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TEST REPORT

SCOPE OF WORK
EMC TESTING – IDD

REPORT NUMBER
103511832BOX-012a

ISSUE DATE
20 August 2018

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DOCUMENT CONTROL NUMBER
Non-Specific Radio Report Shell Rev. December 2017

EMISSIONS TEST REPORT

(FULL COMPLIANCE)

Report Number: 103511832BOX-012a
Project Number: G103511832

Report Issue Date: 08/20/2018

Model(s) Tested: IDD
Model(s) Partially Tested: None
Model(s) Not Tested but declared equivalent by the client: None

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:
Becton Dickinson and Company
200 Bulfinch Drive
Andover, MA 01810
USA

Report prepared by

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
--	AC Mains Conducted Emissions FCC 47CFR Part 15.107: 06/2018 ICES-003 Issue 6 Published: January 2016 Updated: April 2017	N/A*
12	Revision History	--

Notes: Not applicable as the EUT powers from internal battery with no connection to AC mains.

3 Client Information

This EUT was tested at the request of:

Client: Becton Dickinson and Company
200 Bulfinch Drive
Andover, MA 01810
USA

Contact: Mr. Renold Rodrigues
Telephone: 1.978.901.7294
Fax: None provided
Email: renold.rodrigues@bd.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Becton Dickinson and Company
200 Bulfinch Drive
Andover, MA 01810
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Insulin Delivery Device (IDD)	Becton Dickinson and Company	IDD	1628

Receive Date:	07/17/2018
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
The BD Swatch Insulin Delivery System (Swatch) is intended for the continuous subcutaneous delivery of insulin, at set and variable rates, for the management of Type 2 diabetes mellitus in patients requiring insulin. Swatch delivers insulin to the fat under the skin for up to 3 days. Unlike injections, insulin given in this way is similar to how your pancreas delivers insulin normally. A small dose of insulin is delivered throughout the day, while also allowing you to easily and discreetly give yourself more insulin when needed before meals. You will work with your Healthcare Provider (HCP) to adjust the insulin doses to meet your specific needs. Swatch has **2** main components: • The Insulin Delivery Device (IDD), which delivers insulin. • The wireless Remote, which can program the IDD. The IDD can be worn on the body for up to three days. It is designed to be worn during all your activities. The IDD precisely pumps insulin from its internal reservoir once filled.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
Battery 3V (IDD)	N/A	N/A	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Pre-programmed to transmit at Low, Mid, and High channels

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	Pre-programmed using Hyper Terminal
2	Special Software referenced in section equipment under test for EMC test

Radio/Receiver Characteristics	
Frequency Band(s)	2402-2480 MHz
Modulation Type(s)	GFSK
Maximum Output Power	Low Channel (2402 MHz): -9.9 dBm Mid Channel (2442 MHz): -9.9 dBm High Channel (2480 MHz): -9.7 dBm
Test Channels	Low Channel (2402 MHz) Mid Channel (2442 MHz) High Channel (2480 MHz)
Occupied Bandwidth	Low Channel (2402 MHz): 1.228 MHz Mid Channel (2442 MHz): 1.228 MHz High Channel (2480 MHz): 1.208 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)	1
Equipment Type	Standalone
ETSI LBT/Adaptivity	Non-Adaptive
ETSI Adaptivity Type	N/A
ETSI Temperature Category (I, II, III)	N/A
ETSI Receiver Category (1, 2, 3)	3
Antenna Type and Gain	Integrated, -0.91 dBi

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
--	None	--	--	--	--

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None	--	--	--

5.1 Method:

Configuration as required by Configuration as required by FCC Part 15 Subpart C 15.247: 02/2018, FCC Part 15 Subpart B: 02/2018, RSS 247 Issue 2: 02/2017, ICES 003 Issue 6: 01/2016 updated 06/2016, ANSI C 63.10: 2013 and ANSI C 63.4: 2014.

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:

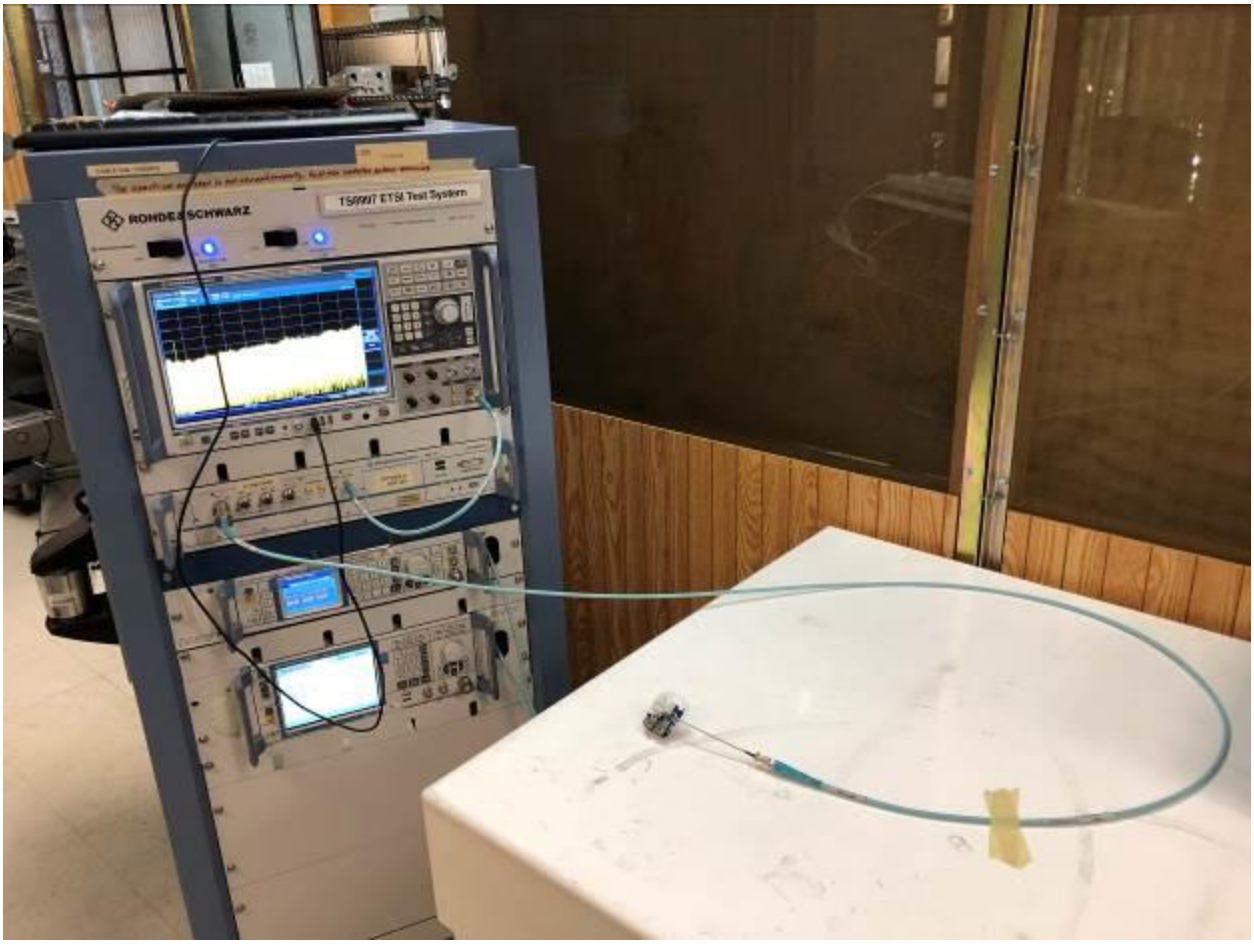
Name	Manufacturer	Version
R&S EMC32/AMS32/WMS32	Rohde & Schwarz	10.30.00

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

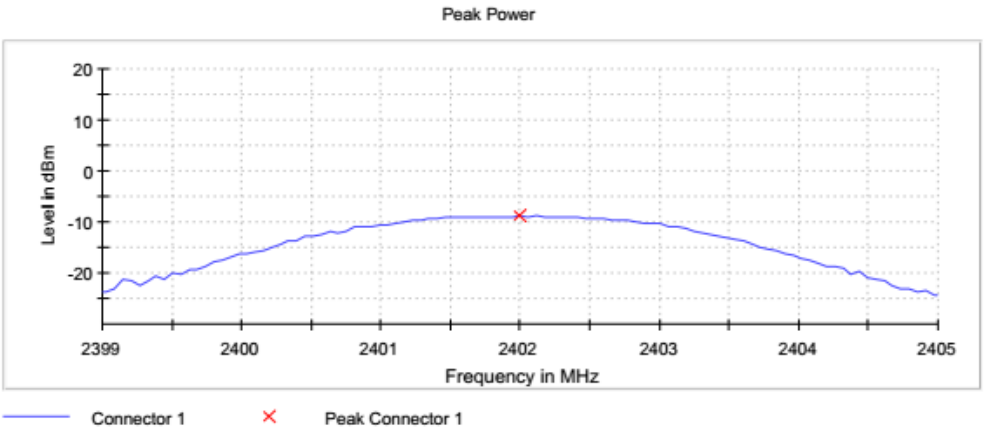
Peak output power (Sweep) (2402 MHz; 30.000 dBm; 1 MHz)

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

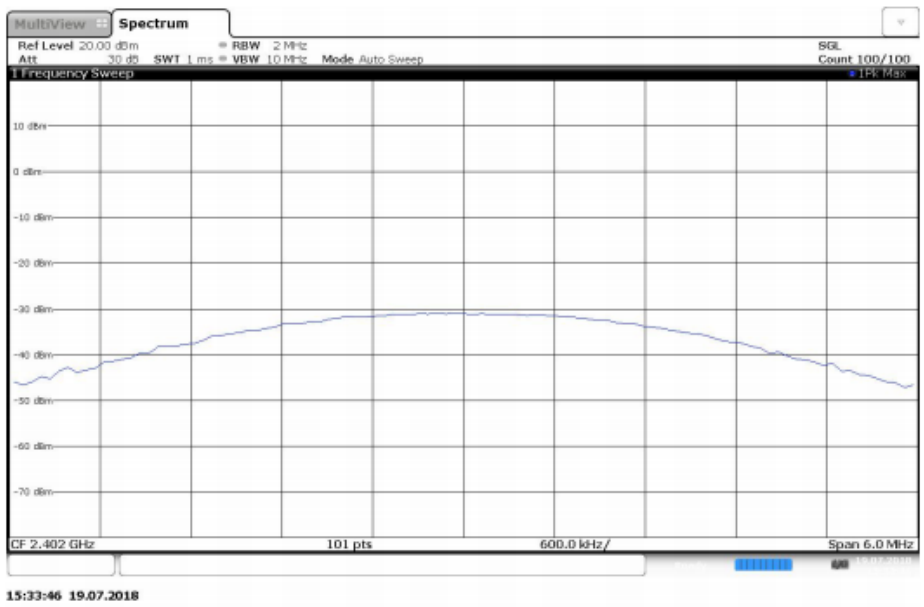
Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2402.000000	-8.8	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

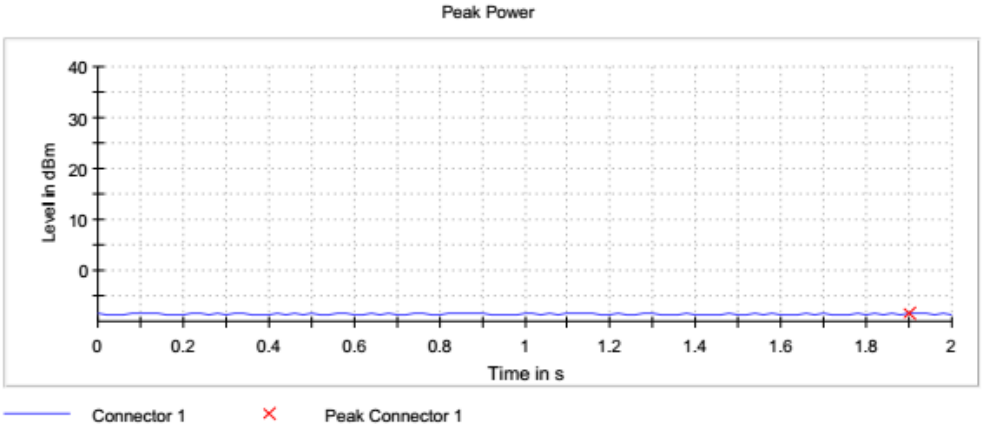
Peak output power (ZeroSpan) (2402 MHz; 30.000 dBm; 1 MHz)

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
2402.000000	-8.4	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 (2402 MHz; 30.000 dBm; 1 MHz)

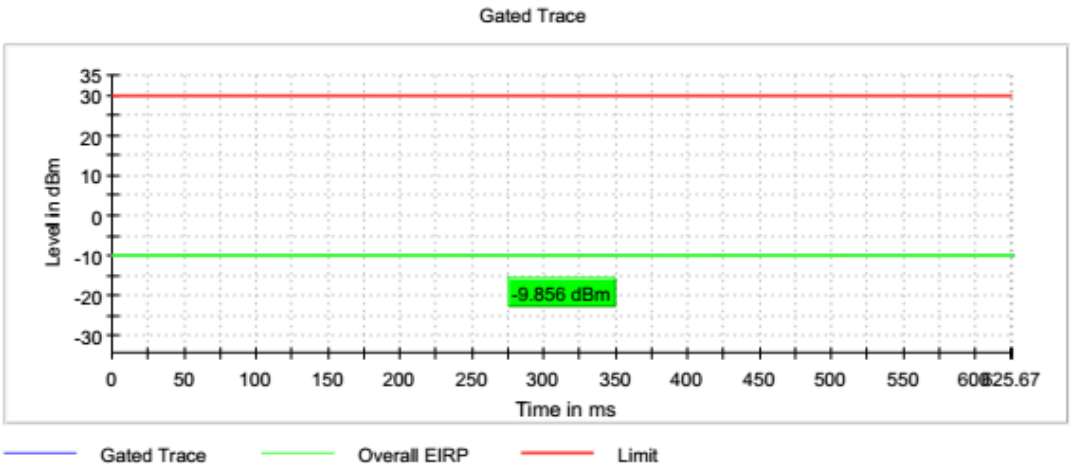
Max level (-9.3 dBm) over 20.0 dB lower then nominal power level.

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
2402.000000	-9.9	30.0	-9.9	62.607	PASS



FCC Part 47 §15.247 2400-2483.5 MHz 2016

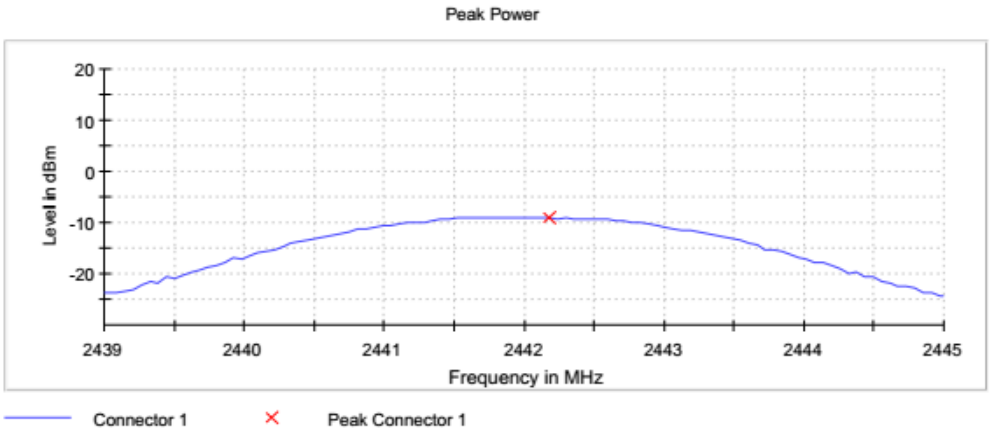
Peak output power (Sweep) (2442 MHz; 30.000 dBm; 1 MHz)

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

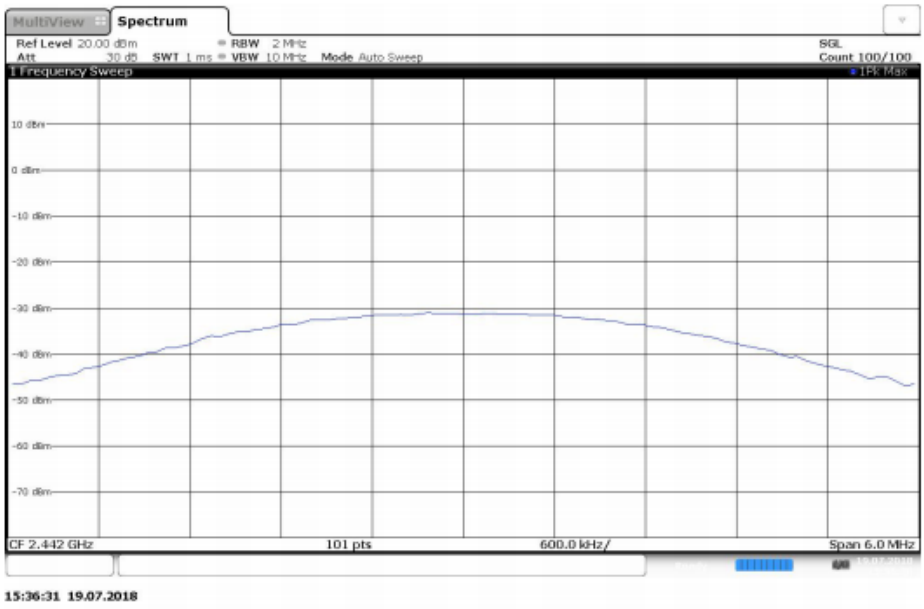
Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2442.000000	-9.0	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

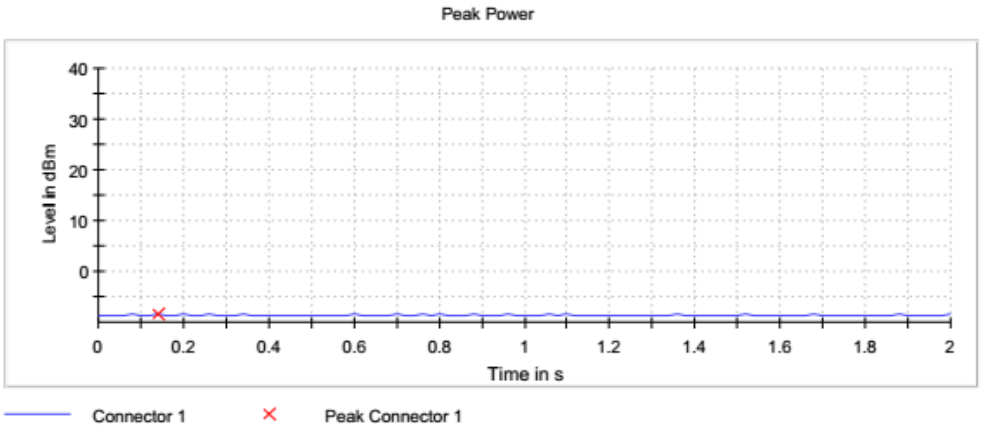
Peak output power (ZeroSpan) (2442 MHz; 30.000 dBm; 1 MHz)

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

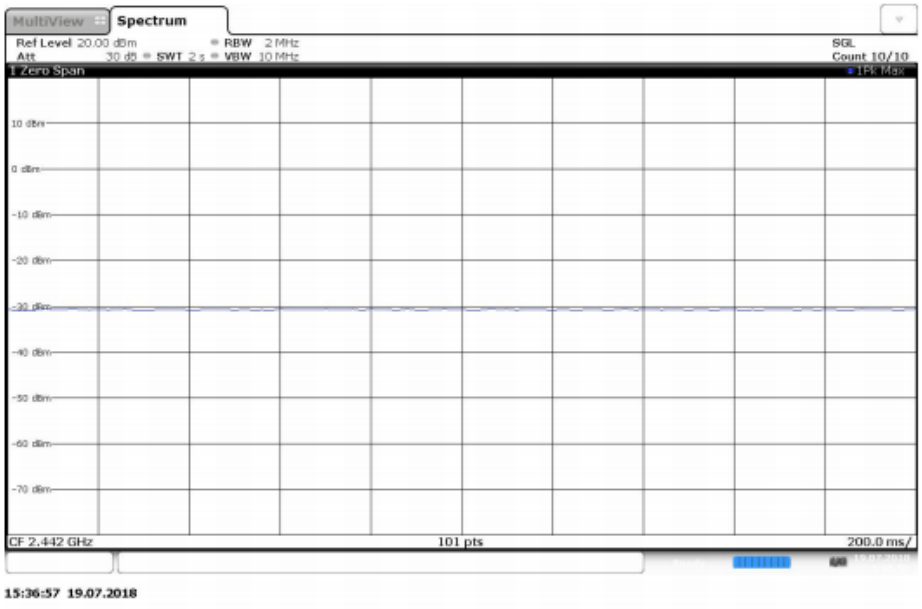
Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2442.000000	-8.5	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 (2442 MHz; 30.000 dBm; 1 MHz)

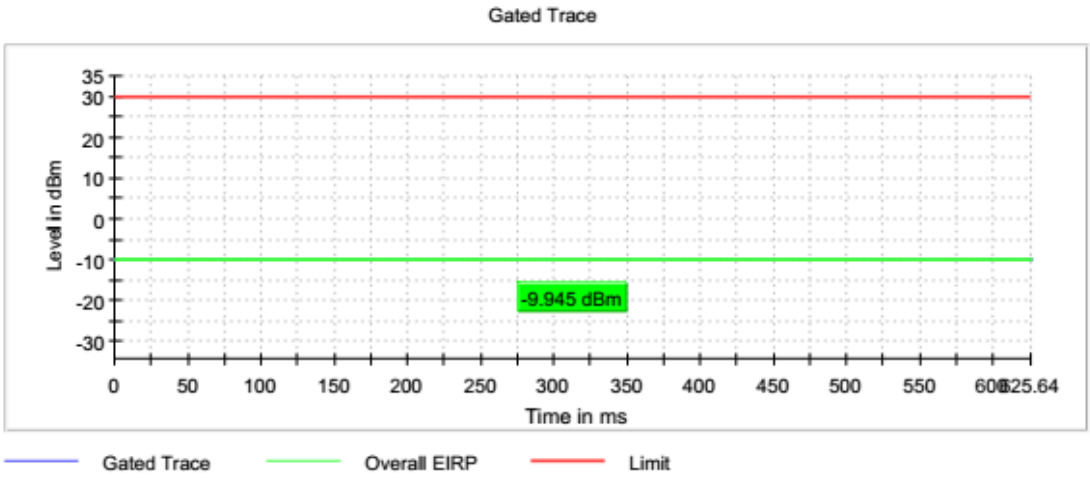
Max level (-9.3 dBm) over 20.0 dB lower then nominal power level.

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
2442.000000	-9.9	30.0	-9.9	62.605	PASS



FCC Part 47 §15.247 2400-2483.5 MHz 2016

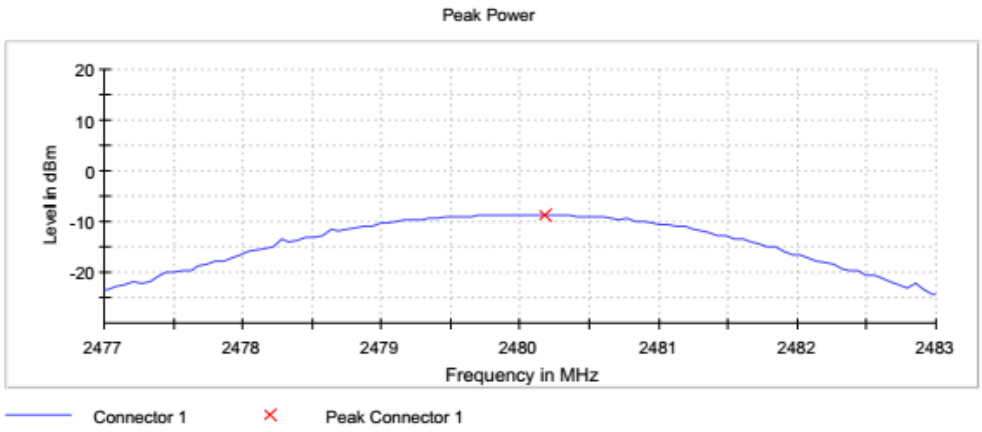
Peak output power (Sweep) (2480 MHz; 30.000 dBm; 1 MHz)

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

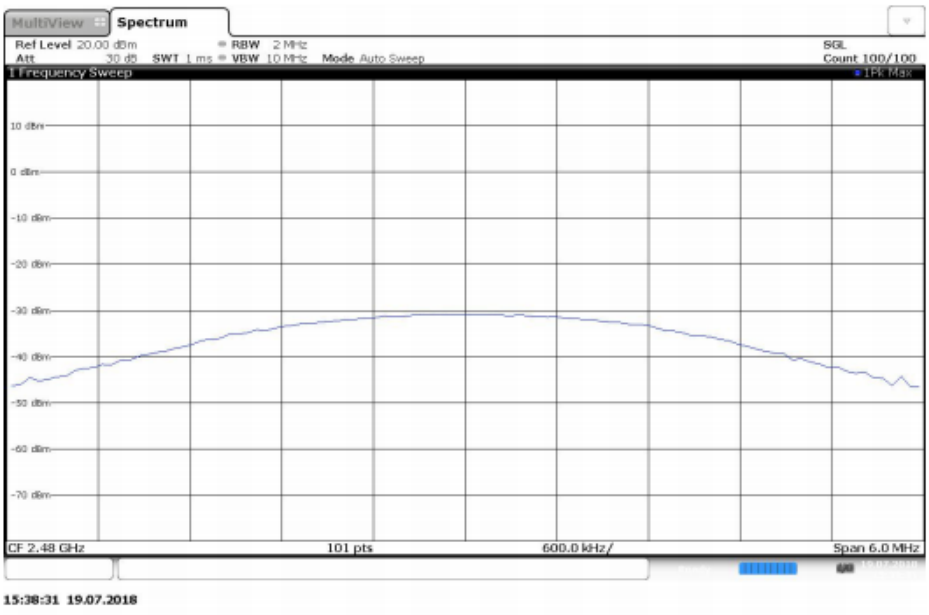
Result

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2480.000000	-8.6	30.0	PASS

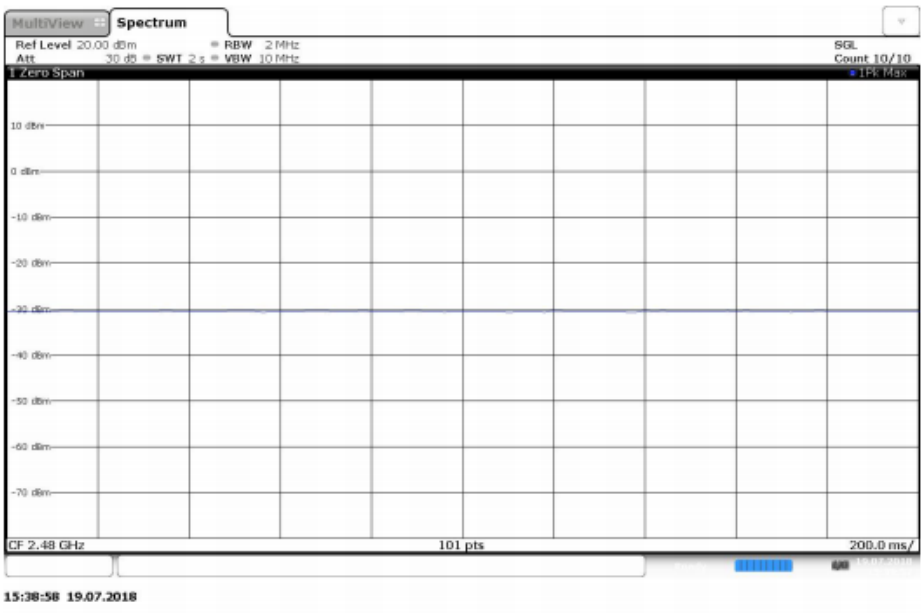


Peak Power 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

RF output power (2480 MHz; 30.000 dBm; 1 MHz)

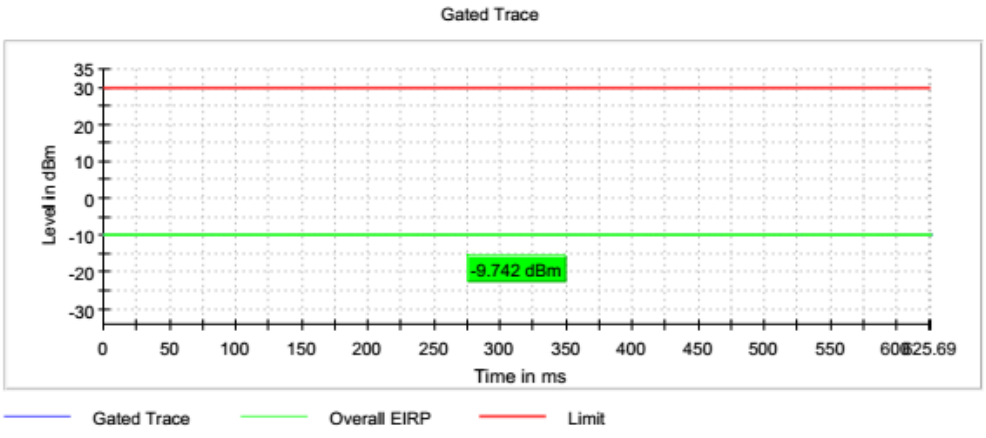
Max level (-9.1 dBm) over 20.0 dB lower then nominal power level.

