TEST REPORT

Test Report No. : UL-RPT-RP-12354335-616-FCC

Applicant	:	Datalogic S.r.l.
Model No.	:	BT-VRG-STD
FCC ID	:	U4FBT-VRG-STD
Technology	:	Bluetooth – Basic Rate (BR) & Enhanced Data Rate (EDR)
Test Standard(s)	:	FCC Parts 15.207, 15.209 & 15.247
		For details of applied tests refer to test result summary

1. This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH.
2. The results in this report apply only to the sample tested.
3. The test results in this report are traceable to the national or international standards.
4. Test Report Version 1.0
5. Result of the tested sample: **PASS**

Prepared by: Abdoufataou, Salifou
Title: Laboratory Engineer
Date: 31.July.2018

Approved by: Ajit, Phadtare
Title: Lead Test Engineer
Date: 31.July.2018

Deutsche Akkreditierungsstelle D-PL-19381-02-00

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

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STU.CTECHLab@ul.com

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1. Customer Information

1.1.Applicant Information

Company Name:	Datalogic S.r.l.
Company Address:	Via San Vitalino 13 – 40012 Lippo di Calderara di Reno (BO) -Italy
Contact Person:	Alberto Gamberini
Contact E-Mail Address:	alberto.gamberini@datalogic.com
Contact Phone No.:	+390513147011

1.2.Manufacturer Information

Company Name:	Datalogic S.r.l.
Company Address:	Via San Vitalino 13 – 40012 Lippo di Calderara di Reno (BO) -Italy
Contact Person:	Alberto Gamberini
Contact E-Mail Address:	alberto.gamberini@datalogic.com
Contact Phone No.:	+390513147011

2. Summary of Testing

2.1. General Information

Applied Standards

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
Test Firm Registration:	399704

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany

Date information

Order Date:	07 June 2018
EUT arrived:	18 June 2018
Test Dates:	25 June2018 to 13 July 2018
EUT returned:	-/-

2.2. Summary of Test Results

Clause	Measurement	Complied	Did not comply	Not performed	Not applicable
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	☒	☐	☐	☐

Note(s):

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:	Datalogic
Model Name or Number:	BT-VRG-STD
Test Sample Serial Number:	B18E92536 (Test Sample for Radiated & AC conducted Measurements)
Hardware Version Number:	A
Software Version Number:	A
FCC ID:	U4FBT-VRG-STD

Brand Name:	Datalogic
Model Name or Number:	BT-VRG-STD
Test Sample Serial Number:	B18E92533 (Test Sample used for Conducted Measurements)
Hardware Version Number:	A
Software Version Number:	A
FCC ID:	U4FBT-VRG-STD

3.2. Description of EUT

The equipment under test was a radio module suppoting Bluetooth BR-EDR & Bluetooth Low Energy modes.

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		
Supported Power Classes:	Class 1: 6 dBm	Class 2: 3 dBm	Class 3 : -12 dBm
Type of Radio Device:	Transceiver		
Power Supply Requirement(s):	Nominal	3.3 V DC	
Mode	Basic Rate	Enhanced Data Rate	
Modulation	GFSK	π/4-DQPSK	8DQPSK
Packet Type: (Maximum Payload):	DH5	2DH5	3DH5
Data Rate (Mbit/s):	1	2	3
Modulation Technique:	GFSK		
Channel Spacing:	1 MHz		
Transmit Frequency Range:	2400 MHz to 2483.5 MHz (ISM Band)		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	0	2402
	Middle	39	2441
	Top	78	2480
Antenna Designation:	Molex 47950-0011		
Antenna Type:	Omnidirectional		
Antenna Gain:	2.27 dBi		

3.5. Support Equipment

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

A. Support Equipment (In-house)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Laptop PC	HP	HP Probook 650 G1	5CG6143YWB
2	Laptop PC	HP	HP Probook 650 G1	5CG614419V
3	USB extension cable	Not Marked or stated	Not Marked or stated	Not Marked or stated

B. Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Test jig	DATALOGIC	Not Marked or stated	Not marked or stated
2	USB/TTL UART Converter cable	Not Marked or stated	Not Marked or stated	Not marked or stated
3	Test jig with tuneable module supply voltage	DATALOGIC	Not Marked or stated	Not Marked or stated
4	AC/DC power adapter cable	DATALOGIC	SA115B-12U	PG12-10P55

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 test modes were activated using “Virgilio regulatory test instructions v.1.4.pdf” supplied by customer.
- The EUT was placed in Test jig and powered via a USB diagnostic cable for all normal condition tests.
- The EUT was placed in Test jig with tuneable module supply voltage and powered via an AC/DC power adapter for AC Conducted Spurious Emissions tests.
- Transmit fixed frequency tests: The laptop PC with the customer’s test application Datalogic “Host Simulator for Virgilio Bluetooth module” sw 1.1 and BlueTest3 were used to place the EUT into Bluetooth fixed frequency test mode. Operating channels were selected in the test application.
- Transmit hopping tests: The laptop PC with the customer’s test application Datalogic “Host Simulator for Virgilio Bluetooth module” sw 1.1 and Bluetooth Tester were used to place the EUT into Bluetooth Hopping mode.
- The transmitter power level of all supported modes was initially measured to determine the worst case configuration. Power verification was performed with all supported Bluetooth Power Classes (1| 2|3). The worst case Power Class (1) with maximum output power was used for all other measurements. xDH5 rate was used for transmitter tests as this was the worst case mode with respect to power.
- Radiated spurious emissions were performed with the EUT positioned on the turn table and rotating 360 degrees while the antenna height varies from 1 to 4 m over the measurement frequency range.
- A directional coupler was employed in the EUT RF output path to facilitate simultaneous connection with a signal analyser and power meter during some conducted port tests. The respective path losses were measured and accounted for as an RF level offset on the test equipment where applicable.
- All accessories/peripherals supplied were employed during spurious emissions testing.
- EMC32 V10.1.0 Software was used for the Radiated spurious emission measurement.

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 DAkkS 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:	Asim Shahzad	**Test Date:**	13 July 2018
Test Sample Serial Number:	B18E92536		
Test Site Identification	SR 7/8		

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

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	35

Settings of the Instrument

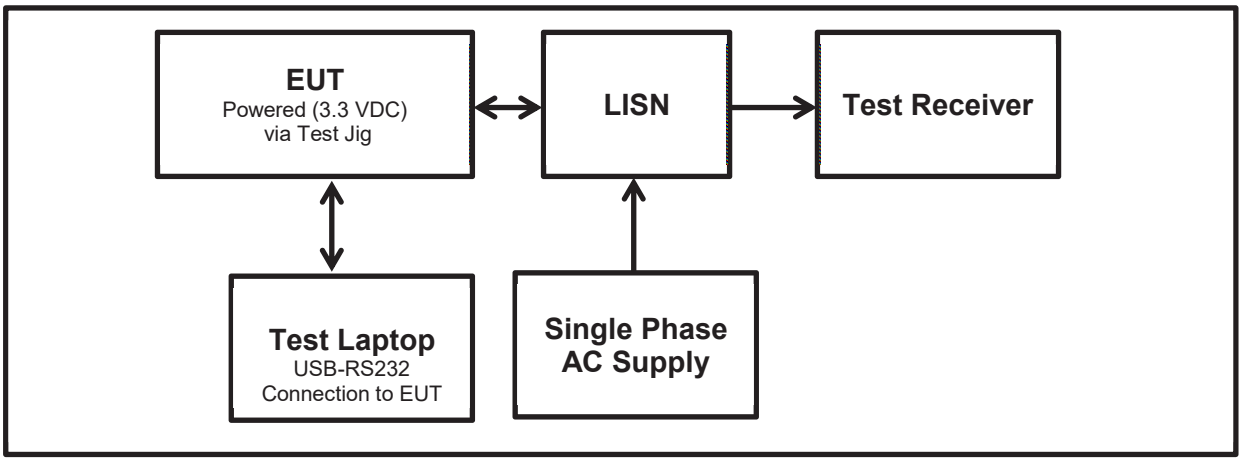
Detector	Quasi Peak/ Average Peak

Note(s):

1. The EUT was plugged into a Test jig which has 12 VDC AC/DC adapter. The AC/DC power supply was connected to 120 VAC 60 Hz single phase supply via a LISN.
2. The final measured value, for the given emission, in the table below incorporate cable loss.
3. 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.
4. The tests were performed with the EUT set to the 3DH5 Hopping Mode.

Transmitter AC Conducted Spurious Emissions (continued)

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
0.26960	Live	56.6	61.1	4.5	Complied
0.68284	Live	46.5	56	9.5	Complied
1.23387	Live	37.4	56	18.6	Complied
1.5556	Live	33.8	56	22.2	Complied
4.52419	Live	29.3	56	26.7	Complied
8.29255	Live	32.8	60	27.2	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.26960	Live	31.5	51.1	19.6	Complied
0.68284	Live	24.6	46	21.4	Complied
1.23387	Live	17.8	46	28.2	Complied
1.5556	Live	19.5	46	26.5	Complied
4.52419	Live	18.1	46	27.9	Complied
8.29255	Live	22.8	50	27.2	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.27143	Neutral	55.1	61.1	6	Complied
0.47514	Neutral	51.4	56.4	5	Complied
0.64194	Neutral	45.9	56	10.1	Complied
1.18559	Neutral	35.5	56	20.5	Complied
1.54987	Neutral	35.1	56	20.9	Complied
1.96428	Neutral	32.2	56	23.8	Complied

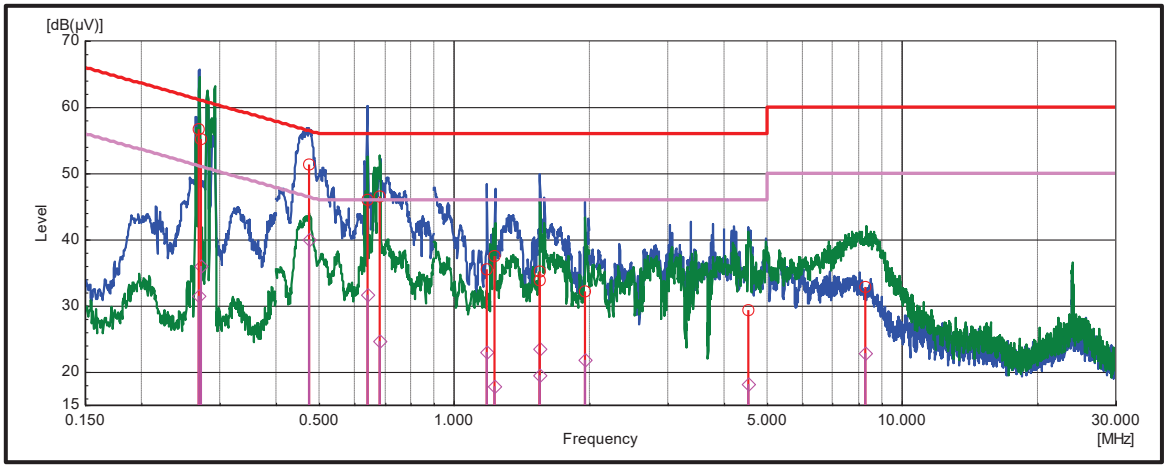
Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.27143	Neutral	36	51.1	15.1	Complied
0.47514	Neutral	40	46.4	6.4	Complied
0.64194	Neutral	31.6	46	14.4	Complied
1.18559	Neutral	22.9	46	23.1	Complied
1.54987	Neutral	23.4	46	22.6	Complied
1.96428	Neutral	21.8	46	24.2	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Plot: Live and Neutral Line



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

5.2.2. Transmitter 20 dB Bandwidth

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Date:**	10 July 2018
Test Sample Serial Number:	B18E92533		
Test Site Identification	SR 9		

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

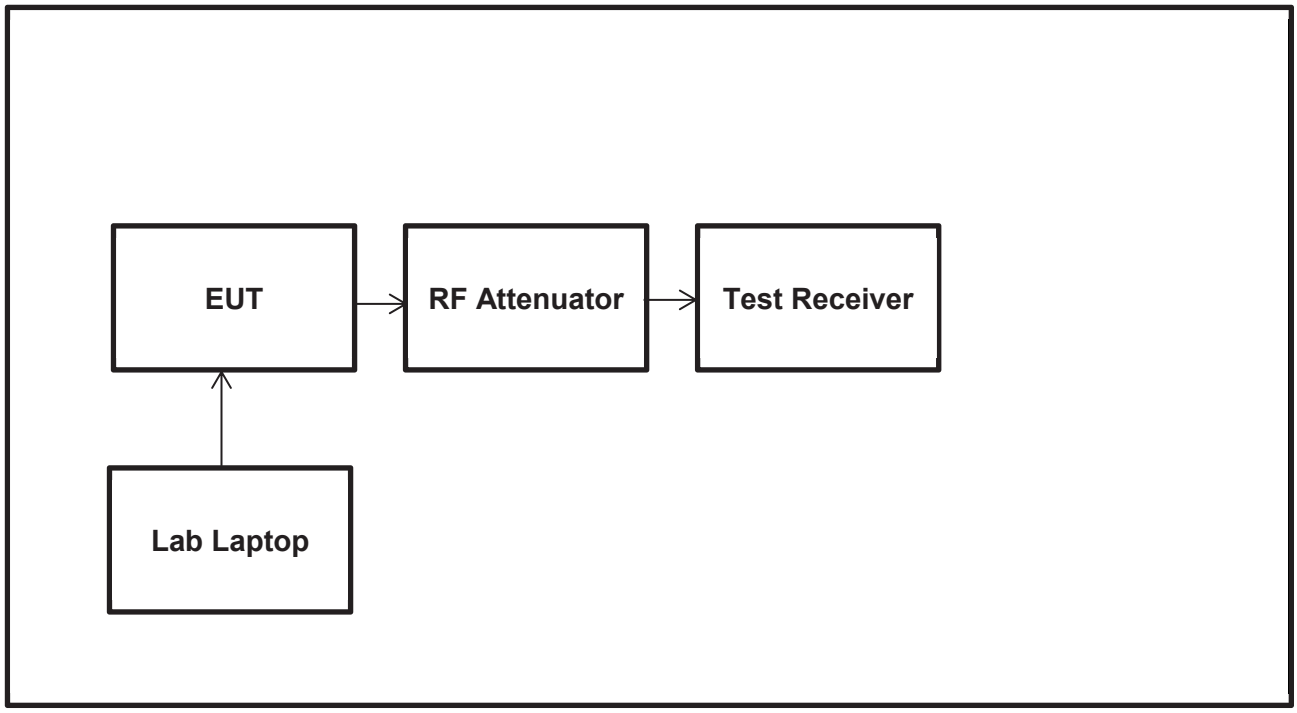
Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	42

Note(s):

1. The test receiver resolution bandwidth was set to 30 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 test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable.
3. Power verification was performed with all supported Bluetooth Power Classes (1| 2|3). The worst case Power Class (1) with maximum output power was used for these measurements.

