# TEST REPORT

| | | |
|---|---|---|
| **Reference No.....................** | : | WTX21X04032044W |
| **FCC ID................................** | : | 2AJOT-BH805 |
| **Applicant ...........................** | : | HMD Global Oy |
| **Address .............................** | : | Bertel Jungin aukio 9, 02600 Espoo, Finland |
| **Product Name ...................** | : | Nokia Noise Cancelling Earbuds |
| **Test Model. ........................** | : | BH-805 |
| **Standards ..........................** | : | FCC Part 15.247 |
| **Date of Receipt sample....** | : | Apr.12, 2021 |
| **Date of Test........................** | : | Apr.12, 2021 to May.14, 2021 |
| **Date of Issue .....................** | : | May.14, 2021 |
| **Test Result.........................** | : | **Pass** |

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.


**Prepared By:**

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|---|---|---|
| Jack Huang | Lion Cai | Silin Chen |
| Jack Huang / Project Engineer | Lion Cai / RF Manager | Silin Chen / Manager |

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## Report version

| Version No. | Date of issue | Description |
|---|---|---|
| Rev.00 | May.14, 2021 | Original |
| / | / | / |

# 1. GENERAL INFORMATION

## 1.1 Product Description for Equipment Under Test (EUT)

**Client Information**

| | |
|---|---|
| Applicant: | HMD Global Oy |
| Address of applicant: | Bertel Jungin aukio 9, 02600 Espoo, Finland |
| Manufacturer: | HMD Global Oy |
| Address of manufacturer: | Bertel Jungin aukio 9, 02600 Espoo, Finland |
| Factory: | Shenzhen AngSi Technology Co., LTD |
| Address of factory | Room 201, Block A, No.1 Qianwan Road, Qianhai Shenzhen-Hong Kong Cooperation Zone, Shenzhen,P.R.C. |

| **General Description of EUT** | |
|---|---|
| Product Name: | Nokia Noise Cancelling Earbuds |
| Trade Name | NOKIA |
| Model No.: | BH-805 |
| Adding Model(s): | / |
| Rated Voltage: | Charging Box : Battery DC 3.7V<br>Headset : Battery DC 3.7V |
| Battery Capacity: | Charging Box : 400mAh<br>Headset : 45mAh |
| Adapter Model: | / |
| Software Version: | / |
| Hardware Version: | / |
| | |
| *Note: The test data is gathered from a production sample, provided by the manufacturer.* | |

| **Technical Characteristics of EUT** | |
|---|---|
| Bluetooth Version: | V5.0BR/EDR mode) |
| Frequency Range: | 2402-2480MHz |
| RF Output Power: | 2.94dBm (Conducted) |
| Data Rate: | 1Mbps, 2Mbps, 3Mbps |
| Modulation: | GFSK, π/4 DQPSK, 8DPSK |
| Quantity of Channels: | 79 |
| Channel Separation: | 1MHz |
| Type of Antenna: | Integral Antenna |
| Antenna Gain: | -1.57dBi |

## 1.2 Test Standards

The tests were performed according to following standards:

**FCC Rules Part 15.247:** Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
**558074 D01 15.247 Meas Guidance v05r02**: Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under section 15.247 of the Fcc rules.
**ANSI C63.10-2013:** American National Standard for Testing Unlicensed Wireless Devices.

**Maintenance of compliance** is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

## 1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013,
The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions.

## 1.4 Test Facility

**Address of the test laboratory**
Laboratory: Waltek Testing Group (Shenzhen) Co., Ltd.
Address: 1/F., Room 101, Building 1, Hongwei Industrial Park, Liuxian 2nd Road, Block 70 Bao'an District, Shenzhen, Guangdong, China

**FCC – Registration No.: 125990**
Waltek Testing Group (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintain ed in our files. The Designation Number is CN5010, and Test Firm Registration Number is 125990.

**Industry Canada (IC) Registration No.: 11464A**
The 3m Semi-anechoic chamber of Waltek Testing Group (Shenzhen) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

## 1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest ossible emissions level, more detailed description as follows:

| **Test Mode List** | | |
|---|---|---|
| Test Mode | Description | Remark |
| TM1 | Low Channel | 2402MHz |
| TM2 | Middle Channel | 2441MHz |
| TM3 | High Channel | 2480MHz |
| TM4 | Hopping | 2402-2480MHz |

| **Modulation Configure** | | | |
|---|---|---|---|
| Modulation | Packet | Packet Type | Packet Size |
| GFSK | DH1 | 4 | 27 |
| | DH3 | 11 | 183 |
| | DH5 | 15 | 339 |
| π /4 DQPSK | 2DH1 | 20 | 54 |
| | 2DH3 | 26 | 367 |
| | 2DH5 | 30 | 679 |
| 8DPSK | 3DH1 | 24 | 83 |
| | 3DH3 | 27 | 552 |
| | 3DH5 | 31 | 1021 |
| Normal mode: the Bluetooth has been tested on the modulation of GFSK, π /4 DQPSK and 8DPSK, compliance test and record the worst case. | | | |

| **Test Conditions** | |
|---|---|
| Temperature: | 23.7 °C |
| Relative Humidity: | 47 % |
| ATM Pressure: | 1019 mbar |

| **EUT Cable List and Details** | | | |
|---|---|---|---|
| Cable Description | Length (m) | Shielded/Unshielded | With / Without Ferrite |
| USB Cable | 0.34 | Unshielded | Without Ferrite |

| **Special Cable List and Details** | | | |
|---|---|---|---|
| Cable Description | Length (m) | Shielded/Unshielded | With / Without Ferrite |
| / | / | / | / |

| Auxiliary Equipment List and Details | | | |
|---|---|---|---|
| Description | Manufacturer | Model | Serial Number |
| Notebook | Lenovo | E445 | EB12648265 |
| Adapter | / | KA1517-0502000CNU | / |
| Mobile phone | HUAWEI | VOG-AL00 | / |

## 1.6 Measurement Uncertainty

| Measurement uncertainty | | |
|---|---|---|
| Parameter | Conditions | Uncertainty |
| RF Output Power | Conducted | ±0.42dB |
| Occupied Bandwidth | Conducted | ±1.5% |
| Conducted Spurious Emission | Conducted | ±2.17dB |
| Conducted Emissions | Conducted | 9-150kHz ±3.74dB |
| | | 0.15-30MHz ±3.34dB |
| Transmitter Spurious Emissions | Radiated | 30-200MHz ±4.52dB |
| | | 0.2-1GHz ±5.56dB |
| | | 1-6GHz ±3.84dB |
| | | 6-26GHz ±3.92dB |

## 1.7 Test Equipment List and Details

| No. | Description | Manufacturer | Model | Serial No. | Cal Date | Due. Date |
|---|---|---|---|---|---|---|
| SEMT-1075 | Communication Tester | Rohde & Schwarz | CMW500 | 148650 | 2021-03-27 | 2022-03-26 |
| SEMT-1063 | GSM Tester | Rohde & Schwarz | CMU200 | 114403 | 2021-03-27 | 2022-03-26 |
| SEMT-1072 | Spectrum Analyzer | Agilent | E4407B | MY41440400 | 2021-03-27 | 2022-03-26 |
| SEMT-1079 | Spectrum Analyzer | Agilent | N9020A | US47140102 | 2021-03-27 | 2022-03-26 |
| SEMT-1080 | Signal Generator | Agilent | 83752A | 3610A01453 | 2021-03-27 | 2022-03-26 |
| SEMT-1081 | Vector Signal Generator | Agilent | N5182A | MY47070202 | 2021-03-27 | 2022-03-26 |
| SEMT-1028 | Power Divider | Weinschel | 1506A | PM204 | 2021-03-27 | 2022-03-26 |
| SEMT-1082 | Power Divider | RF-Lambda | RFLT4W5M18G | 14110400027 | 2021-03-27 | 2022-03-26 |
| SEMT-1031 | Spectrum Analyzer | Rohde & Schwarz | FSP30 | 836079/035 | 2021-03-27 | 2022-03-26 |
| SEMT-1007 | EMI Test Receiver | Rohde & Schwarz | ESVB | 825471/005 | 2021-03-27 | 2022-03-26 |
| SEMT-1008 | Amplifier | Agilent | 8447F | 3113A06717 | 2021-04-12 | 2022-04-11 |
| SEMT-1043 | Amplifier | C&D | PAP-1G18 | 2002 | 2021-04-12 | 2022-04-11 |
| SEMT-1069 | Loop Antenna | Schwarz beck | FMZB 1516 | 9773 | 2021-03-19 | 2023-03-18 |
| SEMT-1068 | Broadband Antenna | Schwarz beck | VULB9163 | 9163-333 | 2021-03-19 | 2023-03-18 |
| SEMT-1042 | Horn Antenna | ETS | 3117 | 00086197 | 2021-03-19 | 2023-03-18 |
| SEMT-1121 | Horn Antenna | Schwarzbeck | BBHA 9170 | BBHA9170582 | 2021-04-27 | 2023-04-26 |
| SEMT-1169 | Pre-amplifier | Direction Systems Inc. | PAP-2640 | 14145-14153 | 2021-04-27 | 2022-04-26 |
| SEMT-1163 | Spectrum Analyzer | Rohde & Schwarz | FSP40 | 100612 | 2021-03-27 | 2022-03-26 |
| SEMT-1166 | Power Limiter | Agilent | N9356B | MY45450376 | 2021-03-27 | 2022-03-26 |
| SEMT-1076 | RF Switcher | Top Precision | RCS03-A2 | / | 2021-03-19 | 2023-03-18 |
| SEMT-C001 | Cable | Zheng DI | LL142-07-07-10M(A) | / | / | / |
| SEMT-C002 | Cable | Zheng DI | ZT40-2.92J-2.92J-6M | / | / | / |
| SEMT-C003 | Cable | Zheng DI | ZT40-2.92J-2.92J-2.5M | / | / | / |
| SEMT-C004 | Cable | Zheng DI | 2M0RFC | / | / | / |
| SEMT-C005 | Cable | Zheng DI | 1M0RFC | / | / | / |
| SEMT-C006 | Cable | Zheng DI | 1M0RFC | / | / | / |

| No. | Description | Manufacturer | Model | Serial No. | Cal Date | Due. Date |
|---|---|---|---|---|---|---|
| SEMT-1121 | Horn Antenna | Schwarzbeck | BBHA 9170 | BBHA9170582 | 2019-05-05 | 2021-05-04 |
| SEMT-1069 | Loop Antenna | Schwarz beck | FMZB 1516 | 9773 | 2019-05-05 | 2021-05-04 |

| Software List | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Version** |
| EMI Test Software (Radiated Emission)* | Farad | EZ-EMC | RA-03A1 |
| EMI Test Software (Conducted Emission)* | Farad | EZ-EMC | RA-03A1 |

*Remark: indicates software version used in the compliance certification testing

## 2. SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test Item | Result |
|---|---|---|
| §15.203; §15.247(b)(4)(i) | Antenna Requirement | Compliant |
| §15.205 | Restricted Band of Operation | Compliant |
| §15.207(a) | Conducted Emission | Compliant |
| §15.209(a) | Radiated Spurious Emissions | Compliant |
| §15.247(a)(1)(iii) | Quantity of Hopping Channel | Compliant |
| §15.247(a)(1) | Channel Separation | Compliant |
| §15.247(a)(1)(iii) | Time of Occupancy (Dwell time) | Compliant |
| §15.247(a) | 20dB Bandwidth | Compliant |
| §15.247(b)(1) | RF Power Output | Compliant |
| §15.247(d) | Band Edge (Out of Band Emissions) | Compliant |
| §15.247(a)(1) | Frequency Hopping Sequence | Compliant |
| §15.247(g), (h) | Frequency Hopping System | Compliant |

N/A: Not applicable

# 3. Antenna Requirement

## 3.1 Standard Applicable

According to FCC Part 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. 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.

## 3.2 Evaluation Information

This product has an Integral antenna, fulfill the requirement of this section.

# 4. Frequency Hopping System Requirements

## 4.1 Standard Applicable

According to FCC Part 15.247(a)(1), the system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

## 4.2 Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

This device was tested with a Bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements for 558074 D01 15.247 Meas Guidance v05r02 and FCC Part 15.247 rule.

## 4.3 EUT Pseudorandom Frequency Hopping Sequence

Pseudorandom Frequency Hopping Sequence Table as below:
Channel: 08, 24, 40, 56, 40, 56, 72, 09, 01, 09, 33, 41, 33, 41, 65, 73, 53, 69, 06, 22, 04, 20, 36, 52, 38, 46, 70, 78, 68, 76, 21, 29, 10, 26, 42, 58, 44, 60, 76, 13, 03, 11, 35, 43, 37, 45, 69, 77, 55, 71, 08, 24, 08, 24, 40, 56, 40, 48, 72, 01, 72, 01, 25, 33, 12, 28, 44, 60, 42, 58, 74, 11, 05, 13, 37, 45 etc.

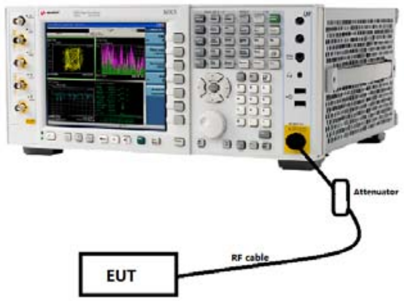
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

# 5. Quantity of Hopping Channels and Channel Separation

## 5.1 Standard Applicable

According to FCC 15.247(a)(1), 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, and frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

## 5.2 Test Setup Block Diagram




## 5.3 Test Procedure

According to KDB 558074 D01 v05r02 Subclause 9 and ANSI C63.10-2013 section 7.8.3, the number of hopping frequencies test method as follows.

a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
c) VBW ≥ RBW.
d) Sweep: Auto.
e) Detector function: Peak.
f) Trace: Max hold.
g) Allow the trace to stabilize.

According to DA 00-705 Section 15.247(a), the EUT shall have its hopping function enabled, the Carrier frequency separation test method as follows:

Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span
Video (or Average) Bandwidth (VBW) ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

## 5.4 Summary of Test Results/Plots

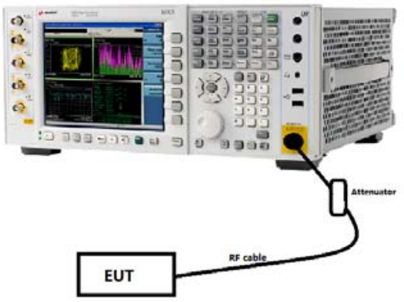
**Please refer to Appendix A**

# 6. Dwell Time of Hopping Channel

## 6.1 Standard Applicable

According to 15.247(a)(1)(iii), frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. 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.

## 6.2 Test Setup Block Diagram




## 6.3 Test Procedure

According to KDB 558074 D01 v05r02 Subclause 9 and ANSI C63.10-2013 section 7.8.4, the dwell time of a hopping channel test method as follows.

a) Span: Zero span, centered on a hopping channel.
b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
d) Detector function: Peak.
e) Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.
Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:
(Number of hops in the period specified in the requirements) =
(number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)

The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation. The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.

