

Report No.: GZEM200901509702

Page: 1 of 63 FCC ID: HBW600

TEST REPORT

Application No.: GZEM2009015097CR

Applicant: Chamberlain Group Inc,The

Address of Applicant: 300 Windsor DrOak Brook, 60523, Illinois, United States

Manufacturer: Grupo Chamberlain S de RL de CV

Address of Manufacturer: Boulevard Luis Donaldo Colosio Murrieta 1891 Colonia Obrera Codigo Postal

84048 Nogales, Sonora, Mexico

Factory: Foshan Foresee Intelligent Control Technology Co., Ltd

Address of Factory: 33 Changbao West Road, Rongli, Ronggui, Shunde, Foshan, 528305

Guangdong, China

Equipment Under Test (EUT):

EUT Name: Sliding Gate Operator

Model No.: SL600

Standard(s): 47 CFR Part 15, Subpart C 15.247

Date of Receipt: 2020-09-15

Date of Test: 2020-09-23 to 2020-11-24

Date of Issue: 2021-02-07

Test Result: Pass*

Kobe Jian EMC Laboratory Manager



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



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Revision Record						
Version	Chapter	Date	Modifier	Remark		
01		2021-02-07		Original		

Authorized for issue by:		
Tested By	Lily_Kuang /Project Engineer	2020-09-23 to 2020-11-24 Date
	Lify_Ruality /Project Engineer	Date
Checked By	Riday Liu	2021-02-07
	Ricky_Liu /Reviewer	Date



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2 Test Summary

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 & Restricted bands	47 CER Part 15 ANSI C63 10 (2013)		47 CFR Part 15, Subpart C 15.205 & 15.209	Pass			

Note:

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

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

According to the declaration from the applicant, the motor is changed for the product, so all the tests were done for the EUT.



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4 General Information

4.1 Details of E.U.T.

Power Supply: AC 120 V, 60Hz

Cable: AC mains

Test Voltage: AC 120 V, 60Hz

Antenna Gain: -5 dBi declared by applicant

Antenna Type: Integrated antenna

Channel Spacing: 500 kHz
Modulation Type: GFSK
Number of Channels: 50

Operation Frequency: 902.25MHz to 926.75MHz

Spectrum Spread Frequency Hopping Spread Spectrum(FHSS)

Technology:

Hardware Version: SL600-R Firmware Version: V1.1 S/N: SN00654

Test Software Version: N/A

RF Power setting level Default and can not be changed by user

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)
/	AF Hadiated Fower	4.8dB (above 1GHz)
8	Padiated Spurious Emission Test	4.5dB (30MHz-1GHz)
0	Radiated Spurious Emission Test	4.8dB (1GHz-18GHz)
9	Temperature	±0.4℃
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:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory, 198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District, Guangzhou, China 510663

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

No tests were sub-contracted.



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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/New Zealand Regulatory Compliance Mark (RCM).

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

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

● CNAS (Lab Code: L0167)

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2018 accreditation criteria for testing laboratories (identical to

ISO/IEC 17025:2017 General Requirements) for the Competence of Testing Laboratories.

● FCC Recognized 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)

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.: R-12460, C-12584, G-10449 and T-11179 respectively.

● CBTL (Lab Code: TL129)

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2005, 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	ChangZhou ZhongYu	8m x 3m x 3.8m	EMC0306	N/A	N/A		
Two-Line V-Network	Rohde & Schwarz	ENV216	EMC0118	2020-01-10	2021-01-09		
LISN	Rohde & Schwarz	ENV216	EMC2135	2020-09-25	2021-09-24		
EMI Test Receiver	Rohde & Schwarz	ESCS30	EMC0506	2020-11-13	2021-11-12		
Coaxial Cable	HangTianXing	2m	EMC0107	2020-09-09	2022-09-08		
Voltage Probe	SGS-EMC	N/A	EMC0106	2019-05-10	2021-05-09		
Conical Metal Housing	SGS-EMC	N/A	EMC0167	2020-04-19	2022-04-18		
Test Software E3c	Audix	Ver. 5.4.1221b	GZE100-62	N/A	N/A		

RF Conducted Test						
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date	
EXA Signal Analzer	AgilentTechnologies	N9010A	EMC2138	2020-09-17	2021-09-16	
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14	
Test Software JS1120-3	HangTianXing	V2.6	GZE100-69	N/A	N/A	
MI CABLE	SGS-EMC	0.8M	EMC2136	2019-11-02	2021-11-01	
MI CABLE	SGS-EMC	0.8M	EMC2137	2019-11-02	2021-11-01	

Radiated Emissions					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver	Rohde & Schwarz	ESIB26	EMC0522	2020-01-10	2021-01-09
EMI Test Receiver	Rohde & Schwarz	ESCI	EMC0056	2020-01-10	2021-01-09
Chamber cable	HangTianXing	N/A	EMC0542	2019-06-28	2021-06-27
Trilog Broadband Antenna 25MHz-1GHz	SCHWARZBECKME SS-ELEKTRONIK	VULB 9168	EMC2174	2018-09-06	2021-09-05
Trilog Broadband Antenna 30MHz-1GHz	SCHWARZBECKME SS-ELEKTRONIK	VULB 9168	SEM003-18	2019-02-22	2022-02-22
Bi-log Type Antenna	Schaffner Chase	CBL6143	EMC0519	2020-06-08	2023-06-07
Horn Antenna 1GHz-18GHz	Rohde & Schwarz	HF906	EMC0518	2018-09-02	2021-09-01
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2020-01-10	2021-01-09
Amplifier	HP	8447F	EMC2065	2020-05-26	2021-05-25
Pre-Amplifier MH648A	ANRITSU CORP	MH648A	EMC2086	2020-11-13	2021-11-12
Active Loop Antenna	ETS-Lindgren	6502	EMC2190	2019-12-27	2021-12-26
High Pass Filter(915MHz)	FSY MICROWAVE	HM1465-9SS	EMC2079	2020-01-10	2021-01-09
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2020-01-10	2021-01-09



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10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2019-10-20	2022-10-19
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-19	2023-12-18
MXE EMI Receiver	Keysight	N9038A	EMC2139	2020-11-13	2021-11-12
EXA Signal Analyzer	Keysight	N9010A	EMC2138	2020-09-17	2021-09-16
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	2020-07-09	2021-07-08
DMM	Fluke	73	EMC0007	2020-07-09	2021-07-08



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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 -5 dBi. Please refer to the internal photos for details.



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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(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:

Everyoney of emission/MH=)	Conducted limit(dBµV)				
Frequency of emission(MHz)	Quasi-peak	Average			
0.15-0.5	66 to 56*	56 to 46*			
0.5-5	56	46			
5-30	60	50			
*Decreases with the logarithm of the	ne frequency.				

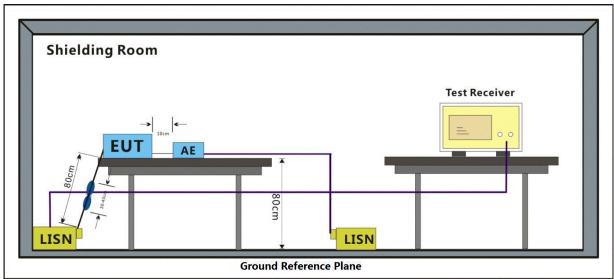
7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 25 °C Humidity: 52 % RH Atmospheric Pressure: 1020 mbar

Test Mode: b:TX mode_Keep the EUT in transmitting with modulation mode.

