TEST REPORT

Application No.:	GZCR2105020355HS
Applicant:	Puzhen Life Co., Ltd.
Address of Applicant:	Unit 1112-1116, 11/F, Delta House, 3 On Yiu Street, Shatin, Hongkong
Manufacturer:	Puzhen Life Co., Ltd.
Address of Manufacturer:	Unit 1112-1116, 11/F, Delta House, 3 On Yiu Street, Shatin, Hongkong
Factory:	K-Star Plastic Mold (Shenzhen) Co. Ltd.
Address of Factory:	Foor 1-4, Factory NO. 2, DongWangYang Industrial East, HuangTian Village, HangCheng Street, BaoAn District, ShenZhen, Guang Dong Province
Equipment Under Test (EUT):	
EUT Name:	Mini Aria Ultrasonic Diffuser
Model No.:	PZ-UA200
Trade Mark:	YOUNG LIVING
Standard(s) :	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2021-05-31
Date of Test:	2021-06-07 to 2021-06-19
Date of Issue:	2021-06-29
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Kobe Jian
EMC Laboratory Manager

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		*2021-06-29*		*Original*

Authorized for issue by				
Tested By		Lily Kuang **Lily Kuang/Project Engineer**		
Reviewed By		Ricky Liu **Ricky Liu/Reviewer**		

SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch Testing Center EEC Laboratory
No.198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District, Guangzhou, China 510663 t (86-20) 82155555 f (86-20) 82075058 www.sgsgroup.com.cn
中国·广州·经济技术开发区科学城科珠路198号 邮编: 510663 t (86-20) 82155555 f (86-20) 82075058 sgs.china@sgs.com

2 Test Summary

Radio Spectrum Technical Requirement				
Item	**Standard**	**Method**	**Requirement**	**Result**
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass
Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence		N/A	47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)	Pass

Radio Spectrum Matter Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Conducted Peak Output Power		ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(1)	Pass
20dB Bandwidth		ANSI C63.10 (2013) Section 7.8.7	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass
Carrier Frequencies Separation		ANSI C63.10 (2013) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
Hopping Channel Number		ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Dwell Time		ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Conducted Band Edges Measurement		ANSI C63.10 (2013) Section 7.8.6	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions		ANSI C63.10 (2013) Section 7.8.8	47 CFR Part 15, Subpart C 15.247(d)	Pass
Radiated Emissions which fall in the restricted bands		ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions		ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass

Note:

E.U.T./EUT means Equipment Under Test.

N/A: Not applicable

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.

3 Contents

Page

1 Cover Page 1

2 Test Summary 3

3 Contents 4

4 General Information 6

4.1 Details of E.U.T. 6
4.2 Description of Support Units 6
4.3 Measurement Uncertainty 7
4.4 Test Location 7
4.5 Test Facility 8
4.6 Deviation from Standards 9
4.7 Abnormalities from Standard Conditions 9

5 Equipment List 10

6 Radio Spectrum Technical Requirement 14

6.1 Antenna Requirement 14
6.1.1 Test Requirement: 14
6.1.2 Conclusion 14
6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence 15
6.2.1 Test Requirement: 15
6.2.2 Conclusion 16

7 Radio Spectrum Matter Test Results 17

7.1 Conducted Emissions at AC Power Line (150kHz-30MHz) 17
7.1.1 E.U.T. Operation 17
7.1.2 Test Mode Description 17
7.1.3 Test Setup Diagram 18
7.1.4 Measurement Procedure and Data 18
7.2 Conducted Peak Output Power 21
7.2.1 E.U.T. Operation 21
7.2.2 Test Mode Description 21
7.2.3 Test Setup Diagram 21
7.2.4 Measurement Procedure and Data 21
7.3 20dB Bandwidth 22
7.3.1 E.U.T. Operation 22
7.3.2 Test Mode Description 22
7.3.3 Test Setup Diagram 22
7.3.4 Measurement Procedure and Data 22
7.4 Carrier Frequencies Separation 23
7.4.1 E.U.T. Operation 23
7.4.2 Test Mode Description 23
7.4.3 Test Setup Diagram 23
7.4.4 Measurement Procedure and Data 23
7.5 Hopping Channel Number 24
7.5.1 E.U.T. Operation 24

7.5.2 Test Mode Description 24
7.5.3 Test Setup Diagram 24
7.5.4 Measurement Procedure and Data 24
7.6 Dwell Time 25
7.6.1 E.U.T. Operation 25
7.6.2 Test Mode Description 25
7.6.3 Test Setup Diagram 25
7.6.4 Measurement Procedure and Data 25
7.7 Conducted Band Edges Measurement 26
7.7.1 E.U.T. Operation 26
7.7.2 Test Mode Description 26
7.7.3 Test Setup Diagram 27
7.7.4 Measurement Procedure and Data 27
7.8 Conducted Spurious Emissions 28
7.8.1 E.U.T. Operation 28
7.8.2 Test Mode Description 28
7.8.3 Test Setup Diagram 28
7.8.4 Measurement Procedure and Data 28
7.9 Radiated Emissions which fall in the restricted bands 29
7.9.1 E.U.T. Operation 29
7.9.2 Test Mode Description 29
7.9.3 Test Setup Diagram 30
7.9.4 Measurement Procedure and Data 30
7.10 Radiated Spurious Emissions 35
7.10.1 E.U.T. Operation 35
7.10.2 Test Mode Description 35
7.10.3 Test Setup Diagram 36
7.10.4 Measurement Procedure and Data 37

8 EUT Constructional Details (EUT Photos) 46

9 Appendix 47

9.1 Appendix A: 20dB Emission Bandwidth 47
9.1.1 Test Result 47
9.1.2 Test Graphs 47
9.2 Appendix B: Maximum conducted output power 52
9.2.1 Test Result 52
9.2.2 Test Graphs 52
9.3 Appendix C: Carrier frequency separation 57
9.3.1 Test Result 57
9.3.2 Test Graphs 57
9.4 Appendix D: Dwell Time 59
9.4.1 Test Result 59
9.4.2 Test Graphs 60
9.5 Appendix E: Number of hopping channels 87
9.5.1 Test Result 87
9.5.2 Test Graphs 87
9.6 Appendix F: Band edge measurements 89
9.6.1 Test Result 89
9.6.2 Test Graphs 89
9.7 Appendix G: Conducted Spurious Emission 96
9.7.1 Test Result 96
9.7.2 Test Graphs 97

No.198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District, Guangzhou, China 510663 t (86-20) 82155555 f (86-20) 82075058 www.sgsgroup.com.cn
中国·广州·经济技术开发区科学城科珠路198号 邮编: 510663 t (86-20) 82155555 f (86-20) 82075058 sgs.china@sgs.com

4 General Information

4.1 Details of E.U.T.

Power supply:	The details of AC/DC adapter as below: Model 1: S018-1B240065VU Input: 100~240V, 50/60Hz, 0.6A Output: DC 24.0V 0.65A Model 2: GPE012P-240065-1 Input: 100~240V, 50/60Hz, 0.5A Output: DC 24.0V 0.65A 15.6W Max
Test Voltage:	AC 120 V, 60 Hz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Function:	Mini Aria Ultrasonic Diffuser with BT classic
Modulation Type:	GFSK, p/4DQPSK, 8DPSK
Number of Channels:	79
Channel Spacing:	1MHz
Antenna Gain	2.81 dBi declared by applicant
Antenna Type	PCB Antenna
Hardware Version:	YT-PCB-469-A21013A-C
Firmware Version:	V02
S/N:	SP-2021061001
Test Software Version:	BT_Tool V1.2
Power setting level	4 dBm can not changed by user

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Notebook	IBM	T30	S/N78-3VMLX 06/01

4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	3.12dB
Conducted Peak Output Power	± 0.75dB
20dB Bandwidth	± 3%
Carrier Frequencies Separation	± 7.25 x 10^{-8}
Hopping Channel Number	± 7.25 x 10^{-8}
Dwell Time	± 0.37%
Conducted Band Edges Measurement	± 0.75dB
Conducted Spurious Emissions	± 0.75dB
Radiated Emissions which fall in the restricted bands	5.06dB （30MHz-1GHz；3m） 4.46dB （30MHz-1GHz；10m） 5.08dB (1GHz-6GHz) 5.14dB (above 6GHz)
Radiated Spurious Emissions	5.06dB （30MHz-1GHz；3m） 4.46dB （30MHz-1GHz；10m） 5.08dB (1GHz-6GHz) 5.14dB (above 6GHz)

4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,

198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District, Guangzhou, China 510663

Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian/New Zealand Regulatory Compliance Mark (RCM).

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2018 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing Laboratories.

- **FCC Recognized Accredited Test Firm(Registration No.: 486818)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818.

- **ISED (Registration No.: 4620B, CAB identifier: CN0052)**

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

- **VCCI (Registration No.: R-12460, C-12584, G-20107 and T-11179)**

The 10m Semi-anechoic chamber, 966 Anechoic Chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-12460, C-12584, G-20107 and T-11179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2017, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

5 Equipment List

Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EMI Test Receiver(9kHz-2.75GHz)	Rohde & Schwarz	ESCS30	EMC0506	2020-11-13	2021-11-12
Shielding Room	ChangZhou ZhongYu	8m x 3m x 3.8m	EMC0306	N/A	N/A
Two-Line V-Network	Rohde & Schwarz	ENV216	EMC0118	2021-01-08	2022-01-06
Coaxial Cable	HangTianXing	2m	EMC0107	2020-09-09	2022-09-08
Test Software E3c	Audix	Ver. 5.4.1221b	GZE100-62	N/A	N/A

Conducted Peak Output Power					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

20dB Bandwidth					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

Carrier Frequencies Separation					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

Hopping Channel Number					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

Dwell Time					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

Conducted Band Edges Measurement					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

Conducted Spurious Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EXA Signal Analzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2020-09-17	2021-09-16
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01

Radiated Emissions which fall in the restricted bands					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Chamber cable(Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2020/9/9	2022/9/8
Horn Antenna(1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2019-09-25	2022-09-24
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-01-08	2022-01-07
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2021-01-08	2022-01-07
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
MXE EMI Receiver(10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2020-11-13	2021-11-12
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2020-09-17	2021-09-16
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Notch Filter (5150-5880)	Mico-Tronics	BRM50716	EMC2168	2020-07-29	2021-07-28
Signal Analyzer (20Hz-26.5GHz)	Rohde & Schwarz	FISQ 26	EMC0069	2020/11/13	2021/11/12

Radiated Spurious Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Chamber cable(Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2020/9/9	2022/9/8
Horn Antenna(1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2019-09-25	2022-09-24
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-01-08	2022-01-07
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2021-01-08	2022-01-07
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
MXE EMI Receiver(10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2020-11-13	2021-11-12
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2020-09-17	2021-09-16
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Notch Filter (5150-5880)	Mico-Tronics	BRM50716	EMC2168	2020-07-29	2021-07-28
Signal Analyzer (20Hz-26.5GHz)	Rohde & Schwarz	FISQ 26	EMC0069	2020/11/13	2021/11/12

General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DMM	Fluke	73	EMC0006	2020-07-09	2021-07-08
DMM	Fluke	73	EMC0007	2020-07-09	2021-07-08

SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch Testing Center, EEC Laboratory.
No.198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District, Guangzhou, China 510663 t (86-20) 82155555 f (86-20) 82075058 www.sgsgroup.com.cn
中国·广州·经济技术开发区科学城科珠路198号 邮编: 510663 t (86-20) 82155555 f (86-20) 82075058 sgs.china@sgs.com

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

6.1.2 Conclusion

Standard Requirement: Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. EUT Antenna: The antenna is integrated on the main PCB and no consideration of replacement.

The best case gain of the antenna is 2.81dBi. Please refer to internal photos.

6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

6.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

Limit:

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom 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.

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.

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

Compliance for section 15.247(a)(1):

According to Technical Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

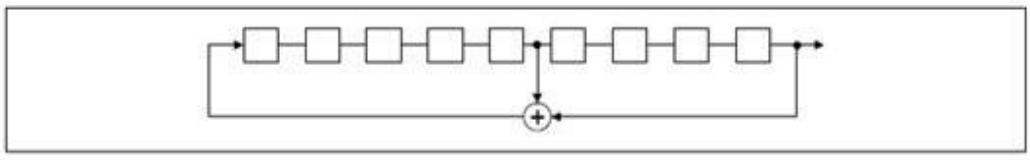
> Number of shift register stages: 9

> Length of pseudo-random sequence: 29 -1 = 511 bits

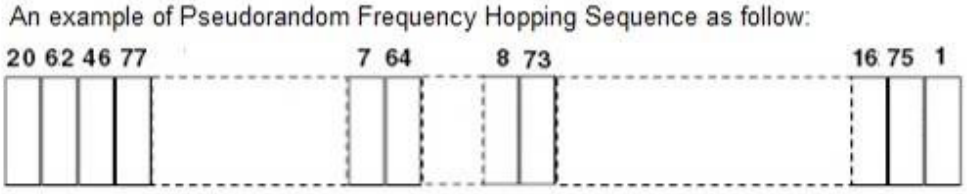
> Longest sequence of zeros: 8 (non-inverted signal)

Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Linear Feedback Shift Register for Generation of the PRBS sequence



Each frequency used equally on the average by each transmitter.

According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g):

According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h):

According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

6.2.2 Conclusion

Standard Requirement: The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom 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. 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. The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted. Compliance for section 15.247(a)(1):According to Technical Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.> Number of shift register stages: 9> Length of pseudo-random sequence: 29 -1 = 511 bits> Longest sequence of zeros: 8 (non-inverted signal)Linear Feedback Shift Register for Generation of the PRBS sequence Each frequency used equally on the average by each transmitter. According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals. Compliance for section 15.247(g): According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system. Compliance for section 15.247(h):According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels. The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

7 Radio Spectrum Matter Test Results

7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

Frequency of emission(MHz)	Conducted limit(dBμV)	
	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.		
Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz		

7.1.1 E.U.T. Operation

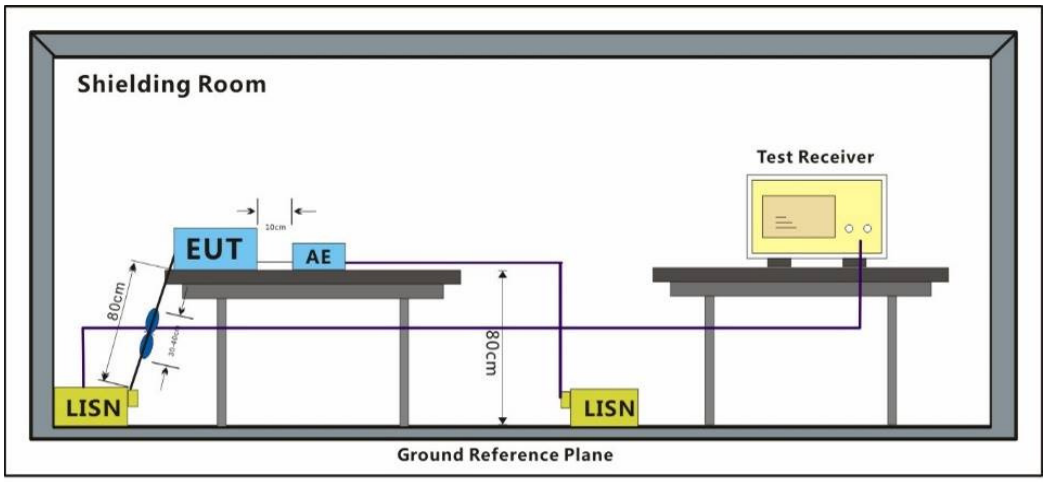
Operating Environment:

Temperature: 23 °C Humidity: 52.5 % RH Atmospheric Pressure: 1010 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	06	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter S018-1B240065VU
Final test	01	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter GPE012P-240065-1.

7.1.3 Test Setup Diagram



7.1.4 Measurement Procedure and Data

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

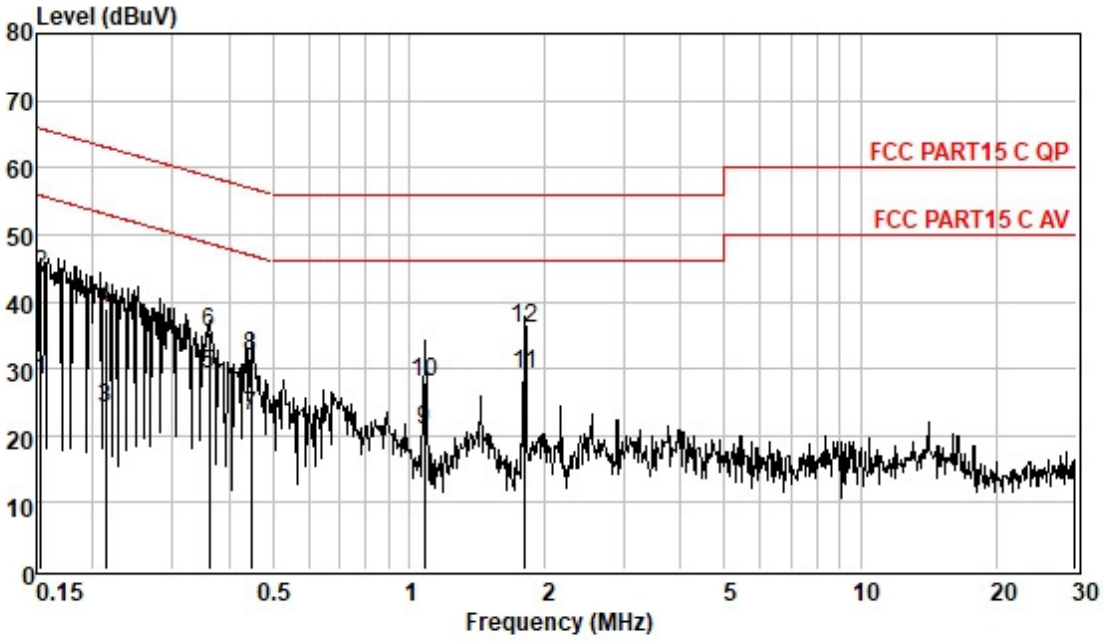
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: LISN=Read Level+ Cable Loss+ LISN Factor

