

TRF No. FCC Part 15.247_R1

Add: West Side of 1/F., Building C, Zone A, Fuyuan New Factory, Jiujiu Industrial Park, Minzhu, Shatou, Shajing, Bao'an District, Shenzhen, Guangdong, China



2DH5 CH00-SE
 Ref Level
 18.23 dBm
 Offset
 8.23 dB
 RBW
 100 kHz

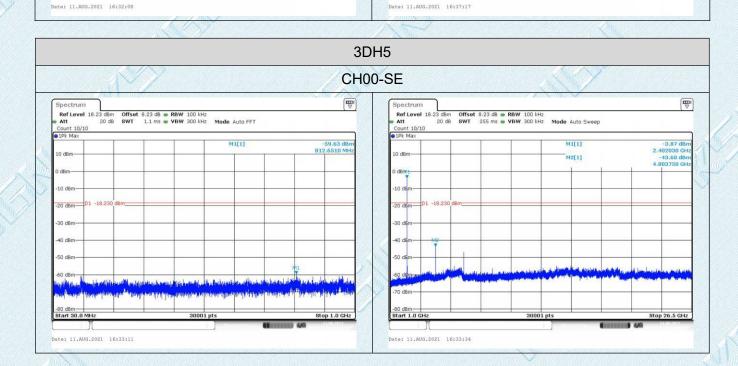
 Att
 20 dB
 SWT
 255 ms
 WBW
 300 kHz
 M2[1] -44.42 dB 803750 GF M2[1] -44.42 dB 803750 GF Date: 11.AUG.2021 16:24:22 Date: 11.AUG.2021 16:24:22 CH39-SE M1[1] CH78-SE
 Ref Level
 18.23 dBm
 Offset
 8.23 dB
 RBW
 100 kHz

 Att
 20 dB
 SWT
 255 ms
 VBW
 300 kHz
 Mode
 Auto Sweep
 M1[1] -60.51 dBr 117.7660 MH M2[1]

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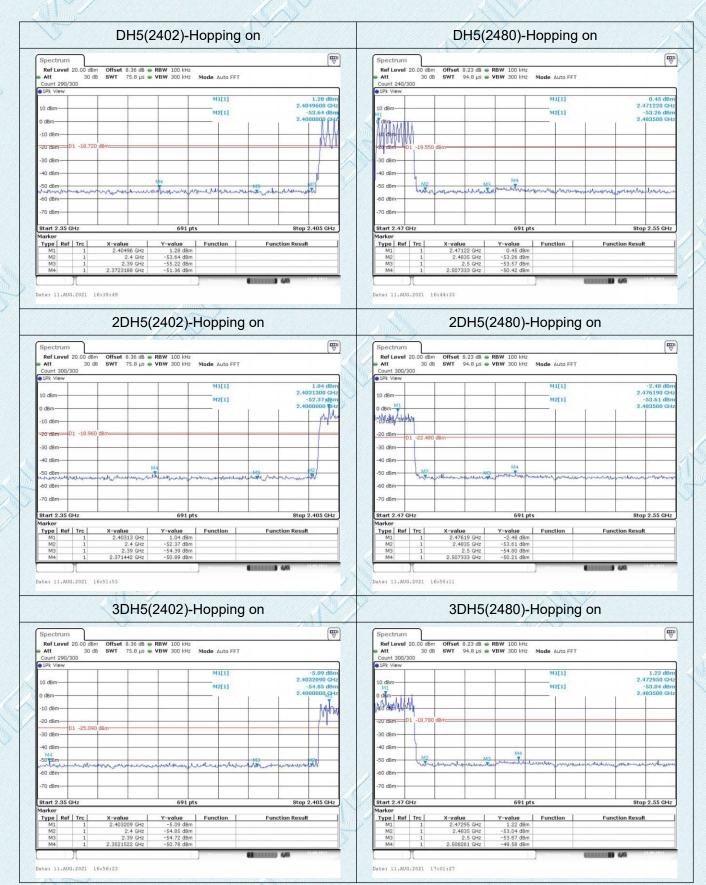


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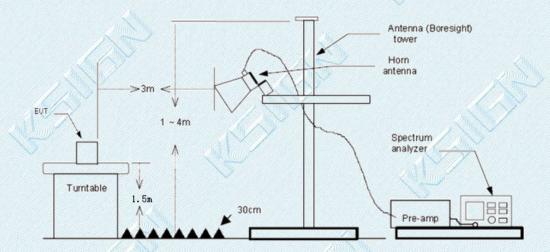
3.8. Band Edge Emissions(Radiated)

Limit

Postrioted Fragues av Bond (MUs)	(dBuV/m)(at 3m)		
Restricted Frequency Band (MHz)	Peak	Average	
2310 ~2390	74	54	
2483.5 ~2500	74	54	

Note: All restriction bands have been tested, only the worst case is reported.

Test Configuration



Test Procedure

- 1. The EUT was setup and tested according to ANSI C63.10:2020 requirements.
- 2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
- 3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
- 4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2020on radiated measurement.
- The receiver set as follow: RBW=1MHz, VBW=3MHz PEAK detector for Peak value. RBW=1MHz, VBW=10Hz with PEAK Detector for Average Value.

