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

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TEST REPORT

Application No.:	GZEM1907014293CR
Applicant:	Kysho Multimedia Ltd.
Address of Applicant:	Flat F, 5/F Valiant Industrial Centre, 2-12 Au Pui Wan St, Fo Tan, Shatin
Manufacturer:	Kysho Multimedia Ltd.
Address of Manufacturer:	Flat F, 5/F Valiant Industrial Centre, 2-12 Au Pui Wan St, Fo Tan, Shatin
Factory:	1. Huizhou ShenKe XinFei Technology Co., Ltd. 2. Dongguan Longyi Electronics Co., Ltd.
Address of Factory:	1. Building C Tangxia Area, Chanjing Village Xinxu Town, Huiyang District, Huizhou Guangdong Province, China 2. Jieling Industrial Zone No. 8, GuangJingTou Village, Fenggang, Dongguan, 523690
Equipment Under Test (EUT):	
EUT Name:	Bluetooth Speaker
Model No.:	IMW479L, IMW449 ¤
¤	Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Standard(s) :	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2019-07-15
Date of Test:	2019-07-25 to 2019-08-30
Date of Issue:	2019-09-11
Test Result:	**Pass***

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

Kobe Jian
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.
If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

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Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2019-09-11		Original

Authorized for issue by:				
Tested By		**Curry_Wu /Project Engineer**		2019-07-25 to 2019-08-30 **Date**
Checked By		**Ricky_Liu /Reviewer**		2019-09-11 **Date**

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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(c)	Pass
Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence	47 CFR Part 15, Subpart C 15.247	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	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(1)	Pass
20dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.7	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass
Carrier Frequencies Separation	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
Hopping Channel Number	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Dwell Time	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.6	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	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	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass

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¤ Declaration of EUT Family Grouping:

Model No.: IMW479L, IMW449

According to the declaration from the applicant, the electrical circuit design, layout, components used and internal wiring were identical for all models, with only difference in the Model No.

Therefore only one model **IMW479L** was tested in this report.

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4 General Information

4.1 Details of E.U.T.

Power Supply:	DC 5V for charging
	DC 3.7V for working
Test Voltage:	DC 3.7V & AC 120V 60Hz
Cable/Ports:	about 0.5m unscreened USB cable
	AUX IN ports
Antenna Gain:	0 dBi
Antenna Type:	PCB antenna
Channel Spacing:	1MHz
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Number of Channels:	79
Operation Frequency:	2402MHz to 2480MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum (FHSS)

4.2 Description of Support Units

The EUT has been tested as an independent unit.

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	±5.5 x 10^{-8}
2	Duty cycle	±0.57%
3	Occupied Bandwidth	±3%
4	RF Conducted power	±0.68dB
5	RF Power Density	±1.50dB
6	Conducted Spurious Emissions	±1.04dB
7	RF Radiated Power	±4.5dB (below 1GHz)
		±4.8dB (above 1GHz)
8	Radiated Spurious Emission Test	±4.5dB (30MHz-1GHz)
		±4.8dB (1GHz-18GHz)
9	Temperature	±0.4°C
10	Humidity	±1.3%
11	Supply Voltages	±1.5%
12	Time	±3%

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4.4 Test Location

All tests were performed at:

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No tests were sub-contracted.

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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 C-Tick mark as a result of our NVLAP accreditation.

- **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

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- **FCC Recognized 2.948 Listed Test Firm(Registration No.: 282399)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 282399, May 31, 2002.

- **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, Jul 13, 2017.

- **Industry Canada (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-10449 and T-11179)**

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- **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 17025:2005, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

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4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

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5 Equipment List

Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
Shielding Room	Zhong Yu	8m x 3m x 3.8m	EMC0306	N/A	N/A
Two-Line V-Netwok	R&S	ENV216	EMC0118	2019-01-11	2020-01-10
LISN	R&S	ENV216	EMC2135	2018-09-21	2019-09-20
EMI Test Receiver	Rohde & Schwarz	ESCS30	EMC0506	2018-11-19	2019-11-18
Coaxial Cable	HangTianXing	2m	EMC0107	2018-09-20	2020-09-19
Voltage Probe	SGS	N/A	EMC0106	2018-04-04	2020-04-03
Conical Metal Housing	SGS-EMC	N/A	EMC0167	2018-04-19	2020-04-18
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	AgilentTechnologies	N9010A	EMC2138	2018-11-19	2019-11-18
6dB Attenuator	HP	8491A	EMC2062	2018-04-04	2020-04-03
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS	0.8M	EMC2136	2017-11-02	2019-11-01
MI CABLE	SGS	0.8M	EMC2137	2017-11-02	2019-11-01

20dB Bandwidth					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EXA Signal Analzer	AgilentTechnologies	N9010A	EMC2138	2018-11-19	2019-11-18
6dB Attenuator	HP	8491A	EMC2062	2018-04-04	2020-04-03
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS	0.8M	EMC2136	2017-11-02	2019-11-01
MI CABLE	SGS	0.8M	EMC2137	2017-11-02	2019-11-01

Carrier Frequencies Separation					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EXA Signal Analzer	AgilentTechnologies	N9010A	EMC2138	2018-11-19	2019-11-18
6dB Attenuator	HP	8491A	EMC2062	2018-04-04	2020-04-03
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS	0.8M	EMC2136	2017-11-02	2019-11-01
MI CABLE	SGS	0.8M	EMC2137	2017-11-02	2019-11-01

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Hopping Channel Number					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EXA Signal Analzer	AgilentTechnologies	N9010A	EMC2138	2018-11-19	2019-11-18
6dB Attenuator	HP	8491A	EMC2062	2018-04-04	2020-04-03
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS	0.8M	EMC2136	2017-11-02	2019-11-01
MI CABLE	SGS	0.8M	EMC2137	2017-11-02	2019-11-01

Dwell Time					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EXA Signal Analzer	AgilentTechnologies	N9010A	EMC2138	2018-11-19	2019-11-18
6dB Attenuator	HP	8491A	EMC2062	2018-04-04	2020-04-03
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS	0.8M	EMC2136	2017-11-02	2019-11-01
MI CABLE	SGS	0.8M	EMC2137	2017-11-02	2019-11-01

Conducted Band Edges Measurement					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
MXA Signal Analyzer	AgilentTechnologies	N9020A	SEM004-10	2019-02-24	2020-02-23
ESG Vector Signal Generator	Keysight	E4438C	SEM006-03	2019-04-05	2020-04-04
EXG Analog Signal Generator	AgilentTechnologies	N5171B	SEM006-04	2017-07-26	2020-07-25
Power Meter	AgilentTechnologies	U2021XA_Ch2	SEM009-02	2018-09-20	2019-09-19
Power Meter	AgilentTechnologies	U2021XA_Ch3	SEM009-03	2018-09-20	2019-09-19
EXA Signal Analzer	AgilentTechnologies	N9010A	EMC2138	2018-11-19	2019-11-18
6dB Attenuator	HP	8491A	EMC2062	2018-04-04	2020-04-03
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS	0.8M	EMC2136	2017-11-02	2019-11-01
MI CABLE	SGS	0.8M	EMC2137	2017-11-02	2019-11-01

Conducted Spurious Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EXA Signal Analzer	AgilentTechnologies	N9010A	EMC2138	2018-11-19	2019-11-18
6dB Attenuator	HP	8491A	EMC2062	2018-04-04	2020-04-03
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A
MI CABLE	SGS	0.8M	EMC2136	2017-11-02	2019-11-01
MI CABLE	SGS	0.8M	EMC2137	2017-11-02	2019-11-01

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Radiated Emissions which fall in the restricted bands					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EMI Test Receiver	Rohde & Schwarz	ESIB26	EMC0522	2019-01-20	2020-01-19
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC0056	2019-01-20	2020-01-19
Chamber cable	HangTianXing	N/A	EMC0542	2019-06-28	2021-06-27
Trilog Broadband Antenna 30MHz-1GHz	SCHWARZBECKMESS-ELEKTRONIK	VULB 9160	EMC2025	2016-09-08	2019-09-07
Bi-log Type Antenna	Schaffner -Chase	CBL6112B	EMC0524	2016-09-08	2019-09-07
Bi-log Type Antenna	Schaffner -Chase	CBL6143	EMC0519	2017-05-04	2020-05-03
Horn Antenna 1GHz-18GHz	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2016-09-09	2019-09-08
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2019-01-07	2020-01-08
Amplifier	HP	8447F	EMC2065	2019-05-29	2020-05-28
Pre-Amplifier MH648A	ANRITSU CORP	MH648A	EMC2086	2018-11-19	2019-11-18
Active Loop Antenna	EMCO	6502	EMC0523	2018-03-05	2020-03-04
High Pass Filter(915MHz)	FSY MICROWAVE	HM1465-9SS	EMC2079	2019-01-11	2020-01-10
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2019-01-11	2020-01-10
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2018-12-08	2019-12-07
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2017-12-19	2019-12-18
MXE EMI Receiver	Keysight	N9038A	EMC2139	2018-11-19	2019-11-18
EXA Signal Analyzer	Keysight	N9010A	EMC2138	2018-11-19	2019-11-18
Trilog Broadband Antenna 30MHz-1GHz	SCHWARZBECKMESS-ELEKTRONIK	VULB 9168	SEM003-18	2019-02-22	2022-02-22
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

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Radiated Spurious Emissions					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
EMI Test Receiver	Rohde & Schwarz	ESIB26	EMC0522	2019-01-20	2020-01-19
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC0056	2019-01-20	2020-01-19
Chamber cable	HangTianXing	N/A	EMC0542	2019-06-28	2021-06-27
Trilog Broadband Antenna 30MHz-1GHz	SCHWARZBECKMESS-ELEKTRONIK	VULB 9160	EMC2025	2016-09-08	2019-09-07
Bi-log Type Antenna	Schaffner -Chase	CBL6112B	EMC0524	2016-09-08	2019-09-07
Bi-log Type Antenna	Schaffner -Chase	CBL6143	EMC0519	2017-05-04	2020-05-03
Horn Antenna 1GHz-18GHz	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2016-09-09	2019-09-08
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2019-01-07	2020-01-08
Amplifier	HP	8447F	EMC2065	2019-05-29	2020-05-28
Pre-Amplifier MH648A	ANRITSU CORP	MH648A	EMC2086	2018-11-19	2019-11-18
Active Loop Antenna	EMCO	6502	EMC0523	2018-03-05	2020-03-04
High Pass Filter(915MHz)	FSY MICROWAVE	HM1465-9SS	EMC2079	2019-01-11	2020-01-10
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2019-01-11	2020-01-10
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2018-12-08	2019-12-07
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2017-12-19	2019-12-18
MXE EMI Receiver	Keysight	N9038A	EMC2139	2018-11-19	2019-11-18
EXA Signal Analyzer	Keysight	N9010A	EMC2138	2018-11-19	2019-11-18
Trilog Broadband Antenna 30MHz-1GHz	SCHWARZBECKMESS-ELEKTRONIK	VULB 9168	SEM003-18	2019-02-22	2022-02-22
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DMM	Fluke	73	EMC0006	2019-07-16	2020-07-15
DMM	Fluke	73	EMC0007	2019-07-16	2020-07-15

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6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

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

6.1.2 Conclusion

Standard Requirement:

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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

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 0 dBi.

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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)

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

An example of Pseudorandom Frequency Hopping Sequence as follow:

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 bands

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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.		

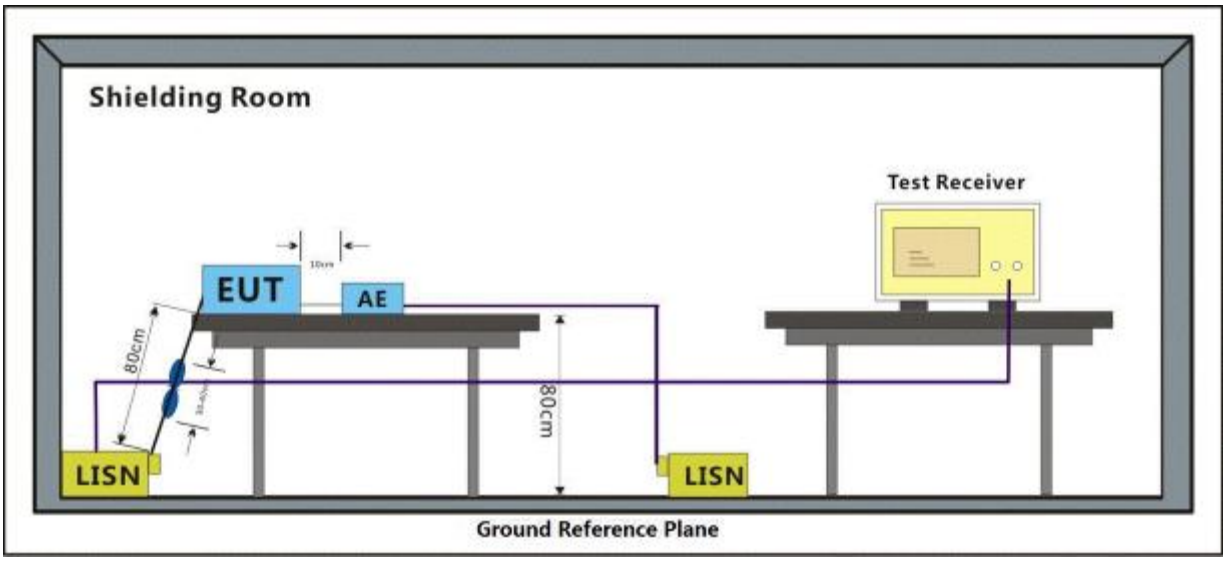
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 22.7 °C Humidity: 57 % RH Atmospheric Pressure: 1020 mbar

Test mode c: Charge + TX_non-Hop mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.1.2 Test Setup Diagram



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7.1.3 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

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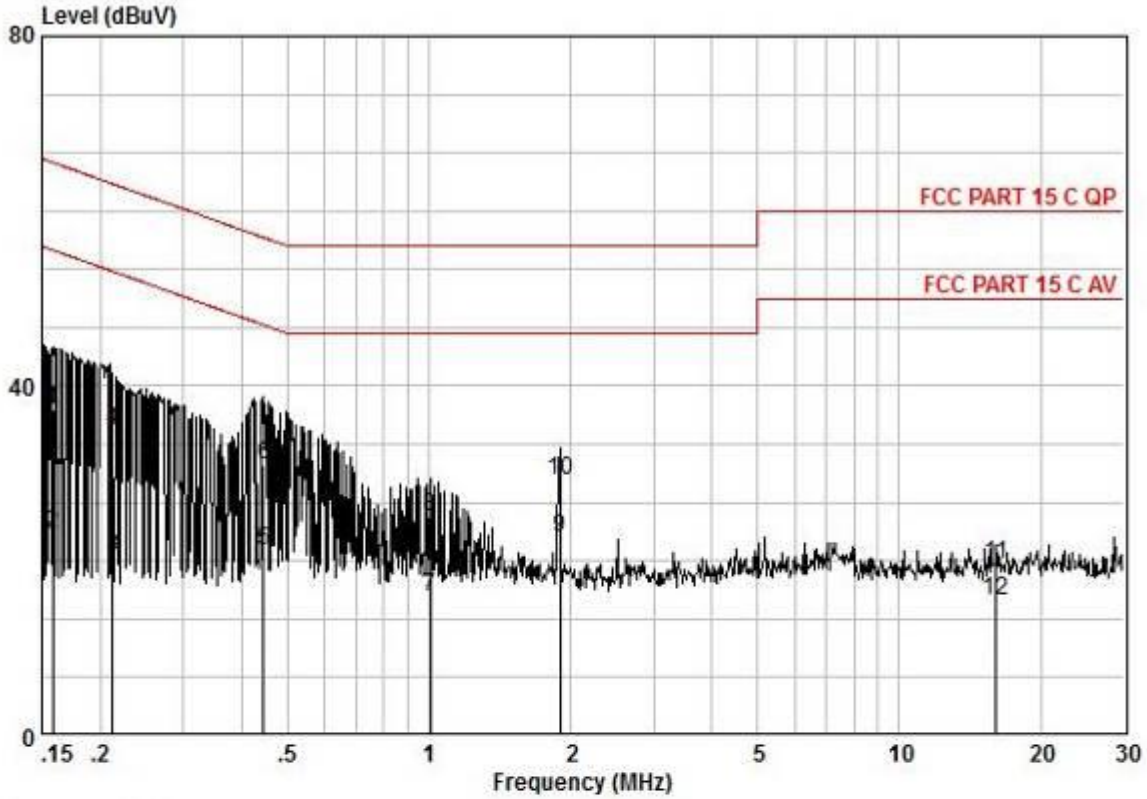
Mode:c; Line:Live Line



Pol :LIVE
No :
Model :