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
2480.000000	-9.7	30.0	-9.7	62.610	PASS



SAR Exemption Calculation

Maximum Conducted Output Power of Transmitter = -9.36dBm = 0.12 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

= (0.12/5)*(sqrt(2.480))

= 0.04 < 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 0.12 mW @ 2480 MHz is less than 2 mW limit specified at 3500 MHz, device meets SAR exclusion.

Test Personnel:	Kouma Sinn KPS	Test Date:	07/19/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247, RSS-102	Limit Applied:	See report section 6.3
Input Voltage:	Internal Battery Powered		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	25 ºC
		Relative Humidity:	32 %
		Atmospheric Pressure:	1008 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

Minimum Emission Bandwidth 6 dB (2402 MHz; 30.000 dBm; 1 MHz)

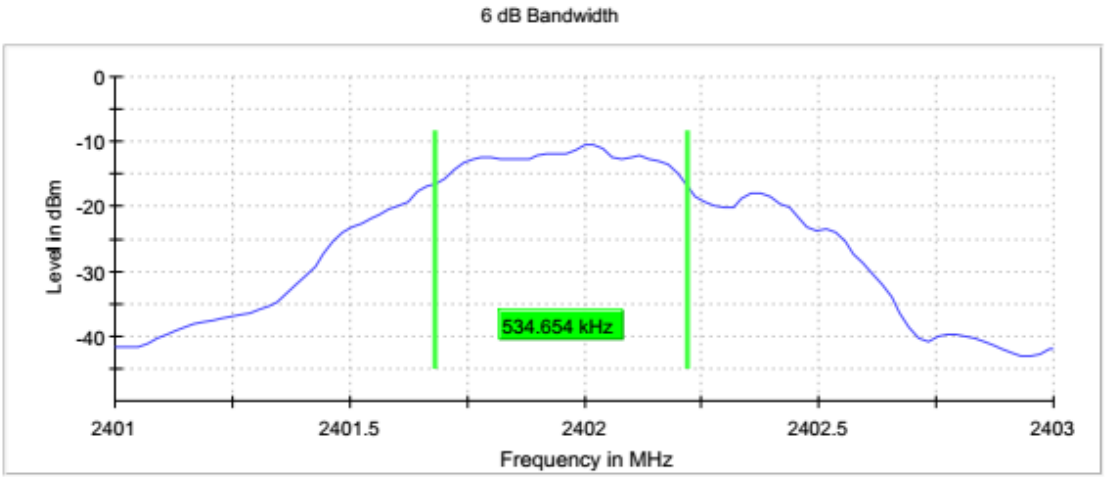
Max level (-10.4 dBm) more than 25.0 dB below the nominal power level.

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%

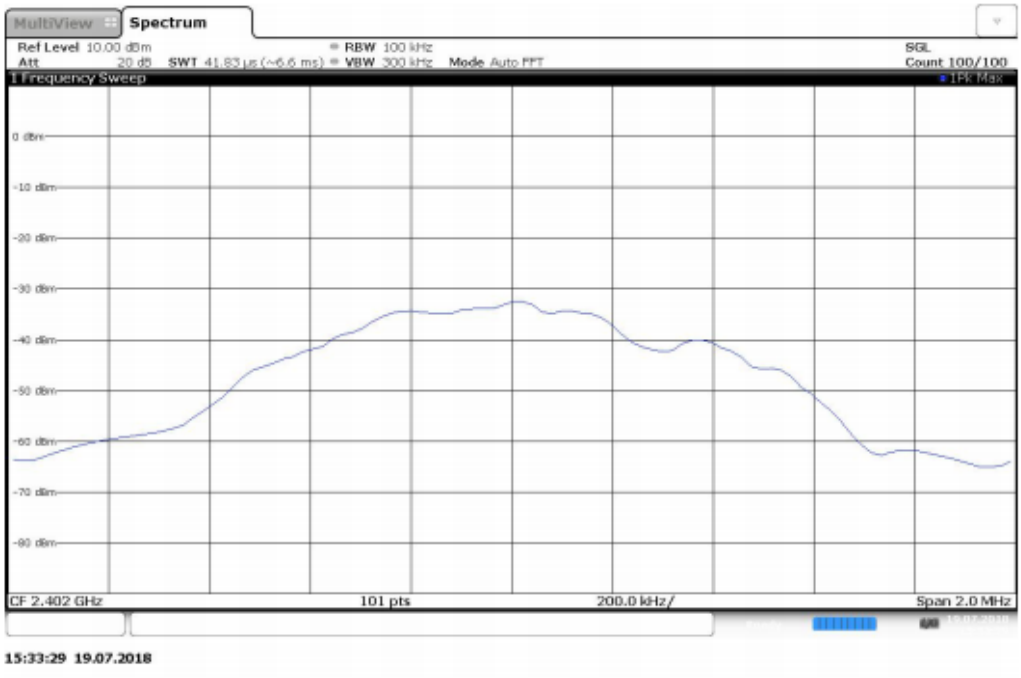
6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2402.000000	0.534654	0.500000	---	2401.683168	2402.217822	-10.4	PASS



Bandwidth

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

Minimum Emission Bandwidth 6 dB (2442 MHz; 30.000 dBm; 1 MHz)

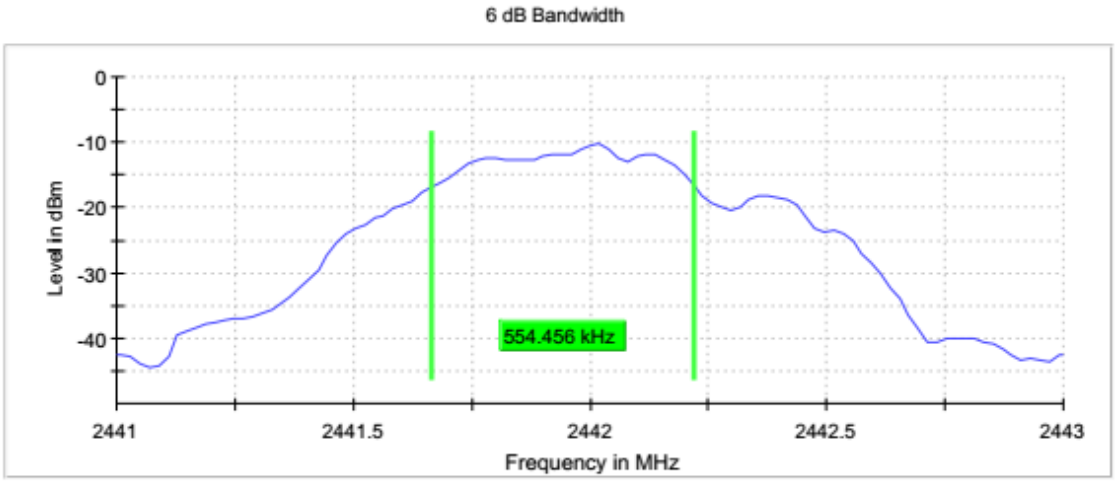
Max level (-10.3 dBm) more than 25.0 dB below the nominal power level.

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%

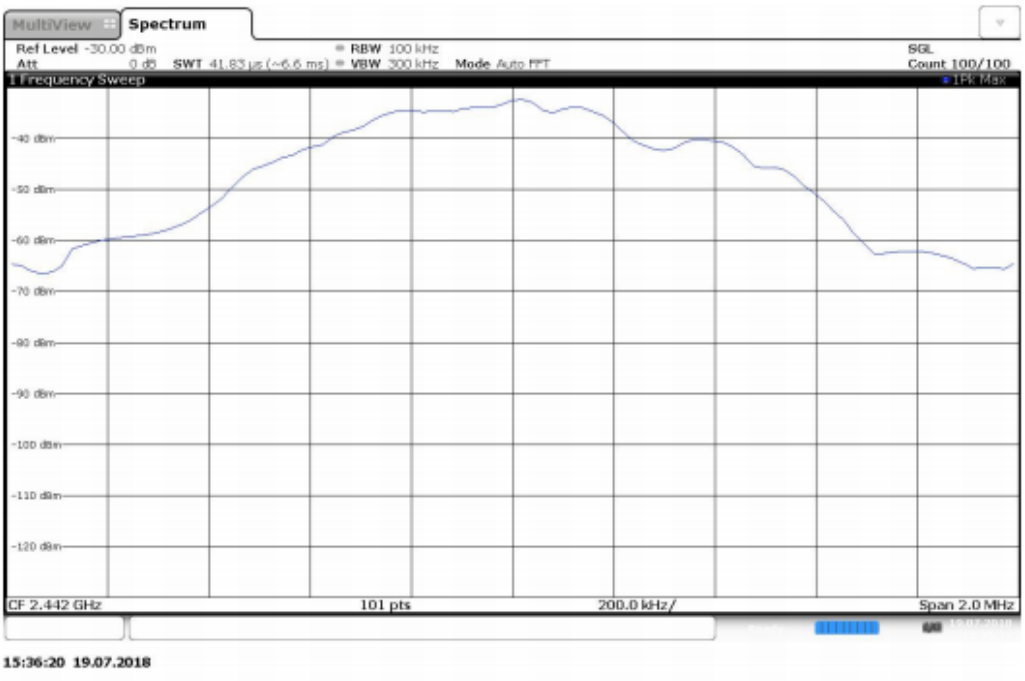
6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2442.000000	0.554456	0.500000	---	2441.663366	2442.217822	-10.3	PASS



Bandwidth

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

Minimum Emission Bandwidth 6 dB (2480 MHz; 30.000 dBm; 1 MHz)

Max level (-10.3 dBm) more than 25.0 dB below the nominal power level.

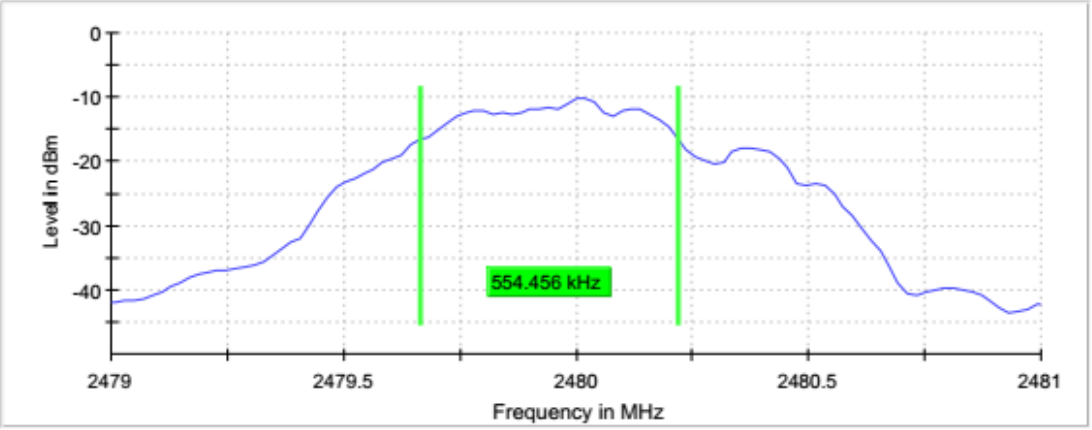
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

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

6 dB Bandwidth

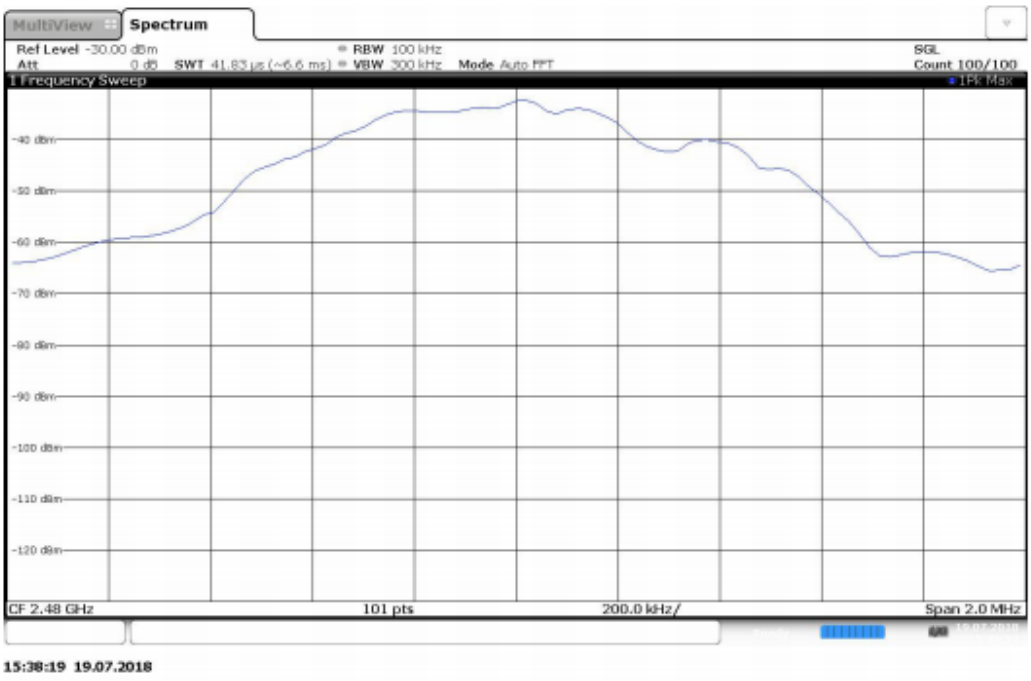
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2480.000000	0.554456	0.500000	---	2479.663366	2480.217822	-10.3	PASS

6 dB Bandwidth



Bandwidth

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

Emission Bandwidth 20 dB (2402 MHz; 30.000 dBm; 1 MHz)

Max level (-10.4 dBm) more than 25.0 dB below the nominal power level.

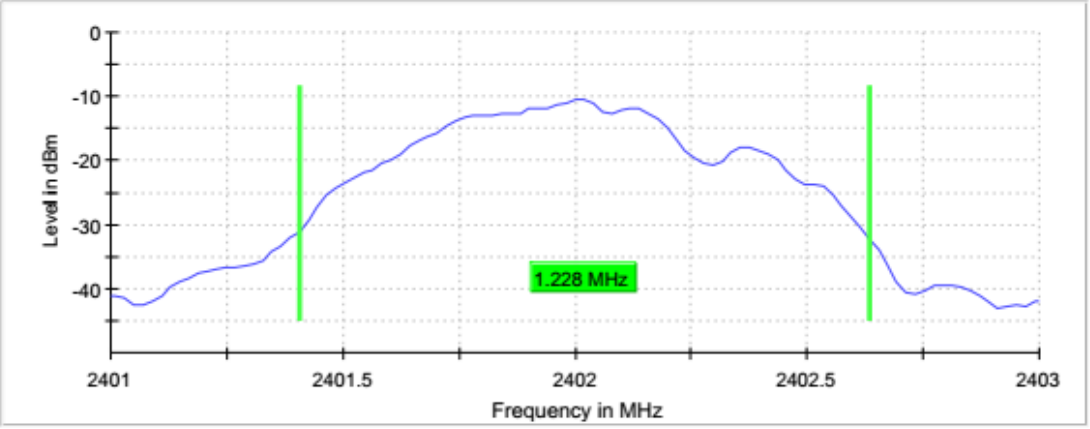
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

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

20 dB Bandwidth

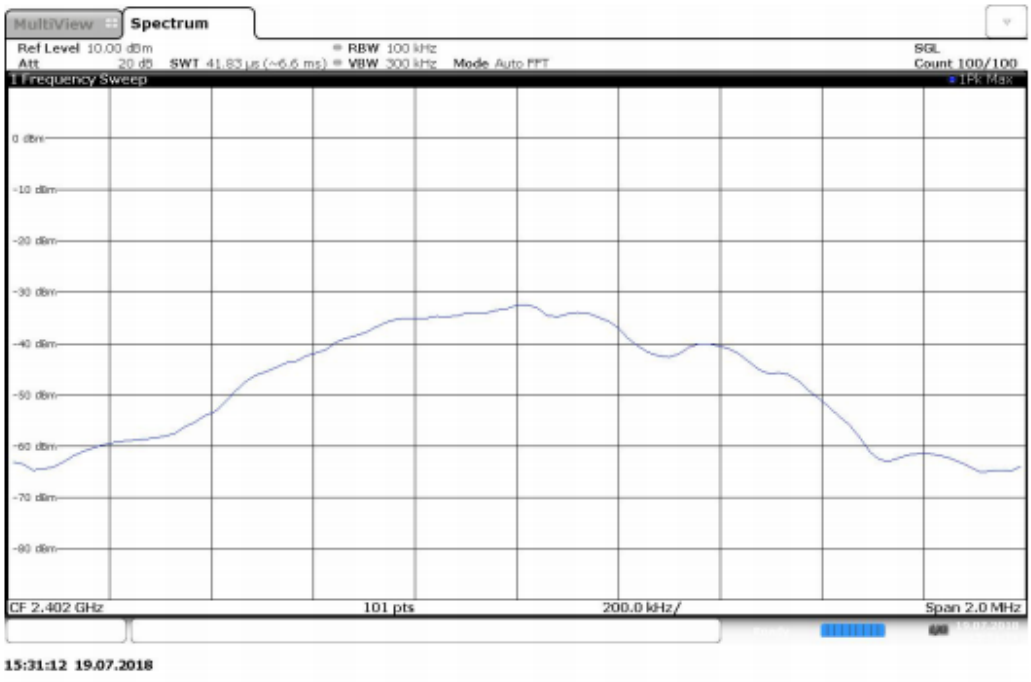
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2402.000000	1.227722	---	---	2401.405941	2402.633663	-10.4	PASS

20 dB Bandwidth



Bandwidth

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

Emission Bandwidth 20 dB (2442 MHz; 30.000 dBm; 1 MHz)

Max level (-10.3 dBm) more than 25.0 dB below the nominal power level.

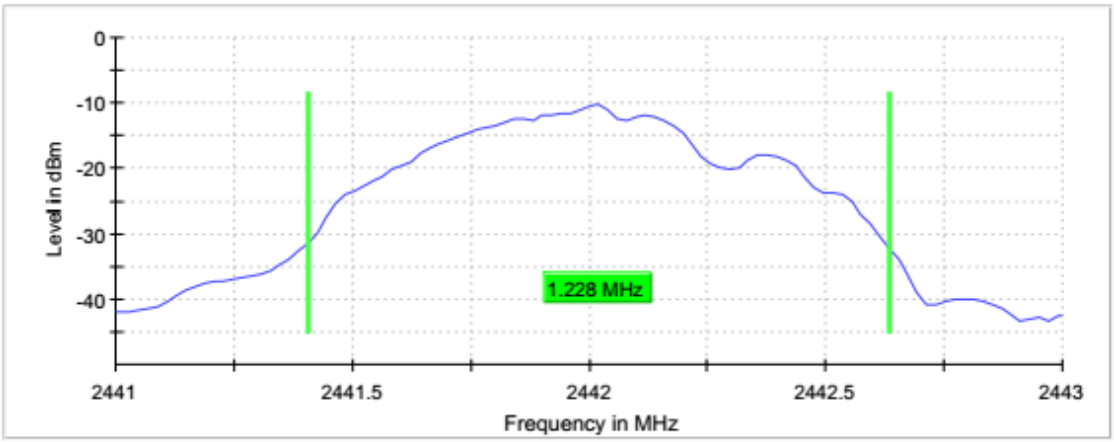
Test according to FCC title 47 part 15 §15.247(a), KDB 558074 D01 DTS Meas Guidance v03r05 and ANSI C63.10

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

20 dB Bandwidth

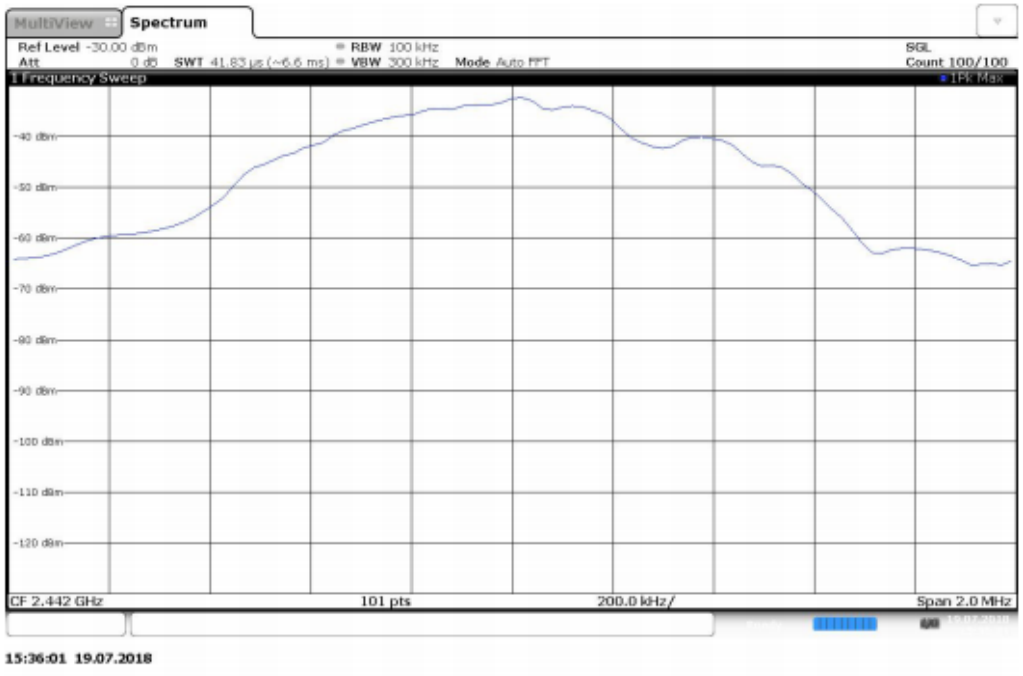
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2442.000000	1.227722	---	---	2441.405941	2442.633663	-10.3	PASS

20 dB Bandwidth



Bandwidth

FCC Part 47 §15.247 2400-2483.5 MHz 2016



FCC Part 47 §15.247 2400-2483.5 MHz 2016

Emission Bandwidth 20 dB (2480 MHz; 30.000 dBm; 1 MHz)

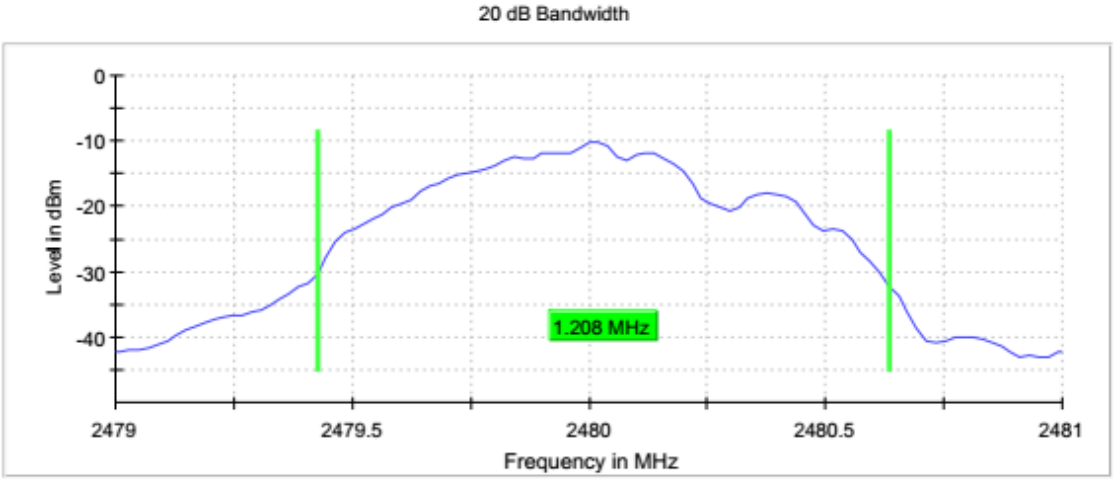
Max level (-10.3 dBm) more than 25.0 dB below the nominal power level.

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%

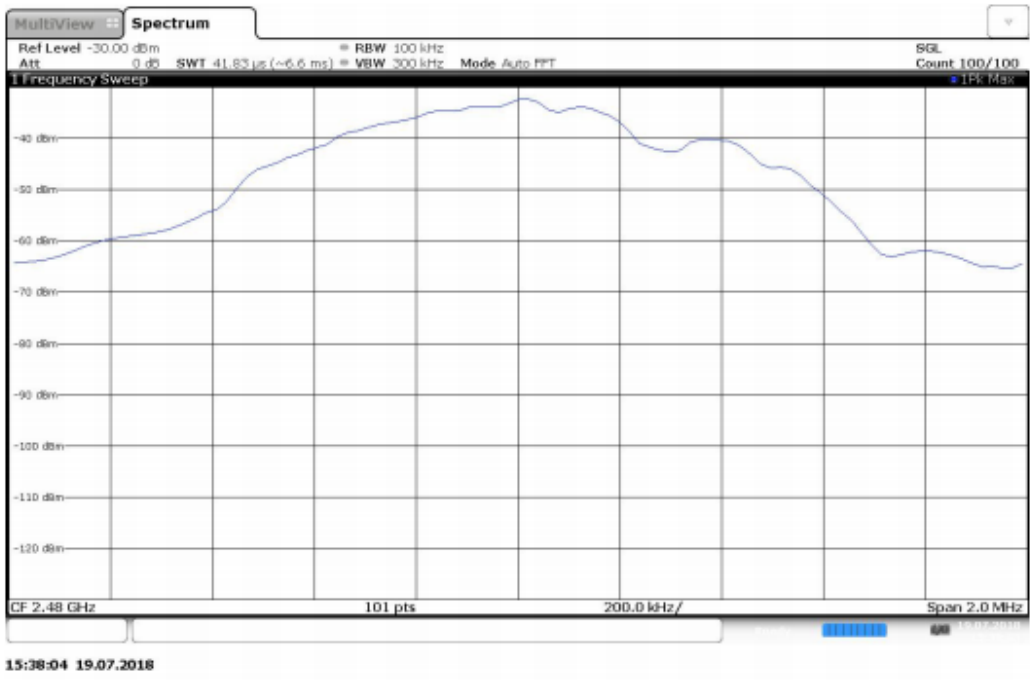
20 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2480.000000	1.207920	---	---	2479.425743	2480.633663	-10.3	PASS



Bandwidth

FCC Part 47 §15.247 2400-2483.5 MHz 2016



Test Personnel:	Kouma Sinn KPS	Test Date:	07/19/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247, RSS-102	Limit Applied:	See report section 7.3
Input Voltage:	Internal Battery Powered		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	25 ºC
		Relative Humidity:	32 %
		Atmospheric Pressure:	1008 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 (2402 MHz; 30.000 dBm; 1 MHz)

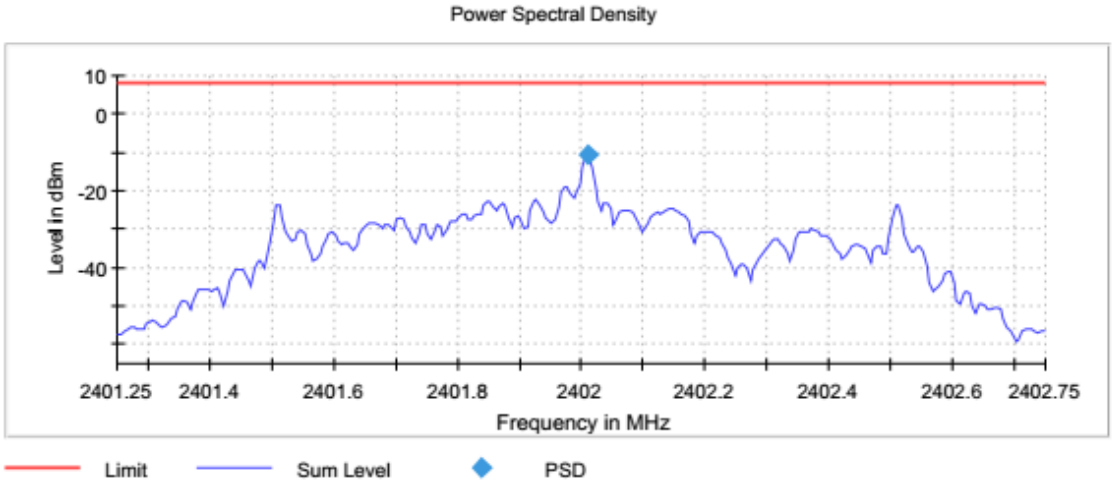
Max level of analyzer (-10.5 dBm) more than 35.0 dB below the nominal power level.

