TEST REPORT

Test Report No. : UL-RPT-RP-12783364-1116-FCC

Applicant	:	Disruptive Technologies Research AS
Model No.	:	Cloud Connector US
FCC ID	:	2ATFX-100590
Technology	:	902 – 928 MHz (FHSS)
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 1.0
5. Result of the tested sample: **PASS**

Prepared by: Krume Ivanov
Title: Laboratory Engineer
Date: 03 December 2019

Approved by: Jakob, Reschke
Title: Project Engineer
Date: 03 December 2019

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
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STU.CTECHLab@ul.com

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1. Customer Information

1.1.Applicant Information

Company Name:	Disruptive Technologies Research AS
Company Address:	Ytrebygdsveien 215, 5258 Blomsterdalen, Bergen, Norway
Contact Person:	Bengt Johannes Lundberg
Contact E-Mail:	bengt.lundberg@disruptive-technologies.com
Contact Phone No.:	+47 91633887

1.2.Manufacturer Information

Company Name:	Zollner Elektronik AG
Company Address:	Manfred-Zollner-Straße 1, 93499 Zandt, Germany
Contact Person:	Thomas Glasschröder (QA Manager)
Contact E-Mail:	thomas_glasschroeder@zollner.de
Contact Phone No.:	+49 9944-201-7146

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:	22 March 2019
EUT arrived:	30 September 2019
Test Dates:	30 September 2019 to 02 October 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)(1)	Transmitter 20 dB Bandwidth	☒	☐	☐	☐
Part 15.247(a)(1)	Transmitter Carrier Frequency Separation	☒	☐	☐	☐
Part 15.247(a)(1)(i)	Transmitter Number of Hopping Frequencies and Average Time of Occupancy	☒	☐	☐	☐
Part 15.247(b)(2)	Transmitter Maximum Peak Output Power	☒	☐	☐	☐
Part 15.247(d)	Transmitter Radiated Emissions	☒	☐	☐	☐
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	☒	☐	☐	☐

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 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:	Disruptive Technologies
Model Name or Number:	Cloud Connector US
Test Sample Serial Number:	bhrqmesc0001233subm0 (Radiated sample)
Hardware Version Number:	100590-1.1
Firmware Version Number	101631
Software Version Number:	develop/2.0.0.136, endre.bjorsvik/channel-hopping-request/2.0.0.2
FCC ID:	2ATFX-100590

Brand Name:	Disruptive Technologies
Model Name or Number:	Cloud Connector US
Test Sample Serial Number:	bhrrsmsc0001233sucq0 (Conducted sample with RF port)
Hardware Version Number:	100590-1.1
Firmware Version Number	101631
Software Version Number:	develop/2.0.0.136, endre.bjorsvik/channel-hopping-request/2.0.0.2
FCC ID:	2ATFX-100590

Brand Name:	Disruptive Technologies
Model Name or Number:	Cloud Connector US
Test Sample Serial Number:	bhrucqkc0001233sue5g (AC-conducted sample)
Hardware Version Number:	100590-1.1
Firmware Version Number	101631
Software Version Number:	develop/2.0.0.136, endre.bjorsvik/channel-hopping-request/2.0.0.2
FCC ID:	2ATFX-100590

3.2. Description of EUT

The equipment under test was a gateway with an 915 MHz RF-Technology, that relays communication between sensors and the cloud. Wireless communication in the frequency band 902-928 MHz is used to the sensors whereas communication over Ethernet is used to the cloud. The equipment is powered over Ethernet.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Tested Technology:	902-928 MHz (FHSS) Boost Mode	
Power Supply Requirement:	Nominal	36 – 57 V AC, Typical 48 V AC
Type of Unit:	Transceiver	
Channel Spacing:	155 kHz	
Modulation:	Frequency Shift Keying (FSK)	
Data Rate (kbps):	25	
Measured Maximum Conducted Output Power:	24.63 dBm	
Integrated Antennas	Antenna 1 & Antenna 2	
Antenna 1 Gain:	0.0 dBi	
Antenna 1 Type:	Integrated PCB Antenna	
Antenna 1 Details :	PCB No. 100605 | PCB Revision: 1.1.0 | Manufacturer: DISRUPTIVE TECHNOLOGIES	
Antenna 2 Gain:	0.0 dBi	
Antenna 2 Type:	Integrated PCB Antenna	
Antenna 2 Details :	PCB No. 100605 | PCB Revision: 1.1.0 | Manufacturer: DISRUPTIVE TECHNOLOGIES	
Transmit Frequency Range:	902.775 MHz to 927.225 MHz	
Transmit Lower Hopping Sequence:	902.775 MHz to 912.540 MHz	
Transmit Upper Hopping Sequence:	917.460 MHz to 927.225 MHz	
Transmit Channels (Fixed Frequency) Tested:	**Channel ID**	**Channel Frequency (MHz)**
	Bottom	902.775
	Middle	915.000
	Top	927.225
Transmit Channels (Hopping Mode) Tested:	**Hopping Sequence**	**Channel Frequency Range (MHz)**
	Lower	902.775 MHz to 912.540 MHz
	Upper	917.460 MHz to 927.225 MHz

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	Wireless Gigabit VDSL/ADSL Modem Router	TP-LINK	Archer VR600-	216C713000272
2	RJ 45 Cable Yellow Cat6A	Not stated	Not stated	Not stated
3	8 Gigabit PoE Switch	Hewlett Packard Enterprise Company	J9562A	CN6280303J
4	Advanced Wireless N Router	TP-Link	TL-WR941ND	12292404777

B. Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Ethernet switch with power-over-ethernet (PoE) Injector	D-Link	DPE-101GI	SQ031HB003386
2	Switching Power Supply (PoE)	mimosa	POE16R-560	502-00005
3	POE/LAN Cable 5 m (M12x Coded to RJ45)	Not stated	1407473	Not stated
4	Laptop computer	Apple	MacBook Pro	C02T60V0GY25
5	50 Ohm terminations	Huber + Suhner	65_SMA-50-0-20	Not stated
6	SMA Jack to RF Switch Probe 50 Ohm	Not stated	Not stated	Not stated
7	50 cm RF SMA Plug Right angle to SMA Jack Cable	Not stated	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 Mode – Boost Mode Fixed Channel Frequency Mode
☒ Transmitting Mode - Boost Mode Frequency Hopping Mode-Lower Hopping Sequence
☒ Transmitting Mode - Boost Mode Frequency Hopping Mode-Upper Hopping Sequence

4.2. Configuration and Peripherals

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

- **EUT Power Supply:**
  - For AC Conducted measurement the EUT was powered via 8 Gigabit Power Over Ethernet (PoE) Switch, connected to 120 V AC 60 Hz.
  - For all conducted measurements the EUT was powered via mimosa RJ45 Switching Power Over Ethernet Supply (PoE), connected to 120 V AC 60 Hz.
  - For all radiated measurements the EUT was powered via D-Link Power Over Ethernet (PoE), connected to 120 V AC 60Hz.
- **Test Mode Activation:**
  - The test mode settings were activated using a test setup instructions “2019-07-24 Instructions for UL to operate CCONs.pdf” supplied by customer.
  - The Test mode configuration files were installed on MacBook supplied by customer.
  - The application was used to enable continuous transmission mode, to select test modes (Fixed Frequency or Hopping Mode), test channels & supported integrated Antenna types as required.
  - The EUT was made to transmit continuously with a duty cycle of more than 98 %. Therefore no duty cycle corrections are required for radiated emissions measured with Average detector.
  - All supported integrated antennas are reported under section 3.4.
- **Conducted Measurements:**
  - RF Output Power, Occupied Channel Bandwidth & Duty Cycles, 20 dB Bandwidth, Carrier Frequency Separation, Number of Hopping Frequencies and Average Time of Occupancy were measured with conducted sample.
  - All measurements were performed on Antenna Port 1 with Antenna Port 2 terminated with 50 Ω termination.
  - 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 (maximum 0.4 dB at the tested frequencies)from the EUT to Analyzer including the 10 dB attenuation at the Spectrum Analyzer input and 1.0 dB for the W. FL-SMA RF cable attenuation was added as a reference level offset (11.4 dB) to each of the conducted plots.
- **AC Conducted Emissions Measurements:**
  - AC conducted tests were performed with all supported integrated antennas .
  - AC conducted tests were performed with all test modes (Fixed Frequency or Hopping Mode).
  - The Toyo EMI Software EP5/CE Ver 4.0.1. was used for these measurements.
- **Radiated Band Edge & Spurious Emission Measurements:**
  - Radiated Band edge & Spurious Emission were performed with all supported integrated antennas.

- Before starting final radiated measurements “worst case verification” with the EUT in Standing-position & Laying-position for each supported Antenna was performed by Lab.
  - Antenna 1: The EUT in Laying position was found to be the worst case therefore this report includes relevant results.
  - Antenna 2: The EUT in Standing position was found to be the worst case therefore this report includes relevant results.
- Radiated spurious emissions were performed with the EUT positioned on the turn table and rotating 360 degrees while the antenna height varies from 1 to 4 m over the measurement frequency range.
- 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:	Vladimir Eppel	**Test Date:**	02 October 2019
Test Sample Serial Number:	bhrucqkc0001233sue5g		
Test Site Identification	SR 7/8		

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

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	39

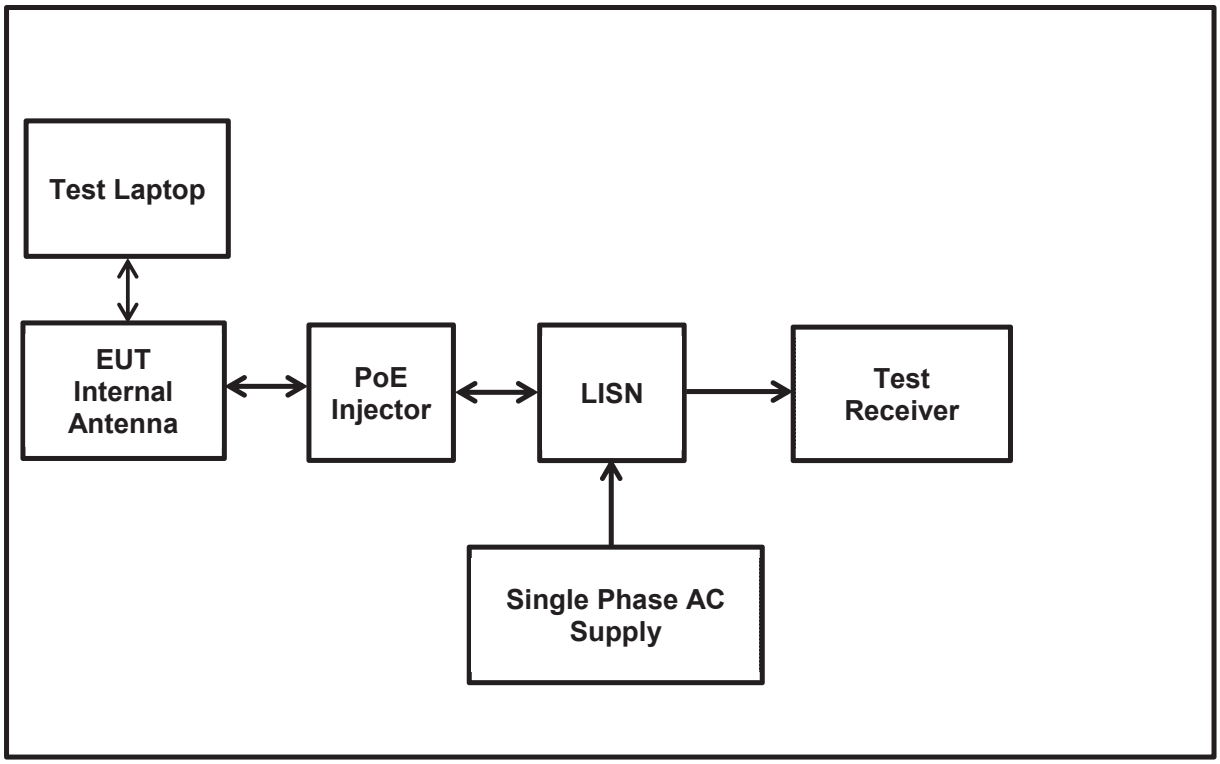
Settings of the Instrument

Detector	Quasi Peak /Average Peak

Note:

1. The EUT was connected to 120 VAC 60 Hz single phase supply via a LISN.
2. AC conducted tests were performed with all supported integrated antennas .
3. AC conducted tests were performed with all test modes (Fixed Frequency or Hopping Mode).
   - TX | Boost Mode | Antenna 1 | Middle Channel – 915.000 MHz
   - TX | Boost Mode | Antenna 1 | Hopping Channels 902.775 - 927.225 MHz
   - TX | Boost Mode | Antenna 2 | Bottom Channel – 902.775 MHz
   - TX | Boost Mode | Antenna 2 | Hopping Channels 902.775 - 927.225 MHz

Transmitter AC Conducted Spurious Emissions (continued)
Test setup:



Transmitter AC Conducted Spurious Emissions (continued)

Boost Mode / Fixed Frequency Mode / Middle Channel / Antenna 1

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.152	Live	36.0	65.9	29.9	Complied
0.15852	Live	34.8	65.5	30.7	Complied
0.16603	Live	33.7	65.2	31.5	Complied
0.17906	Live	31.1	64.5	33.4	Complied
0.19509	Live	28.2	63.8	35.6	Complied
0.52325	Live	16.8	56.0	39.2	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.152	Live	19.1	55.9	36.8	Complied
0.15852	Live	17.0	55.5	38.5	Complied
0.16603	Live	20.0	55.2	35.2	Complied
0.17906	Live	15.7	54.5	38.8	Complied
0.19509	Live	17.6	53.8	36.2	Complied
0.52325	Live	11.6	46.0	34.4	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Boost Mode / Fixed Frequency Mode / Middle Channel / Antenna 1

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.15752	Neutral	35.1	65.6	30.5	Complied
0.16253	Neutral	34.3	65.3	31.0	Complied
0.16904	Neutral	33.5	65.0	31.5	Complied
0.19158	Neutral	29.2	64.0	34.8	Complied
0.21212	Neutral	25.8	63.1	37.3	Complied
0.4491	Neutral	15.5	56.9	41.4	Complied

Results: Neutral / Average / 120 VAC 60 Hz

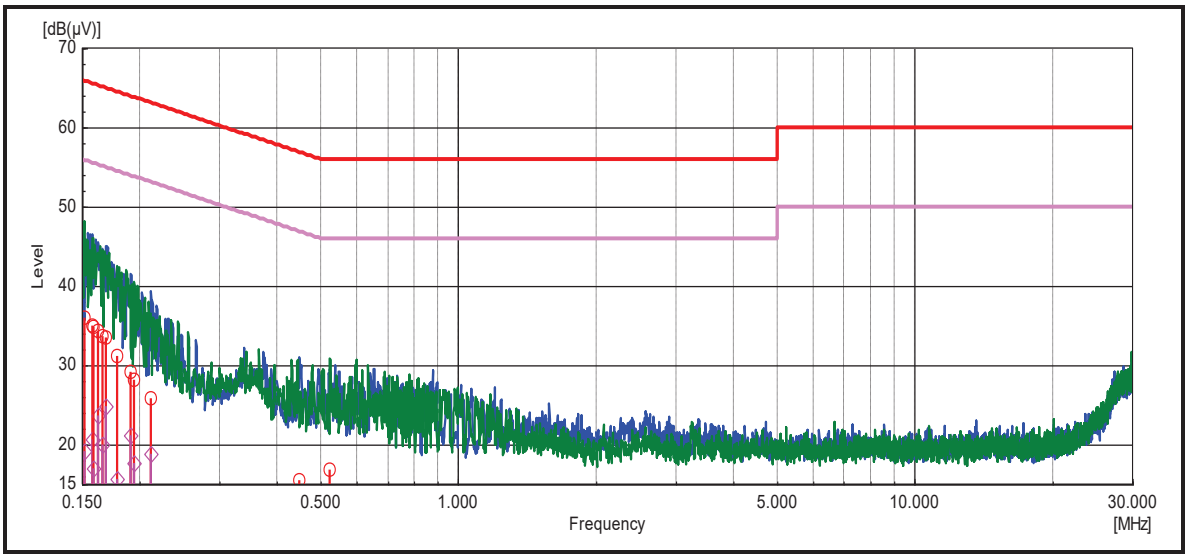
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.15752	Neutral	20.6	55.6	35.0	Complied
0.16253	Neutral	23.7	55.3	31.6	Complied
0.16904	Neutral	24.8	55.0	30.2	Complied
0.19158	Neutral	21.2	54.0	32.8	Complied
0.21212	Neutral	18.8	53.1	34.3	Complied
0.4491	Neutral	10.8	46.9	36.1	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Boost Mode / Fixed Frequency Mode / Middle Channel / Antenna 1

Plot: Live and Neutral Line



Note: The plots show the max hold (peak detector) pre-scan results measured. Blue graph represents the result of the N-Line; green graph - the results for L1-Line. The bar graphs indicate the final measurement result applying the dedicated detector at selected frequencies for each limit line (red cycle for quasi peak limit; violet cycle for average limit).

Legend (Conducted Emissions)	
Items	Description
	Blue graph is the result of peak measurement phase L
	Green graph is the result of peak measurement phase N
	Limit line **Quasi-Peak**
	Limit line **Average**
	Final item **Quasi-Peak**
	Final item **Average**

Transmitter AC Conducted Spurious Emissions (continued)

Boost Mode / Hopping Mode / Antenna 1

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1515	Live	35.4	65.9	30.5	Complied
0.15752	Live	34.5	65.6	31.1	Complied
0.16603	Live	33.0	65.2	32.2	Complied
0.17255	Live	31.5	64.8	33.3	Complied
0.17605	Live	30.8	64.7	33.9	Complied
0.67355	Live	18.1	56.0	37.9	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1515	Live	19.3	55.9	36.6	Complied
0.15752	Live	21.2	55.6	34.4	Complied
0.16603	Live	18.8	55.2	36.4	Complied
0.17255	Live	15.7	54.8	39.1	Complied
0.17605	Live	15.9	54.7	38.8	Complied
0.67355	Live	11.3	46.0	34.7	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Boost Mode / Hopping Mode / Antenna 1

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.15401	Neutral	35.1	65.8	30.7	Complied
0.15451	Neutral	35.0	65.8	30.8	Complied
0.16754	Neutral	32.6	65.1	32.5	Complied
0.17856	Neutral	30.6	64.6	34	Complied
0.20311	Neutral	26.4	63.5	37.1	Complied
0.38697	Neutral	23.9	58.1	34.2	Complied

Results: Neutral / Average / 120 VAC 60 Hz

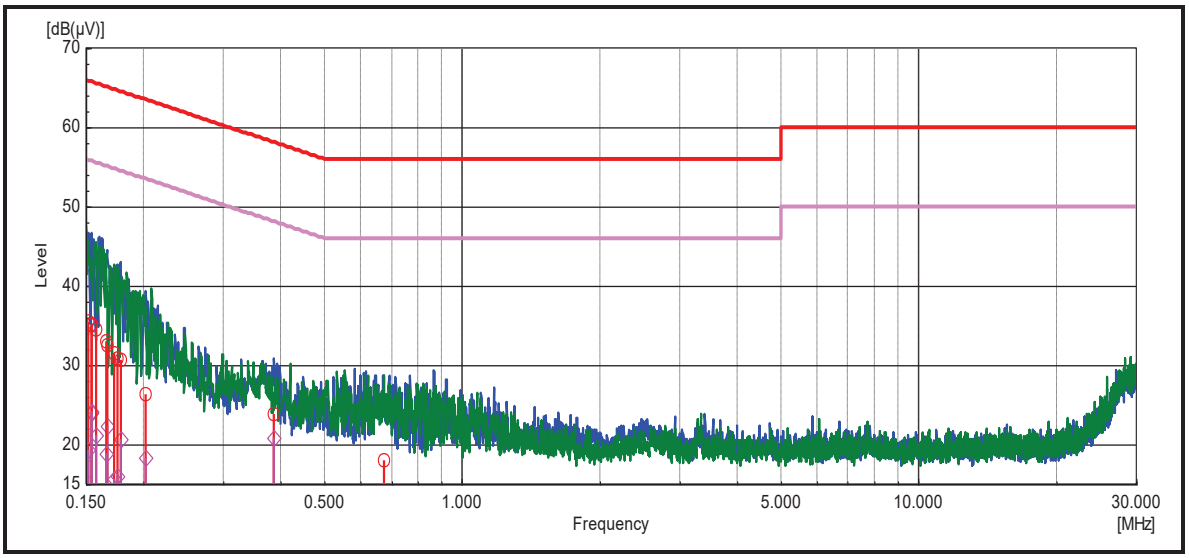
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.15401	Neutral	24.0	55.8	31.8	Complied
0.15451	Neutral	24.2	55.8	31.6	Complied
0.16754	Neutral	22.3	55.1	32.8	Complied
0.17856	Neutral	20.6	54.6	34	Complied
0.20311	Neutral	18.3	53.5	35.2	Complied
0.38697	Neutral	20.9	48.1	27.2	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Boost Mode / Hopping Mode / Antenna 1

Plot: Live and Neutral Line



Note: The plots show the max hold (peak detector) pre-scan results measured. Blue graph represents the result of the N-Line; green graph - the results for L1-Line. The bar graphs indicate the final measurement result applying the dedicated detector at selected frequencies for each limit line (red cycle for quasi peak limit; violet cycle for average limit).