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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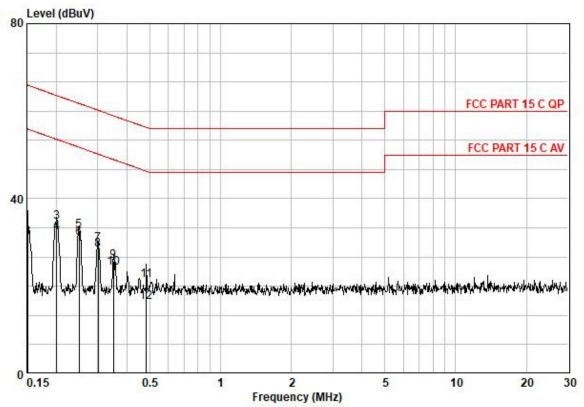
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Mode:b; Line:Live Line



Pol	:LIVE
LOI	THIND
Mode	
Jeo u e	
Model	

Frequency MHz 0.15	read level dBuV 25.04	Cable Loss dB 0.10	LISN Factor dB 9.61	Measured level dBuV 34.75	Limit Line dBuV 65.96	Over limit dB -31.21	Remark QP
0. 15	21. 56	0.10	9. 61	31. 27	55. 96	-24. 69	AVERAGE
0. 20	24. 92	0.10	9. 60	34. 62	63. 58	-28.96	QP
0. 20	22. 58	0.10	9.60	32. 28	53. 58	-21.30	AVERAGE
0. 25	22. 98	0.10	9. 61	32.69	61.73	-29.04	QP
0. 25	21. 18	0. 10	9. 61	30.89	51. 73	-20.84	AVERAGE
0.30	19.84	0.10	9. 60	29. 54	60. 19	-30.65	QP
0.30	18. 63	0.10	9.60	28. 33	50. 19	-21.86	AVERAGE
0.35	16. 12	0.10	9. 60	25. 82	58. 96	-33. 14	QP
0.35	14. 55	0.10	9.60	24. 25	48.96	-24. 71	AVERAGE
0.48	11. 62	0. 10	9. 61	21. 33	56. 27	-34. 94	QP
0.48	6. 57	0.10	9. 61	16, 28	46. 27	-29. 99	AVERAGE



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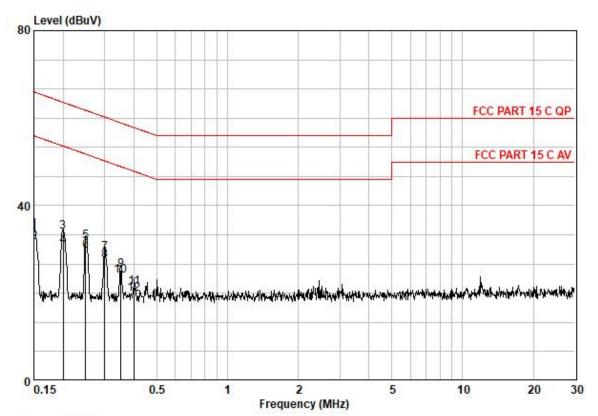
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Mode:b; Line:Neutral Line



Pol : NEUTRAL Mode Model

Frequency MHz 0.15	read level dBuV 24.80	Cable Loss dB 0.10	LISN Factor dB 9.61	Measured level dBuV 34.51	Limit Line dBuV 66.00	Over limit dB -31.49	Remark QP
0. 15	21. 93	0.10	9. 61	31. 64	56.00	-24. 36	AVERAGE
0. 20	24. 36	0.10	9. 62	34. 08	63. 62	-29. 54	QP
0. 20	20.98	0.10	9.62	30. 70	53. 62	-22. 92	AVERAGE
0. 25	22. 04	0.10	9.62	31. 76	61. 78	-30.02	QP
0. 25	19. 91	0.10	9.62	29. 63	51. 78	-22. 15	AVERAGE
0.30	19.46	0.10	9. 63	29. 19	60. 24	-31.05	QP
0.30	17. 73	0.10	9.63	27. 46	50. 24	-22. 78	AVERAGE
0. 35	15. 54	0.10	9. 63	25. 27	58. 91	-33. 64	QP
0. 35	14. 34	0.10	9. 63	24. 07	48. 91	-24. 84	AVERAGE
0.40	11.60	0.10	9. 64	21. 34	57.81	-36. 4 7	QP
0.40	10. 20	0.10	9.64	19.94	47.81	-27.87	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)		
	1 for ≥50 hopping channels		
902-928	0.25 for 25≤ hopping channels <50		
	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 modulati			

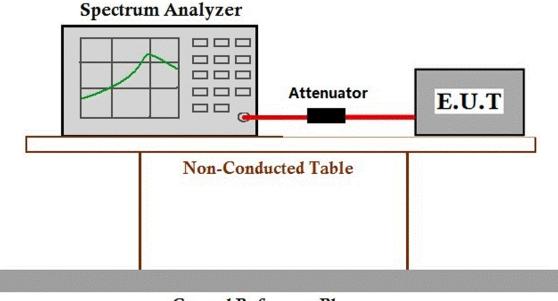
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 24.9 °C Humidity: 64.4 % RH Atmospheric Pressure: 1020 mbar

Test Mode: b:TX mode_Keep the EUT in transmitting with modulation mode.

7.2.2 Test Setup Diagram



Ground Reference Plane

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

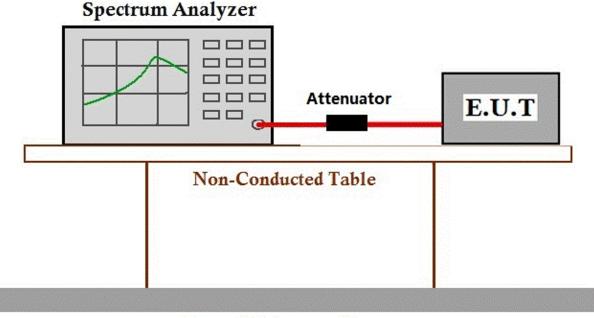
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 24.9 °C Humidity: 64.4 % RH Atmospheric Pressure: 1020 mbar

Test Mode: b:TX mode_Keep the EUT in transmitting with modulation mode.

7.3.2 Test Setup Diagram



Ground Reference Plane

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

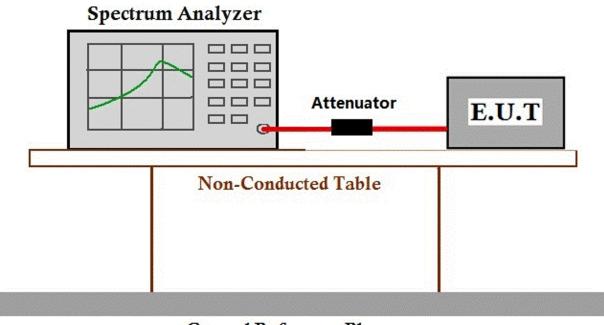
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 24.9 °C Humidity: 64.4 % RH Atmospheric Pressure: 1020 mbar

Test Mode: b:TX mode_Keep the EUT in transmitting with modulation mode.

7.4.2 Test Setup Diagram



Ground Reference Plane

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)
000 000	50 for 20dB bandwidth <250kHz
902-928	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

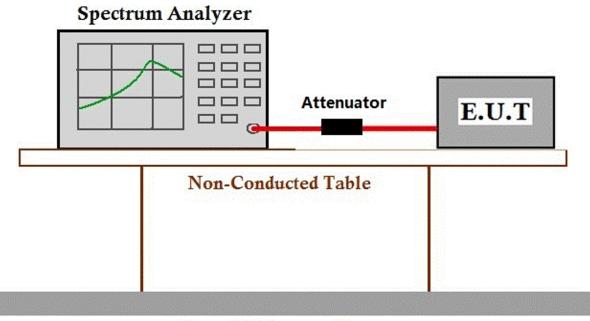
7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 24.9 °C Humidity: 64.4 % RH Atmospheric Pressure: 1020 mbar

Test Mode: b:TX mode Keep the EUT in transmitting with modulation mode.