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

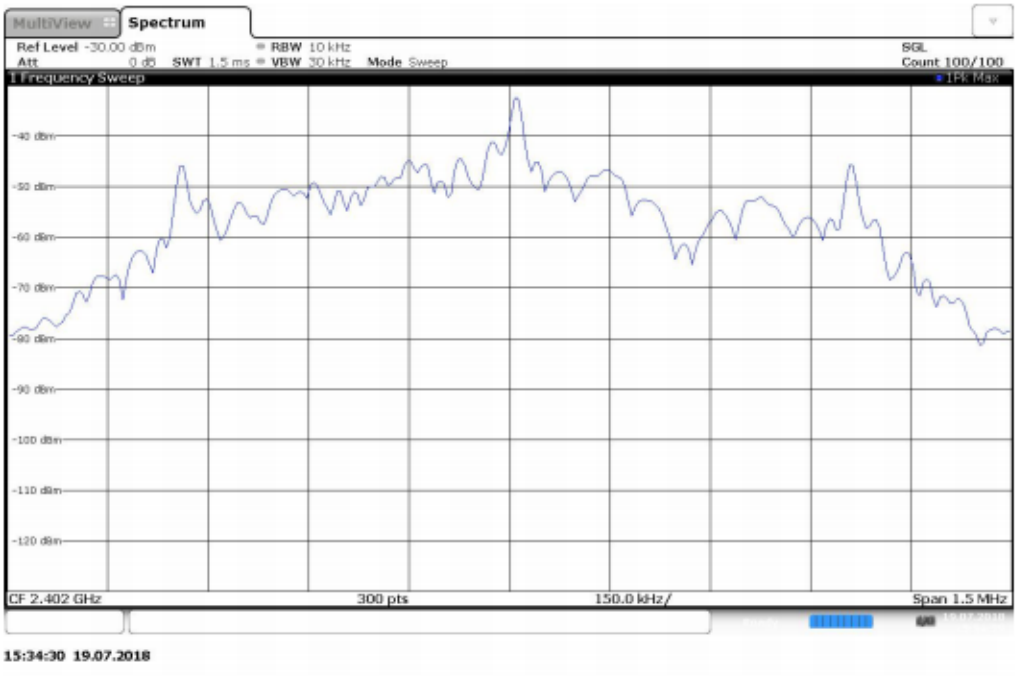
Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2402.012500	-10.464	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 (2402 MHz; 30.000 dBm; 1 MHz)

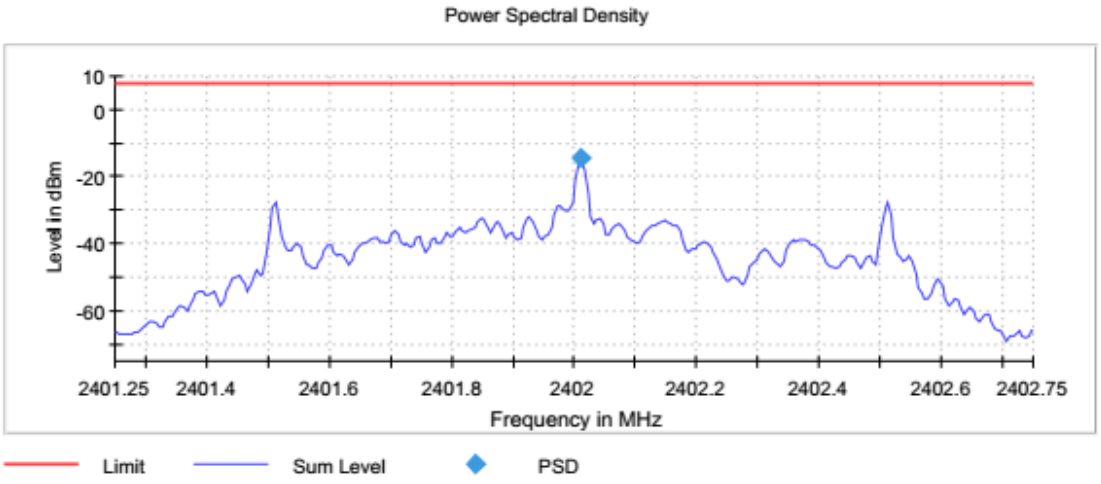
Max level of analyzer (-14.6 dBm) more than 35.0 dB below the nominal power level.

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

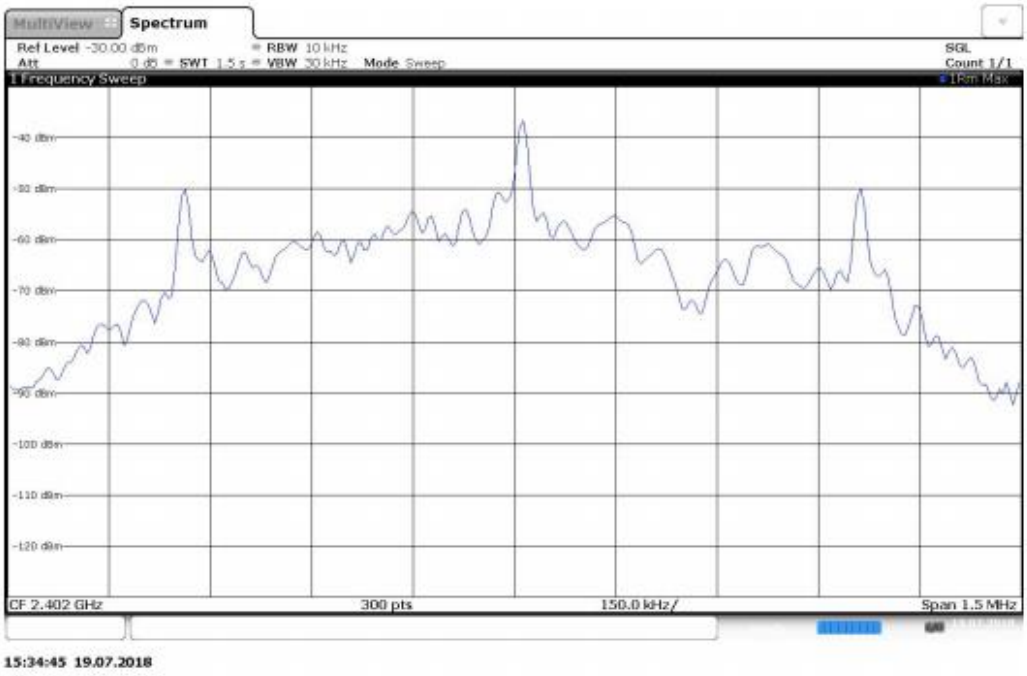
Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2402.000000	2402.012500	-14.564	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 (2442 MHz; 30.000 dBm; 1 MHz)

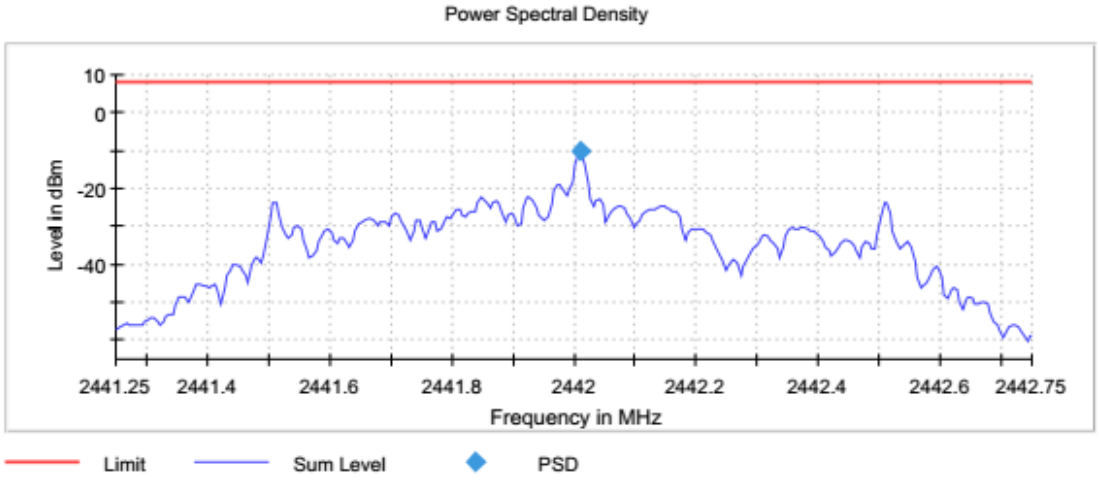
Max level of analyzer (-10.3 dBm) more than 35.0 dB below the nominal power level.

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

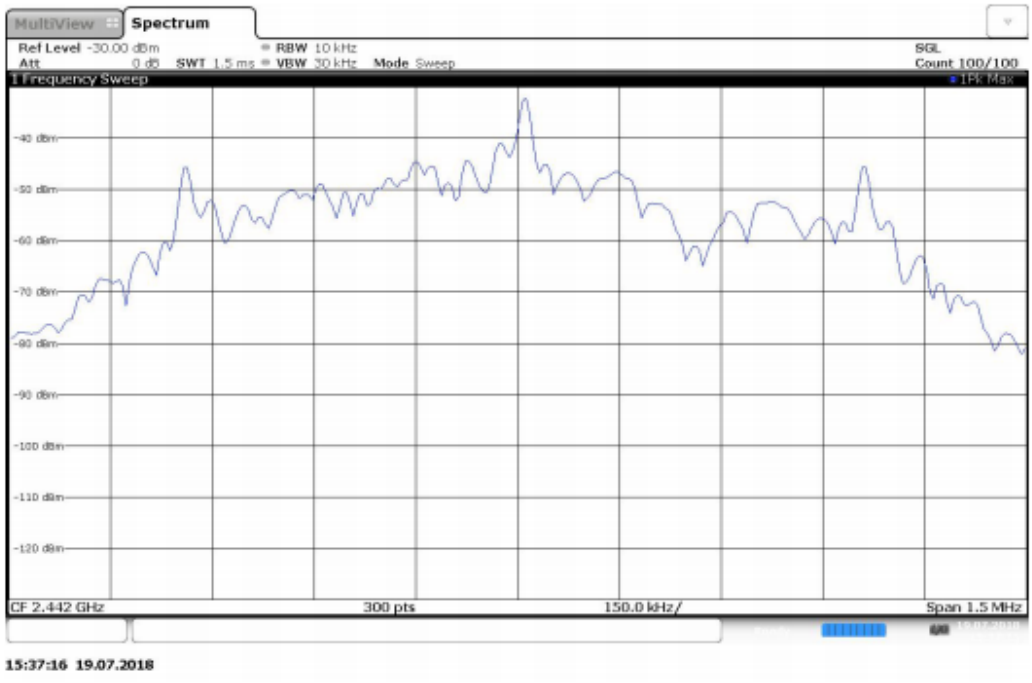
Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2442.000000	2442.012500	-10.298	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 (2442 MHz; 30.000 dBm; 1 MHz)

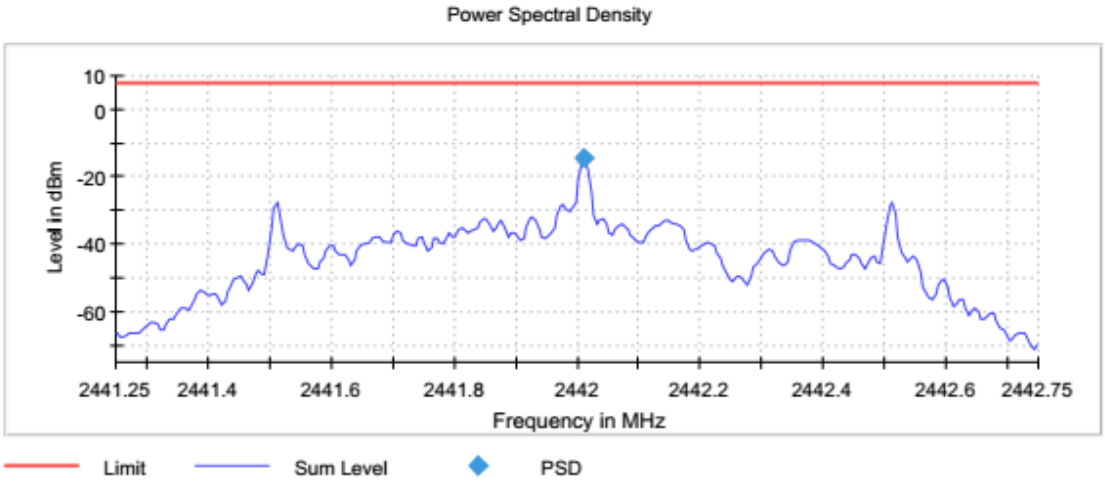
Max level of analyzer (-14.3 dBm) more than 35.0 dB below the nominal power level.

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

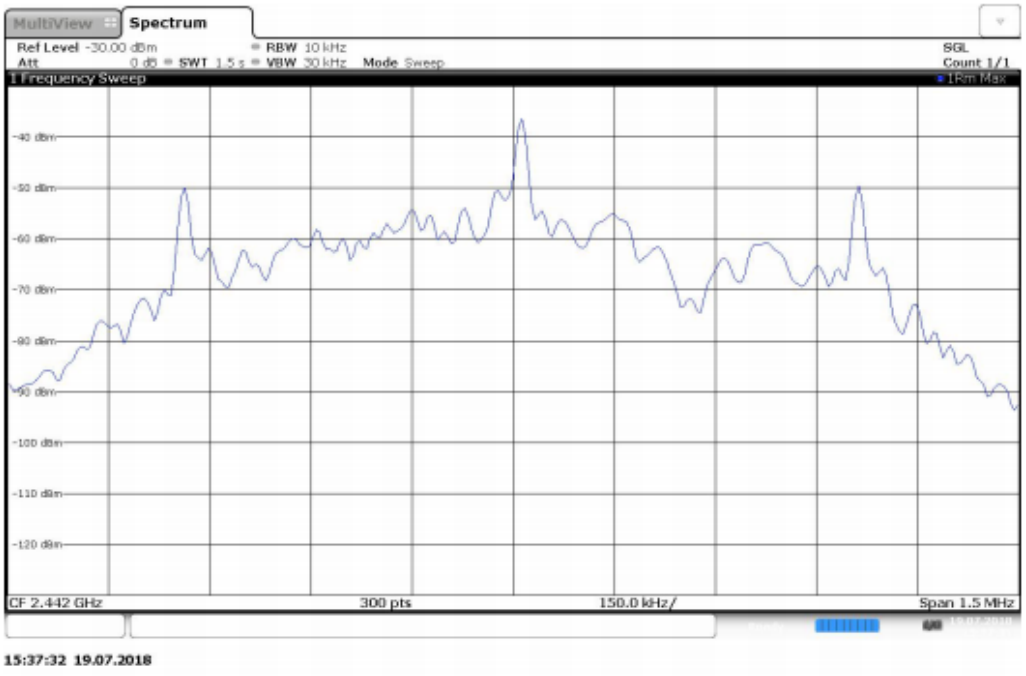
Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2442.000000	2442.012500	-14.350	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 (2480 MHz; 30.000 dBm; 1 MHz)

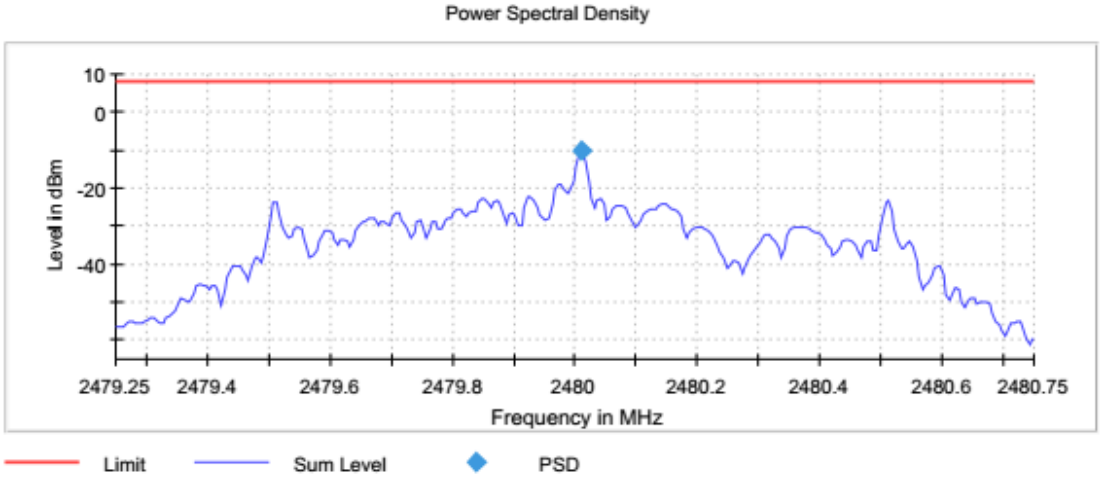
Max level of analyzer (-10.3 dBm) more than 35.0 dB below the nominal power level.

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

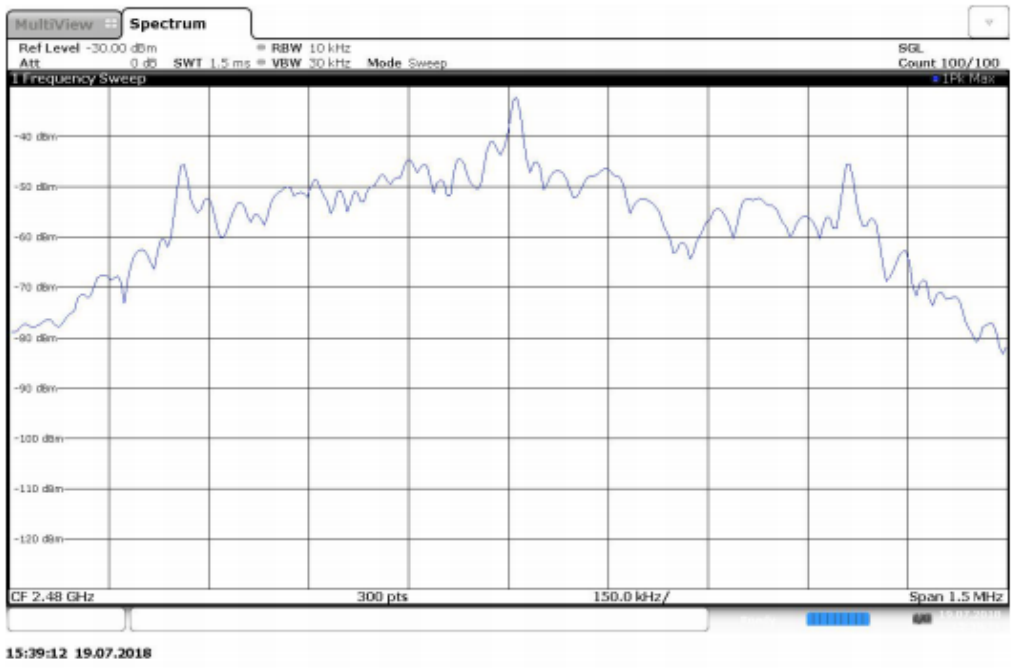
Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2480.000000	2480.012500	-10.280	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 (2480 MHz; 30.000 dBm; 1 MHz)

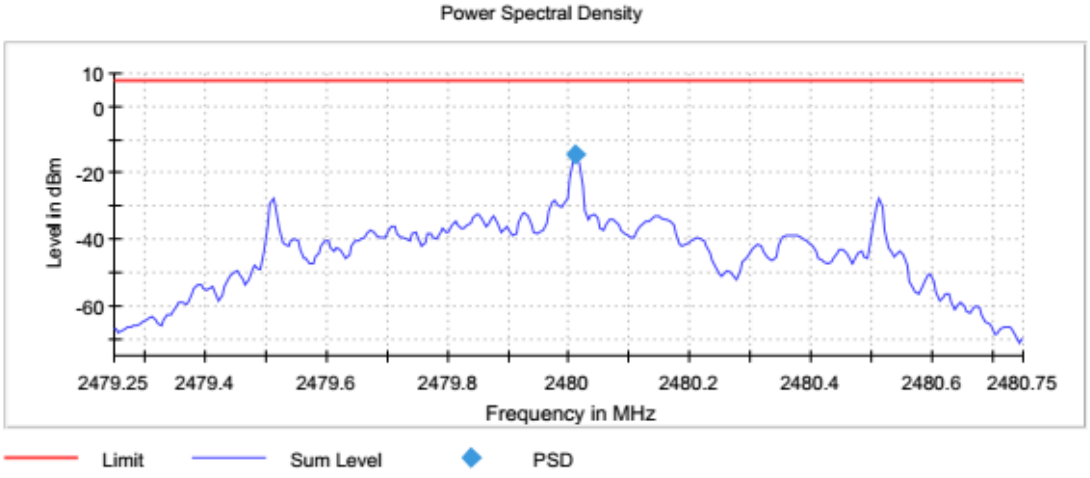
Max level of analyzer (-14.3 dBm) more than 35.0 dB below the nominal power level.

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

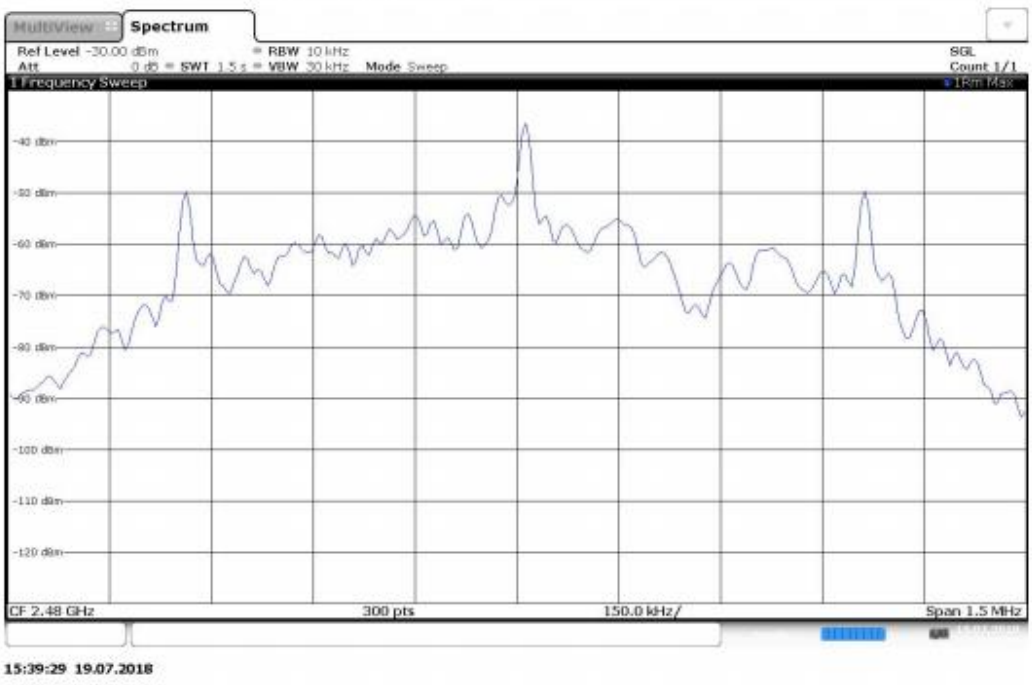
Result

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2480.000000	2480.012500	-14.295	8.0	PASS



PSD Connector 1

FCC Part 47 §15.247 2400-2483.5 MHz 2016



Test Personnel:	Kouma Sinn KPS	Test Date:	07/19/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247, RSS-102	Limit Applied:	See report section 8.3
Input Voltage:	Internal Battery Powered		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	25 ºC
		Relative Humidity:	32 %
		Atmospheric Pressure:	1008 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:

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
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

Name	Manufacturer	Version
EMI Boxborough.xls	Intertek	08/27/2010

Note: Your Laptop may use a different version of Excel. Record the version you actually used!

9.3 Results:

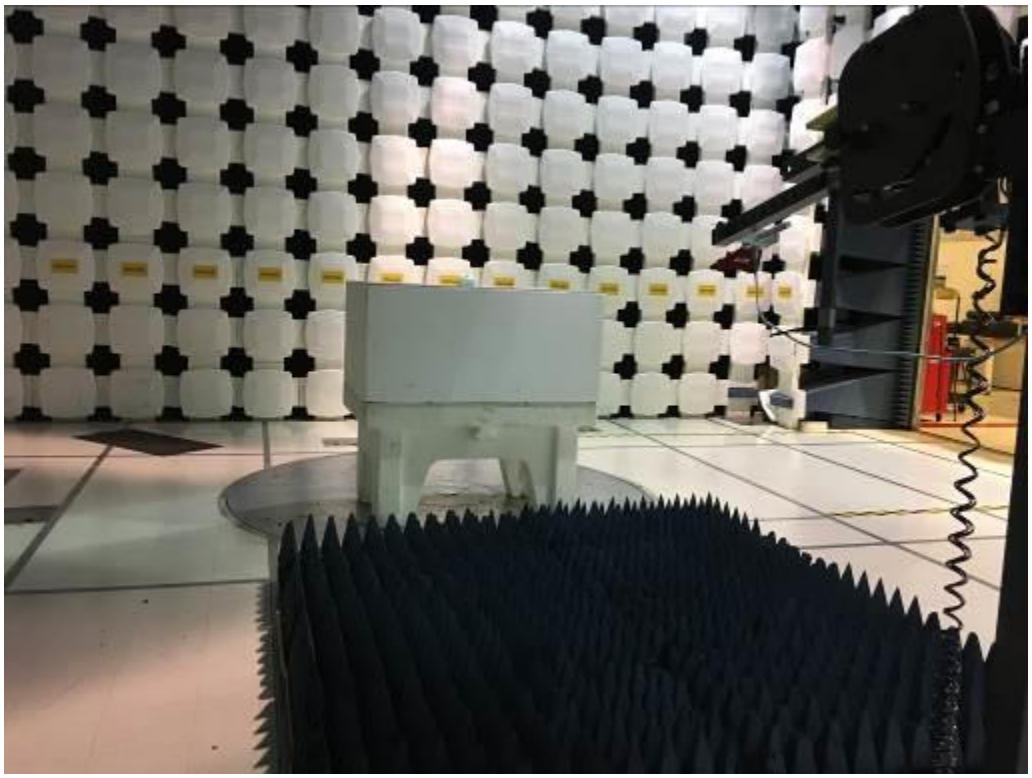
The sample tested was found to Comply.

