

Test Type: Emissions ☒ Immunity ☐

Product Type: Wireless Headphones

Product Name/Number: *Model Numbers: BMD0003 and BMD0004*  
*FCC ID: A94429638*  
*IC: 3232A-429638*

Prepared For: *Design Assurance Engineering Department,*  
*Bose Corporation*

Test Results: Pass ☒ Fail ☐

Applicable Standards: Unintentional Radiated Interference referenced in:  
FCC CFR 47 Part 15 Subpart C  
Industry Canada RSS-247 Issue 2  
Industry Canada RSS-GEN Issue 5

Report Number: *EMC.429638.18.282.3*

General Comments/Special Test Conditions:

This report relates only to the items tested. This report covers EMC marking requirements for models BMD0003 and BMD0004.

|                                    | Print Name   | Signature                                                                            | Date        |
|------------------------------------|--------------|--------------------------------------------------------------------------------------|-------------|
| Prepared By:                       | Karl Klemm   |  | 19 OCT 2018 |
| Electrical Engineer Review*<br>By: | Nathan Cross |  | 19 OCT 2018 |

\* Since every test result is separately reviewed after its completion, the electrical engineer review indicated above represents a higher level review to ensure this report lists and contains all applicable and appropriate requirements.

If the report carries the "accredited" logo, the reviewer must verify all the tests in this report are covered under the current ISO17025 accreditation. The A2LA-accredited logo must be removed if any of the tests in the report are not performed under the current scope of accreditation. It is the responsibility of the reviewer to ensure the A2LA advertising policy is followed.



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# Test Report Summary

## Product Information:

### Description

*The EUT is a wireless headphone that contains DSS/DTS transceivers, manufactured by Cambridge Silicon Radio, CSR8675. The EUT uses Adaptive Frequency Hopping (AFH) mode, using a reduced hop set if interference is detected in band, however a minimum of 20 channels is always maintained.*

*The two models use identical electronics and are differentiated only by cosmetic differences in the enclosure. The differences in the enclosures have no impact on the transmitter function or characteristics. Model BMD003 was used for testing.*

### Setup (Cables and Accessories)

*Spurious emissions was performed with the EUT playing IEC pink noise over the wireless link, with the EUT sensors operating and sending data over the wireless link, or while the EUT battery is charging from an external power supply. The EUT cannot charge and play audio at the same time. EUT is not sold with a power supply so when necessary a Bose model number S008AHU0500160 power supply was used for charging. For radio tests the radio was configured with CSR Blue Suite software (details provided in SOFTWARE AND FIRMWARE section).*

### EUT Antenna Description

*The antenna is an internal PIF variant with antenna gain of 5.65 dBi formed by printed circuit board etch.*

### SOFTWARE AND FIRMWARE

*The firmware installed in the EUT during testing was version 0.6.3*

*The test utility software used during testing was Polycomm, version 0.2.1.0 and CSR Blue Suite version 2.6.2.*

### Scope:

*This report covers EMC requirements. FCC CFR 47 PART 15 SUBPART C, Industry Canada RSS-247 Issue 2, and Industry Canada RSS-GEN Issue 5.*

*All measurements in this report were made radiated, with the EUT antenna connected.*

### Test Objective:

*Verify product meets all applicable EMC requirements.*

### Measurement Method:

*ANSI C63.10 (2013).*

### Results:

*Product complies with all applicable EMC requirements. All final results represent worst-case emissions and/or immunity.*

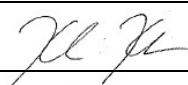
### Conclusions:

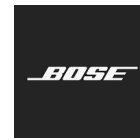
The device under test (D.U.T.):

☒ meets all test standards selected in section 2 of this report.

☐ does not meet all test standards selected in section 2 of this report.

### Affirmation of Test Results:

|                             | Print Name | Signature                                                                            | Date        |
|-----------------------------|------------|--------------------------------------------------------------------------------------|-------------|
| Testing Engineer/Technician | Karl Klemm |  | 15 OCT 2018 |



## Test Standards

### Emissions:

- Standard  
☒ FCC Part 15C  
☒ Canada RSS-247  
☒ Canada RSS-GEN

## Environmental Conditions

### Ambient:

- Temperature: 22±4 °C  
 Humidity: 30-60 %RH  
 Mains Voltage: ☒ 5 Vdc

## FCC Test Site Accreditation.

| Firm Name               | Location                          | Accreditation                                     | MRA Designation Number | Expiration Date | Contact     | Contact Title   |
|-------------------------|-----------------------------------|---------------------------------------------------|------------------------|-----------------|-------------|-----------------|
| <u>Bose Corporation</u> | 1 New York Avenue, Framingham, MA | American Association for Laboratory Accreditation | N/A US1088             | 07/31/2020      | Carole Park | Quality Manager |

## Canadian Test Site Registration.

Radiated emissions below 1GHz were performed in Test Site 3232A-1. Radiated emissions above 1GHz were performed in Test Site 3232A-2.

### Scope of Accreditation for: Bose Corporation

| Test Site | OATS 3m | OATS 10m | OATS 30m | Chamber 3m | Chamber 10m | Expiry Date |
|-----------|---------|----------|----------|------------|-------------|-------------|
| 3232A-2   | No      | No       | No       | Yes        | No          | 2020-06-27  |
| 3232A-1   | No      | No       | No       | Yes        | No          | 2020-04-25  |

# Radiated Emissions 30 MHz to 1 GHz

## Requirement:

Spurious emissions shall not exceed the radiated emissions limits shown below

**radiated emissions limits**

| Frequency<br>(MHz) | Field strength<br>( $\mu\text{V/m}$ at 3 metres) <sup>Note 1</sup> |
|--------------------|--------------------------------------------------------------------|
| 30 – 88            | 100                                                                |
| 88 – 216           | 150                                                                |
| 216 – 960          | 200                                                                |
| Above 960          | 500                                                                |

## Test Procedure:

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz measurements. The EUT is rotated around the vertical axis, the antenna polarization changed from H to V and the antenna height is varied from 1 to 4 meters in order to find the maximum value of the harmonic emission. Account is taken of the beam width of the antenna to make sure the EUT remains in the main lobe of the antenna. EUT was tested in 3 orthogonal axes and the worst-case results are shown below. For measurements below 1 GHz, the resolution bandwidth is set to 120 kHz and a quasi-peak detector was used.

## Test setup details:

EUT is playing pink noise at max volume via Bluetooth from an ipod; sensors are not active (sensors have no impact on radiated emissions performance). EUT is powered by the internal battery. Worst case orientation found to be with the glasses closed and the lenses down.

EUT is connected to a power supply and charging; no audio is playing, no sensors are active. EUT is not provided with a power supply; using Bose power supply MN: S008AHU0500160. Worst case orientation found to be with the glasses open and the lenses forward.

