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Insulet Corporation
TEST REPORT

SCOPE OF WORK
EMC TESTING – POD; Model 18338

REPORT NUMBER
103328054BOX-001

ISSUE DATE
03/12/2018

PAGES
67

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

EMISSIONS TEST REPORT

(FULL COMPLIANCE)

Report Number: 103328054BOX-001
Project Number: G103328054

Report Issue Date: 03/12/2018

Model(s) Tested: POD (18338)
Model(s) Partially Tested: None
Model(s) Not Tested but declared equivalent by the client: None

Standards: CFR47 FCC Part 15.247 Subpart C: 02/2018
CFR47 FCC Part 15 Subpart B: 02/2018
RSS-247 Issue 2: 02/2017
ICES-003 Issue 6: 01/2016
RSS-Gen Issue 4: 11/2014
RSS-102 Issue 5: 03/2015

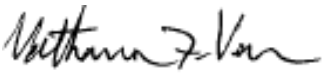
Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
Insulet Corporation
600 Technology Park Drive
Suite 200
Billerica, MA 01821
USA

Report prepared by

Kouma Sinn / EMC Staff Engineer

Report reviewed by



Vathana Ven / EMC Staff Engineer

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:02/2018, Section 15.247 (b)(3) RSS-247 Issue 2: 02/2017, RSS-102 Issue 5: 03/2015)	Pass
7	6 dB Bandwidth and Occupied Bandwidth (CFR47 FCC Part 15 Subpart C: 02/2018, Section 15.247 (a)(2) RSS-247 Issue 2: 02/2017)	Pass
8	Maximum Power Spectral Density (CFR47 FCC Part 15 Subpart C: 02/2018, Section 15.247 (e) RSS-247 Issue 2: 02/2017)	Pass
9	Band Edge Compliance (CFR47 FCC Part 15 Subpart C: 02/2018, 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) RSS247 Issue2: 05/2015)	Pass
11	Digital Device and Receiver Radiated Spurious Emissions (CFR47 FCC Part 15 Subpart B 15.109: 02/2018, ICES-003 Issue 6 January 2016)	Pass
--	AC Mains Conducted Emissions FCC 47CFR Part 15.107:2017 ICES-003 Issue 6: 01/2016	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: Insulet Corporation
600 Technology Park Drive
Suite 200
Billerica, MA 01821
USA

Contact: Jonathan Hardy
Telephone: (978) 600-7976
Fax: None
Email: Johardy@insulet.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Insulet Corporation
600 Technology Park Drive
Suite 200
Billerica, MA 01821
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
ASM, Pod, Dash	Insulet Corporation	18338	Tx 2402 MHz – 0000798
ASM, Pod, Dash	Insulet Corporation	18338	Tx 2440 MHz – 0000814
ASM, Pod, Dash	Insulet Corporation	18338	Tx 2480 MHz – 0000832
ASM, Pod, Dash	Insulet Corporation	18338	Rx 2402 MHz – 0000655

Notes: Multiple samples were used for testing at Low, Mid, High, transmitting channels and receiving channel.

Receive Date:	02/23/2018
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
Insulin management system

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

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	constant_carrier_2402MHz_WithMod_PseudoRandTestPattern_2dBm
2	constant_carrier_2440MHz_WithMod_PseudoRandTestPattern_2dBm
3	constant_carrier_2480MHz_WithMod_PseudoRandTestPattern_2dBm
4	Receive Only_2402MHz

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	Modified QN (PN: 18486) & ER48 (PN: 18483) FW to perform the functions described in the operating mode section

Radio/Receiver Characteristics	
Frequency Band(s)	2402-2480 MHz
Modulation Type(s)	GFSK
Maximum Output Power	2.37 dBm
Test Channels	Low channel – 2402 MHz Mid channel – 2440 MHz High channel – 2480 MHz
Occupied Bandwidth	1.045 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
ETSI LBT/Adaptivity	None
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	PCB mag loop with -3.6 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
DAV002'	Weather Station	Davis Instruments	7400	PE80519A93	06/14/2017	06/14/2018
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/17/2017	11/17/2018
CBLSHF202'	Cable, SMA - SMA, 9kHz-40GHz	Sucoflex (Huber Suhn	104PE	CBLSHF202	08/25/2017	08/25/2018
MIN23'	Attenuator 2 watt 20dB DC-26GHz	Mini Circuits	BW-S20-2W263+	MIN23	05/26/2017	05/26/2018

Software Utilized:

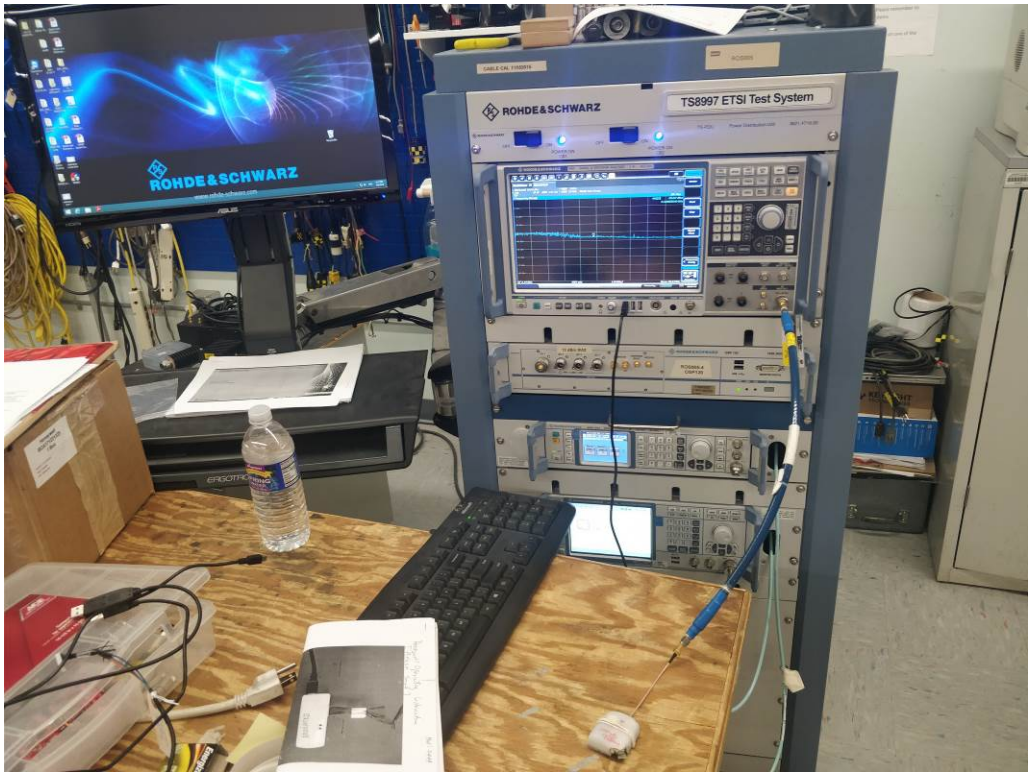
Name	Manufacturer	Version
None	--	--

6.3 Results:

The sample tested was found to Comply.

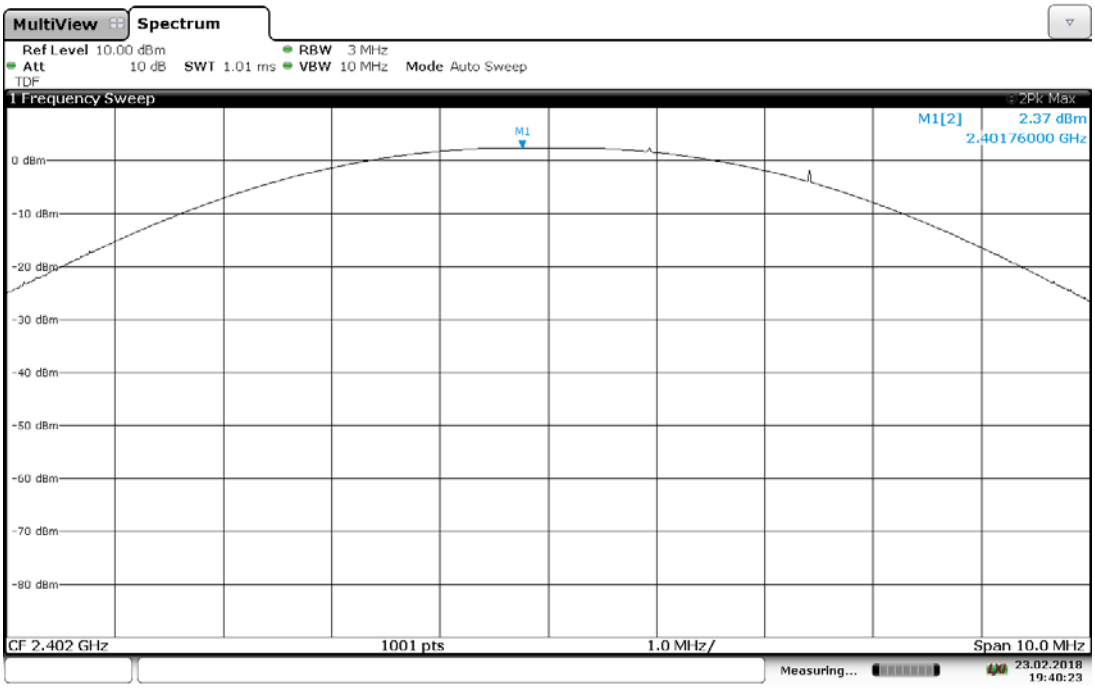
§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt or 30 dBm.

6.4 Setup Photographs:



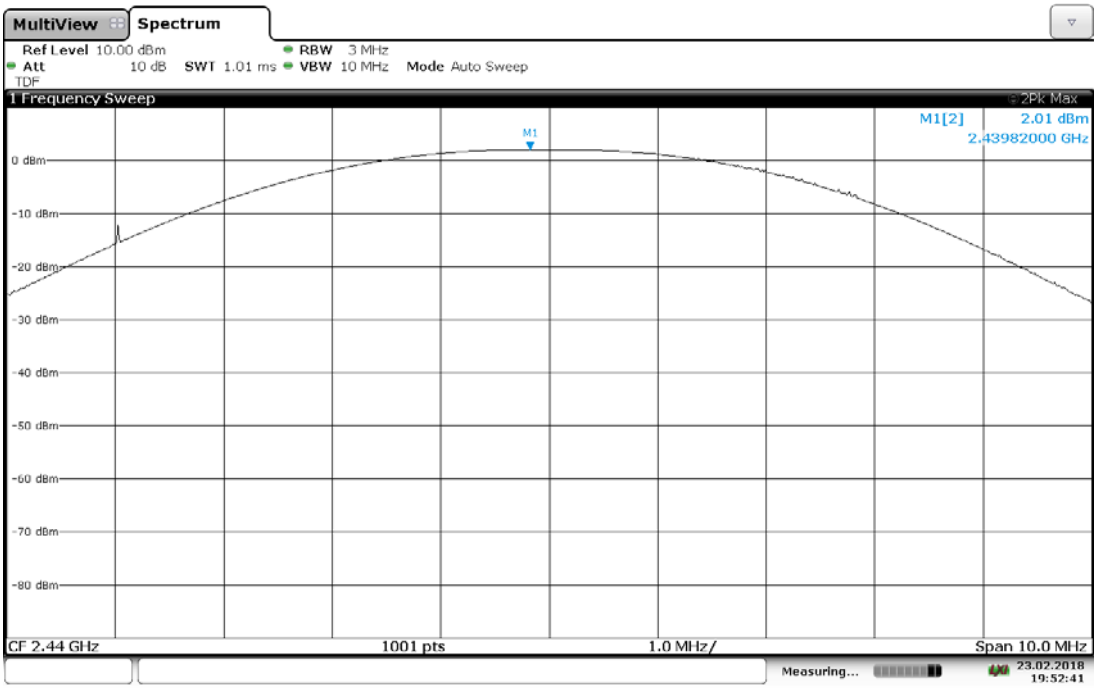
6.5 Plots/Data:

Low Channel Antenna Port Conducted Power, 2.37 dBm



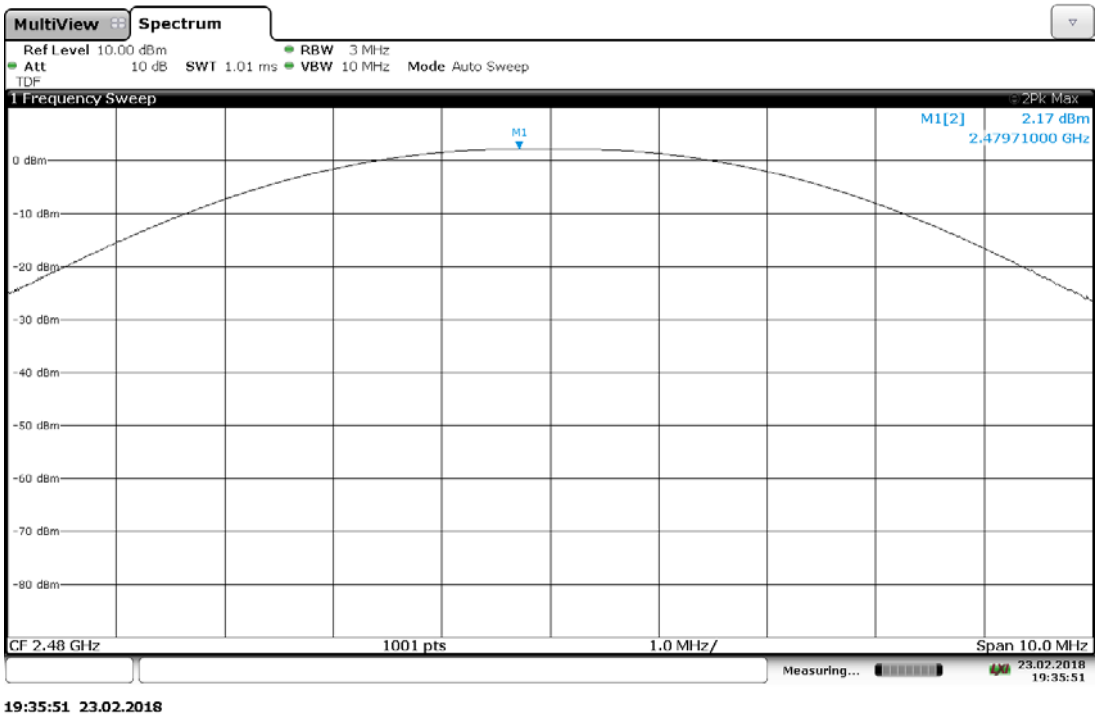
19:40:23 23.02.2018

Mid Channel Antenna Port Conducted Power, 2.01 dBm



19:52:41 23.02.2018

High Channel Antenna Port Conducted Power, 2.17 dBm



SAR Exemption Calculation

Maximum Conducted Output Power of Transmitter = 2.37dBm = 1.72 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

= (1.72/5)*(sqrt(2.402))

= 0.53 < 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 1.72 mW @ 2402 MHz is less than 4 mW limit specified at 2450 MHz, device meets SAR exclusion.

Test Personnel:	Naga Suryadevara N.S	Test Date:	02/23/2018
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:	22 ºC
		Relative Humidity:	18 %
		Atmospheric Pressure:	1003 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
DAV002'	Weather Station	Davis Instruments	7400	PE80519A93	06/14/2017	06/14/2018
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/17/2017	11/17/2018
CBLSHF202'	Cable, SMA - SMA, 9kHz-40GHz	Sucoflex (Huber Suhn	104PE	CBLSHF202	08/25/2017	08/25/2018
MIN23'	Attenuator 2 watt 20dB DC-26GHz	Mini Circuits	BW-S20-2W263+	MIN23	05/26/2017	05/26/2018

Software Utilized:

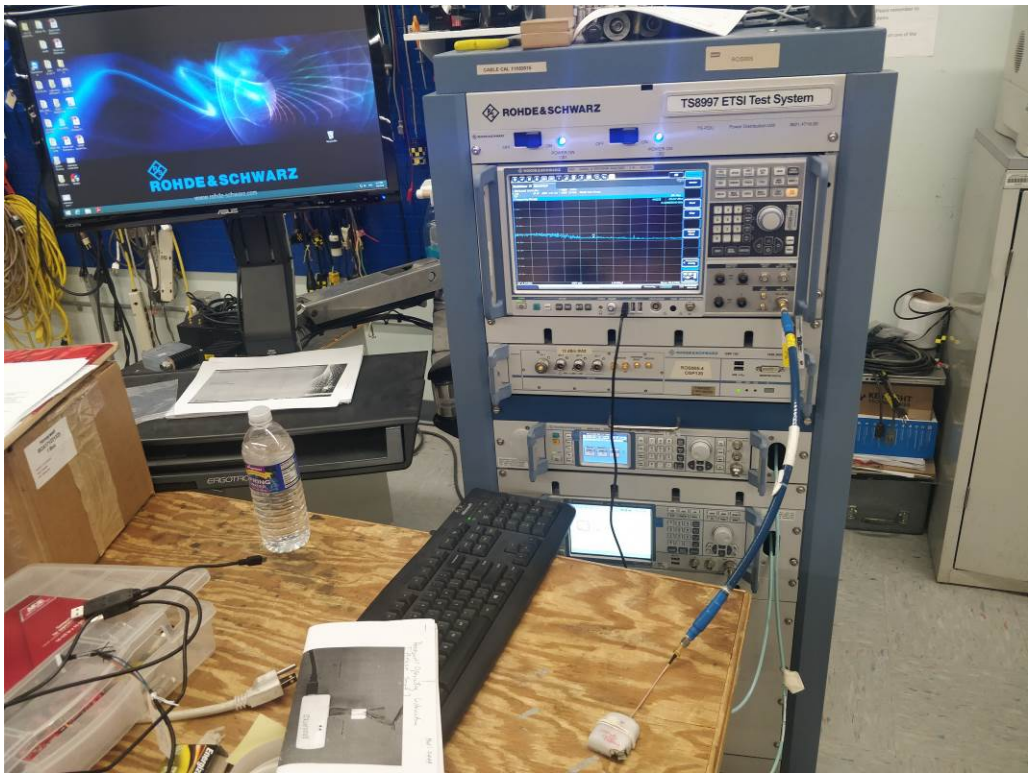
Name	Manufacturer	Version
None	--	--

7.3 Results:

The sample tested was found to Comply.

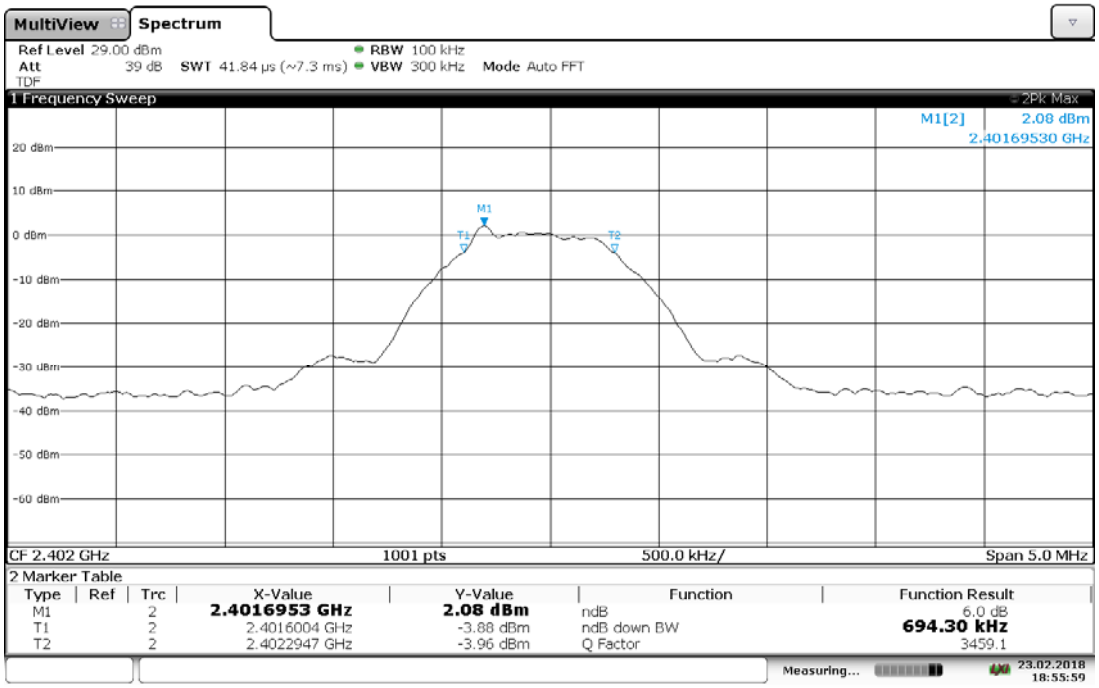
§15.247 (a) (2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

