RF TEST REPORT

Report No.:	SET2021-11491
Product Name:	RDS AV RECEIVER
IC:	775E-K118
FCC ID:	AJDK118
Model No. :	DMH-W2700NEX
Serial Model:	DMH-W2770NEX
Applicant:	PIONEER CORPORATION
Address：	28-8, Honkomagome 2-Chome, Bunkyo-ku, Tokyo 113-0021, Japan.
Dates of Testing:	08/25/2021 —09/08/2021
Issued by:	CCIC Southern Testing Co., Ltd.
Lab Location:	Electronic Testing Building, No. 43 Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China. **Tel:** 86 755 26627338 **Fax:** 86 755 26627238

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Test Report

Product Name.....:	RDS AV RECEIVER
Brand Name.....:	Pioneer
Trade Name.....:	Pioneer
Applicant.....:	PIONEER CORPORATION
Applicant Address.....:	28-8, Honkomagome 2-Chome, Bunkyo-ku, Tokyo 113-0021, Japan
Manufacturer.....:	PIONEER CORPORATION
Manufacturer Address .....:	28-8, Honkomagome 2-Chome, Bunkyo-ku, Tokyo 113-0021, Japan
Test Standards.....:	47 CFR Part 15 Subpart C IC RSS-Gen(Issue 5, March 2019) IC RSS-247(Issue 2, Feb. 2017)
Test Result .....:	PASS

Tested by .....: 2021.09.15

Sun, Test Engineer

Reviewed by .....: 2021.09.15

Chris You, Senior Engineer

Approved by .....: 2021.09.15

Shuangwen Zhang, Manager

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Change History		
Issue	Date	Reason for change
1.0	2021.09.15	First edition
2.0	2021.09.15	Correct the Model Name and SW version

1. General Information

1.1. EUT Description

Product Name	RDS AV RECEIVER	
EUT Type	OEM devices installed in vehicles	
Hardware Version	1.0.0	
Software Version	PIO_WS01_0.1.10	
Frequency Range	BluetoothV4.2 EDR	2402MHz~2480MHz
Channel Number	Bluetooth V4.2 EDR	79
Bit Rate of Transmitter	Bluetooth V4.2 EDR	1/2/3Mbps
Modulation Type	Bluetooth V4.2 EDR	GFSK,PI/4DQPSK,8DPSK
Antenna Type	FPC antenna	
Antenna Gain	-5.6dBi	

Note 1: The EUT is a RDS AV RECEIVER, it contains Bluetooth Module operating at 2.4GHz ISM band; the frequencies allocated for the Bluetooth Module is F(MHz)=2402+1*n (0<=n<=78). The lowest, middle, highest channel numbers of the Bluetooth Module used and tested in this report are separately 0 (2402MHz), 39 (2441MHz) and 78 (2480MHz).

Note 2: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

Note 3: a. When power on, the EUT will scan the whole frequency until a Connection command from the other BT devices.

b. When receiving the signal from the other BT devices, The EUT transmit aresponse signal.

c. The other devices receive the response signal and recognize it, then send aconnection command to establish the connection.

d. After the connection establish successfully, the data transmission is beginning.At the same time, the both devices will shift frequencies in synchronization per asame pseudo randomly ordered list of hopping frequencies, the hopping rate is1600 times per second.

e. The bandwidth of the receiver, which is set to a fixed width by the software.

Note 4: Bluetooth signal has 9 packages 1DH1, 1DH3, 1DH5, 2DH1, 2DH3, 2DH5, 3DH1, 3DH3, 3DH5, DH5 package is largest, we are testing DH5 in the document.

Note 5: The antenna gain and RF adapter/cable insert loss provided by manufacture.

Note 6: The EUT is a RDS AV RECEIVER，it contains 2 models，they are DMH-W2700NEX；DMH-W2770NEX. They have the same size, appearance and internal structure, and the only difference is the model number. and DMH-W2770NEX contain an extra remote control.

1.2. Test Standards and Results

The objective of the report is to perform testing according to below standards for the EUT FCC ID/IC Certification:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C	Radio Frequency Devices
2	ANSI C63.10: 2013	American National Standard for Testing Unlicensed Wireless Devices
3	RSS-Gen (Issue 5, March 2019)	General Requirements for Compliance Of Radio Apparatus
4	RSS-247 (Issue 2, Feb. 2017)	Digital Transmission System(DTSs) Frequency Hopping System(FHSs) and Licence-Exempt Local Area Network (LE-LAN) Device

Test detailed items/section required by FCC /IC rules and results are as below:

No.	Section in CFR 47	IC Rule	Description	Result
1	15.203	RSS-Gen, 6.8	Antenna Requirement	PASS
2	15.247(a)	RSS-247, 5.1(d)	Number of Hopping Frequency	PASS
3	15.247(b)	RSS-247, 5.1(b)	Peak Output Power and EIRP	PASS
4	15.247(a)	RSS-247, 5.1(b) RSS-GEN, 6.7	20dB and 99% Bandwidth	PASS
5	15.247(a)	RSS-247, 5.1(b)	Carrier Frequency Separation	PASS
6	15.247(a)	RSS-247, 5.1(d)	Time of Occupancy (Dwell time)	PASS
7	15.247(d)	RSS-247, 5.5	Conducted Spurious Emission	PASS
8	15.247(d)	RSS-247, 5.5	Conducted Band Edge	PASS
9	15.207	RSS-Gen, 8.8	Conducted Emission	PASS
10	15.209 15.205 15.247(c)	RSS-247, 5.5	Radiated Band Edges and Spurious Emission	PASS

Note: The tests were performed according to the method of measurements prescribed in ANSI C63.10- 2013.

1.3. EUT Operation Test Setup

For RF test items, an engineering test program was provided and enable to make EUT transmitting.

1.4. Frequency Hopping System Requirements

1.4.1. 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 it shops ets 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.

1.4.2. Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.
This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitters witches 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 ANSI C63.10-2013 and FCC Part 15.247 rule.

Carrier Frequency and channel List:

Channel	Frequency(MHz)
0	2402
1	2403
…	…
39	2441
40	2442
…	…
77	2479
78	2480

Note: F(MHz)=2402+1*n (0<=n<=78)

1.5. Facilities and Accreditations

1.5.1. Facilities

CNAS-Lab Code: L1659

CCIC-SET is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659.

FCC-Registration No.: 406086

CCIC Southern Testing Co., Ltd EMC Laboratory has been registered and fully described in a re port filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration Number: 406086, valid time is until April.19th, 2023

ISED Registration: 11185A-1

CAB identifier: CN0064

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engi neering Bureau of Industry Canada for the performance of radiated measurements with Registrati on No. 11185A-1 on Aug. 04, 2016, valid time is until Jun. 30th, 2023.

A2LA Code: 5721.01

CCIC-SET is a third party testing organization accredited by A2LA according to ISO/IEC 17025. The accreditation certificate number is 5721.01.

1.5.2. Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86KPa-106KPa

2. Test Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to 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.

And according to FCC 47 CFR Section 15.247(c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

According to RSSGEN 6.8, The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

2.1.2. Antenna Information

Antenna Category: Internal antenna

An Internal antenna was soldered to the antenna port of EUT via an adaptor cable, can't be removed.

Antenna General Information:

No.	EUT	Operating frequency range	Ant. Type	Ant. Gain
1	RDS AV RECEIVER	2402-2480MHz	FPC	-5.6dBi

2.1.3. Result: comply

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

2.2. Number of Hopping Frequency

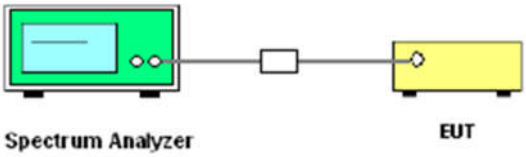
2.2.1. Limit of Number of Hopping Frequency

Frequency hopping systems operating in the 2400MHz to 2483.5MHz bands shall use at least 15 hopping frequencies.

2.2.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.2.3. Test Setup



2.2.4. Test Procedure

1. The testing follows ANSI C63.10-2013 Clause 7.8.3

2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

3. Set to the maximum power setting and enable the EUT transmit continuously.

4. Enable the EUT hopping function.

5. Use the following spectrum analyzer settings: Span = the frequency band of operation;

   Set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth,

   Whichever is smaller. VBW≥RBW, Trace = max hold, Sweep=auto, Detector function=peak.

6. The number of hopping frequency used is defined as the number of total channel.

7. Record the measurement data derived from spectrum analyzer.

2.2.5. Test Results of Number of Hopping Frequency

Please refer to Appendix A for detail

2.3. Peak Output Power and EIRP

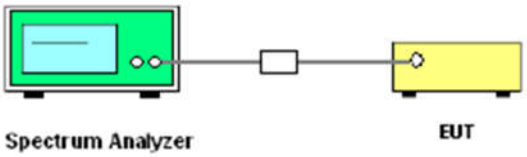
2.3.1. Limit of Peak Output Power and EIRP

Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (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 the5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band0.125 watts , The e.i.r.p. shall not exceed 4 W.
Fequency 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

2.3.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.3.3. Test Setup



2.3.4. Test Procedures

1. The testing follows ANSI C63.10-2013 Clause 7.8.5
2. The RF output of EUT was connected to Spectrum analyzer by RF cable and attenuator. The pathloss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

2.3.5. Test Result of Output Power and EIRP

Please refer to Appendix A for detail

2.4. 20dB and 99% Bandwidth

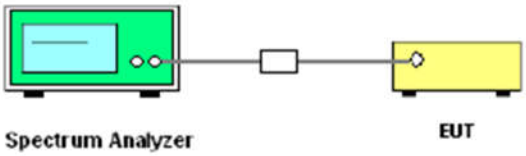
2.4.1. Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*log1% = 20dB) taking the total RF output power.

2.4.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.4.3. Test Setup



2.4.4. Test Procedure

1. The testing follows ANSI C63.10-2013 Clause 6.9.2
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings for 20dB and 99% Bandwidth measurement.

   Span = approximately 2 to 5 times the OBW, centered on a hopping channel;

   RBW≥1% to 5% of the OBW; VBW shall be approximately three times RBW;

   Sweep = auto; Detector function = peak; Trace = max hold.
5. Measure and record the results in the test report.

2.4.5. Test Results of 20dB and 99%Bandwidth

Please refer to Appendix A for detail

2.5. Carried Frequency Separation

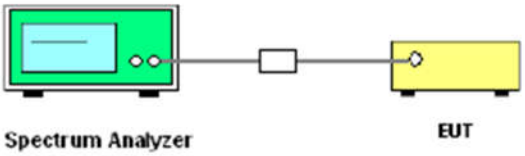
2.5.1. Limit of Carried Frequency Separation

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

2.5.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.5.3. Test Setup



2.5.4. Test Procedure

1. The testing follows ANSI C63.10-2013 Clause 7.8.2.

2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

3. Set to the maximum power setting and enable the EUT transmit continuously.

4. Enable the EUT hopping function.

5. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels; RBW: Start with the RBW set to approximately 30% of the channel spacing;

6. Measure and record the results in the test report.

2.5.5. Test Results of Carried Frequency Separation

Please refer to Appendix A for detail

2.6. Dwell time

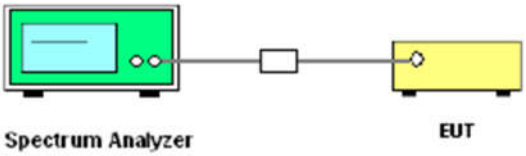
2.6.1. Limit of Dwell Time

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.

2.6.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.6.3. Test Setup



2.6.4. Test Procedure

1. The testing follows ANSI C63.10-2013 Clause 7.8.4.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel; VBW≥RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

2.6.5. Test Results of Dwell Time

Please refer to Appendix A for detail

2.7. Conducted Spurious Emissions

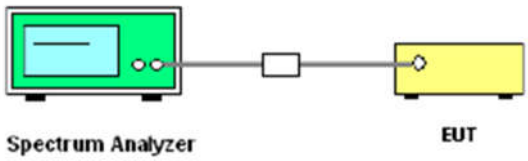
2.7.1. Limit of Spurious Emission

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

2.7.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.7.3. Test Setup



2.7.4. Test Procedure

1. The testing follows the guidelines in Spurious RF Conducted Emissions of ANSI C63.10-2013 Clause 7.8.8.

2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. Thepath loss was compensated to the results for each measurement.

3. Set to the maximum power setting and enable the EUT transmit continuously.

4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs mustbe at least 20 dB down from the highest emission level within the authorized band as measuredwith a 100 kHz RBW.

5. Measure and record the results in the test report.

6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

2.7.5. Test Results of Conducted Spurious Emissions

Please refer to Appendix A for detail

2.8. Conducted Band Edge

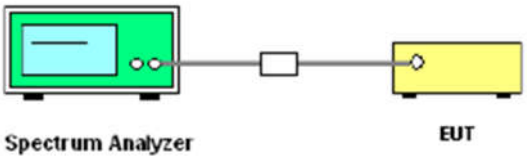
2.8.1. Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

2.8.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.8.3. Test Setup



2.8.1. Test Procedure

1. The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of ANSI C63.10-2013 Clause 7.8.6.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz (≥1% span=10MHz), VBW = 300kHz (≥RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

2.8.2. Test Results of Conducted Band Edge

Please refer to Appendix A for detail

2.9. Conducted Emission

2.9.1. Limit of Conducted Emission

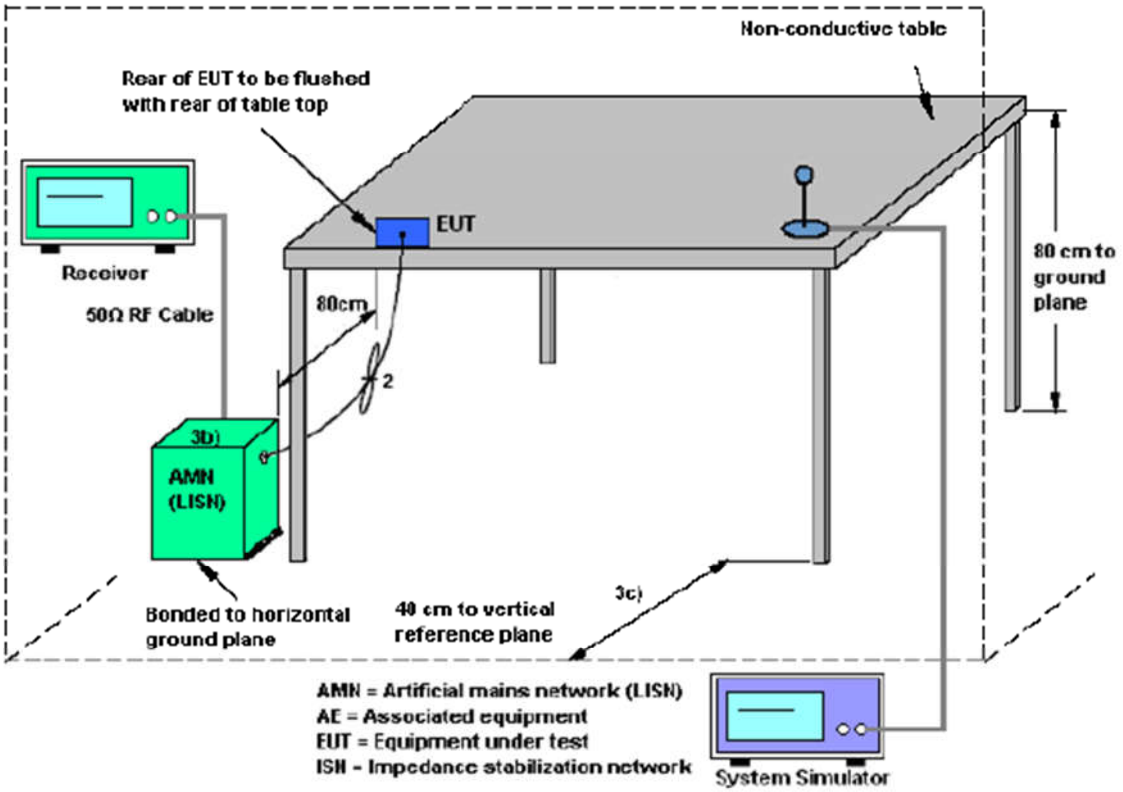
For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

2.9.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.9.3. Test Setup

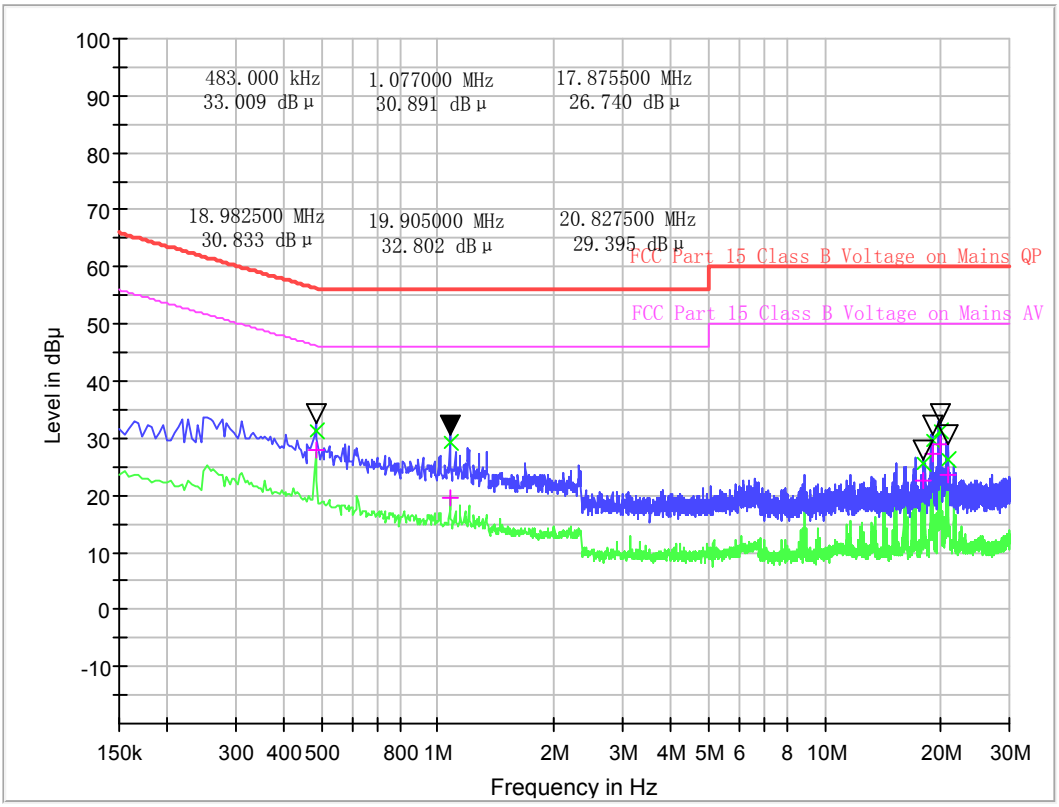


2.9.4. Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 micrometry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

