NVLAP TESTING
LABORATORY CODE 600341-0

BACL Bay Area Compliance Labs Corp.

TEST REPORT

Applicant: **Amaury International Corp**

Address: **7290 NW 70th Street Miami, Florida 33166**

Product Name: **TWS EARBUDS**

FCC ID: **2BDSQ-NVK-A8590L**

Standard(s): **47 CFR Part 15, Subpart C(15.247)**
ANSI C63.10-2013
KDB 558074 D01 15.247 Meas Guidance v05r02

Report Number: **DG1231215-75859E-RF-00B**

Report Date: **2024/1/4**

The above device has been tested and found compliant with the requirement of the relative standards by Bay Area Compliance Laboratories Corp. (Dongguan).

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CONTENTS

DOCUMENT REVISION HISTORY ····· 4

1. GENERAL INFORMATION ····· 5

1.1 GENERAL DESCRIPTION OF EQUIPMENT UNDER TEST ····· 5

1.2 ACCESSORY INFORMATION ····· 5

1.3 ANTENNA INFORMATION DETAIL▲ ····· 5

1.4 EQUIPMENT MODIFICATIONS ····· 5

2. DESCRIPTION OF TEST CONFIGURATION ····· 6

2.1 OPERATION FREQUENCY DETAIL ····· 6

2.2 EUT OPERATION CONDITION ····· 6

2.3 EUT EXERCISE SOFTWARE ····· 6

2.4 SUPPORT EQUIPMENT LIST AND DETAILS ····· 6

2.5 SUPPORT CABLE LIST AND DETAILS ····· 6

2.6 BLOCK DIAGRAM OF TEST SETUP ····· 7

2.7 TEST FACILITY ····· 8

2.8 MEASUREMENT UNCERTAINTY ····· 8

3. SUMMARY OF TEST RESULTS ····· 9

4. REQUIREMENTS AND TEST PROCEDURES ····· 10

4.1 AC LINE CONDUCTED EMISSIONS ····· 10

4.1.1 Applicable Standard ····· 10
4.1.2 EUT Setup ····· 11
4.1.3 EMI Test Receiver Setup ····· 11
4.1.4 Test Procedure ····· 12
4.1.5 Corrected Amplitude & Margin Calculation ····· 12
4.1.6 Test Result ····· 12

4.2 RADIATED SPURIOUS EMISSIONS ····· 13

4.2.1 Applicable Standard ····· 13
4.2.2 EUT Setup ····· 13
4.2.3 EMI Test Receiver & Spectrum Analyzer Setup ····· 15
4.2.4 Test Procedure ····· 15
4.2.5 Corrected Result & Margin Calculation ····· 15
4.2.6 Test Result ····· 15

4.3 20 dB EMISSION BANDWIDTH ····· 16

4.3.1 Applicable Standard ····· 16
4.3.2 EUT Setup ····· 16
4.3.3 Test Procedure ····· 16
4.3.4 Test Result ····· 17

4.4 CHANNEL SEPARATION ····· 18

4.4.1 Applicable Standard ····· 18
4.4.2 EUT Setup ····· 18
4.4.3 Test Procedure ····· 18

4.4.4 Test Result 18
4.5 NUMBER OF HOPPING FREQUENCY 19
4.5.1 Applicable Standard 19
4.5.2 EUT Setup 19
4.5.3 Test Procedure 19
4.5.4 Test Result 19
4.6 TIME OF OCCUPANCY(DWELL TIME) 20
4.6.1 Applicable Standard 20
4.6.2 EUT Setup 20
4.6.3 Test Procedure 20
4.6.4 Test Result 20
4.7 MAXIMUM CONDUCTED OUTPUT POWER 21
4.7.1 Applicable Standard 21
4.7.2 EUT Setup 21
4.7.3 Test Procedure 21
4.7.4 Test Result 21
4.8 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE 22
4.8.1 Applicable Standard 22
4.8.2 EUT Setup 22
4.8.3 Test Procedure 22
4.8.4 Test Result 22
4.9 ANTENNA REQUIREMENT 23
4.9.1 Applicable Standard 23
4.9.2 Judgment 23
5. TEST DATA AND RESULTS 24
5.1 AC LINE CONDUCTED EMISSIONS 24
5.2 RADIATED SPURIOUS EMISSIONS 25
5.3 20 DB EMISSION BANDWIDTH 44
5.4 CHANNEL SEPARATION 46
5.5 NUMBER OF HOPPING FREQUENCY 48
5.6 TIME OF OCCUPANCY (DWELL TIME) 49
5.7 MAXIMUM CONDUCTED OUTPUT POWER 51
5.8 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE 53
6. RF EXPOSURE EVALUATION 55
6.1 APPLICABLE STANDARD 55
6.2 MEASUREMENT RESULT 55
7. EUT PHOTOGRAPHS 56
8. TEST SETUP PHOTOGRAPHS 57

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
1.0	DG1231215-75859E-RF-00B	Original Report	2024/1/4

1. GENERAL INFORMATION

1.1 General Description of Equipment under Test

EUT Name:	TWS EARBUDS
EUT Model:	NVK-A8590
Operation Frequency:	2402-2480 MHz
Maximum Peak Output Power (Conducted):	3.3dBm
Modulation Type:	GFSK, π/4-DQPSK
Rated Input Voltage:	DC 3.7Vdc from battery
Serial Number:	2FBW-2(For RF Conducted Test) 2FBW-1(For Radiated Spurious Emission)
EUT Received Date:	2023/12/15
EUT Received Status:	Good

1.2 Accessory Information

Accessory Description	Manufacturer	Model	Parameters
/	/	/	/

1.3 Antenna Information Detail▲

Antenna Manufacturer	Antenna Type	input impedance (Ohm)	Frequency Range	Antenna Gain
RAIN International Technology Co., Ltd.	Chip	50	2.4~2.5GHz	2 dBi
The Method of §15.203 Compliance: ☒Antenna was permanently attached to the unit. ☐Antenna uses a unique type of connector to attach to the EUT. ☐Unit was professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.				

1.4 Equipment Modifications

No modifications are made to the EUT during all test items.

2. DESCRIPTION OF TEST CONFIGURATION

2.1 Operation Frequency Detail

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	**2402**	40	2442
1	2403	41	2443
…	…	…	…
…	…	…	…
…	…	78	**2480**
39	**2441**	/	/

2.2 EUT Operation Condition

The system was configured for testing in Engineering Mode, which was provided by the manufacturer. The following summary table is showing all test modes to demonstrate in compliance with the standard:

Test Items	Test Modes
RF Conducted	Mode 1: Transmitting_GFSK
	Mode 2: Transmitting_π/4-DQPSK
Radiated Spurious Emission	Mode 1: Transmitting_GFSK
	Mode 2: Transmitting_π/4-DQPSK
AC Line Conducted Emission	N/A
Note: Mode 1 and mode 2 were tested with the frequencies in bold in section 2.1.	

2.3 EUT Exercise Software

EUT Exercise Software:	FCC_assist_1.0.2.2.exe		
The software was provided by manufacturer. The maximum power was configured as below, that was provided by the manufacturer▲:			
Test Modes	Power Level Setting		
	Lowest	Middle	Highest
GFSK	10	10	10
π/4-DQPSK	10	10	10

2.4 Support Equipment List and Details

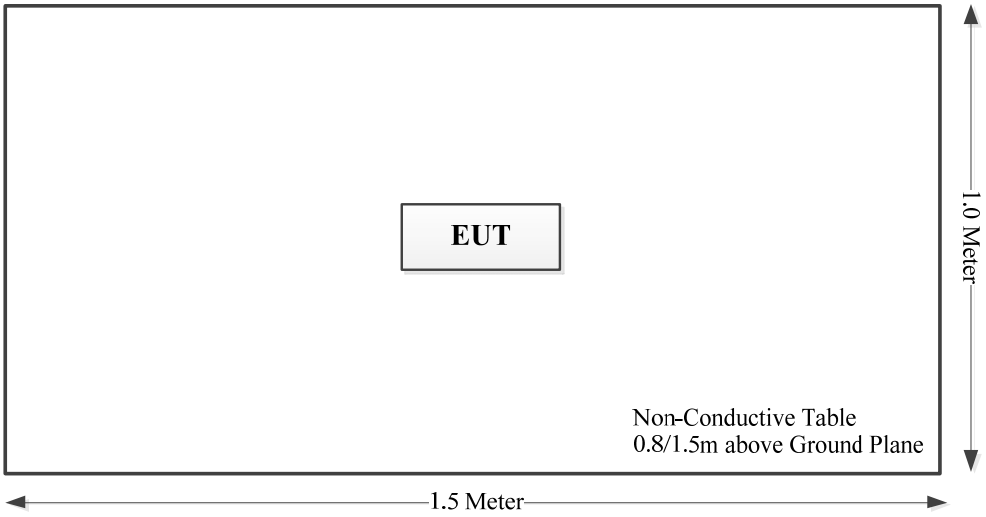
Manufacturer	Description	Model	Serial Number
/	/	/	/

2.5 Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
/	/	/	/	/	/

2.6 Block Diagram of Test Setup

Radiated Spurious Emissions:



2.7 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 829273, the FCC Designation No. : CN5044.

2.8 Measurement Uncertainty

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Power Spectral Density, conducted	±0.61 dB
Unwanted Emissions, radiated	9kHz~30MHz: 3.3dB, 30MHz~200MHz: 4.55 dB, 200MHz~1GHz: 5.92 dB, 1GHz~6GHz: 4.98 dB, 6GHz~18GHz: 5.89 dB, 18GHz~26.5GHz:5.47 dB, 26.5GHz~40GHz:5.63 dB
Unwanted Emissions, conducted	±2.47 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.11 dB (150 kHz to 30 MHz)

3. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.207(a)	AC Line Conducted Emissions	Not Applicable
FCC §15.205, §15.209, §15.247(d)	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(1)	20 dB Emission Bandwidth	Compliant
FCC §15.247(a)(1)	Channel Separation	Compliant
FCC §15.247(a)(1)(iii)	Number Of Hopping Frequency	Compliant
FCC §15.247(a)(1)(iii)	Time Of Occupancy (dwell time)	Compliant
FCC §15.247(b)(1)	Maximum Conducted Output Power	Compliant
FCC §15.247(d)	100 kHz Bandwidth Of Frequency Band Edge	Compliant
FCC §15.203	Antenna Requirement	Compliant
FCC§15.247 (i) & §1.1310	RF Exposure Evaluation	Compliant

4. REQUIREMENTS AND TEST PROCEDURES

4.1 AC Line Conducted Emissions

4.1.1 Applicable Standard

FCC§15.207(a).

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

	Conducted limit (dBµV)	
Frequency of emission (MHz)	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

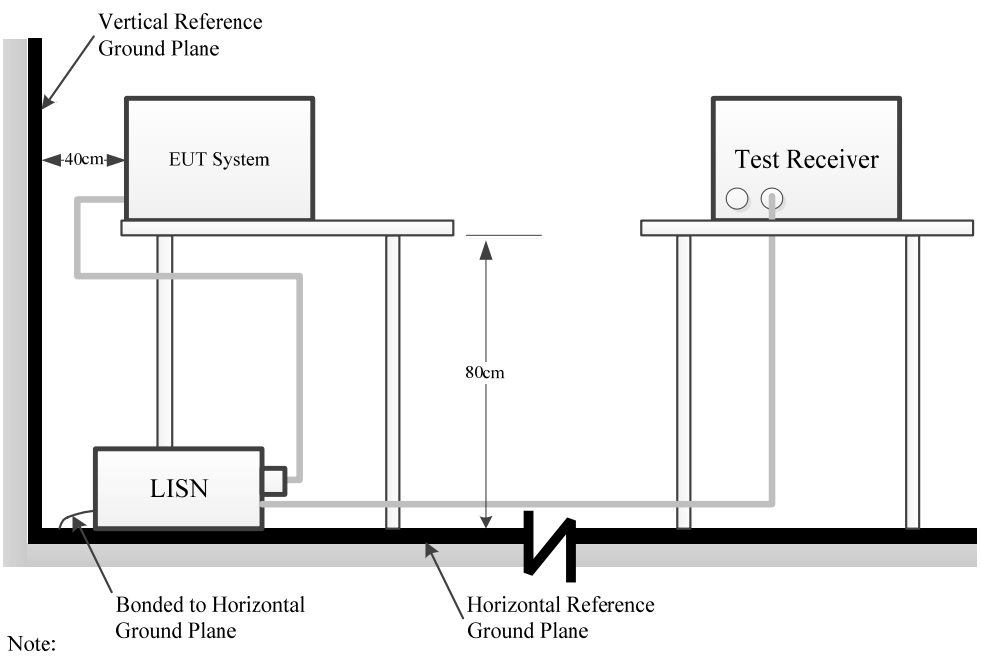
(1) For carrier current system containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 µV within the frequency band 535-1705 kHz, as measured using a 50 µH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in §15.205, §15.209, §15.221, §15.223, or §15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtainig their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

4.1.2 EUT Setup



Note:
1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at least 80 cm from other units and oter metal planes support units.

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

The spacing between the peripherals was 10 cm.

The adapter or EUT was connected to the main LISN with a 120 V/60 Hz AC power source.

4.1.3 EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

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

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

4.1.4 Test Procedure

The frequency and amplitude of the six highest ac power-line conducted emissions relative to the limit, measured over all the current-carrying conductors of the EUT power cords, and the operating frequency or frequency to which the EUT is tuned (if appropriate), should be reported, unless such emissions are more than 20 dB below the limit. AC power-line conducted emissions measurements are to be separately carried out only on each of the phase ("hot") line(s) and (if used) on the neutral line(s), but not on the ground [protective earth] line(s). If less than six emission frequencies are within 20 dB of the limit, then the noise level of the measuring instrument at representative frequencies should be reported. The specific conductor of the power-line cord for each of the reported emissions should be identified. Measure the six highest emissions with respect to the limit on each current-carrying conductor of each power cord associated with the EUT (but not the power cords of associated or peripheral equipment that are part of the test configuration). Then, report the six highest emissions with respect to the limit from among all the measurements identifying the frequency and specific current-carrying conductor identified with the emission. The six highest emissions should be reported for each of the current-carrying conductors, or the six highest emissions may be reported over all the current-carrying conductors.

4.1.5 Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Result = Reading + Factor
Factor = attenuation caused by cable loss + voltage division factor of AMN

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. The equation for margin calculation is as follows:

Margin = Limit – Result

4.1.6 Test Result

Please refer to section 5.1.

