Cooper Crouse Hinds LLC
TEST REPORT

SCOPE OF WORK
EMC TESTING – ECH-LTC5800-01

REPORT NUMBER
103658032BOX-002

ISSUE DATE	**[REVISED DATE]**
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Non-Specific Radio Report Shell Rev. December 2017

EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 103658032BOX-002
Project Number: G103658032

Report Issue Date: 11/16/2018

Model(s) Tested: ECH-LTC5800-01
Model(s) Partially Tested: N/A
Model(s) Not Tested but declared equivalent by the client: N/A

Standards: CFR47 FCC Part 15.247 Subpart C: 06/2018,
CFR47 FCC Part 15 Subpart B: 06/2018,
RSS-247 Issue 2 February 2017,
ICES-003 Issue 6 Published: January 2016 Updated: April 2017,
RSS-Gen Issue 5 April 2018,
RSS-102 Issue 5 March 2015

Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
Cooper Crouse Hinds LLC
1201 Wolf St
Syracuse, NY 13208-1375
USA

Report prepared by Vathana Ven

Vathana Ven/EMC Staff Engineer

Report reviewed by

Michael Murphy/EMC Engineering Supervisor

Table of Contents

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	--
6	Maximum Peak Output Power and Human RF exposure CFR47 FCC Part 15 Subpart C:06/2018, Section 15.247 (b)(3) RSS-247 Issue 2 February 2017, RSS-102 Issue 5 March 2015	Pass
7	6 dB Bandwidth and Occupied Bandwidth CFR47 FCC Part 15 Subpart C: 06/2018, Section 15.247 (a)(2) RSS-247 Issue 2 February 2017	Pass
8	Maximum Power Spectral Density CFR47 FCC Part 15 Subpart C: 02/2018, Section 15.247 (e) RSS-247 Issue 2 February 2017	Pass
9	Band Edge Compliance CFR47 FCC Part 15 Subpart C: 06/2018, Section 15.247 (d) RSS-247 Issue 2: 02/2017)	Pass
10	Transmitter spurious emissions CFR47 FCC Part 15 Subpart C: 02/2018, Section 15.247 (d) RSS-247 Issue 2 February 2017	Pass
11	Digital Device and Receiver Radiated Spurious Emissions (CFR47 FCC Part 15 Subpart B 15.109: 06/2018, ICES-003 Issue 6 Published: January 2016 Updated: April 2017	Pass
12	AC Mains Conducted Emissions FCC 47CFR Part 15.107: 06/2018 ICES-003 Issue 6 Published: January 2016 Updated: April 2017	Pass
13	Revision History	--

3 Client Information

This EUT was tested at the request of:

Client: Cooper Crouse Hinds LLC
1201 Wolf St
Syracuse, NY 13208-1375
USA

Contact: James Sotherden
Telephone: (315) 477-5392
Email: jamessotherden@eaton.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Cooper Crouse Hinds LLC
1201 Wolf St
Syracuse, NY 13208-1375
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Transceiver	Cooper Crouse Hinds LLC	ECH-LTC5800-01	080618

Receive Date:	09/25/2018
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)

Complete wireless node that consists of LTC-5800-WHM SoC, power supply decoupling, crystals and antenna circuitry. The SoC radio transceiver is based on IEEE 802.15.4.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
5VDC	100 mA	N/A	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Tx mode
2	Rx mode

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	HART_RADIO_IMAGE_0307576_REV01

Radio/Receiver Characteristics	
Frequency Band(s)	2405-2475 MHz
Modulation Type(s)	OQPSK
Maximum Output Power	5 dBm
Test Channels	Low Channel = 2405 MHz Mid Channel = 2440 MHz High Channel = 2475 MHz
Occupied Bandwidth	Low Channel, 2 MHz Mid Channel, 2 MHz High Channel, 2 MHz
Frequency Hopper: Number of Hopping Channels	N/A
Frequency Hopper: Channel Dwell Time	N/A
Frequency Hopper: Max interval between two instances of use of the same channel	N/A
MIMO Information (# of Transmit and Receive antenna ports)	N/A
Equipment Type	Standalone, Module, Plug-in Radio Module
ETSI LBT/Adaptivity	N/A
ETSI Adaptivity Type	N/A
ETSI Temperature Category (I, II, III)	N/A
ETSI Receiver Category (1, 2, 3)	N/A
Antenna Type and Gain	External Antenna (2 dBi gain)

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

5 System Setup and Method

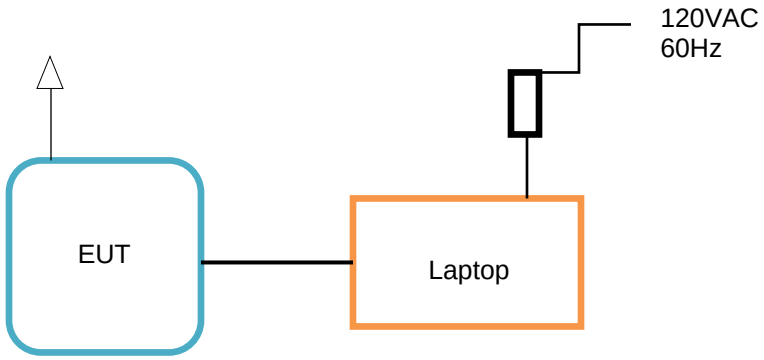
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	Serial – USB cable	1	None	None	Laptop

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop	HP	EliteBook 8460p	Not labeled

5.1 Method:

Configuration as required by CFR47 FCC Part 15.247 Subpart C: 06/2018, CFR47 FCC Part 15 Subpart B: 06/2018, RSS-247 Issue 2 February 2017, ICES-003 Issue 6 Published: January 2016 Updated: April 2017, RSS-Gen Issue 5 April 2018, RSS-102 Issue 5 March 2015, ANSI C63.4:2014, and ANSI C63.10:2013.

5.2 EUT Block Diagram:



6 Maximum Peak Output Power and Human RF exposure

6.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, RSS-102, and ANSI C63.10.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	12/07/2017	12/07/2018
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/07/2017	11/07/2018
DUT 1'	Coaxial Cable	UTIFLEX MICRO-COAX	UFA210A-1-0787-300300	101709	02/01/2018	02/01/2019
--	20 dB Attenuator	Pasternack	PE7004-20	None	Verified Before Used	Verified Before Used

Software Utilized:

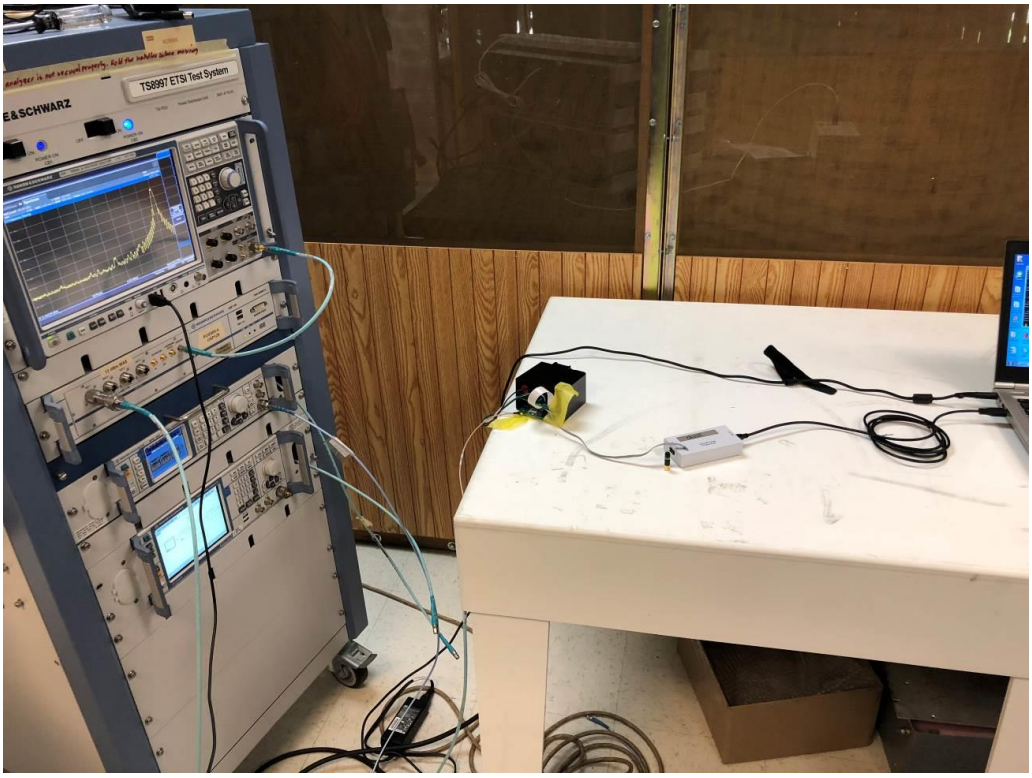
Name	Manufacturer	Version
R&S EMC32/AMS32/WMS32	Rohde & Schwarz	10.30.00

6.3 Results:

The sample tested was found to Comply.

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt or 30 dBm.

6.4 Setup Photograph:



6.5 Plots/Data:

FCC Part 47 §15.247 2400-2483.5 MHz 2016

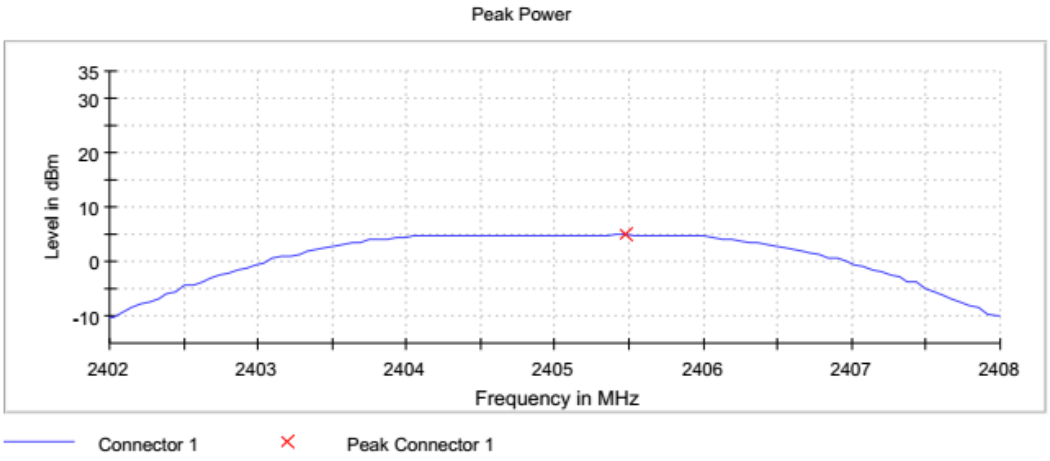
Peak output power (Sweep) (2405 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

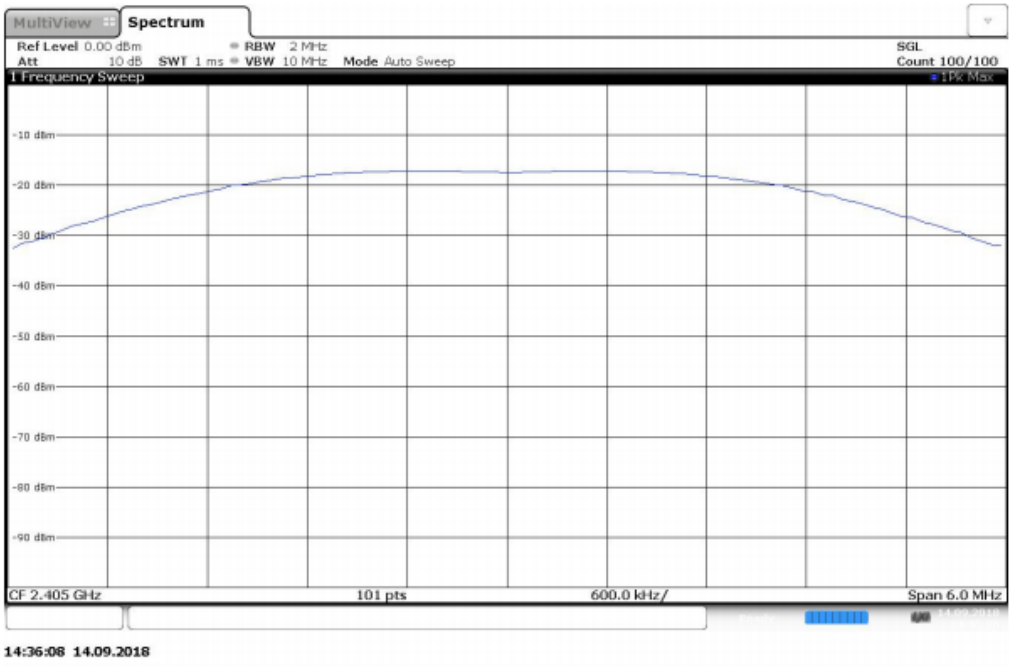
Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2405.000000	4.8	30.0	PASS



Peak Power 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

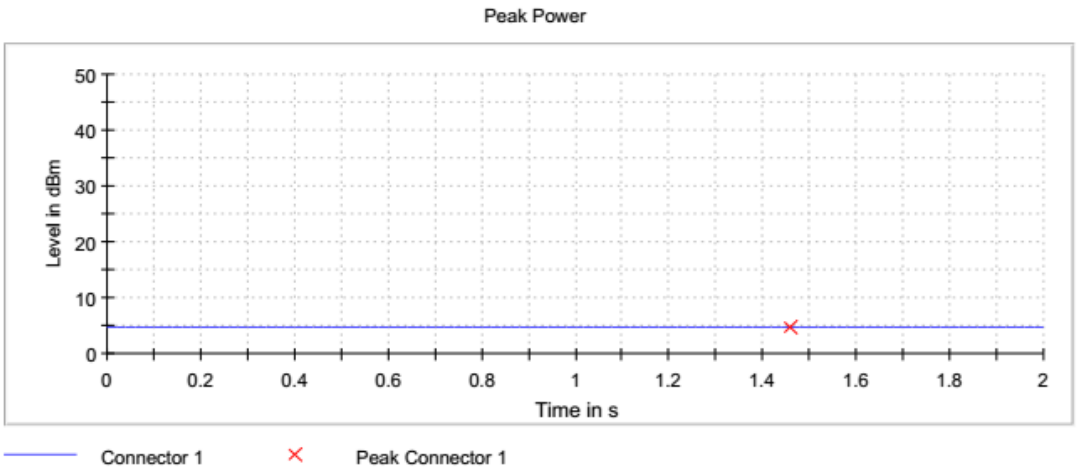
Peak output power (ZeroSpan) (2405 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2405.000000	4.7	30.0	PASS



Peak Power 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016

FCC Part 47 §15.247 2400-2483.5 MHz 2016

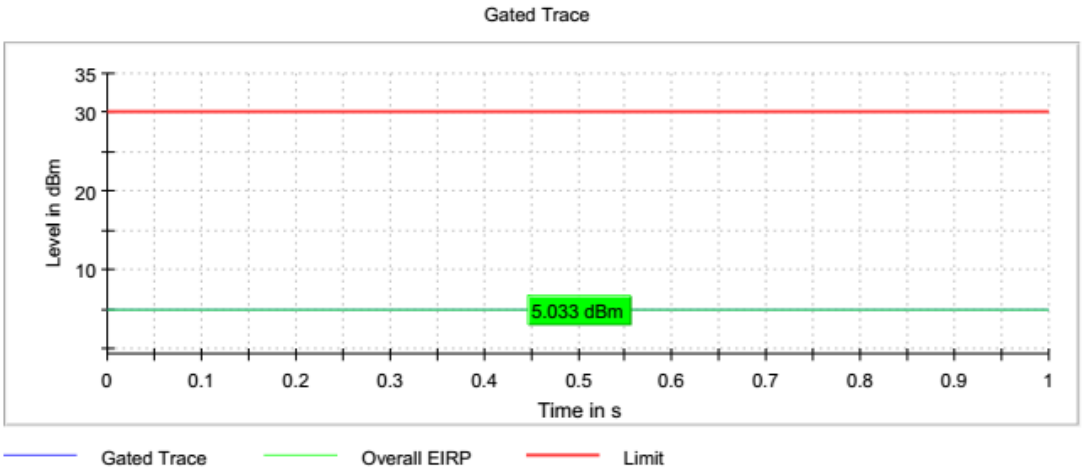
RF output power (2405 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

Result

DUT Frequency (MHz)	Gated RMS (dBm)	Limit Max (dBm)	Gated EIRP (dBm)	DutyCycle (%)	Result
2405.000000	5.0	30.0	5.0	100.000	PASS



FCC Part 47 §15.247 2400-2483.5 MHz 2016

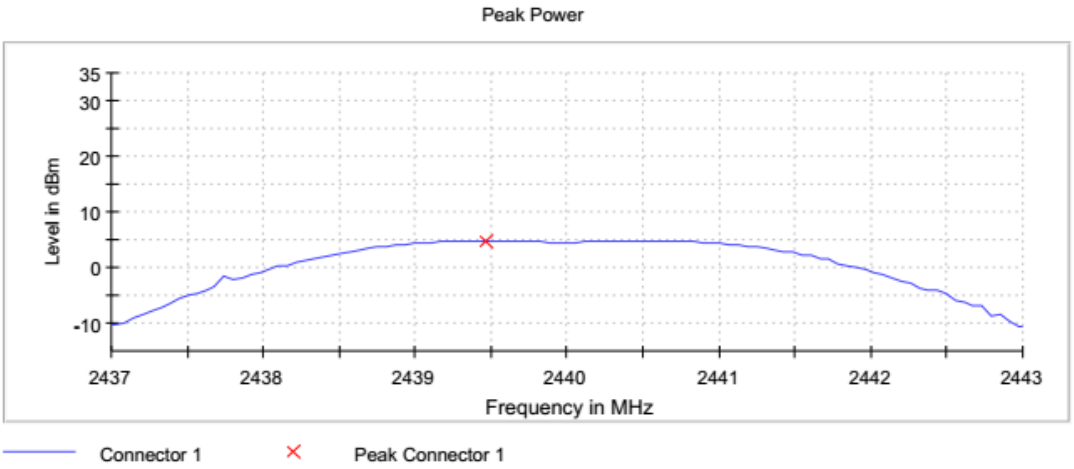
Peak output power (Sweep) (2440 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

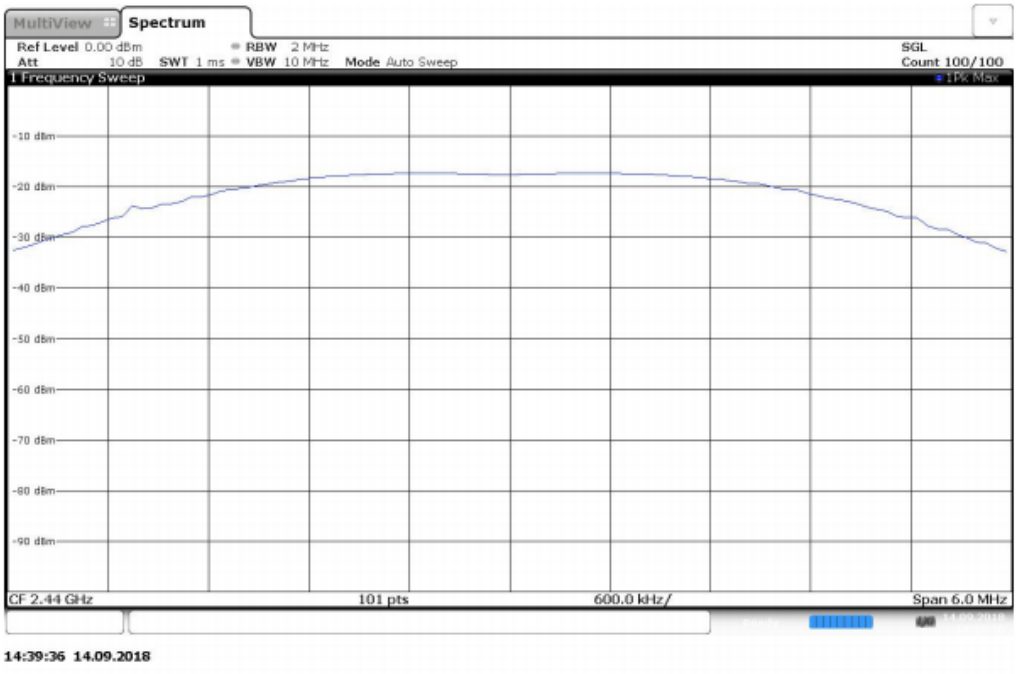
Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2440.000000	4.7	30.0	PASS



Peak Power 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

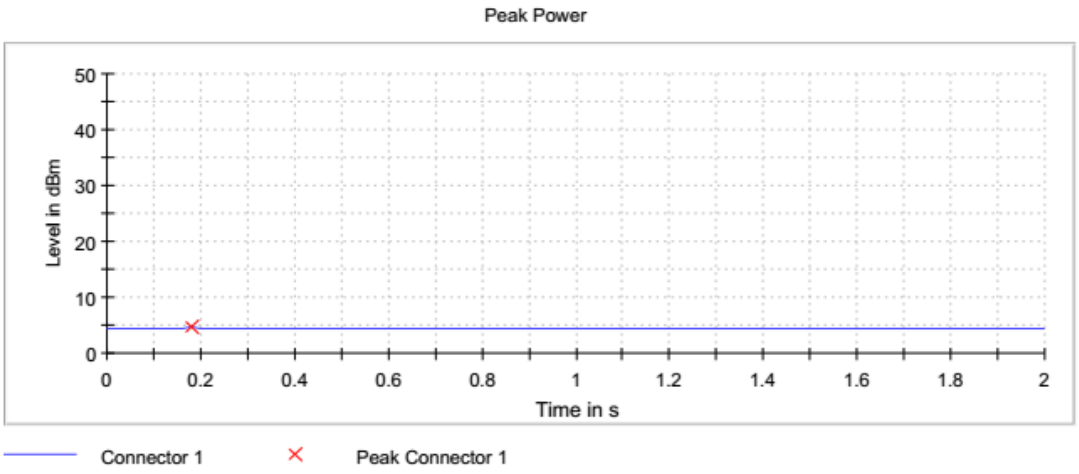
Peak output power (ZeroSpan) (2440 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2440.000000	4.5	30.0	PASS



Peak Power 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016

FCC Part 47 §15.247 2400-2483.5 MHz 2016

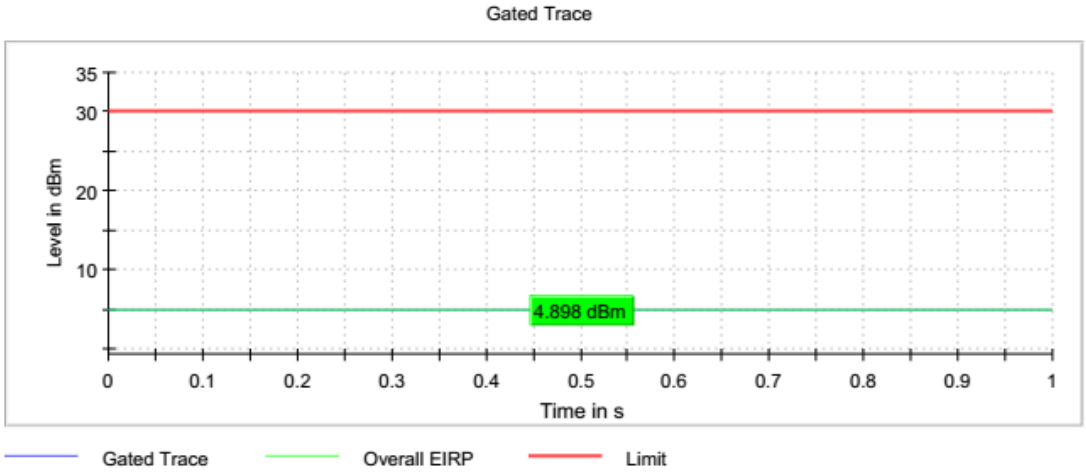
RF output power (2440 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

Result

DUT Frequency (MHz)	Gated RMS (dBm)	Limit Max (dBm)	Gated EIRP (dBm)	DutyCycle (%)	Result
2440.000000	4.9	30.0	4.9	100.000	PASS



FCC Part 47 §15.247 2400-2483.5 MHz 2016

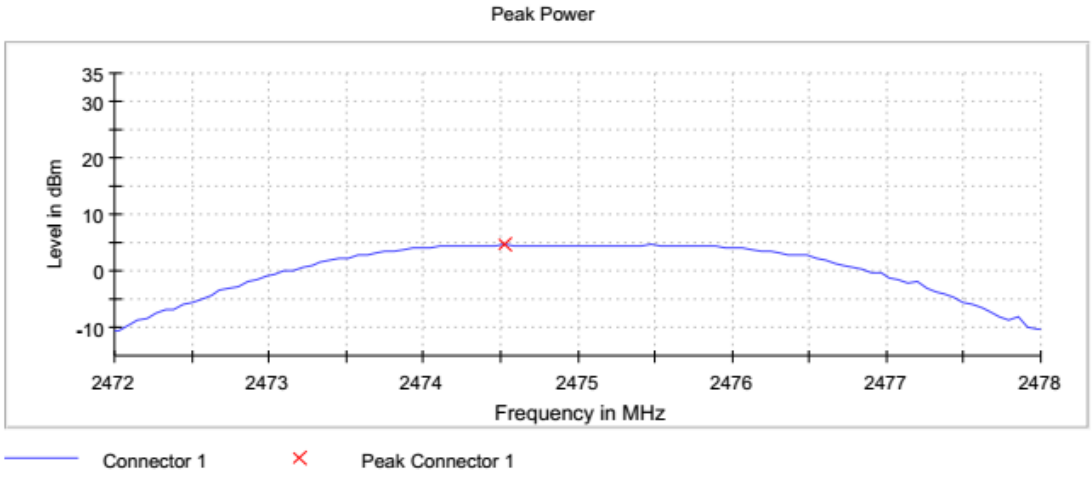
Peak output power (Sweep) (2475 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

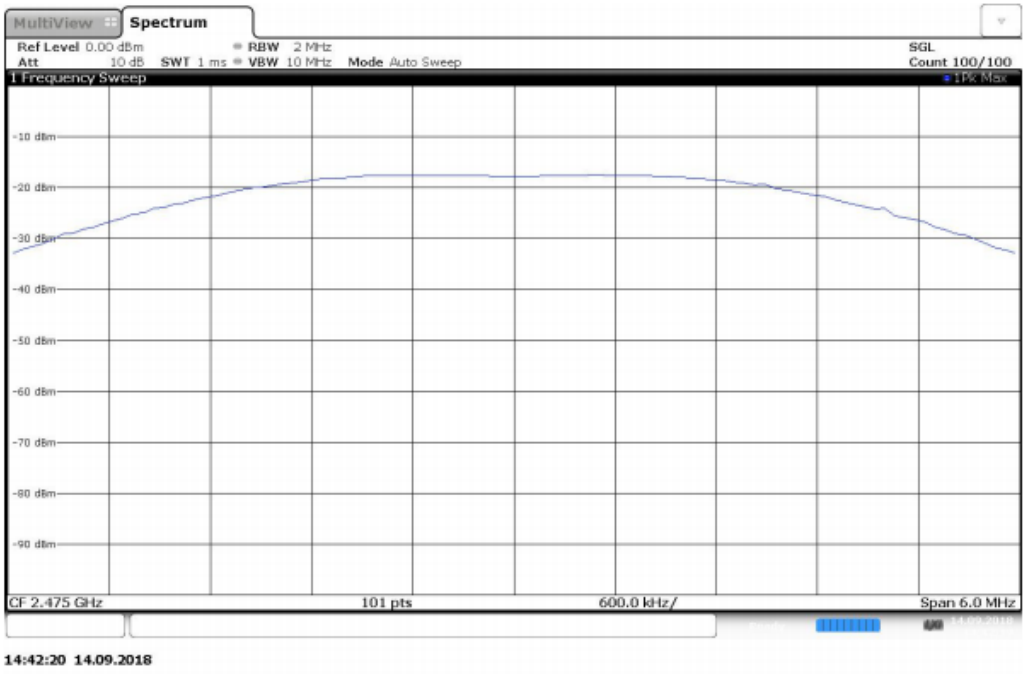
Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2475.000000	4.5	30.0	PASS



Peak Power 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

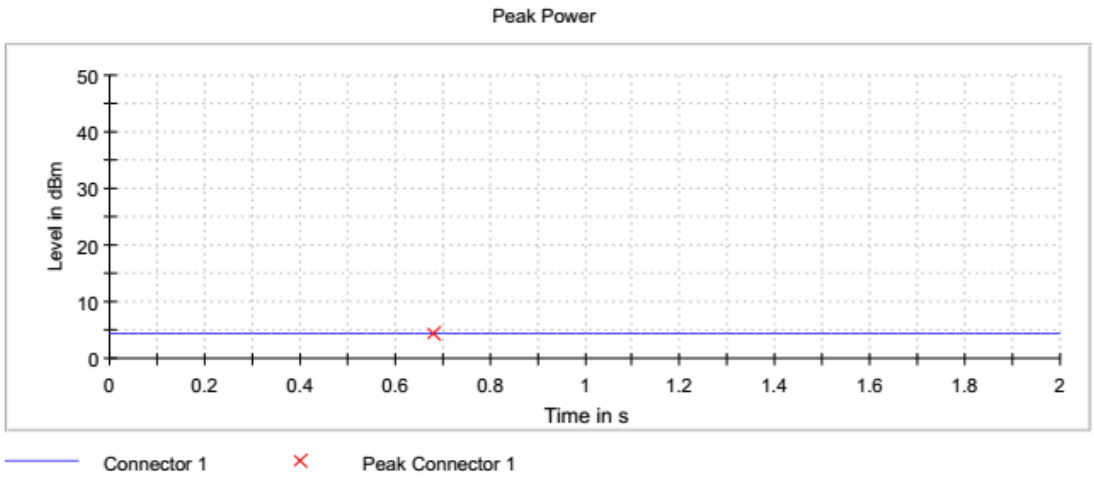
Peak output power (ZeroSpan) (2475 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2475.000000	4.4	30.0	PASS



Peak Power 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016

FCC Part 47 §15.247 2400-2483.5 MHz 2016

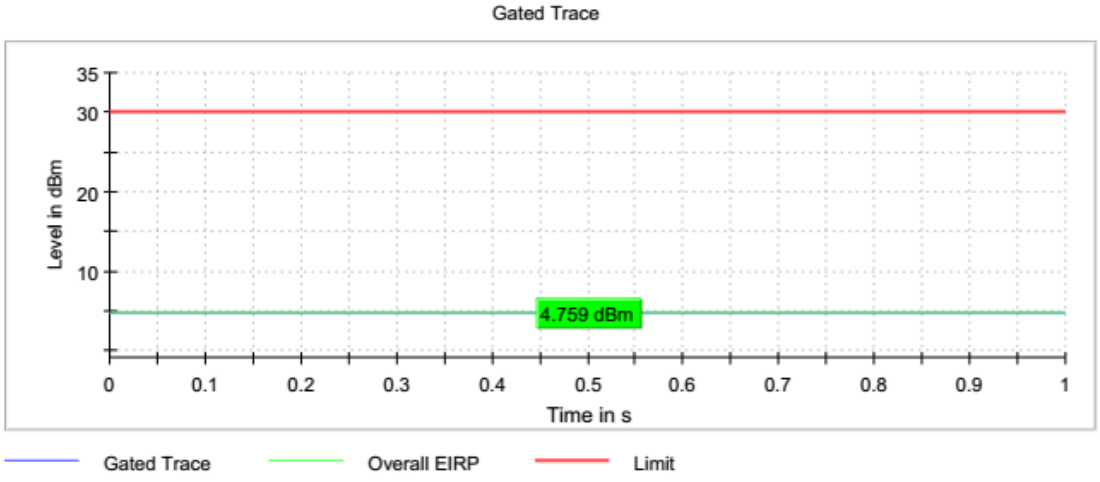
RF output power (2475 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Combined Uncertainty of absolute Level Measurement (K=2) < 0.8 dB

Result

DUT Frequency (MHz)	Gated RMS (dBm)	Limit Max (dBm)	Gated EIRP (dBm)	DutyCycle (%)	Result
2475.000000	4.8	30.0	4.8	100.000	PASS



SAR Exemption Calculation

Maximum Conducted Output Power of Transmitter = 5.0 dBm = 3.162 mW

FCC SAR Exemption per KDB 447498

a) For 100 MHz to 6 GHz and *test separation distances* ≤ 50 mm, the 1-g and 10-g *SAR test exclusion thresholds* are determined by the following:

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR,[30] where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz

= (3.162/5)*(sqrt(2.405))

= 0.981 < 3.0 (below the limit SAR Exempt per FCC)

RSS 102 SAR Exemption

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

The exemption limits in Table 1 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.