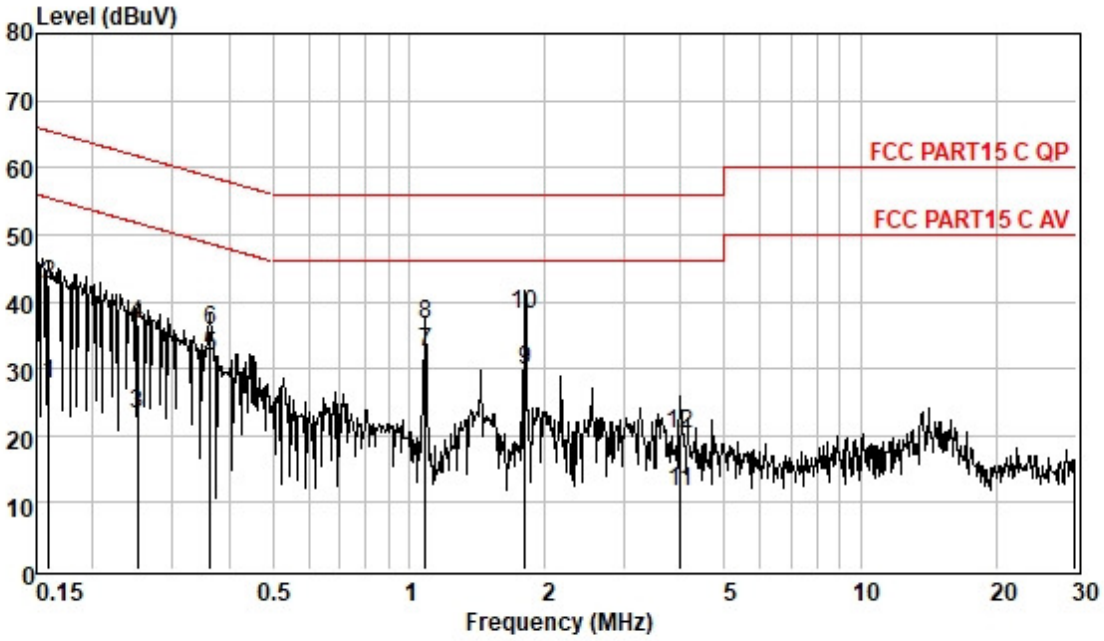
Test Mode: 01; Line: Neutral Line



Pol :LINE
Mode :金盈
Model :

Frequenc MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
0.15	18.59	0.06	9.62	28.27	55.82	-27.55	Average
0.15	34.31	0.06	9.62	43.99	65.82	-21.83	QP
0.21	14.31	0.06	9.63	24.00	53.05	-29.05	Average
0.21	29.36	0.06	9.63	39.05	63.05	-24.00	QP
0.36	19.48	0.06	9.63	29.17	48.69	-19.52	Average
0.36	25.58	0.06	9.63	35.27	58.69	-23.42	QP
0.45	13.20	0.06	9.62	22.88	46.93	-24.05	Average
0.45	22.10	0.06	9.62	31.78	56.93	-25.15	QP
1.08	10.99	0.08	9.62	20.69	46.00	-25.31	Average
1.08	18.23	0.08	9.62	27.93	56.00	-28.07	QP
1.81	19.48	0.11	9.62	29.21	46.00	-16.79	Average
1.81	26.12	0.11	9.62	35.85	56.00	-20.15	QP

Test Mode: 01; Line: Neutral Line



Pol :NEUTRAL
Mode :金盈
Model :

Frequenc MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
0.16	18.08	0.06	9.55	27.69	55.47	-27.78	Average
0.16	32.87	0.06	9.55	42.48	65.47	-22.99	QP
0.25	13.70	0.06	9.55	23.31	51.73	-28.42	Average
0.25	27.00	0.06	9.55	36.61	61.73	-25.12	QP
0.36	22.07	0.06	9.55	31.68	48.65	-16.97	Average
0.36	26.11	0.06	9.55	35.72	58.65	-22.93	QP
1.09	22.65	0.08	9.55	32.28	46.00	-13.72	Average
1.09	26.92	0.08	9.55	36.55	56.00	-19.45	QP
1.81	19.96	0.11	9.54	29.61	46.00	-16.39	Average
1.81	28.46	0.11	9.54	38.11	56.00	-17.89	QP
3.99	1.77	0.17	9.56	11.50	46.00	-34.50	Average
3.99	10.50	0.17	9.56	20.23	56.00	-35.77	QP

7.2 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(1)

Test Method: ANSI C63.10 (2013) Section 7.8.5

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥50 hopping channels
	0.25 for 25≤ hopping channels <50
	1 for digital modulation
2400-2483.5	1 for ≥75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

7.2.1 E.U.T. Operation

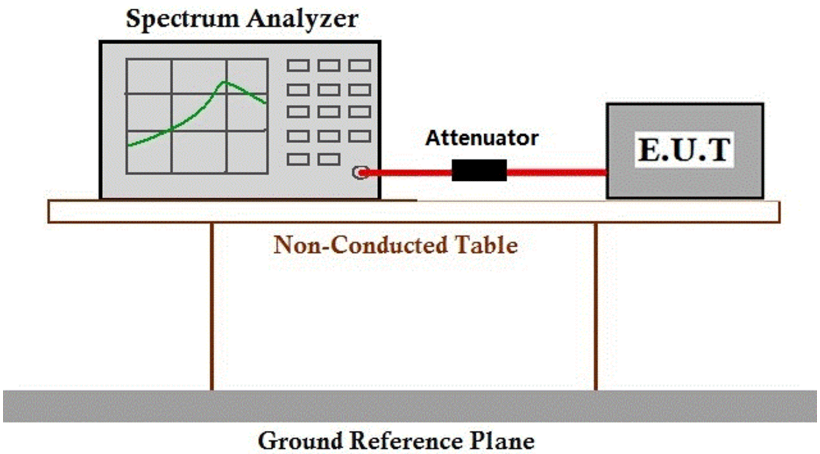
Operating Environment:

Temperature: 25.1 °C Humidity: 63.0 % RH Atmospheric Pressure: 1010 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	06	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter S018-1B240065VU
Final test	01	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter GPE012P-240065-1.

7.2.3 Test Setup Diagram



7.2.4 Measurement Procedure and Data

Please Refer To Appendix For Details

7.3 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247(a)(1)
Test Method: ANSI C63.10 (2013) Section 7.8.7

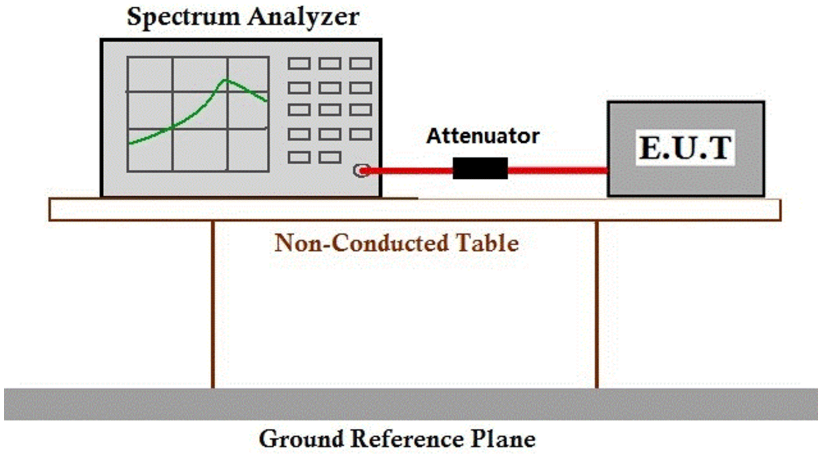
7.3.1 E.U.T. Operation

Operating Environment:
Temperature: 25.1 °C Humidity: 63.0 % RH Atmospheric Pressure: 1010 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter GPE012P-240065-1.
Pre-scan	05	TX_ non-Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter S018-1B240065VU

7.3.3 Test Setup Diagram



7.3.4 Measurement Procedure and Data

Please Refer To Appendix For Details

7.4 Carrier Frequencies Separation

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)

Test Method: ANSI C63.10 (2013) Section 7.8.2

Limit: 2/3 of the 20dB bandwidth base on the transmission power is less than 0.125W.

7.4.1 E.U.T. Operation

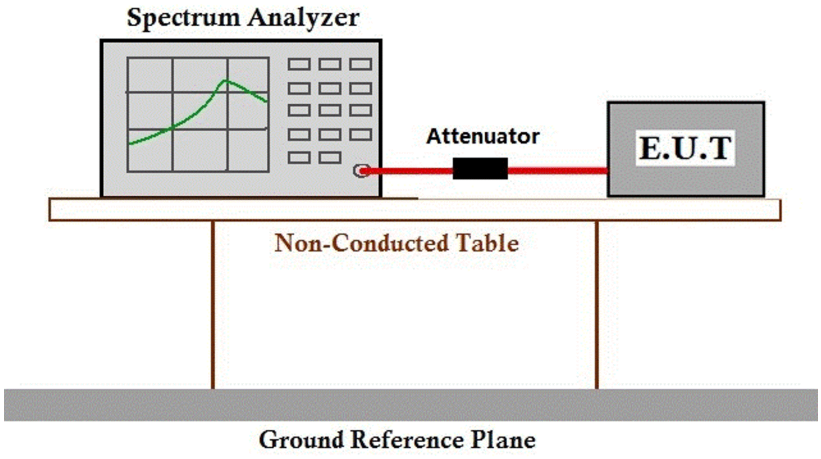
Operating Environment:

Temperature: 25.1 °C Humidity: 63.0 % RH Atmospheric Pressure: 1010 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	06	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter S018-1B240065VU
Final test	01	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter GPE012P-240065-1.

7.4.3 Test Setup Diagram



7.4.4 Measurement Procedure and Data

Please Refer To Appendix For Details

7.5 Hopping Channel Number

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)

Test Method: ANSI C63.10 (2013) Section 7.8.3

Limit:

Frequency range(MHz)	Number of hopping channels (minimum)
902-928	50 for 20dB bandwidth <250kHz
	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

7.5.1 E.U.T. Operation

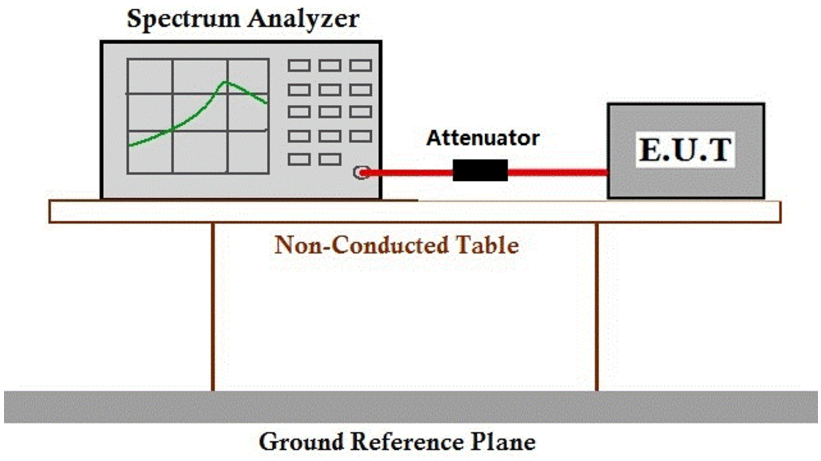
Operating Environment:

Temperature: 25.1 °C Humidity: 63.0 % RH Atmospheric Pressure: 1010 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	06	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter S018-1B240065VU
Final test	01	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter GPE012P-240065-1.

7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

Please Refer To Appendix For Details

7.6 Dwell Time

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)

Test Method: ANSI C63.10 (2013) Section 7.8.4

Limit:

Frequency(MHz)	Limit
902-928	0.4s within a 20s period(20dB bandwidth<250kHz)
	0.4s within a 10s period(20dB bandwidth≥250kHz)
2400-2483.5	0.4s within a period of 0.4s multiplied by the number of hopping channels
5725-5850	0.4s within a 30s period

7.6.1 E.U.T. Operation

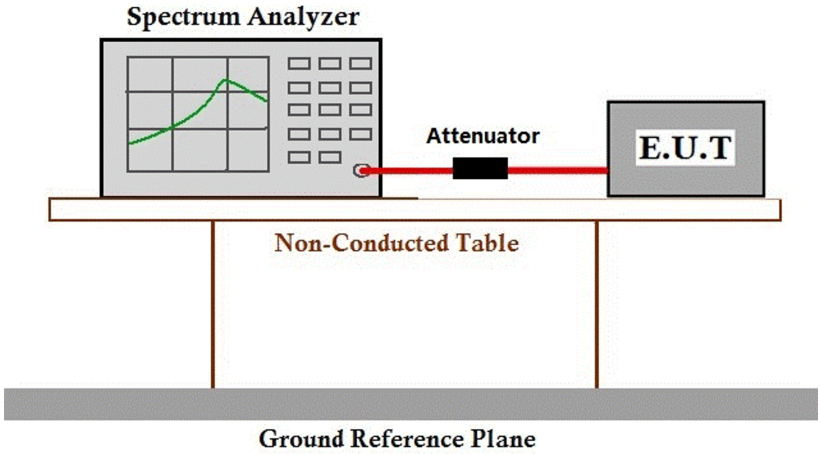
Operating Environment:

Temperature: 25.1 °C Humidity: 63.0 % RH Atmospheric Pressure: 1010 mbar

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	06	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter S018-1B240065VU
Final test	01	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter GPE012P-240065-1.

7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

Please Refer To Appendix For Details

7.7 Conducted Band Edges Measurement

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 7.8.6

Limit: 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).

7.7.1 E.U.T. Operation

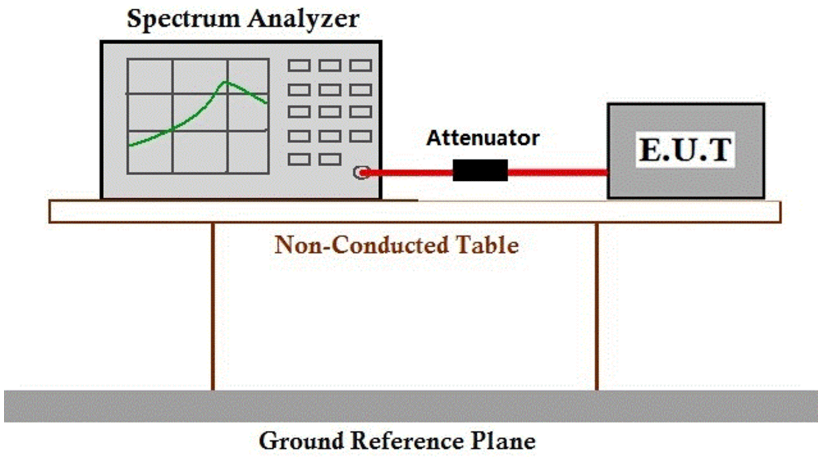
Operating Environment:

Temperature: 25.1 °C Humidity: 63.0 % RH Atmospheric Pressure: 1010 mbar

7.7.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	00	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter S018-1B240065VU.
Pre-scan	05	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter S018-1B240065VU.
Final test	01	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter GPE012P-240065-1.
Final test	06	TX_non-Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter GPE012P-240065-1.

7.7.3 Test Setup Diagram



7.7.4 Measurement Procedure and Data

Please Refer To Appendix For Details

7.8 Conducted Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 7.8.8

Limit: 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).

7.8.1 E.U.T. Operation

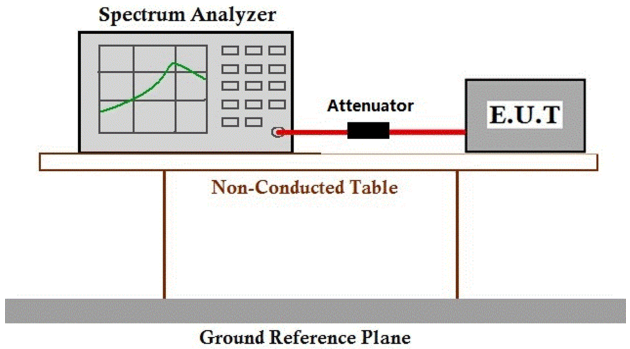
Operating Environment:

Temperature: 25.1 °C Humidity: 63.0 % RH Atmospheric Pressure: 1010 mbar

7.8.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	00	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter S018-1B240065VU.
Final test	05	TX_non-Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter GPE012P-240065-1.

7.8.3 Test Setup Diagram



7.8.4 Measurement Procedure and Data

Please Refer To Appendix For Details

7.9 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.10.5

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
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
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.		

7.9.1 E.U.T. Operation

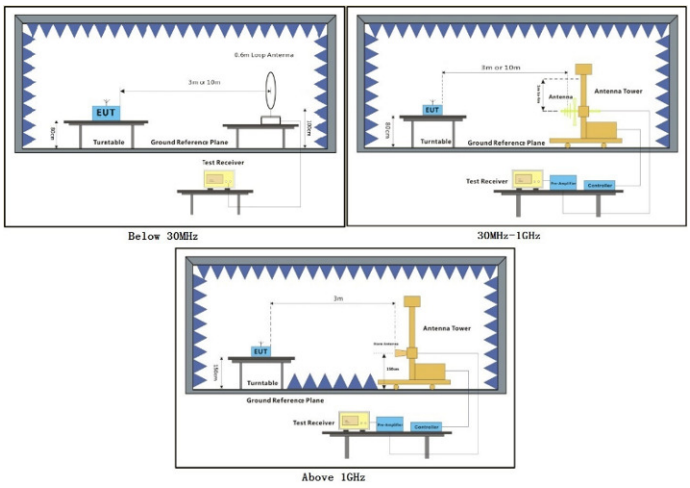
Operating Environment:

Temperature: 25.6 °C Humidity: 61.3 % RH Atmospheric Pressure: 1010 mbar

7.9.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	00	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter S018-1B240065VU.
Final test	05	TX_non-Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter GPE012P-240065-1.

