

Room 101 Building B, No. 7, Lanqing 1st Road, Luhu Community, Guanhu Subdistrict, Longhua District, Shenzhen, Guangdong, China

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	TEST REPORT				
Report No. ·····:	CTC2024145202				
FCC ID······	2BA5U-RRU32121M				
Applicant·····:	Shenzhen RoyalRay Science and T	echnology Co., Ltd			
Address······	West Wing, 4F, A1 Building, Xiufeng I Road, Longgang District, Shenzhen, (•			
Manufacturer	Shenzhen RoyalRay Science and Teo	chnology Co., Ltd			
Address	West Wing, 4F, A1 Building, Xiufeng I Road, Longgang District, Shenzhen, (•			
Product Name·····:	Ex10 UHF RFID Module(1-Port)				
Trade Mark······:	1				
Model/Type reference······	RRU32121M				
Listed Model(s) ······	RRU72121M, RRU52121M				
Standard······:	FCC CFR Title 47 Part 15 Subpart C	Section 15.247			
Date of receipt of test sample:	Jun. 18, 2024				
Date of testing	Jun. 19, 2024~ Jun. 27, 2024				
Date of issue:	Jun. 28, 2024				
Result:	PASS				
Compiled by: (Printed name+signature)	Terry Su	Tenny Su Bic shang			
Supervised by: (Printed name+signature)	Eric Zhang	Zone shang			
Approved by:		Johnas			
(Printed name+signature)	Totti Zhao				
Testing Laboratory Name:	CTC Laboratories, Inc.				
Address	Room 101 Building B, No. 7, Lanqing 1st Road, Luhu Community, Guanhu Subdistrict, Longhua District, Shenzhen, Guangdong, China				
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to claim product endorsement by CTC. The test results in the report only apply to the tested sample. The test report shall be invalid without all the signatures of testing engineers, reviewer and approver. Any objections must be raised to CTC within 15 days since the date when the report is received. It will not be taken into consideration beyond this limit. The test report merely correspond to the test sample.



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1. TEST SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.247: Operation within the bands of 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.

RSS 247 Issue 3: Standard Specifications for Frequency Hopping Systems (FHSs) and Digital Transmission Systems (DTSs) Operating in the Bands 902-928MHz, 2400-2483.5MHz and 5725-5850MHz. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

1.2. Report version

Revised No.	Report No.	Date of issue	Description
01	CTC2024105502 Jun. 28, 2024		Original



1.3. Test Description

FCC Part 15 Subpart C (15.247)/ RSS 247 Issue 3						
Test Item	Standard	Section	Decult	Toot Engineer		
rest tiem	FCC IC		Result	Test Engineer		
Antenna Requirement	15.203	/	Pass	Alicia Liu		
Conducted Emission	15.207	RSS-Gen 8.8	Pass	Evan Hu		
Restricted Bands	15.205	RSS-Gen 8.10	Pass	Alicia Liu		
Hopping Channel Separation	15.247(a)(1)	RSS 247 5.1 (b)	Pass	Alicia Liu		
Dwell Time	15.247(a)(1)(i)	RSS 247 5.1 (c)	Pass	Alicia Liu		
Peak Output Power	15.247(b)(2)	RSS 247 5.4 (a)	Pass	Alicia Liu		
Number of Hopping Frequency	15.247(a)(1)(i)	RSS 247 5.1 (c)	Pass	Alicia Liu		
Conducted Band Edge and Spu- rious Emissions	15.247(d)	RSS 247 5.5	Pass	Alicia Liu		
Radiated Band Edge and Spurious Emissions	15.205&15.209& 15.247(d)	RSS 247 5.5	Pass	Alicia Liu		
Radiated Spurious Emission	15.247(d)&15.20 9	RSS 247 5.5& RSS-Gen 8.9	Pass	Alicia Liu		
20dB Bandwidth	15.247(a)(1)(i)	RSS 247 5.1 (c)	Pass	Alicia Liu		

Note: The measurement uncertainty is not included in the test result.

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Add: Room 101 Building B, Room 107, 108, 207, 208, 303 Building A, No. 7, Lanqing 1st Road, Luhu Community, Guanhu Subdistrict, Longhua District, Shenzhen, Guangdong, China (Formerly 2/F., Building 1 and 1-2/F., Building 2, Jiaquan Building, High-Tech Park, Guanlan Sub-District, Longhua New District, Shenzhen, Guangdong, China)

Laboratory accreditation

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

A2LA-Lab Cert. No.: 4340.01

CTC Laboratories, Inc. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

Industry Canada (Registration No.: 9783A, CAB Identifier: CN0029)

CTC Laboratories, Inc. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 9783A on Jan, 2016.

FCC (Registration No.: 951311, Designation Number CN1208)

CTC Laboratories, Inc. 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 inour files. Registration 951311, Aug 26, 2017.

1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the CTC Laboratories, Inc. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Below is the best measurement capability for CTC Laboratories, Inc.



Test Items	Measurement Uncertainty	Notes
20dB Emission Bandwidth	±0.0196%	(1)
Carrier Frequency Separation	±1.9%	(1)
Number of Hopping Channel	±1.9%	(1)
Time of Occupancy	±0.028%	(1)
Max Peak Conducted Output Power	±0.743 dB	(1)
Band-edge Spurious Emission	±1.328 dB	(1)
Conducted RF Spurious Emission	9kHz-1GHz: ±0.746dB 1GHz-26GHz: ±1.328dB	(1)
Conducted Emissions 9kHz~30MHz	±3.08 dB	(1)
Radiated Emissions 30~1000MHz	±4.51 dB	(1)
Radiated Emissions 1~18GHz	±5.84 dB	(1)
Radiated Emissions 18~40GHz	±6.12 dB	(1)

Note (1): This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.6. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	21°C ~ 27°C
Relative Humidity:	40% ~ 60%
Air Pressure:	101kPa



2. GENERAL INFORMATION

2.1. Client Information

Applicant:	Shenzhen RoyalRay Science and Technology Co., Ltd
Address:	West Wing, 4F, A1 Building, Xiufeng Industrial Park, No.2 Xiufeng Road, Longgang District, Shenzhen, China
Manufacturer:	Shenzhen RoyalRay Science and Technology Co., Ltd
Address:	West Wing, 4F, A1 Building, Xiufeng Industrial Park, No.2 Xiufeng Road, Longgang District, Shenzhen, China

2.2. General Description of EUT

Product Name:	Ex10 UHF RFID Module(1-Port)
Trade Mark:	/
Model/Type reference:	RRU32121M
Listed Model(s):	RRU72121M, RRU52121M
Model Different:	All these models are identical in the same PCB, layout and electrical circuit, The only difference is the model name
Power supply:	3.6~5.5Vdc from PCB board
Hardware version:	/
Software version:	1
RF ID Specification	
Modulation:	ASK
Operation frequency:	902.75MHz ~ 927.25MHz
Channel number:	50
Channel separation:	0.5MHz
Antenna type:	Ceramic Antenna
Antenna gain:	3.81dBi

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2.3. Accessory Equipment information

Equipment Information						
Name	Model	S/N	Manufacturer			
Notebook	ThinkPad T430	MP246QDR	Lenovo			
AC/DC Adapter	A1443		Apple			
Cable Information	Cable Information					
Name	Shielded Type	Ferrite Core	Length			
DC In Cable	Without	Without	0.5M			
Test Software Information						
Name	Version	1	1			
UHFReader288Demo	V6.1	1	1			

2.4. Operation state

Operation Frequency List: The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. Channels 01/26/50 were selected for testing.

Operation Frequency List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	902.75	14	909.25	27	915.75	40	922.25
02	903.25	15	909.75	28	916.25	41	922.75
03	903.75	16	910.25	29	916.75	42	923.25
04	904.25	17	910.75	30	917.25	43	923.75
05	904.75	18	911.25	31	917.75	44	924.25
06	905.25	19	911.75	32	918.25	45	924.75
07	905.75	20	912.25	33	918.75	46	925.25
08	906.25	21	912.75	34	919.25	47	925.75
09	906.75	22	913.25	35	919.75	48	926.25
10	907.25	23	913.75	36	920.25	49	926.75
11	907.75	24	914.25	37	920.75	50	927.25
12	908.25	25	914.75	38	921.25	1	1
13	908.75	26	915.25	39	921.75	1	1

Note: The display in grey were the channel selected for testing.

