TEST REPORT

Test Report No.: UL-RPT-RP-14208157-816-FCC/ISED

Applicant	:	SECO SPA
Model No.	:	SYS-C31-DMV-01-IO
FCC ID / ISED IC:	:	Contains FCC ID: 2ALZB-AW276 / IC: 22688-AW276 2.4 GHz WLAN, 5 GHz WLAN, Bluetooth BR/EDR and Bluetooth LE module Contains FCC ID: XMR201903EG25G / IC: 10224A-201903EG25G Cellular LTE module
Technology	:	Bluetooth – Basic Rate (BR) & Enhanced Data Rate (EDR) + Cellular (LTE Band 4, 7, 12, 41)
Test Standard(s)	:	FCC Parts 15.207, 15.209(a), 15.247 & 27.53 ISED RSS-247 / RSS-130 / RSS-139 / RSS-Gen
		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: Sercan, Usta
Title: Project Engineer
Date: 01 December 2022

Approved by: Rachid, Acharkaoui
Title: Operations Manager
Date: 01 December 2022

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

UL INTERNATIONAL GERMANY GMBH
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STU.CTECHLab@ul.com

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1. Customer Information

1.1.Applicant Information

Company Name:	SECO S.p.A.
Company Address:	Via Achille Grandi 20, 52100 Arezzo AR, Italy
Contact Person:	Giacomo Nucci / Giacomo Martini
Contact E-Mail Address:	giacomo.nucci@seco.com / giacomo.martini@seco.com
Contact Phone No.:	+39 0575 26979

1.2.Manufacturer Information

Company Name:	SECO S.p.A.
Company Address:	Via Achille Grandi 20, 52100 Arezzo AR, Italy
Contact Person:	Giacomo Nucci / Giacomo Martini
Contact E-Mail Address:	giacomo.nucci@seco.com / giacomo.martini@seco.com
Contact Phone No.:	+39 0575 26979

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Specification Reference:	47CFR27.53
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 27 Subpart Subpart C - Technical Standards - Sections 27.53
Specification Reference:	RSS-130 Issue 2 February 2019
Specification Title:	Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz
Specification Reference:	RSS-139 Issue 4 September 2022
Specification Title:	Advanced Wireless Services Equipment Operating in the Bands 1710-1780 MHz and 2110-2200 MHz
Specification Reference:	RSS-Gen Issue 5 April 2018
Specification Title:	General Requirements for Compliance of Radio Apparatus
Specification Reference:	RSS-247 Issue 2 February 2017
Specification Title:	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany
Test Firm Registration:	399704
Company Number.	22511
CABID:	DE0008

Date information

Order Date:	09 February 2022
EUT arrived:	19 April 2022
Test Dates:	10 May 2022 to 20 May 2022
EUT returned:	-/-

2.2. Summary of Test Results

Measurement	FCC Reference (47CFR)	ISED Reference (RSS-)	Complied	Did not comply	Not performed	Not applicable
Transmitter AC Conducted Emissions	Part 15.207	RSS-Gen 8.8	☒	☐	☐	☐
Transmitter Band Edge Radiated Emissions / Transmitter Out of Band Radiated Emission (1)	Part 15.247(d) & 15.209(a) & Part 2.1053/ 27.53(a)	RSS 130 § 4.7 RSS 139 § 6.6 RSS-Gen 6.13 & 8.9 RSS-247 5.5	☒	☐	☐	☐

Note(s):

1. The host device detailed in this report incorporates a pre-certified unlicensed transmitter and a licensed cellular LTE module which can transmit simultaneously. The testing covers the AC conducted emissions and radiated emissions from the host product with Bluetooth BR/EDR and LTE Bands 4, 7, 12 and 4, in turn, transmitting simultaneously.

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	FCC 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:	FCC KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	AC Power-Line Conducted Emissions Frequently Asked Questions
Reference:	ANSI C63.26-2015
Title:	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services.
Reference:	FCC KDB 971168 D01 v03r01, April 9 2018
Title:	Measurement Guidance for Certification of Licensed Digital Transmitters

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:	DMVI
Model Name or Number:	SYS-C31-DMV-01-IO
Test Sample Serial Number:	220405435 (RF Test Sample)
Hardware Version Number:	IO
Firmware Version Number:	C31DMVYY.BBB
FCC ID:	Contains FCC ID: 2ALZB-AW276 and FCC ID: XMR201903EG25G
ISED Certification Number:	Contains IC: 22688-AW276 and IC: 10224A-201903EG25G

3.2. Description of EUT

The equipment under test was an industrial PC gateway Model: SYS-C31-DMV-01-IO that contains a pre-certified radio module which supports 2.4 GHz WLAN, 5 GHz WLAN, Bluetooth BR/EDR and Bluetooth Low Energy RF technologies and a pre-certified cellular LTE 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 – BR/EDR		
Operating Frequency Range:	2402 MHz to 2480 MHz		
	Enhanced Data Rate (EDR)		
	8DPSK (Note 1)		
	3DH5 (Note 1)		
	3 (Note 1)		
Transmit Channels Tested:	**Channel ID**	**RF Channel**	**Frequency (MHz)**
	Bottom	0 (Note 1)	2402
Technology Tested:	LTE Band 4		
Transmit Frequency Range:	1710 – 1755 MHz (Uplink)		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Frequency (MHz)**
	Top	20175) (Note 2)	1732.50
Technology Tested:	LTE Band 7		
Transmit Frequency Range:	2500 – 2570 MHz (Uplink)		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Frequency (MHz)**
	Top	21350 (Note 2)	2560
Technology Tested:	LTE Band 12		
Transmit Frequency Range:	699 – 716 MHz (Uplink)		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Frequency (MHz)**
	Top	23060 (Note 2)	704
Technology Tested:	LTE Band 41		
Transmit Frequency Range:	2496 – 2690 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Frequency (MHz)**
	Top	40620 (Note 2)	2593
(Note 1) Since the unlicensed module is FCC pre-certified the worst-case modulation scheme was determined from the module report, serial number RF161216E08-3, on the basis of the highest conducted output power, for FCC ID: UAY-W8997-M1216			
(Note 2) Since the licensed module is FCC pre-certified the worst-case modulation scheme was determined from the module report, serial number HR/2019/1001601, on the basis of the ERP (for band 12) and EIRP (for bands 4, 7 and 41), for FCC ID: XMR201903EG25G			

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	Laboratory DC Power Supply	GW	GPS-1850D	7662217
2	Test Laptop with Test software: Tera Term	HP	ProBook 650	5CG6143YWB

B. Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	-/-	-/-	-/-	-/-

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):
☒ Continuous Transmitting Fixed Channel Frequency Mode (Hopping OFF) with Modulated Carrier • BT-EDR Mode | Packet Type: 3DH5 | Hopping OFF | Bottom channel | MAX PWR 7 | + LTE Band 4 | 10 MHz | RB1 | CH 20175 | QPSK | LTE Band 7 | 20 MHz | RB1 | CH 21350 | QPSK | LTE Band 12 | 10 MHz | RB1 | CH 23060 | QPSK | LTE Band 41 | 5 MHz | RB1 | CH 40620 | QPSK |
☒ Continuous Transmitting Hopping Channels Frequency Mode (Hopping ON) with Modulated Carrier • BT-EDR Mode | Packet Type: 3DH5 | Hopping On | MAX PWR 7 | + LTE Band 4 | 10 MHz | RB1 | CH 20175 | QPSK | LTE Band 7 | 20 MHz | RB1 | CH 21350 | QPSK | LTE Band 12 | 10 MHz | RB1 | CH 23060 | QPSK | LTE Band 41 | 5 MHz | RB1 | CH 40620 | QPSK |

4.2.Configuration and Peripherals

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

- The applicant or manufacturer supplied test setup instructions “SYS-C31-DMV___Test_Radio_guidance_00” issued on 22 April 2022 was used to configure the EUT.

EUT Power Supply:

- The EUT was powered with 12V DC via an external AC/DC power supply

Test Mode Activation:

- The EUT can be connected with the Test laptop via USB-UART cables supplied by the customer. The cable was used only for configuration and was removed during the measurement.
- The Bluetooth test modes were activated by the terminal software ‘’Tera Term’’. The commands to setup the respective modes and power were defined by the customer in the setup instructions.
- For LTE a direct communication link was setup with the Communication tester CMW 500.

AC Conducted Emissions Measurements:

- The EUT RF sample with antenna was used for AC conducted emissions measurements.
- The measurements were carried out with 120 VAC/60Hz & 240 VAC/60Hz.
- The Toyo EMI Software EP5/CE Ver 4.0.1. was used for these measurements.

Radiated Measurements:

- The EUT RF sample with antenna was used for radiated spurious emissions measurements.
- As per the applicant’s declaration &/operational description of the EUT, the EUT is a tabletop equipment for its intended application. Therefore, EUT’s test setup placement was performed in accordance with ANSI C63.10 section 6.2.3.2 & section 6.12 Figure 4.
- The EUT with its integrated antenna was evaluated for its worst-case position w.r.t to maximum radiated power measured and it was found that EUT in Standing position is the worst-case. Therefore, this report includes relevant results.
- The position of the Antenna was 90° vertical in the z-axis from the EUT.
- Radiated measurements below 30 MHz were performed with the EUT positioned on the turn table and rotating 360 degrees while the loop antenna height was set at 100 cm.
- Radiated measurements above 30 MHz were performed with the EUT positioned on the turn table and rotating 360° while the antenna height varies from 1 to 4 m over the measurement frequency range.
- R&S® EMC32 V11.30 Software was used for the Radiated spurious emission 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:	Muhammad Faiq Khan	**Test Date:**	20 May 2022
Test Sample Serial Number:	220405435 (RF Test Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.207
ISED Reference:	RSS-Gen Section 8.8
Test Method Used:	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	39

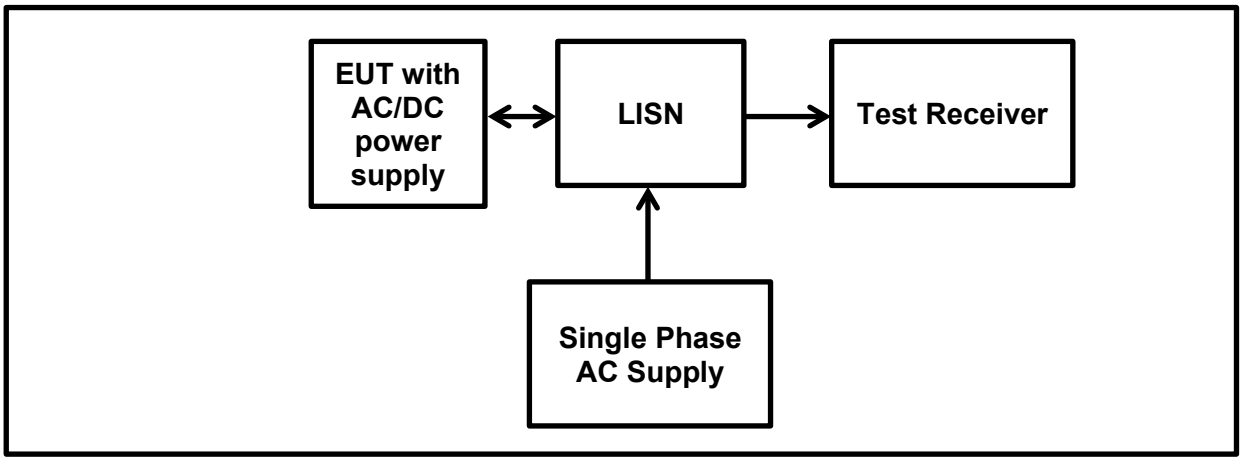
Settings of the Instrument

Detector	Quasi Peak/ Average Peak

Note(s):

1. Measurements were performed in shielded room (SR7/ 8 Asset Number 1603671). The EUT was placed at a height of 10 cm above the reference ground plane and in a distance of 40 cm from the vertical ground plane at the edge of the table.
2. Measurement software used: Toyo EMI Software; CE measurement software EP5/CE Ver 4.0.1.
3. The EUT was plugged into a AC/DC Power Supply. The Power Supply was connected to 120 VAC / 60 Hz and 240 VAC / 60 Hz single phase supply via a LISN.
4. In accordance with FCC KDB 174176 Q4, tests were performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the 100-240 VAC~50/60 Hz power supply.
5. The EUT was configured to transmit simultaneously on both technologies:
    - BT-EDR Mode | Packet Type: 3DH5 | Hopping On | MAX PWR 7
    - LTE B4 / B7 / B12 / B41 Test mode: a communication link with Base station (CMW 500)
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).

