**Results: 3DH5**

Carrier Frequency Separation (kHz)	Limit ($2/3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1001.400	879.867	121.533	Complied

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2005	Thermohygrometer	Testo	608-H1	45046700	22 Feb 2018	12
M1996	Signal Analyser	Rohde & Schwarz	FSV13	100975	27 Nov 2018	12
M1804	Signal Generator	Rohde & Schwarz	SMP22	100026	28 Feb 2019	24
A2505	Directional Coupler	AtlanTecRF	CDC-003060-20	1101230	Calibrated before use	-
A2924	Attenuator	AtlanTecRF	AN18W5-20	832828#7	Calibrated before use	-

5.2.4. Transmitter Number of Hopping Frequencies and Average Time of Occupancy**Test Summary:**

Test Engineer:	Stefan Ho	Test Date:	06 February 2018
Test Sample Serial Number:	010-926332		

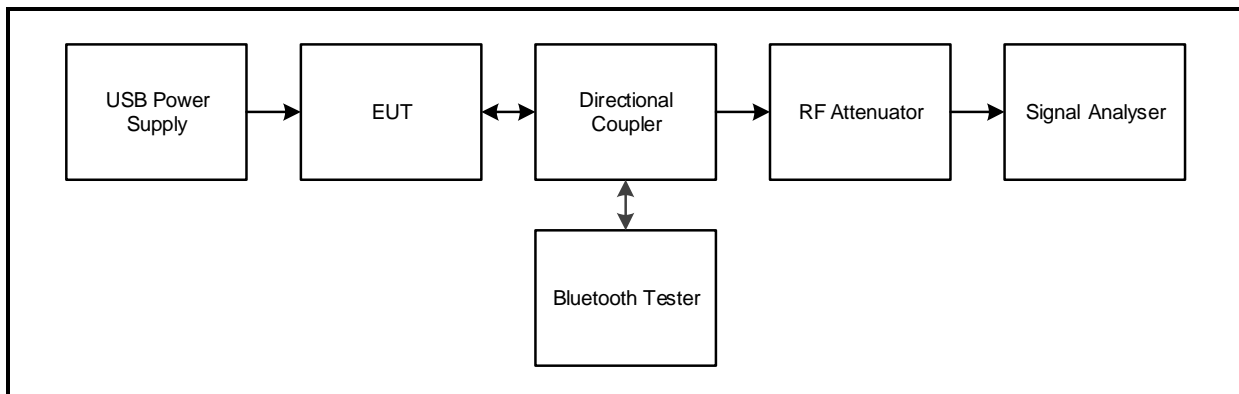
FCC Reference:	Part 15.247(a)(1)(iii)
Test Method Used:	ANSI C63.10 Sections 7.8.3 & 7.8.4

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	34

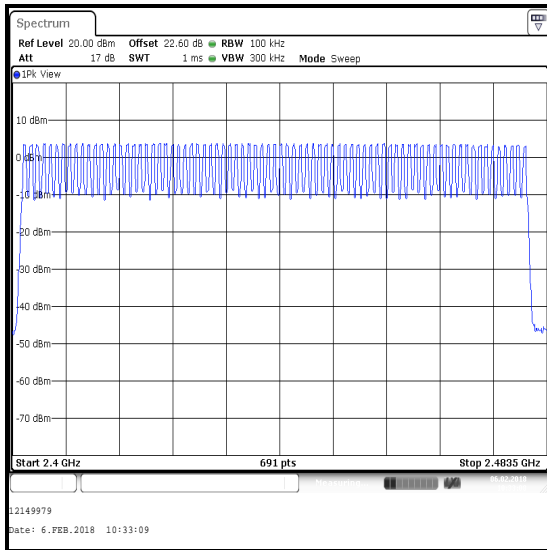
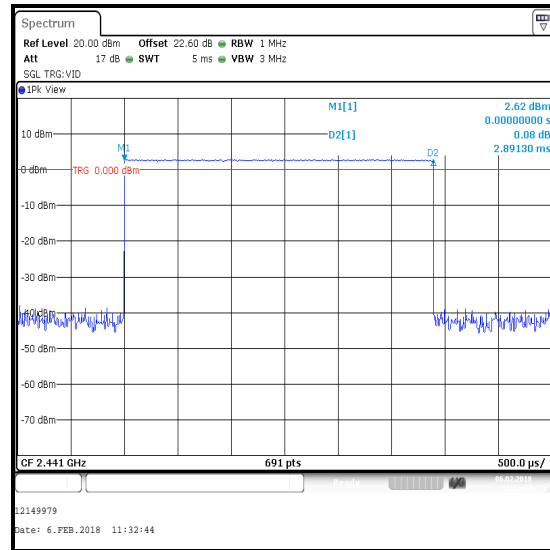
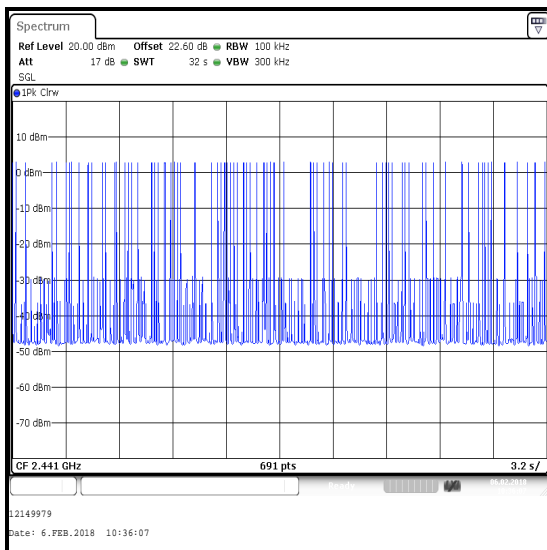
Note(s):

1. Tests were performed to identify the average time of occupancy in number of channels (79) x 0.4 seconds. The calculated period is 31.6 seconds.
2. The signal analyser was set up for the Number of Hopping Frequencies measurement as follows: the resolution bandwidth was set to 100 kHz and video bandwidth of 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 83.5 MHz.
3. The signal analyser was set up for the Emission Width measurement as follows: the resolution bandwidth was set to 1.0 MHz and video bandwidth of 3.0 MHz. A peak detector was used and sweep time was set to auto with a span of zero Hz. The signal analyser was set to trigger at 1 ms, with a marker placed at the start of the emission and a delta marked place at the end of the emission. The emission width is recorded in the table below
4. The signal analyser was set up for the Number of Hopping Frequencies in 32 seconds measurement as follows: the resolution bandwidth was set to 100 kHz and video bandwidth of 300 kHz. A peak detector was used and sweep time was set to 32 seconds. The EUT was set to transmit in a hopping frequency mode with zero span. The total number of hopping frequencies were recorded in the table below.
5. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

Test setup:

Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)**Results:**

Emission Width (μ s)	Number of Hops in 31.6 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Result
2891.3	88	0.25	0.4	0.15	Complied

**Number of Hopping Frequencies****Emission Width****Number of Hopping Frequencies in 32 s**

Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2005	Thermohygrometer	Testo	608-H1	45046700	22 Feb 2018	12
M1996	Signal Analyser	Rohde & Schwarz	FSV13	100975	27 Nov 2018	12
M1804	Signal Generator	Rohde & Schwarz	SMP22	100026	28 Feb 2019	24
A2505	Directional Coupler	AtlanTecRF	CDC-003060-20	1101230	Calibrated before use	-
A2924	Attenuator	AtlanTecRF	AN18W5-20	832828#7	Calibrated before use	-