## 6.4 Summary of Test Results/Plots

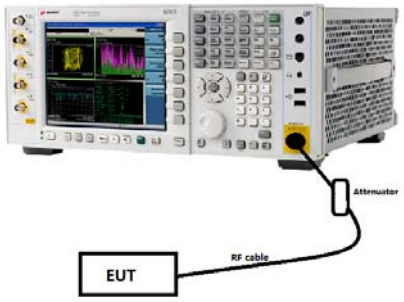
The dwell time within a period in data mode is independent from the packet type (packet length).
The test period: T = 0.4 Second * 79 Channel = 31.6 s
Dwell time = time slot length * (Hopping rate / Number of hopping channels) * Period
**Please refer to Appendix B**

# 7. 20dB Bandwidth

## 7.1 Standard Applicable

According to 15.247(a) and 15.215(c), 20dB bandwidth is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

## 7.2 Test Setup Block Diagram




## 7.3 Test Procedure

According to KDB 558074 D01 v05r02 Subclause 9 and ANSI C63.10-2013 section 6.9.2, the 20dB bandwidth test method as follows.

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.
b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.
c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level.
d) Steps a) through c) might require iteration to adjust within the specified tolerances.
e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target "−xx dB down" requirement; that is, if the requirement calls for measuring the −20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.
f) Set detection mode to peak and trace mode to max hold.
g) Determine the reference value: Set the EUT to transmit an unmodulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
h) Determine the "−xx dB down amplitude" using [(reference value) − xx]. Alternatively, this calculation may be made by using the marker-delta function of the instrument.
i) If the reference value is determined by an unmodulated carrier, then turn the EUT modulation ON, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).

j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the "−xx dB down amplitude" determined in step h). If a marker is below this "−xx dB down amplitude" value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the "−xx dB down amplitude" determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.
k) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

## 7.4 Summary of Test Results/Plots

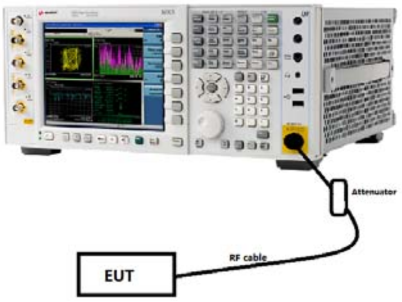
**Please refer to Appendix C**

# 8. RF Output Power

## 8.1 Standard Applicable

According to 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.

## 8.2 Test Setup Block Diagram




## 8.3 Test Procedure

According to KDB 558074 D01 v05r02 Subclause 9 and ANSI C63.10-2013 section 7.8.5, the output power test method as follows.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:
a) Use the following spectrum analyzer settings:
  1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
  2) RBW > 20 dB bandwidth of the emission being measured.
  3) VBW ≥ RBW.
  4) Sweep: Auto.
  5) Detector function: Peak.
  6) Trace: Max hold.
b) Allow trace to stabilize.
c) Use the marker-to-peak function to set the marker to the peak of the emission.
d) The indicated level is the peak output power, after any corrections for external attenuators and cables.
e) A plot of the test results and setup description shall be included in the test report.

## 8.4 Summary of Test Results/Plots

**Please refer to Appendix D**

# 9. Field Strength of Spurious Emissions

## 9.1 Standard Applicable

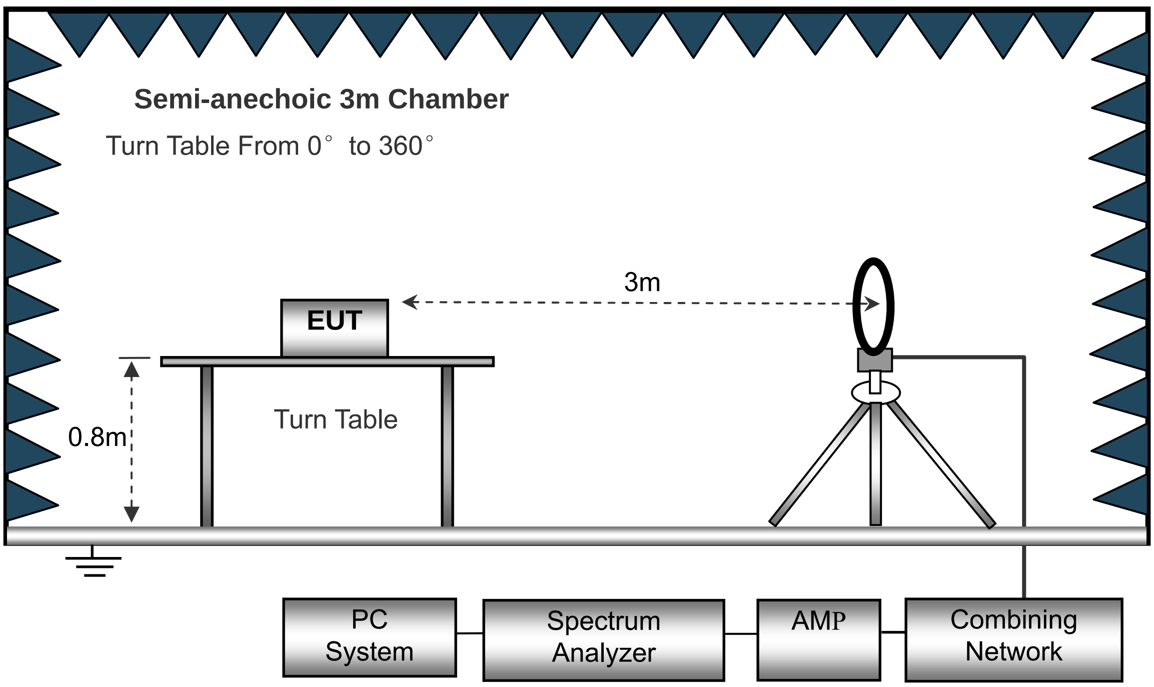
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

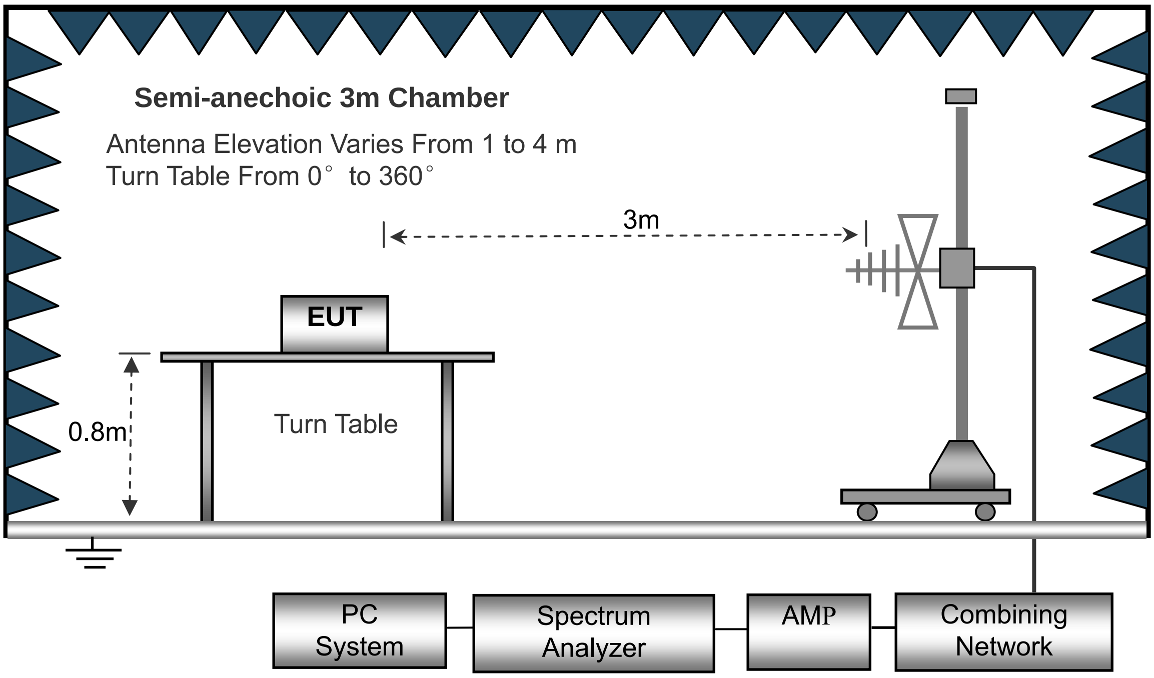
## 9.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.

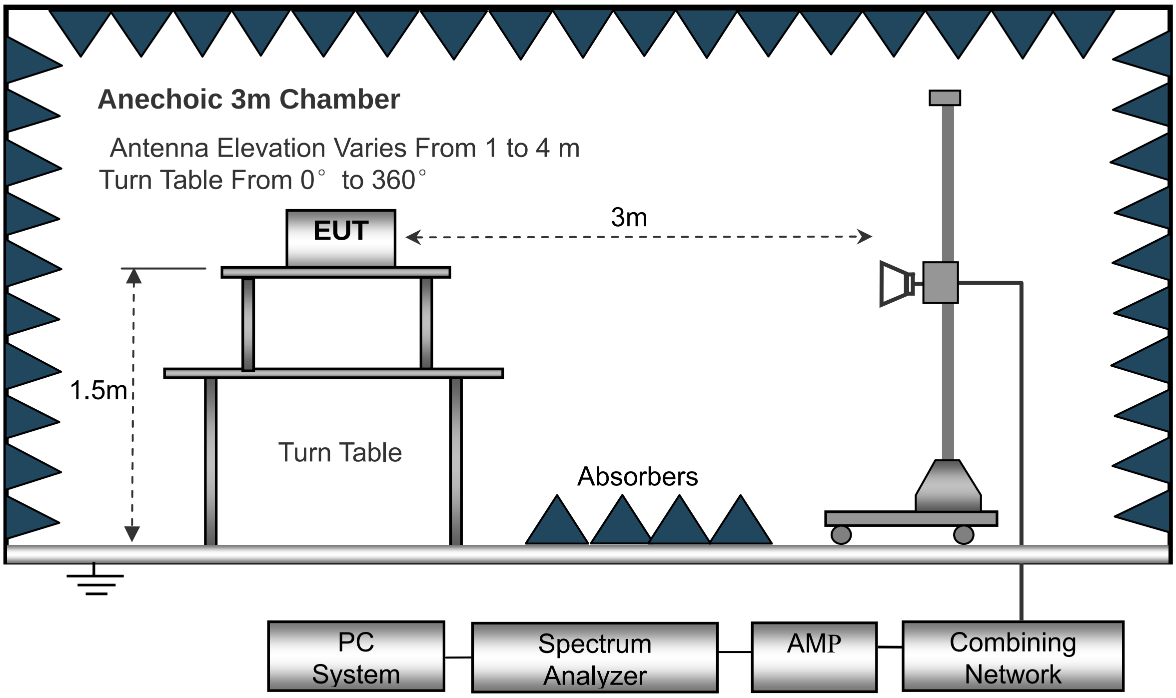
The test setup for emission measurement below 30MHz..



The test setup for emission measurement from 30 MHz to 1 GHz..




The test setup for emission measurement above 1 GHz..



| Frequency :9kHz-30MHz | Frequency :30MHz-1GHz | Frequency :Above 1GHz |
|---|---|---|
| RBW=10KHz, | RBW=120KHz, | RBW=1MHz, |
| VBW =30KHz | VBW=300KHz | VBW=3MHz(Peak), 10Hz(AV) |
| Sweep time= Auto | Sweep time= Auto | Sweep time= Auto |
| Trace = max hold | Trace = max hold | Trace = max hold |
| Detector function = peak | Detector function = peak, QP | Detector function = peak, AV |

## 9.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Correct
Correct = Ant. Factor + Cable Loss – Ampl. Gain

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit. The equation for margin calculation is as follows:

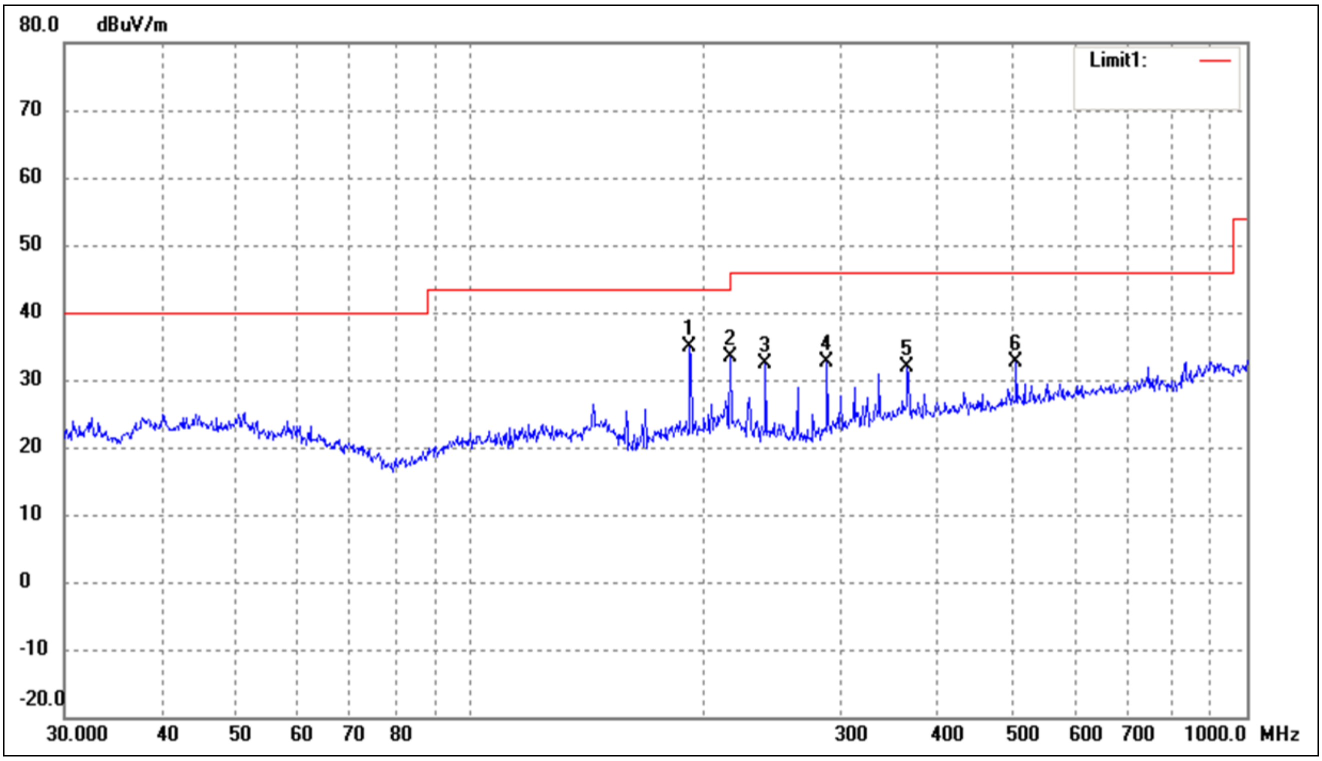
Margin = Corr. Ampl. – FCC Part 15 Limit

## 9.4 Summary of Test Results/Plots

*Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.*
*All test modes (different data rate and different modulation) are performed, but only the worst case (GFSK) is recorded in this report.*