Test setup:


EUT with AC/DC power supply
LISN
Test Receiver
Single Phase AC Supply

Transmitter AC Conducted Spurious Emissions (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 2 / Bottom Channel / RB1 / QPSK

Results: 120 VAC 60 Hz / Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.157730	Live	32.70	65.60	32.90	Complied
0.191470	Live	28.30	64.00	35.70	Complied
0.633230	Live	18.40	56.00	37.60	Complied
9.806950	Live	29.60	60.00	30.40	Complied
12.373090	Live	31.50	60.00	28.50	Complied
14.094640	Live	43.10	60.00	16.90	Complied

Results: 120 VAC 60 Hz / Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.157730	Live	14.70	55.60	40.90	Complied
0.191470	Live	12.60	54.00	41.40	Complied
0.633230	Live	6.00	46.00	40.00	Complied
9.806950	Live	25.50	50.00	24.50	Complied
12.373090	Live	26.60	50.00	23.40	Complied
14.094640	Live	36.30	50.00	13.70	Complied

Results: 120 VAC 60 Hz / Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.156740	Neutral	32.90	65.60	32.70	Complied
0.170880	Neutral	29.40	64.90	35.50	Complied
0.605800	Neutral	16.90	56.00	39.10	Complied
9.780170	Neutral	29.90	60.00	30.10	Complied
12.071290	Neutral	30.50	60.00	29.50	Complied
12.427300	Neutral	32.40	60.00	27.60	Complied

Transmitter AC Conducted Spurious Emissions (continued)

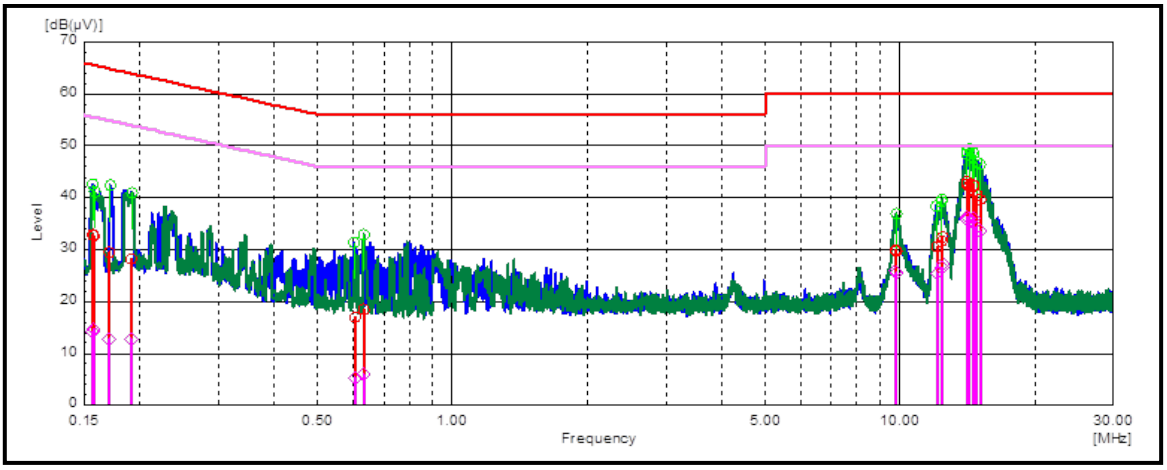
Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 2 / Bottom Channel / RB1 / QPSK

Results: 120 VAC 60 Hz / Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.156740	Neutral	14.20	55.60	41.40	Complied
0.170880	Neutral	12.60	54.90	42.30	Complied
0.605800	Neutral	5.30	46.00	40.70	Complied
9.780170	Neutral	25.80	50.00	24.20	Complied
12.071290	Neutral	25.50	50.00	24.50	Complied
12.427300	Neutral	27.10	50.00	22.90	Complied

Result: Pass

Plot: 120 VAC 60 Hz / Live and Neutral Line



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

Transmitter AC Conducted Spurious Emissions (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 2 / Bottom Channel / RB1 / QPSK

Results: 240 VAC 60 Hz / Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.153380	Live	30.30	65.80	35.50	Complied
0.304430	Live	27.00	60.10	33.10	Complied
0.351500	Live	29.40	58.90	29.50	Complied
0.391680	Live	30.30	58.00	27.70	Complied
0.464010	Live	28.80	56.60	27.80	Complied
0.489170	Live	27.60	56.20	28.60	Complied

Results: 240 VAC 60 Hz / Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.153380	Live	13.60	55.80	42.20	Complied
0.304430	Live	10.30	50.10	39.80	Complied
0.351500	Live	9.30	48.90	39.60	Complied
0.391680	Live	8.40	48.00	39.60	Complied
0.464010	Live	7.30	46.60	39.30	Complied
0.489170	Live	6.60	46.20	39.60	Complied

Results: 240 VAC 60 Hz / Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.153440	Neutral	29.50	65.80	36.30	Complied
0.362920	Neutral	30.00	58.70	28.70	Complied
0.378800	Neutral	30.60	58.30	27.70	Complied
0.385880	Neutral	30.60	58.20	27.60	Complied
0.395110	Neutral	30.80	58.00	27.20	Complied
0.406850	Neutral	30.60	57.70	27.10	Complied

Transmitter AC Conducted Spurious Emissions (continued)

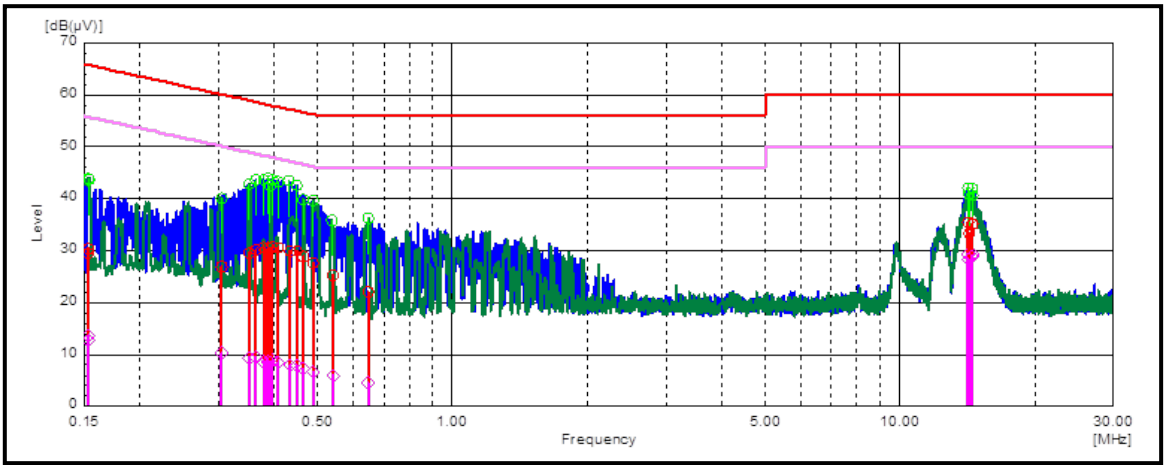
Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 2 / Bottom Channel / RB1 / QPSK

Results: 240 VAC 60 Hz / Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.153440	Neutral	12.60	55.80	43.20	Complied
0.362920	Neutral	9.30	48.70	39.40	Complied
0.378800	Neutral	8.40	48.30	39.90	Complied
0.385880	Neutral	8.40	48.20	39.80	Complied
0.395110	Neutral	8.90	48.00	39.10	Complied
0.406850	Neutral	8.40	47.70	39.30	Complied

Result: Pass

Plot: 240 VAC 60 Hz / 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 Radiated Emissions / Transmitter out of band Radiated Emission

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	16 May 2022
Test Sample Serial Number:	220405435 (RF Test Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.247(d) & 15.209(a) & Part 2.1053/ 27.53(a)
ISED Reference:	RSS 130 § 4.7 / RSS 139 § 6.6 / RSS-Gen 6.13 & 8.9 / RSS-247 5.5
Test Method Used:	ANSI C63.10:2013 Sections 6.3 and 6.4
Frequency Range	9 kHz to 30 MHz

Environmental Conditions:

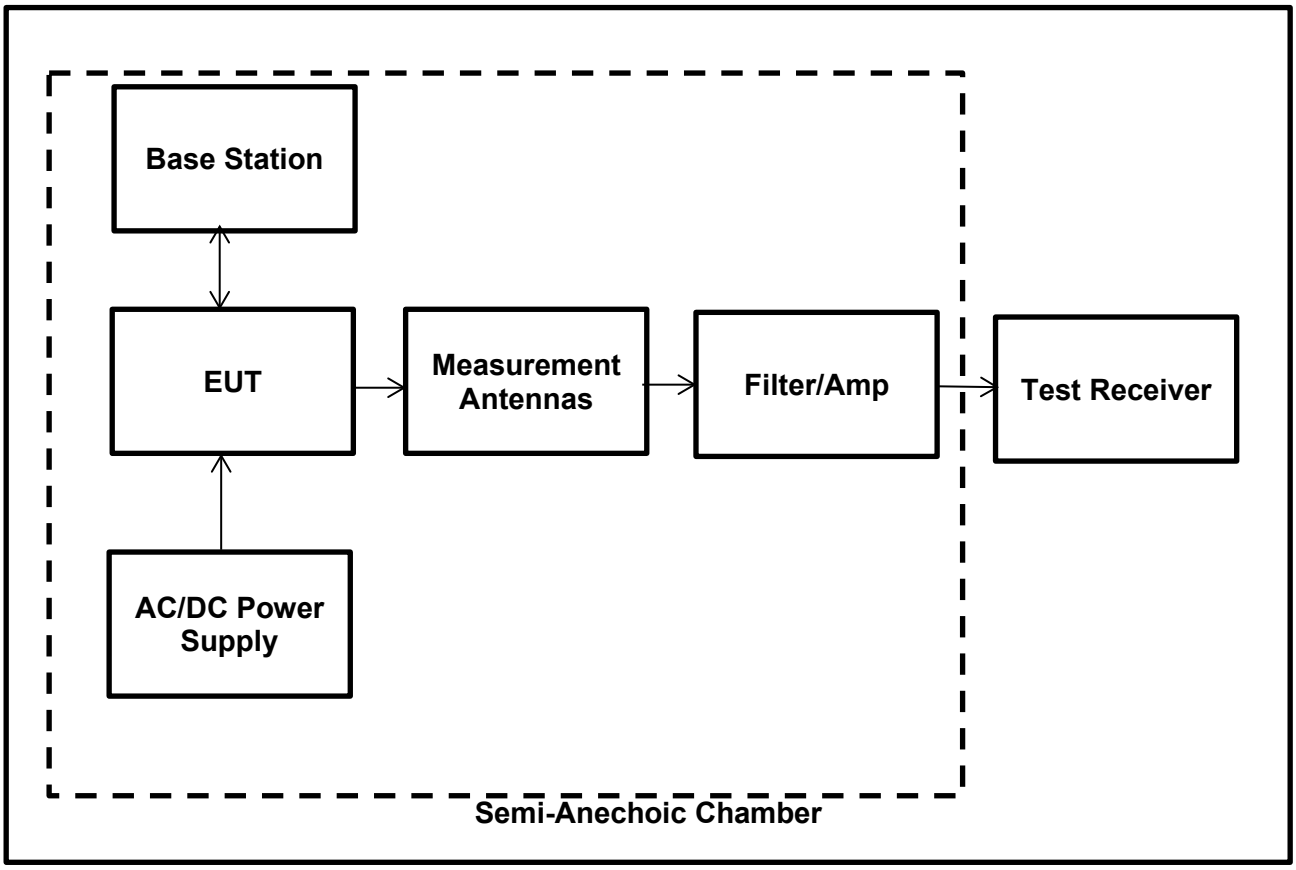
Temperature (°C):	25.0
Relative Humidity (%):	46.9

Notes:

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 distance 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 radiated emissions measurements were performed with the EUT set to the following worst-case mode.
   - BT-EDR Mode | Packet Type: 3DH5 | Hopping On | MAX PWR 7
   - LTE B4 / B7 / B12 / B41 Test mode: a communication link with Base station (CMW 500)
6. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
7. All other emissions shown on the pre-scan plot were investigated and found to be below the measurement system noise floor.
8. 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 / Transmitter out of band Radiated Emission (continued)

Test Setup:

