



FCC / ISED Test Report

FOR:
Axon Enterprise, Inc.

Model Name:
Axon Body 3

Product Description:
Body Worn Camera

FCC ID: X4GS01200
IC: 8803A-S01200

Applied Rules and Standards:
47 CFR Part 15.247 (DSS)
RSS-247 Issue 2 (FHSs) & RSS-Gen Issue 5

REPORT #: EMC_AXONN-004-19001_15.247_DSS

DATE: 2019-07-17



A2LA Accredited

IC recognized #
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 and the relevant ISED Canada standard RSS-247.

No deviations were ascertained.

| Company | Description | Marketing Name | Model # |
|-----------------------|------------------|----------------|---------|
| Axon Enterprise, Inc. | Body Worn Camera | Axon Body 3 | AX1023 |

Responsible for Testing Laboratory:

Cindy Li

2019-07-17

Compliance

(EMC Lab Manager)

| Date | Section | Name | Signature |
|------|---------|------|-----------|
|------|---------|------|-----------|

Responsible for the Report:

Kevin Wang

2019-07-17

Compliance

(Senior EMC Engineer)

| Date | Section | Name | Signature |
|------|---------|------|-----------|
|------|---------|------|-----------|

The test results of this test report relate exclusively to the test item specified in Section 3.

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 |
| Fax: | +1 (408) 586 6299 |
| EMC Lab Manager: | Cindy Li |
| Responsible Project Leader: | Kevin Wang |

2.2 Identification of the Client

| | |
|-------------------|------------------------|
| Applicant's Name: | Axon Enterprise, Inc. |
| Street Address: | 17800 N 85th St. |
| City/Zip Code | Scottsdale, AZ / 85255 |
| Country | USA |

2.3 Identification of the Manufacturer

| | |
|------------------------|-------------------|
| Manufacturer's Name: | Same as Applicant |
| Manufacturers Address: | ----- |
| City/Zip Code | ----- |
| Country | ----- |

3 Equipment Under Test (EUT)

3.1 EUT Specifications

| | |
|---|--|
| Marketing Name: | Axon Body 3 |
| Model No: | AX1023 |
| HW Version : | PVT |
| SW Version : | 1.0.151 |
| FCC-ID : | X4G01200 |
| IC: | 8803A-S01200 |
| FWIN: | N/A |
| HVIN: | AX1023 |
| PMN: | Axon Body 3 |
| Product Description: | Body Worn Camera, with Wi-Fi 802.11a/b/g/n40/ac80, Bluetooth Classis + BLE, Passive NFC TAG, LTE, 3G Fallback support, GPS/GLONASS Receiver Model AX1023 has Sierra Wireless WP7610 |
| Frequency Range / number of channels: | Nominal band: 2400 MHz – 2483.5 MHz Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 78), 79 Channels |
| Type(s) of Modulation: | Bluetooth Basic/EDR: GFSK, $\pi/4$ DQPSK, 8DPSK |
| Modes of Operation: | Hopping |
| Antenna Information as declared: | max gain 3.4 dBi for 2.4GHz, refer to section 3.6 for more information |
| Max. declared output Powers: | Conducted Power 12.01dBm |
| Power Supply/ Rated Operating Voltage Range: | Rechargeable Battery Vmin: 3.4 VDC/ Vnom: 3.8 VDC / Vmax: 4.3 VDC |
| Operating Temperature Range | -20° to 50° C |
| Other Radios included in the device: | Bluetooth 4.0 Low Energy (BT LE) Wi-Fi 802.11 a/b/g/n/ac, Qualcomm WCN3680B GPS, Qualcomm WGR7640 UMTS/LTE, Sierra Wireless WP7610 |
| Sample Revision | <input type="checkbox"/> Prototype Unit; <input type="checkbox"/> Production Unit; <input checked="" type="checkbox"/> Pre-Production |

3.2 EUT Sample details

| EUT # | Serial Number | HW Version | SW Version | Notes/Comments |
|-------|---------------|------------|------------|------------------|
| 1 | X60000190 | DVT3 | 1.0.48 | Conducted Sample |
| 2 | X60495001 | PVT1 | 1.0.68 | Radiated Sample |

3.3 Accessory Equipment (AE) details

| AE # | Type | Model | Manufacturer | Serial Number |
|------|------------|-----------------|--------------|---------------|
| 1 | Laptop | HSTNN-I33C-4 | HP | - |
| 2 | USB Cable | - | AXON | - |
| 3 | AC Adaptor | KSA01A5210100D5 | Ktec | - |

3.4 Test Sample Configuration

| EUT Set-up # | Combination of AE used for test set up | Comments |
|--------------|--|---|
| 1 | EUT#1 + AE#1 + AE#2 | The radio of the EUT was configured to a fixed channel transmission with 30% duty cycle using Putty tool and Qualcomm software QRCT to configure the EUT. The measurement equipment was connected to the 50 ohm RF port of the EUT. |
| 2 | EUT#2 + AE#1 + AE#2 | The radio of the EUT was configured to a fixed channel transmission with 30% duty cycle using Putty tool and Qualcomm software QRCT to configure the EUT. The internal antenna was connected. |
| 3 | EUT#2 + AE#2 + AE#3 | The radio of the EUT was configured to a fixed channel transmission with 30% duty cycle using Putty tool and Qualcomm software QRCT to configure the EUT. The internal antenna was connected. |

3.5 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested with transmitter sets on low, mid and high channels, and 30% duty cycle.

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.

For conducted measurements, the highest power and the widest occupied bandwidth mode of operation (GFSK), was used to evaluate the worst case performance of the EUT, including the band edge compliance and TX radiated spurious emissions testing. Maximum peak conducted output power and spectrum bandwidth, were measured in all supported modulation modes for the EUT.

3.6 Antenna Gain provided by the Customer

| | | | | | |
|--------------------|------|------|------|------|------|
| Frequency (MHz) | 2400 | 2420 | 2440 | 2460 | 2480 |
| Antenna Gain (dBi) | 2.01 | 2.9 | 2.81 | 3.4 | 3.22 |

| | | | | | | | | | | | | | | | |
|--------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Frequency (MHz) | 5150 | 5200 | 5250 | 5300 | 5350 | 5400 | 5450 | 5500 | 5550 | 5600 | 5650 | 5700 | 5750 | 5800 | 5850 |
| Antenna Gain (dBi) | 2.93 | 2.63 | 3.02 | 3.25 | 3.58 | 3.94 | 3.85 | 4.11 | 3.96 | 4.14 | 4.1 | 4.13 | 3.57 | 3.29 | 3.58 |

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 and Radio Standard Specification RSS-247 Issue 2 of ISED Canada.

This test report is to support a request for new equipment authorization under the:

- FCC ID: X4GS01200
- IC: 8803A-S01200

Testing procedures are based on ANSI C63.10:2013 including section 7.8 for FHSS systems.

5 Measurement Results Summary

| Test Specification | Test Case | Temperature and Voltage Conditions | Mode | Pass | NA | NP | Result |
|---|-------------------------------------|------------------------------------|------------------------|------|----|----|----------|
| §15.247(b)(1) RSS-247 5.4(b) | Maximum Peak Conducted Output Power | Nominal | GFSK DQPSK 8DPSK | ■ | □ | □ | Complies |
| §15.247(d) RSS-247 5.5 RSS-Gen 8.10 | Band Edge Compliance | Nominal | GFSK | ■ | □ | □ | Complies |
| §15.247(a)(1) RSS-247 5.1(b) | Spectrum Bandwidth | Nominal | GFSK DQPSK 8DPSK | ■ | □ | □ | Complies |
| §15.247(a)(1) RSS-247 5.1(b) | Carrier Frequency Separation | Nominal | GFSK | ■ | □ | □ | Complies |
| §15.247(a)(1) RSS-247 5.1(d) | Number of Hopping Channels | Nominal | GFSK | ■ | □ | □ | Complies |
| §15.247(a)(1)(iii) RSS-247 5.1(d) | Time of occupancy | Nominal | GFSK | ■ | □ | □ | Complies |
| §15.247(d) §15.209 (a) RSS-Gen 6.13 | TX Spurious emissions-Radiated | Nominal | GFSK | ■ | □ | □ | Complies |
| §15.207(a) RSS-Gen 8.8 | AC Conducted Emissions | Nominal | GFSK | ■ | □ | □ | Complies |

Note1: NA= Not Applicable; NP= Not Performed.

6 Measurements

6.1 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 30MHz | ±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

| | |
|--------------------------|---------|
| RF conducted measurement | ±0.5 dB |
|--------------------------|---------|

6.2 Environmental Conditions During Testing:

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

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

6.3 Dates of Testing:

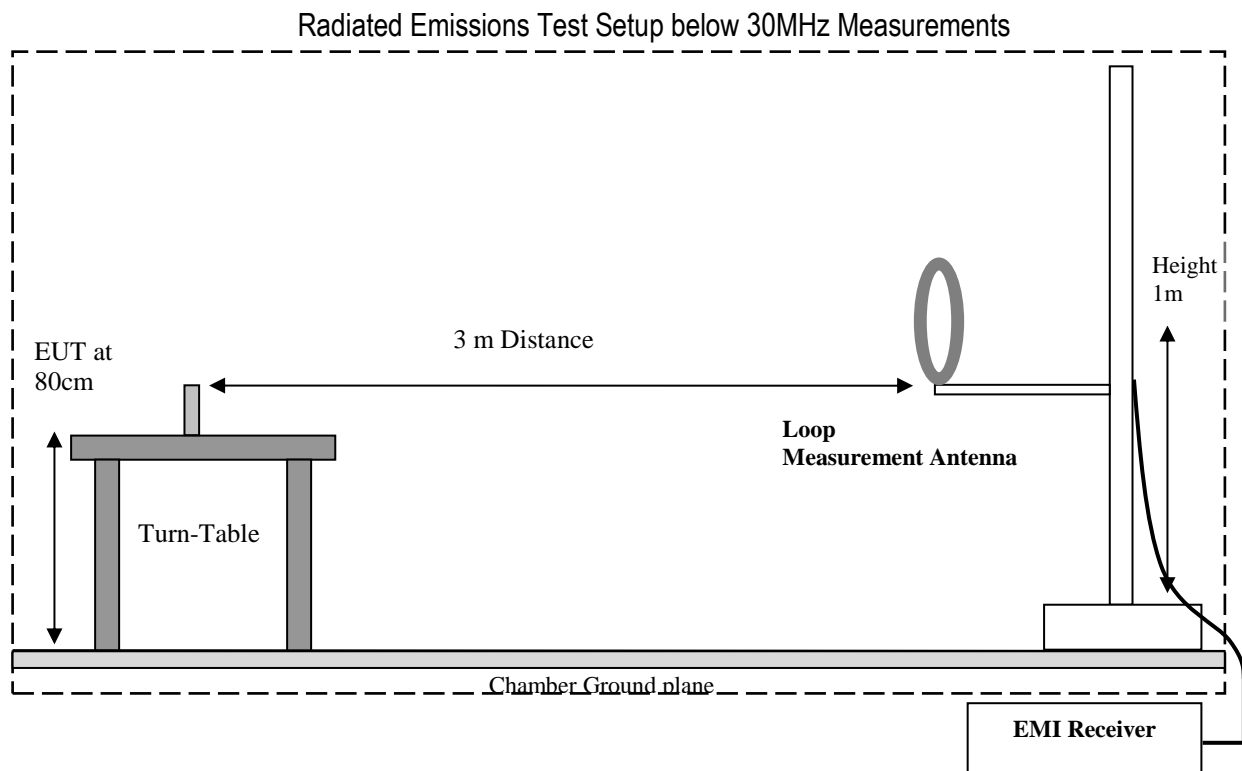
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7 Measurement Procedures