5.2.5. Transmitter Maximum Peak Output Power**Test Summary:**

Test Engineer:	Stefan Ho	Test Date:	06 February 2018
Test Sample Serial Number:	010-926332		

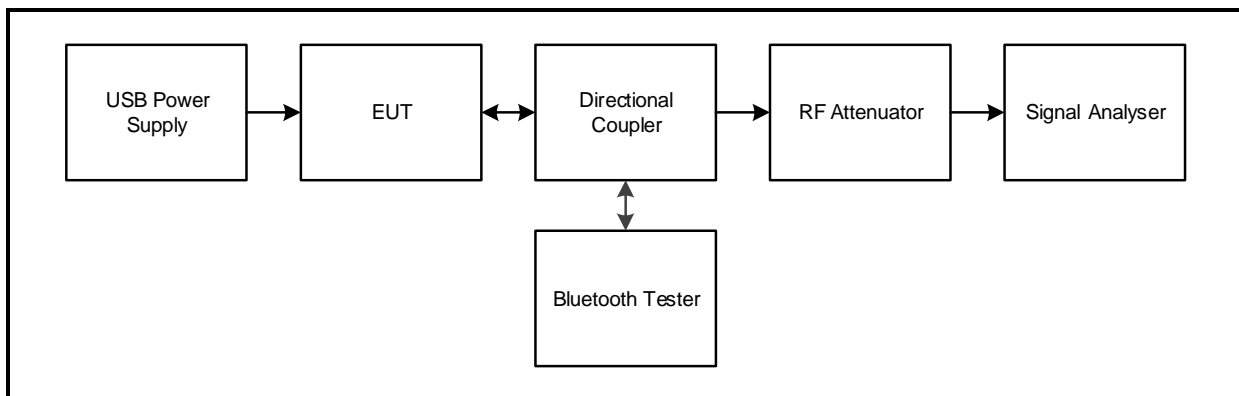
FCC Reference:	Part 15.247(b)(1)
Test Method Used:	ANSI C63.10 Section 7.8.5

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	34

Note(s):

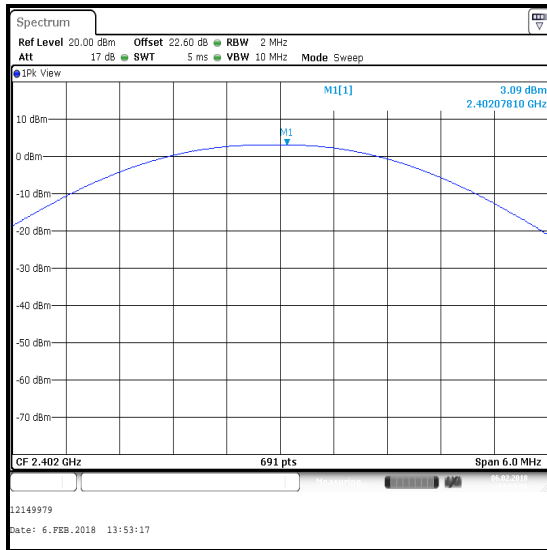
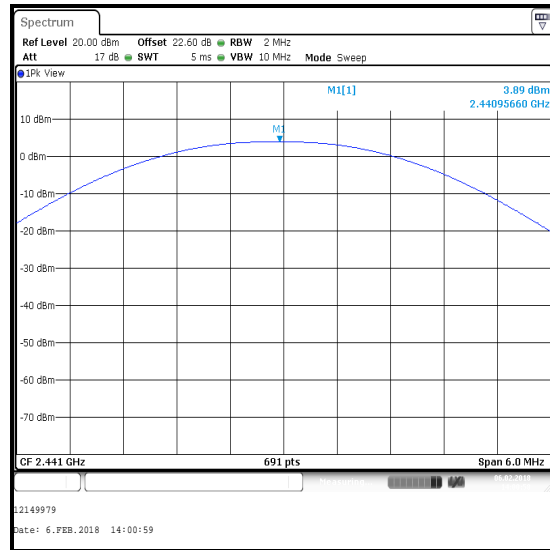
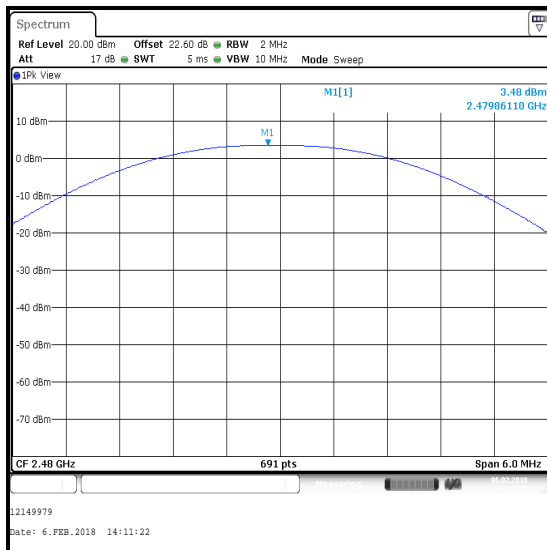
1. The signal analyser resolution bandwidth was set to 2 MHz (20 dB bandwidth) and video bandwidth of 10 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 6.0 MHz (approximately five times the 20 dB bandwidth). A marker was placed at the peak of the signal and the results recorded in the tables below.
2. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF offset level was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.
3. The declared antenna gain was added to the conducted peak power to obtain the EIRP.
4. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF offset level was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.

Test setup:

Transmitter Maximum Peak Output Power (continued)**Results: DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	3.1	30.0	26.9	Complied
Middle	3.9	30.0	26.1	Complied
Top	3.5	30.0	26.5	Complied

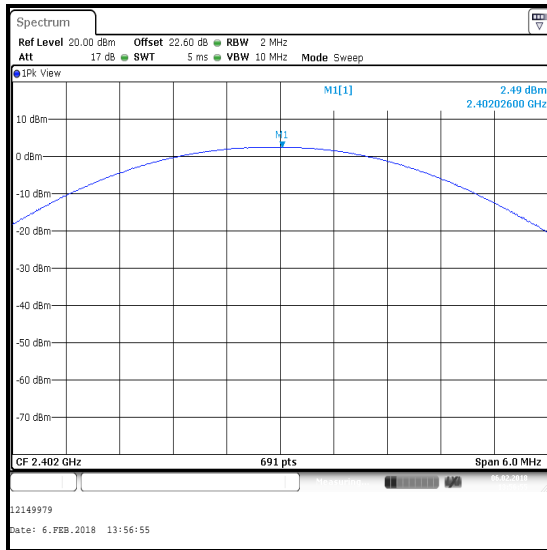
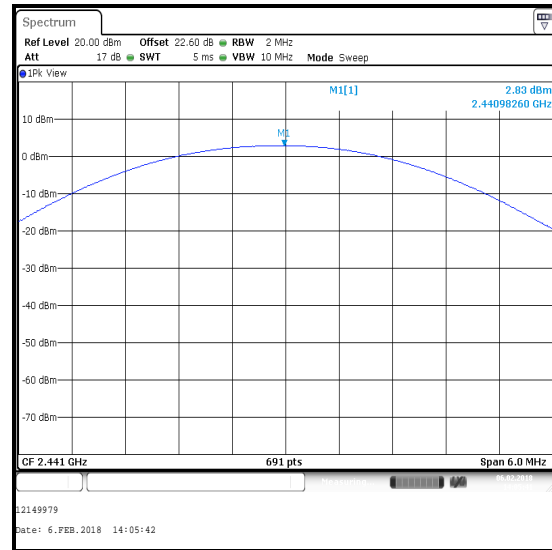
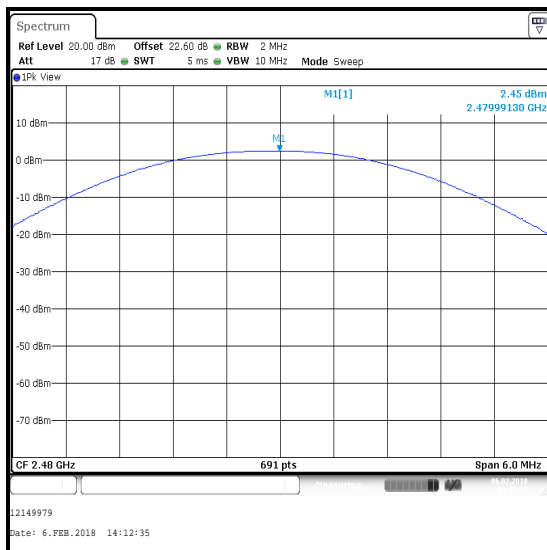
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	3.1	3.5	6.6	36.0	29.4	Complied
Middle	3.9	3.5	7.4	36.0	28.6	Complied
Top	3.5	3.5	7.0	36.0	29.0	Complied

