TEST REPORT

Test Report No. : UL-RPT-RP-11950778-1016

Applicant	:	Alessanderx SpA
Model No.	:	Magni Smartech© Motor
FCC ID	:	2AP5WMASMARTMOT1
Technology	:	Bluetooth – Low Energy
Test Standard(s)	:	FCC Parts 15.207, 15.209(a) & 15.247
		For details of applied tests refer to test result summary

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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: Krume, Ivanov
Title: Laboratory Engineer
Date: 05.June.2019

Approved by: Ajit, Phadtare
Title: Lead Test Engineer
Date: 05.June.2019

DAkkS 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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1. Customer Information

1.1.Applicant Information

Company Name:	Alessanderx SpA
Company Address:	Via S. Leonardo da Porto Maurizio, 24/26/28 – 59100 – Prato, ITALY
Company Phone No.:	+39 057451011
Company E-Mail:	--
Contact Person:	Camilla Bigagli
Contact E-Mail Address:	camilla.bigagli@magniflex.com
Contact Phone No.:	+39 057451011

1.2.Manufacturer Information

Company Name:	Alessanderx SpA
Company Address:	Via S. Leonardo da Porto Maurizio, 24/26/28 – 59100 – Prato, ITALY
Company Phone No.:	+39 057451011
Company E-Mail:	--
Contact Person:	Camilla Bigagli
Contact E-Mail Address:	camilla.bigagli@magniflex.com
Contact Phone No.:	+39 057451011

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:	11 September 2018
EUT arrived:	07 November 2018
Test Dates:	04 December 2018 to 28 March 2019
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)(2)	Transmitter Minimum 6 dB Bandwidth	☒	☐	☐	☐
Part 15.247(e)	Transmitter Power Spectral Density[1]	☒	☐	☐	☐
Part 15.247(b)(3)	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):

1. In accordance with KDB 558074 D01 section 8.4 referencing ANSI C63.10:2013, subclause 11.10.1, PSD is not required if the maximum conducted output power is less than the PSD limit of 8 dBm / 3 kHz. The PSD level is therefore deemed to be equal to the measured total output power

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 558074 D01 15.247 Meas Guidance v05 August 24, 2018
Title:	Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules
Reference:	KDB 414788 D01 Radiated Test Site v01r01 July 12, 2018
Title:	Test Sites For Radiated Emission Measurements
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:	Magni SmarTech ©
Model Name or Number:	Magni Smartech© Motor
Test Sample Serial Number:	201702-A004756002 (Radiated sample)
Hardware Version Number:	MSMH 1.1
Software Version Number:	MSMH 1.1
FCC ID:	2AP5WMASMARTMOT1

Brand Name:	Magni SmarTech ©
Model Name or Number:	Magni Smartech© Motor
Test Sample Serial Number:	201702-A004756003 (Conducted sample with RF port)
Hardware Version Number:	MSMH 1.1
Software Version Number:	MSMH 1.1
FCC ID:	2AP5WMASMARTMOT1

3.2. Description of EUT

The equipment under test was a Magni Smartech© Motor – Control box for adjustable bed frame and anti-snoring system supporting Bluetooth Low Energy.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	Bluetooth Low Energy (Digital Transmission System)		
Type of Unit:	Transceiver		
Channel Spacing:	2 MHz		
Modulation:	GFSK		
Data Rate:	1 Mbps		
Power Supply Requirement(s):	Nominal	110 – 240 V AC 1.5 A to 29 V DC 1.8 A	
Power Supply Type(s):	External (AC-DC Adapter)		
Maximum Conducted Output Power:	1.31 dBm		
Antenna Gain:	-1 dBi		
Antenna Type:	Strip Antenna		
Antenna Details:	Custom Antenna		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	**Channel ID**	**RF Channel**	**Channel Frequency (MHz)**
	Bottom	0	2402
	Middle	19	2440
	Top	39	2480

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	USB extension cable	Not stated	Not stated	Not stated

B. Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	AC/DC Switching Power Supply	OKIN REFINED	W52RA76-290018	RBD4627007977
2	USB/TTL UART Converter	Not stated	Not stated	Not stated
3	2 x deltadrive motor with extension tube	OKIN REFINED	B11359	Q1612414600 127/128
4	2 x deltadrive motor with extension tube	OKIN REFINED	B11360	Q161239580166 5/6
5	4 x DC MOTOR	OKIN REFINED	ZYT-36S-42	201612050 1019/1038/1030/1024
6	2 x Wired Remote Control	Magni Smartech	Not stated	Not stated

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):
☒ Transmitting at maximum power in Bluetooth LE mode with modulation, maximum possible data length available and Pseudorandom Bit Sequence 9.

4.2. Configuration and Peripherals

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

- The EUT was powered via an AC/DC power adapter for the radiated spurious emissions tests.
- Transmit tests: To place the EUT into Bluetooth LE test mode and to set the required test channels, the EUT was connected with the USB cable and the USB/TTL UART converter to the laptop PC. Operating channels were selected using the third party test software “nRFgo Studio”.
- The EUT radiated sample was used for AC conducted emissions and radiated spurious emissions tests.
- AC conducted line emissions were performed with EUT and load i.e. motor accessories (4 motors).
- Radiated spurious emissions below 30 MHz were performed with the EUT positioned on the turn table and rotating 360 degrees.
- Radiated spurious emissions above 30 MHz 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.
- 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:	Bernd Woerl	**Test Date:**	17 December 2018
Test Sample Serial Number:	201702-A004756002		
Test Site Identification	SR 7/8		

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

Environmental Conditions:

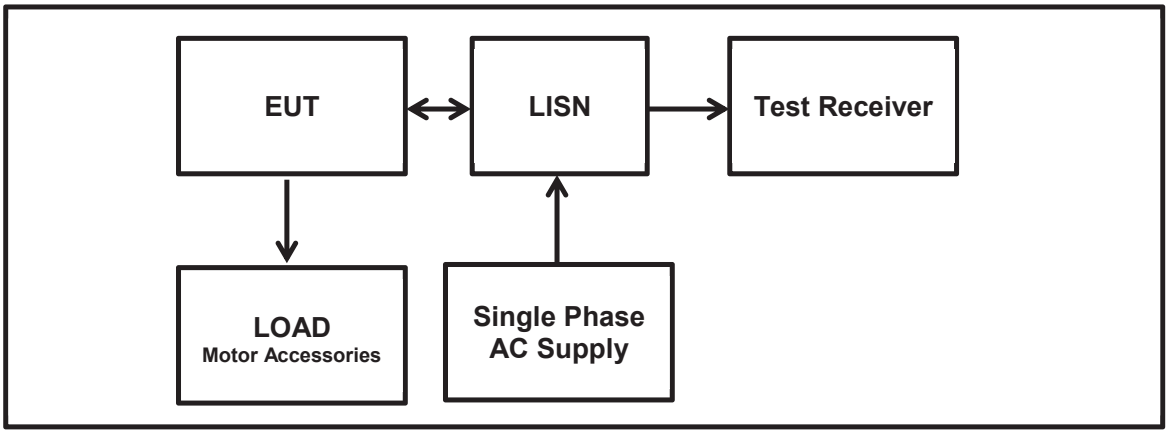
Temperature (°C):	23
Relative Humidity (%):	35

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. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
3. Measurements were performed in shielded room (SR7/ 8 Asset Number 1603671). The EUT was placed at a height of 80 cm above the reference ground plane and in a distance of 40 cm from the vertical ground plane at the edge of the table.
4. The EUT was operated on Test Channel Top.
5. AC conducted line emissions were performed with EUT & load i.e. motor accessories (4 motors).

Transmitter AC Conducted Spurious Emissions (continued)

Test setup:



Transmitter AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak Detector (QP)

Frequency (MHz)	Line	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	QP Result
0.15594	Live	42.0	65.7	23.7	Complied
0.17193	Live	42.7	64.9	22.2	Complied
0.27796	Live	26.0	60.9	34.9	Complied
0.37902	Live	22.6	58.3	35.7	Complied
0.61315	Live	25.6	56.0	30.4	Complied
11.39484	Live	29.2	60.0	30.8	Complied

Results: Live / Average Detector (AV)

Frequency (MHz)	Line	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dB)	AV Result
0.15594	Live	17.8	55.7	37.9	Complied
0.17193	Live	18.7	54.9	36.2	Complied
0.27796	Live	12.2	50.9	38.7	Complied
0.37902	Live	9.9	48.3	38.4	Complied
0.61315	Live	11.3	46.0	34.7	Complied
11.39484	Live	14.0	50.0	36.0	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Results: Neutral / Quasi Peak Detector (QP)

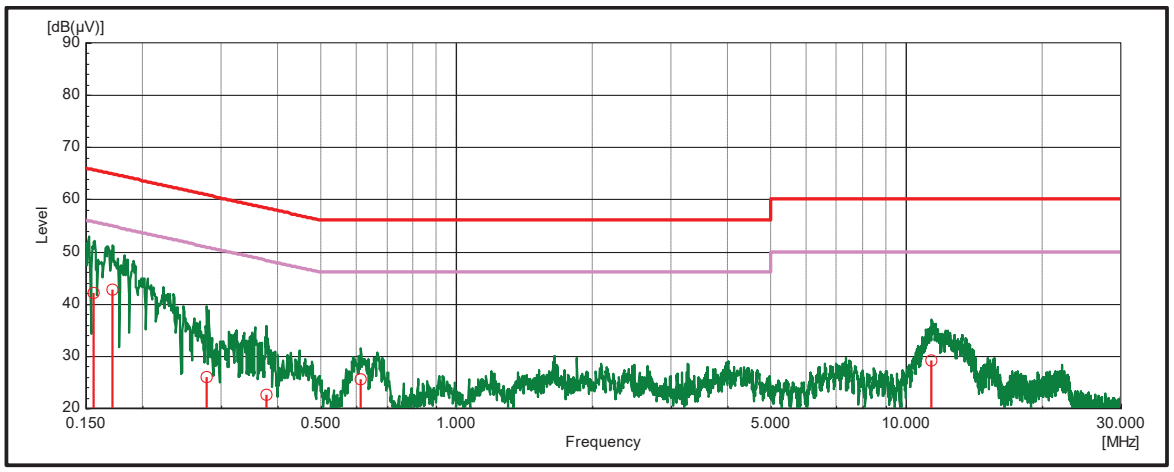
Frequency (MHz)	Line	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dB)	QP Result
0.15376	Neutral	44.8	65.8	21.0	Complied
0.19835	Neutral	33.7	63.7	30.0	Complied
0.24902	Neutral	29.1	61.8	32.7	Complied
0.33951	Neutral	25.6	59.2	33.6	Complied
0.60798	Neutral	23.0	56.0	33.0	Complied
11.49747	Neutral	29.5	60.0	30.5	Complied

Results: Neutral / Average Detector (AV)

