

TEST REPORT

Reference No..... : WTX24X04071731W001
FCC ID : 2AUTE-2TS24E
Applicant : Xiamen Hanin Co.,Ltd.
Address : Room 305A, Angye Building, Pioneering Park,Torch High-tech,
Zone,Xiamen,China
Manufacturer : The same as Applicant
Address : The same as Applicant
Product Name : Portable Photo Printer,Instant Print Camera
Model No..... : HCP-2TS24E
Standards : FCC Part 15.247
Date of Receipt sample : 2024-04-02
Date of Test..... : 2024-04-02 to 2024-04-29
Date of Issue : 2024-04-29
Test Report Form No. : WTX_Part 15_247W
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 approver.

Prepared By:

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Report version

Version No.	Date of issue	Description
Rev.00	2024-04-29	Original
/	/	/

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

General Description of EUT	
Product Name:	Portable Photo Printer,Instant Print Camera
Trade Name	/
Model No.:	HCP-2TS24E
Adding Model(s):	Z3
Rated Voltage:	DC 7.4V
Battery Capacity:	1150mAh
Adapter Model:	/
<i>Note: The test data is gathered from a production sample, provided by the manufacturer. The appearance of others models listed in the report is different from main-test model HCP-2TS24E, but the circuit and the electronic construction do not change, declared by the manufacturer.</i>	

Technical Characteristics of EUT	
Bluetooth Version:	V5.2 (BR/EDR mode)
Frequency Range:	2402-2480MHz
RF Output Power:	-8.68dBm (Conducted)
Data Rate:	1Mbps, 2Mbps, 3Mbps
Modulation:	GFSK, $\pi/4$ DQPSK, 8DPSK
Quantity of Channels:	79
Channel Separation:	1MHz
Type of Antenna:	PCB Antenna
Antenna Gain:	-0.54dBi
<i>Note The Antenna Gain is provided by the customer and can affect the validity of results.</i>	

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 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.

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 maintained 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 and the CAB identifier is CN0057.

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 possible 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
$\pi/4$ 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, $\pi/4$ DQPSK and 8DPSK, compliance test and record the worst case.			

Test Conditions	
Temperature:	22~25 °C
Relative Humidity:	45~55 %
ATM Pressure:	1019 mbar

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
USB Cable	1.0	shielded	With 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
Adapter	Mediacom	BOS050200-02A	/

1.6 Measurement Uncertainty

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

1.7 Test Equipment List and Details

Fixed asset Number	Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
WTXE1041A 1001	Communication Tester	Rohde & Schwarz	CMW500	148650	2024-02-24	2025-02-23
WTXE1005A 1005	Spectrum Analyzer	Agilent	N9020A	US471401 02	2024-03-19	2025-03-18
WTXE1084A 1001	Spectrum Analyzer	Agilent	N9020A	MY543205 48	2024-02-24	2025-02-23
WTXE1004A 1-001	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2024-02-27	2025-02-26
☐ Chamber A: Below 1GHz						
WTXE1005A 1003	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/03 5	2024-02-24	2025-02-23
WTXE1001A 1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2024-03-19	2025-03-18
WTXE1007A 1001	Amplifier	HP	8447F	2805A034 75	2024-02-24	2025-02-23
WTXE1010A 1007	Loop Antenna	Schwarz beck	FMZB 1516	9773	2024-02-26	2025-02-25
WTXE1010A 1006	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2024-02-24	2025-02-23
☐ Chamber A: Above 1GHz						
WTXE1005A 1003	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/03 5	2024-02-24	2025-02-23
WTXE1001A 1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2024-03-19	2025-03-18
WTXE1065A 1001	Amplifier	C&D	PAP-1G18	2002	2024-02-27	2025-02-26
WTXE1010A 1005	Horn Antenna	ETS	3117	00086197	2024-02-26	2025-02-25
WTXE1010A 1010	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2024-03-17	2025-03-16
WTXE1003A 1001	Pre-amplifier	Schwarzbeck	BBV 9721	9721-031	2024-02-29	2025-02-28
☐ Chamber B:Below 1GHz						
WTXE1010A 1006	Trilog Broadband Antenna	Schwarz beck	VULB9163(B)	9163-635	2024-03-17	2027-03-16
WTXE1038A 1001	Amplifier	Agilent	8447D	2944A104 57	2024-02-24	2025-02-23

WTXE1001A 1002	EMI Test Receiver	Rohde & Schwarz	ESPI	101391	2024-02-24	2025-02-23
☒ Chamber C:Below 1GHz						
WTXE1093A 1001	EMI Test Receiver	Rohde & Schwarz	ESIB 26	100401	2024-02-27	2025-02-26
WTXE1010A 1013-1	Trilog Broadband Antenna	Schwarz beck	VULB 9168	1194	2021-05-28	2024-05-27
WTXE1010A 1007	Loop Antenna	Schwarz beck	FMZB 1516	9773	2024-02-26	2025-02-25
WTXE1007A 1002	Amplifier	HP	8447F	2944A038 69	2024-02-24	2025-02-23
☒ Chamber C: Above 1GHz						
WTXE1093A 1001	EMI Test Receiver	Rohde & Schwarz	ESIB 26	100401	2024-02-27	2025-02-26
WTXE1103A 1005	Horn Antenna	POAM	RTF-118A	1820	2023-03-10	2026-03-09
WTXE1103A 1006	Amplifier	Tonscend	TAP01018050	AP22E806 235	2024-02-27	2025-02-26
WTXE1010A 1010	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2024-03-17	2025-03-16
WTXE1003A 1001	Pre-amplifier	Schwarzbeck	BBV 9721	9721-031	2024-02-29	2025-02-28
☐ Conducted Room 1#						
WTXE1104A 1029	EMI Test Receiver	Rohde & Schwarz	ESCI	100525	2023-12-12	2024-12-11
WTXE1002A 1001	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2024-02-24	2025-02-23
WTXE1003A 1001	AC LISN	Schwarz beck	NSLK8126	8126-279	2024-02-24	2025-02-23
☒ Conducted Room 2#						
WTXE1001A 1004	EMI Test Receiver	Rohde & Schwarz	ESPI	101259	2024-02-24	2025-02-23
WTXE1003A 1003	LISN	Rohde & Schwarz	ENV 216	100097	2024-02-24	2025-02-23

Software List			
Description	Manufacturer	Model	Version
EMI Test Software (Radiated Emission)*	Farad	EZ-EMC	RA-03A1
EMI Test Software (Conducted Emission Room 1#)*	Farad	EZ-EMC	RA-03A1
EMI Test Software (Conducted Emission Room 2#)*	SKET	EMC-I	V2.0

*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 a PCB 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 2400-2483.5MHz 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 (1MHz each; centred from 2402 to 2480MHz) in the range 2,400-2,483.5MHz. 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.

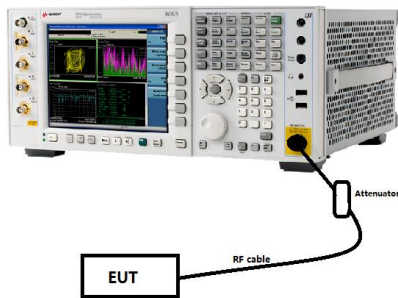
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

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 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, and frequency hopping systems in the 2400-2483.5MHz band shall use at least 15 channels.

5.2 Test Setup Block Diagram



5.3 Test Procedure

According to KDB 558074 D01 v05r02 Sub clause 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 $\geq$ 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) $\geq$ 1% of the span

Video (or Average) Bandwidth (VBW) $\geq$ RBW

Sweep = auto

Detector function = peak

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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

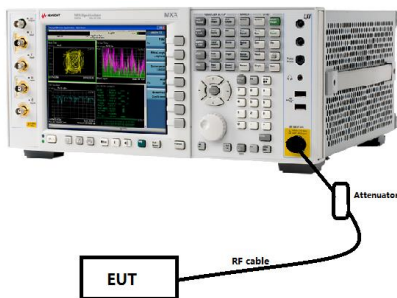
Please refer to Appendix A

6. Dwell Time of Hopping Channel

6.1 Standard Applicable

According to 15.247(a)(1)(iii), frequency hopping systems in the 2400–2483.5MHz 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 Sub clause 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 $\leq$ channel spacing and where possible RBW should be set $\gg 1/T$, 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) $\times$ (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: $T = 0.4 \text{ Second} * 79 \text{ Channel} = 31.6 \text{ s}$

Dwell time = time slot length * (Hopping rate / Number of hopping channels) * Period

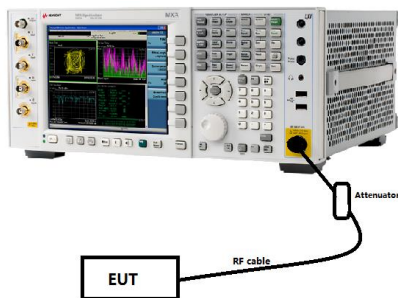
Please refer to Appendix B

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 Sub clause 9 and ANSI C63.10-2013 section 6.9.2, the 20dB bandwidth test method as follows.

- 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.
- The nominal IF filter bandwidth (3dB 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.
- 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 $[10 \log (\text{OBW}/\text{RBW})]$ below the reference level.
- Steps a) through c) might require iteration to adjust within the specified tolerances.
- 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 30dB below the reference value.
- Set detection mode to peak and trace mode to max hold.
- 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).
- Determine the “-xx dB down amplitude” using $[(\text{reference value}) - \text{xx}]$. Alternatively, this calculation may be made by using the marker-delta function of the instrument.
- 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

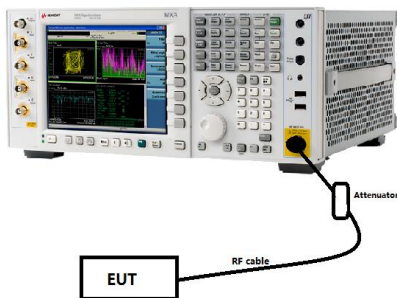
Please refer to Appendix C

8. RF Output Power

8.1 Standard Applicable

According to 15.247(b)(1), for frequency hopping systems operating in the 2400–2483.5MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5MHz 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 20dB bandwidth, centered on a hopping channel.
- 2) RBW > 20dB bandwidth of the emission being measured.
- 3) VBW $\geq$ 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 100kHz 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 20dB below that in the 100kHz 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 30dB instead of 20dB. 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).

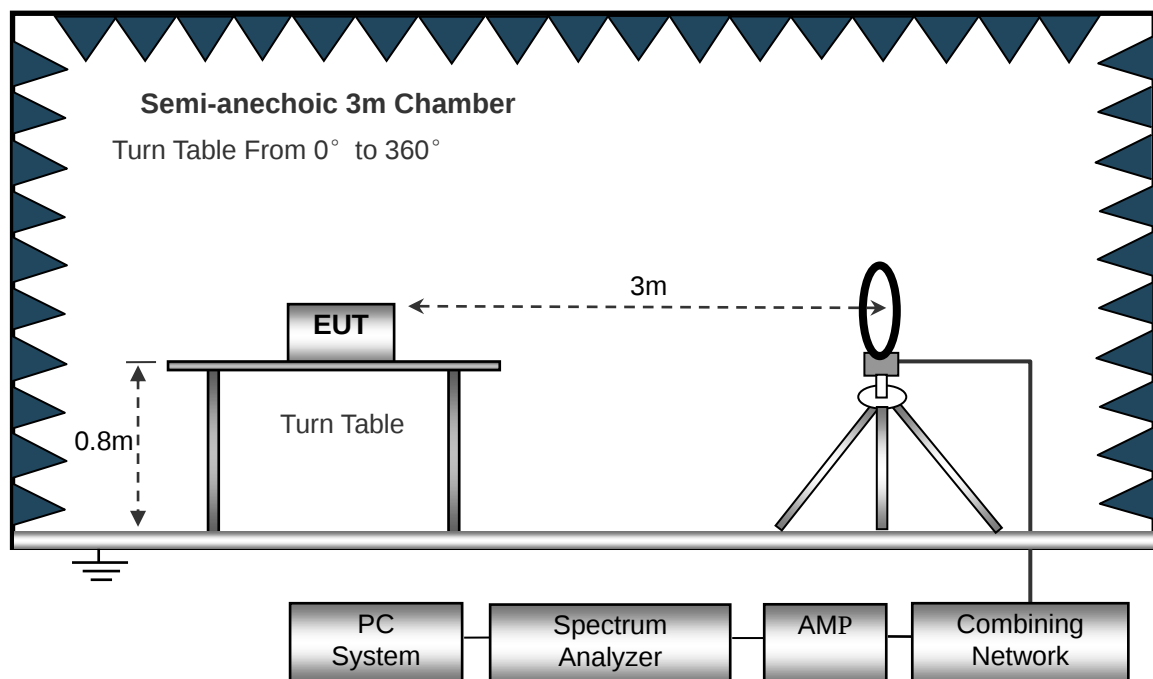
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

9.2 Test Procedure

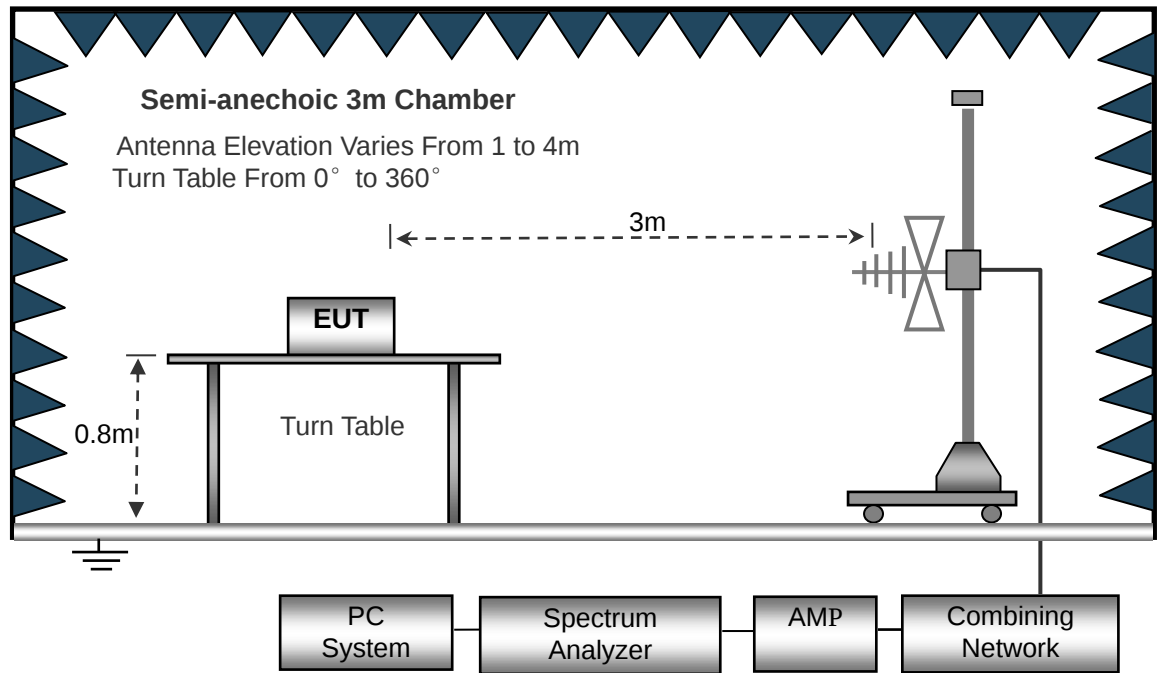
The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40cm long in the middle. The spacing between the peripherals was 10cm.

