

No. 1 Workshop, M-10, Middle section, Science & Technology Park,

Shenzhen, Guangdong, China 518057

Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594 Report No.: SZEM161201139501

Email: +86 (0) 755 2671 0594 Page: 1 of 80

TEST REPORT

Application No.: SZEM1612011395CR

**Applicant:** MODERN ELECTRONICS FACTORY LTD.

Address of Applicant: FLAT C, 10/F, PHASE 4, KWUN TONG INDUSTRIAL CENTRE, 472-478 KWUN

TONG ROAD, HONG KONG

Manufacturer: MODERN ELECTRONICS FACTORY LTD.

Address of Manufacturer: FLAT C, 10/F, PHASE 4, KWUN TONG INDUSTRIAL CENTRE, 472-478 KWUN

TONG ROAD, HONG KONG

**Factory:** Keng Fu Jia Electronics (Shenzhen) Co., Ltd.

Address of Factory: Sui Wai Sun Chuen, Tai Long, Lung Wah, Shenzhen, GDGZ

**Equipment Under Test (EUT):** 

**EUT Name:** Classic Wooden Turntable with Dust Cover

Model No.: MD-909

Trade mark:

by one

FCC ID: SSMMEF909

Standards: 47 CFR Part 15, Subpart C 15.247

**Date of Receipt**: 2017-01-22

**Date of Test**: 2017-02-08 to 2017-03-02

**Date of Issue**: 2017-03-06

Test Result : Pass\*



Jack Zhang 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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<sup>\*</sup> In the configuration tested, the EUT complied with the standards specified above.



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Revision Record						
Version	Chapter	Date	Modifier	Remark		
01		2017-03-06		Original		

Authorized for issue by:		
Tested By	Peter Gene	2017-03-02
	Peter Geng /Project Engineer	Date
Checked By	Eric Fu	2017-03-06
	Eric Fu /Reviewer	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 Disturbance 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			
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			
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			
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 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 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			
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			
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			



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## 4 General Information

### 4.1 Details of E.U.T.

Power supply: adapter model: HK15-HASF0902000

INPUT: AC 100-240V, 50/60Hz

OUTPUT: DC 9.0V, 2000mA

Cable: DC line: 185cm, unshielded

Bluetooth version 2.1+EDR

Modulation type GFSK, Pi/4DQPSK Frequency range 2402-2480MHz

Number of channels 79 Channel separation 1MHz

Antenna type Integral Antenna

Antenna gain 2dBi

## 4.2 Description of Support Units

The EUT has been tested as an independent unit.



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## 4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.25 x 10-8
2	Duty cycle	0.37%
3	Occupied Bandwidth	3%
4	RF conducted power	0.75dB
5	RF power density	2.84dB
6	Conducted Spurious emissions	0.75dB
7	DE Dadiated names	4.5dB (below 1GHz)
/	RF Radiated power	4.8dB (above 1GHz)
	Dadistad Courieus amissies test	4.5dB (30MHz-1GHz)
8	Radiated Spurious emission test	4.8dB (1GHz-18GHz)
9	Temperature test	1℃
10	Humidity test	3%
11	Supply voltages	1.5%
12	Time	3%



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### 4.4 Test Location

All tests were performed at:

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

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

## 4.5 Test Facility

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

### CNAS (No. CNAS L2929)

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

### A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

#### VCC

The 10m Semi-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.: G-823, R-4188, T-1153 and C-2383 respectively.

## • FCC – Registration No.: 556682

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen 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 No.: 556682.

### Industry Canada (IC)

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

### 4.6 Deviation from Standards

None

### 4.7 Abnormalities from Standard Conditions

None



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# 5 Equipment List

Conducted Disturbance at AC Power Line(150kHz-30MHz)						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2016-05-13	2017-05-13	
LISN	Rohde & Schwarz	ENV216	SEM007-01	2016-10-09	2017-10-09	
LISN	ETS-LINDGREN	3816/2	SEM007-02	2016-04-25	2017-04-25	
8 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN- T8-02	EMC0120	2016-09-28	2017-09-28	
4 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN- T4-02	EMC0121	2016-09-28	2017-09-28	
2 Line ISN	Fischer Custom	FCC-TLISN- T2-02	EMC0122	2016-09-28	2017-09-28	

20dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
Signal Generator	Rohde & Schwarz	SML03	SEM006-02	2016-04-25	2017-04-25
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

Conducted Peak Output Power						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09	
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09	
Signal Generator	Rohde & Schwarz	SML03	SEM006-02	2016-04-25	2017-04-25	
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09	

Carrier Frequencies Separation						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09	
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09	
Signal Generator	Rohde & Schwarz	SML03	SEM006-02	2016-04-25	2017-04-25	
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09	



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Hopping Channel Number						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09	
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09	
Signal Generator	Rohde & Schwarz	SML03	SEM006-02	2016-04-25	2017-04-25	
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09	

Dwell Time									
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date				
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09				
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09				
Signal Generator	Rohde & Schwarz	SML03	SEM006-02	2016-04-25	2017-04-25				
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09				

Conducted Spurious Emissions									
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date				
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09				
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09				
Signal Generator	Rohde & Schwarz	SML03	SEM006-02	2016-04-25	2017-04-25				
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09				

Conducted Band Edges Measurement										
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date					
DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09					
Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09					
Signal Generator	Rohde & Schwarz	SML03	SEM006-02	2016-04-25	2017-04-25					
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09					



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General used equipment									
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date				
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	ZJ1-2B	SEM002-03	2016-10-12	2017-10-12				
Humidity/ Temperature Indicator			SEM002-04	2016-10-12	2017-10-12				
Humidity/ Temperature Indicator			SEM002-08	2016-10-12	2017-10-12				
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2016-05-18	2017-05-18				



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# 6 Radio Spectrum Technical Requirement

## 6.1 Antenna Requirement

### 6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247

#### 6.1.2 Conclusion

### Standard Requirment:

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 2dBi.



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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

### 6.2.2 Conclusion

### Standard Requirment:

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.

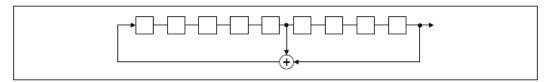
Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented 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):

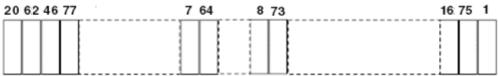
According to Technical Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive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

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

Compliance for section 15.247(g)

According to Bluetooth Core Specification, the Bluetooth 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 Bluetooth Core specification, the Bluetooth 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.

According to the Bluetooth Core specification, the Bluetooth 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.



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# 7 Radio Spectrum Matter Test Results

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

Test Requirement: 47 CFR Part 15, Subpart C 15.247
Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

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

<sup>\*</sup>Decreases with the logarithm of the frequency.



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### 7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 25.0 °C Humidity: 55 % RH Atmospheric Pressure: 1020 mbar

Exploratory Test Non-hopping transmitting mode with all kind of modulation and all kind of

Mode: data type at the lowest, middle, high channel.

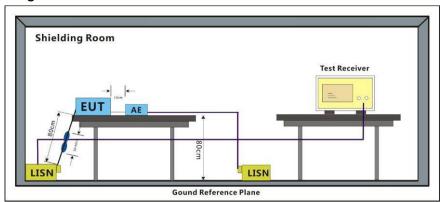
Final Test Mode: a: Tx mode

Through Pre-scan, find the DH1 of data type and GFSK modulation at the lowest

channel is the worst case.

Only the worst case is recorded in the report.

### 7.1.2 Test Setup Diagram



### 7.1.3 Measurement Data

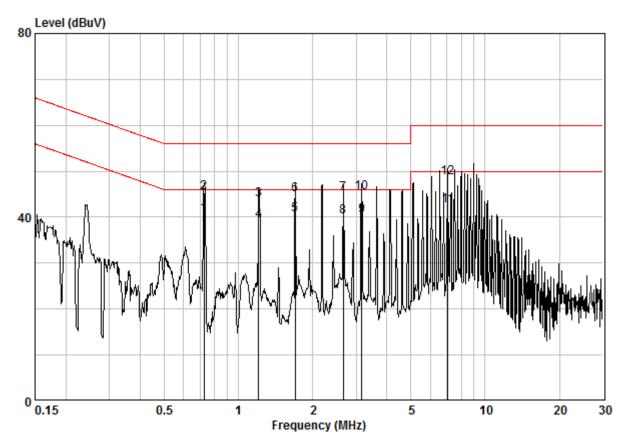
- 1) The mains terminal disturbance voltage test was conducted in a shielded
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50µH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second 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: 2013 on conducted measurement.



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Mode:a; Line:Live Line



Site : Shielding Room Condition : CE LINE Job No. : 11395CR Test Mode : a

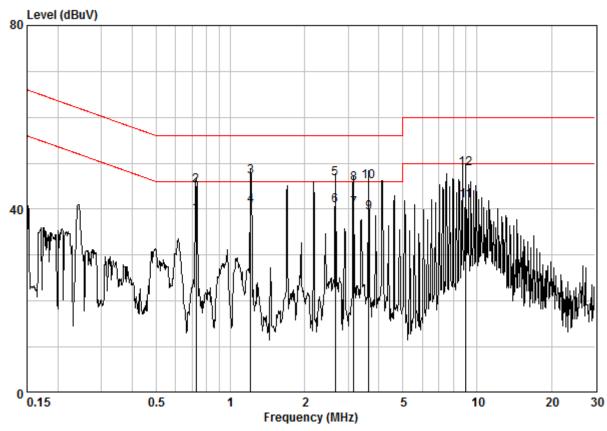
	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.72744	0.03	9.65	30.80	40.47	46.00	-5.53	Average
2	0.72744	0.03	9.65	35.68	45.36	56.00	-10.64	QP
3	1.210	0.03	9.66	34.02	43.71	56.00	-12.29	QP
4	1.210	0.03	9.66	29.57	39.26	46.00	-6.74	Average
5	1.698	0.03	9.66	30.75	40.45	46.00	-5.55	Average
6	1.698	0.03	9.66	35.16	44.85	56.00	-11.15	QP
7	2.664	0.03	9.68	35.44	45.15	56.00	-10.85	QP
8	2.664	0.03	9.68	30.47	40.18	46.00	-5.82	Average
9	3.156	0.03	9.69	30.60	40.32	46.00	-5.68	Average
10	3.156	0.03	9.69	35.72	45.44	56.00	-10.56	QP
11	7.062	0.08	9.79	32.66	42.54	50.00	-7.46	Average
12	7.062	0.08	9.79	38.73	48.60	60.00	-11.40	QP



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Mode:a; Line:Neutral Line



Site : Shielding Room Condition : CE NEUTRAL Job No. : 11395CR Test Mode : a

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.72744	0.03	9.64	29.10	38.77	46.00	-7.23	Average
2	0.72744	0.03	9.64	35.41	45.08	56.00	-10.92	QP
3	1.210	0.03	9.64	37.38	47.05	56.00	-8.95	QP
4	1.210	0.03	9.64	31.00	40.67	46.00	-5.33	Average
5	2.664	0.03	9.66	36.97	46.66	56.00	-9.34	QP
6	2.664	0.03	9.66	31.08	40.77	46.00	-5.23	Average
7	3.156	0.03	9.67	30.41	40.11	46.00	-5.89	Average
8	3.156	0.03	9.67	35.77	45.47	56.00	-10.53	QP
9	3.642	0.02	9.68	29.60	39.31	46.00	-6.69	Average
10	3.642	0.02	9.68	36.22	45.93	56.00	-10.07	QP
11	9.011	0.12	9.82	32.00	41.95	50.00	-8.05	Average
12	9.011	0.12	9.82	38.83	48.77	60.00	-11.23	QP



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### 7.2 20dB Bandwidth

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

### 7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 23.0 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

Pretest these a: Tx mode

mode to find the

worst case:

Non-hopping transmitting with all kind of modulation and all kind of data type.