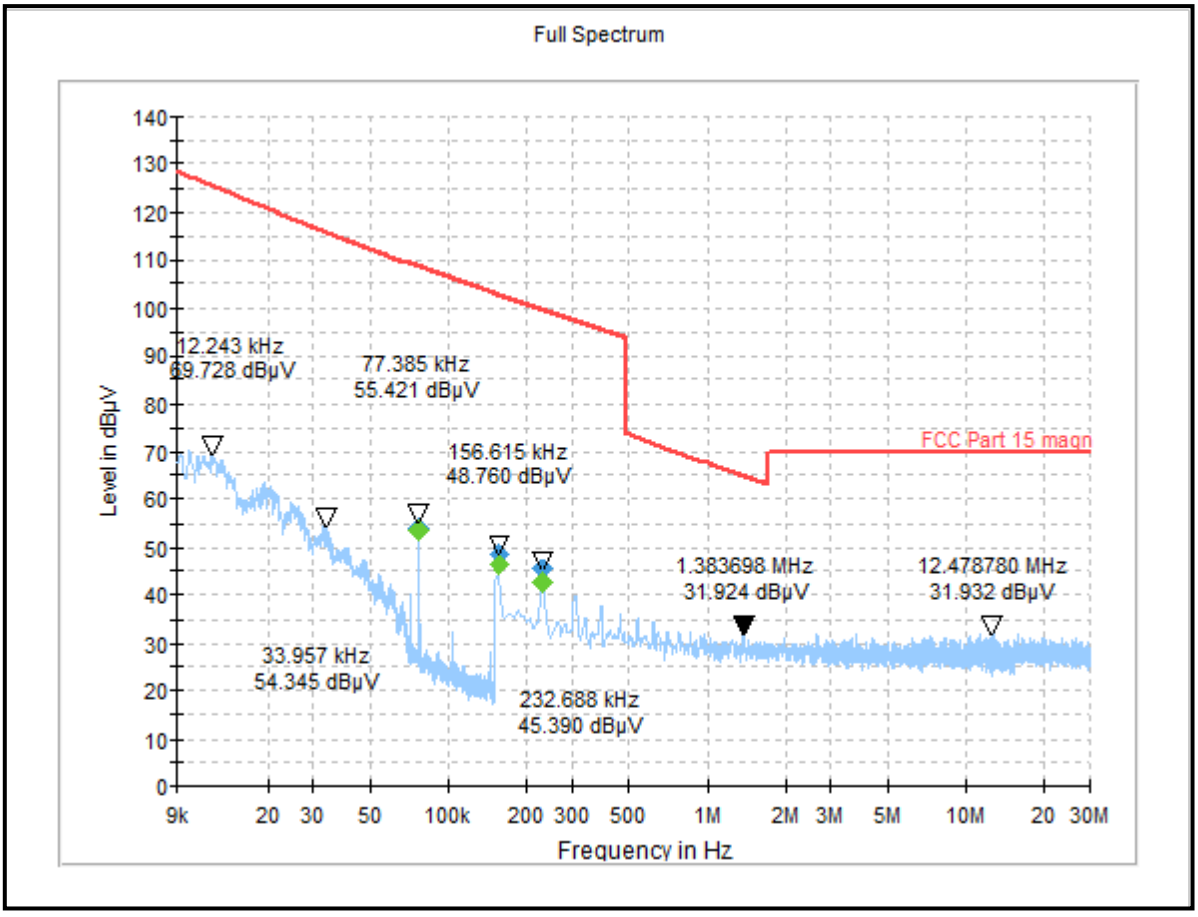


Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 4 / Mid Channel / RB1 / QPSK

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
0.08	0° to the EUT	54.20	108.47	54.27	Complied
0.16	0° to the EUT	48.76	102.62	53.86	Complied
0.23	90° to the EUT	45.39	99.47	54.08	Complied

Plot: 9 kHz – 30 MHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 4 / Mid Channel / RB1 / QPSK



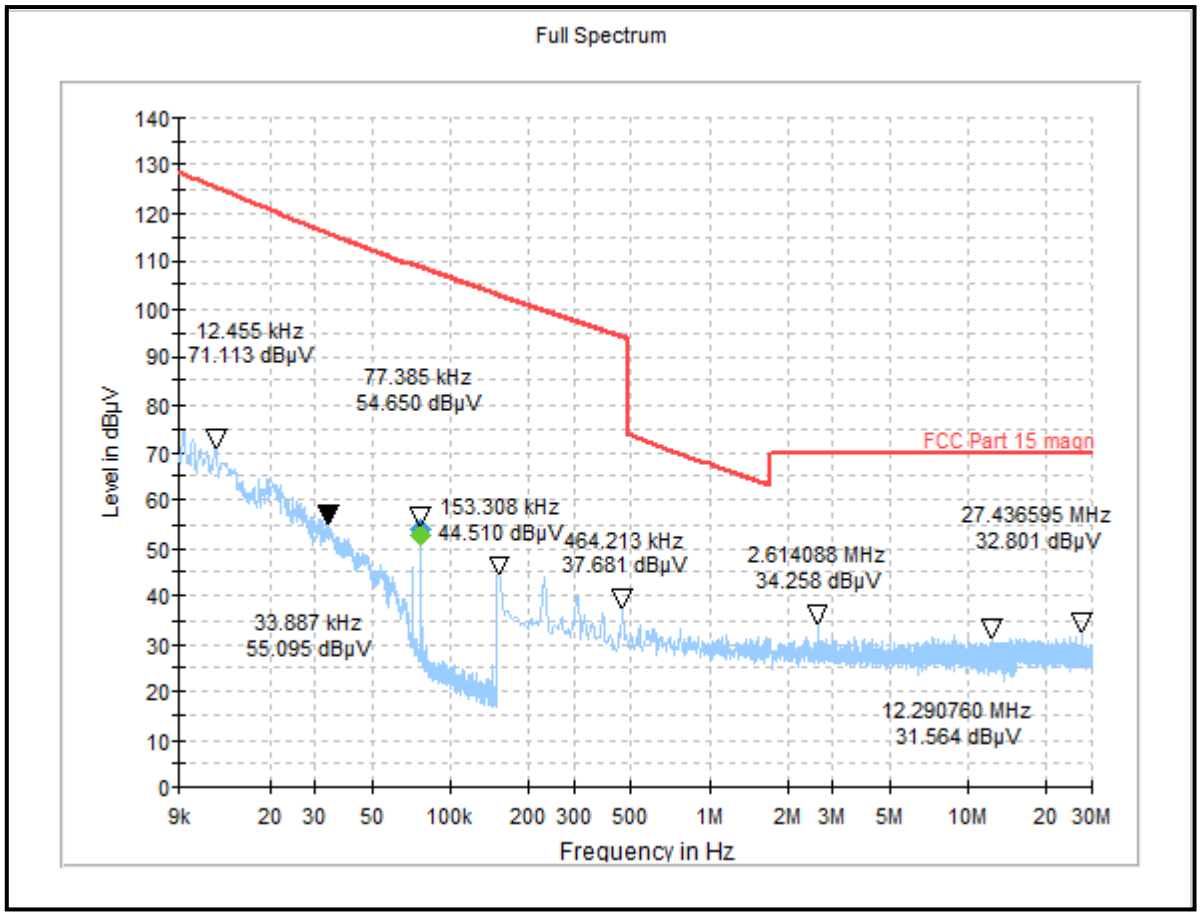
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 7 / Top Channel / RB1 / QPSK

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
0.08	0° to the EUT	54.20	108.47	54.27	Complied

Plot: 9 kHz – 30 MHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 7 / Top Channel / RB1 / QPSK



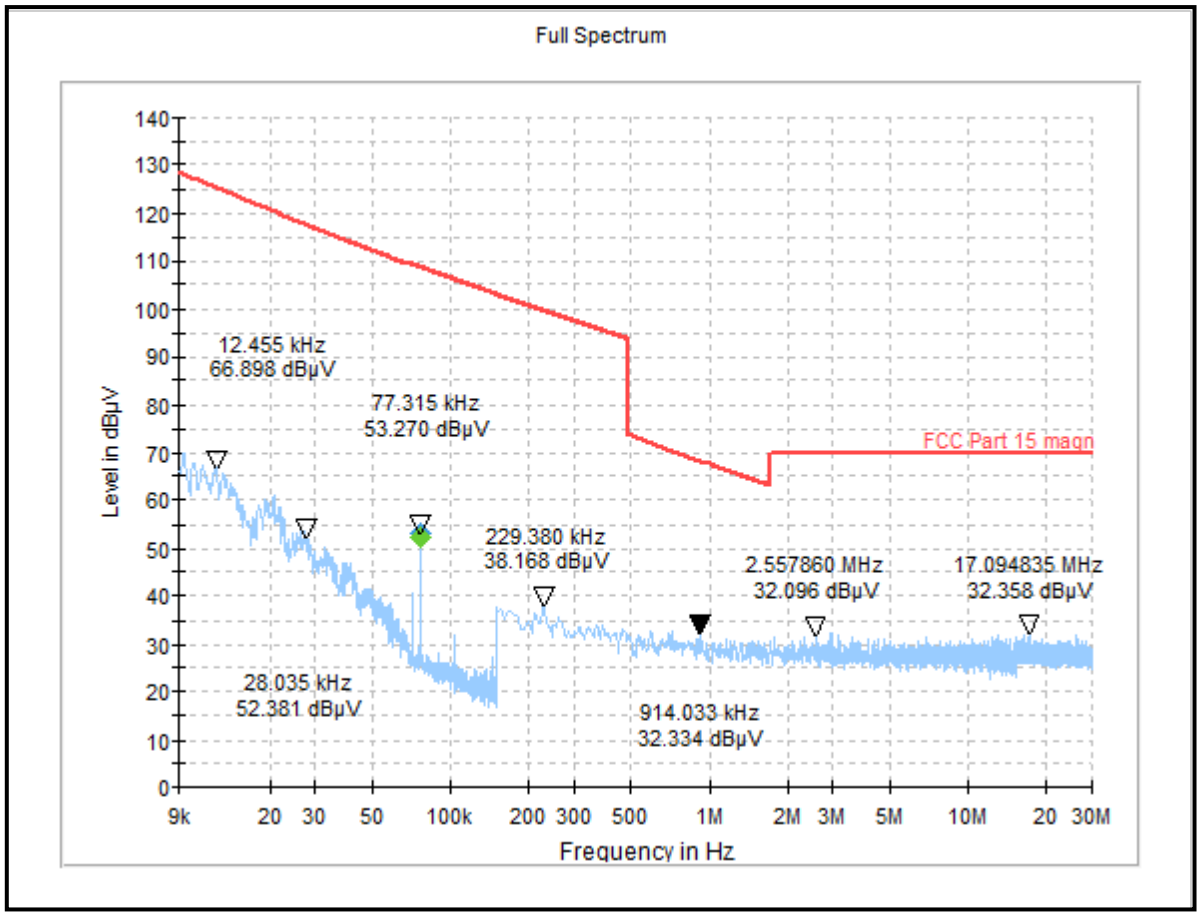
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 12 / Mid Channel / RB1 / QPSK

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
0.08	0° to the EUT	53.27	108.47	55.21	Complied

Plot: 9 kHz – 30 MHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 12 / Mid Channel / RB1 / QPSK