# Test Results:

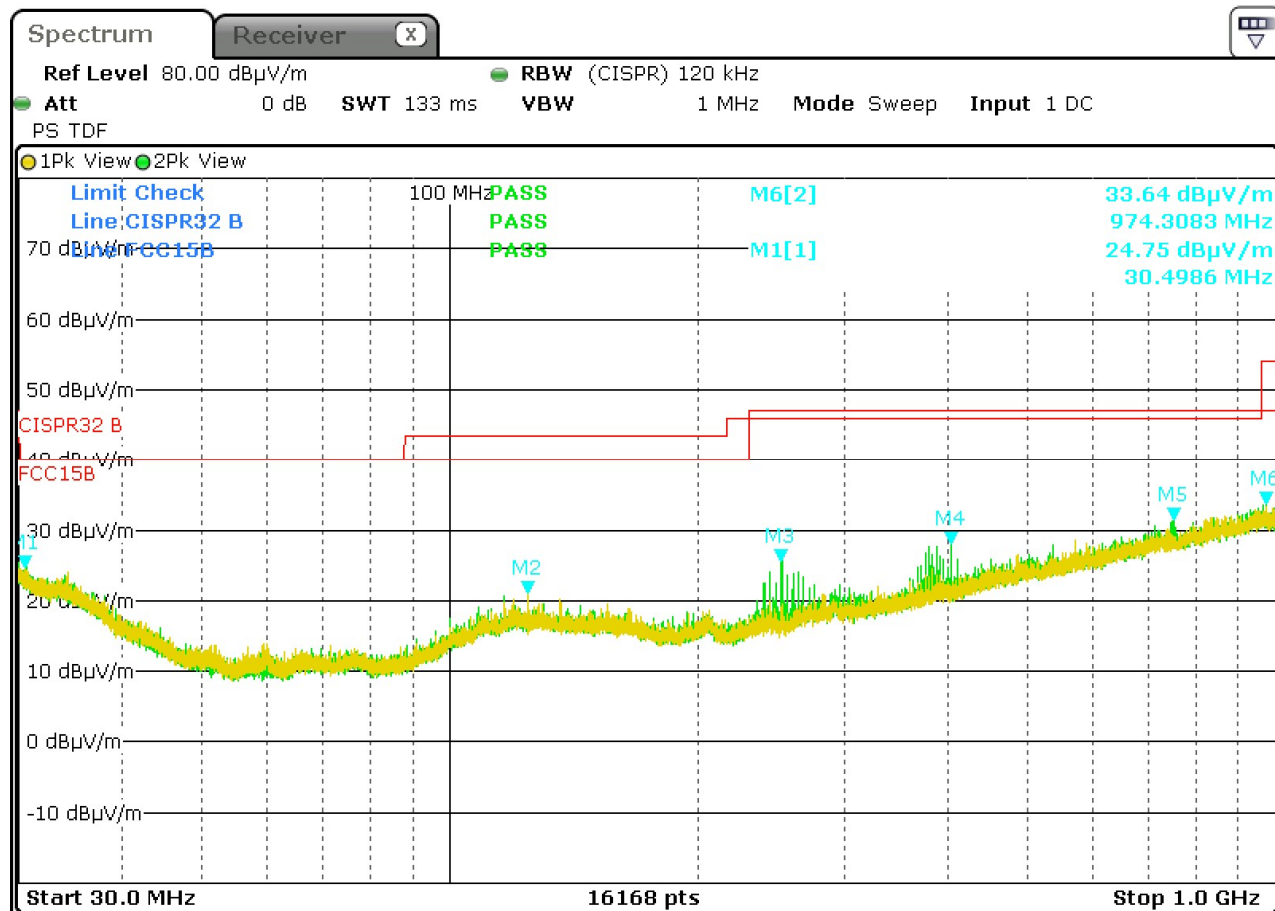


## Max-Hold Pre-scan, 30 MHz to 1 GHz

Playing pink noise at max volume, powered by internal battery  
Glasses closed, lenses down

| CISPR 32&11 "Other" @ 3 Meters and FCC Class B                             |                                |                                  |                   |                |                   |                |                               |                   |                 |              |
|----------------------------------------------------------------------------|--------------------------------|----------------------------------|-------------------|----------------|-------------------|----------------|-------------------------------|-------------------|-----------------|--------------|
| Emission Frequency (MHz)                                                   | Measured Amplitude (dBμV/m) QP | Measured Amplitude (dBμV/m) Peak | CISPR 32          |                | FCC B             |                | Table Azimuth (0° closest to) | Receiving Antenna |                 | Notes / Mode |
|                                                                            |                                |                                  | Limit (dBμV/m) QP | Margin (dB) QP | Limit (dBμV/m) QP | Margin (dB) QP |                               | Pol (H/V)         | Height (Meters) |              |
| <b><u>Playing pink noise at max volume, glasses closed lenses down</u></b> |                                |                                  |                   |                |                   |                |                               |                   |                 |              |
| <b><u>powered by internal battery</u></b>                                  |                                |                                  |                   |                |                   |                |                               |                   |                 |              |
| 30.000                                                                     | 19.60                          | 24.30                            | 40.0              | 20.4           | 40.0              | 20.4           |                               |                   |                 | ambient      |
| 125.360                                                                    | 13.10                          | 19.30                            | 40.0              | 26.9           | 43.5              | 30.4           |                               |                   |                 | ambient      |
| 204.360                                                                    | 12.40                          | 22.20                            | 40.0              | 27.6           | 43.5              | 31.1           |                               |                   |                 | ambient      |
| 312.000                                                                    | 34.70                          | 38.90                            | 47.0              | 12.3           | 46.0              | 11.3           | 184                           | H                 | 1.0             |              |
| 665.090                                                                    | 24.20                          | 34.70                            | 47.0              | 22.8           | 46.0              | 21.8           |                               |                   |                 | ambient      |
| 937.040                                                                    | 28.90                          | 40.20                            | 47.0              | 18.1           | 46.0              | 17.1           |                               |                   |                 | ambient      |

EUT PASSES FCC Class B limits by 12.3 dB at 312.000 MHz and CISPR Class B limits by 11.3 dB at 312.000 MHz.

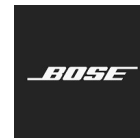


**Max-Hold Pre-scan, 30 MHz to 1 GHz**

Charging, power supply connected to 120 V, 60 Hz  
Glasses open, lenses forward

| Emission Frequency (MHz) | Measured Amplitude (dBμV/m) QP | Measured Amplitude (dBμV/m) Peak | CISPR 32          |                | FCC B             |                | Table Azimuth (0° closest to) | Receiving Antenna |                 | Notes / Mode |
|--------------------------|--------------------------------|----------------------------------|-------------------|----------------|-------------------|----------------|-------------------------------|-------------------|-----------------|--------------|
|                          |                                |                                  | Limit (dBμV/m) QP | Margin (dB) QP | Limit (dBμV/m) QP | Margin (dB) QP |                               | Pol (H/V)         | Height (Meters) |              |
| 30.499                   | 19.10                          | 28.90                            | 40.0              | 20.9           | 40.0              | 20.9           |                               |                   |                 | ambient      |
| 135.990                  | 17.80                          | 23.20                            | 40.0              | 22.2           | 43.5              | 25.7           | 314                           | V                 | 1.0             |              |
| 252.000                  | 24.10                          | 28.20                            | 47.0              | 22.9           | 46.0              | 21.9           | 170                           | H                 | 1.2             |              |
| 384.000                  | 26.60                          | 30.60                            | 47.0              | 20.4           | 46.0              | 19.4           | 215                           | H                 | 2.2             |              |
| 751.010                  | 31.50                          | 37.30                            | 47.0              | 15.5           | 46.0              | 14.5           | 77                            | H                 | 1.6             |              |
| 965.450                  | 25.40                          | 33.90                            | 47.0              | 21.6           | 54.0              | 28.6           |                               |                   |                 | ambient      |

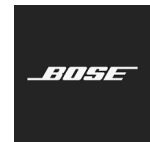
EUT PASSES FCC Class B limits by 15.5 dB at 751.010 MHz and CISPR Class B limits by 14.5 dB at 751.010 MHz.



## Test Equipment Used:

| TN   | Description                                 | Model   | S/N      | Manufacturer        | Most Recent service | Service Due Date |
|------|---------------------------------------------|---------|----------|---------------------|---------------------|------------------|
| 644  | Maxwell House 3 Meter Semi-Anechoic Chamber | N/A     | 1698A    | EM Test             | 20-Dec-2017         | 20-Dec-2019      |
| 1445 | Maxwell House Radiated Emissions Cable Set  | N/A     | N/A      | Bose Corporation    | 28-Jul-2018         | 27-Aug-2018      |
| 2319 | EMI Test Receiver                           | ESR26   | 101276   | Rohde & Schwarz     | 26-Apr-2018         | 26-Apr-2019      |
| 1375 | System Controller                           | SC99V   | 050905-1 | Sunol Sciences Corp | Verify before use   |                  |
| 1541 | Antenna 30MHz - 6GHz                        | JB6     | A050807  | Sunol Sciences Corp | 29-Nov-2017         | 29-Nov-2018      |
| 2077 | PreAmplifier                                | N/A     | N/A      | Bose Corporation    | 28-Jul-2018         | 27-Aug-2018      |
| 1692 | Flexible Microwave Cable                    | HFE160D | 200001   | Rohde & Schwarz     | 28-Jul-2018         | 27-Aug-2018      |

Date(s) of test: 24-Jul-18, 25-Jul-18



# Radiated Emissions 1 GHz to 40 GHz

## Requirement:

FCC 15.205, 15.209, 15.247 (d), IC RSS-GEN Clause 8.9 (Transmitter)

### Restricted Bands:

In any of the restricted bands defined in FCC part 15.209(a), the field strength at a distance of 3 meters shall not exceed 54dBμV/m (average) or 74dBμV/m (peak)

### Non-Restricted Bands:

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, 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.

## Test Procedure:

The EUT is placed in a standard ANSI C63.10 test setup. Standard Gain Horn Antennas and Double-Ridged Guide Horn Antennas with suitable pre-amps mounted directly on the horn antennas are used for the measurement of the harmonics. The EUT hopping is stopped and measurements are made in the low, mid and high end of the frequency range at the defined limit distance of 3 meters. The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz measurements and 1.5 m above the ground plane for above 1GHz measurements. The EUT is rotated around the vertical axis, the antenna polarization changed from H to V and the antenna height is varied from 1 to 4 meters in order to find the maximum value of the harmonic emission. Account is taken of the beam width of the horn antennas to make sure the EUT remains in the main lobe of the antenna. EUT was tested in 3 orthogonal axes and the worst-case results are shown below.

For peak measurements above 1 GHz, a resolution bandwidth of 1 MHz was used and video bandwidth of 3 MHz was used. For average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. An average detector was used and a duty cycle correction factor was added to correspond to the average during the transmission to compute the emission level that would have been measured had the test been performed at 100 % duty cycle. The duty cycle correction factor used was 2.2 dB for DH5 Bluetooth and 3.6 dB for BLE.