Frequency (MHz)	Line	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dB)	AV Result
0.15376	Neutral	19.3	55.8	36.5	Complied
0.19835	Neutral	15.2	53.7	38.5	Complied
0.24902	Neutral	12.9	51.8	38.9	Complied
0.33951	Neutral	11.5	49.2	37.7	Complied
0.60798	Neutral	10.0	46.0	36.0	Complied
11.49747	Neutral	14.3	50.0	35.7	Complied

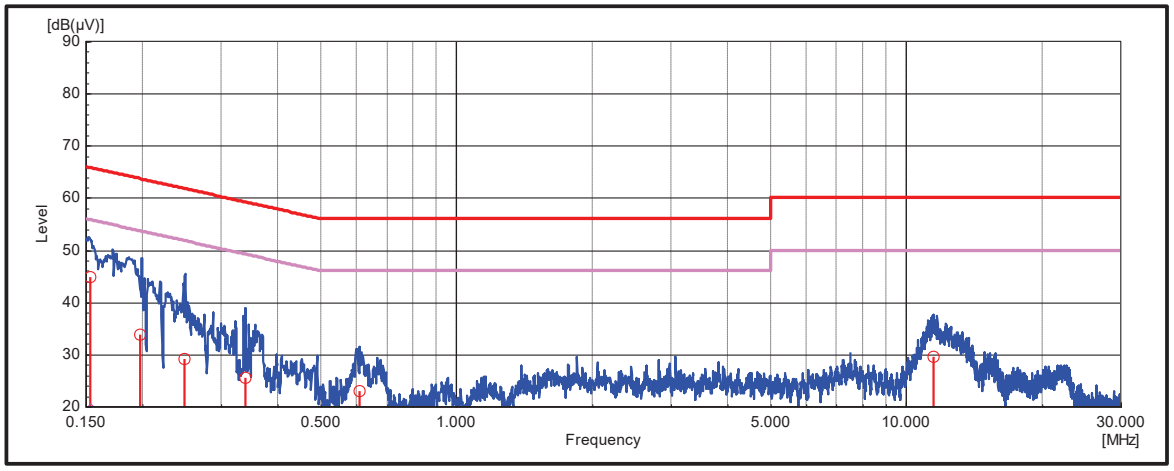
Result: Pass

Plot: Live Line



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

Plot: Neutral Line



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

5.2.2. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Segun Adeniji	**Test Date:**	24 & 28 January 2019
Test Sample Serial Number:	201702-A004756003		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(a)(2)
Test Method Used:	FCC KDB 558074 Section 8.2 referring ANSI C63.10:2013 Section 11.8.1 Option 1

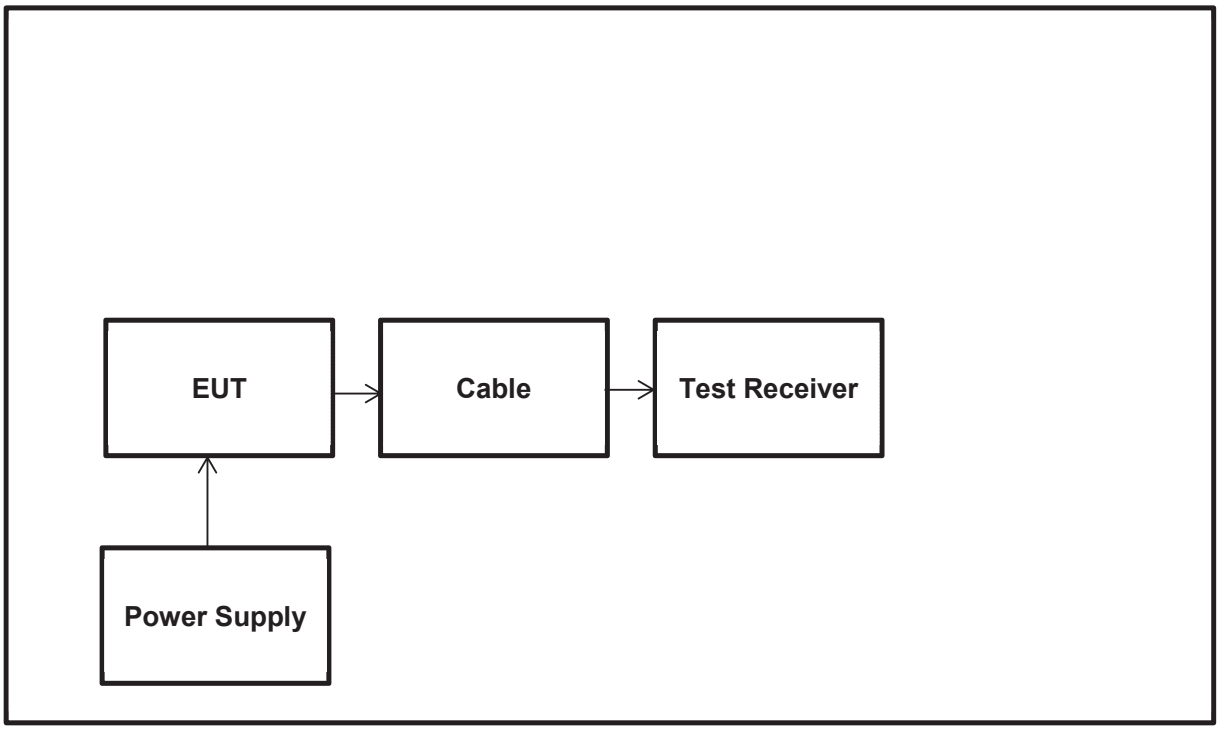
Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	38

Note(s):

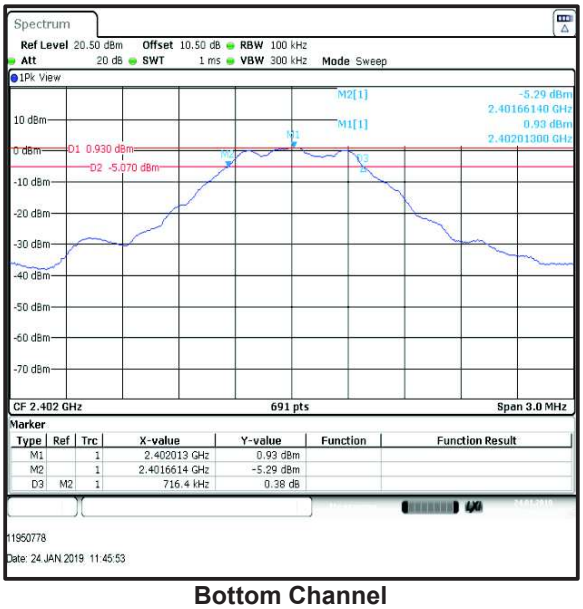
1. 6 dB DTS bandwidth tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.2 referring ANSI C63.10 Section 11.8 (11.8.1 Option 1 measurement procedure). The spectrum analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
2. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

Test Setup:

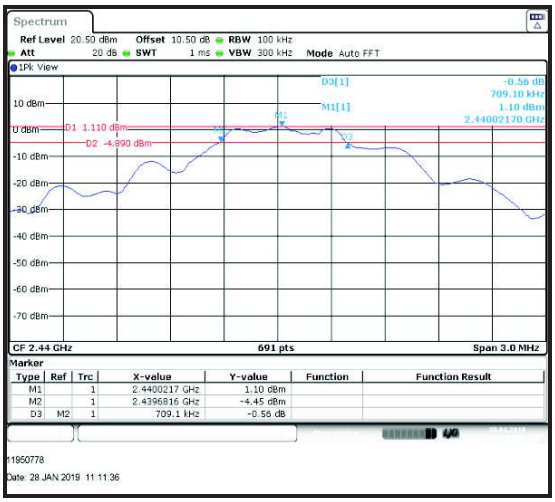


Results:

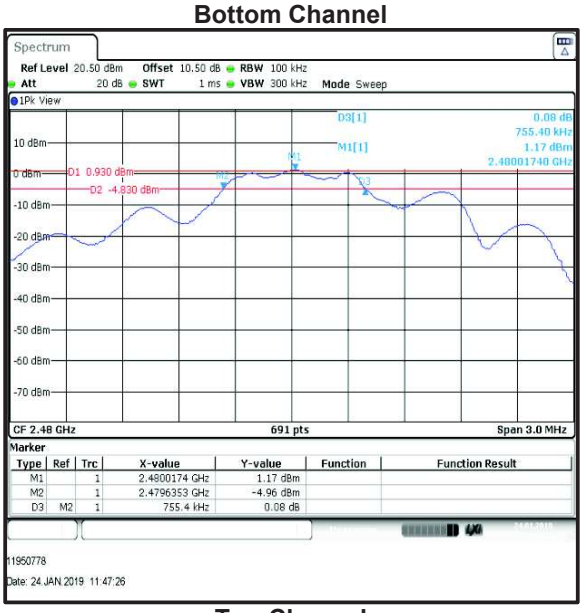
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	716.4	≥500	216.4	Complied
Middle	709.10	≥500	209.1	Complied
Top	755.4	≥500	255.4	Complied



Bottom Channel



Middle Channel



Top Channel

Result: Pass

5.2.3.Transmitter Duty Cycle

Test Summary:

Test Engineer:	Segun Adeniji	**Test Date:**	24 January 2019
Test Sample Serial Number:	201702-A004756003		
Test Site Identification	SR 9		

FCC Reference:	Part 15.35(c)
Test Method Used:	FCC KDB 558074 Section 6.0

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	44

Note(s):

