# CERTIFICATION TEST REPORT

**Report Number. :** 4789651209-E5V1

**Applicant :** SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 16677, KOREA

**Model :** SM-G991B/DS, SM-G991B

**FCC ID :** A3LSMG991B

**EUT Description :** GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, WPT and NFC

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C

**Date Of Issue:**
November 18, 2020

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IAS ACCREDITED
TL-637

## Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| V1 | 11/18/20 | Initial issue | Hyunsik Yun |


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# 1. ATTESTATION OF TEST RESULTS

| | |
|---|---|
| **COMPANY NAME:** | SAMSUNG ELECTRONICS CO., LTD. |
| **EUT DESCRIPTION:** | GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, WPT and NFC |
| **MODEL NUMBER:** | SM-G991B/DS, SM-G991B |
| **SERIAL NUMBER:** | 47d1a444d81f7ece, R3CN80HSZ6E (CONDUCTED); R3CN90P9ETY, R3CN9046PJN (RADIATED); |
| **DATE TESTED:** | OCT 05, 2020 – NOV 09, 2020; |

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| CFR 47 Part 15 Subpart C | Complies |

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
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Junwhan Lee
Suwon Lab Engineer
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Tested By:

Hyunsik Yun
Suwon Lab Engineer
UL Korea, Ltd.


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# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 558074 D01 15.247 Meas Guidance v05r02.
4. ANSI C63.10-2013.

# 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 218 Maeyeong-ro |
|---|
| ☒ Chamber 1 |
| ☒ Chamber 2 |
| ☐ Chamber 3 |

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# 4. DECISION RULES AND MEASUREMENT UNCERTAINTY

## 4.1. METROLOGICAL TRACEABILITY

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

## 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

## 4.3. DECISION RULES

Decision rule for statement(s) of conformity is based on Procedure 1, Clause 4.4.2 in IEC Guide 115:2007.

## 4.4. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER | UNCERTAINTY |
|---|---|
| Conducted Disturbance, 0.15 to 30 MHz | 3.01 dB |
| Radiated Disturbance, 30 MHz to 1 GHz | 4.26 dB |
| Radiated Disturbance, 1 GHz to 18 GHz | 5.90 dB |
| Radiated Disturbance, 18 GHz to 40 GHz | 5.49 dB |

Uncertainty figures are valid to a confidence level of 95%.


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# 5. EQUIPMENT UNDER TEST

## 5.1. EUT DESCRIPTION

The EUT is a GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, WPT and NFC. This test report addresses the BT(DSS) operational mode.

This report covers the Samsung models SM-G991B/DS and SM-G991B.
These models are identical in hardware except SM-G991B has single SIM tray.
With some pre-scan, model SM-G991B/DS was set for final test.

## 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

| Frequency Range [MHz] | Mode | Power Mode | Output Power [dBm] | Output Power [mW] |
|---|---|---|---|---|
| 2 402 - 2 480 | Basic GFSK | Average | 16.801 | 47.874 |
| | | Peak | 17.272 | 53.358 |
| | Enhanced Pi/4-DPSK | Average | 12.206 | 16.619 |
| | | Peak | 15.078 | 32.196 |
| | Enhanced 8PSK | Average | 12.456 | 17.604 |
| | | Peak | 15.643 | 36.669 |

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

**The internal antenna was Permanently attached.**
**Therefore this E.U.T Complies with the requirement of §15.203.**

The radio utilizes an internal antenna, with a maximum gain of -5.15 dBi.


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## 5.4. WORST-CASE CONFIGURATION AND MODE

Radiated emission below 1GHz and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Radiated emission above 1GHz was performed with the EUT set to transmit low/mid/high channels.

The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

Note: GFSK, Pi/4-DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on this mode to showing compliance.


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## 5.5. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Support Equipment List | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number** | **FCC ID** |
| Charger | SAMSUNG | EP-TA800 | R37N8BT85J8SE3 | N/A |
| Data Cable | SAMSUNG | EP-DN980BBE | N/A | N/A |

**I/O CABLE**

| I/O Cable List | | | | | | |
|---|---|---|---|---|---|---|
| **Cable No.** | **Port** | **# of identical ports** | **Connector Type** | **Cable Type** | **Cable Length (m)** | **Remarks** |
| 1 | DC Power | 1 | C Type | Shielded | 1.0 m | N/A |

**TEST SETUP**

The EUT is continuously communicating to the Bluetooth tester during the tests.
Test software enable BT communications.


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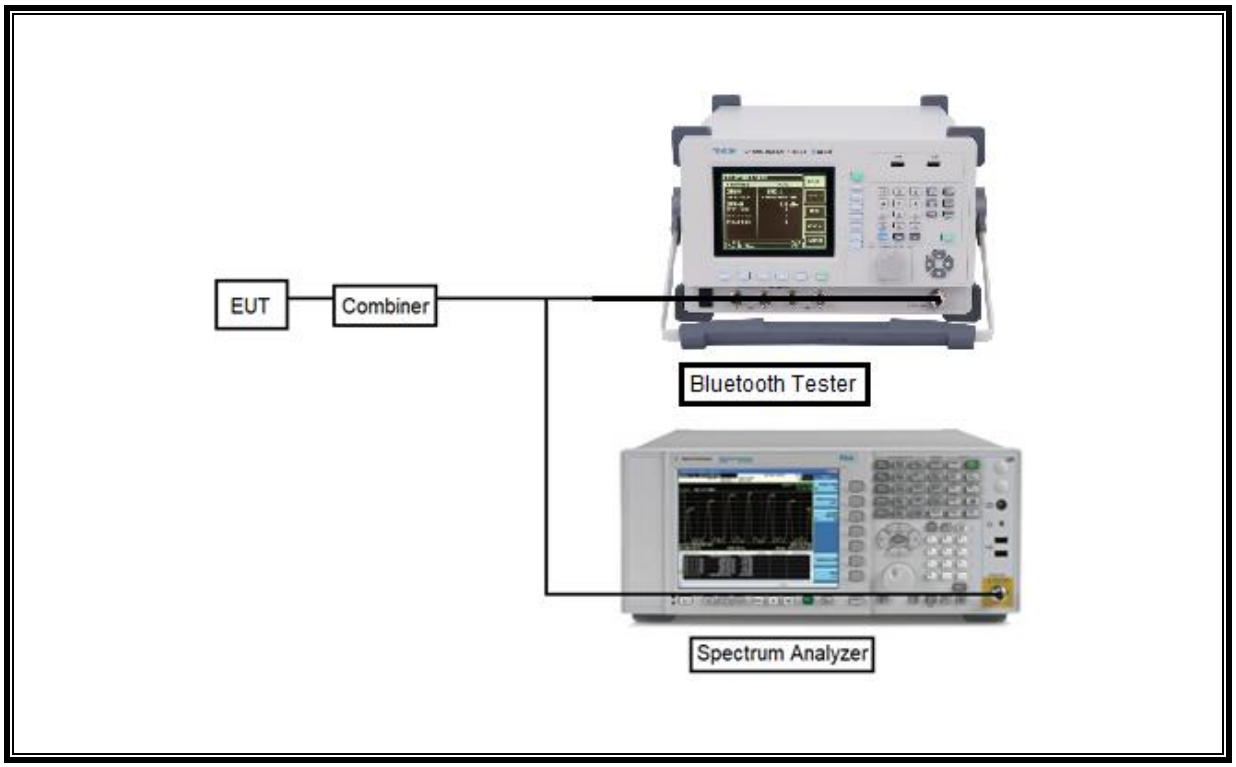
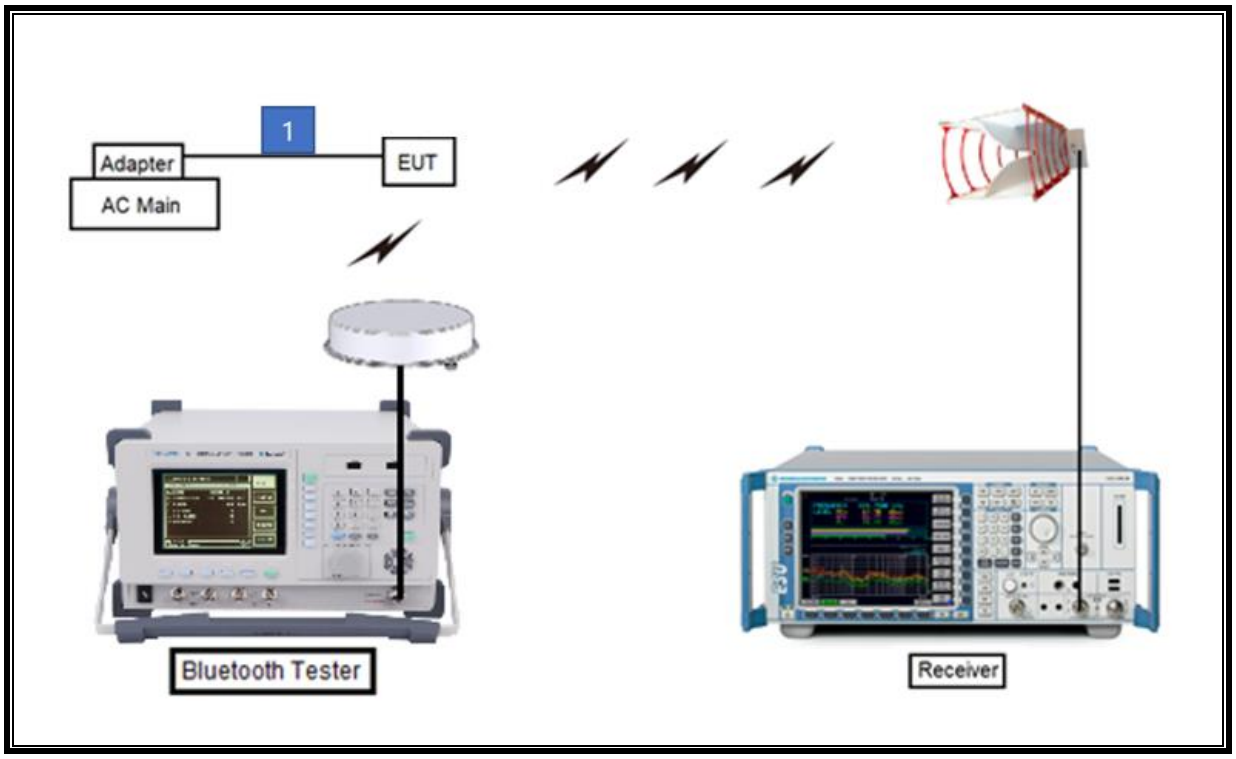
**SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)**




**SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)**





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# 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| Test Equipment List | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **S/N** | **Cal Due** |
| Antenna, Bilog, 30MHz-1GHz | SCHWARZBECK | VULB9163 | 750 | 08-19-22 |
| Antenna, Bilog, 30MHz-1GHz | SCHWARZBECK | VULB9163 | 749 | 08-13-22 |
| Antenna, Bilog, 30MHz-1GHz | SCHWARZBECK | VULB9163 | 845 | 08-13-22 |
| Antenna, Loop, 9kHz-30MHz | R&S | HFH2-Z2 | 100418 | 10-02-21 |
| Antenna, Horn, 18 GHz | ETS | 3115 | 00167211 | 07-27-22 |
| Antenna, Horn, 18 GHz | ETS | 3115 | 00161451 | 08-15-22 |
| Antenna, Horn, 18 GHz | ETS | 3117 | 00168724 | 07-27-22 |
| Antenna, Horn, 18 GHz | ETS | 3117 | 00168717 | 08-15-22 |
| Antenna, Horn, 40 GHz | ETS | 3116C | 00166155 | 08-04-22 |
| Antenna, Horn, 40 GHz | ETS | 3116C | 00168645 | 10-02-21 |
| Preamplifier | ETS | 3116C-PA | 00168841 | 08-06-21 |
| Directional Antenna | Cobham | FPA3-0.8-6.0R/1329 | 80108-0004 | N/A |
| Directional Antenna | Cobham | FPA3-0.8-6.0R/1329 | 110367-0003 | N/A |
| Preamplifier, 1000 MHz | Sonoma | 310N | 341282 | 08-03-21 |
| Preamplifier, 1000 MHz | Sonoma | 310N | 351741 | 08-03-21 |
| Preamplifier, 1000 MHz | Sonoma | 310N | 370599 | 08-06-21 |
| Preamplifier, 18 GHz | Miteq | AFS42-00101800-25-S-42 | 1876511 | 08-03-21 |
| Preamplifier, 18 GHz | Miteq | AFS42-00101800-25-S-42 | 1896138 | 08-03-21 |
| Preamplifier, 18 GHz | Miteq | AFS42-00101800-25-S-42 | 2029169 | 08-04-21 |
| Spectrum Analyzer, 44 GHz | Keysight | N9030B | MY57143717 | 01-20-21 |
| Spectrum Analyzer, 44 GHz | Agilent / HP | N9030A | MY54170614 | 08-05-21 |
| Spectrum Analyzer, 44 GHz | Agilent / HP | N9030A | MY54490312 | 08-05-21 |
| Average Power Sensor | Agilent / HP | U2000 | MY54270007 | 08-05-21 |
| Bluetooth Tester | TESCOM | TC-3000C | 3000C000546 | 08-05-21 |
| Power Splitter | MINI-CIRCUITS | WA1534 | UL001 | 02-05-21 |
| Attenuator | PASTERNACK | PE7087-10 | A001 | 08-03-21 |
| Attenuator | PASTERNACK | PE7087-10 | A008 | 08-03-21 |
| Attenuator | PASTERNACK | PE7004-10 | 2 | 08-04-21 |
| EMI Test Receive, 40 GHz | R&S | ESU40 | 100439 | 08-03-21 |
| EMI Test Receive, 40 GHz | R&S | ESU40 | 100457 | 08-03-21 |
| EMI Test Receive, 3 GHz | R&S | ESR3 | 101832 | 08-03-21 |
| Low Pass Filter 5GHz | Micro-Tronics | LPS17541 | 009 | 08-03-21 |
| Low Pass Filter 5GHz | Micro-Tronics | LPS17541 | 015 | 08-03-21 |
| Low Pass Filter 5GHz | Micro-Tronics | LPS17541 | 020 | 08-04-21 |
| High Pass Filter 3GHz | Micro-Tronics | HPM17543 | 010 | 08-03-21 |
| High Pass Filter 3GHz | Micro-Tronics | HPM17543 | 015 | 08-03-21 |
| High Pass Filter 3GHz | Micro-Tronics | HPM17543 | 020 | 08-04-21 |
| High Pass Filter 6GHz | Micro-Tronics | HPS17542 | 009 | 08-03-21 |
| High Pass Filter 6GHz | Micro-Tronics | HPS17542 | 016 | 08-03-21 |
| High Pass Filter 6GHz | Micro-Tronics | HPS17542 | 021 | 08-04-21 |
| LISN | R&S | ENV-216 | 101837 | 08-06-21 |
| Termination | WEINSCHEL | M1406A | T01 | 08-05-21 |

| UL Software | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Version** |
| Radiated software | UL | UL EMC | Ver 9.5 |
| AC Line Conducted software | UL | UL EMC | Ver 9.5 |


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# 7. TEST RESULTS SUMMARY

| FCC Part Section | Test Description | Test Limit | Test Condition | Test Result |
|---|---|---|---|---|
| 2.1051, 15.247 (d) | Band Edge / Conducted Spurious Emission | -20dBc | Conducted | Pass |
| 15.247 (b)(1) | TX conducted output power | <21dBm | | Pass |
| 15.247 (a)(1) | Hopping frequency separation | > two-thirds of the 20 dB bandwidth | | Pass |
| 15.247 (a)(1)(iii) | Number of Hopping channels | More than 15 non-overlapping channels | | Pass |
| 15.247 (a)(1)(iii) | Avg Time of Occupancy | < 0.4sec | | Pass |
| 15.207 (a) | AC Power Line conducted emissions | Section 10 | Power Line conducted | Pass |
| 15.205, 15.209 | Radiated Spurious Emission | < 54dBuV/m | Radiated | Pass |


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# 8. MEASUREMENT METHODS

20dB BW : ANSI C63.10, Section 6.9.2

99% BW : ANSI C63.10, Section 6.9.3

HOPPING FREQUENCY SEPARATION : ANSI C63.10, Section 7.8.2

NUMBER OF HOPPING CHANNELS : ANSI C63.10, Section 7.8.3

AVERAGE TIME OF OCCUPANCY : ANSI C63.10, Section 7.8.4

OUTPUT POWER : ANSI C63.10, Section 7.8.5.

Out-of-band EMISSIONS (Conducted) : ANSI C63.10, Section 7.8.6, 7.8.8

Out-of-band EMISSIONS IN NON-RESTRICTED BANDS: ANSI C63.10, Section 6.

Out-of-band EMISSIONS IN RESTRICTED BANDS : ANSI C63.10, Section 6.

AC Power Line Conducted Emission : ANSI C63.10-2013, Section 6.2.


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# 9. ANTENNA PORT TEST RESULTS

## 9.1. ON TIME AND DUTY CYCLE

**LIMITS**

None; for reporting purposes only.