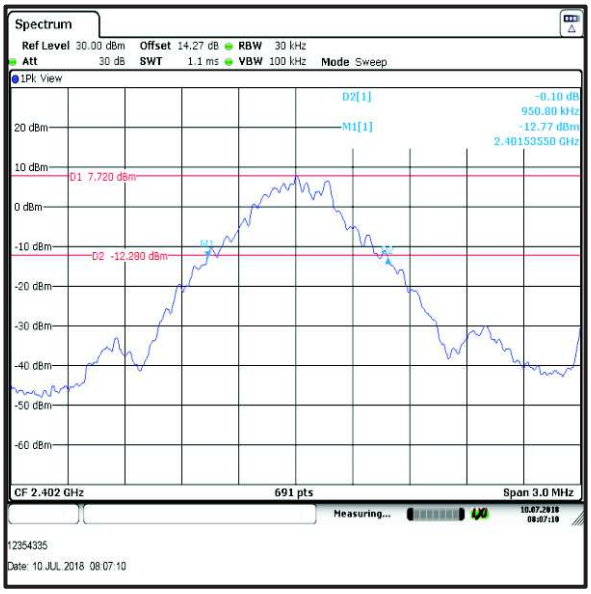
Test setup:



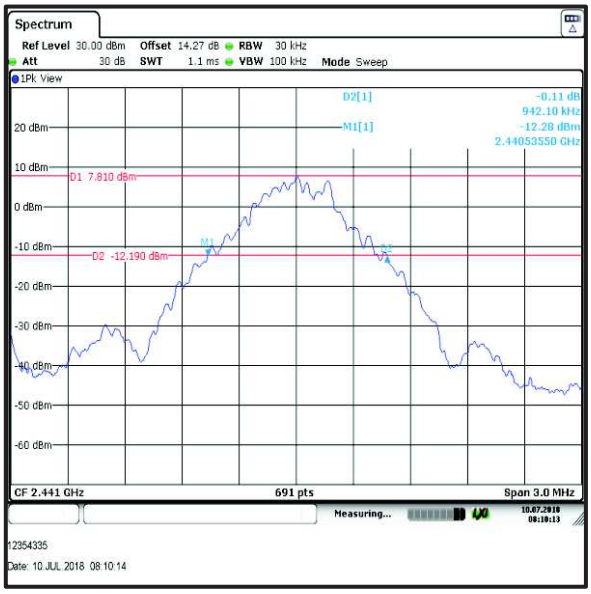
Transmitter 20 dB Bandwidth (continued)

Results DH5:

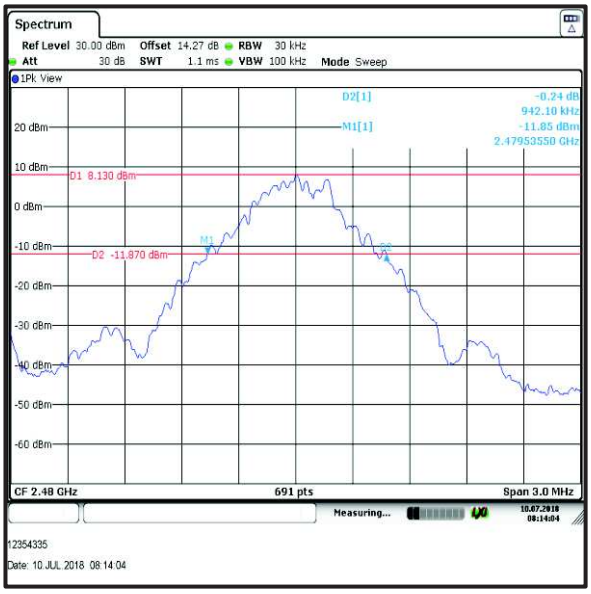
Channel	20 dB Bandwidth (kHz)
Bottom	950.800
Middle	942.100
Top	942.100



Bottom Channel



Middle Channel



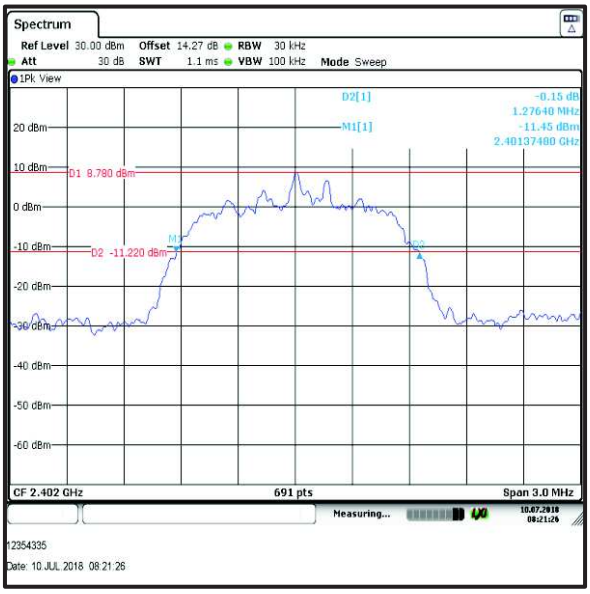
Top Channel

Result: Pass

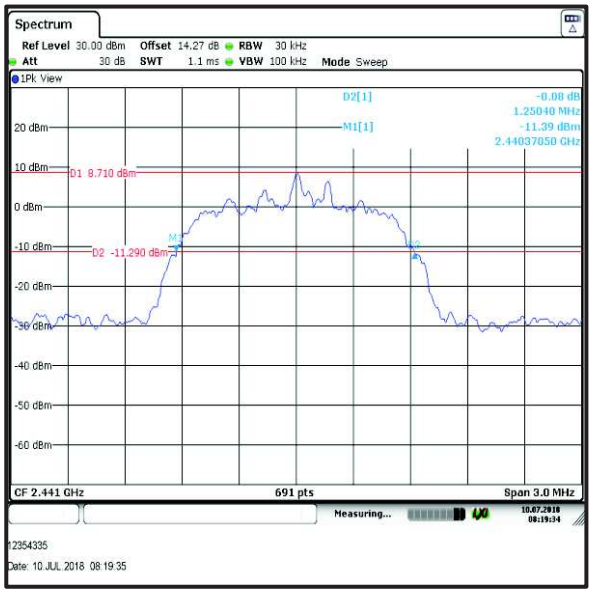
Transmitter 20 dB Bandwidth (continued)

Results 2DH5:

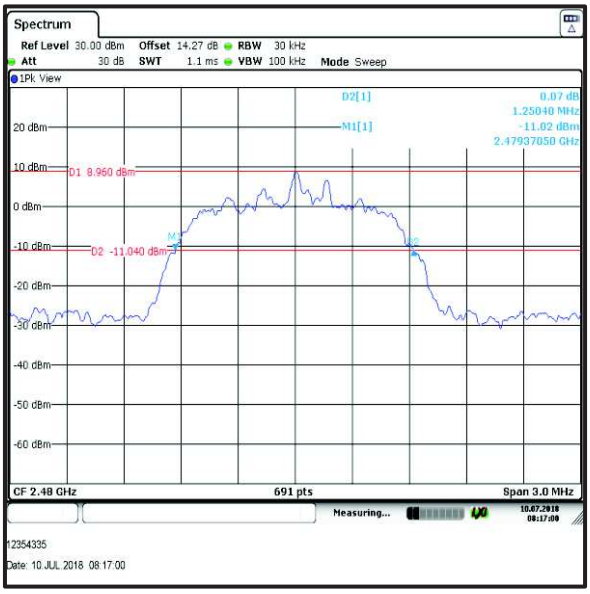
Channel	20 dB Bandwidth (kHz)
Bottom	1276.400
Middle	1250.400
Top	1250.400



Bottom Channel



Middle Channel



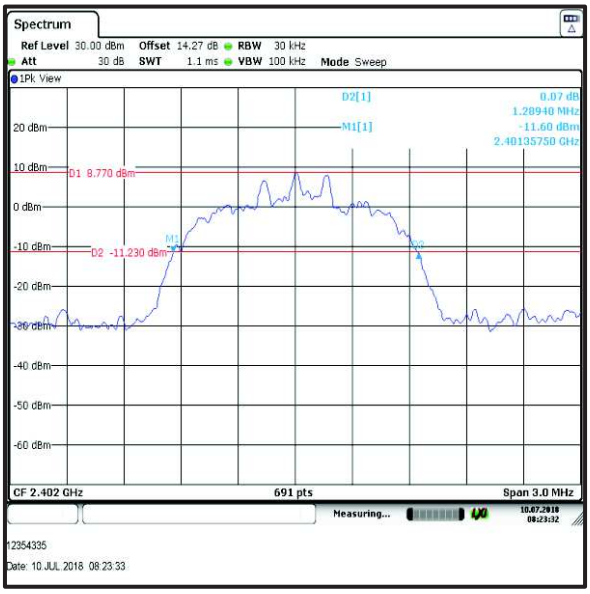
Top Channel

Result: Pass

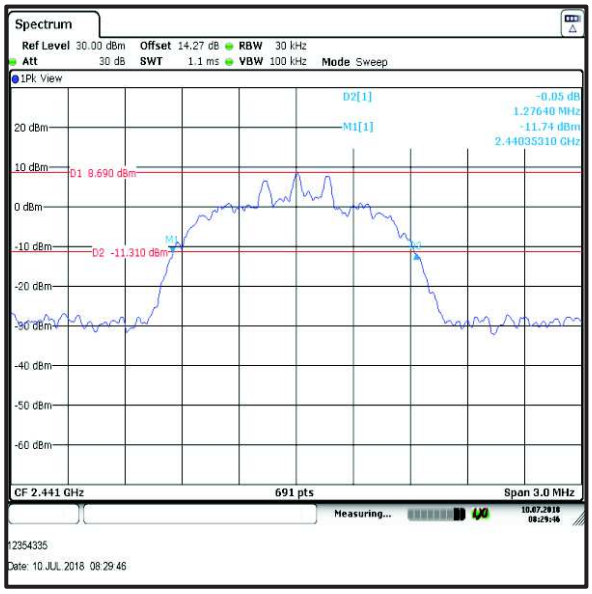
Transmitter 20 dB Bandwidth (continued)

Results 3DH5:

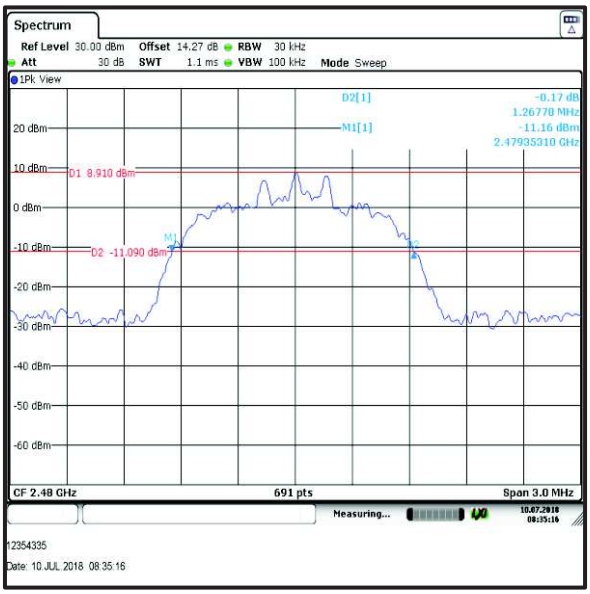
Channel	20 dB Bandwidth (kHz)
Bottom	1289.400
Middle	1276.400
Top	1267.700



Bottom Channel



Middle Channel



Top Channel

Result: Pass

5.2.3. Transmitter Carrier Frequency Separation

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Date:**	10 July 2018
Test Sample Serial Number:	B18E92533		
Test Site Identification	SR 9		

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

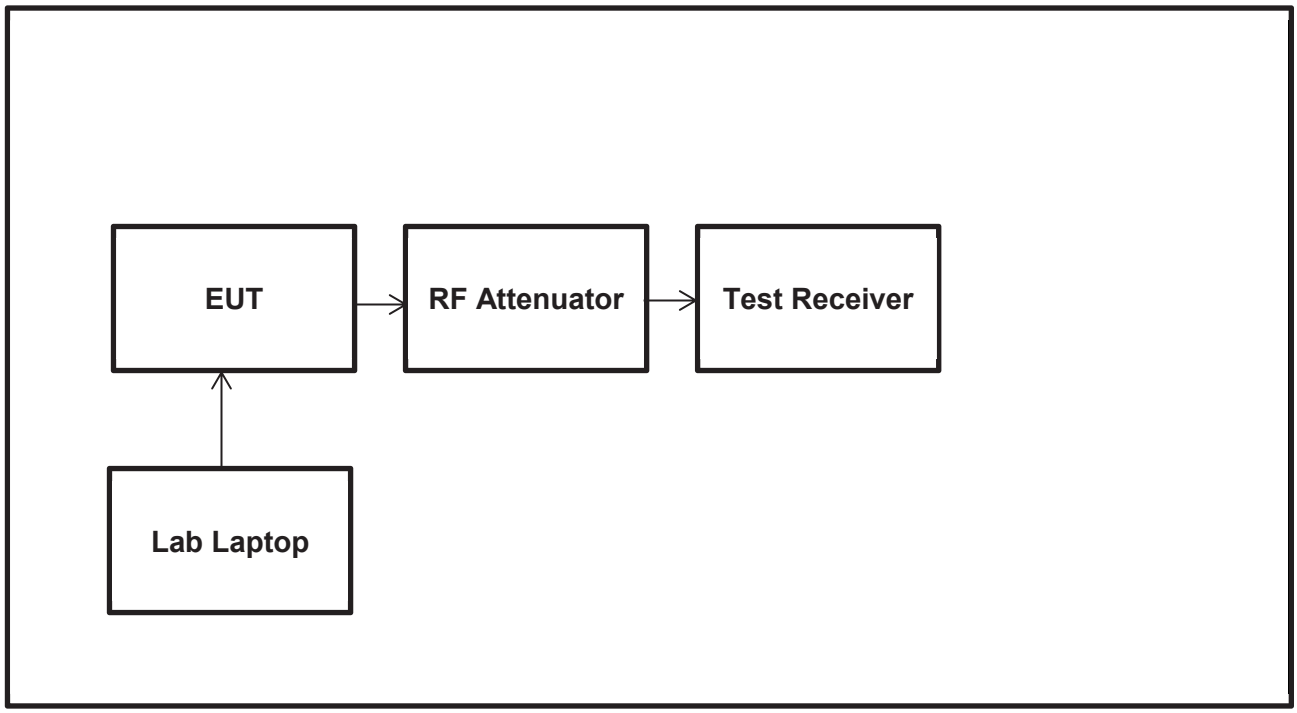
Environmental Conditions:

Temperature (°C):	22.5
Relative Humidity (%):	42

Notes:

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.
2. The test receiver resolution bandwidth was set to 30 kHz and video bandwidth of 100 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 3 MHz. A marker was placed of one signal and then a delta marker was placed in the same place on the second signal, the results are recorded in the table below.
3. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable.
4. Power verification was performed with all supported Bluetooth Power Classes (1| 2|3). The worst case Power Class (1) with maximum output power was used for these measurements.

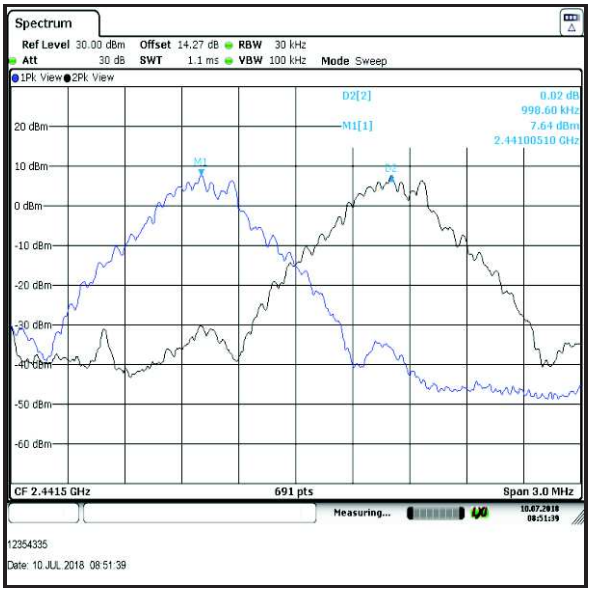
Test setup:



Transmitter Carrier Frequency Separation (continued)

Results: DH5

Carrier Frequency Separation (kHz)	Limit ($^2/_3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
998.600	628.066	370.534	Complied

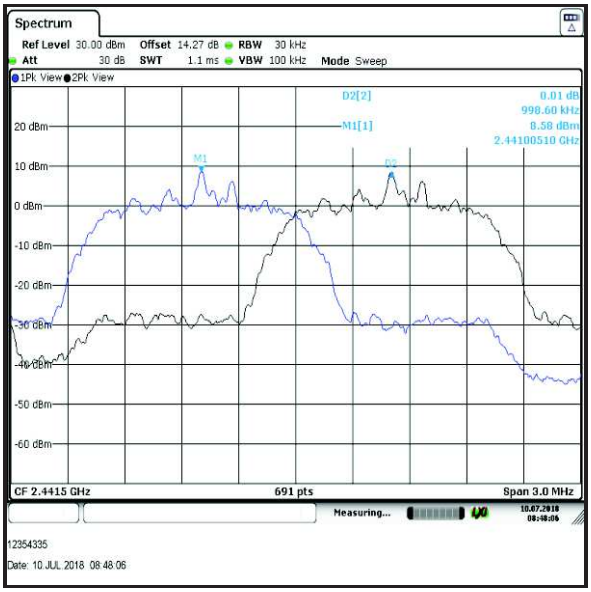


Result: Pass

Transmitter Carrier Frequency Separation (continued)

Results: 2DH5

Carrier Frequency Separation (kHz)	Limit ($^2/_3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
998.600	833.600	165.000	Complied

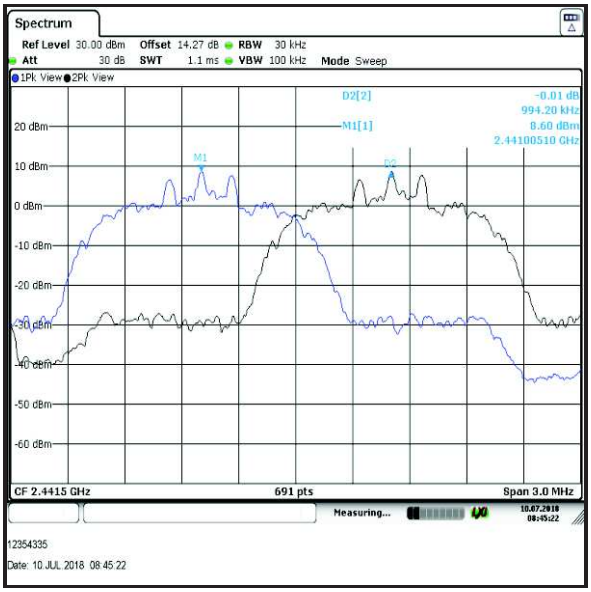


Result: Pass

Transmitter Carrier Frequency Separation (continued)