Frequency MHz	read level dBuV	Cable Loss dB	LISN Factor dB	Measured level dBuV	Limit Line dBuV	Over limit dB	Remark
0.16	27.62	0.10	9.49	37.21	65.56	-28.35	QP
0.16	13.55	0.10	9.49	23.14	55.56	-32.42	AVERAGE
0.21	10.68	0.11	9.62	20.41	53.10	-32.69	AVERAGE
0.21	25.22	0.11	9.62	34.95	63.10	-28.15	QP
0.44	11.39	0.19	9.65	21.22	46.98	-25.75	AVERAGE
0.44	21.17	0.19	9.65	31.00	56.98	-25.97	QP
1.00	6.06	0.30	9.63	15.99	46.00	-30.01	AVERAGE
1.00	15.16	0.30	9.63	25.09	56.00	-30.91	QP
1.90	12.74	0.38	9.61	22.73	46.00	-23.27	AVERAGE
1.90	19.24	0.38	9.61	29.23	56.00	-26.77	QP
16.05	9.14	0.70	9.74	19.58	60.00	-40.42	QP
16.05	5.08	0.70	9.74	15.52	50.00	-34.48	AVERAGE

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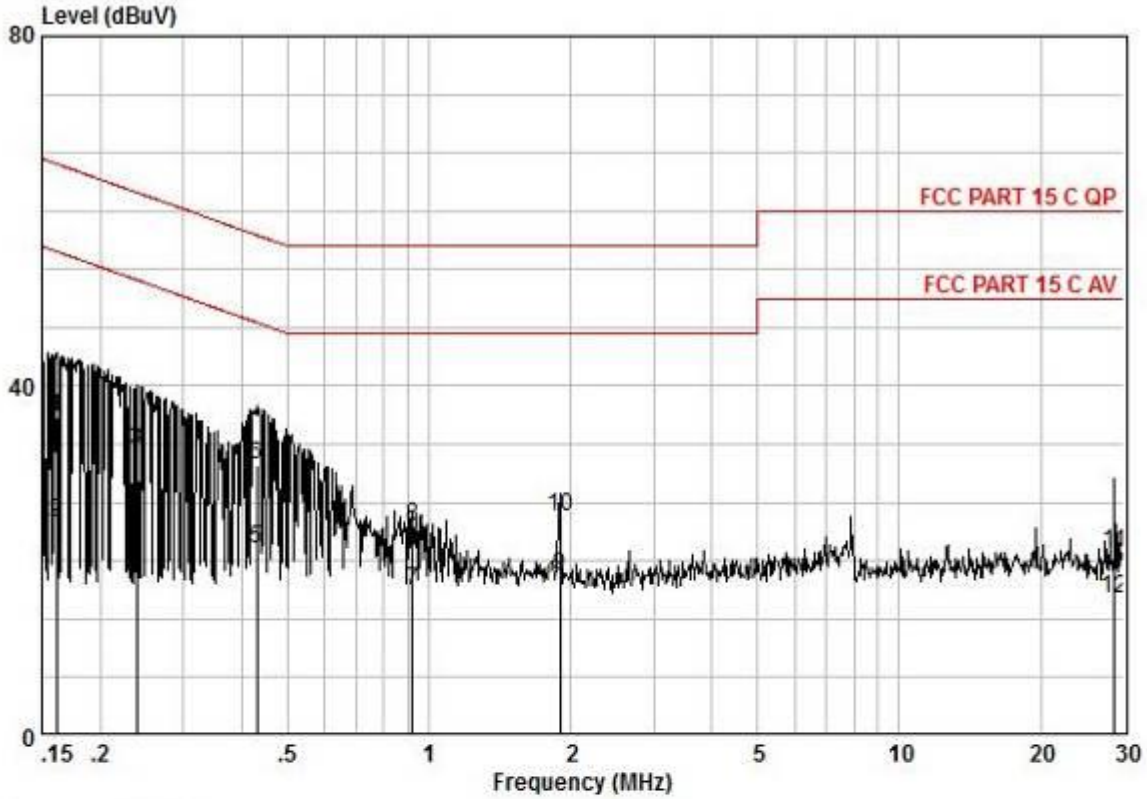
Mode:c; Line:Neutral Line



Pol :NEUTRAL
No :
Model :

Frequency MHz	read level dBuV	Cable Loss dB	LISN Factor dB	Measured level dBuV	Limit Line dBuV	Over limit dB	Remark
0.16	26.90	0.10	9.43	36.43	65.38	-28.95	QP
0.16	14.83	0.10	9.43	24.36	55.38	-31.02	AVERAGE
0.24	22.92	0.12	9.58	32.62	62.13	-29.51	QP
0.24	12.83	0.12	9.58	22.53	52.13	-29.60	AVERAGE
0.43	11.66	0.18	9.56	21.40	47.24	-25.84	AVERAGE
0.43	21.23	0.18	9.56	30.97	57.24	-26.27	QP
0.92	6.62	0.29	9.59	16.50	46.00	-29.50	AVERAGE
0.92	14.15	0.29	9.59	24.03	56.00	-31.97	QP
1.90	8.46	0.38	9.52	18.37	46.00	-27.63	AVERAGE
1.90	15.14	0.38	9.52	25.05	56.00	-30.95	QP
28.75	10.71	0.56	9.68	20.95	60.00	-39.05	QP
28.75	5.44	0.56	9.68	15.68	50.00	-34.32	AVERAGE

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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

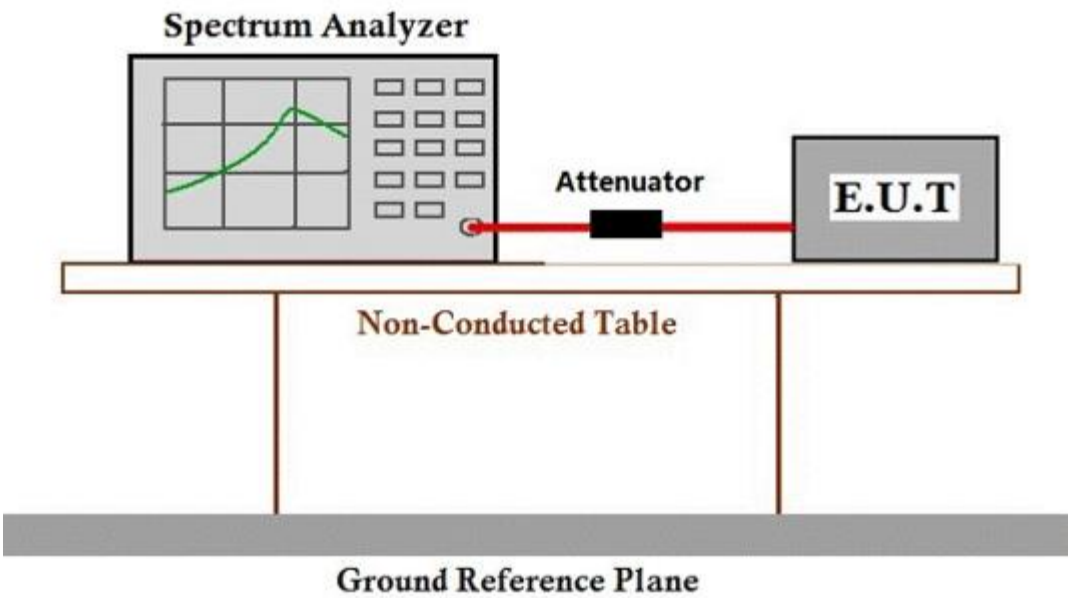
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 25.5 °C Humidity: 64.4 % RH Atmospheric Pressure: 1020 mbar

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.2.2 Test Setup Diagram



7.2.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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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

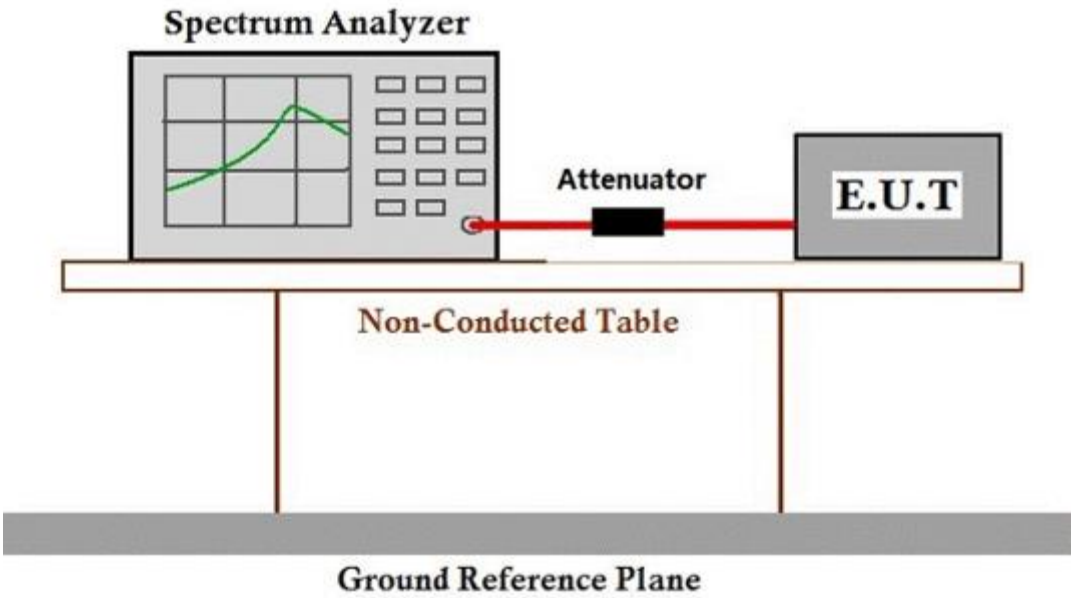
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 25.5 °C Humidity: 64.4 % RH Atmospheric Pressure: 1020 mbar

Test mode b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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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

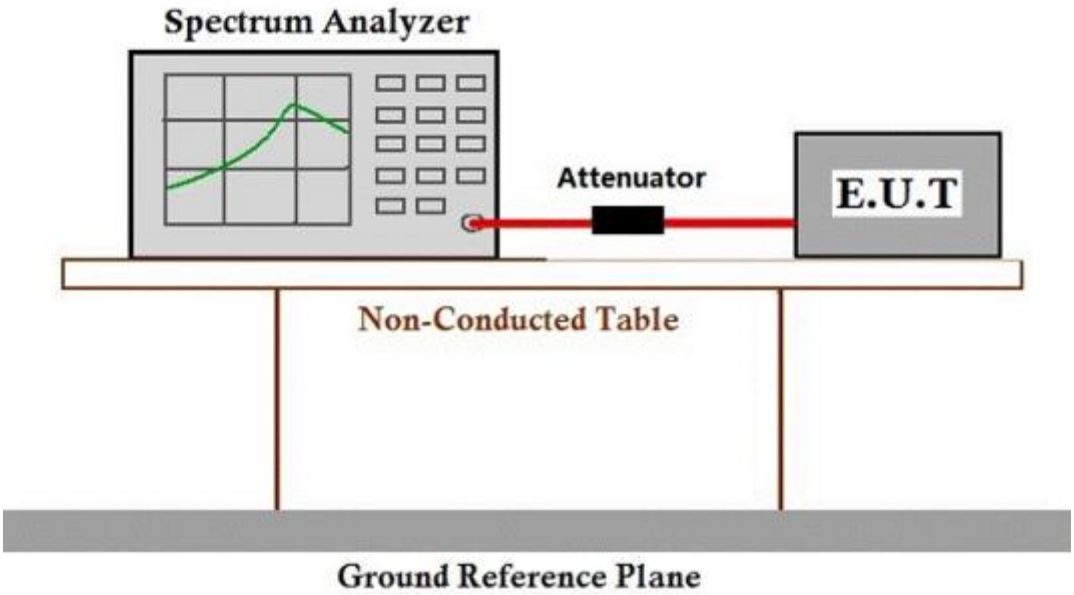
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 25.5 °C Humidity: 64.4 % RH Atmospheric Pressure: 1020 mbar

Test mode: a: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.4.2 Test Setup Diagram



7.4.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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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

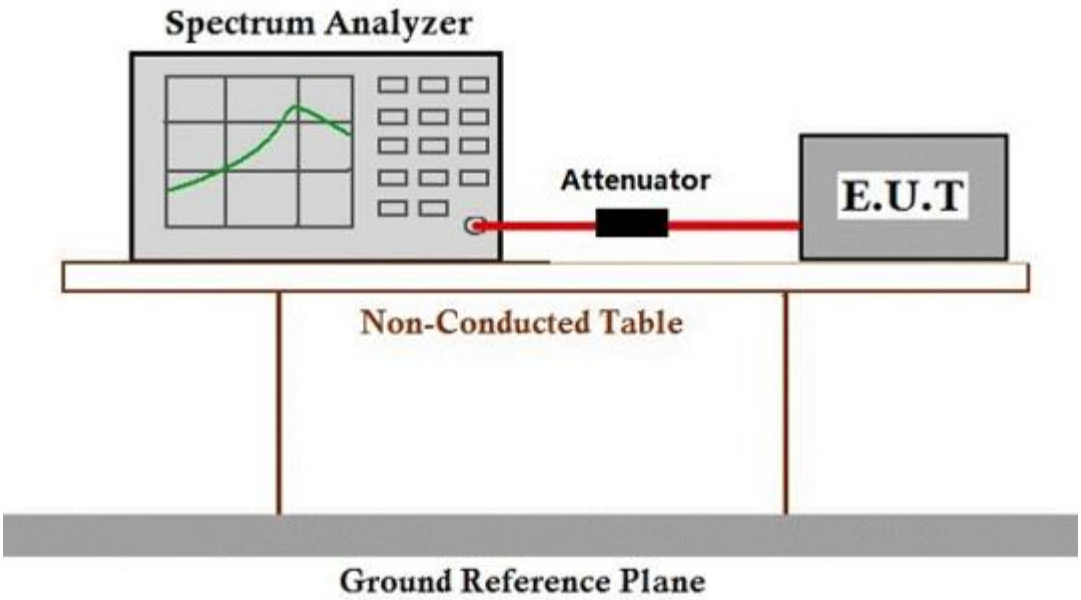
7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 25.5 °C Humidity: 64.4 % RH Atmospheric Pressure: 1020 mbar

Test mode a: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.5.2 Test Setup Diagram



7.5.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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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

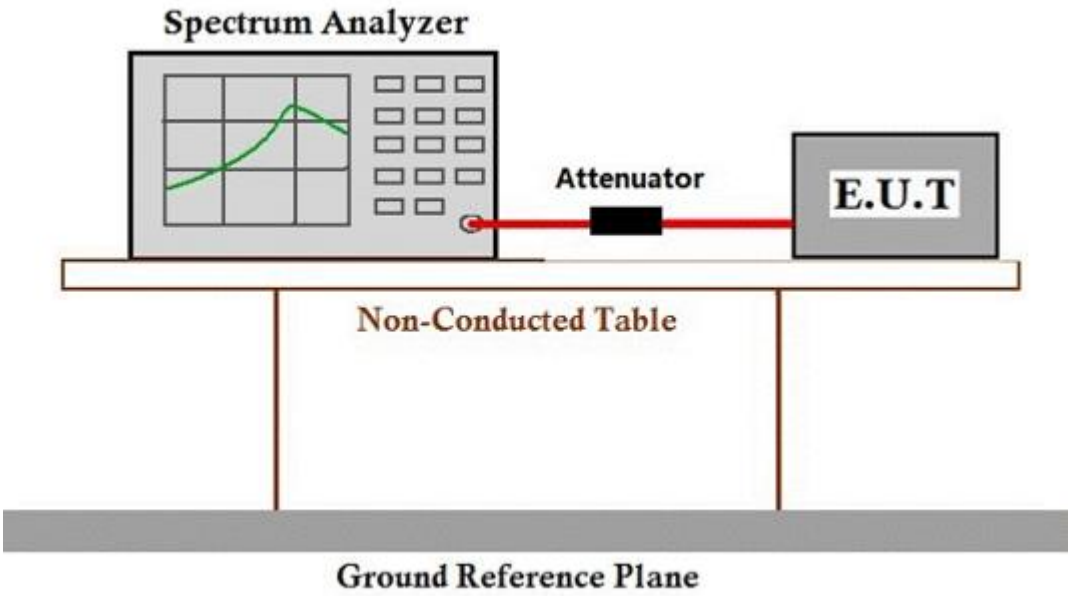
7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 25.5 °C Humidity: 64.4 % RH Atmospheric Pressure: 1020 mbar

Test mode a: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.6.2 Test Setup Diagram



7.6.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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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)