**PROCEDURE**

ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

**ON TIME AND DUTY CYCLE RESULTS**

| Mode | On time [msec] | Period [msec] | Duty Cycle [%] | Duty Cycle Correction Factor[dB] | 1/T Minimum VBW [kHz] |
|---|---|---|---|---|---|
| 2 400 ~ 2 483.5 MHz Band | | | | | |
| Bluetooth | 2.885 | 3.750 | 76.93 | 1.14 | 0.35 |

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## 9.2. 20 dB AND 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

**RESULTS**

### 9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

| Channel | Frequency [MHz] | 20 dB Bandwidth [kHz] | 99% Bandwidth [kHz] |
|---|---|---|---|
| 0 | 2 402 | 1 045.0 | 894.0 |
| 39 | 2 441 | 1 045.0 | 866.2 |
| 78 | 2 480 | 1 043.0 | 865.6 |
| **Worst** | | **1 045.0** | **894.0** |

### 9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

| Channel | Frequency [MHz] | 20 dB Bandwidth [kHz] | 99% Bandwidth [kHz] |
|---|---|---|---|
| 0 | 2 402 | 1 305.0 | 1163.0 |
| 39 | 2 441 | 1 304.0 | 1164.6 |
| 78 | 2 480 | 1 308.0 | 1164.5 |
| **Worst** | | **1 308.0** | **1164.6** |


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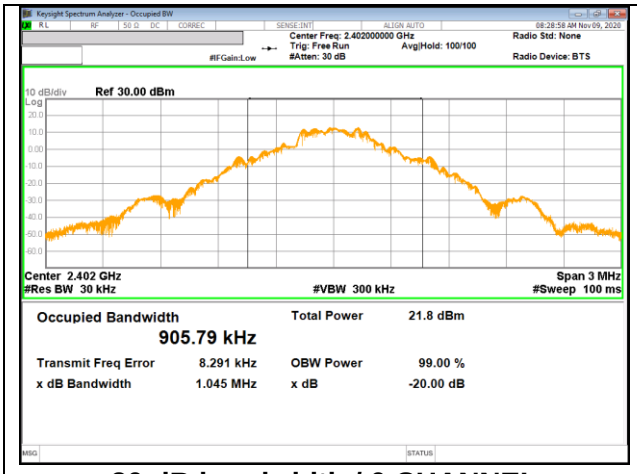
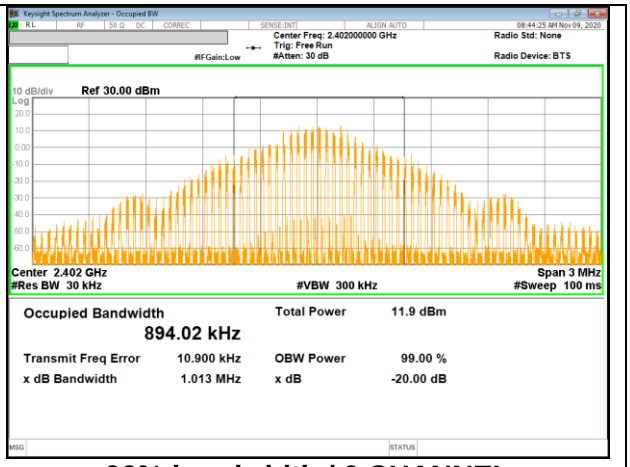
## 9.2.3. Bandwidth Plot

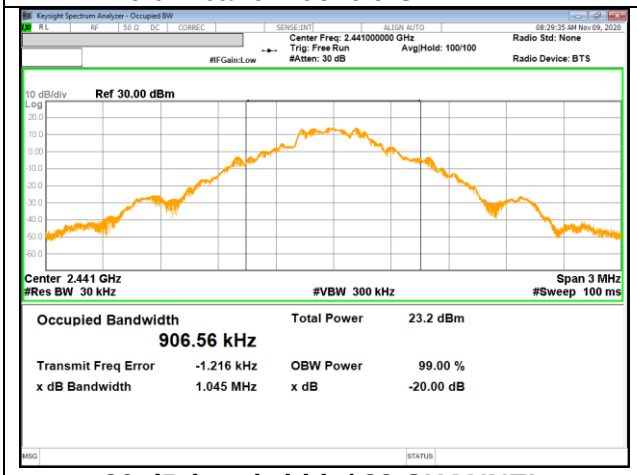
**GFSK**



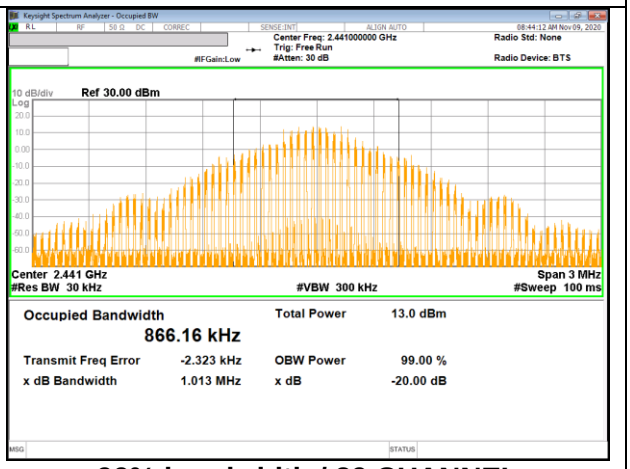

**20 dB bandwidth / 0 CHANNEL**



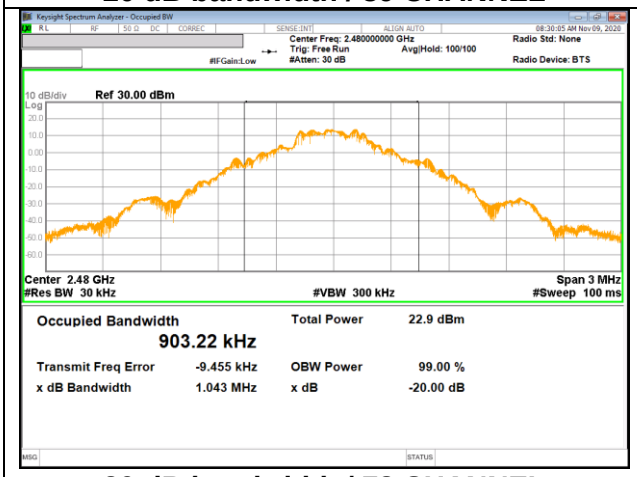

**99% bandwidth / 0 CHANNEL**



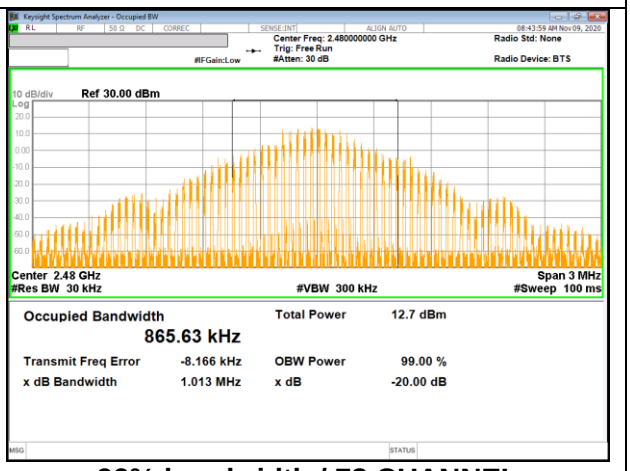

**20 dB bandwidth / 39 CHANNEL**




**99% bandwidth / 39 CHANNEL**




**20 dB bandwidth / 78 CHANNEL**




**99% bandwidth / 78 CHANNEL**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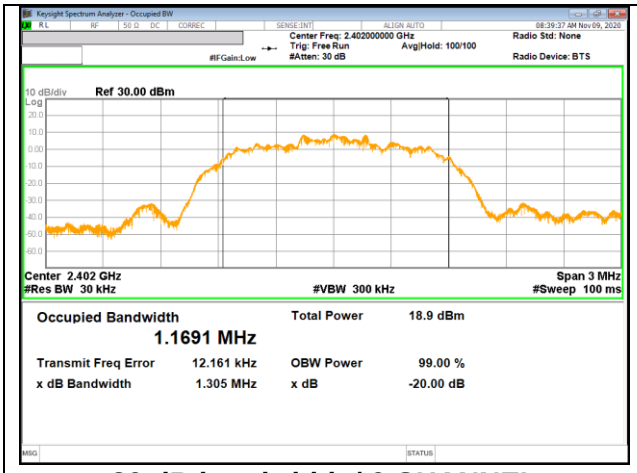
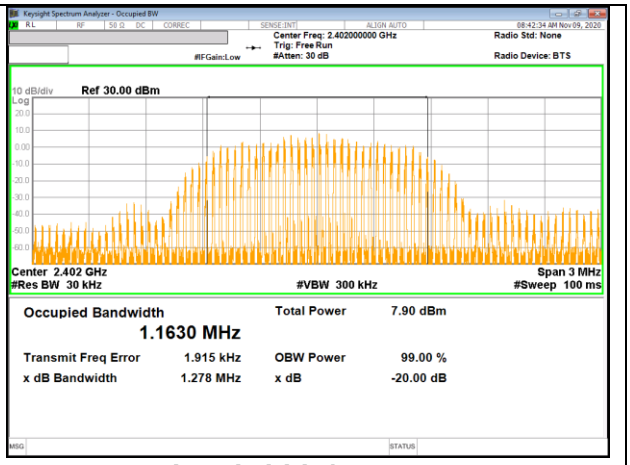
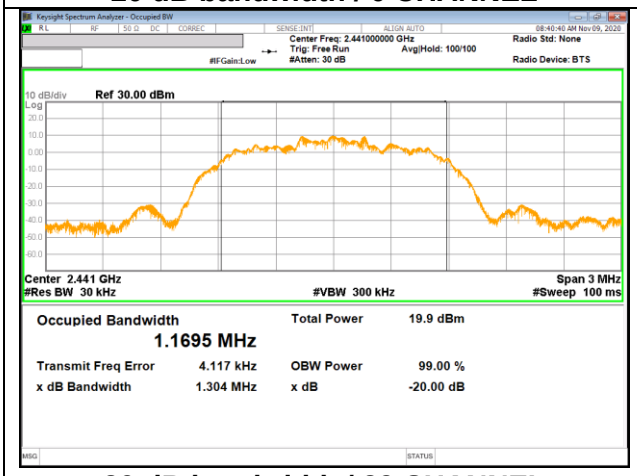
**8PSK**



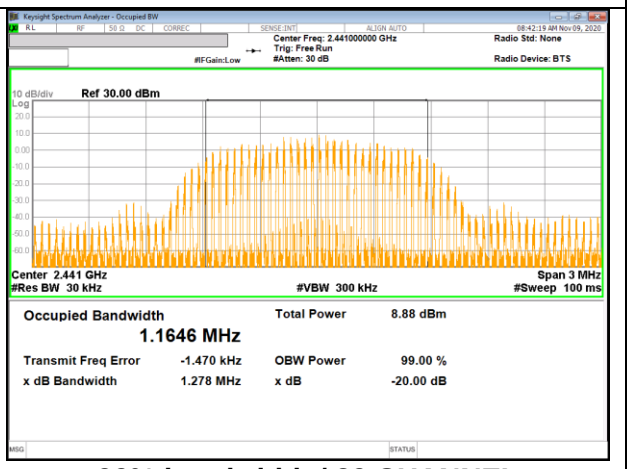

**20 dB bandwidth / 0 CHANNEL**



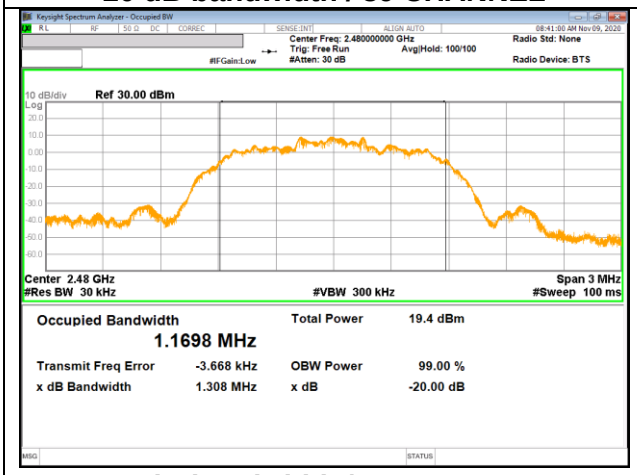

**99% bandwidth / 0 CHANNEL**



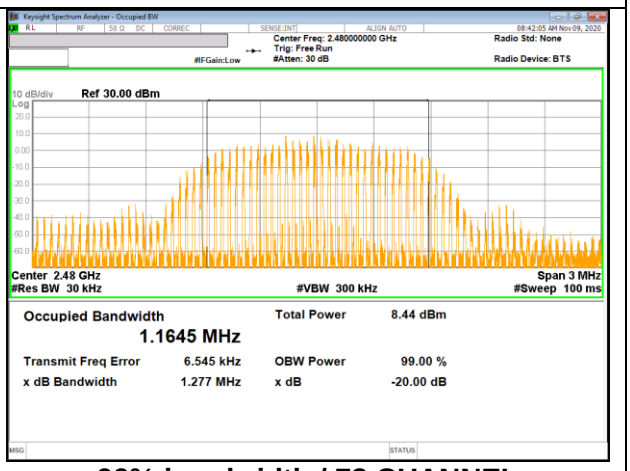

**20 dB bandwidth / 39 CHANNEL**




**99% bandwidth / 39 CHANNEL**




**20 dB bandwidth / 78 CHANNEL**




**99% bandwidth / 78 CHANNEL**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## 9.3. HOPPING FREQUENCY SEPARATION

**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 hoping 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.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to VBW >= RBW. The sweep time is coupled.

**RESULTS**


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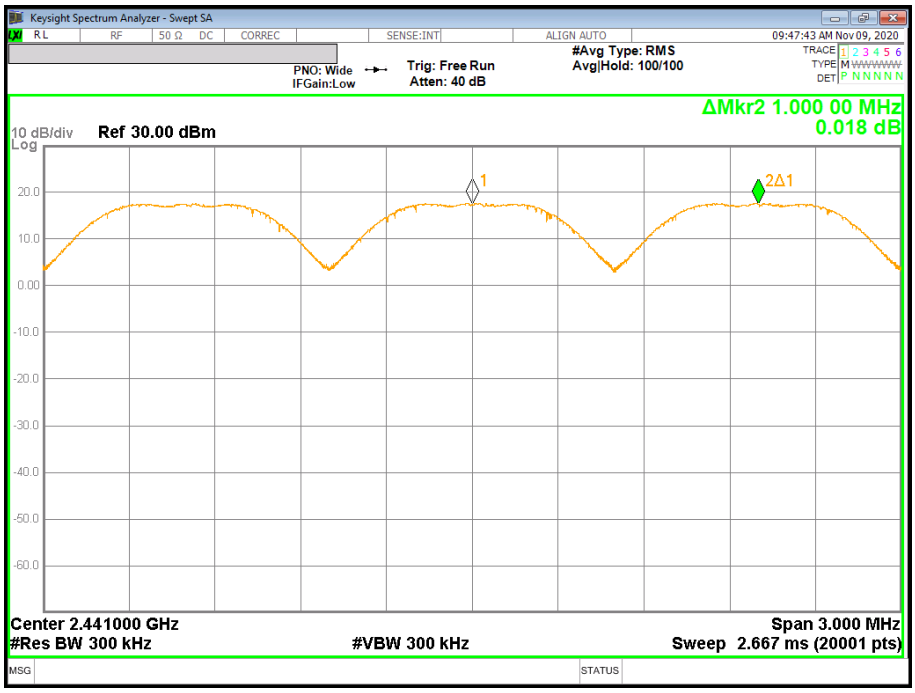
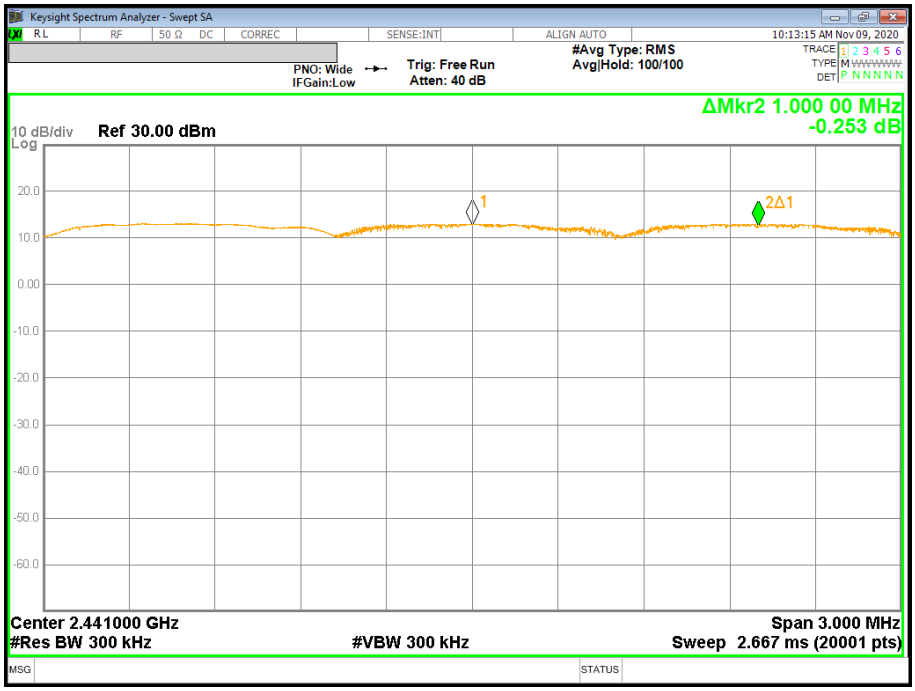
## 9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION




**HOPPING FREQUENCY SEPARATION PLOT**

## 9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION




**HOPPING FREQUENCY SEPARATION PLOT**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## 9.4. NUMBER OF HOPPING CHANNELS

**LIMITS**

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

**RESULTS**

Normal Mode: All Channels Observed


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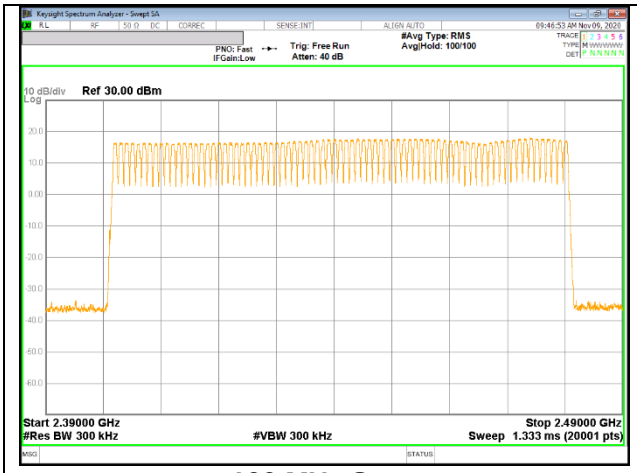
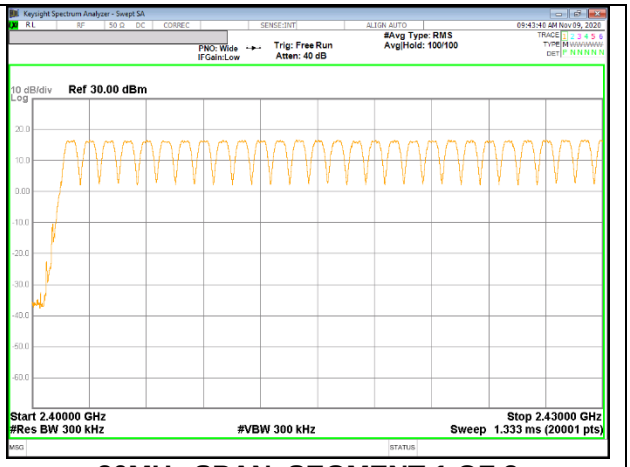
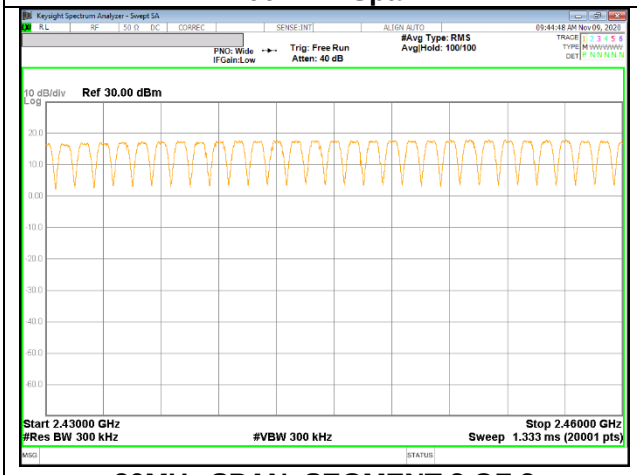
## 9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