The conducted output power of the transmitter 3.162 mW @ 2405MHz is less than 4 mW limit specified at 2450 MHz, device meets SAR exclusion.

Test Personnel:	Kouma Sinn KPS	Test Date:	09/14/2018
Supervising/Reviewing Engineer: (Where Applicable)			
Product Standard:	FCC Part 15.247 RSS-247, RSS-102	Limit Applied:	See Report Section 6.3
Input Voltage:	120VAC 60Hz	Ambient Temperature:	22 ºC
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Relative Humidity:	56 %
		Atmospheric Pressure:	1016 mbars

Deviations, Additions, or Exclusions: None

7 6 dB Bandwidth and Occupied Bandwidth

7.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, RSS-102, and ANSI C63.10.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	12/07/2017	12/07/2018
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/07/2017	11/07/2018
DUT 1'	Coaxial Cable	UTIFLEX MICRO-COAX	UFA210A-1-0787-300300	101709	02/01/2018	02/01/2019
--	20 dB Attenuator	Pasternack	PE7004-20	None	Verified Before Used	Verified Before Used

Software Utilized:

Name	Manufacturer	Version
R&S EMC32/AMS32/WMS32	Rohde & Schwarz	10.30.00

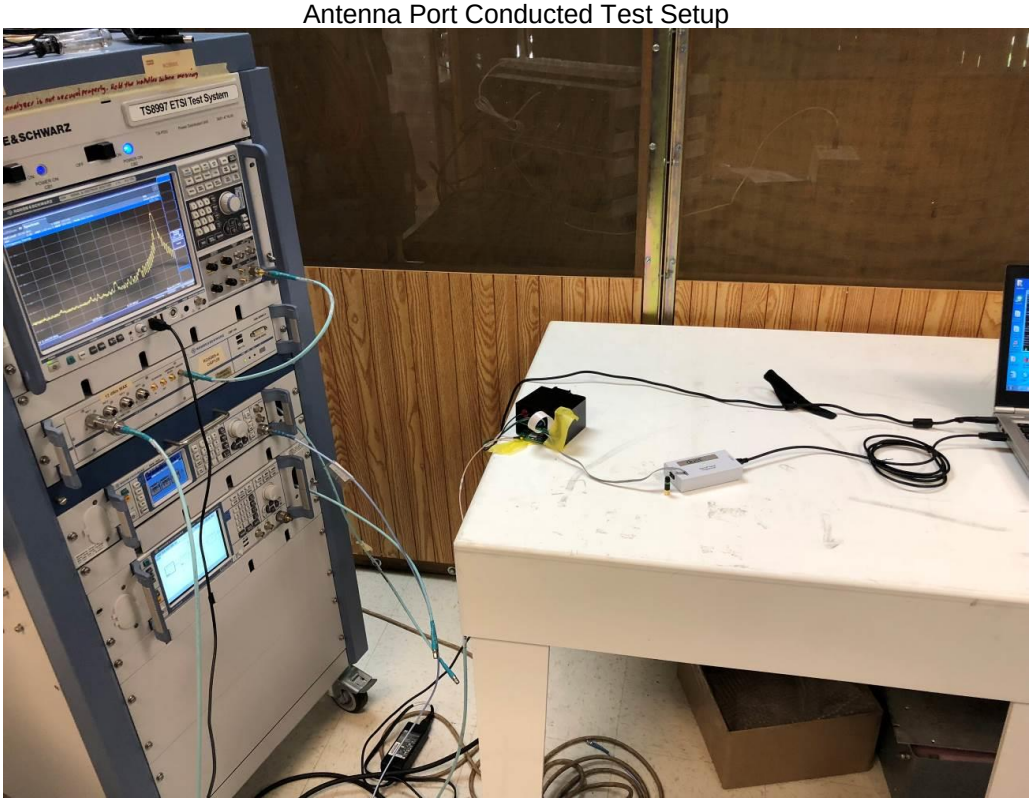
7.3 Results:

The sample tested was found to Comply.

§15.247 (a) (2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

7.4 Setup Photograph:

Antenna Port Conducted Test Setup



7.5 Plots/Data:

FCC Part 47 §15.247 2400-2483.5 MHz 2016

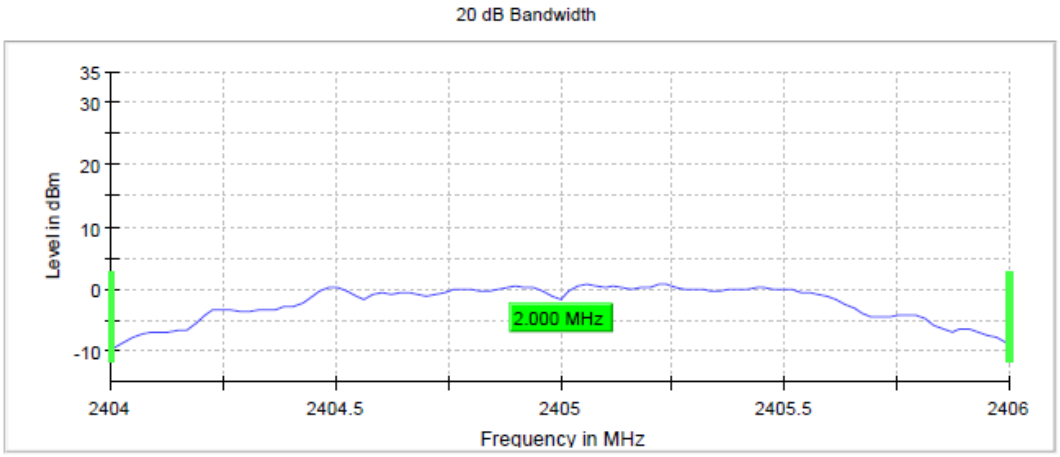
Emission Bandwidth 20 dB (2405 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

20 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2405.000000	2.000000	---	---	2404.000000	2406.000000	0.8	PASS



Bandwidth

FCC Part 47 §15.247 2400-2483.5 MHz 2016

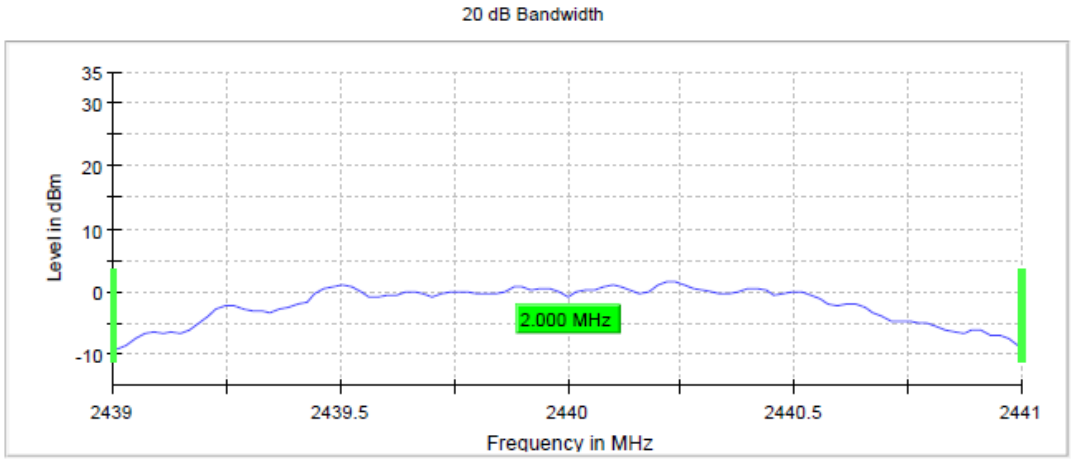
Emission Bandwidth 20 dB (2440 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

20 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2440.000000	2.000000	---	---	2439.000000	2441.000000	1.6	PASS



Bandwidth

FCC Part 47 §15.247 2400-2483.5 MHz 2016

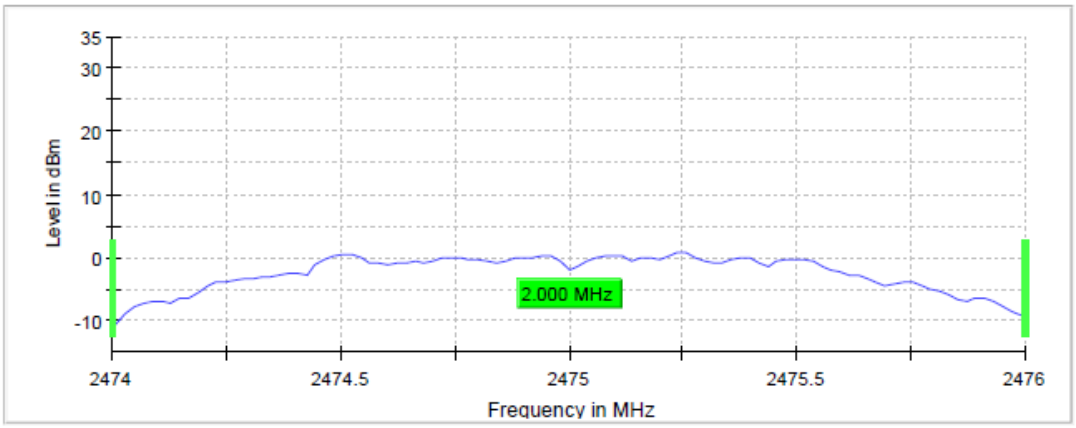
Emission Bandwidth 20 dB (2475 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

20 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2475.000000	2.000000	---	---	2474.000000	2476.000000	0.7	PASS



Bandwidth

FCC Part 47 §15.247 2400-2483.5 MHz 2016

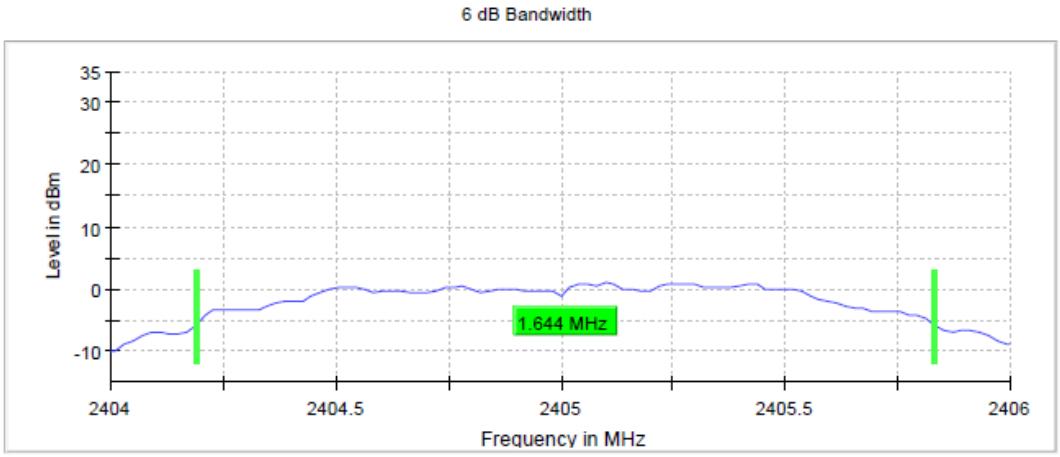
Minimum Emission Bandwidth 6 dB (2405 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2405.000000	1.643564	0.500000	---	2404.188119	2405.831683	1.0	PASS



Bandwidth

FCC Part 47 §15.247 2400-2483.5 MHz 2016

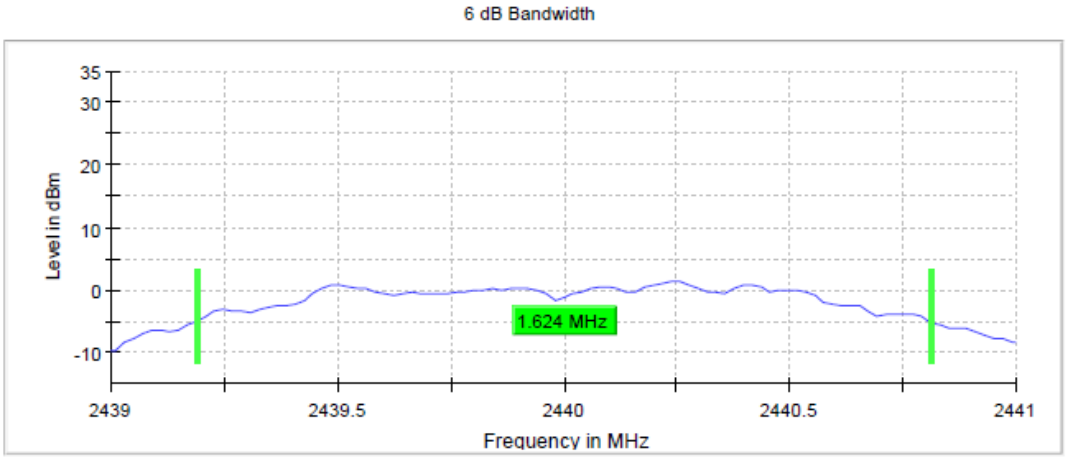
Minimum Emission Bandwidth 6 dB (2440 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2440.000000	1.623762	0.500000	---	2439.188119	2440.811881	1.3	PASS



Bandwidth

FCC Part 47 §15.247 2400-2483.5 MHz 2016

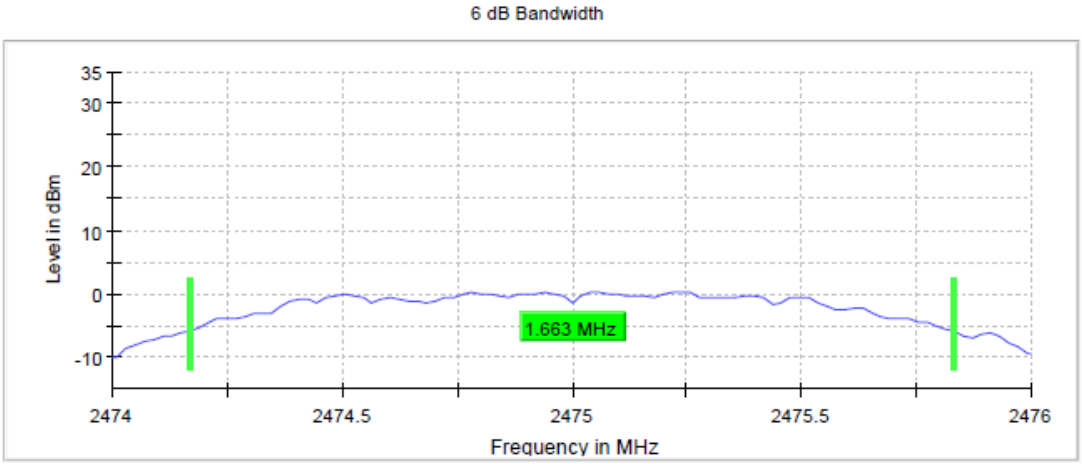
Minimum Emission Bandwidth 6 dB (2475 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 2%

6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2475.000000	1.663366	0.500000	---	2474.168317	2475.831683	0.3	PASS



Bandwidth

Test Personnel:	Kouma Sinn KPS	Test Date:	09/14/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 15.247 RSS-247	Limit Applied:	See Report Section 7.3
Input Voltage:	120VAC 60Hz	Ambient Temperature:	22 ºC
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Relative Humidity:	56 %
		Atmospheric Pressure:	1016 mbars

Deviations, Additions, or Exclusions: None

8 Maximum Power Spectral Density

8.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, RSS-102, and ANSI C63.10.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	12/07/2017	12/07/2018
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/07/2017	11/07/2018
DUT 1'	Coaxial Cable	UTIFLEX MICRO-COAX	UFA210A-1-0787-300300	101709	02/01/2018	02/01/2019
--	20 dB Attenuator	Pasternack	PE7004-20	None	Verified Before Used	Verified Before Used

Software Utilized:

Name	Manufacturer	Version
R&S EMC32/AMS32/WMS32	Rohde & Schwarz	10.30.00

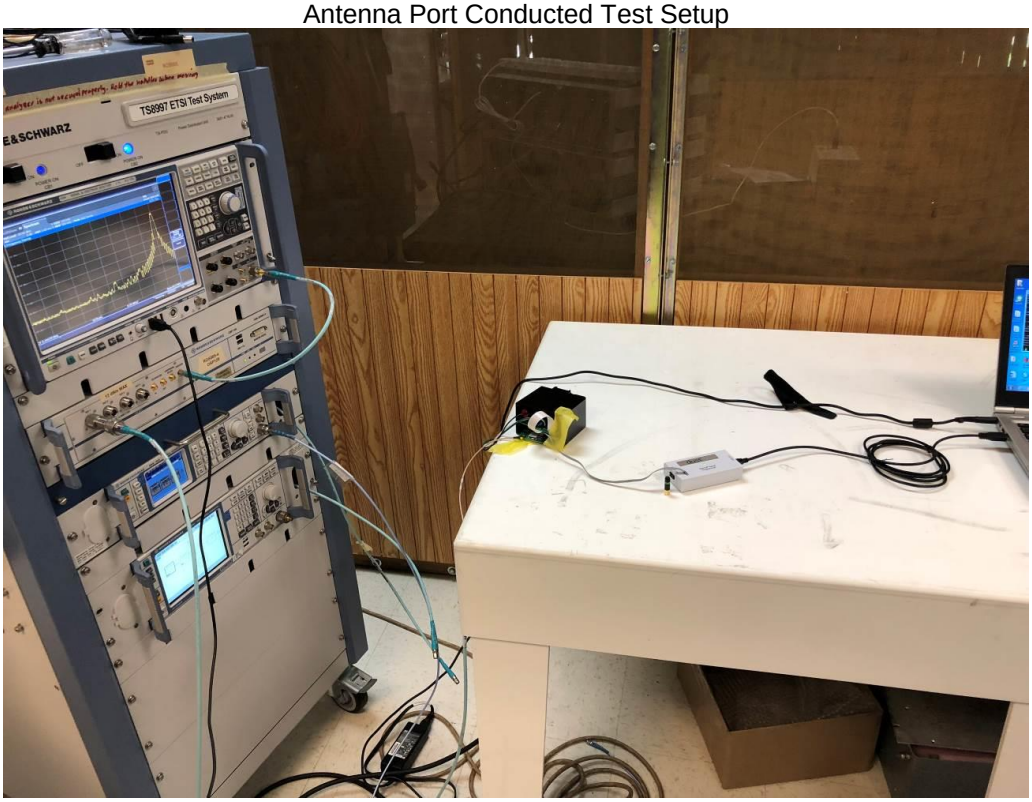
8.3 Results:

The sample tested was found to Comply.

§15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.4 Setup Photograph:

Antenna Port Conducted Test Setup



8.5 Plots/Data:

FCC Part 47 §15.247 2400-2483.5 MHz 2016

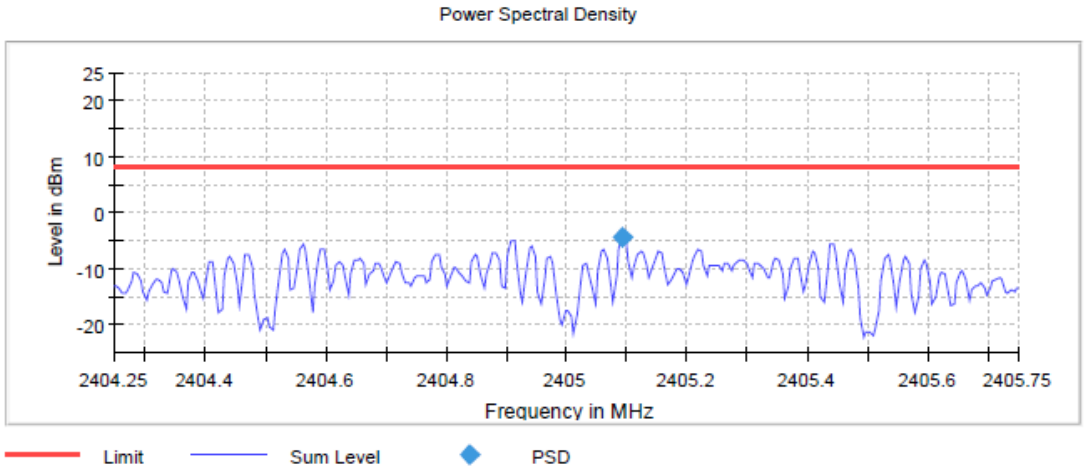
Peak Power Spectral Density (2405 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.1 dB

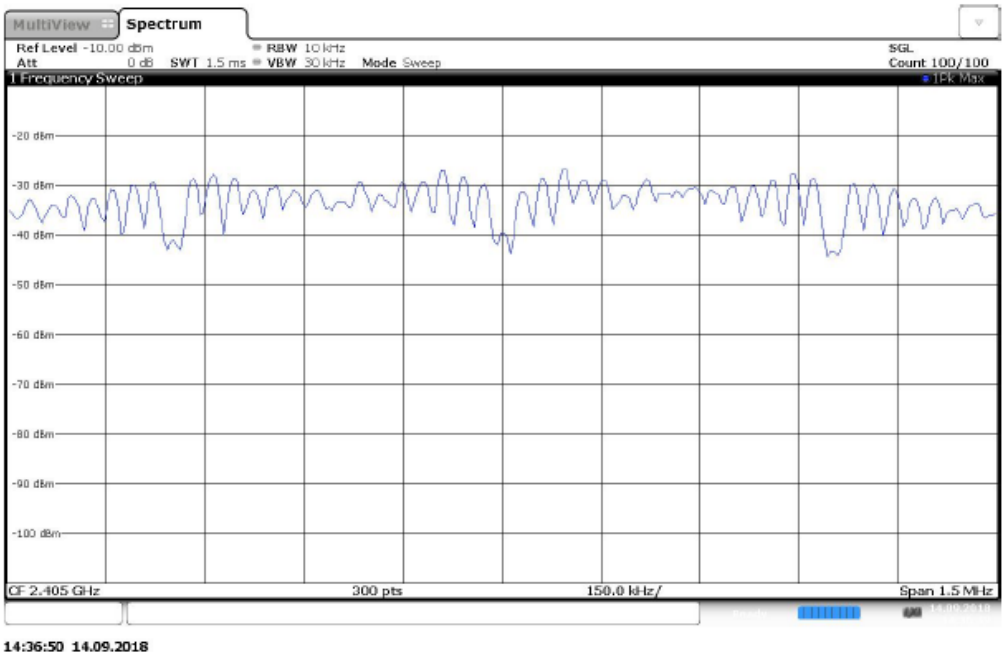
Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2405.000000	2405.092500	-4.510	8.0	PASS



PSD Connector 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

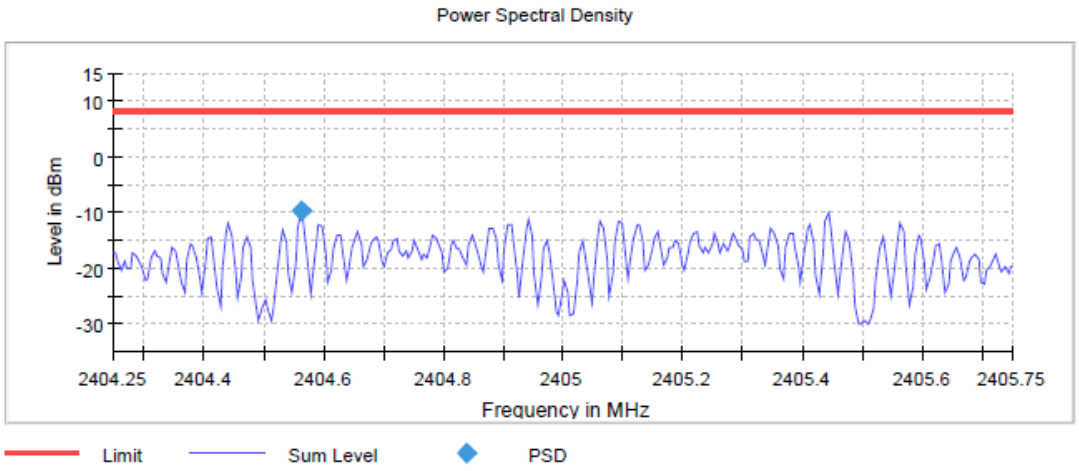
Power Spectral Density (2405 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.1 dB

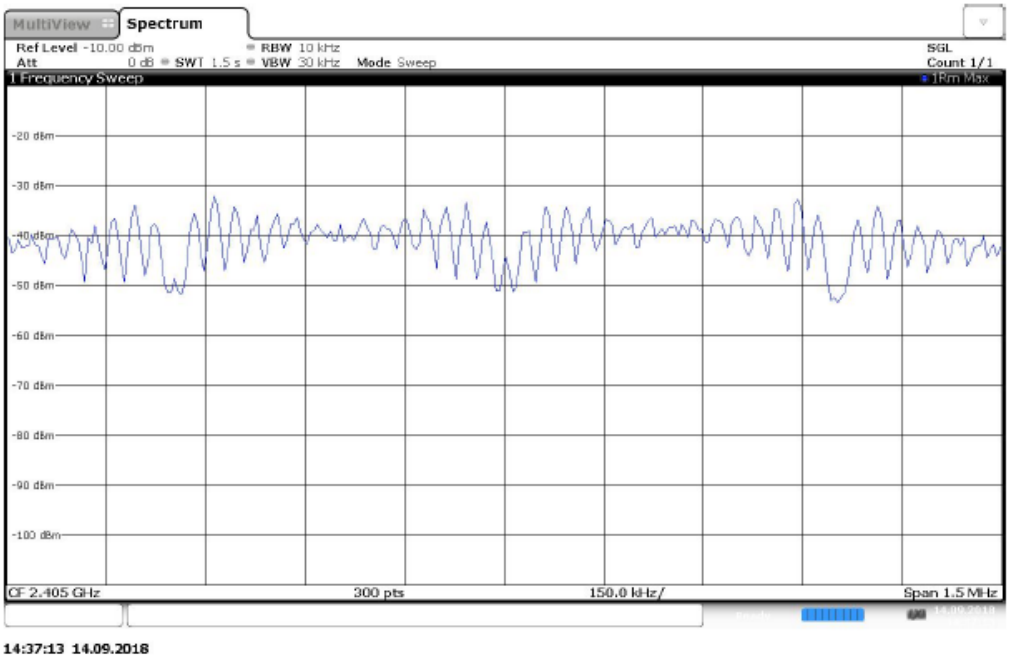
Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2405.000000	2404.562500	-9.787	8.0	PASS



PSD Connector 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

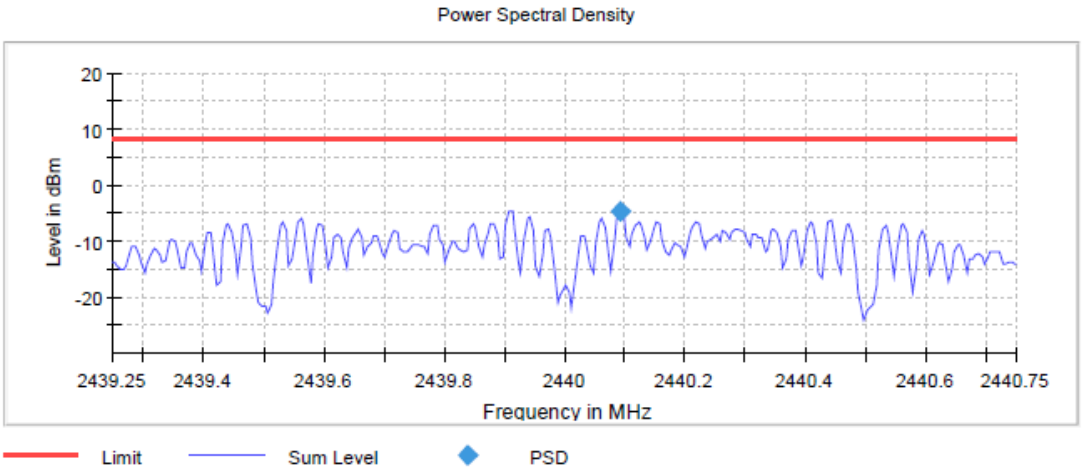
Peak Power Spectral Density (2440 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.1 dB