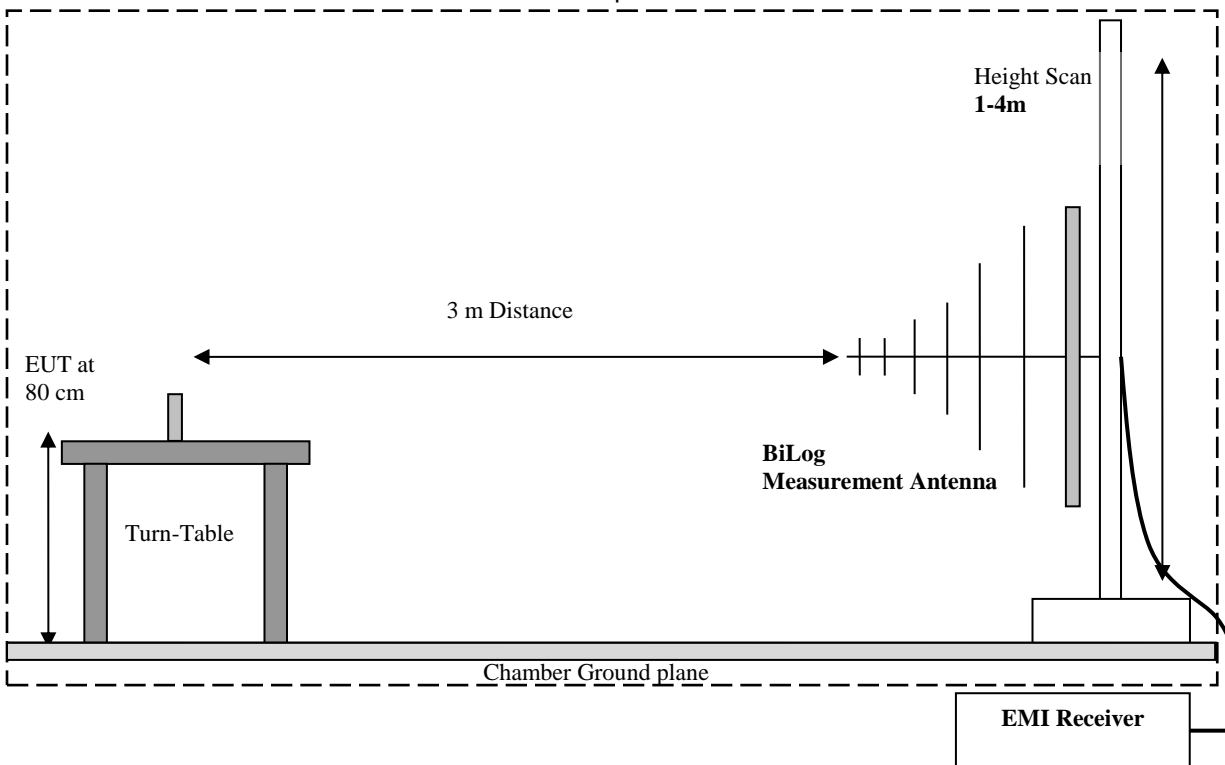
7.1 Radiated Measurement

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

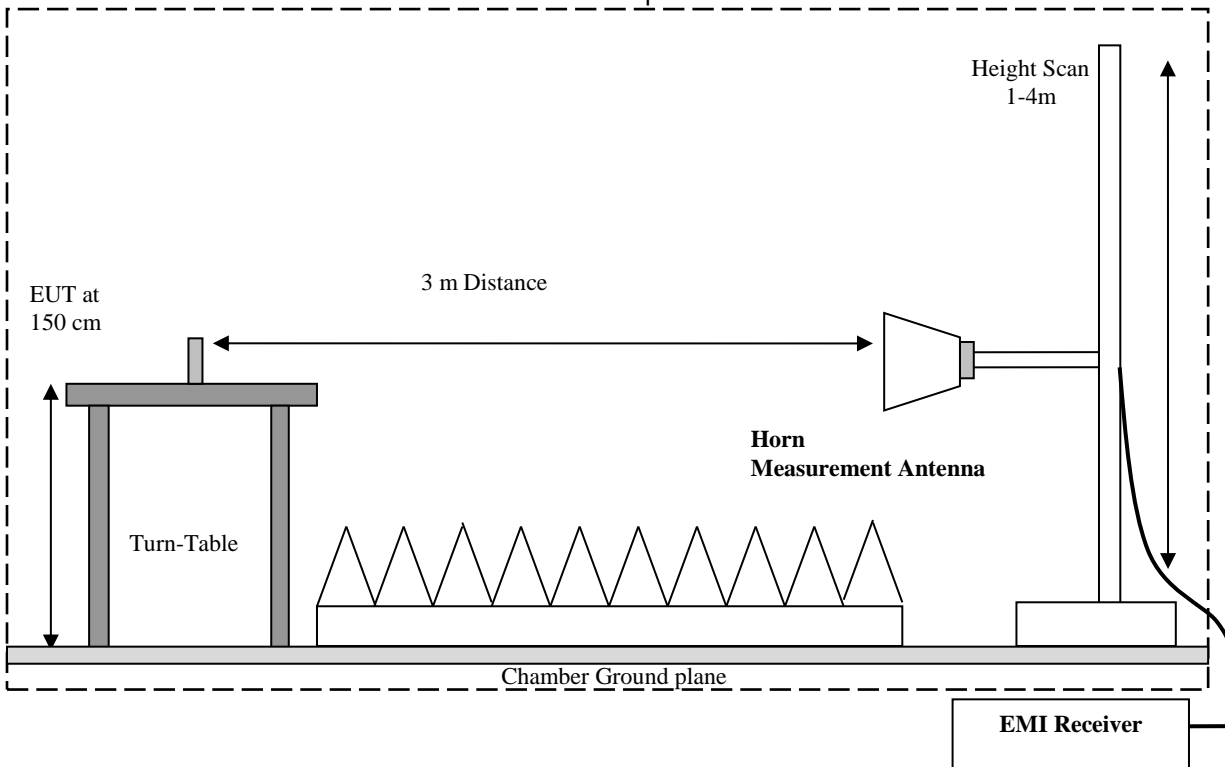
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to 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 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 dB μ V
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:

$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} - \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

Example:

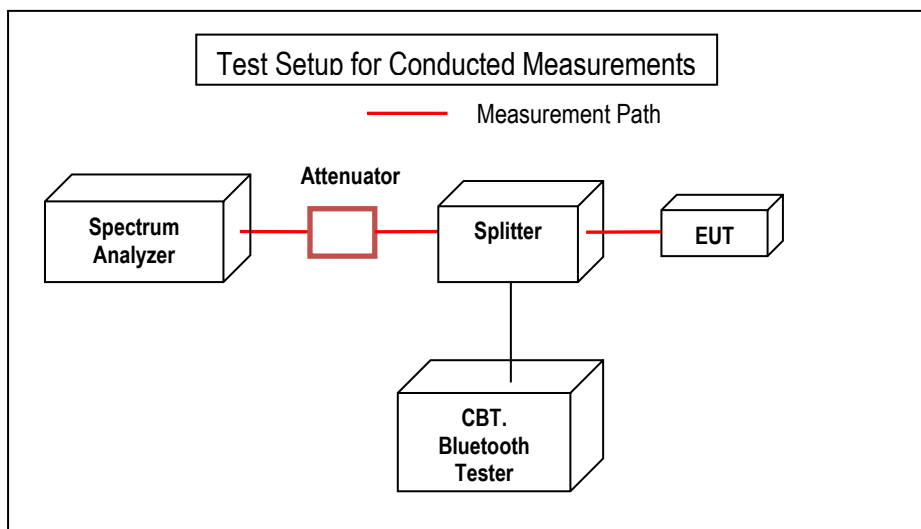
| Frequency (MHz) | Measured SA (dB μ V) | Cable Loss (dB) | Antenna Factor Correction (dB) | Field Strength Result (dB μ V/m) |
|-----------------|--------------------------|-----------------|--------------------------------|--------------------------------------|
| 1000 | 80.5 | 3.5 | 14 | 98.0 |

7.2 Power Line Conducted Measurement Procedure

AC Power Line conducted emissions measurements performed according to: ANSI C63.4 (2014)

7.3 RF Conducted Measurement Procedure

Reference: ANSI C63.10 (2013) Section 6.9, 6.10, and 7.8



- Connect the equipment as shown in the above diagram.
- Adjust the settings of the SA (Rohde-Schwarz Spectrum Analyzer) to connect the EUT at the required mode of test.
- Measurements are to be performed with the EUT set to the low, middle and high channels and for worst case modulation schemes.

8 Test Result Data

8.1 Maximum Peak Conducted Output Power

8.1.1 Measurement according to ANSI C63.10 Section 7.8.5

Spectrum Analyzer settings:

- Span = approximately 5 times the 20 dB bandwidth
- RBW > the 20 dB bandwidth of the emission being measured
- VBW ≥ RBW
- Sweep = Auto Couple
- Detector function = Peak
- Trace = Max hold
- Use the marker-peak function to set the marker to the peak of the emission.

8.1.2 Limits:

Maximum Peak Output Power:

FCC 15.247: (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

- (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

IC RSS-247 5.4:

- (b) For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels.

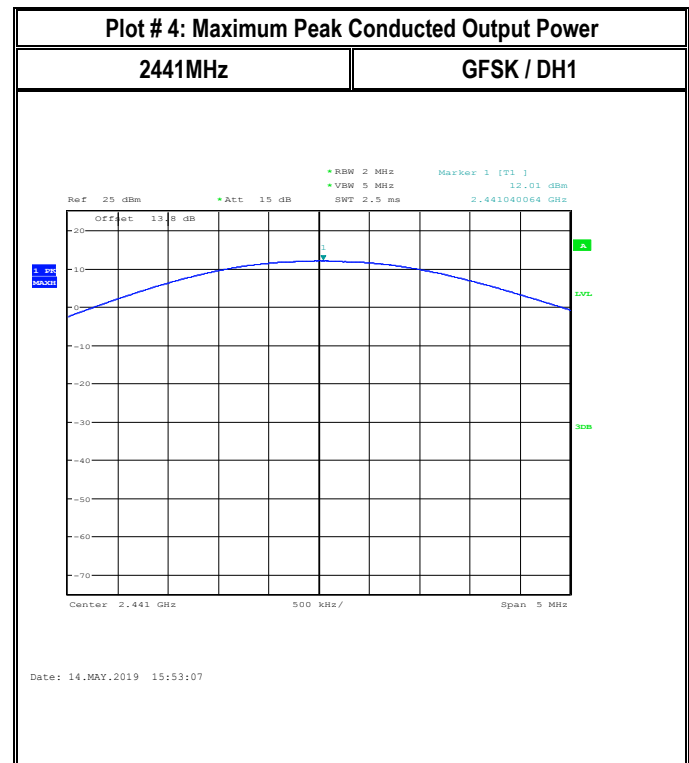
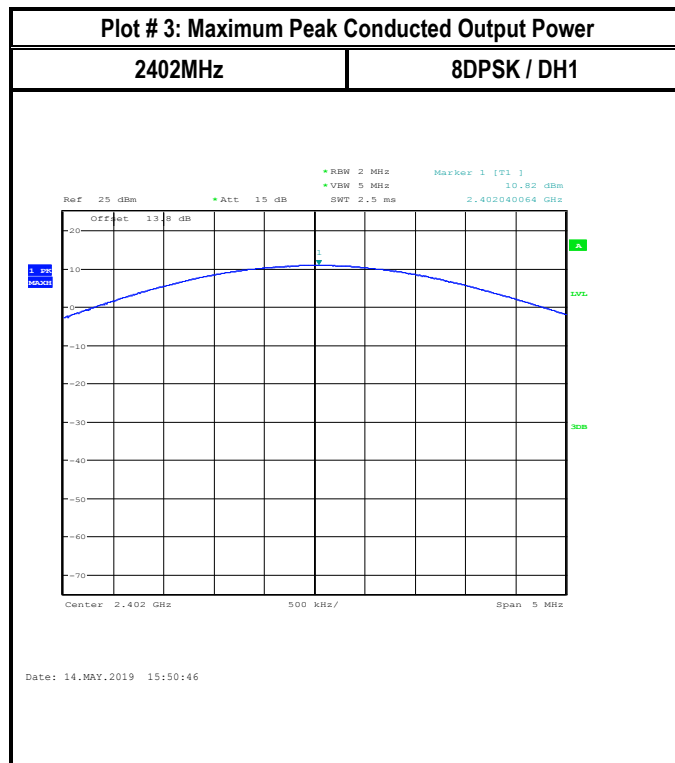
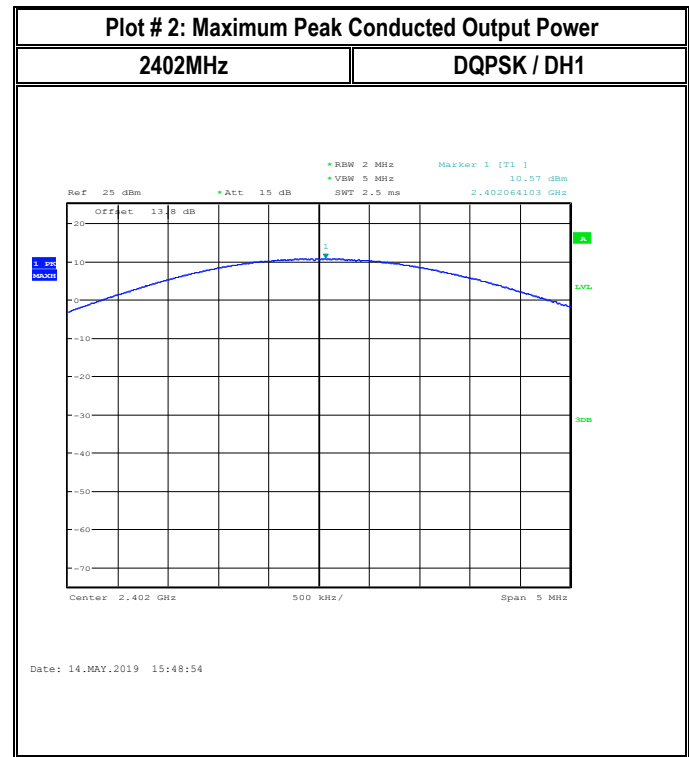
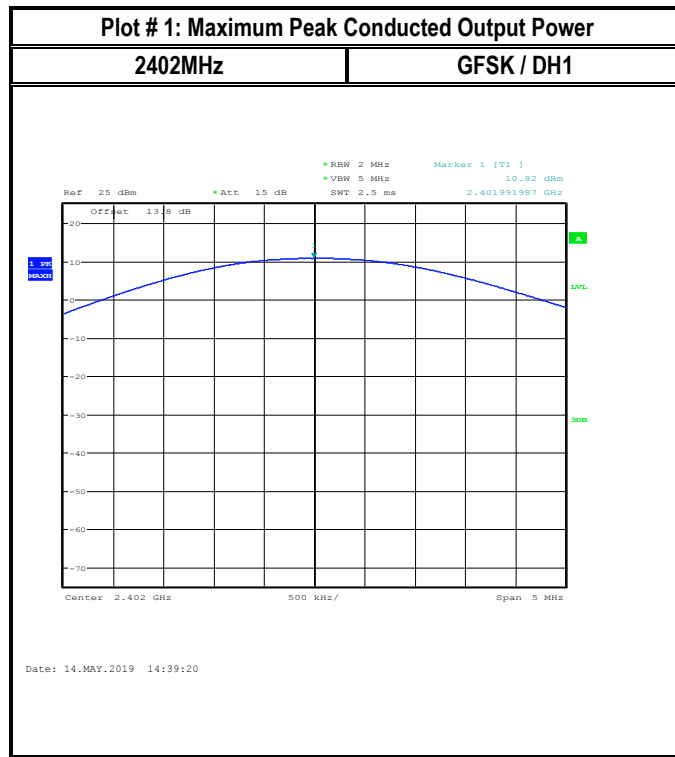
8.1.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input | Antenna Gain |
|---------------------|--------------|--------------------------|-------------|--------------|
| 21° C | 1 | GFSK, DQPSK, 8DPSK – DH1 | 110 VAC | 3.4 dBi |