Legend (Conducted Emissions)	
Items	Description
	Blue graph is the result of peak measurement phase L
	Green graph is the result of peak measurement phase N
	Limit line **Quasi-Peak**
	Limit line **Average**
	Final item **Quasi-Peak**
	Final item **Average**

Transmitter AC Conducted Spurious Emissions (continued)

Boost Mode / Fixed Frequency Mode / Bottom Channel / Antenna 2

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.15401	Live	35.8	65.8	30.0	Complied
0.16954	Live	33.1	65.0	31.9	Complied
0.18006	Live	30.9	64.5	33.6	Complied
0.19459	Live	28.5	63.8	35.3	Complied
0.21012	Live	25.7	63.2	37.5	Complied
0.23467	Live	22.5	62.3	39.8	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.15401	Live	17.4	55.8	38.4	Complied
0.16954	Live	19.0	55.0	36.0	Complied
0.18006	Live	15.2	54.5	39.3	Complied
0.19459	Live	17.8	53.8	36.0	Complied
0.21012	Live	17.8	53.2	35.4	Complied
0.23467	Live	16.8	52.3	35.5	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Boost Mode / Fixed Frequency Mode / Bottom Channel / Antenna 2

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.15401	Neutral	35.8	65.8	30.0	Complied
0.16303	Neutral	34.4	65.3	30.9	Complied
0.17255	Neutral	32.7	64.8	32.1	Complied
0.19108	Neutral	29.6	64.0	34.4	Complied
0.2006	Neutral	27.3	63.6	36.3	Complied
0.21814	Neutral	24.7	62.9	38.2	Complied

Results: Neutral / Average / 120 VAC 60 Hz

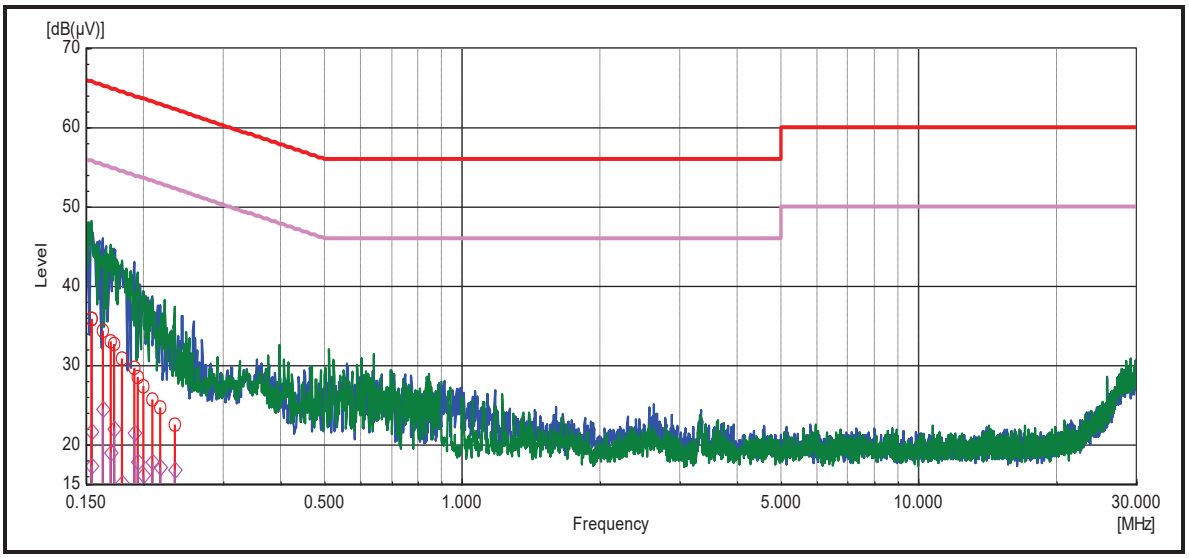
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.15401	Neutral	21.7	55.8	34.1	Complied
0.16303	Neutral	24.4	55.3	30.9	Complied
0.17255	Neutral	22.0	54.8	32.8	Complied
0.19108	Neutral	21.5	54.0	32.5	Complied
0.2006	Neutral	16.2	53.6	37.4	Complied
0.21814	Neutral	17.2	52.9	35.7	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Boost Mode / Fixed Frequency Mode / Bottom Channel / Antenna 2

Plot: Live and Neutral Line



Note: The plots show the max hold (peak detector) pre-scan results measured. Blue graph represents the result of the N-Line; green graph - the results for L1-Line. The bar graphs indicate the final measurement result applying the dedicated detector at selected frequencies for each limit line (red cycle for quasi peak limit; violet cycle for average limit).

Legend (Conducted Emissions)	
Items	Description
	Blue graph is the result of peak measurement phase L
	Green graph is the result of peak measurement phase N
	Limit line **Quasi-Peak**
	Limit line **Average**
	Final item **Quasi-Peak**
	Final item **Average**

Transmitter AC Conducted Spurious Emissions (continued)

Boost Mode / Hopping Mode / Antenna 2

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1505	Live	35.6	66.0	30.4	Complied
0.16353	Live	33.6	65.3	31.7	Complied
0.17756	Live	30.6	64.6	34	Complied
0.18056	Live	30.3	64.5	34.2	Complied
0.19058	Live	28.3	64.0	35.7	Complied
0.25721	Live	19.5	61.5	42	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.1505	Live	18.8	56.0	37.2	Complied
0.16353	Live	20.6	55.3	34.7	Complied
0.17756	Live	16.8	54.6	37.8	Complied
0.18056	Live	17.4	54.5	37.1	Complied
0.19058	Live	16.2	54.0	37.8	Complied
0.25721	Live	14.6	51.5	36.9	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Boost Mode / Hopping Mode / Antenna 2

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.152	Neutral	35.4	65.9	30.5	Complied
0.18507	Neutral	29.5	64.3	34.8	Complied
0.19509	Neutral	27.5	63.8	36.3	Complied
0.21112	Neutral	25.1	63.2	38.1	Complied
0.61543	Neutral	18.8	56.0	37.2	Complied
0.71463	Neutral	14.5	56.0	41.5	Complied

Results: Neutral / Average / 120 VAC 60 Hz

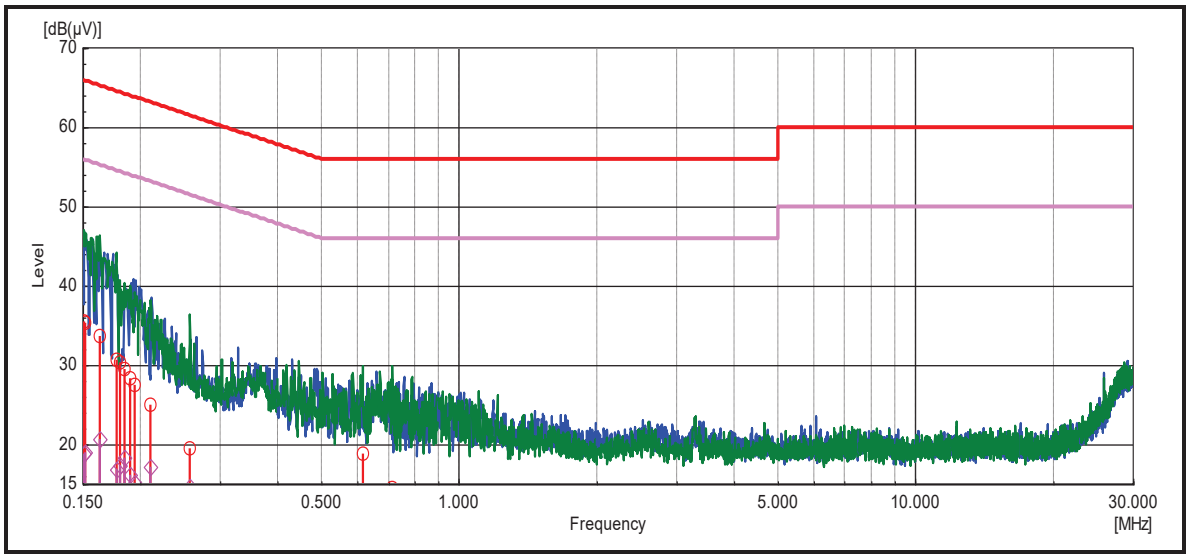
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.152	Neutral	19.0	55.9	36.9	Complied
0.18507	Neutral	18.3	54.3	36.0	Complied
0.19509	Neutral	15.2	53.8	38.6	Complied
0.21112	Neutral	17.2	53.2	36.0	Complied
0.61543	Neutral	13.1	46.0	32.9	Complied
0.71463	Neutral	7.4	46.0	38.6	Complied

Result: Pass

Transmitter AC Conducted Spurious Emissions (continued)

Boost Mode / Hopping Mode / Antenna 2

Plot: Live and Neutral Line



Note: The plots show the max hold (peak detector) pre-scan results measured. Blue graph represents the result of the N-Line; green graph - the results for L1-Line. The bar graphs indicate the final measurement result applying the dedicated detector at selected frequencies for each limit line (red cycle for quasi peak limit; violet cycle for average limit).

Legend (Conducted Emissions)	
Items	Description
	Blue graph is the result of peak measurement phase L
	Green graph is the result of peak measurement phase N
	Limit line **Quasi-Peak**
	Limit line **Average**
	Final item **Quasi-Peak**
	Final item **Average**

5.2.2. Transmitter 20 dB Bandwidth

Test Summary:

Test Engineer:	Ajit Phadtare	**Test Date:**	01 October 2019
Test Sample Serial Number:	bhrrsmsc0001233sucq0		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(a)(1)(i)
Test Method Used:	KDB 558074 Section 9 & ANSI C63.10 Section 6.9.2

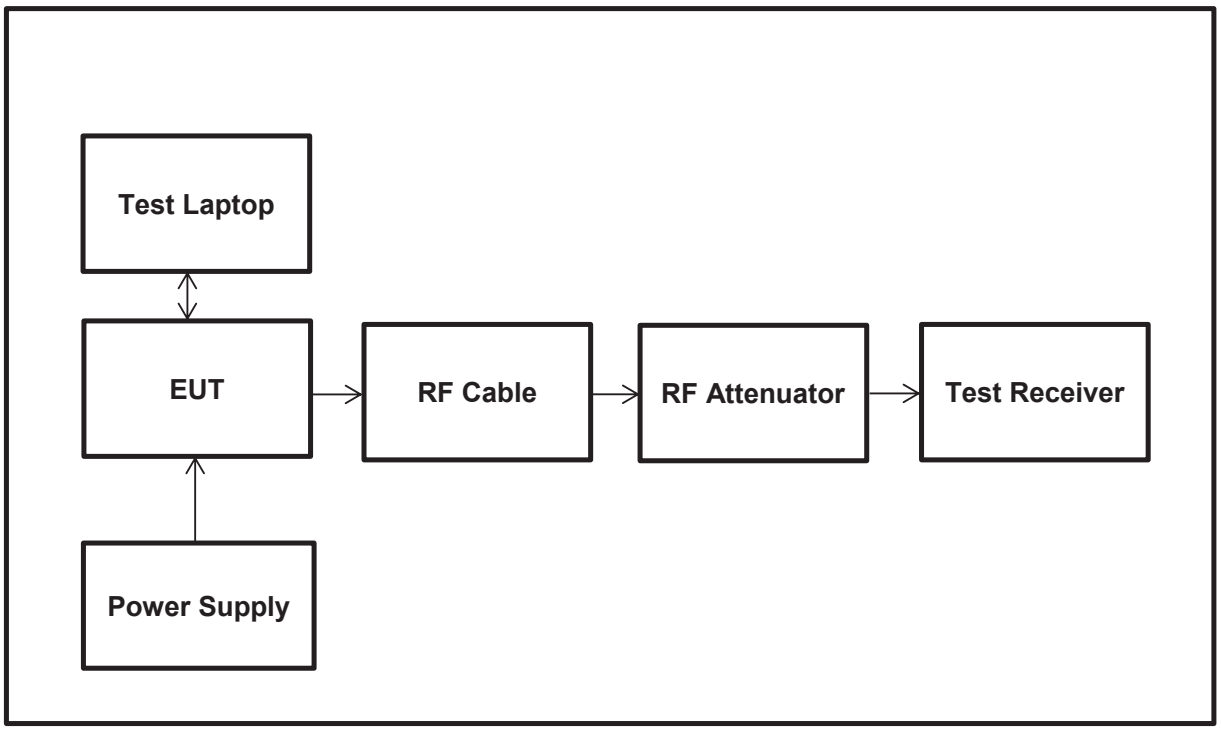
Environmental Conditions:

Temperature (°C):	23.8
Relative Humidity (%):	40

Notes:

1. The test receiver resolution bandwidth was set to 5 kHz and video bandwidth 20 kHz. A Peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 500 kHz. Normal and delta markers were placed 20 dB down from the peak of the carrier. These results are documented in the table below.
2. The 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 (maximum 0.4 dB at the tested frequencies)from the EUT to Analyzer including the 10 dB attenuation at the Spectrum Analyzer input and 1.0 dB for the W. FL-SMA RF cable attenuation was added as a reference level offset (11.4 dB) to each of the conducted plots.

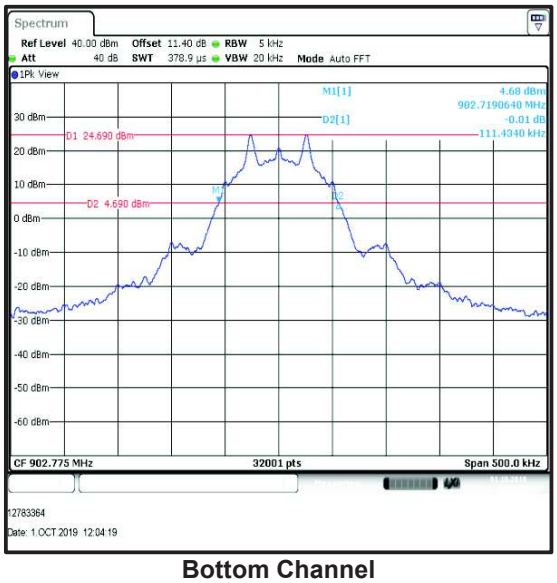
Test setup:



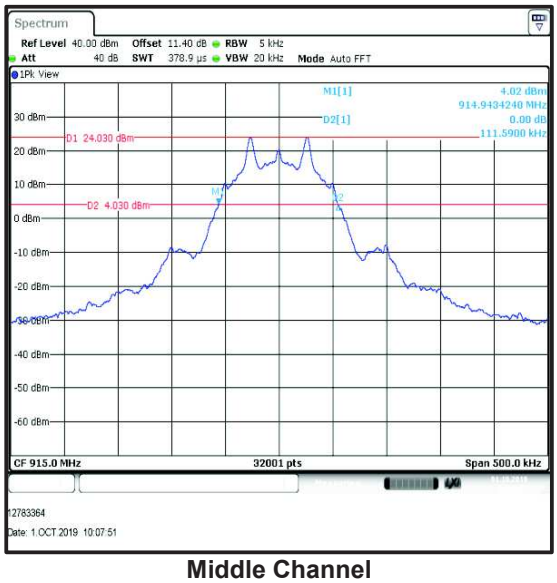
Transmitter 20 dB Bandwidth (continued)

Results :

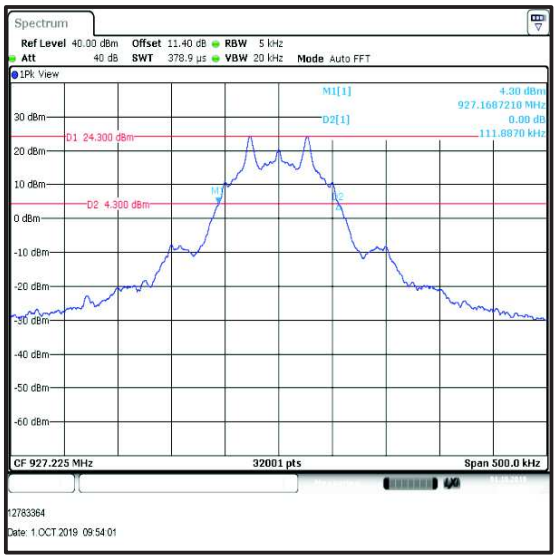
Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	111.434	≤ 500	388.566	Complied
Middle	111.590	≤ 500	388.410	Complied
Top	111.887	≤ 500	388.113	Complied



Bottom Channel



Middle Channel



Top Channel

Result: Pass

5.2.3.Transmitter Duty Cycle

Test Summary:

Test Engineer:	Ajit Phadtare	**Test Date:**	01 October 2019
Test Sample Serial Number:	bhrrsmsc0001233sucq0		
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

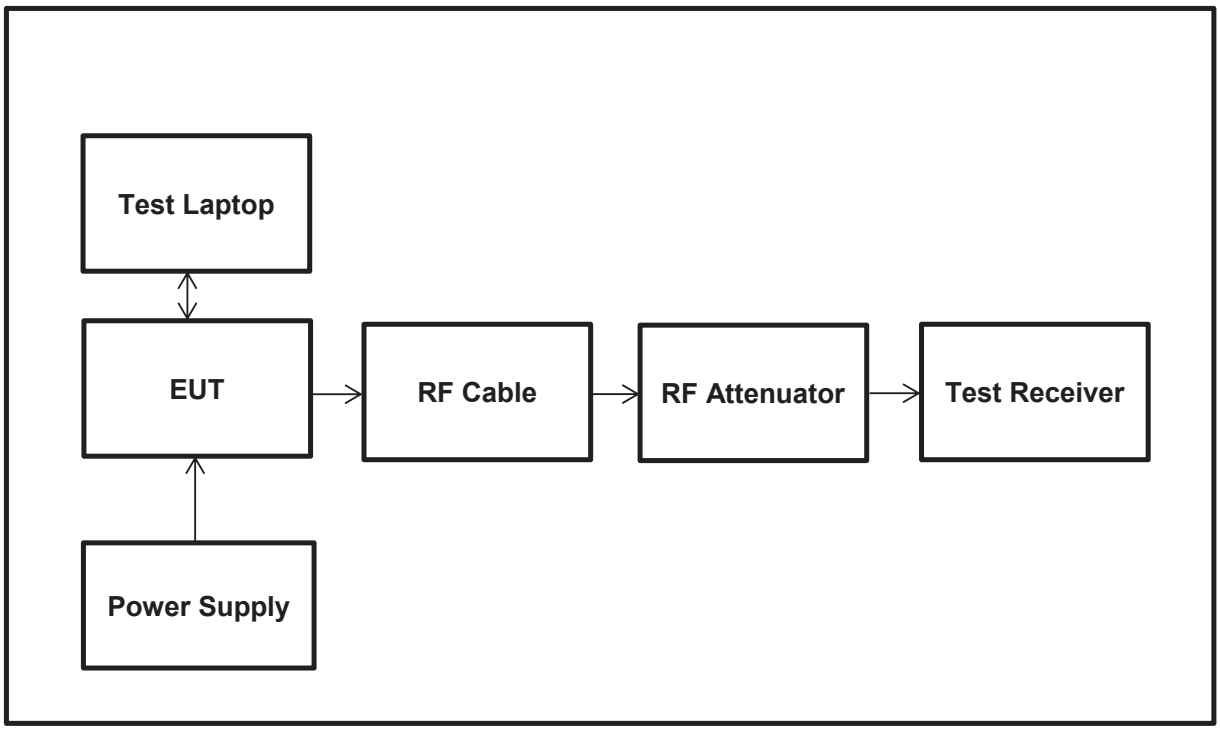
Note(s):