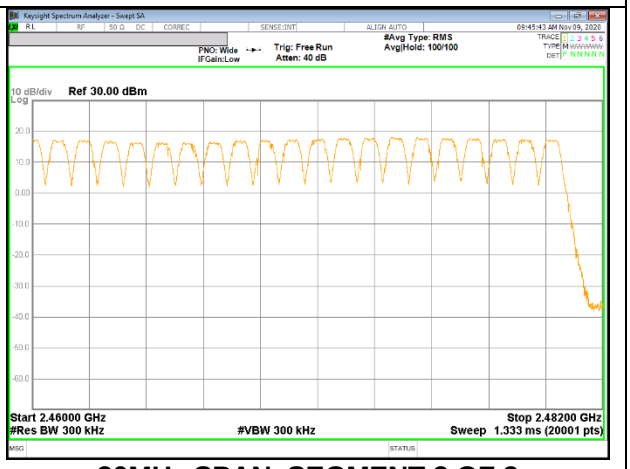

**100 MHz Span**




**30MHz SPAN, SEGMENT 1 OF 3**




**30MHz SPAN, SEGMENT 2 OF 3**




**30MHz SPAN, SEGMENT 3 OF 3**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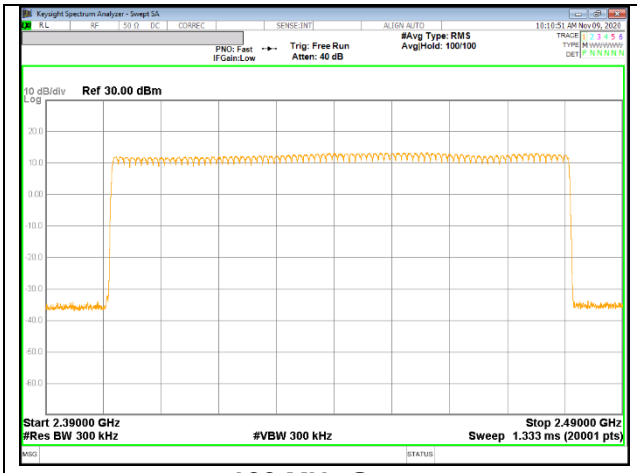
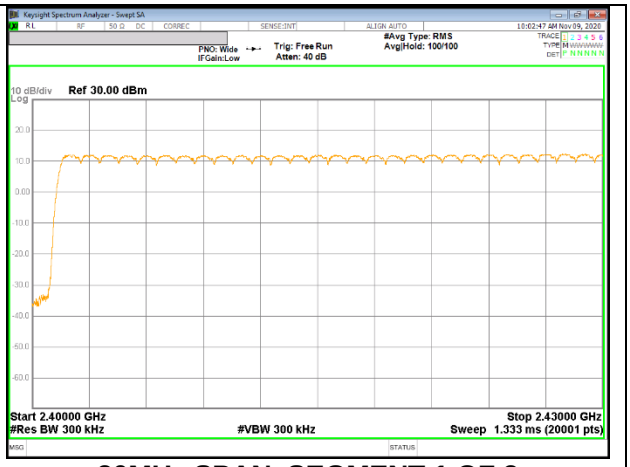
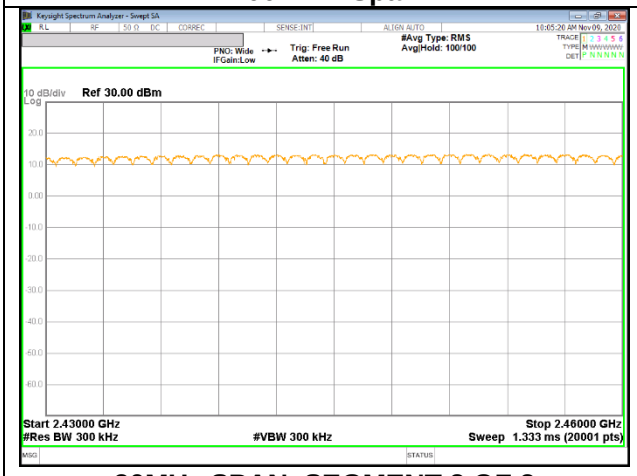
# 9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



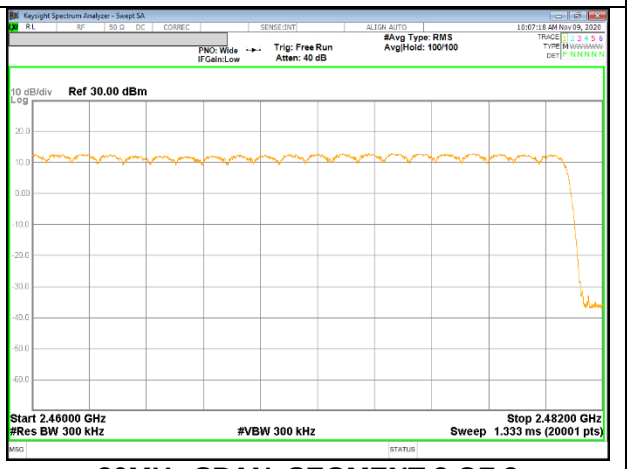

100 MHz Span




30MHz SPAN, SEGMENT 1 OF 3




30MHz SPAN, SEGMENT 2 OF 3




30MHz SPAN, SEGMENT 3 OF 3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## 9.5. AVERAGE TIME OF OCCUPANCY

**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.

**TEST PROCEDURE**

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 3.16 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

**RESULTS**


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## 9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

| DH Packet | Pulse Width [msec] | Number of Pulses in 3.16 seconds | Average Time of Occupancy [sec] | Limit [sec] | Margin [sec] |
|---|---|---|---|---|---|
| GFSK Normal | | | | | |
| DH1 | 0.380 | 32 | 0.122 | 0.400 | -0.278 |
| DH3 | 1.636 | 16 | 0.262 | 0.400 | -0.138 |
| DH5 | 2.883 | 12 | 0.346 | 0.400 | -0.054 |
| | | | | | |
| **DH Packet** | **Pulse Width [msec]** | **Number of Pulses in 0.8 seconds** | **Average Time of Occupancy [sec]** | **Limit [sec]** | **Margin [sec]** |
| GFSK AFH | | | | | |
| DH1 | 0.380 | 8 | 0.030 | 0.400 | -0.370 |
| DH3 | 1.636 | 4 | 0.065 | 0.400 | -0.335 |
| DH5 | 2.883 | 3 | 0.086 | 0.400 | -0.314 |


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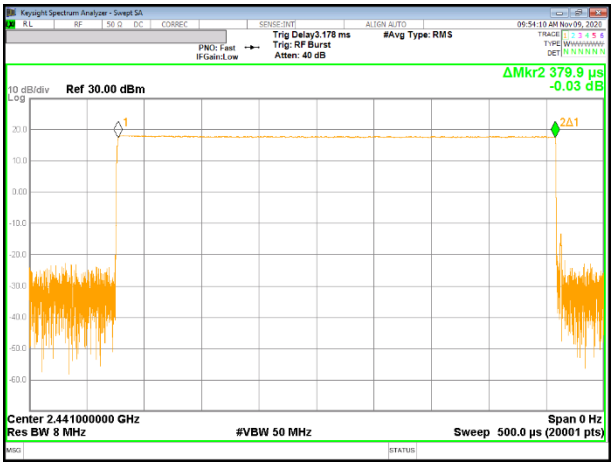
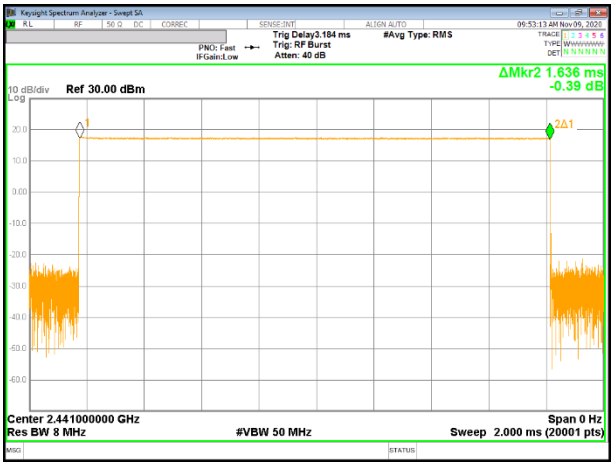
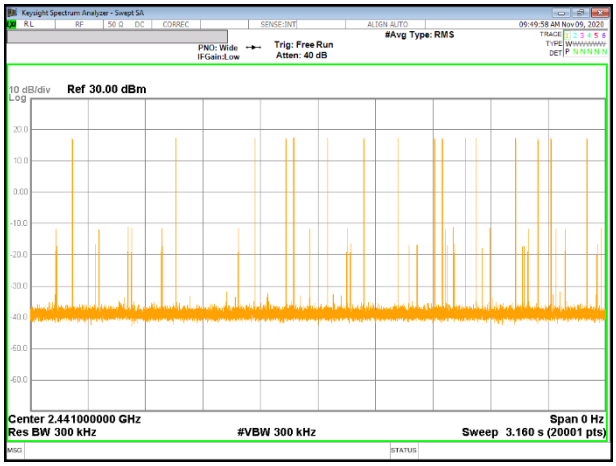



**PULSE WIDTH – DH1**

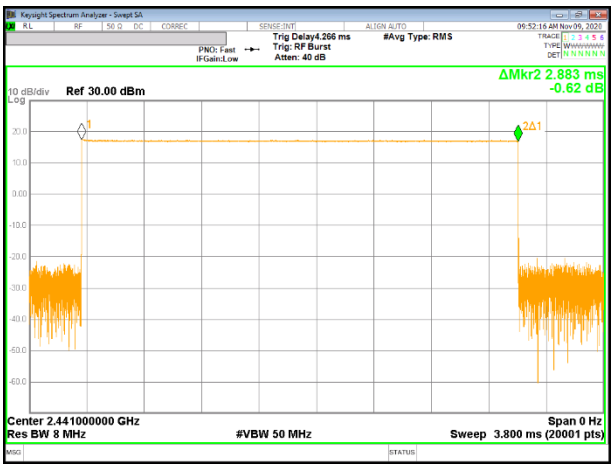
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1**



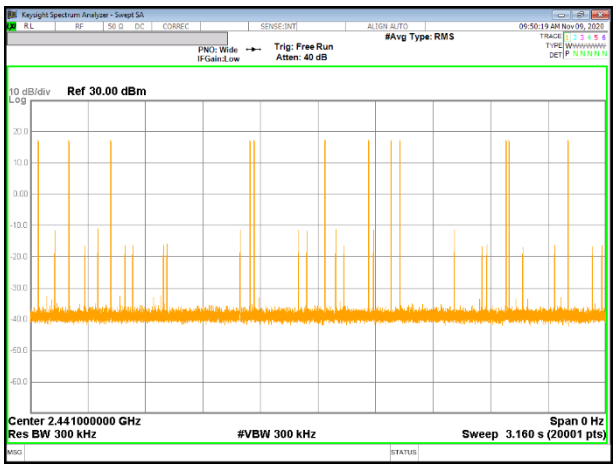

**PULSE WIDTH – DH3**




**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**




**PULSE WIDTH – DH5**




**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**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## 9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

| DH Packet | Pulse Width [msec] | Number of Pulses in 3.16 seconds | Average Time of Occupancy [sec] | Limit [sec] | Margin [sec] |
|---|---|---|---|---|---|
| 8PSK Normal | | | | | |
| DH1 | 0.386 | 32 | 0.124 | 0.400 | -0.276 |
| DH3 | 1.636 | 16 | 0.262 | 0.400 | -0.138 |
| DH5 | 2.887 | 12 | 0.346 | 0.400 | -0.054 |
| | | | | | |
| **DH Packet** | **Pulse Width [msec]** | **Number of Pulses in 0.8 seconds** | **Average Time of Occupancy [sec]** | **Limit [sec]** | **Margin [sec]** |
| 8PSK AFH | | | | | |
| DH1 | 0.386 | 8 | 0.031 | 0.400 | -0.369 |
| DH3 | 1.636 | 4 | 0.065 | 0.400 | -0.335 |
| DH5 | 2.887 | 3 | 0.087 | 0.400 | -0.313 |

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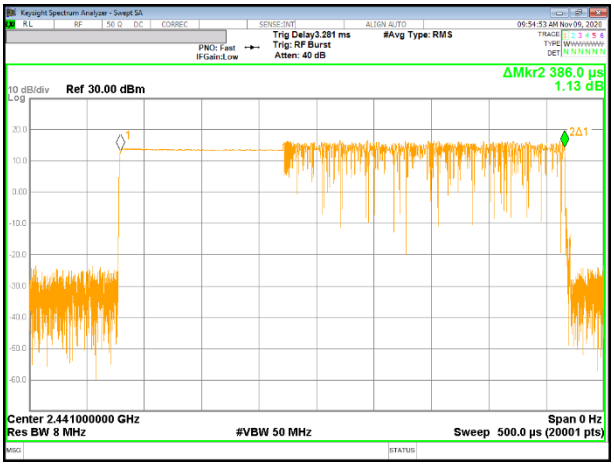
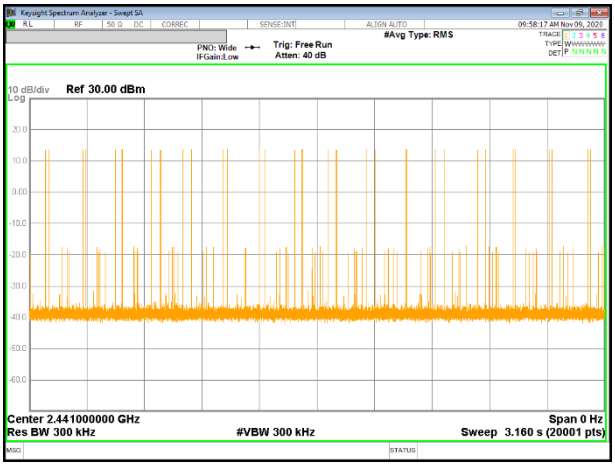
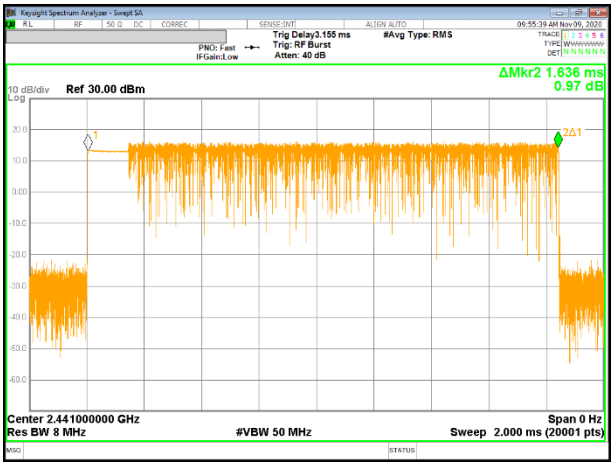


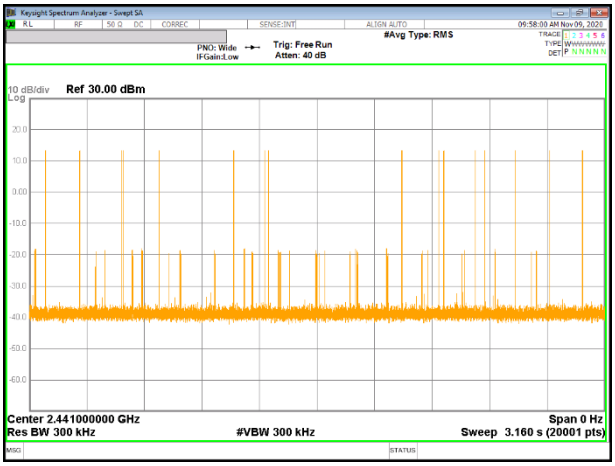

**PULSE WIDTH – 3-DH1**



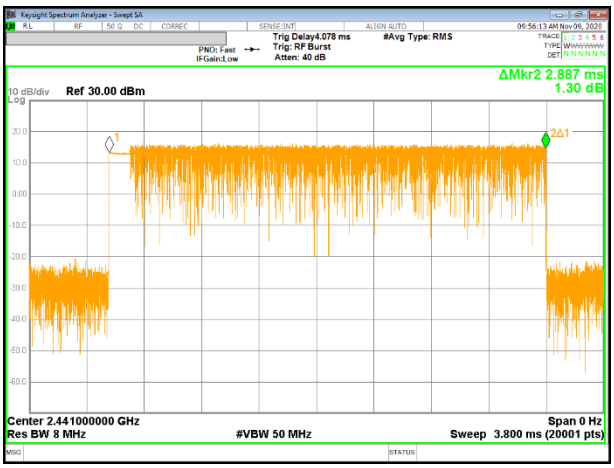

**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH1**



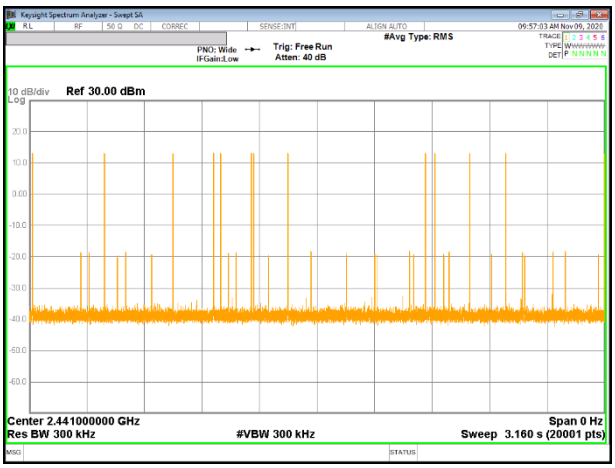

**PULSE WIDTH – 3-DH3**




**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH3**




**PULSE WIDTH – 3-DH5**




**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3-DH5**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## 9.6. OUTPUT POWER

**LIMITS**

§15.247 (b) (1)
The maximum antenna gain is less than 6 dBi, therefore the limit is 21 dBm.