4.2 Radiated Spurious Emissions

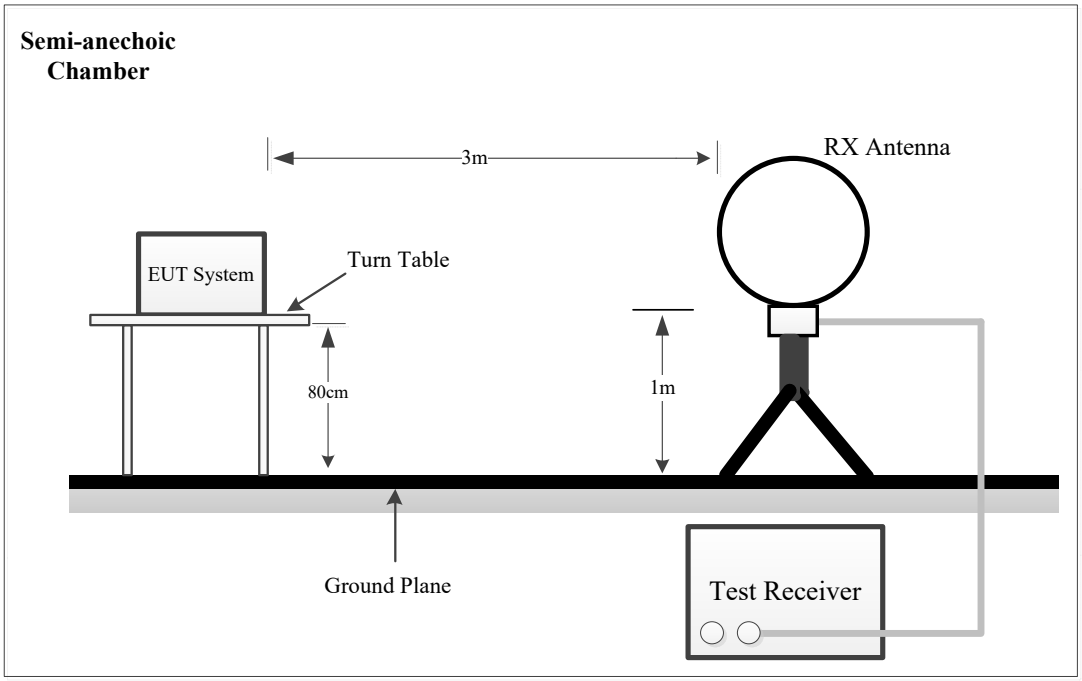
4.2.1 Applicable Standard

FCC §15.247 (d);

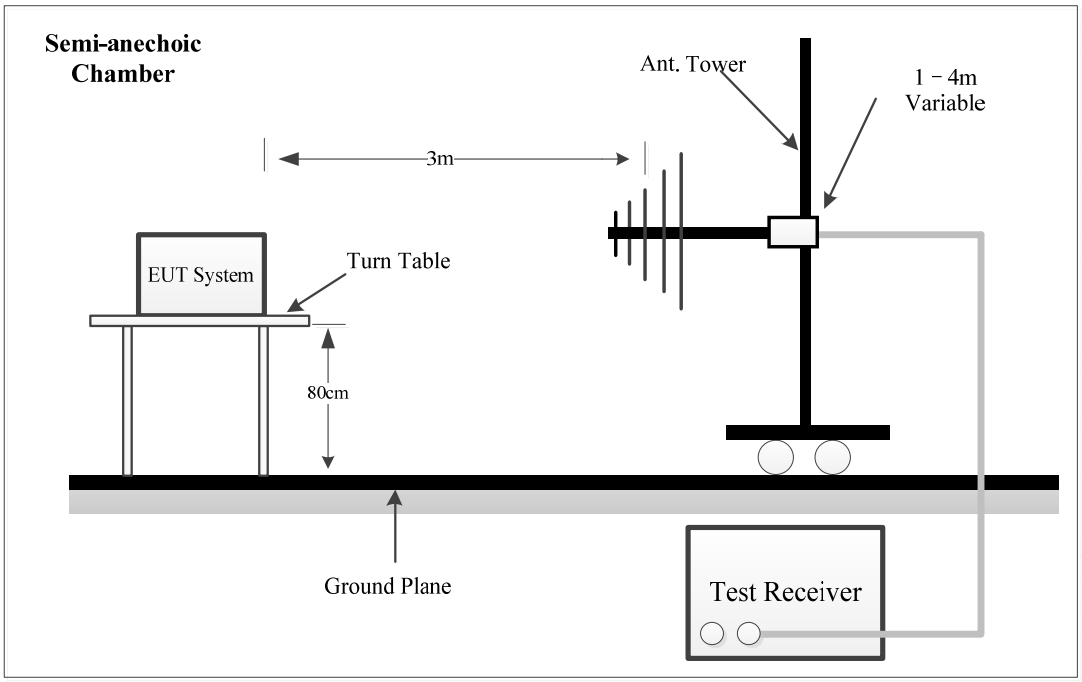
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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) (see §15.205(c)).

4.2.2 EUT Setup

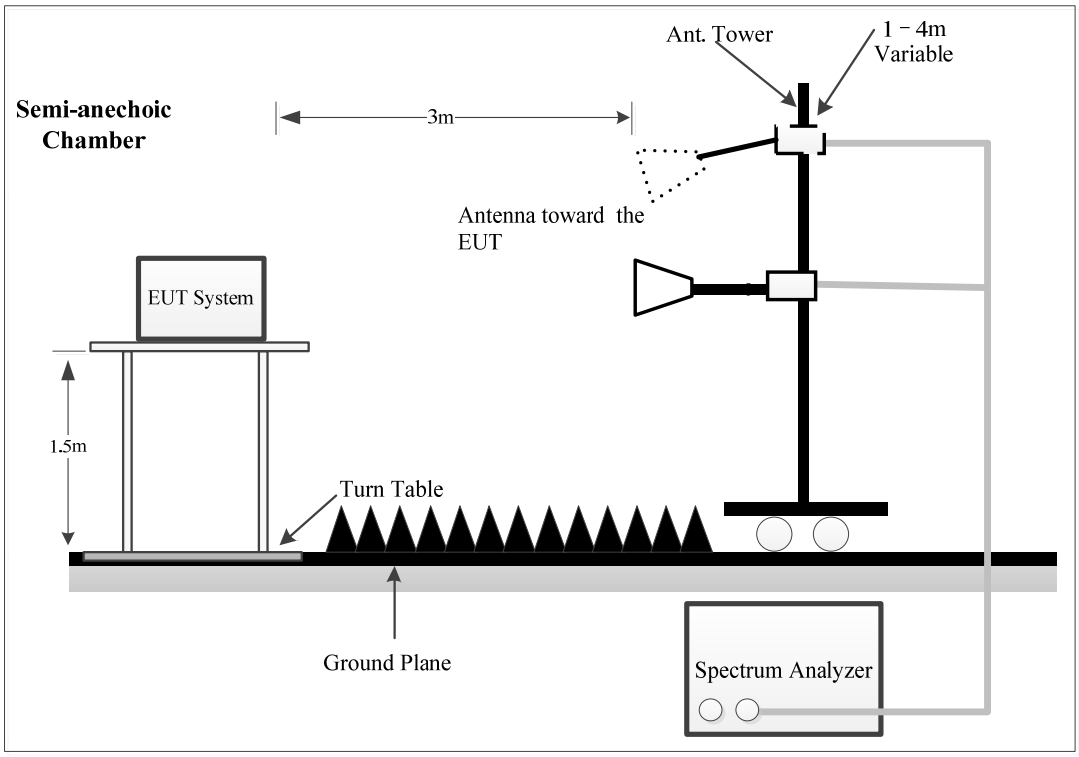
9kHz~30MHz:



30MHz~1GHz:



Above 1GHz:



The radiated emissions were performed in the 3 meters distance, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

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.

For 9kHz-30MHz test, the lowest height of the magnetic antenna shall be 1 m above the ground and three antenna orientations (parallel, perpendicular, and ground-parallel) shall be measured.

4.2.3 EMI Test Receiver & Spectrum Analyzer Setup

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
9 kHz – 150 kHz	200 Hz	1 kHz	200 Hz	QP/AV
150 kHz – 30 MHz	9 kHz	30 kHz	9 kHz	QP/AV
30 MHz – 1000 MHz	100 kHz	300 kHz	/	PK
	/	/	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

4.2.4 Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 9 kHz-1 GHz except 9 – 90 kHz, 110 – 490 kHz, employing an average detector, peak and Average detection modes for frequencies above 1 GHz.

All emissions under the average limit and under the noise floor have not recorded in the report.

4.2.5 Corrected Result & Margin Calculation

The basic equation is as follows:

Result = Reading + Factor
Factor = Antenna Factor + Cable Loss- Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. The equation for margin calculation is as follows:

Margin = Limit – Result

4.2.6 Test Result

Please refer to section 5.2.

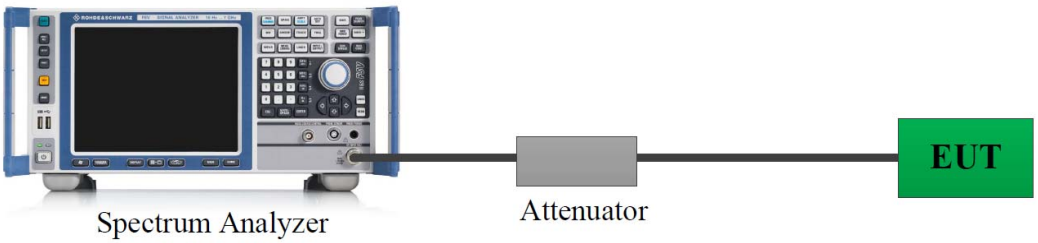
4.3 20 dB Emission Bandwidth

4.3.1 Applicable Standard

FCC §15.247 (a)(1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. 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.

4.3.2 EUT Setup



4.3.3 Test Procedure

According to ANSI C63.10-2013 Section 6.9.2

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. Specific guidance is given in 4.1.5.2
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).

4.3.4 Test Result

Please refer to section 5.3.

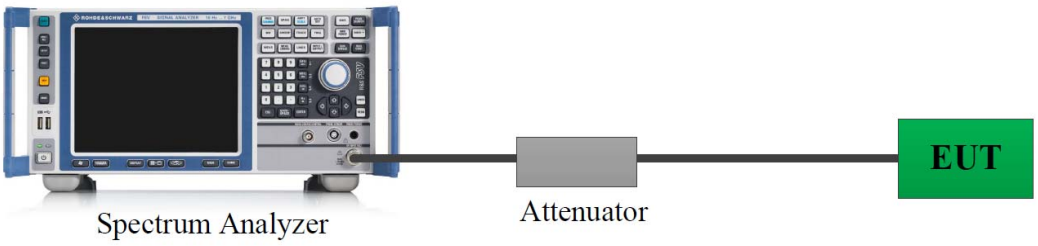
4.4 Channel Separation

4.4.1 Applicable Standard

FCC §15.247 (a)(1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. 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.

4.4.2 EUT Setup



4.4.3 Test Procedure

According to ANSI C63.10-2013 Section 7.8.2

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

a) Span: Wide enough to capture the peaks of two adjacent channels.
b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
c) Video (or average) bandwidth (VBW) ≥ RBW.
d) Sweep: Auto.
e) Detector function: Peak.
f) Trace: Max hold.
g) Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Compliance of an EUT with the appropriate regulatory limit shall be determined. A plot of the data shall be included in the test report.

4.4.4 Test Result

Please refer to section 5.4.

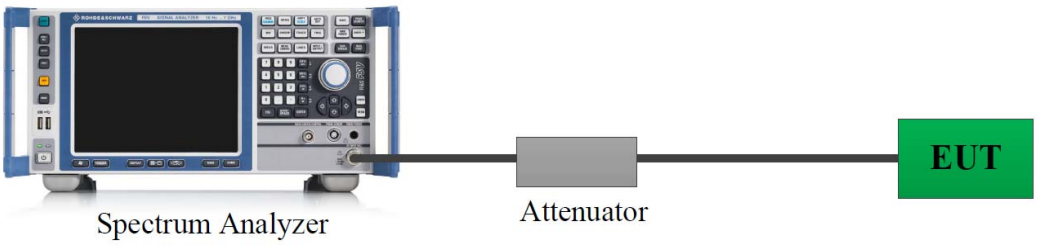
4.5 Number Of Hopping Frequency

4.5.1 Applicable Standard

FCC §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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

4.5.2 EUT Setup



4.5.3 Test Procedure

According to ANSI C63.10-2013 Section 7.8.3

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

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

It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A plot of the data shall be included in the test report.

4.5.4 Test Result

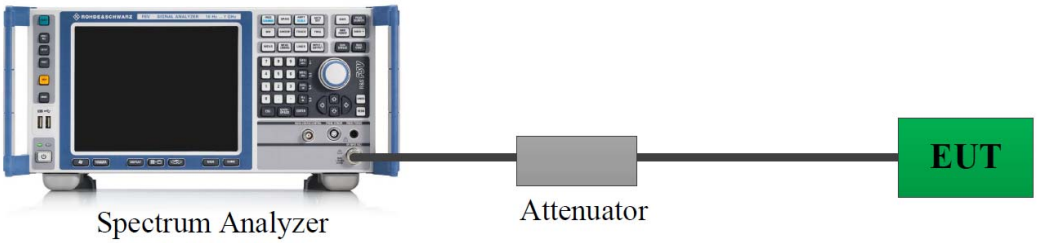
Please refer to section 5.5.

4.6 Time Of Occupancy(Dwell Time)

4.6.1 Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

4.6.2 EUT Setup



4.6.3 Test Procedure

According to ANSI C63.10-2013 Section 7.8.4

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:
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.

4.6.4 Test Result

Please refer to section 5.6.

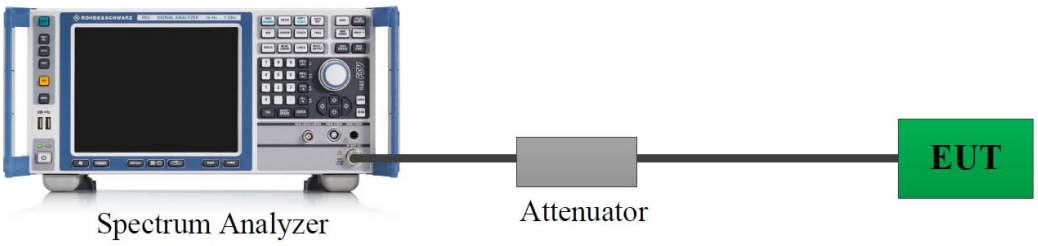
4.7 Maximum Conducted Output Power

4.7.1 Applicable Standard

FCC §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

4.7.2 EUT Setup



4.7.3 Test Procedure

According to ANSI C63.10-2013 Section 7.8.5

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, Offset the Insertion loss of the RF cable, DC Block/ Attenuator into the spectrum analyzer. 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.

NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

4.7.4 Test Result

Please refer to section 5.7.

