# EMC TEST REPORT



Test Type: Emissions [X] Immunity []

Product Type: *Wireless module*

Product Name/Number: Bose® model 416549 Wireless Module

FCC ID: A94416549
IC: 3232A-416549

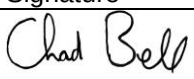
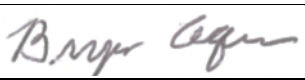
Prepared For: *Design Compliance Engineering Department, Bose Corporation*

Test Results: Pass [**X**] Fail []

Applicable Standards: FCC part 15, RSS210 , RSS-gen and ICES-003

Report Number: EMC.416549.15.15.1

General Comments/Special Test Conditions:
This report relates only to the items tested. This report covers EMC marking requirements for
*Enter product and any special modifications or test conditions.*

| | Print Name | Signature | Date |
|---|---|---|---|
| Prepared By: | Chad Bell |  | 1/22/15 |
| Electrical Engineer Review* By: | Bryan Cerqua |  | 2/20/15 |

* 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 or the reviewer to ensure the A2LA advertising policy is followed.*

**Table of Contents**

## 1.0 Test Report Summary

### 1.1 Product Information

Description:
Bose® model 416549 is a 2.4Ghz and 5GHz wireless module.

EUT Condition/Setup:
For conducted RF testing the antennas were disconnected and U.fl connectors were soldered to the board. U.fl to SMA cables were used to connect to test equipment. The loss of these cables was accounted for via transducer factors. For radiated measurements the long ribbon cables were used to extend the module as far from the enclosure as possible and the module was tested in 3 orthogonal orientations.

Scope
This report covers EMC requirements as defined by the standards indicated in section 2 of this report.

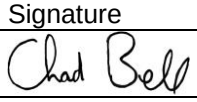
Test Objective
Verify product meets all applicable EMC requirements.

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

### 1.2 Conclusions

The device under test (D.U.T.):
[**X**] 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 | Chad Bell |  | 1/22/15 |

## 2.0 Test Standards

2.1 **Emissions:**

| | Standard | |
|---|---|---|
| [] | FCC Part 15B/Canada ICES-003 | **Class** A [] B [] |
| [X] | FCC Part 15C | |
| [X] | Canada RSS-210/RSS-310/RSS-GEN | |
| [] | EN 55013/CISPR-13/AS-NZS CISPR13/GB13837/CNS13439 | |
| [] | EN 55022/CISPR-22/AS-NZS CISPR22 | **Class** A [] B [] |
| [] | EN 55103-1 | |
| [] | EN 61000-3-2/GB17625.1 | |
| [] | EN 61000-3-3/GB17625.2 | |
| [] | EN 61000-6-3 | |
| [] | EN 61000-6-4 | |
| [] | EN 300 220/AS 4268.2 | |
| [] | EN 300 328 | |
| [] | EN 300 440 | |
| [] | EN 301 489 | |

2.2 **Immunity:**

| | Standard |
|---|---|
| [] | EN 55020/CISPR-20 |
| [] | EN 55024/CISPR-24 |
| [] | EN 55103-2 |
| [] | EN 61000-4-2 |
| [] | EN 61000-4-3 |
| [] | EN 61000-4-4 |
| [] | EN 61000-4-5 |
| [] | EN 61000-4-6 |
| [] | EN 61000-4-8 |
| [] | EN 61000-4-11 |
| [] | EN 61000-6-1 |
| [] | EN 61000-6-2 |
| [] | EN 301 489 |

## 3.0 Environmental Conditions

3.1 Ambient:

| | |
|---|---|
| Temperature: | 22±4°C |
| Humidity: | 30-60%RH |
| Mains Voltage: | [ ] 100VAC |
| | [X] 120VAC |
| | [ ] 230VAC |

## 4.0 Test Results Summary

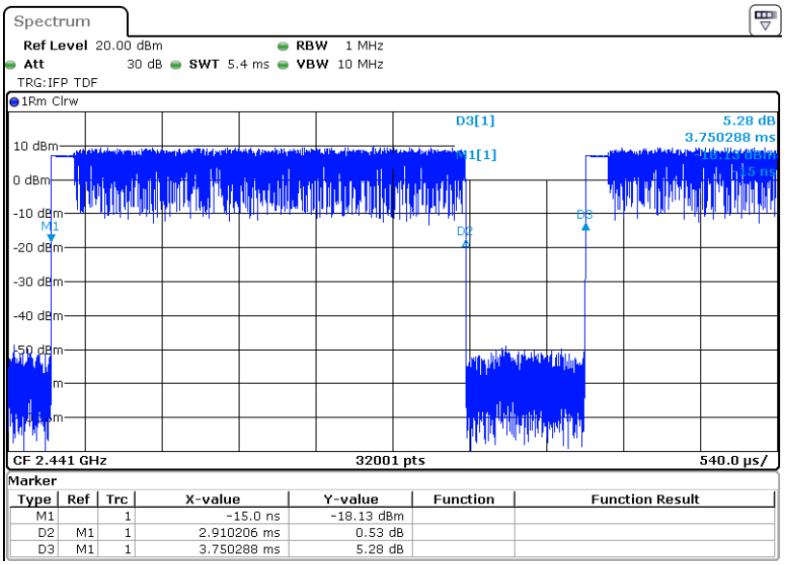
| FCC part 15 | RSS210 | RSS-Gen | Test references. | Result / Data section | Test Date |
|---|---|---|---|---|---|
| 15.15(b) | | 6.3 | There are no user-accessible controls for the adjustment of any transmitter parameters in the device under test. | Complies | N/A |
| 15.27 | | | There are no special devices such as shielded cables or special connectors required for compliance to the applicable standards. | Complies | N/A |
| 15.203 | | | An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.<br>The antennas are not accessible by the user. | Complies | N/A |
| 15.205 | 2.2 | | The device does not operate in either the US or Canadian restricted bands. | Complies Section 5.9 | 1/22/2015 |
| 15.247 (a)(2) | | 6.6 | 20 dB AND 99% Bandwidth | Complies Section 5.2 | 12/2/2014 |
| FCC 15.247 (a) (1) | A8.1 (b) | | Hopping frequency separation | Complies Section 5.3 | 12/11/2014 |
| 15.247 (a) (1) (iii) | A8.1 (d) | | Number of hopping channels | Complies Section 5.4 | 12/11/2014 |
| 5.247 (a) (1) (iii) | A8.1 (d) | | Average Time of Occupancy | Complies Section 5.5 | 12/11/2014 |
| 15.247 (b)(3) | A8.4 (2) | 6.12 | Maximum peak conducted output power | Complies Section 5.6 | 12/2/2014 |
| 15.247(d) | A8.5 | 6.13 | Conducted spurious emissions | Complies Section 5.7 | 11/25/2014 |
| 15.109 15.209 | | 8.9 | Radiated emissions < 1GHz | Complies Section 5.8 | 12/8/2014 |
| 15.247(d) | | 8.9, 8.10 | Radiated emissions > 1 GHz, Transmitter harmonics. | Complies Section 5.9 | 1/22/2015 |
| 15.107 15.207 | | 8.8 | Conducted emissions, 150kHz–30 MHz | Complies Section 5.10 | 12/2/2014 |
| | | 5.2, 7.1 | Receiver Spurious emissions | Not applicable only applies to stand-alone receivers | N/A |
| | | 6.11, 8.11 | Frequency Stability | Not applicable since the occupied bandwidth lies outside the restricted bands and the prohibited TV bands | N/A |

## 5.0 Individual Test Reports and Data

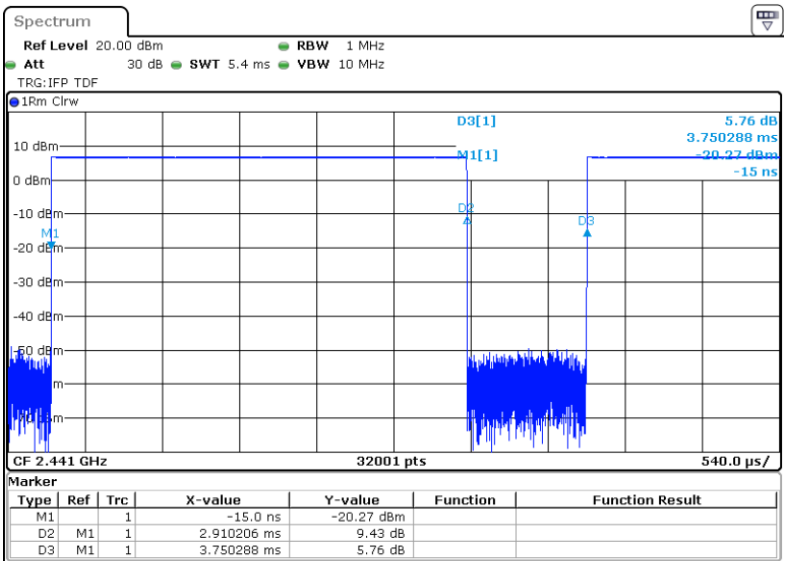
### 5.1 On time and Duty Cycle

| Mode | Pulse Width (uS) | Period (us) | Duty Cycle | Duty Cycle Correction Factor |
|---|---|---|---|---|
| GFSK | 2910 | 3750 | 0.776 | 1.101 |
| 8PSK | 2910 | 3750 | 0.776 | 1.101 |

There are no limits for this test. It is used to determine the duty cycle correction factor.