7.4 Setup Photographs:



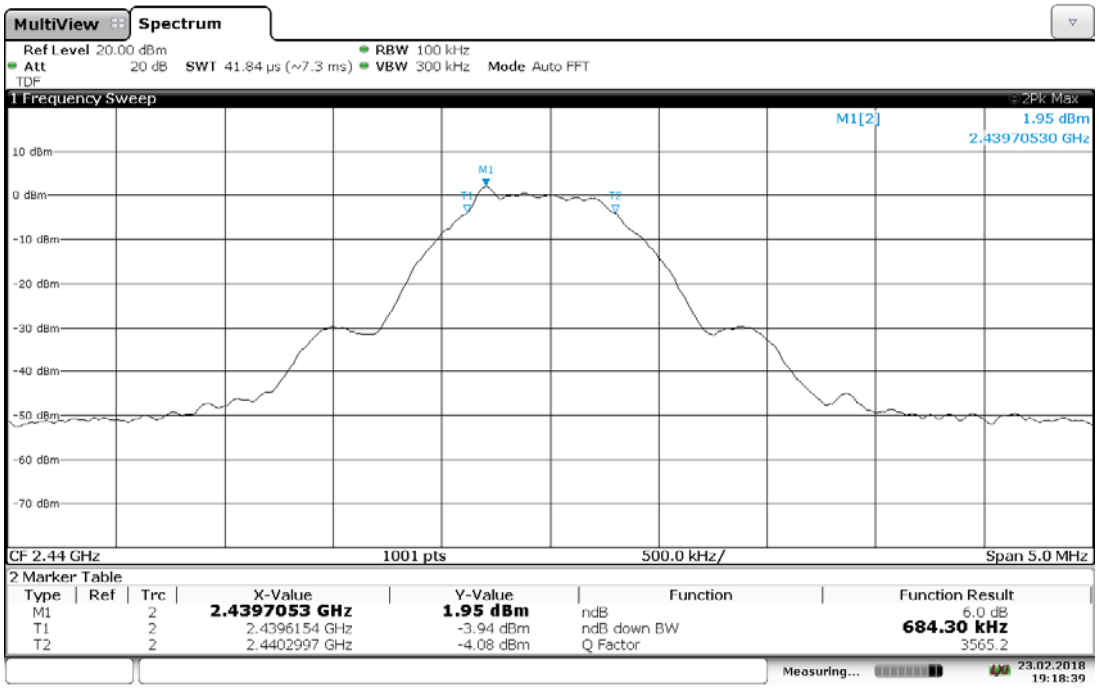
7.5 Plots/Data:

Low Channel 6 dB Bandwidth, 694.3 kHz



18:56:00 23.02.2018

Mid Channel 6 dB Bandwidth, 684.30 kHz



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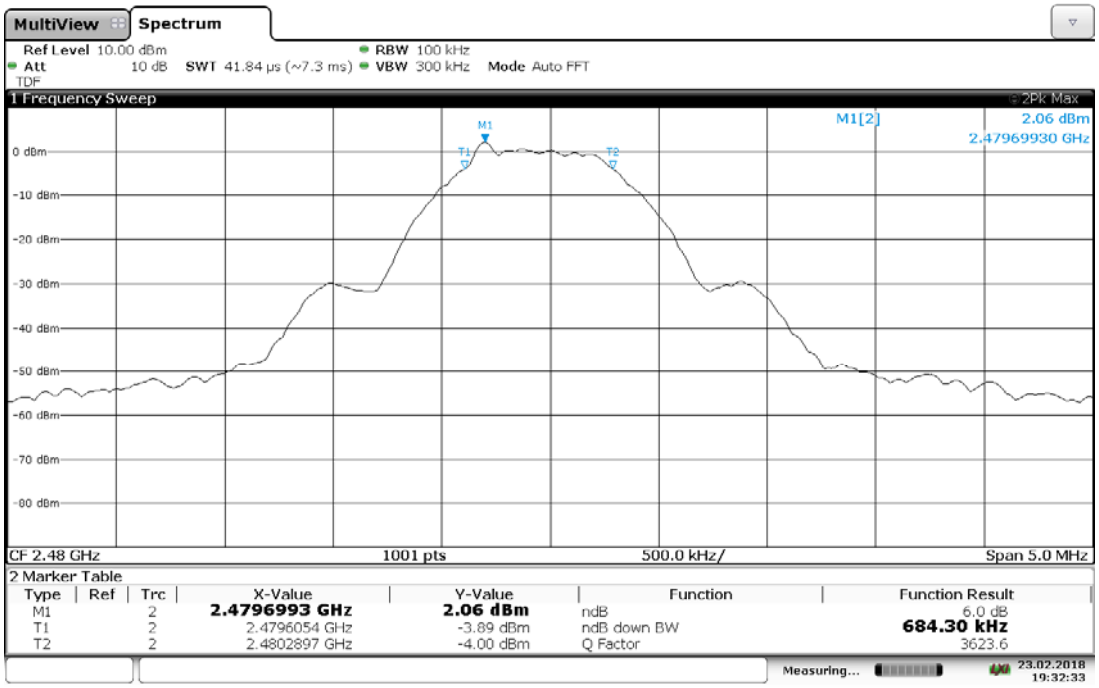
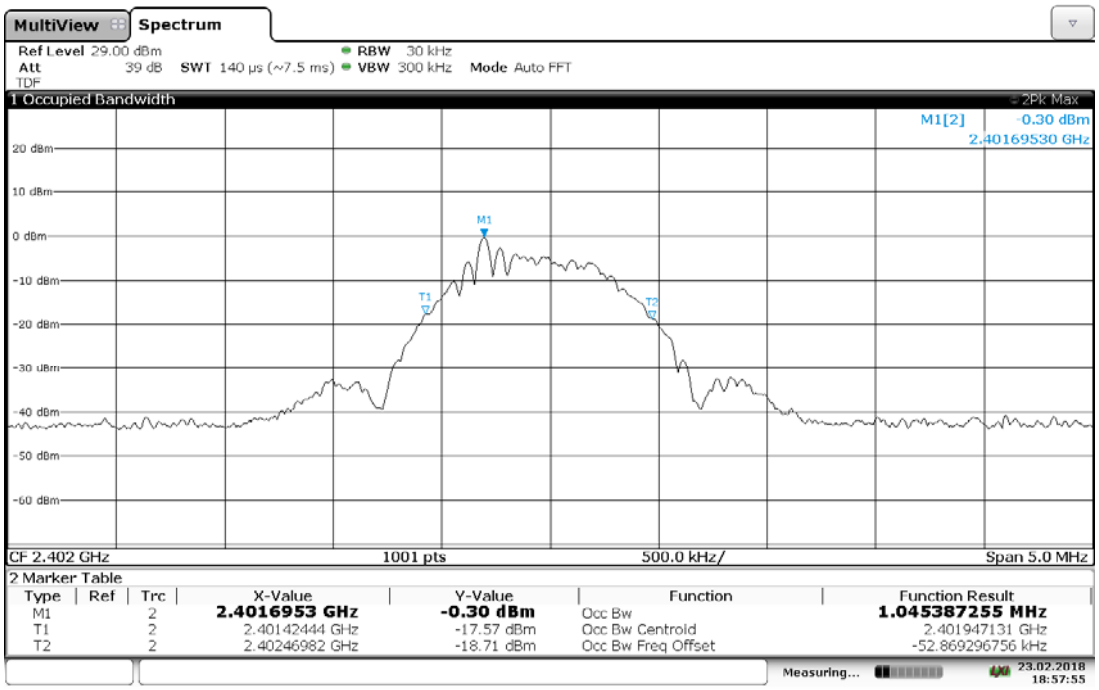
High Channel 6 dB Bandwidth, 684.30 kHz



19:32:33 23.02.2018

Low Channel Occupied Bandwidth, 1.045 MHz

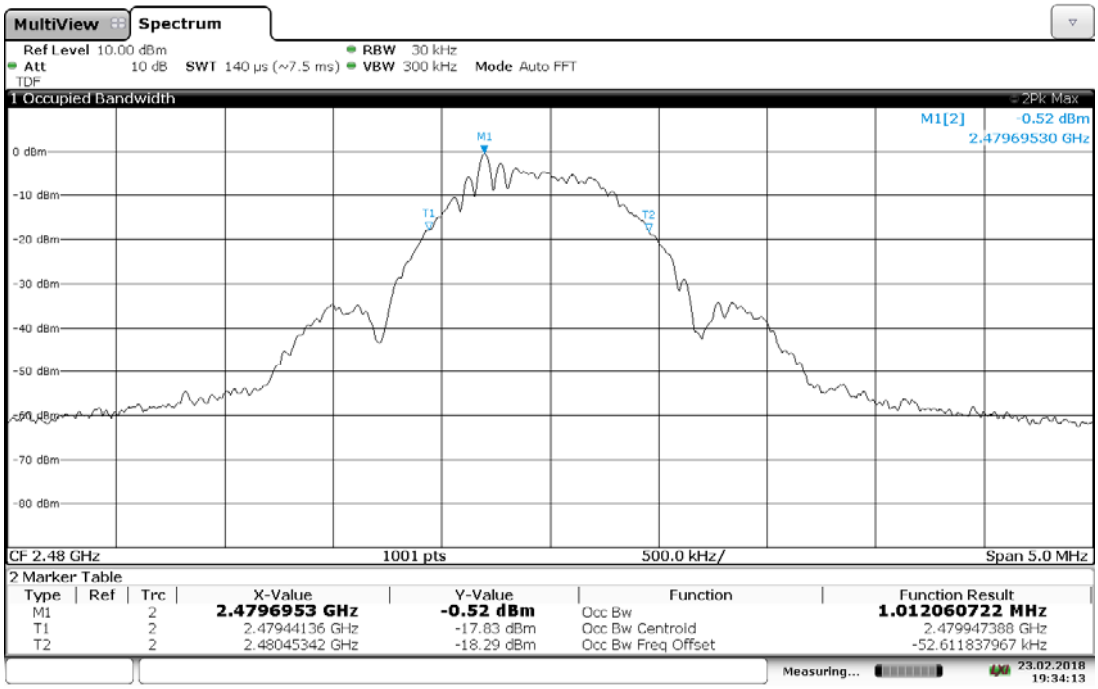


18:57:56 23.02.2018

Mid Channel Occupied Bandwidth, 1.021 MHz

19:20:54 23.02.2018

High Channel Occupied Bandwidth, 1.012 MHz



19:34:13 23.02.2018

Test Personnel:	Naga Suryadevara N.S	Test Date:	02/23/2018
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:	22 ºC
		Relative Humidity:	18 %
		Atmospheric Pressure:	1003 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
DAV002'	Weather Station	Davis Instruments	7400	PE80519A93	06/14/2017	06/14/2018
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/17/2017	11/17/2018
CBLSHF202'	Cable, SMA - SMA, 9kHz-40GHz	Sucoflex (Huber Suhn	104PE	CBLSHF202	08/25/2017	08/25/2018
MIN23'	Attenuator 2 watt 20dB DC-26GHz	Mini Circuits	BW-S20-2W263+	MIN23	05/26/2017	05/26/2018

Software Utilized:

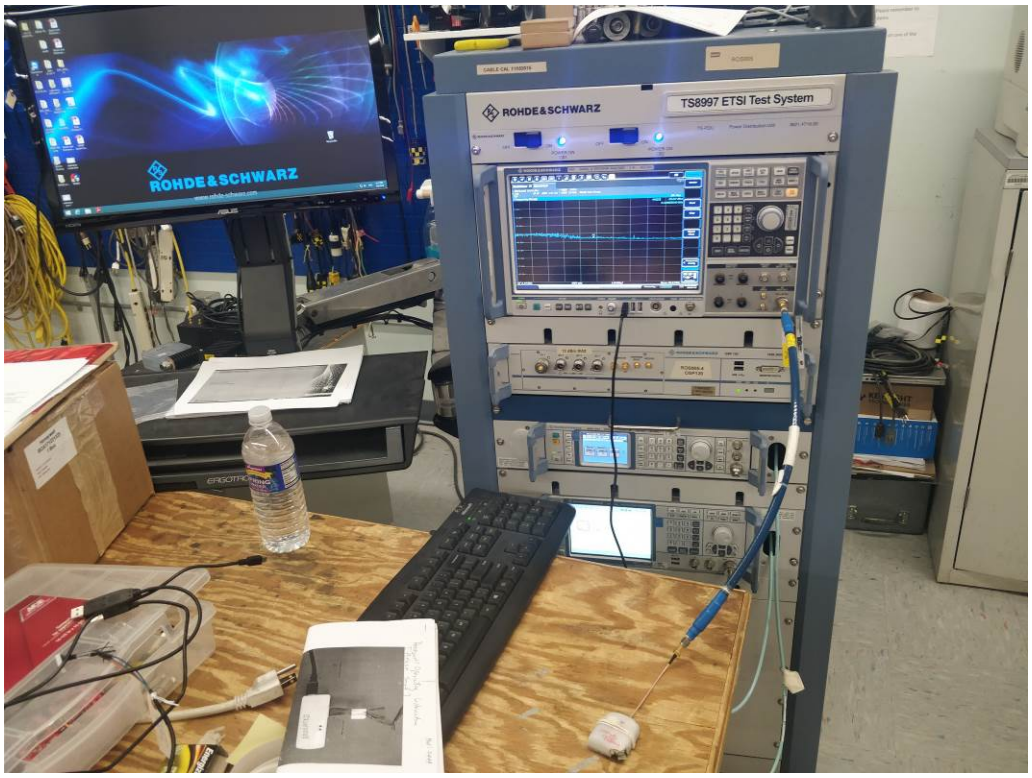
Name	Manufacturer	Version

8.3 Results:

The sample tested was found to Comply.

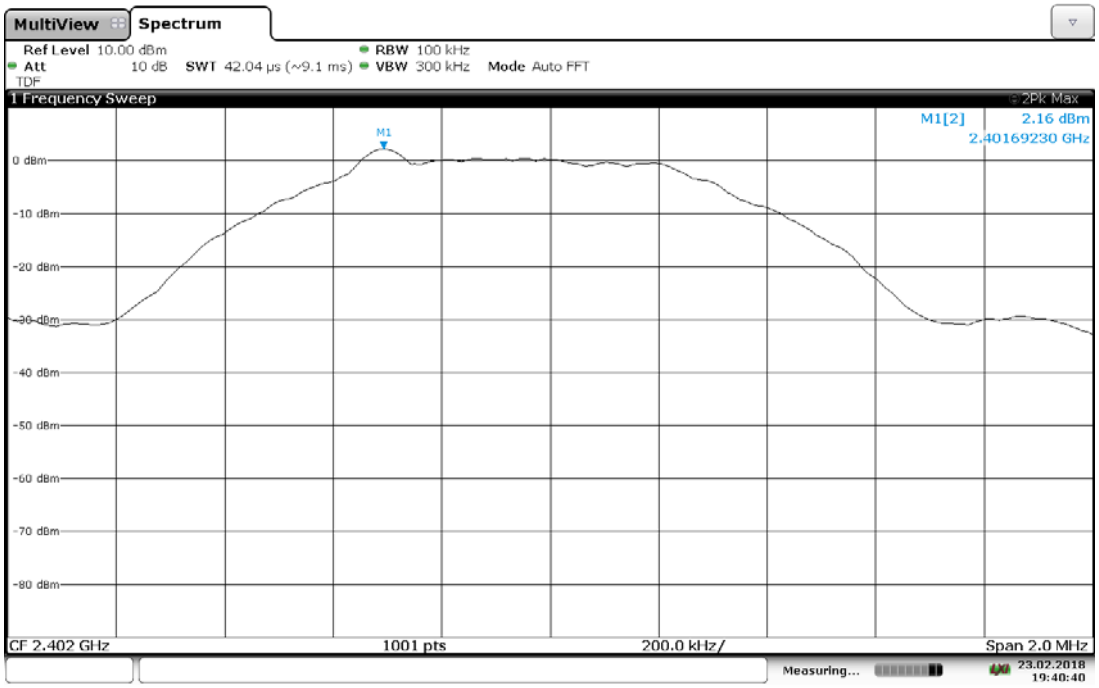
§15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.4 Setup Photographs:



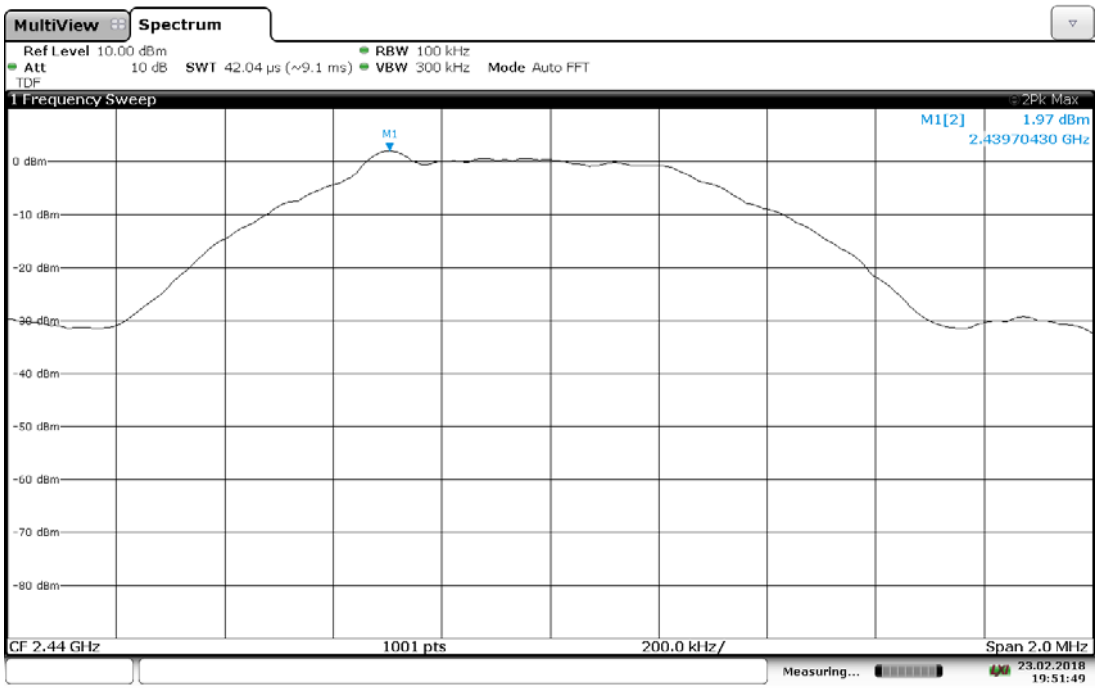
8.5 Plots/Data:

Low Channel Power Spectral Density, 2.16 dBm



19:40:40 23.02.2018

Mid Channel Power Spectral Density, 1.97 dBm



19:51:50 23.02.2018

High Channel Power Spectral Density, 2.05 dBm

Test Personnel:	Naga Suryadevara N.S	Test Date:	02/23/2018
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:	22 ºC
		Relative Humidity:	18 %
		Atmospheric Pressure:	1003 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
DAV002'	Weather Station	Davis Instruments	7400	PE80519A93	06/14/2017	06/14/2018
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/15/2017	03/15/2018
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	05/22/2017	05/22/2018
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2017	07/25/2018

Software Utilized:

Name	Manufacturer	Version
None	--	--

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV002'	Weather Station	Davis Instruments	7400	PE80519A93	06/14/2017	06/14/2018
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/17/2017	11/17/2018
CBLSHF202'	Cable, SMA - SMA, 9kHz-40GHz	Sucoflex (Huber Suhn	104PE	CBLSHF202	08/25/2017	08/25/2018
MIN23'	Attenuator 2 watt 20dB DC-26GHz	Mini Circuits	BW-S20-2W263+	MIN23	05/26/2017	05/26/2018

Software Utilized:

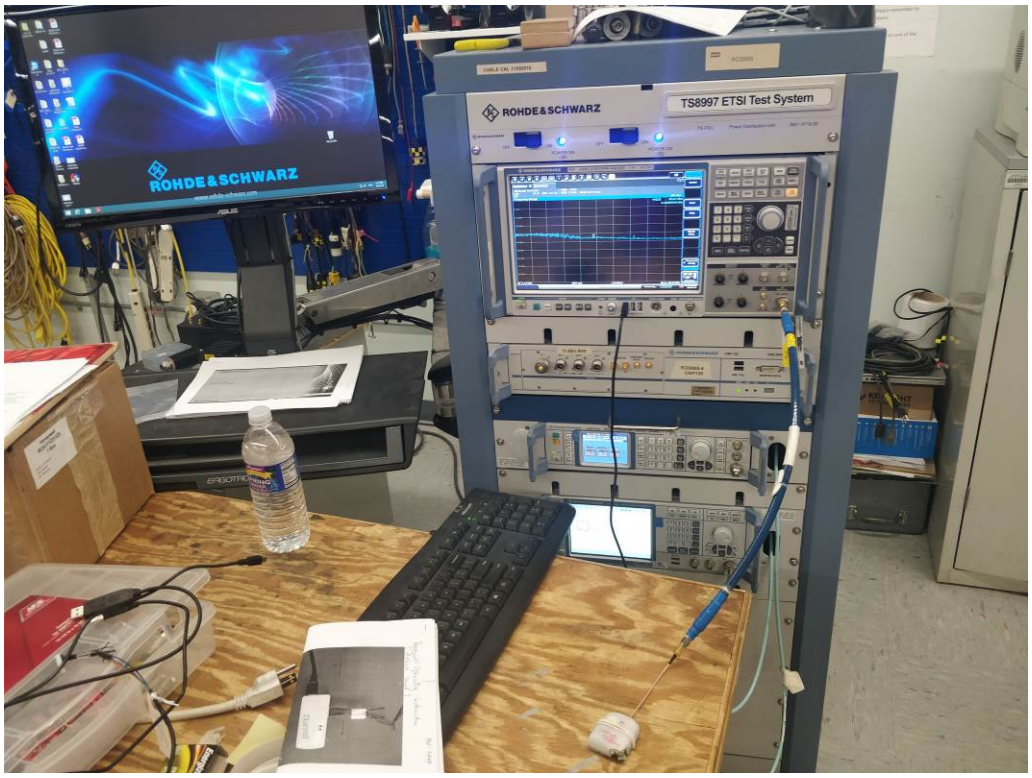
Name	Manufacturer	Version
None	--	--

9.3 Results:

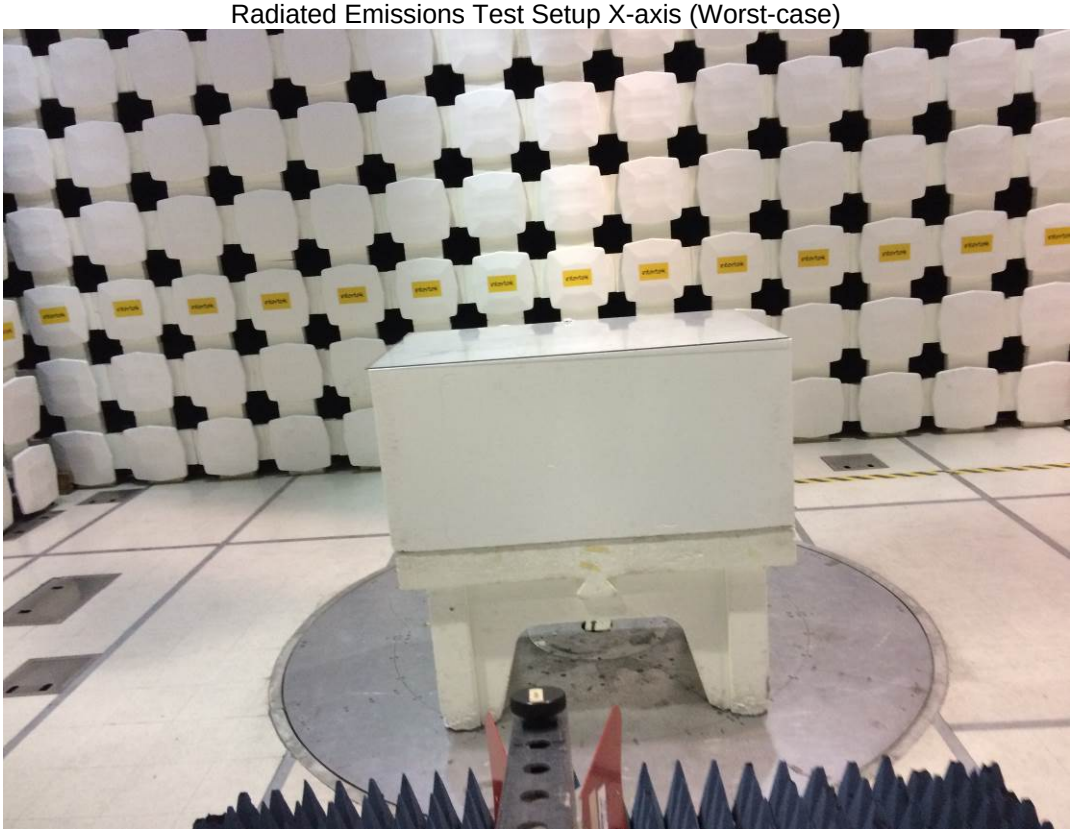
The sample tested was found to Comply.