## Test setup details:

The EUT is software programmed via the USB cable with software which is used to set the test modes of the Bluetooth device. The EUT antenna is connected, the measurements are made using a radiated emissions setup. Testing performed in the worst case orientation - with the glasses closed and the lenses down.

### *Spurious/Harmonics*

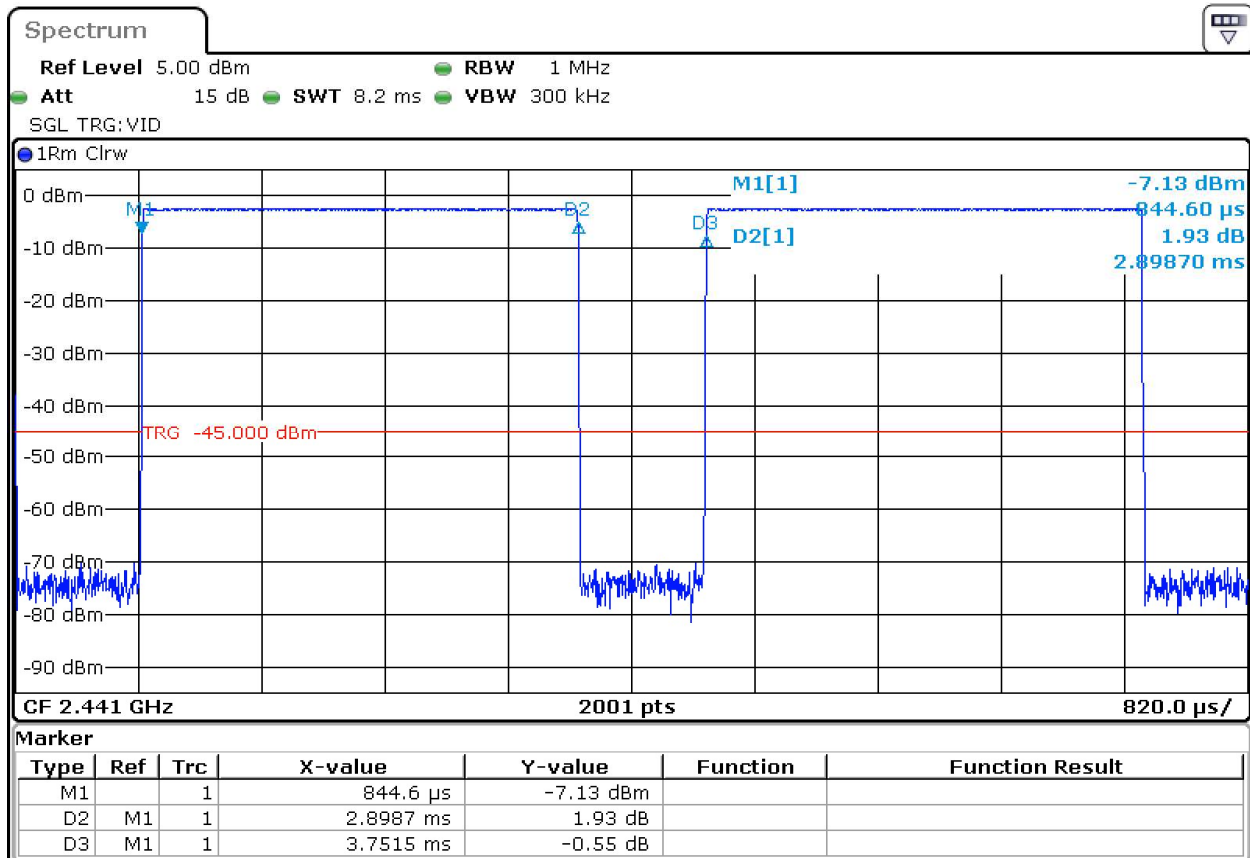
The EUT is transmitting at full power, either on 2402 MHz, 2441 MHz (BT) or 2442 MHz (BLE), 2480 MHz, or hopping on low/mid/high channels. For Bluetooth mode, DH5 packets were used.

### *Band-edge*

The EUT is transmitting at full power, either on 2402 MHz, 2480 MHz, or hopping on all channels. For Bluetooth mode, DH5 and 3DH5 packets were used.

# Test Results:

## Duty Cycle Correction



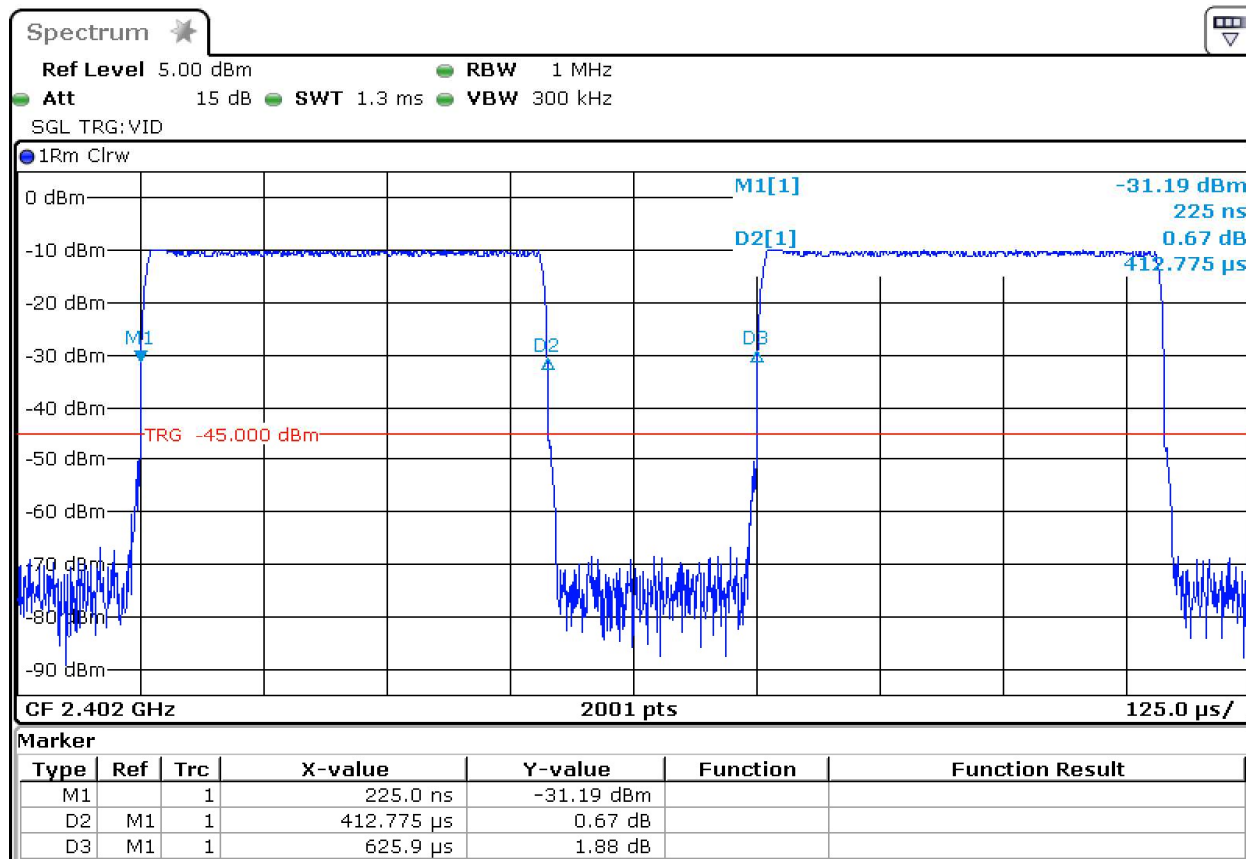
DH5 packets transmitting in test mode. Marker D2 = Time ON, Marker D3 = Period.

$$\begin{aligned}
 \text{Duty Cycle} &= \text{Time ON} / \text{Period} = D3 / D2 \\
 &= 2.8987 / 3.7515 = 0.773
 \end{aligned}$$

$$\text{Duty Cycle (\%)} = 77.3 \%$$

$$\begin{aligned}
 \text{Duty Cycle correction factor (dB)} &= 20 \cdot \text{LOG}(1/\text{Duty Cycle}) \\
 &= 20 \cdot \text{LOG}(1/0.773) = 2.2
 \end{aligned}$$

$$\text{Duty Cycle correction factor (dB)} = 2.2 \text{ dB}$$



BLE packets transmitting in test mode. Marker D2 = Time ON, Marker D3 = Period.