8.1.4 Measurement result:

| Plot # | Frequency (MHz) | EUT operating mode | Maximum Peak Conducted Output Power (dBm) | EIRP (dBm) | Limit (dBm) | Result |
|--------|-----------------|--------------------|---|------------|-------------------|--------|
| 1 | 2402 | GFSK DH1 | 10.82 | 14.22 | 30(Pk) / 36(EIRP) | Pass |
| 2 | 2402 | DQPSK DH1 | 10.57 | 13.97 | 30(Pk) / 36(EIRP) | Pass |
| 3 | 2402 | 8DPSK DH1 | 10.82 | 14.22 | 30(Pk) / 36(EIRP) | Pass |
| 4 | 2441 | GFSK DH1 | 12.01 | 15.41 | 30(Pk) / 36(EIRP) | Pass |
| 5 | 2441 | DQPSK DH1 | 11.79 | 15.19 | 30(Pk) / 36(EIRP) | Pass |
| 6 | 2441 | 8DPSK DH1 | 11.99 | 15.39 | 30(Pk) / 36(EIRP) | Pass |
| 7 | 2480 | GFSK DH1 | 10.4 | 13.8 | 30(Pk) / 36(EIRP) | Pass |
| 8 | 2480 | DQPSK DH1 | 10.24 | 13.64 | 30(Pk) / 36(EIRP) | Pass |
| 9 | 2480 | 8DPSK DH1 | 10.41 | 13.81 | 30(Pk) / 36(EIRP) | Pass |

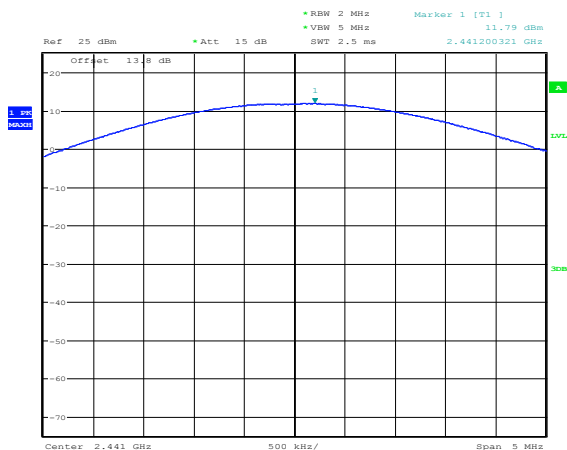
8.1.5 Measurement Plots:



Plot # 5: Maximum Peak Conducted Output Power

2441MHz

DQPSK / DH1

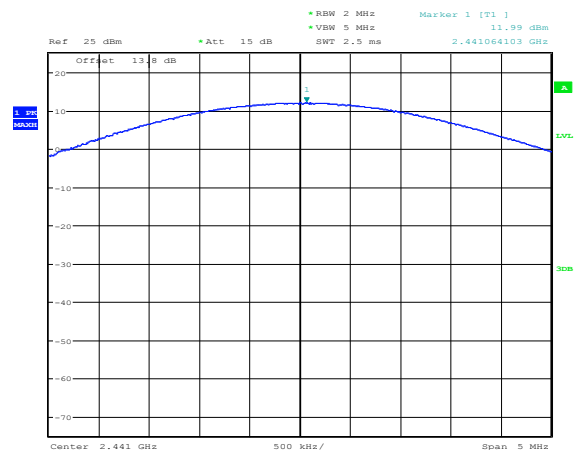


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Plot # 6: Maximum Peak Conducted Output Power

2441MHz

8DPSK / DH1

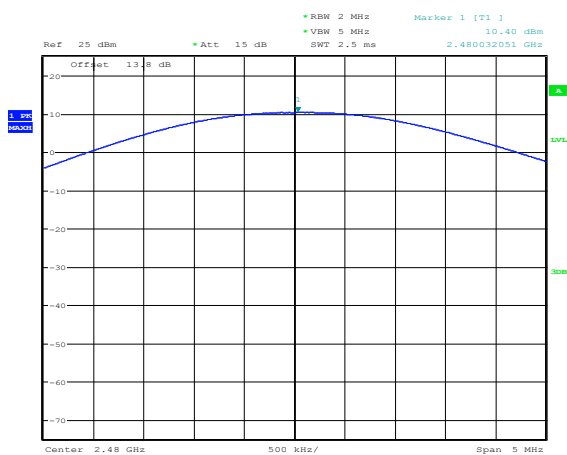


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Plot # 7: Maximum Peak Conducted Output Power

2480MHz

GFSK / DH1

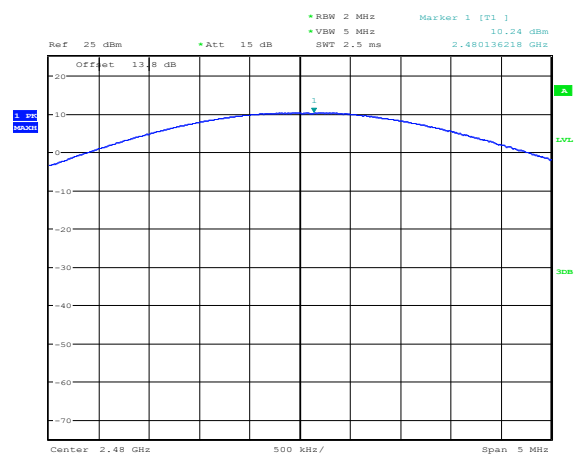


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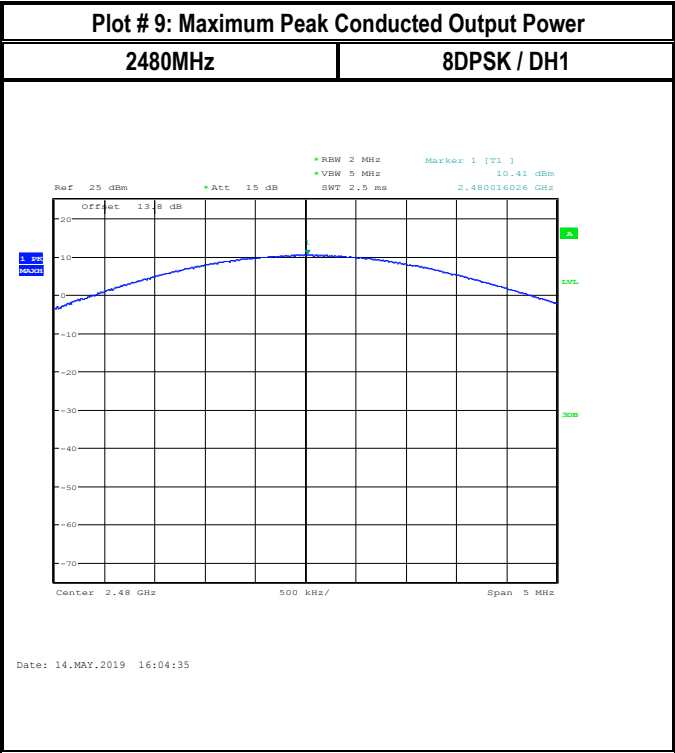
Plot # 8: Maximum Peak Conducted Output Power

2480MHz

DQPSK / DH1



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8.2 Band Edge Compliance

8.2.1 Measurement according to ANSI C63.10 Section 6.10

Non Restricted Band Edge and Restricted Band Edge Peak Measurement Spectrum Analyzer Settings:

- Set the center frequency and span to encompass frequency range to be measured
- RBW = 1 MHz
- VBW $\geq 3 \times$ RBW
- Sweep Time: Auto couple
- Detector = Peak
- Trace = Max hold
- Allow trace to fully stabilize
- Use the peak marker function to determine the maximum amplitude level
- Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge

Restricted Band Edge Average Measurement Spectrum Analyzer Settings(Method VB):

- Set the center frequency and span to encompass frequency range to be measured
- RBW = 1 MHz
- VBW = 10 Hz
- Sweep Time: Auto couple
- Detector = Peak
- Trace = Max hold
- Perform a trace max hold of at least 50 traces if the transmission is continuous or has at least 98% duty cycle. For lower duty cycles, increase the minimum number of traces by a factor of $1/x$, where x is the duty cycle.
- Use the peak marker function to determine the maximum amplitude level
- Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge

8.2.2 Limits: Restricted Band FCC 15.209 and RSS-Gen 8.10

- PEAK LIMIT= 74 dB μ V/m @3 m =-21.23 dBm
- AVG. LIMIT= 54 dB μ V/m @3 m =-41.23 dBm
- Start frequency & stop frequency according to frequency range specified in the restricted band table in FCC section 15.205

Restricted bands of operation:

- Except as shown in CFR 47 Part 15.205 paragraph (d), 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 |
| 10.495-0.505 | 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 | | | |

8.2.3 Limits: Non-restricted Band §15.247 and RSS-247 5.5

FCC15.247 (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)).

RSS-247 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

8.2.4 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input | Antenna gain |
|---------------------|--------------|--------------------------|-------------|--------------|
| 21° C | 1 | GFSK DH1 - fixed channel | 120VAC | 3.4 dBi |