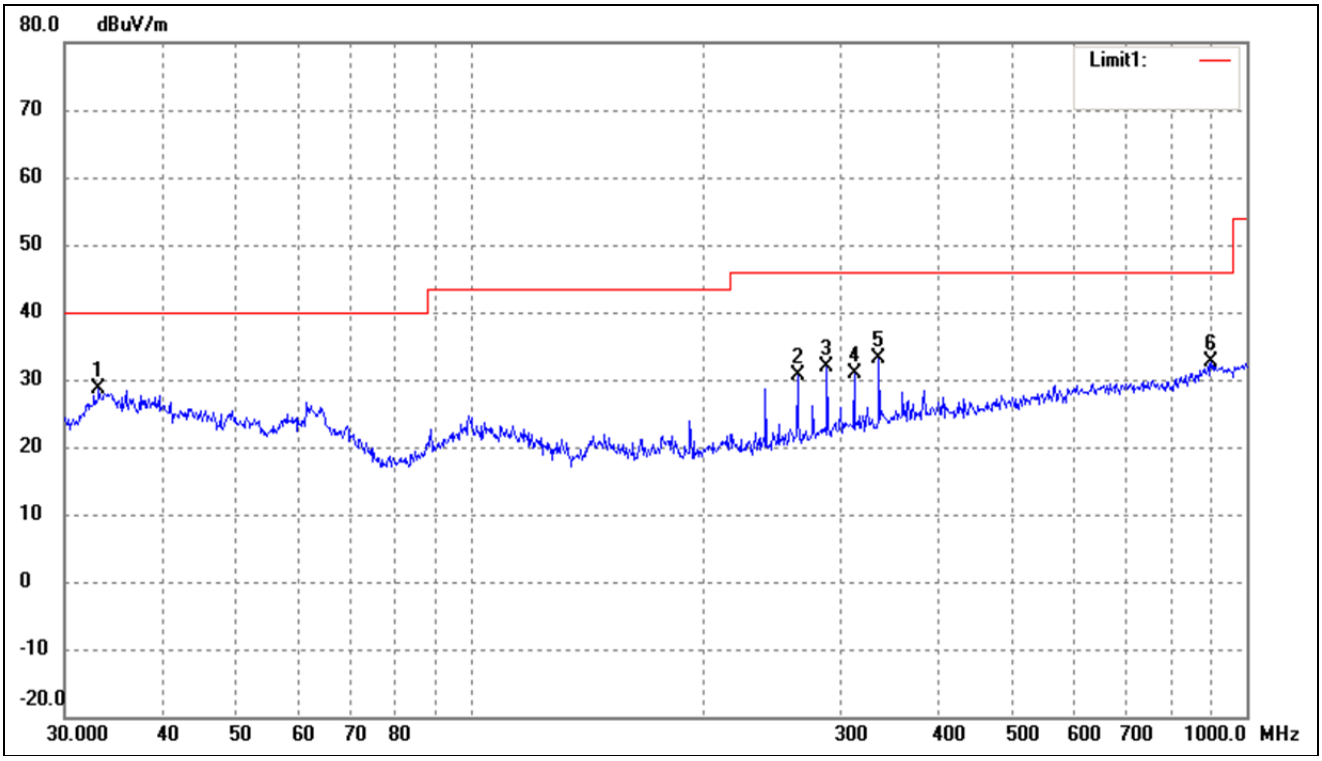
➢ Spurious Emissions Below 1GHz

| Test Channel | Low(worst case) | Polarity: | Horizontal |
|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ) | (cm) | |
| 1 | 191.7450 | 47.83 | -12.99 | 34.84 | 43.50 | -8.66 | - | - | peak |
| 2 | 216.0240 | 45.72 | -12.24 | 33.48 | 46.00 | -12.52 | - | - | peak |
| 3 | 239.9874 | 43.76 | -11.42 | 32.34 | 46.00 | -13.66 | - | - | peak |
| 4 | 287.9904 | 42.40 | -9.81 | 32.59 | 46.00 | -13.41 | - | - | peak |
| 5 | 365.5391 | 39.06 | -7.29 | 31.77 | 46.00 | -14.23 | - | - | peak |
| 6 | 504.7062 | 36.71 | -4.07 | 32.64 | 46.00 | -13.36 | - | - | peak |

| Test Channel | Low(worst case) | Polarity: | Vertical |
|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | ( ) | (cm) | |
| 1 | 33.2112 | 42.48 | -13.97 | 28.51 | 40.00 | -11.49 | - | - | peak |
| 2 | 263.8190 | 41.56 | -10.83 | 30.73 | 46.00 | -15.27 | - | - | peak |
| 3 | 287.9904 | 41.59 | -9.81 | 31.78 | 46.00 | -14.22 | - | - | peak |
| 4 | 312.1794 | 39.82 | -8.95 | 30.87 | 46.00 | -15.13 | - | - | peak |
| 5 | 336.0352 | 41.34 | -8.28 | 33.06 | 46.00 | -12.94 | - | - | peak |
| 6 | 900.1474 | 31.20 | 1.55 | 32.75 | 46.00 | -13.25 | - | - | peak |

Remark: '-'Means' the test Degree and Height are not recorded by the test software and only show the worst case in the test report.

➢ Spurious Emissions Above 1GHz

| **Frequency (MHz)** | **Reading (dBuV/m)** | **Correct dB** | **Result (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Polar H/V** | **Detector** |
|---|---|---|---|---|---|---|---|
| Low Channel-2402MHz | | | | | | | |
| 4804.049 | 49.41 | -4.52 | 44.89 | 54.00 | -9.11 | H | AV |
| 4809.498 | 59.84 | -4.51 | 55.33 | 74.00 | -18.67 | H | PK |
| 7206.000 | 51.59 | -2.20 | 49.39 | 74.00 | -24.61 | H | PK |
| 4804.089 | 48.93 | -4.52 | 44.41 | 54.00 | -9.59 | V | AV |
| 4809.498 | 59.66 | -4.51 | 55.15 | 74.00 | -18.85 | V | PK |
| 7206.000 | 51.13 | -2.20 | 48.93 | 74.00 | -25.07 | V | PK |
| Middle Channel-2441MHz | | | | | | | |
| 4883.519 | 58.41 | -4.47 | 53.94 | 74.00 | -20.06 | H | PK |
| 7323.000 | 49.99 | -2.16 | 47.83 | 74.00 | -26.17 | H | PK |
| 4883.519 | 57.84 | -4.47 | 53.37 | 74.00 | -20.63 | V | PK |
| 7323.000 | 50.14 | -2.16 | 47.98 | 74.00 | -26.02 | V | PK |
| High Channel-2480MHz | | | | | | | |
| 4958.678 | 57.36 | -4.41 | 52.95 | 74.00 | -21.05 | H | PK |
| 7451.566 | 55.30 | -2.12 | 53.18 | 74.00 | -20.82 | H | PK |
| 4958.678 | 54.32 | -4.41 | 49.91 | 74.00 | -24.09 | V | PK |
| 7451.566 | 55.28 | -2.12 | 53.16 | 74.00 | -20.84 | V | PK |

*Note: 1.Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
*2.Average measurement was not performed if peak level is lower than average limit(54 dBuV/m) for above 1GHz.*

# 10. Out of Band Emissions

## 10.1 Standard Applicable

According to §15.247 (d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

## 10.2 Test Procedure

According to ANSI C63.10-2013 section 7.8.6, the Band-edge measurements for RF conducted emissions test method as follows.

a) Connect the EMI receiver or spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described in step e) (be sure to enter all losses between the unlicensed wireless device output and the spectrum analyzer).
b) Set the EUT to the lowest frequency channel (for the hopping on test, the hopping sequence shall include the lowest frequency channel).
c) Set the EUT to operate at maximum output power and 100% duty cycle, or equivalent “normal mode of operation” as specified in 6.10.3.
d) If using the radiated method, then use the applicable procedure(s) of 6.4, 6.5, or 6.6, and orient the EUT and measurement antenna positions to produce the highest emission level.
e) Perform the test as follows:

1) Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.
2) Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than [10 log (OBW/RBW)] below the reference level. Specific guidance is given in 4.1.5.2.
3) Attenuation: Auto (at least 10 dB preferred).
4) Sweep time: Coupled.
5) Resolution bandwidth: 100 kHz.
6) Video bandwidth: 300 kHz.
7) Detector: Peak.
8) Trace: Max hold.

f) Allow the trace to stabilize. For the test with the hopping function turned ON, this can take several minutes to achieve a reasonable probability of intercepting any emissions due to oscillator overshoot.

g) Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
h) Repeat step c) through step e) for every applicable modulation.
i) Set the EUT to the highest frequency channel (for the hopping on test, the hopping sequence shall include the highest frequency channel) and repeat step c) through step d).
j) The band-edge measurement shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

Restricted-band band-edge test method please refers to ANSI C63.10-2013 section 6.10.5. The emission must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205. Note that the method of measurement KDB publication number: 913591 may be used for the radiated band-edge measurements.

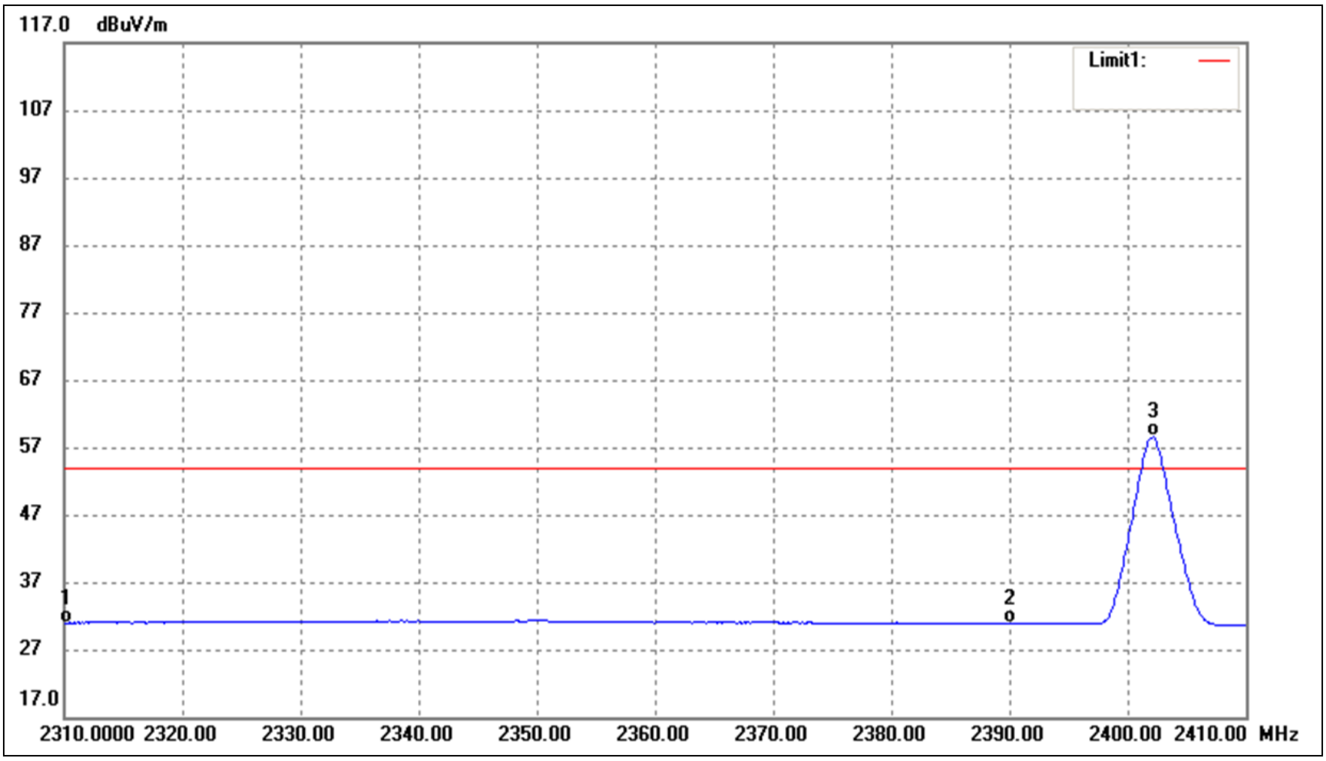
According to ANSI C63.10-2013 section 7.8.8, Conducted spurious emissions shall be measured for the transmit frequency, per 5.5 and 5.6, and at the maximum transmit powers.
Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The instrument shall span 30 MHz to 10 times the operating frequency in GHz, with a resolution bandwidth of 100 kHz, video bandwidth of 300 kHz, and a coupled sweep time with a peak detector. The band 30 MHz to the highest frequency may be split into smaller spans, as long as the entire spectrum is covered.

## 10.3 Summary of Test Results/Plots

*Note: All test modes (different data rate and different modulation) are performed, but only the worst case（GFSK） is recorded in this report.*

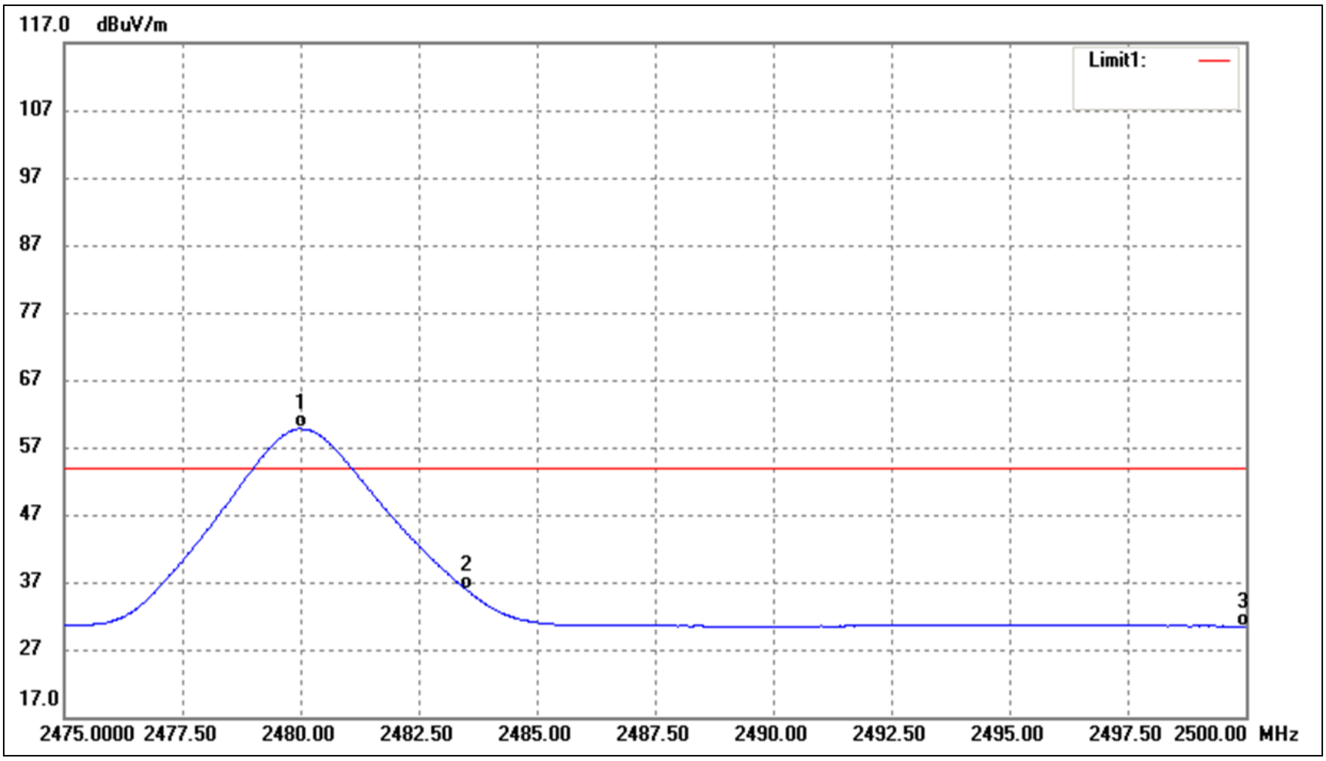
- Radiated test
- GFSK

| Test Channel | Low | Polarity: | Horizontal (worst case) |
|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | Factor(dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2310.000 | 40.62 | -9.66 | 30.96 | 54.00 | -23.04 | Average Detector |
| | 2310.000 | 53.03 | -9.66 | 43.37 | 74.00 | -30.63 | Peak Detector |
| 2 | 2390.000 | 40.31 | -9.50 | 30.81 | 54.00 | -23.19 | Average Detector |
| | 2390.000 | 51.98 | -9.50 | 42.48 | 74.00 | -31.52 | Peak Detector |
| 3 | 2402.200 | 68.01 | -9.47 | 58.54 | / | / | Average Detector |
| | 2401.900 | 88.35 | -9.48 | 78.87 | / | / | Peak Detector |