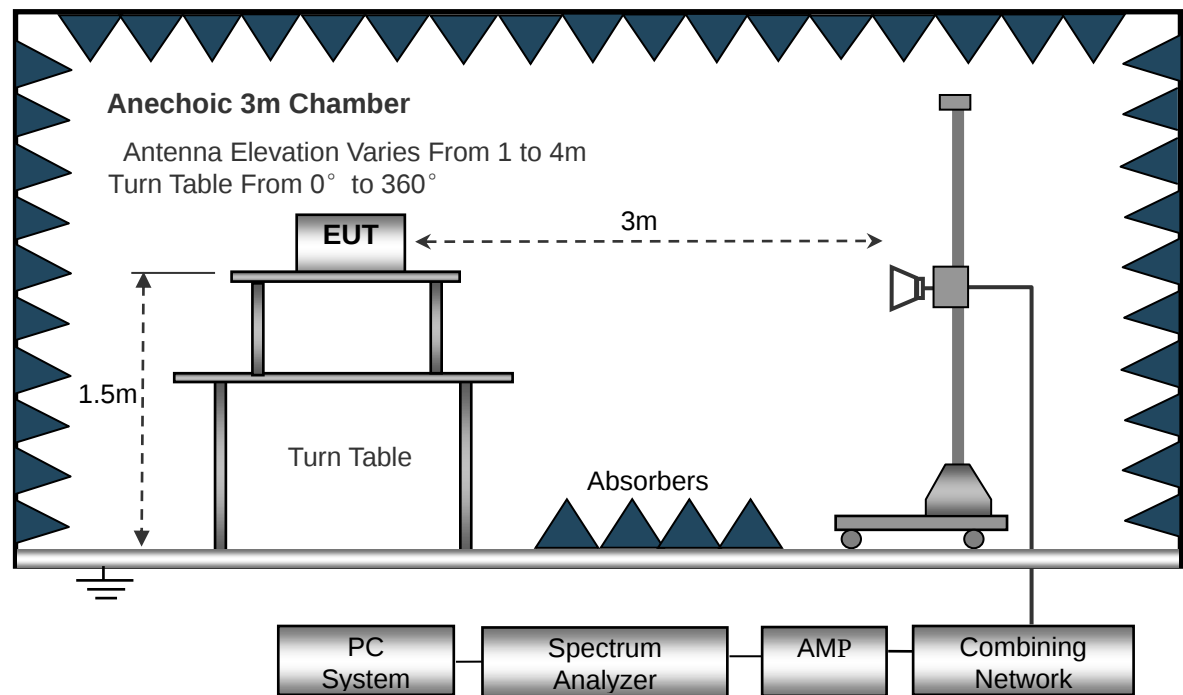
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1GHz.



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:

$$\begin{aligned}\text{Corr. Ampl.} &= \text{Indicated Reading} + \text{Correct} \\ \text{Correct} &= \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}\end{aligned}$$

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

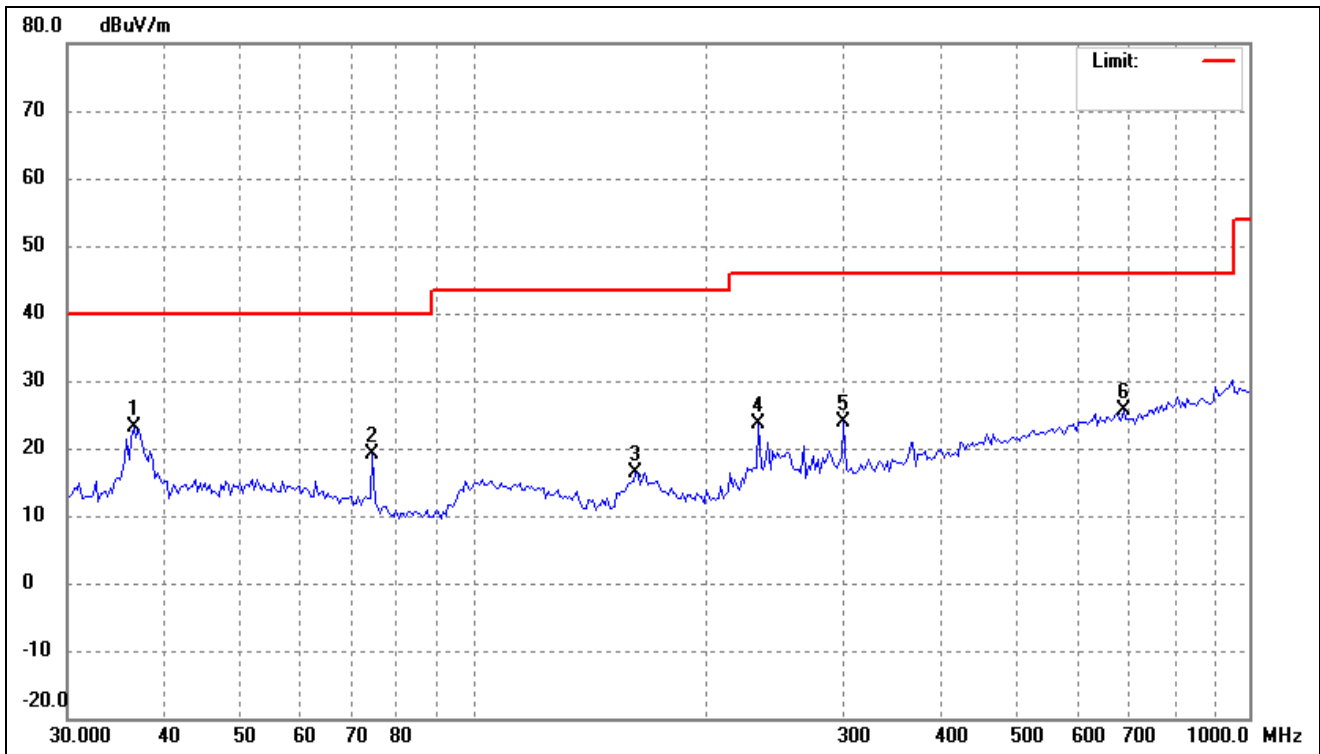
$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

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.

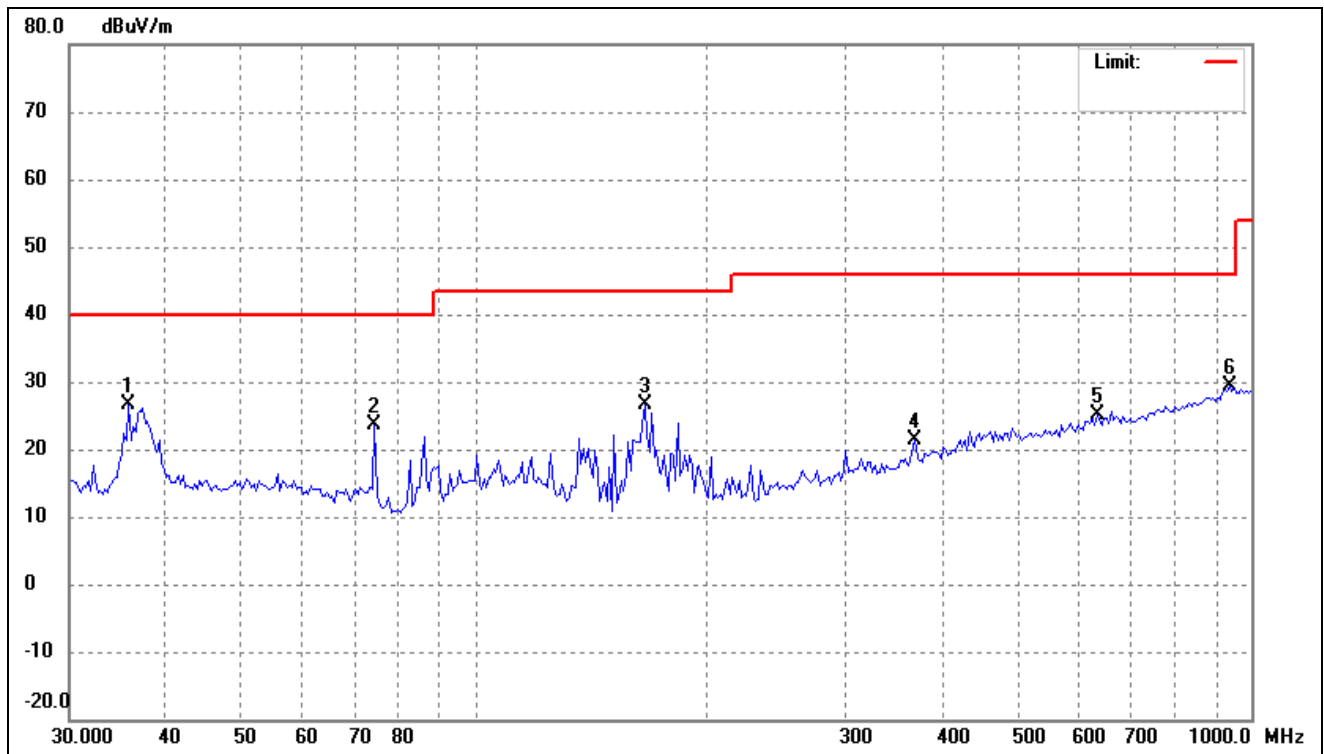
➤ Spurious Emissions Below 1GHz

Test Channel	Low(worst case)	Polarity:	Horizontal
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	36.5236	36.36	-13.22	23.14	40.00	-16.86	-	-	peak
2	74.2696	34.81	-15.70	19.11	40.00	-20.89	-	-	peak
3	162.0197	29.09	-12.66	16.43	43.50	-27.07	-	-	peak
4	233.4881	38.99	-15.26	23.73	46.00	-22.27	-	-	peak
5	300.6988	36.13	-12.24	23.89	46.00	-22.11	-	-	peak
6	689.0510	30.70	-5.16	25.54	46.00	-20.46	-	-	peak

Test Channel	Low(worst case)	Polarity:	Vertical
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	35.7617	40.07	-13.39	26.68	40.00	-13.32	-	-	peak
2	74.2696	39.23	-15.70	23.53	40.00	-16.47	-	-	peak
3	165.4716	39.44	-12.76	26.68	43.50	-16.82	-	-	peak
4	368.6682	32.08	-10.63	21.45	46.00	-24.55	-	-	peak
5	633.3285	30.56	-5.37	25.19	46.00	-20.81	-	-	peak
6	938.7139	31.36	-2.06	29.30	46.00	-16.70	-	-	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	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2402MHz							
4804.000	54.51	-12.67	41.84	74.00	-32.16	H	PK
7206.000	54.33	-6.21	48.12	74.00	-25.88	H	PK
4804.000	54.67	-12.67	42.00	74.00	-32.00	V	PK
7206.000	54.32	-6.21	48.11	74.00	-25.89	V	PK
Middle Channel-2441MHz							
4882.000	55.85	-12.56	43.29	74.00	-30.71	H	PK
7323.000	54.11	-6.50	47.61	74.00	-26.39	H	PK
4882.000	53.96	-12.56	41.40	74.00	-32.60	V	PK
7323.000	53.61	-6.50	47.11	74.00	-26.89	V	PK
High Channel-2480MHz							
4960.000	53.95	-12.44	41.51	74.00	-32.49	H	PK
7440.000	52.93	-6.80	46.13	74.00	-27.87	H	PK
4960.000	54.41	-12.44	41.97	74.00	-32.03	V	PK
7440.000	52.92	-6.80	46.12	74.00	-27.88	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 100kHz 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 20dB below that in the 100kHz 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 30dB instead of 20dB. 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 10dB preferred).
 - 4) Sweep time: Coupled.
 - 5) Resolution bandwidth: 100kHz.
 - 6) Video bandwidth: 300kHz.
 - 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.