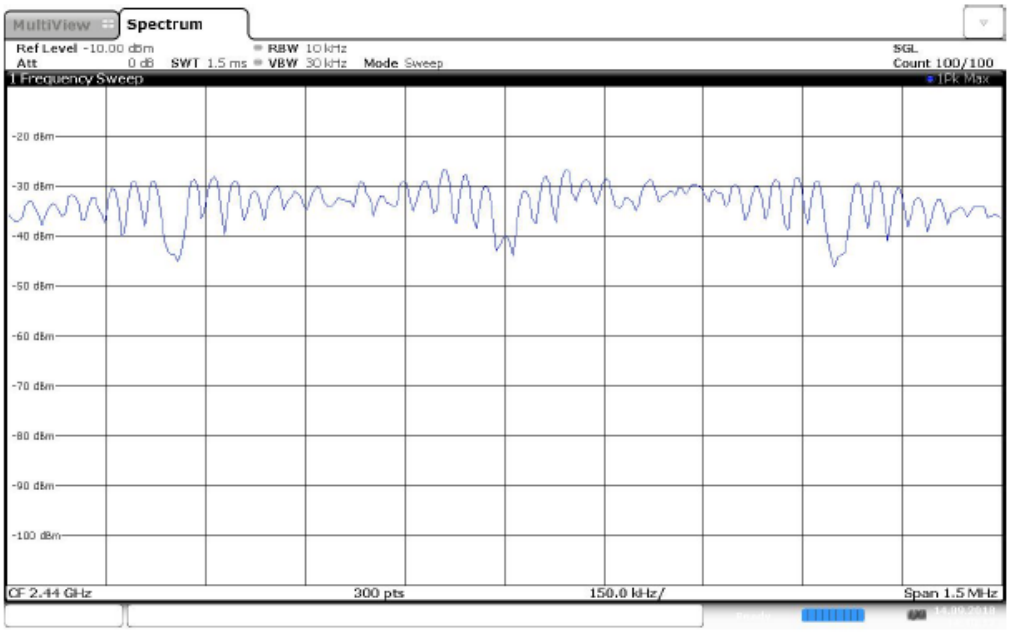
Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2440.000000	2440.092500	-4.556	8.0	PASS



PSD Connector 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

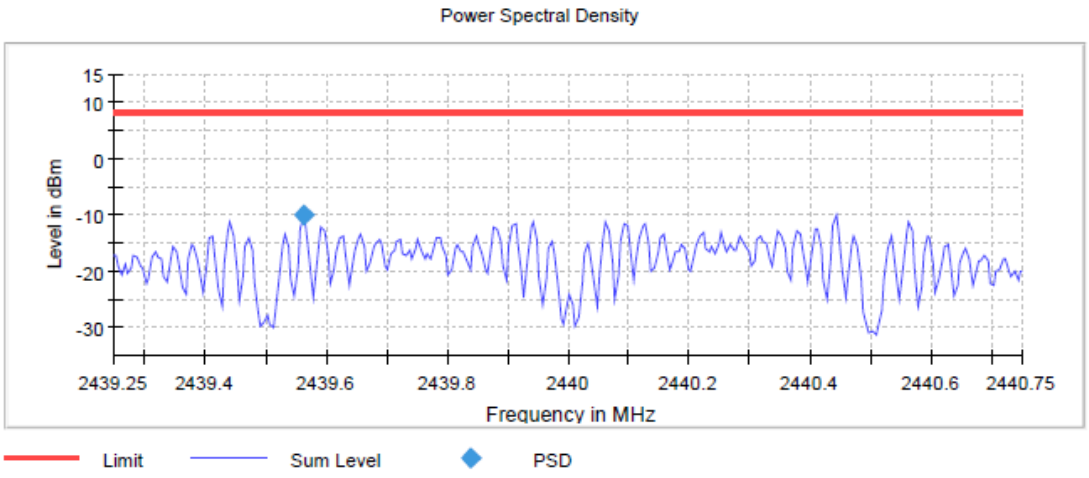
Power Spectral Density (2440 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.1 dB

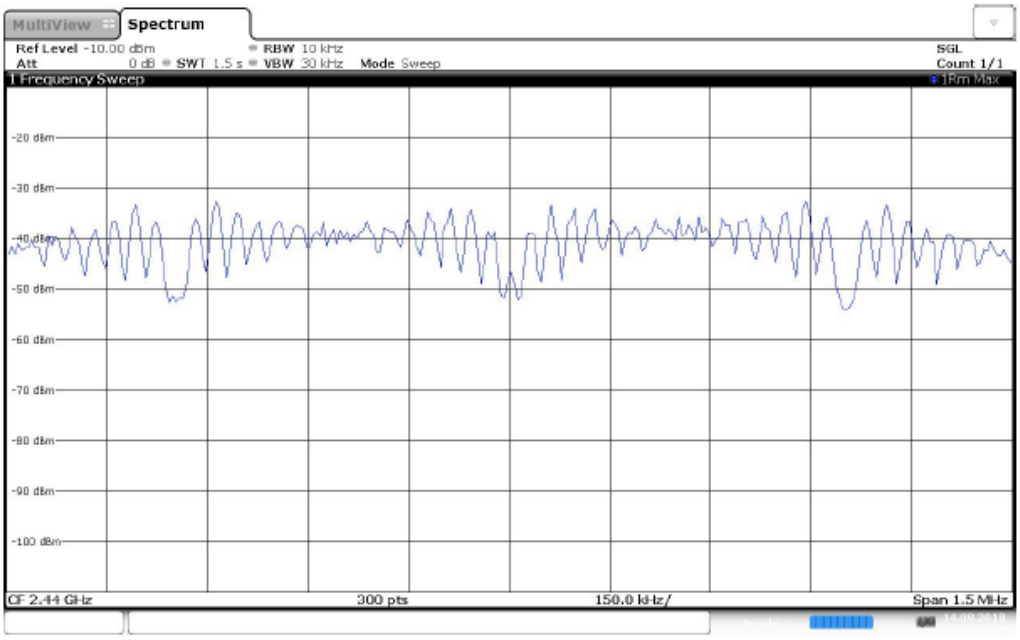
Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2440.000000	2439.562500	-10.041	8.0	PASS



PSD Connector 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

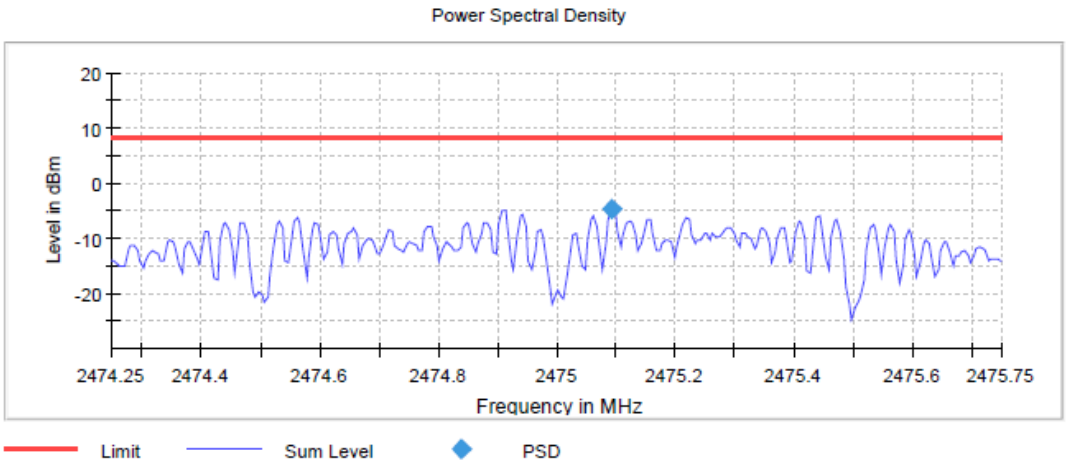
Peak Power Spectral Density (2475 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.1 dB

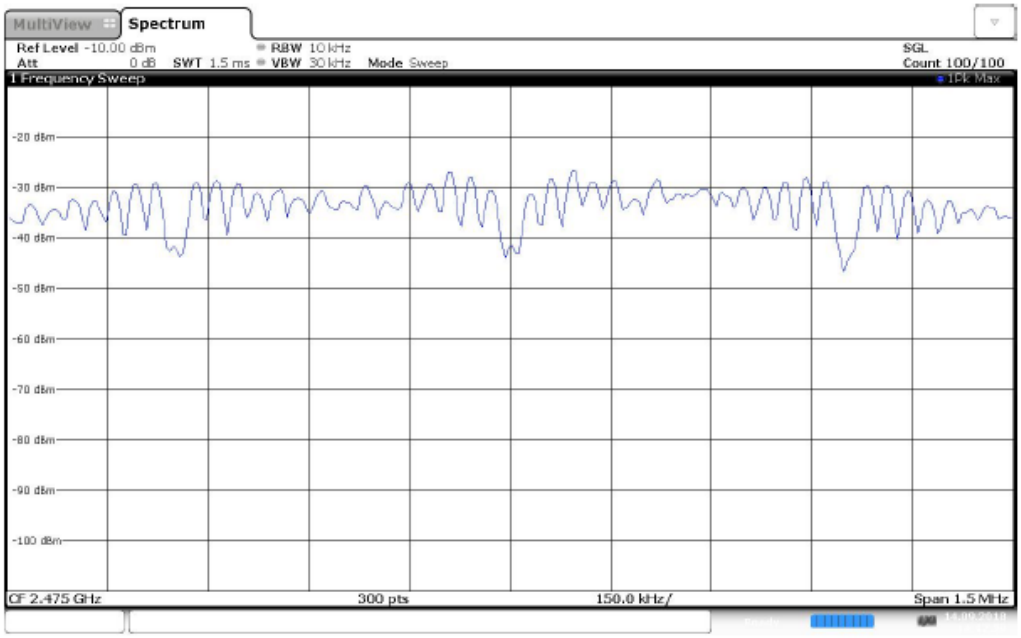
Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2475.000000	2475.092500	-4.563	8.0	PASS



PSD Connector 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

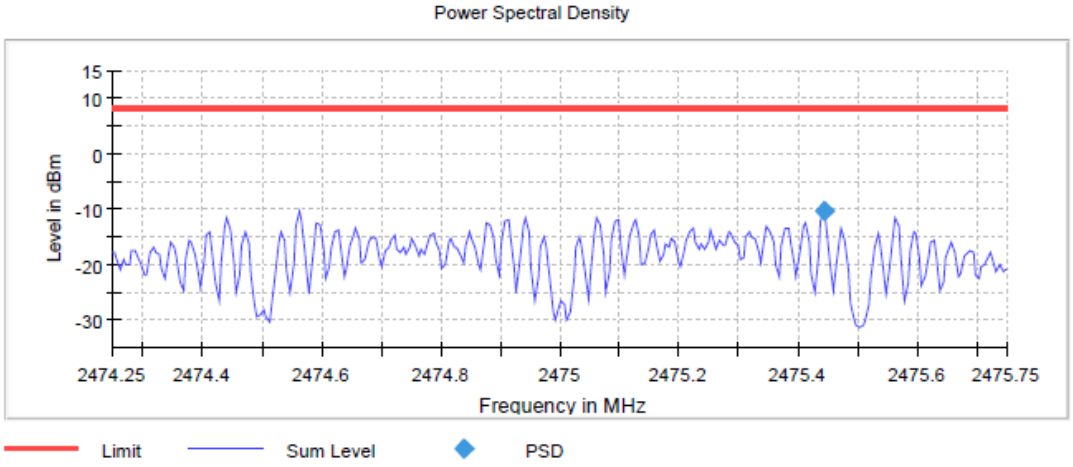
Power Spectral Density (2475 MHz; 8.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

Measurement uncertainty calculated in accordance with ETSI TR 100 028-1.
Expanded Uncertainty (K=2) < 1.1 dB

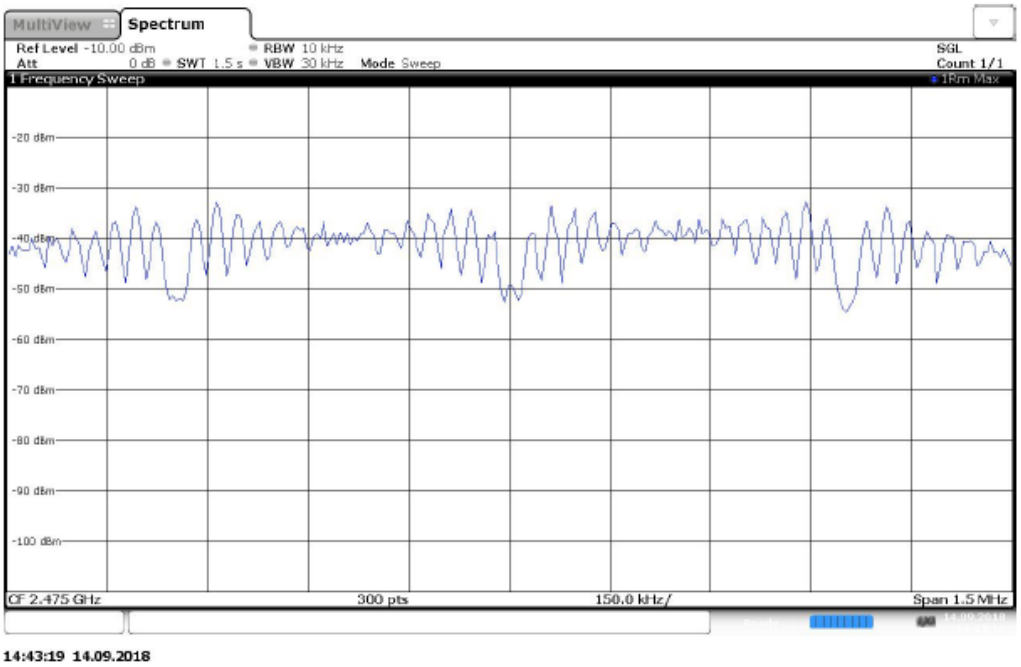
Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2475.000000	2475.442500	-10.230	8.0	PASS



PSD Connector 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016



Test Personnel:	Kouma Sinn KPS	Test Date:	09/14/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 15.247 RSS-247	Limit Applied:	See Report Section 8.3
Input Voltage:	120VAC 60Hz	Ambient Temperature:	22 ºC
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Relative Humidity:	56 %
		Atmospheric Pressure:	1016 mbars

Deviations, Additions, or Exclusions: None

9 Band Edge Compliance

9.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.247 RSS 247, ANSI C 63.10, and ANSI C 63.4.

TEST SITE: EMC Lab & 10m ALSE

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	12/07/2017	12/07/2018
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/07/2017	11/07/2018
DUT 1'	Coaxial Cable	UTIFLEX MICRO-COAX	UFA210A-1-0787-300300	101709	02/01/2018	02/01/2019
--	20 dB Attenuator	Pasternack	PE7004-20	None	Verified Before Used	Verified Before Used

Radiated measurements

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
BAR1'	Digital 4 Line Barometer	Mannix	0ABA116	BAR1	04/30/2018	04/30/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/22/2018	03/22/2019
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2018	07/25/2019
ETS005'	1-18GHz horn antenna	ETS-Lindgren	3117	00218279	05/14/2018	05/14/2019

Software Utilized:

Name	Manufacturer	Version
R&S EMC32/AMS32/WMS32	Rohde & Schwarz	10.30.00
EMI Boxborough.xls	Intertek	08/27/2010

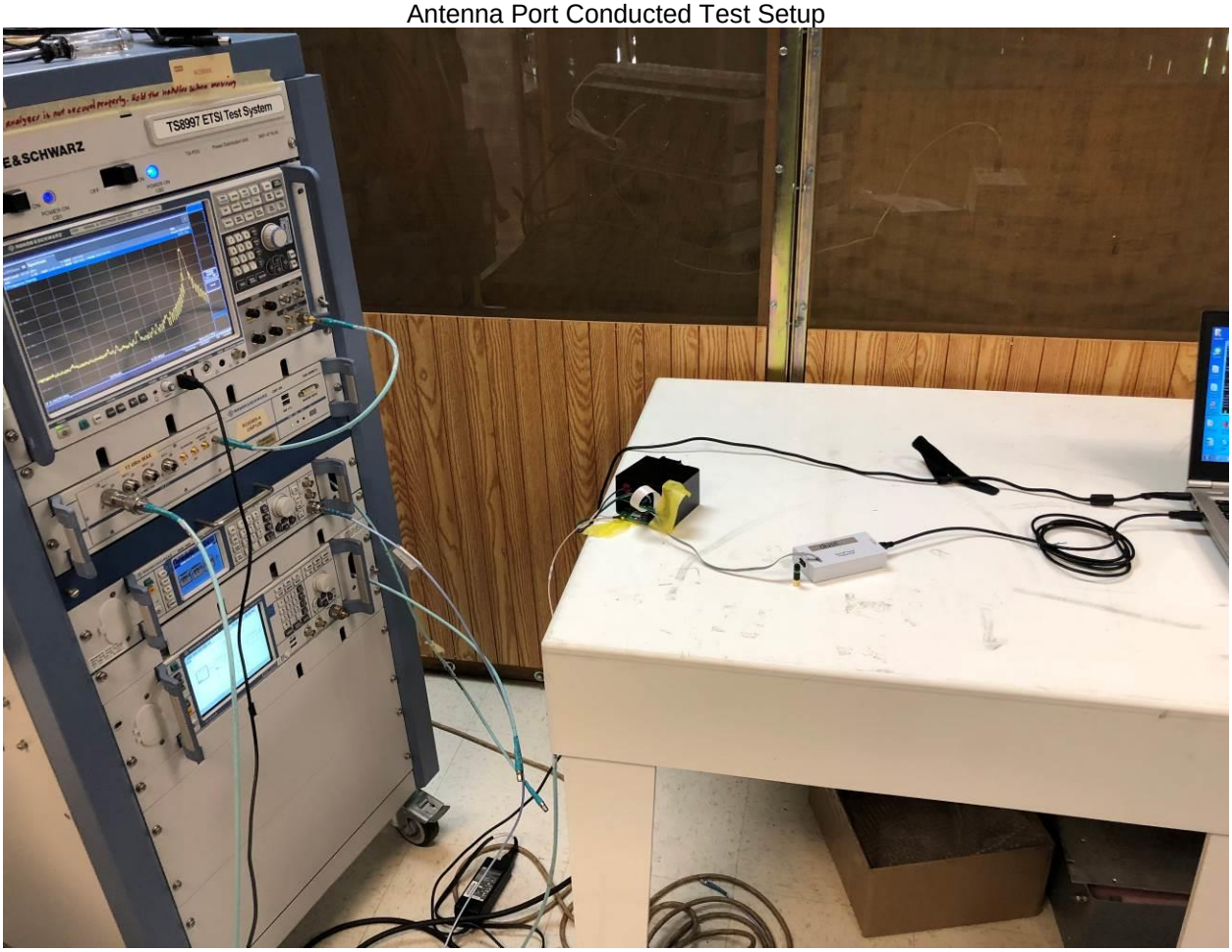
9.3 Results:

The sample tested was found to Comply.

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

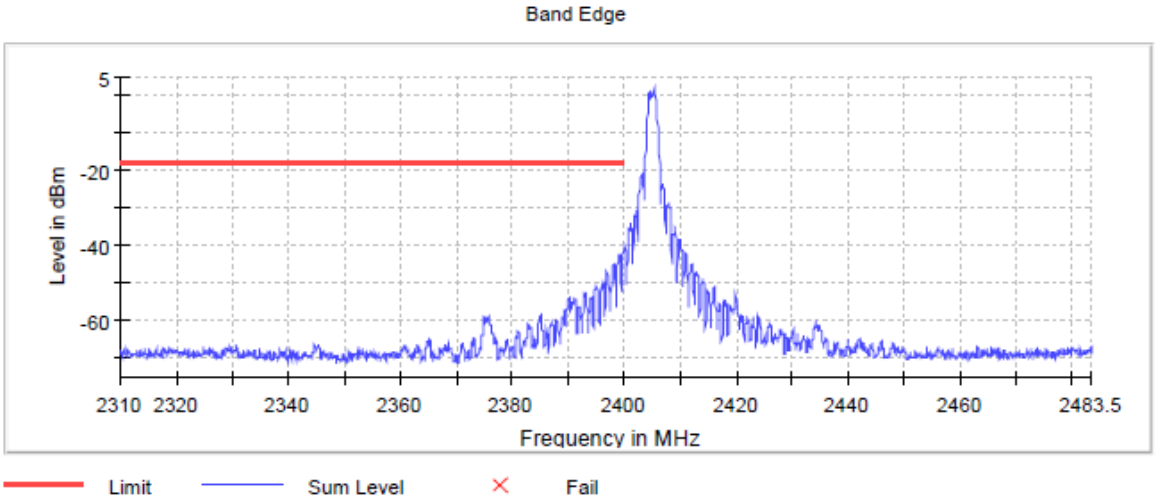
9.4 Setup Photograph:

Antenna Port Conducted Test Setup



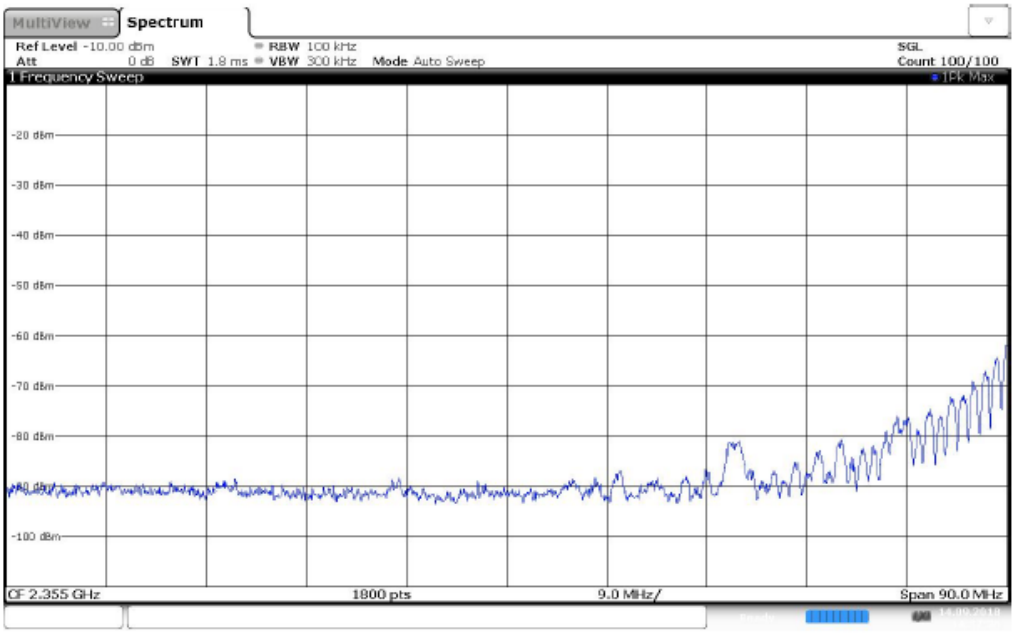
Radiated Setup

9.5 Plots/Data:



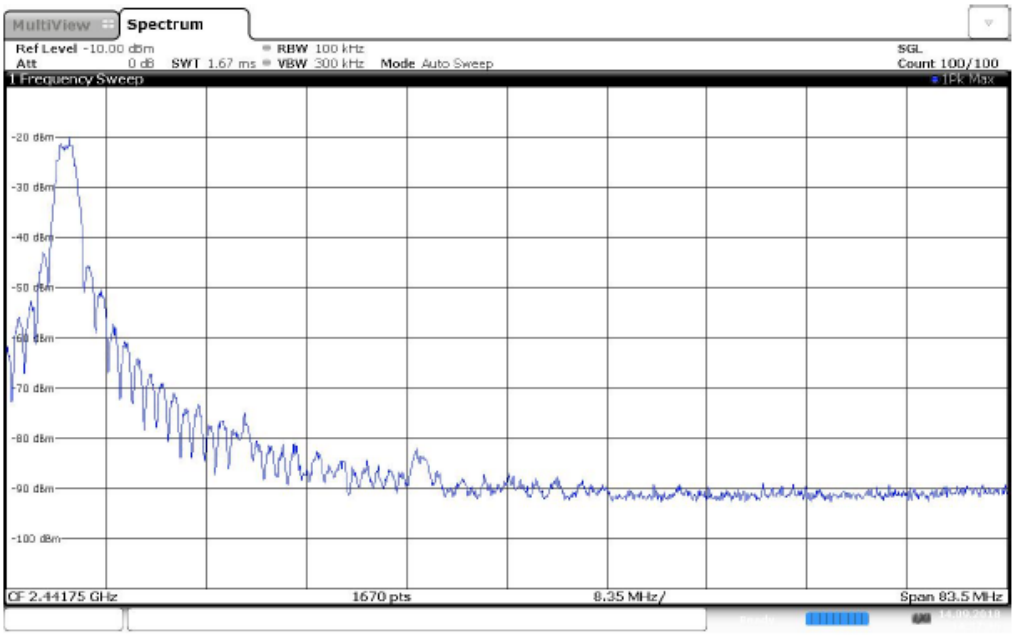
FCC Part 47 §15.247 2400-2483.5 MHz 2016

Band Edge Connector 1_0

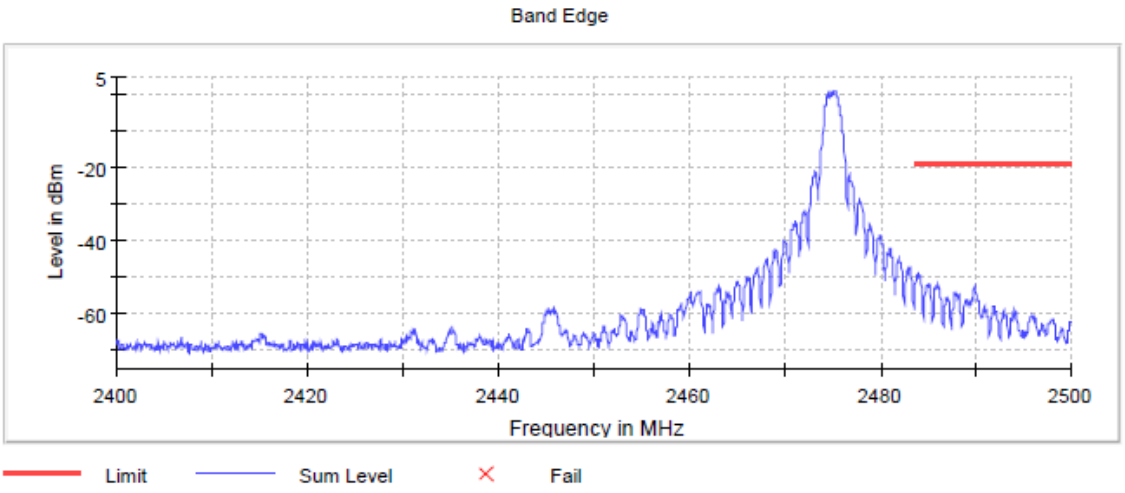


14:37:29 14.09.2018

Band Edge Connector 1_1

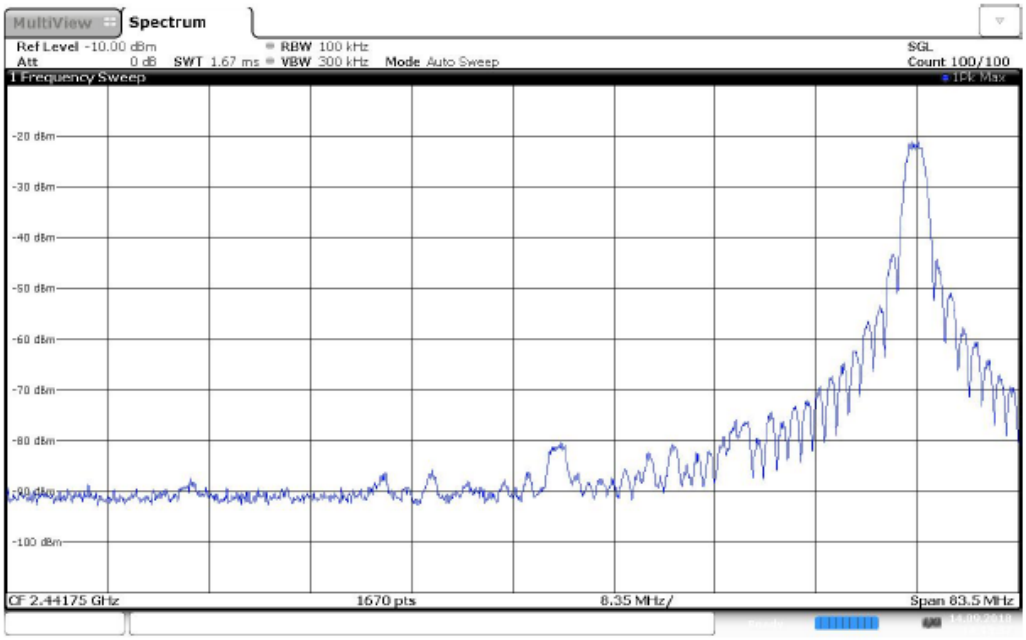


14:37:47 14.09.2018


Band Edge
5
-20
-40
-60
Level in dBm
2400
2420
2440
2460
2480
2500
Frequency in MHz
Limit
Sum Level
Fail

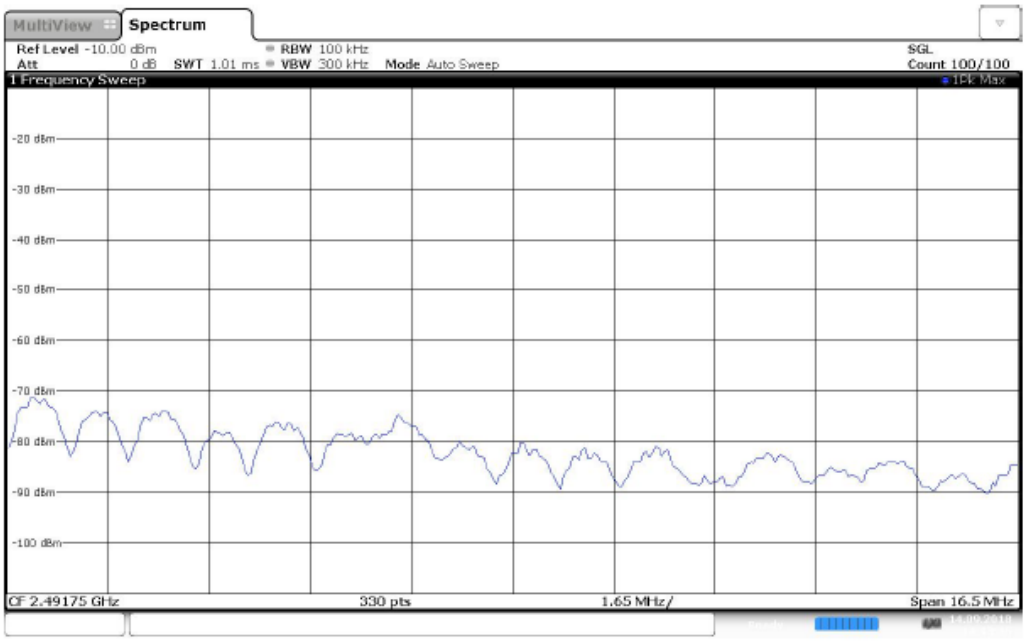
FCC Part 47 §15.247 2400-2483.5 MHz 2016