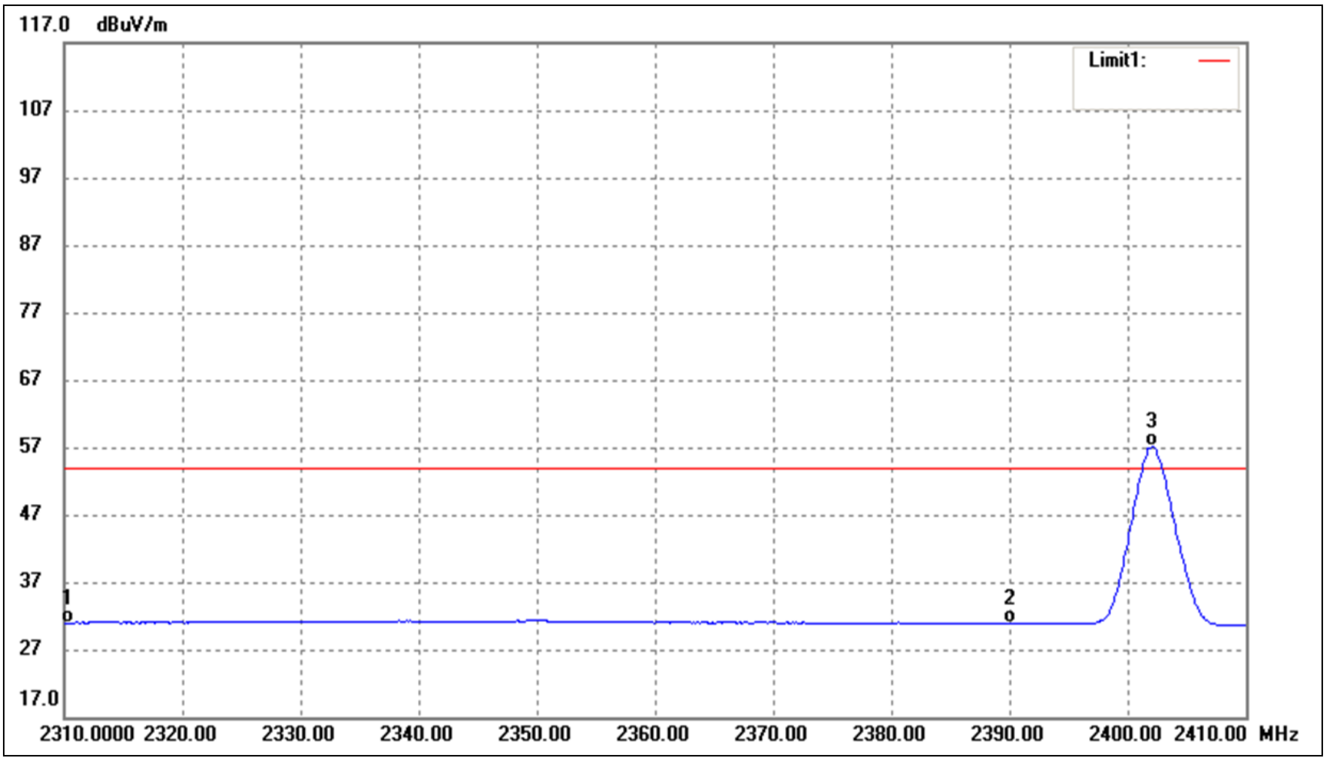
| Test Channel | High | Polarity: | Horizontal (worst case) |
|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | Factor(dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2480.025 | 69.08 | -9.32 | 59.76 | / | / | Average Detector |
| | 2479.950 | 90.65 | -9.32 | 81.33 | / | / | Peak Detector |
| 2 | 2483.500 | 45.21 | -9.31 | 35.90 | 54.00 | -18.10 | Average Detector |
| | 2483.500 | 58.33 | -9.31 | 49.02 | 74.00 | -24.98 | Peak Detector |
| 3 | 2500.000 | 39.76 | -9.28 | 30.48 | 54.00 | -23.52 | Average Detector |
| | 2500.000 | 52.76 | -9.28 | 43.48 | 74.00 | -30.52 | Peak Detector |

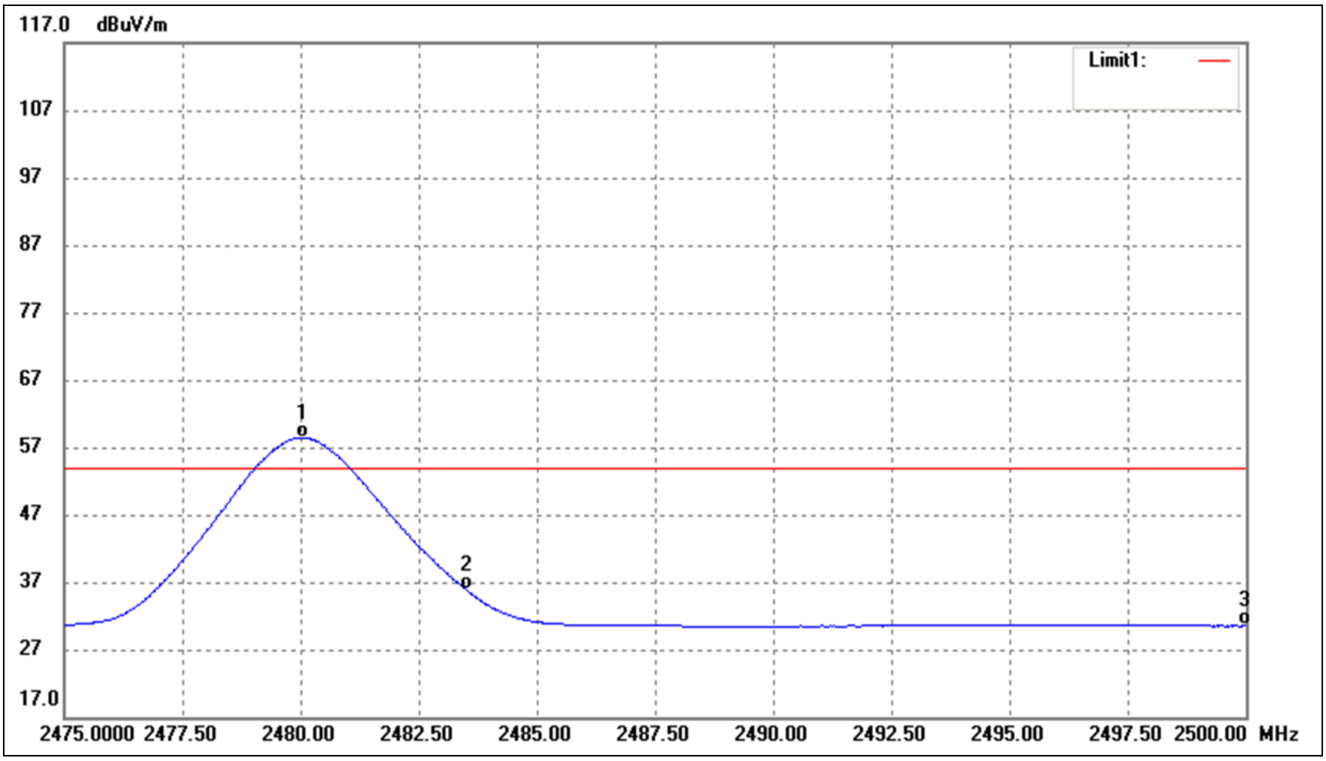
➢ π /4 DQPSK

| Test Channel | Low | Polarity: | Horizontal (worst case) |
|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | Factor(dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2310.000 | 40.64 | -9.66 | 30.98 | 54.00 | -23.02 | Average Detector |
| | 2310.000 | 53.82 | -9.66 | 44.16 | 74.00 | -29.84 | Peak Detector |
| 2 | 2390.000 | 40.27 | -9.50 | 30.77 | 54.00 | -23.23 | Average Detector |
| | 2390.000 | 52.98 | -9.50 | 43.48 | 74.00 | -30.52 | Peak Detector |
| 3 | 2402.100 | 66.53 | -9.47 | 57.06 | / | / | Average Detector |
| | 2401.900 | 88.34 | -9.48 | 78.86 | / | / | Peak Detector |

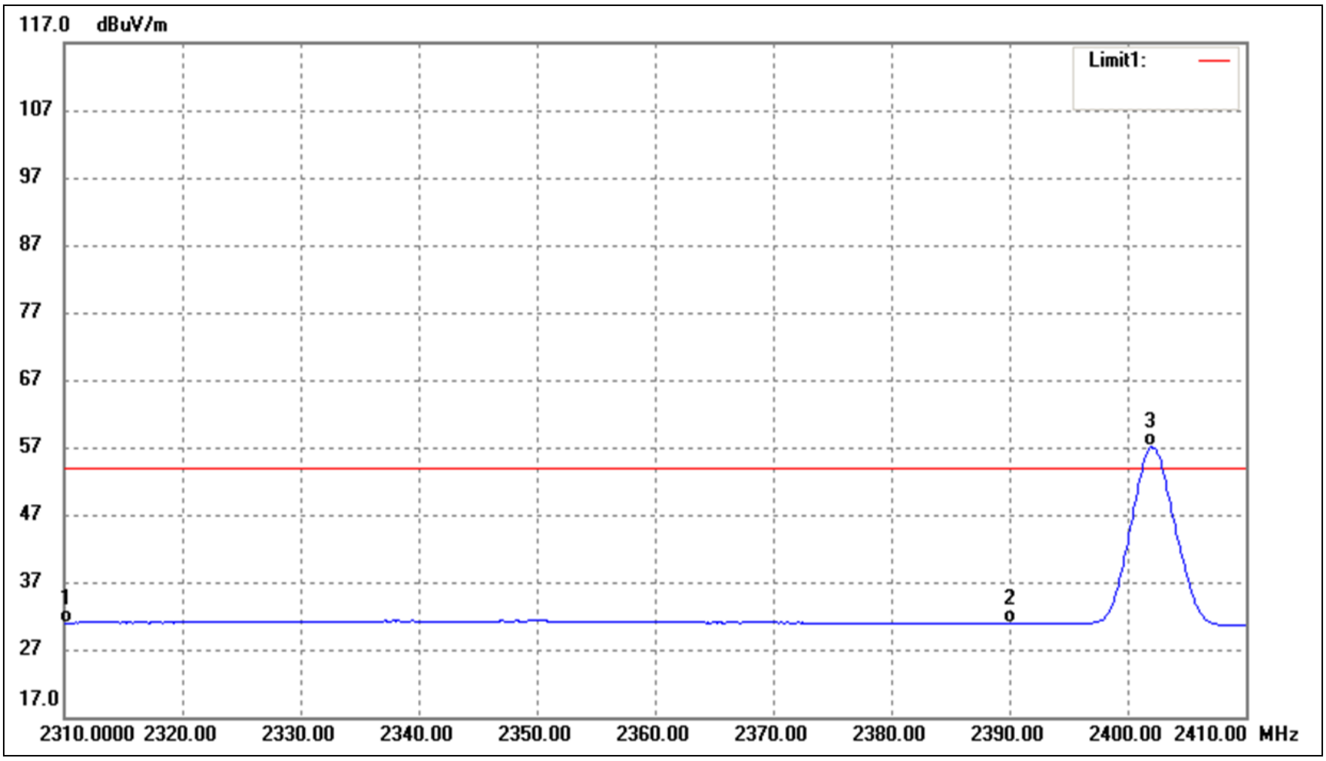
| Test Channel | High | Polarity: | Horizontal (worst case) |
|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | Factor(dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2480.050 | 67.80 | -9.32 | 58.48 | / | / | Average Detector |
| | 2479.950 | 90.78 | -9.32 | 81.46 | / | / | Peak Detector |
| 2 | 2483.500 | 45.19 | -9.31 | 35.88 | 54.00 | -18.12 | Average Detector |
| | 2483.500 | 61.33 | -9.31 | 52.02 | 74.00 | -21.98 | Peak Detector |
| 3 | 2500.000 | 39.80 | -9.28 | 30.52 | 54.00 | -23.48 | Average Detector |
| | 2500.000 | 52.61 | -9.28 | 43.33 | 74.00 | -30.67 | Peak Detector |

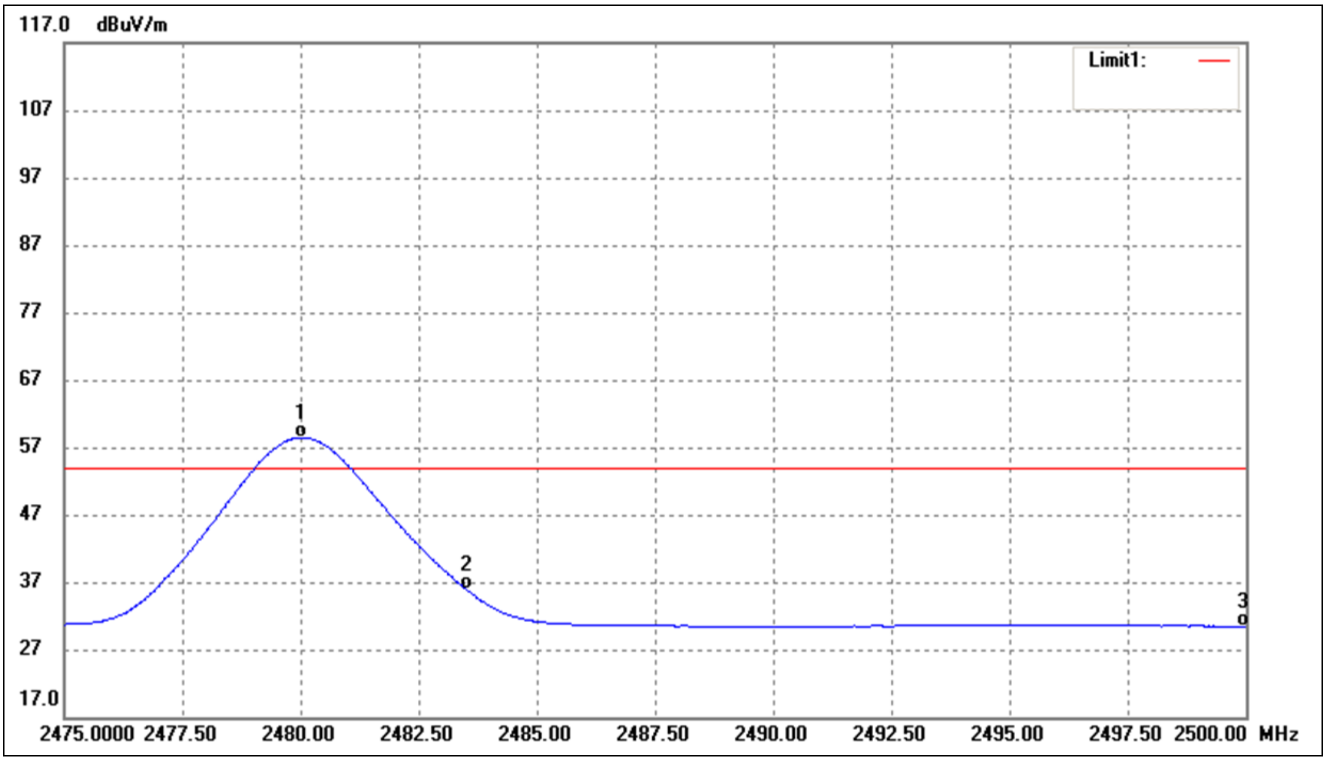
➢ 8DPSK

| | | | |
|---|---|---|---|
| Test Channel | Low | Polarity: | Horizontal (worst case) |