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

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

Duty cycle: 20 log (1 / (10.00 ms/ 10.00 ms)) = 0.00 dB

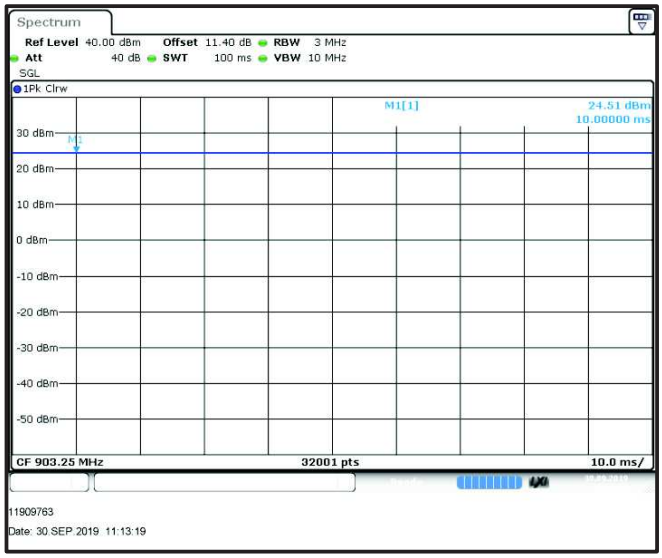
Test Setup:



Transmitter Duty Cycle (continued)

Results:

Pulse Duration (ms)	Period (µs)	Duty Cycle (dB)
10.00	10.00	0.00



5.2.4. Transmitter Carrier Frequency Separation

Test Summary:

Test Engineer:	Ajit Phadtare	**Test Date:**	01 October 2019
Test Sample Serial Number:	bhrrsmsc0001233sucq0		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(a)(1)
Test Method Used:	KDB 558074 Section 9 & ANSI C63.10 Section 7.8.2

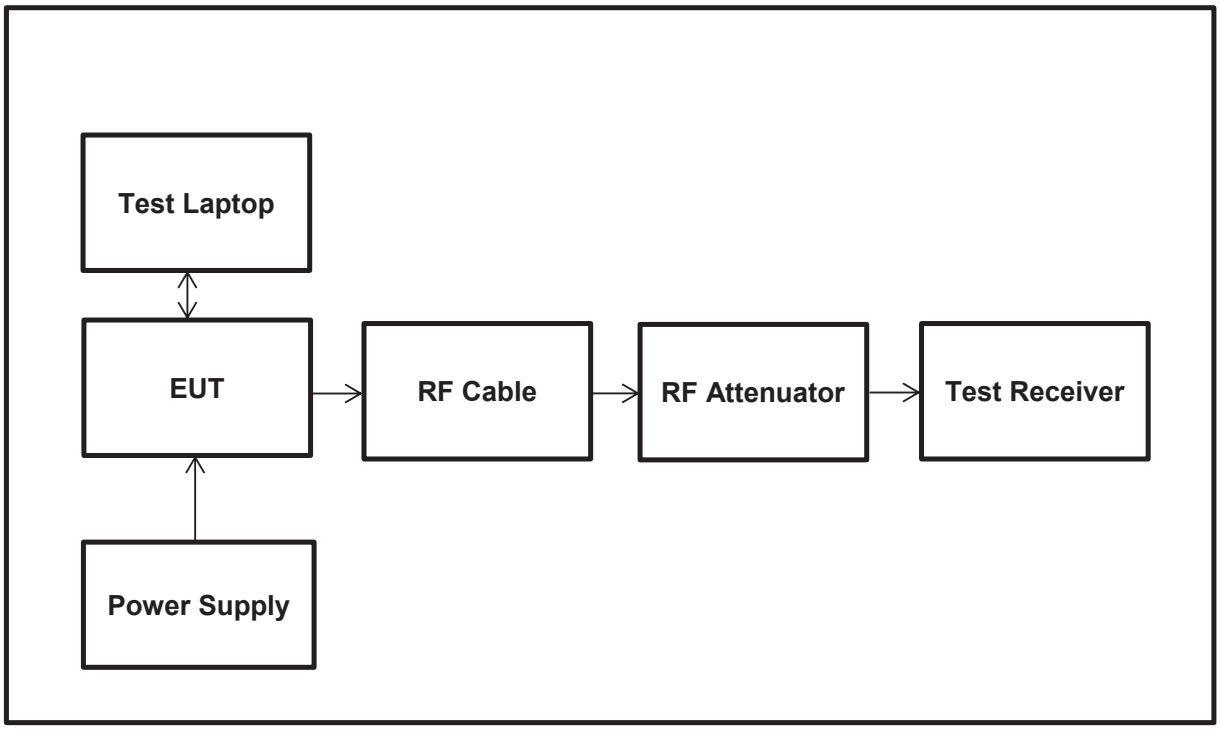
Environmental Conditions:

Temperature (°C):	22.4
Relative Humidity (%):	40

Notes:

1. The 20 dB bandwidth measured for the top channel operating at 927.225 MHz was used to calculate the limit.
2. The test receiver resolution bandwidth was set to 50 kHz and video bandwidth of 200 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 500 kHz. A marker was placed at the centre of one signal and then a delta marker was placed in the same place on the second signal, the results are recorded in the table below.
3. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable.

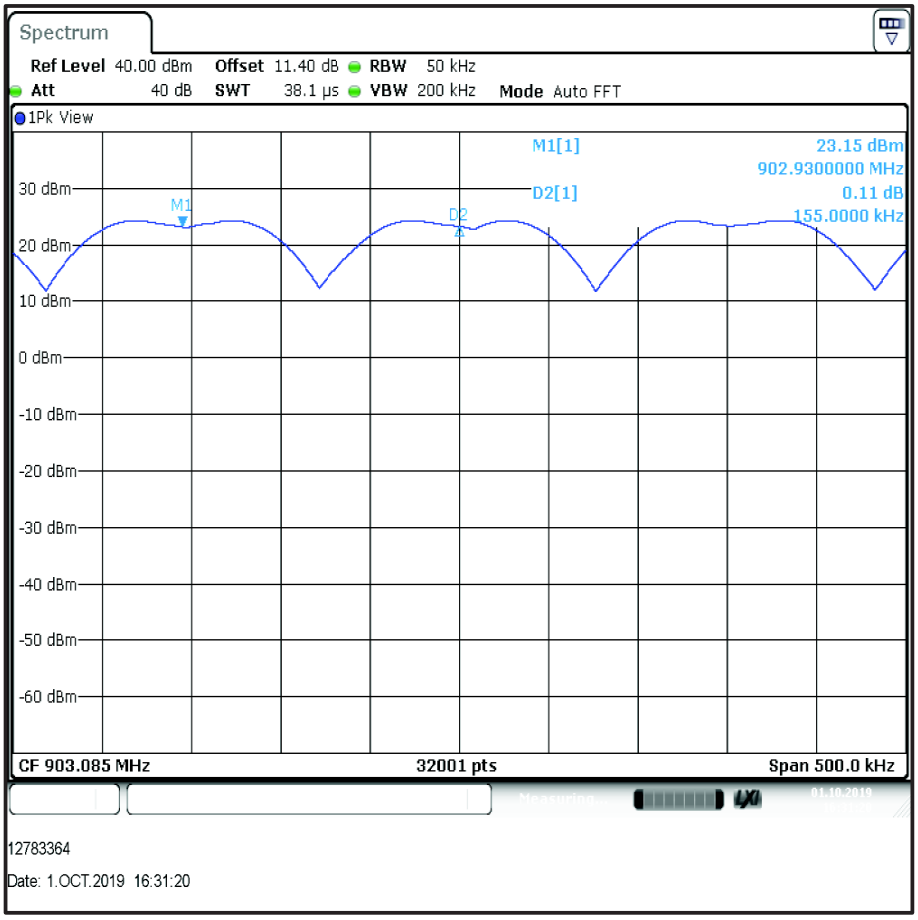
Test setup:



Transmitter Carrier Frequency Separation (continued)

Results: Carrier Frequency Separation / Lower Hopping Sequence

Carrier Frequency Separation (kHz)	Limit (20 dB BW) (kHz)	Margin (kHz)	Result
155.00	≥ 111.887	43.113	Complied

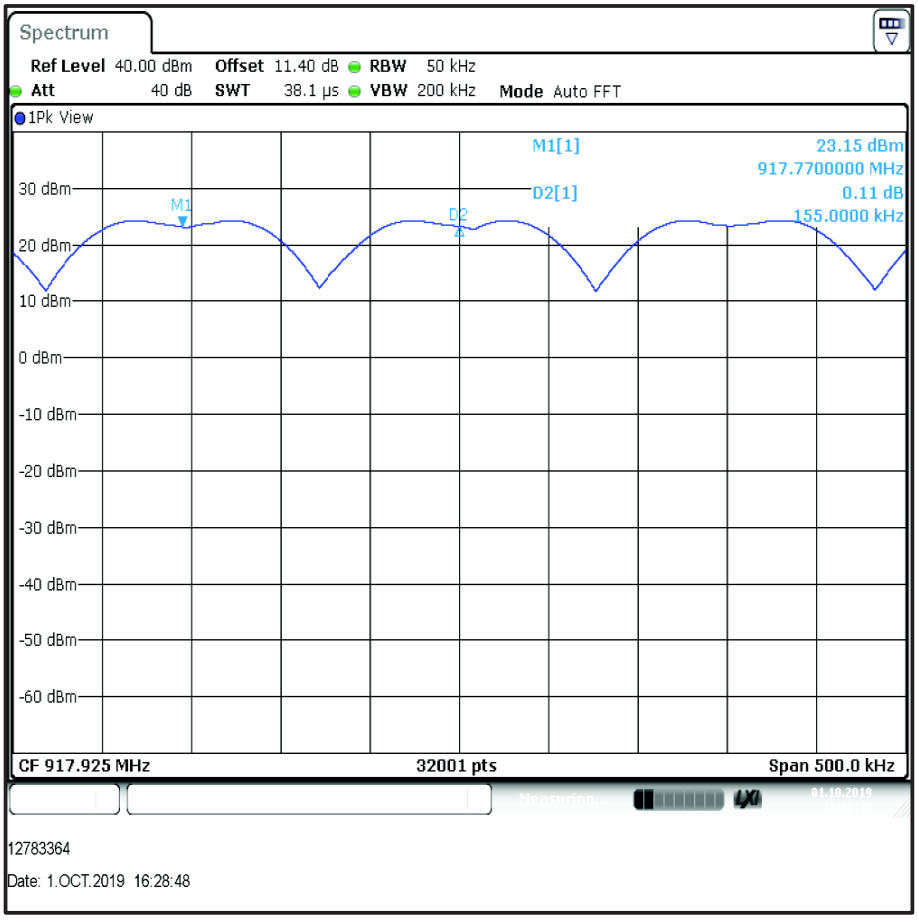


Result: Pass

Transmitter Carrier Frequency Separation (continued)

Results: Carrier Frequency Separation / Upper Hopping Sequence

Carrier Frequency Separation (kHz)	Limit (20 dB BW) (kHz)	Margin (kHz)	Result
155.00	≥ 111.887	43.113	Complied



Result: Pass

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

Test Summary:

Test Engineer:	Ajit Phadtare	**Test Date:**	01 October 2019
Test Sample Serial Number:	bhrrsmsc0001233sucq0		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(a)(1)(i)
Test Method Used:	KDB 558074 Section 9 & ANSI C63.10 Sections 7.8.3 & 7.8.4

Environmental Conditions:

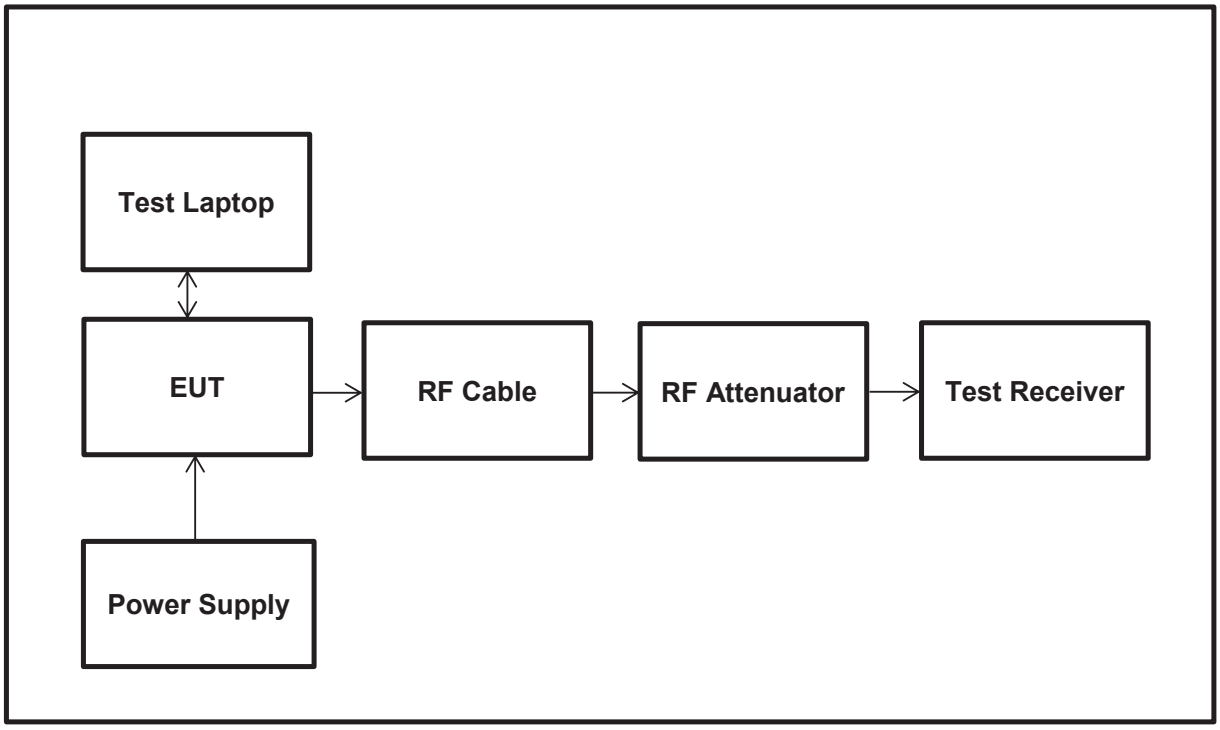
Temperature (°C):	22.4
Relative Humidity (%):	40

Notes:

1. For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.
2. The test receiver was set up for the Number of Hopping Frequencies measurement as follows: the resolution bandwidth was set to 30 kHz and video bandwidth of 100 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 28 MHz.
3. The test receiver was set up for the Emission Width measurement as follows: the resolution bandwidth was set to 10 kHz and video bandwidth of 30 kHz. A peak detector was used and sweep time was set to auto with a span of zero Hz. The emission width is recorded in the table below.
4. The test receiver was set up for the Number of Hopping Frequencies in 2 seconds measurement as follows: the resolution bandwidth was set to 30 kHz and video bandwidth of 100 kHz. A peak detector was used and sweep time was set to 2 seconds. The EUT was set to transmit in a hopping frequency mode with zero span. The total number of hopping frequencies were recorded in the table below.
5. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable.

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

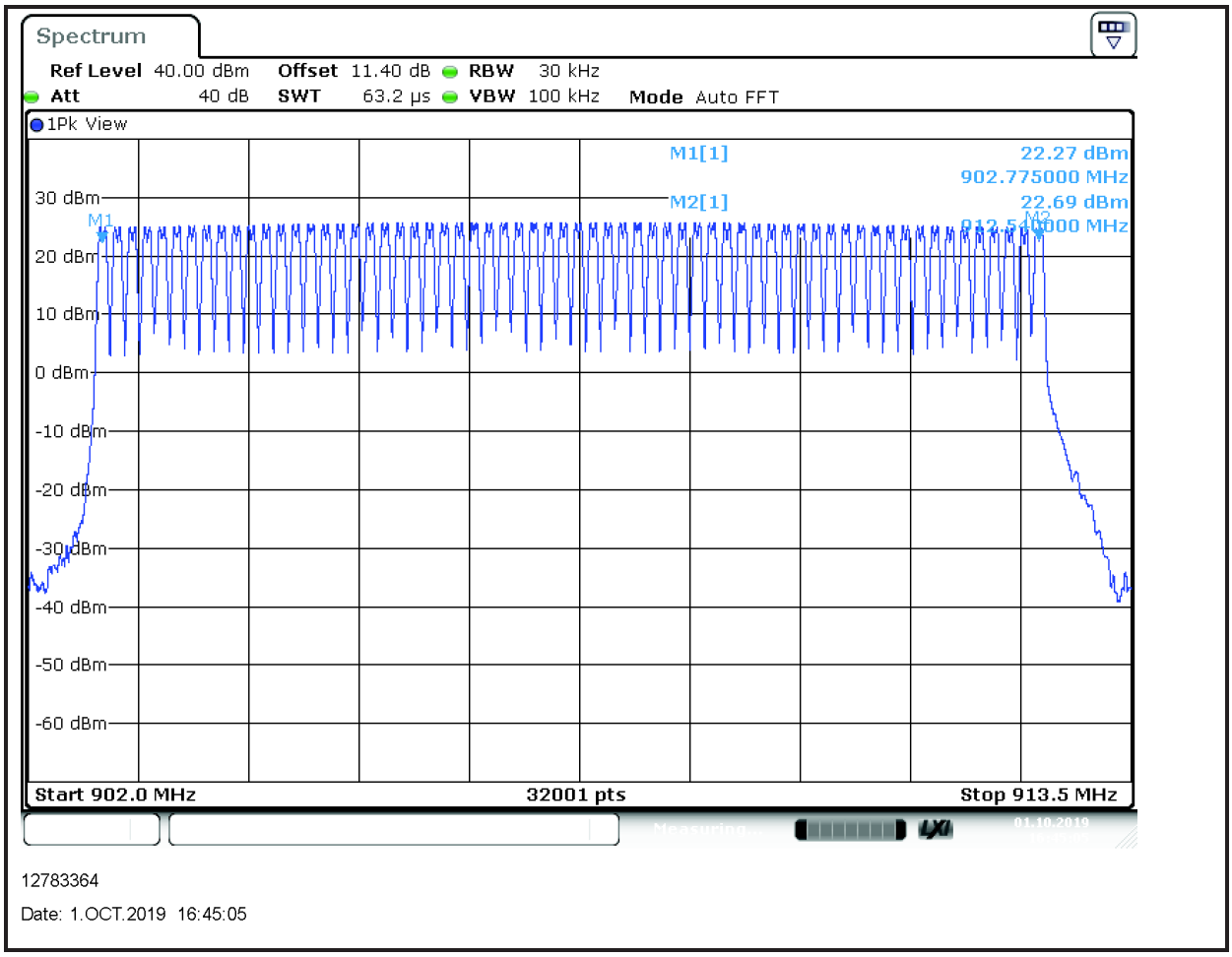
Test setup:



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

Results: Number of Hopping Frequencies / Lower Hopping Sequence

Lowest Channel Frequency (MHz)	Highest Channel Frequency (MHz)	Number of Hopping Channels	Limit (Min. No. of Channels)	Margin (No. of Channels)	Result
902.775	912.540	64	50	-14	Complied

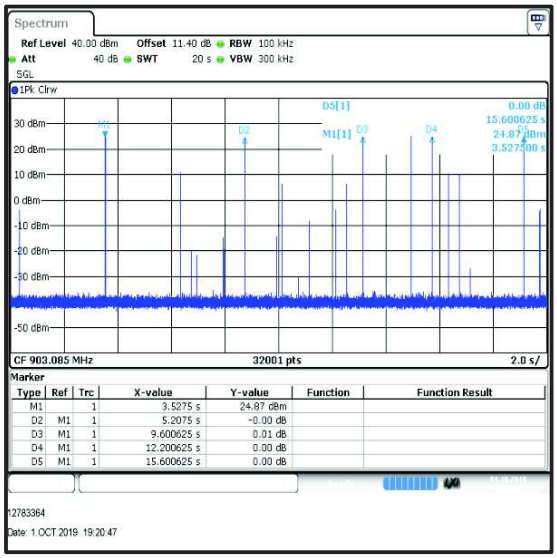


Result: Pass

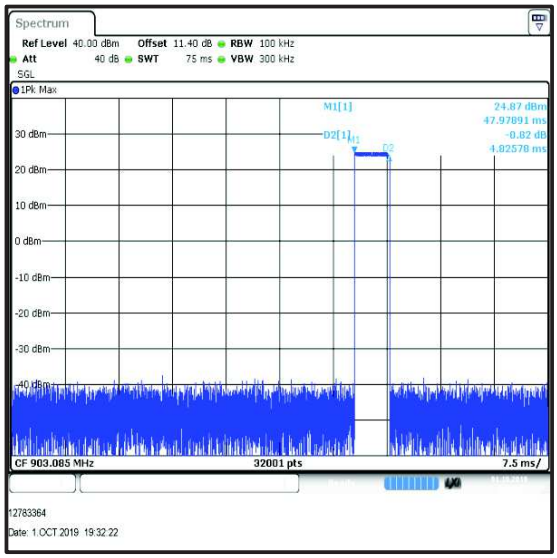
Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)