Basic Rate GFSK Duty Cycle Plot



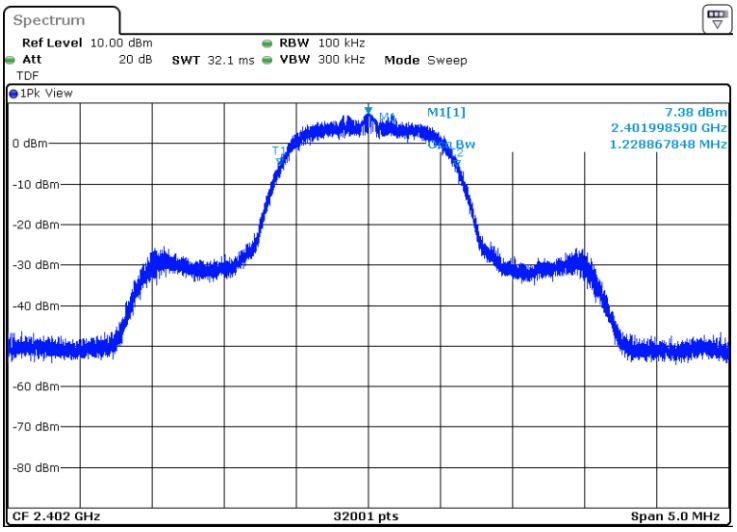
Enhanced Rate 8DPSK Duty Cycle Plot

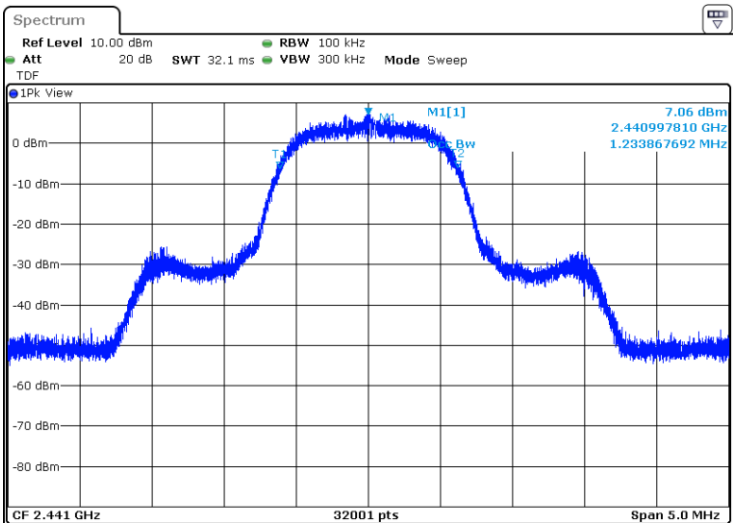
## 5.2 20 dB AND 99% Bandwidth

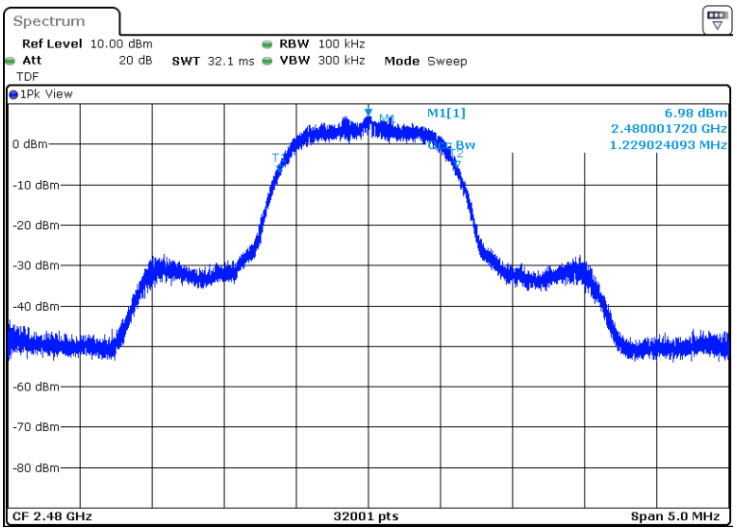
Requirement(s)
None, for reporting purposes only.

| Frequency (MHz) | Data Rate | Measurement Type | Bandwidth (kHz) |
|---|---|---|---|
| 2402 | DH5 | 99%_OBW | 916.3776 |
| 2441 | DH5 | 99%_OBW | 915.1277 |
| 2480 | DH5 | 99%_OBW | 917.3151 |
| 2402 | 3-DH5 | 99%_OBW | 1228.8678 |
| 2441 | 3-DH5 | 99%_OBW | 1233.8677 |
| 2480 | 3-DH5 | 99%_OBW | 1229.0241 |
| 2402 | DH5 | 20dB_OBW | 1007.7800 |
| 2441 | DH5 | 20dB_OBW | 984.0300 |
| 2480 | DH5 | 20dB_OBW | 972.4700 |
| 2402 | 3-DH5 | 20dB_OBW | 1356.8300 |
| 2441 | 3-DH5 | 20dB_OBW | 1338.7100 |
| 2480 | 3-DH5 | 20dB_OBW | 1340.7400 |

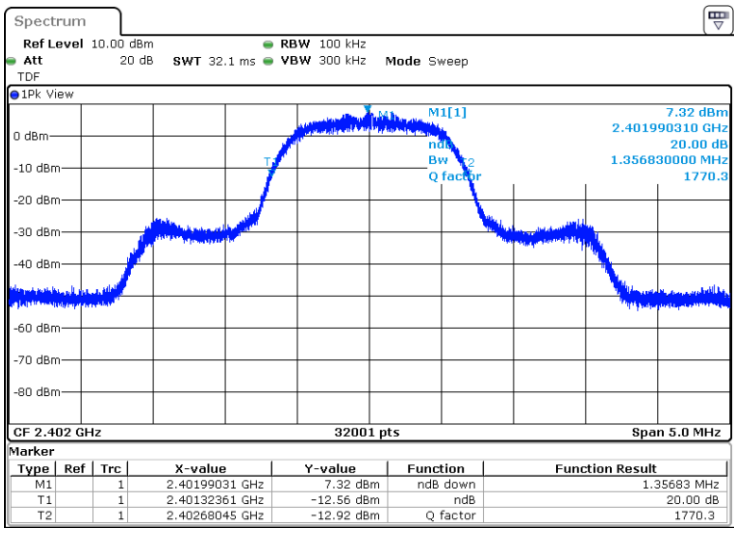
Representative 99% Bandwidth Plots

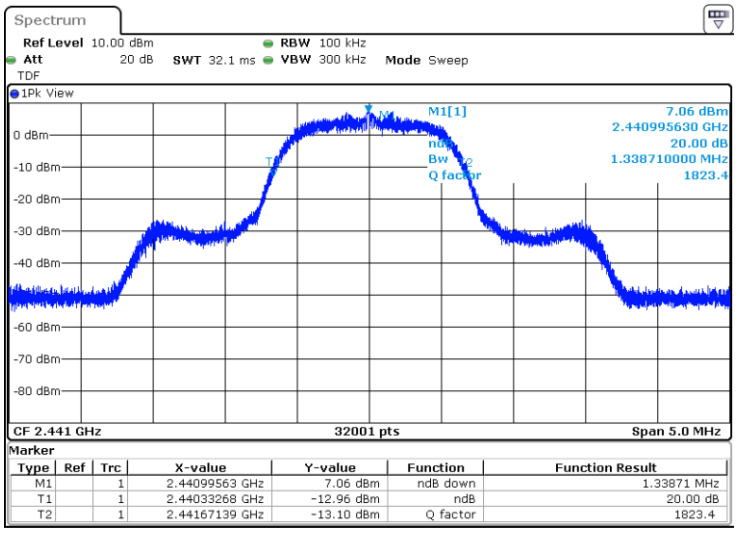


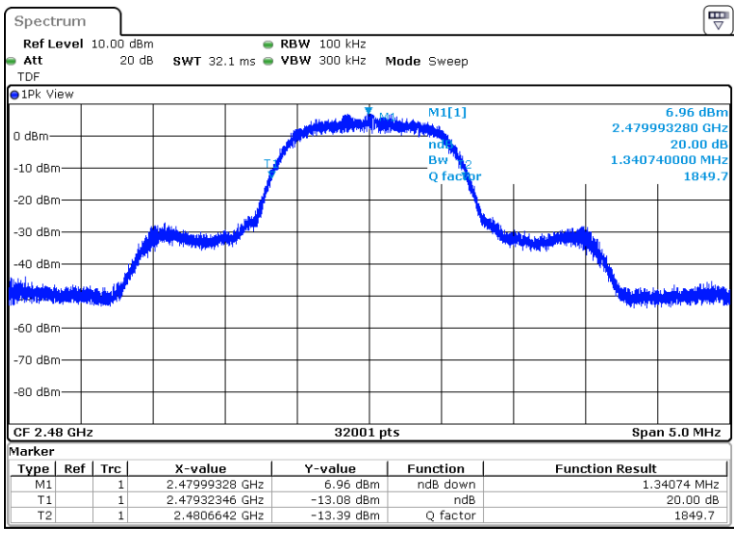



Representative 20dB Bandwidth Plots



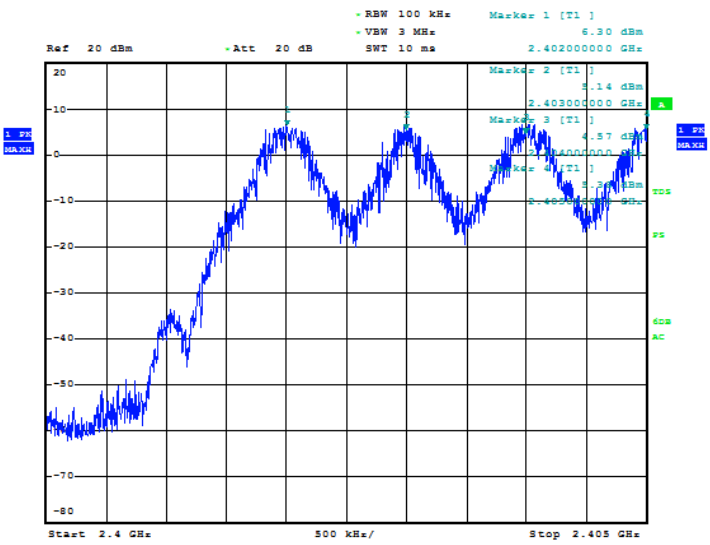



### 5.3 Hopping frequency separation

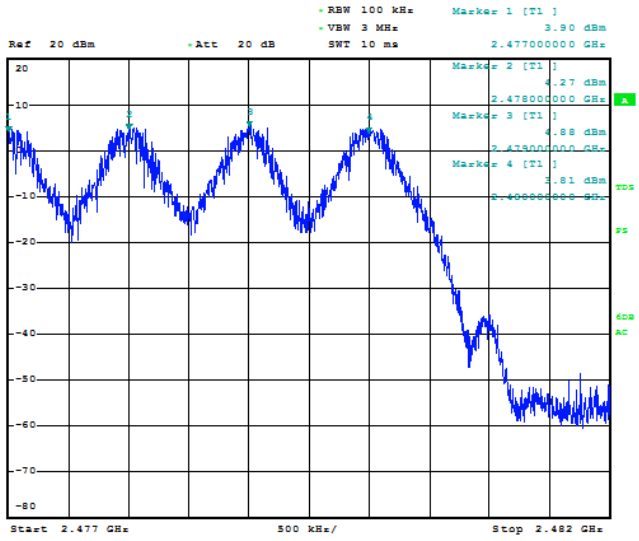
Requirement(s)

FCC 15.247 (a) (1)
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.

IC RSS-210 A8.1 (b)
Alternatively, frequency hopping systems operating in the band 2400–2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.