Test mode

For RF test items:

The engineering test program was provided and enabled to make EUT continuous transmit

For AC power line conducted emissions:

The EUT was set to connect with the instrument under large package sizes transmission.

For Radiated spurious emissions test item:

The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.



2.5. Measurement Instruments List

RF Test System						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until	
1	Spectrum Analyzer	R&S	FSV40-N	101331	Mar. 21, 2025	
2	Spectrum Analyzer	R&S	FSV40-N	101654	Aug. 07, 2024	
3	Spectrum Analyzer	R&S	FSU26	100105	Dec. 12, 2024	
4	MXA Signal Analyzer	Keysight	N9020A	MY46471737	Dec. 12, 2024	
5	MXA Signal Analyzer	Keysight	N9020A	MY52091402	Aug. 22, 2024	
6	MXG Vector Signal Generator	Agilent	N5182A	MY47420864	Dec. 12, 2024	
7	PSG Analog Signal Generator	Agilent	E8257D	MY46521908	Dec. 12, 2024	
8	EXG Analog Signal Generator	Keysight	N5173B	MY59100842	Dec. 12, 2024	
9	MXG Vector Signal Generator	Keysight	N5182B	MY59100212	Dec. 12, 2024	
10	USB Wideband Power Sensor	Keysight	U2021XA	MY55130004	Mar. 21, 2025	
11	USB Wideband Power Sensor	Keysight	U2021XA	MY55130006	Mar. 21, 2025	
12	Wideband Radio Com- munication Tester	R&S	CMW500	102414	Dec. 12, 2024	
13	RF Control Unit	Tonscend	JS0806-2	/	Aug. 22, 2024	
14	High and low tempera- ture test chamber	ESPEC	MT3035	/	Mar. 21, 2025	
15	Test Software	Tonscend	JS1120-3	V2.6.88.0346	/	
16	Test Software	Tonscend	JS1120-3	V3.3.38	/	
17	Test Software	WCS	WCS-WCN	2023.08.04	/	

Radia	Radiated Emission (3m chamber 2)						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until		
1	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	9168-1013	Dec. 07, 2024		
2	Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-648	Dec. 07, 2024		
3	Spectrum Analyzer	R&S	FSU26	100105	Dec. 12, 2024		
4	Spectrum Analyzer	R&S	FSV40-N	101331	Mar. 15, 2025		
5	Pre-Amplifier	SONOMA	310	186194	Dec. 12, 2024		
6	Low Noise Pre-Amplifier	EMCI	EMC051835	980075	Dec. 12, 2024		
7	Test Receiver	R&S	ESCI7	100967	Dec. 12, 2024		
8	3m chamber 2	Frankonia	EE025	/	Oct. 23, 2024		
9	Test Software	FARA	EZ-EMC	FA-03A2	/		

Radia	Radiated Emission (3m chamber 3)										
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until						
1	Trilog-Broadband Antenna	Schwarzbeck	VULB 9163	01026	Dec. 18, 2024						
2	Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-647	Dec. 01, 2024						
3	Test Receiver	Keysight	N9038A	MY56400071	Dec. 12, 2024						

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4	Broadband Amplifier	SCHWARZBECK	BBV9743B	259	Dec. 12, 2024
5	Mirowave Broadband Amplifier	SCHWARZBECK	BBV9718C	111	Dec. 12, 2024
6	3m chamber 3	YIHENG	EE106	/	Aug. 28, 2026
7	Test Software	FARA	EZ-EMC	FA-03A2	/

Condu	ucted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until	
1	LISN	R&S	ENV216	101112	Dec. 12, 2024	
2	LISN	R&S	ENV216	101113	Dec. 12, 2024	
3	EMI Test Receiver	R&S	ESCS30	100353	Dec. 12, 2024	
4	ISN CAT6	Schwarzbeck	NTFM 8158	CAT6-8158-0046	Dec. 12, 2024	
5	ISN CAT5	Schwarzbeck	NTFM 8158	CAT5-8158-0046	Dec. 12, 2024	
6	Test Software	R&S	EMC32	6.10.10	/	

Note: 1. The Cal. Interval was one year.

2. The Cal. Interval was three year of the chamber

3. The cable loss has calculated in test result which connection between each test instruments.





3.1. Conducted Emission

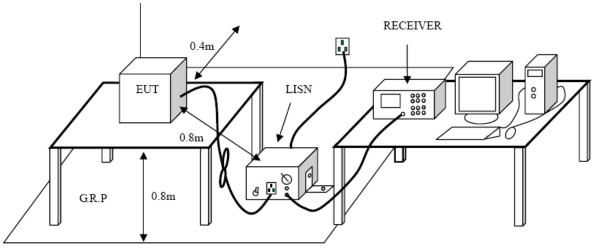
Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.207/ RSS - Gen 8.8

	Limit (dBuV)						
Frequency range (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 frequency.

Test Configuration



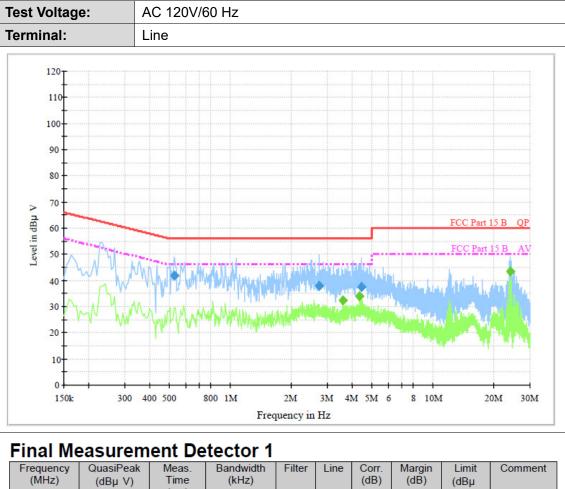
Test Procedure

- 1. The EUT was setup according to ANSI C63.10:2013 requirements.
- The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting 2. 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.
- The EUT and simulators are connected to the main power through a line impedances stabilization 3. network (LISN). The LISN provides a 500hm /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)
- Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was 4. individually connected through a LISN to the input power source.
- The excess length of the power cord between the EUT and the LISN receptacle were folded back and 5. 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 2.4.





	(MHz)	QuasiPeak (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	(dB)	Margin (dB)	(dBµ V)	Comment
	0.528000	42.0	1000.00	9.000	On	L1	9.5	14.0	56.0	
Γ	2.728500	37.9	1000.00	9.000	On	L1	9.5	18.1	56.0	
	4.420500	37.4	1000.00	9.000	On	L1	9.5	18.6	56.0	

Final Measurement Detector 2

Frequency (MHz)	Average (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
3.574500	32.5	1000.00	9.000	On	L1	9.5	13.5	46.0	
4.339500	34.0	1000.00	9.000	On	L1	9.5	12.0	46.0	
23.982000	43.6	1000.00	9.000	On	L1	9.7	6.4	50.0	

Emission Level= Read Level+ Correct Factor

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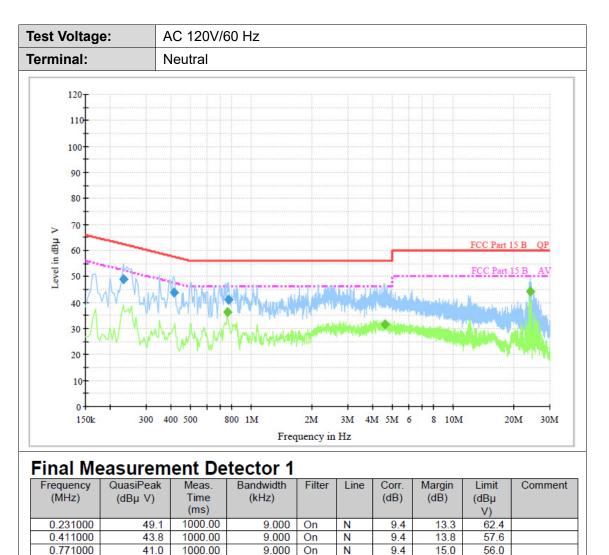
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Final	Measurement Detector 2	

Frequency (MHz)	Average (dBµ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµ V)	Comment
0.757500	36.2	1000.00	9.000	On	N	9.4	9.8	46.0	
4.555500	31.4	1000.00	9.000	On	Ν	9.4	14.6	46.0	
23.941500	44.2	1000.00	9.000	On	Ν	9.5	5.8	50.0	