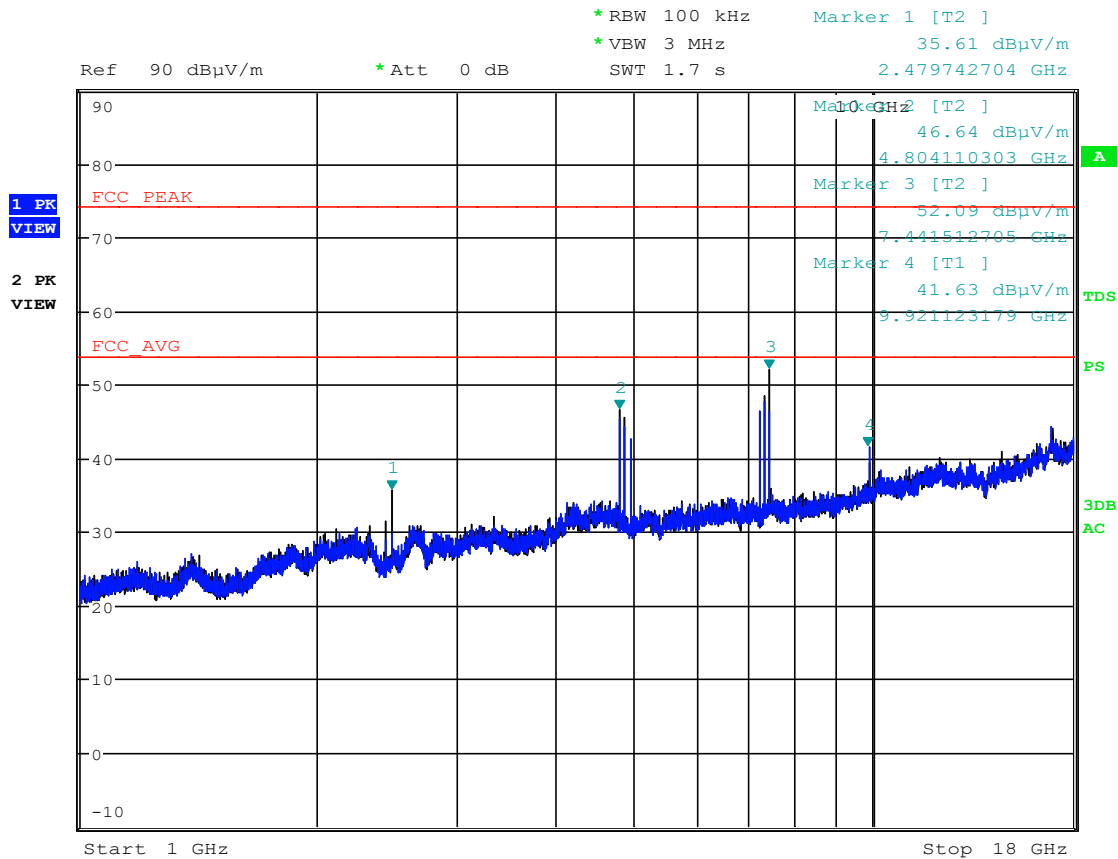
$$\begin{aligned}
 \text{Duty Cycle} &= \text{Time ON} / \text{Period} = D3 / D2 \\
 &= 412.775 / 625.9 = 0.659
 \end{aligned}$$

$$\text{Duty Cycle (\%)} = 65.9 \%$$

$$\begin{aligned}
 \text{Duty Cycle correction factor (dB)} &= 20 \cdot \text{LOG}(1/\text{Duty Cycle}) \\
 &= 20 \cdot \text{LOG}(1/0.659) = 3.6
 \end{aligned}$$

$$\text{Duty Cycle correction factor (dB)} = 3.6 \text{ dB}$$

## Harmonics/Spurious



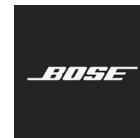
Max-Hold pre-scan, 1 GHz to 18 GHz  
 Hopping on Low/Mid/High channels  
 Glasses closed, lenses down

BT PASSES FCC Class B limits by 1.2 dB at 7440.000 MHz.

BLE PASSES FCC Class B limits by 7.6 dB at 4884.000 MHz.

All emissions were below the restricted band limits, which are more stringent than the non-restricted band limits.

Note: no emissions were visible over the noise floor above 18 GHz.



## DSS Radio - BT (DH5) Data

| FCC 15B Class B Product (Residential) @ 3 Meters |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
|--------------------------------------------------|-----------------------------|-----------------------------------|------------------------------|----------------------------------|--------------------|---------------------|-----------------|------------------|-------------------------------|-------------------|-----------------|----------------------------|
| Emission Frequency (MHz)                         | Measured Amplitude (dBμV/m) | AVG                               |                              | Peak Measured Amplitude (dBμV/m) | FCC 15B            |                     |                 |                  | Table Azimuth (0° closest to) | Receiving Antenna |                 | Notes / Mode               |
|                                                  |                             | Duty Cycle Correction Factor (dB) | Corrected Amplitude (dBμV/m) |                                  | Limit (dBμV/m) AVG | Limit (dBμV/m) Peak | Margin (dB) AVG | Margin (dB) Peak |                               | Pol (H/V)         | Height (Meters) |                            |
| Tx on 2402 MHz, DH5                              |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| Glasses closed, lenses down                      |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| 4804.000                                         | 48.4                        | 2.2                               | 50.6                         | 54.1                             | 54.0               | 74.0                | 3.4             | 19.9             | 160                           | H                 | 1.5             | AVG corrected for D.C.     |
| 7206.000                                         | 44.1                        | 2.2                               | 46.3                         | 52.2                             | 54.0               | 74.0                | 7.7             | 21.8             | 70                            | H                 | 1.0             | AVG corrected for D.C.     |
| 9608.600                                         | 33.4                        | 2.2                               | 35.6                         | 47.2                             | 54.0               | 74.0                | 18.4            | 26.8             | 293                           | H                 | 3.0             | AVG corrected for D.C.     |
| 12010.600                                        | 37.1                        | 2.2                               | 39.3                         | 50.4                             | 54.0               | 74.0                | 14.7            | 23.6             | 139                           | H                 | 2.0             | AVG corrected for D.C.     |
| 14412.000                                        | 34.8                        | n/a                               | 34.8                         | 49.4                             | 54.0               | 74.0                | 19.2            | 24.6             |                               |                   |                 | noise floor. No correction |
| 16814.000                                        | 39.2                        | n/a                               | 39.2                         | 53.9                             | 54.0               | 74.0                | 14.8            | 20.1             |                               |                   |                 | noise floor. No correction |

| FCC 15B Class B Product (Residential) @ 3 Meters |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
|--------------------------------------------------|-----------------------------|-----------------------------------|------------------------------|----------------------------------|--------------------|---------------------|-----------------|------------------|-------------------------------|-------------------|-----------------|----------------------------|
| Emission Frequency (MHz)                         | Measured Amplitude (dBμV/m) | AVG                               |                              | Peak Measured Amplitude (dBμV/m) | FCC 15B            |                     |                 |                  | Table Azimuth (0° closest to) | Receiving Antenna |                 | Notes / Mode               |
|                                                  |                             | Duty Cycle Correction Factor (dB) | Corrected Amplitude (dBμV/m) |                                  | Limit (dBμV/m) AVG | Limit (dBμV/m) Peak | Margin (dB) AVG | Margin (dB) Peak |                               | Pol (H/V)         | Height (Meters) |                            |
| Tx on 2441 MHz, DH5                              |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| Glasses closed, lenses down                      |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| 4882.000                                         | 47.8                        | 2.2                               | 50.0                         | 53.5                             | 54.0               | 74.0                | 4.0             | 20.5             | 157                           | H                 | 1.3             | AVG corrected for D.C.     |
| 7323.000                                         | 48.1                        | 2.2                               | 50.3                         | 55.6                             | 54.0               | 74.0                | 3.7             | 18.4             | 290                           | H                 | 2.1             | AVG corrected for D.C.     |
| 9763.900                                         | 33.4                        | 2.2                               | 35.6                         | 47.0                             | 54.0               | 74.0                | 18.4            | 27.0             | 217                           | H                 | 2.3             | AVG corrected for D.C.     |
| 12204.400                                        | 38.3                        | 2.2                               | 40.5                         | 52.2                             | 54.0               | 74.0                | 13.5            | 21.8             | 128                           | H                 | 2.3             | AVG corrected for D.C.     |
| 14646.000                                        | 35.6                        | n/a                               | 35.6                         | 49.7                             | 54.0               | 74.0                | 18.4            | 24.3             |                               |                   |                 | noise floor. No correction |
| 17087.000                                        | 38.1                        | n/a                               | 38.1                         | 52.4                             | 54.0               | 74.0                | 15.9            | 21.6             |                               |                   |                 | noise floor. No correction |