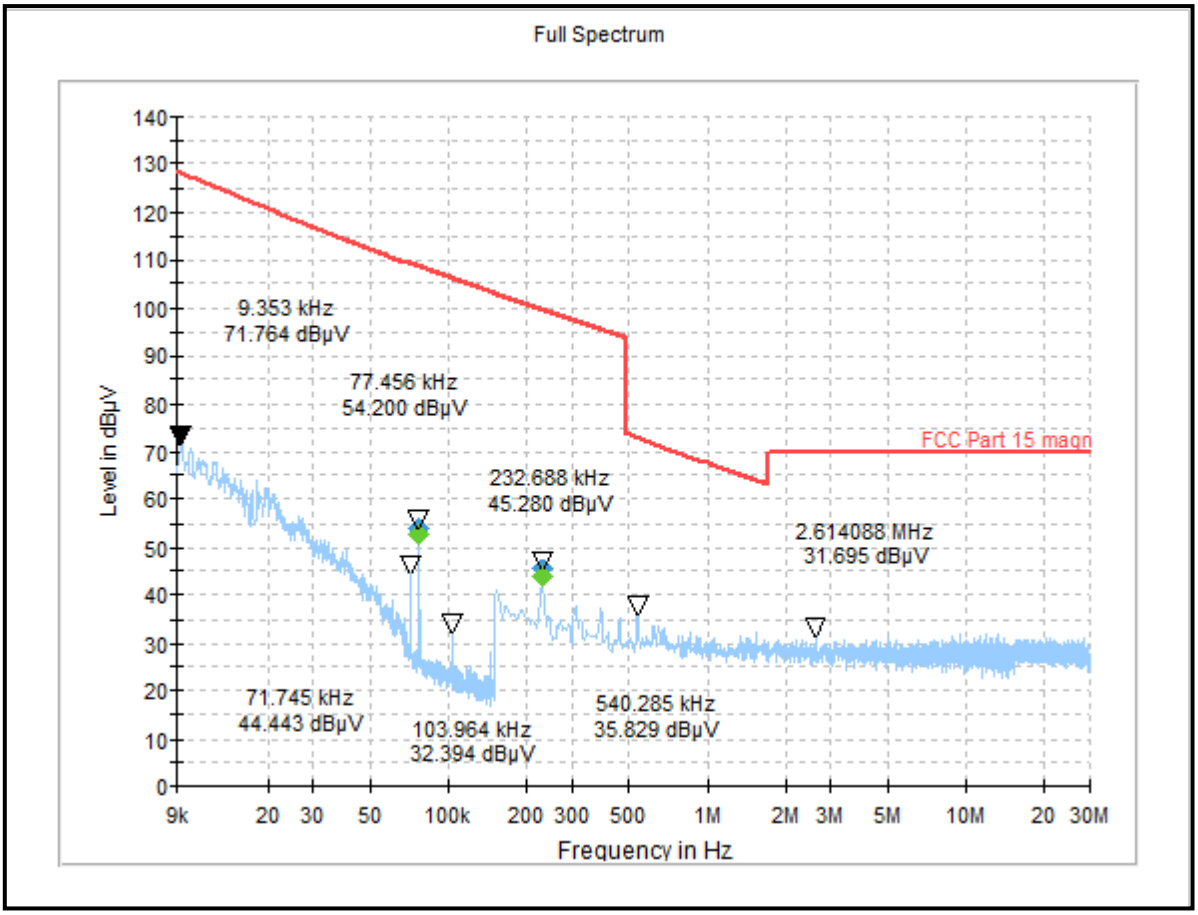
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 41 / Mid Channel / RB1 / QPSK

Frequency (MHz)	Loop Antenna Orientation	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
0.08	0° to the EUT	54.20	108.47	54.27	Complied
0.23	90° to the EUT	45.28	99.47	54.19	Complied

Plot: 9 kHz – 30 MHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 41 / Mid Channel / RB1 / QPSK



Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Date:**	16 May 2022
Test Sample Serial Number:	220405435 (RF Test Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.247(d) & 15.209(a) & Part 2.1053/ 27.53(a)
ISED Reference:	RSS 130 § 4.7 / RSS 139 § 6.6 / RSS-Gen 6.13 & 8.9 / RSS-247 5.5
Test Method Used:	ANSI C63.10:2013 Sections 6.3 and 6.5 KDB 971168 Section 6.1 referencing ANSI C63.26:2015 section 5.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

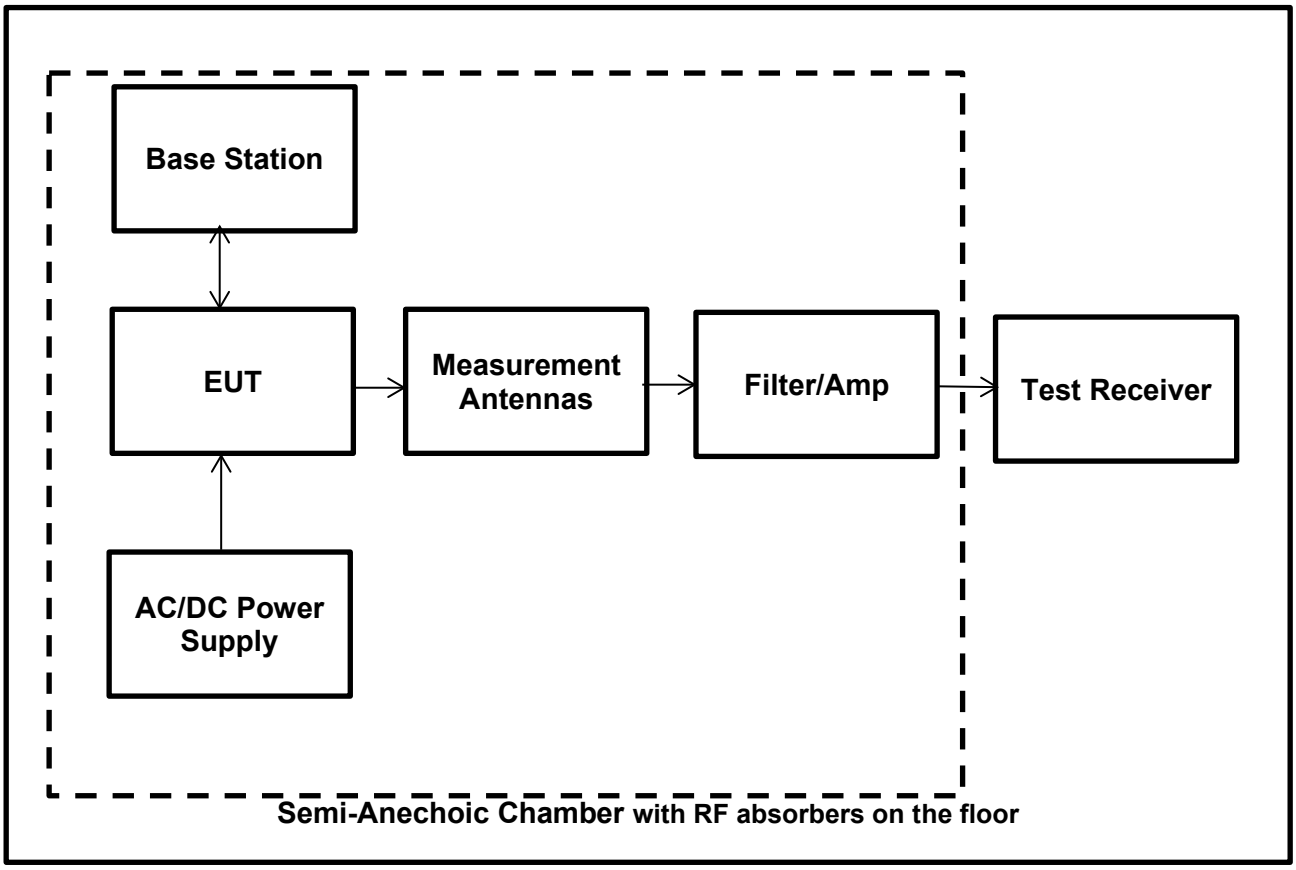
Temperature (°C):	24.4
Relative Humidity (%):	44.1

Note(s):

1. The emissions shown at frequencies approximately 600 MHz – 800 MHz plots are the EUT fundamental for the tested channel.
2. 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.
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. The radiated emissions measurements were performed with the EUT set to the following worst-case mode.
   BT-EDR Mode | Packet Type: 3DH5 | Hopping On | MAX PWR 7
   LTE B4 / B7 / B12 / B41 Test mode: a communication link with Base station (CMW 500)
5. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
6. All other emissions shown on the pre-scan plot were investigated and found to be below the measurement system noise floor.

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Test Setup:

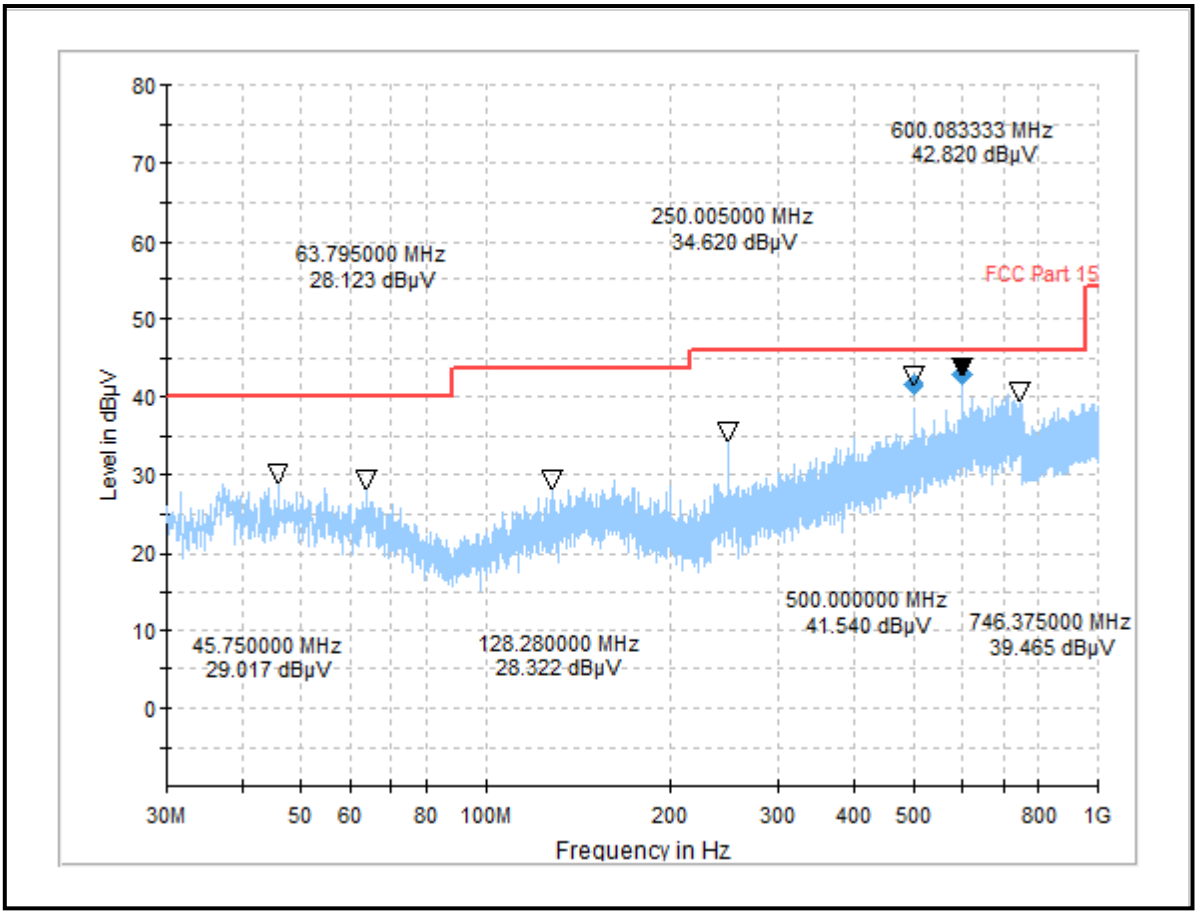


Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 4 / Mid Channel / RB1 / QPSK

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
500.00	Vertical	41.54	46.00	4.46	Complied
600.08	Horizontal	42.82	46.00	3.18	Complied

Plot: 30 MHz – 1 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 4 / Mid Channel / RB1 / QPSK