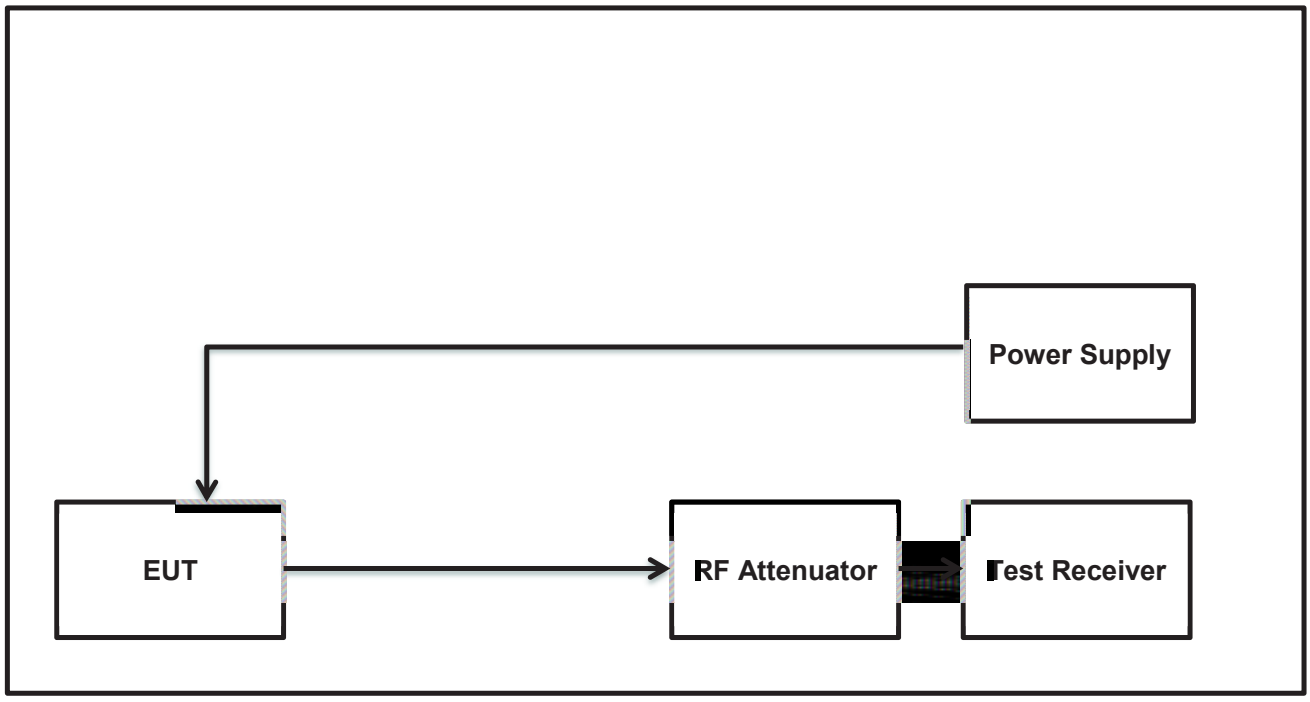
The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by using the following calculation:

BLE duty cycle: 20 log (1 / (431.88 µs/ (626.09) µs))

= 20 log (1 / (431.88 µs/ (626.09) µs))

= 3.22 dB

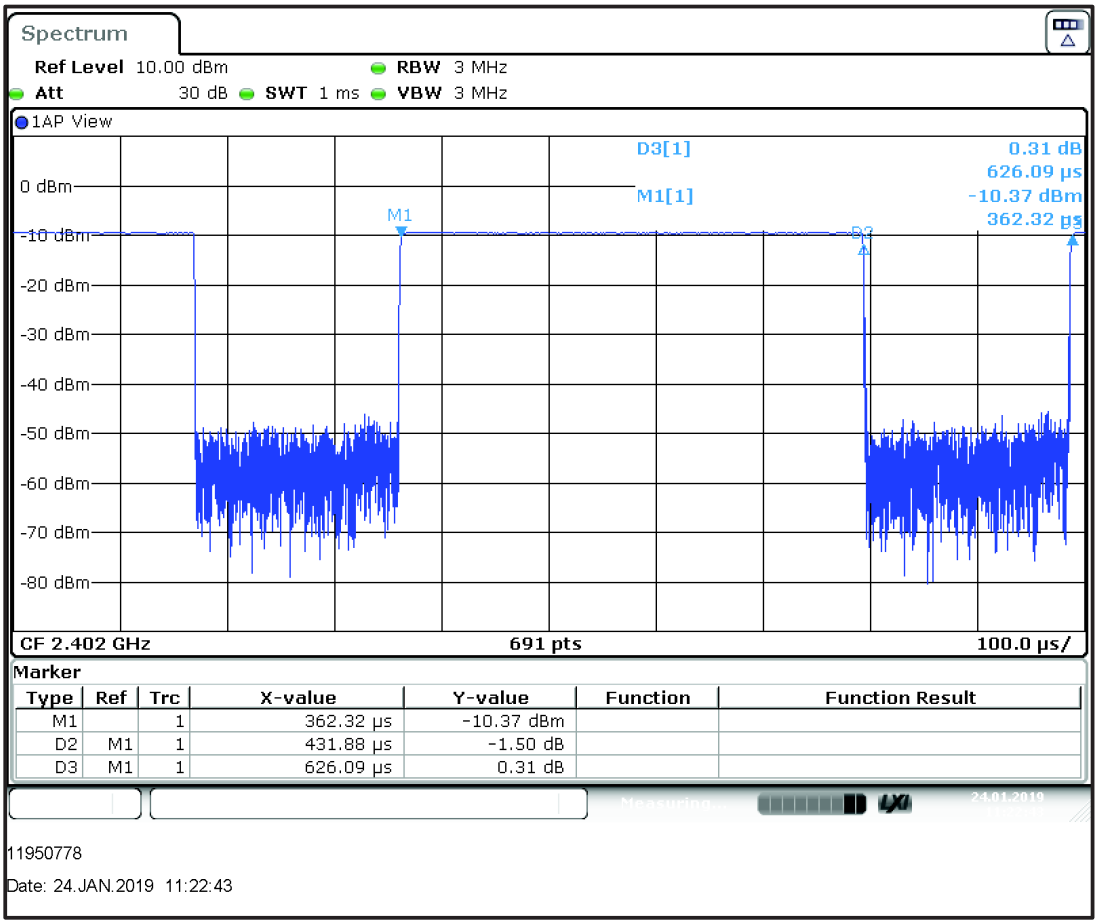
Transmitter Duty Cycle Test setup:



Transmitter Duty Cycle continued

Results:

Pulse Duration (µs)	Period (µs)	Duty Cycle Correction (dB)
431.88	626.09	3.22



5.2.4. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Segun I. Adeniji	**Test Date:**	24 January 2019
Test Sample Serial Number:	201702-A004756003		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Section 8.3.1 referring ANSI C63.10 Section 11.9.1.1

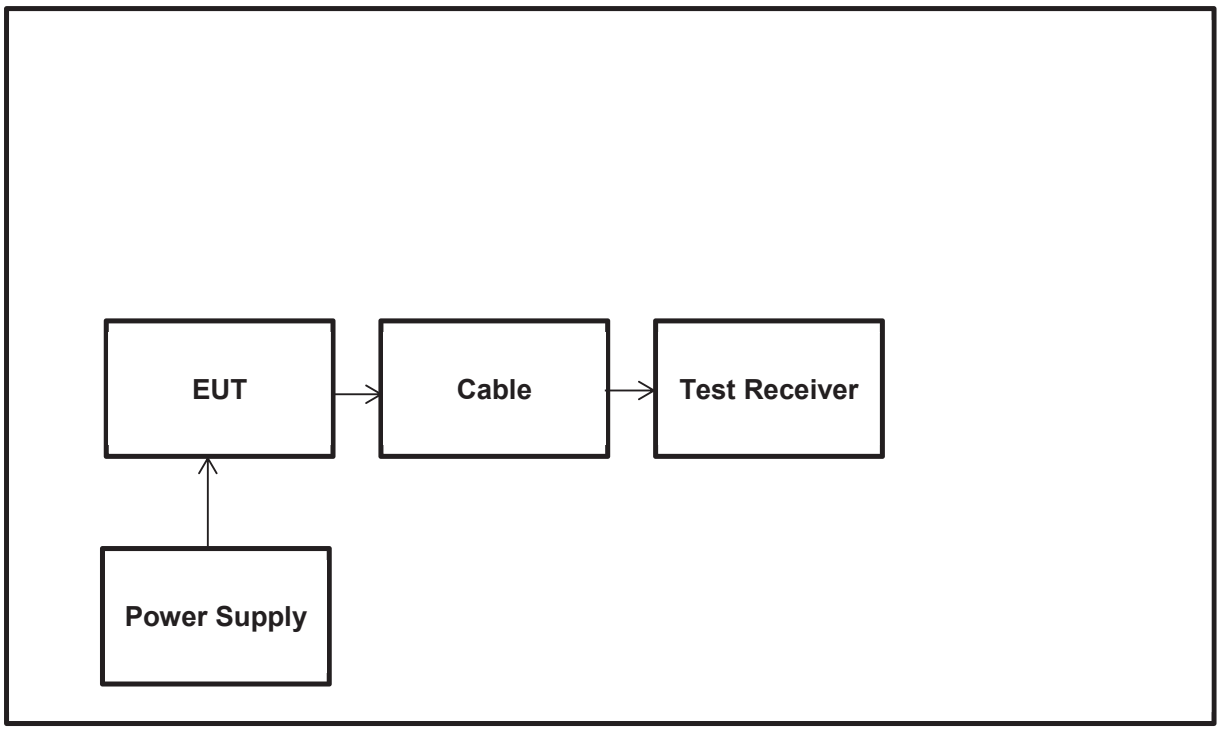
Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	38

Note(s):

1. Conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.3.1 with the RBW ≥ *DTS bandwidth* referring ANSI C63.10 Section 11.9.1.1.
2. The signal analyser resolution bandwidth was set to 1 MHz and video bandwidth of 3 MHz. 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 at the peak of the signal and the results recorded in the table below.
3. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.
4. The measurement was made with highest possible duty cycle
5. The declared antenna gain was added to conducted power to obtain the EIRP.
6. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors. The RF cable attenuation (0.5 dB@2.4GHz) from the EUT to Analyzer including the 10 dB attenuation at the Spectrum Analyzer input was added as a reference level offset (10.5 dB) to each of the conducted plots.

Test setup:

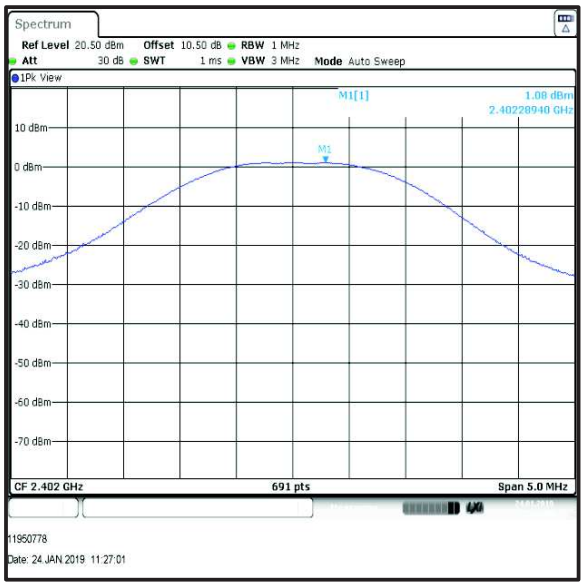


Results:

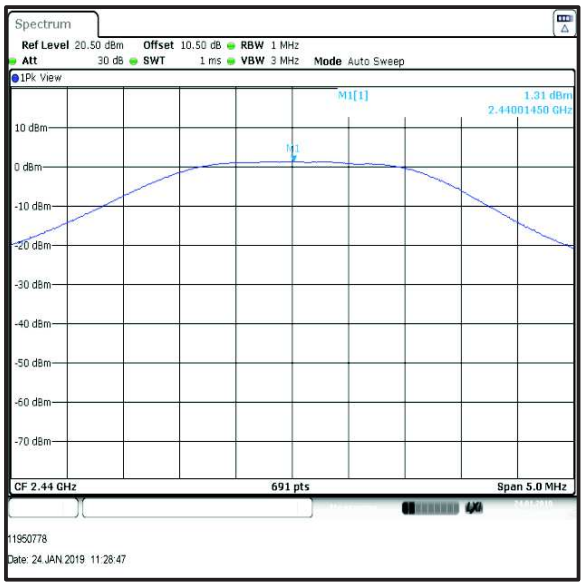
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	1.08	30.0	28.92	Complied
Middle	1.31	30.0	28.69	Complied
Top	1.23	30.0	28.77	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1.08	-1.0	0.08	36.0	35.92	Complied
Middle	1.31	-1.0	0.31	36.0	35.69	Complied
Top	1.23	-1.0	0.23	36.0	35.77	Complied

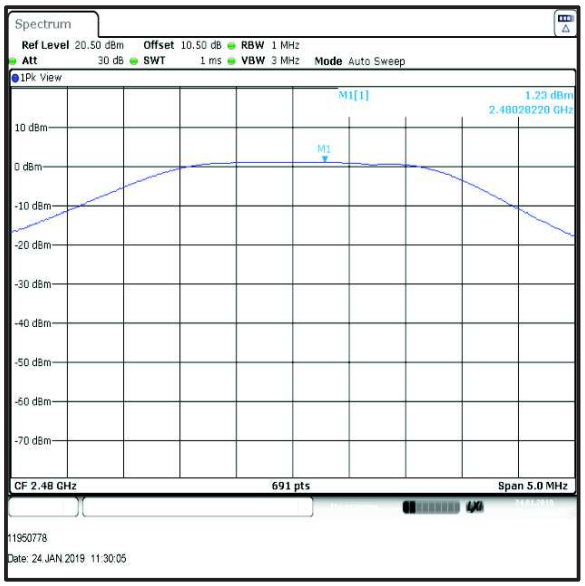
Transmitter Peak Output Power continued



Bottom Channel



Middle Channel



Top Channel

Result: Pass

5.2.5. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	28 March 2019
Test Sample Serial Number:	201702-A004756002		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referring ANSI C63.10 Sections 11.10 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.4
Frequency Range	9 kHz to 30 MHz

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	29

Settings of the Instrument

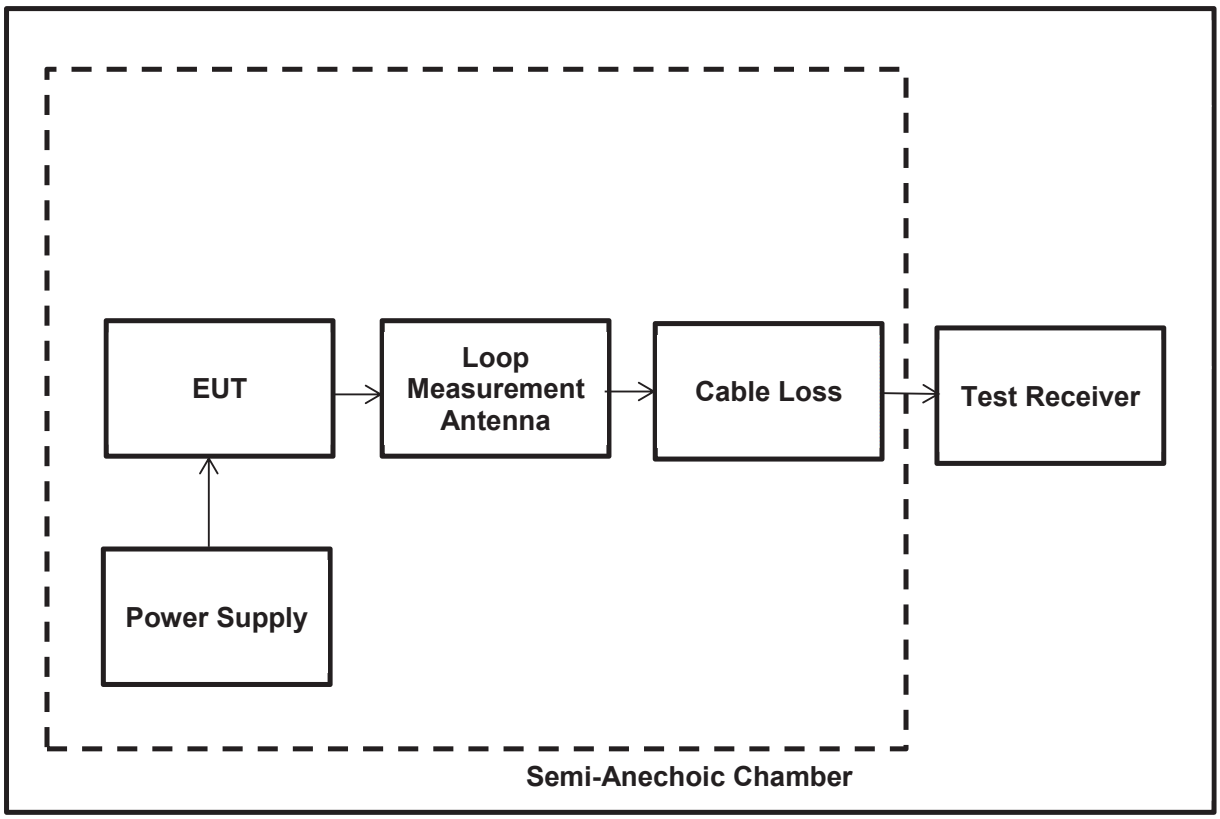
Frequency Range	RBW	VBW	Detector
9 kHz-150 kHz	300 Hz	1 kHz	Peak Detector
150 kHz-30 MHz	10 kHz	30 kHz	Peak Detector

Note(s):

1. In accordance with FCC KDB 414788 D01. Instead of an OATS a Semi Anechoic Chamber was used where evidence was shown that the behaviour is the same. A maximum deviation of 1.69 at 9 kHz was observed. This deviation is also taken into account to the result.
2. The limits are specified either at a test distance of 300 or 30 metres. However, as specified by FCC Section 15.31 (f)(2), measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor.
3. The measurement was performed at a measurement distance of 3 m where field strength of X dBuV/m was measured.
    - 9 kHz- 490 kHz: measured level extrapolated to a distance of 300 m by subtracting 80 dB from the result.
    - 490kHz-1705 kHz: measured level extrapolated to a distance of 30 m by subtracting 40 dB from the result.
4. The preliminary scans showed similar emission levels below 30 MHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the Top channels only.
5. All 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. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
6. Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined.
7. A transducer factor was used on the spectrum analyser during open field tests. This factor includes correction between the fixed gain of the magnetic loop antenna and the calibration values. It also includes the value of the RF cable used to connect the antenna to the spectrum analyser which was incorporated into the annual calibration of the magnetic loop antenna.

8. Pre-scans were performed and markers placed on the highest measured levels. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
9. Since the field strength level measured with peak detector were below the quasi peak limit, hence no quasi-peak detector measurements were required.

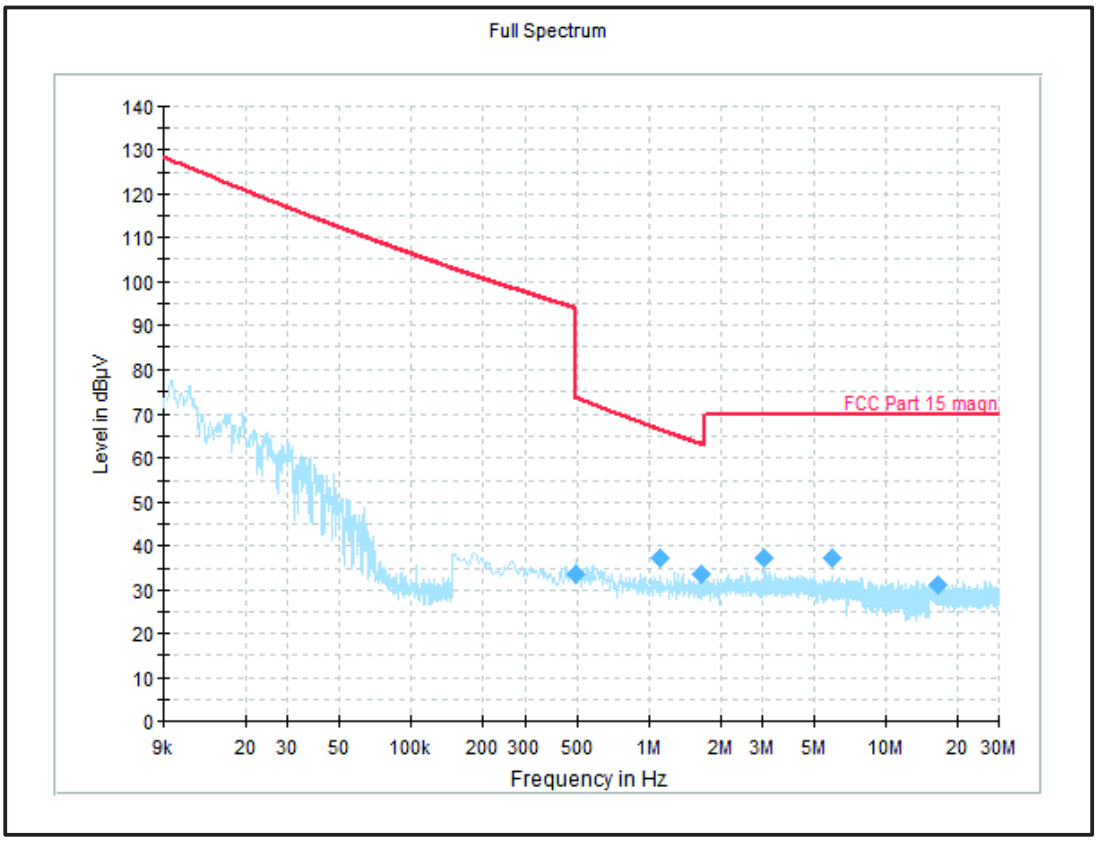
Transmitter Radiated Emissions Test setup



Results: Top Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
0.490	V	33.74	73.79	40.05	Complied
1.115	H	37.44	66.46	29.02	Complied
1.658	V	33.74	63.19	29.45	Complied
3.063	V	37.44	70.00	32.56	Complied
5.954	V	37.44	70.00	32.56	Complied
16.463	H	30.93	70.00	39.07	Complied

Plot: 9 kHz – 30 MHz



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	04 & 19 December 2018
Test Sample Serial Number:	201702-A004756002		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referring ANSI C63.10 Sections 11.10 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	28