Results: Average Time of Occupancy / Lower Hopping Sequence

Emission Width of Each Hop (ms)	Number of Hops in 20 s	Average Time of Occupancy in 20 s (ms)	Limit (ms)	Margin (ms)	Result
4.82578	6	28.95	400	371.05	Complied



Number of Hops in 20 s



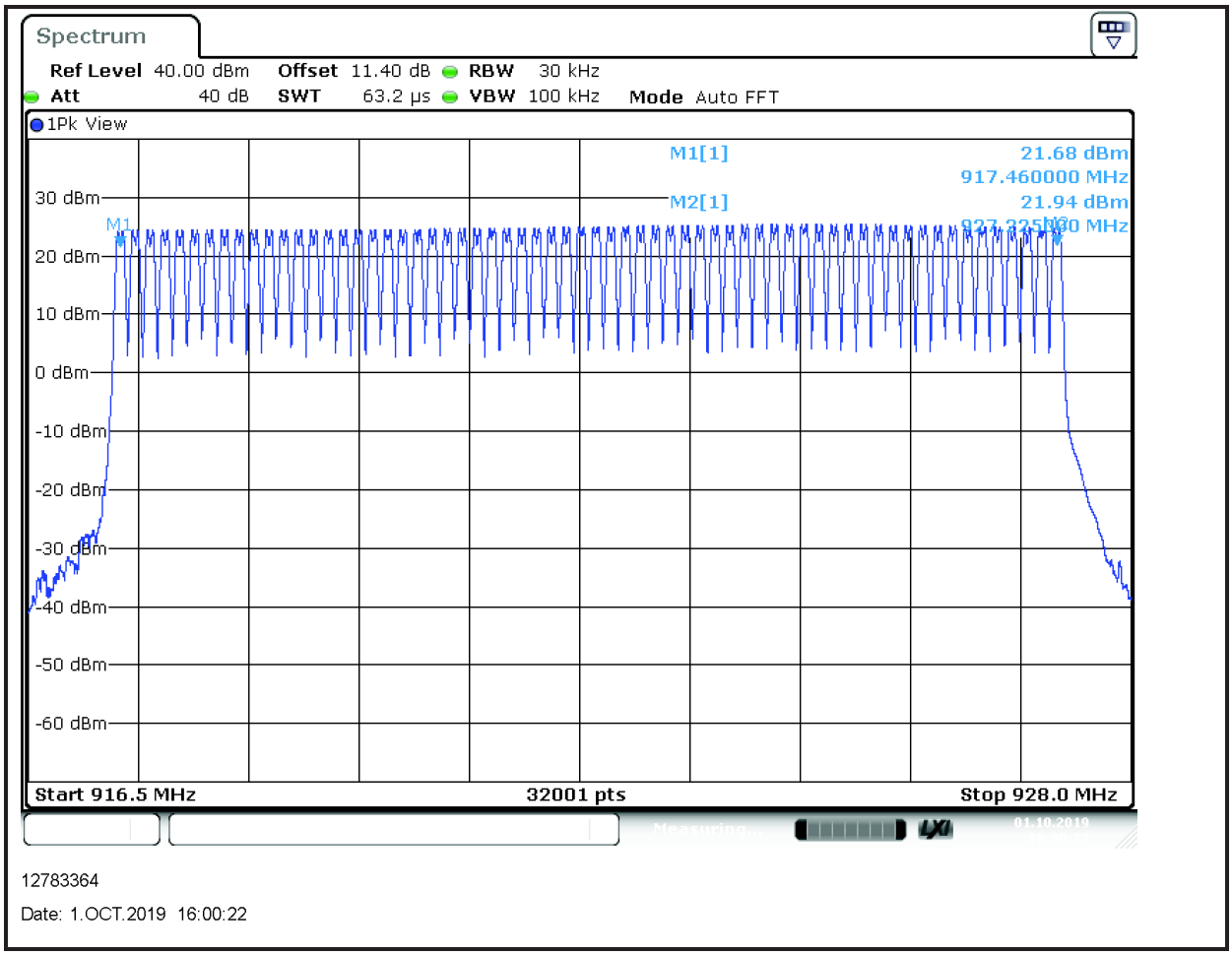
Emission Width of Each Hop

Result: Pass

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

Results: Number of Hopping Frequencies / Higher Hopping Sequence

Lowest Channel Frequency (MHz)	Highest Channel Frequency (MHz)	Number of Hopping Channels	Limit (Min. No. of Channels)	Margin (No. of Channels)	Result
917.460	927.225	64	50	-14	Complied

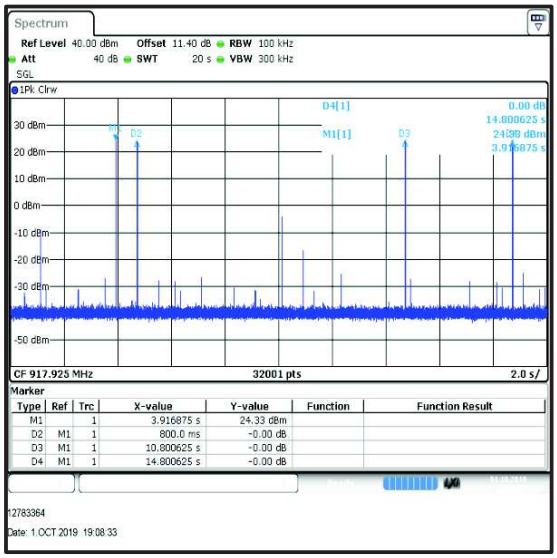


Result: Pass

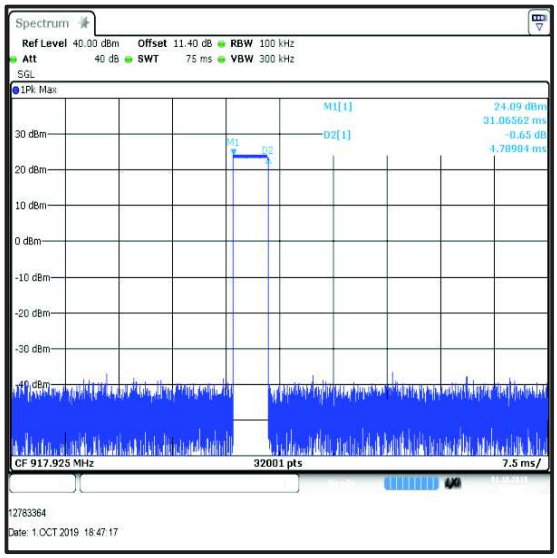
Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)

Results: Average Time of Occupancy / Higher Hopping Sequence

Emission Width of Each Hop (ms)	Number of Hops in 20 s	Average Time of Occupancy in 20 s (ms)	Limit (ms)	Margin (ms)	Result
4.78984	4	19.16	400	380.84	Complied



Number of Hops in 20 s



Emission Width of Each Hop

Result: Pass

5.2.6. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Ajit Phadtare	**Test Date:**	01 October 2019
Test Sample Serial Number:	bhrrsmsc0001233sucq0		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(b)(2)
Test Method Used:	KDB 558074 Section 9 & ANSI C63.10 Section 7.8.5

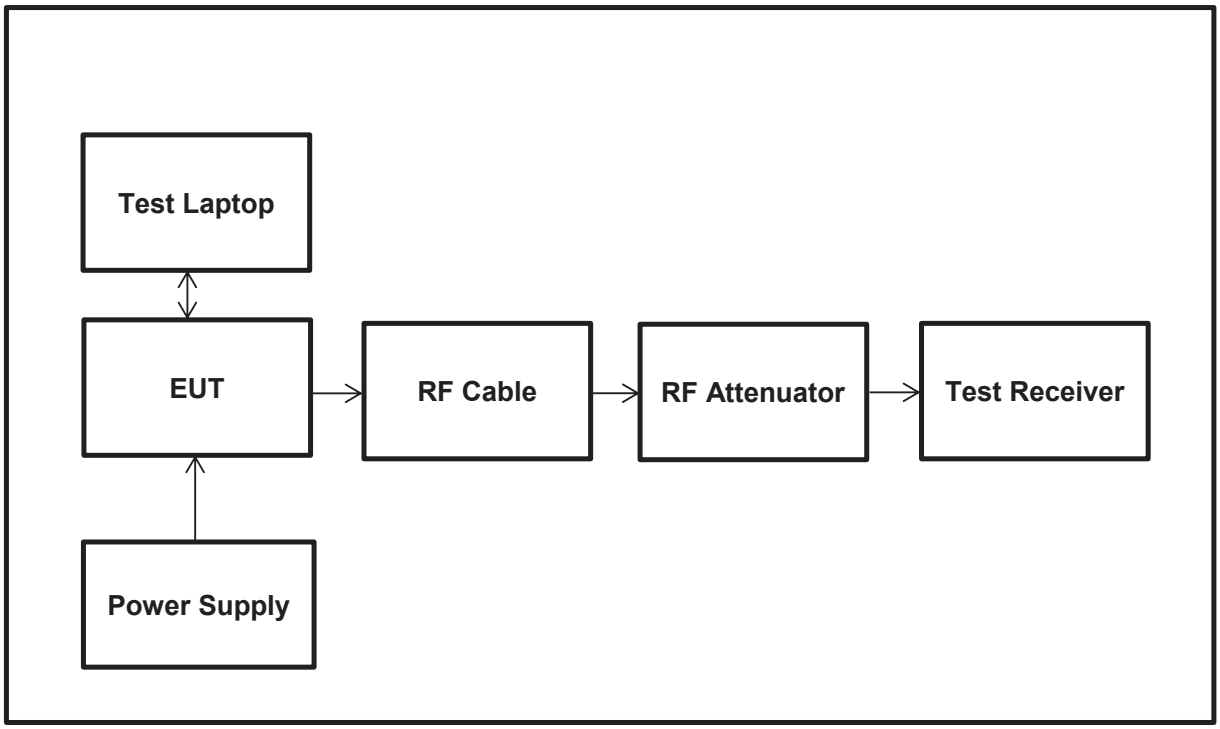
Environmental Conditions:

Temperature (°C):	22.4
Relative Humidity (%):	40

Notes:

1. The test receiver resolution bandwidth was set to 200 kHz (>20 dB bandwidth) and video bandwidth of 500 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 575 kHz (approximately five times the 20 dB bandwidth). A marker was placed at the peak of the signal and the results recorded in the tables below.
2. The declared antenna gain was added to the conducted peak power to obtain the EIRP.
3. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF offset level was entered on the test receiver to compensate for the loss of the attenuator and RF cable.

Test setup:



Transmitter Maximum Peak Output Power (continued)

Results: Boost Mode / Antenna 1

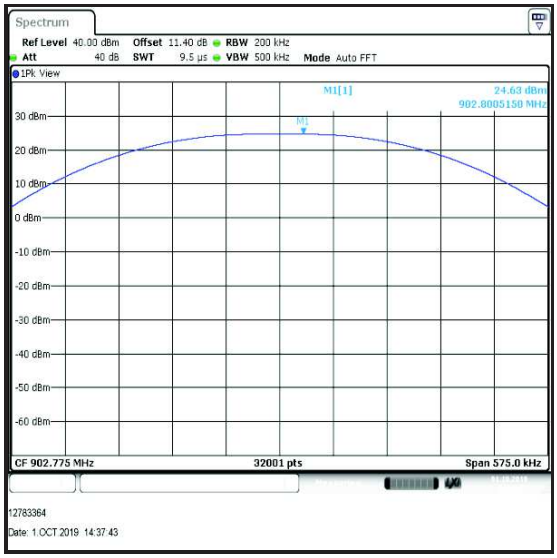
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	24.63	30.0	5.37	Complied
Middle	23.87	30.0	6.13	Complied
Top	24.27	30.0	5.73	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	24.63	0	24.63	36.0	11.37	Complied
Middle	23.87	0	23.87	36.0	12.13	Complied
Top	24.27	0	24.27	36.0	11.73	Complied

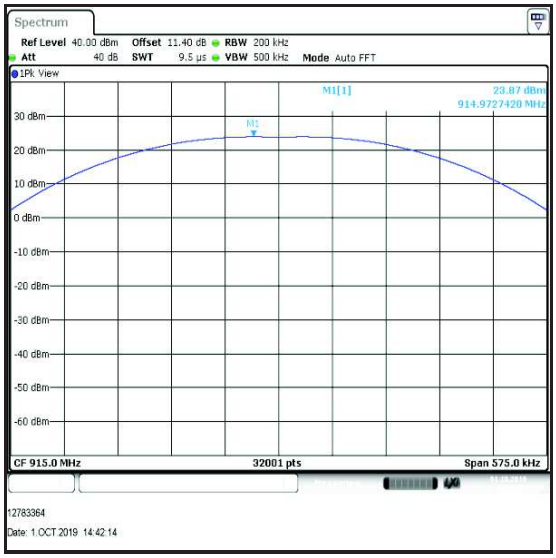
Result: Pass

Transmitter Maximum Peak Conducted Output Power (continued)

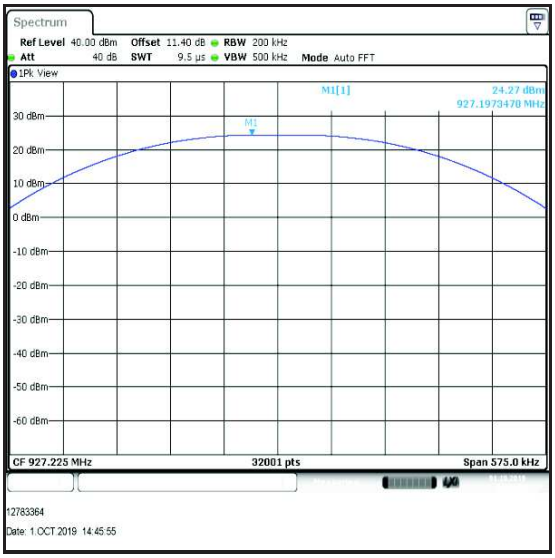
Results: Boost Mode / Antenna 1



Bottom Channel



Middle Channel



Top Channel

5.2.7. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	01 October 2019
Test Sample Serial Number:	bhrqmesc0001233subm0		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.209(a) & Part 15.247(d)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.4
Frequency Range	9 kHz to 30 MHz

Environmental Conditions:

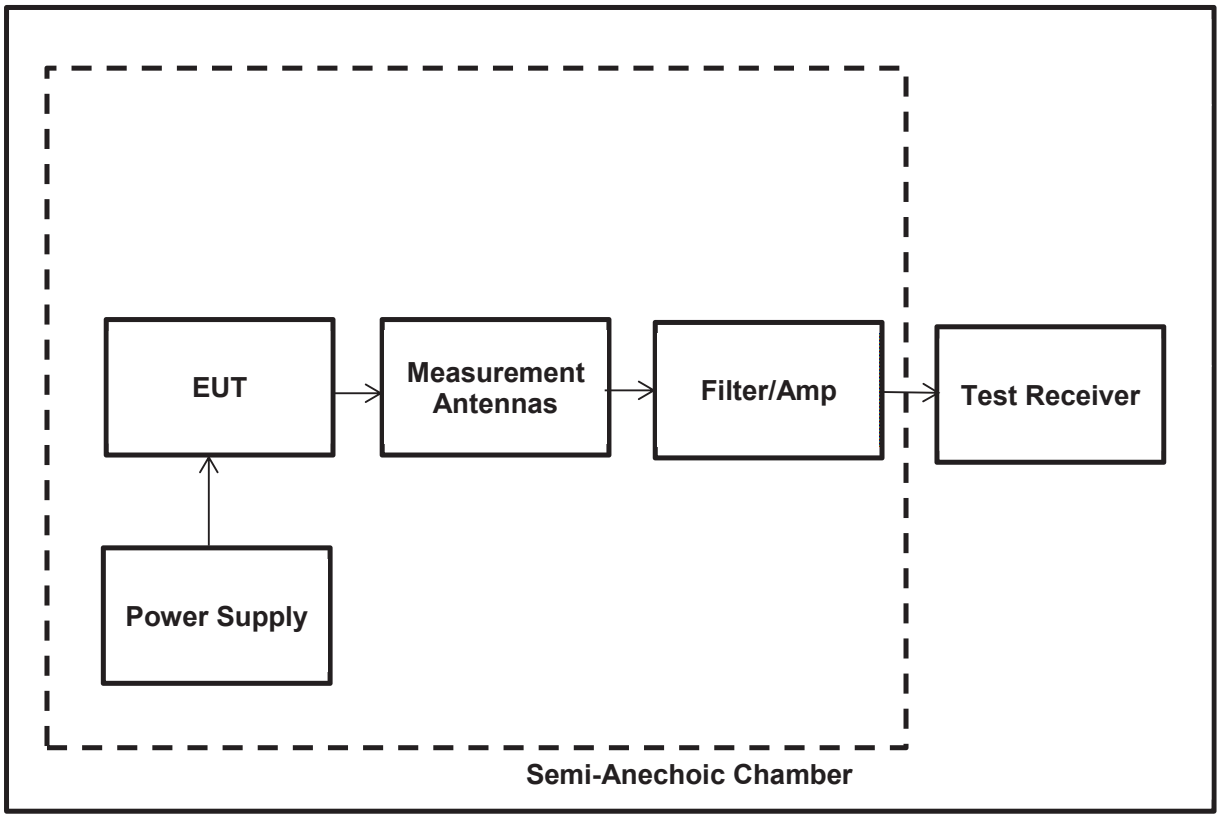
Temperature (°C):	21
Relative Humidity (%):	28

Note(s):

1. In accordance with FCC KDB 414788, an alternative test site may be used for the measurement below 30 MHz (The OATS / SAC comparison data is available upon request). Therefore the result from the semi-anechoic chamber tests is shown in this section of the test report.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. The preliminary scans showed similar emission levels below 30 MHz, for fixed frequency mode for each channel. Therefore final radiated emissions measurements were performed with the EUT for antenna 1 set on the middle channel only and for the antenna 2 set on the bottom channel only.
4. All emissions shown on the pre-scan plots were investigated and found to be ambient or > 20 dB below the appropriate limit.
5. The final radiated emissions measurements were also performed with the EUT set to the hopping mode.
6. Measurements below 30 MHz were performed in a semi-anechoic chamber (Asset Number 1603665) at a distance of 3 meters. 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 searching the loop antenna polarizations set at height of 1 meter.
7. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
8. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 9 kHz, using a CISPR quasi-peak detector and span big enough to see the whole emission.