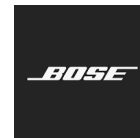
| FCC 15B Class B Product (Residential) @ 3 Meters |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
|--------------------------------------------------|-----------------------------|-----------------------------------|------------------------------|----------------------------------|--------------------|---------------------|-----------------|------------------|-------------------------------|-------------------|-----------------|----------------------------|
| Emission Frequency (MHz)                         | Measured Amplitude (dBµV/m) | AVG                               |                              | Peak Measured Amplitude (dBµV/m) | FCC 15B            |                     |                 |                  | Table Azimuth (0° closest to) | Receiving Antenna |                 | Notes / Mode               |
|                                                  |                             | Duty Cycle Correction Factor (dB) | Corrected Amplitude (dBµV/m) |                                  | Limit (dBµV/m) AVG | Limit (dBµV/m) Peak | Margin (dB) AVG | Margin (dB) Peak |                               | Pol (H/V)         | Height (Meters) |                            |
|                                                  |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| <b><u>Tx on 2480 MHz, DH5</u></b>                |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| <b><u>Glasses closed, lenses down</u></b>        |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| 4960.000                                         | 45.3                        | 2.2                               | 47.5                         | 51.8                             | 54.0               | 74.0                | 6.5             | 22.2             | 155                           | H                 | 1.0             | AVG corrected for D.C.     |
| 7440.000                                         | 50.6                        | 2.2                               | 52.8                         | 57.9                             | 54.0               | 74.0                | 1.2             | 16.1             | 289                           | H                 | 3.0             | AVG corrected for D.C.     |
| 9919.491                                         | 36.8                        | 2.2                               | 39.0                         | 50.0                             | 54.0               | 74.0                | 15.0            | 24.0             | 139                           | H                 | 2.5             | AVG corrected for D.C.     |
| 12399.500                                        | 38.0                        | 2.2                               | 40.2                         | 50.8                             | 54.0               | 74.0                | 13.8            | 23.2             | 227                           | H                 | 2.4             | AVG corrected for D.C.     |
| 14880.000                                        | 35.4                        | n/a                               | 35.4                         | 48.7                             | 54.0               | 74.0                | 18.6            | 25.3             |                               |                   |                 | noise floor. No correction |
| 17360.000                                        | 37.8                        | n/a                               | 37.8                         | 51.3                             | 54.0               | 74.0                | 16.2            | 22.7             |                               |                   |                 | noise floor. No correction |

Duty cycle correction was added to all average measurements above the noise floor. The raw and corrected readings are displayed in the tables above.

Duty cycle = 77.3 %, correction factor = 2.2 dB

The duty cycle corrected average values were calculated by adding the duty cycle correction to the measured average reading.  
AVG corrected for D.C. = AVG reading(raw) + correction factor

For 7440 MHz:  
AVG corrected for D.C. = 50.6 dBuV/m + 2.2 dB = 52.8 dBuV/m



## DTS radio - BLE Data

| FCC 15B Class B Product (Residential) @ 3 Meters |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
|--------------------------------------------------|-----------------------------|-----------------------------------|------------------------------|----------------------------------|--------------------|---------------------|-----------------|------------------|-------------------------------|-------------------|-----------------|----------------------------|
| Emission Frequency (MHz)                         | Measured Amplitude (dBµV/m) | AVG                               |                              | Peak Measured Amplitude (dBµV/m) | FCC 15B            |                     |                 |                  | Table Azimuth (0° closest to) | Receiving Antenna |                 | Notes / Mode               |
|                                                  |                             | Duty Cycle Correction Factor (dB) | Corrected Amplitude (dBµV/m) |                                  | Limit (dBµV/m) AVG | Limit (dBµV/m) Peak | Margin (dB) AVG | Margin (dB) Peak |                               | Pol (H/V)         | Height (Meters) |                            |
| <b><u>Tx on 2402 MHz, BLE</u></b>                |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| <b><u>Glasses closed, lenses down</u></b>        |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| 4804.000                                         | 41.4                        | 3.6                               | 45.0                         | 51.2                             | 54.0               | 74.0                | 9.0             | 22.8             | 159                           | H                 | 1.5             | AVG corrected for D.C.     |
| 7206.600                                         | 35.0                        | 3.6                               | 38.6                         | 48.3                             | 54.0               | 74.0                | 15.4            | 25.7             | 71                            | H                 | 1.0             | AVG corrected for D.C.     |
| 9609.900                                         | 33.9                        | 3.6                               | 37.5                         | 46.9                             | 54.0               | 74.0                | 16.5            | 27.1             | 293                           | H                 | 3.0             | AVG corrected for D.C.     |
| 12010.600                                        | 35.3                        | n/a                               | 35.3                         | 49.3                             | 54.0               | 74.0                | 18.7            | 24.7             |                               |                   |                 | noise floor. No correction |
| 14412.000                                        | 34.7                        | n/a                               | 34.7                         | 48.1                             | 54.0               | 74.0                | 19.3            | 25.9             |                               |                   |                 | noise floor. No correction |
| 16814.000                                        | 39.2                        | n/a                               | 39.2                         | 52.1                             | 54.0               | 74.0                | 14.8            | 21.9             |                               |                   |                 | noise floor. No correction |

| FCC 15B Class B Product (Residential) @ 3 Meters |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
|--------------------------------------------------|-----------------------------|-----------------------------------|------------------------------|----------------------------------|--------------------|---------------------|-----------------|------------------|-------------------------------|-------------------|-----------------|----------------------------|
| Emission Frequency (MHz)                         | Measured Amplitude (dBµV/m) | AVG                               |                              | Peak Measured Amplitude (dBµV/m) | FCC 15B            |                     |                 |                  | Table Azimuth (0° closest to) | Receiving Antenna |                 | Notes / Mode               |
|                                                  |                             | Duty Cycle Correction Factor (dB) | Corrected Amplitude (dBµV/m) |                                  | Limit (dBµV/m) AVG | Limit (dBµV/m) Peak | Margin (dB) AVG | Margin (dB) Peak |                               | Pol (H/V)         | Height (Meters) |                            |
| <b><u>Tx on 2442 MHz, BLE</u></b>                |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| <b><u>Glasses closed, lenses down</u></b>        |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| 4884.000                                         | 42.8                        | 3.6                               | 46.4                         | 52.4                             | 54.0               | 74.0                | 7.6             | 21.6             | 159                           | H                 | 1.3             | AVG corrected for D.C.     |
| 7325.300                                         | 38.1                        | 3.6                               | 41.7                         | 50.4                             | 54.0               | 74.0                | 12.3            | 23.6             | 290                           | H                 | 2.1             | AVG corrected for D.C.     |
| 9766.600                                         | 32.6                        | 3.6                               | 36.2                         | 46.7                             | 54.0               | 74.0                | 17.8            | 27.3             | 239                           | H                 | 2.3             | AVG corrected for D.C.     |
| 12210.000                                        | 35.9                        | n/a                               | 35.9                         | 49.1                             | 54.0               | 74.0                | 18.1            | 24.9             |                               |                   |                 | noise floor. No correction |
| 14652.000                                        | 35.5                        | n/a                               | 35.5                         | 48.9                             | 54.0               | 74.0                | 18.5            | 25.1             |                               |                   |                 | noise floor. No correction |
| 17094.000                                        | 38.0                        | n/a                               | 38.0                         | 51.0                             | 54.0               | 74.0                | 16.0            | 23.0             |                               |                   |                 | noise floor. No correction |

| FCC 15B Class B Product (Residential) @ 3 Meters |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
|--------------------------------------------------|-----------------------------|-----------------------------------|------------------------------|----------------------------------|--------------------|---------------------|-----------------|------------------|-------------------------------|-------------------|-----------------|----------------------------|
| Emission Frequency (MHz)                         | Measured Amplitude (dBµV/m) | AVG                               |                              | Peak Measured Amplitude (dBµV/m) | FCC 15B            |                     |                 |                  | Table Azimuth (0° closest to) | Receiving Antenna |                 | Notes / Mode               |
|                                                  |                             | Duty Cycle Correction Factor (dB) | Corrected Amplitude (dBµV/m) |                                  | Limit (dBµV/m) AVG | Limit (dBµV/m) Peak | Margin (dB) AVG | Margin (dB) Peak |                               | Pol (H/V)         | Height (Meters) |                            |
|                                                  |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| <b><u>Tx on 2480 MHz, BLE</u></b>                |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| <b><u>Glasses closed, lenses down</u></b>        |                             |                                   |                              |                                  |                    |                     |                 |                  |                               |                   |                 |                            |
| 4960.000                                         | 41.2                        | 3.6                               | 44.8                         | 50.9                             | 54.0               | 74.0                | 9.2             | 23.1             | 157                           | H                 | 1.0             | AVG corrected for D.C.     |
| 7439.200                                         | 37.5                        | 3.6                               | 41.1                         | 50.4                             | 54.0               | 74.0                | 12.9            | 23.6             | 289                           | H                 | 3.0             | AVG corrected for D.C.     |
| 9917.891                                         | 33.8                        | 3.6                               | 37.4                         | 47.3                             | 54.0               | 74.0                | 16.6            | 26.7             | 135                           | H                 | 2.5             | AVG corrected for D.C.     |
| 12398.800                                        | 34.9                        | n/a                               | 34.9                         | 48.2                             | 54.0               | 74.0                | 19.1            | 25.8             | 238                           | H                 | 2.4             | noise floor. No correction |
| 14880.000                                        | 35.4                        | n/a                               | 35.4                         | 48.7                             | 54.0               | 74.0                | 18.6            | 25.3             |                               |                   |                 | noise floor. No correction |
| 17360.000                                        | 37.9                        | n/a                               | 37.9                         | 51.3                             | 54.0               | 74.0                | 16.1            | 22.7             |                               |                   |                 | noise floor. No correction |

Duty cycle correction was added to all average measurements above the noise floor. The raw and corrected readings are displayed in the tables above.