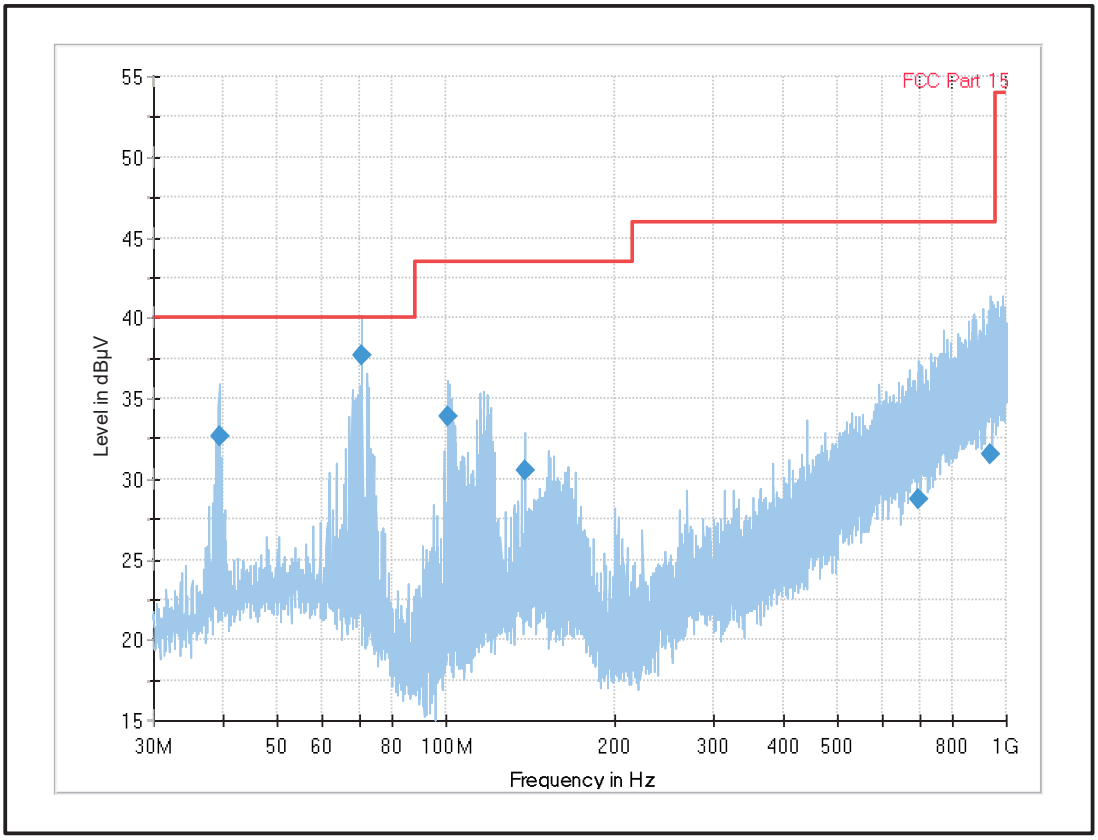
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The 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 Bottom & Top channels only.
3. All 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. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
4. 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.
5. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
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. 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 CISPR quasi-peak detector and span big enough to see the whole emission.

Results: Bottom Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
39.315	H	32.69	40.00	7.31	Complied
70.635	V	37.70	40.00	2.30	Complied
100.785	V	33.90	43.50	9.60	Complied
138.585	H	30.53	43.50	12.97	Complied
698.000	V	28.78	46.00	17.22	Complied
935.625	H	31.59	46.00	14.41	Complied

Plot: 30 MHz – 1GHz



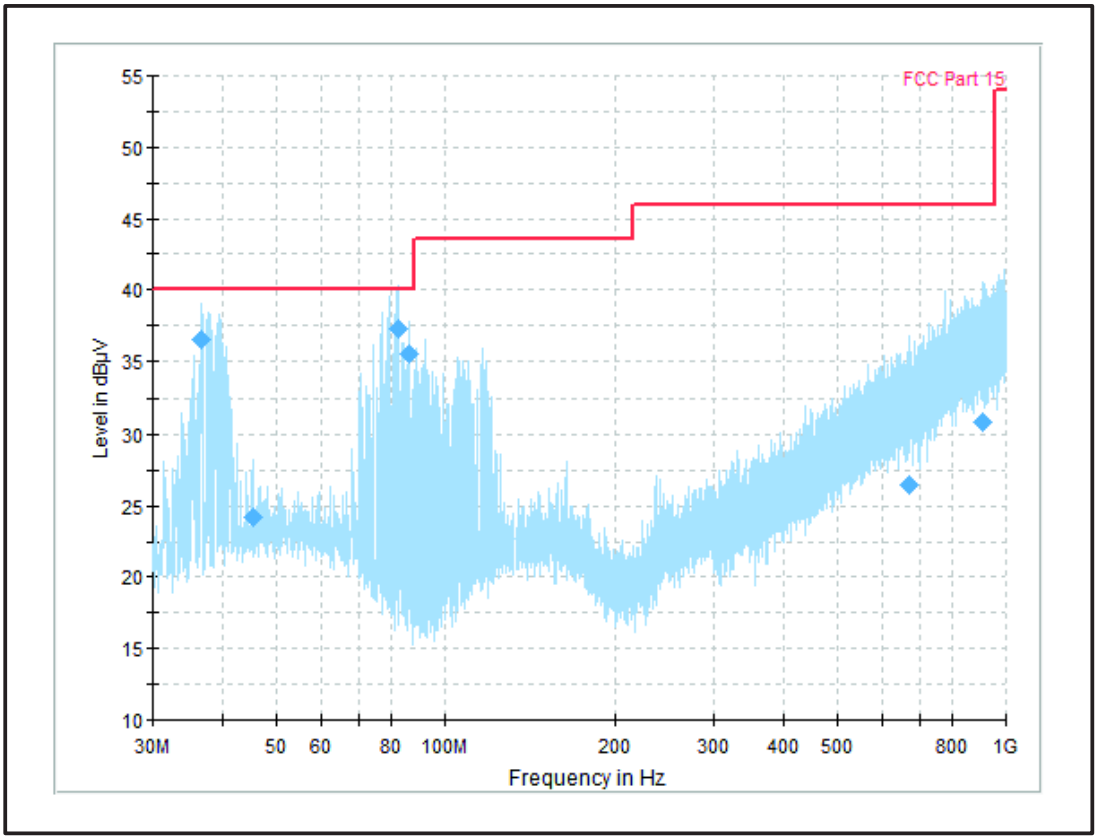
Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Result: Pass

Results: Top Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
36.750	V	36.48	40.00	3.52	Complied
45.435	V	24.21	40.00	15.79	Complied
82.245	V	37.33	40.00	2.67	Complied
86.115	v	35.48	40.00	4.52	Complied
670.958	H	26.52	46.00	19.48	Complied
906.583	H	30.83	46.00	15.17	Complied

Plot: 30 MHz – 1GHz



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	04,13,19 December 2018 15,28 January 2019
Test Sample Serial Number:	201702-A004756002		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.5 & 8.6 referring ANSI C63.10 Sections 11.10 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.6
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	29

Note(s):

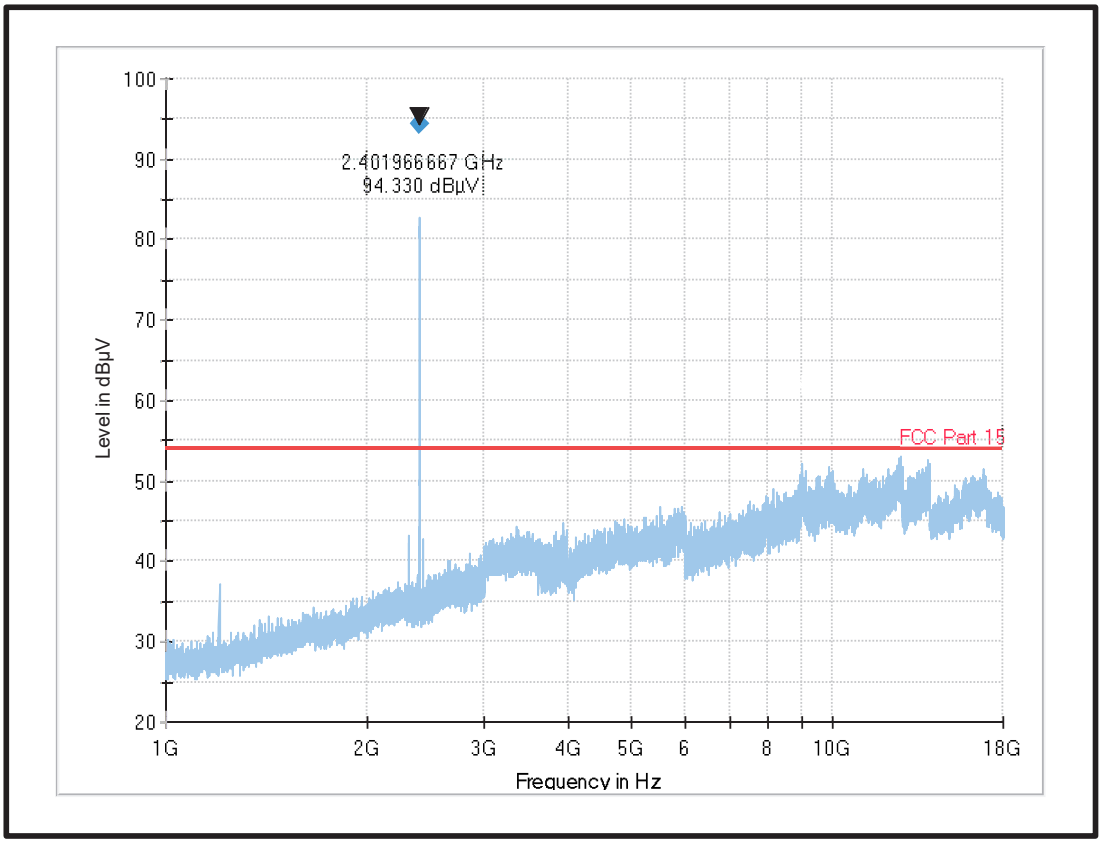
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
3. 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 above. 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.
4. The emission shown on the 2.4 GHz is the EUT fundamental.
5. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) 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 K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
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.
7. *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.
8. The reference level for the emission in the non-restricted band was established by following KDB 558074 Section 8.5 referring Section 11.11 of ANSI C63.10.
9. **-20 dBc limit applies in non-restricted band as the conducted output power measurements were performed using a peak detector.