Transmitter Radiated Emissions (continued)

Test Setup:

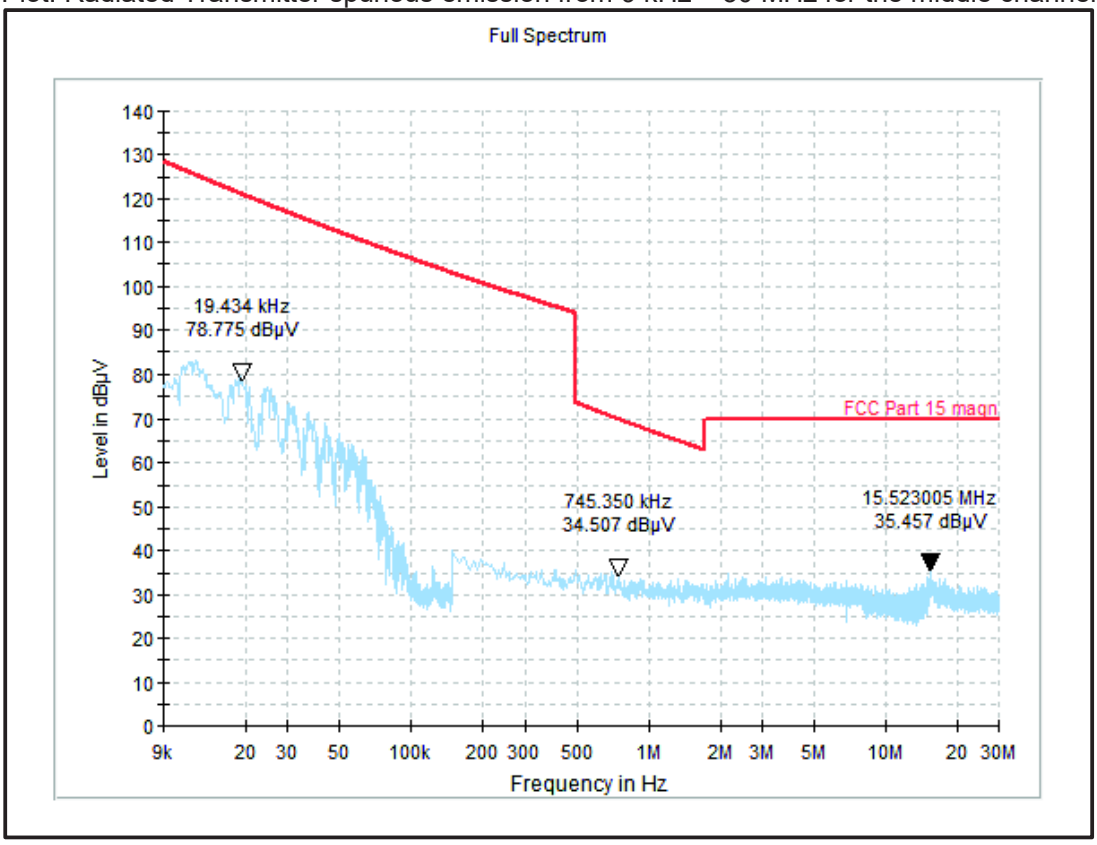


Transmitter Radiated Emissions (continued)

Results: Boost Mode / Middle Channel / Antenna 1

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

Plot: Radiated Transmitter spurious emission from 9 kHz – 30 MHz for the middle channel



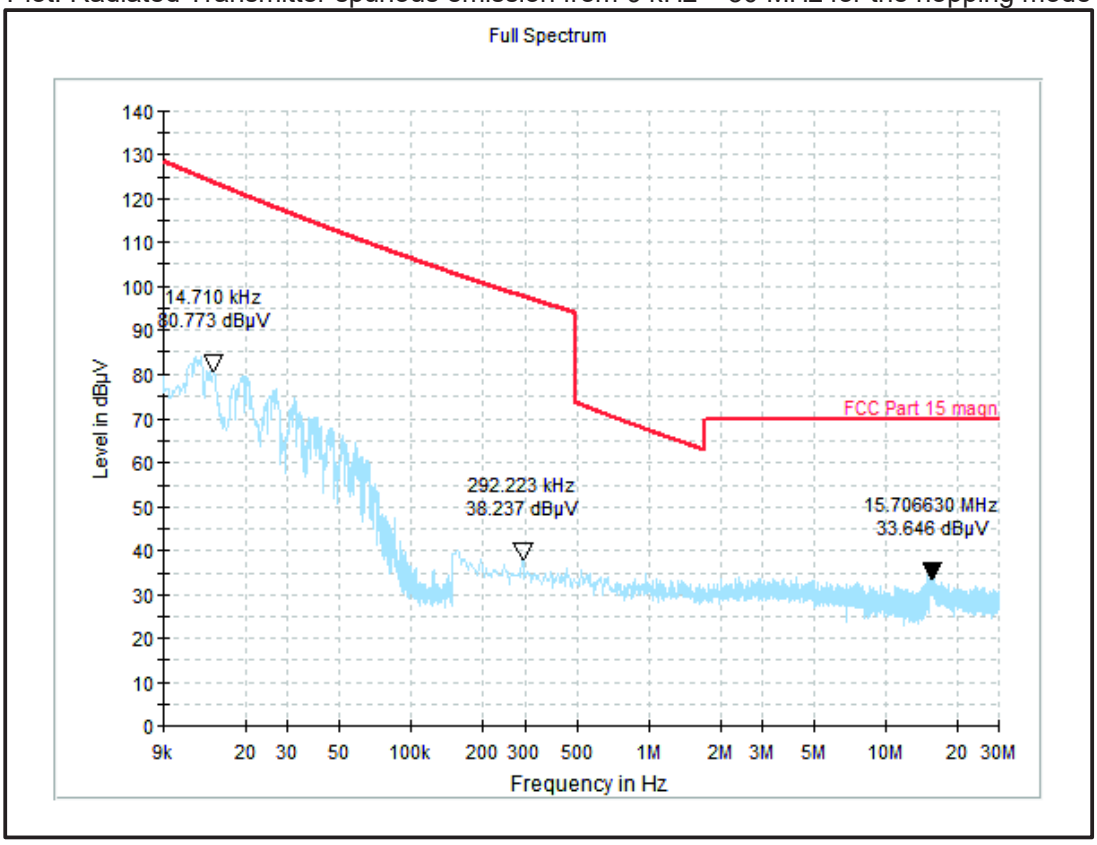
Result: Pass

Transmitter Radiated Emissions (continued)

Results: Boost Mode / Hopping Mode / Antenna 1

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

Plot: Radiated Transmitter spurious emission from 9 kHz – 30 MHz for the hopping mode



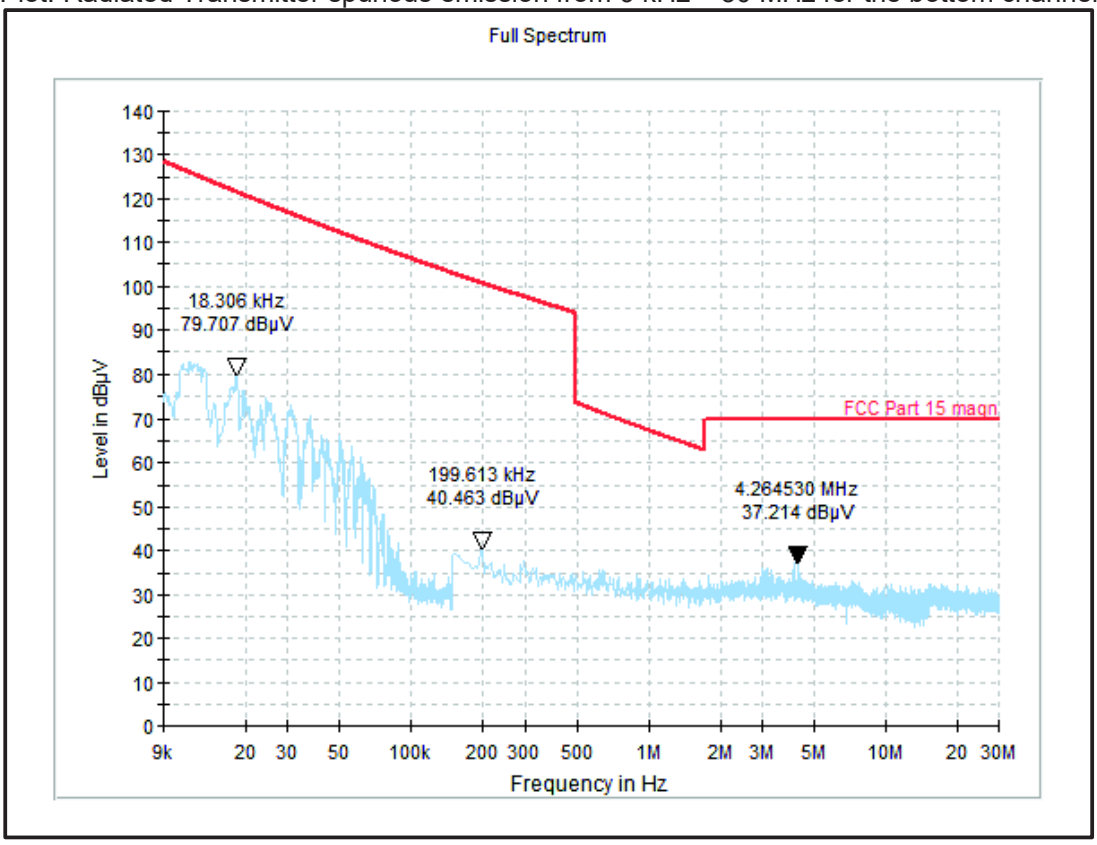
Result: Pass

Transmitter Radiated Emissions (continued)

Results: Boost Mode / Bottom Channel / Antenna 2

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

Plot: Radiated Transmitter spurious emission from 9 kHz – 30 MHz for the bottom channel



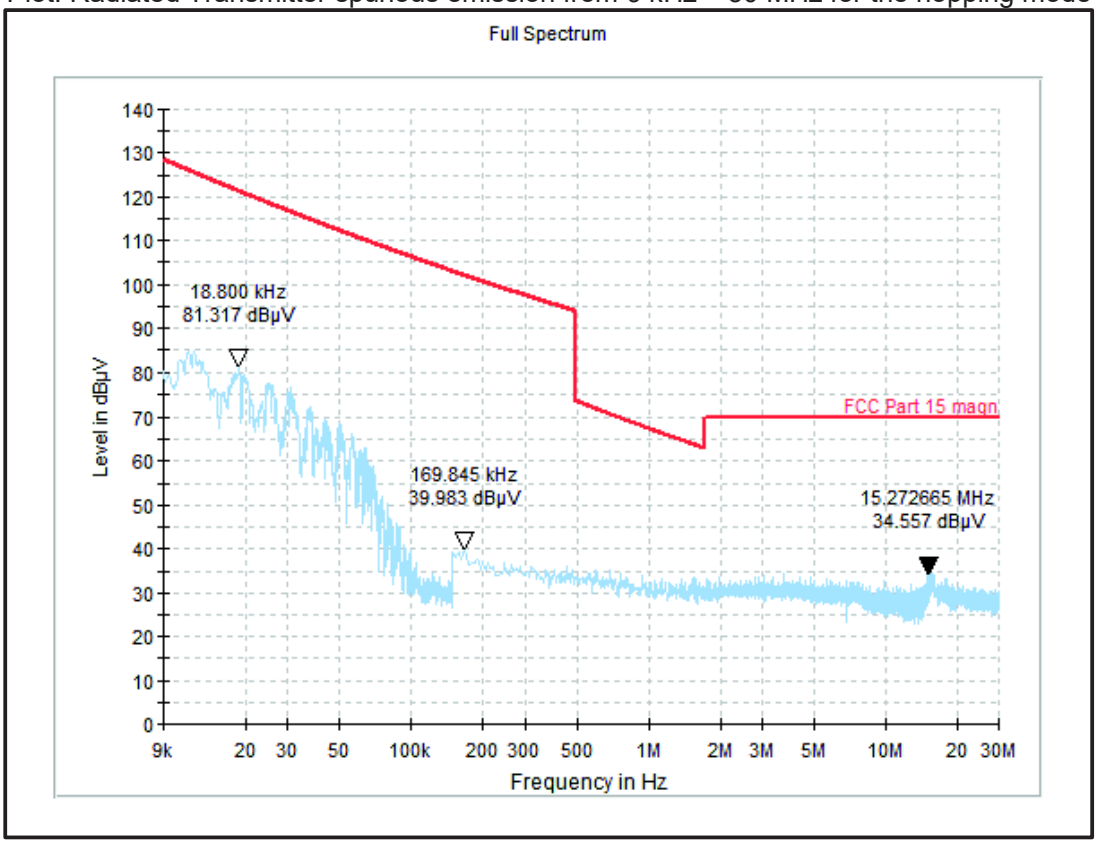
Result: Pass

Transmitter Radiated Emissions (continued)

Results: Boost Mode / Hopping Mode / Antenna 2

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

Plot: Radiated Transmitter spurious emission from 9 kHz – 30 MHz for the hopping mode



Result: Pass

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	01 October 2019
Test Sample Serial Number:	bhrqmesc0001233subm0		
Test Site Identification	SR 1/2		

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

Environmental Conditions:

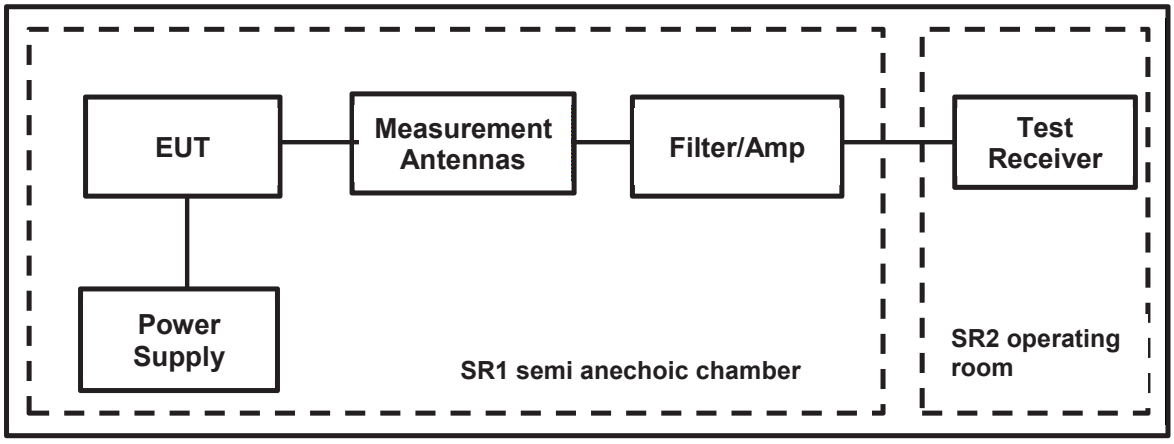
Temperature (°C):	21
Relative Humidity (%):	28

Note(s):

9. The emissions shown at frequencies between approximately 903 to 927 MHz on the 30 MHz to 1 GHz plots are the EUT fundamental for the given channel.
10. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
11. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K1603665) at a distance of 3 meters. 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 meter to 4 meters.
12. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. The sweep time was set to auto. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
13. 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.

Transmitter Radiated Emissions (continued)

Test Setup:



Transmitter Radiated Emissions (continued)

Results: Boost Mode / Bottom Channel / Antenna 1

Frequency (MHz)	Antenna Polarization	Quasi-Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
80.175	Vertical	24.05	40.00	15.95	Complied

Results: Boost Mode / Middle Channel / Antenna 1

Frequency (MHz)	Antenna Polarization	Quasi-Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
80.175	Vertical	24.94	40.00	15.06	Complied

Results: Boost Mode / Top Channel / Antenna 1

Frequency (MHz)	Antenna Polarization	Quasi-Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
48.090	Vertical	20.54	40.00	19.46	Complied
80.175	Vertical	24.61	40.00	15.39	Complied
96.195	Vertical	18.95	43.50	24.55	Complied

Results: Boost Mode / Hopping Mode / Antenna 1

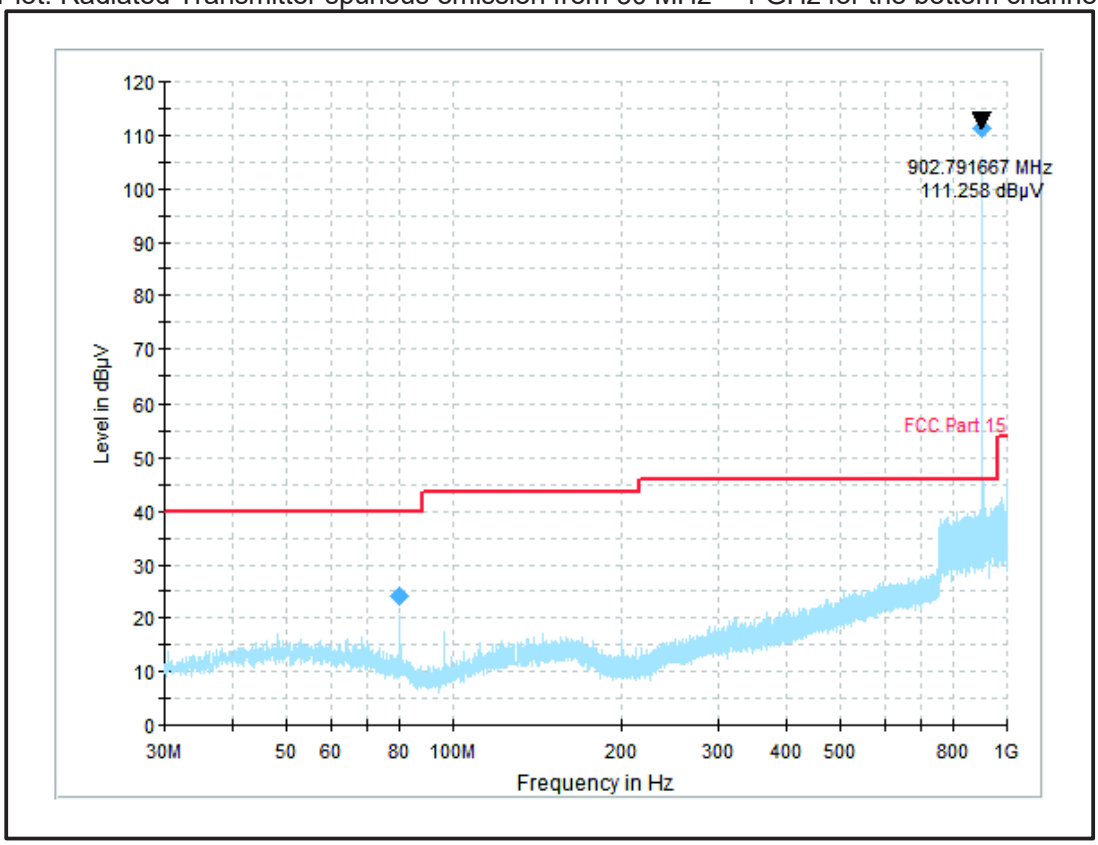
Frequency (MHz)	Antenna Polarization	Quasi-Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
80.175	Vertical	25.21	40.00	14.79	Complied

Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 1

Plot: Radiated Transmitter spurious emission from 30 MHz – 1 GHz for the bottom channel

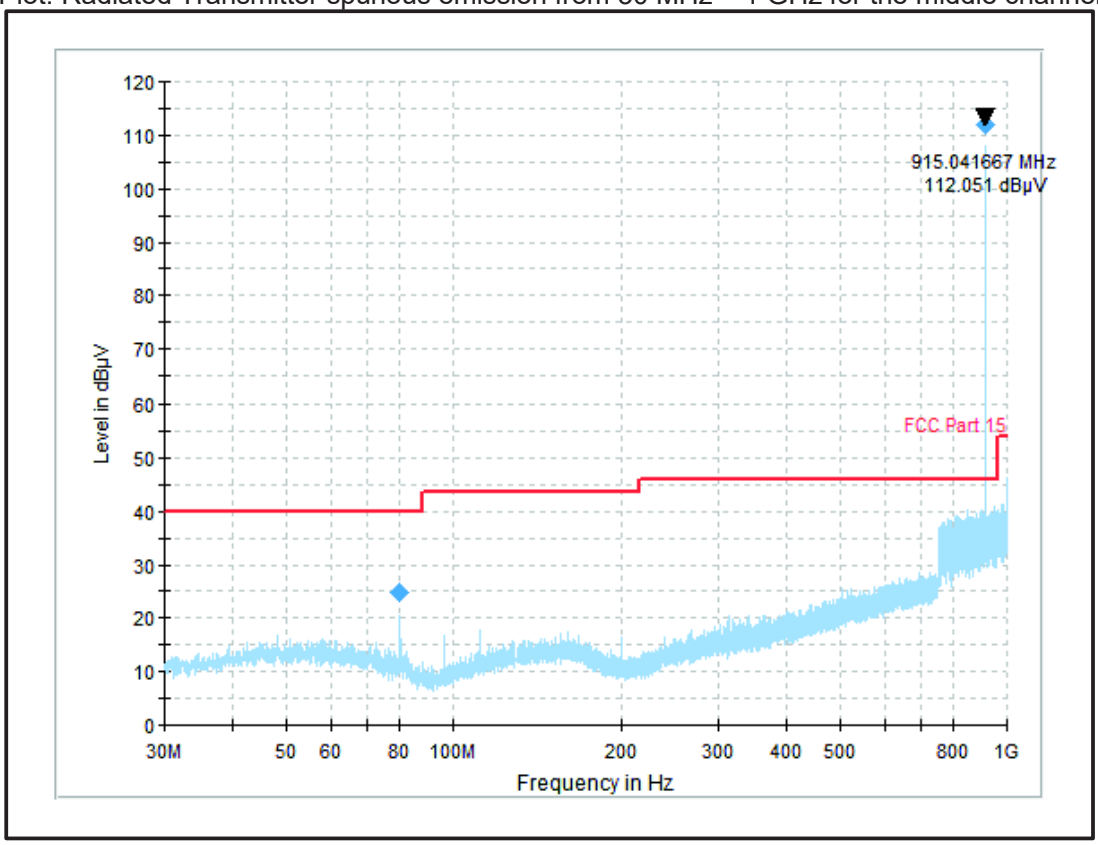


Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 1

Plot: Radiated Transmitter spurious emission from 30 MHz – 1 GHz for the middle channel

