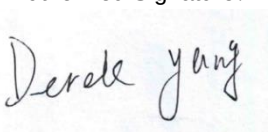
FCC TEST REPORT

Application No.:	AR/2021/10008
Applicant:	Xiaomi Communications Co., Ltd.
Address of Applicant	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
Manufacturer:	Xiaomi Communications Co., Ltd.
Address of Manufacturer	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
EUT Description:	Mobile Phone
Model No.:	M2103K19G / M2103K19PG
Trade Mark:	Redmi / POCO
FCC ID:	2AFZZK19G
Standards:	47 CFR FCC Part 2, Subpart J 47 CFR Part 15, Subpart C
Date of Receipt:	2021/2/8
Date of Test:	2021/2/8 to 2021/3/30
Date of Issue:	2021/3/30
Test Result :	**PASS ***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:



Derek Yang
Wireless Laboratory Manager

1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086 t (86-29) 6282 7885 www.sgsgroup.com.cn
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086 t (86-29) 6282 7885 sgs.china@sgs.com

1 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2021-03-30		Original

Authorized for issue by:				
Prepared By		Ben Huang **(Ben Huang) /Project Engineer**		
Checked By		Jimmy zhu **(Jimmy zhu) /Reviewer**		

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. | 1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086 | t (86-29) 6282 7885 | www.sgsgroup.com.cn
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086 | t (86-29) 6282 7885 | sgs.china@sgs.com

2 Test Summary

Test Item	Test Requirement	Test Method	Test Result	Result
AC Power Line Conducted Emission	15.207	ANSI C63.10 (2013)	Clause 4.3	PASS
Radiated Spurious emissions	15.247(d); 15.205/15.209	ANSI C63.10 (2013)	Clause 4.4	PASS
Restricted bands around fundamental frequency (Radiated Emission)	15.247(d); 15.205/15.209	ANSI C63.10 (2013)	Clause 4.5	PASS

Note: The differences between M2103K19G（K19）and M2103K19PG （K19P）are as below:

Model name	Brand Name	rear cover
M2103K19G	Redmi	The material is the same, drawing is different, laser engraving is different
M2103K19PG	POCO	

Except listings above, the others are all the same as previous version.

Based on the above differences, the main test only performs M2103K19G

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. Wireless Laboratory
1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086
t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

Contents

3 General Information

3.1 Details of Client

Applicant:	Xiaomi Communications Co., Ltd.
Address of Applicant	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
Manufacturer:	Xiaomi Communications Co., Ltd.
Address of Manufacturer	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

3.2 Test Location

Company:	SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD.
Address:	1/F, Unit D, Building 1, Kanghong Orange Technology Park, No.137, Keyuan 3rd Road, Fengdong New City, Xi'an, Shaanxi China
Post code:	710086

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. Wireless Laboratory
1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086
t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

3.3 Test Facility

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

A2LA (Certificate No. 4854.01)

SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.

Designation Number: CN1271.

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. Wireless Laboratory
1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086
t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

3.4 General Description of EUT

EUT Description:	Mobile Phone
Model No.:	M2103K19G / M2103K19PG
Trade Mark:	Redmi / POCO
Hardware Version:	P2
Software Version:	MIUI 12
Operation Frequency:	2400MHz~2483.5MHz fc = 2402 MHz + N * 2 MHz, where: -fc = “Operating Frequency” in MHz, -N = “Channel Number” with the range from 0 to 39.
Bluetooth version:	Bluetooth V5.1
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Number of Channel:	79
Hopping Channel Type:	Adaptive Frequency Hopping systems
Sample Type:	☒ Portable Device, ☐Module
Antenna Type:	PIFA Antenna
Antenna Gain:	-1.3dBi

Operation Frequency of each channel							
Channel	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**	**Channel**	**Frequency**
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
2	2404MHz	22	2424MHz	42	2444MHz	62	2464MHz
3	2405MHz	23	2425MHz	43	2445MHz	63	2465MHz
4	2406MHz	24	2426MHz	44	2446MHz	64	2466MHz
5	2407MHz	25	2427MHz	45	2447MHz	65	2467MHz
6	2408MHz	26	2428MHz	46	2448MHz	66	2468MHz
7	2409MHz	27	2429MHz	47	2449MHz	67	2469MHz
8	2410MHz	28	2430MHz	48	2450MHz	68	2470MHz
9	2411MHz	29	2431MHz	49	2451MHz	69	2471MHz
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
12	2414MHz	32	2434MHz	52	2454MHz	72	2474MHz
13	2415MHz	33	2435MHz	53	2455MHz	73	2475MHz
14	2416MHz	34	2436MHz	54	2456MHz	74	2476MHz
15	2417MHz	35	2437MHz	55	2457MHz	75	2477MHz

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. Wireless Laboratory
1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086
t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

16	2418MHz	36	2438MHz	56	2458MHz	76	2478MHz
17	2419MHz	37	2439MHz	57	2459MHz	77	2479MHz
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	59	2461MHz		

Remark:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel(CH0)	2402MHz
The Middle channel(CH39)	2441MHz
The Highest channel(CH78)	2480MHz

3.5 Test Environment

Operating Environment:	
Temperature:	25.0 ˚C
Humidity:	50 % RH
Atmospheric Pressure:	101.30 KPa

3.6 Description of Support Units

The EUT has been tested independent unit.

4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
15.203 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.	
The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -1.3dBi.	

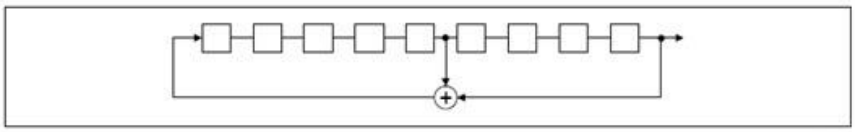
4.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

4.2.1 Test Requirement:

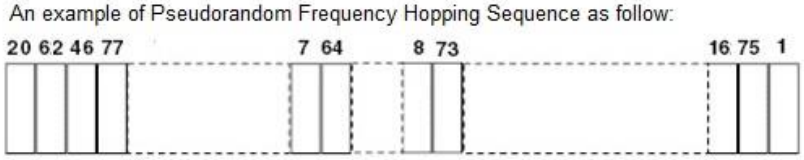
47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

4.2.2 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:



Linear Feedback Shift Register for Generation of the PRBS sequence

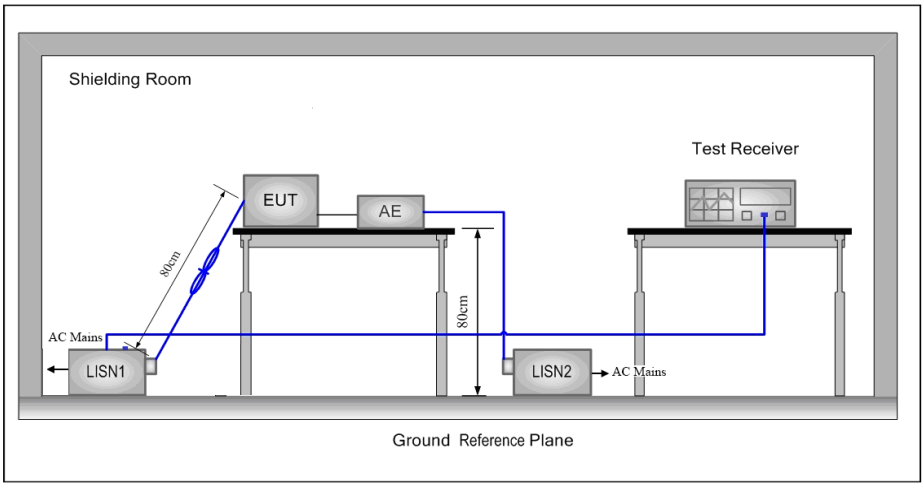


Each frequency used equally on the average by each transmitter.
According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.
Compliance for section 15.247(g):
According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the RF system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.
Compliance for section 15.247(h):
According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels. The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. Wireless Laboratory
1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086 t (86-29) 6282 7885 www.sgsgroup.com.cn
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086 t (86-29) 6282 7885 sgs.china@sgs.com

4.3 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150kHz to 30MHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test Procedure:	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 50Ω/50μH + 5Ω 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.		

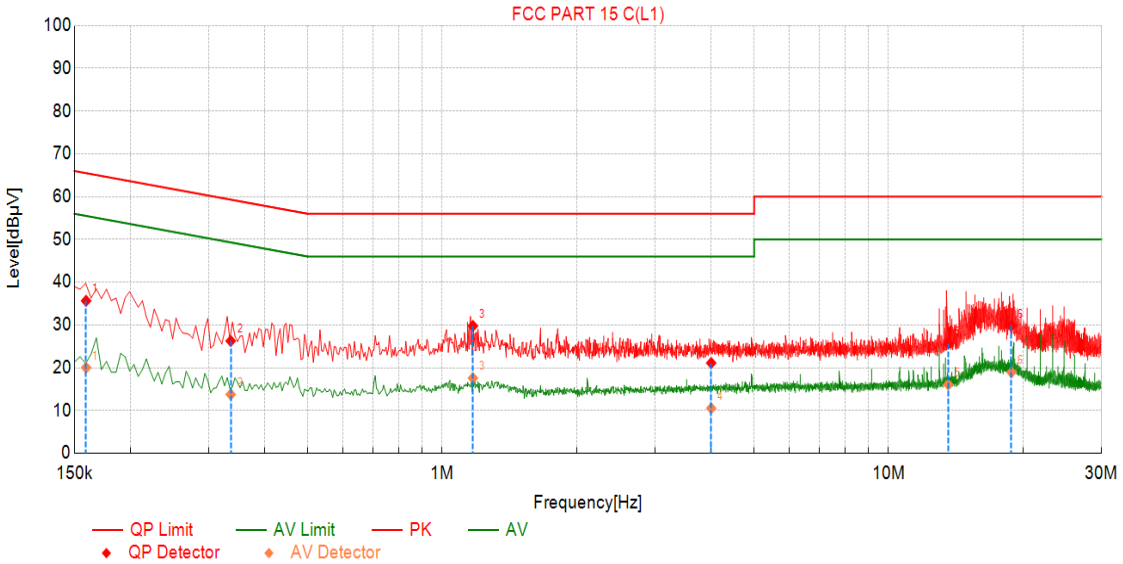
Test Setup:	
Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type at the lowest, middle, high channel. Charge + Transmitting mode.
Final Test Mode:	Through Pre-scan, find the DH5 of data type and GFSK modulation at the lowest channel is the worst case. Charge + Transmitting mode Only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. Wireless Laboratory
1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086 t (86-29) 6282 7885 www.sgsgroup.com.cn
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086 t (86-29) 6282 7885 sgs.china@sgs.com

Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

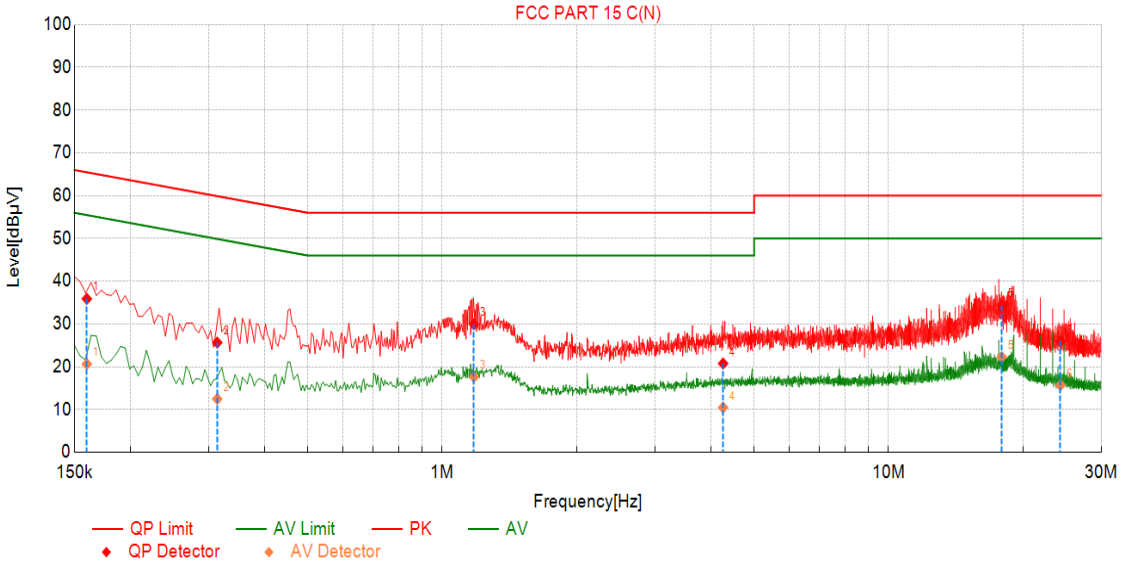
Live Line:



Test Graph

Final Data List								
NO.	Freq. [MHz]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.1594	35.65	65.50	29.85	20.03	55.50	35.47	PASS
2	0.3360	26.27	59.30	33.03	13.76	49.30	35.54	PASS
3	1.1721	29.77	56.00	26.23	17.59	46.00	28.41	PASS
4	4.0059	21.11	56.00	34.89	10.53	46.00	35.47	PASS
5	13.6051	25.64	60.00	34.36	16.07	50.00	33.93	PASS
6	18.8506	29.87	60.00	30.13	18.95	50.00	31.05	PASS

Neutral Line:



Test Graph

Final Data List								
NO.	Freq. [MHz]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.1600	35.88	65.46	29.58	20.63	55.46	34.83	PASS
2	0.3135	25.65	59.88	34.23	12.48	49.88	37.40	PASS
3	1.1786	29.95	56.00	26.05	17.61	46.00	28.39	PASS
4	4.2601	20.75	56.00	35.25	10.47	46.00	35.53	PASS
5	17.9313	34.35	60.00	25.65	22.29	50.00	27.71	PASS
6	24.2698	25.98	60.00	34.02	15.68	50.00	34.32	PASS

Remarks:

1. The following Quasi-Peak and Average measurements were performed on the EUT:

2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

4.4 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10 :2013 Section 11.12				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
	Remark: 15.35(b),Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.				