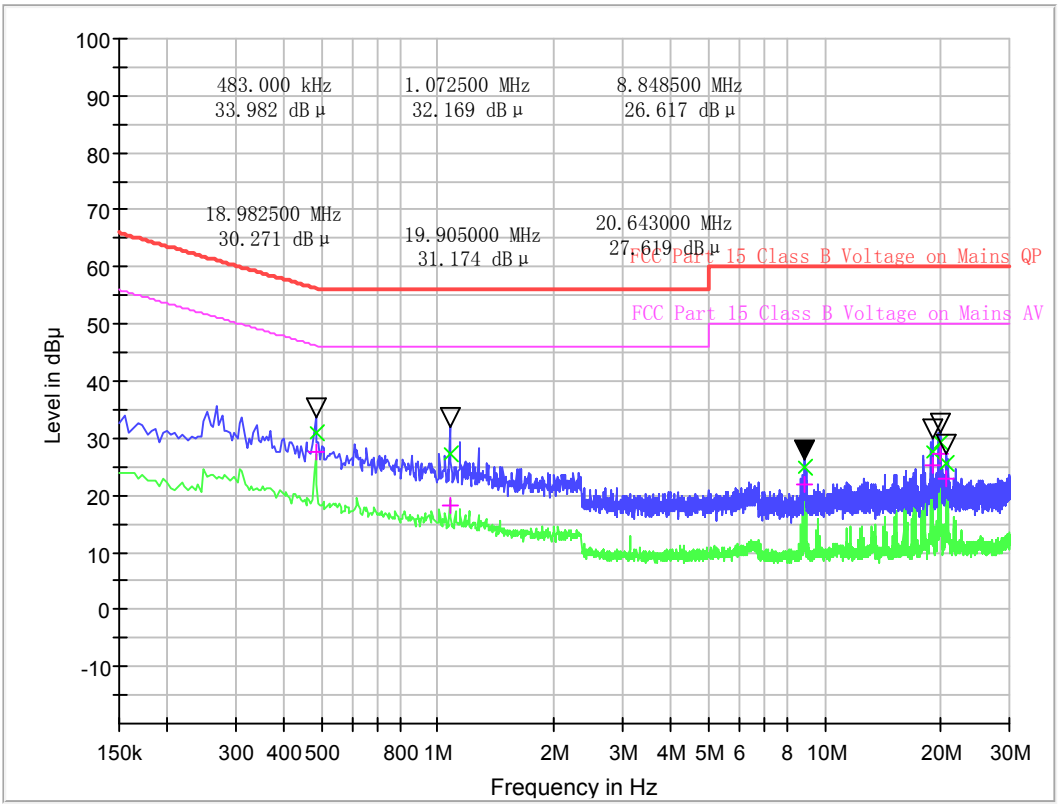
2.9.3. Test Results of Conducted Emission

The EUT configuration of the emission tests is Bluetooth Link + DC Power on



(Plot A: L Phase)

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dBµV)
0.483000	31.26	27.95	0.1	10.1	25.03	56.3	18.34	46.3
1.077000	29.19	19.47	0.1	10.1	26.81	56.0	26.53	46.0
17.875500	25.47	22.56	0.6	10.6	34.53	60.0	27.44	50.0
18.982500	29.45	27.30	0.6	10.6	30.55	60.0	22.70	50.0
19.905000	31.28	29.06	0.6	10.6	28.72	60.0	20.94	50.0
20.827500	26.41	23.43	0.7	10.7	33.59	60.0	26.57	50.0



(Plot B: N Phase)

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dBµV)
0.483000	30.91	27.47	0.1	10.1	25.38	56.3	18.82	46.3
1.072500	27.34	18.15	0.1	10.1	28.66	56.0	27.85	46.0
8.848500	24.90	21.97	0.1	10.1	35.10	60.0	28.03	50.0
18.982500	27.72	25.37	0.1	10.1	32.28	60.0	24.63	50.0
19.905000	29.44	27.15	0.2	10.2	30.56	60.0	22.85	50.0
20.643000	25.56	22.79	0.2	10.2	34.44	60.0	27.21	50.0

Test Result: PASS

Note: Correction factor=Cabel loss+ attenuation factor

attenuation factor=10dB

2.10. Radiated Band Edges and Spurious Emission

2.10.1. Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spuriousmust be at least 20 dB below the highest emission level within the authorized band. In addition,radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209limits as below.

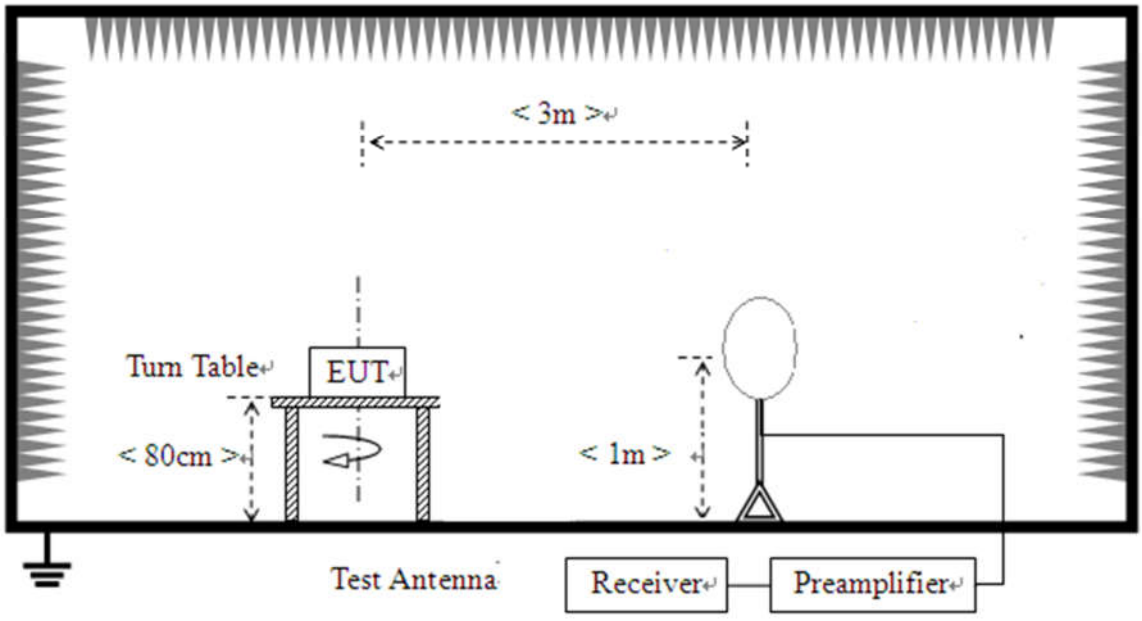
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

2.10.2. Measuring Instruments

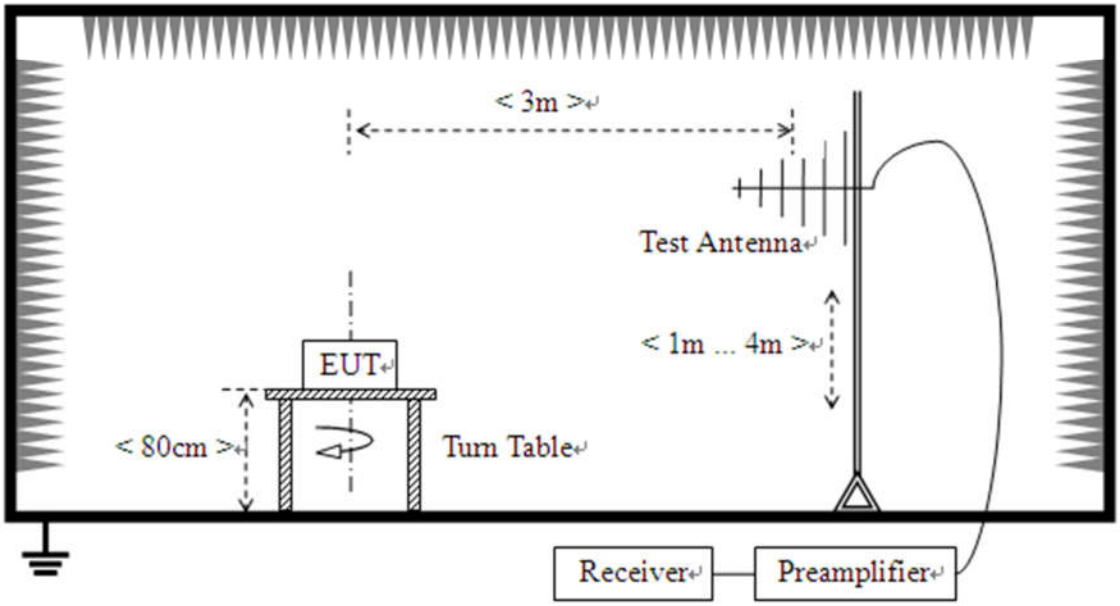
The measuring equipment is listed in the section 3 of this test report.

2.10.3. Test Setup

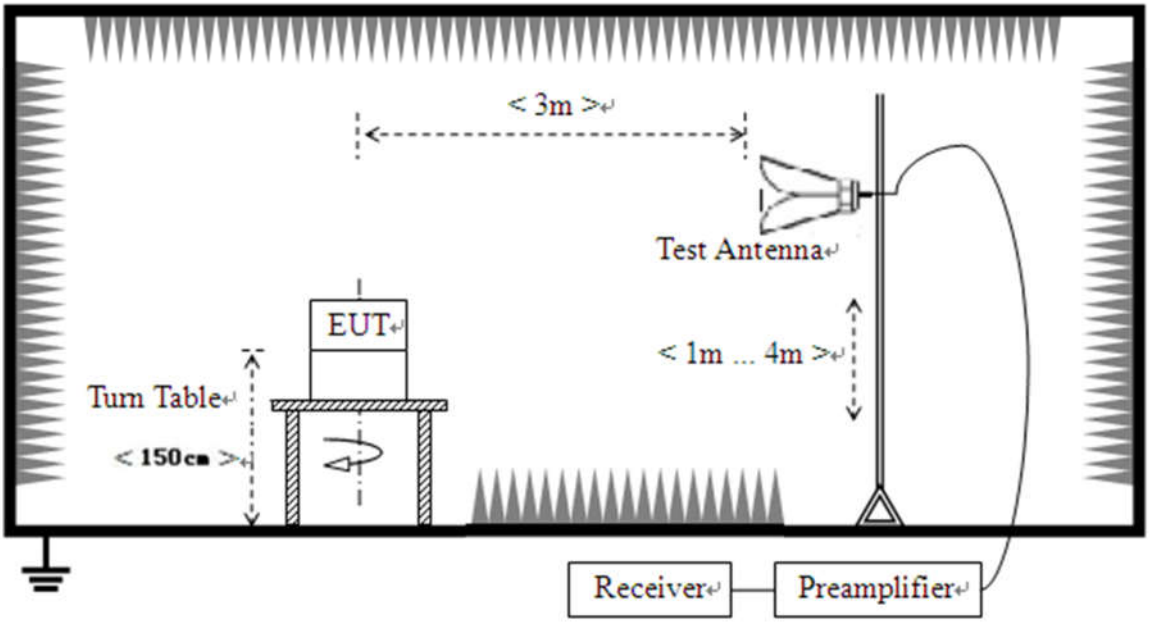
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



2.10.4. Test Procedure

1. The EUT was placed on a turntable 0.8m below 1GHz and 1.5m above 1GHz above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on thetop of a variable height antenna tower.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:

(1) Span shall wide enough to fully capture the emission being measured;

(2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW≥RBW; Sweep = auto;Detector function = peak; Trace = max hold for peak

(3) For average measurement: use duty cycle correction factor method per 15.35(c).

Duty cycle = On time/100 milliseconds

On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+Nn*Ln$

Where N_1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.

Average Emission Level = Peak Emission Level + 20*log(Duty cycle)

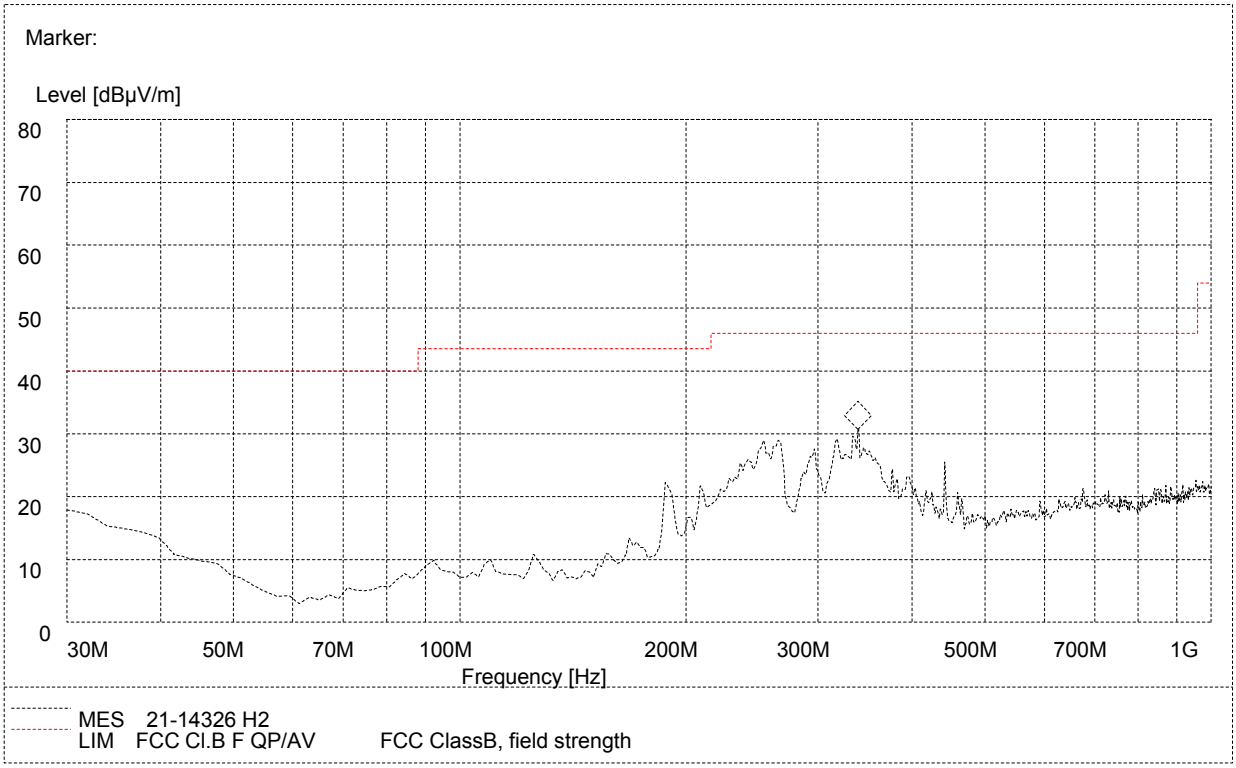
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

2.10.5. Test Results of Radiated Band Edge and Spurious Emission

For 9 KHz to 30MHz

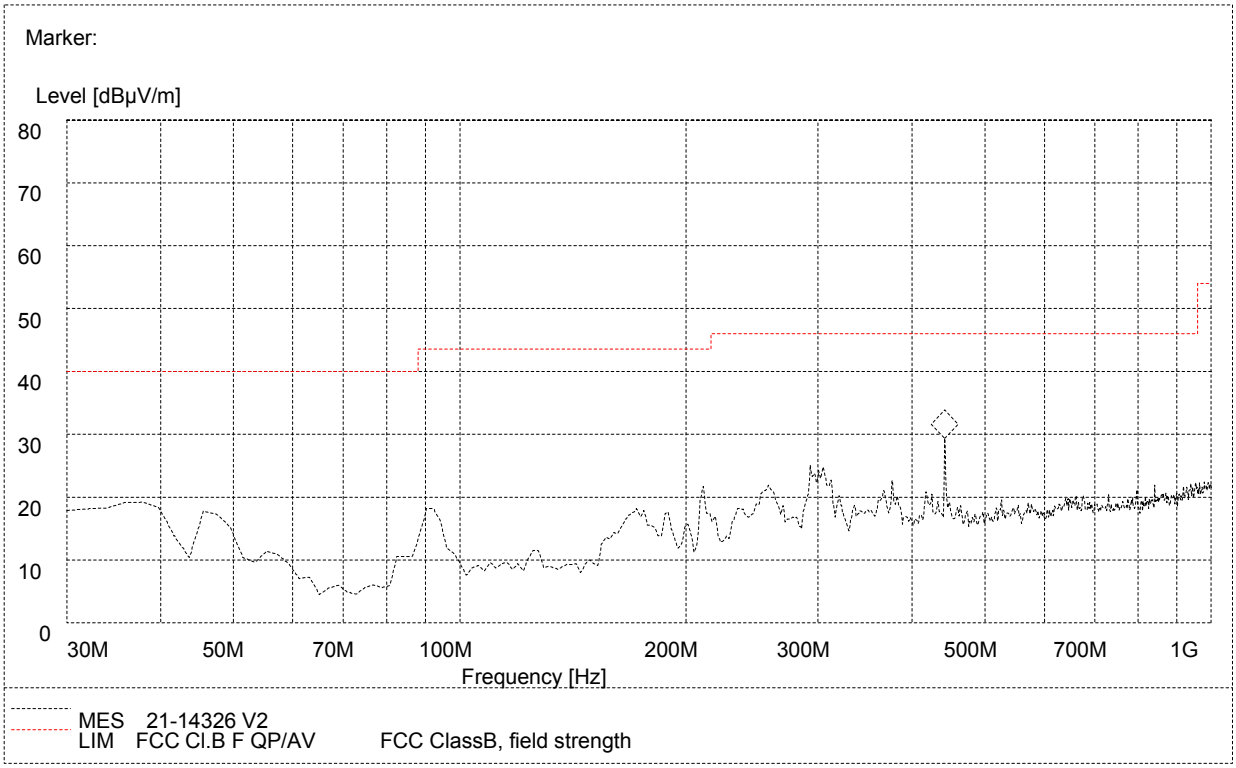
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

For 30MHz to 1000MHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Correction Factor (dB/m)	Antenna height (cm)	Limit (dBµV/m)	Margin	Antenna	Verdict
30.000000	16.82	120.000	17.9	100.0	40.0	23.18	Horizontal	Pass
187.050000	22.04	120.000	13.7	100.0	43.5	21.46	Horizontal	Pass
253.050000	28.05	120.000	12.3	100.0	46.0	17.95	Horizontal	Pass
265.210000	27.82	120.000	17.5	100.0	46.0	18.18	Horizontal	Pass
317.680000	28.69	120.000	17.5	100.0	46.0	17.31	Horizontal	Pass
339.070000	29.82	120.000	23.9	100.0	46.0	16.18	Horizontal	Pass

(Plot A: 30MHz to 1GHz, Antenna Horizontal)