Low end Hopping Frequency Separation




High end Hopping Frequency Separation

**Test Results**

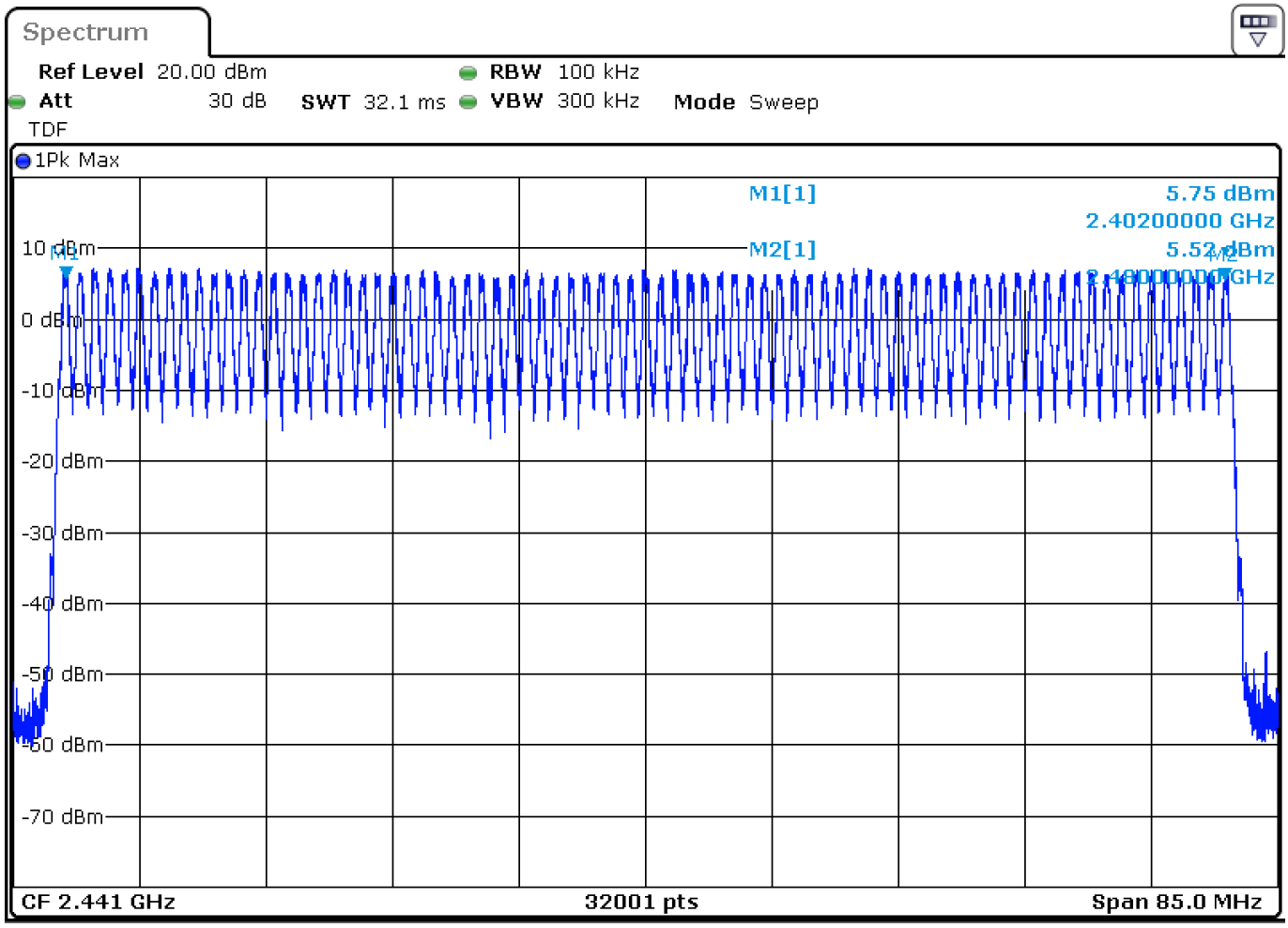
Since the 1MHz hopping frequency seperation is less than the highest 20dB occupied bandwidth of 1.357MHz but greater than 2/3 of the highest 20dB occupied bandwidth the output power no greater than 125 mW.

### 5.4 Number of hopping channels

Requirement(s)

FCC 15.247 (a) (1) (iii)
Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

IC RSS-210 A8.1 (d)
Frequency hopping systems operating in the band 2400–2483.5 MHz shall use at least 15 hopping channels.




**Test Results**

In normal hopping mode there are 79 hopping channels observed which is greater than the minimum required 15 hopping channels. The specification requires a minimum set of at least twenty channels.

### 5.5 Average time of occupancy

FCC 15.247 (a) (1) (iii)
IC RSS-210 A8.1 (d)

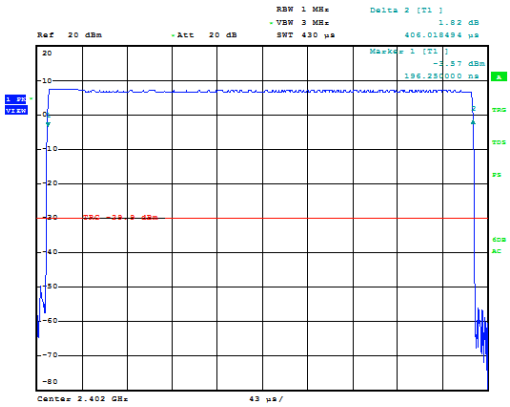
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

**Test Method**
The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

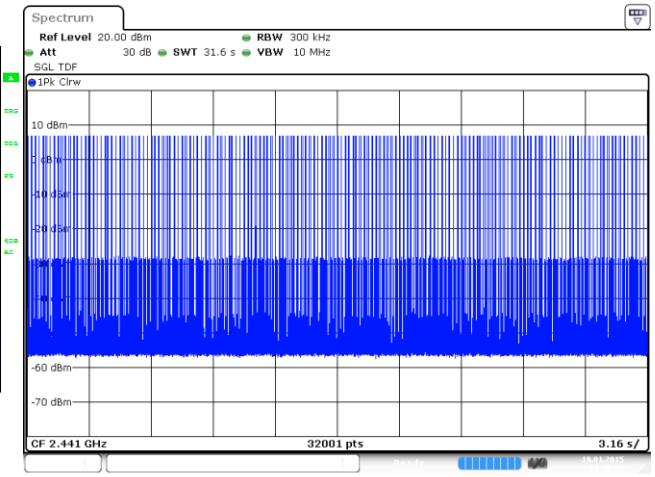
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

**Test Results**

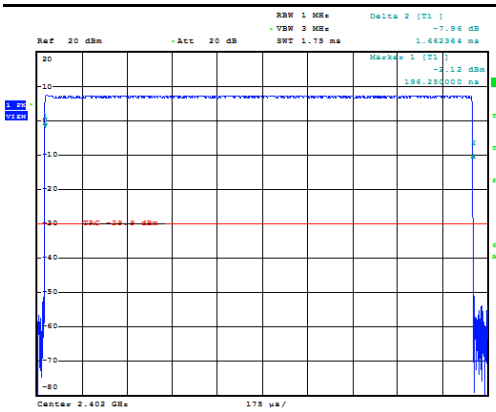
| Mode | # of Slots | Pulse Width (uS) | Number of pulses in 31.6 seconds | Dwell Time (s) | Limit (s) | Result |
|---|---|---|---|---|---|---|
| DH1 | 2 | 406 | 196 | 0.080 | 0.400 | Pass |
| DH3 | 4 | 1662 | 130 | 0.216 | 0.400 | Pass |
| DH5 | 6 | 2909 | 87 | 0.253 | 0.400 | Pass |
| | | | | | | |



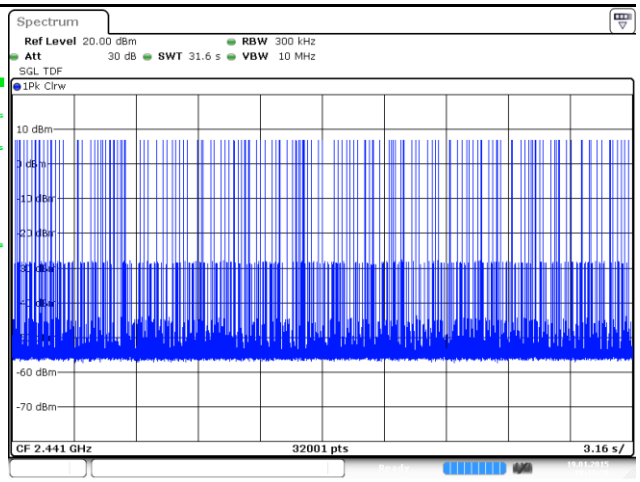

DH1 Pulse Width
Date: 11.DEC.2014 12:16:45



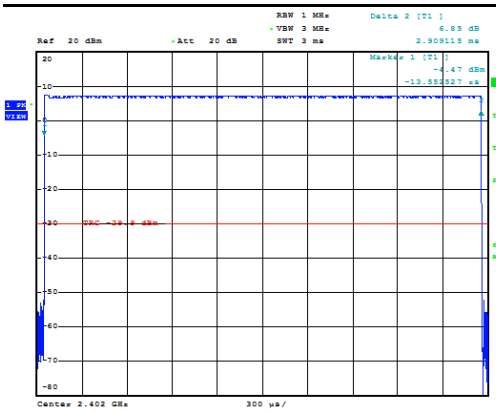

DH1 number of pulses



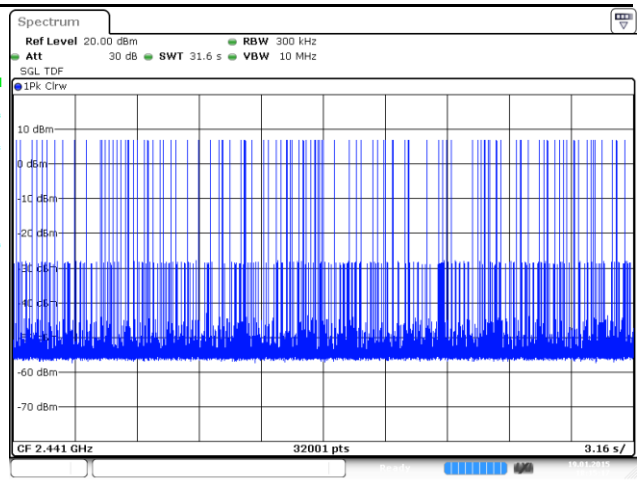

DH3 Pulse Width
Date: 11.DEC.2014 12:18:52




DH3 number of pulses




DH5 Pulse Width
Date: 11.DEC.2014 12:23:54




DH5 number of pulses

## 5.6 Output power

**Requirement(s)**

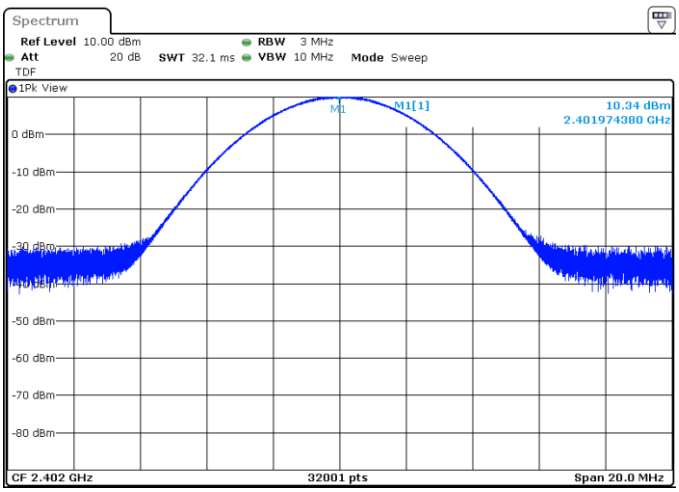
Since the 1MHz hopping frequency seperation is less than the highest 20dB occupied bandwidth of 1.357MHz but greater than 2/3 of the highest 20dB occupied bandwidth the output power no greater than 125 mW.