Test Setup:	

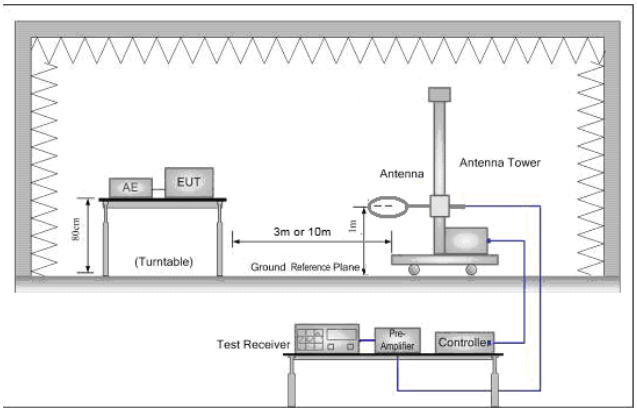


Figure 1. Below 30MHz

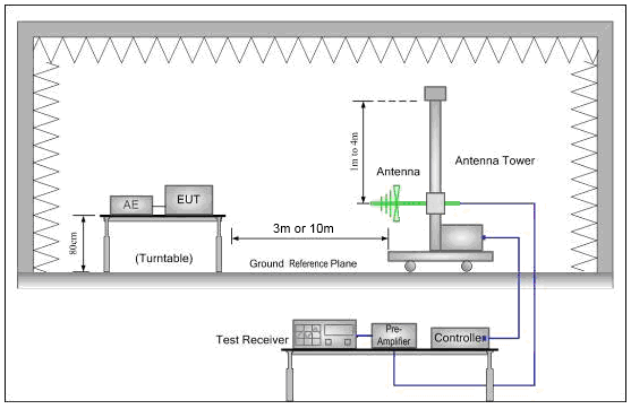


Figure 2. 30MHz to 1GHz

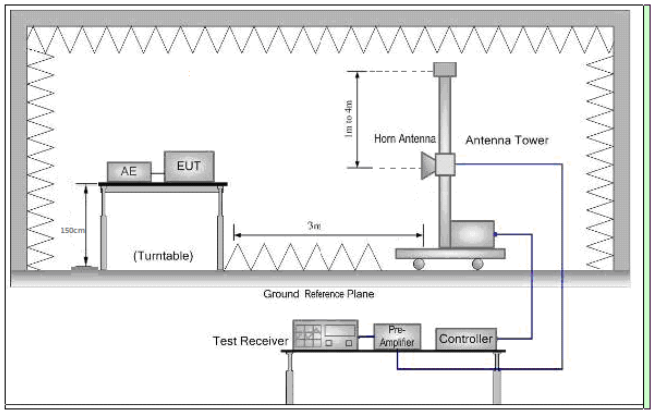


Figure 3. Above 1 GHz

Test Procedure:	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 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. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak (3) For average measurement: use duty cycle correction factor method per 15.35(c).

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. | 1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086
t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

	Duty cycle = On time/100 milliseconds On time = N 1 *L 1 +N 2 *L 2 +...+N n-1 *LN n-1 +N n *L n Where N 1 is number of type 1 pulses, L 1 is length of type 1 pulses, etc. Average Emission Level = Peak Emission Level + 20*log(Duty cycle) f. 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. g. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. h. 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. i. Test the EUT in the lowest channel, the middle channel ,the Highest channel. j. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case. k. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type Charge + Transmitting mode.
Test Configuration:	Measurements Below 1000MHz • RBW = 120 kHz • VBW = 300 kHz • Detector = Peak • Trace mode = max hold Peak Measurements Above 1000 MHz • RBW = 1 MHz • VBW ⩾ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold Average Measurements Above 1000MHz • RBW = 1 MHz • VBW = 10 Hz, when duty cycle is no less than 98 percent. • VBW ⩾ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
Final Test Mode:	Through Pre-scan, find the DH5 of data type and GFSK modulation is the worst case. Pretest the EUT at Charge + Transmitting mode For below 1GHz part, through pre-scan, the worst case is the lowest channel.

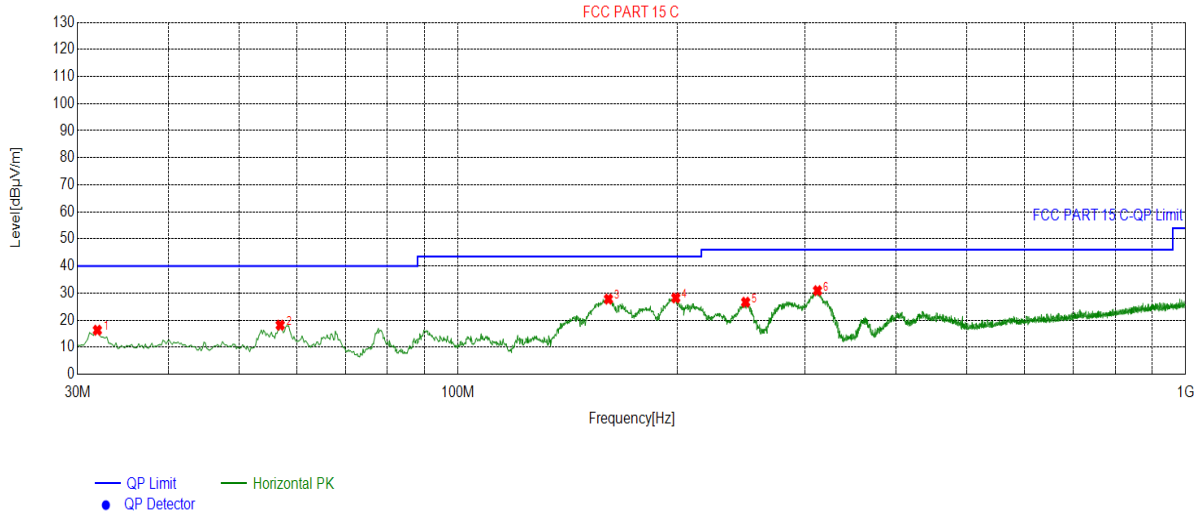
	Only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details
Test Results:	Pass

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. Wireless Laboratory
1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086
t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