7.9.3 Test Setup Diagram



7.9.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

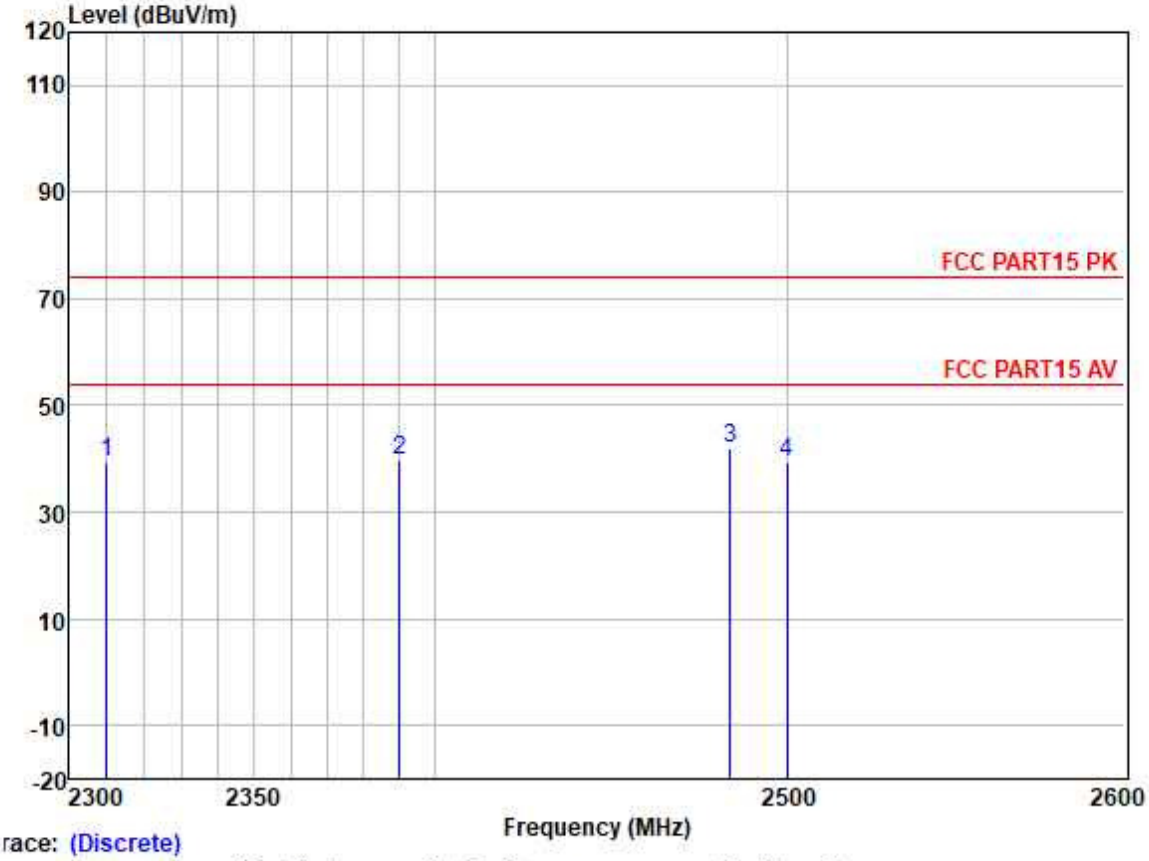
j. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Remark 3: Antenna: 3 denotes the type of antenna for above 1000MHz.

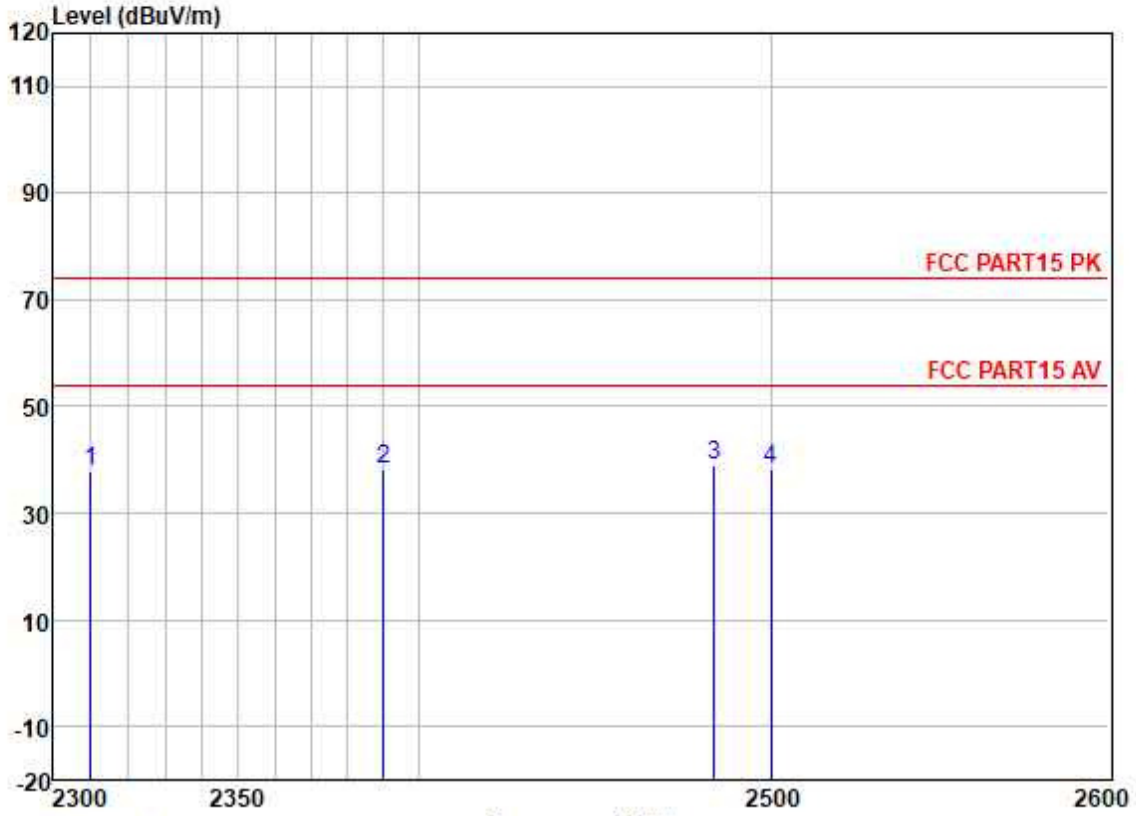
Test Mode: 05; Polarity: Horizontal; Modulation:GFSK; Channel:High; Antenna: 3



race: (Discrete)

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2310.000	46.49	27.15	3.32	37.62	39.34	74.00	-34.66	HORIZONTAL	Peak
2	2390.000	46.43	27.33	3.48	37.59	39.65	74.00	-34.35	HORIZONTAL	Peak
3	2483.500	48.71	27.48	3.53	37.57	42.15	74.00	-31.85	HORIZONTAL	Peak
4	2500.000	45.87	27.50	3.40	37.56	39.21	74.00	-34.79	HORIZONTAL	Peak

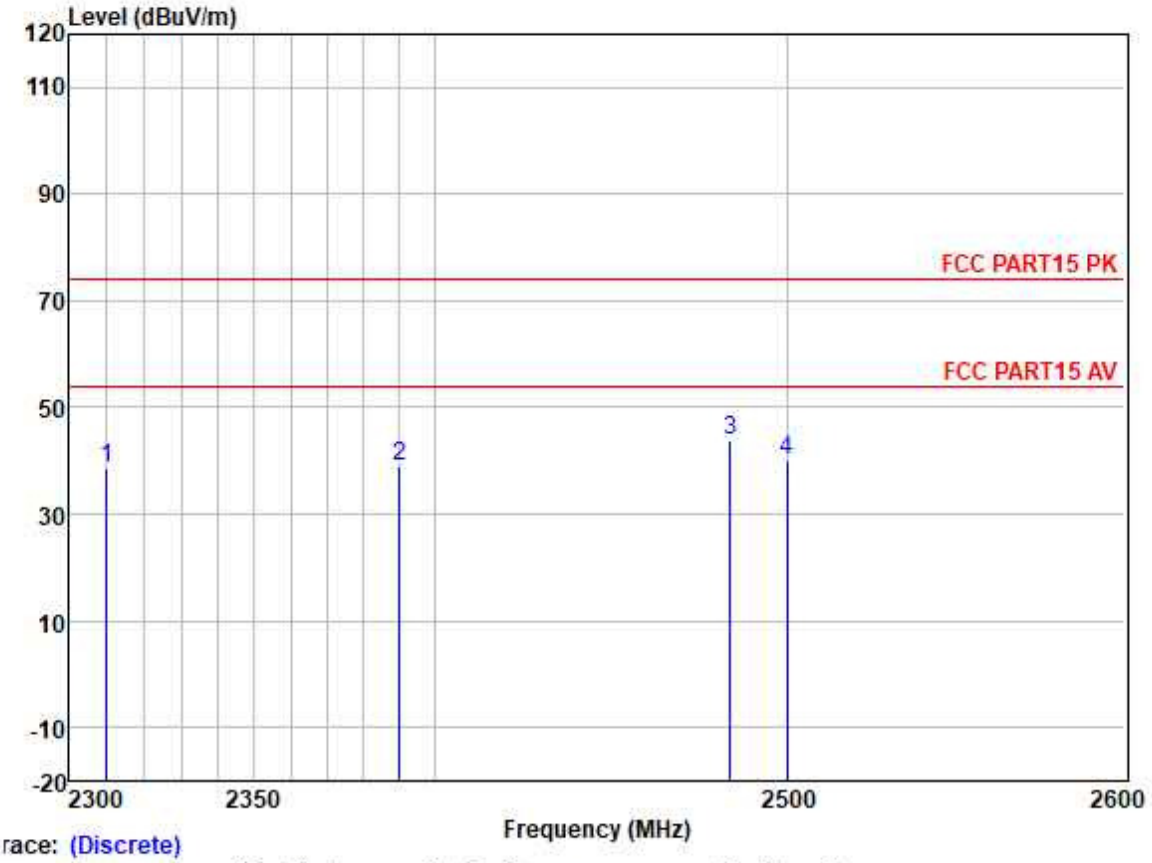
Test Mode: 05; Polarity: Horizontal; Modulation:GFSK; Channel:Low; Antenna: 3



race: (Discrete)

	Freq	ReadAntenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2310.000	45.18	27.15	3.32	37.62	38.03	74.00	-35.97	HORIZONTAL	Peak
2	2390.000	44.99	27.33	3.48	37.59	38.21	74.00	-35.79	HORIZONTAL	Peak
3	2483.500	45.68	27.48	3.53	37.57	39.12	74.00	-34.88	HORIZONTAL	Peak
4	2500.000	45.08	27.50	3.40	37.56	38.42	74.00	-35.58	HORIZONTAL	Peak

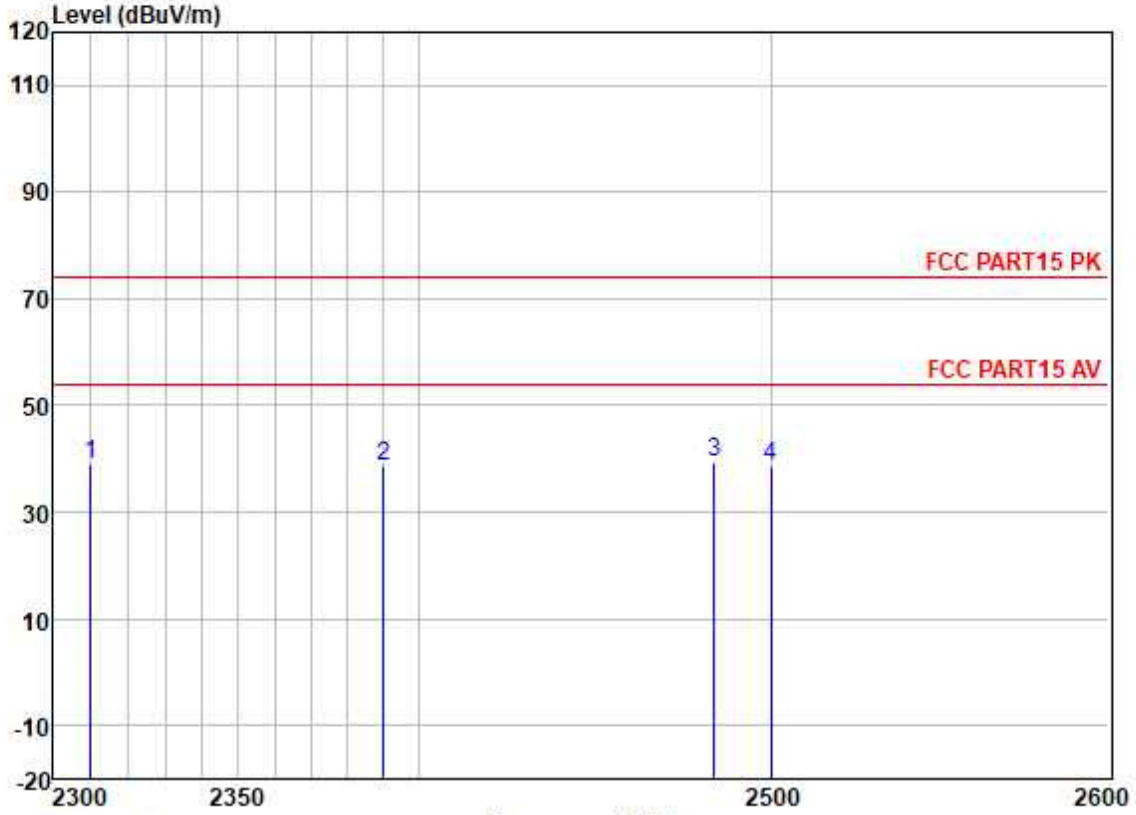
Test Mode: 05; Polarity: Vertical; Modulation:GFSK; Channel:High; Antenna: 3



race: (Discrete)

	Freq	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2310.000	45.81	27.15	3.32	37.62	38.66	74.00	-35.34	VERTICAL	Peak
2	2390.000	45.91	27.33	3.48	37.59	39.13	74.00	-34.87	VERTICAL	Peak
3	2483.500	50.34	27.48	3.53	37.57	43.78	74.00	-30.22	VERTICAL	Peak
4	2500.000	46.77	27.50	3.40	37.56	40.11	74.00	-33.89	VERTICAL	Peak

Test Mode: 05; Polarity: Vertical; Modulation:GFSK; Channel:Low; Antenna: 3



race: (Discrete)

	Freq	ReadAntenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2310.000	46.17	27.15	3.32	37.62	39.02	74.00	-34.98	VERTICAL	Peak
2	2390.000	45.45	27.33	3.48	37.59	38.67	74.00	-35.33	VERTICAL	Peak
3	2483.500	45.75	27.48	3.53	37.57	39.19	74.00	-34.81	VERTICAL	Peak
4	2500.000	45.28	27.50	3.40	37.56	38.62	74.00	-35.38	VERTICAL	Peak

7.10 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6
Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
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
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.		

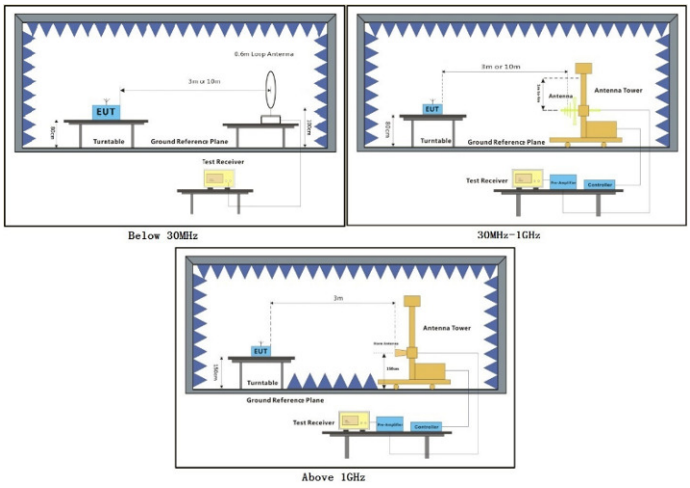
7.10.1 E.U.T. Operation

Operating Environment:
Temperature: 25.6 °C Humidity: 61.3 % RH Atmospheric Pressure: 1010 mbar

7.10.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Pre-scan	00	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter S018-1B240065VU.
Final test	05	TX_non-Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, p/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report with adapter GPE012P-240065-1.

7.10.3 Test Setup Diagram



7.10.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark:

1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

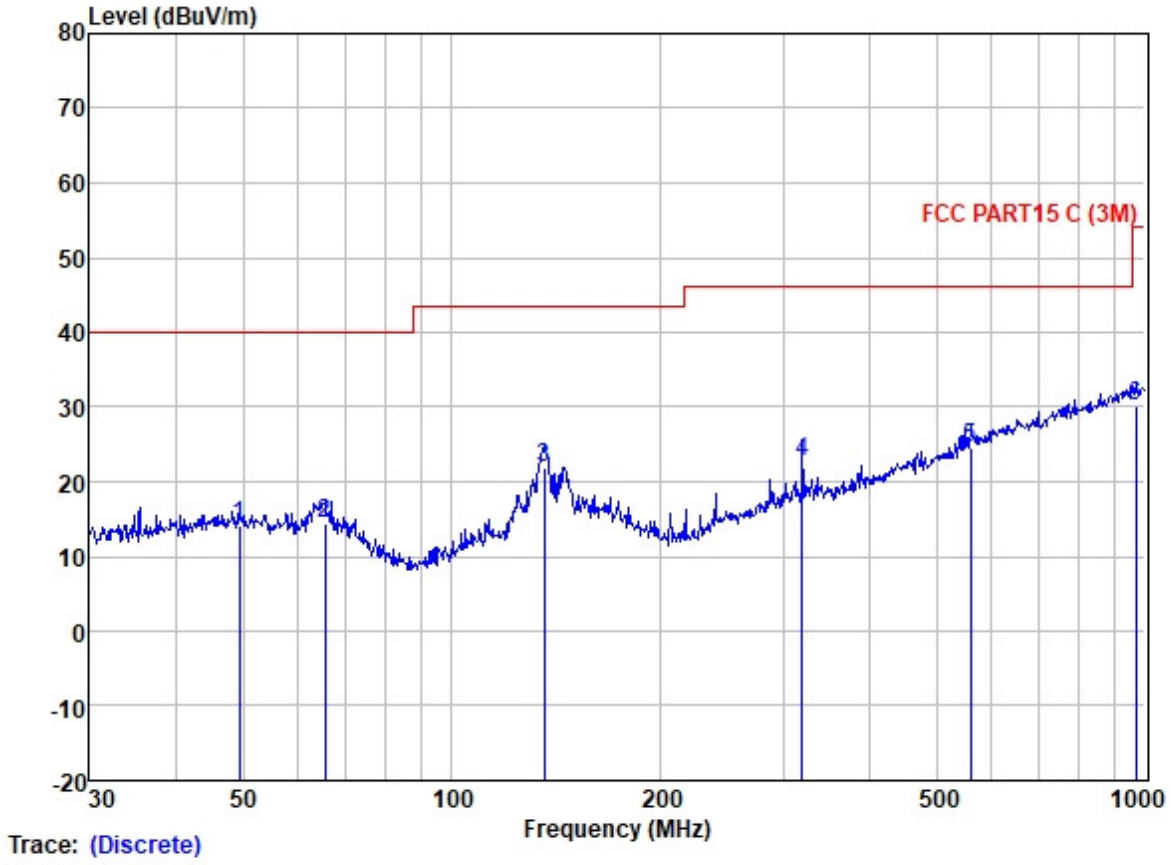
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor

3) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

5) Antenna: 2 denotes the type of antenna for 30-1000MHz; Antenna: 3 denotes the type of antenna for above 1000MHz.