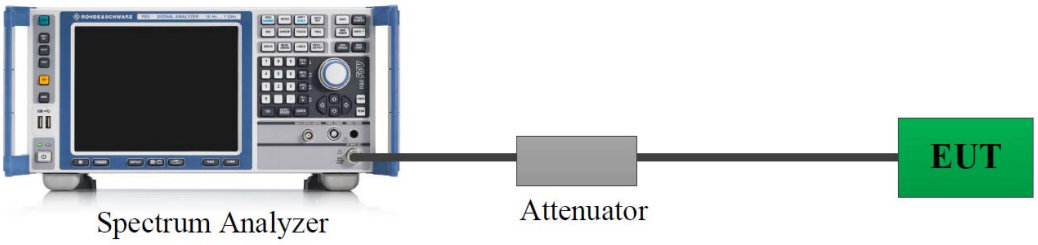
4.8 100 kHz Bandwidth Of Frequency Band Edge

4.8.1 Applicable Standard

FCC §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) (see §15.205(c)).

4.8.2 EUT Setup



4.8.3 Test Procedure

According to ANSI C63.10-2013 Section 7.8.6

For band-edge measurements, use the band-edge procedure in 6.10. Band-edge measurements shall be tested both on single channels, and with the EUT hopping.

a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100 kHz.
c) Set the VBW ≥ [3 × RBW].
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements. Report the three highest emissions relative to the limit.

4.8.4 Test Result

Please refer to section 5.8.

4.9 Antenna Requirement

4.9.1 Applicable Standard

FCC §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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

4.9.2 Judgment

Compliant. Please refer to the Antenna Information detail in Section 1.3.

5. TEST DATA AND RESULTS

5.1 AC Line Conducted Emissions

Not Applicable.
The device was powered by battery when operating, the Bluetooth can`t transmit when charging.

5.2 Radiated Spurious Emissions

Serial Number:	2F88-1	Test Date:	Below 1GHz: 2023/12/22 Above 1GHz: 2023/12/20~2024/1/4
Test Site:	Chamber 10m, Chamber B	Test Mode:	Transmitting
Tester:	Zoo Zou, Colin Yang	Test Result:	Pass

Environmental Conditions:					
Temperature: (℃)	17.2~22.2	Relative Humidity: (%)	40~46	ATM Pressure: (kPa)	101.5~102.6

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
9kHz~1000MHz					
EMCO	Passive Loop Antenna	6512	9706-1206	2021/03/5	2024/03/05
Sunol Sciences	Hybrid Antenna	JB3	A060611-1	2023/09/06	2024/09/05
Narda	Attenuator	779-6dB	04269	2023/09/06	2024/09/05
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2023/08/01	2024/07/31
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-04	2023/08/01	2024/07/31
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2023/08/01	2024/07/31
Sonoma	Amplifier	310N	185914	2023/08/01	2024/07/31
R&S	EMI Test Receiver	ESCI	100224	2023/08/18	2024/08/17
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Above 1GHz					
ETS-Lindgren	Horn Antenna	3115	000 527 35	2023/09/07	2024/09/06
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-02 1304	2023/02/22	2026/02/21
Xinhang Macrowave	Coaxial Cable	XH750A-N/J-SMA/J-10M	20231117004 #0001	2023/11/18	2024/11/17
Xinhang Macrowave	Coaxial Cable	XH360A-2.92/J-2.92/J-6M-A	20231208001 #0001	2023/12/11	2024/12/10
AH	Preamplifier	PAM-0118P	469	2023/08/19	2024/08/18
AH	Preamplifier	PAM-1840VH	191	2023/09/07	2024/09/06
R&S	Spectrum Analyzer	FSV40	101944	2023/10/18	2024/10/17
E-Microwave	Band Rejection Filter	OBSF-2400-2483.5-S	OE01601525	2023/06/16	2024/06/15
Mini Circuits	High Pass Filter	VHF-6010+	31118	2023/06/16	2024/06/15
Audix	Test Software	E3	191218 (V9)	N/A	N/A

** Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Please refer to the below table and plots.

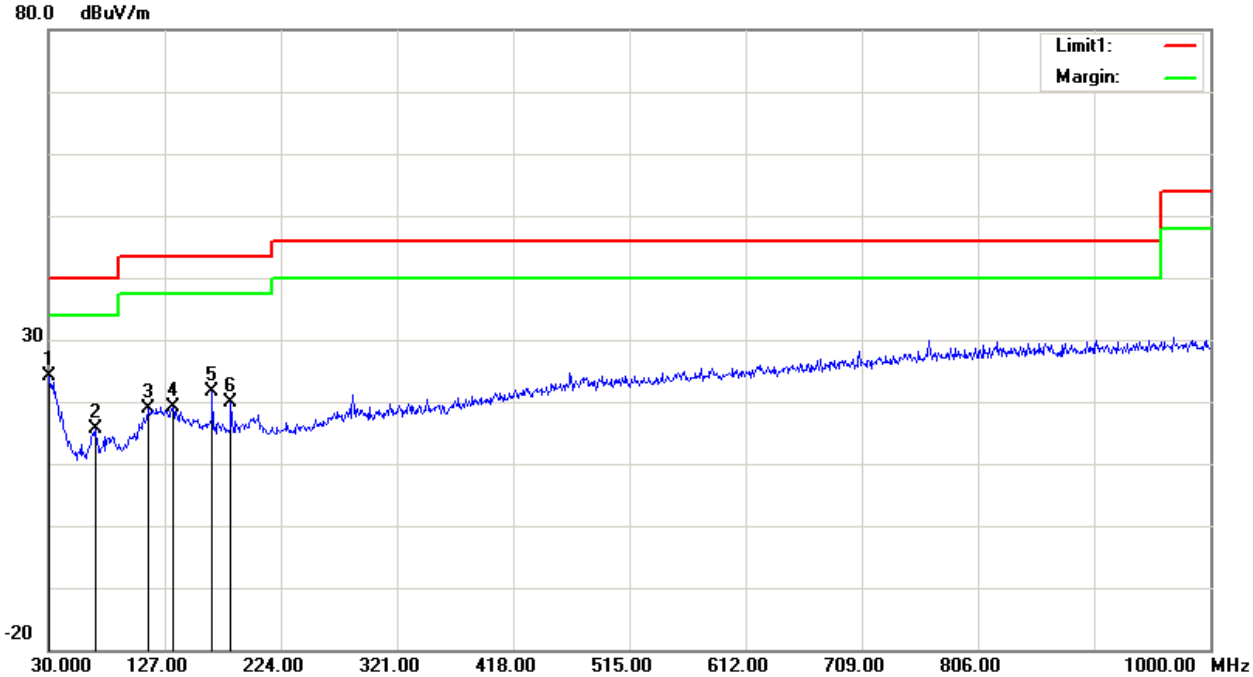
After pre-scan in the X, Y and Z axes of orientation, the worst case is below:

1) 9kHz~30MHz

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

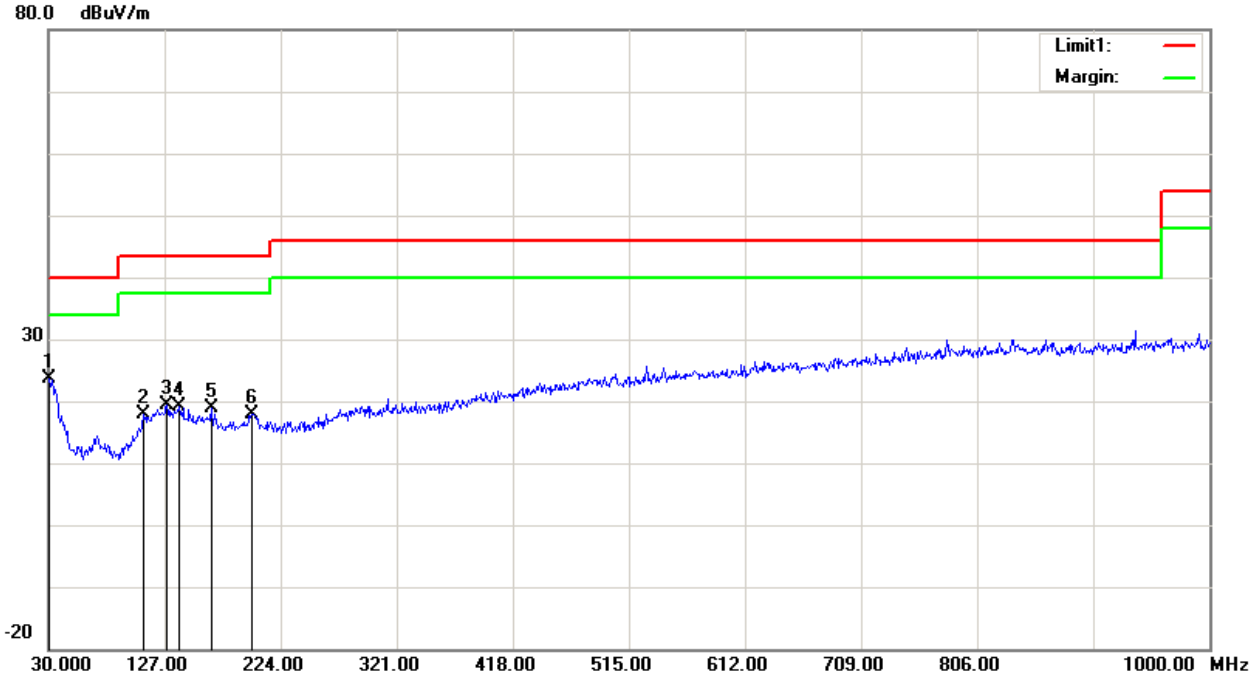
2) 30MHz-1GHz (maximum output power mode (2EDR mode))

Project No:	DG1231215-75859E-RF
Test Engineer:	Zoo Zou
Test Date:	2023-12-22
Polarization:	Horizontal
Test Mode:	Transmitting_Low channel
Power Source:	DC 3.7V



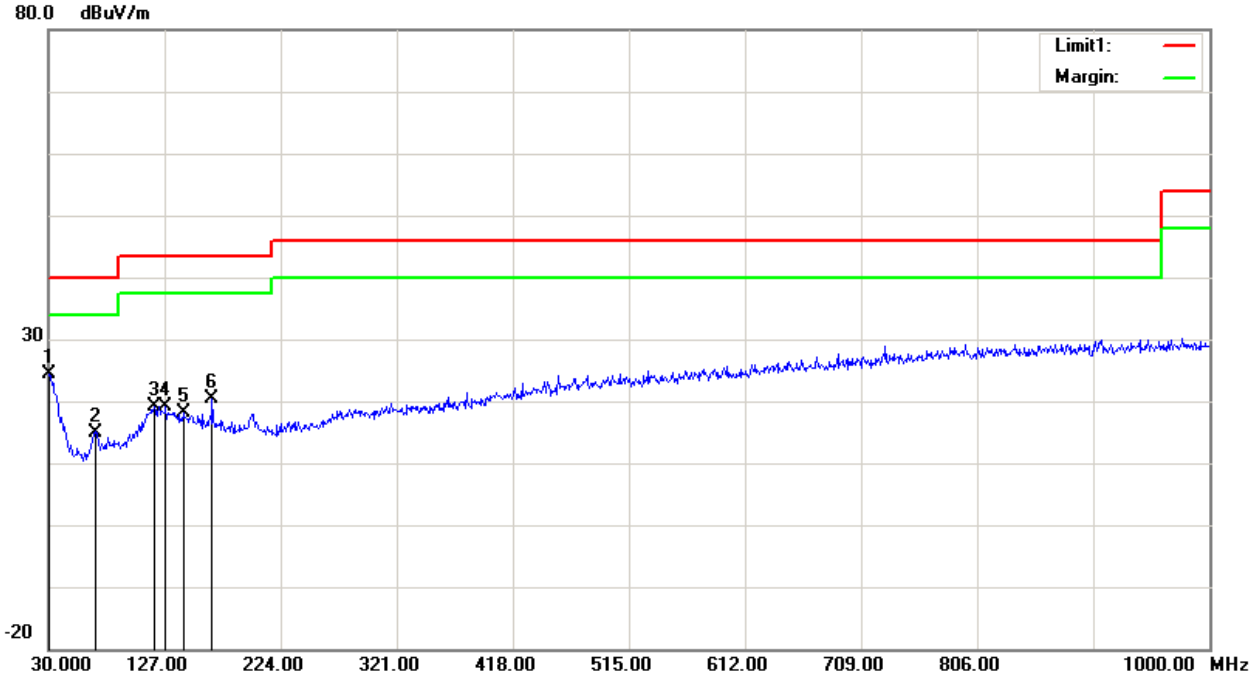
No.	Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	30.0000	27.96	peak	-3.80	24.16	40.00	15.84
2	68.8000	31.79	peak	-16.28	15.51	40.00	24.49
3	113.4200	29.65	peak	-10.77	18.88	43.50	24.62
4	133.7900	29.21	peak	-10.00	19.21	43.50	24.29
5	166.7700	33.10	peak	-11.47	21.63	43.50	21.87
6	182.2900	32.14	peak	-12.26	19.88	43.50	23.62

Project No: DG1231215-75859E-RF
Test Engineer: Zoo Zou
Test Date: 2023-12-22
Polarization: Vertical
Test Mode: Transmitting_Low channel
Power Source: DC 3.7V