Transmitter Maximum Peak Output Power (continued)**Results: DH5****Bottom Channel****Middle Channel****Top Channel**

Transmitter Maximum Peak Output Power (continued)**Results: 2DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	2.5	21.0	18.5	Complied
Middle	2.8	21.0	18.2	Complied
Top	2.5	21.0	18.5	Complied

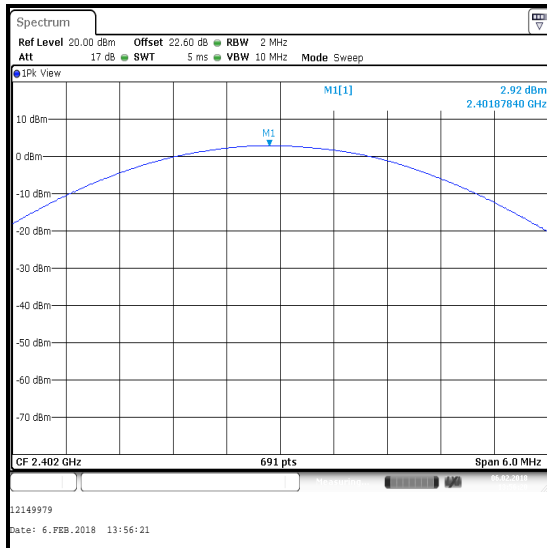
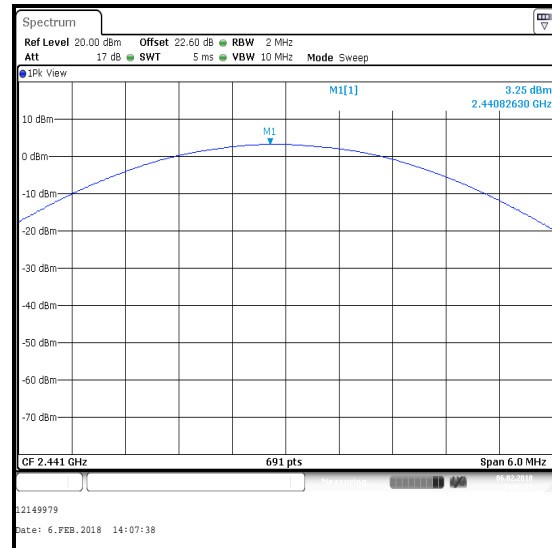
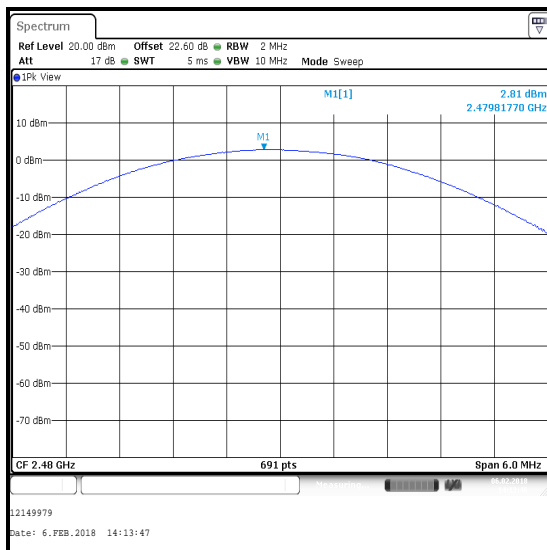
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	2.5	3.5	6.0	27.0	21.0	Complied
Middle	2.8	3.5	6.3	27.0	20.7	Complied
Top	2.5	3.5	6.0	27.0	21.0	Complied

Transmitter Maximum Peak Output Power (continued)**Results: 2DH5****Bottom Channel****Middle Channel****Top Channel**

Transmitter Maximum Peak Output Power (continued)**Results: 3DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	2.9	21.0	18.1	Complied
Middle	3.3	21.0	17.7	Complied
Top	2.8	21.0	18.2	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	2.9	3.5	6.4	27.0	20.6	Complied
Middle	3.3	3.5	6.8	27.0	20.2	Complied
Top	2.8	3.5	6.3	27.0	20.7	Complied

Transmitter Maximum Peak Output Power (continued)**Results: 3DH5****Bottom Channel****Middle Channel****Top Channel**

Transmitter Maximum Peak Output Power (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2005	Thermohygrometer	Testo	608-H1	45046700	22 Feb 2018	12
M1996	Signal Analyser	Rohde & Schwarz	FSV13	100975	27 Nov 2018	12
M1804	Signal Generator	Rohde & Schwarz	SMP22	100026	28 Feb 2019	24
A2505	Directional Coupler	AtlanTecRF	CDC-003060-20	1101230	Calibrated before use	-
A2924	Attenuator	AtlanTecRF	AN18W5-20	832828#7	Calibrated before use	-

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

Test Engineer:	Andrew Edwards	Test Date:	13 February 2018
Test Sample Serial Number:	010-926337		