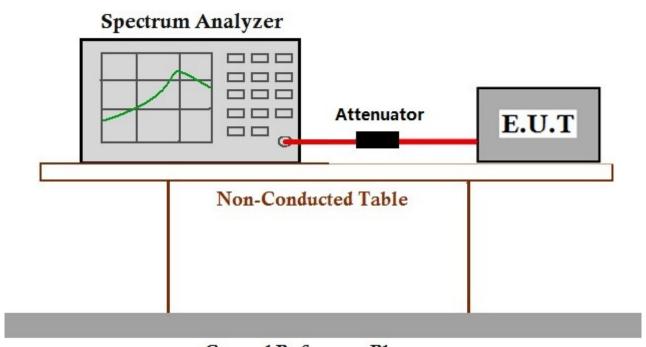
The worst case Through Pressor for final test: type, 2-DH1 or

Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation

type, 2-DH1 of data type is the worst case of  $\pi/4DQPSK$  modulation type.

Only the worst case is reported.

### 7.2.2 Test Setup Diagram



## Ground Reference Plane

### 7.2.3 Measurement Data

The detailed test data see: Appendix 15.247

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## 7.3 Conducted Peak Output Power

Test Requirement: 47 CFR Part 15, Subpart C 15.247
Test Method: ANSI C63.10 (2013) Section 7.8.5

Limit:

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



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### 7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 23.0 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

Pretest these a: Tx mode

mode to find the

worst case:

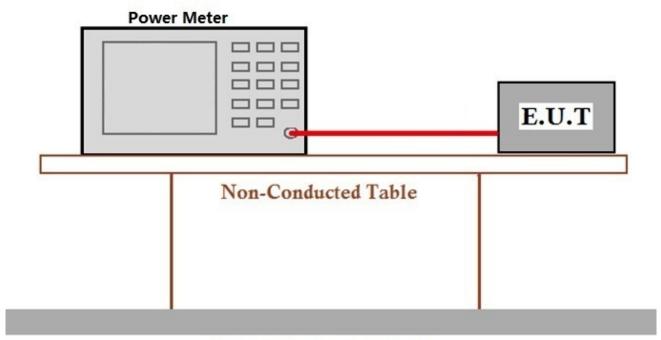
Non-hopping transmitting with all kind of modulation and all kind of data type.

The worst case Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation

for final test: type, 2-DH1 of data type is the worst case of  $\pi/4DQPSK$  modulation type.

Only the worst case is reported.

### 7.3.2 Test Setup Diagram



## Ground Reference Plane

### 7.3.3 Measurement 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 15.247
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: 23.0 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

Pretest these a:Tx mode

mode to find the

Hopping transmitting with all kind of modulation and all kind of data type.

worst case:

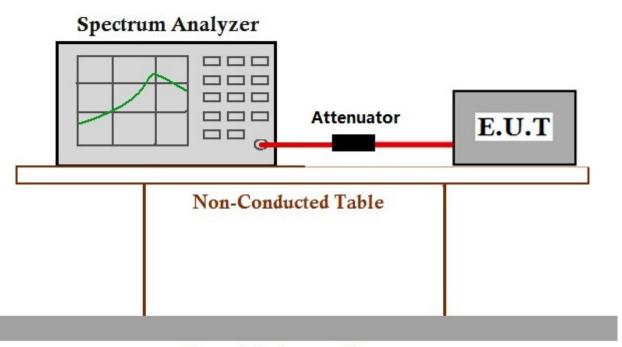
The worst case

Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation

for final test: type, 2-DH1 of data type is the worst case of  $\pi/4DQPSK$  modulation type.

Only the worst case is reported.

### 7.4.2 Test Setup Diagram



## Ground Reference Plane

### 7.4.3 Measurement 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 15.247
Test Method: ANSI C63.10 (2013) Section 7.8.3

Limit:

Frequency range(MHz)	Channel Number(minimum)		
902-928	50 for 20dB bandwidth <250kHz		
	25 for 20dB bandwidth ≥250kHz		
2400-2483.5	15		
2725-5850	75		



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## 7.5.1 E.U.T. Operation

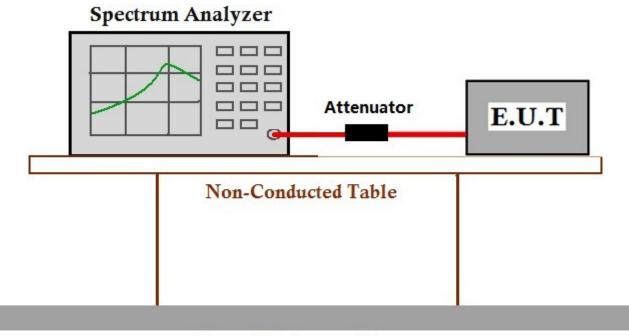
Operating Environment:

Temperature: 23.0 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

a:Tx mode

Test mode: Hopping transmitting with all kind of modulation

### 7.5.2 Test Setup Diagram



## Ground Reference Plane

### 7.5.3 Measurement 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 15.247
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		
5725-5850	0.4S within a 30S period		



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### 7.6.1 E.U.T. Operation

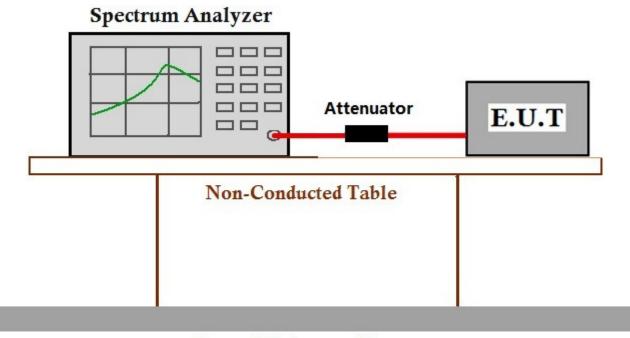
Operating Environment:

Temperature: 23.0 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

a:Tx mode

Test mode: Hopping transmitting with all kind of modulation and all kind of data type.

### 7.6.2 Test Setup Diagram



## Ground Reference Plane

### 7.6.3 Measurement Data

The detailed test data see: Appendix 15.247



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## 7.7 Conducted Spurious Emissions

Test Requirement: 47 CFR Part 15, Subpart C 15.247
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 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.

## 7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 23.0 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

Exploratory Test a:Tx mode

Mode: Hopping and Non-hopping transmitting with all kind of modulation and all kind of data

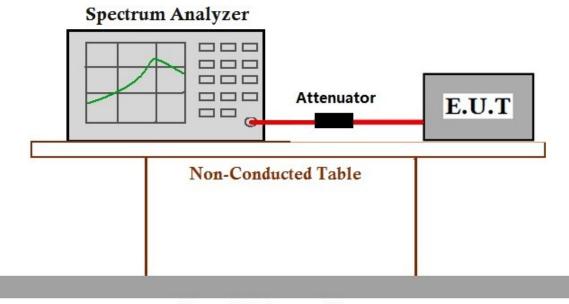
type.

Final Test Mode: Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation

type, 2-DH1 of data type is the worst case of  $\pi/4DQPSK$  modulation type.

Only the worst case is reported.

### 7.7.2 Test Setup Diagram



### Ground Reference Plane

### 7.7.3 Measurement Data

The detailed test data see: Appendix 15.247

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## 7.8 Radiated Spurious Emissions

Test Requirement: 47 CFR Part 15, Subpart C 15.247
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.



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## 7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 25.0 °C Humidity: 50 % RH Atmospheric Pressure: 1020 mbar

Pretest these a:Tx mode

mode to find the Non-hopping transmitting mode with all kind of modulation and all kind of

worst case: data type

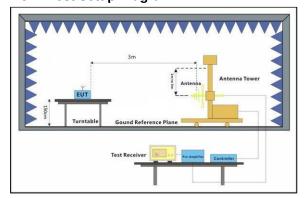
The worst case Through Pre-scan, find the DH1 of data type and GFSK modulation is the worst

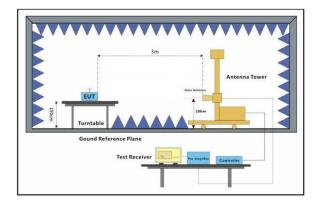
for final test: case.

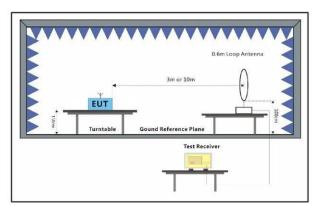
For below 1GHz part, through pre-scan, the worst case is the lowest channel.

Only the worst case is recorded in the report.

### 7.8.2 Test Setup Diagram









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#### 7.8.3 Measurement 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 and 10 meter semi-anechoic camber. 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 semi-anechoic camber. 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 (2402MHz),the middle channel (2441MHz),the Highest channel (2480MHz)
- 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.