Test Mode

Please refer to the clause 2.2.

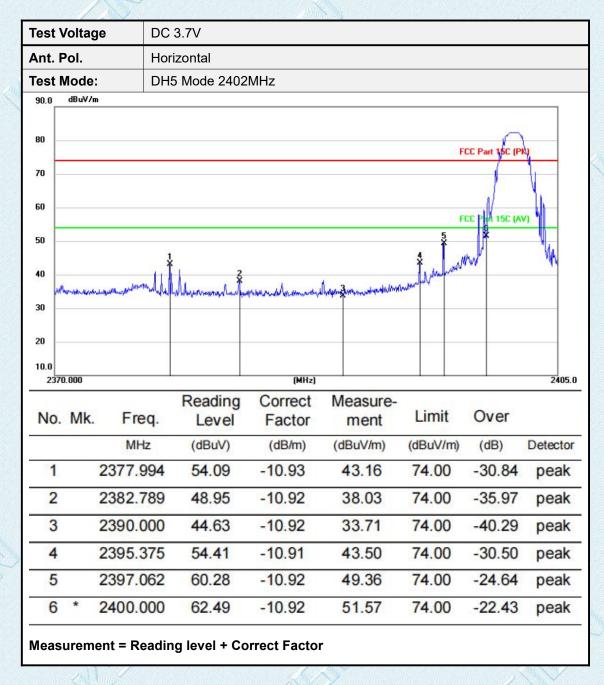
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Note:

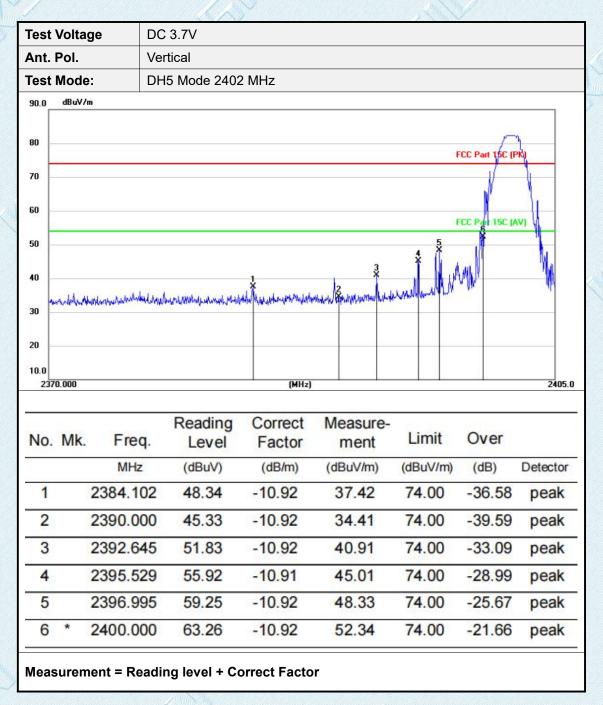
- 1. Measurement = Reading level + Correct Factor
- 2. Correct Factor=Antenna Factor + Cable Loss Preamplifier Factor
- 3.Pre-scan DH5, 2DH5 and 3DH5 modulation, and found the DH5 modulation which it is worse case, so only show the test data for worse case.