Transmitter Radiated Emissions (continued)

Results: Peak / Bottom Channel

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

Plot: 1 GHz – 18GHz (bottom channel)



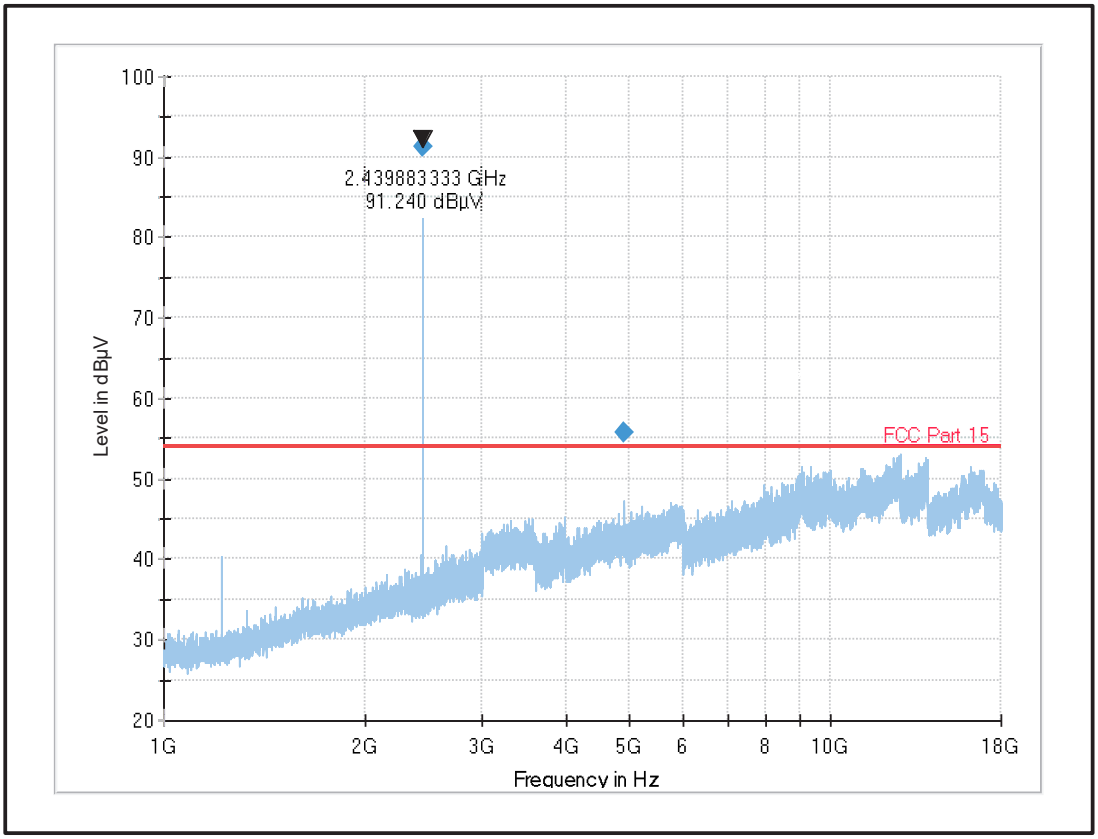
Note: The above plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

Result: Pass

Results: Peak & Average / Middle Channel

Frequency (MHz)	Antenna Polarization	Measured RMS Level (dBµV/m)	Duty Cycle Correction (dB)	Corrected RMS Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4880.560	V	49.28	3.22	52.50	54.00	1.50	Complied

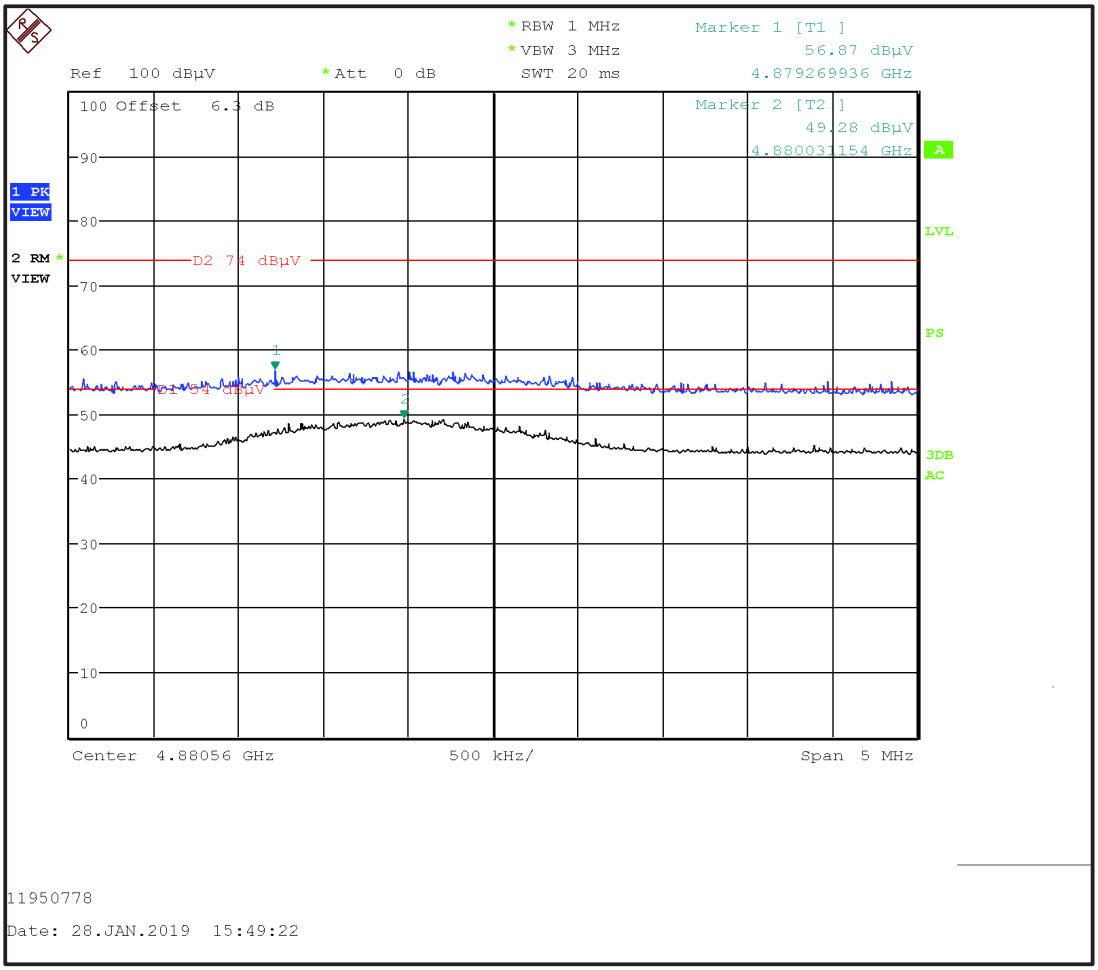
Plot: 1 GHz – 18GHz (middle channel)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Result: Pass

Plot: RMS Measurements @ 4.88 GHz (middle channel)

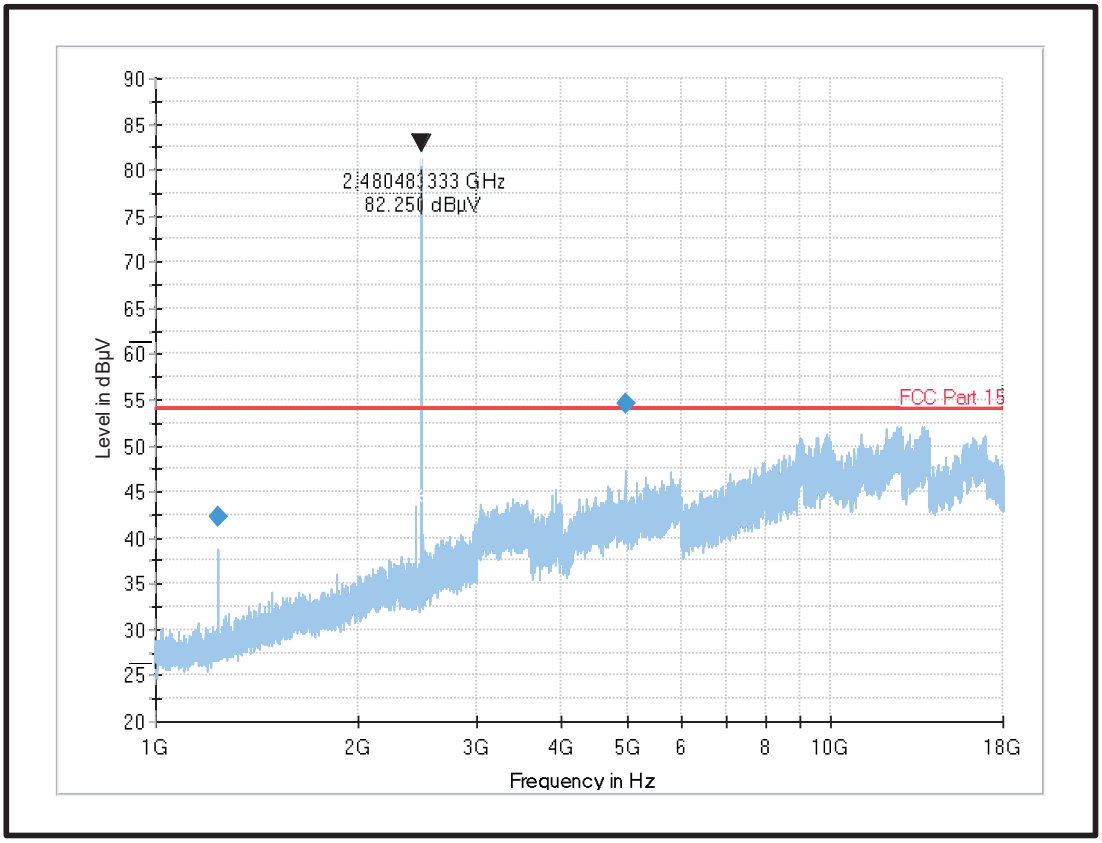


Result: Pass

Results: Peak & Average / Top Channel

Frequency (MHz)	Antenna Polarization	Measured RMS Level (dBµV/m)	Duty Cycle Correction (dB)	Corrected RMS Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4960.000	V	45.18	3.22	48.40	54.00	5.60	Complied