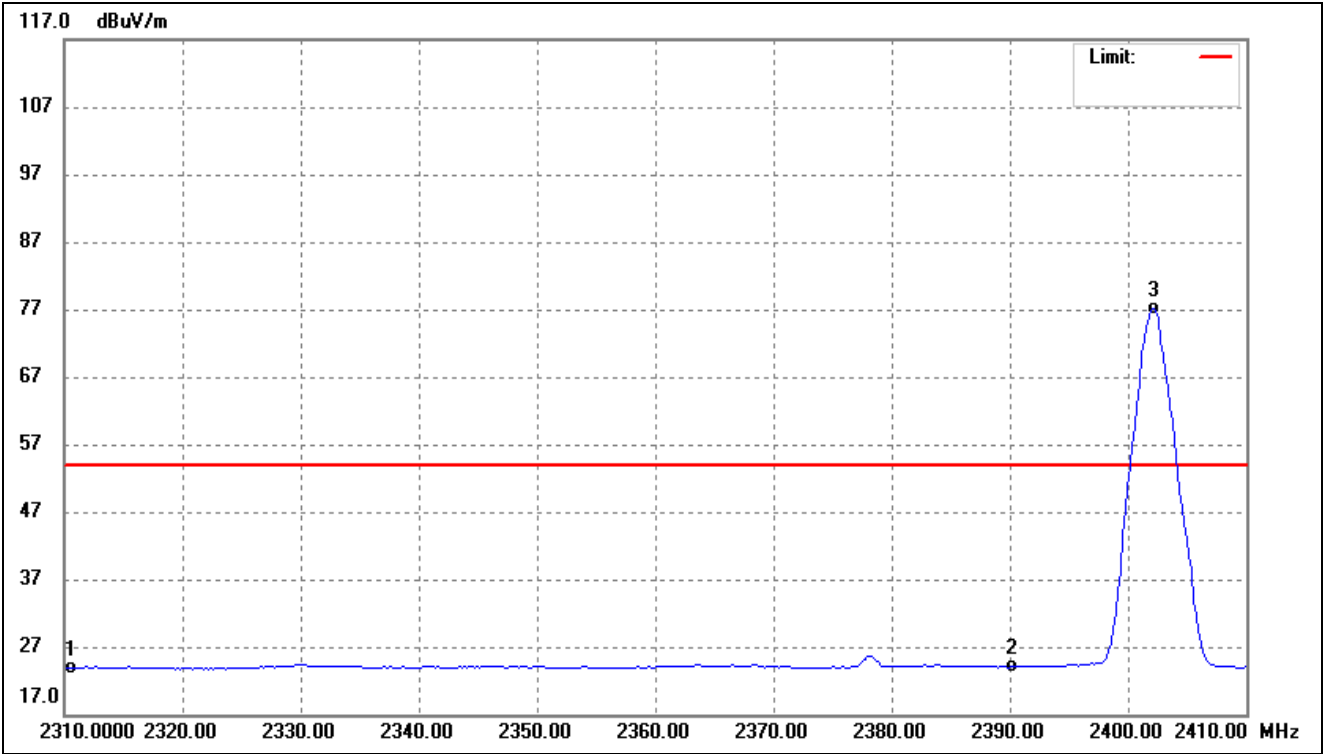
Connect the primary antenna port through an attenuator to the spectrum analyzer input; in the results, account for all losses between the unlicensed wireless device output and the spectrum analyzer. The instrument shall span 30 MHz to 10 times the operating frequency in GHz, with a resolution bandwidth 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.

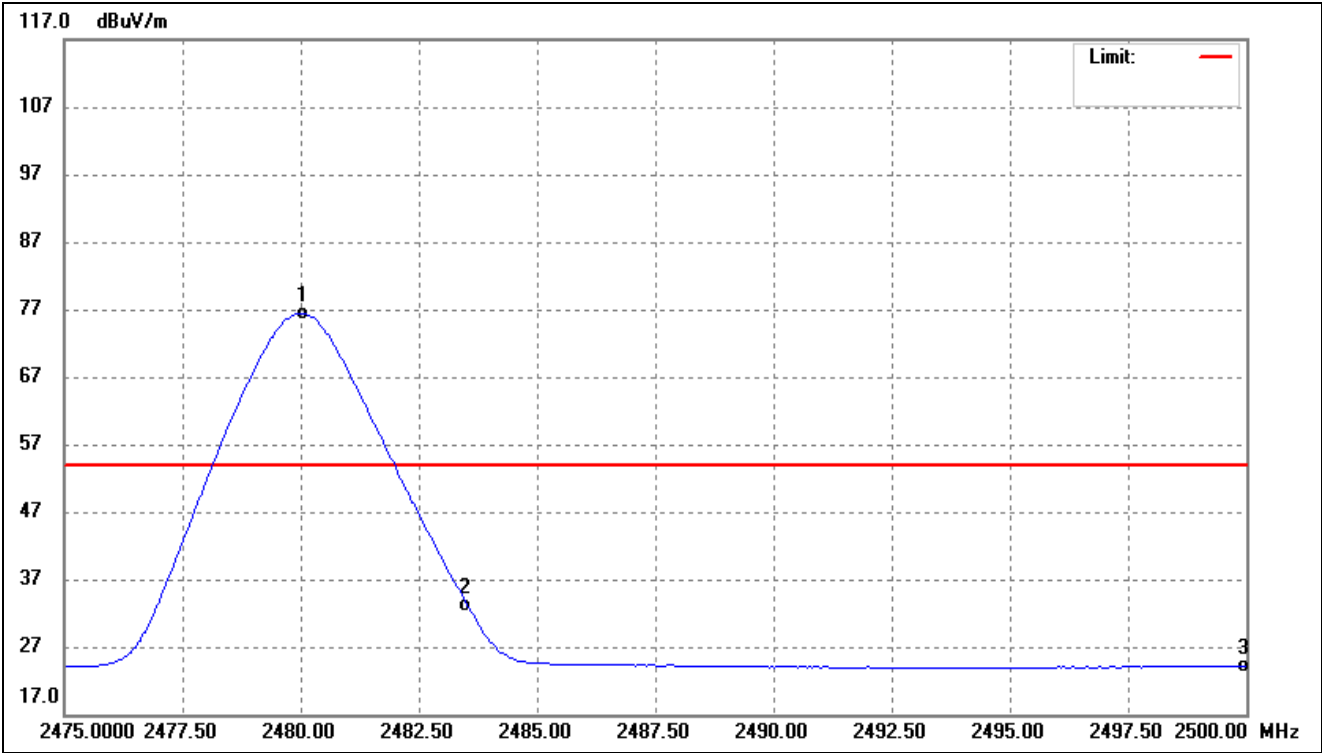
➤ Radiated test

Test Channel	Low	Polarity:	Vertical(worst case)
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	42.88	-19.02	23.86	54.00	-30.14	Average Detector
	2310.000	59.97	-19.02	40.95	74.00	-33.05	Peak Detector
2	2390.000	42.89	-18.87	24.02	54.00	-29.98	Average Detector
	2390.000	73.68	-18.87	54.81	74.00	-19.19	Peak Detector
3	2402.184	96.05	-18.85	77.20	/	/	Average Detector
	2401.984	106.76	-18.85	87.91	/	/	Peak Detector

Test Channel	High	Polarity:	Vertical(worst case)
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.060	95.10	-18.68	76.42	/	/	Average Detector
	2480.010	105.70	-18.68	87.02	/	/	Peak Detector
2	2483.500	51.80	-18.68	33.12	54.00	-20.88	Average Detector
	2483.500	82.76	-18.68	64.08	74.00	-9.92	Peak Detector
3	2500.000	42.84	-18.65	24.19	54.00	-29.81	Average Detector
	2500.000	65.17	-18.65	46.52	74.00	-27.48	Peak Detector

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

➤ Conducted test
Please refer to Appendix E

11. Conducted Emissions

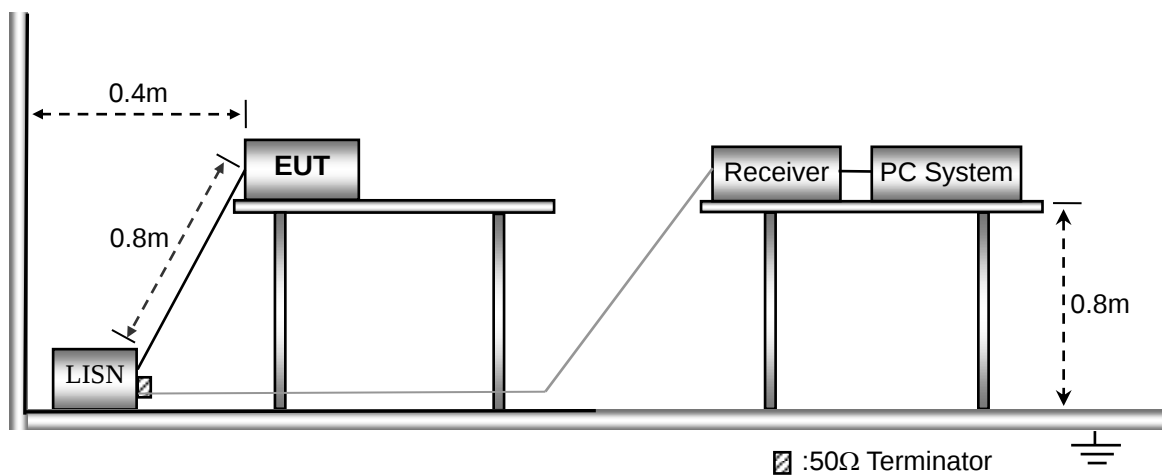
11.1 Test Procedure

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 40cm long in the middle. The spacing between the peripherals was 10cm.

11.2 Basic Test Setup Block Diagram

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



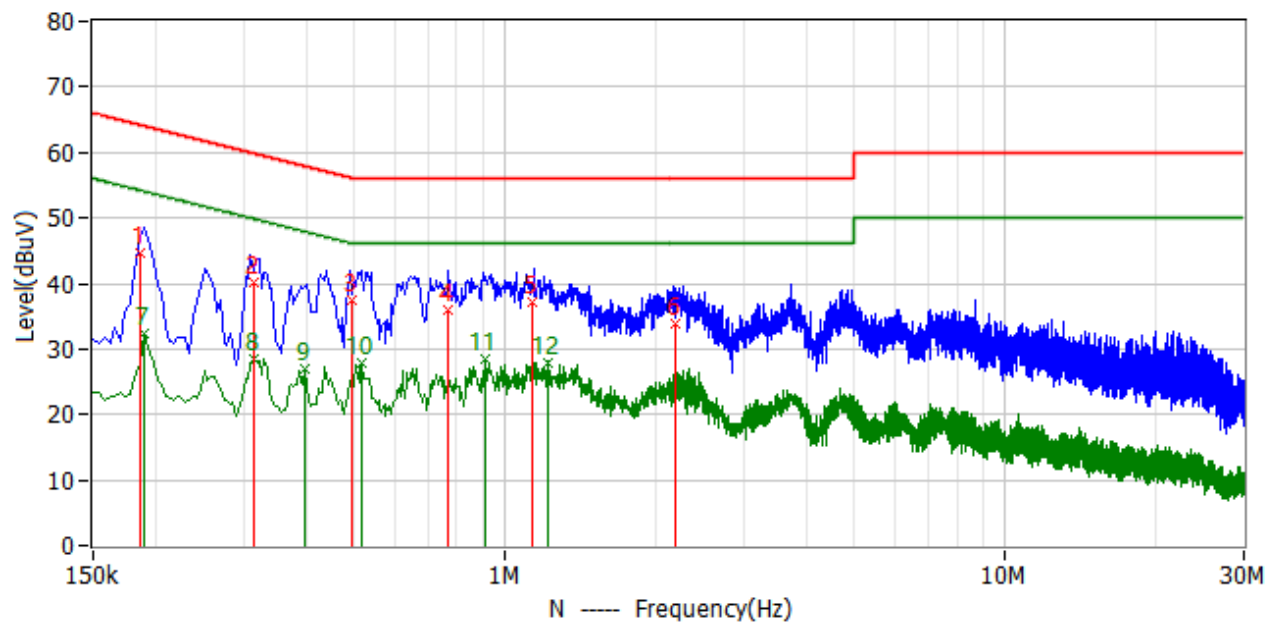
11.3 Test Receiver Setup

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

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

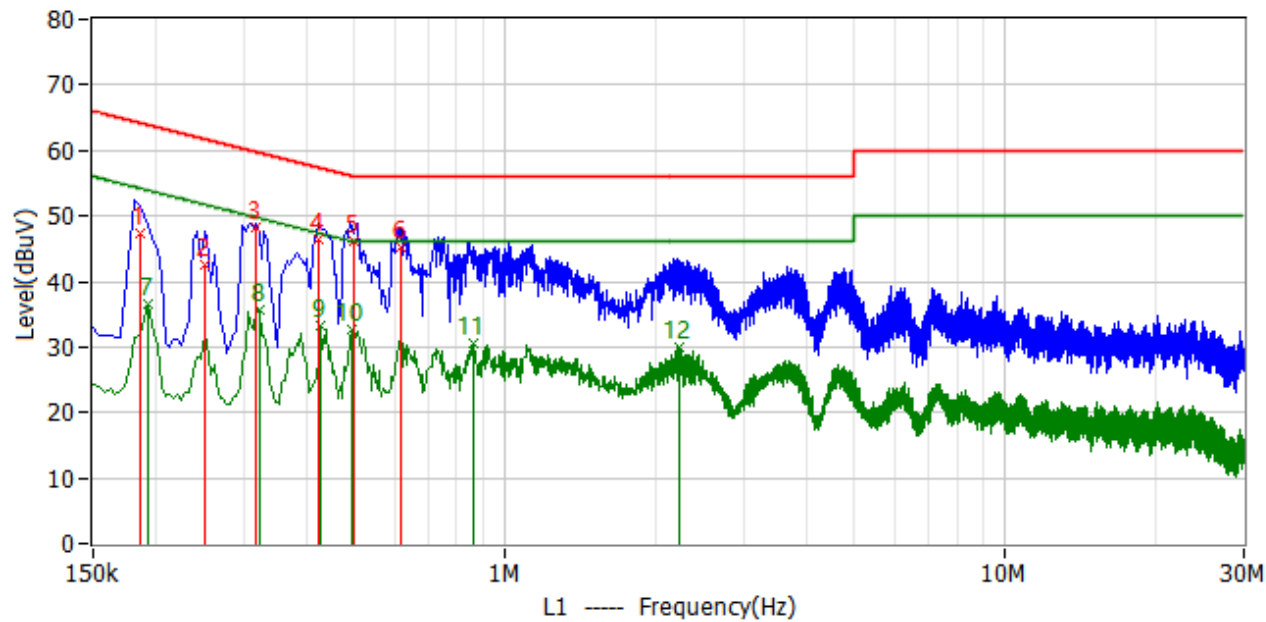
11.4 Summary of Test Results/Plots

Test Mode	Communication	AC120V 60Hz	Polarity:	Neutral
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No.	Frequency	Limit dBuV	Level dBuV	Delta dB	Reading dBuV	Factor dB	Detector
1	186.000kHz	64.2	44.5	-19.7	34.8	9.7	QP
2	314.000kHz	59.9	40.2	-19.6	30.2	10.0	QP
3	494.000kHz	56.1	37.4	-18.7	27.8	9.6	QP
4	770.000kHz	56.0	36.0	-20.0	26.3	9.7	QP
5	1.134MHz	56.0	37.1	-18.9	27.4	9.7	QP
6	2.190MHz	56.0	33.8	-22.2	24.1	9.7	QP
7*	190.000kHz	54.0	32.3	-21.7	22.6	9.7	AV
8*	314.000kHz	49.9	28.6	-21.3	18.6	10.0	AV
9*	398.000kHz	47.9	27.1	-20.8	17.2	9.9	AV
10*	518.000kHz	46.0	28.0	-18.0	18.4	9.6	AV
11*	914.000kHz	46.0	28.4	-17.6	18.7	9.7	AV
12*	1.222MHz	46.0	28.0	-18.0	18.3	9.7	AV