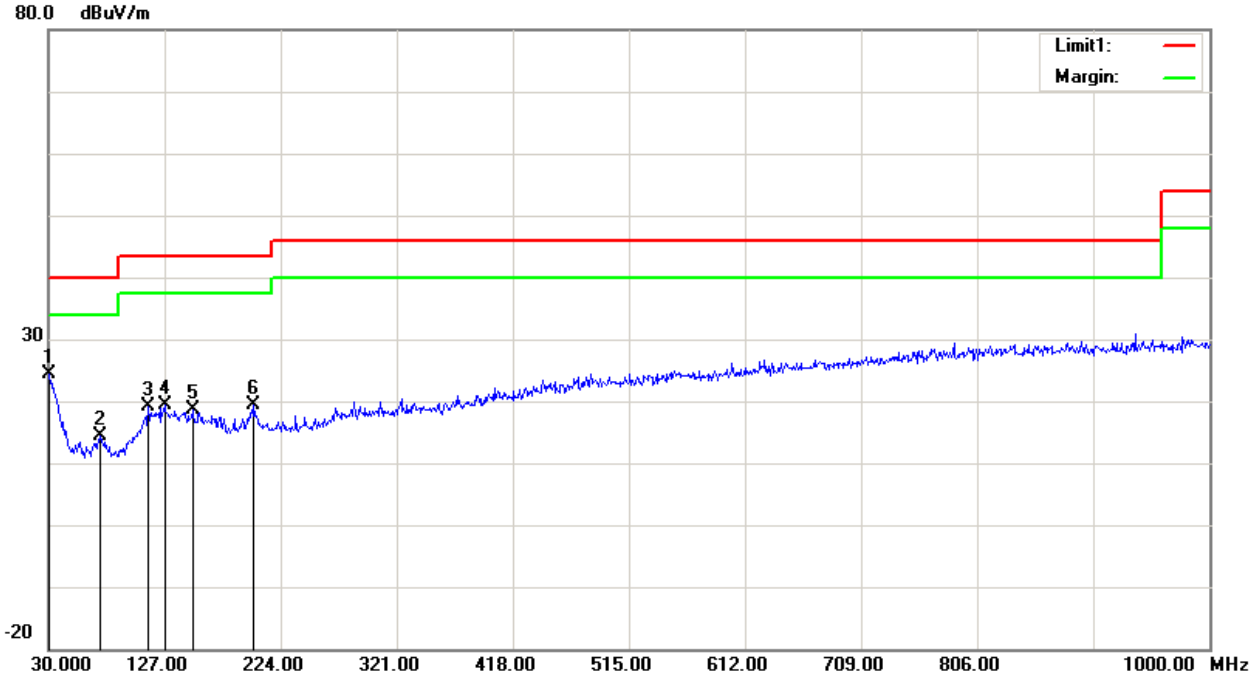
No.	Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	30.0000	27.50	peak	-3.80	23.70	40.00	16.30
2	109.5400	29.39	peak	-11.47	17.92	43.50	25.58
3	128.9400	29.09	peak	-9.73	19.36	43.50	24.14
4	138.6400	29.43	peak	-10.41	19.02	43.50	24.48
5	165.8000	30.37	peak	-11.45	18.92	43.50	24.58
6	199.7500	29.48	peak	-11.53	17.95	43.50	25.55

Project No: DG1231215-75859E-RF
Test Engineer: Zoo Zou
Test Date: 2023-12-22
Polarization: Horizontal
Test Mode: Transmitting_Middle Channel
Power Source: DC 3.7V



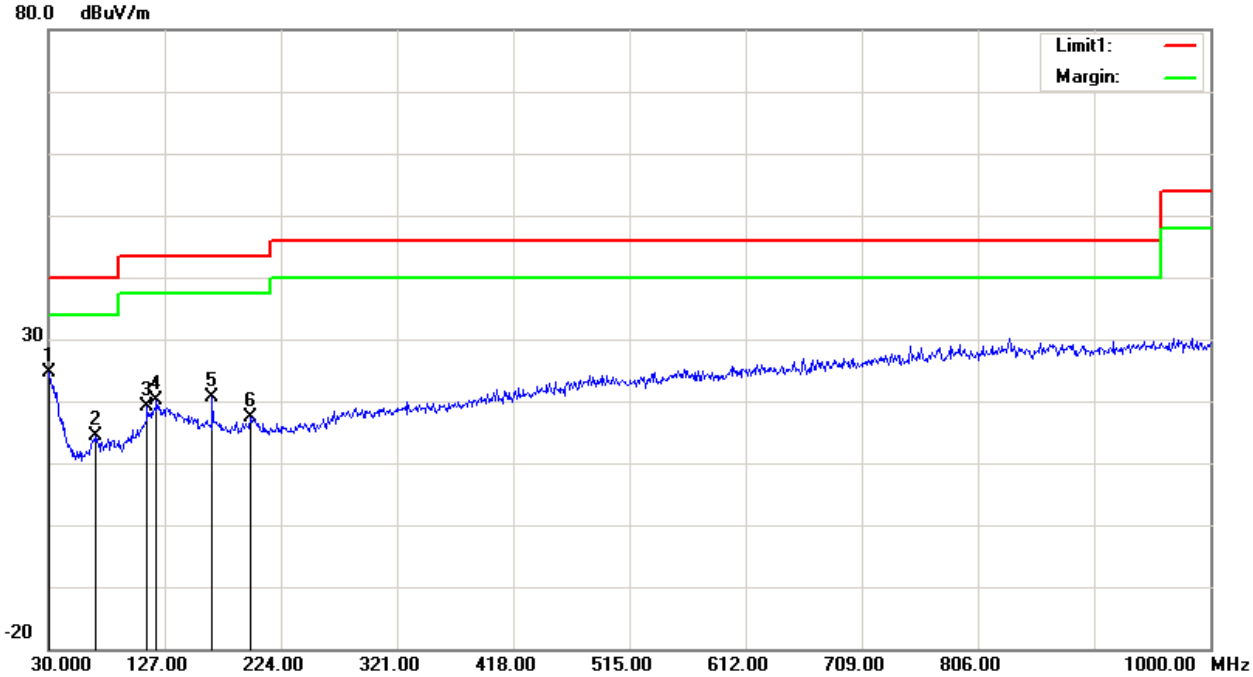
No.	Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	30.9700	28.74	peak	-4.31	24.43	40.00	15.57
2	68.8000	31.28	peak	-16.28	15.00	40.00	25.00
3	118.2700	29.08	peak	-10.03	19.05	43.50	24.45
4	127.9700	28.66	peak	-9.64	19.02	43.50	24.48
5	142.5200	28.74	peak	-10.69	18.05	43.50	25.45
6	166.7700	31.74	peak	-11.47	20.27	43.50	23.23

Project No: DG1231215-75859E-RF
Test Engineer: Zoo Zou
Test Date: 2023-12-22
Polarization: Vertical
Test Mode: Transmitting_Middle Channel
Power Source: DC 3.7V



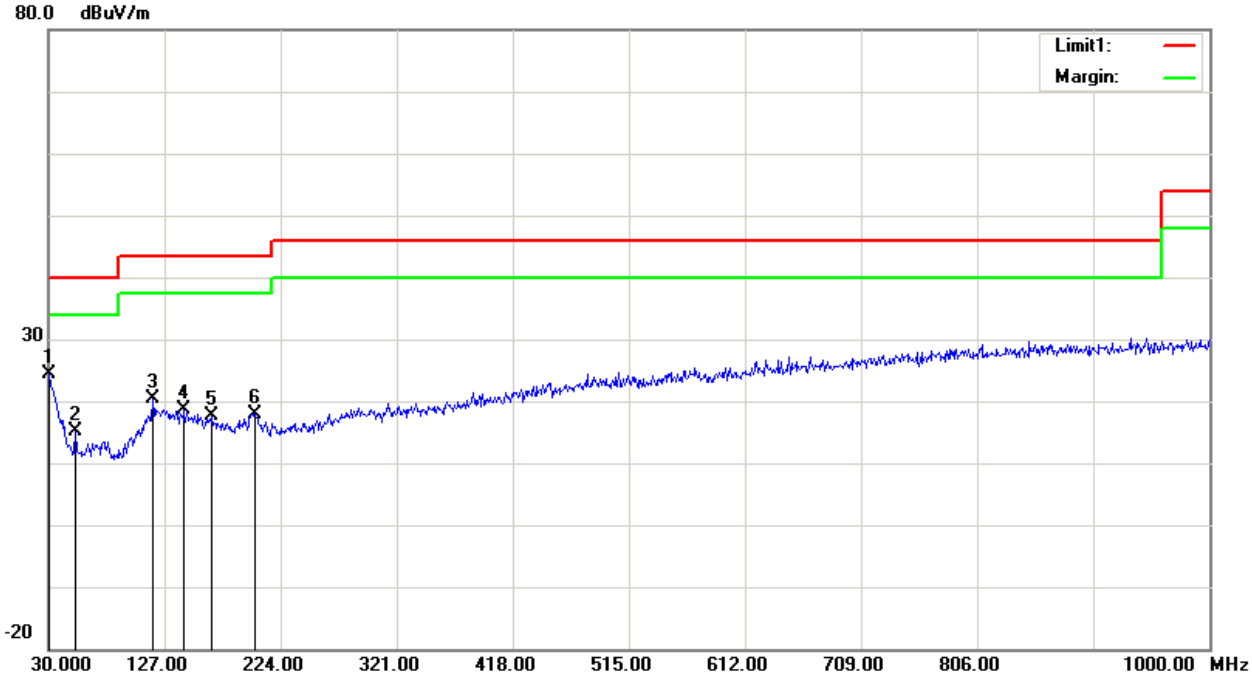
No.	Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	30.0000	28.24	peak	-3.80	24.44	40.00	15.56
2	73.6500	30.66	peak	-16.24	14.42	40.00	25.58
3	113.4200	30.01	peak	-10.77	19.24	43.50	24.26
4	127.0000	28.95	peak	-9.62	19.33	43.50	24.17
5	150.2800	29.78	peak	-11.05	18.73	43.50	24.77
6	201.6900	31.03	peak	-11.69	19.34	43.50	24.16

Project No: DG1231215-75859E-RF
Test Engineer: Zoo Zou
Test Date: 2023-12-22
Polarization: Horizontal
Test Mode: Transmitting_High Channel
Power Source: DC 3.7V



No.	Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	30.9700	29.00	peak	-4.31	24.69	40.00	15.31
2	68.8000	30.69	peak	-16.28	14.41	40.00	25.59
3	112.4500	30.19	peak	-10.97	19.22	43.50	24.28
4	120.2100	30.07	peak	-9.92	20.15	43.50	23.35
5	166.7700	32.19	peak	-11.47	20.72	43.50	22.78
6	198.7800	28.90	peak	-11.54	17.36	43.50	26.14

Project No: DG1231215-75859E-RF
Test Engineer: Zoo Zou
Test Date: 2023-12-22
Polarization: Vertical
Test Mode: Transmitting_High Channel
Power Source: DC 3.7V

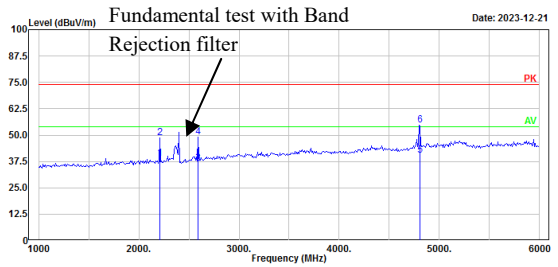


No.	Frequency (MHz)	Reading (dBuV)	Detector	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	30.0000	28.18	peak	-3.80	24.38	40.00	15.62
2	52.3100	31.66	peak	-16.49	15.17	40.00	24.83
3	117.3000	30.59	peak	-10.16	20.43	43.50	23.07
4	143.4900	29.31	peak	-10.73	18.58	43.50	24.92
5	166.7700	29.02	peak	-11.47	17.55	43.50	25.95
6	202.6600	29.75	peak	-11.78	17.97	43.50	25.53

3) 1-18GHz:

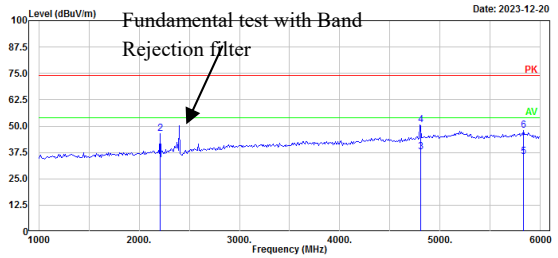
GFSK, Low Channel, Horizontal	GFSK, Low Channel, Vertical

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: BDR_low channel 2402 MHz
Note:



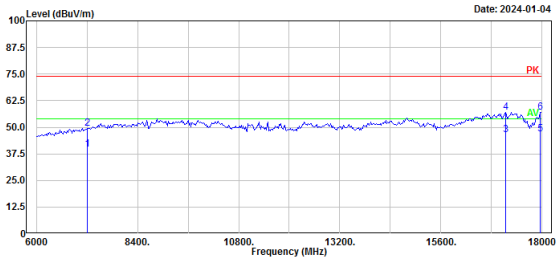
No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2208.33	47.53	-8.63	38.90	54.00	15.10	Average
2	2208.33	57.28	-8.63	48.65	74.00	25.35	Peak
3	2591.67	44.32	-7.53	36.79	54.00	17.21	Average
4	2591.67	56.55	-7.53	49.02	74.00	24.98	Peak
5	4804.00	43.42	-3.08	40.34	54.00	13.66	Average
6	4804.00	57.72	-3.08	54.64	74.00	19.36	Peak

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: BDR_low channel 2402 MHz
Note:



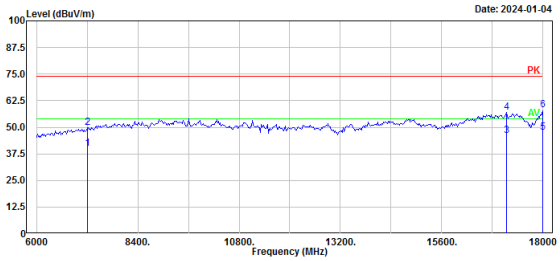
No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2208.33	42.71	-8.63	34.08	54.00	19.92	Average
2	2208.33	55.06	-8.63	46.43	74.00	27.57	Peak
3	4804.00	40.96	-3.08	37.88	54.00	16.12	Average
4	4804.00	53.75	-3.08	50.67	74.00	23.33	Peak
5	5833.33	37.10	-1.52	35.58	54.00	18.42	Average
6	5833.33	49.33	-1.52	47.81	74.00	26.19	Peak

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: BDR_low channel 2402 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7206.00	38.04	1.62	39.66	54.00	14.34	Average
2	7206.00	47.64	1.62	49.26	74.00	24.74	Peak
3	17140.00	33.45	13.07	46.52	54.00	7.48	Average
4	17140.00	43.98	13.07	57.05	74.00	16.95	Peak
5	17960.00	28.86	17.99	46.85	54.00	7.15	Average
6	17960.00	39.09	17.99	57.08	74.00	16.92	Peak

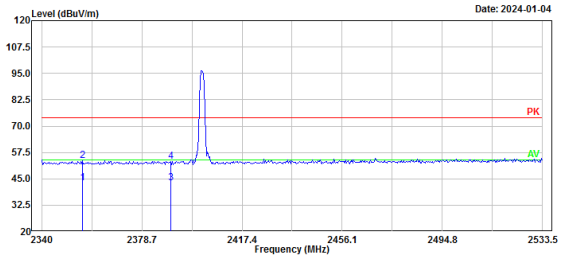
Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: BDR_low channel 2402 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7206.00	38.29	1.62	39.91	54.00	14.09	Average
2	7206.00	48.29	1.62	49.91	74.00	24.09	Peak
3	17140.00	33.05	13.07	46.12	54.00	7.88	Average
4	17140.00	43.76	13.07	56.83	74.00	17.17	Peak
5	18000.00	29.33	18.15	47.48	54.00	6.52	Average
6	18000.00	40.06	18.15	58.21	74.00	15.79	Peak