**TEST PROCEDURE**
**The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.**

**RESULTS**

### 9.6.1. BASIC DATA RATE GFSK MODULATION

| Channel | Frequency [MHz] | Output Power [dBm] | Limit [dBm] | Margin [dBm] |
|---|---|---|---|---|
| 0 | 2 402 | 16.066 | 21.000 | -4.934 |
| 39 | 2 441 | 17.272 | 21.000 | -3.728 |
| 78 | 2 480 | 17.208 | 21.000 | -3.792 |
| **Worst** | | **17.272** | **21.000** | **-3.728** |

### 9.6.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

| Channel | Frequency [MHz] | Output Power [dBm] | Limit [dBm] | Margin [dBm] |
|---|---|---|---|---|
| 0 | 2 402 | 14.122 | 21.000 | -6.878 |
| 39 | 2 441 | 15.078 | 21.000 | -5.922 |
| 78 | 2 480 | 14.638 | 21.000 | -6.362 |
| **Worst** | | **15.078** | **21.000** | **-5.922** |

### 9.6.3. ENHANCED DATA RATE 8PSK MODULATION

| Channel | Frequency [MHz] | Output Power [dBm] | Limit [dBm] | Margin [dBm] |
|---|---|---|---|---|
| 0 | 2 402 | 14.507 | 21.000 | -6.493 |
| 39 | 2 441 | 15.643 | 21.000 | -5.357 |
| 78 | 2 480 | 15.240 | 21.000 | -5.760 |
| **Worst** | | **15.643** | **21.000** | **-5.357** |


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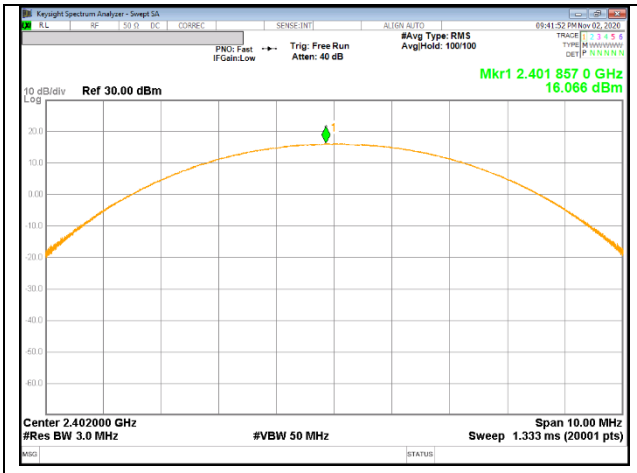
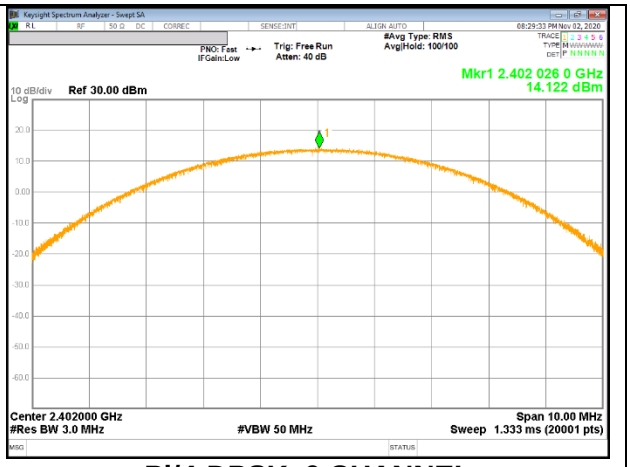
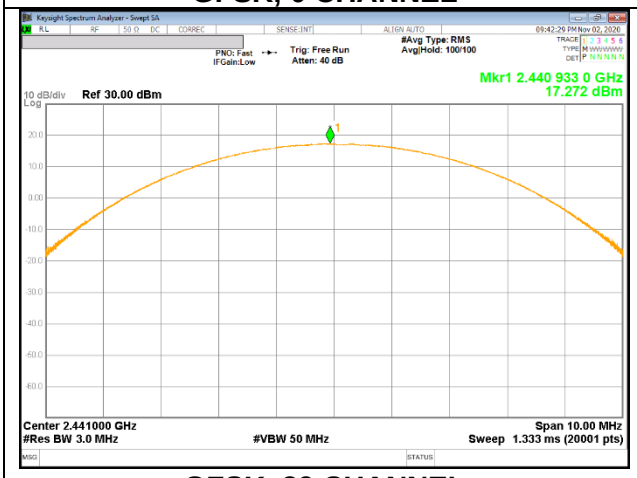
## 9.6.4. OUTPUT POWER PLOTS



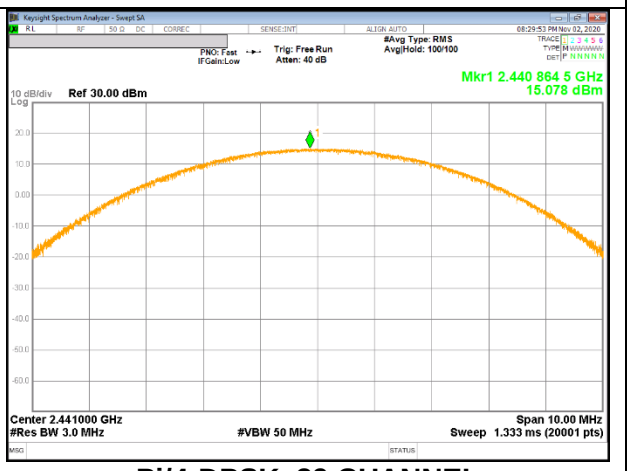

GFSK, 0 CHANNEL



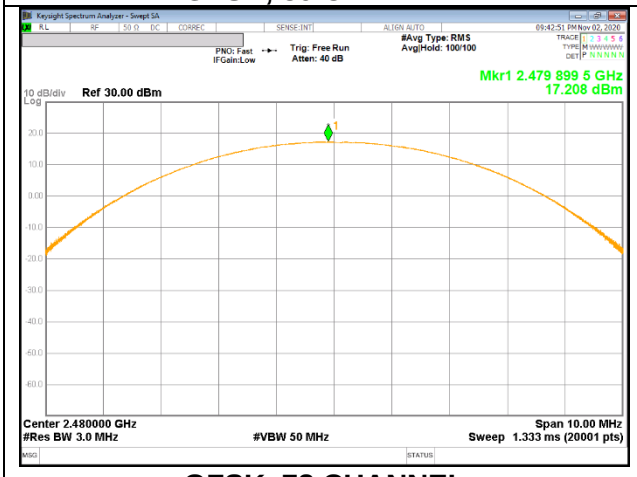

Pi/4-DPSK, 0 CHANNEL



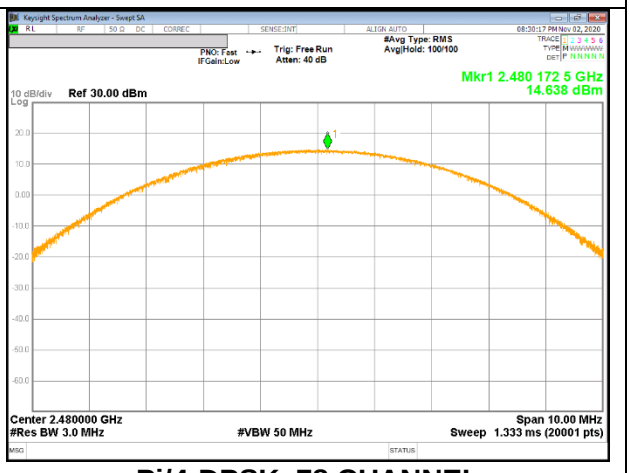

GFSK, 39 CHANNEL




Pi/4-DPSK, 39 CHANNEL




GFSK, 78 CHANNEL




Pi/4-DPSK, 78 CHANNEL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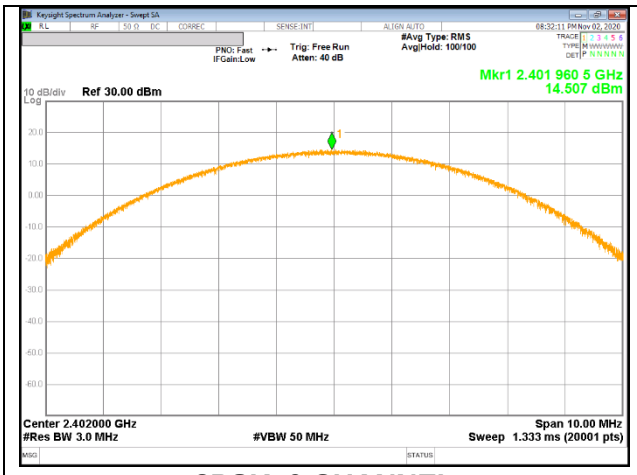
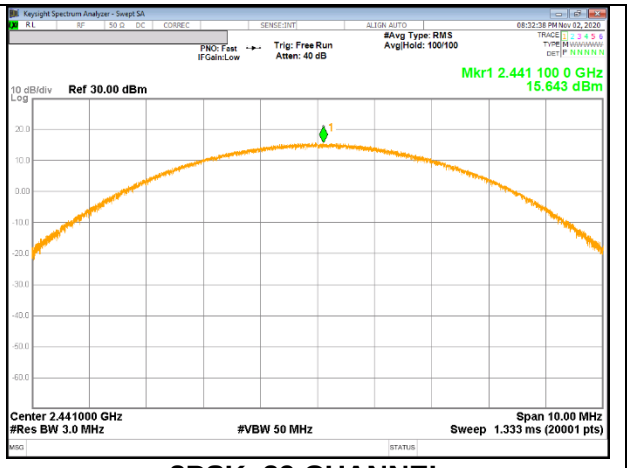
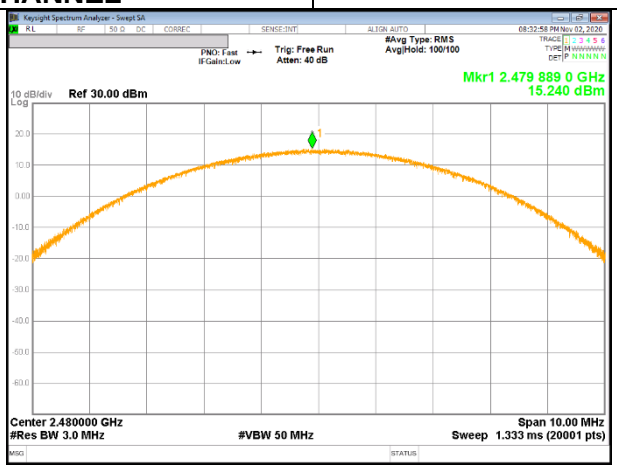



**8PSK, 0 CHANNEL**




**8PSK, 39 CHANNEL**




**8PSK, 78 CHANNEL**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## 9.7. AVERAGE POWER

**LIMITS**

None; for reporting purposes only

**TEST PROCEDURE**

Measurements perform using a wideband gated RF power meter.
The cable assembly insertion loss was entered as an offset in the power meter to allow for direct reading of power.

**RESULTS**

### 9.7.1. BASIC DATA RATE GFSK MODULATION

| Channel | Frequency [MHz] | AV power [dBm] | AV power [mW] |
|---|---|---|---|
| 0 | 2 402 | 15.538 | 35.793 |
| 39 | 2 441 | 16.731 | 47.109 |
| 78 | 2 480 | 16.801 | 47.874 |

### 9.7.2. ENHANCED DATA RATE PI/4-DQPSK MODULATION

| Channel | Frequency [MHz] | AV power [dBm] | AV power [mW] |
|---|---|---|---|
| 0 | 2 402 | 11.305 | 13.505 |
| 39 | 2 441 | 12.206 | 16.619 |
| 78 | 2 480 | 12.103 | 16.229 |

### 9.7.3. ENHANCED DATA RATE 8PSK MODULATION

| Channel | Frequency [MHz] | AV power [dBm] | AV power [mW] |
|---|---|---|---|
| 0 | 2 402 | 11.294 | 13.471 |
| 39 | 2 441 | 12.456 | 17.604 |
| 78 | 2 480 | 12.131 | 16.334 |


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## 9.8. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

Limit = -20 dBc

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The band-edges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

**RESULTS**


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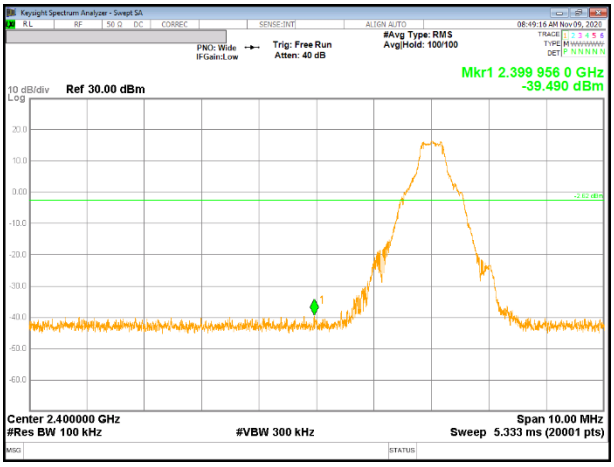
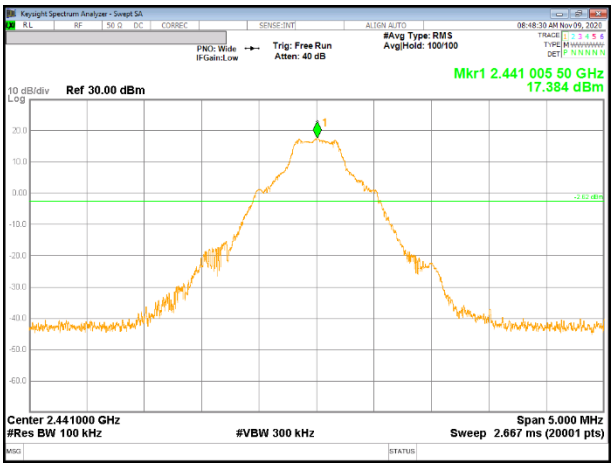
# 9.8.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

**SPURIOUS EMISSIONS, NON-HOPPING**



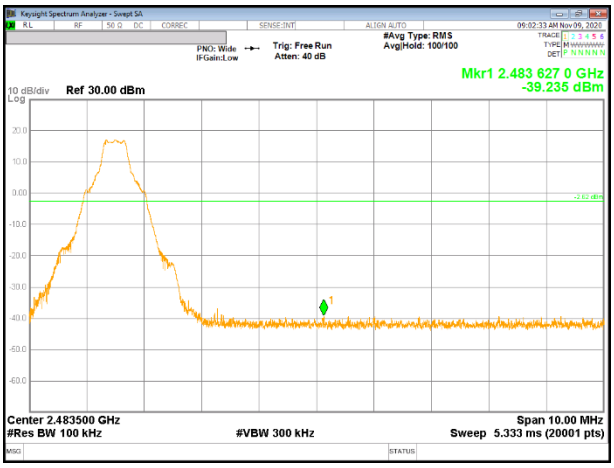

**0 CHANNEL BANDEDGE**

**OUT-OF-BAND 0 CHANNEL**




**IN-BAND REFERENCE LEVEL**

**OUT-OF-BAND 39 CHANNEL**




**78 CHANNEL BANDEDGE**

**OUT-OF-BAND 78 CHANNEL**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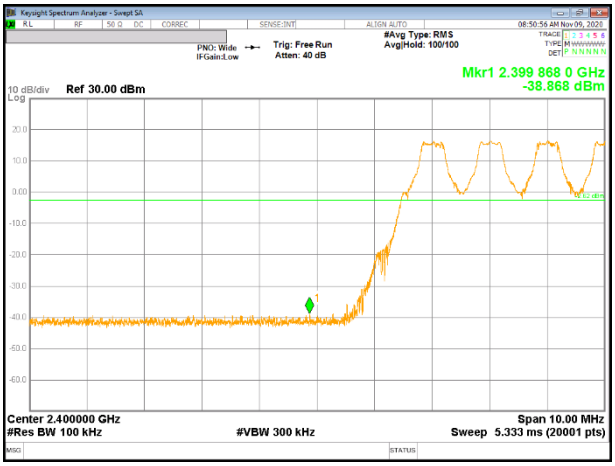
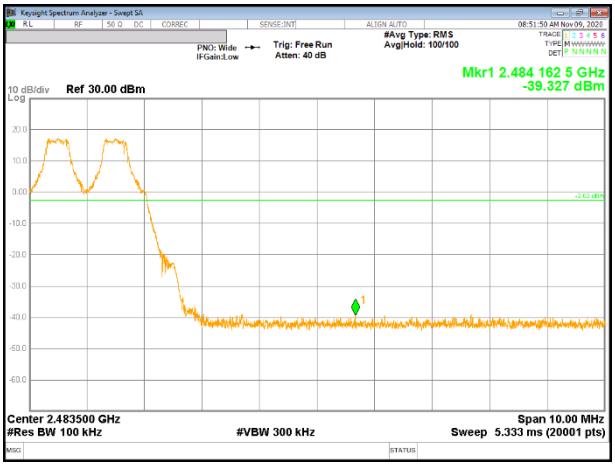
**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**




**LOW BANDEDGE**




**HIGH BANDEDGE**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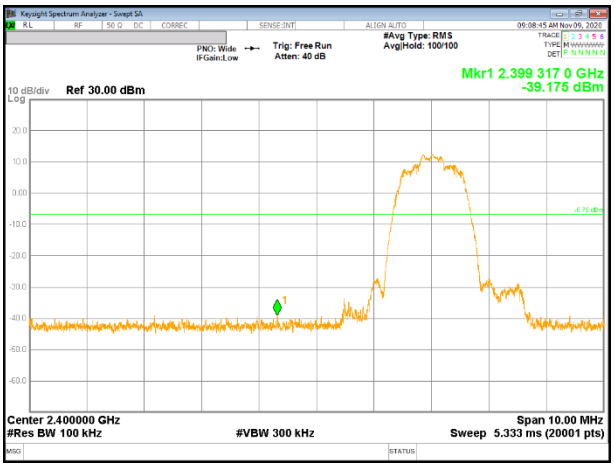
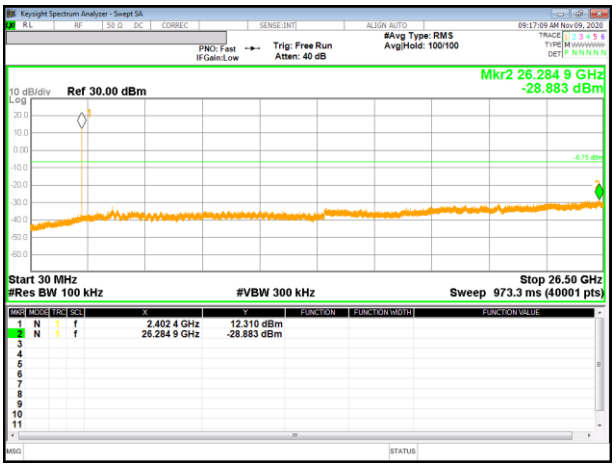
# 9.8.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

