TEST REPORT

Test Report No. : UL-RPT-RP-13762846-516-FCC

Applicant	:	Siemens AG
Model No.	:	3WA9111-0EE62
FCC ID	:	2AJRO-TUI600
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

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 1.2 supersede Version 1.1 with immediate effect**
   Test Report No. UL-RPT-RP-13762846-516-FCC Version 1.2, Issue Date 16 NOVEMBER 2021 replaces
   Test Report No. UL-RPT-RP-13762846-516-FCC Version 1.1, Issue Date 16 NOVEMBER 2021, which is no longer valid.
5. Result of the tested sample: **PASS**

Prepared by: Sercan, Usta
Title: Laboratory Engineer
Date: 16 November 2021

Approved by: Ajit, Phadtare
Title: Lead Test Engineer
Date: 16 November 2021

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.

UL INTERNATIONAL GERMANY GMBH
Hedelfinger Str. 61
70327 Stuttgart, Germany
STU.CTECHLab@ul.com

This page has been left intentionally blank.

Table of Contents

1. Customer Information

1.1.Applicant Information

Company Name:	Siemens AG
Company Address:	Siemens Str. 10 D-93055 Regensburg, Germany
Company Phone No.:	-/-
Company E-Mail:	support.electricalproducts.si@siemens.com
Contact Person:	Franziska Spitzer / Jens Witlatschil
Contact E-Mail Address:	franziska.spitzer@siemens.com / jens.witlatschil@siemens.com
Contact Phone No.:	+491733874798 / +491727369182

1.2. Manufacturer Information

Company Name:	Siemens AG
Company Address:	Siemens Str. 10 D-93055 Regensburg, Germany
Company Phone No.:	-/-
Company E-Mail:	support.electricalproducts.si@siemens.com
Contact Person:	Franziska Spitzer / Jens Witlatschil
Contact E-Mail Address:	franziska.spitzer@siemens.com / jens.witlatschil@siemens.com
Contact Phone No.:	+491733874798 / +491727369182

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

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany
Test Firm Registration:	399704

Date information

Order Date:	30 March 2021
EUT arrived:	03 May 2021
Test Dates:	12 May 2021 to 14 May 2021
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(1)	☒	☐	☐	☐
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	☐	☐	☒	☐
Part 15.35(c)	Transmitter Duty Cycle(2)	☒	☐	☐	☐
Part 15.247(e)	Transmitter Power Spectral Density	☐	☐	☒	☐
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	☐	☐	☒	☐
Part 15.247(d)/15.209(a)	Transmitter Radiated Emissions(1)	☒	☐	☐	☐
Part 15.247(d)/15.209(a)	Transmitter Band Edge Radiated Emissions(1)	☒	☐	☐	☐

Note:

1. The EUT is a host product integrating FCC pre-certified radio transmitter module (Model: BLUENRG-M2SA | FCC ID: S9NBNRGM2SA). Therefore, only partial testing is performed [refer section 3.4]. For further details refer FCC pre-certified radio transmitter module's (Model: BLUENRG-M2SA | FCC ID: S9NBNRGM2SA), Report No. AR18-0031792-01| Rev. 0 |Issue Date: 2018-10-26 | Issued by: IMQ S.p.A. - Via Quintiliano, 43 – I-20138 Milano.
2. The measurement was performed to assist in the calculation of the average measurements.

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 DTS Meas Guidance v05r02 April 2, 2019
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 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:	Siemens 3WA
Model Name:	ETU600
Model Number:	3WA9111-0EE62
Test Sample Serial Number:	46-44-5A-2F-31-30-30-31-42-55-30-30-30-31-39-35 (Radiated Test Sample)
Hardware Version :	AS05
Firmware Version:	uCA: 01.00.00.00_01.01.00.55
	uCC: 01.00.00.00_01.01.00.13
FCC ID:	2AJRO-TUI600

3.2. Description of EUT

The equipment under test, the ETU600 Electronic Trip Unit, is a Communication Gateway for ACBs 3WA which incorporates a TUI600 Radio unit which, in turn, contains a pre-certified Bluetooth Low Energy radio module.

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	24 V DC	
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	**Channel ID**	**RF Channel**	**Channel Frequency (MHz)**
	Bottom	37	2402
	Middle	17	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 with Siemens Software config tool Version: 2020_12_17	HP	HP Probook 650 G1	5CG614419V
2	DC Power Cable (0.2 m)	N/A	N/A	N/A
3	USB-cable (1m) Typ A to Typ C	N/A	N/A	N/A

B. Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	4 X Current Transformers (Round Coils)	Siemens	3WL9112-8AK46-0AA0	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):
☒ Transmitter Mode: Continuous transmissions with modulated carrier with the combination of BT-LE Test Mode: 1 Mbps | Pseudorandom Bit Sequence 9 (PRBS9) | Maximum Power

4.2. Configuration and Peripherals

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

- The following customer supplied test setup instruction was used
  - "3WA_ETU-CCC-Aprobation_TUI600_2020_012_22.pdf, issue date 2020-18-12".

EUT Power Supply:

- The EUT was connected to 24 V DC supplied by laboratory power supply.

Test Mode Activation:

- The required test modes, test channels were activated via USB-cable connection using the Configuration Tool , firmware version D01000000_01010009.
- The commands sent from ` Configuration Tool ´ application were used to enable continuous transmission (PRBS9) mode and to select the test channels as required.
- The transmitter test modes were configured to maximum power settings (MAX PWR) configured by the customer.
- As the EUT continuous transmission of the EUT (D ≥ 98%) cannot be achieved and EUT was transmitting continuously with a constant Duty Cycle of 61.78% (duty cycle variations are less than ±2%). Therefore, a Duty Cycle Correction Factor of 2.09 dB was added to all average measurements, to compute the corrected average values of the emissions that would have been measured had the test been performed at 100% Duty Cycle.

Radiated Measurements:

- In accordance with ANSI C63.10 section 5.10.7, the EUT allows for the connection of external accessories, including external electrical control signals; hence EUT has been tested with the 4 Current Transformers which form part of a system, were used for radiated spurious emission, radiated band edge & AC conducted emission measurements.
- In accordance with ANSI C63.10 section 5.10.7, emission tests shall be performed with the EUT and accessories configured in a manner that tends to produce maximum emissions; therefore 4 Current Transformers were used.
- Before starting final radiated spurious emission measurements "worst case verification" with the EUT with it's accessories in Standing-position & Laying-position was performed by Lab.
- EUT in Standing Position was found to be the worst case therefore this report includes relevant results.
- The radiated spurious emissions below 30 MHz were performed with the EUT positioned on the turn table and rotating 360 degrees while the loop antenna height was set to 80 cm.
- The radiated bandedge emissions and spurious emissions above 9 kHz 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.
- R&S®EMC32 Measurement Software V10.60.10 Software was used for these measurements.

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:	Krume Ivanov	**Test Date:**	12 May 2021
Test Sample Serial Number:	46-44-5A-2F-31-30-30-31-42-55-30-30-30-31-39-35 (Radiated Test Sample)		
Test Site Identification	SR 7/8		

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

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	43

Settings of the Instrument

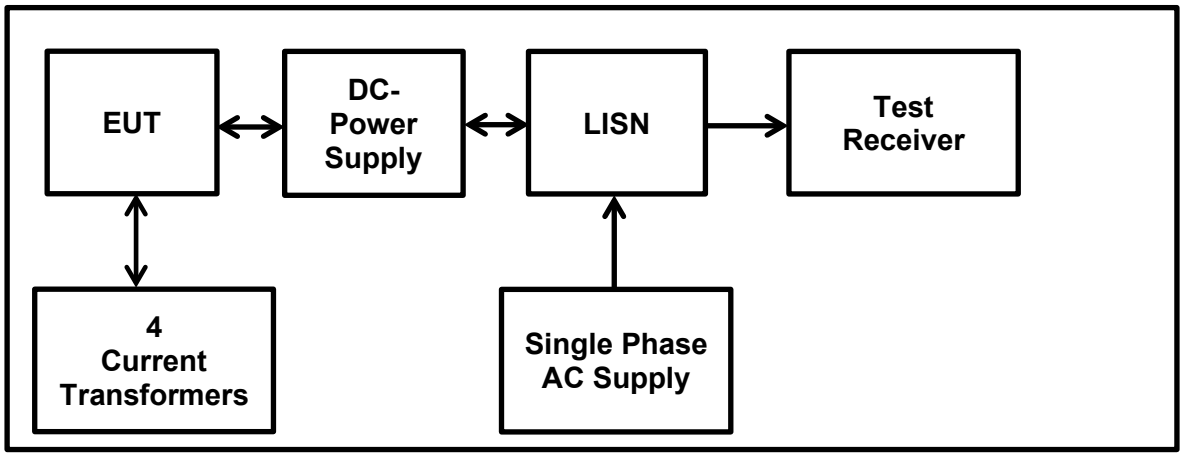
Detector	Quasi Peak/ Average Peak

Note(s):