7.5.2 Test Setup Diagram



Ground Reference Plane

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)				
902-928	0.4S within a 10S period(20dB bandwidth≥250kHz)				
2400 2482 5	0.4S within a period of 0.4S multiplied by the number				
2400-2483.5	of hopping channels				
5725-5850	0.4S within a 30S period				

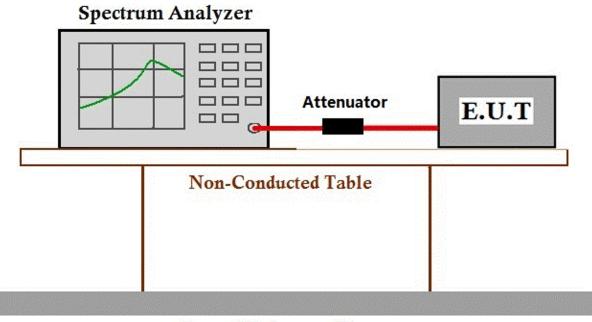
7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 24.9 °C Humidity: 64.3 % RH Atmospheric Pressure: 1020 mbar

Test Mode: b:TX mode Keep the EUT in transmitting with modulation mode.

7.6.2 Test Setup Diagram



Ground Reference Plane

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: 24.9 °C Humidity: 63.7 % RH Atmospheric Pressure: 1020 mbar

Test mode: b:TX mode_Keep the EUT in transmitting with modulation mode.



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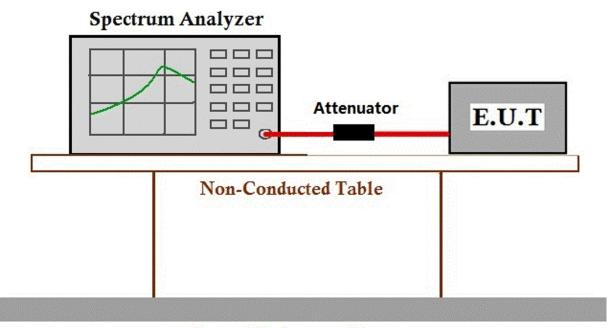
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7.7.2 Test Setup Diagram



Ground Reference Plane

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)

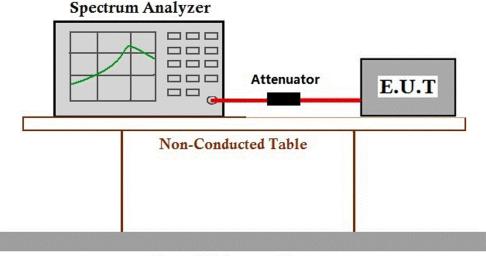
7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 24.9 °C Humidity: 63.3 % RH Atmospheric Pressure: 1020 mbar

Test Mode: b:TX mode_Keep the EUT in transmitting with modulation mode.

7.8.2 Test Setup Diagram



Ground Reference Plane

7.8.3 Measurement Procedure and Data

The detailed test data see: Appendix 15.247



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7.9 Radiated Emissions & Restricted bands

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

7.9.1 E.U.T. Operation

Operating Environment:

Temperature: Humidity: 52 % RH Atmospheric Pressure: 1020 mbar

Test Mode: b:TX mode Keep the EUT in transmitting with modulation mode.



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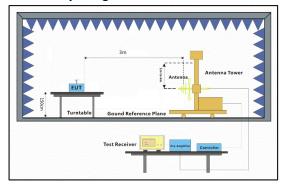
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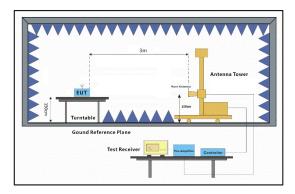


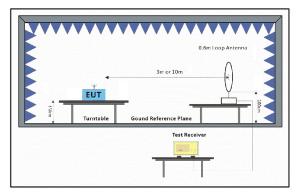
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7.9.2 Test Setup Diagram









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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) 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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According to the clause 7.5 of ANSI C63.10-2013:

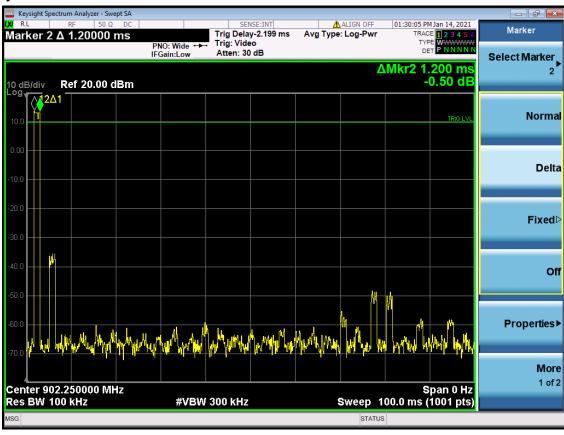
The average correction factor is computed by analyzing the on time in 100ms over one complete pulse train. Analysis of the remote transmitter on time in one complete pulse train, therefore the average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle), where the duty factor is calculated from following formula:

20log (Duty cycle) =
$$20log(T_{pulse}/100) = 20log(1.2/100) = -38.4dB$$

Here
$$T_{pulse} = 1.2$$
 (ms)

Please refer to below plots for more details.

Duty cycle:





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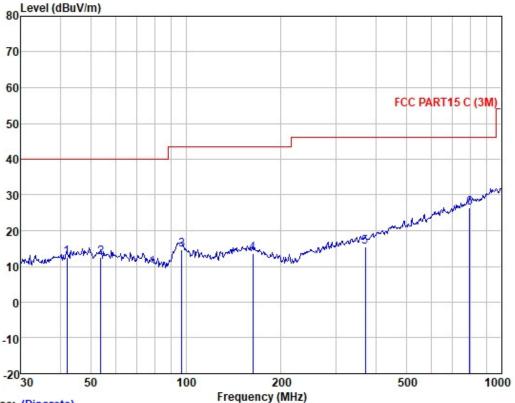


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30MHz-1G: Field Strength of Unwanted Emissions. Quasi-Peak Measurement:

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



Trace: (Discrete)

Site : SGS

Condition: FCC PART15 C (3M) 3m HORIZONTAL

Job : Model : Power : Test Mode:

	Freq		ntenna Factor						Pol/Phase	Remark
0	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	42.007	24.82	13.70	1.11	27.17	12.46	40.00	-27.54	HORIZONTAL	QP
2	53.693	24.63	13.83	1.25	27.17	12.54	40.00	-27.46	HORIZONTAL	QP
3	97.115	31.45	8.70	1.61	27.08	14.68	43.50	-28.82	HORIZONTAL	QP
4	163.182	24.76	13.53	2.17	26.79	13.67	43.50	-29.83	HORIZONTAL	QP
5	370.702	24.04	15.25	3.40	27.19	15.50	46.00	-30.50	HORIZONTAL	QP
6	793.396	26.05	22.53	5.78	28.04	26.32	46.00	-19.68	HORIZONTAL	QP



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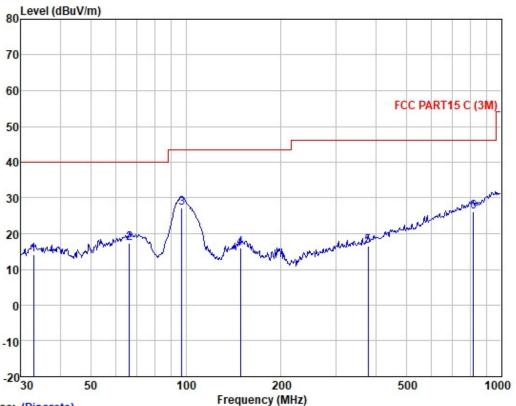
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Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:Low



Trace: (Discrete)

Site : SGS

Condition: FCC PART15 C (3M) 3m VERTICAL

Job : Model : Power : Test Mode:

		Dond		Cabla	Danama		13-34	0		
	Enog		Antenna						Pol/Phase	Domank
	rreq	rever	ractor	LUSS	ractor	rever	LINE	LIMIL	POI/Filase	Kelliai K
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	5	
1	32.864	27.51	12.74	1.03	27.19	14.09	40.00	-25.91	VERTICAL	QP
2	66.266	30.71	12.56	1.30	27.14	17.43	40.00	-22.57	VERTICAL	QP
3	97.115	44.10	8.70	1.61	27.08	27.33	43.50	-16.17	VERTICAL	QP
4	148.963	27.09	13.75	2.05	26.84	16.05	43.50	-27.45	VERTICAL	QP
5	378.584	24.88	15.48	3.43	27.24	16.55	46.00	-29.45	VERTICAL	QP
6	815.968	25.52	22.77	5.90	28.01	26.18	46.00	-19.82	VERTICAL	QP