Duty cycle = 65.9 %, correction factor = 3.6 dB

The duty cycle corrected average values were calculated by adding the duty cycle correction to the measured average reading.  
AVG corrected for D.C. = AVG reading(raw) + correction factor

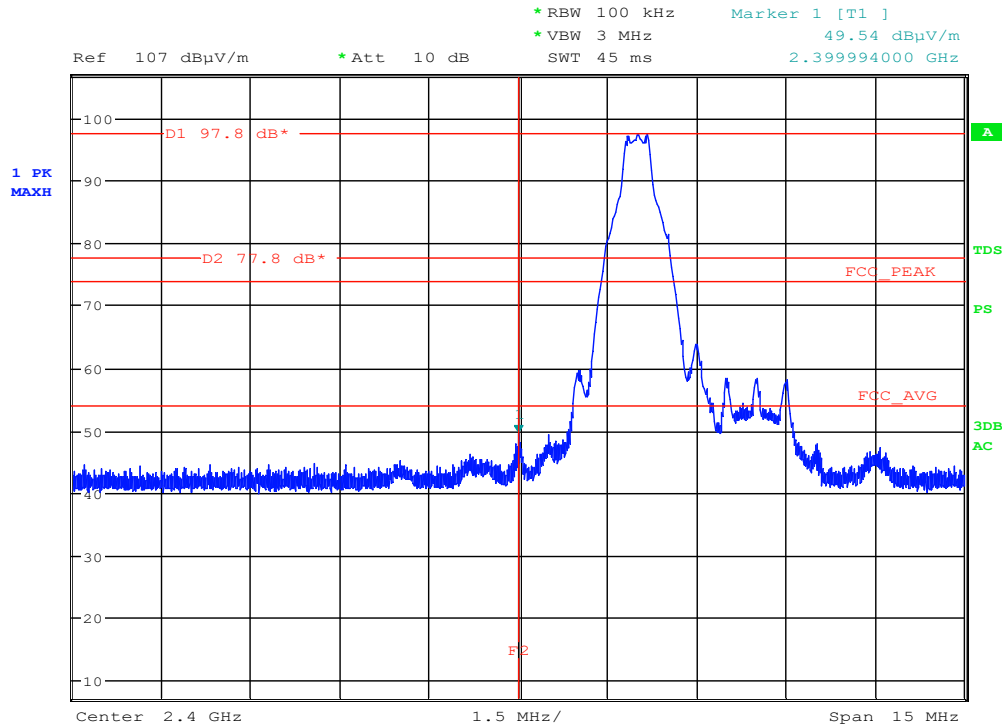
For 4884 MHz:

AVG corrected for D.C. = 42.8 dBuV/m + 3.6 dB = 46.4 dBuV/m

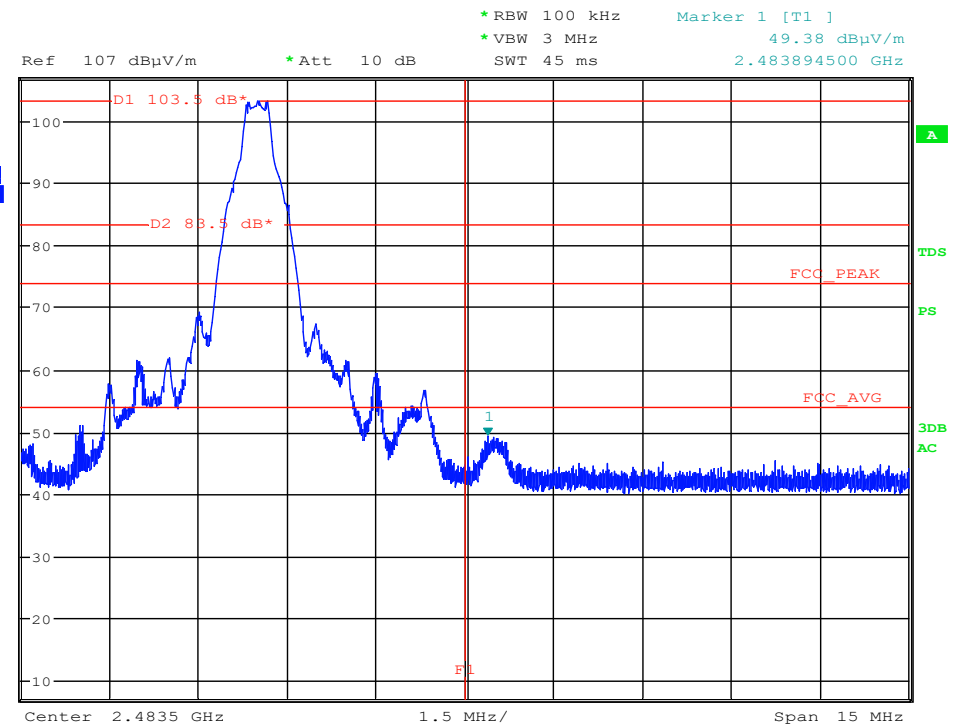


### Band-edge

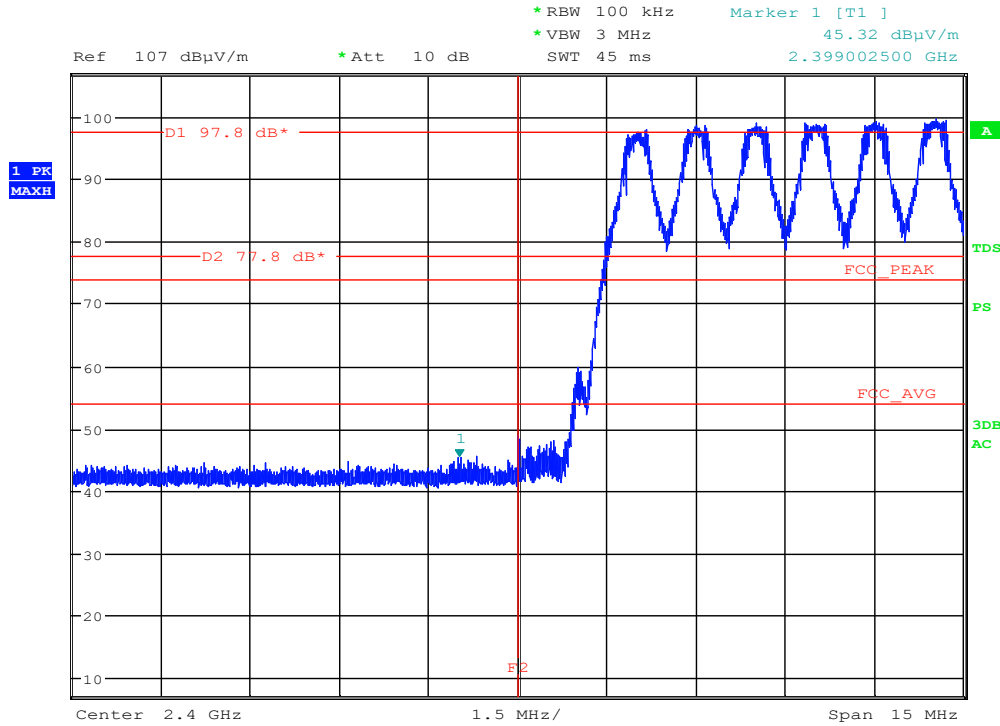
Plots show both the restricted band limits (FCC\_PEAK, FCC\_AVG) and the non-restricted band limits of -20 dBc (Line D2, X.Y dB\*). The frequency marker, F1 or F2, denotes the edge of the band.