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))

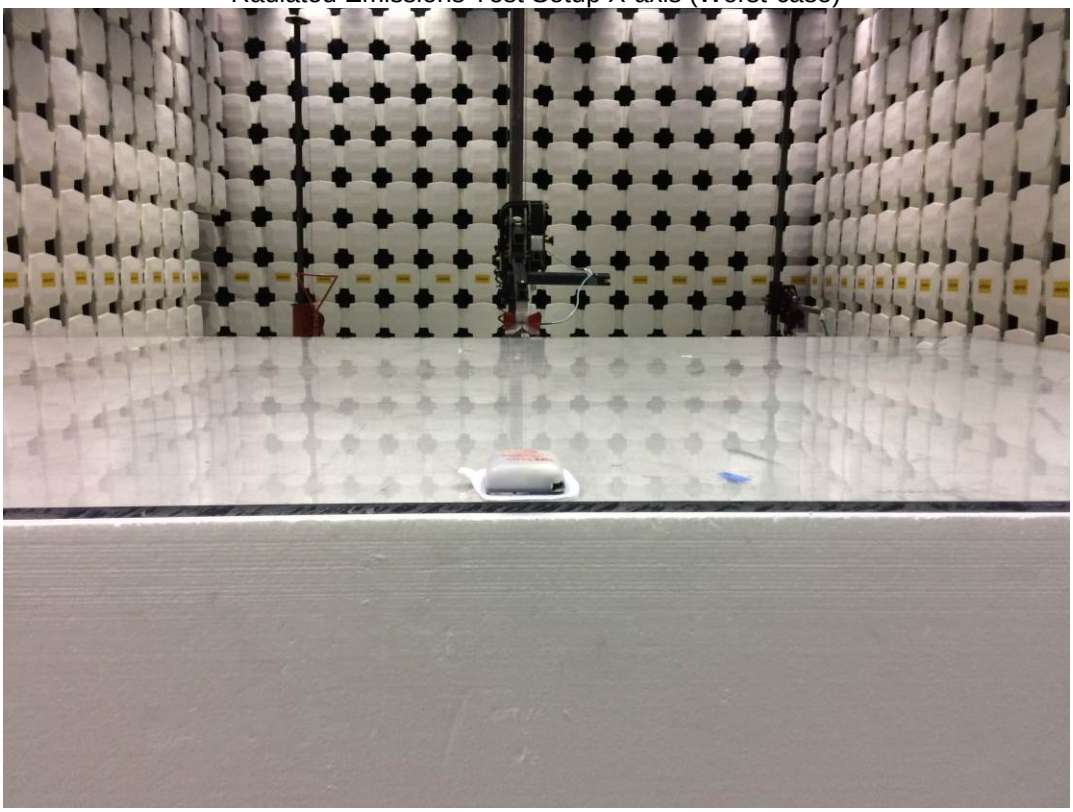
9.4 Setup Photographs:



Radiated Emissions Test Setup X-axis (Worst-case)

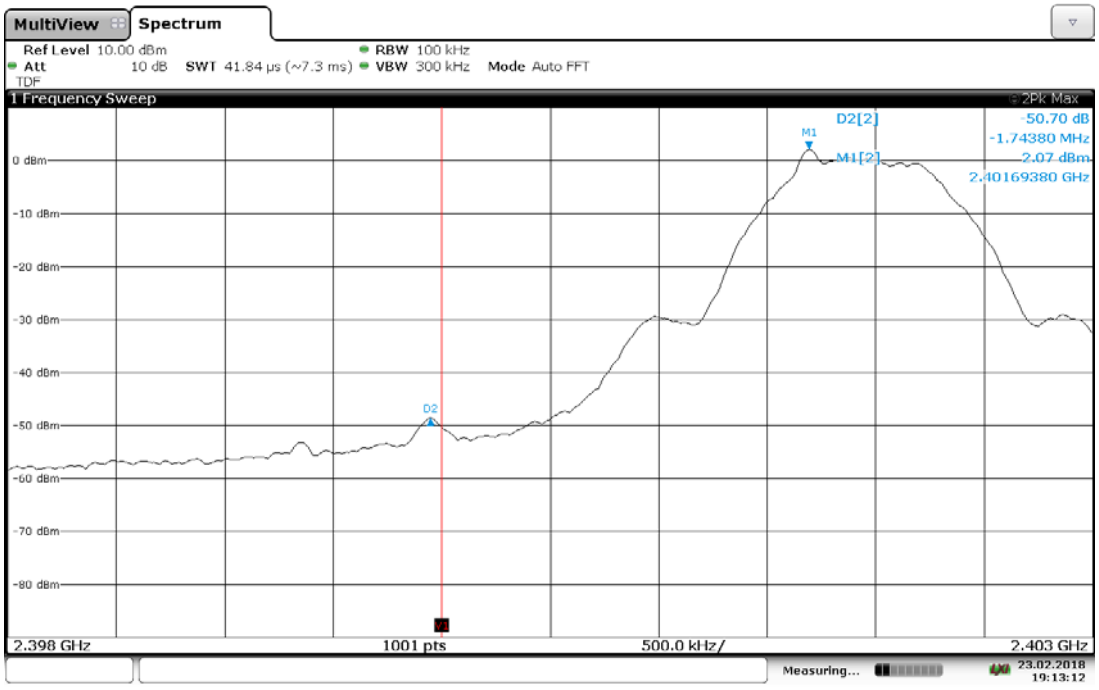


Radiated Emissions Test Setup X-axis (Worst-case)



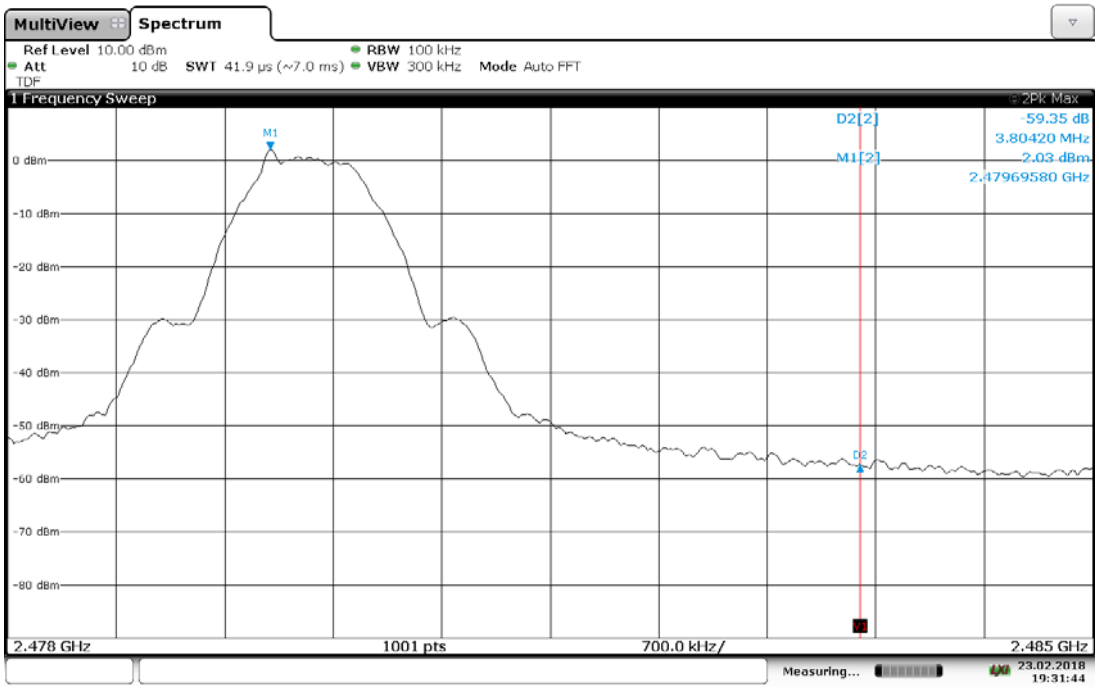
9.5 Plots/Data:

Antenna Port Conducted Lower Band Edge



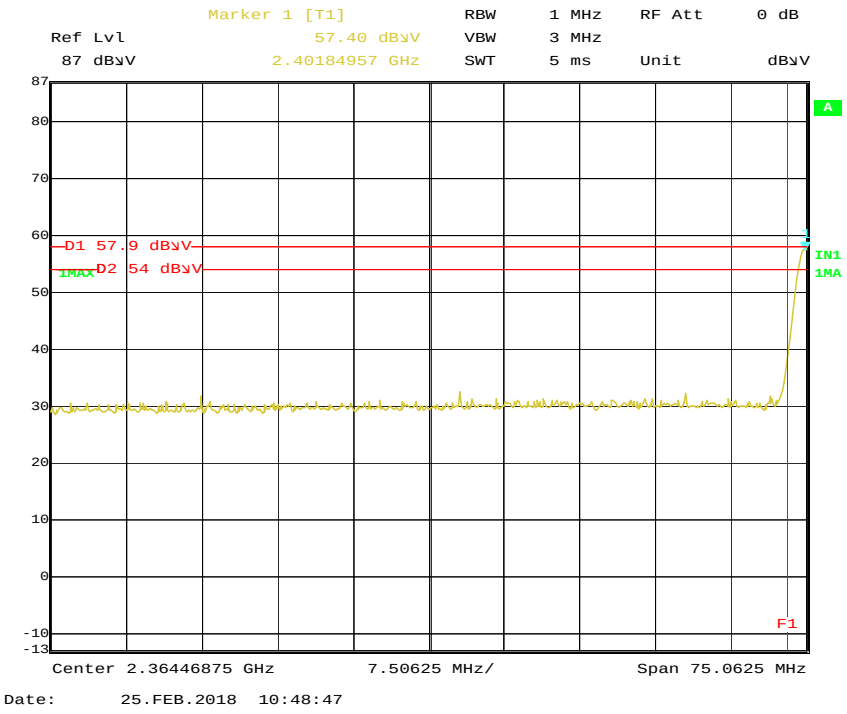
19:13:12 23.02.2018

Antenna Port Conducted Upper Band Edge

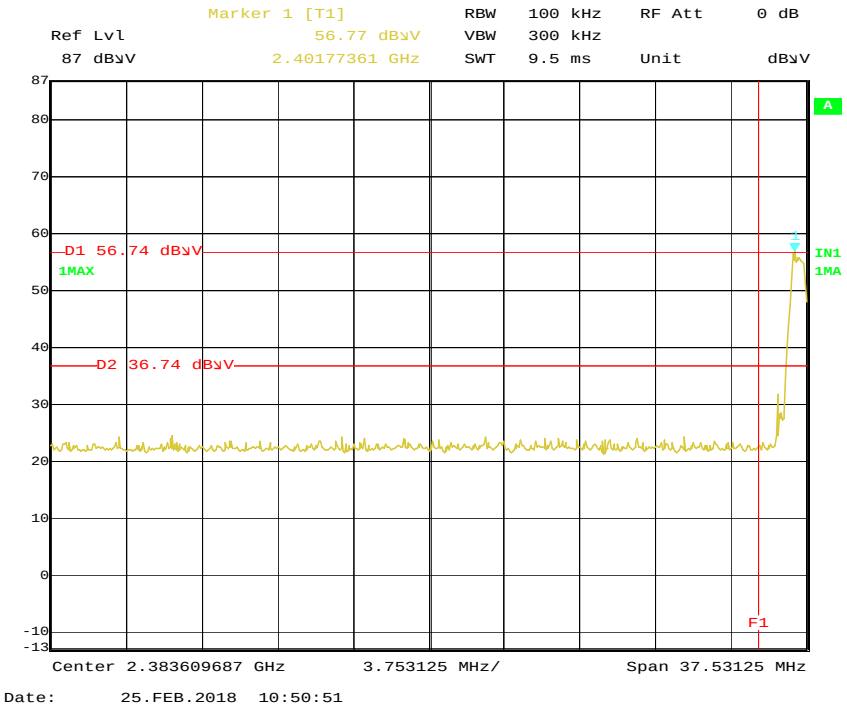


19:31:45 23.02.2018

Radiated Lower Band Edge (ResBW = 1 MHz)

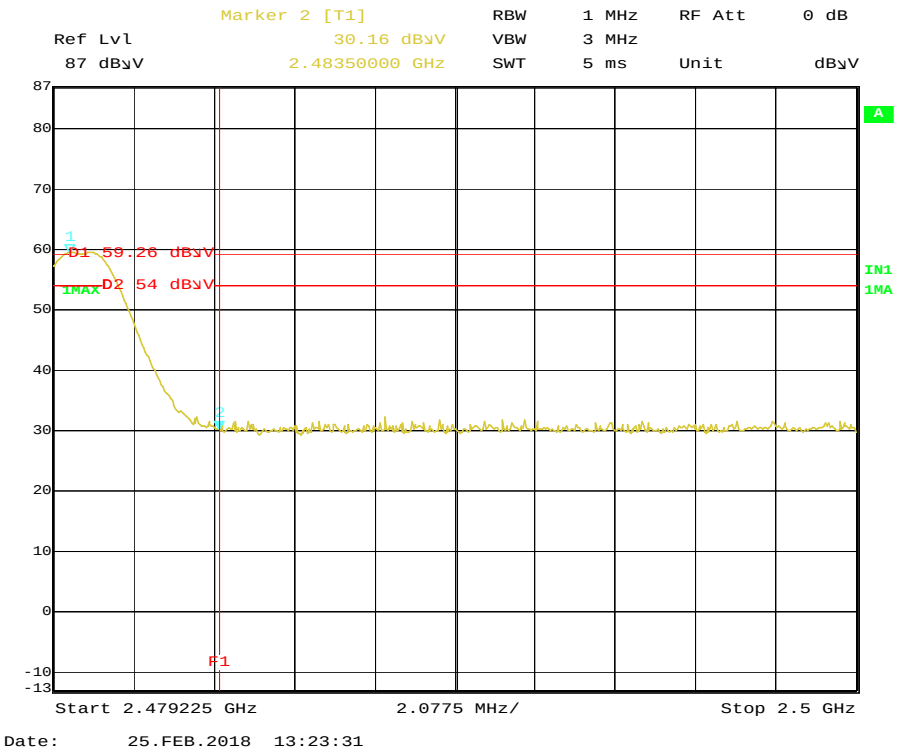


Radiated Lower Band Edge (ResBW = 100 kHz)

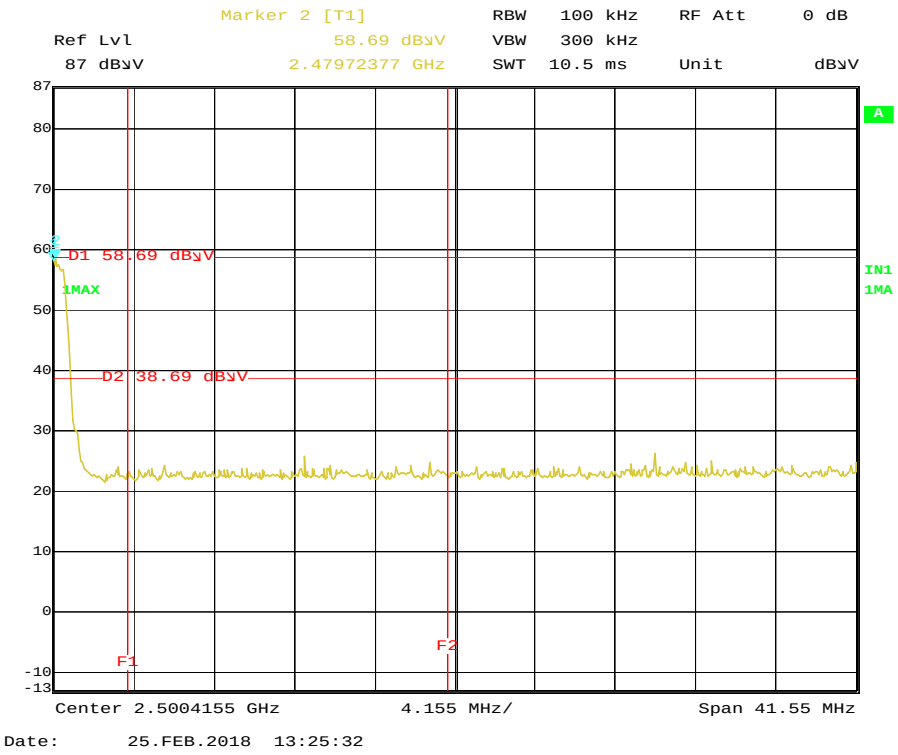


Notes: No emission was detected at the band edge. The measurement was measured in the worst-case axis (X-axis).

Radiated Upper Band Edge (ResBW = 1 MHz)



Radiated Upper Band Edge (ResBW = 100 kHz)



Notes: No emission was detected at the band edge. The measurement was measured in the worst-case axis (X-axis).