15.247 (b) (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.**

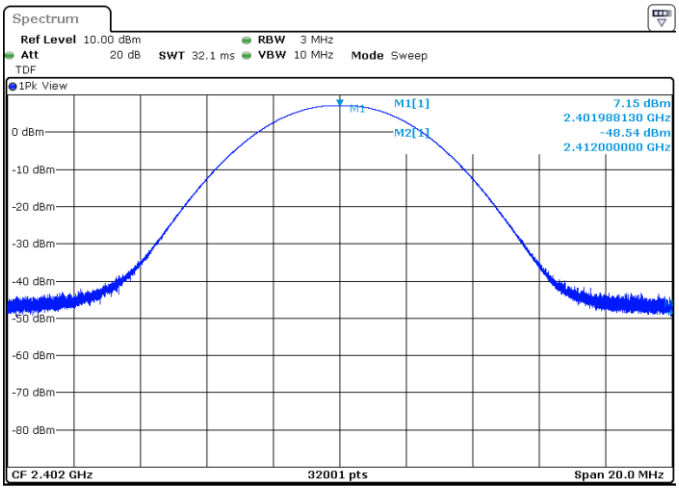
**Test Method**

Measure per KDB 558074 v03r02 section 9.1.1 RBW ≥ DTS bandwidth

| Frequency (MHz) | Data Rate | Output Power (dBm) | Limit (dBm) | Margin (dBm) |
|---|---|---|---|---|
| 2402 | DH5 | 7.15 | 21.00 | 13.8500 |
| 2441 | DH5 | 6.82 | 21.00 | 14.1800 |
| 2480 | DH5 | 6.75 | 21.00 | 14.2500 |
| 2402 | 3-DH5 | 10.34 | 21.00 | 10.6600 |
| 2441 | 3-DH5 | 10.16 | 21.00 | 10.8400 |
| 2480 | 3-DH5 | 10.04 | 21.00 | 10.9600 |




Representative EDR power measurement




Representative Basic Rate power measurement

## 5.7 Conducted Spurious Emissions

**Requirement(s)**

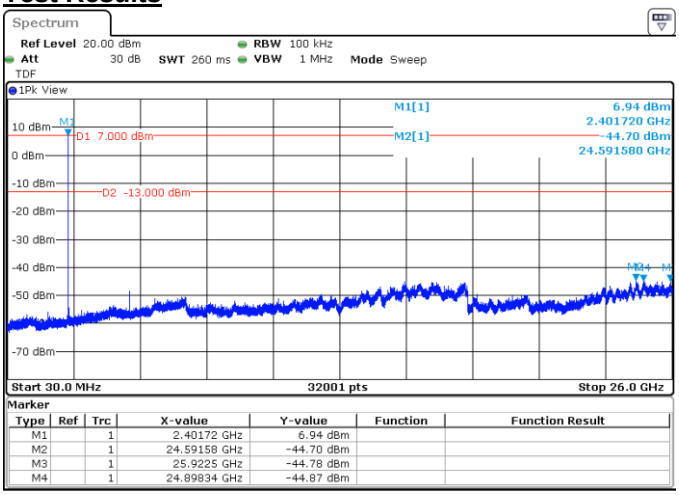
FCC 15.247 (d)/ IC RSS-210 A8.5

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.

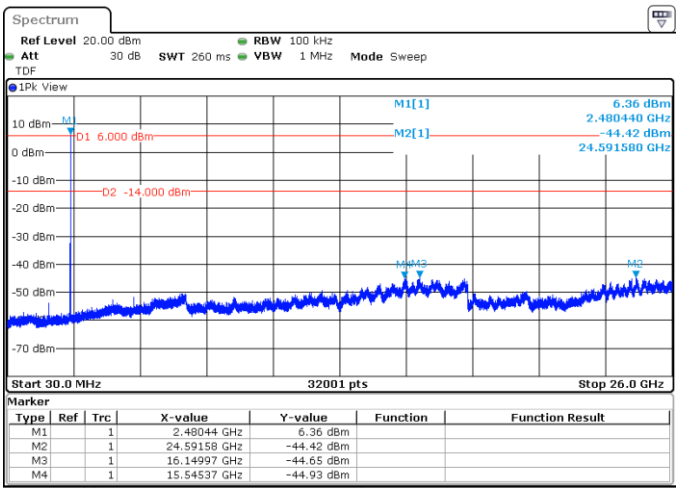
**Test Method**

Measure per KDB 558074 v03r02 section 11.0

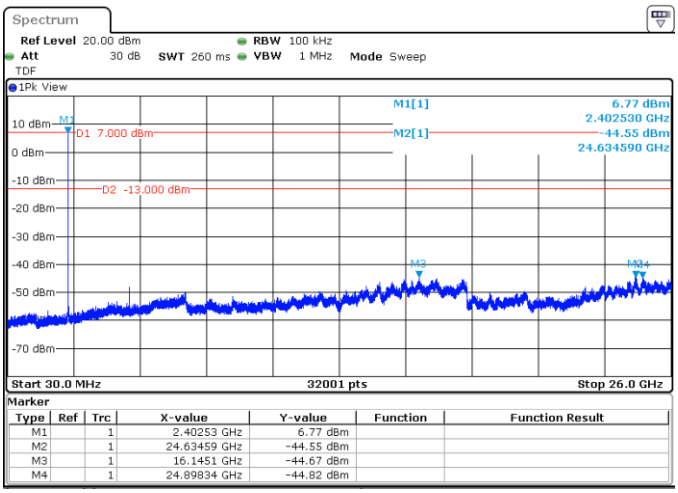
**Test Results**



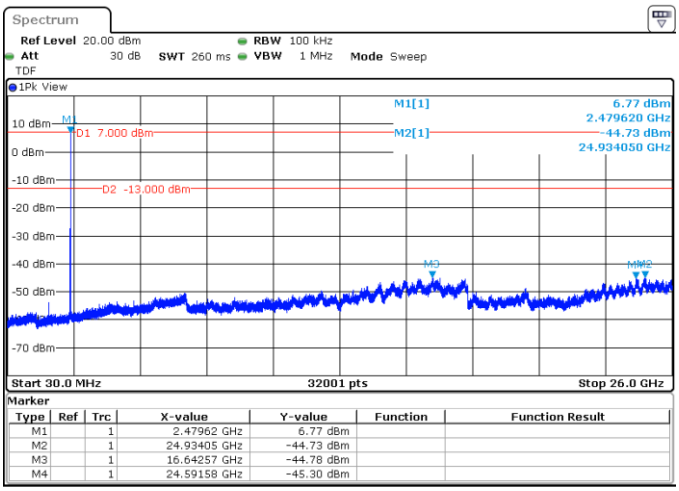

Low Channel DH5 spurious



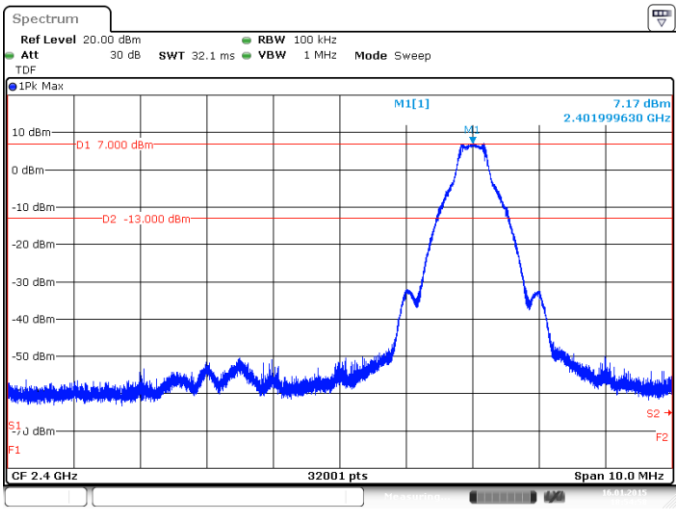

High Channel DH5 spurious




Low Channel 3DH5 spurious

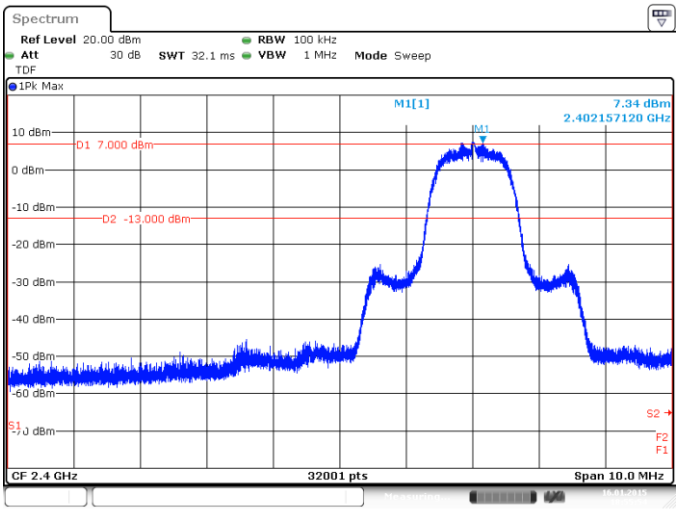



High Channel 3DH5 spurious



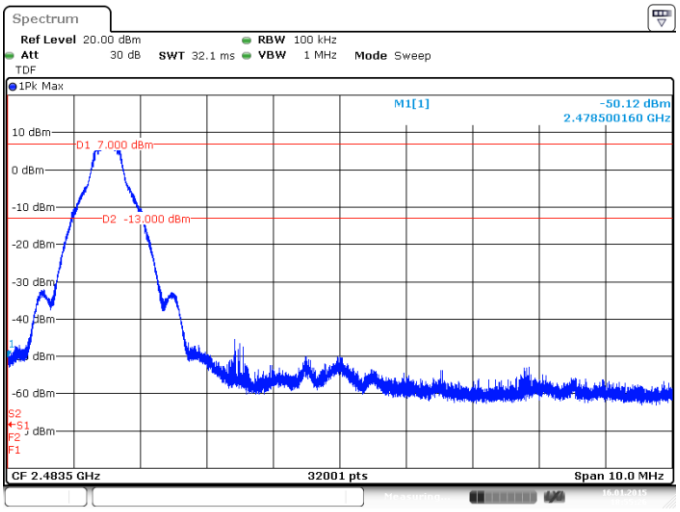

T1 L Band Edge 2402MHz DH5 P7 ANT2

DH5 spurious lower band edge



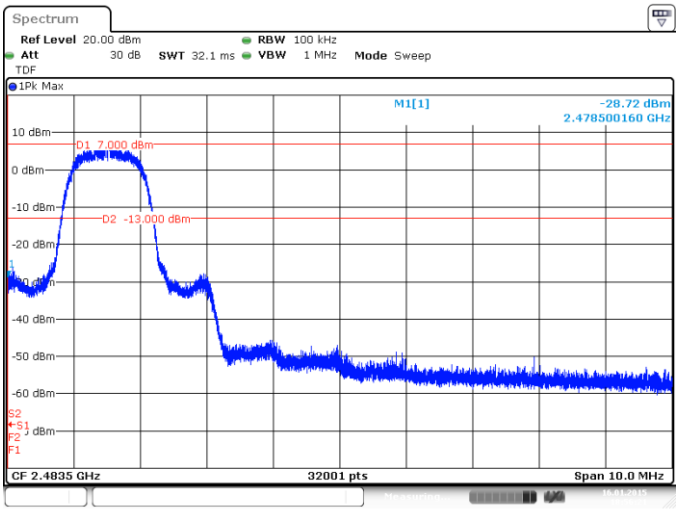

T2 U Band Edge 2480MHz DH5 P7 ANT2

3DH5 spurious lower band edge




T2 U Band Edge 2480MHz DH5 P7 ANT2

DH5 spurious upper band edge




T2 U Band Edge 2480MHz DH5 P7 ANT2

3DH5 spurious upper band edge

**Test Results**

All emissions outside of the 2.4-2.4835GHz band are more than the required 20dB below the fundamental.