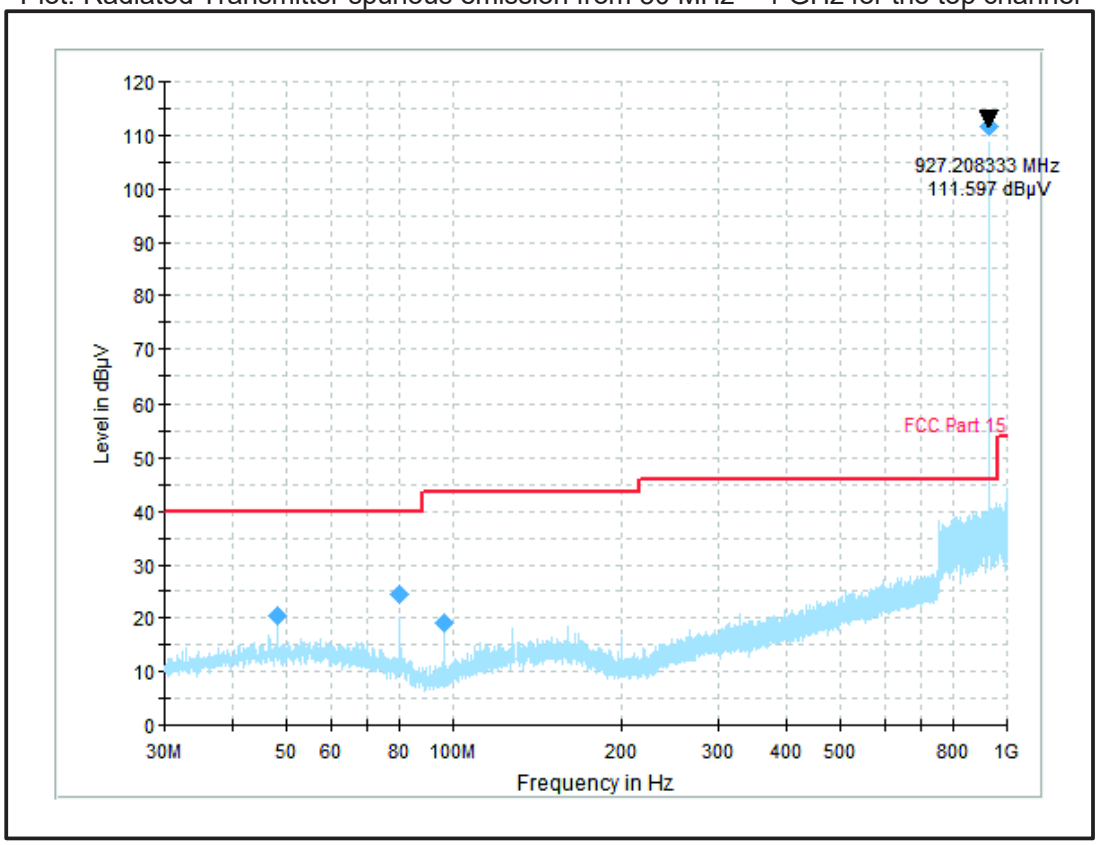


Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 1

Plot: Radiated Transmitter spurious emission from 30 MHz – 1 GHz for the top channel

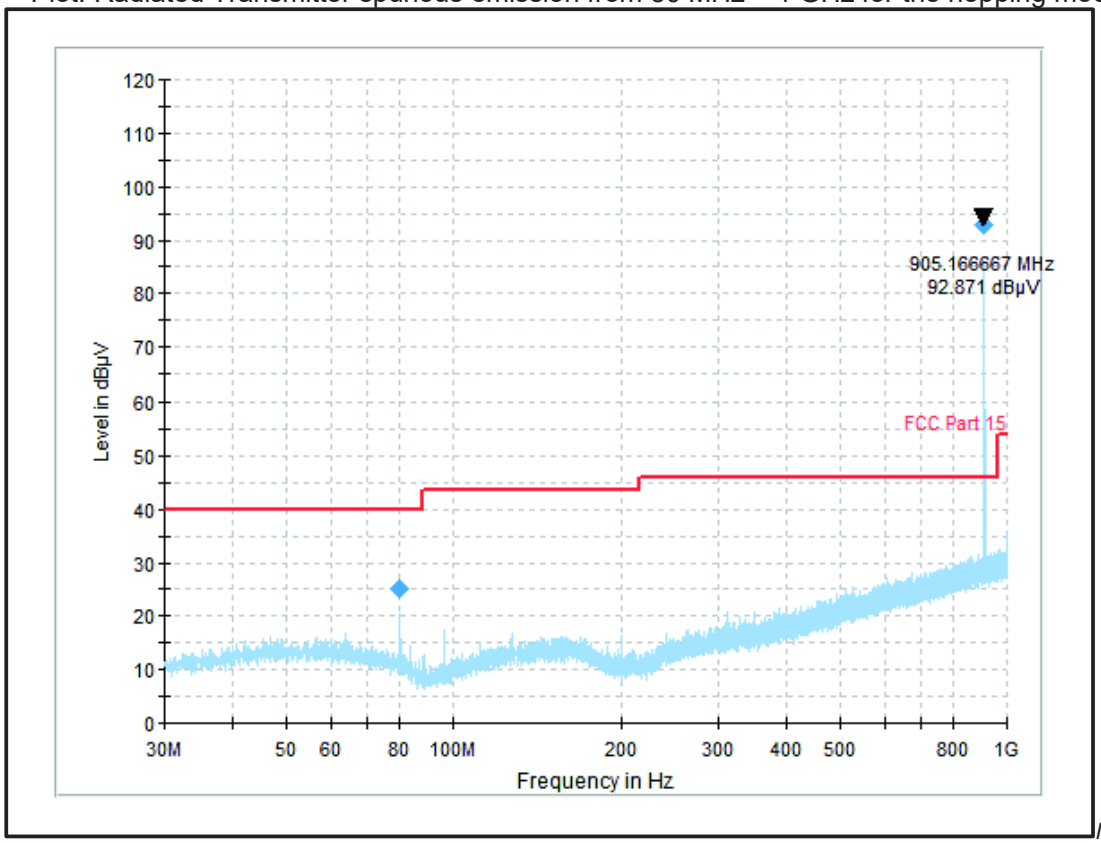


Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 1

Plot: Radiated Transmitter spurious emission from 30 MHz – 1 GHz for the hopping mode



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

Result: Pass

Transmitter Radiated Emissions (continued)

Results: Boost Mode / Bottom Channel / Antenna 2

Frequency (MHz)	Antenna Polarization	Quasi-Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
80.175	Vertical	24.84	40.00	15.16	Complied
96.195	Vertical	19.03	43.50	24.47	Complied

Results: Boost Mode / Middle Channel / Antenna 2

Frequency (MHz)	Antenna Polarization	Quasi-Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
48.090	Vertical	19.75	40.00	20.25	Complied
80.175	Vertical	25.15	40.00	14.85	Complied

Results: Boost Mode / Top Channel / Antenna 2

Frequency (MHz)	Antenna Polarization	Quasi-Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
80.175	Vertical	25.18	40.00	14.82	Complied

Results: Boost Mode / Hopping Mode / Antenna 2

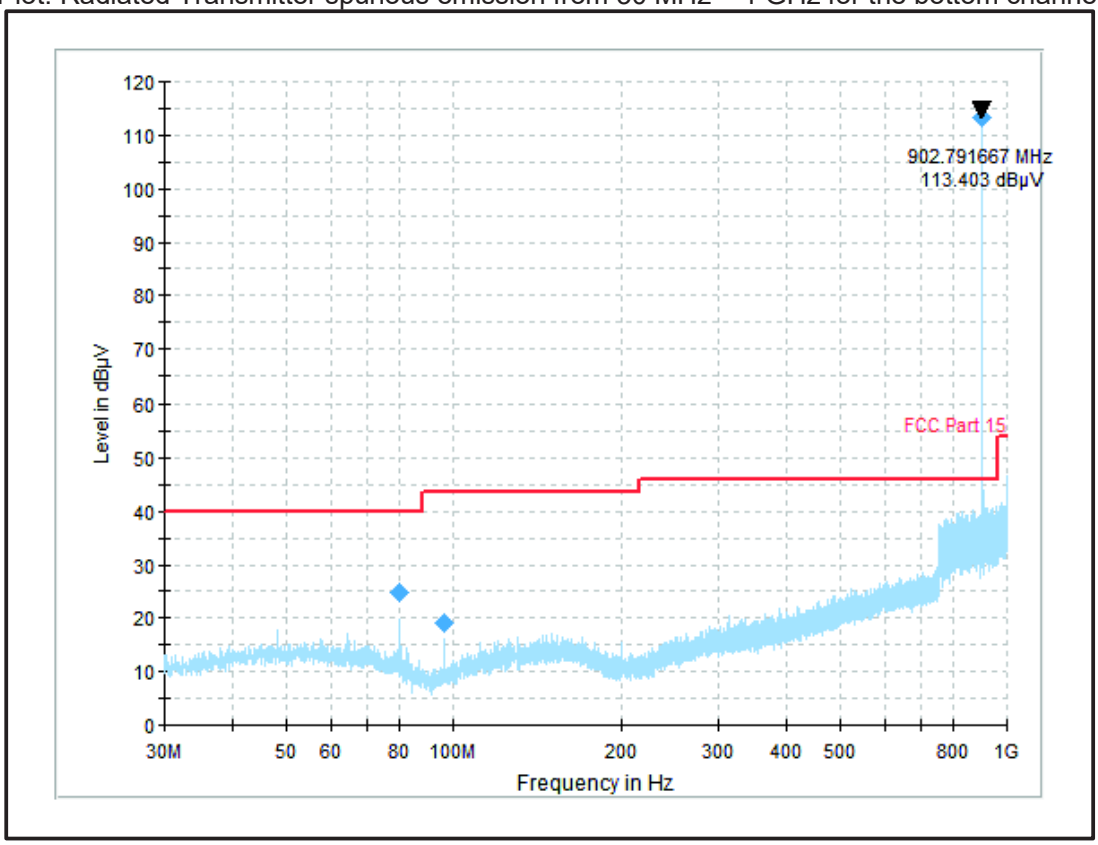
Frequency (MHz)	Antenna Polarization	Quasi-Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
80.130	Vertical	24.48	40.00	15.52	Complied

Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 2

Plot: Radiated Transmitter spurious emission from 30 MHz – 1 GHz for the bottom channel

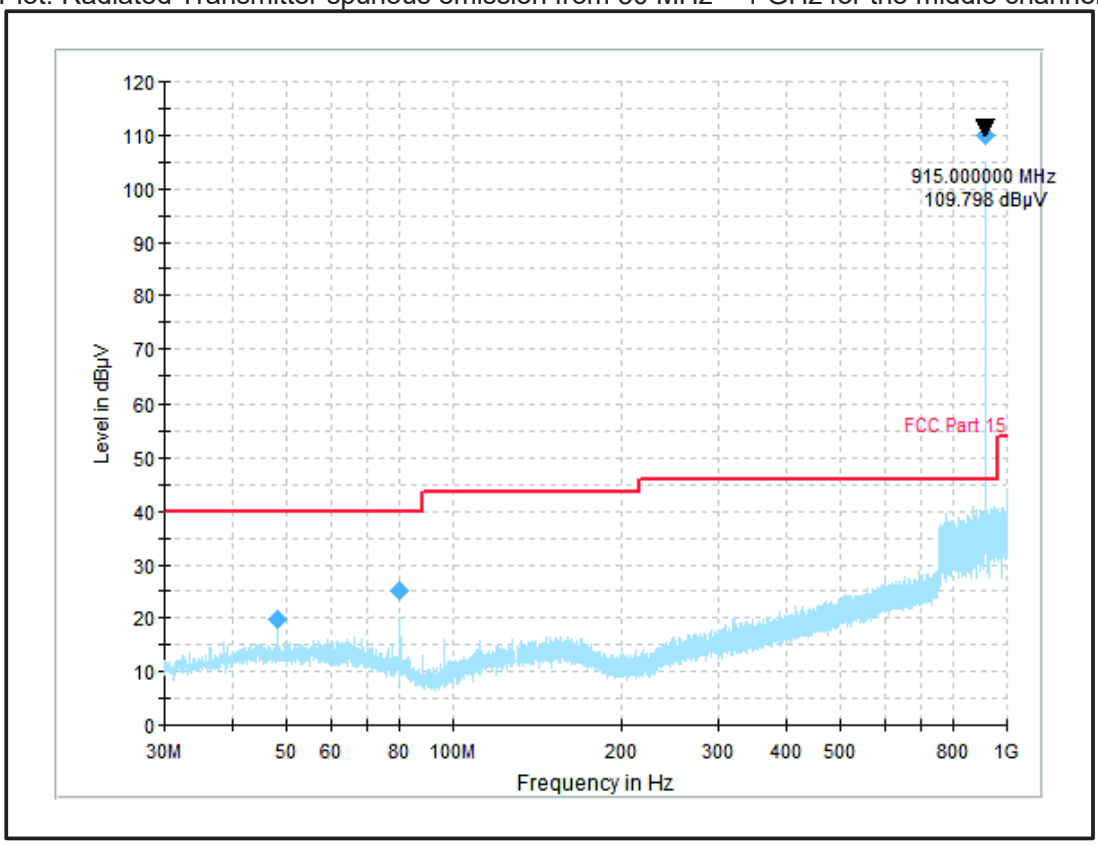


Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 2

Plot: Radiated Transmitter spurious emission from 30 MHz – 1 GHz for the middle channel

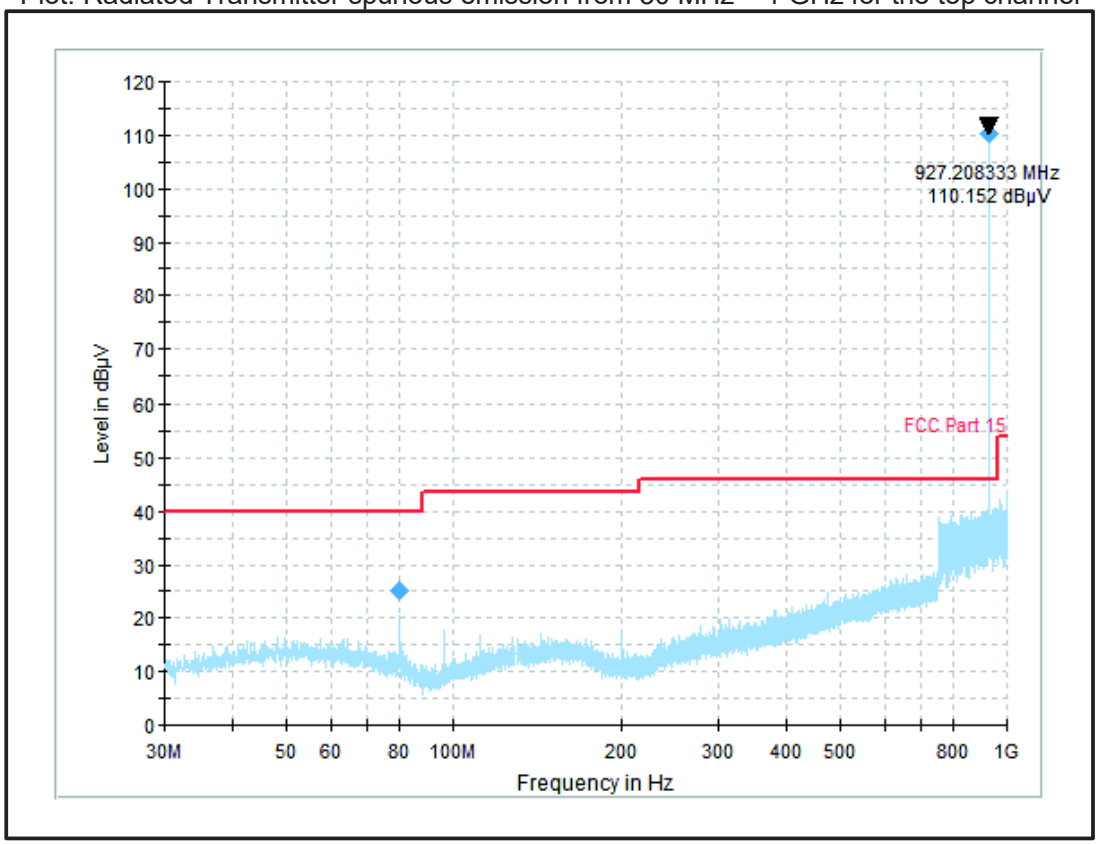


Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 2

Plot: Radiated Transmitter spurious emission from 30 MHz – 1 GHz for the top channel

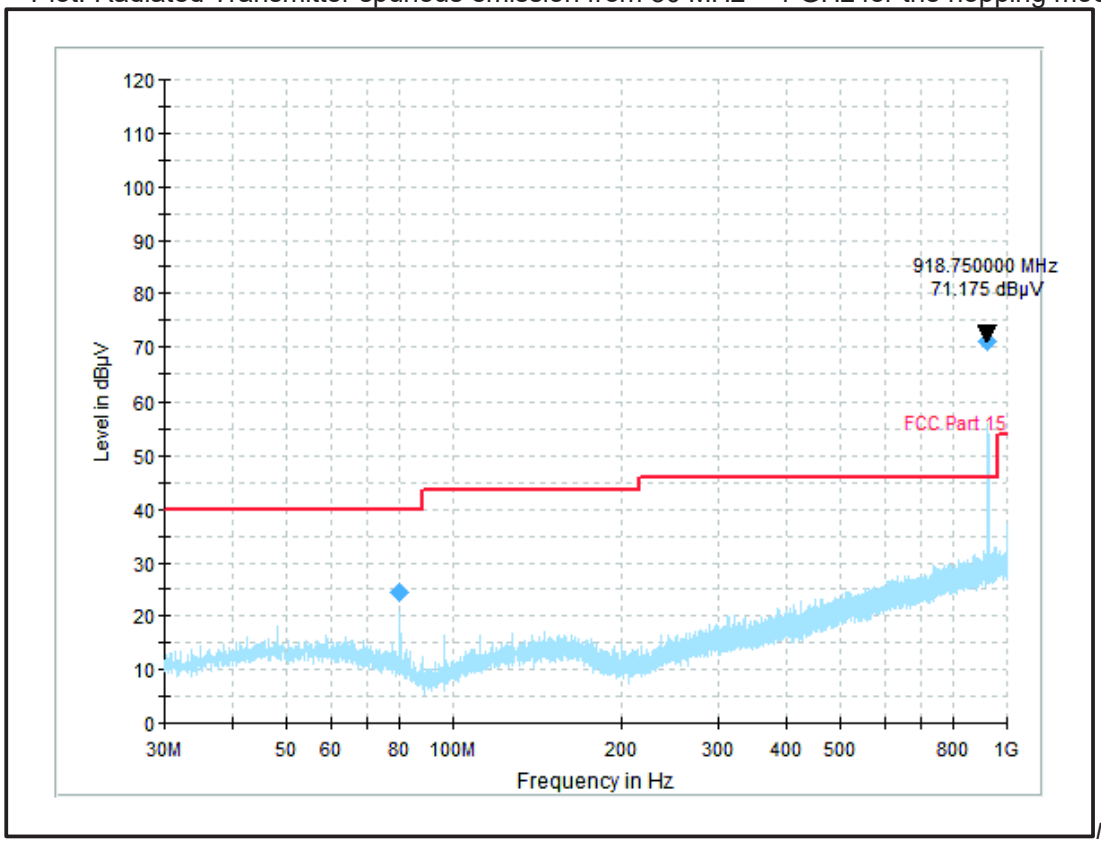


Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 2

Plot: Radiated Transmitter spurious emission from 30 MHz – 1 GHz for the hopping mode



Note: These plots are pre-scans 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:**	01 October 2019
Test Sample Serial Number:	bhrqmesc0001233subm0		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.209(a) & Part 15.247(d)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.6
Frequency Range	1 GHz to 10 GHz

Environmental Conditions:

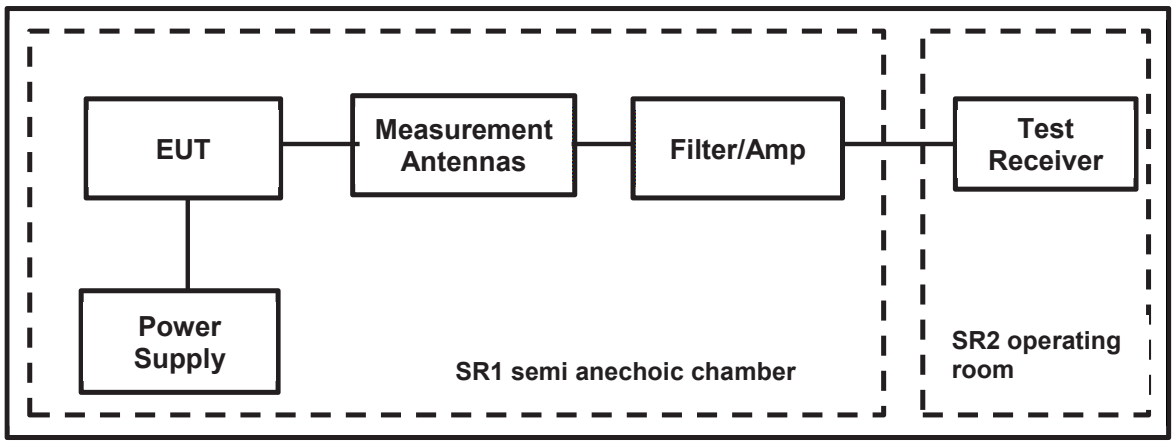
Temperature (°C):	21
Relative Humidity (%):	28

Note(s):

14. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
15. 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.
16. Pre-scans above 1 GHz were performed in a semi-anechoic chamber SR1/ 2 (Asset Number 1603665) with absorbers on the ground at a distance of 3 meters. The EUT was placed at a height of 1.5 meters above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 meters 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 absorbers on the ground at a distance of 3 meters. 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 meter to 4 meters.
17. 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.
18. *In accordance with ANSI C63.10 Section 6.6.4.3, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.