Test Personnel:	Naga Suryadevara NS	Test Date:	02/23/2018
	Kouma Sinn KPS		02/25/2018
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247	Limit Applied:	See report section 8.3
Input Voltage:	Internal Battery Powered	Ambient Temperature:	19 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	28 %
		Atmospheric Pressure:	1012 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:

Test equipment used for radiated measurements

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV002'	Weather Station	Davis Instruments	7400	PE80519A93	06/14/2017	06/14/2018
REA008'	band reject filter 2.4GHz	Reactel, Inc	12RX7-2441.75-x140 S	17-01	07/07/2017	07/07/2018
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/15/2017	03/15/2018
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	06/03/2017	06/03/2018
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	05/22/2017	05/22/2018
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2017	07/25/2018
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/02/2017	05/02/2018
PRE11'	50dB gain pre-amp	Keith H	PRE11	PRE11	12/02/2017	12/02/2018
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/25/2017	07/25/2018

Name	Manufacturer	Version
BAT-EMC Emissions	Nexio	3.16.0.69

Test equipment used for conducted measurements

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV002'	Weather Station	Davis Instruments	7400	PE80519A93	06/14/2017	06/14/2018
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/17/2017	11/17/2018
CBLSHF202'	Cable, SMA - SMA, 9kHz-40GHz	Sucoflex (Huber Suhn	104PE	CBLSHF202	08/25/2017	08/25/2018
MIN23'	Attenuator 2 watt 20dB DC-26GHz	Mini Circuits	BW-S20-2W263+	MIN23	05/26/2017	05/26/2018

Software Utilized:

Name	Manufacturer	Version
None		

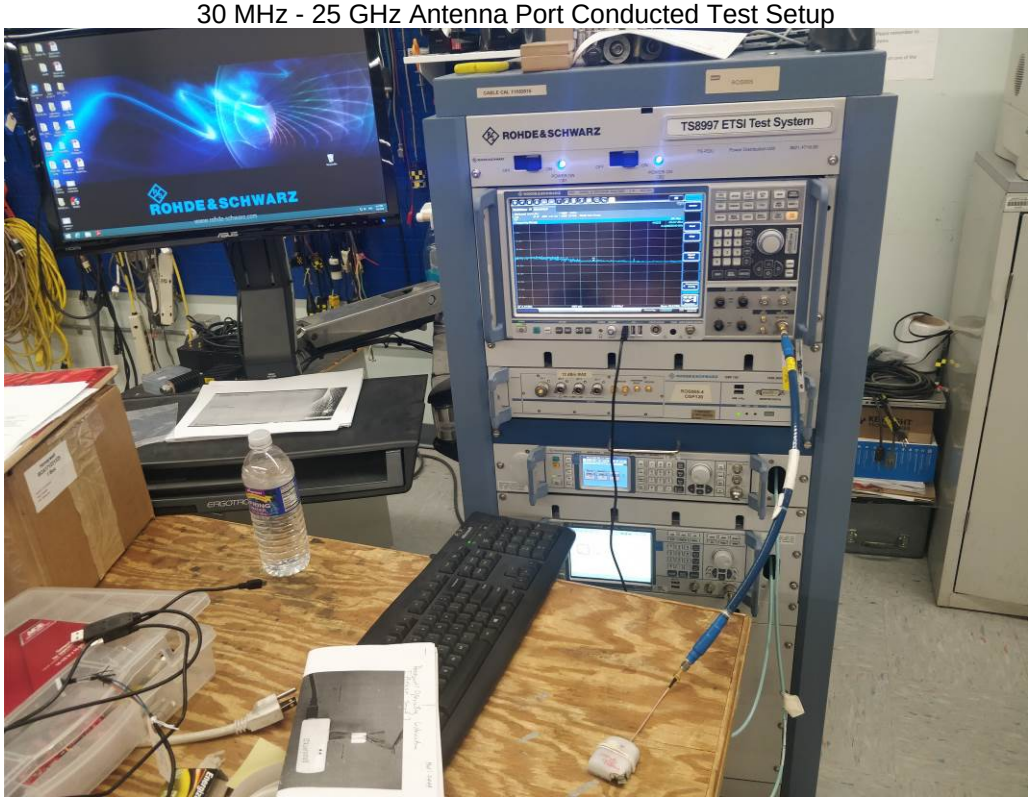
10.3 Results:

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))

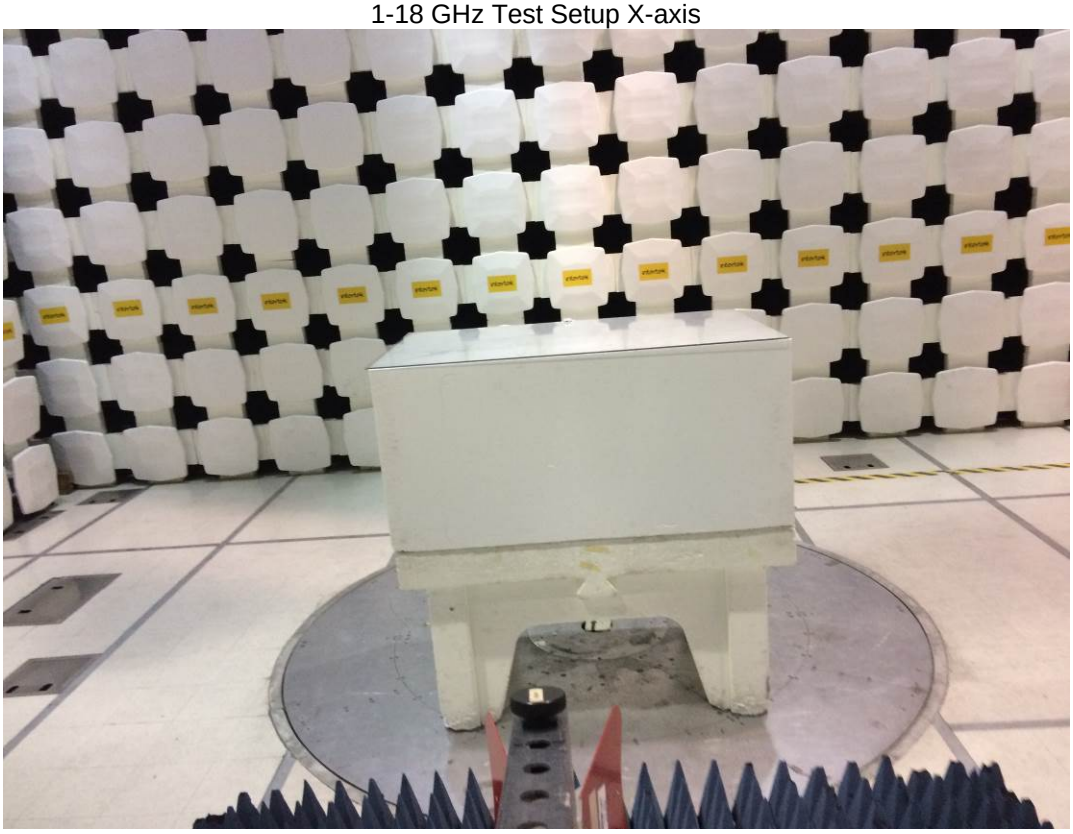
10.4 Setup Photographs:

30 MHz - 25 GHz Antenna Port Conducted Test Setup

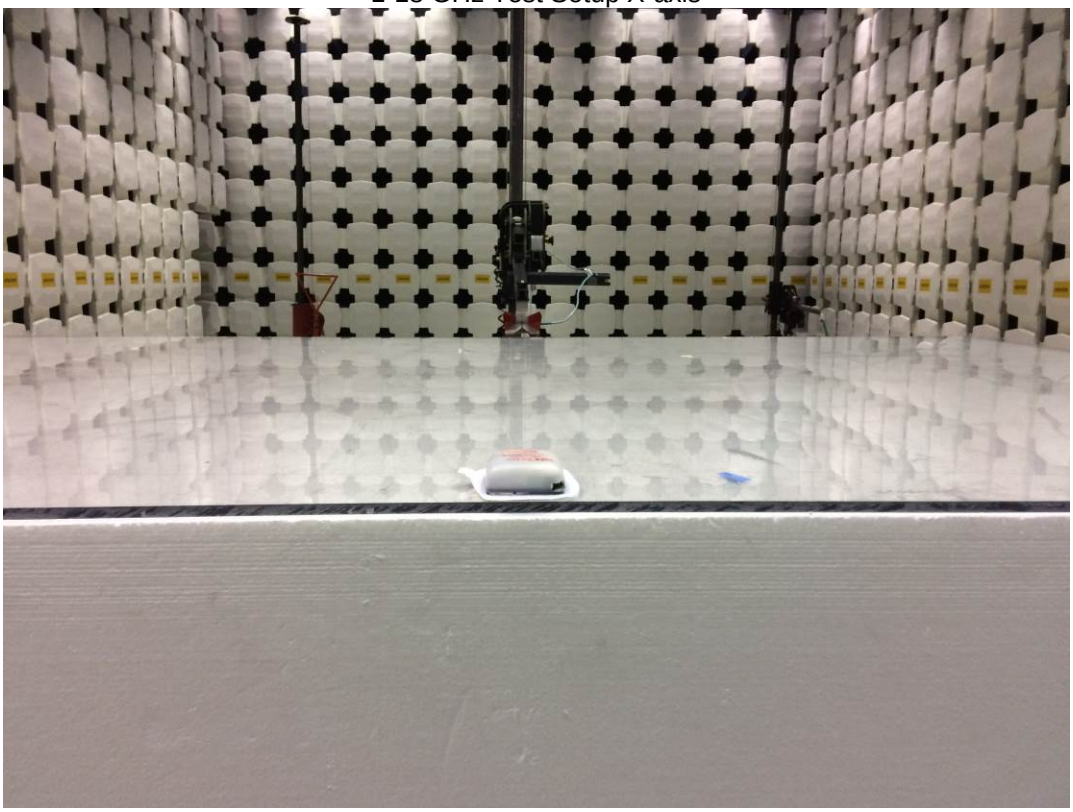


30 MHz - 1000 MHz Radiated Emissions Test Setup

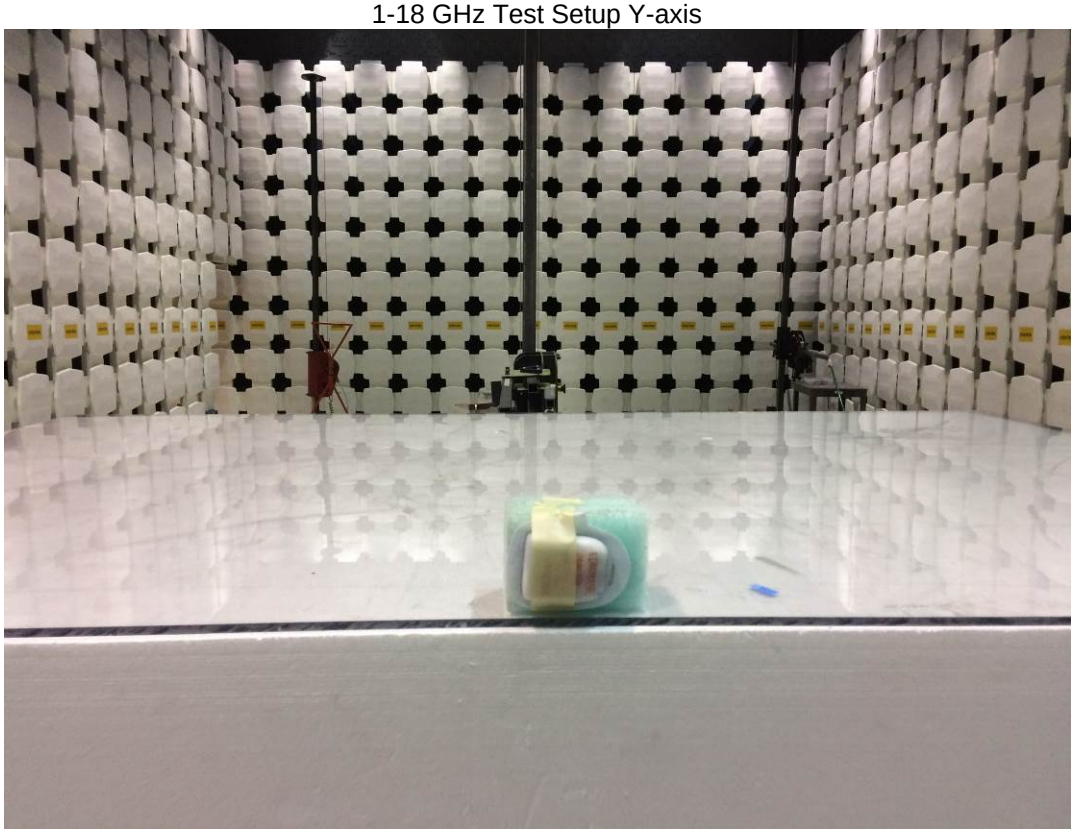
1-18 GHz Test Setup X-axis



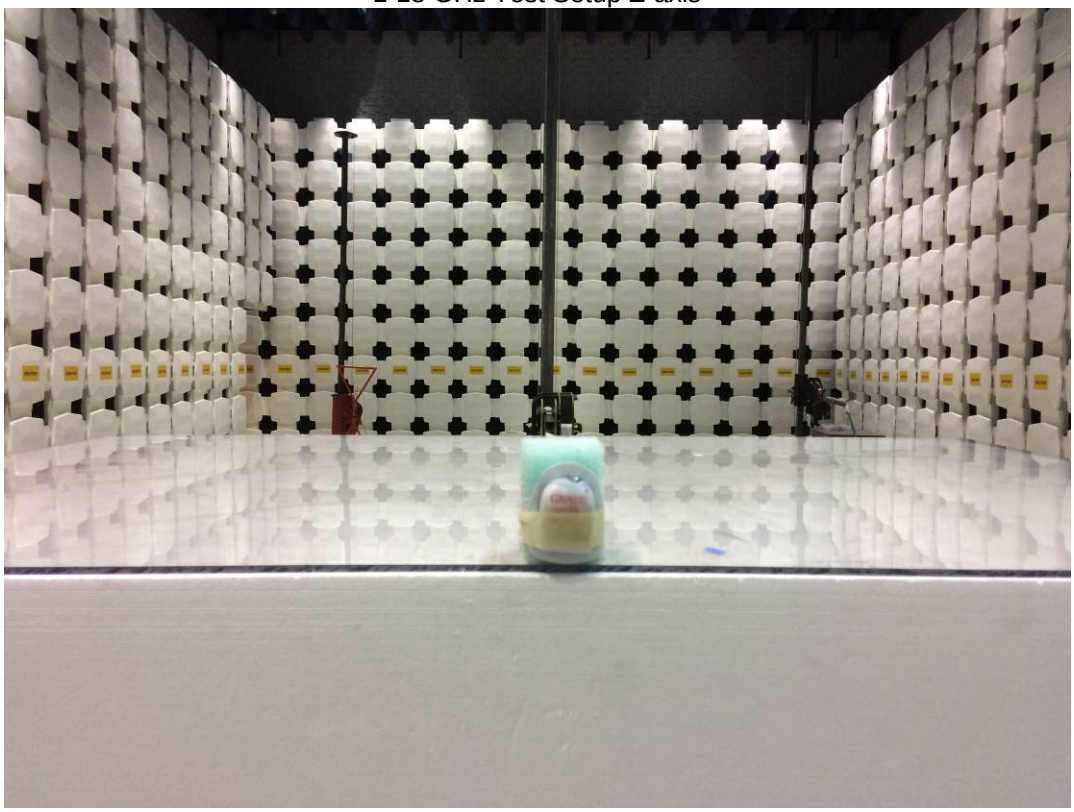
1-18 GHz Test Setup X-axis



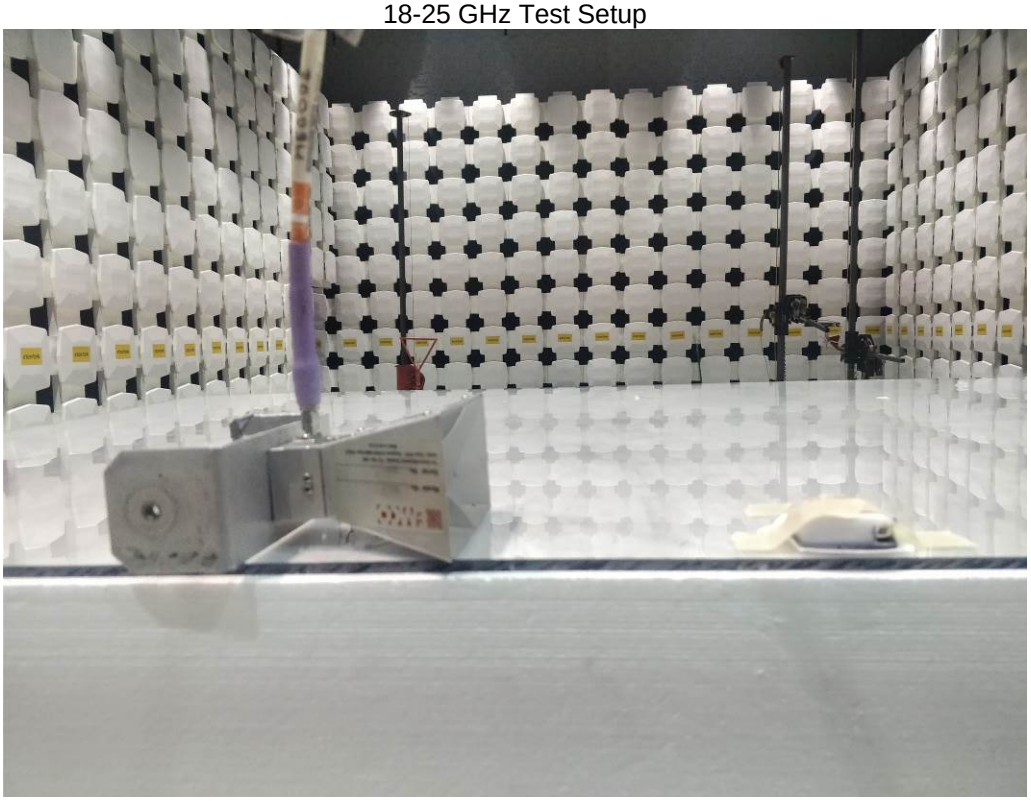
1-18 GHz Test Setup Y-axis



1-18 GHz Test Setup Z-axis

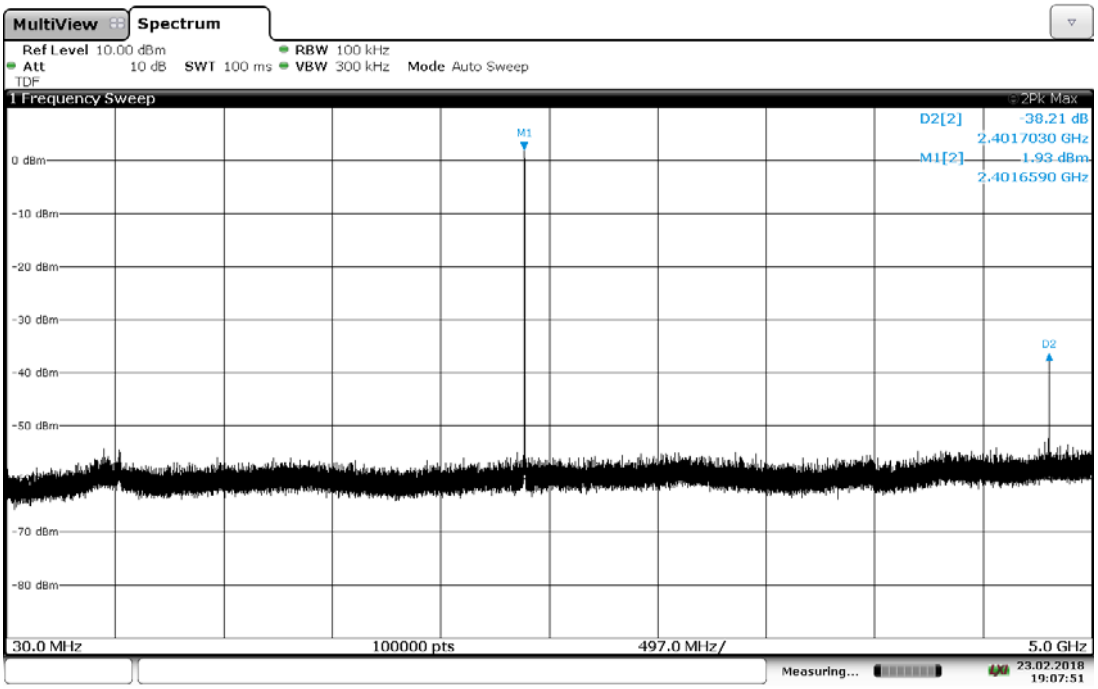


18-25 GHz Test Setup



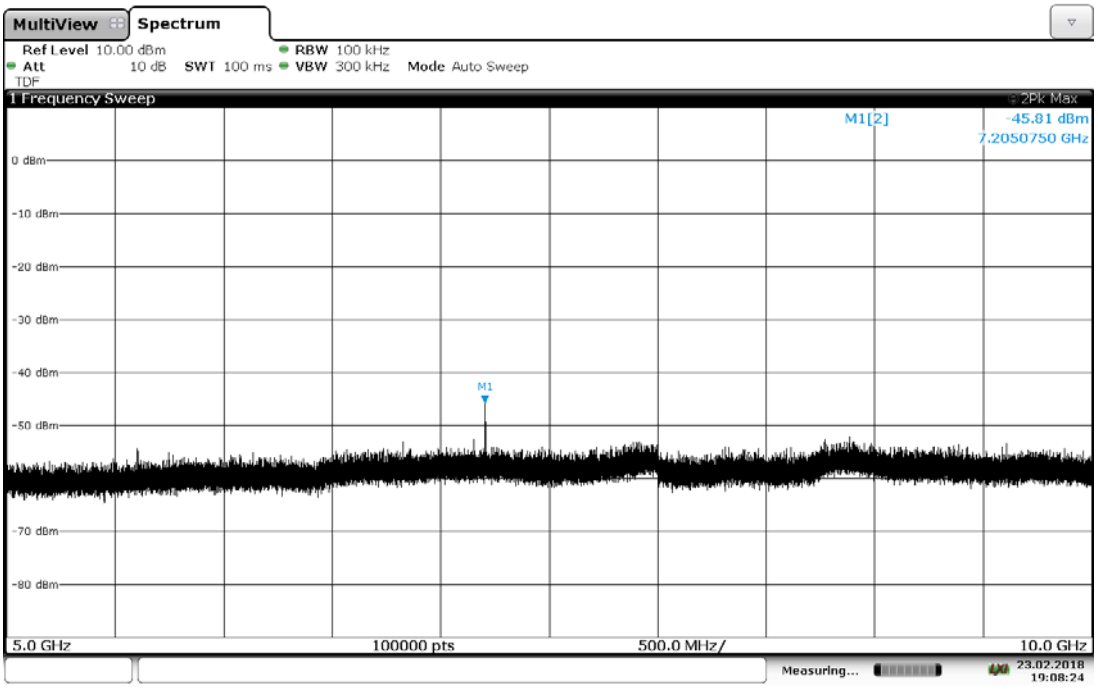
10.5 Plots/Data:

Low Channel Antenna Port Conducted Spurious Emissions, 30 MHz-5 GHz



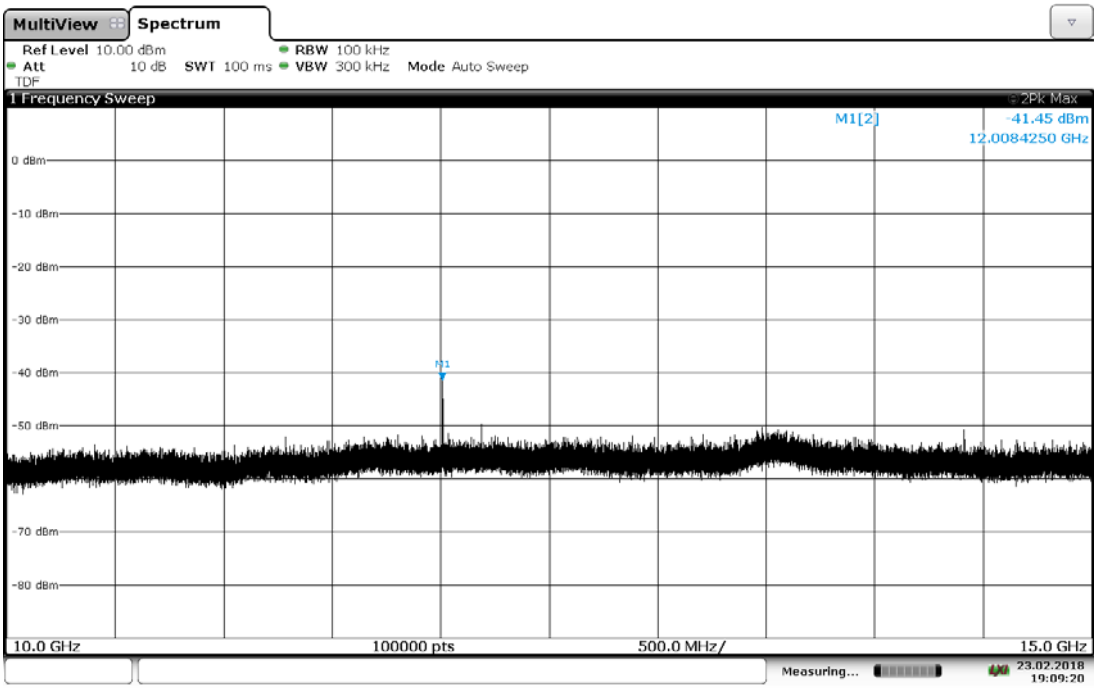
19:07:51 23.02.2018

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



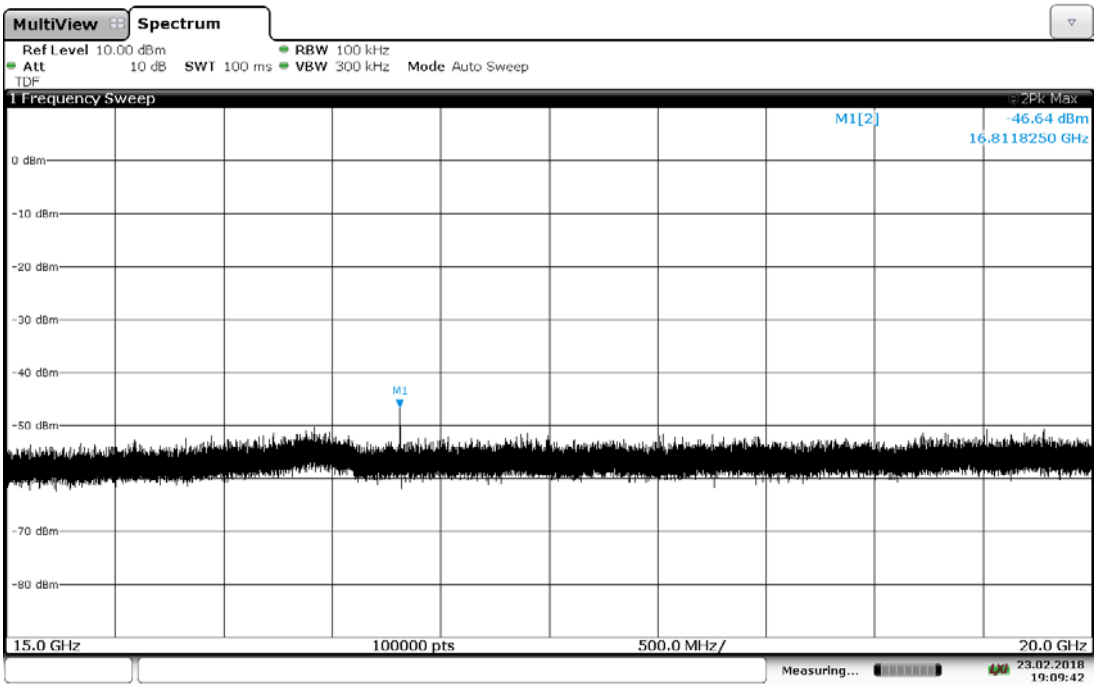
19:08:24 23.02.2018

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



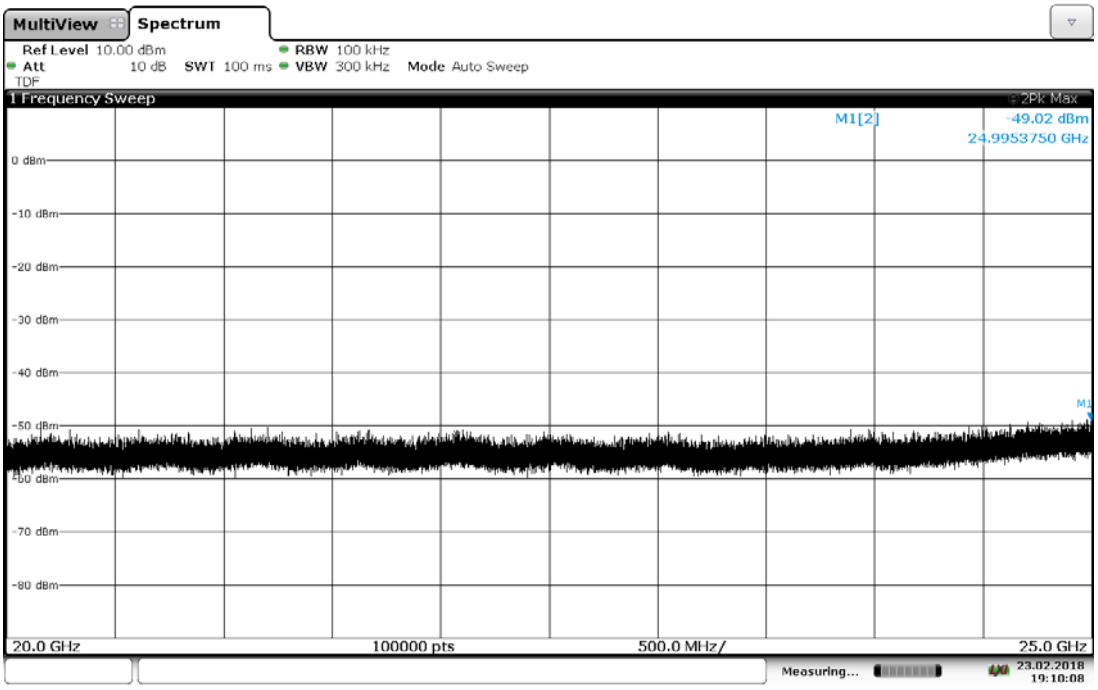
19:09:20 23.02.2018

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



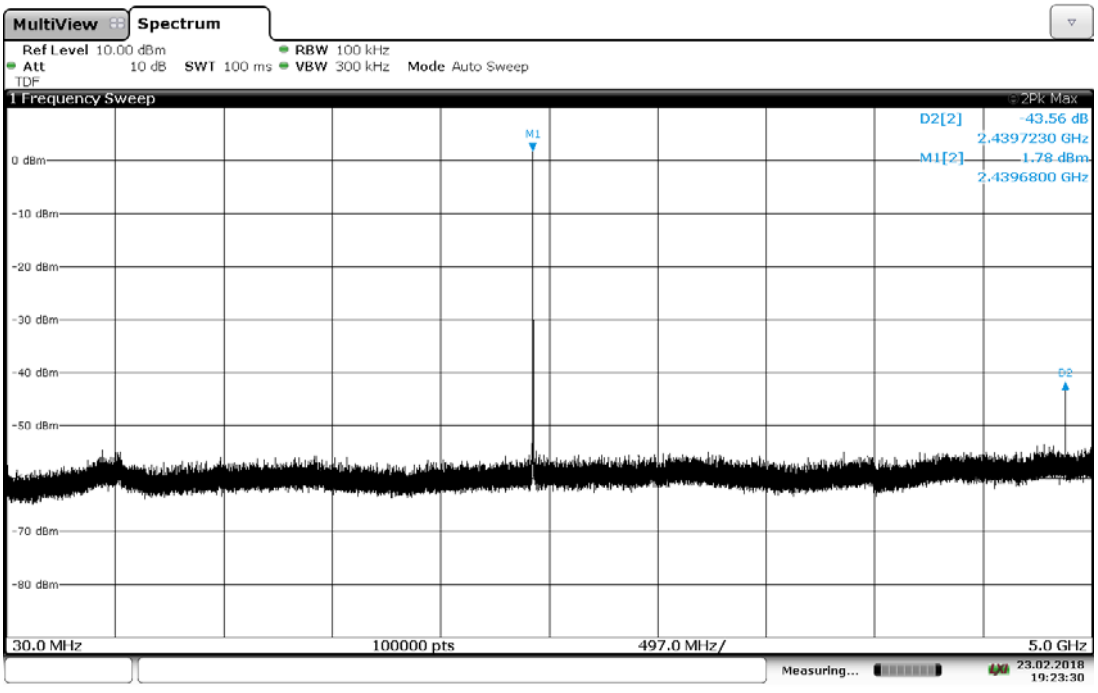
19:09:42 23.02.2018

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



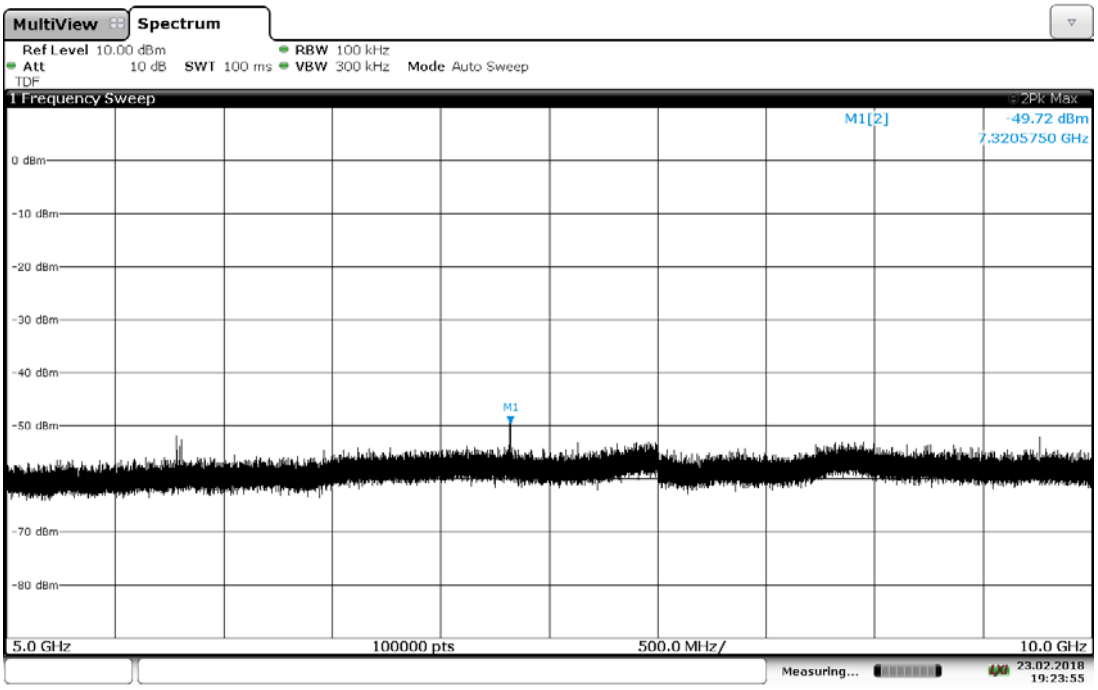
19:10:09 23.02.2018

Mid Channel Antenna Port Conducted Spurious Emissions, 30 MHz-5 GHz



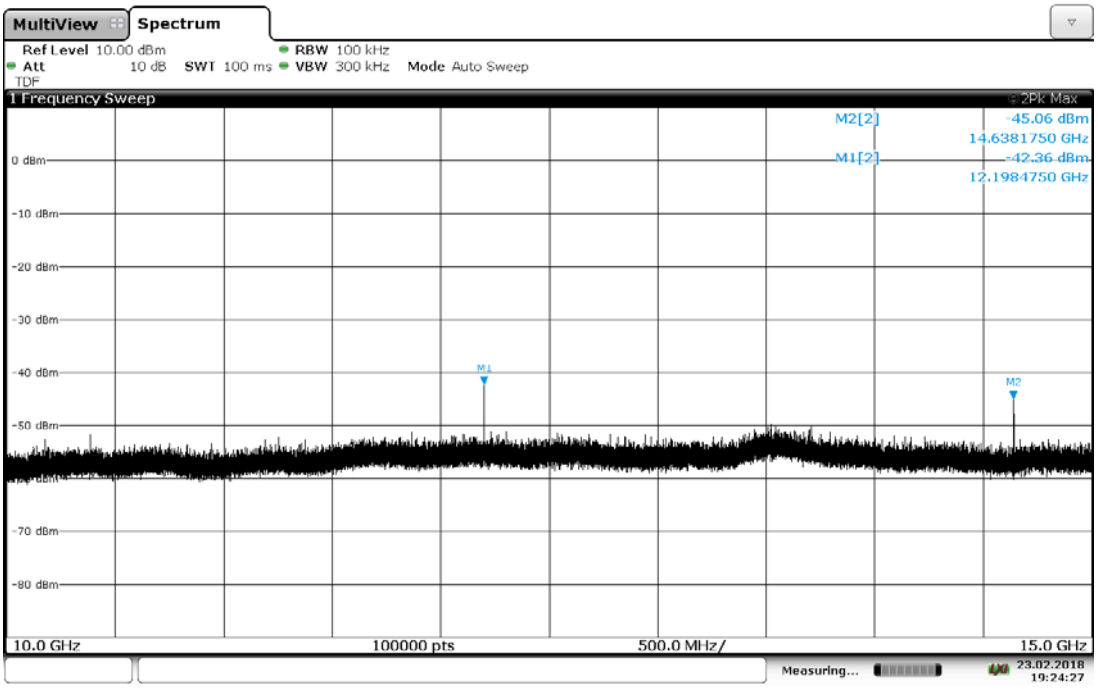
19:23:30 23.02.2018

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



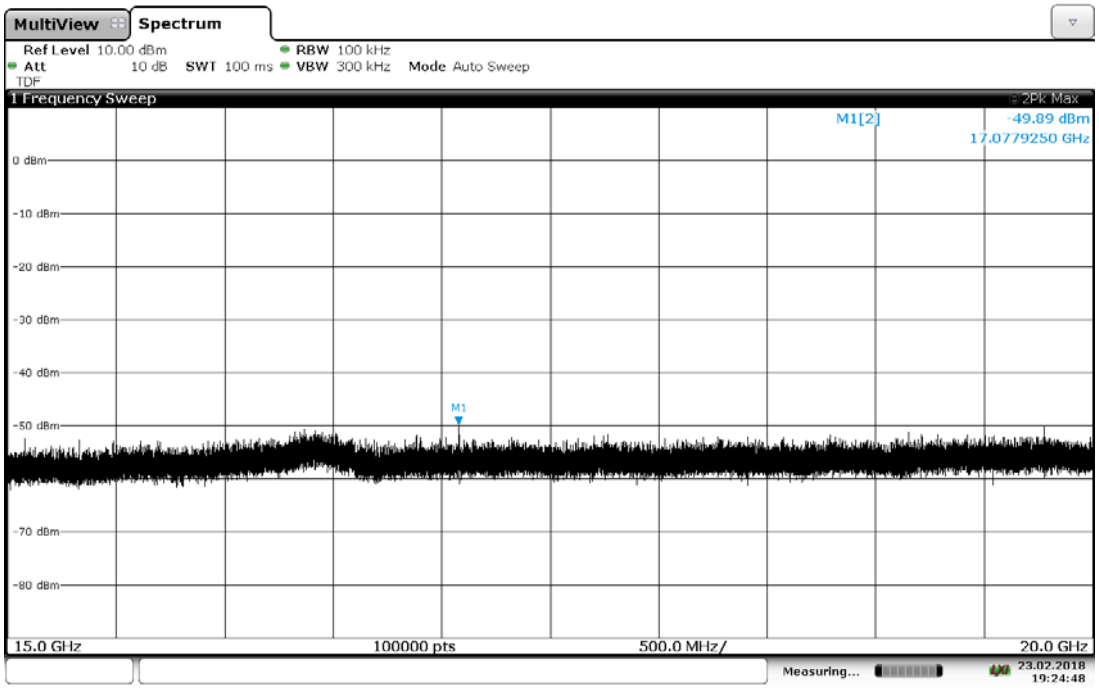
19:23:55 23.02.2018

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



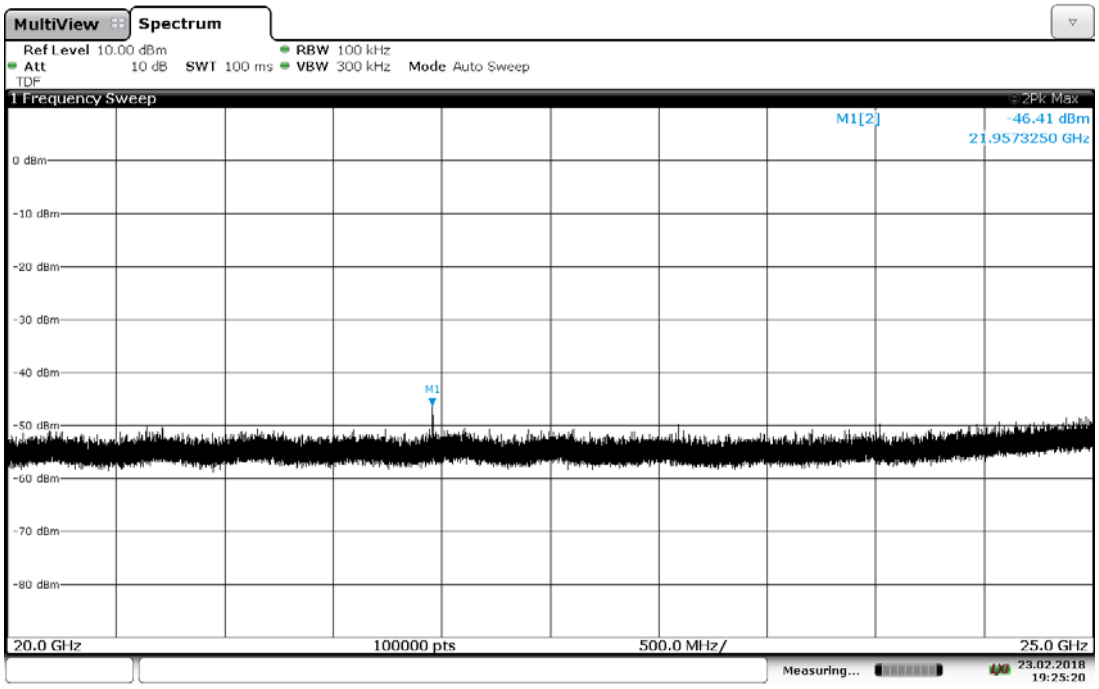
19:24:28 23.02.2018

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



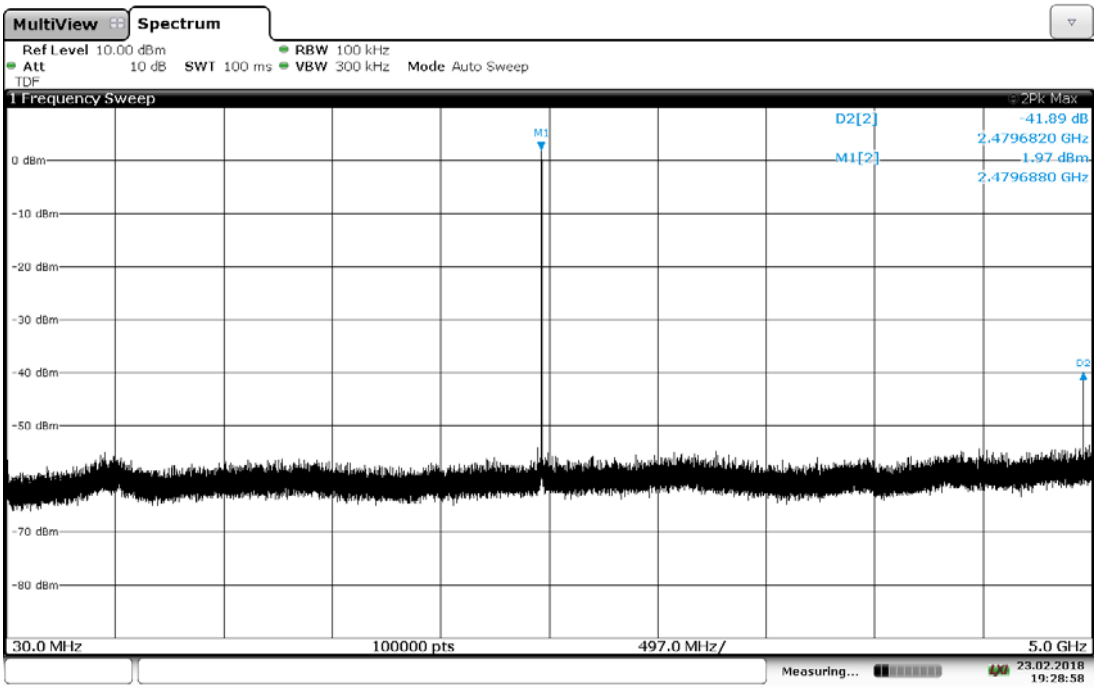
19:24:48 23.02.2018

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



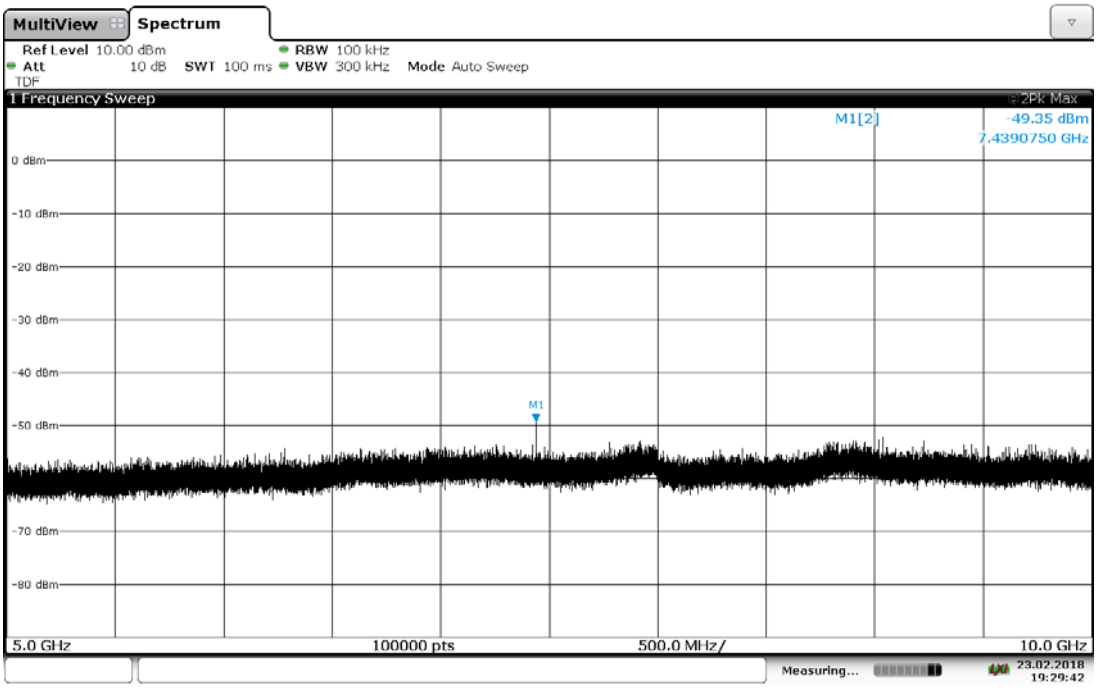
19:25:21 23.02.2018

High Channel Antenna Port Conducted Spurious Emissions, 30 MHz-5 GHz



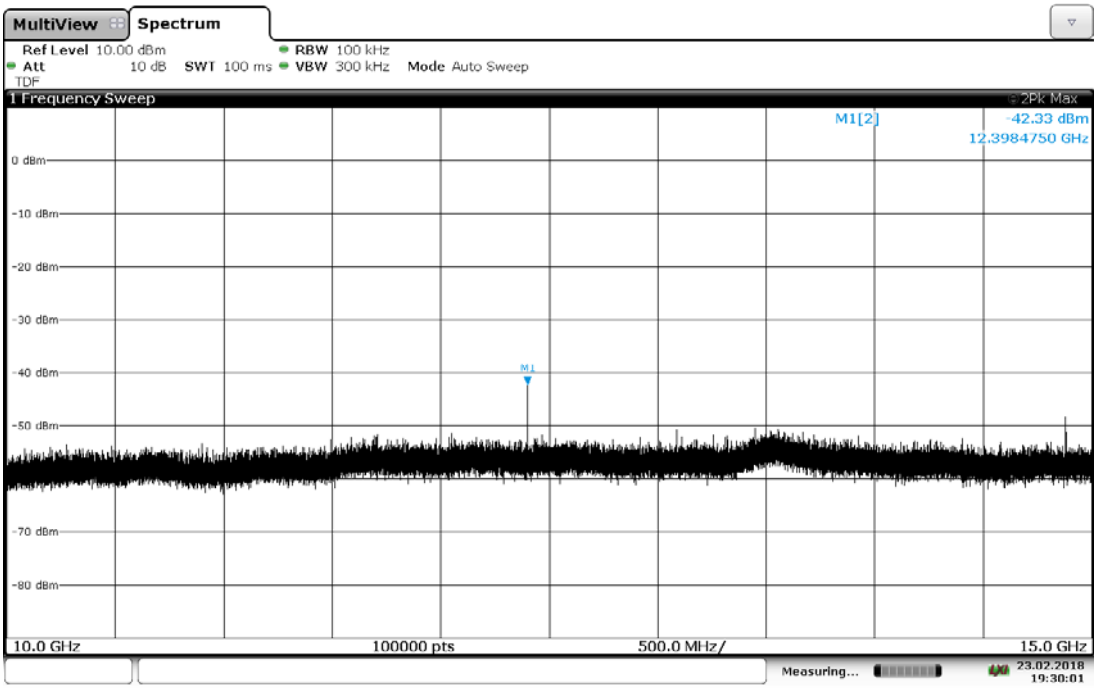
19:28:58 23.02.2018

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



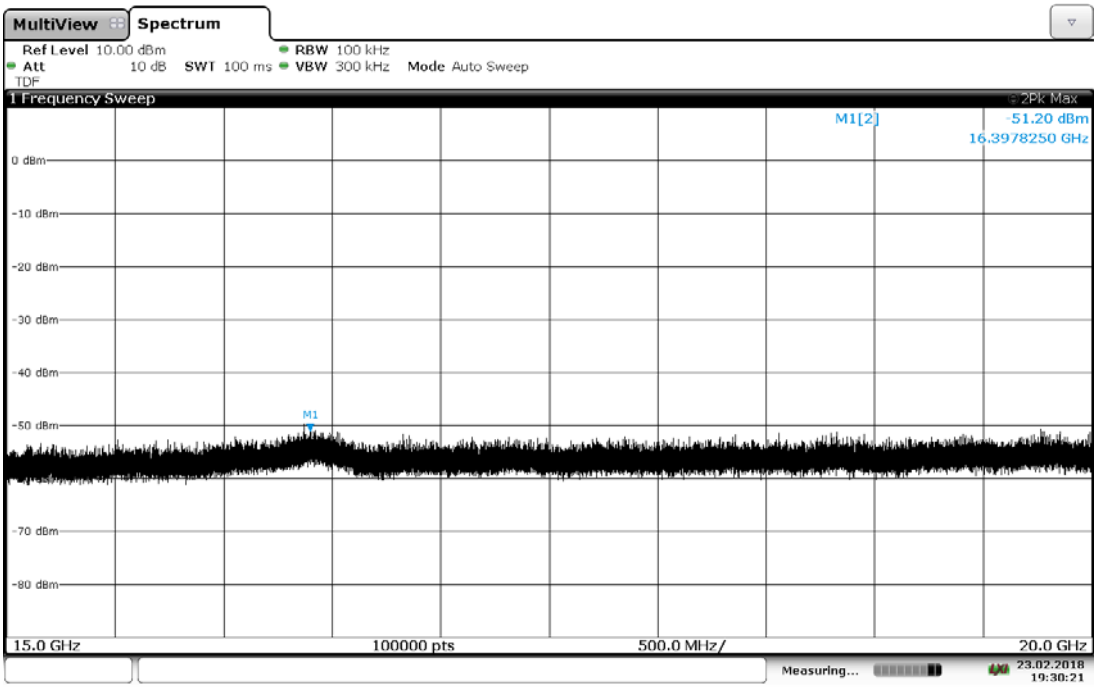
19:29:42 23.02.2018

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



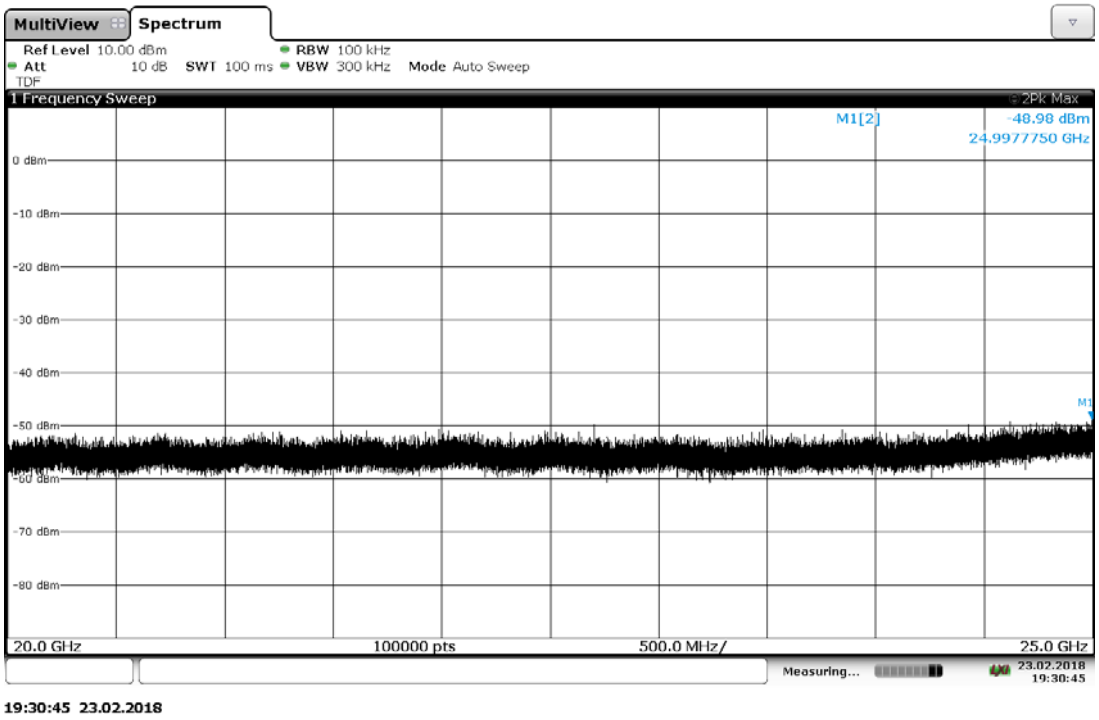
19:30:02 23.02.2018

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



19:30:22 23.02.2018

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