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | Factor(dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2310.000 | 40.63 | -9.66 | 30.97 | 54.00 | -23.03 | Average Detector |
| | 2310.000 | 52.62 | -9.66 | 42.96 | 74.00 | -31.04 | Peak Detector |
| 2 | 2390.000 | 40.32 | -9.50 | 30.82 | 54.00 | -23.18 | Average Detector |
| | 2390.000 | 52.31 | -9.50 | 42.81 | 74.00 | -31.19 | Peak Detector |
| 3 | 2401.900 | 66.61 | -9.48 | 57.13 | / | / | Average Detector |
| | 2401.800 | 88.16 | -9.48 | 78.68 | / | / | Peak Detector |

| Test Channel | High | Polarity: | Horizontal (worst case) |
|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | Factor(dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 2480.000 | 67.77 | -9.32 | 58.45 | / | / | Average Detector |
| | 2480.175 | 90.91 | -9.32 | 81.59 | / | / | Peak Detector |
| 2 | 2483.500 | 45.26 | -9.31 | 35.95 | 54.00 | -18.05 | Average Detector |
| | 2483.500 | 61.68 | -9.31 | 52.37 | 74.00 | -21.63 | Peak Detector |
| 3 | 2500.000 | 39.73 | -9.28 | 30.45 | 54.00 | -23.55 | Average Detector |
| | 2500.000 | 51.73 | -9.28 | 42.45 | 74.00 | -31.55 | Peak Detector |

*Note: Average measurement was not performed if peak level is lower than average limit(54 dBuV/m) for above 1GHz.*

➢ Conducted test

**Please refer to Appendix E**

# 11. Conducted Emissions

## 11.1 Test Procedure

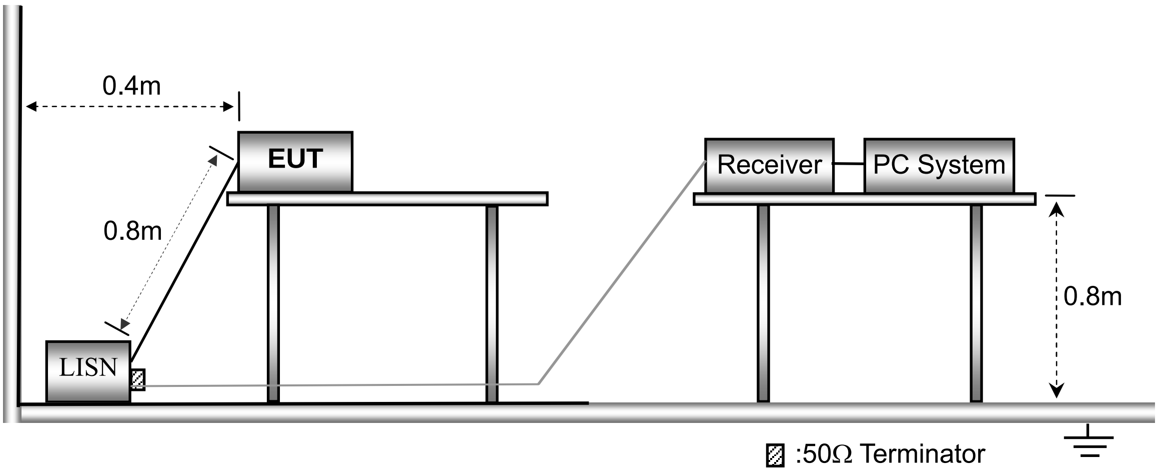
The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

## 11.2 Basic Test Setup Block Diagram

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



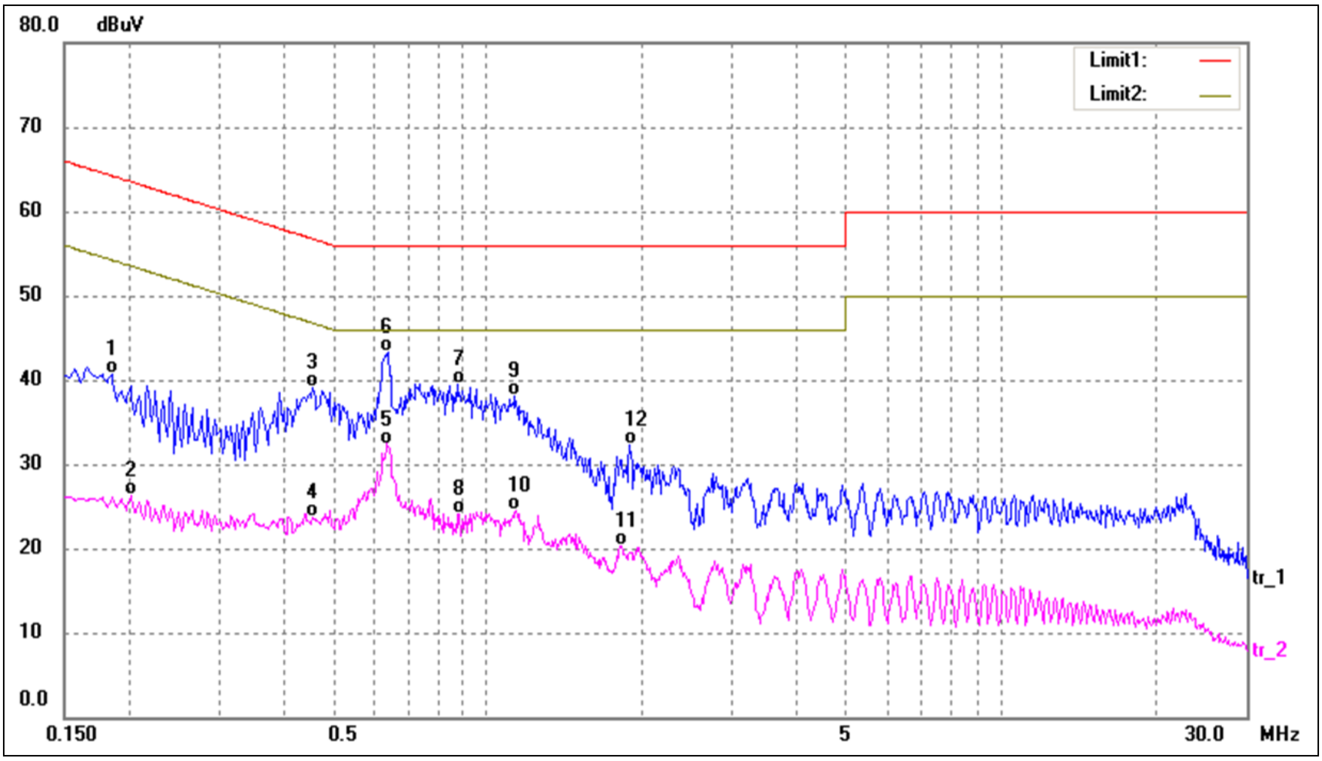

## 11.3 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ........................................................................ 150 kHz
Stop Frequency ........................................................................ 30 MHz
Sweep Speed ........................................................................... Auto
IF Bandwidth............................................................................ 10 kHz
Quasi-Peak Adapter Bandwidth ............................................... 9 kHz
Quasi-Peak Adapter Mode ....................................................... Normal

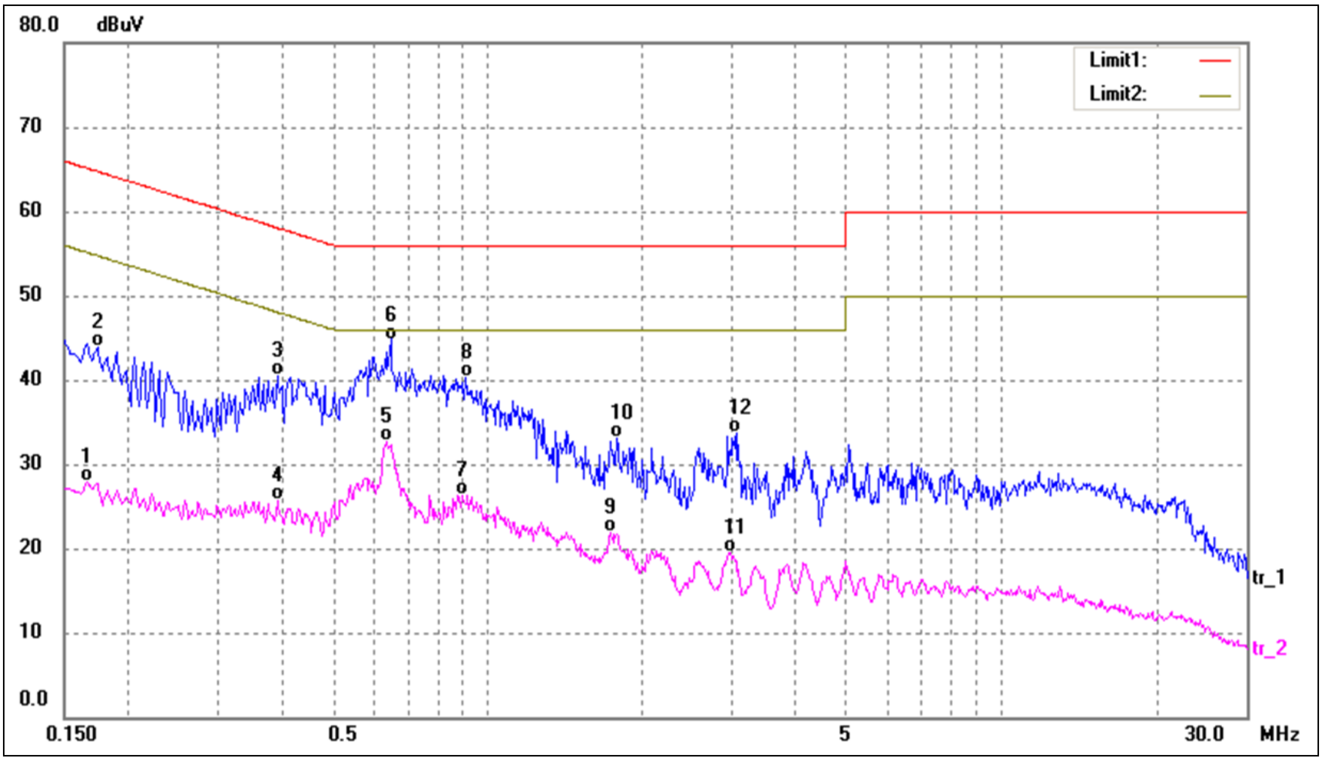
## 11.4 Summary of Test Results/Plots

| Test Mode | Communication | AC120V 60Hz | Polarity: | Neutral |
|---|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Detector |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | (dB/m) | (dBuV) | (dBuV) | (dB) | |
| 1 | 0.1860 | 30.40 | 10.26 | 40.66 | 64.21 | -23.55 | QP |
| 2 | 0.2020 | 16.07 | 10.27 | 26.34 | 53.52 | -27.18 | AVG |
| 3 | 0.4580 | 28.80 | 10.22 | 39.02 | 56.73 | -17.71 | QP |
| 4 | 0.4580 | 13.40 | 10.22 | 23.62 | 46.73 | -23.11 | AVG |
| 5 | 0.6380 | 22.21 | 10.19 | 32.40 | 46.00 | -13.60 | AVG |
| 6* | 0.6419 | 33.04 | 10.19 | 43.23 | 56.00 | -12.77 | QP |
| 7 | 0.8740 | 29.22 | 10.21 | 39.43 | 56.00 | -16.57 | QP |
| 8 | 0.8820 | 13.87 | 10.22 | 24.09 | 46.00 | -21.91 | AVG |
| 9 | 1.1340 | 27.82 | 10.21 | 38.03 | 56.00 | -17.97 | QP |
| 10 | 1.1380 | 14.20 | 10.21 | 24.41 | 46.00 | -21.59 | AVG |
| 11 | 1.8260 | 10.06 | 10.27 | 20.33 | 46.00 | -25.67 | AVG |
| 12 | 1.8940 | 22.13 | 10.27 | 32.40 | 56.00 | -23.60 | QP |

| Test Mode | Communication | AC120V 60Hz | Polarity: | Line |
|---|---|---|---|---|




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Detector |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | (dB/m) | (dBuV) | (dBuV) | (dB) | |
| 1 | 0.1660 | 17.62 | 10.26 | 27.88 | 55.15 | -27.27 | AVG |
| 2 | 0.1740 | 33.62 | 10.25 | 43.87 | 64.76 | -20.89 | QP |
| 3 | 0.3899 | 30.21 | 10.24 | 40.45 | 58.06 | -17.61 | QP |
| 4 | 0.3899 | 15.41 | 10.24 | 25.65 | 48.06 | -22.41 | AVG |
| 5 | 0.6380 | 22.46 | 10.19 | 32.65 | 46.00 | -13.35 | AVG |
| 6* | 0.6500 | 34.61 | 10.19 | 44.80 | 56.00 | -11.20 | QP |
| 7 | 0.8940 | 16.16 | 10.22 | 26.38 | 46.00 | -19.62 | AVG |
| 8 | 0.9060 | 30.09 | 10.22 | 40.31 | 56.00 | -15.69 | QP |
| 9 | 1.7380 | 11.61 | 10.26 | 21.87 | 46.00 | -24.13 | AVG |
| 10 | 1.7820 | 22.87 | 10.26 | 33.13 | 56.00 | -22.87 | QP |
| 11 | 2.9660 | 9.19 | 10.27 | 19.46 | 46.00 | -26.54 | AVG |
| 12 | 3.0579 | 23.35 | 10.26 | 33.61 | 56.00 | -22.39 | QP |

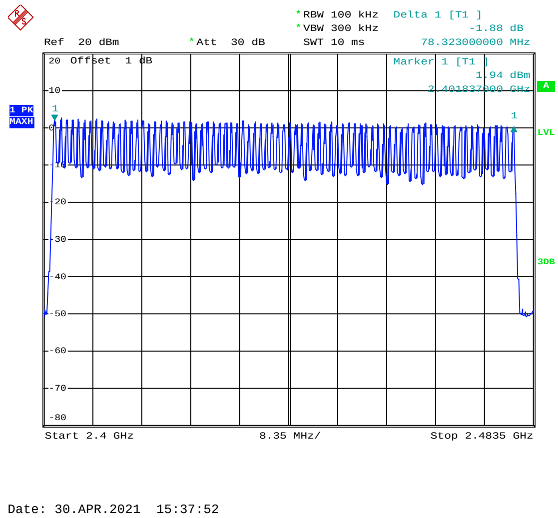
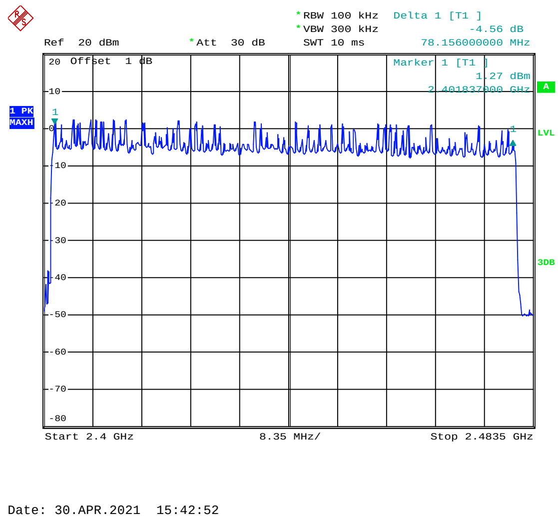
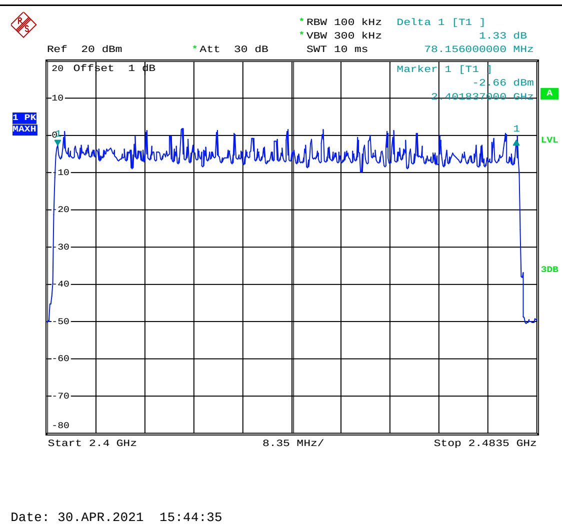
# APPENDIX SUMMARY

| | | | |
|---|---|---|---|
| Project No. | WTX21X04032044W | Test Engineer | cg Liang |
| Start date | 2021/4/30 | Finish date | 2021/4/30 |
| Temperature | 23.7℃ | Humidity | 47% |
| RF specifications | BT-BR/EDR | | |