Frequency (MHz)	QuasiPeak (dB µ V/m)	Bandwidth (kHz)	Correction Factor (dB/m)	Antenna height (cm)	Limit (dB µ V/m)	Margin	Antenna	Verdict
37.250000	18.93	120.000	17.90	100.0	40.0	21.07	Vertical	Pass
45.050000	16.82	120.000	10.60	100.0	43.5	26.68	Vertical	Pass
187.830000	17.20	120.000	10.30	100.0	43.5	26.3	Vertical	Pass
171.830000	17.83	120.000	12.50	100.0	43.5	25.67	Vertical	Pass
210.780000	20.83	120.000	17.50	100.0	43.5	22.67	Vertical	Pass
442.010000	28.20	120.000	17.50	100.0	46.0	17.8	Vertical	Pass

(Plot B: 30MHz to 1GHz, Antenna Vertical)

For 1GHz to 25GHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（GFSK_2402MHz）												
No.	Fre. (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2390.00	48.52	PK	74.00	-25.48	1.60	200.00	47.22	5.20	28.60	32.50	1.30
2	2390.00	36.89	AV	54.00	-17.11	1.60	200.00	35.59	5.20	28.60	32.50	1.30
3	4804.00	52.22	PK	74.00	-21.78	1.60	200.00	45.82	7.40	30.40	31.40	6.40
4	4804.00	40.46	AV	54.00	-13.54	1.60	200.00	34.06	7.40	30.40	31.40	6.40
5	7206.00	53.69	PK	74.00	-20.31	1.60	200.00	44.39	9.90	31.50	32.10	9.30
6	7206.00	41.81	AV	54.00	-12.19	1.60	200.00	32.51	9.90	31.50	32.10	9.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（GFSK_2402MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2390.00	49.65	PK	74.00	-24.35	17.00	280.00	48.35	5.20	28.60	32.50	1.30
2	2390.00	38.16	AV	54.00	-15.84	17.00	280.00	36.86	5.20	28.60	32.50	1.30
3	4804.00	52.55	PK	74.00	-21.45	17.00	280.00	46.15	7.40	30.40	31.40	6.40
4	4804.00	39.92	AV	54.00	-14.08	17.00	280.00	33.52	7.40	30.40	31.40	6.40
5	7206.00	53.06	PK	74.00	-20.94	17.00	280.00	43.76	9.90	31.50	32.10	9.30
6	7206.00	41.38	AV	54.00	-12.62	17.00	280.00	32.08	9.90	31.50	32.10	9.30

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（GFSK_2441MHz）												
No.	Fre. (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	4882.00	52.33	PK	74.00	-21.67	1.60	200.00	45.93	6.70	31.20	31.50	6.40
2	4882.00	39.95	AV	54.00	-14.05	1.60	200.00	33.55	6.70	31.20	31.50	6.40
3	7323.00	53.06	PK	74.00	-20.94	1.60	200.00	43.66	10.10	31.50	32.30	9.40
4	7323.00	39.78	AV	54.00	-14.22	1.60	200.00	30.38	10.10	31.50	32.30	9.40
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（GFSK_2441MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	4882.00	48.99	PK	74.00	-25.01	1.70	280.00	42.59	6.70	31.20	31.50	6.40
2	4882.00	36.25	AV	54.00	-17.75	1.70	280.00	29.85	6.70	31.20	31.50	6.40
3	7323.00	52.64	PK	74.00	-21.36	1.70	280.00	43.24	10.10	31.50	32.30	9.40
4	7323.00	39.99	AV	54.00	-14.01	1.70	280.00	30.59	10.10	31.50	32.30	9.40

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（GFSK_2480MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2483.50	48.52	PK	74.00	-25.48	1.60	200.00	45.92	5.70	28.70	31.80	2.60
2	2483.50	38.41	AV	54.00	-15.59	1.60	200.00	35.81	5.70	28.70	31.80	2.60
3	4960.00	52.00	PK	74.00	-22.00	1.60	200.00	45.30	7.00	31.20	31.50	6.70
4	4960.00	40.87	AV	54.00	-13.13	1.60	200.00	34.17	7.00	31.20	31.50	6.70
5	7440.00	52.69	PK	74.00	-21.31	1.60	200.00	43.19	10.20	31.60	32.40	9.50
6	7440.00	40.71	AV	54.00	-13.29	1.60	200.00	31.21	10.20	31.60	32.40	9.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（GFSK_2480MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2483.50	47.95	PK	74.00	-26.05	1.70	280.00	45.35	5.70	28.70	31.80	2.60
2	2483.50	36.93	AV	54.00	-17.07	1.70	280.00	34.33	5.70	28.70	31.80	2.60
3	4960.00	51.22	PK	74.00	-22.78	1.70	280.00	44.52	7.00	31.20	31.50	6.70
4	4960.00	41.12	AV	54.00	-12.88	1.70	280.00	34.42	7.00	31.20	31.50	6.70
5	7440.00	52.95	PK	74.00	-21.05	1.70	280.00	43.45	10.20	31.60	32.40	9.50
6	7440.00	41.89	AV	54.00	-12.11	1.70	280.00	32.39	10.20	31.60	32.40	9.50

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（pi/4DQPSK_2402MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2390.00	47.52	PK	74.00	-26.48	1.60	300.00	46.22	5.20	28.60	32.50	1.30
2	2390.00	34.55	AV	54.00	-19.45	1.60	300.00	33.25	5.20	28.60	32.50	1.30
3	4804.00	52.64	PK	74.00	-21.36	1.60	300.00	46.24	6.70	31.20	31.50	6.40
4	4804.00	40.66	AV	54.00	-13.34	1.60	300.00	34.26	6.70	31.20	31.50	6.40
5	7206.00	53.95	PK	74.00	-20.05	1.60	300.00	39.05	16.00	30.90	32.00	14.90
6	7206.00	42.11	AV	54.00	-11.89	1.60	300.00	27.21	16.00	30.90	32.00	14.90

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（pi/4DQPSK_2402MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2390.00	47.95	PK	74.00	-26.05	1.70	280.00	46.65	5.20	28.60	32.50	1.30
2	2390.00	34.81	AV	54.00	-19.19	1.70	280.00	33.51	5.20	28.60	32.50	1.30
3	4804.00	51.33	PK	74.00	-22.67	1.70	280.00	44.93	6.70	31.20	31.50	6.40
4	4804.00	39.35	AV	54.00	-14.65	1.70	280.00	32.95	6.70	31.20	31.50	6.40
5	7206.00	52.47	PK	74.00	-21.53	1.70	280.00	37.57	16.00	30.90	32.00	14.90
6	7206.00	41.42	AV	54.00	-12.58	1.70	280.00	26.52	16.00	30.90	32.00	14.90

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（pi/4DQPSK_2441MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	4882.00	51.62	PK	74.00	-22.38	1.70	120.00	45.22	6.70	31.20	31.50	6.40
2	4882.00	39.88	AV	54.00	-14.12	1.70	120.00	33.48	6.70	31.20	31.50	6.40
3	7323.00	52.00	PK	74.00	-22.00	1.70	120.00	42.60	10.10	31.50	32.30	9.40
4	7323.00	40.85	AV	54.00	-13.15	1.70	120.00	31.45	10.10	31.50	32.30	9.40
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（pi/4DQPSK_2441MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	4882.00	51.48	PK	74.00	-22.52	1.80	300.00	45.08	6.70	31.20	31.50	6.40
2	4882.00	40.42	AV	54.00	-13.58	1.80	300.00	34.02	6.70	31.20	31.50	6.40
3	7323.00	52.33	PK	74.00	-21.67	1.80	300.00	42.93	10.10	31.50	32.30	9.40
4	7323.00	41.29	AV	54.00	-12.71	1.80	300.00	31.89	10.10	31.50	32.30	9.40

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（pi/4DQPSK_2480MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2483.50	47.65	PK	74.00	-26.35	1.60	280.00	45.05	5.70	28.70	31.80	2.60
2	2483.50	37.18	AV	54.00	-16.82	1.60	280.00	34.58	5.70	28.70	31.80	2.60
3	4960.00	51.65	PK	74.00	-22.35	1.60	280.00	44.95	7.00	31.20	31.50	6.70
4	4960.00	40.29	AV	54.00	-13.71	1.60	280.00	33.59	7.00	31.20	31.50	6.70
5	7440.00	52.59	PK	74.00	-21.41	1.60	280.00	43.09	10.20	31.60	32.40	9.50
6	7440.00	41.44	AV	54.00	-12.56	1.60	280.00	31.94	10.20	31.60	32.40	9.50
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（pi/4DQPSK_2480MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2483.50	48.52	PK	74.00	-25.48	1.70	280.00	45.92	5.70	28.70	31.80	2.60
2	2483.50	38.19	AV	54.00	-15.81	1.70	280.00	35.59	5.70	28.70	31.80	2.60
3	4960.00	51.69	PK	74.00	-22.31	1.70	280.00	44.99	7.00	31.20	31.50	6.70
4	4960.00	41.73	AV	54.00	-12.27	1.70	280.00	35.03	7.00	31.20	31.50	6.70
5	7440.00	52.88	PK	74.00	-21.12	1.70	280.00	43.38	10.20	31.60	32.40	9.50
6	7440.00	41.72	AV	54.00	-12.28	1.70	280.00	32.22	10.20	31.60	32.40	9.50

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（8DPSK_2402MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2390.00	48.95	PK	74.00	-25.05	1.50	280.00	47.65	5.20	28.60	32.50	1.30
2	2390.00	35.66	AV	54.00	-18.34	1.50	280.00	34.36	5.20	28.60	32.50	1.30
3	4804.00	51.00	PK	74.00	-23.00	1.50	280.00	44.60	7.40	30.40	31.40	6.40
4	4804.00	38.25	AV	54.00	-15.75	1.50	280.00	31.85	7.40	30.40	31.40	6.40
5	7206.00	52.88	PK	74.00	-21.12	1.50	280.00	43.58	9.90	31.50	32.10	9.30
6	7206.00	40.89	AV	54.00	-13.11	1.50	280.00	31.59	9.90	31.50	32.10	9.30

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（8DPSK_2402MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2390.00	49.36	PK	74.00	-24.64	1.50	280.00	48.06	5.20	28.60	32.50	1.30
2	2390.00	36.02	AV	54.00	-17.98	1.50	280.00	34.72	5.20	28.60	32.50	1.30
3	4804.00	51.47	PK	74.00	-22.53	1.50	280.00	45.07	7.40	30.40	31.40	6.40
4	4804.00	39.82	AV	54.00	-14.18	1.50	280.00	33.42	7.40	30.40	31.40	6.40
5	7206.00	54.02	PK	74.00	-19.98	1.50	280.00	44.72	9.90	31.50	32.10	9.30
6	7206.00	42.23	AV	54.00	-11.77	1.50	280.00	32.93	9.90	31.50	32.10	9.30

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（8DPSK_2441MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	4882.00	51.58	PK	74.00	-22.42	1.50	280.00	45.18	6.70	31.20	31.50	6.40
2	4882.00	40.33	AV	54.00	-13.67	1.50	280.00	33.93	6.70	31.20	31.50	6.40
3	7323.00	53.24	PK	74.00	-20.76	1.50	280.00	43.84	10.10	31.50	32.30	9.40
4	7323.00	41.98	AV	54.00	-12.02	1.50	280.00	32.58	10.10	31.50	32.30	9.40
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（8DPSK_2441MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	4882.00	49.95	PK	74.00	-24.05	1.70	300.00	43.55	6.70	31.20	31.50	6.40
2	4882.00	38.60	AV	54.00	-15.40	1.70	300.00	32.20	6.70	31.20	31.50	6.40
3	7323.00	52.14	PK	74.00	-21.86	1.70	300.00	42.74	10.10	31.50	32.30	9.40
4	7323.00	40.73	AV	54.00	-13.27	1.70	300.00	31.33	10.10	31.50	32.30	9.40

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（8DPSK_2480MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2483.50	48.52	PK	74.00	-25.48	1.60	280.00	45.92	5.70	28.70	31.80	2.60
2	2483.50	36.20	AV	54.00	-17.80	1.60	280.00	33.60	5.70	28.70	31.80	2.60
3	4960.00	51.62	PK	74.00	-22.38	1.60	280.00	45.22	6.70	31.20	31.50	6.40
4	4960.00	39.63	AV	54.00	-14.37	1.60	280.00	33.23	6.70	31.20	31.50	6.40
5	7440.00	52.58	PK	74.00	-21.42	1.60	280.00	37.68	16.00	30.90	32.00	14.90
6	7440.00	41.43	AV	54.00	-12.57	1.60	280.00	26.53	16.00	30.90	32.00	14.90
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（8DPSK_2480MHz）												
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV/m)	Cab. Loss (dB)	Ant. Factor (dB)	Pre. Amp. (dB)	Cor. Factor (dB/m)
1	2483.50	48.52	PK	74.00	-25.48	1.70	300.00	45.92	5.70	28.70	31.80	2.60
2	2483.50	37.38	AV	54.00	-16.62	1.70	300.00	34.78	5.70	28.70	31.80	2.60
3	4960.00	51.95	PK	74.00	-22.05	1.70	300.00	45.55	6.70	31.20	31.50	6.40
4	4960.00	40.53	AV	54.00	-13.47	1.70	300.00	34.13	6.70	31.20	31.50	6.40
5	7440.00	53.00	PK	74.00	-21.00	1.70	300.00	38.10	16.00	30.90	32.00	14.90
6	7440.00	41.14	AV	54.00	-12.86	1.70	300.00	26.24	16.00	30.90	32.00	14.90

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

3. List of measuring equipment

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	EMI TEST RECEIVER	KEYSIGHT	N9038A	A141202036	2020.09.21	2021.09.20
2	Power Meter	R&S	NRP-Z31	102872	2021.04.26	2022.04.25
3	TURNTABLE	ETS	2088	2149	N/A	N/A
4	ANTENNA MAST	ETS	2075	2346	N/A	N/A
5	EMI TEST Software	R&S	ESK1	N/A	N/A	N/A
6	Horn antenna (18GHz~26.5GHz)	AR	AT4003A	325306	2020.09.16	2022.09.15
7	Amplifier 30M~1GHz	MILMEGA	80RF1000-10004	A140101634	2021.01.26	2022.01.25
8	Amplifier 1G~18GHz	MILMEGA	AS0104R-800/400	A160302517	2021.01.26	2022.01.25
9	High pass filter	Compliance Direction systems	BSU-6	34202	2020.11.10	2021.11.09
10	Horn Antenna	R&S	HF906	A0304225	2019.04.17	2022.04.16
11	Horn Antenna	R&S	ESIB7	A0501375	2020.06.24	2022.06.22
12	ULTRA-BROADBAND ANTENNA	SCHWARZBECK	VULB9160	A0805560	2019.05.24	2022.05.23
13	Passive Loop Antenna	R&S	HFH2-Z2	100047	2019.04.26	2022.04.25
14	Temperature chamber	TABAI	PS-232	A8708054	2020.10.30	2021.10.29
15	Spectrum Analyzer	KEYSIGHT	N9030A	A160702554	2021.04.26	2022.04.25
16	Power Supply	R&S	ESIB26	A0304218	2021.01.04	2022.01.03
17	LISN	ROHDE&SCHWARZ	ENV216	A140701847	2020.09.22	2021.09.21
18	Test software	ECIT	Eagle	V2.0	N/A	N/A
19	Horn antenna (26.5GHz~40GHz)	R&S	Oct-60	A0902600	2020.09.27	2023.09.26
20	Pre-Amplifier (26.5GHz~40GHz)	R&S	Oct-60 S/N1360-2715	A0902600	2020.09.27	2023.09.26
21	Pre-Amplifier (18GHz~26.5GHz)	R&S	Sep-60 S/N1299056	A0902599	2020.09.27	2023.09.26

4. Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence . The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Emission Measurement (150KHz~30MHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	2.8dB

Uncertainty of Radiated Emission Measurement (30MHz~1GHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	3.91dB

Uncertainty of Radiated Emission Measurement (1GHz~18GHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	4.5dB

Uncertainty of Radiated Emission Measurement (18GHz~40GHz)

Measuring Uncertainty for a level of confidence of 95%(U=2Uc(y))	4.9dB

Appendix A

RF Output Power and EIRP
Test Result and Data

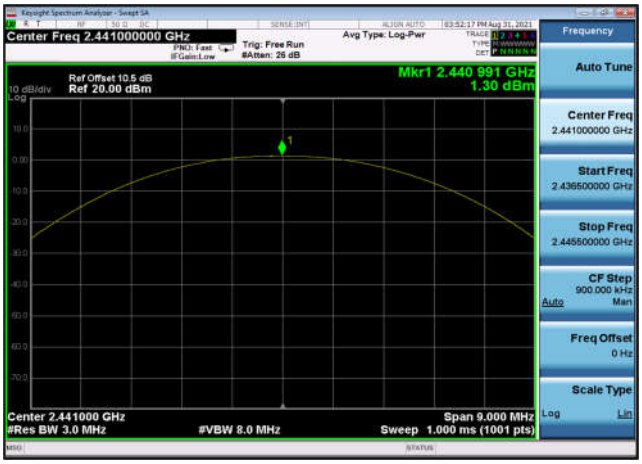
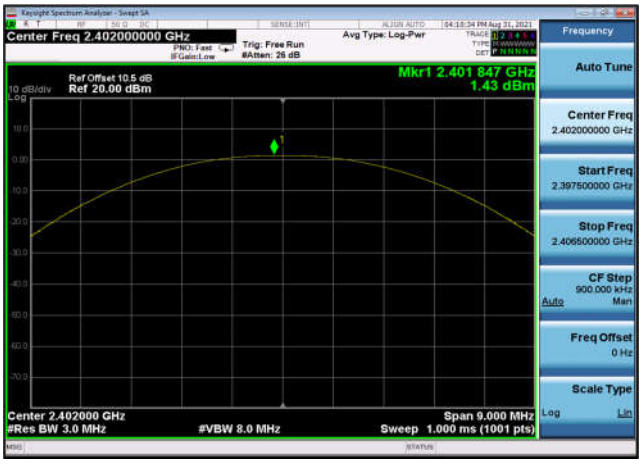
BT Maximum Conducted Output Power					
Mode	Test Frequency	Packet Type	Power(dBm)	Limit(dBm)	Result
GFSK	2402	DH5	0.76	20.9	Pass
GFSK	2441	DH5	1.30	20.9	Pass
GFSK	2480	DH5	1.71	20.9	Pass
pi/4DQPSK	2402	2DH5	1.43	20.9	Pass
pi/4DQPSK	2441	2DH5	2.21	20.9	Pass
pi/4DQPSK	2480	2DH5	2.66	20.9	Pass
8DPSK	2402	3DH5	1.99	20.9	Pass
8DPSK	2441	3DH5	2.69	20.9	Pass
8DPSK	2480	3DH5	3.18	20.9	Pass