1.1.1 Radiated Emission below 1GHz

1.1.1.1 Charge + Transmitting

Test Graph

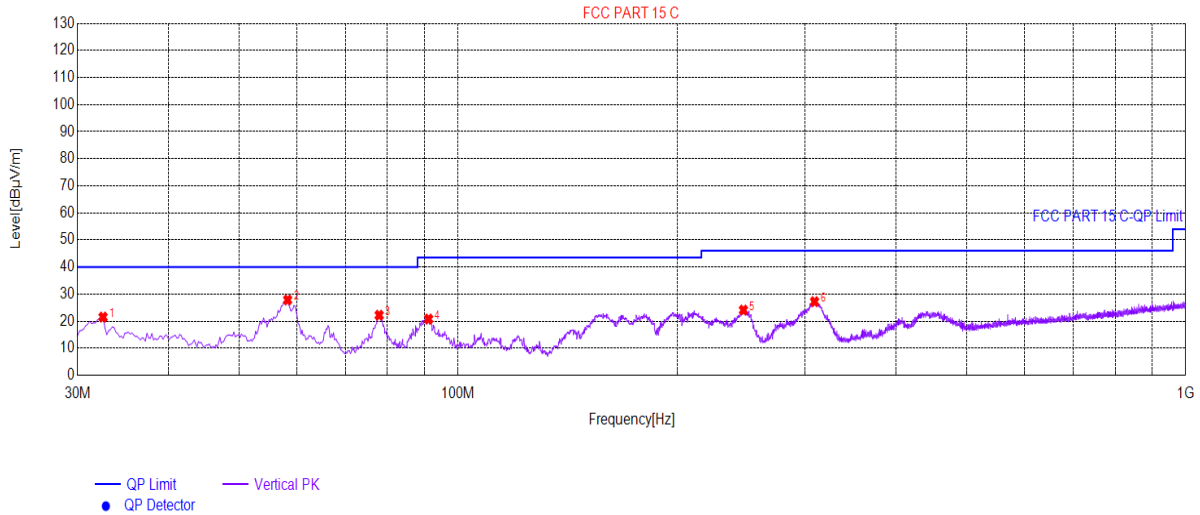


Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	31.9404	16.29	-30.03	40.00	23.71	174	90	Horizontal
2	56.9714	18.15	-31.41	40.00	21.85	226	68	Horizontal
3	160.976	27.78	-34.57	43.50	15.72	235	87	Horizontal
4	199.201	28.22	-31.27	43.50	15.28	249	237	Horizontal
5	248.487	26.63	-29.72	46.00	19.37	241	229	Horizontal
6	311.938	30.90	-27.93	46.00	15.10	179	289	Horizontal

Final Data List

Test Graph



Suspected List

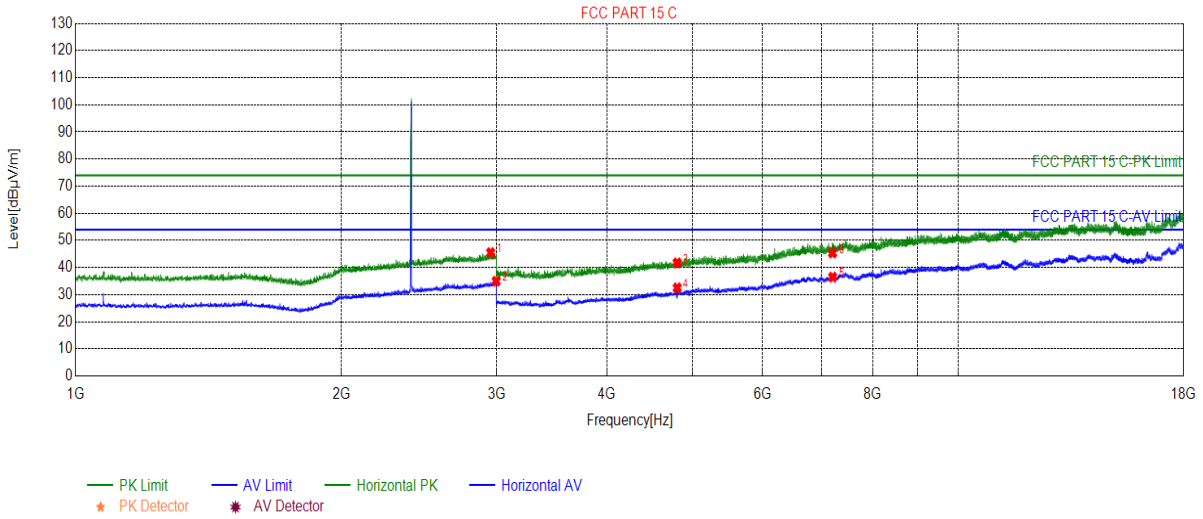
Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	32.5225	21.50	-30.02	40.00	18.50	226	195	Vertical
2	58.3297	27.84	-31.61	40.00	12.16	247	7	Vertical
3	77.9276	22.19	-35.78	40.00	17.81	189	64	Vertical
4	91.1222	20.78	-33.53	43.50	22.72	274	90	Vertical
5	246.741	24.08	-29.79	46.00	21.92	149	30	Vertical
6	309.027	27.20	-28.01	46.00	18.80	186	45	Vertical

Final Data List

1.1.2 Transmitter Emission above 1GHz

1.1.2.1 GFSK_Channel 0

Test Graph



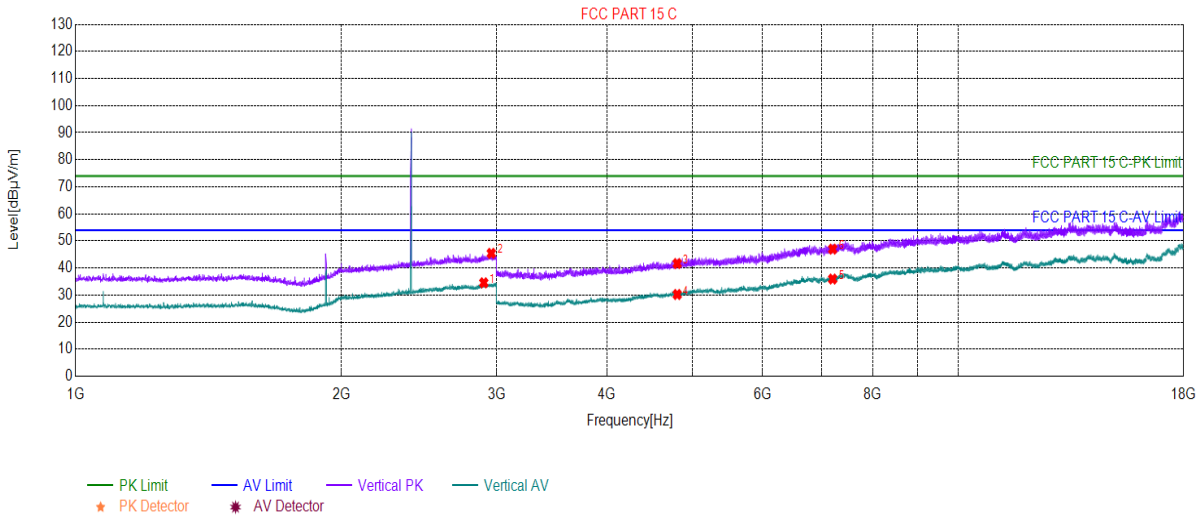
Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2952.98	45.47	10.71	74.00	28.53	158	168	Horizontal
2	2995.99	34.96	10.71	54.00	19.04	157	156	Horizontal
3	4804.00	41.71	-17.18	74.00	32.29	163	163	Horizontal
4	4804.00	32.50	-17.18	54.00	21.50	178	186	Horizontal
5	7206.00	36.46	-9.48	54.00	17.54	159	43	Horizontal
6	7206.00	45.39	-9.48	74.00	28.61	164	231	Horizontal