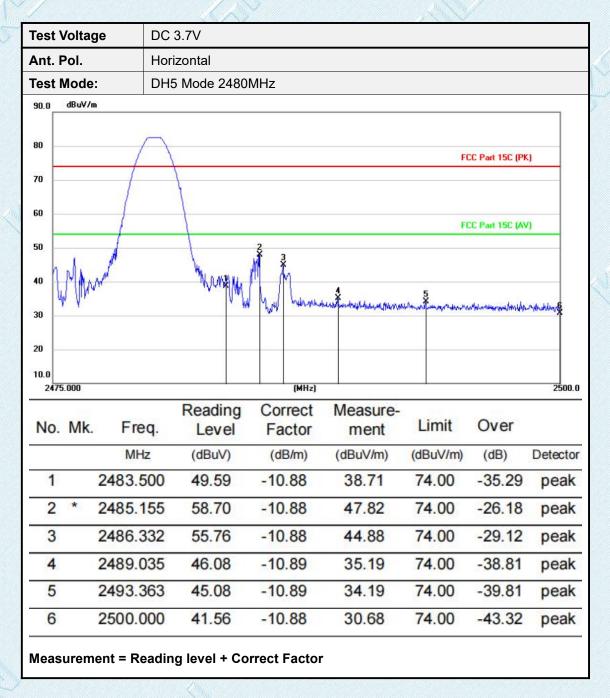
TRF No. FCC Part 15.247_R1

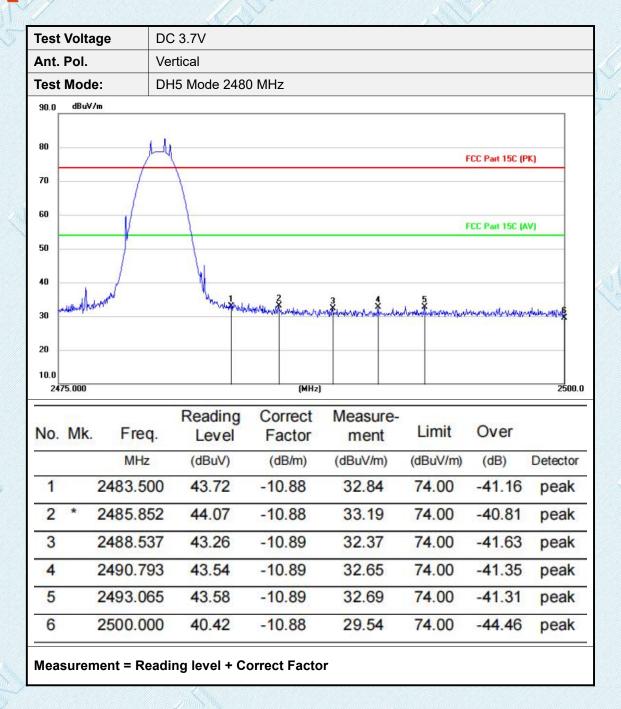
Add:West Side of 1/F., Building C, Zone A, Fuyuan New Factory, Jiujiu Industrial Park, Minzhu, Shatou, Shajing, Bao'an District, Shenzhen, Guangdong, China



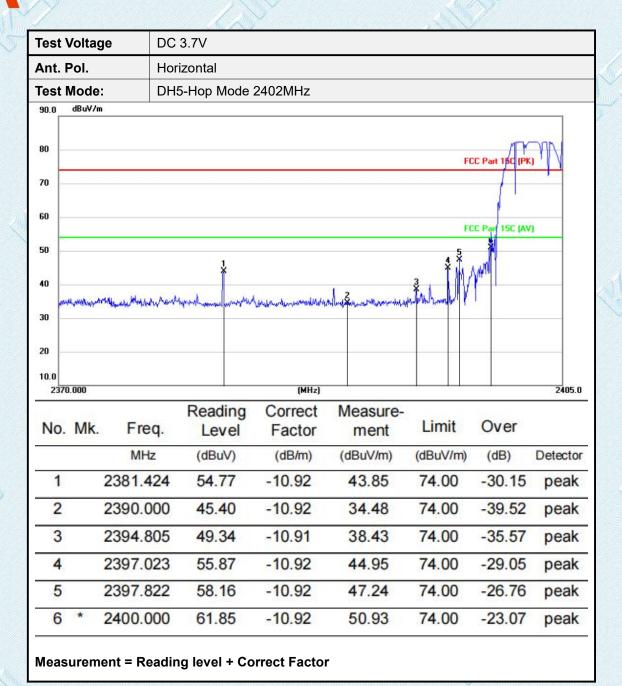


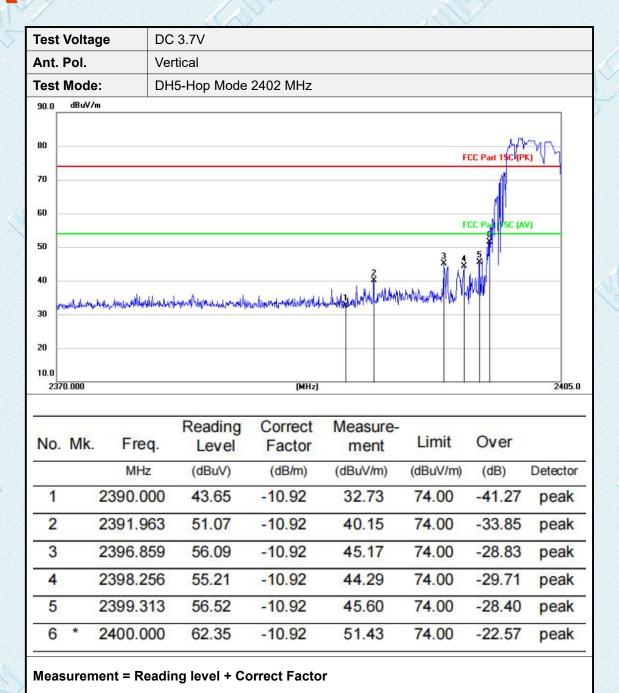










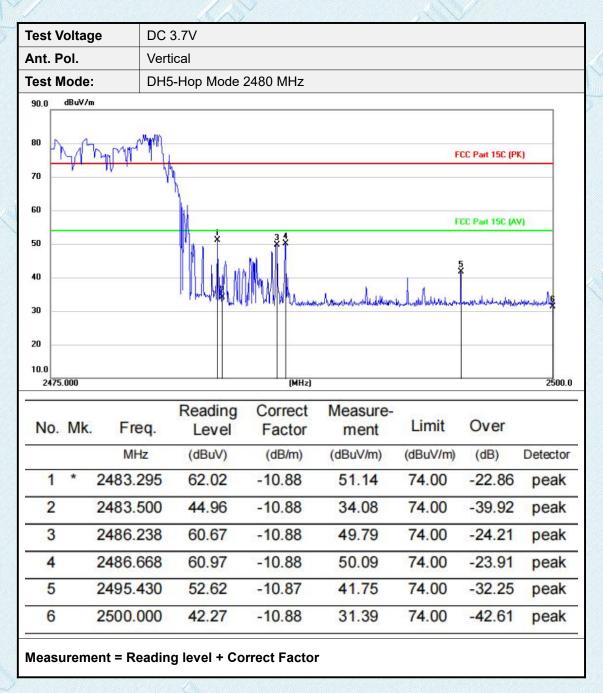


K516N[®]