Band Edge Connector 1_0



14:43:38 14.09.2018

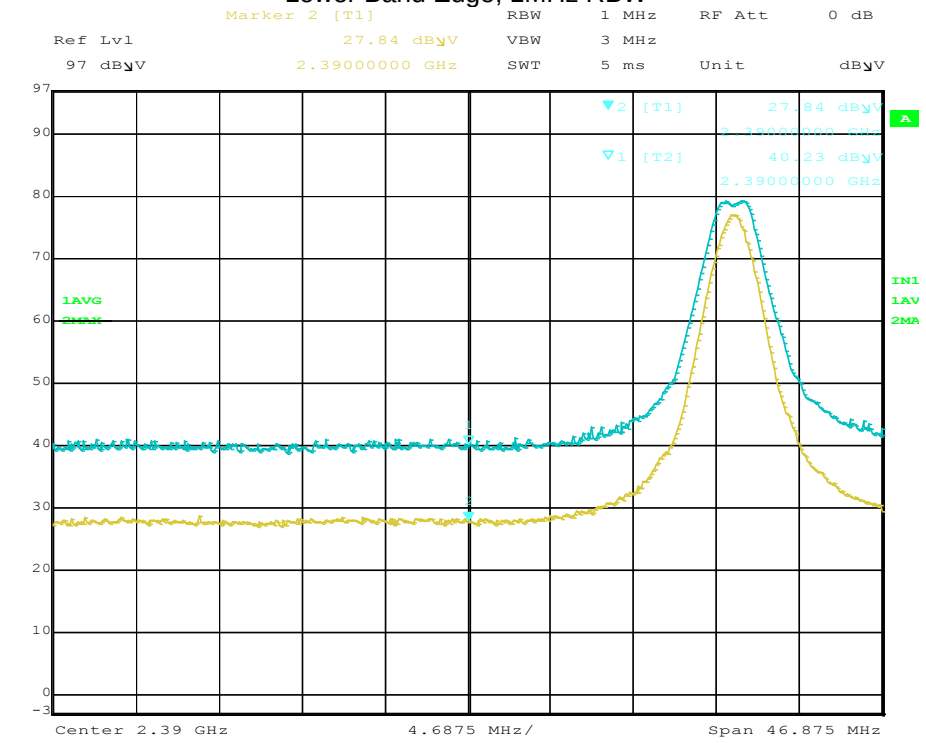
Band Edge Connector 1_1



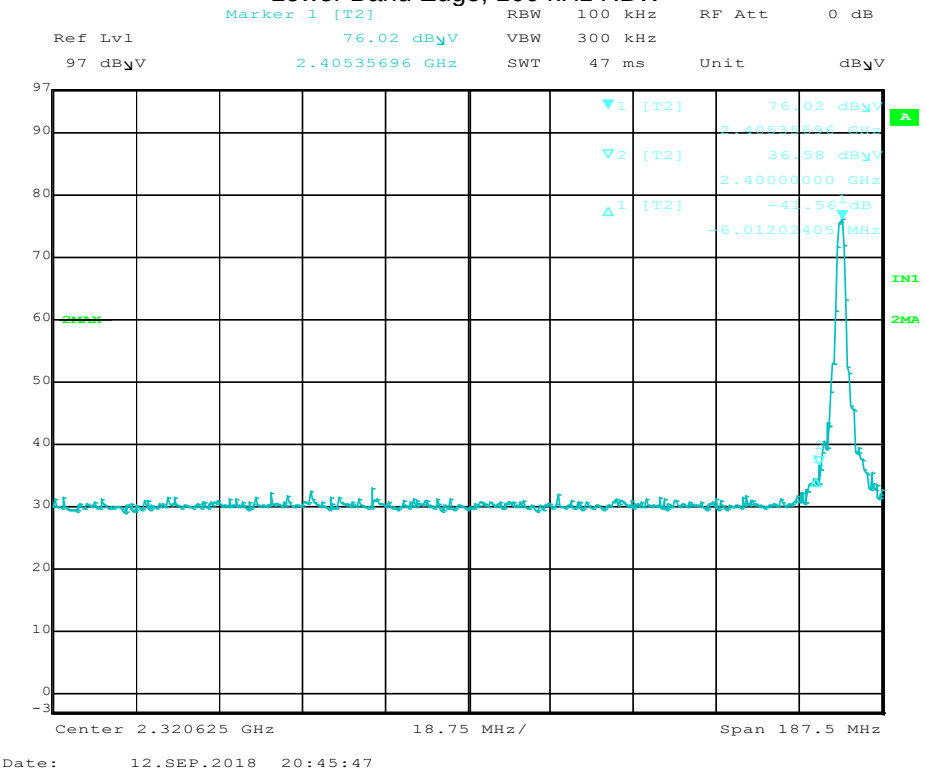
14:43:47 14.09.2018

Radiated measurements

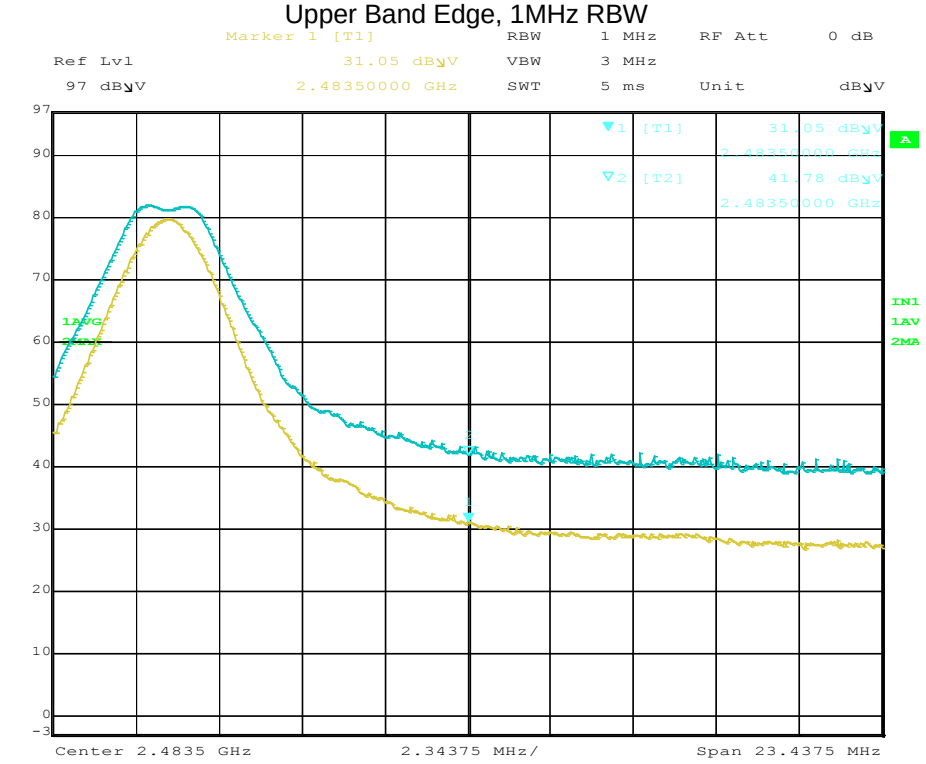
Lower Band Edge, 1MHz RBW



Lower Band Edge, 100 kHz RBW

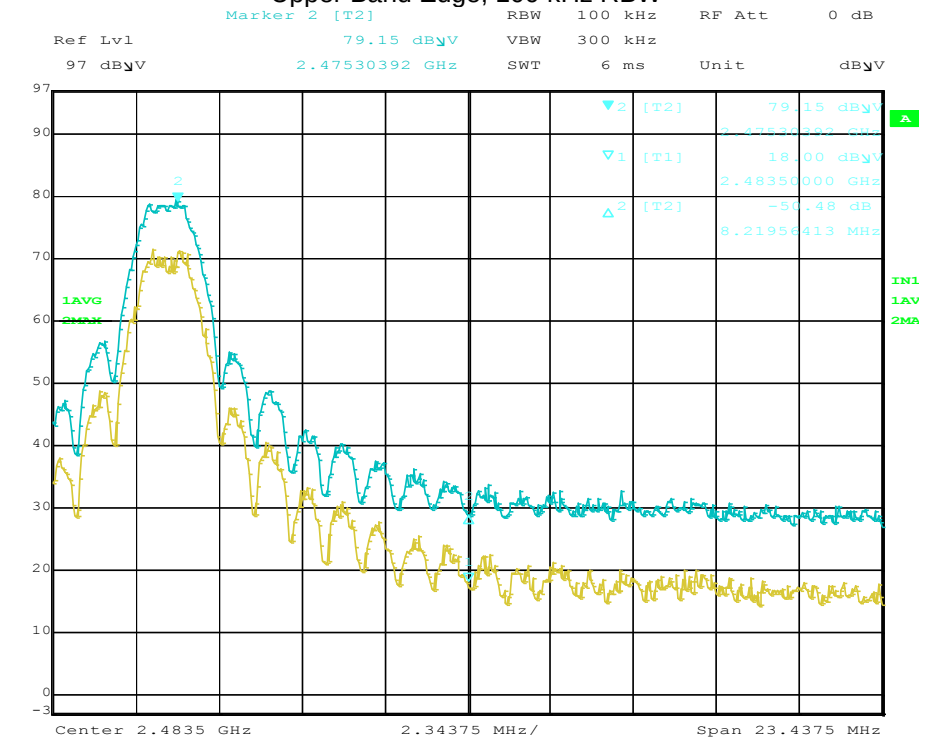


Upper Band Edge, 1MHz RBW



Date: 12.SEP.2018 20:17:45

Upper Band Edge, 100 kHz RBW



Date: 12.SEP.2018 20:23:43

Radiated Emissions

Company: Cooper Crouse Hinds
Model #: ECH-LTC5800-01
Serial #: BOX1809120826-003
Engineers: Vathana Ven
Project #: G103658032
Standard: FCC Part 15 Subpart B Class B
Receiver: R&S ESI (145-128) 03-22-2019
PreAmp: 145014__6-14-2019.txt
PreAmp Used? (Y or N): Y
Date(s): 09/12/18
Location: 10M
Limit Distance (m): 3
Test Distance (m): 3
Voltage/Frequency: 120VAC 60hz
Antenna & Cables: HF
Antenna: ETS005_Horizontal_5-14-2019.txt
Cable(s): 3M track B_10k-18GHz.txt
Barometer: BAR1
Temp/Humidity/Pressure: 21 deg C
Bands: N, LF, HF, SHF
ETS005_Horizontal_5-14-2019.txt
NONE.
Filter: NONE
50%
1016 mB
Frequency Range: See below

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC
Lower Band Edge Compliance (worst-case orientation)													
PK	V	2390.000	39.50	32.10	5.09	33.89	0.00	42.81	74.00	-31.19	1/3 MHz	RB	RB
AVG	V	2390.000	27.90	32.10	5.09	33.89	0.00	31.21	54.00	-22.79	1/3 MHz	RB	RB
Upper Band Edge Compliance (worst-case orientation)													
PK	H	2483.500	41.78	32.27	5.18	33.90	0.00	45.33	74.00	-28.67	1/3 MHz	RB	
AVG	H	2483.500	31.00	32.27	5.18	33.90	0.00	34.55	54.00	-19.45	1/3 MHz	RB	

Test Personnel:	Vathana Ven VSV	Test Date:	09/12/2018
	Kouma Sinn KPS		09/14/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247, RSS-102	Limit Applied:	See report section 9.3
Input Voltage:	120VAC 60Hz		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	21, 22 ºC
		Relative Humidity:	50, 56 %
		Atmospheric Pressure:	1016, 1016 mbars

Deviations, Additions, or Exclusions: None

10 Transmitter spurious emissions

10.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.247, FCC Part 15 Subpart B, RSS 247 ICES 003, ANSI C 63.10, and ANSI C 63.4.

TEST SITE: EMC Lab & 10m ALSE

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

10.2 Test Equipment Used:

Conducted measurements

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	12/07/2017	12/07/2018
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/07/2017	11/07/2018
DUT 1'	Coaxial Cable	UTIFLEX MICRO-COAX	UFA210A-1-0787-300300	101709	02/01/2018	02/01/2019
--	20 dB Attenuator	Pasternack	PE7004-20	None	Verified Before Used	Verified Before Used

Radiated measurements

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
BAR1'	Digital 4 Line Barometer	Mannix	0ABA116	BAR1	04/30/2018	04/30/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/22/2018	03/22/2019
ETS005'	1-18GHz horn antenna	ETS-Lindgren	3117	00218279	05/14/2018	05/14/2019
EMC04'	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	09/21/2017	09/21/2018
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/25/2018	07/25/2019
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2018	07/25/2019
PRE11'	50dB gain pre-amp	Keith H	PRE11	PRE11	12/02/2017	12/02/2018
PRE8'	PREAMPLFIER 1- 40 GHz	MITEQ	NSP4000-NF	507145	10/02/2017	10/02/2018
REA008'	band reject filter 2.4GHz	Reactel, Inc	12RX7-2441.75-x140 S	17-01	07/13/2018	07/13/2019
145108'	EMI Test Receiver (20Hz - 40GHz)	Rohde & Schwarz	ESIB40	100209	06/01/2018	06/01/2019
MEG002'	Cable,SMA-SMA,9KHz-40GHz, (Cable Kit 6)	Megaphase	TM40-K1K1-197	59006401001	09/13/2018	09/13/2019
CBLSHF204'	Cable, SMA - SMA, 9kHz -40GHz, (Cable Kit 5)	Huber + Suhner	Sucoflex 102EA	234714001	10/30/2017	10/30/2018
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/16/2018	05/16/2019

Software Utilized:

Name	Manufacturer	Version
R&S EMC32/AMS32/WMS32	Rohde & Schwarz	10.30.00
BAT-EMC	Nexio	3.17.0.3

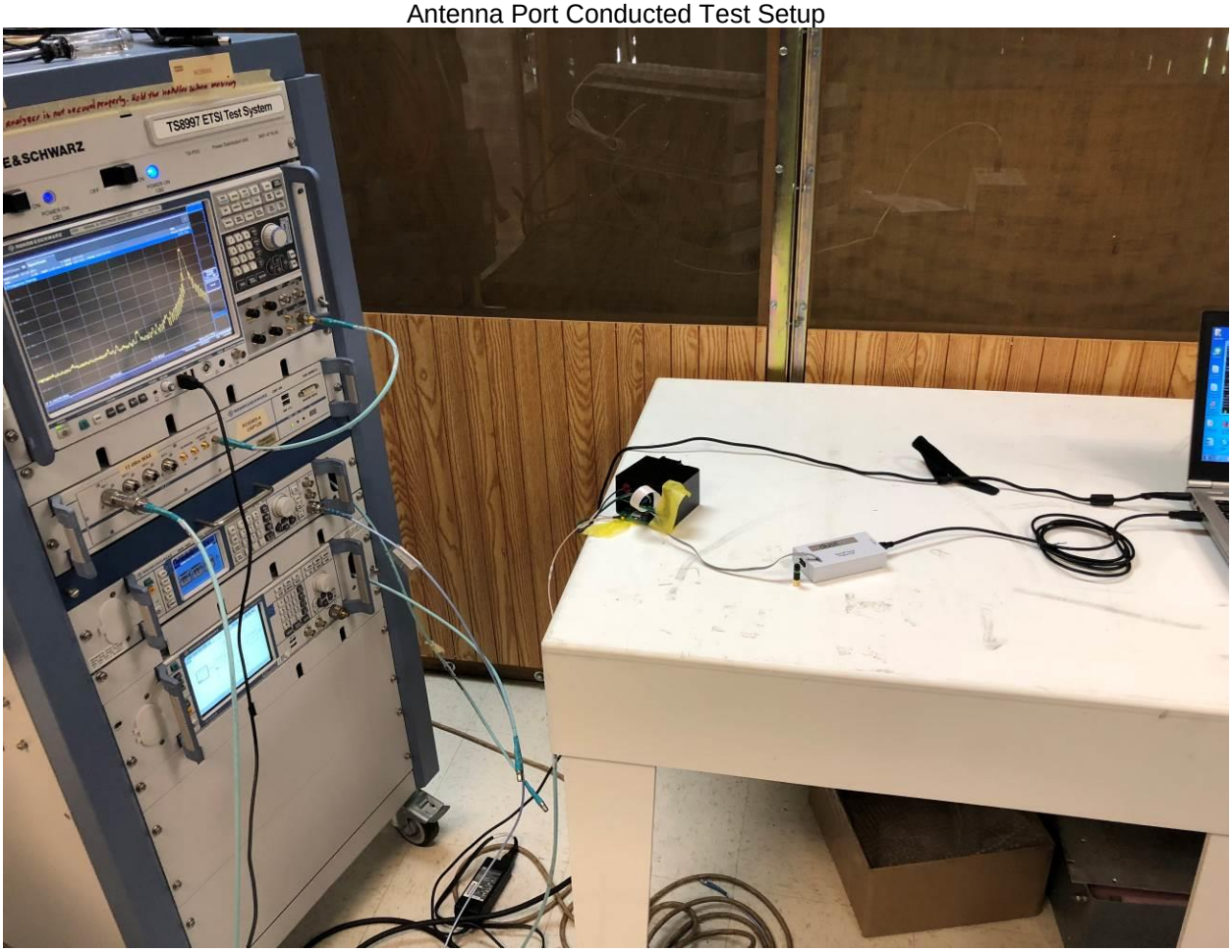
10.3 Results:

The sample tested was found to Comply.

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

10.4 Setup Photographs:

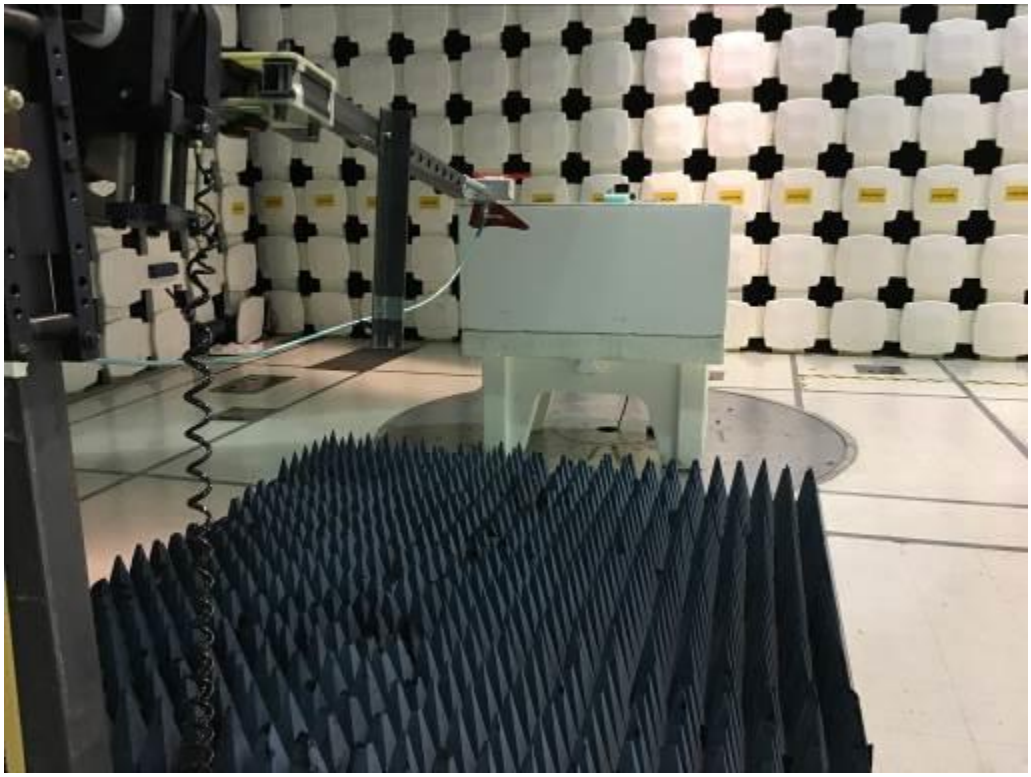
Antenna Port Conducted Test Setup



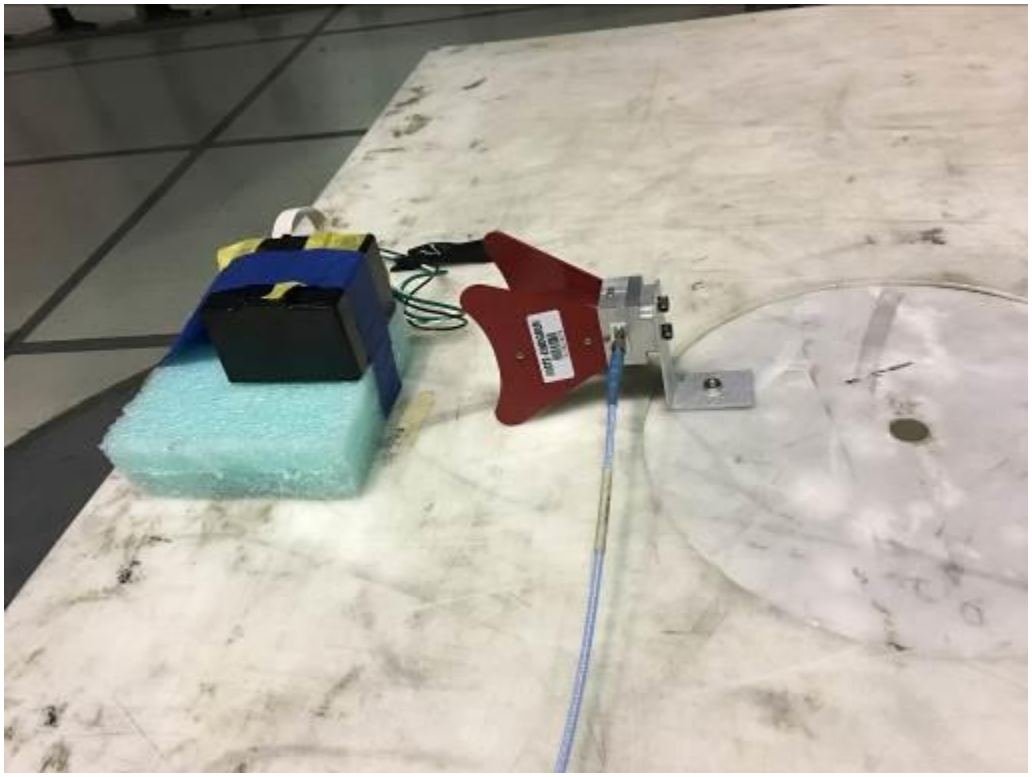
Radiated Setup

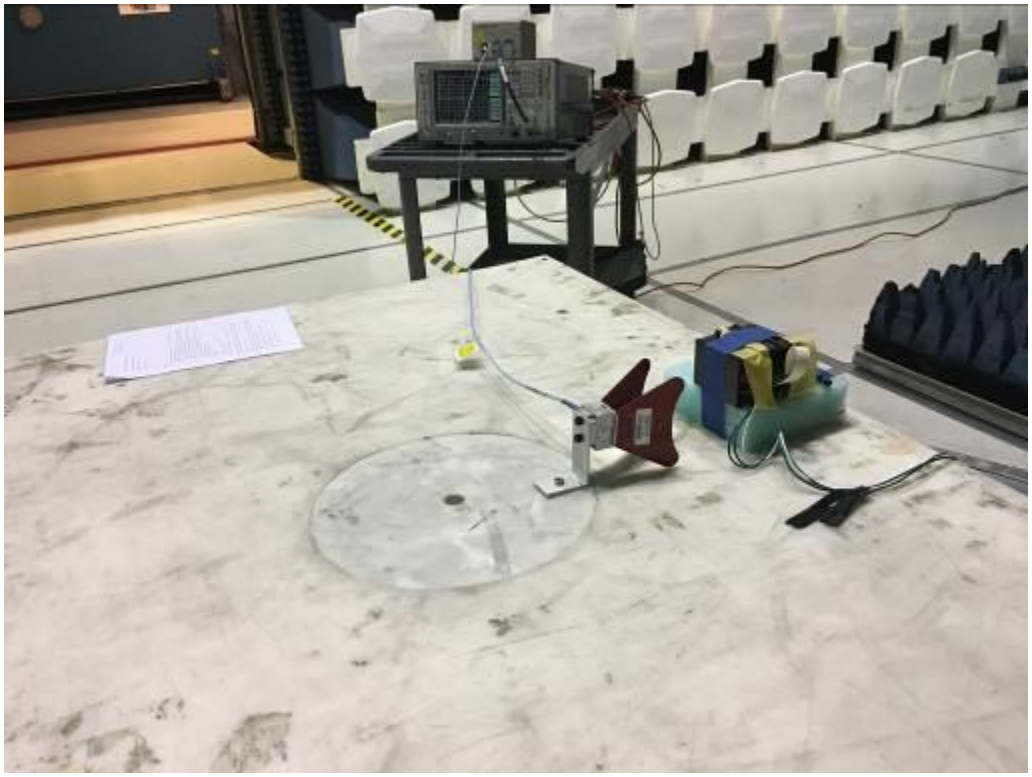
30-1000 MHz, USB power

1-18 GHz



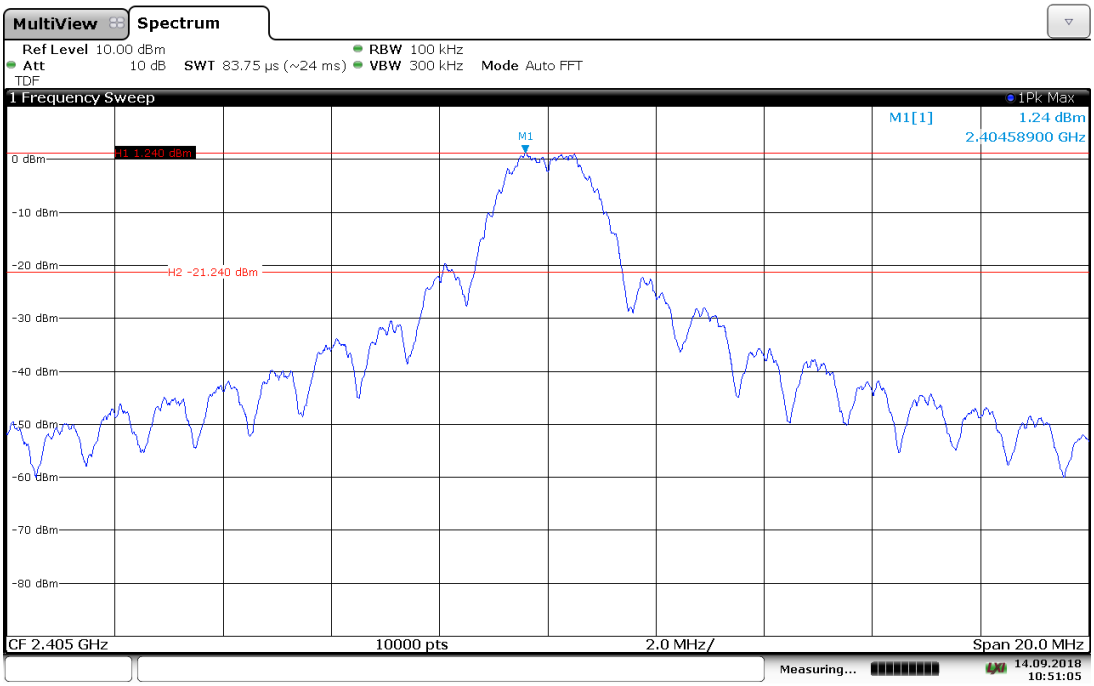
18-25 GHz





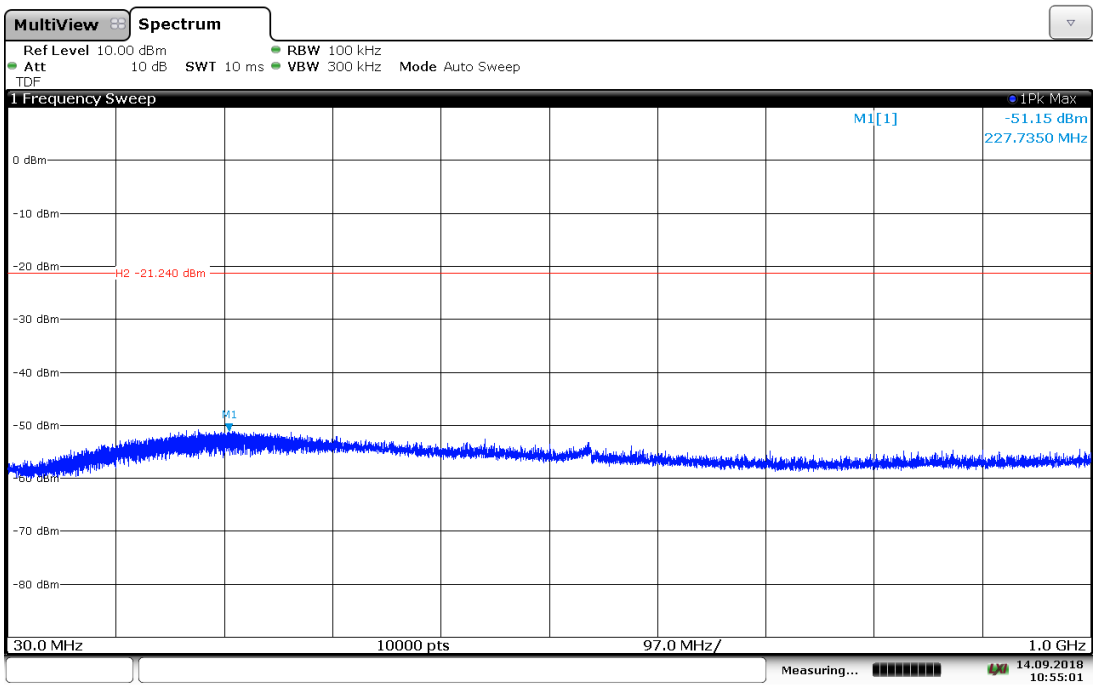
10.5 Plots/Data:

Limit: 20 dB down from the carrier (low channel)