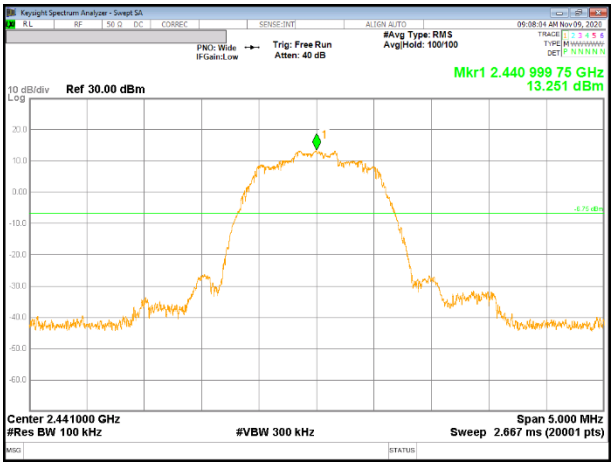
## SPURIOUS EMISSIONS, NON-HOPPING




0 CHANNEL BANDEDGE

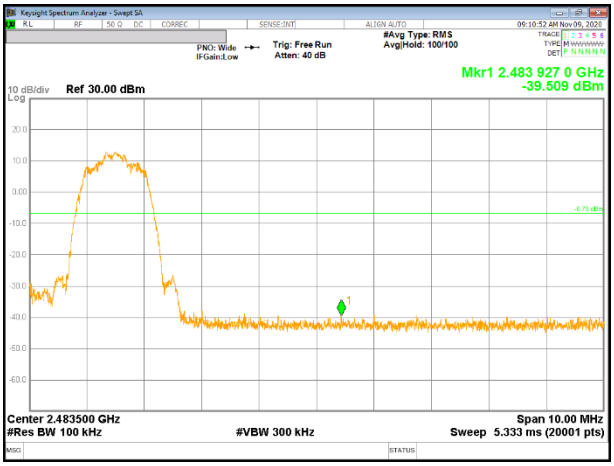



OUT-OF-BAND 0 CHANNEL

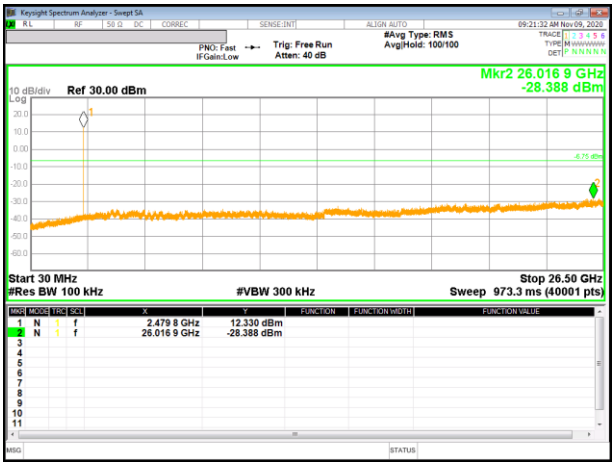



IN-BAND REFERENCE LEVEL

OUT-OF-BAND 39 CHANNEL




78 CHANNEL BANDEDGE




OUT-OF-BAND 78 CHANNEL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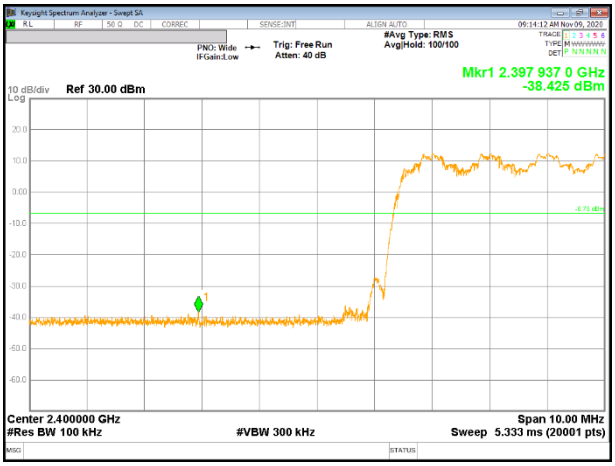
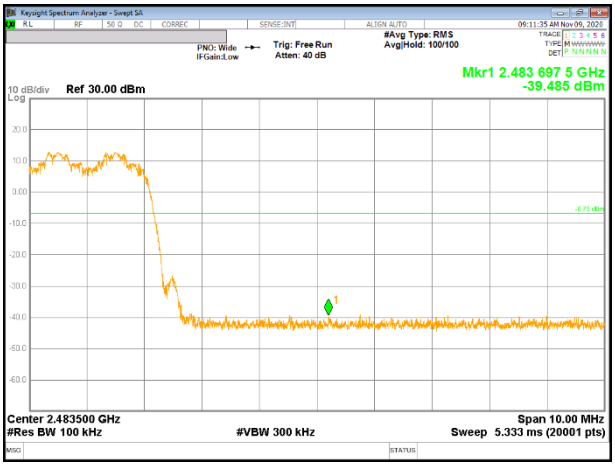
**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**




**LOW BANDEDGE**




**HIGH BANDEDGE**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# 10. RADIATED TEST RESULTS

**LIMITS**

FCC §15.205 and §15.209

| Limits for radiated disturbance of an intentional radiator | | |
|---|---|---|
| Frequency range (MHz) | Limits (µV/m) | Measurement Distance (m) |
| 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 |

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.

FCC Part 15.205 (a) : Only spurious emissions are permitted in any of the frequency bands listed below :

| MHz | MHz | MHz | MHz | GHz | GHz |
|---|---|---|---|---|---|
| 0.009 ~ 0.110 | 8.41425 ~ 8.41475 | 108 ~ 121.94 | 1300 ~ 1427 | 4.5 ~ 5.15 | 14.47 ~ 14.5 |
| 0.495 ~ 0.505 | 12.29 ~ 12.293 | 123 ~ 138 | 1435 ~ 1626.5 | 5.35 ~ 5.46 | 15.35 ~ 16.2 |
| 2.1735 ~ 2.1905 | 12.51975 ~ 12.52025 | 149.9 ~ 150.05 | 1645.5 ~ 1646.5 | 7.25 ~ 7.75 | 17.7 ~ 21.4 |
| 4.125 ~ 4.128 | 12.57675 ~ 12.57725 | 156.52475 ~ | 1660 ~ 1710 | 8.025 ~ 8.5 | 22.01 ~ 23.12 |
| 4.17725 ~ 4.17775 | 13.36 ~ 13.41 | 156.52525 | 1718.8 ~ 1722.2 | 9.0 ~ 9.2 | 23.6 ~ 24.0 |
| 4.20725 ~ 4.20775 | 16.42 ~ 16.423 | 156.7 ~ 156.9 | 2200 ~ 2300 | 9.3 ~ 9.5 | 31.2 ~ 31.8 |
| 6.215 ~ 6.218 | 16.69475 ~ 16.69525 | 162.0125 ~ | 2310 ~ 2390 | 10.6 ~ 12.7 | 36.43 ~ 36.5 |
| 6.26775 ~ 6.26825 | 16.80425 ~ 16.80475 | 167.17 | 2483.5 ~ 2500 | 13.25 ~ 13.4 | Above 38.6 |
| 6.31175 ~ 6.31225 | 25.5 ~ 25.67 | 167.72 ~ 173.2 | 2655 ~ 2900 | | |
| 8.291 ~ 8.294 | 37.5 ~ 38.25 | 240 ~ 285 | 3260 ~ 3267 | | |
| 8.362 ~ 8.366 | 73 ~ 74.6 | 322 ~ 335.4 | 3332 ~ 3339 | | |
| 8.37625 ~ 8.38675 | 74.8 ~ 75.2 | 399.90 ~ 410 | 3345.8 ~ 3358 | | |
| | | 608 ~ 614 | 3600 ~ 4400 | | |
| | | 960 ~ 1240 | | | |

▪ FCC Part 15.205(b) : The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.


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**TEST PROCEDURE**

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150 cm for above 1GHz. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements.(Pre-scans to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 kHz for peak measurements.)

For band edge measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1/T (on time) for average measurement.

GFSK = 1/T = 1 / 0.002885S = 347Hz.

The minimum VBW was 347Hz, but test receiver(ESU40) couldn't set value 347Hz. Due to this reason, testing VBW was set to 500Hz(Worst cases).

The spectrum from 1GHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.
(From 30MHz to 1GHz, test was performed with the EUT set to transmit at the channel with highest output power)

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

Note : Emission was pre-scanned from 9kHz to 30MHz; No emissions were detected which was at least 20dB below the specification limit (consider distance correction factor).
Per FCC part 15.31(o), test results were not reported.

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open are test site.
Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the one of tests made in an open field based on KDB 414788.


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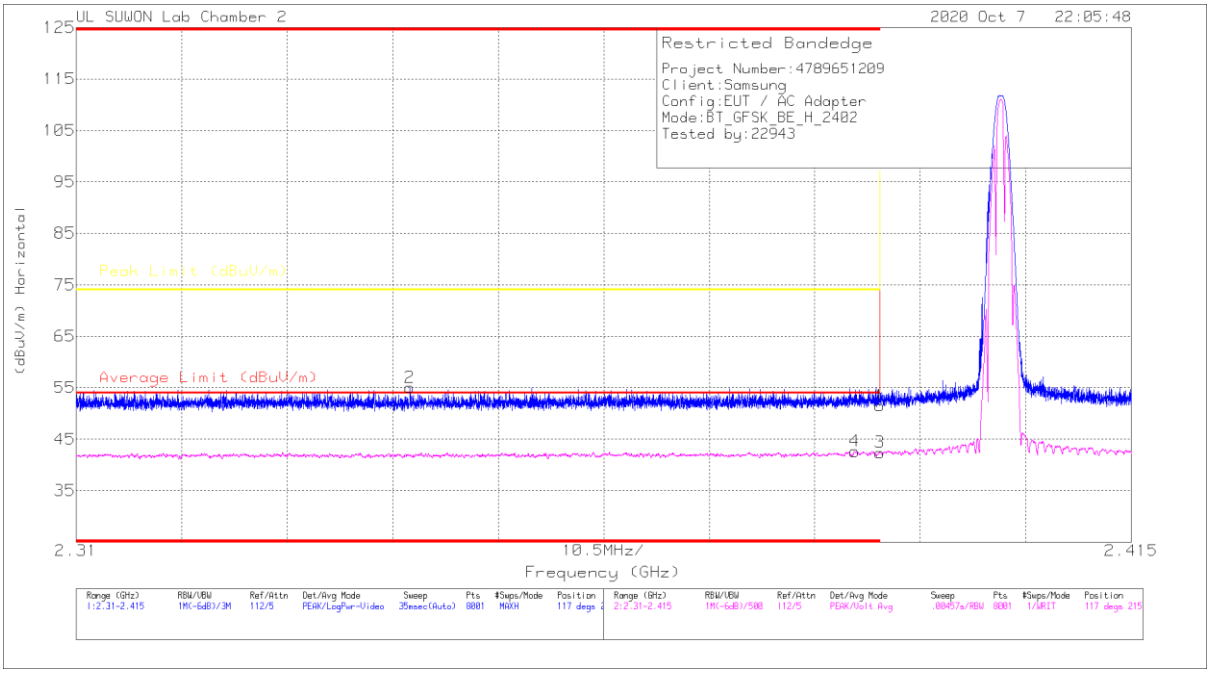
# 10.1. TRANSMITTER ABOVE 1 GHz

## 10.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

### BANDEDGE (0 CHANNEL)

### HORIZONTAL RESULT




Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168724 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.39 | 39.91 | Pk | 31.9 | -20.3 | 51.51 | - | - | 74 | -22.49 | 117 | 215 | H |
| 2 | * 2.34322 | 43.75 | Pk | 31.8 | -20.5 | 55.05 | - | - | 74 | -18.95 | 117 | 215 | H |
| 3 | * 2.39 | 30.8 | VA1T | 31.9 | -20.3 | 42.4 | 54 | -11.6 | - | - | 117 | 215 | H |
| 4 | * 2.38746 | 30.95 | VA1T | 31.9 | -20.2 | 42.65 | 54 | -11.35 | - | - | 117 | 215 | H |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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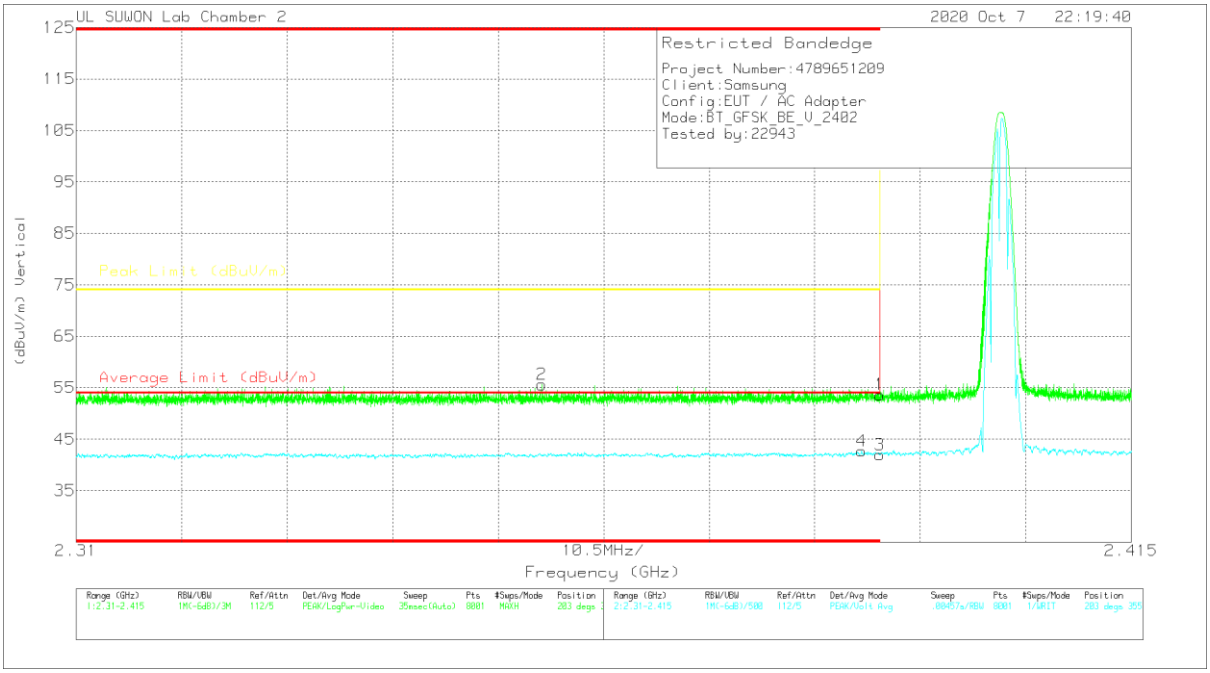
# VERTICAL RESULT




## Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168724 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.39 | 42.04 | Pk | 31.9 | -20.3 | 53.64 | - | - | 74 | -20.36 | 203 | 355 | V |
| 2 | * 2.35633 | 44.23 | Pk | 31.8 | -20.4 | 55.63 | - | - | 74 | -18.37 | 203 | 355 | V |
| 3 | * 2.39 | 30.35 | VA1T | 31.9 | -20.3 | 41.95 | 54 | -12.05 | - | - | 203 | 355 | V |
| 4 | * 2.38815 | 30.99 | VA1T | 31.9 | -20.2 | 42.69 | 54 | -11.31 | - | - | 203 | 355 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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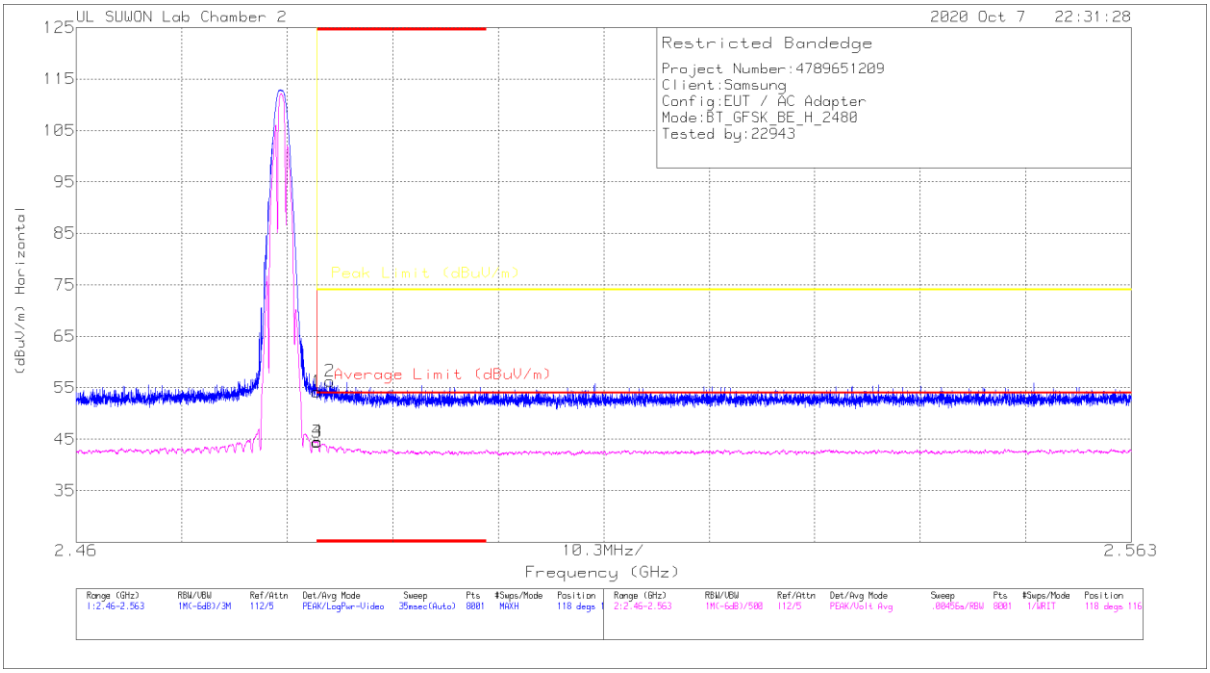
## BANDEDGE (78 CHANNEL)