1. The EUT was connected to 24 V DC supplied by laboratory power supply which in turn was connected to 120 VAC / 60 Hz single phase supply via a LISN.
2. In accordance with FCC KDB 174176 Q4, tests were also performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the 100-240 VAC~50/60 Hz power supply.
3. The EUT was configured inon BT-LE Test mode on the Middle Channel.
4. 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.
5. Measurement software used: Toyo EMI Software; CE measurement software EP5/CE Ver 4.0.1.
6. All other emissions shown on the pre-scan plot were investigated. Only the highest 6 emissions have been reported in the tables below in accordance with ANSI C63.10 section 6.2.5.
7. The final measured value, for the given emission, in the table below incorporates the cable loss. Calculation: Level = test receiver reading + path loss (cable attenuation + correction LISN).

Transmitter AC Conducted Spurious Emissions (continued)

Test Setup:



Transmitter AC Conducted Spurious Emissions (continued)

Results: Middle Channel

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1669	Live	18.30	65.10	46.80	Complied
0.2042	Live	17.00	63.40	46.40	Complied
0.3154	Live	13.50	59.80	46.30	Complied
1.2403	Live	7.30	56.00	48.70	Complied
18.5019	Live	12.10	60.00	47.90	Complied
20.8143	Live	19.30	60.00	40.70	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1669	Live	11.90	55.10	43.20	Complied
0.2042	Live	11.60	53.40	41.80	Complied
0.3154	Live	8.30	49.80	41.50	Complied
1.2403	Live	3.40	46.00	42.60	Complied
18.5019	Live	7.50	50.00	42.50	Complied
20.8143	Live	13.90	50.00	36.10	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1512	Neutral	19.90	65.90	46.00	Complied
0.1761	Neutral	17.80	64.70	46.90	Complied
0.2330	Neutral	16.60	62.30	45.70	Complied
0.6715	Neutral	8.00	56.00	48.00	Complied
12.3539	Neutral	9.60	60.00	50.40	Complied
20.8143	Neutral	19.40	60.00	40.60	Complied

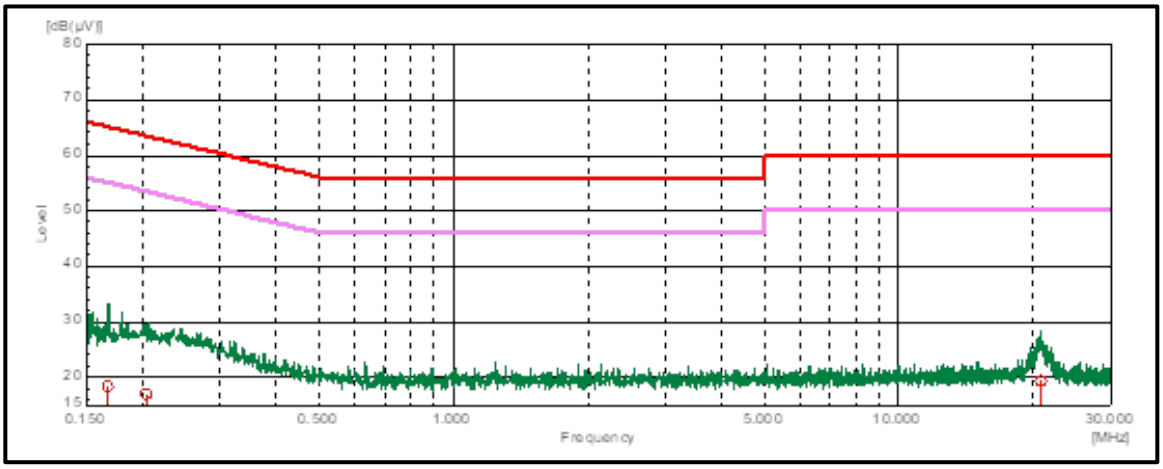
Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
11.7664	Neutral	11.90	55.90	44.00	Complied
11.9207	Neutral	11.60	54.70	43.10	Complied
12.0769	Neutral	11.60	52.30	40.70	Complied
12.2307	Neutral	4.40	46.00	41.60	Complied
12.3891	Neutral	5.40	50.00	44.60	Complied
12.5422	Neutral	13.90	50.00	36.10	Complied

Transmitter AC Conducted Spurious Emissions (continued)

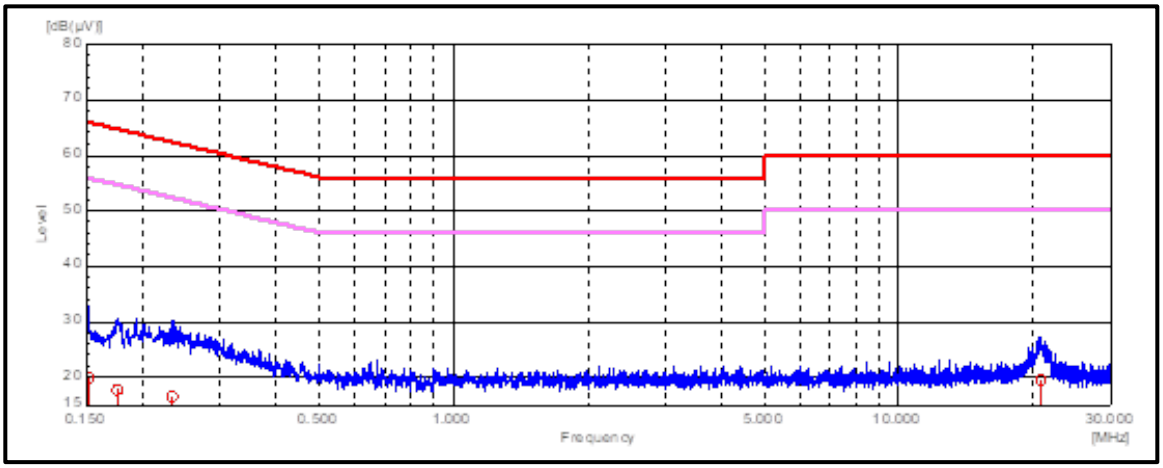
Results: Middle Channel

Plot: Live Line / 120 VAC 60 Hz



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

Plot: Neutral Line / 120 VAC 60 Hz



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

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Results: Middle Channel

Results: Live / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.2063	Live	16.80	63.40	46.60	Complied
0.4101	Live	17.20	57.60	40.40	Complied
0.4614	Live	15.90	56.70	40.80	Complied
0.6014	Live	13.40	56.00	42.60	Complied
17.3034	Live	10.60	60.00	49.40	Complied
20.8402	Live	18.40	60.00	41.60	Complied

Results: Live / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.2063	Live	11.60	53.40	41.80	Complied
0.4101	Live	6.60	47.60	41.00	Complied
0.4614	Live	5.20	46.70	41.50	Complied
0.6014	Live	4.40	46.00	41.60	Complied
17.3034	Live	6.10	50.00	43.90	Complied
20.8402	Live	13.30	50.00	36.70	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1914	Neutral	17.00	64.00	47.00	Complied
0.4282	Neutral	17.20	57.30	40.10	Complied
0.4816	Neutral	15.20	56.30	41.10	Complied
0.5712	Neutral	13.40	56.00	42.60	Complied
2.7735	Neutral	8.40	56.00	47.60	Complied
20.7703	Neutral	18.80	60.00	41.20	Complied