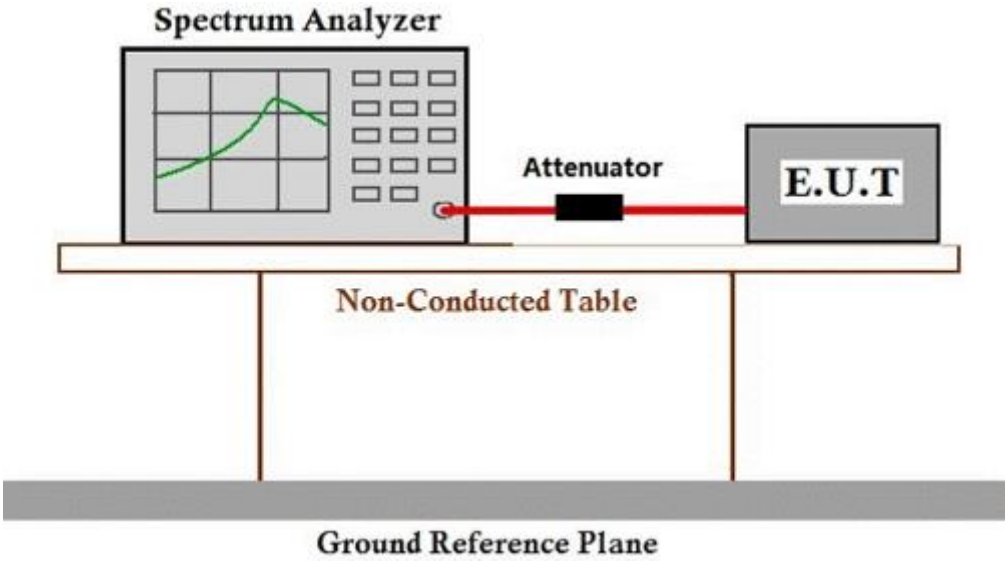
7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 25.5 °C Humidity: 64.4 % RH Atmospheric Pressure: 1020 mbar

Test mode: a: TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.7.2 Test Setup Diagram



7.7.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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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)

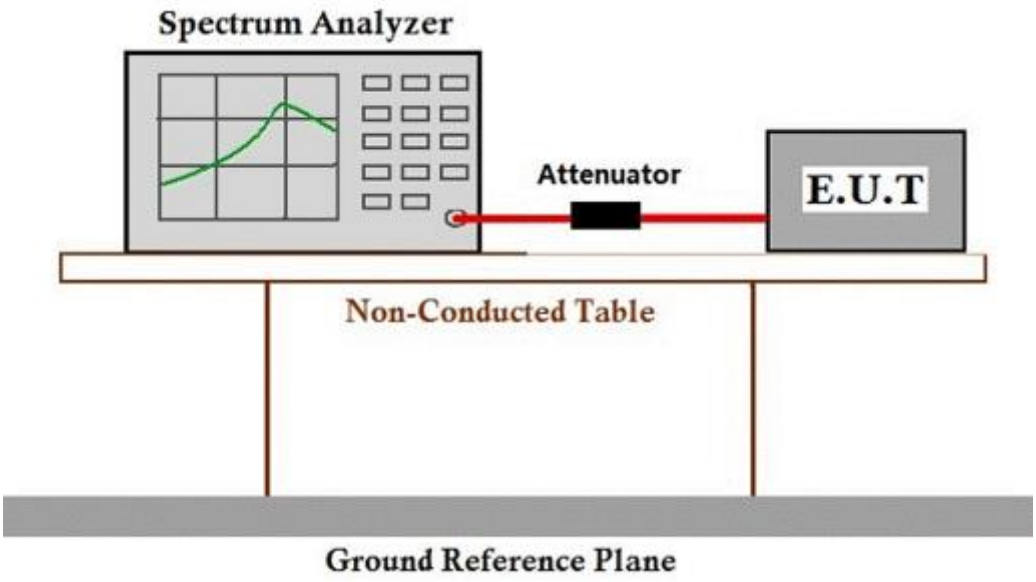
7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 25.5 °C Humidity: 64.4 % RH Atmospheric Pressure: 1020 mbar

Test mode: b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.8.2 Test Setup Diagram



7.8.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247

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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

Measurement Distance: 3m

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

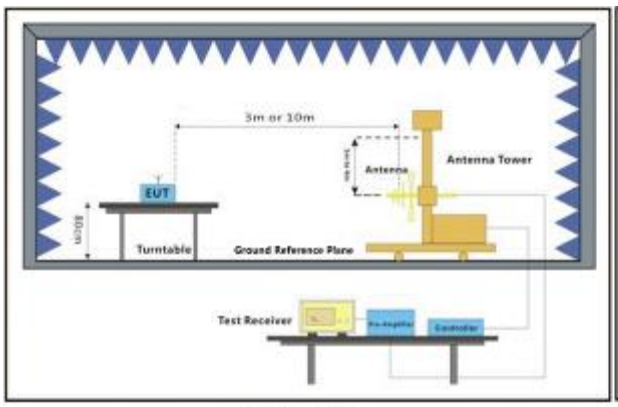
Operating Environment:

Temperature: 21 °C Humidity: 52 % RH Atmospheric Pressure: 1020 mbar

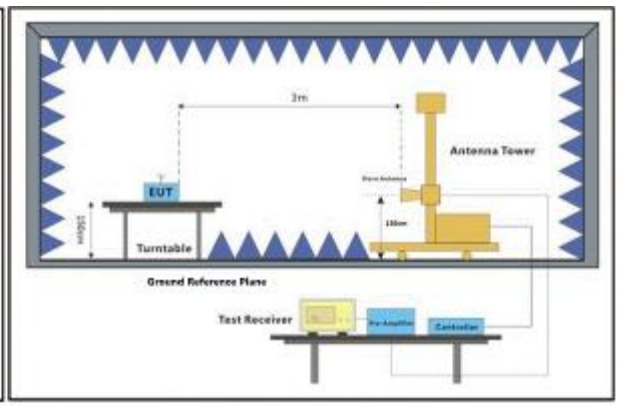
Pretest these modes to find the worst case: b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
c: Charge + TX_non-Hop mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

The worst case for final test: b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.9.2 Test Setup Diagram



30MHz-1GHz



Above 1GHz

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7.9.3 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: 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.

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

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Mode:b; Polarization:Horizontal; Modulation:GFSK; Channel:Low

	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	36.70	26.25	5.03	37.44	30.54	54.00	-23.46	HORIZONTAL	Average
2	2310.000	46.63	26.25	5.03	37.44	40.47	74.00	-33.53	HORIZONTAL	Peak
3	2390.000	32.96	26.43	4.88	37.42	26.85	54.00	-27.15	HORIZONTAL	Average
4	2390.000	45.42	26.43	4.88	37.42	39.31	74.00	-34.69	HORIZONTAL	Peak
5	2483.500	33.73	26.58	5.23	37.40	28.14	54.00	-25.86	HORIZONTAL	Average
6	2483.500	45.63	26.58	5.23	37.40	40.04	74.00	-33.96	HORIZONTAL	Peak
7	2500.000	34.13	26.60	4.95	37.39	28.29	54.00	-25.71	HORIZONTAL	Average
8	2500.000	44.81	26.60	4.95	37.39	38.97	74.00	-35.03	HORIZONTAL	Peak

Mode:b; Polarization:Vertical; Modulation:GFSK; Channel:Low

	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	38.72	26.25	5.03	37.44	32.56	54.00	-21.44	VERTICAL	Average
2	2310.000	46.96	26.25	5.03	37.44	40.80	74.00	-33.20	VERTICAL	Peak
3	2390.000	37.41	26.43	4.88	37.42	31.30	54.00	-22.70	VERTICAL	Average
4	2390.000	45.42	26.43	4.88	37.42	39.31	74.00	-34.69	VERTICAL	Peak
5	2483.500	36.42	26.58	5.23	37.40	30.83	54.00	-23.17	VERTICAL	Average
6	2483.500	46.48	26.58	5.23	37.40	40.89	74.00	-33.11	VERTICAL	Peak
7	2500.000	35.97	26.60	4.95	37.39	30.13	54.00	-23.87	VERTICAL	Average
8	2500.000	46.82	26.60	4.95	37.39	40.98	74.00	-33.02	VERTICAL	Peak

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Mode:b; Polarization:Horizontal; Modulation:GFSK; Channel:High

	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	31.47	26.25	5.03	37.44	25.31	54.00	-28.69	HORIZONTAL	Average
2	2310.000	45.10	26.25	5.03	37.44	38.94	74.00	-35.06	HORIZONTAL	Peak
3	2390.000	32.01	26.43	4.88	37.42	25.90	54.00	-28.10	HORIZONTAL	Average
4	2390.000	45.31	26.43	4.88	37.42	39.20	74.00	-34.80	HORIZONTAL	Peak
5	2483.500	35.77	26.58	5.23	37.40	30.18	54.00	-23.82	HORIZONTAL	Average
6	2483.500	54.90	26.58	5.23	37.40	49.31	74.00	-24.69	HORIZONTAL	Peak
7	2500.000	32.36	26.60	4.95	37.39	26.52	54.00	-27.48	HORIZONTAL	Average
8	2500.000	45.71	26.60	4.95	37.39	39.87	74.00	-34.13	HORIZONTAL	Peak

Mode:b; Polarization:Vertical; Modulation:GFSK; Channel:High

	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	34.10	26.25	5.03	37.44	27.94	54.00	-26.06	VERTICAL	Average
2	2310.000	45.21	26.25	5.03	37.44	39.05	74.00	-34.95	VERTICAL	Peak
3	2390.000	33.97	26.43	4.88	37.42	27.86	54.00	-26.14	VERTICAL	Average
4	2390.000	45.68	26.43	4.88	37.42	39.57	74.00	-34.43	VERTICAL	Peak
5	2483.500	46.80	26.58	5.23	37.40	41.21	54.00	-12.79	VERTICAL	Average
6	2483.500	62.81	26.58	5.23	37.40	57.22	74.00	-16.78	VERTICAL	Peak
7	2500.000	36.14	26.60	4.95	37.39	30.30	54.00	-23.70	VERTICAL	Average
8	2500.000	44.67	26.60	4.95	37.39	38.83	74.00	-35.17	VERTICAL	Peak

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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

Measurement Distance: 3m

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: 21 °C Humidity: 52 % RH Atmospheric Pressure: 1020 mbar

Pretest these modes to find the worst case: b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

c: Charge + TX_non-Hop mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

The worst case for final test: b: TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

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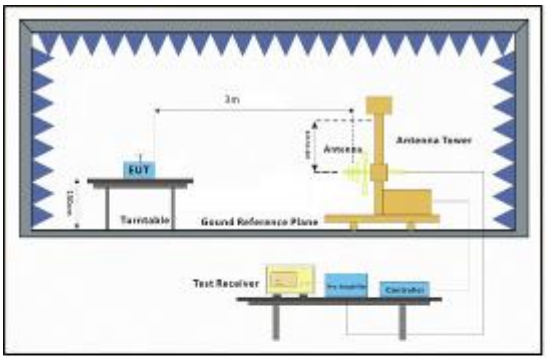
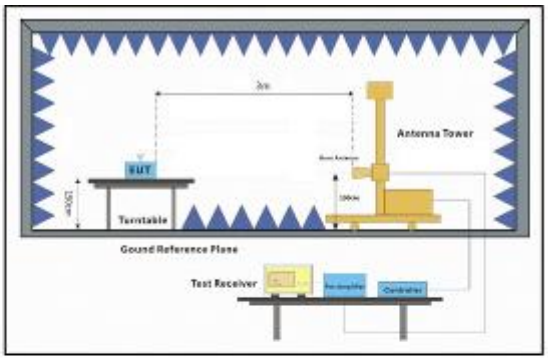
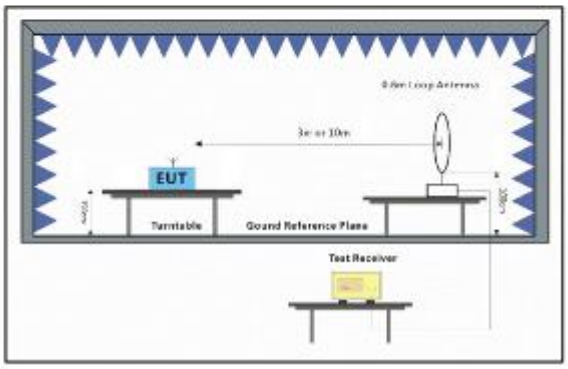
7.10.2 Test Setup Diagram







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7.10.3 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

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Mode:b; Polarization:Horizontal; Modulation:GFSK; Channel:Low

	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	58.819	40.28	14.13	0.80	26.49	28.72	40.00	-11.28	HORIZONTAL	QP
2	75.446	46.14	10.88	0.92	26.43	31.51	40.00	-8.49	HORIZONTAL	QP
3	102.001	46.37	9.33	1.11	26.40	30.41	43.50	-13.09	HORIZONTAL	QP
4	166.651	42.92	13.40	1.37	26.44	31.25	43.50	-12.25	HORIZONTAL	QP
5	345.595	36.38	15.03	1.93	27.19	26.15	46.00	-19.85	HORIZONTAL	QP
6	739.661	29.08	21.71	2.90	27.31	26.38	46.00	-19.62	HORIZONTAL	QP

Mode:b; Polarization:Horizontal; Modulation:GFSK; Channel:Low

	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	2871.934	35.46	27.70	3.70	37.15	29.71	54.00	-24.29	HORIZONTAL	Average
2	2871.934	45.93	27.70	3.70	37.15	40.18	74.00	-33.82	HORIZONTAL	Peak
3	3790.361	36.27	28.97	4.60	36.92	32.92	54.00	-21.08	HORIZONTAL	Average
4	3790.361	45.75	28.97	4.60	36.92	42.40	74.00	-31.60	HORIZONTAL	Peak
5	4748.888	36.76	30.64	5.40	36.93	35.87	54.00	-18.13	HORIZONTAL	Average
6	4748.888	45.45	30.64	5.40	36.93	44.56	74.00	-29.44	HORIZONTAL	Peak
7	7807.262	35.09	36.34	6.19	36.90	40.72	54.00	-13.28	HORIZONTAL	Average
8	7807.262	45.40	36.34	6.19	36.90	51.03	74.00	-22.97	HORIZONTAL	Peak
9	11454.800	30.95	39.15	8.37	37.18	41.29	54.00	-12.71	HORIZONTAL	Average
10	11454.800	44.11	39.15	8.37	37.18	54.45	74.00	-19.55	HORIZONTAL	Peak
11	17181.800	28.48	42.11	9.92	35.80	44.71	54.00	-9.29	HORIZONTAL	Average
12	17181.800	46.89	42.11	9.92	35.80	63.12	74.00	-10.88	HORIZONTAL	Peak

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Mode:b; Polarization:Vertical; Modulation:GFSK; Channel:Low

	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	50.409	34.46	14.49	0.71	26.50	23.16	40.00	-16.84	VERTICAL	QP
2	60.492	39.36	14.06	0.80	26.48	27.74	40.00	-12.26	VERTICAL	QP
3	76.512	41.24	10.47	0.93	26.43	26.21	40.00	-13.79	VERTICAL	QP
4	105.642	36.42	9.61	1.13	26.40	20.76	43.50	-22.74	VERTICAL	QP
5	211.527	41.28	11.20	1.53	26.47	27.54	43.50	-15.96	VERTICAL	QP
6	755.387	28.32	21.99	2.90	27.30	25.91	46.00	-20.09	VERTICAL	QP

Mode:b; Polarization:Vertical; Modulation:GFSK; Channel:Low

	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	2671.730	38.21	26.98	3.57	37.32	31.44	54.00	-22.56	VERTICAL	Average
2	2671.730	47.68	26.98	3.57	37.32	40.91	74.00	-33.09	VERTICAL	Peak
3	3386.297	34.15	27.90	4.10	36.97	29.18	54.00	-24.82	VERTICAL	Average
4	3386.297	45.60	27.90	4.10	36.97	40.63	74.00	-33.37	VERTICAL	Peak
5	4600.276	32.16	30.26	5.40	36.92	30.90	54.00	-23.10	VERTICAL	Average
6	4600.276	44.90	30.26	5.40	36.92	43.64	74.00	-30.36	VERTICAL	Peak
7	7852.524	34.82	36.39	6.17	36.90	40.48	54.00	-13.52	VERTICAL	Average
8	7852.524	44.62	36.39	6.17	36.90	50.28	74.00	-23.72	VERTICAL	Peak
9	11454.250	31.67	39.15	8.37	37.18	42.01	54.00	-11.99	VERTICAL	Average
10	11454.250	45.21	39.15	8.37	37.18	55.55	74.00	-18.45	VERTICAL	Peak
11	17181.460	27.40	42.11	9.92	35.80	43.63	54.00	-10.37	VERTICAL	Average
12	17181.460	43.89	42.11	9.92	35.80	60.12	74.00	-13.88	VERTICAL	Peak

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Mode:b; Polarization:Horizontal; Modulation:GFSK; Channel:middle

	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	3790.361	39.14	28.97	7.83	36.92	39.02	54.00	-14.98	HORIZONTAL	Average
2	3790.361	45.34	28.97	7.83	36.92	45.22	74.00	-28.78	HORIZONTAL	Peak
3	4882.151	40.31	30.95	6.86	36.95	41.17	54.00	-12.83	HORIZONTAL	Average
4	4882.151	49.61	30.95	6.86	36.95	50.47	74.00	-23.53	HORIZONTAL	Peak
5	5730.396	39.91	32.08	6.99	36.99	41.99	54.00	-12.01	HORIZONTAL	Average
6	5730.396	46.39	32.08	6.99	36.99	48.47	74.00	-25.53	HORIZONTAL	Peak
7	7323.833	35.17	35.74	7.39	36.92	41.38	54.00	-12.62	HORIZONTAL	Average
8	7323.833	44.54	35.74	7.39	36.92	50.75	74.00	-23.25	HORIZONTAL	Peak
9	9764.432	37.85	37.70	8.33	37.09	46.79	54.00	-7.21	HORIZONTAL	Average
10	9764.432	45.25	37.70	8.33	37.09	54.19	74.00	-19.81	HORIZONTAL	Peak
11	12205.950	31.97	39.21	10.98	37.06	45.10	54.00	-8.90	HORIZONTAL	Average
12	12205.950	44.48	39.21	10.98	37.06	57.61	74.00	-16.39	HORIZONTAL	Peak