GFSK, Low Channel, Bandedge, Horizontal

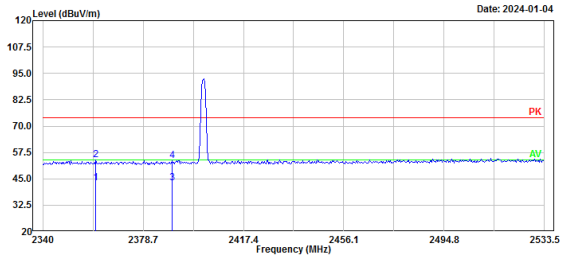
Project No.: DG1231215-75859E-RF
Serial No.: 2FBW-1
Polarization: Horizontal
Tester: Colin Yang
Test Mode: BDR_low channel 2402 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2355.80	14.48	28.42	42.90	54.00	11.10	Average
2	2355.80	25.11	28.42	53.53	74.00	20.47	Peak
3	2390.00	14.33	28.57	42.90	54.00	11.10	Average
4	2390.00	24.71	28.57	53.28	74.00	20.72	Peak

GFSK, Low Channel, Bandedge, Vertical

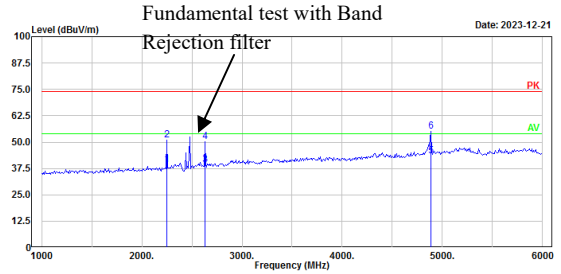
Project No.: DG1231215-75859E-RF
Serial No.: 2FBW-1
Polarization: Vertical
Tester: Colin Yang
Test Mode: BDR_low channel 2402 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2360.32	14.58	28.44	43.02	54.00	10.98	Average
2	2360.32	25.54	28.44	53.98	74.00	20.02	Peak
3	2390.00	14.41	28.57	42.98	54.00	11.02	Average
4	2390.00	24.91	28.57	53.48	74.00	20.52	Peak

GFSK, Middle Channel, Horizontal

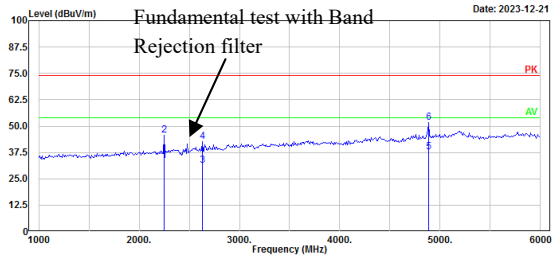
Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: BDR_middle channel 2441 MHz
Note:



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	2250.00	47.66	-8.55	39.11	54.00	14.89	Average
2	2250.00	59.51	-8.55	50.96	74.00	23.04	Peak
3	2633.33	46.44	-7.34	39.10	54.00	14.90	Average
4	2633.33	57.50	-7.34	50.16	74.00	23.84	Peak
5	4882.00	46.06	-2.72	43.34	54.00	10.66	Average
6	4882.00	57.72	-2.72	55.00	74.00	19.00	Peak

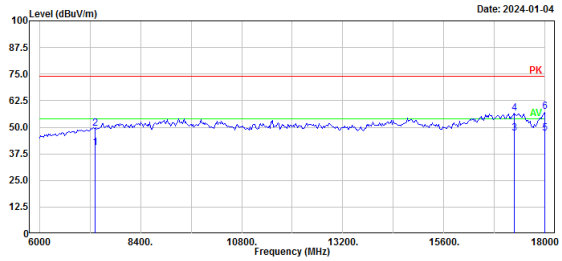
GFSK, Middle Channel, Vertical

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: BDR_middle channel 2441 MHz
Note:



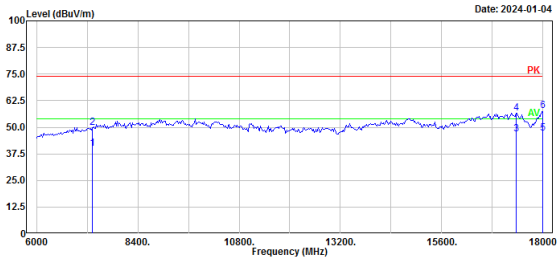
No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	2250.00	42.17	-8.55	33.62	54.00	20.38	Average
2	2250.00	54.20	-8.55	45.65	74.00	28.35	Peak
3	2633.33	38.60	-7.34	31.26	54.00	22.74	Average
4	2633.33	50.02	-7.34	42.68	74.00	31.32	Peak
5	4882.00	40.45	-2.72	37.73	54.00	16.27	Average
6	4882.00	54.57	-2.72	51.85	74.00	22.15	Peak

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: BDR_middle channel 2441 MHz
Note:



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	7323.00	38.30	2.11	40.41	54.00	13.59	Average
2	7323.00	47.35	2.11	49.46	74.00	24.54	Peak
3	17260.00	33.08	13.94	47.02	54.00	6.98	Average
4	17260.00	42.61	13.94	56.55	74.00	17.45	Peak
5	18000.00	28.86	18.15	47.01	54.00	6.99	Average
6	18000.00	39.04	18.15	57.19	74.00	16.81	Peak

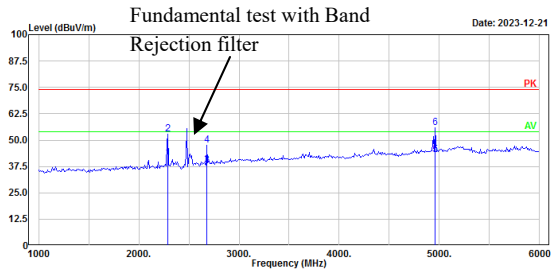
Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: BDR_middle channel 2441 MHz
Note:



No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	7323.00	37.77	2.11	39.88	54.00	14.12	Average
2	7323.00	47.64	2.11	49.75	74.00	24.25	Peak
3	17360.00	32.07	14.74	46.81	54.00	7.19	Average
4	17360.00	41.87	14.74	56.61	74.00	17.39	Peak
5	18000.00	29.14	18.15	47.29	54.00	6.71	Average
6	18000.00	39.67	18.15	57.82	74.00	16.18	Peak

GFSK, High Channel, Horizontal

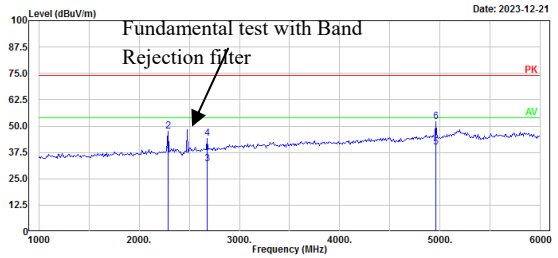
Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: BDR_high channel 2480 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2291.67	49.89	-8.41	41.48	54.00	12.52	Average
2	2291.67	61.40	-8.41	52.99	74.00	21.01	Peak
3	2675.00	45.19	-7.11	38.08	54.00	15.92	Average
4	2675.00	54.65	-7.11	47.54	74.00	26.46	Peak
5	4960.00	45.42	-2.35	43.07	54.00	10.93	Average
6	4960.00	58.23	-2.35	55.88	74.00	18.12	Peak

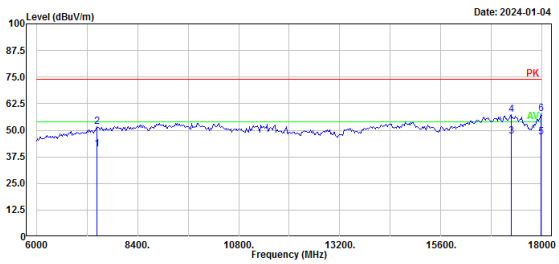
GFSK, High Channel, Vertical

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: BDR_high channel 2480 MHz
Note:



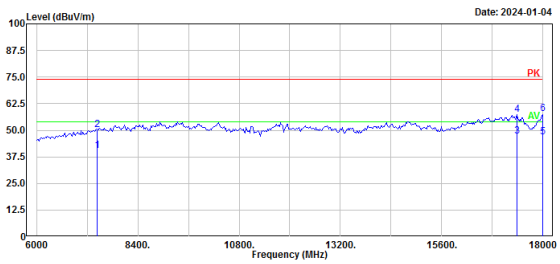
No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2291.67	44.58	-8.41	36.17	54.00	17.83	Average
2	2291.67	55.89	-8.41	47.48	74.00	26.52	Peak
3	2675.00	39.11	-7.11	32.00	54.00	22.00	Average
4	2675.00	51.26	-7.11	44.15	74.00	29.85	Peak
5	4960.00	42.36	-2.35	40.01	54.00	13.99	Average
6	4960.00	54.52	-2.35	52.17	74.00	21.83	Peak

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: BDR_high channel 2480 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7440.00	38.78	2.47	41.25	54.00	12.75	Average
2	7440.00	49.39	2.47	51.86	74.00	22.14	Peak
3	17260.00	33.09	13.94	47.03	54.00	6.97	Average
4	17260.00	43.55	13.94	57.49	74.00	16.51	Peak
5	17980.00	28.88	18.08	46.96	54.00	7.04	Average
6	17980.00	39.78	18.08	57.86	74.00	16.14	Peak

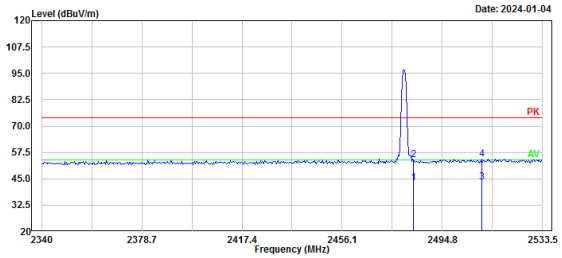
Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: BDR_high channel 2480 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7440.00	38.05	2.47	40.52	54.00	13.48	Average
2	7440.00	47.67	2.47	50.14	74.00	23.86	Peak
3	17380.00	32.36	14.91	47.27	54.00	6.73	Average
4	17380.00	42.29	14.91	57.20	74.00	16.80	Peak
5	18000.00	28.77	18.15	46.92	54.00	7.08	Average
6	18000.00	39.59	18.15	57.74	74.00	16.26	Peak

GFSK, High Channel, Bandedge, Horizontal

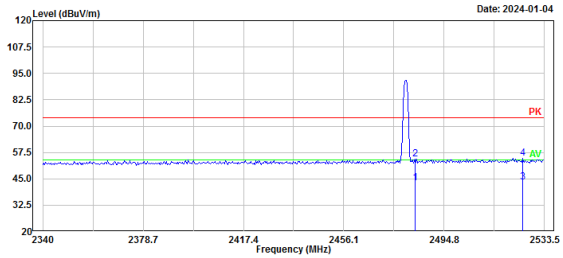
Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: BDR_high channel 2480 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2483.50	14.04	28.95	42.99	54.00	11.01	Average
2	2483.50	24.92	28.95	53.87	74.00	20.13	Peak
3	2509.96	14.29	29.06	43.35	54.00	10.65	Average
4	2509.96	25.29	29.06	54.35	74.00	19.65	Peak

GFSK, High Channel, Bandedge, Vertical

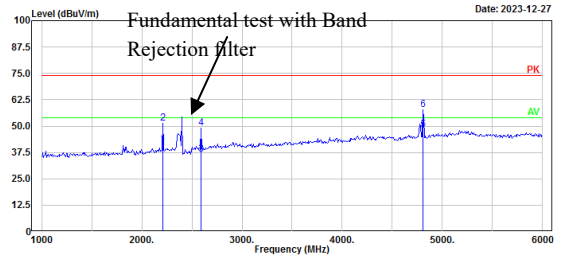
Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: BDR_high channel 2480 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2483.50	14.21	28.95	43.16	54.00	10.84	Average
2	2483.50	25.23	28.95	54.18	74.00	19.82	Peak
3	2525.12	14.28	29.12	43.40	54.00	10.60	Average
4	2525.12	25.57	29.12	54.69	74.00	19.31	Peak

π/4-DQPSK, Low Channel, Horizontal

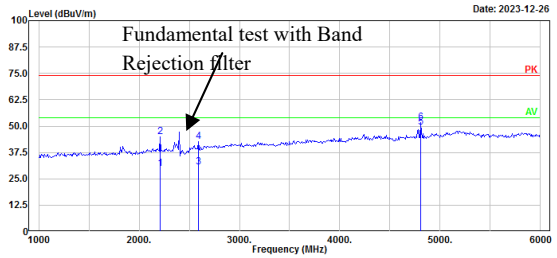
Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: 2EDR_low channel 2402 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2210.15	50.21	-8.62	41.59	54.00	12.41	Average
2	2210.15	60.04	-8.62	51.42	74.00	22.58	Peak
3	2594.20	44.21	-7.52	36.69	54.00	17.31	Average
4	2594.20	56.59	-7.52	49.07	74.00	24.93	Peak
5	4804.00	51.28	-3.08	48.20	54.00	5.80	Average
6	4804.00	60.82	-3.08	57.74	74.00	16.26	Peak

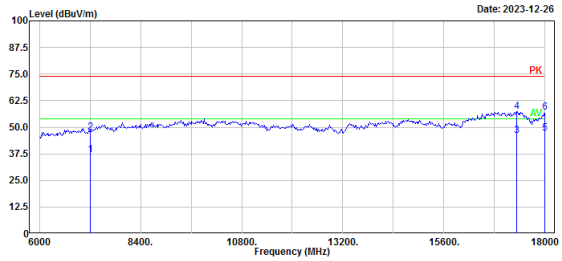
π/4-DQPSK, Low Channel, Vertical

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: 2EDR_low channel 2402 MHz
Note:



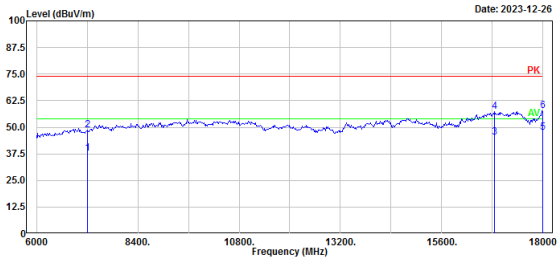
No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2210.15	38.54	-8.62	29.92	54.00	24.08	Average
2	2210.15	53.34	-8.62	44.72	74.00	29.28	Peak
3	2594.20	38.15	-7.52	30.63	54.00	23.37	Average
4	2594.20	50.24	-7.52	42.72	74.00	31.28	Peak
5	4804.00	52.52	-3.08	49.44	54.00	4.56	Average
6	4804.00	54.89	-3.08	51.81	74.00	22.19	Peak

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: 2EDR_low channel 2402 MHz
Note:

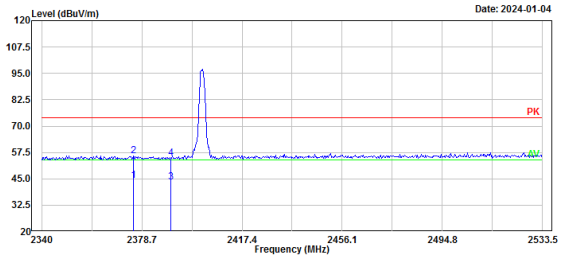
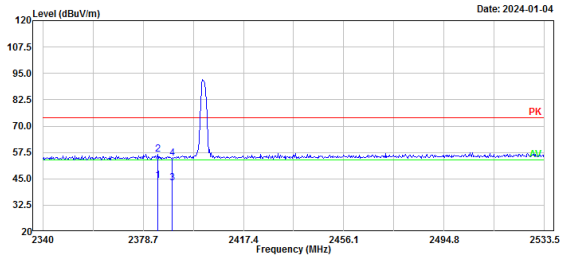


No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7206.00	35.41	1.62	37.03	54.00	16.97	Average
2	7206.00	46.09	1.62	47.71	74.00	26.29	Peak
3	17321.74	31.66	14.43	46.09	54.00	7.91	Average
4	17321.74	42.84	14.43	57.27	74.00	16.73	Peak
5	18000.00	28.99	18.15	47.14	54.00	6.86	Average
6	18000.00	38.73	18.15	56.88	74.00	17.12	Peak

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: 2EDR_low channel 2402 MHz
Note:

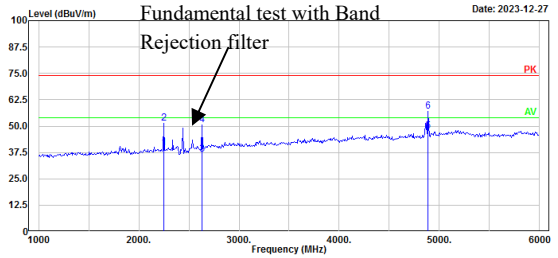


No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7206.00	36.28	1.62	37.90	54.00	16.10	Average
2	7206.00	47.00	1.62	48.62	74.00	25.38	Peak
3	16852.17	34.08	11.15	45.23	54.00	8.77	Average
4	16852.17	46.11	11.15	57.26	74.00	16.74	Peak
5	18000.00	29.28	18.15	47.43	54.00	6.57	Average
6	18000.00	39.75	18.15	57.90	74.00	16.10	Peak

π/4-DQPSK, Low Channel, Bandedge, Horizontal	π/4-DQPSK, Low Channel, Bandedge, Vertical
Project No.: DG1231215-75859E-RF Polarization: Horizontal Test Mode: 2EDR_low channel 2402 MHz Note: Serial No.: 2FBW-1 Tester: Colin Yang  No. Frequency (MHz) Reading (dBμV) Factor (dB/m) Result (dBμV/m) Limit (dBμV/m) Margin (dB) Detector 1 2375.34 15.52 28.51 44.03 54.00 9.97 Average 2 2375.34 27.45 28.51 55.96 74.00 18.04 Peak 3 2390.00 14.87 28.57 43.44 54.00 10.56 Average 4 2390.00 26.30 28.57 54.87 74.00 19.13 Peak	Project No.: DG1231215-75859E-RF Polarization: Vertical Test Mode: 2EDR_low channel 2402 MHz Note: Serial No.: 2FBW-1 Tester: Colin Yang  No. Frequency (MHz) Reading (dBμV) Factor (dB/m) Result (dBμV/m) Limit (dBμV/m) Margin (dB) Detector 1 2384.31 15.76 28.54 44.30 54.00 9.70 Average 2 2384.31 28.00 28.54 56.54 74.00 17.46 Peak 3 2390.00 14.47 28.57 43.04 54.00 10.96 Average 4 2390.00 26.03 28.57 54.60 74.00 19.40 Peak

π/4-DQPSK, Middle Channel, Horizontal

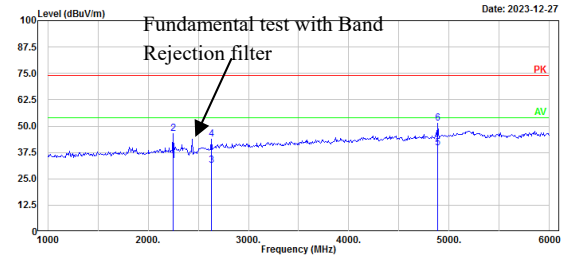
Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: 2EDR_middle channel 2441 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2246.38	48.36	-8.56	39.80	54.00	14.20	Average
2	2246.38	59.83	-8.56	51.27	74.00	22.73	Peak
3	2630.44	44.11	-7.35	36.76	54.00	17.24	Average
4	2630.44	57.87	-7.35	50.52	74.00	23.48	Peak
5	4882.00	50.21	-2.72	47.49	54.00	6.51	Average
6	4882.00	59.81	-2.72	57.09	74.00	16.91	Peak

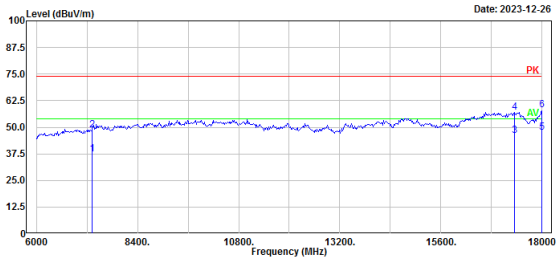
π/4-DQPSK, Middle Channel, Vertical

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: 2EDR_middle channel 2441 MHz
Note:



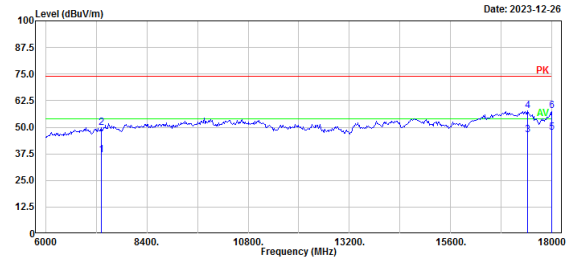
No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2246.38	42.15	-8.56	33.59	54.00	20.41	Average
2	2246.38	54.79	-8.56	46.23	74.00	27.77	Peak
3	2630.44	38.53	-7.35	31.18	54.00	22.82	Average
4	2630.44	50.99	-7.35	43.64	74.00	30.36	Peak
5	4882.00	42.45	-2.72	39.73	54.00	14.27	Average
6	4882.00	53.94	-2.72	51.22	74.00	22.78	Peak

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: 2EDR_middle channel 2441 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7323.00	35.21	2.11	37.32	54.00	16.68	Average
2	7323.00	46.72	2.11	48.83	74.00	25.17	Peak
3	17339.13	31.34	14.58	45.92	54.00	8.08	Average
4	17339.13	42.43	14.58	57.01	74.00	16.99	Peak
5	18000.00	29.24	18.15	47.39	54.00	6.61	Average
6	18000.00	40.03	18.15	58.18	74.00	15.82	Peak

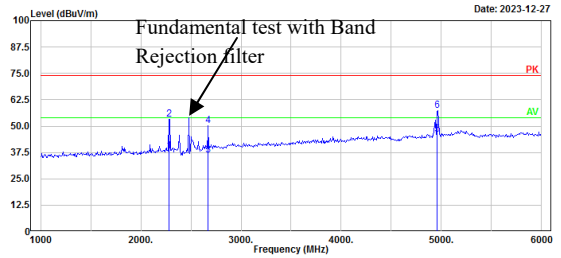
Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: 2EDR_middle channel 2441 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7323.00	35.01	2.11	37.12	54.00	16.88	Average
2	7323.00	47.63	2.11	49.74	74.00	24.26	Peak
3	17426.09	31.26	15.28	46.54	54.00	7.46	Average
4	17426.09	42.28	15.28	57.56	74.00	16.44	Peak
5	18000.00	29.37	18.15	47.52	54.00	6.48	Average
6	18000.00	39.61	18.15	57.76	74.00	16.24	Peak

π/4-DQPSK, High Channel, Horizontal

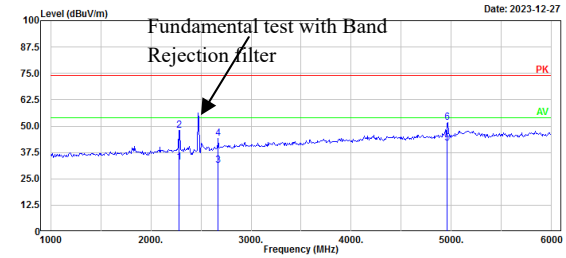
Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: 2EDR_high channel 2480 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2282.61	46.62	-8.45	38.17	54.00	15.83	Average
2	2282.61	61.83	-8.45	53.38	74.00	20.62	Peak
3	2673.91	43.21	-7.12	36.09	54.00	17.91	Average
4	2673.91	57.22	-7.12	50.10	74.00	23.90	Peak
5	4960.00	48.22	-2.35	45.87	54.00	8.13	Average
6	4960.00	59.65	-2.35	57.30	74.00	16.70	Peak

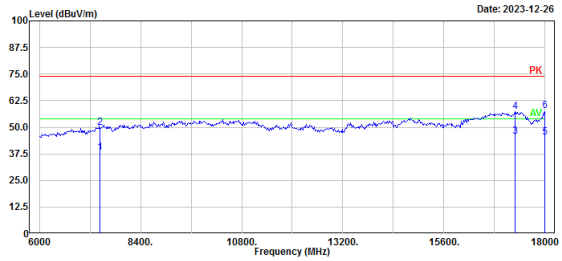
π/4-DQPSK, High Channel, Vertical

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: 2EDR_high channel 2480 MHz
Note:



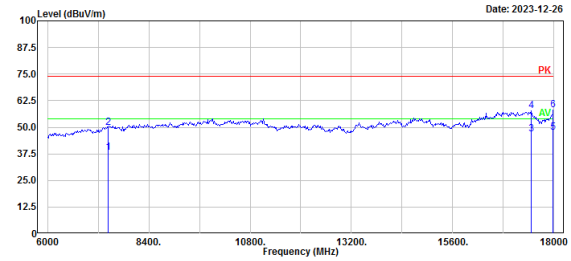
No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2282.61	41.15	-8.45	32.70	54.00	21.30	Average
2	2282.61	56.53	-8.45	48.08	74.00	25.92	Peak
3	2673.91	38.36	-7.12	31.24	54.00	22.76	Average
4	2673.91	51.40	-7.12	44.28	74.00	29.72	Peak
5	4960.00	44.15	-2.35	41.80	54.00	12.20	Average
6	4960.00	54.12	-2.35	51.77	74.00	22.23	Peak

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: 2EDR_high channel 2480 MHz
Note:

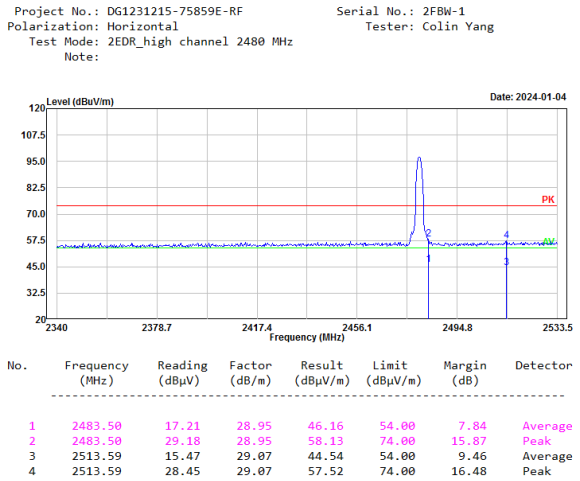
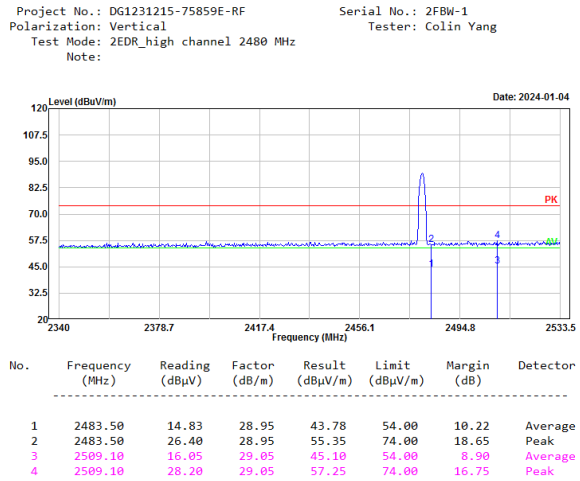


No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7440.00	35.61	2.47	38.08	54.00	15.92	Average
2	7440.00	47.29	2.47	49.76	74.00	24.24	Peak
3	17286.96	31.35	14.15	45.50	54.00	8.50	Average
4	17286.96	43.36	14.15	57.51	74.00	16.49	Peak
5	18000.00	27.26	18.15	45.41	54.00	8.59	Average
6	18000.00	39.42	18.15	57.57	74.00	16.43	Peak

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: 2EDR_high channel 2480 MHz
Note:



No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7440.00	35.56	2.47	38.03	54.00	15.97	Average
2	7440.00	47.18	2.47	49.65	74.00	24.35	Peak
3	17460.87	31.34	15.56	46.90	54.00	7.10	Average
4	17460.87	42.24	15.56	57.80	74.00	16.20	Peak
5	17982.61	29.41	18.08	47.49	54.00	6.51	Average
6	17982.61	40.22	18.08	58.30	74.00	15.70	Peak

π/4-DQPSK, High Channel, Bandedge, Horizontal	π/4-DQPSK, High Channel,Bandedge, Vertical
	

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Horizontal Tester: Colin Yang
Test Mode: 2EDR_high channel 2480 MHz
Note:

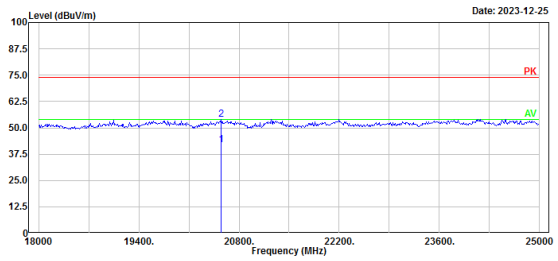
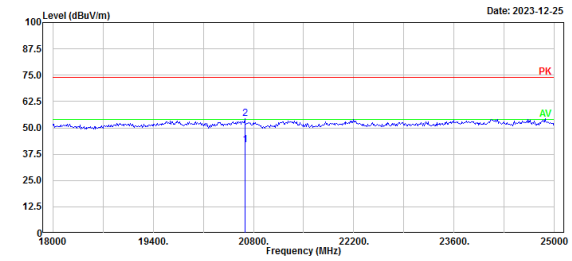
No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2483.50	17.21	28.95	46.16	54.00	7.84	Average
2	2483.50	29.18	28.95	58.13	74.00	15.87	Peak
3	2513.59	15.47	29.07	44.54	54.00	9.46	Average
4	2513.59	28.45	29.07	57.52	74.00	16.48	Peak

Project No.: DG1231215-75859E-RF Serial No.: 2FBW-1
Polarization: Vertical Tester: Colin Yang
Test Mode: 2EDR_high channel 2480 MHz
Note:

No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	2483.50	14.83	28.95	43.78	54.00	10.22	Average
2	2483.50	26.40	28.95	55.35	74.00	18.65	Peak
3	2509.10	16.05	29.05	45.10	54.00	8.90	Average
4	2509.10	28.20	29.05	57.25	74.00	16.75	Peak

18-25GHz:

No Emission was detected in the range 18-25GHz, test was performed on the mode and channel which with the maximum power.