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Mode:a; Polarization:Horizontal; Modulation Type:GFSK; ; Channel:Low

Frequency (MHz)	Antenna factors (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading Level (dB V)	Level (dB V/m)	Limit (dB V/m)	Over limit (dB)
3808.951	33.09	7.74	37.98	45.65	48.50	74.00	-25.50
4804.000	34.16	8.87	38.40	43.57	48.20	74.00	-25.80
6060.637	34.75	10.48	38.24	43.15	50.14	74.00	-23.86
7206.000	36.42	10.68	37.11	41.21	51.20	74.00	-22.80
9608.000	37.52	12.50	35.10	37.77	52.69	74.00	-21.31
12015.620	38.61	14.55	35.64	35.96	53.48	74.00	-20.52

Mode:a; Polarization: Vertical; Modulation Type: GFSK; ; Channel: Low

Frequency (MHz)	Antenna factors (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading Level (dB V)	Level (dB V/m)	Limit (dB V/m)	Over limit (dB)
3721.784	32.84	7.71	37.97	45.03	47.61	74.00	-26.39
4804.000	34.16	8.87	38.40	42.26	46.89	74.00	-27.11
5947.702	34.67	10.42	38.31	45.10	51.88	74.00	-22.12
7206.000	36.42	10.68	37.11	41.51	51.50	74.00	-22.50
9608.000	37.52	12.50	35.10	38.01	52.93	74.00	-21.07
12279.260	38.77	14.33	36.27	36.91	53.74	74.00	-20.26



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Mode:a; Polarization:Horizontal; Modulation Type:GFSK; ; Channel:middle

Frequency (MHz)	Antenna factors (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading Level (dB V)	Level (dB V/m)	Limit (dB V/m)	Over limit (dB)
3847.726	33.19	7.76	37.98	44.10	47.07	74.00	-26.93
4882.000	34.30	8.98	38.44	42.67	47.51	74.00	-26.49
6113.481	34.79	10.41	38.19	44.91	51.92	74.00	-22.08
7323.000	36.37	10.72	37.01	41.40	51.48	74.00	-22.52
9764.000	37.55	12.58	35.02	36.91	52.02	74.00	-21.98
12155.510	38.69	14.43	35.97	36.15	53.30	74.00	-20.70

Mode:a; Polarization: Vertical; Modulation Type: GFSK; ; Channel: middle

Frequency (MHz)	Antenna factors (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading Level (dB V)	Level (dB V/m)	Limit (dB V/m)	Over limit (dB)
3847.726	33.19	7.76	37.98	45.05	48.02	74.00	-25.98
4882.000	34.30	8.98	38.44	43.03	47.87	74.00	-26.13
6078.201	34.76	10.46	38.22	45.36	52.36	74.00	-21.64
7323.000	36.37	10.72	37.01	41.17	51.25	74.00	-22.75
9764.000	37.55	12.58	35.02	37.77	52.88	74.00	-21.12
12279.260	38.77	14.33	36.27	36.91	53.74	74.00	-20.26



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Mode:a; Polarization:Horizontal; Modulation Type:GFSK; ; Channel:High

Frequency (MHz)	Antenna factors (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading Level (dB V)	Level (dB V/m)	Limit (dB V/m)	Over limit (dB)
3579.190	32.43	7.66	37.96	44.40	46.53	74.00	-27.47
4960.000	34.43	9.09	38.48	44.23	49.27	74.00	-24.73
6087.002	34.77	10.45	38.21	43.00	50.01	74.00	-23.99
7440.000	36.32	10.77	36.90	40.82	51.01	74.00	-22.99
9920.000	37.58	12.67	34.94	36.26	51.57	74.00	-22.43
12155.510	38.69	14.43	35.97	36.15	53.30	74.00	-20.70

Mode:a; Polarization:Vertical; Modulation Type:GFSK; ; Channel:High

Frequency (MHz)	Antenna factors (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Reading Level (dB V)	Level (dB V/m)	Limit (dB V/m)	Over limit (dB)
3700.306	32.78	7.71	37.97	43.87	46.39	74.00	-27.61
4960.000	34.43	9.09	38.48	42.59	47.63	74.00	-26.37
6087.002	34.77	10.45	38.21	44.58	51.59	74.00	-22.41
7440.000	36.32	10.77	36.90	40.70	50.89	74.00	-23.11
9920.000	37.58	12.67	34.94	36.80	52.11	74.00	-21.89
11929.010	38.53	14.48	35.59	36.25	53.67	74.00	-20.33



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### 7.9 Radiated Emissions which fall in the restricted bands

Test Requirement: 47 CFR Part 15, Subpart C 15.247
Test Method: ANSI C63.10 (2013) Section 6.10.5

Measurement Distance: 3m

## 7.9.1 E.U.T. Operation

Operating Environment:

Temperature: 23.0 °C Humidity: 54 % RH Atmospheric Pressure: 1020 mbar

Exploratory Test a:Tx mode

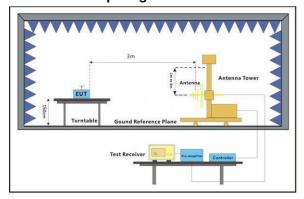
Mode: Non-hopping transmitting mode with all kind of modulation and all kind of data type

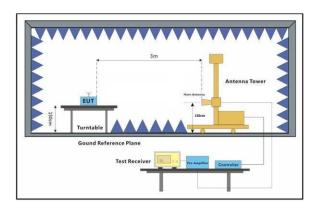
Final Test Mode: Through Pre-scan, find the DH5 of data type and GFSK modulation is the worst

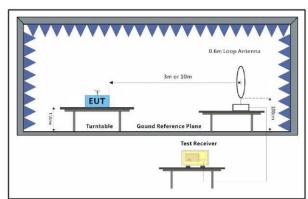
case.

Only the worst case is recorded in the report.

### 7.9.2 Test Setup Diagram









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#### 7.9.3 Measurement 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 and 10 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

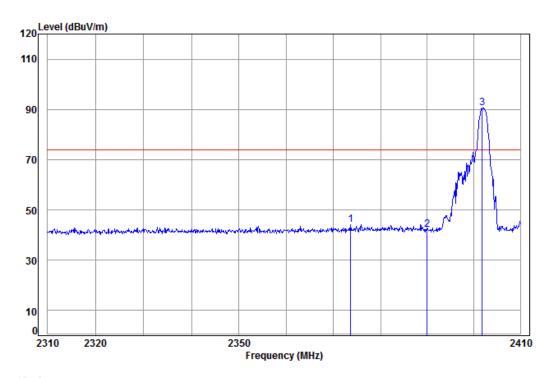
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, 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 (2402MHz),the middle channel (2441MHz),the Highest channel (2480MHz)
- 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.



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Mode:a; Polarization:Horizontal; Modulation Type:GFSK; ; Channel:Low



Condition: 3m HORIZONTAL

Job No: : 11395CR

Mode: : 2402 Band edge

: BT

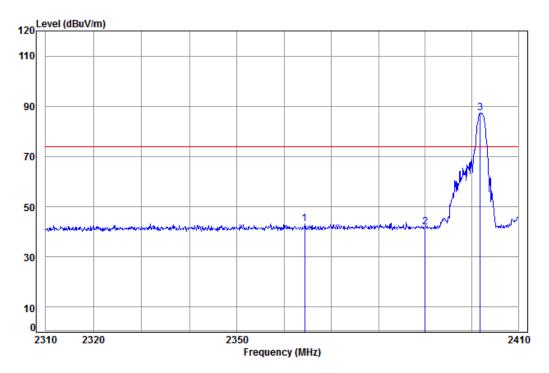
		Freq			Preamp Factor					Remark
	-	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1		2373.611	5.32	29.03	37.96	47.82	44.21	74.00	-29.79	
2		2390.000	5.34	29.08	37.96	45.88	42.34	74.00	-31.66	
3	pp	2401.843	5.35	29.11	37.96	94.20	90.70	74.00	16.70	



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Mode:a; Polarization: Vertical; Modulation Type: GFSK; ; Channel: Low



Condition: 3m VERTICAL Job No: : 11395CR

Mode: : 2402 Band edge

: BT

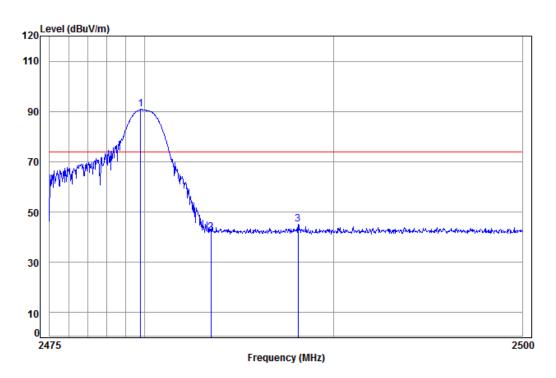
	Freq			Preamp Factor					Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2364.275	5.32	29.00	37.96	46.91	43.27	74.00	-30.73	
2	2390.000	5.34	29.08	37.96	45.53	41.99	74.00	-32.01	
3 рр	2401.843	5.35	29.11	37.96	90.81	87.31	74.00	13.31	



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Mode:a; Polarization:Horizontal; Modulation Type:GFSK; ; Channel:High



Condition: 3m HORIZONTAL

Job No: : 11395CR

Mode: : 2480 Band edge

: BT

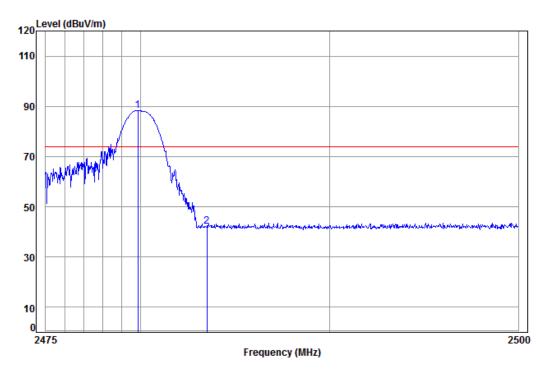
Freq			Preamp Factor					Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 pp 2479.805	5.41	29.34	37.95	93.96	90.76	74.00	16.76	
2 2483.500	5.41	29.35	37.95	44.98	41.79	74.00	-32.21	
3 2488.119	5.41	29.37	37.95	48.14	44.97	74.00	-29.03	



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Mode:a; Polarization: Vertical; Modulation Type: GFSK; ; Channel: High



Condition: 3m VERTICAL Job No: : 11395CR

Mode: : 2480 Band edge

: BT

Freq			Preamp Factor					Remark	
 MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB		_
 479.855 483.500									



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#### 7.10 Conducted Band Edges Measurement

Test Requirement: 47 CFR Part 15, Subpart C 15.247
Test Method: ANSI C63.10 (2013) Section 7.8.6

#### 7.10.1 E.U.T. Operation

Operating Environment:

Temperature: 23.0 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

Exploratory Test a:Tx mode

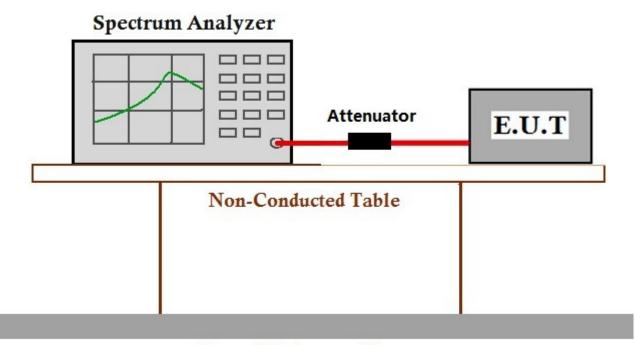
Mode: Non-hopping transmitting with all kind of modulation and all kind of data type

Final Test Mode: Through Pre-scan, find the DH1 of data type is the worst case of GFSK modulation

type, 2-DH1 of data type is the worst case of  $\pi/4DQPSK$  modulation type.