Test Mode: 05; Polarity: Horizontal; Modulation:GFSK; Channel:Low; Antenna: 2

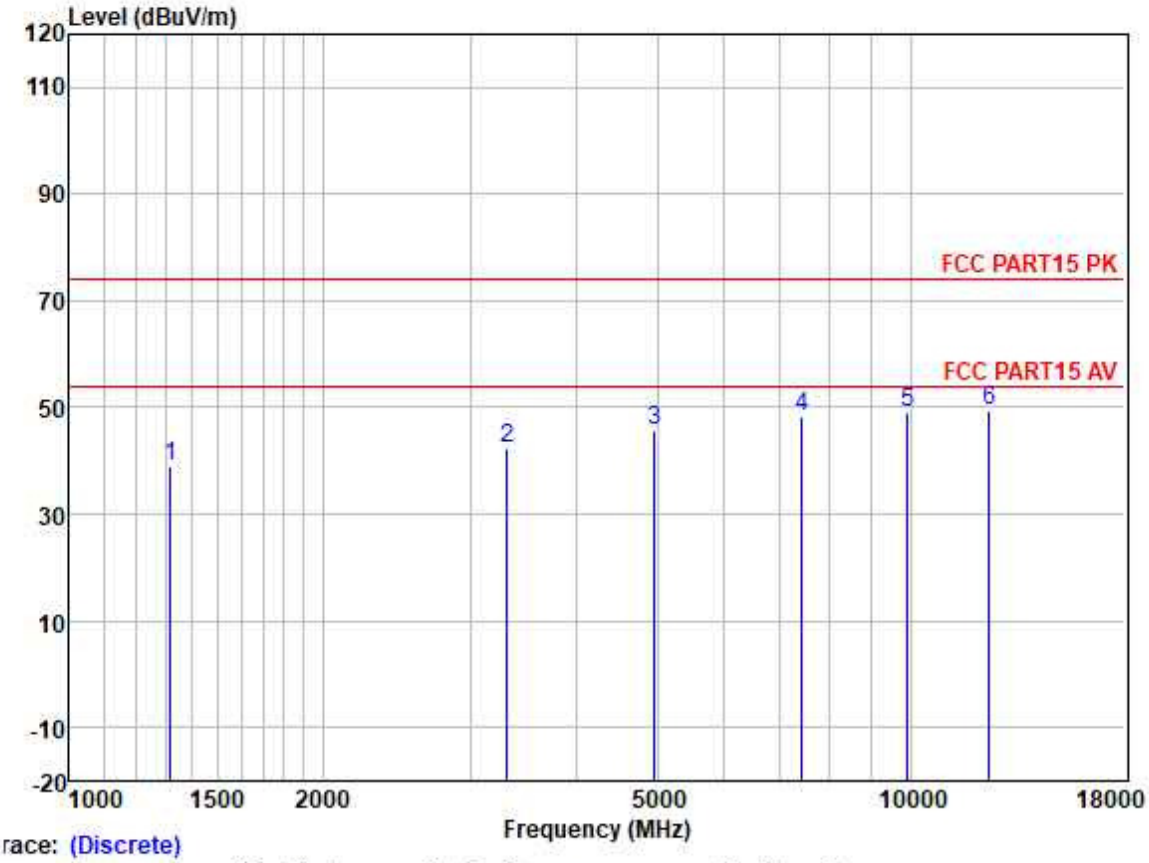


Trace: (Discrete)

Site : SGS
Condition : FCC PART15 C (3M) HORIZONTAL
Job :
Model : 金盈
Power :
Test Mode :

	Freq	Read Level	Anterna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/ Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dBuV		
1	49.36	26.17	13.93	1.14	27.17	14.07	40.00	-25.93	HORIZONTAL	QP
2	65.57	27.53	12.65	1.35	27.15	14.38	40.00	-25.62	HORIZONTAL	QP
3	135.98	33.96	12.80	2.03	26.96	21.83	43.50	-21.67	HORIZONTAL	QP
4	319.94	31.63	14.30	3.32	26.66	22.59	46.00	-23.41	HORIZONTAL	QP
5	558.73	29.04	18.78	4.88	28.13	24.57	46.00	-21.43	HORIZONTAL	QP
6	968.93	26.78	23.90	7.25	27.70	30.23	54.00	-23.77	HORIZONTAL	QP

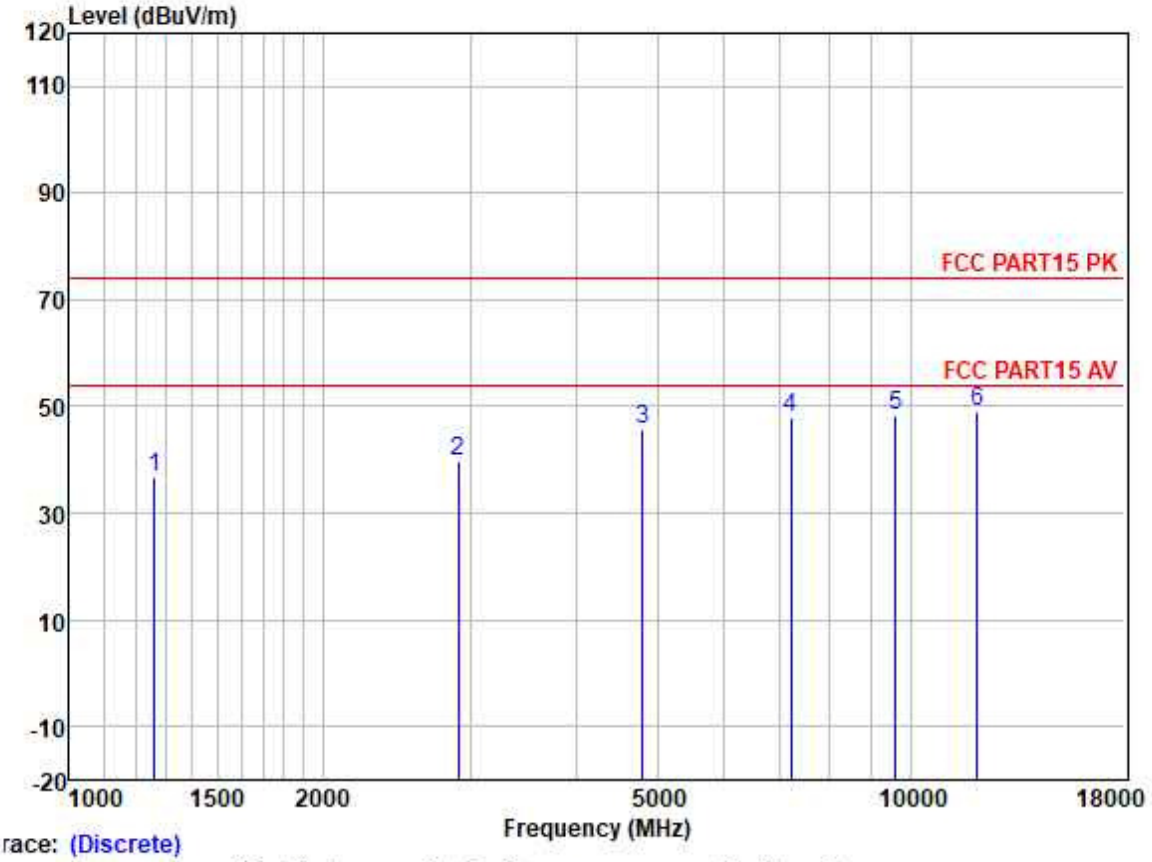
Test Mode: 05; Polarity: Horizontal; Modulation:GFSK; Channel:High; Antenna: 3



race: (Discrete)

	Freq	ReadAntenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1319.794	49.39	25.25	2.60	38.29	38.95	74.00	-35.05	HORIZONTAL	Peak
2	3318.471	46.63	28.77	4.07	37.02	42.45	74.00	-31.55	HORIZONTAL	Peak
3	4960.993	45.26	31.65	5.65	36.84	45.72	74.00	-28.28	HORIZONTAL	Peak
4	7440.684	43.26	36.27	6.22	37.47	48.28	74.00	-25.72	HORIZONTAL	Peak
5	9920.020	40.95	38.65	6.96	37.40	49.16	74.00	-24.84	HORIZONTAL	Peak
6	12400.670	39.81	38.57	7.97	36.88	49.47	74.00	-24.53	HORIZONTAL	Peak

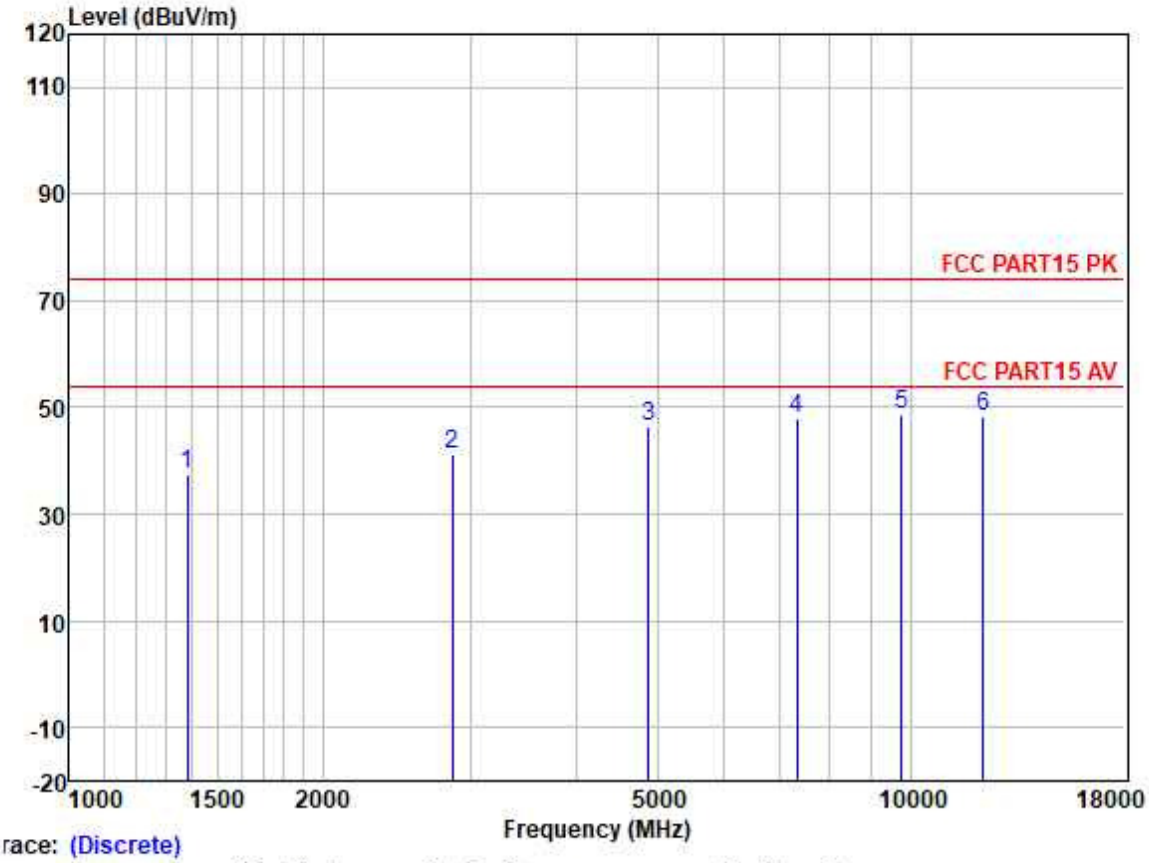
Test Mode: 05; Polarity: Horizontal; Modulation:GFSK; Channel:Low; Antenna: 3



race: (Discrete)

	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1263.796	47.46	25.08	2.42	38.33	36.63	74.00	-37.37	HORIZONTAL	Peak
2	2896.945	44.92	28.29	3.70	37.34	39.57	74.00	-34.43	HORIZONTAL	Peak
3	4804.419	45.84	31.42	5.40	36.83	45.83	74.00	-28.17	HORIZONTAL	Peak
4	7206.763	43.99	35.54	5.98	37.38	48.13	74.00	-25.87	HORIZONTAL	Peak
5	9608.789	40.39	38.37	7.07	37.42	48.41	74.00	-25.59	HORIZONTAL	Peak
6	12010.350	39.15	38.90	8.19	37.10	49.14	74.00	-24.86	HORIZONTAL	Peak

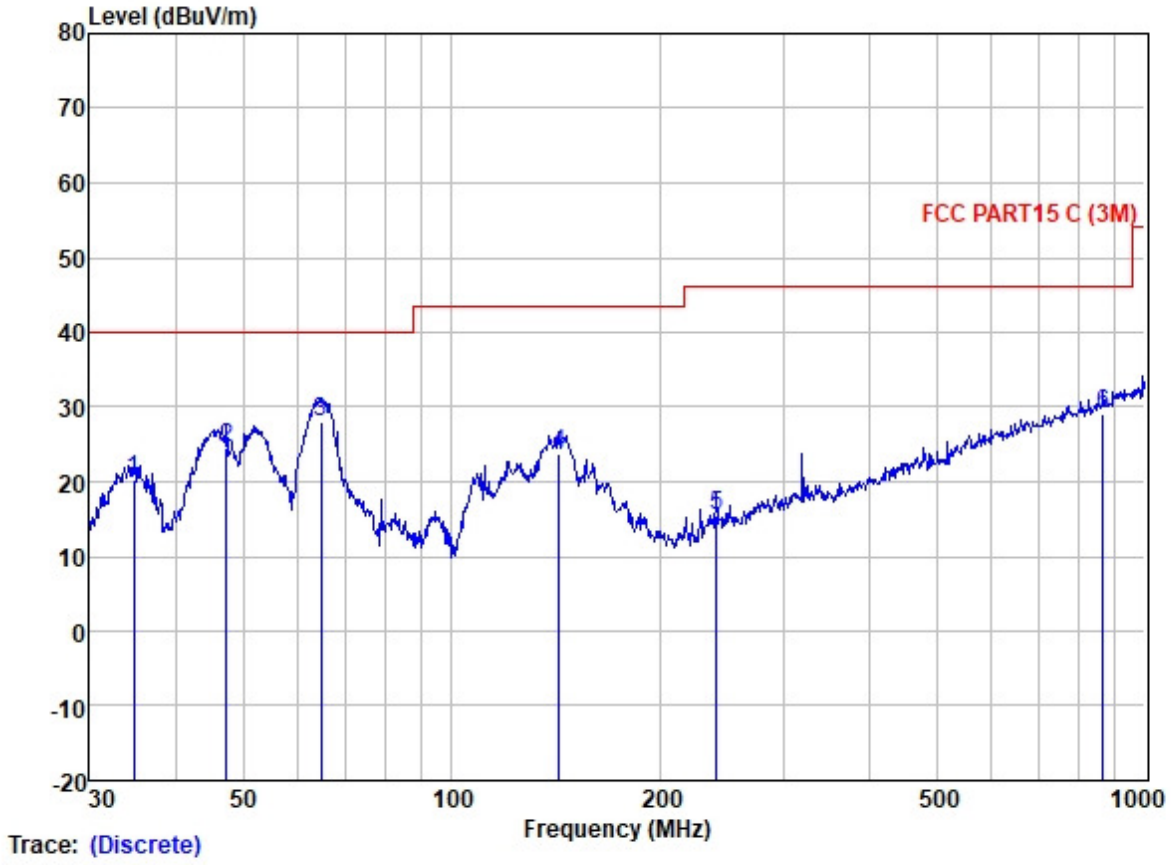
Test Mode: 05; Polarity: Horizontal; Modulation:GFSK; Channel:middle; Antenna: 3



race: (Discrete)

	Freq	ReadAntenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1382.262	47.67	25.37	2.60	38.25	37.39	74.00	-36.61	HORIZONTAL	Peak
2	2855.380	46.65	28.24	3.70	37.38	41.21	74.00	-32.79	HORIZONTAL	Peak
3	4882.975	46.19	31.56	5.52	36.84	46.43	74.00	-27.57	HORIZONTAL	Peak
4	7323.040	43.24	36.00	6.13	37.43	47.94	74.00	-26.06	HORIZONTAL	Peak
5	9764.684	40.51	38.50	7.02	37.41	48.62	74.00	-25.38	HORIZONTAL	Peak
6	12205.350	38.60	38.74	8.08	37.00	48.42	74.00	-25.58	HORIZONTAL	Peak

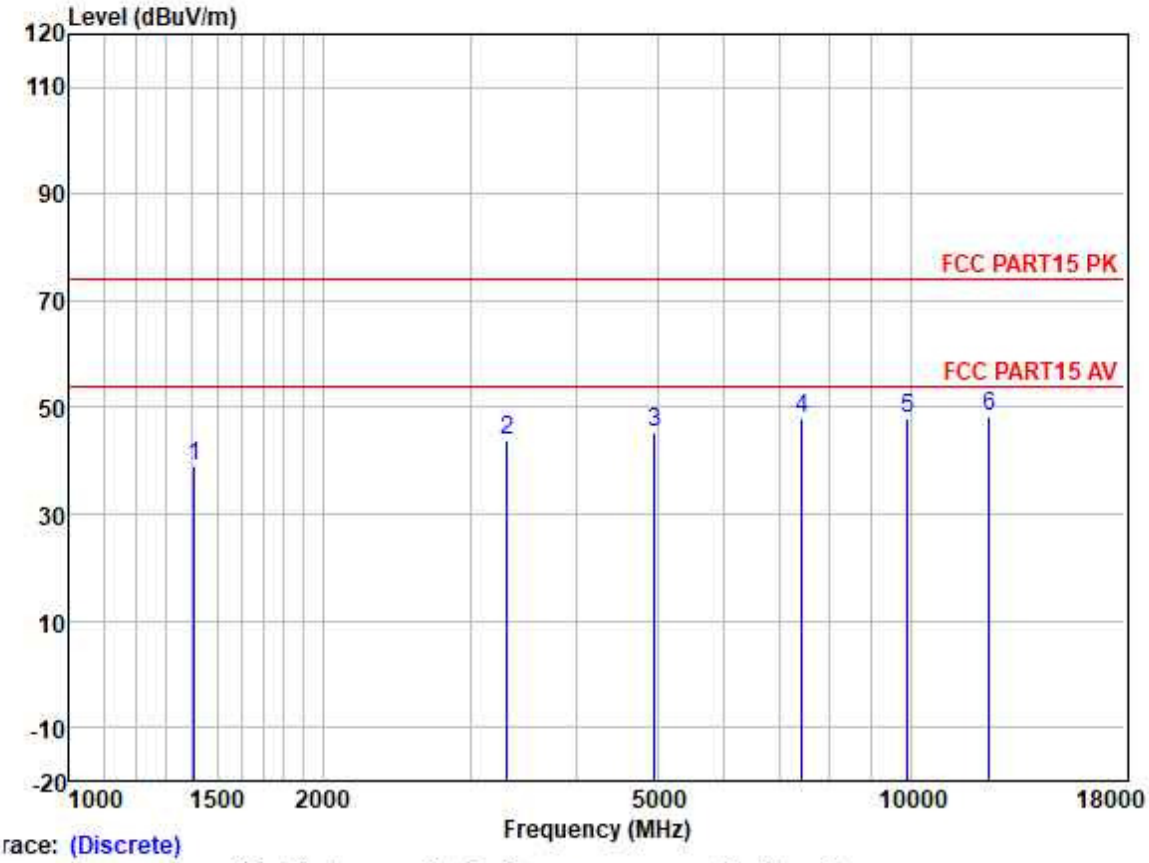
Test Mode: 05; Polarity: Vertical; Modulation:GFSK; Channel:Low; Antenna: 2