Horizontal	Vertical
Project No.: DG1231215-75859E-RF Polarization: Horizontal Test Mode: 2EDR_low channel 2402 MHz Note: Serial No.: 2FBW-1 Tester: Colin Yang  No. Frequency (MHz) Reading (dBµV) Factor (dB/m) Result (dBµV/m) Limit (dBµV/m) Margin (dB) Detector 1 20546.38 34.11 7.75 41.86 54.00 12.14 Average 2 20546.38 46.31 7.75 54.06 74.00 19.94 Peak	Project No.: DG1231215-75859E-RF Polarization: Vertical Test Mode: 2EDR_low channel 2402 MHz Note: Serial No.: 2FBW-1 Tester: Colin Yang  No. Frequency (MHz) Reading (dBµV) Factor (dB/m) Result (dBµV/m) Limit (dBµV/m) Margin (dB) Detector 1 20678.26 34.45 7.50 41.95 54.00 12.05 Average 2 20678.26 46.85 7.50 54.35 74.00 19.65 Peak

5.3 20 dB Emission Bandwidth

Serial No.:	2FBW-2	**Test Date:**	2023/12/28
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Jojo Zhou	**Test Result:**	Pass

Environmental Conditions:

Temperature: (℃)	23.9	**Relative Humidity: (%)**	37	**ATM Pressure: (kPa)**	101.6

Test Equipment List and Details:

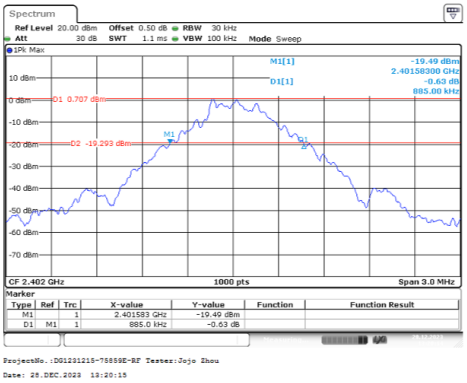
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101947	2023/10/18	2024/10/17
E-Microwave	Blocking Control	EMDCB-00036	OE01201047	2023/05/06	2024/05/05
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	2023/09/01	2024/08/31

** Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

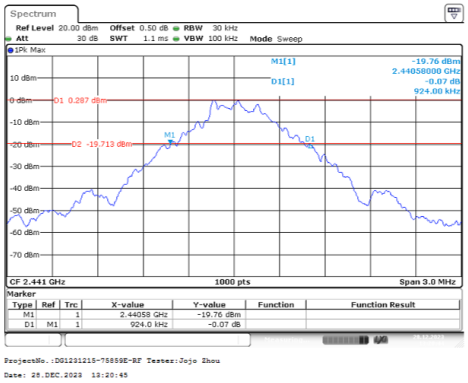
Test Data:

Mode	Value (MHz)	Result
GFSK_Low_DH1	0.885	Pass
GFSK_Mid_DH1	0.924	Pass
GFSK_High_DH1	0.933	Pass
PI/4-DQPSK_Low_2DH1	1.257	Pass
PI/4-DQPSK_Mid_2DH1	1.257	Pass
PI/4-DQPSK_High_2DH1	1.254	Pass

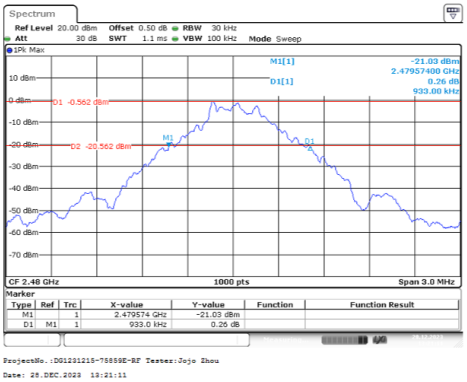
GFSK_Low_DH1



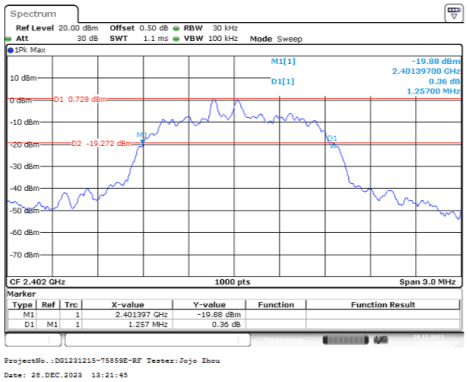
GFSK_Mid_DH1



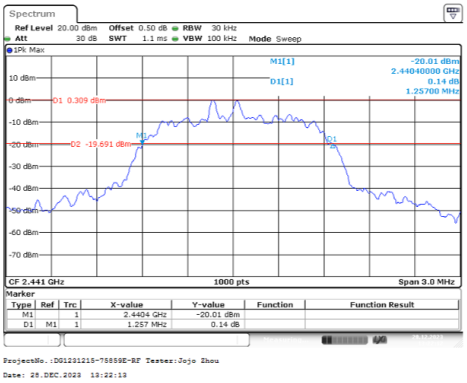
GFSK_High_DH1



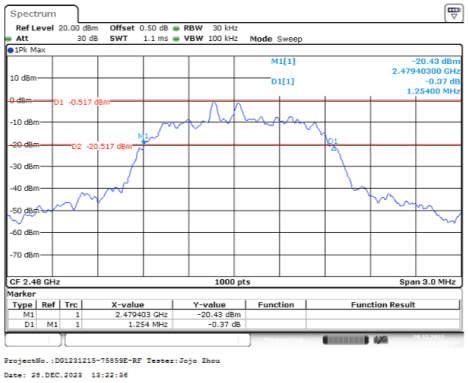
PI/4-DQPSK_Low_2DH1



PI/4-DQPSK_Mid_2DH1



PI/4-DQPSK_High_2DH1



5.4 Channel Separation

Serial No.:	2FBW-2	**Test Date:**	2023/12/28
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Jojo Zhou	**Test Result:**	Pass

Environmental Conditions:

Temperature: (℃)	23.9	**Relative Humidity: (%)**	37	**ATM Pressure: (kPa)**	101.6

Test Equipment List and Details:

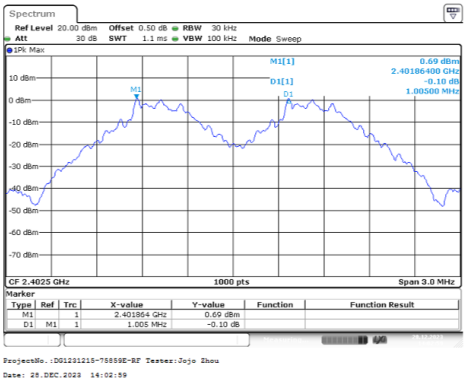
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101947	2023/10/18	2024/10/17
E-Microwave	Blocking Control	EMDCB-00036	OE01201047	2023/05/06	2024/05/05
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	2023/09/01	2024/08/31

** Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

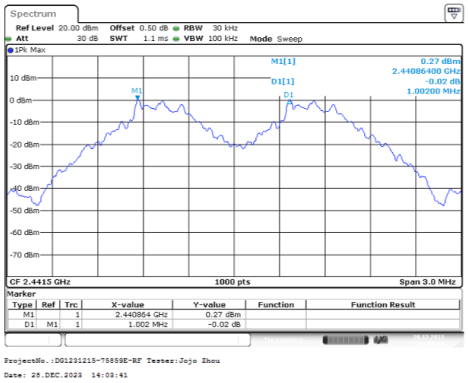
Test Data:

Mode	Value (MHz)	Limit (MHz)	Result
GFSK_Low_DH1	1.005	0.590	Pass
GFSK_Mid_DH1	1.002	0.616	Pass
GFSK_High_DH1	1.002	0.622	Pass
PI/4-DQPSK_Low_2DH1	1.002	0.838	Pass
PI/4-DQPSK_Mid_2DH1	1.002	0.838	Pass
PI/4-DQPSK_High_2DH1	1.002	0.836	Pass

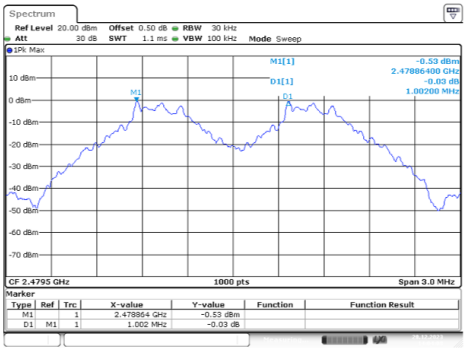
GFSK_Low_DH1



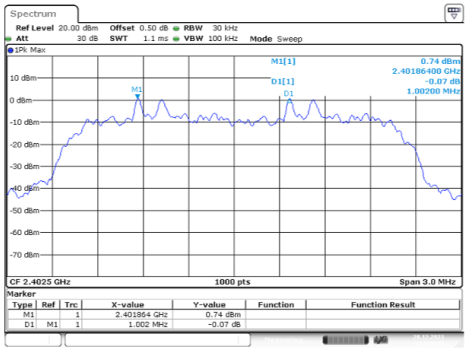
GFSK_Mid_DH1



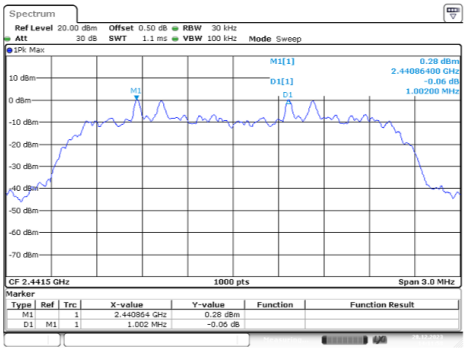
GFSK_High_DH1



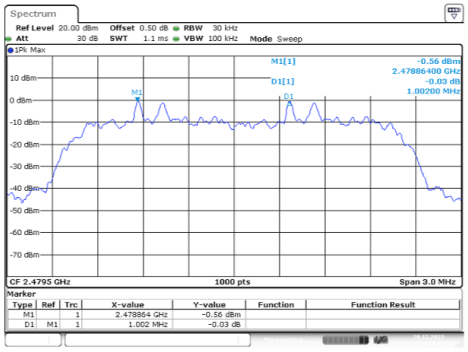
PI/4-DQPSK_Low_2DH1



PI/4-DQPSK_Mid_2DH1



PI/4-DQPSK_High_2DH1



5.5 Number Of Hopping Frequency

Serial No.:	2FBW-2	**Test Date:**	2023/12/28
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Jojo Zhou	**Test Result:**	Pass

Environmental Conditions:

Temperature: (℃)	23.9	**Relative Humidity: (%)**	37	**ATM Pressure: (kPa)**	101.6

Test Equipment List and Details:

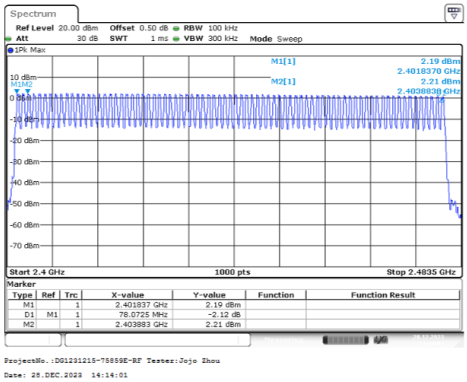
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101947	2023/10/18	2024/10/17
E-Microwave	Blocking Control	EMDCB-00036	OE01201047	2023/05/06	2024/05/05
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	2023/09/01	2024/08/31

** Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

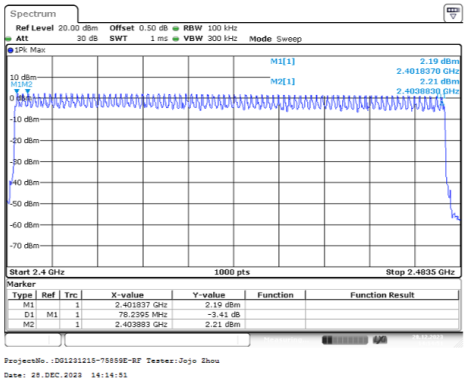
Test Data:

Mode	Value	Limit	Result
GFSK_Hopping_DH1	79	15	Pass
PI/4-DQPSK_Hopping_2DH1	79	15	Pass

GFSK_Hopping_DH1



PI/4-DQPSK_Hopping_2DH1



5.6 Time Of Occupancy (Dwell Time)

Serial No.:	2FBW-2	**Test Date:**	2023/12/28~2023/12/29
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Jojo Zhou	**Test Result:**	Pass

Environmental Conditions:

Temperature: (℃)	24.1~24.4	**Relative Humidity: (%)**	38~42	**ATM Pressure: (kPa)**	101.5~101.6

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101947	2023/10/18	2024/10/17
E-Microwave	Blocking Control	EMDCB-00036	OE01201047	2023/05/06	2024/05/05
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	2023/09/01	2024/08/31

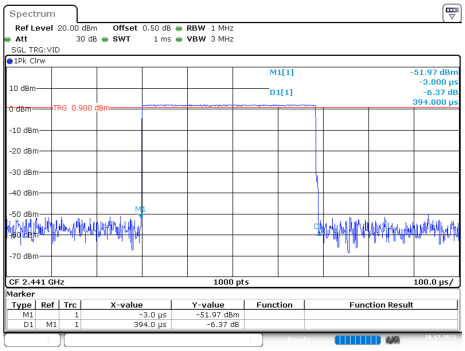
** Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