### HORIZONTAL RESULT




## Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168724 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.48351 | 42.44 | Pk | 32 | -20.2 | 54.24 | - | - | 74 | -19.76 | 118 | 116 | H |
| 2 | * 2.4848 | 44.5 | Pk | 32 | -20.2 | 56.3 | - | - | 74 | -17.7 | 118 | 116 | H |
| 3 | * 2.48351 | 32.66 | VA1T | 32 | -20.2 | 44.46 | 54 | -9.54 | - | - | 118 | 116 | H |
| 4 | * 2.48354 | 32.79 | VA1T | 32 | -20.2 | 44.59 | 54 | -9.41 | - | - | 118 | 116 | H |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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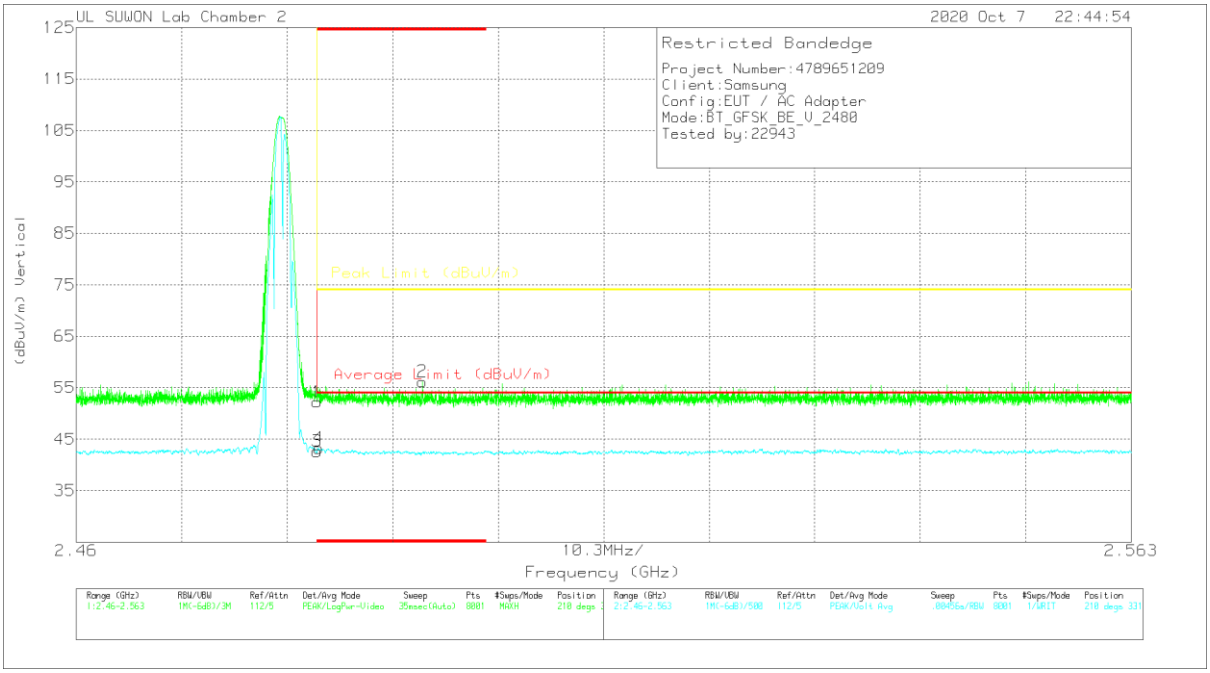
# VERTICAL RESULT




## Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168724 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.48351 | 40.42 | Pk | 32 | -20.2 | 52.22 | - | - | 74 | -21.78 | 210 | 331 | V |
| 2 | * 2.49381 | 44.3 | Pk | 32.1 | -20.2 | 56.2 | - | - | 74 | -17.8 | 210 | 331 | V |
| 3 | * 2.48351 | 30.86 | VA1T | 32 | -20.2 | 42.66 | 54 | -11.34 | - | - | 210 | 331 | V |
| 4 | * 2.48365 | 31.46 | VA1T | 32 | -20.2 | 43.26 | 54 | -10.74 | - | - | 210 | 331 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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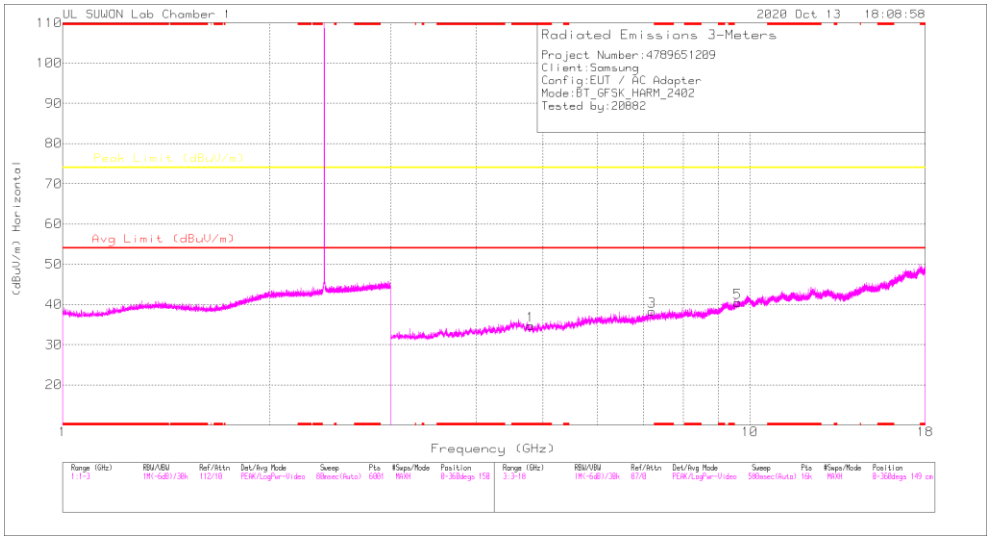
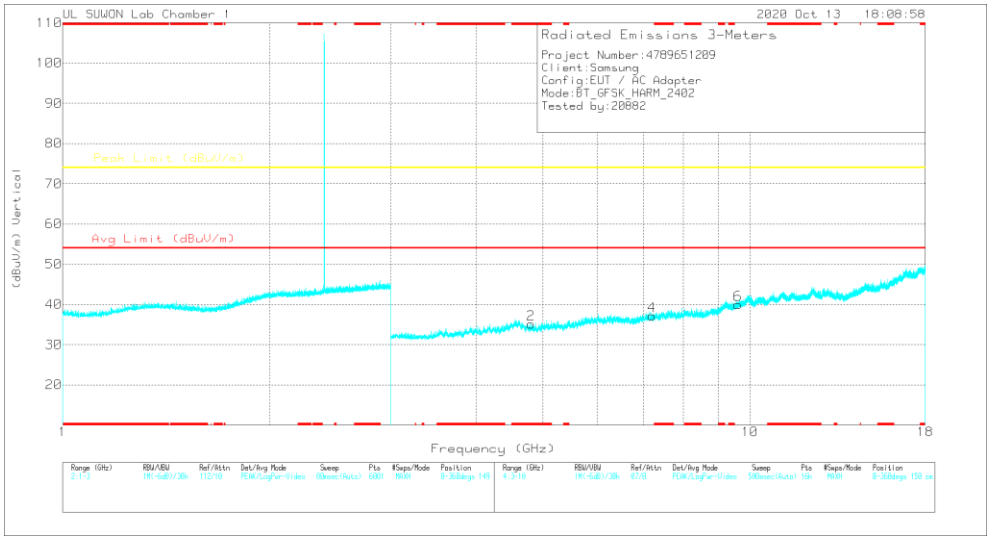
# HARMONICS AND SPURIOUS EMISSIONS

## 0 CHANNEL RESULTS




## HORIZONTAL




## VERTICAL

## RADIATED EMISSIONS

| Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * 4.79611 | 39.08 | PKFH | 34.1 | -31.5 | 41.68 | - | - | 74 | -32.32 | 360 | 100 | H |
| * 4.80278 | 39.93 | PKFH | 34.1 | -31.4 | 42.63 | - | - | 74 | -31.37 | 360 | 100 | V |
| 7.20711 | 35.4 | PKFH | 35.9 | -27.7 | 43.6 | - | - | 74 | -30.4 | 360 | 100 | H |
| 7.20796 | 35.55 | PKFH | 35.9 | -27.7 | 43.75 | - | - | 74 | -30.25 | 360 | 100 | V |
| 9.6087 | 33.25 | PKFH | 37.1 | -23 | 47.35 | - | - | 74 | -26.65 | 360 | 100 | H |
| 9.60857 | 33.5 | PKFH | 37.1 | -23 | 47.6 | - | - | 74 | -26.4 | 360 | 100 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak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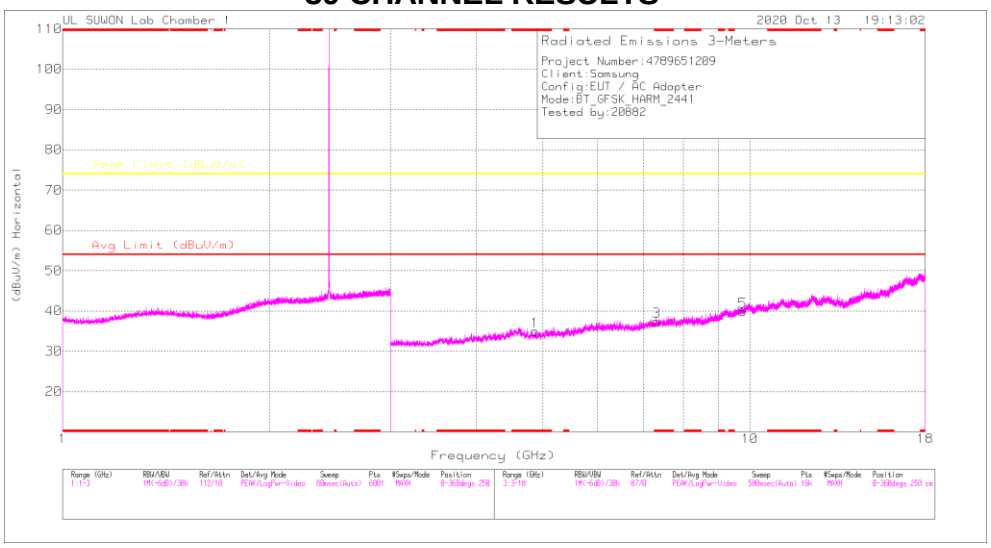
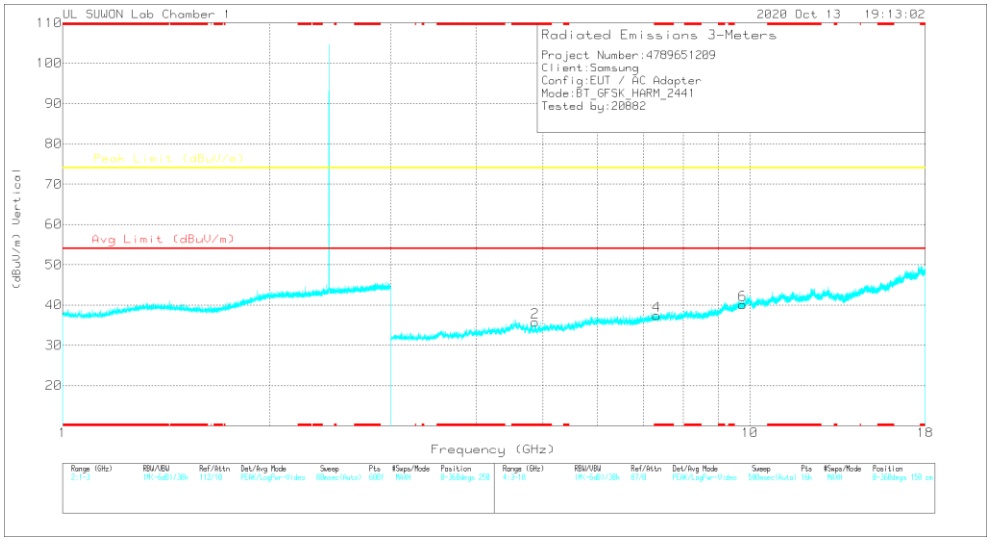
## 39 CHANNEL RESULTS




## HORIZONTAL




## VERTICAL

## RADIATED EMISSIONS

| Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * 4.87548 | 39.26 | PKFH | 34.1 | -31.3 | 42.06 | - | - | 74 | -31.94 | 360 | 100 | H |
| * 4.87249 | 39.03 | PKFH | 34.1 | -31.3 | 41.83 | - | - | 74 | -32.17 | 360 | 100 | V |
| * 7.321 | 36.86 | PKFH | 35.8 | -27.4 | 45.26 | - | - | 74 | -28.74 | 360 | 100 | H |
| * 7.31934 | 36.19 | PKFH | 35.8 | -27.2 | 44.79 | - | - | 74 | -29.21 | 360 | 100 | V |
| 9.7663 | 33.85 | PKFH | 37.4 | -23.8 | 47.45 | - | - | 74 | -26.55 | 360 | 100 | H |
| 9.76614 | 32.96 | PKFH | 37.4 | -23.7 | 46.66 | - | - | 74 | -27.34 | 360 | 100 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak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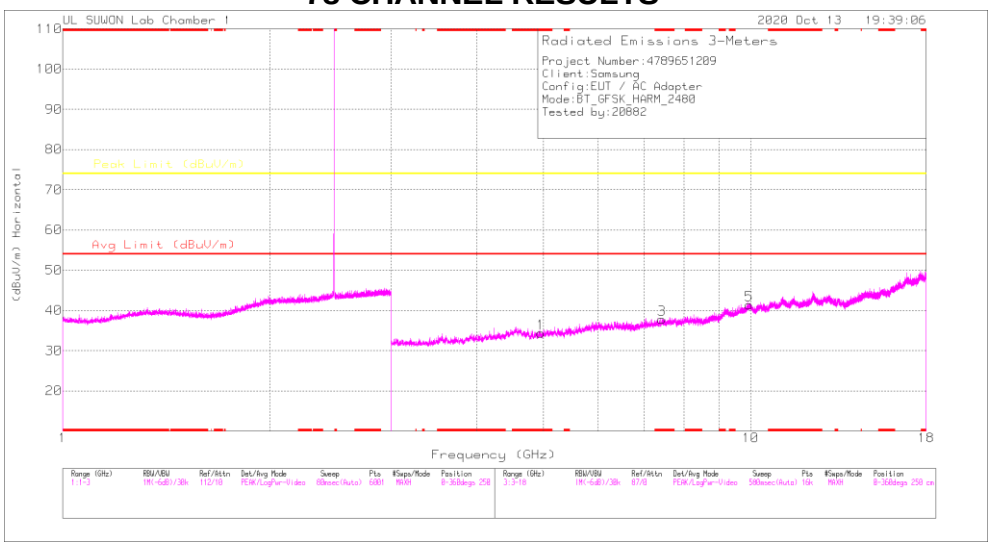
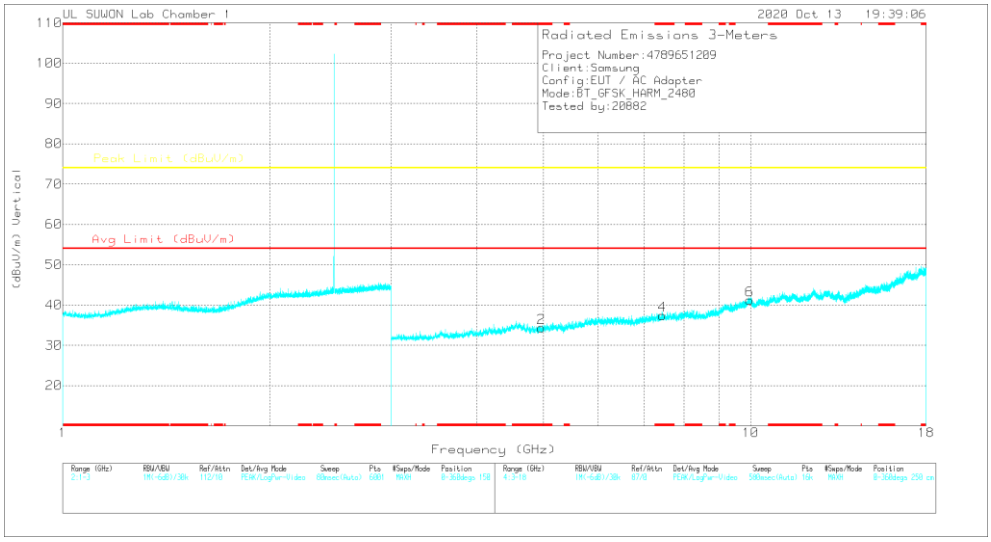
## 78 CHANNEL RESULTS




## HORIZONTAL




## VERTICAL

## RADIATED EMISSIONS

| Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * 4.95464 | 39.29 | PKFH | 34.1 | -31.5 | 41.89 | - | - | 74 | -32.11 | 360 | 100 | H |
| * 4.96138 | 38.53 | PKFH | 34.1 | -31.5 | 41.13 | - | - | 74 | -32.87 | 360 | 100 | V |
| * 7.43801 | 36.63 | PKFH | 35.8 | -26.8 | 45.63 | - | - | 74 | -28.37 | 360 | 100 | H |
| * 7.43929 | 36.11 | PKFH | 35.8 | -26.8 | 45.11 | - | - | 74 | -28.89 | 360 | 100 | V |
| 9.92012 | 32.26 | PKFH | 37.7 | -21.6 | 48.36 | - | - | 74 | -25.64 | 360 | 100 | H |
| 9.91892 | 31.84 | PKFH | 37.7 | -21.6 | 47.94 | - | - | 74 | -26.06 | 360 | 100 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak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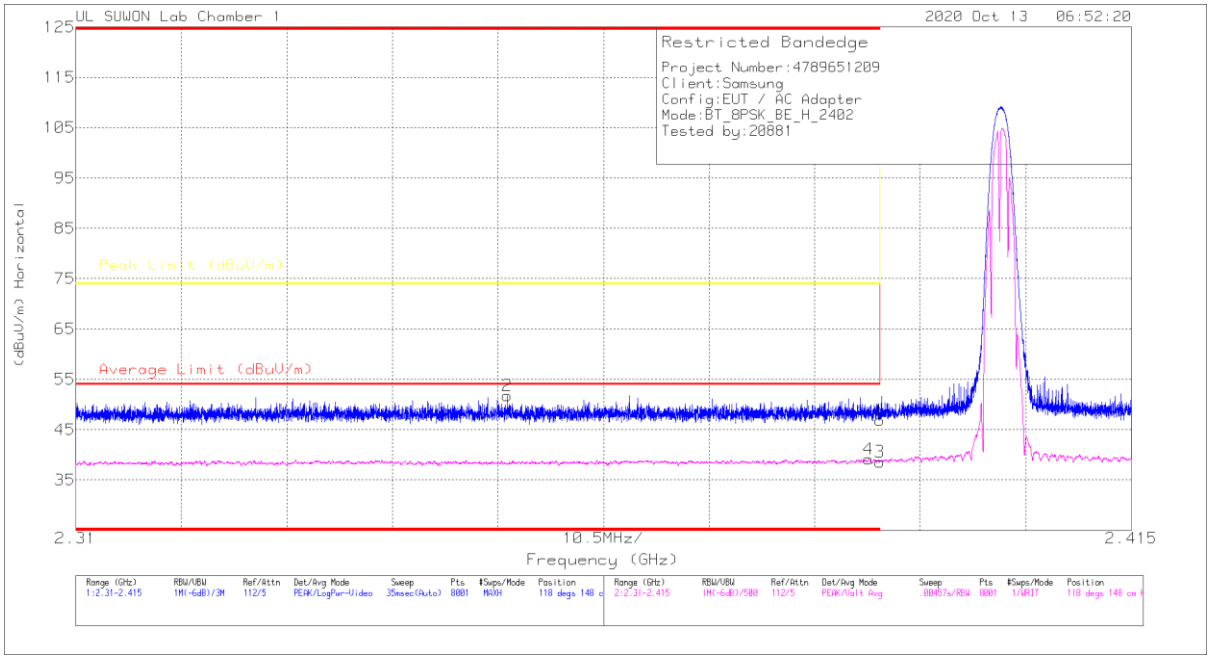
## 10.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