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 low (2402 MHz; 30.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(d), 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) < 0.6 dB

Result

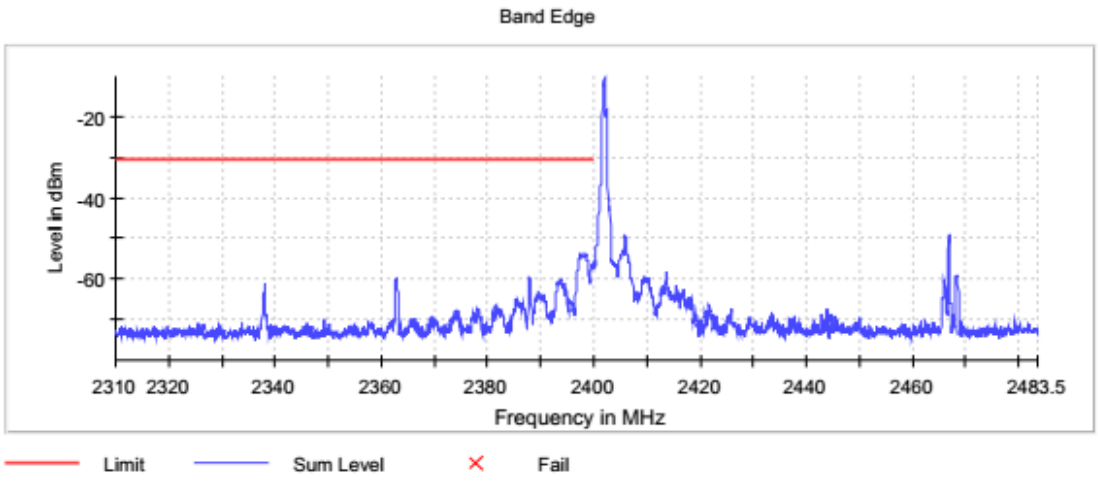
DUT Frequency (MHz)	Result
2402.000000	PASS

Inband Peak

Frequency (MHz)	Level (dBm)
2401.975000	-10.5

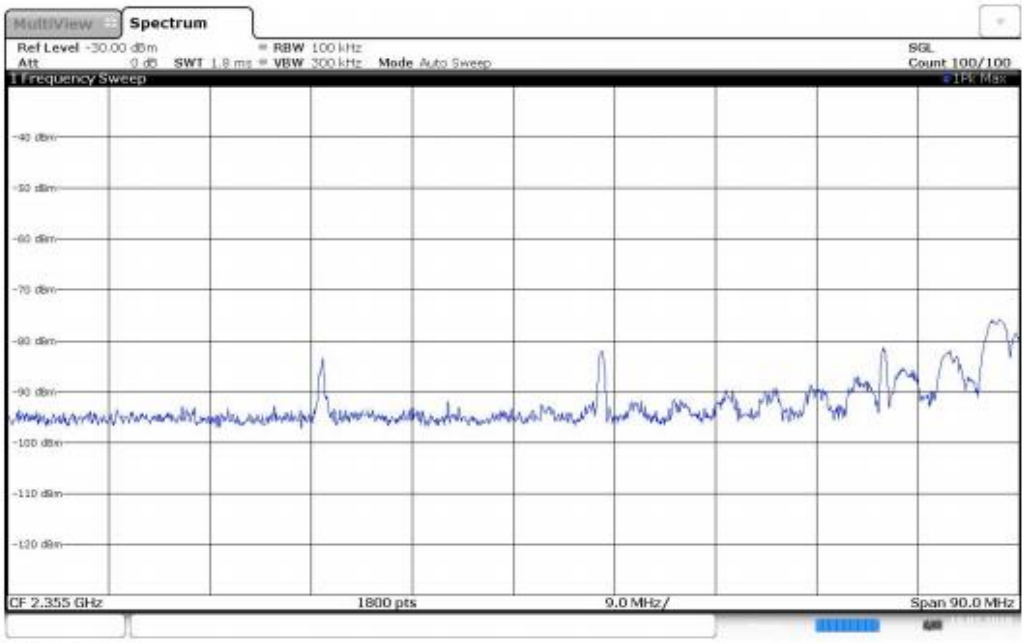
Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2398.225000	-53.7	23.1	-30.5	PASS
2398.275000	-53.8	23.3	-30.5	PASS
2398.325000	-53.9	23.3	-30.5	PASS
2397.575000	-53.9	23.3	-30.5	PASS
2397.625000	-53.9	23.4	-30.5	PASS
2398.425000	-53.9	23.4	-30.5	PASS
2398.175000	-54.0	23.4	-30.5	PASS
2398.375000	-54.0	23.5	-30.5	PASS
2397.675000	-54.1	23.6	-30.5	PASS
2397.475000	-54.2	23.6	-30.5	PASS
2398.125000	-54.2	23.6	-30.5	PASS
2398.475000	-54.3	23.7	-30.5	PASS
2397.425000	-54.4	23.8	-30.5	PASS
2397.775000	-54.4	23.8	-30.5	PASS
2397.725000	-54.4	23.8	-30.5	PASS



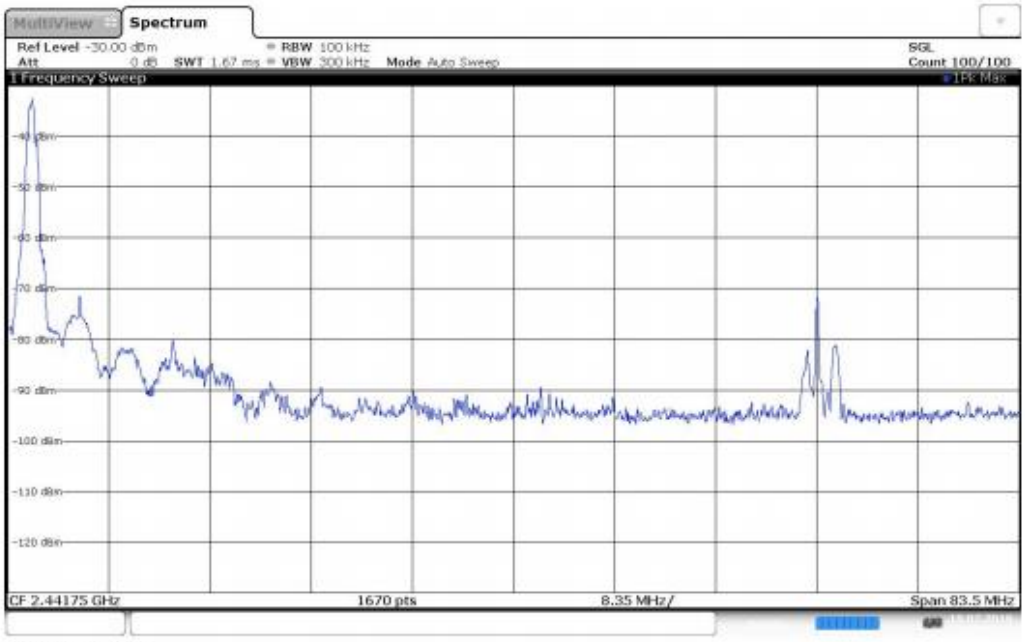
FCC Part 47 §15.247 2400-2483.5 MHz 2016

Band Edge Connector 1_0



15:35:06 19.07.2018

Band Edge Connector 1_1



15:35:19 19.07.2018

FCC Part 47 §15.247 2400-2483.5 MHz 2016

Band Edge high (2480 MHz; 30.000 dBm; 1 MHz)

Test according to FCC title 47 part 15 §15.247(d), 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) < 0.6 dB

Result

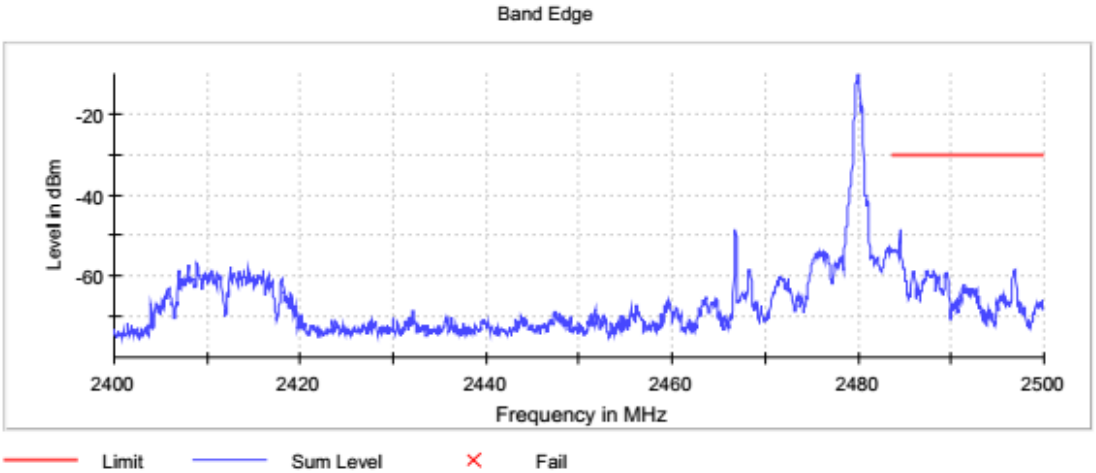
DUT Frequency (MHz)	Result
2480.000000	PASS

Inband Peak

Frequency (MHz)	Level (dBm)
2479.975000	-10.2

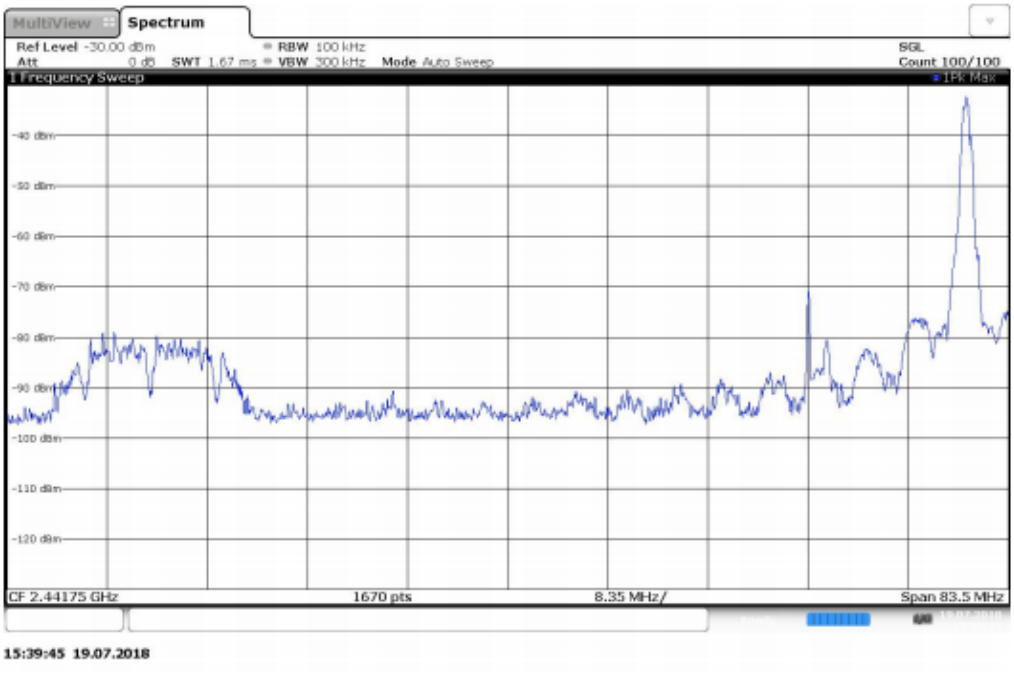
Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2484.575000	-48.6	18.4	-30.2	PASS
2484.525000	-48.8	18.5	-30.2	PASS
2484.625000	-50.1	19.8	-30.2	PASS
2484.475000	-52.6	22.3	-30.2	PASS
2483.525000	-53.2	23.0	-30.2	PASS
2483.625000	-53.3	23.1	-30.2	PASS
2484.025000	-53.4	23.2	-30.2	PASS
2483.725000	-53.5	23.3	-30.2	PASS
2484.275000	-53.6	23.3	-30.2	PASS
2483.975000	-53.6	23.4	-30.2	PASS
2483.675000	-53.7	23.4	-30.2	PASS
2484.075000	-53.7	23.5	-30.2	PASS
2484.125000	-53.7	23.5	-30.2	PASS
2484.175000	-53.7	23.5	-30.2	PASS
2483.775000	-53.8	23.5	-30.2	PASS

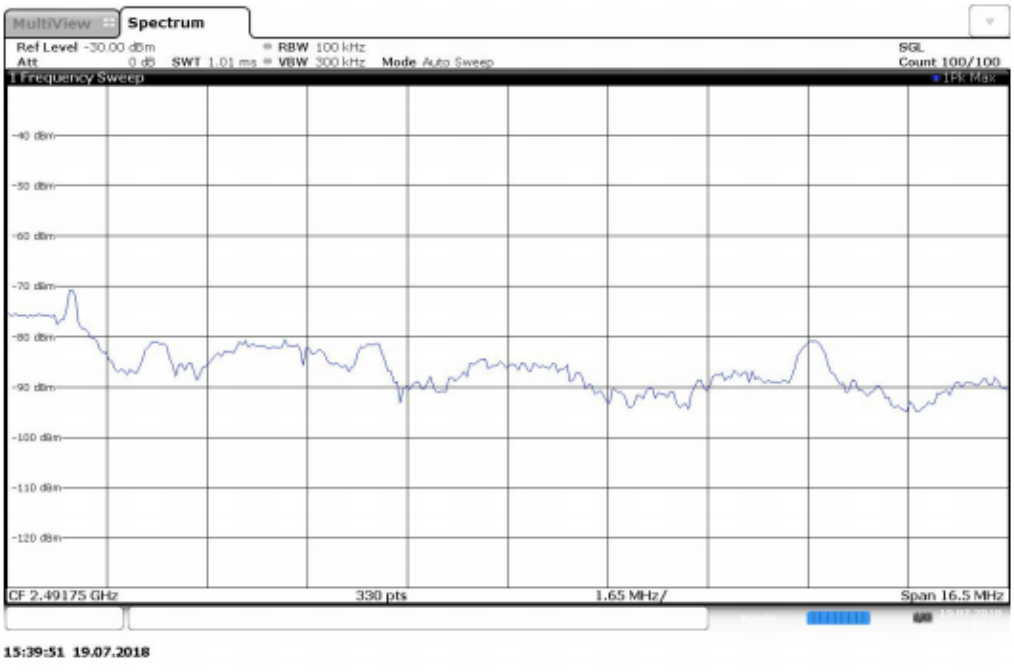


FCC Part 47 §15.247 2400-2483.5 MHz 2016

Band Edge Connector 1_0

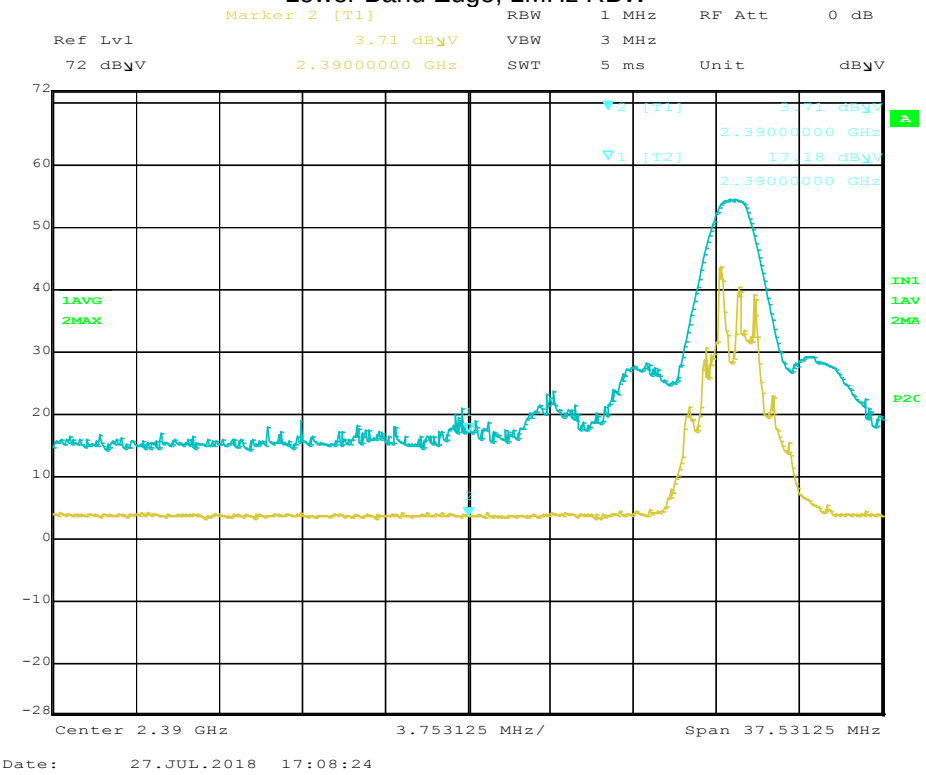


Band Edge Connector 1_1



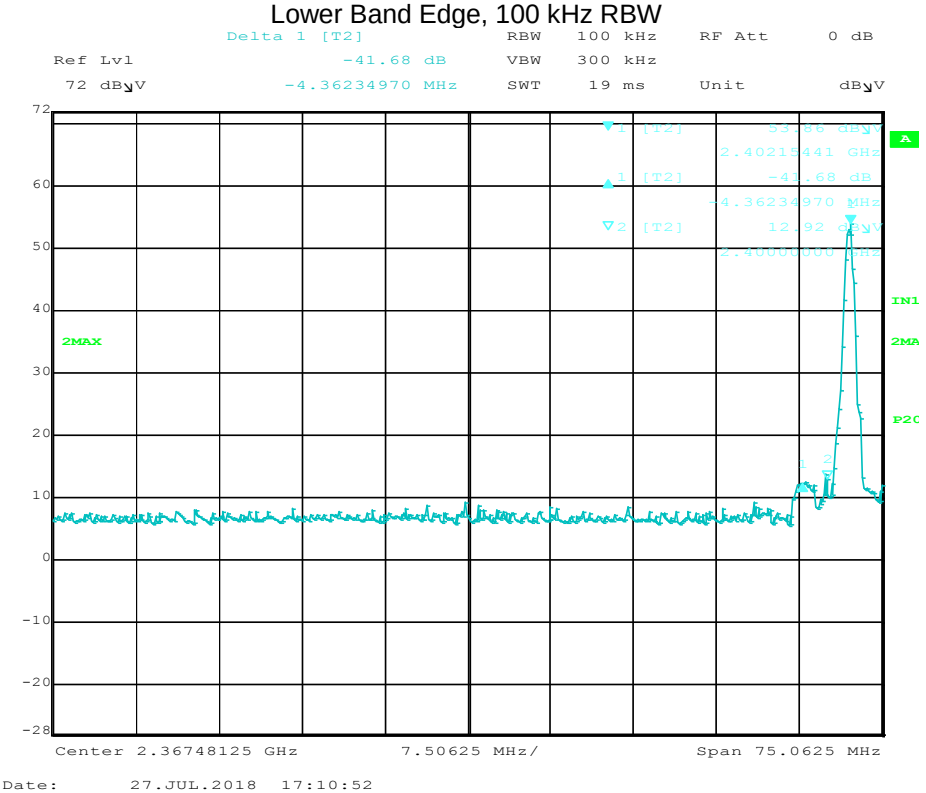
Radiated measurements

Lower Band Edge, 1MHz RBW



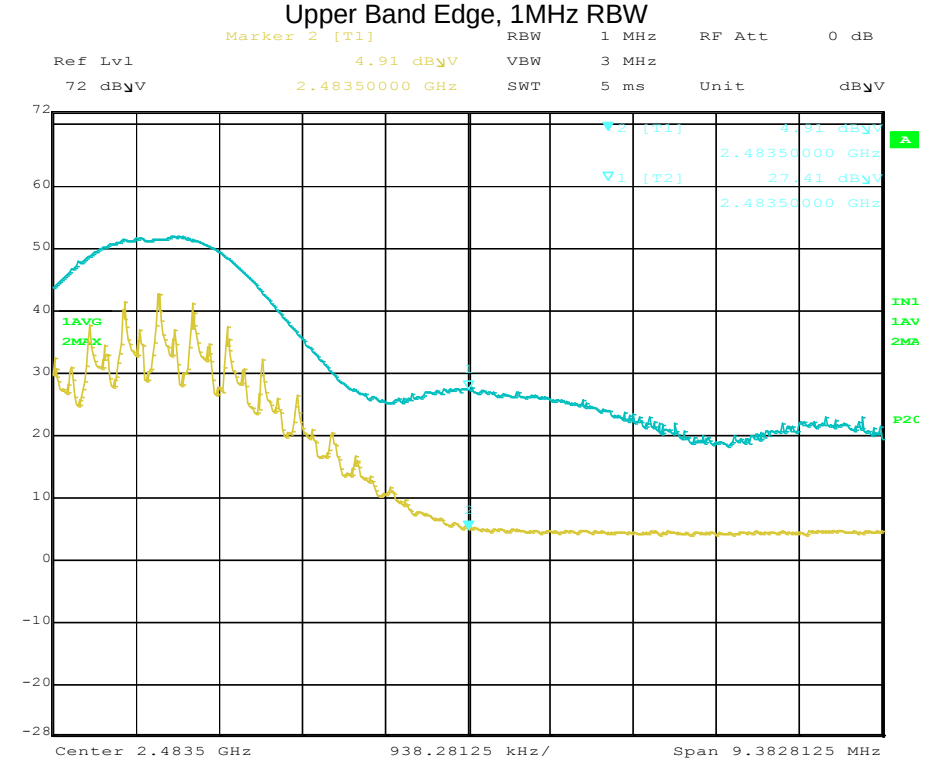
Date: 27.JUL.2018 17:08:24

Lower Band Edge, 100 kHz RBW



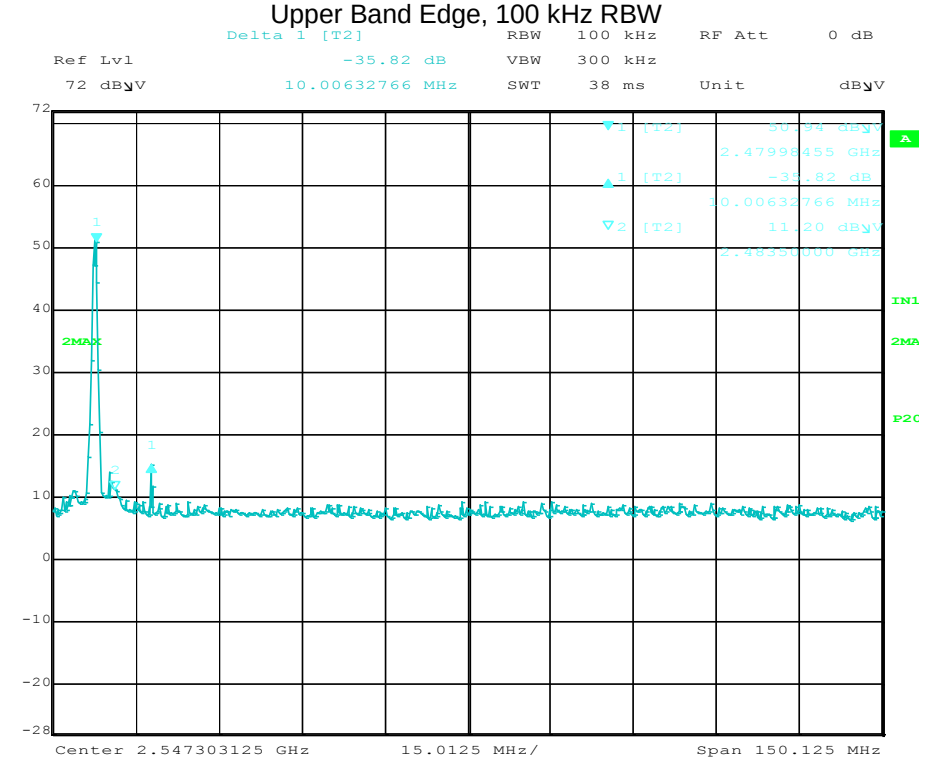
Date: 27.JUL.2018 17:10:52

Upper Band Edge, 1MHz RBW



Date: 27.JUL.2018 17:59:16

Upper Band Edge, 100 kHz RBW



Date: 27.JUL.2018 18:01:09

Test Personnel:	Kouma Sinn KPS Vathana Ven VSV	Test Date:	07/19/2018 07/29/2018
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:	Internal Battery Powered		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	25, 21 ºC
		Relative Humidity:	32, 50 %
		Atmospheric Pressure:	1008, 1001 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	07/25/2017	07/25/2018
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2017	07/25/2018
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	09/05/2017	09/05/2018
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.