Final Data List

1.1.2.2 GFSK_Channel 0

Test Graph



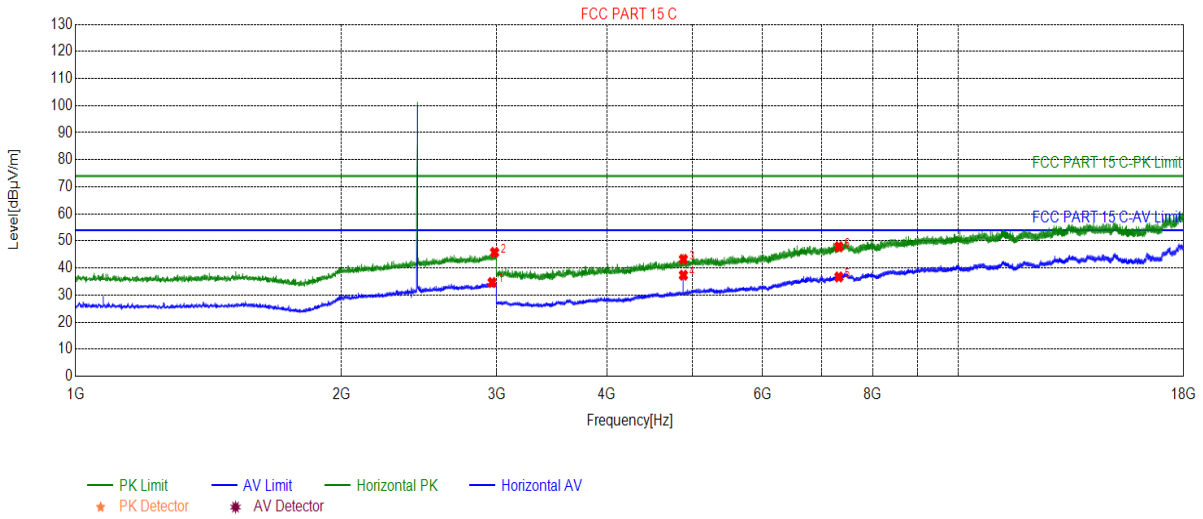
Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2900.47	34.54	10.42	54.00	19.46	275	32	Vertical
2	2957.98	45.43	10.61	74.00	28.57	241	286	Vertical
3	4804.00	41.66	-17.18	74.00	32.34	263	250	Vertical
4	4804.00	30.23	-17.18	54.00	23.77	271	38	Vertical
5	7206.00	35.93	-9.48	54.00	18.07	249	69	Vertical
6	7206.00	46.99	-9.48	74.00	27.01	281	144	Vertical

Final Data List

1.1.2.3 GFSK_Channel 39

Test Graph



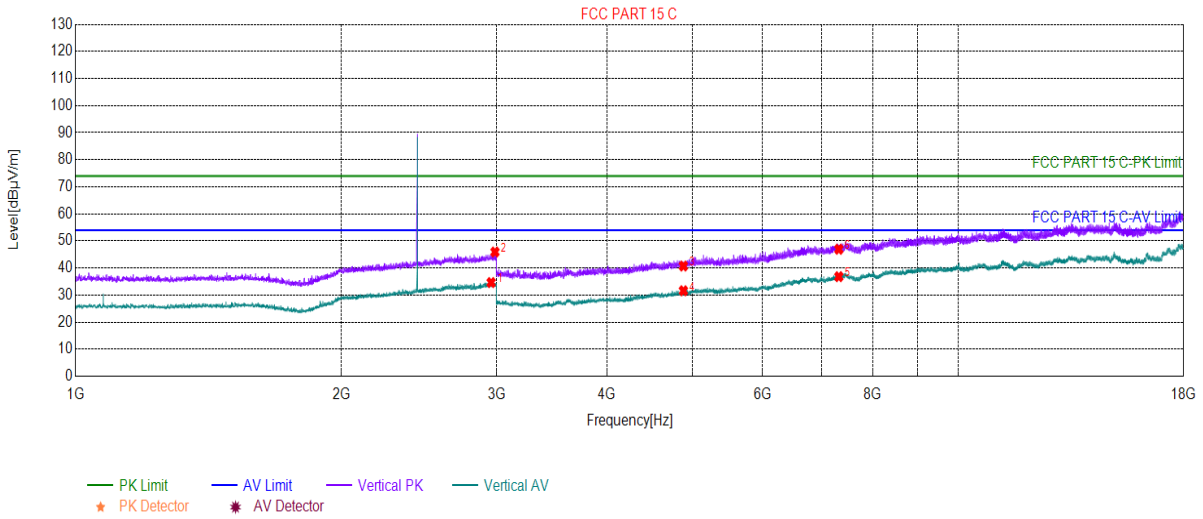
Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2963.99	34.66	10.53	54.00	19.34	157	20	Horizontal
2	2983.49	45.76	10.61	74.00	28.24	163	183	Horizontal
3	4882.00	43.20	-16.80	74.00	30.80	174	1	Horizontal
4	4882.00	37.35	-16.80	54.00	16.65	168	1	Horizontal
5	7323.00	36.70	-9.27	54.00	17.30	176	1	Horizontal
6	7323.00	47.88	-9.27	74.00	26.12	179	112	Horizontal

Final Data List

1.1.2.4 GFSK_Channel 39

Test Graph



Suspected List

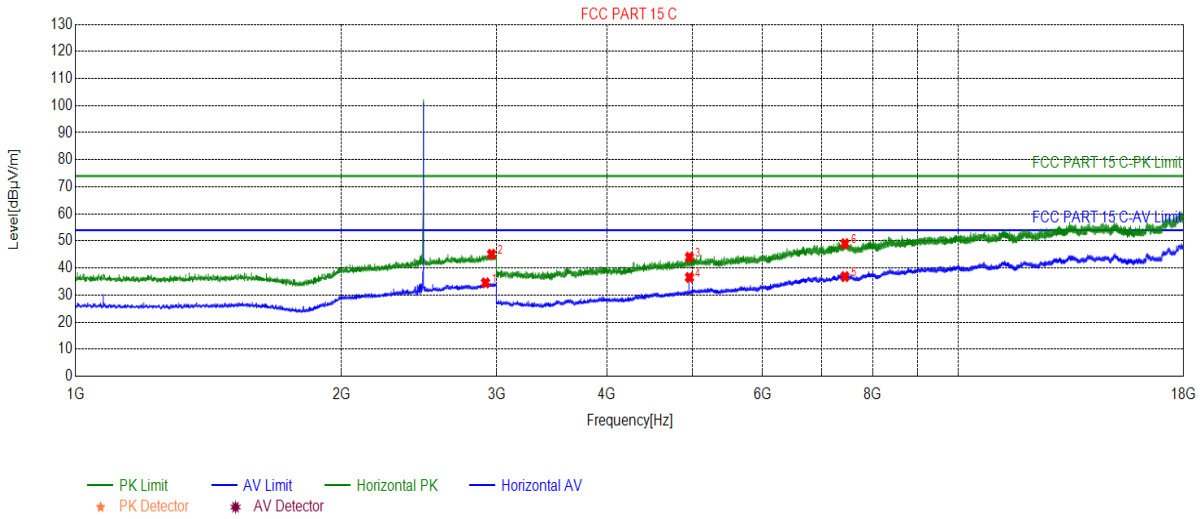
Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2956.98	34.64	10.66	54.00	19.36	245	128	Vertical
2	2986.49	45.92	10.59	74.00	28.08	223	167	Vertical
3	4882.00	40.72	-16.80	74.00	33.28	271	301	Vertical
4	4882.00	31.61	-16.80	54.00	22.39	218	353	Vertical
5	7323.00	36.81	-9.27	54.00	17.19	279	31	Vertical
6	7323.00	46.94	-9.27	74.00	27.06	227	294	Vertical