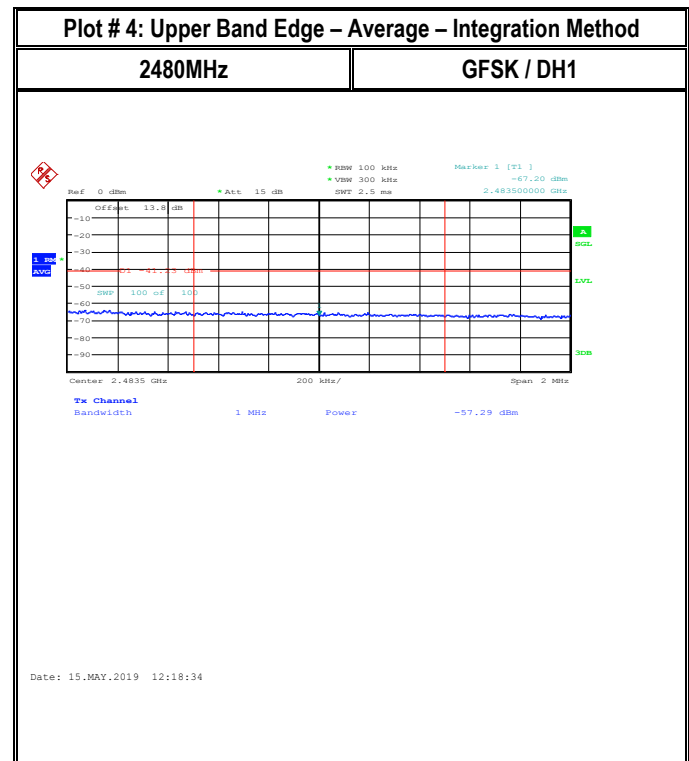
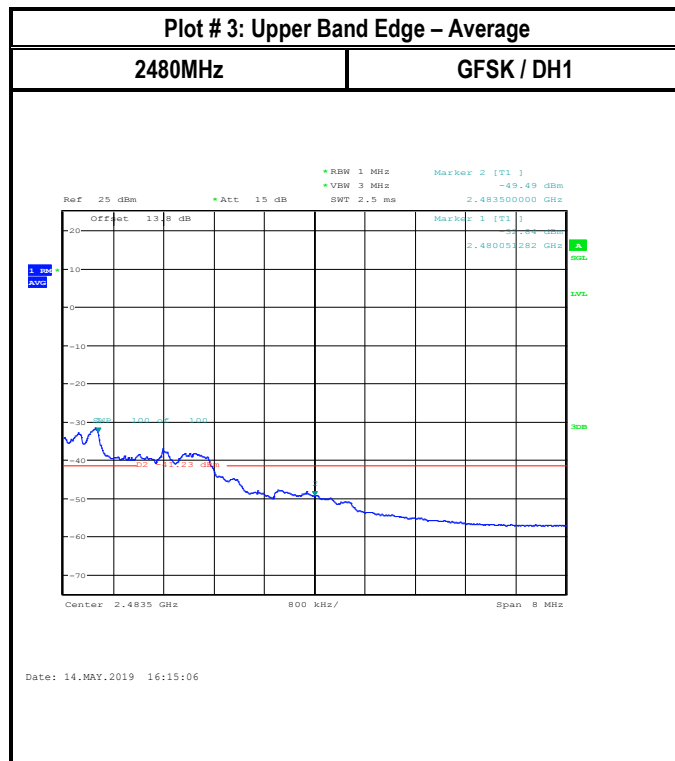
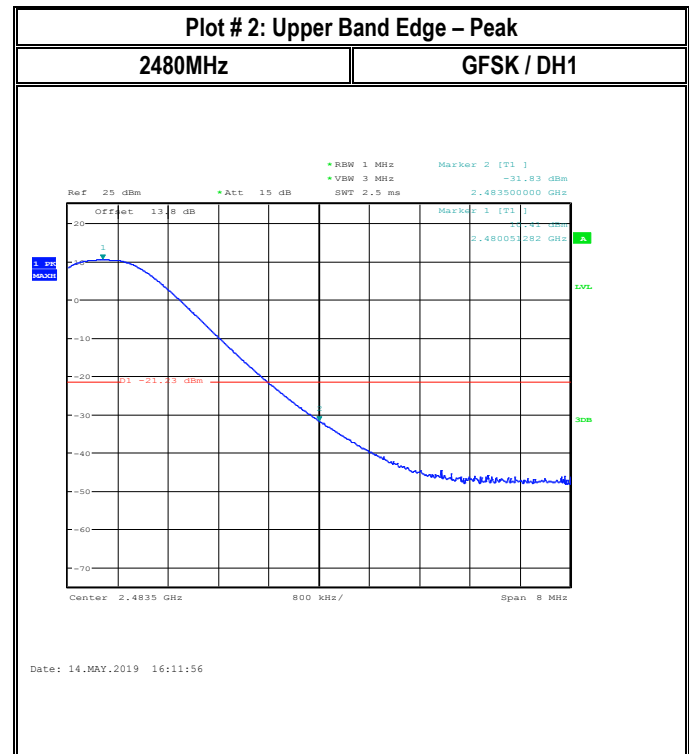
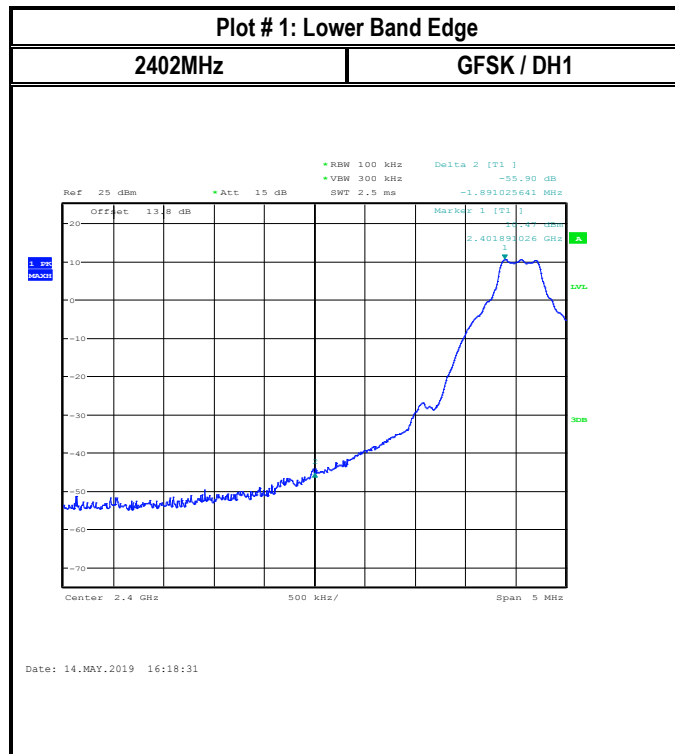
8.2.5 Measurement result:

| Plot # | EUT operating mode | Band Edge | Band Edge Delta (dBc) | Limit (dBc) | Result |
|--------|------------------------|-----------------------|-----------------------|-------------|--------|
| 1 | GFSK DH1 fixed channel | Lower, non-restricted | 55.9 | > 20 | Pass |

| Plot # | EUT operating mode | Band Edge | Measured value | Corrected by duty cycle | Corrected by Antenna gain | Limit (dBm) | Result |
|---------|------------------------|--------------------------|----------------|-------------------------|---------------------------|-------------|--------|
| 2 | GFSK DH1 fixed channel | Upper restricted Peak | -31.83 | NA due to peak detector | -28.43 | -21.23 Peak | Pass |
| 3, 4, 5 | GFSK DH1 fixed channel | Upper restricted Average | -57.29 | -52.09 | -48.69 | -41.23 AVG | Pass |

Note: Duty Cycle: $D = 0.376/1.25 = 30\%$
Then Correction factor = $10 \cdot \log(1/D) = 5.2$

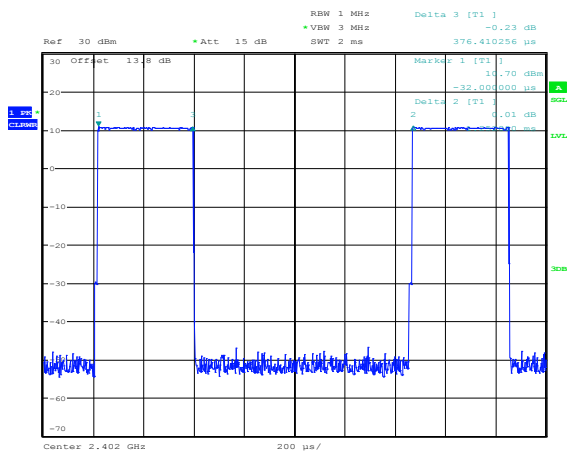
8.2.6 Measurement Plots:



Plot # 5: Duty Cycle

2441MHz

GFSK / DH1



Date: 14.MAY.2019 16:44:11

8.3 20dB Bandwidth

8.3.1 Measurement according to ANSI C63.10 Section 6.9.2

Spectrum Analyzer settings:

- Span: approximately 2 to 3 times the 20 dB bandwidth, centered on the hopping channel
- RBW \geq 1% of the 20 dB bandwidth
- Sweep Time = Auto couple
- Detector = Peak
- Trace = Max hold

8.3.2 Limits: FCC 15.247 (a) (1), RSS-247 5.1(b)

Frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

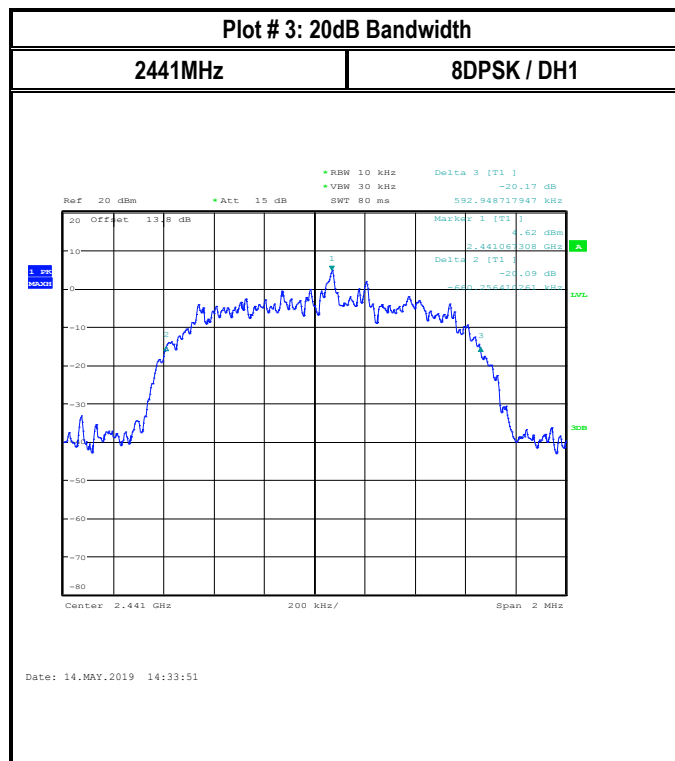
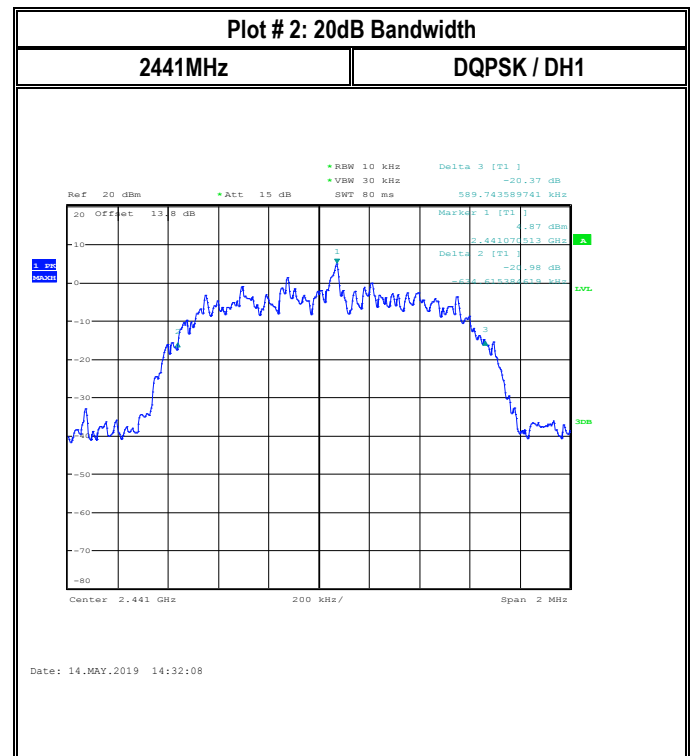
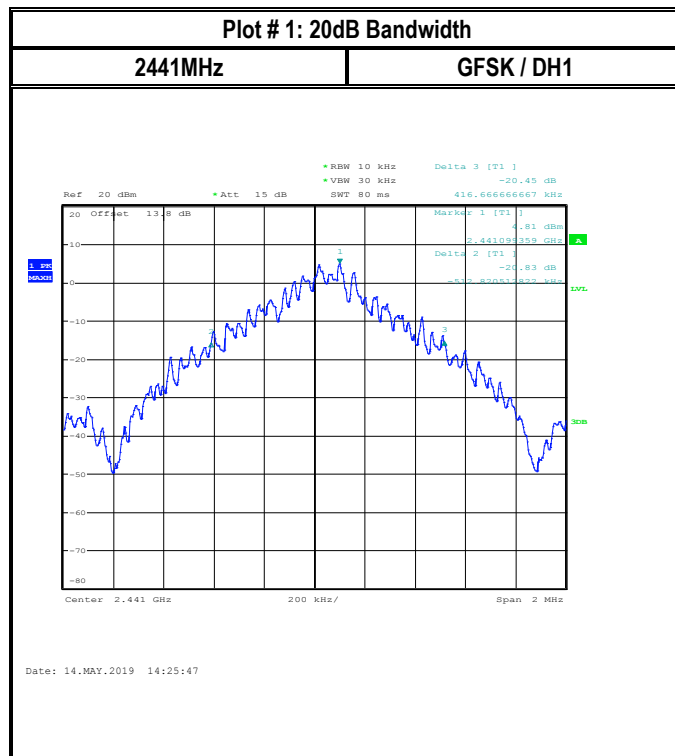
8.3.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input |
|---------------------|--------------|--------------------------|-------------|
| 21° C | 1 | GFSK, DQPSK, 8DPSK – DH1 | 120 VAC |

8.3.4 Measurement result:

| Plot # | EUT operating mode | 20 dB Bandwidth (MHz) |
|--------|-------------------------|-----------------------|
| 1 | GFSK DH1 fixed channel | 0.929 |
| 2 | DQPSK DH1 fixed channel | 1.224 |
| 3 | 8DPSK DH1 fixed channel | 1.253 |

8.3.5 Measurement Plots:



8.4 Carrier Frequency Separation

8.4.1 Measurement according to ANSI C63.10 Section 7.8.2

Spectrum Analyzer settings:

- Span = Wide enough to capture the peaks of the two adjacent channels
- RBW \geq 1% of the span
- VBW \geq RBW or 3 x
- Sweep = Auto couple
- Detector function = Peak
- Trace = Max hold
- Use marker-delta function to determine the separation between the peaks of the two adjacent channels.