Test Mode	Communication	AC120V 60Hz	Polarity:	Line
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No.	Frequency	Limit dBuV	Level dBuV	Delta dB	Reading dBuV	Factor dB	Detector
1	186.000kHz	64.2	47.2	-17.0	37.5	9.7	QP
2	250.000kHz	61.8	42.4	-19.4	32.5	9.9	QP
3	318.000kHz	59.8	48.3	-11.5	38.2	10.1	QP
4	422.000kHz	57.4	46.3	-11.1	36.5	9.8	QP
5	498.000kHz	56.0	46.1	-9.9	36.4	9.7	QP
6	618.000kHz	56.0	45.3	-10.7	35.6	9.7	QP
7*	194.000kHz	53.9	36.5	-17.4	26.8	9.7	AV
8*	322.000kHz	49.7	35.8	-13.9	25.7	10.1	AV
9*	426.000kHz	47.3	33.2	-14.1	23.4	9.8	AV
10*	494.000kHz	46.1	32.6	-13.5	22.9	9.7	AV
11*	862.000kHz	46.0	30.5	-15.5	20.7	9.8	AV
12*	2.222MHz	46.0	29.9	-16.1	20.1	9.8	AV

APPENDIX SUMMARY

Project No.	WTX24X04071731W	Test Engineer	Elin Su
Start date	2024/4/10	Finish date	2024/4/10
Temperature	23℃	Humidity	51%
RF specifications	BT-BR/EDR		

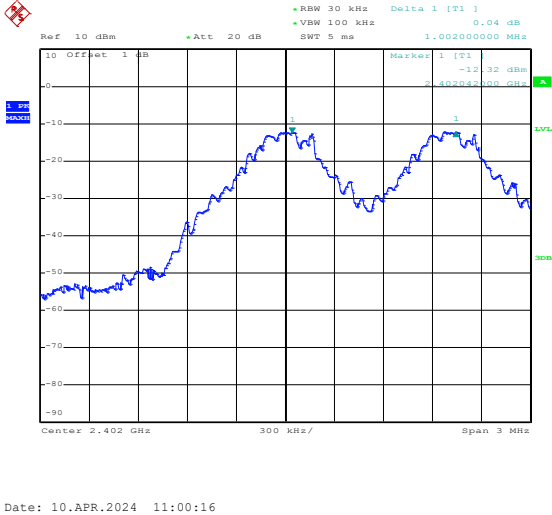
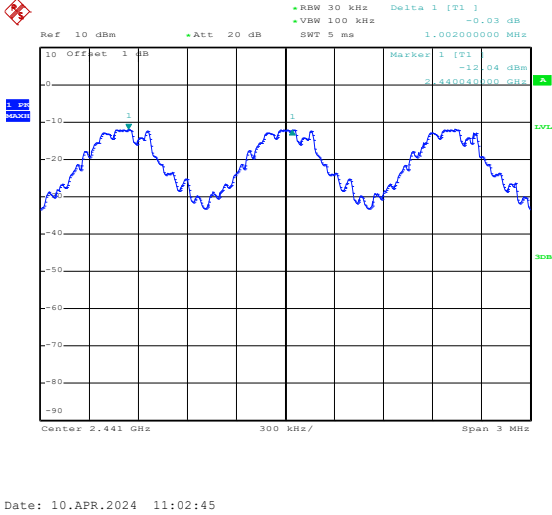
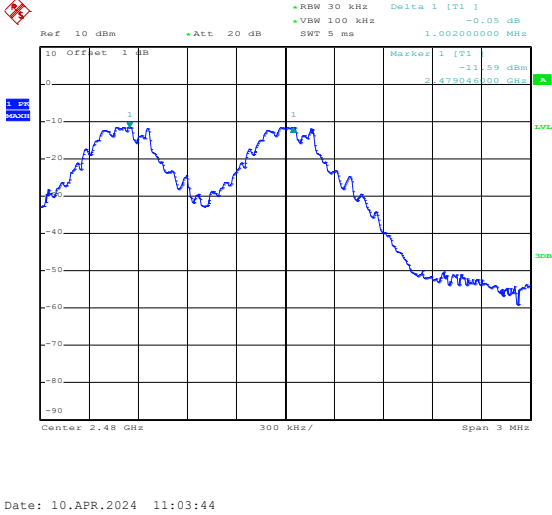
APPENDIX	Description of Test Item	Result
A	Hopping Channels and Channel Separation	Compliant
B	Dwell Time of Hopping Channel	Compliant
C	20dB Bandwidth	Compliant
D	RF Output Power	Compliant
E	Conducted Out of Band Emissions	Compliant

APPENDIX A

Hopping Channels Number			
Mode	Test Result	Limit	Result
GFSK	79	≥15	Pass
π/4 DQPSK	79	≥15	Pass
8DPSK	79	≥15	Pass

GFSK	Date: 10.APR.2024 11:15:15
$\pi/4$ DQPSK	Date: 10.APR.2024 11:16:23
8DPSK	Date: 10.APR.2024 11:17:57

Channel Separation			
Mode	Channel	Carrier Frequencies Separation (kHz)	Result
GFSK	Low	1002	Pass
	Middle	1002	Pass
	High	1002	Pass
8DPSK	Low	1002	Pass
	Middle	1008	Pass
	High	1002	Pass

GFSK-Low	 Date: 10.APR.2024 11:00:16
GFSK-Middle	 Date: 10.APR.2024 11:02:45
GFSK-High	 Date: 10.APR.2024 11:03:44

Modulation	Plot Description	Ref	Att	RBW	VBW	SWT	Delta 1 (T1)	Marker 1 (T1)	Marker 2 (T2)	Marker 3 (T3)	Marker 4 (T4)	Marker 5 (T5)	Marker 6 (T6)	Marker 7 (T7)	Marker 8 (T8)	Marker 9 (T9)	Marker 10 (T10)	Marker 11 (T11)	Marker 12 (T12)	Marker 13 (T13)	Marker 14 (T14)	Marker 15 (T15)	Marker 16 (T16)	Marker 17 (T17)	Marker 18 (T18)	Marker 19 (T19)	Marker 20 (T20)	Marker 21 (T21)	Marker 22 (T22)	Marker 23 (T23)	Marker 24 (T24)	Marker 25 (T25)	Marker 26 (T26)	Marker 27 (T27)	Marker 28 (T28)	Marker 29 (T29)	Marker 30 (T30)	Marker 31 (T31)	Marker 32 (T32)	Marker 33 (T33)	Marker 34 (T34)	Marker 35 (T35)	Marker 36 (T36)	Marker 37 (T37)	Marker 38 (T38)	Marker 39 (T39)	Marker 40 (T40)	Marker 41 (T41)	Marker 42 (T42)	Marker 43 (T43)	Marker 44 (T44)	Marker 45 (T45)	Marker 46 (T46)	Marker 47 (T47)	Marker 48 (T48)	Marker 49 (T49)	Marker 50 (T50)	Marker 51 (T51)	Marker 52 (T52)	Marker 53 (T53)	Marker 54 (T54)	Marker 55 (T55)	Marker 56 (T56)	Marker 57 (T57)	Marker 58 (T58)	Marker 59 (T59)	Marker 60 (T60)	Marker 61 (T61)	Marker 62 (T62)	Marker 63 (T63)	Marker 64 (T64)	Marker 65 (T65)	Marker 66 (T66)	Marker 67 (T67)	Marker 68 (T68)	Marker 69 (T69)	Marker 70 (T70)	Marker 71 (T71)	Marker 72 (T72)	Marker 73 (T73)	Marker 74 (T74)	Marker 75 (T75)	Marker 76 (T76)	Marker 77 (T77)	Marker 78 (T78)	Marker 79 (T79)	Marker 80 (T80)	Marker 81 (T81)	Marker 82 (T82)	Marker 83 (T83)	Marker 84 (T84)	Marker 85 (T85)	Marker 86 (T86)	Marker 87 (T87)	Marker 88 (T88)	Marker 89 (T89)	Marker 90 (T90)	Marker 91 (T91)	Marker 92 (T92)	Marker 93 (T93)	Marker 94 (T94)	Marker 95 (T95)	Marker 96 (T96)	Marker 97 (T97)	Marker 98 (T98)	Marker 99 (T99)	Marker 100 (T100)	Marker 101 (T101)	Marker 102 (T102)	Marker 103 (T103)	Marker 104 (T104)	Marker 105 (T105)	Marker 106 (T106)	Marker 107 (T107)	Marker 108 (T108)	Marker 109 (T109)	Marker 110 (T110)	Marker 111 (T111)	Marker 112 (T112)	Marker 113 (T113)	Marker 114 (T114)	Marker 115 (T115)	Marker 116 (T116)	Marker 117 (T117)	Marker 118 (T118)	Marker 119 (T119)	Marker 120 (T120)	Marker 121 (T121)	Marker 122 (T122)	Marker 123 (T123)	Marker 124 (T124)	Marker 125 (T125)	Marker 126 (T126)	Marker 127 (T127)	Marker 128 (T128)	Marker 129 (T129)	Marker 130 (T130)	Marker 131 (T131)	Marker 132 (T132)	Marker 133 (T133)	Marker 134 (T134)	Marker 135 (T135)	Marker 136 (T136)	Marker 137 (T137)	Marker 138 (T138)	Marker 139 (T139)	Marker 140 (T140)	Marker 141 (T141)	Marker 142 (T142)	Marker 143 (T143)	Marker 144 (T144)	Marker 145 (T145)	Marker 146 (T146)	Marker 147 (T147)	Marker 148 (T148)	Marker 149 (T149)	Marker 150 (T150)	Marker 151 (T151)	Marker 152 (T152)	Marker 153 (T153)	Marker 154 (T154)	Marker 155 (T155)	Marker 156 (T156)	Marker 157 (T157)	Marker 158 (T158)	Marker 159 (T159)	Marker 160 (T160)	Marker 161 (T161)	Marker 162 (T162)	Marker 163 (T163)	Marker 164 (T164)	Marker 165 (T165)	Marker 166 (T166)	Marker 167 (T167)	Marker 168 (T168)	Marker 169 (T169)	Marker 170 (T170)	Marker 171 (T171)	Marker 172 (T172)	Marker 173 (T173)	Marker 174 (T174)	Marker 175 (T175)	Marker 176 (T176)	Marker 177 (T177)	Marker 178 (T178)	Marker 179 (T179)	Marker 180 (T180)	Marker 181 (T181)	Marker 182 (T182)	Marker 183 (T183)	Marker 184 (T184)	Marker 185 (T185)	Marker 186 (T186)	Marker 187 (T187)	Marker 188 (T188)	Marker 189 (T189)	Marker 190 (T190)	Marker 191 (T191)	Marker 192 (T192)	Marker 193 (T193)	Marker 194 (T194)	Marker 195 (T195)	Marker 196 (T196)	Marker 197 (T197)	Marker 198 (T198)	Marker 199 (T199)	Marker 200 (T200)	Marker 201 (T201)	Marker 202 (T202)	Marker 203 (T203)	Marker 204 (T204)	Marker 205 (T205)	Marker 206 (T206)	Marker 207 (T207)	Marker 208 (T208)	Marker 209 (T209)	Marker 210 (T210)	Marker 211 (T211)	Marker 212 (T212)	Marker 213 (T213)	Marker 214 (T214)	Marker 215 (T215)	Marker 216 (T216)	Marker 217 (T217)	Marker 218 (T218)	Marker 219 (T219)	Marker 220 (T220)	Marker 221 (T221)	Marker 222 (T222)	Marker 223 (T223)	Marker 224 (T224)	Marker 225 (T225)	Marker 226 (T226)	Marker 227 (T227)	Marker 228 (T228)	Marker 229 (T229)	Marker 230 (T230)	Marker 231 (T231)	Marker 232 (T232)	Marker 233 (T233)	Marker 234 (T234)	Marker 235 (T235)	Marker 236 (T236)	Marker 237 (T237)	Marker 238 (T238)	Marker 239 (T239)	Marker 240 (T240)	Marker 241 (T241)	Marker 242 (T242)	Marker 243 (T243)	Marker 244 (T244)	Marker 245 (T245)	Marker 246 (T246)	Marker 247 (T247)	Marker 248 (T248)	Marker 249 (T249)	Marker 250 (T250)	Marker 251 (T251)	Marker 252 (T252)	Marker 253 (T253)	Marker 254 (T254)	Marker 255 (T255)	Marker 256 (T256)	Marker 257 (T257)	Marker 258 (T258)	Marker 259 (T259)	Marker 260 (T260)	Marker 261 (T261)	Marker 262 (T262)	Marker 263 (T263)	Marker 264 (T264)	Marker 265 (T265)	Marker 266 (T266)	Marker 267 (T267)	Marker 268 (T268)	Marker 269 (T269)	Marker 270 (T270)	Marker 271 (T271)	Marker 272 (T272)	Marker 273 (T273)	Marker 274 (T274)	Marker 275 (T275)	Marker 276 (T276)	Marker 277 (T277)	Marker 278 (T278)	Marker 279 (T279)	Marker 280 (T280)	Marker 281 (T281)	Marker 28
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APPENDIX B