Transmitter Radiated Emissions (continued)

Test Setup:



Transmitter Radiated Emissions (continued)

Results: Boost Mode / Bottom Channel / Antenna 1

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1805.675	Horizontal	42.25	54.00	11.75	Complied

Results: Boost Mode / Middle Channel / Antenna 1

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1830.050	Horizontal	44.74	54.00	9.26	Complied

Results: Boost Mode / Top Channel / Antenna 1

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1854.425	Horizontal	47.27	54.00	6.73	Complied

Results: Boost Mode / Hopping Mode / Antenna 1

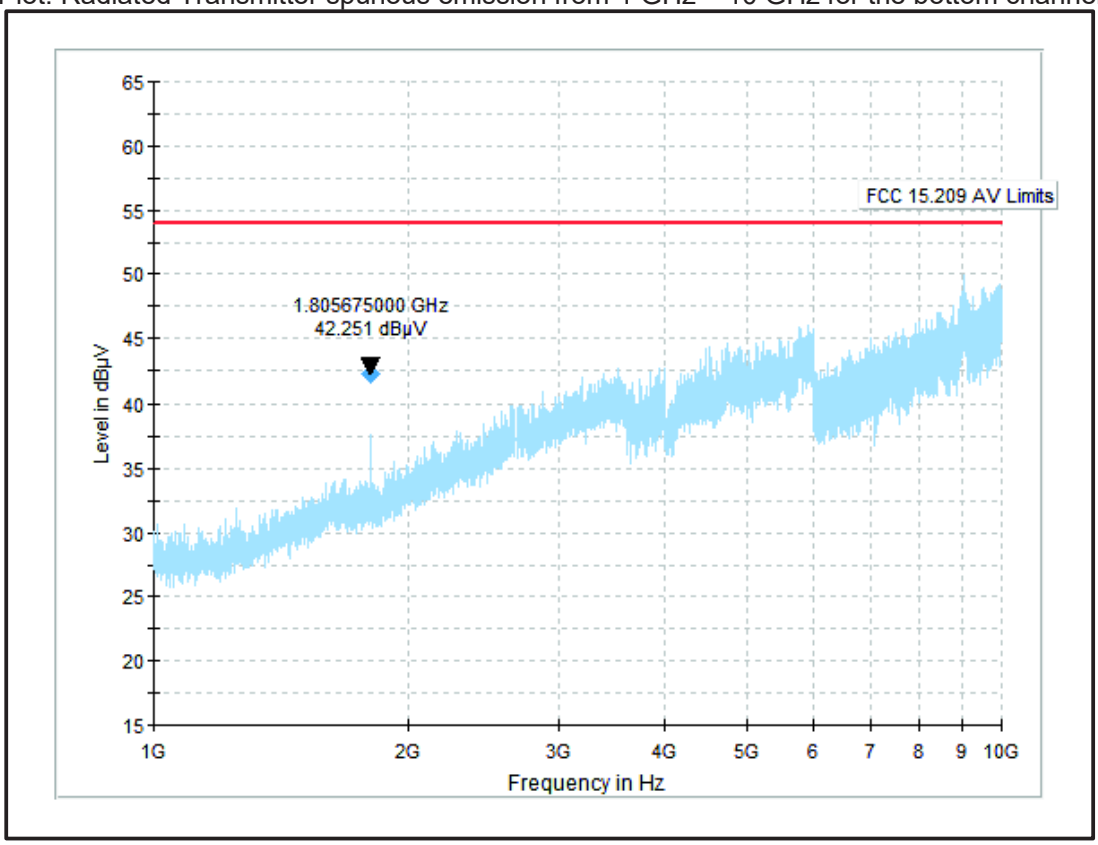
Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
No spurious emissions were detected					

Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 1

Plot: Radiated Transmitter spurious emission from 1 GHz – 10 GHz for the bottom channel

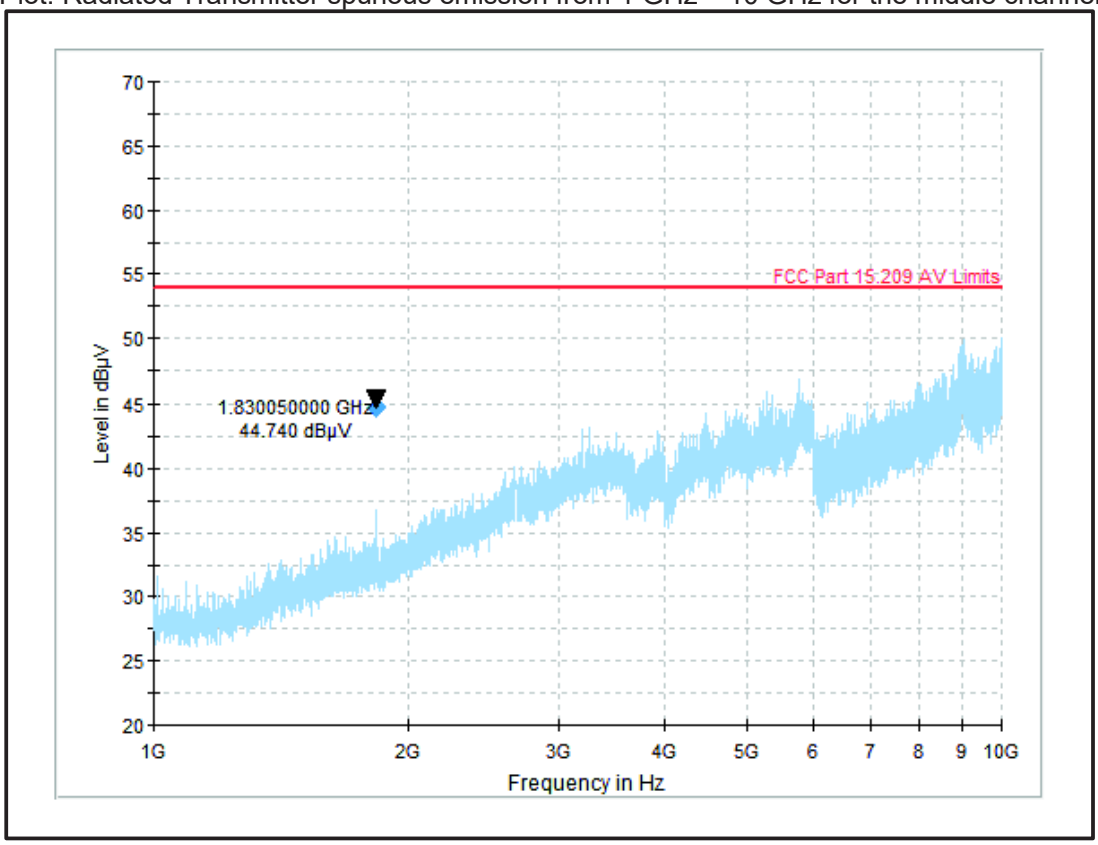


Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 1

Plot: Radiated Transmitter spurious emission from 1 GHz – 10 GHz for the middle channel

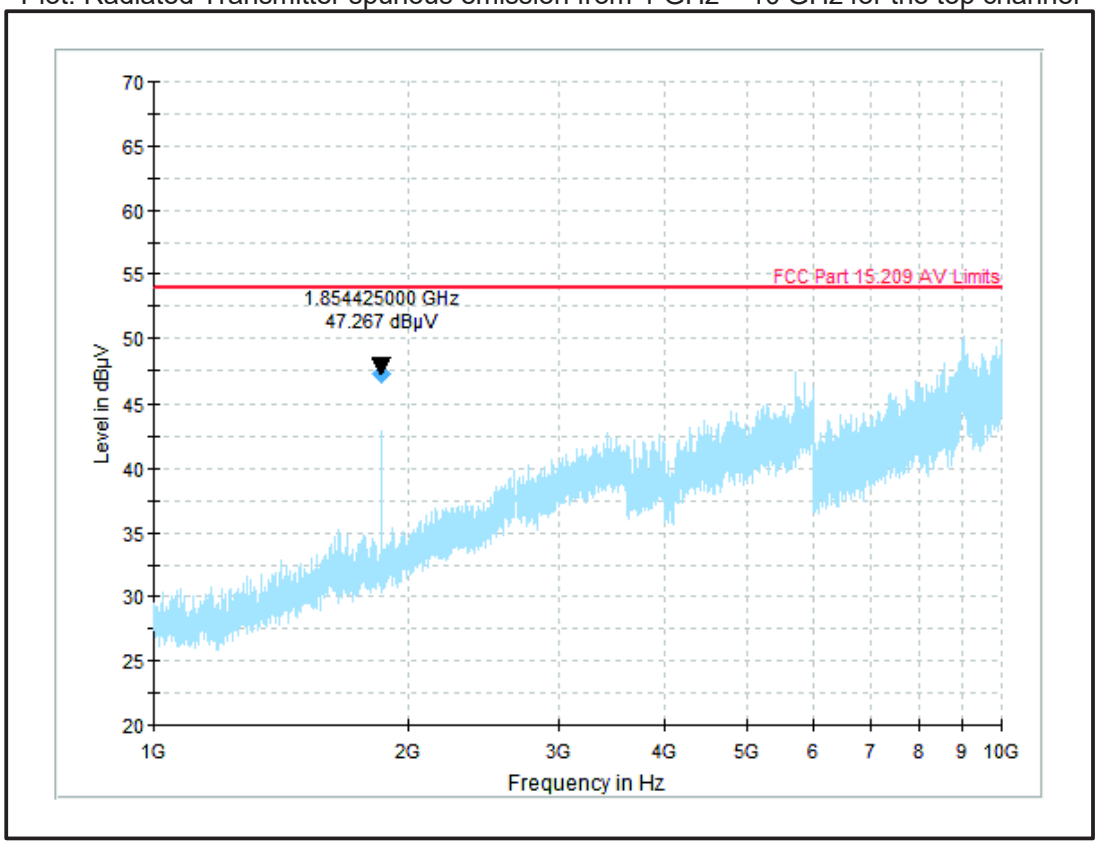


Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 1

Plot: Radiated Transmitter spurious emission from 1 GHz – 10 GHz for the top channel

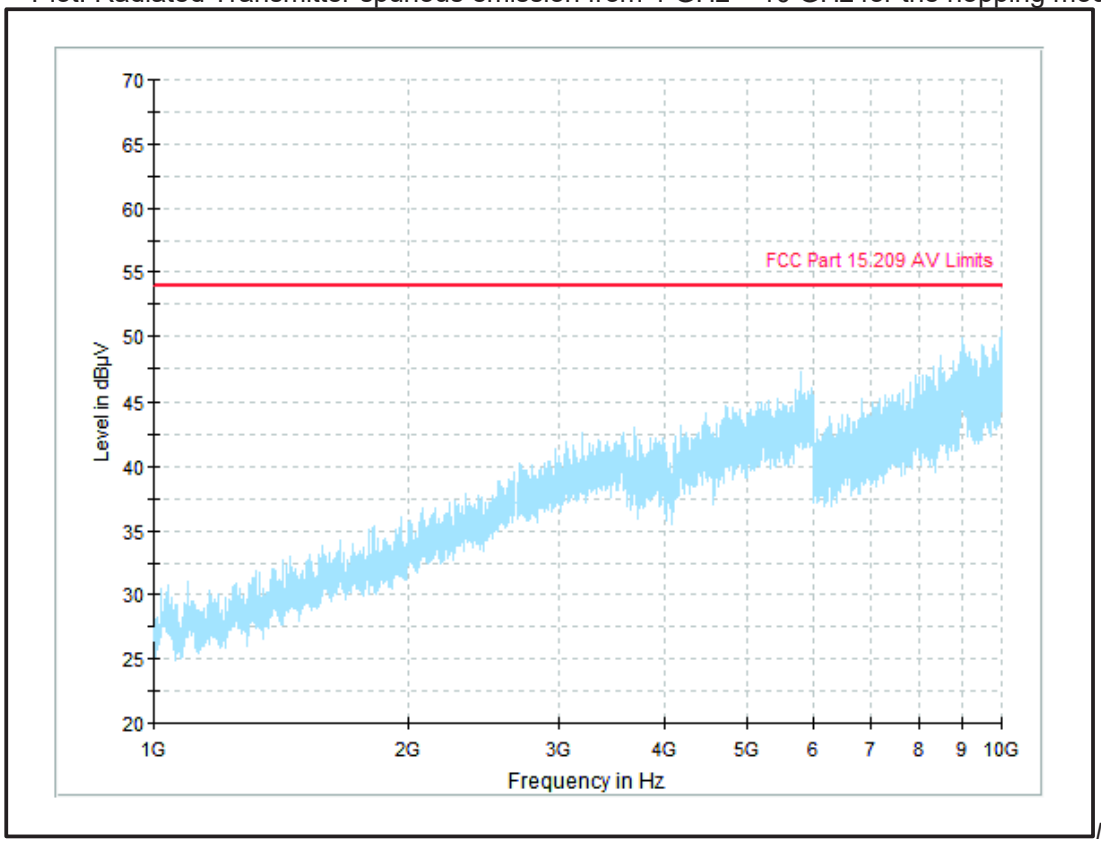


Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 1

Plot: Radiated Transmitter spurious emission from 1 GHz – 10 GHz for the hopping mode



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

Result: Pass

Transmitter Radiated Emissions (continued)

Results: Boost Mode / Bottom Channel / Antenna 2

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1805.675	Horizontal	44.18	54.00	9.82	Complied

Results: Boost Mode / Middle Channel / Antenna 2

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1830.050	Horizontal	42.64	54.00	11.36	Complied

Results: Boost Mode / Top Channel / Antenna 2

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

Results: Boost Mode / Hopping Mode / Antenna 2

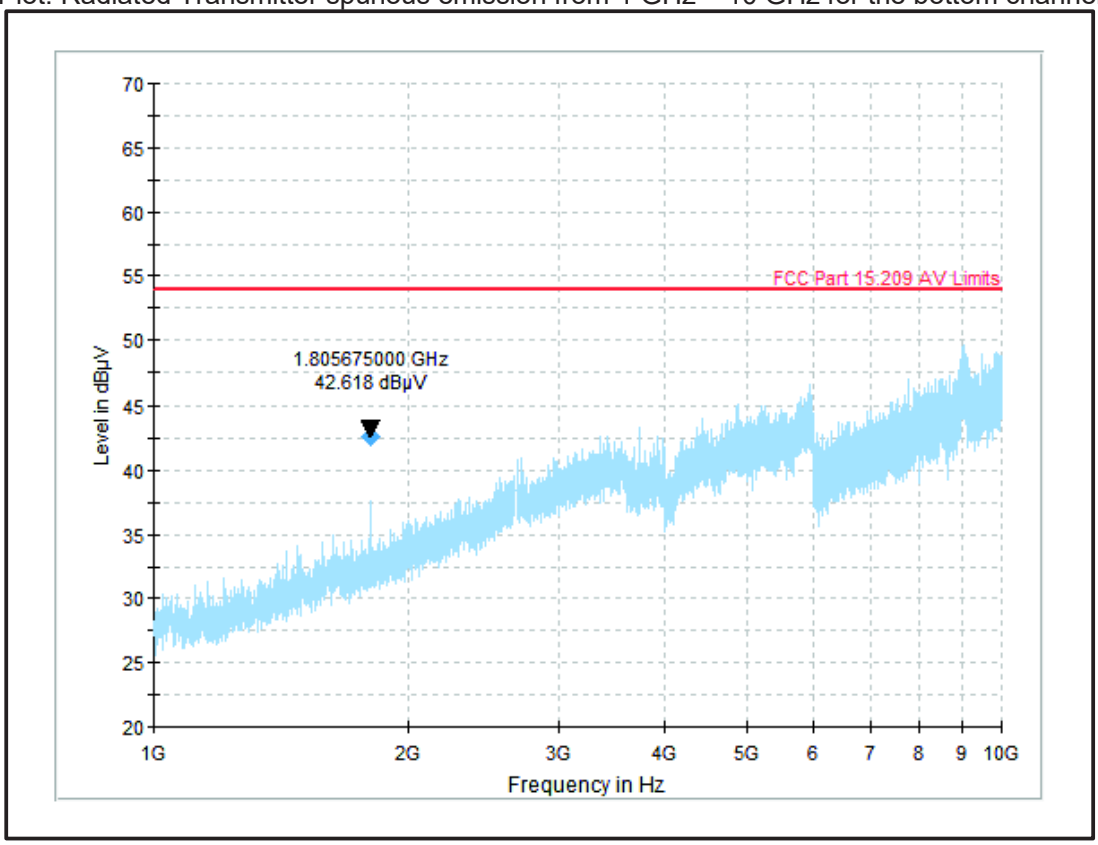
Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1909.675	Vertical	40.16	54.00	13.84	Complied

Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 2

Plot: Radiated Transmitter spurious emission from 1 GHz – 10 GHz for the bottom channel

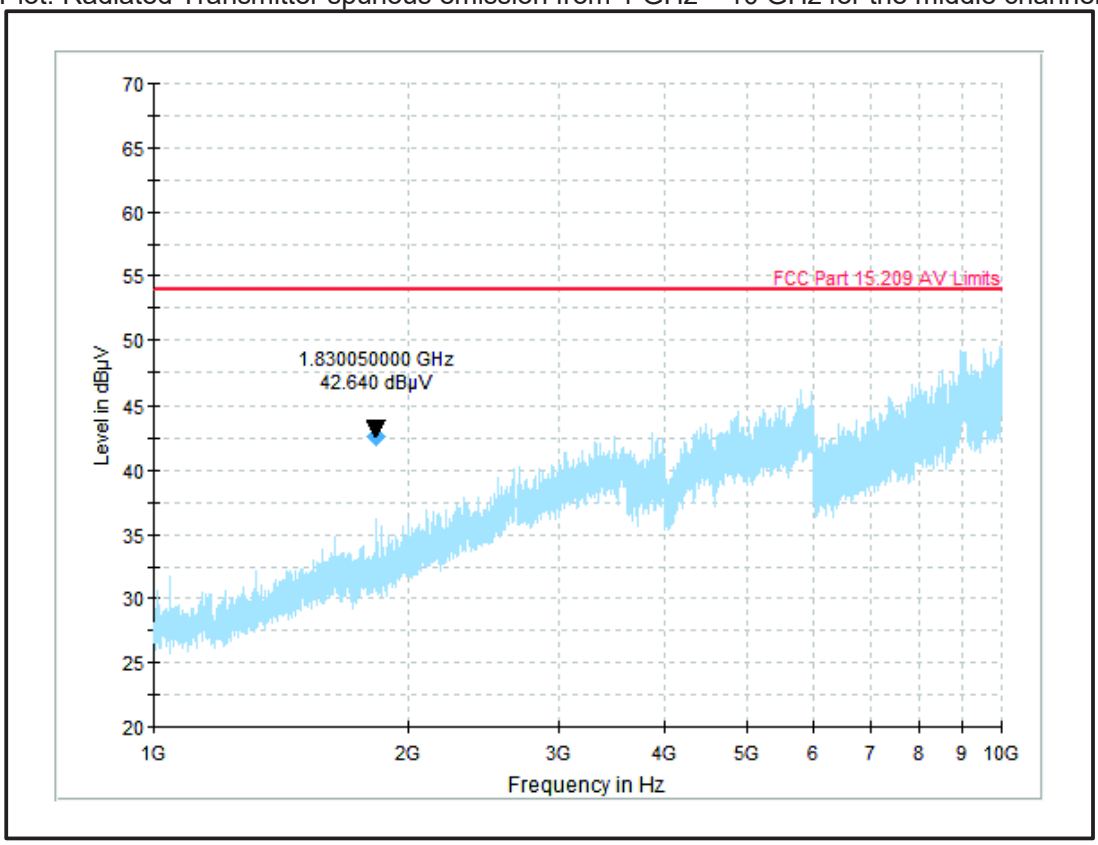


Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 2

Plot: Radiated Transmitter spurious emission from 1 GHz – 10 GHz for the middle channel