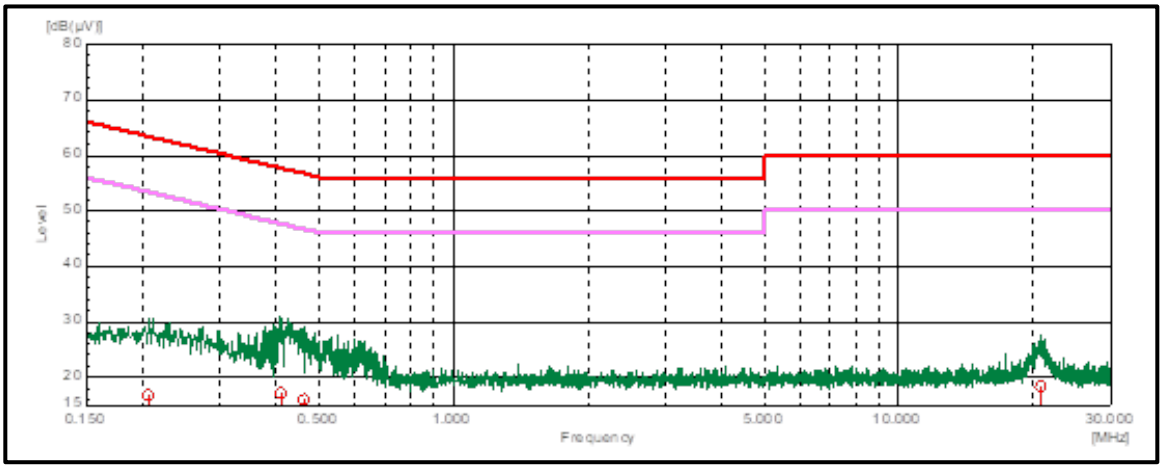
Results: Neutral / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1914	Neutral	11.60	54.00	42.40	Complied
0.4282	Neutral	6.60	47.30	40.70	Complied
0.4816	Neutral	5.20	46.30	41.10	Complied
0.5712	Neutral	4.40	46.00	41.60	Complied
2.7735	Neutral	4.30	46.00	41.70	Complied
20.7703	Neutral	13.30	50.00	36.70	Complied

Transmitter AC Conducted Spurious Emissions (continued)

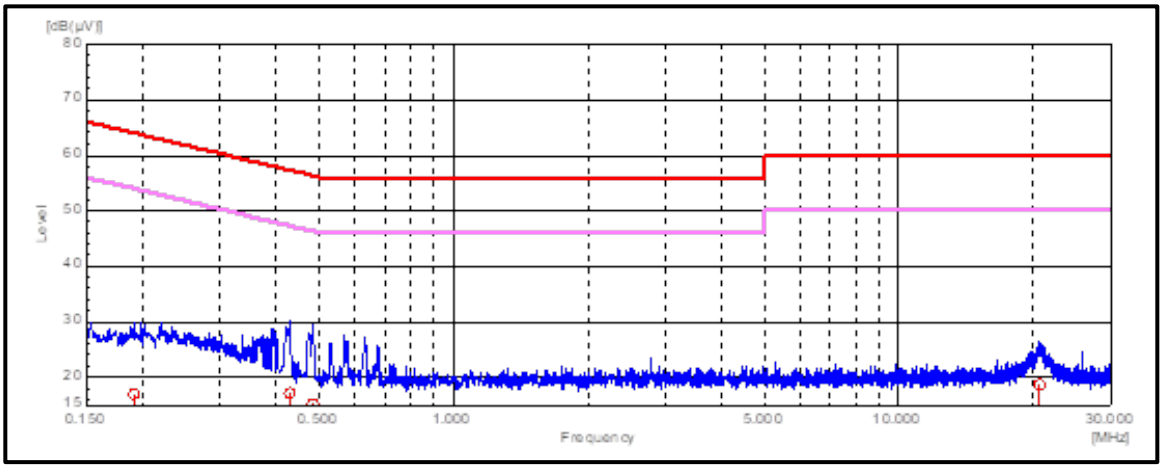
Results: Middle Channel

Plot: Live Line / 240 VAC 60 Hz



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

Plot: Neutral Line / 240 VAC 60 Hz



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

Result: Pass

5.2.2.Transmitter Duty Cycle

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	14 May 2021
Test Sample Serial Number:	46-44-5A-2F-31-30-30-31-42-55-30-30-30-31-39-35 (Radiated Test Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.35(c)
Test Method Used:	FCC KDB 558074 Section 6.0 referencing ANSI C63.10 Section 11.6

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	44

Note:

1. The transmitter duty cycle was measured using a test receiver in the time domain and calculated by using the following calculation:

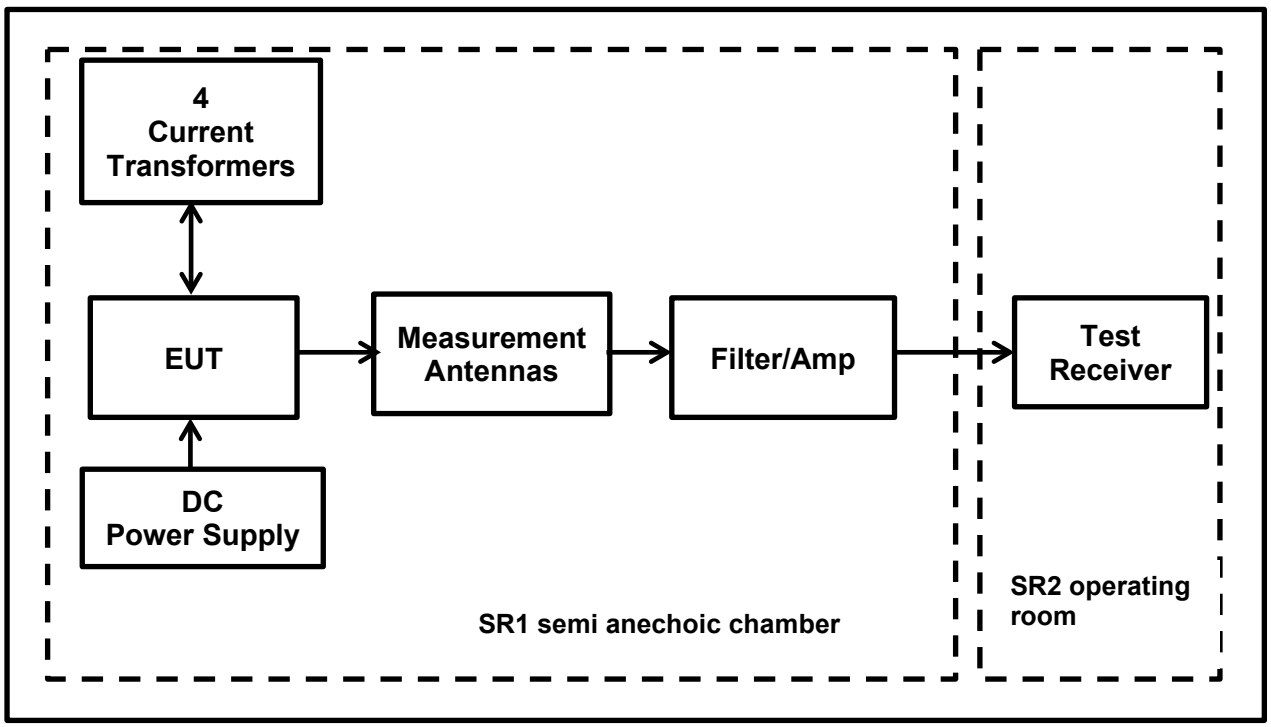
   Duty Cycle (%) = 100 X [On Time (T_{ON})] / [Period(T_{ON}+ T_{OFF}) or 100ms whichever is the lesser]

   Duty Cycle Correction Factor= 10 log 1 / [On Time (T_{ON})] / [Period(T_{ON}+ T_{OFF}) or 100ms whichever is the lesser]