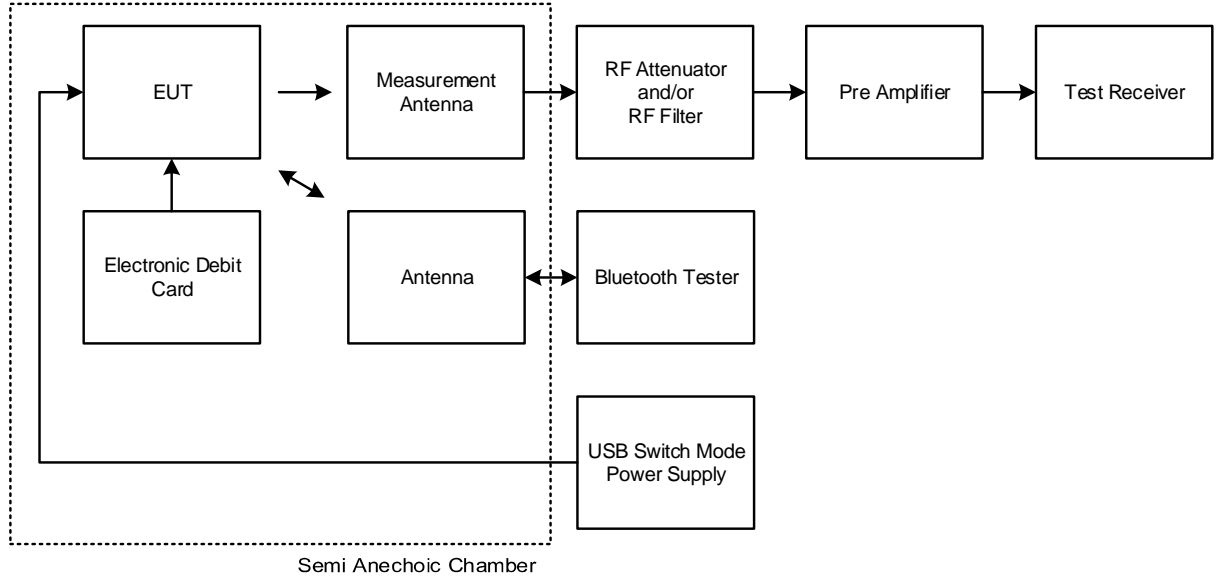
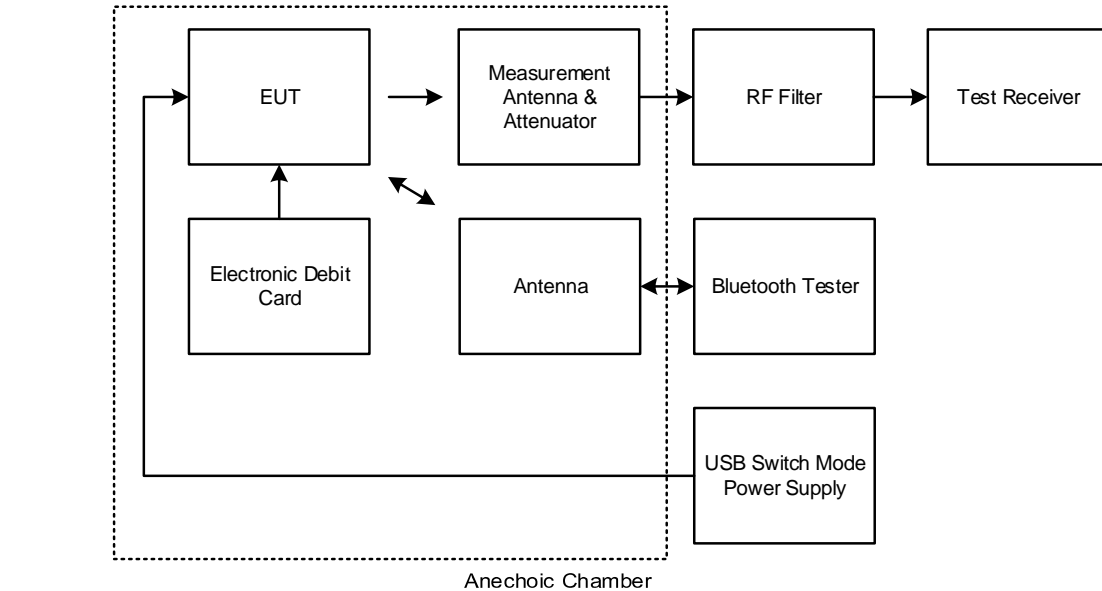
FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

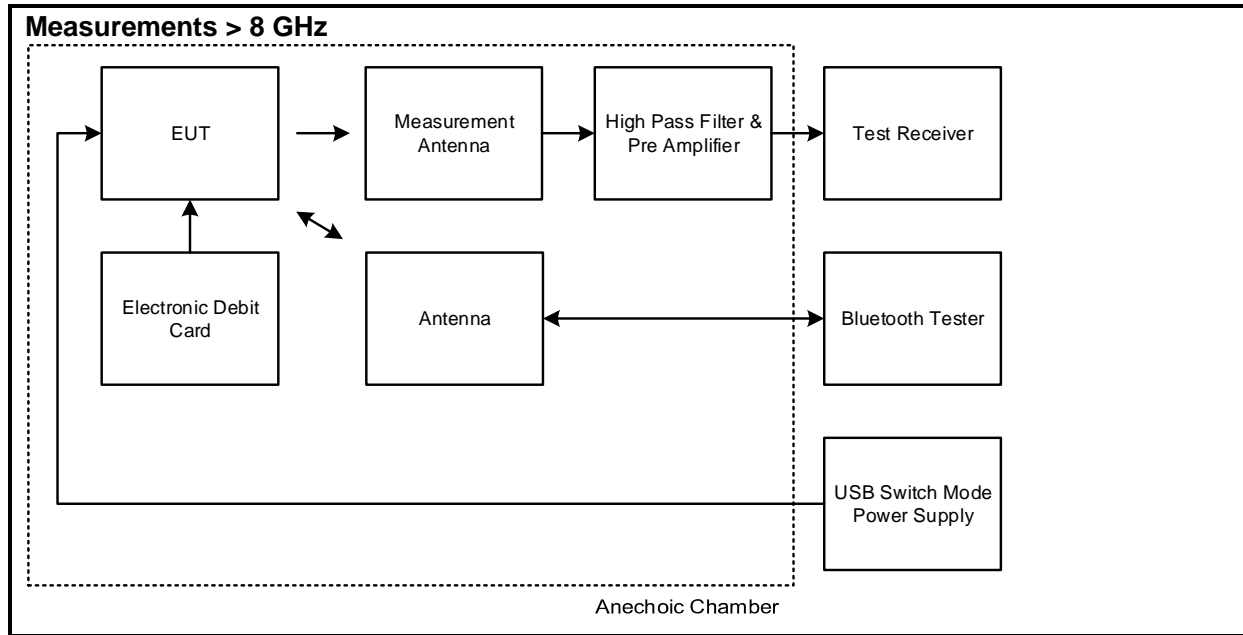
Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	38

Note(s):

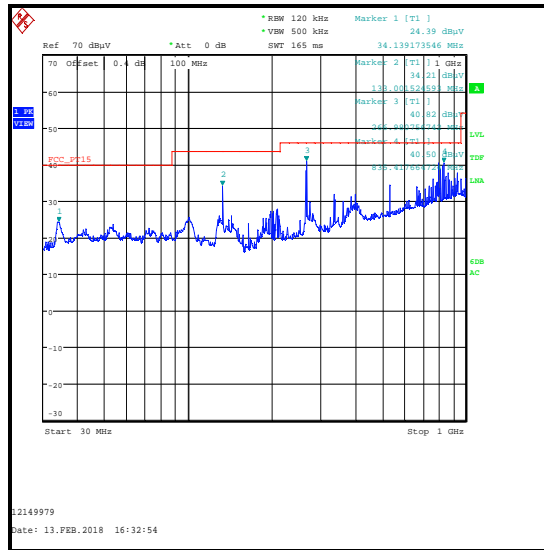
1. Transmitter radiated spurious emissions tests were performed with the EUT transmitting in DH5 mode as this was found to transmit the highest power and therefore deemed worst case.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.
4. 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.
5. 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.
6. 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.
7. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz, using a peak detector with max hold enabled and span wide enough to see the whole emission.