Final Data List

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. | 1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086 | t (86-29) 6282 7885 | www.sgsgroup.com.cn
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086 | t (86-29) 6282 7885 | sgs.china@sgs.com

1.1.2.5 GFSK_Channel 78

Test Graph



Suspected List

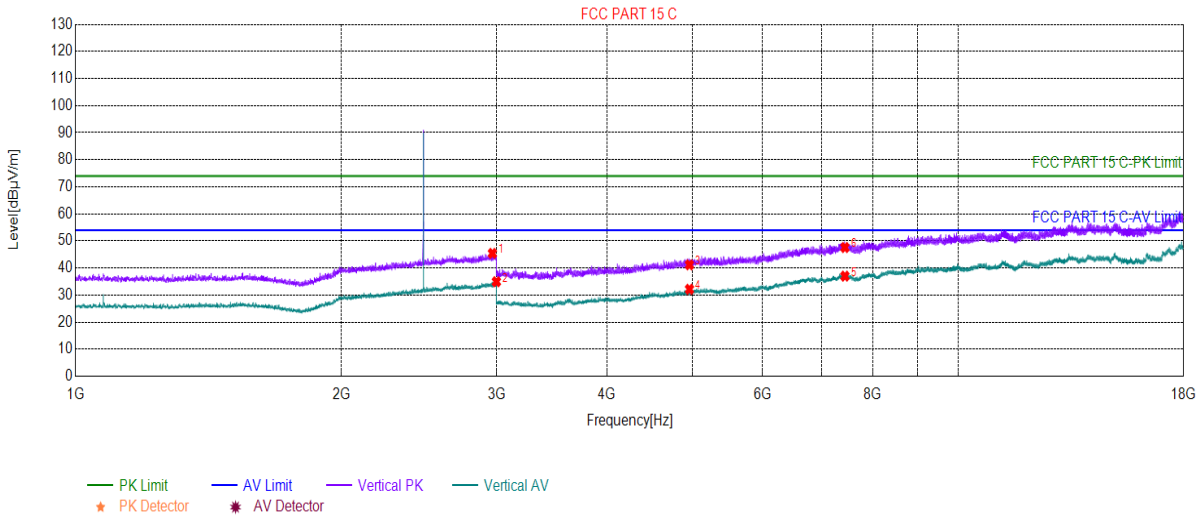
Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2913.47	34.52	10.53	54.00	19.48	163	215	Horizontal
2	2959.99	45.10	10.53	74.00	28.90	179	309	Horizontal
3	4960.00	44.01	-16.28	74.00	29.99	189	7	Horizontal
4	4960.00	36.55	-16.28	54.00	17.45	163	358	Horizontal
5	7440.00	36.82	-8.83	54.00	17.18	178	82	Horizontal
6	7440.00	49.02	-8.83	74.00	24.98	175	52	Horizontal

Final Data List

1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086
t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

1.1.2.6 GFSK_Channel 78

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2966.49	45.41	10.57	74.00	28.59	255	48	Vertical
2	2997.49	34.94	10.74	54.00	19.06	289	21	Vertical
3	4960.00	41.16	-16.28	74.00	32.84	274	196	Vertical
4	4960.00	32.16	-16.28	54.00	21.84	263	196	Vertical
5	7440.00	37.00	-8.83	54.00	17.00	241	61	Vertical
6	7440.00	47.58	-8.83	74.00	26.42	225	159	Vertical

Final Data List

Remark:

1) 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

2) Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz and 18GHz to 25GHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

3)As shown in this section, 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. So, only the peak measurements were shown in the report.

4）All Modes have been tested, but only the worst case data displayed in this report.

4.5 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10: 2013		
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m)	Remark
	30MHz-88MHz	40.0	Quasi-peak
	88MHz-216MHz	43.5	Quasi-peak
	216MHz-960MHz	46.0	Quasi-peak
	960MHz-1GHz	54.0	Quasi-peak
	Above 1GHz	54.0	Average Value
		74.0	Peak Value
Test Setup:			

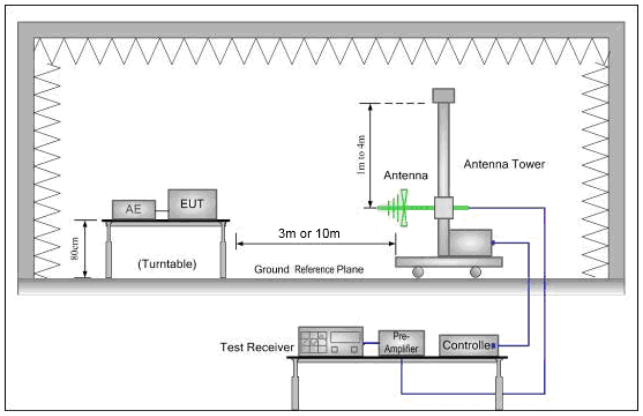


Figure 1. 30MHz to 1GHz

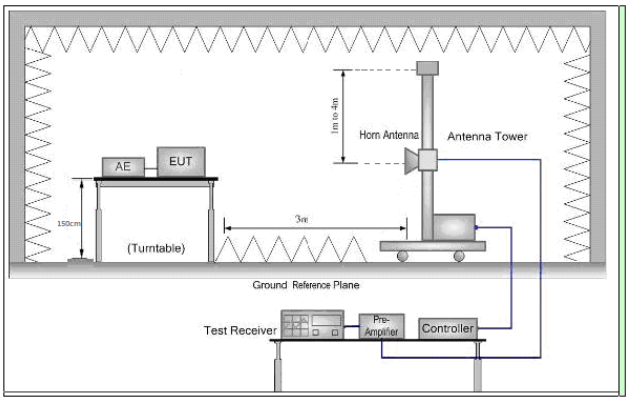


Figure 2. Above 1 GHz

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. | 1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086
t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

Test Procedure:	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 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 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. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel h. Test the EUT in the lowest channel , the Highest channel i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode,And found the X axis positioning which it is worse case. j. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type Charge + Transmitting mode.
Test Configuration:	Measurements Below 1000MHz • RBW = 120 kHz • VBW = 300 kHz • Detector = Peak • Trace mode = max hold Peak Measurements Above 1000 MHz • RBW = 1 MHz • VBW ⩾ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold Average Measurements Above 1000MHz • RBW = 1 MHz • VBW = 10 Hz, when duty cycle is no less than 98 percent. • VBW ⩾ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