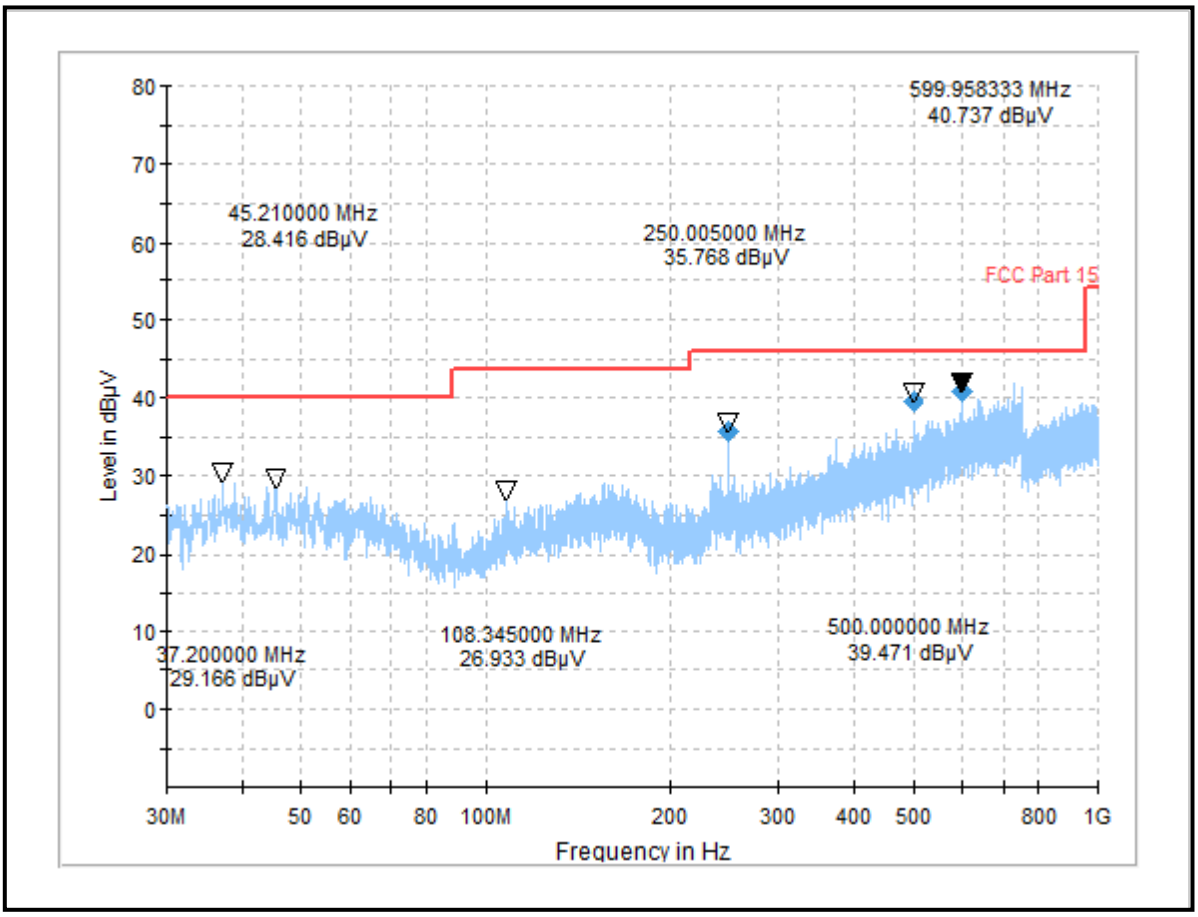
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 7 / Top Channel / RB1 / QPSK

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
250.01	Horizontal	35.67	46.00	10.33	Complied
500.00	Vertical	39.47	46.00	6.53	Complied
599.96	Horizontal	40.74	46.00	5.26	Complied

Plot: 30 MHz – 1 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 7 / Top Channel / RB1 / QPSK



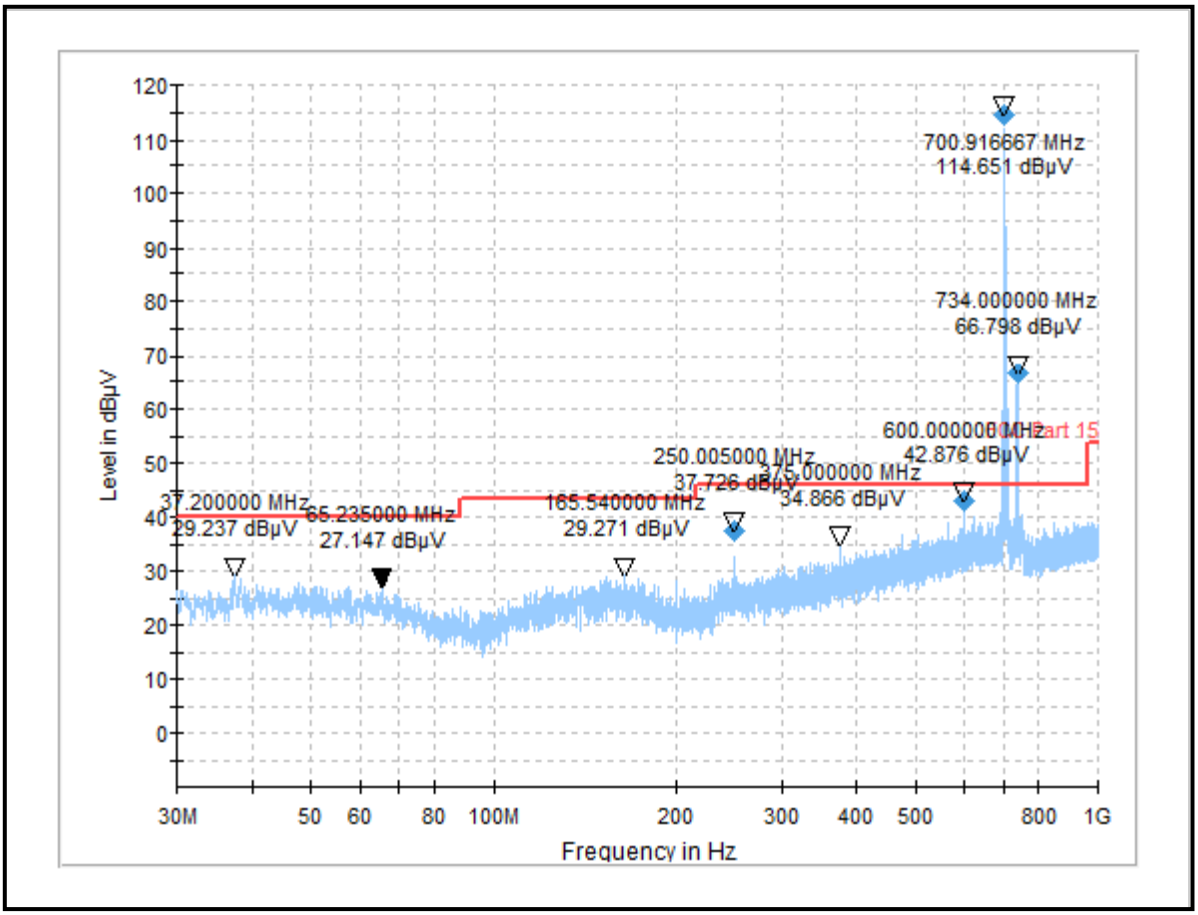
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 12 / Mid Channel / RB1 / QPSK

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
250.01	Horizontal	37.73	46.00	8.27	Complied
600.00	Horizontal	42.88	46.00	3.12	Complied

Plot: 30 MHz – 1 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 12 / Mid Channel / RB1 / QPSK



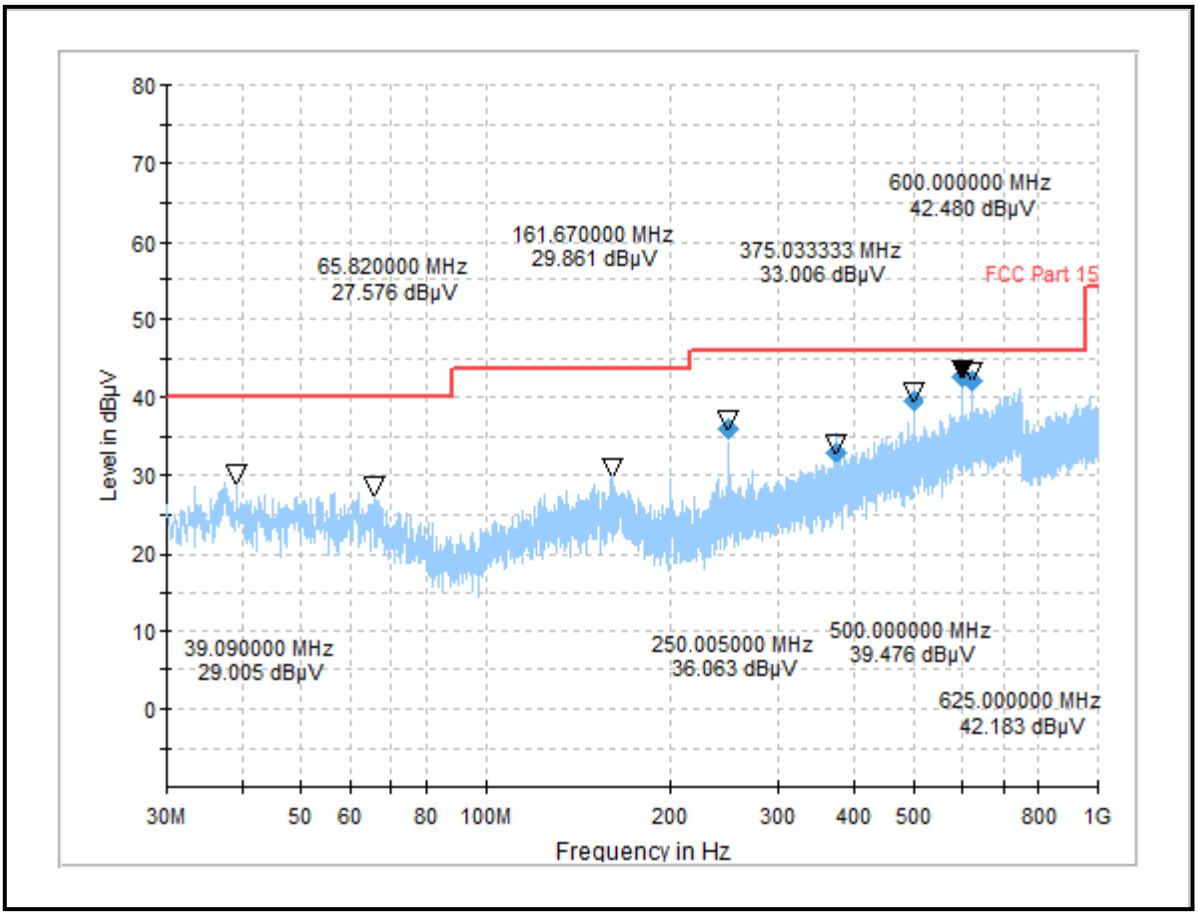
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 41 / Mid Channel / RB1 / QPSK

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
250.01	Horizontal	36.06	46.00	9.94	Complied
375.03	Horizontal	33.01	46.00	12.99	Complied
500.00	Vertical	39.48	46.00	6.52	Complied
600.00	Horizontal	42.48	46.00	3.52	Complied
625.00	Horizontal	42.08	46.00	3.92	Complied

Plot: 30 MHz – 1 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 41 / Mid Channel / RB1 / QPSK



Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Muhammad Faiq Khan	**Test Dates:**	10 & 11 & 16 May 2022
Test Sample Serial Number:	220405435 (RF Test Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.247(d) & 15.209(a) & Part 2.1053/ 27.53(a)
ISED Reference:	RSS 130 § 4.7 / RSS 139 § 6.6 / RSS-Gen 6.13 & 8.9 / RSS-247 5.5
Test Method Used:	ANSI C63.10:2013 Sections 6.3 and 6.5 KDB 971168 Section 6.1 referencing ANSI C63.26:2015 section 5.5
Frequency Range:	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	24.4 & 24.3 & 25.2
Relative Humidity (%):	44.1 & 45.3 & 44.7

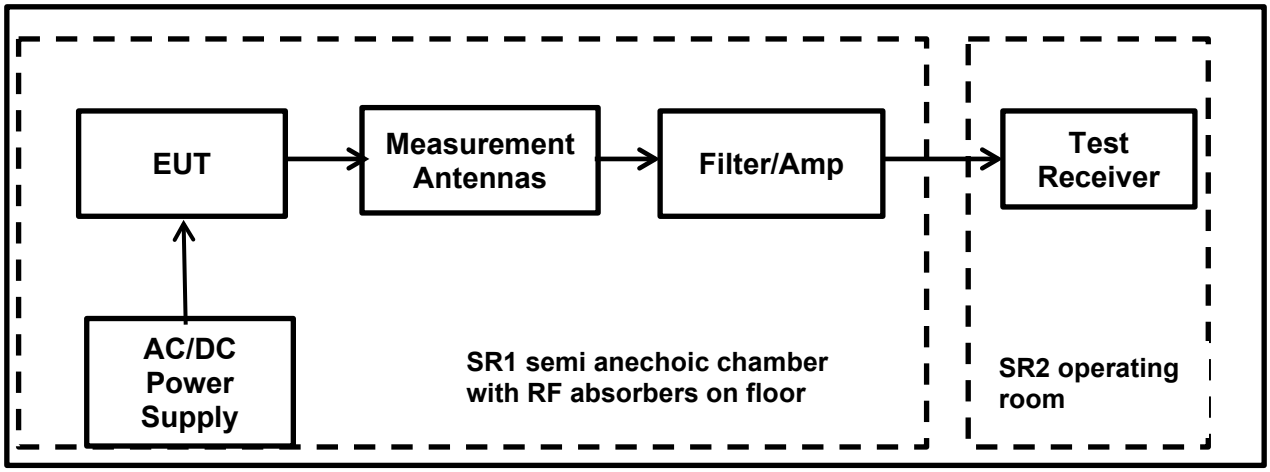
Note(s):

1. The emissions shown at frequencies approximately 2.4 GHz to 2.4835 GHz and 1.8 GHz to 1.9 GHz on the 1 GHz to 18 GHz plots are the EUT fundamental for the tested channel.
2. 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.
3. For frequency range between 1 GHz and 18 GHz, the final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
4. All other emissions shown on the pre-scan plots were investigated and found to be below system noise floor.
5. The radiated emissions measurements were performed with the EUT set to the following worst-case mode.
   - BT-EDR Mode | Packet Type: 3DH5 | Hopping On | MAX PWR 7
   - LTE B4 / B7 / B12 / B41 Test mode: a communication link with Base station (CMW 500)
6. In accordance with ANSI C63.10-2013 Section 5.3.3 & 6.5.3 measurements above 18 GHz were performed at closer distance (1 m); because at specified measurement distance (3m) for compliance the instrumentation noise floor was typically close to the radiated emission limit.
7. For frequency range between 18 GHz and 25 GHz, no critical emissions were found.
8. FCC Part 27.53 Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB, which always comes out to be -13 dBm or 82.2 dBuV/m for frequency ranges above 30 MHz
9. In accordance with FCC KDB 996369 D04 Section 3.1, The radio spectrum is to be investigated with all the transmitters in the final host product functioning to determine that no emissions exceed the highest limit permitted for any one individual transmitter as required by Section §2.947(f).