Only the worst case is reported.

#### 7.10.2Test Setup Diagram



#### Ground Reference Plane

#### 7.10.3 Measurement Data

The detailed test data see: Appendix 15.247



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#### 8 Photographs

#### 8.1 Conducted Disturbance at AC Power Line(150kHz-30MHz) Test Setup



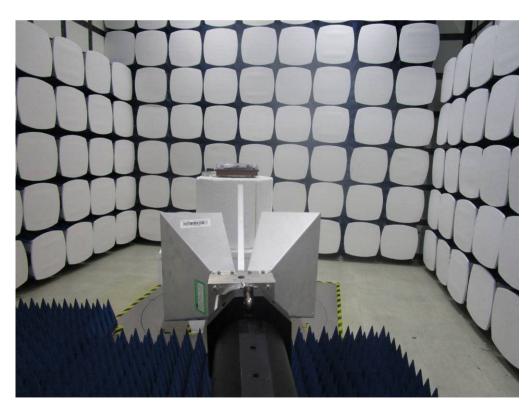


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#### 8.2 Radiated Spurious Emissions Test Setup







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#### 8.3 EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM1612011395CR.



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#### 9 Appendix

#### 9.1 Appendix 15.247

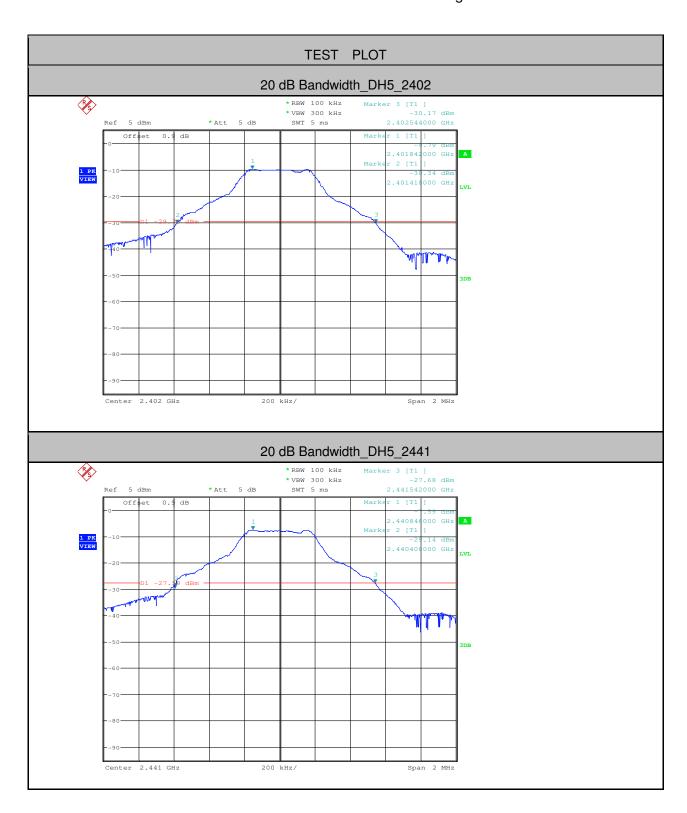
#### 1.20 dB Bandwidth

1.20 ab banav				
Test Mode	Test Channel	EBW[MHz]	Limit	Verdict
DH5	2402	1.126		PASS
DH5	2441	1.134		PASS
DH5	2480	1.122		PASS
2DH5	2402	1.380		PASS
2DH5	2441	1.378		PASS
2DH5	2480	1.378		PASS



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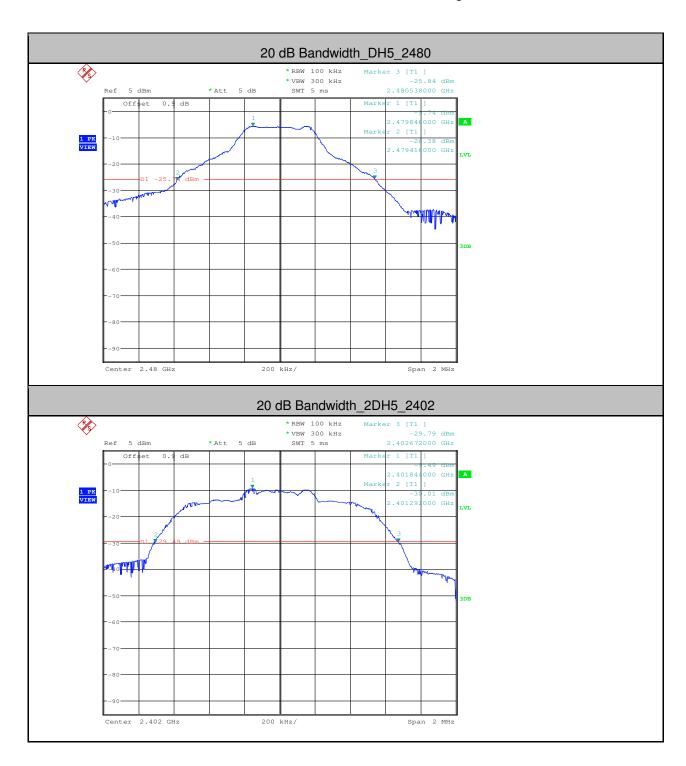
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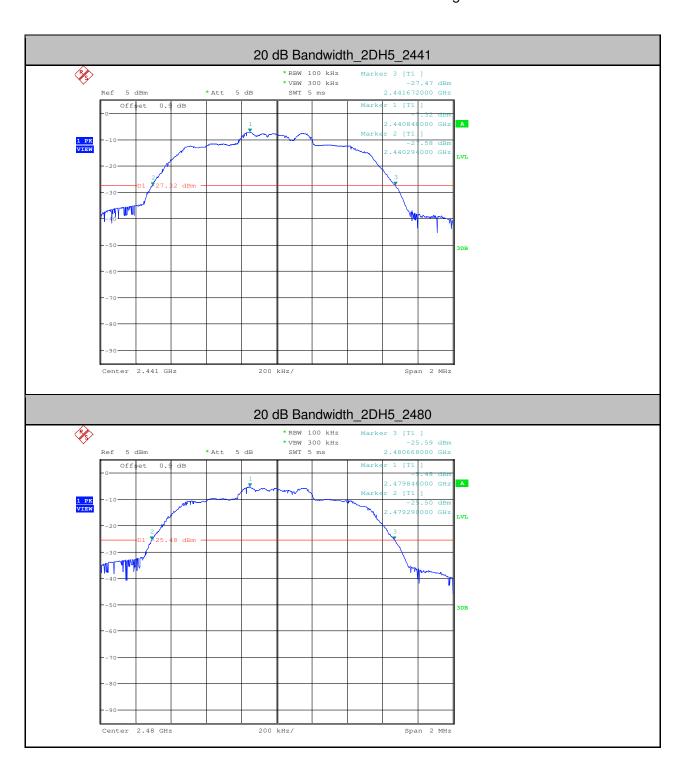
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2.Occupied Bandwidth

Test Mode	Test Channel	OBW[MHz]	EBW[MHz]	Verdict
DH5	2402	0.962		PASS
DH5	2441	0.972		PASS
DH5	2480	0.964		PASS
2DH5	2402	1.210		PASS
2DH5	2441	1.210		PASS
2DH5	2480	1.210		PASS



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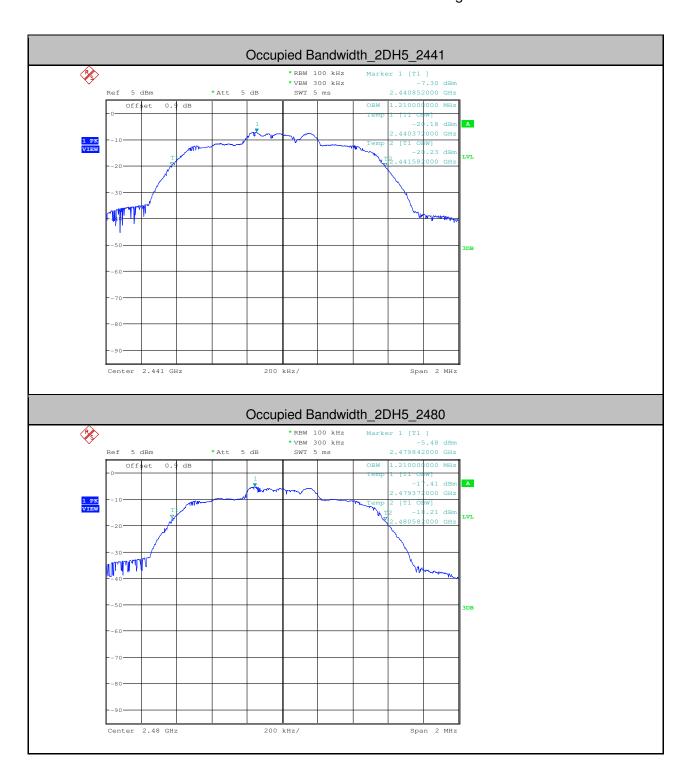
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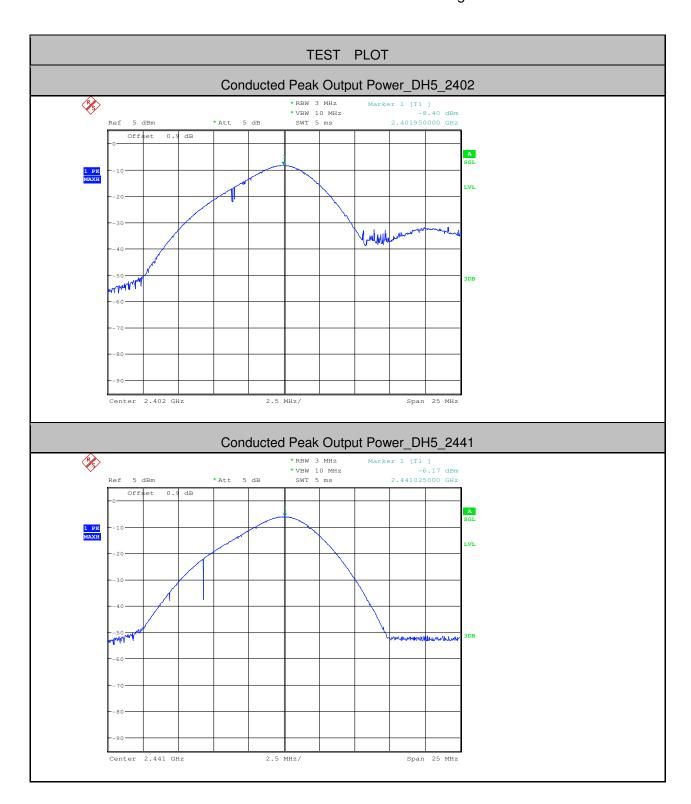
3.Conducted Peak Output Power