8.4.2 Limits: FCC 15.247 (a) (1) & RSS-247 5.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

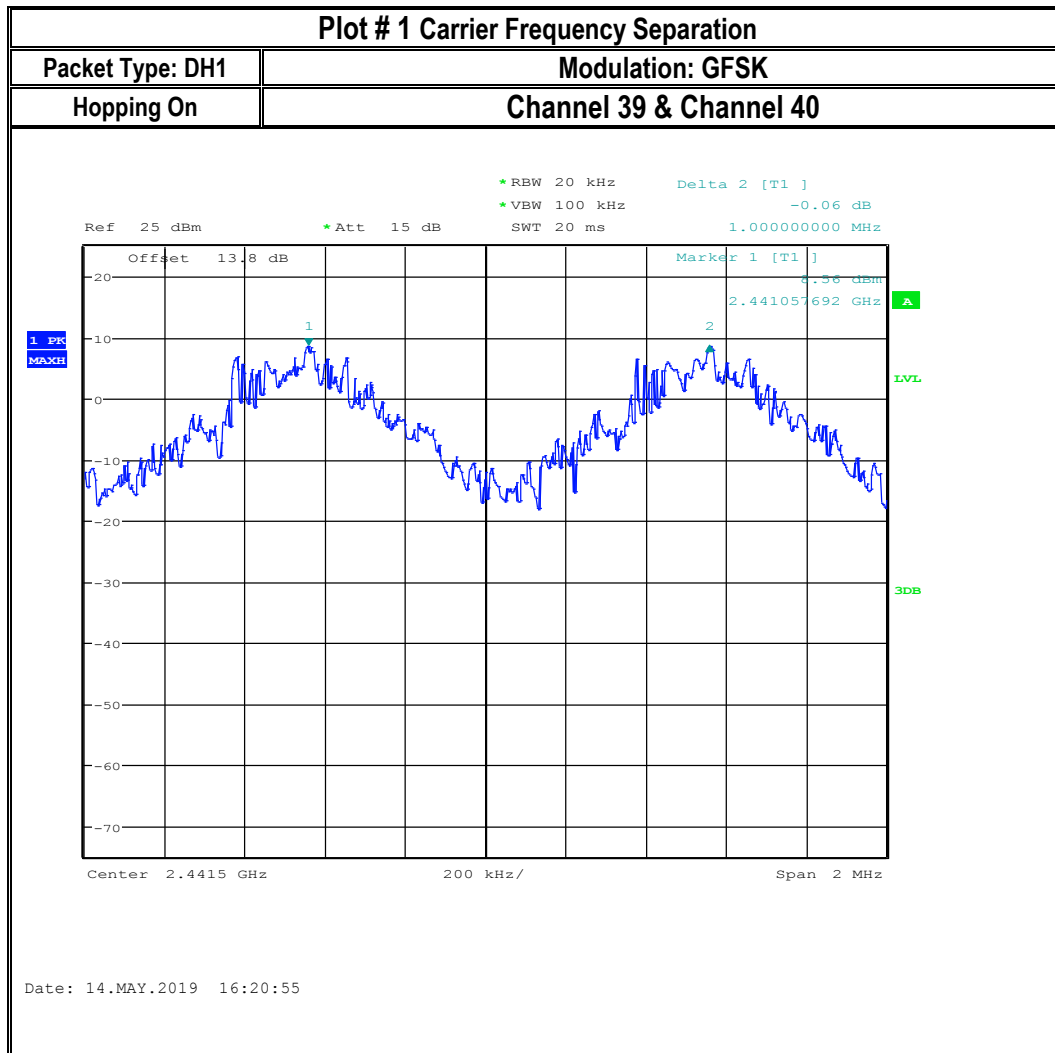
8.4.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input |
|---------------------|--------------|--------------------|-------------|
| 21° C | 1 | GFSK DH1 Hopping | 120 VAC |

8.4.4 Measurement result:

| Plot # | Carrier Frequency Separation (MHz) | Limit (MHz) | Result |
|--------|------------------------------------|-----------------------|--------|
| 1 | 1.00 | $> 2/3 * OBW = 0.835$ | Pass |

8.4.5 Measurement Plots:



8.5 Number of hopping channels

8.5.1 Measurement according to ANSI C63.10 Section 7.8.3

Spectrum Analyzer settings:

- Span = the entire frequency band of operation
- RBW \geq 50 KHz
- VBW \geq RBW or 3X
- Sweep = Auto couple
- Detector function = Peak
- Trace = Max hold

8.5.2 Limits: FCC 15.247 (a) (1) (ii)(iii) & RSS-247 5.1 (d)

At least 15 non-overlapping channels

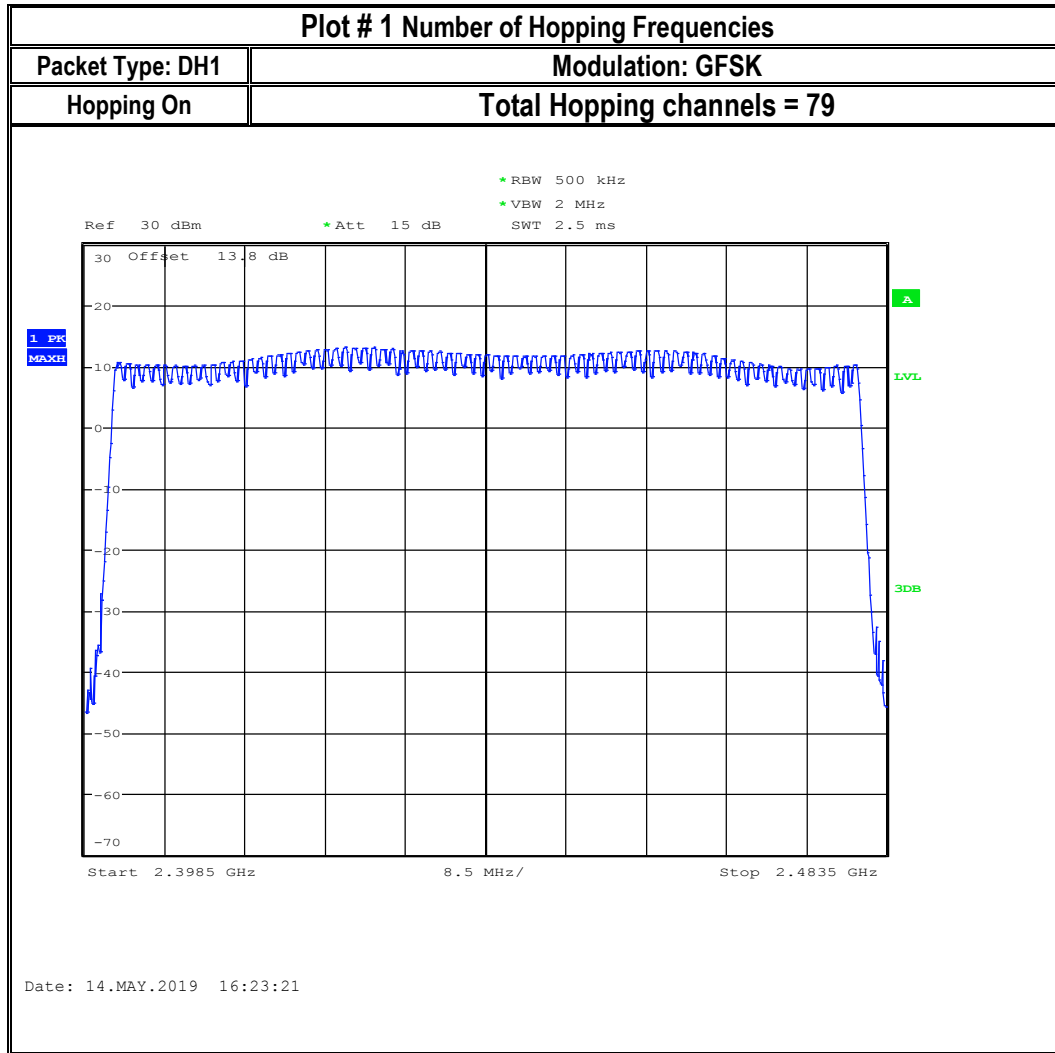
8.5.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input |
|---------------------|--------------|--------------------|-------------|
| 21° C | 1 | GFSK DH1 hopping | 120 VAC |

8.5.4 Measurement result:

| Plot # | Number of Hopping Frequencies | Limit | Result |
|--------|-------------------------------|-----------------------------|--------|
| 1 | 79 | 15 non-overlapping channels | Pass |

8.5.5 Measurement Plots:



8.6 Time of Occupancy (Dwell Time)

8.6.1 Measurement according to ANSI C63.10 Section 7.8.4

Spectrum Analyzer settings:

Duration of Pulse Measurement

- RBW = 1 MHz
- VBW = 3 MHz
- Span = 0
- Sweep Time = 10 ms
- Sweep Mode = Single
- Detector = Peak
- Trigger = Video

Observation Period

- RBW = 1 MHz
- VBW = 3 MHz
- Span = 0
- Sweep Time = 31.6 s
- Sweep Mode = Single
- Detector = Peak
- Trigger = Free Run

Observation Period = 0.4s x No. of hopping channels = 0.4 x 79 = 31.6 s

8.6.2 Limits: FCC 15.247 (a) (1) (iii) & RSS-247 5.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

8.6.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input |
|---------------------|--------------|--------------------|-------------|
| 21° C | 1 | GFSK DH1 hopping | 120 VAC |

8.6.4 Measurement result:

| Plot # | Modulation | Timing | Number of hops 31.6s | Pulse Width (ms) | Total Dwell Time in 31.6s (ms) | Limit (ms) | Result |
|--------|------------|--------|----------------------|------------------|--------------------------------|----------------|--------|
| 1 | GFSK | DH1 | 320 | 0.381 | 121.92 | < 400 in 31.6s | Pass |

8.7 Transmitter Spurious Emissions and Restricted Bands

8.7.1 Measurement according to ANSI C63.10

Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector = Peak
- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW = 120 KHz (<1 GHz)
- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1MHz

Plots reported here represent the worst case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT. Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.

8.7.2 Limits: FCC 15.247(d)/15.209(a) /RSS-Gen 6.13

| MHz | MHz | MHz | GHz |
|-------------------|---------------------|---------------|-------------|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| 10.495-0.505 | 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= 74dB μ V/m
- AVG. LIMIT= 54dB μ V/m
- Except as shown in CFR 47 Part 15.205 paragraph (d), only spurious emissions are permitted in any of the frequency bands listed below

| 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 |

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 described in 5.4.

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 as follow:

$$\text{Conversion factor (CF)} = 40 \log (D/d) = 40 \log (300 \text{ m} / 3 \text{ m}) = 80 \text{ dB}$$

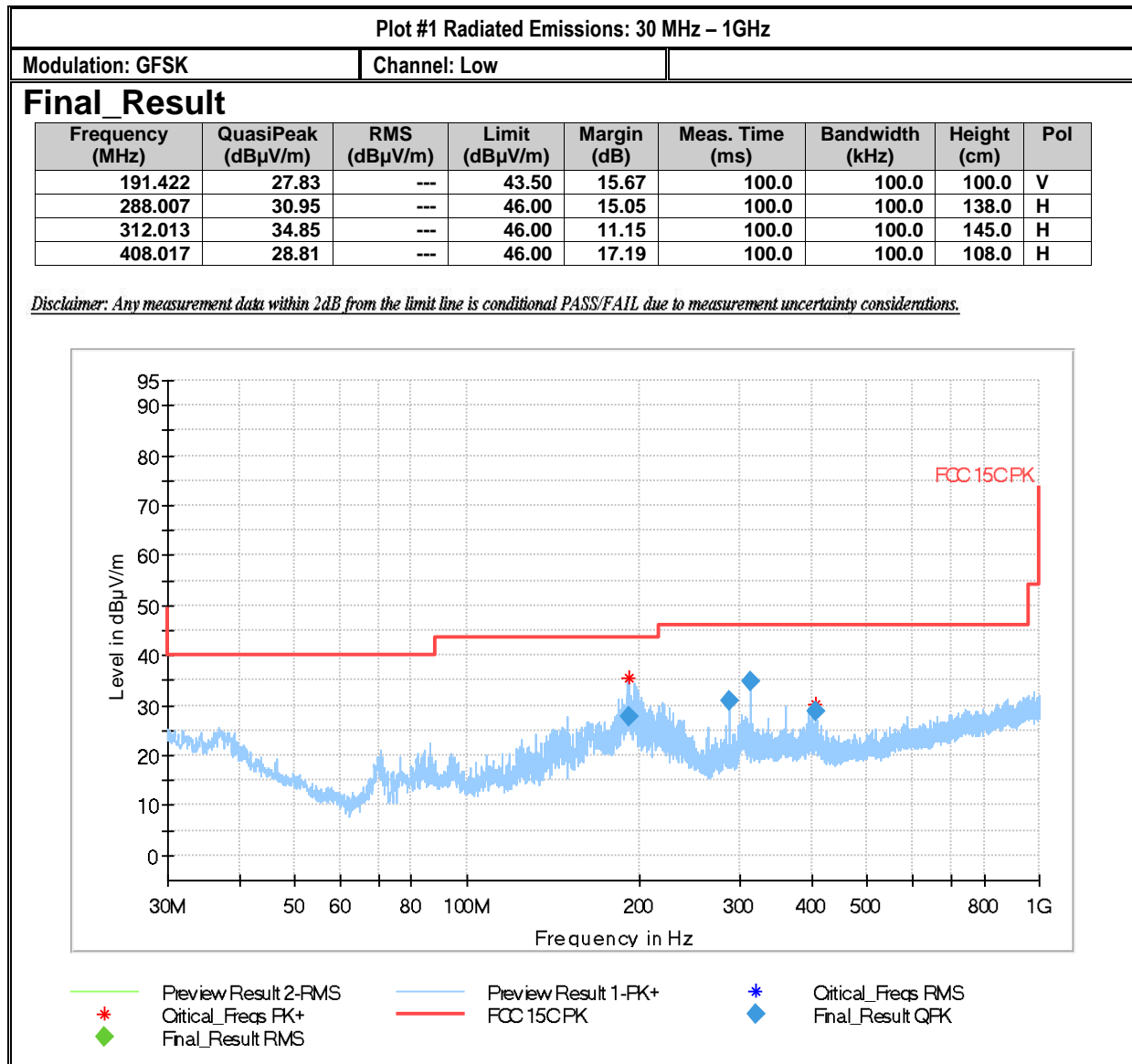
8.7.3 Test conditions and setup:

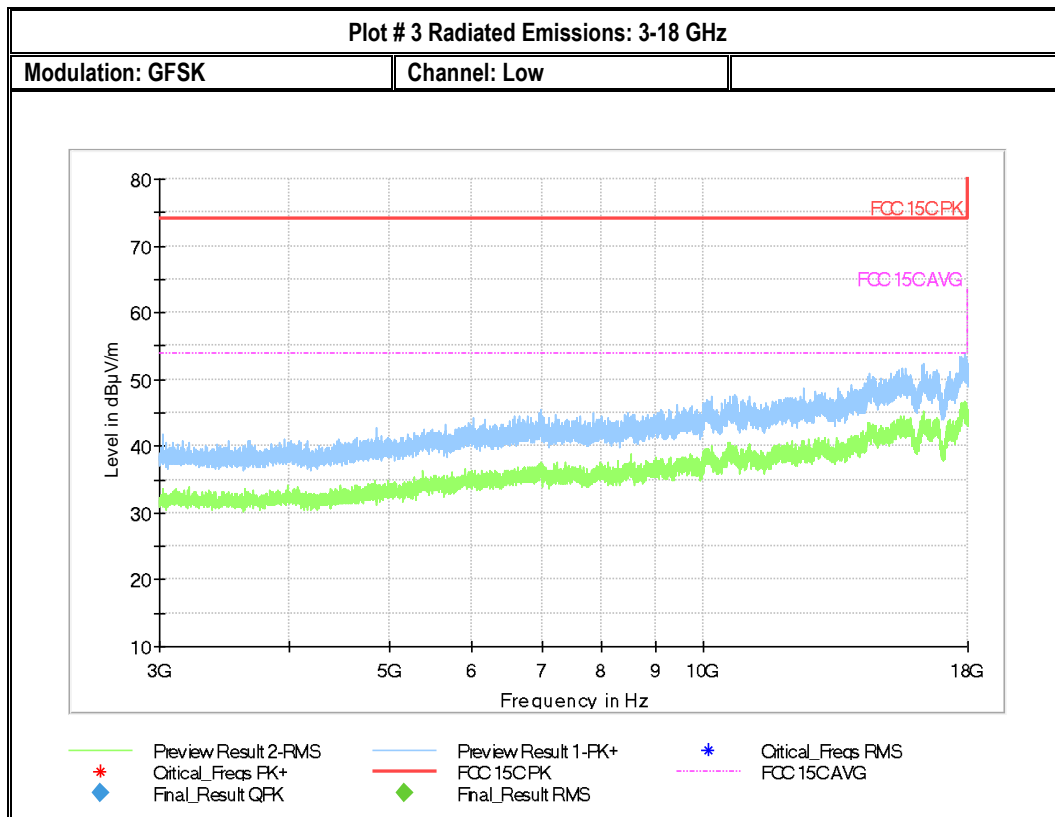
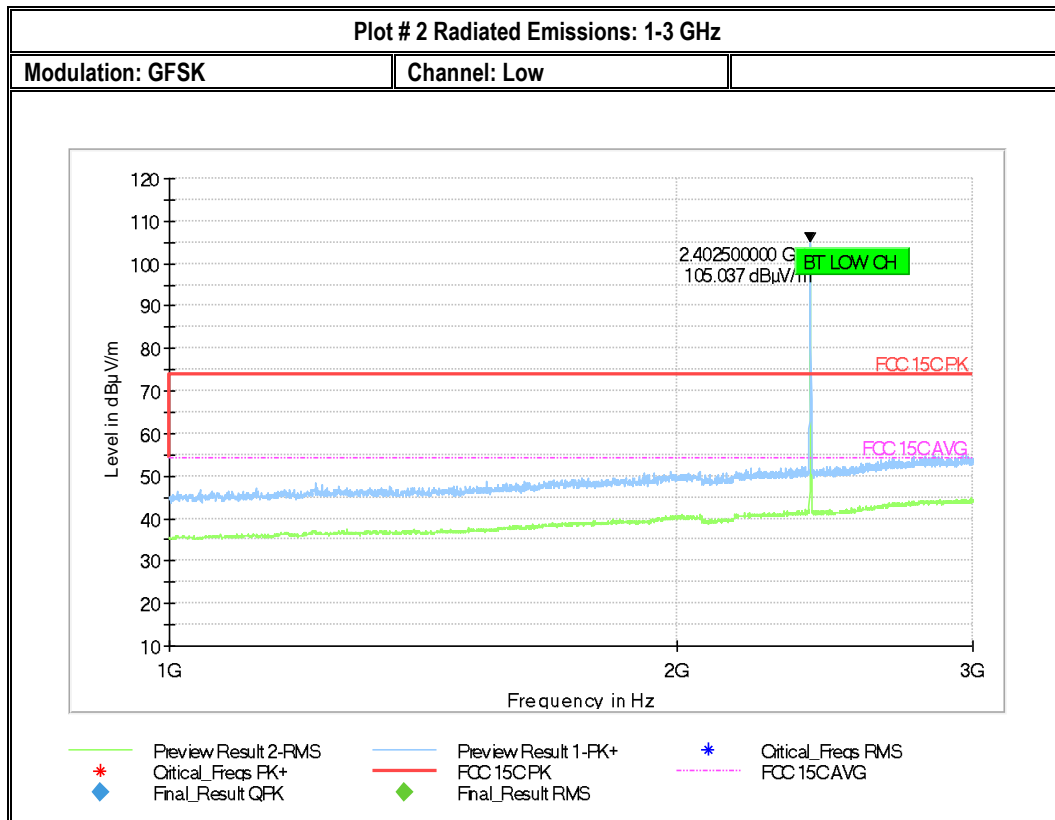
| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input |
|---------------------|--------------|------------------------|-------------|
| 23° C | 2 | GFSK DH1 fixed channel | 120 VAC |

8.7.4 Measurement result:

| Plot # | Channel # | Scan Frequency | Limit | Result |
|--------|-----------|-----------------|-------------------|--------|
| 1-3 | Low | 30 MHz – 18 GHz | See section 8.7.2 | Pass |
| 4-8 | Mid | 9 kHz – 26 GHz | See section 8.7.2 | Pass |
| 9-11 | High | 30 MHz – 18 GHz | See section 8.7.2 | Pass |

8.7.5 Measurement Plots:

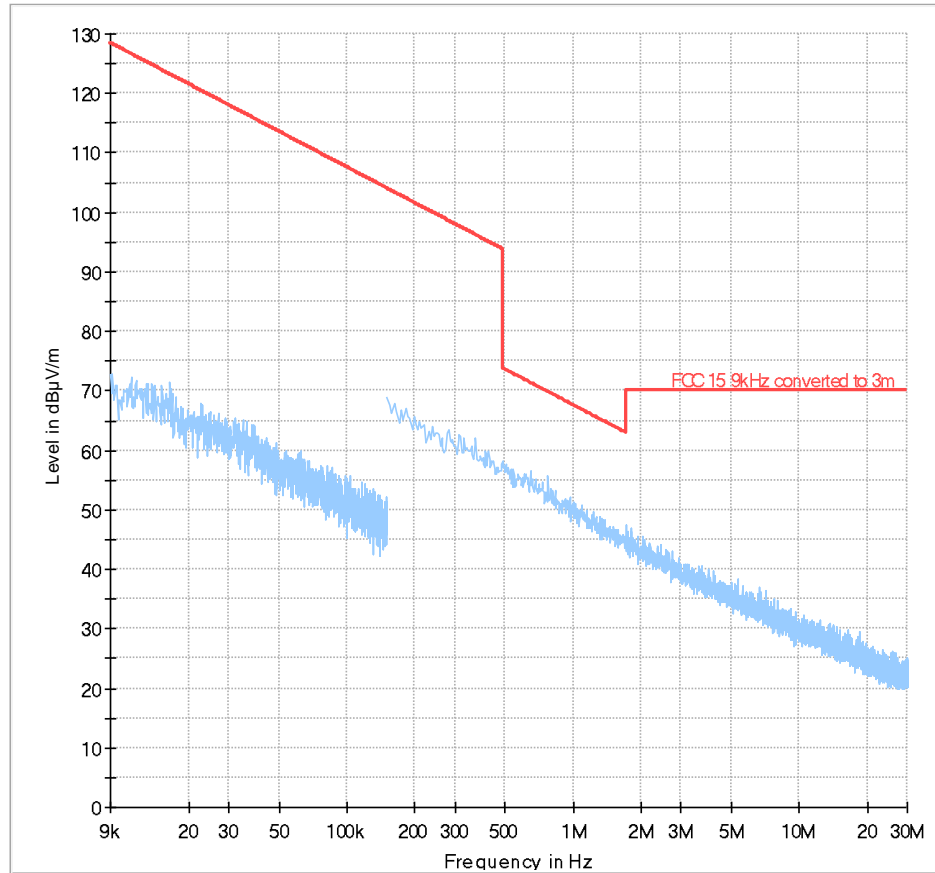




Plot # 4 Radiated Emissions: 9 KHz - 30 MHz

Modulation: GFSK

Channel: Mid

Disclaimer: Any measurement data within 2dB from the limit line is conditional PASS/FAIL due to measurement uncertainty considerations.

| | |
|-------------------------------|----------------------|
| Preview Result 2-RMS | Preview Result 1-PK+ |
| * Critical_Freqs RMS | * Critical_Freqs PK+ |
| — FCC 15 9kHz converted to 3m | ◆ Final_Result PK+ |
| ◆ Final_Result RMS | |

Plot #5 Radiated Emissions: 30 MHz – 1GHz

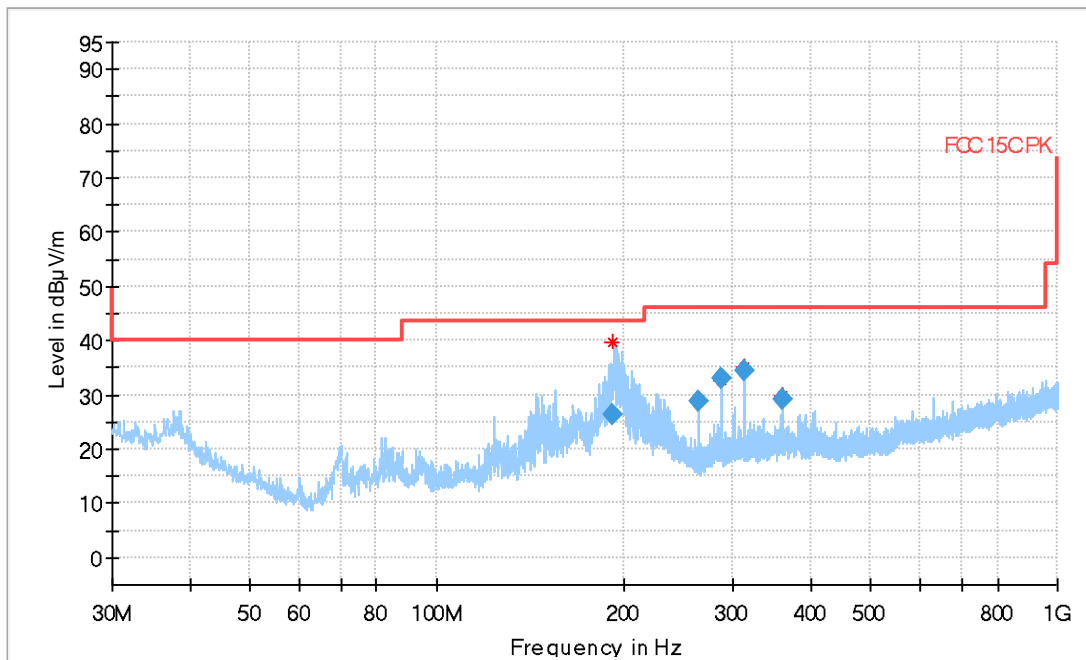
Modulation: GFSK

Channel: Mid

Final Result

| Frequency (MHz) | QuasiPeak (dBμV/m) | RMS (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|--------------------|--------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 192.489 | 26.47 | --- | 43.50 | 17.03 | 100.0 | 100.0 | 143.0 | V |
| 264.006 | 28.75 | --- | 46.00 | 17.25 | 100.0 | 100.0 | 100.0 | V |
| 287.991 | 32.94 | --- | 46.00 | 13.06 | 100.0 | 100.0 | 145.0 | H |
| 312.001 | 34.53 | --- | 46.00 | 11.47 | 100.0 | 100.0 | 138.0 | H |
| 359.965 | 29.09 | --- | 46.00 | 16.91 | 100.0 | 100.0 | 100.0 | H |