Results: 3DH5

Carrier Frequency Separation (kHz)	Limit ($^2/_3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
994.200	845.130	149.070	Complied



Result: Pass

5.2.4. Transmitter Number of Hopping Frequencies and Average Time of Occupancy

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Date:**	10 July 2018
Test Sample Serial Number:	B18E92533		
Test Site Identification	SR 9		

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

Environmental Conditions:

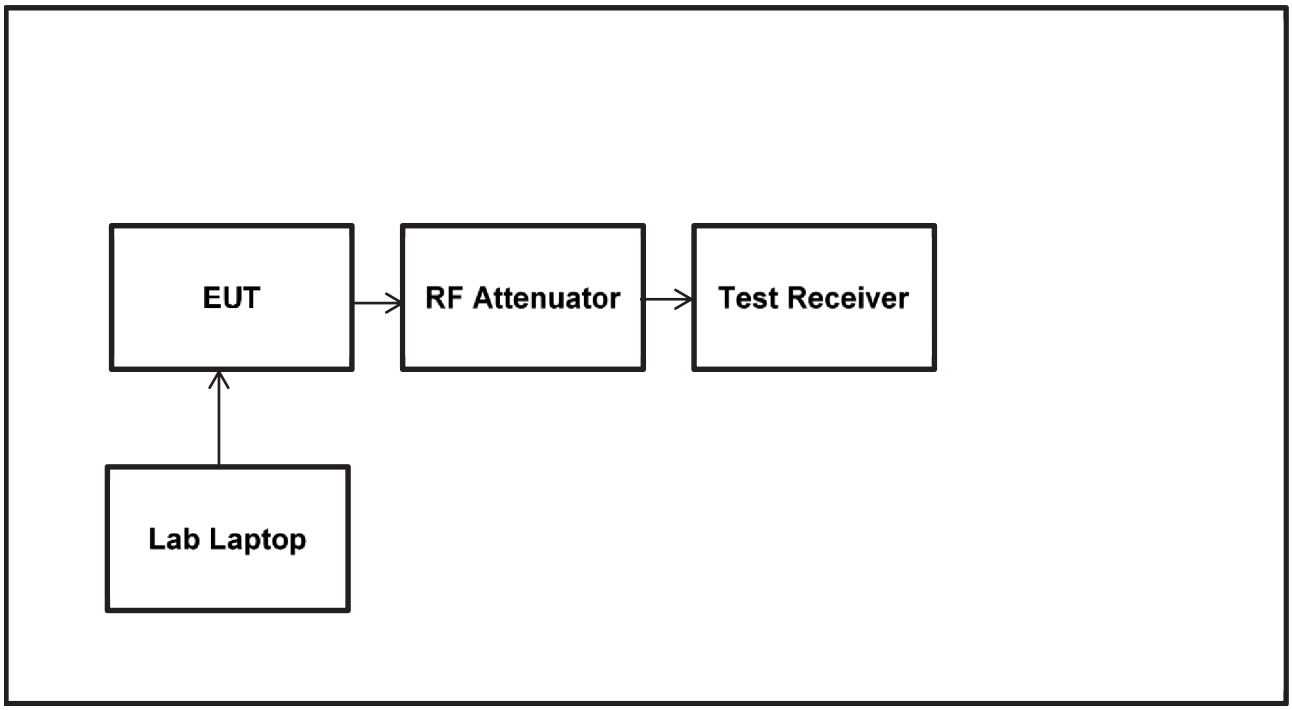
Temperature (°C):	23.4
Relative Humidity (%):	42

Notes:

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 test receiver was set up for the Number of Hopping Frequencies measurement as follows: the resolution bandwidth was set to 300 kHz and video bandwidth of 1 MHz. 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 test receiver was set up for the Emission Width measurement as follows: the resolution bandwidth was set to 1 MHz and video bandwidth of 3 MHz. A peak detector was used and sweep time was set to auto with a span of zero Hz. The emission width is recorded in the table below
4. The test receiver was set up for the Number of Hopping Frequencies in 32 seconds measurement as follows: the resolution bandwidth was set to 300 kHz and video bandwidth of 1 MHz. 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 test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable.
6. Power verification was performed with all supported Bluetooth Power Classes (1| 2|3). The worst case Power Class (1) with maximum output power was used for these measurements.

Transmitter Number of Hopping Frequencies and Average Time of Occupancy

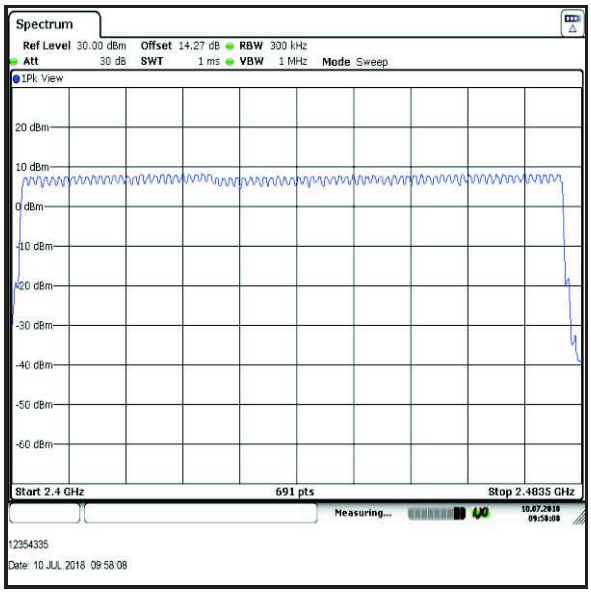
Test setup:



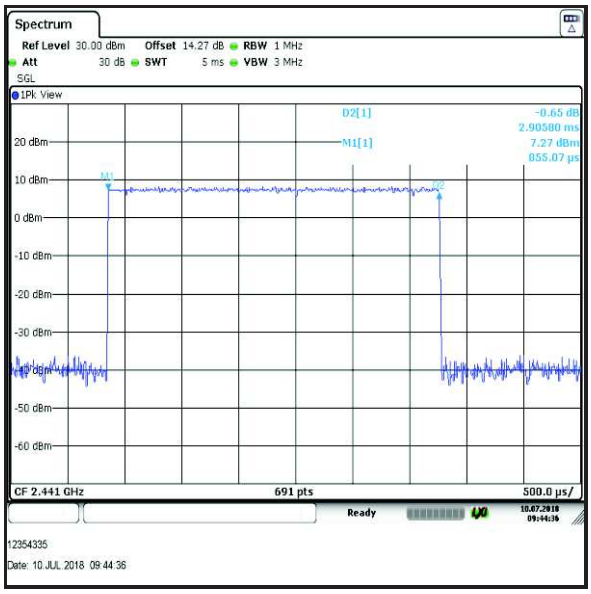
Transmitter Number of Hopping Frequencies and Average Time of Occupancy

Results:

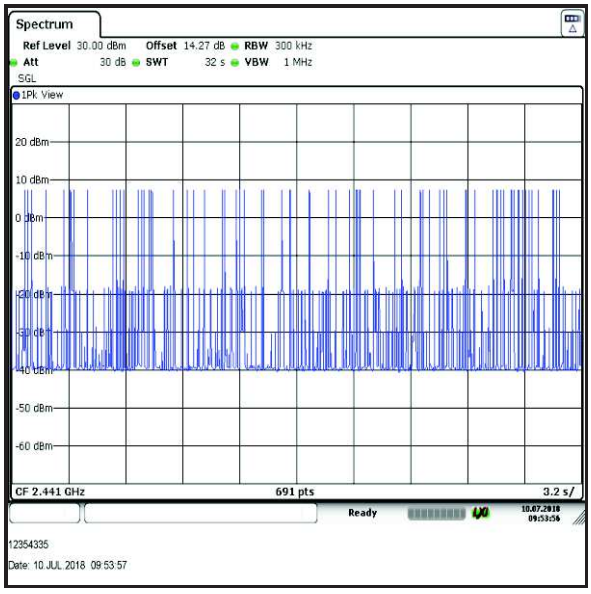
Emission Width (µs)	Number of Hops in 31.6 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Result
2905.80	65	0.188	0.4	0.212	Complied



Number of Hopping Frequencies



Emission Width



Number of Hopping Frequencies in 32 s

Result: Pass

5.2.5. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Date:**	10 &11 July 2018
Test Sample Serial Number:	B18E92533		
Test Site Identification	SR 9		

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

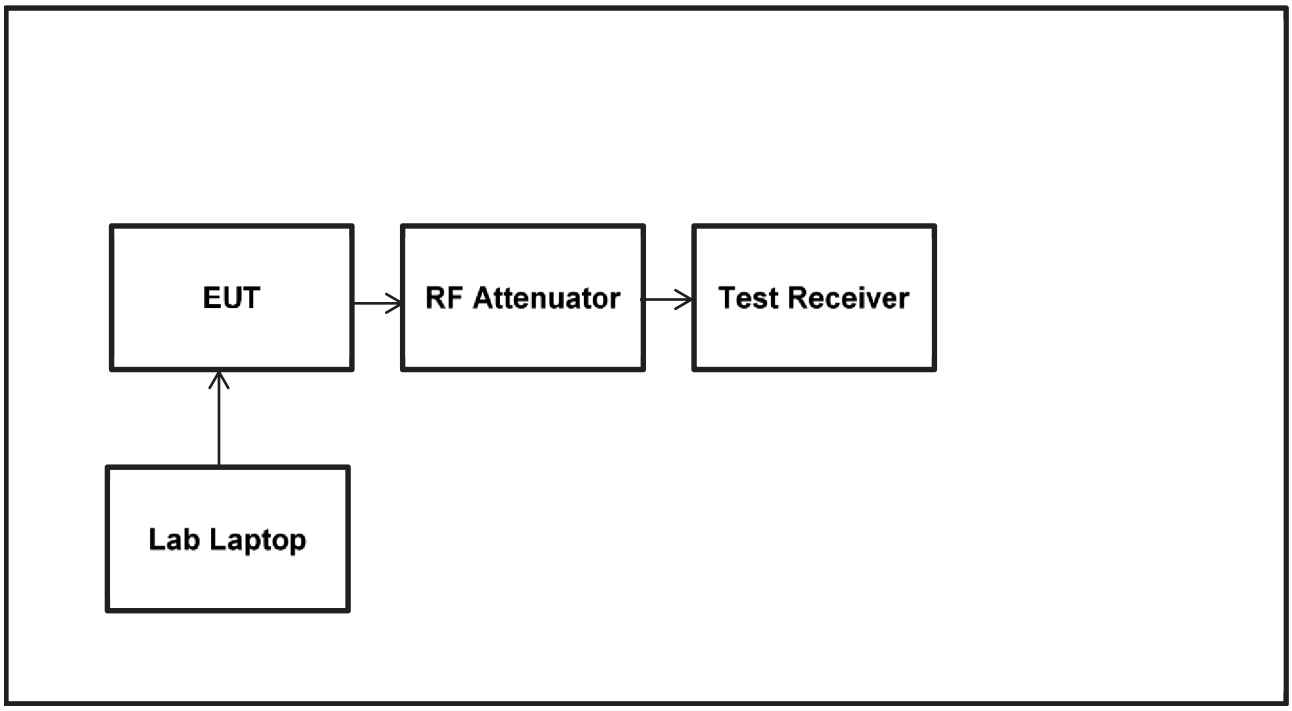
Environmental Conditions:

Temperature (°C):	23 & 22
Relative Humidity (%):	42 & 43

Notes:

1. The test receiver resolution bandwidth was set to 2 MHz (20 dB bandwidth) and video bandwidth of 5 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 5 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. These tests were performed radiated; therefore the EUT antenna gain is encompassed in the final
3. The declared antenna gain was added to the conducted peak power to obtain the EIRP.
4. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF offset level was entered on the test receiver to compensate for the loss of the attenuator and RF cable.
5. Power verification was performed with all supported Bluetooth Power Classes (1| 2|3). The worst case Power Class (1) with maximum output power was used for all other measurements.

Test setup:



Transmitter Maximum Peak Output Power (continued)

Results Power Class 1- DH5

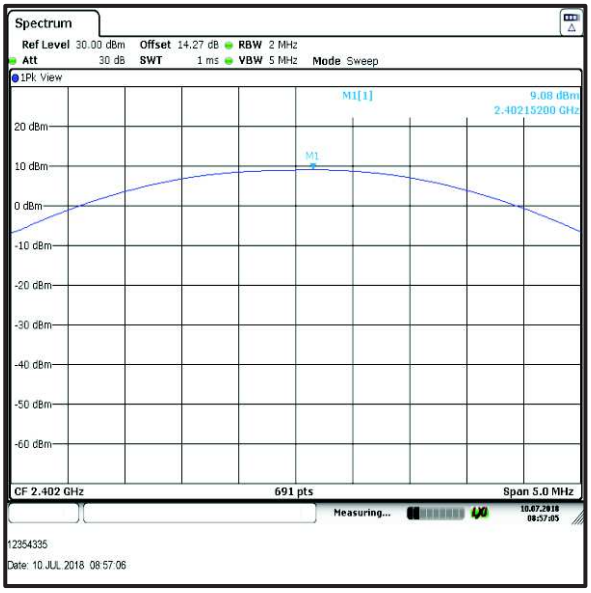
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	6.8	21.0	14.2	Complied
Middle	6.7	21.0	14.3	Complied
Top	7.0	21.0	14.0	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	6.8	2.3	9.1	27.0	17.9	Complied
Middle	6.7	2.3	9.0	27.0	18.0	Complied
Top	7.0	2.3	9.3	27.0	17.7	Complied

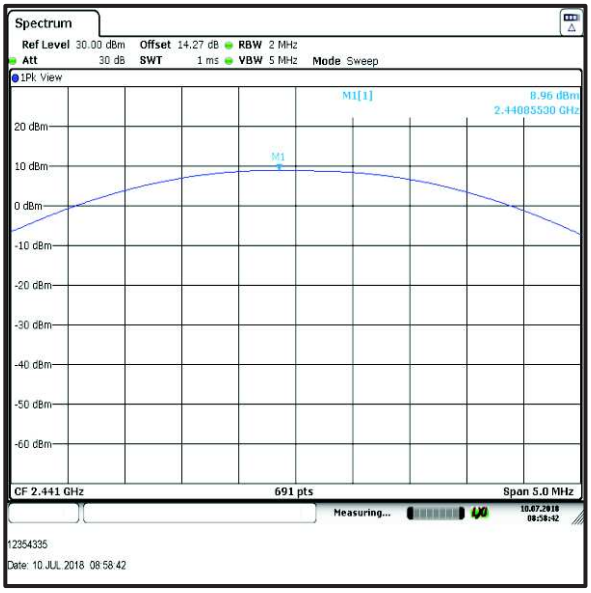
Result: Pass

Transmitter Maximum Peak Output Power (continued)

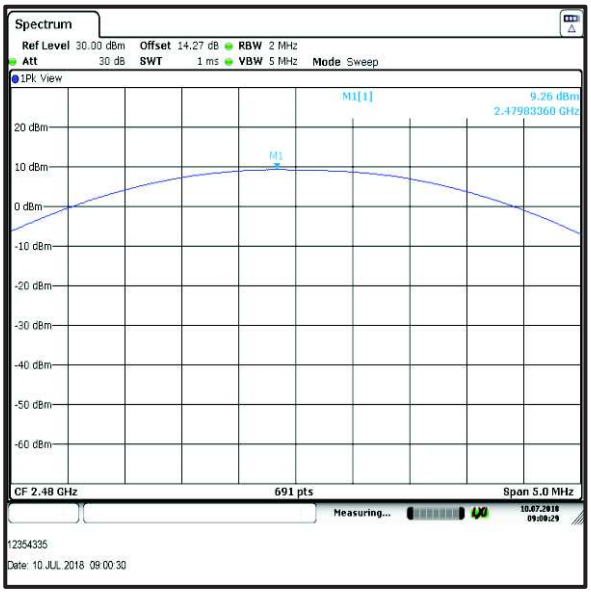
Results Power Class 1- DH5



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

Results Power Class 1- 2DH5

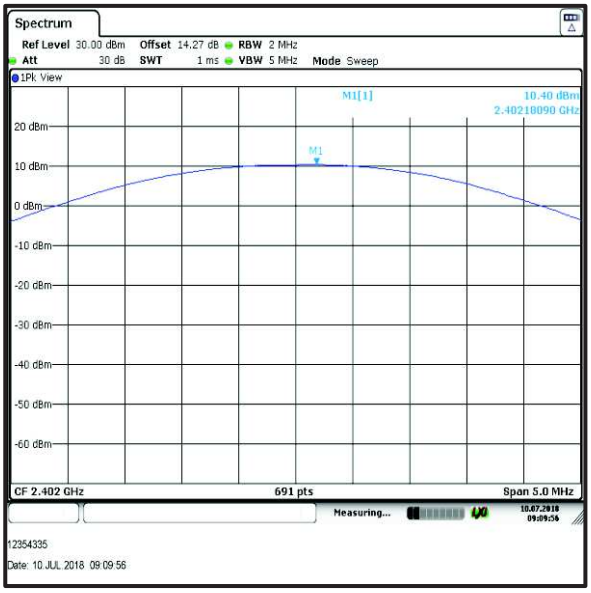
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	8.1	21.0	12.9	Complied
Middle	8.1	21.0	12.9	Complied
Top	8.2	21.0	12.8	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	8.1	2.3	10.4	27.0	16.6	Complied
Middle	8.1	2.3	10.4	27.0	16.6	Complied
Top	8.2	2.3	10.5	27.0	16.5	Complied