Test Mode	Test Channel	Power[dBm]	Limit[dBm]	Verdict
DH5	2402	-8.40	<20.97dBm(125mW)	PASS
DH5	2441	-6.17	<20.97dBm(125mW)	PASS
DH5	2480	-4.32	<20.97dBm(125mW)	PASS
2DH5	2402	-7.95	<20.97dBm(125mW)	PASS
2DH5	2441	-5.77	<20.97dBm(125mW)	PASS
2DH5	2480	-3.95	<20.97dBm(125mW)	PASS



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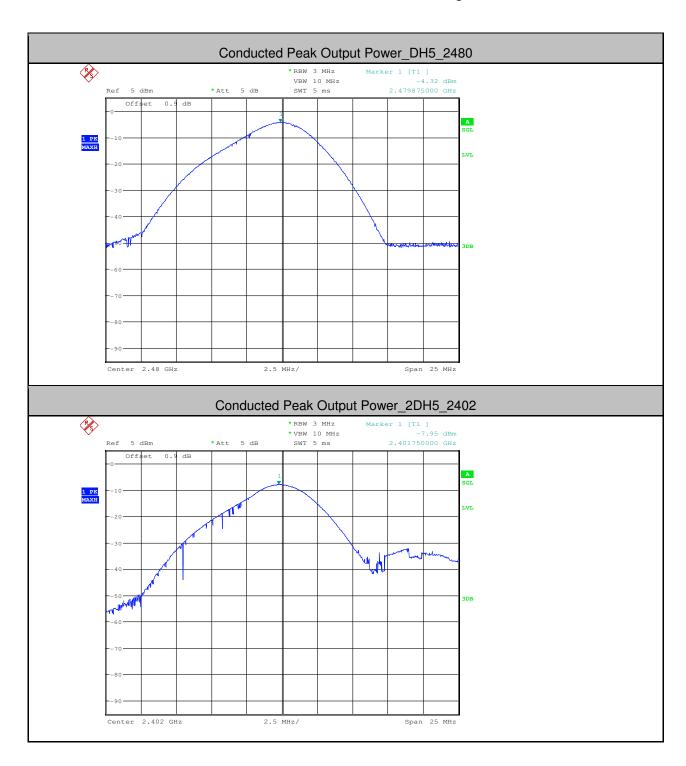
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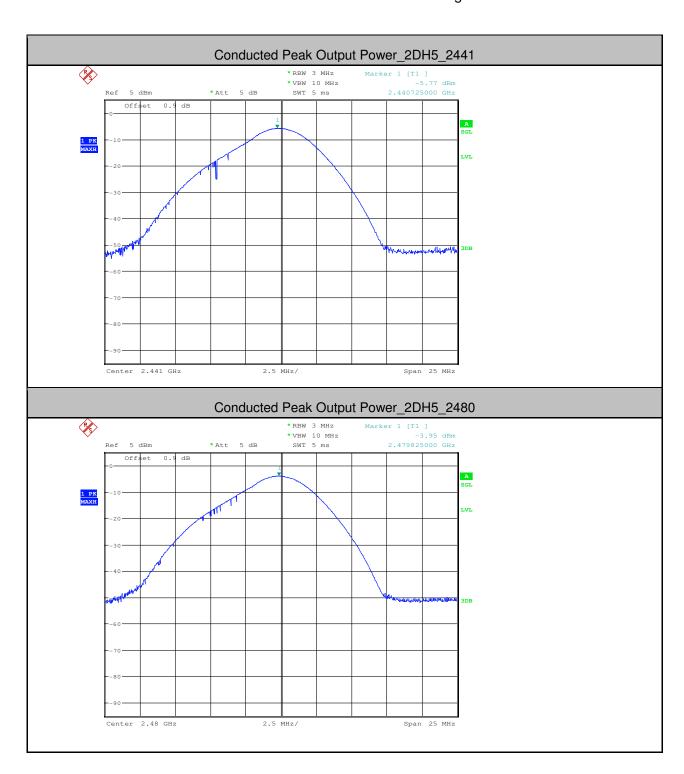
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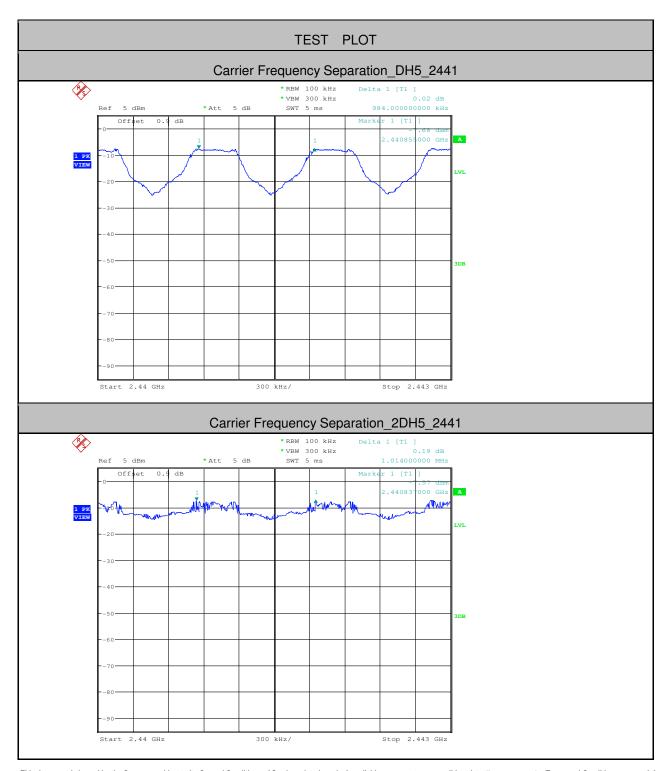


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4. Carrier Frequency Separation

Test Mode	Test Channel	Result[MHz]	Verdict
DH5	2441	0.984	PASS
2DH5	2441	1.014	PASS



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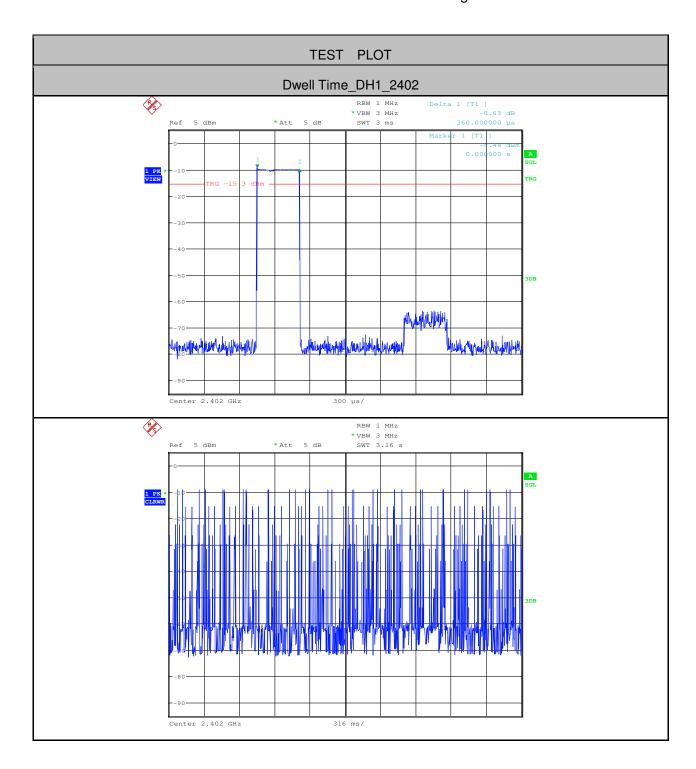
#### 5.Dwell Time

Test Mode	Test Channel	Burst Width[ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[ms]	Limit[ms]	Verdict
DH1	2402	0.36	320	0.115	<0.4	PASS
DH3	2402	1.62	140	0.227	<0.4	PASS
DH5	2402	2.86	50	0.143	<0.4	PASS
2DH1	2402	0.37	310	0.115	<0.4	PASS
2DH3	2402	1.63	190	0.310	<0.4	PASS
2DH5	2402	2.87	50	0.144	<0.4	PASS