Site : SGS
Condition : FCC PART15 C (3M) VERTICAL
Job :
Model : 金盈
Power :
Test Mode :

	Freq	Read Level	Anterna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/ Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dBuV		
1	34.76	33.44	12.87	1.07	27.18	20.20	40.00	-19.80	VERTICAL	QP
2	47.33	36.73	13.97	1.13	27.17	24.66	40.00	-15.34	VERTICAL	QP
3	64.66	40.97	12.79	1.34	27.15	27.95	40.00	-12.05	VERTICAL	QP
4	142.82	34.94	13.55	2.12	26.88	23.73	43.50	-19.77	VERTICAL	QP
5	240.83	27.27	11.92	2.81	26.66	15.34	46.00	-30.66	VERTICAL	QP
6	869.13	27.35	22.90	6.71	27.89	29.07	46.00	-16.93	VERTICAL	QP

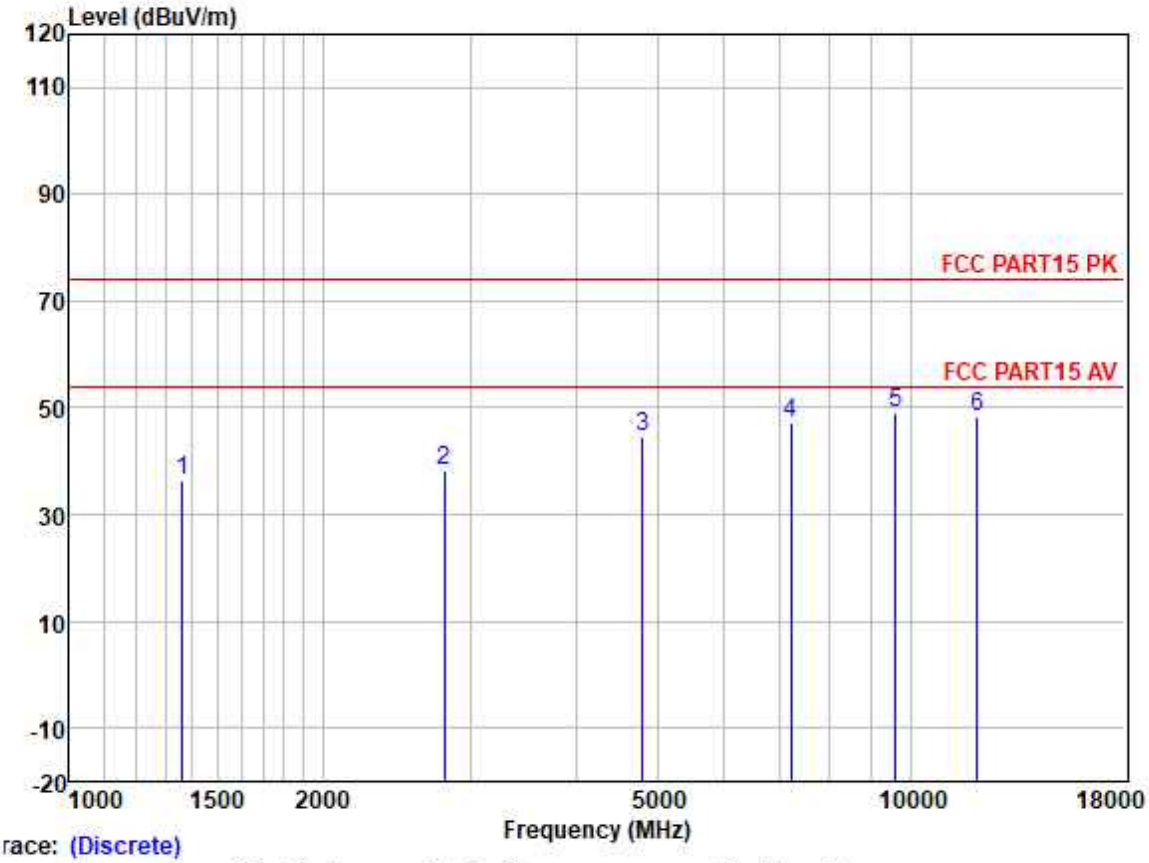
Test Mode: 05; Polarity: Vertical; Modulation:GFSK; Channel:High; Antenna: 3



race: (Discrete)

	Freq	ReadAntenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1406.443	49.29	25.40	2.61	38.22	39.08	74.00	-34.92	VERTICAL	Peak
2	3318.471	48.02	28.77	4.07	37.02	43.84	74.00	-30.16	VERTICAL	Peak
3	4960.833	44.92	31.65	5.65	36.84	45.38	74.00	-28.62	VERTICAL	Peak
4	7440.684	42.89	36.27	6.22	37.47	47.91	74.00	-26.09	VERTICAL	Peak
5	9920.580	39.85	38.65	6.96	37.40	48.06	74.00	-25.94	VERTICAL	Peak
6	12400.910	38.64	38.57	7.97	36.88	48.30	74.00	-25.70	VERTICAL	Peak

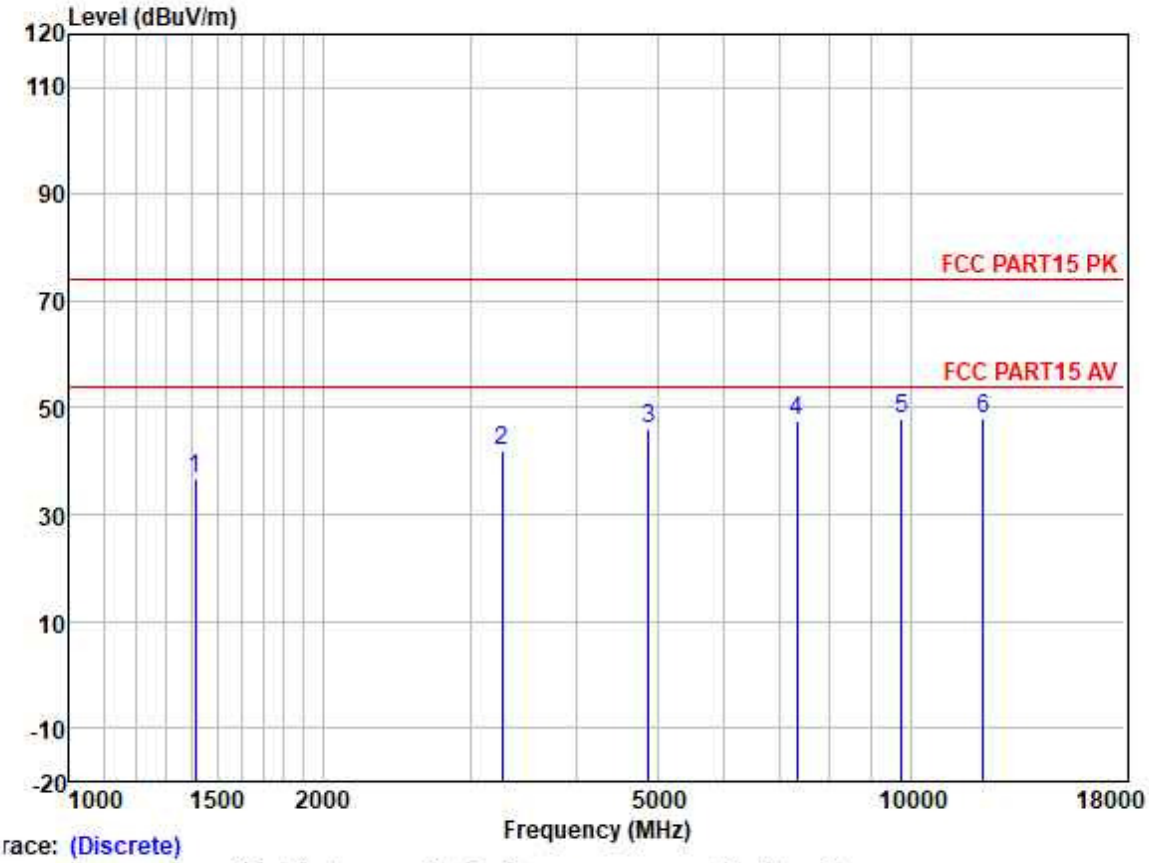
Test Mode: 05; Polarity: Vertical; Modulation:GFSK; Channel:Low; Antenna: 3



race: (Discrete)

	Freq	ReadAntenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1362.430	46.79	25.33	2.60	38.27	36.45	74.00	-37.55	VERTICAL	Peak
2	2790.113	43.88	28.12	3.69	37.41	38.28	74.00	-35.72	VERTICAL	Peak
3	4804.833	44.59	31.42	5.40	36.83	44.58	74.00	-29.42	VERTICAL	Peak
4	7206.161	43.16	35.54	5.98	37.38	47.30	74.00	-26.70	VERTICAL	Peak
5	9608.020	40.92	38.37	7.07	37.42	48.94	74.00	-25.06	VERTICAL	Peak
6	12010.130	38.15	38.90	8.19	37.10	48.14	74.00	-25.86	VERTICAL	Peak

Test Mode: 05; Polarity: Vertical; Modulation:GFSK; Channel:middle; Antenna: 3



race: (Discrete)

	Freq	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1410.514	46.94	25.40	2.62	38.22	36.74	74.00	-37.26	VERTICAL	Peak
2	3270.858	46.20	28.71	4.04	37.04	41.91	74.00	-32.09	VERTICAL	Peak
3	4882.151	45.76	31.56	5.52	36.84	46.00	74.00	-28.00	VERTICAL	Peak
4	7323.542	42.87	36.00	6.13	37.43	47.57	74.00	-26.43	VERTICAL	Peak
5	9764.925	39.94	38.50	7.02	37.41	48.05	74.00	-25.95	VERTICAL	Peak
6	12205.710	38.21	38.74	8.08	37.00	48.03	74.00	-25.97	VERTICAL	Peak

8 EUT Constructional Details (EUT Photos)

Refer to external and internal photos for GZCR2105020355HS

9 Appendix

Cable Loss=0.9 dB

9.1 Appendix A: 20dB Emission Bandwidth

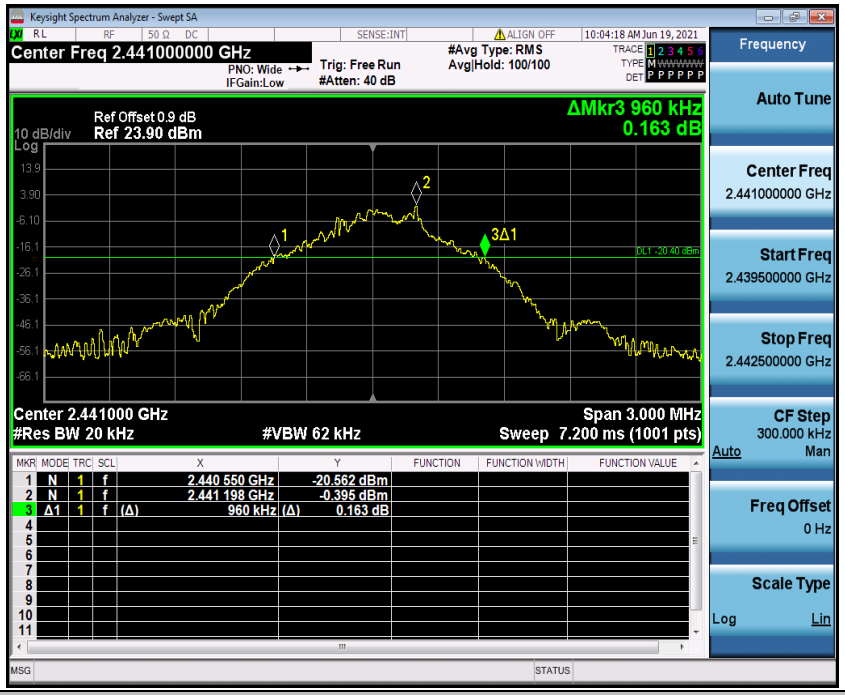
9.1.1 Test Result

TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.954	2401.553	2402.507	---	PASS
		2441	0.960	2440.550	2441.510	---	PASS
		2480	0.978	2479.523	2480.501	---	PASS
2DH5	Ant1	2402	1.296	2401.397	2402.693	---	PASS
		2441	1.269	2440.415	2441.684	---	PASS
		2480	1.287	2479.397	2480.684	---	PASS
3DH5	Ant1	2402	1.287	2401.376	2402.663	---	PASS
		2441	1.275	2440.382	2441.657	---	PASS
		2480	1.266	2479.394	2480.660	---	PASS

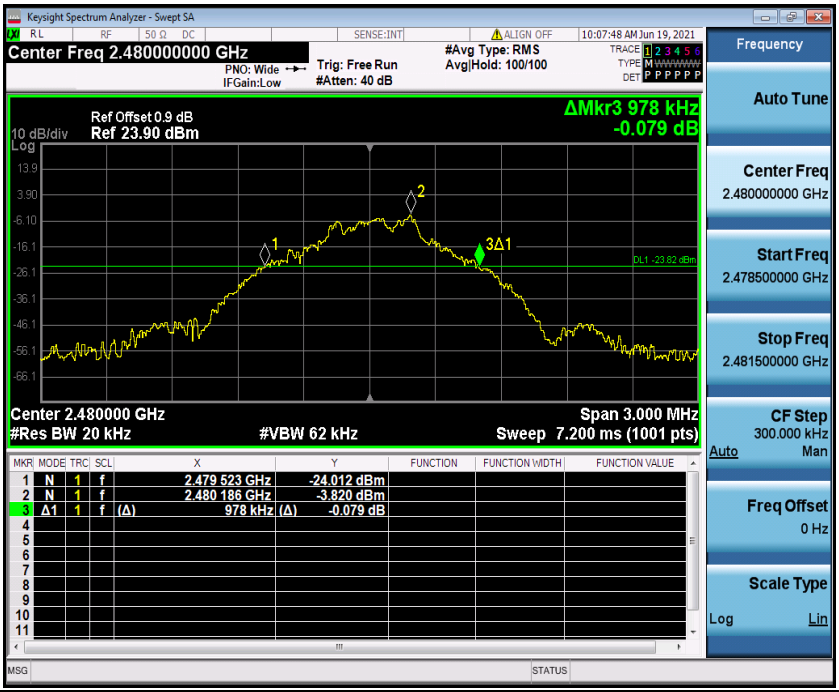
9.1.2 Test Graphs

DH5_Ant1_2402

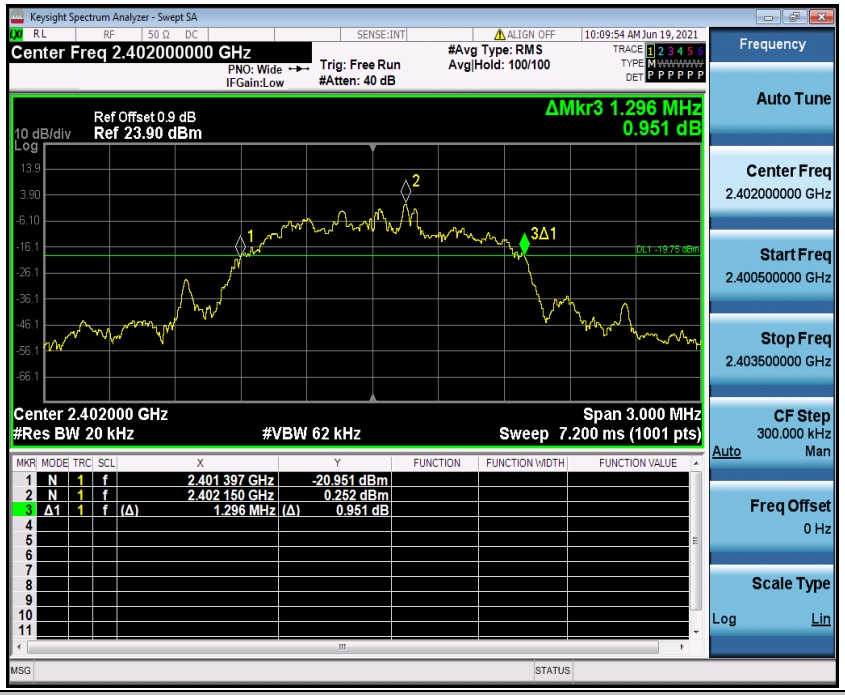
DH5_Ant1_2441



DH5_Ant1_2480



2DH5_Ant1_2402



2DH5_Ant1_2441

2DH5_Ant1_2480

3DH5_Ant1_2402

3DH5_Ant1_2441

3DH5_Ant1_2480

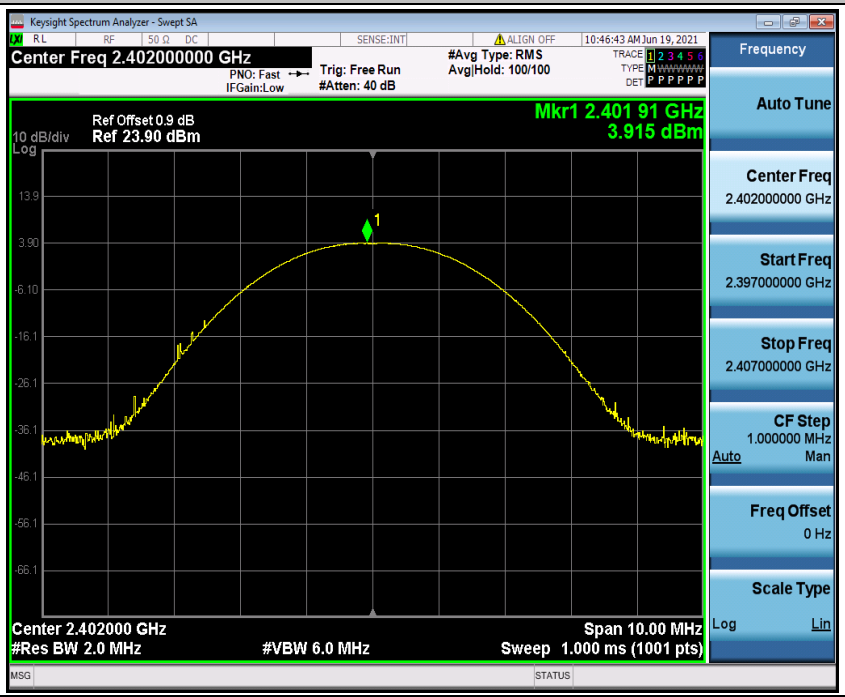
9.2 Appendix B: Maximum conducted output power