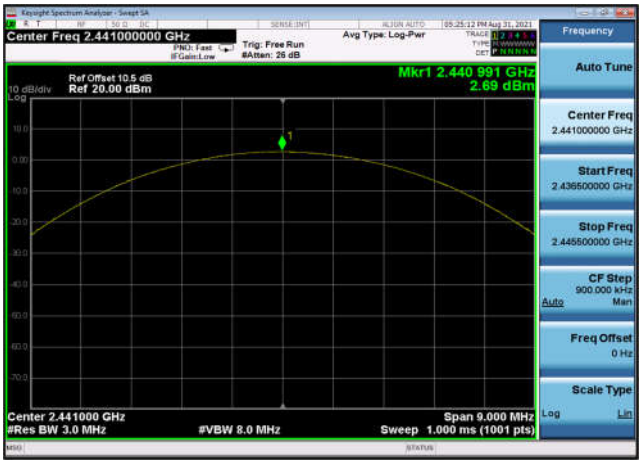
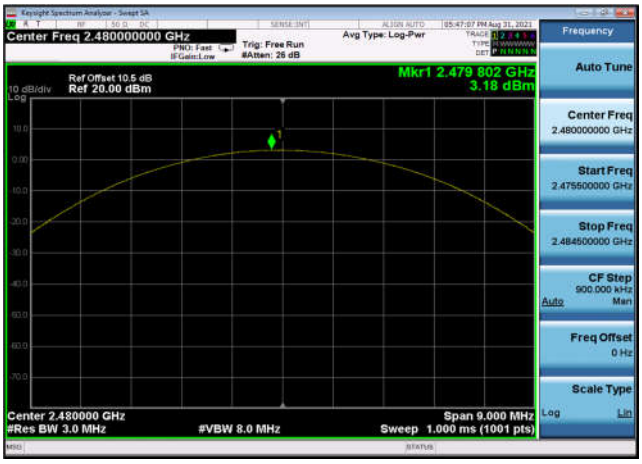
BT EIRP					
Mode	Test Frequency	Packet Type	EIRP(dBm)	Limit(dBm)	Result
GFSK	2402	DH5	-4.84	36	Pass
GFSK	2441	DH5	-4.30	36	Pass
GFSK	2480	DH5	-3.89	36	Pass
pi/4DQPSK	2402	2DH5	-4.17	36	Pass
pi/4DQPSK	2441	2DH5	-3.39	36	Pass
pi/4DQPSK	2480	2DH5	-2.94	36	Pass
8DPSK	2402	3DH5	-3.61	36	Pass
8DPSK	2441	3DH5	-2.91	36	Pass
8DPSK	2480	3DH5	-2.42	36	Pass

EIRP= Conducted Output Power+Antenna Gain

Antenna Gain：-5.6dBi

Test Plots

Output Power：GFSK,2402MHz,DH5	Output Power：GFSK,2441MHz,DH5
	
Output Power：GFSK,2480MHz,DH5	**Output Power：DQPSK,2402MHz,2DH5**
	
Output Power：DQPSK,2441MHz,2DH5	**Output Power：DQPSK,2480MHz,2DH5**
	

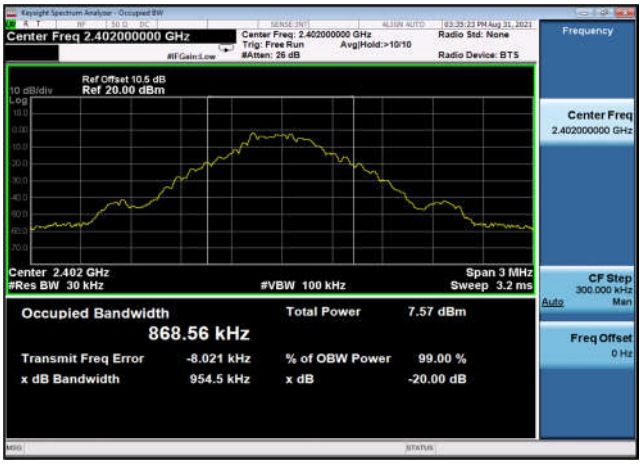
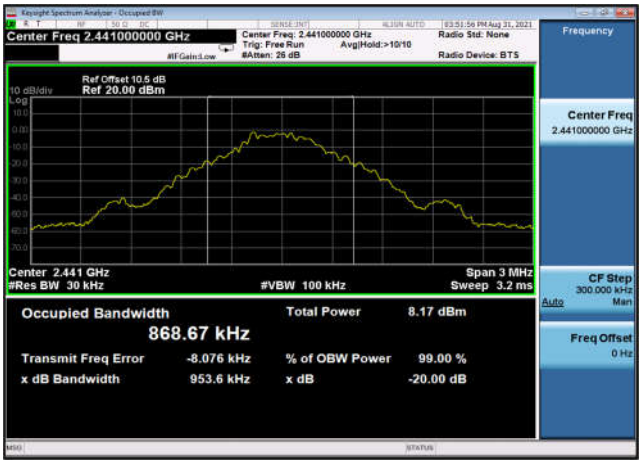
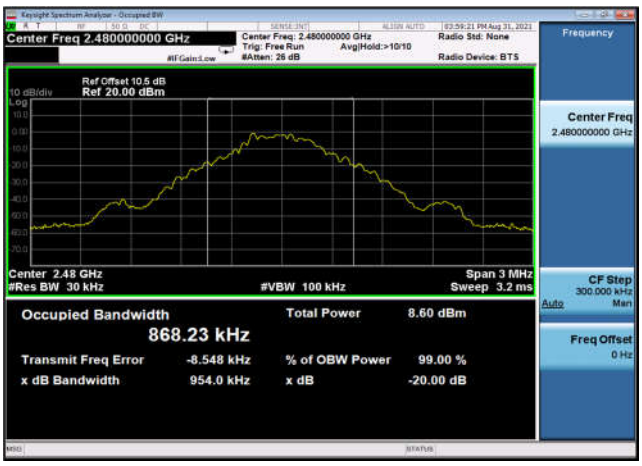
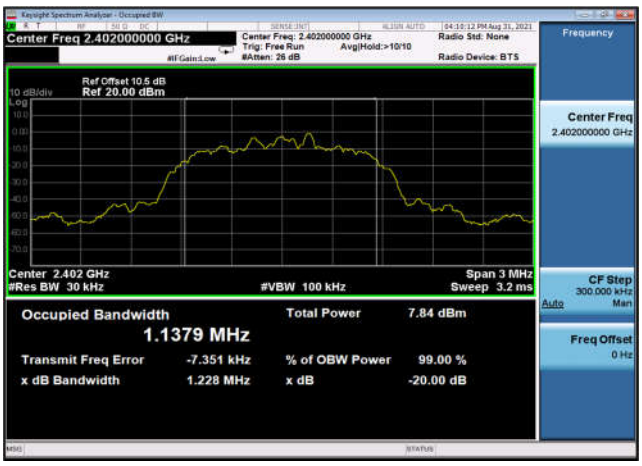
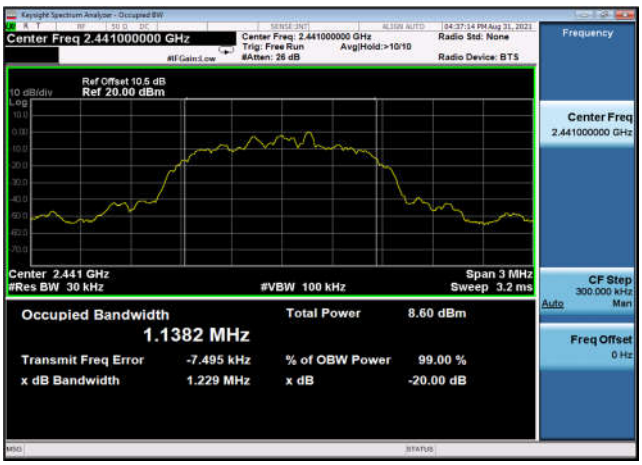
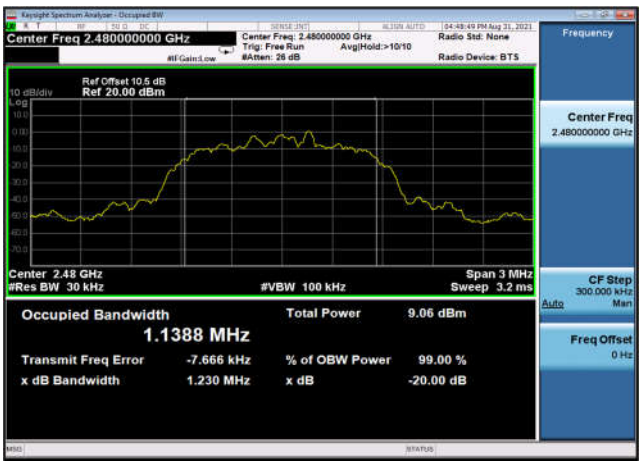
Output Power：8DPSK,2402MHz,3DH5	Output Power：8DPSK,2441MHz,3DH5
	
Output Power：8DPSK,2480MHz,3DH5	
	

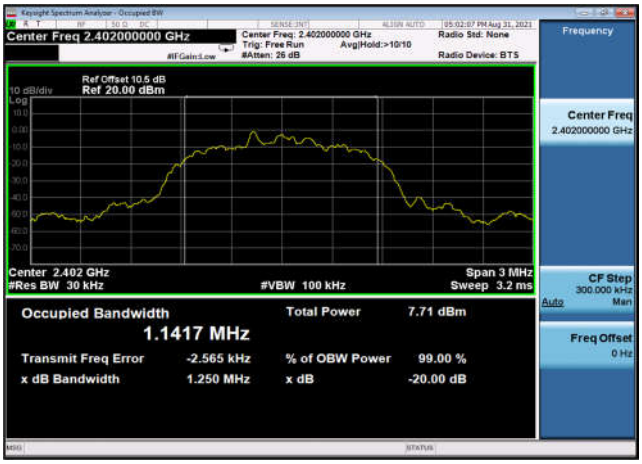
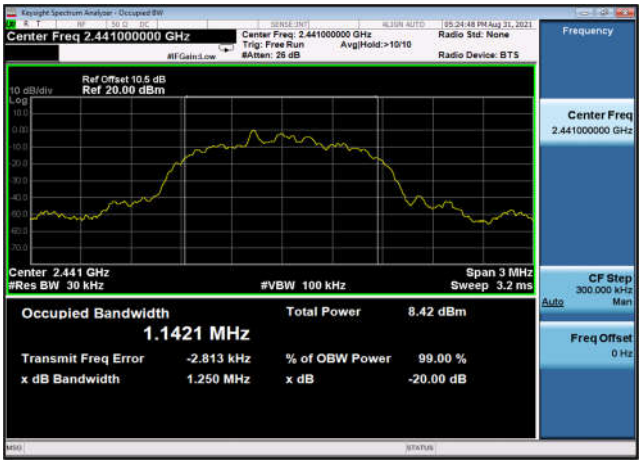
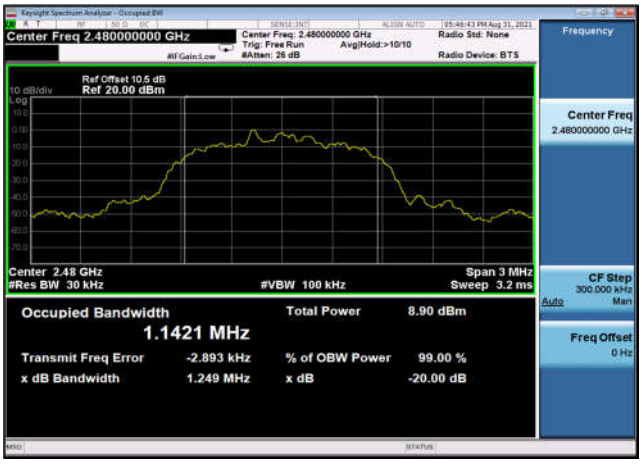
20dB Bandwidth

Test Result and Data

BT Occupied 20dB Bandwidth				
Mode	Test Frequency	Packet Type	-20dB Bandwidth (kHz)	Result
GFSK	2402	DH5	954.470	Pass
GFSK	2441	DH5	953.644	Pass
GFSK	2480	DH5	954.041	Pass
DQPSK	2402	2DH5	1228.124	Pass
DQPSK	2441	2DH5	1228.508	Pass
DQPSK	2480	2DH5	1229.685	Pass
8DPSK	2402	3DH5	1249.860	Pass
8DPSK	2441	3DH5	1249.853	Pass
8DPSK	2480	3DH5	1249.286	Pass

Test Plot

20dB Bandwidth：GFSK,2402MHz,DH5	20dB Bandwidth：GFSK,2441MHz,DH5
	
20dB Bandwidth：GFSK,2480MHz,DH5	20dB Bandwidth：DQPSK,2402MHz,2DH5
	
20dB Bandwidth：DQPSK,2441MHz,2DH5	20dB Bandwidth：DQPSK,2480MHz,2DH5
	

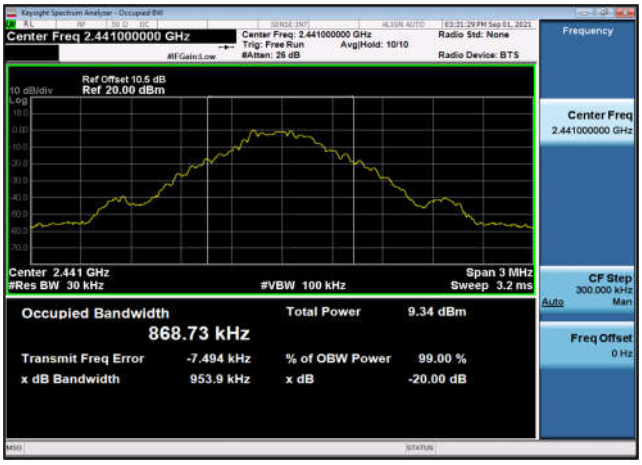
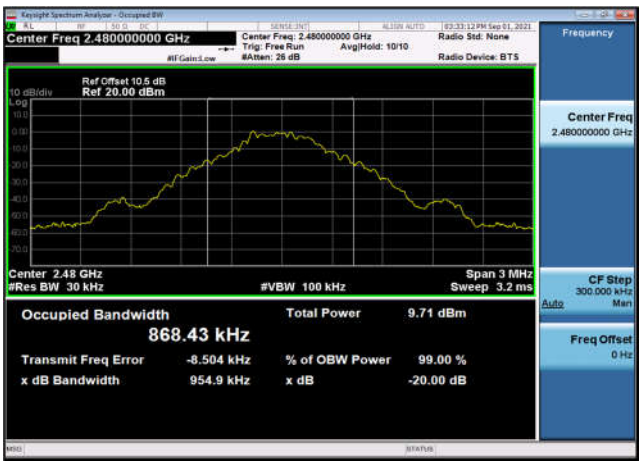
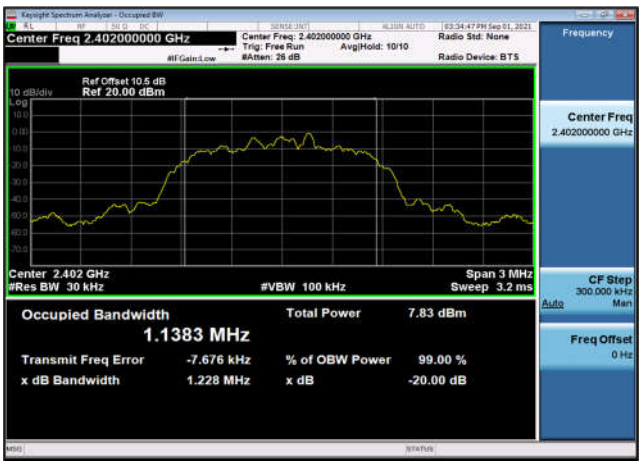
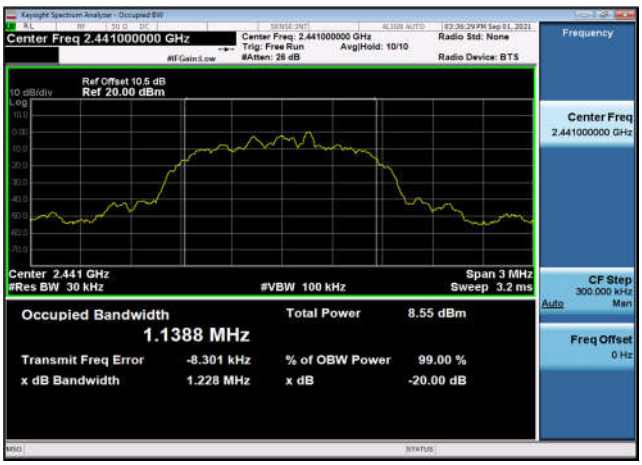
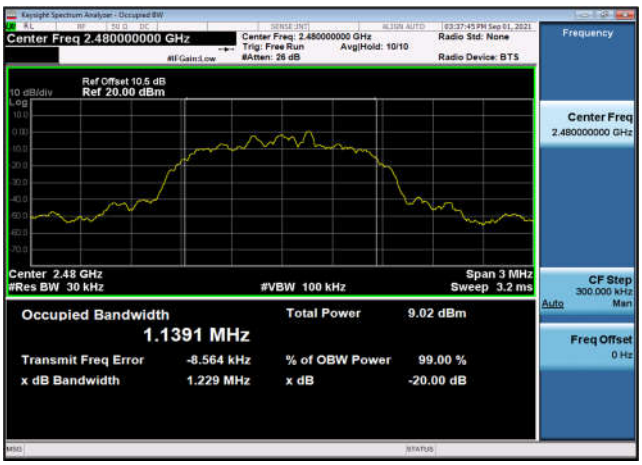
20dB Bandwidth：8DPSK,2402MHz,3DH5	20dB Bandwidth：8DPSK,2441MHz,3DH5
	