Final Test Mode:	Through Pre-scan, find the DH5 of data type and GFSK modulation is the worst case. Pretest the EUT at Charge + Transmitting mode, Only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details
Test Results:	Pass

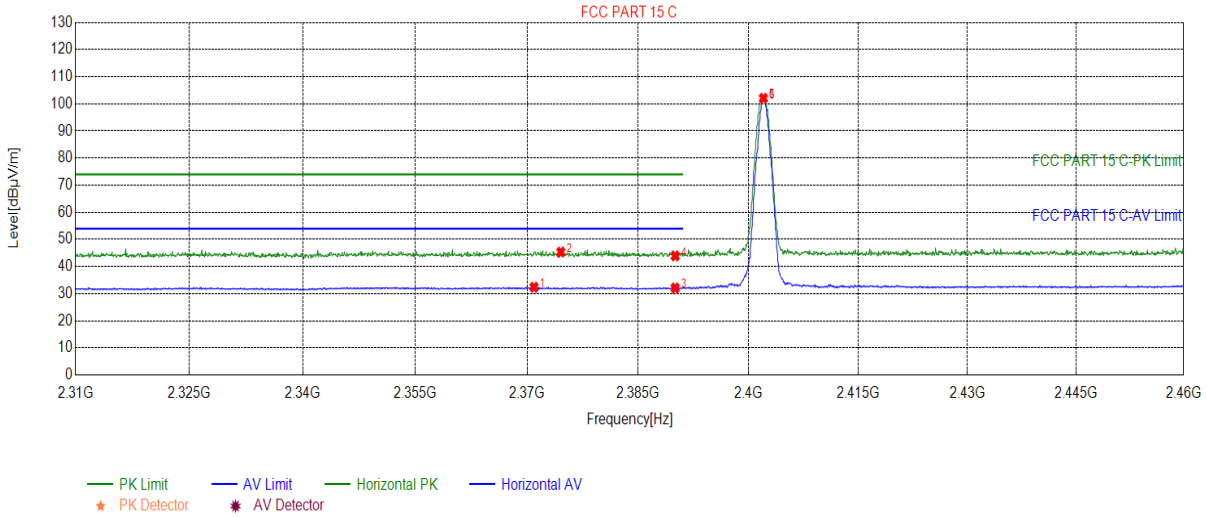
SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. Wireless Laboratory
1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086
t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

4.5.1 Test Plots

1.1.2.7 Worst Case Mode (GFSK(DH5))

1.1.2.8 GFSK_Channel 0

Test Graph



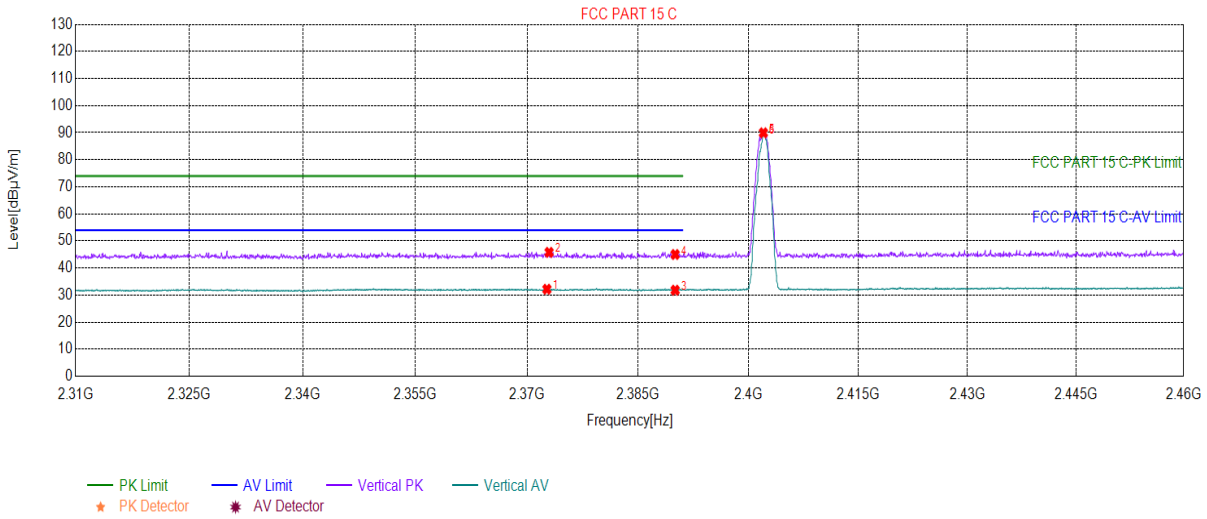
Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2370.93	32.38	8.06	54.00	21.62	154	336	Horizontal
2	2374.53	45.34	7.96	74.00	28.66	178	340	Horizontal
3	2390.00	32.09	7.98	54.00	21.91	168	315	Horizontal
4	2390.00	43.92	7.98	74.00	30.08	194	68	Horizontal
5	2402.00	102.05	8.06	0.00	-102.05	176	207	Horizontal
6	2402.00	101.92	8.06	0.00	-101.92	153	207	Horizontal

Final Data List

1.1.2.9 GFSK_Channel 0

Test Graph



Suspected List

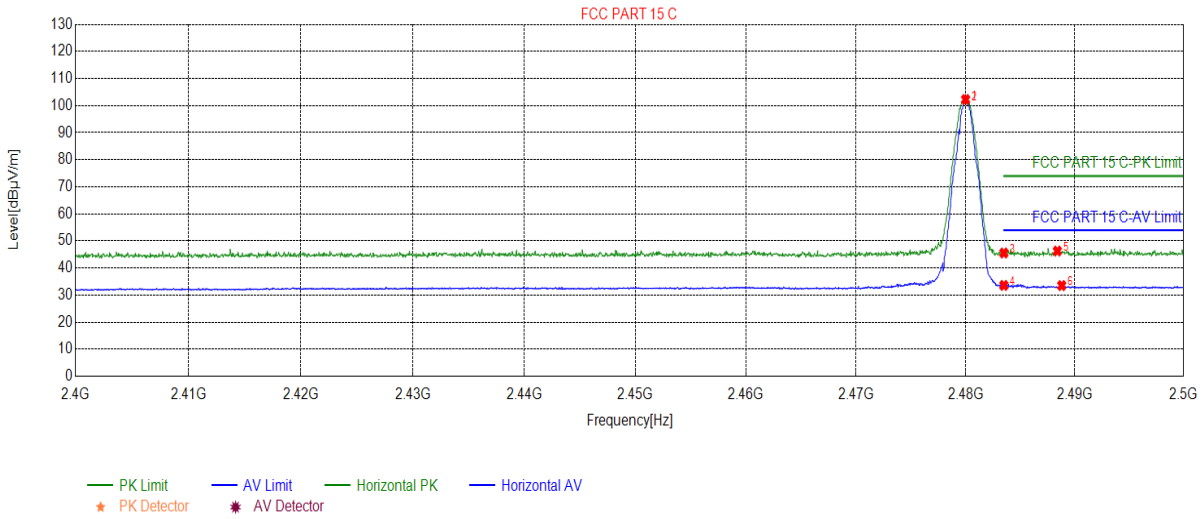
Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2372.65	32.18	8.01	54.00	21.82	265	114	Vertical
2	2372.95	45.80	8.00	74.00	28.20	229	64	Vertical
3	2390.00	31.81	7.98	54.00	22.19	241	304	Vertical
4	2390.00	45.01	7.98	74.00	28.99	262	321	Vertical
5	2402.00	89.95	8.06	0.00	-89.95	224	275	Vertical
6	2402.00	89.76	8.06	0.00	-89.76	278	272	Vertical