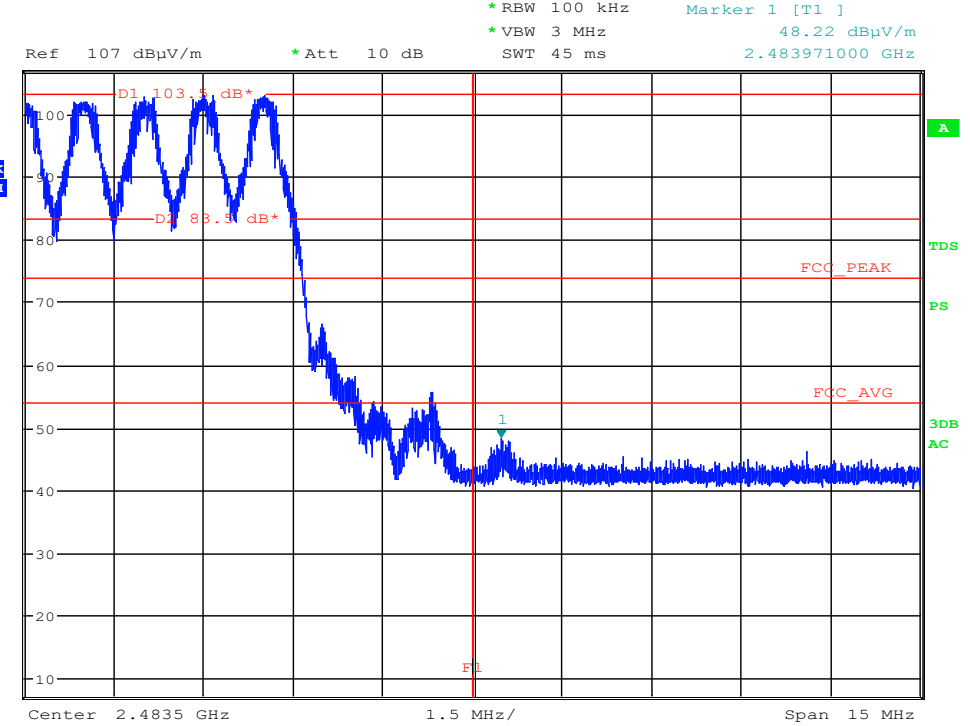
Lower Bandedge DH5



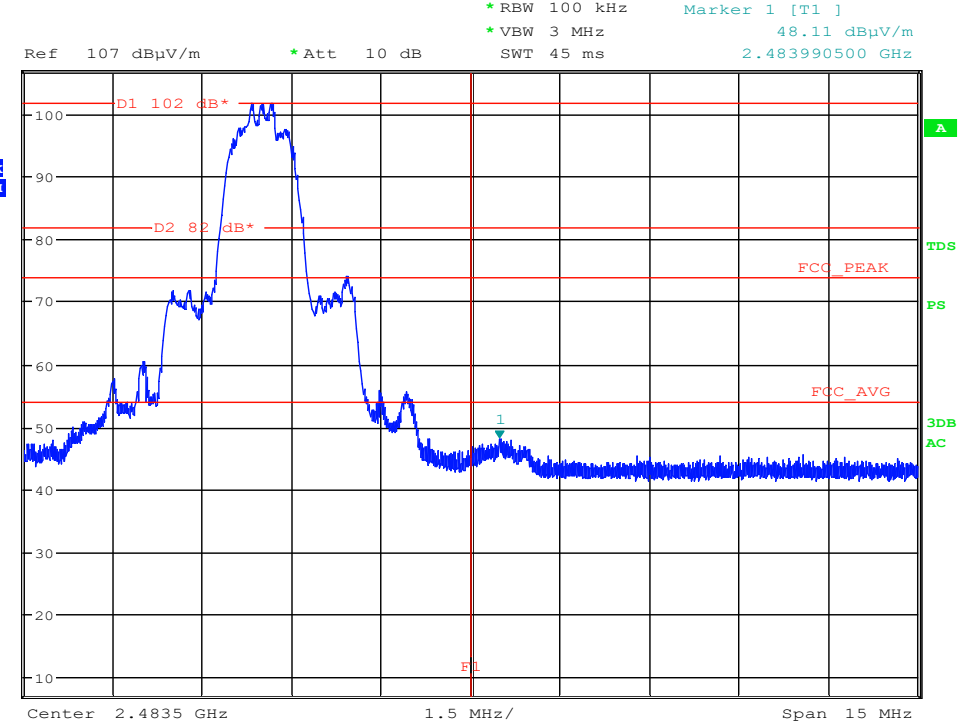
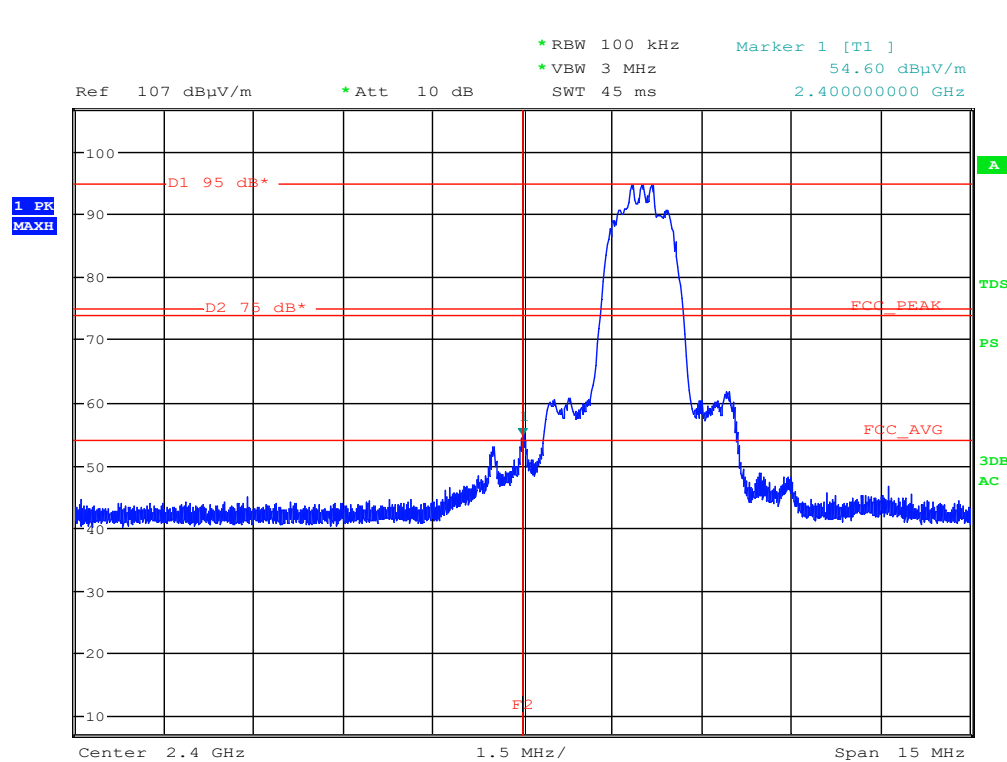
Upper Bandedge DH5