   10 Log (1 / (On Time / [Period or 100 ms whichever is the lesser])

   BT-LE duty cycle: 10 log (1 / (0.388 ms/ 0.628ms)) = 2.091 dB

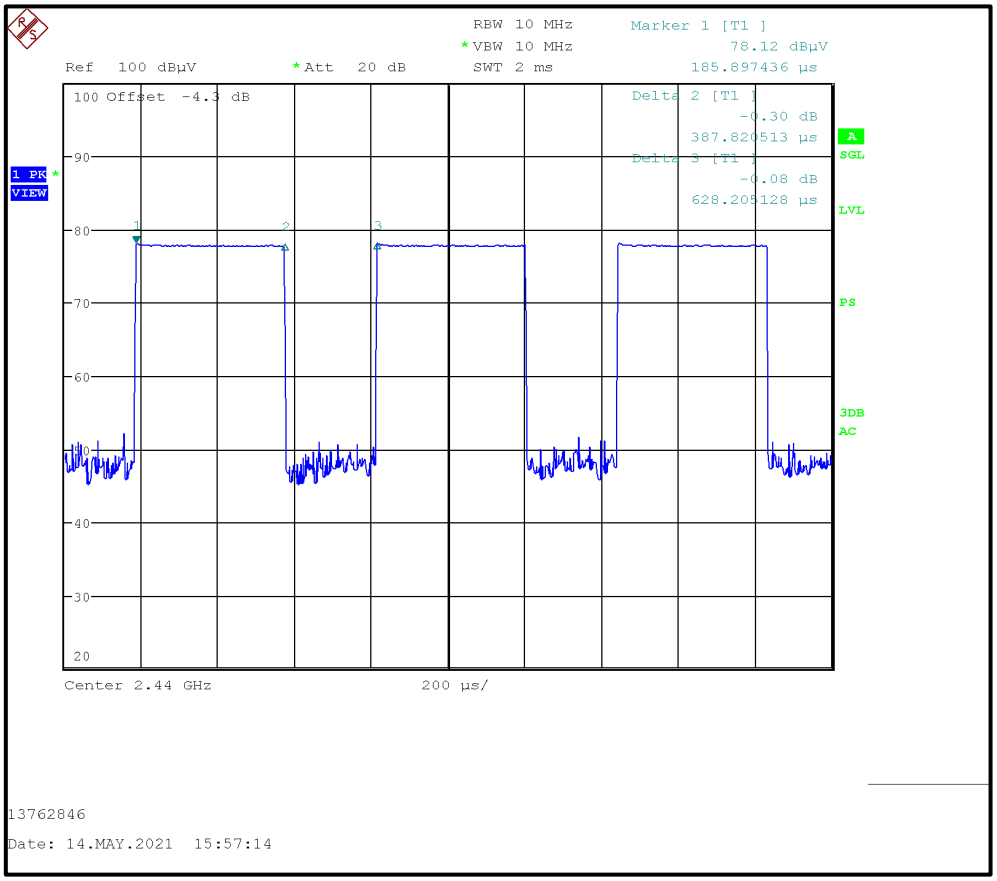
Test Setup:



Transmitter Duty Cycle (continued)

Results:

Pulse On Time (T_{ON}) (ms)	Pulse Period (T_{ON} +T_{OFF}) (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
0.388	0.628	61.78	2.09



5.2.3. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	14 May 2021
Test Sample Serial Number:	46-44-5A-2F-31-30-30-31-42-55-30-30-30-31-39-35 (Radiated Test Sample)		
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 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.4
Frequency Range	9 kHz to 30 MHz

Environmental Conditions:

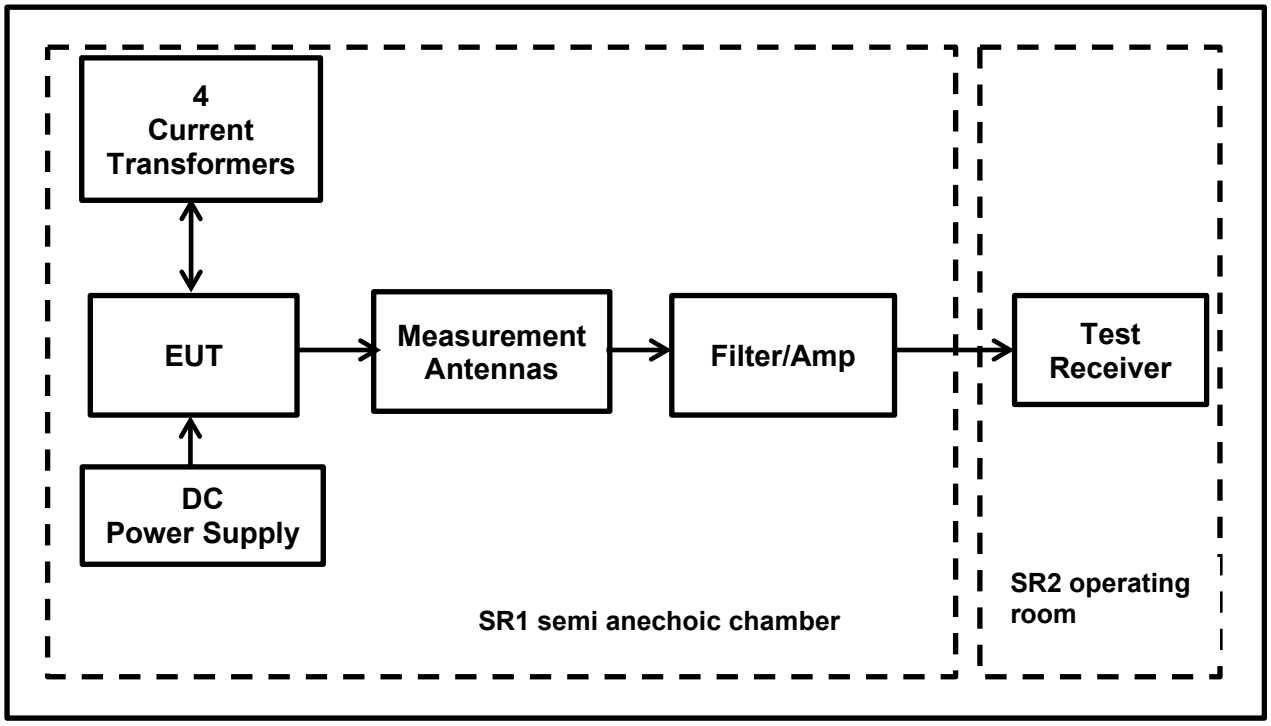
Temperature (°C):	22
Relative Humidity (%):	47

Note(s):

1. In accordance with FCC KDB 414788 D01 Radiated Test Site & ANSI C63.10 clause 5.2 an alternative test site that can demonstrate equivalence to a open area test site may be used. Therefore, the measurement was performed in a Semi Anechoic Chamber. (The OATS / SAC comparison data is available upon request).
2. The limits are specified at a test distances of 30 and 300 metres. However, as specified in FCC Section 15.31 (f)(2) & ANSI C63.10 clause 6.4.3, measurements may be performed at a closer distance and the measured level extrapolated to the specified measurement distance using the method described in clauses 6.4.4, specifically sub-clause 6.4.4.1 which specifies that the measured level shall be extrapolated to the specified distance by conservatively presuming that the field strength decays at 40 dB/decade. Therefore, measurements were performed at a measurement distance of 3 m.
3. Therefore, the limit values are extrapolated to a measurement distance of 3 m.
    - 9 kHz- 490 kHz: limits extrapolated from 300 m to 3 m by adding 80 dB at 40 dB /decade.
    - 490 kHz-1705 kHz: limits extrapolated from 30 m to 3 m by adding 40 dB at 40 dB /decade.
4. Measurements below 30 MHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. The measurement loop antenna height was 80 cm.
5. The preliminary scans showed similar emission levels below 30 MHz, for each channel & modes of operation. Therefore, final radiated emissions measurements were performed with the EUT set to the middle channel only.
6. All emissions shown on the pre-scan plots were investigated and found to be below system noise floor.
7. Pre-scans were performed and markers placed on the highest measured levels. The test receiver was set to:
    - Frequency range: 9 kHz-150 kHz : RBW: 1 kHz /VBW: 3 kHz
    - Frequency range: 150 kHz – 30 MHz: RBW: 10 kHz /VBW: 30 kHz
    - Detector: Max-Peak detector
    - Trace Mode: Max Hold

Transmitter Radiated Emissions (continued)

Test Setup:

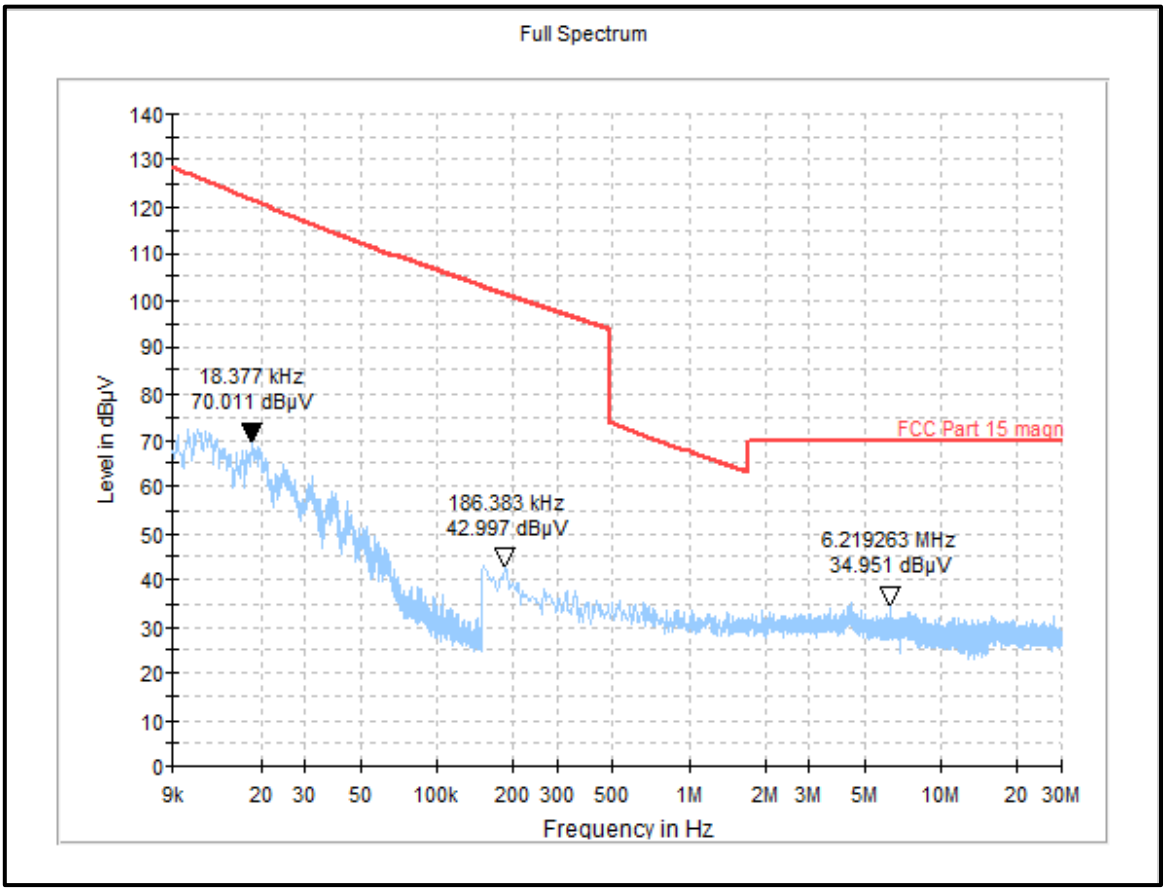


Transmitter Radiated Emissions (continued)

Results: Middle Channel

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical spurious emissions were detected					

Plot: 9 kHz - 30 MHz: Middle Channel



Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	14 May 2021
Test Sample Serial Number:	46-44-5A-2F-31-30-30-31-42-55-30-30-30-31-39-35 (Radiated Test Sample)		
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 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

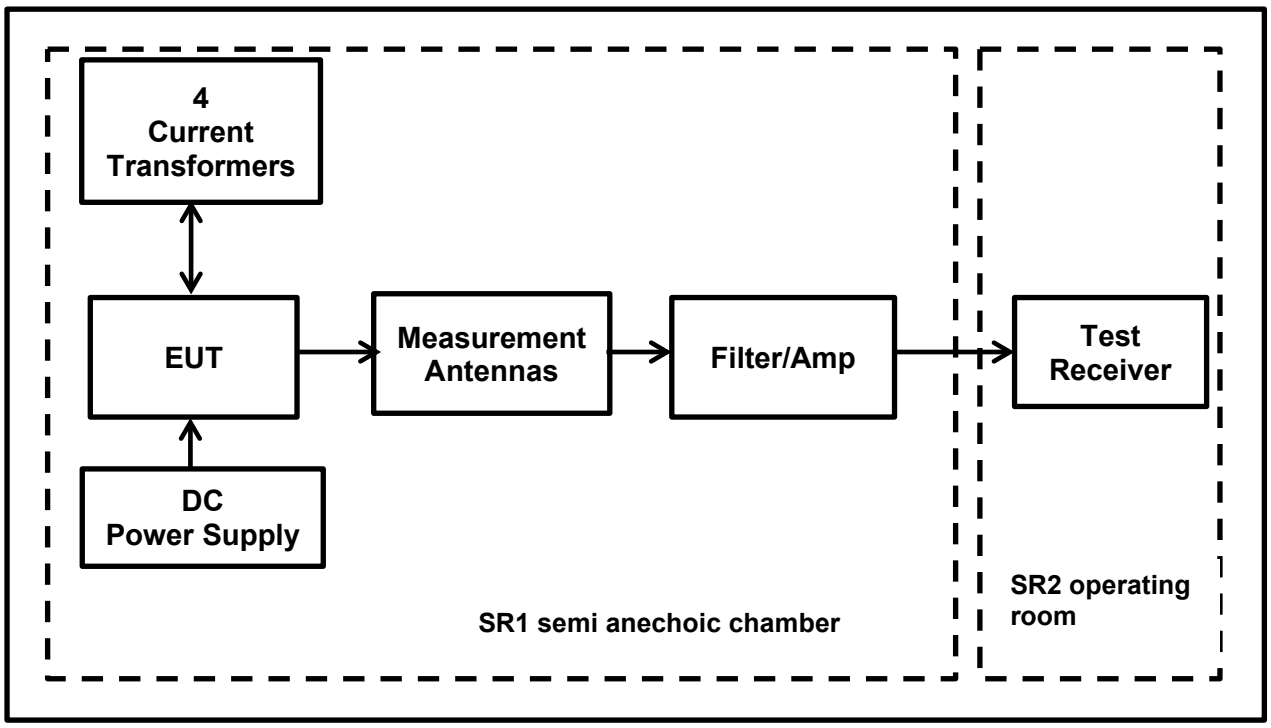
Temperature (°C):	22
Relative Humidity (%):	44

Note(s):

1. Measurements below 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) at a distance of 3 m. 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 m to 4 m.
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 middle channel only.
3. 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.
4. All emissions shown on the pre-scan plots were investigated and found to be below system noise floor.

Transmitter Radiated Emissions (continued)

Test Setup:

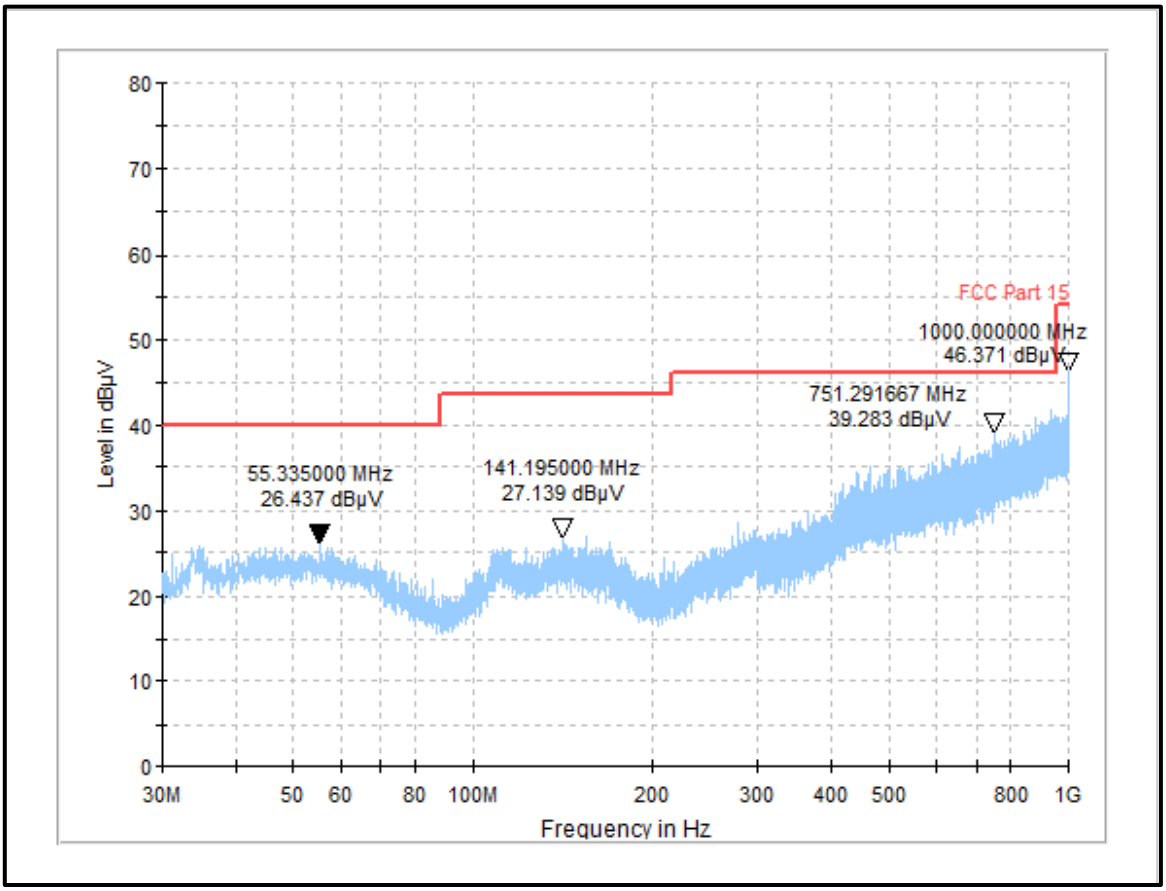


Transmitter Radiated Emissions (continued)