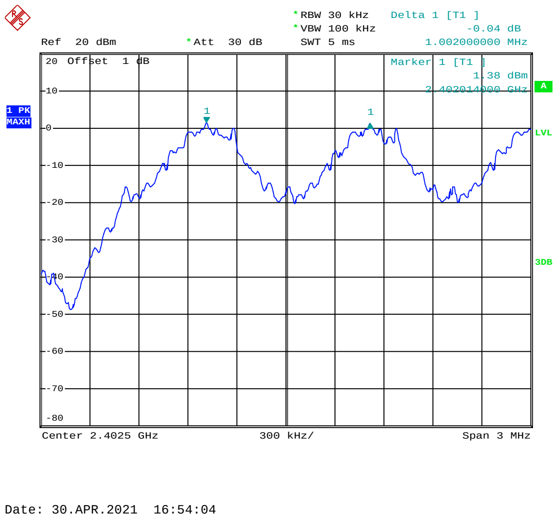
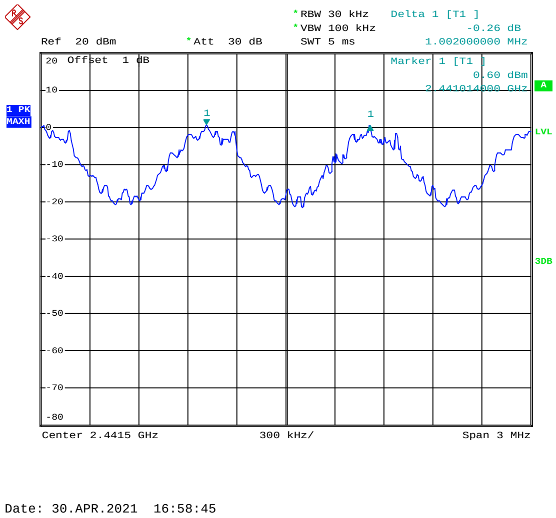
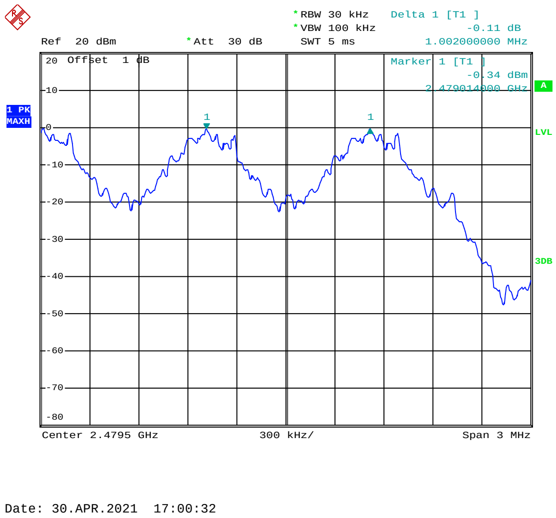
| APPENDIX | Description of Test Item | Result |
|---|---|---|
| A | Hopping Channels and Channel Separation | Compliant |
| B | Dwell Time of Hopping Channel | Compliant |
| C | 20dB Bandwidth | Compliant |
| D | RF Output Power | Compliant |
| E | Conducted Out of Band Emissions | Compliant |

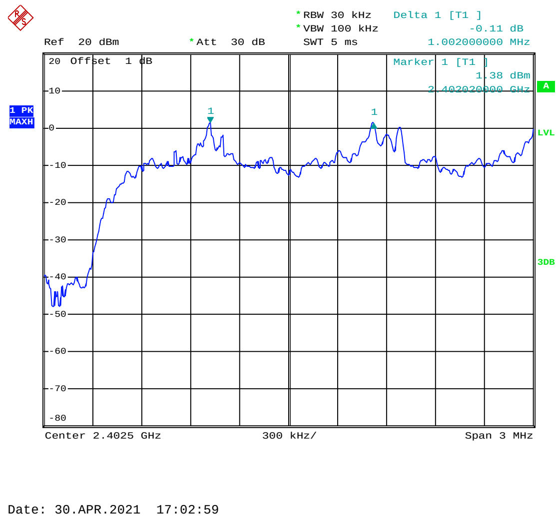
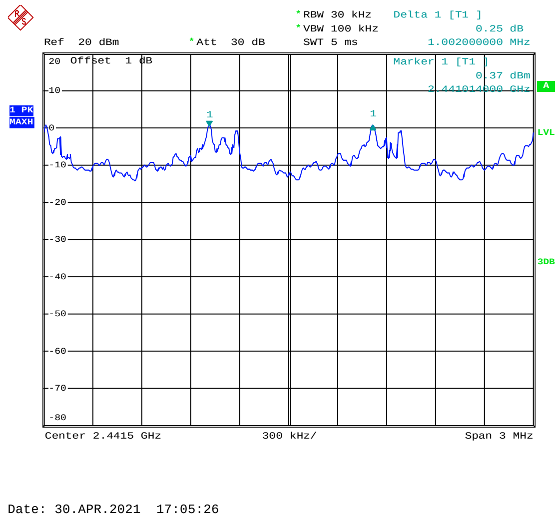
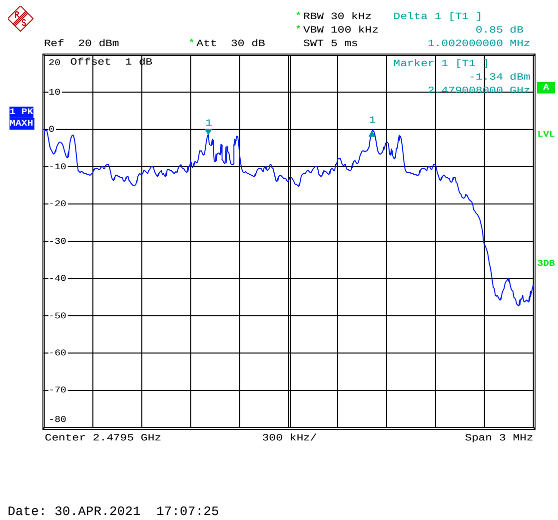
# APPENDIX A

| Hopping Channels Number | | | |
|---|---|---|---|
| Mode | Test Result | Limit | Result |
| GFSK | 79 | ≥75 | Pass |
| π/4 DQPSK | 79 | ≥75 | Pass |
| 8DPSK | 79 | ≥75 | Pass |

| | |
|---|---|
| GFSK |  |
| π/4 DQPSK |  |
| 8DPSK |  |

| Channel Separation | | | |
|---|---|---|---|
| Mode | Channel | Carrier Frequencies Separation (kHz) | Result |
| GFSK | Low | 1002 | Pass |
| | Middle | 1002 | Pass |
| | High | 1002 | Pass |
| 8DPSK | Low | 1002 | Pass |
| | Middle | 1002 | Pass |
| | High | 1002 | Pass |

| | |
|---|---|
| GFSK-Low |  |
| GFSK-Middle |  |
| GFSK-High |  |

| | |
|---|---|
| 8DPSK-Low |  |
| 8DPSK-Middle |  |
| 8DPSK-High |  |

# APPENDIX B

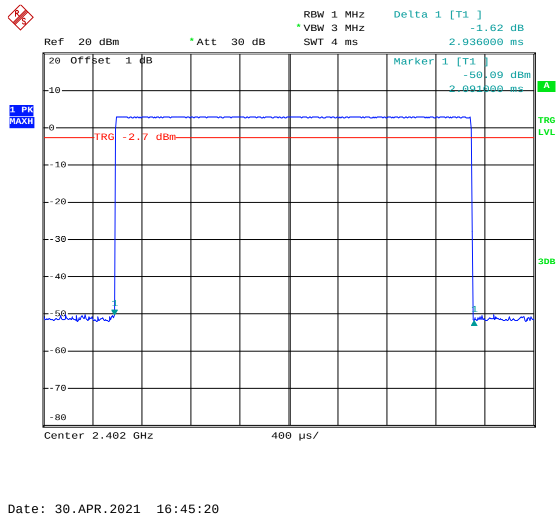
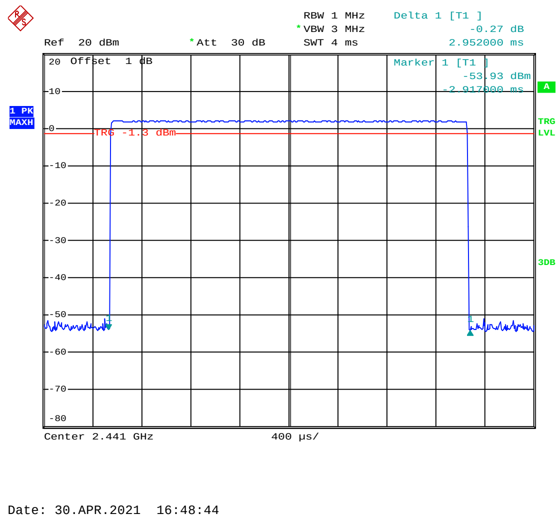
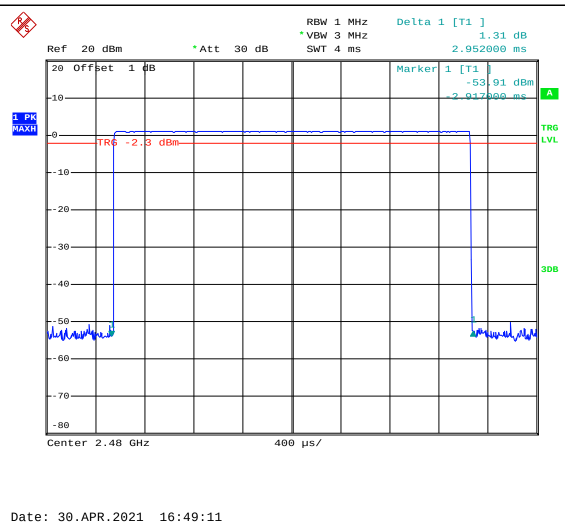
| Dwell Time of Hopping Channel | | | | | |
|---|---|---|---|---|---|
| Modulation | Packet | Test Channel | Time Slot Length | Dwell Time | Limit |
| | | | ms | ms | ms |
| GFSK | DH5 | Low | 2.936 | 313.17 | ≤400 |
| | | Middle | 2.952 | 314.88 | ≤400 |
| | | High | 2.952 | 314.88 | ≤400 |
| π/4 DQPSK | 2DH5 | Low | 2.952 | 314.88 | ≤400 |
| | | Middle | 2.952 | 314.88 | ≤400 |
| | | High | 2.952 | 314.88 | ≤400 |
| 8DPSK | 3DH5 | Low | 2.952 | 314.88 | ≤400 |
| | | Middle | 2.952 | 314.88 | ≤400 |
| | | High | 2.952 | 314.88 | ≤400 |

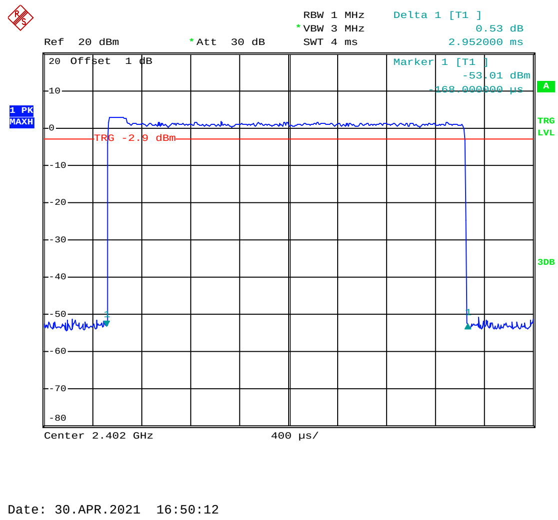
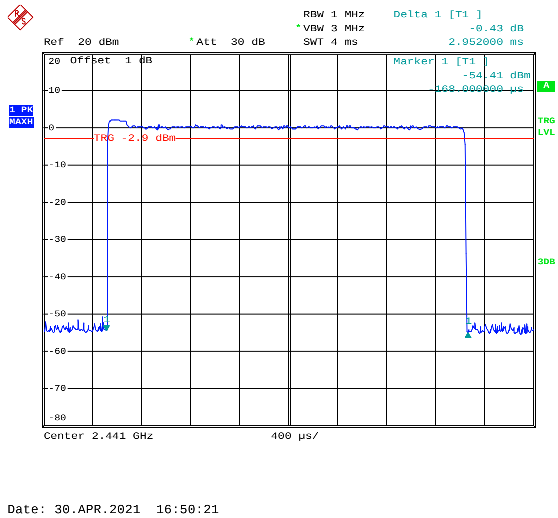
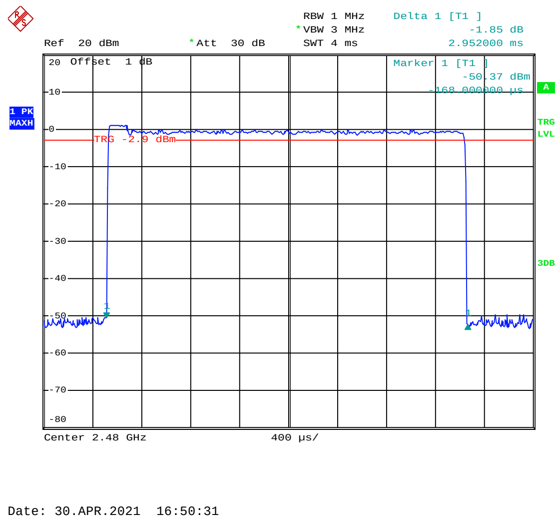
Note: The test period: T = 0.4 Second * 79 Channel = 31.6 s
Dwell time = time slot length * (Hopping rate / Number of hopping channels) * Period