Mode:b; Polarization:Vertical; Modulation:GFSK; Channel:middle

	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	2973.293	42.53	27.87	4.67	37.09	37.98	54.00	-16.02	VERTICAL	Average
2	2973.293	51.67	27.87	4.67	37.09	47.12	74.00	-26.88	VERTICAL	Peak
3	3856.668	39.64	29.19	7.73	36.91	39.65	54.00	-14.35	VERTICAL	Average
4	3856.668	45.92	29.19	7.73	36.91	45.93	74.00	-28.07	VERTICAL	Peak
5	4882.058	41.69	30.95	6.86	36.95	42.55	54.00	-11.45	VERTICAL	Average
6	4882.058	50.63	30.95	6.86	36.95	51.49	74.00	-22.51	VERTICAL	Peak
7	7323.015	39.16	35.74	7.39	36.92	45.37	54.00	-8.63	VERTICAL	Average
8	7323.015	45.70	35.74	7.39	36.92	51.91	74.00	-22.09	VERTICAL	Peak
9	9764.149	38.61	37.70	8.33	37.09	47.55	54.00	-6.45	VERTICAL	Average
10	9764.149	45.41	37.70	8.33	37.09	54.35	74.00	-19.65	VERTICAL	Peak
11	12205.270	33.18	39.21	10.98	37.06	46.31	54.00	-7.69	VERTICAL	Average
12	12205.270	44.90	39.21	10.98	37.06	58.03	74.00	-15.97	VERTICAL	Peak

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Mode:b; Polarization:Horizontal; Modulation:GFSK; Channel:High

	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	3347.371	31.60	27.90	5.57	36.98	28.09	54.00	-25.91	HORIZONTAL	Average
2	3347.371	47.28	27.90	5.57	36.98	43.77	74.00	-30.23	HORIZONTAL	Peak
3	4027.554	38.52	29.52	7.17	36.90	38.31	54.00	-15.69	HORIZONTAL	Average
4	4027.554	45.65	29.52	7.17	36.90	45.44	74.00	-28.56	HORIZONTAL	Peak
5	4960.993	40.66	31.05	7.84	36.96	42.59	54.00	-11.41	HORIZONTAL	Average
6	4960.993	49.16	31.05	7.84	36.96	51.09	74.00	-22.91	HORIZONTAL	Peak
7	7440.914	38.68	35.92	7.43	36.92	45.11	54.00	-8.89	HORIZONTAL	Average
8	7440.914	45.84	35.92	7.43	36.92	52.27	74.00	-21.73	HORIZONTAL	Peak
9	9920.684	32.67	37.92	8.63	37.10	42.12	54.00	-11.88	HORIZONTAL	Average
10	9920.684	44.49	37.92	8.63	37.10	53.94	74.00	-20.06	HORIZONTAL	Peak
11	12400.950	31.25	38.93	11.17	36.90	44.45	54.00	-9.55	HORIZONTAL	Average
12	12400.950	44.96	38.93	11.17	36.90	58.16	74.00	-15.84	HORIZONTAL	Peak

Mode:b; Polarization:Vertical; Modulation:GFSK; Channel:High

	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	3935.493	40.85	29.37	7.43	36.90	40.75	54.00	-13.25	VERTICAL	Average
2	3935.493	47.78	29.37	7.43	36.90	47.68	74.00	-26.32	VERTICAL	Peak
3	4960.058	41.46	31.05	7.84	36.96	43.39	54.00	-10.61	VERTICAL	Average
4	4960.058	51.18	31.05	7.84	36.96	53.11	74.00	-20.89	VERTICAL	Peak
5	6621.375	37.94	34.46	7.14	36.98	42.56	54.00	-11.44	VERTICAL	Average
6	6621.375	45.64	34.46	7.14	36.98	50.26	74.00	-23.74	VERTICAL	Peak
7	7944.838	39.88	36.47	8.38	36.90	47.83	54.00	-6.17	VERTICAL	Average
8	7944.838	45.08	36.47	8.38	36.90	53.03	74.00	-20.97	VERTICAL	Peak
9	9920.230	36.42	37.92	8.63	37.10	45.87	54.00	-8.13	VERTICAL	Average
10	9920.230	46.66	37.92	8.63	37.10	56.11	74.00	-17.89	VERTICAL	Peak
11	12400.930	34.56	38.93	11.17	36.90	47.76	54.00	-6.24	VERTICAL	Average
12	12400.930	46.65	38.93	11.17	36.90	59.85	74.00	-14.15	VERTICAL	Peak

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8 Appendix

8.1 Appendix 15.247

1.20 dB Bandwidth

Test Mode	Test Channel	OBW[MHz]	EBW[MHz]	Limit[MHz]	Verdict
DH5	2402	0.91168	1.039	---	PASS
DH5	2441	0.91397	1.032	---	PASS
DH5	2480	0.91067	1.028	---	PASS
2DH5	2402	1.1952	1.365	---	PASS
2DH5	2441	1.1954	1.364	---	PASS
2DH5	2480	1.1970	1.366	---	PASS
3DH5	2402	1.2060	1.345	---	PASS
3DH5	2441	1.2052	1.347	---	PASS
3DH5	2480	1.2038	1.344	---	PASS

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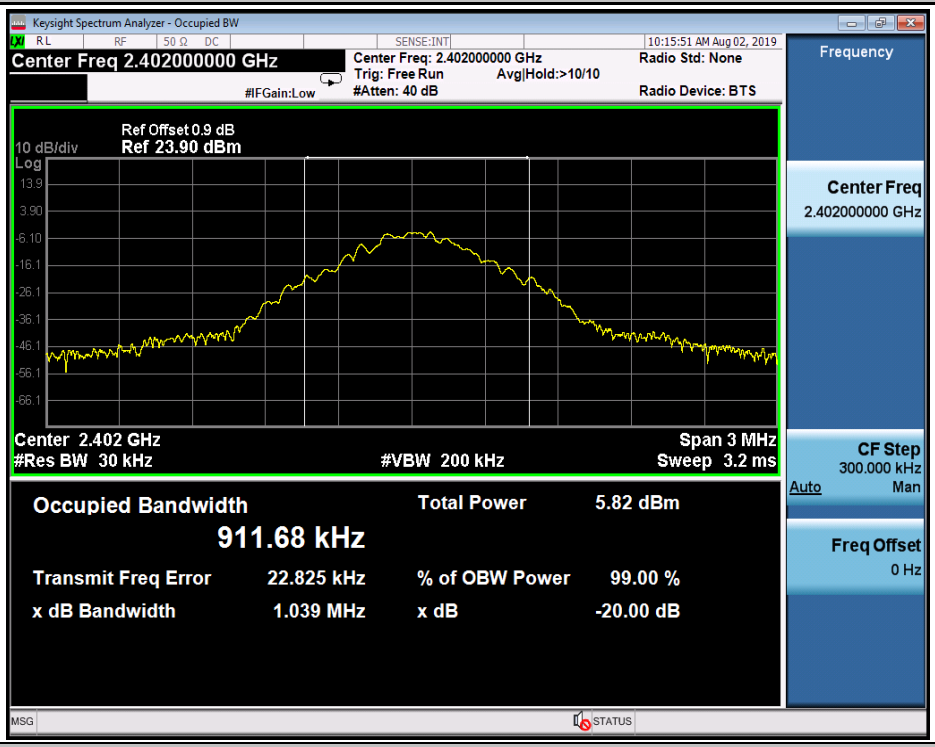
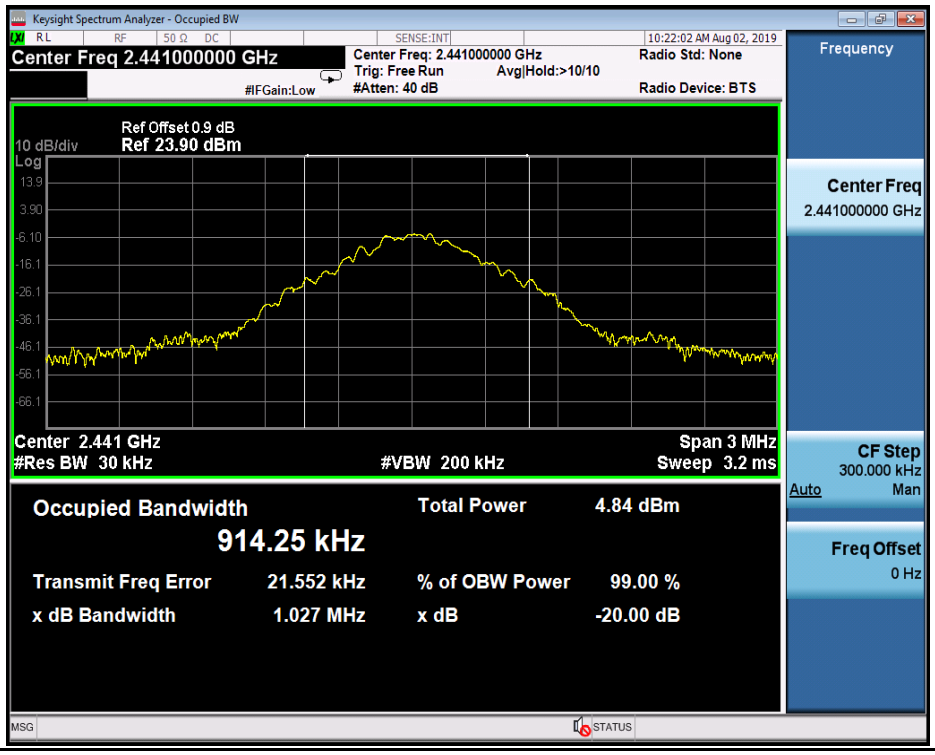
TEST PLOT

20 dB Bandwidth_DH5_2402



20 dB Bandwidth_DH5_2441



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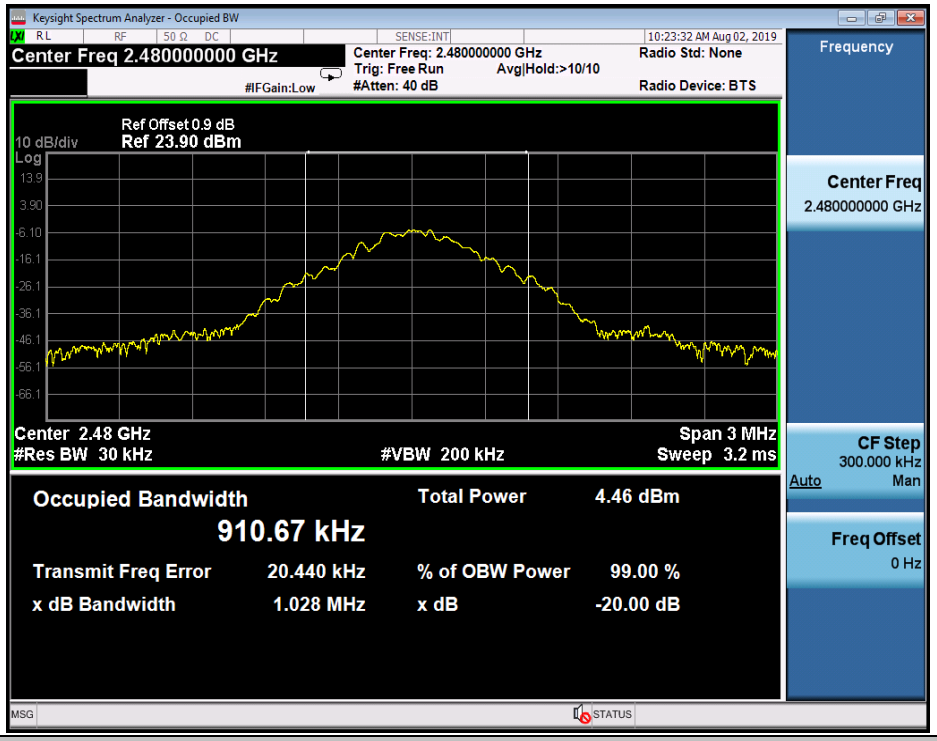
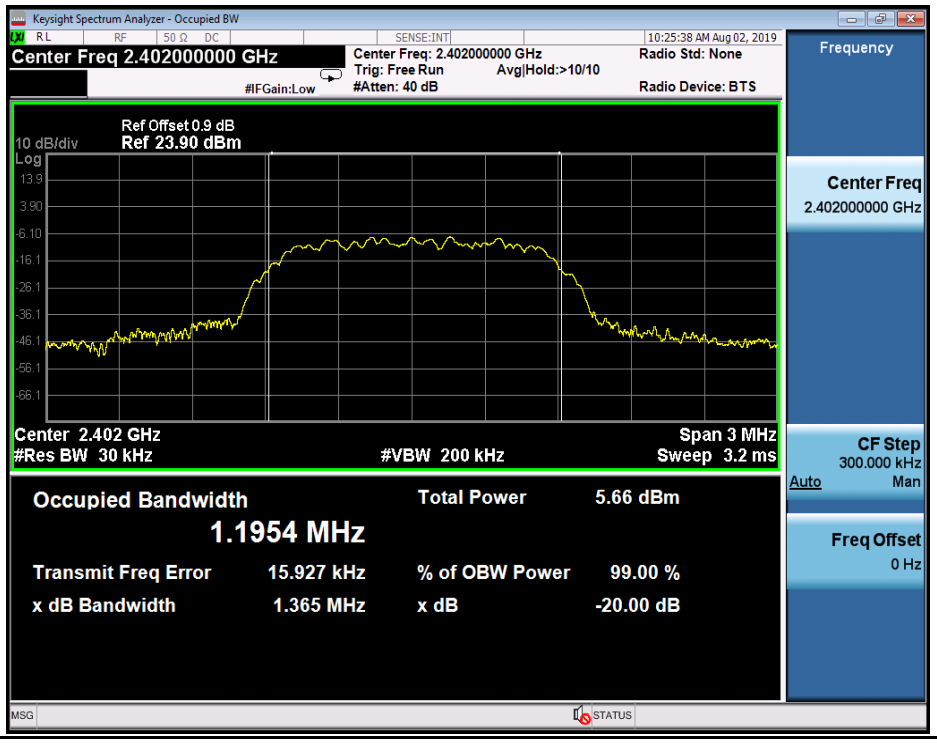
20 dB Bandwidth_DH5_2480



20 dB Bandwidth_2DH5_2402



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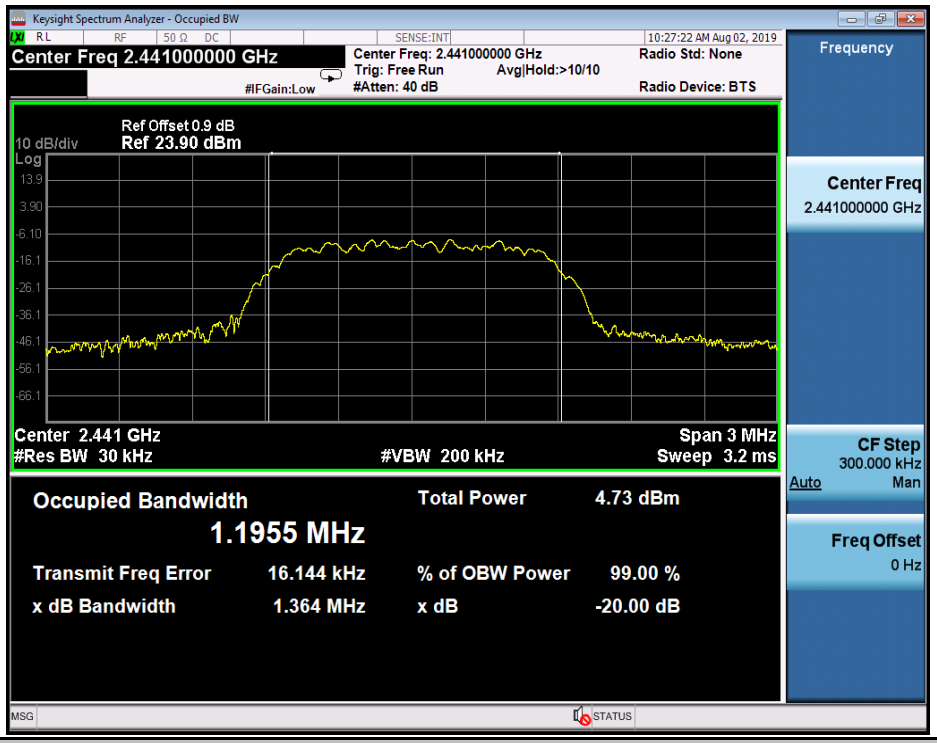
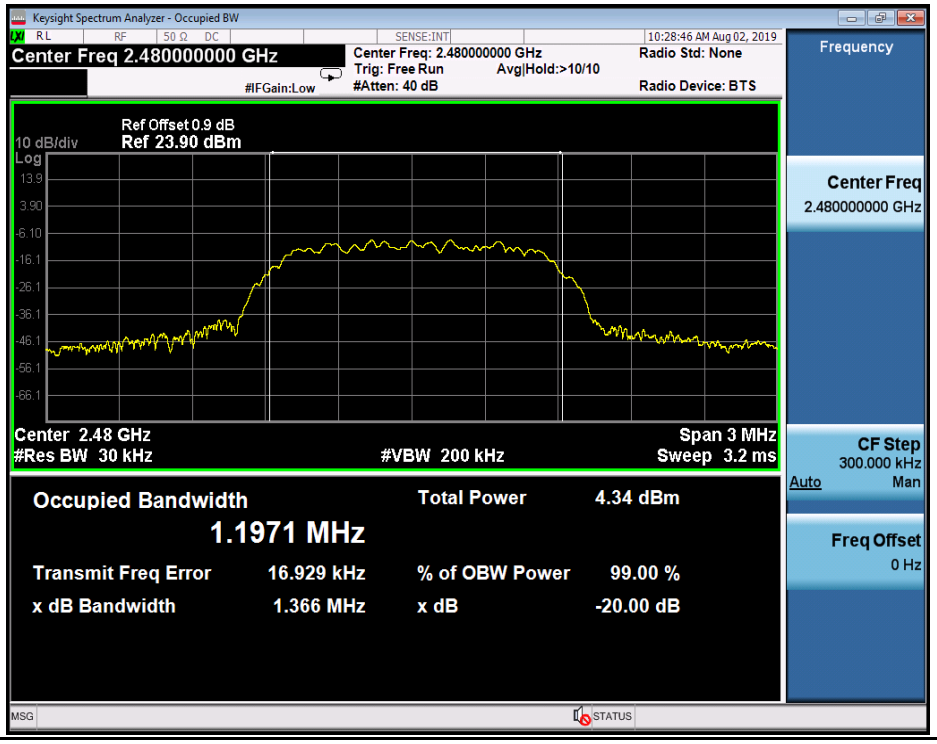
20 dB Bandwidth_2DH5_2441