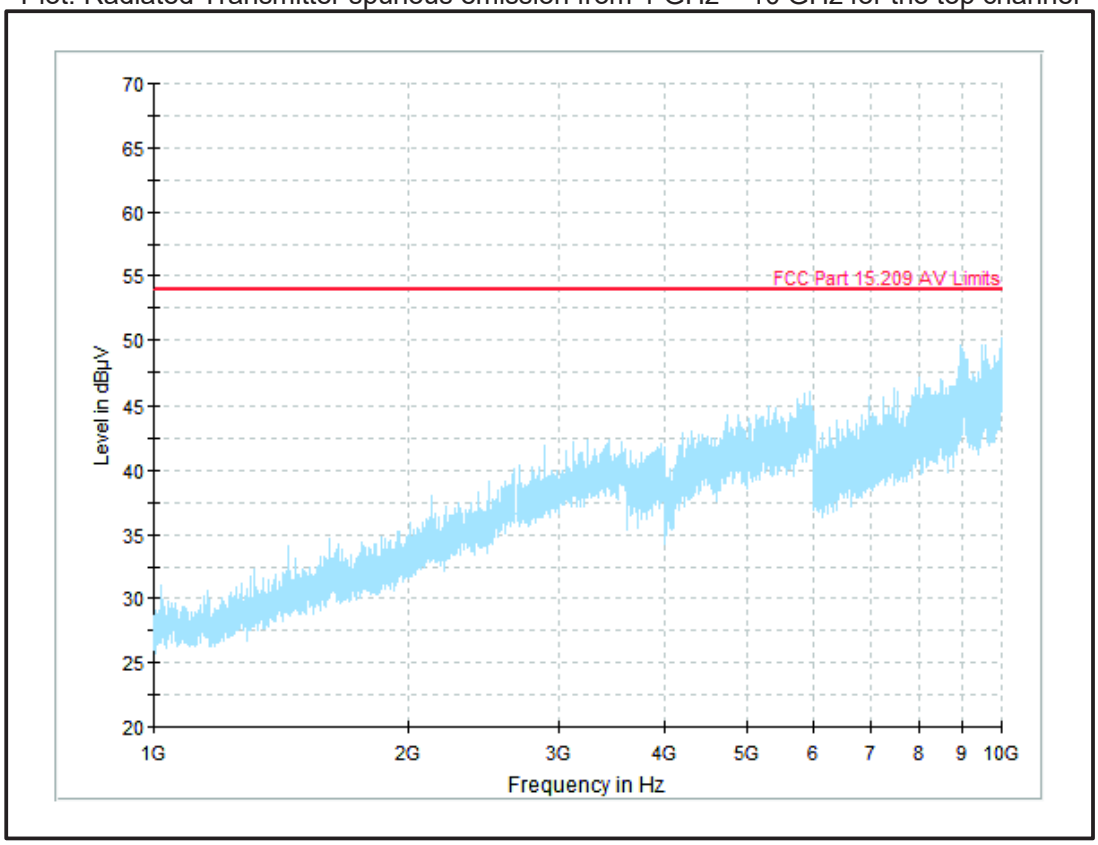


Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 2

Plot: Radiated Transmitter spurious emission from 1 GHz – 10 GHz for the top channel

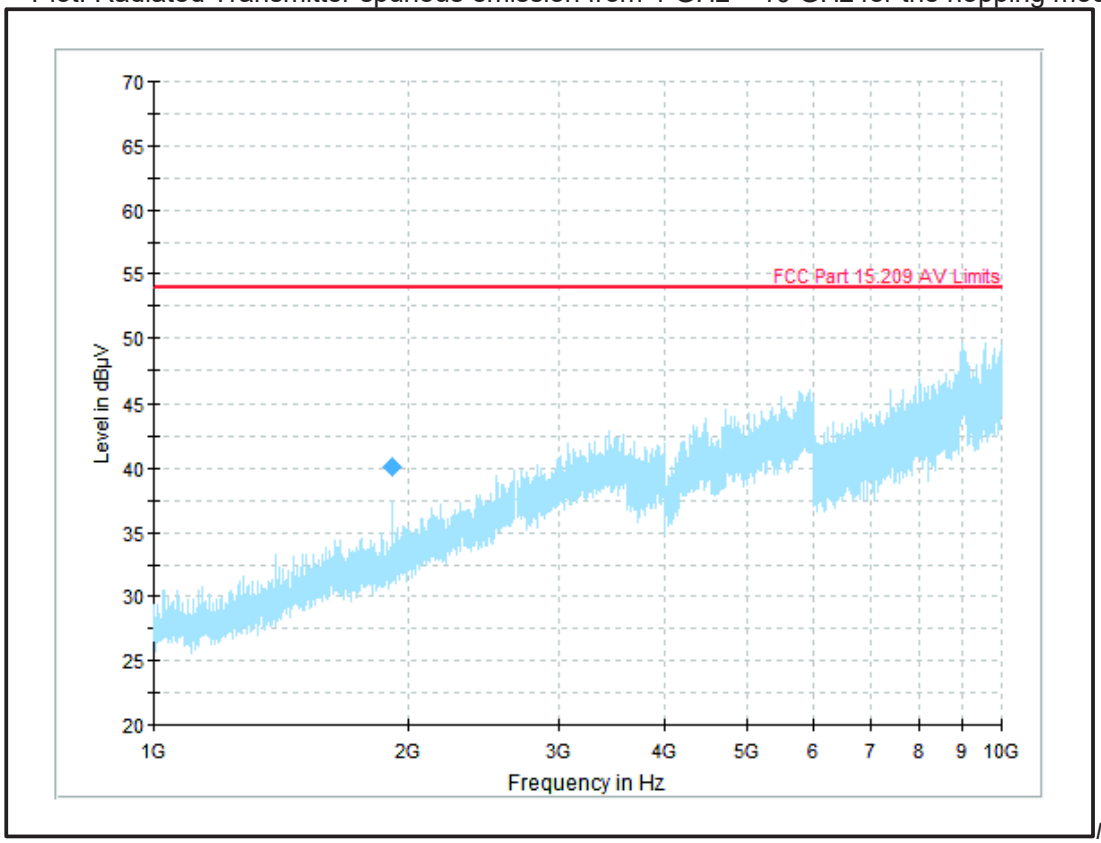


Result: Pass

Transmitter Radiated Emissions (continued)

Boost Mode / Antenna 2

Plot: Radiated Transmitter spurious emission from 1 GHz – 10 GHz for the hopping mode



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

Result: Pass

5.2.8. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	30 September 2019
Test Sample Serial Number:	bhrqmesc0001233subm0		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d)
Test Method Used:	KDB 558074 Section 9 & ANSI C63.10 Section 6.10.4, 6.10.5

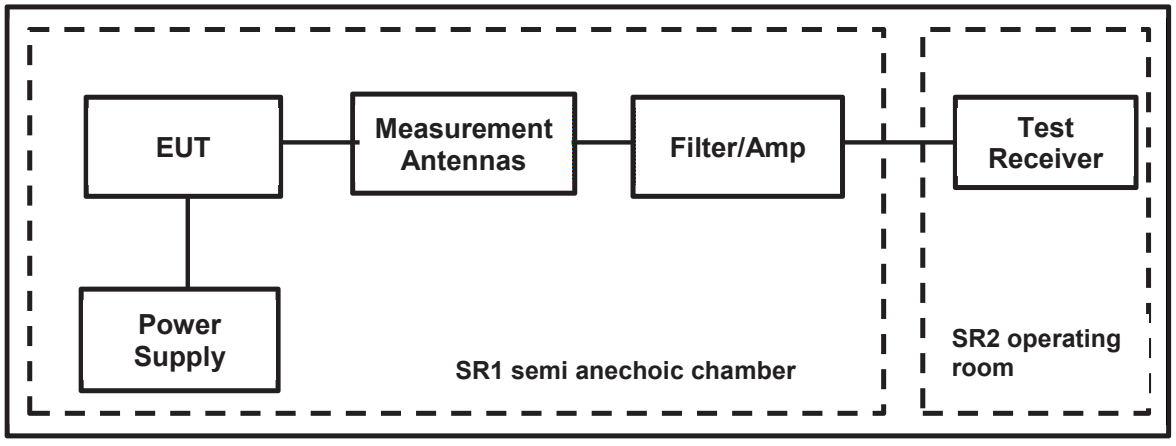
Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	46

Notes:

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. As the maximum peak conducted output power was previously measured. In accordance with FCC KDB 558074 Section 8.7 lower band edge measurement was performed with a peak detector and the -20 dBc limit applied.
3. 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 plots shown on the following page were performed using a peak detector.
5. The EUT was transmitting continuously with 100 % duty cycle, therefore no duty cycle correction was required.
6. In accordance with ANSI C63.10 Section 6.10.4 the measurements were carried out in fixed frequency mode as well as in Hopping Mode.

Test Setup:



Transmitter Band Edge Radiated Emissions (continued)

Boost Mode / Antenna 1

Results: Lower Band Edge / Bottom Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
902.000	Vertical	56.35	91.80	35.45	Complied
901.807	Vertical	57.33	91.80	34.47	Complied
901.278	Vertical	55.20	91.80	36.60	Complied

Results: Upper Band Edge / Top Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
928.000	Vertical	54.67	90.15	35.48	Complied
928.128	Vertical	56.00	90.15	34.15	Complied

Results: Lower Band Edge / Hopping Mode

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
902.000	Horizontal	54.03	95.24	41.21	Complied
899.467	Horizontal	57.26	95.24	37.98	Complied
897.673	Horizontal	55.64	95.24	39.60	Complied

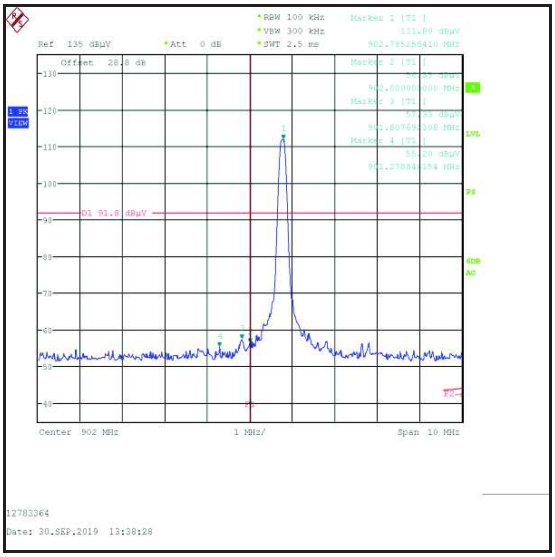
Results: Upper Band Edge / Hopping Mode

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
928.000	Horizontal	54.23	94.34	40.11	Complied
929.858	Horizontal	55.85	94.34	38.49	Complied

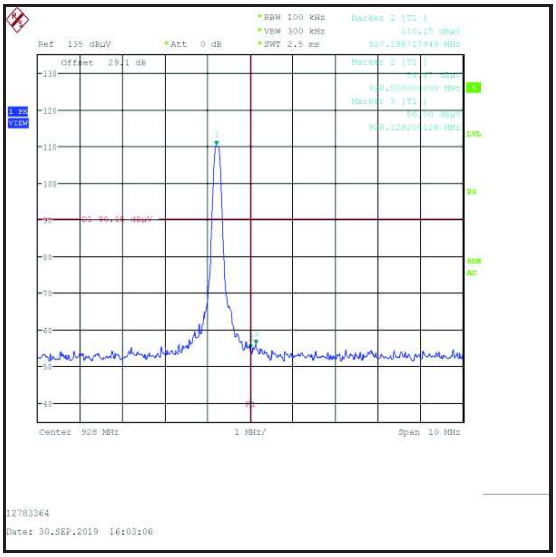
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

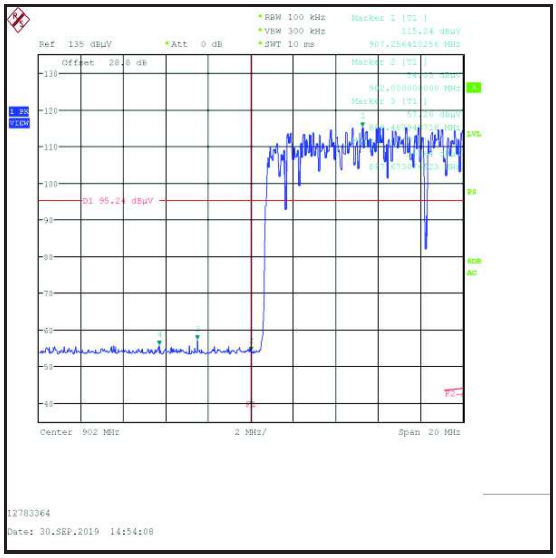
Boost Mode / Antenna 1



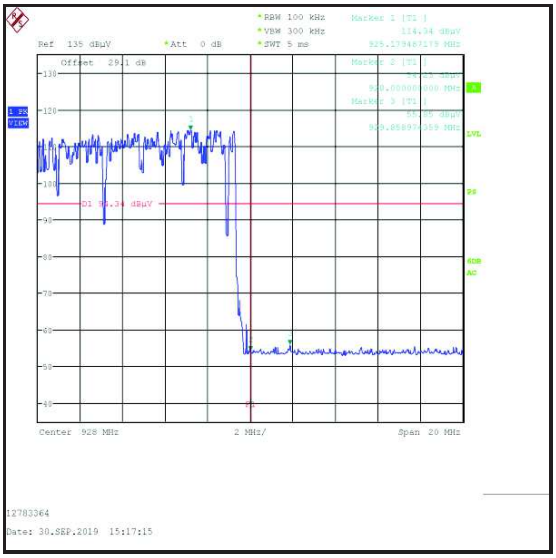
Lower Band Edge / Bottom Channel



Upper Band Edge / Top Channel



Lower Band Edge / Hopping mode



Upper Band Edge / Hopping mode

Transmitter Band Edge Radiated Emissions (continued)

Boost Mode / Antenna 2

Results: Lower Band Edge / Bottom Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
902.000	Vertical	55.42	92.25	36.83	Complied
901.759	Vertical	58.09	92.25	34.16	Complied
900.990	Vertical	56.13	92.25	36.12	Complied

Results: Upper Band Edge / Top Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
928.000	Vertical	54.27	87.13	32.86	Complied
928.256	Vertical	55.33	87.13	31.80	Complied

Results: Lower Band Edge / Hopping Mode

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
902.000	Vertical	67.30	93.21	25.91	Complied
901.679	Vertical	57.06	93.21	36.15	Complied
901.423	Vertical	56.29	93.21	36.92	Complied

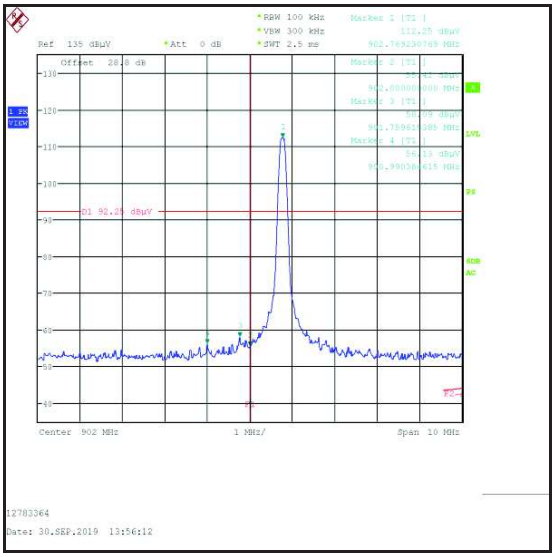
Results: Upper Band Edge / Hopping Mode

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
928.000	Vertical	53.45	93.42	39.97	Complied
934.666	Vertical	55.93	93.42	37.49	Complied

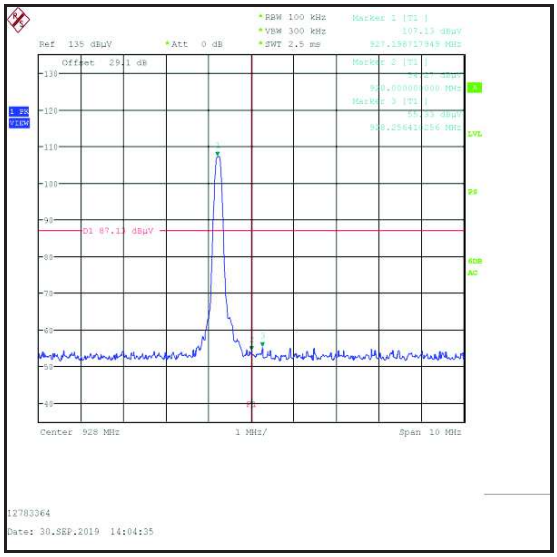
Result: Pass

Transmitter Band Edge Radiated Emissions (continued)

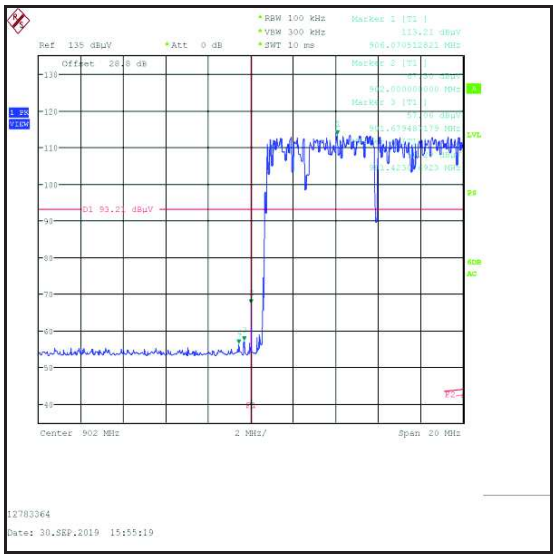
Boost Mode / Antenna 2



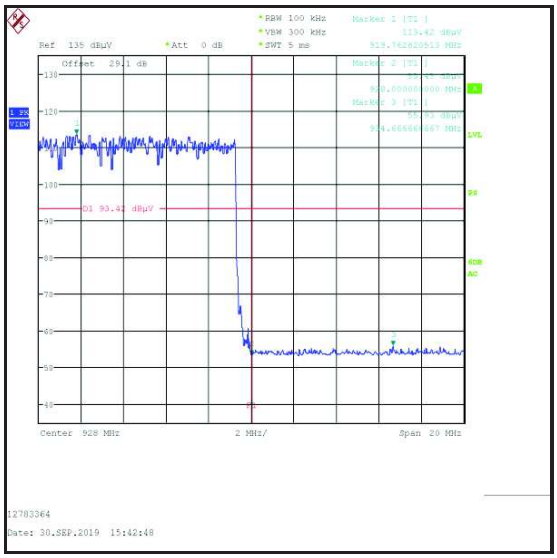
Lower Band Edge / Bottom Channel



Upper Band Edge / Top Channel



Lower Band Edge / Hopping mode



Upper Band Edge / Hopping mode

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
20 dB Bandwidth	95%	±0.87 %
Transmitter Duty Cycle	95%	±3.4%
Carrier Frequency Separation	95%	±92 Hz
Average Time of Occupancy	95%	±3.53 ns
Conducted Maximum Peak Output Power	95%	±0.59 dB
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	7/11/2019	36
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	7/10/2019	12
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	55929	7/16/2019	12
460	Deisl	Turntable	DT 4250 S	n/a	n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	3/20/2019	24
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	2/19/2019	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	7/9/2019	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

Test site: SR 7/8

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
22	Rohde & Schwarz	Artificial Mains	ESH3-Z5	831767/014	9/7/2019	12
23	Rohde & Schwarz	Artificial Mains	ESH3-Z5	831767/013	9/7/2019	12
28	Rohde & Schwarz	Passive Probe	ESH2-Z3	none	11/7/2019	12
215	Rohde & Schwarz	Artificial Mains Network	ESH2-Z5	879675/002	5/7/2019	12
349	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/009	10/7/2019	12
351	Rohde & Schwarz	network, Artificial Mains	ESH3-Z5	862770/018	8/7/2019	12
564	Teseq	Impedance stabilisation network (ISN)	ISN T800	26076	8/7/2019	24
616	Rohde & Schwarz	ISN	ENY81-CA6	101656	9/7/2019	12
-/-	Testo	Thermo-Hygrometer	608-H1	08	lab verification	n/a

Test site: SR 9

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	55929	7/16/2019	12
445	Huber & Suhner	RF Attenuator (10dB)	6810.17.AC	--	Cal Before Use	12
621	Ahlborn-Almemo	Temperatur-/ Feuchtemessgerät	MA2470-S2	H16080099	3/15/2019	12
634	Rohde & Schwarz	Wireless Devices Test System	TS8997	--	lab verification	12
636	Rohde & Schwarz	switching unit	OSP120	101698	7/19/2019	12
637	Rohde & Schwarz	Spectrum Analyzer	FSV40	101587	7/11/2019	12
-/-	Testo	Thermo-Hygrometer	608-H1	07	lab verification	n/a

8. Report Revision History

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