Dwell Time of Hopping Channel					
Modulation	Packet	Test Channel	Time Slot Length	Dwell Time	Limit
			ms	ms	ms
GFSK	DH5	Low	2.928	312.32	≤400
		Middle	2.936	313.17	≤400
		High	2.928	312.32	≤400
π/4 DQPSK	2DH5	Low	2.936	313.17	≤400
		Middle	2.952	314.88	≤400
		High	2.952	314.88	≤400
8DPSK	3DH5	Low	2.936	313.17	≤400
		Middle	2.936	313.17	≤400
		High	2.944	314.03	≤400

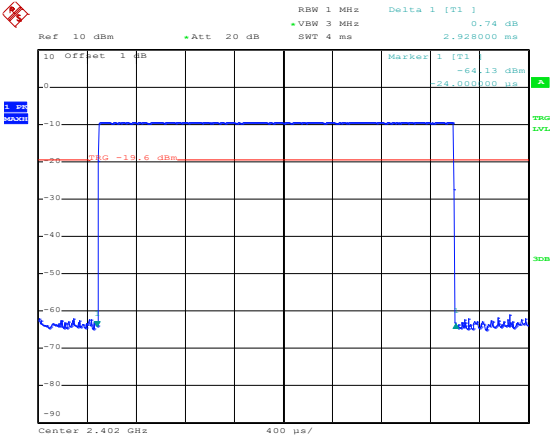
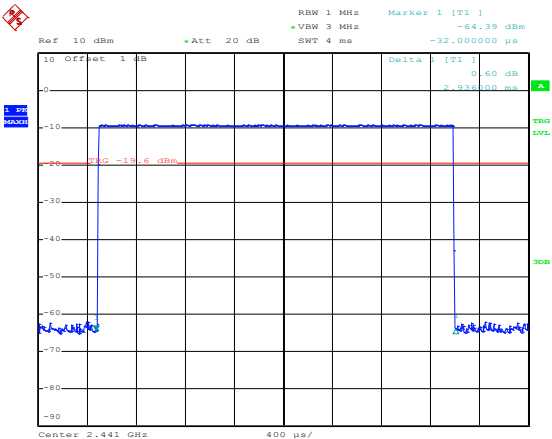
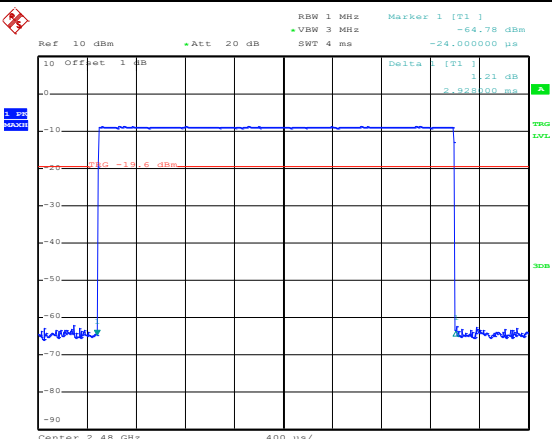
Note: The test period: $T = 0.4 \text{ Second} \times 79 \text{ Channel} = 31.6 \text{ s}$

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

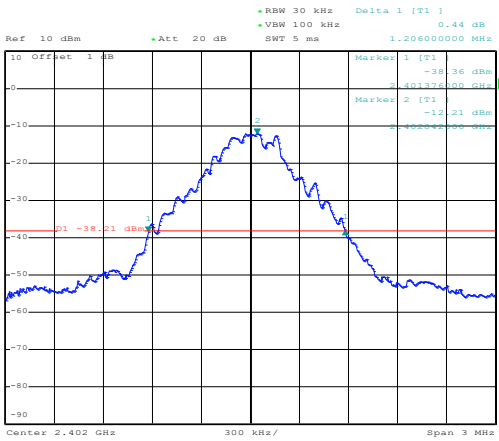
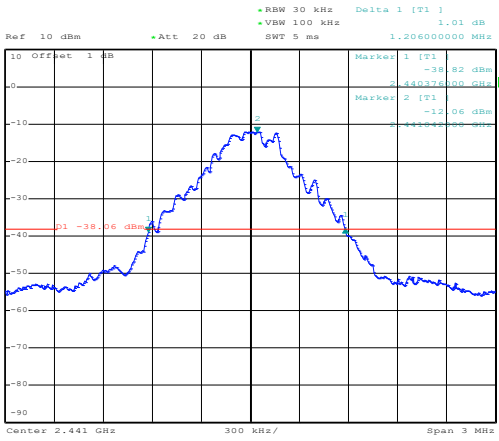
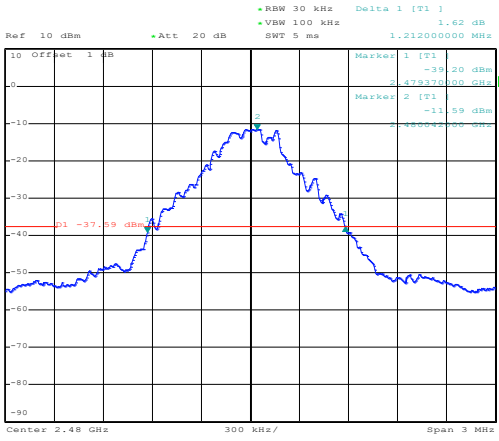
DH5-Low	 Ref 10 dBm *Att 20 dB RBW 1 MHz Delta 1 [T1] 0.74 dB VBW 3 MHz SWT 4 ms 2.928000 ms Marker 1 [T1] -64.13 dBm -24.000000 μs TRG LVL 30dB Center 2.402 GHz 400 μs/ Date: 10.APR.2024 11:19:27
DH5-Middle	 Ref 10 dBm *Att 20 dB RBW 1 MHz Marker 1 [T1] -64.39 dBm VBW 3 MHz SWT 4 ms Delta 1 [T1] 0.60 dB -32.000000 μs TRG LVL 30dB Center 2.441 GHz 400 μs/ Date: 10.APR.2024 11:19:36
DH5-High	 Ref 10 dBm *Att 20 dB RBW 1 MHz Marker 1 [T1] -64.78 dBm VBW 3 MHz SWT 4 ms Delta 1 [T1] 1.21 dB -24.000000 μs TRG LVL 30dB Center 2.48 GHz 400 μs/ Date: 10.APR.2024 11:19:44

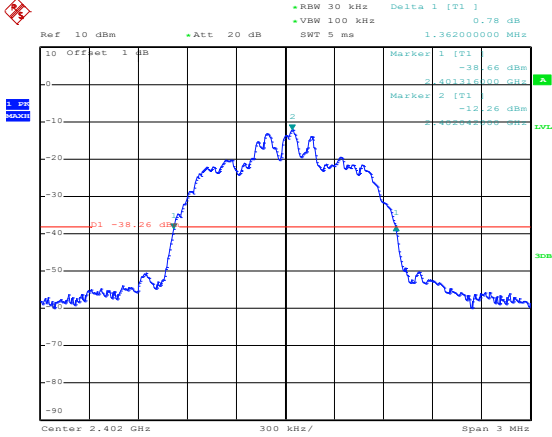
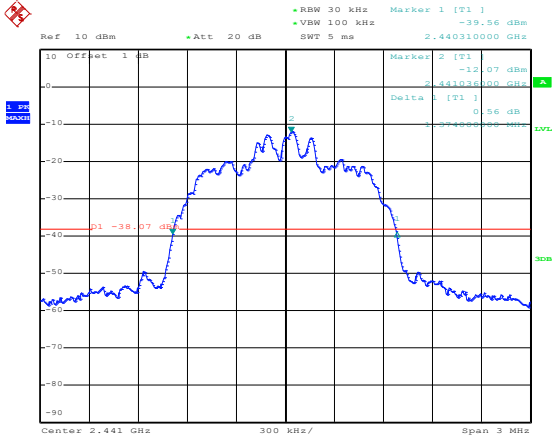
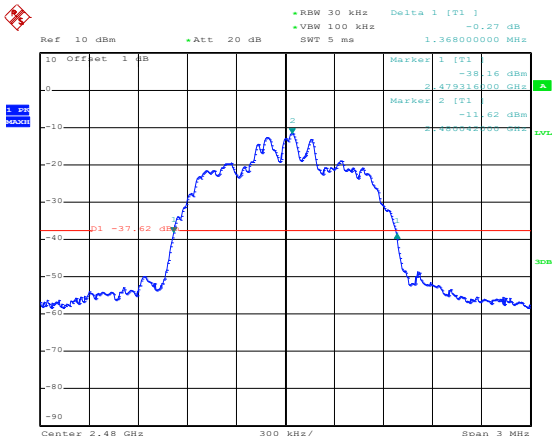
Channel	Plot Type	Frequency (GHz)	Power Level (dBm)	Marker 1 [T1]	Delta 1 [T1]	Date
2DH5-Low	Power Spectral Density	2.402	-16.4	-65.14 dBm	2.936000 μ s	10.APR.2024 11:20:29
2DH5-Middle	Power Spectral Density	2.441	-16.4	-64.35 dBm	2.936000 μ s	10.APR.2024 11:20:46
2DH5-High	Power Spectral Density	2.48	-17	-65.07 dBm	2.936000 μ s	10.APR.2024 11:21:05

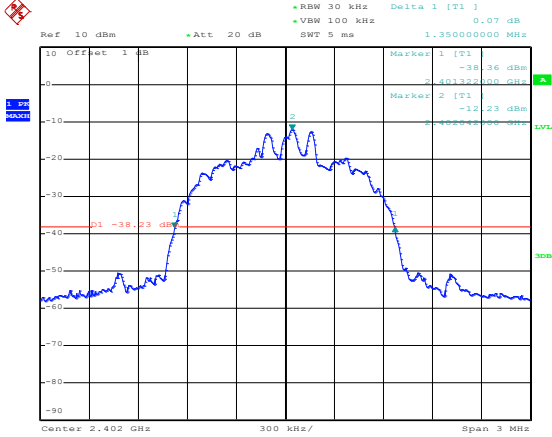
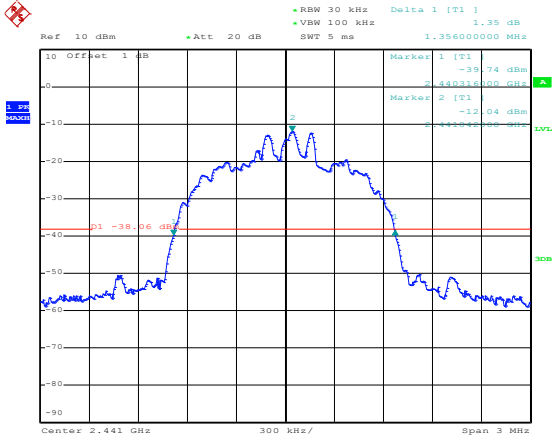
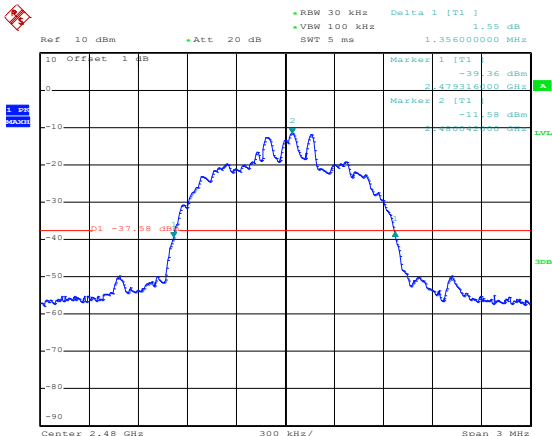
3DH5-Low	RBW 1 MHz Marker 1 [T1] -64.30 dBm VBW 3 MHz SWF 4 ms Ref 10 dBm Att 20 dB Delta 1 [T1] -0.53 dB 2.402000 ps 27.5 dBm 2.402 GHz 400 ps/ 10 Offset 1 dB 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 3100 3200 3300 3400 3500 3600 3700 3800 3900 4000 4100 4200 4300 4400 4500 4600 4700 4800 4900 5000 5100 5200 5300 5400 5500 5600 5700 5800 5900 6000 6100 6200 6300 6400 6500 6600 6700 6800 6900 7000 7100 7200 7300 7400 7500 7600 7700 7800 7900 8000 8100 8200 8300 8400 8500 8600 8700 8800 8900 9000 9100 9200 9300 9400 9500 9600 9700 9800 9900 10000 10100 10200 10300 10400 10500 10600 10700 10800 10900 11000 11100 11200 11300 11400 11500 11600 11700 11800 11900 12000 12100 12200 12300 12400 12500 12600 12700 12800 12900 13000 13100 13200 13300 13400 13500 13600 13700 13800 13900 14000 14100 14200 14300 14400 14500 14600 14700 14800 14900 15000 15100 15200 15300 15400 15500 15600 15700 15800 15900 16000 16100 16200 16300 16400 16500 16600 16700 16800 16900 17000 17100 17200 17300 17400 17500 17600 17700 17800 17900 18000 18100 18200 18300 18400 18500 18600 18700 18800 18900 19000 19100 19200 19300 19400 19500 19600 19700 19800 19900 20000 20100 20200 20300 20400 20500 20600 20700 20800 20900 21000 21100 21200 21300 21400 21500 21600 21700 21800 21900 22000 22100 22200 22300 22400 22500 22600 22700 22800 22900 23000 23100 23200 23300 23400 23500 23600 23700 23800 23900 24000 24100 24200 24300 24400 24500 24600 24700 24800 24900 25000 25100 25200 25300 25400 25500 25600 25700 25800 25900 26000 26100 26200 26300 26400 26500 26600 26700 26800 26900 27000 27100 27200 27300 27400 27500 27600 27700 27800 27900 28000 28100 28200 28300 28400 28500 28600 28700 28800 28900 29000 29100 29200 29300 29400 29500 29600 29700 29800 29900 30000 30100 30200 30300 30400 30500 30600 30700 30800 30900 31000 31100 31200 31300 31400 31500 31600 31700 31800 31900 32000 32100 32200 32300 32400 32500 32600 32700 32800 32900 33000 33100 33200 33300 33400 33500 33600 33700 33800 33900 34000 34100 34200 34300 34400 34500 34600 34700 34800 34900 35000 35100 35200 35300 35400 35500 35600 35700 35800 35900 36000 36100 36200 36300 36400 36500 36600 36700 36800 36900 37000 37100 37200 37300 37400 37500 37600 37700 37800 37900 38000 38100 38200 38300 38400 38500 38600 38700 38800 38900 39000 39100 39200 39300 39400 39500 39600 39700 39800 39900 40000 40100 40200 40300 40400 40500 40600 40700 40800 40900 41000 41100 41200 41300 41400 41500 41600 41700 41800 41900 42000 42100 42200 42300 42400 42500 42600 42700 42800 42900 43000 43100 43200 43300 43400 43500 43600 43700 43800 43900 44000 44100 44200 44300 44400 44500 44600 44700 44800 44900 45000 45100 45200 45300 45400 45500 45600 45700 45800 45900 46000 46100 46200 46300 46400 46500 46600 46700 46800 46900 47000 47100 47200 47300 47400 47500 47600 47700 47800 47900 48000 48100 48200 48300 48400 48500 48600 48700 48800 48900 49000 49100 49200 49300 49400 49500 49600 49700 49800 49900 50000 50100 50200 50300 50400 50500 50600 50700 50800 50900 51000 51100 51200 51300 51400 51500 51600 51700 51800 51900 52000 52100 52200 52300 52400 52500 52600 52700 52800 52900 53000 53100 53200 53300 53400 53500 53600 53700 53800 53900 54000 54100 54200 54300 54400 54500 54600 54700 54800 54900 55000 55100 55200 55300 55400 55500 55600 55700 55800 55900 56000 56100 56200 56300 56400 56500 56600 56700 56800 56900 57000 57100 57200 57300 57400 57500 57600 57700 57800 57900 58000 58100 58200 58300 58400 58500 58600 58700 58800 58900 59000 59100 59200 59300 59400 59500 59600 59700 59800 59900 60000 60100 60200 60300 60400 60500 60600 60700 60800 60900 61000 61100 61200 61300 61400 61500 61600 61700 61800 61900 62000 62100 62200 62300 62400 62500 62600 62700 62800 62900 63000 63100 63200 63300 63400 63500 63600 63700 63800
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APPENDIX C