Final Data List

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. | 1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086 | t (86-29) 6282 7885 | www.sgsgroup.com.cn
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086 | t (86-29) 6282 7885 | sgs.china@sgs.com

1.1.2.10 GFSK_Channel 78

Test Graph



Suspected List

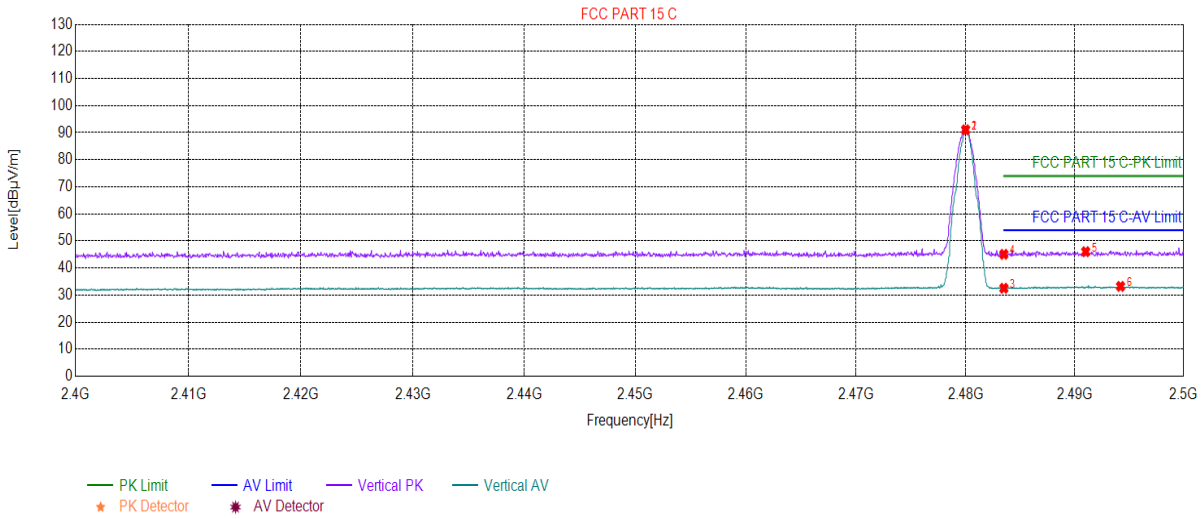
Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2480.00	102.25	8.54	0.00	-102.25	157	207	Horizontal
2	2480.00	101.93	8.54	0.00	-101.93	196	207	Horizontal
3	2483.50	45.56	8.50	74.00	28.44	178	231	Horizontal
4	2483.50	33.58	8.50	54.00	20.42	196	214	Horizontal
5	2488.39	46.29	8.58	74.00	27.71	163	75	Horizontal
6	2488.79	33.52	8.59	54.00	20.48	159	207	Horizontal

Final Data List

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. | 1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086 | t (86-29) 6282 7885 | www.sgsgroup.com.cn
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086 | t (86-29) 6282 7885 | sgs.china@sgs.com

1.1.2.11 GFSK_Channel 78

Test Graph



Suspected List

Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2480.00	91.06	8.54	0.00	-91.06	225	278	Vertical
2	2480.00	90.94	8.54	0.00	-90.94	241	275	Vertical
3	2483.50	32.54	8.50	54.00	21.46	263	28	Vertical
4	2483.50	45.07	8.50	74.00	28.93	278	113	Vertical
5	2490.99	46.06	8.62	74.00	27.94	254	41	Vertical
6	2494.19	33.22	8.59	54.00	20.78	266	41	Vertical

Final Data List

Remark:
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
All Modes have been tested, but only the worst case data displayed in this report.

5 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Radiated Spurious emission test	±4.8dB (30MHz-1GHz)
		±5.2dB (1GHz-6GHz)
		±5.5dB (6GHz-18GHz)
		±5.02dB (18GHz-40GHz)
2	Conduct emission test	±3.4 dB (9KHz- 30MHz)

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. Wireless Laboratory
1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086
t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

6 Equipment List

RSE&RE&CE Test System					
Equipment	**Manufacturer**	**Model No.**	**Cal Date**	**Cal Due Date**	**Inventory No.**
Semi-Anechoic Chamber	Brilliant-emc	966	NCR	NCR	XAW03-35-01
MXA signal analyzer	Keysight	N9020A	2020-04-02	2021-04-02	XAW01-06-01
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	2020-04-02	2021-04-02	XAW01-03-02
Test receiver	ROHDE&SCHWARZ	ESR	2020-09-11	2021-09-10	XAW01-08-01
Receiving antenna	Rosenberger	VULB 9163	2019-10-13	2021-10-12	XAW01-09-01
Receiving antenna	Rosenberger	BBHA 9120D	2019-10-13	2021-10-12	XAW01-09-02
Receiving antenna	Rosenberger	BBHA 9170	2019-10-13	2021-10-12	XAW01-09-03
Directional antenna rack controller	Max-Full	MF-7802BS	NCR	NCR	XAW03-03-01
High-speed antenna rack controller	Max-Full	MF-7802	NCR	NCR	XAW03-04-01
Filter bank	Tonscend	JS0806-F	NCR	NCR	XAW03-05-01
Filter bank	Tonscend	JS0806s	NCR	NCR	XAW03-05-02
Amplifier	Tonscend	TAP00903040	2020-10-26	2021-10-25	XAW01-41-01
Amplifier	Tonscend	TAP01018048	2020-10-26	2021-10-25	XAW01-41-02
Amplifier	Tonscend	TAP18040048	2020-10-26	2021-10-25	XAW01-41-03
Amplifier	Shanghai Steed	YX28980930	2020-10-26	2021-10-25	XAW01-41-06
Artificial network	ROHDE&SCHWARZ	ENV216	2020-08-04	2021-08-03	XAW01-19-02
Temperature and humidity meter	MingGao	TH101B	2020-06-11	2021-05-11	XAW01-01-01
Measurement Software	Tonscend	TS+ RSE&RE	NCR	NCR	XAW02-05-01
Measurement Software	Tonscend	TS+ CE	NCR	NCR	XAW02-05-02

1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086
t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com

7 Photographs - EUT Constructional Details

Refer to Appendix A Setup Photos.

The End

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. Wireless Laboratory
1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi'an, Shaanxi, China 710086
中国·西安·沣东新城科源三路137号康鸿橙方科技园1号楼D单元1层 邮编: 710086
t (86-29) 6282 7885 www.sgsgroup.com.cn
t (86-29) 6282 7885 sgs.china@sgs.com