Report No.: KS2108S2480E

Test \	Voltage	DC 3	5.7V					
Ant. F	Pol.	Horiz	ontal					
Test I	Mode:	DH5-	Hop Mode	2480MHz				
90.0	dBuV/m							
80 70	The Market					ı	FCC Part 15C (F	PK)
60			\			11	FCC Part 15C (/	AV)
50			, 2 X	3 4 5 1 4 5				
			"WALL	M. M. I				
40			W		A STATE OF THE STATE OF THE			1,1111111111111111111111111111111111111
30			1 1	M Whi	an white free free was the same	hopindanistychodolyk	de Maria di di madamatan politica	who had had
			\\ \[\] \\ \\ \ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\		ann of the gradient of the said	houndarrisht-lidge	de Model de Contraction de la	ornopenturbis.
30 – 20 – 10.0	5.000		V [*	(MHz)	ann an dhigh an dhear an agus tha an dh	homedownidesh-dished	de Marie dinastro e produce de la constanta de	2500.
30 20 10.0 2475	5.000 Mk. Fre		Reading Level	(MHz) Correct Factor	Measure- ment	Limit	Over	
30 20 10.0 2475	8000 F000	eq.		Correct	Measure-			
30 20 10.0 2475	Mk. Fre	eq. Iz	Level	Correct Factor	Measure- ment	Limit	Over	2500.
30 20 10.0 2475 No.	Mk. Fre	eq. Iz 500	Level (dBuV)	Correct Factor (dB/m)	Measure- ment (dBuV/m)	Limit (dBuV/m)	Over (dB)	2500.
30 20 10.0 2475 No.	Mk. Fre	eq. dz 500 023	(dBuV) 47.10	Correct Factor (dB/m) -10.88	Measure- ment (dBuV/m) 36.22	Limit (dBuV/m) 74.00	Over (dB) -37.78	2500. Detector peak
30 20 10.0 2475 No.	Mk. Fre	eq. 500 023	(dBuV) 47.10 60.71	Correct Factor (dB/m) -10.88	Measure- ment (dBuV/m) 36.22 49.83	Limit (dBuV/m) 74.00 74.00	Over (dB) -37.78 -24.17	Detector peak peak
30 20 10.0 2475 No. 1 2	Mk. Fre	eq. 500 023 660	Level (dBuV) 47.10 60.71 60.54	Correct Factor (dB/m) -10.88 -10.88	Measure- ment (dBuV/m) 36.22 49.83 49.66	Limit (dBuV/m) 74.00 74.00 74.00	Over (dB) -37.78 -24.17 -24.34	Detector peak peak peak







3.9. Radiated Spurious Emissions

Limit

Radiated Emission Limits (9 kHz~1000 MHz)

Frequency (MHz)	Field Strength (microvolt/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

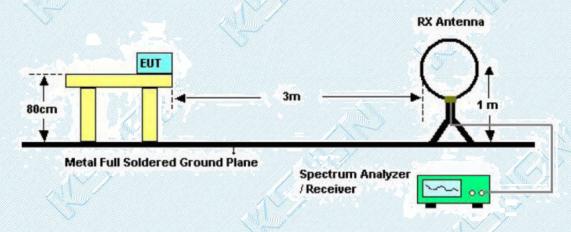
Radiated Emission Limit (Above 1000MHz)

Frequency	Distance Meters(at 3m)			
(MHz)	Peak Average			
Above 1000	74	54		

Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission Level (dBuV/m)=20log Emission Level (uV/m).

Test Configuration

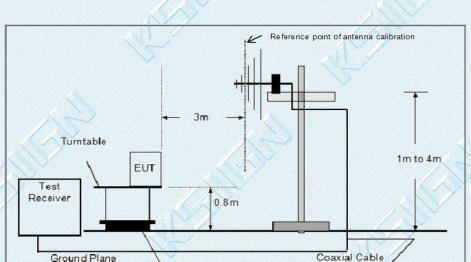


Below 30MHz Test Setup

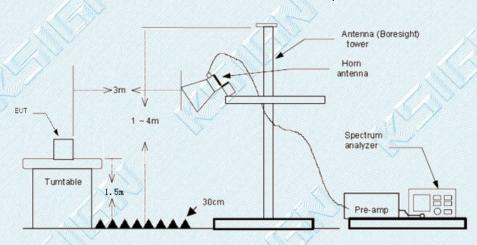
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Below 1000MHz Test Setup



Above 1GHz Test Setup

Test Procedure

- The EUT was setup and tested according to ANSI C63.10:2020
- 2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
- 3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
- 4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
- 5. Set to the maximum power setting and enable the EUT transmit continuously.
- Use the following spectrum analyzer settings
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Below 1 GHz:

RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;

If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

(3) From 1 GHz to 10th harmonic:

RBW=1MHz, VBW=3MHz Peak detector for Peak value.