9.2.1 Test Result

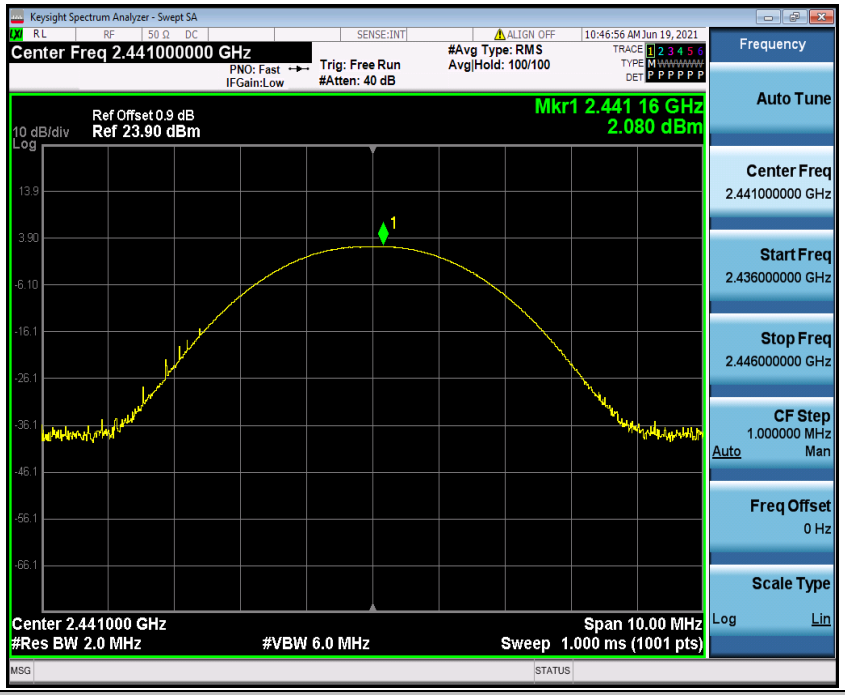
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH5	Ant1	2402	3.92	<=20.97	PASS
		2441	2.08	<=20.97	PASS
		2480	-0.1	<=20.97	PASS
2DH5	Ant1	2402	3.82	<=20.97	PASS
		2441	2.1	<=20.97	PASS
		2480	-0.1	<=20.97	PASS
3DH5	Ant1	2402	3.83	<=20.97	PASS
		2441	2.03	<=20.97	PASS
		2480	-0.1	<=20.97	PASS

9.2.2 Test Graphs

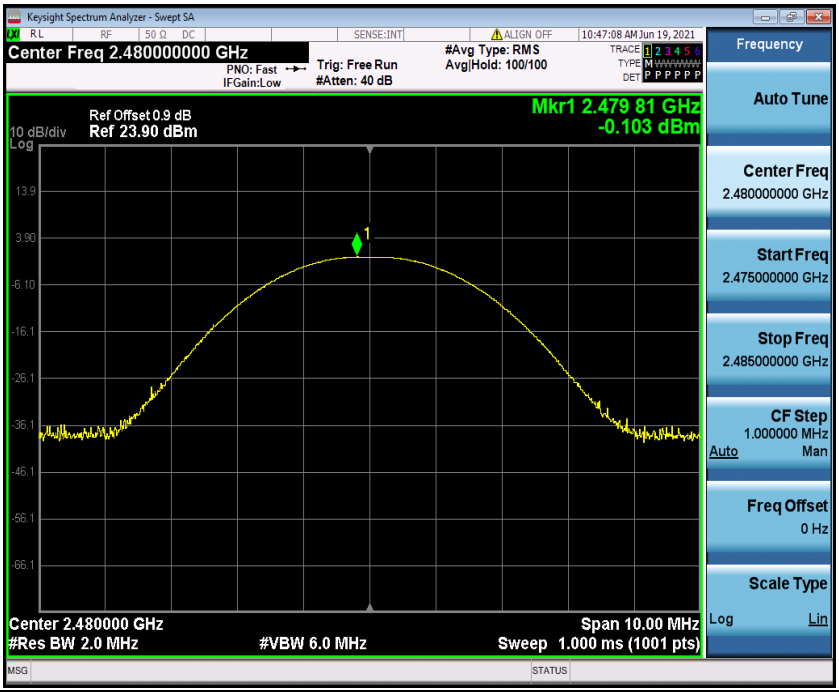
DH5_Ant1_2402



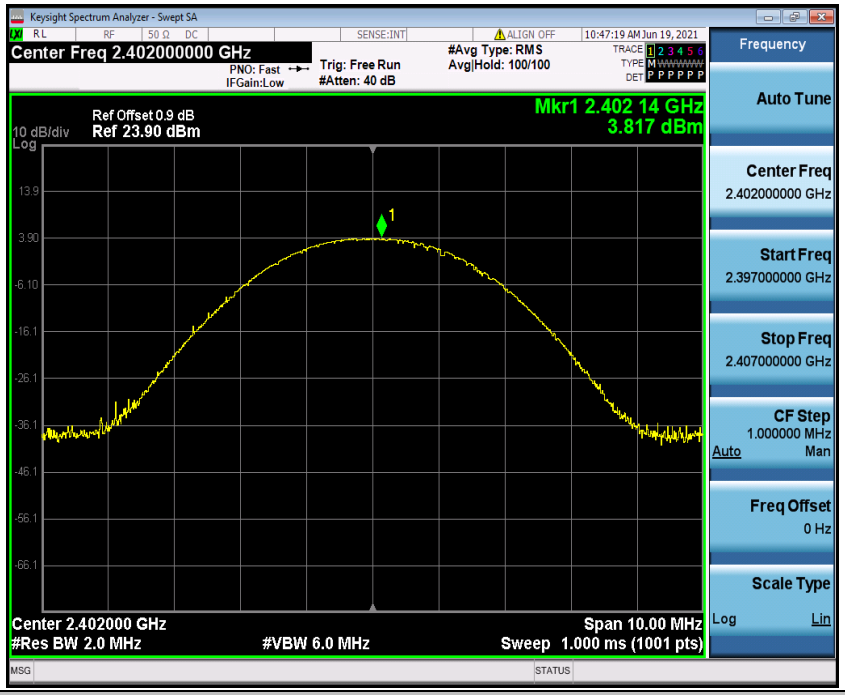
DH5_Ant1_2441



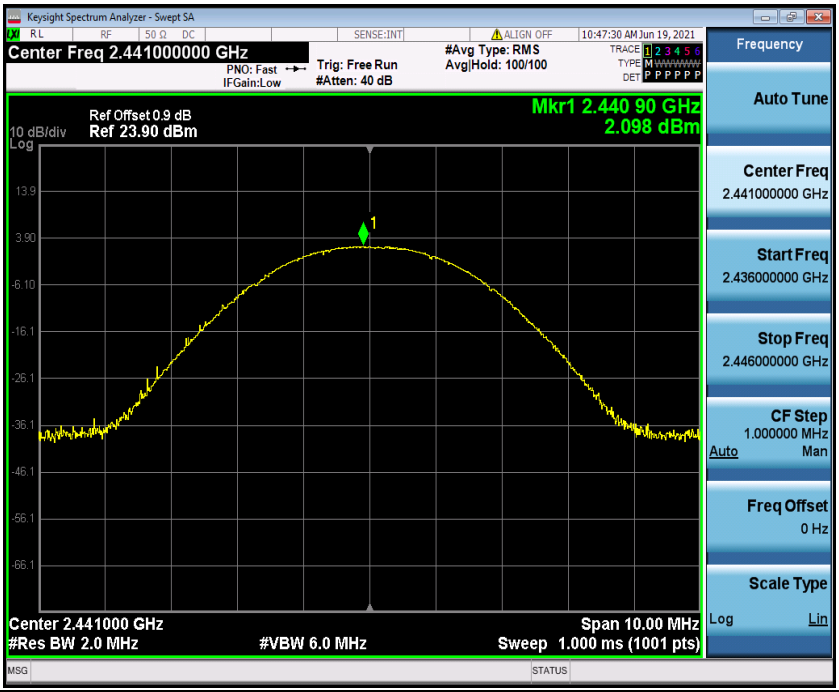
DH5_Ant1_2480



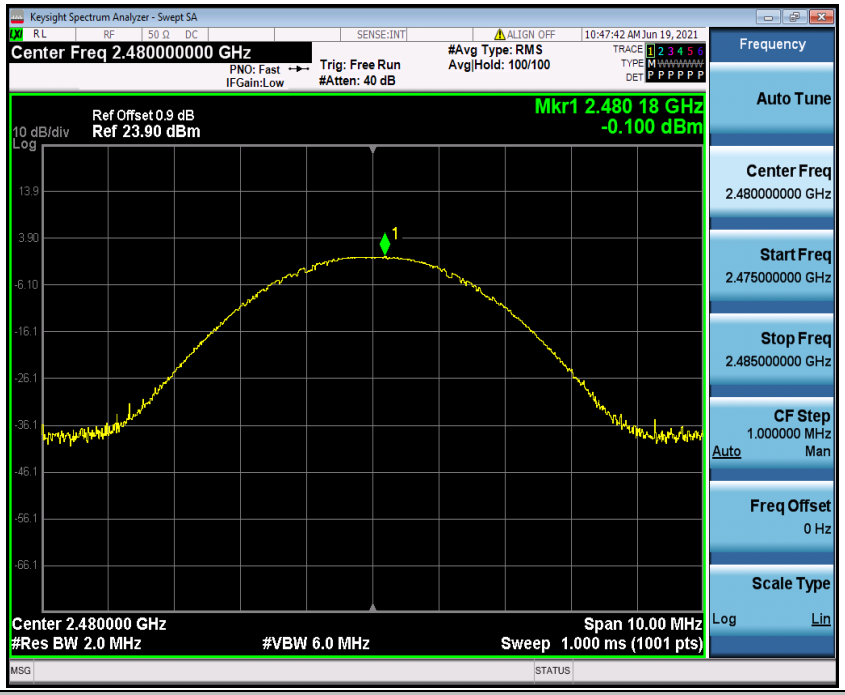
2DH5_Ant1_2402



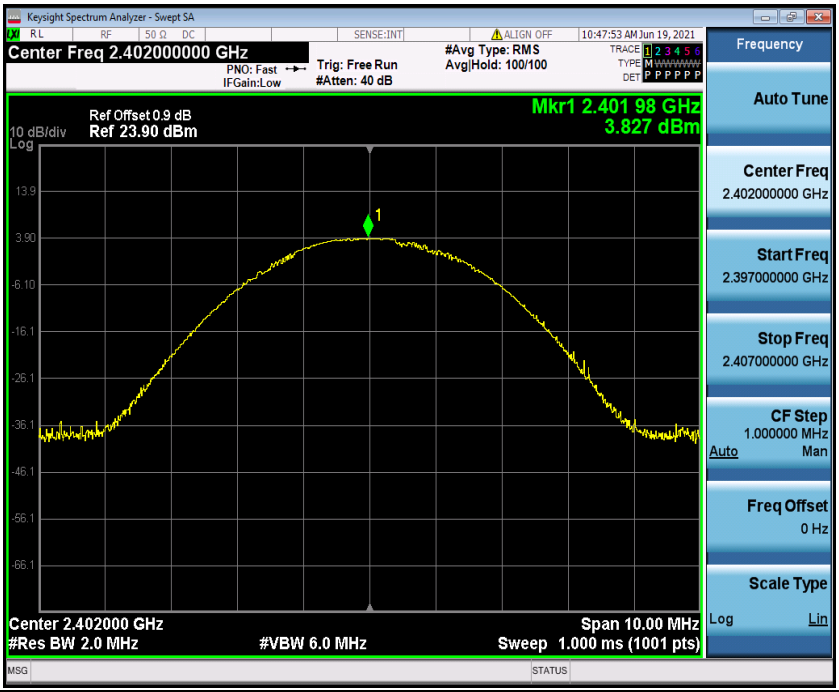
2DH5_Ant1_2441



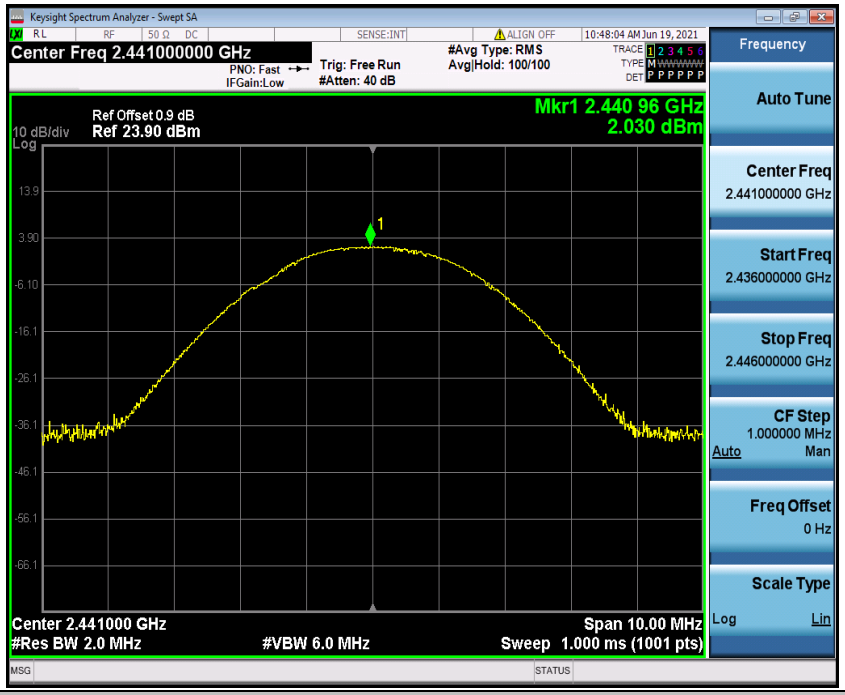
2DH5_Ant1_2480



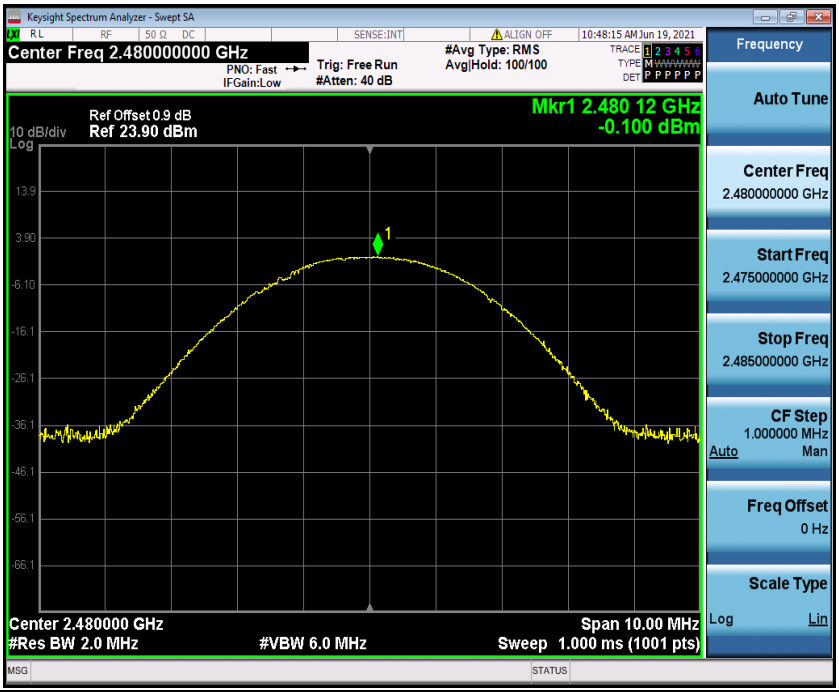
3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480



9.3 Appendix C: Carrier frequency separation

9.3.1 Test Result

TestMode	Antenna	Channel	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Hop_2402	1.014	>=0.636	PASS
		Hop_2441	0.969	>=0.640	PASS
		Hop_2480	0.957	>=0.652	PASS