### 5.8 Radiated Emissions Below 1GHz

**Requirement(s)**

FCC 15.205 and 15.209

| Frequency | Limit in uV/m @ 3m | Limit in dBµV/m @3m |
|---|---|---|
| MHz | Quasi-peak | Quasi-peak |
| 30 – 88 | 100 | 40 |
| 88 - 216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500* | 54* |

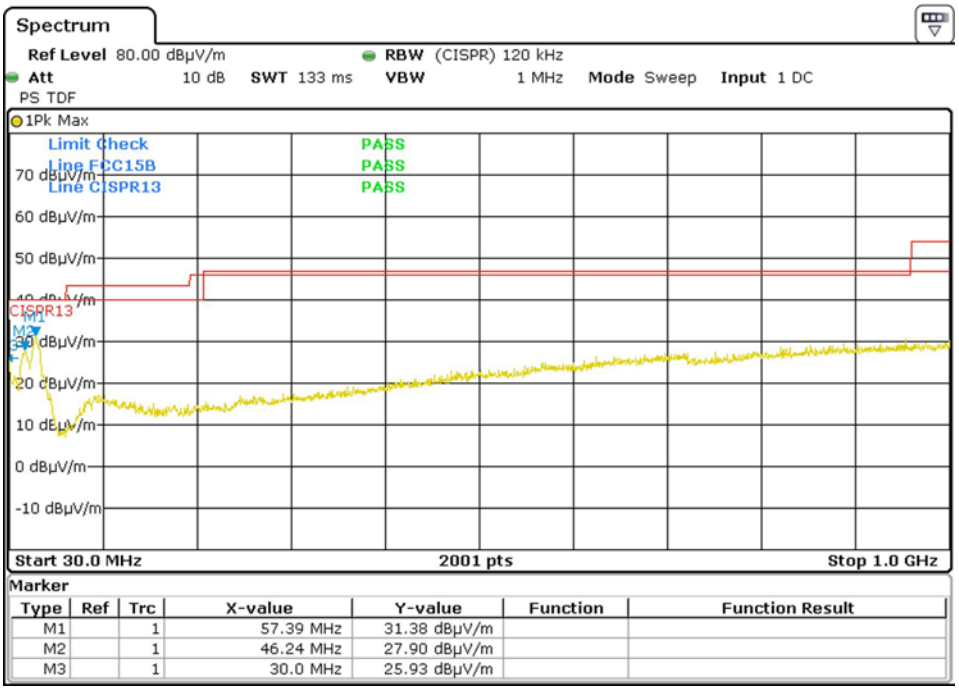
**Test setup details**

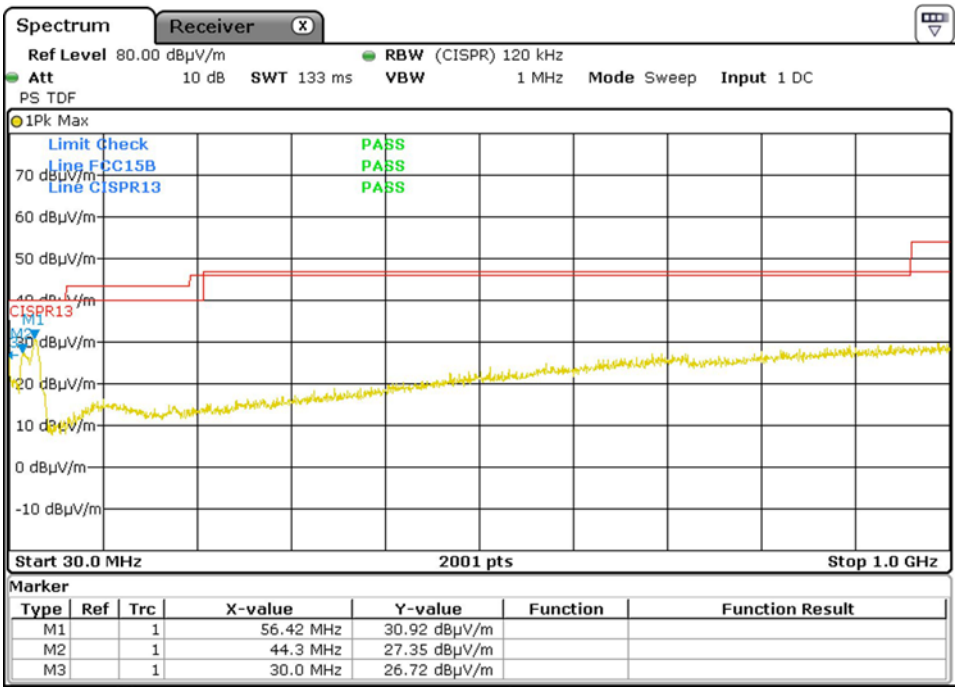
The EUT was placed on an 80 cm high table and configured for worst case emissions based on previous testing. EUT was maximized in 3 orthogonal planes for radiated spurious emissions; plots shown represent worst case orientation.

Photos of the orientations are included in the Test Setup Photos document.

**Test Results**

| Emission Frequency (MHz) | Measured Amplitude (dBµV/m) QP/AVG* | Measured Amplitude (dBµV/m) Peak | FCC 15B Limit (dBµV/m) QP/AVG* | FCC 15B Limit (dBµV/m) Peak | FCC 15B Margin (dB) QP/AVG* | FCC 15B Margin (dB) Peak | Table Azimuth (0° closest to ant) | Receiving Antenna Pol (H/V) | Receiving Antenna Height (Meters) | *Average detector used for frequencies above 1 GHz. Notes / Mode |
|---|---|---|---|---|---|---|---|---|---|---|
| 30.000 | 23.00 | 29.00 | 40.0 | N/A | 17.0 | N/A | 330 | V | 1.0 | Hopping in EDR Mode |
| 46.240 | 25.20 | 28.30 | 40.0 | N/A | 14.8 | N/A | 146 | V | 1.0 | Hopping in EDR Mode |
| 57.390 | 29.60 | 32.80 | 40.0 | N/A | 10.4 | N/A | 280 | V | 1.0 | Hopping in EDR Mode |
| 30.000 | 23.00 | 29.00 | 40.0 | N/A | 17.0 | N/A | 330 | V | 1.0 | Hopping in Basic Rate Mode |
| 46.240 | 25.20 | 28.30 | 40.0 | N/A | 14.8 | N/A | 146 | V | 1.0 | Hopping in Basic Rate Mode |
| 57.390 | 29.60 | 32.80 | 40.0 | N/A | 10.4 | N/A | 280 | V | 1.0 | Hopping in Basic Rate Mode |






**Test Results Summary**

Worst case emission is passing Class B by 10.4dB.

## 5.9 Radiated Emissions Above 1GHz

**Requirement(s)**

FCC 15.205 and 15.209

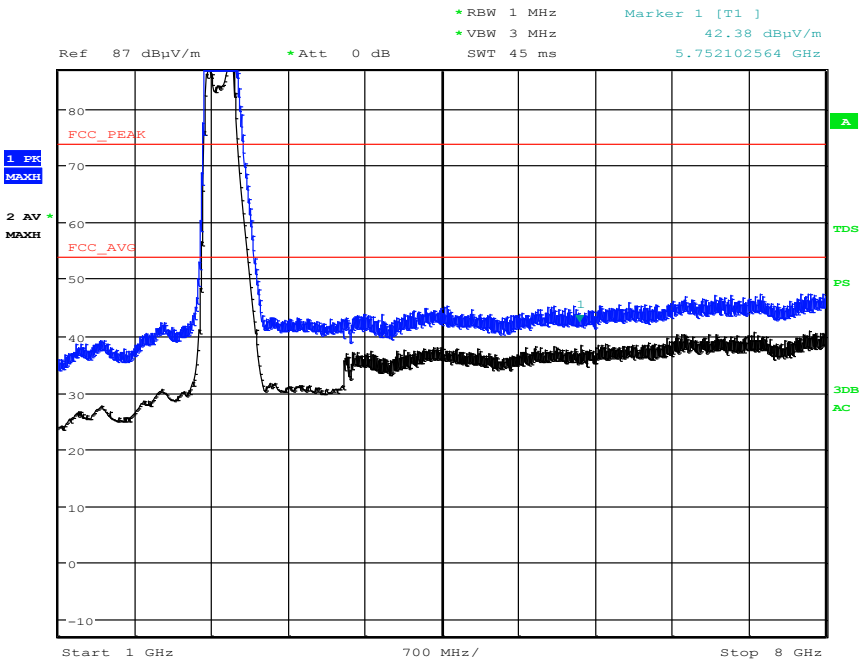
| Frequency | Limit in uV/m @ 3m | Limit in dBµV/m @3m |
|---|---|---|
| MHz | Quasi-peak | Quasi-peak |
| 30 – 88 | 100 | 40 |
| 88 - 216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500* | 54* |

**Test setup details**

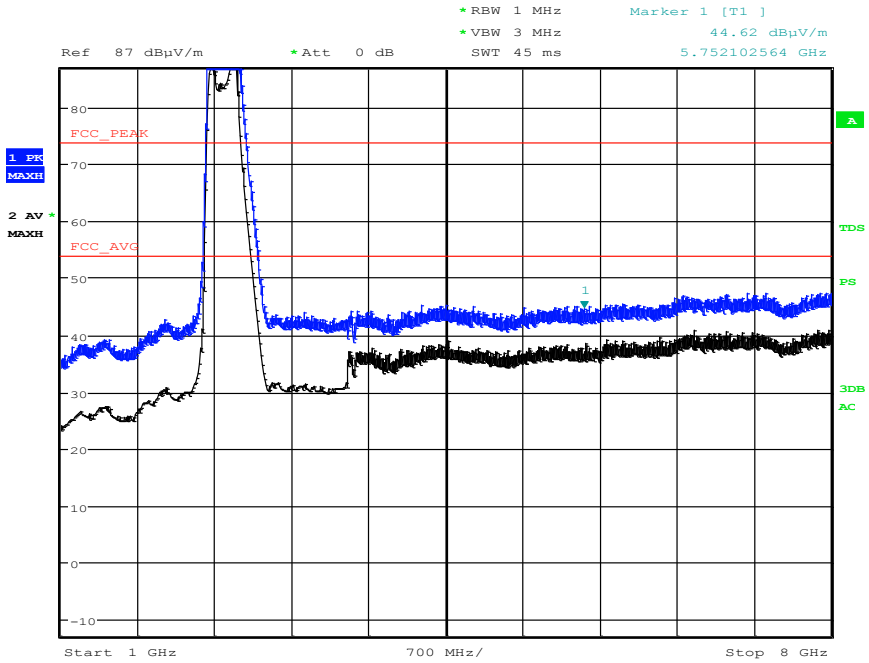
The EUT was placed on an 80 cm high table and configured for worst case emissions based on previous testing. EUT was maximized in 3 orthogonal planes for radiated spurious emissions; plots shown represent worst case orientation.

Photos of the orientations are included in the Test Setup Photos document.