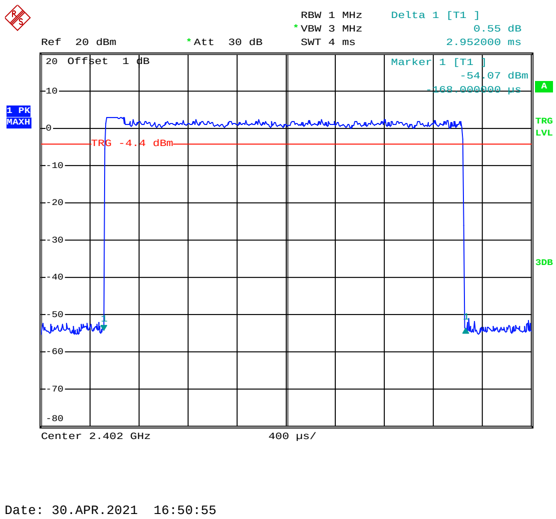
Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2-DH1, 3-DH1

Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2-DH3, 3-DH3

Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2-DH5, 3-DH5

| | |
|---|---|
| DH5-Low |  |
| DH5-Middle |  |
| DH5-High |  |

| | |
|---|---|
| 2DH5-Low |  |
| 2DH5-Middle |  |
| 2DH5-High |  |

<table>
<tr><td>3DH5-Low</td><td>
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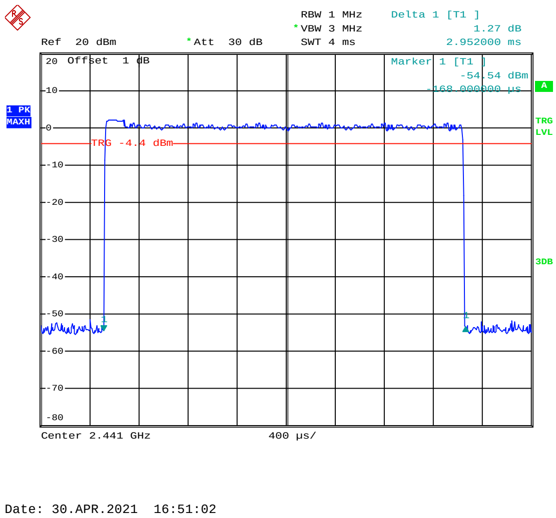
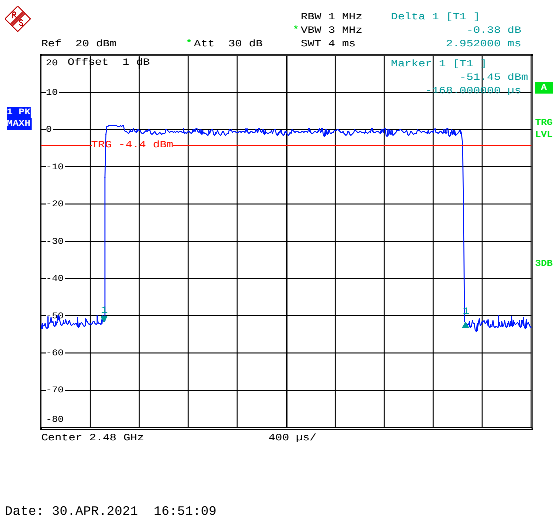
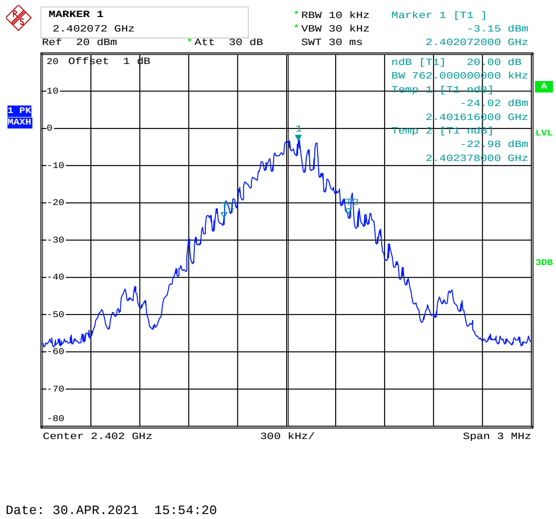
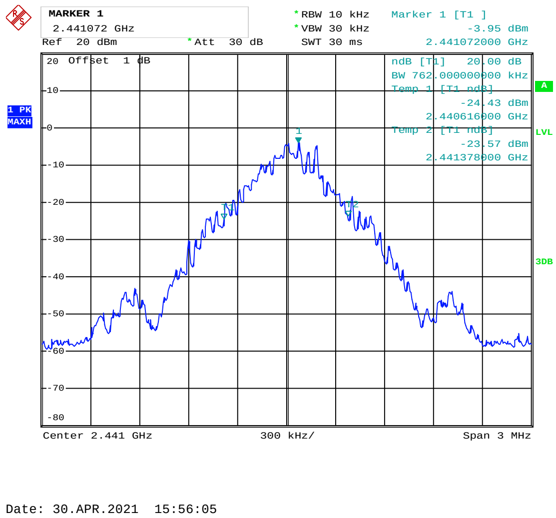
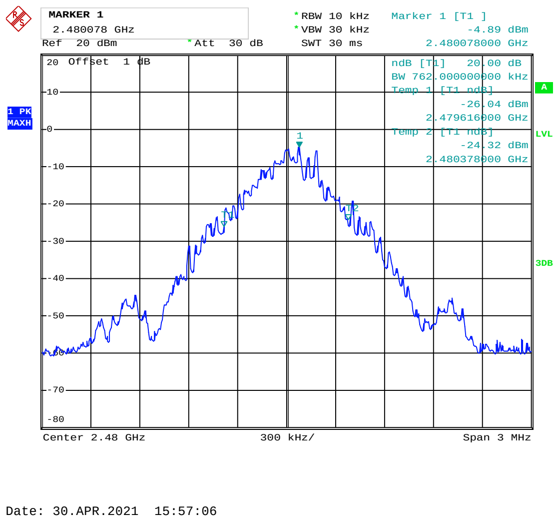
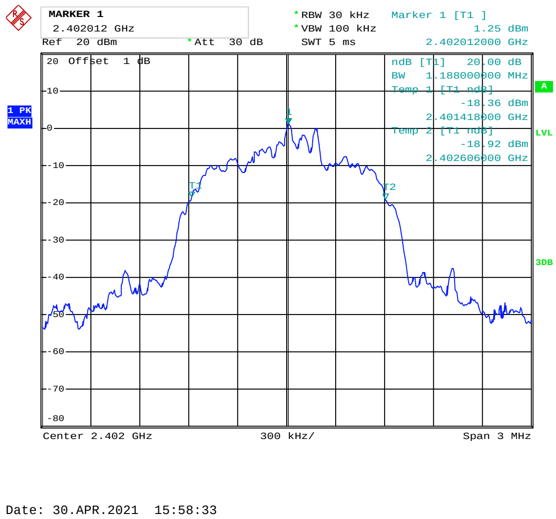
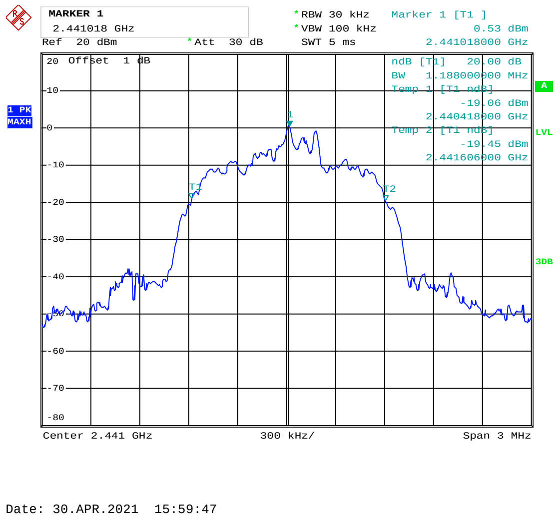
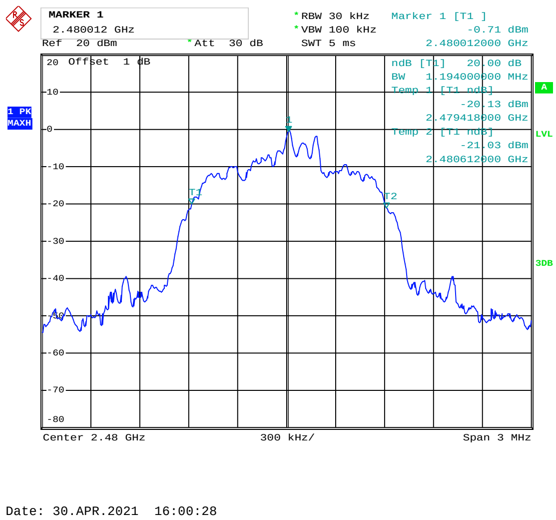
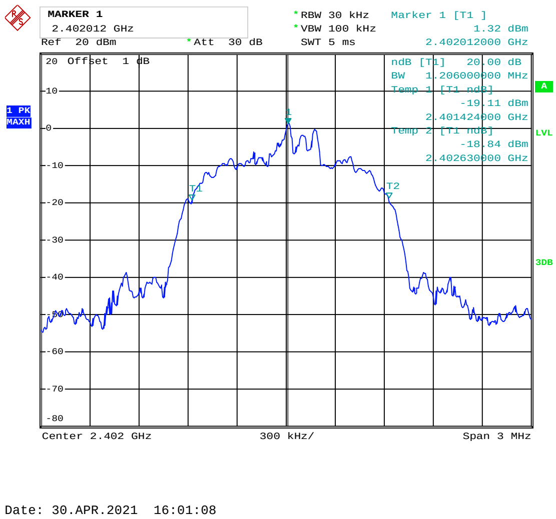
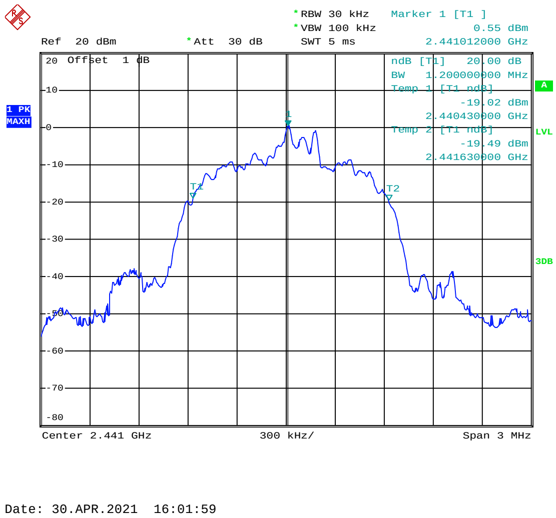
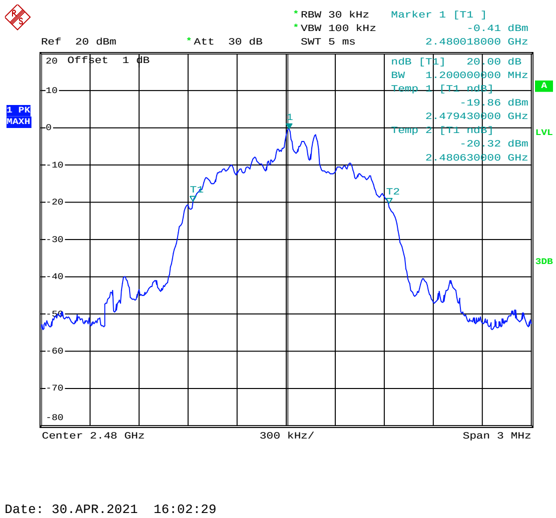
<tr><td>3DH5-Middle</td><td>
</td></tr>
<tr><td>3DH5-High</td><td>
</td></tr>
</table>

# APPENDIX C

| 20 dB Bandwidth | | | |
|---|---|---|---|
| Test Mode | Test Channel<br>MHz | 20 dB Bandwidth<br>MHz | Result |
| GFSK | 2402 | 0.762 | Pass |
| | 2441 | 0.762 | Pass |
| | 2480 | 0.762 | Pass |
| π/4 DQPSK | 2402 | 1.188 | Pass |
| | 2441 | 1.188 | Pass |
| | 2480 | 1.194 | Pass |
| 8DPSK | 2402 | 1.206 | Pass |
| | 2441 | 1.200 | Pass |
| | 2480 | 1.200 | Pass |

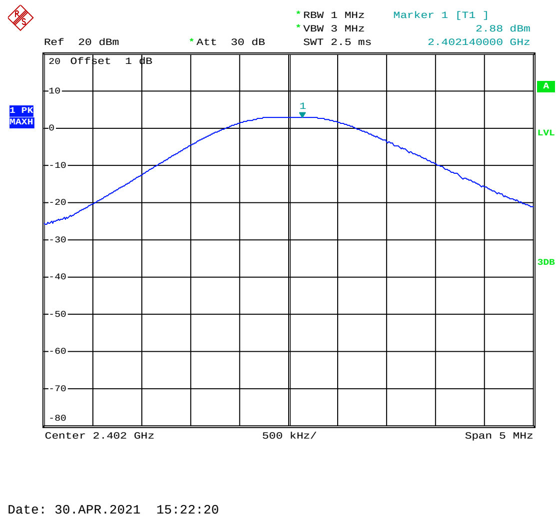
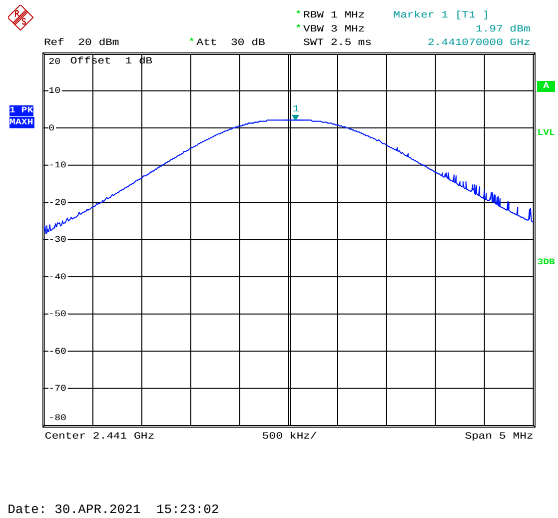
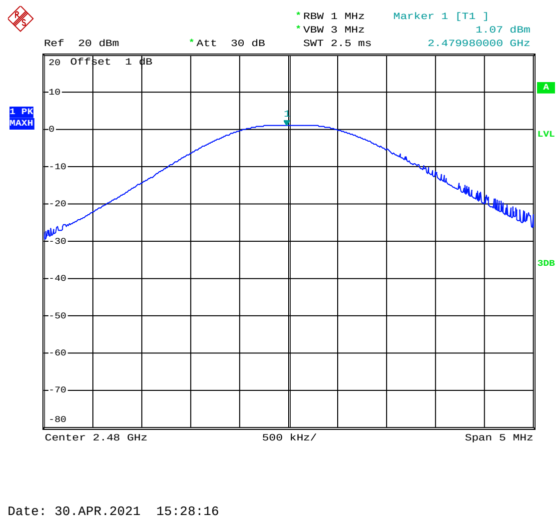
| | |
|---|---|
| GFSK-Low |  |
| GFSK-Middle |  |
| GFSK-High |  |