Results: Middle Channel

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
No critical spurious emissions were detected					

Plot: 30 MHz – 1GHz: Middle Channel



Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	14 May 2021
Test Sample Serial Number:	46-44-5A-2F-31-30-30-31-42-55-30-30-30-31-39-35 (Radiated Test Sample)		
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 referencing ANSI C63.10 Sections 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.6
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

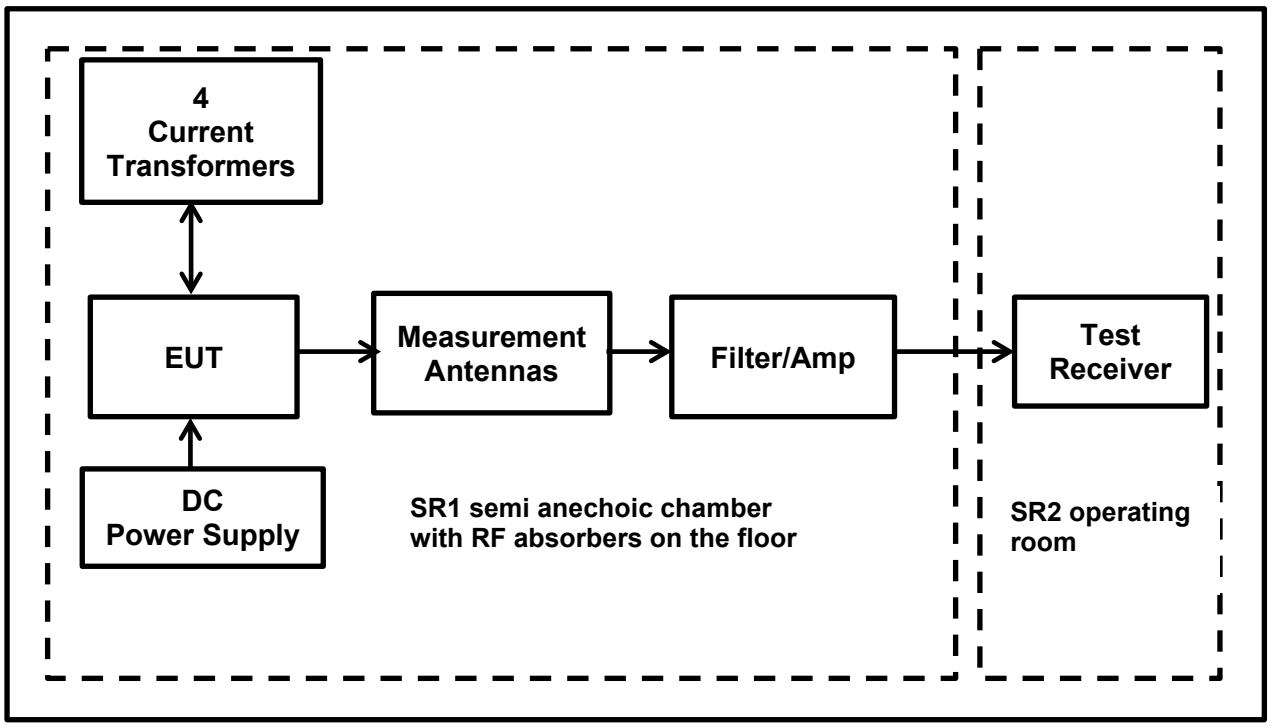
Temperature (°C):	22
Relative Humidity (%):	44

Note(s):

1. Pre-scans above 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with absorber on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 m above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with absorber on the floor at a distance of 3 m. 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 m to 4 m.
2. 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.
3. The preliminary scans showed similar emission levels above 1 GHz, for each channel & modes of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.
4. The emissions shown at frequencies approximately 2.4 GHz to 2.4835 GHz on the 1 GHz to 18 GHz plots are the EUT fundamental for the tested channel.
5. For frequency range between between 1 GHz to 18 GHz, no critical emissions were found.
6. For frequency range between 18 GHz and 25 GHz, no critical emissions were found.

Transmitter Radiated Emissions (continued)

Test Setup:

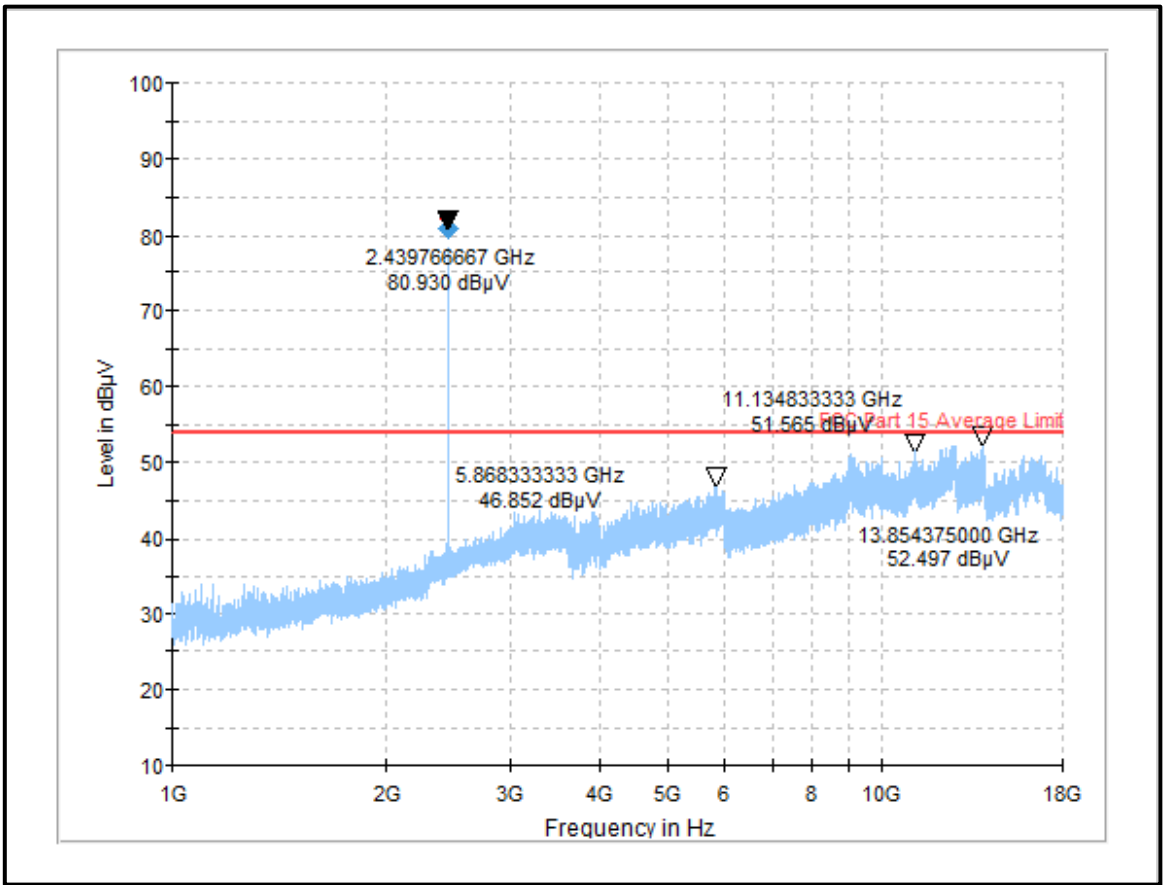


Transmitter Radiated Emissions (continued)