20dB Bandwidth：8DPSK,2480MHz,3DH5	
	

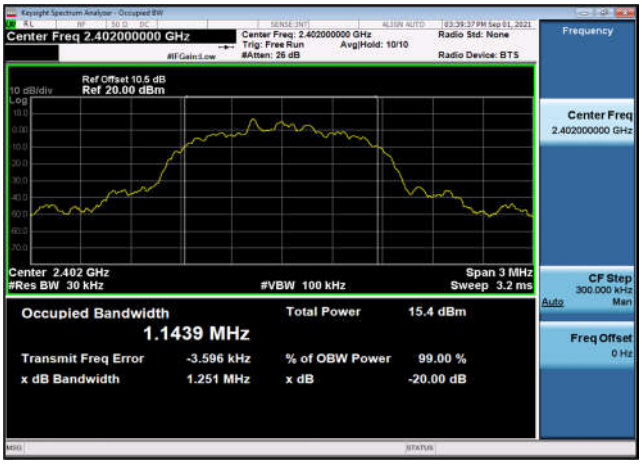
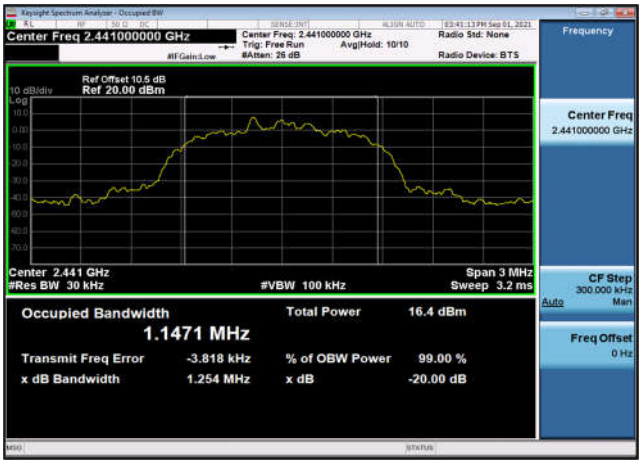
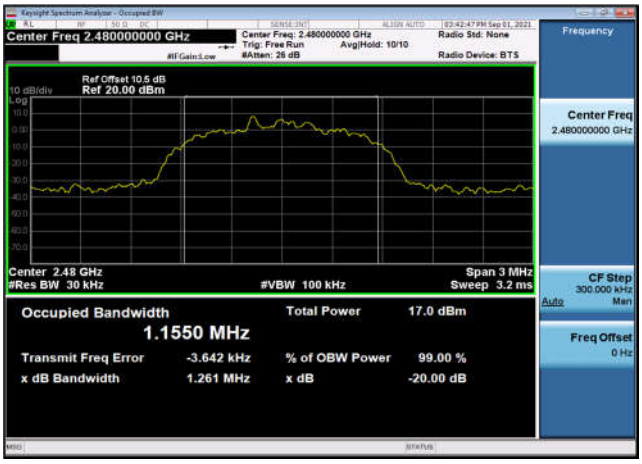
99% Bandwidth

Test Result and Data

BT 99% Occupied Bandwidth				
Mode	Test Frequency	Packet Type	99% Occupied Bandwidth (kHz)	Result
GFSK	2402	DH5	869.401	Pass
GFSK	2441	DH5	868.730	Pass
GFSK	2480	DH5	868.428	Pass
DQPSK	2402	2DH5	1138.300	Pass
DQPSK	2441	2DH5	1138.815	Pass
DQPSK	2480	2DH5	1139.094	Pass
8DPSK	2402	3DH5	1143.941	Pass
8DPSK	2441	3DH5	1147.079	Pass
8DPSK	2480	3DH5	1154.969	Pass

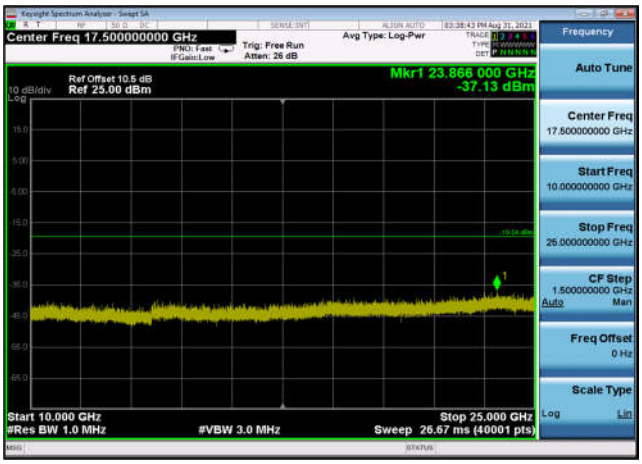
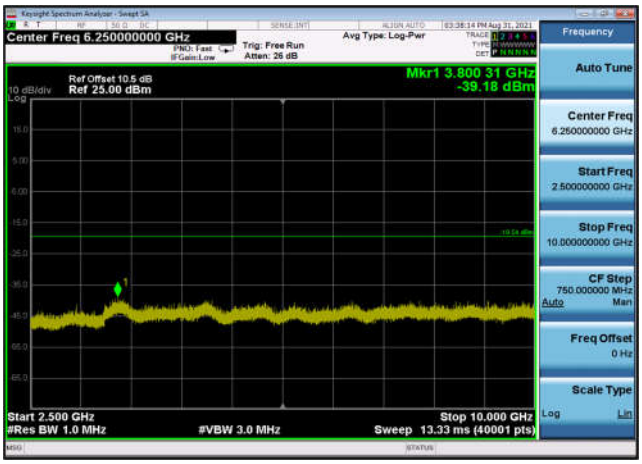
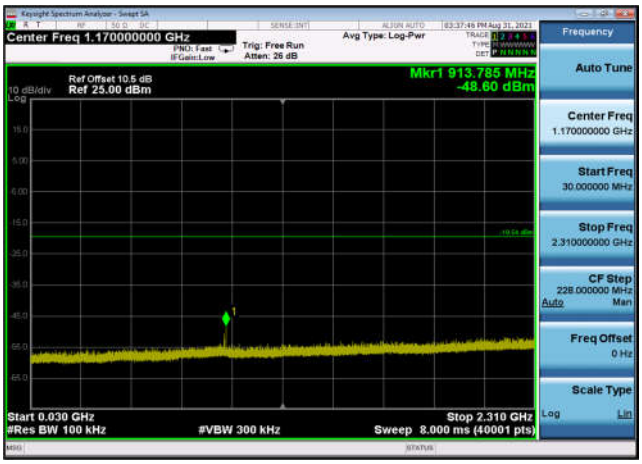
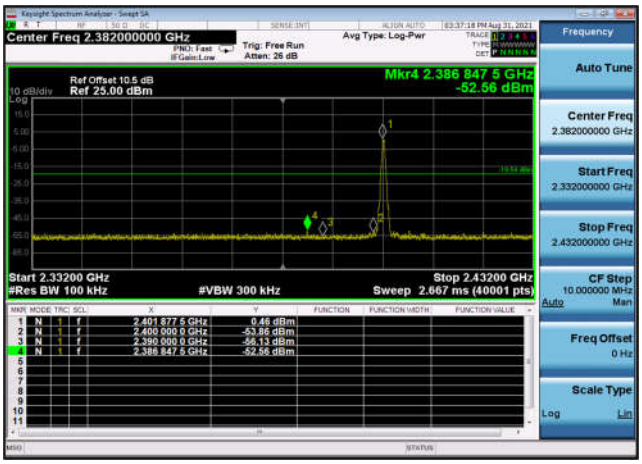
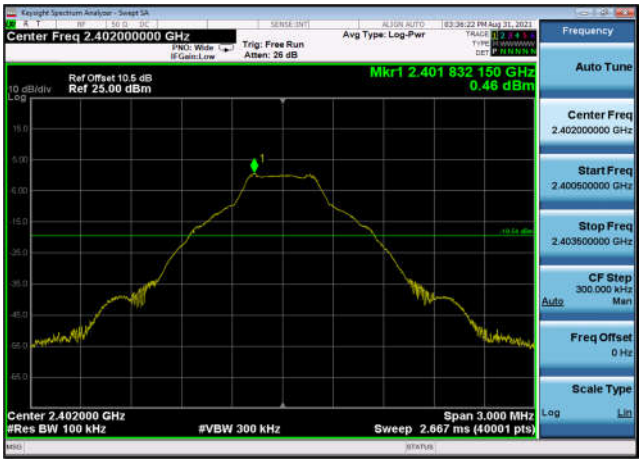
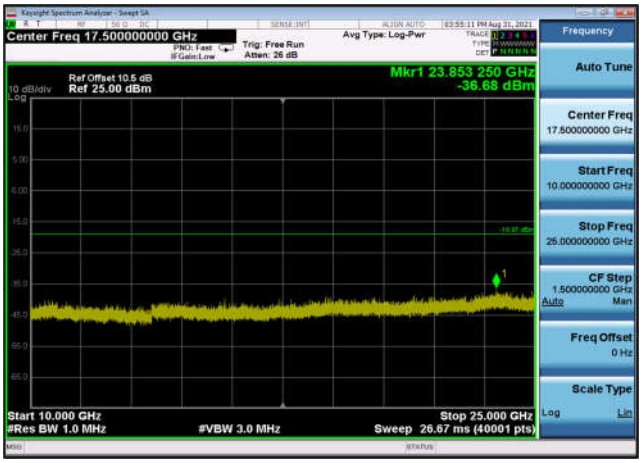
Test Plots

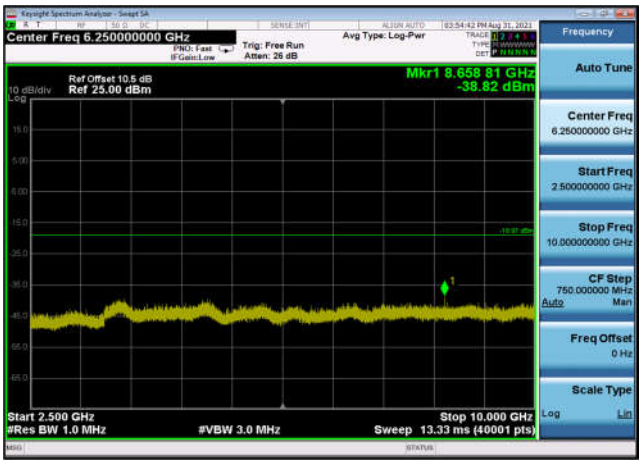
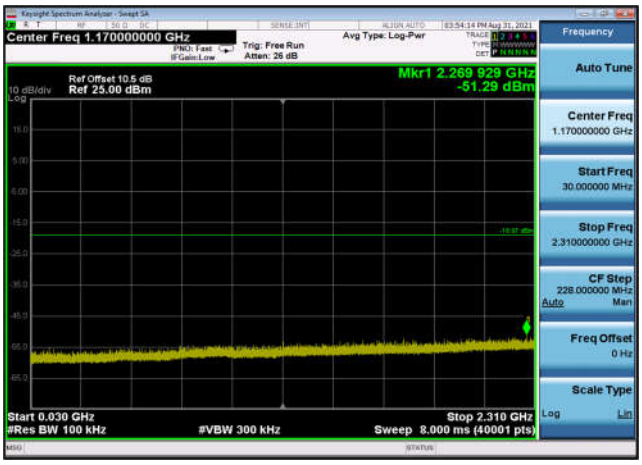
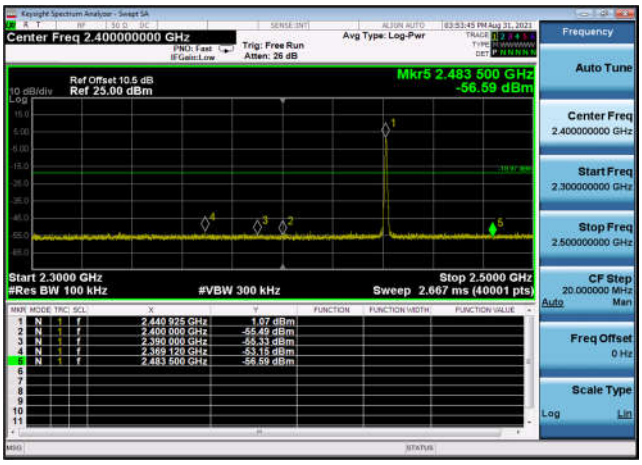
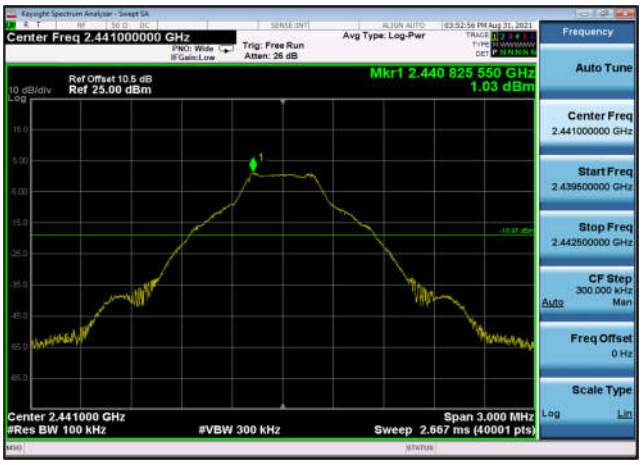
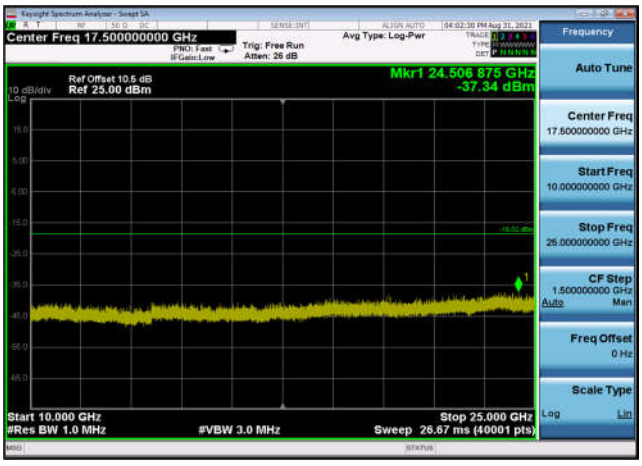
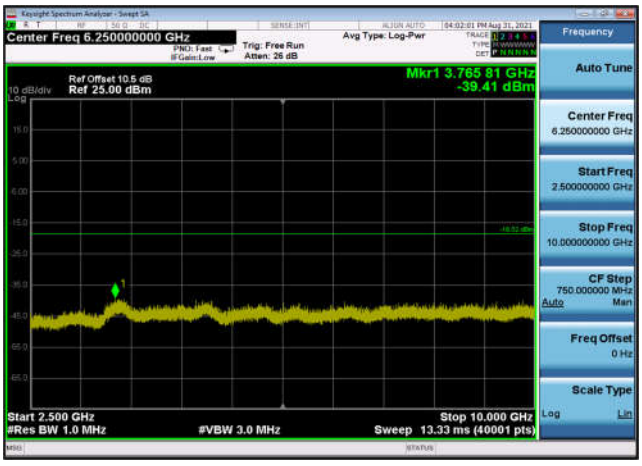
99% Bandwidth：GFSK,2402MHz,DH5	99% Bandwidth：GFSK,2441MHz,DH5
	
99% Bandwidth：GFSK,2480MHz,DH5	99% Bandwidth：DQPSK,2402MHz,2DH5
	
99% Bandwidth：DQPSK,2441MHz,2DH5	99% Bandwidth：DQPSK,2480MHz,2DH5
	

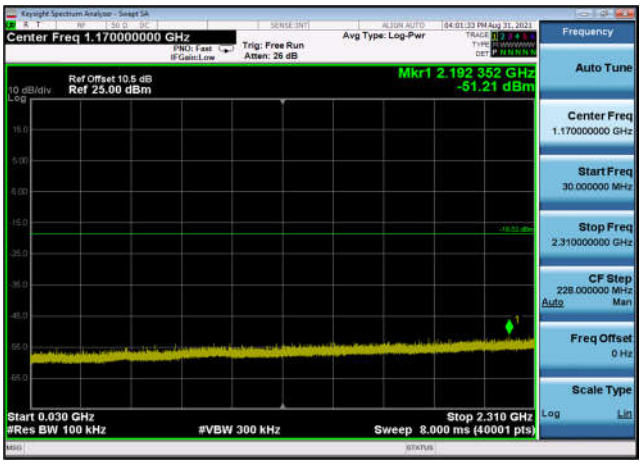
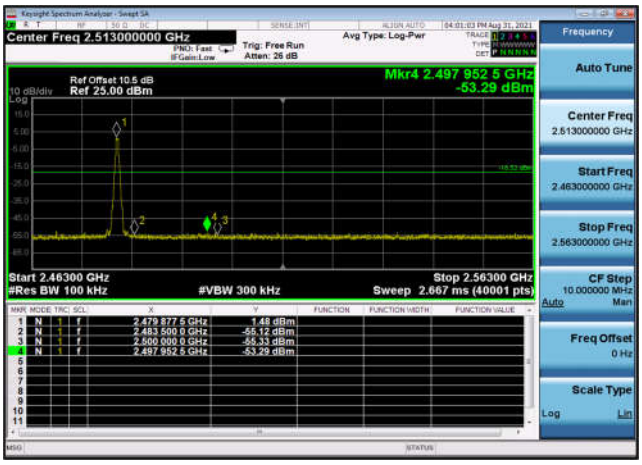
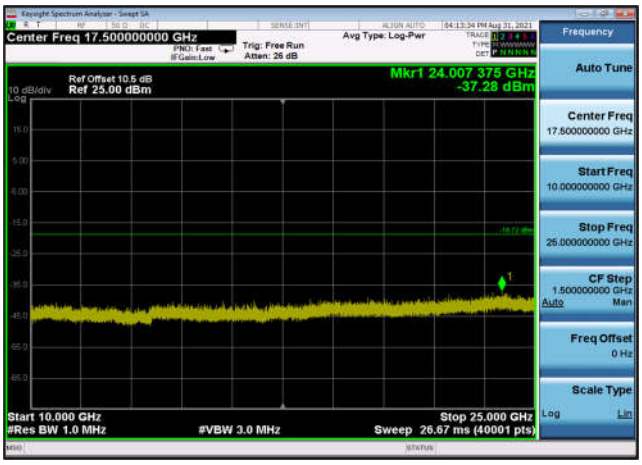
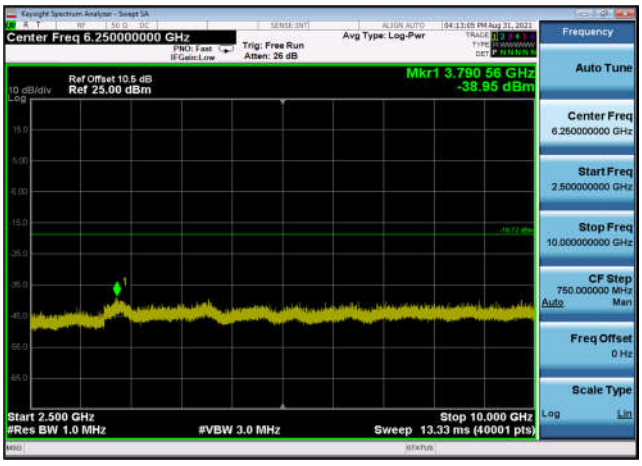
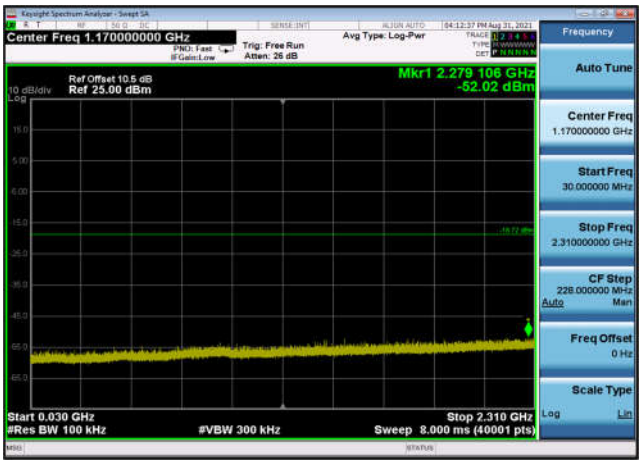
99% Bandwidth：8DPSK,2402MHz,3DH5	99% Bandwidth：8DPSK,2441MHz,3DH5
	