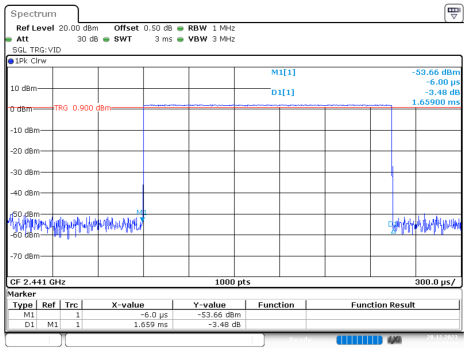
Mode	Pulse width (ms)	Dwell time (s)	Limit (s)	Result
GFSK_Hopping_DH1	0.394	0.126	0.400	Pass
GFSK_Hopping_DH3	1.659	0.265	0.400	Pass
GFSK_Hopping_DH5	2.915	0.311	0.400	Pass
PI/4-DQPSK_Hopping_2DH1	0.404	0.129	0.400	Pass
PI/4-DQPSK_Hopping_2DH3	1.665	0.266	0.400	Pass
PI/4-DQPSK_Hopping_2DH5	2.920	0.311	0.400	Pass

Note:
DH1:Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s
DH3:Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s
DH5:Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s
2DH1: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s
2DH3: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s
2DH5: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s

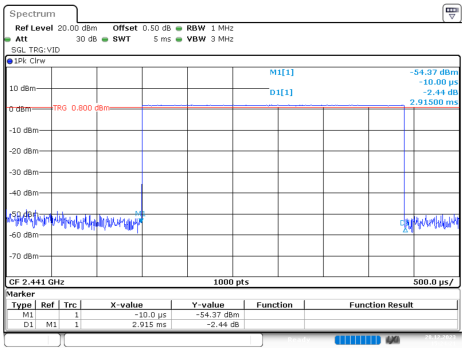
GFSK_Hopping_DH1



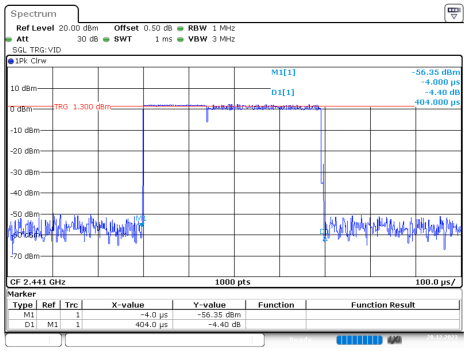
GFSK_Hopping_DH3



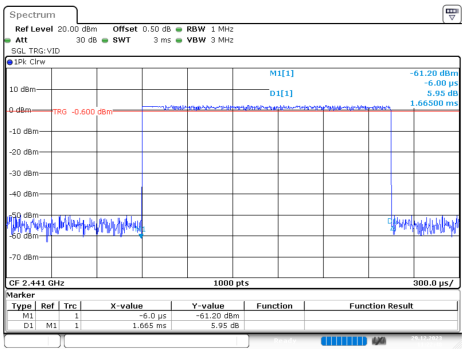
GFSK_Hopping_DH5



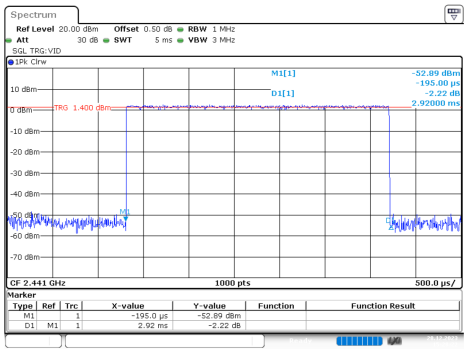
PI/4-DQPSK_Hopping_2DH1



PI/4-DQPSK_Hopping_2DH3



PI/4-DQPSK_Hopping_2DH5



5.7 Maximum Conducted Output Power

Serial No.:	2FBW-2	**Test Date:**	2023/12/28
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Jojo Zhou	**Test Result:**	Pass

Environmental Conditions:

Temperature: (℃)	23.9	**Relative Humidity: (%)**	37	**ATM Pressure: (kPa)**	101.6

Test Equipment List and Details:

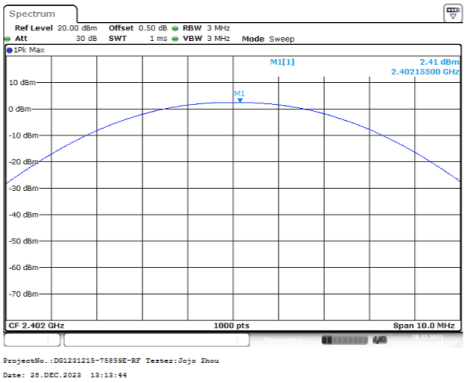
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101947	2023/10/18	2024/10/17
E-Microwave	Blocking Control	EMDCB-00036	OE01201047	2023/05/06	2024/05/05
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	2023/09/01	2024/08/31

** Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

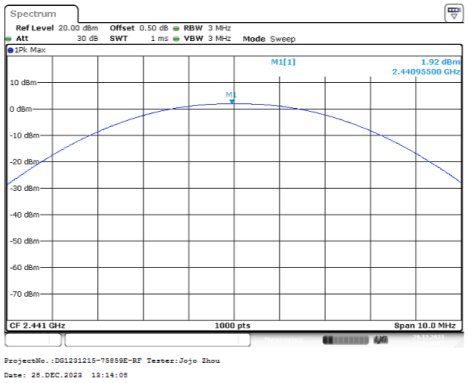
Test Data:

Mode	Value (dBm)	Limit (dBm)	Result
GFSK_Low_DH1	2.41	21.00	Pass
GFSK_Mid_DH1	1.92	21.00	Pass
GFSK_High_DH1	1.07	21.00	Pass
PI/4-DQPSK_Low_2DH1	3.30	21.00	Pass
PI/4-DQPSK_Mid_2DH1	2.84	21.00	Pass
PI/4-DQPSK_High_2DH1	1.99	21.00	Pass

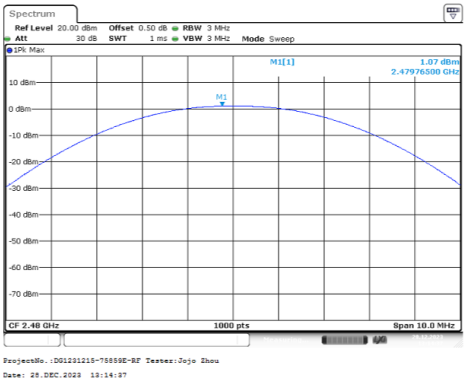
GFSK_Low_DH1



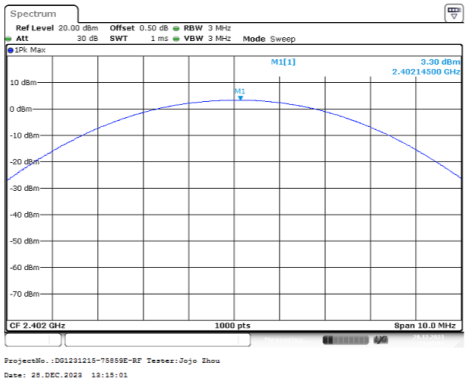
GFSK_Mid_DH1



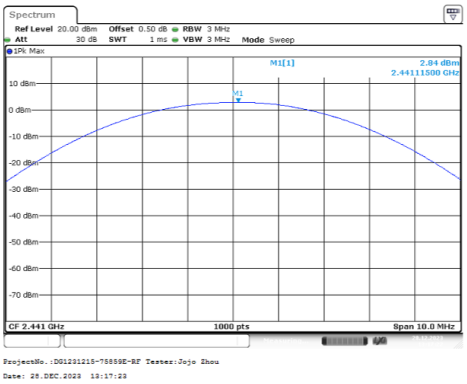
GFSK_High_DH1



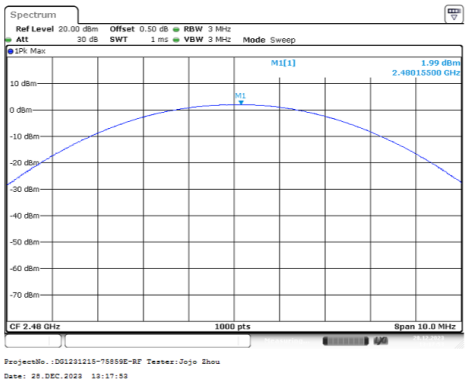
PI/4-DQPSK_Low_2DH1



PI/4-DQPSK_Mid_2DH1



PI/4-DQPSK_High_2DH1



5.8 100 kHz Bandwidth of Frequency Band Edge

Serial No.:	2FBW-2	**Test Date:**	2023/12/28
Test Site:	RF	**Test Mode:**	Transmitting
Tester:	Jojo Zhou	**Test Result:**	Pass

Environmental Conditions:

Temperature: (℃)	24.1	**Relative Humidity: (%)**	38	**ATM Pressure: (kPa)**	101.6

Test Equipment List and Details:

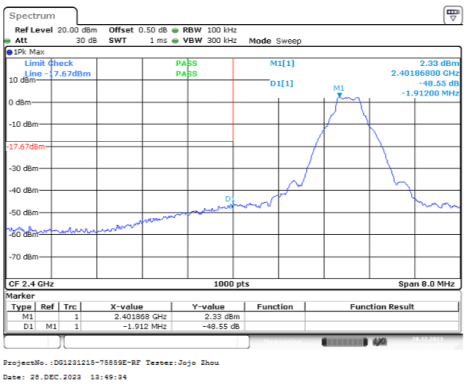
Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101947	2023/10/18	2024/10/17
E-Microwave	Blocking Control	EMDCB-00036	OE01201047	2023/05/06	2024/05/05
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41010012	2023/09/01	2024/08/31

** Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

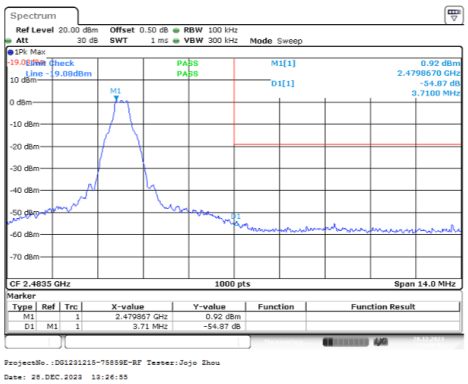
Test Data:

Please refer to the below plots:

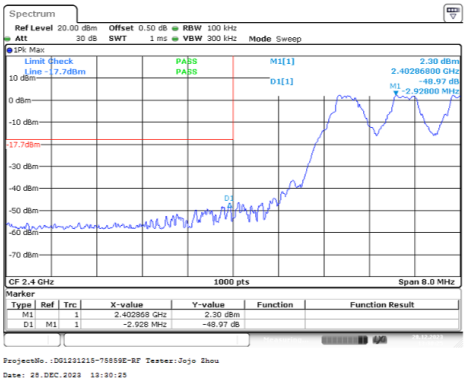
GFSK_Low_DH1



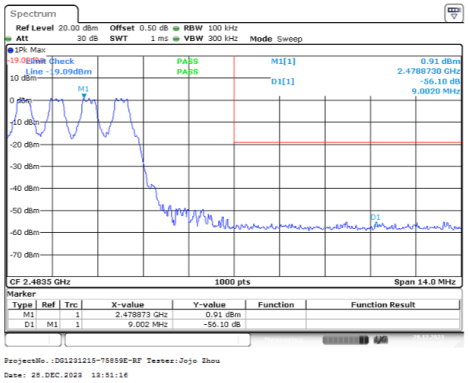
GFSK_High_DH1



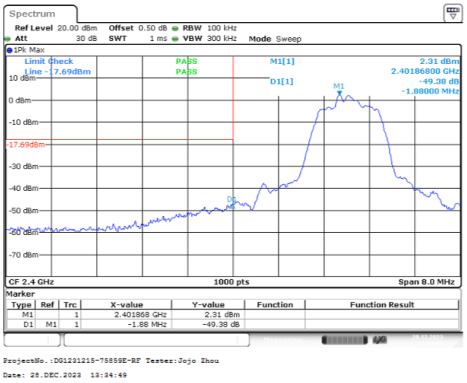
GFSK_Hopping_Lower_DH1



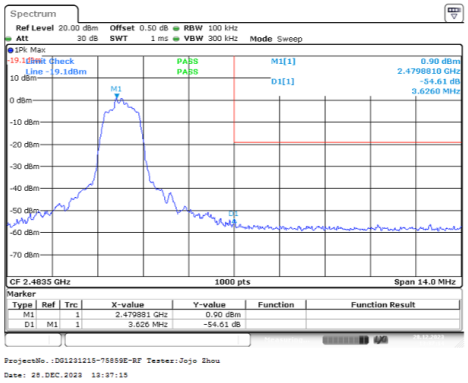
GFSK_Hopping_Upper_DH1



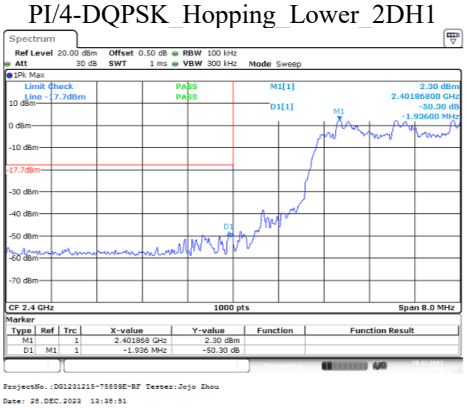
PI/4-DQPSK_Low_2DH1



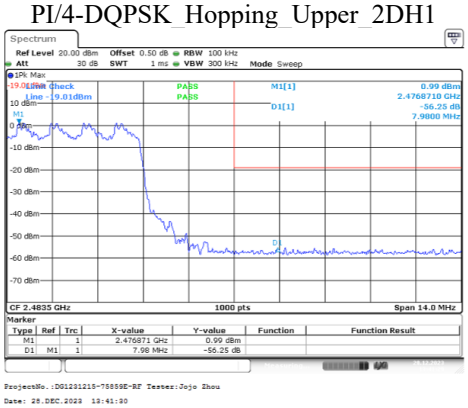
PI/4-DQPSK_High_2DH1



PI/4-DQPSK_Hopping_Lower_2DH1



PI/4-DQPSK_Hopping_Upper_2DH1



6. RF EXPOSURE EVALUATION

6.1 Applicable Standard

According to§15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

6.2 Measurement Result

The max conducted power including tune-up tolerance is 4.0dBm (2.51 mW).
[(max. power of channel, mW)/(min. test separation distance, mm)][√f(GHz)]
=2.51/5*(√2.480) = 0.8< 3.0

Result: Compliant. The stand-alone SAR evaluation is not necessary.

7. EUT PHOTOGRAPHS

Please refer to the attachment DG1231215-75859E-RF-EXP EUT external photographs and DG1231215-75859E-RF-INP EUT internal photographs.

8. TEST SETUP PHOTOGRAPHS

Please refer to the attachment DG1231215-75859E-RF-00B-TSP test setup photographs.

===== END OF REPORT =====