### BANDEDGE (0 CHANNEL)

### HORIZONTAL RESULT




Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.39 | 40.71 | Pk | 31.8 | -25.6 | 46.91 | - | - | 74 | -27.09 | 118 | 148 | H |
| 2 | * 2.35292 | 45.79 | Pk | 31.7 | -25.7 | 51.79 | - | - | 74 | -22.21 | 118 | 148 | H |
| 3 | * 2.39 | 32.4 | VA1T | 31.8 | -25.6 | 38.6 | 54 | -15.4 | - | - | 118 | 148 | H |
| 4 | * 2.38886 | 32.89 | VA1T | 31.8 | -25.5 | 39.19 | 54 | -14.81 | - | - | 118 | 148 | H |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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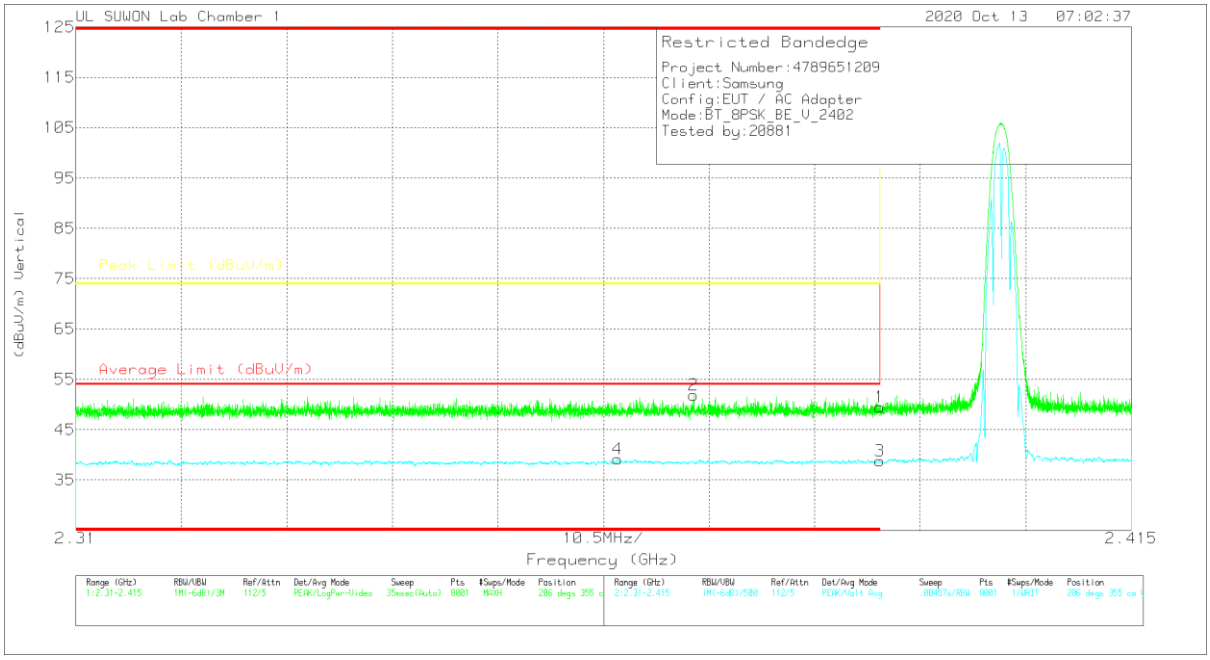
# VERTICAL RESULT




## Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.39 | 43.27 | Pk | 31.8 | -25.6 | 49.47 | - | - | 74 | -24.53 | 206 | 355 | V |
| 2 | * 2.37148 | 45.8 | Pk | 31.7 | -25.6 | 51.9 | - | - | 74 | -22.1 | 206 | 355 | V |
| 3 | * 2.39 | 32.55 | VA1T | 31.8 | -25.6 | 38.75 | 54 | -15.25 | - | - | 206 | 355 | V |
| 4 | * 2.36389 | 33.04 | VA1T | 31.7 | -25.6 | 39.14 | 54 | -14.86 | - | - | 206 | 355 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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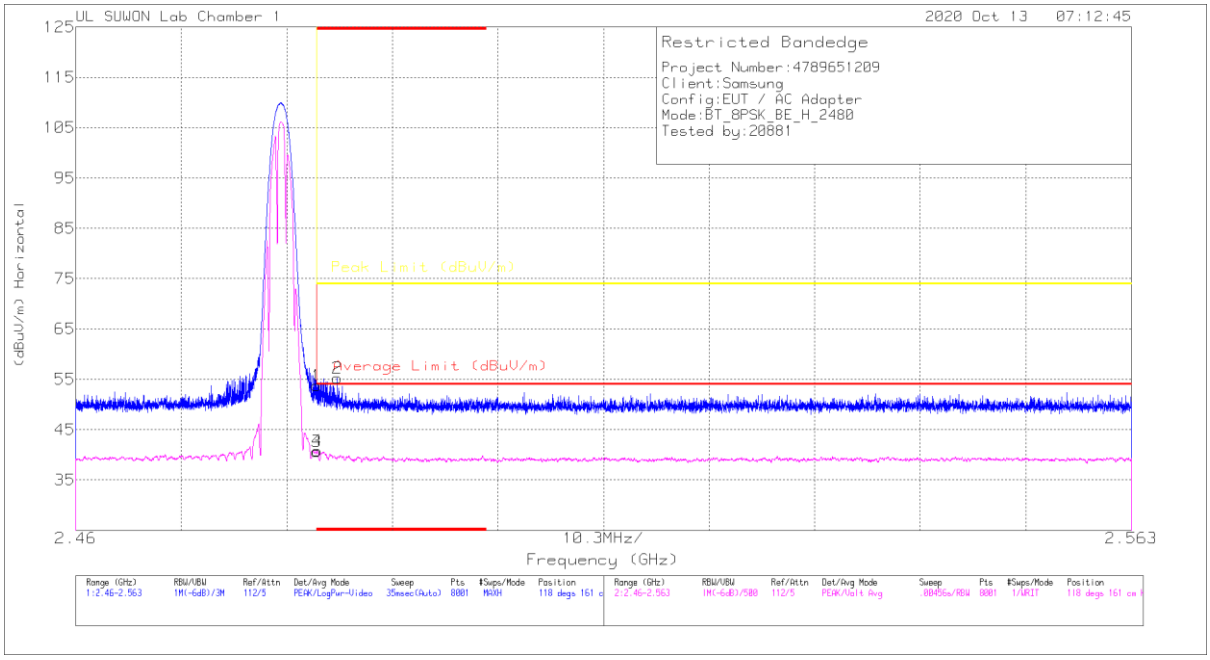
## BANDEDGE (78 CHANNEL)

### HORIZONTAL RESULT




## Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.48351 | 47.09 | Pk | 32 | -25.3 | 53.79 | - | - | 74 | -20.21 | 118 | 161 | H |
| 2 | * 2.48551 | 48.52 | Pk | 32 | -25.3 | 55.22 | - | - | 74 | -18.78 | 118 | 161 | H |
| 3 | * 2.48351 | 34 | VA1T | 32 | -25.3 | 40.7 | 54 | -13.3 | - | - | 118 | 161 | H |
| 4 | * 2.48356 | 34.11 | VA1T | 32 | -25.3 | 40.81 | 54 | -13.19 | - | - | 118 | 161 | H |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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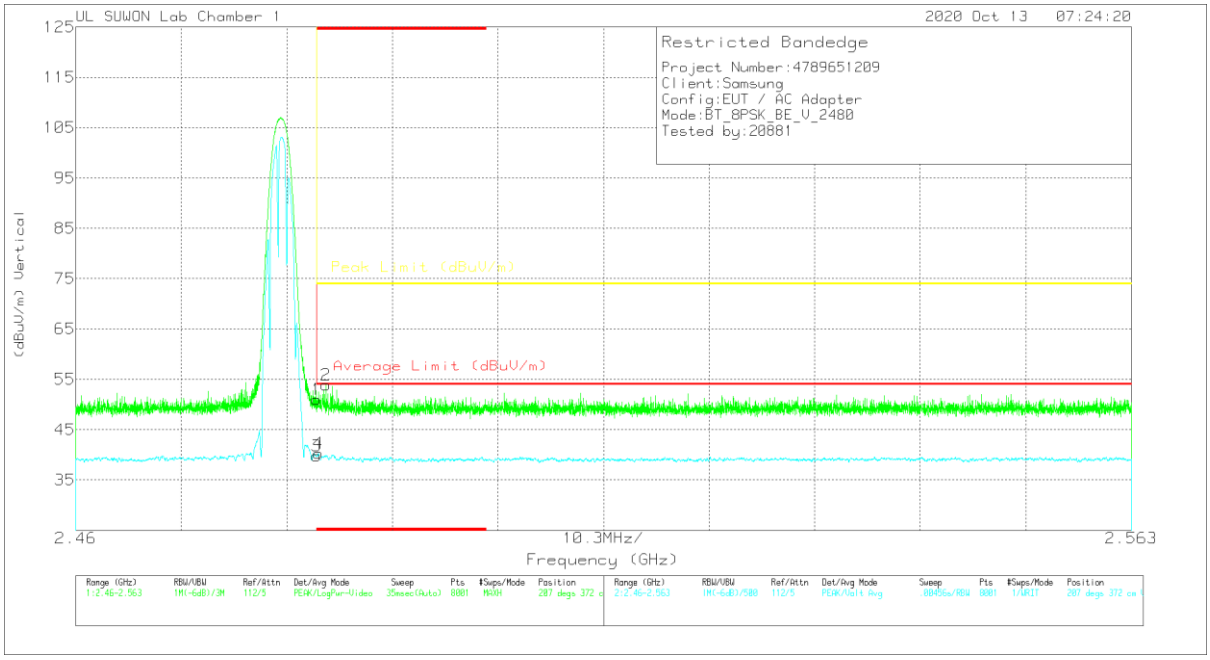
# VERTICAL RESULT




## Trace Markers

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 10dB_ATT[dB] | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * 2.48351 | 44.26 | Pk | 32 | -25.3 | 50.96 | - | - | 74 | -23.04 | 207 | 372 | V |
| 2 | * 2.48444 | 47.08 | Pk | 32 | -25.2 | 53.88 | - | - | 74 | -20.12 | 207 | 372 | V |
| 3 | * 2.48351 | 33.11 | VA1T | 32 | -25.3 | 39.81 | 54 | -14.19 | - | - | 207 | 372 | V |
| 4 | * 2.48365 | 33.54 | VA1T | 32 | -25.3 | 40.24 | 54 | -13.76 | - | - | 207 | 372 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration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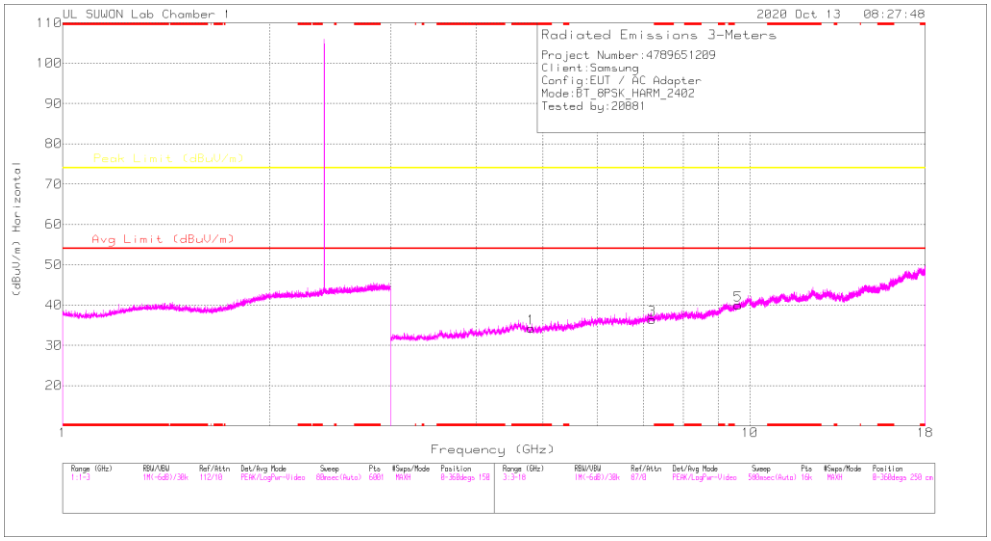
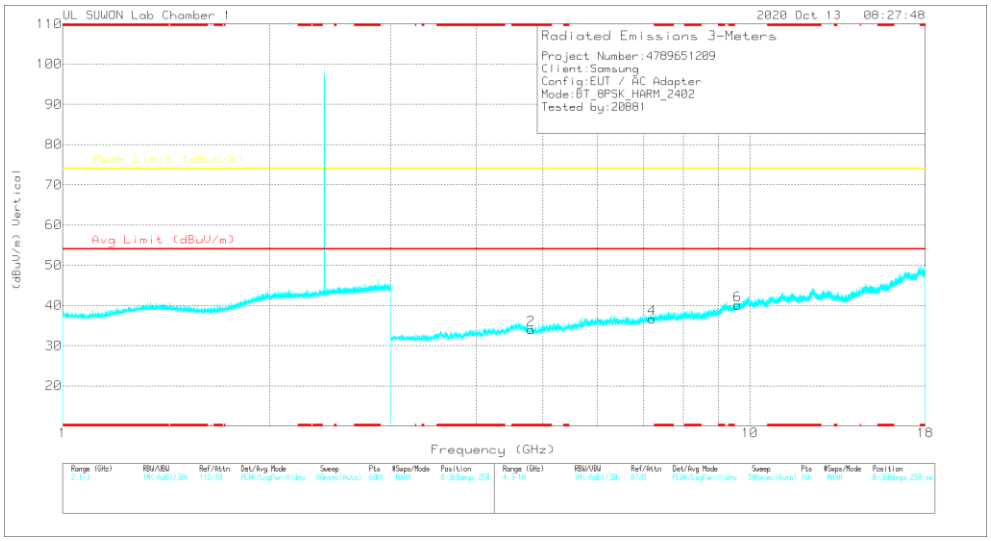
# HARMONICS AND SPURIOUS EMISSIONS

## 0 CHANNEL RESULTS




## HORIZONTAL




## VERTICAL

## RADIATED EMISSIONS

| Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * 4.80258 | 39.15 | PKFH | 34.1 | -31.4 | 41.85 | - | - | 74 | -32.15 | 360 | 100 | H |
| * 4.80468 | 39.56 | PKFH | 34.1 | -31.5 | 42.16 | - | - | 74 | -31.84 | 360 | 100 | V |
| 7.20749 | 35.77 | PKFH | 35.9 | -27.7 | 43.97 | - | - | 74 | -30.03 | 360 | 100 | H |
| 7.2044 | 35.94 | PKFH | 35.9 | -27.6 | 44.24 | - | - | 74 | -29.76 | 360 | 100 | V |
| 9.60804 | 35.4 | PKFH | 37.1 | -23 | 49.5 | - | - | 74 | -24.5 | 360 | 100 | H |
| 9.60609 | 33.06 | PKFH | 37.1 | -23 | 47.16 | - | - | 74 | -26.84 | 360 | 100 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak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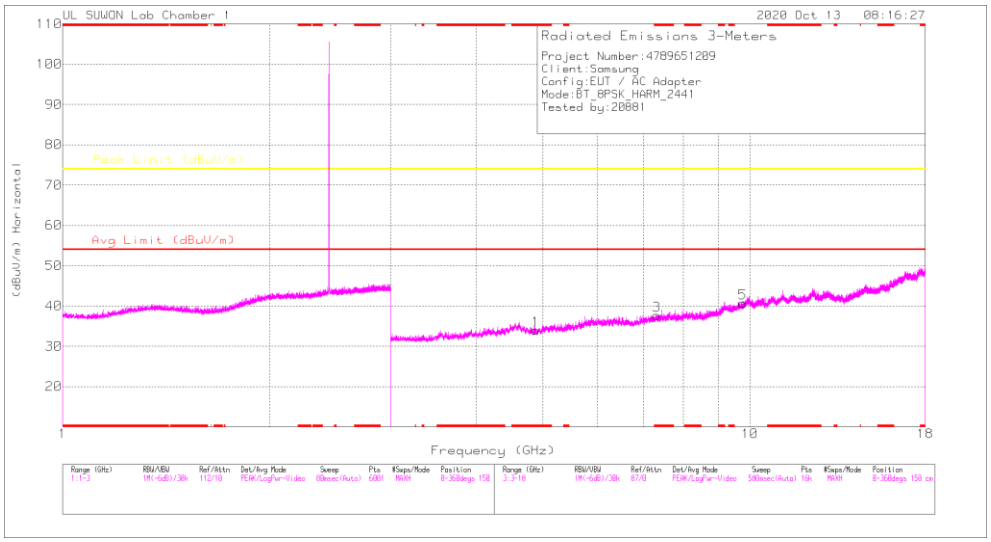
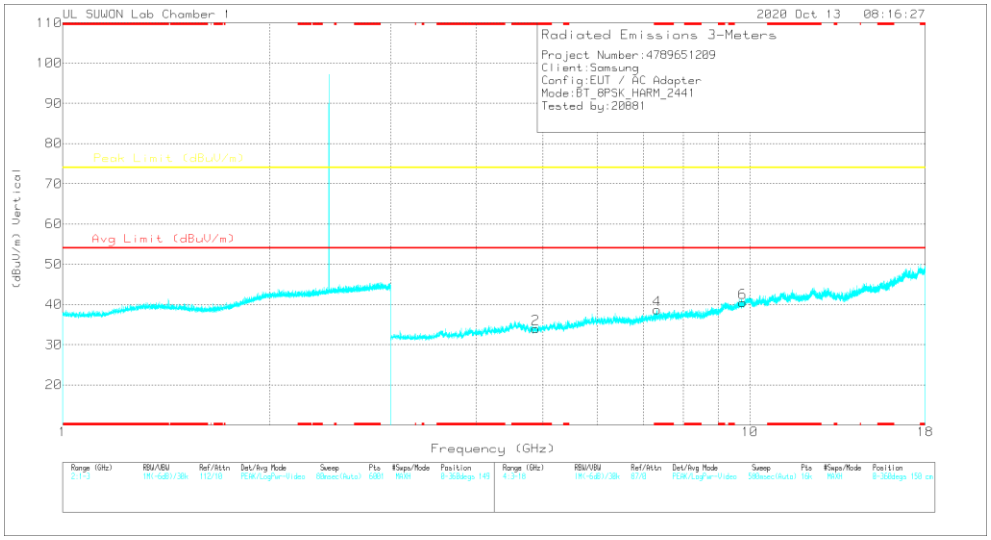
# 39 CHANNEL RESULTS