20 dB Bandwidth			
Test Mode	Test Channel MHz	20 dB Bandwidth MHz	Result
GFSK	2402	1.206	Pass
	2441	1.206	Pass
	2480	1.212	Pass
$\pi/4$ DQPSK	2402	1.362	Pass
	2441	1.374	Pass
	2480	1.368	Pass
8DPSK	2402	1.350	Pass
	2441	1.356	Pass
	2480	1.356	Pass

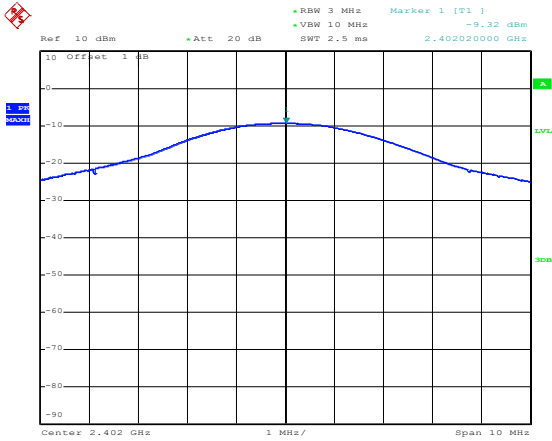
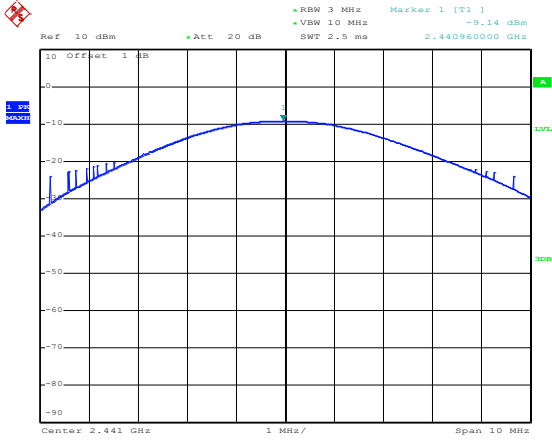
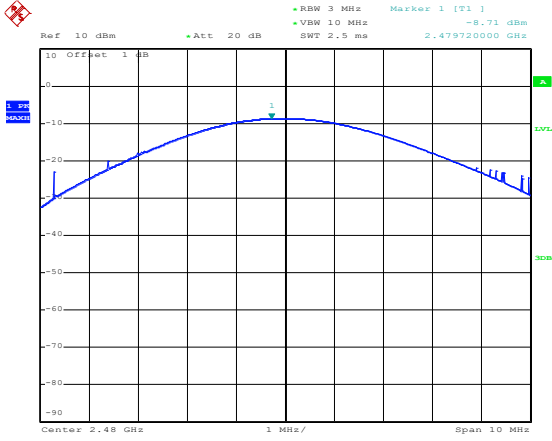
GFSK-Low	 Ref 10 dBm Att 20 dB RBW 30 kHz VBW 100 kHz Delta 1 [T1] 0.44 dB Marker 1 [T1] -38.36 dBm 2.401375000 GHz Marker 2 [T1] -12.21 dBm 2.400000000 GHz Center 2.402 GHz 300 kHz/ Span 3 MHz Date: 10.APR.2024 09:47:47
GFSK-Middle	 Ref 10 dBm Att 20 dB RBW 30 kHz VBW 100 kHz Delta 1 [T1] 1.01 dB Marker 1 [T1] -38.82 dBm 2.440375000 GHz Marker 2 [T1] -12.06 dBm 2.440000000 GHz Center 2.441 GHz 300 kHz/ Span 3 MHz Date: 10.APR.2024 09:49:53
GFSK-High	 Ref 10 dBm Att 20 dB RBW 30 kHz VBW 100 kHz Delta 1 [T1] 1.62 dB Marker 1 [T1] -39.20 dBm 2.479375000 GHz Marker 2 [T1] -11.59 dBm 2.480000000 GHz Center 2.48 GHz 300 kHz/ Span 3 MHz Date: 10.APR.2024 10:25:58

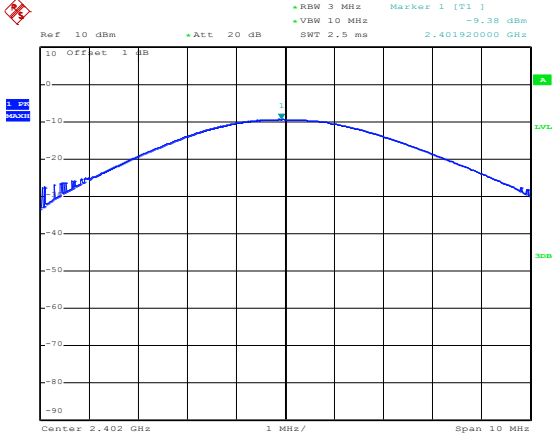
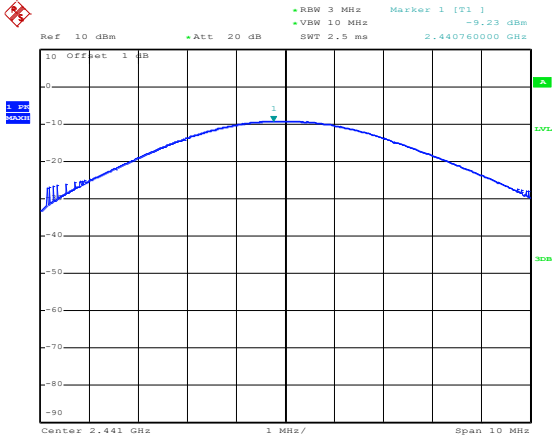
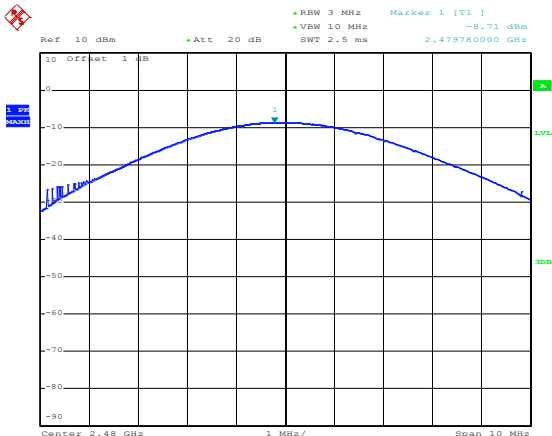
π/4 DQPSK-Low	 Ref 10 dBm Att 20 dB RBW 30 kHz VBW 100 kHz SWT 5 ms Delta 1 [T1] 0.78 dB 1.362000000 MHz Marker 1 [T1] -38.66 dBm 2.401315000 GHz Marker 2 [T1] -12.26 dBm 2.402000000 GHz Center 2.402 GHz 300 kHz/ Span 3 MHz Date: 10.APR.2024 10:27:19
π/4 DQPSK-Middle	 Ref 10 dBm Att 20 dB RBW 30 kHz VBW 100 kHz SWT 5 ms Marker 1 [T1] -39.56 dBm 2.440310000 GHz Marker 2 [T1] -12.07 dBm 2.441000000 GHz Delta 1 [T1] 0.56 dB Center 2.441 GHz 300 kHz/ Span 3 MHz Date: 10.APR.2024 10:29:44
π/4 DQPSK-High	 Ref 10 dBm Att 20 dB RBW 30 kHz VBW 100 kHz SWT 5 ms Delta 1 [T1] -0.27 dB 1.366000000 MHz Marker 1 [T1] -39.16 dBm 2.479315000 GHz Marker 2 [T1] -11.62 dBm 2.480000000 GHz Center 2.48 GHz 300 kHz/ Span 3 MHz Date: 10.APR.2024 10:31:16

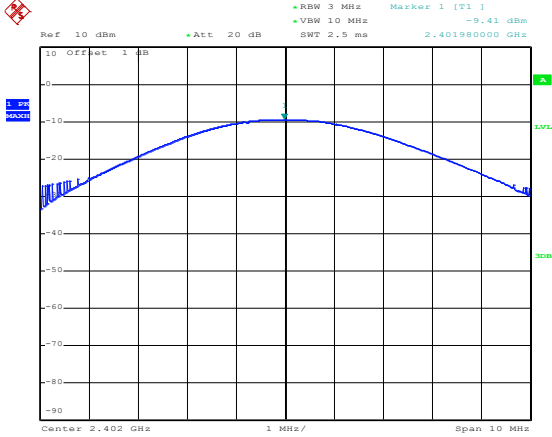
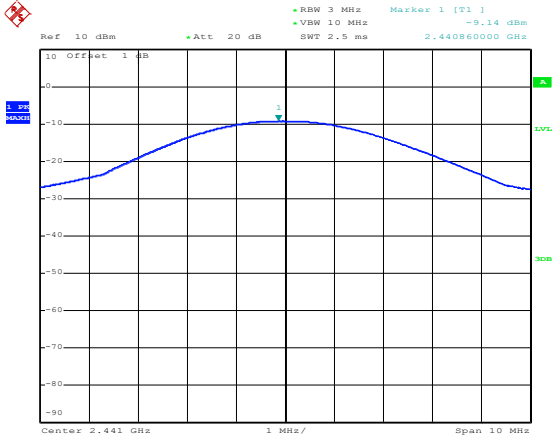
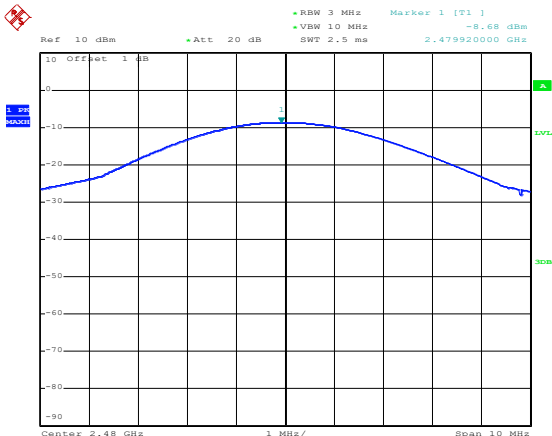
8DPSK-Low	 Ref 10 dBm Att 20 dB RBW 30 kHz VBW 100 kHz SWT 5 ms Delta 1 [T1] 0.07 dB 1.350000000 MHz Marker 1 [T1] -38.36 dBm 2.401322500 GHz Marker 2 [T1] -12.23 dBm 2.400445000 GHz Center 2.402 GHz 300 kHz/ Span 3 MHz Date: 10.APR.2024 10:35:28
8DPSK-Middle	 Ref 10 dBm Att 20 dB RBW 30 kHz VBW 100 kHz SWT 5 ms Delta 1 [T1] 1.35 dB 1.356000000 MHz Marker 1 [T1] -39.74 dBm 2.440315000 GHz Marker 2 [T1] -12.04 dBm 2.439445000 GHz Center 2.441 GHz 300 kHz/ Span 3 MHz Date: 10.APR.2024 10:36:41
8DPSK-High	 Ref 10 dBm Att 20 dB RBW 30 kHz VBW 100 kHz SWT 5 ms Delta 1 [T1] 1.55 dB 1.356000000 MHz Marker 1 [T1] -39.36 dBm 2.479315000 GHz Marker 2 [T1] -11.58 dBm 2.478445000 GHz Center 2.48 GHz 300 kHz/ Span 3 MHz Date: 10.APR.2024 10:38:24