20 dB Bandwidth_2DH5_2480



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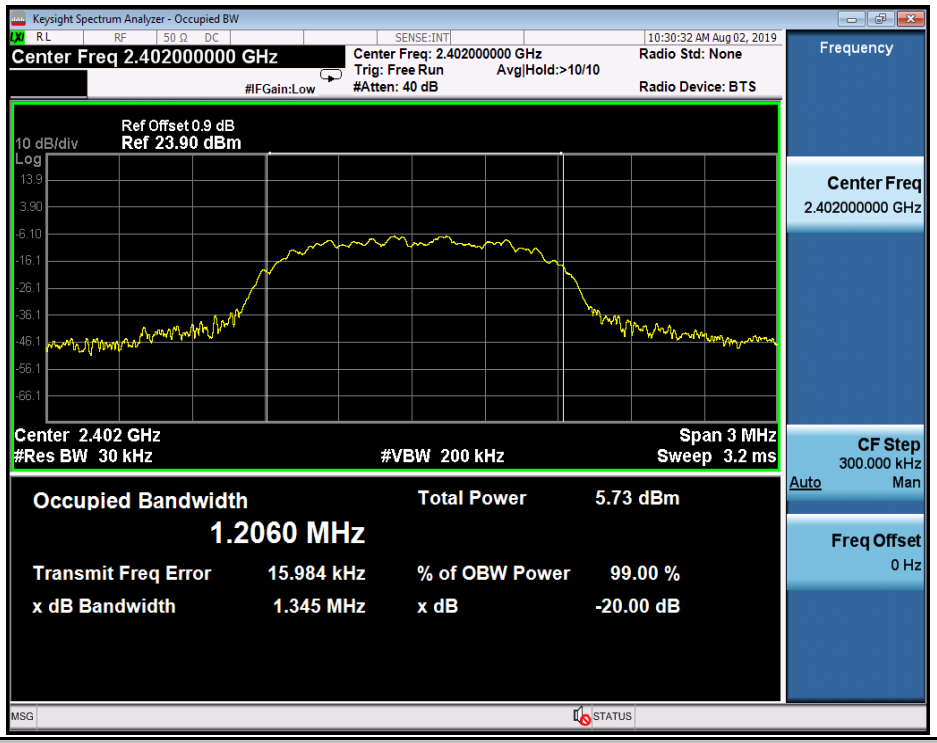
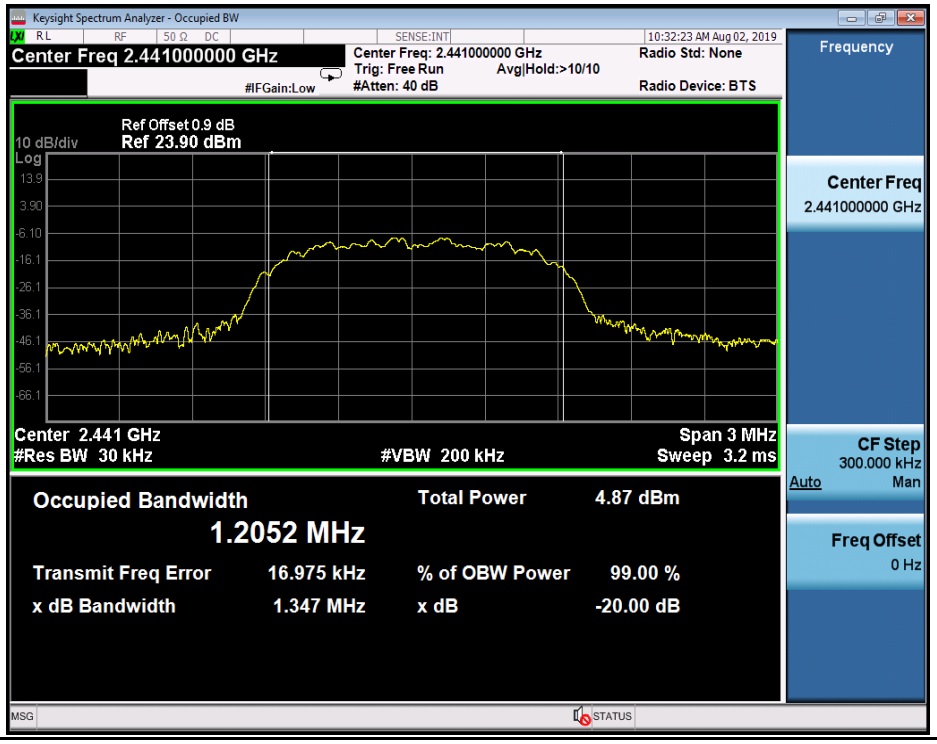
20 dB Bandwidth_3DH5_2402



20 dB Bandwidth_3DH5_2441



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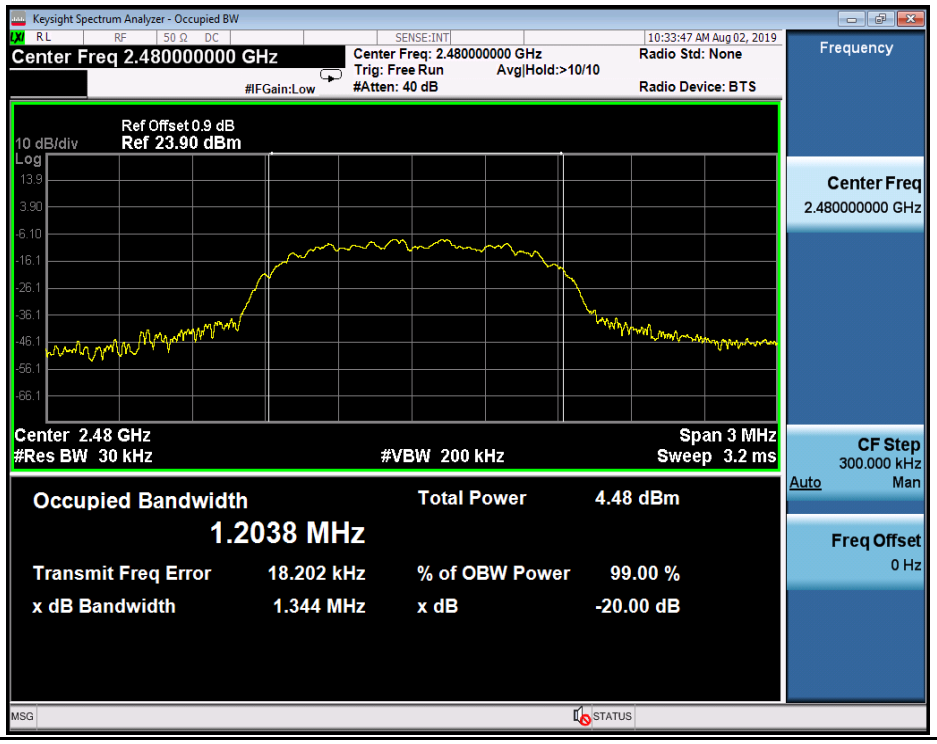
20 dB Bandwidth_3DH5_2480



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2.Conducted Peak Output Power

Test Mode	Test Channel	Power[dBm]	Limit[dBm]	Verdict
DH5	2402	-0.798	21	PASS
DH5	2441	-1.739	21	PASS
DH5	2480	-2.11	21	PASS
2DH5	2402	1.329	21	PASS
2DH5	2441	0.46	21	PASS
2DH5	2480	0.076	21	PASS
3DH5	2402	1.503	21	PASS
3DH5	2441	0.671	21	PASS
3DH5	2480	0.163	21	PASS

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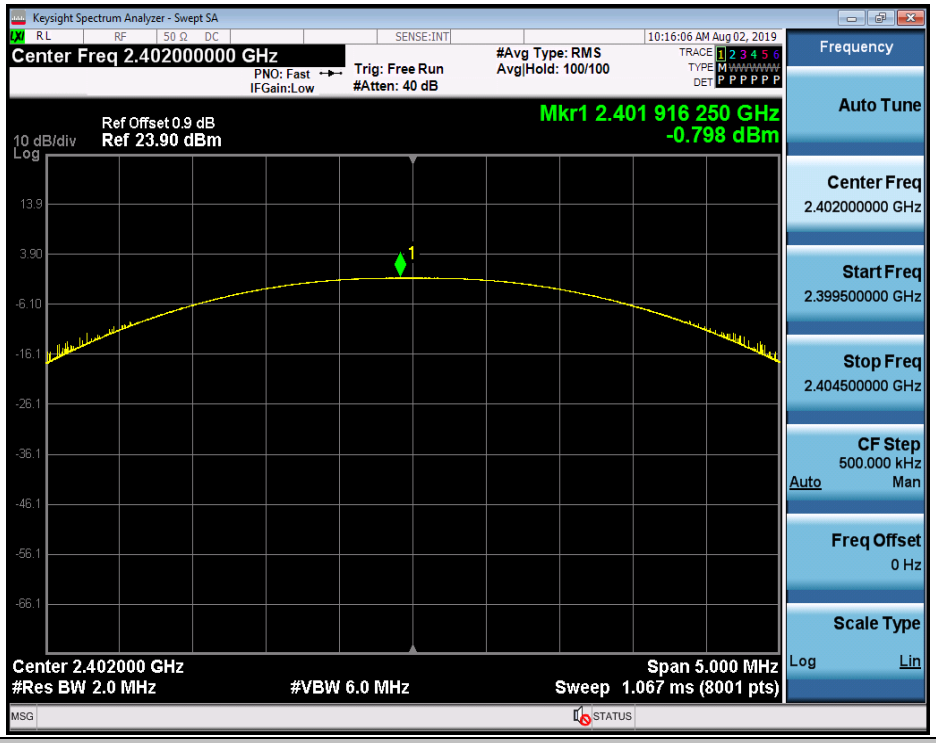
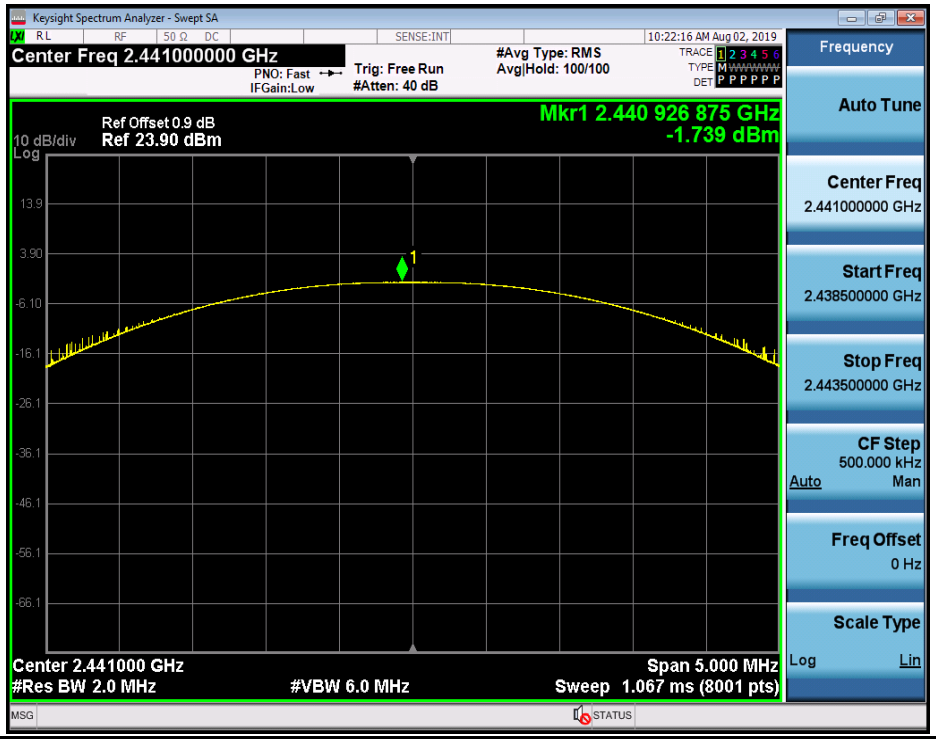
TEST PLOT

Conducted Peak Output Power_DH5_2402



Conducted Peak Output Power_DH5_2441



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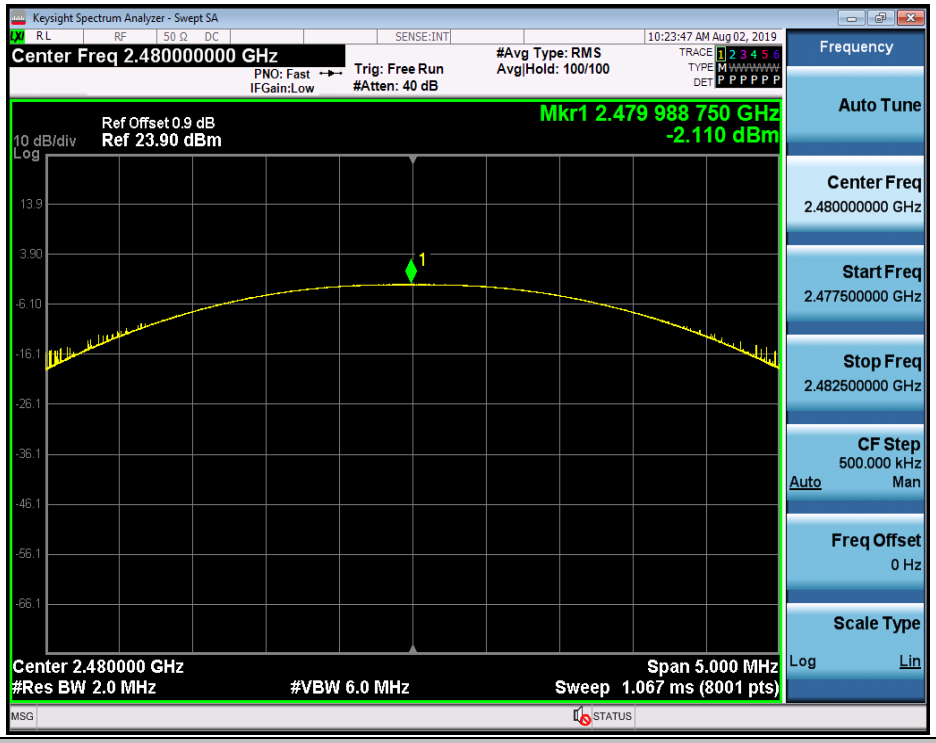
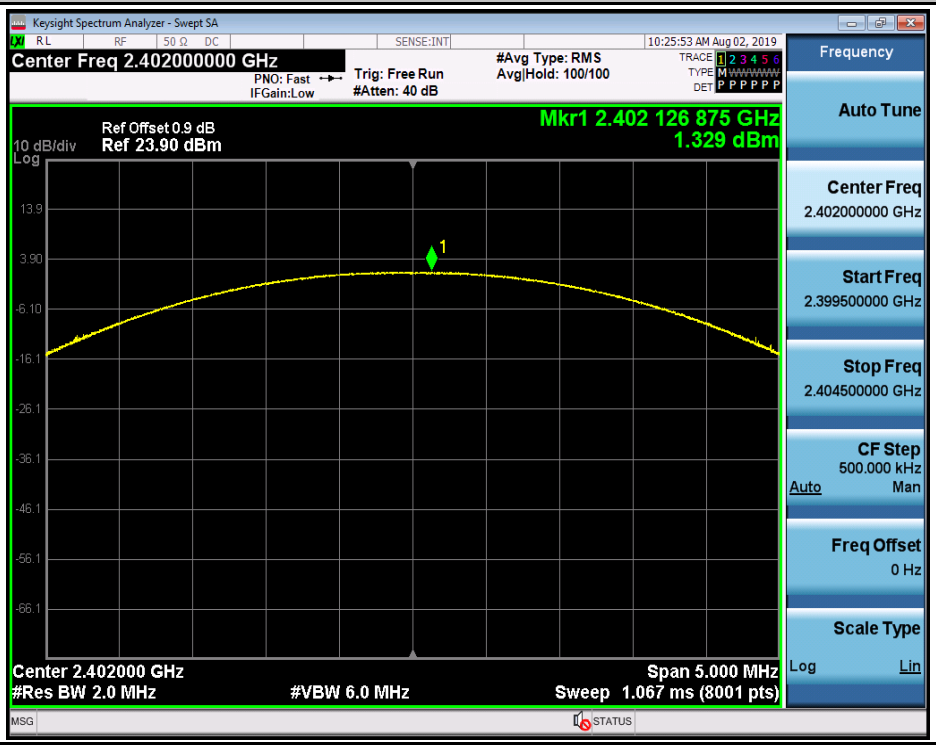
Conducted Peak Output Power_DH5_2480