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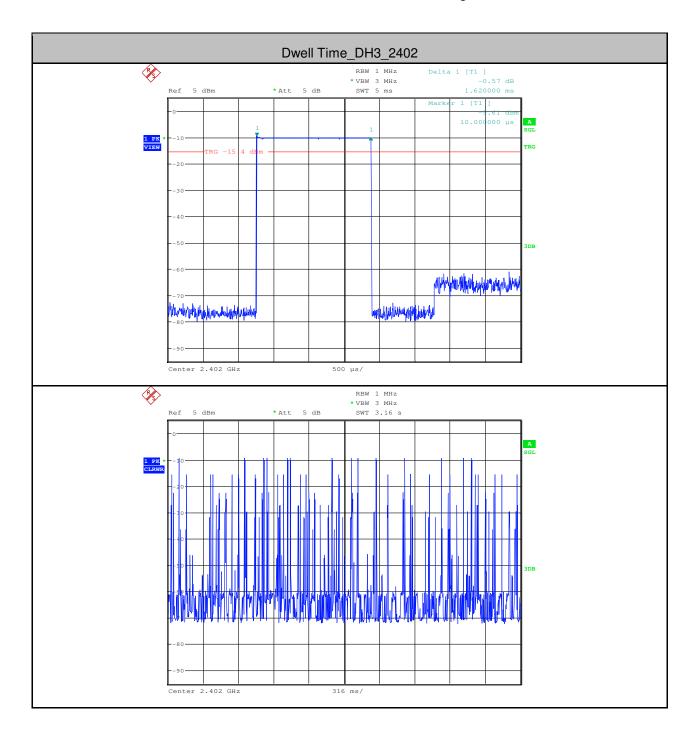
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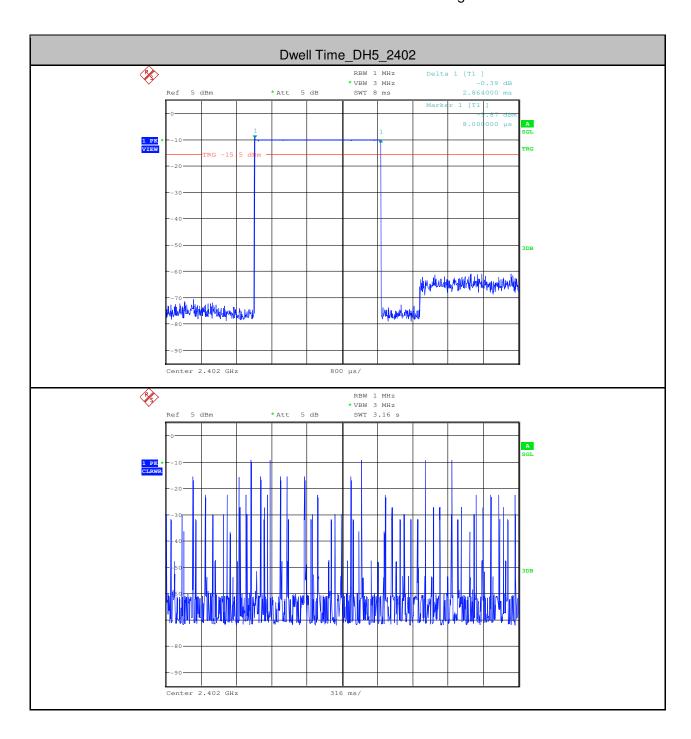
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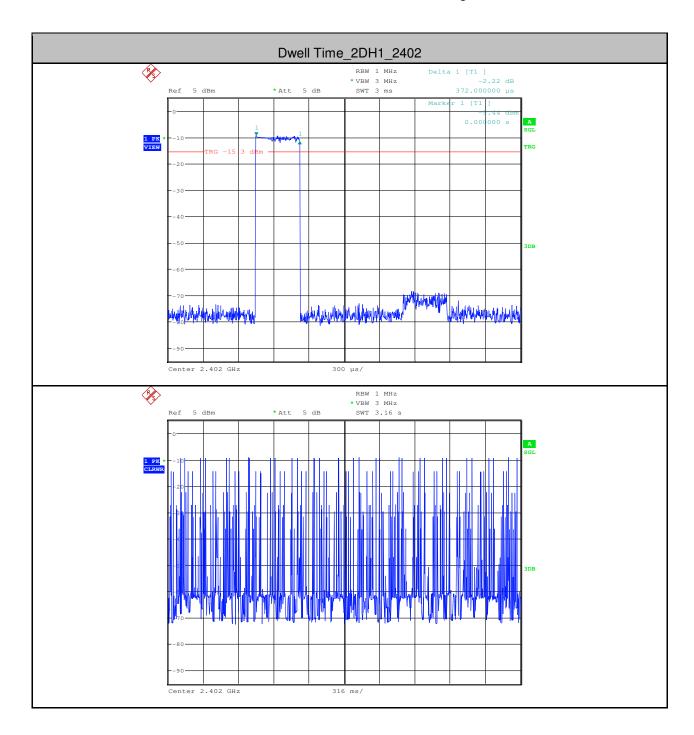
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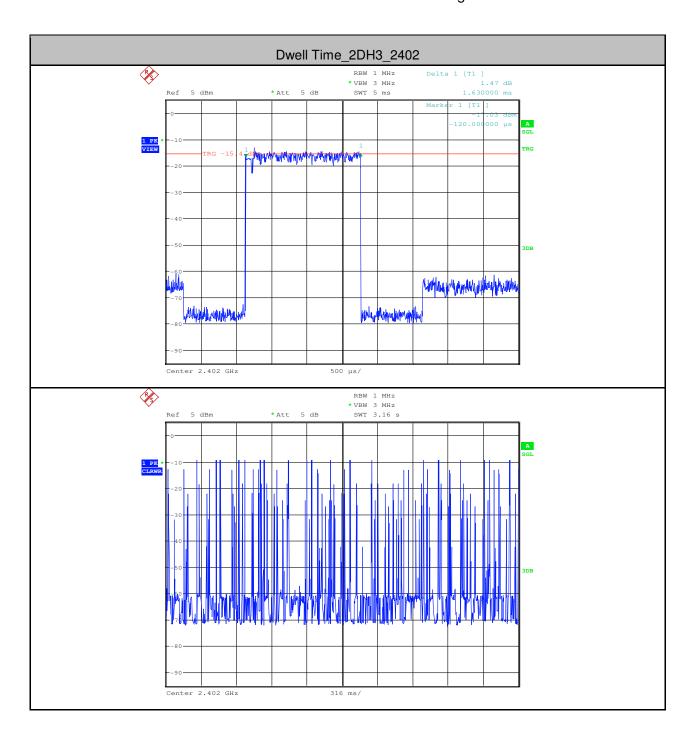
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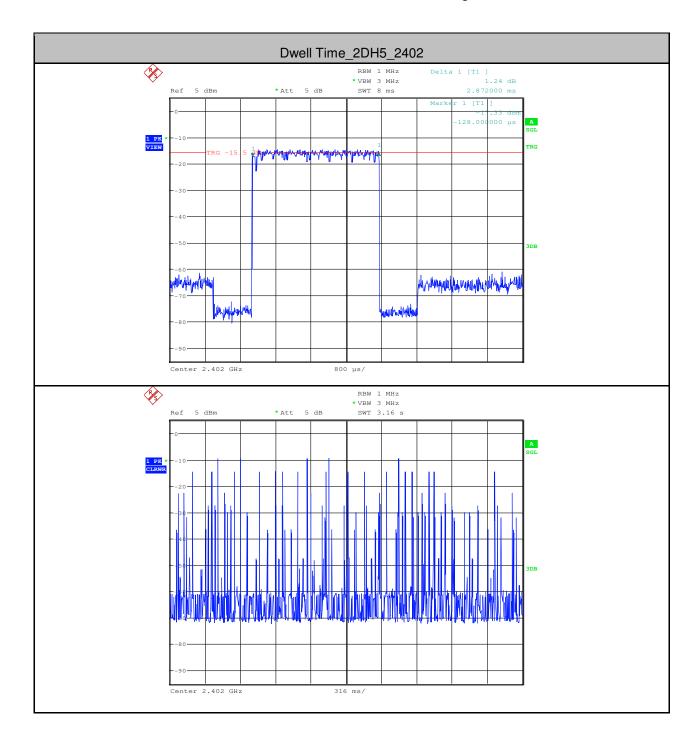
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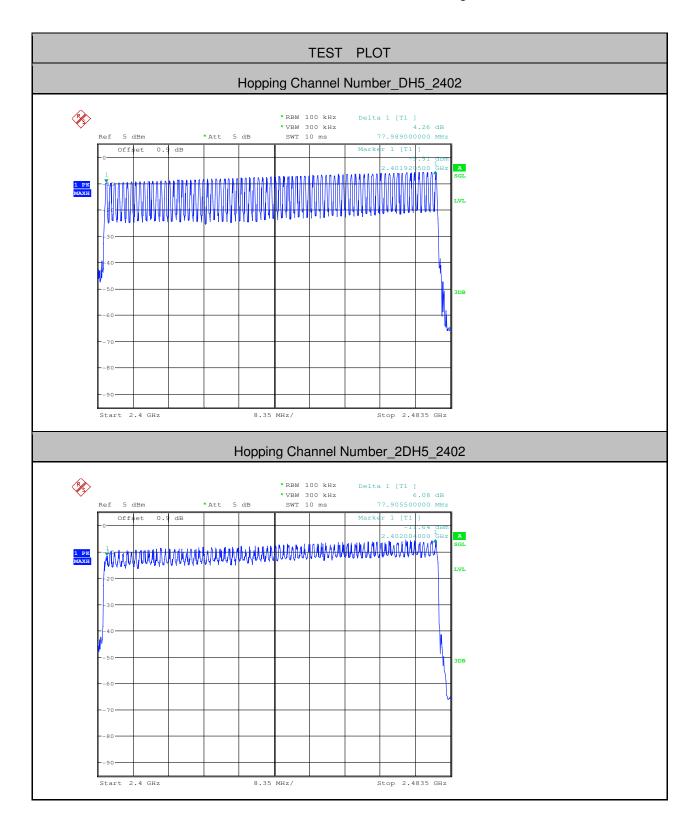
**6.Hopping Channel Number** 

Test Mode	Test Channel	Number of Hopping Channel[N]	Limit[N]	Verdict
DH5	2402	79	>=15	PASS
2DH5	2402	79	>=15	PASS