Transmitter Radiated Emissions (continued)**Test setup for radiated measurements:****Measurements < 1 GHz****1 to 8 GHz Measurements**

Transmitter Radiated Emissions (continued)**Test setup for radiated measurements:**

Transmitter Radiated Emissions (continued)**Results: Peak / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
133.024	Vertical	40.8	43.5	2.7	Complied
269.024	Horizontal	42.0	46.0	4.0	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 Feb 2018	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	14 Apr 2018	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	13 Apr 2018	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	25 Apr 2018	12
A2147	Attenuator	AtlanTecRF	AN18-06	09020206-06	25 Apr 2018	12
A2131	Low Pass Filter	AtlanTecRF	AFL-02000	JFB1004-002	27 Feb 2018	12

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

Test Engineer:	Andrew Edwards	Test Dates:	12 February 2018 & 13 February 2018
Test Sample Serial Number:	010-926337		

FCC Reference:	Parts 15.247(d) & 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 23
Relative Humidity (%):	33 to 36

Note(s):

1. Transmitter radiated spurious emissions tests were performed with the EUT transmitting in DH5 mode as this was found to transmit the highest power and therefore deemed worst case.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. The emission shown on the 1 GHz to 3 GHz plot is the EUT fundamental at 2441 MHz.
4. All other emissions shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
5. Pre-scans 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. Final measurements above 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 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.
6. 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 their own appropriate detectors during the pre-scan measurements.

Transmitter Radiated Emissions (continued)**Results: Peak / Middle Channel / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7322.304	Horizontal	55.4	74.0	18.6	Complied

Results: Average / Middle Channel / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7322.304	Horizontal	50.6	54.0	3.4	Complied

Results: Peak / Top Channel / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7440.282	Horizontal	55.6	74.0	18.4	Complied

Results: Average / Top Channel / DH5

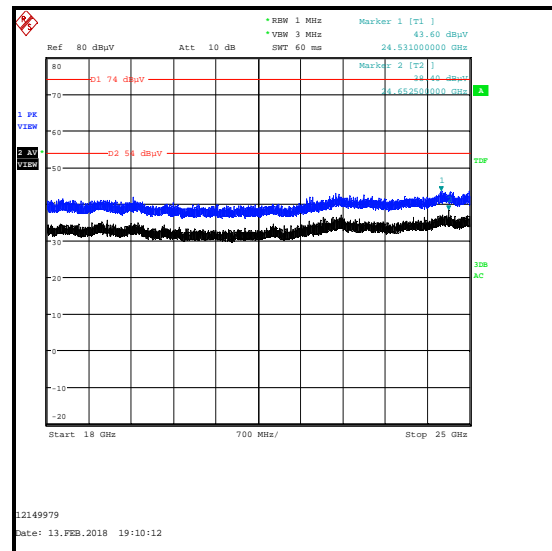
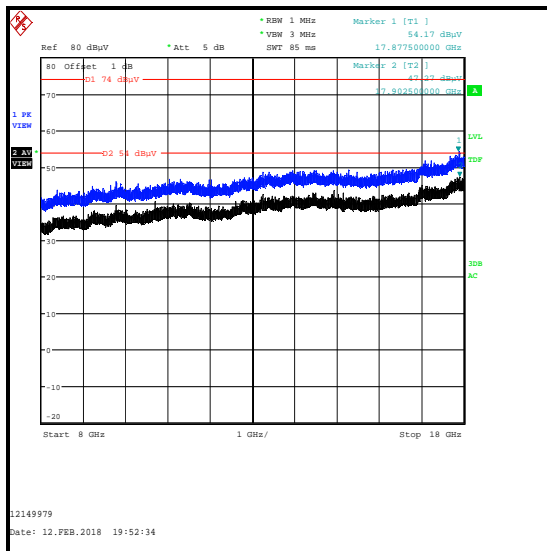
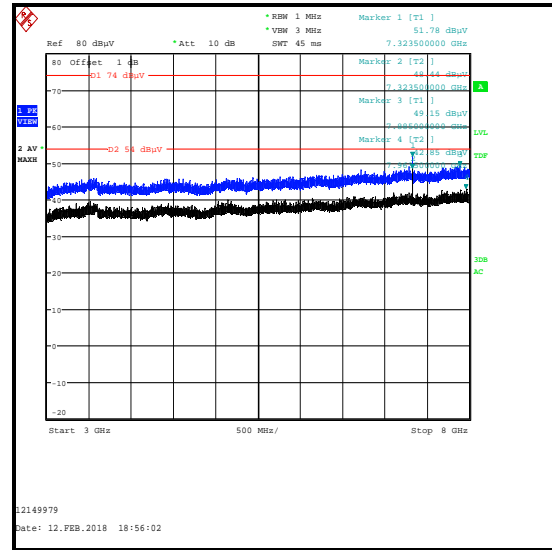
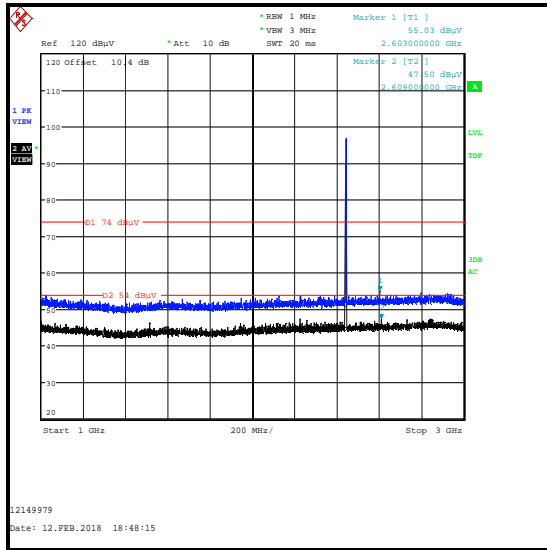
Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7440.282	Horizontal	50.9	54.0	3.1	Complied

Results: Peak / Hopping Mode / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7404.120	Horizontal	55.0	74.0	19.0	Complied

Results: Average / Hopping Mode / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7382.228	Horizontal	50.8	54.0	3.2	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 Feb 2018	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	14 Apr 2018	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	13 Apr 2018	12
A2863	Pre Amplifier	Agilent	8449B	3008A02100	11 Apr 2018	12
A2891	Pre Amplifier	Schwarzbeck	BBV 9718	9718-306	11 Apr 2018	12
A2893	Pre Amplifier	Schwarzbeck	BBV 9721	9721-021	11 Apr 2018	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	11 Apr 2018	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	11 Apr 2018	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	11 Apr 2018	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	03 Mar 2018	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	06 Mar 2018	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	18 May 2018	12

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

Test Engineer:	Andrew Edwards	Test Date:	12 February 2018
Test Sample Serial Number:	010-926337		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	37

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 lower band edge is adjacent to a non-restricted band. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent band (where a higher level emission was present). Marker frequencies and levels were recorded.
3. The upper band edge is adjacent to a restricted band. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. Peak and average measurements were performed with their respective detectors, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent band (where a higher level emission was present). Marker frequencies and levels were recorded.
4. There is a restricted band 10 MHz below the lower band edge. 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.
5. * -20 dBc limit.