APPENDIX D

RF Output Power				
Modulation type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	Low	-9.32	30.00	Pass
	Middle	-9.14		
	High	-8.71		
$\pi/4$ DQPSK	Low	-9.38	20.97	Pass
	Middle	-9.23		
	High	-8.71		
8DPSK	Low	-9.41	20.97	Pass
	Middle	-9.14		
	High	-8.68		

GFSK-Low	 Ref 10 dBm Att 20 dB RBW 3 MHz VBW 10 MHz Marker 1 [T1] -9.32 dBm 2.402020000 GHz 10 Offset 1 dB 10 dB 1 MHz/ Span 10 MHz Date: 10.APR.2024 10:43:21
GFSK-Middle	 Ref 10 dBm Att 20 dB RBW 3 MHz VBW 10 MHz Marker 1 [T1] -9.14 dBm 2.440960000 GHz 10 Offset 1 dB 10 dB 1 MHz/ Span 10 MHz Date: 10.APR.2024 10:47:28
GFSK-High	 Ref 10 dBm Att 20 dB RBW 3 MHz VBW 10 MHz Marker 1 [T1] -8.71 dBm 2.479720000 GHz 10 Offset 1 dB 10 dB 1 MHz/ Span 10 MHz Date: 10.APR.2024 10:47:57

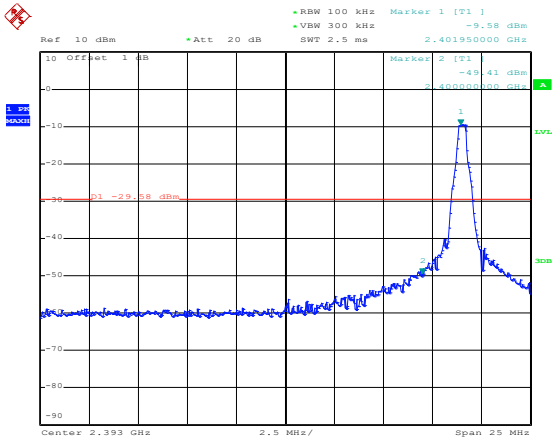
π/4 DQPSK-Low	 Ref 10 dBm Att 20 dB RBW 3 MHz Marker 1 [T1] -9.38 dBm VBW 10 MHz SWT 2.5 ms 2.401920000 GHz Center 2.402 GHz 1 MHz/ Span 10 MHz Date: 10.APR.2024 10:48:43
π/4 DQPSK-Middle	 Ref 10 dBm Att 20 dB RBW 3 MHz Marker 1 [T1] -9.23 dBm VBW 10 MHz SWT 2.5 ms 2.440760000 GHz Center 2.441 GHz 1 MHz/ Span 10 MHz Date: 10.APR.2024 10:49:03
π/4 DQPSK-High	 Ref 10 dBm Att 20 dB RBW 3 MHz Marker 1 [T1] -8.71 dBm VBW 10 MHz SWT 2.5 ms 2.479760000 GHz Center 2.48 GHz 1 MHz/ Span 10 MHz Date: 10.APR.2024 10:49:28

8DPSK-Low	 Ref 10 dBm Att 20 dB RBW 3 MHz VBW 10 MHz Marker 1 [T1] -9.41 dBm 2.401980000 GHz SWT 2.5 ms 10 Offset 1 dB 1.92 dBm 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 Center 2.402 GHz 1 MHz/ Span 10 MHz 10V 30dB Date: 10.APR.2024 10:49:55
8DPSK-Middle	 Ref 10 dBm Att 20 dB RBW 3 MHz VBW 10 MHz Marker 1 [T1] -9.14 dBm 2.440860000 GHz SWT 2.5 ms 10 Offset 1 dB 1.92 dBm 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 Center 2.441 GHz 1 MHz/ Span 10 MHz 10V 30dB Date: 10.APR.2024 10:54:31
8DPSK-High	 Ref 10 dBm Att 20 dB RBW 3 MHz VBW 10 MHz Marker 1 [T1] -8.68 dBm 2.479920000 GHz SWT 2.5 ms 10 Offset 1 dB 1.92 dBm 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 Center 2.48 GHz 1 MHz/ Span 10 MHz 10V 30dB Date: 10.APR.2024 10:57:57

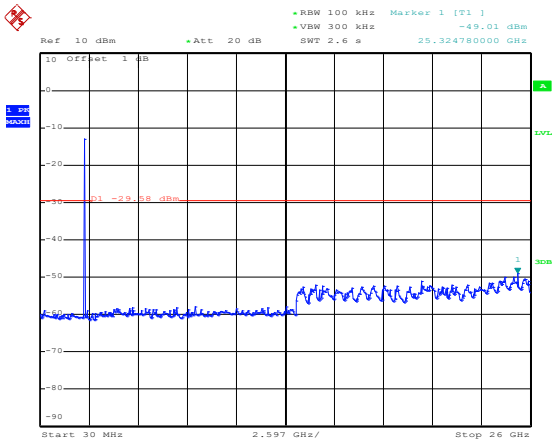
APPENDIX E

Conducted Out of Band Emissions

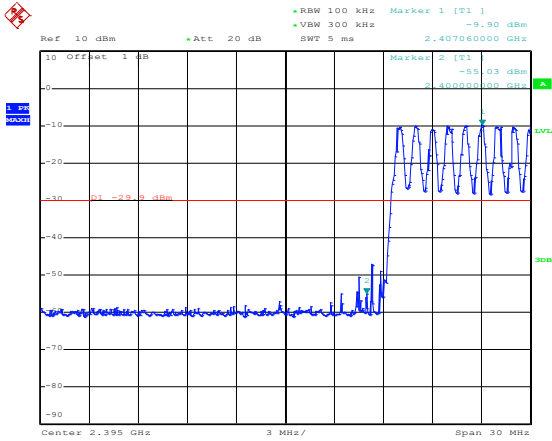
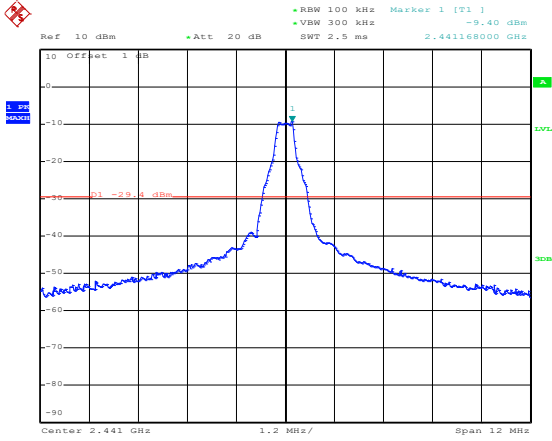
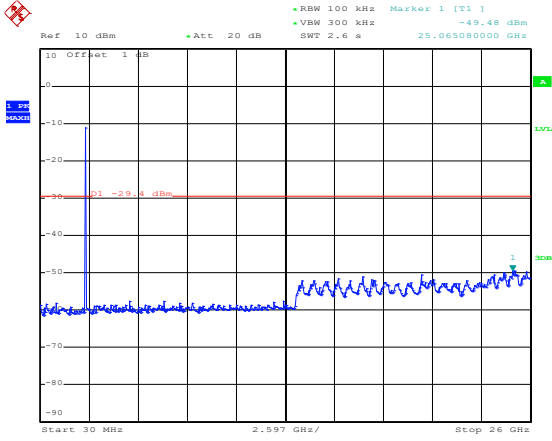
1Mbps Low



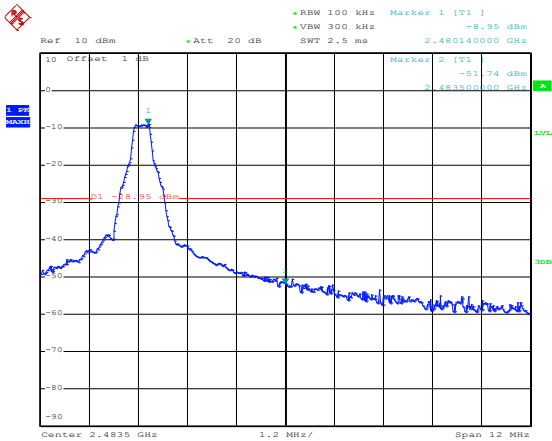
Date: 10.APR.2024 11:23:57



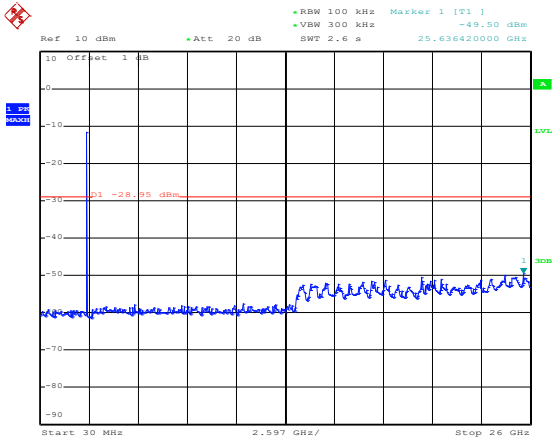
Date: 10.APR.2024 11:24:18

	 Ref 10 dBm • Att 20 dB • RBW 100 kHz Marker 1 [T1] -9.90 dBm • VBW 300 kHz 2.40706000 GHz 2.40706000 GHz 10 Offset 1 dB Center 2.395 GHz 3 MHz/ Span 30 MHz Date: 10.APR.2024 11:25:27
1Mbps Middle	 Ref 10 dBm • Att 20 dB • RBW 100 kHz Marker 1 [T1] -9.40 dBm • VBW 300 kHz 2.44116800 GHz 2.44116800 GHz 10 Offset 1 dB Center 2.441 GHz 1.2 MHz/ Span 12 MHz Date: 10.APR.2024 11:32:27
	 Ref 10 dBm • Att 20 dB • RBW 100 kHz Marker 1 [T1] -49.48 dBm • VBW 300 kHz 2.597 GHz 2.597 GHz 10 Offset 1 dB Start 30 MHz 2.597 GHz/ Stop 26 GHz Date: 10.APR.2024 11:32:46

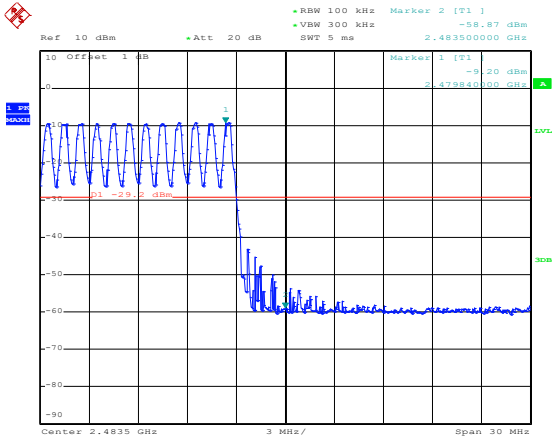
1Mbps High



Date: 10.APR.2024 11:36:14

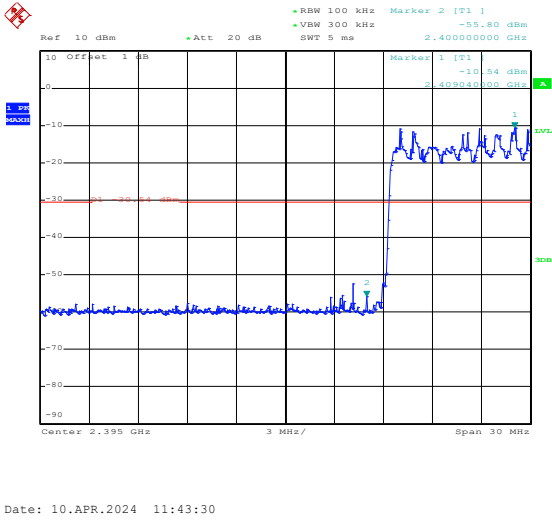
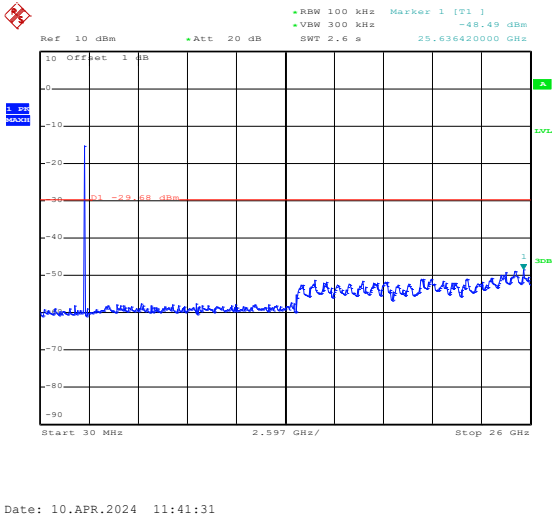
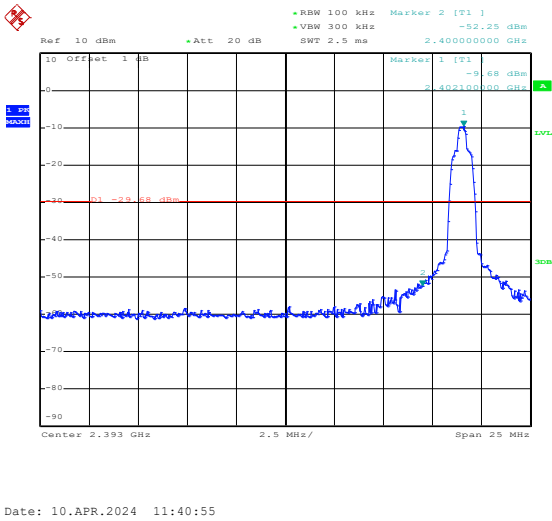