Lower Bandedge DH5, hopping

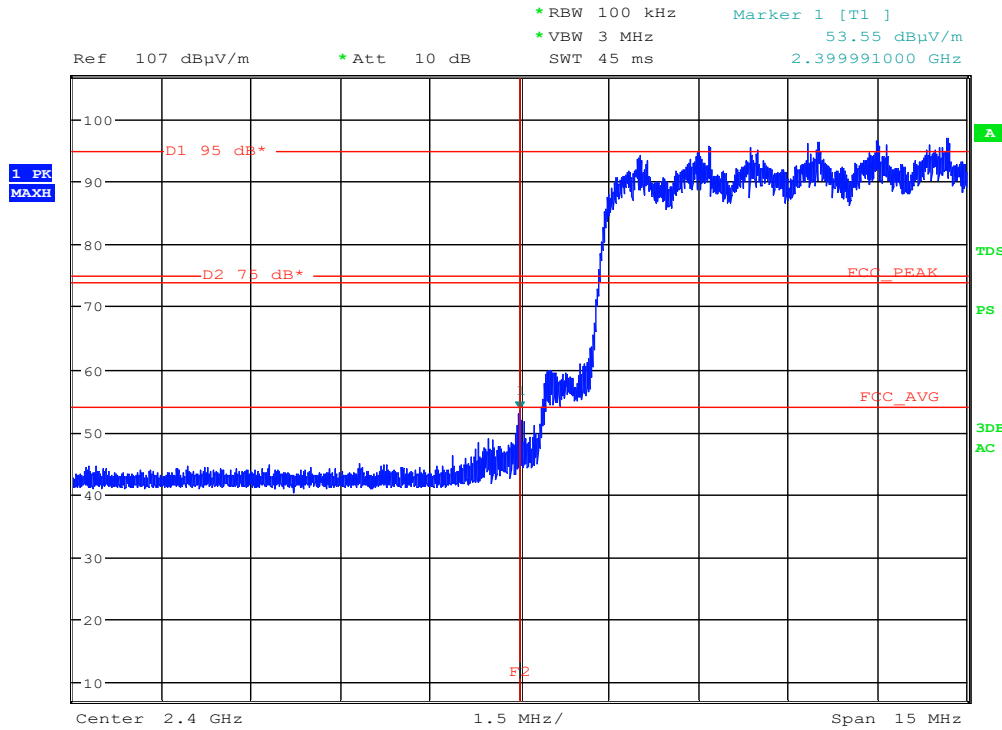


Upper Bandedge DH5, hopping

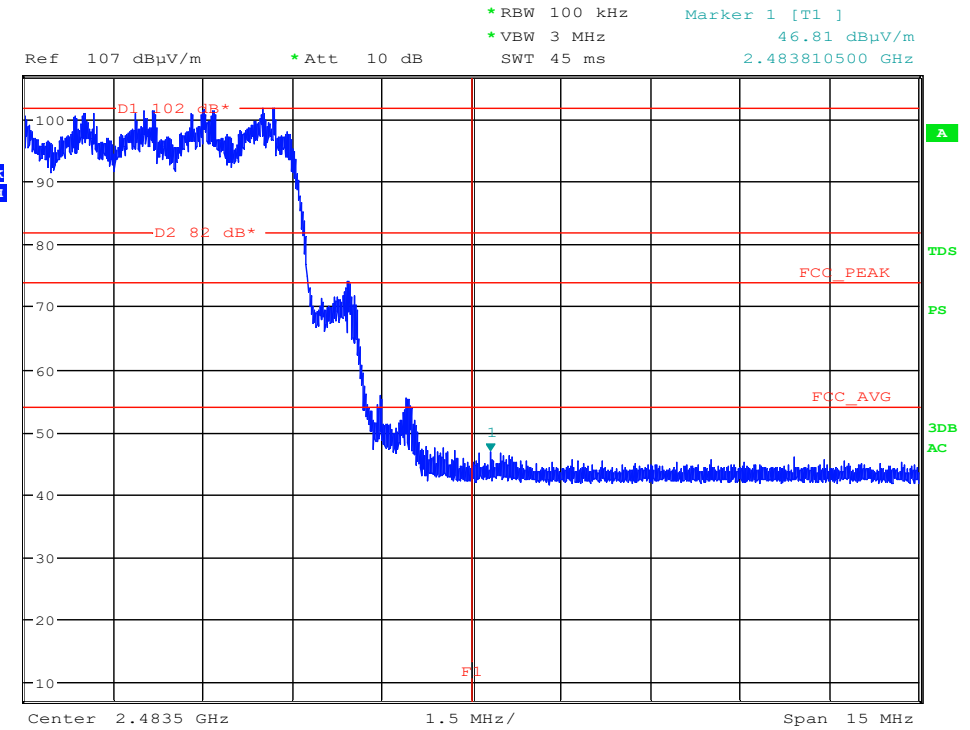


Upper Bandedge 3DH5

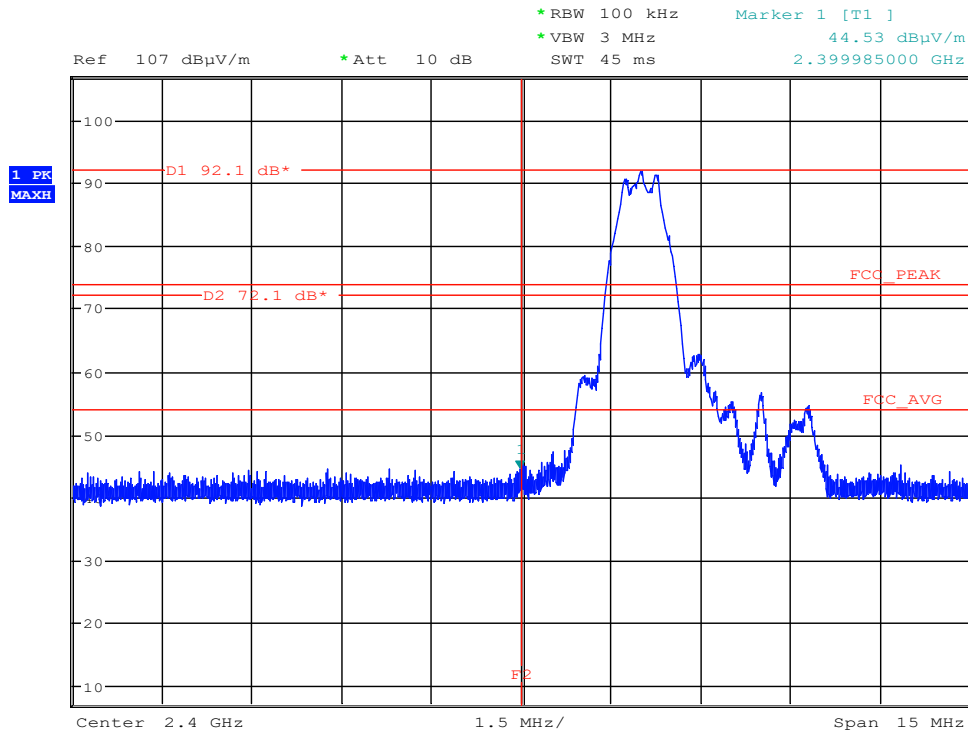
Lower Bandedge 3DH5



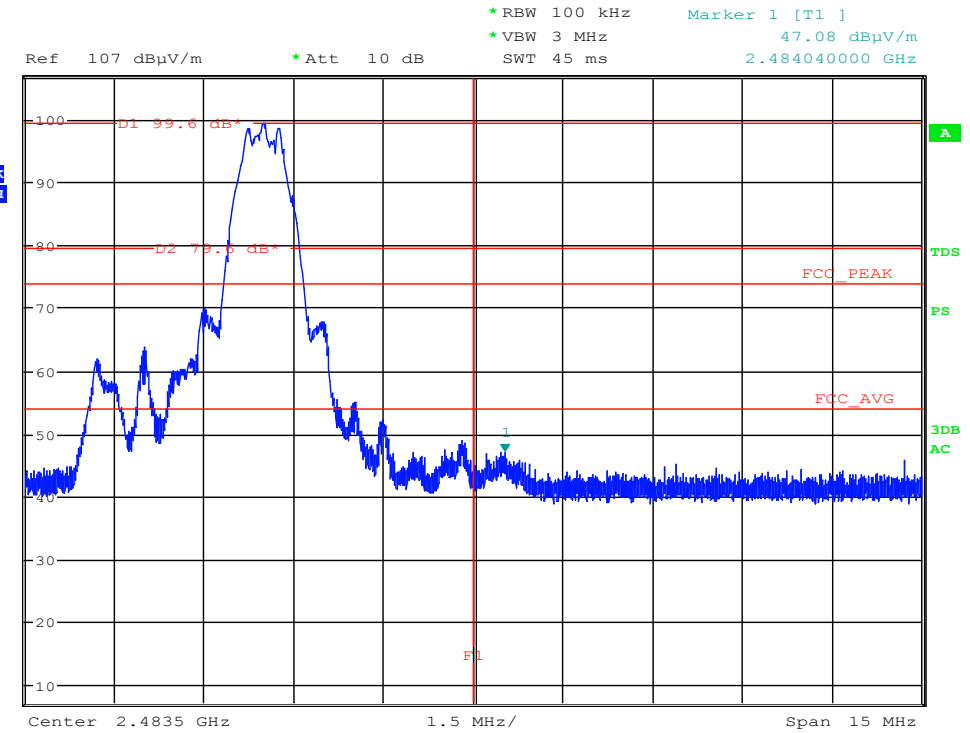
Lower Bandedge 3DH5, hopping



Upper Bandedge 3DH5, hopping



Lower Bandedge BLE

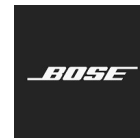


Upper Bandedge BLE

## Test Equipment Used:

| TN   | Description                                           | Model                    | S/N          | Manufacturer    | Most Recent Calibration | Calibration Due Date |
|------|-------------------------------------------------------|--------------------------|--------------|-----------------|-------------------------|----------------------|
| 2349 | Double Ridge Waveguide Horn Antenna 1-18GHz           | 3117                     | 00152406     | ETS Lindgren    | 27-Dec-2017             | 27-Dec-2018          |
| 2602 | Miteq pre-amp 1-18GHz 35dB                            | AFS42-01001800-28-10P-42 | N/A          | Miteq           | 09-Feb-2018             | 09-Feb-2019          |
| 2373 | RF Cable 30MHz-18GHz - 25 feet "N"                    | TRU-300                  | N/A          | TRU Corporation | Verify before use       |                      |
| 2479 | RF cable 30MHz-18GHz                                  | 257-257-3052640          | N/A          | SRC Haverhill   | 26-Jan-2018             | 26-Jan-2019          |
| 2357 | RF Cable 30MHz-18GHz                                  | TRU-300                  | TRU-12707-03 | TRU Corporation | 26-Jan-2018             | 26-Jan-2019          |
| 2414 | Band Reject Filter (2.4GHz)                           | BRM50702-07              | 003          | Micro-Tronics   | 07-Mar-2018             | 07-Mar-2019          |
| 2929 | Mini-circuits band-edge pre-amp 300 MHz - 8 GHz 20 dB | ZX60HV-83LN+             | N/A          | Mini-Circuits   | 20-Dec-2017             | 20-Dec-2018          |

Date(s) of test: 04-Oct-18, 08-Oct-18



# End of Report