FCC Test Report

FOR:
Philips Respironics

Model Number(s):
DSX510H11C, DSX510T11C, DSX520H11C, DSX520T11C

Marketing Name:
DreamStation 2 Auto CPAP

Product Description:
Continuous Airway Pressure Device with integrated Bluetooth (LE) and Cellular Radios (LTE Cat M1) that sends and receives data.

FCC ID: THO1141623

Applied Rules and Standards:
47 CFR Part 15.247 (DTS)

REPORT #: EMC_PHIL4-067-20001_15.247_BLE_DTS

DATE: 2020-04-10

A2LA Accredited

IC recognized #
3462B-1
3462B-2

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1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations.

No deviations were ascertained.

Company	Description	Model #
Philips Respironics	Continuous Airway Pressure Device with integrated Bluetooth (LE) and Cellular Radios (LTE Cat M1) that sends and receives data	DSX510H11C DSX510T11C DSX520H11C DSX520T11C

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2020-04-10	Compliance	Cindy Li (Lab Manager)	Cindy Li Digitally signed by cindy.li@cetecom.com DN: CN=cindy.li@cetecom.com Reason: I am approving this document Location: Date: 2020-04-10 16:29:19

Responsible for the Report:

Date	Section	Name	Signature
2020-04-10	Compliance	Issa Ghanma (EMC Engineer)	Issa W Ghanma Digitally signed by: Issa W Ghanma DN: CN = Issa W Ghanma email = Issaghanma@cetecom.com C = US O = CETECOM Inc. OU = EMC Date: 2020.04.10 14:09:52 -07'00'

The test results of this test report relate exclusively to the test item specified in Section3.
CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
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EMC Lab Manager:	Cindy Li
Responsible Project Leader:	Cathy Palacios

2.2 Identification of the Client

Client's Name:	Philips Respironics
Street Address:	1001 Murry Ridge Lane
City/Zip Code:	Murrysville, PA 15668
Country:	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Client
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Model No:	DSX520H11C
HW Version :	05
SW Version :	D1.0.0.1323
FCC-ID:	XPY2AGQN4NNN
HVIN:	DSX520H11C
PMN:	DreamStation 2 Advanced Auto CPAP
Product Description:	Continuous Airway Pressure Device with integrated Bluetooth (LE)
Frequency Range / number of channels:	Module Name: Dialog Module Nummer: DA14585 Nominal band: 2400 MHz – 2483.5 MHz; Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 39), 40 channels
Type(s) of Modulation:	Bluetooth Low Energy, using Dynamic Sequence Spread Spectrum with GFSK modulation.
Modes of Operation:	Bluetooth LE in both advertising and connected mode of operation
BLE Antenna gain [Measured]:	Low channel 2402 MHz: 2.37 dBi Mid channel 2442 MHz: 2.81 dBi High channel 2480 MHz: 1.92 dBi
Max. Peak Output Power:	Conducted Power 0.69 dBm
Power Supply/ Rated Operating Voltage Range:	Vmin: 10.8 VDC/ Vnom: 12 VDC / Vmax: 13.2 VDC
Operating Temperature Range:	Tmin: 5 ºC / Tnom: 21 ºC / Tmax: 35 ºC
Other Radios included in the device:	❖ LTE • Module name: U-blox • Model number: SARA-R410M-02B • FCC ID: XPY2AGQN4NNN
Sample Revision:	☐Prototype Unit; ☐Production Unit; ■Pre-Production

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	D0PP10204393D6	04	D1.0.0.1323	Radiated Emissions AC Conducted Emissions

3.3 Accessory Equipment (AE) Details

AE #	Type	Model	Manufacturer	Serial Number
1	DreamStation Power Supply	MDS-080AAS12 A	Respironics Inc.	70HW93S0BRS

3.4 Support Equipment

SE #	Comments
1	Segger J-Link, Part No: 8.08.00, S/N: 50129736
2	USB Cable – A to Micro B (11mm Length Micro B)
3	Bluetooth USB-to-UART Cable
4	USB Cable – A to B (for Segger J-Link)
5	Laptop

3.5 Test Sample Configuration

Set-up #	Combination of AE used for test set up	Comments
1	EUT # 1 + AE # 1	-

3.6 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op.1	BLE Co-TX with LTE	**SmartSnippets Toolbox;** An application window used to configure the Bluetooth LE radio to low, mid and high channels provided by the client that will not be available to the end user. **ModTunn.exe;** An application used to configured the Cellular radio to transmit simultaneously, on LTE Band 2 while testing below 1 GHz, and LTE Band 12 while testing above 1 GHz. **ModTunn.exe** will not be available to the end user. For radiated measurements, the internal antenna was connected.

3.7 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested in Co-TX mode;
BLE transmitter sets on low, mid and high channels, while based on client declaration, the BLE will be always configured to transmit at the maximum power, and highest duty cycle.

Cellular radio is transmitting simultaneously on highest power LTE Band 2 or 12, Based on module grant (U-blox SARA-R410M-02B).

For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations.

Based on Client declaration; 'DSX510H11C, DSX510T11C, DSX520H11C and DSX520T11C, are using the same PCBA (Printed Circuit Board Assembly). Furthermore, the application firmware loaded on to each model is identical as well. The application firmware task that is responsible for controlling the radios is the identical for all models.
There is no difference in how the radios are controlled between the model types.' Thus all conducted measurement were leveraged from Report #: EMC_PHIL4-064-20001_15.247_BT_DTS

Testing procedures are based on 558074 D01 DTS Meas Guidance v04 – "GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER SECTION 15.247" - April 5, 2017, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.

5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
§15.247(a)(1)	Emission Bandwidth	Nominal	-	☐	☐	■	See Note1 See Note2
§15.247(e)	Power Spectral Density	Nominal	-	☐	☐	■	See Note1 See Note2
§15.247(b)(1)	Maximum Conducted Output Power and EIRP	Nominal	-	☐	☐	■	See Note1 See Note2
§15.247(d)	Band edge compliance Unrestricted Band Edges	Nominal	-	☐	☐	■	See Note1 See Note2
§15.247; 15.209; 15.205	Band edge compliance Restricted Band Edges	Nominal	-	☐	☐	■	See Note1 See Note2
§15.247(d); §15.209	TX Spurious emissions-Radiated	Nominal	Op.1	■	☐	☐	Complies
§15.207(a)	AC Conducted Emissions	Nominal	Op.1	■	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Leveraged from module certification report#: EMC_PHIL4_064_20001_15.247_BT_DTS

6 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

Radiated measurement

9 kHz to 30 MHz	±2.5 dB (Magnetic Loop Antenna)
30 MHz to 1000 MHz	±2.0 dB (Biconilog Antenna)
1 GHz to 40 GHz	±2.3 dB (Horn Antenna)

Conducted measurement

150 kHz to 30 MHz	±0.7 dB (LISN)

RF conducted measurement	±0.5 dB

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: http://physics.nist.gov/cuu/Uncertainty/typeb.html. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3 dB to the limit.

6.1 Environmental Conditions During Testing:

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25° C
- Relative humidity: 40-60%