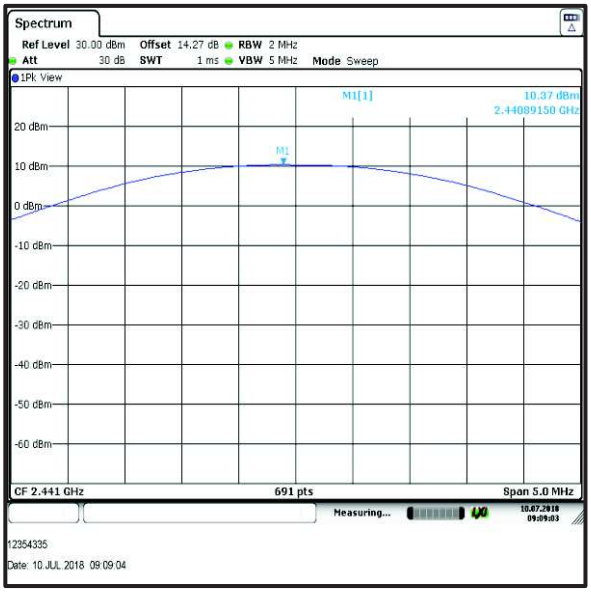
Result: Pass

Transmitter Maximum Peak Output Power (continued)

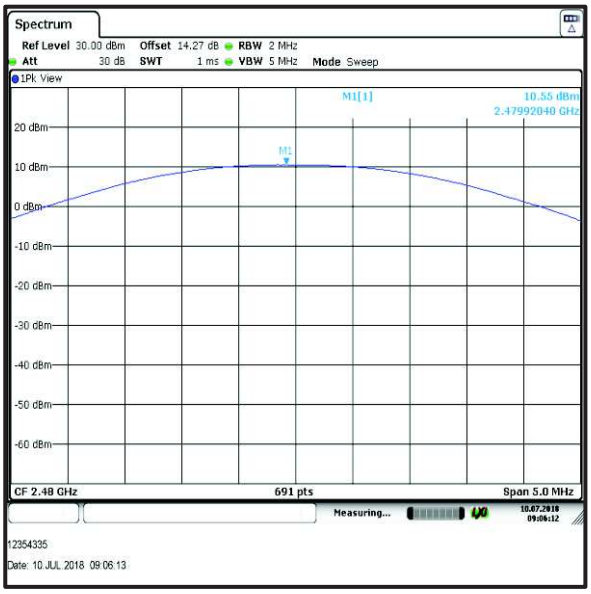
Results Power Class 1- 2DH5



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

Results Results Power Class 1- 3DH5

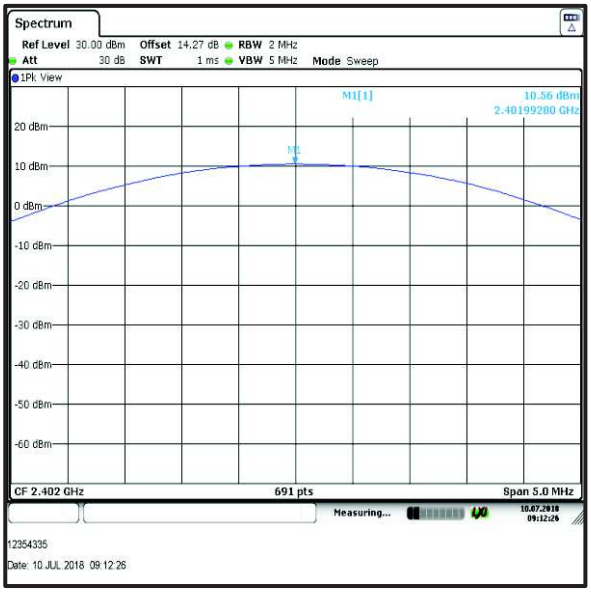
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	8.3	21.0	12.7	Complied
Middle	8.3	21.0	12.7	Complied
Top	8.4	21.0	12.6	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	8.3	2.3	10.6	27.0	16.4	Complied
Middle	8.3	2.3	10.6	27.0	16.4	Complied
Top	8.4	2.3	10.7	27.0	16.3	Complied

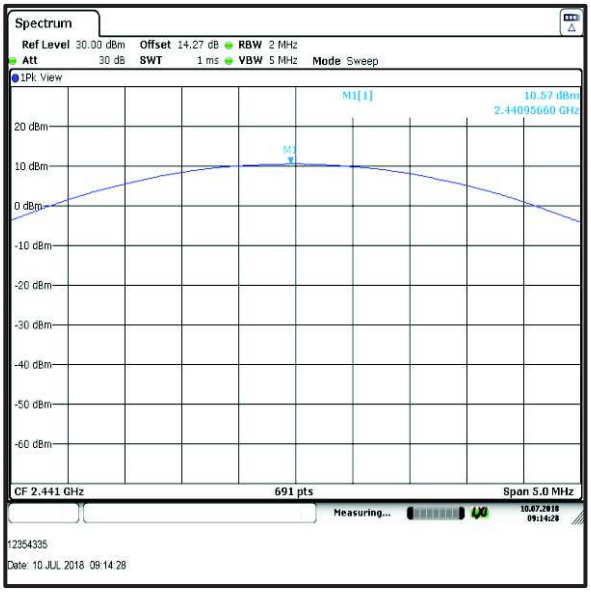
Result: Pass

Transmitter Maximum Peak Output Power (continued)

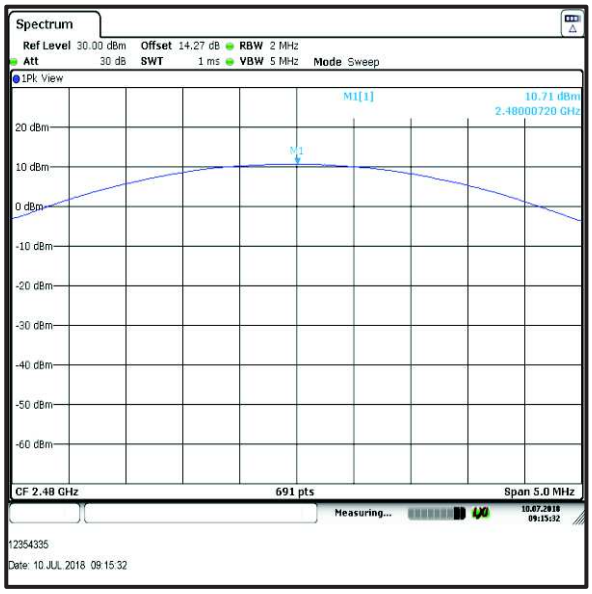
Results Power Class 1- 3DH5



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

Results Power Class 2- DH5

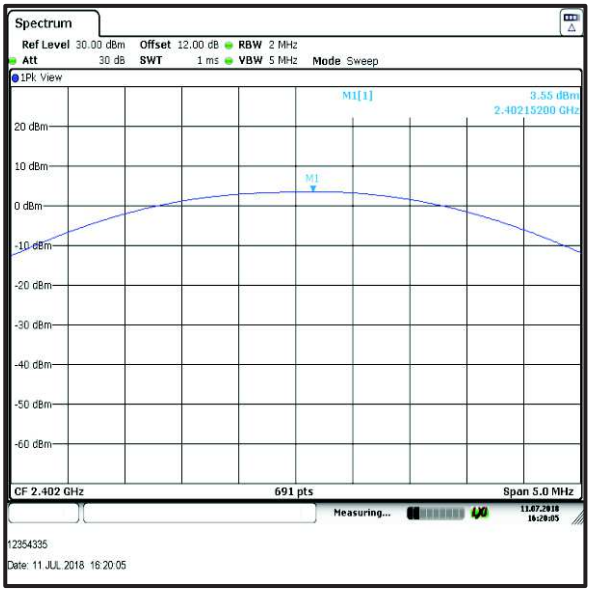
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	3.5	21.0	17.5	Complied
Middle	3.3	21.0	17.3	Complied
Top	3.8	21.0	17.2	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	3.5	2.3	5.8	27.0	21.2	Complied
Middle	3.3	2.3	5.6	27.0	21.4	Complied
Top	3.8	2.3	6.1	27.0	20.9	Complied

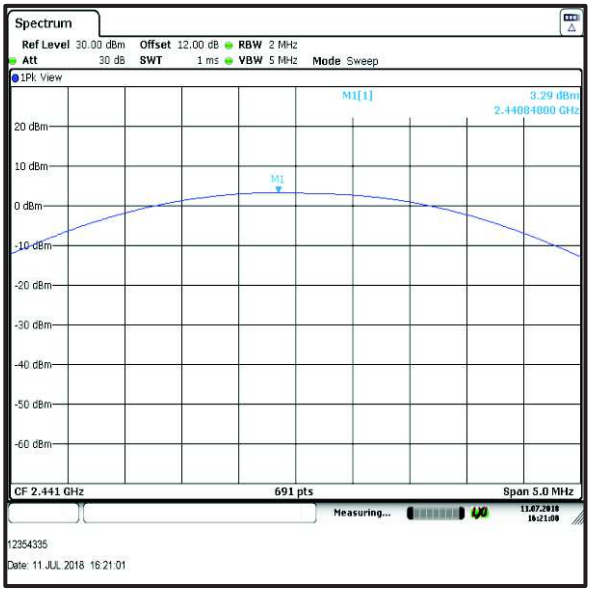
Result: Pass

Transmitter Maximum Peak Output Power (continued)

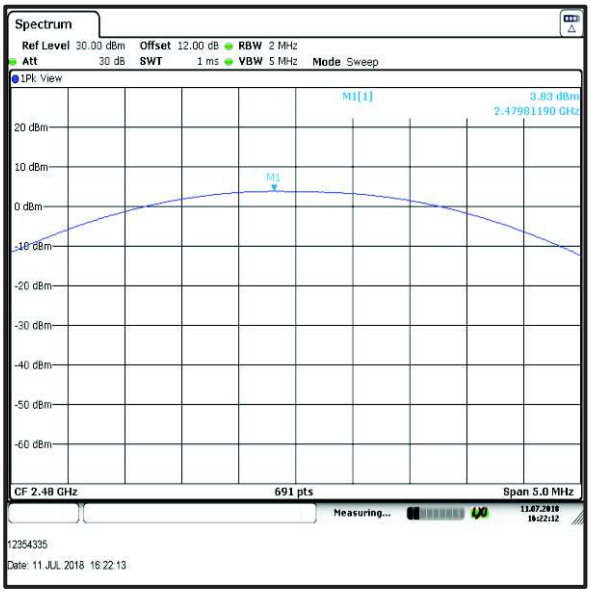
Results Power Class 2- DH5



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

Results Power Class 2- 2DH5

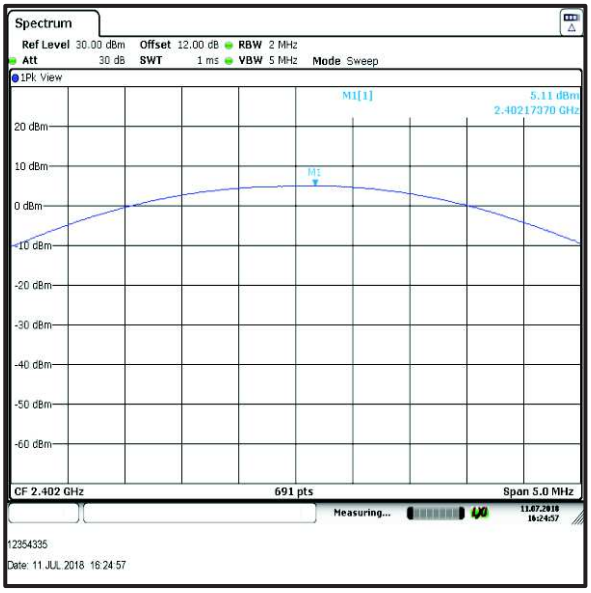
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	5.1	21.0	15.9	Complied
Middle	4.9	21.0	16.1	Complied
Top	5.3	21.0	15.7	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	5.1	2.3	7.4	27.0	19.6	Complied
Middle	4.9	2.3	7.2	27.0	19.8	Complied
Top	5.3	2.3	7.6	27.0	19.4	Complied

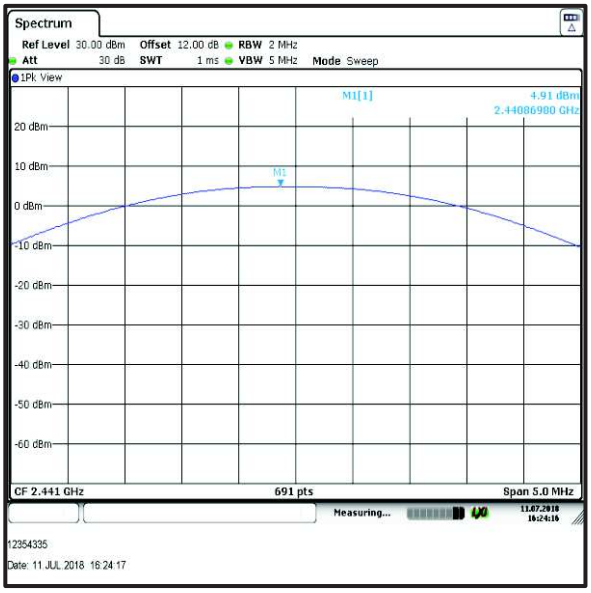
Result: Pass

Transmitter Maximum Peak Output Power (continued)

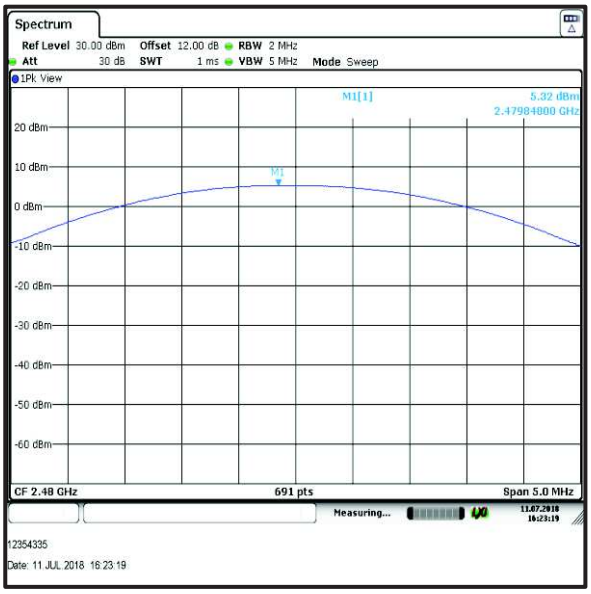
Results Power Class 2- 2DH5



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

Results Power Class 2- 3DH5

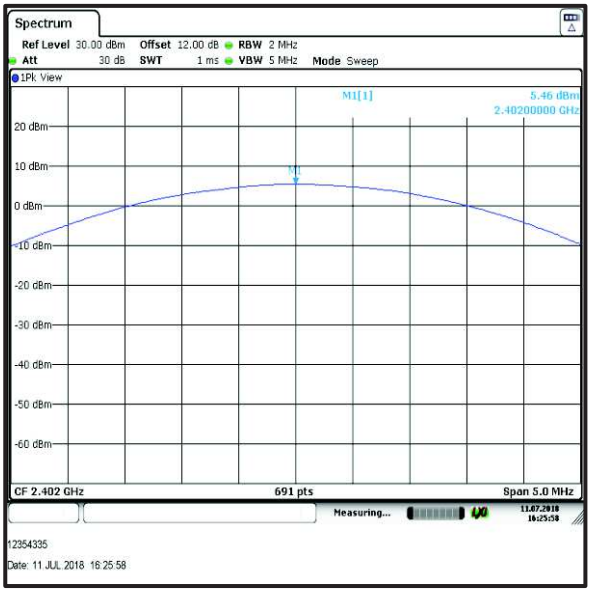
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	5.5	21.0	15.5	Complied
Middle	5.2	21.0	15.8	Complied
Top	5.6	21.0	15.4	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	5.5	2.3	7.8	27.0	19.2	Complied
Middle	5.2	2.3	7.5	27.0	19.5	Complied
Top	5.6	2.3	7.9	27.0	19.1	Complied