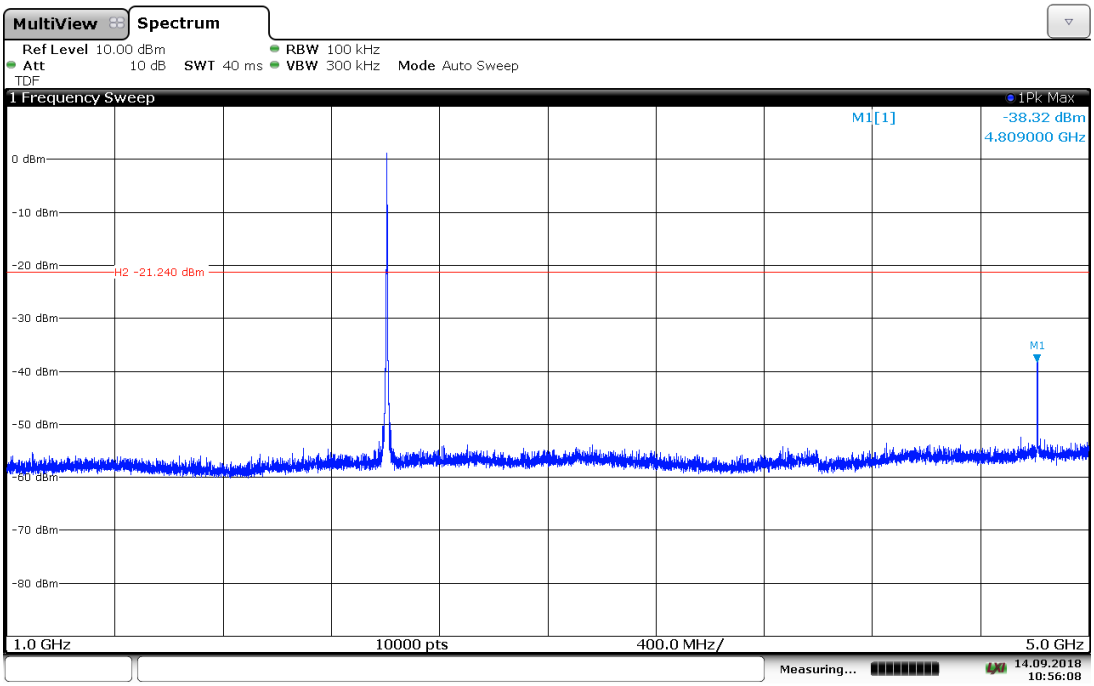
10:51:06 14.09.2018

Low Channel Antenna Port Conducted Spurious Emissions, 30 MHz-1000 MHz



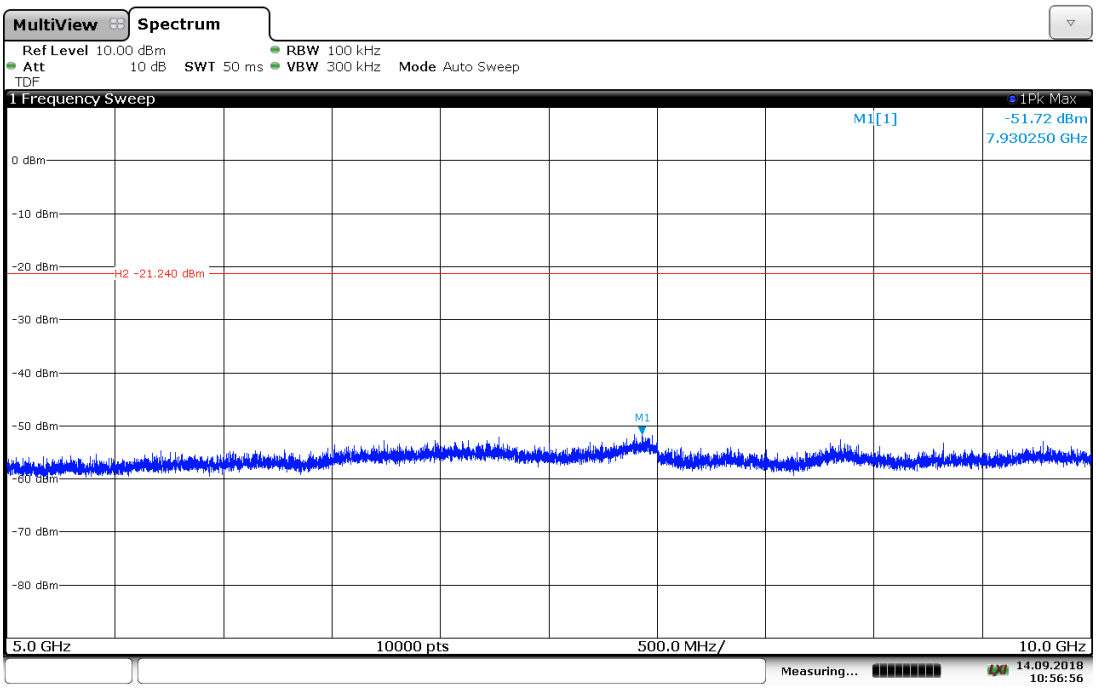
10:55:02 14.09.2018

Low Channel Antenna Port Conducted Spurious Emissions, 1-5 GHz



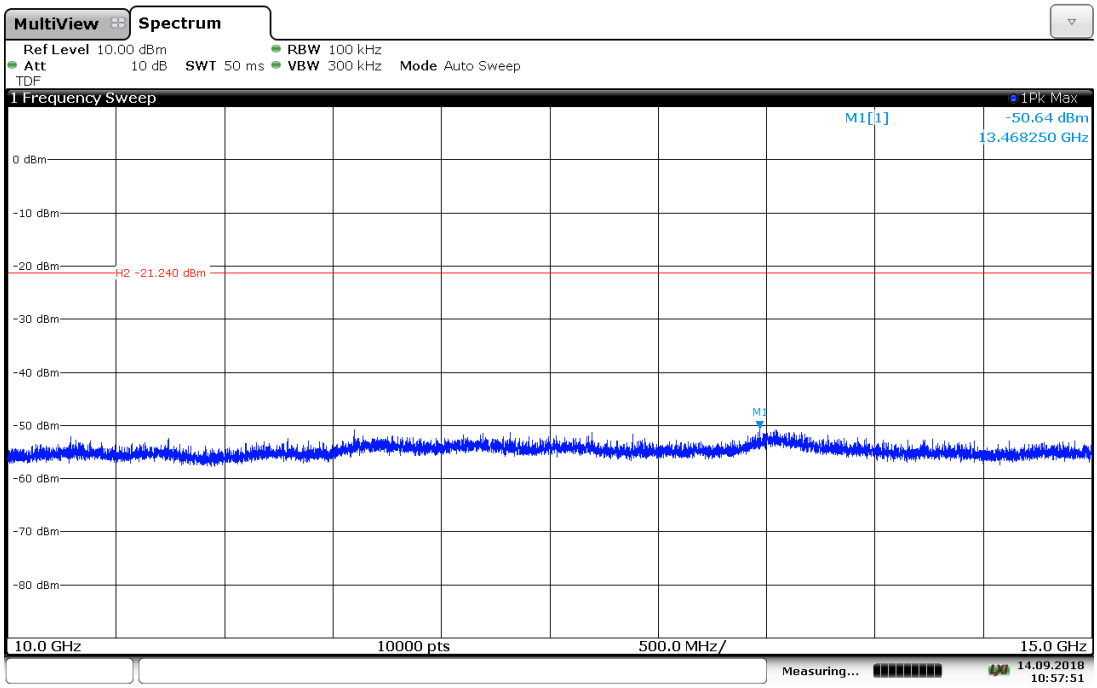
10:56:08 14.09.2018

Low Channel Antenna Port Conducted Spurious Emissions, 5-10 GHz



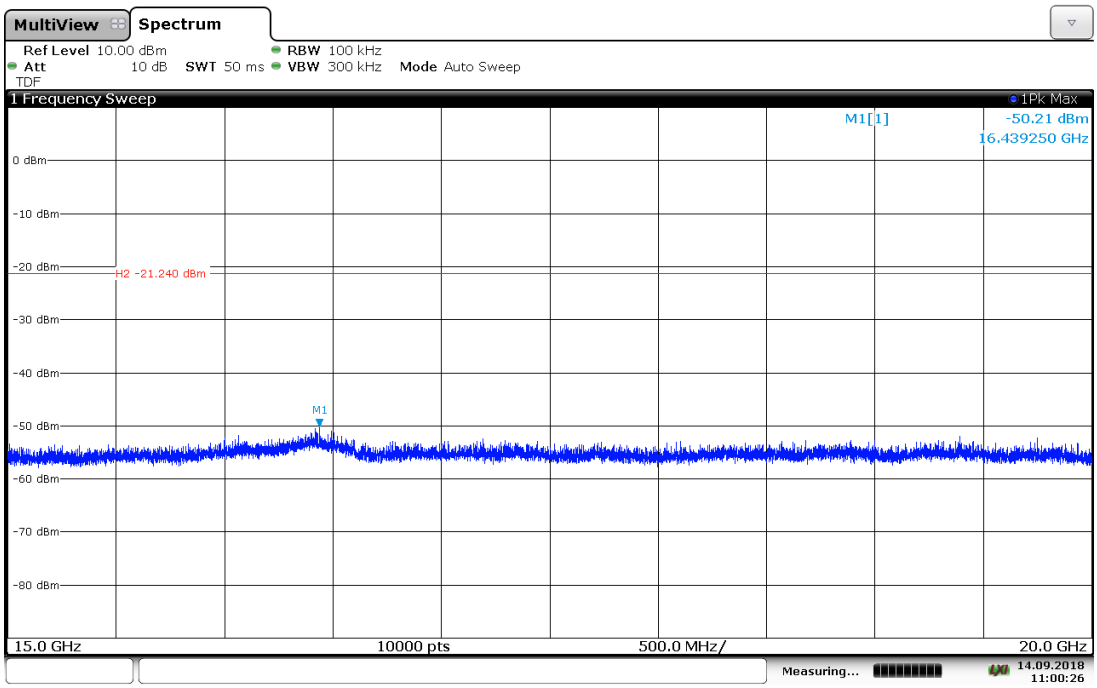
10:56:57 14.09.2018

Low Channel Antenna Port Conducted Spurious Emissions, 10-15 GHz



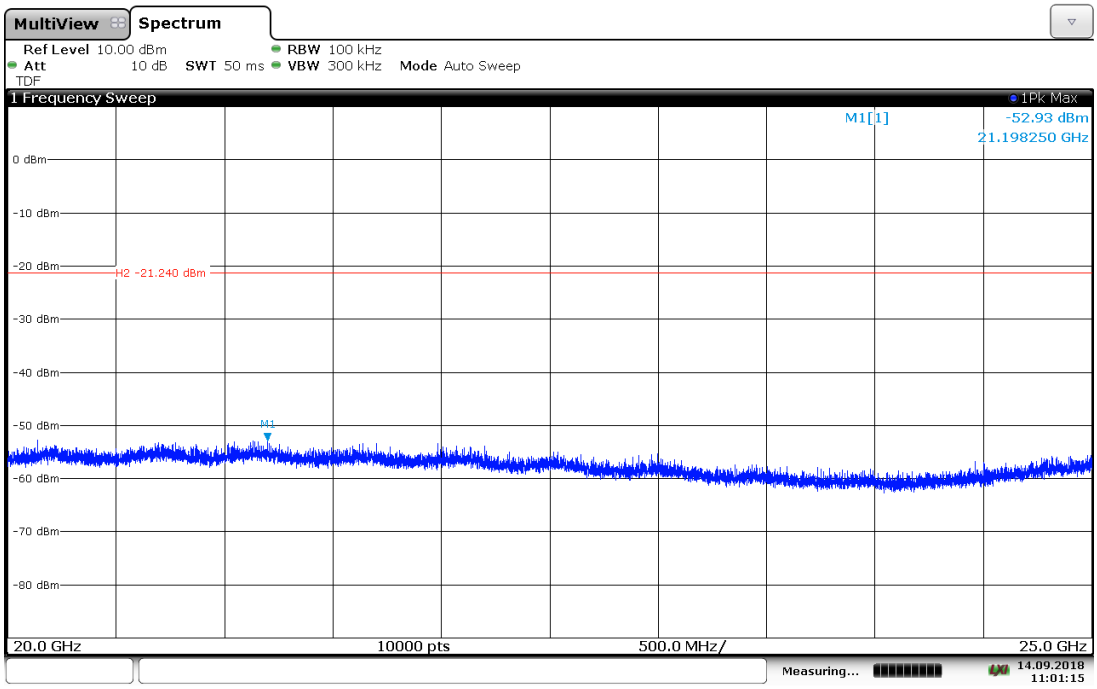
10:57:51 14.09.2018

Low Channel Antenna Port Conducted Spurious Emissions, 15-20 GHz



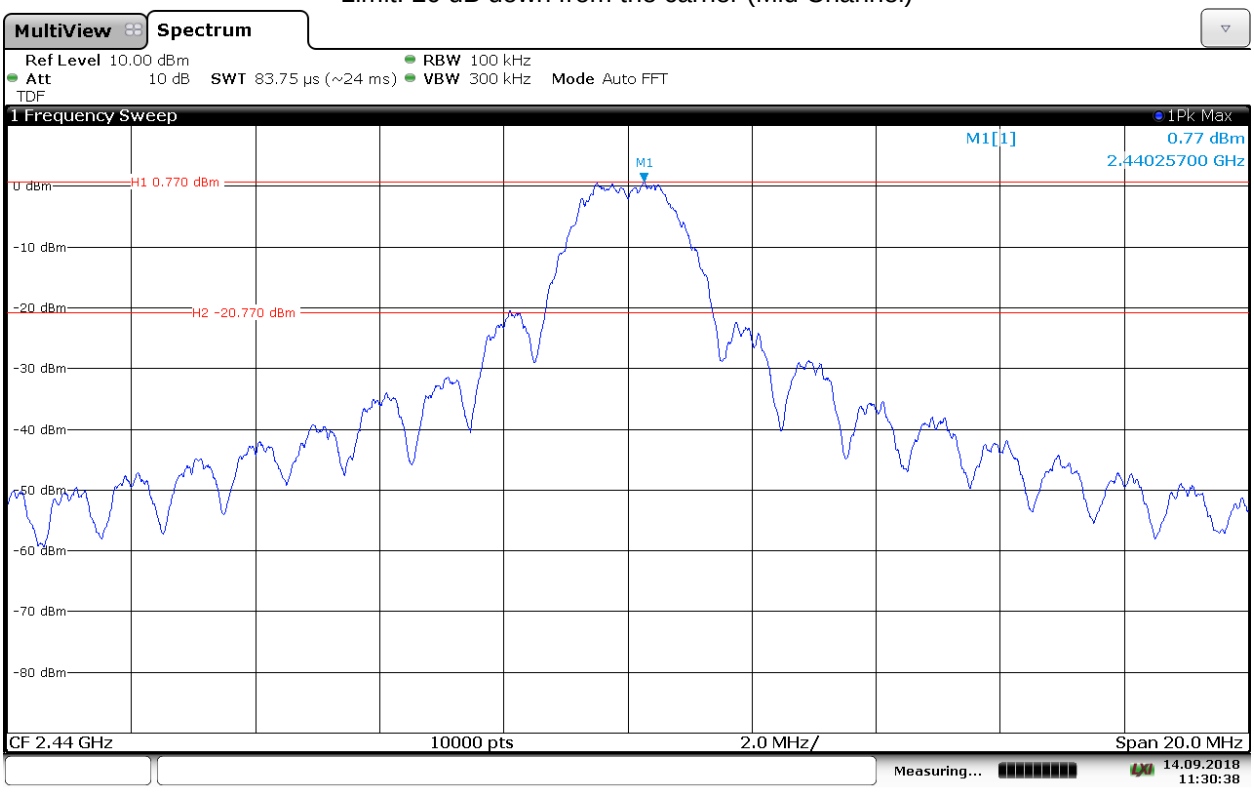
11:00:27 14.09.2018

Low Channel Antenna Port Conducted Spurious Emissions, 20-25 GHz



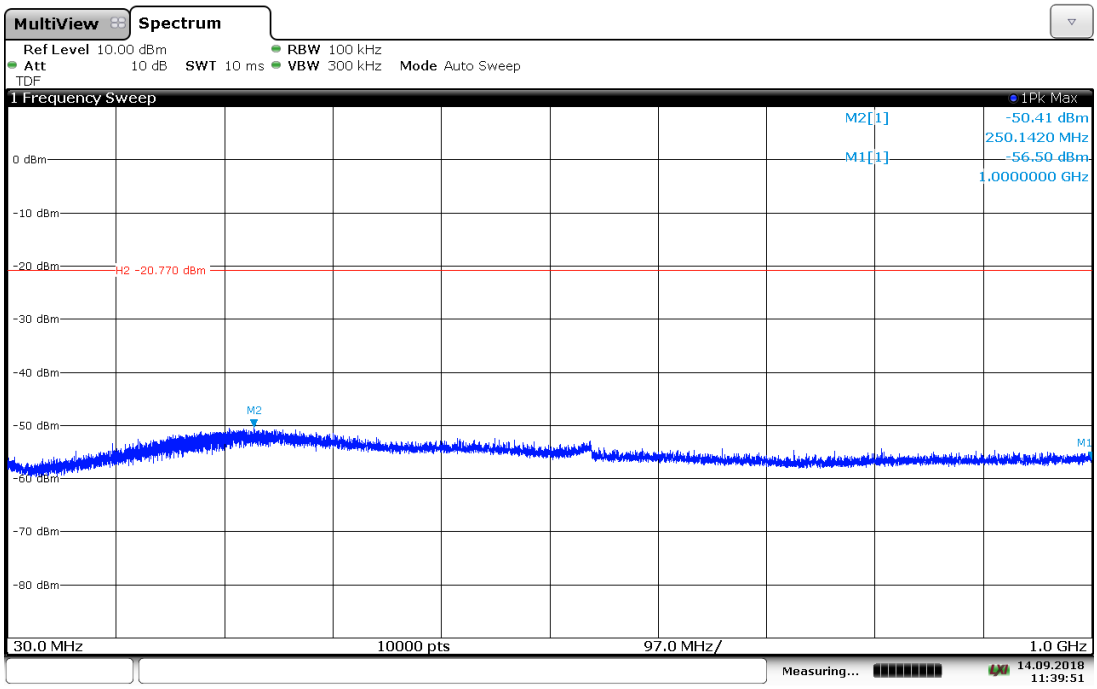
11:01:16 14.09.2018

Limit: 20 dB down from the carrier (Mid Channel)