6.2 Dates of Testing:

03/05/2020-03/09/2020

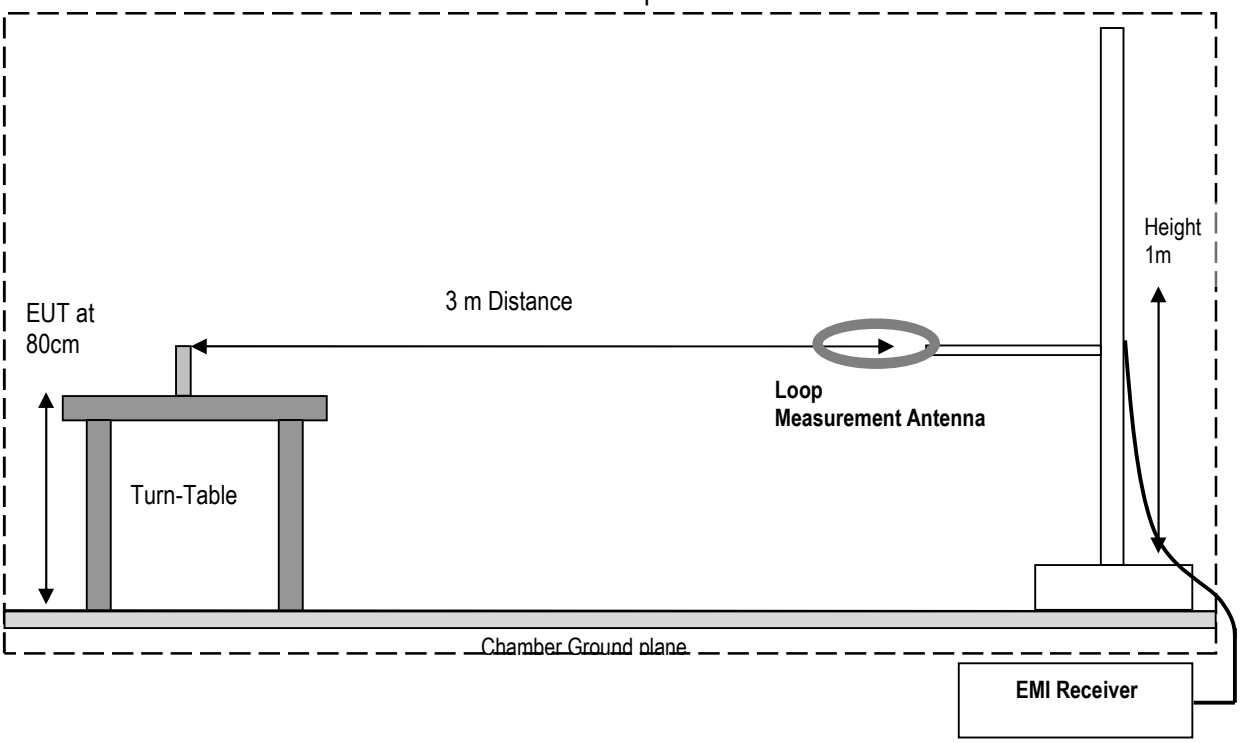
7 Measurement Procedures

7.1 Radiated Measurement

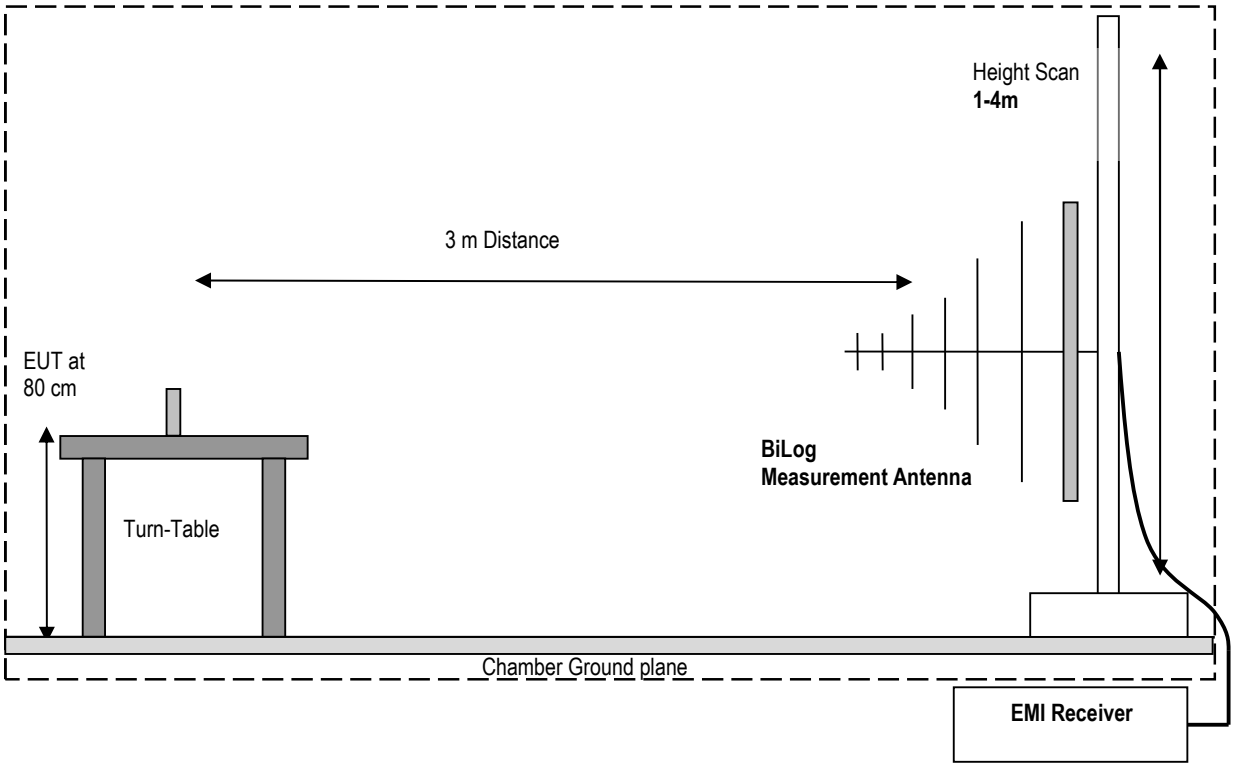
The radiated measurement is performed according to ANSI C63.10 (2013)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

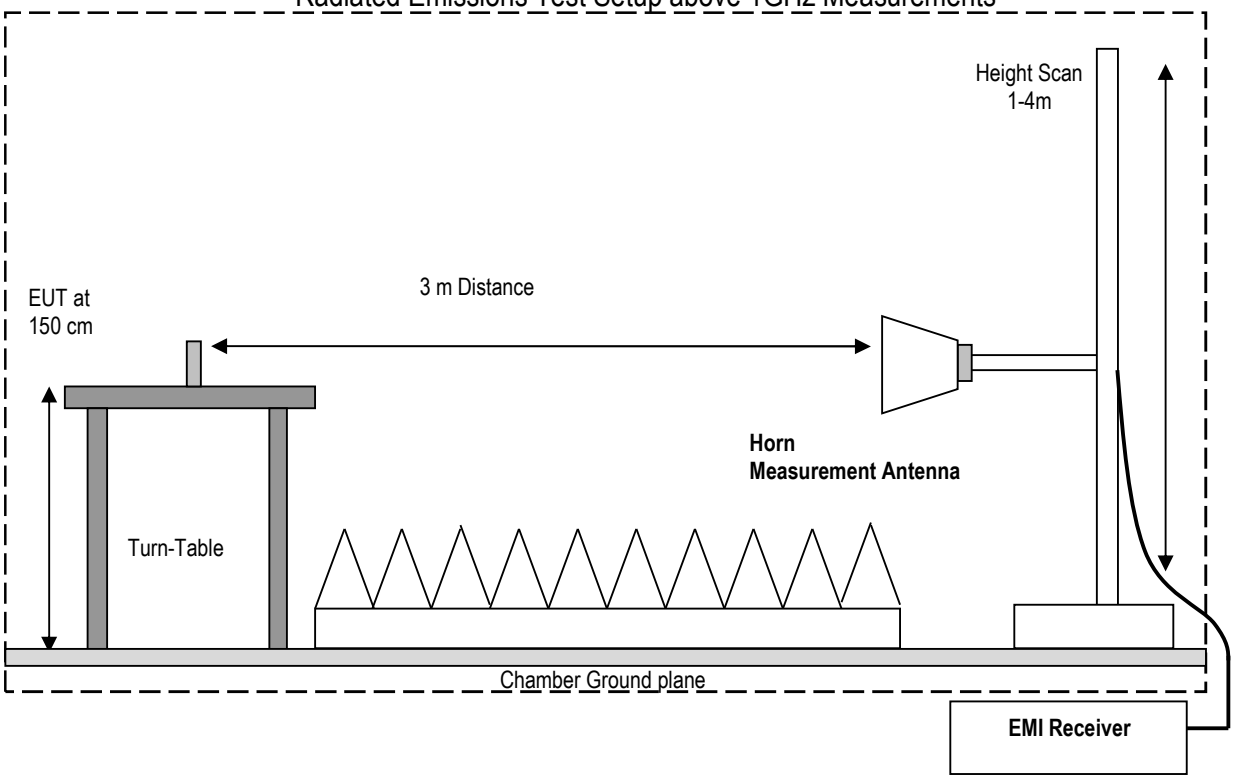
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



7.1.1 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

FS (dBµV/m) = Measured Value on SA (dBµV)- Cable Loss (dB)+ Antenna Factor (dB/m)

Example:

Frequency (MHz)	Measured SA (dBµV)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dBµV/m)
1000	80.5	3.5	14	98.0

8 Test Result Data

8.1 Radiated Transmitter Spurious Emissions and Restricted Bands

8.1.1 Measurement according to ANSI C63.10 (2013)

Spectrum Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector: Peak

- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW= 120 KHz (<1GHz)

- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1 MHz

- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) data rate shall be recorded for each measurement.
- For testing at distance other than the specified in the standard, the limit conversion is calculated by using 40 dB/decade extrapolation factor as follow: Conversion factor (CF) = 40 log (D/d) = 40 log (300m / 3m) = 80dB

8.1.2 Limits:

FCC §15.247

- 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)).