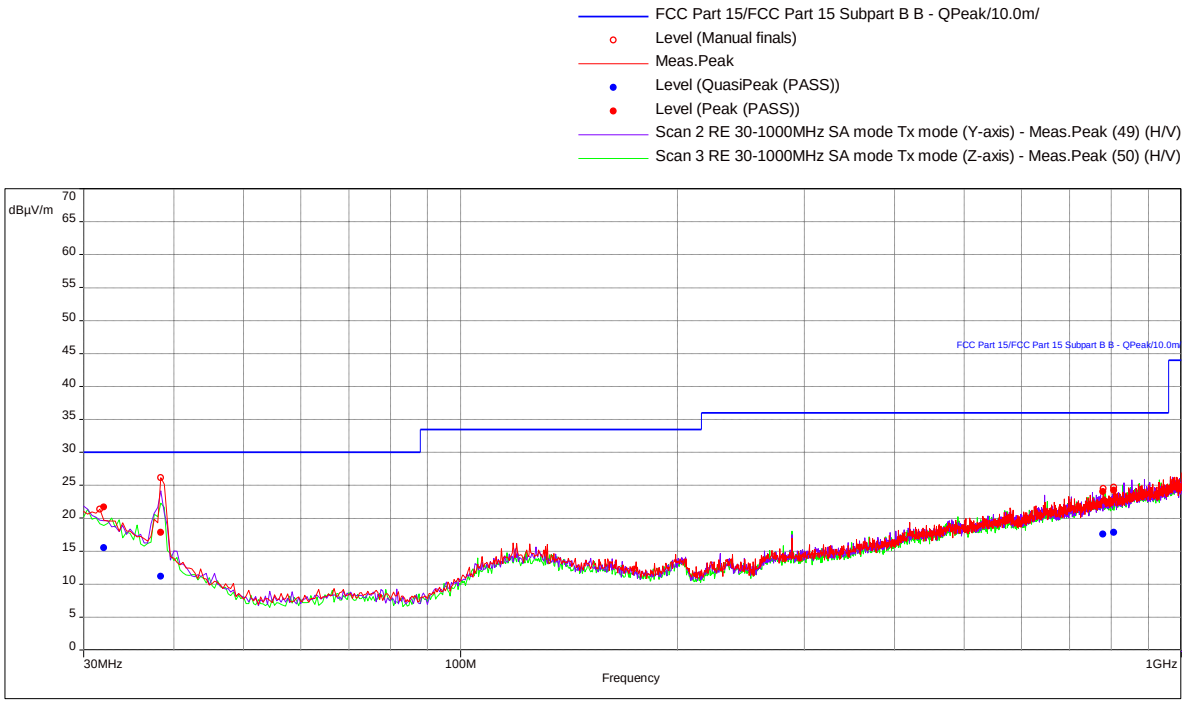


Low Channel Radiated Spurious Emissions (X, Y, Z -axis), 30-1000 MHz

Test Information:

Date and Time	2/25/2018 6:32:28 AM
Client and Project Number	Insulet
Engineer	Naga Suryadevara
Temperature	19C
Humidity	27%
Atmospheric Pressure	1014mbars
Comments	Scan 1 RE 30-1000MHz

Graph:



Results:

QuasiPeak (PASS) (4)

Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
31.82105263	30.00	-14.51	284.00	2.49	Vertical	120000.00	-23.93
38.49473684	30.00	-18.81	79.00	1.54	Vertical	120000.00	-28.89
778.6631579	36.00	-18.43	152.00	4.00	Vertical	120000.00	-18.21
806.1789474	36.00	-18.16	232.00	3.21	Vertical	120000.00	-17.94

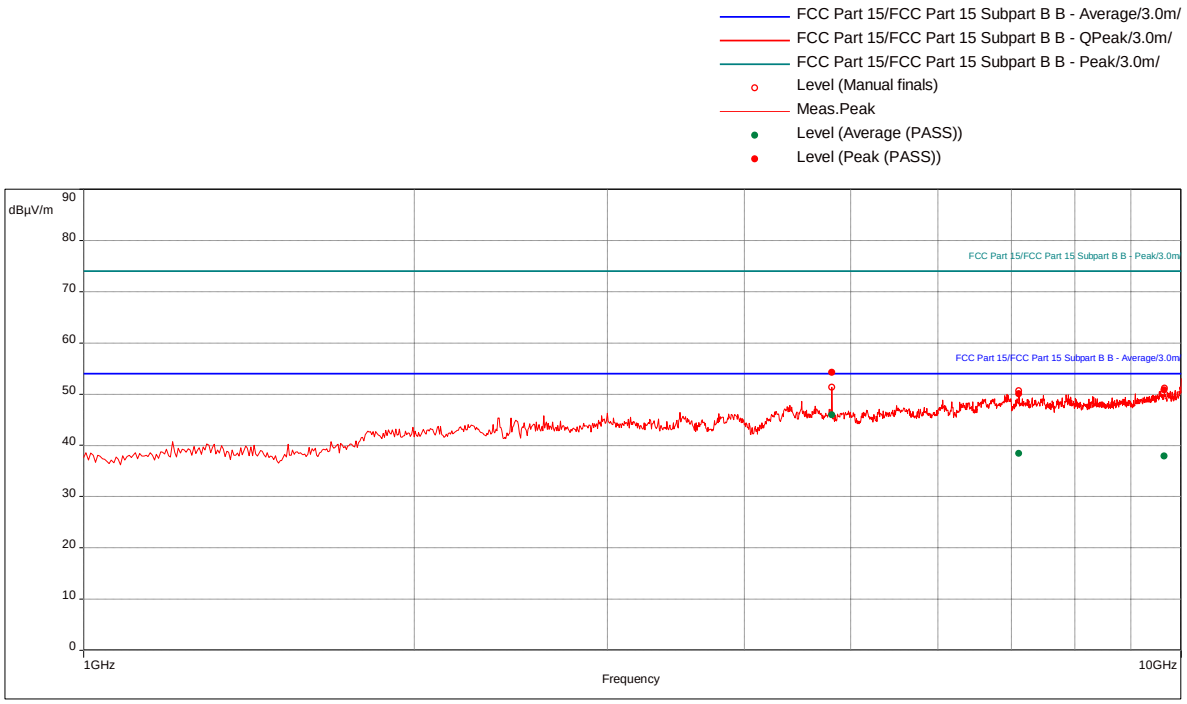
Notes: X, Y, Z, axis data were combined into one plot.

Low Channel Radiated Spurious Emissions (X-axis), 1-25 GHz

Test Information:

Date and Time	2/25/2018 9:41:52 AM
Client and Project Number	Insulet
Engineer	Kouma Sinn
Temperature	19C
Humidity	28%
Atmospheric Pressure	1012mbars
Comments	Scan 1: 1 to 10 GHz_2402 MHz (X-axis)

Graph:



Results:

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4803.421053	54.27	74.00	-19.73	274.00	1.30	Vertical	1000000.00	9.27
7112.894737	50.06	74.00	-23.94	216.00	2.73	Horizontal	1000000.00	11.98
9651.842105	50.86	74.00	-23.14	350.00	3.46	Vertical	1000000.00	13.06

Average (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4803.421053	45.94	54.00	-8.06	274.00	1.30	Vertical	1000000.00	9.27
7112.894737	38.43	54.00	-15.57	216.00	2.73	Horizontal	1000000.00	11.98
9651.842105	37.92	54.00	-16.08	350.00	3.46	Vertical	1000000.00	13.06

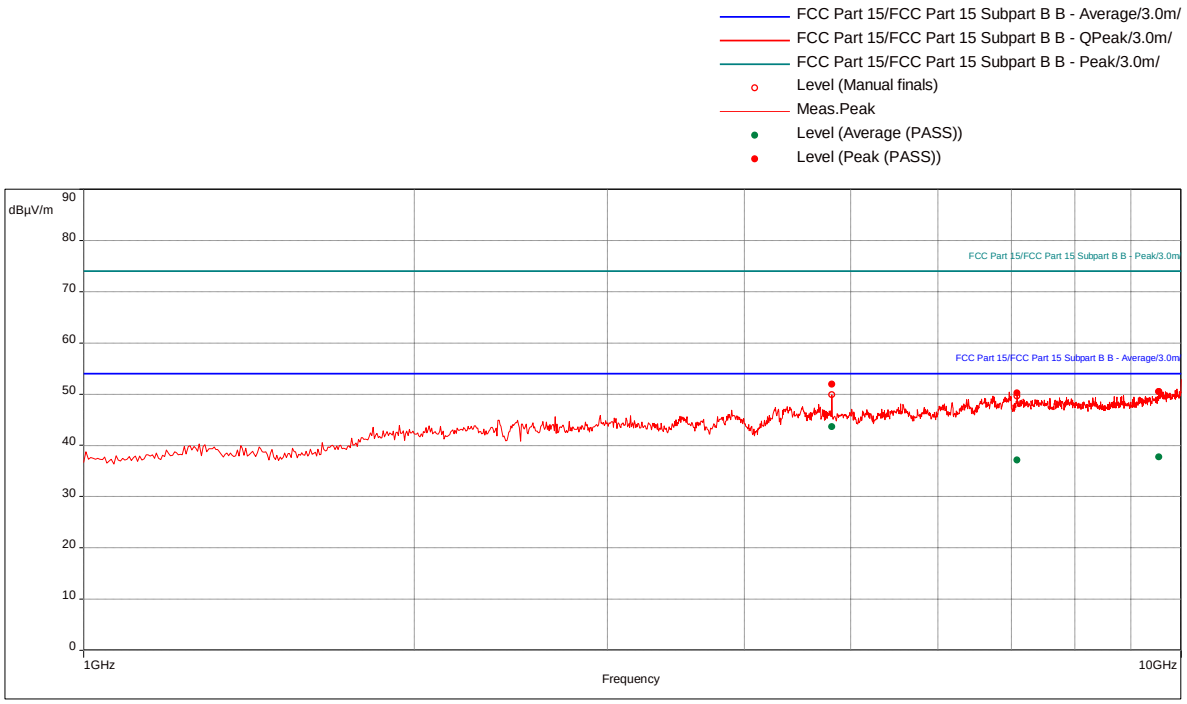
Notes: Test was performed manually from 10-25 GHz with no emissions were detected.