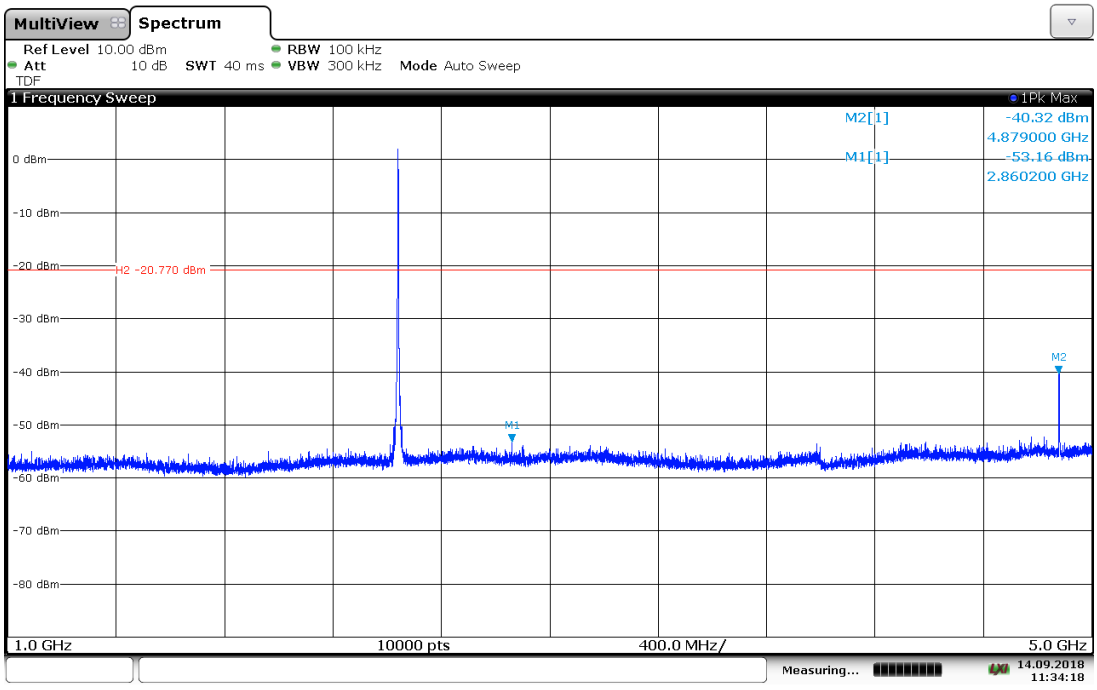
11:30:38 14.09.2018

Mid Channel Antenna Port Conducted Spurious Emissions, 30 MHz-1000 MHz



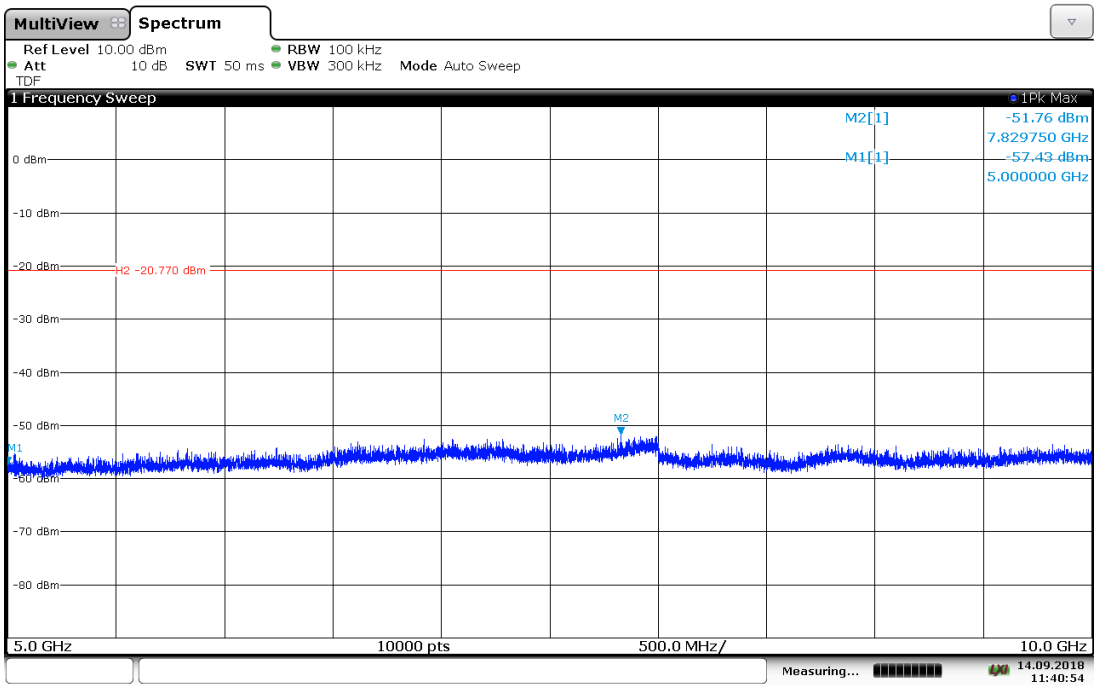
11:39:51 14.09.2018

Mid Channel Antenna Port Conducted Spurious Emissions, 1-5 GHz



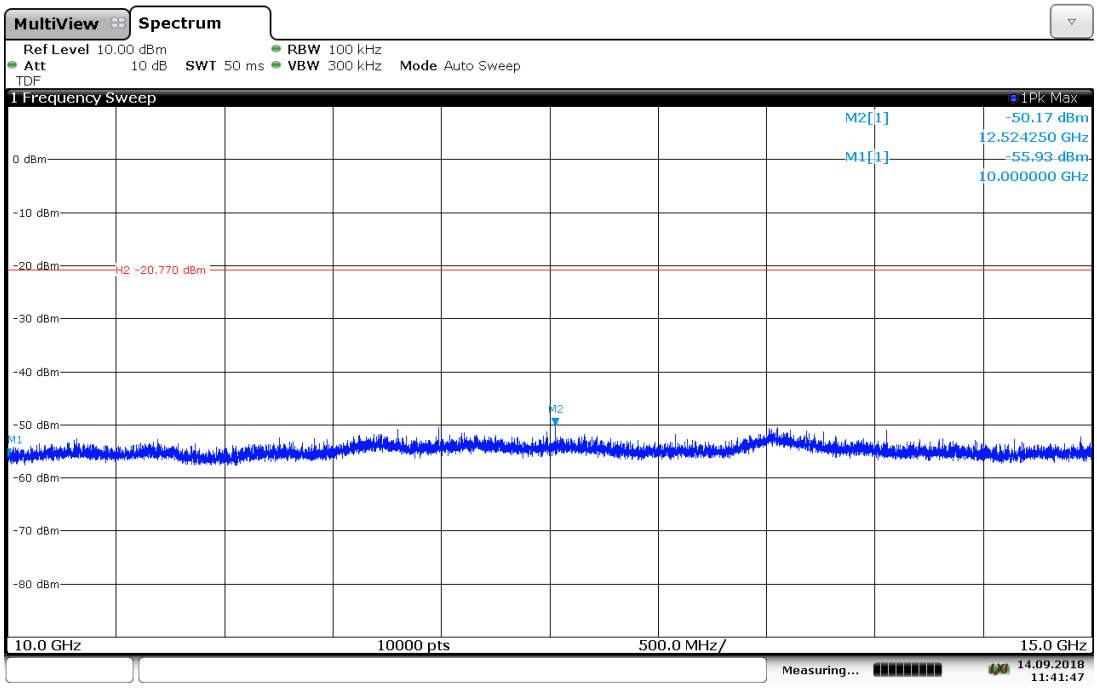
11:34:18 14.09.2018

Mid Channel Antenna Port Conducted Spurious Emissions, 5-10 GHz



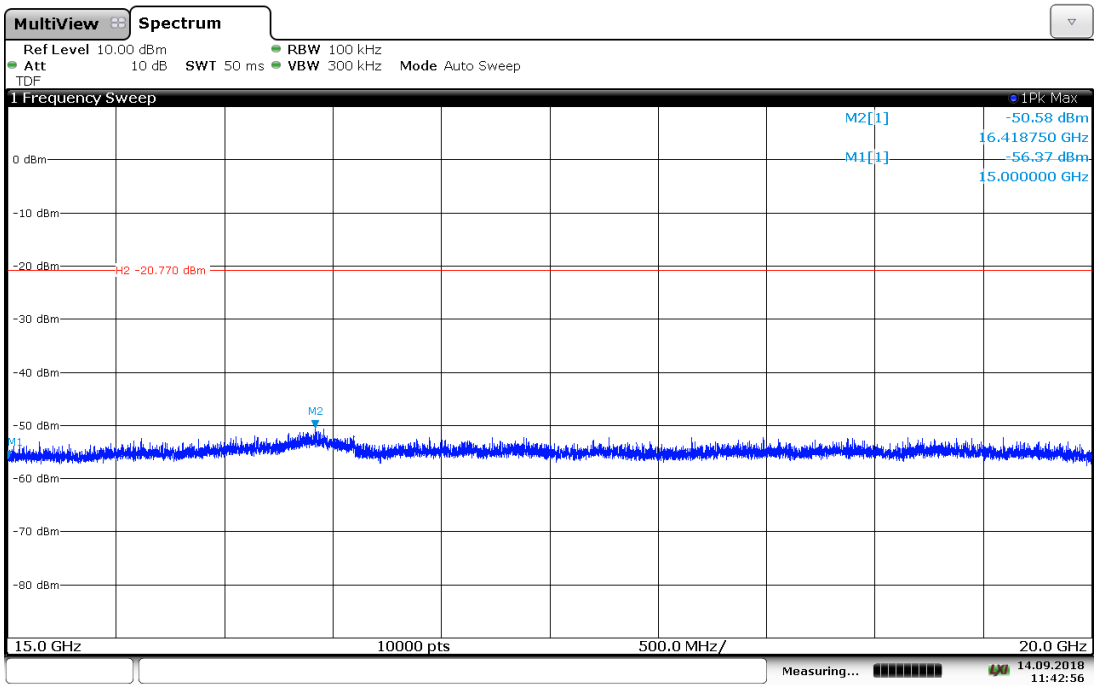
11:40:54 14.09.2018

Mid Channel Antenna Port Conducted Spurious Emissions, 10-15 GHz



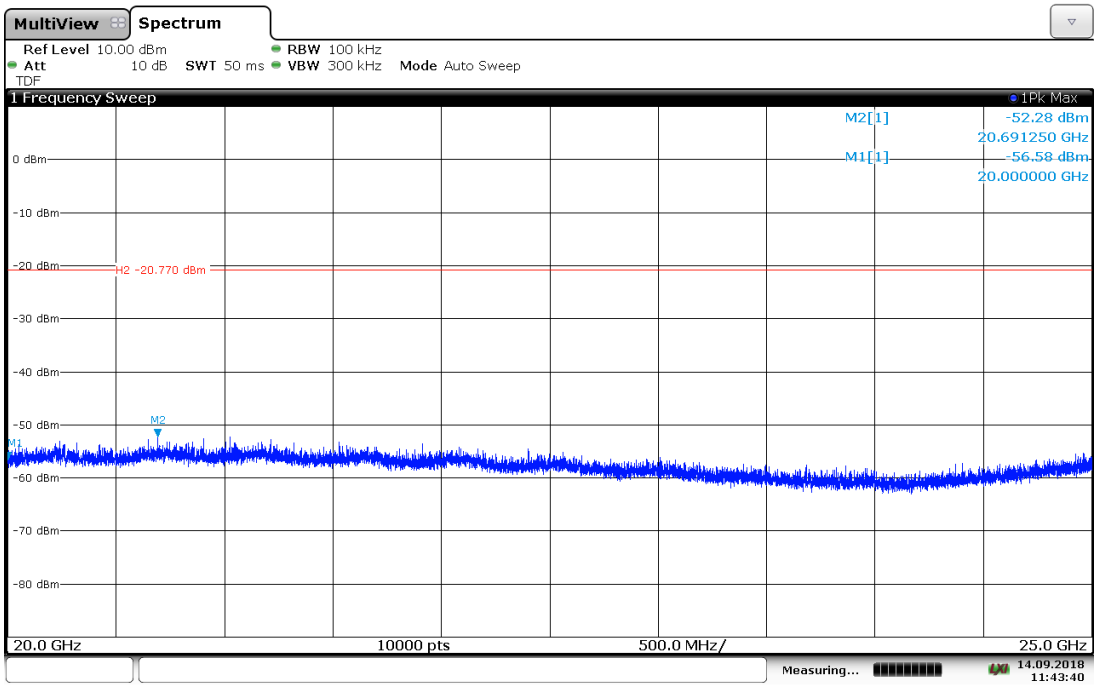
11:41:47 14.09.2018

Mid Channel Antenna Port Conducted Spurious Emissions, 15-20 GHz



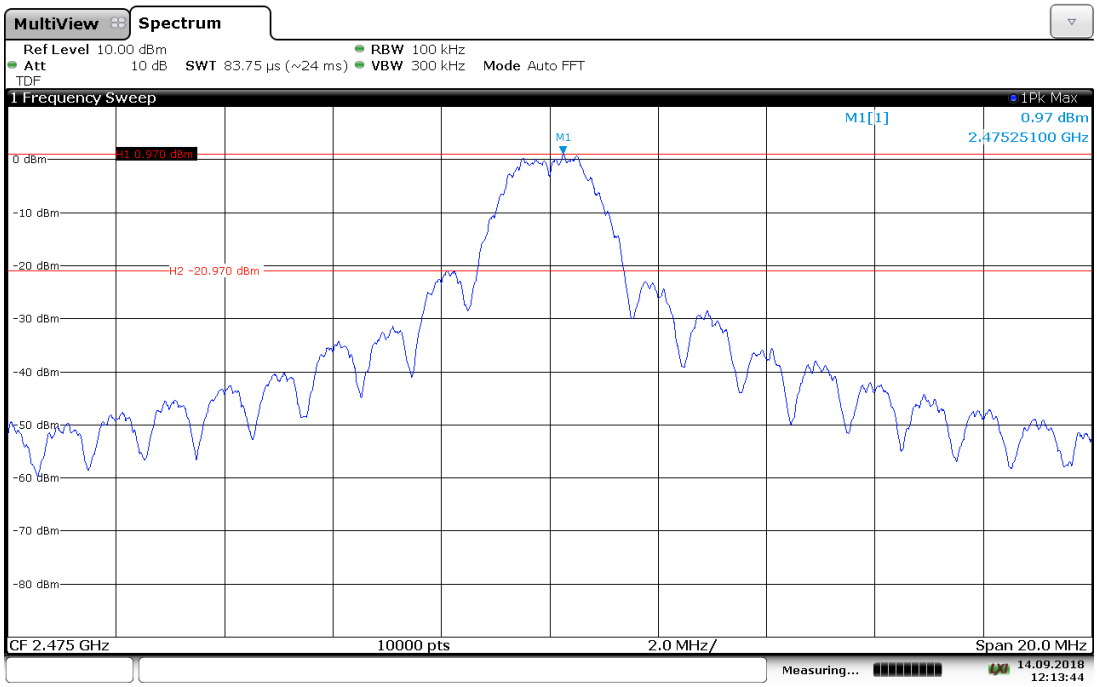
11:42:56 14.09.2018

Mid Channel Antenna Port Conducted Spurious Emissions, 20-25 GHz



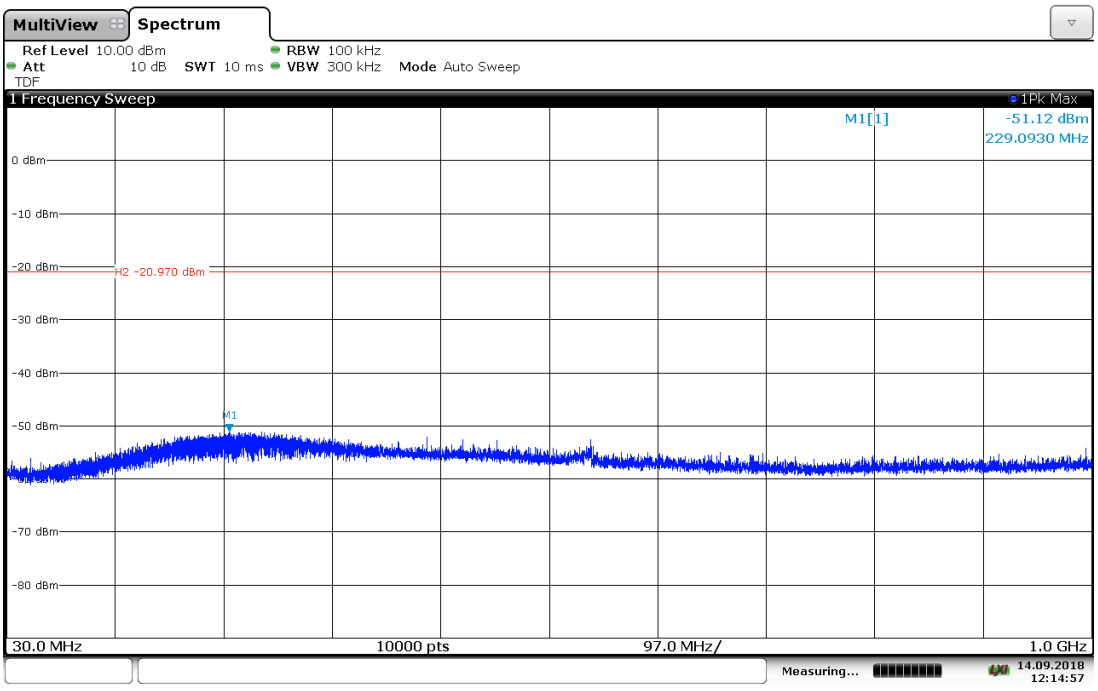
11:43:40 14.09.2018

Limit: 20 dB down from carrier (High Channel)



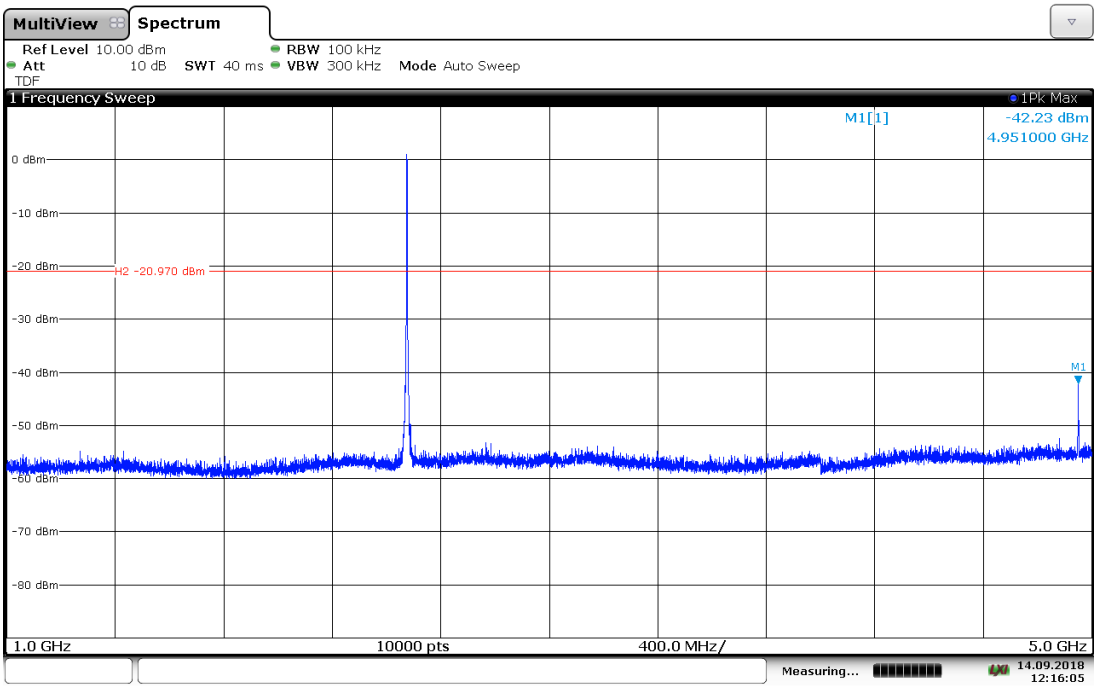
12:13:44 14.09.2018

High Channel Antenna Port Conducted Spurious Emissions, 30 MHz-1000 MHz



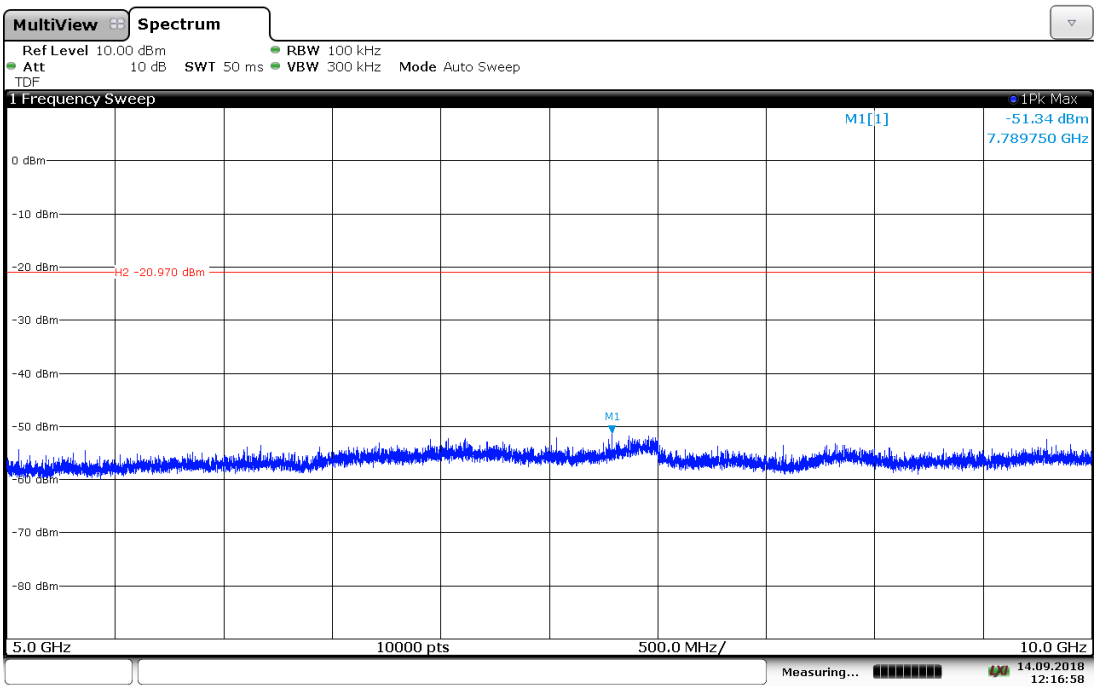
12:14:57 14.09.2018

High Channel Antenna Port Conducted Spurious Emissions, 1-5 GHz



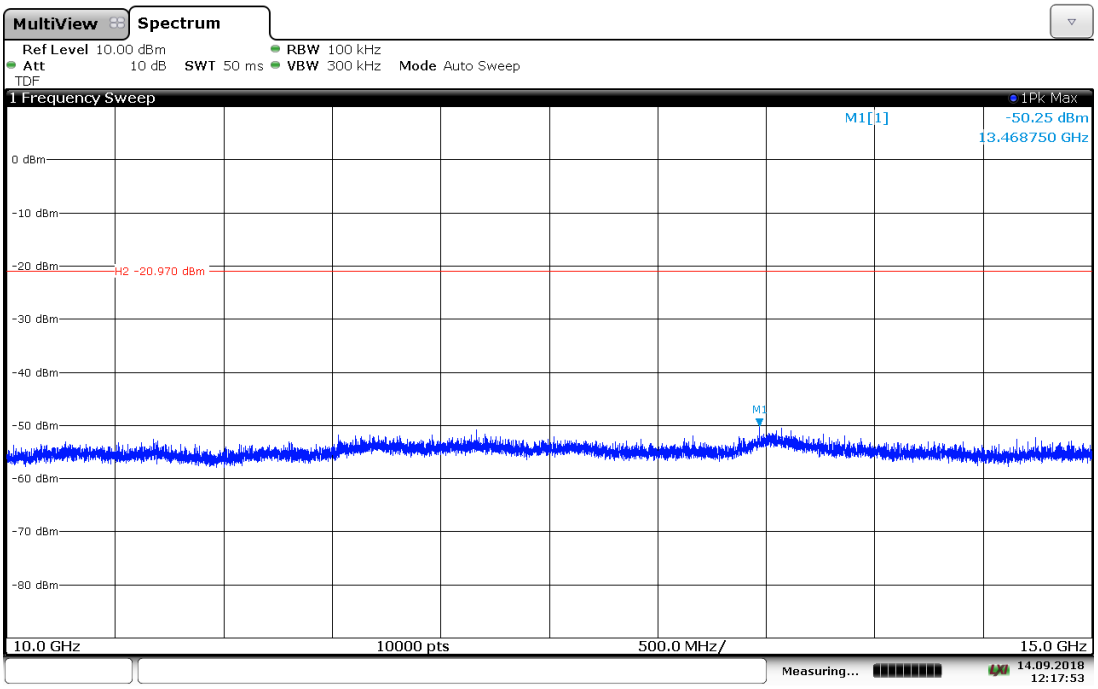
12:16:06 14.09.2018

High Channel Antenna Port Conducted Spurious Emissions, 5-10 GHz



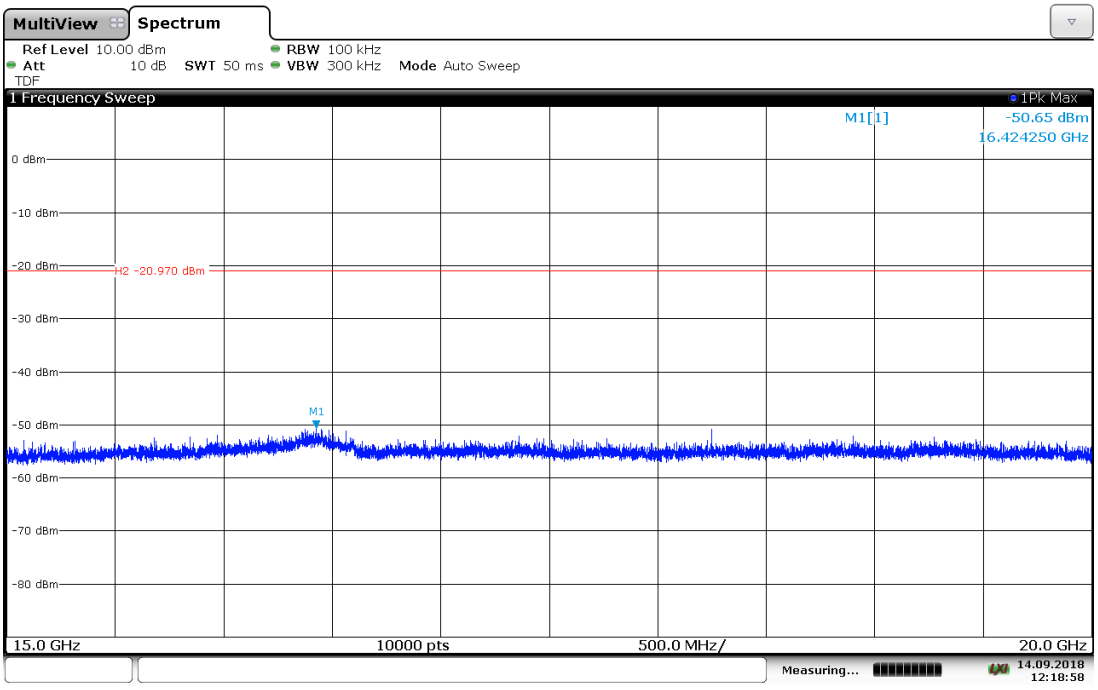
12:16:59 14.09.2018

High Channel Antenna Port Conducted Spurious Emissions, 10-15 GHz



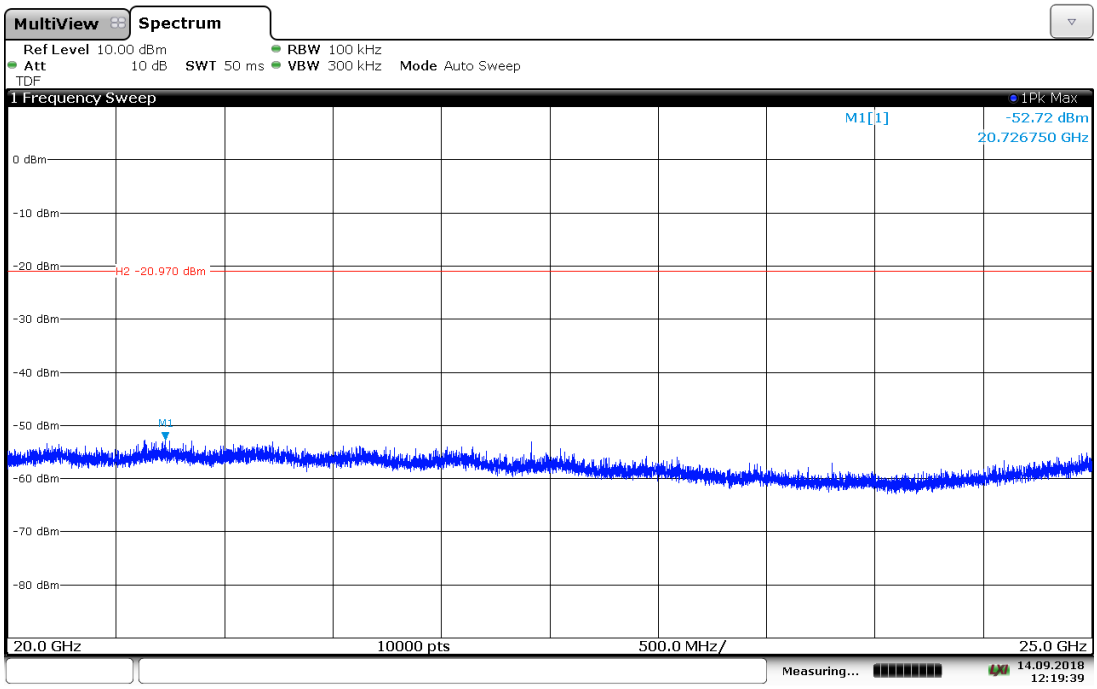
12:17:53 14.09.2018

High Channel Antenna Port Conducted Spurious Emissions, 15-20 GHz



12:18:58 14.09.2018

High Channel Antenna Port Conducted Spurious Emissions, 20-25 GHz



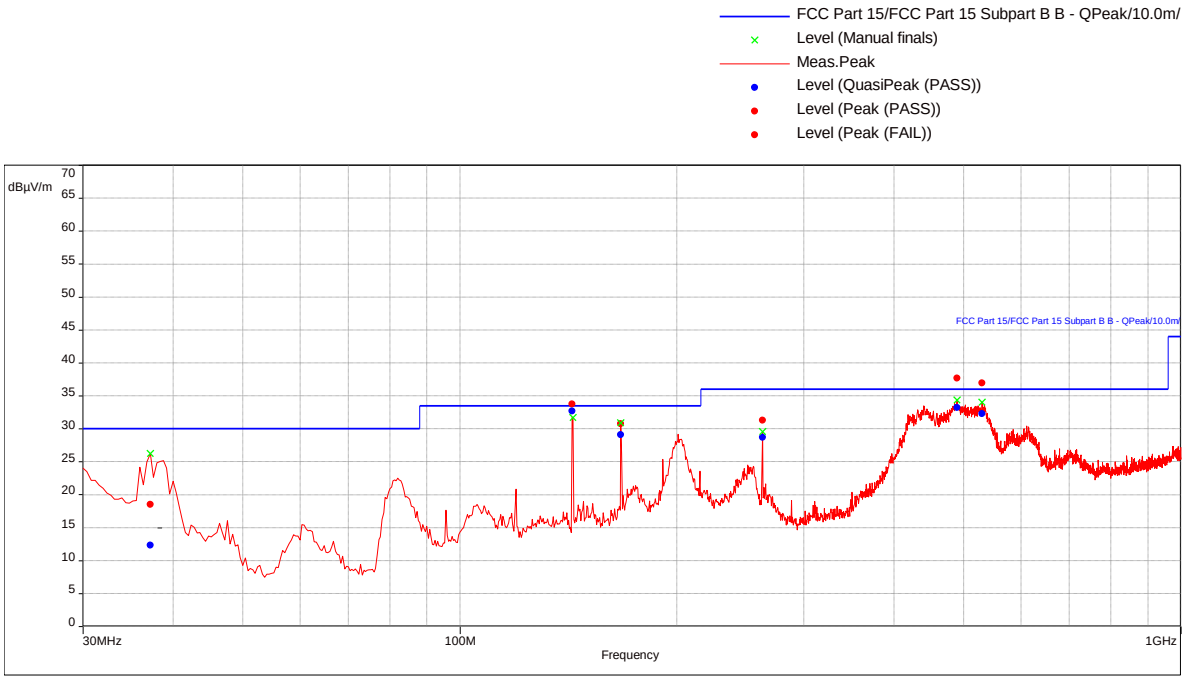
12:19:40 14.09.2018

Low Channel, 2405 MHz, Tx mode, X-Axis, 30 – 1000 MHz

Test Information:

Date and Time	9/11/2018 6:34:40 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	23 deg C
Humidity	43%
Atmospheric Pressure	1010 mB
Comments	RE 30-1000MHz_120VAC 60Hz_Tx mode_Low Ch_X-axis

Graph:



Results:

QuasiPeak (PASS) (6)

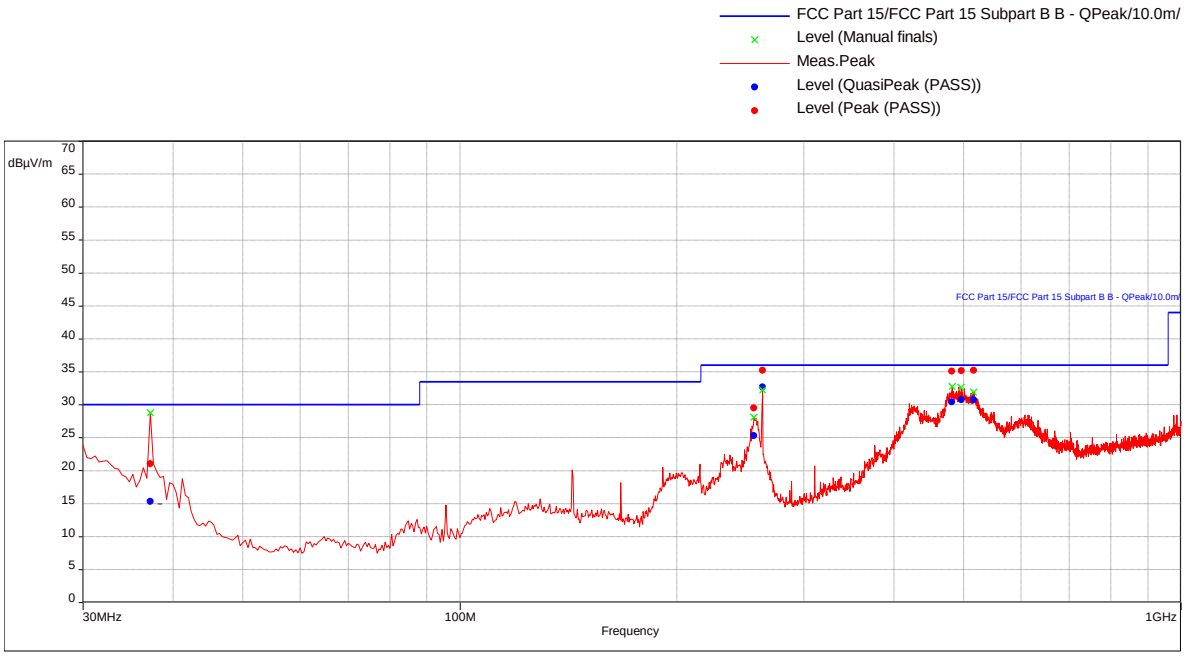
Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
37.35789474	30.00	-17.66	32.00	2.32	Vertical	120000.00	-27.38
143.3473684	33.50	-0.83	25.00	1.38	Vertical	120000.00	-29.95
167.2631579	33.50	-4.42	129.00	1.67	Vertical	120000.00	-30.45
262.8315789	36.00	-7.31	135.00	1.00	Vertical	120000.00	-28.98
489.0736842	36.00	-2.81	17.00	1.81	Horizontal	120000.00	-22.98
530.1263158	36.00	-3.74	25.00	2.04	Horizontal	120000.00	-22.15

Low Channel, 2405 MHz, Tx mode, Y-Axis, 30 – 1000 MHz

Test Information:

Date and Time	9/11/2018 7:37:53 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	23 deg C
Humidity	43%
Atmospheric Pressure	1010 mB
Comments	RE 30-1000MHz_120VAC 60Hz_Tx mode_Low Ch_Y-axis

Graph:



Results:

QuasiPeak (PASS) (6)

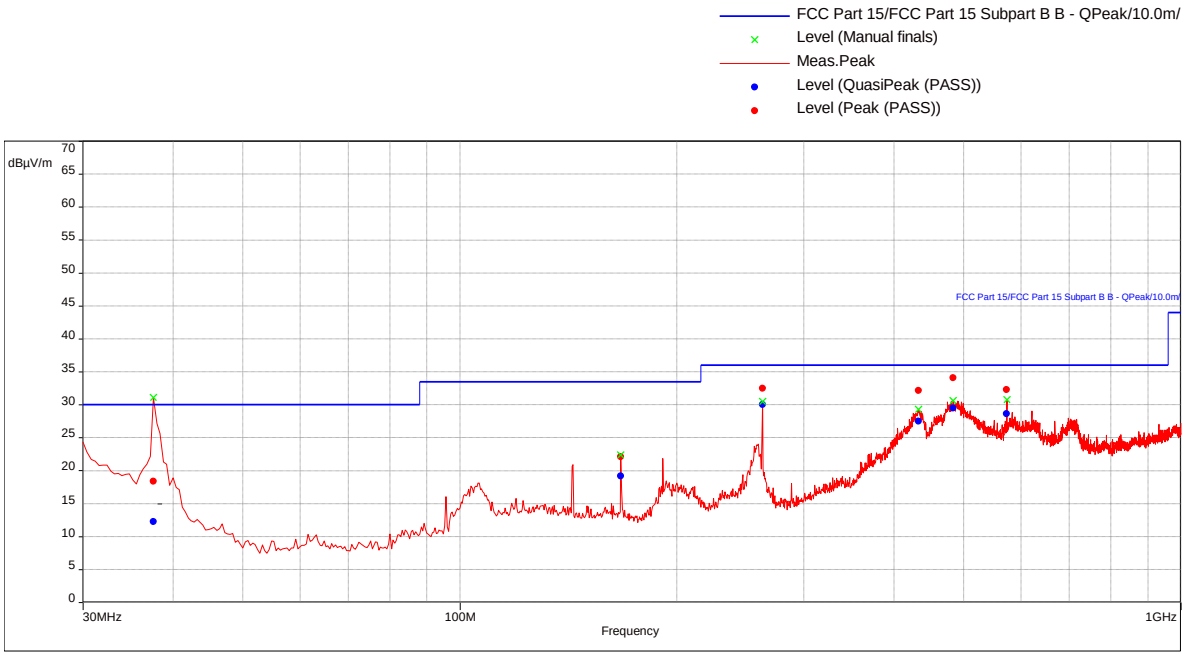
Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
37.04210526	30.00	-14.67	25.00	3.74	Vertical	120000.00	-27.17
255.5684211	36.00	-10.73	143.00	1.00	Vertical	120000.00	-30.03
262.8	36.00	-3.30	136.00	1.00	Vertical	120000.00	-28.99
481.3789474	36.00	-5.56	240.00	1.90	Horizontal	120000.00	-22.92
495.8210526	36.00	-5.27	62.00	1.98	Horizontal	120000.00	-22.76
515.9368421	36.00	-5.28	84.00	1.65	Horizontal	120000.00	-22.39

Low Channel, 2405 MHz, Tx mode, Z-Axis, 30 – 1000 MHz

Test Information:

Date and Time	9/11/2018 8:05:14 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	23 deg C
Humidity	43%
Atmospheric Pressure	1010 mB
Comments	RE 30-1000MHz_120VAC 60Hz_Tx mode_Low Ch_Z-axis_Ferrite on power cable

Graph:



Results:

QuasiPeak (PASS) (6)

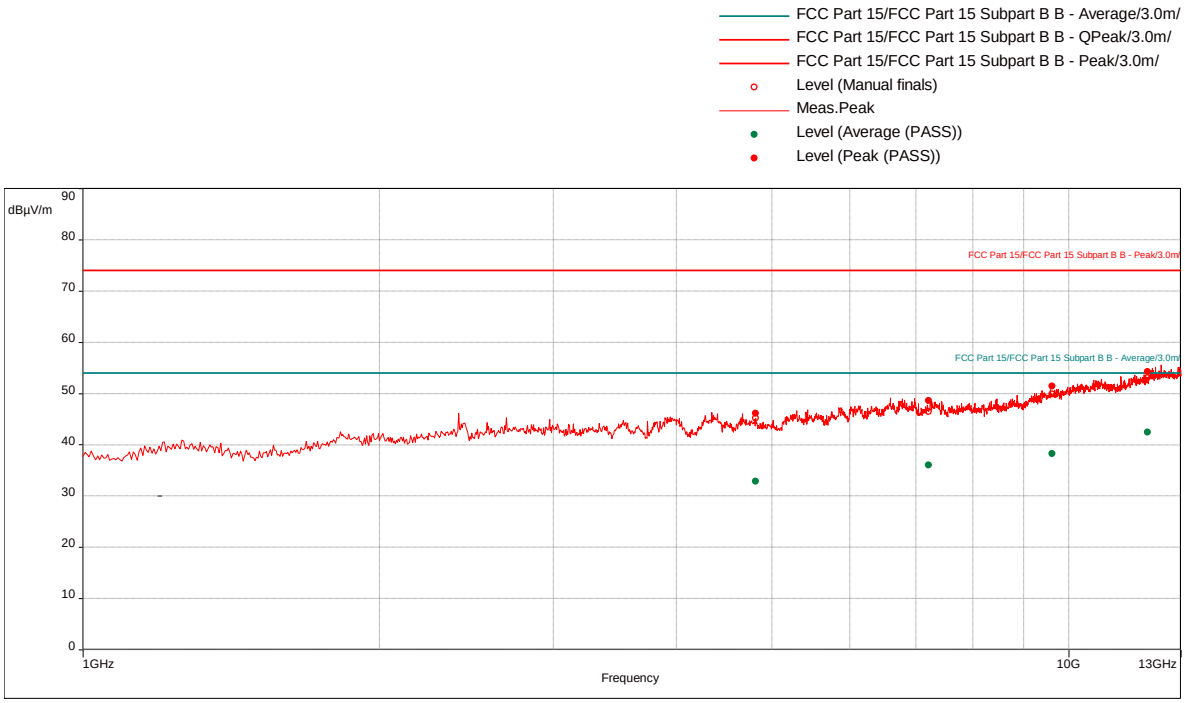
Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
37.53684211	30.00	-17.77	32.00	2.40	Vertical	120000.00	-27.50
167.2631579	33.50	-14.30	99.00	1.52	Vertical	120000.00	-30.45
262.8	36.00	-5.96	70.00	1.00	Vertical	120000.00	-28.99
432.4	36.00	-8.55	358.00	3.22	Horizontal	120000.00	-24.06
483.1368421	36.00	-6.50	0.00	2.43	Horizontal	120000.00	-22.91
573.3157895	36.00	-7.41	166.00	1.37	Horizontal	120000.00	-21.07

Low Channel, 2405 MHz, Tx mode, X-Axis, 1 – 25 GHz

Test Information:

Date and Time	9/11/2018 10:13:47 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	23 deg C
Humidity	43%
Atmospheric Pressure	1010 mB
Comments	RE 1 to 25 GHz_120VAC 60Hz_Tx mode_Low Ch_X-Axis

Graph:



Note : Manual scan was performed from 13 – 25 GHz. No emissions were detected.

Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4813.157895	46.16	74.00	-27.84	341.00	1.61	Vertical	1000000.00	7.76
7212.368421	48.62	74.00	-25.38	0.00	1.38	Horizontal	1000000.00	11.04
9618.947368	51.46	74.00	-22.54	106.00	1.46	Horizontal	1000000.00	13.75
12026.84211	54.22	74.00	-19.78	283.00	1.94	Vertical	1000000.00	18.93

Average (PASS) (4)

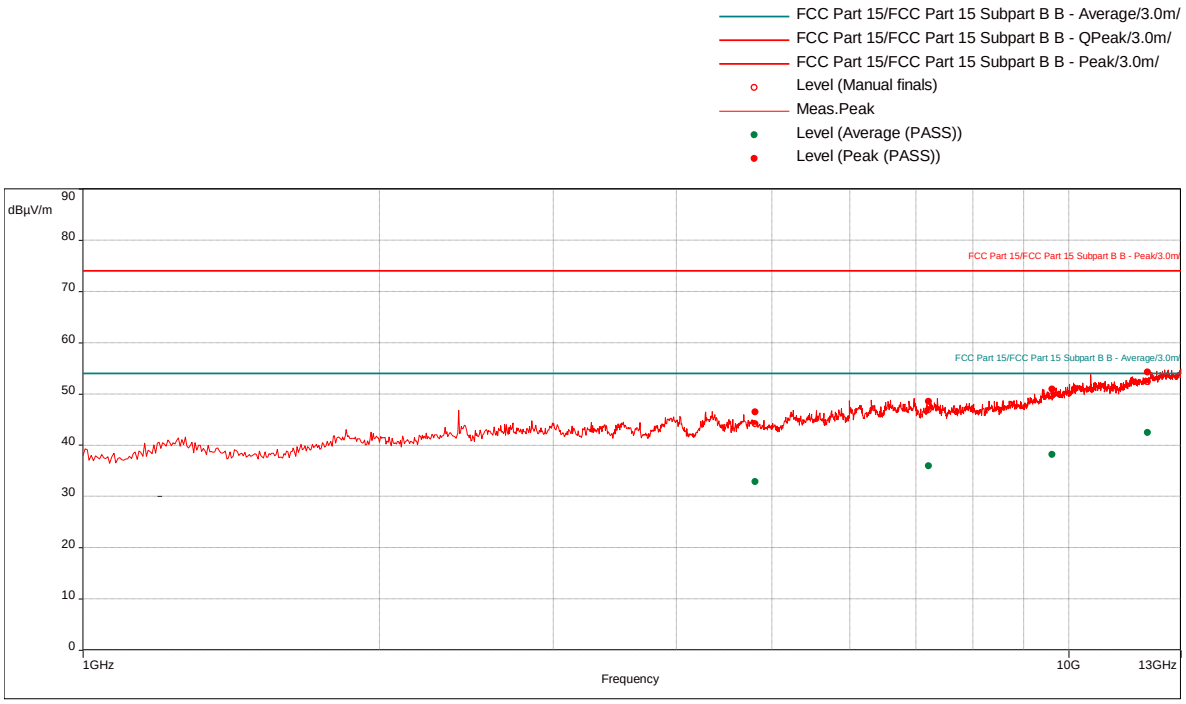
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4813.157895	32.86	54.00	-21.14	341.00	1.61	Vertical	1000000.00	7.76
7212.368421	35.98	54.00	-18.02	0.00	1.38	Horizontal	1000000.00	11.04
9618.947368	38.27	54.00	-15.73	106.00	1.46	Horizontal	1000000.00	13.75
12026.84211	42.45	54.00	-11.55	283.00	1.94	Vertical	1000000.00	18.93

Low Channel, 2405 MHz, Tx mode, Y-Axis, 1 – 25 GHz

Test Information:

Date and Time	9/11/2018 10:40:33 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	23 deg C
Humidity	43%
Atmospheric Pressure	1010 mB
Comments	RE 1 to 25 GHz_120VAC 60Hz_Tx mode_Low Ch_Y-Axis

Graph:



Note : Manual scan was performed from 13 – 25 GHz. No emissions were detected.

Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4811.315789	46.42	74.00	-27.58	113.00	3.93	Horizontal	1000000.00	7.76
7210.526316	48.48	74.00	-25.52	239.00	2.27	Horizontal	1000000.00	11.04
9619.736842	50.94	74.00	-23.06	165.00	1.56	Vertical	1000000.00	13.75
12027.89474	54.23	74.00	-19.77	195.00	2.61	Horizontal	1000000.00	18.93

Average (PASS) (4)

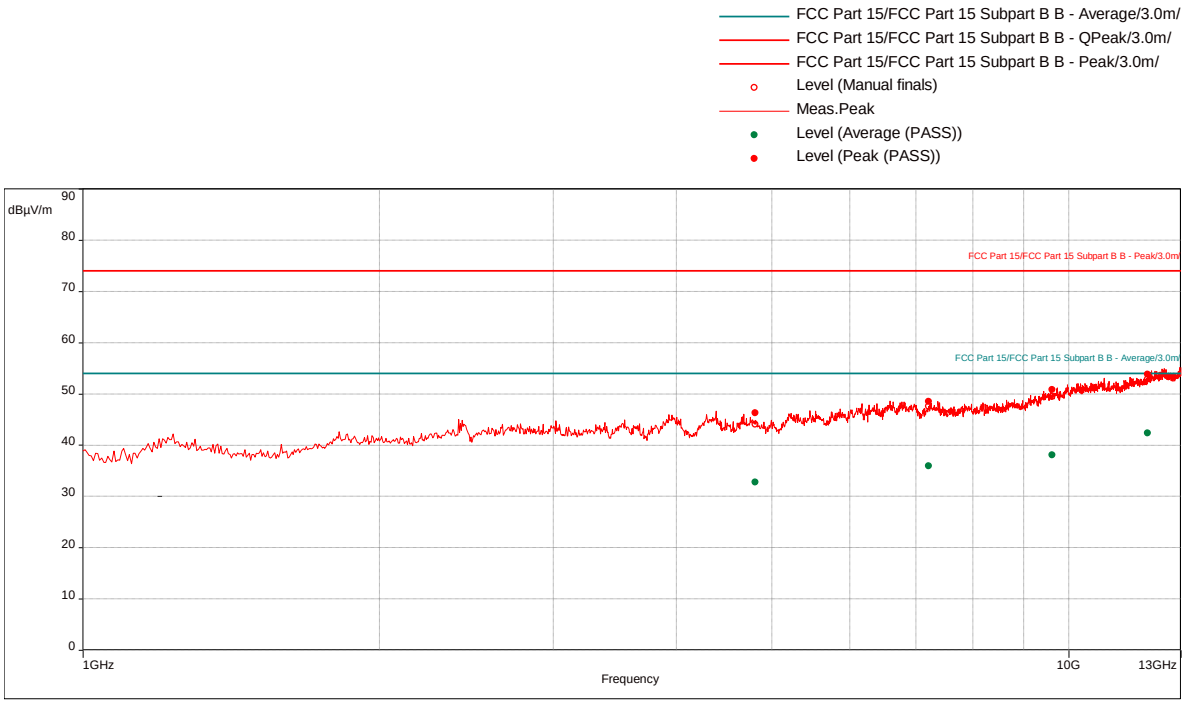
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4811.315789	32.87	54.00	-21.13	113.00	3.93	Horizontal	1000000.00	7.76
7210.526316	35.90	54.00	-18.10	239.00	2.27	Horizontal	1000000.00	11.04
9619.736842	38.19	54.00	-15.81	165.00	1.56	Vertical	1000000.00	13.75
12027.89474	42.45	54.00	-11.55	195.00	2.61	Horizontal	1000000.00	18.93

Low Channel, 2405 MHz, Tx mode, Z-Axis, 1 – 25 GHz

Test Information:

Date and Time	9/11/2018 11:05:03 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	23 deg C
Humidity	43%
Atmospheric Pressure	1010 mB
Comments	RE 1 to 25 GHz_120VAC 60Hz_Tx mode_Low Ch_Z-Axis

Graph:



Note : Manual scan was performed from 13 – 25 GHz. No emissions were detected.

Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4812.105263	46.28	74.00	-27.72	335.00	1.89	Horizontal	1000000.00	7.76
7212.894737	48.48	74.00	-25.52	143.00	2.11	Horizontal	1000000.00	11.04
9620.263158	50.80	74.00	-23.20	305.00	3.99	Vertical	1000000.00	13.75
12023.94737	53.78	74.00	-20.22	253.00	3.30	Vertical	1000000.00	18.92

Average (PASS) (4)

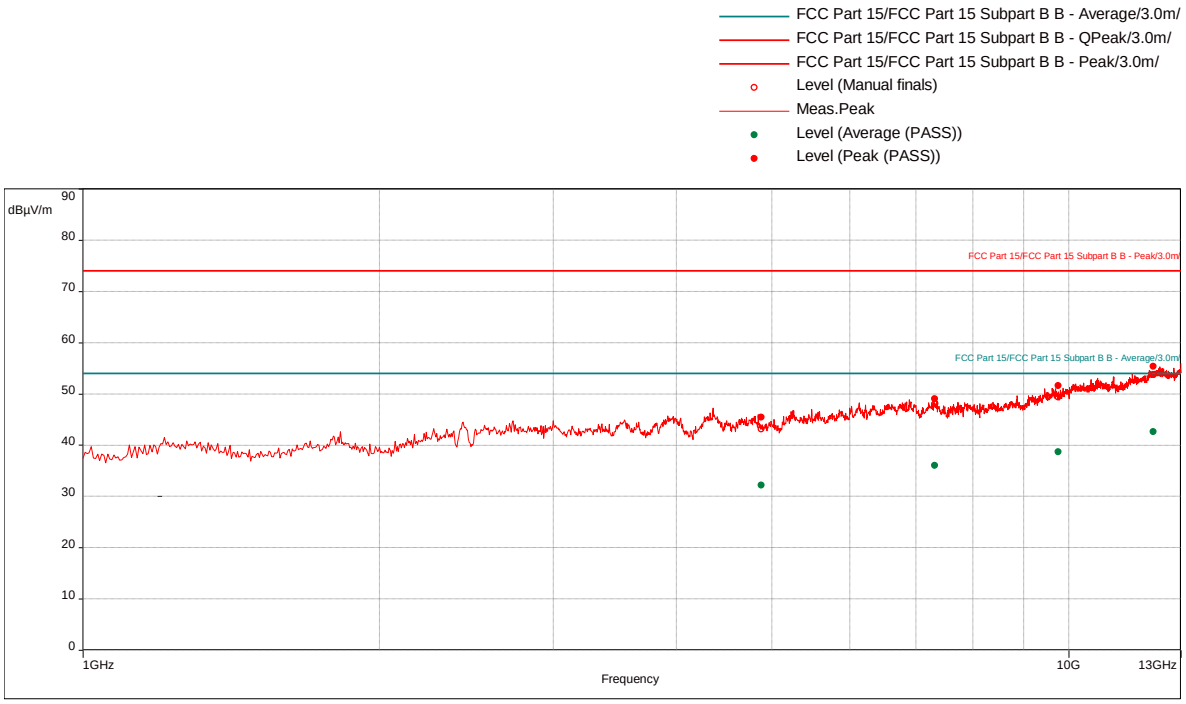
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4812.105263	32.78	54.00	-21.22	335.00	1.89	Horizontal	1000000.00	7.76
7212.894737	35.90	54.00	-18.10	143.00	2.11	Horizontal	1000000.00	11.04
9620.263158	38.10	54.00	-15.90	305.00	3.99	Vertical	1000000.00	13.75
12023.94737	42.34	54.00	-11.66	253.00	3.30	Vertical	1000000.00	18.92

Mid Channel, 2440 MHz, Tx mode, X-Axis, 1 – 25 GHz

Test Information:

Date and Time	9/12/2018 4:32:18 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	21 deg C
Humidity	50%
Atmospheric Pressure	1016 mB
Comments	RE 1 to 25 GHz_120VAC 60Hz_Tx mode_Mid Ch_X-Axis

Graph:



Note : Manual scan was performed from 13 – 25 GHz. No emissions were detected.

Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4881.842105	45.48	74.00	-28.52	143.00	1.41	Horizontal	1000000.00	7.64
7317.105263	49.04	74.00	-24.96	225.00	2.19	Vertical	1000000.00	11.05
9761.052632	51.60	74.00	-22.40	291.00	3.67	Horizontal	1000000.00	14.16
12197.10526	55.32	74.00	-18.68	210.00	2.00	Horizontal	1000000.00	19.20

Average (PASS) (4)

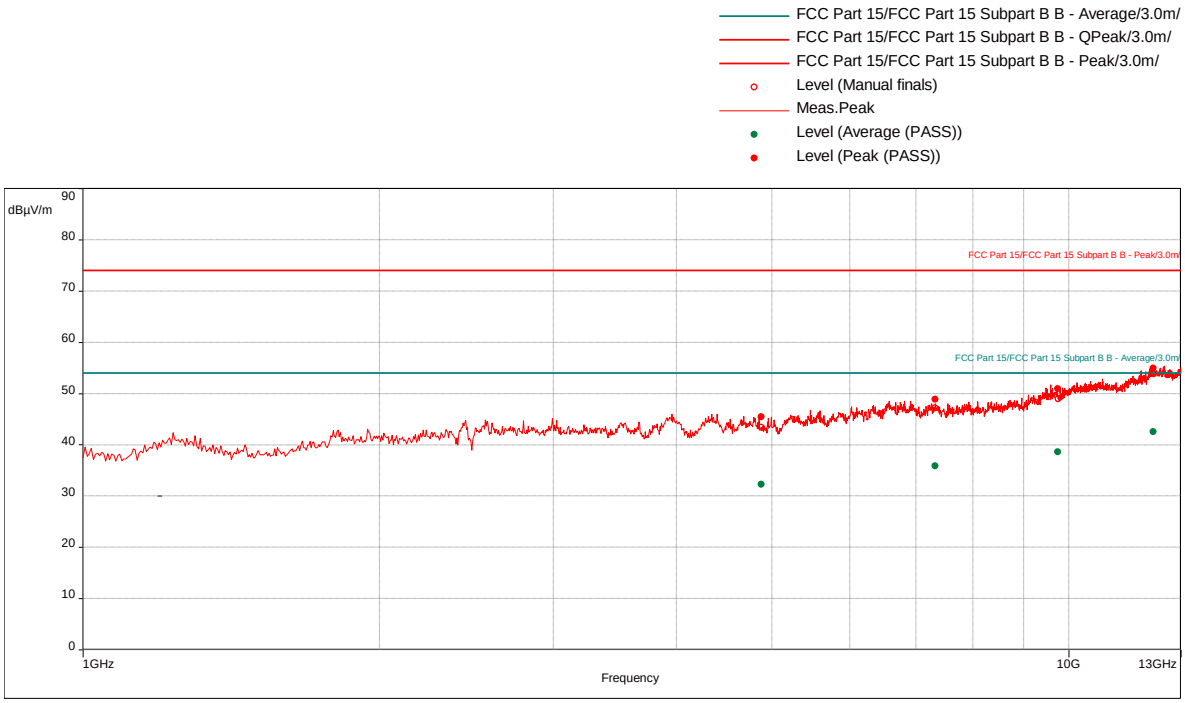
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4881.842105	32.16	54.00	-21.84	143.00	1.41	Horizontal	1000000.00	7.64
7317.105263	35.99	54.00	-18.01	225.00	2.19	Vertical	1000000.00	11.05
9761.052632	38.68	54.00	-15.32	291.00	3.67	Horizontal	1000000.00	14.16
12197.10526	42.62	54.00	-11.38	210.00	2.00	Horizontal	1000000.00	19.20

Mid Channel, 2440 MHz, Tx mode, Y-Axis, 1 – 25 GHz

Test Information:

Date and Time	9/12/2018 5:29:55 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	21 deg C
Humidity	50%
Atmospheric Pressure	1016 mB
Comments	RE 1 to 25 GHz_120VAC 60Hz_Tx mode_Mid Ch_Y-Axis

Graph:



Note : Manual scan was performed from 13 – 25 GHz. No emissions were detected.

Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4880.526316	45.48	74.00	-28.52	113.00	2.17	Vertical	1000000.00	7.64
7319.736842	48.89	74.00	-25.11	4.00	2.23	Vertical	1000000.00	11.05
9756.842105	50.92	74.00	-23.08	113.00	2.95	Vertical	1000000.00	14.14
12196.84211	54.90	74.00	-19.10	232.00	3.35	Vertical	1000000.00	19.20

Average (PASS) (4)

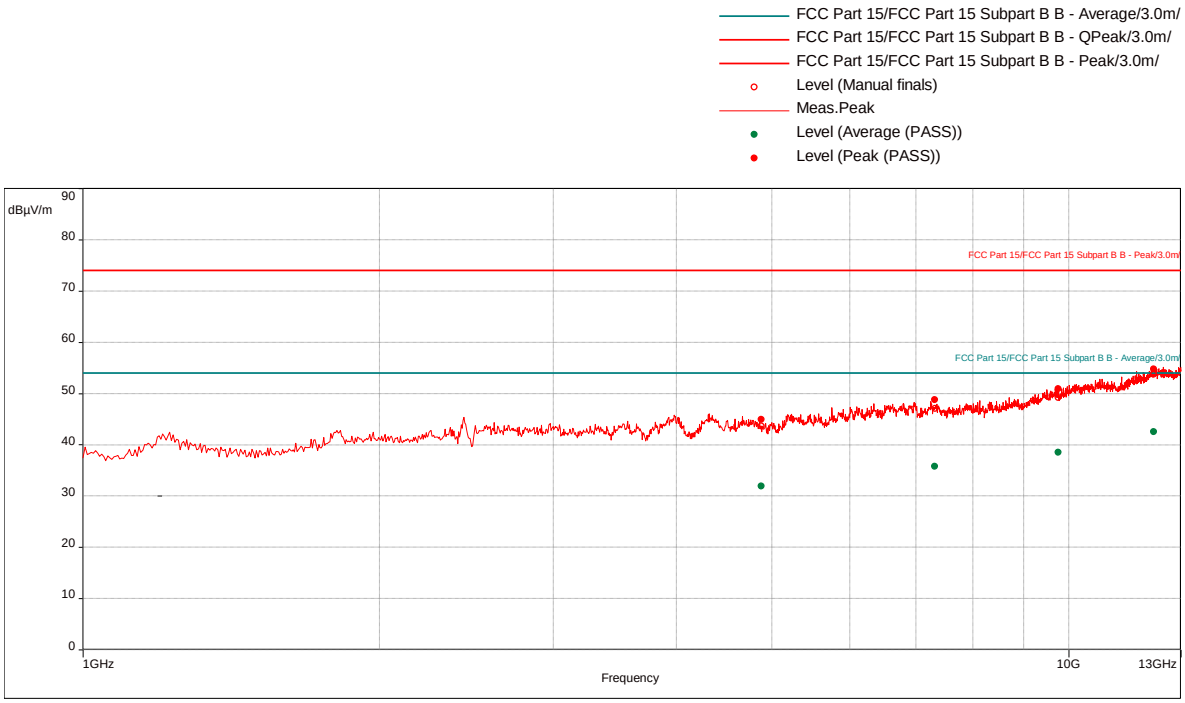
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4880.526316	32.24	54.00	-21.76	113.00	2.17	Vertical	1000000.00	7.64
7319.736842	35.82	54.00	-18.18	4.00	2.23	Vertical	1000000.00	11.05
9756.842105	38.58	54.00	-15.42	113.00	2.95	Vertical	1000000.00	14.14
12196.84211	42.52	54.00	-11.48	232.00	3.35	Vertical	1000000.00	19.20

Mid Channel, 2440 MHz, Tx mode, Z-Axis, 1 – 25 GHz

Test Information:

Date and Time	9/12/2018 5:57:59 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	21 deg C
Humidity	50%
Atmospheric Pressure	1016 mB
Comments	RE 1 to 25 GHz_120VAC 60Hz_Tx mode_Mid Ch_Z-Axis

Graph:



Note : Manual scan was performed from 13 – 25 GHz. No emissions were detected.

Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4879.736842	44.94	74.00	-29.06	99.00	1.38	Vertical	1000000.00	7.64
7316.842105	48.76	74.00	-25.24	255.00	2.62	Horizontal	1000000.00	11.05
9761.842105	50.94	74.00	-23.06	159.00	3.75	Horizontal	1000000.00	14.16
12199.73684	54.76	74.00	-19.24	255.00	2.89	Horizontal	1000000.00	19.20

Average (PASS) (4)

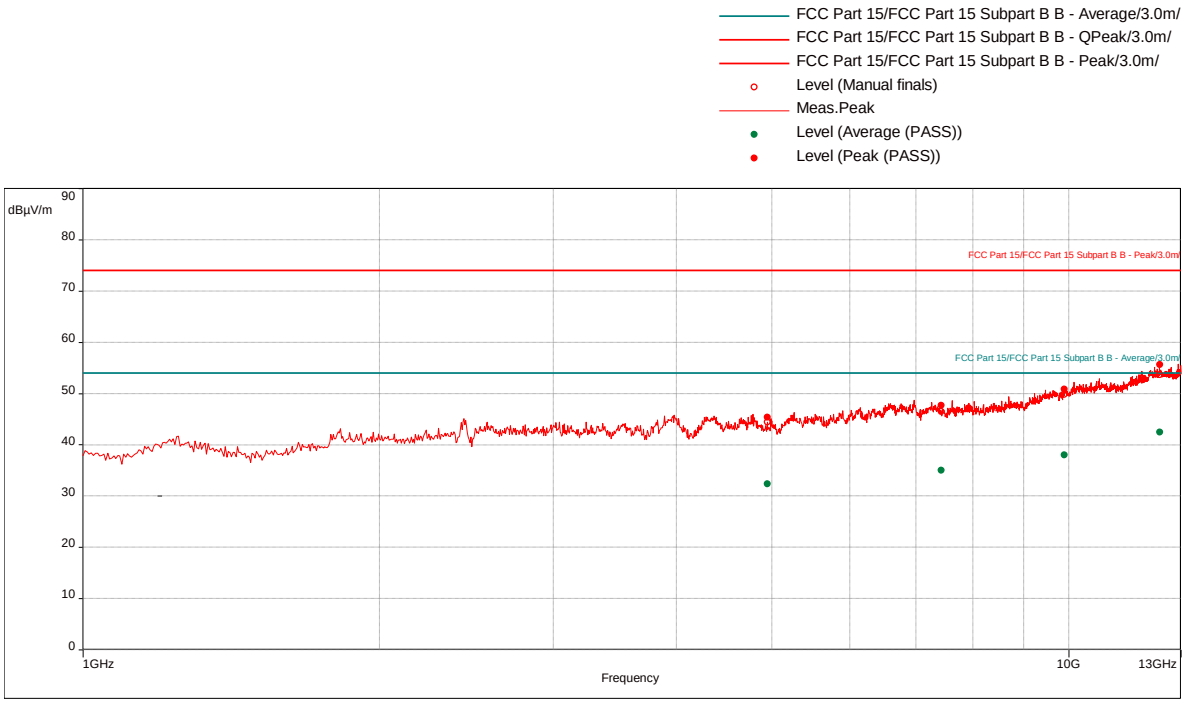
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4879.736842	31.90	54.00	-22.10	99.00	1.38	Vertical	1000000.00	7.64
7316.842105	35.74	54.00	-18.26	255.00	2.62	Horizontal	1000000.00	11.05
9761.842105	38.51	54.00	-15.49	159.00	3.75	Horizontal	1000000.00	14.16
12199.73684	42.52	54.00	-11.48	255.00	2.89	Horizontal	1000000.00	19.20

High Channel, 2475 MHz, Tx mode, X-Axis, 1 – 25 GHz

Test Information:

Date and Time	9/12/2018 6:33:12 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	21 deg C
Humidity	50%
Atmospheric Pressure	1016 mB
Comments	Copy RE 1 to 25 GHz_120VAC 60Hz_Tx mode_High Ch_X-Axis

Graph:



Note : Manual scan was performed from 13 – 25 GHz. No emissions were detected.

Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4951.315789	45.31	74.00	-28.69	121.00	1.00	Vertical	1000000.00	7.60
7426.315789	47.66	74.00	-26.34	19.00	3.43	Vertical	1000000.00	10.89
9901.578947	50.83	74.00	-23.17	359.00	2.80	Horizontal	1000000.00	14.44
12374.73684	55.63	74.00	-18.37	143.00	2.66	Vertical	1000000.00	19.24

Average (PASS) (4)

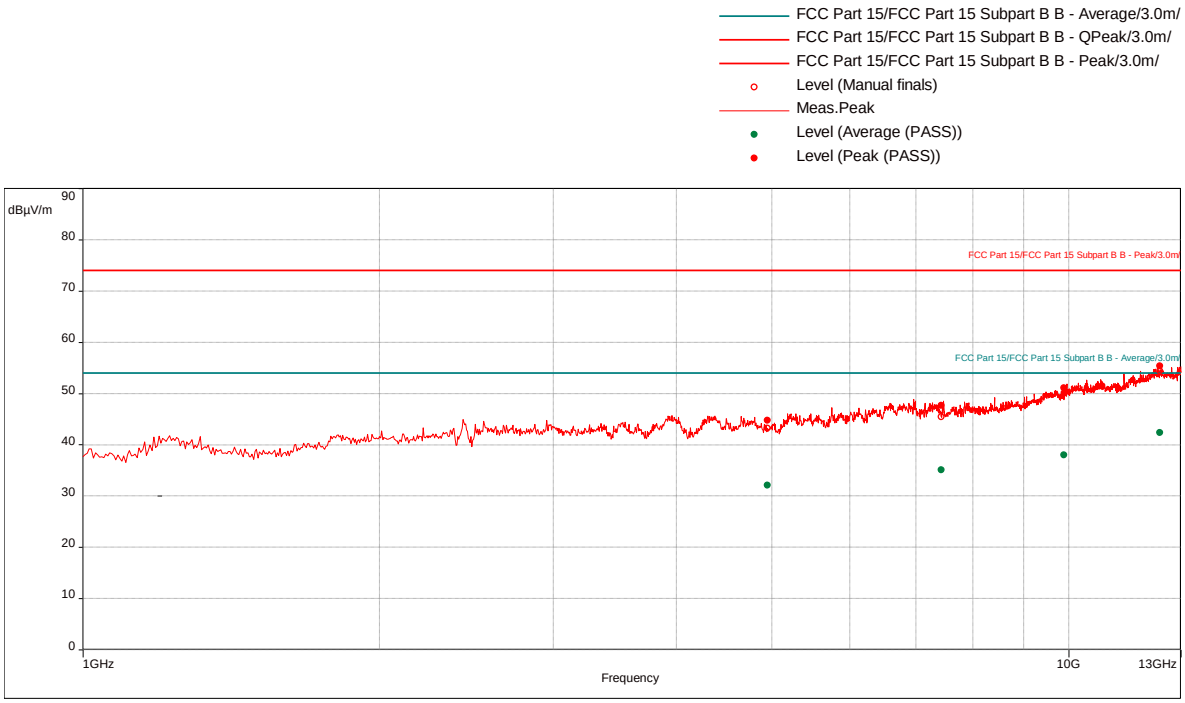
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4951.315789	32.37	54.00	-21.63	121.00	1.00	Vertical	1000000.00	7.60
7426.315789	34.97	54.00	-19.03	19.00	3.43	Vertical	1000000.00	10.89
9901.578947	37.96	54.00	-16.04	359.00	2.80	Horizontal	1000000.00	14.44
12374.73684	42.47	54.00	-11.53	143.00	2.66	Vertical	1000000.00	19.24

High Channel, 2475 MHz, Tx mode, Y-Axis, 1 – 25 GHz

Test Information:

Date and Time	9/12/2018 7:06:36 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	21 deg C
Humidity	50%
Atmospheric Pressure	1016 mB
Comments	RE 1 to 25 GHz_120VAC 60Hz_Tx mode_High Ch_Y-Axis

Graph:



Note : Manual scan was performed from 13 – 25 GHz. No emissions were detected.

Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4948.684211	44.78	74.00	-29.22	269.00	1.50	Vertical	1000000.00	7.60
7424.736842	47.66	74.00	-26.34	47.00	2.10	Horizontal	1000000.00	10.89
9895.789474	51.09	74.00	-22.91	195.00	2.00	Horizontal	1000000.00	14.44
12372.63158	55.36	74.00	-18.64	144.00	1.27	Horizontal	1000000.00	19.24

Average (PASS) (4)

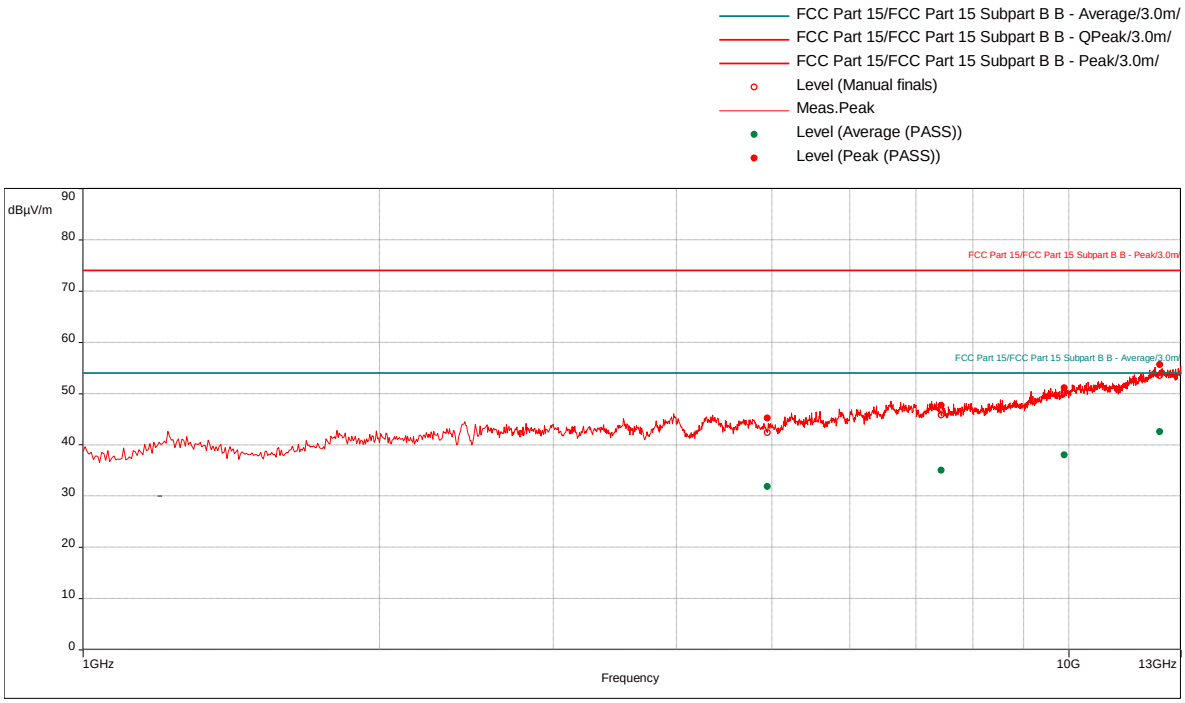
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4948.684211	32.12	54.00	-21.88	269.00	1.50	Vertical	1000000.00	7.60
7424.736842	35.06	54.00	-18.94	47.00	2.10	Horizontal	1000000.00	10.89
9895.789474	37.96	54.00	-16.04	195.00	2.00	Horizontal	1000000.00	14.44
12372.63158	42.37	54.00	-11.63	144.00	1.27	Horizontal	1000000.00	19.24

High Channel, 2475 MHz, Tx mode, Z-Axis, 1 – 25 GHz

Test Information:

Date and Time	9/12/2018 7:30:35 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	21 deg C
Humidity	50%
Atmospheric Pressure	1016 mB
Comments	RE 1 to 25 GHz_120VAC 60Hz_Tx mode_High Ch_Z-Axis

Graph:



Note : Manual scan was performed from 13 – 25 GHz. No emissions were detected.

Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4948.157895	45.17	74.00	-28.83	292.00	3.05	Horizontal	1000000.00	7.60
7424.210526	47.67	74.00	-26.33	221.00	3.09	Vertical	1000000.00	10.89
9900.263158	51.09	74.00	-22.91	61.00	2.90	Vertical	1000000.00	14.44
12377.36842	55.63	74.00	-18.37	121.00	2.72	Horizontal	1000000.00	19.24

Average (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4948.157895	31.86	54.00	-22.14	292.00	3.05	Horizontal	1000000.00	7.60
7424.210526	34.97	54.00	-19.03	221.00	3.09	Vertical	1000000.00	10.89
9900.263158	37.96	54.00	-16.04	61.00	2.90	Vertical	1000000.00	14.44
12377.36842	42.56	54.00	-11.44	121.00	2.72	Horizontal	1000000.00	19.24

Test Personnel:	Vathana Ven VSV	Test Date:	09/11/2018
	Kouma Sinn KPS		09/14/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247, RSS-102	Limit Applied:	See report section 10.3
Input Voltage:	120VAC 60Hz		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	23, 22 ºC
		Relative Humidity:	43, 66 %
		Atmospheric Pressure:	1010, 1016 mbars

Deviations, Additions, or Exclusions: None

11 Digital Device and Receiver Radiated Spurious Emissions

11.1 Method

Tests are performed in accordance with FCC Part 15 Subpart B, ICES 003, and ANSI C 63.4.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
BAR1'	Digital 4 Line Barometer	Mannix	0ABA116	BAR1	04/30/2018	04/30/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/22/2018	03/22/2019
ETS005'	1-18GHz horn antenna	ETS-Lindgren	3117	00218279	05/14/2018	05/14/2019
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/25/2018	07/25/2019
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2018	07/25/2019
PRE11'	50dB gain pre-amp	Keith H	PRE11	PRE11	12/02/2017	12/02/2018
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	06/14/2018	06/14/2019
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/16/2018	05/16/2019

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	3.17.0.3

11.3 Results:

The sample tested was found to Comply.

§15.209 Radiated emission limits; general requirements.

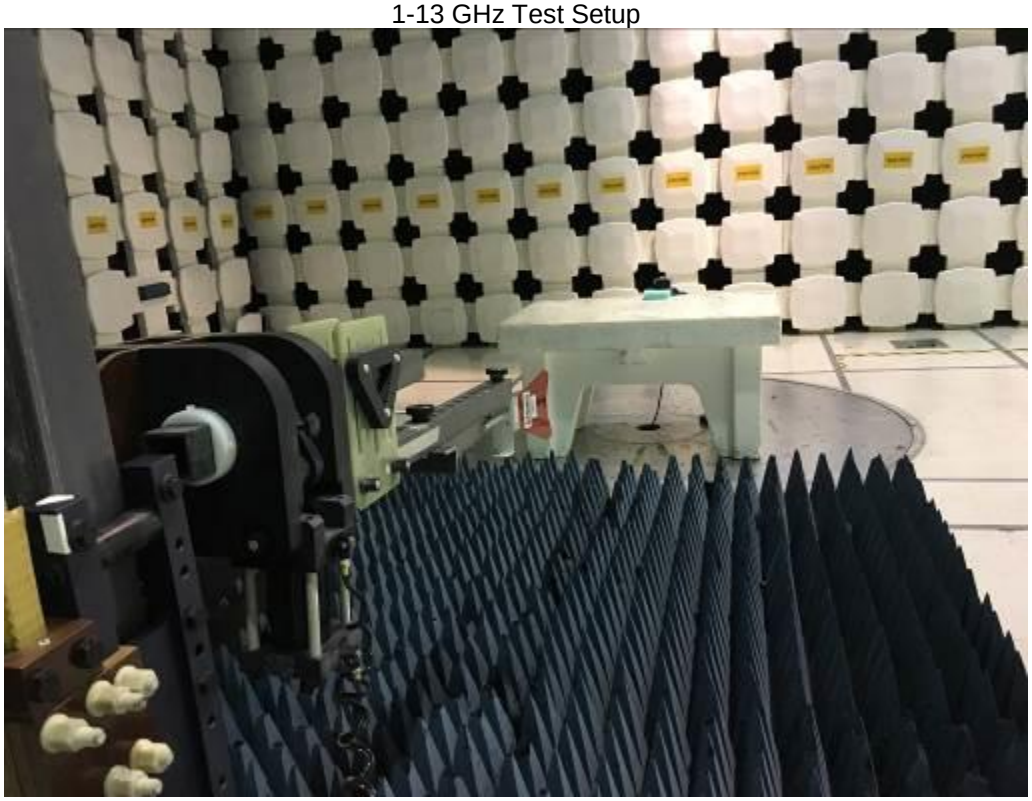
(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

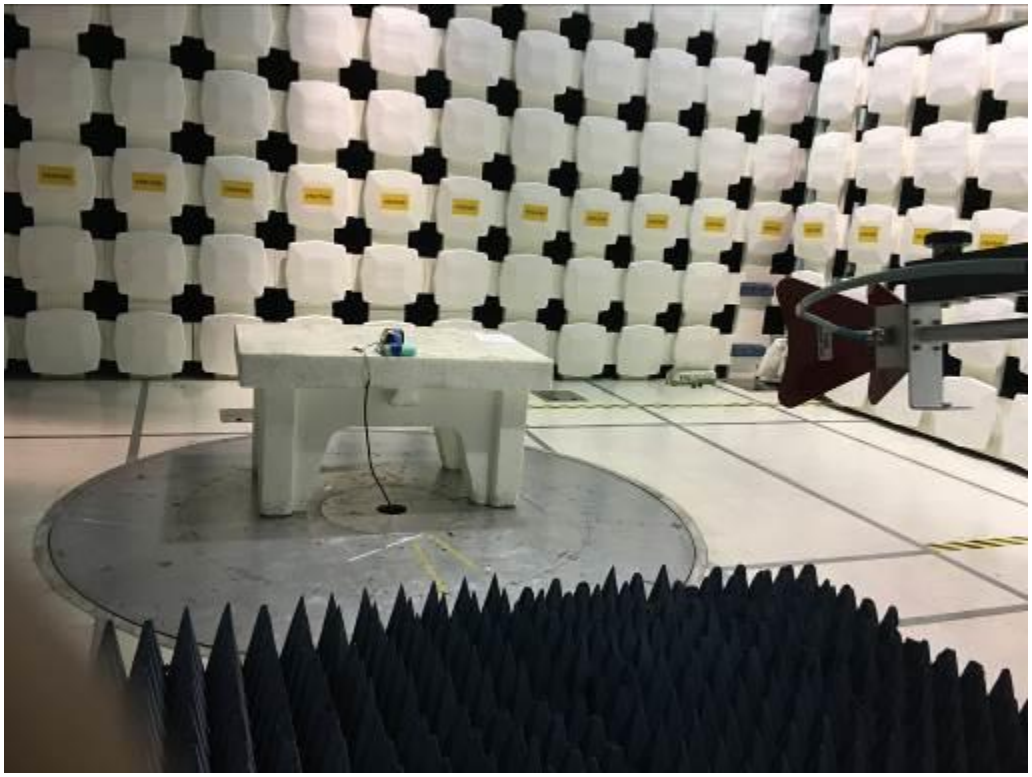
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

11.4 Setup Photographs:

30-1000 MHz Test Setup, device was USB powered

1-13 GHz Test Setup



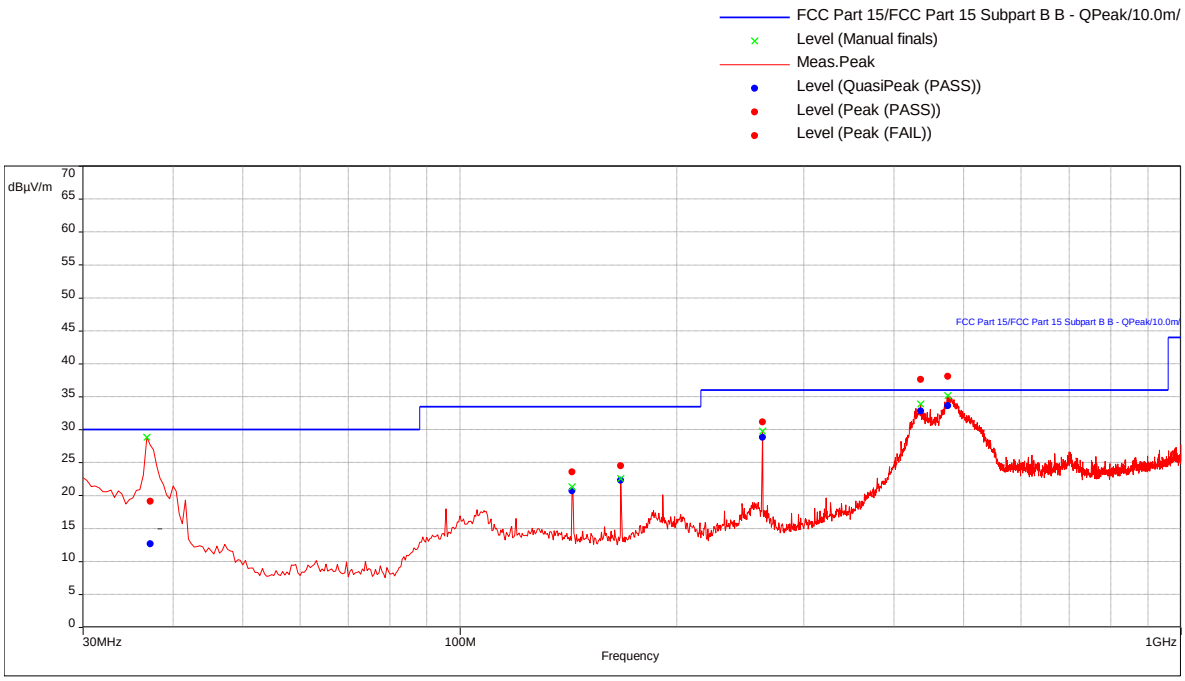


11.5 Plots/Data:

Test Information:

Date and Time	9/11/2018 8:40:02 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	23 deg C
Humidity	43%
Atmospheric Pressure	1010 mB
Comments	RE 30-1000MHz_120VAC 60Hz_Rx mode_Ferrite on power cable

Graph:



Results:

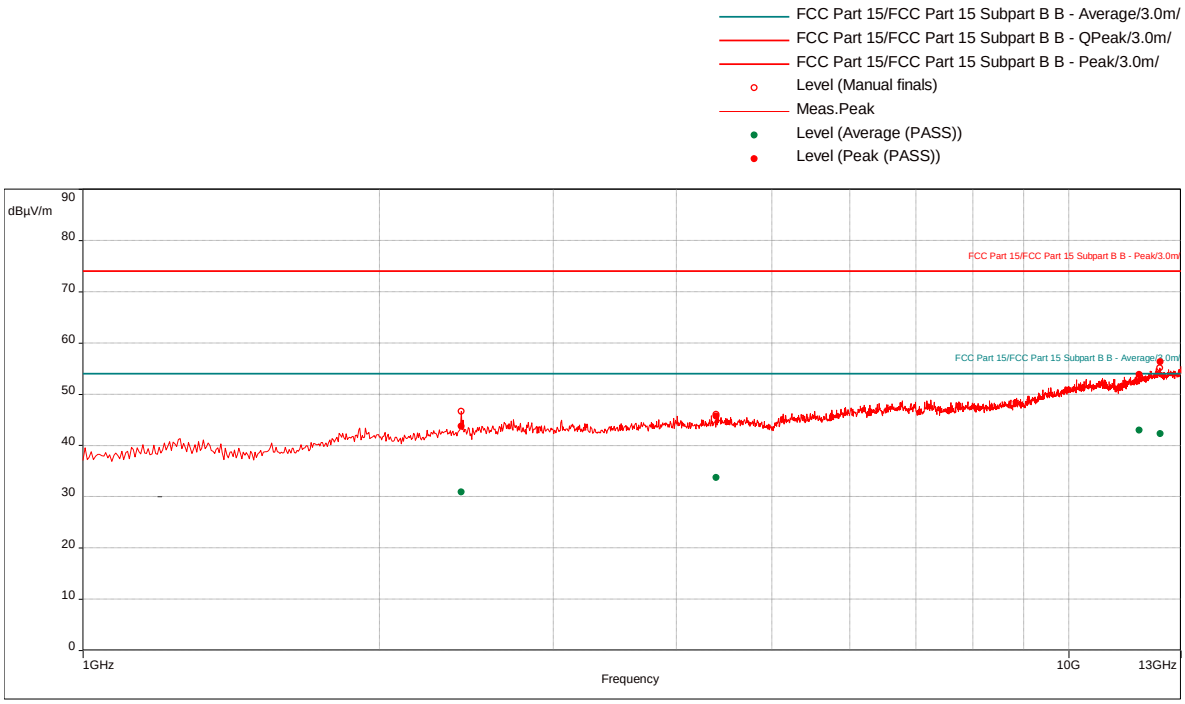
QuasiPeak (PASS) (6)

Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
37.08421053	30.00	-17.33	32.00	2.55	Vertical	120000.00	-27.20
143.3894737	33.50	-12.80	298.00	1.44	Vertical	120000.00	-29.96
167.2947368	33.50	-11.17	85.00	1.37	Vertical	120000.00	-30.45
262.8947368	36.00	-7.19	314.00	1.00	Vertical	120000.00	-28.97
435.5368421	36.00	-3.19	219.00	2.47	Horizontal	120000.00	-24.09
475.2631579	36.00	-2.40	224.00	1.96	Horizontal	120000.00	-23.04

Test Information:

Date and Time	9/11/2018 9:23:56 PM
Client and Project Number	Cooper Crouse Hinds_G103658032
Engineer	Vathana Ven
Temperature	23 deg C
Humidity	43%
Atmospheric Pressure	1010 mB
Comments	RE 1 to 13 GHz_120VAC 60Hz_Rx mode_Ferrite on power cables

Graph:



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
2419.473684	43.75	74.00	-30.25	320.00	1.00	Horizontal	1000000.00	4.54
4390.789474	45.65	74.00	-28.35	25.00	3.85	Vertical	1000000.00	7.67
11801.31579	53.84	74.00	-20.16	135.00	3.81	Vertical	1000000.00	18.42
12385.78947	56.28	74.00	-17.72	240.00	1.95	Vertical	1000000.00	19.24

Average (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
2419.473684	30.91	54.00	-23.09	320.00	1.00	Horizontal	1000000.00	4.54
4390.789474	33.68	54.00	-20.32	25.00	3.85	Vertical	1000000.00	7.67
11801.31579	42.95	54.00	-11.05	135.00	3.81	Vertical	1000000.00	18.42
12385.78947	42.26	54.00	-11.74	240.00	1.95	Vertical	1000000.00	19.24

Test Personnel:	Vathana Ven VSV	Test Date:	09/11/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 15 Subpart B, ICES-003	Limit Applied:	See report section 11.3
Input Voltage:	120VAC 60Hz	Ambient Temperature:	23 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	43 %
		Atmospheric Pressure:	1010 mbars

Deviations, Additions, or Exclusions: None

12 AC Mains Conducted Emissions

12.1 Method

Tests are performed in accordance with FCC Part 15B, ICES-003.

TEST SITE: EMC

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
AC Line Conducted Emissions	150 kHz - 30 MHz	2.8dB	3.4dB
Telco Port Emissions	150 kHz - 30 MHz	3.2dB	5.0dB

As shown in the table above our conducted emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculations

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN or ISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(49.1\ dB\mu V / 20)}$ = 285.1 μV/m

12.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
147275'	Signal Generator	Rohde & Schwarz	SML01	100931	04/13/2018	04/13/2019
CBL044'	15 ft BNC cable	Pomona	RG58	CBL044	04/26/2018	04/26/2019
ROS002'	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	08/08/2018	08/08/2019
TEL057'	Digital Multimeter	Fluke	87 III	74851042	06/14/2018	06/14/2019
LISN32'	LISN - CISPR16 Compliant 9kHz-30MHz	Com-Power	LI-215A	191955	05/03/2018	05/03/2019
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	12/07/2017	12/07/2018

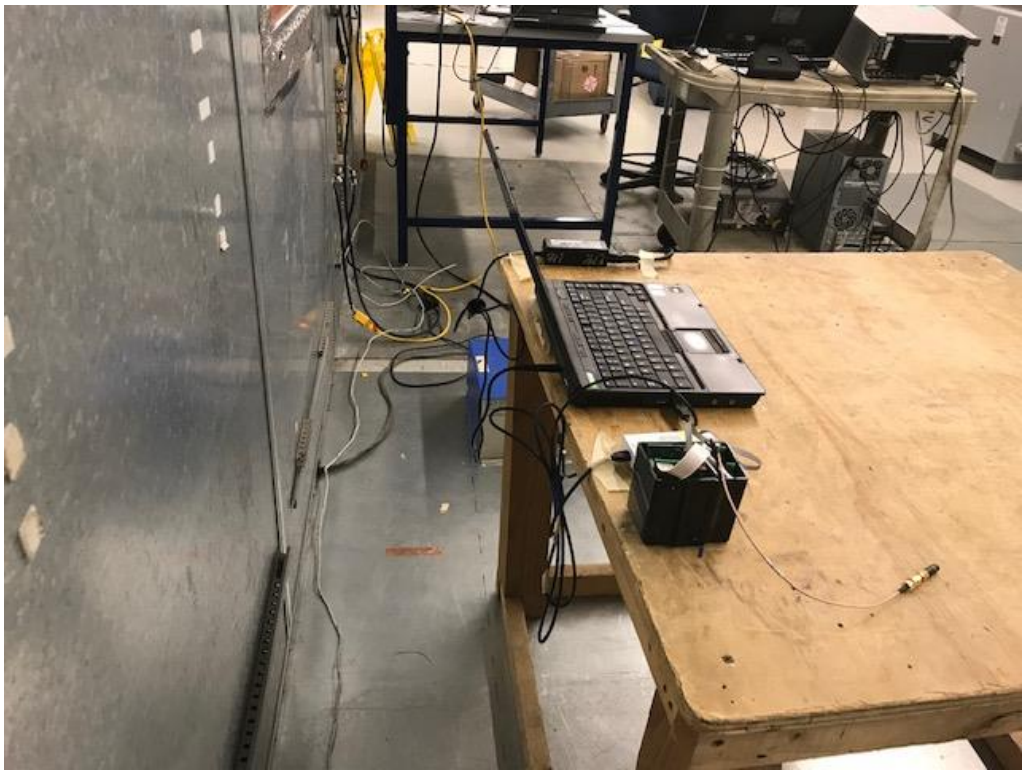
Software Utilized:

Name	Manufacturer	Version
C5 Emissions	TESEQ	5.26.46.46

12.3 Results:

The sample tested was found to Comply.

12.4 Setup Photographs:

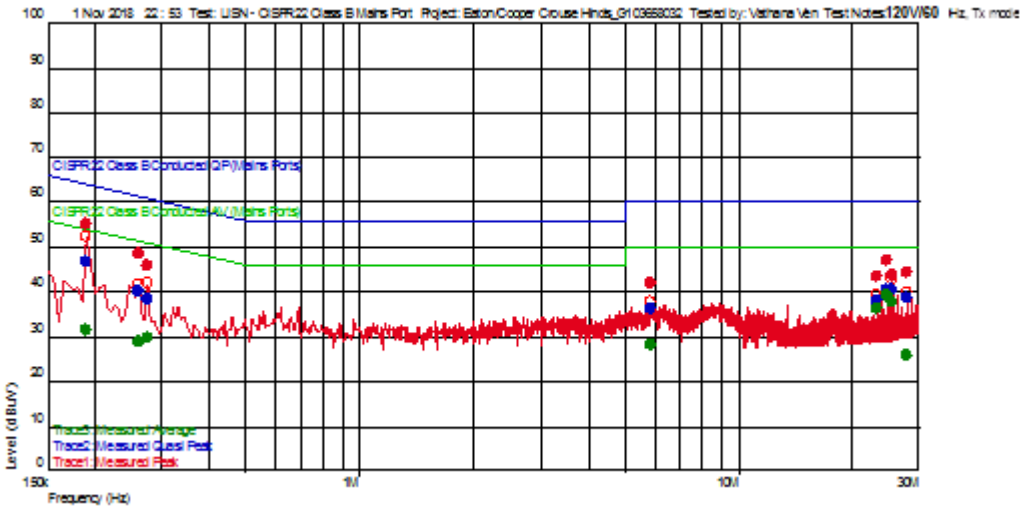


12.5 Plots/Data:

Test Information

Test Details	User Entry	Additional Information
Test:	LISN – FCC Part 15 Class B Mains Port	
Project:	Eaton/Cooper Crouse Hinds_G103658032	
Test Notes:	120VAC 60Hz, Tx mode	
Temperature:	20 deg C	
Humidity:	43%, 1002 mB	
Tested by:	Vathana Ven	
Test Started:	1 Nov 2018 22 : 53	

Prescan Emission Graph



- Measured Peak Value
- Measured Quasi Peak Value
- Measured Average Value
- Maximum Value of Mast and Turntable
- Swept Peak Data
- Swept Quasi Peak Data
- Swept Average Data

Emissions Test Data

Trace2: Measured Quasi Peak

Frequency(Hz)	Level(dBuV)	TF	PA+CL	Limit(dBuV)	Margin(dBuV)	RBW(Hz)	Comment	LINE
5.885 M	36.26	0.325	20.281	60.000	-23.74	9 k		L1
275.0 k	38.44	0.775	20.139	60.966	-22.52	9 k		L1
23.215 M	38.08	0.356	20.508	60.000	-21.92	9 k		L1
27.85 M	38.70	0.366	20.555	60.000	-21.30	9 k		N
260.0 k	40.23	0.856	20.138	61.431	-21.20	9 k		L1
24.76 M	40.36	0.360	20.524	60.000	-19.64	9 k		L1
25.535 M	40.51	0.361	20.531	60.000	-19.49	9 k		N
190.0 k	46.77	1.278	20.135	64.037	-17.26	9 k		N

Trace3: Measured Average

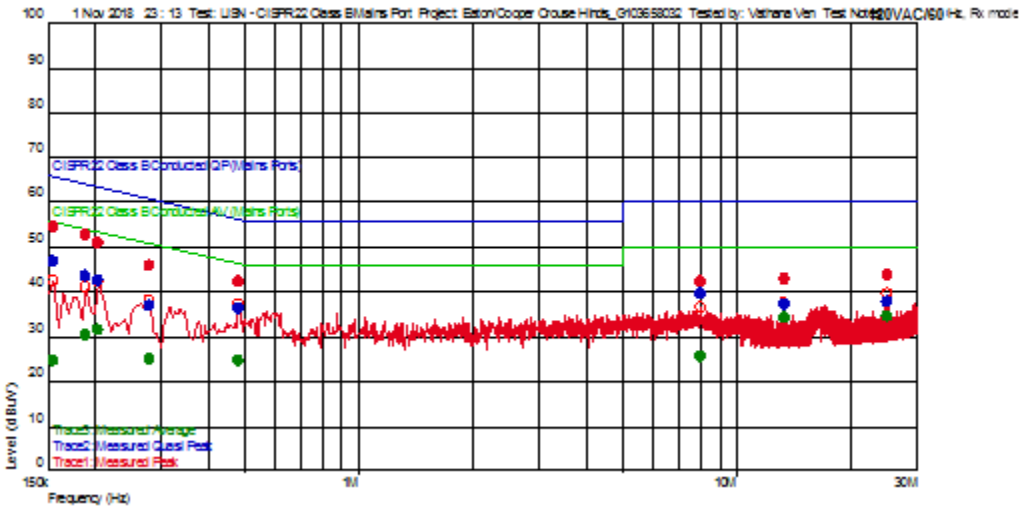
Frequency(Hz)	Level(dBuV)	TF	PA+CL	Limit(dBuV)	Margin(dBuV)	RBW(Hz)	Comment	LINE
27.85 M	25.83	0.366	20.555	50.000	-24.17	9 k		N
190.0 k	31.43	1.278	20.135	54.037	-22.60	9 k		N
260.0 k	28.86	0.856	20.138	51.431	-22.57	9 k		L1
5.885 M	28.24	0.325	20.281	50.000	-21.76	9 k		L1
275.0 k	29.67	0.775	20.139	50.966	-21.29	9 k		L1
23.215 M	36.18	0.356	20.508	50.000	-13.82	9 k		L1
25.535 M	37.83	0.361	20.531	50.000	-12.17	9 k		N
24.76 M	39.30	0.360	20.524	50.000	-10.70	9 k		L1

FCC and CISPR LIMITS identical

Test Information

Test Details	User Entry	Additional Information
Test:	LISN – FCC Part 15 Class B Mains Port	
Project:	Eaton/Cooper Crouse Hinds_G103658032	
Test Notes:	120VAC 60Hz, Rx mode	
Temperature:	20 deg C	
Humidity:	43%, 1002 mB	
Tested by:	Vathana Ven	
Test Started:	1 Nov 2018 23 : 13	

Prescan Emission Graph



Measured Peak Value
Measured Quasi Peak Value
Measured Average Value
Maximum Value of Mast and Turntable
Swept Peak Data
Swept Quasi Peak Data
Swept Average Data

Emissions Test Data

Trace2: Measured Quasi Peak

Frequency(Hz)	Level(dBuV)	TF	PA+CL	Limit(dBuV)	Margin(dBuV)	RBW(Hz)	Comment	LINE
280.0 k	36.94	0.748	20.139	60.816	-23.88	9 k		L1
13.4 M	37.05	0.350	20.408	60.000	-22.95	9 k		N
25.125 M	37.87	0.360	20.527	60.000	-22.13	9 k		L1
205.0 k	42.66	1.153	20.135	63.405	-20.75	9 k		N
190.0 k	43.53	1.278	20.135	64.037	-20.50	9 k		N
8.045 M	39.51	0.338	20.329	60.000	-20.49	9 k		N
480.0 k	36.37	0.508	20.149	56.339	-19.97	9 k		L1
155.0 k	46.69	1.621	20.133	65.728	-19.03	9 k		N

Trace3: Measured Average

Frequency(Hz)	Level(dBuV)	TF	PA+CL	Limit(dBuV)	Margin(dBuV)	RBW(Hz)	Comment	LINE
155.0 k	24.71	1.621	20.133	55.728	-31.01	9 k		N
280.0 k	24.91	0.748	20.139	50.816	-25.91	9 k		L1
8.045 M	25.66	0.338	20.329	50.000	-24.34	9 k		N
190.0 k	30.23	1.278	20.135	54.037	-23.80	9 k		N
205.0 k	31.64	1.153	20.135	53.405	-21.77	9 k		N
480.0 k	24.74	0.508	20.149	46.339	-21.60	9 k		L1
13.4 M	34.25	0.350	20.408	50.000	-15.75	9 k		N
25.125 M	34.36	0.360	20.527	50.000	-15.64	9 k		L1

FCC and CISPR LIMITS identical

Test Personnel:	Vathana Ven VSV	Test Date:	11/01/2018
Supervising/Reviewing Engineer: (Where Applicable)			
Product Standard:	FCC Part 15B ICES-003	Limit Applied:	Class B
Input Voltage:	120V0AC 60Hz	Ambient Temperature:	20 ºC
Pretest Verification w/ Ambient Signals or BB Source:	**Yes**	Relative Humidity:	43 %
		Atmospheric Pressure:	1002 mbars

Deviations, Additions, or Exclusions: None

13 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	11/16/2018	103658032BOX-002	VFV	MFM	Original Issue