FCC §15.209

- 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 of emission (MHz)	Field strength (µV/m)	Measurement Distance (m)	Field strength @ 3m (dBµV/m)
0.009–0.490	2400/F(kHz) / ---------	300	-
0.490–1.705	24000/F(kHz) / --------	30	-
1.705–30.0	30 / (29.5)	30	-
30–88	100	3	40 dBµV/m
88–216	150	3	43.5 dBµV/m
216–960	200	3	46 dBµV/m
Above 960	500	3	54 dBµV/m

FCC §15.205

- Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

- 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)).
  *PEAK LIMIT= 74 dBµV/m
  *AVG. LIMIT= 54 dBµV/m

8.1.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	1	Op.1	12 VDC

8.1.4 Measurement result:

Plot #	Channel #	Scan Frequency	Limit	Result
1 – 3	Low	30 MHz – 18 GHz	See section 8.1.2	Pass
4 – 8	Mid	9 kHz – 40 GHz	See section 8.1.2	Pass
9 – 11	High	30 MHz – 18 GHz	See section 8.1.2	Pass

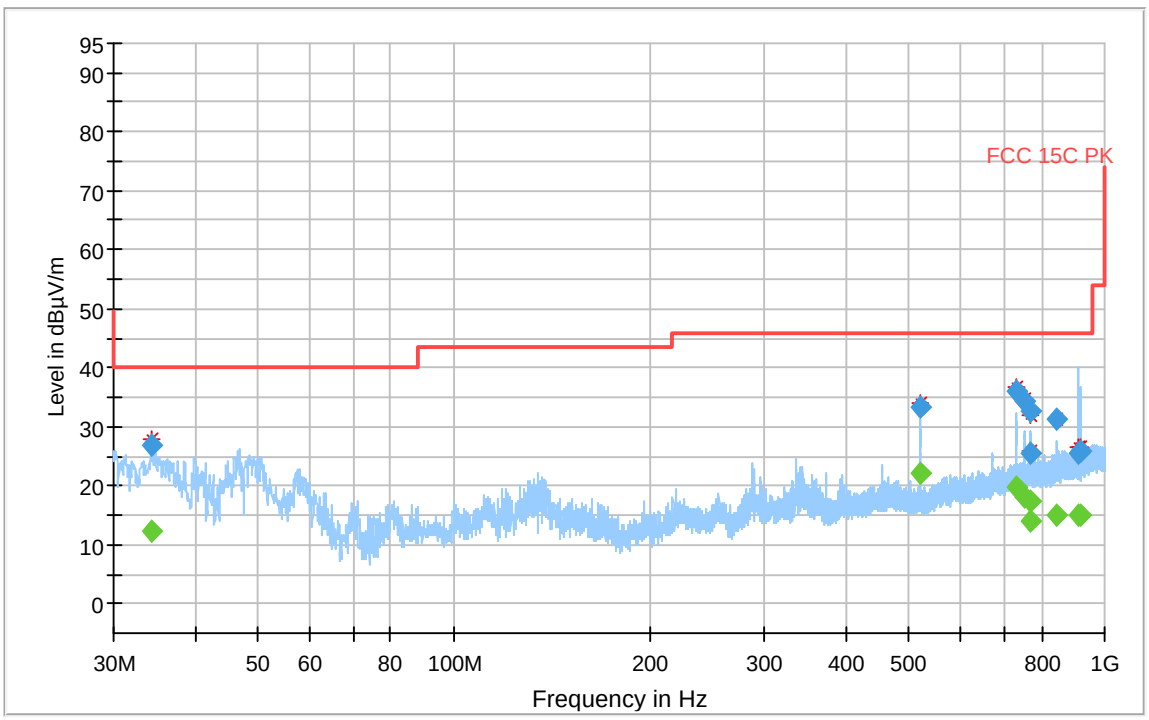
8.1.5 Measurement Plots:

Plot #1 Radiated Emissions: 30 MHz – 1GHz

Modulation: BT LE	Channel: Low	Duty Cycle ≥ 98%

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
34.385	---	12.446	---	---	500.0	100.000	116.0	V	16.0	-12.0	8:11:45 PM - 3/5/2020
34.385	27.001	---	40.00	13.00	500.0	100.000	116.0	V	16.0	-12.0	8:11:45 PM - 3/5/2020
522.441	---	22.215	---	---	500.0	100.000	125.0	V	250.0	-12.2	8:14:53 PM - 3/5/2020
522.441	33.178	---	46.00	12.82	500.0	100.000	125.0	V	250.0	-12.2	8:14:53 PM - 3/5/2020
732.749	---	19.622	---	---	500.0	100.000	125.0	H	321.0	-7.7	8:17:54 PM - 3/5/2020
732.749	36.112	---	46.00	9.89	500.0	100.000	125.0	H	321.0	-7.7	8:17:54 PM - 3/5/2020
752.251	---	17.923	---	---	500.0	100.000	116.0	H	260.0	-7.6	8:20:52 PM - 3/5/2020
752.251	34.213	---	46.00	11.79	500.0	100.000	116.0	H	260.0	-7.6	8:20:52 PM - 3/5/2020
768.591	---	14.067	---	---	500.0	100.000	224.0	H	324.0	-7.2	8:23:33 PM - 3/5/2020
768.591	25.396	---	46.00	20.60	500.0	100.000	224.0	H	324.0	-7.2	8:23:33 PM - 3/5/2020
770.975	---	17.255	---	---	500.0	100.000	107.0	H	262.0	-7.2	8:26:38 PM - 3/5/2020
770.975	32.582	---	46.00	13.42	500.0	100.000	107.0	H	262.0	-7.2	8:26:38 PM - 3/5/2020
844.787	---	14.978	---	---	500.0	100.000	100.0	H	322.0	-6.5	8:29:32 PM - 3/5/2020
844.787	31.341	---	46.00	14.66	500.0	100.000	100.0	H	322.0	-6.5	8:29:32 PM - 3/5/2020
912.507	---	14.917	---	---	500.0	100.000	107.0	V	332.0	-6.0	8:32:20 PM - 3/5/2020
912.507	25.628	---	46.00	20.37	500.0	100.000	107.0	V	332.0	-6.0	8:32:20 PM - 3/5/2020
917.886	---	15.085	---	---	500.0	100.000	243.0	V	258.0	-5.8	8:35:00 PM - 3/5/2020
917.886	25.709	---	46.00	20.29	500.0	100.000	243.0	V	258.0	-5.8	8:35:00 PM - 3/5/2020



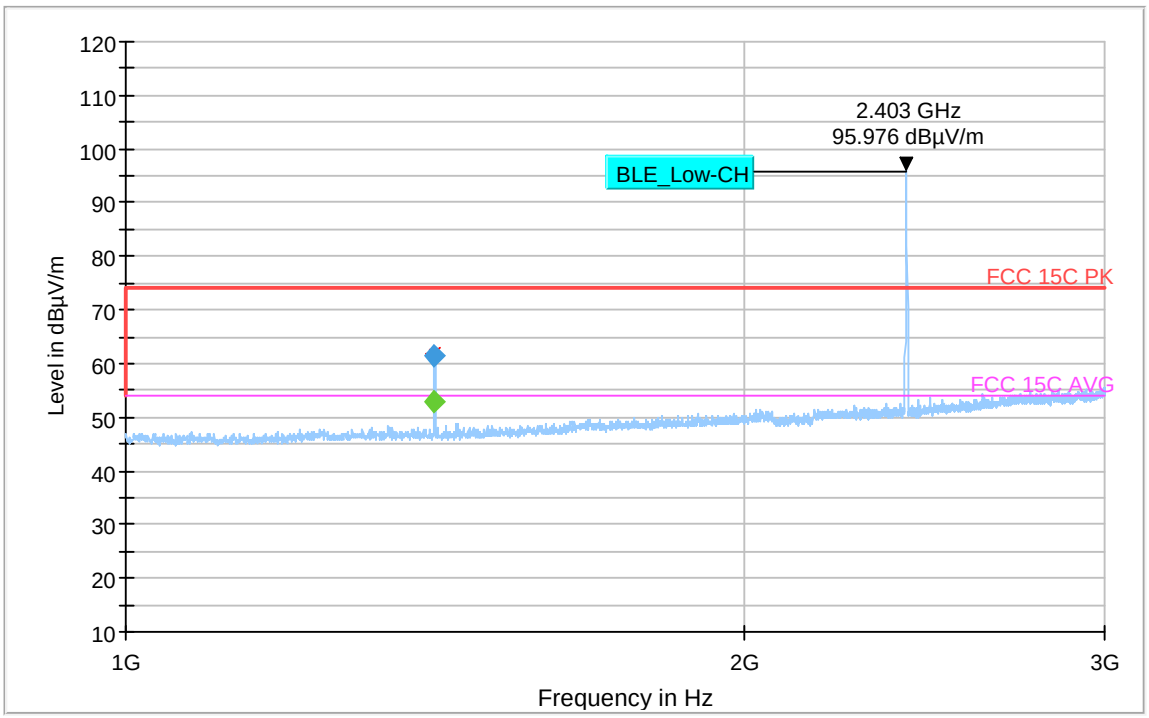
Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
Final_Result PK+ | Final_Result RMS