Low Channel Radiated Spurious Emissions (Y-axis), 1-25 GHz

Test Information:

Date and Time	2/25/2018 10:09:53 AM
Client and Project Number	Insulet
Engineer	Kouma Sinn
Temperature	19C
Humidity	28%
Atmospheric Pressure	1012mbars
Comments	Scan 2: 1 to 10 GHz_2402 MHz (Y-axis)

Graph:



Results:

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4803.684211	51.97	74.00	-22.03	283.00	1.41	Vertical	1000000.00	9.27
7085.789474	50.20	74.00	-23.80	313.00	2.86	Horizontal	1000000.00	11.98
9538.684211	50.48	74.00	-23.52	320.00	1.29	Horizontal	1000000.00	12.81

Average (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4803.684211	43.64	54.00	-10.36	283.00	1.41	Vertical	1000000.00	9.27
7085.789474	37.16	54.00	-16.84	313.00	2.86	Horizontal	1000000.00	11.98
9538.684211	37.75	54.00	-16.25	320.00	1.29	Horizontal	1000000.00	12.81

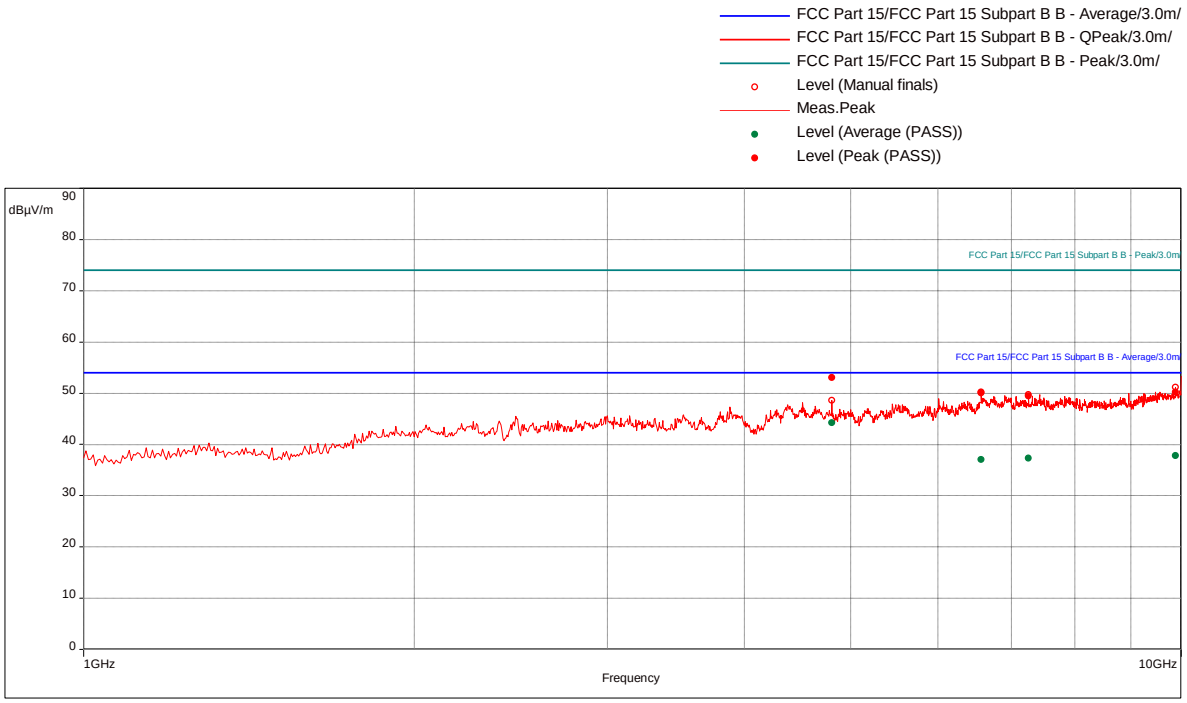
Notes: Test was performed manually from 10-25 GHz with no emissions were detected.

Low Channel Radiated Spurious Emissions (Z-axis), 1-25 GHz

Test Information:

Date and Time	2/25/2018 10:34:11 AM
Client and Project Number	Insulet
Engineer	Kouma Sinn
Temperature	19C
Humidity	28%
Atmospheric Pressure	1012mbars
Comments	Scan 3: 1 to 10 GHz_2402 MHz (Z-axis)

Graph:



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4803.421053	53.05	74.00	-20.95	187.00	3.12	Horizontal	1000000.00	9.27
6573.421053	50.20	74.00	-23.80	128.00	3.51	Vertical	1000000.00	11.33
7256.315789	49.48	74.00	-24.52	259.00	2.80	Vertical	1000000.00	11.94
9879.210526	50.23	74.00	-23.77	55.00	1.57	Horizontal	1000000.00	13.62

Average (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4803.421053	44.26	54.00	-9.74	187.00	3.12	Horizontal	1000000.00	9.27
6573.421053	37.05	54.00	-16.95	128.00	3.51	Vertical	1000000.00	11.33
7256.315789	37.28	54.00	-16.72	259.00	2.80	Vertical	1000000.00	11.94
9879.210526	37.79	54.00	-16.21	55.00	1.57	Horizontal	1000000.00	13.62

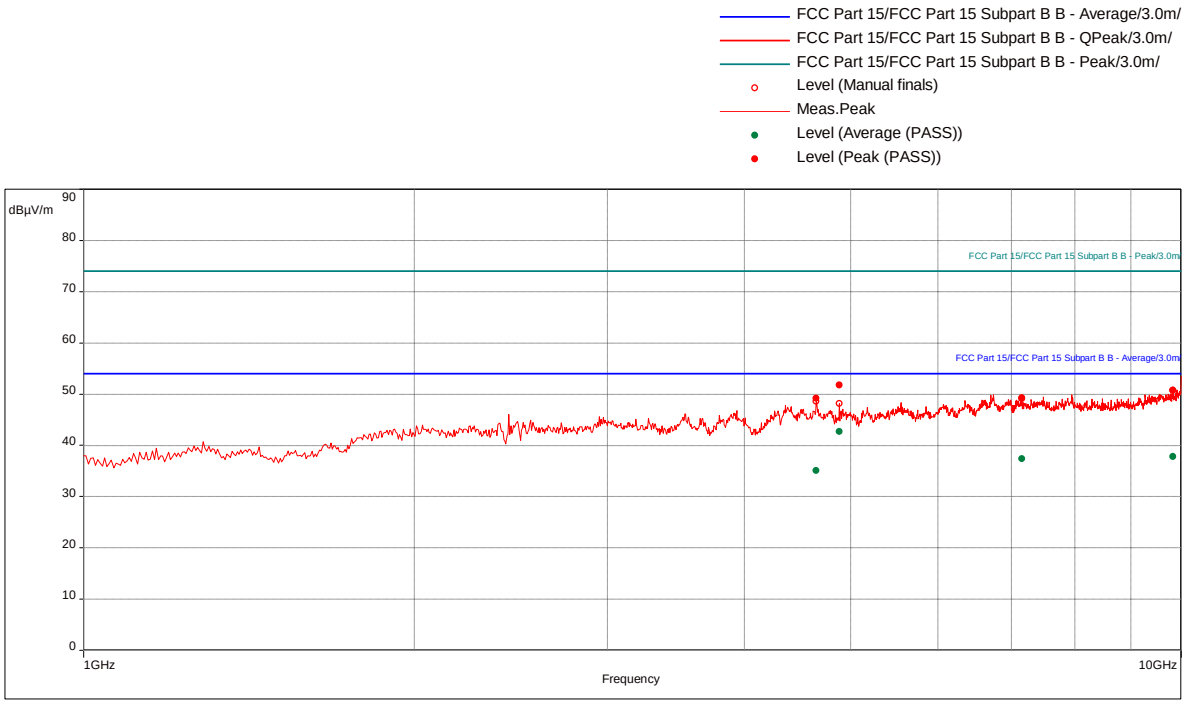
Notes: Test was performed manually from 10-25 GHz with no emissions were detected.

Mid Channel Radiated Spurious Emissions (X-axis), 1-25 GHz

Test Information:

Date and Time	2/25/2018 11:31:56 AM
Client and Project Number	Insulet
Engineer	Kouma Sinn
Temperature	19C
Humidity	28%
Atmospheric Pressure	1012mbars
Comments	Scan 4: 1 to 10 GHz_2440 MHz (X-axis)

Graph:



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4651.052632	49.22	74.00	-24.78	0.00	2.50	Vertical	1000000.00	9.65
4879.473684	51.77	74.00	-22.23	40.00	1.92	Horizontal	1000000.00	9.21
7158.947368	49.26	74.00	-24.74	54.00	1.83	Vertical	1000000.00	12.00
9829.473684	50.72	74.00	-23.28	270.00	2.43	Horizontal	1000000.00	13.45

Average (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4651.052632	35.07	54.00	-18.93	0.00	2.50	Vertical	1000000.00	9.65
4879.473684	42.71	54.00	-11.29	40.00	1.92	Horizontal	1000000.00	9.21
7158.947368	37.42	54.00	-16.58	54.00	1.83	Vertical	1000000.00	12.00
9829.473684	37.80	54.00	-16.20	270.00	2.43	Horizontal	1000000.00	13.45

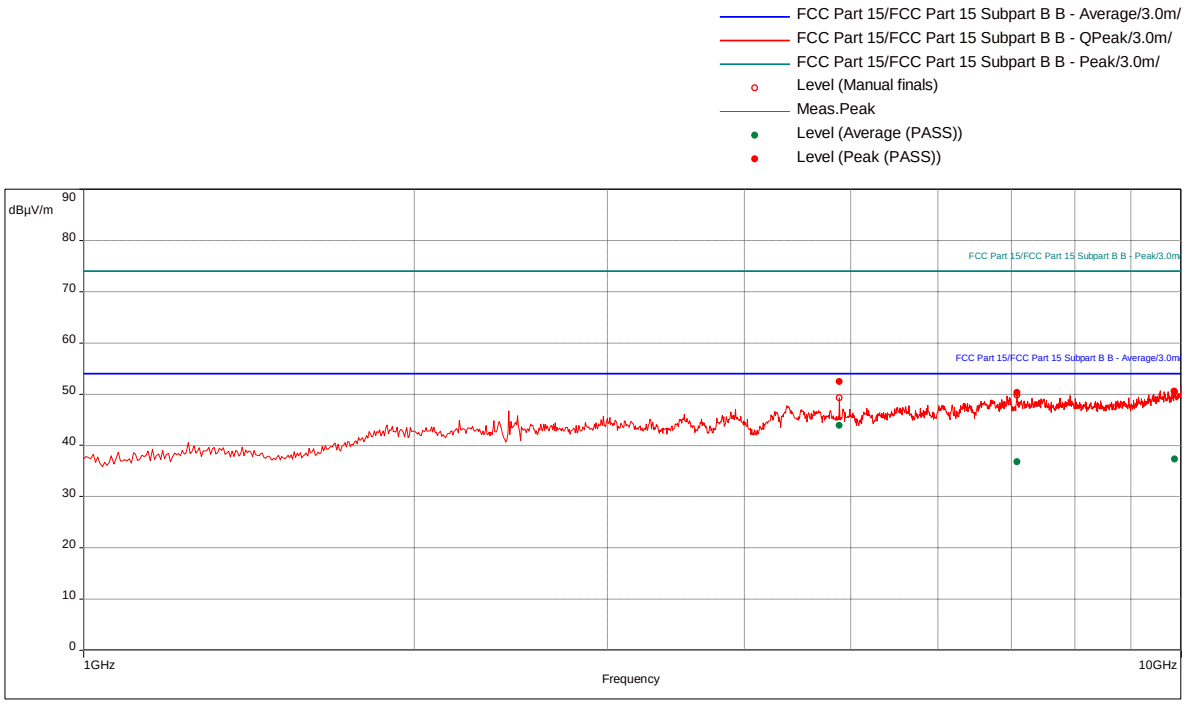
Notes: Test was performed manually from 10-25 GHz with no emissions were detected.

Mid Channel Radiated Spurious Emissions (Y-axis), 1-25 GHz

Test Information:

Date and Time	2/25/2018 11:57:59 AM
Client and Project Number	Insulet
Engineer	Kouma Sinn
Temperature	19C
Humidity	28%
Atmospheric Pressure	1012mbars
Comments	Scan 5: 1 to 10 GHz_2440 MHz (Y-axis)

Graph:



Results:

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4879.473684	52.46	74.00	-21.54	283.00	1.22	Vertical	1000000.00	9.21
7085.263158	50.32	74.00	-23.68	47.00	1.61	Horizontal	1000000.00	11.98
9857.894737	50.43	74.00	-23.57	313.00	3.24	Horizontal	1000000.00	13.56

Average (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4879.473684	43.85	54.00	-10.15	283.00	1.22	Vertical	1000000.00	9.21
7085.263158	36.75	54.00	-17.25	47.00	1.61	Horizontal	1000000.00	11.98
9857.894737	37.27	54.00	-16.73	313.00	3.24	Horizontal	1000000.00	13.56

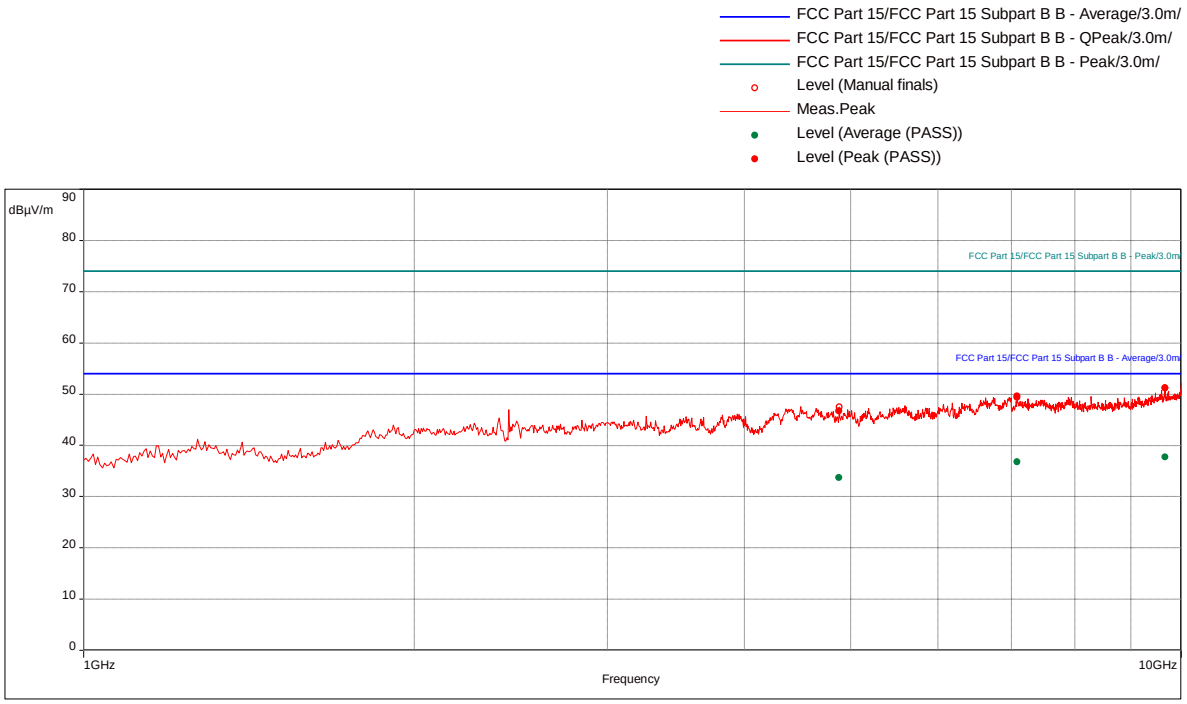
Notes: Test was performed manually from 10-25 GHz with no emissions were detected.

Mid Channel Radiated Spurious Emissions (Z-axis), 1-25 GHz

Test Information:

Date and Time	2/25/2018 12:20:48 PM
Client and Project Number	Insulet
Engineer	Kouma Sinn
Temperature	19C
Humidity	28%
Atmospheric Pressure	1012mbars
Comments	Scan 6: 1 to 10 GHz_2440 MHz (Z-axis)

Graph:



Results:

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4877.368421	46.75	74.00	-27.25	187.00	3.73	Horizontal	1000000.00	9.21
7085.789474	49.65	74.00	-24.35	0.00	3.05	Vertical	1000000.00	11.98
9666.842105	51.16	74.00	-22.84	299.00	2.60	Vertical	1000000.00	13.08

Average (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4877.368421	33.73	54.00	-20.27	187.00	3.73	Horizontal	1000000.00	9.21
7085.789474	36.75	54.00	-17.25	0.00	3.05	Vertical	1000000.00	11.98
9666.842105	37.77	54.00	-16.23	299.00	2.60	Vertical	1000000.00	13.08

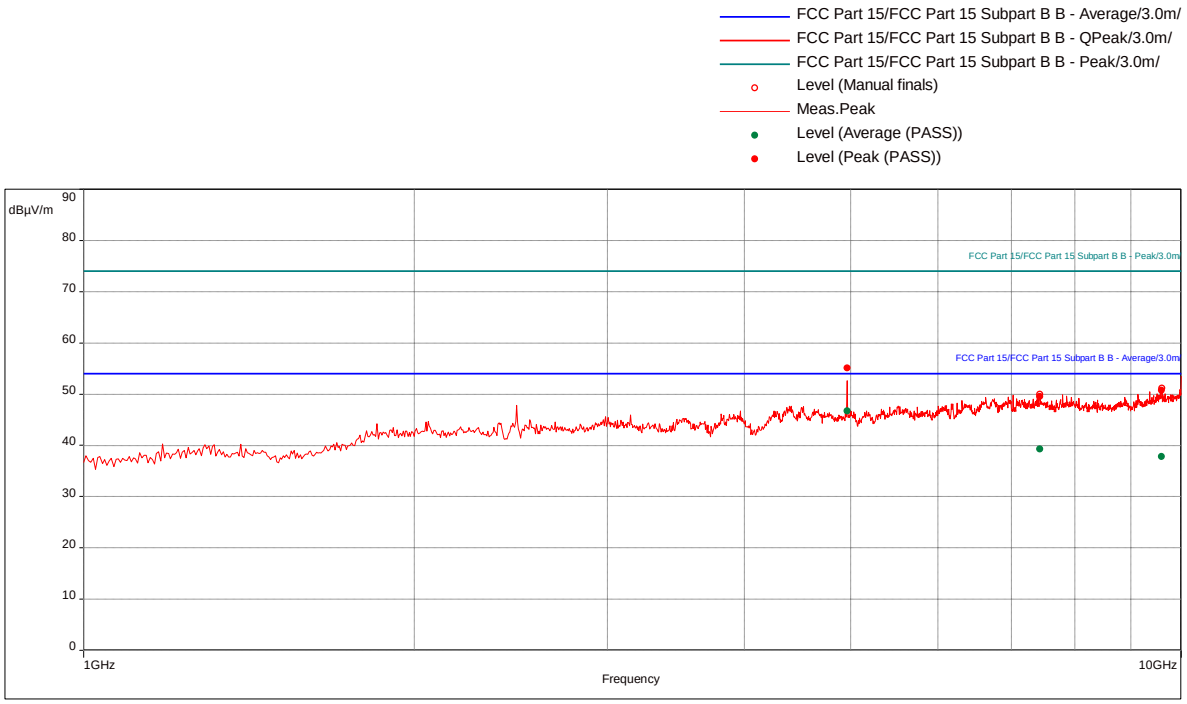
Notes: Test was performed manually from 10-25 GHz with no emissions were detected.

High Channel Radiated Spurious Emissions (X-axis), 1-25 GHz

Test Information:

Date and Time	2/25/2018 12:42:43 PM
Client and Project Number	Insulet
Engineer	Kouma Sinn
Temperature	19C
Humidity	28%
Atmospheric Pressure	1012mbars
Comments	Scan 7: 1 to 10 GHz_2480 MHz (X-axis)

Graph:



Results:

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4960.263158	55.08	74.00	-18.92	85.00	1.26	Vertical	1000000.00	9.32
7430.789474	49.55	74.00	-24.45	62.00	1.76	Horizontal	1000000.00	11.87
9596.578947	50.77	74.00	-23.23	99.00	1.33	Horizontal	1000000.00	12.96

Average (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4960.263158	46.74	54.00	-7.26	85.00	1.26	Vertical	1000000.00	9.32
7430.789474	39.29	54.00	-14.71	62.00	1.76	Horizontal	1000000.00	11.87
9596.578947	37.82	54.00	-16.18	99.00	1.33	Horizontal	1000000.00	12.96

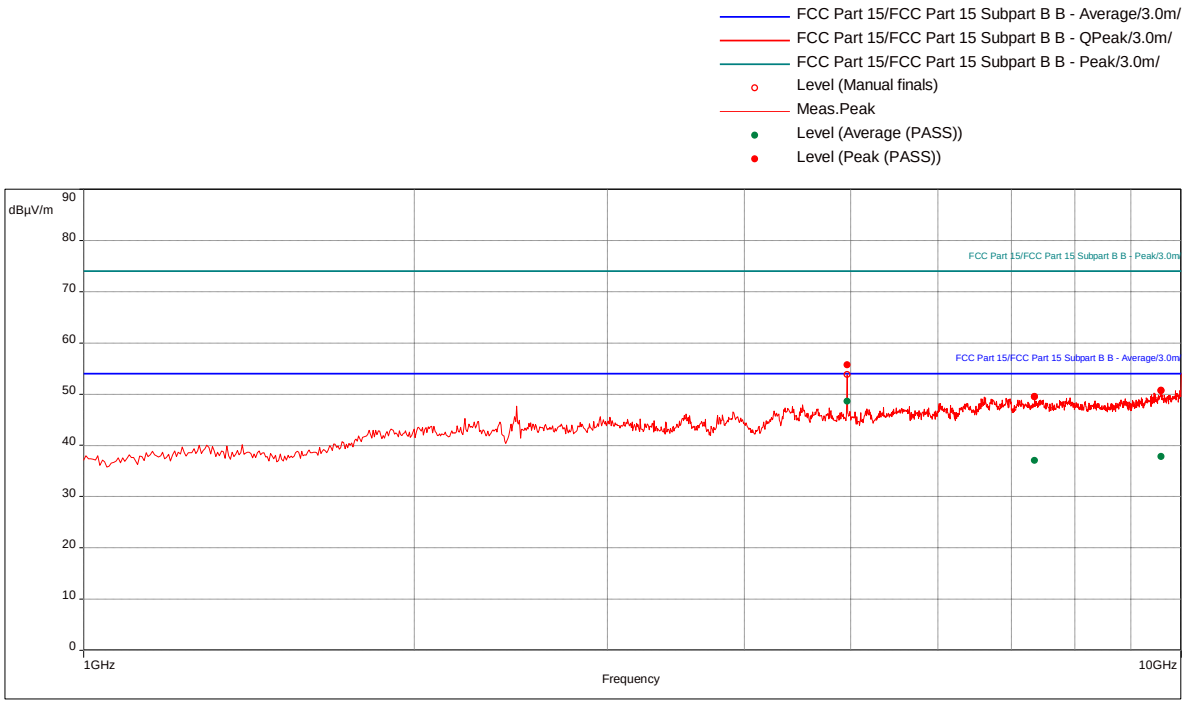
Notes: Test was performed manually from 10-25 GHz with no emissions were detected.