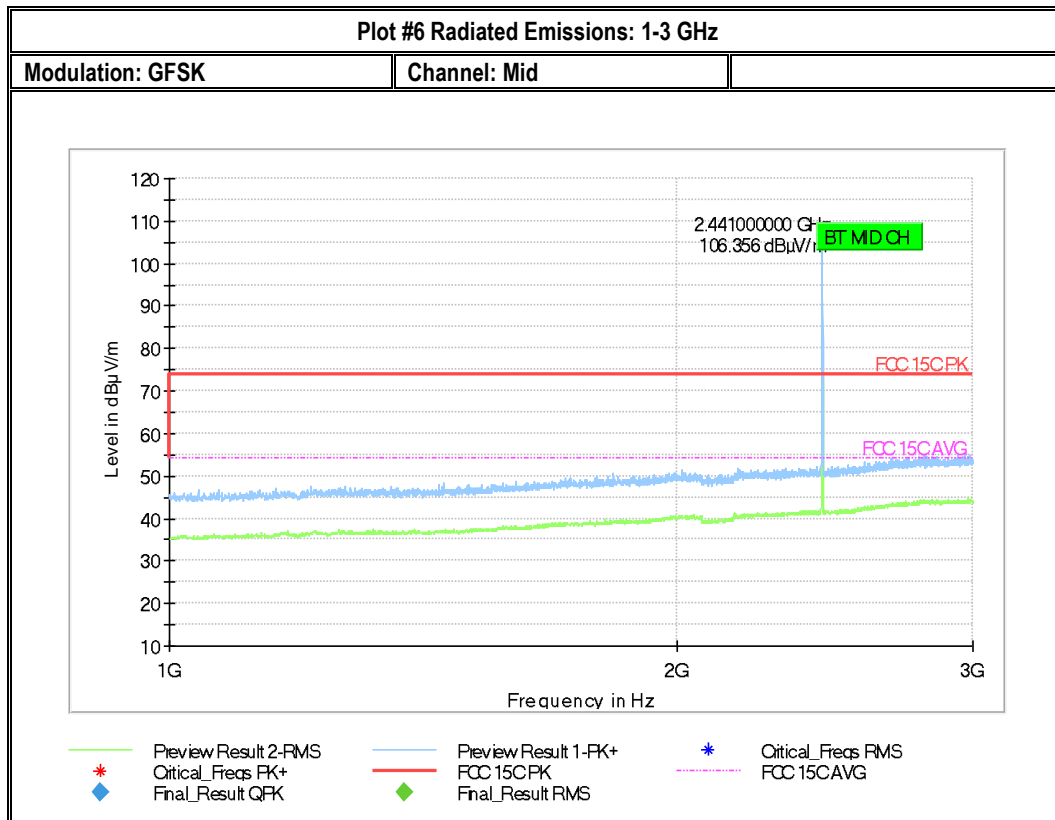
Disclaimer: Any measurement data within 2dB from the limit line is conditional PASS/FAIL due to measurement uncertainty considerations.



* Preview Result 2-RMS
Critical_Freqs PK+
Final_Result RMS

Preview Result 1-PK+
FCC 15C PK

* Critical_Freqs RMS
Final_Result QFK



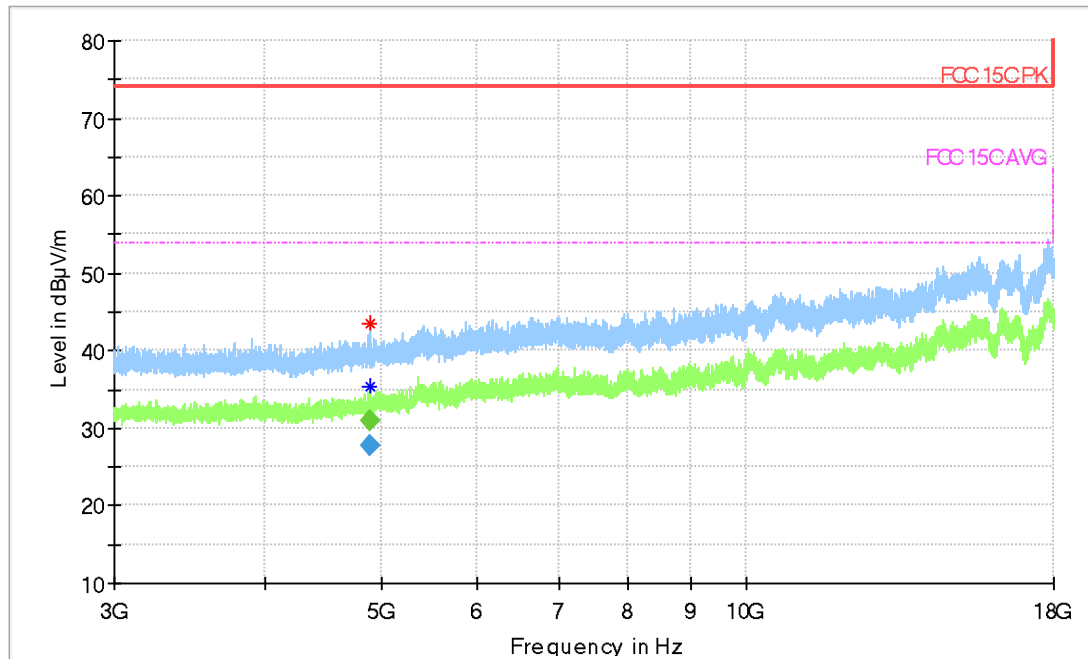
Plot #7 Radiated Emissions: 3-18 GHz

Modulation: GFSK

Channel: Mid

Final Result

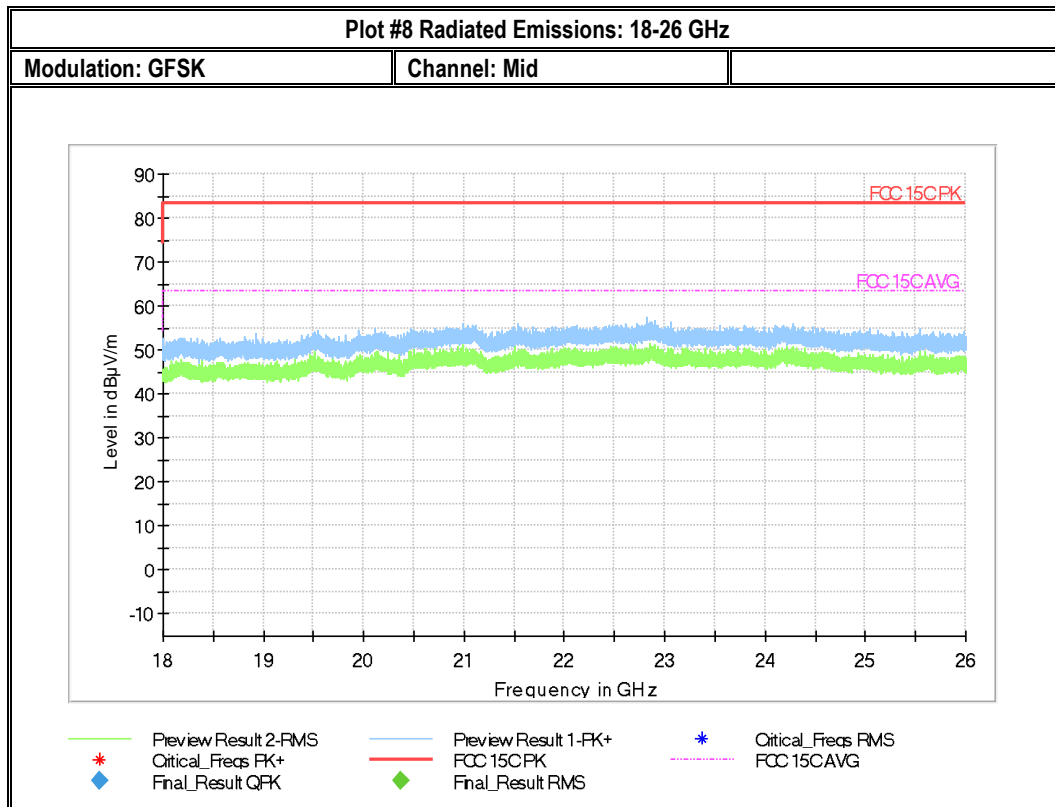
| Frequency (MHz) | QuasiPeak (dBμV/m) | RMS (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|--------------------|--------------|----------------|-------------|-----------------|-----------------|-------------|-----|
| 4881.746 | --- | 30.98 | 53.98 | 23.00 | 200.0 | 1000.0 | 131.0 | V |
| 4881.877 | 27.74 | --- | 73.99 | 46.25 | 200.0 | 1000.0 | 204.0 | V |



Preview Result 2-RMS
Critical_Freqs PK+
Final_Result QPK

Preview Result 1-PK+
FCC 15CPK
Final_Result RMS

Critical_Freqs RMS
FCC 15CAVG



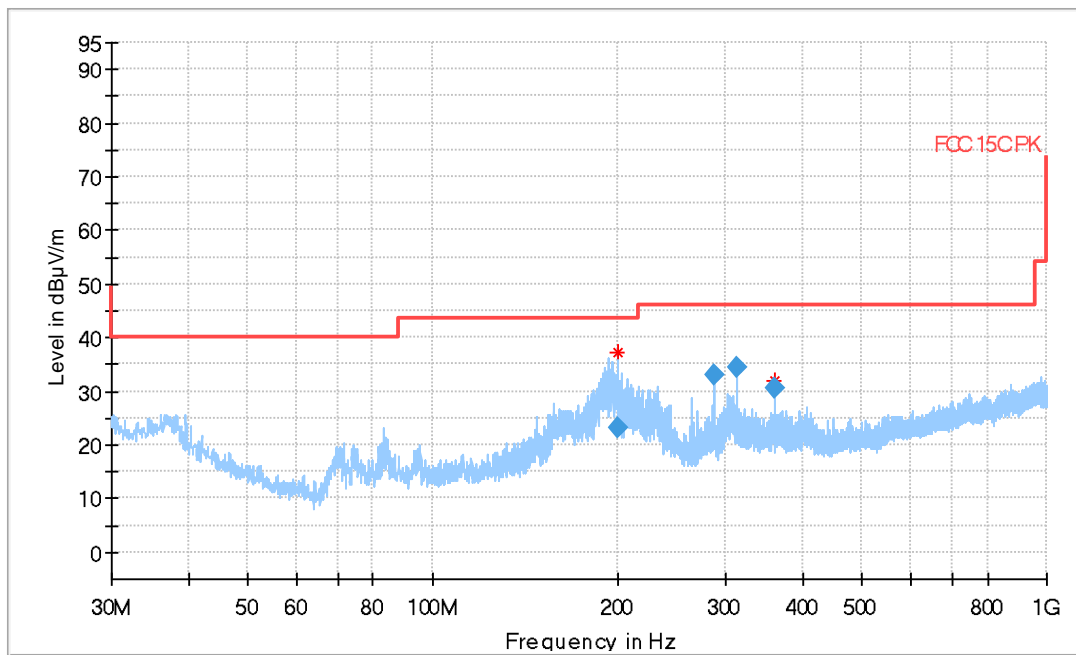
Plot #9 Radiated Emissions: 30 MHz – 1GHz

Modulation: GFSK

Channel: High

Final_Result

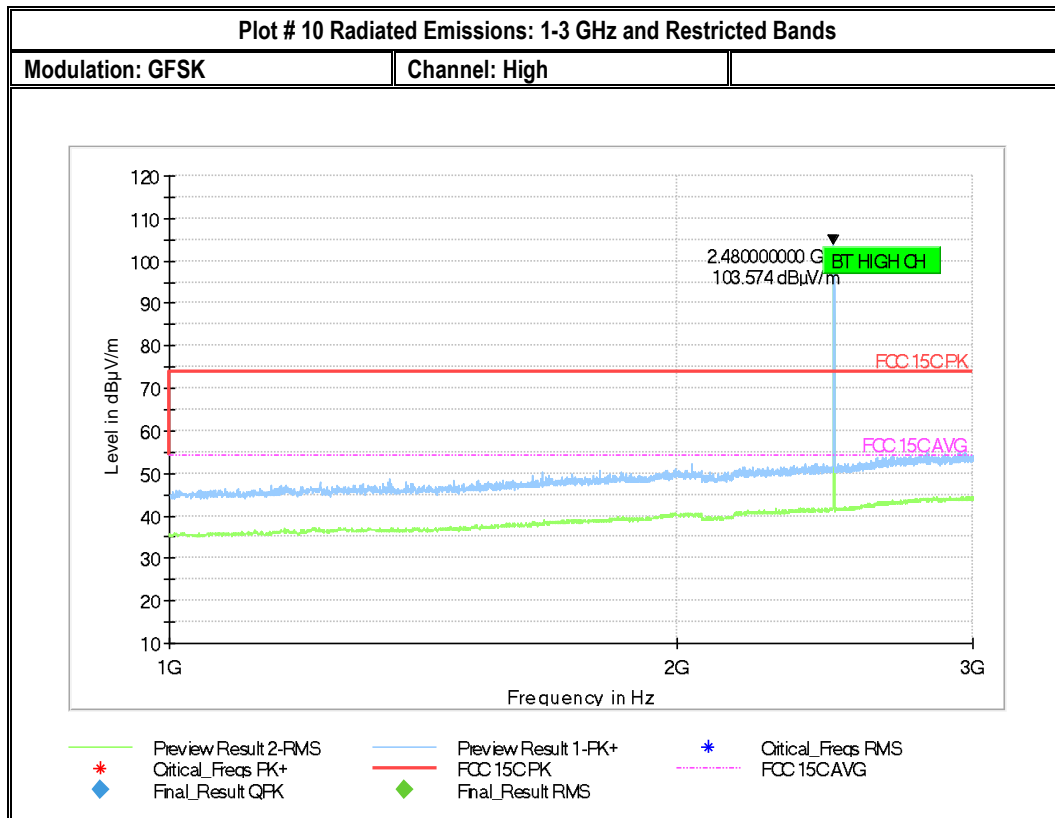
| Frequency (MHz) | QuasiPeak (dB μ V/m) | RMS (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol |
|-----------------|--------------------------|--------------------|----------------------|-------------|-----------------|-----------------|-------------|-----|
| 200.545 | 23.12 | --- | 43.50 | 20.38 | 100.0 | 100.0 | 100.0 | V |
| 288.005 | 32.97 | --- | 46.00 | 13.03 | 100.0 | 100.0 | 117.0 | H |
| 312.009 | 34.26 | --- | 46.00 | 11.74 | 100.0 | 100.0 | 145.0 | H |
| 359.990 | 30.52 | --- | 46.00 | 15.48 | 100.0 | 100.0 | 100.0 | H |