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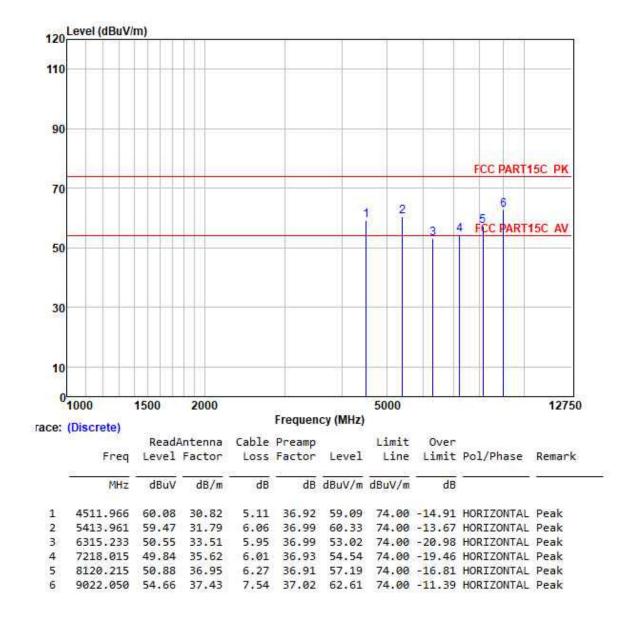


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1GHz~10GHz Field Strength of Unwanted Emissions Measurement:

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





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Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
4511.966	60.08	30.82	5.11	36.92	59.09	74.00	-14.91	Peak
4511.966	N/A	N/A	N/A	N/A	20.69	54.00	-33.31	Average
5413.961	59.47	31.79	6.06	36.99	60.33	74.00	-13.67	Peak
5413.961	N/A	N/A	N/A	N/A	21.93	54.00	-32.07	Average
6315.233	50.55	33.51	5.95	36.99	53.02	74.00	-25.24	Peak
6315.233	N/A	N/A	N/A	N/A	14.62	54.00	-39.38	Average
7218.015	49.84	35.62	6.01	36.93	54.54	74.00	-27.83	Peak
7218.015	N/A	N/A	N/A	N/A	16.14	54.00	-37.86	Average
8120.215	50.88	36.95	6.27	36.91	57.19	74.00	-18.83	Peak
8120.215	N/A	N/A	N/A	N/A	18.79	54.00	-35.21	Average
9022.05	54.66	37.43	7.54	37.02	62.61	74.00	-20.01	Peak
9022.05	N/A	N/A	N/A	N/A	24.21	54.00	-29.79	Average



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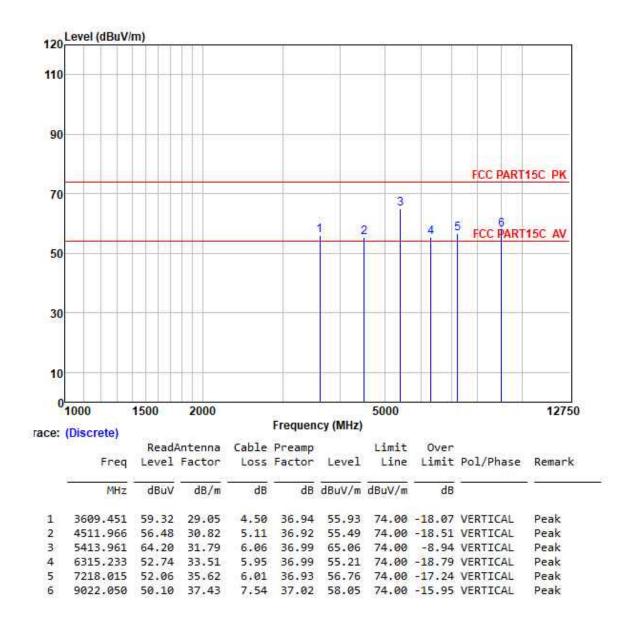
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Mode:a; Polarization:Vertical; Modulation:GFSK; ; Channel:Low





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Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
3609.451	59.32	29.05	4.5	36.94	55.93	74.00	-18.07	Peak
3609.451	N/A	N/A	N/A	N/A	17.53	54.00	-36.47	Average
4511.966	56.48	30.82	5.11	36.92	55.49	74.00	-18.51	Peak
4511.966	N/A	N/A	N/A	N/A	17.09	54.00	-36.91	Average
5413.961	64.2	31.79	6.06	36.99	65.06	74.00	-8.94	Peak
5413.961	N/A	N/A	N/A	N/A	26.66	54.00	-27.34	Average
6315.233	52.74	33.51	5.95	36.99	55.21	74.00	-18.79	Peak
6315.233	N/A	N/A	N/A	N/A	16.81	54.00	-37.19	Average
7218.015	52.06	35.62	6.01	36.93	56.76	74.00	-17.24	Peak
7218.015	N/A	N/A	N/A	N/A	18.36	54.00	-35.64	Average
9022.05	50.1	37.43	7.54	37.02	58.05	74.00	-15.95	Peak
9022.05	N/A	N/A	N/A	N/A	19.65	54.00	-34.35	Average



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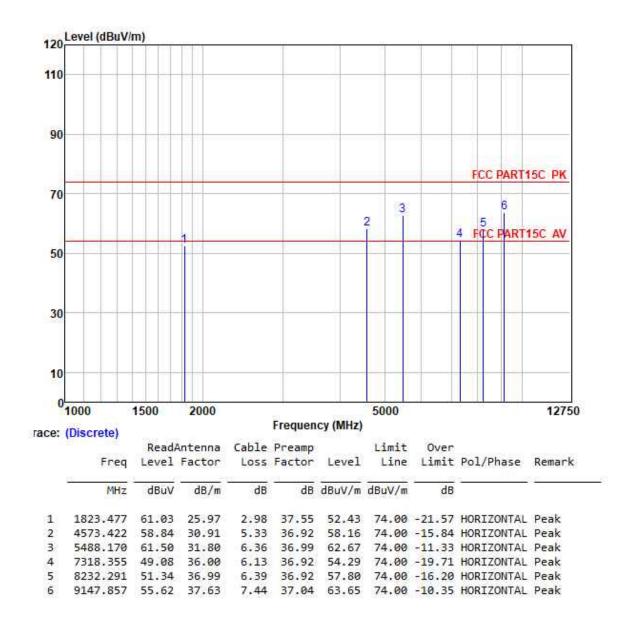
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Mode:a; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle





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Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
1823.477	61.03	25.97	2.98	37.55	52.43	74.00	-21.57	Peak
1823.477	N/A	N/A	N/A	N/A	14.03	54.00	-39.97	Average
4573.422	58.84	30.91	5.33	36.92	58.16	74.00	-15.84	Peak
4573.422	N/A	N/A	N/A	N/A	19.76	54.00	-34.24	Average
5488.17	61.5	31.8	6.36	36.99	62.67	74.00	-11.33	Peak
5488.17	N/A	N/A	N/A	N/A	24.27	54.00	-29.73	Average
7318.355	49.08	36	6.13	36.92	54.29	74.00	-19.71	Peak
7318.355	N/A	N/A	N/A	N/A	15.89	54.00	-38.11	Average
8232.291	51.34	36.99	6.39	36.92	57.8	74.00	-16.2	Peak
8232.291	N/A	N/A	N/A	N/A	19.4	54.00	-34.6	Average
9147.857	55.62	37.63	7.44	37.04	63.65	74.00	-10.35	Peak
9147.857	N/A	N/A	N/A	N/A	25.25	54.00	-28.75	Average