99% Bandwidth：8DPSK,2480MHz,3DH5	
	

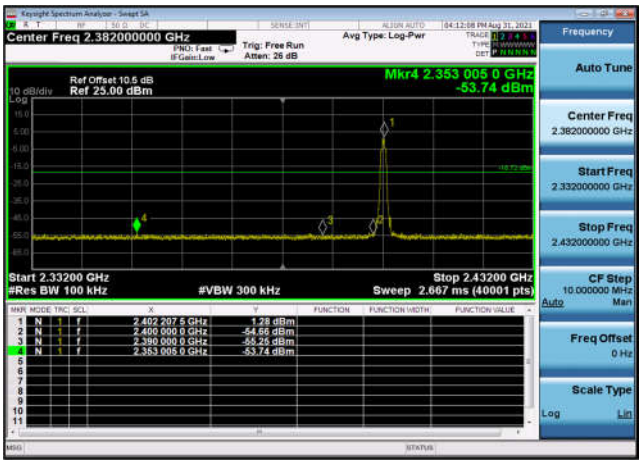
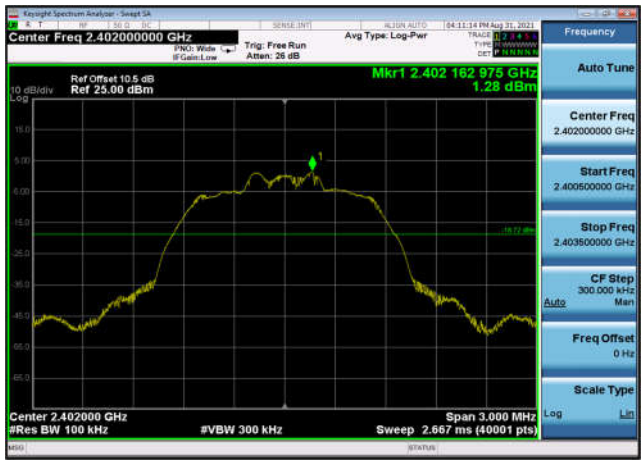
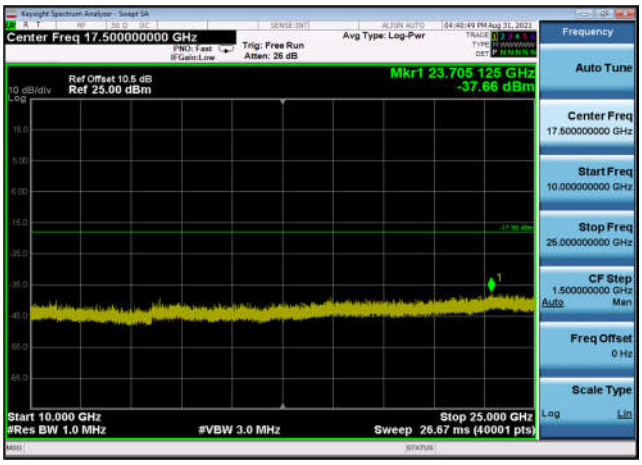
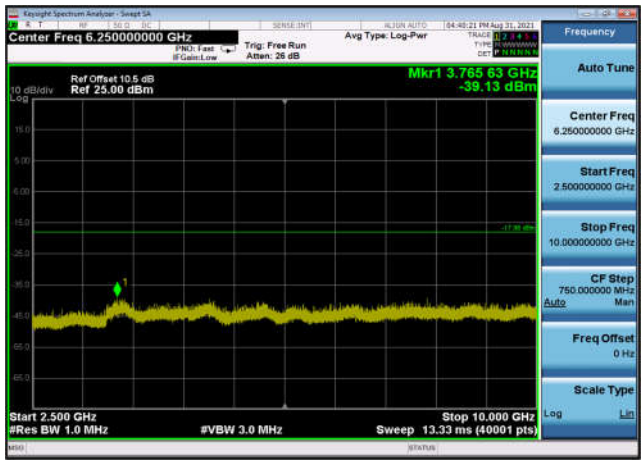
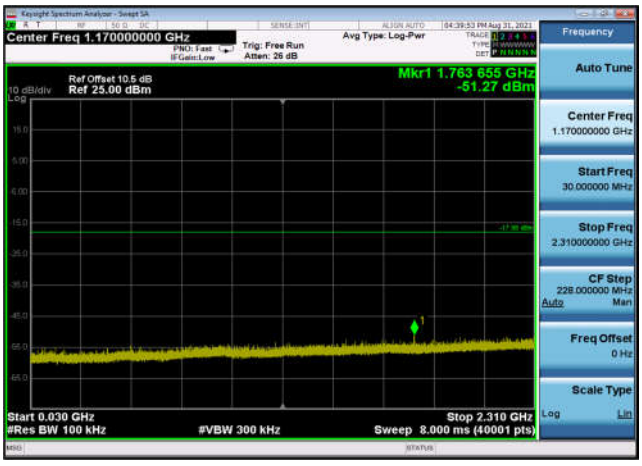
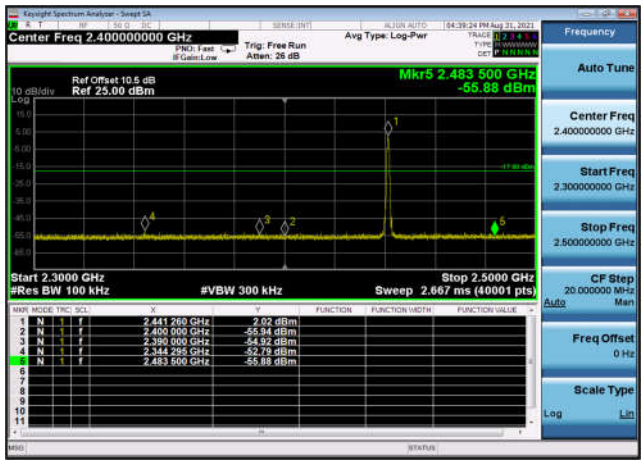
Transmitter Spurious Emission and Bandedge

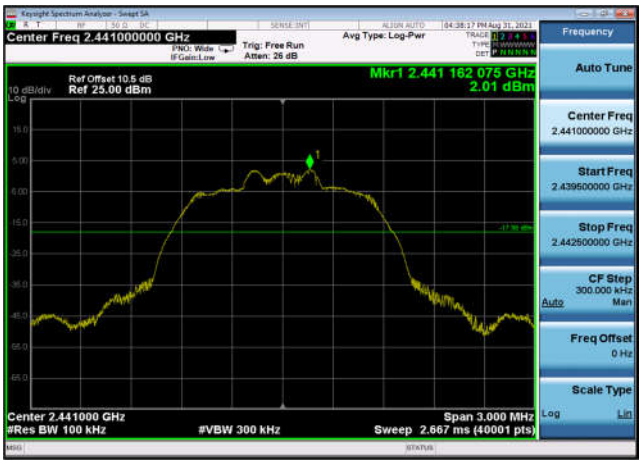
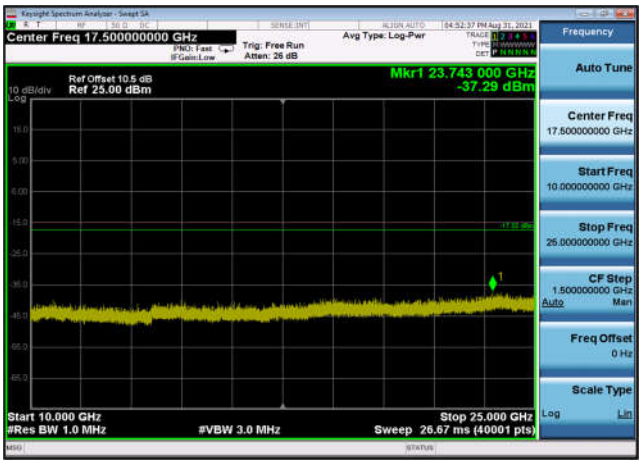
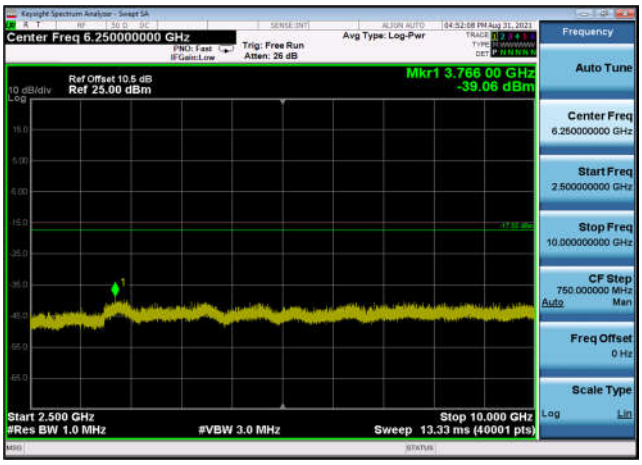
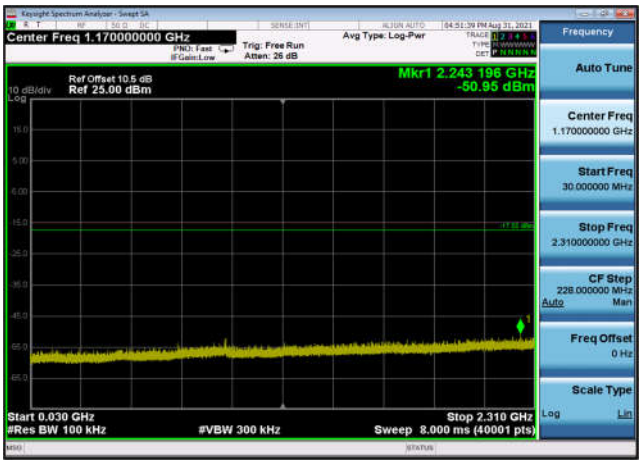
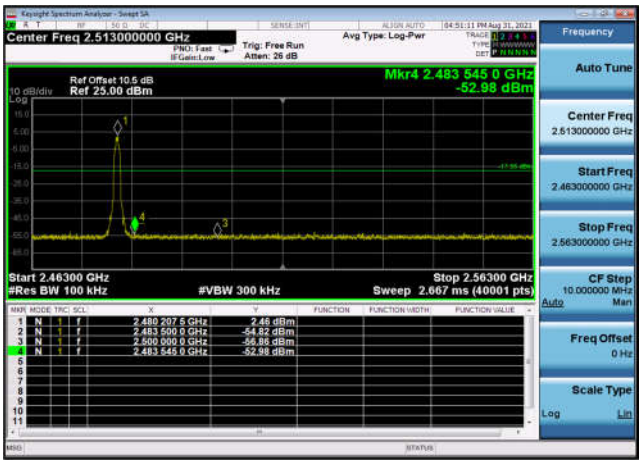
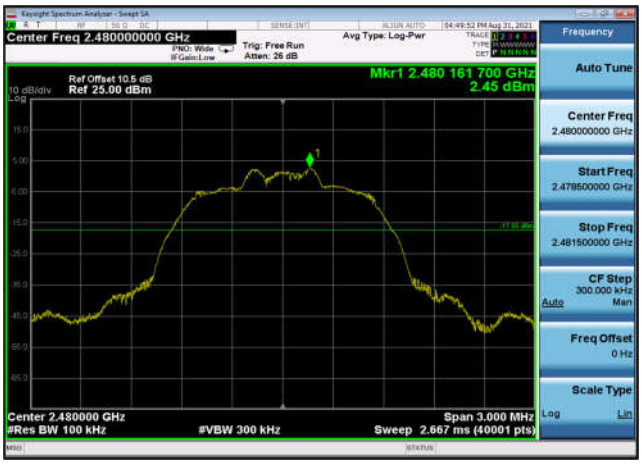
Test Result and Data

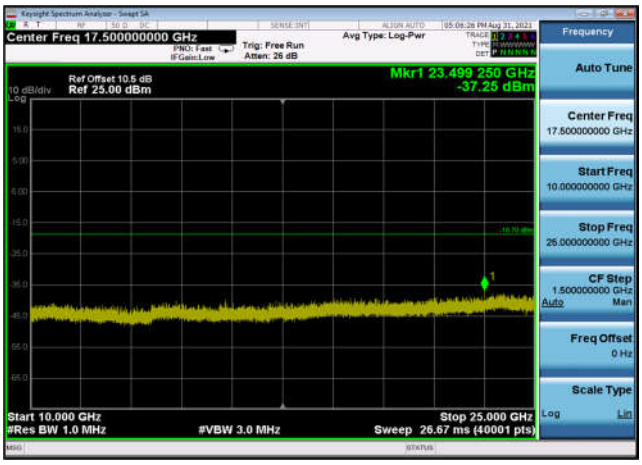
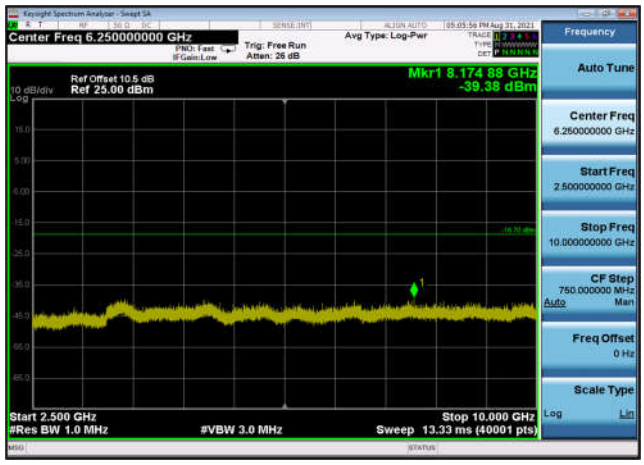
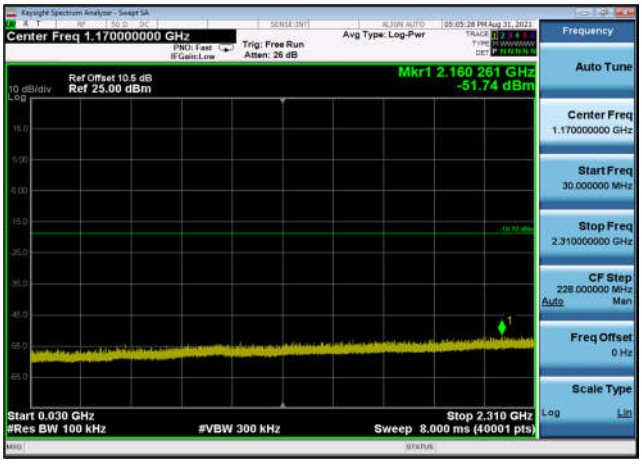
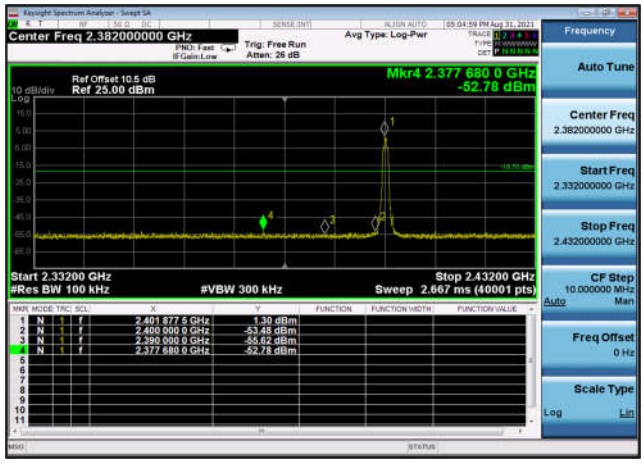
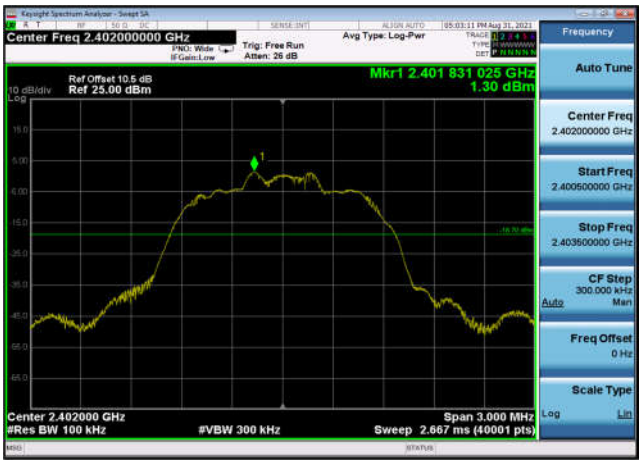
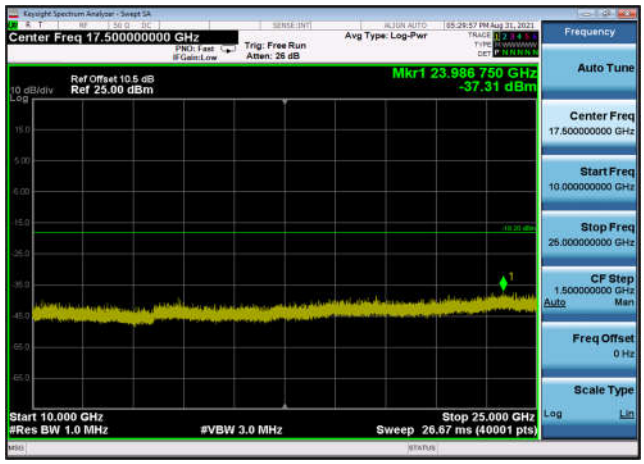
Conducted Emission：GFSK,2402,DH5 ,10000MHz~25000MHz	Conducted Emission：GFSK,2402,DH5 ,2500MHz~10000MHz
	
Conducted Emission：GFSK,2402,DH5 ,30MHz~2310MHz	Conducted Emission：GFSK,2402,DH5 ,Band Edge HoppingOFF
	
Conducted Emission：GFSK,2402,DH5 ,Reference Level	Conducted Emission：GFSK,2441,DH5 ,10000MHz~25000MHz
	