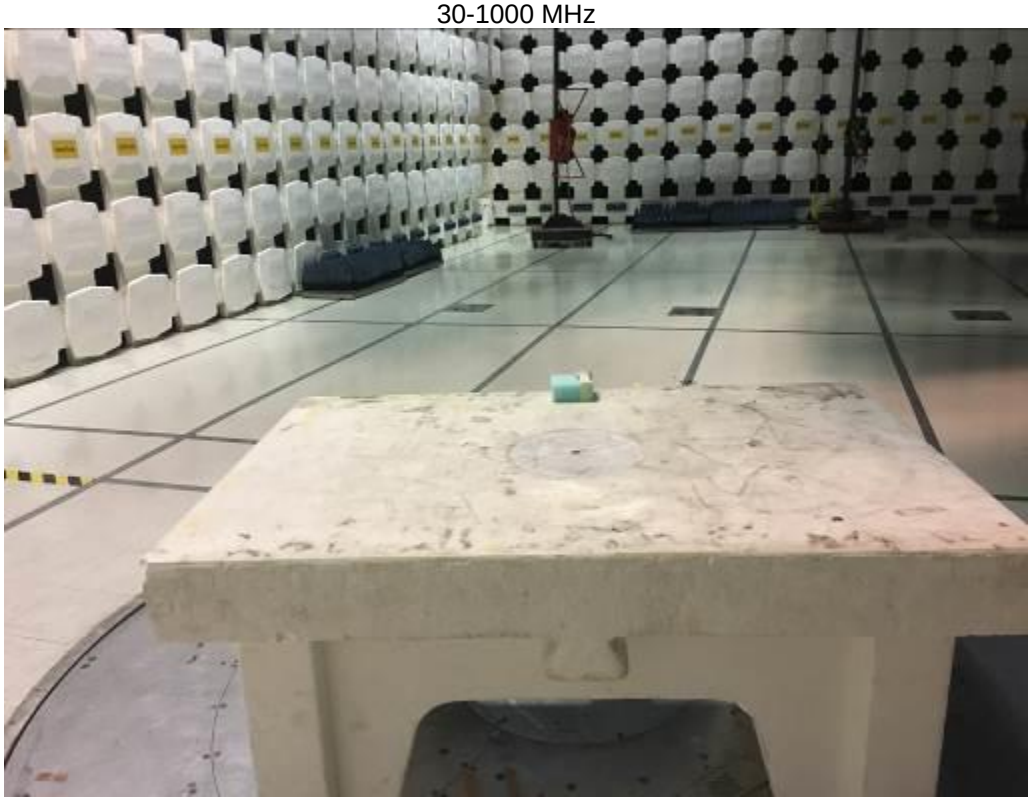
15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that 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:

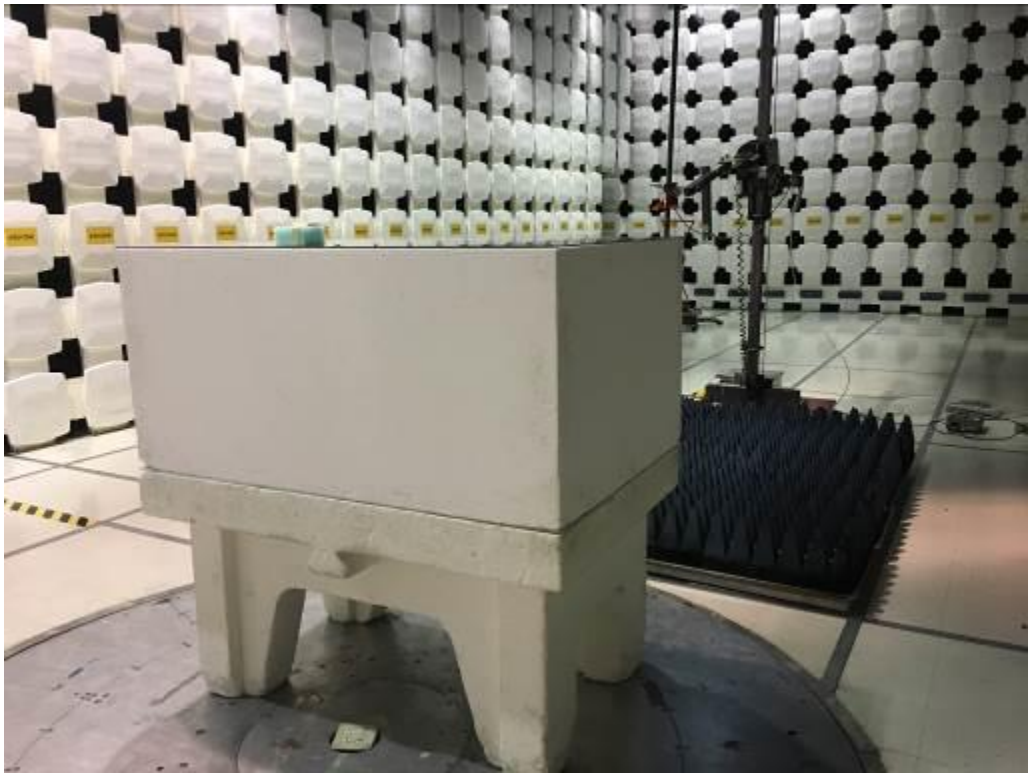
Antenna Port Conducted Test Setup

Radiated Setup

30-1000 MHz



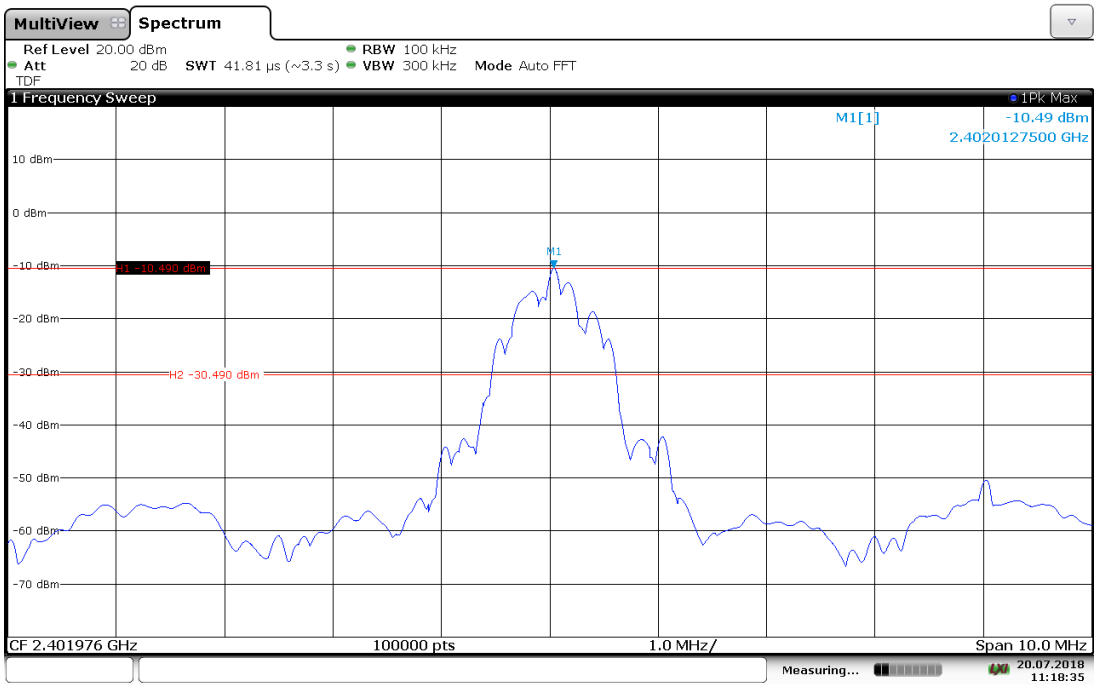
1-18 GHz



18-25 GHz

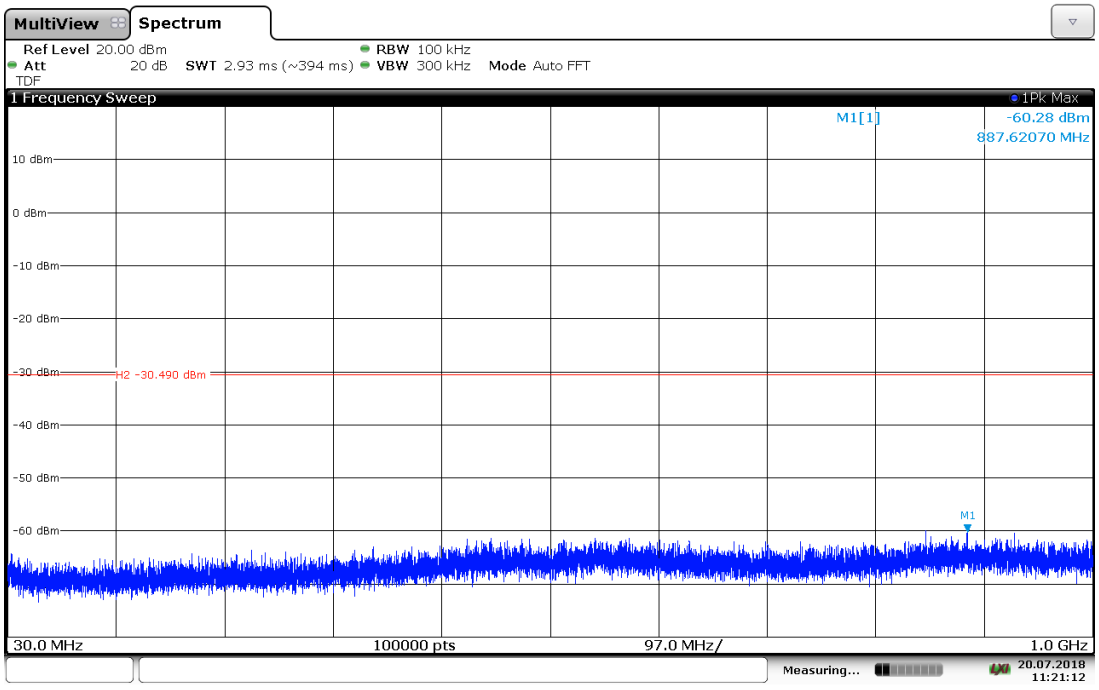
10.5 Plots/Data:

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



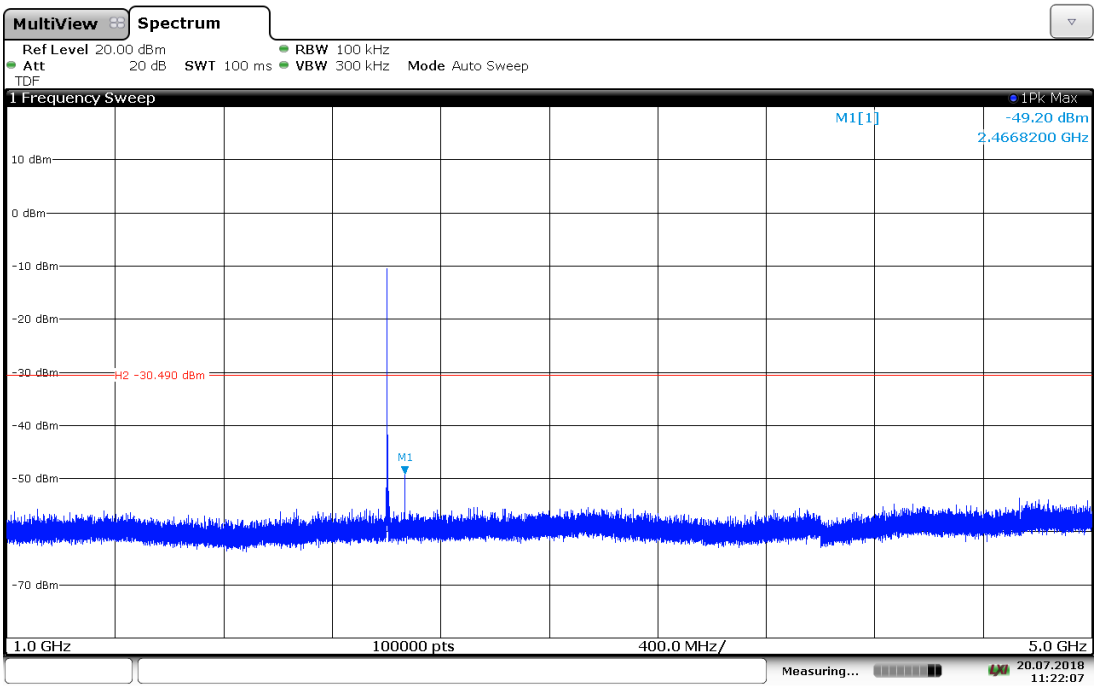
11:18:36 20.07.2018

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



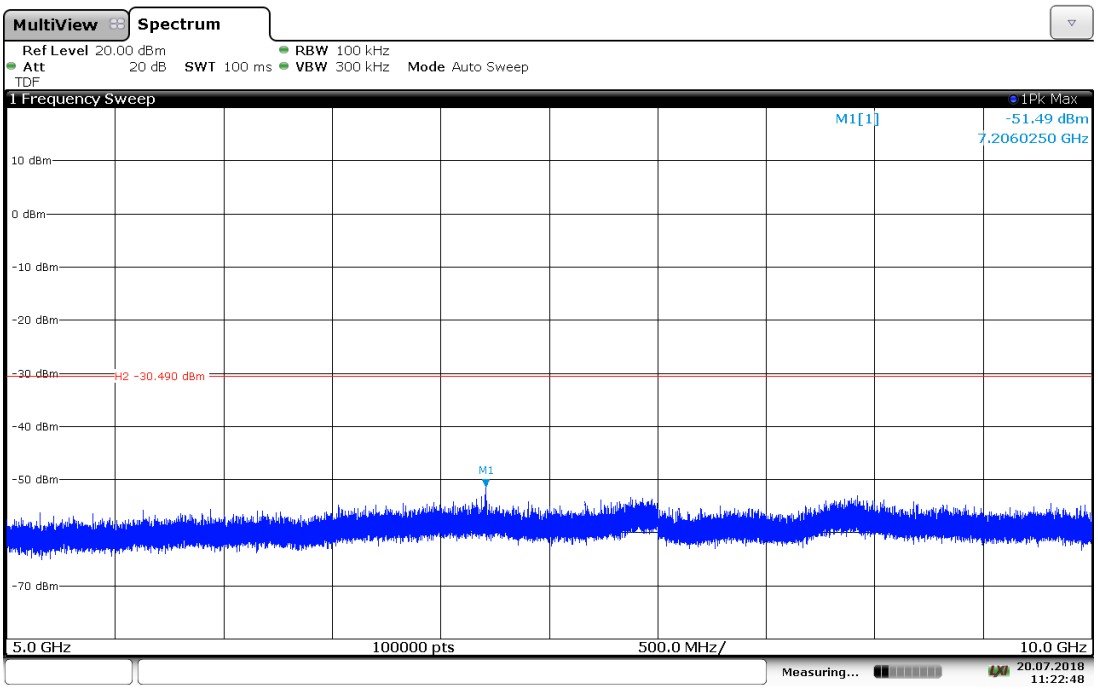
11:21:13 20.07.2018

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



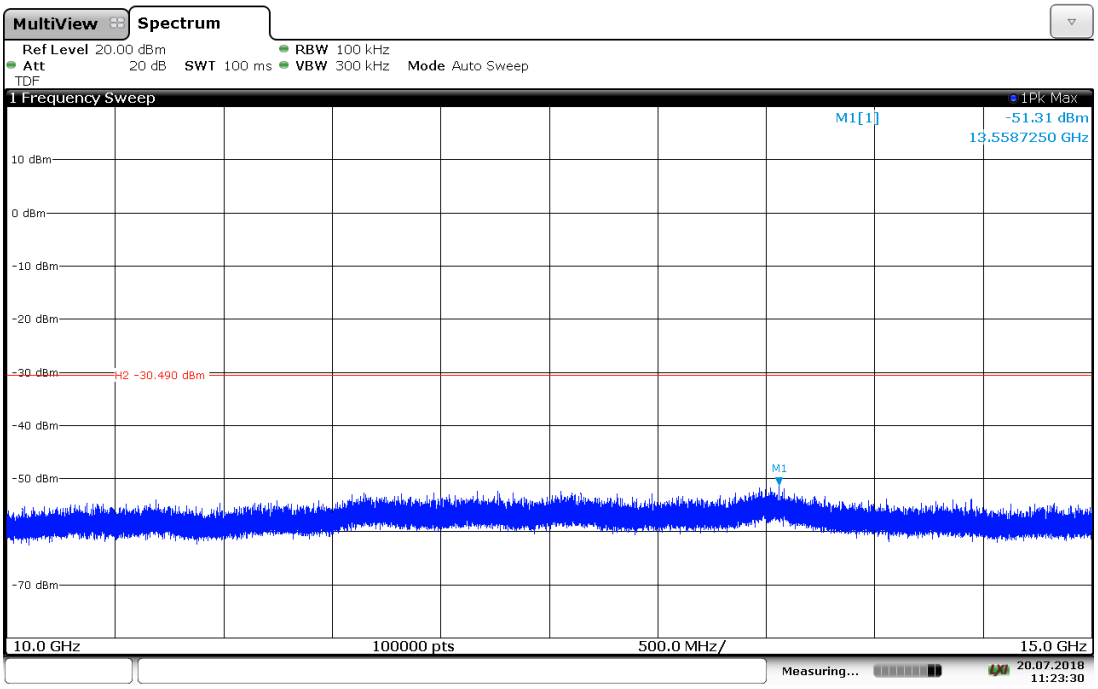
11:22:07 20.07.2018

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



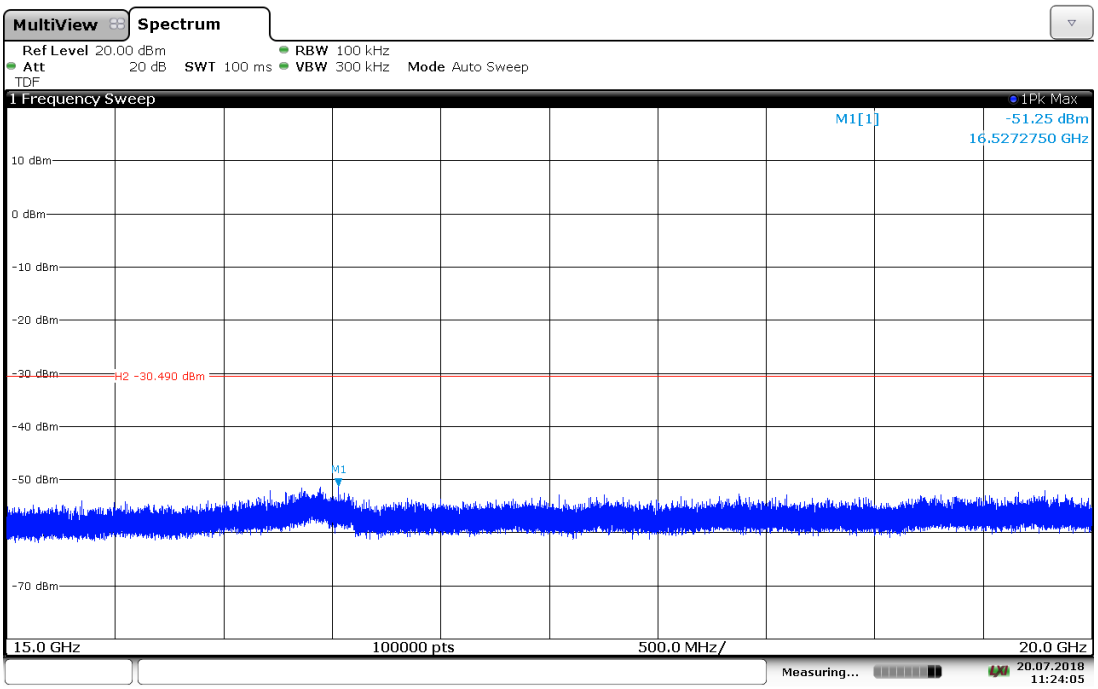
11:22:48 20.07.2018

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



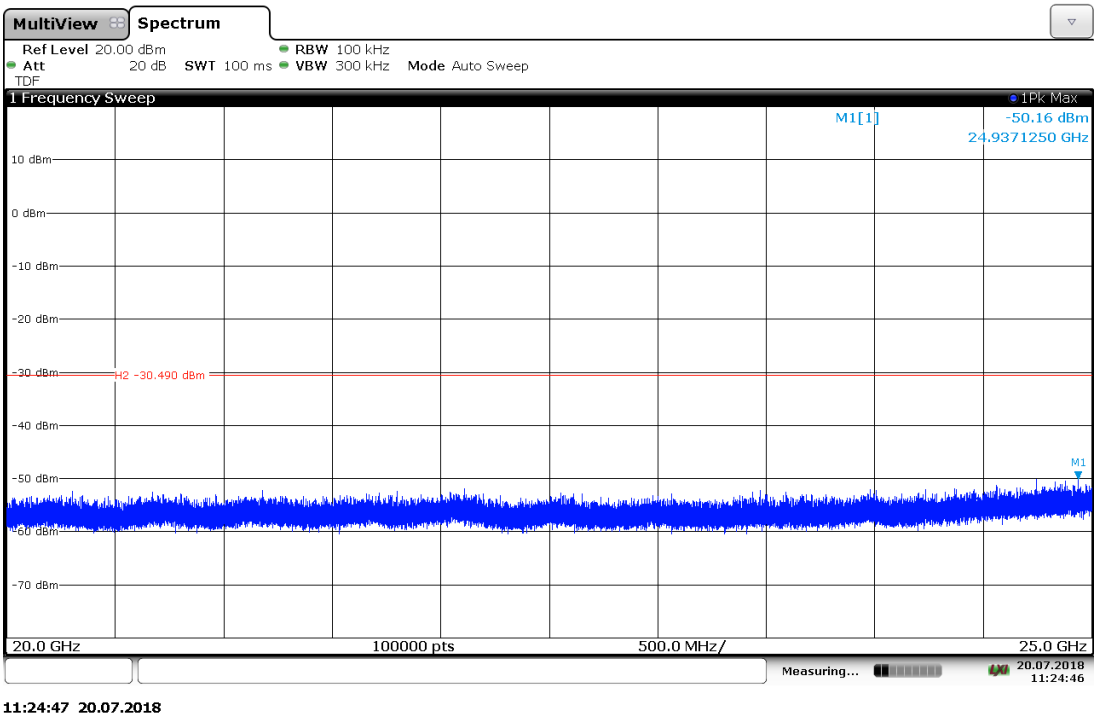
11:23:30 20.07.2018

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

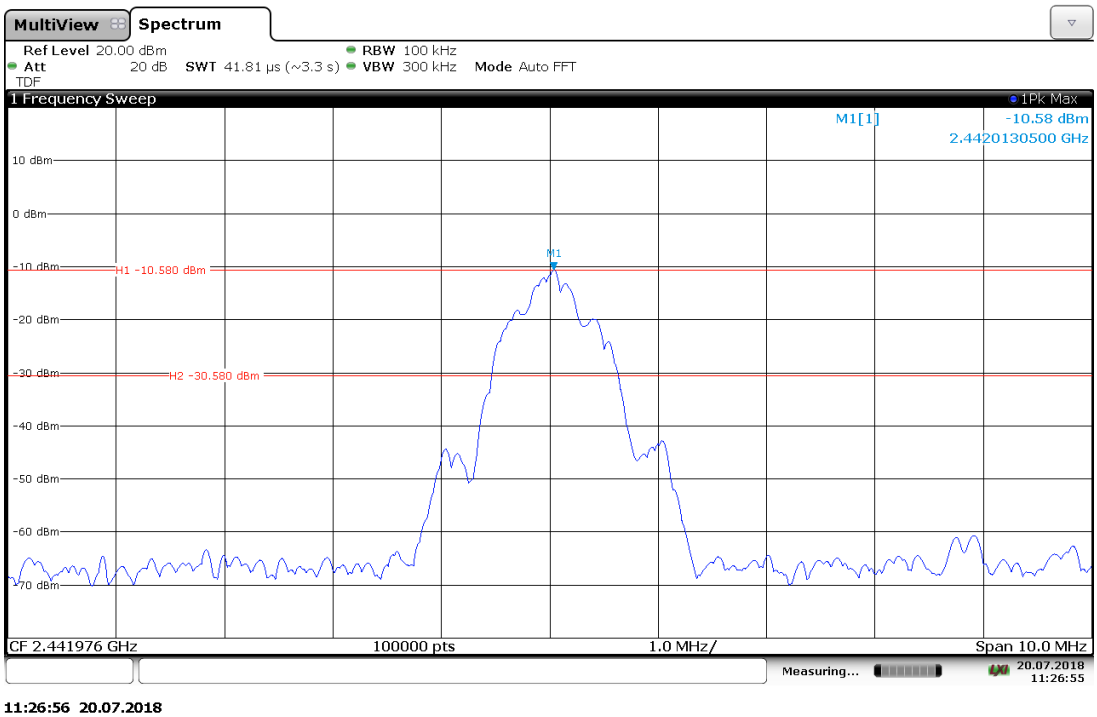


11:24:06 20.07.2018

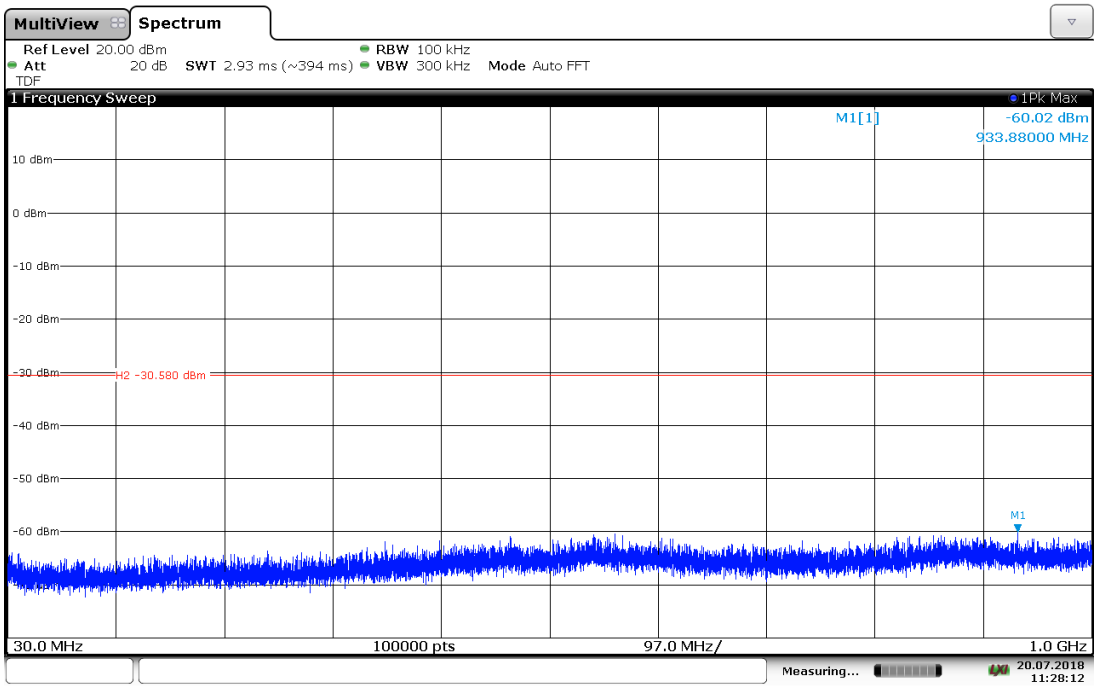
Low Channel Antenna Port Conducted Spurious Emissions, 20-25 GHz