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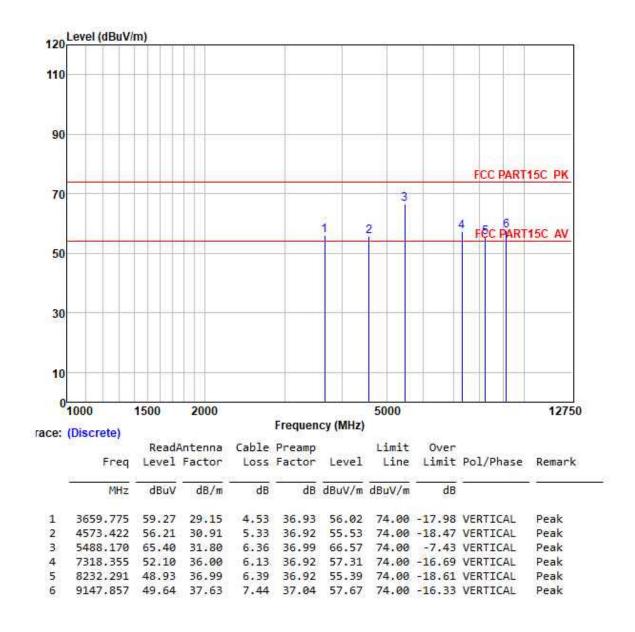
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Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
3659.775	59.27	29.15	4.53	36.93	56.02	74.00	-17.98	Peak
3659.775	N/A	N/A	N/A	N/A	17.62	54.00	-36.38	Average
4573.422	56.21	30.91	5.33	36.92	55.53	74.00	-18.47	Peak
4573.422	N/A	N/A	N/A	N/A	17.13	54.00	-36.87	Average
5488.17	65.4	31.8	6.36	36.99	66.57	74.00	-7.43	Peak
5488.17	N/A	N/A	N/A	N/A	28.17	54.00	-25.83	Average
7318.355	52.1	36	6.13	36.92	57.31	74.00	-16.69	Peak
7318.355	N/A	N/A	N/A	N/A	18.91	54.00	-35.09	Average
8232.291	48.93	36.99	6.39	36.92	55.39	74.00	-18.61	Peak
8232.291	N/A	N/A	N/A	N/A	16.99	54.00	-37.01	Average
9147.857	49.64	37.63	7.44	37.04	57.67	74.00	-16.33	Peak
9147.857	N/A	N/A	N/A	N/A	19.27	54.00	-34.73	Average



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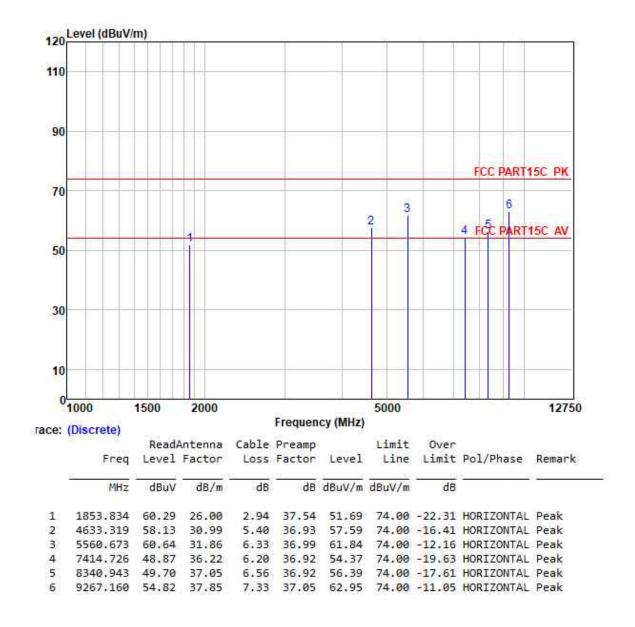
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Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
1853.834	60.29	26	2.94	37.54	51.69	74.00	-22.31	Peak
1853.834	N/A	N/A	N/A	N/A	13.29	54.00	-40.71	Average
4633.319	58.13	30.99	5.4	36.93	57.59	74.00	-16.41	Peak
4633.319	N/A	N/A	N/A	N/A	19.19	54.00	-34.81	Average
5560.673	60.64	31.86	6.33	36.99	61.84	74.00	-12.16	Peak
5560.673	N/A	N/A	N/A	N/A	23.44	54.00	-30.56	Average
7414.726	48.87	36.22	6.2	36.92	54.37	74.00	-19.63	Peak
7414.726	N/A	N/A	N/A	N/A	15.97	54.00	-38.03	Average
8340.943	49.7	37.05	6.56	36.92	56.39	74.00	-17.61	Peak
8340.943	N/A	N/A	N/A	N/A	17.99	54.00	-36.01	Average
9267.16	54.82	37.85	7.33	37.05	62.95	74.00	-11.05	Peak
9267.16	N/A	N/A	N/A	N/A	24.55	54.00	-29.45	Average



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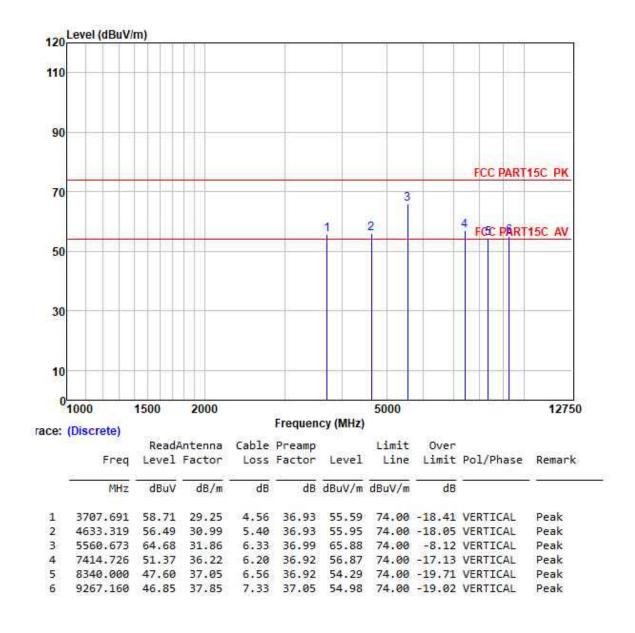
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Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
3707.691	58.71	29.25	4.56	36.93	55.59	74.00	-18.41	Peak
3707.691	N/A	N/A	N/A	N/A	17.19	54.00	-36.81	Average
4633.319	56.49	30.99	5.4	36.93	55.95	74.00	-18.05	Peak
4633.319	N/A	N/A	N/A	N/A	17.55	54.00	-36.45	Average
5560.673	64.68	31.86	6.33	36.99	65.88	74.00	-8.12	Peak
5560.673	N/A	N/A	N/A	N/A	27.48	54.00	-26.52	Average
7414.726	51.37	36.22	6.2	36.92	56.87	74.00	-17.13	Peak
7414.726	N/A	N/A	N/A	N/A	18.47	54.00	-35.53	Average
8340.000	47.6	37.05	6.56	36.92	54.29	74.00	-19.71	Peak
8340.000	N/A	N/A	N/A	N/A	15.89	54.00	-38.11	Average
9267.16	46.85	37.85	7.33	37.05	54.98	74.00	-19.02	Peak
9267.16	N/A	N/A	N/A	N/A	16.58	54.00	-37.42	Average



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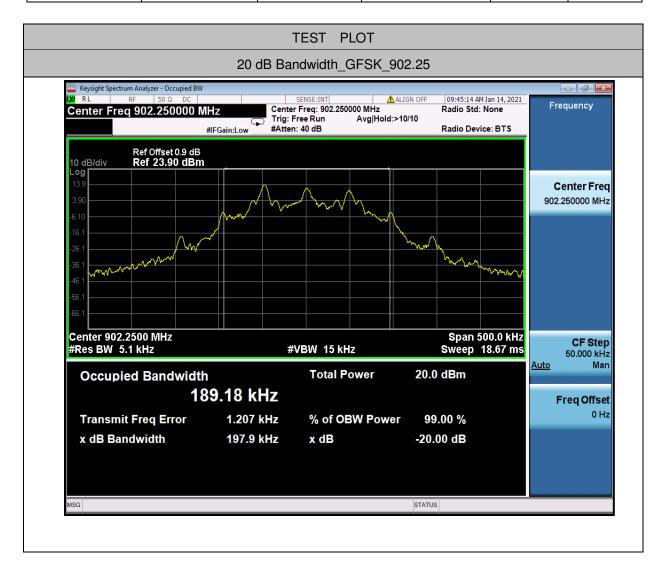
8 Appendix