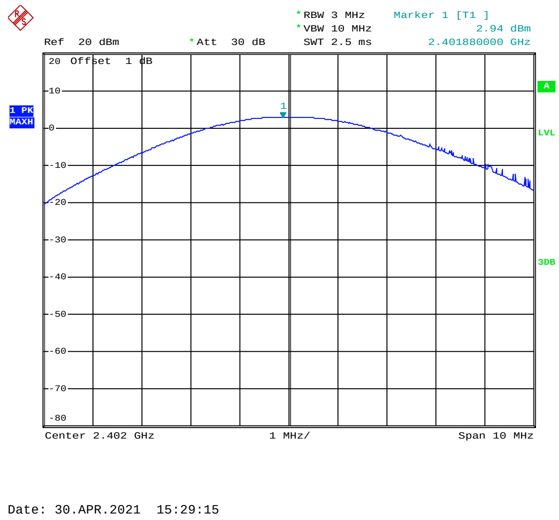
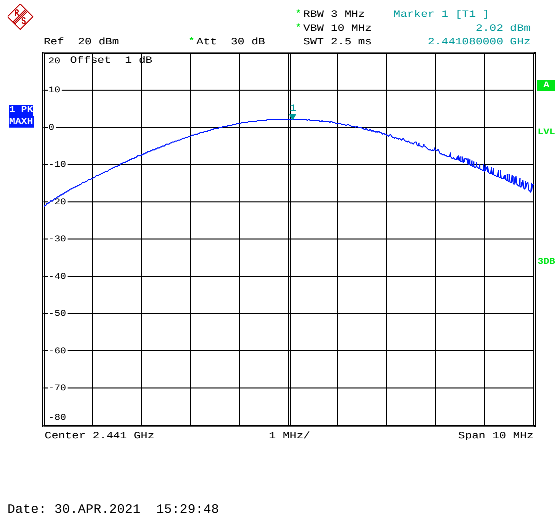
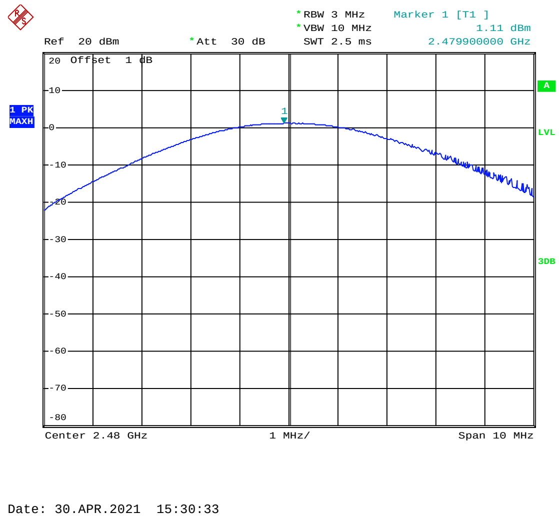
| | |
|---|---|
| π/4 DQPSK-Low |  |
| π/4 DQPSK-Middle |  |
| π/4 DQPSK-High |  |

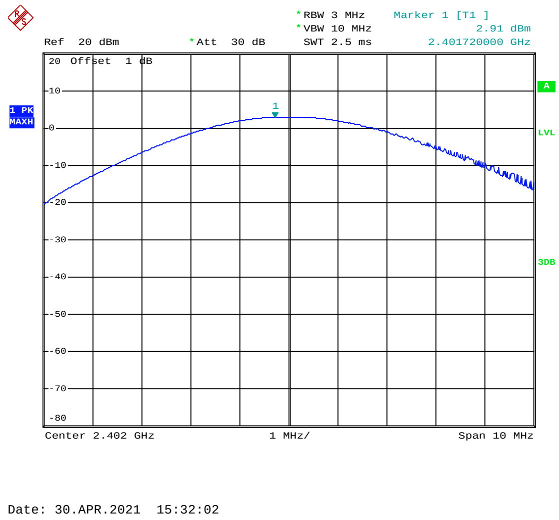
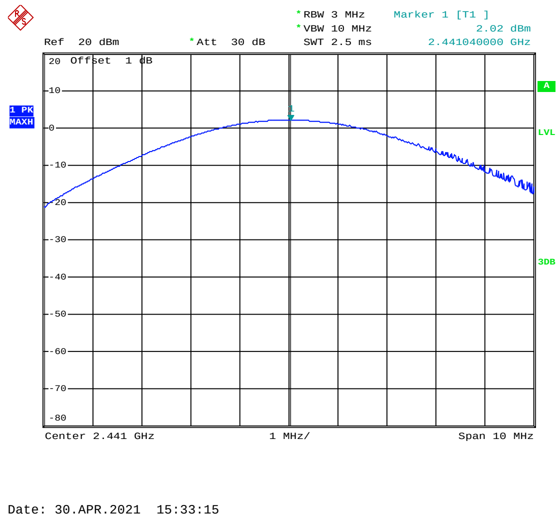
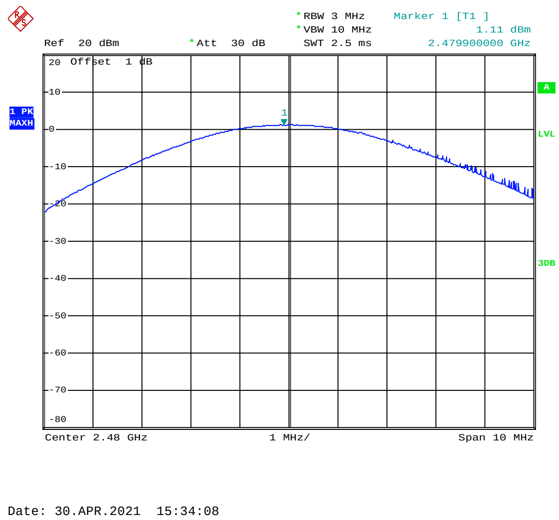
| | |
|---|---|
| 8DPSK-Low |  |
| 8DPSK-Middle |  |
| 8DPSK-High |  |

# APPENDIX D

| RF Output Power | | | | |
|---|---|---|---|---|
| Modulation type | Channel | Output power (dBm) | Limit (dBm) | Result |
| GFSK | Low | 2.88 | 30.00 | Pass |
| | Middle | 1.97 | | |
| | High | 1.07 | | |
| π/4 DQPSK | Low | 2.94 | 30.00 | Pass |
| | Middle | 2.02 | | |
| | High | 1.11 | | |
| 8DPSK | Low | 2.91 | 30.00 | Pass |
| | Middle | 2.02 | | |
| | High | 1.11 | | |

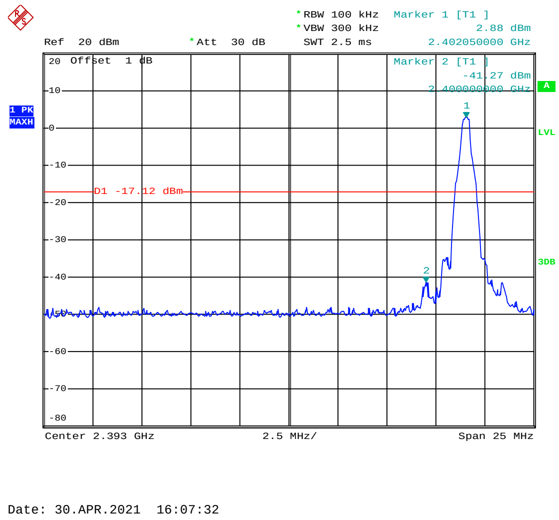
| | |
|---|---|
| GFSK-Low |  |
| GFSK-Middle |  |
| GFSK-High |  |

| | |
|---|---|
| π/4 DQPSK-Low |  |
| π/4 DQPSK-Middle |  |
| π/4 DQPSK-High |  |

| | |
|---|---|
| 8DPSK-Low |  |
| 8DPSK-Middle |  |
| 8DPSK-High |  |

# APPENDIX E

Conducted Out of Band Emissions

<table>
<tr><td rowspan="2">Low</td><td>
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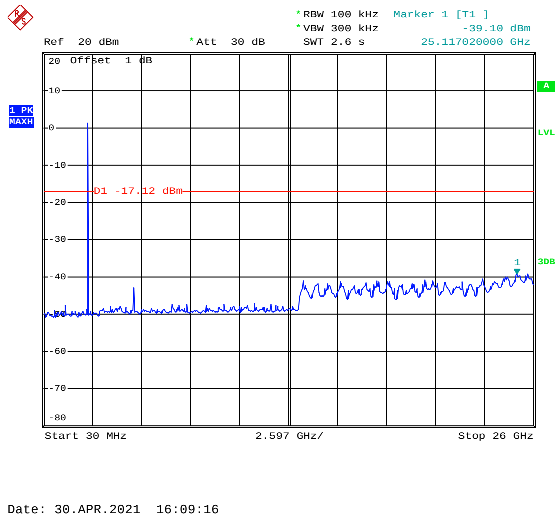
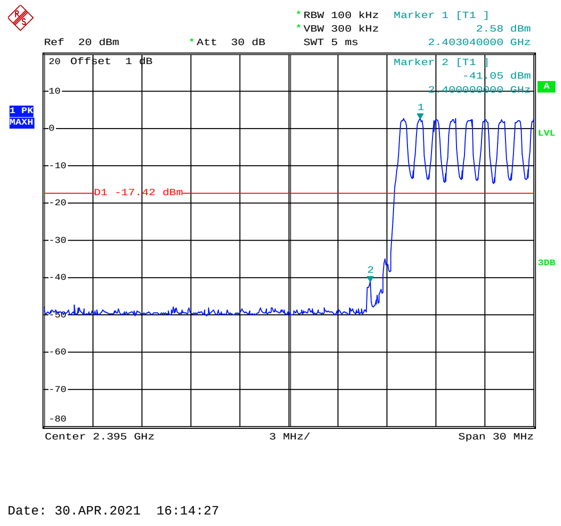
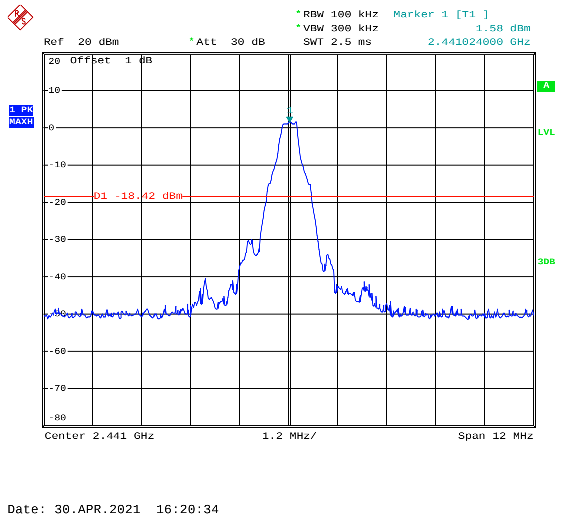
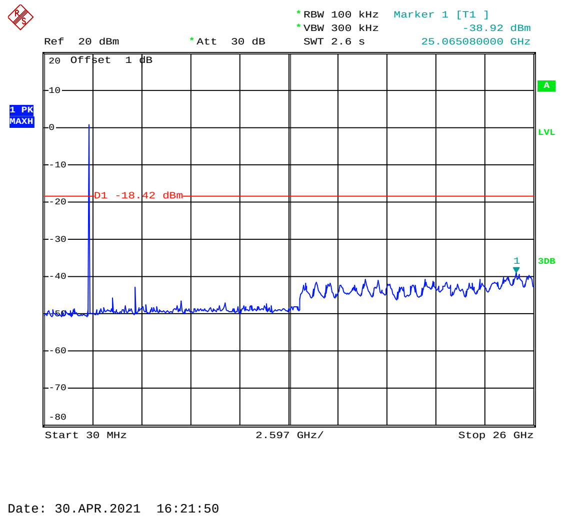
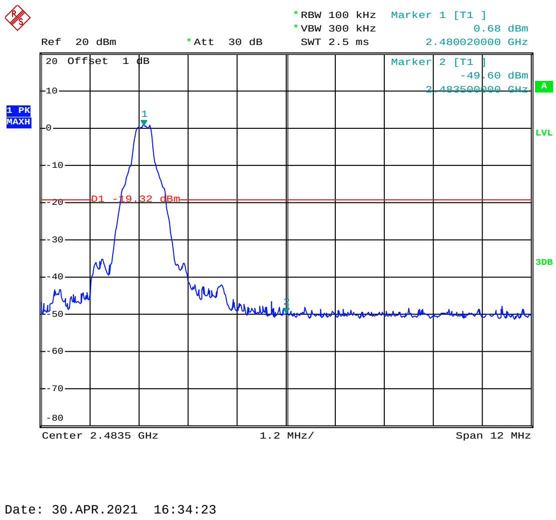
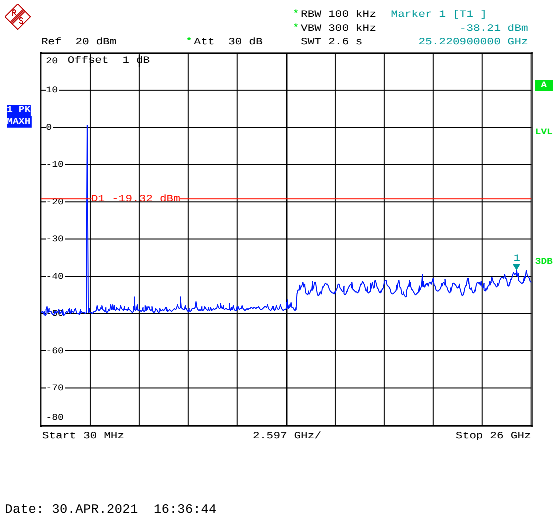
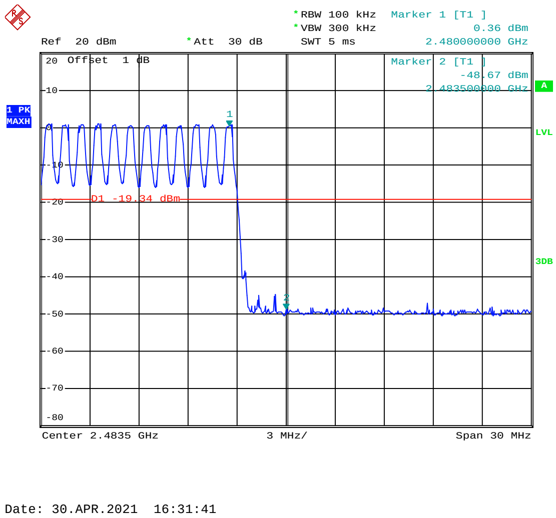
<tr><td>
</td></tr>
</table>

<table>
<tr><td></td><td>
</td></tr>
<tr><td rowspan="2">Middle</td><td>
</td></tr>
<tr><td>
</td></tr>
</table>

High


*RBW 100 kHz Marker 1 [T1 ]
*VBW 300 kHz 0.68 dBm
Ref 20 dBm *Att 30 dB SWT 2.5 ms 2.480020000 GHz
20 Offset 1 dB
Marker 2 [T1 ]
-49.60 dBm
2.483500000 GHz
1 PK MAXH
D1 -19.32 dBm
LVL
3DB
Center 2.4835 GHz 1.2 MHz/ Span 12 MHz
Date: 30.APR.2021 16:34:23


*RBW 100 kHz Marker 1 [T1 ]
*VBW 300 kHz -38.21 dBm
Ref 20 dBm *Att 30 dB SWT 2.6 s 25.220900000 GHz
20 Offset 1 dB
1 PK MAXH
D1 -19.32 dBm
LVL
3DB
Start 30 MHz 2.597 GHz/ Stop 26 GHz
Date: 30.APR.2021 16:36:44


*RBW 100 kHz Marker 1 [T1 ]
*VBW 300 kHz 0.36 dBm
Ref 20 dBm *Att 30 dB SWT 5 ms 2.480000000 GHz
20 Offset 1 dB
Marker 2 [T1 ]
-48.67 dBm
2.483500000 GHz
1 PK MAXH
D1 -19.34 dBm
LVL
3DB
Center 2.4835 GHz 3 MHz/ Span 30 MHz
Date: 30.APR.2021 16:31:41

# APPENDIX PHOTOGRAPHS

**Please refer to "ANNEX"**

******* END OF REPORT *******