9.3.2 Test Graphs

DH5_Ant1_Hop_2402

DH5_Ant1_Hop_2441

DH5_Ant1_Hop_2480

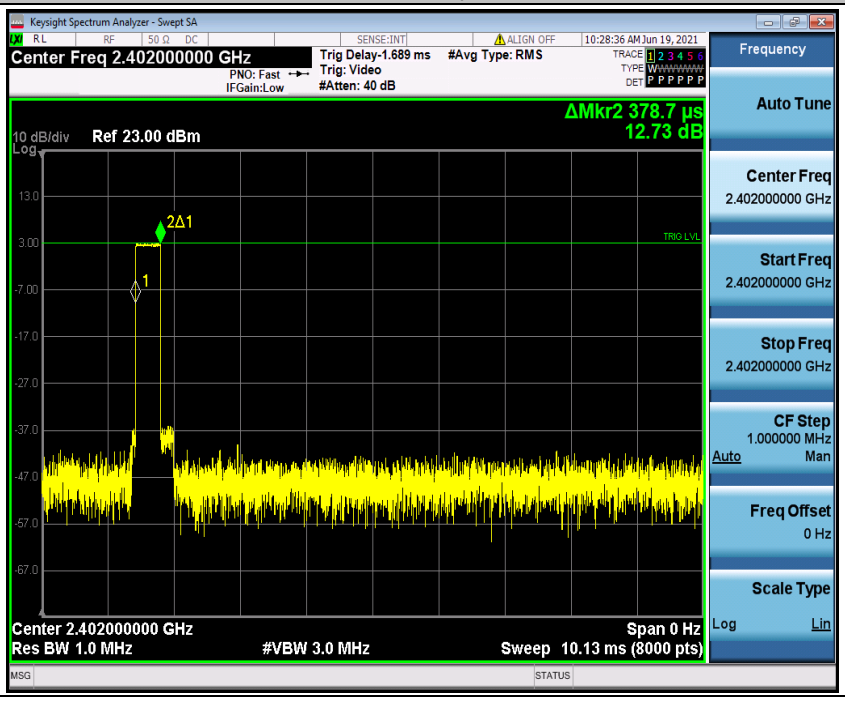
9.4 Appendix D: Dwell Time

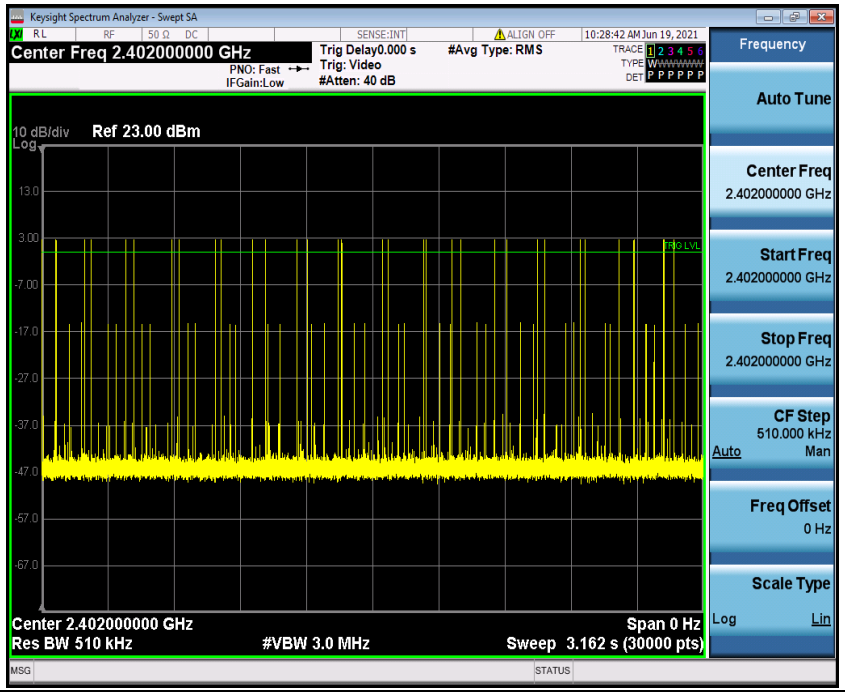
9.4.1 Test Result

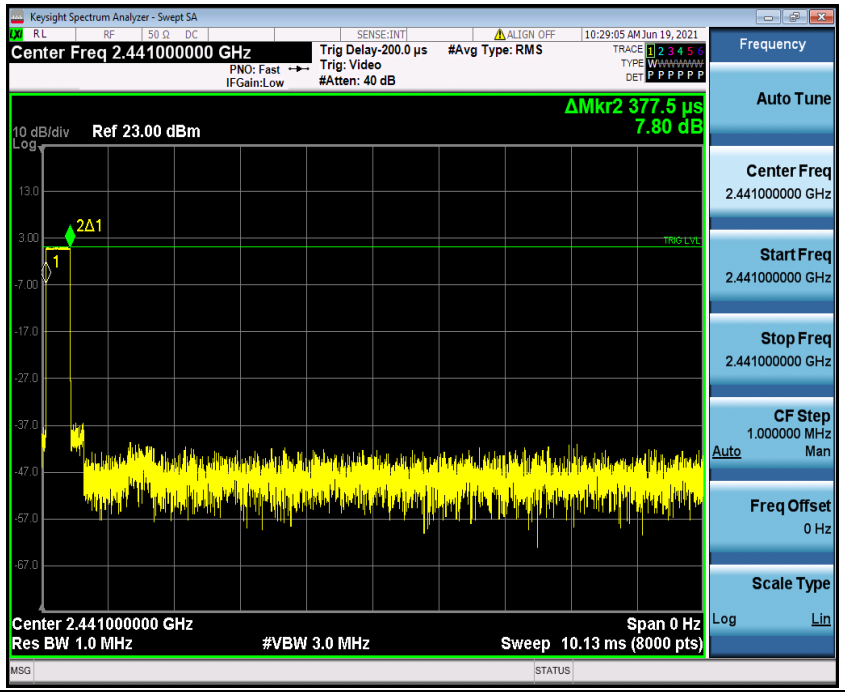
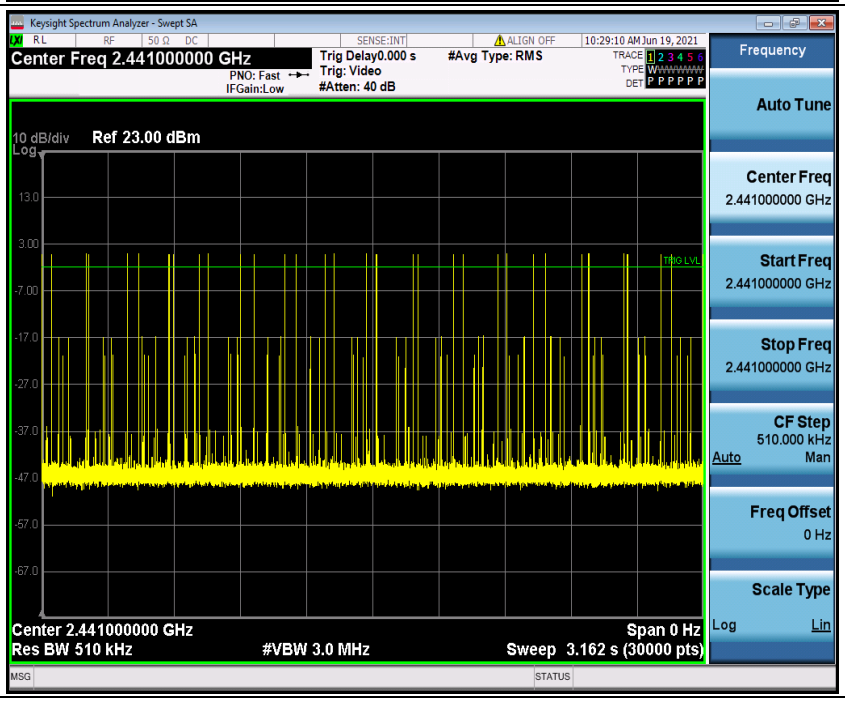
TestMode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop_2402	0.38	320	0.121	<=0.4	PASS
		Hop_2441	0.38	330	0.125	<=0.4	PASS
		Hop_2480	0.38	330	0.125	<=0.4	PASS
DH3	Ant1	Hop_2402	1.64	150	0.246	<=0.4	PASS
		Hop_2441	1.64	170	0.279	<=0.4	PASS
		Hop_2480	1.64	150	0.246	<=0.4	PASS
DH5	Ant1	Hop_2402	2.89	130	0.376	<=0.4	PASS
		Hop_2441	2.89	120	0.347	<=0.4	PASS
		Hop_2480	2.89	120	0.347	<=0.4	PASS
2DH1	Ant1	Hop_2402	0.39	330	0.127	<=0.4	PASS
		Hop_2441	0.39	320	0.124	<=0.4	PASS
		Hop_2480	0.39	320	0.124	<=0.4	PASS
2DH3	Ant1	Hop_2402	1.64	160	0.262	<=0.4	PASS
		Hop_2441	1.64	170	0.278	<=0.4	PASS
		Hop_2480	1.64	160	0.262	<=0.4	PASS
2DH5	Ant1	Hop_2402	2.89	70	0.202	<=0.4	PASS
		Hop_2441	2.89	100	0.289	<=0.4	PASS
		Hop_2480	2.89	100	0.289	<=0.4	PASS
3DH1	Ant1	Hop_2402	0.39	330	0.127	<=0.4	PASS
		Hop_2441	0.39	330	0.127	<=0.4	PASS
		Hop_2480	0.39	320	0.124	<=0.4	PASS
3DH3	Ant1	Hop_2402	1.64	150	0.245	<=0.4	PASS
		Hop_2441	1.64	200	0.327	<=0.4	PASS
		Hop_2480	1.64	170	0.278	<=0.4	PASS
3DH5	Ant1	Hop_2402	2.89	90	0.26	<=0.4	PASS
		Hop_2441	2.89	90	0.26	<=0.4	PASS
		Hop_2480	2.89	120	0.346	<=0.4	PASS

9.4.2 Test Graphs

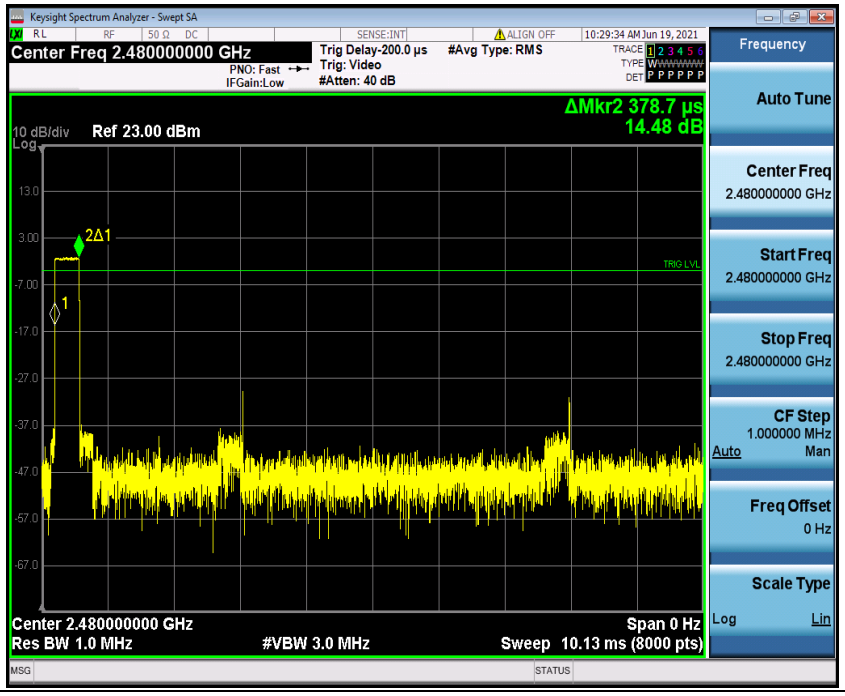
DH1_Ant1_Hop_2402

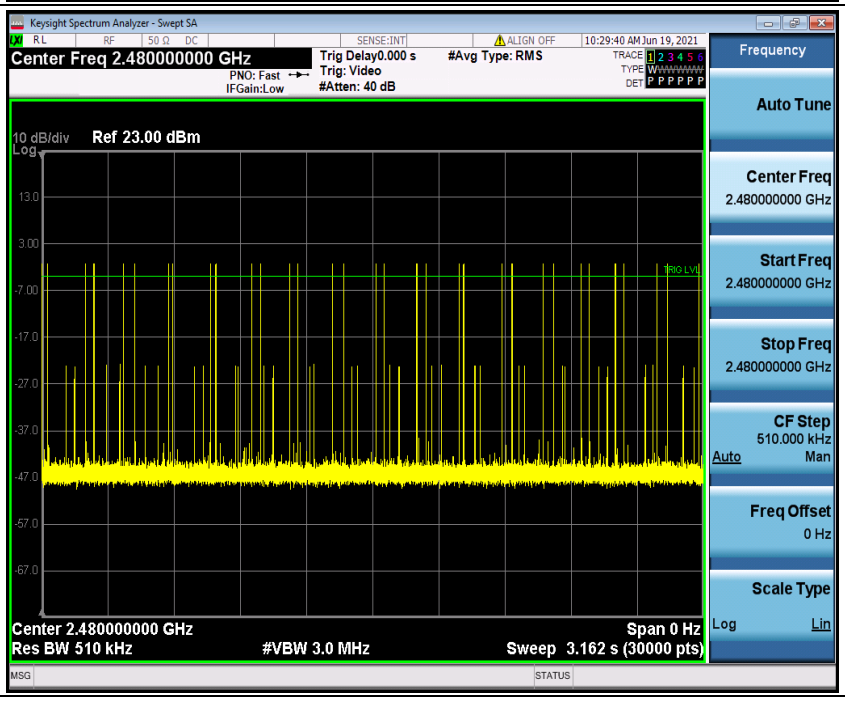


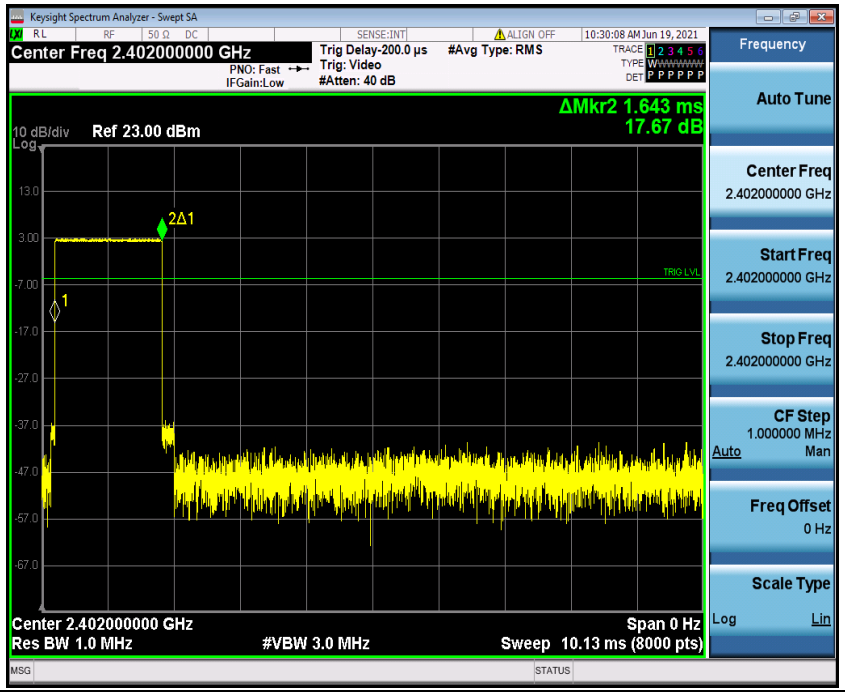
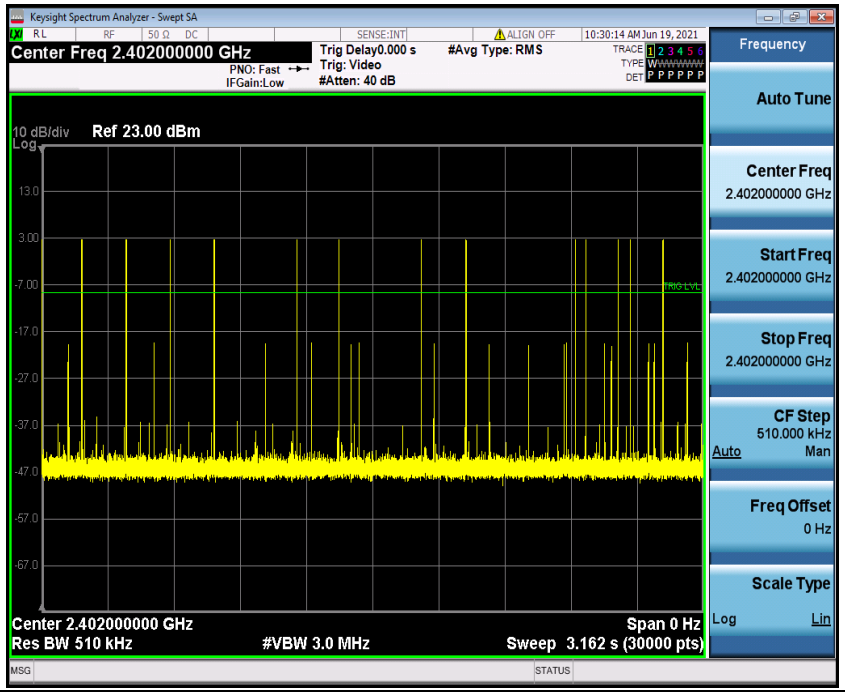