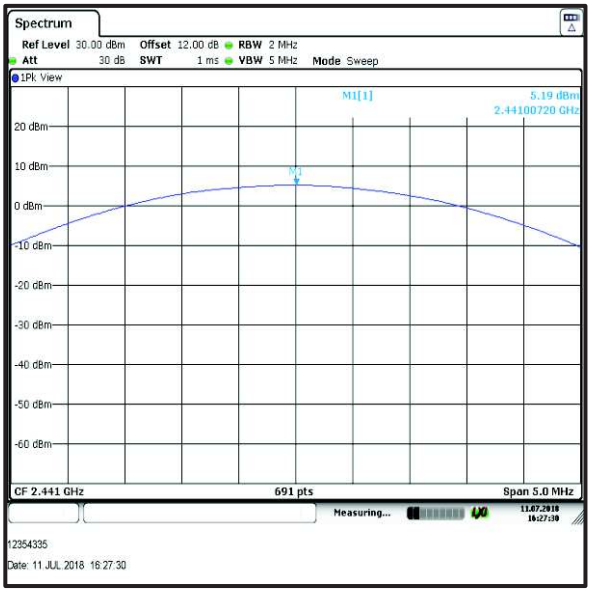
Result: Pass

Transmitter Maximum Peak Output Power (continued)

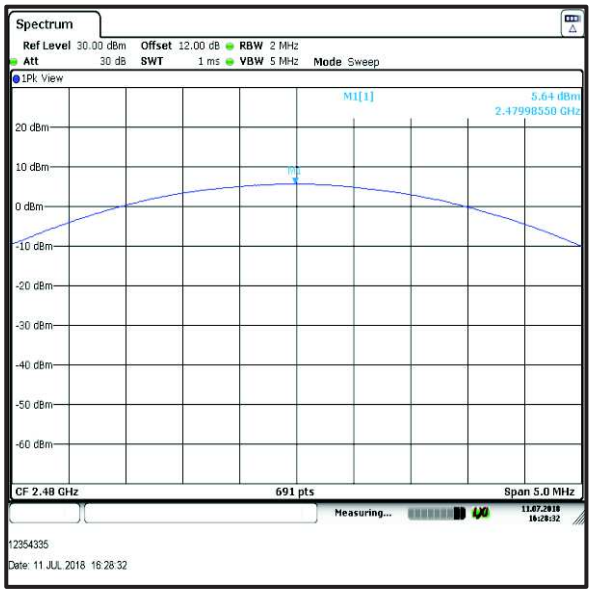
Results Power Class 2- 3DH5



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

Results Power Class 3- DH5

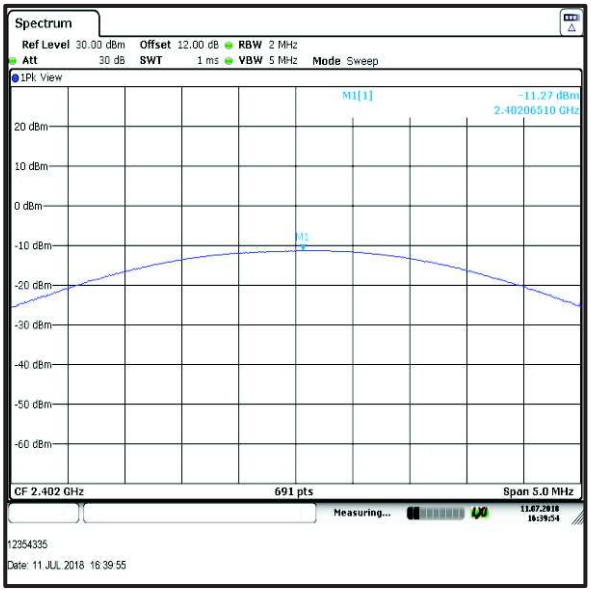
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-11.3	21.0	32.3	Complied
Middle	-11.7	21.0	32.7	Complied
Top	-10.4	21.0	31.4	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-11.3	2.3	-9.0	27.0	36.0	Complied
Middle	-11.7	2.3	-9.4	27.0	36.4	Complied
Top	-10.4	2.3	-8.1	27.0	35.1	Complied

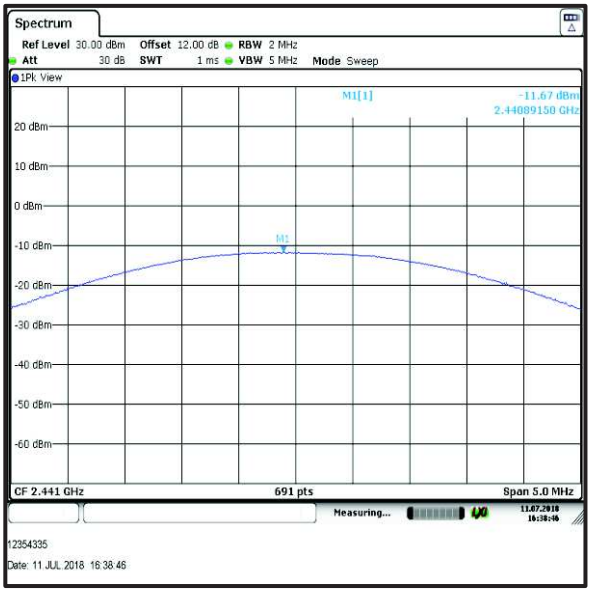
Result: Pass

Transmitter Maximum Peak Output Power (continued)

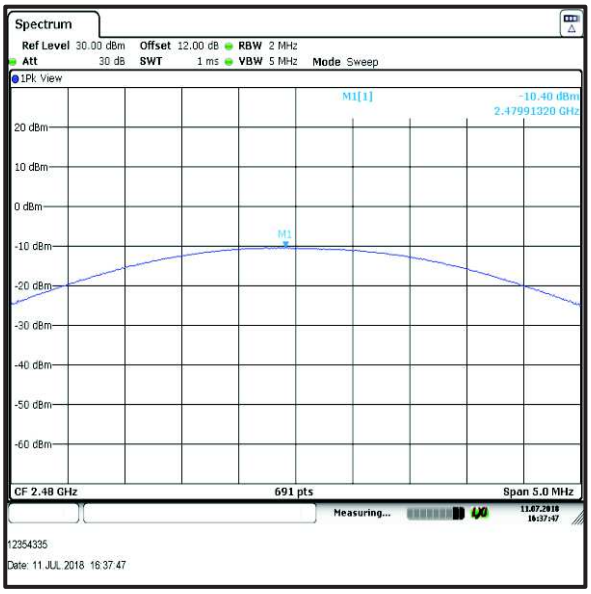
Results Power Class 3- DH5



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

Results Power Class 3- 2DH5

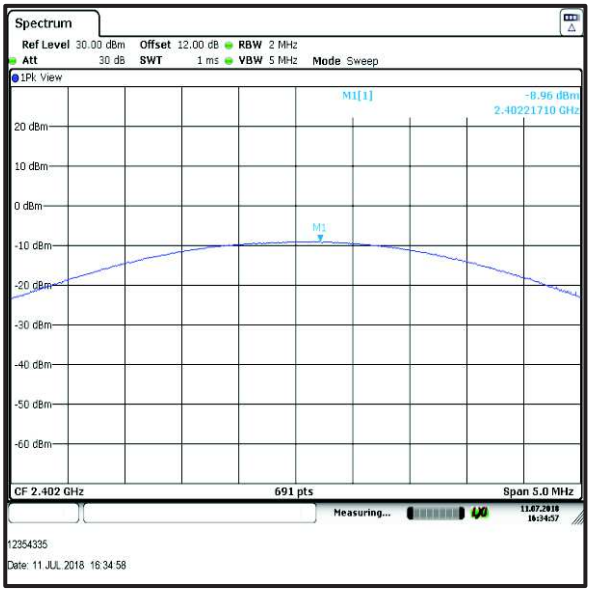
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-7.0	21.0	28.0	Complied
Middle	-9.4	21.0	30.4	Complied
Top	-7.0	21.0	28.0	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-7.0	2.3	-5.7	27.0	32.7	Complied
Middle	-9.4	2.3	-7.1	27.0	34.1	Complied
Top	-7.0	2.3	-5.7	27.0	32.7	Complied

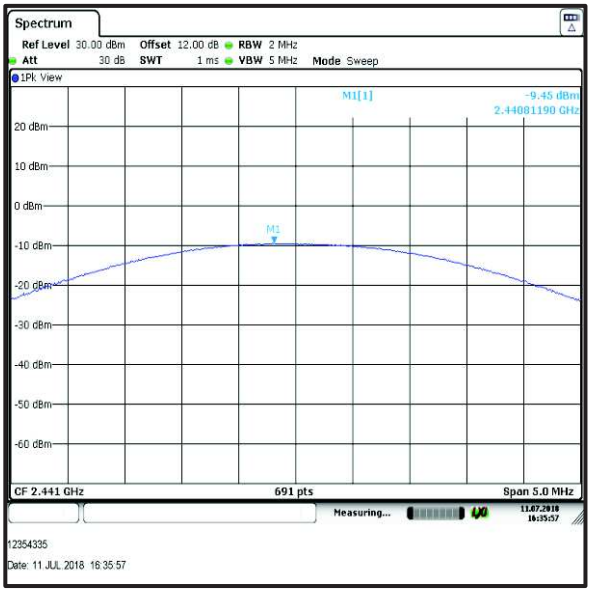
Result: Pass

Transmitter Maximum Peak Output Power (continued)

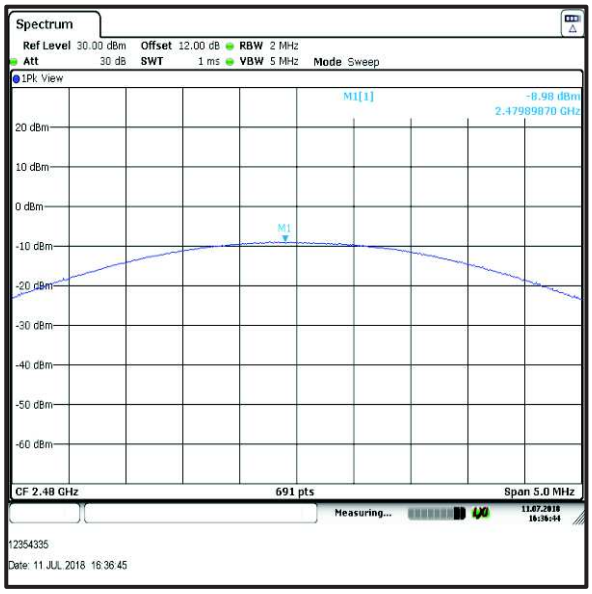
Results Power Class 3- 2DH5



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

Results Power Class 3- 3DH5

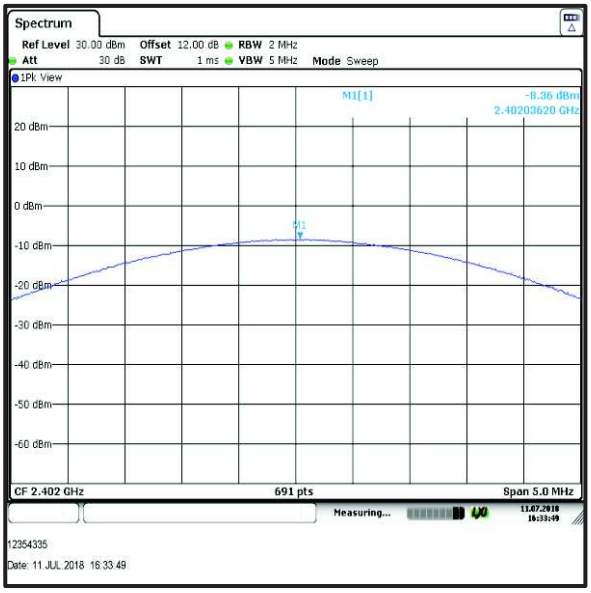
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-8.4	21.0	29.4	Complied
Middle	-8.8	21.0	29.8	Complied
Top	-8.1	21.0	29.1	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-8.4	2.3	-6.1	27.0	33.1	Complied
Middle	-8.8	2.3	-6.5	27.0	33.5	Complied
Top	-8.1	2.3	-5.8	27.0	32.8	Complied

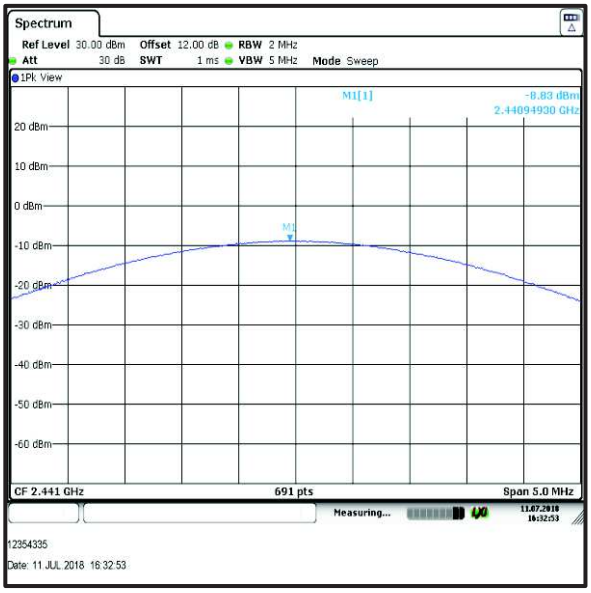
Result: Pass

Transmitter Maximum Peak Output Power (continued)

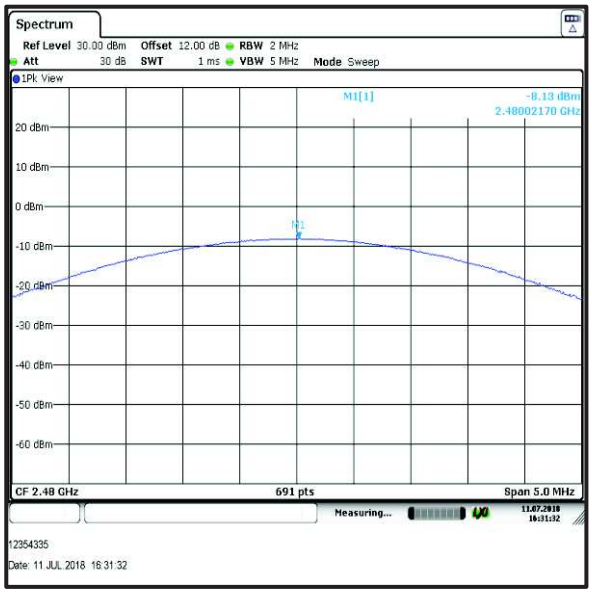
Results Power Class 3- 3DH5



Bottom Channel



Middle Channel



Top Channel

5.2.6. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Date:**	25 June 2018
Test Sample Serial Number:	B18E92536		
Test Site Identification	SR 1/2		

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:

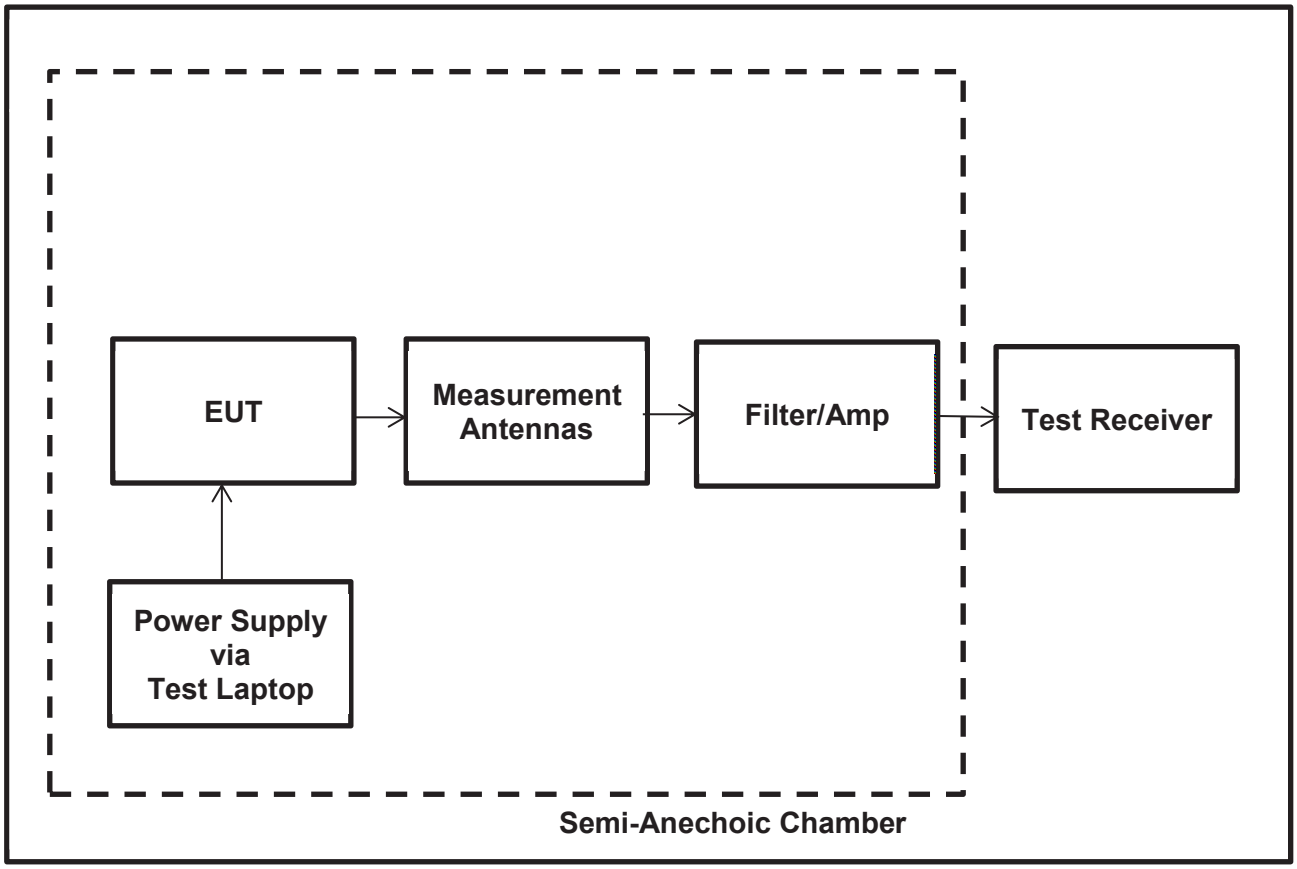
Temperature (°C):	22.3
Relative Humidity (%):	34

Notes:

1. Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 3DH5 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. No spurious emissions were detected above the noise floor of the measuring receiver.
5. Measurements below 1 GHz were performed in a semi-anechoic chamber at a distance of 3 meter. 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 meter.
6. 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:

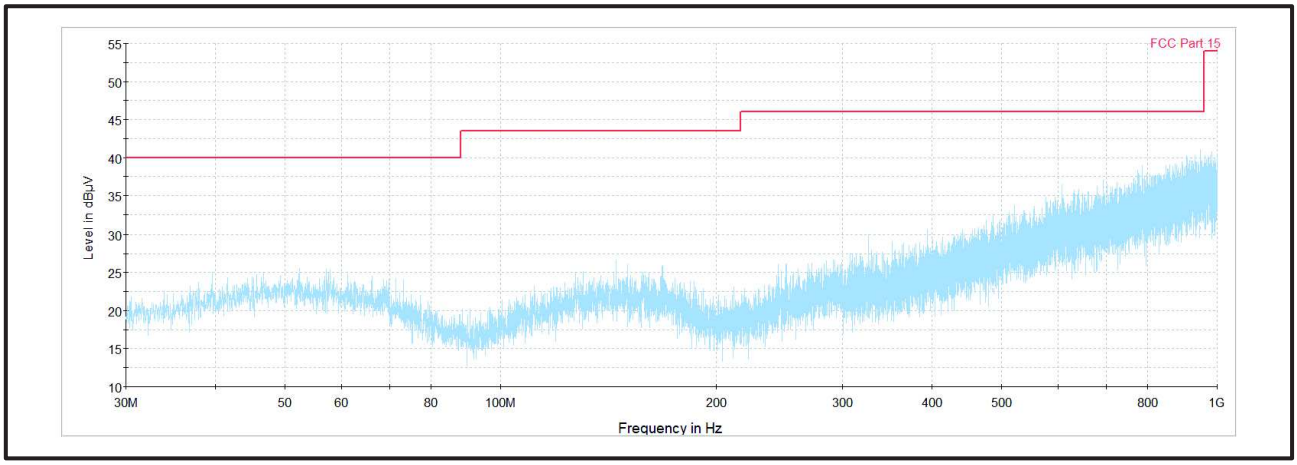


Transmitter Radiated Emissions (continued)

Results: Middle Channel

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical spurious was found					

Plot: 30 MHz – 1GHz



Result: Pass

Test Summary:

Test Engineer:	Segun Adeniji	**Test Date:**	11 July 2018
Test Sample Serial Number:	B18E92536		
Test Site Identification	SR 1/2		

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):	24
Relative Humidity (%):	35

Settings of the Instrument

RBW/VBW	100 kHz / 300 kHz
Detector	Peak

Note(s):

1. Transmitter radiated spurious emissions tests were performed with the EUT transmitting in DH5, 2DH5 and 3DH5. The 3DH5 result has been presented in this report 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 at around 2.4 GHz are the EUT fundamentals at their transmitting frequencies.
4. *In accordance with ANSI C63.10 Section 6.6.4.3 (Note 1), if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
5. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below. The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.
6. 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.
7. For measurement above 18 GHz, no spurious emission was detected both for static frequency mode and hopping mode hence, only the middle channel of the 3 DH5 has been presented in the plot below.
8. Measurements were performed in a semi-anechoic chamber at a distance of 3 meter. 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 meter.
9. 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.

Results: Peak / Bottom Channel / 3DH5

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2558.07	H	44.49	54.0	9.51	Complied

Results: Peak / Middle Channel / 3DH5

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2596.10	H	42.73	54.0	6.6	Complied

Results: Peak / Top Channel / 3DH5

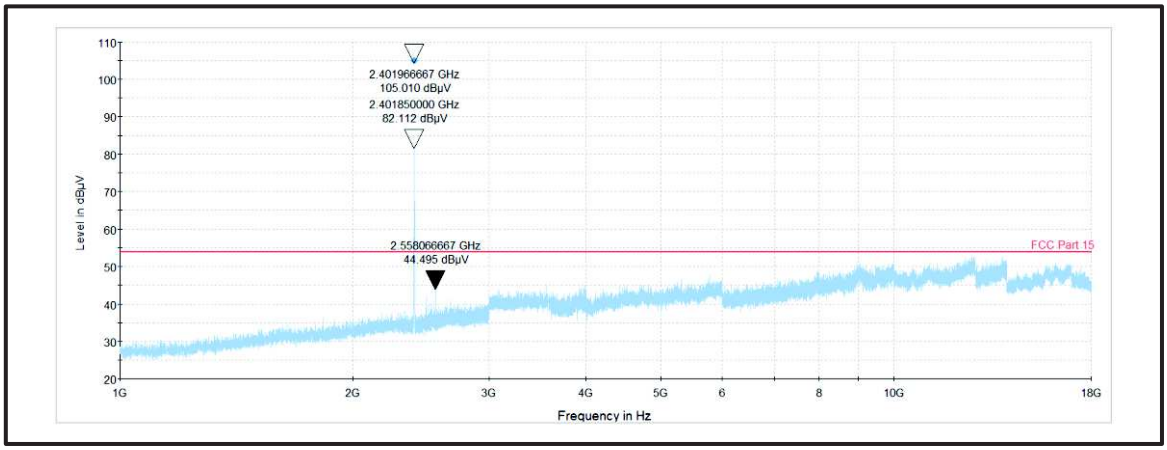
Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2323.80	H	41.13	54.0	7.0	Complied

Results: Peak / Hopping Mode / 3DH5

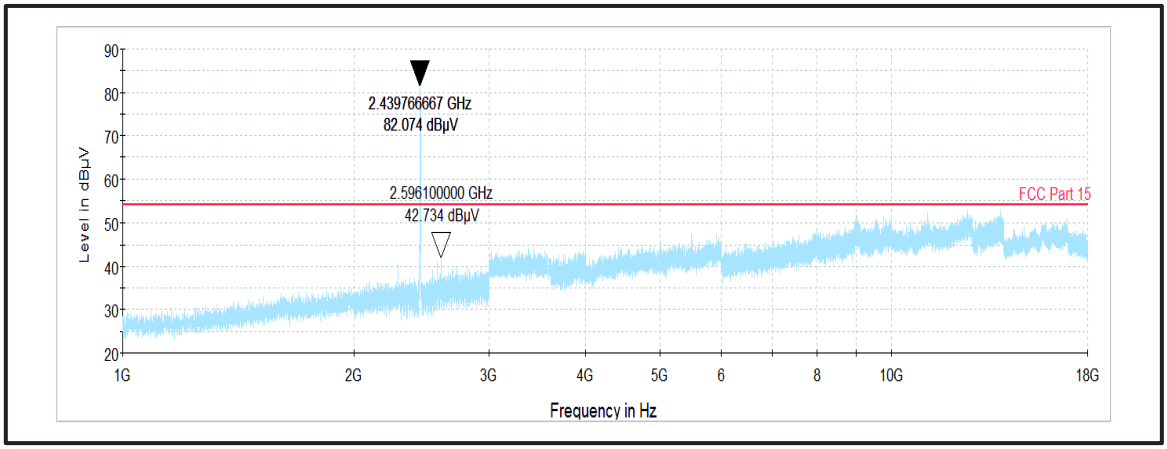
Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
7338.0	H	41.00	54.0	7.1	Complied

Result: Pass

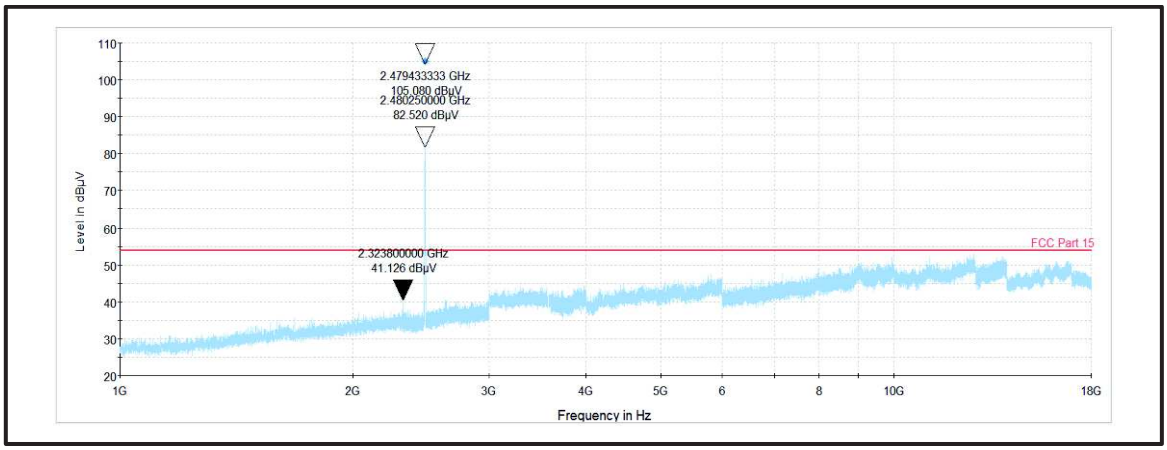
Plot: Peak / Bottom Channel / 3DH5



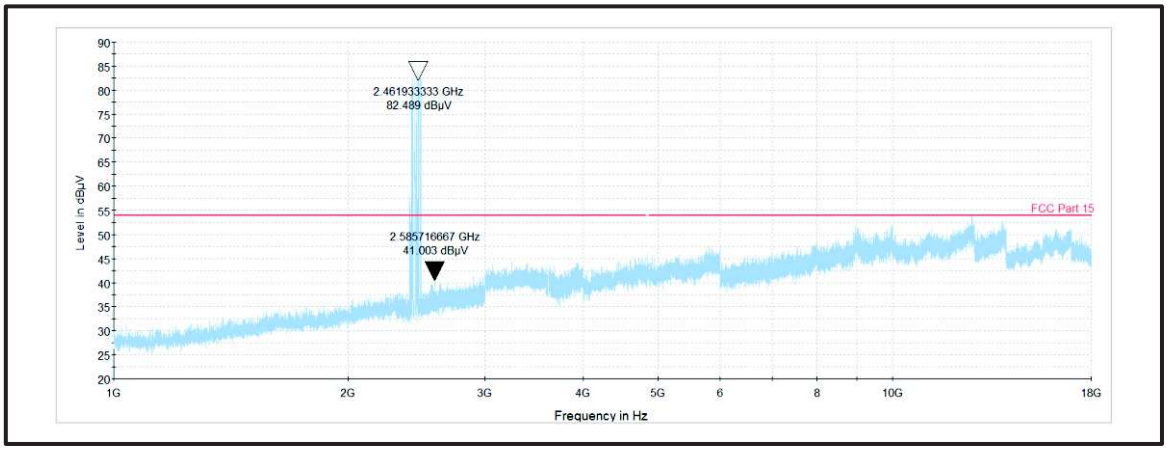
Plot: Peak / Middle Channel / 3DH5



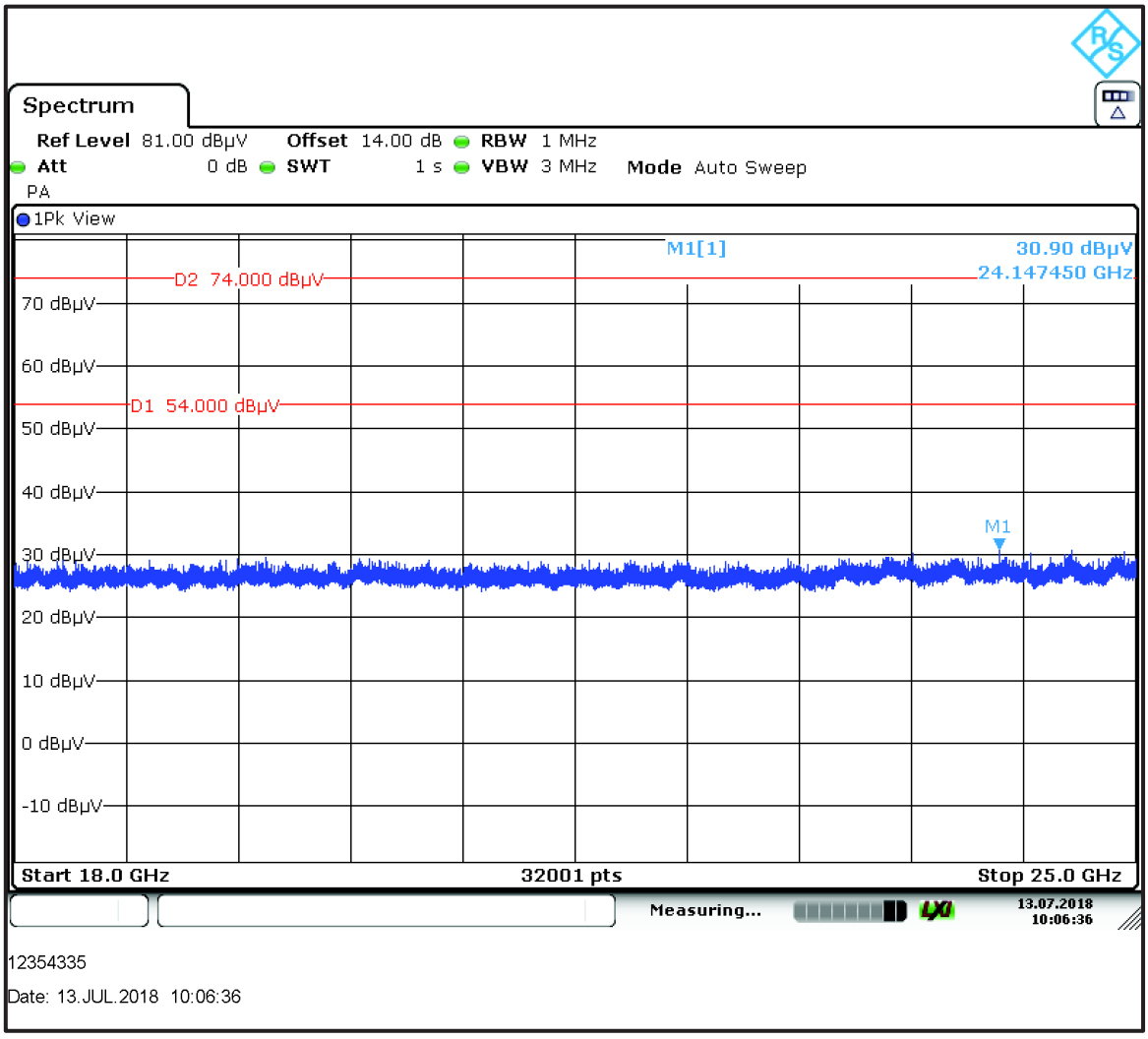
Plot: Peak / Bottom Channel / 3DH5



Plot: Peak / Hopping / 3DH5



Plot: Peak / Middle / 3DH5 / 18 GHz – 25 GHz



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

5.2.7. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Segun Adeniji	**Test Date:**	11 July 2018
Test Sample Serial Number:	B18E92536		
Test Site Identification	SR 1/2		