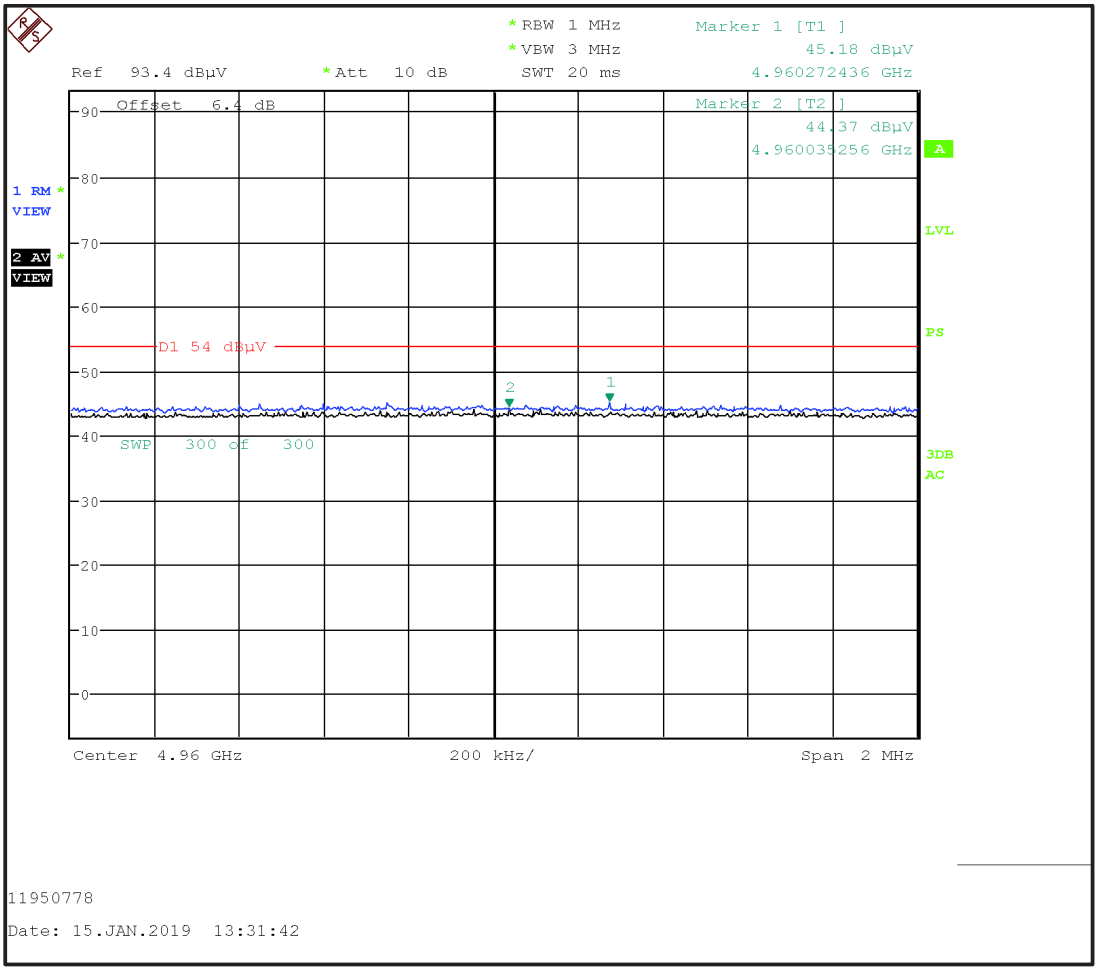
Plot: 1 GHz – 18GHz (top channel)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Result: Pass

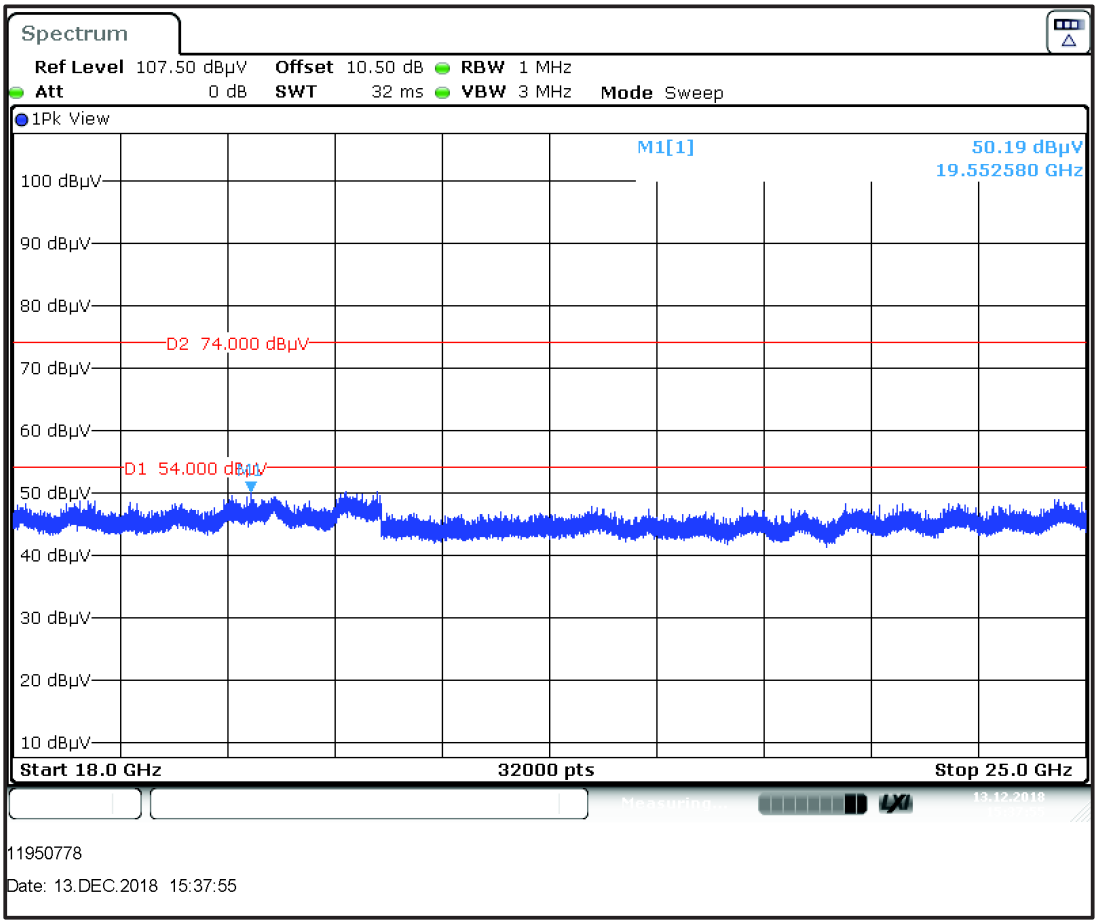
Plot: Re-Measurements for top channel



Result: Pass

Transmitter Radiated Emissions (continued)

Plot: 18 GHz – 25 GHz (top channel)



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

Result: Pass

5.2.6. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	19 December 2018
Test Sample Serial Number:	201702-A004756002		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	FCC KDB 558074 Sections 8.7 ANSI C63.10:2013 Section 6.10.4, 6.10.5 & Section 11.11

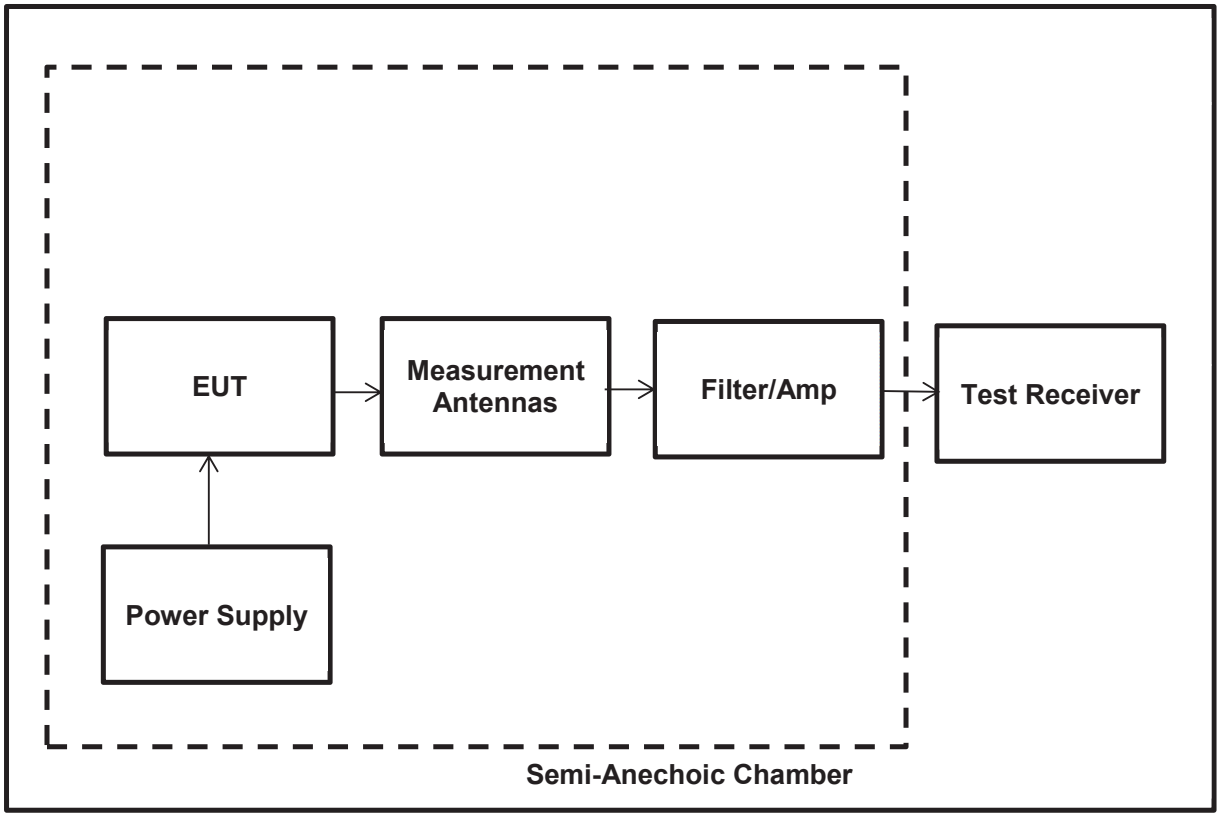
Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	29

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 maximum peak conducted output power was previously measured. In accordance with FCC KDB 558074 Section 8.7.1, the lower band edge measurement was performed with a peak detector and the -20 dBc limit applied.
3. As the lower band edge falls within a non-restricted band, 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 conducted (average) output power was measured using an RMS detector in accordance with FCC KDB 558074 Section 9.2.2.4 an out-of-band limit line was placed 30 dB (FCC KDB 558074 Section 11.1(b)) below the peak level. 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.
4. 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 10 Hz. 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 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. The Top channel final measurement was performed with Integrated measurement method as provided by ANSI C63.10:2013 Section 6.10.5
5. 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.
6. Appropriate reference level was set in order to achieve sufficient headroom.