RBW=1MHz, VBW=10Hz Peak detector for Peak value.

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Test Mode

Please refer to the clause 2.2.

Test Result

9 KHz~30 MHz and 18GHz~25GHz

From 9 KHz~30 MHz and 18GHz~25GHz: Conclusion: PASS

Note:

- Measurement = Reading level + Correct Factor
 Correct Factor=Antenna Factor + Cable Loss Preamplifier Factor
- 2) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.
- 3) The emission levels of other frequencies are very lower than the limit and not show in test report.
- 4) The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
- 5) Pre-scan DH5, 2DH5 and 3DH5 modulation, found the DH5-CH00 Channel Below 1GHz and found the DH5 modulation which it is worse case for above 1GHz, so only show the test data for worse case.

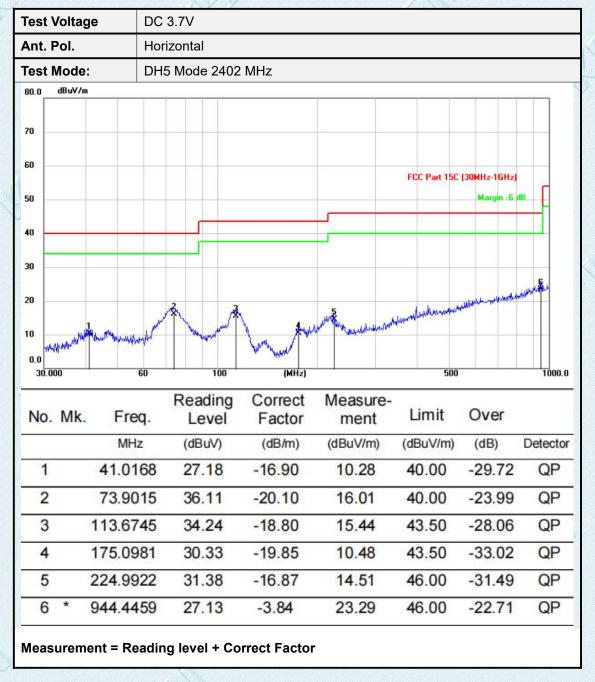
RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

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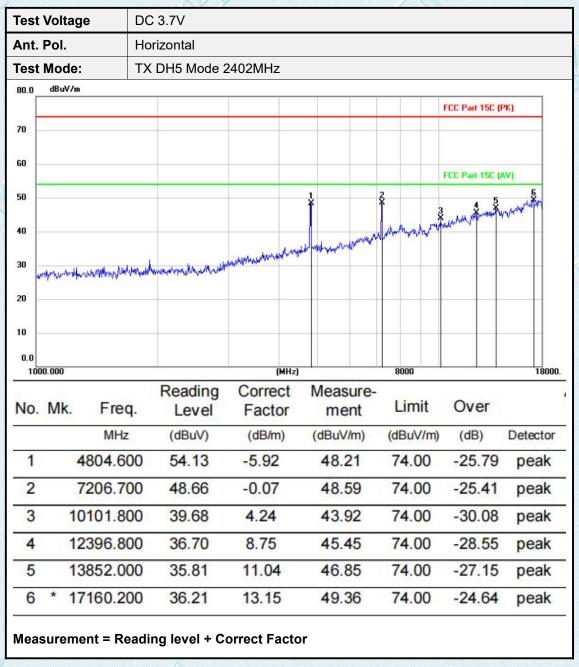






Test Voltage	DC	DC 3.7V						
Ant. Pol.	Ver	Vertical						
Test Mode:	DH	DH5 Mode 2402 MHz						
80.0 dBuV/m								
70								
60					FCC Part 15C (30MHz-1GHz)			
50					rut Part 15t	Margin -6		
30								
40								
30								
10 0.0 30.000	60	100	(MHz)	Colonida James	hadiriya Mahadiriya ka		1000.	
No. Mk.	Freq.	Reading Level	Correct	Measure- ment	Limit	Over		
INO. IVIK.	MHz	(dBuV)	020000000	86.150.0018	(dBuV/m)	(dB)	Detector	
4 04	Dieser Mi		(dB/m)	(dBuV/m)				
35 (5),(1	.9321	42.64	-18.64	24.00	40.00	-16.00	QP	
2 72	2.5916	44.93	-19.97	24.96	40.00	-15.04	QP	
3 * 80	.9557	46.82	-21.30	25.52	40.00	-14.48	QP	
4 109	.6421	40.55	-18.36	22.19	43.50	-21.31	QP	
5 211	.8234	41.34	-17.48	23.86	43.50	-19.64	QP	
6 946	5.7670	27.40	-3.82	23.58	46.00	-22.42	QP	
Measurement	= Readin	g level + Co	orrect Facto	r				