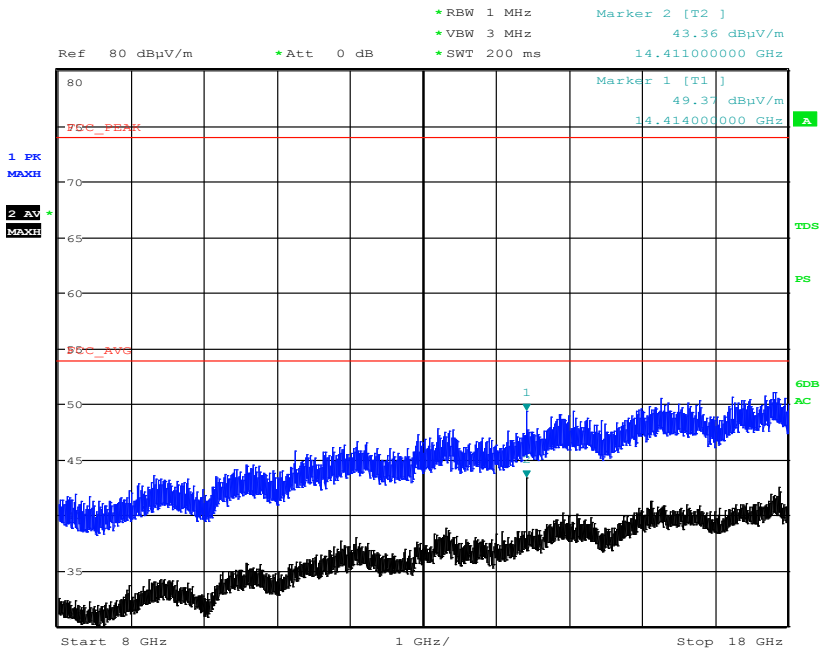
**Test Results**



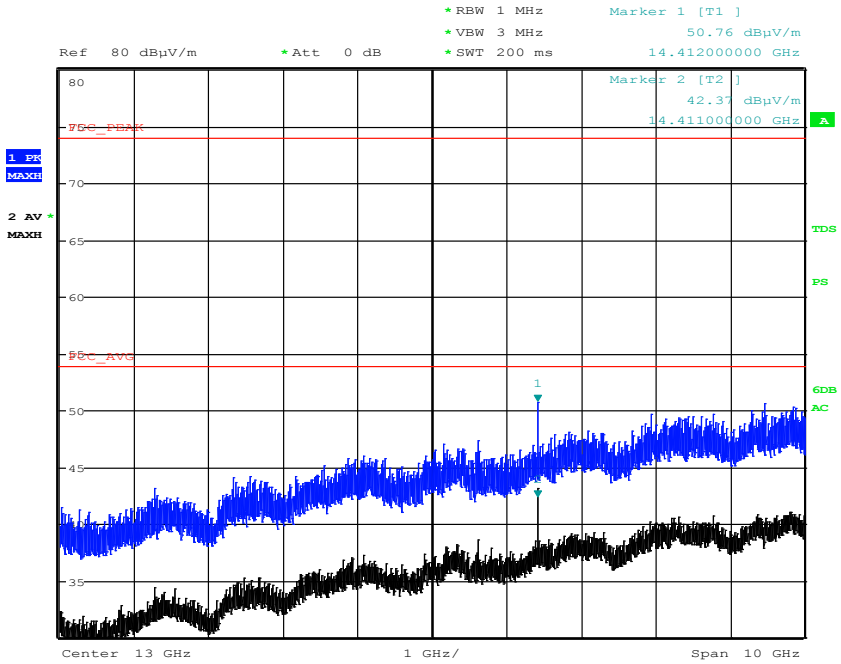

Max-Hold Peak Pre-scan, 1 - 8GHz, 3 orthogonal axes measured representative plot shown, Basic Rate Mode, The spike above the limit is due to the correction factor for the 2.4GHz band reject filter, this will be examined more closely during band-edge measurements. Trace shows Horizontal and Vertical polarity. There are no emissions within 10dB of the limit line.



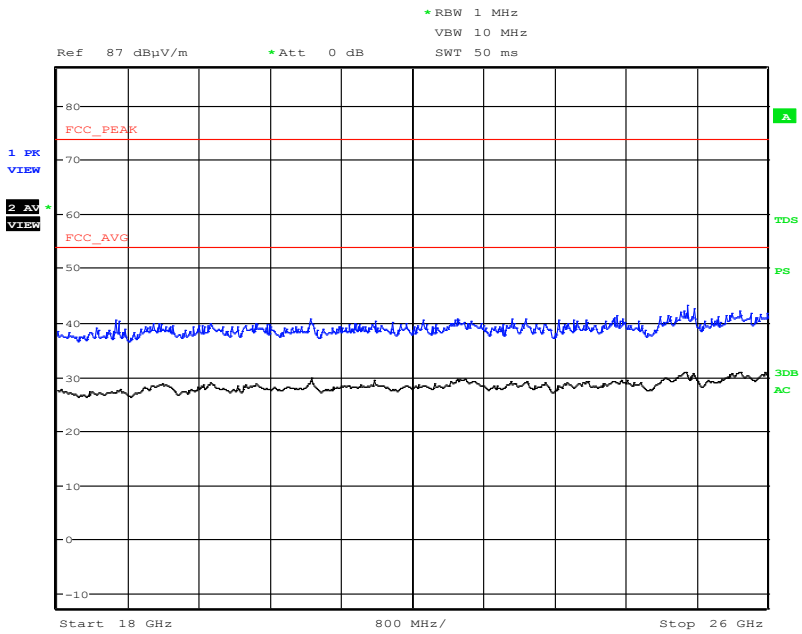

Max-Hold Peak Pre-scan, 1 - 8GHz, 3 orthogonal axes measured representative plot shown, EDR Mode, The spike above the limit is due to the correction factor for the 2.4GHz band reject filter, this will be examined more closely during band-edge measurements. Trace shows Horizontal and Vertical polarity. There are no emissions within 10dB of the limit line.




Max-Hold Peak Pre-scan, 8-18GHz, , 3 orthogonal axes measured representative plot shown, Basic Rate, Trace shows Horizontal and Vertical polarity. There are no emissions within 10dB of the limit line.




Max-Hold Peak Pre-scan, 8-18GHz, , 3 orthogonal axes measured representative plot shown, EDR Mode, Trace shows Horizontal and Vertical polarity. There are no emissions within 10dB of the limit line.




Max-Hold Peak Pre-scan, 18-26GHz, Analyzer was on max hold through all 3 orientations, Trace shows Horizontal and Vertical polarity.

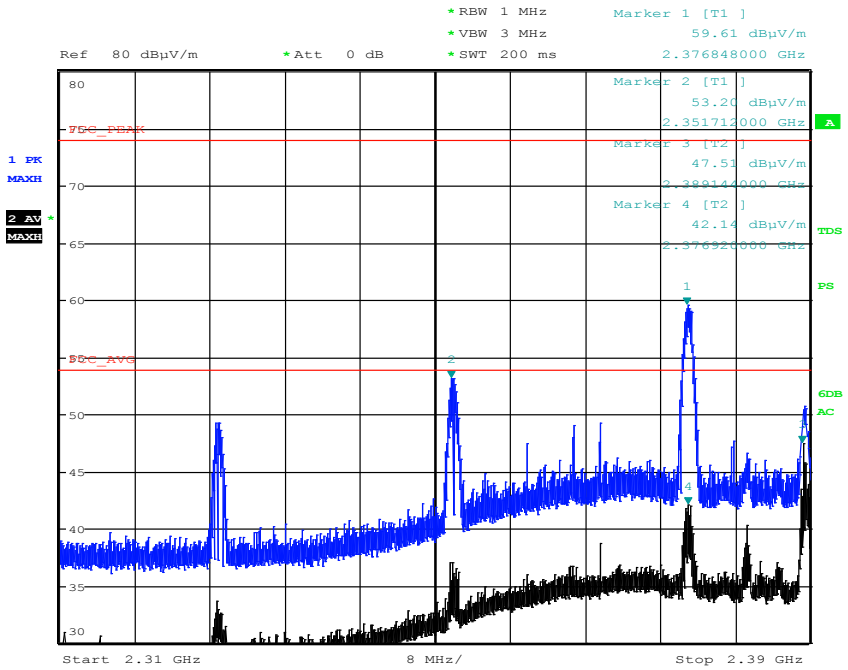
There are no emissions within 10dB of the limit.

## Test Results Summary

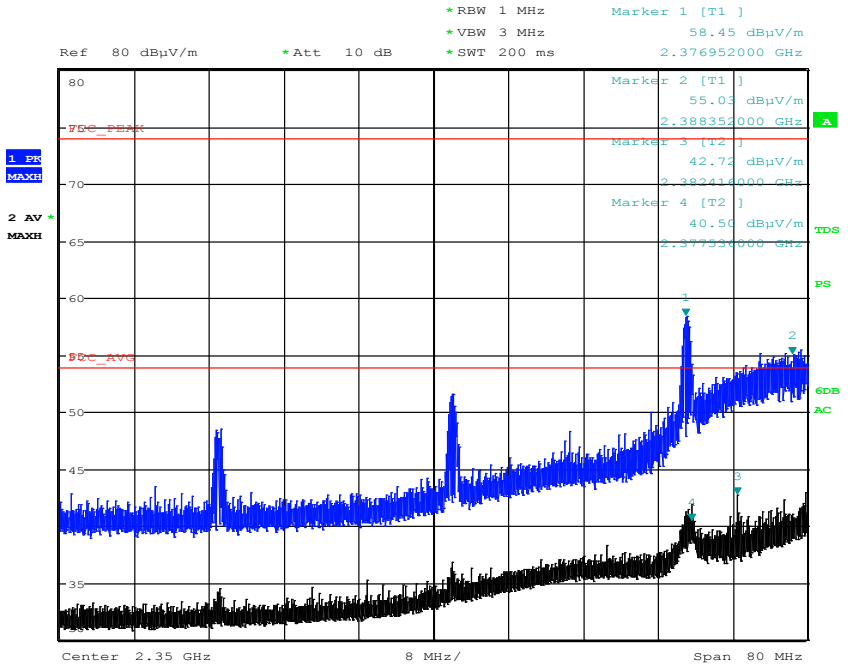
Bose® model 416549 Wireless Module passes radiated emissions above 1GHz since there were not any emissions observed during the pre-scan that were within 10dB of the limit