Conducted Peak Output Power_2DH5_2402



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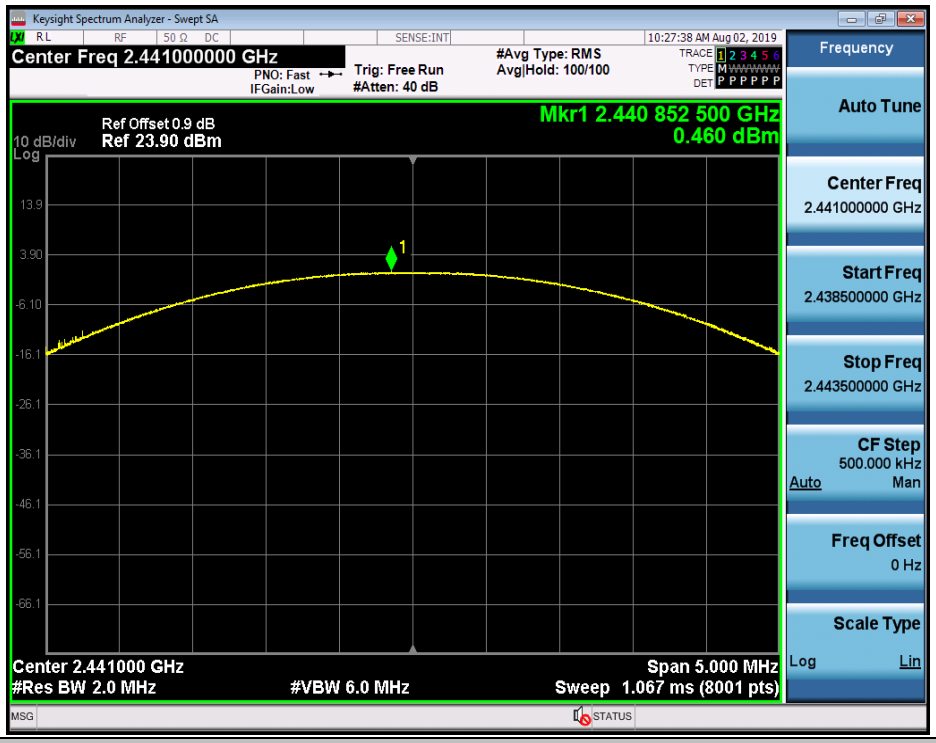
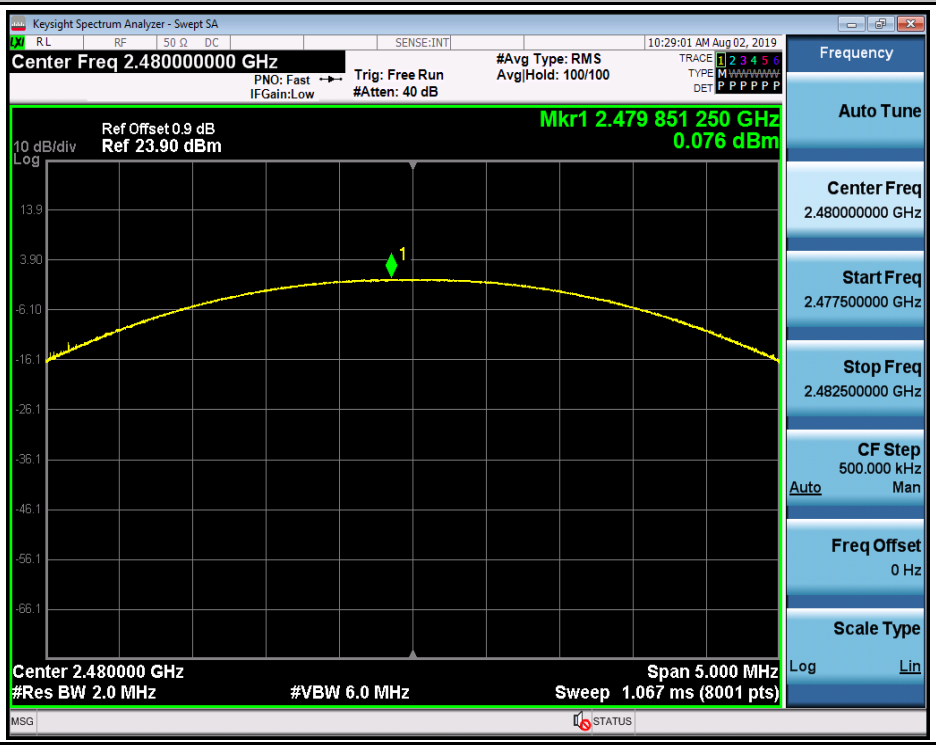
Conducted Peak Output Power_2DH5_2441



Conducted Peak Output Power_2DH5_2480



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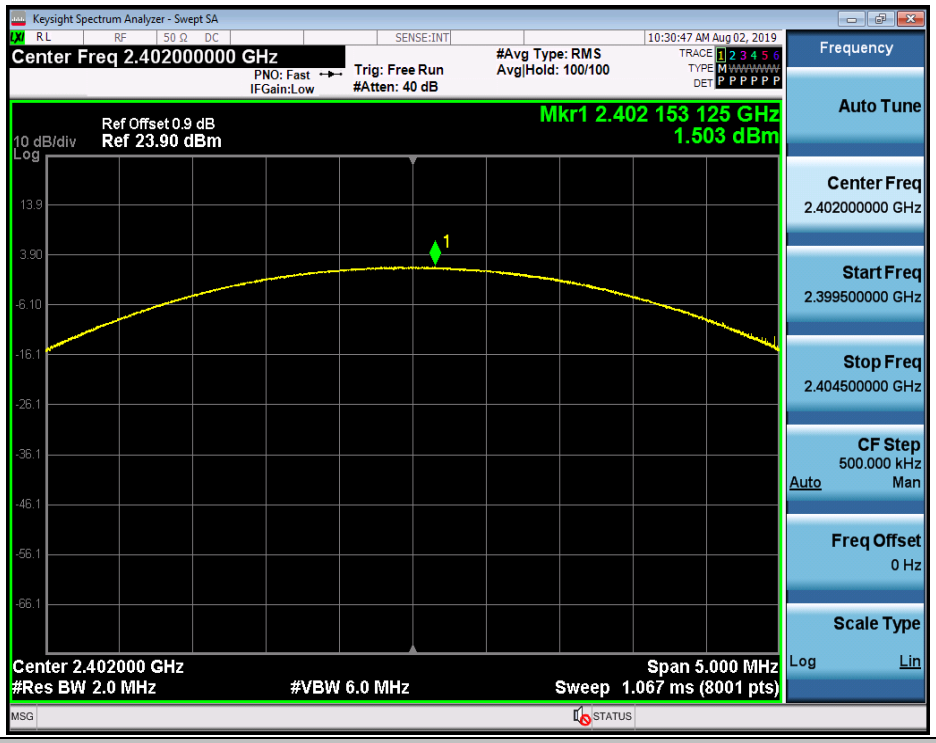
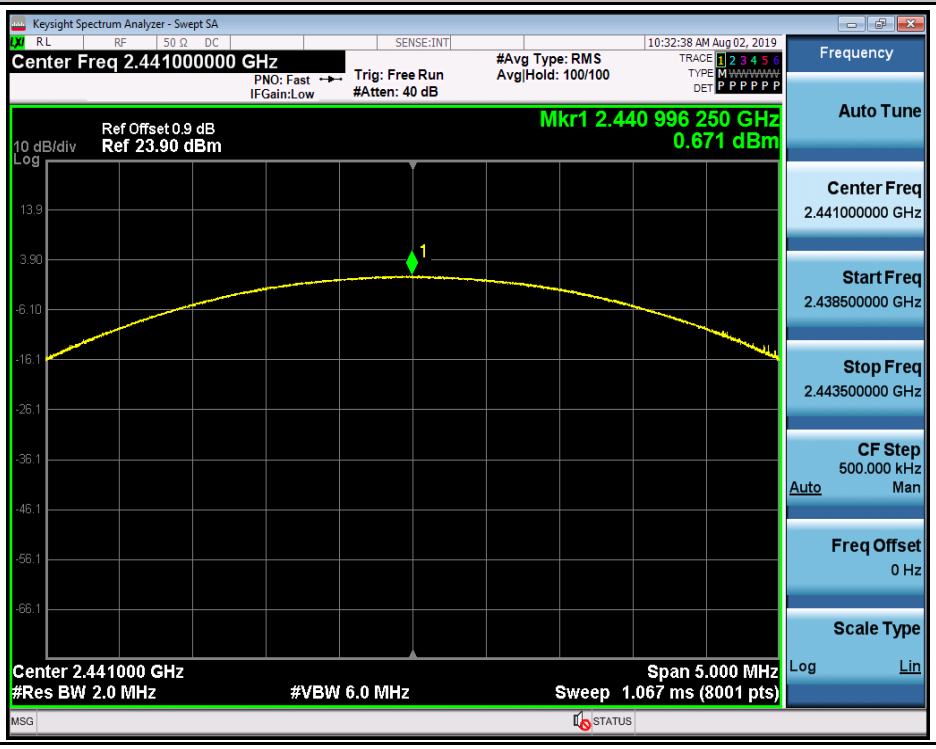
Conducted Peak Output Power_3DH5_2402



Conducted Peak Output Power_3DH5_2441



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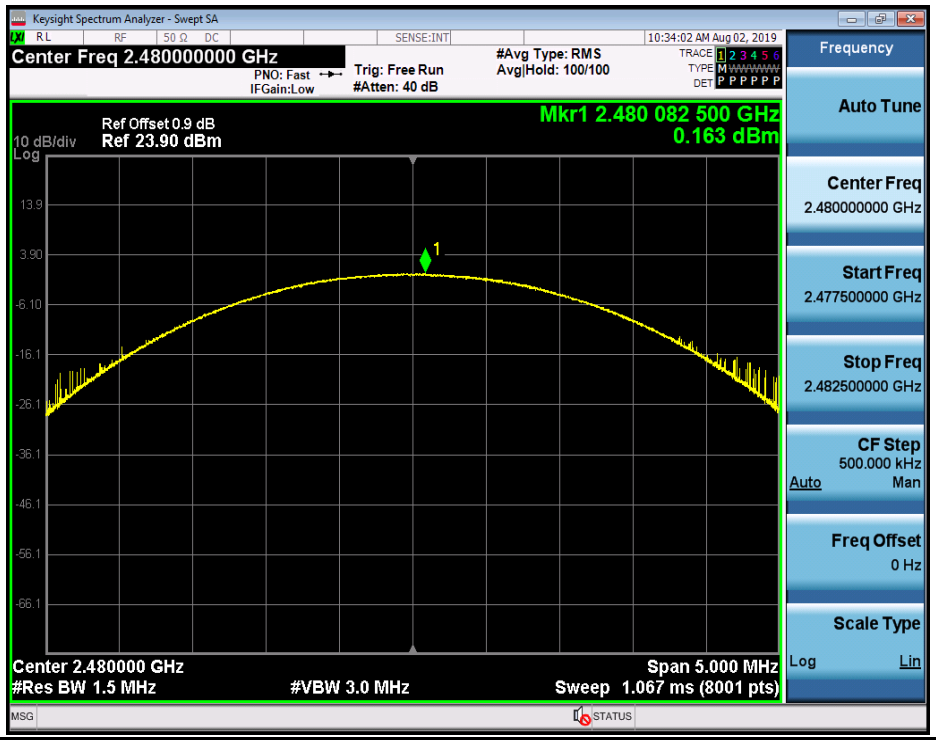
Conducted Peak Output Power_3DH5_2480



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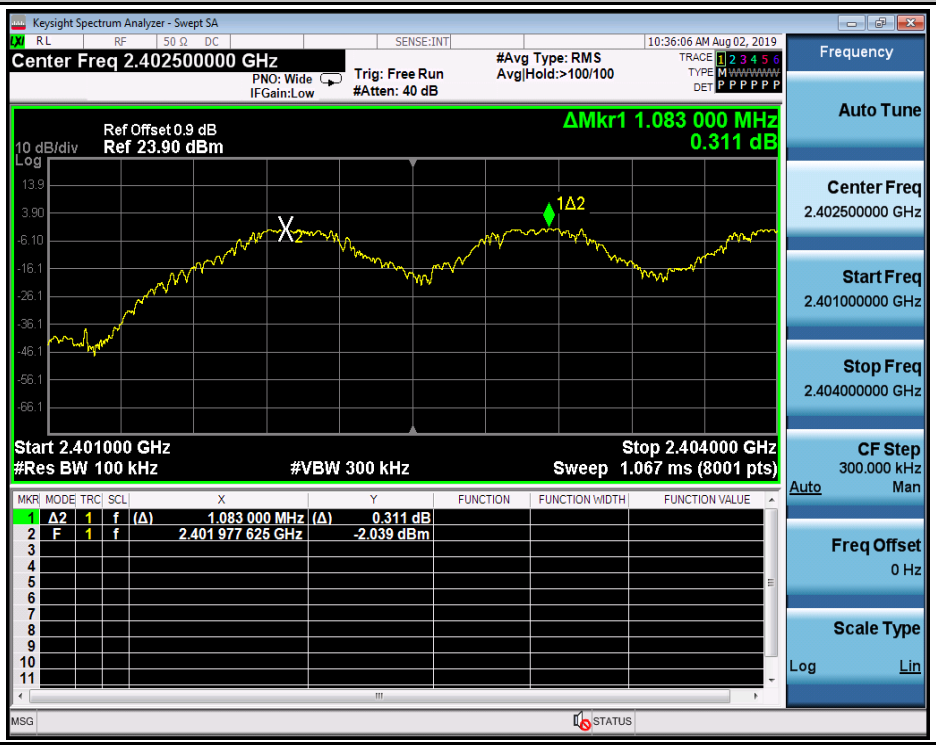
3.Carrier Frequency Separation

Test Mode	Test Channel	Result[MHz]	Limit[MHz]	Verdict
DH5	2402	1.083	0.693	PASS
DH5	2441	1.011	0.688	PASS
DH5	2480	1.004	0.685	PASS

TEST PLOT
Carrier Frequency Separation_DH5_2402



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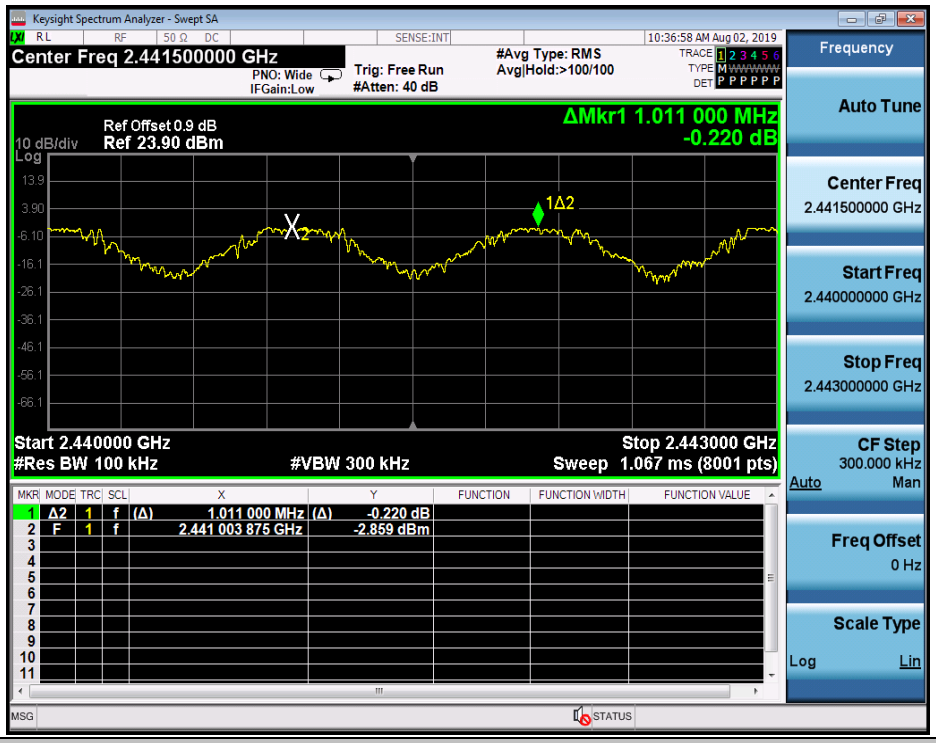
Carrier Frequency Separation_DH5_2441