Emission Level= Read Level+ Correct Factor

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3.2. Radiated Emission

<u>Limit</u>

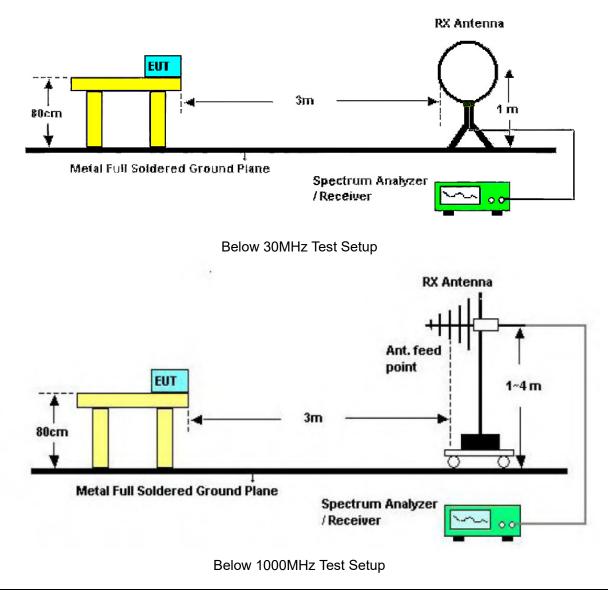
FCC CFR Title 47 Part 15 Subpart C Section 15.209/ RSS - Gen 8.9

Frequency	Limit (dBuV/m @3m)	Value		
30 MHz ~ 88 MHz	40.00	Quasi-peak		
88 MHz ~ 216 MHz	43.50	Quasi-peak		
216 MHz ~ 960 MHz	46.00	Quasi-peak		
960 MHz ~ 1 GHz	54.00	Quasi-peak		
Above 1 CUIT	54.00	Average		
Above 1 GHz	74.00	Peak		

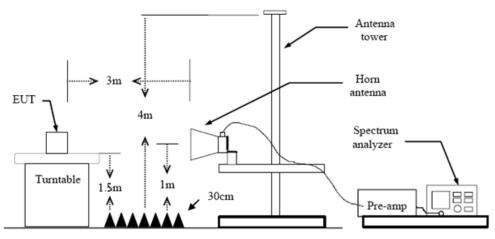
Note:

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

Test Configuration







Above 1GHz Test Setup

Test Procedure

- 1. The EUT was setup and tested according to ANSI C63.10:2013
- 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.
- 6. 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 \geq 1/T Peak detector for Average value.

Note 1: For the 1/T& Duty Cycle please refer to clause 3.10 Duty Cycle.

Test Mode

Please refer to the clause 2.4.

<u>Test Result</u>

9 KHz~30 MHz

From 9 KHz to 30 MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.



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nt. Po	4.	Hori	Horizontal TX Mode 902.75MHz Only worse case is reported									
est Mo	ode:	TX I										
Remark	(:	Only										
90.0 dB	uV/m											
BO												
70												
60						E00 F	Part15 C 30-	10001				
50							n -6 dB					
40												
30							5	6				
20				1 Same	A MANNA	werther marken and herein	Mary Superior	Walangagan				
	an Markan	Mar I.	الدين بقير .	there are	Alex Land Med	Went Man Press and a second						
1 A I Y Y		" MARIA	when a showing the									
		" "~\&e\}	welder to approve the orall									
0		•••••••••••	vielde gebreide very and and									
D		60.00	webeent-dewywereper-	(MHz)	300).00		1000.0				
)		60.00 ncy	Reading (dBu∨)	(мнг) Factor (dB/m)	Level	Limit (dBuV/m)	Margin (dB)	1000.0				
) -10 30.000	Frequer	60.00 ncy)	Reading	Factor	Level	Limit						
no.	Frequer (MHz	60.00 ncy) 33	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	(dB)	Detector				
No.	Frequer (MHz 121.503	60.00 hcy) 33 67	Reading (dBuV) 42.47	Factor (dB/m) -19.66	Level (dBuV/m) 22.81	Limit (dBuV/m) 43.50	(dB) -20.69	Detector QP				
No.	Frequer (MHz 121.503 145.106	60.00 hcy) 33 67 67	Reading (dBuV) 42.47 44.12	Factor (dB/m) -19.66 -21.32	Level (dBuV/m) 22.81 22.80	Limit (dBuV/m) 43.50 43.50	(dB) -20.69 -20.70	Detector QP QP				
No.	Frequer (MHz 121.503 145.100 201.360	60.00 hcy) 33 67 67 00	Reading (dBuV) 42.47 44.12 41.81	Factor (dB/m) -19.66 -21.32 -17.73	Level (dBuV/m) 22.81 22.80 24.08	Limit (dBuV/m) 43.50 43.50 43.50	(dB) -20.69 -20.70 -19.42	Detector QP QP QP				

 Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value



nt. Po	I.	Ver	tical							
est Mo	ode:	ТΧ	Mode 902.	75MHz						
Remark		Only worse case is reported								
10.0 dB	uV/m									
80										
0										
i0						FCC	Part1 5 C 30-	1000N		
io						Margi	n -6 dB			
10										
								<u>6</u>		
10	1	2		3	5	nder and the second state	1 Manuter Marth	HUTHIN MANY		
20	Non marine	Maria		White A Barry	an with Almondation	New March 19 - 19 - 19 - 19 - 19 - 19 - 19 - 19	www.			
0		n in Mil	1 work when the second	. the could area	dition of the					
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30.000		60.00		(MHz)	30	0.00		1000.0		
	F		D	F a tan	11	1.1				
No.	Frequen (MHz)		Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector		
	38,406	7	38.13	-16.86	21.27	40.00	-18.73	QP		
1	00.400	•								
1 2	59.100	-	37.47	-17.07	20.40	40.00	-19.60	QP		
		0	37.47 41.19	-17.07 -19.66	20.40 21.53	40.00 43.50	-19.60 -21.97	QP QP		
2	59.100	0 33								
2	59.100 121.503	0 33 36	41.19	-19.66	21.53	43.50	-21.97	QP		

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

CTC Laboratories, Inc.



Ant	. Pol	•	Horizontal										
Tes	t Mo	de:	TX N	/lode	e 902.7	5MHz							
Rer	nark		No r scrib			e emissio	on v	which	more t	han 10) dB	below the	e pre-
100.0) dBu	V/m											
90													
80										FCCI	Part15	C - Above 1	G PK
70							_						
	ş												
60										FCC	Part15	C - Above 1	GAV
50	1×												
40													
30													
20							-						
10							-						
0.0		3400.00 5	B00.00		0.00 10	600.00 (N	(Hz)		00.00 1	7800.00	2020	0.00 22600	.00 25000.0
								1					
N	lo.	Frequer (MHz			ading BuV)	Facto (dB/m			vel IV/m)	Lin (dBu)		Margin (dB)	Detector
1	*	1854.5	75	1	7.39	28.4	5	45	.84	54.	00	-8.16	AVG
2	2	1855.1	50	3	4.04	28.4	5	62	.49	74.	00	-11.51	peak

Remarks:

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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EN

Ant	. Pol	•	Vert	ical											
Tes	t Mo	de:	TXI	Node	e 902.7	75MH	z								
Rer	nark		No r scrit			ne em	issio	n v	vhich	more t	han 10) dB l	pelow t	he pre	-
100.	0 dBu	V/m													
90															
80											FCC	Part15 (C - Above	1G PK	_
70											100			TUFK	-
60	1×														
50						_					FCC	Part15 (C - Above	16 AV	-
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40															
30															-
20															_
10															_
0.0		3400.00 5	800.00		0.00 1	0600.0	0 (MI			100.00 1	7800.00	20200		00.00 2	5000.0
	100.000	5100.00	000.00	020	0.00	0000.0	<u>o (</u> mi	12)	13	00.00	7000.00	20200		00.00 2	3000.0
N	lo.	Frequer (MHz	-		ading BuV)		acto IB/m			evel iV/m)	Lin (dBu		Margi (dB)		ector
	1	1804.6	89	3	3.59	2	8.14		61	.73	74.	00	-12.2	7 pe	ak
2	2 *	1806.4	87	1	7.86	2	8.15		46	.01	54.	00	-7.99) A\	/G
	narks	5: (dP/m) =													

Page 20 of 53

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

CTC Laboratories, Inc.