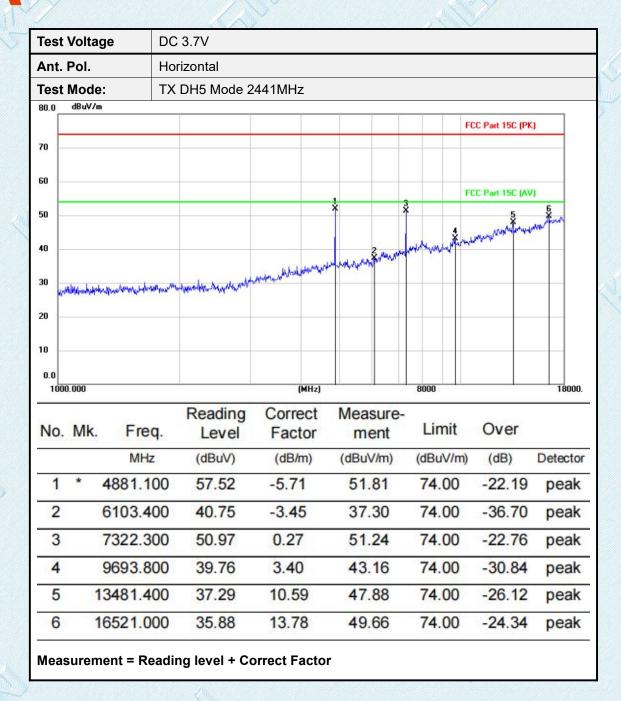






DC 3.7V **Test Voltage** Vertical Ant. Pol. **Test Mode:** TX DH5 Mode 2402MHz dBuV/m FCC Part 15C (PK) 70 60 FCC Part 15C (AV) 50 40 30 20 10 0.0 1000.000 (MHz) 8000 18000. Correct Reading Measure-Limit Over No. Mk. Freq. Level Factor ment MHz (dBuV) (dB/m) (dBuV/m) (dBuV/m) (dB) Detector 4804.600 50.98 -28.941 -5.9245.06 74.00 peak 2 6982.300 40.17 -0.7639.41 74.00 -34.59peak 3 8094.100 40.19 2.05 42.24 74.00 -31.76peak 11166.000 38.55 6.09 44.64 74.00 -29.364 peak 5 13799.300 -26.0436.98 10.98 47.96 74.00 peak 6 17243.500 37.71 13.21 50.92 74.00 -23.08peak

Measurement = Reading level + Correct Factor





DC 3.7V **Test Voltage** Vertical Ant. Pol. Test Mode: TX DH5 Mode 2441MHz dBuV/m FCC Part 15C (PK) 70 60 FCC Part 15C (AV) 50 40 30 20 10 0.0 1000.000 (MHz) 8000 Reading Correct Measure-Limit Over No. Mk. Freq. Level Factor ment MHz (dBuV) (dB/m) (dBuV/m) (dBuV/m) (dB) Detector 1 4882.800 53.79 -5.7148.08 74.00 -25.92peak 2 7322.300 44.27 0.2744.54 74.00 -29.46peak 3 8082.200 40.91 2.05 42.96 74.00 -31.04peak 4 11475.400 37.70 6.81 44.51 74.00 -29.49peak 5 13908.100 47.53 74.00 -26.4736.41 11.12 peak 17008.900 6 36.72 13.03 49.75 74.00 -24.25peak

Measurement = Reading level + Correct Factor



Test Voltage DC 3.7V Ant. Pol. Horizontal **Test Mode:** TX DH5 Mode 2480MHz dBuV/m 80.0 FCC Part 15C (PK) 70 60 FCC Part 15C (AV) 50 40 30 20 10 0.0 1000.000 (MHz) 8000 Correct Reading Measure-Limit Over Freq. No. Mk. Level Factor ment MHz (dBuV) (dB/m) (dBuV/m) (dBuV/m) (dB) Detector 4959.300 1 57.21 -5.5151.70 74.00 -22.30peak 2 7439.600 51.46 0.64 52.10 74.00 -21.90peak 3 10103.500 39.44 4.24 43.68 74.00 -30.32peak 4 12333.900 37.28 8.60 45.88 74.00 -28.12peak 5 13955.700 36.68 11.17 47.85 74.00 -26.15peak 6 17722,900 36.21 13,49 49.70 74.00 -24.30peak

Measurement = Reading level + Correct Factor



DC 3.7V Test Voltage Ant. Pol. Vertical **Test Mode:** TX DH5 Mode 2480MHz dBuV/m 80.0 FCC Part 15C (PK) 70 60 FCC Part 15C (AV) 50 40 30 20 10 1000.000 (MHz) 8000 18000 Correct Reading Measure-Limit Over No. Mk. Freq. Level Factor ment MHz (dBuV) (dBuV/m) (dBuV/m) (dB) (dB/m) Detector 4959.300 55.89 -5.5174.00 -23.6250.38 peak 2 47.48 7439.600 46.84 0.64 74.00 -26.52peak 3 9681.900 39.48 3.37 42.85 74.00 -31.15peak 11602.900 37.99 7.06 45.05 74.00 -28.954 peak 5 14028.800 35.79 11.19 46.98 74.00 -27.02peak 6 16515.900 35.03 13.79 48.82 74.00 -25.18peak

Note:

- 1.All test modes had been tested. The GFSK(DH5) modulation is the worst case and recorded in the report.
- 2. 18GHz-26.5GHz is the background of the site, there is no radiated spurious.