8.1 Appendix 15.247

Cable Loss = 0.9 dB

1.20 dB Bandwidth

Test Mode	Test Channel	OBW[MHz]	EBW[MHz]	Limit[MHz]	Verdict
GFSK	902.25	0.18913	0.1979	<=0.5	PASS
GFSK	914.75	0.18965	0.1981	<=0.5	PASS
GFSK	926.75	0.17922	0.1957	<=0.5	PASS





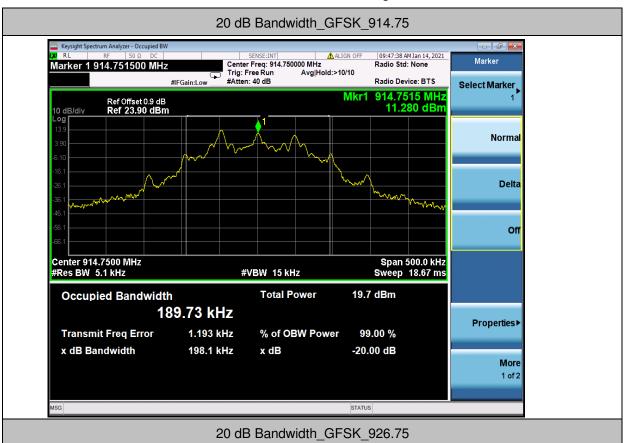
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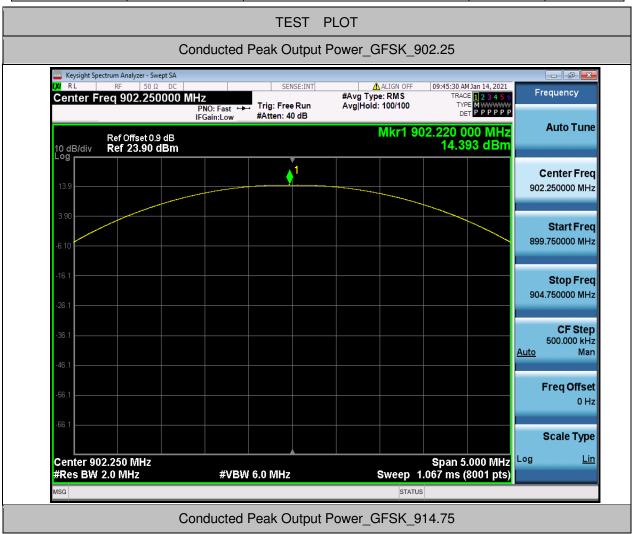


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2.Conducted Peak Output Power

Test Mode	Test Channel	Power[dBm]	Limit[dBm]	Verdict
GFSK	902.25	14.393	<=30	PASS
GFSK	914.75	14.138	<=30	PASS
GFSK	926.75	14.001	<=30	PASS





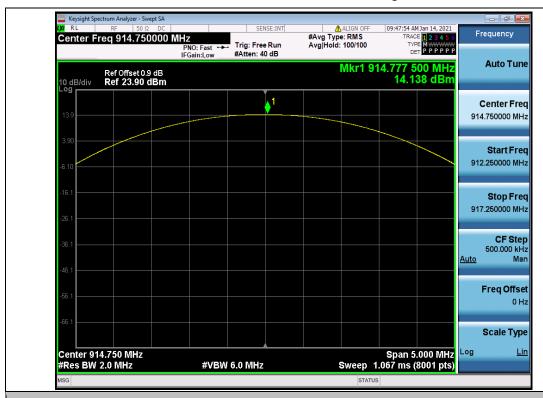
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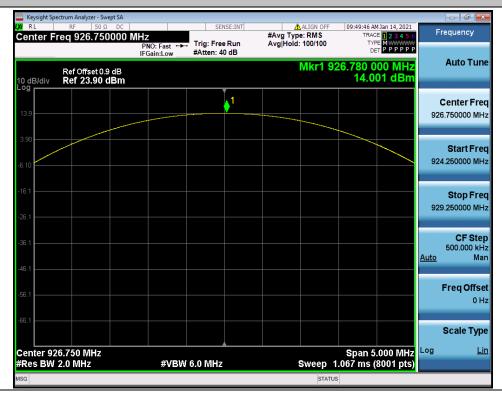


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Conducted Peak Output Power_GFSK_926.75





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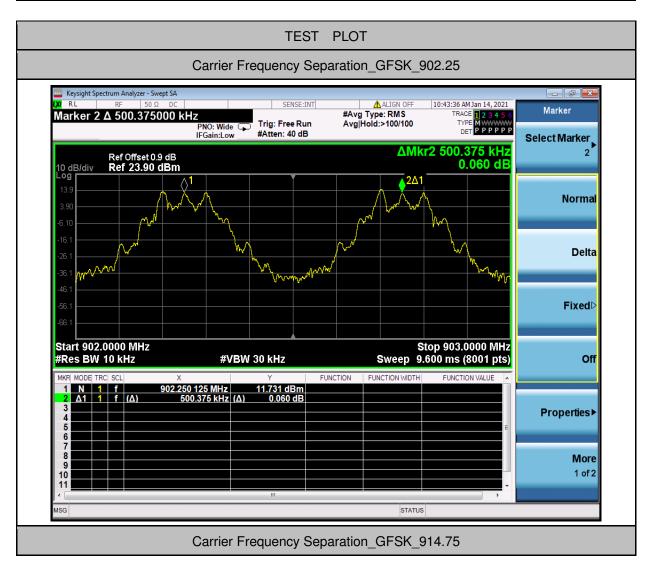


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3. Carrier Frequency Separation

Test Mode	Test Channel	Result[MHz]	Limit[MHz]	Verdict
GFSK	902.25	0.500	>=0.1979	PASS
GFSK	914.75	0.500	>=0.1981	PASS
GFSK	926.75	0.499	>=0.1957	PASS





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Carrier Frequency Separation_GFSK_926.75





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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
GFSK	902.25	1.31	90	0.12	0.4	PASS
GFSK	914.75	1.31	80	0.11	0.4	PASS
GFSK	926.75	1.31	90	0.12	0.4	PASS