Transmitter Band Edge Radiated Emissions (continued)**Results: Static Mode / DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2399.920	Horizontal	43.4	75.2*	31.8	Complied
2400.0	Horizontal	42.1	75.2*	33.1	Complied
2483.5	Horizontal	51.7	74.0	22.3	Complied
2498.404	Horizontal	53.1	74.0	20.9	Complied

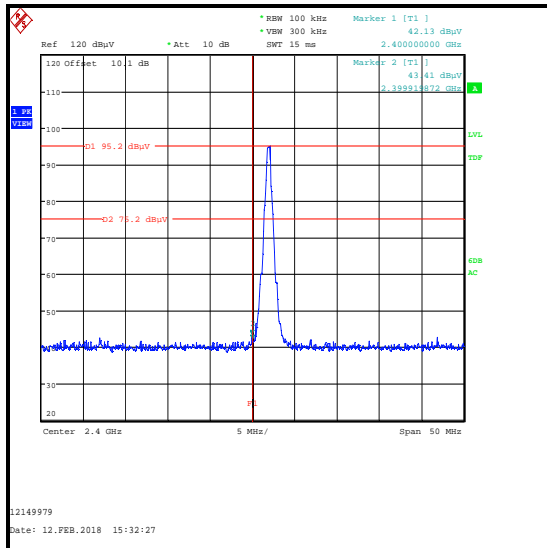
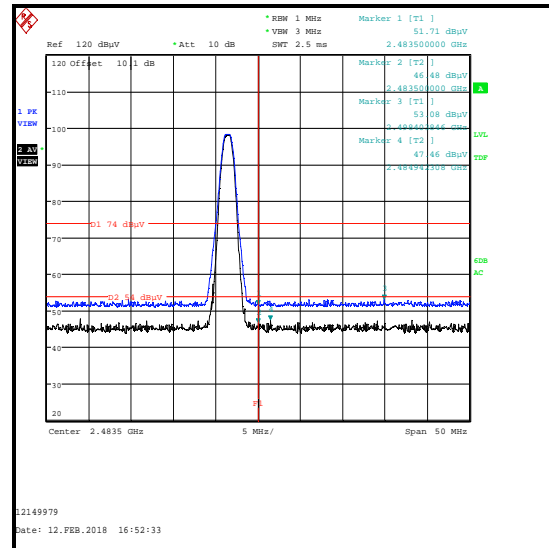
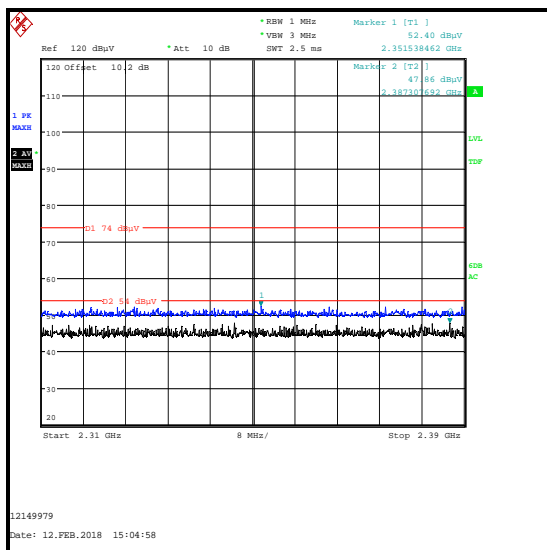
Frequency (MHz)	Antenna Polarity	Average Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2483.5	Horizontal	46.5	54.0	7.5	Complied
2484.942	Horizontal	47.5	54.0	6.5	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2351.538	Horizontal	52.4	74.0	21.6	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Antenna Polarity	Average Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2387.308	Horizontal	47.9	54.0	6.1	Complied

Transmitter Band Edge Radiated Emissions (continued)**Results: Static Mode / DH5****Lower Band Edge Peak Static****Upper Band Edge Static****2310 MHz to 2390 MHz Restricted Band**

Transmitter Band Edge Radiated Emissions (continued)**Results: Hopping Mode / DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2399.038	Horizontal	51.4	76.0*	24.6	Complied
2400.0	Horizontal	49.6	76.0*	26.4	Complied
2483.5	Horizontal	52.0	74.0	22.0	Complied
2486.785	Horizontal	52.7	74.0	21.3	Complied

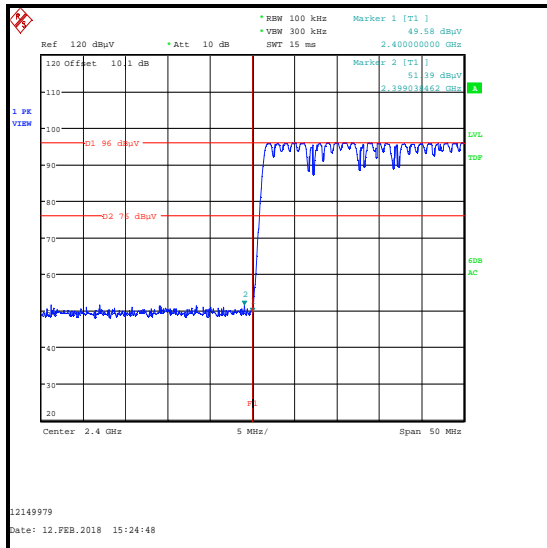
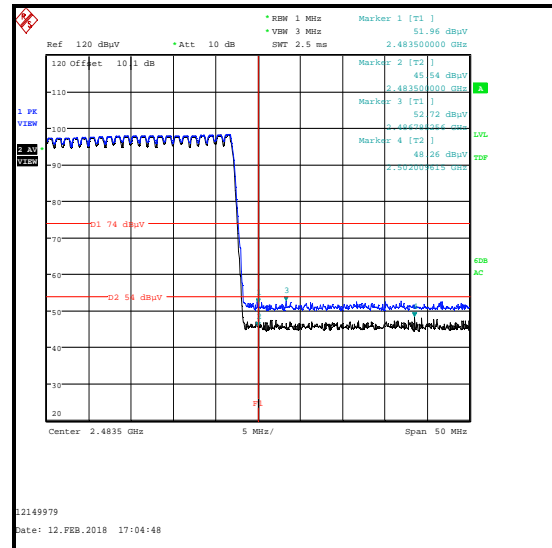
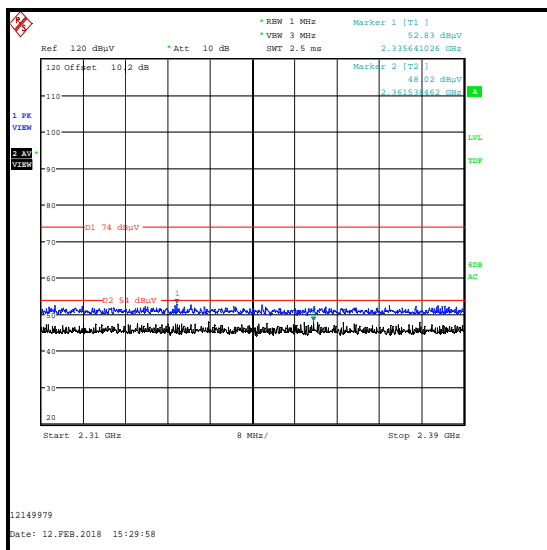
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	45.5	54.0	8.5	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2335.641	Horizontal	52.8	74.0	21.2	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2361.538	Horizontal	48.0	54.0	6.0	Complied

Transmitter Band Edge Radiated Emissions (continued)**Results: Hopping Mode / DH5****Lower Band Edge Peak Hopping****Upper Band Edge Hopping****2310 MHz to 2390 MHz Restricted Band**

Transmitter Band Edge Radiated Emissions (continued)**Results: Static Mode / 2DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2399.679	Horizontal	43.2	72.0*	28.8	Complied
2400.0	Horizontal	41.8	72.0*	30.2	Complied
2483.5	Horizontal	52.1	74.0	21.9	Complied
2490.311	Horizontal	52.8	74.0	21.2	Complied