Date: 10.APR.2024 11:36:32

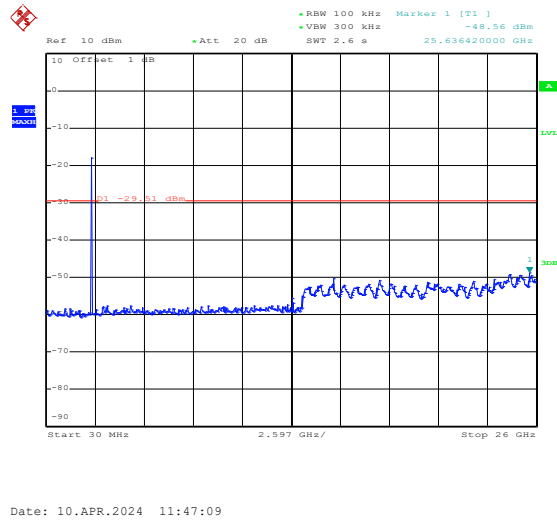
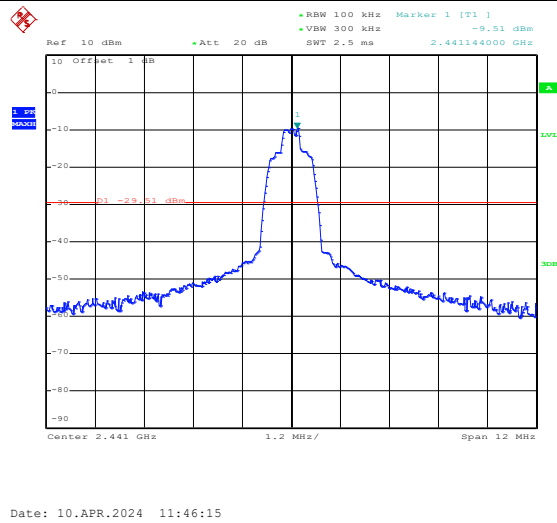


Date: 10.APR.2024 11:39:10

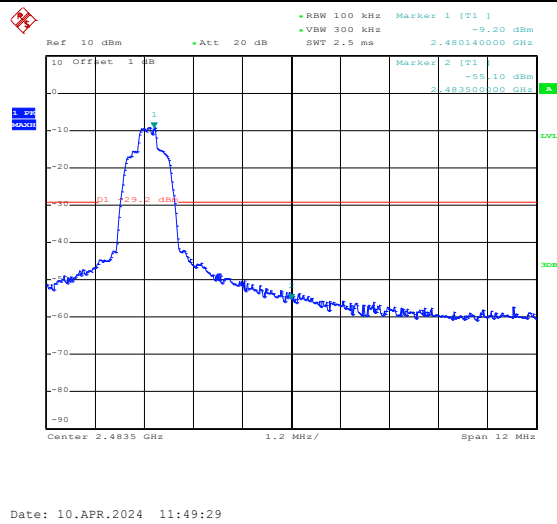
2Mbps Low

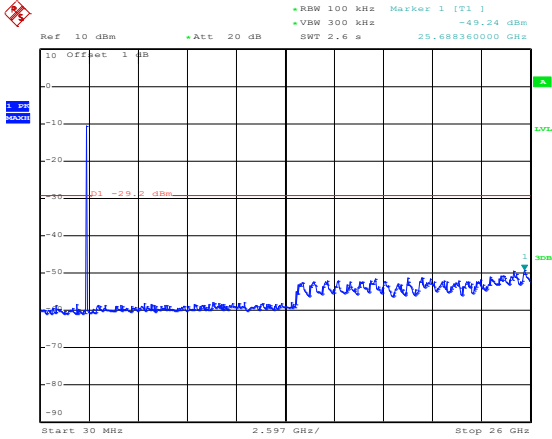
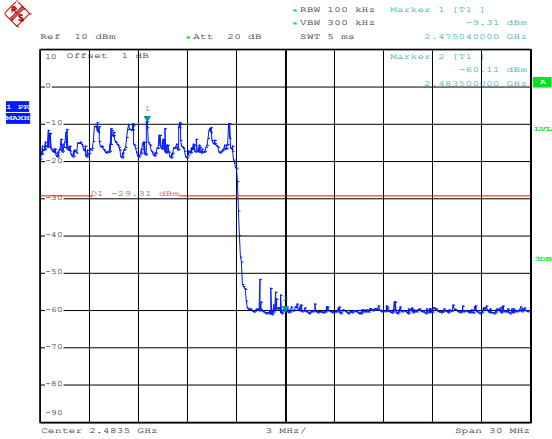
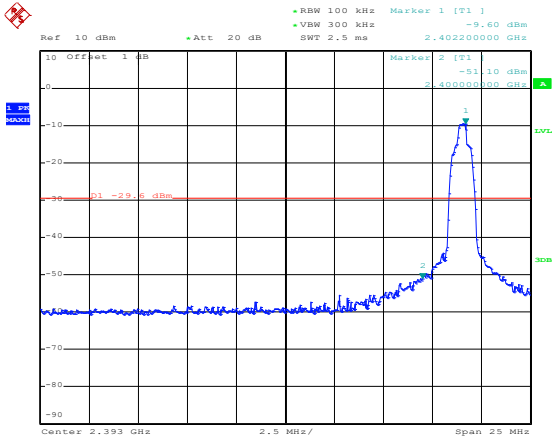


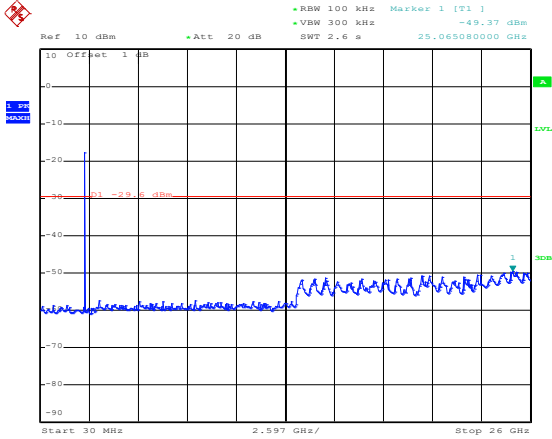
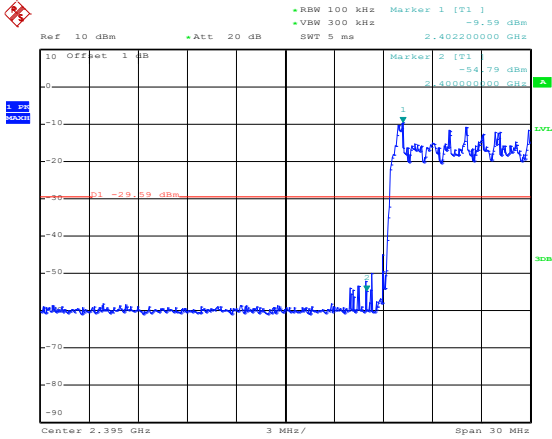
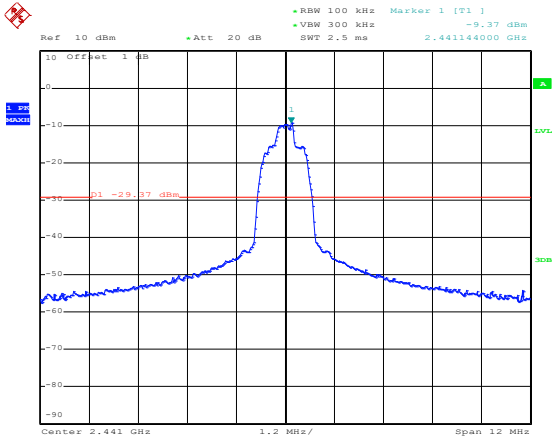
2Mbps Middle

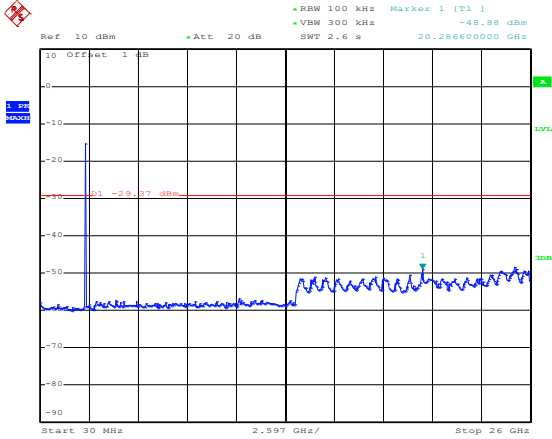
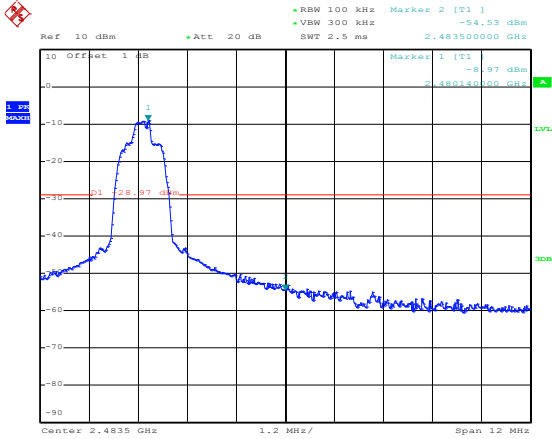
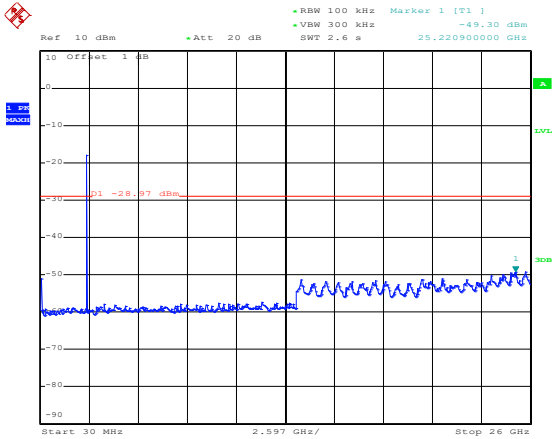


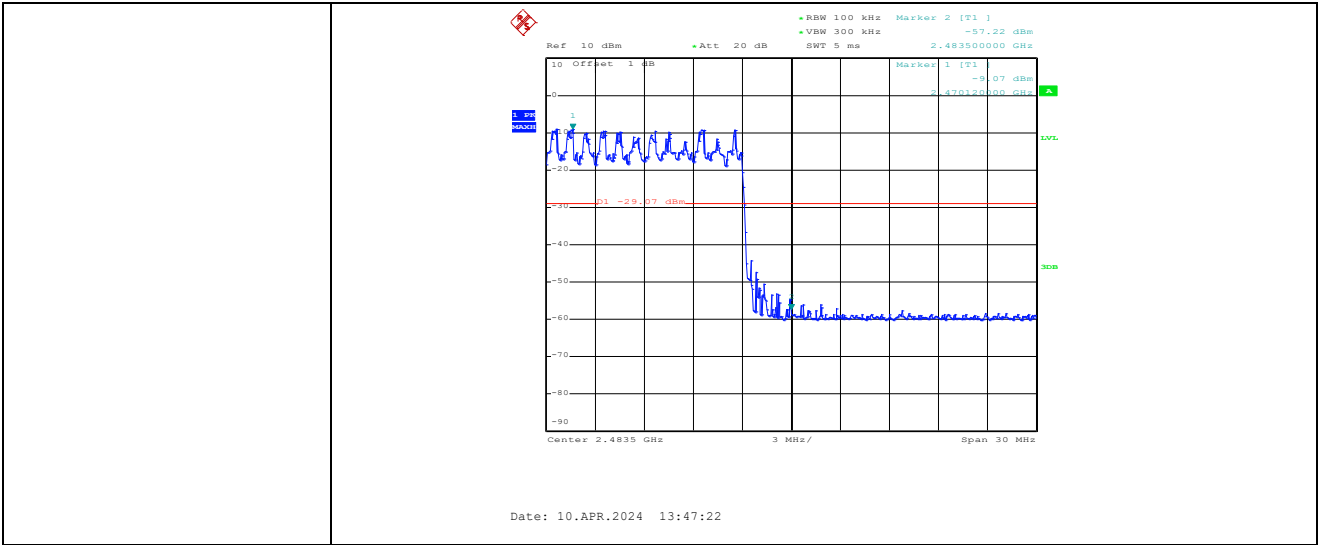
2Mbps High



	 Ref 10 dBm • Att 20 dB • RBW 100 kHz Marker 1 [T1] -49.24 dBm • VBW 300 kHz SWT 2.6 s 25.68836000 GHz Start 30 MHz 2.597 GHz/ Stop 26 GHz Date: 10.APR.2024 11:49:53
	 Ref 10 dBm • Att 20 dB • RBW 100 kHz Marker 1 [T1] -9.31 dBm • VBW 300 kHz SWT 5 ms 2.47504000 GHz Center 2.4835 GHz 3 MHz/ Span 30 MHz Date: 10.APR.2024 11:51:33
3Mbps Low	 Ref 10 dBm • Att 20 dB • RBW 100 kHz Marker 1 [T1] -9.60 dBm • VBW 300 kHz SWT 2.5 ms 2.40220000 GHz Center 2.393 GHz 2.5 MHz/ Span 25 MHz Date: 10.APR.2024 11:54:24

	 Date: 10.APR.2024 11:55:03
	 Date: 10.APR.2024 11:56:25
3Mbps Middle	 Date: 10.APR.2024 13:36:07

	 Date: 10.APR.2024 13:38:43
3Mbps High	 Date: 10.APR.2024 13:42:08
	 Date: 10.APR.2024 13:42:51



APPENDIX PHOTOGRAPHS

Please refer to “ANNEX”

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