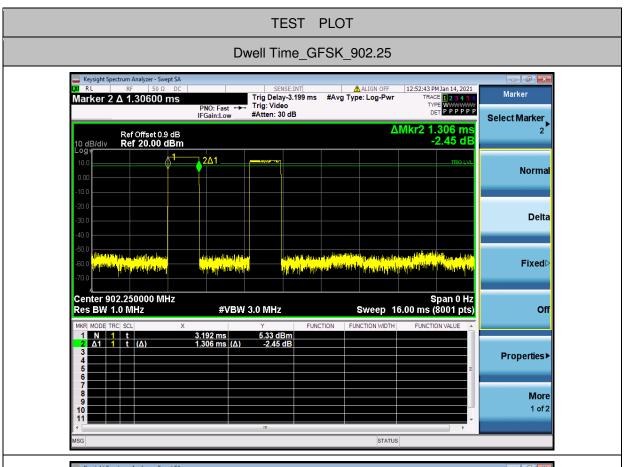
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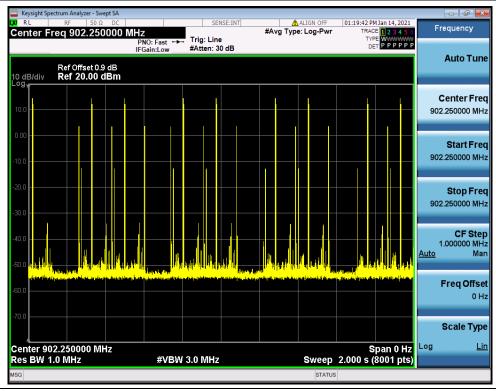
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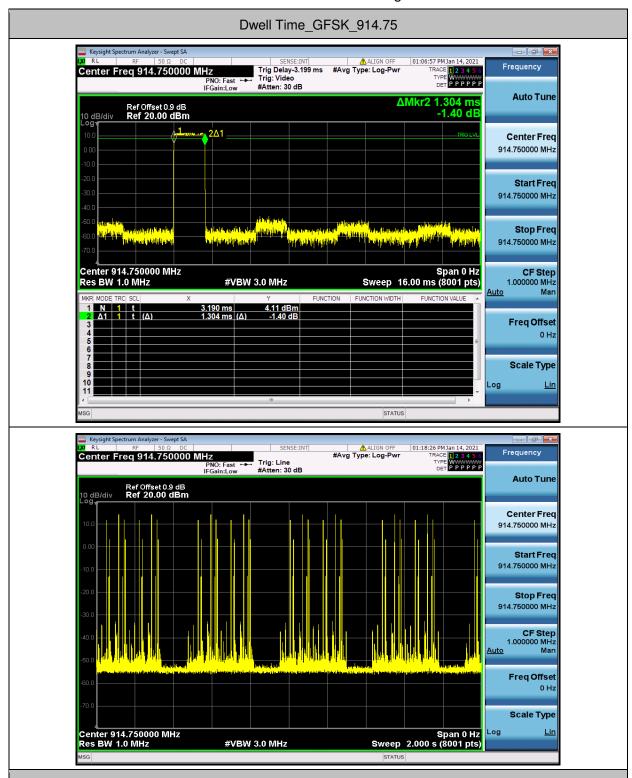
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Dwell Time GFSK 926.75



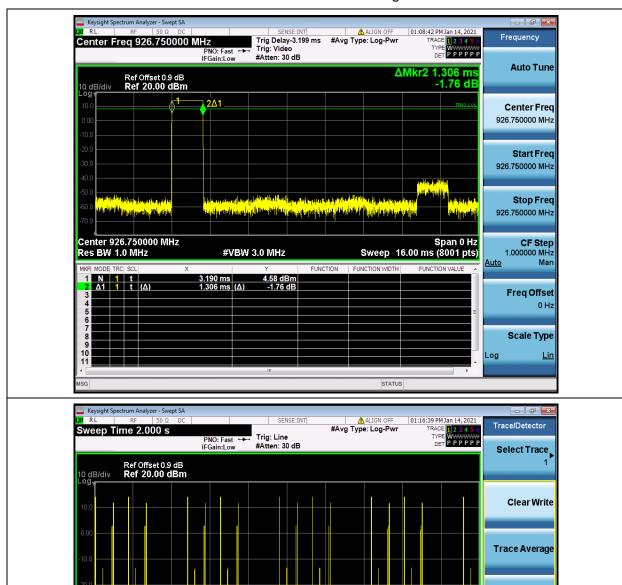
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Center 926.750000 MHz Res BW 1.0 MHz

#VBW 3.0 MHz

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Span 0 Hz Sweep 2.000 s (8001 pts)

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Max Hold

Min Hold

More 1 of 3

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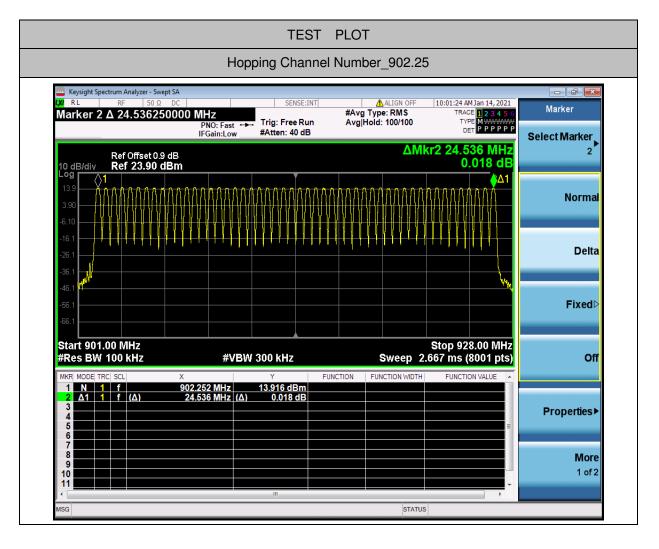


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5. Hopping Channel Number

Test Mode	Test Channel	Number of Hopping Channel[N]	Limit[N]	Verdict
GFSK	All hopping channels	50	>=50	PASS





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6.Band-edge for RF Conducted Emissions

Test Channel	Hopping	Carrier Power[dBm]	Max. Spurious Level [dBm]	Limit[dBm]	Verdict
902.25	On	14.778	-46.836	<=-5.23	PASS
902.25	Off	14.819	-42.002	<=-5.19	PASS
926.75	On	14.576	-40.089	<=-5.42	PASS
926.75	Off	14.473	-43.163	<=-5.53	PASS



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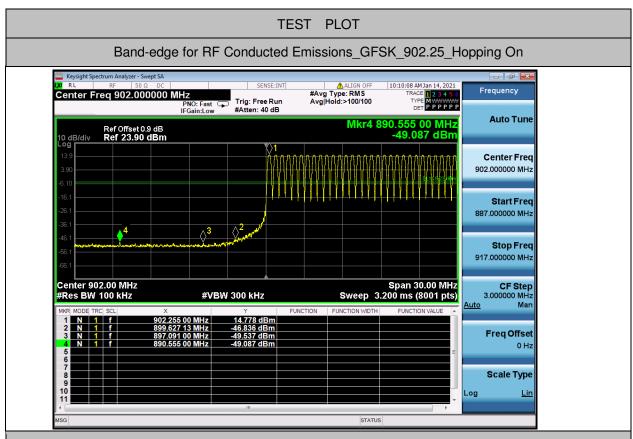
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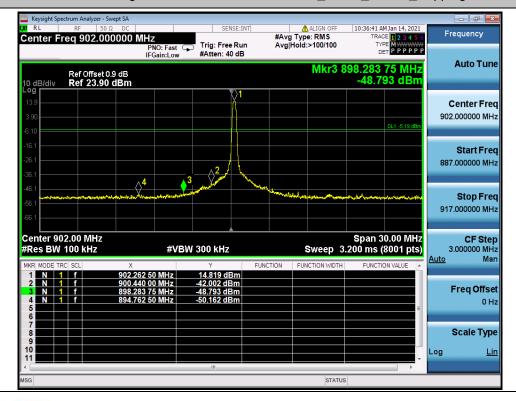


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Band-edge for RF Conducted Emissions_GFSK_902.25_Hopping Off





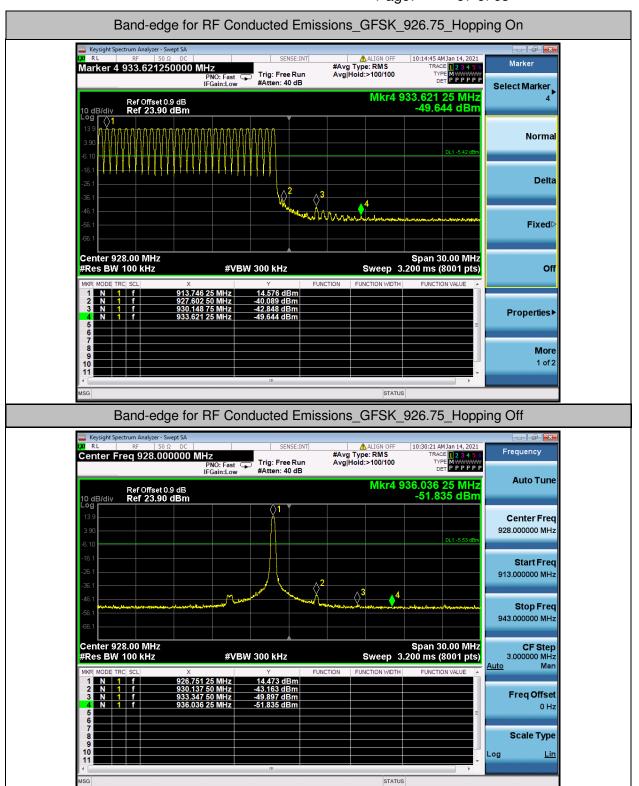
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7.RF Conducted Spurious Emissions