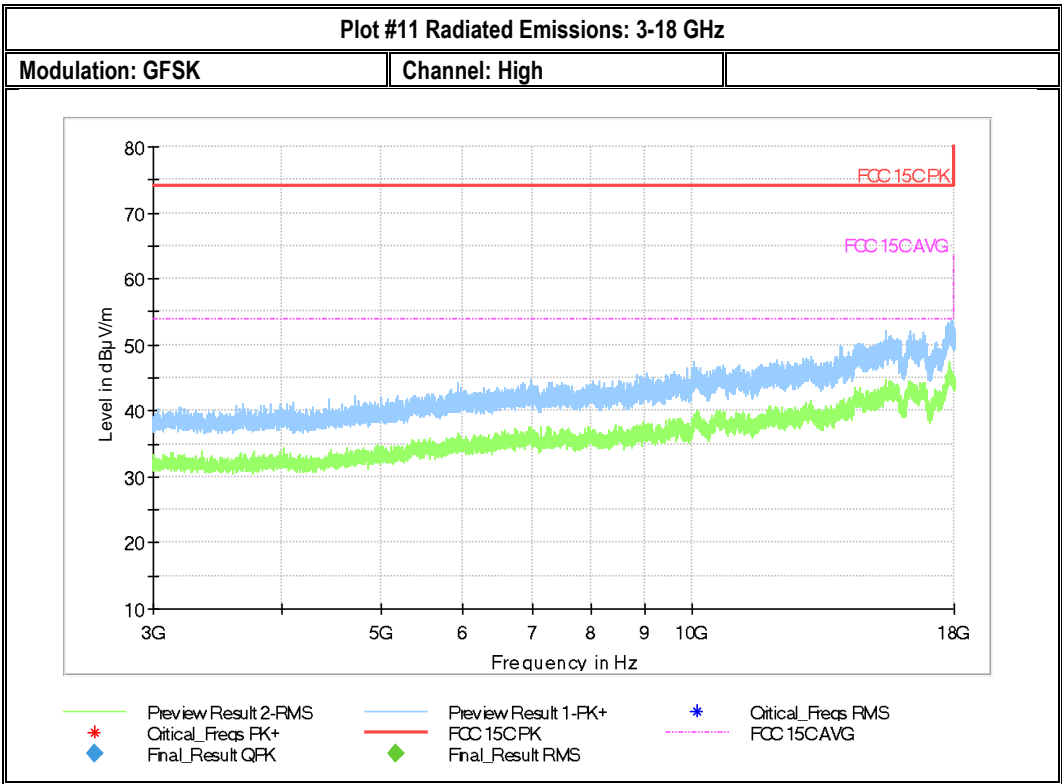


Preview Result 2-RMS
Critical_Freqs PK+
Final_Result RMS

Preview Result 1-FK+
FCC 15C PK

Critical_Freqs RMS
Final_Result QPK





8.8 AC Power Line Conducted Emissions

8.8.1 Measurement according to ANSI C63.4

Analyzer Settings:

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

8.8.2 Limits: FCC 15.207 & RSS-Gen 8.8

(a) 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 μ H/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 (dB μ V) | |
|-----------------------------|------------------------------|-----------|
| | 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.

8.8.3 Test conditions and setup:

| Ambient Temperature (C) | EUT Set-Up # | EUT operating mode | Power line (L1, L2, L3, N) | Power Input |
|-------------------------|--------------|-------------------------------|----------------------------|---------------|
| 22 | 3 | GFSK continuous fixed channel | Line & Neutral | 110 V / 60 Hz |

8.8.4 Measurement Result:

| Plot # | Port | EUT Set-Up # | EUT operating mode | Scan Frequency | Limit | Result |
|--------|--------------|--------------|-------------------------------|------------------|-------------------|--------|
| 1 | AC Mains - L | 3 | GFSK continuous fixed channel | 150 kHz – 30 MHz | See section 8.8.2 | Pass |
| 2 | AC Mains - N | 3 | GFSK continuous fixed channel | 150 kHz – 30 MHz | See section 8.8.2 | Pass |

8.8.5 Measurement Plots:

Plot # 1

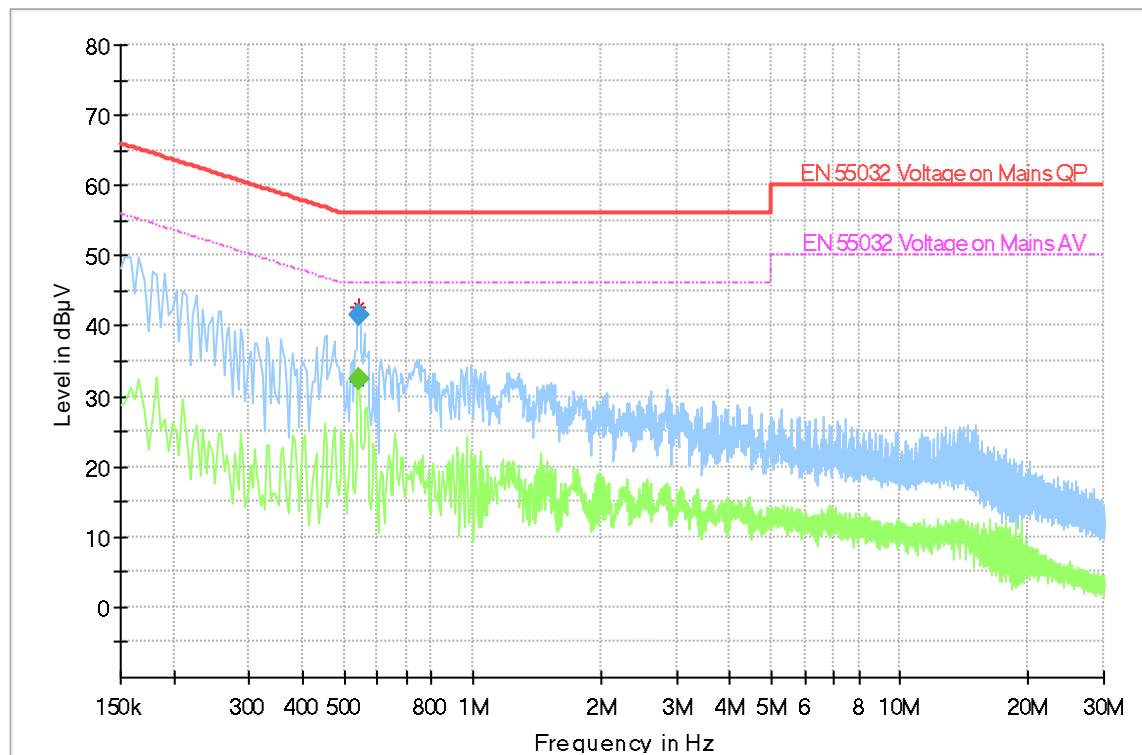
EUT Information

EUT Serial Number: X60495001
Manufacturer: AXON
Comment: L

Final Result

| Frequency (MHz) | QuasiPeak (dBμV) | CAverage (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | PE | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|-----|------------|
| 0.542000 | --- | 32.43 | 46.00 | 13.57 | 500.0 | 9.000 | L1 | GND | 10.2 |
| 0.542000 | 41.57 | --- | 56.00 | 14.43 | 500.0 | 9.000 | L1 | GND | 10.2 |

Disclaimer: Any measurement data within 2dB from the limit line is conditional PASS/FAIL due to measurement uncertainty considerations.



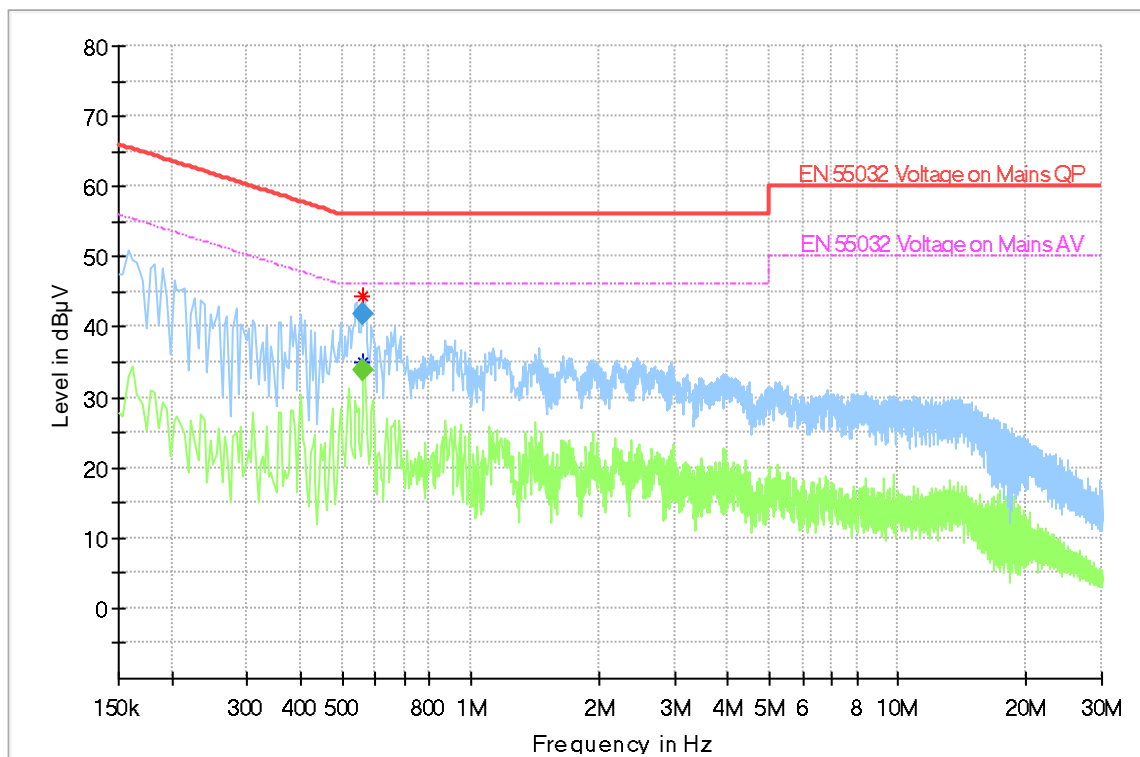
Plot # 2**EUT Information**

EUT Serial Number: X60495001
Manufacturer: AXON
Comment: N

Final Result

| Frequency (MHz) | QuasiPeak (dBμV) | CAverage (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | PE | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|-----|------------|
| 0.558000 | 41.81 | --- | 56.00 | 14.19 | 500.0 | 9.000 | N | GND | 10.3 |
| 0.562000 | --- | 33.99 | 46.00 | 12.01 | 500.0 | 9.000 | N | GND | 10.3 |

Disclaimer: Any measurement data within 2dB from the limit line is conditional PASS/FAIL due to measurement uncertainty considerations.



9 Test setup photos

Setup photos are included in supporting file name: "EMC_AXONN-004-19001_FCC_Setup_Photos.pdf"

10 Test Equipment And Ancillaries Used For Testing

| Item Name | Equipment Type | Manufacturer | Model | Serial # | Calibration Cycle | Last Calibration Date |
|----------------------------|----------------------|--------------|---------------------|----------|-------------------|-----------------------|
| Antenna Biconilog 3142E | Biconilog Antenna | EMCO | 3142E | 166067 | 3 years | 6/28/2017 |
| Antenna Horn 3115 SN 35114 | Horn Antenna | EMCO | 3115 | 35114 | 3 years | 7/31/2017 |
| Antenna Horn 3117 | Horn Antenna | ETS Lindgren | 3117PA | 169547 | 3 years | 8/8/2017 |
| Antenna Horn 3116 | Horn Antenna | ETS Lindgren | 3116C-PA | 169535 | 3 years | 9/24/2017 |
| Active Loop Antenna | Active Loop Antenna | ETS Lindgren | 6507 | 161344 | 3 years | 10/26/2017 |
| FSV40 | Spectrum Analyzer | R&S | FSV40 | 101022 | 3 years | 7/5/2017 |
| Thermometer Humidity | Thermometer Humidity | Dickson | TM320 | 5280063 | 3 years | 11/02/2017 |
| FSU | Spectrum Analyzer | R&S | FSU26 | 200302 | 2 Years | 7/5/2017 |
| LISN | LISN | FCC | FCC-LISN-50-25-2-08 | 8014 | 3 years | 11/10/2016 |

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 |
|------------|--------------------------------|-------------------|--------------------|
| 2019-07-11 | EMC_AXONN-004-19001_15.247_DSS | Initial Version | Kevin Wang |
| | | | |