Plot #2 Radiated Emissions: 1 – 3 GHz

Modulation: BT LE	Channel: Low	Duty Cycle ≥ 98%

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1414.250	---	52.776	53.98	1.20	300.0	1000.000	271.0	H	120.0	3.0	5:30:54 PM - 3/5/2020
1414.250	61.519	---	74.00	12.48	300.0	1000.000	271.0	H	120.0	3.0	5:30:53 PM - 3/5/2020



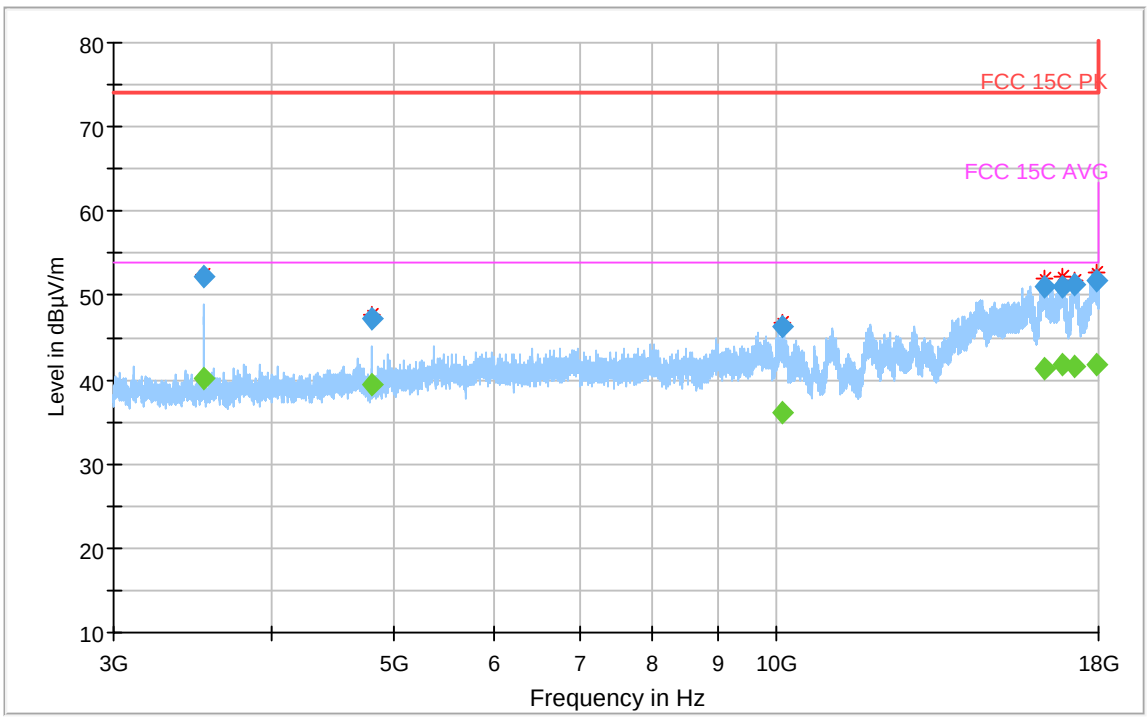
Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
FCC 15C AVG | Final_Result PK+ | Final_Result RMS

Plot #3 Radiated Emissions: 3 – 18 GHz

Modulation: BT LE	Channel: Low	Duty Cycle ≥ 98%

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
3537.318	52.237	---	73.99	21.75	500.0	1000.000	208.0	V	202.0	-8.3	2:51:21 PM - 3/5/2020
3537.318	---	40.120	53.98	13.86	500.0	1000.000	208.0	V	202.0	-8.3	2:51:21 PM - 3/5/2020
4804.449	47.151	---	73.99	26.84	500.0	1000.000	158.0	V	286.0	-6.0	3:00:19 PM - 3/5/2020
4804.449	---	39.542	53.98	14.44	500.0	1000.000	158.0	V	286.0	-6.0	3:00:19 PM - 3/5/2020
10110.033	---	35.998	53.98	17.98	10.0	1000.000	315.0	V	109.0	3.9	2:48:10 PM - 3/5/2020
10110.033	46.312	---	73.98	27.67	10.0	1000.000	315.0	V	109.0	3.9	2:48:10 PM - 3/5/2020
16297.474	51.120	---	73.98	22.86	10.0	1000.000	161.0	V	250.0	11.6	2:54:10 PM - 3/5/2020
16297.474	---	41.352	53.98	12.63	10.0	1000.000	161.0	V	250.0	11.6	2:54:11 PM - 3/5/2020
16829.698	---	41.897	53.98	12.08	10.0	1000.000	172.0	V	221.0	12.6	2:57:10 PM - 3/5/2020
16829.698	51.138	---	73.98	22.84	10.0	1000.000	172.0	V	221.0	12.6	2:57:09 PM - 3/5/2020
17245.433	---	41.480	53.98	12.50	10.0	1000.000	236.0	H	237.0	13.4	2:41:18 PM - 3/5/2020
17245.433	51.302	---	73.98	22.68	10.0	1000.000	236.0	H	237.0	13.4	2:41:18 PM - 3/5/2020
17910.446	51.769	---	73.98	22.21	10.0	1000.000	118.0	H	327.0	13.7	2:44:56 PM - 3/5/2020
17910.446	---	41.728	53.98	12.25	10.0	1000.000	118.0	H	327.0	13.7	2:44:56 PM - 3/5/2020



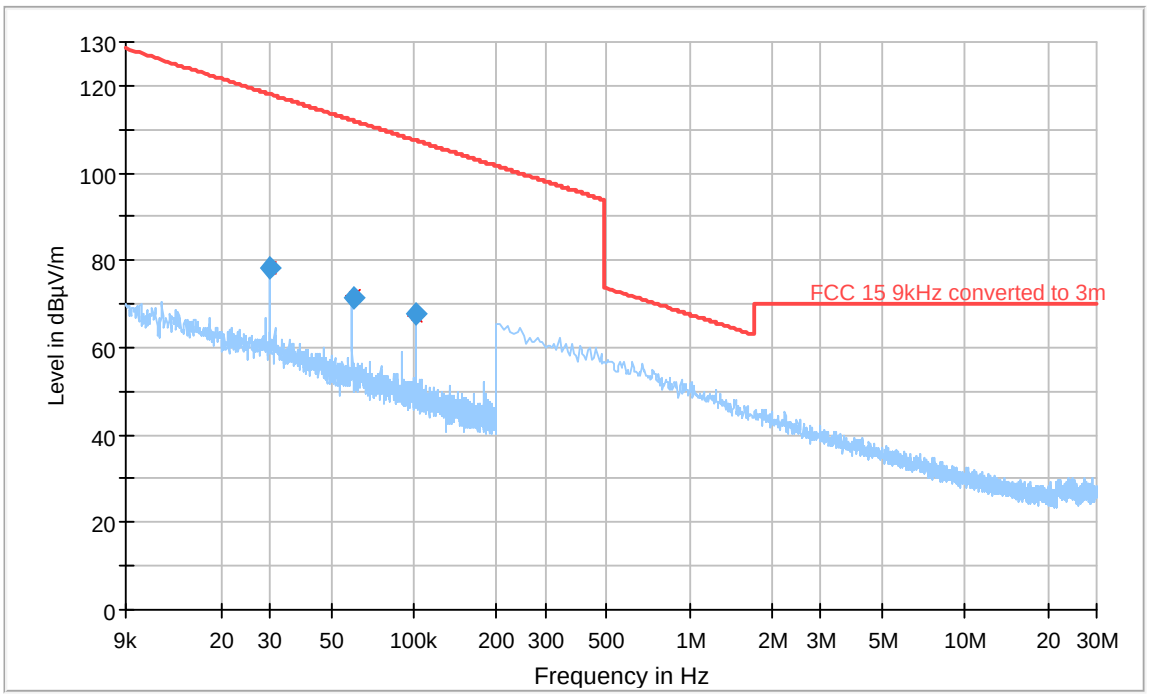
Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
FCC 15C AVG | Final_Result PK+ | Final_Result RMS