10. ‘When integrating transmitter modules certified under different rule parts into a single host product, the allowable limit for spurious emissions, caused by simultaneous operation, is the highest limit level allowed by any rule part.

Transmitter Radiated Emissions Test setup

Test Setup:

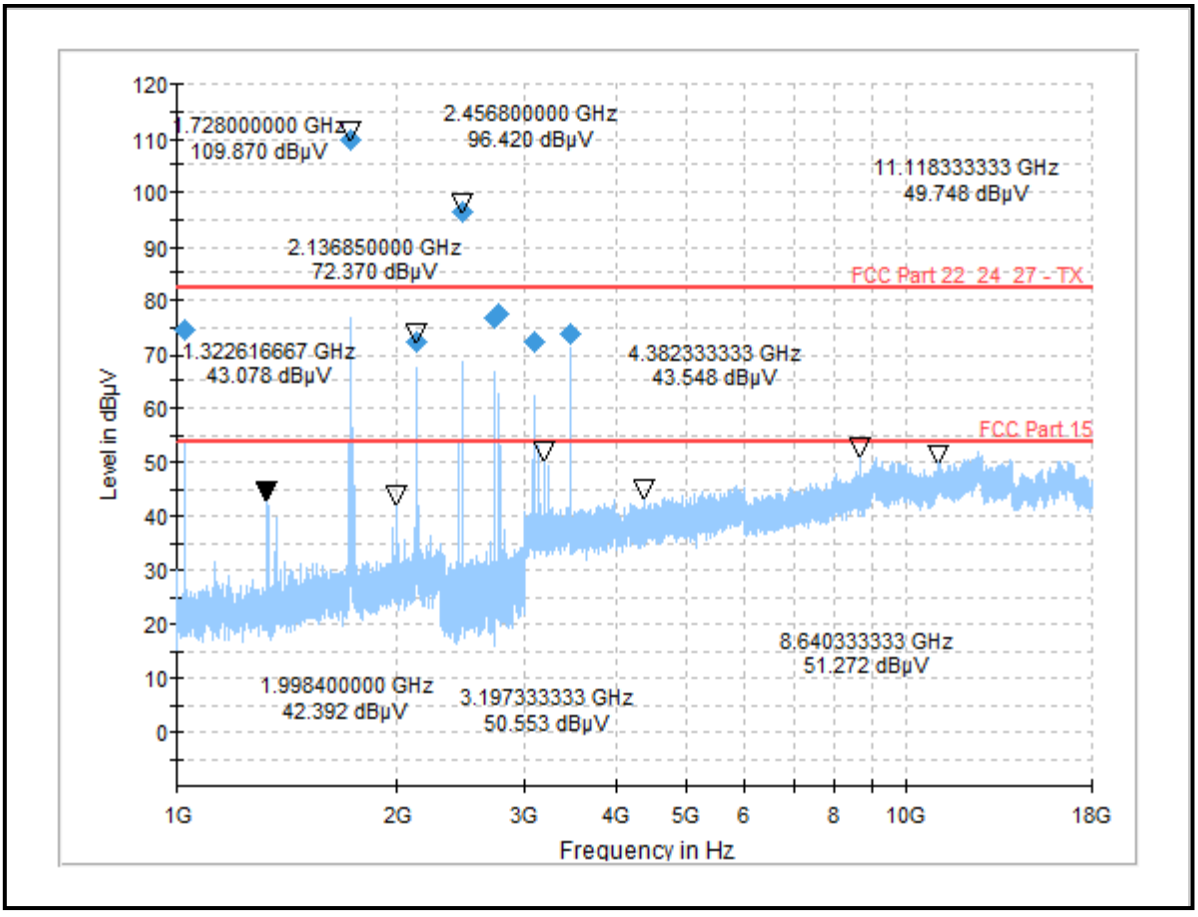


Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 4 / Mid Channel / RB1 / QPSK

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
1026.87	Horizontal	74.60	82.20	7.60	Complied
2136.85	Vertical	72.37	82.20	9.83	Complied
2711.02	Horizontal	76.81	82.20	5.39	Complied
2768.65	Horizontal	77.60	82.20	4.60	Complied
3097.67	Horizontal	72.57	82.20	9.63	Complied
3456.33	Horizontal	73.71	82.20	8.49	Complied

Plot: 1 GHz – 18 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 4 / Mid Channel / RB1 / QPSK



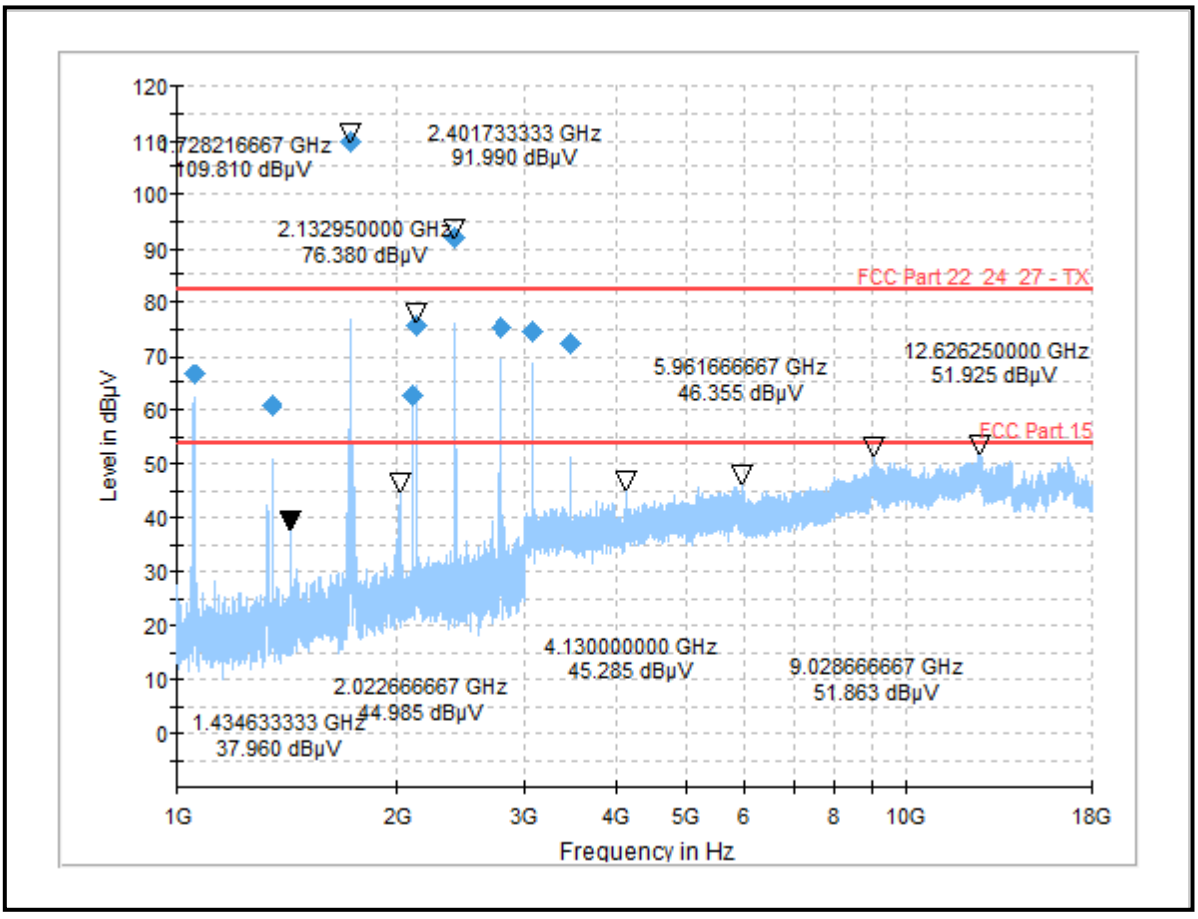
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping OFF / MAX PWR 7 / + LTE Band 4 / Mid Channel / RB1 / QPSK

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
1347.53	Horizontal	60.70	82.20	21.50	Complied
2132.95	Vertical	75.85	82.20	6.35	Complied
2781.95	Horizontal	75.25	82.20	6.95	Complied
1054.17	Horizontal	66.60	82.20	15.60	Complied
2109.33	Horizontal	62.54	82.20	19.66	Complied
3075.83	Horizontal	74.58	82.20	7.62	Complied
3456.00	Horizontal	72.32	82.20	9.88	Complied

Plot: 1 GHz – 18 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping OFF / MAX PWR 7 / + LTE Band 4 / Mid Channel / RB1 / QPSK



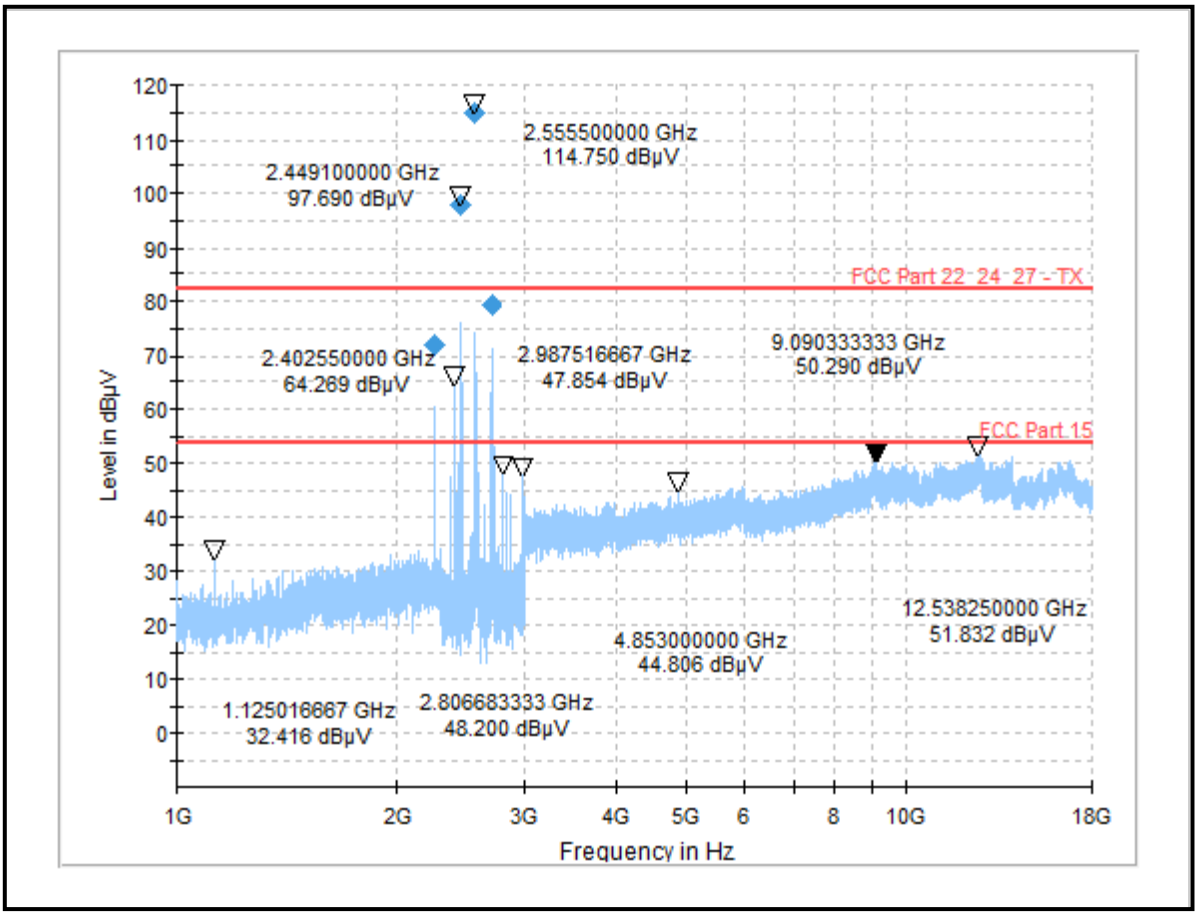
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 7 / Top Channel / RB1 / QPSK