Measurement = Reading level + Correct Factor

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3.10. Conducted Emission

Limit

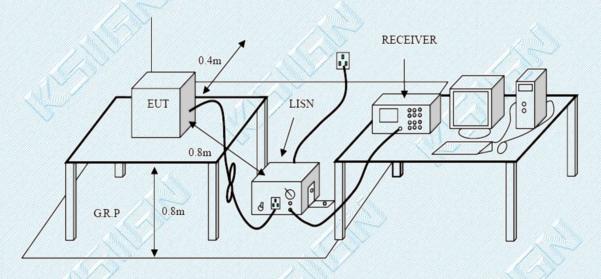
Conducted Emission Test Limit

	Maximum RF Line Voltage (dBμV)			
Frequency	Quasi-peak Level	Average Level		
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *		
500kHz~5MHz	56	46		
5MHz~30MHz	60	50		

Notes:

- (1) *Decreasing linearly with logarithm of the frequency.
- (2) The lower limit shall apply at the transition frequencies.
- (3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

Test Configuration



Test Procedure

- 1. The EUT was setup according to ANSI C63.10:2020 requirements.
- 2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
- 3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50ohm /50uH coupling impedance for the measuring equipment.
 - The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
- 4. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
- 5. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
- 6. Conducted Emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
- 7. During the above scans, the emissions were maximized by cable manipulation.

Test Mode:

Please refer to the clause 2.2

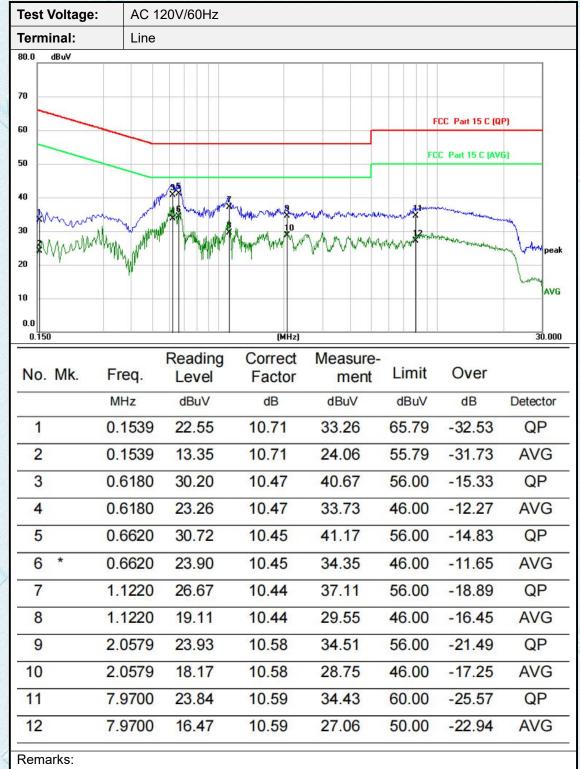
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Test Results

Pre-scan DH5, 2DH5,3DH5 modulation, and found the DH5 modulation 2402MHz which it is worse case, so only show the test data for worse case.



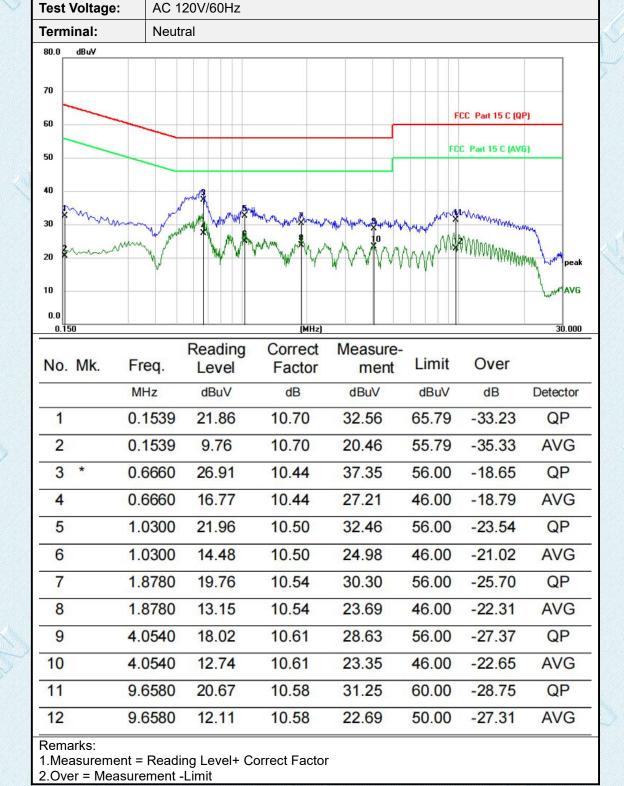
^{1.}Measurement = Reading Level+ Correct Factor

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^{2.}Over = Measurement -Limit





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3.11. Pseudorandom Frequency Hopping Sequence

LIMIT

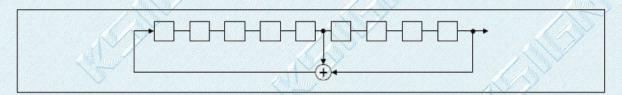
FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly 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 hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