Test Setup:


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

Results: Lower Band Edge/Peak

Frequency (MHz)	Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2396.59	79.62	110.56	30.94	Complied
2400.00	81.52	110.56	29.04	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2347.94	55.79	74.0	18.21	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

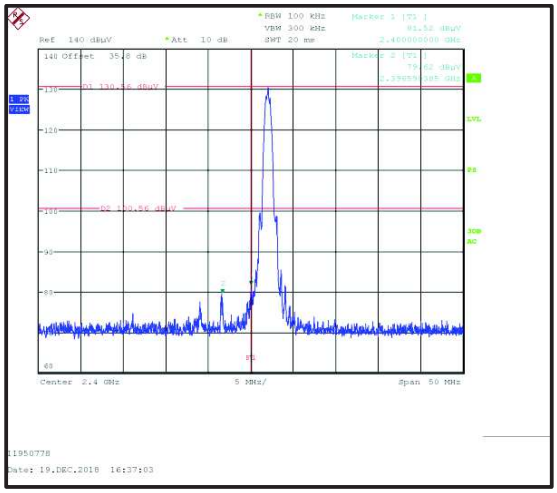
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2389.23	44.57	54.0	9.43	Complied

Results: Upper Band Edge / Restricted Band / Peak

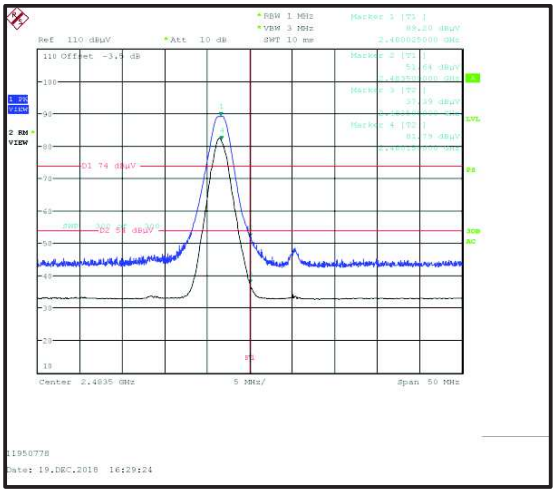
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.50	51.64	74.0	22.36	Complied

Results: Upper Band Edge / Restricted Band / Average

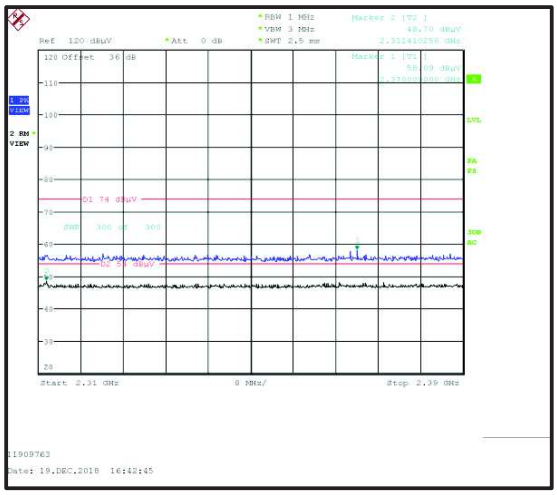
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.50	37.39	54.0	16.61	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak / Average Measurement



2310 MHz to 2390 MHz Restricted Band Plot

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
Conducted Maximum Peak Output Power	95%	±0.59 dB
Radiated Spurious Emissions	95%	±3.10 dB
Band Edge Radiated Emissions	95%	±3.10 dB
Minimum 6 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
383	Rohde & Schwarz	Antenna, Rod	HFH2-Z1	890151/11	7/14/2017	24
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
460	Deisl	Turntable	DT 4250 S		n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	8/8/2016	36
495	Rohde & Schwarz	Antenna, Log.- Periodical	HL050	100296	7/20/2016	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
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	4/8/2014	60
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
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
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
195	SPS	Power Supply	TOE8842-24	51455	Verified by Multimeter	12
216	Agilent	Multimeter	34401A	US36017458	7/11/2017	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. Open-Area-Test Site comparison

GPS coordinates
48.765746, 9.250684

Test Setup

The following listed equipment was used for the measurement:

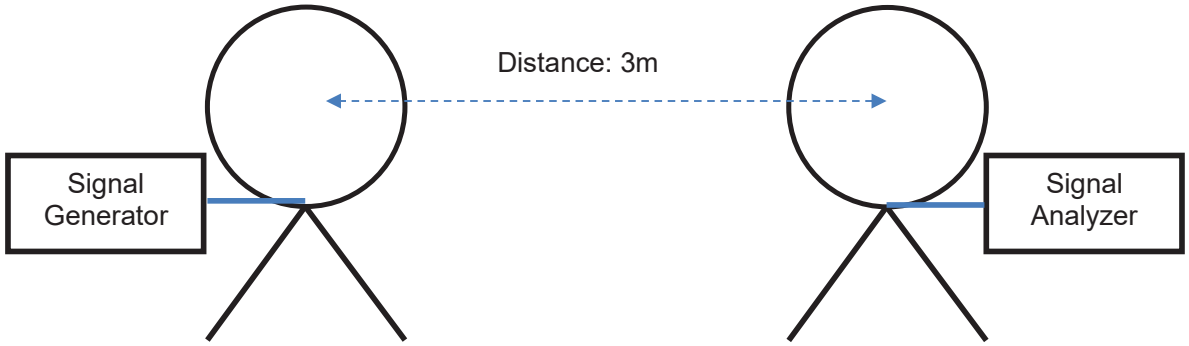
Manufacturer	Type	Model	Frequency Range
Rohde & Schwarz	Receiver, EMI Test	SML03	9 kHz – 30 MHz
Rohde & Schwarz	Receiver, EMI Test	ESIB7	20 Hz – 7 GHz
Rohde & Schwarz	Antenna, Loop	HFH2-Z2	1 kHz – 30 MHz
ETS LINDGREN	Antenna, Loop	6512	1 kHz – 30 MHz
Huber and Suhner	RF Cable	-	-
Elspec	BNC Cable	-	-

The transmit signal to the ETS Lindgren loop antenna is supplied by the SML signal generator.

The distance of the transmit and receive Antenna was 3m. No other distances can be achieved in SR1 so 10m and 30m distances are not possible. Due to this no comparison is possible.

The Results are valid for equipment which is not larger as the loop antenna which represents in the comparison the EUT.
If an EUT is bigger measurements on an OATS are needed.

The measurement was performed on the lowest frequency 9 kHz and was increased by 10 kHz Steps up to 100 kHz. Then the step size was 100 kHz up to 1000 kHz. From 1 MHz up to the last frequency of 30 MHz the step size was 1 MHz. The HFH2-Z2 loop antenna placed at 80 cm height was used as the receive antenna. The intercepted RF signal from this antenna was measured with the ESIB7 Test Receiver and the values were recorded accordingly.



Numeric values

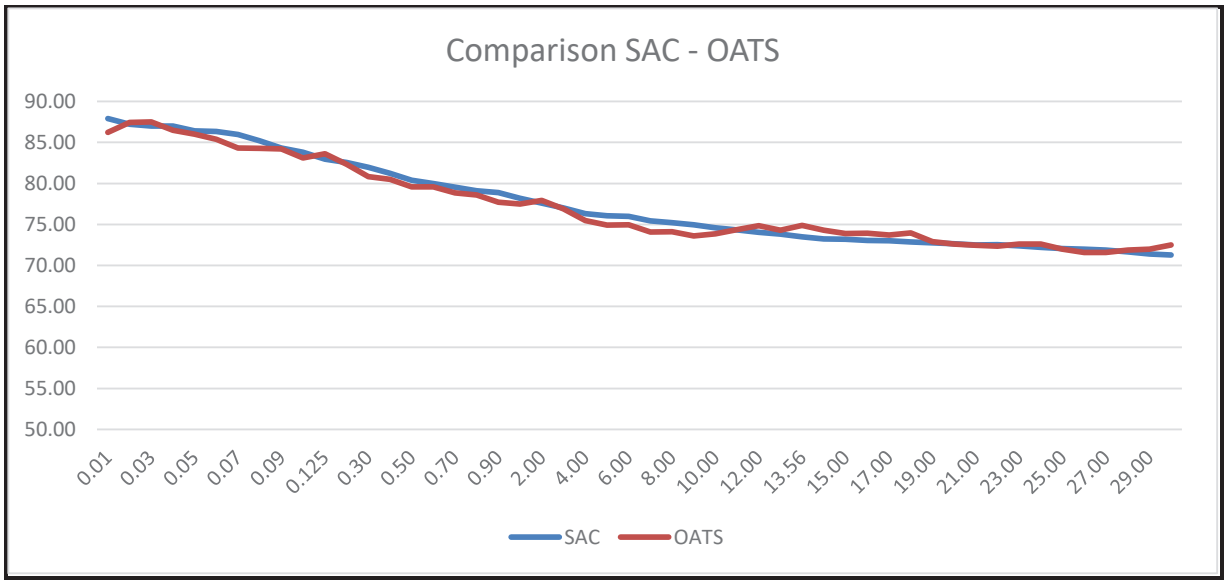
Frequency (MHz)	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**	**0.10**	**0.125**	**0.20**
SR1 Measured power (dBµV)	87.91	87.22	87.01	86.98	86.40	86.32	85.98	85.20	84.30	83.80	82.96	82.55
OATS Measured power (dBµV)	86.22	87.42	87.50	86.49	86.01	85.39	84.32	84.29	84.20	83.10	83.60	82.32
Delta (dB)	-1.69	0.20	0.49	-0.49	-0.39	-0.93	-1.66	-0.91	-0.10	-0.70	0.64	-0.23

Frequency (MHz)	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**	**1.00**	**2.00**	**3.00**	**4.00**	**5.00**
SR1 Measured power (dBµV)	81.98	81.23	80.39	80.00	79.53	79.10	78.87	78.20	77.60	77.01	76.32	76.04
OATS Measured power (dBµV)	80.84	80.49	79.58	79.58	78.85	78.59	77.69	77.50	77.91	76.90	75.45	74.90
Delta (dB)	-1.14	-0.74	-0.81	-0.42	-0.68	-0.51	-1.18	-0.70	0.31	-0.11	-0.87	-1.14

Frequency (MHz)	**6.00**	**7.00**	**8.00**	**9.00**	**10.00**	**11.00**	**12.00**	**13.00**	**13.56**	**14.00**	**15.00**	**16.00**
SR1 Measured power (dBµV)	75.98	75.43	75.20	74.97	74.59	74.32	74.05	73.83	73.50	73.22	73.20	73.05
OATS Measured power (dBµV)	74.94	74.09	74.11	73.58	73.87	74.38	74.84	74.31	74.88	74.29	73.90	73.93
Delta (dB)	-1.04	-1.34	-1.09	-1.39	-0.72	0.06	0.79	0.48	1.38	1.07	0.70	0.88

Frequency (MHz)	**17.00**	**18.00**	**19.00**	**20.00**	**21.00**	**22.00**	**23.00**	**24.00**	**25.00**	**26.00**	**27.00**	**28.00**	**29.00**	**30.00**
SR1 Measured power (dBµV)	73.00	72.86	72.74	72.64	72.50	72.52	72.39	72.20	72.04	71.97	71.86	71.64	71.41	71.27
OATS Measured power (dBµV)	73.70	73.98	72.90	72.60	72.45	72.34	72.59	72.59	71.97	71.59	71.58	71.88	71.98	72.49
Delta (dB)	0.70	1.12	0.16	-0.04	-0.05	-0.18	0.20	0.39	-0.07	-0.38	-0.28	0.24	0.57	1.22

Graph



Conclusion: Maximum difference is 1.69 dB @ 9 kHz

9. Report Revision History

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

--- END OF REPORT ---