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

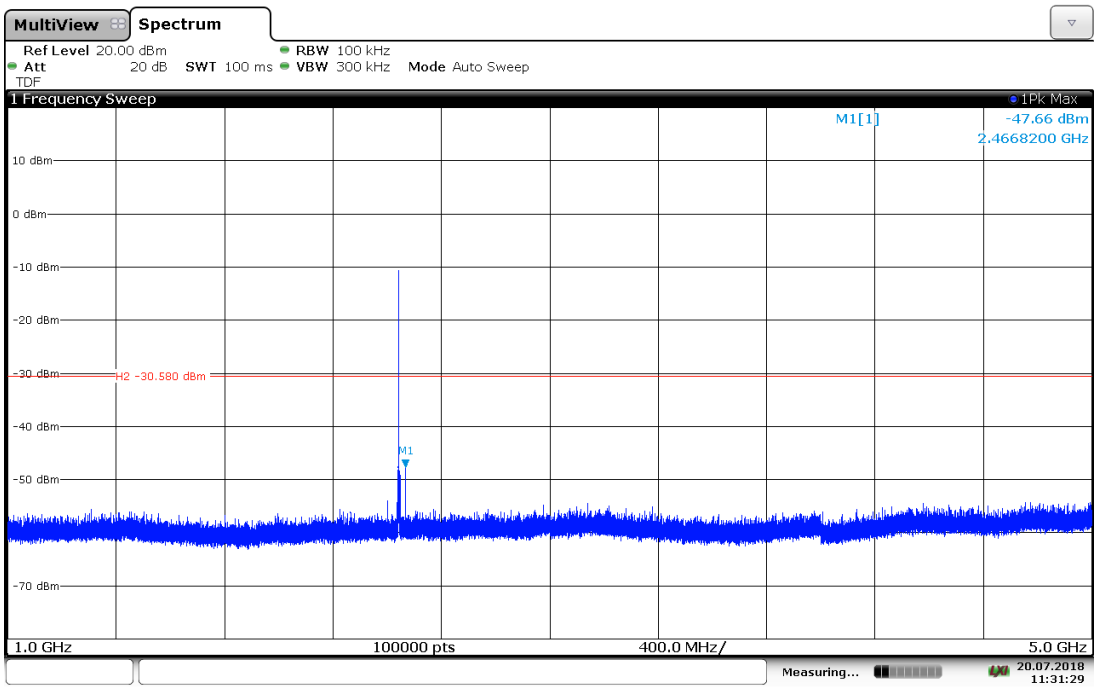


Mid Channel Antenna Port Conducted Spurious Emissions, 30 MHz-1000 MHz



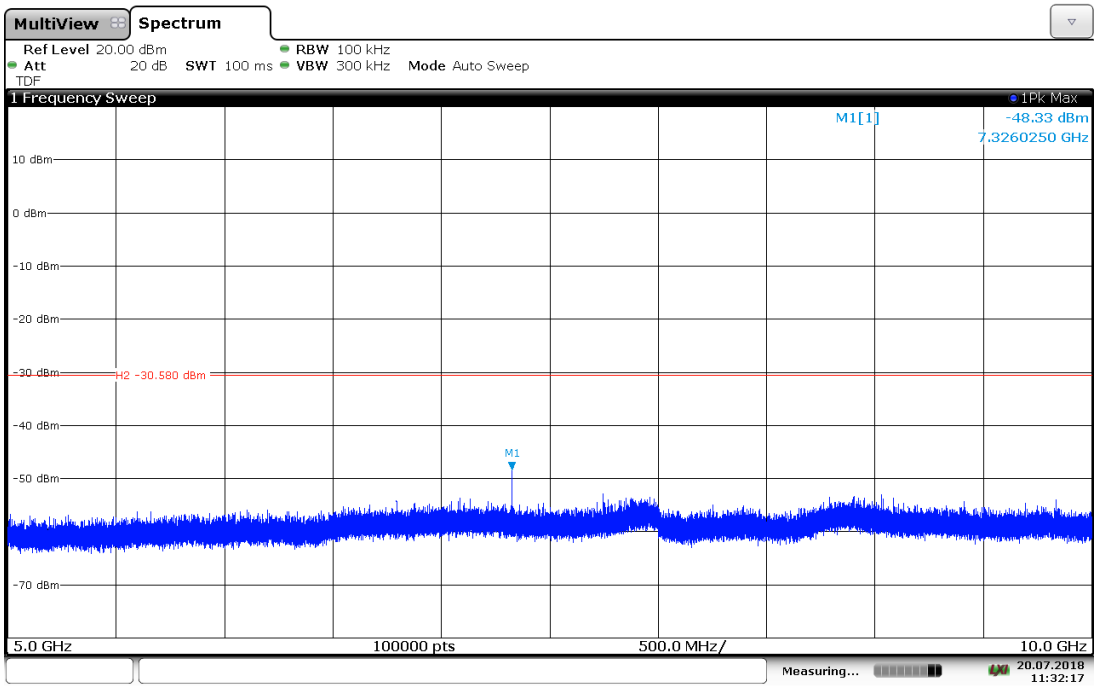
11:28:13 20.07.2018

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



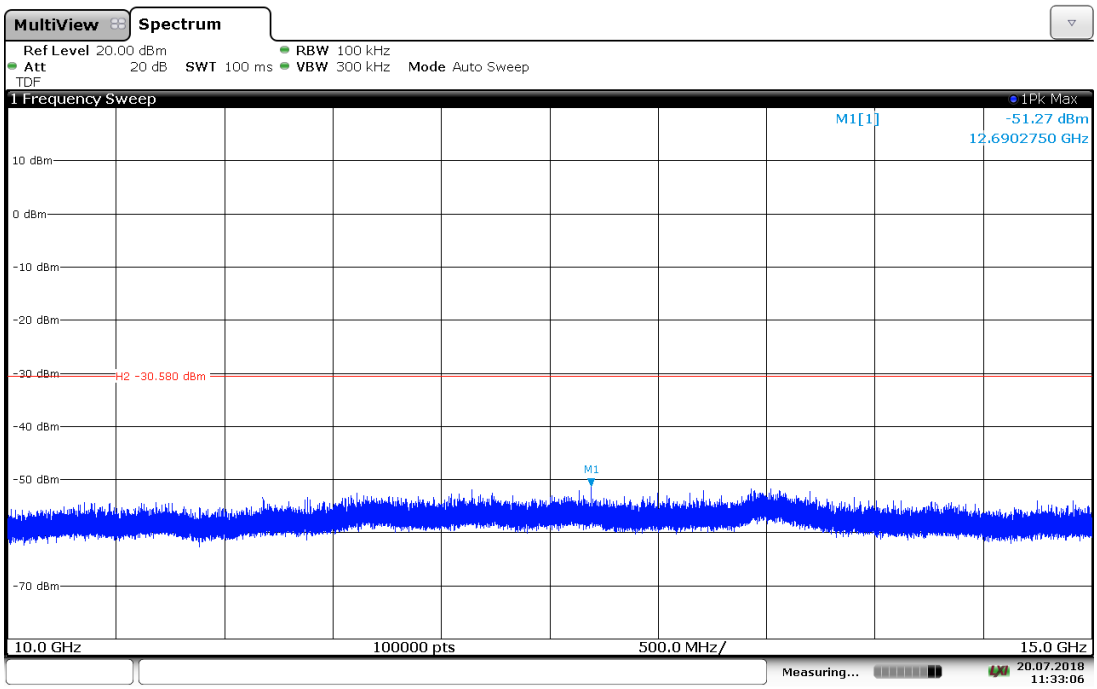
11:31:29 20.07.2018

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



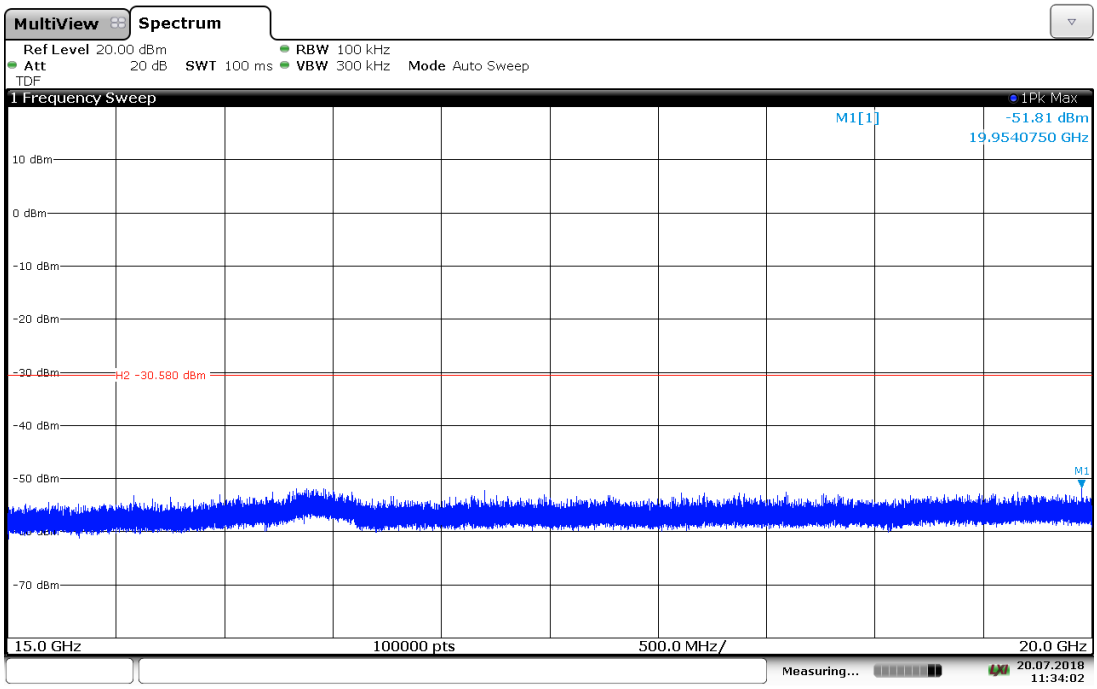
11:32:17 20.07.2018

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



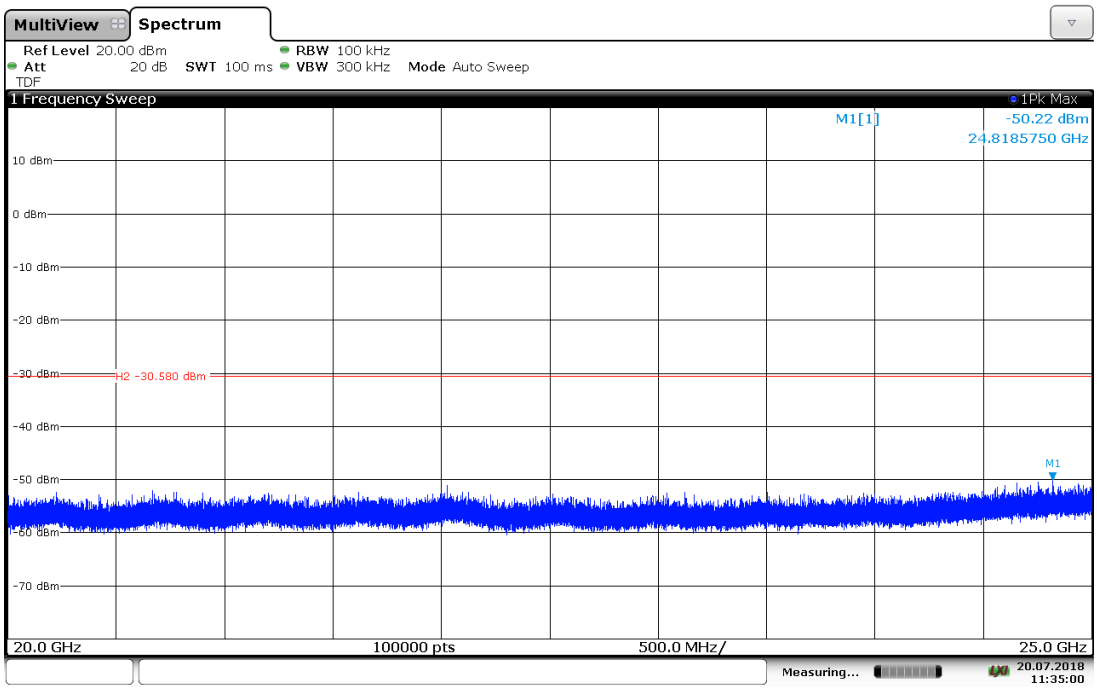
11:33:07 20.07.2018

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



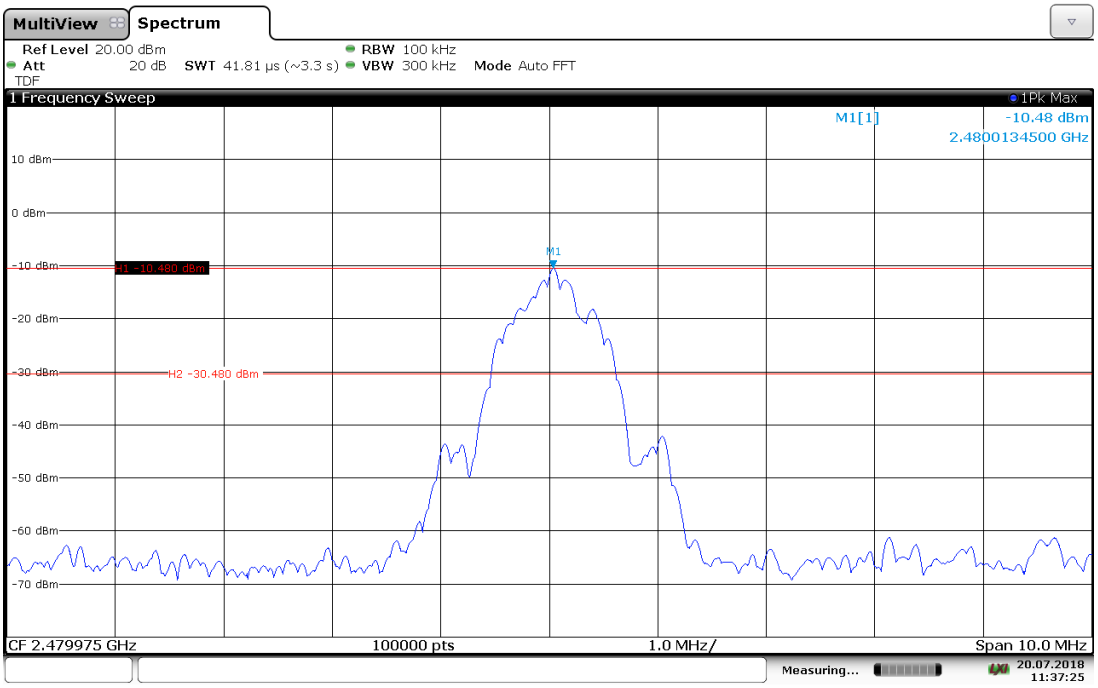
11:34:03 20.07.2018

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



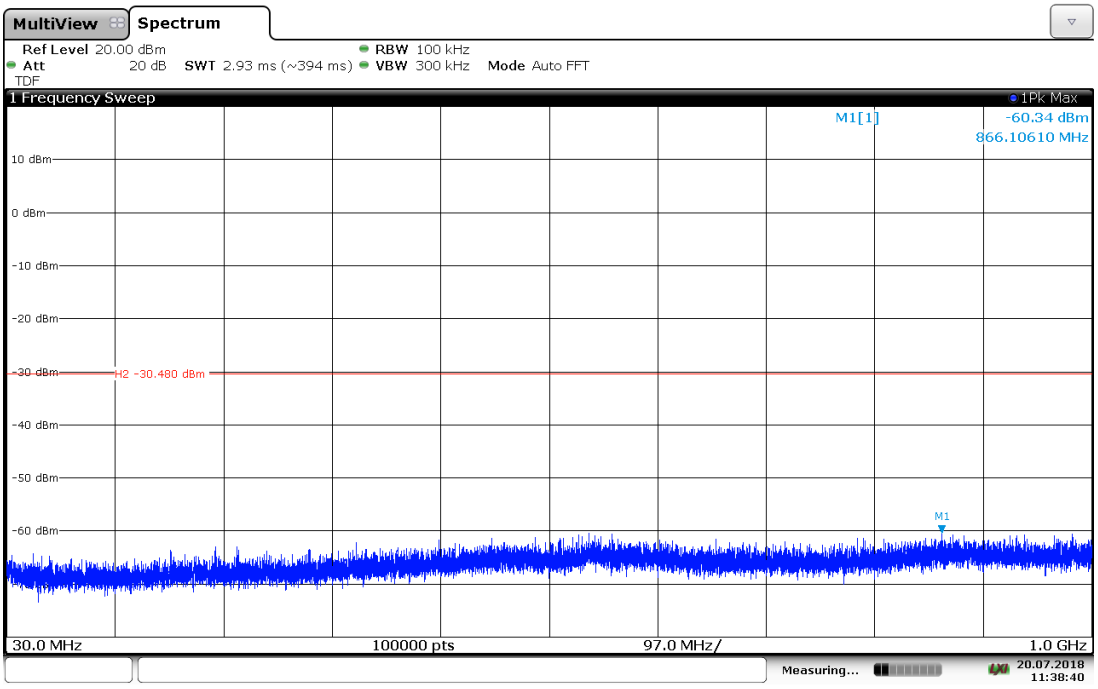
11:35:01 20.07.2018

Limit: 20 dB down from carrier (High Channel)



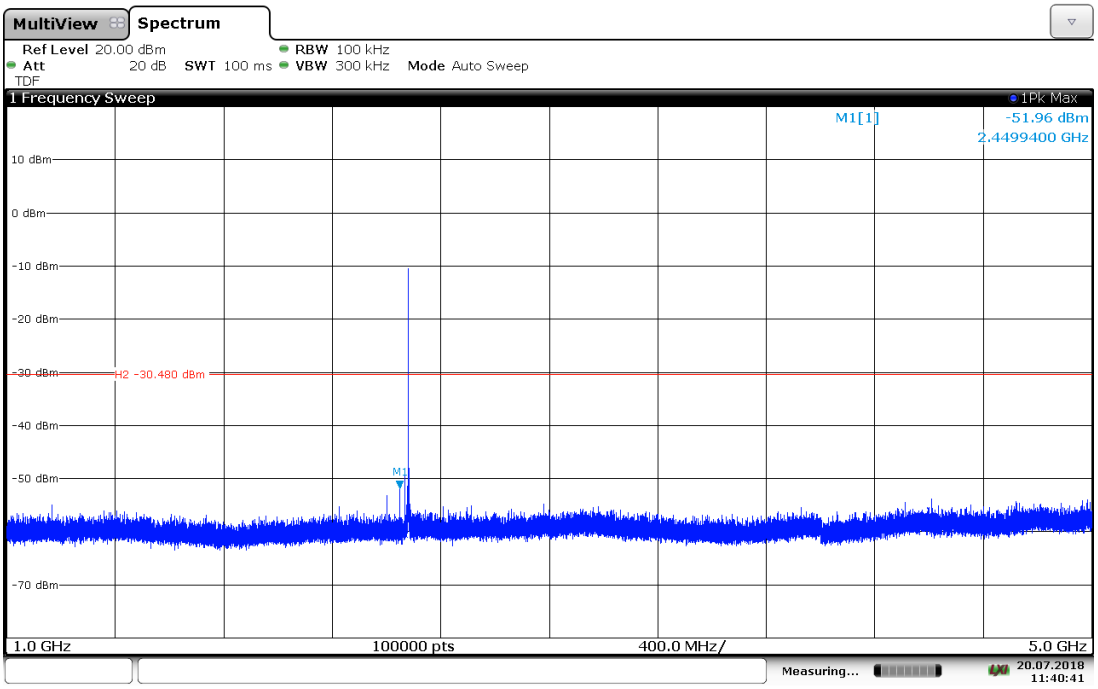
11:37:25 20.07.2018

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



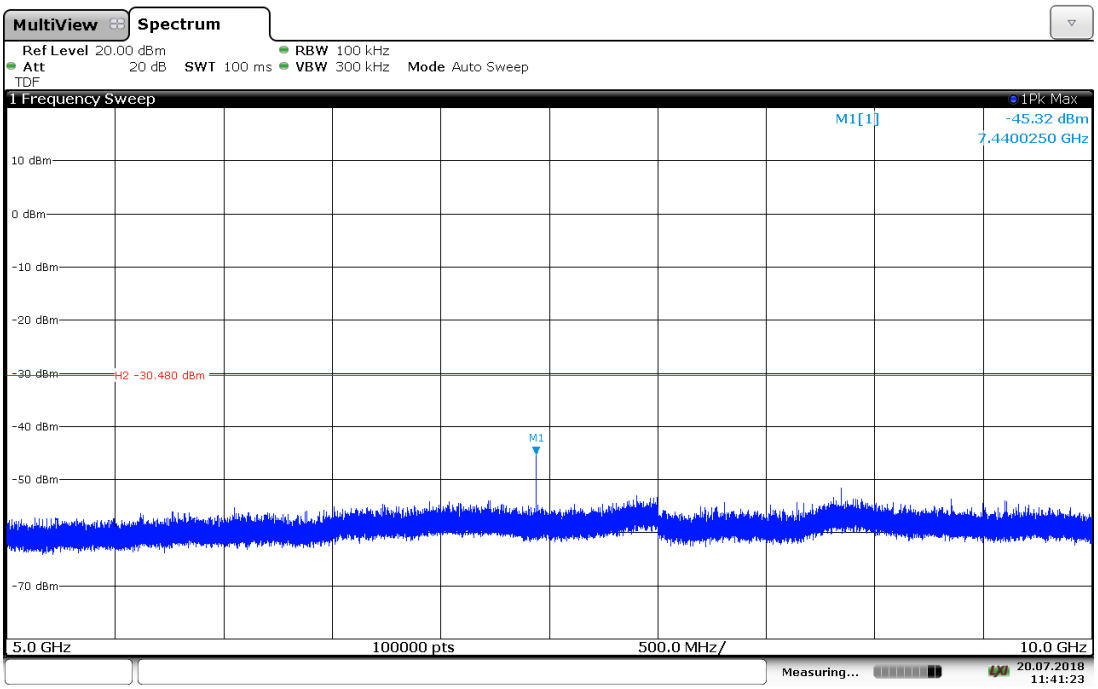
11:38:41 20.07.2018

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



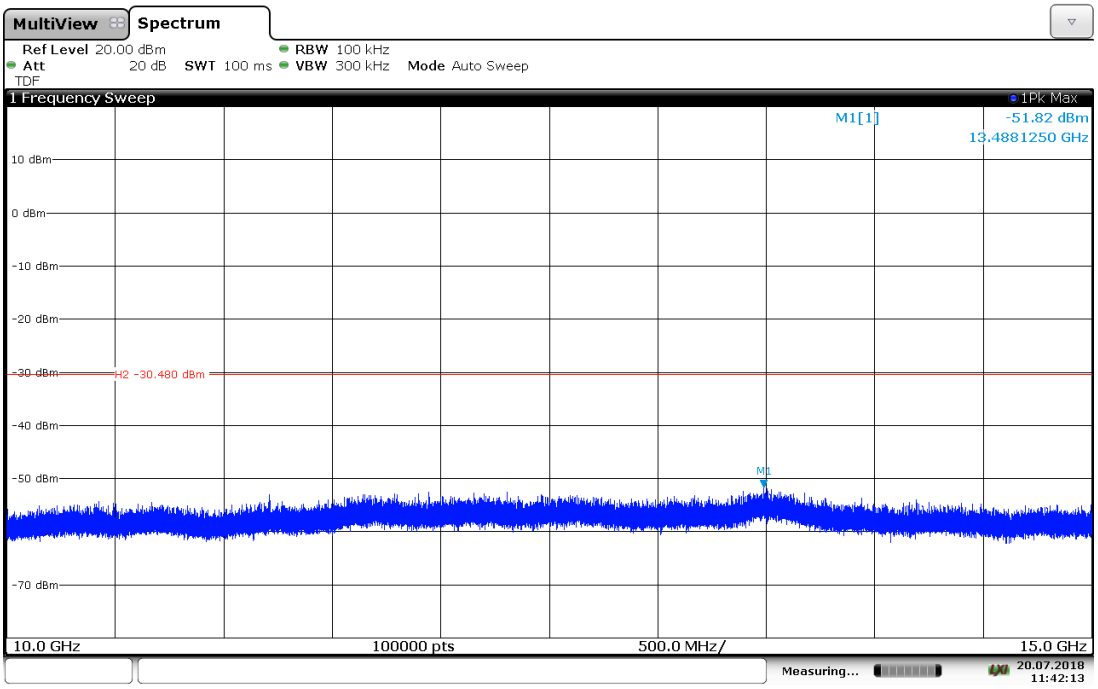
11:40:41 20.07.2018

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



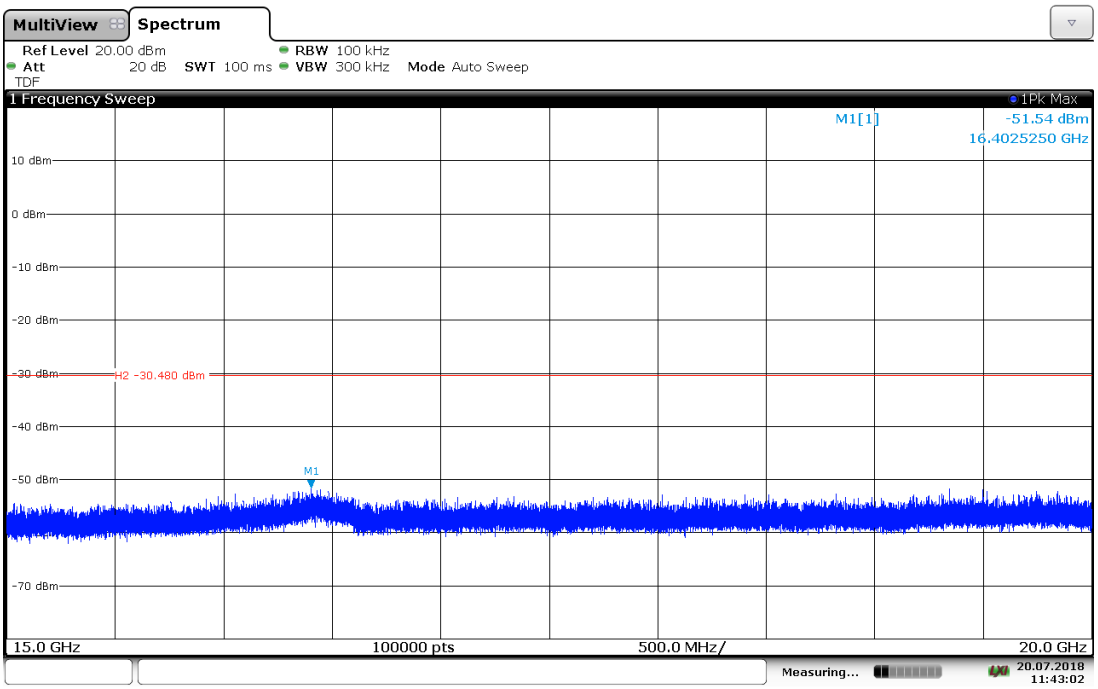
11:41:23 20.07.2018

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



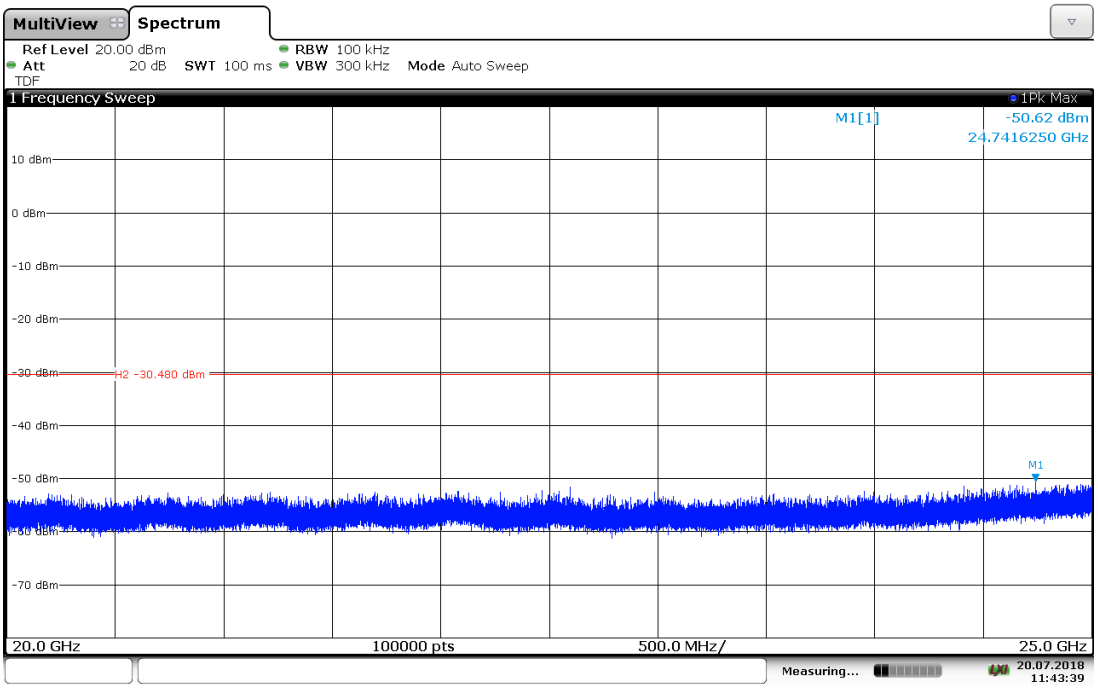
11:42:13 20.07.2018

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



11:43:03 20.07.2018

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

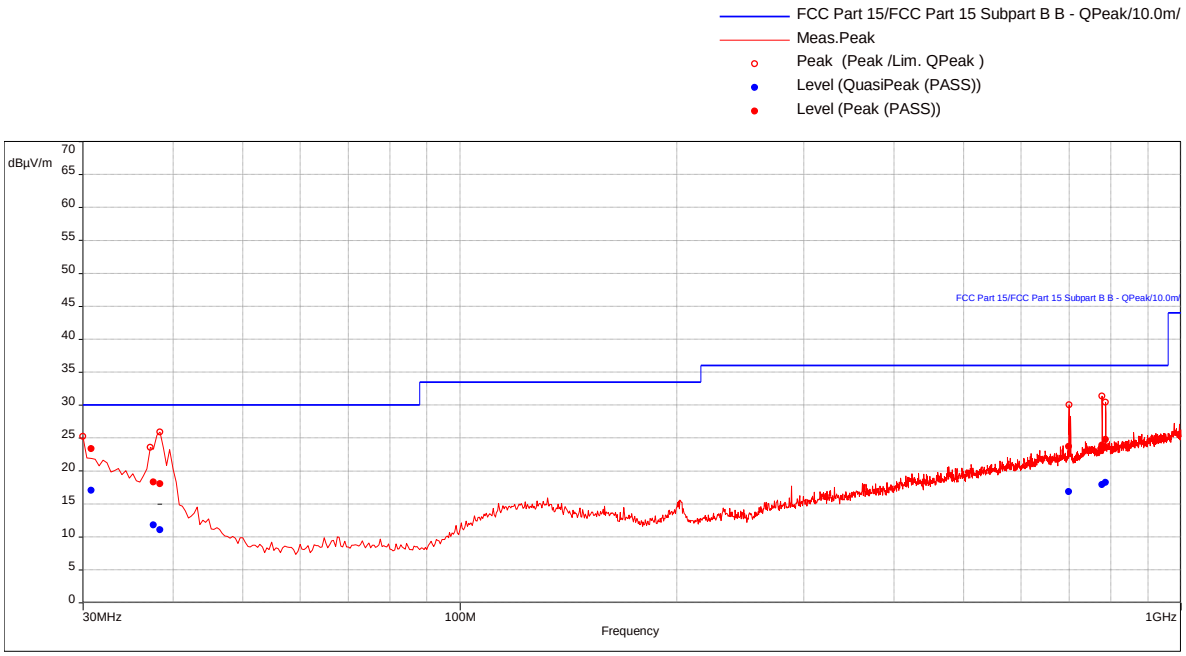


Low Channel, 2402 MHz, Tx mode, X-Axis, 30 – 1000 MHz

Test Information:

Date and Time	7/24/2018 5:13:00 PM
Client and Project Number	Becton Dickinson
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	47%
Atmospheric Pressure	1012 mB
Comments	IDD_Tx at Lo Ch_0.8m Height

Graph:



Results:

QuasiPeak (PASS) (6)

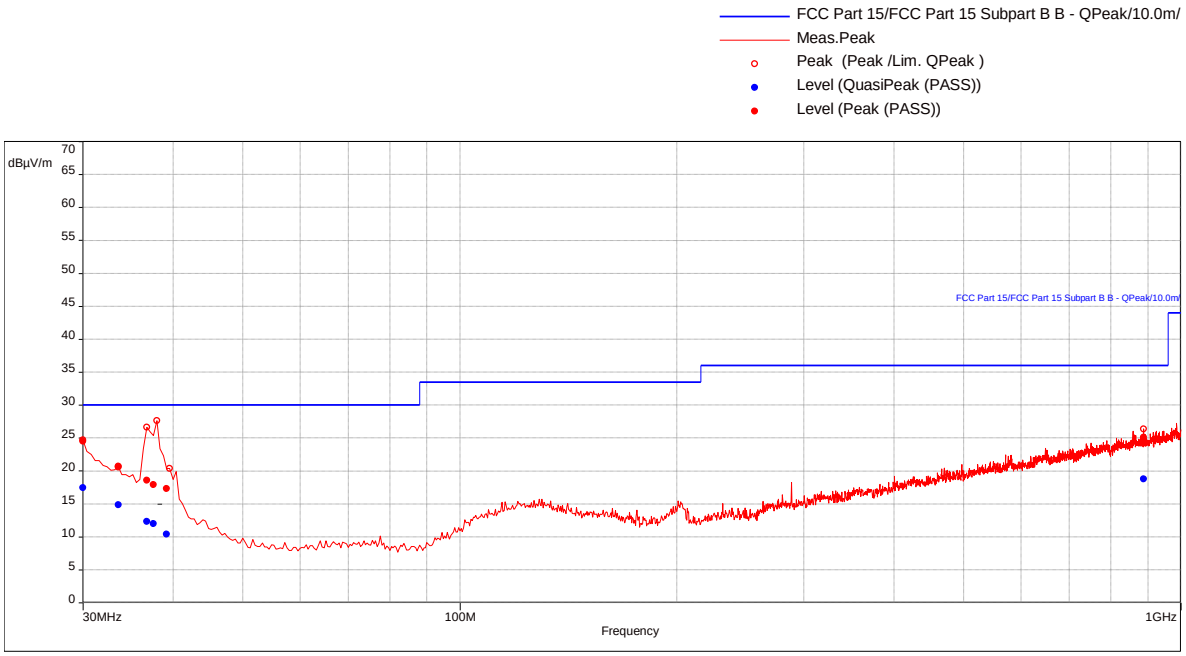
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
30.61578947	17.01	30.00	-12.99	242.00	3.13	Vertical	120000.00	-22.23
37.64210526	11.75	30.00	-18.25	26.00	1.60	Vertical	120000.00	-27.56
38.58947368	11.02	30.00	-18.98	25.00	2.98	Vertical	120000.00	-28.27
699.3789474	16.83	36.00	-19.17	307.00	3.96	Horizontal	120000.00	-19.10
777.3473684	17.90	36.00	-18.10	19.00	1.96	Vertical	120000.00	-17.71
786.3684211	18.22	36.00	-17.78	248.00	2.27	Vertical	120000.00	-17.49

Low Channel, 2402 MHz, Tx mode, Y-Axis, 30 – 1000 MHz

Test Information:

Date and Time	7/24/2018 5:33:04 PM
Client and Project Number	Becton Dickinson
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	47%
Atmospheric Pressure	1012 mB
Comments	IDD_Tx at Lo Ch_Y-Axis

Graph:



Results:

QuasiPeak (PASS) (6)

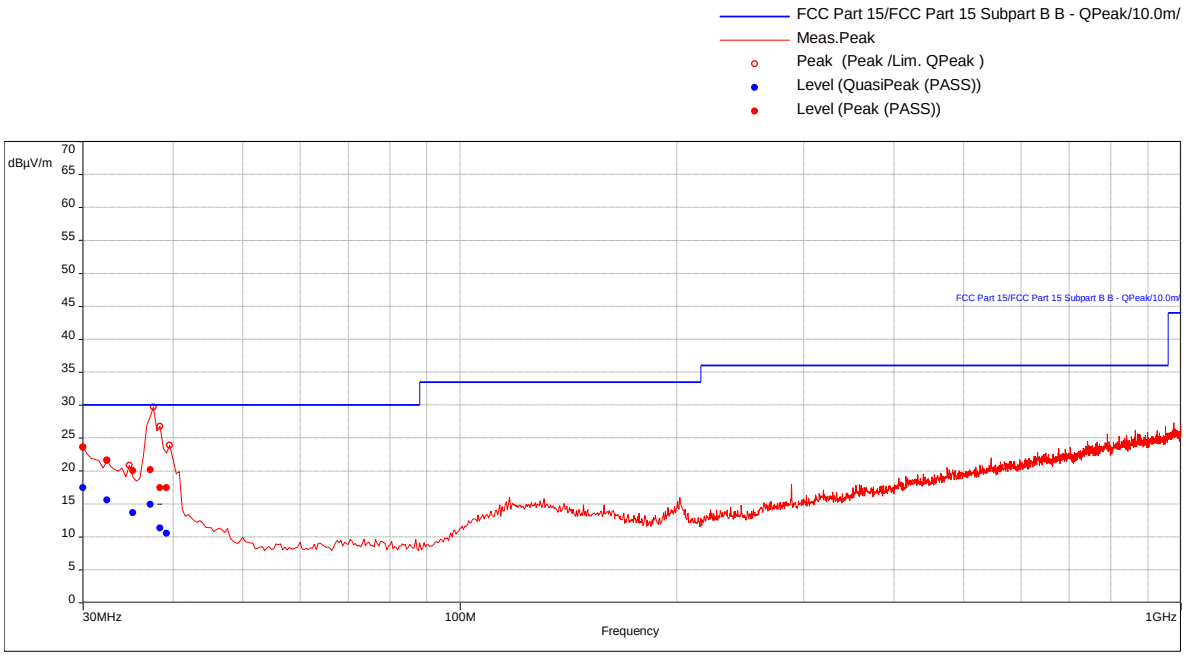
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
30.12631579	17.46	30.00	-12.54	240.00	3.53	Vertical	120000.00	-21.90
33.47368421	14.84	30.00	-15.16	114.00	3.60	Vertical	120000.00	-24.34
36.95789474	12.29	30.00	-17.71	26.00	3.96	Vertical	120000.00	-27.09
37.49473684	11.98	30.00	-18.02	26.00	1.00	Vertical	120000.00	-27.45
39.25263158	10.35	30.00	-19.65	48.00	1.89	Horizontal	120000.00	-28.76
888.5894737	18.74	36.00	-17.26	41.00	3.86	Vertical	120000.00	-16.40

Low Channel, 2402 MHz, Tx mode, Z-Axis, 30 – 1000 MHz

Test Information:

Date and Time	7/24/2018 6:21:39 PM
Client and Project Number	Becton Dickinson
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	47%
Atmospheric Pressure	1012 mB
Comments	IDD_Tx at Lo Ch_Z-Axis

Graph:



Results:

QuasiPeak (PASS) (6)

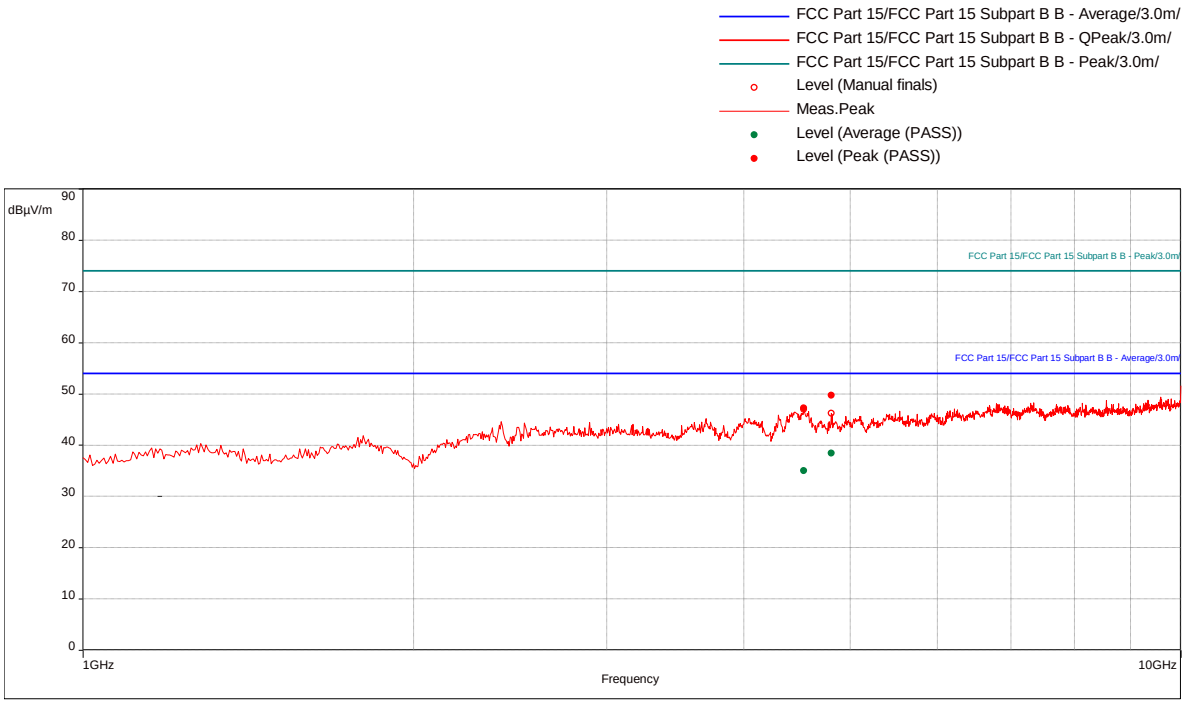
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
30.06315789	17.44	30.00	-12.56	240.00	1.81	Vertical	120000.00	-21.86
32.4	15.57	30.00	-14.43	0.00	2.80	Vertical	120000.00	-23.56
35.14736842	13.67	30.00	-16.33	143.00	2.64	Vertical	120000.00	-25.66
37.31578947	14.91	30.00	-15.09	26.00	3.99	Vertical	120000.00	-27.33
38.30526316	11.31	30.00	-18.69	40.00	1.37	Vertical	120000.00	-28.04
39.12631579	10.50	30.00	-19.50	32.00	3.99	Vertical	120000.00	-28.68

Low Channel, 2402 MHz, Tx mode, X-Axis, 1 – 25 GHz

Test Information:

Date and Time	7/25/2018 3:41:37 PM
Client and Project Number	Becton Dickinson
Engineer	Kouma Sinn
Temperature	23C
Humidity	54%
Atmospheric Pressure	1009mbar
Comments	New_Ew0-01626_IDD Tx Low (x-axis, battery side) 1 to 10 GHz SA mode

Graph:



Note : Scan from 10 – 25 GHz was performed manually, no emissions were detected above the measuring equipment noise floor.

Results:

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4535.526316	47.22	74.00	-26.78	291.00	1.42	Horizontal	1000000.00	9.01
4803.684211	49.72	74.00	-24.28	77.00	1.00	Vertical	1000000.00	7.98

Average (PASS) (2)

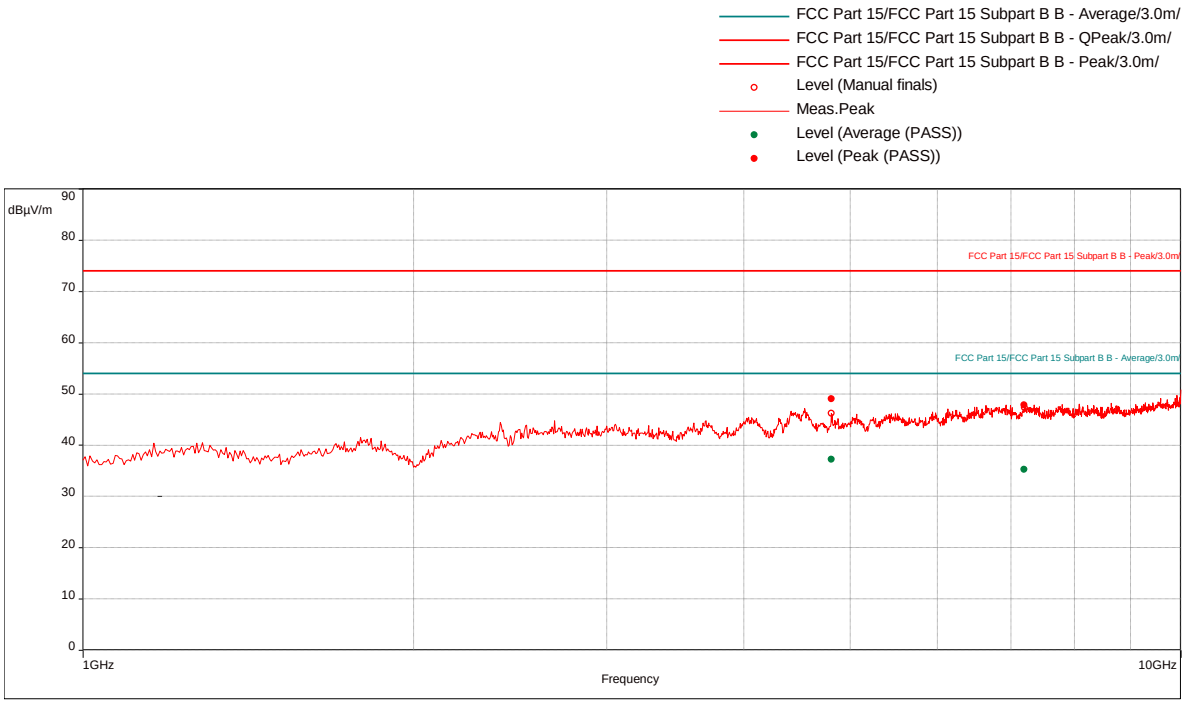
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4535.526316	34.96	54.00	-19.04	291.00	1.42	Horizontal	1000000.00	9.01
4803.684211	38.44	54.00	-15.56	77.00	1.00	Vertical	1000000.00	7.98

Low Channel, 2402 MHz, Tx mode, Y-Axis, 1 – 25 GHz

Test Information:

Date and Time	7/25/2018 4:00:44 PM
Client and Project Number	Becton Dickinson
Engineer	Kouma Sinn
Temperature	23C
Humidity	54%
Atmospheric Pressure	1009mbar
Comments	New_Ew0-01626_IDD Tx Low (y-axis, long side) 1 to 10 GHz SA mode

Graph:



Note : Scan from 10 – 25 GHz was performed manually, no emissions were detected above the measuring equipment noise floor.

Results:

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4804.210526	49.05	74.00	-24.95	55.00	1.00	Vertical	1000000.00	7.98
7201.842105	47.83	74.00	-26.17	159.00	3.16	Horizontal	1000000.00	10.83

Average (PASS) (2)

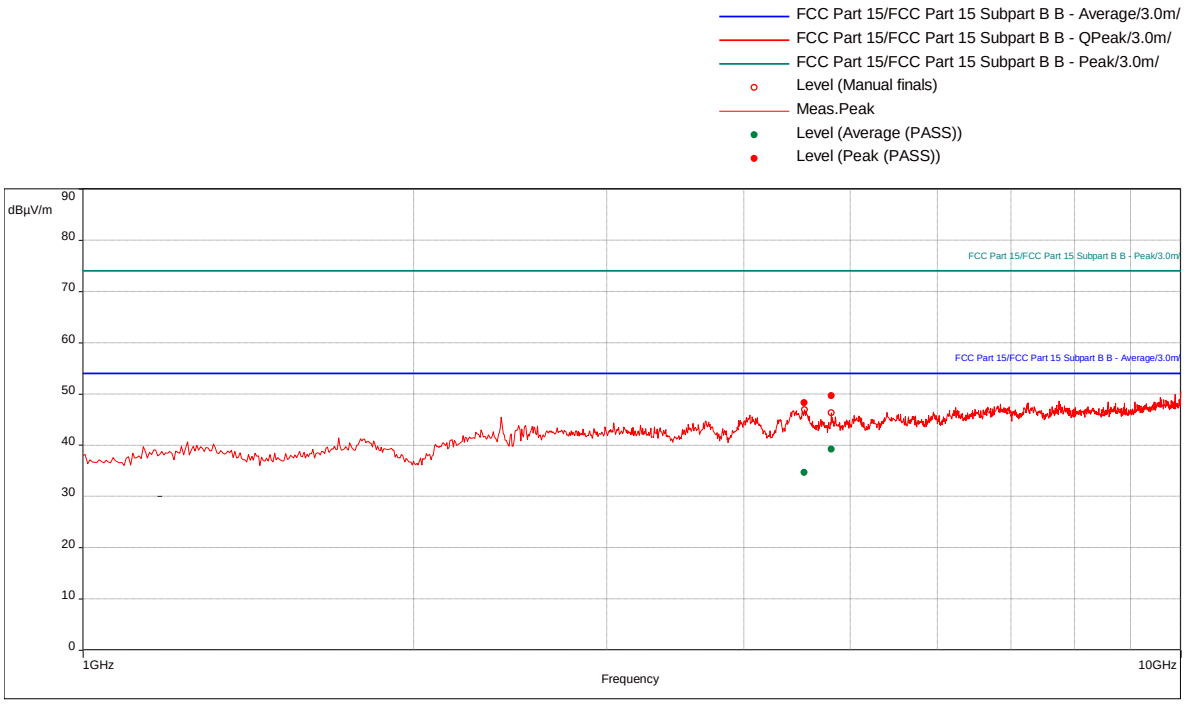
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4804.210526	37.23	54.00	-16.77	55.00	1.00	Vertical	1000000.00	7.98
7201.842105	35.26	54.00	-18.74	159.00	3.16	Horizontal	1000000.00	10.83

Low Channel, 2402 MHz, Tx mode, Z-Axis, 1 – 25 GHz

Test Information:

Date and Time	7/25/2018 3:23:25 PM
Client and Project Number	Becton Dickinson
Engineer	Kouma Sinn
Temperature	23C
Humidity	54%
Atmospheric Pressure	1009mbar
Comments	New_Ew0-01626_IDD Tx Low (z-axis, back side) 1 to 10 GHz SA mode

Graph:



Note : Scan from 10 – 25 GHz was performed manually, no emissions were detected above the measuring equipment noise floor.

Results:

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4540.789474	48.26	74.00	-25.74	304.00	3.79	Vertical	1000000.00	8.99
4803.947368	49.59	74.00	-24.41	33.00	1.00	Vertical	1000000.00	7.98

Average (PASS) (2)

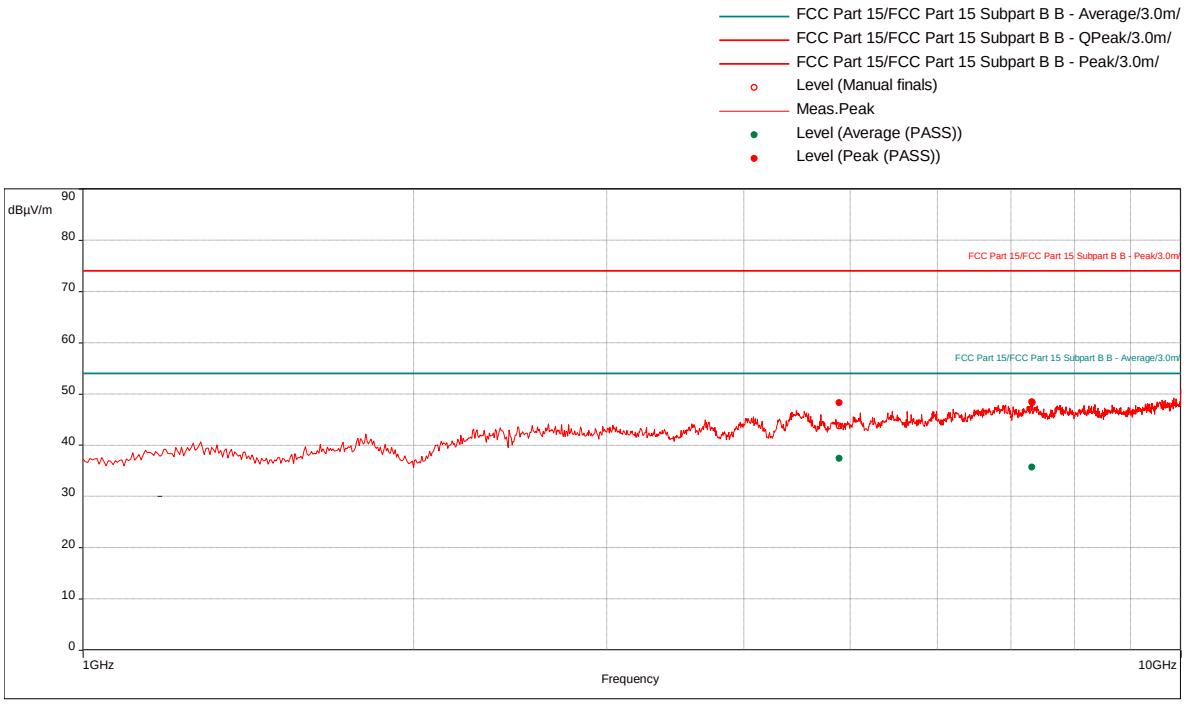
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4540.789474	34.64	54.00	-19.36	304.00	3.79	Vertical	1000000.00	8.99
4803.947368	39.19	54.00	-14.81	33.00	1.00	Vertical	1000000.00	7.98

Mid Channel, 2442 MHz, Tx mode, X-Axis, 1 – 25 GHz

Test Information:

Date and Time	7/25/2018 4:56:58 PM
Client and Project Number	Becton Dickinson
Engineer	Vathana Ven
Temperature	23C
Humidity	54%
Atmospheric Pressure	1009mbar
Comments	New_Ew0-01626_IDD Tx Mid (X-axis, flat) 1 to 10 GHz

Graph:



Note : Scan from 10 – 25 GHz was performed manually, no emissions were detected above the measuring equipment noise floor.

Results:

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4883.947368	48.29	74.00	-25.71	275.00	2.30	Vertical	1000000.00	8.03
7321.842105	48.41	74.00	-25.59	136.00	3.24	Vertical	1000000.00	10.87

Average (PASS) (2)

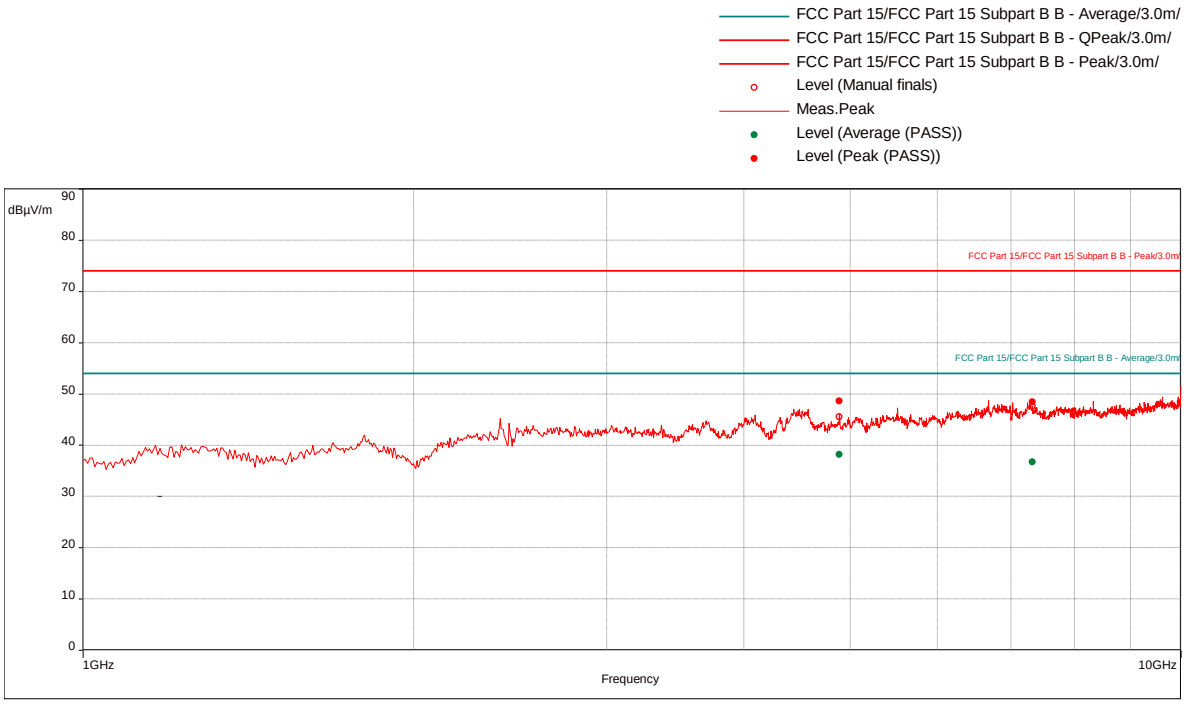
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4883.947368	37.38	54.00	-16.62	275.00	2.30	Vertical	1000000.00	8.03
7321.842105	35.65	54.00	-18.35	136.00	3.24	Vertical	1000000.00	10.87

Mid Channel, 2442 MHz, Tx mode, Y-Axis, 1 – 25 GHz

Test Information:

Date and Time	7/25/2018 4:21:17 PM
Client and Project Number	Becton Dickinson
Engineer	Vathana Ven
Temperature	23C
Humidity	54%
Atmospheric Pressure	1009mbar
Comments	New_Ew0-01626_IDD Tx Mid (Y-axis, long side) 1 to 10 GHz

Graph:



Note : Scan from 10 – 25 GHz was performed manually, no emissions were detected above the measuring equipment noise floor.