TEST RESULTS

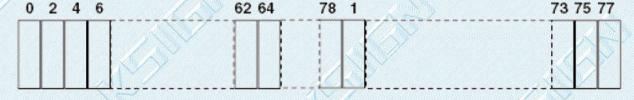
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the friststage. The sequence begins with the frist one of 9 consecutive ones, for example: the 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 explame of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

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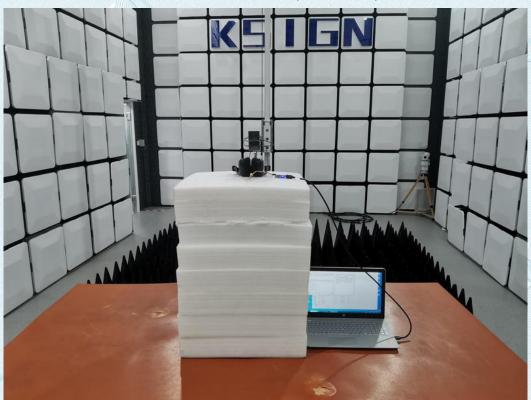
Add:West Side of 1/F., Building C, Zone A, Fuyuan New Factory, Jiujiu Industrial Park, Minzhu, Shatou, Shajing, Bao'an District, Shenzhen, Guangdong, China



4. EUT TEST PHOTOS



Radiated Measurement (Above 1GHz)



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RF Conducted



CONDUCTED EMISSION



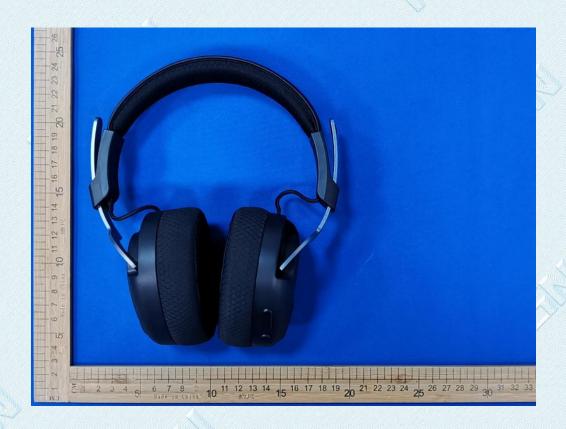
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5.PHOTOGRAPHS OF EUT CONSTRUCTIONAL





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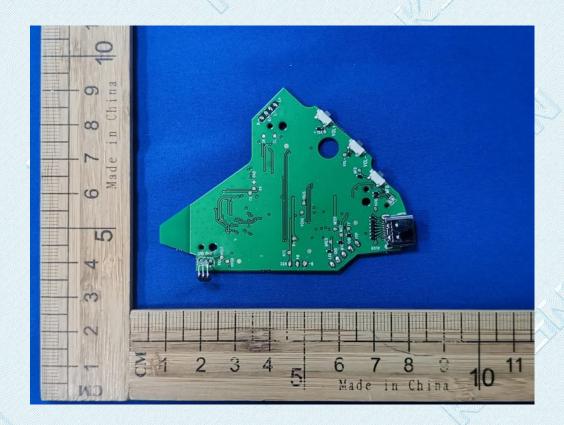






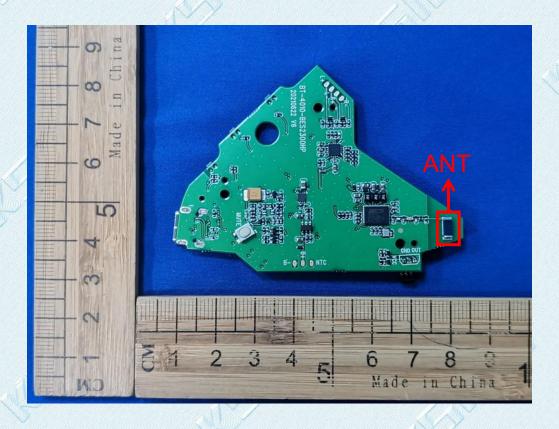


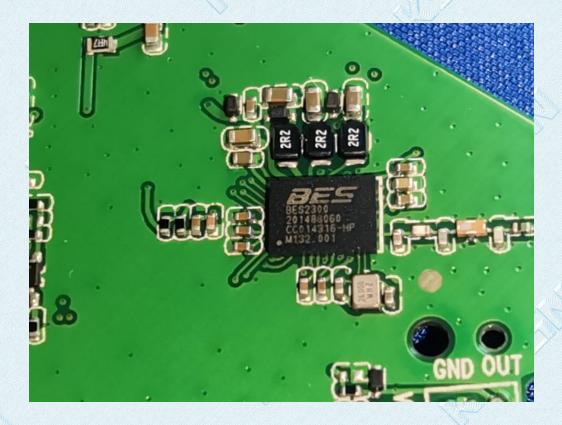
















--THE END--

TRF No. FCC Part 15.247_R1

Add: West Side of 1/F., Building C, Zone A, Fuyuan New Factory, Jiujiu Industrial Park, Minzhu, Shatou, Shajing, Bao'an District, Shenzhen, Guangdong, China