Carrier Frequency Separation_DH5_2480

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4.Dwell Time

Test Mode	Test Channel	Burst Width[ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Limit[s]	Verdict
DH1	2402	0.38	370	0.14	0.4	PASS
DH1	2441	0.38	370	0.14	0.4	PASS
DH1	2480	0.38	370	0.14	0.4	PASS
DH3	2402	1.66	170	0.28	0.4	PASS
DH3	2441	1.65	170	0.28	0.4	PASS
DH3	2480	1.65	170	0.28	0.4	PASS
DH5	2402	2.92	110	0.32	0.4	PASS
DH5	2441	2.91	110	0.32	0.4	PASS
DH5	2480	2.93	110	0.32	0.4	PASS
2DH1	2402	0.38	370	0.14	0.4	PASS
2DH1	2441	0.40	370	0.14	0.4	PASS
2DH1	2480	0.38	370	0.14	0.4	PASS
2DH3	2402	1.66	170	0.28	0.4	PASS
2DH3	2441	1.65	170	0.28	0.4	PASS
2DH3	2480	1.66	170	0.28	0.4	PASS
2DH5	2402	2.91	110	0.32	0.4	PASS
2DH5	2441	2.91	110	0.32	0.4	PASS
2DH5	2480	2.91	110	0.32	0.4	PASS
3DH1	2402	0.38	370	0.14	0.4	PASS
3DH1	2441	0.40	370	0.15	0.4	PASS
3DH1	2480	0.40	370	0.15	0.4	PASS
3DH3	2402	1.66	160	0.27	0.4	PASS
3DH3	2441	1.66	170	0.28	0.4	PASS
3DH3	2480	1.64	170	0.28	0.4	PASS
3DH5	2402	2.93	110	0.32	0.4	PASS
3DH5	2441	2.93	110	0.32	0.4	PASS
3DH5	2480	2.91	110	0.32	0.4	PASS

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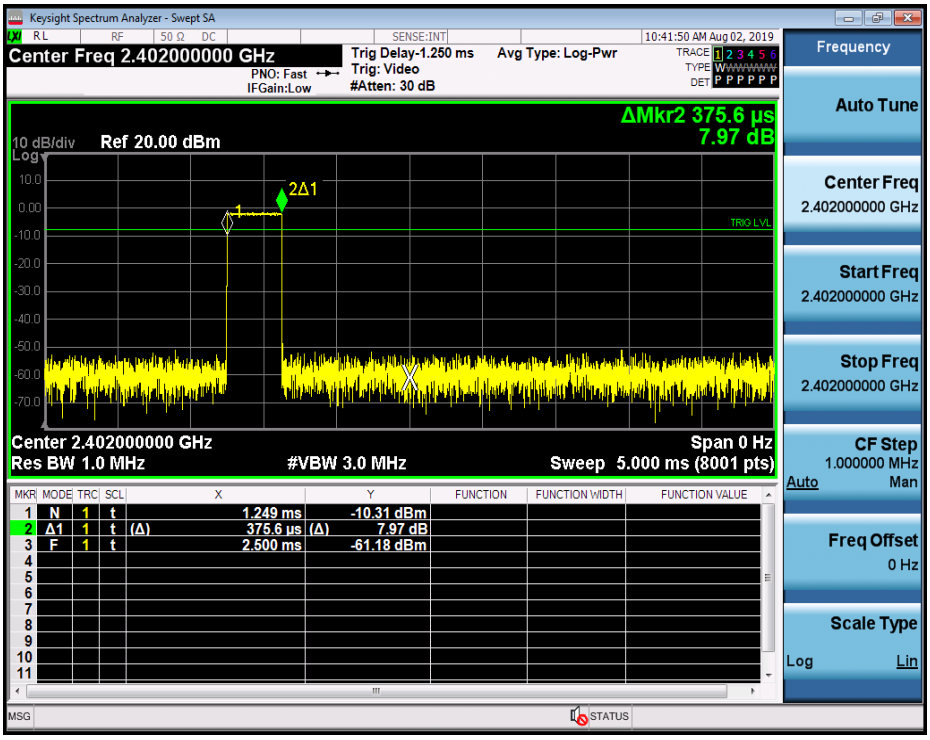
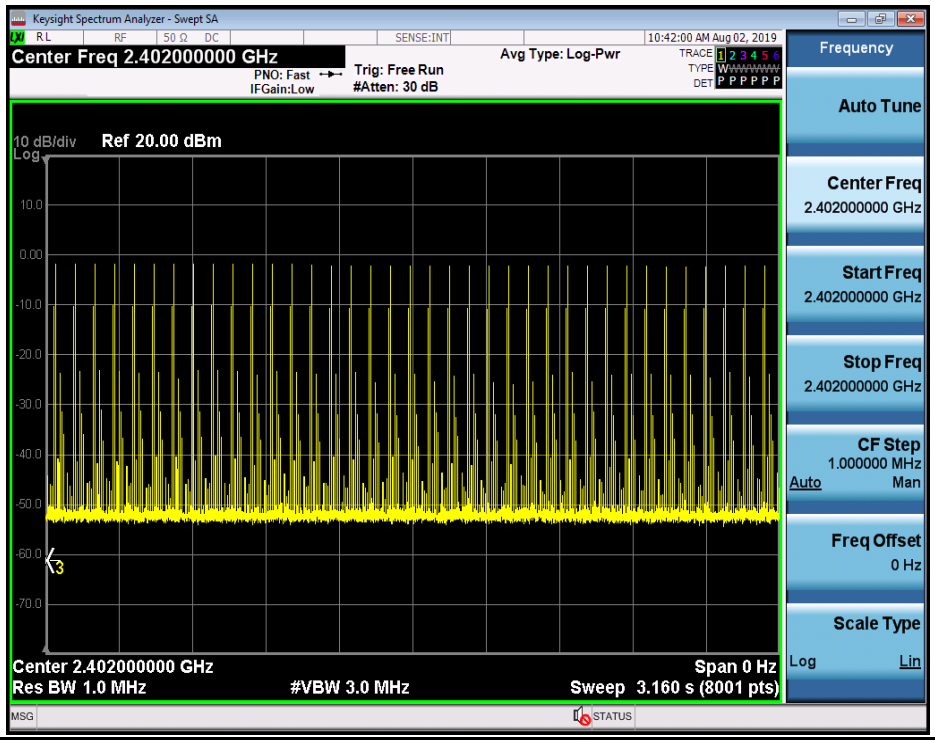
TEST PLOT

Dwell Time_DH1_2402





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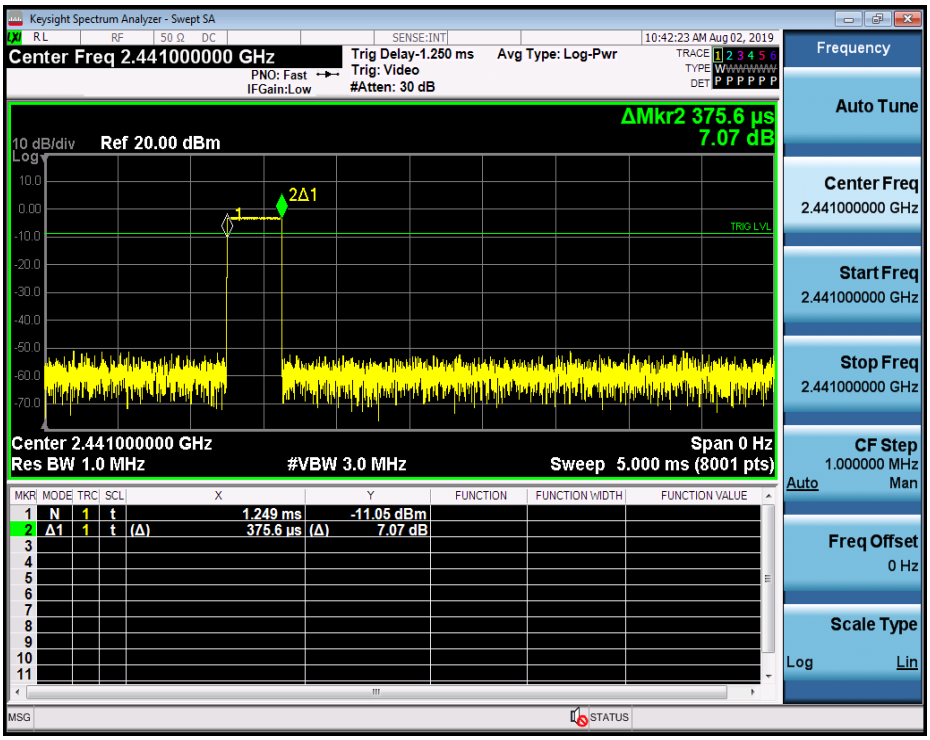
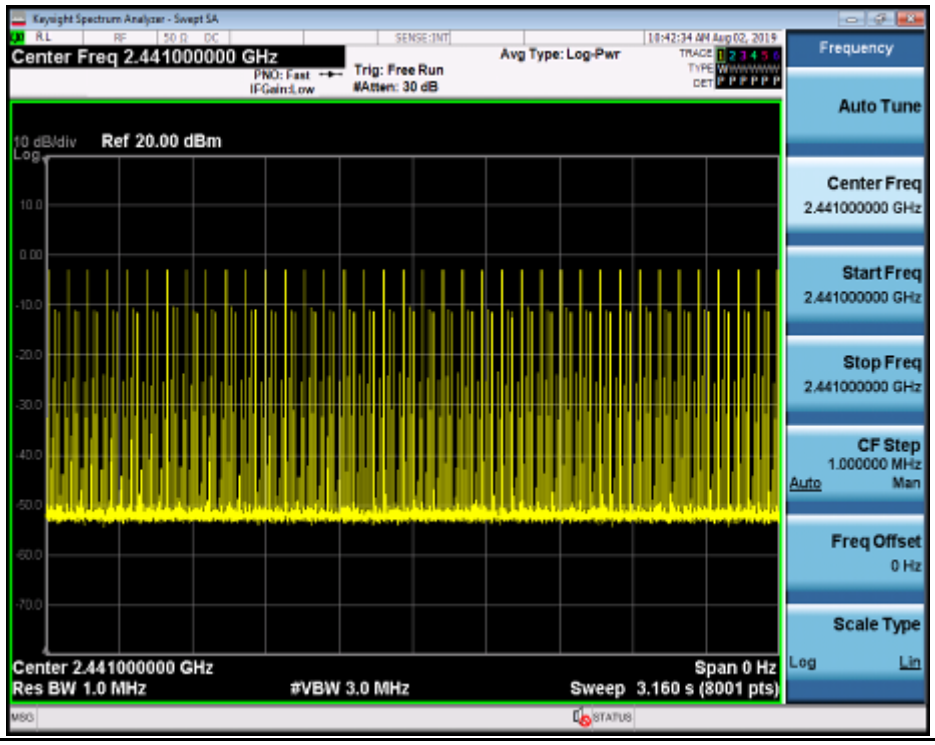
Dwell Time_DH1_2441





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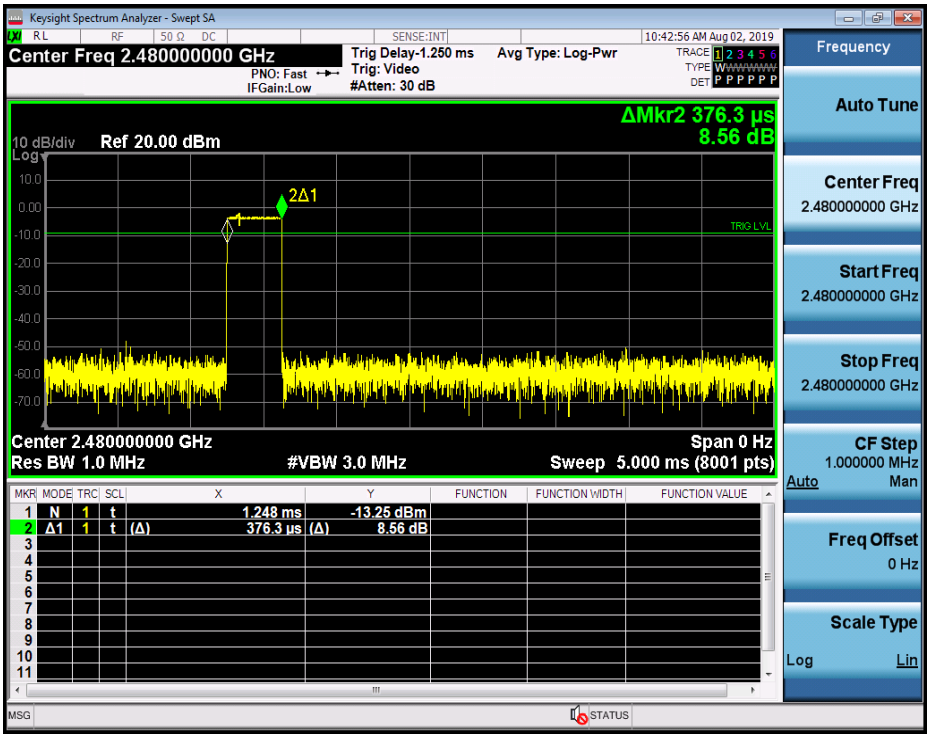
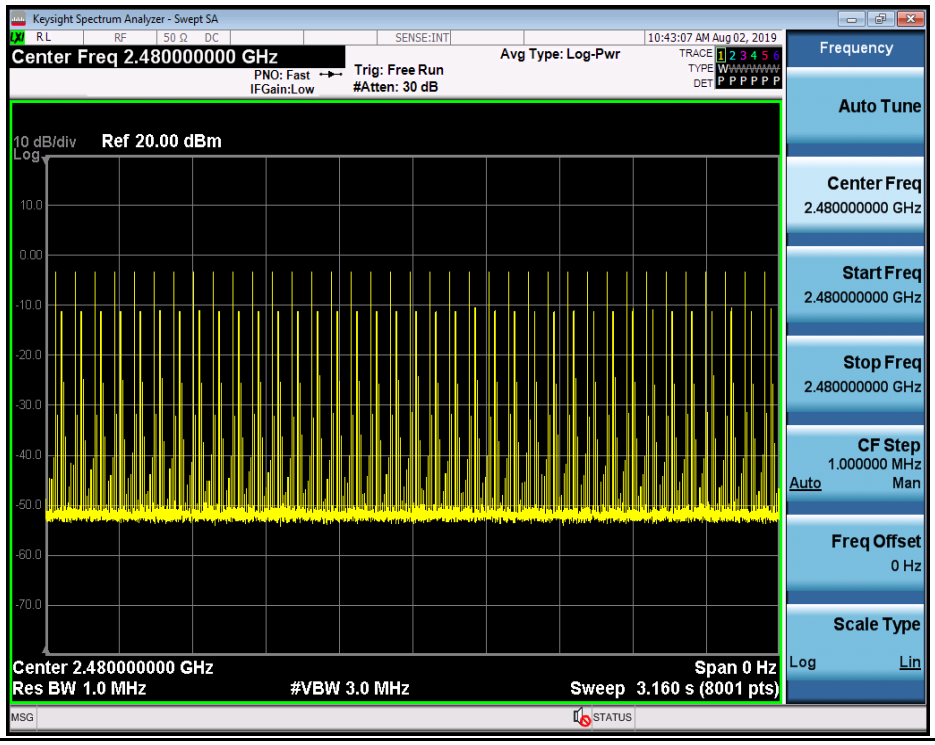
Dwell Time_DH1_2480