### 5.9.1 Restricted Band edge

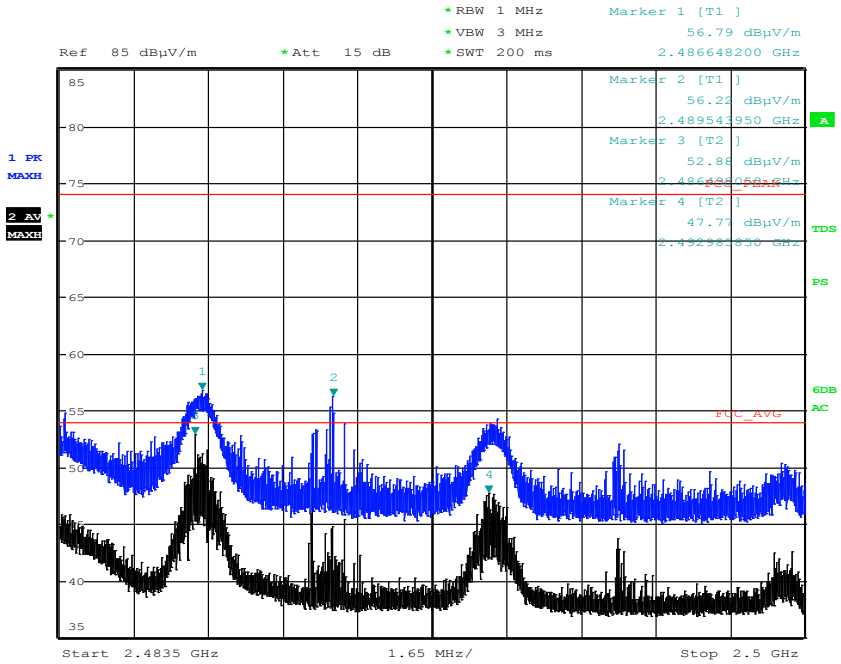
## Test Results



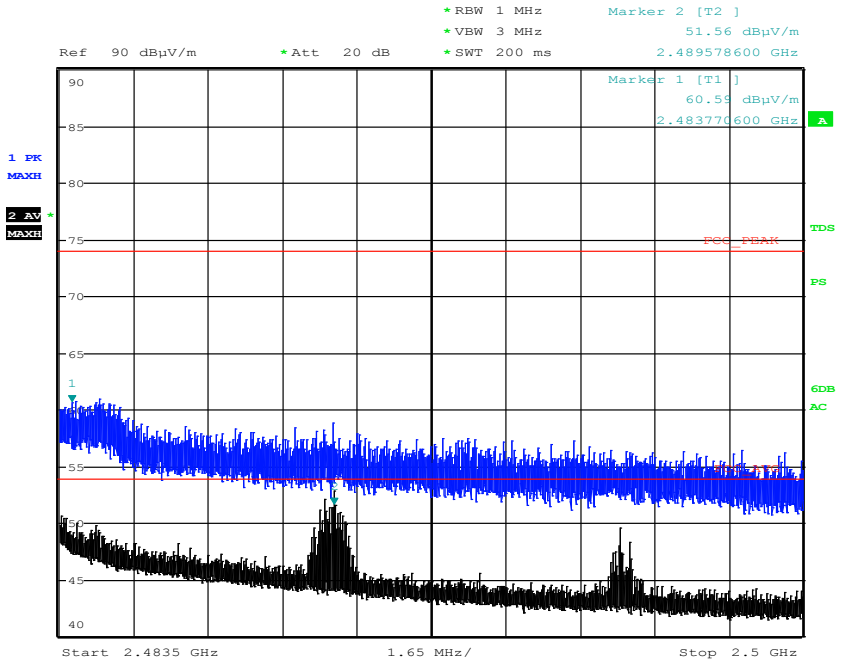

Max-Hold Peak Pre-scan, Lower Band Edge (2310-2390MHz), Basic Rate Mode, Trace shows Horizontal and Vertical polarity.




Max-Hold Peak Pre-scan, Lower Band Edge (2310-2390MHz), EDR, Trace shows Horizontal and Vertical polarity.




Max-Hold Peak Pre-scan, Upper Band Edge (2483.5-2500MHz), Basic Rate Mode, Trace shows Horizontal and Vertical polarity.




Max-Hold Peak Pre-scan, Upper Band Edge (2483.5-2500MHz), EDR, Trace shows Horizontal and Vertical polarity.

| FCC 15B Class B Product (Residential) @ 3 Meters | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Emission Frequency (MHz) | Measured Amplitude (dBµV/m) QP/AVG* | Measured Amplitude (dBµV/m) Peak | FCC 15B Limit (dBµV/m) QP/AVG* | FCC 15B Limit (dBµV/m) Peak | Margin (dB) QP/AVG* | Margin (dB) Peak | Table Azimuth (0° closest to ant) | Receiving Antenna Pol (H/V) | Receiving Antenna Height (Meters) | *Average detector used for frequencies above 1 GHz. Notes / Mode |
| | | | | | | | | | | LOWER BAND EDGE |
| | | | | | | | | | | EUT orientation 1. (Carrier antenna end facing horn antenna) |
| 2351.712 | 28.70 | 51.90 | 54.0 | 74.0 | 25.3 | 22.1 | 160.0 | H | 1.57 | Calibrator(4,2402, -60, -65535, 7,2) Basic Rate |
| 2389.144 | 30.70 | 50.40 | 54.0 | 74.0 | 23.3 | 23.6 | 160.0 | H | 1.57 | Calibrator(4,2402, -60, -65535, 7,2) Basic Rate |
| 2326.944 | 26.80 | 48.90 | 54.0 | 74.0 | 27.2 | 25.1 | 160.0 | H | 1.57 | Calibrator(4,2402, -60, -65535, 7,2) Basic Rate |
| 2376.864 | 32.60 | 60.70 | 54.0 | 74.0 | 21.4 | 13.3 | 136.0 | H | 2.06 | Calibrator(4,2402, -60, -65535, 7,2) Basic Rate |
| 2376.864 | 35.70 | 60.80 | 54.0 | 74.0 | 18.3 | 13.2 | 136.0 | H | 2.06 | Calibrator(4,2402, -120, -65535, 7,2) EDR Rate |
| 2390.000 | 36.80 | 57.90 | 54.0 | 74.0 | 17.2 | 16.1 | 136.0 | H | 2.06 | Calibrator(4,2402, -120, -65535, 7,2) EDR Rate |
| 2377.096 | 35.80 | 60.60 | 54.0 | 74.0 | 18.2 | 13.4 | 136.0 | H | 2.06 | Calibrator(4,2402, -120, -65535, 7,2) EDR Rate |
| | | | | | | | | | | EUT orientation 2. (Carrier antenna end facing horn antenna) |
| 2376.864 | 27.90 | 51.10 | 54.0 | 74.0 | 26.1 | 22.9 | 160.0 | H | 1.57 | Calibrator(4,2402, -60, -65535, 7,2) Basic Rate |
| 2376.864 | 29.20 | 51.40 | 54.0 | 74.0 | 24.8 | 22.6 | 160.0 | H | 1.57 | Calibrator(4,2402, -120, -65535, 7,2) EDR Rate |
| 2390.000 | 29.20 | 51.40 | 54.0 | 74.0 | 24.8 | 22.6 | 160.0 | H | 1.57 | Calibrator(4,2402, -120, -65535, 7,2) EDR Rate |
| 2377.096 | 29.10 | 50.90 | 54.0 | 74.0 | 24.9 | 23.1 | 160.0 | H | 1.57 | Calibrator(4,2402, -120, -65535, 7,2) EDR Rate |
| | | | | | | | | | | EUT orientation 3. (Carrier antenna end facing horn antenna) |
| 2376.864 | 29.50 | 55.10 | 54.0 | 74.0 | 24.5 | 18.9 | 119.0 | H | 1.4 | Calibrator(4,2402, -60, -65535, 7,2) Basic Rate |
| 2376.864 | 29.20 | 54.60 | 54.0 | 74.0 | 24.8 | 19.4 | 119 | H | 1.4 | Calibrator(4,2402, -120, -65535, 7,2) EDR Rate |
| 2390.000 | 28.90 | 43.90 | 54.0 | 74.0 | 25.1 | 30.1 | 124.0 | H | 1.4 | Calibrator(4,2402, -120, -65535, 7,2) EDR Rate |
| 2377.096 | 29.20 | 54.50 | 54.0 | 74.0 | 24.8 | 19.5 | 118.0 | H | 1.4 | Calibrator(4,2402, -120, -65535, 7,2) EDR Rate |
| | | | | | | | | | | |
| | | | | | | | | | | UPPER BAND EDGE |
| | | | | | | | | | | EUT orientation 1. (Carrier antenna end facing horn antenna) |
| 2483.500 | 40.50 | 56.20 | 54.0 | 74.0 | 13.5 | 17.8 | 137 | H | 1.4 | Calibrator(4,2480, -60, -65535, 7,2) Basic Rate |
| 2486.518 | 35.30 | 55.20 | 54.0 | 74.0 | 18.7 | 18.8 | 137 | H | 1.4 | Calibrator(4,2480, -60, -65535, 7,2) Basic Rate |
| 2489.544 | 32.00 | 53.30 | 54.0 | 74.0 | 22.0 | 20.7 | 144 | H | 1.4 | Calibrator(4,2480, -60, -65535, 7,2) Basic Rate |
| 2492.986 | 34.10 | 54.70 | 54.0 | 74.0 | 19.9 | 19.3 | 144 | H | 1.4 | Calibrator(4,2480, -60, -65535, 7,2) Basic Rate |
| 2483.500 | 43.50 | 60.90 | 54.0 | 74.0 | 10.5 | 13.1 | 137 | H | 1.4 | Calibrator(4,2480, -120, -65535, 7,2) EDR Rate |
| 2489.579 | 37.70 | 58.10 | 54.0 | 74.0 | 16.3 | 15.9 | 143 | H | 1.4 | Calibrator(4,2480, -120, -65535, 7,2) EDR Rate |
| | | | | | | | | | | EUT orientation 2. (Carrier antenna end facing horn antenna) |
| 2483.500 | 37.30 | 52.50 | 54.0 | 74.0 | 16.7 | 21.5 | 320 | V | 2.3 | Calibrator(4,2480, -60, -65535, 7,2) Basic Rate |
| 2486.518 | 31.70 | 51.40 | 54.0 | 74.0 | 22.3 | 22.6 | 320 | V | 2.3 | Calibrator(4,2480, -60, -65535, 7,2) Basic Rate |
| 2489.544 | 31.90 | 52.00 | 54.0 | 74.0 | 22.1 | 22.0 | 320 | V | 2.3 | Calibrator(4,2480, -60, -65535, 7,2) Basic Rate |
| 2492.986 | 29.60 | 48.70 | 54.0 | 74.0 | 24.4 | 25.3 | 320 | V | 2.3 | Calibrator(4,2480, -60, -65535, 7,2) Basic Rate |
| 2483.500 | 39.40 | 56.40 | 54.0 | 74.0 | 14.6 | 17.6 | 320 | V | 2.3 | Calibrator(4,2480, -120, -65535, 7,2) EDR Rate |
| 2489.579 | 34.00 | 54.30 | 54.0 | 74.0 | 20.0 | 19.7 | 320 | V | 2.3 | Calibrator(4,2480, -120, -65535, 7,2) EDR Rate |
| | | | | | | | | | | EUT orientation 3. (Carrier antenna end facing horn antenna) |
| 2483.500 | 36.60 | 50.70 | 54.0 | 74.0 | 17.4 | 23.3 | 133 | H | 1.1 | Calibrator(4,2480, -60, -65535, 7,2) Basic Rate |
| 2486.518 | 32.10 | 51.10 | 54.0 | 74.0 | 21.9 | 22.9 | 133.0 | H | 1.1 | Calibrator(4,2480, -60, -65535, 7,2) Basic Rate |
| 2489.544 | 29.80 | 45.60 | 54.0 | 74.0 | 24.2 | 28.4 | 133.0 | H | 1.1 | Calibrator(4,2480, -60, -65535, 7,2) Basic Rate |
| 2492.986 | 29.30 | 48.60 | 54.0 | 74.0 | 24.7 | 25.4 | 133 | H | 1.1 | Calibrator(4,2480, -60, -65535, 7,2) Basic Rate |
| 2483.500 | 39.50 | 57.00 | 54.0 | 74.0 | 14.5 | 17.0 | 133.0 | H | 1.1 | Calibrator(4,2480, -120, -65535, 7,2) EDR Rate |
| 2489.579 | 34.00 | 52.80 | 54.0 | 74.0 | 20.0 | 21.2 | 133.0 | H | 1.1 | Calibrator(4,2480, -120, -65535, 7,2) EDR Rate |