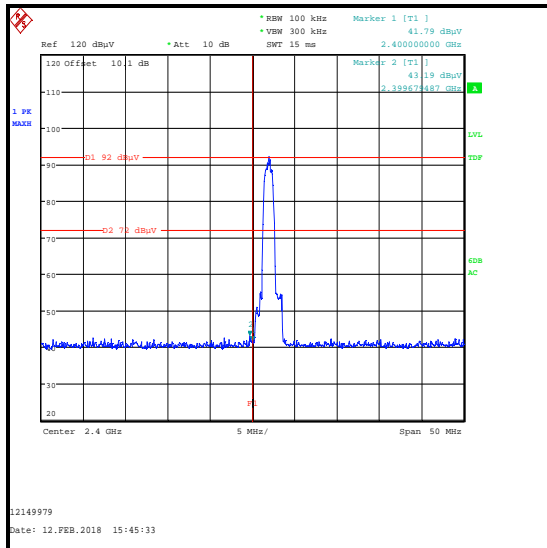
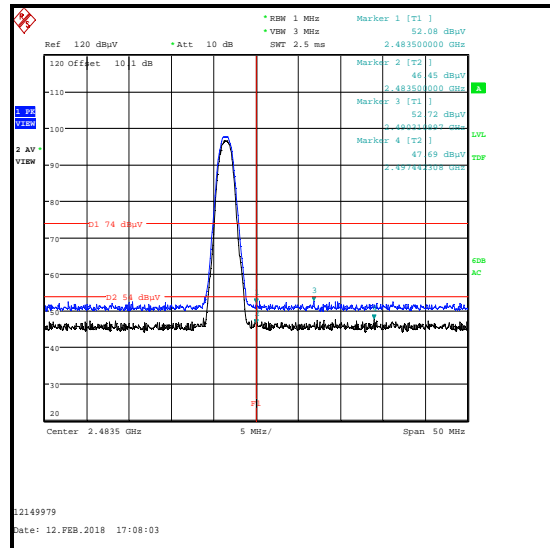
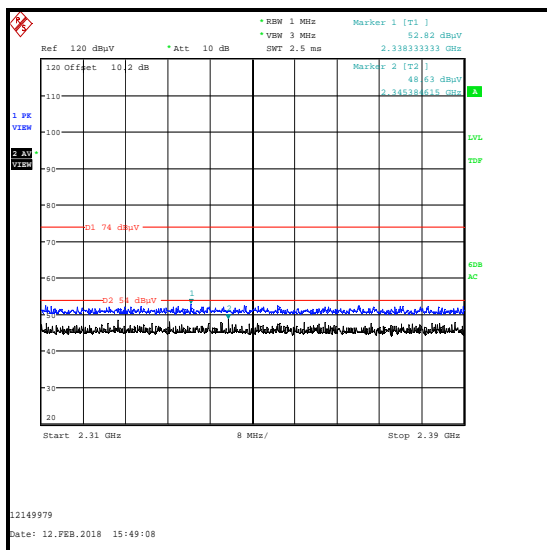
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	46.5	54.0	7.5	Complied
2497.442	Horizontal	47.7	54.0	6.3	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2338.333	Horizontal	52.8	74.0	21.2	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2345.385	Horizontal	48.6	54.0	5.4	Complied

Transmitter Band Edge Radiated Emissions (continued)**Results: Static Mode / 2DH5****Lower Band Edge Peak Static****Upper Band Edge Static****2310 MHz to 2390 MHz Restricted Band**

Transmitter Band Edge Radiated Emissions (continued)**Results: Hopping Mode / 2DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2396.154	Horizontal	42.4	72.4*	30.0	Complied
2400.0	Horizontal	41.4	72.4*	31.0	Complied
2483.5	Horizontal	51.6	74.0	22.4	Complied
2497.763	Horizontal	52.6	74.0	21.4	Complied

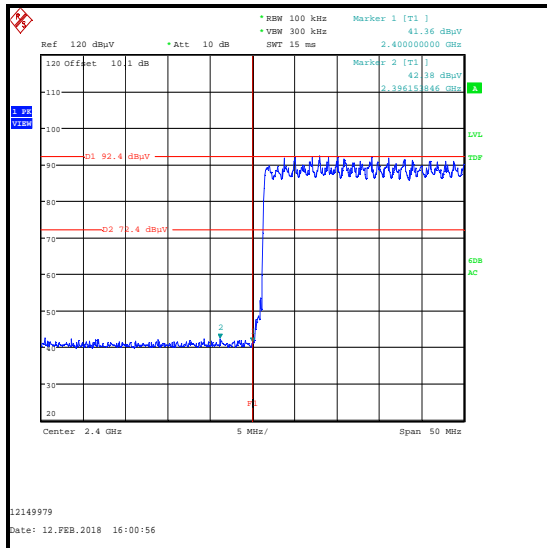
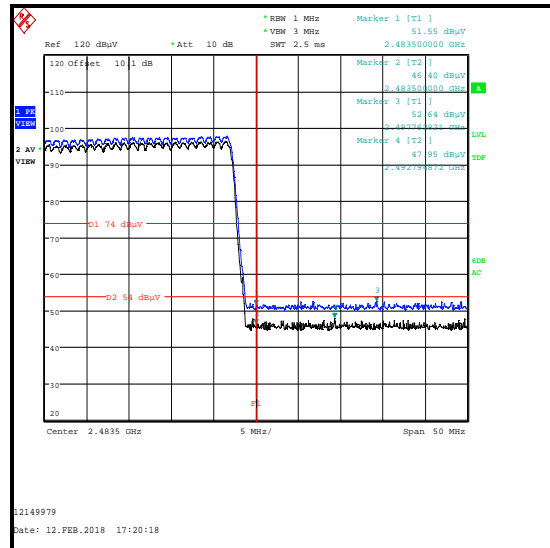
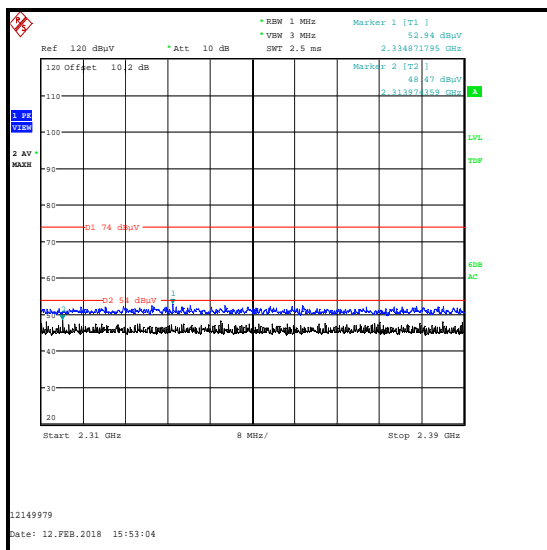
Frequency (MHz)	Antenna Polarity	Average Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2483.5	Horizontal	46.4	54.0	7.6	Complied
2492.795	Horizontal	48.0	54.0	6.0	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2334.872	Horizontal	52.9	74.0	21.1	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Antenna Polarity	Average Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2313.974	Horizontal	48.5	54.0	5.5	Complied

Transmitter Band Edge Radiated Emissions (continued)**Results: Hopping Mode / 2DH5****Lower Band Edge Peak Hopping****Upper Band Edge Hopping****2310 MHz to 2390 MHz Restricted Band**

Transmitter Band Edge Radiated Emissions (continued)**Results: Static Mode / 3DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2391.987	Horizontal	42.7	72.3*	29.6	Complied
2400.0	Horizontal	41.7	72.3*	30.6	Complied
2483.5	Horizontal	50.8	74.0	23.2	Complied
2496.801	Horizontal	52.3	74.0	21.7	Complied