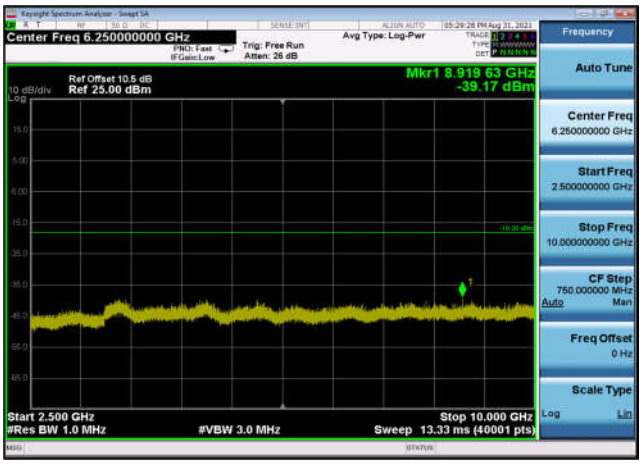
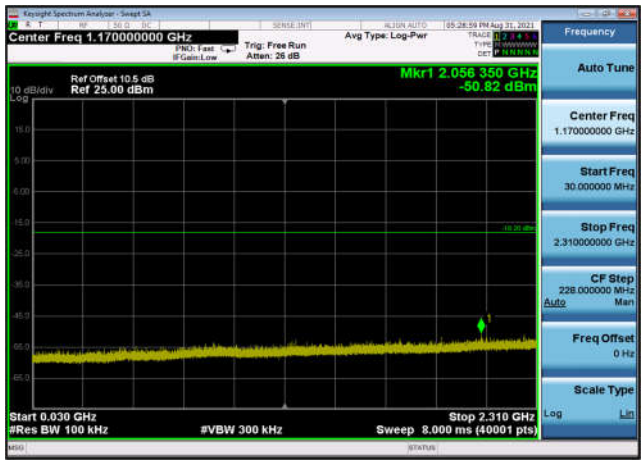
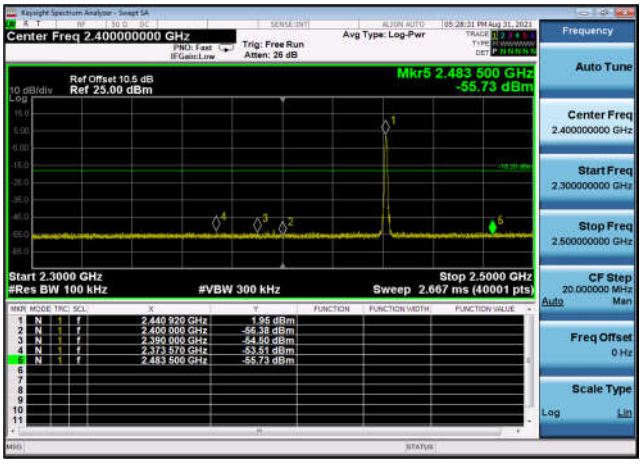
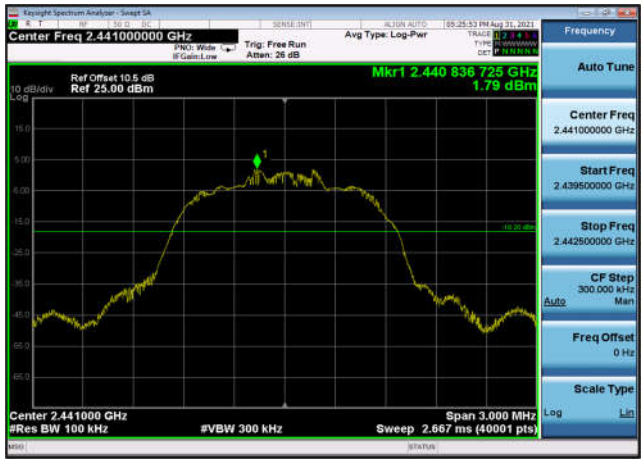
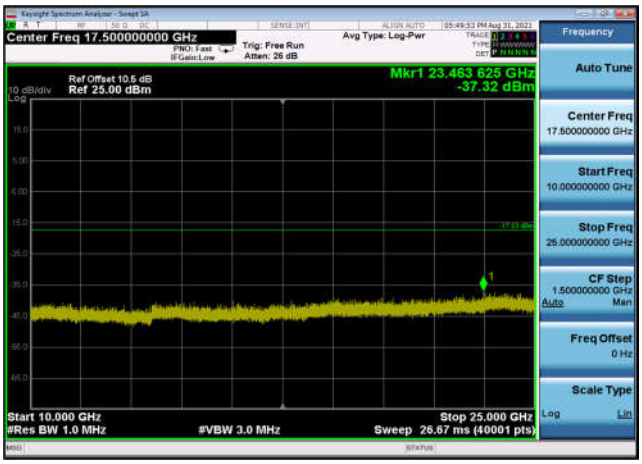
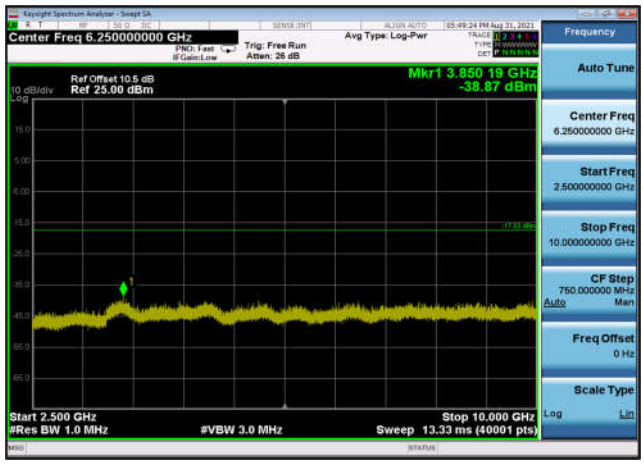
Conducted Emission：GFSK,2441,DH5 ,2500MHz~10000MHz	Conducted Emission：GFSK,2441,DH5 ,30MHz~2310MHz
	
Conducted Emission：GFSK,2441,DH5 ,Band Edge HoppingOFF	Conducted Emission：GFSK,2441,DH5 ,Reference Level
	
Conducted Emission：GFSK,2480,DH5 ,10000MHz~25000MHz	Conducted Emission：GFSK,2480,DH5 ,2500MHz~10000MHz
	

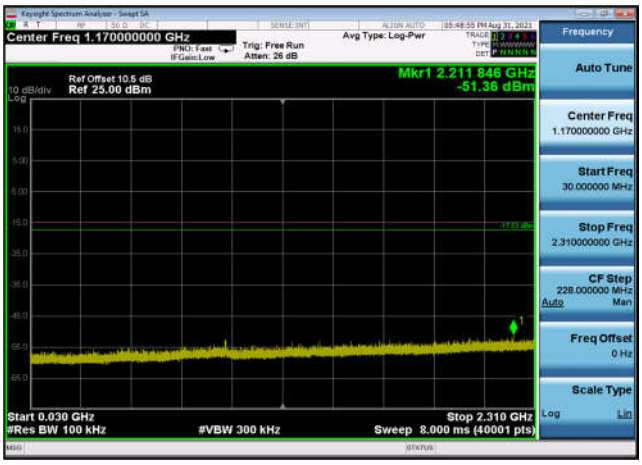
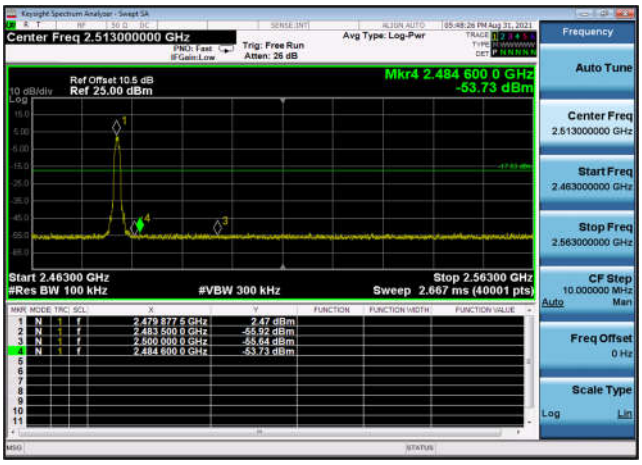
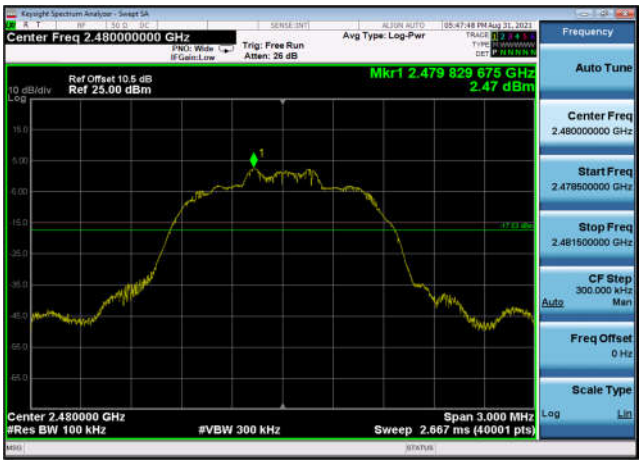
Conducted Emission：GFSK,2480,DH5 ,30MHz~2310MHz	Conducted Emission：GFSK,2480,DH5 ,Band Edge HoppingOFF
	
Conducted Emission：GFSK,2480,DH5 ,Reference Level	Conducted Emission：DQPSK,2402,2DH5 ,10000MHz~25000MHz
	
Conducted Emission：DQPSK,2402,2DH5 ,2500MHz~10000MHz	Conducted Emission：DQPSK,2402,2DH5 ,30MHz~2310MHz
	

Conducted Emission：DQPSK,2402,2DH5 ,Band Edge HoppingOFF	Conducted Emission：DQPSK,2402,2DH5 ,Reference Level
	
Conducted Emission：DQPSK,2441,2DH5 ,10000MHz~25000MHz	Conducted Emission：DQPSK,2441,2DH5 ,2500MHz~10000MHz
	
Conducted Emission：DQPSK,2441,2DH5 ,30MHz~2310MHz	Conducted Emission：DQPSK,2441,2DH5 ,Band Edge HoppingOFF
	

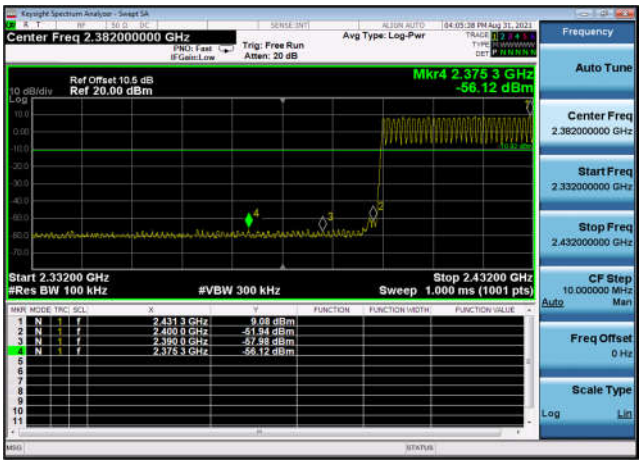
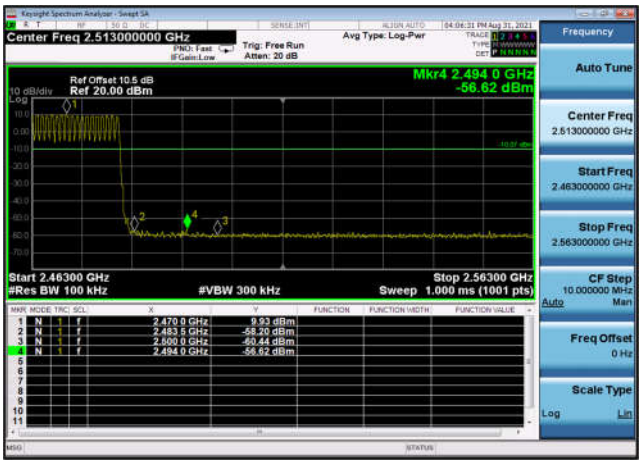
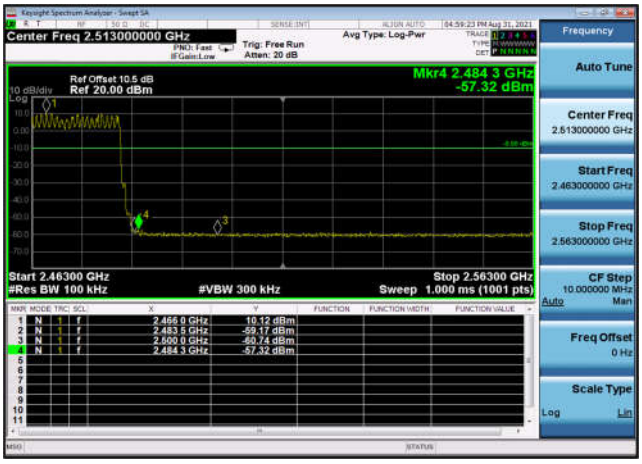
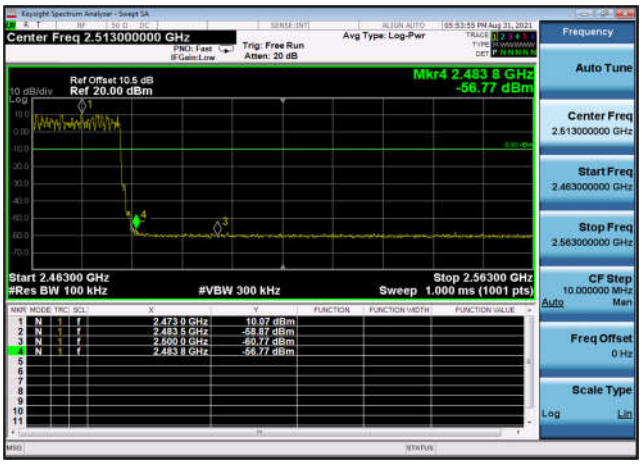
Conducted Emission：DQPSK,2441,2DH5 ,Reference Level	Conducted Emission：DQPSK,2480,2DH5 ,10000MHz~25000MHz
	
Conducted Emission：DQPSK,2480,2DH5 ,2500MHz~10000MHz	Conducted Emission：DQPSK,2480,2DH5 ,30MHz~2310MHz
	
Conducted Emission：DQPSK,2480,2DH5 ,Band Edge HoppingOFF	Conducted Emission：DQPSK,2480,2DH5 ,Reference Level
	

Conducted Emission：8DPSK,2402,3DH5 ,10000MHz~25000MHz	Conducted Emission：8DPSK,2402,3DH5 ,2500MHz~10000MHz
	
Conducted Emission：8DPSK,2402,3DH5 ,30MHz~2310MHz	Conducted Emission：8DPSK,2402,3DH5 ,Band Edge HoppingOFF
	
Conducted Emission：8DPSK,2402,3DH5 ,Reference Level	Conducted Emission：8DPSK,2441,3DH5 ,10000MHz~25000MHz
	

Conducted Emission：8DPSK,2441,3DH5 ,2500MHz~10000MHz	Conducted Emission：8DPSK,2441,3DH5 ,30MHz~2310MHz
	
Conducted Emission：8DPSK,2441,3DH5 ,Band Edge HoppingOFF	Conducted Emission：8DPSK,2441,3DH5 ,Reference Level
	
Conducted Emission：8DPSK,2480,3DH5 ,10000MHz~25000MHz	Conducted Emission：8DPSK,2480,3DH5 ,2500MHz~10000MHz
	

Conducted Emission：8DPSK,2480,3DH5 ,30MHz~2310MHz	Conducted Emission：8DPSK,2480,3DH5 ,Band Edge HoppingOFF
	
Conducted Emission：8DPSK,2480,3DH5 ,Reference Level	
	

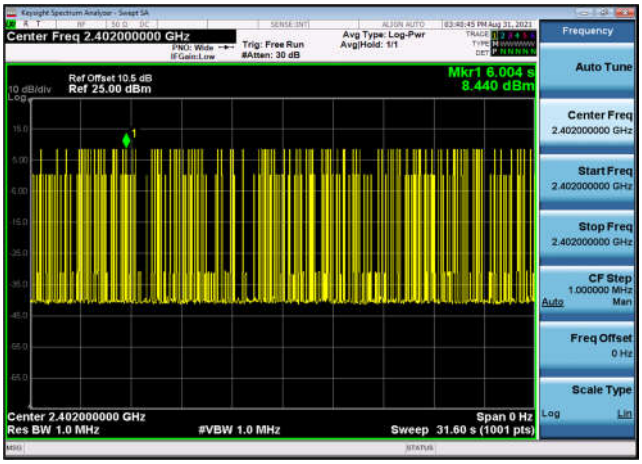
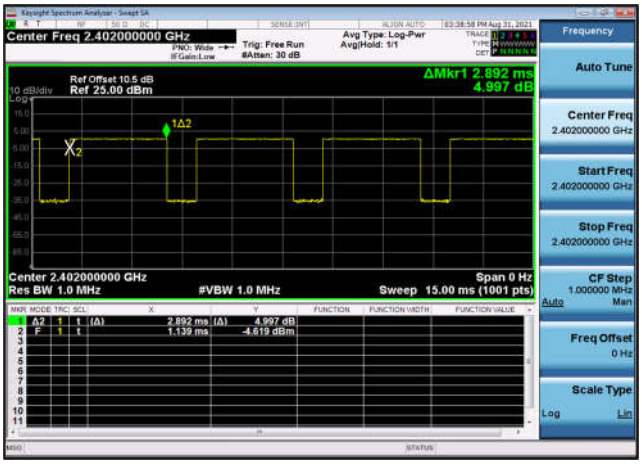
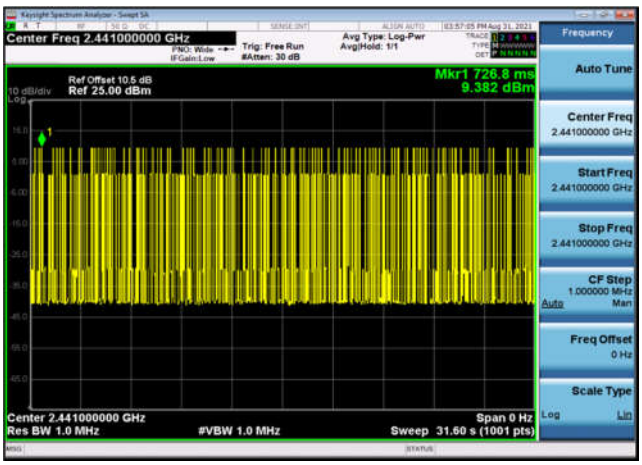
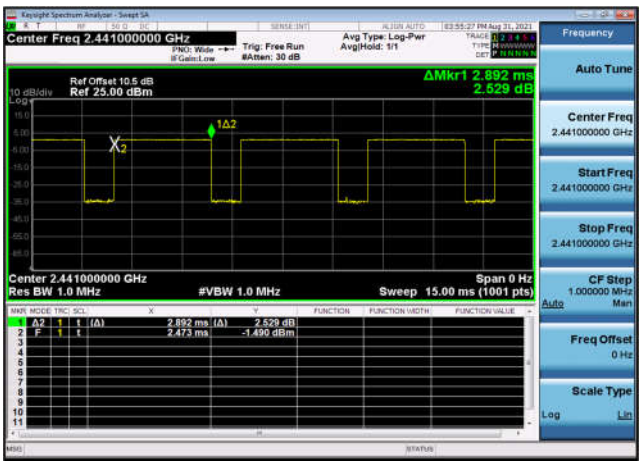
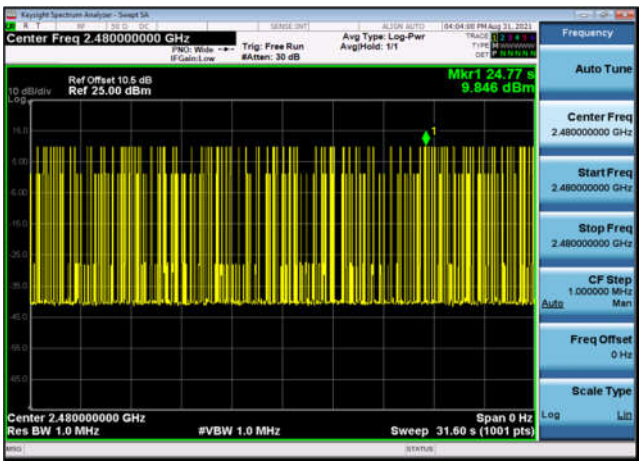
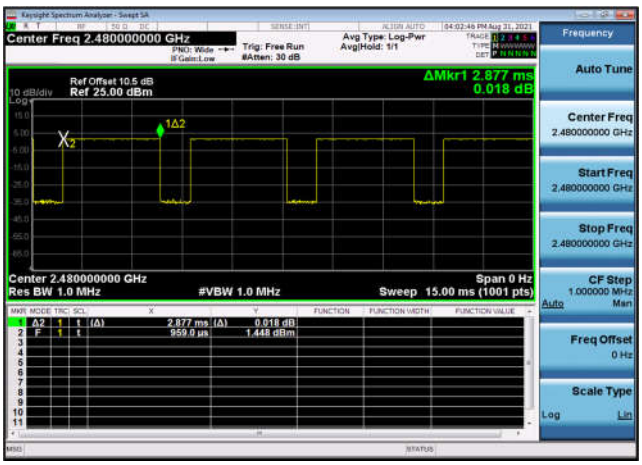
Hopping Mode