High Channel Radiated Spurious Emissions (Y-axis), 1-25 GHz

Test Information:

Date and Time	2/25/2018 1:03:36 PM
Client and Project Number	Insulet
Engineer	Kouma Sinn
Temperature	19C
Humidity	28%
Atmospheric Pressure	1012mbars
Comments	Scan 8: 1 to 10GHz_2480 MHz (Y-axis)

Graph:



Results:

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4959.473684	55.73	74.00	-18.27	76.00	1.22	Vertical	1000000.00	9.31
7356.315789	49.44	74.00	-24.56	344.00	3.99	Vertical	1000000.00	11.90
9591.578947	50.62	74.00	-23.38	99.00	1.69	Vertical	1000000.00	12.95

Average (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4959.473684	48.62	54.00	-5.38	76.00	1.22	Vertical	1000000.00	9.31
7356.315789	37.08	54.00	-16.92	344.00	3.99	Vertical	1000000.00	11.90
9591.578947	37.81	54.00	-16.19	99.00	1.69	Vertical	1000000.00	12.95

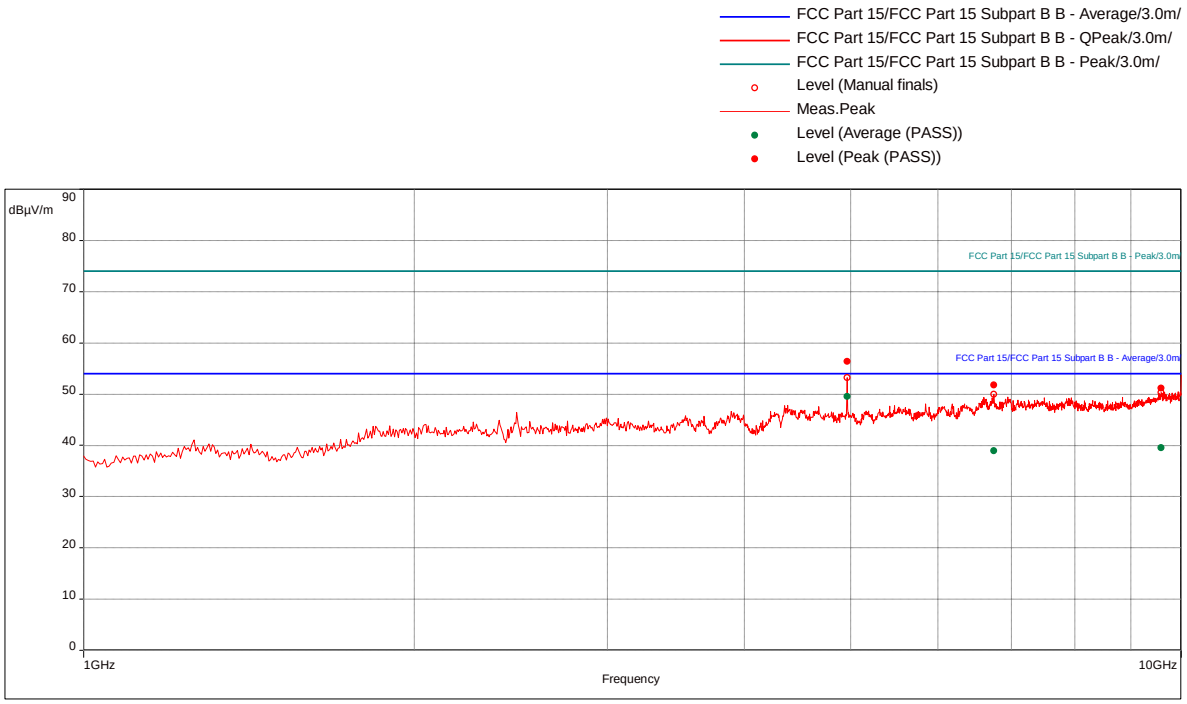
Notes: Test was performed manually from 10-25 GHz with no emissions were detected.

High Channel Radiated Spurious Emissions (Z-axis), 1-25 GHz

Test Information:

Date and Time	2/25/2018 1:23:25 PM
Client and Project Number	Insulet
Engineer	Kouma Sinn
Temperature	19C
Humidity	28%
Atmospheric Pressure	1012mbars
Comments	Scan 9: 1 to 10GHz_2480 MHz (Z-axis)

Graph:



Results:

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4959.473684	56.37	74.00	-17.63	164.00	2.95	Horizontal	1000000.00	9.31
6749.210526	51.80	74.00	-22.20	69.00	3.74	Horizontal	1000000.00	11.67
9588.684211	51.16	74.00	-22.84	150.00	1.83	Horizontal	1000000.00	12.94

Average (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
4959.473684	49.51	54.00	-4.49	164.00	2.95	Horizontal	1000000.00	9.31
6749.210526	38.96	54.00	-15.04	69.00	3.74	Horizontal	1000000.00	11.67
9588.684211	39.52	54.00	-14.48	150.00	1.83	Horizontal	1000000.00	12.94

Notes: Test was performed manually from 10-25 GHz with no emissions were detected.

Test Personnel:	Naga Suryadevara N.S	Test Date:	02/25/2018 (3rd shift)
	Kouma Sinn KPS		02/25/2018 (1st shift)
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 15.247, FCC Part 15 Subpart B, RSS-247, ICES-003	Limit Applied:	See report section 10.3
Input Voltage:	Internal Battery	Ambient Temperature:	19, 19 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	27, 28 %
		Atmospheric Pressure:	1014, 1012 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
DAV002'	Weather Station	Davis Instruments	7400	PE80519A93	06/14/2017	06/14/2018
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/15/2017	03/15/2018
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	06/03/2017	06/03/2018
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	05/22/2017	05/22/2018
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2017	07/25/2018
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/02/2017	05/02/2018
PRE11'	50dB gain pre-amp	Keith H	PRE11	PRE11	12/02/2017	12/02/2018
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/25/2017	07/25/2018

Software Utilized:

Name	Manufacturer	Version
BAT-EMC Emissions	Nexio	3.16.0.69

11.3 Results:

The sample tested was found to Comply.

§15.209 Radiated emission limits; general requirements.

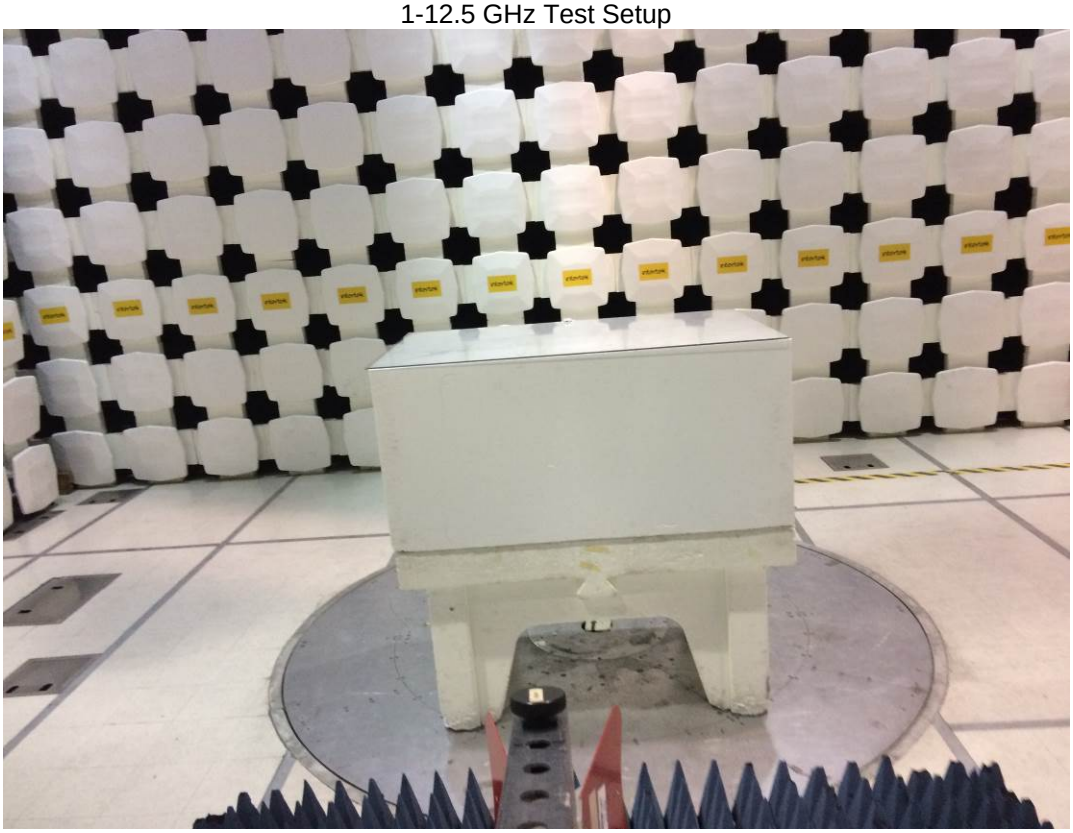
(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

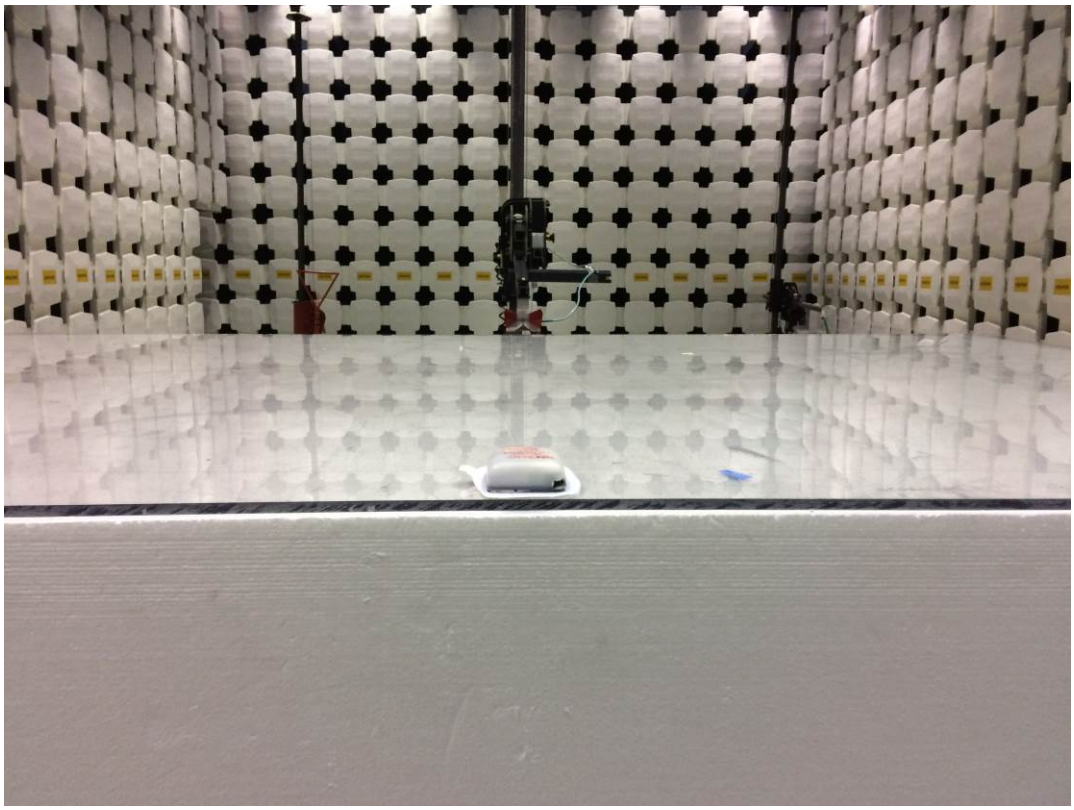
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

11.4 Setup Photographs:

30-1000 MHz Test Setup

1-12.5 GHz Test Setup





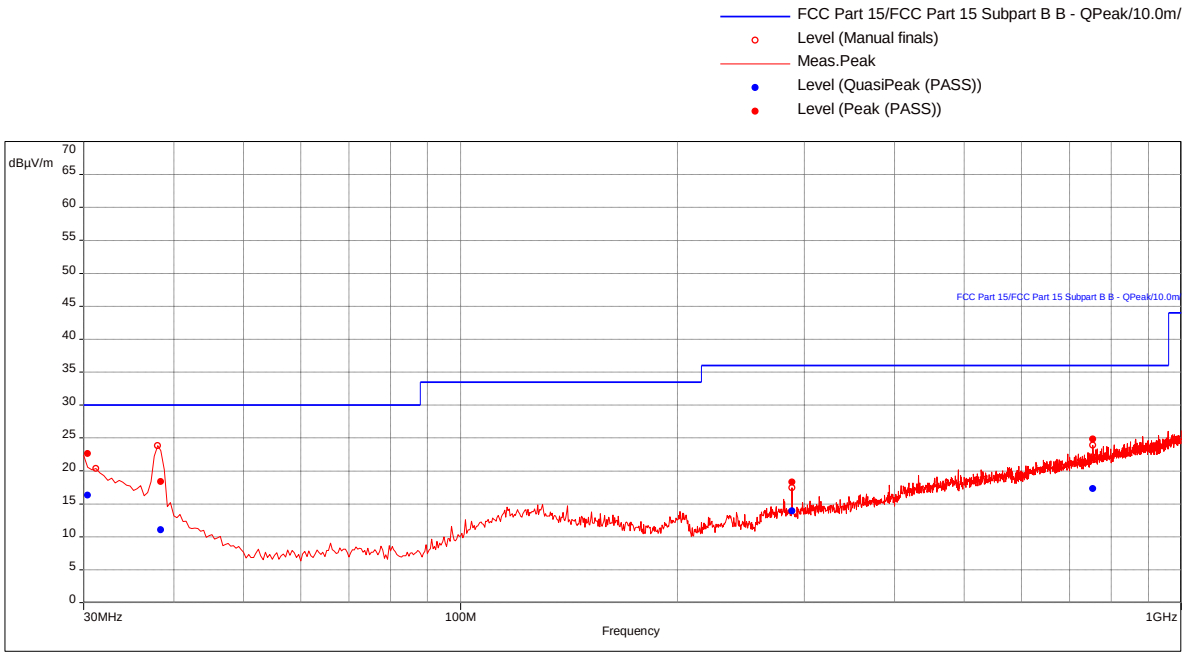
11.5 Plots/Data:

Digital Device Radiated Spurious Emissions (X-axis), 30-1000 MHz

Test Information:

Date and Time	2/25/2018 7:08:35 AM
Client and Project Number	Insulet
Engineer	Naga Suryadevara
Temperature	19C
Humidity	27%
Atmospheric Pressure	1014mbars
Comments	Scan 4 RE 30-1000MHz SA mode Rx mode (X-axis)

Graph:



Results:

QuasiPeak (PASS) (4)

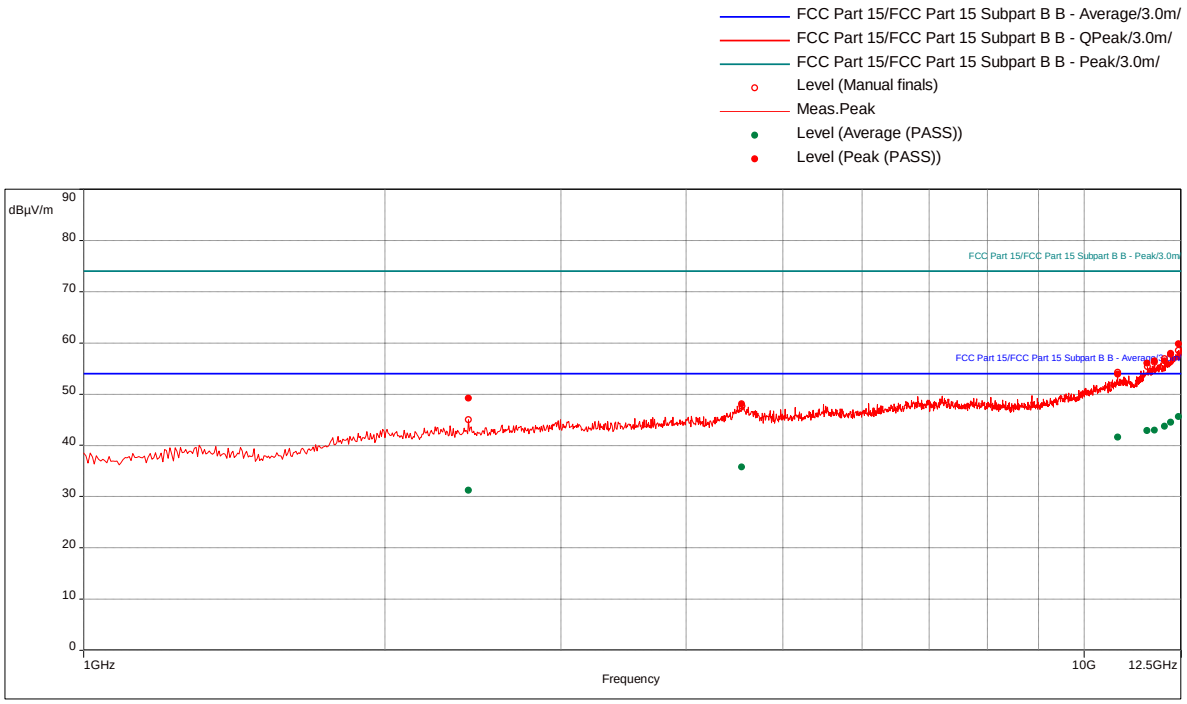
Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
30.6	30.00	-13.71	343.00	1.59	Vertical	120000.00	-22.97
38.22105263	30.00	-18.93	78.00	3.95	Vertical	120000.00	-28.68
288.5263158	36.00	-22.06	217.00	1.45	Vertical	120000.00	-28.72
754.1789474	36.00	-18.72	209.00	3.66	Vertical	120000.00	-18.57

Digital Device Radiated Spurious Emissions (X-axis), 1-12.5 GHz

Test Information:

Date and Time	2/25/2018 2:07:51 PM
Client and Project Number	Insulet
Engineer	Kouma Sinn
Temperature	19C
Humidity	28%
Atmospheric Pressure	1012mbars
Comments	Scan 10: 1 to 12.5 GHz_Rx 2402MHz

Graph:



Results:

Peak (PASS) (8)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
2426.052632	49.17	74.00	-24.83	217.00	3.34	Vertical	1000000.00	5.25
4547.368421	48.10	74.00	-25.90	166.00	1.60	Horizontal	1000000.00	10.14
10803.68421	53.87	74.00	-20.13	18.00	3.46	Vertical	1000000.00	16.87
11561.84211	56.02	74.00	-17.98	194.00	2.11	Horizontal	1000000.00	19.68
11759.21053	56.45	74.00	-17.55	267.00	3.72	Horizontal	1000000.00	20.38
12028.68421	56.50	74.00	-17.50	25.00	2.34	Vertical	1000000.00	21.23
12202.36842	57.92	74.00	-16.08	342.00	1.00	Vertical	1000000.00	21.57
12418.15789	59.79	74.00	-14.21	106.00	2.03	Vertical	1000000.00	22.52

Average (PASS) (8)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Correction (dB)
2426.052632	31.27	54.00	-22.73	217.00	3.34	Vertical	1000000.00	5.25
4547.368421	35.79	54.00	-18.21	166.00	1.60	Horizontal	1000000.00	10.14
10803.68421	41.56	54.00	-12.44	18.00	3.46	Vertical	1000000.00	16.87
11561.84211	42.90	54.00	-11.10	194.00	2.11	Horizontal	1000000.00	19.68
11759.21053	42.98	54.00	-11.02	267.00	3.72	Horizontal	1000000.00	20.38
12028.68421	43.73	54.00	-10.27	25.00	2.34	Vertical	1000000.00	21.23
12202.36842	44.49	54.00	-9.51	342.00	1.00	Vertical	1000000.00	21.57
12418.15789	45.65	54.00	-8.35	106.00	2.03	Vertical	1000000.00	22.52

Test Personnel:	Naga Suryadevara N.S	Test Date:	02/25/2018 (2nd shift)
	Kouma Sinn KPS		02/25/2018 (1st shift)
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:	19, 19 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	27, 28 %
		Atmospheric Pressure:	1014, 1012 mbars

Deviations, Additions, or Exclusions: None

12 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	03/02/2018	103328054BOX-001	KPS	VFV	Original Issue