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2254.716667	Horizontal	82.20	10.13	10.33	Complied
2701.100000	Horizontal	82.20	3.02	5.26	Complied

Plot: 1 GHz – 18 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 7 / Top Channel / RB1 / QPSK



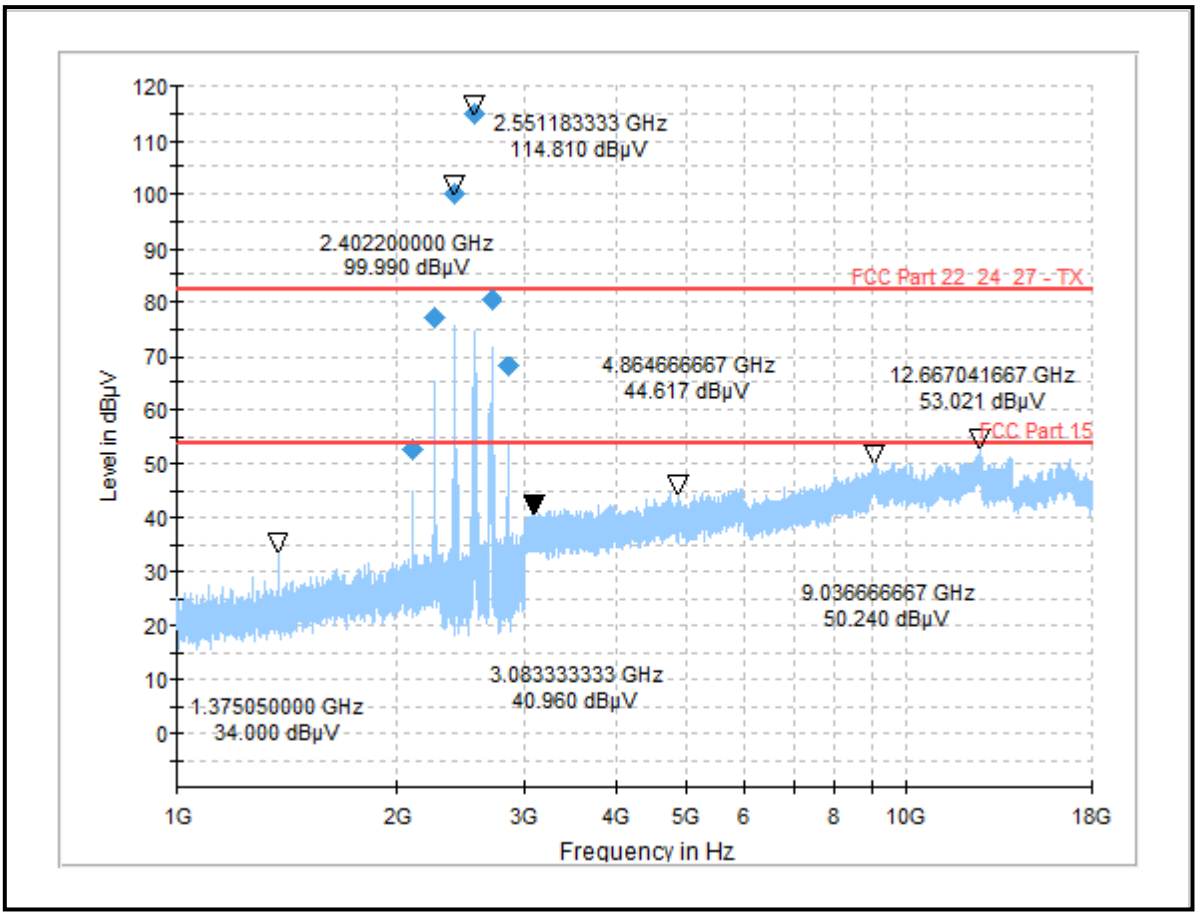
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping OFF / MAX PWR 7 / + LTE Band 7 / Top Channel / RB1 / QPSK

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2103.92	Horizontal	52.68	82.20	29.52	Complied
2253.20	Horizontal	77.02	82.20	5.18	Complied
2700.28	Horizontal	80.35	82.20	1.85	Complied
2849.15	Horizontal	68.22	82.20	13.98	Complied

Plot: 1 GHz – 18 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping OFF / MAX PWR 7 / + LTE Band 7 / Top Channel / RB1 / QPSK



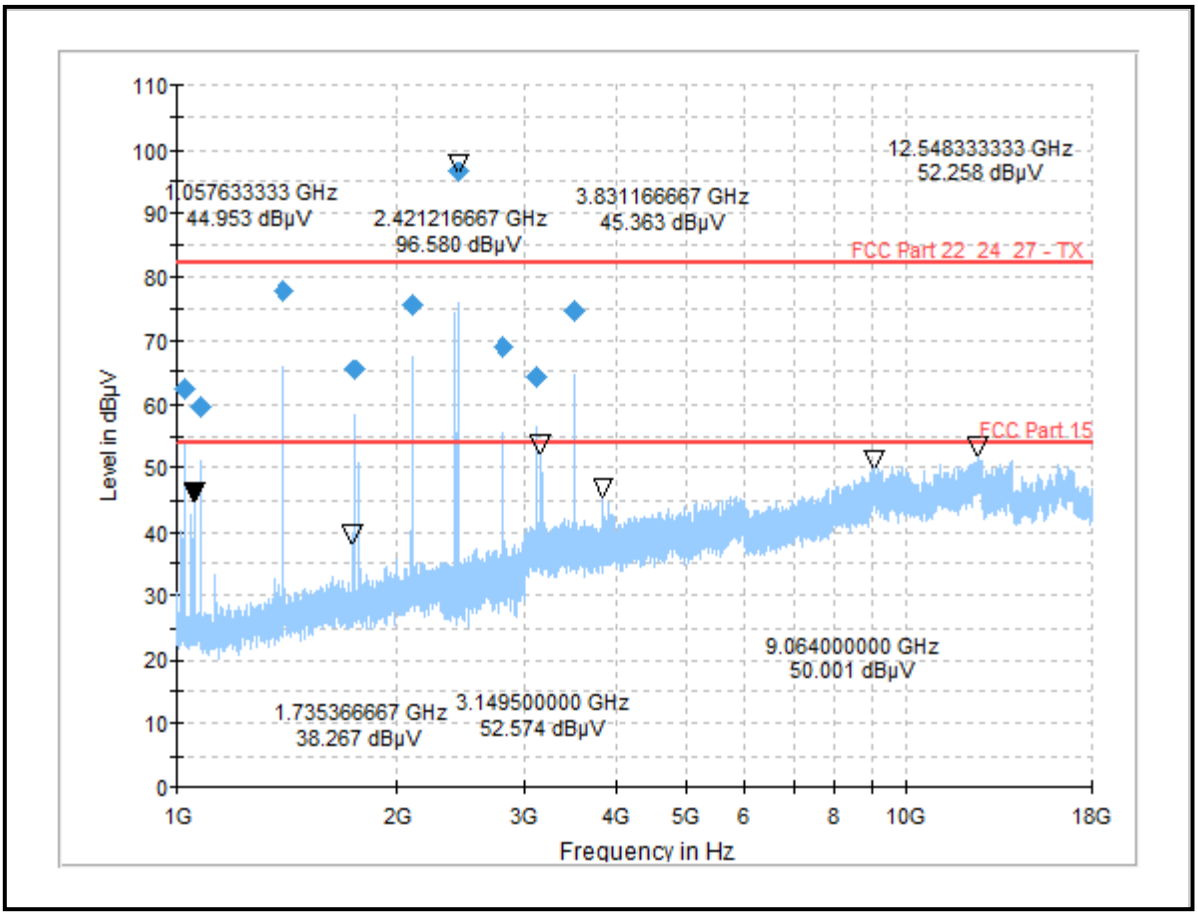
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 12 / Mid Channel / RB1 / QPSK

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
1022.75	Horizontal	62.47	82.20	19.73	Complied
1075.83	Horizontal	59.67	82.20	22.53	Complied
1401.05	Horizontal	77.67	82.20	4.53	Complied
1750.53	Horizontal	65.40	82.20	16.80	Complied
2101.97	Horizontal	75.44	82.20	6.76	Complied
2802.48	Horizontal	68.99	82.20	13.21	Complied
3103.33	Horizontal	64.13	82.20	18.07	Complied
3503.00	Horizontal	74.67	82.20	7.53	Complied

Plot: 1 GHz – 18 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 12 / Mid Channel / RB1 / QPSK



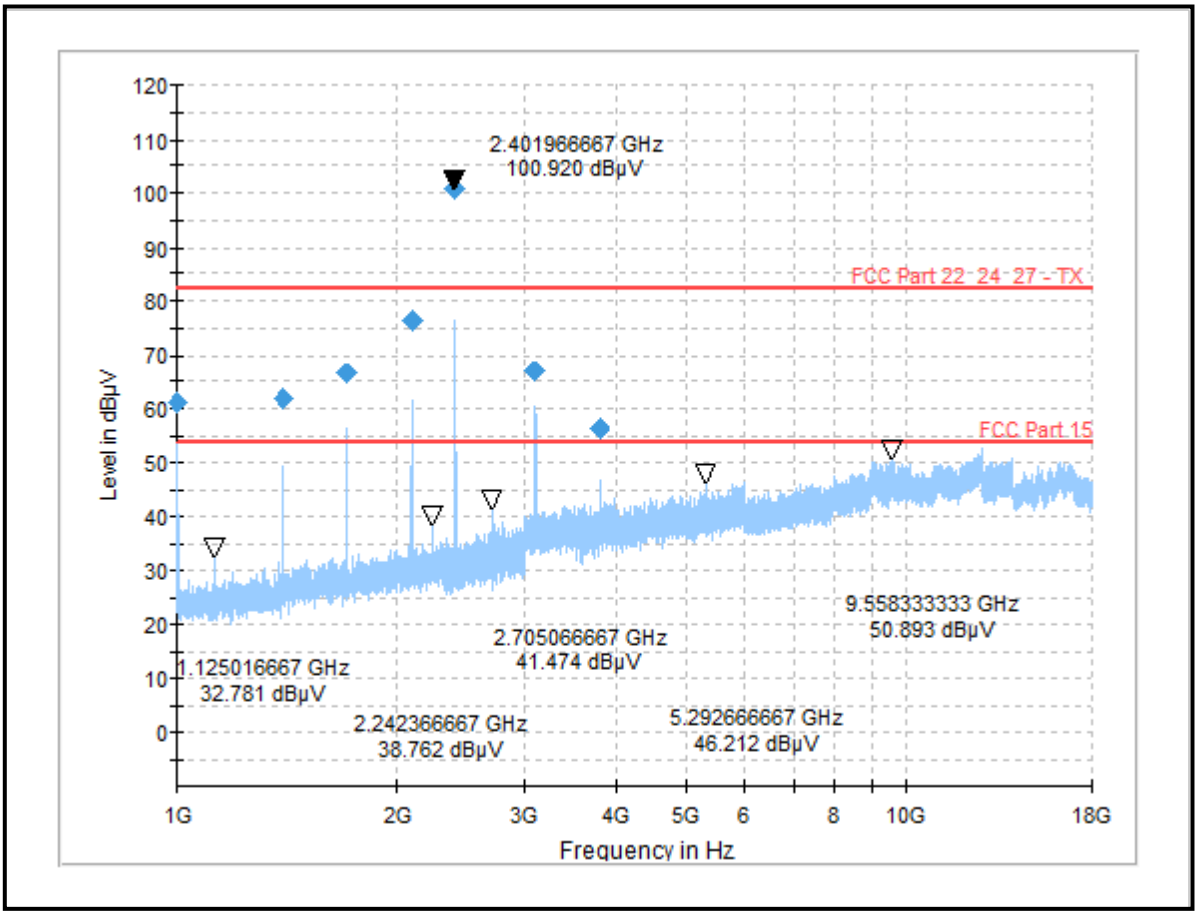
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping OFF / MAX PWR 7 / + LTE Band 12 / Mid Channel / RB1 / QPSK