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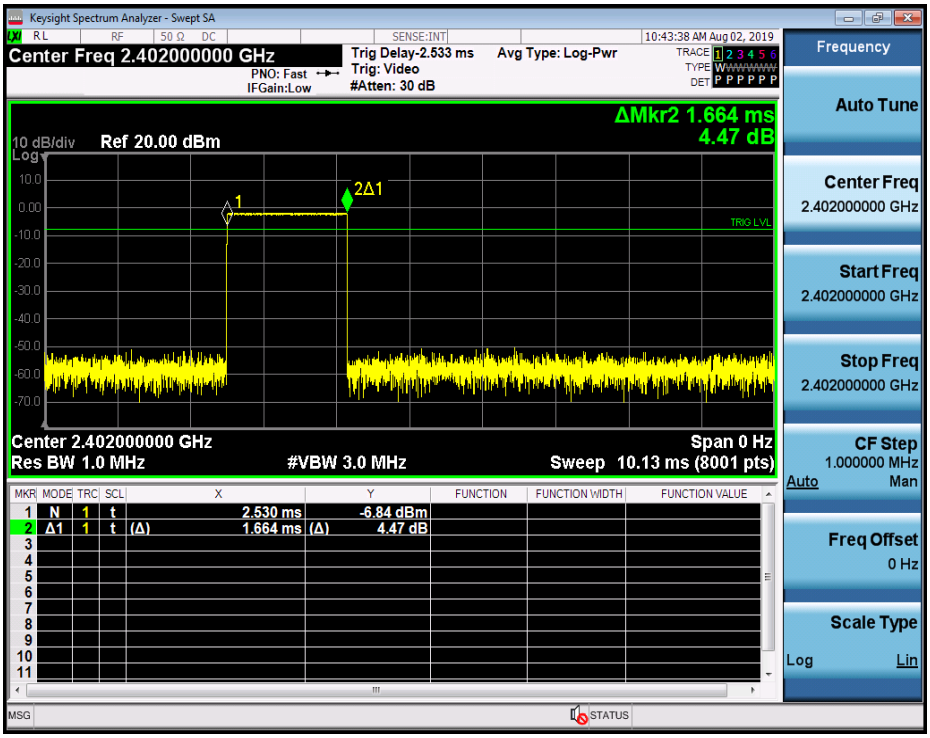
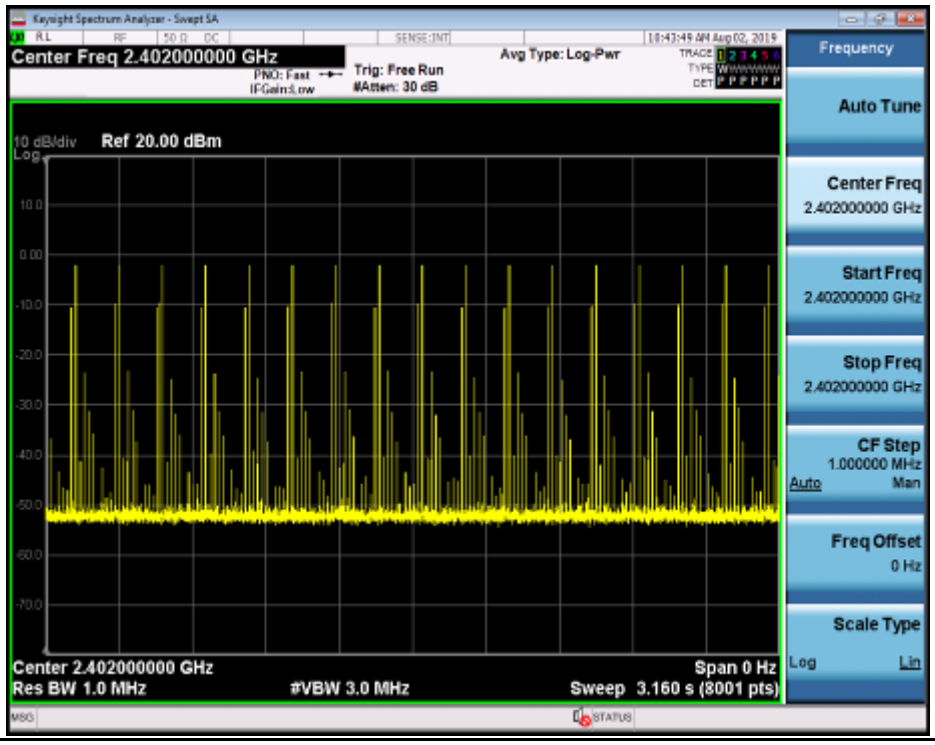
Dwell Time_DH3_2402





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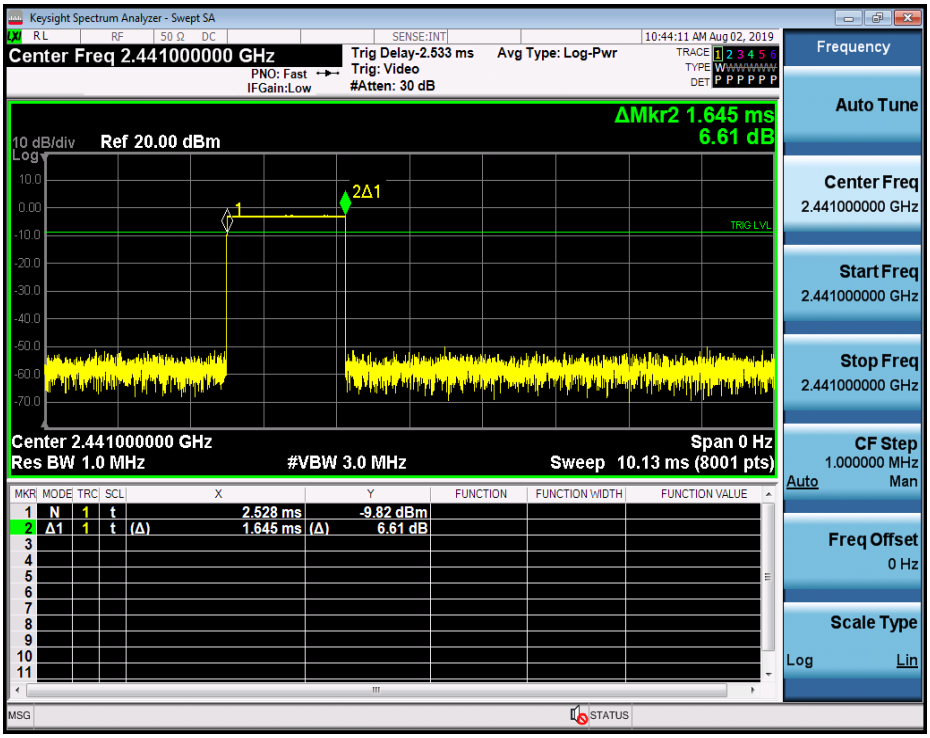
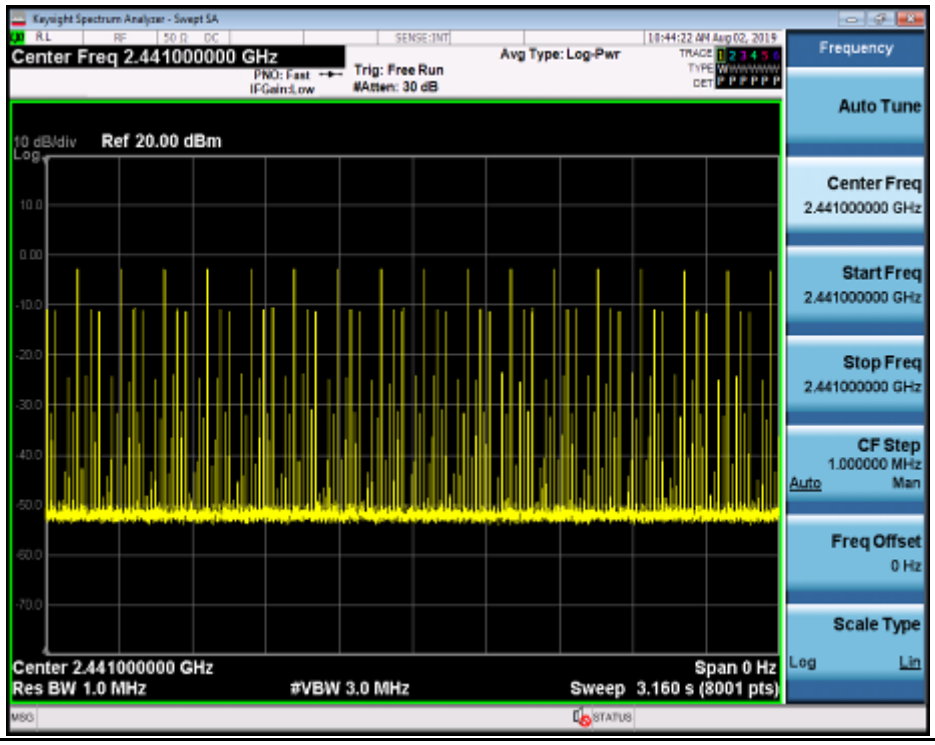
Dwell Time_DH3_2441





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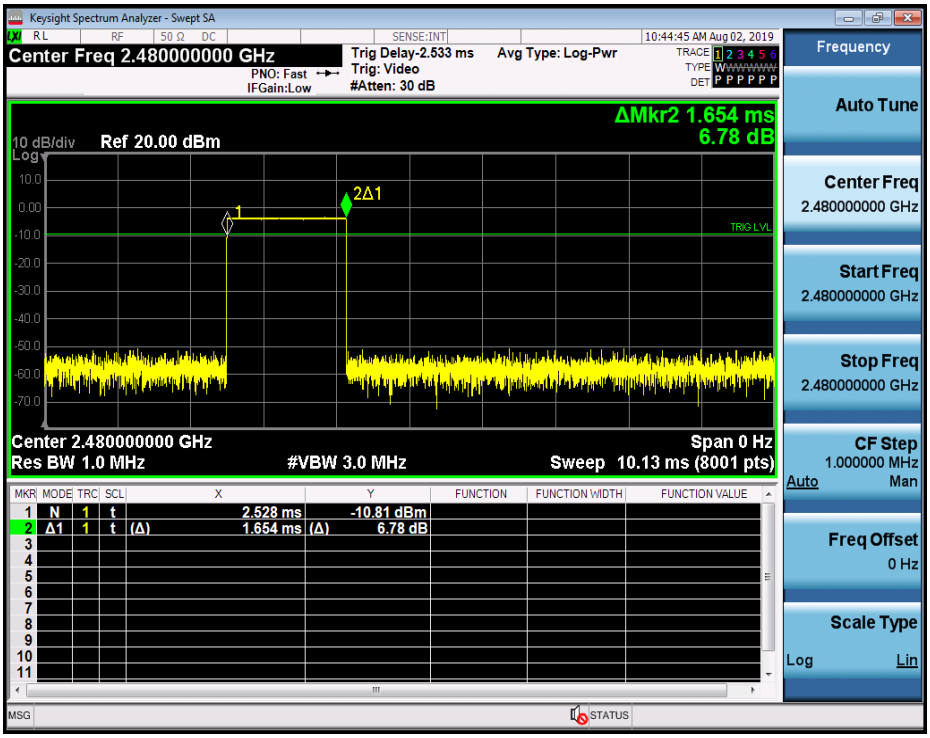

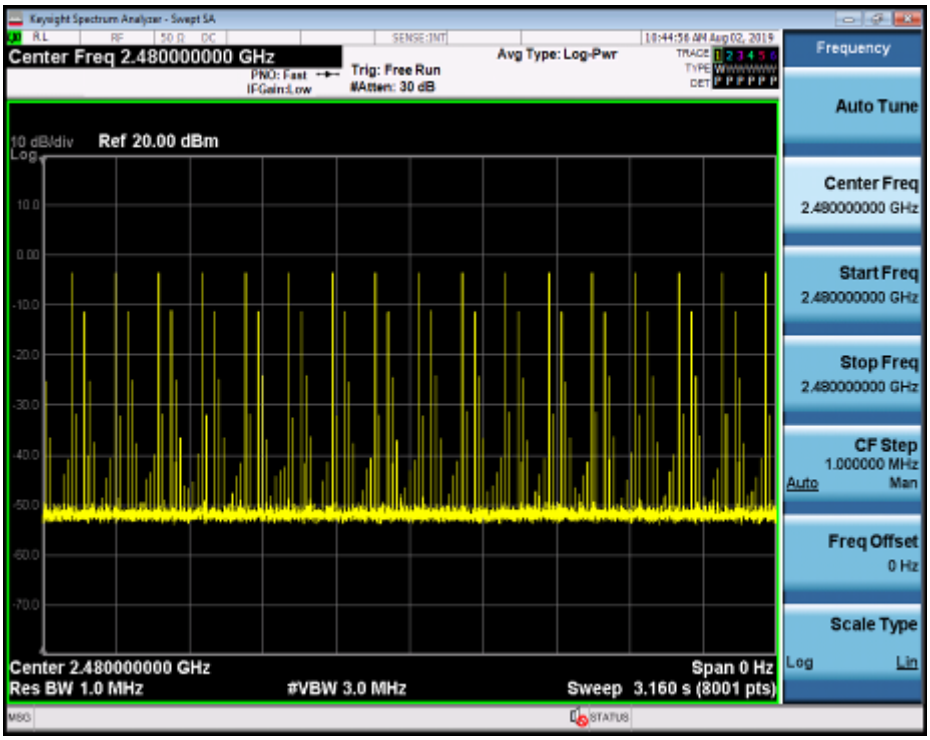

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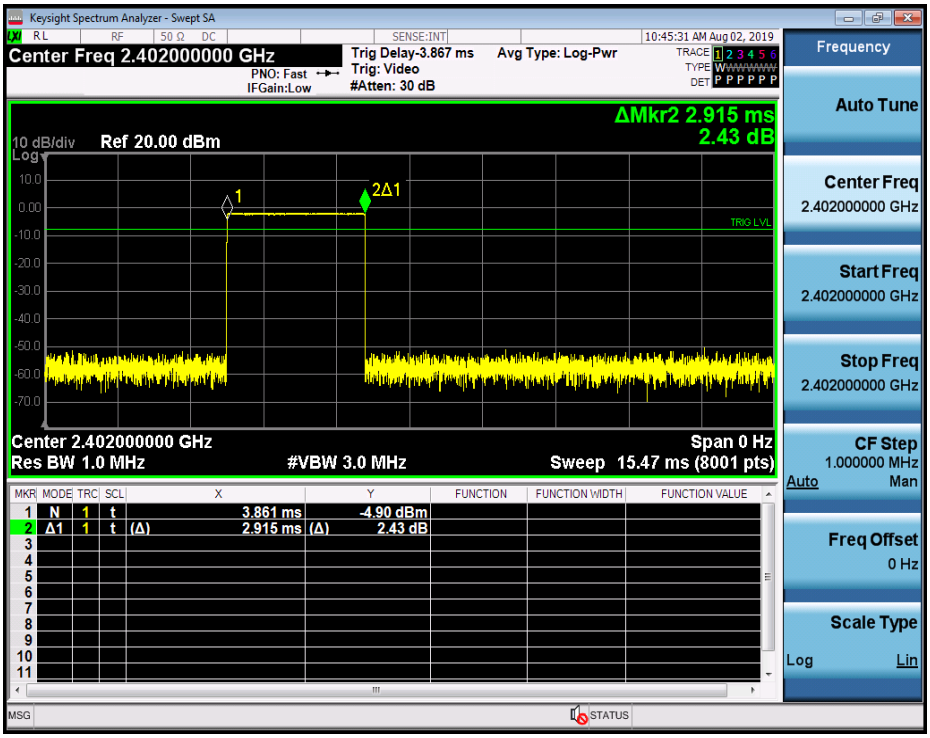
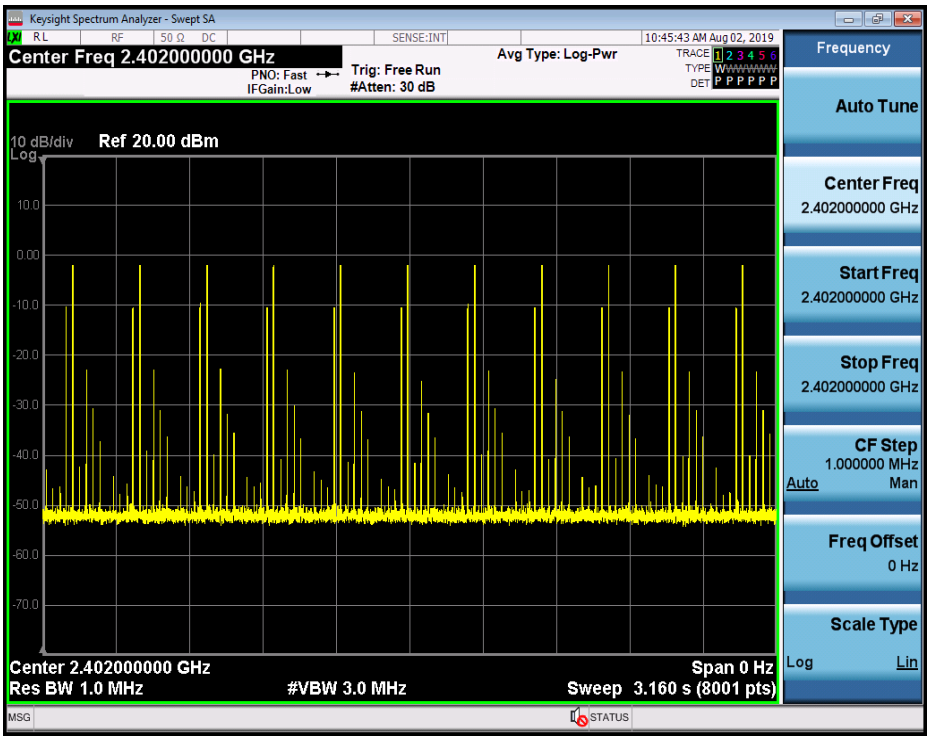
Dwell Time_DH5_2402





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