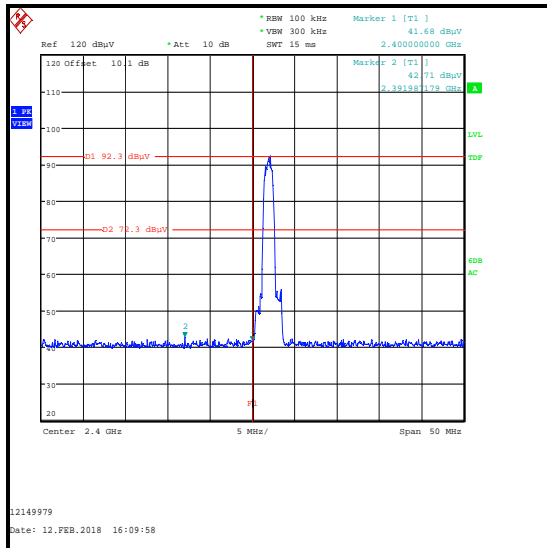
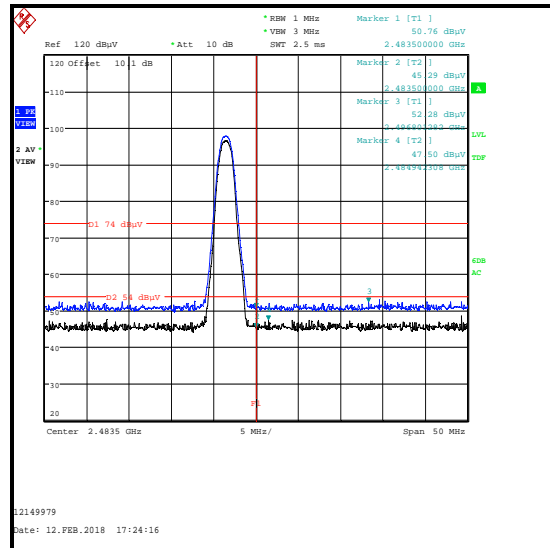
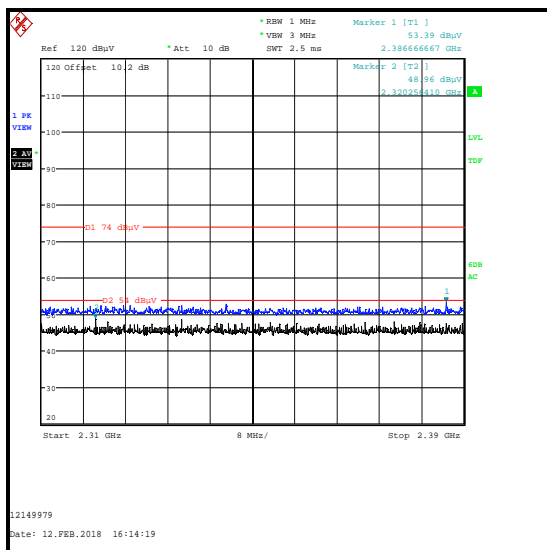
Frequency (MHz)	Antenna Polarity	Average Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2483.5	Horizontal	45.3	54.0	8.7	Complied
2484.942	Horizontal	47.5	54.0	6.5	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2386.667	Horizontal	53.4	74.0	20.6	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Antenna Polarity	Average Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2320.256	Horizontal	49.0	54.0	5.0	Complied

Transmitter Band Edge Radiated Emissions (continued)**Results: Static Mode / 3DH5****Lower Band Edge Peak Static****Upper Band Edge Static****2310 MHz to 2390 MHz Restricted Band**

Transmitter Band Edge Radiated Emissions (continued)**Results: Hopping Mode / 3DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2392.147	Horizontal	42.3	72.5*	30.2	Complied
2400.0	Horizontal	40.2	72.5*	32.3	Complied
2483.5	Horizontal	50.5	74.0	23.5	Complied
2485.663	Horizontal	52.6	74.0	21.4	Complied

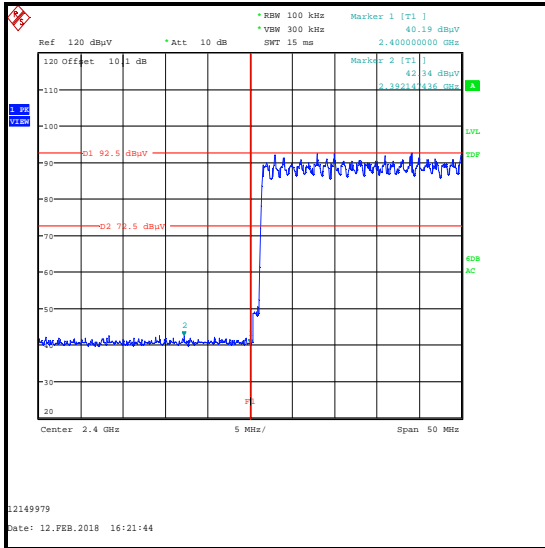
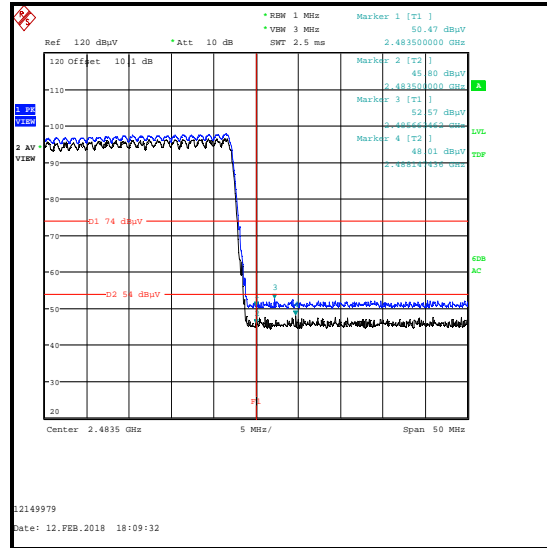
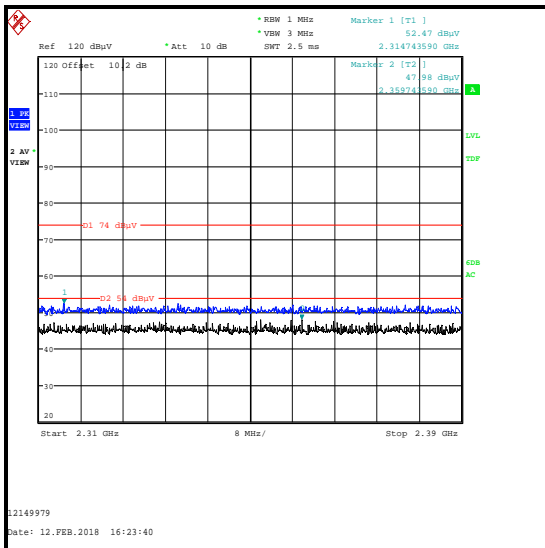
Frequency (MHz)	Antenna Polarity	Average Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2483.5	Horizontal	45.8	54.0	8.2	Complied
2488.147	Horizontal	48.0	54.0	6.0	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2314.744	Horizontal	52.5	74.0	21.5	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Antenna Polarity	Average Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2359.744	Horizontal	48.0	54.0	6.0	Complied

Transmitter Band Edge Radiated Emissions (continued)**Results: Hopping Mode / 3DH5****Lower Band Edge Peak Hopping****Upper Band Edge Hopping****2310 MHz to 2390 MHz Restricted Band**

Transmitter Band Edge 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 Feb 2018	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	14 Apr 2018	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	13 Apr 2018	12
A2863	Pre Amplifier	Agilent	8449B	3008A02100	11 Apr 2018	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	11 Apr 2018	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	03 Mar 2018	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%	±2.4 dB
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Carrier Frequency Separation	2.4 GHz to 2.4835 GHz	95%	±4.59 %
Average Time of Occupancy	2.4 GHz to 2.4835 GHz	95%	±3.53 ns
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
2.0	1 & 6	-	Changed model name to 'M010'

--- END OF REPORT ---