Results: Middle Channel

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical spurious emissions were detected					

Plot: 1 GHz – 18GHz: Middle Channel



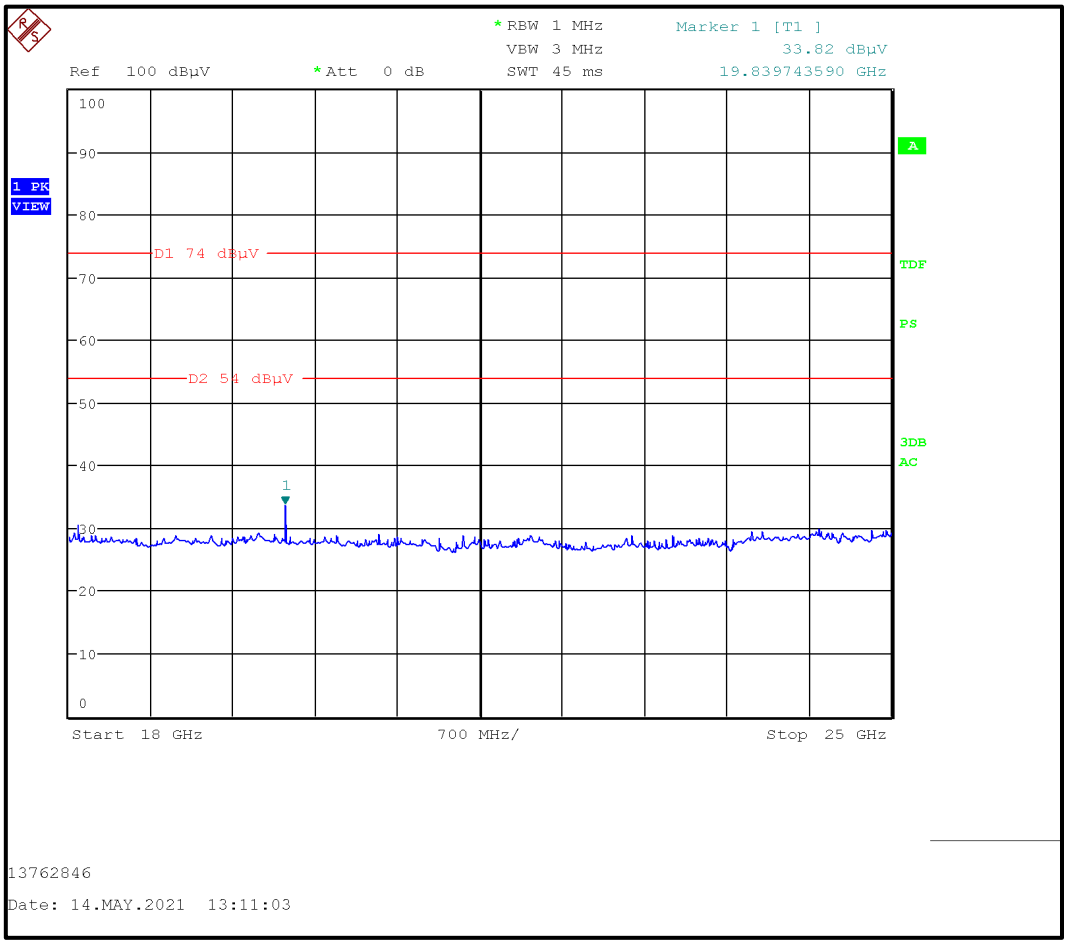
Result: Pass

Transmitter Radiated Emissions (continued)

Results: Middle Channel

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical spurious emissions were detected					

Plot: 18 GHz – 25GHz : Middle Channel



Result: Pass

5.2.4. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	14 May 2021
Test Sample Serial Number:	46-44-5A-2F-31-30-30-31-42-55-30-30-30-31-39-35 (Radiated Test Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d)
Test Method Used:	FCC KDB 558074 Section 8.7 referencing ANSI C63.10:2013 Sections 6.10.4, 6.10.5, 11.11, 11.12, 11.13

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	44

Note(s):

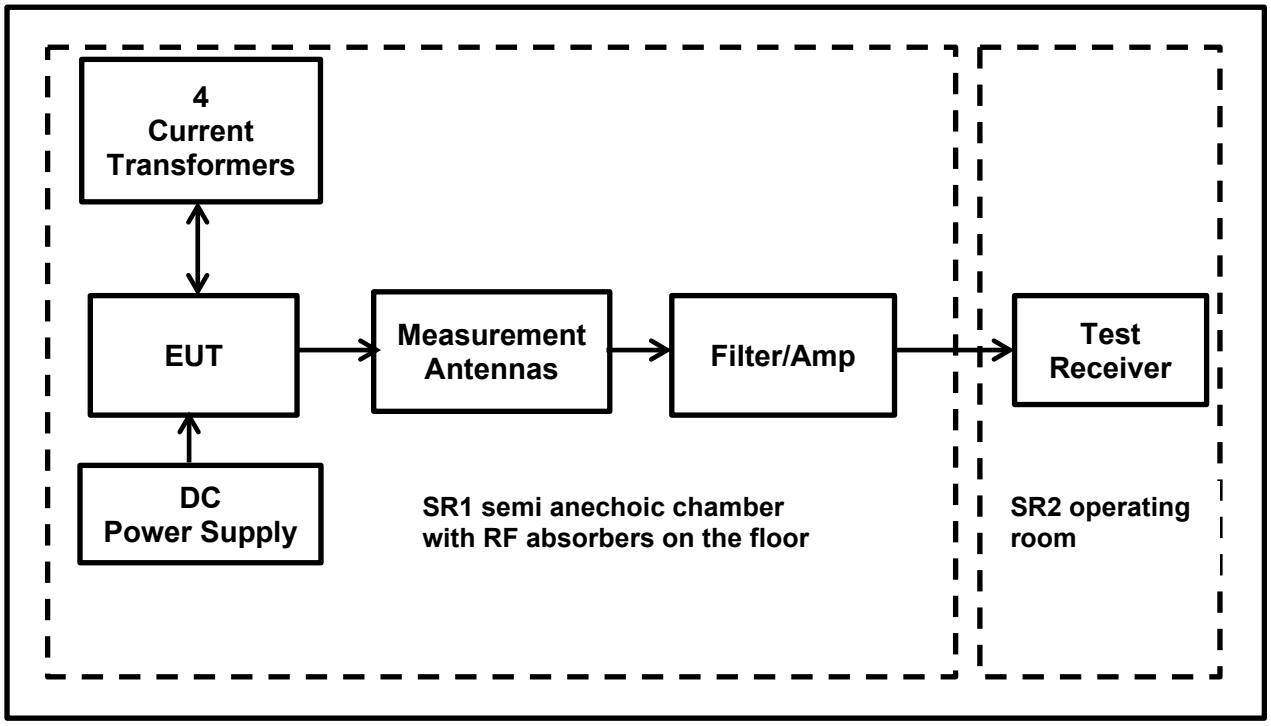
1. The measurments were in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with RF absorbers on the floor at a distance of 3 m. The EUT was placed at a height of 1.5 m above the test chamber floor in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 m to 4 m
2. As the lower band edge falls within a non-restricted band, measurements were performed in accordance with ANSI C63.10 Section 11.11. As the maximum peak conducted output power was previously measured, in accordance with ANSI C63.10 Section 11.11.1(a) 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. 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. Marker frequencies and levels were recorded.
4. The restricted band peak measurements were performed in accordance with ANSI C63.10 Section 11.12.2.4.
5. As the EUT continuous transmission of the EUT ($D \geq 98\%$) cannot be achieved and the duty cycle is constant (duty cycle variations are less than ±2%), the restricted band average measurements were performed in accordance with ANSI C63.10 Section 11.12.2.5.2.
6. 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. A RMS detector in linear power avergaging mode was used. 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.

Transmitter Band Edge Radiated Emissions (continued)

Note(s):

7. 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.
8. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
9. **As the EUT was transmitting continuously with a Duty Cycle of 61.78%, a Duty Cycle Correction Factor of 2.09 dB was added to all average measurements.