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

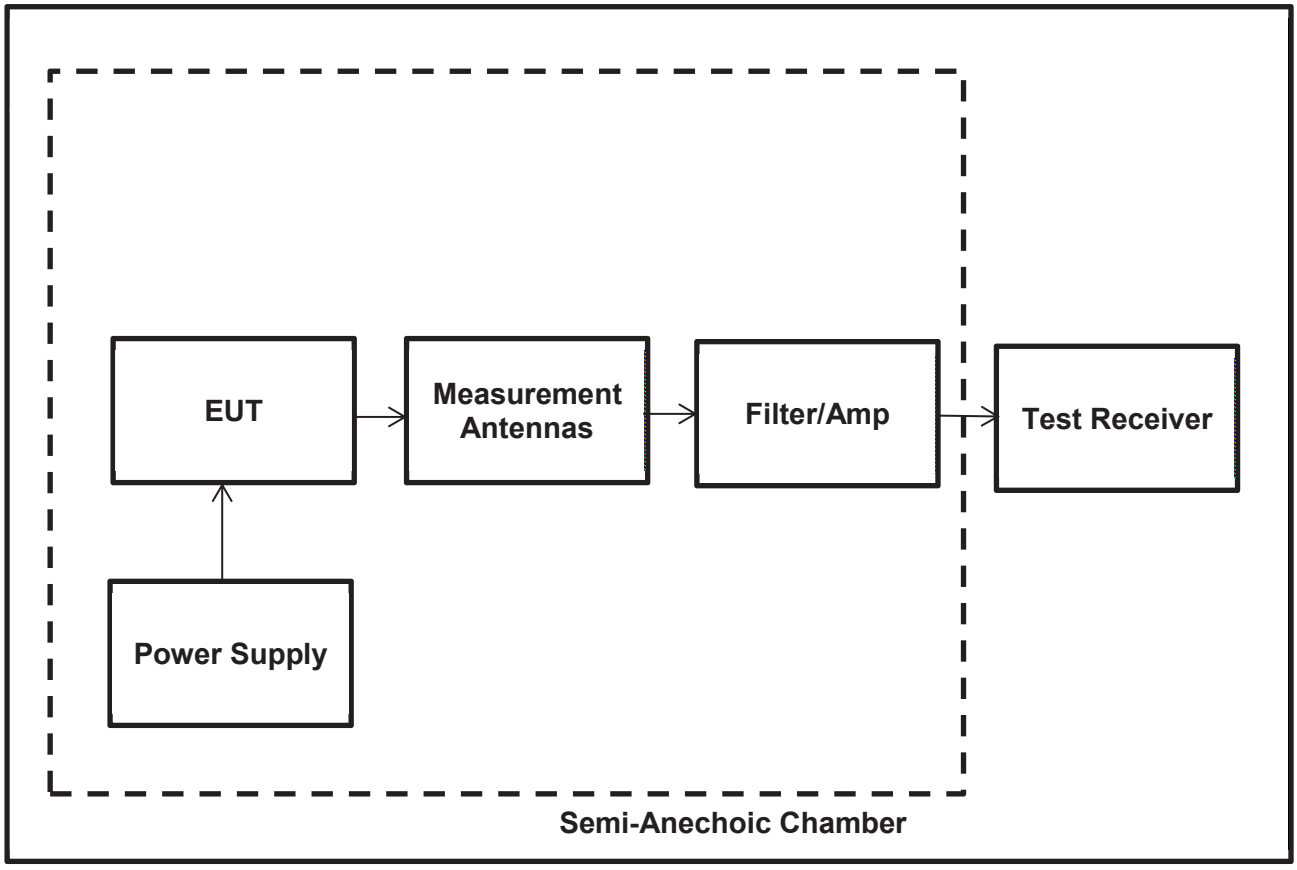
Environmental Conditions:

Temperature (°C):	22.6
Relative Humidity (%):	23

Note(s):

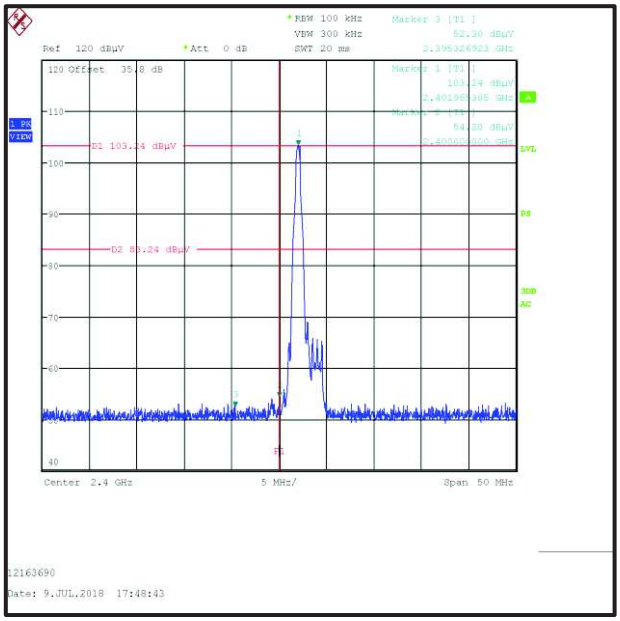
1. As the lower band edges fall within non-restricted bands, only peak measurements are required. In accordance with FCC KDB 558074 Section 11.1, the test method in Section 11.3 was followed: the test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, 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. As the maximum peak conducted output power was measured using a peak detector in accordance with FCC KDB 558074 Section 9.1.1 an out-of-band limit line was placed 20 dB below the peak level (FCC KDB 558074 Section 11.1(a)). A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent non-restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
2. As the upper band edge falls within a restricted band both peak and average measurements were recorded by placing a marker at the edge of the band. For peak measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. For average measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. An RMS 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 was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
3. 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.
4. *Emissions in restricted bands: In accordance with C63.10 Section 6.6.4.3, Note 1, where the peak detected amplitude was shown to comply with the average limit, an average measurement was not performed.
5. The measurement was made with 6 dB Channel filter on the top channel as the EUT was failing with 3 dB Channel filter.

Test setup:

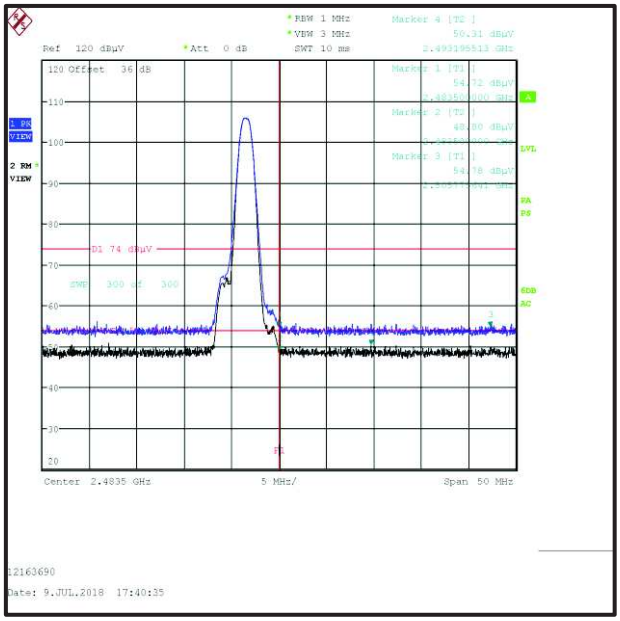

EUT
Measurement Antennas
Filter/Amp
Test Receiver
Power Supply
Semi-Anechoic Chamber

Results: Static Mode / DH5

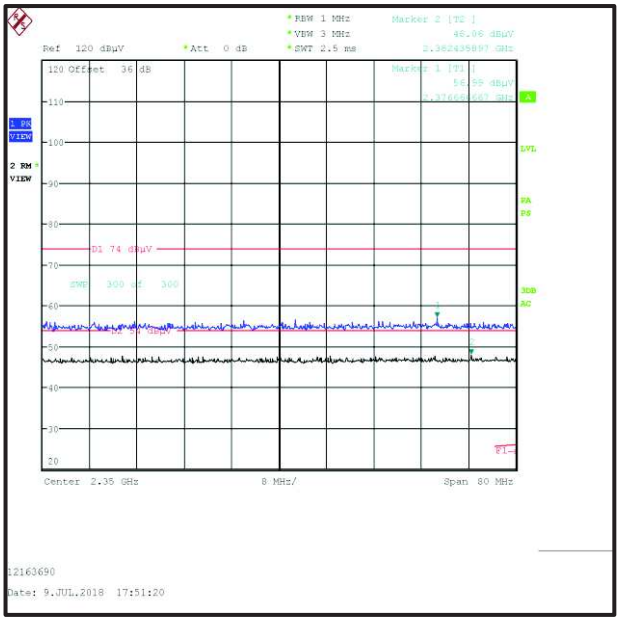
Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2376.6	Horizontal	56.99	74.0	17.01	Complied
2382.4	Horizontal	48.06	54.0	5.94	Complied
2400.0	Horizontal	54.28	83.24	28.96	Complied
2483.5	Horizontal	54.72	74.0	19.28	Complied
2483.5	Horizontal	48.80	54.0	5.20	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak/Average Static



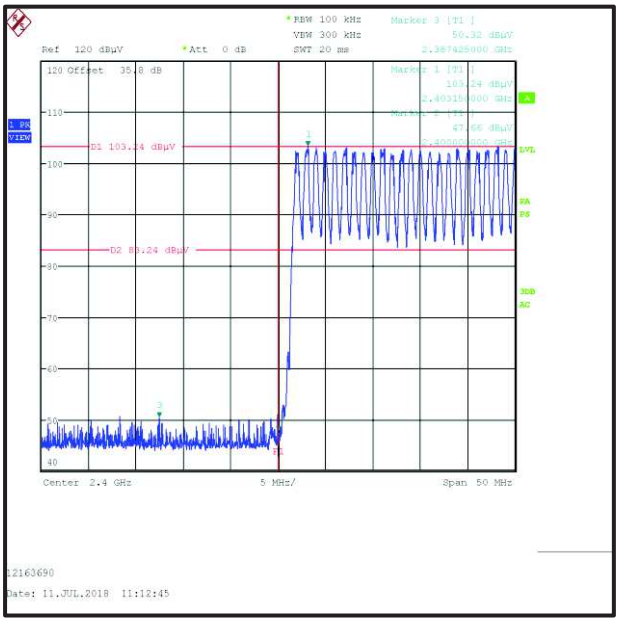
2310 MHz to 2390 MHz Restricted Band Plot

Result: Pass

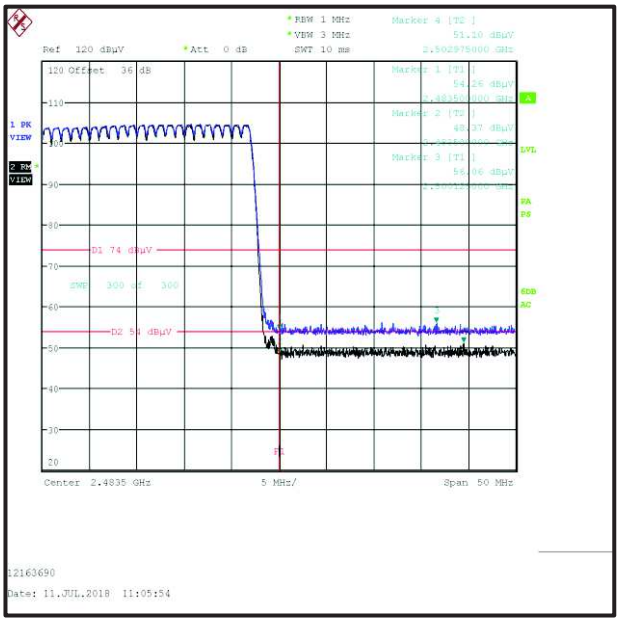
Transmitter Band Edge Radiated Emissions (continued)

Results: Hopping Mode / DH5

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	47.7	83.24	35.54	Complied
2387.4	Horizontal	50.32	83.24	32.92	Complied
2483.5	Horizontal	54.26	74.0	19.74	Complied
2483.5	Horizontal	48.37	54.0	5.63	Complied



Lower Band Edge Peak Hopping



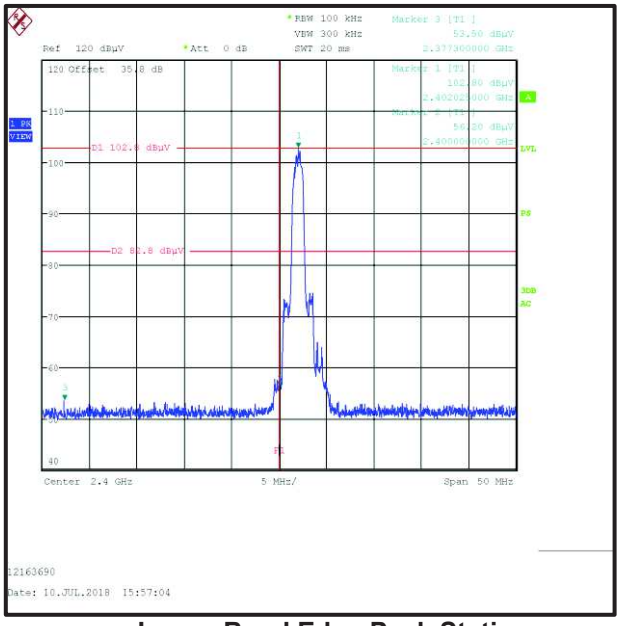
Upper Band Edge Peak/Average Hopping

Result: Pass

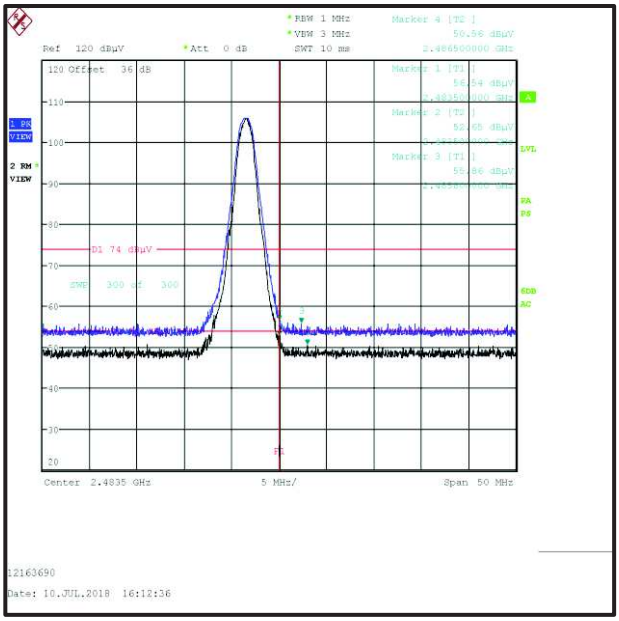
Transmitter Band Edge Radiated Emissions (continued)

Results: Static Mode / 2DH5

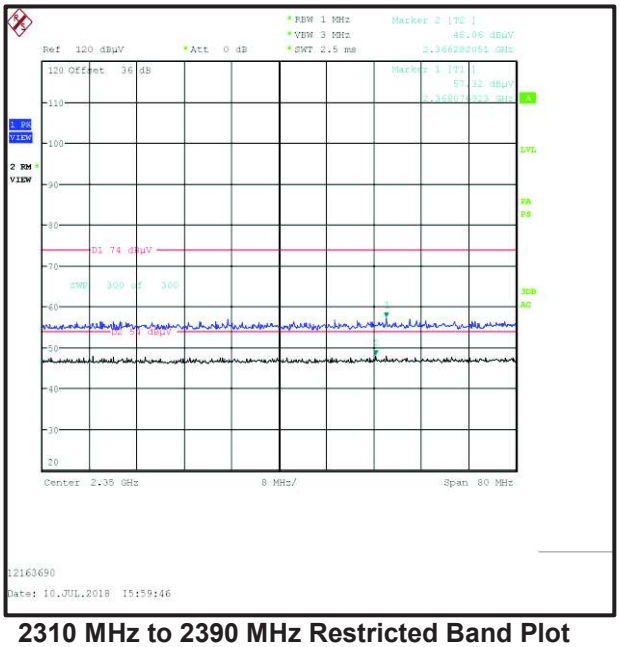
Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2366.28	Horizontal	48.06	54.0	5.94	Complied
2368.07	Horizontal	57.32	74.0	16.68	Complied
2400.0	Horizontal	56.20	82.80	26.6	Complied
2483.5	Horizontal	56.54	74.0	17.46	Complied
2483.5	Horizontal	52.65	54.0	1.35	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak/Average Static