Plot #4 Radiated Emissions: 9 KHz – 30 MHz

Modulation: BT LE	Channel: Mid	Duty Cycle ≥ 98%

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
0.030	78.358	118.04	39.68	500.0	0.200	100.0	V	192.0	22.8	8:11:46 AM - 3/6/2020
0.060	71.632	112.02	40.38	500.0	0.200	100.0	V	172.0	19.5	8:14:17 AM - 3/6/2020
0.101	67.657	107.48	39.83	500.0	0.200	100.0	H	196.0	18.6	8:09:12 AM - 3/6/2020



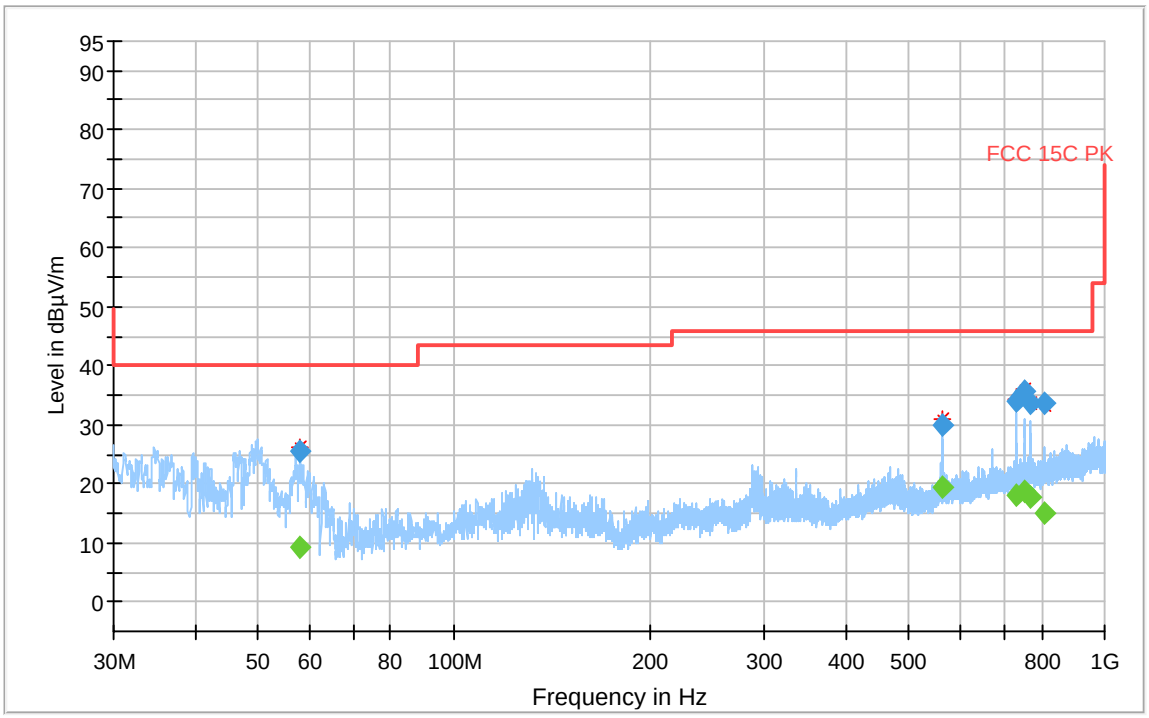
Preview Result 1-PK+
FCC 15 9kHz converted to 3m
Final_Result RMS
Critical_Freqs PK+
Final_Result PK+

Plot #5 Radiated Emissions: 30 MHz – 1 GHz

Modulation: BT LE	Channel: Mid	Duty Cycle ≥ 98%

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
57.940	---	9.175	---	---	500.0	100.000	149.0	V	349.0	-21.6	7:36:42 PM - 3/5/2020
57.940	25.452	---	40.00	14.55	500.0	100.000	149.0	V	349.0	-21.6	7:36:42 PM - 3/5/2020
561.871	---	19.458	---	---	500.0	100.000	133.0	V	273.0	-10.1	7:39:39 PM - 3/5/2020
561.871	29.978	---	46.00	16.02	500.0	100.000	133.0	V	273.0	-10.1	7:39:39 PM - 3/5/2020
732.451	---	17.910	---	---	500.0	100.000	133.0	H	114.0	-7.8	7:42:50 PM - 3/5/2020
732.451	34.111	---	46.00	11.89	500.0	100.000	133.0	H	114.0	-7.8	7:42:50 PM - 3/5/2020
751.873	---	18.872	---	---	500.0	100.000	125.0	H	116.0	-7.6	7:45:41 PM - 3/5/2020
751.873	35.727	---	46.00	10.27	500.0	100.000	125.0	H	116.0	-7.6	7:45:40 PM - 3/5/2020
771.643	---	17.747	---	---	500.0	100.000	107.0	H	115.0	-7.2	7:48:32 PM - 3/5/2020
771.643	33.720	---	46.00	12.28	500.0	100.000	107.0	H	115.0	-7.2	7:48:32 PM - 3/5/2020
806.352	---	15.152	---	---	500.0	100.000	125.0	H	94.0	-6.7	7:51:22 PM - 3/5/2020
806.352	33.694	---	46.00	12.31	500.0	100.000	125.0	H	94.0	-6.7	7:51:22 PM - 3/5/2020



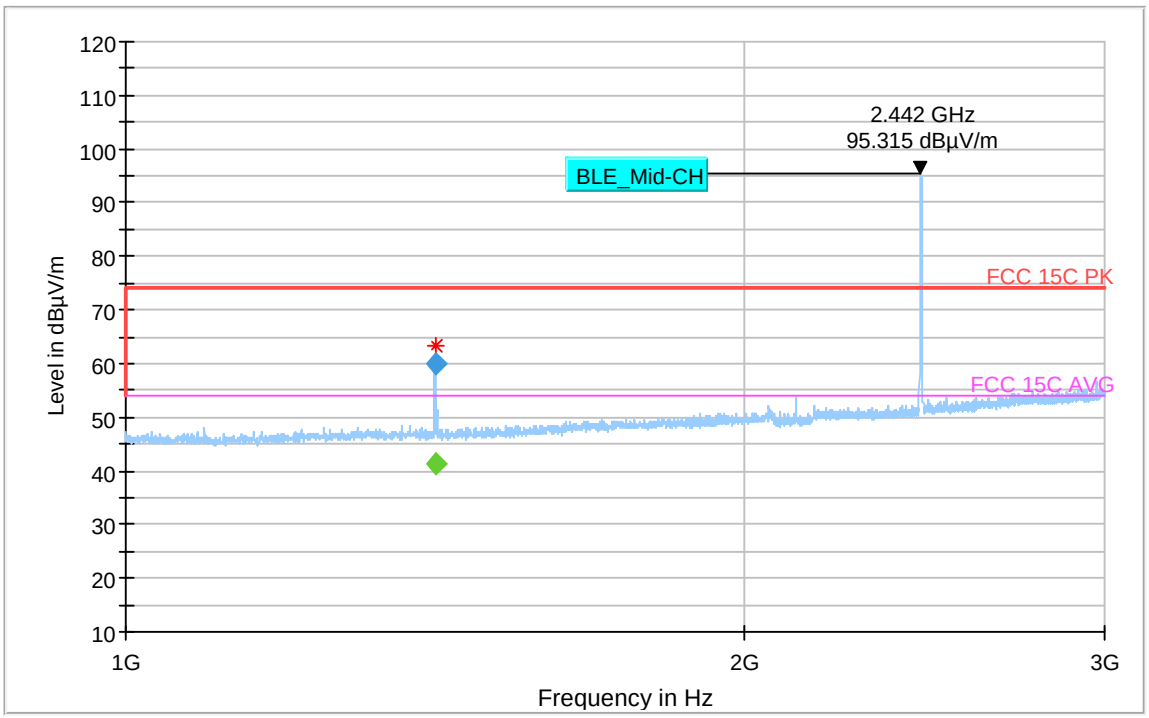
Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
Final_Result PK+ | Final_Result RMS

Plot #6 Radiated Emissions: 1 – 3 GHz

Modulation: BT LE	Channel: Mid	Duty Cycle ≥ 98%

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1416.445	---	41.442	53.98	12.54	300.0	1000.000	298.0	H	349.0	3.0	4:13:53 PM - 3/5/2020
1416.445	59.789	---	74.00	14.21	300.0	1000.000	298.0	H	349.0	3.0	4:13:53 PM - 3/5/2020