	. Pol t Mo			zontal Node 915.	25M⊔-				
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	2						FCC Part15 (C-Above 10	Э РК
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	ş								
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	0.000	3400.00	5800.00	8200.00 1	10600.00 (MHz)	15400.00 1	7800.00 20200	.00 22600.	00 25000
N	0.		uency Hz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detecto
1	*	1830).348	17.63	28.30	45.93	54.00	-8.07	AVG
2	2	1831	.009	33.30	28.30	61.60	74.00	-12.40	peak
	1000.040				1				

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1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value



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	Mo ark:			N	o re	ероі	e 915. t for tl imit.	-		sion v	vhich	more	than 10 dE	below the	e pre-
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ı -															
	2		_				-					FCC Part1	5 C - Above 1	<u>G PK</u>	
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.0 100	00.000	340).00	5800	.00	820	0.00	1060	0.00	(MHz)	15	400.00 1	7800.00 202	00.00 22600	.00 25000
No	b .		eque (MH		/		ading BuV)		Fac (dB/r			evel JV/m)	Limit (dBuV/m	Margin (dB)	Detector
1	*	18	329.	544		1	7.53		28.2	29	45	5.82	54.00	-8.18	AVG
2		18	331.	151		3!	5.16		28.3	30	63	3.46	74.00	-10.54	peak
	1	arks: ctor (dB/m) = Antenna Fact						I			1	1			

2.Margin value = Level -Limit value

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Ant	. Pol		Hori	zont	al									
Tes	t Moo	de:	TX N	Node	e 927.28	5MHz								
Rer	nark:		No r scrib			e emissio	on w	vhich	more t	han 10	dB b	elow the	e pre-	
100.	0 dBu'	V/m												
90			_											
80										FCC P	art15 (C-Above 1	G PK	
70														
60	X													
50										FCC P	art15 (C - Above 1	GAV	
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40														
30														
20														
10														
0.0	00.000	3400.00 5	800.00	0.00	0.00 10	600.00 (N	41.1-2	154	00.00 1	7800.00	20200	.00 22600	100 250	00.0
	100.000	3400.00 3	000.00	021	10.00 10	600.00 (N	(Hz)	154	UU.UU I	7000.00	20200	1.00 2260	J.UU 25U	UU.U
N	lo.	Freque (MHz			ading BuV)	Facto (dB/n			vel iV/m)	Lim (dBu∖		Margin (dB)	Detec	tor
	1	1805.5	49	3	3.65	28.1	4	61	.79	74.0	0	-12.21	pea	k
2	2 *	1805.7	68	1	7.67	28.1	4	45	.81	54.0	0	-8.19	AVC	3
	n o riko											·	-	

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Remarks:

EN

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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An	t. Pol		Vert	ical										
Tes	st Mo	de:	TX	Node	e 927.28	5MHz								
Rei	mark	:	No r scrit			e emissio	on v	vhich	more t	han 10 dE	3 below the	e pre-		
100.	0 dBu	V/m												
90														
80				FCC Part15 C - Above 1G PK										
70	2													
60	Š									ECC Part1	5 C - Above 1	GAV		
50	1 X						_							
40	^													
30														
20														
10 0.0														
)00.000	3400.00	5800.00	820	0.00 10	600.00 (M	IHz)	154	00.00 1	7800.00 202	200.00 22600	1.00 25000.0		
1														
١	۹o.	Freque (MH:			ading BuV)	Facto (dB/m			evel uV/m)	Limit (dBuV/n	n) (dB)	Detector		
	1 *	1855.0	061 17.40 28.45 45.85 54.00 -8.15 AVG									AVG		
	2	1855.3	314	14 33.64 28.45 62.09 74.00 -11.91 peak										
	2 1855.314 33.64 28.45 62.09 74.00 -11.91 peak													
Rer	marks	5:												

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Remarks:

EN

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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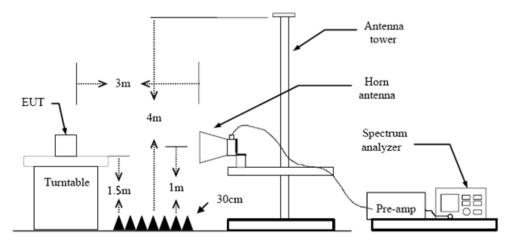
3.3. Band Edge Emissions (Radiated)

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d)/ RSS - 247 5.5

Restricted Frequency Band	(dBuV/n	n)(at 3m)
(MHz)	Peak	Average
2310 ~ 2390	74	54
2483.5 ~ 2500	74	54

Test Configuration



Test Procedure

- 1. The EUT was setup and tested according to ANSI C63.10:2013 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 C63.10:2013 on radiated measurement.
- 5. The receiver set as follow: RBW=1MHz, VBW=3MHz Peak detector for Peak value. RBW=1MHz, VBW see note 1 with Peak Detector for Average Value.

Test Mode

Please refer to the clause 2.4.

Test Results

Pre-scan all antenna, only show the test data for worse case antenna on the test report.





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est M	lode	:	902.	75MH	z								
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₩ <u>₩</u> ₩ D D.0	00 81	11.00	822.00	833.0 Rea		^{344.00}		Le		877.00 Lir	888.	Margir (dB)	.00 910.
	00 81	Ti.00	822.00 lency Hz)	833.0 Rea (dB	no e Iding	Fa (dB	(MHz)	Le ^v	6.00 Vel	877.00 Lir	888. nit V/m)	Margir	1 Detecto
No.	00 81	Frequ (MF	822.00 lency Hz) 3767	833.0 Rea (dB 35.	nding suV)	Fa (dB	(MHz)	Le (dBu 30	₀.00 vel V/m)	877.00 Lir (dBu	888. nit V/m)	Margir (dB)	Detecto
No.	00 81	Frequ (MH 804.8 837.5 861.5	822.00 lency Hz) 3767 5467 5633	833.0 Rea (dB 35 34 34	ading auV) .69 .11 .30	Fa (dB -5.	(MHz) ctor s/m) .32	Le (dBu 30	vel V/m) .37 .20	877.00 Lir (dBu 46	888. nit V/m) .00	Margir (dB) -15.63 -16.80 -16.29	Detecto peak peak peak
No. 1 2 3 4	00 81	Frequ (MH 804.8 837.5 861.5 879.0	822.00 ency Hz) 3767 5467 5633 0167	833.0 Rea (dB 35 34 34 34	ading auV) .69 .11 .30 .92	Fa (dB -5. -4. -4.	(мнг ctor s/m) .32 .91 .59 .33	Le (dBu 30 29 30	5.00 Vel V/m) .37 .20 .71 .59	877.00 Lir (dBu 46 46 46	888. nit V/m) .00 .00 .00	Margir (dB) -15.63 -16.80 -16.29 -15.41	Detecto peak peak peak peak
No. 1 3	00 81	Frequ (MH 804.8 837.5 861.5	822.00 ency Hz) 3767 5467 5633 0167	833.0 Rea (dB 35 34 34 34	ading auV) .69 .11 .30	Fa (dB -5. -4. -4.	(мнг ctor в/m) .32 .91 .59	Le (dBu 30 29 30	s.00 vel V/m) .37 .20 .71	877.00 Lir (dBu 46 46 46	888. nit V/m) .00 .00	Margir (dB) -15.63 -16.80 -16.29	Detecto peak peak peak peak

Remarks:

EN

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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Vk/H-w/y 0 0.0		822.00 ncy	833. Rea) 860 Lev	6.00	877.00	t	소 사 (dB)	1
0.0 800.000	811.00 Freque	822.00 ncy z)	833. Rea (dE	00 8 ading	44.00 (MH) Factor) 860 Lev	6.00 vel V/m)	877.00 Limi	t ′m)	Margin	
0 0.0 800.000 No.	811.00 Freque (MH2	822.00 ncy 2)	833. Rea (dE 34	ading au∨)	Factor (dB/m)) 860 Lev (dBu	^{6.00} vel V/m)	877.00 Limi (dBuV/	t 'm) 0	Margin (dB)	Detector
No.	811.00 Freque (MHz 838.53	822.00 ncy z) 367	833. Rea (dE 34 34	.00 8 ading 3u∨)	44.00 (мна Factor (dB/m) -4.90) 860 Lev (dBu 29.	6.00 ∨el V/m) .83 .27	877.00 Limi (dBuV/ 46.00	t (m) 0 0	Margin (dB) -16.17	Detector peak
No. 1 2	811.00 Freque (MHz 838.53 867.50	ncy 2) 367 333	833. Rea (dE 34 34 34	ading 3u∨) 1.73	44.00 (MHa Factor (dB/m) -4.90 -4.50) 860 Lev (dBu 29. 30.	6.00 Vel V/m) .83 .27 .72	877.00 Limi (dBuV/ 46.00 46.00	t (m) 0 0	Margin (dB) -16.17 -15.73	Detector peak peak
No. 1 2 3	811.00 Freque (MHz 838.53 867.50 887.74	ncy 2) 367 333 33	833. Rea (dE 34 34 34 36	ading 3uV) 1.73 1.77	44.00 (MHa Factor (dB/m) -4.90 -4.50 -4.19) 860 (dBu 29. 30.	6.00 ∨el ∨/m) .83 .27 .72 .40	877.00 Limir (dBuV/ 46.00 46.00	t (m) 0 0 0	Margin (dB) -16.17 -15.73 -15.28	Detector peak peak peak