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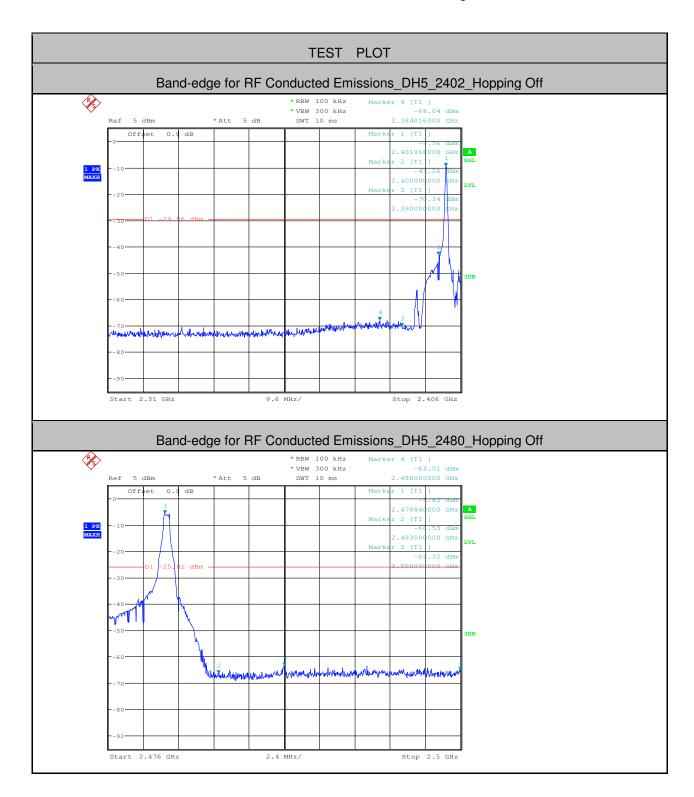
7.Band-edge for RF Conducted Emissions

Test Mode	Test Channel	Hopping	Carrier Power[dBm]	Max. Spurious Level [dBm]	Limit[dBm]	Verdict
DH5	2402	Off	-9.560	-68.044	<-29.56	PASS
DH5	2480	Off	-5.820	-63.514	<-25.82	PASS
2DH5	2402	Off	-9.520	-68.373	<-29.52	PASS
2DH5	2480	Off	-5.510	-63.967	<-25.51	PASS
DH5	2402	On	-9.410	-66.899	<-29.41	PASS
DH5	2480	On	-5.870	-62.504	<-25.87	PASS
2DH5	2402	On	-10.110	-67.577	<-30.11	PASS
2DH5	2480	On	-5.720	-63.377	<-25.72	PASS



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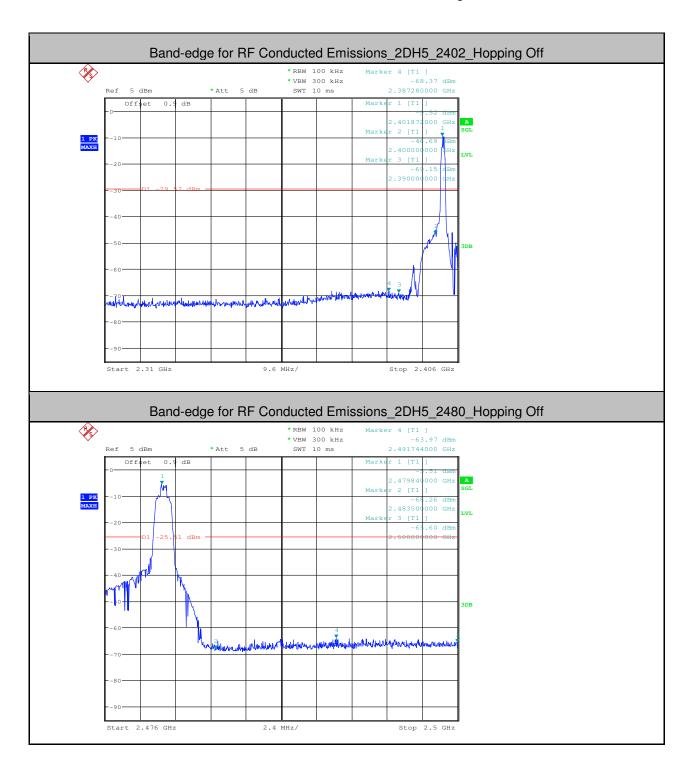
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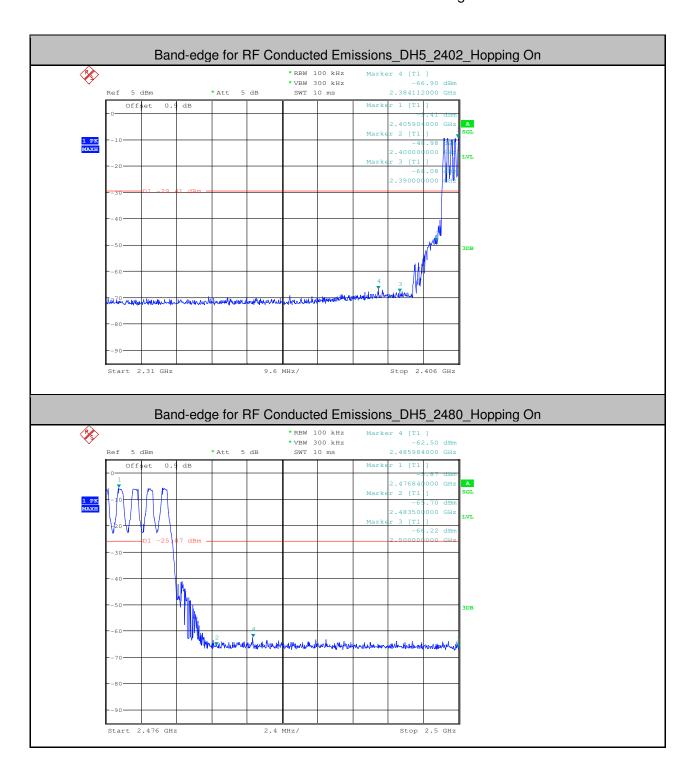
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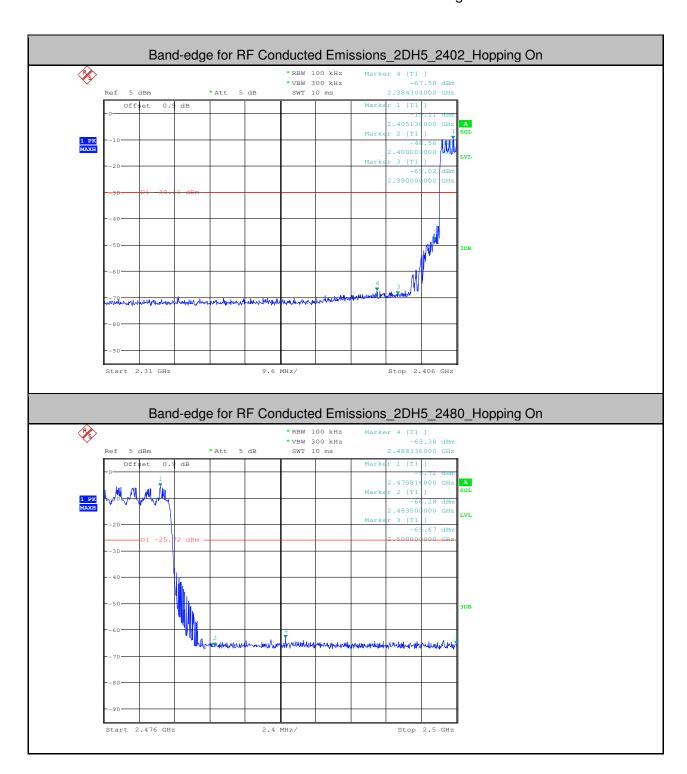
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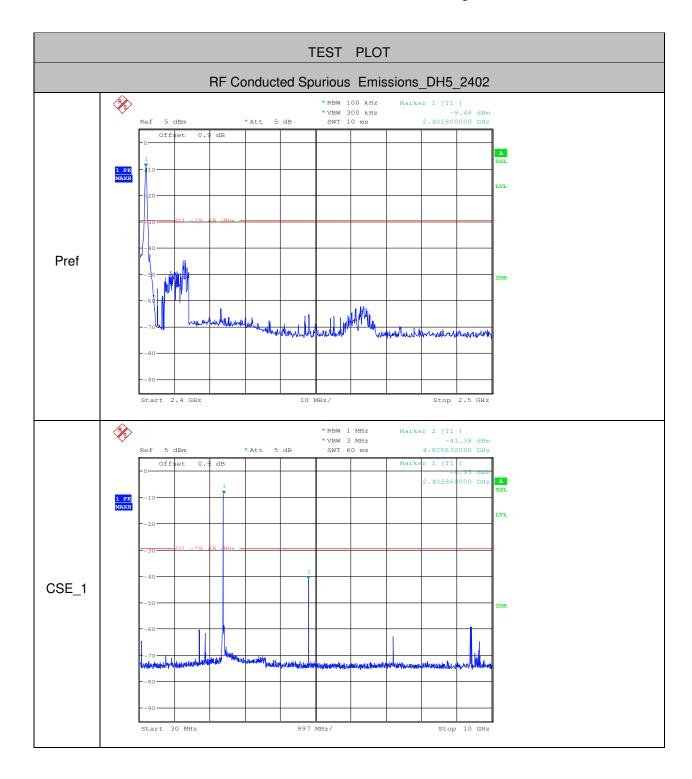
8.RF Conducted Spurious Emissions

0.111 0011	ducted Spurio	us Lilliss	10113						
Test Mode	Test Channel	StartFre [MHz]	StopFre [MHz]	RBW [kHz]	VBW [kHz]	Pref[dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
DH5	2402	30	10000	1000	3000	-9.48	-41.380	<-29.48	PASS
DH5	2402	10000	25000	1000	3000	-9.48	-66.000	<-29.48	PASS
DH5	2441	30	10000	1000	3000	-7.36	-41.390	<-27.36	PASS
DH5	2441	10000	25000	1000	3000	-7.36	-63.860	<-27.36	PASS
DH5	2480	30	10000	1000	3000	-5.55	-41.660	<-25.55	PASS
DH5	2480	10000	25000	1000	3000	-5.55	-63.220	<-25.55	PASS
2DH5	2402	30	10000	1000	3000	-9.53	-40.670	<-29.53	PASS
2DH5	2402	10000	25000	1000	3000	-9.53	-65.870	<-29.53	PASS
2DH5	2441	30	10000	1000	3000	-7.4	-40.870	<-27.4	PASS
2DH5	2441	10000	25000	1000	3000	-7.4	-64.030	<-27.4	PASS
2DH5	2480	30	10000	1000	3000	-5.67	-41.310	<-25.67	PASS
2DH5	2480	10000	25000	1000	3000	-5.67	-63.350	<-25.67	PASS