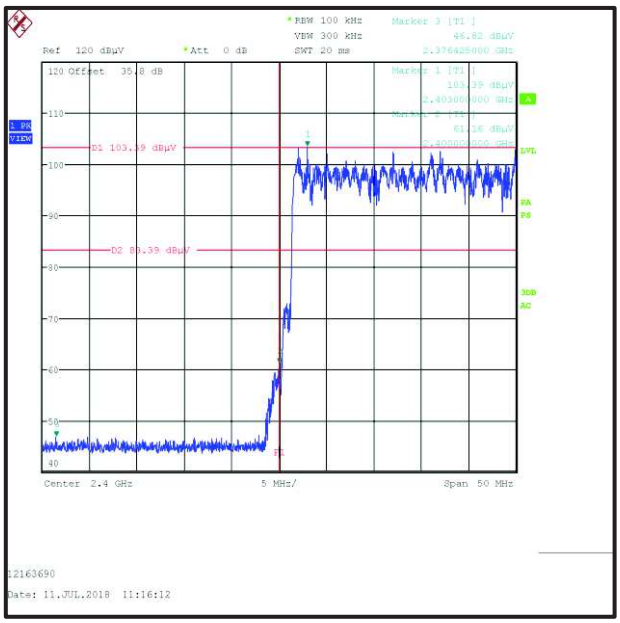
2310 MHz to 2390 MHz Restricted Band Plot

Result: Pass

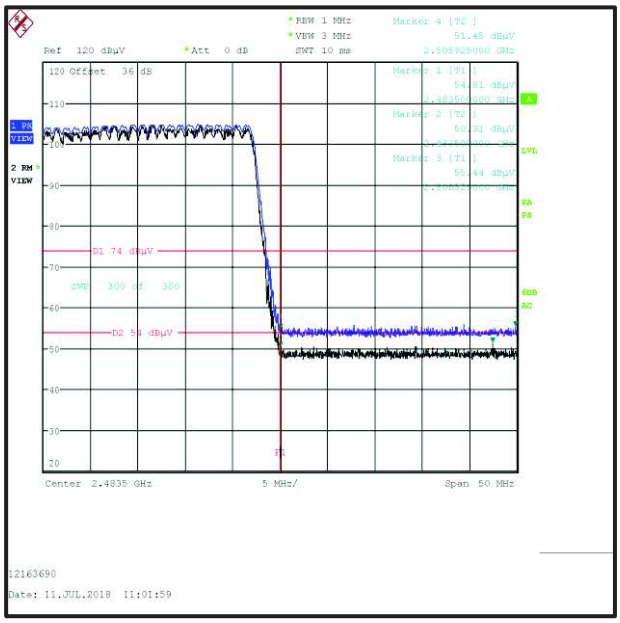
Transmitter Band Edge Radiated Emissions (continued)

Results: Hopping Mode / 2DH5

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	61.16	83.39	22.23	Complied
2376.4	Horizontal	46.82	83.24	36.42	Complied
2483.5	Horizontal	54.21	74.0	19.79	Complied
2483.5	Horizontal	50.31	54.0	3.69	Complied



Lower Band Edge Peak Hopping



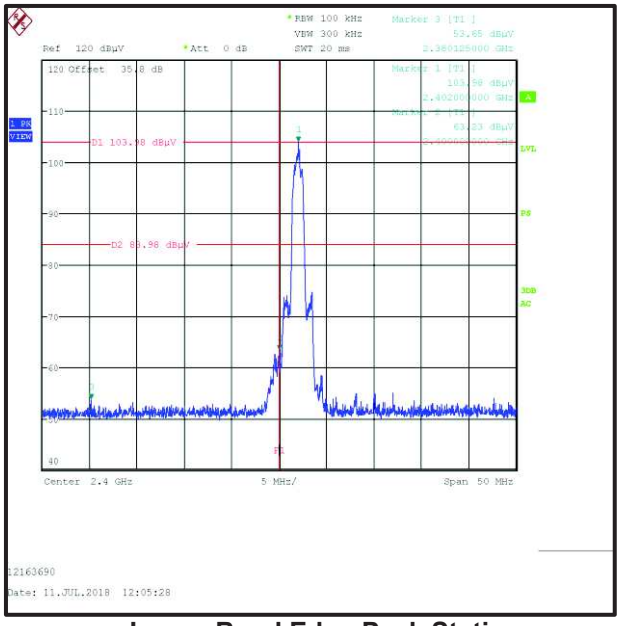
Upper Band Edge Peak/Average Hopping

Result: Pass

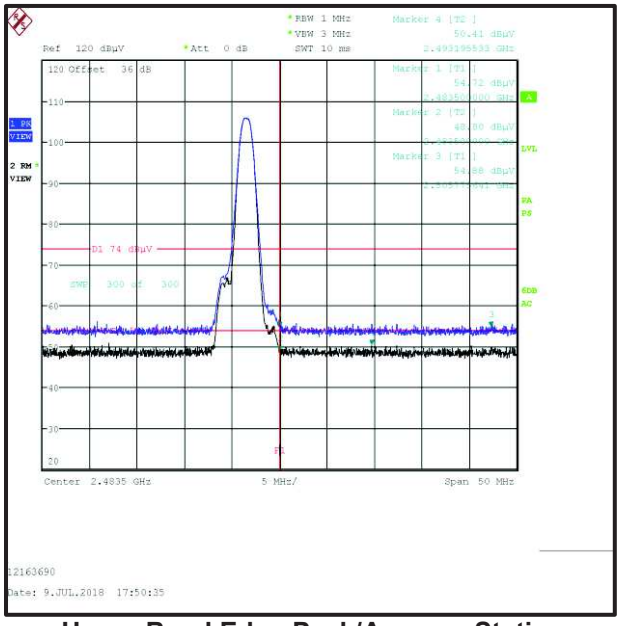
Transmitter Band Edge Radiated Emissions (continued)

Results: Static Mode / 3DH5

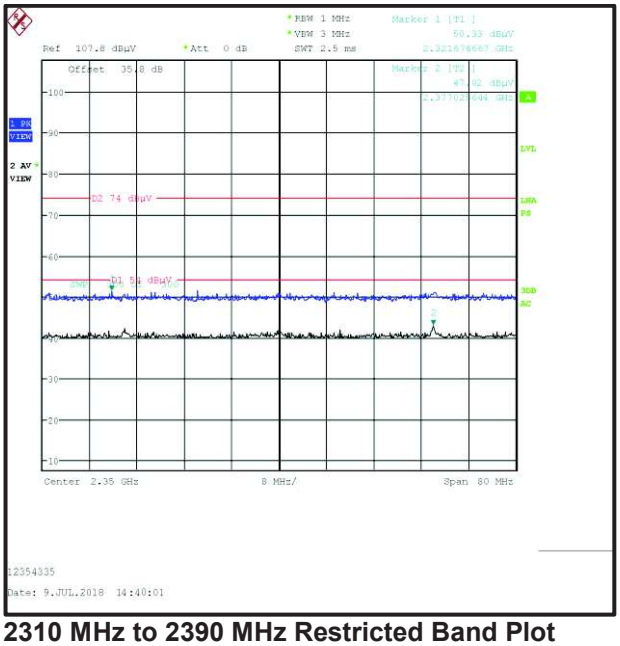
Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2321.6	Horizontal	50.33	74.0	23.67	Complied
2376.0	Horizontal	42.02	54.0	11.98	Complied
2400.0	Horizontal	63.23	83.98	20.75	Complied
2483.5	Horizontal	54.72	74.0	19.28	Complied
2483.5	Horizontal	48.80	54.0	5.20	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak/Average Static



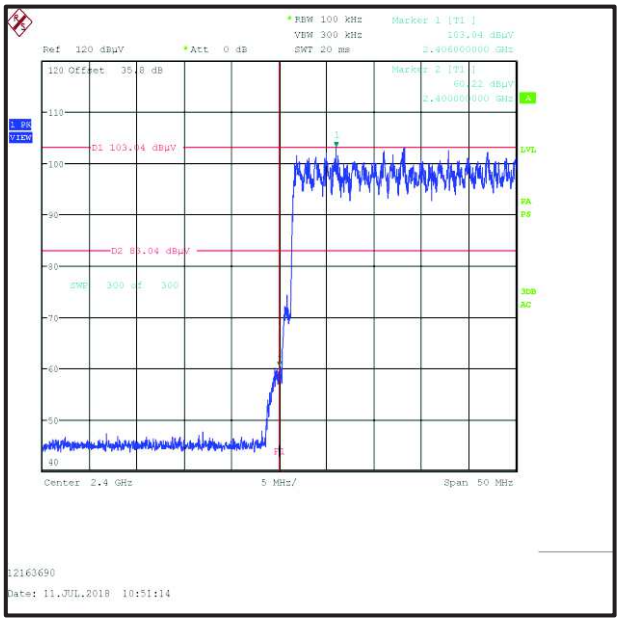
2310 MHz to 2390 MHz Restricted Band Plot

Result: Pass

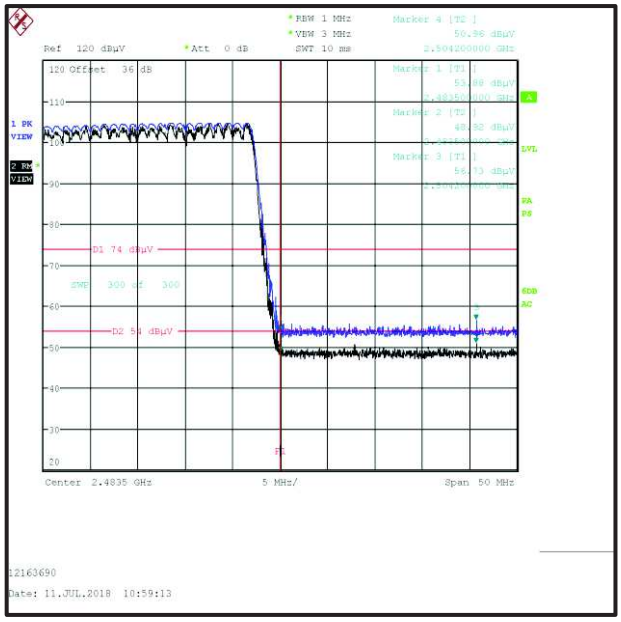
Transmitter Band Edge Radiated Emissions (continued)

Results: Hopping Mode / 3DH5

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	60.22	83.24	35.54	Complied
2483.5	Horizontal	53.88	74.0	19.74	Complied
2483.5	Horizontal	50.96	54.0	5.63	Complied
2504.2	Horizontal	56.73	74.0	17.27	Complied
2504.2	Horizontal	50.96	54.0	3.04	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping

Result: Pass

6. Measurement Uncertainty

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	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	95%	±2.49 dB
Radiated Maximum Peak Output Power	95%	±3.10 dB
Conducted Maximum Peak Output Power	95%	±0.59 dB
Conducted Spurious Emissions	95%	±0.59 dB
Radiated Spurious Emissions	95%	±3.10 dB
Band Edge Radiated Emissions	95%	±3.10 dB
Carrier Frequency Separation	95%	±92 Hz
Average Time of Occupancy	95%	±3.53 ns
Minimum 6 dB Bandwidth	95%	±0.87 %
99% Emission Bandwidth	95%	±0.87 %
20 dB Bandwidth	95%	±0.87 %

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. Used equipment

Test site: SR 1/2

ID	Manufacturer	Type	Model	Serial No.	Calibration Date	Cal. Cycle
1	Rohde & Schwarz	Antenna, Loop	HFH2-Z2	831247/012	8/5/2016	36
103	EMCO	Antenna, Horn	3115	9008/3485	7/20/2016	36
104	EMCO	Antenna, Horn	3115	9008/3486	7/20/2016	36
156	Rohde & Schwarz	V-Network	ESH3-Z6	843864/004	7/11/2018	12
350	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/014	7/12/2018	12
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	7/12/2018	12
383	Rohde & Schwarz	Antenna, Rod	HFH2-Z1	890151/11	7/14/2017	24
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	055929	7/12/2018	12
424	EMCO	Antenna, Horn	EMCO 3116	00046537	7/28/2016	24
425	Agilent	Generator, CW Signal	E8247C	MY43320849	7/10/2018	24
426	Agilent	Spectrum Analyzer	E4446A	US44020316	7/11/2018	24
460	Deisl	Turntable	DT 4250 S		n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	8/8/2016	36
474	Agilent	Analyzer, ENA Network	E5071C	MY46100912	7/13/2018	24
495	Rohde & Schwarz	Antenna, Log.- Periodical	HL050	100296	7/20/2016	24
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	7/20/2016	24
497	Schwarzbeck	Antenna, Biconical	VHBB 9124	423	7/7/2016	36
499	Schwarzbeck	Antenna, log.-per	VUSLP 9111	317	8/2/2016	36
587	Maturo	antenna mast, tilting	TAM 4.0-E	011/7180311	n/a	n/a
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
591	Rohde & Schwarz	Receiver	ESU 40	100244/040	7/12/2018	12
607	Schwarzbeck	Antenna broadband horn antenna	BBHA 9170	9170-561	7/28/2016	24
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	4/8/2014	60
363	Wainwright	Notch Filter GSM900	WW-NF9	100002	Lab verification	n/a
611	Wainwright Instruments	Band Reject Filter DL LTE	WRCGV8-	1	Lab verification	n/a
612	Wainwright Instruments	Band Reject Filter UL LTE	WRCGV8-	1	Lab verification	n/a
613	Wainwright Instruments	Band Reject Filter WLAN/ BT	WRCTF12-	1	Lab verification	n/a
614	Wainwright Instruments	Highpass Filter 3GHz	WHKX10-	1	Lab verification	n/a
615	Wainwright Instruments	Highpass Filter 1GHz	WHKX12-	3	Lab verification	n/a
620	Bonn Elektronik	pre-amplifier	BLNA 0110-01N	1510111	7/12/2017	24
624	Wainwright	6 GHz high-pass filter	WHKX10-5850-6500-18000-40SS	5	Lab verification	n/a
628	Maturo	Antenna mast	CAM 4.0-P	224/19590716	n/a	n/a
629	Maturo	Kippeinrichtung	KE 2.5-R-M	MAT002	n/a	n/a

Test site: SR 9

ID	Manufacturer	Type	Model	Serial No.	Calibration Date	Cal. Cycle
424	EMCO	Antenna, Horn	EMCO 3116	00046537	7/28/2016	24
472	Rohde & Schwarz	Generator, Vektorsignal	SMU200A	102409	7/11/2018	12
592	Rohde & Schwarz	Wideband Radio Communication tester	CMW 500	119593	8/15/2017	12
622	Rohde & Schwarz	Step Attenuator	RSC	101904	7/12/2018	12
625	Schwarzbeck	Antenna, H-field	HFSL 7101	109	Verification - only relative measurements	n/a
626	Rohde & Schwarz	Bluetooth Tester	CBT	100481	Signaling Only	24
635	Rohde & Schwarz	Signal generator	SMB100A	179875	7/10/2018	12
636	Rohde & Schwarz	switching unit	OSP120	101698	7/12/2018	12
637	Rohde & Schwarz	Spectrum Analyzer	FSV40	101587	7/11/2018	12
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	55929	7/12/2018	24
451	Rohde & Schwarz	Power Meter, Dual Channel	NRVD	101190	7/10/2018	12
427	Rohde & Schwarz	Probe, Power Sensor	NRV-Z5	100106	7/12/2018	12
195	SPS	Power Supply	TOE8842-24	51455	Verified by Multimeter	12
216	Agilent	Multimeter	34401A	US36017458	7/11/2017	24
378	ESPEC/ Thermotec	Climatic Chamber	PL-1FT	5100869	8/9/2016	36

Additional Control Equipment

ID	Manufacturer	Type	Model	Serial No.	Calibration Date	Cal. Cycle
592	Rohde & Schwarz	Wideband Radio Communication tester	CMW 500	119593	8/15/2017	12
626	Rohde & Schwarz	Bluetooth Tester	CBT	100481	Signaling Only	24

Test site: SR 7/8

ID	Manufacturer	Type	Model	Serial No.	Calibration Date	Cal. Cycle
22	Rohde & Schwarz	Artificial Mains	50 Ohm// 50uH	831767/014	7/11/2018	12
215	Rohde & Schwarz	Artificial Mains Network	9 kHz - 30 MHz; 3 phase	879675/002	7/11/2018	12
349	Rohde & Schwarz	Receiver, EMI Test	20 Hz - 7 GHz	836697/009	7/10/2018	12
616	Rohde & Schwarz	ISN	8 wire ISN for CAT6	101656	7/12/2018	12

8. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version