DH1_Ant1_Hop_2441



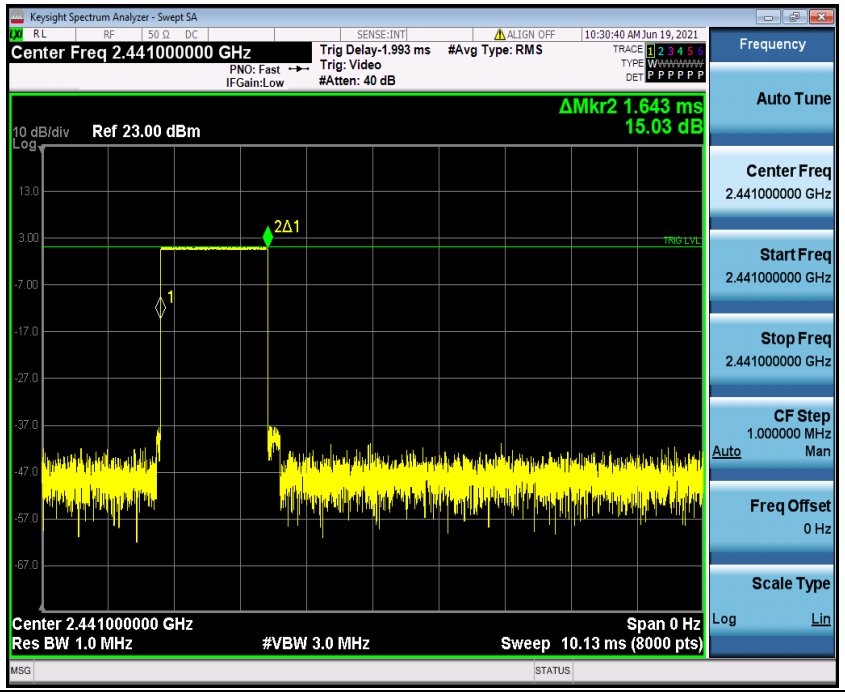
DH1_Ant1_Hop_2480

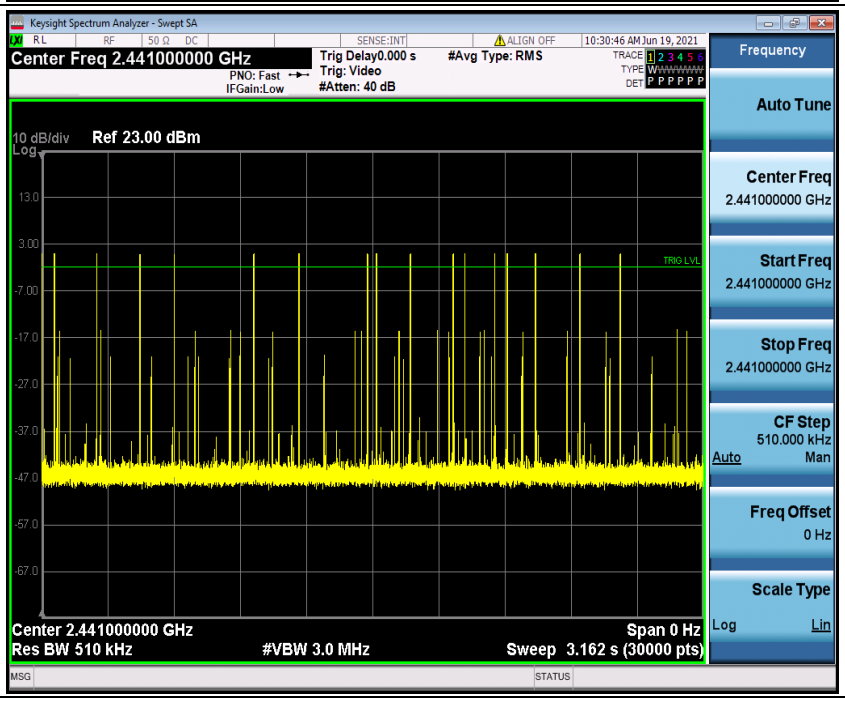




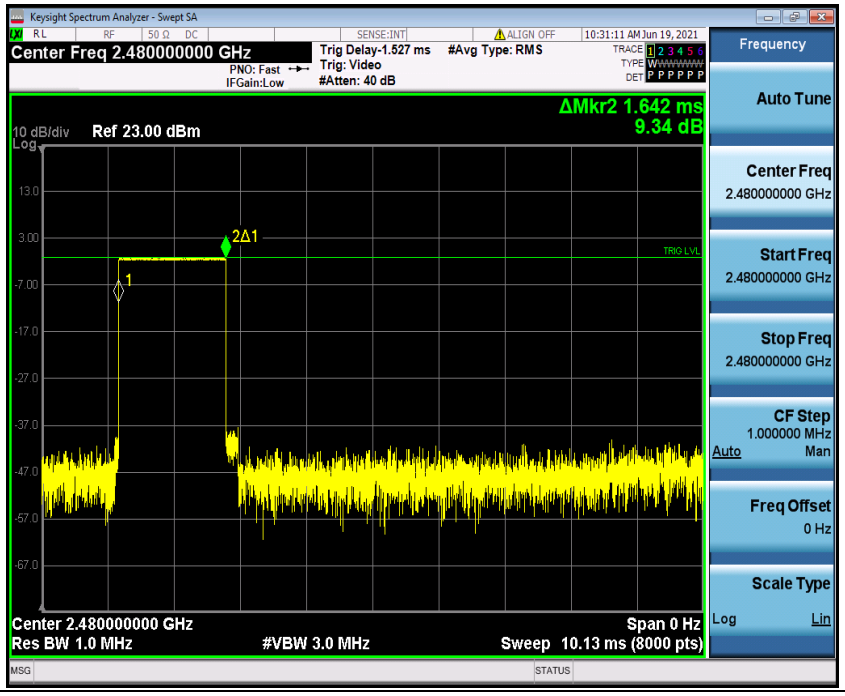
DH3_Ant1_Hop_2402



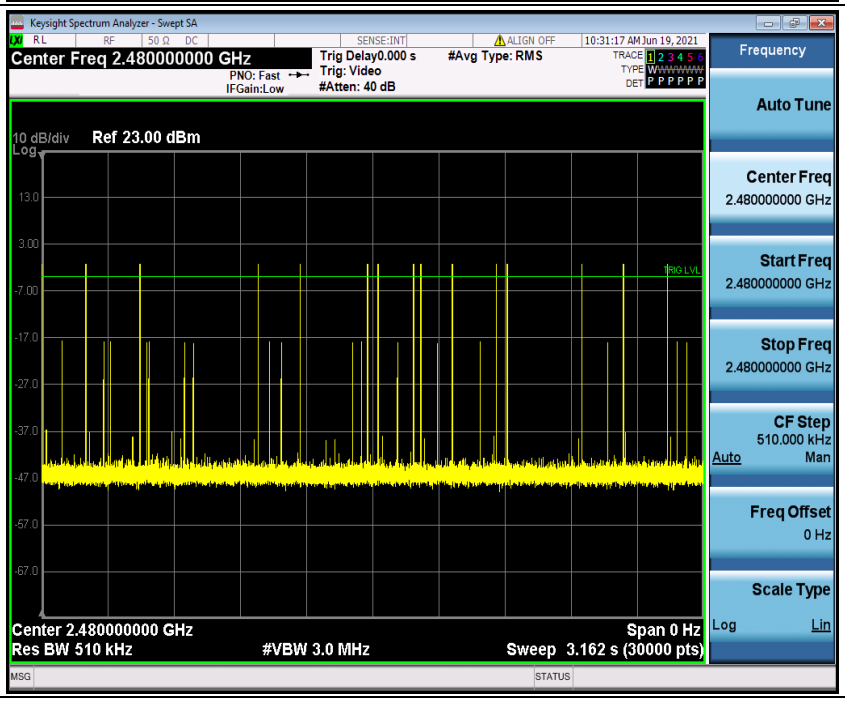
DH3_Ant1_Hop_2441



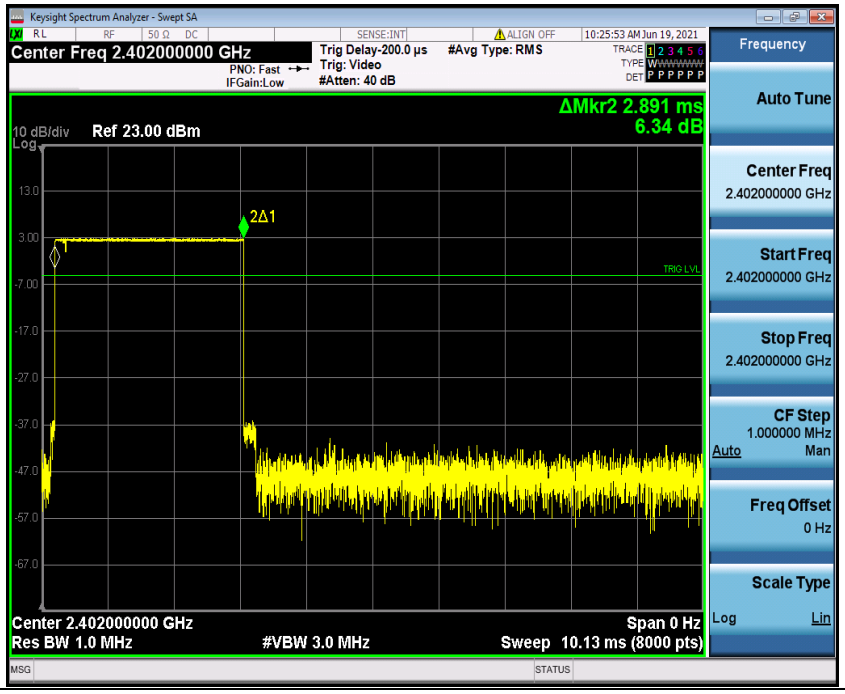


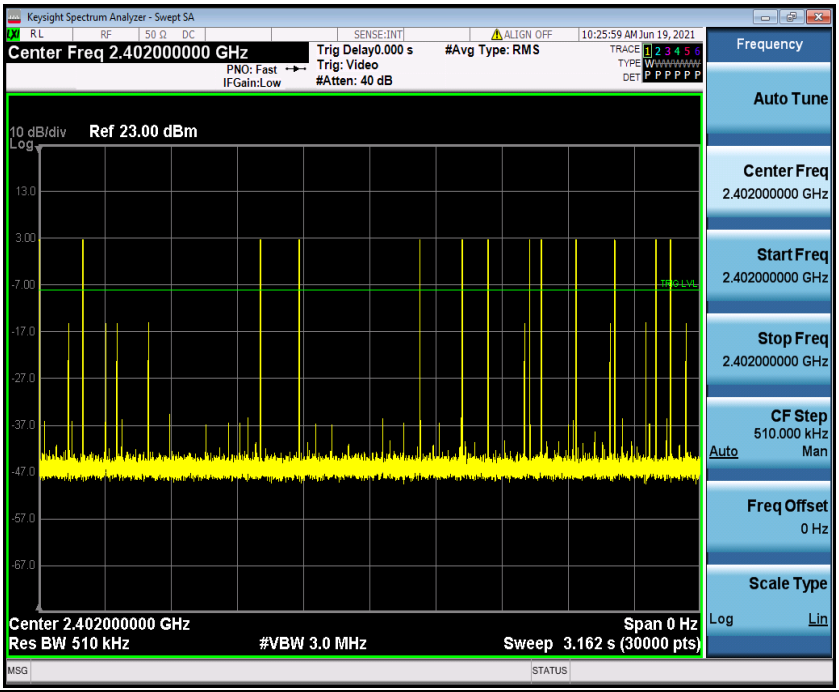
DH3_Ant1_Hop_2480



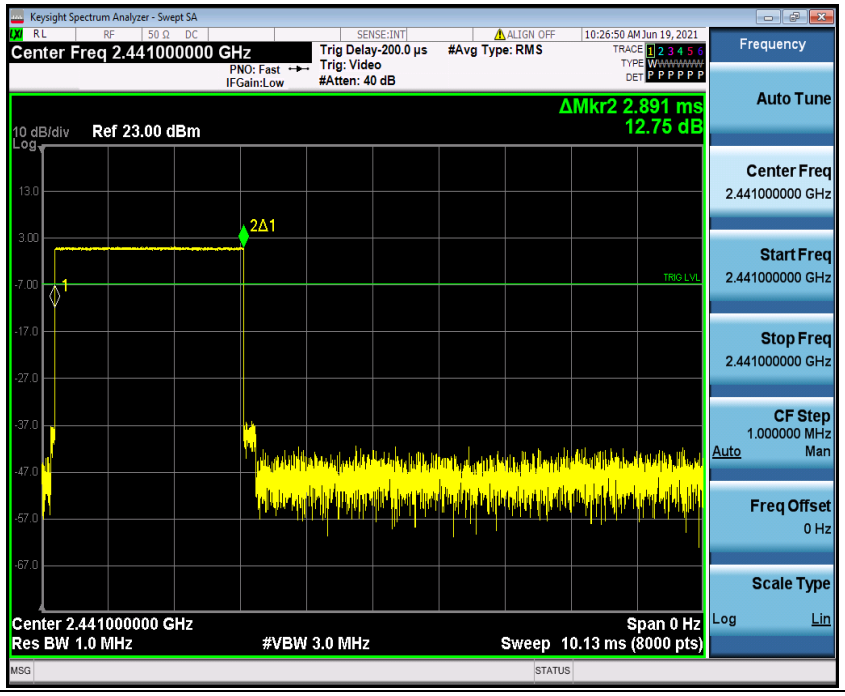


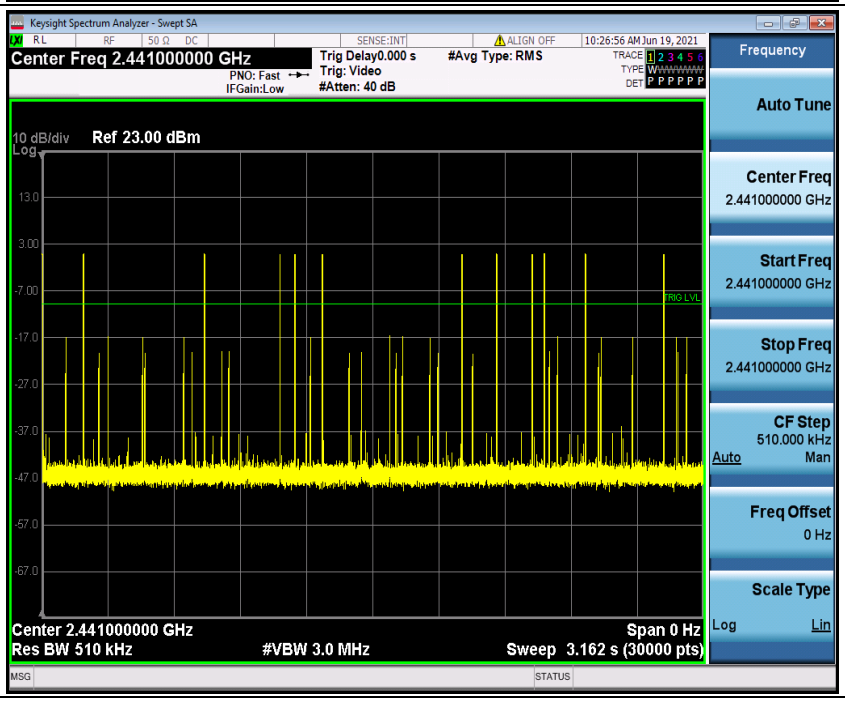
DH5_Ant1_Hop_2402



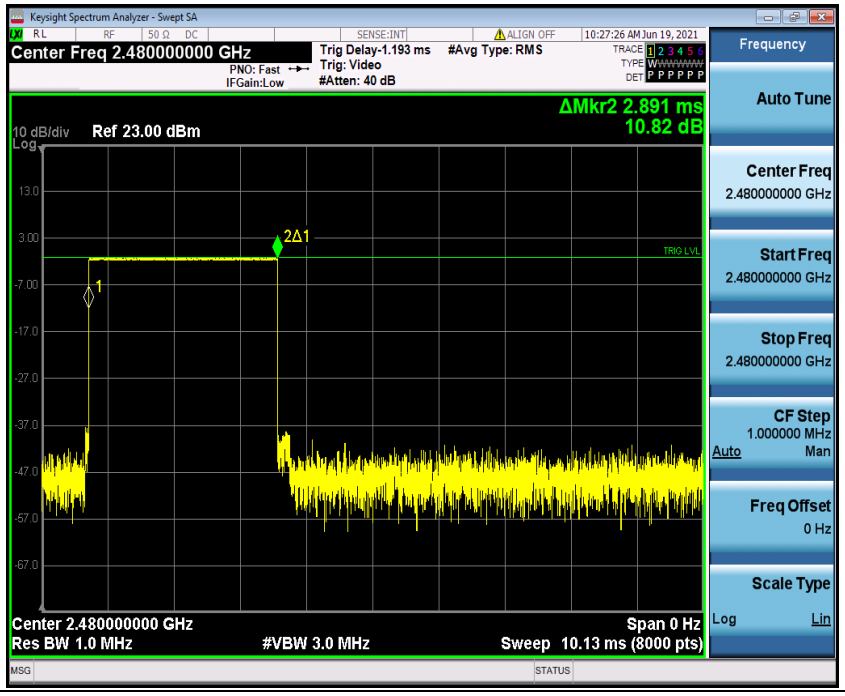


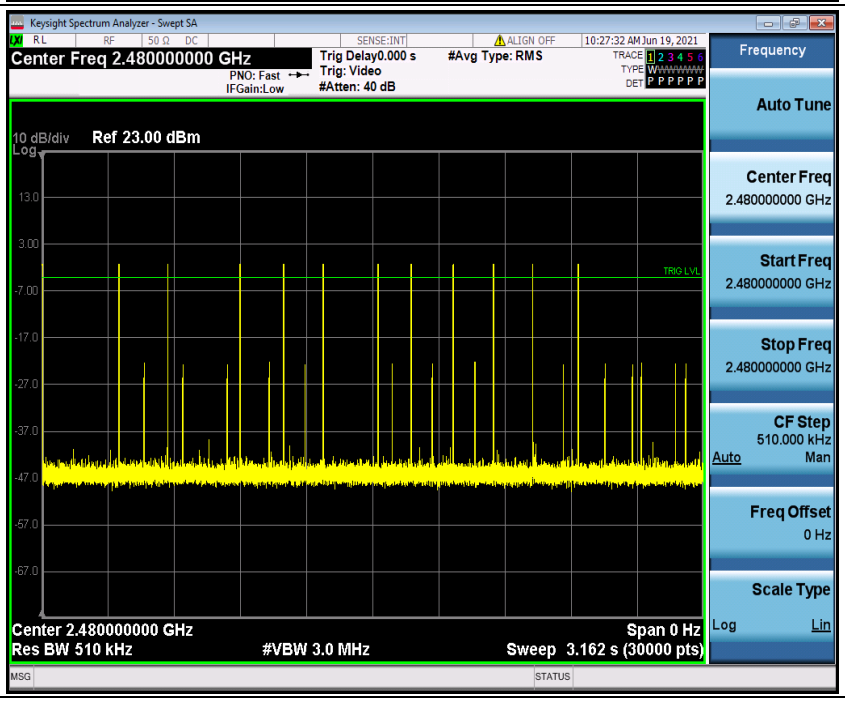
DH5_Ant1_Hop_2441

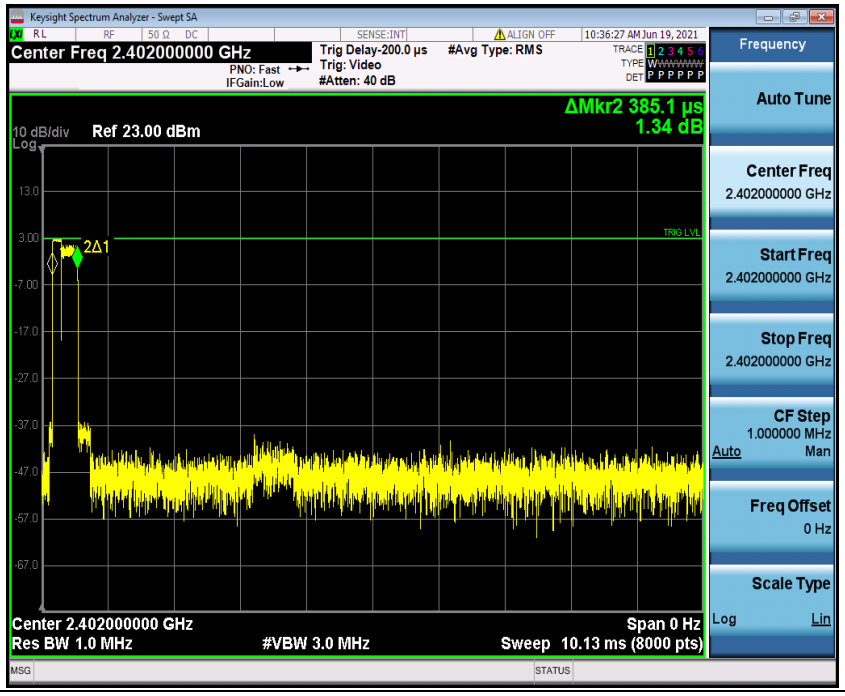
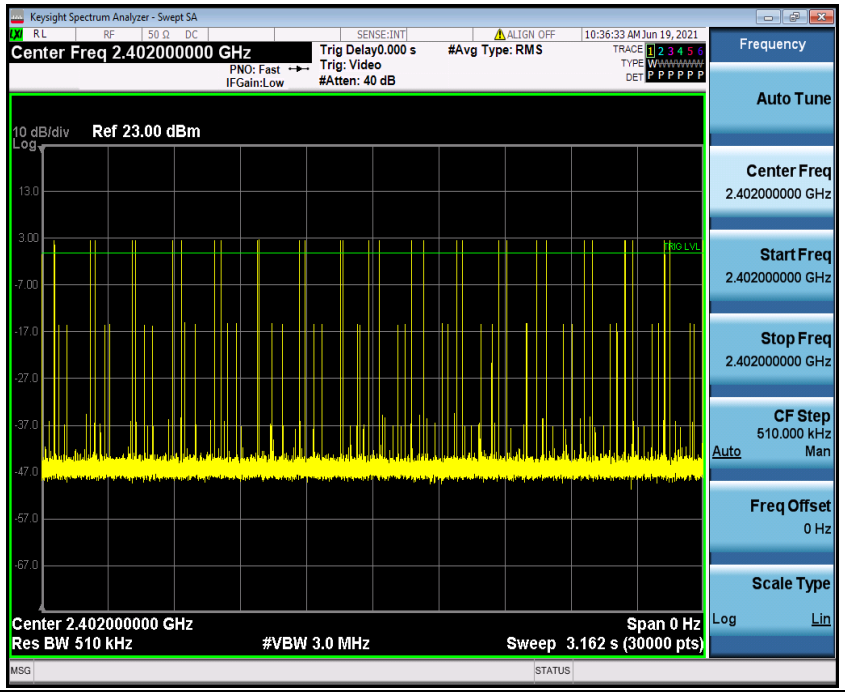




DH5_Ant1_Hop_2480





2DH1_Ant1_Hop_2402



2DH1_Ant1_Hop_2441