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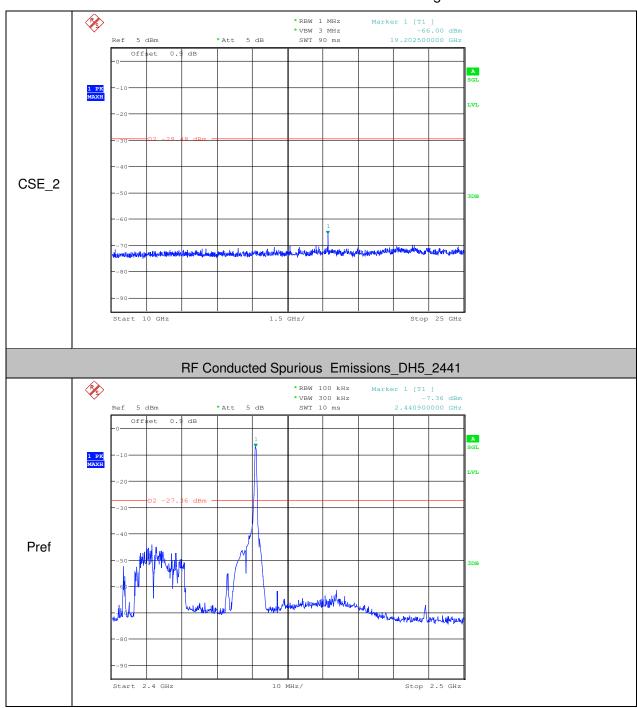
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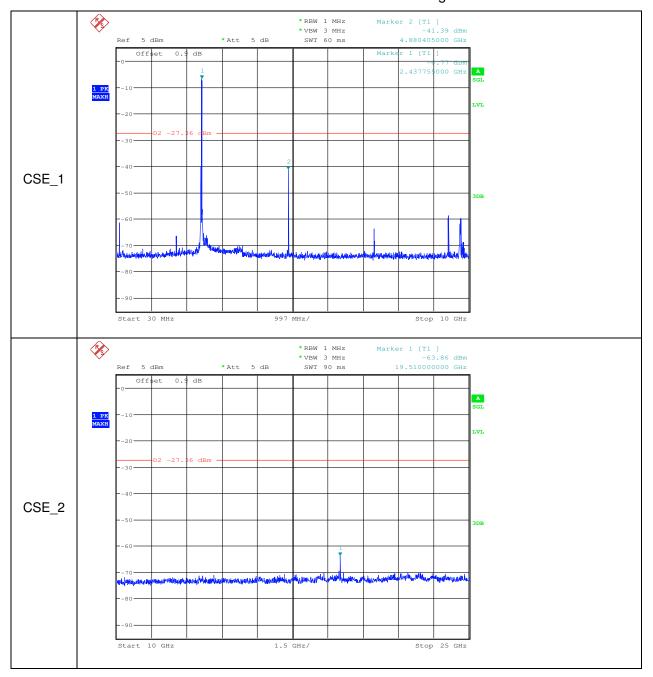
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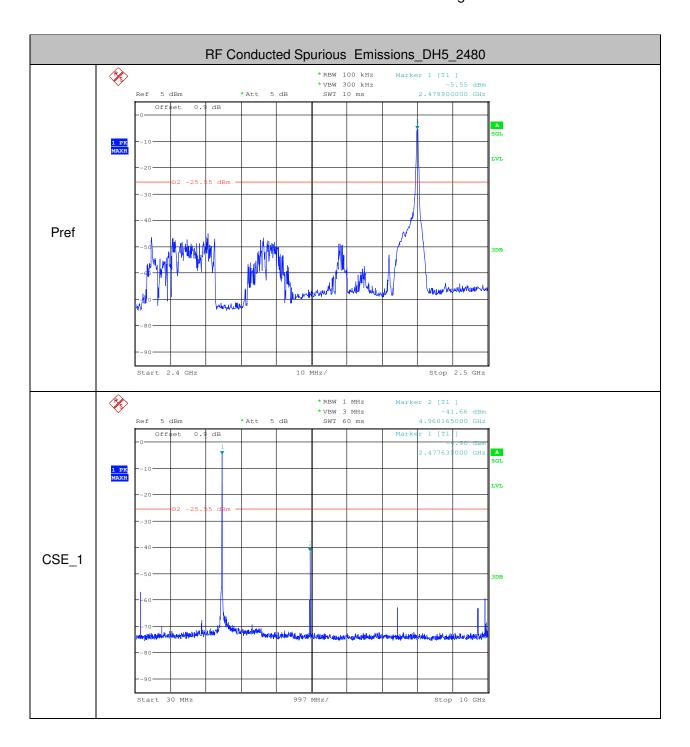
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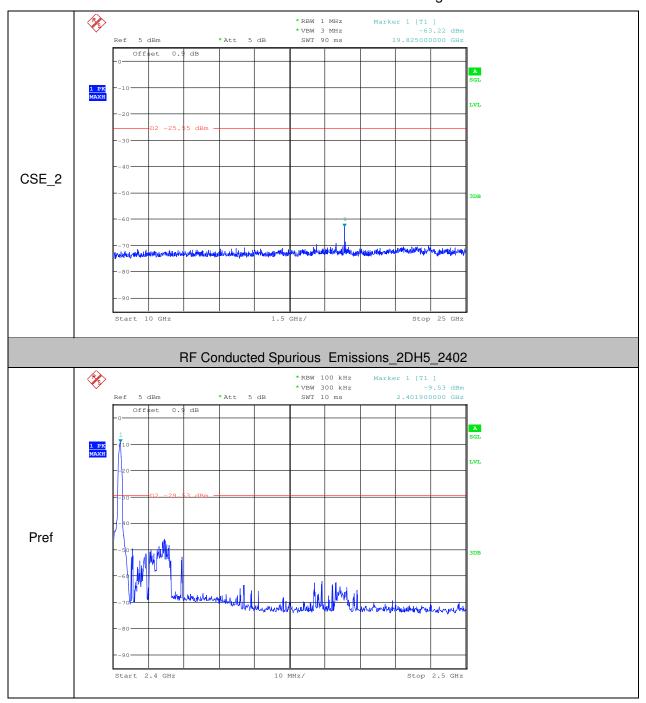
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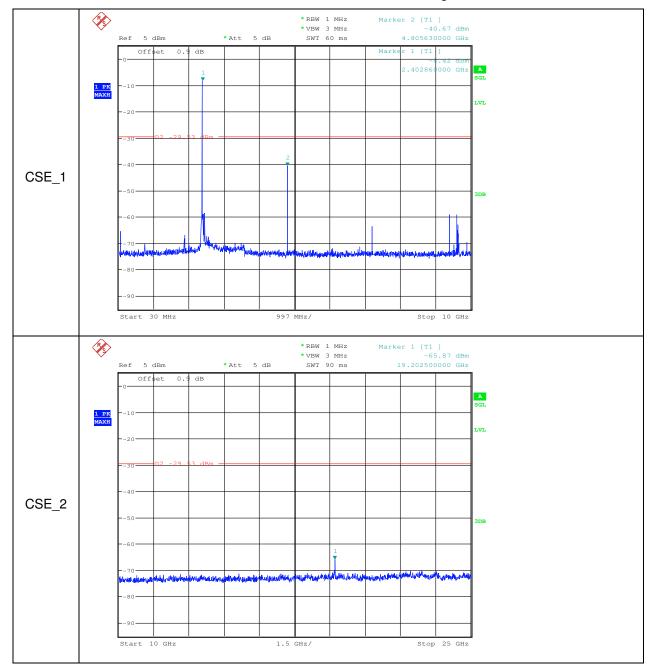
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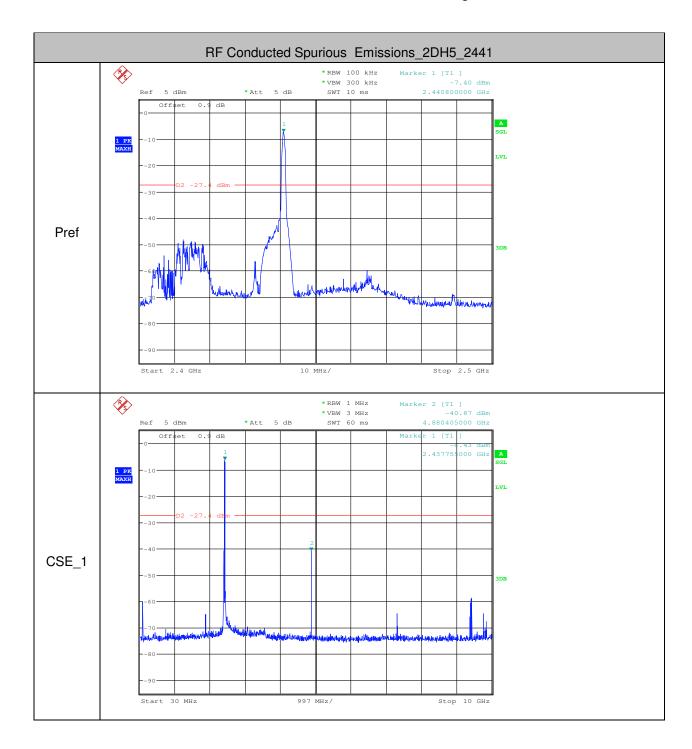
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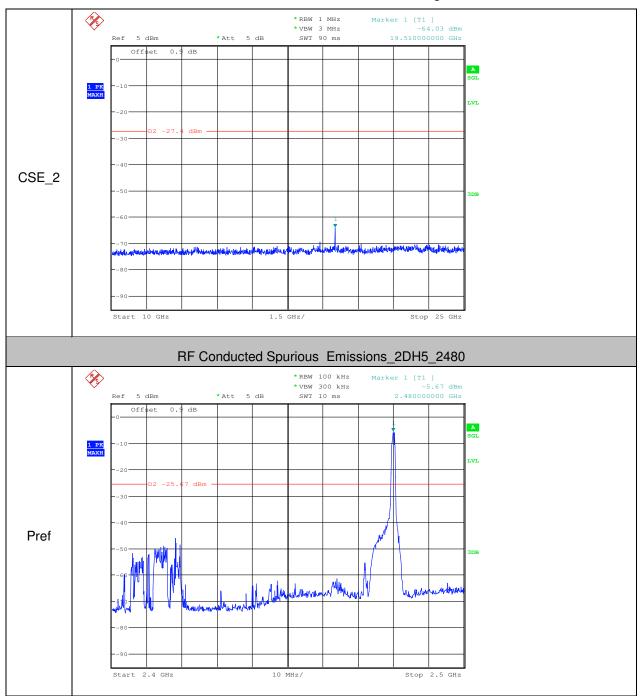
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