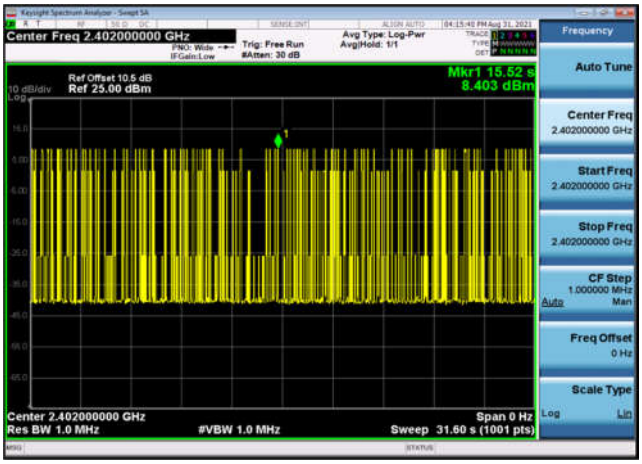
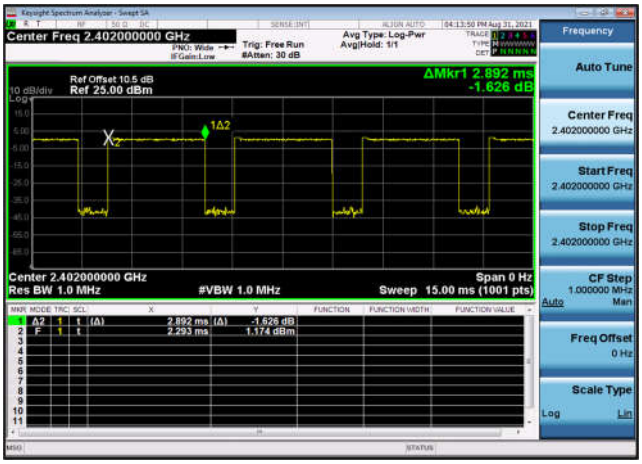
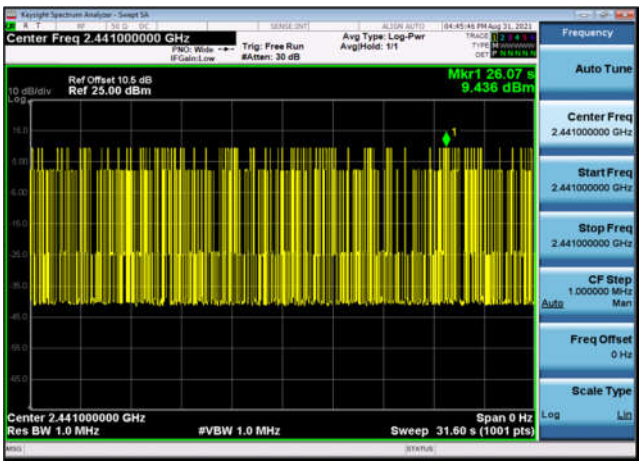
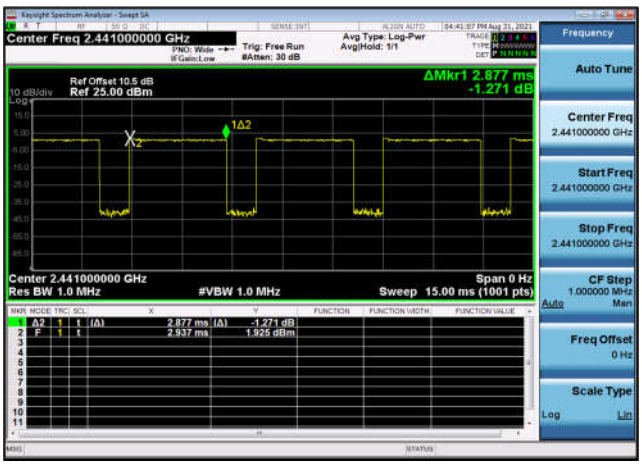
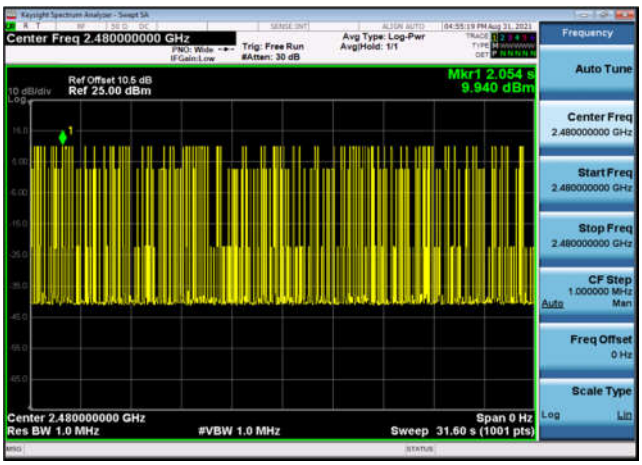
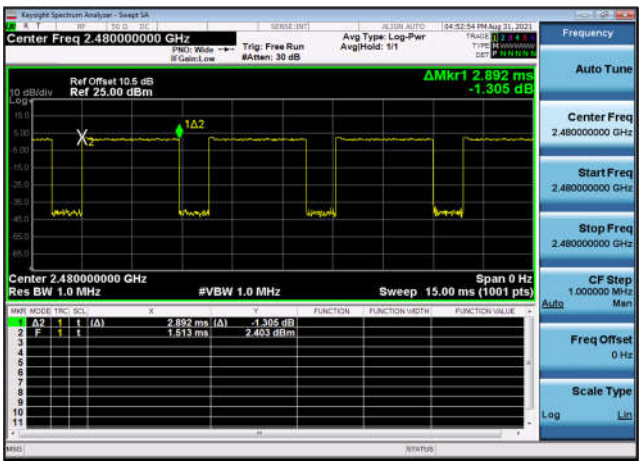
Conducted Emission：GFSK,2402,DH5 ,Band Edge	Conducted Emission：GFSK,2480,DH5 ,Band Edge
	
Conducted Emission：DQPSK,2402,2DH5 ,Band Edge	Conducted Emission：DQPSK,2480,2DH5 ,Band Edge
	
Conducted Emission：8DPSK,2402,3DH5 ,Band Edge	Conducted Emission：8DPSK,2480,3DH5 ,Band Edge
	

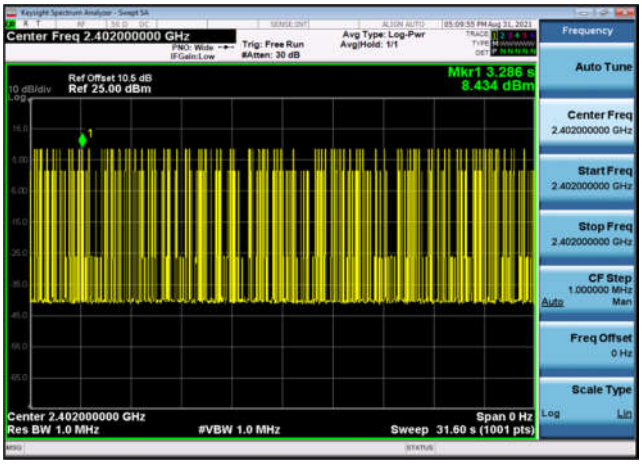
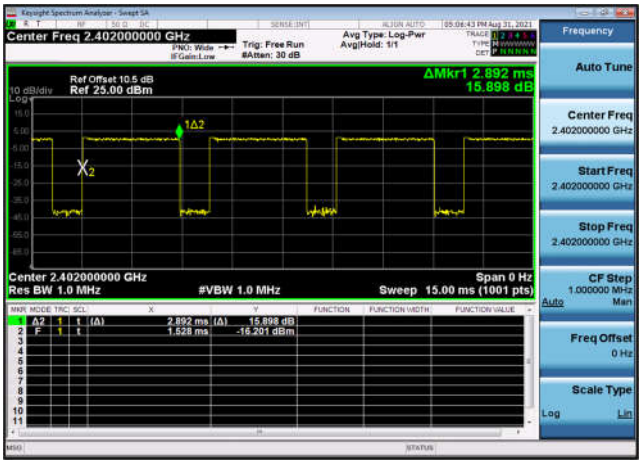
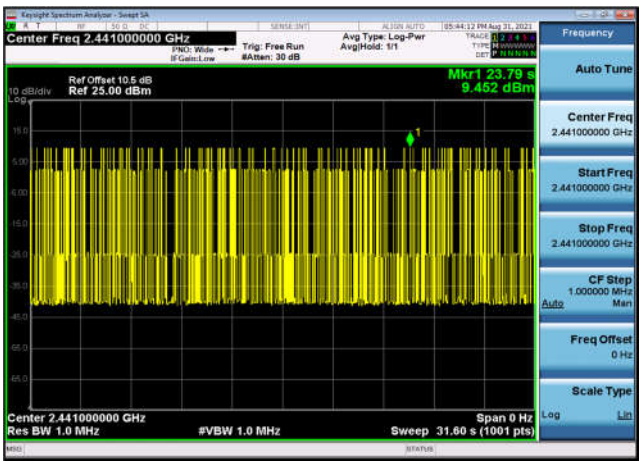
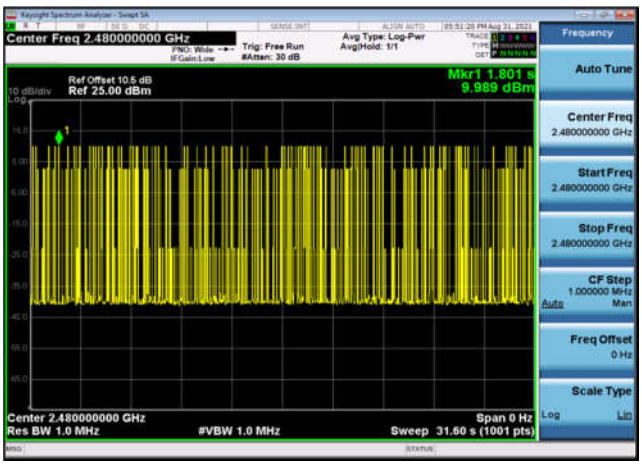
Dwell Time

Test Result and Data

BT Dwell Time						
Mode	Test Frequency	Packet Type	Transmission Time(ms)	Number	Dwell Time(ms)	Result
GFSK	2402	DH5	2.89	100	289.21	Pass
GFSK	2441	DH5	2.89	105	303.67	Pass
GFSK	2480	DH5	2.88	99	284.84	Pass
pi/4DQPSK	2402	2DH5	2.89	98	283.43	Pass
pi/4DQPSK	2441	2DH5	2.88	92	264.7	Pass
pi/4DQPSK	2480	2DH5	2.89	93	268.97	Pass
8DPSK	2402	3DH5	2.89	96	277.64	Pass
8DPSK	2441	3DH5	2.89	99	286.32	Pass
8DPSK	2480	3DH5	2.89	95	274.75	Pass

GFSK,2402,DH5,Transmission Number	GFSK,2402,DH5,Transmission Time
	
GFSK,2441,DH5,Transmission Number	GFSK,2441,DH5,Transmission Time
	
GFSK,2480,DH5,Transmission Number	GFSK,2480,DH5,Transmission Time
	

DQPSK,2402,2DH5,Transmission Number	DQPSK,2402,2DH5,Transmission Time
	
DQPSK,2441,2DH5,Transmission Number	DQPSK,2441,2DH5,Transmission Time
	
DQPSK,2480,2DH5,Transmission Number	DQPSK,2480,2DH5,Transmission Time
	

8DPSK,2402,3DH5,Transmission Number	8DPSK,2402,3DH5,Transmission Time
	
8DPSK,2441,3DH5,Transmission Number	8DPSK,2441,3DH5,Transmission Time
	
8DPSK,2480,3DH5,Transmission Number	8DPSK,2480,3DH5,Transmission Time
	

CarrierFrequencySeparation
Test Result and Data

BT Carrier Frequency Separation						
Mode	Test Frequency	Packet Type	Range (MHz~MHz)	Separation (KHz)	(Limit) (KHz)	Result
GFSK	Hopping	DH5	2401.5MHz~2403.5MHz	1006.99	⩾636.3133	Pass
GFSK	Hopping	DH5	2440.5MHz~2442.5MHz	865.13	⩾635.7627	Pass
GFSK	Hopping	DH5	2478.5MHz~2480.5MHz	1204.80	⩾636.0273	Pass
pi/4DQPSK	Hopping	2DH5	2401.5MHz~2403.5MHz	989.00	⩾818.7493	Pass
pi/4DQPSK	Hopping	2DH5	2440.5MHz~2442.5MHz	999.00	⩾819.0053	Pass
pi/4DQPSK	Hopping	2DH5	2478.5MHz~2480.5MHz	979.00	⩾819.7900	Pass
8DPSK	Hopping	3DH5	2401.5MHz~2403.5MHz	1334.67	⩾833.2400	Pass
8DPSK	Hopping	3DH5	2440.5MHz~2442.5MHz	993.01	⩾833.2353	Pass
8DPSK	Hopping	3DH5	2478.5MHz~2480.5MHz	1198.80	⩾832.8573	Pass

Note：The limit is 2/3 of 20dB bandwidth

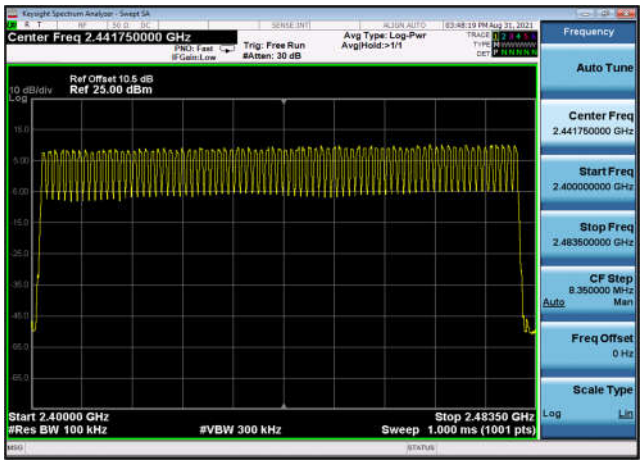
GFSK,HoppingDH5,2401.5~2403.5	GFSK,HoppingDH5,2440.5~2442.5
	
GFSK,HoppingDH5,2478.5~2480.5	**DQPSK,Hopping2DH5,2401.5~2403.5**
	
DQPSK,Hopping2DH5,2440.5~2442.5	**DQPSK,Hopping2DH5,2478.5~2480.5**
	

8DPSK,Hopping3DH5,2401.5~2403.5	8DPSK,Hopping3DH5,2440.5~2442.5
	
8DPSK,Hopping3DH5,2478.5~2480.5	
	

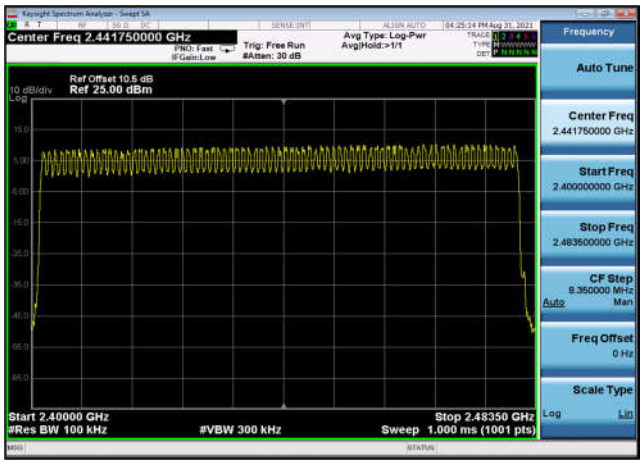
Hopping Channel Numbers
Test Result and Data

BT Number Of Hopping Channels					
Mode	Test Frequency	Packet Type	Test Range(MHz~MHz)	Limit	Result
GFSK	Hopping	DH5	2400~2483.5	⩾15	Pass
pi/4DQPSK	Hopping	2DH5	2400~2483.5	⩾15	Pass
8DPSK	Hopping	3DH5	2400~2483.5	⩾15	Pass

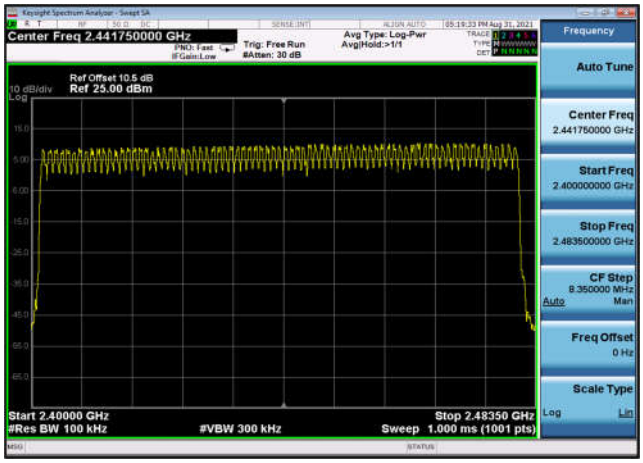
Number Of Hopping Channels：GFSK ,HoppingMhz,DH5__2400~2483.5



Number Of Hopping Channels：DQPSK ,HoppingMhz,2DH5__2400~2483.5



Number Of Hopping Channels：8DPSK ,HoppingMhz,3DH5__2400~2483.5



** END OF REPORT **