### 5.10 AC Power Line Conducted Emissions

**Requirement(s)**

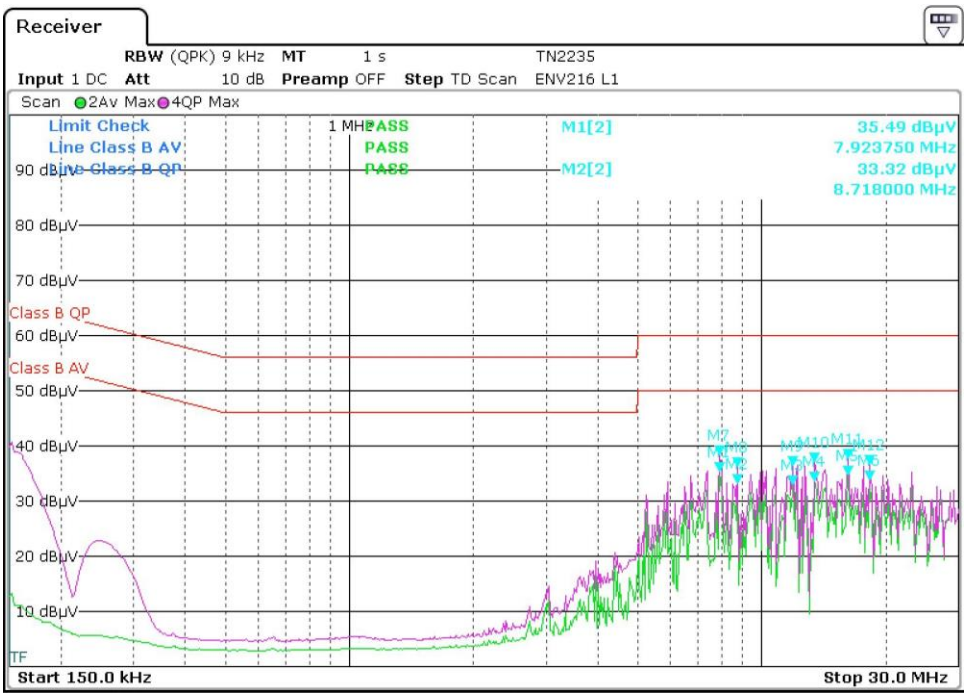
FCC rules part 15.207, RSS 210 section 7.2.4, RSS-Gen section 8.8

| Frequency | Limits dB(μV) | |
|---|---|---|
| MHz | Quasi-peak | Average |
| 0.15 -0.5 | 66-56 | 56-46 |
| 0.5 – 1.6 | 56 | 46 |
| 1.6 – 30 | 60 | 50 |

**Test Method**

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average. Line conducted data is recorded for both Line and Neutral.

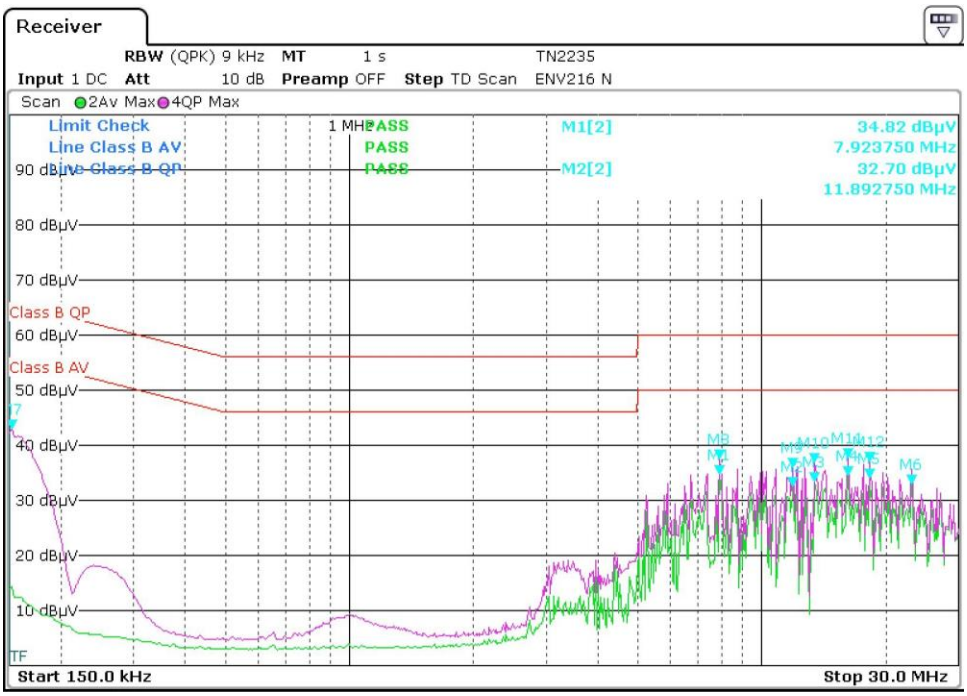
## Test Results




Max Hold plot: 150 kHz to 30 MHz, Line – wired, muted, Aux port grounded.
120 V, 60 Hz

| Frequency | MEASURED | | LIMIT | | MARGIN | |
|---|---|---|---|---|---|---|
| MHz | dBµV QP | dBµV AVG | dBµV QP | dBµV AVG | dB QP | dB AVG |
| 7.9238 | 38.50 | 35.50 | 60.0 | 50.0 | 21.5 | 14.5 |
| 8.7180 | 36.30 | 33.30 | 60.0 | 50.0 | 23.7 | 16.7 |
| 11.8928 | 36.50 | 33.10 | 60.0 | 50.0 | 23.5 | 16.9 |
| 13.4205 | 37.10 | 33.70 | 60.0 | 50.0 | 22.9 | 16.3 |
| 16.2285 | 37.80 | 34.70 | 60.0 | 50.0 | 22.2 | 15.3 |
| 18.2445 | 36.80 | 33.80 | 60.0 | 50.0 | 23.2 | 16.2 |

Bose® model 416549 Wireless Module **PASSES** FCC conducted emissions limits by 14.5 dB at 7.9238 MHz (AVG measurement) on the Line side.




Max Hold plot: 150 kHz to 30 MHz, Neutral - wired, muted, Aux port grounded. 120 V, 60 Hz

| Frequency | MEASURED | | LIMIT | | MARGIN | |
|---|---|---|---|---|---|---|
| MHz | dBµV QP | dBµV AVG | dBµV QP | dBµV AVG | dB QP | dB AVG |
| 7.9238 | 37.70 | 34.80 | 60.0 | 50.0 | 22.3 | 15.2 |
| 11.8928 | 36.10 | 32.70 | 60.0 | 50.0 | 23.9 | 17.3 |
| 13.4205 | 36.80 | 33.40 | 60.0 | 50.0 | 23.2 | 16.6 |
| 16.2285 | 37.70 | 34.60 | 60.0 | 50.0 | 22.3 | 15.4 |
| 18.2445 | 37.10 | 34.10 | 60.0 | 50.0 | 22.9 | 15.9 |
| 23.1293 | 35.70 | 33.10 | 60.0 | 50.0 | 24.3 | 16.9 |

Bose® model 416549 Wireless Module **PASSES** FCC conducted emissions limits by 15.2 dB at 7.9238 MHz (AVG measurement) on the Neutral side.

**Test Results Summary**

Bose® model 416549 Wireless Module **PASSES** FCC conducted emissions limits by worst case 14.5 dB at 7.9238 MHz (AVG measurement) on the Line side.

## 6.0 Test Equipment Used

| Tracking Number | Description | Model | Manufacturer | Calibration due date | Verification due date | Calibration interval | Verification interval |
|---|---|---|---|---|---|---|---|
| 1620 | Comb Generator 1GHz - 10GHz | CGO-5100 | Com-Power Corporation | Verify before use | Verify before use | Verify before use | Verify before use |
| 1663 | ESU40 EMI Test Receiver | ESU40 | Rohde & Schwarz | 11-Apr-15 | N/A | 1 Year | N/A |
| 1672 | MITEQ pre-amp 100MHz-20GHz | AFS4-00102000-30-10P-4 | Bose Corporation | N/A | 13-Nov-15 | N/A | 1 Year |
| 2241 | iPhone 5 | 16GB | Apple | Verify before use | Verify before use | Verify before use | Verify before use |
| 2342 | Band Reject Filter | BRM50702-07 | Micro-Tronics | N/A | 25-Aug-15 | N/A | 1 Year |
| 2343 | Band Reject Filter | BRM18192 | Micro-Tronics | N/A | 25-Aug-15 | N/A | 1 Year |
| 2348 | Double Ridge Waveguide Horn Antenna 1-18GHz | 3117 | ETS Lindgren | 16-Oct-15 | N/A | 1 Year | N/A |
| 2367 | RF Cable 30MHz-18GHz | TRU-300 | TRU Corporation | N/A | 12-Nov-15 | N/A | 1 Year |
| 2373 | RF Cable 30MHz-18GHz - 25 feet "N" | TRU-300 | TRU Corporation | N/A | 12-Nov-15 | N/A | 1 Year |
| 2383 | RF Cable 30MHz-18GHz - 20 feet, "N" connectors | TRU-300 | TRU Corporation | N/A | 12-Nov-15 | N/A | 1 Year |
| 2385 | Marconi Manor | 3 Meter Semi Anechoic Chamber | AP Americas | N/A | 18-Nov-15 | N/A | 1 Year |
| 728 | Microwave Horn Antenna 8GHz - 18GHz | AT4004 | Amplifier Research | 28-Feb-15 | N/A | 3 year | N/A |
| 1307 | Standard Gain Horn Antenna 18GHz - 26.5GHz | 3160-09 | EMCO | 13-Mar-17 | N/A | 3 year | N/A |
| 2368 | RF Cable 30MHz-26.5GHz | TRU-210 | TRU Corporation | 12-Nov-15 | N/A | 1 Year | N/A |
| 2397 | MITEQ pre-amp 18-40GHz | TTA1840-35 | Miteq | 9-Dec-15 | N/A | 1 Year | N/A |

## 7.0 Measurement Uncertainty

| Uncertainty Budget | | | | |
|---|---|---|---|---|
| | | | | |
| Title: | Conducted Emissions | | | |
| | | | | |
| Source of Uncertainty | Value units:+/-dB | Distribution | Divisor | Uncertainty (± dB) |
| RF spec anal-level-Ref. | 0.6 | Rect. | 1.73 | 0.35 |
| RF spec anal-level-Freq resp. | 1.0 | Rect. | 1.73 | 0.58 |
| RF spec anal-level-Display | 0.3 | Rect. | 1.73 | 0.17 |
| RF spec anal-level-QP det. | 1.0 | Rect. | 1.73 | 0.58 |
| Transient limiter loss | 0.1 | Rect. | 1.73 | 0.06 |
| LISN impedance/loss | 0.7 | Norm. | 2.00 | 0.35 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | Combined uncertainty (RSS): | 0.97 |
| | | | Coverage factor (2 sigma): | 2.00 |
| | | | Extended uncertainty (95% confidence): | **1.94** |

| Uncertainty Budget | | | | |
|---|---|---|---|---|
| | | | | |
| Title: | Radiated Emissions | | | |
| | | | | |
| Source of Uncertainty | Value units:+/-dB | Distribution | Divisor | Uncertainty (± dB) |
| RF spec anal-level-Ref. | 0.6 | Rect. | 1.73 | 0.35 |
| RF spec anal-level-Freq resp. | 1.0 | Rect. | 1.73 | 0.58 |
| RF spec anal-level-Display | 0.3 | Rect. | 1.73 | 0.17 |
| RF spec anal-level-QP det. | 1.0 | Rect. | 1.73 | 0.58 |
| Antenna factor | 0.9 | Norm. | 2.00 | 0.45 |
| Preamp corr. Factor | 0.5 | Rect. | 1.73 | 0.29 |
| Cable corr. Factor | 0.5 | Rect. | 1.73 | 0.29 |
| | | | | |
| | | | | |
| | | | | |
| | | | Combined uncertainty (RSS): | 1.09 |
| | | | Coverage factor (2 sigma): | 2.00 |
| | | | Extended uncertainty (95% confidence): | **2.18** |