## HORIZONTAL




## VERTICAL

## RADIATED EMISSIONS

| Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * 4.88183 | 39.1 | PKFH | 34.1 | -31.3 | 41.9 | - | - | 74 | -32.1 | 360 | 100 | H |
| * 4.88193 | 39.36 | PKFH | 34.1 | -31.3 | 42.16 | - | - | 74 | -31.84 | 360 | 100 | V |
| * 7.32404 | 35.93 | PKFH | 35.8 | -27.3 | 44.43 | - | - | 74 | -29.57 | 360 | 100 | H |
| * 7.32239 | 36.04 | PKFH | 35.8 | -27.3 | 44.54 | - | - | 74 | -29.46 | 360 | 100 | V |
| 9.76339 | 33.91 | PKFH | 37.4 | -23.7 | 47.61 | - | - | 74 | -26.39 | 360 | 100 | H |
| 9.7645 | 33.77 | PKFH | 37.4 | -23.7 | 47.47 | - | - | 74 | -26.53 | 360 | 100 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak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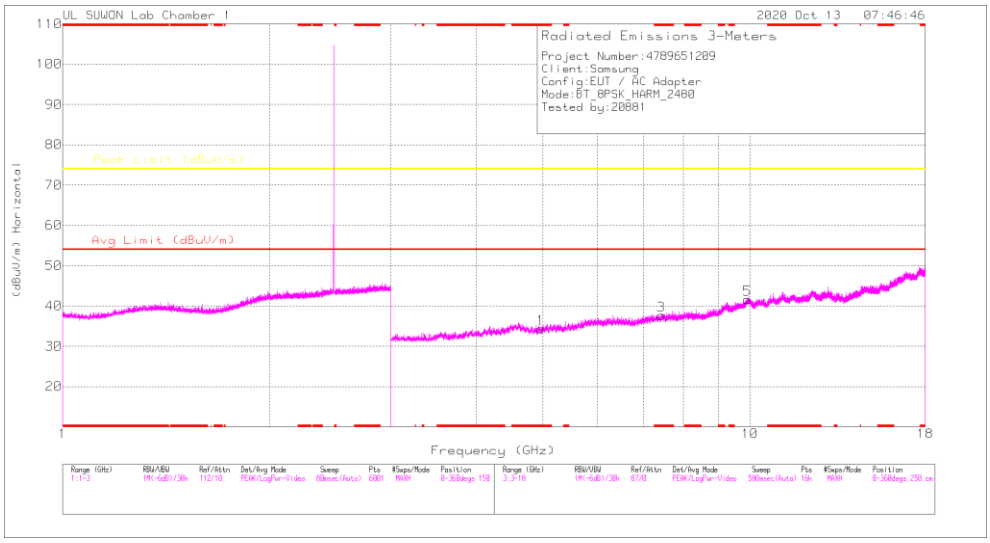
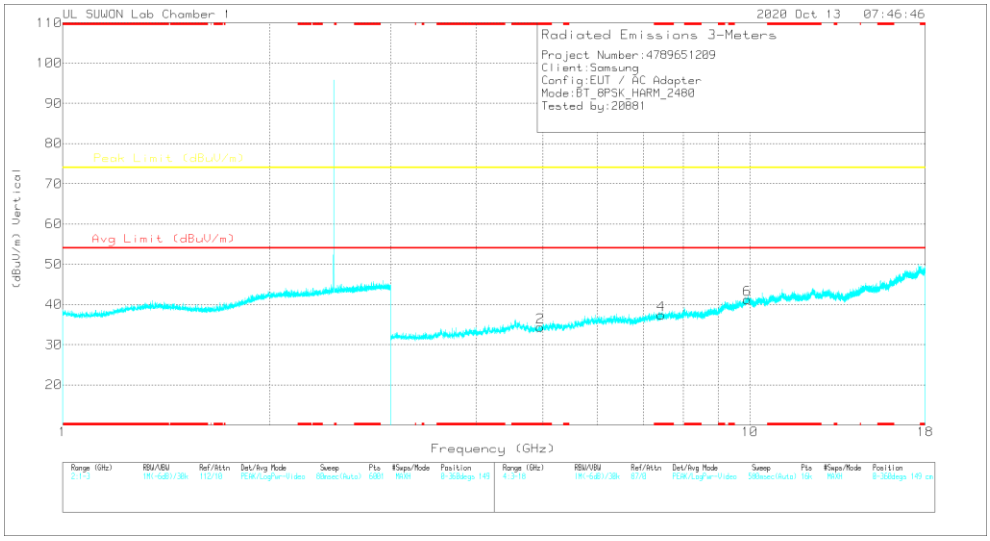
# 78 CHANNEL RESULTS




## HORIZONTAL




## VERTICAL

## RADIATED EMISSIONS

| Frequency (GHz) | Meter Reading (dBuV) | Det | 3117_00168717 | 3GHz_HP[dB] | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * 4.96015 | 38.14 | PKFH | 34.1 | -31.5 | 40.74 | - | - | 74 | -33.26 | 360 | 100 | H |
| * 4.9591 | 39.09 | PKFH | 34.1 | -31.4 | 41.79 | - | - | 74 | -32.21 | 360 | 100 | V |
| * 7.43969 | 35.54 | PKFH | 35.8 | -26.8 | 44.54 | - | - | 74 | -29.46 | 360 | 100 | H |
| * 7.43978 | 35.84 | PKFH | 35.8 | -26.8 | 44.84 | - | - | 74 | -29.16 | 360 | 100 | V |
| 9.91803 | 33.38 | PKFH | 37.7 | -21.6 | 49.48 | - | - | 74 | -24.52 | 360 | 100 | H |
| 9.91852 | 32.6 | PKFH | 37.7 | -21.6 | 48.7 | - | - | 74 | -25.3 | 360 | 100 | V |

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak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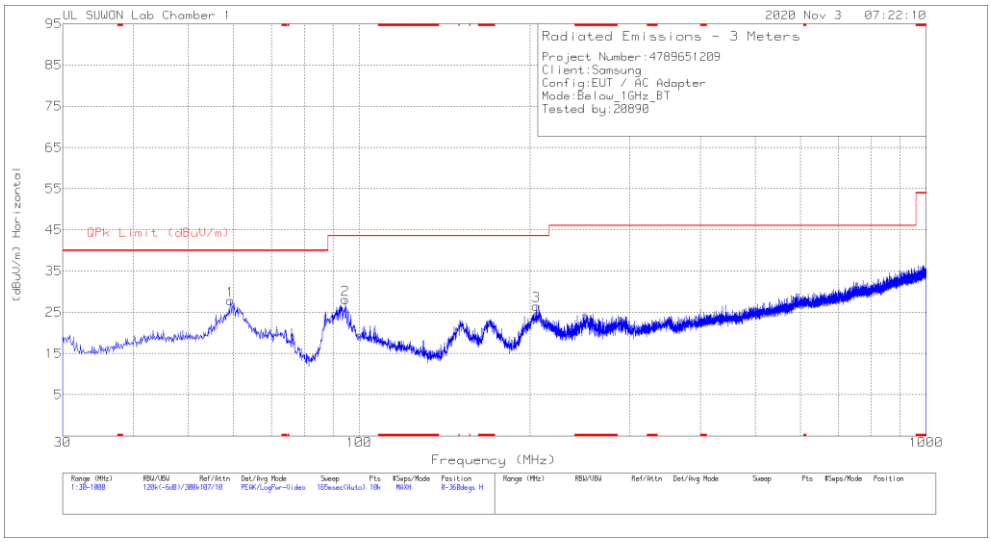
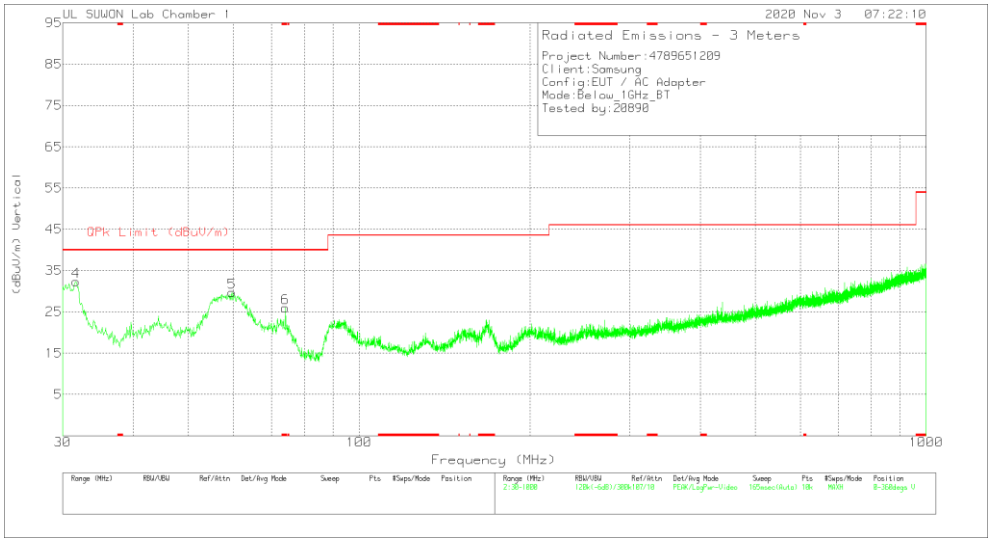
## 10.2. WORST CASE BELOW 1 GHZ

**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)**




**HORIZONTAL**




**VERTICAL**

## Below 1GHz Data

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | VULB9163_750 | Below_1G[dB] | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 59.294 | 39.34 | Pk | 18.7 | -30.2 | 27.84 | 40 | -12.16 | 0-360 | 400 | H |
| 2 | 94.505 | 41.42 | Pk | 16.5 | -29.8 | 28.12 | 43.52 | -15.4 | 0-360 | 300 | H |
| 3 | 205.376 | 38.45 | Pk | 16.6 | -28.5 | 26.55 | 43.52 | -16.97 | 0-360 | 200 | H |
| 4 | 31.649 | 48 | Pk | 15.6 | -31.2 | 32.4 | 40 | -7.6 | 0-360 | 100 | V |
| 5 | 59.682 | 41.18 | Pk | 18.7 | -30.2 | 29.68 | 40 | -10.32 | 0-360 | 100 | V |
| 6 | * 74.135 | 42.31 | Pk | 13.7 | -30 | 26.01 | 40 | -13.99 | 0-360 | 300 | V |

Pk - Peak detector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# 11. AC POWER LINE CONDUCTED EMISSIONS

**LIMITS**

FCC §15.207 (a)

RSS-Gen 8.8

| Frequency of Emission (MHz) | Conducted Limit (dBuV) | |
|---|---|---|
| | 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.

**TEST PROCEDURE**

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 NEUTRAL and HOT lines.

**RESULTS**


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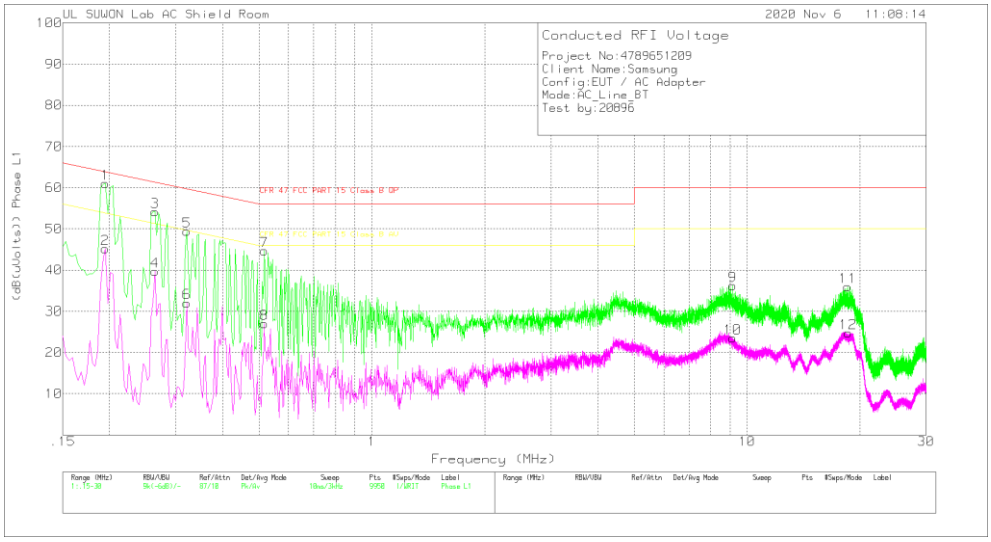
### 11.1.1. AC Power Line Host

## LINE 1 RESULTS




## Trace Markers

Range 1: Phase L1 .15 - 30MHz

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | 101836_With EX_L1[dB] | CABLELOSS(dB) | Corrected Reading (dB(uVolts)) | CFR 47 FCC PART 15 Class B QP | Margin (dB) | CFR 47 FCC PART 15 Class B AV | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .195 | 50.93 | Pk | 9.9 | .2 | 61.03 | 63.82 | -2.79 | - | - |
| 2 | .195 | 35.05 | Av | 9.9 | .2 | 45.15 | - | - | 53.82 | -8.67 |
| 3 | .264 | 44.24 | Pk | 9.7 | .2 | 54.14 | 61.3 | -7.16 | - | - |
| 4 | .264 | 29.76 | Av | 9.7 | .2 | 39.66 | - | - | 51.3 | -11.64 |
| 5 | .321 | 39.43 | Pk | 9.8 | .2 | 49.43 | 59.68 | -10.25 | - | - |
| 6 | .321 | 22.05 | Av | 9.8 | .2 | 32.05 | - | - | 49.68 | -17.63 |
| 7 | .516 | 34.61 | Pk | 9.9 | .2 | 44.71 | 56 | -11.29 | - | - |
| 8 | .516 | 16.95 | Av | 9.9 | .2 | 27.05 | - | - | 46 | -18.95 |
| 9 | 9.165 | 25.95 | Pk | 9.9 | .4 | 36.25 | 60 | -23.75 | - | - |
| 10 | 9.141 | 13.23 | Av | 9.9 | .4 | 23.53 | - | - | 50 | -26.47 |
| 11 | 18.558 | 25.35 | Pk | 10.2 | .4 | 35.95 | 60 | -24.05 | - | - |
| 12 | 18.582 | 14.13 | Av | 10.2 | .4 | 24.73 | - | - | 50 | -25.27 |

Pk - Peak detector
Av - Average detection

## Quasi-Peak Emissions

Range 1: Phase L1 .15 - 30MHz

| Frequency (MHz) | Meter Reading (dBuV) | Det | 101836_With EX_L1[dB] | CABLELOSS(dB) | Corrected Reading (dB(uVolts)) | CFR 47 FCC PART 15 Class B QP | Margin (dB) | CFR 47 FCC PART 15 Class B AV | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| .19425 | 40.84 | Qp | 9.9 | .2 | 50.94 | 63.85 | -12.91 | - | - |
| .26475 | 33.55 | Qp | 9.7 | .2 | 43.45 | 61.28 | -17.83 | - | - |

Qp - Quasi-Peak detector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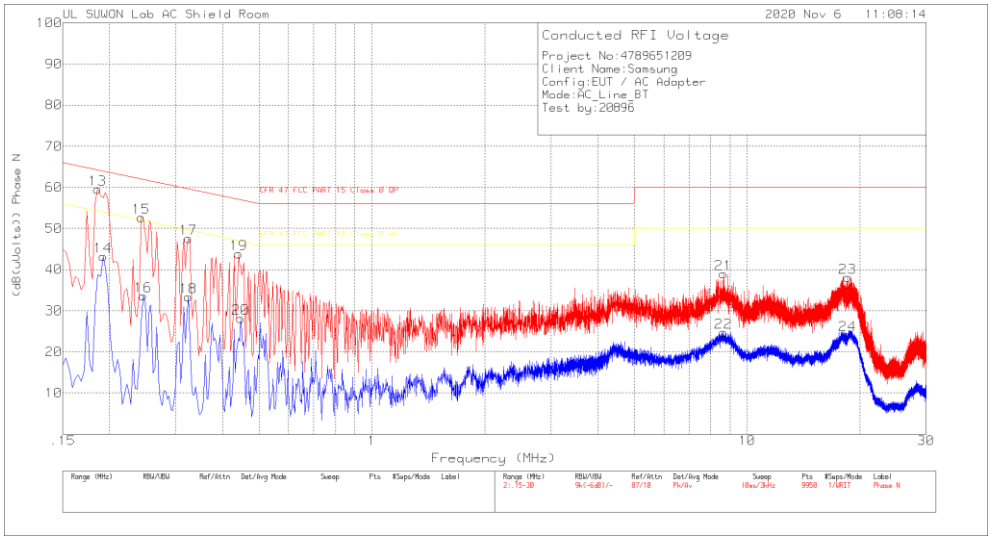
# LINE 2 RESULTS




## Trace Markers

Range 2: Phase N .15 - 30MHz

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | 101836_With EX_N[dB] | CABLELOSS(dB) | Corrected Reading (dB(uVolts)) | CFR 47 FCC PART 15 Class B QP | Margin (dB) | CFR 47 FCC PART 15 Class B AV | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 13 | .186 | 49.37 | Pk | 10 | .2 | 59.57 | 64.21 | -4.64 | - | - |
| 14 | .192 | 33.09 | Av | 9.9 | .2 | 43.19 | - | - | 53.95 | -10.76 |
| 15 | .243 | 42.73 | Pk | 9.7 | .2 | 52.63 | 61.99 | -9.36 | - | - |
| 16 | .246 | 23.73 | Av | 9.7 | .2 | 33.63 | - | - | 51.89 | -18.26 |
| 17 | .324 | 37.52 | Pk | 9.8 | .2 | 47.52 | 59.6 | -12.08 | - | - |
| 18 | .324 | 23.41 | Av | 9.8 | .2 | 33.41 | - | - | 49.6 | -16.19 |
| 19 | .441 | 33.73 | Pk | 9.9 | .2 | 43.83 | 57.04 | -13.21 | - | - |
| 20 | .447 | 18.08 | Av | 9.9 | .2 | 28.18 | - | - | 46.93 | -18.75 |
| 21 | 8.652 | 28.72 | Pk | 9.9 | .3 | 38.92 | 60 | -21.08 | - | - |
| 22 | 8.64 | 14.54 | Av | 9.9 | .3 | 24.74 | - | - | 50 | -25.26 |
| 23 | 18.528 | 27.49 | Pk | 10.2 | .4 | 38.09 | 60 | -21.91 | - | - |
| 24 | 18.531 | 13.5 | Av | 10.2 | .4 | 24.1 | - | - | 50 | -25.9 |

Pk - Peak detector

Av - Average detection

## Quasi-Peak Emissions

Range 2: Phase N .15 - 30MHz

| Frequency (MHz) | Meter Reading (dBuV) | Det | 101836_With EX_N[dB] | CABLELOSS(dB) | Corrected Reading (dB(uVolts)) | CFR 47 FCC PART 15 Class B QP | Margin (dB) | CFR 47 FCC PART 15 Class B AV | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| .18525 | 41.84 | Qp | 10 | .2 | 52.04 | 64.25 | -12.21 | - | - |
| .24375 | 34.32 | Qp | 9.7 | .2 | 44.22 | 61.97 | -17.75 | - | - |

Qp - Quasi-Peak detector

# END OF TEST REPORT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