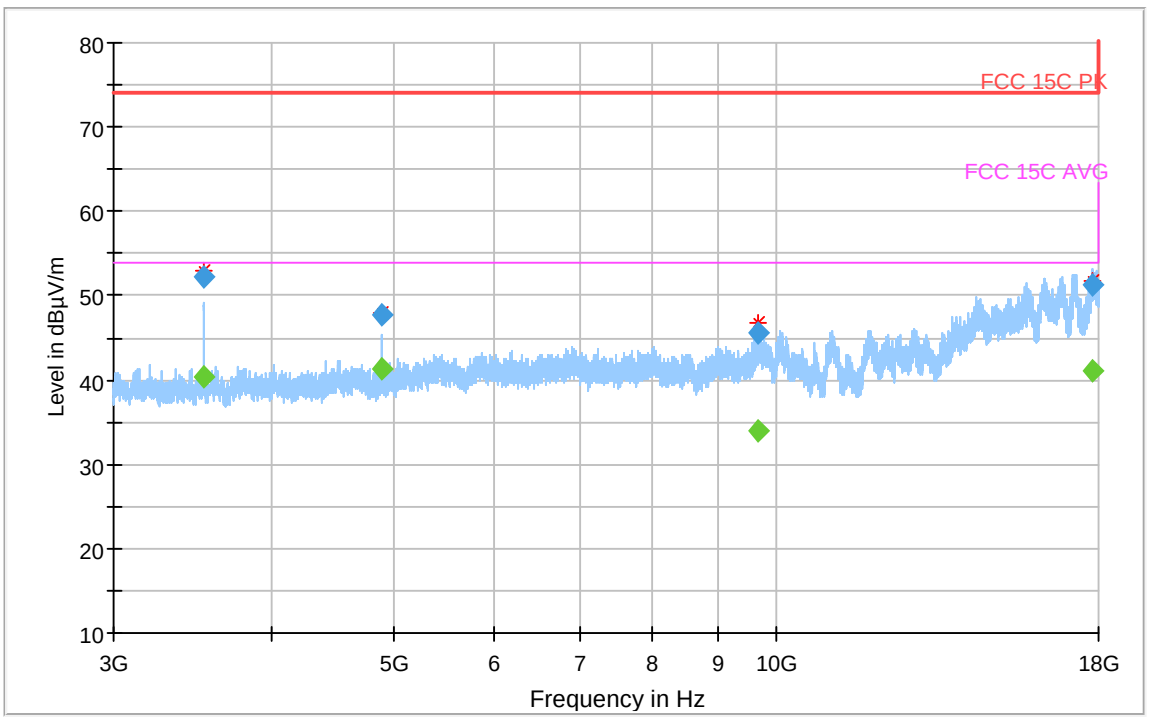
Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
FCC 15C AVG | Final_Result PK+ | Final_Result RMS

Plot #7 Radiated Emissions: 3 – 18 GHz

Modulation: BT LE	Channel: Mid	Duty Cycle ≥ 98%

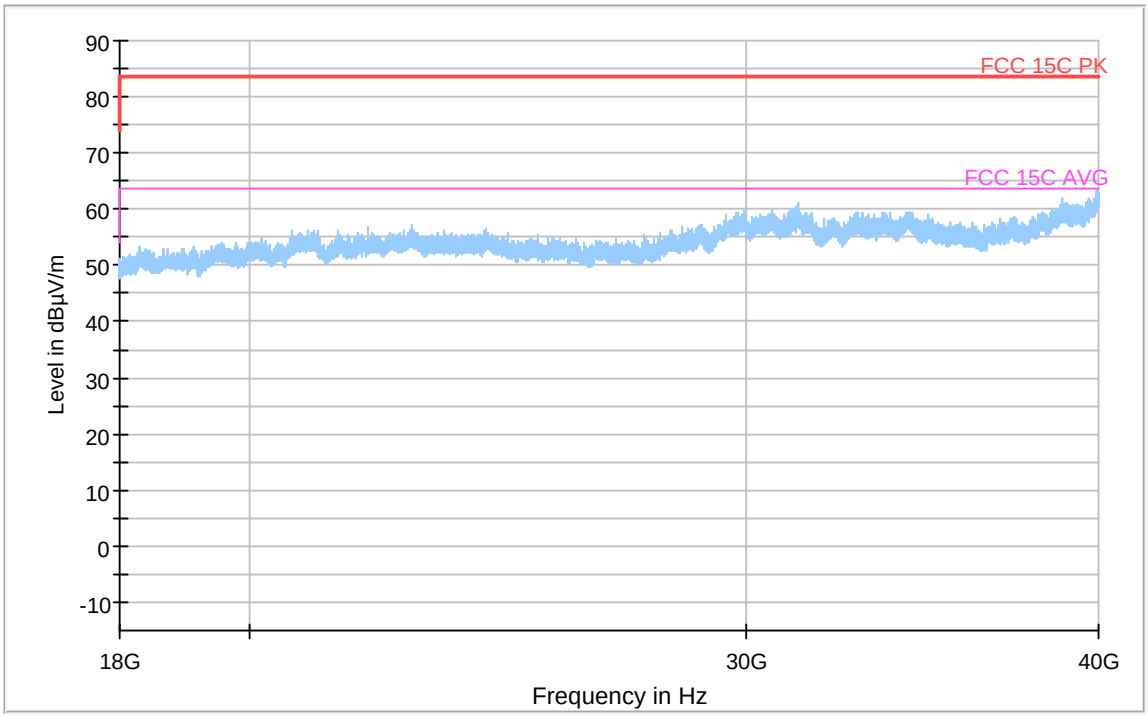
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
3537.315	---	40.468	53.98	13.51	500.0	1000.000	125.0	V	206.0	-8.3	6:50:05 PM - 3/5/2020
3537.315	52.131	---	73.99	21.86	500.0	1000.000	125.0	V	206.0	-8.3	6:50:05 PM - 3/5/2020
4883.713	---	41.318	53.98	12.66	500.0	1000.000	167.0	V	288.0	-5.7	6:53:23 PM - 3/5/2020
4883.713	47.709	---	73.99	26.28	500.0	1000.000	167.0	V	288.0	-5.7	6:53:22 PM - 3/5/2020
9701.948	45.561	---	73.98	28.42	500.0	1000.000	243.0	V	131.0	2.8	6:46:46 PM - 3/5/2020
9701.948	---	34.035	53.98	19.94	500.0	1000.000	243.0	V	131.0	2.8	6:46:47 PM - 3/5/2020
17793.285	51.265	---	73.98	22.71	10.0	1000.000	201.0	V	63.0	13.0	6:43:24 PM - 3/5/2020
17793.285	---	41.187	53.98	12.79	10.0	1000.000	201.0	V	63.0	13.0	6:43:24 PM - 3/5/2020



Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
FCC 15C AVG | Final_Result PK+ | Final_Result RMS

Plot #8 Radiated Emissions: 18 – 40 GHz		
Modulation: BT LE	**Channel: Mid**	**Duty Cycle ≥ 98%**



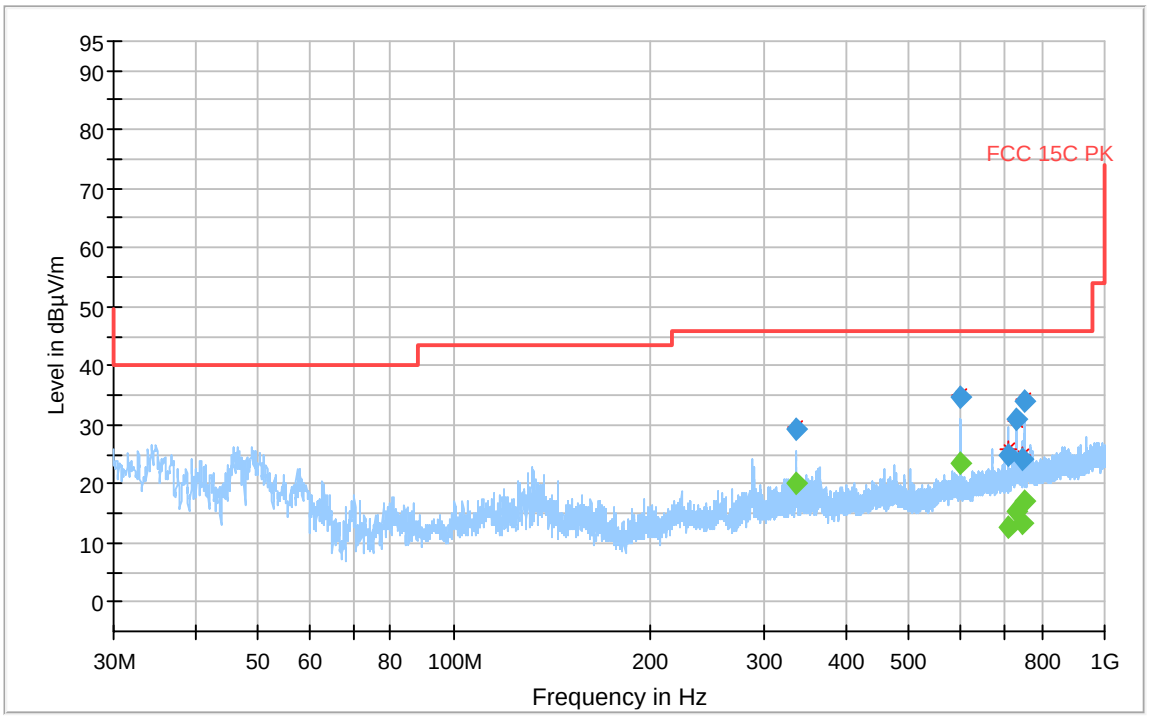
Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
FCC 15C AVG | Final_Result PK+ | Final_Result RMS