Results:

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4883.947368	48.56	74.00	-25.44	277.00	1.24	Vertical	1000000.00	8.03
7325.789474	48.41	74.00	-25.59	5.00	2.07	Vertical	1000000.00	10.87

Average (PASS) (2)

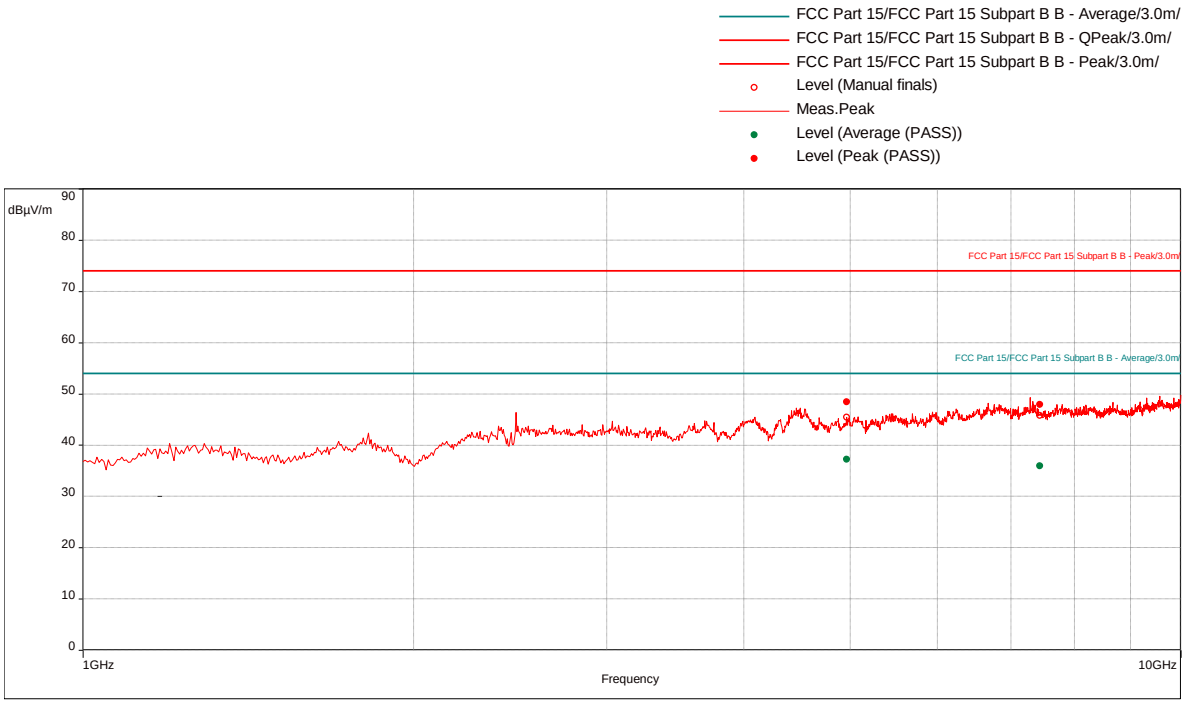
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4883.947368	38.13	54.00	-15.87	277.00	1.24	Vertical	1000000.00	8.03
7325.789474	36.67	54.00	-17.33	5.00	2.07	Vertical	1000000.00	10.87

Mid Channel, 2442 MHz, Tx mode, Z-Axis, 1 – 25 GHz

Test Information:

Date and Time	7/25/2018 5:43:30 PM
Client and Project Number	Becton Dickinson
Engineer	Vathana Ven
Temperature	23C
Humidity	54%
Atmospheric Pressure	1009mbar
Comments	New_Ew0-01626_IDD Tx High (Z-axis, Short side) 1 to 10 GHz

Graph:



Note : Scan from 10 – 25 GHz was performed manually, no emissions were detected above the measuring equipment noise floor.

Results:

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4960.263158	48.44	74.00	-25.56	55.00	1.00	Vertical	1000000.00	8.19
7439.210526	47.92	74.00	-26.08	202.00	3.43	Vertical	1000000.00	10.79

Average (PASS) (2)

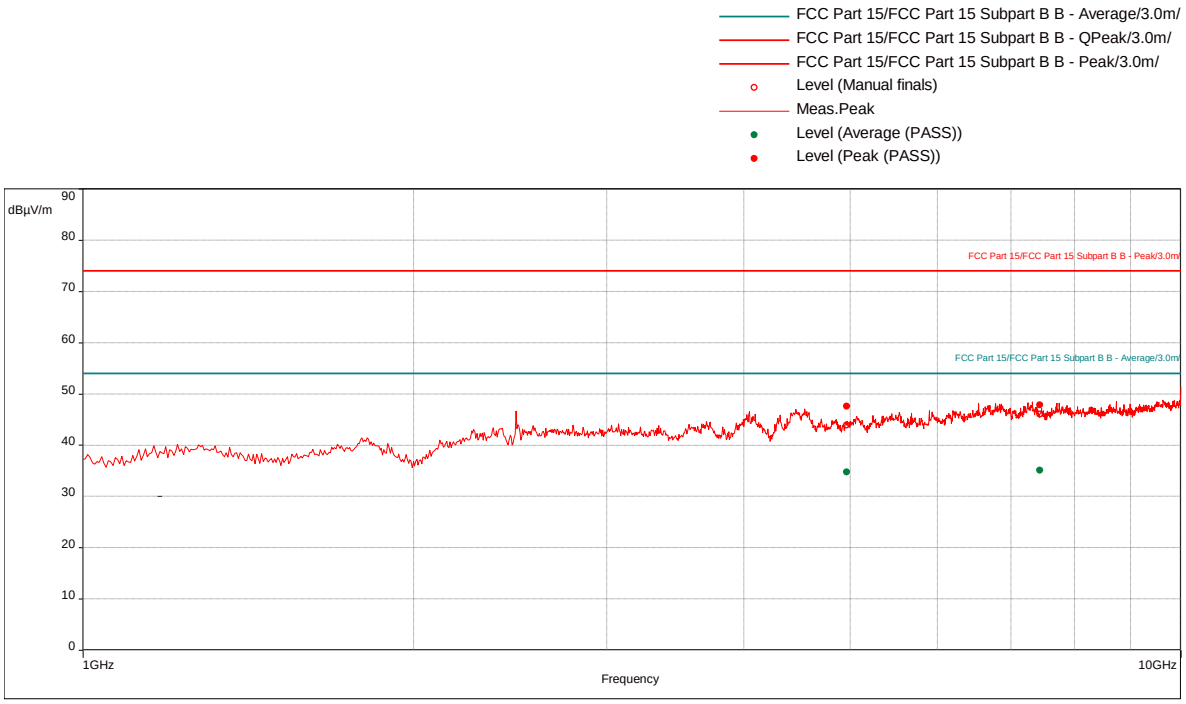
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4960.263158	37.18	54.00	-16.82	55.00	1.00	Vertical	1000000.00	8.19
7439.210526	35.97	54.00	-18.03	202.00	3.43	Vertical	1000000.00	10.79

High Channel, 2480 MHz, Tx mode, X-Axis, 1 – 25 GHz

Test Information:

Date and Time	7/25/2018 5:17:13 PM
Client and Project Number	Becton Dickinson
Engineer	Vathana Ven
Temperature	23C
Humidity	54%
Atmospheric Pressure	1009mbar
Comments	New_Ew0-01626_IDD Tx High (X-axis, Flat) 1 to 10 GHz

Graph:



Note : Scan from 10 – 25 GHz was performed manually, no emissions were detected above the measuring equipment noise floor.

Results:

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4959.473684	47.60	74.00	-26.40	194.00	3.53	Horizontal	1000000.00	8.19
7440	47.79	74.00	-26.21	93.00	3.00	Vertical	1000000.00	10.79

Average (PASS) (2)

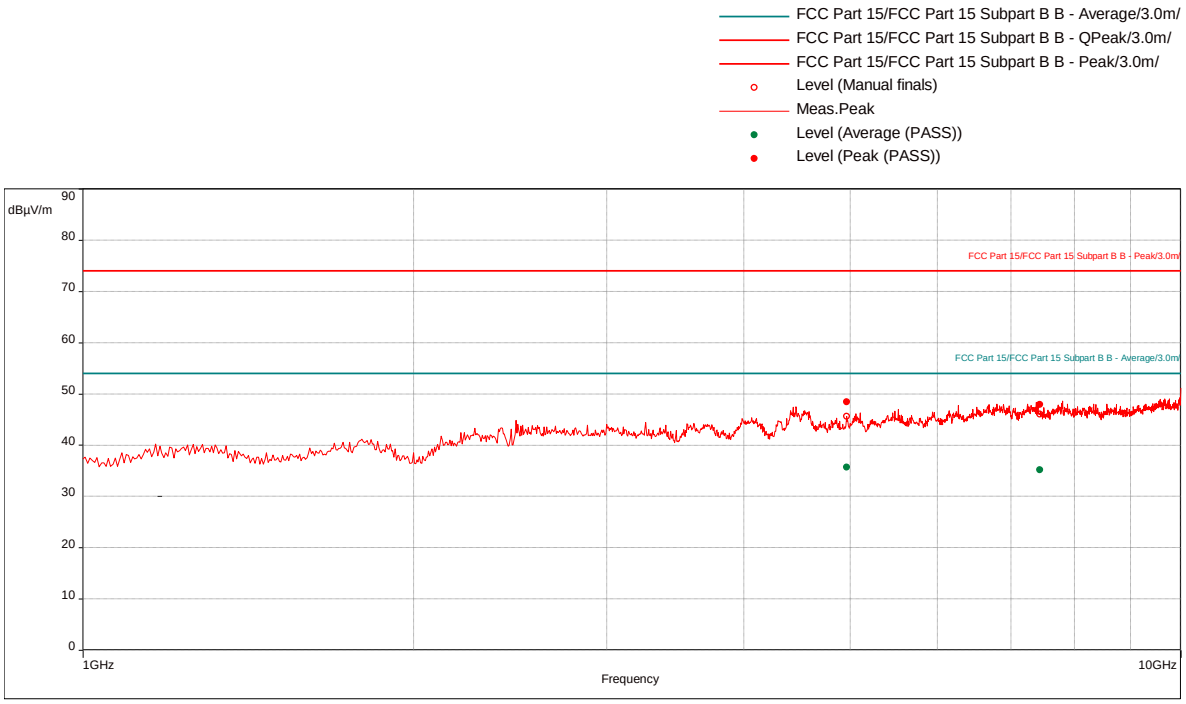
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4959.473684	34.76	54.00	-19.24	194.00	3.53	Horizontal	1000000.00	8.19
7440	35.05	54.00	-18.95	93.00	3.00	Vertical	1000000.00	10.79

High Channel, 2480 MHz, Tx mode, Y-Axis, 1 – 25 GHz

Test Information:

Date and Time	7/25/2018 5:59:11 PM
Client and Project Number	Becton Dickinson
Engineer	Vathana Ven
Temperature	23C
Humidity	54%
Atmospheric Pressure	1009mbar
Comments	New_Ew0-01626_IDD Tx High (Y-axis, long side) 1 to 10 GHz

Graph:



Note : Scan from 10 – 25 GHz was performed manually, no emissions were detected above the measuring equipment noise floor.

Results:

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4960.526316	48.44	74.00	-25.56	78.00	1.00	Vertical	1000000.00	8.19
7440	47.92	74.00	-26.08	269.00	2.78	Horizontal	1000000.00	10.79

Average (PASS) (2)

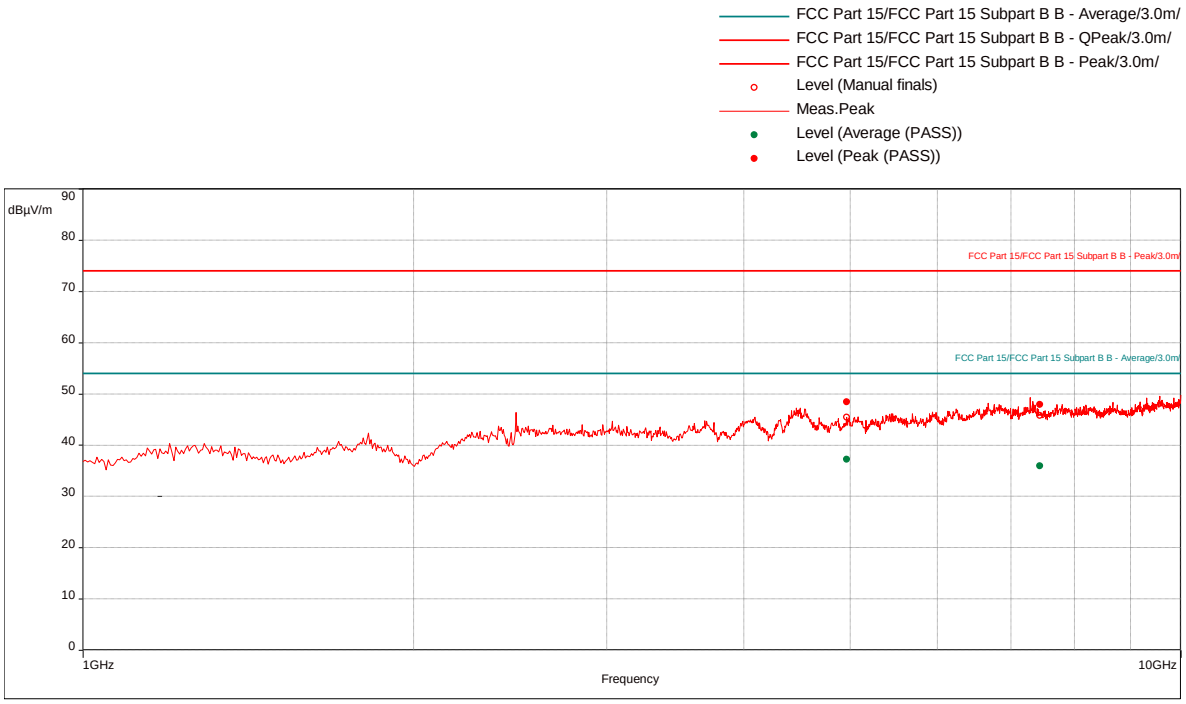
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4960.526316	35.67	54.00	-18.33	78.00	1.00	Vertical	1000000.00	8.19
7440	35.14	54.00	-18.86	269.00	2.78	Horizontal	1000000.00	10.79

High Channel, 2480 MHz, Tx mode, Z-Axis, 1 – 25 GHz

Test Information:

Date and Time	7/25/2018 5:43:30 PM
Client and Project Number	Becton Dickinson
Engineer	Vathana Ven
Temperature	23C
Humidity	54%
Atmospheric Pressure	1009mbar
Comments	New_Ew0-01626_IDD Tx High (Z-axis, Short side) 1 to 10 GHz

Graph:



Note : Scan from 10 – 25 GHz was performed manually, no emissions were detected above the measuring equipment noise floor.

Results:

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4960.263158	48.44	74.00	-25.56	55.00	1.00	Vertical	1000000.00	8.19
7439.210526	47.92	74.00	-26.08	202.00	3.43	Vertical	1000000.00	10.79

Average (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4960.263158	37.18	54.00	-16.82	55.00	1.00	Vertical	1000000.00	8.19
7439.210526	35.97	54.00	-18.03	202.00	3.43	Vertical	1000000.00	10.79

Test Personnel:	Kouma Sinn KPS Vathana Ven VJV	Test Date:	07/20/2018 07/25/2018
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:	Internal Battery Powered		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	23, 23 ºC
		Relative Humidity:	47, 54 %
		Atmospheric Pressure:	1010, 1009 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.

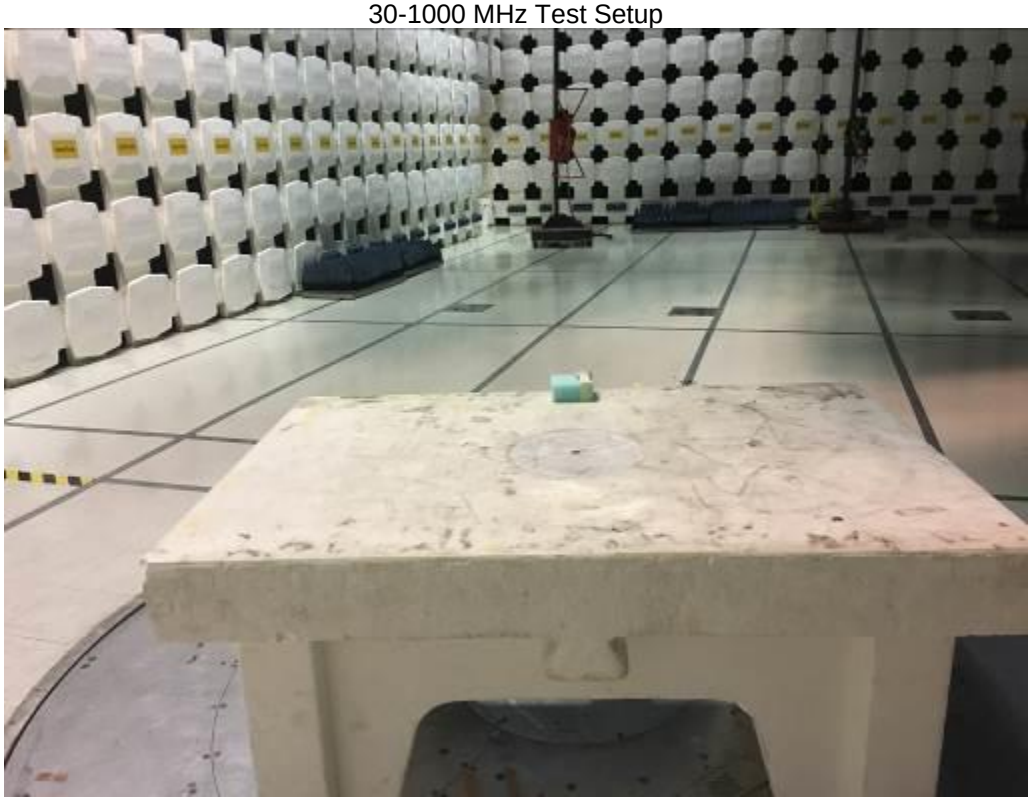
§15.209 Radiated emission limits; general requirements.

(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

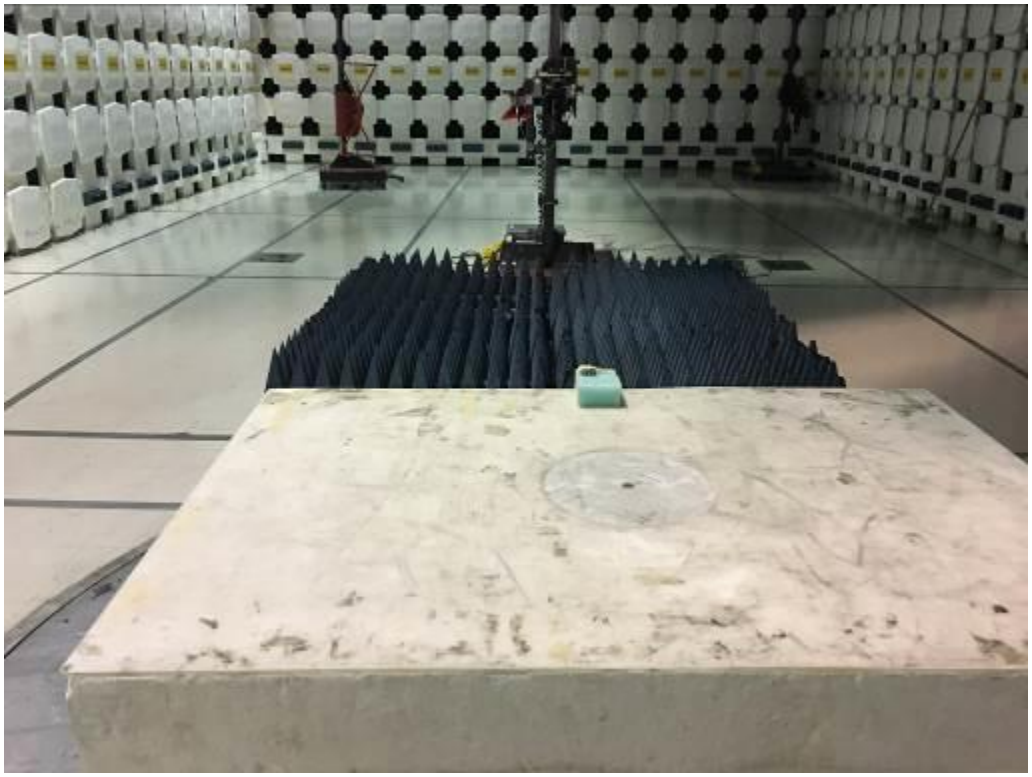
11.4 Setup Photographs:

30-1000 MHz Test Setup



1-13 GHz Test Setup

1 – 13 GHz



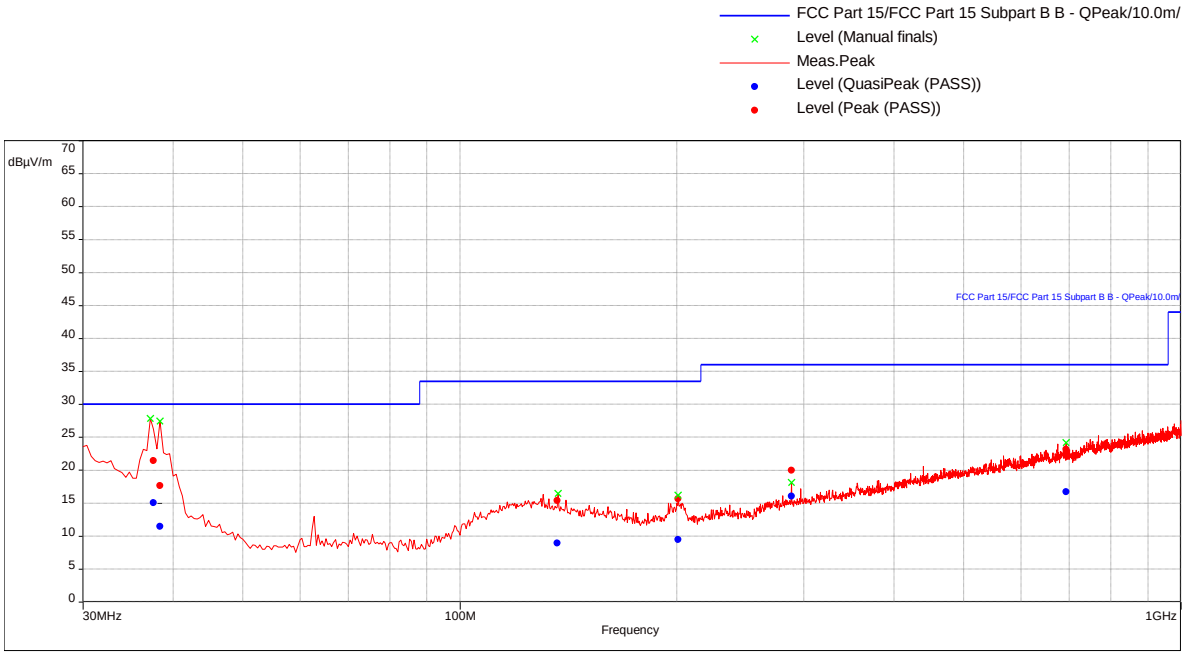
11.5 Plots/Data:

Digital Electronics Spurious Emissions

Test Information:

Date and Time	7/24/2018 11:51:26 AM
Client and Project Number	Becton Dikinson
Engineer	Kouma Sinn
Temperature	22C
Humidity	54%
Atmospheric Pressure	1015mbar
Comments	IDD_Rx at Low Ch

Graph:



Results:

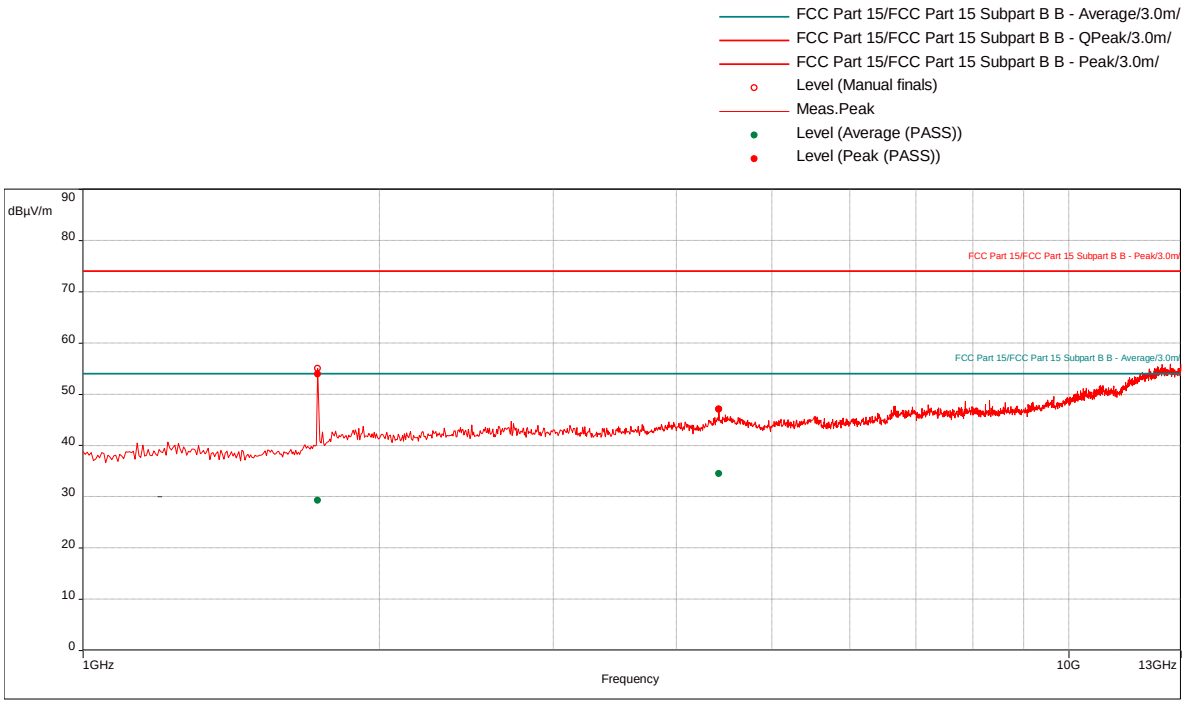
QuasiPeak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
37.57894737	15.03	30.00	-14.97	25.00	3.30	Vertical	120000.00	-27.51
38.27368421	11.43	30.00	-18.57	40.00	3.37	Vertical	120000.00	-28.02
136.5473684	8.94	33.50	-24.56	63.00	2.50	Vertical	120000.00	-29.22
200.9578947	9.46	33.50	-24.04	239.00	1.75	Vertical	120000.00	-29.13
288.5578947	16.06	36.00	-19.94	19.00	1.00	Vertical	120000.00	-28.32
693.2315789	16.70	36.00	-19.30	188.00	3.96	Horizontal	120000.00	-19.26

Test Information:

Date and Time	7/24/2018 8:50:14 PM
Client and Project Number	Becton Dickinson
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	47%
Atmospheric Pressure	1012 mB
Comments	RE 1 to 13 GHz_IDD_Lo Channel_Rx mode

Graph:



Results:

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1730.526316	53.93	74.00	-20.07	299.00	1.95	Vertical	1000000.00	2.30
4418.684211	47.09	74.00	-26.91	247.00	1.42	Vertical	1000000.00	8.62

Average (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
1730.526316	29.28	54.00	-24.72	299.00	1.95	Vertical	1000000.00	2.30
4418.684211	34.49	54.00	-19.51	247.00	1.42	Vertical	1000000.00	8.62

Test Personnel:	Vathana Ven VSV	Test Date:	07/24/2018
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:	Internal Battery	Ambient Temperature:	24 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	47 %
		Atmospheric Pressure:	1012 mbars

Deviations, Additions, or Exclusions: None

12 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	08/20/2018	103511832BOX-012a	VFV	MFM	Original Issue