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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920.000	928.00 \$	36.00	944.	.00 9	952.00	I (M	(Hz)	968	B.00 9	176.00	984.0	0 992.	
алари 1 1.0		36.00 ncy	944		952.00		(Hz) Dr	968 Le		176.00 Lir	984.0 nit		
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920.000 No.	928.00 S Freque (MHz	36.00 ncy :) 33	944 Rea (dl	ading BuV)	952.00	Facto	(Hz) or 1)	960 Le (dBu 30	^{8.00} 9 evel uV/m)	Lir (dBu	984.0 nit V/m)	0 992. Margir (dB)	Detector
No.	928.00 S Freque (MHz 929.49	36.00 ncy :) 33 67	944 Re: (dl 34 34	.00 s ading BuV) 4.64	952.00	Facto dB/m -3.76	nHz) Dr 1) S	960 Le (dBu 30 31	8.00 s evel uV/m)).88	176.00 Lir (dBu 46.	984.0 nit V/m) .00	0 992. Margir (dB) -15.12	Detector 2 peak 7 peak
No.	928.00 9 Freque (MHz 929.49 939.14	36.00 ncy :) 33 67 67	944 (dl 34 34	ading BuV) 4.64 4.71	952.00	Facto dB/m -3.76 -3.68	or 1) 3	960 Le (dBu 30 31 30	8.00 9 evel uV/m) 0.88 1.03	Lir (dBu 46. 46.	984.0 nit V/m) .00	0 992. Margir (dB) -15.12 -14.97	Detector 2 peak 7 peak 0 peak
No. 1 2 * 3	928.00 9 Freque (MHz 929.49 939.14 951.22	36.00 ncy 2) 33 67 67 67	944 Rea (dl 34 34 34 34	ading BuV) 4.64 4.71 4.18	952.00	Facto dB/m -3.76 -3.68	11Hz) Dr 1) 3 3 3	961 Le (dBu 30 31 30 29	evel uV/m)).88 1.03).60	Lir (dBu 46. 46. 46.	984.0 nit V/m) .00 .00	0 992. Margir (dB) -15.12 -14.97 -15.40	Detector 2 peak 7 peak 0 peak 1 peak

Remarks:

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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920.000 928.00

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Ant	t. Pol.		Vertical							
Tes	t Mode:	:	927.25N	/Hz						
110.	0 dBuV/m	1								
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90										
80										
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No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	935.2000	33.60	-3.72	29.88	46.00	-16.12	peak
2	941.8400	33.59	-3.65	29.94	46.00	-16.06	peak
3 *	953.7066	34.84	-3.54	31.30	46.00	-14.70	peak
4	962.0000	35.19	-3.44	31.75	54.00	-22.25	peak
5	967.2800	35.30	-3.38	31.92	54.00	-22.08	peak
6	992.5333	33.98	-3.06	30.92	54.00	-23.08	peak

(MHz)

968.00

976.00

984.00

992.00

1000.00

Remarks:

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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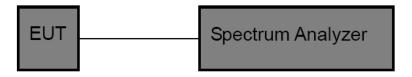
3.4. Band edge and Spurious Emissions (Conducted)

<u>Limit</u>

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

RSS-247 (5.5):In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Test Configuration



Test Procedure

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- 3. Use the following spectrum analyzer settings:
 - RBW = 100 kHz, VBW \ge RBW, scan up through 10th harmonic.
- Sweep = auto, Detector function = peak, Trace = max hold
- 4. Measure and record the results in the test report.

Test Mode

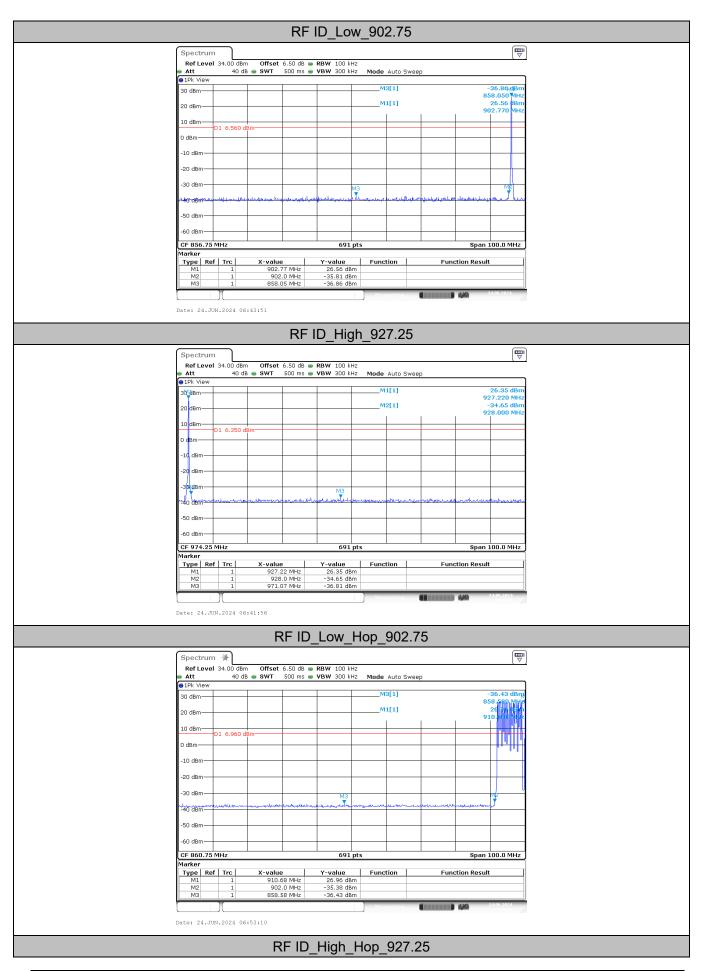
Please refer to the clause 2.4.

Test Results



(1) Band edge Conducted Test

Test Mode	Frequency [MHz]	Ref Level[dBm]	Result[dBm]	Limit[dBm]	Verdict
	902.75	26.56	-35.81	≤6.56	PASS
RF ID	927.25	26.35	-34.65	≤6.35	PASS
KF ID	Hop_902.75	26.96	-35.38	≤6.96	PASS
	Hop_927.25	26.62	-36.23	≤6.62	PASS



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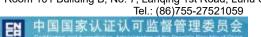


Spectrum Ref Level 34.00 dBm Att 40 dB 9 IPk View 30 dBm 10 35 T 0 15 T 0 16.620 dBm -10 dBm -10 dBm		RBW 100 kHz VBW 300 kHz	Mode Auto S M3[1] M1[1]	weep	981 2	€.23 dBm .930 MHz 6.62 dBm 7.820 MHz
• Att 40 dB • • Ibk View 130 dBm - • G IBm - • 0 1 6.620 dBm • g Bm - • 0 1 6.620 dBm	SWT 500 ms		M3[1]	weep	981 2	6.23 dBm 1.930 MHz 6.62 dBm
1Pk View 10 dbm 10 dbm 10 ds		VBW 300 kHz	M3[1]	weep	981 2	.930 MHz 6.62 dBm
130 dBm 136 g primi 10 g primi 10 g primi 0 g pri					981 2	.930 MHz 6.62 dBm
0 d5 01 6.620 dBm 0 d3 01 6.620 dBm				_	981 2	.930 MHz 6.62 dBm
10 43 − 0 13m 0 13m			M1[1]	_	2	6.62 dBm
<mark>10 15−1 01 6.620 dam 9 dam</mark>				_		
i di tamini				_		
i o jaban						
			1			
-10 dBm						
-20 dBm						
-30 dBm			M3			
-40 dBm	ed-methological provided	norman have	wander and with	where the second	amenum	hermonitan
-ro abii						
-50 dBm						
-60 dBm						
CF 967.75 MHz		691 pts			Span 10	0.0 MHz
Marker]
Type Ref Trc M1 1	X-value 917.82 MHz	Y-value 26.62 dBm	Function	Fun	ction Result	
M1 1 M2 1	917.82 MHz 928.0 MHz	-37.97 dBm				
M3 1	981.93 MHz	-36.23 dBm				
			Measuring.		4,40 24	06.2024
			J	-		
Date: 24.JUN.2024 06:57	7:16					