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
1002.60	Horizontal	61.24	82.20	20.96	Complied
1399.10	Horizontal	61.95	82.20	20.25	Complied
1702.22	Horizontal	66.63	82.20	15.57	Complied
2098.93	Horizontal	76.43	82.20	5.77	Complied
3101.50	Horizontal	66.96	82.20	15.24	Complied
3801.17	Horizontal	56.35	82.20	25.85	Complied

Plot: 1 GHz – 18 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping OFF / MAX PWR 7 / + LTE Band 12 / Mid Channel / RB1 / QPSK



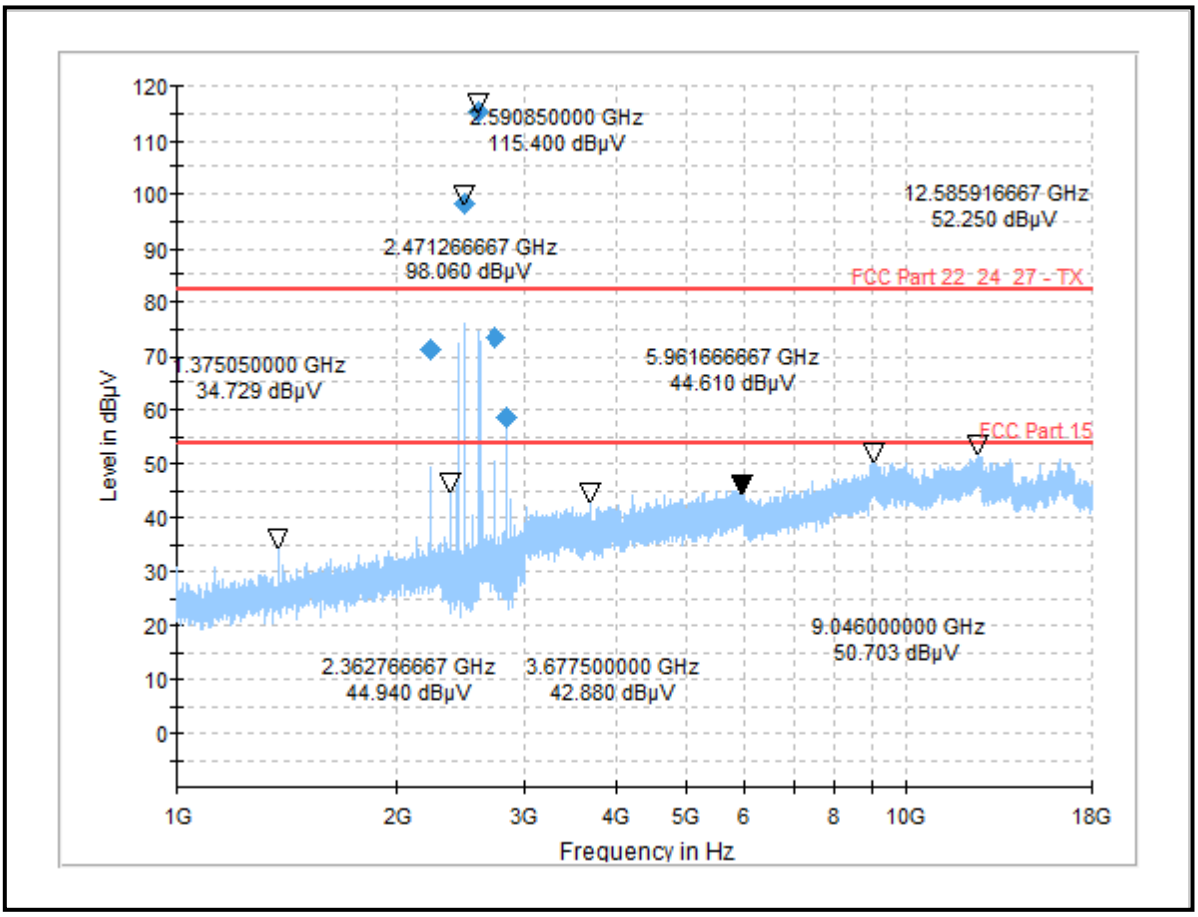
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 41 / Mid Channel / RB1 / QPSK

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2229.37	Horizontal	71.20	82.20	11.00	Complied
2726.53	Horizontal	73.42	82.20	8.78	Complied
2838.65	Horizontal	58.51	82.20	23.69	Complied

Plot: 1 GHz – 18 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 41 / Mid Channel / RB1 / QPSK



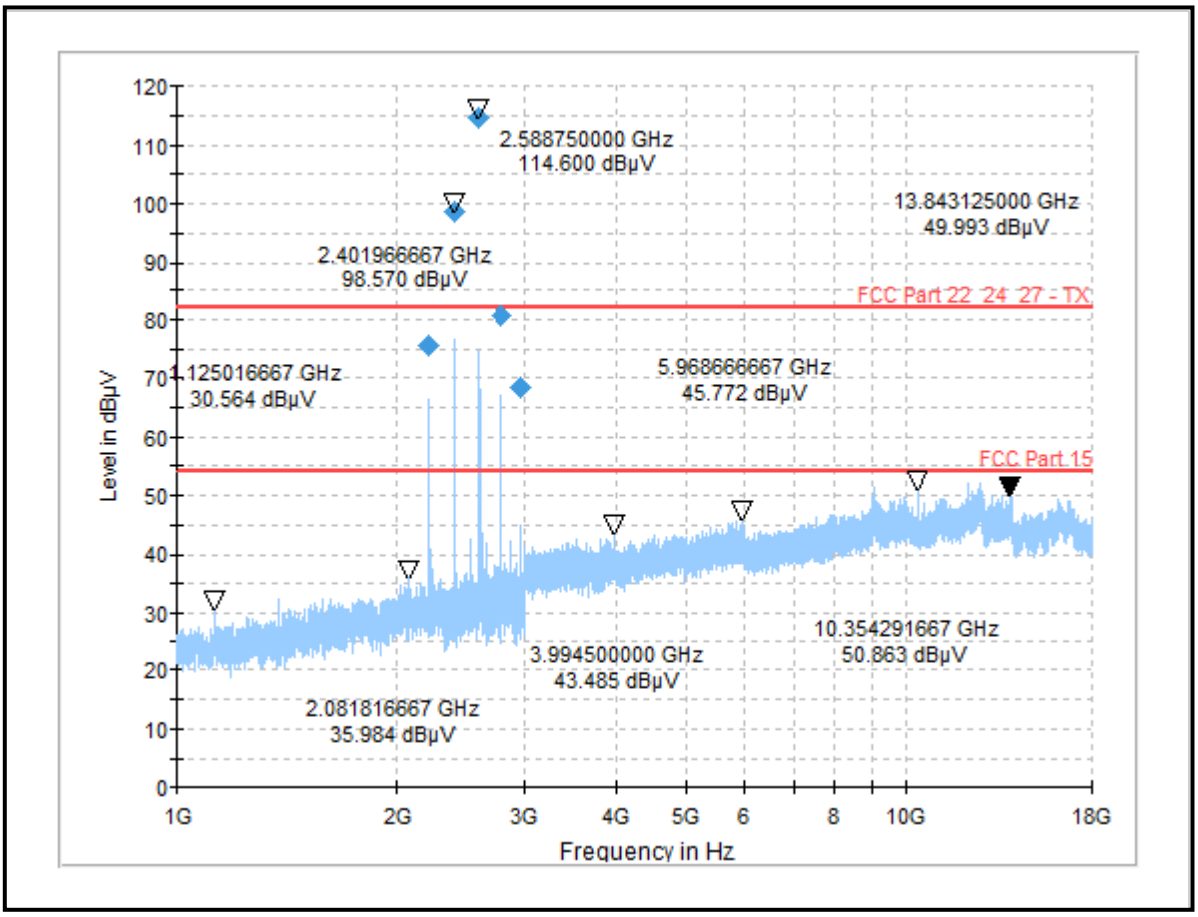
Result: Pass

Transmitter Radiated Emissions / Transmitter out of band Radiated Emission (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping OFF / MAX PWR 7 / + LTE Band 41 / Mid Channel / RB1 / QPSK

Frequency (MHz)	Antenna Polarization	MaxPeak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2215.50	Horizontal	75.80	82.20	6.40	Complied
2775.07	Horizontal	80.73	82.20	1.47	Complied
2961.85	Horizontal	68.33	82.20	13.87	Complied

Plot: 1 GHz – 18 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping OFF / MAX PWR 7 / + LTE Band 41 / Mid Channel / RB1 / QPSK



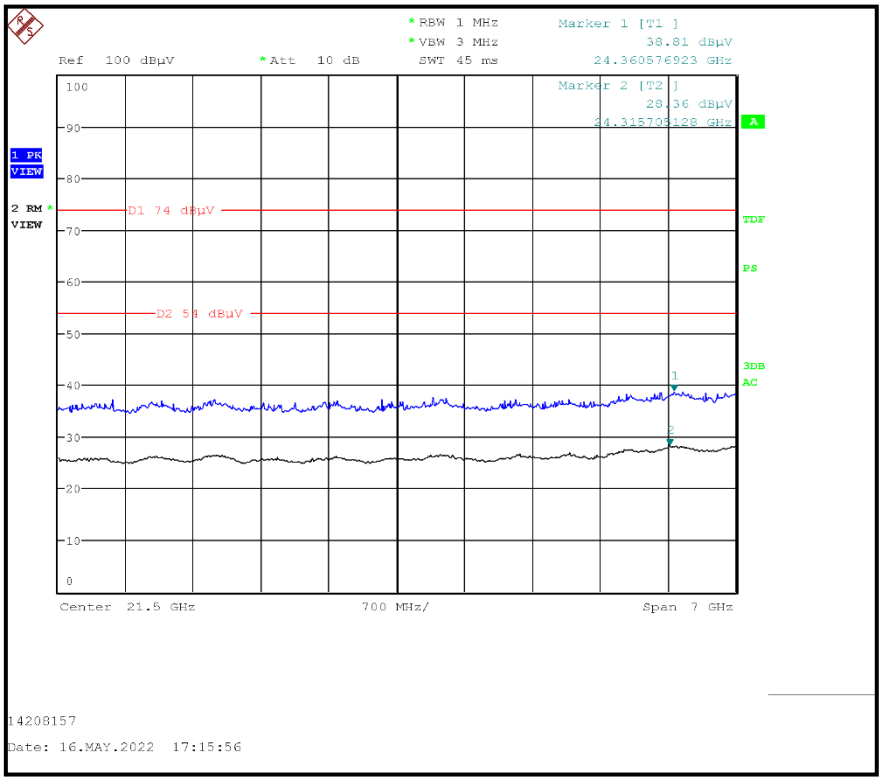
Result: Pass

Transmitter Radiated Emissions (continued)

Results: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 4 / Middle Channel / RB1 / QPSK

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

Plot: 18 GHz – 25 GHz: BT-EDR Mode / Packet Type: 3DH5 / Hopping ON / MAX PWR 7 / + LTE Band 4 / Middle Channel / RB1 / QPSK



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 Spurious 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	2020-07-10	36
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	55929	2021-07-16	12
607	Schwarzbeck	Antenna broadband horn antenna	BBHA 9170	9170-561	2019-10-15	36
460	Deisl	Turntable	DT 4250 S	n/a	n/a	n/a
452	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	2020-09-02	24
496	Rohde & Schwarz	Antenna, Log-Periodic Broadband	HL050	100297	2020-08-05	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	2021-06-28	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 9

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
625	Schwarzbeck	Antenna, H-field	HFSL 7101	109	lab verification only relative measurements	n/a
637	Rohde & Schwarz	Spectrum Analyser	FSV40	101587	2021-07-13	12
-/-	Testo	Thermo-Hygrometer	608-H1	07	lab verification	n/a
645	Weiss Umwelttechnik	Climatic Chamber	LabEvent T/110/70/3	5822619794 0010	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	36	-	Initial Version

--- END OF REPORT ---