Plot #9 Radiated Emissions: 30 MHz – 1 GHz

Modulation: BT LE	Channel: High	Duty Cycle ≥ 98%

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
335.928	---	20.019	---	---	500.0	100.000	107.0	H	307.0	-16.3	8:51:17 PM - 3/5/2020
335.928	29.136	---	46.00	16.86	500.0	100.000	107.0	H	307.0	-16.3	8:51:17 PM - 3/5/2020
599.954	---	23.386	---	---	500.0	100.000	100.0	V	118.0	-10.2	8:54:33 PM - 3/5/2020
599.954	34.524	---	46.00	11.48	500.0	100.000	100.0	V	118.0	-10.2	8:54:33 PM - 3/5/2020
710.237	---	12.636	---	---	500.0	100.000	116.0	H	108.0	-8.6	8:57:30 PM - 3/5/2020
710.237	24.934	---	46.00	21.07	500.0	100.000	116.0	H	108.0	-8.6	8:57:30 PM - 3/5/2020
732.520	---	15.451	---	---	500.0	100.000	100.0	V	45.0	-7.7	9:00:37 PM - 3/5/2020
732.520	30.842	---	46.00	15.16	500.0	100.000	100.0	V	45.0	-7.7	9:00:37 PM - 3/5/2020
749.388	---	13.189	---	---	500.0	100.000	222.0	H	270.0	-7.7	9:03:40 PM - 3/5/2020
749.388	24.011	---	46.00	21.99	500.0	100.000	222.0	H	270.0	-7.7	9:03:40 PM - 3/5/2020
752.303	---	17.109	---	---	500.0	100.000	120.0	H	260.0	-7.6	9:06:51 PM - 3/5/2020
752.303	34.104	---	46.00	11.90	500.0	100.000	120.0	H	260.0	-7.6	9:06:51 PM - 3/5/2020



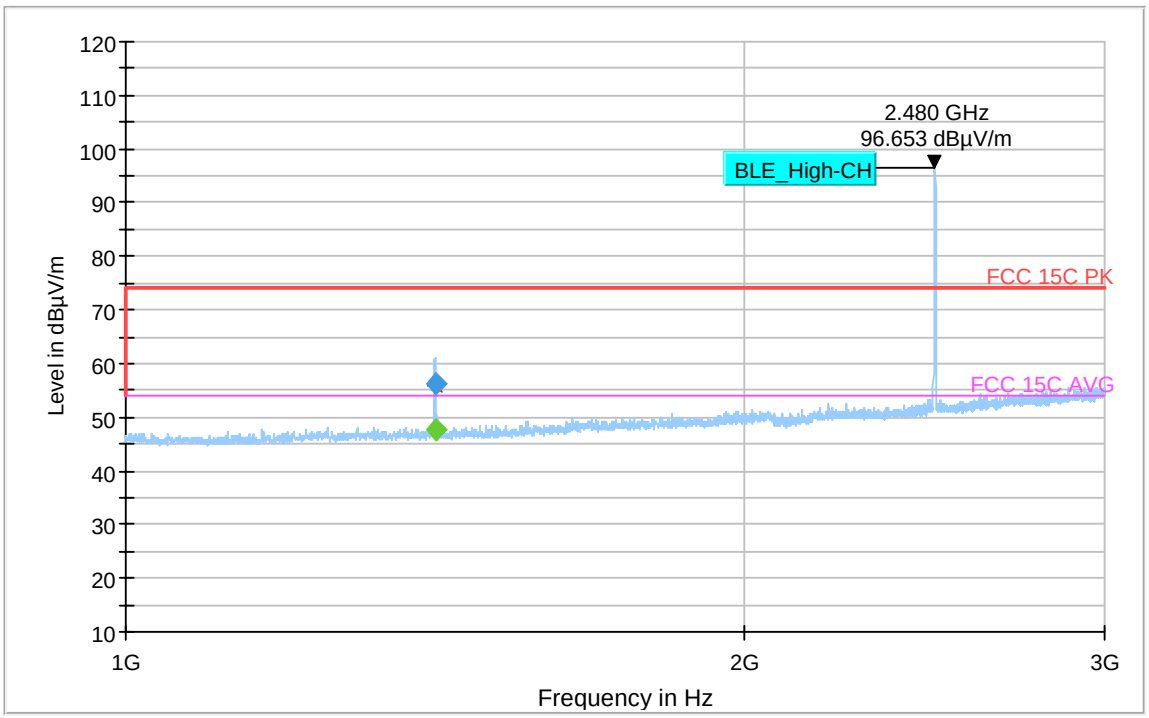
Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
Final_Result PK+ | Final_Result RMS

Plot #10 Radiated Emissions: 1 – 3 GHz

Modulation: BT LE	Channel: High	Duty Cycle ≥ 98%

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1415.425	---	47.510	53.98	6.47	300.0	1000.000	274.0	H	126.0	3.0	5:53:59 PM - 3/5/2020
1415.425	56.236	---	74.00	17.76	300.0	1000.000	274.0	H	126.0	3.0	5:53:59 PM - 3/5/2020



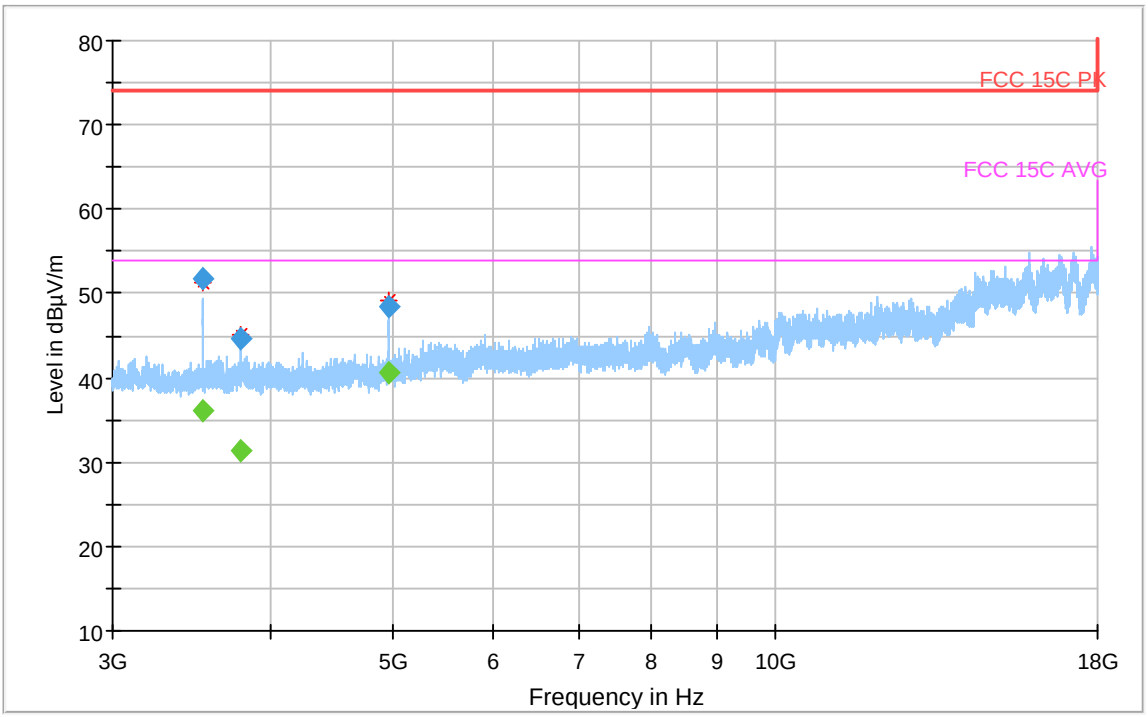
Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
FCC 15C AVG | Final_Result PK+ | Final_Result RMS