Test Channel	StartFre [MHz]	StopFre [MHz]	RBW [kHz]	VBW [kHz]	Pref[dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
902.25	30	10000	100	300	14.471	-46.924	<-5.529	PASS
902.25	10000	26000	100	300	14.471	-51.408	<-5.529	PASS
914.75	30	10000	100	300	14.207	-39.474	<-5.793	PASS
914.75	10000	26000	100	300	14.207	-51.903	<-5.793	PASS
926.75	30	10000	100	300	14.088	-41.237	<-5.912	PASS
926.75	10000	26000	100	300	14.088	-51.795	<-5.912	PASS



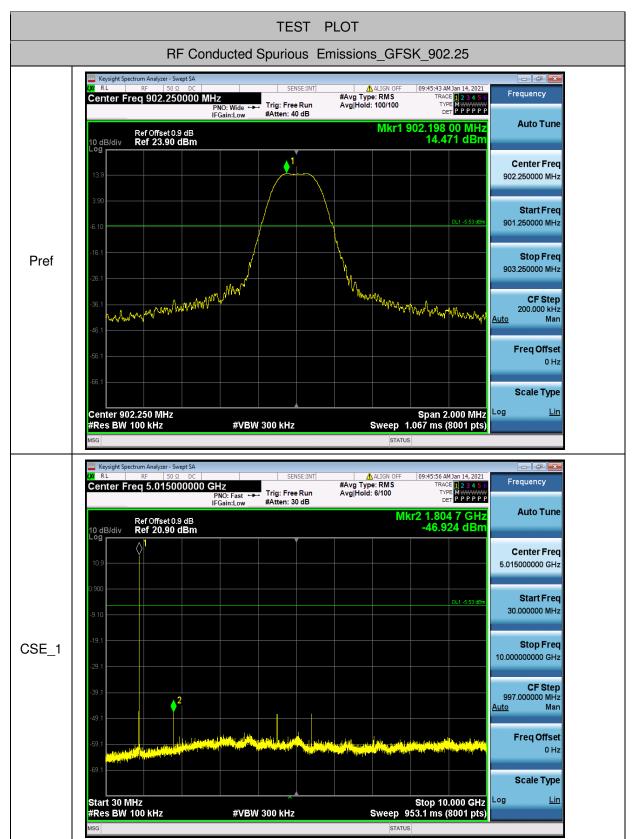
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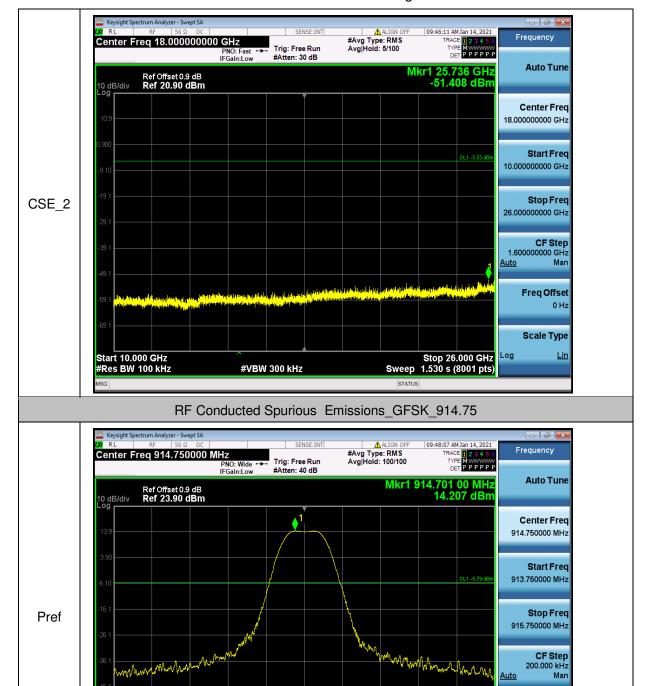
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Center 914.750 MHz #Res BW 100 kHz

#VBW 300 kHz

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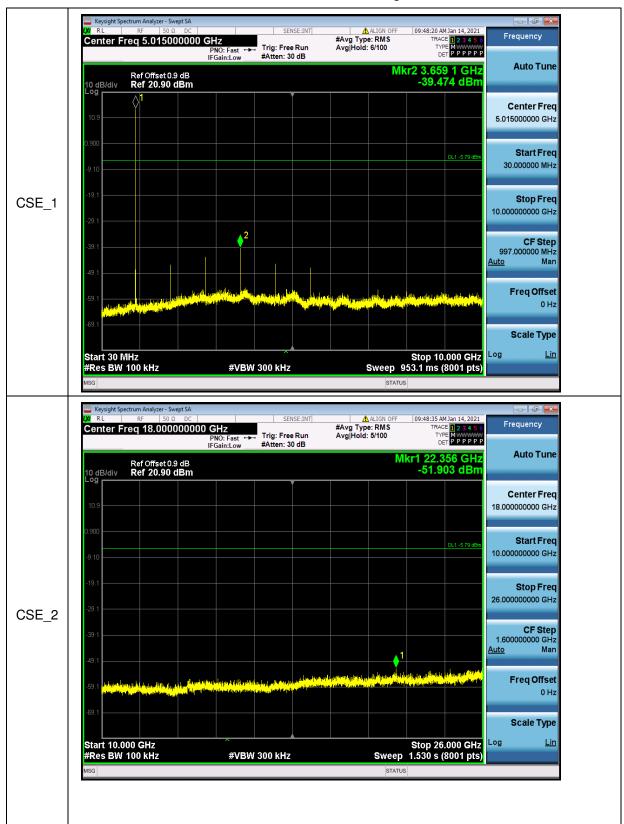
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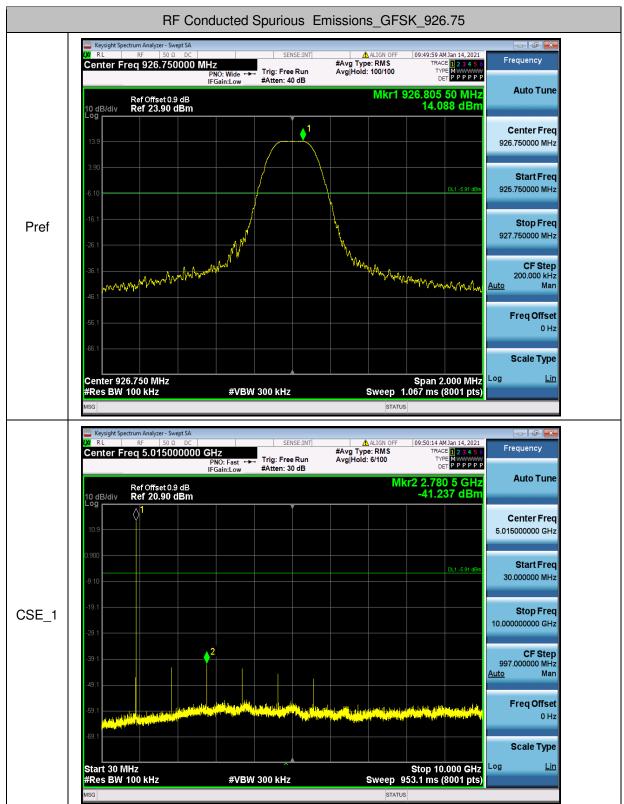
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