Test Setup:



Transmitter Band Edge Radiated Emissions (Continued)

Results:

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.95	43.70	58.82	15.12	Complied
2400.00	41.40	58.82	17.42	Complied

Results: 2310 to 2390 MHz Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2389.23	48.44	74.0	25.56	Complied

Results: 2310 to 2390 MHz Restricted Band / Average

Frequency (MHz)	Average Level (dBµV/m)	Duty Cycle Correction Factor (dB)	Corrected Avarage Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2389.87	33.81	2.09	35.90**	54.0	18.10	Complied

Results: Upper Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	53.15	74.0	20.85	Complied
2483.86	52.40	74.0	21.60	Complied

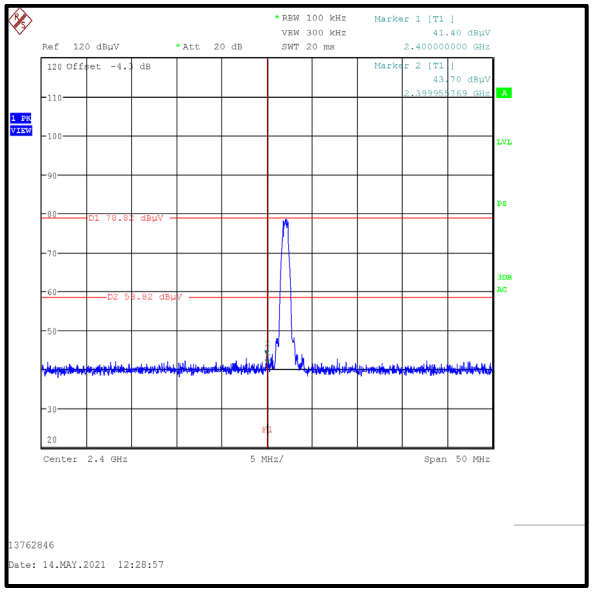
Results: Upper Band Edge / Average

Frequency (MHz)	Average Level (dBµV/m)	Duty Cycle Correction Factor (dB)	Corrected Avarage Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	37.76	2.09	39.85**	54.0	54.00	Complied
2483.51	37.63	2.09	39.72**	54.0	54.00	Complied

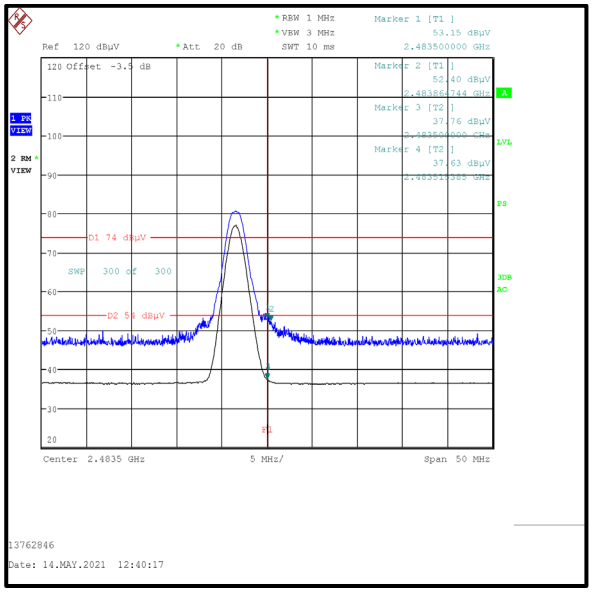
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

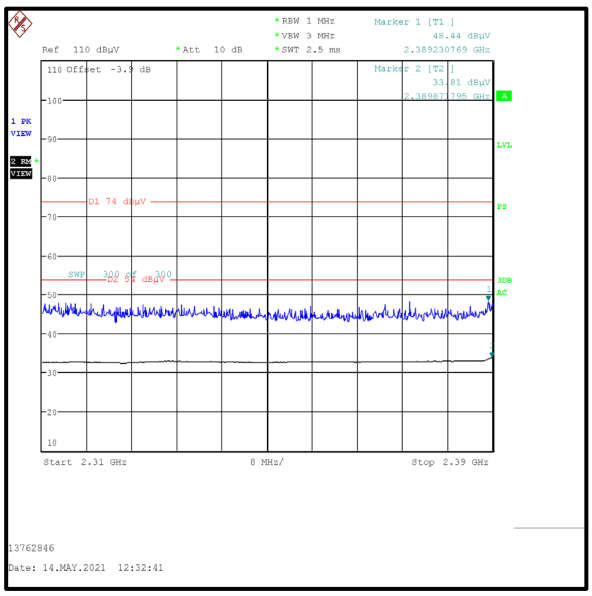
Results:



Lower Band Edge Peak Measurement



Upper Band Edge Peak & Average Measurement



2310 MHz to 2390 MHz Restricted Band

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
Transmitter Duty Cycle	95%	±3.4%
Radiated Spurious Emissions	95%	±3.10 dB
Band Edge Radiated Emissions	95%	±3.10 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Used equipment

Test site: SR 1/2

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
1	Rohde & Schwarz	Antenna, Loop	HFH2-Z2	831247/012	10/07/2020	36
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	08/07/2020	12
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	55929	09/07/2020	12
460	Deisel	Turntable	DT 4250 S	n/a	n/a	n/a
452	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	02/09/2020	24
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	05/08/2020	36
607	Schwarzbeck	Antenna broadband horn antenna	BBHA 9170	9170-561	15/10/2019	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	07/072020	12
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	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
-/-	Testo	Thermo-Hygrometer	608-H1	01	lab verification	n/a
328	SPS	AC/DC power distribution system	PAS 5000	A2464 00/2 0200	lab verification	n/a
1603665	Siemens Matsushita Components	semi-anechoic chamber SR1/ 2	-/-	B83117-A1421-T161	n/a	n/a

Test site: SR 7/8

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
23	Rohde & Schwarz	Artificial Mains Network	ESH3-Z5	831767/013	07/07/2020	12
S0585	Aim TTi	AC/DC power supply	CPX400S	472218	lab verification	n/a
349	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/009	09/07/2020	12
-/-	Testo	Thermo-Hygrometer	608-H1	08	lab verification	n/a
327	SPS	AC/DC power distribution system	PAS 5000	A2464 00/1 0200	lab verification	n/a

8. Report Revision History

Version Number	Revision Details		
	Page No(s)	**Clause**	**Details**
1.0	-	-	Initial Version
Test Report Version 1.1 supersede Version 1.0 with immediate effect Test Report No. UL-RPT-RP-13762846-516-FCC Version 1.1, Issue Date 16 NOVEMBER 2021 replaces Test Report No. UL-RPT-RP-13762846-516-FCC Version 1.0, Issue Date 07 JULY 2021, which is no longer valid.			
1.1	as below	as below	Current Version
	6	2.2	Note 1 corrected & Note 1 reference to Measurments corrected
	7	3.1	Model Name included
	7	3.2	Description of EUT was updated including Model No. & Name details
	8	3.4	Antenna Information (Gain | Type | Details) removed Information related with Partial Testing scope removed Reference to pre certified radio module's test report & original filing removed
	9	4.1	Section updated to remove power setting details
	9	4.2	Test Mode Activation section updated to remove power setting details
	11	5.2.1	Note 2 updated to include word 'also' Note 3 updated to remove test mode configuration details (except test channel) & power setting details
	13 to 16	5.2.1	Results: title header was updated to remove test mode configuration details (except test channel)
	18	5.2.2	Results: title header was updated to remove test mode configuration details
	21,24,27 & 28	5.2.3	Results: title header was updated to remove test mode configuration details (except test channel) Plot: title header was updated to remove test mode configuration details (except test channel)
	29	5.2.4	FCC reference updated to remove 15.209(a) reference Test Method Used updated to remove FCC KDB 558074 Section 8.5 referencing Note 2 was updated to remove FCC KDB 558074 Section 8.5 referencing
	33 & 32	5.2.4	Results: title header was updated to remove test mode configuration details Plot: title header was updated to remove test mode configuration details
Test Report Version 1.2 supersede Version 1.1 with immediate effect Test Report No. UL-RPT-RP-13762846-516-FCC Version 1.2, Issue Date 16 NOVEMBER 2021 replaces Test Report No. UL-RPT-RP-13762846-516-FCC Version 1.1, Issue Date 16 NOVEMBER 2021, which is no longer valid.			
1.2	1	-	The EUT Model No. was corrected from 3WA9111-0EE82 to 3WA9111-0EE62
	6	3.1	The EUT Model No. was corrected from 3WA9111-0EE82 to 3WA9111-0EE62
	7	3.2	Description of EUT was updated & Model No. reference details were removed