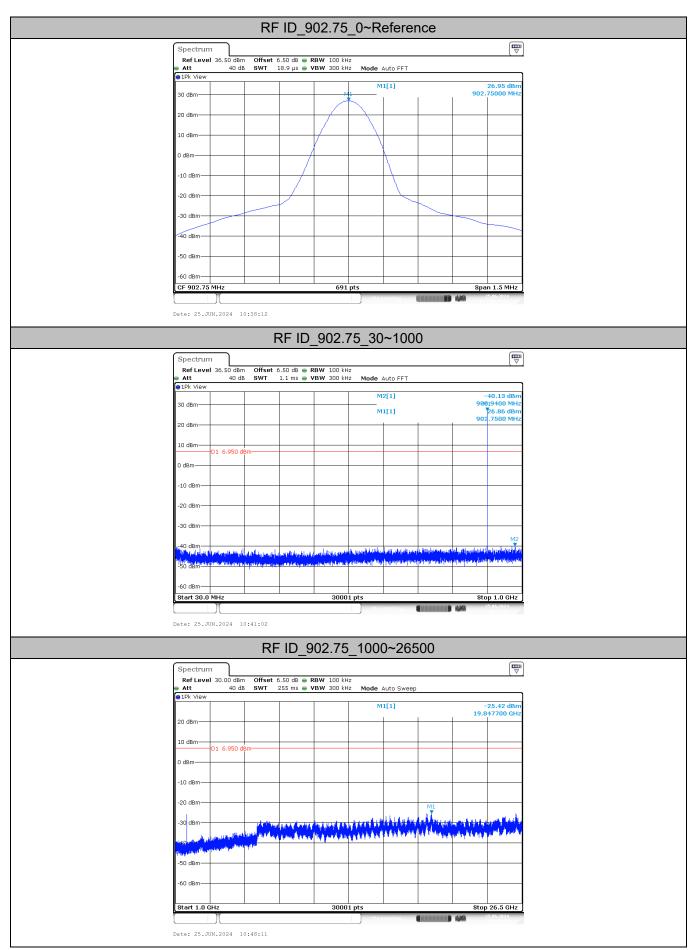


(2) Conducted Spurious Emissions Test

Test Mode	Frequency [MHz]	Freq Range [Mhz]	Ref Level [dBm]	Result [dBm]	Limit [dBm]	Verdict
RF ID	902.75	Reference	26.95	26.95		PASS
		30~1000	26.95	-40.13	≤6.95	PASS
		1000~26500	26.95	-25.42	≤6.95	PASS
	915.25	Reference	26.87	26.87		PASS
		30~1000	26.87	-39.77	≤6.87	PASS
		1000~26500	26.87	-19.86	≤6.87	PASS
	927.25	Reference	26.82	26.82		PASS
		30~1000	26.82	-39.66	≤6.82	PASS
		1000~26500	26.82	-24.87	≤6.82	PASS



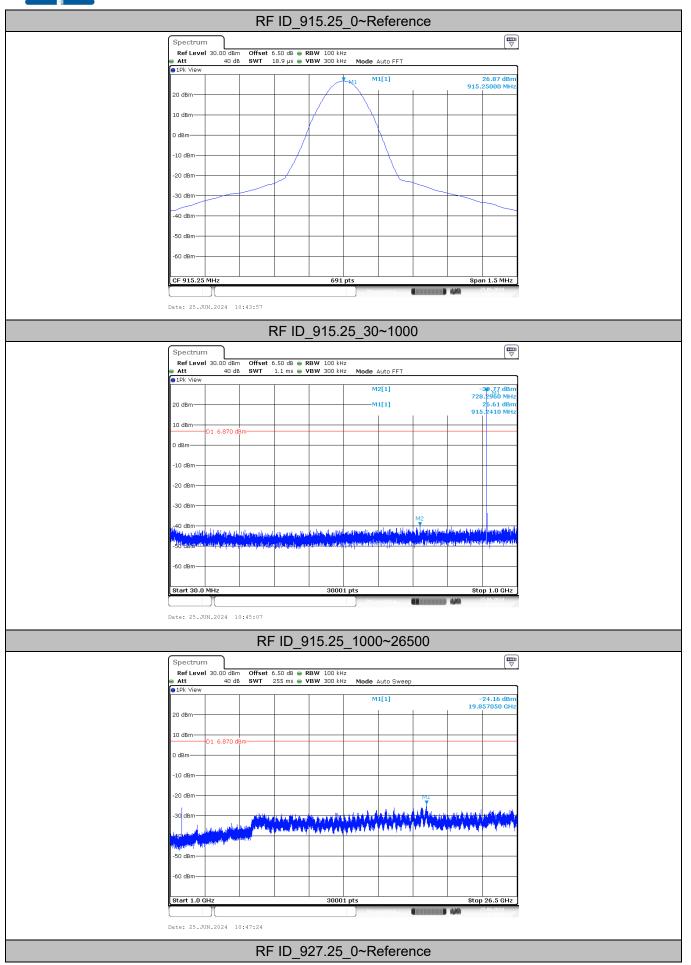






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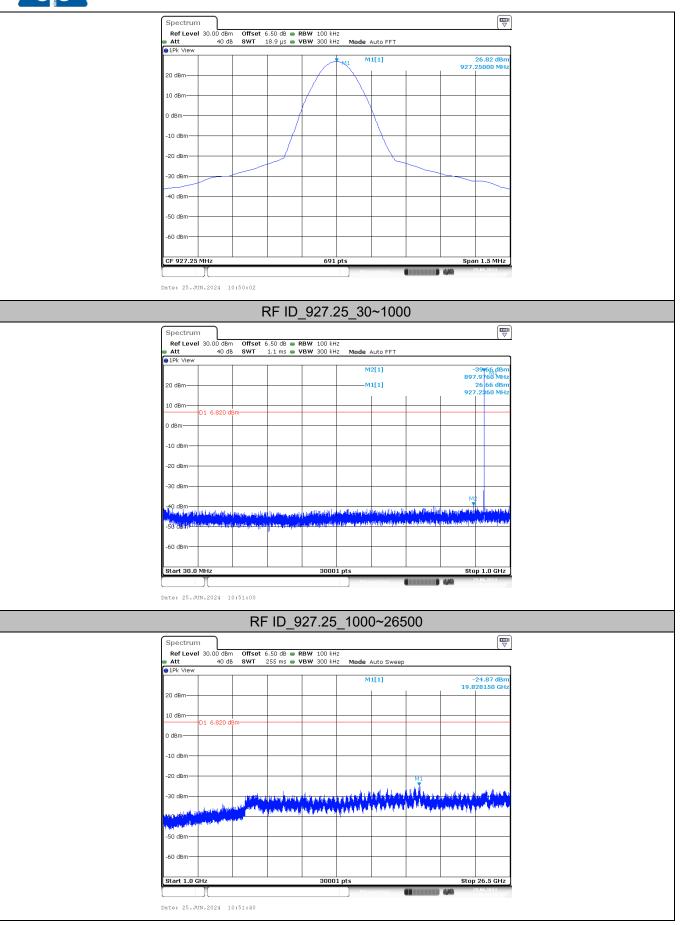


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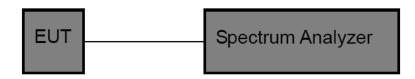


3.5. 20DB Bandwidth

<u>Limit</u>

The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

Test Configuration



Test Procedure

- 1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- 2. OCB and 20dB Spectrum Setting:
 - (1) Set RBW = $1\% \sim 5\%$ occupied bandwidth.
 - (2) Set the video bandwidth (VBW) \geq 3 RBW.
 - (3) Detector = Peak.
 - (4) Trace mode = Max hold.
 - (5) Sweep = Auto couple.

Note: The EUT was set to continuously transmitting in each mode and low, middle and high channel for the test.