Plot #11 Radiated Emissions: 3 – 18 GHz

Modulation: BT LE	Channel: High	Duty Cycle ≥ 98%

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
3538.562	51.743	---	73.99	22.25	500.0	1000.000	149.0	H	252.0	-8.3	1:32:10 PM - 3/5/2020
3538.562	---	36.037	53.98	17.94	500.0	1000.000	149.0	H	252.0	-8.3	1:32:11 PM - 3/5/2020
3787.697	44.549	---	73.99	29.44	500.0	1000.000	318.0	V	114.0	-7.0	1:35:17 PM - 3/5/2020
3787.697	---	31.371	53.98	22.61	500.0	1000.000	318.0	V	114.0	-7.0	1:35:18 PM - 3/5/2020
4959.534	---	40.618	53.98	13.36	500.0	1000.000	145.0	H	84.0	-5.6	1:28:58 PM - 3/5/2020
4959.534	48.436	---	73.99	25.55	500.0	1000.000	145.0	H	84.0	-5.6	1:28:58 PM - 3/5/2020



Preview Result 1-PK+ | Critical_Freqs PK+ | FCC 15C PK
FCC 15C AVG | Final_Result PK+ | Final_Result RMS

8.2 AC Power Line Conducted Emissions

8.2.1 Measurement according to ANSI C63.4

Analyzer Settings:

- RBW = 9 KHz (CISPR Bandwidth)
- Detector: Peak / Average for Pre-scan
- Quasi-Peak/Average for Final Measurements

8.2.2 Limits: §15.207 & RSS-Gen 8.8

FCC §15.207(a) & RSS-Gen 8.8

- Except as shown in paragraphs (b) and (c) of this section of the CFR, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table (1), as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

8.2.3 Test conditions and setup:

Ambient Temperature ©	EUT Set-Up #	EUT operating mode	Power line (L1, L2, L3, N)	Power Input
22° C	1	Op.1	Line & Neutral	110V / 60Hz

8.2.4 Measurement Result:

Plot #	Port	EUT Set-Up #:	EUT operating mode	Scan Frequency	Limit	Result
1	AC Mains	3	BT LE continuous fixed channel	150 kHz – 30 MHz	See section 8.2.2	Pass

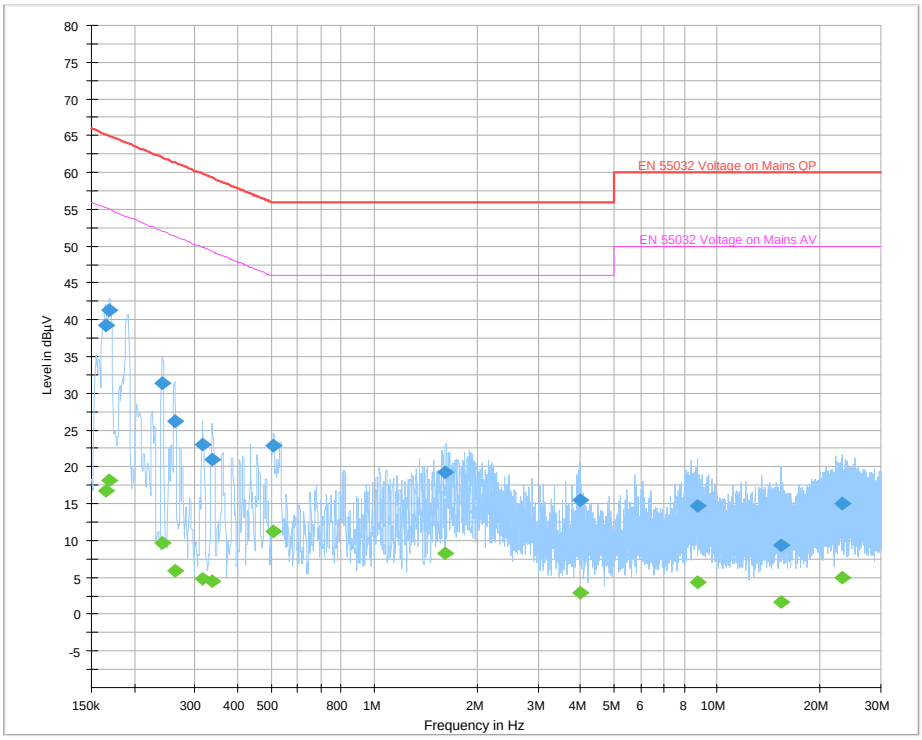
8.2.5 Measurement Plots:

Plot #1 Radiated Emissions: 3 – 18 GHz

Modulation: BT LE	Channel: High	Duty Cycle ≥ 98%

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.165	39.31	---	65.21	25.91	500.0	9.000	N	GND	10.6
0.165	---	16.80	55.21	38.41	500.0	9.000	N	GND	10.6
0.169	41.25	---	65.00	23.75	500.0	9.000	L1	GND	10.9
0.169	---	18.14	55.00	36.86	500.0	9.000	L1	GND	10.9
0.242	---	9.64	52.04	42.40	500.0	9.000	N	GND	10.7
0.242	31.44	---	62.04	30.60	500.0	9.000	N	GND	10.7
0.262	---	5.90	51.37	45.47	500.0	9.000	N	GND	10.5
0.262	26.25	---	61.37	35.12	500.0	9.000	N	GND	10.5
0.315	---	4.78	49.83	45.05	500.0	9.000	N	GND	10.3
0.315	22.98	---	59.83	36.85	500.0	9.000	N	GND	10.3
0.338	20.96	---	59.26	38.30	500.0	9.000	N	GND	10.3
0.338	---	4.51	49.26	44.76	500.0	9.000	N	GND	10.3
0.509	22.95	---	56.00	33.05	500.0	9.000	L1	GND	10.3
0.509	---	11.17	46.00	34.83	500.0	9.000	L1	GND	10.3
1.619	19.27	---	56.00	36.73	500.0	9.000	N	GND	10.3
1.619	---	8.24	46.00	37.76	500.0	9.000	N	GND	10.3
3.987	---	2.93	46.00	43.07	500.0	9.000	N	GND	10.3
3.987	15.51	---	56.00	40.49	500.0	9.000	N	GND	10.3
8.745	---	4.31	50.00	45.69	500.0	9.000	L1	GND	10.5
8.745	14.67	---	60.00	45.33	500.0	9.000	L1	GND	10.5
15.435	---	1.59	50.00	48.41	500.0	9.000	N	GND	10.8
15.435	9.43	---	60.00	50.57	500.0	9.000	N	GND	10.8
23.108	15.05	---	60.00	44.95	500.0	9.000	L1	GND	11.0
23.108	---	4.96	50.00	45.04	500.0	9.000	L1	GND	11.0



9 Test setup photos

Setup photos are included in supporting file name: “EMC_PHIL4_067_20001_15.247_Setup_Photos.pdf”

10 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
ACTIVE LOOP ANTENNA	ETS LINDGREN	6512	49838	3 YEARS	07/28/2017
BILOG ANTENNA	TESEO	CBL 6141B	41106	3 YEARS	11/01/2017
HORN ANTENNA	ETS LINDGREN	3115	00035111	3 YEARS	04/17/2019
HORN ANTENNA	ETS LINDGREN	3117	00169547	3 YEARS	08/08/2017
HORN ANTENNA	ETS LINDGREN	3116C	00169535	3 YEARS	09/24/2017
WIDEBAND RADIO COMMUNICATION	R&S	CMW500	109825	1 YEARS	03/09/2020
SIGNAL ANALYZER	R&S	FSV 40	101022	2 YEARS	07/15/2019
COMPACT DIGITAL BAROMETER	CONTROL COMPANY	35519-055	91119547	3 YEARS	06/20/2017
DIGITAL THRMOMETER	CONTROL COMPANY	36934-164	191871994	2 YEARS	01/10/2019

Note: Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels. Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated “N/A” for cal status either do not specifically require calibration or is internally characterized before use.

11 Revision History

Date	Report Name	Changes to report	Report prepared by
2020-04-10	EMC_PHIL4_067_20001_15.247_BLE_DTS	Initial version	Issa Ghanma

<<The End>>