<u>Test Mode</u>

Please refer to the clause 2.4.

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Test Results

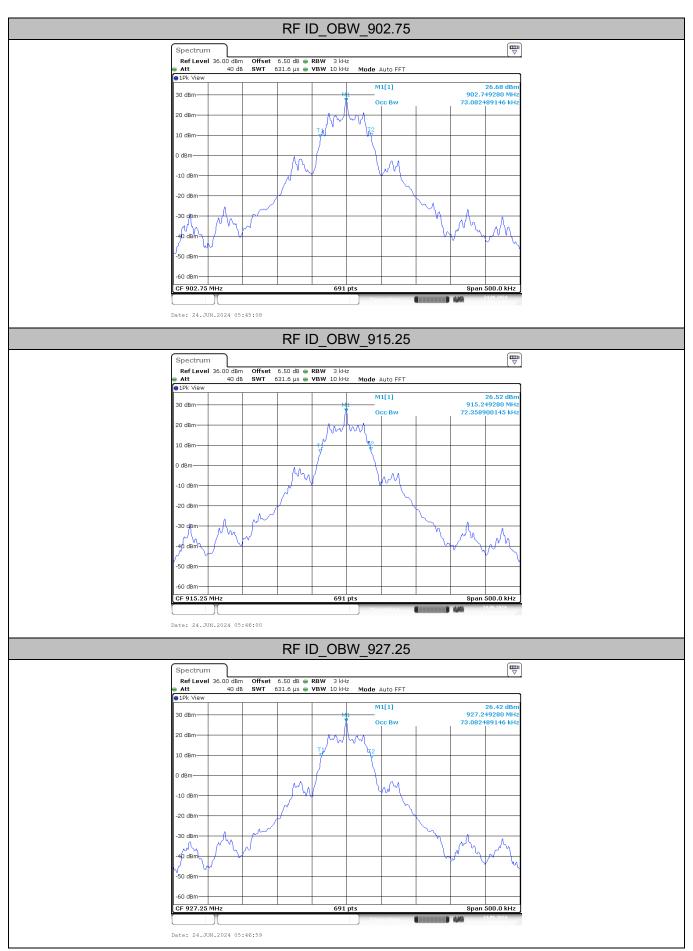
Test Mode	Frequency [MHz]	99% Bandwidth[kHz]	20db EBW[kHz]	Limit[kHz]	Verdict
	902.75	73.08	75.98	500	PASS
RF ID	915.25	72.36	72.36	500	PASS
	927.25	73.08	75.25	500	PASS

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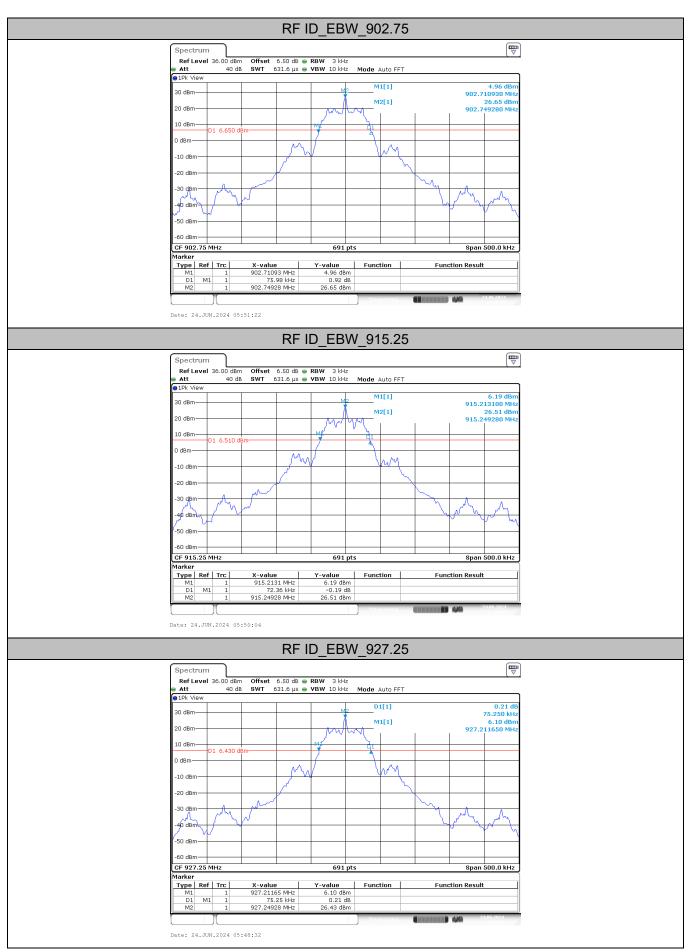
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3.6. Channel Separation

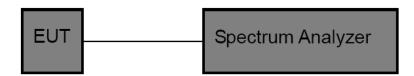
<u>Limit</u>

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1)/ RSS-247 5.1 b :

FCC 15.247: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively

RSS-247: FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Test Configuration



Test Procedure

- 1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- 2. Spectrum Setting:
 - (1) Set RBW = 100 kHz.
 - (2) Set the video bandwidth (VBW) \geq 3 RBW.
 - (3) Detector = Peak.
 - (4) Trace mode = Max hold.
 - (5) Sweep = Auto couple.

Test Mode

Please refer to the clause 2.4.

Test Results

Test Mode	Frequency [MHz]	Result[kHz]	Limit[kHz]	Verdict
RF ID	Hop_915.25	505.80	>173.7	PASS

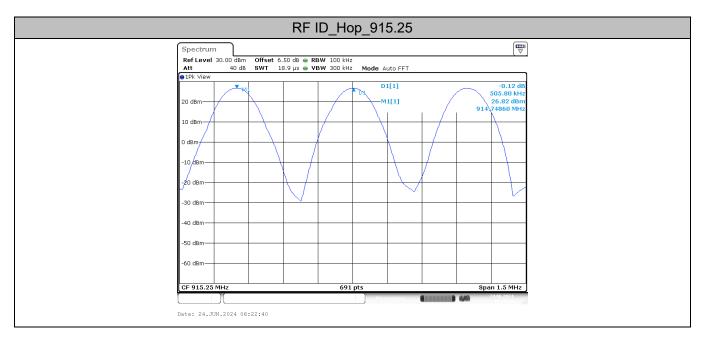
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3.7. Number of Hopping Channel

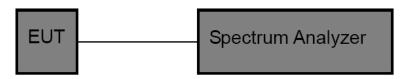
Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1)(i)/ RSS-247 5.1 c :

FCC 15.247: (i)For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

RSS-247: For FHSs in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

Test Configuration



Test Procedure

The EUT was directly connected to the spectrum analyzer and antenna output port as show in the 1. block diagram above.

- 2. Spectrum Setting:
 - (1) Peak Detector: RBW=100 kHz, VBW≥RBW, Sweep time= Auto.

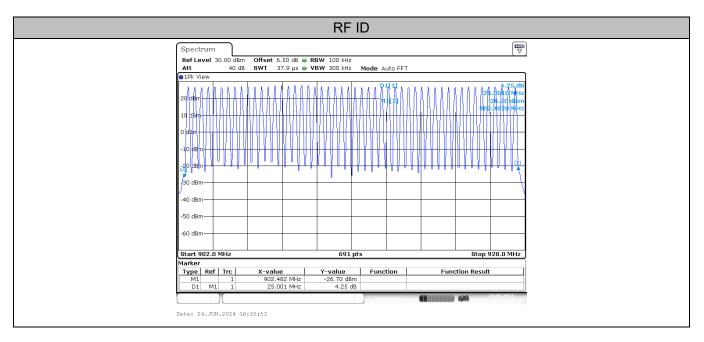
Test Mode

Please refer to the clause 2.4.

Test Result

Test Mode	Channel number	Limit	Result
RF ID	50	≥25.00	Pass









3.8. Dwell Time

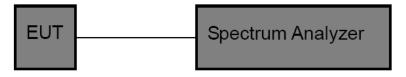
Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1)(i)/ RSS-247 5.1 c :

FCC 15.247: For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

RSS-247: For FHSs in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period.

Test Configuration



Test Procedure

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the 1. block diagram above.
- Spectrum Setting: 2.
 - (1) Spectrum Setting: RBW=1MHz, VBW≥RBW.
 - (2) Use video trigger with the trigger level set to enable triggering only on full pulses.
 - (3) Sweep Time is more than once pulse time.
- (4) Set the center frequency on any frequency would be measure and set the frequency span to zero.
 - (5) Measure the maximum time duration of one single pulse.
 - (6) Set the EUT for packet transmitting.

Test Mode

Please refer to the clause 2.4.



<u>Test Result</u>

Test Mode	Frequency [MHz]	Pulse Time (ms)	Total of Dwell (ms)	Limit (Second)	Verdict
RF ID	915.25	27.83	278.30	≤ 0.4	PASS

Note:

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1. Occupied time for each channel = 27.83 ms

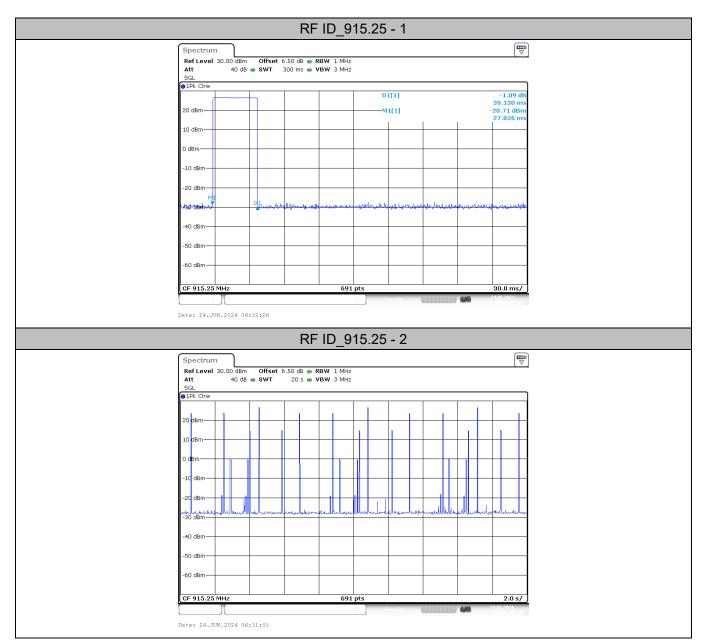
2. The number of occupied channels per 20 seconds = 10

3. (Total dwell time) = (Occupied time) x (Channel number)

27.83 x 10 = 278.30 (ms)

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3.9. Peak Output Power

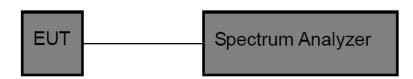
<u>Limit</u>

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(2) / RSS-247 5.4 a:

FCC 15.247: For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

RSS-247: For FHSs operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

- 2. Spectrum Setting:
 - (1) Set RBW> 20DB Bandwidth.
 - (2) Set the video bandwidth (VBW) \geq RBW.
 - (3) Detector = Peak.
 - (4) Trace mode = Max hold.
 - (5) Sweep = Auto couple.

Test Mode

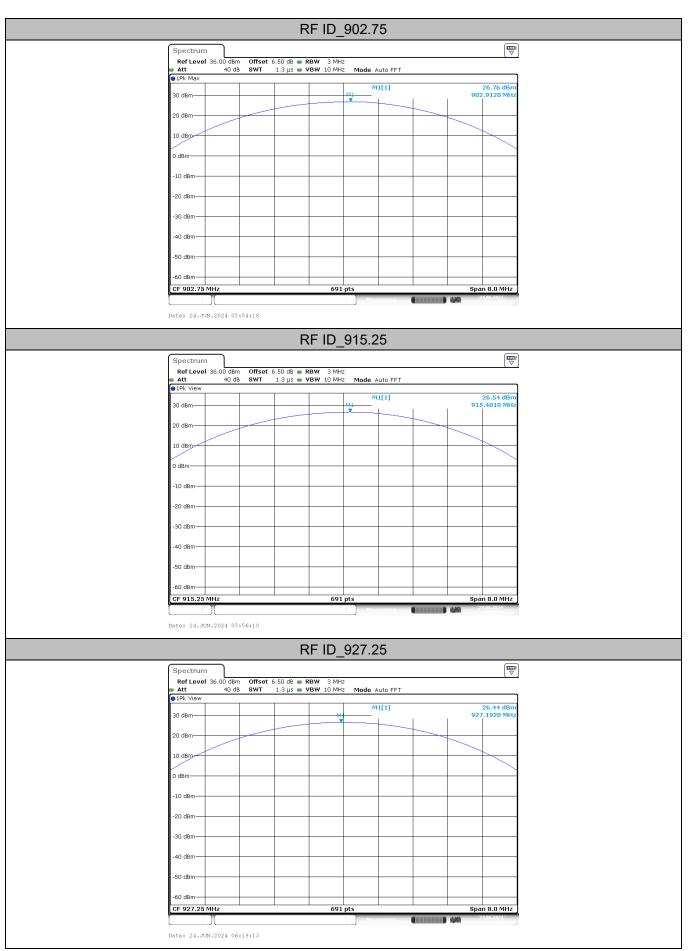
Please refer to the clause 2.4.



Test Result

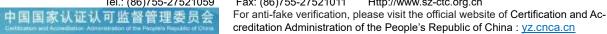
Test Mode	Frequency [MHz]	Result[dBm]	Limit[dBm]	Verdict
	902.75	26.76	<=30	PASS
RF ID	915.25	26.54	<=30	PASS
	927.25	26.44	<=30	PASS





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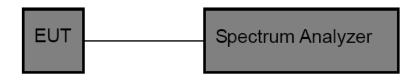


3.10. Duty Cycle

<u>Limit</u>

None, for report purposes only.

Test Configuration



Test Procedure

- 1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- 2. The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance v05r02.

3. Spectrum Setting:

Set analyzer center frequency to test channel center frequency. Set the span to 0Hz Set the RBW to 10MHz Set the VBW to 10MHz Detector: Peak Sweep time: Auto

Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

Test Mode

Please refer to the clause 2.4.

Test Result

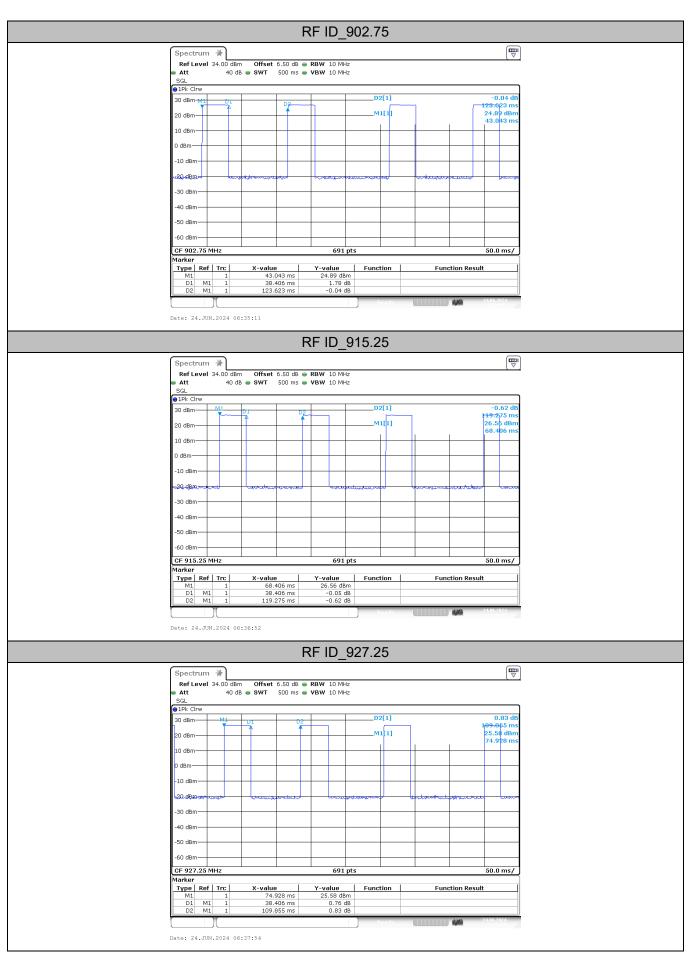
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Test Mode	Frequency [MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	1/T Minimum VBW (kHz)	Final setting For VBW (kHz)
	902.75	38.41	123.62	31.07	0.026	1
RF ID	915.25	38.40	119.28	32.19	0.026	1
	927.25	38.41	109.86	34.96	0.026	1

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3.11. Antenna requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 15.203:

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 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.

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

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

Test Result

The directional gain of the antenna less than 6dBi, please refer to the EUT internal photographs antenna photo.

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